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 2. HSLRR APPENDICES

U.S. Army Corps of Engineers
New York District

New York State
Department of Environmental Conservation

August 2015

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

Appendix A:

Pertinent Correspondence

U.S. Army Corps of Engineers
New York District

May 2015

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Water, Bureau of Flood Protection and Dam Safety
625 Broadway, Albany, New York 12233-3504
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May 19, 2015

Anthony Ciorra, P.E.
Chief, Coastal Restoration and Special Project Branch
United States Army Corps of Engineers, New York District
26 Federal Plaza, Room 2119A
New York, New York 10278-0090

RE: Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, Coastal Storm Risk Management Project (Long Beach Island Project)

Dear Mr. Ciorra:

The purpose of this letter is to confirm the New York State Department of Environmental Conservation's (Department) continued interest in participating in the Long Beach Island Project as the non-federal sponsor. Furthermore, the Department supports the selected plan contained in the United States Army Corps of Engineers (USACE), Long Beach Island Project, Hurricane Sandy Limited Reevaluation Report of 2015.

The Department understands that to the extent the Disaster Relief Appropriation Act of 2013, Public Law 113-2 enacted January 29, 2013 (DRAA 13) funds appropriated by Congress are available, USACE will construct the Long Beach Island Project at 100 percent Federal expense. In the event that there are insufficient DRRA 13 funds to complete construction of the Long Beach Island Project, such completion shall be subject to cost-sharing otherwise applicable to construction of the Long Beach Island Project and amendment of the proposed Project Partnership Agreement (PPA).

This letter is not a commitment for the funding of any portion of the Long Beach Island Project. The commitment can only be made when the proposed PPA with USACE is executed by the New York State Office of the Comptroller.

The Department will continue working with USACE to move the Long Beach Island Project forward to construction. If you have any questions, please contact the Project Manager, Anna Servidone by e-mail at anna.servidone@dec.ny.gov or by telephone (518) 402-8147.

Sincerely,

Alan A. Fuchs, P.E.
Director
Bureau of Flood Protection and Dam Safety

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

ec: E. Brickman, USACE
S. Couch, USACE
R. Pinzon, USACE
J. LaCarruba, City of Long Beach
R. Masters, Town of Hempstead
B. Schneider, County of Nassau
E. Star, NYSDEC Reg.1
S. McCormick, NYSDEC
A. Servidone, NYSDEC

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS, NEW YORK DISTRICT
JACOB K. JAVITS FEDERAL BUILDING
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Environmental Branch

February 20, 2015

Mr. David Stilwell
Field Supervisor
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, New York 13045

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

Dear Mr. Stilwell:

The U.S. Army Corps of Engineer, New York District (District) is in receipt of the U.S. Fish and Wildlife Service's (Service) Biological Opinion and Conference Opinion (BO) dated November 24, 2014. The BO addressed the effects on the threatened piping plover (*Charadrius melodus;* Atlantic Coast population), the threatened seabeach amaranth (*Amaranthus pumilus*; threatened), and the rufa red knot (*Calidris canutus rufa*; red knot). The District has reviewed the Service's BO and respectfully does not concur with some of the measures as written as they relate to the proposed action.

As you are aware, it is important to recognize that all our work is dependent on the availability of funding which is appropriated by Congress annually. The Service should recognize the distinction between initial construction (and scheduled renourishments) of the recommended coastal storm risk management alternative with its related construction monitoring (committed budget funds) versus annual maintenance and monitoring. The District and the Project's local sponsors will implement the Reasonable and Prudent Measures (RPM) to the best extent practible. It should be noted that given the highest degree of collaboration and agreement between the Federal, State and local agencies in this important effort, the District does not control how the State and local agencies conduct local land management practices. Following construction or re-nourishment, beach management activities will be the responsibility of the local municipality or other appropriate landowner. The Town of Hempstead for example already has a management plan in place that provides protective measures for piping plover including: establishment of protective zones; restrictions on beach maintenance and other municipal activities; and actions to reduce impacts to the local plover population from predators and humans.

After our analysis of the BO and with substantial coordination with the non-Federal and local sponsors, the District concurs, in part with some of Service's recommendations, but not all of them. To better execute the RPMs, the District requests that the Service provide a table and figures/maps that better reflects how and where the RPMs should be implemented for the listed species.

The following paragraphs specifically discuss each RPM and recommendation that the District has concerns with:

1. Pg 5, under the section *"Description of the proposed project"*, there is no mention of the 136 acres ("preservation area") the District has set aside for habitat preservation. Was this area accounted for within the BO's analysis? The District believes that the Service misinterpreted the conservation measures contained within the Biological Assessment (BA). Most of the measures were to be applied within the designated 136 acre preservation area of which the majority of the Long Beach Island piping plover population is located.

2. Pg 30, Par 4, under section *Conservation: No major construction between June 1 – November 1 to protect seabeach amaranth.* The District agrees to a no work window from March 31 to August 31 within in the 136 acre preservation area as presented in the BA. To date, the District is unaware of a total "no work window" for seabeach amaranth within the States of New York and New Jersey and has been successful in utilizing monitors and collecting seed. The District cannot concur with this conservation measure as written.

3. Pg 83, Piping Plover Conservation Measure #10. *Beach fill would not be placed within 1,000 m of known populations of piping plover or other state or federally-listed shorebirds/seabirds during the breeding season, except in the area of the terminal groin at Point Lookout:* This measure should parallel the work within New Jersey which states *"1000 m of an active nest"*.

4. Pg 83, Piping Plover Conservation Measure #11 *Implement a 200 m work zone around terminal groin 58, delineated by fencing that is impenetrable to plover chicks to minimize impacts plovers as a result of groin reconstruction activities:* The District agrees with this measure and will apply the same conservation measure for Groins A-D and the two groin rehabilitations between Groin A and the Terminal Groin at Point Lookout. The District requires this measure to be applied to these structures to ensure that there is adequate time to complete their proper construction prior to beach nourishment phase of the project.

5. Pg 92, Piping Plover RPM #2 para 7. *The Corps shall not plant beach grass west of groin D, except in the front of the residential areas noted above. Beach grass planting may lead to increases in the berm elevation and reduce the potential for ephemeral ponding and the frequency at which it occurs:* The District disagrees with this measure and will plant any dunes created within the project area. The proposed dune footprint is located in areas that are currently vegetated. The State has indicated to the District that their Coastal Erosion Hazard Area (CEHA) Program regulations require them to direct any applicant to replant a newly created dune that covers or augments an existing vegetated dune.

6. Pg 92, Piping Plover RPM #2 para 8. *In order to address habitat loss, degradation, and fragmentation in the Action Area, the Corps shall undertake habitat restoration (vegetation removal and topographical management), west of proposed groin D. The Corps shall devise a restoration plan in coordination with the Town, Nassau County, and the Service. The plan shall be finalized prior to initial construction of the project:* The District only concurs with RPM if it applies to the 136 acre "preservation area" and not the Service defined "action area" (the entire footprint of the project). This action has been identified as a maintenance feature that would be implemented by the non-Federal sponsor.

7. Pg 92, Piping Plover RPM #2 para 9. *In order to address take associated with decreases in prey resources on the oceanside, the Corps shall ensure that intensive monitoring of invertebrates in the intertidal zone, berm, and backshore is conducted based on a sampling program that has been devised in consultation with, and agreed to by, the Service prior to its implementation. The information collected during this monitoring program shall be used to adaptively manage the operation and maintenance phases of the project to further avoid and minimize take. The plan shall be finalized prior to initial construction of the project:* The District requests that the reference to benthic sampling of the backshore area be removed. The project will only be constructed on the oceanside of the barrier island. No work is occurring on the bayside.

8. Pg 92, Piping Plover RPM # 2 para 12. *The Corps shall develop a biological monitoring program for the Action Area, to be approved by the Service and implemented by the Service or Service-approved entity:* The District concurs with this measure but will be seeking to designate a third-party representative if the program is implemented.

9. Pg 93, Piping Plover RPM #2 para 13. *The Corps shall ensure that the subaerial extent of the proposed groins A-D during are covered during the construction and maintenance phases of the project to minimize habitat fragmentation and ensure plover chicks are able to traverse nesting and foraging areas:* The District concurs with this measure, but would like to define the area of the groins to be covered. Our recommendation is the following: "On April 1 of any calendar year, the newly constructed groins east of the 136 acre preservation area will be covered to the design template. The District defines this area as the 110-foot berm from the toe of the dune seaward."

10. Pg 124, 2nd Bullet (Red Knot). *The proposed time-of-year restrictions that prohibit construction during the piping plover and seabeach amaranth (April to November, inclusive), along with the 1,000-m buffer zone would minimize direct impacts to the species:* The time of year restriction should be limited to April 1 – September 1 along with a 1000m buffer when there an active nest is present or until the last piping plover chick has fledged.

11. Pg 126, RPM # 2. *Dredging submerged and emergent shoals shall be avoided to preserve beach dynamics and shorebird habitat:* The project as proposed does not describe dredging of any submerged and/or emergent shoals and request that this measure be removed from the BO.

12. Pg 127, Red Knot RPM #1 para 11. *In order to address take associated with decreases in prey resources on the oceanside, the Corps shall ensure that intensive monitoring of invertebrates in the intertidal zone, berm, and backshore is conducted based on a sampling program that has been devised in consultation with, and agreed to by, the Service prior to its implementation:* There are no backshore areas within the project description. Request that any discussion related to this be removed from your recommendations.

Acknowledging that the RPMs and the accompanying terms and conditions provided within the BO nondiscretionary and are designed to minimize incidental take of threatened and endangered species, the District requests that the Service review and concur with the above statements that clarify the District's commitment to implement the revised RPMs on our ongoing commitment to protection of federally listed species. I look forward to working with you and your staff on finalizing these RPMs and the BO. If you should have any questions, please contact Mr. Robert J. Smith of my staff at 917-790-8729.

Sincerely,

Paul E. Owen
Colonel, U.S. Army
District Engineer New York District

cc. USFWS-LIFO

United States Department of the Interior

FISH AND WILDLIFE SERVICE
3817 Luker Road
Cortland, New York 13045

March 31, 2015

Colonel Paul E. Owen
District Engineer
New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Colonel Owen:

This is in response to the your letter dated February 20, 2015, providing the U.S. Army Corps of Engineers' (Corps) comments on the endangered species conservation measures, reasonable and prudent measures (RPMs), and terms and conditions, contained in the U.S. Fish and Wildlife Service's (Service) biological opinion (Opinion) for the Corps' Jones Beach Inlet to East Rockaway Inlet, Long Beach Island, New York Coastal Storm Risk Management Project.

We believe that some of your comments may have been the result of discrepancies or contradictory statements in the Corps' Biological Assessment (BA). We have attempted to address these and discuss them further in our response that follows. In terms of the significance of the changes the Corps is requesting relative to the conservation measures, RPMs, terms and conditions, or conclusion sections of the piping plover Opinion and red knot conference opinion and their impacts on the Opinion's effects analysis, it will be necessary for the Corps to reinitiate consultation under section 7 of the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) in order to amend the Opinion. The "Reinitiation Clause" in the Opinion, (page 96; reproduced below) provides the conditions for reinitiation of consultation:

> "This concludes formal consultation on the action(s) outlined in the BA. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of

incidental take is exceeded, any operations causing such take must cease pending reinitiation."

The red knot conference opinion was developed prior to the listing of the species under the ESA. Therefore, the Corps may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation as the species has since been listed as threatened. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used in the conference, the Service will confirm the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary for this project.

Please be advised that the incidental take statement provided in the conference opinion does not become effective until the conference opinion is adopted as the biological opinion issued through formal consultation. No take of the species may occur between the listing of the species and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation.

Service Response to the Corps' Comments

Corps' Comment (1):

Pg 5, under the section "Description of the Proposed Project,": There is no mention of the 136 acres (preservation area) the District has set aside for habitat preservation. Was this area accounted for within the BO's analysis? The District believes that the Service misinterpreted the conservation measures contained within the BA. Most of the measures were to be applied within the designated 136-acre (ac) preservation area of which the majority of the Long Beach Island piping plover population is located.

Service Response:

The Service agrees that the Opinion does not refer to the 136 ac as a Corps-designated habitat preservation area. The BA did not stipulate that lands would be set aside for habitat preservation, and be managed as such by the federal government. The BA does make specific statements relative to prohibiting certain construction activities in the 136 ac, but makes no reference to protecting the areas as a preserve:

- Section 2.0 of the BA entitled, "Proposed Federal Action," states the following: "...the Project modification would result in limited construction activities originally proposed within a 136-acre shorebird nesting/foraging area which will be excluded from the Project (Table 1). The proposed Project modification would, however, result in an increase of walkover extensions and vehicle access as well as the rehabilitation of two additional groins, and the rehabilitation and extension of the east jetty."

- Section 2.1.7 of the BA, entitled, "Bird Nesting and Foraging Area," states:

  "The proposed Project modification has limited Project activities (intermitted dune repair) within a 93.4 acre ephemeral pool and a 42.3 acre tern/piping plover nesting area located in Point Lookout, near the Jones Inlet ebb shoal attachment point (Appendix J). Project activities were proposed within this area as part of the original plan that was selected in 1995. However, the USACE reevaluated proposed Project activities in direct response to concerns regarding shorebird habitat from Federal and State agencies and other interested parties (USACE 1995). As a result, construction of a beach berm within the bird nesting/foraging area has been eliminated from the proposed Project to allow for the continued unimpeded use of the area as shorebird nesting and foraging habitat. Two new groins were originally proposed within the tern/piping plover nesting area. However, based on a re-evaluation of the Project, construction of these groins has been deferred. No beach fill activities will take place within the bird foraging and nesting area."

As the land is locally-owned and managed, the Service requests clarification on the terms of habitat preservation and how the Corps plans to ensure protection of piping plover habitat in this parcel. We note that this area is also used for Town and County human recreation. While a small portion is known locally as the "sanctuary," the entire 136 ac supports a mix of human recreation and shorebird use.

Service Response to *"Was this area accounted for in the BO?"*

Yes. The Service considered the Corps' decision to eliminate initial beach nourishment within the 136 acre area during initial construction. We also considered that the 136 ac would experience adverse effects from other project features such as dune construction, beach grass planting, sand fence installation, dune walkover construction, vehicle access corridor construction, and increases in recreation. Other activities such as the construction of groins A-D, rehabilitation of the terminal and two existing groins in Point Lookout, as well as dune and beach nourishment activities proposed on adjacent beaches and their impacts to this area were also considered. The Service noted in the Opinion that future ESA consultation would be needed should the Corps opt to construct the two deferred groins in this area, due to downdrift erosional impacts stemming from construction of groins A-D (see U.S. Fish and Wildlife Service 2014b at pp 75-76).

Overall, the Service agrees with the Corps that in order to avoid adverse effects to piping plovers and their habitats, areas should be preserved and protected from large-scale beach nourishment and groin construction projects. We appreciate the Corps' project condition which eliminated beach nourishment and deferred construction of two groins in the 136 ac as part of the initial construction, but note that piping plovers also use the beaches east and west of this area. All of these considerations were factored into the Opinion.

Service Response to *"The District believes that the Service misinterpreted the conservation measures contained within the Biological Assessment (BA). Most of the measures were to be applied within the designated 136 acre preservation area of which the majority of the Long Beach Island piping plover population is located."*

The Service notes that the BA did not stipulate that conservation measures were limited to the 136 ac. Section 5.0 of the Biological Assessment, entitled "Recommendations" (U.S. Army Corps of Engineers 2014), which provides the Corps' avoidance and minimization measures, does not mention the 136 ac, but does refer to the "Project Area." We understood the project area to be defined in Section 1.3 of the BA, entitled, "Project Area Description," which states:

> "The Project Area covers approximately 6.7 miles (of which 6.4 miles represents coastal storm risk management provided by the selected plan), 35,500 linear feet (lf) of the Long Beach barrier island. The Project Area is situated within Nassau County, New York, and from east to west includes the Town of Hempstead (Point Lookout and Lido Beach), Nassau County (Nickerson Beach) and the City of Long Beach (USACE 2006)."

Overall, the Service appreciates the Corps' clarification that <u>most</u> of the conservation measures were meant to be applied to the 136-ac preservation area. The Corps should furnish additional clarification as to which measures do or do not apply to this area, should be applied elsewhere, or will be delegated to the local cost share sponsors by the Corps, when consultation is reinitiated.

<u>Corps' Comment (2)</u>:

Pg 30, Part 4, under section "Conservation": No major construction between June 1 - November 1 to protect seabeach amaranth. The District agrees to a no work window from March 31 to August 31 within in the 136 acre preservation as presented in the BA. To date, the District is unaware of a total "no work window" for seabeach amaranth within the States of New York and New Jersey and has been successful in utilizing monitors and collecting seed. The District cannot concur with this conservation measure as written.

<u>Service Response</u>:

This comment references the "Conclusion" section of the seabeach amaranth Opinion, wherein the Service determined that the proposed project would not jeopardize the continued existence of seabeach amaranth, based on a consideration of several factors. One of the factors was "the Corps will not undertake major construction activities from June to November which spans a major portion of the germination and growing period for seabeach amaranth."

As stated in the BA, Section 5 (Recommendations), subsection 5.2 (Seabeach Amaranth), No. 3, the Corps will "Restrict construction activities in areas of known populations during the growing season (allow limited activities only from June to November). This statement is supported by Section 6.0 (Conclusion) of the BA which states:

> "...impacts can largely be avoided if the period of construction is limited to periods outside of the piping plover nesting season which occurs from April 1 through September 1, **and outside of the growing season for seabeach amaranth which extends from June through November. Therefore, the USACE has incorporated these construction window recommendations, as well as other recommendations from the USFWS, into the Project construction plans** (emphasis added in bold)."

If the Corps wishes to rescind these conservation measures, then the BA should be amended and resubmitted during reinitiation of consultation.

Corps' Comment (3):

Pg 83, Piping Plover Conservation Measure No. 10: "Beach Fill would not be placed within 1,000 m of known populations of piping plover or other state or federally-listed shorebird/ seabirds during the breeding season, except in the area of the terminal groin at Point Lookout:" This measure should parallel the work within New Jersey which states "1000 m of an active nest".

Service Response:

This comment references the "Contributions of Conservation Measure Implementation Toward Minimizing Adverse Effects," section of the piping plover Opinion which provides the Corps' conservation measures to avoid and reduce impacts of the project to piping plover. The Service incorporated the 1,000 meter (m) buffer distance, which would extend from the boundaries of delineated plover breeding habitat, based on coordination with the Corps and reflected in the "Consultation History" of the Opinion:

> "November 21, 2014: The Corps agrees to implement a 1,000 m buffer for construction activities in the western portion of the Action Area. The Corps also proposes to establish a 200 m buffer around terminal groin number 58 and conduct construction activities in that location during the piping plover season."

We note that the 1,000-m buffer zone around breeding areas is consistent with the Corps' proposal for the Fire Island Inlet to Moriches Inlet Stabilization Project (FIMI), which states: "The project description indicates that construction activities will not occur during the piping plover season (April 1 to September 1) in Smith Point County Park, Fire Island Lighthouse Beach and Robert Moses State Park. Within the FIIS Communities, the Corps proposes to maintain a 1,000 m buffer between piping plover breeding areas and construction activities." (U.S. Fish and Wildlife Service 2014a at page 104).

We coordinated with the Service's New Jersey Field Office (NJFO) concerning the Corps' comment that the buffer zone "...should parallel the work within New Jersey which states 1,000 m of an active nest." We were advised by the NJFO to reference page 25 of the Service's 2002 Monmouth County, New Jersey, Programmatic Biological Opinion (PBO), which establishes the protocol for establishing buffer zones relative to nesting areas. The PBO states a nesting area is defined as "1,000 meters on either side of a site [as determined by a Service-approved field monitor (monitor) and confirmed by the Service] currently occupied by courting, territorial, incubating, or brood-rearing piping plovers, nests with eggs, or unfledged chicks, or any site so occupied during any of the most recent three nesting seasons (including the current one if territories have already been established for the year)."

Corps' comment (4):

Pg 83, Piping Plover Conservation Measure No. 11: "Implement a 200 m work zone around terminal groin 58 delineated by fencing that is impenetrable to plover chicks to minimize impacts

as a result of groin reconstruction activities." The District agrees with this measure and will apply the same conservation measure for Groins A-D and the two groin rehabilitations between Groin A and the Terminal Groin at Point Lookout. The District requires this measure to be applied to these structures to ensure that there is adequate time to complete their proper construction prior to beach nourishment phase of the project.

Service Response:

This comment refers to the section in the piping plover Opinion entitled, "Contributions of Conservation Measure Implementation Toward Minimizing Adverse Effects," which provides the Corps' conservation measures to avoid and reduce impacts of the project to piping plover as given in the BA and via further coordination with the Service.

The Corps' comment both reaffirms the commitment to implement the 200 m buffer around the terminal groin and introduces a plan to work in the plover season using a 200-m buffer to construct and rehabilitate the remaining groins in Point Lookout. The latter proposal would have to be addressed during reinitiation of consultation, as the effects of the proposed construction activities were not evaluated in the Opinion. A 200-m buffer will be inadequate and not protect plovers from disturbance. Use of this buffer zone will result in adverse effects and an increase in incidental take, which would have to be factored into the Opinion's jeopardy analysis.

We also note that the proposed change is inconsistent with the Corps' existing conservation measure found in Section 5.1 Piping Plover, No. 3, on page 31, of the BA which states, "The USACE will conduct construction activities near known plover nesting areas from September 2 through April 14 to avoid the key shorebird nesting period." In an email to the Service dated October 7, 2014, the Corps clarified the time of year restriction as April 1 to September 1. Known plover nesting areas based on New York State Department of Environmental Conservation's (NYSDEC) Long Island Colonial Waterbird and Piping Plover Survey data extend from south of the community of Point Lookout to Lido Beach Town Park West.

Corps' Comment (5):
Pg 92, Piping Plover RPM No. 2, paragraph 7: "The Corps shall not plant beach grass west of groin D, except in front of the residential areas noted above. Beach grass planting may lead to increases in the berm elevation and reduce the potential for ephemeral ponding and the frequency at which it occurs." The District disagrees with this measure and will plant any dune created within the project area. The proposed dune footprint is located in areas that are currently vegetated. The State has indicated to the District that their Coastal Erosion Hazard Area (CEHA) Program regulations require them to direct any applicant to replant a newly created dune that covers or augments an existing vegetated dune.

Service Response:

This comment refers to Terms and Conditions for RPM 2, No. 7, of the piping plover Opinion.

The Service notes that the Corps agreed to limiting beach grass plantings to the north side of the dunes for the West of Shinnecock Inlet Interim Project (U.S. Fish and Wildlife Service 2001), and observed that the Corps limited beach grass planting to the north side of the constructed dune

at the Smith Point County Park Great Gun plover restoration area. The Service believes it is appropriate to apply the same condition to this project and retains this as a term and condition.

Corps' Comment (6):

Pg 92, Piping Plover RPM No. 2, paragraph 8: "In order to address habitat loss, degradation, and fragmentation in the Action Area, the Corps shall undertake habitat restoration (vegetation removal and topographical management), west of proposed groin D. The Corps shall devise a restoration plan in coordination with the Town, Nassau County, and the Service. The plan shall be finalized prior to initial construction of the project:" The District only concurs with RPM if it apples to the 136 acre "preservation area" and not the Service defined "Action Area" (the entire footprint of the project. This action has been identified as a maintenance feature that would be implemented by the non-Federal sponsor.

Service Response:

This comment refers to Terms and Conditions for RPM 2, No. 8, of the piping plover Opinion.

This application of this term and condition can be clarified by understanding the definition and limits of the Action Area as presented in the Opinion. "Action Area" is defined by regulation as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02)."

The section of the piping plover Opinion entitled, "Environmental Baseline, Description of the Action Area," identified the Action Area as an area that extends "... from Jones Inlet west to the Lido Beach West Town Park, a distance of about 3 mi, and encompassing 74 hectares (ha) of beach habitat. This area corresponds to Corps' plan sheets numbered 8-14 found in U.S. Army Corp of Engineers (2014b)."

As noted above, the Action Area only includes 3 miles (mi) of the project area, and does not include the "entire footprint of the project," as it excludes the area from Lido Beach West Town Park to the border of the City of Long Beach and Village of Atlantic Beach, a distance of about 3.5 mi. This term and condition specifically applies to a portion of the Action Area stretching from west of groin D to Lido Beach West Town Park. If the Corps expects to limit habitat restoration to the 136 ac shorebird area, then this will need to be addressed during reinitiation of consultation.

Corps' Comment (7):

Pg 92, Piping Plover RPM No. 2, paragraph 9: "In order to address take associated with decreases in prey resources on the oceanside, the Corps shall ensure that intensive monitoring of invertebrates in the intertidal zone, berm and backshore is conducted based on a sampling program that been devised in consultation with, and agree to by, the Service prior to its implementation. The information collected during the monitoring program shall be used to adaptively manage the operation and maintenance phases of the project to further avoid and minimize take. The plan shall be finalized prior to initial construction of the project:" The

District requests that the reference to benthic sampling of the backshore area be removed. The project will only be constructed on the oceanside of the barrier island. No work is occurring on the bayside.

Service Response:

Thank you for reaffirming that the project will not have any bayside features. We understood this to be the case, but appreciate additional clarification. We used the term "backshore" to define barrier island habitats between the berm and dune. A definition can be found in several sources including the Corps' Coastal Engineering Manual EM 1110-2-1100.[1]

Corps' Comment (8):

Pg 92, Piping Plover RPM No. 2, paragraph 12: "The Corps shall develop a biological monitoring program for the Action Area to be approved by the Service and implemented by the Service or Service approved entity:" The District concurs with this measure but will be seeking to designate a third-party representative if the program is implemented.

Service Response:

This comment refers to Terms and Conditions for RPM 2, No. 12, of the piping plover Opinion.

The term and condition requires that the biological monitoring plan be implemented by the Service or a Service-approved entity. If the agencies agree to move forward with a "third-party representative," the "representative" shall be Service-approved. The Corps shall seek this approval prior to entering into any contracts or agreement. We look forward to further coordination with the Corps on implementing this term and condition.

Corps' Comment (9):

Piping Plover RPM No. 2 paragraph 13. "The Corps shall ensure that the subaerial extent of the proposed groins A-D during are covered during the construction and maintenance phases of the project to minimize habitat fragmentation and ensure plover chicks are able to traverse nesting and foraging areas:" The District concurs with this measure, but would like to define the area of the groins to be covered. Our recommendation is the following: "On April 1 of any calendar year, the newly constructed groins east of the 136 acre preservation area will be covered to the design template. The District defines this area as the 110-foot berm from the toes of the dune seaward."

Service Response:

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1 The Corps' Coastal Engineering Manual EM 1110-2-1100 defines the backshore as "The zone of the shore or beach that lies between the foreshore and the coastline comprising the berm and acted upon by the waves only during severe storms, especially when combined with high water."

Acknowledged. We anticipate that the Corps will fill the subaerial portion of the groins and conform to any NYSDEC Water Quality Certificate conditions governing the covering of the groins during the plover season at lower elevations on the foreshore. Please provide plan layout and cross-section profiles depicting this recommendation when consultation is reinitiated.

Corps' Comment (10):

Pg 124, 2nd Bullet (Red Knot): "The proposed time of year restrictions that prohibit construction during the piping plover and seabeach amaranth (April to November, inclusive) along with the 1000-m buffer zone would minimize direct impacts to the species:" The time of year restriction should be limited to April 1 - September 1 along with a 1,000-m buffer when there an active nest is present or until the last piping plover chick has fledged.

Service Response:

This reference concerns the "Conclusion" section of the red knot conference opinion. The Service does not concur with the Corps' time-of-year restriction for red knots. Red knots typically use mid-Atlantic stopovers enroute to northern breeding areas from late April through late May or early June (Cohen *et al.* 2009; Niles *et al.* 2008). Southbound red knots start arriving in July. Numbers of adults peak in mid-August and most depart by late September, although geolocators are showing some birds stay through November. Migrant juveniles begin to appear along the U.S. Atlantic coast in mid-August, occurring in much lower numbers and scattered over a much wider area than adults (Harrington 2001; Morrison and Harrington 1992).

We believe that the application of a 1,000-m buffer for red knots outside of the time of year restriction would be protective. However, we note that establishing 1,000-m buffer zone around plover breeding areas is consistent with the Corps' proposal for the Fire Island Inlet to Moriches Inlet Stabilization Project, which states: "The project description indicates that construction activities will not occur during the piping plover season (April 1 to September 1) in Smith Point County Park, Fire Island Lighthouse Beach and Robert Moses State Park. Within the FIIS Communities, the Corps proposes to maintain a 1,000-m buffer between piping plover breeding areas and construction activities." (U.S. Fish and Wildlife Service 2014, pg. 104).

We coordinated with the Service's NJFO concerning the Corps' comment that the buffer should parallel the work within New Jersey which states '1,000 m of an active nest.' We were advised to reference page 25 of the Service's 2002 Monmouth County, New Jersey, Programmatic Biological Opinion, which discusses establishing the buffer zones around nesting areas. The PBO states a nesting area is defined as "1,000 meters on either side of a site [as determined by a Service-approved field monitor (monitor) and confirmed by the Service] currently occupied by courting, territorial, incubating, or brood-rearing piping plovers, nests with eggs, or unfledged chicks, or any site so occupied during any of the most recent three nesting seasons (including the current one if territories have already been established for the year)."

Corps' Comment (11):

Pg 126, RPM No. 2: "Dredging submerged and emergent shoals shall be avoided to preserve beach dynamics and shorebird habitat:" The project as proposed does not describe dredging of any submerged and/or emergent shoals and request that this measure be removed from the BO.

Service Response:

The Service believed it was reasonable to include this measure, as we assumed that Jones Inlet will continue to be dredged in the future and as part of this project as referenced in U.S. Army Corps of Engineers (2014). The easternmost beach fill segment of the proposed project overlaps with the Point Lookout beach area that receives dredge spoil placement from Jones Inlet under a Corps' Section 933 project (Coastal Planning and Engineering, Inc. 2009). Shoals that are outside of the authorized Jones Inlet navigation channel shall not be mined for sand to provide sand for this project.

Corps' comment (12):

Pg 127, Red Knot RPM No. 1, paragraph 11: "In order to address take associated with decreases in prey resources on the Oceanside, the Corps shall ensure that intensive monitoring of invertebrates in the intertidal zone, berm and backshore is conducted based on a sampling program that has been devised in consultation with, and agreed to by, the Service prior to its implementation:" There are no backshore areas within the project description. Request that any discussion relative to this be removed from your recommendations.

Service Response:

See Comment No. 5, above.

Thank you for the opportunity to assist your agency in addressing and clarifying aspects of the Opinion and BA. If you have any questions or require further assistance, please contact Steve Papa of the Long Island Field Office at (631) 286-0485. We look forward to receiving your reinitiation package.

Sincerely,

David A. Stilwell
Field Supervisor

cc: USACE, New York District, New York, NY (P. Weppler)
NYSDEC, Region I, Stony Brook, NY (R. Marsh)

References:

Coastal Planning & Engineering, Inc. (CPE). 2009. Coastal Protection Study, City of Long Beach, New York, Oceanside Shore Protection Plan. New York, NY. 60 pp. Available

at http://www.longbeachny.gov/vertical/sites/%7BC3C1054A-3D3A-41B3-8896-814D00B86D2A%7D/uploads/%7B413002EC-E9A4-45AA-8AB7-D193D9294877%7D.PDF.

Cohen, J.B., Karpanty, S.M., Fraser, J.D., Watts, B.D., and B.R. Truitt. 2009. Residence Probability and Population Size of Red Knots During Spring Stopover in the Mid-Atlantic Region of the United States. *Journal of Wildlife Management* 73(6): 939-945.

Harrington, B.A. 2001. Red Knot (*Calidris canutus*). In The Birds of North America, No. 563 (A. Poole and F. Gill, *eds.*). The Birds of North America, Inc., Philadelphia, PA.

Morrison R.I.G. and B.A. Harrington. 1992. The Migration System of the Red Knot *Calidris canutus rufa* in the New World. *Wader Study Group Bull.* 64, suppl.: 71–84.

Niles, L.J., Sitters, H.P., Dey, A.D., Atkinson, P.W., Baker, A.J., Bennett, K.A., Carmona, R., Clark, K.E., Clark, N.A., and C. Espoza. 2008. Status of the Red Knot (*Calidris canutus rufa*) in the Western Hemisphere. *Studies in Avian Biology* 36: 1-185.

U.S. Army Corps of Engineers. 2014. Atlantic Coast of Long Island Jones Inlet to East Rockaway Inlet Long Beach Island, New York, Coastal Storm Risk Management Project, Hurricane Sandy Limited Re-evaluation Report Volume 1. Main Report and Environmental Assessment. 76 pp.

U.S. Fish and Wildlife Service. 2001. Biological Opinion on the U.S. Army Corps of Engineers' Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, Reach II: Moriches Inlet to Shinnecock Inlet, West of Shinnecock Inlet Interim Storm Damage Protection Project. 63 pp.

_____ 2014a. Biological Opinion and Conference Opinion Fire Island Inlet to Moriches Inlet Fire Island Stabilization Project Suffolk County, New York. 217 pp.

_____ 2014b. Biological Opinion and Conference Opinion on the Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, Coastal Storm Damage Risk Management Project. 165 pp.

New York State Department of Environmental Conservation
Division of Water
Bureau of Flood Protection and Dam Safety, 4th Floor
625 Broadway, Albany, New York 12233-3504
Phone: (518) 402-8185 • **FAX:** (518) 402-9029
Website: www.dec.ny.gov

Joe Martens
Commissioner

February 12, 2014

Anthony Ciorra, P.E.
Chief - Coastal Restoration and Special Project Branch
United States Army Corps of Engineers - New York District
26 Federal Plaza - Room 2119A
New York, New York 10278-0090

Re: Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, Hurricane and Storm Damage Reduction Project (Long Beach Project)

Dear Mr. Ciorra:

This letter is in response to the United States Army Corps of Engineers (Corps) request for their non-federal sponsor, New York State Department of Environmental Conservation (Department), to provide a letter of support to move the subject project to the next step in obtaining Corps approval of the Hurricane Sandy Limited Reevaluation Report (HSLRR). The Department reaffirms its support of the Long Beach Project, as stated in its June 24, 2013 letter to Mr. Eugene Brickman, and supports the recommendations included in the Hurricane Sandy Limited Reevaluation Report (HSLRR) for the Long Beach Project.

The Department continues to work with the Corps in moving this project forward and is anticipating the finalization of the HSLRR by the Corps in an expedited manor in order to move into construction as soon as possible and provide the much needed protections for these communities which this project will bring. The Department continues to provide the necessary staffing and support to move the Long Beach Project into Design and Construction. If you have any questions, please contact the Project Manager, John Scudder, by telephone at (518) 402-7082 or email at jsscudde@gw.dec.state.ny.us.

Sincerely,

Alan A. Fuchs, P.E.
Director
Bureau of Flood Protection and Dam Safety

ec: E. Brickman, USACE
S. Couch, USACE
J. LaCarruba, City of Long Beach
R. Master, Town of Hempstead
T. Kelly, County of Nassau

ec: P. Scully, NYSDEC Reg.1
S. McCormick, NYSDEC
A. Servidone, NYSDEC
J. Scudder, NYSDEC

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

REPLY TO
ATTENTION OF

Planning Division

March 14, 2013

Jack Schnirman
City Manager
One West Chester Street
Long Beach, NY 11561

Dear Mr. Schnirman,

On Friday, March 8, 2013, a meeting was held at the City of Long Beach to discuss the path forward for the Atlantic Coast of Long Island, Jones Inlet to Rockaway Inlet, Long Beach Island, New York Hurricane and Storm Damage Reduction Project ("the Long Beach Project"). Representatives from the U.S. Army Corps of Engineers – New York District (USACE), New York State Department of Environmental Conservation (NYSDEC), City of Long Beach, Town of Hempstead, and Nassau County were in attendance.

In 2012, USACE was diligently working on a modified plan that included a beach berm and dune that afforded a level of risk reduction within 20% of the 1995 authorized plan. This plan forward was in accordance with USACE guidance for a Limited Reevaluation Report (LRR).

On October 29, 2012, the City of Long Beach was significantly impacted by Hurricane Sandy and its record setting storm surge and wave heights. Hundreds of structures were either damaged or destroyed. Work on the LRR was put on hold as the District assisted with storm recovery responsibilities.

On January 29, 2013, President Obama signed the Hurricane Sandy Disaster Relief Appropriations Act (P.L. 113-2) to assist state and local governments with recovery. Although final implementation guidance has not yet been received, it is interpreted by the USACE that the Act allows for construction of projects that have been previously authorized, as long as it is the previously authorized plan that is recommended for implementation.

The recommended plan from the 1995 Feasibility Study included 41,000 linear feet of beach fill and generally extended from the eastern end of the barrier island at Point Lookout to Yates Avenue in East Atlantic Village where the plan tapered into the existing shoreline in Atlantic Beach. This plan consisted of:

- a dune with a top elevation of + 15 ft above NGVD, a top width of 25 ft, and landward and seaward slopes of 1V:5H;
- a beach berm extending 110 ft from the seaward toe of the recommended dune at an elevation of +10 ft NGVD, thus gradually sloping approximately between 1V:25H and 1V:35H to match the existing bathymetry;
- a total sand quantity of 8,642,000 cy for the initial beach fill placement, including tolerance, overfill and advanced nourishment;
- planting of 29 acres dune grass and installation of 90,000 linear ft of sand fence;
- 16 dune walkovers and 13 timber ramps for boardwalk access, and 12 vehicle access ramps over the dunes;
- 6 new groins at the eastern end of the island
- rehabilitation of 16 of the existing groins, including the rehabilitation of 640 ft of the existing revetment on the western side of Jones Inlet;
- advanced nourishment to ensure the integrity of the initial beach fill design; and

- periodic nourishment of approximately 2,111,000 cy of beach fill material at 5 year intervals for the 50 year life of the project.

It is the position of the USACE that very minor modifications will be allowed to be made to the 1995 authorized plan and recommended in the LRR because they deal primarily with changes to the project alignment. The recommended plan will include 29,000 linear feet of beach fill and generally extends from the eastern end of the barrier island at Point Lookout to the western boundary of the City of Long Beach, with an incidental taper to Capri Drive East in East Atlantic Beach. Since the project was authorized for construction in 1996, both the Village of Atlantic Beach and East Atlantic Beach decided to drop out of the project.

The allowable modifications to the 1995 authorized plan will be as follows:

- Remove the 15 ft wide dune maintenance pathway between the front of the boardwalk and the landward slope of the dune and position the dune directly in front of the boardwalk.
- Construct the beach berm with a step to help alleviate scarping at the water line. The beach berm will extend 40 ft at an elevation of +10 ft NGVD, slope 20 ft at 1V:10H to +8 ft NGVD and extend 120 ft at an elevation of +8 ft NGVD to slope into the water.
- The slope of the beach berm into the water will be reduced from 1V:35H to 1V:30H, which better matches the existing beach slope (based upon 2010 surveys).
- The advanced nourishment will not be placed in the City of Long Beach since the shoreline has stabilized since completion of the 1995 authorized plan. The shoreline is still very low leaving the City of Long Beach vulnerable to inundation.
- A bird nesting and foraging area (5,000 ft) for piping plovers and least terns (within the Town of Hempstead) will be created. Beach fill will not be placed in this area if equivalent protection is provided.

Based upon the allowable modifications listed above, the quantity of sand planned for placement is expected to be considerably less than what was recommended in the 1995 authorized plan and is being calculated using the latest available beach surveys. It is anticipated that sand will be placed in the surf zone and there will be some coverage of the existing groins; however the potential impact has been reduced from that of the 1995 authorized plan.

After you carefully review what has been laid out in this letter, please provide a letter to the NYSDEC clearly stating your intentions regarding the Long Beach Project. We look forward to working with the City of Long Beach to finalize the LRR and move the project closer to construction. If you have any questions about the content of this letter or the intended path forward, please do not hesitate to contact the Project Manager, Ronald Pinzon at 917-790-8627 or by email at ronald.r.pinzon@usace.army.mil or the Project Planner, Donald E. Cresitello at 917-790-8608 or by email at donald.e.cresitello@usace.army.mil.

Sincerely,

Eugene Brickman, P.G.
Deputy Chief, Planning Division

Cf:
Fuchs
McCormick
Scully
Masters
Arnold
LaCarrubba

TOWN OF HEMPSTEAD
DEPARTMENT
OF
CONSERVATION & WATERWAYS
LIDO BOULEVARD
P.O. BOX 180
POINT LOOKOUT, N.Y. 11569-0180
(516) 431-9200

FAX 516-431-0088

FACSIMILE (FAX) TRANSMITTAL LETTER

DATE: 4/4/13

COMPANY: NYSDEC

ATTN: Anna Servidone

TOTAL NUMBER OF PAGES SENT (INCLUDING THIS COVER SHEET 2

COMMENTS:

SENT BY: Comm. Ron Masters

CASE NO. 25252 RESOLUTION NO. 312-2013

Adopted: March 19, 2013

Supervisor Murray offered the following resolution and moved its adoption:

RESOLUTION AUTHORIZING THE TOWN OF HEMPSTEAD TO ENTER INTO A COOPERATIVE PROJECT WITH THE FEDERAL GOVERNMENT, THE STATE OF NEW YORK, AND OTHER INVOLVED MUNICIPALITIES FOR THE DESIGN AND CONSTRUCTION OF THE LONG BEACH ISLAND STORM DAMAGE REDUCTION PROJECT

WHEREAS, the Town Board of the Town of Hempstead fully supports the Long Beach Island Storm Damage Reduction Project ("the Project"):

NOW, THEREFORE, BE IT

RESOLVED, that the Town of Hempstead will enter into a project cooperation agreement with the State of New York and any other necessary party for the purpose of proceeding with design and construction of the Project, including the grant of all rights of entry; and, BE IT FURTHER

RESOLVED, that the Town will provide all lands, easements and rights-of-way for the construction of the project, periodic renourishment, inspection, and, if necessary for the purposes of operating, maintaining, repairing, replacing or rehabilitating the Project or a functional portion of the project; and, BE IT FURTHER

RESOLVED, that the Town will operate, maintain, repair and rehabilitate the completed project or functional portion of the project, and provide public access to the entire constructed Project or functional portion of the Project.

The foregoing resolution was seconded by Councilman Santino and adopted upon roll call as follows:

AYES: SIX (6)

NOES: NONE (0)

84/204

RESOLUTION NO. 84- 2013

A RESOLUTION AUTHORIZING THE COUNTY EXECUTIVE TO ENTER INTO A PROJECT PARTNERSHIP AGREEMENT WITH THE STATE OF NEW YORK TO PROCEED WITH THE DESIGN AND CONSTRUCTION OF THE ATLANTIC COAST OF LONG ISLAND, JONES INLET TO ROCKAWAY INLET, LONG BEACH ISLAND, NEW YORK HURRICANE AND STORM DAMAGE REDUCTION PROJECT (THE "LONG BEACH PROJECT")

D FORM
ttorney

STATE OF NEW YORK
COUNTY OF NASSAU } ss.:

Issued to: *COMPTROLLER/TREASURER*

I, WILLIAM J. MULLER III, *Clerk Of the Legislature of the County of Nassau, do hereby certify that the foregoing is a true and correct copy of the original* Resolution 84-13 *duly passed by the Nassau County Legislature, Mineola, New York, on* Monday, May 20, 2013 *and approved by the County Executive on* Thursday, May 23, 2013 *and on file in my office and recorded in the record of proceedings of the Nassau County Legislature and is the whole of said original.*

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of said Nassau County Legislature

This 20 th *day of* June,

in the Year two thousand and 13.

WILLIAM J. MULLER III

Clerk of the Legislature
County of Nassau
Ninth Legislature

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access
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84204

RESOLUTION NO. 84- 2013

A RESOLUTION AUTHORIZING THE COUNTY EXECUTIVE TO ENTER INTO A PROJECT PARTNERSHIP AGREEMENT WITH THE STATE OF NEW YORK TO PROCEED WITH THE DESIGN AND CONSTRUCTION OF THE ATLANTIC COAST OF LONG ISLAND, JONES INLET TO ROCKAWAY INLET, LONG BEACH ISLAND, NEW YORK HURRICANE AND STORM DAMAGE REDUCTION PROJECT (THE "LONG BEACH PROJECT")

APPROVED AS TO FORM
Deputy County Attorney

Passed by Nassau County Legislature on
5/20/13 **A voice vote was taken with** 18
Legislators present.
Voting: aye 18 **, nay** 0 **, abstained** 0 **, recused** 0
Became a resolution on 5/23/13
With the approval of the County Executive

WHEREAS, the County of Nassau supports the selected alternative from the 1995 Feasibility Plan for Long Beach Island Storm Damage Reduction Project (the "Long Beach Project"); and

WHEREAS, this Project requires the approval and support of the County, the City of Long Beach and the Town of Hempstead; and

WHEREAS, the County desires to enter into a Project Partnership Agreement with the New York State Department of Environmental Conservation (NYSDEC) in partnership with the U.S. Army Corps of Engineers (the "Corps") to proceed with the design and construction of the Long Beach Project; and

WHEREAS, the County will provide NYSDEC and the Corps with all access easements and rights-of-way for the construction of the Project, periodic re-nourishment,

inspections and, if necessary for the purpose of operating, maintaining, repairing, replacing or rehabilitating the Project or functional portion of the Project with the County's jurisdiction; and

WHEREAS, the County will obtain all necessary real estate title and easements required to ensure adequate public access to the constructed Project within the County's jurisdiction through the preparation of a Public Access Plan; and

WHEREAS, the County will operate and maintain the completed Project or functional of the Project under the County's jurisdiction; and

WHEREAS, the County is committed to supporting this Project and assisting NYSDEC and the Corps in its share of the cost of this effort, if necessary; now, therefore, be it

RESOLVED, that the County Executive is authorized to enter into a Project Partnership Agreement with the NYSDEC for the Long Beach Project; and be it further

RESOLVED, that it is hereby determined, pursuant to the provisions of the State Environmental Quality Review Act, 8 N.Y.E.C.L. section 0101 et seq. and its implementing regulations, Part 617 of 6 N.Y.C.R.R., and Section 1611 of the County Government Law of Nassau County, that this renaming is a "Type II" Action within the meaning of Section 617.5(c) of 6 N.Y.C.R.R. and, accordingly, is of a class of actions which do not have a significant effect on the environment; and no further review is required.

APPROVED

County Executive

DATE 5/23/2013

New York State Department of Environmental Conservation
Division of Water
Bureau of Flood Protection and Dam Safety, 4th Floor
625 Broadway, Albany, New York 12233-3504
Phone: (518) 402-8185 • **FAX:** (518) 402-9029
Website: www.dec.ny.gov

Joe Martens
Commissioner

June 24, 2013

Eugene Brickman, P.G.
Deputy Chief, Planning Division
United States Army Corps of Engineers
New York District
26 Federal Plaza
New York, New York 10278

Re: Atlantic Coast of Long Island, Jones Inlet to Rockaway Inlet, Long Beach Island, New York, Hurricane and Storm Damage Reduction Project (Long Beach Project)

Dear Mr. Brickman:

It was a pleasure meeting with the United States Army Corps of Engineers (Corps), the City of Long Beach (City), the Town of Hempstead (Town) and Nassau County (County) representatives on March 8, 2013. During the meeting the New York State Department of Environmental Conservation (Department) agreed to support completion of the Limited Reevaluation Report (LRR) for the Long Beach Project, provided that the City, the Town and the County submit resolutions authorizing them to enter into a project cooperation agreement with the Department for Design and Construction of the Long Beach Project and to fulfill their responsibilities as the local sponsors.

With the resolutions (enclosed) that the Department received from the City, Resolution No. 42/13, dated March 19, 2013; from the Town, Resolution No. 312-2013, dated March 19, 2013; and from the County, Resolution No. 84-2013, dated May 20, 2013 authorizing the City, the Town and the County to enter into a project cooperation agreement with the Department for the Design and Construction of the Long Beach Project and with the parties' willingness to provide lands, easements and rights-of-way for the Long Beach Project; to operate and maintain the Long Beach Project; and to provide public access to the constructed Long Beach Project, the Department is in support of completing the LRR.

The Department is looking forward to working with the Corps to finalize the LRR and move the Long Beach Project into Design and Construction. If you have any questions, please contact the Project Manager, Anna Servidone, at (518) 402-8147 or axservid@gw.dec.state.ny.us.

Sincerely,

Alan A. Fuchs, P.E., Director
Bureau of Flood Protection and Dam Safety

Enclosures
cc w/Encls.: R. Pinzon, USACE
J. LaCarruba, City of Long Beach
R. Masters, Town of Hempstead
K. Arnold, County of Nassau
P. Scully, NYSDEC
S. McCormick, NYSDEC
A. Servidone, NYSDEC

DIVISION OF WATER
RECEIVED
MAR 25 2013
BUREAU OF WATER COMPLIANCE

City of Long Beach

ONE WEST CHESTER STREET
LONG BEACH, NEW YORK 11561

TEL: (516) 431-1011
FAX: (516) 431-5008

JAMES LACARRUBBA
COMMISSIONER OF PUBLIC WORKS

March 22, 2013

Ms. Susan McCormick, P.E.
Chief, Coastal Erosion Management Section
NYSDEC
625 Broadway, 4th Floor
Albany, New York

Re: Resolution authorizing a Project Partnership Agreement with the City of Beach, NYSDEC and U.S. Army Corps of Engineers

Dear Ms. McCormick:

The City of Long Beach is pleased to submit the enclosed City of Long Beach Resolution for the above stated project

Please contact me if you have any questions; I look forward to working with you on this project.

Sincerely,

James LaCarrubba

JL/cm
Enc.

cc: Jack Schnirman, City Manager

March 19, 2013

Item No. 9
Resolution No. 42/13

DIVISION OF WATER
RECEIVED
MAR 25 2013
BUREAU OF WATER COMPLIANCE

The following Resolution was moved by Mr. Torres and seconded by Pres. Mandel :

Resolution Authorizing the City Manager to Enter into a Project Partnership Agreement with the State of New York to Proceed with Design and Construction of the Atlantic Coast of Long Island, Jones Inlet to Rockaway Inlet, Long Beach Island, New York Hurricane and Storm Damage Reduction Project (the "Long Beach Project").

WHEREAS, the City of Long Beach supports the selected alternative from the 1995 Feasibility Plan for Long Beach Island Storm Damage Reduction Project (the "Long Beach Project"); and

WHEREAS, this Project requires the approval and support of the City of Long Beach, the Town of Hempstead and County of Nassau; and

WHEREAS, the City of Long Beach desires to enter into a Project Partnership Agreement with New York State Department of Environmental Conservation ("NYSDEC") in partnership with the U.S. Army Corps of Engineers ("Corps") to proceed with the design and construction of the Long Beach Project; and

WHEREAS, the City of Long Beach will provide the NYSDEC and the Corps all access easements and rights-of-way for the construction of the Project, periodic re-nourishment, inspections and if necessary, for the purposes of operating, maintaining, repairing, replacing or rehabilitating the Project or functional portion of the Project within the City limits; and

WHEREAS, the City of Long Beach will obtain all necessary real estate title and easements required to ensure adequate public access to the constructed Project within the City limits through the preparation of a Public Access Plan; and

WHEREAS, the City of Long Beach will operate and maintain the completed Project or functional portion of the Project within the City limits; and

WHEREAS, the City of Long Beach has committed to supporting this Project and assisting the State and the Army Corps in its share of the cost of this effort, if necessary; and

NOW, THEREFORE, be it

RESOLVED, that the City Council, as Lead Agency for the City of Long Beach, hereby adopts this Resolution and determines that this Project Partnership Agreement constitutes a Type II action pursuant to SEQRA; and be it further

RESOLVED, by the City Council of the City of Long Beach, New York that the City Manager be and he hereby is authorized to enter into a Project Partnership Agreement with the NYSDEC for the above said Project.

APPROVED:

City Manager

APPROVED AS TO FORM & LEGALITY:

Corporation Counsel

VOTING:

Council Member Adelson	-	AYE
Council Member Goggin	-	AYE
Council Member McLaughlin	-	AYE
Council Member Torres	-	AYE
President Mandel	-	AYE

A TRUE COPY
DATED, LONG BEACH, N.Y.
3/21/13

CITY CLERK

CITY OF LONG BEACH

1 WEST CHESTER STREET
LONG BEACH, NEW YORK 11561
(516) 431-1001
FAX: (516) 431-1389

JACK SCHNIRMAN
CITY MANAGER

December 14, 2012

Department of Environmental Conservation
Peter A. Scully, Regional Director
SUNY @ Stony Brook
50 Circle Road
Stony Brook, New York 11790-3409

Al Fuchs, Director
Division of Water
Bureau of Flood Protection and Dam Safety
625 Broadway
Albany, New York 12233-3504

Dear Sirs:

Enclosed please find for your records a true copy of the Long Beach City Council Resolution No. 141/12, duly passed on December 4, 2012, affirming that the City of Long Beach supports moving forward with a U.S. Army Corps of Engineers Storm Damage Reduction Project for Long Beach for the next phase including development of plans and specifications for construction.

Sincerely,

Jack Schnirman
City Manager

RECEIVED
BUREAU OF
DEC 20 2012
FLOOD PROTECTION
AND DAM SAFETY

December 4, 2012

Item No. 11
Resolution No. 141/12

The following Resolution was moved by Mr. Fagen and seconded by Pres. Torres :

Resolution Affirming that the City of Long Beach Supports Moving Forward with a U.S. Army Corps of Engineers Storm Damage Reduction Project for Long Beach for the Next Phase Including Development of Plans and Specifications for Construction.

WHEEAS, the City of Long Beach wishes to re-invite the U.S. Army Corps of Engineers to work with us in recovering from Hurricane Sandy; and

WHEREAS, on May 4, 2006, the City of Long Beach unanimously defeated a resolution to authorize participation in the U.S. Army Corps of Engineers Storm Damage Reduction Project for Long Beach, thus declining further participation at that time and ; and

WHEREAS, the City of Long Beach sustained extensive damage as a result of coastal flooding and wave impacts due to Hurricane Sandy, losing five feet in elevation of sand on the beaches and the high tide is now 25 feet from the boardwalk versus 125 feet prior to the storm and the City remains vulnerable to future storms due to substantial beach dune erosion caused by Hurricane Sandy; and

WHEREAS, the City of Long Beach recognizes and is increasingly concerned over the impacts of global climate change and volatility, rising sea levels and the potential for more frequent and/or more intense coastal storms and hurricanes; and

WHEREAS, the City of Long Beach is greatly concerned for increased flood risks and related damages and the associated nature demonstrated vulnerability that threatens the protection of the life and health of the residents of Long Beach from both the Atlantic Ocean and Reynolds Channel; and

WHEREAS, nothing in this resolution commits the City of Long Beach to funding the project at this time or in the future and the City of Long Beach will be required to enter into a mutually agreeable cost-sharing agreement with the New York State Department of Environmental Conservation as the local sponsor in order to construct the project and the City will bring positives to the table while ensuring that the public safety needs of Long Beach are met;

NOW, THEREFORE, be it

RESOLVED, that the City Council of the City of Long Beach, New York hereby affirms their support and re-invites the U.S. Army Corps of Engineers to work in a positive manner towards a Storm Damage Reduction Project for the City of Long Beach moving forward for the development of plans and specifications for construction.

A TRUE COPY
DATED, LONG BEACH, N.Y.
12/14/12
CITY CLERK

RECEIVED
BUREAU OF
DEC 20 2012
FLOOD PROTECTION
AND DAM SAFETY

APPROVED:

Commissioner of Public Works

APPROVED AS TO ADMINISTRATION:

City Manager

APPROVED AS TO FORM & LEGALITY:

Corporation Counsel

VOTING:

Council Member Adelson	-	AYE
Council Member Fagen	-	AYE
Council Member Mandel	-	AYE
Council Member McLaughlin	-	AYE
President Torres	-	AYE

Atlantic Coast of Long Island
Jones Inlet to East Rockaway Inlet

Long Beach Island, New York
Hurricane and Storm Damage Reduction
Hurricane Sandy Limited Reevaluation Report

Appendix B:

Engineering and Design

U.S. Army Corps of Engineers
New York District

June 2015

APPENDIX B
ENGINEERING DESIGN

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Section 1

Description of the 1995 Feasibility Report Recommended Plan

1. The 1995 Feasibility Report Recommended Plan is a beach fill plan which is characterized by a 110 ft wide beach berm at an elevation of +10 ft above NGVD (+9 ft NAVD), and a dune system with a top elevation of +15 ft NGVD (+14 ft NAVD). The plan includes approximately 41,000 linear feet of beach fill which extends from the easternmost end of the barrier island at Point Lookout to Yates Avenue in East Atlantic Village, where the recommended plan tapers into the existing shoreline in Atlantic Village. Details of the Feasibility Report Recommended Plan are shown on Figures 1-1 through 1-12 and itemized below.

2. The 1995 Recommended Plan includes the beach fill for Plan 5 in the February 1995 Feasibility Report. The components of the beach fill include:

a) Dune: Crest elevation of +15 ft NGVD (+14 ft NAVD) for a crest width of 25 ft with 1 on 5 side slopes on the landward and seaward sides; a 15 to 25 ft maintenance area is included landward of the dune.

b) Berm: Extending 110 ft from the seaward toe of the dune at an elevation of +10 ft NGVD (+9 ft NAVD) with a shore slope of 1 on 25 for the easternmost 5,500 lf of the project, thence transitioning to a 1 on 35 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 29 acres of planting dune grass and 90,000 lf of sand fence for dune sand entrapment.

e) 16 dune walkovers and 13 timber ramps for boardwalk access, and 12 vehicle access ramps over the dune, plus relocation of 1 lifeguard station and timber retaining walls around six (6) at-grade comfort stations.

f) 6 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.

g) Rehabilitation of 16 of the existing groins, including rehabilitation of 640 ft of the existing revetment on the western side of Jones Inlet.

h) Renourishment of approximately 2,111,000 cy of sand fill from the offshore borrow area every 5 years for the 50 year project life. 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 of the barrier island of Long Beach.

i) To properly assess the functioning of the 1995 Feasibility Report Recommended 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.

Section 2

Technical Reanalysis of the Shoreline Stabilization Measures Eastern Portion of Long Beach Island, New York

2.1 Introduction

3. Long Beach Island, New York, located on the south shore of Long Island, was the subject of a Feasibility Study that was completed by the New York District in 1995. The study was performed to determine shoreline stabilization measures for the length of the barrier island, which borders Jones Inlet at its eastern end and East Rockaway Inlet at its western end as shown in Figure 2-1. The recommended plan from that study included the construction of six new rubble mound groins and beach nourishment along the eastern portion of the island shown in Figure 2-2.

4. Local residents and 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. Local interests requested a reanalysis of the groin field and shoreline west to the border of the City of Long Beach known as Lido Beach.

5. A second area of concern was identified based on a changed shoreline condition since the Feasibility Study in 1995. Significant accretion has taken place in the western portion of the reanalysis area, especially in the area of the ebb shoal attachment point (herein also called the ebb shoal “weldment”). The weldment area location is shown on Figure 2-1. However, to the east of the weldment, beach erosion has continued, increasing the potential for flooding and other types of storm damage including endangering the shorefront bath house and parking facilities.

6. This report includes the reanalysis of approximately half (18,000 lf) of the total Long Beach project area extending from Jones Inlet to the vicinity of the eastern boundary of the City of Long Beach, done in 1998-2000. Design conditions were updated using recently collected monitoring data from the Atlantic Coast of New York Monitoring Project (ACNYMP) and field measurements collected as part of this Reanalysis. Numerical modeling of shoreline changes for both without-project conditions and numerous engineering alternatives were performed using both U.S. Army Corps of Engineers software and a system developed by the Danish Hydraulic Institute.

7. Three central coastal processes issues were evaluated. The first issue is the degree of stability of the shoreline position in Lido Beach. During recent years significant accretion has taken place in the western portion of the Lido Beach/Hempstead Beach portion of the project area, especially in the area of the ebb shoal attachment point, the weldment. 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 1933, Lido Beach has experienced a noticeable degree of shoreline stability and has accreted as sand from the ebb shoal attachment point and the beach fills has been transported to the west. Only in the extreme western portion of Lido Beach has there been slight shoreline recession since 1990. The numerical modeling performed in this reanalysis effort has been calibrated to reproduce those historical trends.

8. The second issue is the bypassing of sediment from Jones Beach into the Jones Inlet ebb shoal and westward to the shoreline on Long Beach Island.

9. The third issue is the process by which erosion occurs between the ebb shoal attachment point and Jones inlet.

10. These central coastal processes issues were evaluated using more advanced numerical modeling tools and expanded physical data from the area that became available after completion of the Feasibility Study.

2.2 Data Sources and Processes

11. Since the completion of the 1995 Feasibility Study, considerable data have been obtained that verify, supplement, or displace the perceived understanding of beach conditions and coastal processes at the project site. The new data, provided by the New York District, and data developed as a part of this study are described in the following paragraphs:

12. **2.2.1 Sand Placements**. The project area including Point Lookout, Hempstead Beach and Lido Beach has received beach nourishment on numerous occasions since the early 1950's. A summary of these events is shown in Table 2-1.

Table 2-1
Sand Placement Summary

Year	Hempstead/Point Lookout	Hempstead Beach (Offshore)	Lido Beach
1956			100,000
1962			40,000
1973	454,000		
1979		227,000	
1980	157,000		
1982	216,000		
1985	266,000		
1987		504,000	
1990	387,000		
1994	703,000		
1996	458,900		
Total 1956-1996	2,641,900	731,000	140,000

13. **2.2.2 Shoreline Position Data.** In order to investigate the shoreline changes in the study area, recent aerial photography was obtained along with available mean high water shoreline maps dating back to 1909. Mean high water shoreline positions from these sources were then compiled in a historical shoreline change map using the May 1998 topographical survey as a base map. The resulting historical shoreline map is shown in Figure 2-3. Analysis of Figure 2-3 indicates a significant variability in the shoreline position in the Point Lookout and Hempstead Beach area with increasing stability in shoreline position moving to the west into Lido Beach and Long Beach. Analysis of the more recent shorelines from 1990 to 1998 identifies the development of the weldment in the Hempstead Beach area which is believed to be the result of sand bypassing from the Jones Inlet area.

14. **2.2.3 Beach Profiles.** Beach profile data are available from 1991 to 1997 along the study area. Proceeding from west to east, Figures 2-4 to 2-9 illustrate the variation of each beach profile over the 7-year period. A spring profile is denoted with a .s extension (with the year of the survey) and a fall profile is denoted with a .f extension (with the year of the survey). The figures illustrate beach profile shapes and characteristics that have been relatively constant at profiles 180-200 except for post-winter recession of the berm and the presence of a typical offshore bar. The profiles within the weldment area, profiles 160-172, exhibit accretion at the beach face and berm as the weldment has grown and widened.

15. The examination of beach profile data suggests that west of the ebb shoal attachment (weldment) area, west of profile 182, the beach profiles exhibit relatively constant features and shapes both spatially and temporally. However, since 1992, the weldment area has accreted and widened considerably, increasing the storm protection. East of profile 160, tidal currents dominate the coastal processes. This process is not represented using the representative beach profiles or numerical modeling analyses presented in the Feasibility Study.

16. **2.2.4 Wave Data**. The Feasibility Study (1995) utilized the 20-year time series of hindcasted wave heights, periods and angles from the Wave Information Study (WIS) station 73 for the period 1956-1975 (Hubertz et al. 1993). This station is location at 40.50 degrees North Latitude and 73.75 degrees West Longitude in about -18m water depth. These data were used for shoreline change modeling as well as for estimated extreme storm wave heights up to the 500-year level. The data were developed at 3-hour intervals. The updated WIS hindcast for the period 1976-1993 was not available at the time of the Feasibility Study. The WIS data sets had very little validation against measured data, especially in the Long Island area. NOAA buoy 44025 was installed in 1991 at a location approximately 20 miles south of Fire Island Inlet and measures waves that are representative of incident conditions off the coast of Long Beach Island. The buoy is located at about 40.25 degrees North Latitude and 73.30 degrees west Longitude, or about 38 nautical miles southeast of WIS station 73.

17. A comparison of the bulk wave parameters reported by the buoy for the 1991-1997 time period with the wave statistics used in the Feasibility Study are shown in Tables 2-2 and 2-3. The comparison tables indicate the following:

- The measured mean annual wave heights are about 25% higher than in the Feasibility Study
- The measured mean annual peak wave periods are about 1.3 seconds less than in the Feasibility Study
- The range of measured mean annual wave directions are essentially the same as in the Feasibility Study
- Every measured maximum annual wave height except one exceeds the Feasibility Study maximum annual wave height while peak periods are about the same as in the Feasibility Study
- Measured wave directions exhibit a greater percentage of occurrences from the easterly quadrants than in the Feasibility Study, possibly indicating a higher longshore sediment transport rate to the west.

Table 2-2 Comparison of Wave Statistics at Buoy 44025 to Feasibility Study						
Year	Mean Wave Height Hmo (m)	Mean Sqrt (Energy) (m)	Mean Wave Period (s)	Mean Direction (deg, to, N)	Max Hmo (m)	Assoc. T (s)
1991	**1.13**	**1.34**	**6.70**	**137.5**	**5.80**	**16.70**
1992	**1.21**	**1.45**	**6.93**	**125.9**	**9.30**	**12.50**
1993	**1.23**	**1.46**	**7.10**	**131.7**	**7.30**	**14.30**
1994	**1.22**	**1.45**	**7.11**	**140.3**	**7.40**	**11.10**
1995	**1.29**	**1.46**	**7.54**	**150.5**	**4.60**	**9.10**
1996	**1.29**	**1.50**	**7.63**	**136.9**	**7.24**	**11.11**
1997	**1.28**	**1.48**	**7.03**	**145.7**	**5.72**	**10.00**
1991-1997	**1.25**	**1.46**	**7.18**	**138.2**	**9.30**	**12.50**
Feasibility Study	**1.0**	**--**	**8.40**	**135-150**	**5.70**	**12.50**
Hindcast for this Report	**1.3**	**--**	**7.14**	**135-150**	**9.1**	**12.50**

Table 2-3 Comparison of Wave Direction at Buoy 44025 to Feasibility Study								
Direction Band	0 (N)	45 (NE)	90 (E)	135 (SE)	180 (S)	225 (SW)	270 (W)	315 (NW)
44025 1991-97	**2.0**	**3.3**	**20.4**	**29.3**	**22.3**	**8.7**	**8.8**	**4.6**
Feasibility Study	**5.7**	**2.5**	**6.6**	**37.1**	**22.2**	**5.4**	**9.9**	**10.6**
Hindcast for this Report	**2.5**	**3.5**	**17.0**	**31.8**	**21.0**	**10.4**	**9.9**	**3.9**

18. **2.2.5 Stage-Frequency Curves.** Extreme water levels were required as input parameters for cross-shore transport and flooding analysis in the Feasibility Study. Total water levels (storm surge plus astronomical tide) for the 1995 Feasibility Study were extracted from the astronomical tide and surge database produced during the New York District's Fire Island to Montauk Point (FIMP) study (Butler and Prater 1986, Butler and Hardy 1986, Prater et al. 1984). This work was developed by the USACE Waterways Experiment Station. The Technical Reanalysis Report (USACE 2000) presents a comparison of the Feasibility Study and an interim

product from a detailed reanalysis of the frequency of extreme water levels along the southern shore of Long Island also performed for the New York District's Fire Island to Montauk Point Reformulation Study (FIMP). Stage-frequency data presented in the Technical Reanalysis has been superseded by final results of the FIMP frequency analysis completed in August 2005.

19. A comparison of 2005 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. Table 2-4 gives comparative stage-frequency values.

Table 2-4: Comparison of 1995 and 2005 Stage-Frequency Data

	Still Water Level (no wave set-up)		Still Water Level (with wave set-up)	
	Originial	Updated	Originial	Updated
Return Period	1985 FIMP	2005 FIMP (1)	1985 FIMP	2005 FIMP (2)
(years)	ft NGVD	ft. NGVD	ft NGVD	ft. NGVD
2	5.6	5.25	7	7.4
5	6.1	5.81	7.6	8.5
10	6.6	6.66	8.4	8.75
20	7.4	7.66	9.2	9.5
50	8.9	8.85	10.8	10.9
100	10.1	9.94	12.1	12.4
200	11.4	10.78	13.6	13.5
500	13	11.81	15.3	15.1
(1) FIMP 2005 results, node 55 Long Beach (ocean) combined 50%tile, adjusted to 2000SLR				
(2) Nearest FIMP 2005 node with calculated set up: node 41, 95%tile wave setup				

20. **2.2.6 Lido/Hempstead Long Term Erosion Rates Up to 1998.** The Technical Reanalysis examined long term erosion rates for the Lido/Hempstead reach up to the year 1998. Figure 2-3, showing the Mean High Water shorelines in the study area from 1909 to 1998, was analyzed to develop long-term erosion rates for three regions in the area. Region 1, 2,550 ft in length, consists of the three-groin region adjacent to Jones Inlet. Region 2, 5,000 ft in length, consists of the Hempstead Park shoreline. Region 3, 11,000 ft in length, consists of the Lido Beach shoreline. Annual shoreline change rates were developed for various time periods as shown in Figure 2-11 to 2-15. A summary of the shoreline change rates by region is presented in Table 2-5.

Table 2-5
Shoreline Change Summary

	Point Lookout	Hempstead Beach	Lido Beach
Time Period			
1909-1926	+59.5 ft/yr	-7.2 ft/yr	-27.2 ft/yr
1926-1933	+32.2 ft/yr	+37.5 ft/yr	-6.1 ft/yr
1933-1963	-2.6 ft/yr	+22.8 ft/yr	+9.6 ft/yr
1963-1990			
w/ beach fills	+2.0 ft/yr	-1.7 ft/yr	+6.4 ft/yr
w/o beach fills	- 5.4 ft/yr	-9.1 ft/yr	
1990-1998			
w/ beach fills	-7.1 ft/yr	+20.4 ft/yr	+8.2 ft/yr
w/o beach fills	-24.6 ft/yr	+2.9 ft/yr	

21. Analysis of Figures 2-1 to 2-15 and the summarized data in Table 2-4 indicates that during recent years significant accretion has taken place in the western portion of the project area, especially in the area of the ebb shoal attachment point (the weldment). To the east of the weldment, beach erosion has continued to occur, endangering shorefront bath house and parking facilities. Hempstead Beach and Lido Beach have benefited significantly from the beach fills placed during the time periods evaluated. Since 1933, Lido Beach has experienced a noticeable degree of shoreline stability and has accreted as sand from the ebb shoal attachment point and the beach fills has been transported west. Only in the extreme western portion of Lido Beach has there been slight shoreline recession since 1990. 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.

22. **2.2.7 Influence of Tidal Current.** The influence of tidal currents is important, and can be the dominant forcing, along coastal areas adjacent to an inlet. No quantitative information about the currents at Jones Inlet and Long Beach Island were available; however, the recognition of the importance of tidal currents resulted in both field measurements and numerical model investigations in this project.

23. On October 6, 1998, a field measurement investigation of the distribution and magnitude of tidal currents was performed using an Acoustic Doppler Current Profiler (ADCP) deployed from a work boat. Current measurements provided observations of the temporal and spatial variability of the flow regime during a single spring tidal cycle. The survey was designed to observe tidal flow through Jones Inlet, as well as observe the fate and evolution of the tidal jet exiting the inlet as it collided and mixed with the prevailing east-to-west longshore flow. A spring tidal condition was chosen so that the astronomical influences would be most pronounced.

24. During the survey, tidal currents through the inlet reached maximum speeds of approximately 150 cm/sec (3 kts) during the flood tide, and maximum ebb speeds of approximately 175 cm/sec (3½ kts). On that day, Jones Inlet could be described as a 'flood dominant' system, characterized by a higher discharge during the flood phase. The flood tide entered the inlet initially along the downcoast side (western side) before spreading evenly through the entire throat region. The onset of ebb tide was sensed initially along the upcoast (eastern) edge of the inlet.

25. During the survey, a persistent current flowing east to west was observed south of the east jetty. This current was variable, perhaps modified by tidal forcing, but in general was consistently directed to the west. Evidence that the tide enters the study region from the east was presented as a gradual curvature of the flow field around the east jetty and into the inlet during flood tide. During ebb tide, the longshore flow mixed with the exiting tidal jet to deflect offshore flow vectors to the southwest.

26. Measurements in nearshore regions to the west of the inlet were complex and highly variable. In general, currents during the flood phase were directed alongshore towards the inlet, while ebb flow was directed to the west.

27. The field data indicated that, although currents were not of sufficient magnitude to merit the use of a wave model with wave-current interaction, there was a well-defined boundary between an area with a relatively simple open coast environment and one dominated by the inlet tidal currents. The boundary apparently was at the ebb shoal attachment point ("weldment"). Further, more qualitative, examination was performed with a finite-element numerical circulation model, ADCIRC, that had already been set up for the Long Island coast by CHL.

28. Figures 2-16 and 2-17 show general circulation patterns predicted by the numerical model for a typical spring tide similar to that measured in the field. The patterns are similar to those measured and the magnitudes of the currents were generally and successfully compared. Based upon these observations, it was concluded that the project area west of the weldment can be adequately represented by numerical models that are available for open coast applications without the complications caused by adjacent tidal inlets. However, the area east of the weldment could more accurately be examined by models that account for the dominance of current and inlet-induced circulation patterns.

2.3 Feasible Alternatives For Reanalysis Design At Point Lookout, Lido Beach and Hempstead Beach

29. The following preliminary design alternatives for beach erosion control and storm damage protection for the 18,000 lf of the easternmost segment of the total project area (referred to as the project area in this Section) were developed in conjunction with New York District, CHL, New York State personnel, and local officials from the Town of Hempstead and the City of Long Beach:

30. **2.3.1 Alternative Plan 1- Beach Nourishment**. This alternative, shown in Figure 2-18, consists of the placement of beach fill from an offshore borrow source in order to widen and stabilize the existing beach profile with a dune and berm fill from Point Lookout west to the eastern section of Long Beach (approximately 18,000 lf). This plan includes a berm width of 110 ft at elevation +10 ft NGVD (+9 ft NAVD) with a shore slope of 1 on 25 for the easternmost 5,500 lf of the project, a 1,500 lf transition, thence a 1 on 35 slope for the remaining 11,000 lf.

The dune crest elevation is +15 ft NGVD (+14 ft NAVD) for a crest width of 25 ft with 1 on 5 side slopes on the landward and seaward sides. The total sand fill quantity is 2,845,300 cy including tolerance, overfill and advanced nourishment and will add between 100 and 400 ft of design beach at 0.0 ft NGVD (-1 ft NAVD) to the existing beach.

31. **2.3.2 Alternative Plan 2 – Beach Nourishment With (6) Groins At 1200 FT Intervals (Recommended Plan from Feasibility Report).** This alternative, shown in Figure 2-19, provides the same beach restoration plan as described above with the addition of 6 stone groins, each 700 lf, spaced at equal intervals of 1,200 ft The total length of groin construction is 4,200 lf.

32. **2.3.3 Alternative Plan 3 – Beach Nourishment With (12) Groins At 1200 FT Intervals With Tapered Transition At Westerly End.** This alternative, shown in Figure 2-20, provides the same beach restoration plan as described above with the addition of 12 stone groins, spaced at equal intervals of 1,200 ft with a 6 degree tapered transition at the westerly end. The total length of groin construction is 6,925 lf

33. **2.3.4 Alternative Plan 4 – Beach Nourishment With (6) Groins At 1200 FT Intervals With Tapered Transition At Westerly End.** This alternative, shown in Figure 2-21, provides the same beach restoration plan as described above with the addition of 6 stone groins, spaced at equal intervals of 1,200 ft with a 6 degree tapered transition at the westerly end. The total length of groin construction is 3,475 lf.

34. **2.3.5 Alternative Plan 5 – Beach Nourishment With (16) Groins At 900 FT Intervals.** This alternative, shown in Figure 2-22, provides the same beach restoration plan as described above with the addition of 16 stone groins, spaced at equal intervals of 900 ft with a 6 degree tapered transition at the westerly end. The total length of groin construction is 9,400 lf.

35. **2.3.6 Alternative Plan 6 – Beach Nourishment With (6) Groins At 1200 FT Intervals.** This alternative, shown in Figure 2-23, provides the same beach restoration plan as described above with the addition of 3 stone groins at the eastern end of the project area, spaced at equal intervals of 1,200, each with a length of 700 lf. Three additional stone groins are provided at the western end of the project area, spaced at equal intervals of 1,200, each with a length of 400 lf. The total length of groin construction is 3,300 lf.

36. Two additional plan alternatives were developed during the course of the work. These plans, Alternative 3A-D and Alternative 4A, are presented in Section 5.1.4 and Section 9.1, respectively, in the report entitled "**Technical Reanalysis of the Shoreline Stabilization Measures Eastern Portion of Long Beach Island, New York", March 2000"** and in Figure 2-24 and Figure 2-25, respectively.

2.4 Shoreline Change Modeling (West of the Weldment)

37. Shoreline change modeling was performed to determine the future position of the shoreline. Two different modeling packages were used to provide confirmation of conclusions concerning the preferred alternative for this project.

38. **2.4.1 Application of GENESIS Model.** GENESIS (GENEralized model for SImulating Shoreline change) was used to describe the long term planform evolution of the beach in the course of its approach to equilibrium in response to imposed wave conditions, boundary conditions, configurations of coastal structures, and other engineering activities. GENESIS is

well suited for quantitative and systematic evaluation of the proposed groins/beach nourishment and the effects along the study area shoreline. GENESIS provides a framework for evaluating alternative designs and optimizing the selected design.

39. **2.4.2 Nearshore Wave Transformations Using STWAVE**. Shoreline change modeling requires as input a wave time history of height, period and direction at discrete points along a nearshore reference line. A wave transformation matrix for application to the offshore wave database was constructed along the nearshore reference line using a Corps of Engineers finite-difference directional spectral wave model STWAVE .

40. For the present application, STWAVE was set up on a regular square grid system aligned in the north-south direction (the x-axis of the model is positive toward the north). The grid includes 51 elements in the north direction and 76 elements in the east direction. The bathymetry was developed by gridding a data set that combined information from the GEODAS database (chart information from NOAA's web site), 1998 beach profile data, and 1998 inlet survey data compiled by the New York District. The STWAVE grid coverage and model bathymetric contours are illustrated in Figure 2-26.

41. The nearshore reference line in Figure 2-26 extends approximately along the –19.7 ft (-6m) NGVD contour (-20.7 ft NAVD) except over the ebb shoal attachment ("weldment").

42. The output from the offshore wave model was scanned to extract representative wave spectra for the range of incident wave height, period and direction. Those spectra were transformed to the nearshore reference line, where at each point the resulting integrated wave height, wave period and wave direction were archived. These data were converted to the GENESIS nearshore wave transformation matrix (NSW) format for input to that model.

43. **2.4.3 Validation of GENESIS Model**. The GENESIS model was set up with 238 alongshore calculation cells at a grid spacing of 100 feet as shown in Figure 2-27. The model reach extended from Groin 3 (G3) at cell 18 to Groin 41 (G41) at cell 220 in Long Beach. The simulations started at grid cell 18 with gated boundary conditions at G3 in Point Lookout and at G41 at the western end of the study area. A gated boundary condition is represented by the location of a groin or jetty on the boundary which results in the regulation of the amount of sand that can pass the boundary. The groin/jetty thus acts as a selective "gate".

44. The calibration effort was conducted for the interval April 18, 1990 to May 28, 1998 using measured shoreline data from field surveys for these dates. The wave data used in the calibration effort consisted of hindcast data from 1990 to 1996 with the value of the time step in the wave data file at 3 hours.

45. The initial GENESIS configuration for the calibration simulations was as follows:

- 3 beach fills were included and treated as added berm widths in July 1990, March 1994 and January 1996
- 1 diffracting groin was located at cell 18 (G3) and 7 non-diffracting groins were located at cells 172, 181, 189, 196, 204, 212 and 220
- initial groin permeabilities were 0.8 based on prior CERC investigation

46. Following the completion of numerous initial calibration simulations, the importance of sand bypassing from Jones Inlet became evident. These simulations, analysis of the shoreline change maps and input from various personal observations indicated that bypassing played an important role in the development and stability of the shoreline weldment feature to the west of

Point Lookout. To investigate the rate and frequency of the bypassing, a sediment budget analysis was conducted. For this analysis, four control volumes were developed including 1) Jones Inlet, 2) Point Lookout, 3) HempsteadBeach/Lido Beach and 4) Long Beach.

47. A summary of shoreline and sand volume changes was developed for four regions in the study area for various time periods between 1909 and 1998:

- Region 1- Point Lookout (1900 lf. from Jones Inlet to G3)
- Region 2- Hempstead Beach (11,900 lf. from G3 to G54)
- Region 3- Lido Beach (4,100 lf. from G54 to 18,000 lf. study limit)
- Region 4- Long Beach (> 18,000 lf.)

48. Control volumes were set up for the study area as shown in Figures 2-28 to 2-39 corresponding to the four regions. Beach fill and shoreline volumetric changes were added to the control volumes based on the data available for varying time periods.

49. GENESIS was set up with the grid starting in the Jones Beach area with the jetty included in the model as a diffractive structure. The shoreline was modeled as a continuous shoreline from the jetty to Groin 1 (G1) in Point Lookout. The objective of this setup was to get an idea of the quantity of longshore transport that could be transported to the Jones Inlet area and the sheltering effects of the Jones Beach shoreline and jetty on the transport rates in Point Lookout. The groins in Point Lookout and the groins in Lido Beach were also included in the model with assumed permeabilities.

50. The model was then run for each of the wave years from 1987 through 1996 and the left transport and right transport at each of the control volume boundaries was averaged and added to the control volumes for the various time periods. The transport shown in Figures 2-28 to 2-39 is the transport calculated by GENESIS except the right transport at the Jones Inlet jetty was increased to 400,000 cy/yr which is the average transport predicted along the shoreline east of the jetty. Originally, the jetty was modeled with a permeability = 0 which blocked all transport to the inlet. Given the accretion along that shoreline and the discussion in the 1995 Feasibility study, it was assumed that a significant amount (if not all) of the transport was bypassing the jetty and being transported to the inlet's shoals.

51. The control volumes were then balanced with estimates of inlet shoaling and welding from the offshore area for the various time periods. This exercise essentially indicated that to get the control volumes to balance, significant rates of welding must occur given the assumptions made in the setup. From this evaluation, it was concluded that during the period from April 18, 1990 to May 28, 1998 the bypassing rate required to balance the Hempstead Beach control volume was 328,000 cy./yr. For the period from April 4, 1984 to April 18, 1990 the bypassing rate required to balance the Hempstead Beach control volume was 184,000 cy./yr.

52. Additional trial calibrations (approximately 75) were then conducted using various combinations of the above calibration parameters. The results of the final calibration are presented in Figure 2-40. These results were selected to be the most representative of actual shoreline evolution from 1990 to 1998.

53. Following the completion of the calibration effort, verification of the calibrated model was conducted using measured shoreline data from an independent time period. This verification

effort was conducted from April 4, 1984 to April 18, 1990 using field survey measured shoreline data.

54. The initial GENESIS configuration for the verification simulations included:

- 238 alongshore calculation cells at a grid spacing of 100 feet
- simulations started at grid cell 18 with a gated boundary condition at G3 and at the western end
- 1 beach fill was included and treated as added berm width in April 1985
- 1 diffracting groin was located at cell 18 (G3) and 7 non-diffracting groins were located at cells 172, 181, 189, 196, 204, 212 and 220
- groin permeabilities were 0.0 for G3 and 0.4 for the remaining groins based on the model calibration

55. The preliminary verification efforts concentrated on varying the sand bypass rates from Jones Inlet to reproduce the weldment and varying the beach fill location along the project area shoreline. A number of trial verification simulations (approximately 9) were conducted using various combinations of these parameters.

56. The results of the final verification are presented in Figure 2-41. These results were selected to be the most representative of actual shoreline evolution from April 4, 1984 to April 18, 1990.

57. **2.4.4 Simulation of Feasible Alternatives**. Following the calibration and verification of the model, prediction of the future positions of the shoreline for alternative shoreline stabilization designs were simulated. The simulations were conducted with the same model parameters used in the calibration simulation. The without-project condition was simulated by the GENESIS model followed by simulations of each potential engineering alternative. The predicted shorelines for the various alternatives were then compared to the without-project result to assess relative changes and impacts due to that alternative.

The following simulations were conducted:

- Without Project - (No Action)
- Alternative Plan 1 – Beach Nourishment
- Alternative Plan 2 – Beach Nourishment With (6) Groins At 1200 FT Intervals
- Alternative Plan 3 – Beach Nourishment With (12) Groins At 1200 FT Intervals With Tapered Transition At Westerly End
- Alternative Plan 4 – Beach Nourishment With (6) Groins At 1200 FT Intervals With Tapered Transition At Westerly End
- Alternative Plan 5 – Beach Nourishment With (16) Groins At 900 FT Intervals
- Alternative Plan 6 – Beach Nourishment With (6) Groins At 1200 FT Intervals

58. The predicted shorelines from the 5 year simulations from 1998 to 2003 for each of the alternative plans are presented in Figures 2-42 to 2-47 including the without project predicted shorelines for both with bypassing and without bypassing from Jones Inlet. Based on the sediment budget analysis and the final calibration of the GENESIS model, the with-bypassing scenario is considered to be the most probable existing and future scenario for the study area. The predicted shoreline change rates for each alternative versus the without project simulation

are presented in Figures 2-48 to 2-58. The results of these simulations are discussed in the following paragraphs.

59. The preceding analysis compares the performance of Alternatives 2-6 with the without-project alternative to identify positive or negative impacts of each alternative in the major project reaches. Based on this analysis, Alternatives 3, 5, and 6 are predicted to cause increased erosion rates west of Groin 48. This predicted result is due to the location of groins at the western end of the project area in each of these alternatives which results in a decrease in longshore sediment transport to the area west of Groin 48, which is located off Pacific Blvd. in the City of Long Beach. In addition, Alternatives 3 and 5 which include groins immediately east of West Lido Beach also result in predicted increased erosion in West Lido Beach.

60. Overall, the modeling results indicate that Alternatives 2 and 4 provide the best performance with Alternative 2 having a slight negative impact in the Lido Beach area. This negative impact is a result of the full length groins in Alternative 2 versus the tapered length groins along the west end of Alternative 4 which allow more longshore sediment transport to reach the Lido Beach area. With the proposed tapered groins, the modeling analysis does not predict adverse impacts west of the weldment and Lido Beach for Alternative 4.

61. **2.4.5 Simulation of Alternative 3 With Overfilling.** As discussed in Section 2.4.4, preliminary evaluation of the results of the simulation for Alternative 3 with proposed groins throughout the project area (12 groins at 1200 ft intervals) indicated potential adverse downdrift impacts. To investigate this potential impact, overfilling of the western groin compartments in this plan was modeled as a mechanism to offset the potential negative impact of the full groin field on the City of Long Beach. For each alternative, the shoreline was filled out to near the seaward ends of the proposed groins. GENESIS runs were conducted for various overfill configurations for the westernmost groin compartments in Alternative 3 as shown in Figure 2-59. The fill configurations for each alternative were as follows:

- Alternative 3A - Fill in compartments 1-6
- Alternative 3B - Fill in compartments 3-6
- Alternative 3C - Fill in compartments 4-6
- Alternative 3D - Fill in compartments 5-6

62. The shoreline changes for each of these simulations are presented in Figures 2-60 and 2-61. From these simulations, it appears that Alternative 3D, overfilling of the two westernmost compartments successfully reduced losses west of the groin field to less than without-project rates. Alternative 3C, overfilling of the three westernmost compartments successfully eliminated losses west of the groin field during the 5 yr. simulation.

2.5 Application of the DHI Shoreline Change Model.

63. In order to provide additional confirmation of shoreline change modeling, the Danish Hydraulic Institute's MIKE21 and LITPACK modeling systems were applied to the Long Beach Island. Similar to GENESIS, the LITPACK modeling system was used to describe the long term planform evolution of the beach in the course of its approach to equilibrium in response to imposed wave conditions, boundary conditions, configurations of coastal structures, and other engineering activities.

64. **2.5.1 Nearshore Wave Transformations Using NSW.** The DHI shoreline change model also requires the calculation of a wave time history of height, period and direction at

discrete points in the nearshore area. This transformation was performed using DHI's nearshore spectral wave model MIKE 21 NSW (Nearshore Spectral Wave). This model describes the propagation, growth and decay of short-period waves in nearshore areas. MIKE 21 NSW is a steady-state model that represents a wave spectrum using a two-parameter function spread over a discrete number of wave directions.

65. The output from the hindcasted offshore wave model was scanned to extract representative wave spectra for the range of incident wave height, period and direction. These data were converted to the input to the NSW model, which in turn produced transformed nearshore wave data for the LITPACK model.

66. **2.5.2 Validation of LITPACK Model**. Based on the sediment budget results, the Coastline Evolution model LITLINE was setup in the area of study. The objective of this modelling exercise is to predict the coastline evolution at the western side of Jones Inlet. Figures 2-62 and 2-63 present an overview of the study area.

- The calibration effort was conducted from April 18, 1990 to May 28, 1998 using measured shoreline data from field surveys for these dates for Long Beach Island only. The wave information used in the calibration effort consisted of hindcast data from 1990 to 1996 with the value of the time step in the wave data file at 3 hours.

67. As with GENESIS, following the completion of numerous initial calibration simulations, the importance of sand bypassing from Jones Inlet became evident. These simulations, analysis of the shoreline change maps and input from various personal observations indicated that bypassing played an important role in the development and stability of the shoreline weldment feature to the west of Point Lookout. Bypassing rates were varied. Case A assumes no sand bypassing via the weldment, Case B assumes a bypassing rate of 125,000 cu m (163,000 cu yd) per year, and Case C assumes a bypassing rate of 250,000 cu m (327,000 cu yd) per year. The difference in the results as a function of bypassing rate primarily affects the evolution of the weldment area, where the sand is entering the project area. The sediment entering the area is transported downdrift of the weldment, also affecting the evolution of the modeled shoreline. The results indicate the best fit to the measured coastline is achieved with case C. Figure 2-64 presents the results of the calibration.

68. Following the completion of the calibration effort, verification of the calibrated model was conducted using measured shoreline data from an independent time period. This verification effort was conducted from April 4, 1984 to April 18, 1990 using field survey measured shoreline data. The wave data used for the verification consisted of hindcast data from 1987 to 1990 with the time step in the wave data file at 3 hours. The external wave model NSW was used to produce wave data in the nearshore area. The calculated April 18, 1990 shoreline position was compared with the measured April 18, 1990 shoreline position to evaluate the verification effort. The verification simulation produced reasonable agreement with the measured shoreline, including the weldment area. Figure 2-65 presents the results of the verification. The modeled shoreline is slightly landward of the measured shoreline in the western reaches of the project area, which is a different result than that produced in the calibration. However, the overall model performance in the combined calibration and verification exercises is considered to be acceptable.

69. **2.5.3 Simulation of Feasible Alternatives**. Following the calibration and verification of the model, prediction of the future positions of the shoreline for alternative shoreline stabilization designs were simulated. The simulations were conducted with the same model parameters

used in the calibration simulation. The without-project condition was simulated, followed by simulations of each potential engineering alternative. The predicted shorelines for the various alternatives were then compared to the without-project result to assess relative changes and impacts due to that alternative. The simulations were conducted for a 5-year period starting from the May 28, 1998 measured shoreline position. The wave data time series consisted of hindcast wave data for the 5 years 1991, 1993-1996.

The following simulations were conducted:

- Without Project – No Action
- Alternative Plan 1 – Beach Nourishment
- Alternative Plan 2 – Beach Nourishment With (6) Groins At 1200 FT Intervals
- Alternative Plan 3 – Beach Nourishment With (12) Groins At 1200 FT Intervals With Tapered Transition At Westerly End
- Alternative Plan 4 – Beach Nourishment With (6) Groins At 1200 FT Intervals With Tapered Transition At Westerly End
- Alternative Plan 5 – Beach Nourishment With (16) Groins At 900 FT Intervals
- Alternative Plan 6 – Beach Nourishment With (6) Groins At 1200 FT Intervals

70. The predicted shorelines from the 5 year simulations from 1998 to 2003 for each of the alternative plans are presented in Figures 2-66 to 2-71.

71. **2.5.4 Results and Recommended Plan**. Two shoreline change modeling systems were applied to the Long Beach project area to provide a basis for choosing a recommended plan. The application of two models are viewed as two “tools” for reaching an engineering decision, as well as to discern whether two systems can confirm or contradict each other.

72. The GENESIS model was used to analyze the potential effects of the engineering alternatives in a variety of ways. In order to summarize the results for assessment, the GENESIS output is summarized in Table 2-6 (with bypassing via the ebb tidal shoal to the beach) and in Table 2-7 (without bypassing). The tables compare the performance of alternatives 2-6 with the without-project alternative to assess positive or negative impacts in the major project reaches. A review of the tables indicates the following:

- Alternatives 3, 5, and 6 cause increased erosion rates west of Groin 48
- Alternatives 3 and 5 cause increased erosion in West Lido Beach
- Alternatives 2 and 4 provide the best performance; however, alternative 2 has a slight negative impact in the Lido Beach area
- With or without bypassing, alternative 4 provides no projected adverse impact west of the weldment and Lido Beach.

Table 2-6. GENESIS Results for Long Beach Island Alternatives With Bypassing
(average shoreline change & annual volume change in cu yd/yr in major project reaches)

	Genesis Cells	Without Project	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Hempstead (Cut)	**20-45**	**-31'/yr -76800**	**-4'/yr -9800**	**-4'/yr -9600**	**-4'/yr -11100**	**-2'/yr -5300**	**-5'/yr -11300**
Weldment Area	**45-90**	**+2'/yr +10700**	**+15'/yr +67800**	**+17'/yr +76900**	**+12'/yr +52900**	**+17'/yr +75200**	**+12'/yr +55400**
Lido Beach	**90-130**	**+9'/yr +34300**	**+6'/yr +24200**	**+14'/yr +55100**	**+9'/yr +36800**	**+15'/yr +60700**	**+15'/yr +60100**
West Lido Beach	**130-165**	**+8'/yr +29200**	**+7'/yr +26000**	**+3'/yr +11800**	**+8'/yr +29100**	**-0.5'/yr -900**	**+8'/yr +27700**
Groin 48 and West	**165-180**	**-10'/yr -15600**	**-10'/yr -15700**	**-20'/yr -29900**	**-10'/yr -15600**	**-20'/yr -30100**	**-20'/yr -29700**

Purple (or dark gray) = increased erosion or lessened accretion
Yellow (or light gray = lessened erosion or increased accretion

Table 2-7. GENESIS Results for Long Beach Island Alternatives Without Bypassing
(average shoreline change & volume change in cu yd/yr in major project reaches)

	Genesis Cells	Without Project	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Hempstead (Cut)	**20-45**	**-46'/yr -116000**	**-15'/yr -38000**	**-15/yr -37800**	**-16'/yr -40600**	**-13'/yr -32100**	**-16'/yr -41000**
Weldment Area	**45-90**	**-35'/yr -155000**	**-22'/yr -90000**	**-20'/yr -90500**	**-22'/yr -99900**	**-21'/yr -92700**	**-26'/yr -118800**
Lido Beach	**90-130**	**-0.5'/yr -1100**	**-5'/yr -19600**	**+3'/yr +11000**	**+0.5'/yr +1100**	**+4'/yr +15000**	**+6'/yr +24100**
West Lido Beach	**130-165**	**+8'/yr +27500**	**+7'/yr +24000**	**+3'/yr +9900**	**+8'/yr +27400**	**-1'/yr -2900**	**+7'/yr +26000**
Groin 48 and West	**165-180**	**-10'/yr -15600**	**-11'/yr -15800**	**-20'/yr -29900**	**-10'/yr -15600**	**-20'/yr -30100**	**-20'/yr -29800**

Purple (or dark gray) = increased erosion or lessened accretion
Yellow (or light gray) = lessened erosion or increased accretion

73. A review of the maximum erosion that occurred during the 5-year simulations within each project reach yields similar observations of performance and impacts. Pertinent values by project reach are presented in Tables 2-8 and 2-9.

- Alternatives 3, 5, and 6 cause increased erosion rates west of Groin 48
- Alternatives 3, 5, and 6 cause increased erosion in West Lido Beach
- All alternatives provide positive impacts in the weldment and Lido Beach
- Alternative 4 provides no projected adverse impact west of the weldment and Lido Beach.
- Alternatives 2 and 4 reduce the maximum eroded shoreline position.

Table 2-8. GENESIS Results for Long Beach Island Alternatives With Bypassing
(maximum shoreline change in ft during 5yr simulation in major project reaches)

	Genesis Cells	Without Project	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Hempstead (Cut)	**20-45**	**-50'**	**-20'**	**-20'**	**-20'**	**-15'**	**-20'**
Weldment Area	**45-90**	**-30'**	**-10'**	**-10'**	**-15'**	**-15'**	**-15'**
Lido Beach	**90-130**	**-10'**	**-10'**	**None**	**-10'**	**None**	**-5'**
West Lido Beach	**130-165**	**-5'**	**-5'**	**-10'**	**-5'**	**-15'**	**-15'**
Groin 48 and West	**165-180**	**-15'**	**-15'**	**-25'**	**-15'**	**-25'**	**-25'**

Purple (or dark gray) = increased erosion or lessened accretion
Yellow (or light gray) = lessened erosion or increased accretion

Table 2-9. GENESIS Results for Long Beach Island Alternatives Without Bypassing
(maximum shoreline change in ft during 5yr simulation in major project reaches)

	Genesis Cells	Without Project	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Hempstead (Cut)	**20-45**	**-65'**	**-25'**	**-25'**	**-25'**	**-25'**	**-25'**
Weldment Area	**45-90**	**-60'**	**-40'**	**-40'**	**-45'**	**-40'**	**-45'**
Lido Beach	**90-130**	**-35'**	**-30'**	**-20'**	**-30'**	**-25'**	**-30'**
West Lido Beach	**130-165**	**-5**	**-5'**	**-5'**	**-5'**	**-15'**	**-15'**
Groin 48 and West	**165-180**	**-15'**	**-15'**	**-25'**	**-15'**	**-25'**	**-25'**

Purple (or dark gray) = increased erosion or lessened accretion
Yellow (or light gray) = lessened erosion or increased accretion

74. A comparison of GENESIS and LITLINE results for the same project reaches is presented in Tables 2-10 and 2-11 for average shoreline change and maximum recession during the 5-year simulations. Because of the differences in numerical models and independently-calibrated parameters, there are some differences in the absolute values of the results, especially in the Hempstead region. However, we are not analyzing the Hempstead area as part of the shoreline change modeling because it is more appropriately modeled in Section 6.

75. Despite the differences in the absolute values of shoreline changes, the models yield similar conclusions concerning the performance of the engineering alternatives. For average shoreline change in the 5-year period:

- Alternatives 3, 5, and 6 cause increased erosion rates west of Groin 48
- Alternatives 3 and 5 cause increased erosion in West Lido Beach
- Alternatives 2 and 4 provide the best performance; however alternative 2 has a slight negative impact in the Lido Beach area

- With or without bypassing, alternative 4 provides no projected adverse impact west of the weldment and Lido Beach.

76. A review of the maximum shoreline recession during the 5-year period, again the results are consistent:

- Alternatives 3, 5, and 6 cause increased erosion rates west of Groin 48
- Alternatives 3, 5, and 6 cause increased erosion in West Lido Beach
- All alternatives provide positive impacts in the weldment and Lido Beach, except alternative 6
- Alternatives 2 and 4 appear to provide positive performance in reducing maximum eroded shoreline position.

Table 2-10. GENESIS and LITLINE Results for Long Beach Island Alternatives With Bypassing
(average shoreline change in 5yr simulation in major project reaches ft/yr)
(note that shoreline changes are given for both models: GENESIS/LITLINE)

	Genesis Cells	Without Project	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Hempstead (Cut)	**20-45**	**-31/+20**	**-4/+26**	**-4/+21**	**-4/+26**	**-2/+26**	**-5/+21**
Weldment Area	**45-90**	**+2/-17**	**+15/-9**	**+17/-8**	**+12/-19**	**+17/-11**	**+12/-9**
Lido Beach	**90-130**	**+9/+15**	**+6/+4**	**+14/+21**	**+9/+13**	**+15/+17**	**+15/+8**
West Lido Beach	**130-165**	**+8/+14**	**+7/+10**	**+3/+12**	**+8/+13**	**-1/-11**	**+8/+10**
Groin 48 and West	**165-180**	**-10'/+14**	**-10/+10**	**-20/+12**	**-10/+13**	**-20/-11**	**-20/+10**

Dark Gray = increased erosion or lessened accretion
Light Gray = lessened erosion or increased accretion

Table 2-11. GENESIS and LITLINE Results for Long Beach Island Alternatives With Bypassing
(maximum shoreline change in 5yr simulation in major project reaches ft/yr)
(note that shoreline changes are given for both models: GENESIS/LITLINE)

	Genesis Cells	Without Project	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Hempstead (Cut)	**20-45**	**-50/-18**	**-20/-16**	**-20/-14**	**-20/-16**	**-15/-7**	**-20/-20**
Weldment Area	**45-90**	**-30/-46**	**-10/-31**	**-10/-45**	**-15/-54**	**-15/-41**	**-15/-42**
Lido Beach	**90-130**	**-10/+4**	**-10/-12**	**0/+10**	**-10/+2**	**0/+4**	**-5/-3**
West Lido Beach	**130-165**	**-5/-13**	**-5/-14**	**-10/-31**	**-5/-13**	**-15/-15**	**-15/-14**
Groin 48 and West	**165-180**	**-15/-13**	**-15/-14**	**-25/-31**	**-15/-13**	**-25/-15**	**-25/-14**

Dark Gray = increased erosion or lessened accretion
Light Gray = lessened erosion or increased accretion

77. From this assessment of shoreline change models for areas west of the weldment, it is concluded that Alternative 4 appears to provide positive long-term stabilization impacts in the weldment and Lido Beach areas while avoiding downdrift negative impacts to West Lido Beach and Long Beach.

78. Assuming that bypassing continues, the weldment feature is expected to remain stable generally in its existing location. Alternative 4 includes three (3) groins in the weldment area that will require excavation for construction and will be substantially buried following construction and non-functional as shoreline erosion control measures. The primary purpose of these groins will be to stabilize the shoreline in this area if the weldment migrates from its existing location or substantially decreases in volume due to a cessation of bypassing from Jones Inlet. Until these events occur, the construction of the westernmost three groins is not required and should be considered for deferred construction in the future on an as needed basis.

2.6 Circulation and Sediment Transport Modeling East of the Weldment

79. Based upon applications of the shoreline change models and the investigation of hydrodynamic conditions along the eastern end of Long Beach Island, Long Island, New York, the most effective shore stabilization alternative with minimal downdrift impacts is a “modified” Feasibility Plan. This plan, also termed Alternative 4a, consists of seven groins constructed just to the west of Groin 3 at Point Lookout. The seven groins create 4 compartments that are approximately 800 feet in the alongshore direction and three compartments that are 1200 feet long. The original Alternative 4 plan provided for six groins creating six compartments of approximately 1200 feet in length.

80. In this section, simulations of representative wave, tide and sediment transport conditions in this area are presented that were developed using the Danish Hydraulic Institute’s MIKE21 modeling system.

81. The modeling indicates that net sand transport is toward the west in the nearshore portion of the beach profile and toward the east further offshore. By carefully selecting sand budget cells that appropriately delineate these areas, it appears that Alternative 4a can reduce the rate of sand transport toward the west in the presently erosive area just west of existing Groin 3. This should increase the stability of that area and, according to the model results, help to confine any increase in erosion to the weldment area where onshore transport is expected to supply sediment. It should be recognized that groins can increase offshore transport during storms, which is not represented in these models.

82. **2.6.1 Wave Model.** Because of the complexity and time-consuming nature of the numerical modeling task in the vicinity of the inlet, the offshore wave model output was simplified into four representative wave conditions. The conditions were selected to represent the entire wave distribution based upon their large contribution to the total littoral drift within the project area. In addition, two storm cases and two “normal condition” cases were selected to provide insight into the coastal processes associated with these events. The four wave conditions selected were:

Table 2-12: Representative offshore wave conditions.

Case No.	Description
1	H_{m0}=3.25m, T_p=11.5s, MWD=110 ^oN
2	H_{m0}=3.25m, T_p=10.5s, MWD=130 ^oN
3	H_{m0}=1.25m, T_p=10.5s, MWD=110 ^oN
4	H_{m0}=1.50m, T_p=6.0s, MWD=205 ^oN

83. In order to transform these wave conditions to the nearshore project area, a numerical model was used: the DHI parabolic mild slope model, MIKE 21 PMS. The main purpose of this model is to calculate very nearshore wave patterns that, in turn, provide radiation stresses to be used in the hydrodynamic model and integral wave parameters to be used in the sand transport model.

84. The area modeled is shown in Figure 2-72. The area shown is discretized on grid spacings of 10m and 5m for the wave model, and the model orientation is turned such that the x-direction points in the direction of wave propagation. After the numerical simulations, the radiation stresses and integral wave parameters are transformed onto the hydrodynamic model grid for simulations at hourly intervals.

85. **2.6.2 Circulation Model.** In order to simulate the effects of currents generated by astronomical tides and wave radiation stresses, the MIKE21 HD (hydrodynamic) module was used. The hydrodynamic model is an unsteady two-dimensional finite-difference implicit formulation. The model includes wind stress, bottom stress, advection, wetting/drying, radiation stresses and various capabilities for driving the side boundaries.

86. In order to generate offshore boundary and bay tides, tidal constituents were used. The modeling grids had 60m and 20m resolution, with the results of the 60m grid being saved and then used to drive the 20m grid at its boundaries. The grids are shown in Figures 2-73 and 2-74.

87. The hydrodynamic model was used to simulate the tidally-driven flows that occurred during the ADCP survey on October 6, 1998, which was a moderate spring tide with a range of approximately 6 feet. This tidal condition was used to generally verify the hydrodynamic model locally and to develop hourly circulation fields for calculating sediment transport. Current patterns early in the day of the ADCP survey are shown, as produced by the numerical model, in Figure 2-75.

88. **2.6.3 Sediment Transport Modelling**. Sediment transport patterns were calculated on the same grid as the hydrodynamic model using the DHI MIKE21 module ST (sediment transport). The integral wave parameters calculated with MIKE 21 PMS and the flow field calculated with MIKE 21 HD were used as input for the sand transport model. The median sand grain size, D_{50} was taken as 0.22mm, corresponding to the average of the composite native beach median grain size.

89. From these simplified simulations, the models are found to be in general agreement with field data and observations of processes. The hydrodynamic model indicates that the net transport is northwards (into the bay) in the western part of the inlet, and towards the ocean in

the eastern half of the inlet. The flood flow is stronger on the western half of the inlet, while the ebb flow is stronger on the eastern half of the inlet. The wave modeling indicates that during periods of significant wave action, intense wave breaking over the shoal causes strong wave-induced currents, which move the sand on the shoal towards the coast. Near the shoreline, a shifting nodal point (location of the nodal point changes with the wave conditions) is calculated. With the present configuration of the shoal, the rate of sand transport towards the coast (coastline of about 2km west of the inlet) is calculated to be greater than the sand losses due to the currents parallel to the shore. The sand transported toward shore from the shoal has flattened the beach profile, widening the shoal, but does not reach the shallower parts of the beach profile. Because of this, erosion still occurs west of Groin 3, since the alongshore sand losses occur closer to the shoreline. On the open coast, the sand transport rate due to tides alone is negligible compared to the sand transport rate in the presence of waves. However, the calculated sand transport rate in combined waves and tides is significantly higher than the sand transport rate calculated with waves alone.

90. **2.6.4 Simulation of Alternative 4**. In order to evaluate the feasibility of a proposed beach protection scheme west of Jones Inlet, a series of simulations were carried out with the Danish Hydraulic Institute (DHI) 2D modeling system MIKE 21, as described in the previous section. Figure 2-76 presents an overview of the existing condition layout and that of Alternative 4 (the Feasibility Plan alternative), which consists of beach fill and 6 groins with a 1200 foot spacing just west of existing Groin 3 at Point Lookout.

91. As observed in Fig 2-76, the new groins associated with Alternative 4 are placed west of existing Groin 3. Six groins have been proposed for the alternative. Those within the ebb shoal shore attachment area (called the ”weldment”) are landward of the 1998 shoreline location and thus do not show in the gridded model bathymetry and do not affect the results in a model of this type. In order to formulate the effects of combined tidal- and wave-driven currents, five separate runs of models are required: a pure tidal current simulation and the four wave conditions that statistically represent the long term wave distribution at the project site. The four wave conditions are listed in Table 2-12.

92. A spring tidal condition was used for generating the astronomical tide component of the circulation.

93. For the existing conditions, there appears to be a westward longshore sediment transport for conditions 1, 2 and 3 immediately west of groin 3, whereas for condition 4 sediment is directed towards east. Sediment transport associated with condition 4 provides significant sediment in the area just west of groin 3. The construction of the groin west of existing Groin 3 slightly changes the process but does not improve the erosional nature of the area west of Groin 3. Slight changes in longshore transport could be partly due to the reduction of the water depth by the beach filling and partly due to the flow pattern induced by the proposed groin.

94. The MIKE 21 simulations show that:

a) During storm events from the East to the SE (i.e. events 1 and 2), the littoral drift near the shoreline (shoreward of a depth of -2m NAVD88) is west-directed. Further offshore, the littoral drift is east-directed, with significant onshore-directed sediment transport from the shoal.

b) For the mild wave events occurring from the SW, the littoral drift is generally east-directed.

In the Alternative 4 layout, increased erosion is calculated in cell 1 adjacent to Groin 3 and deposition is calculated adjacent to the new groin. This indicates that this bay will reshape by turning in the counterclockwise direction. The calculated accretion in the western end of the bay (cell 2) is an initial morphological response, which may further be dominated with time by the offshore loss in the rip currents along the groin. Some accumulation is calculated in cell 3 adjacent to the western end of the first new groin, and increased erosion in cell 4 and 5. The accumulation in cell 3 is caused by gradients in wave setup, which induces a clockwise eddy towards the western end of the new groin. The erosion further west is caused as the littoral drift moves towards equilibrium.

Table 2-13 Computed sediment budgets for the present condition and the proposed alternative (events 1, 2, 3 and 4) in m^3/year (solid volume). The computed differences between the two layouts are also shown. Note: The results for each event have been calculated with a hypothetical 100% occurrence in a year.

Event 1			
Cell	Sediment Budget		Difference
	Present	Alternative	
1	-7000	-58000	-51000
2	12000	63000	51000
3	-97000	1000	98000
4	-27000	-107000	-80000
5	-22000	-25000	-3000
6	149000	147000	-2000
Event 2			
Cell	Sediment Budget		Difference
	Present	Alternative	
1	-35000	-143000	-108000
2	18000	140000	122000
3	-208000	-8000	200000
4	118000	3000	-115000
5	-15000	-67000	-52000
6	150000	142000	-8000
Event 3			
Cell	Sediment Budget		Difference
	Present	Alternative	
1	-1000	-5000	-4000
2	1000	6000	5000
3	9000	7000	-2000
4	-21000	-38000	-17000
5	-60000	-61000	-1000
6	147000	158000	11000
Event 4			
Cell	Sediment Budget		Difference
	Present	Alternative	

1	2000	5000	3000
2	30000	35000	5000
3	92000	69000	-23000
4	79000	61000	-18000
5	1000	32000	31000
6	-40000	-38000	2000

Table 2-14 Associated weights for the MIKE 21 simulations.

Event	Hs (m)	Tp (s)	MWD (^{o}N)	Weights (%)
1	3.25	11.5	110	3.35
2	3.25	10.5	130	3.52
3	1.25	10.5	110	43.38
4	1.50	6.0	205	22.07

Table 2-15 Computed sediment budgets in m^3/year (solid volume) for the present condition and the proposed Alternative 4.

Cell	Sediment Budget		Difference
	Present (no action)	Alternative 4	
1	-2000	-9000	-7000
2	1000	10000	9000
3	-7000	3000	10000
4	-7000	-20000	-13000
5	-27000	-30000	-3000
6	74000	78000	4000

2.7 Conclusion Based Upon Simulation of Alternative 4

95. MIKE 21 simulations appear to adequately describe the sedimentation processes in the region between Groin 3 and the weldment; however, the sediment budget analysis required finer-resolution cells and careful application of occurrence weightings to wave conditions. Furthermore, the construction of the groins and the nourishment as in the Feasibility Plan alternative apparently will lead to erosion west of existing Groin 3, and to a reshaping of the beach fill and likely cross-shore losses of sand from the bays due to rip currents along the new structures.

96. **2.7.1 Simulation of Alternative 4a**. The simulation of hydrodynamics and sediment transport for Alternative 4 indicated a potentially-significant erosive condition to the west of groin 3. An examination of those results indicated that a reduction in groin spacing might reduce the erosion potential in that area. An additional alternative, Alternative 4a, was specified where an additional groin was added to Alternative 4 by decreasing the groin spacing east of the weldment from 1200 feet to 800 feet. The result is a groin field where the easternmost four groins are spaced at 800-foot intervals west of groin 3 followed by an additional 3 groins

proceeding to the west with a longshore spacing of 1200 feet. The layout of Alternative 4A was gridded for MIKE21 as shown in Figure 2-77.

97. Figure 2-77 illustrates that the three new groins are exposed (not buried) to the west of the present Groin 3, which is the second groin from the right in the figure. Of the three new groins that are exposed (seaward of the 1998 shoreline position) the westernmost groin is largely placed on land and its effect cannot be evaluated by the model. Furthermore, beach nourishment is placed between the new groins, as specified by the Feasibility plan fill.

98. The modeling approach was the same as that applied to Alternative 4. The computed sediment transport pattern for Alternative 4a is in Figure 2-78. The primary differences between the no-action alternative and alternative 4a are observed in the vicinity of the proposed groins west of groin 3. In order to quantify the impact of the proposed protection plan a sediment budget analysis is again performed. Figure 2-79 presents a general overview of the six sediment budget cells for alternative 4a. It is important to note that the cell boundaries were adjusted slightly as compared to Alternative 4 to coincide with the groin locations.

Table 2-16 Computed sediment budgets in m^3/year (solid volume) for the present condition and the proposed Alternative 4a.

Cell	Sediment Budget		Difference
	Present (no action)	Alternative 4a	
1	-2000	0	2000
2	1000	0	-1000
3	-7000	-5000	2000
4	-7000	-14000	-7000
5	-27000	-27000	0
6	74000	72000	-2000

99. **2.7.2 Conclusions from Circulation and Sediment Transport Modeling East of the Weldment**

1. Alternative 4a is found to provide an improvement of the coastal stability of the critical area west of existing Groin 3 over both the no-action alternative and alternative 4. Modeled results show zero net sediment transport in cells 1 and 2, indicating increased stability. Total volume of material moving in cells 1-3 is reduced compared to the no-action alternative and alternative 4, again indicating greater stability. By reducing the spacing of the groin compartment, the performance of the groin field is enhanced and the area of potential erosion is more confined.

2. A counterclockwise rotation of the shoreline within the first cell west of Groin 3 is expected.

3. Some increased erosion is predicted by the model in cell 4, the groin compartment just east of the ebb shoal attachment point (“weldment”). This is a location where a supply of sediment is pushed onshore that should help in remedying the steady-state condition predicted by the models.

4. Increased offshore transport normally results from circulation cells within the groin compartments. Regular monitoring of the beach condition will indicate any morphological changes not resolved by the numerical modeling system.

5. Flow accelerations and erosion at the tips of the proposed groins is anticipated according to the model results.

6. Nearshore wave measurements would provide an additional source of validity for the hindcasted nearshore wave distributions upon which these analyses are based. Current measurements inside the ebb shoal attachment point (east of the weldment) would also enhance the model validity.

2.8 Cost Comparisons of Alternatives

100. A summary of the first costs for the alternative plans is presented in Table 2-16. A summary of the total annual costs for the alternative plans is presented in Table 2-17.

101. The beach fill included in all of the alternative plans is the recommended beach fill for Plan 5 in the February 1995 Feasibility Report. Initial beach fill quantities are based on beach surveys taken in May 1998. The recommended beach fill consists of the following components:

102. a) Dune and berm fill from Point Lookout west through the eastern section of Long Beach (approximately 18,000 lf). The design berm fill will taper at an angle of approximately 6 degrees at the western termination and will tie into the existing shoreline at the eastern termination in Point Lookout.

103. b) Dune: Crest elevation of +15 ft NGVD (+14 ft NAVD) for a crest width of 25 ft with 1 on 5 side slopes on the landward and seaward sides.

104. c) Berm: Fronting the dune, a berm width of 110 ft at elevation +10 ft NGVD (+9 ft NAVD) with a shore slope of 1 on 20 for the easternmost 5,500 lf of the project between the proposed groins, a 1,500 lf transition, thence a 1 on 35 slope for the remaining 11,000 lf.

105. d) The total sand fill quantity for Alternative 1 is 2,868,700 cy which will add approximately 150 ft to 450 ft of design beach at 0.0 ft NGVD (-1 ft NAVD) to the existing beach. The total sand fill quantity of 2,335,300 cy for Alternatives 2-6 will add approximately 100 ft to 400 ft of design beach at 0.0 ft NGVD (-1 ft NAVD) to the existing beach. These quantities of sand fill include the following:

- +1.0 ft tolerance
- overfill factor of 2.5%
- advanced nourishment width of 50 ft except for a 100 ft width for Alternative 1.

106. e) Of the initial fill placement, 1,088,200 cy is for advanced nourishment for Alternative 1 and 544,100 cy. for Alternatives 2-6.

107. f) The dune construction includes 13 acres of planting dune grass and 18,000 lf of sand fence for dune sand entrapment as well as walkovers for access over the dune.

108. The design of the groins in each alternative plan is based on the groin cross-section developed in the February 1995 Feasibility Report. Each groin has an inshore end with a crest elevation of +10 ft NGVD (+9 ft NAVD) to match the adjacent berm crest elevation of the design beach fill and an offshore end with a trunk and head section with a crest elevation of +5.0 ft NGVD (+4 ft NAVD). The intermediate section of the trunk transitions between the inshore section and the offshore section at 1 on 20. The groin side slopes are 1 on 1.5.

Table 2-17

2000 TECHNICAL REANALYSIS REPORT SUMMARY OF FIRST COST *

Code of Account	Description	Plan 1	Plan 2**	Plan 3	Plan 3A	Plan 3B	Plan 3C	Plan 3 D	Plan 4	Plan 4A	Plan 5	Plan 6
		+ 15 NGVD	+ 15 NGVD	+ 15 NGVD	+ 15 NGVD	+ 15 NGVD	+ 15 NGVD	+ 15 NGVD	+ 15 NGVD	+ 15 NGVD	+ 15 NGVD	+ 15 NGVD
		NGVD Dune	NGVD Dune	NGVD Dune	NGVD Dune	NGVD Dune	NGVD Dune	NGVD Dune	NGVD Dune	NGVD Dune	NGVD Dune	NGVD Dune
		110'Berm	110'Berm	110'Berm	110'Berm	110'Berm	110'Berm	110'Berm	110'Berm	110'Berm	110'Berm	110'Berm
			6 Groins	12 Groins	12 Groins	12 Groins	12 Groins	12 Groins	6 Groins	7 Groins	16 Groins	6 Groins
					w/6 Over-Filled	w/3 Over-Filled	w/2 Over-Filled	w/4 Over-Filled				
					Compartments	Compartments	Compartments	Compartments				
01	Lands and Damages											
02	Relocations											
10	Breakwaters & Seawalls											
	New Groin Work		$12,180,000	$20,082,500	$20,082,500	$20,082,500	$20,082,500	$20,082,500	$10,077,500	$16,072,742	$27,260,000	$9,570,000
17	Beach Replenishment											
	Mob & Demob	$1,035,000	$1,035,000	$1,035,000	$1,035,000	$1,035,000	$1,035,000	$1,035,000	$1,035,000	$1,035,000	$1,035,000	$1,035,000
	Placement of sand	$14,974,600	$12,190,300	$12,190,300	$17,410,300	$14,800,300	$14,069,500	$15,948,700	$12,190,300	$11,205,310	$12,190,300	$12,190,300
	Dune grass & sand fence	$469,200	$469,200	$469,200	$469,200	$469,200	$469,200	$469,200	$469,200	$760,082	$469,200	$469,200
	Subtotal	$16,478,800	$25,874,500	$33,777,000	$38,997,000	$36,387,000	$35,656,200	$37,535,400	$23,772,000	$29,073,134	$40,954,500	$23,264,500
	E&D	$988,728	$1,552,470	$2,026,620	$2,339,820	$2,183,220	$2,139,372	$2,252,124	$1,426,320	$1,743,563	$2,457,270	$1,395,870
	Construction Management	$1,153,516	$1,811,215	$2,364,390	$2,729,790	$2,547,090	$2,495,934	$2,627,478	$1,664,040	$2,034,157	$2,866,815	$1,628,515
	Total First Cost	$18,621,044	$29,238,185	$38,168,010	$44,066,610	$41,117,310	$40,291,506	$42,415,002	$26,862,360	$32,850,853	$46,278,585	$26,288,885

(a) Includes contingency of 20 % for relocations, 15% for everything else
* From Technical Reanalysis of Eastern Portion (USACE 2000), Table 7-12 (1999 price level)
**Feasibility Recommended Plan

Table 2-17

Summary of Total First Cost & Total Annual Cost*

Plan	Total First Cost	Interest During Construction (a)	Total Investment Cost	Annual Investment Cost (b)	Annualized Nourishment Cost	Annual Major Rehabilitation Cost (c)	Annual Monitoring (d)	Dune & Groin Maintenance (e)	Jones Inlet Impacts	Annual NED Costs
1	$18,621,044	$301,661	$18,922,705	$1,307,322	$2,275,000	$114,100	$124,400	$25,310	$0	$3,846,132
2**	$29,238,185	$2,242,569	$31,480,754	$2,174,927	$1,276,800	$57,100	$124,400	$39,741	"	$3,672,968
3	$38,168,010	$2,927,486	$41,095,496	$2,839,185	$1,006,700	$57,100	$124,400	$51,878	"	$4,079,263
3A	$44,066,610	$3,379,909	$47,446,519	$3,277,961	$1,006,700	$57,100	$124,400	$59,896	"	$4,526,057
3B	$41,117,310	$3,153,698	$44,271,008	$3,058,573	$1,006,700	$57,100	$124,400	$55,887	"	$4,302,660
3C	$40,291,506	$3,090,359	$43,381,865	$2,977,145	$1,006,700	$57,100	$124,400	$54,764	"	$4,220,109
3D	$42,415,002	$3,253,231	$45,668,233	$3,155,104	$1,006,700	$57,100	$124,400	$57,651	"	$4,400,955
4	$26,862,360	$2,060,343	$28,922,703	$1,998,197	$1,238,300	$57,100	$124,400	$36,512	"	$3,454,509
4A	$32,850,853	$2,519,660	$35,370,513	$2,443,660	$1,136,400	$57,100	$124,400	$44,651	"	$3,806,211
5	$46,278,585	$3,549,567	$49,828,152	$3,442,502	$1,188,300	$57,100	$124,400	$62,902	"	$4,875,204
6	$26,288,885	$2,016,357	$28,305,242	$1,955,538	$1,219,100	$57,100	$124,400	$35,732	"	$3,391,870

(a) Based on 0.5 years of construction for Plan 1 and 2.3 years of construction @ 6 5/8%

(b) I = 6 5/8%, n = 50 years

c From Table 9-3

(d) Indexed to Nov. 1999 from June 1994 and prorated for 18,000 L.F. project area

(e) Based on percentage from 1995 Feasibility Report

* From Technical Reanalysis of Eastern Portion (USACE 2000), Table 7-14 (1999 Price Level)

**Feasibility Recommended Plan

2.9 Effects of Borrow Area Dredging On Shoreline Changes

109. The effects of utilizing offshore sands for beach filling were studied using the Corps of Engineers modeling tools discussed in Section 2.4: nearshore wave transformation model STWAVE and the shoreline change model GENESIS. The wave transformation matrix for GENESIS was developed for each of two borrow cases, Case 1 and Case 2, over the same computational grid. However, the bathymetry was changed using theoretical dredged areas. The dredged areas extend along virtually the entire project area west of the ebb shoal attachment point and both borrow cases are identical except that Borrow Case 2 extends the dredged area 1000 feet close to shore. The contoured bathymetries that incorporate the borrow areas and depths are illustrated in Figures 2-80 and 2-81.

110. Revised nearshore wave transformation matrices (NSWAV) files were developed reflecting the subsequent wave climate modifications for each borrow area scenario, Case 1 (b1) and Case 2 (b2). Using these files, 5 year GENESIS simulations were conducted for Alternatives 1 – 6 including alternative 4a for the following wave conditions:

- Existing bathymetry (Ex)
- Case 1 Borrow area bathymetry (B1)
- Case 2 Borrow area bathymetry (B2)

111. Net longshore transport rates and average shoreline changes for each alternative for each bathymetry scenario were compared. In general, variations in the net longshore transport rates for each bathymetry scenario typically ranged between 25,000 to 50,000 cu. meters per year. Variations in average shoreline change for each bathymetry scenario typically ranged between 3 to 5 feet per year.

112. Figure 2-82 illustrates the predicted annual shoreline changes along the project area shoreline for Alternative 4A with the existing bathymetry and the incremental change between the existing bathymetry and the modified bathymetries, Case 1 (B1) and Case 2 (B2). Analysis of Figure 2-82 indicates that over the majority of the shoreline, the Case 1 (B1) bathymetry results in a decrease in erosion as compared to the existing bathymetry. The exception is at the western end of the project area where increased erosion of about 2 ft per year is indicated. A similar general trend is noted with the Case 2 (B2) bathymetry except that an increase in erosion of on the order of 3 ft per year is indicated in the Hempstead Beach area as compared to the existing condition bathymetry as well as increase in erosion of on the order of 5 ft per year in the western end of the project area.

113. Based on this analysis, the Case 1 (B1) borrow area scenario is recommended. The increased erosional pressure at the western end of the project that is estimated to occur for this borrow area scenario can be minimized by using the easternmost and offshoremost sections of the borrow area first. These sections of the borrow area will also infill the quickest from material bypassing Jones Inlet from Jones Island.

2.10 Conclusions and Recommendations

114. The Recommended Plan from the Feasibility Study that was completed by the New York District in 1995 included the construction of six new rubble mound groins along a portion of the eastern shoreline of Long Beach Island, New York. The proposed groin field was found to be required to reduce sand losses to the berm and dune system portion of the Feasibility Study Recommended Plan which provides protection for the community against flooding and other types of storm damage. These proposed groins were approximately 700 feet in length and were spaced at approximately 1200-foot intervals along the shoreline. The proposed groin field

would extend westward from the three existing groins in Point Lookout at the eastern end of the island, and terminate about 7,000 feet to the west, at a location where the curvature of the island shifts seaward. A gap of approximately 7,000 feet would exist between the western end of the new groin field and the existing groin field in the City of Long Beach.

115. Local residents and 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. Concerns of local residents were based to some extent on a partially analogous situation at nearby Westhampton, New York, where a groin field was constructed over the eastern part of a barrier island. Westhampton experienced significant erosion downdrift (to the west) of the groin field along the ungroined shoreline over the years, while the groined portion of the barrier beach remained stable. The Long Beach Island Feasibility Study stated that the change in shoreline orientation west of the proposed groin field differs from the Westhampton case and Long Beach Island, therefore, would be unlikely to experience severe downdrift impacts.

116. Since the Feasibility Study was performed in 1995, the New York District's Atlantic Coast of New York Monitoring Program (ACNYMP) has collected significant amounts of data to document beach conditions and processes. The enhanced understanding of the coastal processes over those available at the time of the Feasibility Study, together with dramatically changing conditions and improved numerical modeling tools, have been used in this report to reanalyze shoreline stabilization measures for the eastern end of Long Beach Island. Some of the conclusions reached during this reanalysis are as follows:

117. **2.10.1 Recent and Predicted Shoreline Changes.** During recent years significant accretion has taken place in the western portion of the project area, especially in the area of the ebb shoal attachment point, the weldment. 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 1933, Lido Beach has experienced a noticeable degree of shoreline stability and has accreted as sand from the ebb shoal attachment point and the beach fills has been transported to the west. Only in the extreme western portion of Lido Beach has there been slight shoreline recession since 1990. The numerical modeling performed in this reanalysis effort has been validated to reproduce those historical trends.

118**.** **2.10.2 Bypassing Of Sediment From Jones Beach To The Shoreline On Long Beach Island.** Calibrated numerical modeling of shoreline changes west of the ebb shoal attachment point (Lido Beach to Long Beach) requires a sediment influx that is consistent with the long term longshore sand transport rate and inlet bypassing rate determined using long term wave statistics. The physical characteristics of the inlet features, the continued growth of the ebb shoal attachment point, and the requirement for a sediment supply at the attachment point for successful simulations of shoreline evolution indicate that bypassing of sediment from Jones Beach to Long Beach is occurring and will continue.

119. **2.10.3 Erosion Between The Ebb Shoal Attachment Point And The Inlet.** The present work indicates that this area exhibits coastal processes that are very different than those west of the ebb shoal attachment point. Numerical modeling performed in this study indicates that during storm events from the easterly directions the littoral drift near the shoreline is toward the west. However, further offshore, the littoral drift is toward the east, with significant onshore-directed sediment transport from the shoal. It has been during storm conditions that erosion of the beach has been observed, when material is carried both toward the west and offshore, where the high currents then carry the sediment back toward the inlet where it is deposited. During mild wave conditions from the southwest, the littoral drift is generally east-

directed both very near the beach and in the offshore area. It is during the milder wave conditions that the onshore-directed sand transport from the shoal and the general east-directed transport creates an accreting condition offshore of the –2m NGVD (-2.3 ft NAVD) contour, which appears to be responsible for the relatively flat bathymetry over this area. Further applications of numerical models indicate that a groin field can inhibit the erosional processes in this area.

120. Based on a better understanding of these central coastal processes through more advanced numerical modeling tools and expanded physical data from the area, the objective of the reanalysis presented in this report was to develop a shoreline stabilization plan that addresses beach erosion conditions while minimizing project cost and potential impacts on downdrift shoreline areas.

121. To accomplish this objective, the modeling analysis compared the performance of numerous alternatives with the without-project alternative to identify positive or negative impacts of each alternative in the major project reaches. Based on this analysis, stabilization measures that included a groin field that extended from Point Lookout to Long Beach were predicted to cause increased erosion rates west of Groin 48 in Long Beach due to a decrease in longshore sediment. In addition, alternatives that include groins immediately east of West Lido Beach resulted in increased erosion in West Lido Beach.

122. Overall, the modeling results indicated that Alternative 2 (Feasibility Study Recommended Plan) and Alternative 4 (the Feasibility Study Recommended Plan with tapered groin lengths toward the west) will provide the best performance, with Alternative 2 having a slight negative (erosive) impact in the Lido Beach area. By tapering the westernmost groins, the downdrift erosion in Lido Beach was alleviated.

123. Because the sediment transport processes are dominated by tidal currents and complex bathymetry east of the weldment, Alternative 4 was further analyzed using the Danish Hydraulic Institute's MIKE21 modeling system. The simulation of hydrodynamics and sediment transport for Alternative 4 indicated a potentially-significant erosive condition to the west of groin 3. An examination of those results indicated that a reduction in groin spacing might reduce the erosion potential in that area. An additional alternative, Alternative 4a, was specified where an additional groin was added to Alternative 4 by decreasing the groin spacing east of the weldment from 1200 feet to 800 feet. The result was a groin field where the easternmost four groins are spaced at 800-foot intervals west of groin 3 followed by an additional 3 groins proceeding (and tapered) to the west with a longshore spacing of 1200 feet.

124. . Alternative 4a was found to provide an improvement in the coastal stability of the area west of existing Groin 3 over both the no-action alternative and Alternative 4. By reducing the spacing of the groin compartment, the performance of the groin field was enhanced and the area of potential erosion was more confined.

125. Previous modeling efforts combined with the historical stability of the shoreline west of the proposed groins in Alternative 4A have led to the conclusion by the District and CHL that new groins west of the structures modeled in Alternative 4A are neither necessary nor advisable; particularly since GENESIS simulations show that additional groins west of the westernmost groin in Alternative 4A such as the six westernmost groins in Alternative 3 result in potential adverse downdrift impacts. As shown in Section 2.4.5, mitigation of these impacts such as overfilling groin compartments as in Alternatives 3A-3D would be required and would add cost over a shoreline reach where models and field data indicate a historically stable or accretive shoreline.

2.11 Technical Reanalysis Selected Plan

126. Based on the results of the circulation and sediment transport modeling, Alternative 4A, as shown in Figure 2-83, is the recommended plan. Alternative Plan 4A consists of 7 groins with the first groin constructed 800 ft west of existing Groin 3 in Point Lookout and the second through fourth groins constructed with tapered lengths at intervals of 800 ft. The remaining 3 groins will be constructed at 1,200 ft intervals with tapered lengths.

127. Based on a review of Smith and Kraus (1999), spacing-length ratios between 1.0 and 2.0 appear to result in maximum fill ratios in groin compartments. Fill ratio is defined as the ratio of dry beach within a groin compartment to the area that would result if the groin compartment were completely filled with dry beach in a straight line between the seaward groin tips. A decreasing trend in fill ratio with increasing spacing-length ratio was observed. As a result, spacing-length ratios between 1.0 and 2.0 are recommended for functional design alternatives.

128. Using this guidance, the original Alternative Plan 4 was re-evaluated and modified as Alternative 4A. Groin spacing for the proposed groins in the high erosion area west of existing Groin 3 in Point Lookout was selected to be 800 ft, which is about 100 ft less than the 900 ft spacing between Groin 2 and Groin 3 in Point Lookout. In order to minimize the potential impacts to the shoreline to the west, a tapered groin field is recommended with a recommended 6-degree taper starting at the seaward tip of Groin 3. This taper results in a proposed length of 500 ft from the proposed seaward top of berm to the seaward tip of the first proposed groin to the west of Groin 3. These dimensions result in a spacing-length ratio of 1.6 for the first groin compartment west of Groin 3. The lengths of the remaining groins are reduced to meet the 6 degree taper for the groin field as shown in Figure 2-83.

129. Initial construction of the 4 easternmost groins (groins A-E) is recommended to provide the required erosion control and storm protection for the severely eroded shoreline area. The New York District recommends constructing the fourth groin in Alternative 4a (fourth new groin west of existing Groin 55) to account for possible alongshore shifting of the weldment and to help in isolating the erosional cell found in the MIKE21 simulations. The remaining 3 groins further west (groins F-G) which would be largely buried in the existing weldment area are proposed for deferred construction as needed based on the stability of the weldment area.

130. The role of the proposed groin field (groins A-E) is to address the problems that are occurring east of the weldment, inside the Jones Inlet ebb tidal shoal. The deferred tapered groins (groins F-G) are retained in the plan to address the possibility that the weldment may migrate westward at some time in the future, creating erosional pressure to the east as it moves. Areas to the west of the ebb shoal weldment location presently benefit from sediment entering from the weldment, which is supplied from the ebb tidal shoal. Based on this Technical Reanalysis, it is concluded that the flow of sand from the weldment toward areas further west should not be interrupted by the proposed groin field (groins A-E), due to their location inside the shoal. Additionally, the proposed groins were designed to taper in length, shorter groins to the west, which will act to further minimize the possibility of down drift impacts. 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.

2.11.1 Design Basis and Features

(Features listed below are as presented in the 2000 Technical Reanalysis for the eastern half (approx. 18,000 lf of 41,000 lf covered by the Feasibility Study) of the Long Beach Project and reflect survey conditions at that time. Fill quantities listed below are the basis for cost comparisons presented in Table 2-16 and 2-17.)

131. **2.11.1.a Fill**. The beach fill included in Alternative 4A is basically the recommended beach fill for Plan 5 in the February 1995 Feasibility Report. Typical sections of the beach fill are shown in Figures 2-84 and 2-85. The recommended beach fill consists of the following components:

132. a) Dune and berm fill from Point Lookout west through the eastern section of Long Beach (approximately 18,000 lf). The design berm fill will taper at an angle of approximately 6 degrees at the western termination and will tie into the existing shoreline at the eastern termination in Point Lookout.

133. b) Dune: Crest elevation of +15 ft NGVD (+14 ft NAVD) or a crest width of 25 ft with 1 on 5 side slopes on the landward and seaward sides.

134. c) Berm: Fronting the dune, a berm width of 110 ft minimum at elevation +10 ft NGVD (+9 ft NAVD) with a shore slope of 1 on 20 for the easternmost 5,500 lf of the project, a 1,500 lf transition, thence a 1 on 35 slope for the remaining 11,000 lf. The slope in the eastern section of the project was changed to 1 on 20 (from 1 on 25 in the 1995 Feasibility Report) to account for the steepening effect of the proposed groins. This slope was selected based on a review of the Westhampton project and results in the toe of the fill intersecting the existing profile at the seaward end of the proposed groins. Any additional reduction in the fill template is not recommended given the District's requirement to maintain a minimum 110 ft berm width and CHL's recommendation to maintain a straight shoreline (resulting from any adjusted fill sections) in the region of the new groins.

135. d) A total initial sand fill quantity of 2,146,200 c.y will add approximately 100 to 400 ft of design beach at 0.0 ft NGVD (-1 ft NAVD) to the existing beach. These quantities of sand fill include the following:

- +1.0 ft tolerance
- overfill factor of 2.5%
- advanced nourishment width of 50 ft (528,800 cy of the 2,146,200 cy initial fill is for advanced nourishment

136. e) The initial dune construction includes planting of 13 acres of dune grass and 18,000 lf of sand fence for dune sand entrapment as well as ramps and walkovers for access over the dune.

137. f) Renourishments of 857,200 cy per cycle are included in the plan at 5-year intervals. This volume assumes no placement of maintenance dredge material from Jones Inlet, due to uncertainty in available quantity and timing. Actual renourishment needs will be reduced to account for placement of dredged material as needed.

138. **2.11.1.b Groin Design and Configuration.** The design of the 7 groins in Alternative Plan 4A incorporated the requirement that they be sand tight and of rubble mound stone construction. Each groin has an inshore end with a crest elevation of +10 ft NGVD (+9 ft NAVD) to match the adjacent berm crest elevation of the design beach fill and an offshore end with a trunk and head section with a crest elevation of +5.0 ft NGVD (+4 ft NAVD) to increase the sand retention capability of the groins. The intermediate section of the trunk transitions between the inshore section and the offshore section at 1 on 20. The landward extent of each groin extends to 25 ft seaward of the dune toe to preclude flanking and allow for maintenance. The seaward extent of the head section crest terminates at about the design fill closure for the two easternmost groins. The seaward extent of the head section crest terminates landward for the remaining five westernmost groins and is buried for the four westernmost groins. Per District

guidance, the groin side slopes are 1 on 2.0 and the head section crest length is 50 ft with an end slope of 1 on 2.0.

139. **2.11.1.c Design Wave**. The design wave condition for the proposed 7 groins in Alternative Plan 4A is the same as the February 1995 Feasibility Report. This report determined the design wave condition to be a breaking wave height of 11.0 ft with a wave period of 10 sec.

140. Using the design wave data from the February 1995 Feasibility Report, Hudson's equation and guidance from the District to use a single layer of armor stone, the required stone sizes were determined along with the required crest widths and layer thicknesses. The foundation of the groins consists of a 2-ft thick bedding stone layer overlying geotextile fabric. The bedding layer is extended 20 ft beyond the toe of the armor stone at the head of the groins and tapers to 10 ft beyond the toe of the armor stone at the inshore end of the groins. Typical groin sections are shown on Figure 2-86 and typical groin profiles are shown on Figures 2-87 to 2-93.

2.11.2 Potential Impact on Inlet

141. The MIKE21 model results were analyzed to examine the effect of alternatives 4 and 4a on sediment transport patterns in the inlet and ebb shoal areas. Alternative 4a causes a redistribution of sediment within the inlet cells shown in Figure 2-94, but the net change is negligible. The results should be used with caution as cell boundary locations can highly affect interpretation. Also, the differences between the alternatives are somewhat related to numerical accuracy, although the simulations were done consistently.

2.11.3 T-Groins and Other Possible Design Enhancements.

142. Other enhancements to the groin concept have been discussed throughout the performance of this project. One alternative is T-groins. Although T-groins would likely further increase sand retention in the Hempstead/Point Lookout area, those increases would come at a much higher cost because the T-head stone would be in relatively deep water. The straight groins considered in this study appear to provide an acceptable improvement in performance and are similar to the groins that are presently effective along Point Lookout. Although T-groins would provide some improvement in retention of sand already within the compartments, they will limit the volume of sand that would be able to refill the groin compartments during times of onshore sand transport and during longshore transport reversals (from the west). They may also have the disbenefit of channelizing tidal flow along the offshore side of the T-heads, leading to scour near the structures. T-groins would change the character of the recreational beach from open water to partially enclosed compartments. However, if a long-term monitoring program indicates the future need for a design modification, T-heads could be added at a later date to the proposed straight groins, but would require a new environmental assessment as part of the process.

Section 3

Terminal Groin Rehabilitation and Extension

3.1 Introduction

143. An assessment and design for rehabilitation and extension of the terminal groin was done in February 1999 (USACE, 1999), and is summarized in this section. The 175-foot long terminal groin is situated within the unincorporated community of Point Lookout, located at the eastern end of Long Beach Island. Long Beach Island is located within Nassau County and is approximately 23 miles southeast of New York City (Figure 3-1). The terminal groin and a 2,800-foot long revetment provide shoreline stabilization to the Point Lookout community from both the Atlantic Ocean and adjacent Jones Inlet.

144. The rubble-mound terminal groin and the adjacent 2,800-foot long rubble-mound revetment were constructed in 1953 as initial attempts to stabilize Jones Inlet and protect 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 for the rehabilitation and extension of the groin.

3.2 History of Construction- Terminal Groin, East Jetty, and Revetment

145. Stabilization of Jones Inlet was initially started in 1939 when a timber-pile and stone revetment was placed along the western shoreline of Jones Inlet to protect the community of Point Lookout. The addition of the revetment did not limit the migration of the inlet nor prevent the accumulation of sand within the main channel. Navigation continued to be hazardous as the size and height of the ebb shoal was constantly changing. Natural processes later destroyed the revetment. The continual westward migration of the inlet prompted the construction of a stone seawall during the 1940's, which lined the western bank of the inlet. Further stabilization of the inlet commenced in 1953 with construction of the three groins, including the terminal groin, which were placed along the Point Lookout ocean shoreline. During this period, the east jetty was constructed (completed in 1959). With the completion of the east jetty, the navigation channel was dredged to a design depth of 12-ft MLW and a 250-ft width.

146. Since the late 1950's, on-going repair of the structures has taken place. The concrete seawall along the western bank of the inlet was replaced by a 2,800 foot stone revetment, which eventually failed after repeated nor'easters in 1991 and 1992. In 1997, repairs were made to the east jetty that consisted of tightening the capstone and raising the crest elevation 1.5 feet to 7.9-ft NGVD (6.9 ft NAVD). In late 1997, the Town of Hempstead placed excess armor stone from the east jetty repairs along a 1200-ft section of the revetment as a provisional improvement.

147. The location of the navigation channel was moved closer to the east jetty in 1963, and during the 1987 and 1990 dredging operations, a 750-ft wide and 16-ft deep deposition basin was included for inlet maintenance. The terminal groin, as constructed, was 175-feet long, with the centerline oriented approximately 20 degree west of south. Details of the design are scarce and as-built plans or construction specifications could not be located. The design template of the groin appears to have specified a single layer of 3' diameter armor cap stone and an inner section consisting of 5-lb to 1-ton core/bedding material, crest width of 12', and 1V:1.5 side slopes. Plans from 1952 show a length of 640 ft., however the actual structure is approximately 175 ft long and armor stone is significantly larger (ref. Beach Protection (Stone Jetties) at Point Lookout, Town of Hempstead, Nassau Col, sheet 2 of 2 dated 5/7/1952). Based on a visual survey conducted by the USACE (USACE, 1995), the existing groin crest height was estimated

at elevation 5.5 feet NGVD; a crest width of 12 feet; and side slopes of 1V:1.5H. A recent topographic survey of the site shows the actual average crest height of the terminal groin to be elevation 4.9 feet NGVD (TVGA, 1996).

3.3 Structural Integrity - Terminal Groin and Revetment

148. The geometry of the groin structure has basically been retained since its construction. The side slopes of the structure have retained their original placement except in the areas where undermining of the core stone has resulted in the sloughing of the cross section as evidenced along the eastern (inlet) side of the groin and at the groin head.

149. Inspection of the groin was done in 1998 (USACE 1999) and again in September 2003 as part of this HSLRR. To facilitate in the assessment of the groin, stationing was developed along the centerline of the groin which ties into the centerline and subsequent stationing developed for the revetment. A definition of excessive void spacing was also developed to assess the condition of structure's integrity. For this evaluation, excessive void spacing was defined as the area between armor capstones that could fit, at a minimum, a sphere having a one-foot diameter. A one-foot diameter sphere was chosen because it represents the median diameter of the existing core/bedding stone beneath the armor capstones. The field inspection indicated that approximately 25% of the structure (measured along the crest and side slopes) had voids greater than the criteria. In these areas, the contact points between the faces of the armor capstones were typically less than three. In several instances, though, large voids occurred when contact points between faces were equal or greater than three. This occurrence can be attributed to poor fitting of the armor capstone during construction, where interlocking of stone was not done. The loss of interlocking, coupled with larger void spacing has resulted in the displacement of the armor due to wave action and loss of the core material. Settlement of armor especially along and immediately below the water line on the inlet side is evident.

150. Station 0+00 to Station 0+40: The west side of the groin is completely submerged below the beach berm, making an assessment of the structure's west side slope impossible. The armor capstone situated along the crest is in good condition. The eastern side of the groin along the inlet is weathered but stable, showing a proper side slope and transition to the revetment.

151. Station 0+40 to Station 0+90: The west side of the groin is partially buried by the beach up to and including Station 0+80. This section of the structure is not subject to normal wave attack and has retained its geometry, although physical weathering of the stone is apparent. Along the entire 50-foot reach, the eastern side of the groin has slumped severely. The slumped stones are approximately 3 feet below the crest of the groin and are no longer interlocked with surrounding stones (no point contacts). Washout of the bedding layer is apparent within the slumped area and sand is present among the slumped armor. The crest has been partially dislodged and tilts in toward the slumped section.

152. Station 0+90 to 1+55: The groin has retained a trapezoidal geometry although the armor capstone is not well interlocked along the crest or either side slope. Some sand has accreted against the groin along the inlet side, but does not extend into the inlet past the influence of the stones. The armor stone is severely weathered, with cracking and spalling apparent on most stones. In some instances where stone is susceptible to continual splash, the freeze/thaw process has caused cracks to propagate through the entire stone, resulting in separation of large armor into smaller pieces. These smaller armor stone are more susceptible to displacement by wave action, and several smaller stones are resting at the water line. Station 1+55 is the head of the groin and has become partially unraveled. The rock is severely weathered and has spalled, causing several armor stones to have broken into smaller pieces. The groin head has taken a flatter than 1 V:1.5H slope and had settled slightly, causing some

armor to have fallen into the water. Overall the terminal groin is in adequate to poor condition. The eastern side needs repair from Station 0+40 to 1+55, and the entire groin requires repair from Station 1+30 to 1+55.

153. The provisional repairs made to the revetment by the Town of Hempstead appear to provide adequate protection to the shoreline at the present time. The stone that was placed along the improved section is judged to be of adequate size based on the wave conditions expected within the inlet. However, the inability to precisely place the stone on the revetment slope results in side slopes that are steeper than 1 V:1.5H, which is considered the minimum slope for stone stability. The lack of core material (to create a secure foundation) and the steep slopes created by the placement method prevents the structure from meeting USACE criteria. The entire structure will likely require additional repairs in the next ten years. The Town's action provides a timely and cost effective measure to temporarily reduce the erosion of the western shoreline of Jones Inlet.

3.4 Armor Stone Estimate

154. The size and weight of the armor stone is critical in assessing what design condition the existing structure is able to withstand without significant damage. Estimates of the armor stone weight were made by measuring each stone's length, width, and depth at its centroid. These dimensions were then used to calculate the volume of each stone, which was then multiplied by the specific weight of the stone to estimate the weight. Field measurements indicate that the estimated armor stone weight ranges between 4 and 12 tons, with the W_{50} equal to approximately 10 tons. This stone is significantly larger than the stone size estimates previously collected (USACE, 1995). However, the size of the stone does not seem extreme given that that the rehabilitation of the east jetty at Jones Inlet stipulates 6 to 15 ton armor stone, with 75% of the stone quantity greater than 12 tons. It appears that the stone size used for the construction of the existing groin is adequate, if slightly undersized, for the conditions experienced at the inlet.

3.5 Determination of Extension Length

155. The lengthening of the terminal groin is an integral step in the overall shore protection project for eastern end of Long Beach Island. The additional length will help alleviate the potential increase in shoaling at Jones Inlet that could occur from sand placement associated with the shore protection project, and will aid in retaining placed fill.

156. 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 8 years (e.g. 1991-1999).

157. Working in concert with the wave-induced currents is tidal currents at the inlet. The topography of the ebb-tidal delta and the navigation channel create avenues for tidal flows in and out of the inlet. One such avenue has been the marginal flood channel running parallel to the shoreline (approximately 750 feet offshore) and extending from the terminal groin westward

approximately 3,000 feet. This channel, which ranges in depth from 15 to 25 feet, may produce strong currents in the middle and lower portion of the water column, especially during the flood tide. The sediment initially suspended by the incoming wave may be carried along this channel by the flood current, and into the inlet.

158. The mechanics of sand transport past the terminal groin will be altered once the shore protection project is complete. The beach fill design presented in the feasibility report (USACE, 1995) and as modified by this Hurricane Sandy Limited Reevaluation Report adds beach width to both groin compartments, with the goal of maintaining the position of these shorelines once the fill is complete. A tapering of the beach fill within the eastern groin compartment (adjacent to the terminal groin) has been designed to minimize sediment transport past the terminal groin into Jones Inlet.

159. But the additional sand placed within the last groin compartment will shift the active sediment transport zone approximately 50 to 100 feet further offshore and nearer to the marginal flood channel. The nearshore slope of 1V:20H used in the proposed beach fill plan (USACE, 1995) is too mild if the existing beach slope (1V:10H) is an indication of stability. Sand from both groin compartments will not be retained by the existing terminal groin and will enter Jones Inlet as the beach profile adjusts to a quasi-equilibrium state. An extension of the terminal groin will be required to maintain the sediment trapping characteristics of the existing groin once the beach fill project is complete.

160. Given the location of the marginal flood channel, extending the groin approximately 750 feet (resulting in a total terminal groin length of approximately 950 feet) may substantially reduce the amount of sediment entering the inlet by inhibiting currents flowing through the marginal flood channel. However, extending the terminal groin this length could have severe ramifications on the inlet process occurring at Jones. Interrupting the marginal flood channel may result in the migration of that channel further offshore. If the channel migrates, the westward extent of the channel could change, creating a path for sediment transportation in a shoreline location presently not experiencing erosional problems. A groin extension of this magnitude could also alter the inlet dynamics, resulting in changes in the ebb-tidal delta, shoaling within the inlet, and behavior of the shoreline downdrift. Aside from the geomorphologic changes that might occur with a longer groin extension, the deep water in which the structure would be situated would require extensive armoring given its exposure to larger incoming waves. Designing a structure to withstand severe wave conditions in deeper water would require large amounts of stone, with corresponding increase in project cost.

161. Previous studies (USACE, 1995) have examined extending the terminal groin and have concluded that, *"the engineering benefits of the extension of terminal groin are moderate, with significant negative impacts possible."* This statement is too limiting. Extending the terminal groin a set length may decrease the amount of sediment lost toward the inlet after the beach fill project and possibly retain additional alongshore sediment transport without causing large changes in inlet dynamics. Approximately 30,000 cubic yards per year (cy/yr) to 80,000 cy/yr of sediment annually bypasses the terminal groin and enter the inlet. If the groin extension can retain the beach fill (after its equilibrium state) and trap a portion of alongshore sediment quantity, it is anticipated that the shoreline in the eastern groin compartment will remain stable or increase slightly.

162. No one method is universal for setting the optimum groin length for maximum sediment retention. Theories estimating the optimum length are either derived from theoretical relationships or analytical solution based on the results of laboratory experiments. Prototype information on the performance of groins designed using these theories is practically non-

existent. Nagai (1958) and Horikawa (1958) suggested that the optimum groin length for sediment saturation within a groin compartment to be between 40 to 60% of the distance to the predominant plunger line. Presently, the predominant plunger line is contained within the existing groin compartment during prevailing (non-storm) conditions. However, the beach fill project will push the plunger line approximately 50 to 100 feet further offshore based on revised beach profiles in the feasibility report. The distance between the line denoting the northern extent of the surge on the beach and plunger line is approximately 350 feet (assuming a -10 feet NGVD plunger line depth). Based on this theory, the optimum groin length would range from 140 to 210 feet, starting at the beach surge line. Adjusting the baselines, the groin would need to be extended up to 60 feet.

163. Herbich (1990) suggests the optimum groin length for sediment saturation within a groin compartment can be determined by assuming the existing groin compartment is analogous to the evolution of a beach between two coastal headlands. Based on this assumption, the optimum groin length to groin spacing for sediment saturation within the groin field is determined, resulting in the selection of the groin length. This theory accounts for the obliquity of incoming waves as it relates to beach evolution within the groin field. Since incident waves with compass bearings between 180 and 225 generate the eastward-directed wave-induced currents, it was determined that the optimum groin width/length ratio for the last groin field is between 2.5 and 4. Since the groin field width is approximately 780 feet, this would equate to a total groin length between 195 and 340 feet from the mean tide line. This translates to an extension length ranging from 150 to 300 feet.

164. Hallermeier (1983) theorized that the effective groin length could be developed by comparing the depth of the seaward extent of the groin with the effective seaward limit of the littoral zone (where intense sand transport ends). From this ratio, the percent reduction in the sediment transport rate past the groin could be assessed. Thus, the optimum groin length could be determined. The effective seaward limit of the littoral zone was calculated for prevailing conditions and storm conditions up to and including the 2-year return period event. The 2-year storm event was selected as the upper bound since larger storms would push the littoral zone into water depths where a groin extension could affect inlet processes. It was determined that a 50% reduction in the alongshore sediment transport rate would occur for conditions up to and including the 2-year storm event if the groin structure was lengthened an additional 100 feet. If the groin is lengthened beyond 100 feet, the reduction in the sediment transport rate would level off while the risk of impacting the inlet processes grows.

165. Examining the results from the three methods, only Hallermeier's theory appears to capture the essence of what is trying to be determined; the sediment retention capability of a single structure. Herbich's theory determines the effective groin length based on the relationship between the incident wave angle and the width of the groin compartment. It does not take into account wave steepness, wave period, grain size, or the location of the active littoral zone; factors that influence sediment transport. Nagai (1956) and Horikawa (1958) fail along similar lines and neither of their methods examines the impact of a single structure, just the total system. Only Hallermeirer's theory relates sediment transport mechanics with the single structure length, providing the most convincing solution to the optimum groin length. Extending the groin more than 100 ft appears to reduce the effectiveness per foot of the groin in capturing sediment while creating the possibility of undesirable changes to inlet processes. Therefore, a 100-foot extension is recommended.

166. It is expected that the lengthened groin structure will perform in a similar fashion to that of the existing groin structure. The majority of beach fill plan will be retained (after it reaches equilibrium) and a more significant portion of the alongshore sediment that travels eastward will be arrested during prevailing (non-storm) conditions than currently exists.

167. During storm conditions, the groin will allow a significant amount of sediment to be transported into the inlet, as is currently the case. Also, during the first year following the initial beach fill and subsequent beach renourishments, sediment transport around the tip of the groin will be greater than average as the littoral zone within the groin compartment adjusts to a quasi-equilibrium state.

168. The quantity of sediment that can be captured by the structure prior to reaching its capacity can be estimated through geometric means. Using beach plan and profile evolution information from the Coney Island groin impoundment as a comparative baseline, the volume of sand retained by the structure can be determined (USACE, 1998). For the calculation, the entire groin field was considered as one system. The intermediate groin, which terminates at a shallower water depth, does not function to retain alongshore sediment. Its primary function is to retain the beach within the western compartment. Presently, the existing terminal groin does not have additional capacity to retain sand. By extending the groin an additional 100-feet, approximately 23,000 cubic yards of sediment can be accumulated prior to the completion of the beach nourishment project. Once the beach fill project is complete, the lengthened groin will continue to function as it presently does. Sand will be retained during prevailing conditions and will bypass the extended groin during storm conditions.

3.6 Determination of Groin Height

169. Selection of the groin crest height must balance between the groin's intended function and its stability during storm conditions. The crest height factors into the functionality of the structure since the height of the groin is directly related to effectiveness of the structure in capturing sand at various water levels. In terms of stability, the groin height determines the critical design water level and subsequently leads to stability criteria for the structure.

170. The crest height of the existing terminal groin is approximately at elevation 5 feet NGVD (4 ft NAVD). At this elevation, sediment can be captured by the structure during periods of elevated water levels up to and including the 2-year return event. Beyond this return event, the structure becomes submerged and its effectiveness as a sediment trap is reduced. In terms of stability, the 5-foot NGVD (4 ft NAVD) crest elevation sets the critical water level elevation, resulting in a 10-12 ton armor stone requirement to achieve stability for the structure during storms.

171. Lowering the crest height would reduce the stability requirement on the structure since the critical water level and subsequently, the design wave condition, would be lower. A crest height set at the existing high tide line will result in armor stone in the 8 to 10 ton range. The trade-off of the lower crest height may include an increase in construction cost (since water-based construction must be used), greater sand retention loss during storm conditions, and the advent of navigation issues. Because stability of the structure can be altered with changes in the sideslope of structure, crest elevation changes were not considered further. For the design of the groin extension, a 5-foot NGVD (4 ft NAVD) crest elevation was used.

3.7 Groin Orientation

172. The terminal groin is presently skewed 20 degrees west of due south. It is assumed that this orientation was selected to minimize both structural damage of the groin and the erosive force on the beach from storm waves. This orientation might have also been selected to provide greater control of the littoral movement. Since the inlet dynamics and shoreline evolution process has not significantly changed in the 10 years prior to this design, a change in the orientation of the groin was not initially considered. However, it was noted that rip currents could

more easily be deflected seaward at the existing orientation. To minimize this affect, the extension was skewed an additional 20 degrees westward. Added benefits of this orientation include placing the structure toe further from a small scour hole that is forming in this part of the inlet. This orientation also places the structure in shallower water, which can decrease the incident wave height at the structure as well as reduce scour potential and construction costs.

3.8 Structural Stability and Damage Level

173. The stability of a coastal protection structure is dependent on the combination of wave, water level, and current conditions that produce the maximum forces on the structure. The U.S Army Corps of Engineers stipulates that the life cycle of rubble-mound structures should range between 25 and 50-years if the structure is to be justified economically for its intended role. Given that the terminal groin has provided functional protection to the Point Lookout shoreline for close to 50 years, the 100-foot extension and rehabilitation of the groin should be designed for the same longevity. During a 50-year period, the combination of storm, water level, and current that produces the largest force occurs at the 2-year return period surge, when the water level is approximately equal to the crest elevation of the structure. Although storm events greater than the 2-year can occur in 50-years, the forces on the structure are reduced as the structure becomes submerged. The stability of the submerged groin during these larger events was examined using the method outlined by Ahrens (1988) and it was determined that deformation of the structure would be minor. Therefore, the stability of the structure was designed to the 2-year design event.

174. USACE recommends that coastal shore protection structures do not sustain greater than 5% damage during their lifespan. The existing groin structure was not designed to USACE standards. In situation where repair or rehabilitation of an existing structure is required, the USACE recommends a 20% damage level be used. The extension of the terminal groin will require the construction of a new groin cross section and the rehabilitation of the existing groin cross section. New groin cross sections are designed to meet USACE standards (5% damage levels). Rehabilitation of the terminal groin is designed for a 20% damage level. The transition between new and existing sections is designed to the 20% damage level.

3.9 Settlement Analysis

175. Structure deformation due to underlying soil settlement was examined as part of the design process. Three core-boring logs, which recorded the type of soil lying below the water in the area where the groin extension would be constructed, were used in the assessment. The borings indicate that soil composition is fairly uniform and is composed of fine to medium grained poorly graded sand. It should be noted that one of the borings was terminated at a depth of -7.2 feet NGVD (-8.2 ft NAVD) due to encountering a boulder. The other borings indicate that the sand layer extends 30 feet below the ground surface.

176. Settlement estimates for sand are usually made on the basis of the relative density of the sand as measured by standard penetration tests. The relative density of sand is determined by the number of blows of the standard 140 pound hammer required to advance the standard split spoon sampler a distance of one foot. This number of blows is the "N" value for the soil material. The "N" values for the three borings indicate that the sand is loose to medium dense for the upper two feet. Below this depth, the blow count indicates very dense conditions. Using the very conservative "N" values from the upper two feet, the resulting settlement is 4.9 inches for the groin design. Settlement, when it occurs, will be completed quickly and should not be experienced after the construction of the groin extension. Since groin construction tolerances are generally set at 12 inches, settlement appears to pose little problem to the future structural

integrity of the groin.

3.10 Groin Extension Design

177. Beginning at Station 1+40, the 100-foot extension will be constructed. The existing groin head from Station 1+40 seaward will be removed since its structural integrity is severely compromised. The design template for the 100-foot groin extension will retain a majority of the exterior features that exist in the original groin design template with one alteration. The side slopes of the outer 50-ft of the extension will be 1V:2H slopes, instead of 1V:1.5H to increase the stability of the armor layer. The crest width has been increased from 12-feet to 15-feet to meet the recommended USACE guidelines, which calls for the placement of three armor capstones across the top of the structure. The armor section will consist of two-layers of stone. Due to the loss of core material from the existing groin, a double layer of secondary armor stone has been added to the design to provide protection against material losses. It was also felt that the secondary armor layer would increase the stability of the exterior armor capstones, which will be susceptible to attack from larger waves at the outer end. A buried toe, designed to recommended USACE guidelines, was designed from Station 1+40 on the eastern (inlet) side around the head to Station 2+50 on the west side as moderate to severe scour is possible (especially on the inlet side). The toe will also prevent premature slumping of the design section.

178. The transition from a double armor layer and 1V:2H side slope to a single armor layer and 1V:1.5H side slope will take place along a 30-ft transition section from Station 1+60 to 1+90. This transition between new and existing sections will prevent a change in the exterior profile of existing groin and avoid the removal of the existing core material. The 30-ft long transition will consist of a single-layer of armor capstone placed atop a double layer of secondary armor stone. The reduced stability provided by the single-layer was examined but the sheltering of this section by the structure head was deemed sufficient to reduce the wave height (and the impact on stability) for this section.

3.11 Rehabilitation Design

179. Due to slumping that has occurred along the existing terminal groin, it is recommended that the groin be rehabilitated along the eastern side and crest, from station 0+40 to 1+40 and completely reconstructed from 1+40 to 1+60 (5 feet added to accommodate groin extension). Beginning at station 0+40, the armor stone across the crest and along the inlet side of the groin will be removed, allowing for a reconfiguration of the core stone and the addition of a single-layer of secondary armor stone along the inlet side. The addition of the secondary armor stone will reduce the potential for bedding/core material to leach out of the voids between armor capstones. The additional stone will also provided a more stable base on which the armor capstones can be placed. The placement of secondary armor stone to the design template will require the crest width be extended from 12-feet to 15-feet. This has been taken into account in the design of the groin extension so abrupt breaks in the groin profile will be prevented. Because mild scour is a possibility along the inlet side of the rehabilitation, a minimal toe is included in the design. A single layer of secondary armor stone will be placed on a layer of bedding/core stone from Station 0+40 to Station 1+40.

3.12 Design Wave

180. The completion of the refraction, diffraction, and shoaling analyses produced a set of wave conditions, sorted by return period and direction, just offshore of the terminal groin. Since wave conditions in directional bins 202.5 and 225 degrees (compass bearings) are considerably smaller due to the effects of the ebb-shoal and shallow weldment just downdrift of the site and the wave heights in directional bins 157.5 and 180 degrees are within two tenths of each other,

the final design wave are based on those refracted in directional bin 180 degrees (compass bearing).

181. USACE recommends the $H_l o$ wave height value be used for the design of coastal shore protection structures. Except for the two year condition, the $H_l o$ values calculated could not be supported at the location of the terminal groin structure. Wave heights for greater than the 2-year frequency should reflect both the breaking effects of the ebb-shoal, and any subsequent modification as they propagate landward. Given the uncertainty of the manual wave refraction/shoaling technique, which was employed from the ebb-shoal shoreward, this study presents the depth limited wave height values calculated at the shallowest point of the ebb-shoal for storms of a greater than 2-year frequency for the 180-degree wave bin. Should an accurate extremal wave climate landward of the shoal be required in the future, numerical or physical modeling should be performed. Table 3-1 lists the wave conditions from the 180-degree bin and the corresponding surge elevation for each return period storm.

3.13 Wave Runup

182. The computed theoretical maximum runup along the terminal groin is 15 feet during the 2-year storm event, which can not be achieved due to the crest elevation limitation of 5 feet NGVD, and a storm surge elevation of 5.5 feet NGVD. For larger storm events, the existing structure becomes submerged and wave runup computations were not performed. Unless the groin extension is designed for a crest elevation significantly greater than 5 feet NGVD, runup should not present any structural problems for the design as armor size determined using Hudson's formula will account for any pressure differentials induced by wave runup.

Table 3-1 Design Wave Height and Water Level

Return Period	Wave Height (feet)	Limiting Depth Over Shoals (ft NGVD)	Significant Period, T (seconds)	Wave Length (feet)	Storm Surge (ft NGVD)
2-Year	12.74(1)	15.5	6.2	154.8	5.5
5-Year	13.52(2)	16.1	8.2	178.5	6.1
10-Year	14.20(2)	16.7	9.6	214.3	6.7
20-Year	14.80(2)	17.4	10.8	247.8	7.4
50-Year	16.07(2)	18.9	12.6	302.3	8.9
100-Year	17.00(2)	20.0	13.8	341.6	10.0

(1) $H_l o$ at structure head, non-breaking (d=20 ft + surge, 180 degree wave bin)
(2) Depth limited wave height calculated at inner edge of ebb shoal (d=10 ft + surge, 180 degree wave bin)
Depths are referenced to NGVD

3.14 Armor Stone Requirements

183. The median weight (W_{50}) for armor comprising the 60-ft section of the extension (Station 1+90 to Station 2+50) will be 10.75 tons, based on stability calculations (assumes 5% damage). Gradation of stone for this section will range from 8 tons to 13.5 tons, with 75% of the stone weighing greater than or equal to 10.75 tons. The 30-ft transition portion of the extension

(Station 1+60 to 1+90), the reconstructed groin section (Station 1+40 to 1+60) and rehabilitation section (0+40 to 1+40 - East Side) will have armor capstone with a W_{50} of 10 tons, based on stability calculations (assuming 20% damage). Stone gradations range from 8 tons and 12.5 tons to ensure that stability is met for the single armor layer sections.

184. The permeability of the double armor layer structure was considered and it was determined that the structure's sand retention capabilities would not be comprised. The groin extension will be constructed in a water depth which places the core and underlayer layers at elevations approximately 8 feet below mean high water. The majority of sediment movement occurs in the lower portion of the water column at this water depth. Therefore, the permeability of the structure should be sufficient to retard sediment transport. A minimal toe (Station 0+40 to Station 1+40 - East Side) is comprised of a single layer of secondary armor stone placed on a layer of bedding/core stone. A buried toe (Station 1+40 to Station 2+50 - East Side, around the groin head to Station 2+50 - West Side), is comprised of stone at the higher end of the armor cap stone gradation for this section, or 1.25 x W_{50} = 12 tons, with a 1 ton tolerance allowed. The area between Station 1+30 and Station 1+40 provides a zone of transition between the two toe designs.

185. The recommended terminal groin rehabilitation and extension design is shown in Figures 3-2 to 3-4.

Section 4

Groin Condition Survey and Recommendations for Groin Rehabilitation

4.1 Introduction

186. A condition survey of 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.

187. A complete documentation of the existing protective structures along the ocean front of Long Beach Island, from Jones Inlet to East Rockaway Inlet was presented in the report entitled "Beach Erosion Control and Hurricane Protection Study, Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet" by the New York District Army Corps of Engineers, 1965. An update of this condition survey was conducted in 1988 and again during the week of December 14, 1993. To facilitate the survey conducted in 1993, the existing structures were catalogued from number 1 to number 58 in order from East Rockaway Inlet Jetty east to Jones Inlet. Of the 58 catalogued structures, there are 50 groins, 7 bulkheads and 1 jetty.

188. The current update to the groin condition survey was conducted on September 29-30, 2003. This survey 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 series of photographs were taken during the survey period to support the assessment of the existing structure conditions. The field photos, notes, and structural inspection check-sheets completed during the site inspection are included as Appendix C.1 – September 2003 Groin Evaluation.

189. The results of the existing condition survey are presented in 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.

4.2 Long Beach

190. There are 23 groins in this stretch of beach, between (and including) Groin No. 24 at the west end of Long Beach and Groin No. 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.

4.3 Lido Beach

191. There are four groins on this length of shoreline, Groin Nos. 51-54. Each of these groins is in poor condition and is considered to be deteriorated to such a point that they have ceased

functioning and therefore are not candidates for rehabilitation.

4.4 Point Lookout

192. There are three stone groins on this length of shoreline, Groin Nos. 55, 56 & 58. Groin Nos. 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. Based on a review of the report entitled “Terminal Groin Rehabilitation and Extension At Jones Inlet, Long Beach Island”, February 1999, by Michael Baker Jr., Inc., it is recommended that Groin No. 58, the terminal groin, be rehabilitated and extended 100 feet in accordance with the design proposed in the report.

4.5 Summary

193. The updated structure condition survey is shown in Table 4-1. Of the 30 groins inspected, 15 groins in Long Beach are recommended for rehabilitation along with 2 groins recommended for rehabilitation in Point Lookout and the rehabilitation and extension of the terminal groin, for a total of 18 structures.

Table 4-1

GROIN CONDITION SURVEY AND REHABILITATION RECOMMENDATION

Groin Number	Recommended for Rehab in Feasibility Rpt.	1988 Condition (1) Structural Condition	1988 Condition (1) Sand Trapping	1993 (2) Condition	September 2003 Inspection (3) Structural Condition	September 2003 Inspection (3) Sand Trapping	September 2003 Inspection (3) Planform Holding	2003 Conclusions	2003 Rehabilitation Recommendation	Groin Number	Estimated Rehab Length, ft.
14		Good	Good	Good	Good	Effective	Good	No repairs		Groins	
15		Good	Good	Good	Good	Effective	Good	No repairs		14 - 23 are	
16		Good	Good	Good	Good	Effective	Good	No repairs		no longer	
17		Good	Good	Good	Good	Effective	Good	No repairs		in the	
18		Good	Good	Good	Good	Effective	Good	2-3 armor stones replace in crest		project	
19		Good	Good	Good	Good	Effective	Good	Some settlement in crest, no repairs		area and	
20		Fair	Fair	Fair	Good	Effective	Moderate	2 20'x20' plus 4-5 single armor stones replaced in crest layer		are no	
21		Good	Good	Good	Good	Effective	Moderate	20'x20' hole plus several single armor stones need replacing in crest		longer	
22		Good	Good	Good	Good	Effective	Moderate	No repairs		considered	
23		Fair	Fair	Fair	Good	Effective	Moderate	No repairs		for rehab	
24	Y	Fair	Fair	Fair	Fair	Effective	Moderate	150' at seaward end needs rehab	Y	24	199
25	Y	Fair	Fair	Fair	Fair	Moderate	Moderate	150' at seaward end needs rehab	Y	25	200
26	Y	Fair	Fair	Fair	Fair	Moderate	Moderate	50' at seaward end needs rehab	Y	26	156
27	Y	Fair	Fair	Poor/Fair	Fair	Moderate	Moderate	150' at seaward end needs rehab	Y	27	164
28	Y	Fair	Fair	Fair	Fair	Moderate	Moderate	50' at seaward end needs rehab	Y	28	164
29	Y	Fair	Fair	Poor/Fair	Fair	Moderate	Moderate	100' at seaward end needs rehab	Y	29	178
30		Poor	Poor	Poor	Poor	Poor	Poor	Requires complete rebuild, with less than 40% of required stone available	N	30	0
32		Poor	Poor	Poor	Poor	Poor	Poor	Requires complete rebuild, with less than 40% of required stone available	N	32	0
33		Poor	Poor	Poor	Poor	Poor	Poor	Requires complete rebuild, with less than 40% of required stone available	N	33	0
34	Y	Poor	Poor	Very Poor	Poor	Poor	Moderate	Requires complete rebuild, with less than 40% of required stone available	Y	34	330
35	Y	Poor	Poor	Very Poor	Poor	Poor	Moderate	Requires complete rebuild, with less than 40% of required stone available	Y	35	310
36		Poor	Poor	Very Poor	Poor	Poor	Moderate	Requires complete rebuild, with less than 40% of required stone available	Y	36	260
37		Poor	Poor	Very Poor	Poor	Poor	Poor	Requires complete rebuild, with less than 40% of required stone available	N	37	0
38	Y	Poor	Poor	Very Poor	Poor	Poor	Moderate	Requires complete rebuild, with less than 40% of required stone available	Y	38	250
39		Poor	Poor	Poor	Poor	Poor	Poor	Requires complete rebuild, with less than 40% of required stone available	N	39	0
40		Very Poor	Poor	Poor	Poor	Poor	Moderate	Requires complete rebuild, with less than 40% of required stone available	Y	40	275
41	Y	Poor	Poor	Very Poor	Poor	Poor	Poor	Requires complete rebuild, with less than 40% of required stone available	N	41	0
42	Y	Poor	Poor	Poor	Poor	Poor	Poor	Requires complete rebuild, with less than 40% of required stone available	N	42	0
43	Y	Poor	Poor	Poor	Poor	Poor	Poor	Requires complete rebuild, with less than 40% of required stone available	N	43	0
44	Y	Poor	Poor	Poor	Poor	Poor	Moderate	Requires complete rebuild, with less than 40% of required stone available	Y	44	330
45		Poor	Poor	Poor	Poor	Poor	Moderate	Requires complete rebuild, with less than 40% of required stone available	Y	45	225
47	Y	Fair	Fair	Poor	Fair	Moderate	Moderate	100' at seaward end needs rehab. Rework crest stones near base to tighten.	Y	47	77
48	Y	Fair	Poor	Poor	Fair	Moderate	Moderate	100' at seaward end needs rehab. Rework crest stones near base to tighten.	Y	48	188
51		Very Poor	Very Poor	Very Poor	Very Poor	Zero	Zero	Structure totally ineffective (5)	N	51	0
52		Very Poor	Very Poor	Very Poor	Very Poor	Zero	Zero	Structure totally ineffective (5)	N	52	0
53		Very Poor	Very Poor	Very Poor	Very Poor	Zero	Zero	Structure totally ineffective (5)	N	53	0
54		Very Poor	Very Poor	Very Poor	Very Poor	Zero	Zero	Structure totally ineffective (5)	N	54	0
55		Good	Fair	Good	Good	Effective	Good	Rebuild head	Y	55	100
56		Good	Fair	Good	Good	Effective	Good	Rebuild head	Y	56	100
58		Good	Fair	Good	Good	Effective	Good	Rebuild head and rework hole in crest	Y	58	125
		(1) Coastal Structures Condition Survey, Long Beach Island, NY, by Frederic R. Harris, Inc.,1988.						Total Rehabs	18		
		(2) From 1995 Feasibility Study, Table A10, Condition of Coastal Structures, December 1993						Ave length			202
		(3) Groin Inspection, Offshore and Coastal Technologies, Inc. and Andrews Miller, Inc., September 2003							15	30	
		(4) Average width of groins to be rehabbed is 33 ft. from toe to toe, based on 1995 groin profiles.							8		
		(5) Groins 51, 52, 53, & 54 are completely nonfunctional, and are not included in the Recommended Plan							23		
		(6) Groin condition will be reevaluated prior to completion of construction plans and specifications.									

Section 5

Physical Description of Bird Nesting/Foraging Area and Representative Profile

5.1 Introduction

194. Beach fronting Lido Boulevard Park has an exceptionally wide existing berm and is a prime area for ephemeral pool formation, and, as such, is a prime shorebird nesting and foraging area. Existing berm widths and heights were examined as summarized below to determine if the existing profile has storm damage reduction capacity equivalent to the recommended plan cross-section. If so, placement of fill in the bird nesting and foraging area will be deferred until such time as erosion reduces existing berm widths below a defined minimum cross-section. Figure 5-1 shows the proposed ephemeral pool dimensions and positioning for the nesting/foraging area. As shown in Figure 5-1, the ephemeral pool encompasses a 93.4 acre area and the piping plover and least tern nesting area encompasses a 42.3 acre area.

195. A representative beach profile was developed by the New York District for the bird nesting/foraging area using available survey data collected from 1995 and 2002. Profiles 172, 174 and 180 are those located within the area; however, profile 174 was judged to have the most representative shape and was used as a basis for developing a beach profile for storm impact assessment. All available data for Profile 174 from 1995 to 2002 were averaged using the Beach Morphology Analysis Package (BMAP). Because the back side of the dune was not surveyed during the time period, a back slope was added to the dune of the averaged profile, down to an elevation of +7.0 ft NGVD (+6 NAVD) at a slope of 1V:5H. The berm, approximately at elevation +7.0 ft NGVD (+6 NAVD), was shortened from the average width of 780 feet to a width of 600 feet to match the average width of the berm of Profiles 172, 174 and 180 for the period 1995 to 2002.

196. The resulting representative beach profile for assessing storm impacts is shown in Figure 5-2. The profile has a maximum dune elevation of +21.5 ft NGVD (+20.5 ft NAVD). The dune is 287 ft wide and is fronted by a berm that has an average elevation of approximately +7.0 ft, and varies between +5.5 ft NGVD (+4.5 ft NAVD) and +9.5 ft NGVD (+8.5 ft NAVD). The berm is approximately 600 feet wide and then slopes at about a 1V:25H slope out to about -13 ft NGVD (12 ft NAVD), where the slope becomes much flatter due to the presence of the ebb shoal attachment bar.

5.2 Evaluation of Equivalent Storm Protection

197. The storm protection capability of the existing beach in the bird nesting/foraging area is evaluated for the 73-year design storm condition using the Storm-Induced BEAch CHange Model (SBEACH). SBEACH (Larson and Kraus, 1989a, Larson, Kraus and Byrnes, 1990) is a numerical simulation model for predicting beach, berm and dune erosion due to storm waves and water levels. Assumed in the application of the model is that beach profile change during a storm event is dominated by cross-shore processes and that long shore transport effects are negligible. This assumption is expected to be valid for short-term storm-induced profile response on open coasts. This model is the same as that used in the Feasibility Study.

198. Storm parameters required by SBEACH include time histories of total water level (astronomical tide plus storm surge), wave height, wave period and wave angle. Wind data can

also be used; however, model sensitivity to wind effects was evaluated in the Feasibility Study and was determined to be insignificant for the profiles at Long Beach.

199. Based upon a review of the Feasibility Study, the Reanalysis Study and the design report for the terminal groin at Jones Inlet, the 73-year event exhibits a peak total water level (astronomical tide plus storm surge) of +9.7 ft NGVD (+8.7 ft NAVD), a peak offshore wave height (Hmo) of 22.1 ft, and a peak wave period (Tp) of 14.3 seconds. Because SBEACH requires that a storm time history for each parameter be used as input, storm time histories are developed from available data sources that measured such an extreme event.

200. A water level time history for the event is developed by acquiring data for the December 1992 nor'easter (7-16 December, 1992) at Sandy Hook, New Jersey (NOS Station 8531680). The time history is re-referenced from Mean Lower Low Water (MLLW) to NGVD by subtracting 2.25 feet from all water elevation data points (NGVD29 is 2.25 feet above MLLW). This conversion is taken from tidal benchmark information for the Long Beach/Jones Inlet area (Section 933 Evaluation Report, Jones Inlet, New York District, 1992). The predicted astronomical tide is removed from the time history and the storm surge component time history is increased by a factor of 1.4889 so that the sum of the tide and surge time histories exhibits a peak total water level of +9.7 ft NGVD (+8.7 ft NAVD). The resulting time history thus includes the predicted astronomical tide time history and storm surge time history for the 73-year event (as specified in the 1995 Feasibility Report).

201. Wave height and period time histories are derived from the Wave Information Study Level 3 wave hindcast for 1990-1999 (www.frf.usace.army.mil/wis/). Wave conditions are extracted for Station 119 for the same time period as the water level time history. The hindcasted time history of wave height is scaled by a factor of 0.9489 to result in a 73-year storm peak wave height of 22.1 feet. The wave period time history does not require scaling because the peak wave period of 14.3 seconds is equivalent to that of the 73-year design storm event.

202. Figure 5-3 illustrates the time histories developed as input for the SBEACH design storm simulation in the bird nesting/foraging area.

203. Using the representative beach profile and storm time histories, the SBEACH model simulation indicates that the seaward edge of the berm recedes 220 feet landward during the 73-year event. There is a slight leveling of the undulations on the berm, but the significant sand transport rate is limited to the seaward third of the berm. Figure 5-4 illustrates the change in the profile configuration due to the storm. A second simulation with the same storm input and a berm narrowed to 250 ft indicates slight scarping of the toe of the main dune and would be the condition under which design storm protection would be compromised.

203a. Criteria for construction of the deferred fill in the bird nesting/foraging area, including design fill and renourishment, will be reduction of the existing berm to 250-ft or less (berm defined as the distance between the dune toe and the seawardmost +7 ft NGVD (+6 ft NAVD) contour) which persists for one year. A one-year time period will ensure that the narrowed berm condition is representative of a long-term trend, and not seasonal or temporary.

204. Because there is no berm fill required in this area to achieve design-level protection, the project plan has been modified to taper adjacent beach fill areas into the existing berm width and height, in areas where the present berm width exceeds 250 ft. The design dune has been

retained and located as far landward as possible. Placement will consist of filling any gaps in the existing dune as needed along the project dune alignment.

Section 6

Dune Walkovers and Relocation Modifications for the Updated 1995 Feasibility Report Recommended Plan

6.1 Introduction

205. 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. Modified accessways are described below and are listed in Table 6-1, from west to east, with approximate locations. Table 6-2 gives totals for each type of accessway, by community. 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.

6.2 City of Long Beach

206. A total of 38 pedestrian and vehicular accessways over the dune to the berm will be provided in approximately the same locations as in the pre-project condition. Two (2) gravel surface vehicle accessways will be constructed, one east and one west of the boardwalk. Twenty-one timber (21) ADA compliant pedestrian dune walkovers will be provided east and west of the boardwalk. Two (2) timber vehicular 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.

207. 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.

6.3 Town of Hempstead

208. 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. The dune alignment fronting the bathhouses in the Town of Hempstead park has been shifted seaward to avoid the need for relocation of those structures. One (1) sun shelter in Point Lookout south of Freeport Avenue will be relocated.

6.4 Nassau County

209. 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 dune walkover, and three (3) timber Non-ADA walkovers will be constructed.

210. The proposed locations for each of these structures are shown as a component of the Recommended Plan in Figure 8-1 to Figure 8-14. Typical plan, elevation and cross-section views of the beach access structures are shown on Figures 6-1 to Figure 6-3.

Table 6-1: Dune Walkovers and Vehicle Access

Updated 1995 Feasibility Report Recommendations

Stucture ID (west to east)	Municipality	Type	Structure	Location	Approximate Easting
1	LB	timber	Timber Dune Walkover - ADA	Ohio Ave.	1,067,450
2	LB	timber	Timber Dune Walkover - ADA	Illinois Ave.	1,067,625
3	LB	timber	Timber Dune Walkover - ADA	Connecticut Ave.	1,067,800
4	LB	timber	Timber Dune Walkover - ADA	Georgia Ave.	1,068,100
5	LB	timber	Timber Dune Walkover - ADA	Indiana Ave.	1,068,400
6	LB	timber	Timber Dune Walkover - ADA	Maryland Ave.	1,068,725
7	LB	timber	Timber Dune Walkover - ADA	Minnesota Ave.	1,069,050
8	LB	timber	Timber Dune Walkover - ADA	Tennessee Ave.	1,069,350
9	LB	timber	Timber Dune Walkover - ADA	Virginia Ave.	1,069,650
10	LB	timber	Timber Dune Walkover - ADA	Wyoming St.	1,069,975
11	LB	timber	Timber Dune Walkover - ADA	Delaware St.	1,070,300
12	LB	timber	Timber Dune Walkover - ADA	Arizona St.	1,070,600
13	LB	timber	Timber Dune Walkover - ADA	Pennsylvania Ave	1,070,950
14	LB	gravel	Gravel Surface Vehicle Access	New York Ave.	1,071,100
15	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	New York Ave.	1,071,250
16	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Grand Blvd.	1,071,950
17	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Lindel Ave.	1,071,200
18	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Washington Blvd.	1,073,600
19	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Lafayette Blvd.	1,072,800
20	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Laurelton Blvd.	1,075,200
21	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Magnolia Blvd.	1,076,000
22	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	National Blvd.	1,076,800
23	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Edwards Blvd.	1,077,600
24	LB	timber	Timber Vehicle and Pedestrian Access boardwalk to berm	Riverside Blvd	1,078,350
25	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Long Beach Blvd.	1,079,150
26	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Monroe St.	1,079,950
27	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Lincoln St.	1,080,850
28	LB	timber	Timber Vehicle and Pedestrian Access boardwalk to berm	Franklin St.	1,081,600
29	LB	timber	Timber Dune Walkover boardwalk to berm - ADA	Neptune St.	1,082,300
30	LB	timber	Timber Dune Walkover - ADA	Between Neptune St. and Roosevelt St.	1,082, 620
31	LB	timber	Timber Dune Walkover - ADA	Between Neptune St. and Roosevelt St.	1,082, 840
32	LB	timber	Timber Dune Walkover - ADA	Between Neptune St. and Roosevelt St.	1,083,010
33	LB	timber	Timber Dune Walkover - ADA	Roosevelt St.	1,083,250
34	LB	timber	Timber Dune Walkover - ADA	Between Roosevelt St. and Pacific Blvd.	1,083, 460
35	LB	timber	Timber Dune Walkover - ADA	Pacific Blvd.	1,084,000
36	LB	gravel	Gravel Surface Vehicle Access	Pacific Blvd.	1,083,950

Table 6-1 (continued): Dune Walkovers and Vehicle Access

Updated 1995 Feasibility Report Recommendations (cont)

Stucture ID (west to east)	Municipality	Type	Structure	Location	Approximate Easting
37	LB	timber	Timber Dune Walkover - ADA	east of Pacific Blvd.	1,084,260
38	LB	timber	Timber Dune Walkover - ADA	east of Pacific Blvd.	1,084,550
39	TOH	timber	Timber Dune Walkover - ADA	Lido Towers	1,085,230
40	TOH	timber	Timber Dune Walkover - Non-ADA	East of Lido Towers	1,085,965
41	TOH	timber	Timber Dune Walkover - ADA	Lido Town Park West from facility building	1,086,750
42	TOH	gravel	Gravel Surface Vehicle and Pedestrian Access	Lido Town Park West from parking lot	1,087,050
43	TOH	timber	Timber Dune Walkover - Non-ADA	Lido Civic at Buxton St	1,088,000
44	TOH	timber	Timber Dune Walkover - Non-ADA	Lido Civic at Pinehurst St.	1,088,300
45	TOH	timber	Timber Dune Walkover - Non-ADA	Lido Civic at Matlock St.	1,088,650
46	TOH	timber	Timber Dune Walkover - Non-ADA	Lido Civic at Biaritz St.	1,088,950
47	TOH	timber	Timber Dune Walkover - Non-ADA	Lido Civic at Woodhail St.	1,089,500
48	TOH	timber	Timber Dune Walkover - Non-ADA	Lido Civic at Saratoga St.	1,089,800
49	TOH	timber	Timber Dune Walkover - ADA	North Woodmere Park/Lido Blvd Park, east of Prescott St.	1,090,650
50	TOH	gravel	Gravel Surface Vehicle and Pedestrian Access	Lido Beach Town Park, west side by mushrooms, east of tennis court	1,091,475
51	TOH	gravel	Gravel Surface Vehicle and Pedestrian Access	Sands Beach Club	1,092,025
52	TOH	timber	Timber Dune Walkover - ADA	Lido Townhouses	1,092,550
53	NASSAU	timber	Timber Dune Walkover - Non-ADA	East of Lido Townhouses	1,092,800
54	NASSAU	gravel	Gravel Surface Vehicle and Pedestrian Access	Nassau Beach east of groin F	1,094,100
55	NASSAU	timber	Timber Dune Walkover - Non-ADA	Nickerson Town Park west side parking lot	1,094,370
56	NASSAU	timber	Timber Dune Walkover - ADA	Nickerson Town Park east side parking lot	1,094,720
57	NASSAU	gravel	Gravel Surface Vehicle and Pedestrian Access	Nickerson Town Park playground (just east of groin E)	1,095,085
58	NASSAU	timber	Timber Dune Walkover - Non-ADA	Nassau Beach cabannas	1,095,275
59	TOH	gravel	Gravel Surface Vehicle and Pedestrian Access	Malibu Town Park (west side)	1,096,035
60	TOH	timber	Timber Dune Walkover - ADA	Malibu Town Park (east side)	1,096,540
61	TOH	timber	Timber Dune Walkover - Non-ADA	Point Lookout Town Park, east of Groin C, at cabanas	1,097,200
62	TOH	gravel	Gravel Surface Vehicle and Pedestrian Access	Point Lookout Town Park, east of Groin B, west of bathouses	1,097,850
63	TOH	timber	Timber Dune Walkover - Non-ADA	Point Lookout Town Park, between bathouses	1,098,100
64	TOH	timber	Timber Dune Walkover - ADA	Point Lookout Town Park, east side of parking lot	1,099,430
65	TOH	timber	Timber Dune Walkover - ADA	Point Lookout, east of Garden City Ave. at comfort station	1,100,730

Table 6-2 Pedestrian and Vehicular Access Structures – Totals by Type and Community

Type	Pedestrian and Vehicle Access Structures	Long Beach		Town of Hempstead		Nassau Co.	
1	Gravel Surface Vehicle and Pedestrian Access	Long Beach	0	Town of Hempstead	5	Nassau	2
2	Gravel Surface Vehicle Access	Long Beach	2	Town of Hempstead	0	Nassau	0
3	Timber Dune Walkover - ADA	Long Beach	21	Town of Hempstead	7	Nassau	1
4	Timber Dune Walkover - Non-ADA	Long Beach	0	Town of Hempstead	9	Nassau	3
5	Timber Dune Walkover boardwalk to berm - ADA	Long Beach	13	Town of Hempstead	0	Nassau	0
6	Timber Vehicle and Pedestrian Access boardwalk to berm	Long Beach	2	Town of Hempstead	0	Nassau	0
	Total by community		38		21		6
	Total					Total	65

SECTION 7

The Recommended Plan Updated to 2013 Conditions

7.1 Modification of Fill Template

211. Numerous profile surveys have been obtained for the Long Beach project area since completion of the 1995 Feasibility Study and design of the Recommended Plan. Refinements to the fill offshore slope west of the ebb shoal weldment location are warranted based on more extensive data collection. In addition, experience with constructed beach fills on Long Island has shown that scarping of the beach face is a concern for flat berm configurations at elevation +7 ft NAVD and above. Incorporation of a stepped berm better replicates measured berm characteristics and would reduce or eliminate vertical scarping following storms. These design modifications are described below and are incorporated into Figures 8-1 thru 8-14 which show the final HSLRR Recommended Plan.

212. Additionally, bathymetry has been updated to current, post-Hurricane Sandy conditions and incorporated into the HSLRR fill layout and quantity estimates.

7.2 Offshore Slope

213. Long range profile survey data from dates and locations listed in Table 7-1 were examined to determine existing long-term offshore average slope. All existing long range profile data for each profile line were compiled and aligned at 0 ft NGVD to allow investigation of slope independent of varying berm widths. Average profiles were computed for each line, including data taken in all seasons. This resulted in a temporal average profile for each profile location, and eliminated seasonal effects. Temporally averaged profiles were then combined for each shoreline reach, and a single spatially averaged profile was constructed. The resulting long term profile for the Long Beach area (profiles 182 through 230) showed an offshore slope of 1V:30H between +10 ft to -5 ft NGVD. The beach fill template for the Lido/Long Beach reach was modified from 1V:35H (1995 Feasibility Recommended Plan slope) to 1V:30H to better replicate the long-term averaged upper slope. Offshore slope for the Pt. Lookout reach was changed from 1V:25H to 1V:20H, to account for the steepening affect of the new groins, as described in Section 2.

Table 7-1: Seasonal Long Range Profiles

	Profiles										
Date	**182**	**184**	**190**	**194**	**200**	**204**	**210**	**214**	**220**	**224**	**230**
F1991	x	x	x	x	x	x	x	x	x	x	x
S1995	x	x	x	x	x	x	x	x	x	x	x
S1996			x			x			x		
F1996			x			x			x		
S1997			x			x			x		
F1997			x			x			x		
S1998			x			x			x		
F1998			x		x	x		x	x		x
S2001			x		x	x		x	x		x
S2010	x	x	x	x	x	x	x	x	x	x	x
HSLRR	x	x	x	x	x	x	x	x	x	x	x

*There were two surveys in the spring of 1995 and both were used in the computation.

7.3 Stepped Berm

214. The Recommended Plan includes a 110-ft wide flat berm at +9 ft NAVD extending seaward from the dune toe. Examination of profile data collected before and after completion of the Feasibility Study show that the natural berm generally slopes downward from the toe of the dune rather than extending seaward at a constant elevation. 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 NAVD to a 40-ft wide flat berm at +9 NAVD, sloping on 1V:10H over 20 ft to +7 ft, extending 130 ft seaward at +7 ft NAVD and then sloping to meet existing bottom at 1V:30H. Note that this step geometry matches the width of the 1995 Recommended Plan at elevation +7 ft. NAVD (e.g. 190-ft wide from dune toe at +7-ft NAVD). Cross-sections are shown in Figures 8-15 thru 8-28.

7.4 Update Renourishment Quantity

215. Renourishment fill requirements were modified to reflect updates to the Recommended Plan. Specifically the length of shoreline receiving beach fill was reduced from the Feasibility Recommended Plan length of approximately 41,000 lf to approximately 35,250 lf due to withdrawal of East Atlantic Beach from the project, and renourishment quantities were reduced accordingly. Renourishment quantities are calculated using the same method as in the Feasibility Study and include fill for long-term erosion, storm-induced erosion, and the historic rate of sea level rise. As in the Feasibility Plan, renourishment quantities in the Point Lookout reach are computed assuming no placement of dredged material from Jones Inlet. This conservative assumption was made to incorporate the uncertainty of timing and available quantity of inlet dredged material.

7.5 Update of Stage-Frequency Relationships

216. A comparison of 2005 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. Table 2-4 gives comparative stage-frequency values, and Figure 2-10 plots these graphically.

217. A check as 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 the COE in September 2013. Note that this work does not include Hurricane Sandy. Outputs from this modeling include locations in Nassau County, but the COE 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 COE was further informed that FEMA, as of the date of this report, is using COE 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.

7.6 Update Long-Term Erosion Rates to 2010

218. Long term erosion rates were updated to include the interval between 1990 (last surveyed shoreline in the Feasibility Study) and 2010. The mean high water line position was extracted from the 2010 beach profile survey and plotted in Microstation along with the 1990 shoreline. Changes in the MHW shoreline position were measured at 500-ft intervals, retaining the reach designations used in the Feasibility Study. Yearly average shoreline change rates in ft/yr/linear foot of shoreline were then computed. Fill placement volumes for operations which took place within the survey interval were converted to beach widths and subtracted from the yearly average shoreline change values. Fill was placed only in the Pt. Lookout reach during the 1990-2010 time period. The yearly average shoreline change for 1990-2010 was then combined with the previously computed shoreline change rates for 1963-1990 by use of weighted averages. Updated long-term erosion rates by reach for the 47 year period from 1963-2010 are shown in Table 7-2 below.

Table 7-2: Shoreline Change Rates by Reach 1963-2010

Reach	Reach Length (ft)	1963-1990 (27 yrs) (ft/yr/lf)	1990-2010 (20 yrs) (ft/yr/lf)	1963-2010 (47 yrs) (ft/yr/lf)
Long Beach	17,424	-4.0	0.54	-2.1
Lido Beach	11,616	-5.0	6.67	0.0
Pt. Lookout	4,752	-5.0	-9.59	-7.0

7.7 Sea Level Change.

219. Sea Level Change (SLC) is the combined effect of the eustatic (i.e. global average) sea level increase due to global warming trend and the land movement in the region. The Long Island, New York coastline is one of the areas experiencing land subsidence due to geologic process; therefore, the net relative sea level rise at the study area is higher than the eustatic SLC. The future SLC for the project area is estimated based on the National Research Council (NRC) and Intergovernmental Panel for Climate Change (IPCC) estimates of eustatic SLC and corrected to include the local land subsidence. Both the historic SLC trend and the future accelerated rate are identified and used for planning, design, sensitivity and risk & uncertainty analysis.

220. 7.7.1 SLC Guidance. In October 2011, USACE published guidance to incorporate sea-level change for project planning and design (ref. EC1165-2-212). 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. The recommendations are summarized as follows:

1) An extrapolation of the historic rate of local mean-sea-level change shall be used as the low rate of sea level change for analysis, design, and evaluation;

2) Estimate the intermediate rate of local mean sea-level change using the modified NRC Curve I and NRC equations 2 and 3, and add those to the local rate of vertical land movement.

$$E(t) = 0.0017t + bt_2 \quad \text{(NRC Equation 2)}$$

$$E(t_2) - E(t_1) = 0.0017(t_2 - t_1) + b(t_2^2 - t_1^2) \quad \text{(NRC Equation 3)}$$

3) An upper (high) rate of local sea level change shall be estimated by considering the modified NRC Curve III value, and combining these numbers with the local rate of vertical land movement. This scenario of high rate of local mean sea level change exceeds the upper bounds of the IPCC estimates from both the 2001 and 2007 and also includes additional sea-level change to accommodate the potential for rapid loss of ice from Antarctica and Greenland;

4) All plans and designs shall be evaluated to determine how sensitive they 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.

221. **7.7.2 Historical Trend (Low Rate of Sea Level Change)**. The historical SLC, based on a 75 year record (1932-2006) at Sandy Hook tidal station maintained by NOAA, is shown in Figure 7-1. This tidal station is in the same geographic region as the Long island, New York Atlantic shoreline and is affected by the same geologic processes. As a result, this station is selected as the reference station for regional SLC analysis. As shown in the figure, the mean SLC trend is 1.28 ft/100 years, or 1.36 ft/100 years with 95% confidence (use 1.4 ft. /100 years and 0.7 ft for 50-years). The future eustatic SLC by year 2060 is therefore estimated as follows:

- Low Rate: +0.7 ft

222. **7.7.3 Land Subsidence**. Stevenson et al. (1986) is referenced in quantifying the land subsidence at Sandy Hook, New Jersey to be 0.059 in/yr higher than that in New York City. With the New York City subsidence rate at the Battery at 0.059 in/yr, this results in a Sandy Hook subsidence value of 0.118 in/yr, or 1.0 ft/100 years. The NRC global average of eustatic SLC is approximately 0.4 ft/100 years; therefore, the land subsidence component is approximately 1.0 ft/100 years.

223. **7.7.4 Intermediate and High Rate of SLC.** The intermediate and high rate of SLC is estimated based on the modified NRC (1987) eustatic sea-level change scenarios and the IPCC (2007) scenario estimates shown in Figure 7-2. For a feasibility study with a 50-year design life, the future SLC in year 2060 is used. Future eustatic SLC by year 2060 is estimated as +0.8 ft (intermediate rate) and +2.1 ft (high rate). Including 0.5 ft land subsidence in 50 years, the future SLC is estimated as follows:

- Intermediate Rate: +1.3 ft in year 2060
- High Rate: +2.6 ft in year 2060

224. **7.7.5 Sea Level Change Recommendations.** The following local Sea Level Change (SLC) rates are recommended for use:

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 can

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.

7.8 Elimination of Westernmost Deferred Groin (Groin G).

225. Authorization language for the Feasibility Recommended Plan includes provision for 6 new groins. The 2000 Technical Reanalysis incorporated changed shoreline conditions and resulted in a reconfiguration to 7 new groins, with deferred construction of the 3 westernmost structures. To remain within authorization, the HSRR recommended plan will include 6 new groins, with deferred construction of the 2 westernmost structures. Groin G, the westernmost deferred groin included in the recommended plan following the Technical Reanalysis, will be removed from the plan. This structure is entirely landlocked at the present time, and removal of it will have no effect on project performance, barring significant change to existing coastal processes.

7.9 Additional Sampling of Offshore Borrow Area and Refinement of Overfill Factor Ra

226. Offshore borrow area sampling data collected in 1992 were not independently verifiable by the local sponsors. In response to community concerns about sediment quality in the designated offshore borrow area, additional sampling was done in 2010 and 2011 within the borrow area delineated in the Feasibility Study. Samples taken are summarized in Table 7-3 below. Figure 7-3 shows the locations of core samples taken in 1992, 2010 and 2011, color coded for suitability as beach fill. Figure 7-4 shows the location of seismic survey lines and all core samples. Evaluation of the 1992, 2010 and 2011 vibracores suggests potential for sufficient beach quality material within the Feasibility Study borrow area limits to construct the Recommended Plan.

Table 7-3: Summary of Offshore Sampling Taken in 2010 and 2011

Number of vibracores collected in 2010	5
Total number of subsamples (vibracore) extracted from 2010 vibracores	21
Total number of subsamples (vibracore) analyzed from 2010 vibracores	20
Number of vibracores collected in 2011	10
Total number of subsamples (vibracore) extracted from 2011 vibracores	52
Total number of subsamples (vibracore) analyzed from 2011 vibracores	52
Line miles of geophysical (seismic and bathymetric) data collected in 2011	28

227. Five (5) vibracore samples were collected during the 2010 investigation and analyzed for sediment characteristics. The vibracores were color coded based on suitability (Ref. Coastal Planning and Engineering of New York, Jan 2011). Analysis of the geotechnical data identified one (1) vibracore containing potentially beach compatible sediments (C-20), two (2) vibracores that contained marginal quality sediment with silty overburden (C-17 and C-19), and two (2) vibracores that identified areas with sediment not suitable for beach nourishment (C-16 and C-18).

228. In 2011 further geophysical (seismic profiling) and geotechnical (vibracore) investigations were conducted to help refine existing sand borrow sources. Work was performed by Coastal Planning and Engineering of New York, as a subcontractor to Moffatt & Nichol (MN) (Ref. USACE Aug 2011). Ten (10) vibracores and 28 line miles of seismic data were collected and analyzed. Analysis of the geotechnical data indicated that all but one (1) vibracore (LBNY-11-28) contained beach quality material. LBNY-11-28 was predominantly clay and was found unsuitable. Additionally, the seismic data collected in 2011 indicated the presence of several paleofluvial channels within the investigation area that should be avoided.

229. Compatibility analyses were performed between all core samples (1992, 2010, and 2011) and native beach sand models used for the Feasibility Study. Findings resulted in an overfill factor Ra equal to 1.06, indicating that 6% additional fill volume will be required for placement to ensure the full design template will remain in place after sorting losses. Four subareas within the Feasibility Borrow Area limits, designated NE, NW, SE and SW, were defined around the suitable core samples. These subareas contain sufficient volume of material for use in initial construction. Coordinates of these subareas are given below, plus estimated volume available per subarea, assuming removal to a 10-foot depth. Additional suitable material is available below the 10-foot cut limit. Borrow area delineations are shown in Figure 7-5.

Table 7- 4: Borrow Sub-areas for Initial Construction; Coordinates, Area (sf), and Volume of Suitable Material Available in Top 10-feet

ID	Easting (NAD83)	Northing (NAD83)	Area (sf)	Median Grain Size (mm)	Volume (0-5 ft cut) (cy)	Volume (5-10 ft cut) (cy)
NW-1	1,080,365	148,479	12,000,000	0.44		
NW-2	1,086,365	148,479				
NW-3	1,086,365	146,479				
NW-4	1,080,365	146,479				
NE-1	1,092,365	148,479	6,000,000	0.35		
NE-2	1,096,365	148,479				
NE-3	1,096,365	146,979				
NE-4	1,092,365	146,979				
SW-1	1,082,365	146,479	6,000,000	0.33		
SW-2	1,085,365	146,479				
SW-3	1,085,365	144,479				
SW-4	1,082,365	144,479				
SE-1	1,092,365	145,979	6,000,000	0.33		
SE-2	1,096,365	145,979				
SE-3	1,096,365	144,479				
SE-4	1,092,365	144,479			3,500,000	2,500,000
Total Volume (cy) (10-ft cut)						6,000,000

SECTION 8

The Recommended Plan with Post-Feasibility Modifications and Refinements

8.1 Introduction

230. The Long Beach Project is a storm damage reduction project, which has been designed to provide protection against wave attack and inundation for homes and businesses along 6.4 miles of oceanfront, including Point Lookout, Nassau Beach, Lido Beach, and the City of Long Beach. This area has been subject to major flooding during storms, causing damage to infrastructure along the barrier island. Over the years, continued erosion has resulted in a reduction in the height and width of the beachfront, which has increased the potential for storm damages.

231. The Recommended Plan has been developed to reduce storm damages to the highly developed communities that are susceptible to wave attack and flooding during major storms and hurricanes. The plan has been developed to provide protection against a 100-year storm event.

232. The Recommended Plan, although somewhat modified and refined, is essentially the same as the authorized plan with regard to its storm damage features and design protection. It is a beach fill plan which is characterized by a 110 ft wide beach berm at an elevation of +9 ft above NAVD or a stepped berm as described below, and a dune system with a top elevation of +14 ft NAVD. The plan includes approximately 35,000 linear feet of beach fill extending from the eastern end of the barrier island at Point Lookout to the western boundary of the City of Long Beach, including an incidental taper into East Atlantic Beach. The Recommended Plan consists of the following components. Details of the Recommended Plan are shown on Figures 8-1 through 8-28.

8.2 Plan Components

233. The HSLRR Recommended Plan includes the plan components of Plan 5 from the February 1995 Feasibility Report with some modifications as described below. The components of the plan include:

1. A dune with a top elevation of +14 ft above NAVD, a crest width of 25 ft, and landward and seaward slopes of 1V:5H (1V:3H on landward slope fronting the boardwalk) along the entire;
2. 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 NAVD, then sloping at 1V:20H to intersection with existing bathymetry;
3. Identification of 5,000 If of bird nesting and foraging area for piping plovers and least terns (In the Nickerson Beach area in Nassau County and in the Town of Hempstead), which will have dune construction only (deferred berm construction);
4. In Lido Beach and the City of Long Beach, a stepped beach berm extending 40 ft. from the seaward toe of the recommended dune at an elevation of +9 ft NAVD, a 1V:10H slope downward to +7 ft NAVD, a 130 ft flat berm at +7 ft NAVD, then sloping 1V:30H to intersection with existing bathymetry;
5. Total sandfill quantity of 4,720,000 cy for the initial fill placement, including 1.0 ft tolerance, overfill equal to 6.0%, and advanced nourishment (based on 2013 post-Hurricane Sandy survey);

6. Planting of 34 acres of dune grass and mixed native species and installation of 75,000 If of sand fence excluding areas identified in the Biological Opinion.
7. In the City of Long Beach, a total of 38 pedestrian and vehicular accessways over the dune to the berm will be provided including:
    - Two (2) gravel surface vehicle accessways;
    - Twenty-one (21) ADA compliant timber pedestrian dune walkovers;
    - Thirteen (13) timber ADA compliant dune walkovers from the boardwalk to the berm;
    - Two (2) timber vehicle and pedestrian accessways from the boardwalk to the berm.
8. In the Town of Hempstead, a total of 21 pedestrian and vehicular accessways over the dune to the berm will be provided including;
    - Five (5) gravel surface vehicle and pedestrian accessways;
    - Seven (7) ADA compliant timber pedestrian dune walkovers;
    - Nine (9) non-ADA compliant timber pedestrian dune walkovers;
9. In Nassau County, a total of 6 pedestrian and vehicular accessways over the dune to the berm will be provided including;
    - Two (2) gravel surface vehicle and pedestrian accessways;
    - One (1) ADA compliant timber pedestrian dune walkovers;
    - Three (3) non-ADA compliant timber pedestrian dune walkovers;
10. One relocation in the City of Long Beach consisting of modifications to an existing comfort station under the boardwalk at National Ave. required to maintain pre-project functionality; One sun shelter in Point Lookout south of Freeport Ave. will be relocated.
11. Retention of 26 existing groins as project elements. Rehabilitation of seventeen (17) of these existing groins, plus the rehabilitation and extension of the existing terminal groin at Point Lookout (18 structures total) to take place during initial construction plus inclusion of all 26 in major rehabilitation and groin maintenance estimates;
12. Six (6) newly constructed groins at the eastern end of the island (2 of which are deferred construction to be built in the future if required);
13. Advanced nourishment to ensure the integrity of the initial fill design;
14. Periodic nourishment of approximately 1,770,000 cy of fill material at 5 year intervals for the 50-year life of the project. 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 of the barrier island of Long Beach.

8.3 Summary of Changes to the Recommended Plan since the Feasibility Report

234. Since the completion of the Feasibility Report in 1995, there have been refinements to design and changes in the existing conditions. Accordingly, a number of modifications have been incorporated into the Recommended Plan based on work completed to date since the completion of the Feasibility Report. These modifications are described in the following paragraphs.

235. **8.3.1 Elimination of Timber Retaining Walls and Reduction to Relocations**. Comfort and lifeguard stations which were located on the berm in the City of Long Beach have been destroyed by Hurricane Sandy. The City of Long Beach is reconstructing and raising these facilities up on the boardwalk deck. These structures no longer need relocation or timber

retaining walls due to construction of the Recommended Plan, and these elements have been removed from the plan. One relocation in the City of Long Beach will still be required consisting of modifications to an existing comfort station under the boardwalk at National Ave. required to maintain pre-project functionality.

236. **8.3.2 Terminal Groin Rehabilitation and Extension.** Based on the report entitled "Terminal Groin Rehabilitation and Extension At Jones Inlet, Long Beach Island", February 1999, prepared by Michael Baker Jr., Inc., the Recommended Plan has been modified to include the rehabilitation and extension of Groin No. 58, the easternmost terminal groin in Point Lookout, in accordance with the typical design proposed in the referenced report (See Figures 3-2 to 3-4).

237. **8.3.3 New Groin Construction.** Based on the report entitled "Technical Reanalysis of the Shoreline Stabilization Measures for the Eastern Portion of the Long Beach Island, New York Project", March 2000, prepared by Offshore and Coastal Technologies, Inc./Andrews, Miller & Assoc., Inc., and HSRR adjustments to remain within authorizing language, the Recommended Plan has been modified to include the construction of 6 new groins in the Point Lookout area. The first groin will be constructed 800 ft west of existing Groin 55 in Point Lookout and the second through fourth groins constructed with tapered lengths at intervals of 800 ft The remaining 2 groins would be constructed at 1,200 ft intervals with tapered lengths. In order to minimize the potential impacts to the shoreline to the west, a tapered groin field is recommended with a 6-degree taper starting at the seaward tip of Groin 3. This taper results in a proposed length of 500 ft from the proposed seaward top of berm to the seaward tip of the first proposed groin to the west of Groin 3. The lengths of the remaining groins are reduced to meet the 6 degree taper for the groin field (See Figures 8-29 to 8-37).

238. Initial construction of the 4 easternmost groins is recommended to provide the required erosion control and storm protection for the severely eroded shoreline area. The remaining 2 groins, which would be largely buried in the existing weldment area, are proposed for deferred construction as needed, based on the degree of stability of the weldment area. The deferred tapered groins are included to address the possibility that the weldment might migrate westward, creating erosional pressure to the east as it moves.

239. **8.3.4 Rehabilitation of Existing Groins.** Based on a condition survey of the existing groins conducted in September 2003, the plans for rehabilitation of existing groins in the Recommended Plan has been modified to include rehabilitation of those groins that were found in poor or fair condition that would be beneficial to the beach stability. Based on this evaluation, 15 of the 23 groins in the City of Long Beach and 2 groins in Point Lookout should be rehabilitated. The proposed rehabilitation would consist of repositioning existing armor stone and adding additional armor stone along the seaward 100-330 feet of each of the groins. A minimum constructable crest width of approximately 13 ft was selected with side slopes of 1V on 2H. A primary armor weight of approximately 5 tons was selected in order to approximately match the existing armor stone (See Figures 4-1 to 4-2).

240. **8.3.5 Modifications to Fill Cross-Section and Initial Fill Quantities.** Based on profile surveys collected between 1991 and 2010, berm offshore slope in Long Beach/Lido has been changed from 1V:35H to 1V:30H, which better matches measured long-term average slope. Fill slope in Point Lookout has been changed from 1V:25H to 1V:20H to account for the steepening effect of the new and rehabilitated groins. Berm in Long Beach/Lido has been stepped to better match long term existing berm measurements and to reduce post-storm scarping. Finally, the dune position in the City of Long Beach where it fronts the boardwalk has been shifted landward

such that the landside toe is directly beneath the seaward edge of the boardwalk, at the request of the City of Long Beach. This is an elimination of a 25-ft wide maintenance corridor which had been included in the Feasibility Recommended Plan at the request of the City at that time.

241. Initial construction beach fill quantities have reduced significantly, compared to the Feasibility Study, due to changes made to the fill template. Additionally, sand moving west past the ebb shoal attachment has resulted in wider berms in eastern Long Beach. Contributors to initial fill volume reduction between the Feasibility Study Recommended Plan and the HSLRR updated plan are:

1) 6,000 lf shortening of project due to the withdrawal of East Atlantic Beach
2) Deferral of berm construction in the bird nesting/foraging area
3) Changes in fill cross-section including
    a. Stepped berm
    b. Steeper offshore slopes
    c. Elimination of 25-ft wide maintenance corridor between dune and boardwalk
4) Increases in berm width west of ebb shoal attachment due to natural accumulation

242. **8.3.6 Bird Nesting and Foraging Area.** The Recommended Plan has been modified 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. This plan will allow for the continued unimpeded use of this area as shorebird nesting and foraging areas. In order to avoid construction in this nesting/foraging area, evaluations were conducted to ensure that the existing condition has at least the same storm damage level of protection as the recommended design section. The level of protection against storm erosion and overtopping for the existing berm and dune width and height was compared to that required in the Feasibility Study and found to provide a comparable level of protection (less than 80% dune material displacement). A future trigger, a minimum berm width of 250 ft, has been determined and included in the HSLRR and OMRR&R Manual, such that if the berm width falls below that minimum width required storm protection, construction of deferred project elements will be initiated including placement of the full design section as per the Feasibility Study. The Recommended Plan dune line will be demarked across this area, with placement of fill at initial construction consisting of in-filling gaps in the existing dune line within the project dune footprint to ensure a continuous dune elevation of +14 ft NAVD. Placement of the full feasibility cross-section (or equivalent protection) in the nesting/foraging area at a future date will be considered a part of major rehabilitation contingency, for determining project costs. The ephemeral pool encompasses a 93.4 acre area and the plover and least tern nesting area encompasses a 42.3 acre area.

242a. It is noted that construction of dunes west of Groin D to the western boundary of Lido Beach West Town Park (see figure 8-36) will not use any sediment scraped from the beach or ponding areas. Use of heavy equipment in this area will be limited to avoid damage to invertebrate fauna and to avoid compaction.

243. **8.3.7 Modifications to Post-Construction 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 HSRR 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.

243a. **8.3.7.1 Changes to Coastal Monitoring Based on Biological Opinion Reasonable and Prudent Measures – LIDAR Survey**. Following receipt of the Biological Opinion from the Fish & Wildlife Service, additional monitoring activities have been incorporated for the Fish & Wildlife area of interest shown in Figure 8-36. Annual LIDAR survey over the 50-year project life will be performed on approximately 0.4 square miles to monitor changes to ephemeral pool conditions and general topography. These surveys will be used to establish target elevations for maintenance of ephemeral pool habitats. Target elevations will be established by the Fish and Wildlife Service and USACE in coordination. Any maintenance activity for ephemeral pool habitat will be developed jointly by the USACE, local sponsors, and resource agencies. LIDAR survey data will also be used to monitor changes to the landform which may trigger construction of deferred groins, described in the paragraph below.

243b. **8.3.7.2 Changes to Coastal Monitoring Based on Biological Opinion Reasonable and Prudent Measures – Vegetation**. Vegetation planting of the new dune within the Fish & Wildlife Area of Interest, shall incorporate a mix of native dune plant species and not be limited to a single grass species. Use of beach grass will be limited to property fronting residential areas. Plantings will be made in a random manner (i.e. not in rows with uniform spacing). The intent is that the plantings will mimic natural dune vegetation in the region in species diversity, density, and spacing. Planting plans will be developed jointly by USACE, project local sponsors, and resource agencies.

243c. **8.3.7.3 Changes to Coastal Monitoring Based on Biological Opinion Reasonable and Prudent Measures – Sand Fencing**. Sand fencing plans for initial construction will be developed jointly by USACE, project local sponsors, and resource agencies for the Fish & Wildlife Area of Interest. Sand fencing may be deployed on properties fronting residential areas, e.g. the Lido Beach Towne House Condominiums, and from Prescott St. to Allevard St, in Lido Beach. In support of bird nesting and foraging, sand fencing west of Groin D to Lido Beach East Town Park West fronting non-residential areas will be done per input from local sponsors and resource agencies, and will likely be eliminated from initial construction.

243d. **8.3.7.4 Changes to Coastal Monitoring Based on Biological Opinion Reasonable and Prudent Measures – Sand Cover Over New Groins**. In order to minimize habitat fragmentation and to enable plover chicks to traverse the new groin structures while foraging, sand cover over the landward ends of the four (4) new groins A-D will be maintained to the extent practicable. Placement of sand cover will be done once each year prior to 31 March, with a maximum placement volume of 300 cy per groin. During years with renourishment operations, no maintenance cover will be placed. Coverage details will be developed jointly by the USACE, local sponsors, and resource agencies as part of preparation of the Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRRR) Manual. It is anticipated that some stockpiled sand will be provided during initial construction and subsequent renourishment operations for this purpose, at a location to be jointly determined by the USACE, local sponsors, and resource agencies.

244. **8.3.8 Physical Criteria for Initiating Construction of Deferred Project Elements.** Construction of deferred plan elements, the two westernmost groins and beach fill in the bird nesting and foraging area at Lido Beach, could 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 presently stable condition to an eroded condition in the area where the deferred structures are to be located. The criteria include field measurements and analysis.

245. The Jones Inlet ebb shoal attachment point, or "weldment," feature is a shallow nearshore feature that bridges the ebb tidal shoal offshore of Jones Inlet to the beaches to the west. The weldment is characterized by a bulge in the shoreline that has grown since 1962 and particularly through the 1990's. The initiation of the feature appears to coincide with the completion of the jetty on the eastern side of Jones Inlet and the subsequent growth of the ebb shoal south of the inlet. By 1980, the jetty fillet was reported to be nearly saturated, thus causing increased dredging requirements in the Jones Inlet navigation channel and an increased sediment supply to the tidal shoal (particularly the ebb shoal) features.

246. In the 1990's, two major beach fills were placed in the Point Lookout to Hempstead Beach area totaling 1,160,000 cubic yards. The weldment became a relatively stable feature (length and shoreline position) in the 1995, 1997 and 1998 shorelines as shown in Figure 2-3. At the shoreline, the weldment is approximately 6000 feet long and extends from the Town of Hempstead Beach to the eastern end of Lido Beach.

247. The relevant features that dictate the present configuration of the weldment encompass the entire inlet system:

- The updrift fillet at the Jones Inlet east jetty on Jones Island, which is the origination of sand supply to the inlet system,
- The Jones Inlet channel, which hydraulically determines the position and size of the ebb and flood shoals,
- The ebb and flood shoals, which are in dynamic equilibrium with the inlet hydraulics and supply sediment to the bypassing bar that is a sediment bridge to the weldment.

248. The Long Beach Technical Reanalysis report (USACE 2000) resulted in a recommended plan, called Alternative 4a, shown in Figure 2-25, that includes seven new groins extending westward from the three existing groins in Point Lookout, terminating about 7,000 feet to the west. The groin field includes four groins with tapered lengths spaced at 800-ft intervals west of existing Groin 3 in Point Lookout, and three more tapered groins spaced at 1,200 feet in the weldment. The purpose of the tapered lengths is to avoid negative impacts to the west by allowing some sediment to bypass the groins and supply the downdrift beach.

249. The three westerly groins (groins E, F & G) will be largely buried in the existing weldment area and were proposed for deferred construction, to be built based on a lack of stability of the weldment area sometime in the future. This HSRR report has eliminated the westernmost, most landlocked deferred groin (groin G) in order to remain within authorization, reducing the number of new groins to 6 and deferred groins to 2. Deferred groins will be required if increased measures become necessary to maintain adequate shoreline stability in that area. The westernmost non-deferred new groin (groin D, located at approx. E 1096200) falls within the proposed ephemeral pool area, and, at this time, is sufficiently buried to merit consideration for deferred construction. However, this location at the eastern end of the weldment would then be the most susceptible of all the deferred structures to a reduction in

beach width if the weldment migrates to the west. This groin also fronts an area that has more shorefront structures than the deferred groins to the west. Accordingly, deferring construction of this groin is not recommended at this time.

250. Overall, there are three conditions that may occur that would create a need for building the deferred groins:

1. The weldment may dissipate, i.e., the shoreline position and size of the weldment feature may recede. This process would indicate a reduction or termination of sediment supply to the shoreline from the inlet/shoal system that includes all the features described above. If the continuity of sediment flow throughout the system is interrupted, the weldment could dissipate. For example, if sediment is removed from the east jetty fillet, it could slow the bypassing rate of sediment into the inlet, which in turn would reduce the flow of sediment to the weldment. Removal of sand from the ebb shoal or flood shoal needs to be carefully assessed because, again, this could create a demand for sediment within the shoals that would reduce the supply of sand to the weldment.

2. The weldment may migrate to the east or west, exposing the area to the north of the weldment to increased wave energy and possible beach recession. This process would likely be a result of changes to the inlet hydraulics caused by a change in channel configuration, location or geometry. Excessive shoaling (or, conversely, dredging) within the inlet channel could result in a change in hydraulic efficiency, which in turn could alter the position and size of the ebb and flood shoals. Because the position of the ebb shoal determines the size and location of the bypassing bar, the weldment would respond by moving in the alongshore direction. Lowered currents in the inlet might cause ebb shoal accretion closer to shore, causing the weldment to move to the east. Higher currents in the inlet could cause the ebb shoal to be shifted further offshore, causing the weldment to move to the west.

3. New groins constructed east (updrift) of the site might contribute to the trigger for construction of the deferred groins. The new groins may contribute to a reduction in sand supply toward the west, reducing the beach width.

251. The response of the weldment would likely take place over a long period of time (a year or more) that should be adequate to accomplish the construction of the deferred groin structures. This assumes that appropriate monitoring 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.

252. As shown in Figure 5-4, numerical modeling of beach profile response in the weldment area under design storm (73-year event) conditions indicates that approximately 250 feet of berm erosion is expected to occur during that event. Therefore a berm width of approximately 250 feet at existing elevations is required to avoid significant scarping of the dune. The berm in the weldment area is the region of the beach between the dune and the seawardmost +6 ft NAVD (+7 ft NGVD29) contour. If monitoring data indicate that the berm from the seaward base

of the dune to the 6ft NAVD contour is continuously narrower than 250 feet for more than a one-year period, the erosion processes need to be viewed as a long term trend and not seasonal or temporary. Thus, the construction process for the beach fill and/or deferred structure(s) in the narrow beach area should be initiated.

253. There are other possible data sources that would indicate the need for construction, such as trends in the movement of the weldment and attachment bar, or changes in the volume and position of the ebb shoal. However, these features are submerged even at low tide and are difficult to completely monitor for quantifying trigger points for groin construction.

254. The process of developing construction documents, bids, funding and contracts will take place over a several-month period and will allow further investigation of the cause(s) of the narrowed (eroded) berm. These causes may indicate other or additional measures needed to prevent further erosion or reduced effectiveness of the groin field.

255. The paragraphs below describe the field data collection efforts required to identify the conditions that would trigger the initiation of construction of deferred project elements as well as the cause(s) of the erosion and possible reduced effectiveness of the groin field.

256. Table 8 – 1 summarizes the recommended field efforts and analysis.

1. Monitoring of the Weldment and Adjacent Beach Area. Beach profiling should be performed from Lido Beach to the existing Groin 2 in Point Lookout so that the weldment and the adjacent beaches are included. Specifically, beach profiles should be surveyed at least annually in February - early March to avoid the bird nesting season and to capture the post-winter condition from the landward limit of the beach to -30 feet NAVD (or a maximum of 5000 ft length) at 500-ft spacings from E1085000 to E1100000. These data will provide an accurate assessment of site conditions and changes over time both above the water line and deeper on the beach profiles. The data should be plotted in both profile and plan views and then immediately analyzed to identify changes since the last survey and site conditions relative to design conditions and the berm width relative to the trigger width of 250 feet. Significant narrowing of the berm, especially when the berm approaches or is narrower than 250-ft, should be identified. Trends in narrowing between consecutive surveys should also be described.

   Additionally, LIDAR survey of the Fish & Wildlife Area of Interest will be done annually which will capture surface conditions of the dry beach. This data will be used in conjunction with aerials and beach profiles to define changes over time above the water line.

2. Aerial Photography of the Weldment and Adjacent Beach Area, the Inlet Shoals and Shorelines, and the East Jetty Fillet. Aerial photography has been the primary source of detailed shoreline positions and resulting sediment budgets in the study area. Photography should be taken annually in the spring to capture the post-winter condition and analyzed to extract shoreline position from approximately two miles east of Jones Inlet to Lido Beach (E1085000). The data should be plotted in plan view and then immediately analyzed to identify changes since the last shoreline and site conditions relative to design conditions. Significant changes since the prior photography should be identified (especially trends or shifts in weldment position).

3. Hydrographic Surveys of the Inlet. Every three years or when a potential trigger condition is met for construction of deferred structures, hydrographic surveys (single or multibeam) should be collected that include the inlet and the exterior of the ebb and flood shoals. The surveys will indicate, for example, changes in the long term supply of sediment to the shoreline that may indicate a need for increased fill in the groin field. Hydrographic surveys may be combined with on-going navigation channel condition surveying, if advantageous to do so.

4. Hydraulic Measurements of Waves, Currents and Water Levels. A directional wave gage immediately seaward of the Point Lookout area should be re-established to provide a measurement of incident wave energy to the area. The water level gage at Point Lookout, now operated by the USGS (USGS 01310740 REYNOLDS CHANNEL AT POINT LOOKOUT NY), and existing meteorological station(s) should be maintained.

5. Monitoring Analysis Report. The data described above should be analyzed by experienced coastal engineers to determine the long term changes occurring to the inlet system and, ultimately, to the weldment. The analysis should also present project conditions relative to the desired design condition. Significant deviations to the design conditions assumed in the weldment area will signal that the deferred groins should be constructed. If berm widths and usable beach widths (dune to Mean Sea Level) are narrower than overall beach fill design parameters, then construction of the deferred structures should be considered.

Table 8-1. Summary of recommended monitoring activities to indicate a trigger for construction of deferred project elements.

Recommended Activity	Required Analysis	Frequency of Activity and Analysis	Expected Products	Criteria for Triggering Construction or Affecting Maintenance
Beach profile survey	Compare profiles to previous survey, compare berm width to required trigger (250' berm width), indicate trends in berm width by comparing present width to prior three surveys.	Minimum annually in February – early March	Scaled profile plots comparing present profile to prior three surveys, scaled plan view plot with contours overlaid on prior position of +6' NAVD contour and dune toe, table comparing berm widths and changes in berm width to prior three surveys.	Berm width less than 250' will trigger construction; trends in berm width change will indicate potential trigger condition in the future. Erosion of the Jones Beach fillet will indicate an interruption in sand supply.
Aerial photography	Digitize photography; digitize shoreline position from approximately two miles east of Jones Inlet to Lido	Annually in early spring	Digitized shoreline plotted in plan view atop mapping with comparison to previous three available	With profile data, a shift in the weldment position will indicate how many deferred structures are (or will be) required.

	Beach		shorelines.	
LIDAR survey of dry beach	Plot contours, define shorelines in combination with aerial photography and beach profiles.	Annual in early spring.	Contour plots at 1'-intervals of surveyed area in plan view.	With profile and aerial data, a shift in the weldment position will indicate how many deferred structures are (or will be) required.
Hydrographic surveys of the inlet and shoals	Produce a digital survey of the inlet and shoal features; also a contour plot of digital terrain model of the features to quantify volumes of sediment erosion or accretion.	Every three years or when a trigger point is identified or imminent (trend indicates a trigger within a year in the future)	Digital file of survey data, contour plot of digital terrain model of bottom features.	Changes in position, geometry, shoaling or erosion of the channels and/or shoals; identify processes causing changes, trends. Recommend changes to long term project maintenance.
Directional wave and water level measurements	Quantify waves and water levels impacting the project.	Continuously from project start for 5 years.	Annual and long term graphs of water level, wave height, period and direction, wave rose, and summary of the top 20 significant storm events by water level and wave height (annually and for all project years.	Will provide a correlation between profile change and incident wave and water level conditions. Will help to verify that a trend or trigger is not a temporary result of storm or seasonal conditions.
Analysis report	Report to include all analyses described above.	Annually, to include each activity described above.	Digital and hard copy report, analyzed data sets in digital form	Coastal engineering analysis of all tasks including construction trigger or trends toward triggering deferred construction.

References

Ambrose, W.G. Jr., D.S. Jones, and I. Thompson. 1980. Distance from shore and growth rate of the suspension feeding bivalve, Spisula solidissima. Proc. Nat. Shellfish Assoc. 70: 207-215.

Andrle, R.F. and J. Carroll. 1988. The Atlas of Breeding Birds in New York State. Cornell University Press, Ithaca, New York.

Buonaiuto, F.S., Z. Demirbilek and N.C. Kraus. 2003. "Threes," An unusual surfing spot at Shinnecock Inlet, New York. Submitted to Shore and Beach.

Cerrato, R.M. and D.L. Keith. 1992. Age structure, growth and morphometric variations in the Atlantic surf clam. Mar. Biol. 114:581-593.

Coastal Planning & Engineering of New York, PC. January 2011. "Long Beach Island, New York, Storm Damage Reduction Project, City of Long Beach Segment, Geotechnical Analysis of 2010 USACE Vibracores.

Fay, C.W., R.J. Neves, and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): surf clam. U.S. Fish Wildlife Service, Div. Biol. Serv., FWS/OBS-82/11.13.23 pp.

Hallermeier, R.J. 1983. Sand transport limits in coastal structure designs. Conference on Coastal Structures '83**.** 703-716.

Naqvi S.M. and E.J. Pullen, 1982. Effects of beach nourishment and borrowing on marine organisms. U.S. Army Corps of Engineers Coastal Engineering Research Center Miscellaneous Report No. 82-14.

New York State. Department of Environmental Conservation. 1994. 1994 Long Island Colonial Waterbird and Piping Plover Survey. Preliminary Tables 1.

New York State. Department of State. 1987. Significant Coastal Fish and Wildlife Habitats in Nassau and Suffolk Counties. 16, February.

Pickman, Arnold. 1993. Cultural Resource Reconnaissance Atlantic Coast of Long Island Jones Inlet to East Rockaway Inlet Long Beach Island Nassau County, New York. Prepared for USACOE, New York District.

Reilly F.J., Jr. and V.J. Bellis. 1978. A Study of the Ecological Impact of Beach Nourishment with Dredged Materials on the Intertidal Zone. Institute for Coastal and Marine Resources Technical Report No. 4. East Carolina University, Greenville, NC. 107 pp.

Ropes, J.W. 1978. Biology and distribution of surf clams (Spisul solidissima) and ocean Quahogs (Arctica islandica) off the northeast coast of the United States. In Proc. Northeast clam industries: management of the future, April 27-28, Hyannis, MA.

Sherk, J.A., Jr. 1971. The Effects of Suspended and Deposited Sediments on Estuarine Organisms: Literature summary and research needs. Chesapeake Biol. Lab. Contrib. No. 443. Solomons, MD. 73 pp.

Steimle , F. and R. Stone. 1973. Abundance and Distribution of Inshore Benthic Fauna of Southwestern Long Island, New York. NOAA Tech. Ref. NMFS SSRF-673.

U.S. Army Corps of Engineers, New York District. 1965. Beach erosion control and interim hurricane study for the Atlantic coast of Long Island, New York, Jones Inlet to Rockaway Inlet, draft survey report.

U.S. Army Corps of Engineers, New York District. 1989. Atlantic coast of Long Island, Jones Inlet to East Rockaway Inlet, Long beach island, New York, Reconnaissance Report.

U.S. Army Corps of Engineers, New York District. 1993, Section 933 Evaluation Report, Jones Inlet, New York.

U.S. Army Corps of Engineers, New York District. 1998. Long Beach Island, New York, Feasibility Report with Final Environmental Impact Statement for Storm Damage Reduction.

U.S. Army Corps of Engineers, New York District. 1999. Terminal Groin Rehabilitation and Extension at Jones Inlet, Long Beach Island, New York.

U.S. Army Corps of Engineers, New York District. 2000. Technical Reanalysis of the shoreline stabilization measures for the eastern portion of Long Beach Island, New York.

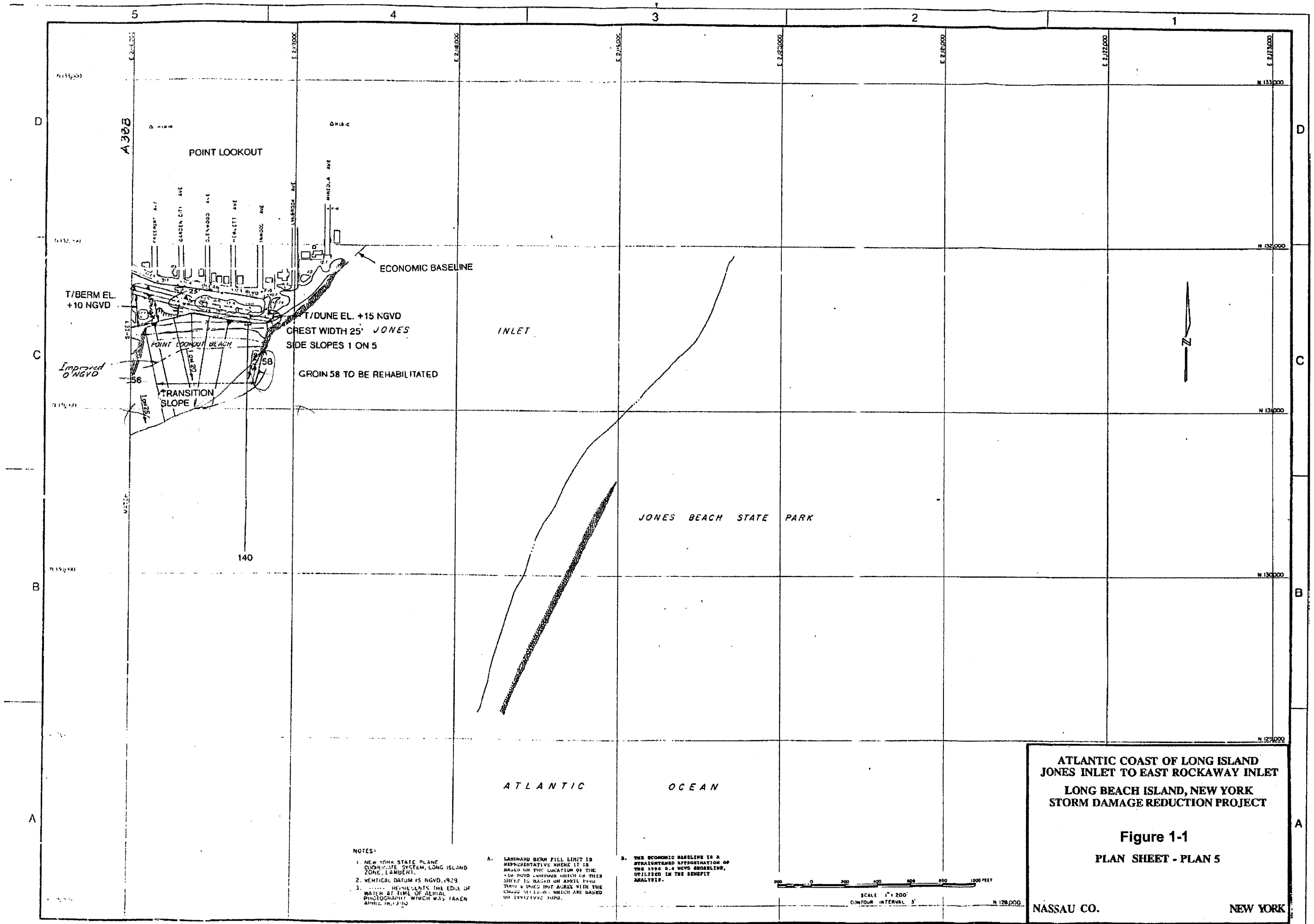
U.S. Army Corps of Engineers, New York District. 2002. Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, Storm Damage Reduction Reformulation Study – Surf Clam Assessment.

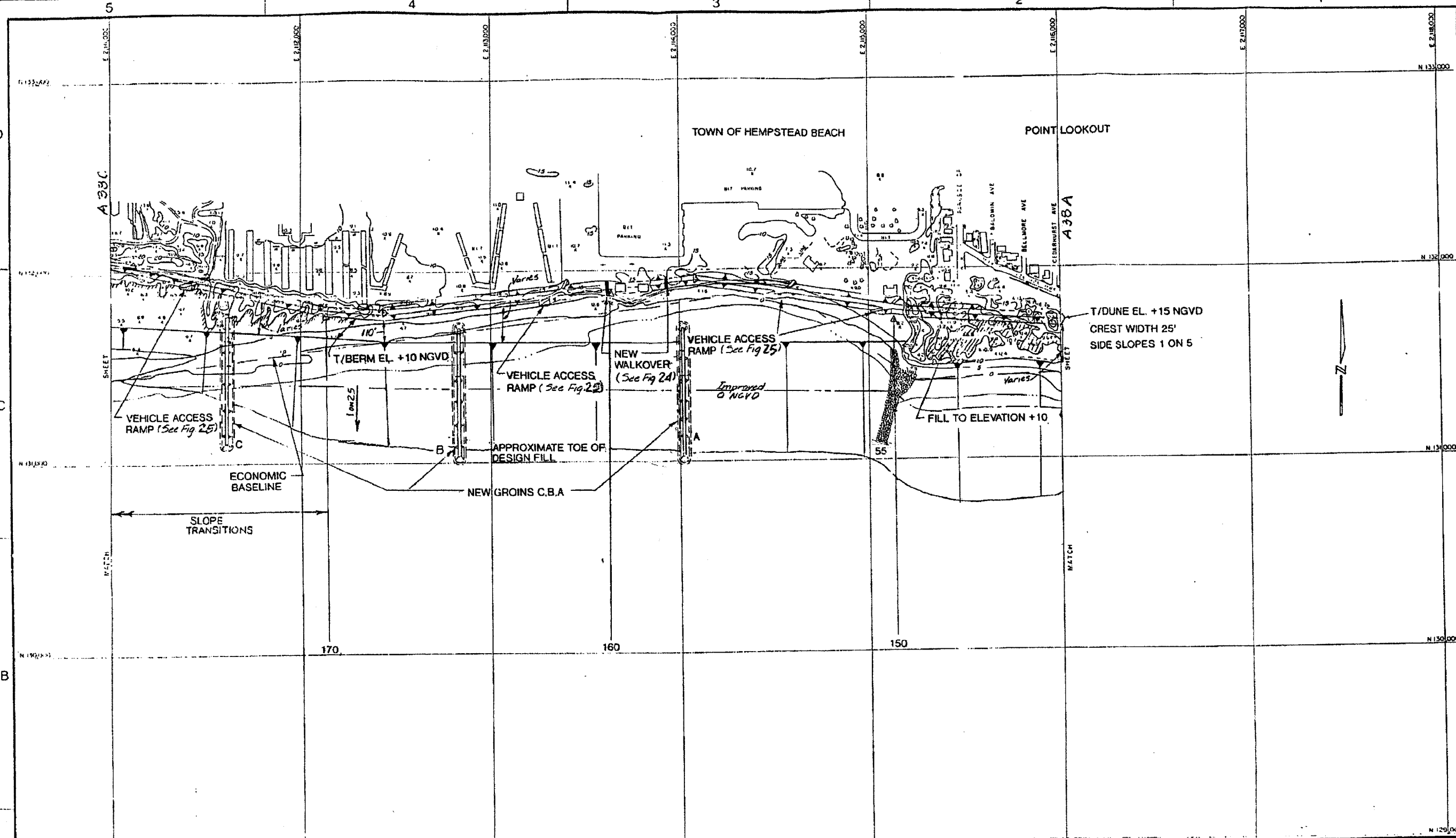
U.S. Army Corps of Engineers, New York District. August 2011. “Offshore Field Investigation to Update the Limited Reevaluation Report (LRR) for the Island of Long Beach, New York, Task 1: Refinement of Existing Sand Borrow Areas”.

Wagner, E.S. 1984. Growth rate and annual shell structure patterns in a single year class of surf clams (Spisula solidissima) off Atlantic City, New Jersey. M.S. Thesis, Rutgers University, New Brunswick, NJ. 161 pp.

Walker, J.R. 1974. Recreational Surf Parameters. Look Lab TR-30, University of Hawaii, Department of Ocean Engineering, Honolulu, Hawaii.

Woodhead, P.M.J., and S.S. McCafferty. 1986. Report on the Fish Community of Lower New York Harbor in Relation to Borrow Pit Sites. MSRC Report prepared for the New York District.


A38B
POINT LOOKOUT
ECONOMIC BASELINE
T/BERM EL.
+10 NGVD
T/DUNE EL. +15 NGVD
CREST WIDTH 25'
SIDE SLOPES 1 ON 5
JONES
INLET
POINT LOOKOUT BEACH
Improved
0'NGVD
56
58
GROIN 58 TO BE REHABILITATED
TRANSITION
SLOPE
140
JONES BEACH STATE PARK
ATLANTIC
OCEAN
N
NOTES:
1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929.
3. ..... REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY WHICH WAS TAKEN APRIL 18, 1990
4. LANDWARD BERM FILL LIMIT IS REPRESENTATIVE WHERE IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 TOPO & DOES NOT AGREE WITH THE CROSS SECTIONS WHICH ARE BASED ON 1991/1992 TOPO.
5. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 0.0 NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.
200 0 200 400 600 800 1000 FEET
SCALE 1" = 200'
CONTOUR INTERVAL 5'
N 133,000
N 132,000
N 131,000
N 130,000
N 129,000
N 128,000
E 2,117,000
E 2,118,000
E 2,119,000
E 2,120,000
E 2,121,000
E 2,122,000
E 2,123,000
ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
Figure 1-1
PLAN SHEET - PLAN 5
NASSAU CO.
NEW YORK
FIGURE NO. A38A



NOTES:

1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929.
3. — · — · — · — REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY WHICH WAS TAKEN APRIL 18, 1990

A. LANDWARD BERM FILL LIMIT IS REPRESENTATIVE WHERE IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 TOPO & DOES NOT AGREE WITH THE CROSS SECTIONS WHICH ARE BASED ON 1991/1992 SURV.

B. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 6.8 NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.

SCALE 1" = 200'
CONTOUR INTERVAL 5'

ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET

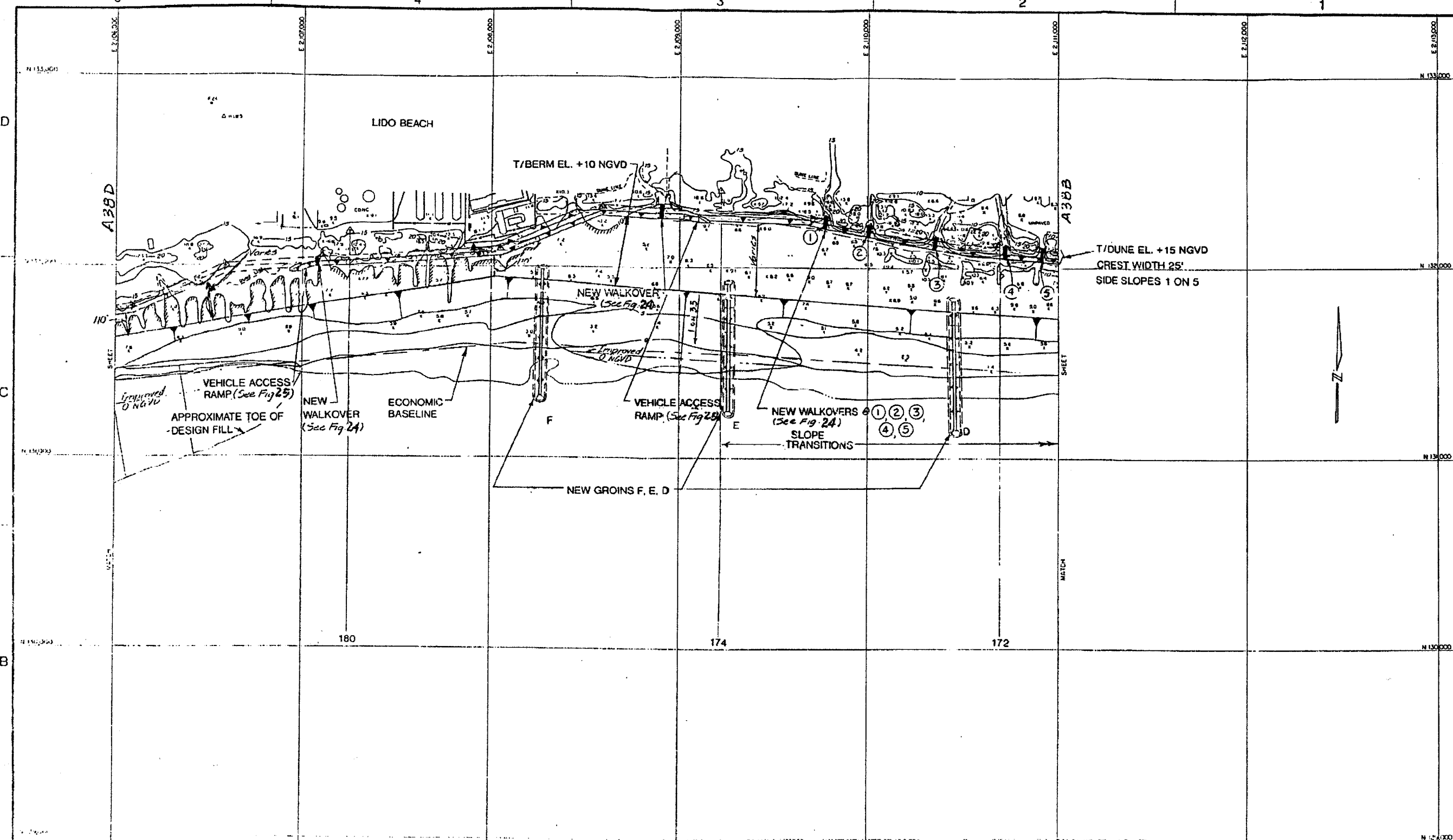
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

Figure 1-2

PLAN SHEET - PLAN 5

NASSAU CO. NEW YORK

FIGURE NO. A 38 B



NOTES:

1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929.
3. ---- REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY, WHICH WAS TAKEN APRIL 18, 1990

4. LANDWARD DUNE FILL LIMIT IS REPRESENTATIVE WHERE IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 TOPO & DOES NOT AGREE WITH THE CROSS SECTIONS WHICH ARE BASED ON 1997/1992 TOPO.

5. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 0.0 NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.

200 0 200 400 600 800 1000 FEET

SCALE 1" = 200'

CONTOUR INTERVAL 5'

ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET

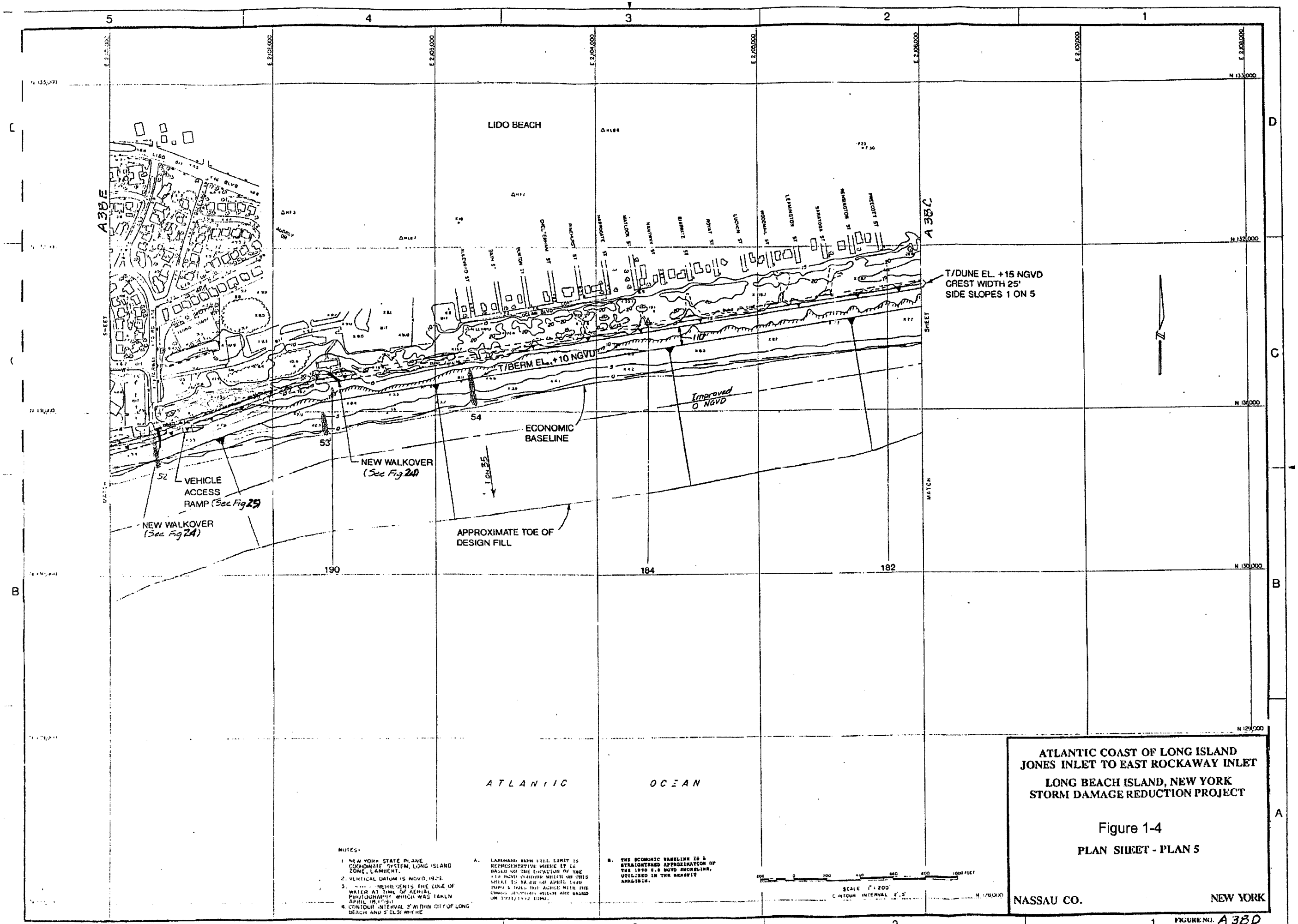
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

Figure 1-3

PLAN SHEET - PLAN 5

NASSAU CO. NEW YORK

FIGURE NO. A38C



ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

Figure 1-4

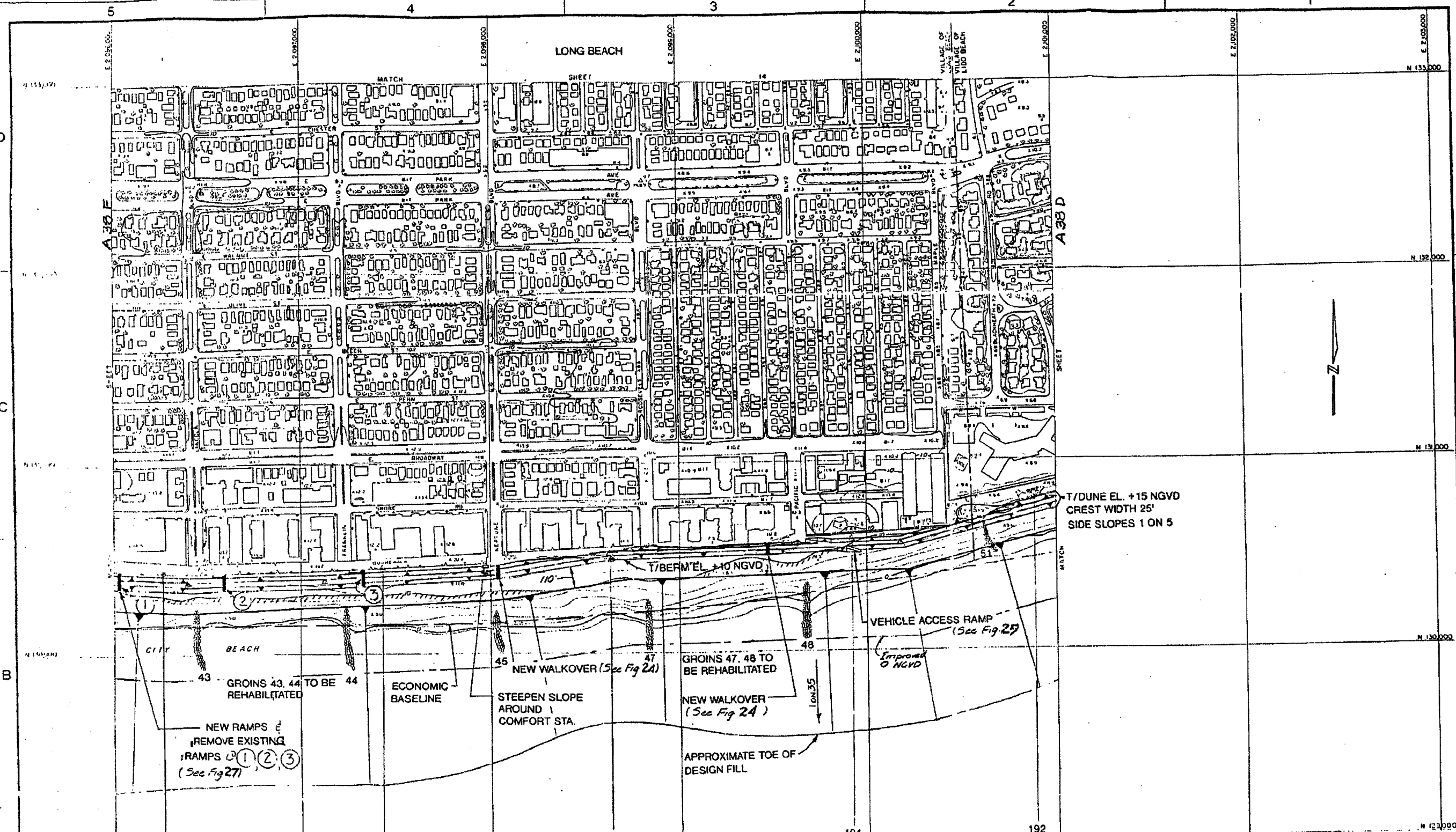
PLAN SHEET - PLAN 5

NOTES:

1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929.
3. ---- REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY WHICH WAS TAKEN APRIL 19, 1990.
4. CONTOUR INTERVAL 2' WITHIN CITY OF LONG BEACH AND 5' ELSEWHERE.

A. LANDWARD BERM FILL LIMIT IS REPRESENTATIVE WHERE IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 DATA & DOES NOT AGREE WITH THE CROSS SECTIONS WHICH ARE BASED ON 1991/1992 DATA.

B. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 U.S. NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.



NOTES:

1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929.
3. ..... REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY WHICH WAS TAKEN APRIL 18, 1990

A. LANDWARD BERM FILL LIMIT IS REPRESENTATIVE MEANS IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 DATA AND NOT MORE WITH THE CROSS SECTIONS WHICH ARE BASED ON 10/17/1992 DATA.

B. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 0.0 NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.

SCALE 1" = 200'
CONTOUR INTERVAL 2'

ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET

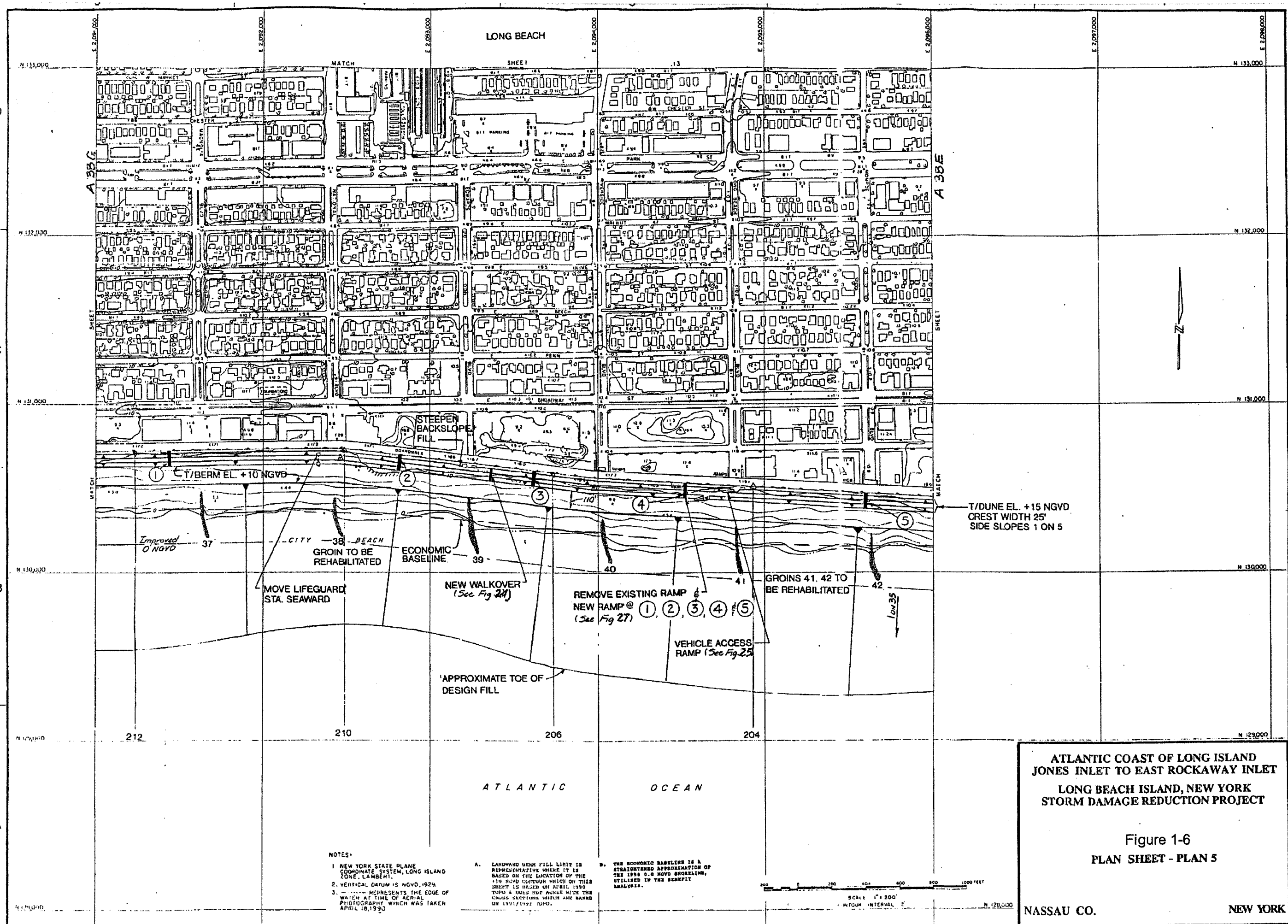
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

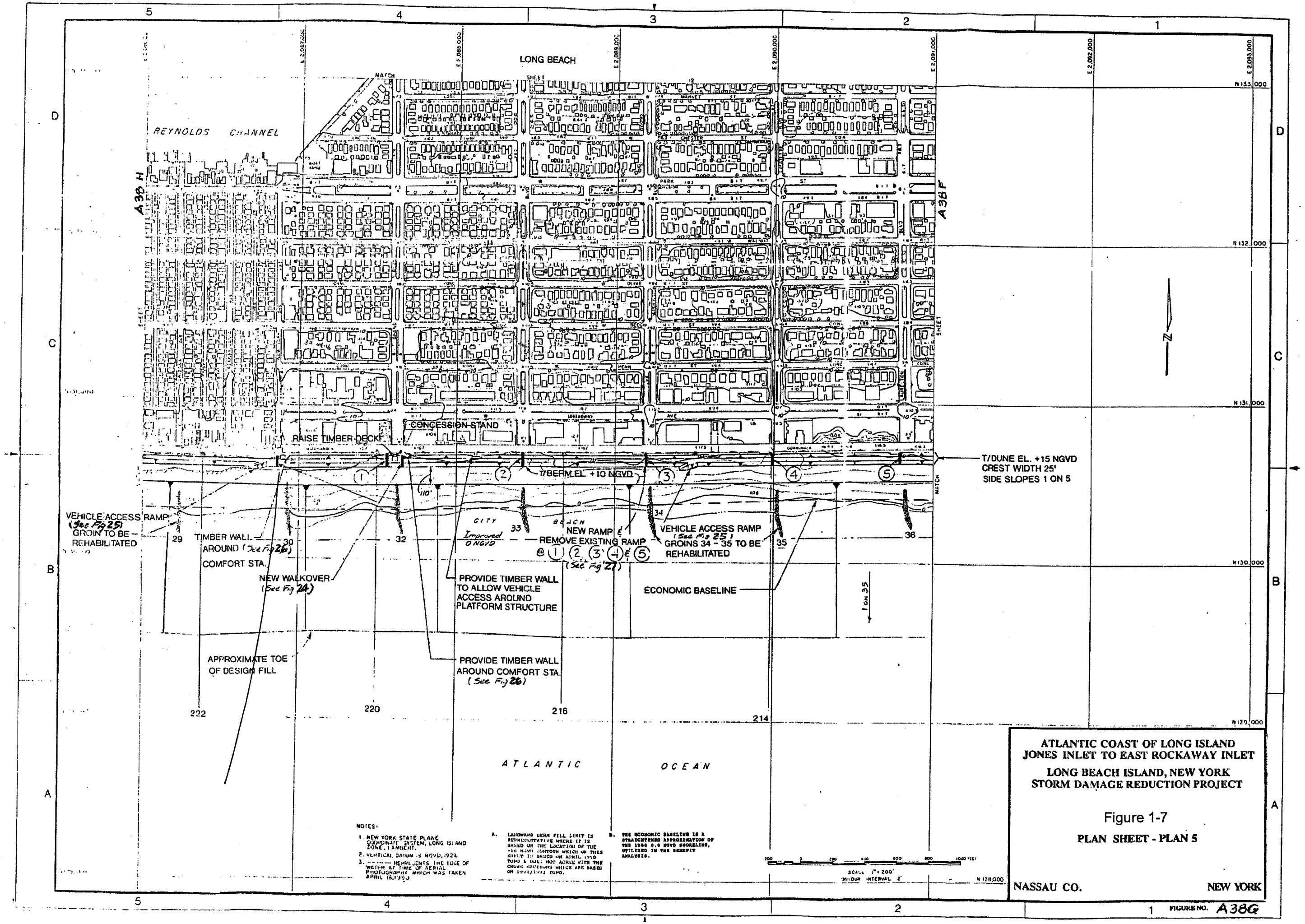
Figure 1-5

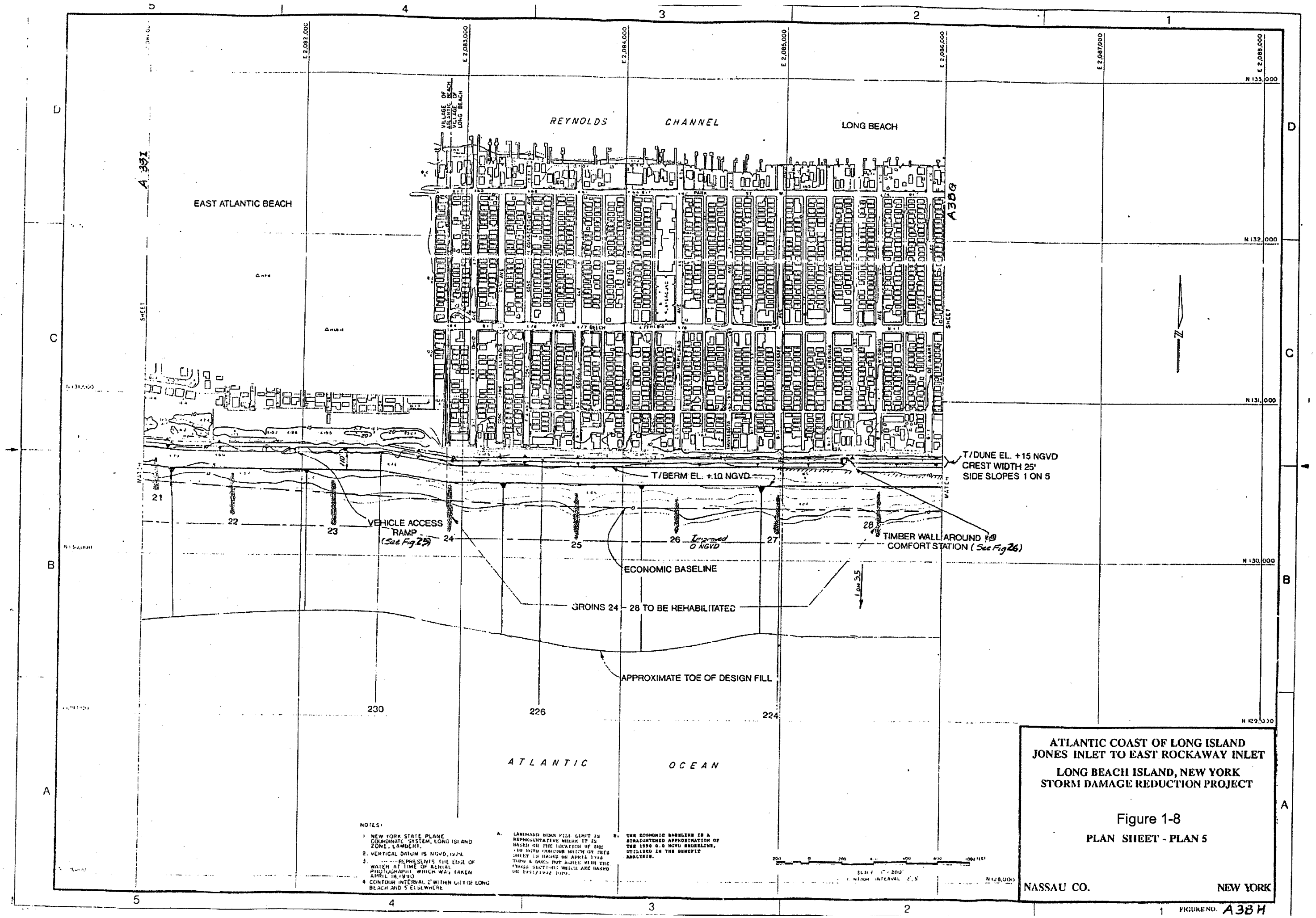
PLAN SHEET - PLAN 5

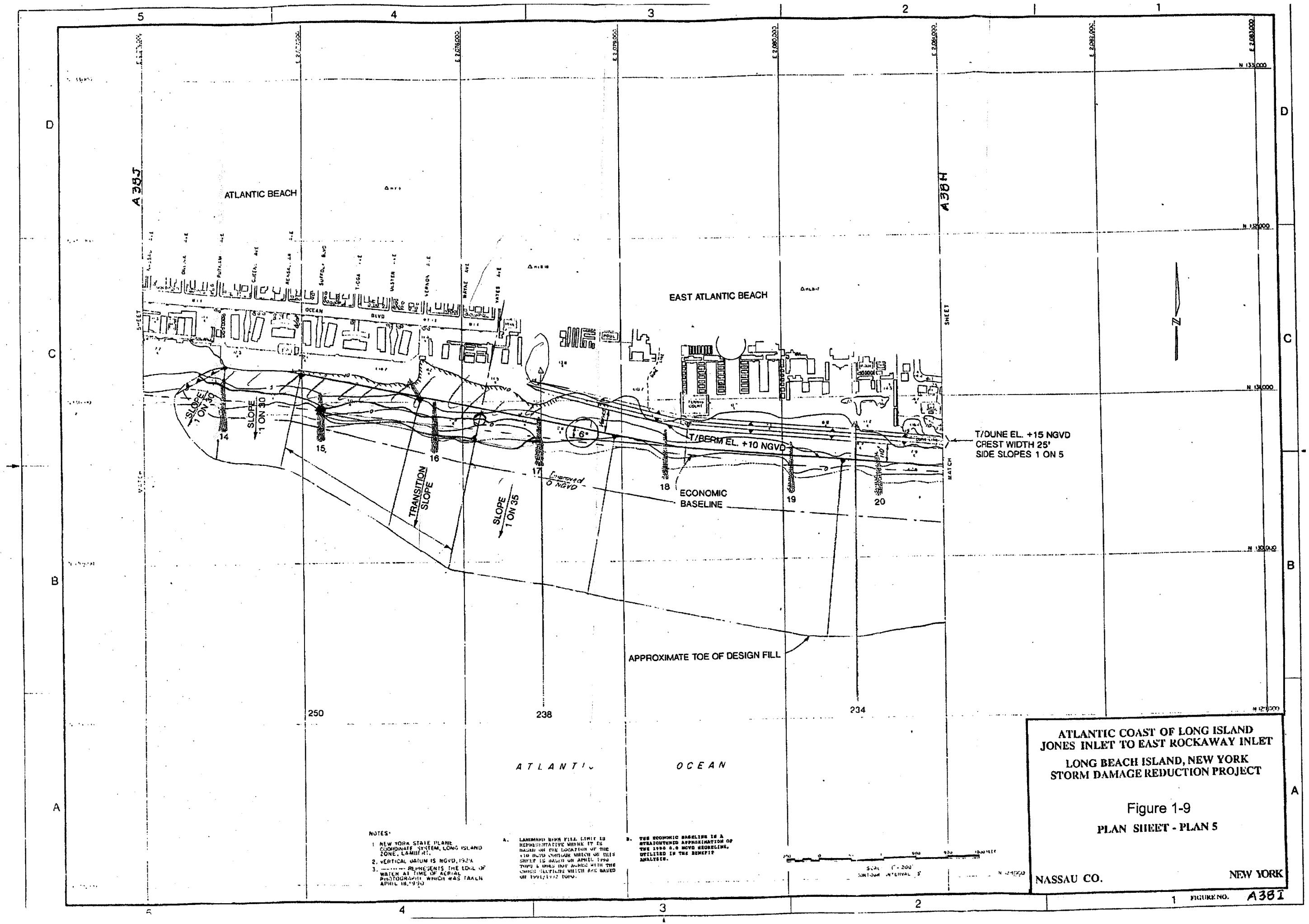
NASSAU CO. NEW YORK

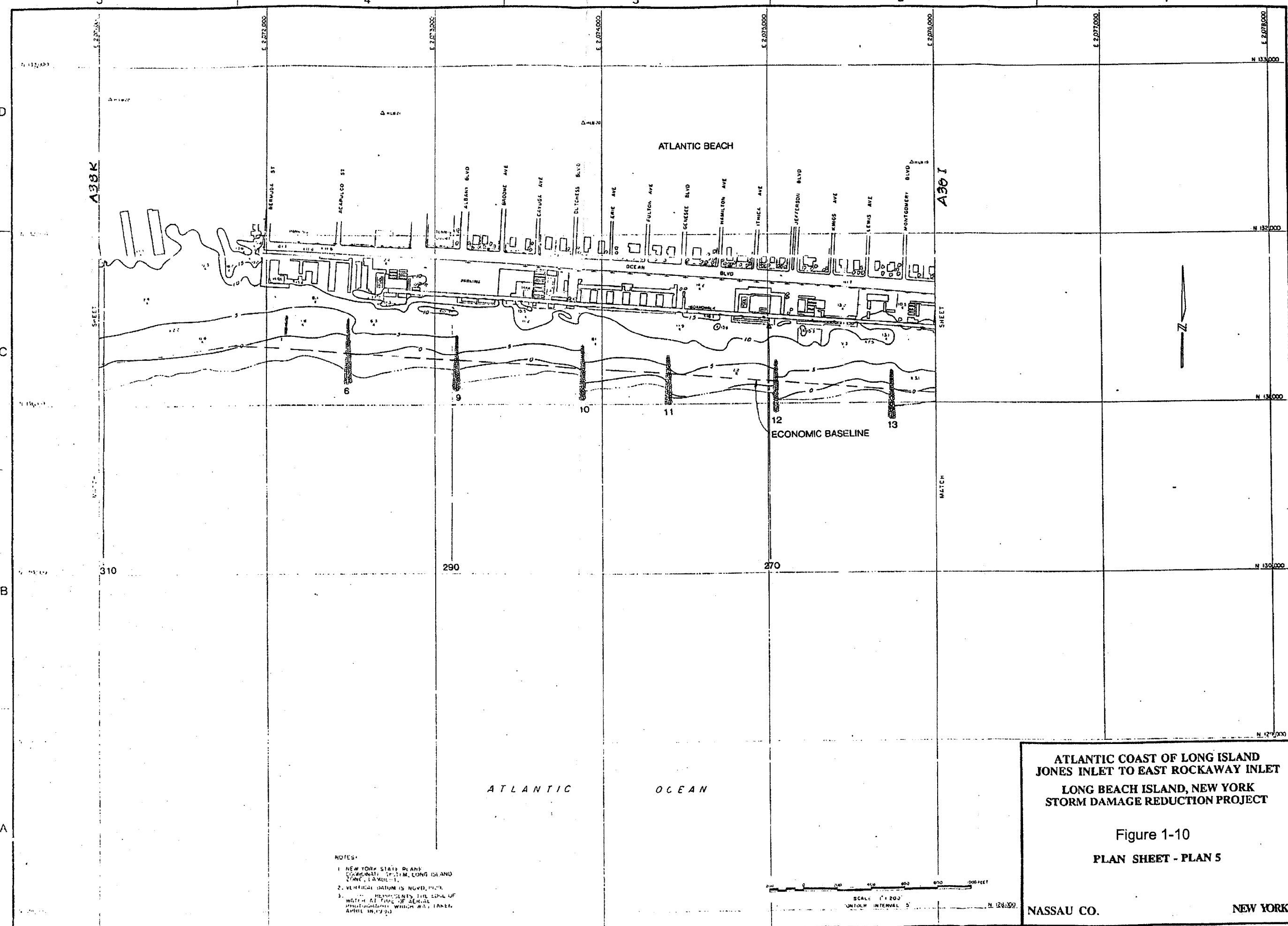
FIGURE NO. A38E

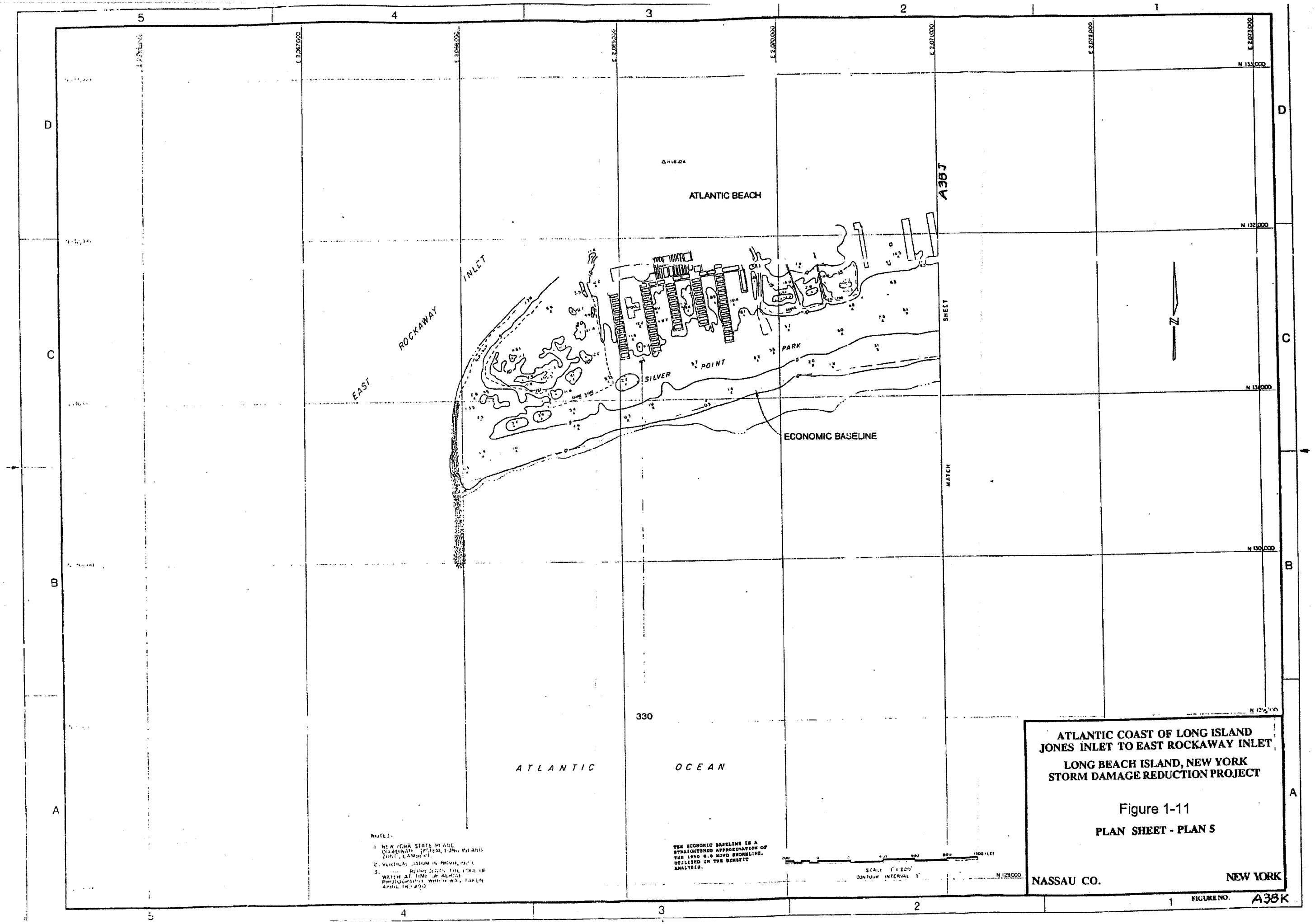

LONG BEACH
MATCH SHEET 13
A 38G
A 38E
STEEPEN BACKSLOPE FILL
T/BERM EL. +10 NGVD
T/DUNE EL. +15 NGVD
CREST WIDTH 25'
SIDE SLOPES 1 ON 5
Improved 0' NGVD
CITY BEACH
GROIN TO BE REHABILITATED
ECONOMIC BASELINE
MOVE LIFEGUARD STA. SEAWARD
NEW WALKOVER (See Fig 24)
REMOVE EXISTING RAMP
NEW RAMP @ (See Fig 27)
GROINS 41, 42 TO BE REHABILITATED
VEHICLE ACCESS RAMP (See Fig. 25)
APPROXIMATE TOE OF DESIGN FILL
ATLANTIC OCEAN
212
210
206
204
N 133,000
N 132,000
N 131,000
N 130,000
N 129,000
N 128,000
E 2,091,000
E 2,092,000
E 2,093,000
E 2,094,000
E 2,095,000
E 2,096,000
E 2,097,000
E 2,098,000
NOTES:
1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929.
3. — ·—·— REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY, WHICH WAS TAKEN APRIL 18, 1990
A. LANDWARD BERM FILL LIMIT IS REPRESENTATIVE WHERE IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 TOPO & DOES NOT AGREE WITH THE CROSS SECTIONS WHICH ARE BASED ON 1991/1992 TOPO.
B. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 0.0 NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.
SCALE 1" = 200'
CONTOUR INTERVAL 2'
ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
Figure 1-6
PLAN SHEET - PLAN 5
NASSAU CO.
NEW YORK
FIGURE NO. A 38F

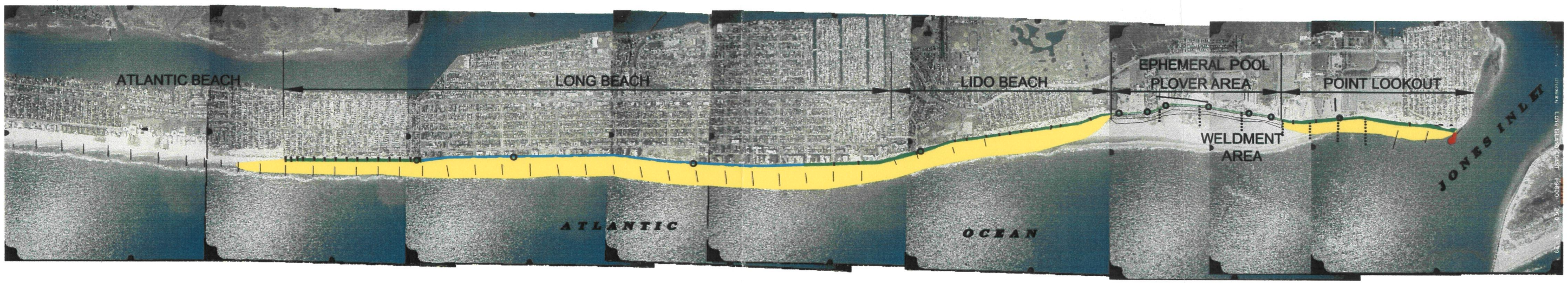

LONG BEACH
REYNOLDS CHANNEL
A38 H
A38 F
CONCESSION STAND
RAISE TIMBER DECK
T/BERM EL. +10 NGVD
T/DUNE EL. +15 NGVD
CREST WIDTH 25'
SIDE SLOPES 1 ON 5
VEHICLE ACCESS RAMP (See Fig 25)
GROIN TO BE REHABILITATED
TIMBER WALL AROUND (See Fig 26)
COMFORT STA.
NEW WALKOVER (See Fig 24)
PROVIDE TIMBER WALL TO ALLOW VEHICLE ACCESS AROUND PLATFORM STRUCTURE
NEW RAMP ℄
REMOVE EXISTING RAMP @ 1 2 3 4 ℄ 5 (See Fig 27)
VEHICLE ACCESS RAMP (See Fig 25)
GROINS 34 - 35 TO BE REHABILITATED
ECONOMIC BASELINE
1 ON 35
APPROXIMATE TOE OF DESIGN FILL
PROVIDE TIMBER WALL AROUND COMFORT STA. (See Fig 26)
CITY BEACH
Improved 0 NGVD
ATLANTIC OCEAN
29
30
32
33
34
35
36
222
220
216
214
N 133,000
N 132,000
N 131,000
N 130,000
N 129,000
N 128,000
E 2,087,000
E 2,088,000
E 2,089,000
E 2,090,000
E 2,091,000
E 2,092,000
E 2,093,000
NOTES:
1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929.
3. ——— REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY WHICH WAS TAKEN APRIL 18, 1990
A. LANDWARD BERM FILL LIMIT IS REPRESENTATIVE WHERE IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 TOPO & DOES NOT AGREE WITH THE CROSS SECTIONS WHICH ARE BASED ON 1991/1992 TOPO.
B. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 0.0 NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.
SCALE 1" = 200'
CONTOUR INTERVAL 2'
ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
Figure 1-7
PLAN SHEET - PLAN 5
NASSAU CO.
NEW YORK
FIGURE NO. A38G


REYNOLDS CHANNEL
LONG BEACH
EAST ATLANTIC BEACH
VILLAGE OF ATLANTIC BEACH
VILLAGE OF LONG BEACH
A 38I
A 38G
SHEET
T/DUNE EL. +15 NGVD
CREST WIDTH 25'
SIDE SLOPES 1 ON 5
T/BERM EL. +10 NGVD
VEHICLE ACCESS RAMP (See Fig 25)
Improved 0 NGVD
TIMBER WALL AROUND COMFORT STATION (See Fig 26)
ECONOMIC BASELINE
1 ON 3.5
GROINS 24 - 28 TO BE REHABILITATED
APPROXIMATE TOE OF DESIGN FILL
ATLANTIC OCEAN
21
22
23
24
25
26
27
28
230
226
224
E 2,082,000
E 2,083,000
E 2,084,000
E 2,085,000
E 2,086,000
E 2,087,000
E 2,088,000
N 133,000
N 132,000
N 131,000
N 130,000
N 129,000
N 128,000
N 131,000
N 130,000
N 129,000
N 128,000
NOTES:
1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929.
3. ---- REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY WHICH WAS TAKEN APRIL 18, 1990
4. CONTOUR INTERVAL 2' WITHIN CITY OF LONG BEACH AND 5' ELSEWHERE
A. LANDWARD HIGH POLE LIMIT IS REPRESENTATIVE MEANS IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 TOPO & DOES NOT AGREE WITH THE CROSS SECTIONS WHICH ARE BASED ON 1991/1992 DATA.
B. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 O.G NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.
SCALE 1" = 200'
CONTOUR INTERVAL 2.5'
ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
Figure 1-8
PLAN SHEET - PLAN 5
NASSAU CO.
NEW YORK
FIGURE NO. A38H


ATLANTIC BEACH
EAST ATLANTIC BEACH
A38J
A38H
SHEET
MATCH
OCEAN BLVD
SLOPE 1 ON 30
SLOPE 1 ON 30
TRANSITION SLOPE
SLOPE 1 ON 35
T/BERM EL. +10 NGVD
T/DUNE EL. +15 NGVD
CREST WIDTH 25'
SIDE SLOPES 1 ON 5
Excavated 0 NGVD
ECONOMIC BASELINE
APPROXIMATE TOE OF DESIGN FILL
14
15
16
17
18
19
20
250
238
234
ATLANTIC OCEAN
NOTES:
1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, LAMBERT.
2. VERTICAL DATUM IS NGVD, 1929
3. ——— REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY WHICH WAS TAKEN APRIL 18, 1990
A. LANDWARD BERM FILL LIMIT IS REPRESENTATIVE WHERE IT IS BASED ON THE LOCATION OF THE +10 NGVD CONTOUR WHICH ON THIS SHEET IS BASED ON APRIL 1990 TOPO & DOES NOT AGREE WITH THE CROSS SECTIONS WHICH ARE BASED ON 1991/1992 TOPO.
B. THE ECONOMIC BASELINE IS A STRAIGHTENED APPROXIMATION OF THE 1990 0.0 NGVD SHORELINE, UTILIZED IN THE BENEFIT ANALYSIS.
SCALE 1" = 200'
CONTOUR INTERVAL 5'
ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
Figure 1-9
PLAN SHEET - PLAN 5
NASSAU CO.
NEW YORK
FIGURE NO. A381


ATLANTIC BEACH
A38K
A38I
BERMUDA ST
ACAPULCO ST
ALBANY BLVD
MADONE AVE
CAYUGA AVE
DILTONESS BLVD
ERIE AVE
FULTON AVE
GENESEE BLVD
HAMILTON AVE
ITHICA AVE
JEFFERSON BLVD
KINGS AVE
LEWIS AVE
MONTGOMERY BLVD
OCEAN BLVD
PARKWAY
6
9
10
11
12
13
ECONOMIC BASELINE
310
290
270
ATLANTIC
OCEAN
MATCH SHEET
N 133,000
N 132,000
N 131,000
N 130,000
N 129,000
N 128,000
E 2,072,000
E 2,073,000
E 2,074,000
E 2,075,000
E 2,076,000
E 2,077,000
E 2,078,000
NOTES:
1. NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE (LAMBERT).
2. VERTICAL DATUM IS NGVD, 1929.
3. ... REPRESENTS THE EDGE OF WATER AT TIME OF AERIAL PHOTOGRAPHY WHICH WAS TAKEN APRIL 18, 1990.
SCALE 1" = 200'
CONTOUR INTERVAL 5'
ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
Figure 1-10
PLAN SHEET - PLAN 5
NASSAU CO.
NEW YORK
FIGURE NO. A38J


ATLANTIC BEACH
EAST ROCKAWAY INLET
SILVER POINT PARK
ECONOMIC BASELINE
ATLANTIC OCEAN
330
A38J
SHEET MATCH
N
ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
Figure 1-11
PLAN SHEET - PLAN 5
NASSAU CO.
NEW YORK
FIGURE NO. A38K



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

LEGEND

- DUNE (WITH GRASS AND PROTECTIVE FENCING)
- SAND BARRIER
- BEACHFILL
- NEW GROINS
- EXISTING GROINS
- DUNE WALKOVERS
- VEHICULAR ACCESS RAMPS
- TERMINAL GROIN REHABILITATION

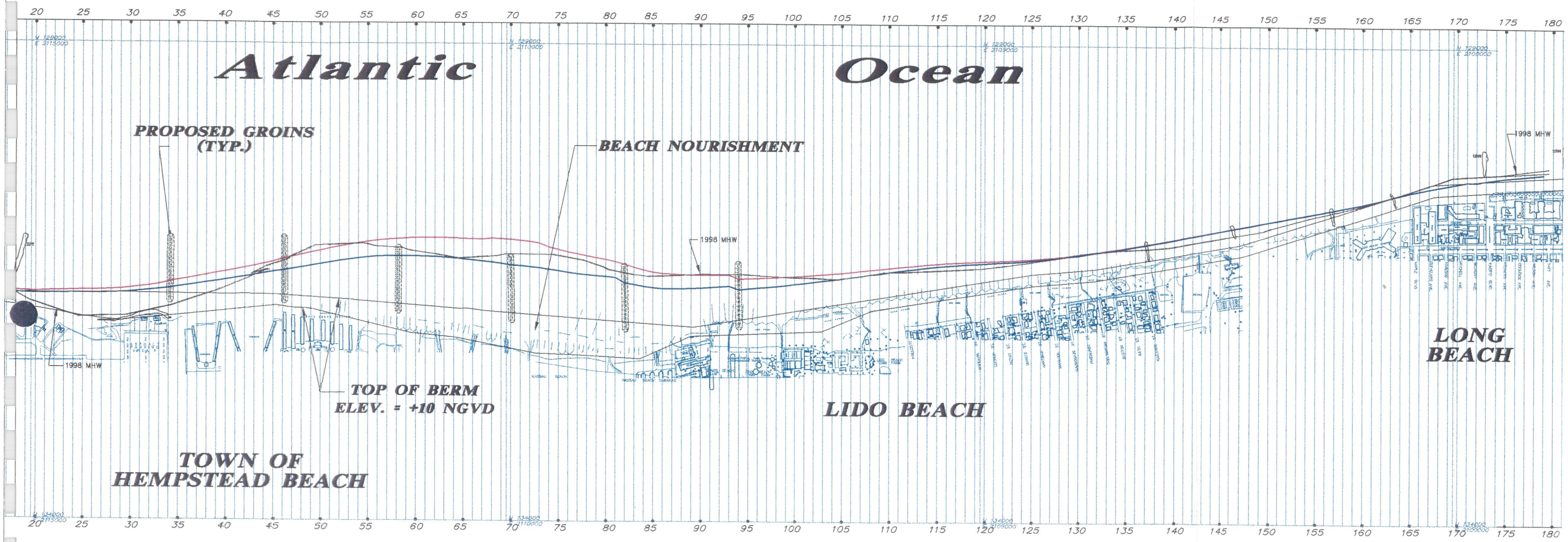
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

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'

NASSAU COUNTY Figure No. ~~13~~ 2-1 NEW YORK



LEGEND

MEASURED MHW – 1998

CALCULATED 2003 MHW WITH ALT. – 2 WITH BYPASSING.

CALCULATED 2003 MHW WITH ALT. – 2 WITHOUT BYPASSING.

SCALE : ONE INCH = 1000 FEET

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

ALTERNATIVE PLAN 2
BEACH NOURISHMENT
WITH SIX (6) 700 LF GROINS AT
1200 FT INTERVALS
(PLAN 5 FROM FEASIBILITY REPORT)

NASSAU COUNTY NEW YORK

Figure 2-2

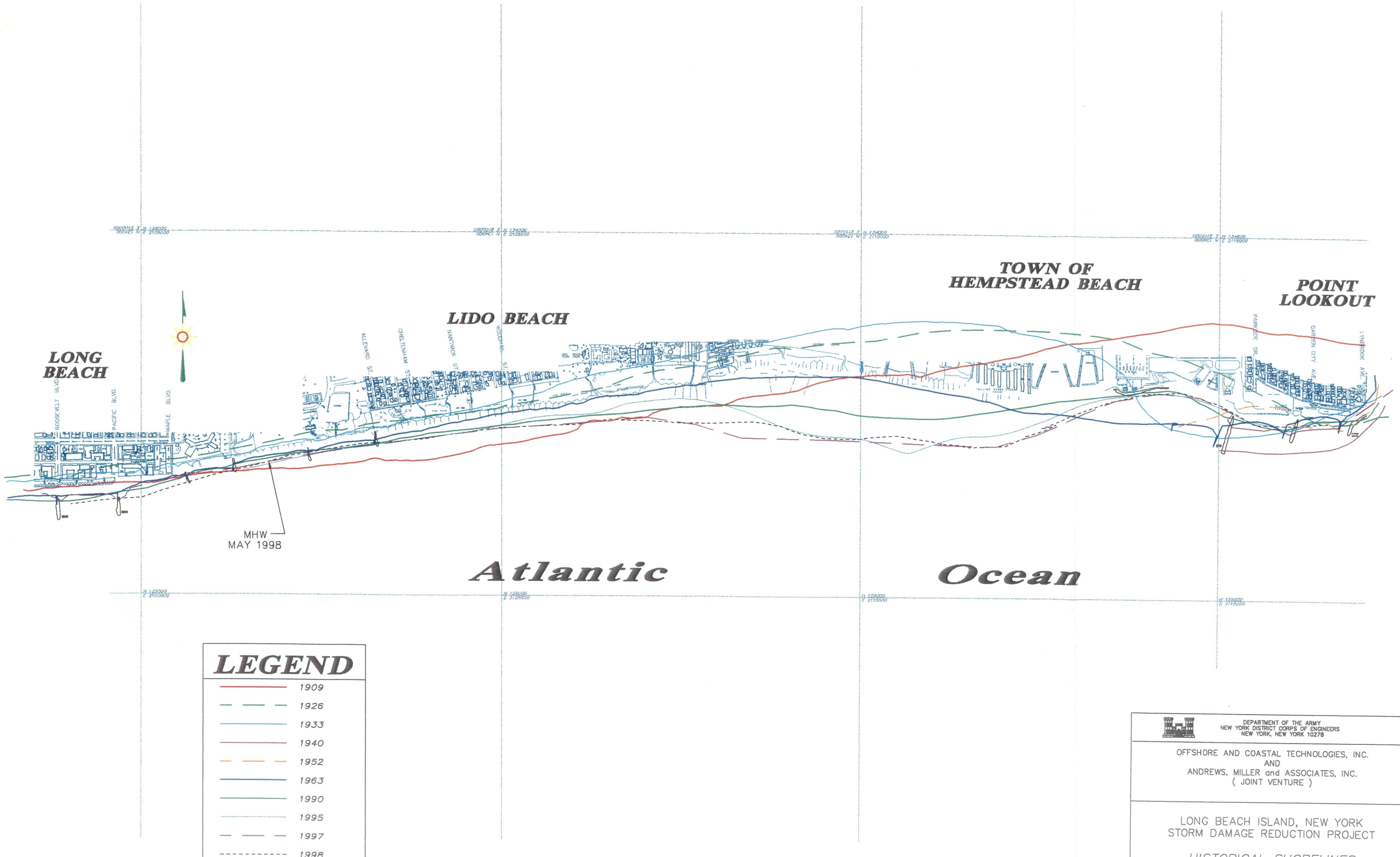

LONG BEACH
LIDO BEACH
TOWN OF HEMPSTEAD BEACH
POINT LOOKOUT
ROOSEVELT BLVD.
PACIFIC BLVD.
MAPLE BLVD.
ALLEYARD ST.
CHELTENHAM ST.
NANTWICH ST.
WOODMERE ST.
PARKSIDE DR.
GARDEN CITY AVE.
LYNBROOK AVE.
MHW
MAY 1998
Atlantic
Ocean
LEGEND
1909
1926
1933
1940
1952
1963
1990
1995
1997
1998
SCALE : ONE INCH = 1200 FEET
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278
OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER and ASSOCIATES, INC.
(JOINT VENTURE)
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
HISTORICAL SHORELINES

Figure 2-3

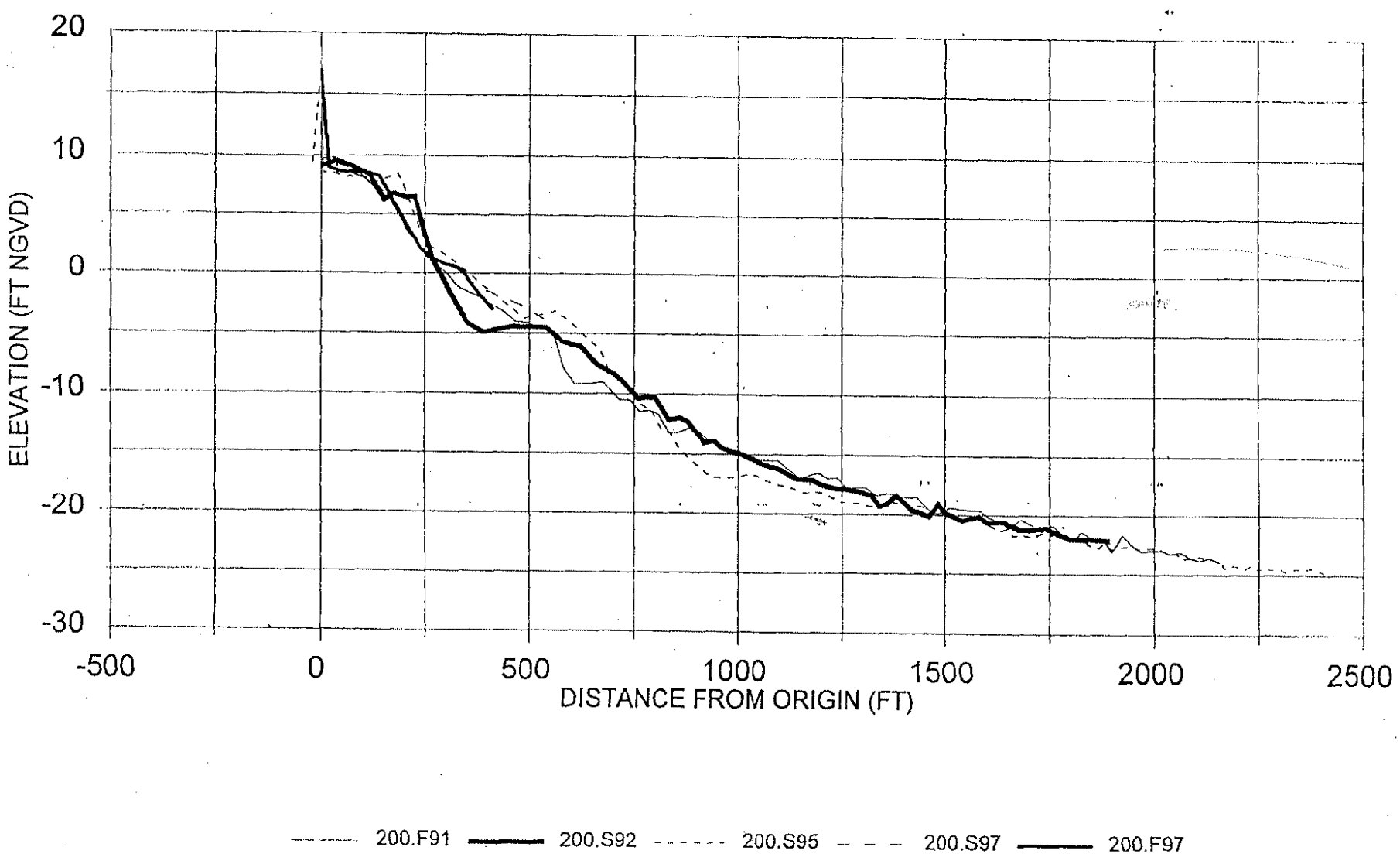

LONG BEACH ISLAND PROFILES
PROFILE 200
ELEVATION (FT NGVD)
20
10
0
-10
-20
-30
-500
0
500
1000
1500
2000
2500
DISTANCE FROM ORIGIN (FT)
200.F91
200.S92
200.S95
200.S97
200.F97

Figure 2-4

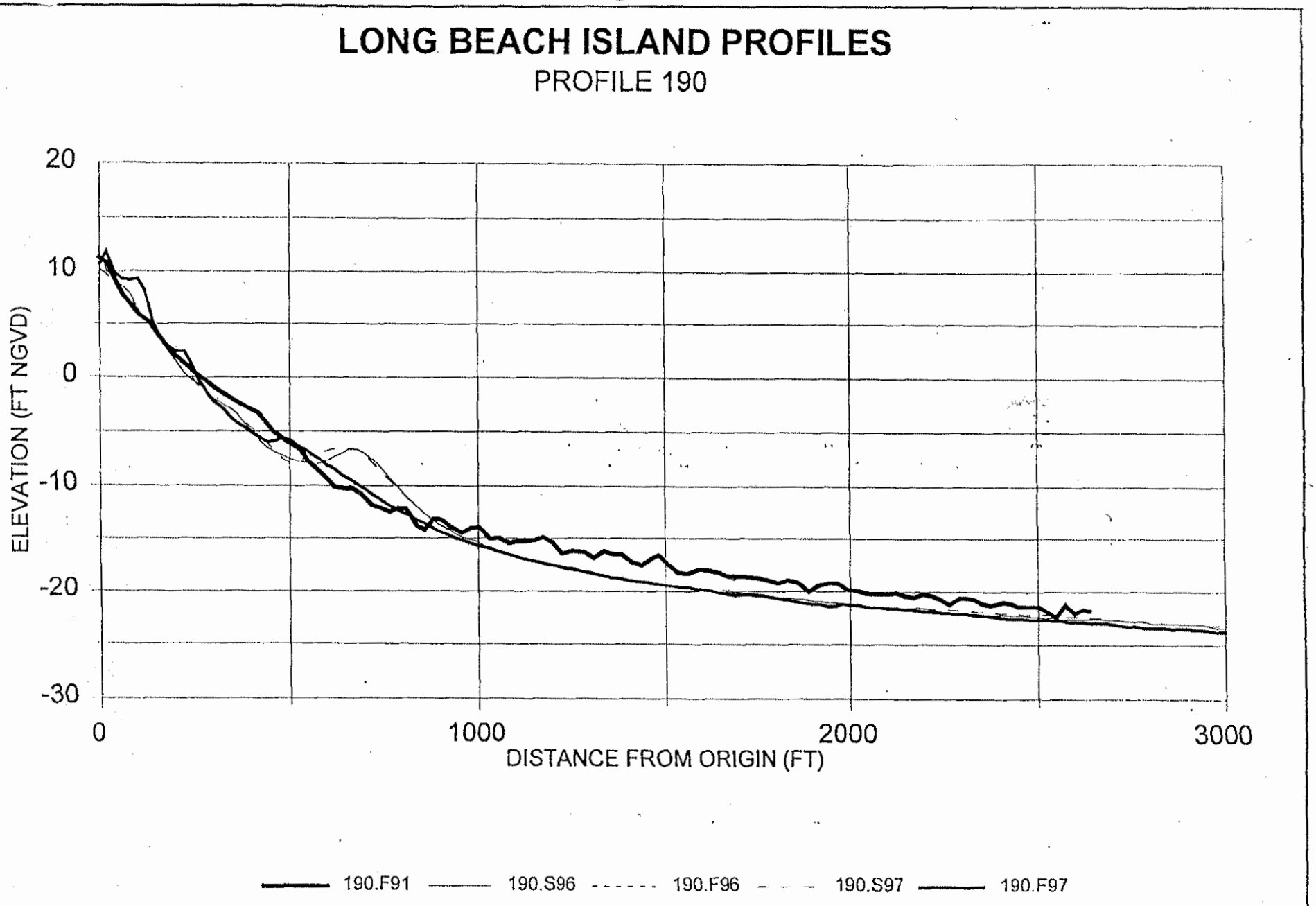

LONG BEACH ISLAND PROFILES
PROFILE 190
ELEVATION (FT NGVD)
20
10
0
-10
-20
-30
0
1000
2000
3000
DISTANCE FROM ORIGIN (FT)
190.F91
190.S96
190.F96
190.S97
190.F97

Figure 2-5

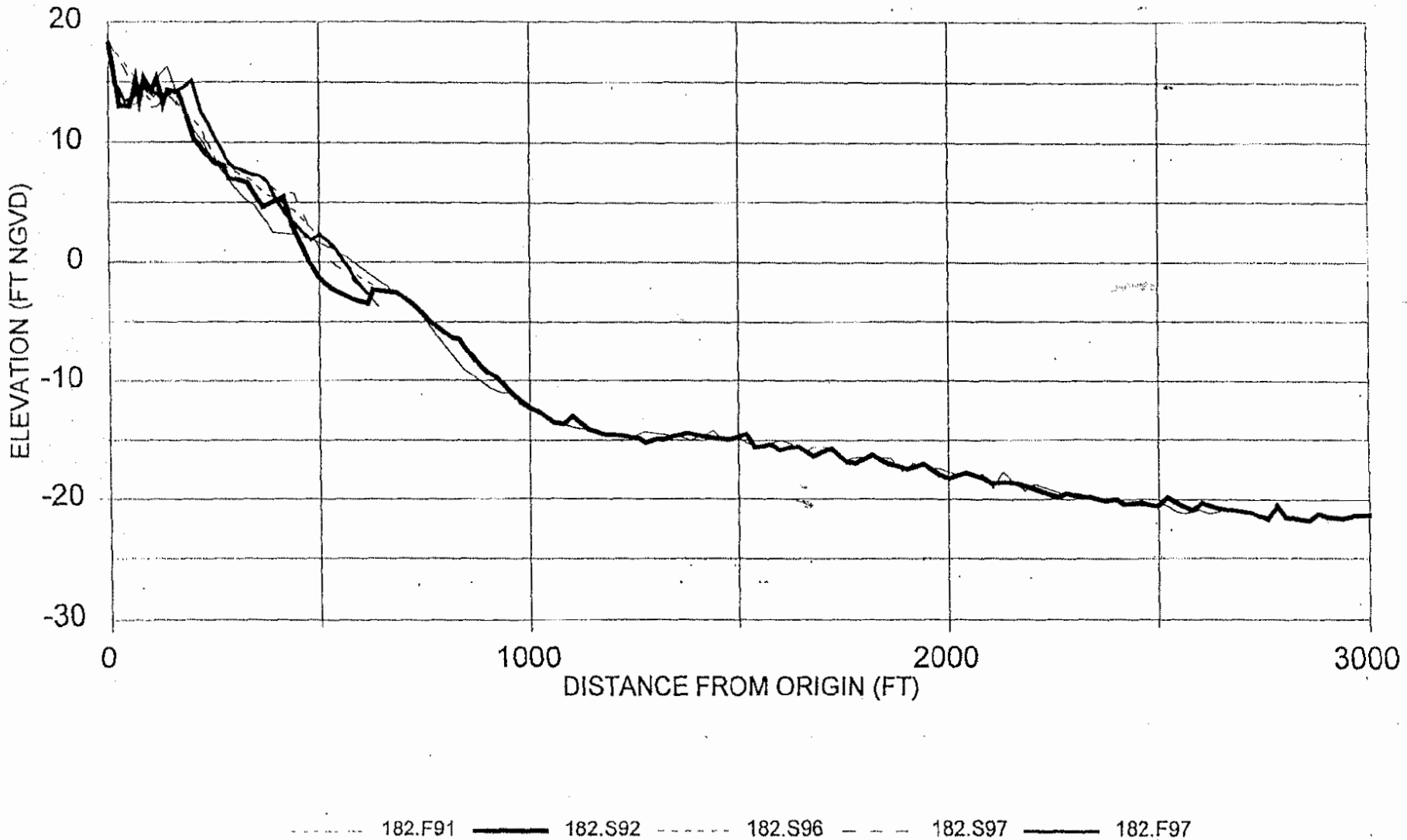

LONG BEACH ISLAND PROFILES
PROFILE 182
ELEVATION (FT NGVD)
20
10
0
-10
-20
-30
0
1000
2000
3000
DISTANCE FROM ORIGIN (FT)
182.F91
182.S92
182.S96
182.S97
182.F97

Figure 2-6

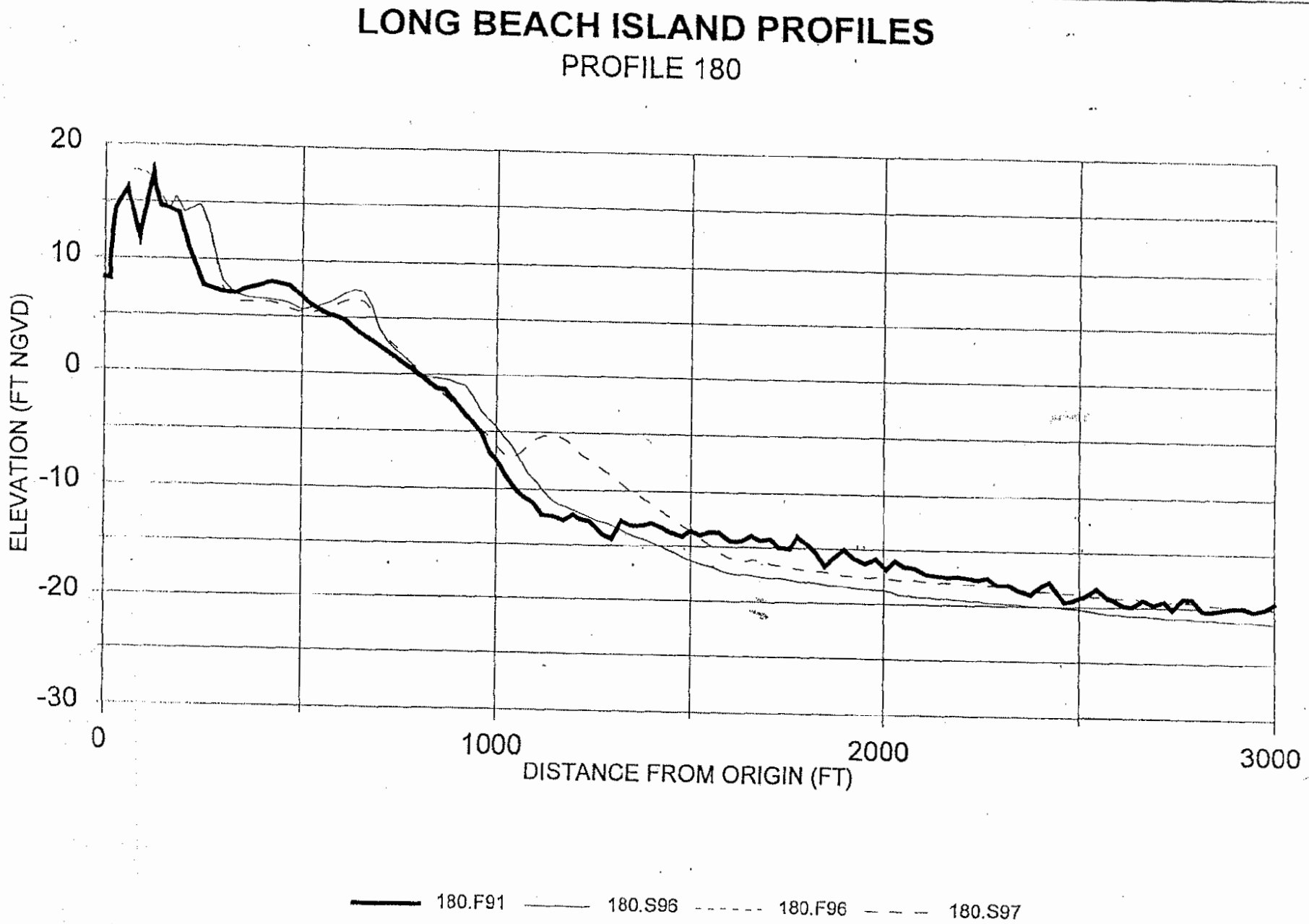

LONG BEACH ISLAND PROFILES
PROFILE 180
ELEVATION (FT NGVD)
20
10
0
-10
-20
-30
0
1000
2000
3000
DISTANCE FROM ORIGIN (FT)
180.F91
180.S96
180.F96
180.S97

Figure 2-7

LONG BEACH ISLAND PROFILES

PROFILE 172

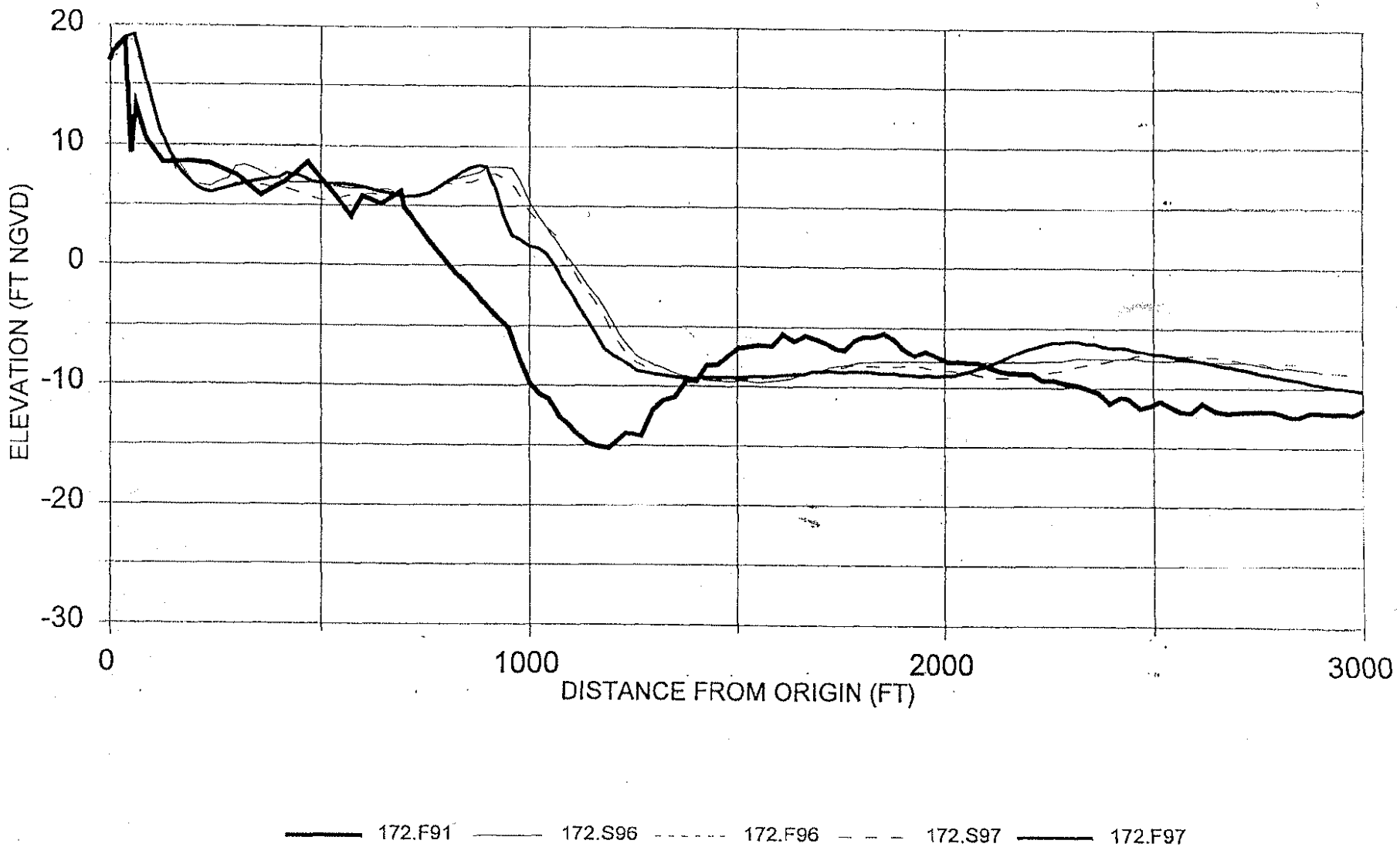


Figure 2-8

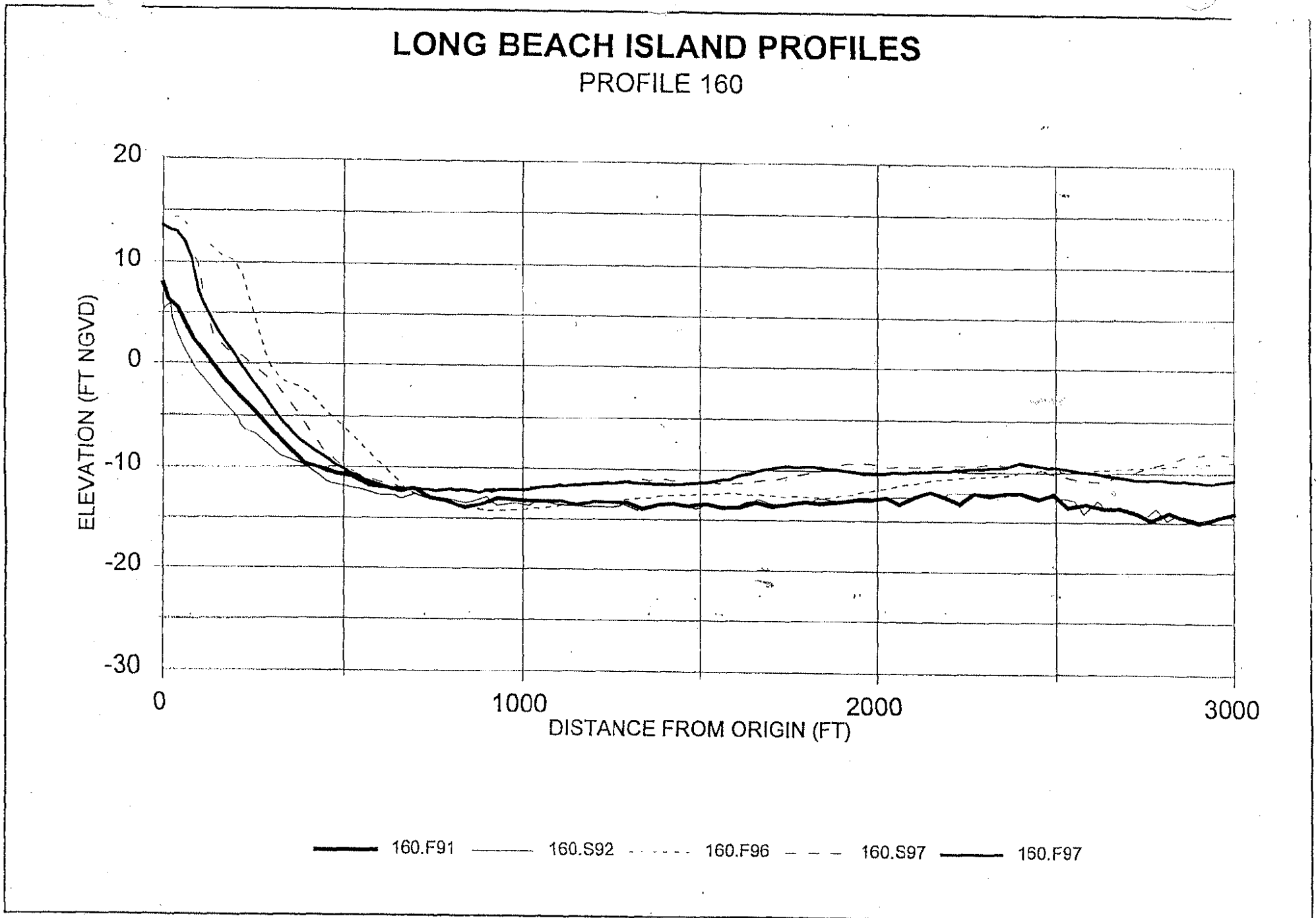

LONG BEACH ISLAND PROFILES
PROFILE 160
ELEVATION (FT NGVD)
20
10
0
-10
-20
-30
0
1000
2000
3000
DISTANCE FROM ORIGIN (FT)
160.F91
160.S92
160.F96
160.S97
160.F97

Figure 2-9

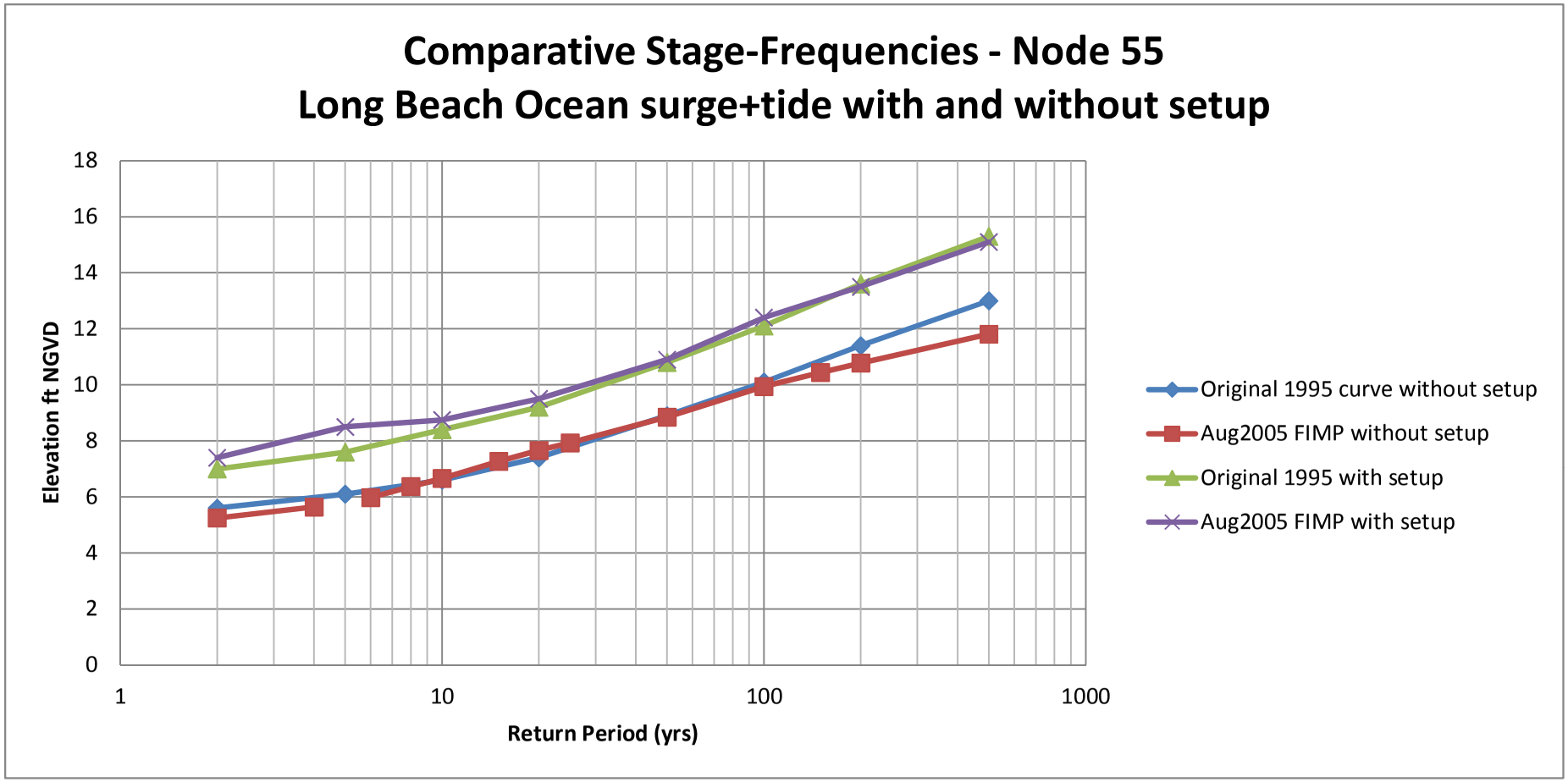

Comparative Stage-Frequencies - Node 55
Long Beach Ocean surge+tide with and without setup
Elevation ft NGVD
18
16
14
12
10
8
6
4
2
0
1
10
100
1000
Return Period (yrs)
Original 1995 curve without setup
Aug2005 FIMP without setup
Original 1995 with setup
Aug2005 FIMP with setup

Figure 2-10

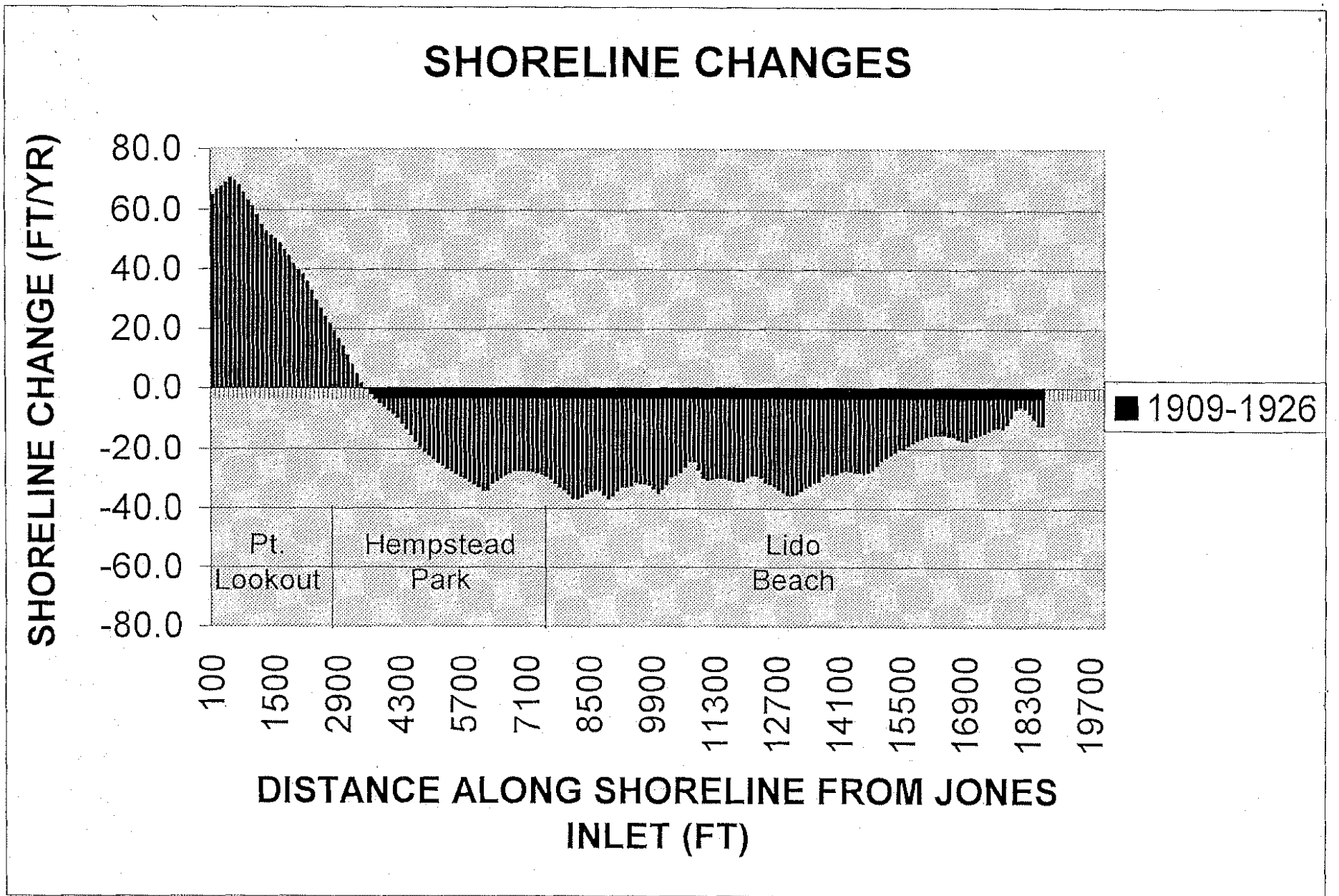

SHORELINE CHANGES
SHORELINE CHANGE (FT/YR)
80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
-60.0
-80.0
Pt. Lookout
Hempstead Park
Lido Beach
1909-1926
100
1500
2900
4300
5700
7100
8500
9900
11300
12700
14100
15500
16900
18300
19700
DISTANCE ALONG SHORELINE FROM JONES INLET (FT)

Figure 2-11

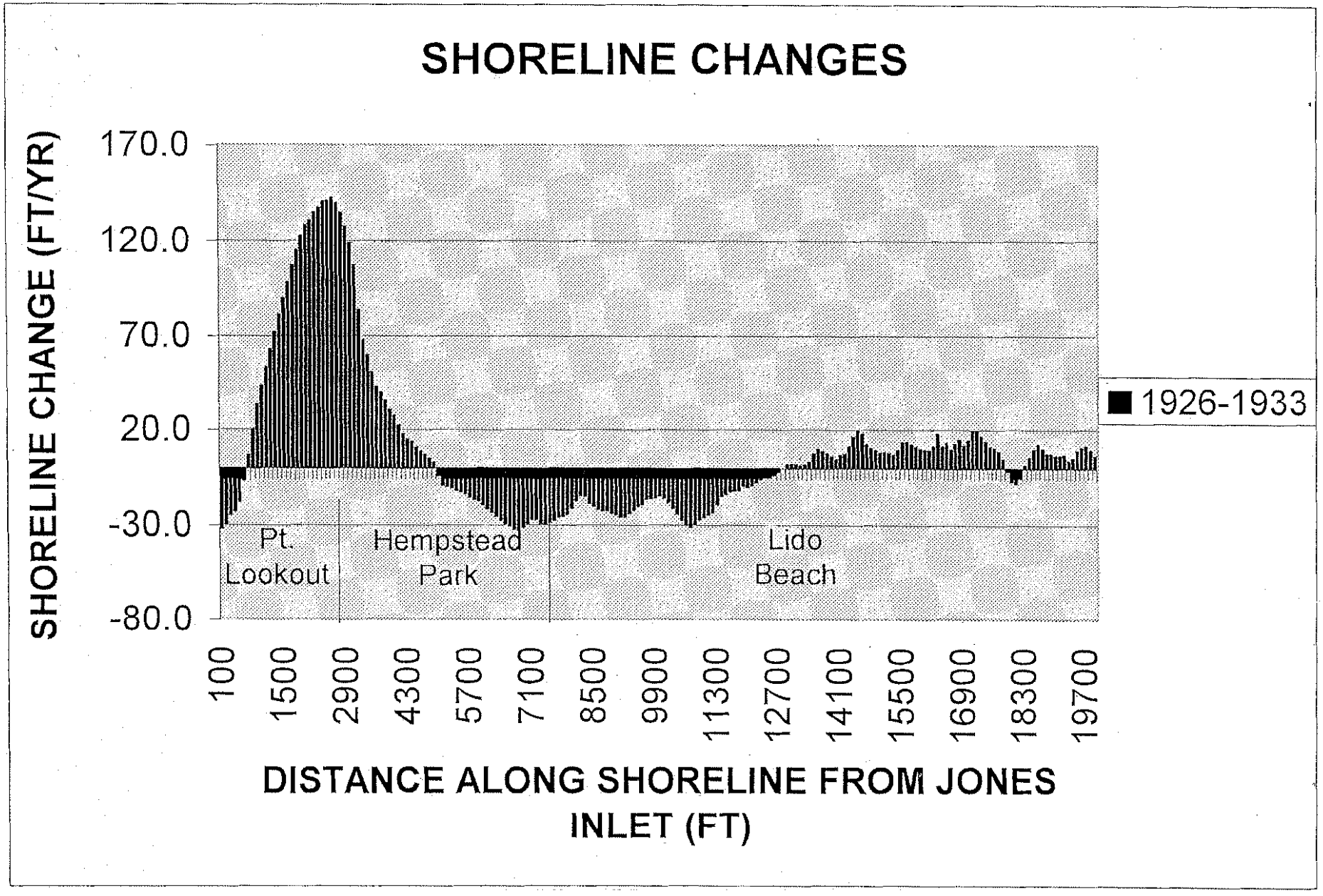

SHORELINE CHANGES
SHORELINE CHANGE (FT/YR)
170.0
120.0
70.0
20.0
-30.0
-80.0
Pt. Lookout
Hempstead Park
Lido Beach
1926-1933
100
1500
2900
4300
5700
7100
8500
9900
11300
12700
14100
15500
16900
18300
19700
DISTANCE ALONG SHORELINE FROM JONES INLET (FT)

Figure 2-12

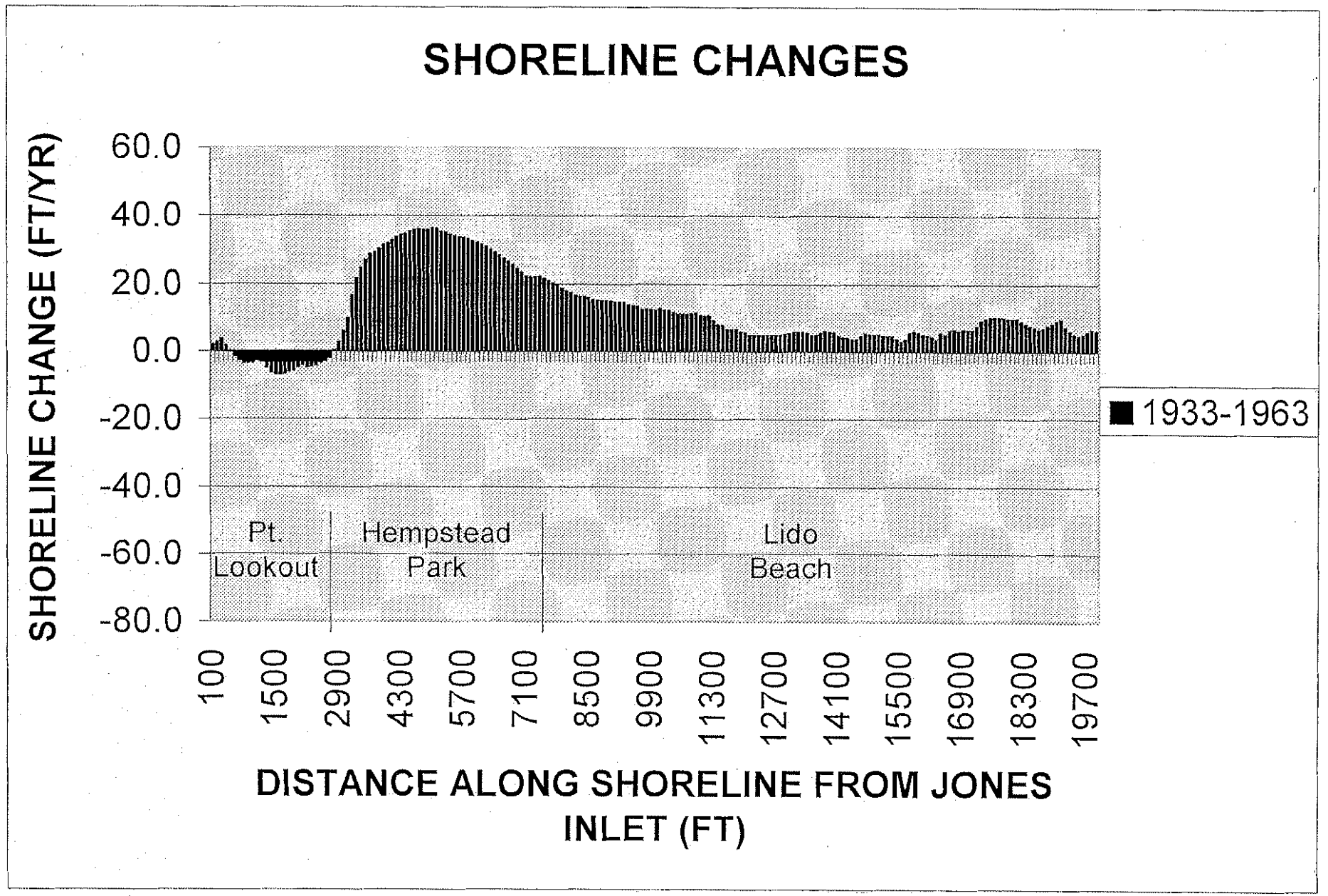

SHORELINE CHANGES
SHORELINE CHANGE (FT/YR)
60.0
40.0
20.0
0.0
-20.0
-40.0
-60.0
-80.0
Pt. Lookout
Hempstead Park
Lido Beach
1933-1963
100
1500
2900
4300
5700
7100
8500
9900
11300
12700
14100
15500
16900
18300
19700
DISTANCE ALONG SHORELINE FROM JONES INLET (FT)

Figure 2-13

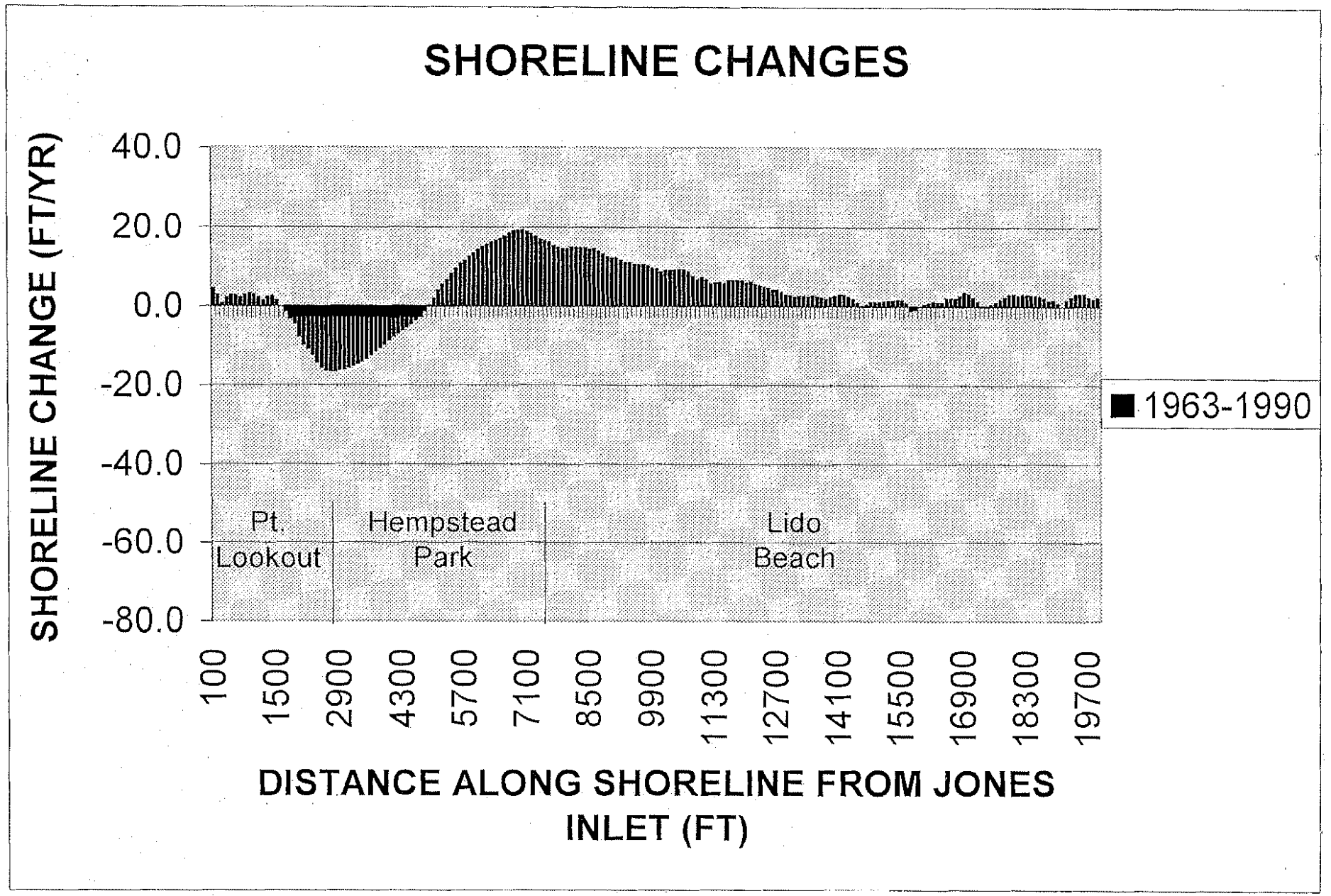

SHORELINE CHANGES
SHORELINE CHANGE (FT/YR)
40.0
20.0
0.0
-20.0
-40.0
-60.0
-80.0
Pt. Lookout
Hempstead Park
Lido Beach
1963-1990
100
1500
2900
4300
5700
7100
8500
9900
11300
12700
14100
15500
16900
18300
19700
DISTANCE ALONG SHORELINE FROM JONES INLET (FT)

Figure 2-14

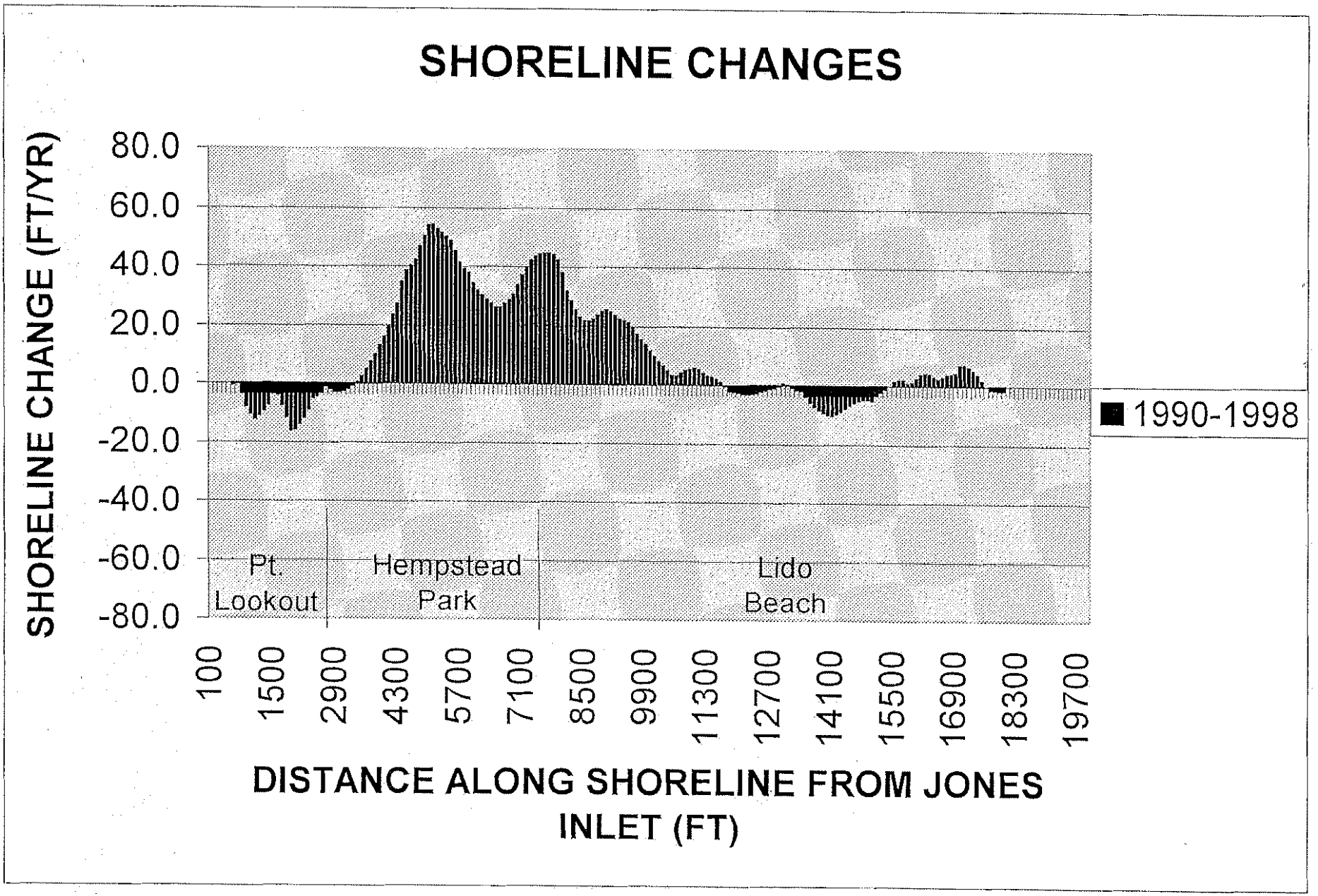

SHORELINE CHANGES
SHORELINE CHANGE (FT/YR)
80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
-60.0
-80.0
Pt. Lookout
Hempstead Park
Lido Beach
1990-1998
100
1500
2900
4300
5700
7100
8500
9900
11300
12700
14100
15500
16900
18300
19700
DISTANCE ALONG SHORELINE FROM JONES INLET (FT)

Figure 2-15

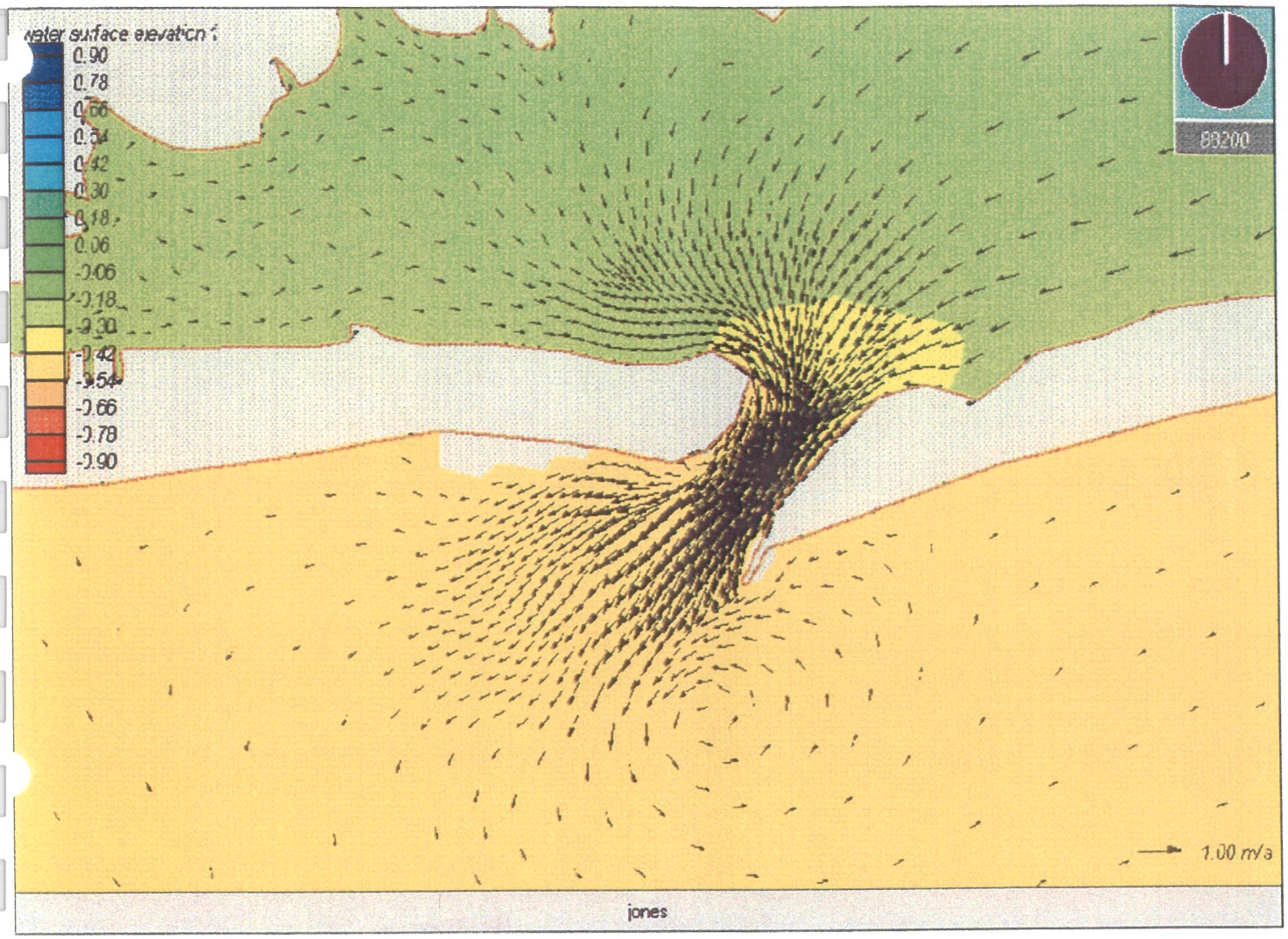


Figure 2-16 **Currents at Jones Inlet at Ebb Tide (ADCIRC)**

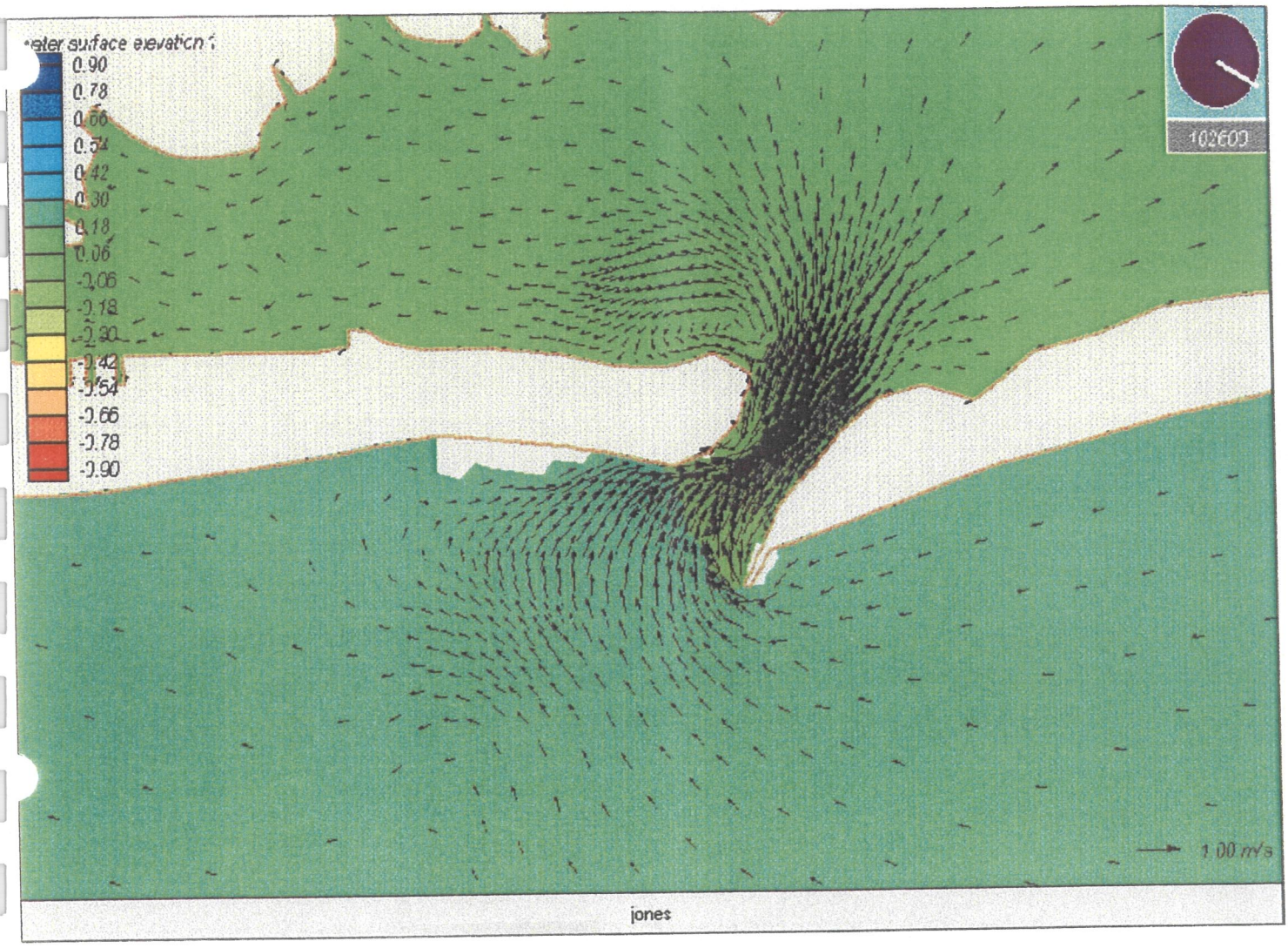
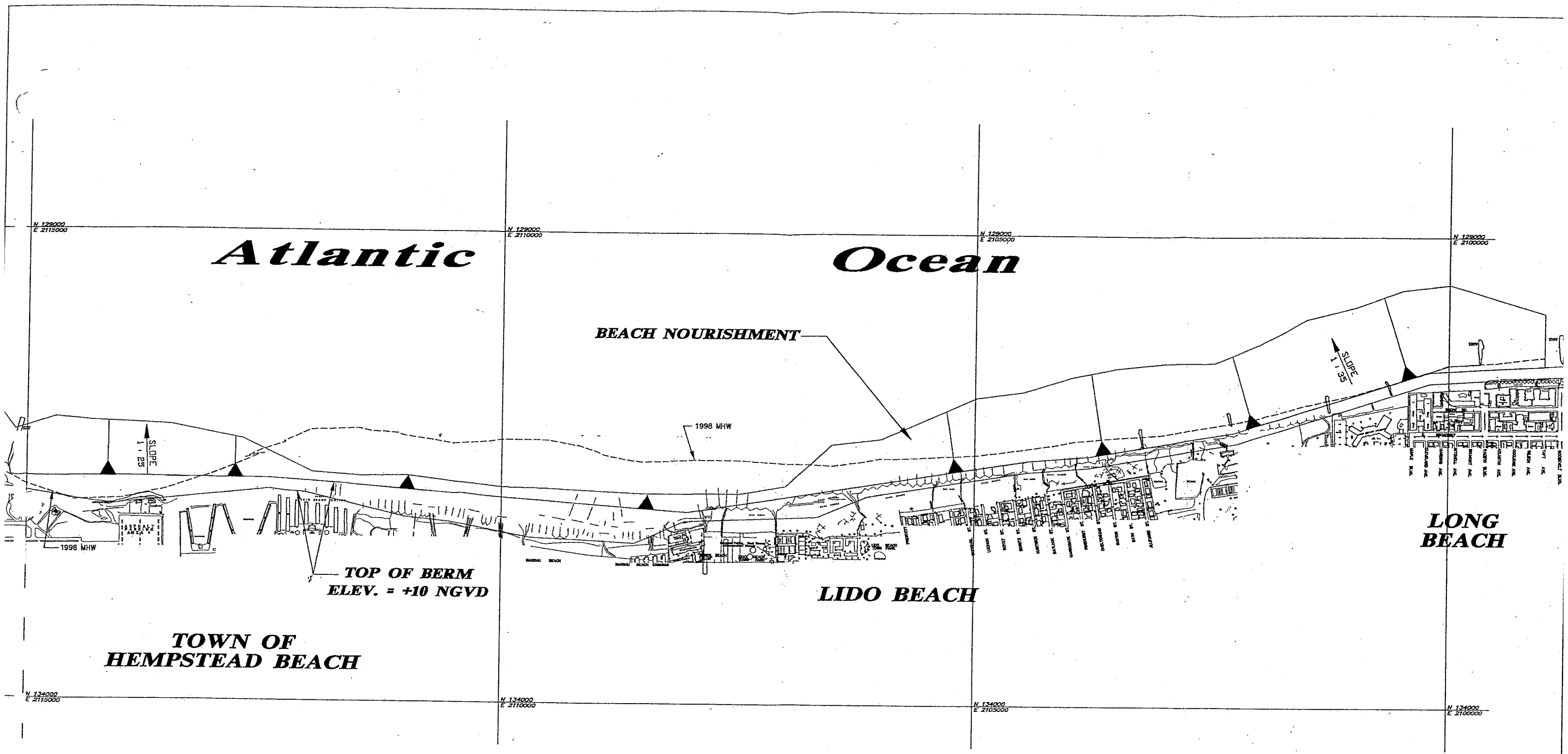


Figure 2-17 **Jones Inlet at Flood Tide (ADCIRC)**



LEGEND

MEASURED MHW — 1998 ----------

SCALE : ONE INCH = 1000 FEET

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

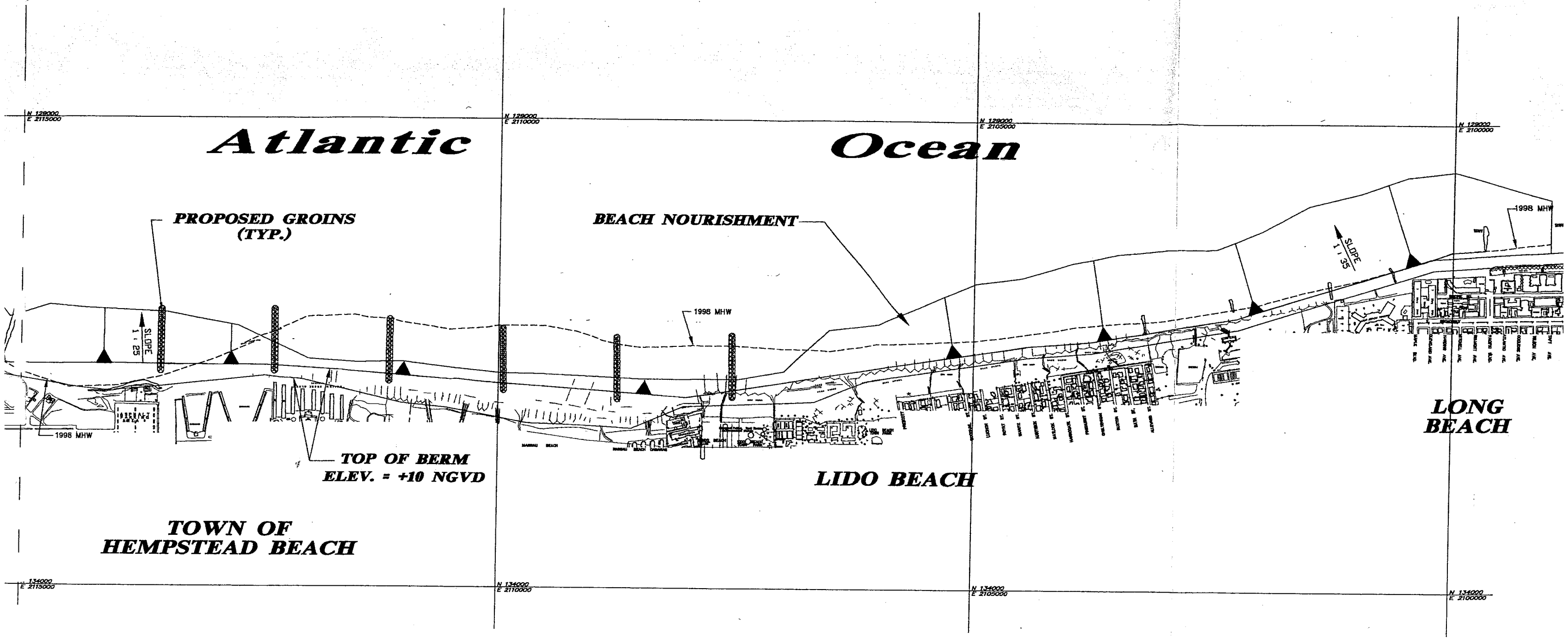
OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

ALTERNATIVE PLAN 1
BEACH NOURISHMENT

Figure 2-18

NASSAU COUNTY NEW YORK



LEGEND

MEASURED MHW — 1998

SCALE : ONE INCH = 1000 FEET

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

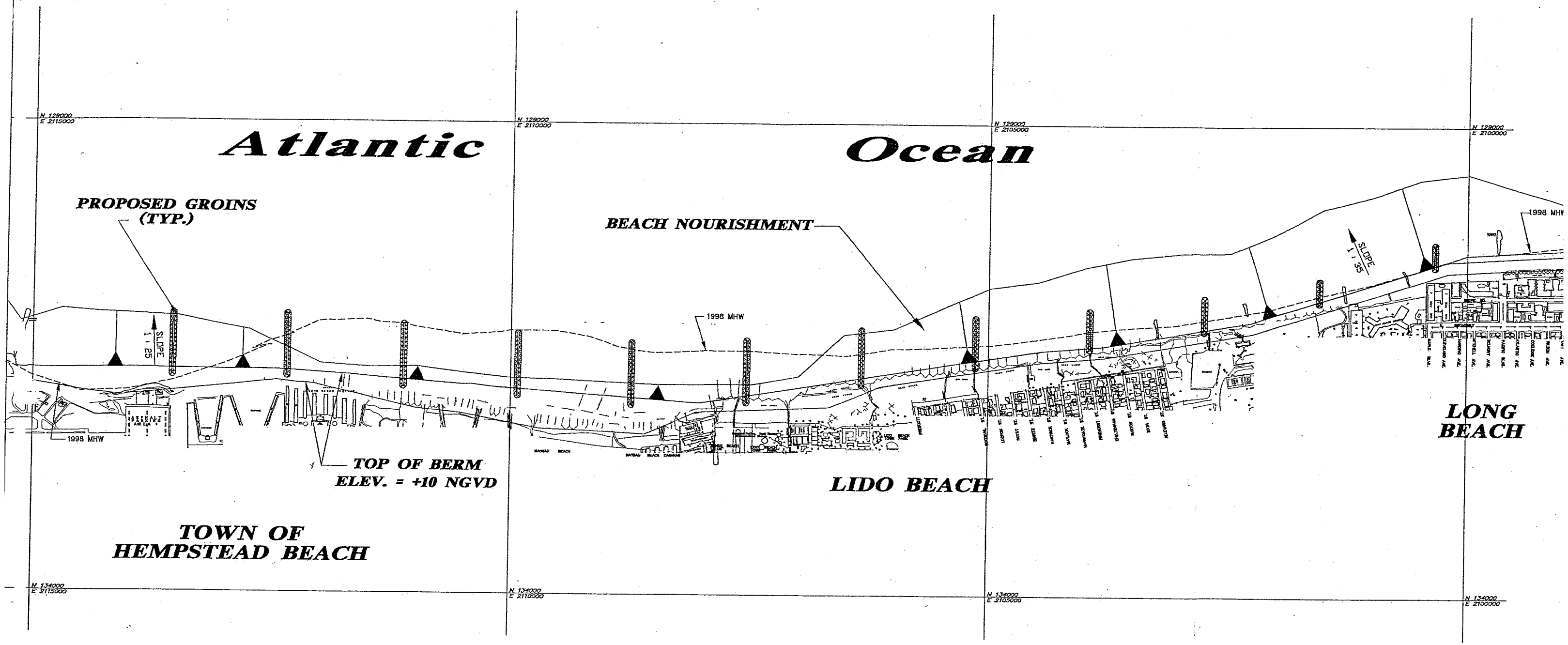
OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

ALTERNATIVE PLAN 2
BEACH NOURISHMENT
WITH SIX (6) 700 LF GROINS AT
1200 FT INTERVALS
(PLAN 5 FROM FEASIBILITY REPORT)

NASSAU COUNTY NEW YORK

Figure No. 2-19



LEGEND

MEASURED MHW – 1998 ————————

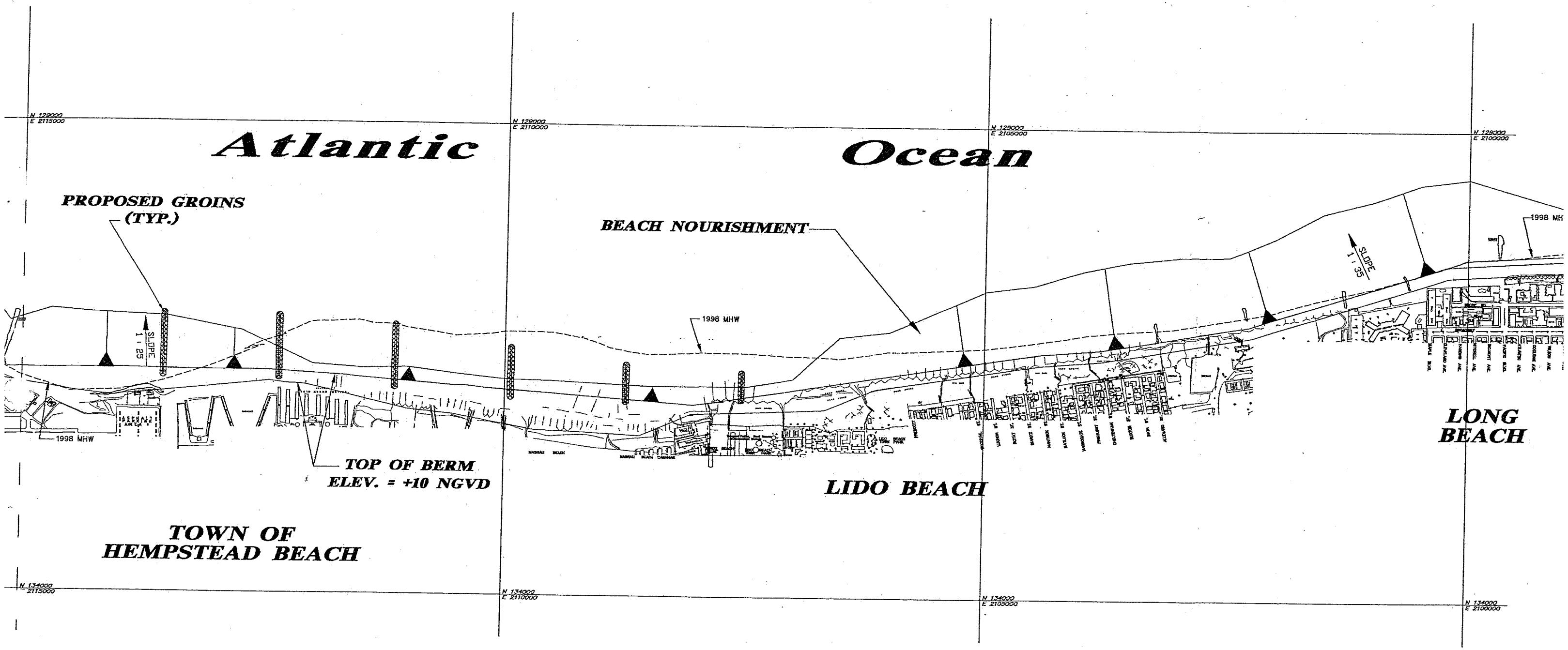
SCALE : ONE INCH = 1000 FEET

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
ALTERNATIVE PLAN 3
BEACH NOURISHMENT
WITH TWELVE (12) GROINS AT
1200 FT INTERVALS
WITH TAPERED TRANSITION AT
WESTERLY END

NASSAU COUNTY NEW YORK



LEGEND

MEASURED MHW – 1998

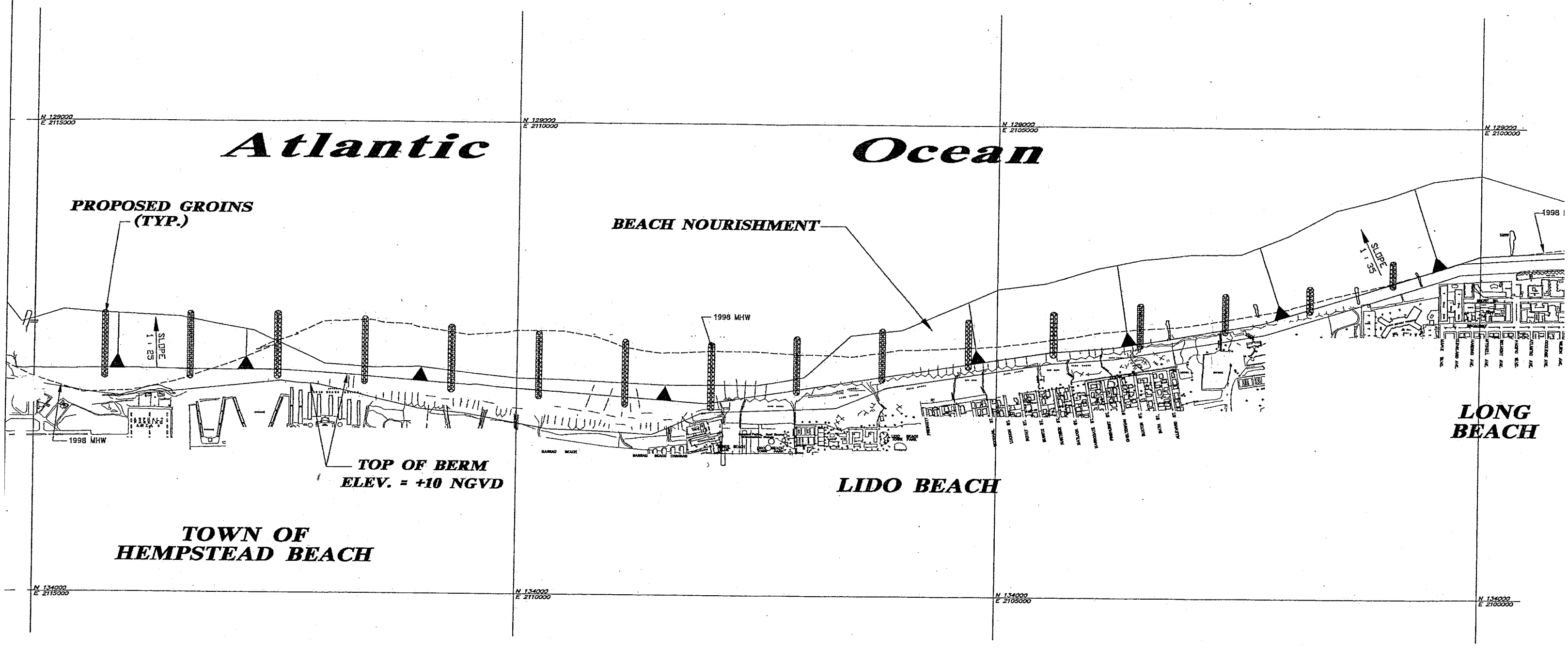
SCALE : ONE INCH = 1000 FEET

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
ALTERNATIVE PLAN 4
BEACH NOURISHMENT
WITH SIX (6) GROINS AT
1200 FT INTERVALS
WITH TAPERED TRANSITION AT
WESTERLY END

NASSAU COUNTY NEW YOR



LEGEND

MEASURED MHW – 1998

SCALE : ONE INCH = 1000 FEET

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)

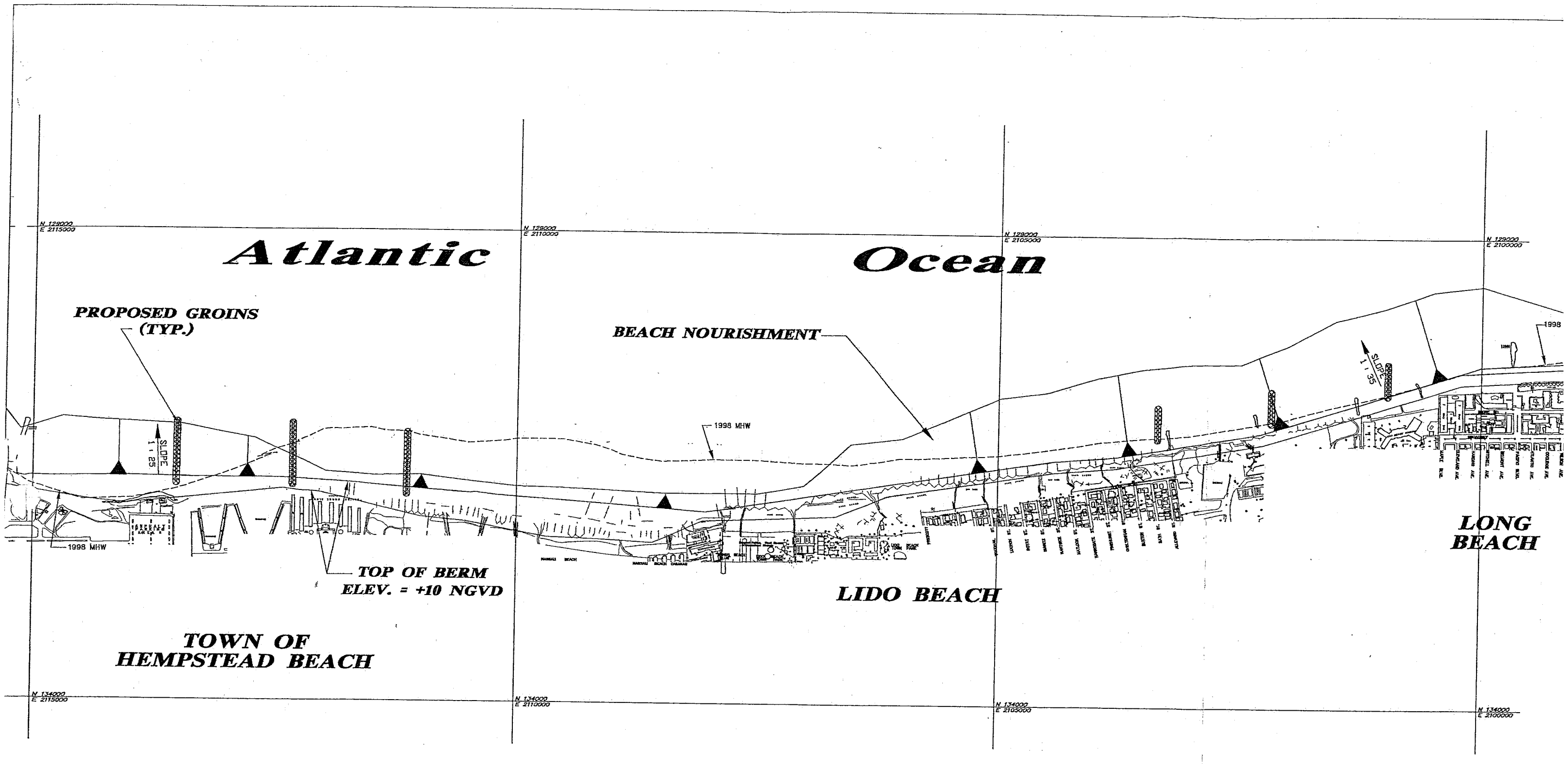
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

ALTERNATIVE PLAN 5
BEACH NOURISHMENT
WITH SIXTEEN (16) GROINS AT
900 FT INTERVALS

NASSAU COUNTY

Figure 2-22

NEW Y



LEGEND

MEASURED MHW – 1998

SCALE : ONE INCH = 1000 FEET

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

ALTERNATIVE PLAN 6
BEACH NOURISHMENT
WITH SIX (6) GROINS AT
1200 FT INTERVALS

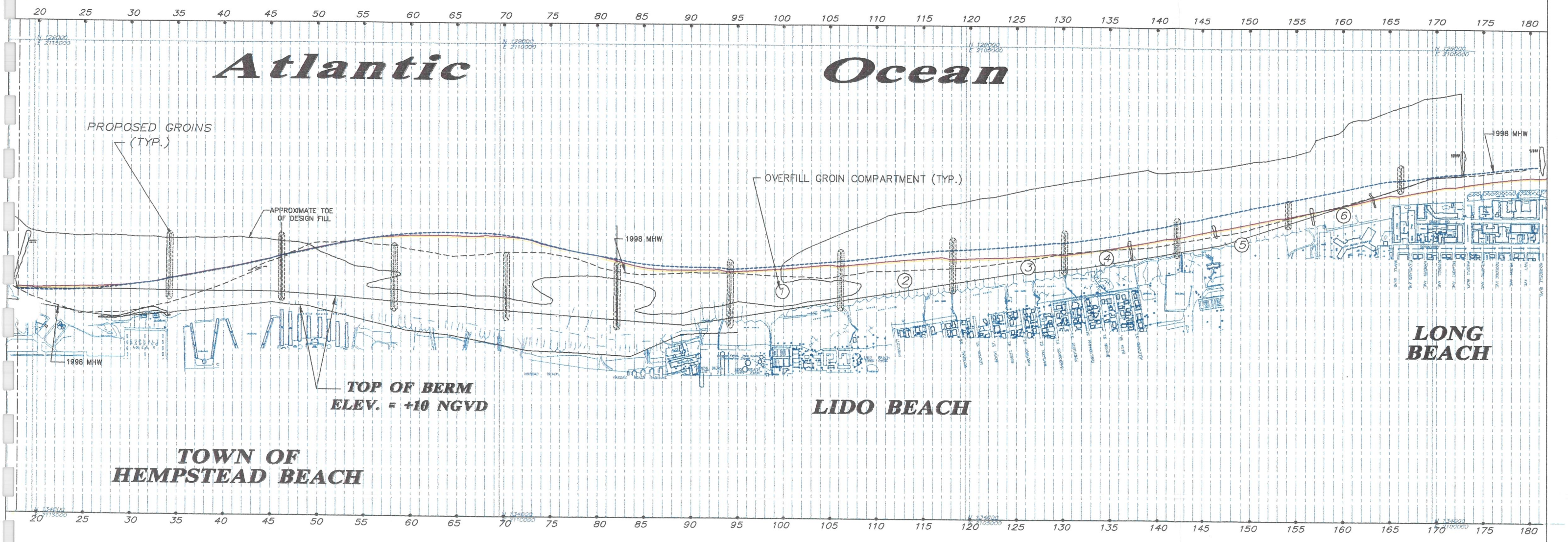
NASSAU COUNTY

Figure 2-23

NEW Y

CORPS OF ENGINEERS

U.S. ARMY



LEGEND

MEASURED MHW – 1998

CALCULATED 2003 MHW WITHOUT PROJECT WITH BYPASSING.

CALCULATED 2003 MHW WITH ALT. – 3D WITH BYPASSING.

SCALE : ONE INCH = 1000 FEET

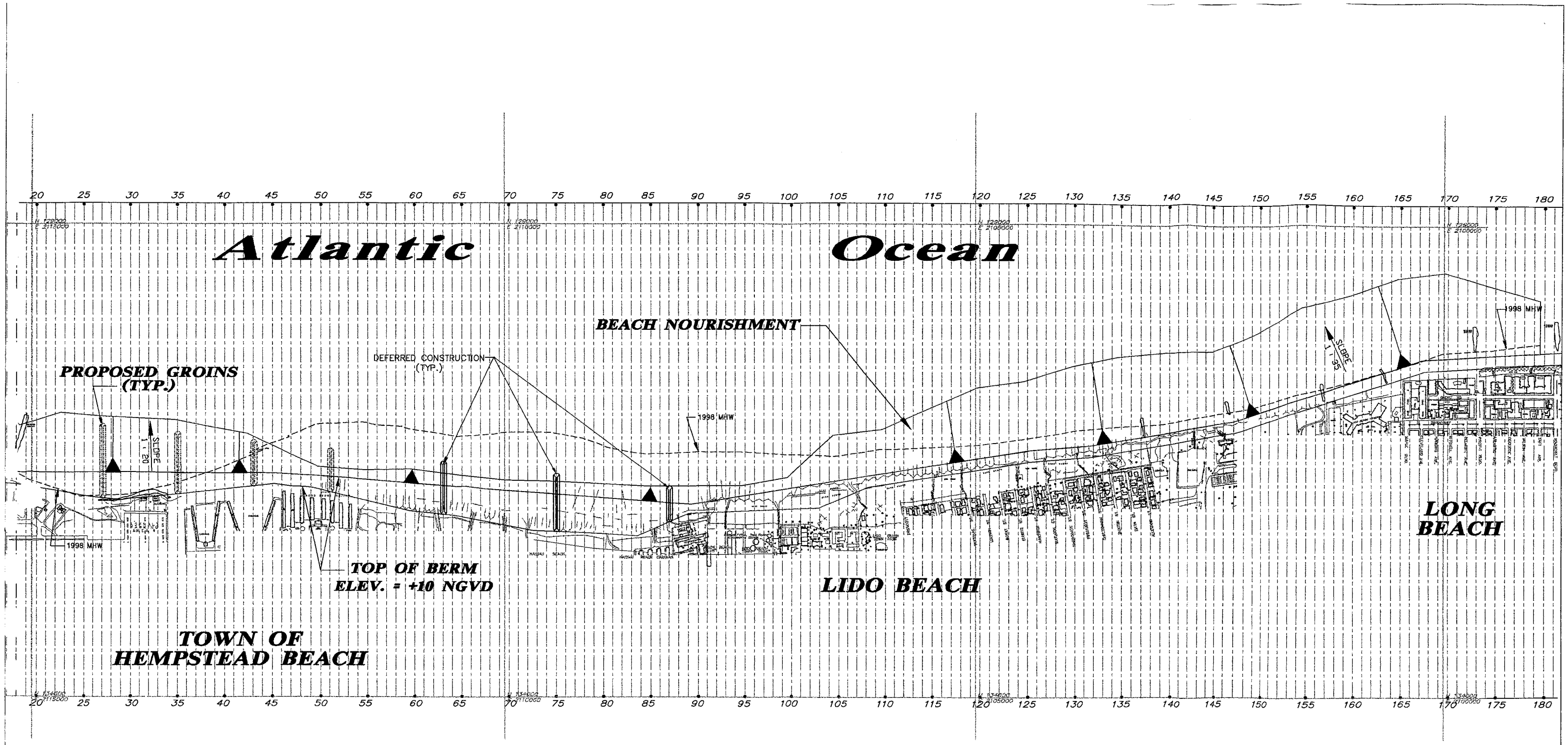
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
ALTERNATIVE PLAN 3A – 3D
BEACH NOURISHMENT
WITH TWELVE (12) GROINS AT
1200 FT INTERVALS
WITH TAPERED TRANSITION AT
WESTERLY END

NASSAU COUNTY NEW YORK

Figure 2-24



LEGEND

MEASURED MHW – 1998 ----------

SCALE : ONE INCH = 1000 FEET

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
ALTERNATIVE PLAN 4A
BEACH NOURISHMENT
WITH SEVEN (7) GROINS
WITH TAPER

NASSAU COUNTY

Figure 2-25

NEW YORK

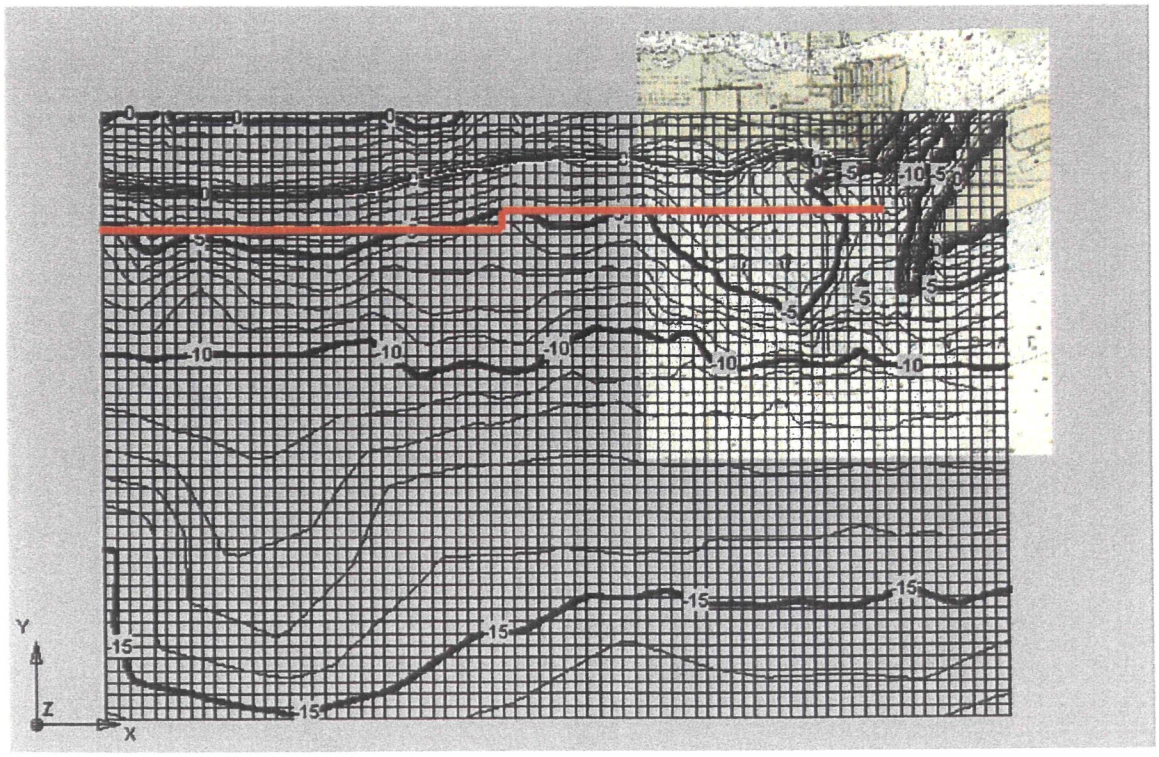
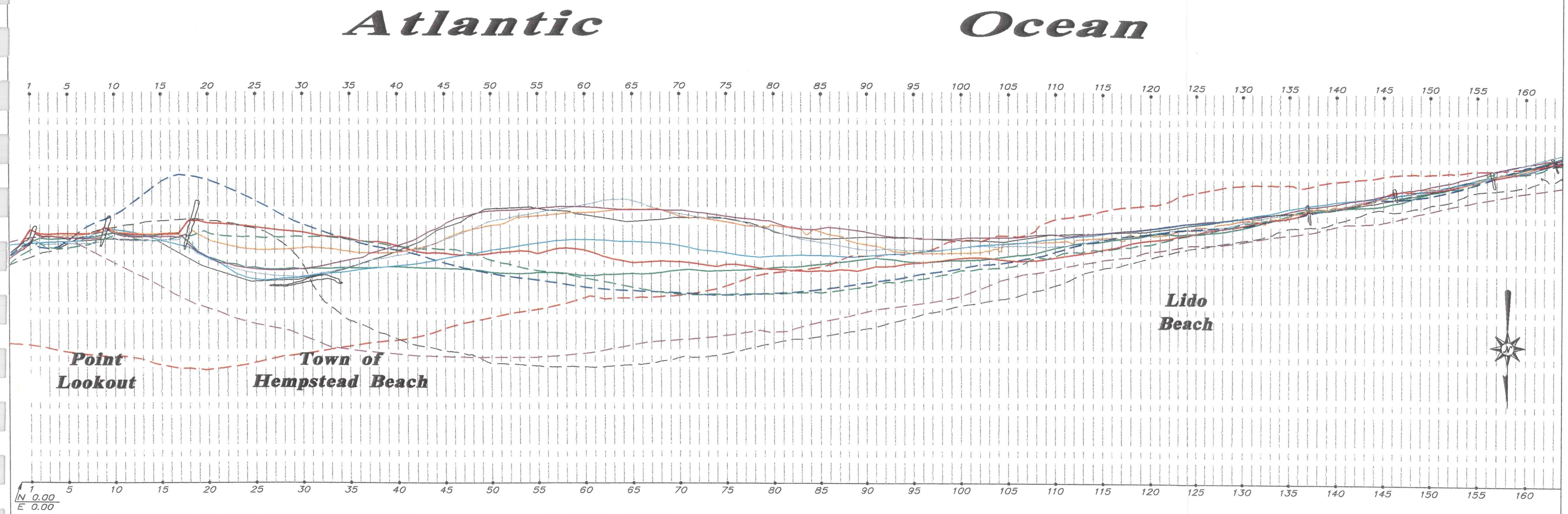


Figure 2-26 **STWAVE Grid. Nearshore reference line location is shown in red. Depths shown are in meters.**



LEGEND

1909		April 4, 1984	
1926		April 18, 1990	
1933		March 27, 1995	
1963		March 30, 1996	
April 30, 1972		April 22, 1997	
May 4, 1978		May 28, 1998	

SCALE ONE INCH = 1000 FEET

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

SHORELINE MODELING GRID

Figure 2-27

NASSAU COUNTY NEW YORK

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1963-1972

(Ql, Qr Avg. 1987-1996)

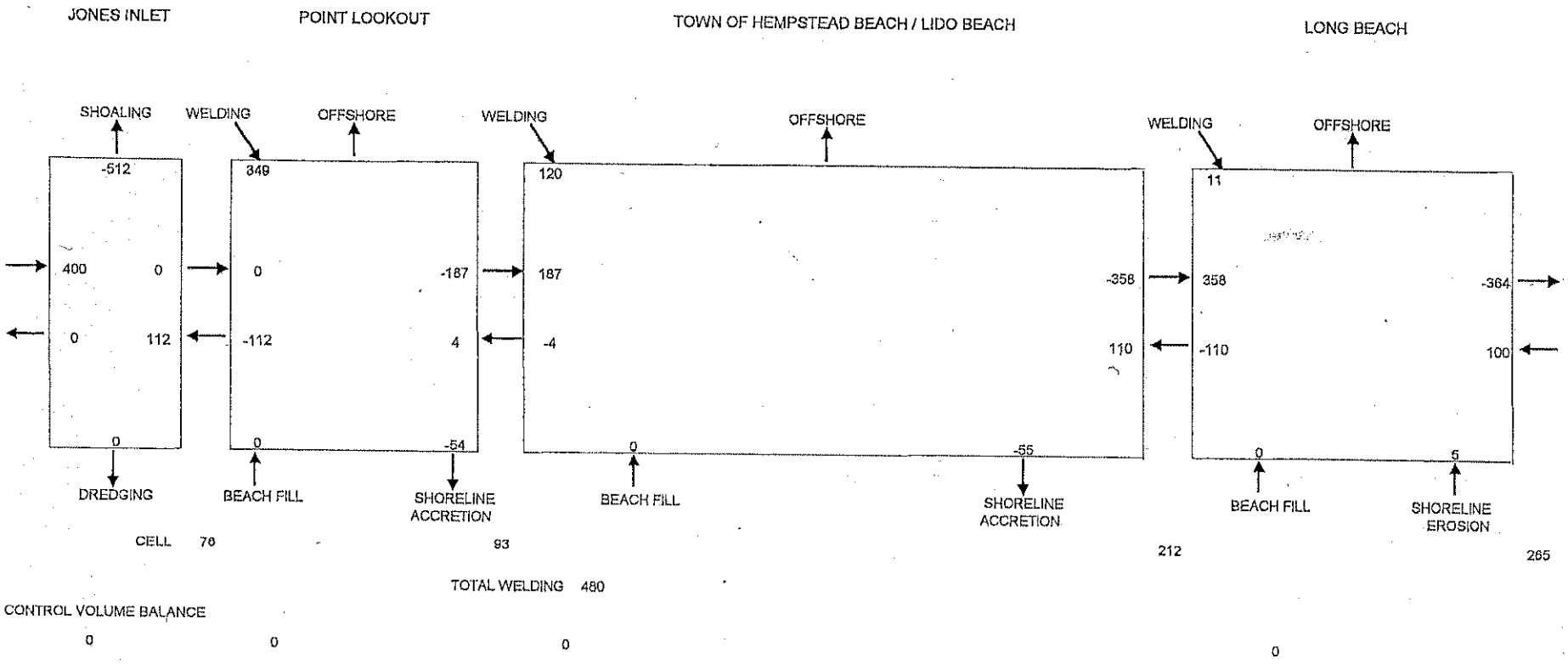


Figure 2-28

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1963-1972

(Ql, Qr Avg. 1987-1996 and Qnet = 0 @ G3)

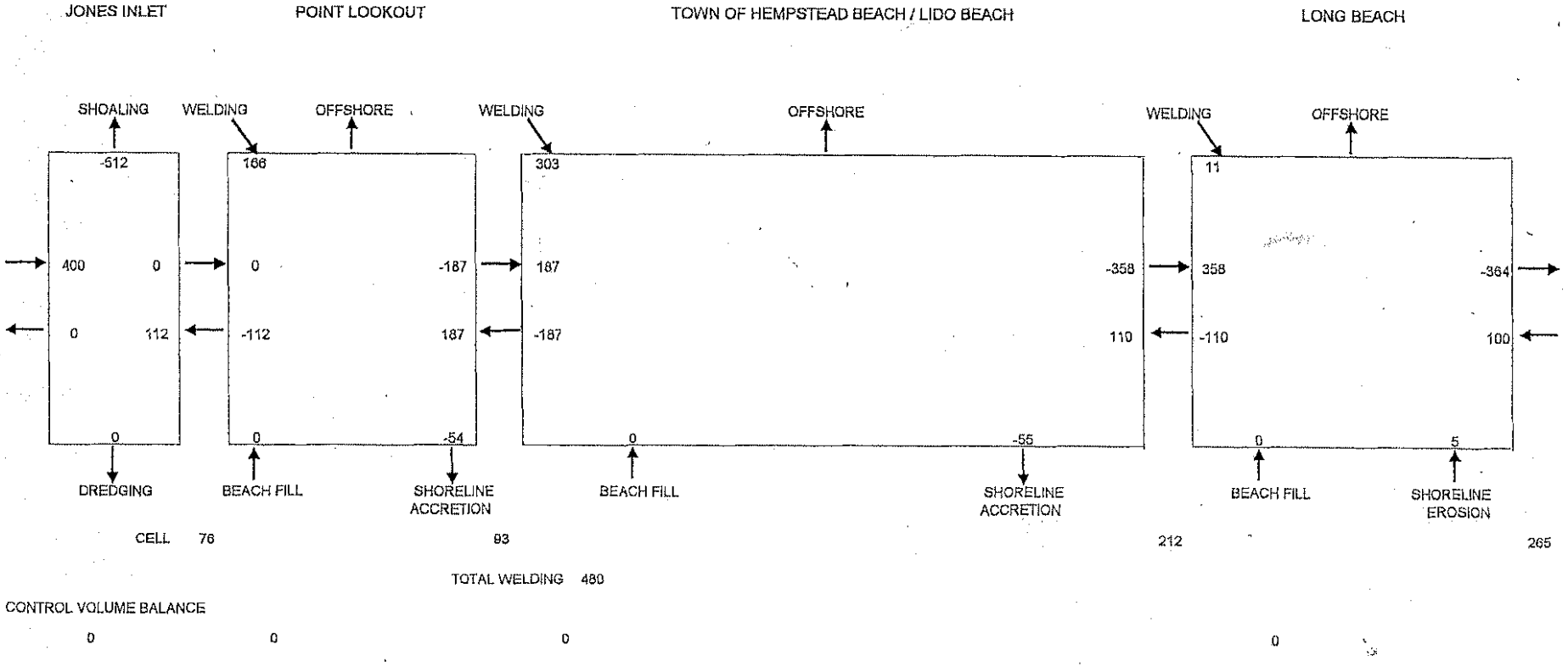


Figure 2-29

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1972-1978

(Ql, Qr Avg. 1987-1996)

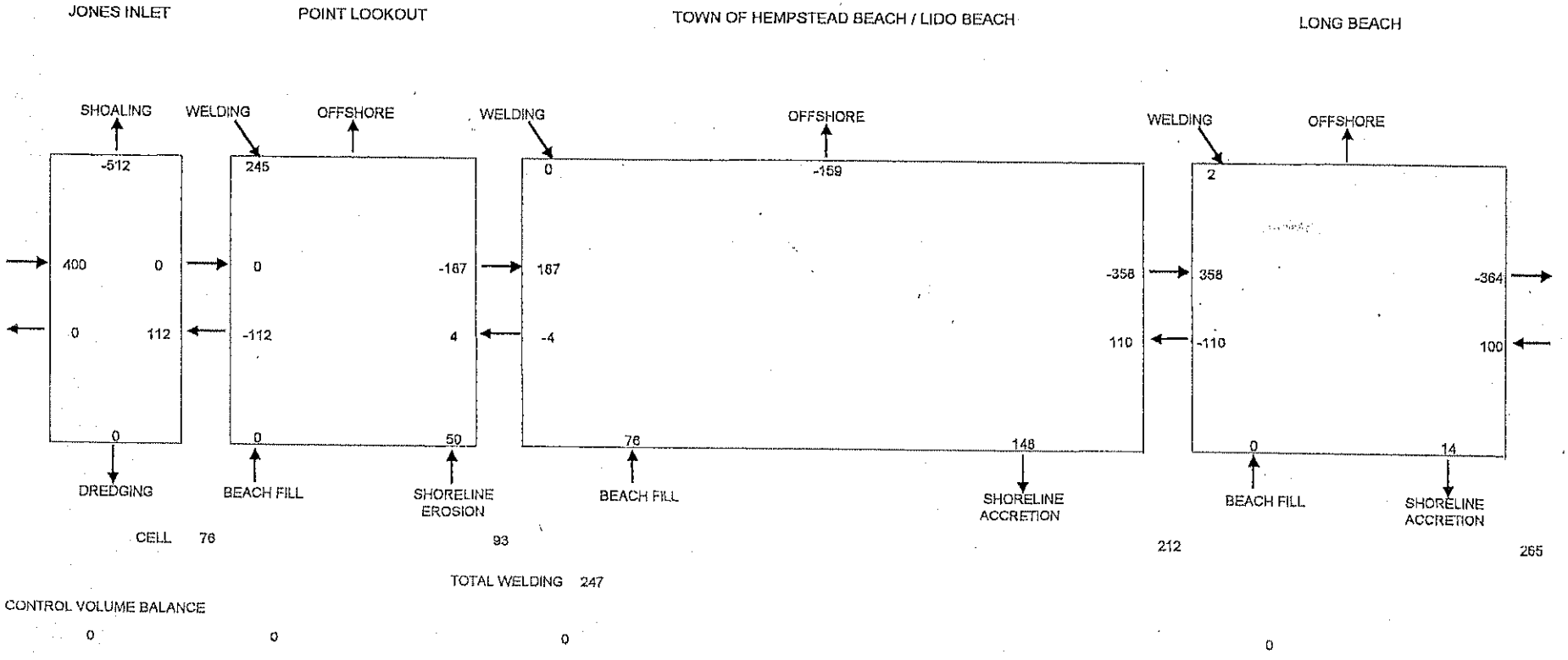


Figure 2-30

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1972-1978

(Ql, Qr Avg. 1987-1996 and Qnet = 0 @ G3)

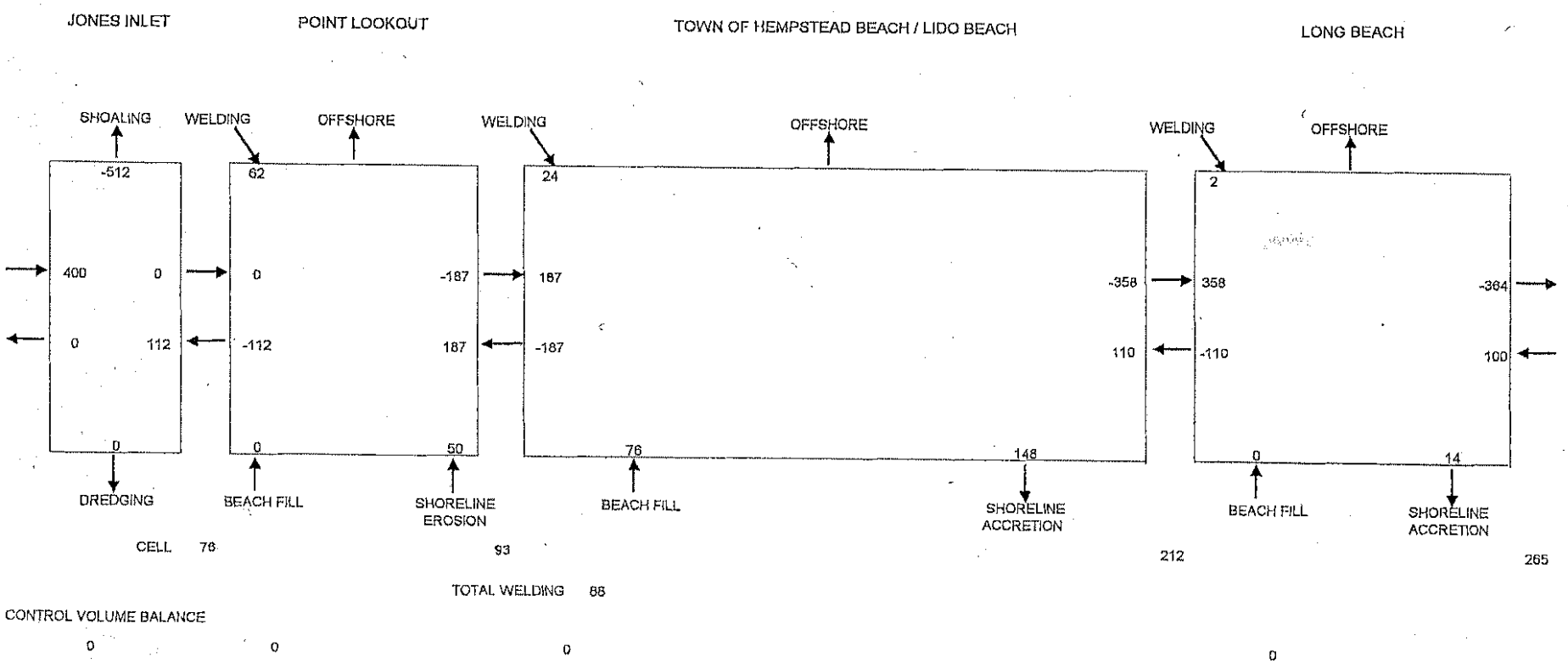


Figure 2-31

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1978-1984

(Ql, Qr Avg. 1987-1996)

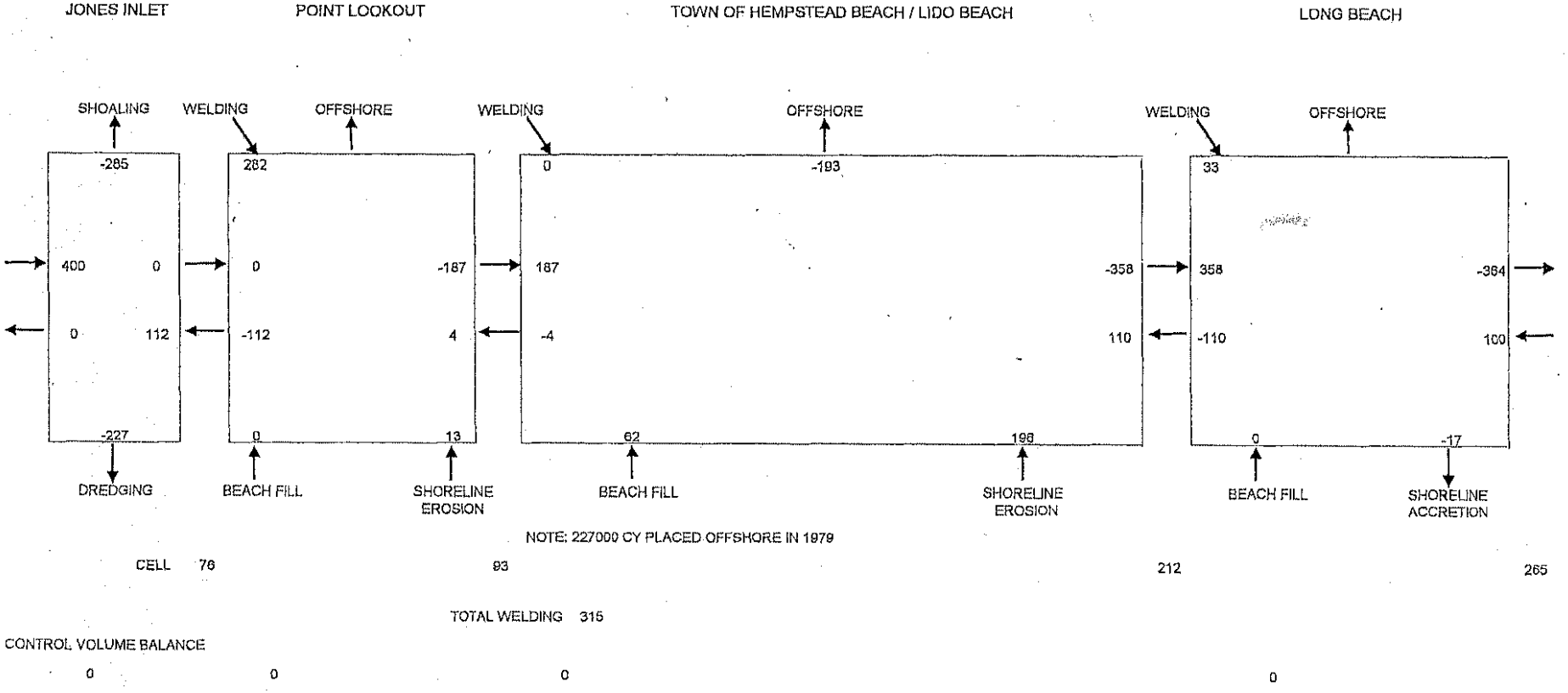


Figure 2-32

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1978-1984

(Ql, Qr Avg. 1987-1996 and Qnet = 0 @ G3)

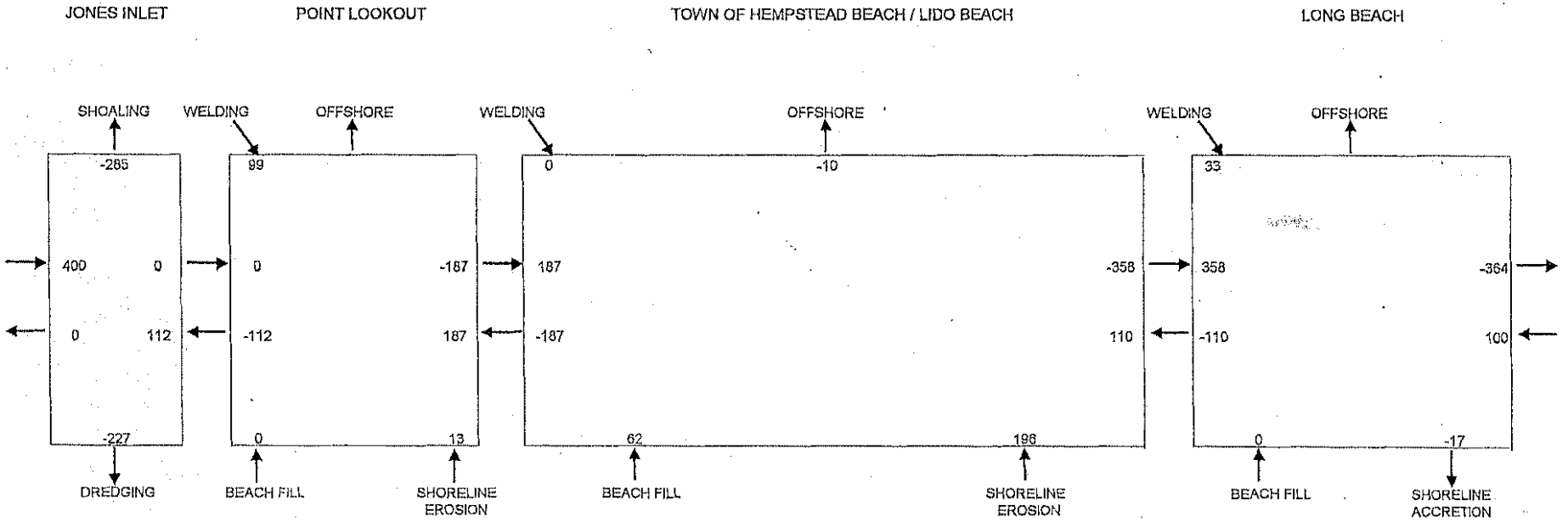


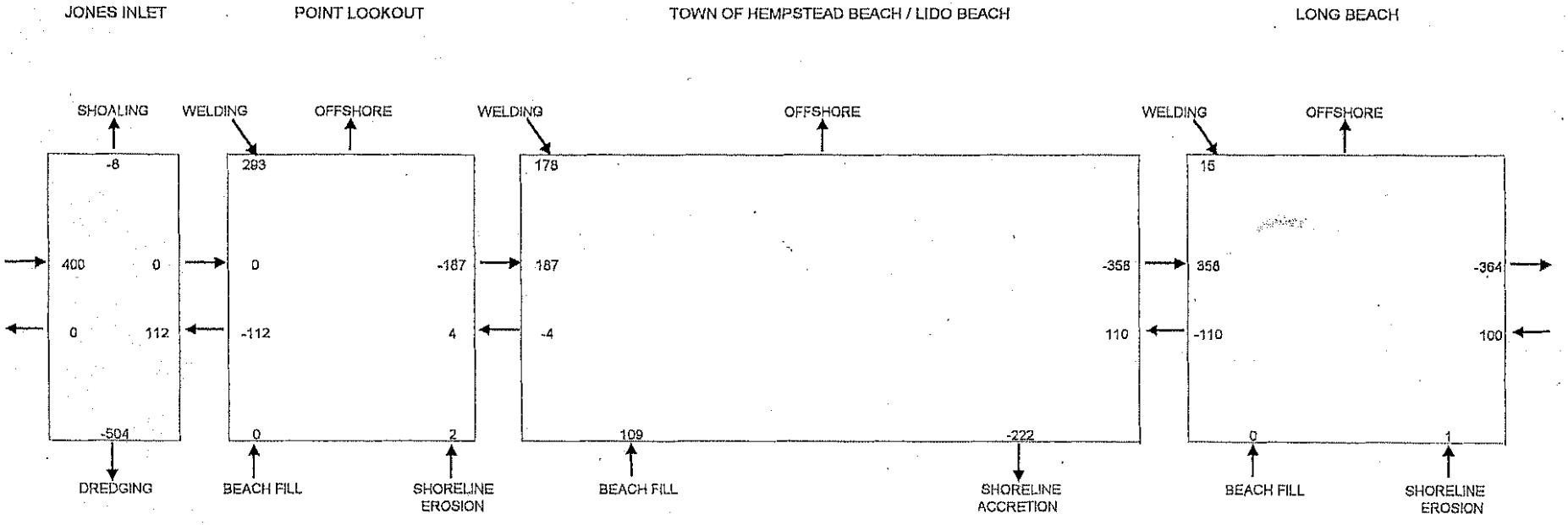
Figure 2-33

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1984-1990

(Ql, Qr Avg. 1987-1996)



NOTE: 504000 CY PLACED OFFSHORE IN 1987

CELL 76 93 212 265

TOTAL WELDING 486

CONTROL VOLUME BALANCE

0 0 0 0

Figure 2-34

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1984-1990

(Ql, Qr Avg. 1987-1996 and Qnet = 0 @ G3)

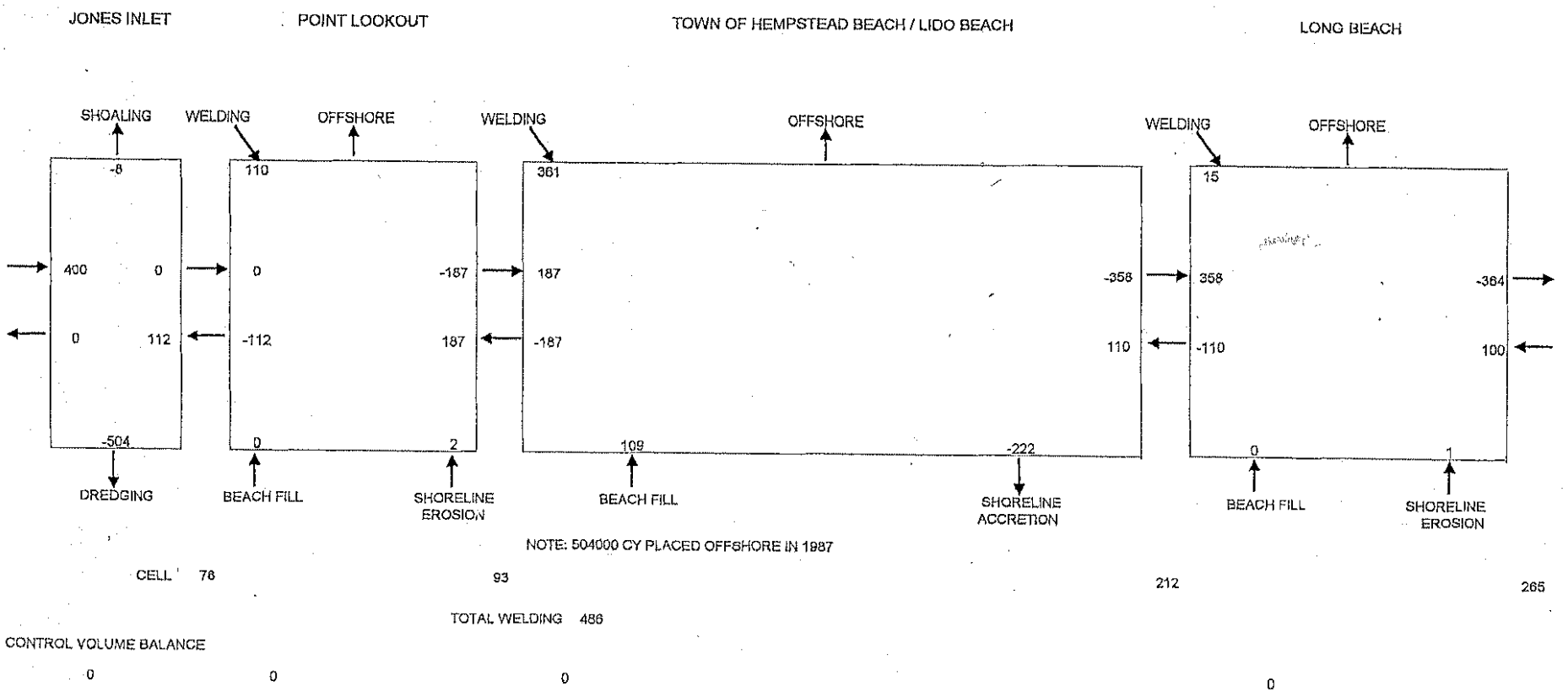


Figure 2-35

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1984-1990

(Ql, Qr Avg. 1987-1990)

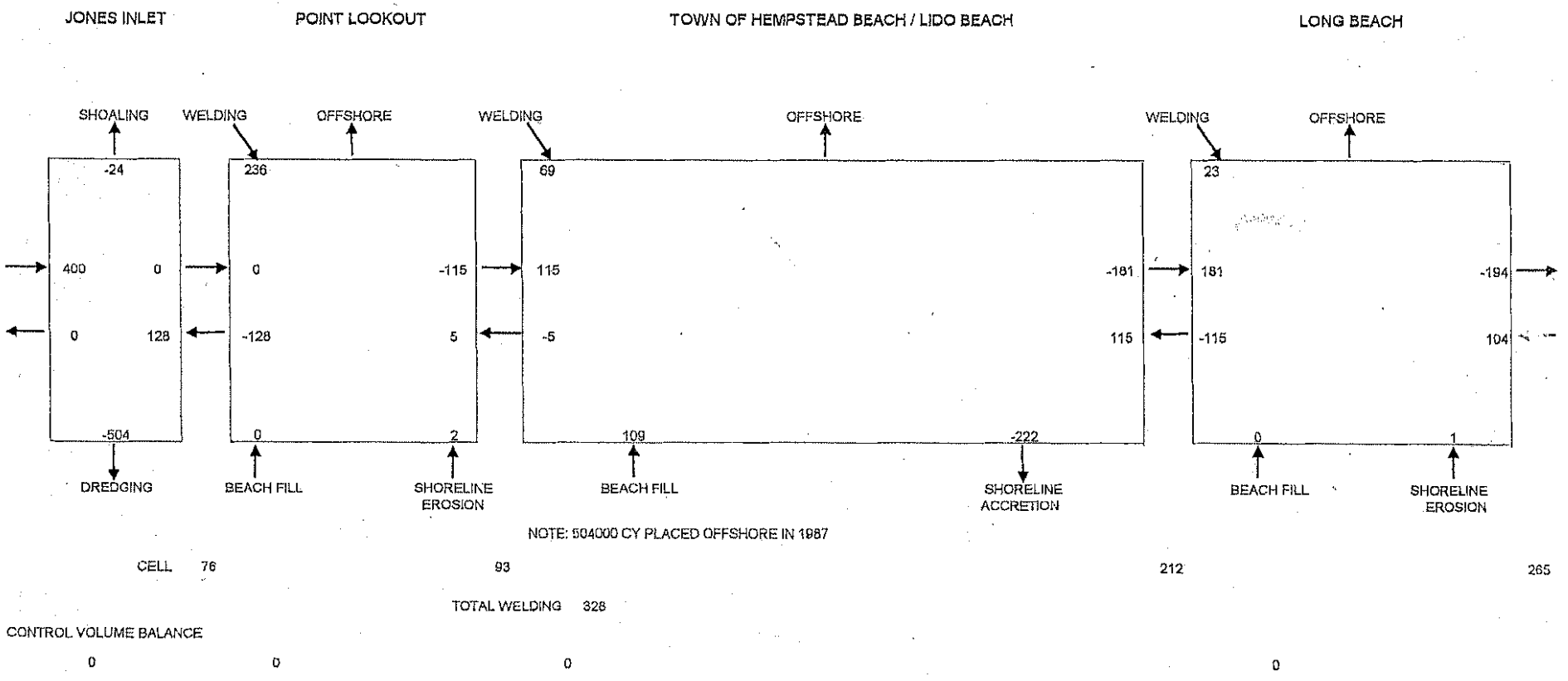


Figure 2-36

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1984-1990

(Ql_3 Qr Avg. 1987-1990 and Qnet = 0 @ G3)

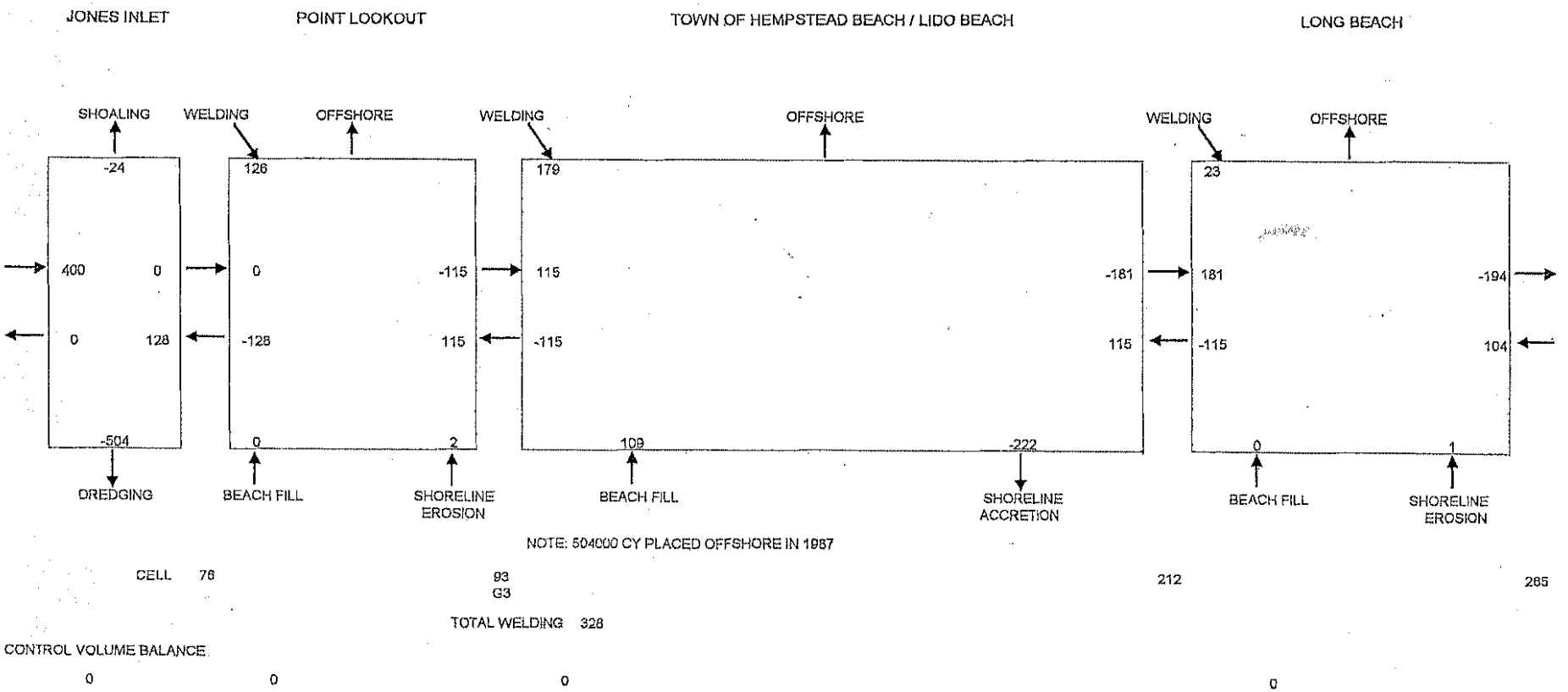


Figure 2-37

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1990-1998

(Ql, Qr Avg. 1980-1996)

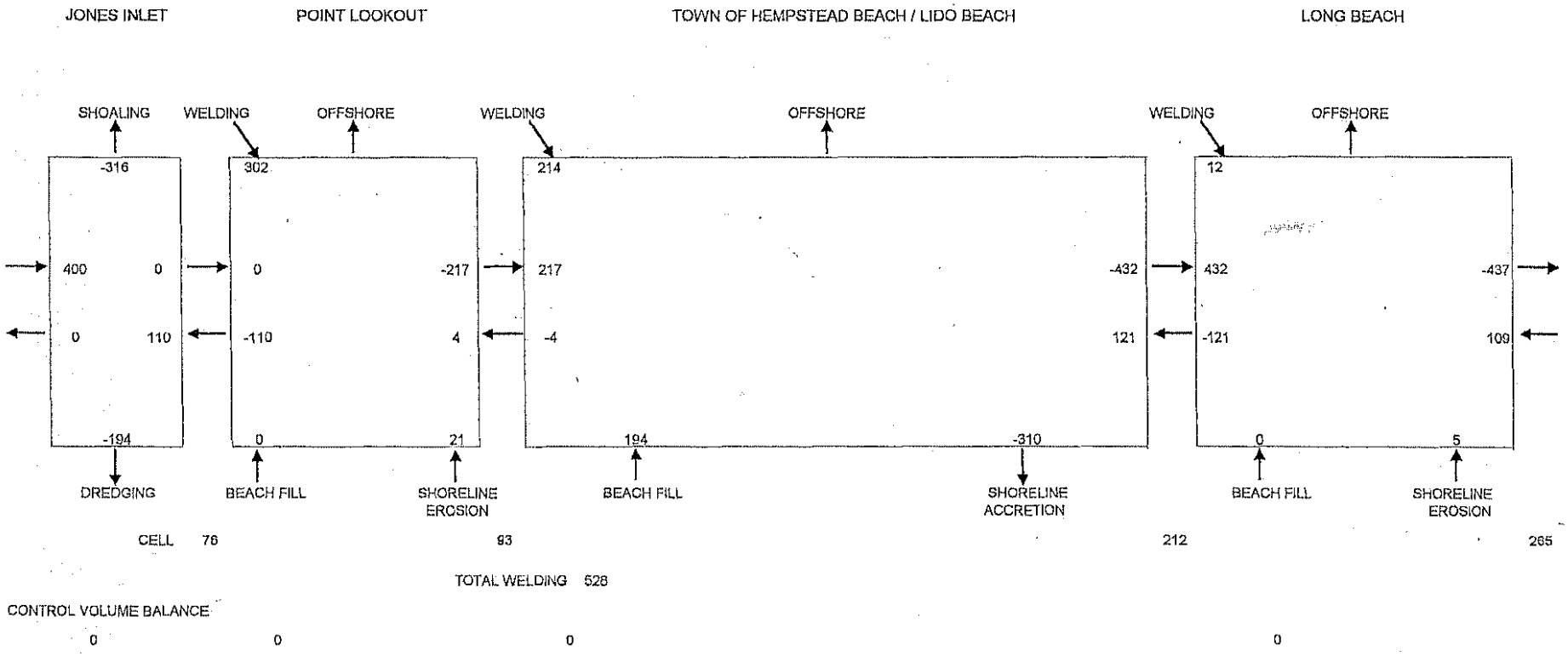


Figure 2-38

JONES INLET TO LONG BEACH

SEDIMENT BUDGET

1990-1998

(Ql, Qr Avg. 1990-1996 and Qnet = 0 @ G3)

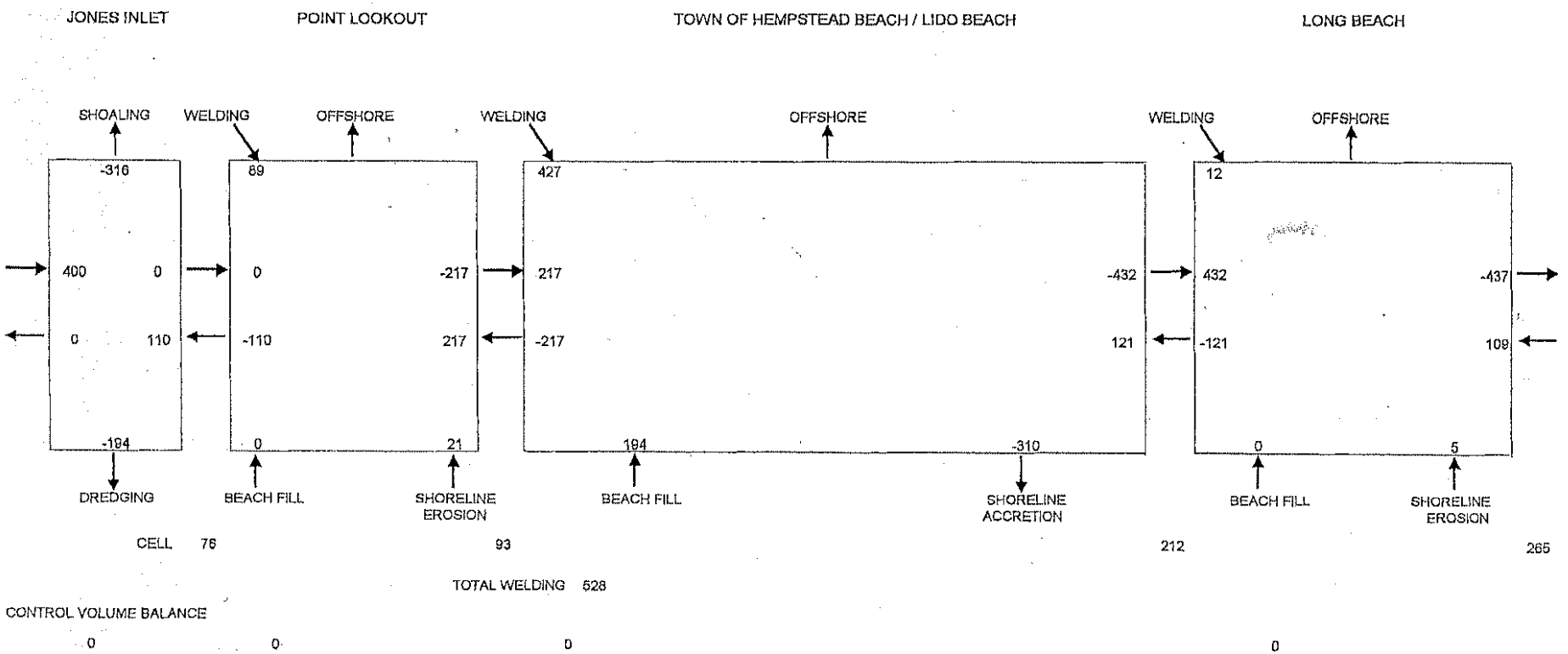
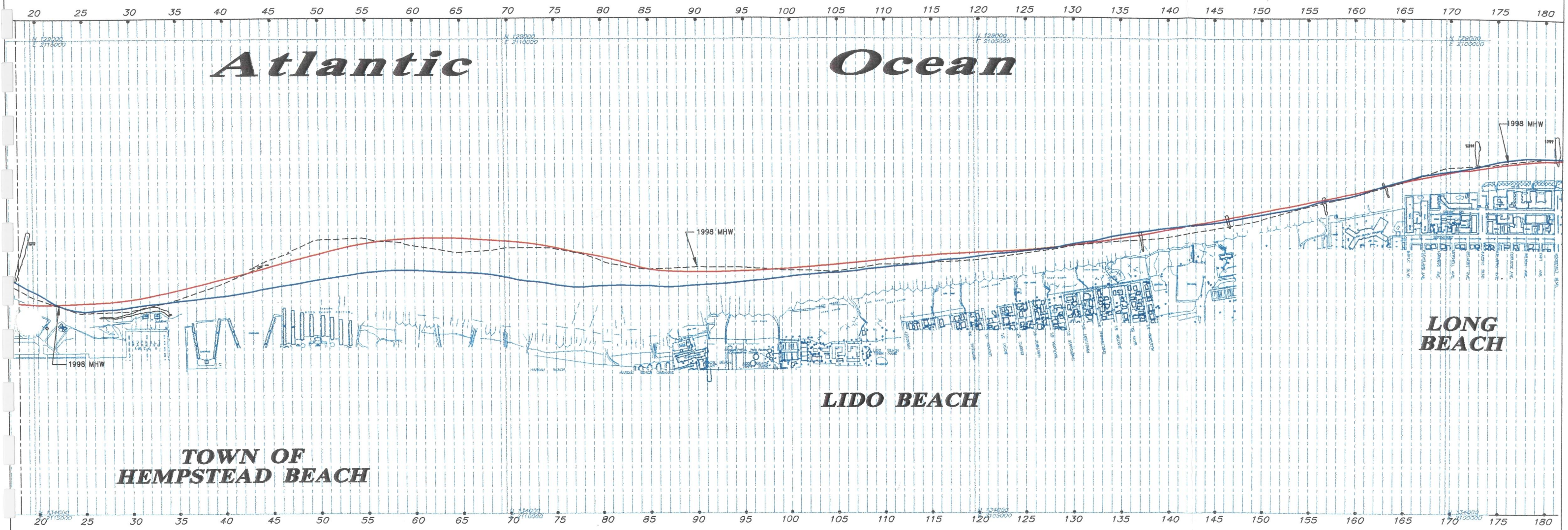


Figure 2-39



LEGEND

MEASURED MHW – 1990

MEASURED MHW – 1998

CALCULATED MHW – 1998

SCALE : ONE INCH = 1000 FEET

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

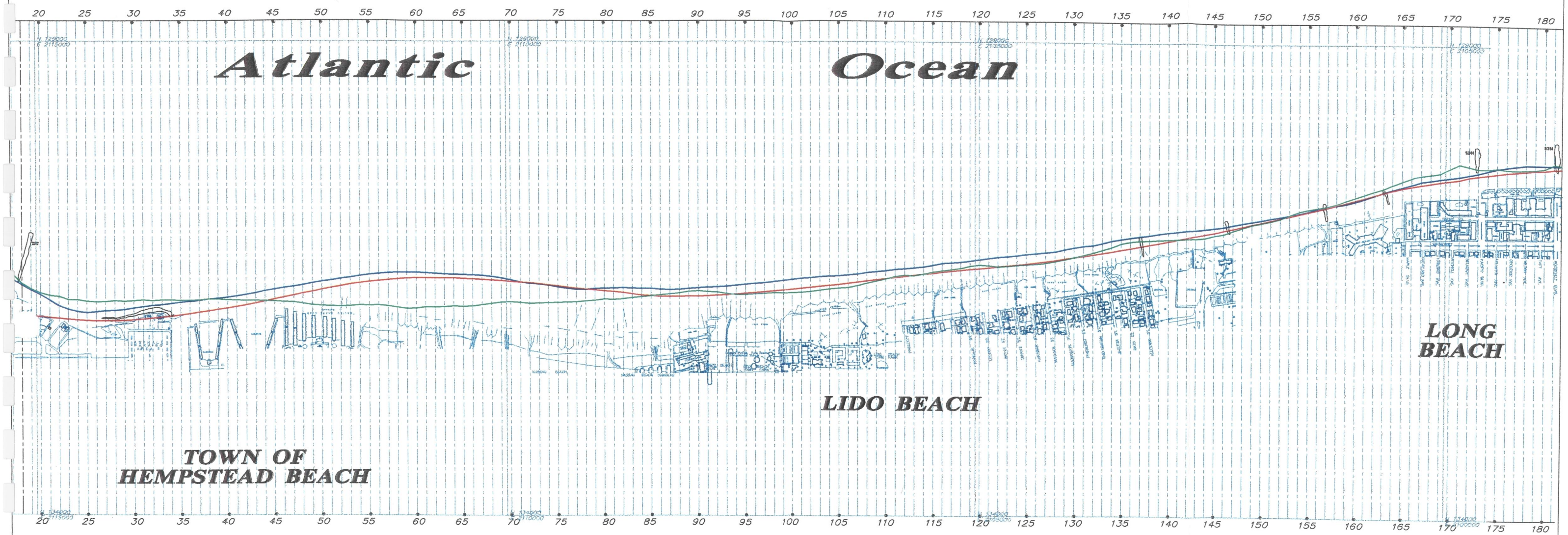
OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
FINAL GENESIS CALIBRATION

Figure 2-40

NASSAU COUNTY

NEW YORK



LEGEND

MEASURED MHW – 1984

MEASURED MHW – 1990

CALCULATED MHW – 1990

SCALE : ONE INCH = 1000 FEET

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

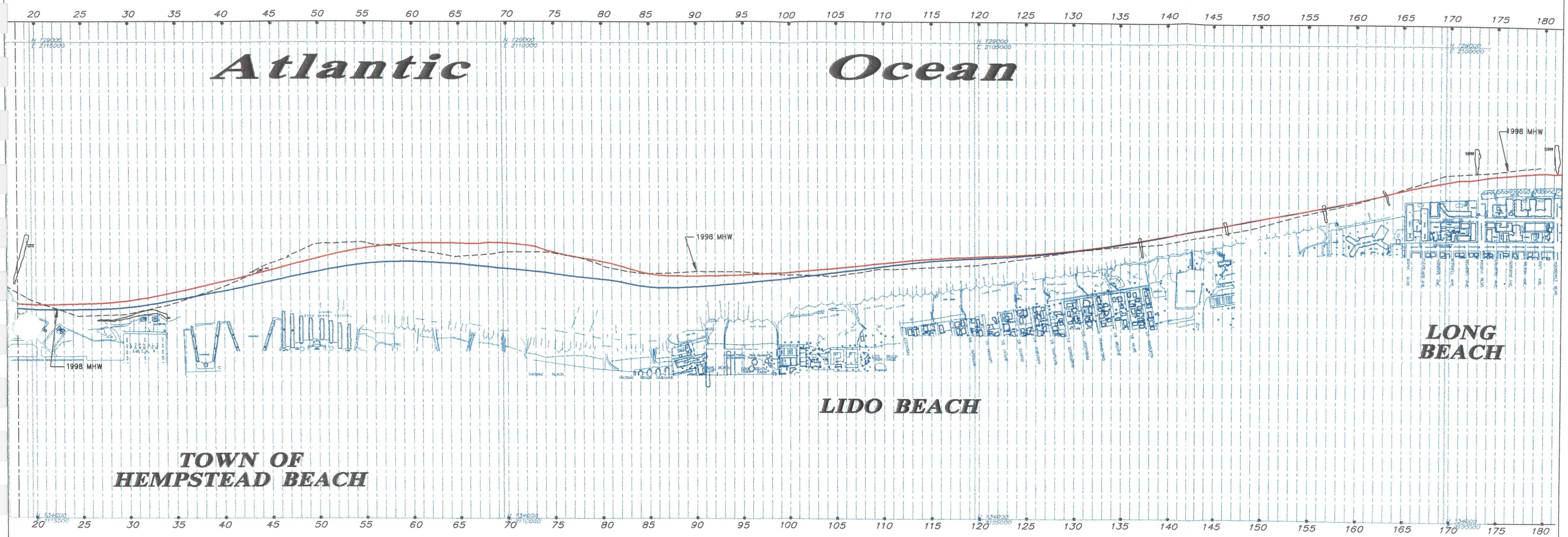
OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
FINAL GENESIS VERIFICATION

Figure 2-41

NASSAU COUNTY

NEW YORK



LEGEND

MEASURED MHW – 1998 ----------

CALCULATED 2003 MHW WITHOUT PROJECT WITH BYPASSING. ———

CALCULATED 2003 MHW WITHOUT PROJECT WITHOUT BYPASSING. ———

SCALE : ONE INCH = 1000 FEET

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

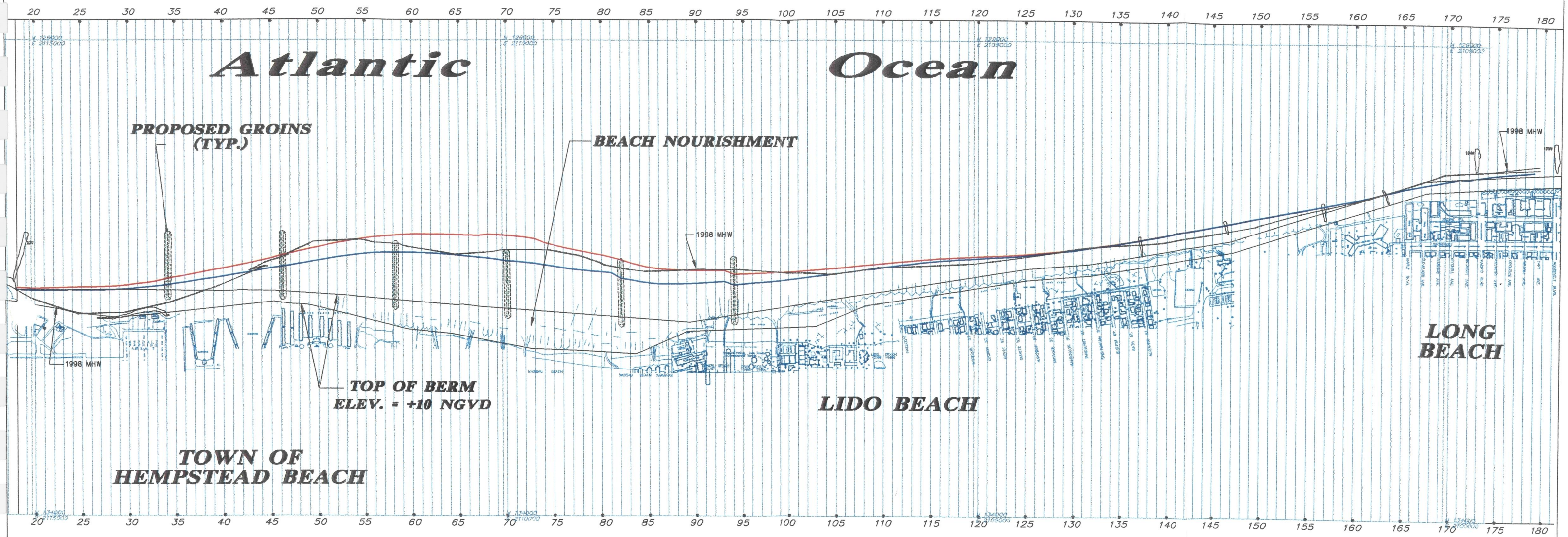
OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

WITHOUT PROJECT

Figure 2-42

NASSAU COUNTY NEW YORK



LEGEND

MEASURED MHW – 1998

CALCULATED 2003 MHW WITH ALT. – 2 WITH BYPASSING.

CALCULATED 2003 MHW WITH ALT. – 2 WITHOUT BYPASSING.

SCALE : ONE INCH = 1000 FEET

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

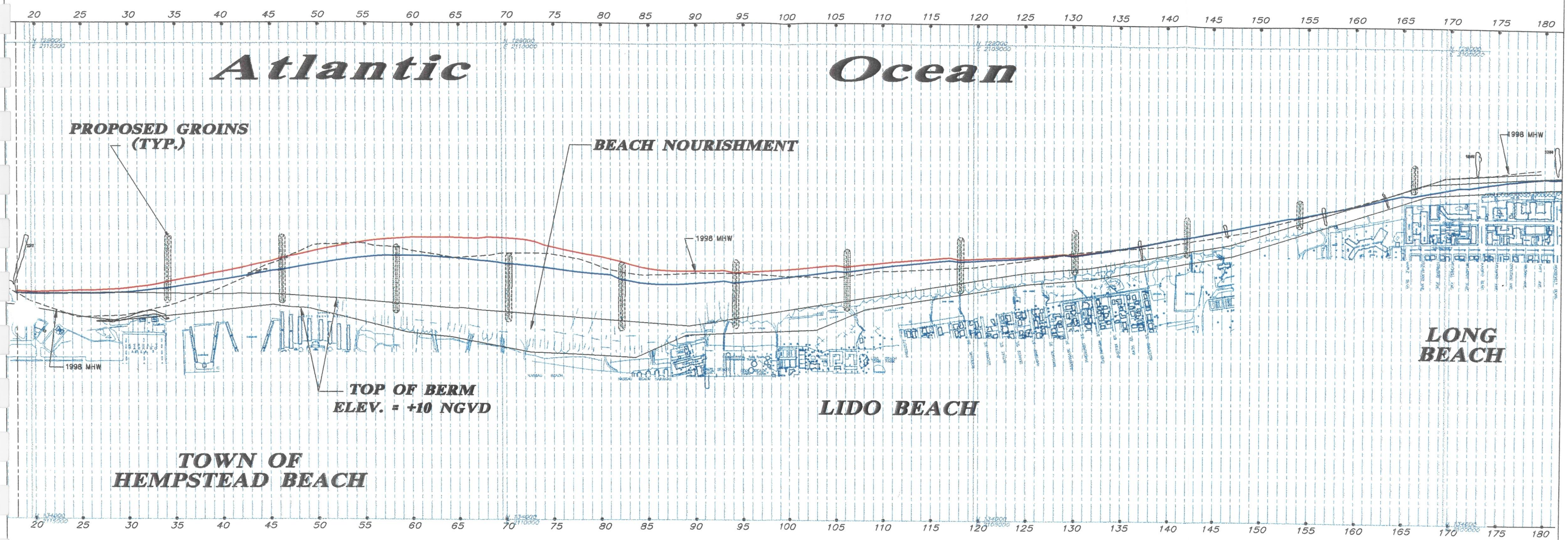
OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

ALTERNATIVE PLAN 2
BEACH NOURISHMENT
WITH SIX (6) 700 LF GROINS AT
1200 FT INTERVALS
(PLAN 5 FROM FEASIBILITY REPORT)

NASSAU COUNTY NEW YORK

Figure 2-43



LEGEND

MEASURED MHW – 1998

CALCULATED 2003 MHW WITH ALT. – 3 WITH BYPASSING.

CALCULATED 2003 MHW WITH ALT. – 3 WITHOUT BYPASSING.

SCALE : ONE INCH = 1000 FEET

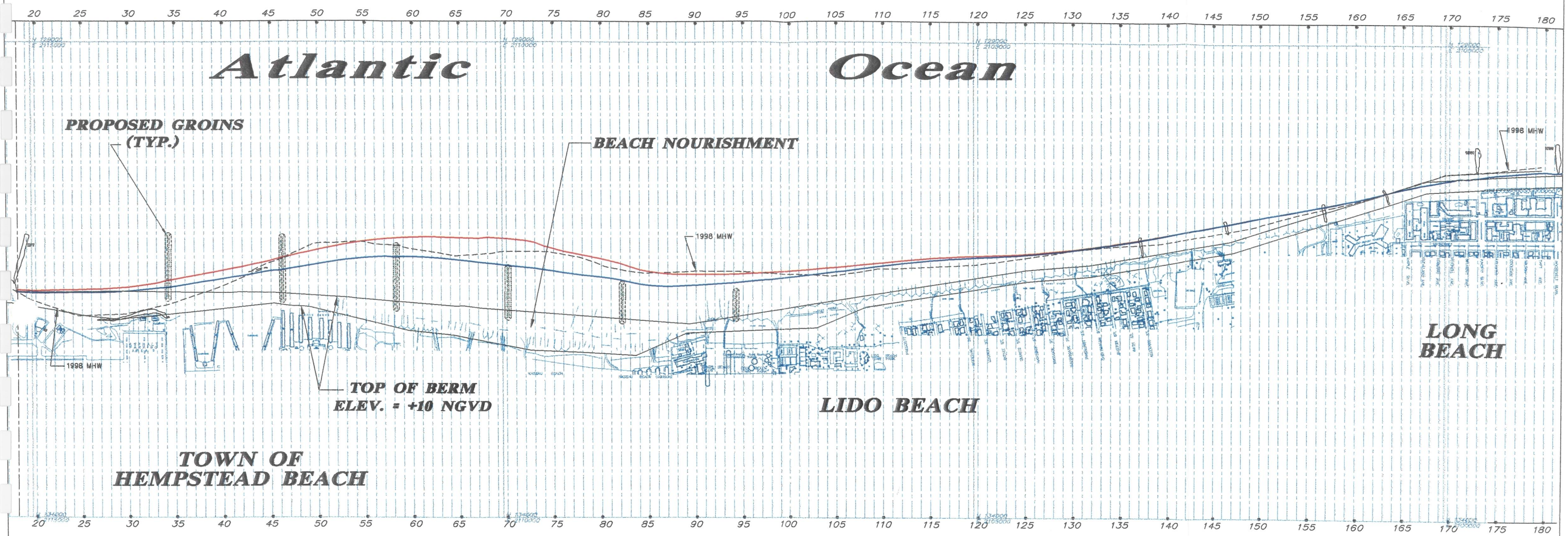
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
ALTERNATIVE PLAN 3
BEACH NOURISHMENT
WITH TWELVE (12) GROINS AT
1200 FT INTERVALS
WITH TAPERED TRANSITION AT
WESTERLY END

NASSAU COUNTY NEW YORK

Figure 2-44



LEGEND

MEASURED MHW – 1998

CALCULATED 2003 MHW WITH ALT. – 4 WITH BYPASSING.

CALCULATED 2003 MHW WITH ALT. – 4 WITHOUT BYPASSING.

SCALE : ONE INCH = 1000 FEET

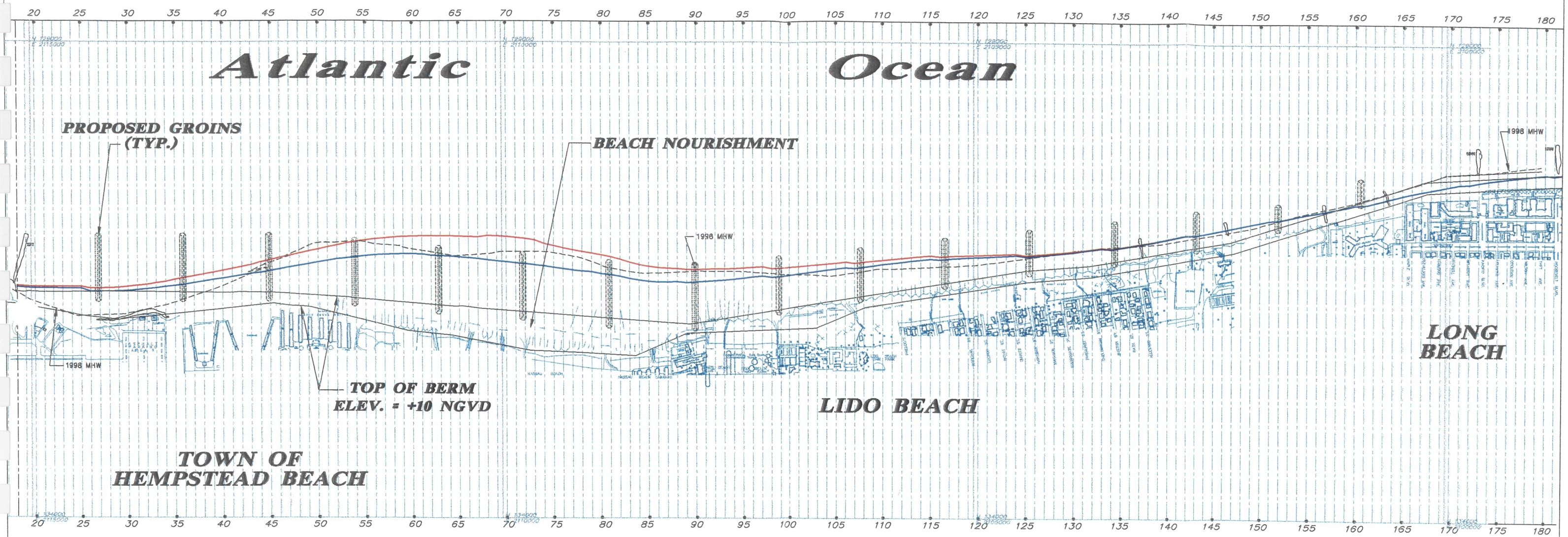
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
ALTERNATIVE PLAN 4
BEACH NOURISHMENT
WITH SIX (6) GROINS AT
1200 FT INTERVALS
WITH TAPERED TRANSITION AT
WESTERLY END

NASSAU COUNTY NEW YORK

Figure 2-45



LEGEND

MEASURED MHW – 1998

CALCULATED 2003 MHW WITH ALT. – 5 WITH BYPASSING.

CALCULATED 2003 MHW WITH ALT. – 5 WITHOUT BYPASSING.

SCALE : ONE INCH = 1000 FEET

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)

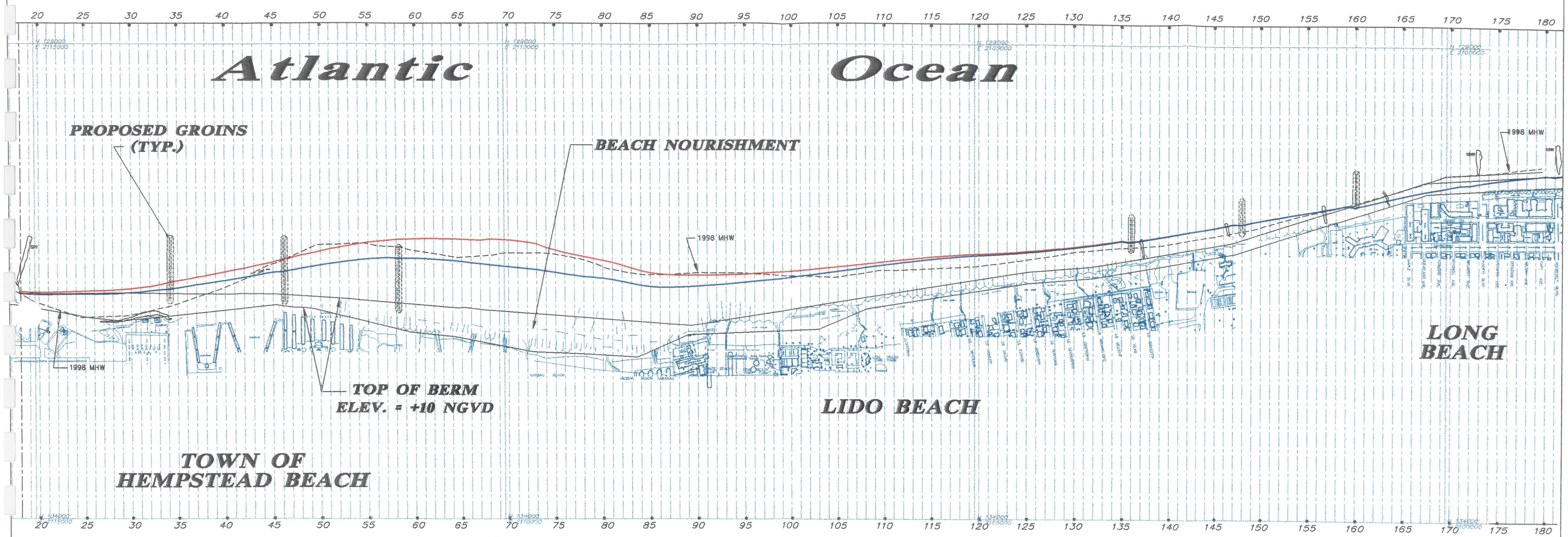
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

ALTERNATIVE PLAN 5
BEACH NOURISHMENT
WITH SIXTEEN (16) GROINS AT
900 FT INTERVALS

NASSAU COUNTY

Figure 2-46

NEW YORK



LEGEND

MEASURED MHW – 1998 ----------

CALCULATED 2003 MHW WITH ALT. – 6 WITH BYPASSING. ———

CALCULATED 2003 MHW WITH ALT. – 6 WITHOUT BYPASSING. ———

SCALE : ONE INCH = 1000 FEET

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)

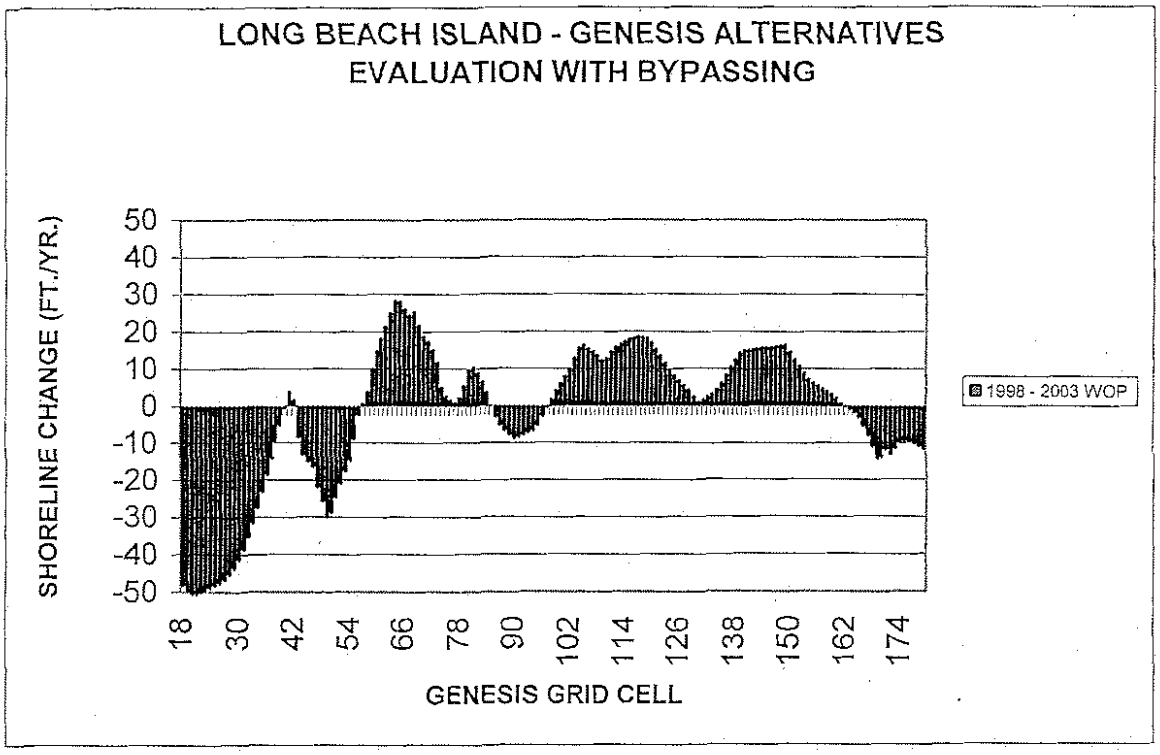
LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

ALTERNATIVE PLAN 6
BEACH NOURISHMENT
WITH SIX (6) GROINS AT
1200 FT INTERVALS

NASSAU COUNTY

Figure 2-47

NEW YORK


LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE (FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
30
42
54
66
78
90
102
114
126
138
150
162
174
GENESIS GRID CELL
1998 - 2003 WOP

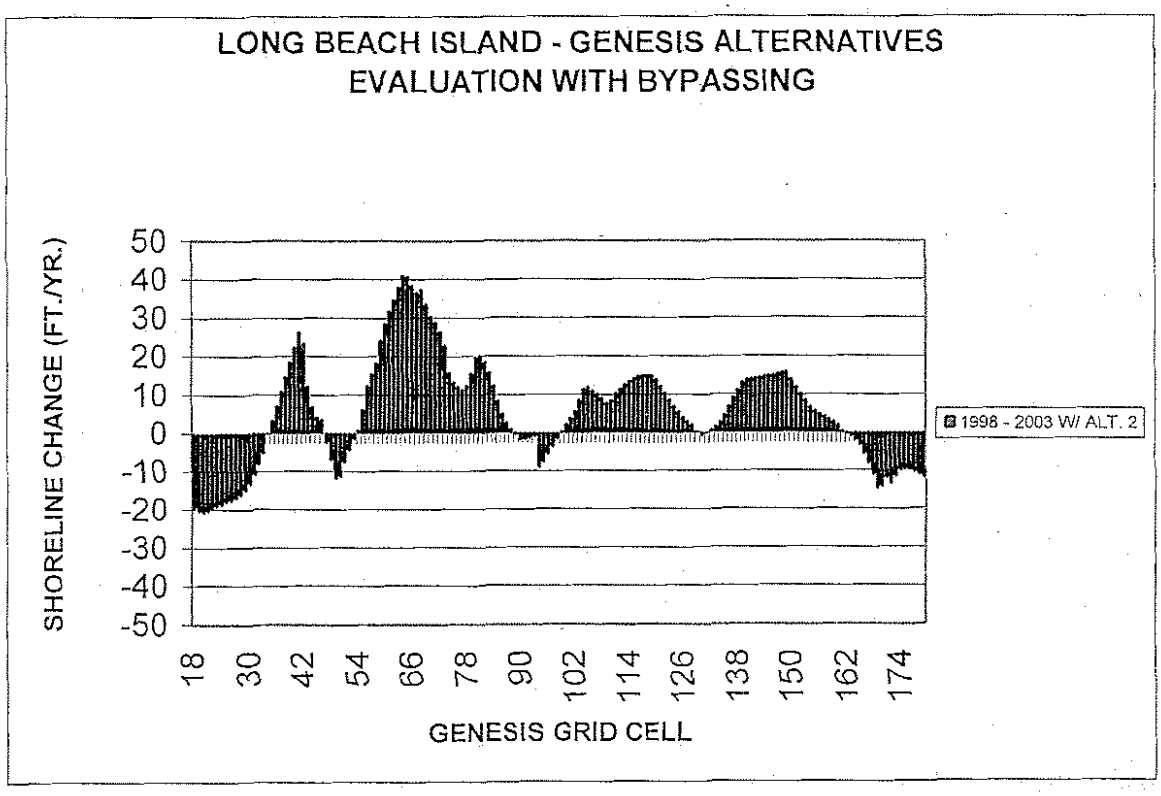
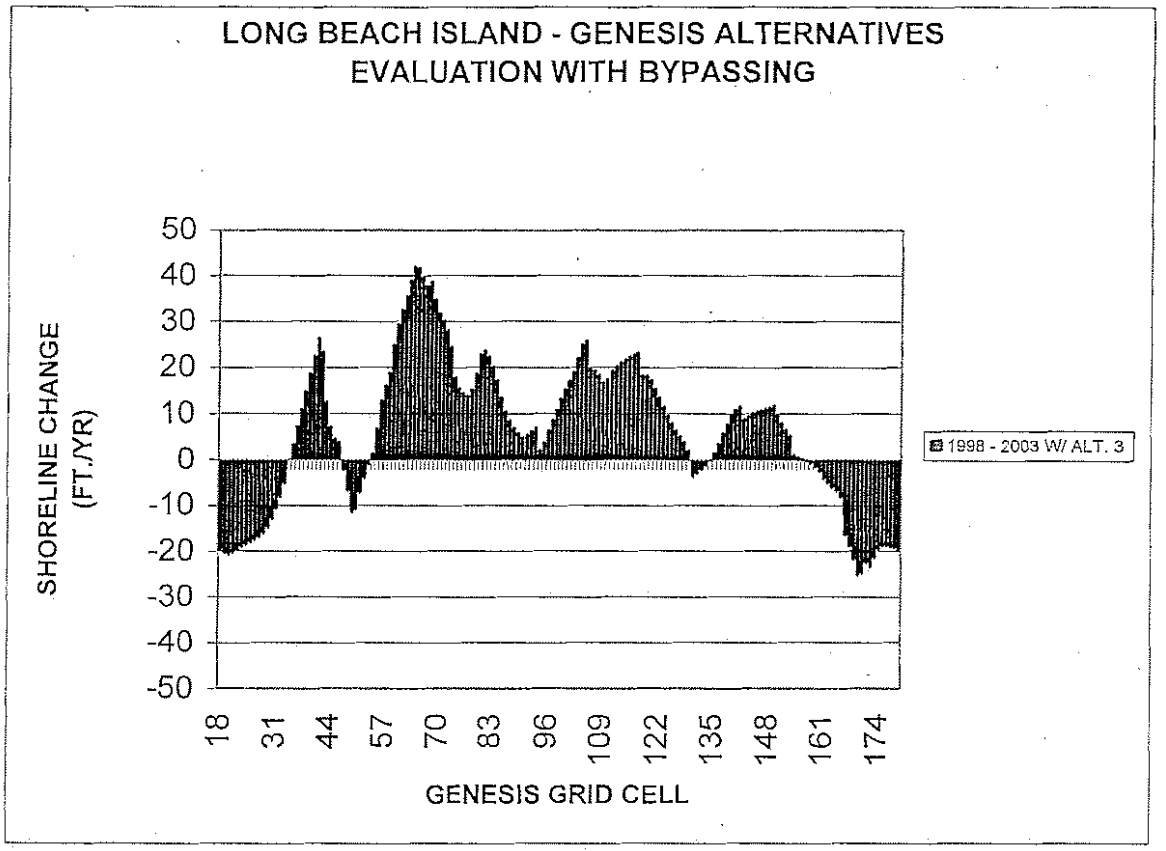

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE (FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
30
42
54
66
78
90
102
114
126
138
150
162
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 2

Figure 2-48


LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE (FT./YR)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 3

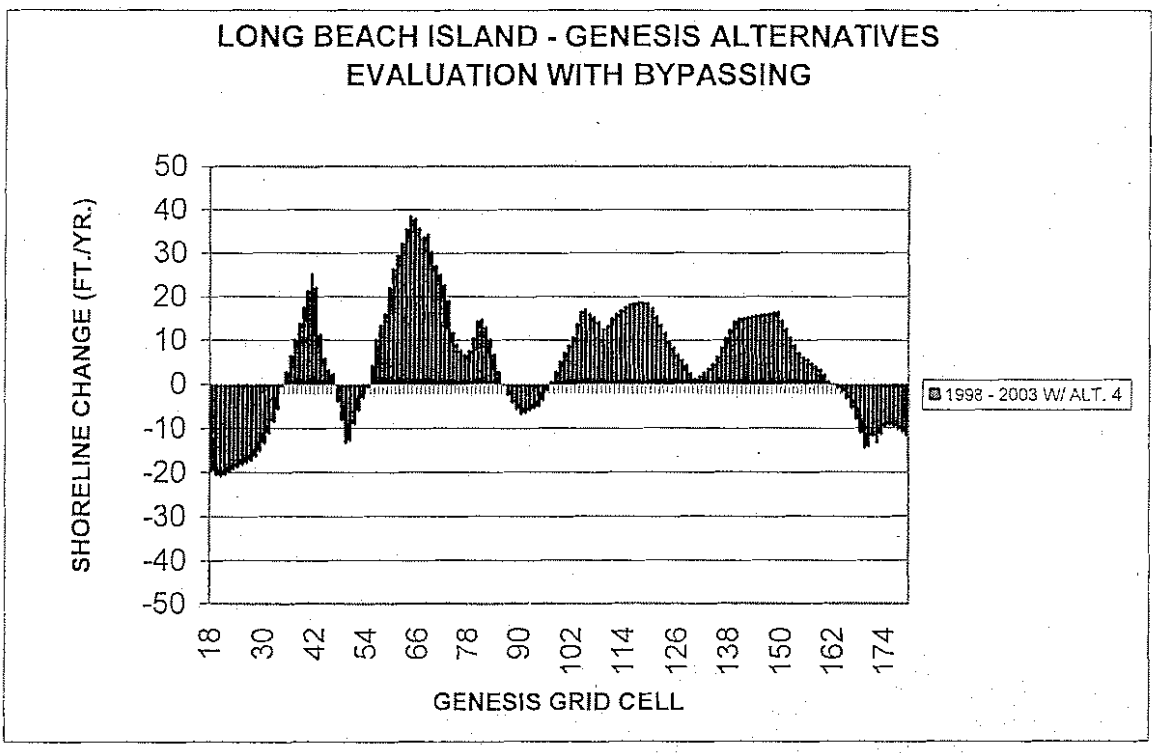
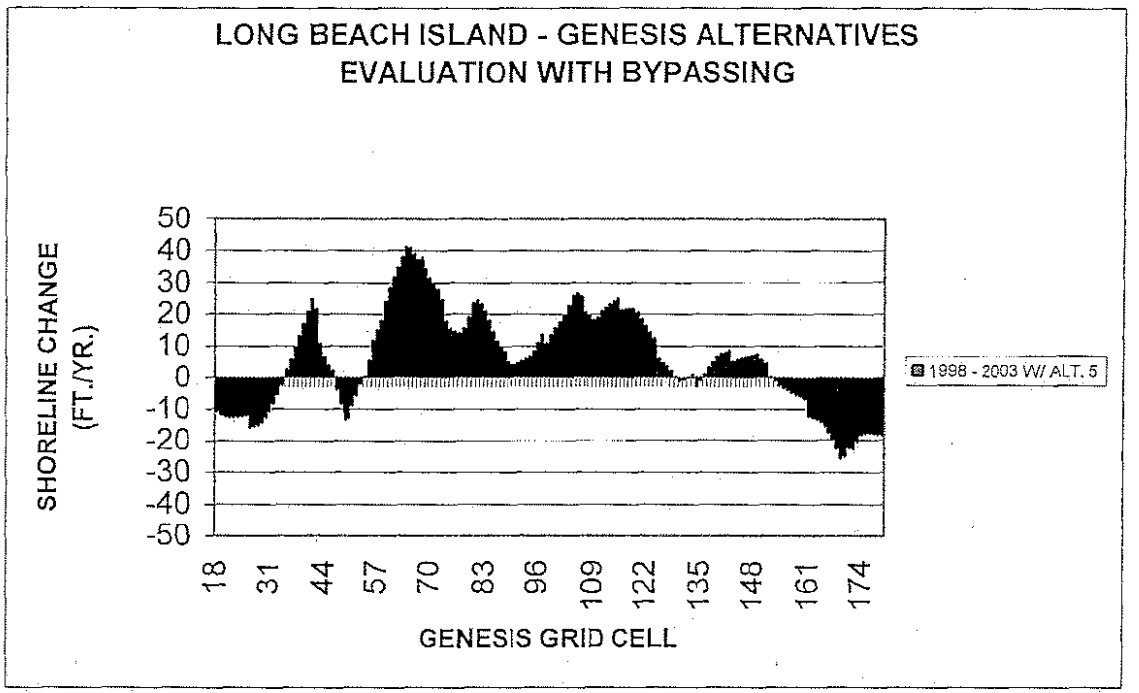

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE (FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
30
42
54
66
78
90
102
114
126
138
150
162
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 4

Figure 2-49


LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE
(FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 5

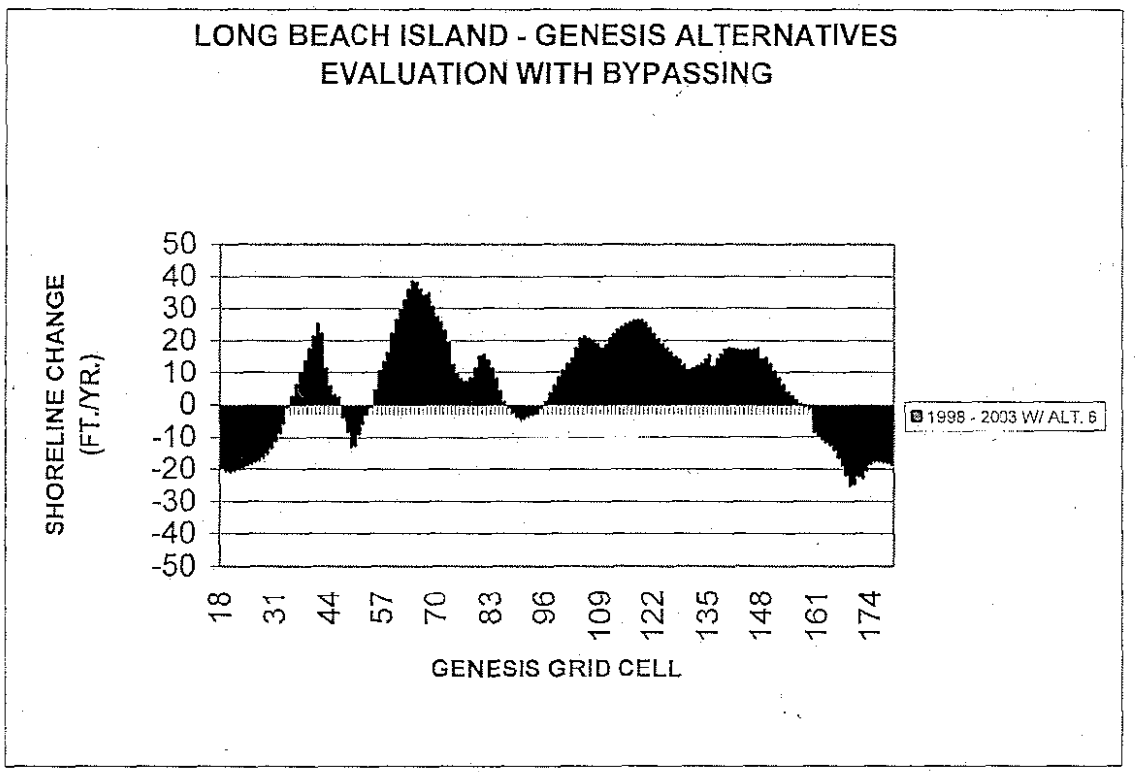
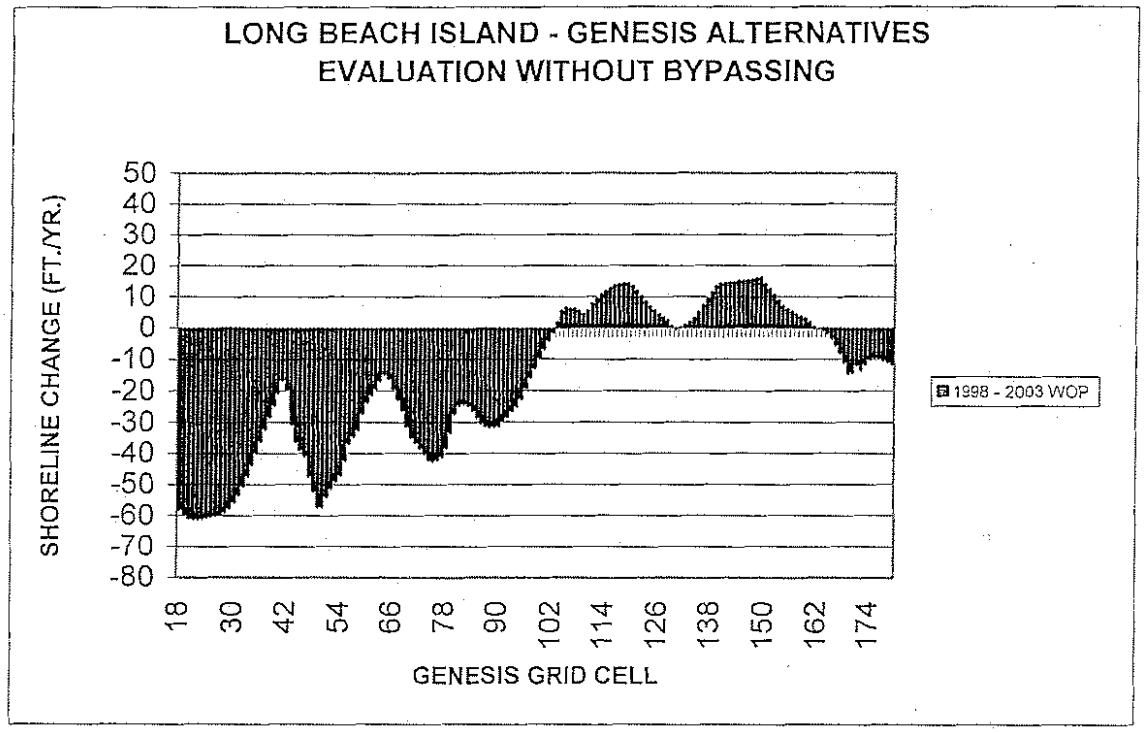

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE
(FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 6

Figure 2-50


LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITHOUT BYPASSING
SHORELINE CHANGE (FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
18
30
42
54
66
78
90
102
114
126
138
150
162
174
GENESIS GRID CELL
1998 - 2003 WOP

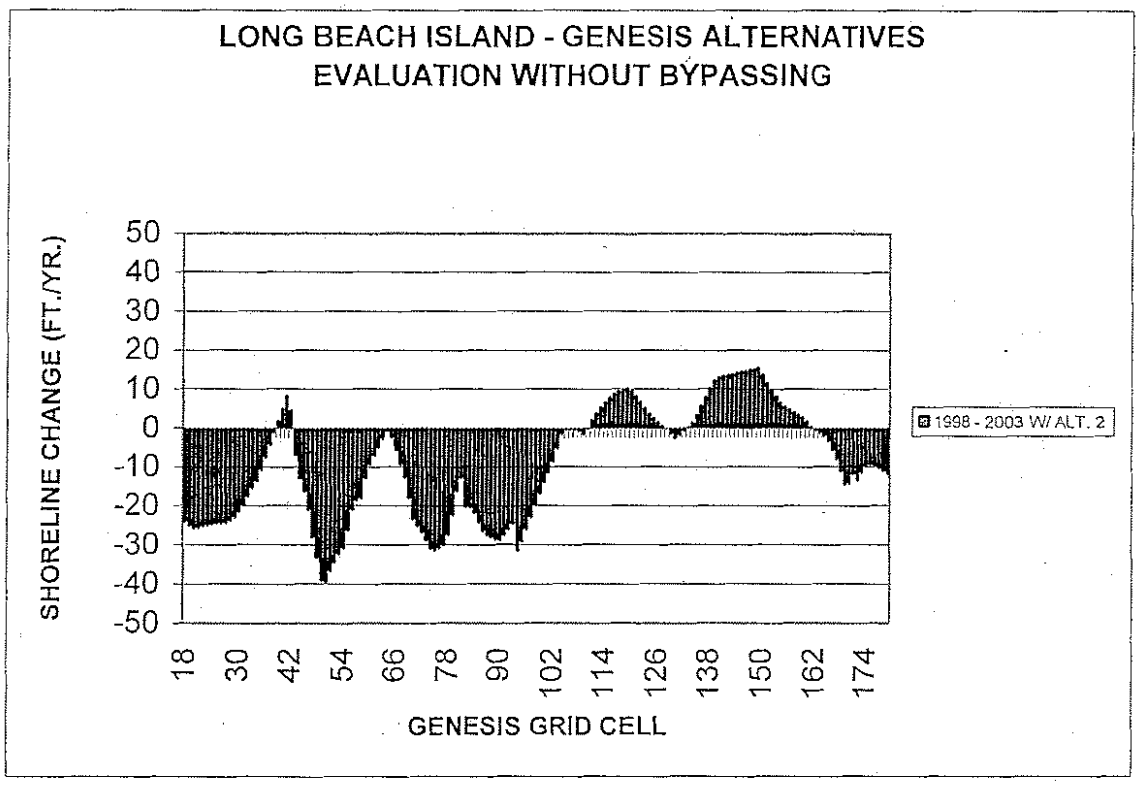
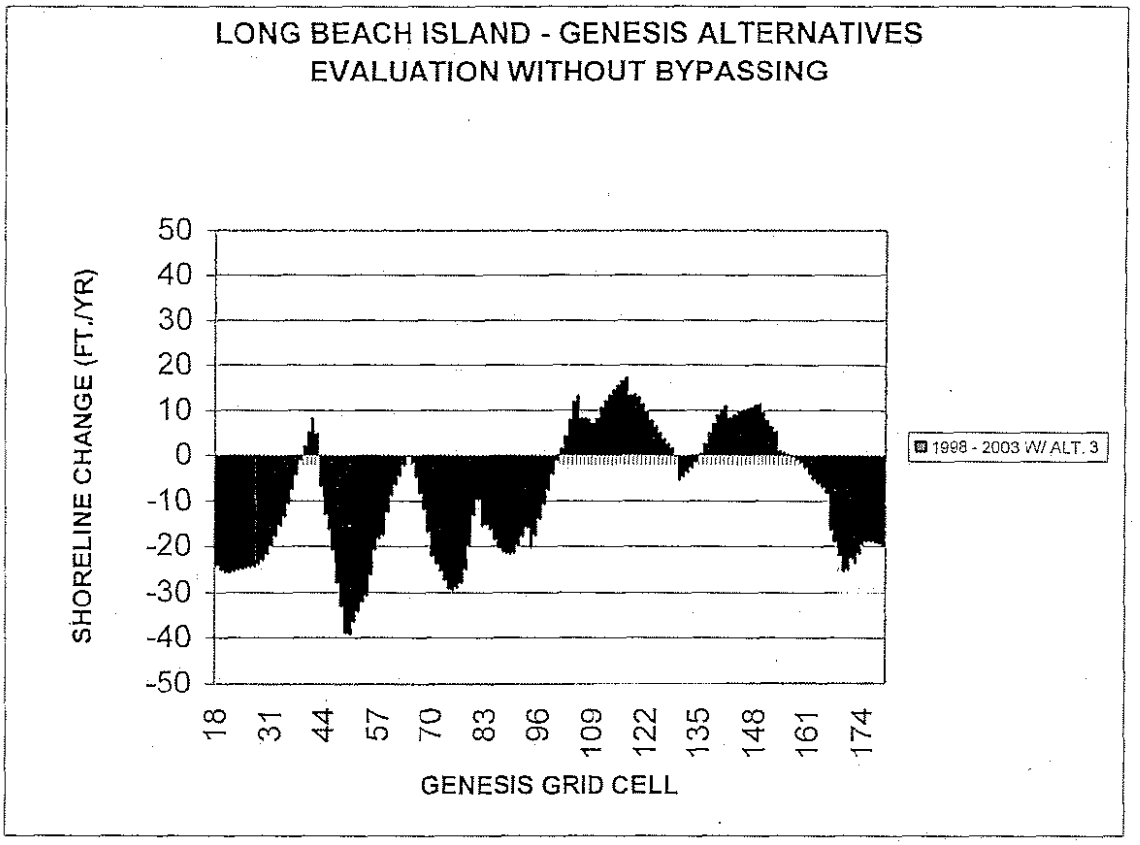

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITHOUT BYPASSING
SHORELINE CHANGE (FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
30
42
54
66
78
90
102
114
126
138
150
162
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 2

Figure 2-51


LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITHOUT BYPASSING
SHORELINE CHANGE (FT./YR)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 3

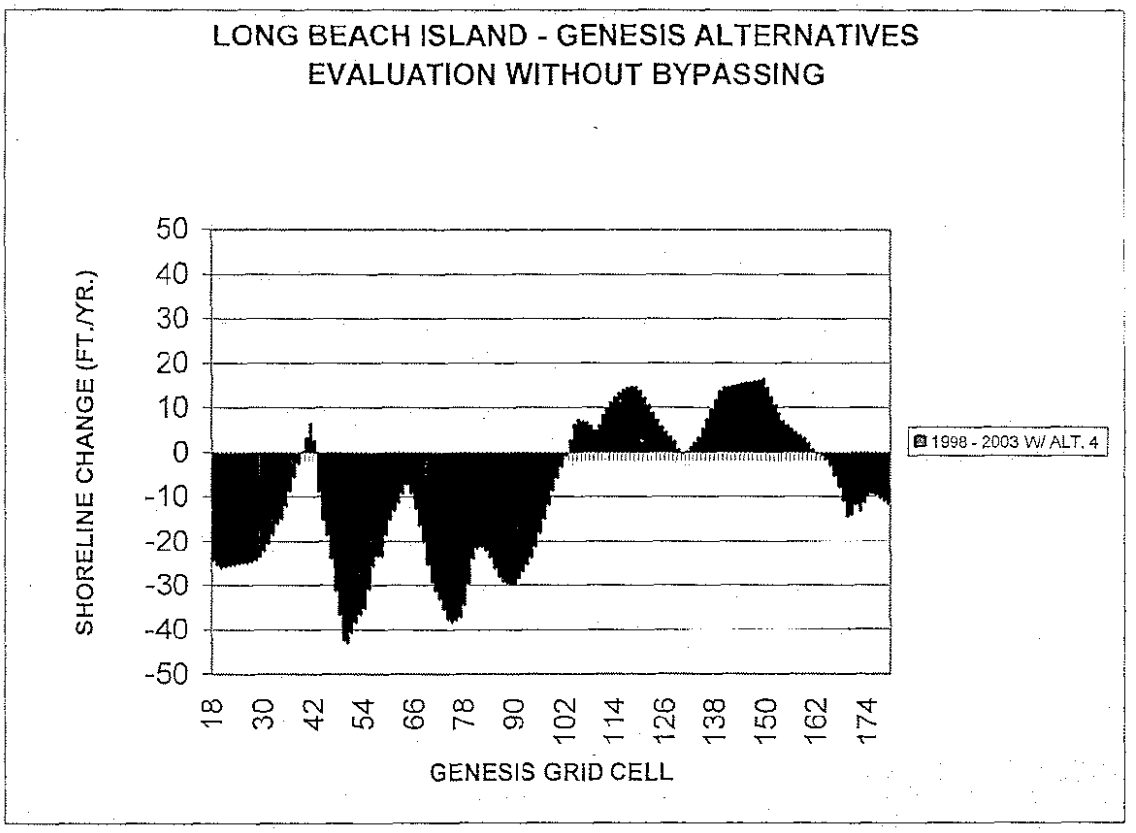
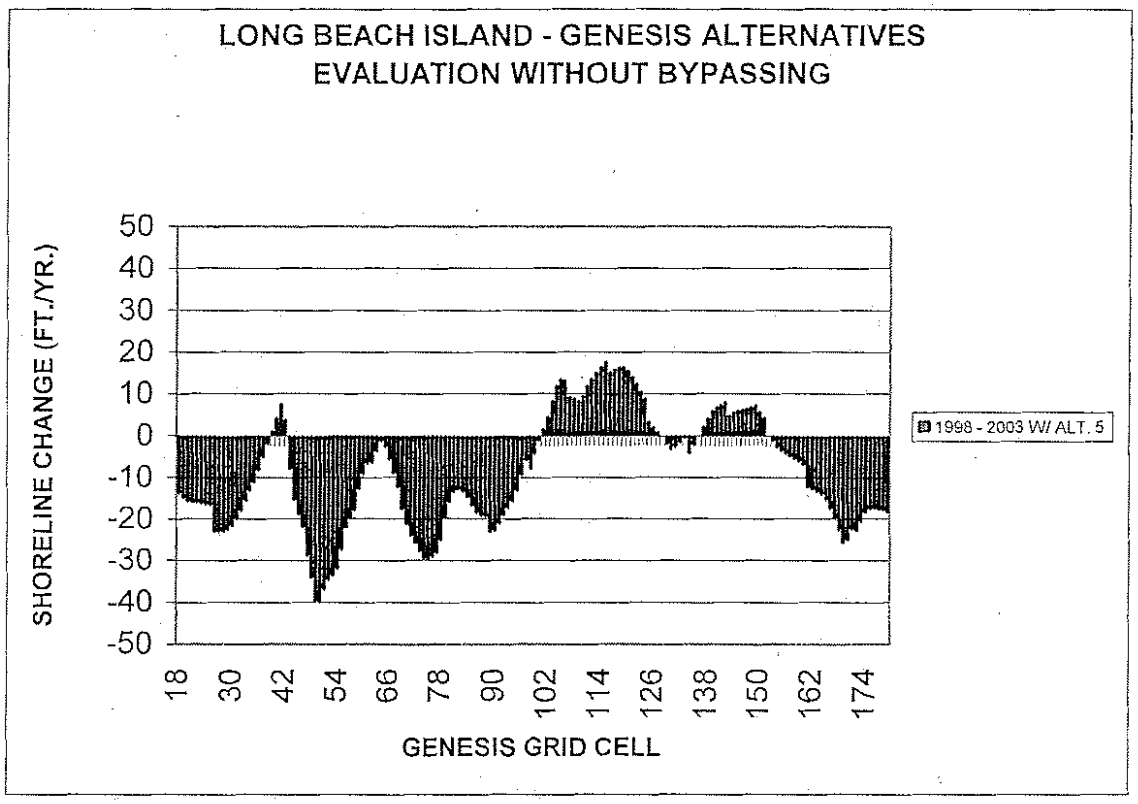

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITHOUT BYPASSING
SHORELINE CHANGE (FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
30
42
54
66
78
90
102
114
126
138
150
162
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 4

Figure 2-52


LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITHOUT BYPASSING
SHORELINE CHANGE (FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
30
42
54
66
78
90
102
114
126
138
150
162
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 5

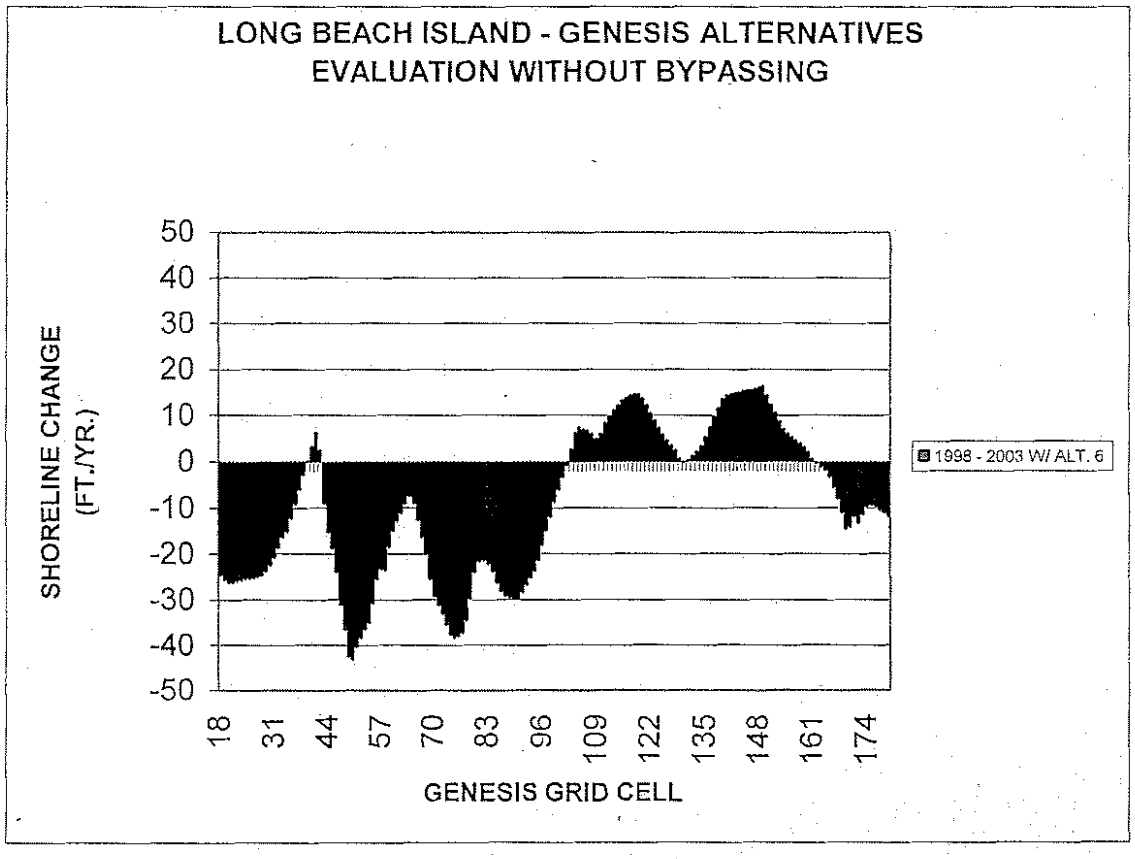

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITHOUT BYPASSING
SHORELINE CHANGE
(FT./YR.)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 6

Figure 2-53

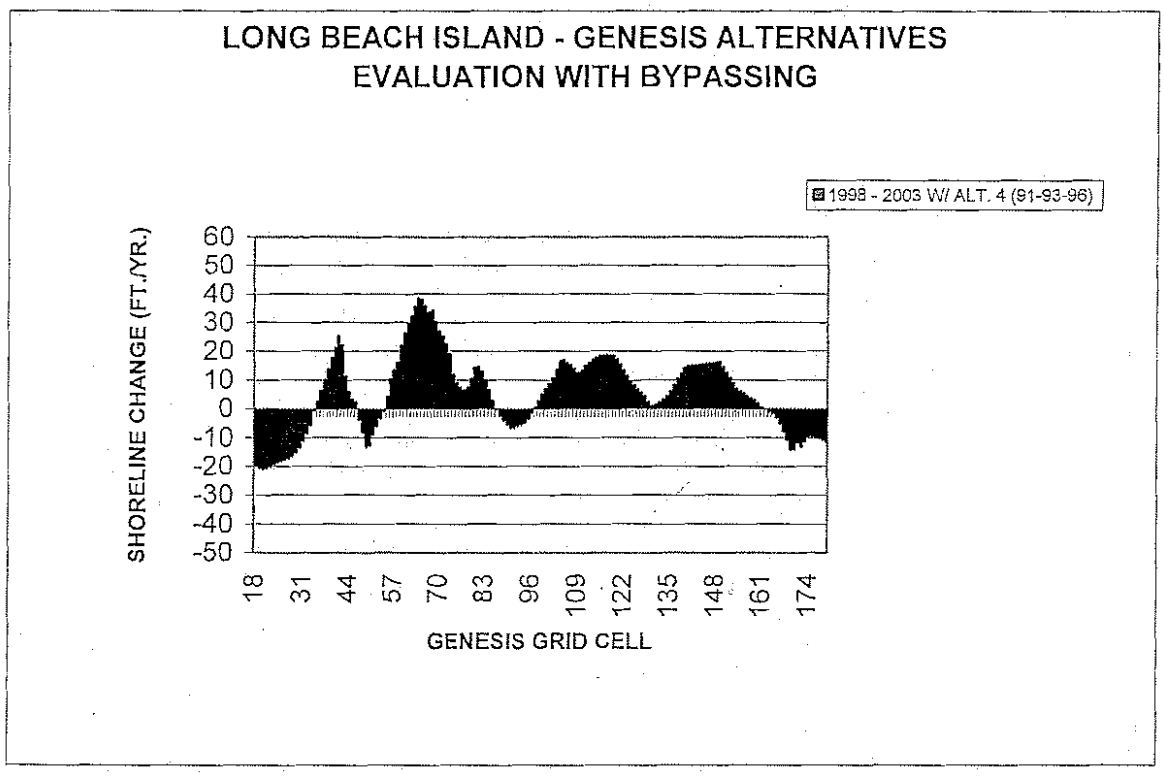

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
1998 - 2003 W/ ALT. 4 (91-93-96)
SHORELINE CHANGE (FT./YR.)
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL

Figure 2-54

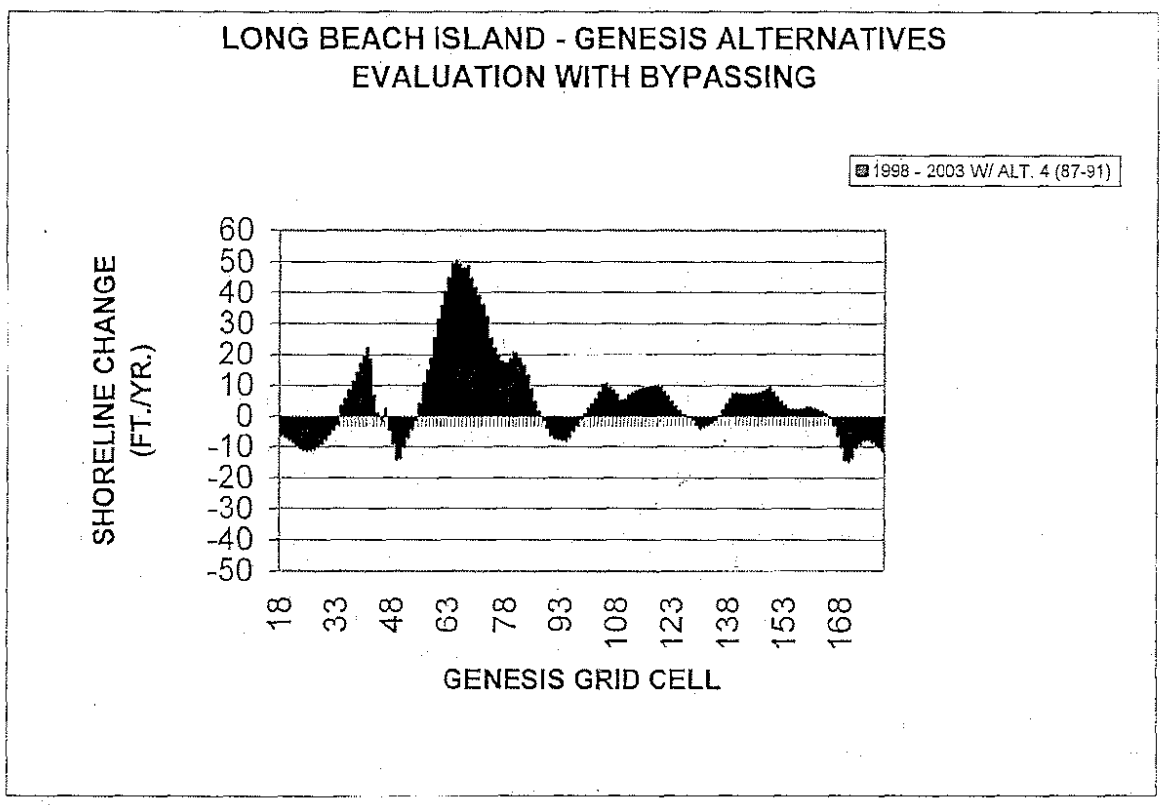

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
1998 - 2003 W/ ALT. 4 (87-91)
SHORELINE CHANGE
(FT./YR.)
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
33
48
63
78
93
108
123
138
153
168
GENESIS GRID CELL

Figure 2-55

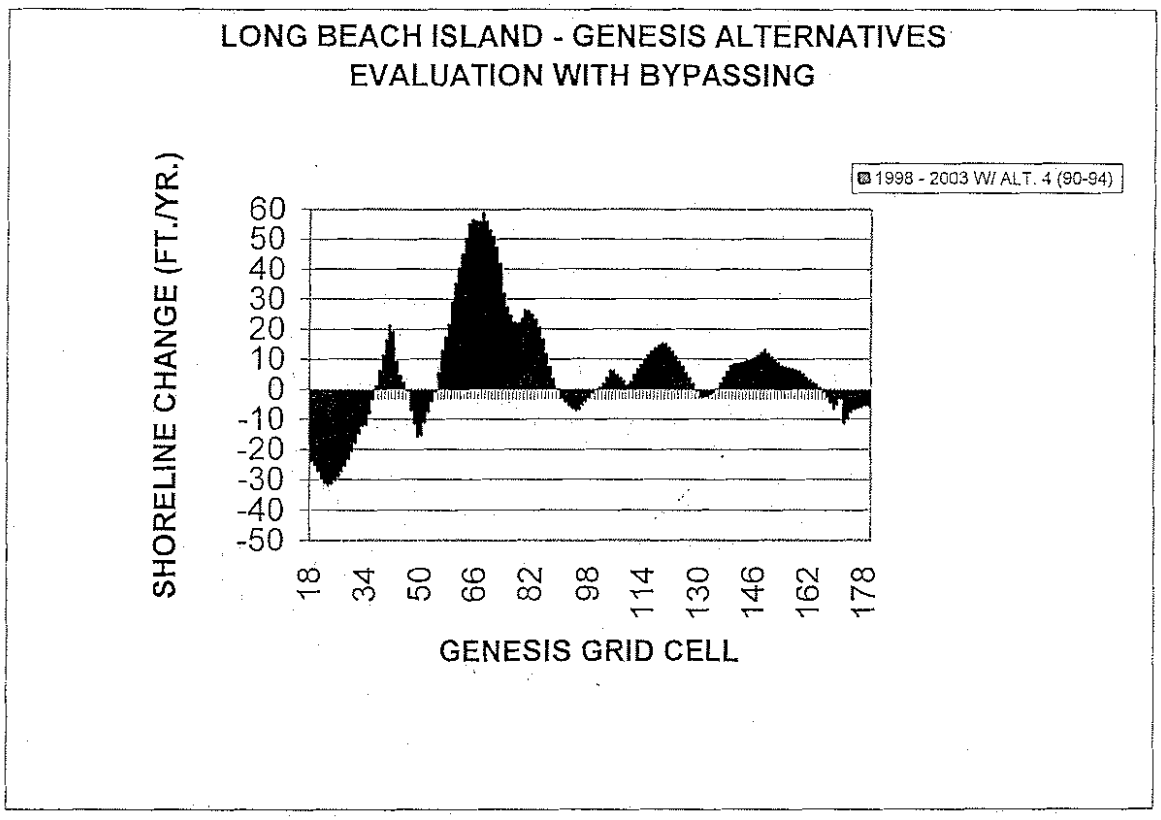

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
1998 - 2003 W/ ALT. 4 (90-94)
SHORELINE CHANGE (FT./YR.)
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
34
50
66
82
98
114
130
146
162
178
GENESIS GRID CELL

Figure 2-56

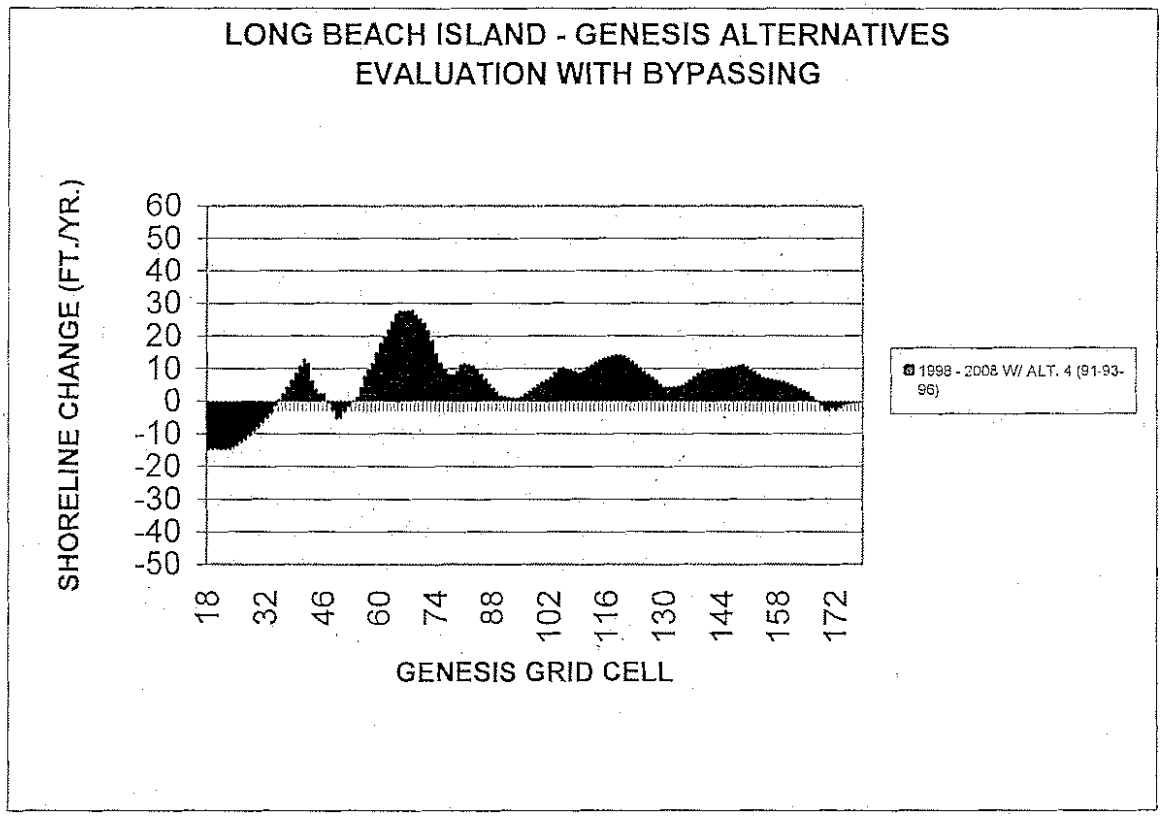

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE (FT./YR.)
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
32
46
60
74
88
102
116
130
144
158
172
GENESIS GRID CELL
1998 - 2008 W/ ALT. 4 (91-93-96)

Figure 2-57

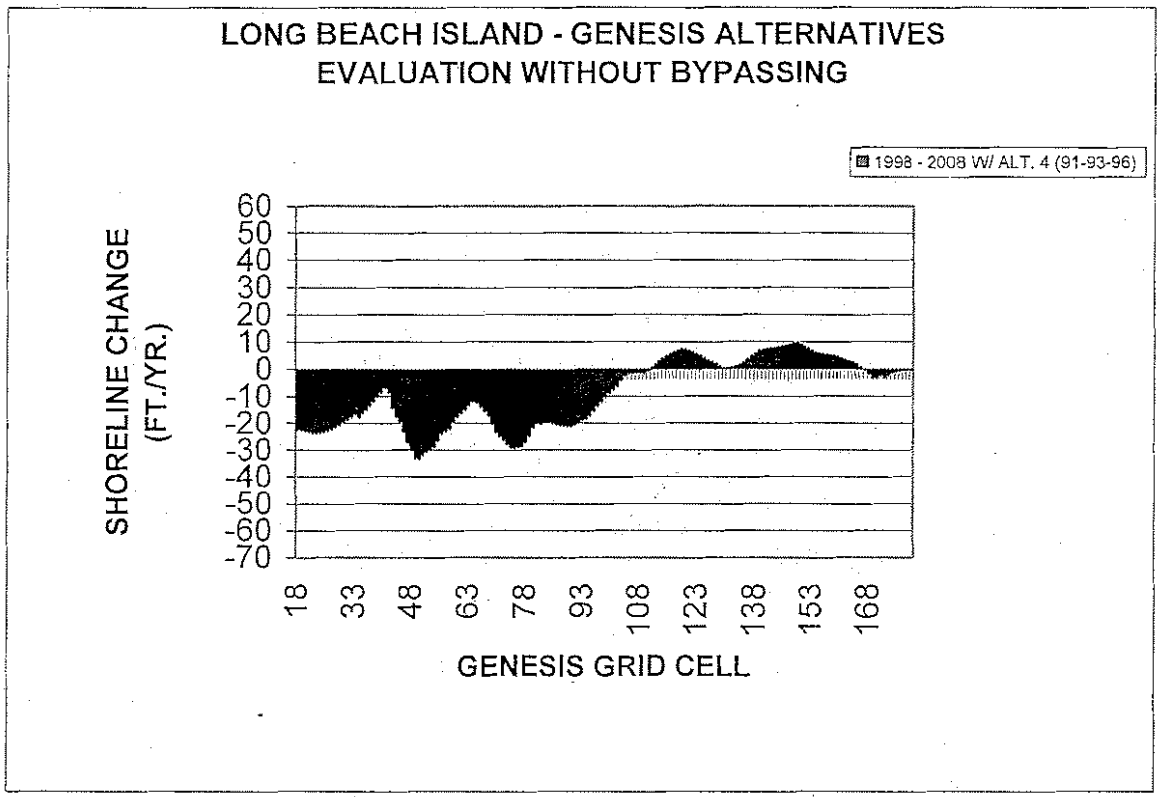
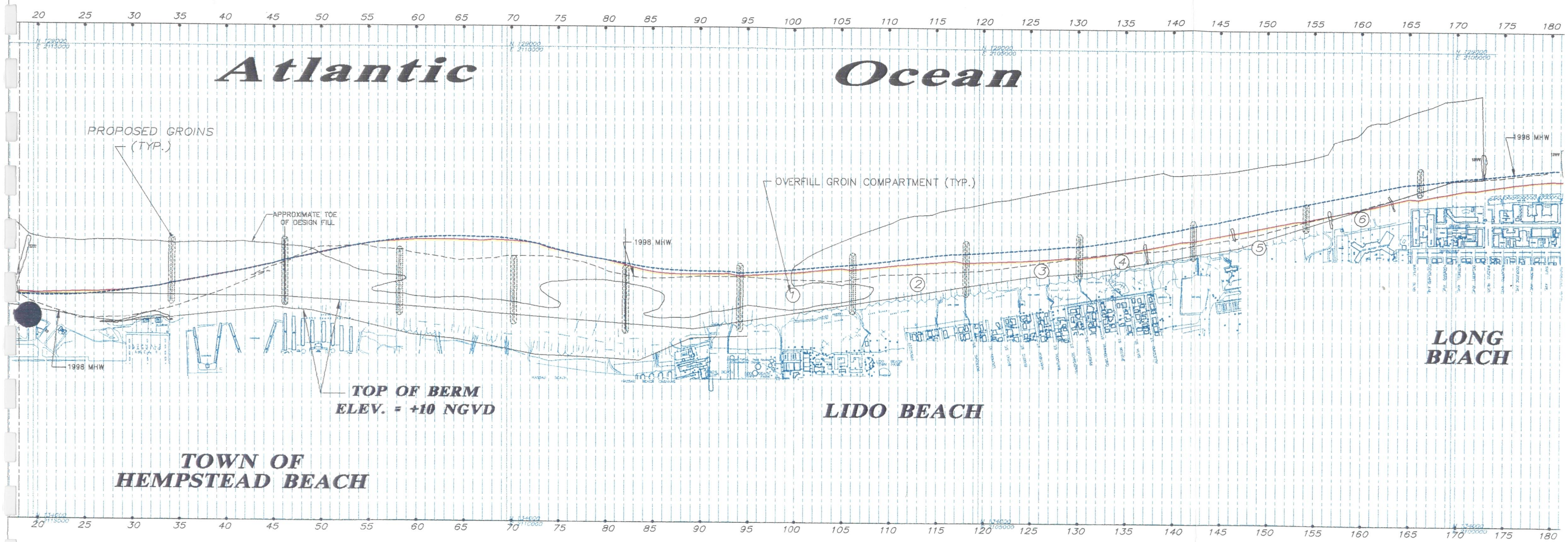

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITHOUT BYPASSING
1998 - 2008 W/ ALT. 4 (91-93-96)
SHORELINE CHANGE
(FT./YR.)
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
18
33
48
63
78
93
108
123
138
153
168
GENESIS GRID CELL

Figure 2-58

CORPS OF ENGINEERS

U.S. ARMY



LEGEND

MEASURED MHW – 1998 ----------

CALCULATED 2003 MHW WITHOUT PROJECT WITH BYPASSING. ————

CALCULATED 2003 MHW WITH ALT. – 3D WITH BYPASSING. ----------

SCALE : ONE INCH = 1000 FEET

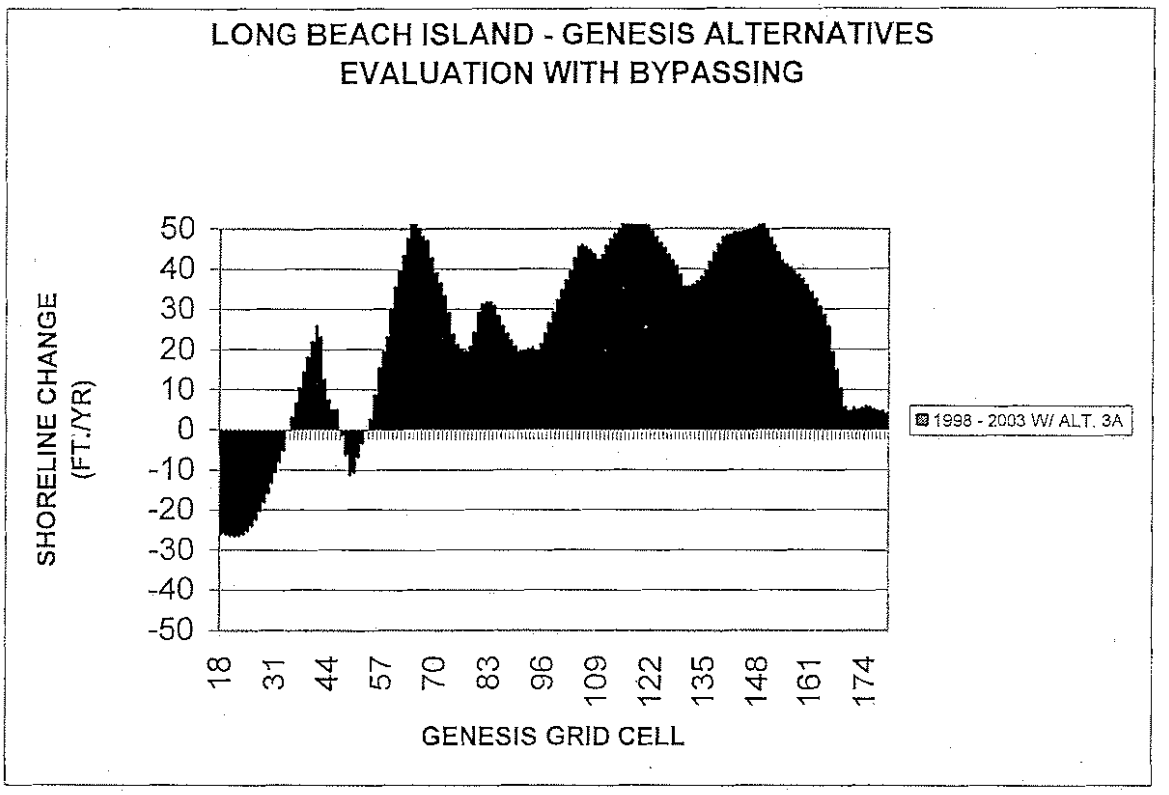
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.
(JOINT VENTURE)

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
ALTERNATIVE PLAN 3A – 3D
BEACH NOURISHMENT
WITH TWELVE (12) GROINS AT
1200 FT INTERVALS
WITH TAPERED TRANSITION AT
WESTERLY END

NASSAU COUNTY NEW YORK

Figure 2-59


LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE
(FT./YR)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 3A

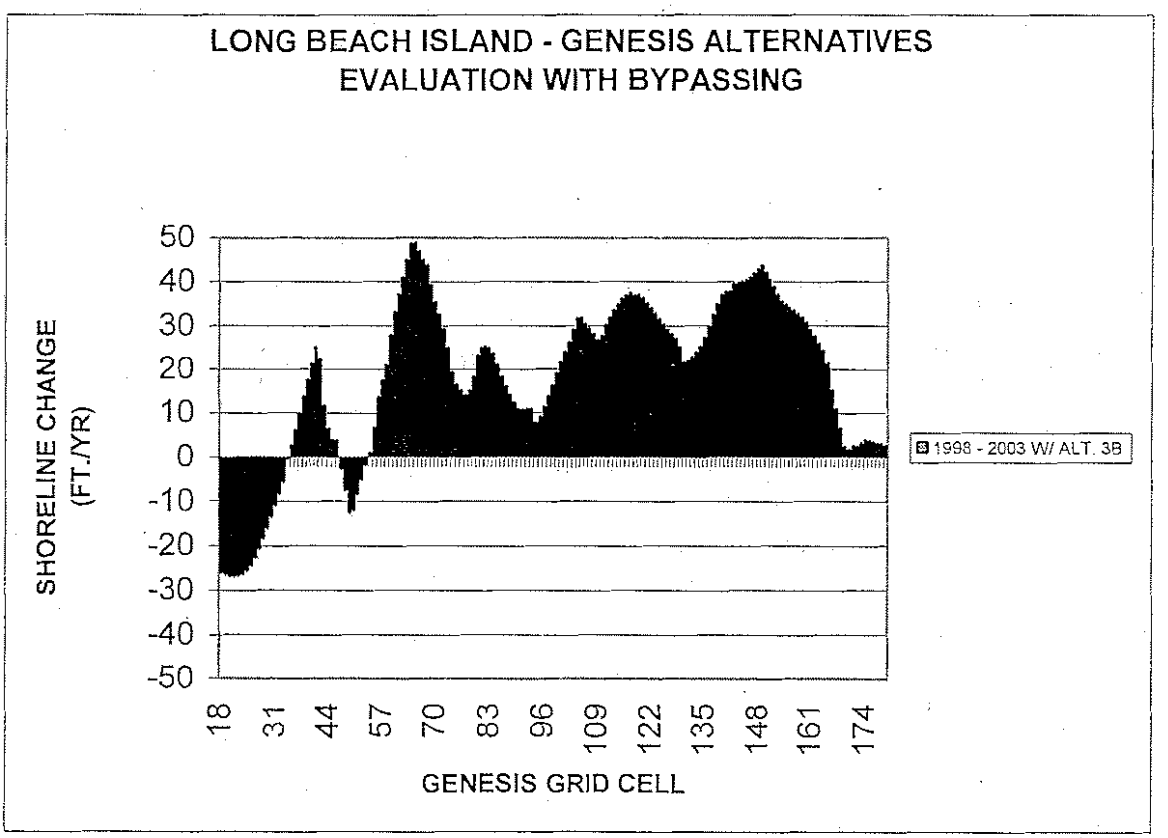
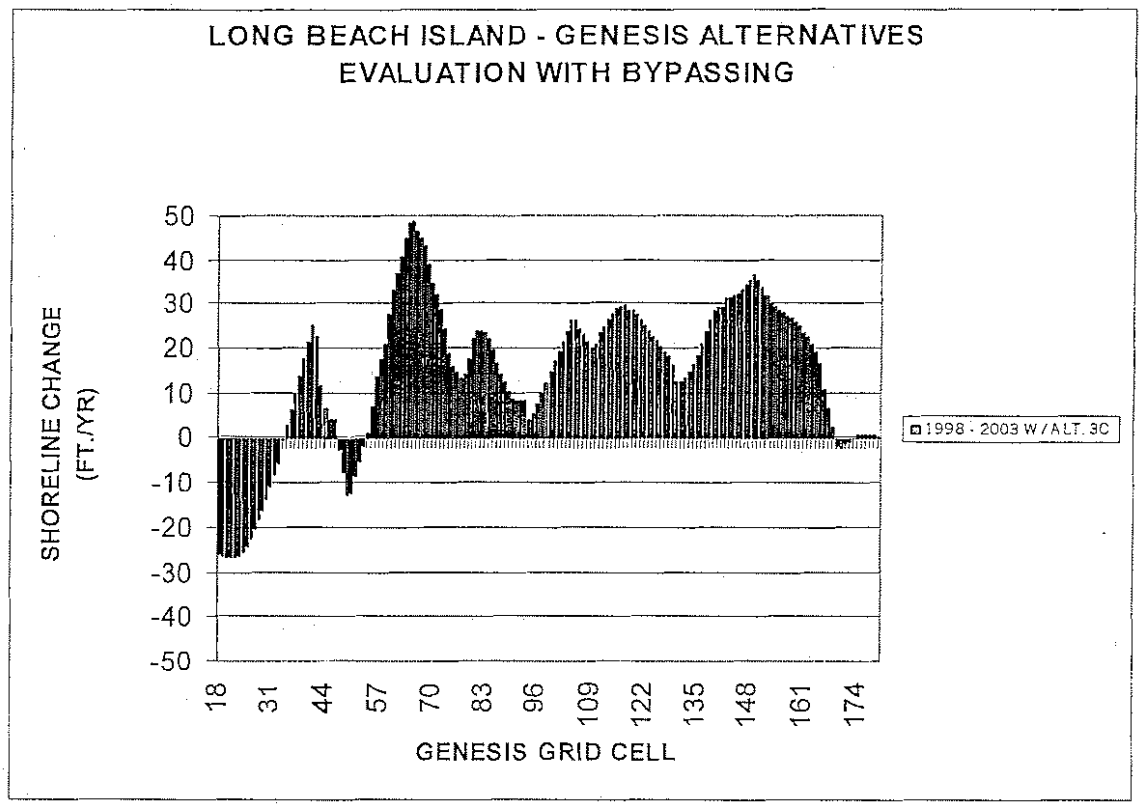

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE
(FT./YR)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 3B

Figure 2-60


LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE
(FT./YR)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ALT. 3C

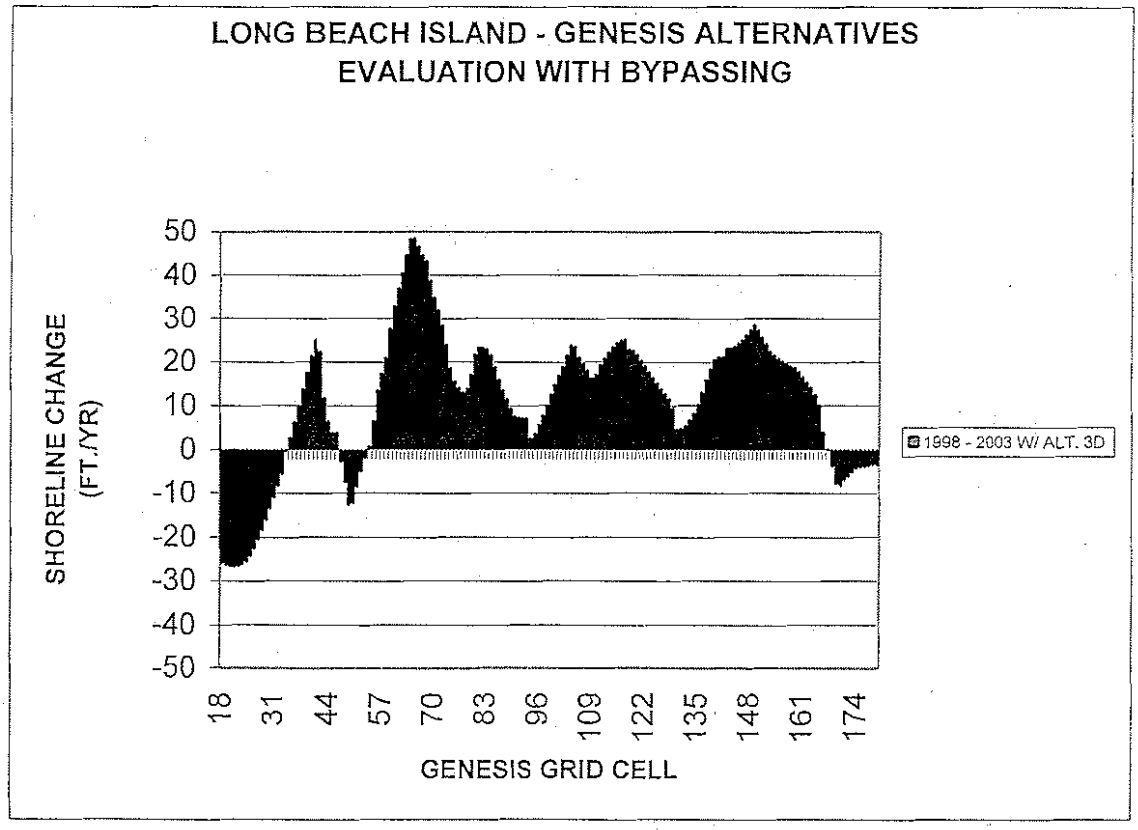

LONG BEACH ISLAND - GENESIS ALTERNATIVES
EVALUATION WITH BYPASSING
SHORELINE CHANGE
(FT./YR)
50
40
30
20
10
0
-10
-20
-30
-40
-50
18
31
44
57
70
83
96
109
122
135
148
161
174
GENESIS GRID CELL
1998 - 2003 W/ ALT. 3D

Figure 2-61

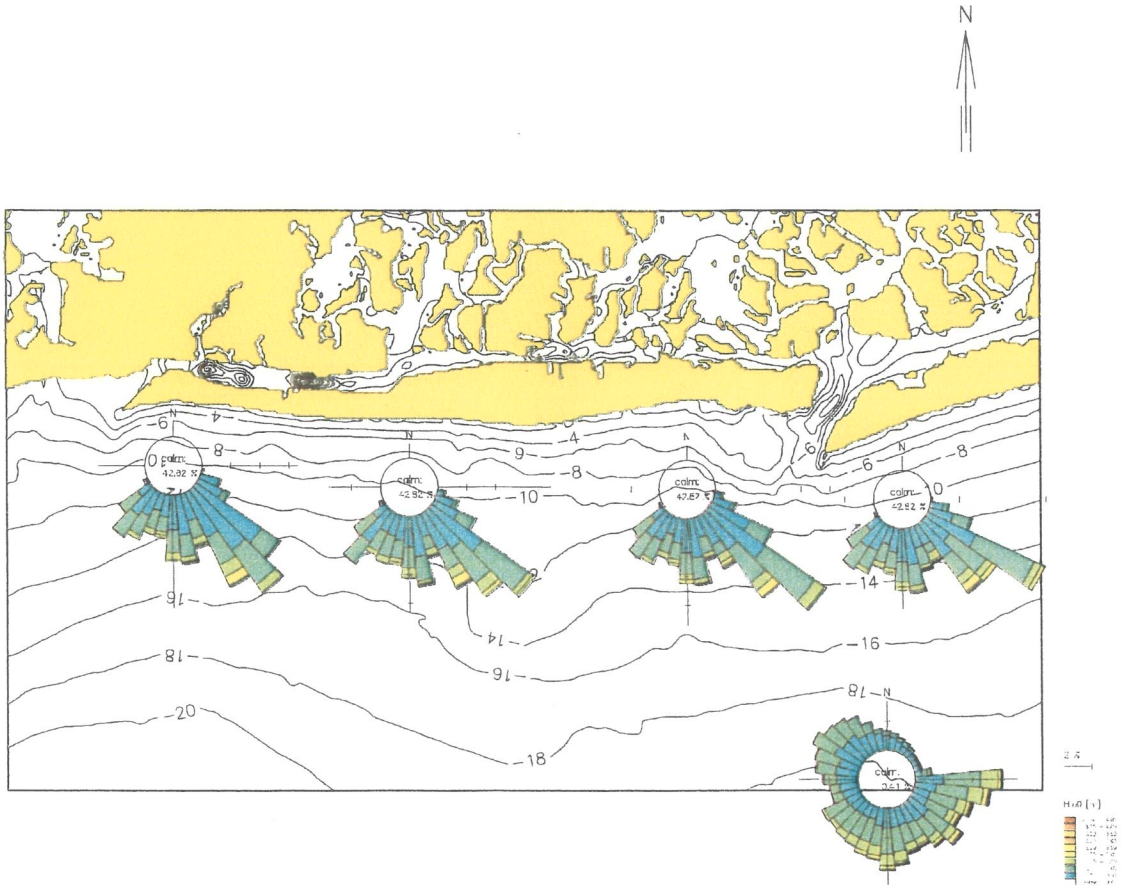


Figure 2-62 **NSW Coverage Area. Transformed wave roses shown for representative locations. Depths shown are in meters.**

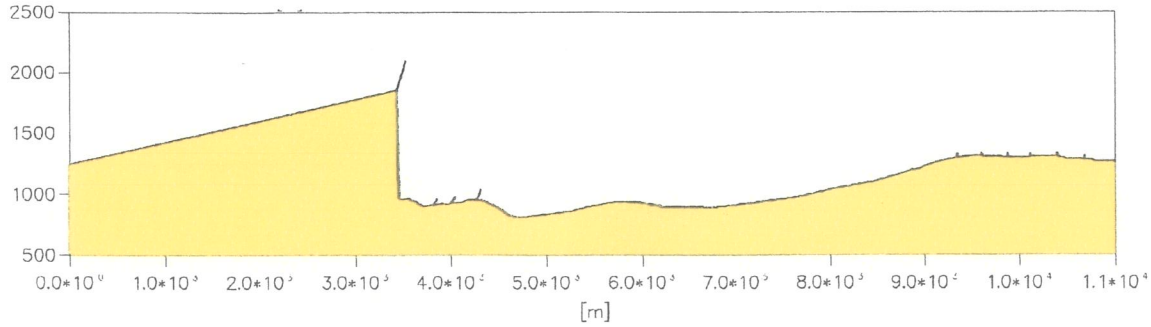


Figure 2-63 **Area included in LITPACK simulations**

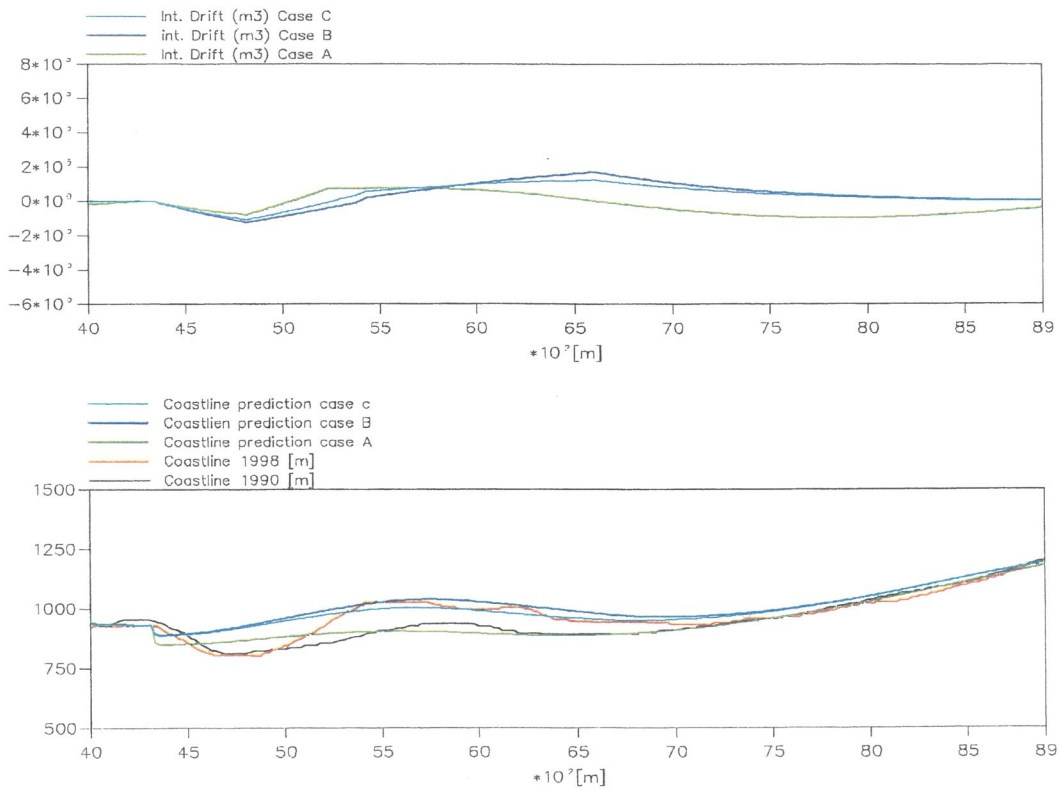


Figure 2-64 **Calibration of LITLINE while varying bypassing rates. (Case A is no bypassing via ebb shoal, Case B is 125,000 cubic meters per year, and Case C is 250,000 cubic meters per year).**

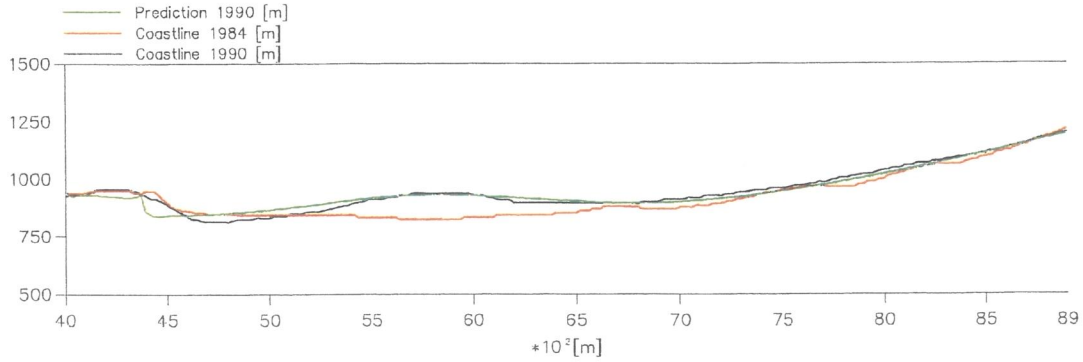


Figure 2-65 **Shoreline change prediction using LITPACK for verification period**

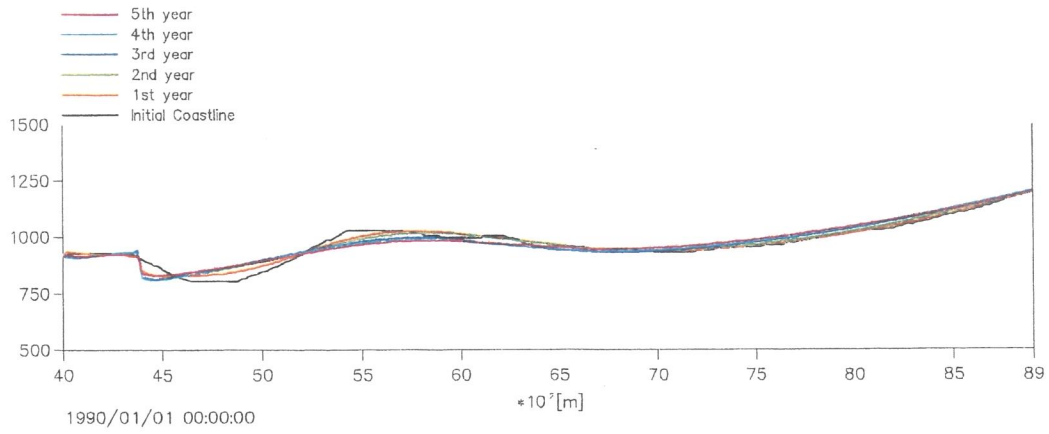


Figure 2-66 **Shoreline predictions using LITLINE for without project condition**

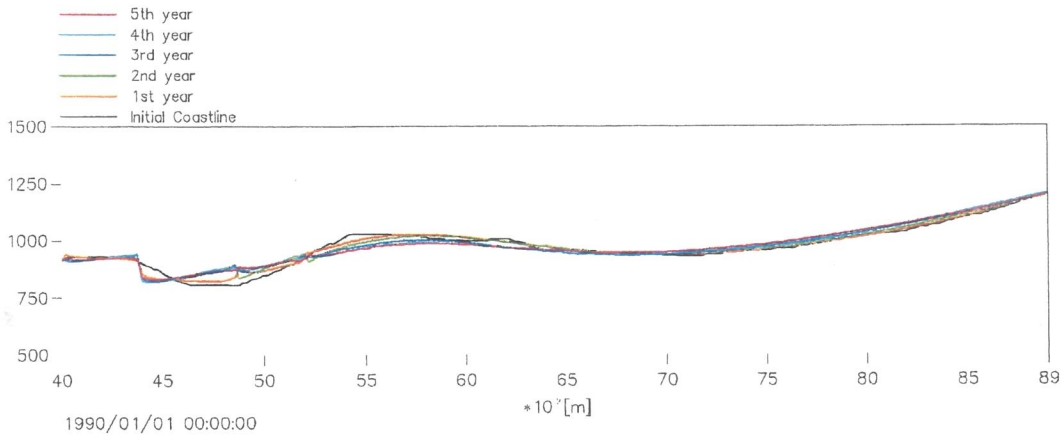


Figure 2-67 **Shoreline predictions using LITLINE for Alternative 2**

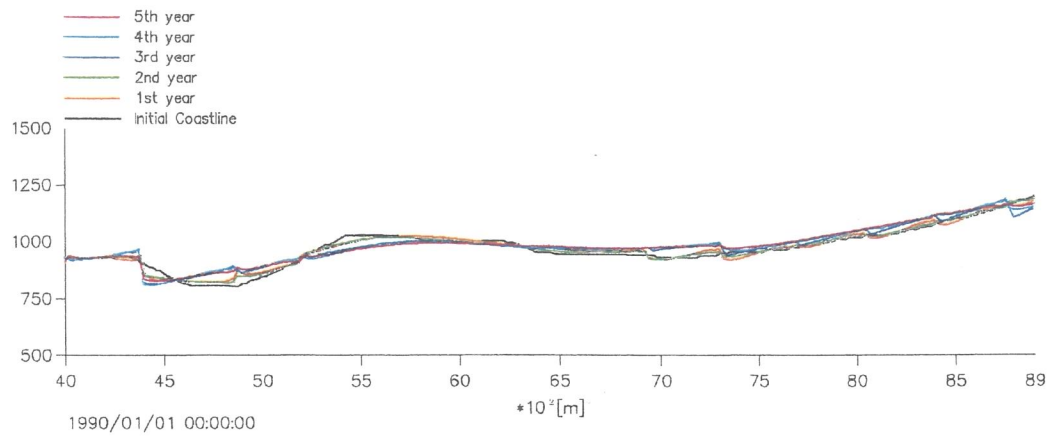


Figure 2-68 **Shoreline predictions using LITLINE for Alternative 3**

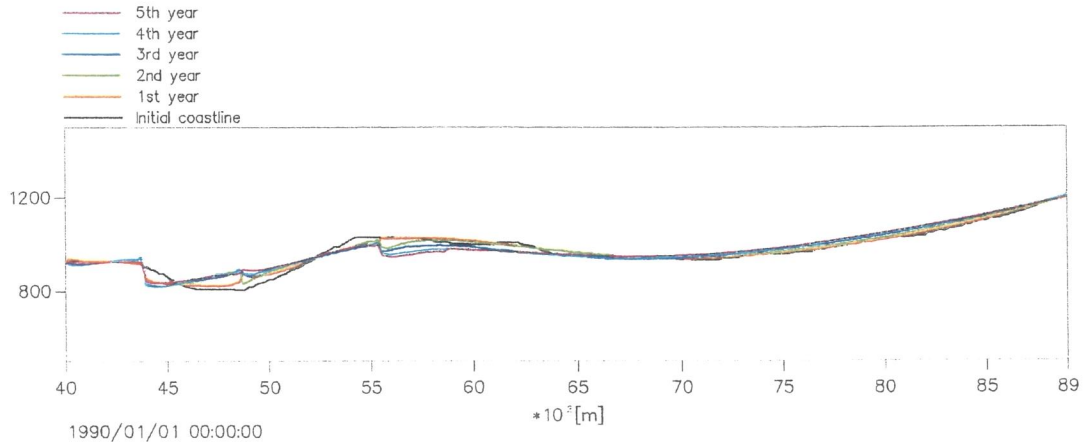


Figure 2-69 **Shoreline predictions using LITLINE for Alternative 4**

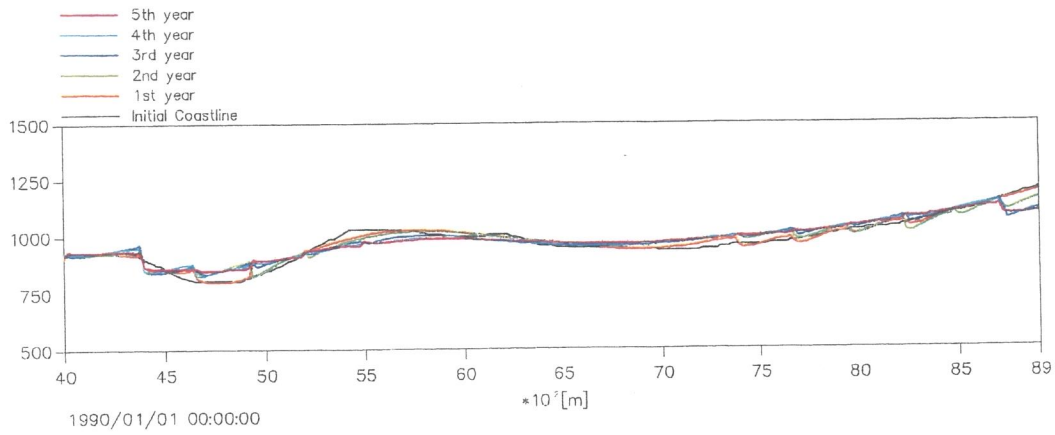


Figure 2-70 **Shoreline predictions using LITLINE for Alternative 5**

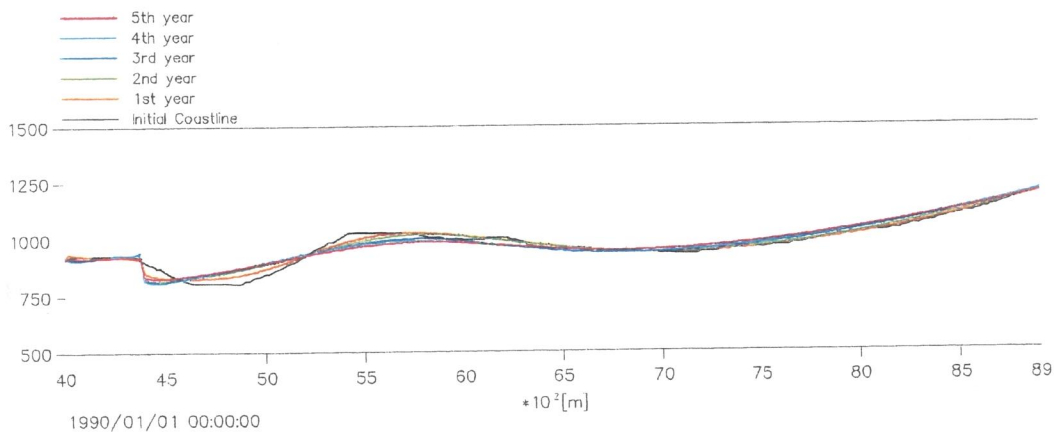


Figure 2-71 **Shoreline predictions using LITLINE for Alternative 6**

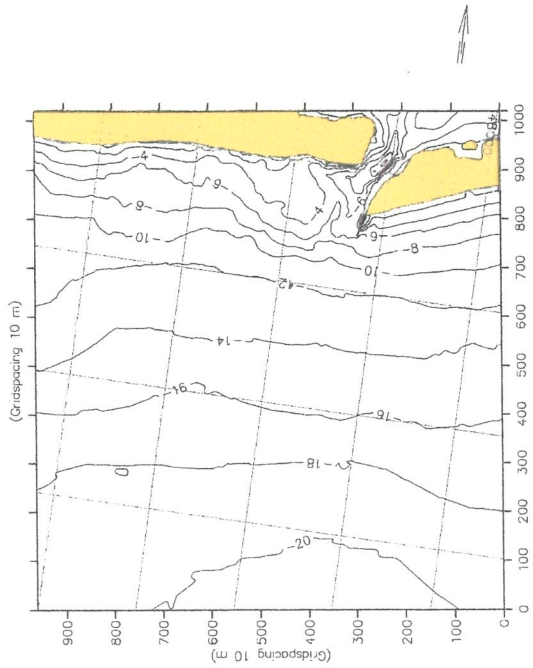
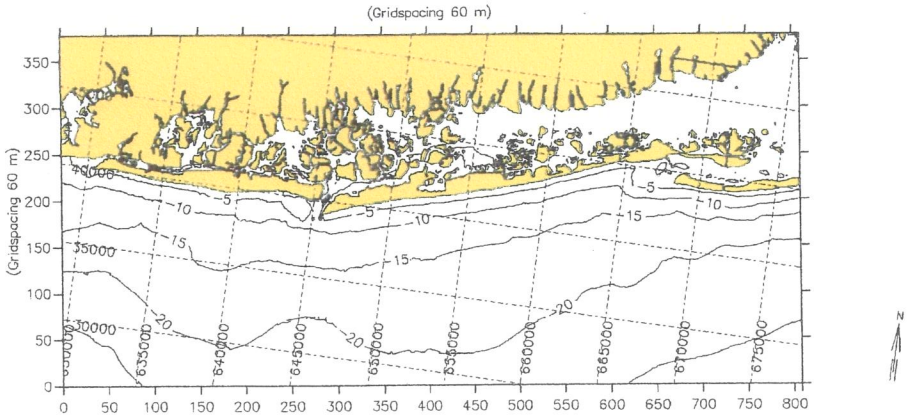


Figure 2-72 **Local wave model area**



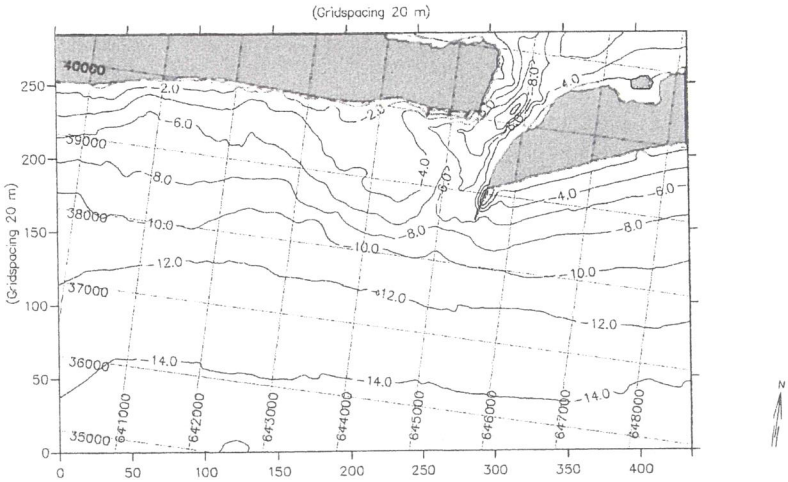


Figure 2-73 (upper) and Figure 2-74 (lower): Regional (60m grid) and Local (20m grid) modeled areas for hydrodynamic flow model

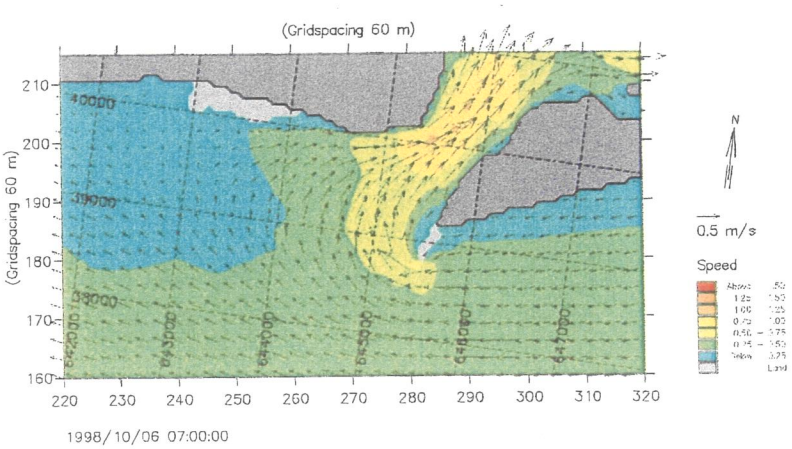


Figure 2-75 **Calculated tidal flow pattern on 06-Oct-98 07:00:00**

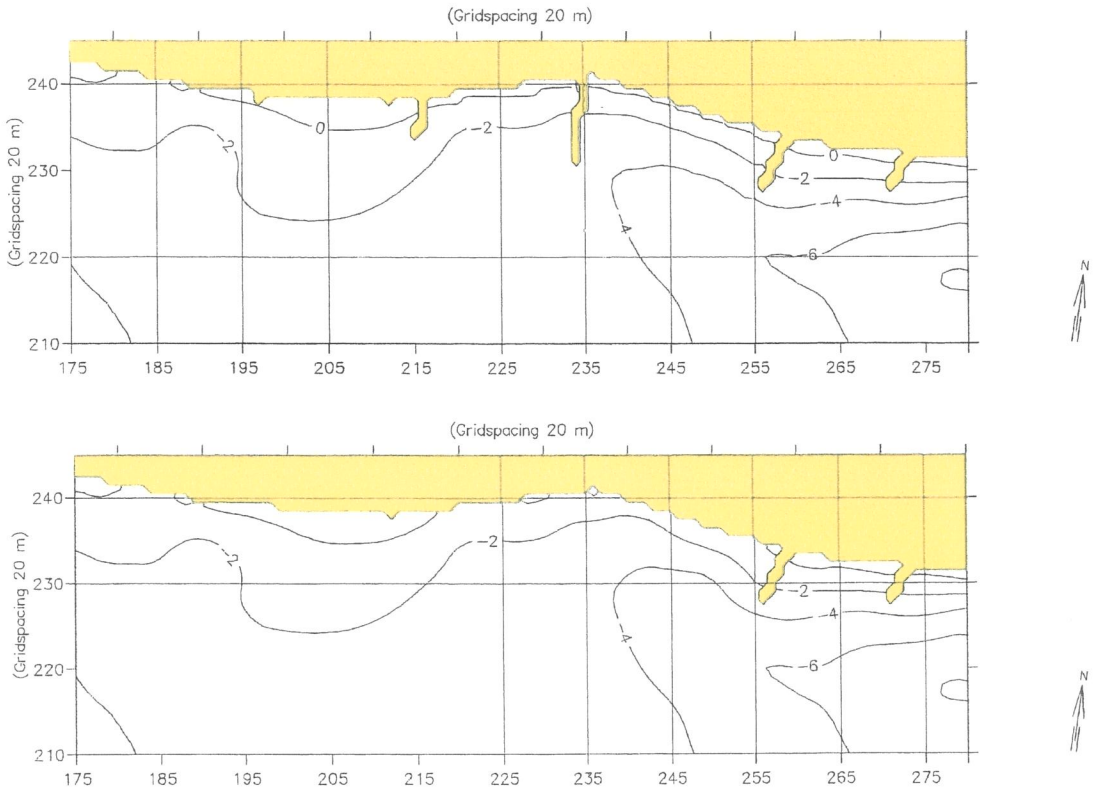


Figure 2-76 **Bathymetry and structure locations for existing (1998) conditions (lower map) and for the Feasibility Plan alternative (upper map). Note that the structures in the Feasibility Plan in the weldment area are "buried", i.e. are landward of the 1998 shoreline location.**

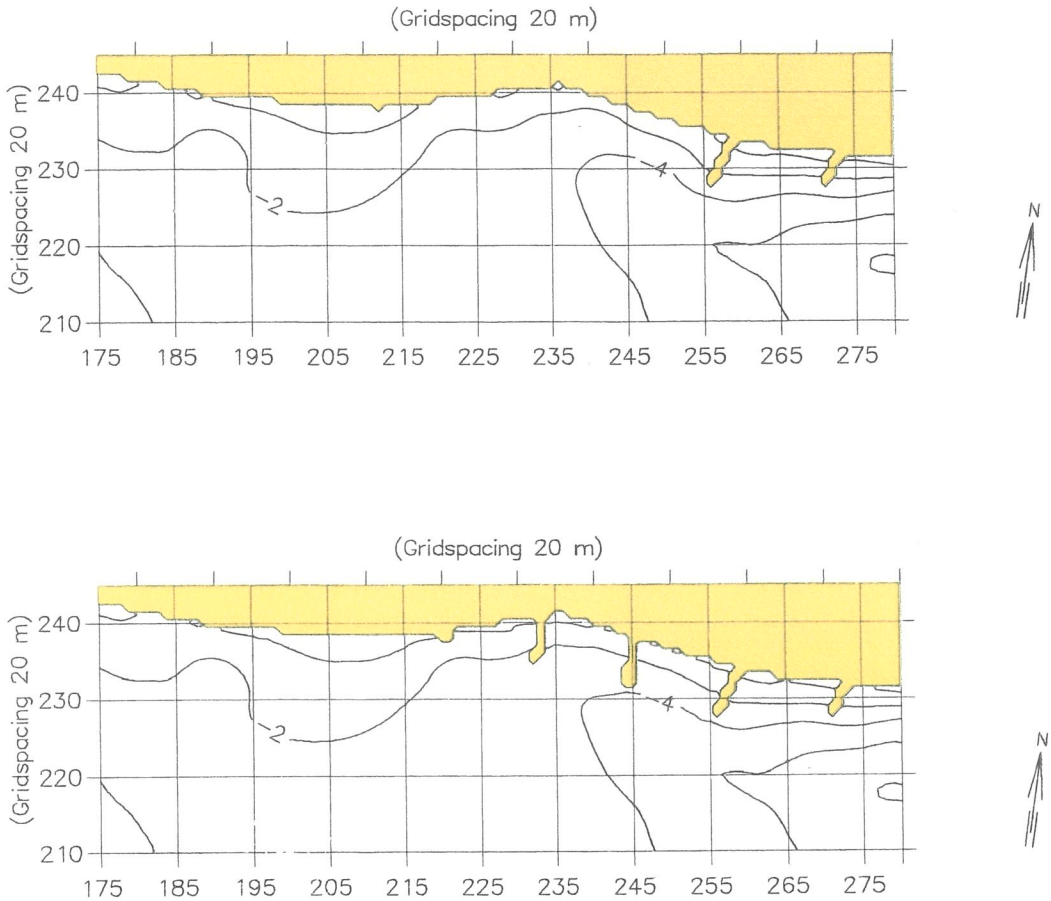


Figure 2-77 **Bathymetry specified for MIKE21 for the present-day (1998) conditions (upper plot) and for Alternative 4a (lower plot)**

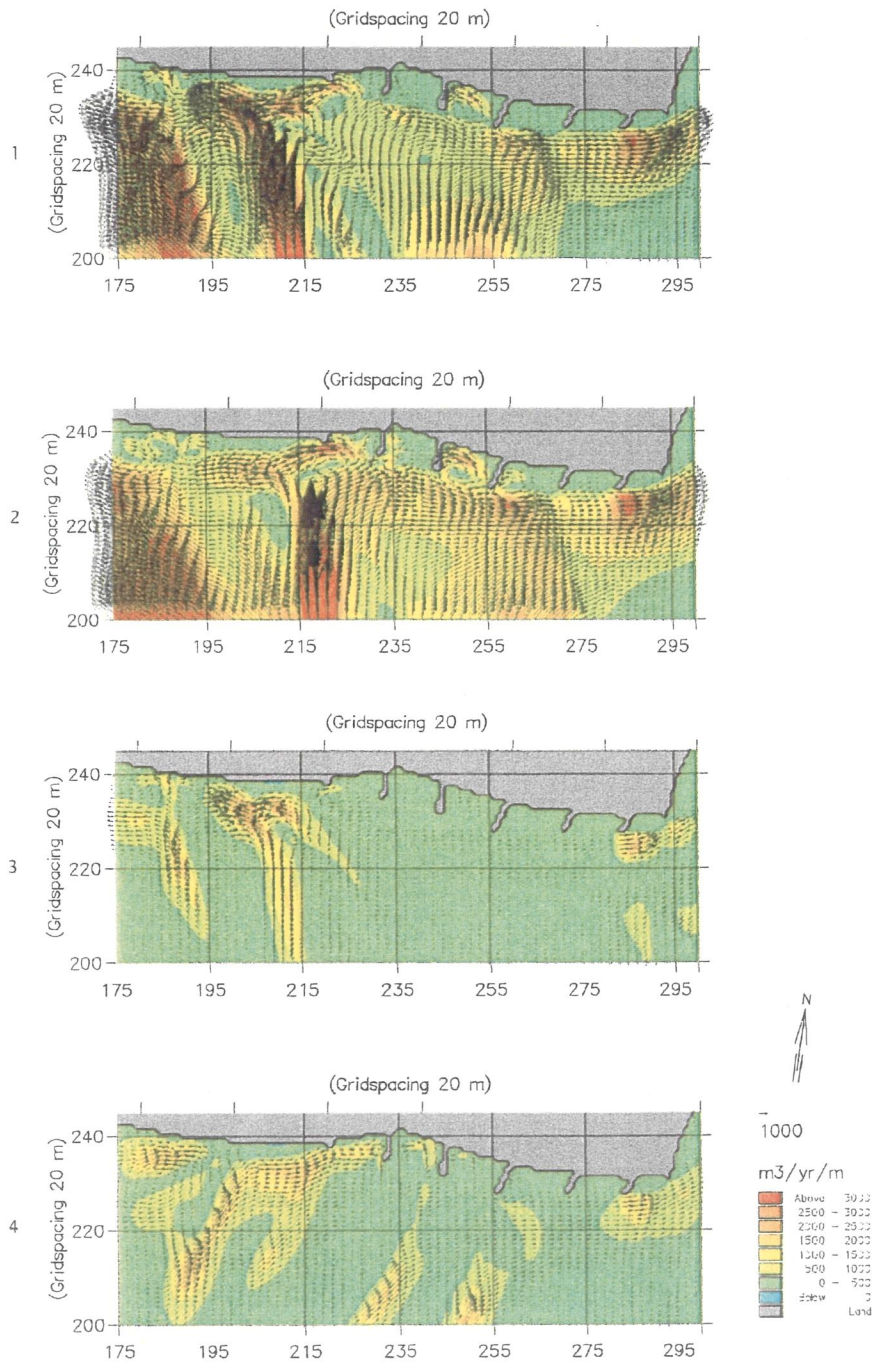


Figure 2-78 **Averaged sediment transport rates averaged over two tidal cycles for wave conditions 1 to 4. (Alternative 4a).**

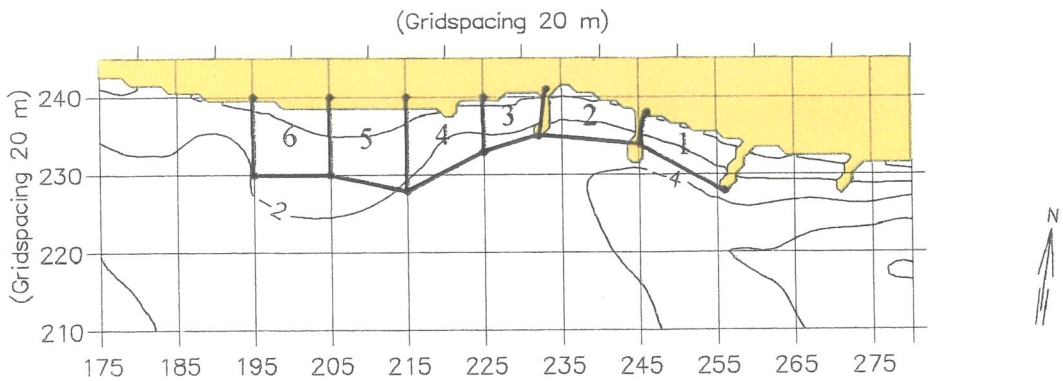


Figure 2-79 **The sediment budget cells for Alternative 4a.**

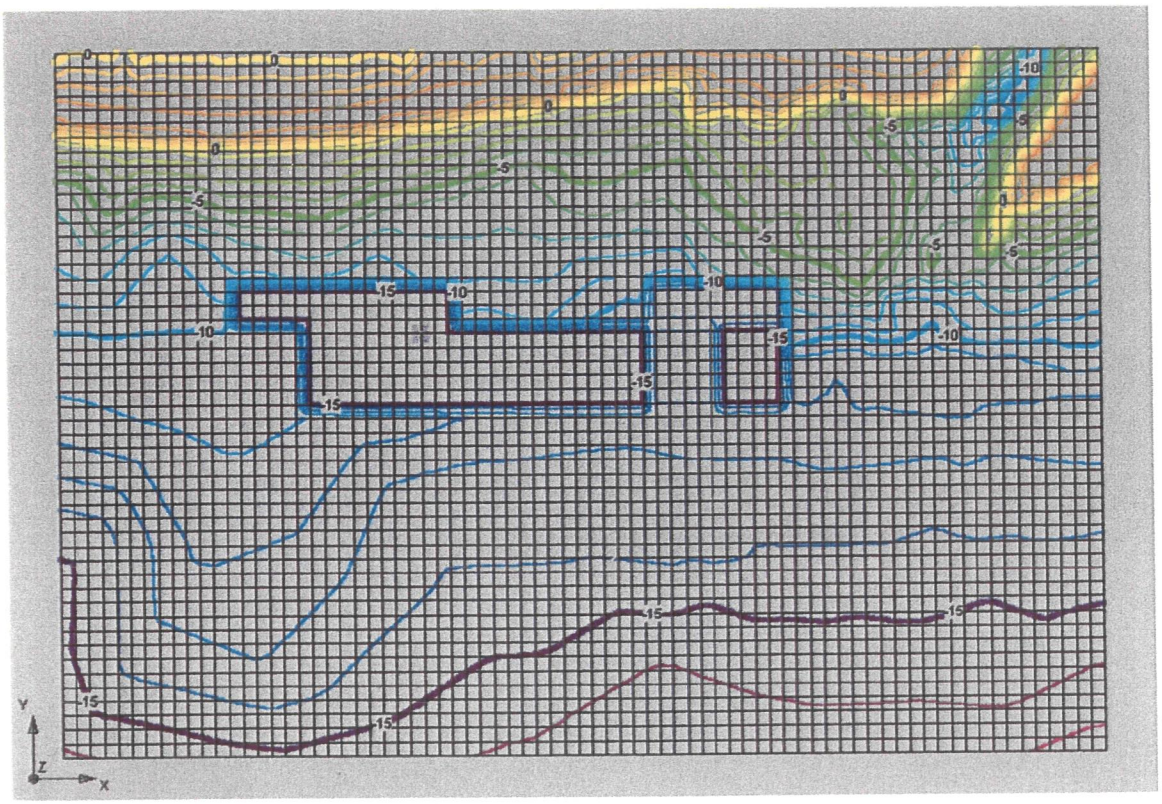


Figure 2-80 **STWAVE grid with Borrow Case 1**

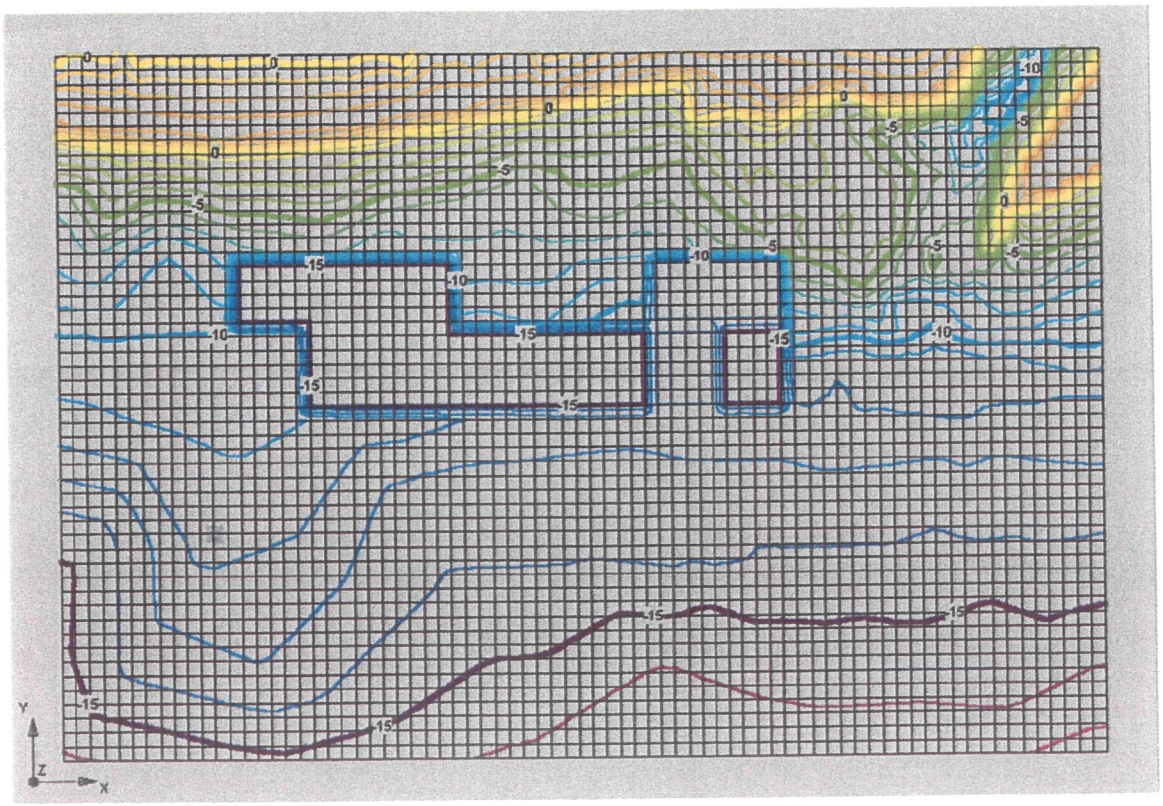
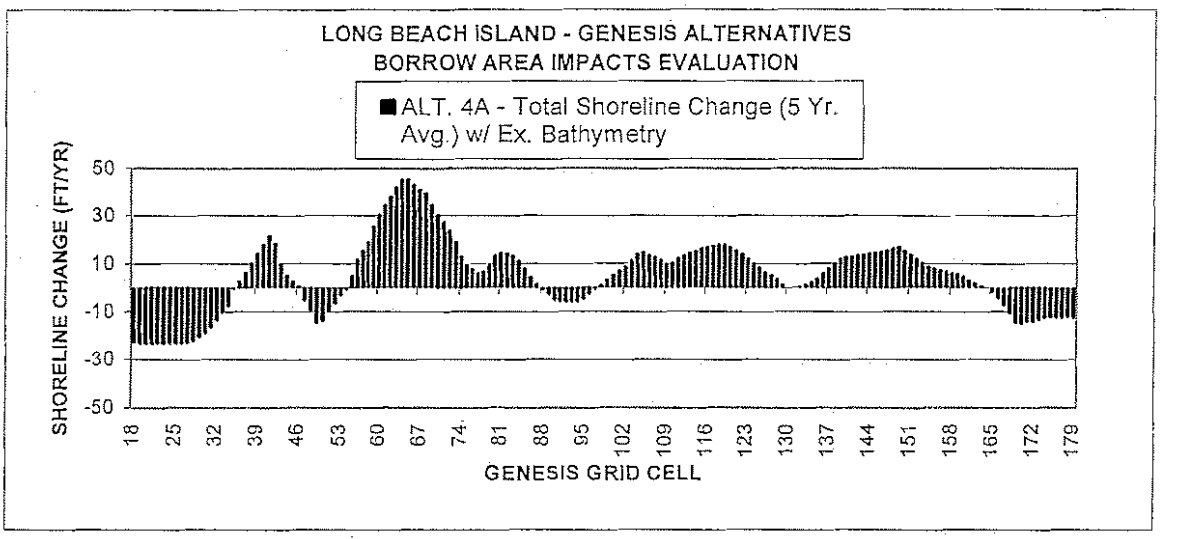
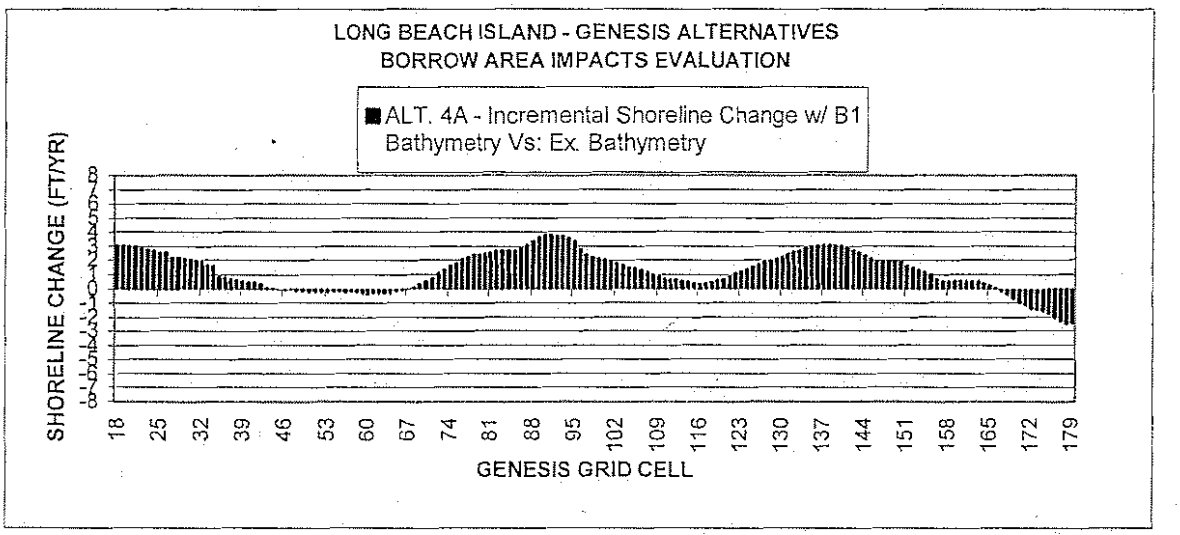


Figure 2-81 **STWAVE grid with Borrow Case 2**


LONG BEACH ISLAND - GENESIS ALTERNATIVES
BORROW AREA IMPACTS EVALUATION
ALT. 4A - Total Shoreline Change (5 Yr. Avg.) w/ Ex. Bathymetry
SHORELINE CHANGE (FT/YR)
50
30
10
-10
-30
-50
18 25 32 39 46 53 60 67 74 81 88 95 102 109 116 123 130 137 144 151 158 165 172 179
GENESIS GRID CELL


LONG BEACH ISLAND - GENESIS ALTERNATIVES
BORROW AREA IMPACTS EVALUATION
ALT. 4A - Incremental Shoreline Change w/ B1 Bathymetry Vs: Ex. Bathymetry
SHORELINE CHANGE (FT/YR)
18 25 32 39 46 53 60 67 74 81 88 95 102 109 116 123 130 137 144 151 158 165 172 179
GENESIS GRID CELL

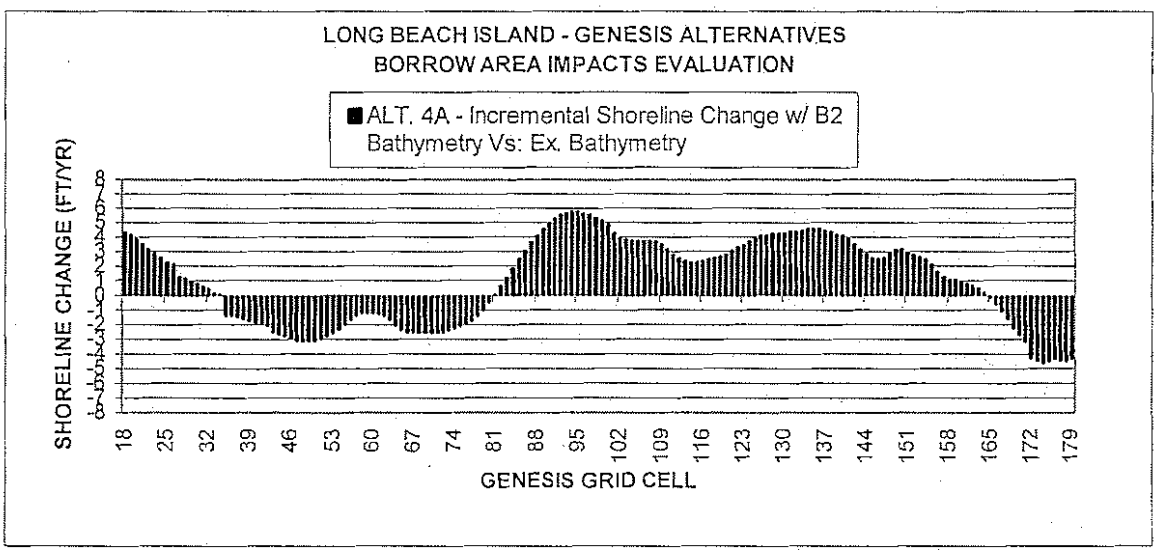
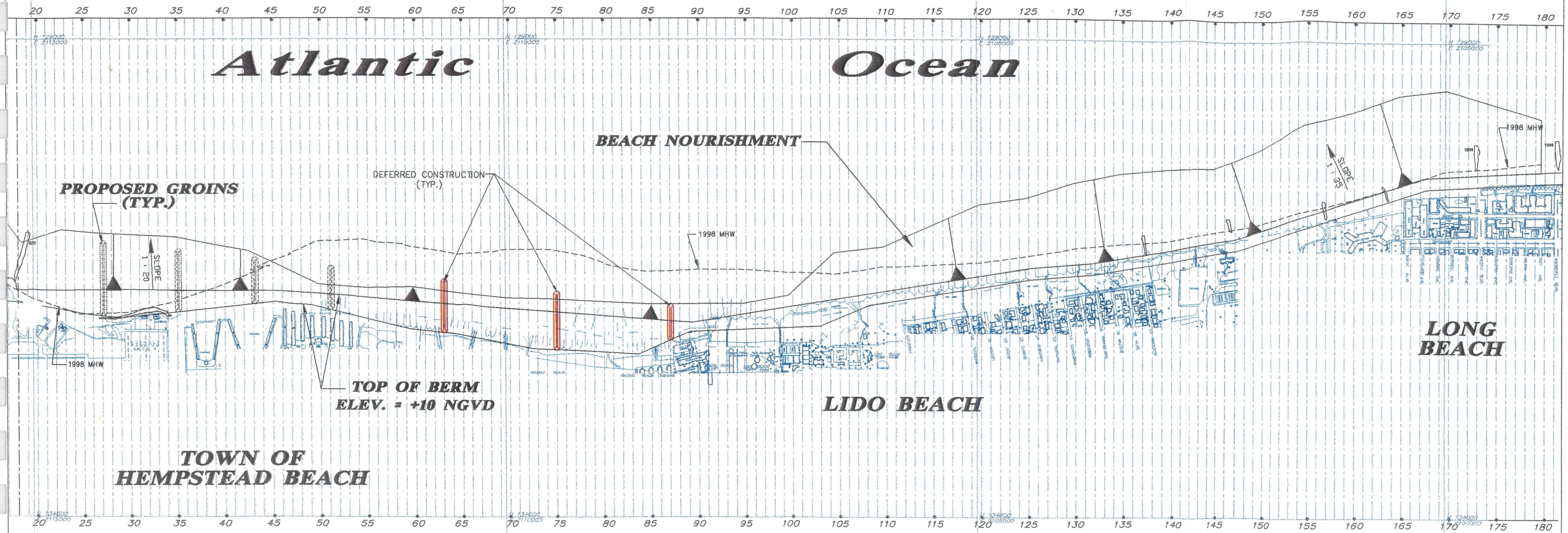

LONG BEACH ISLAND - GENESIS ALTERNATIVES
BORROW AREA IMPACTS EVALUATION
ALT. 4A - Incremental Shoreline Change w/ B2 Bathymetry Vs: Ex. Bathymetry
SHORELINE CHANGE (FT/YR)
18 25 32 39 46 53 60 67 74 81 88 95 102 109 116 123 130 137 144 151 158 165 172 179
GENESIS GRID CELL

Figure 2-82



LEGEND

MEASURED MHW – 1998 ----------

SCALE : ONE INCH = 1000 FEET

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
ALTERNATIVE PLAN 4A
BEACH NOURISHMENT
WITH SEVEN (7) GROINS
WITH TAPER

NASSAU COUNTY

Figure 2-83

NEW YORK

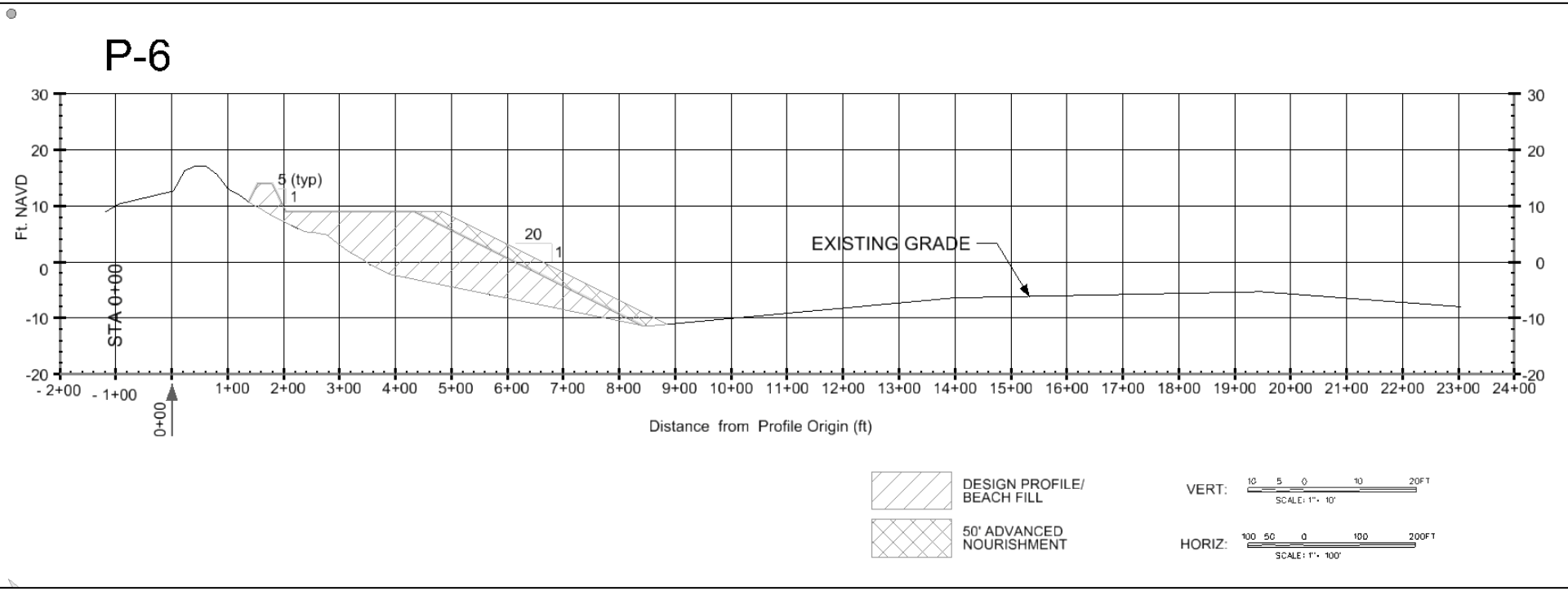


Figure 2-84: Typical Profile Pt. Lookout Reach

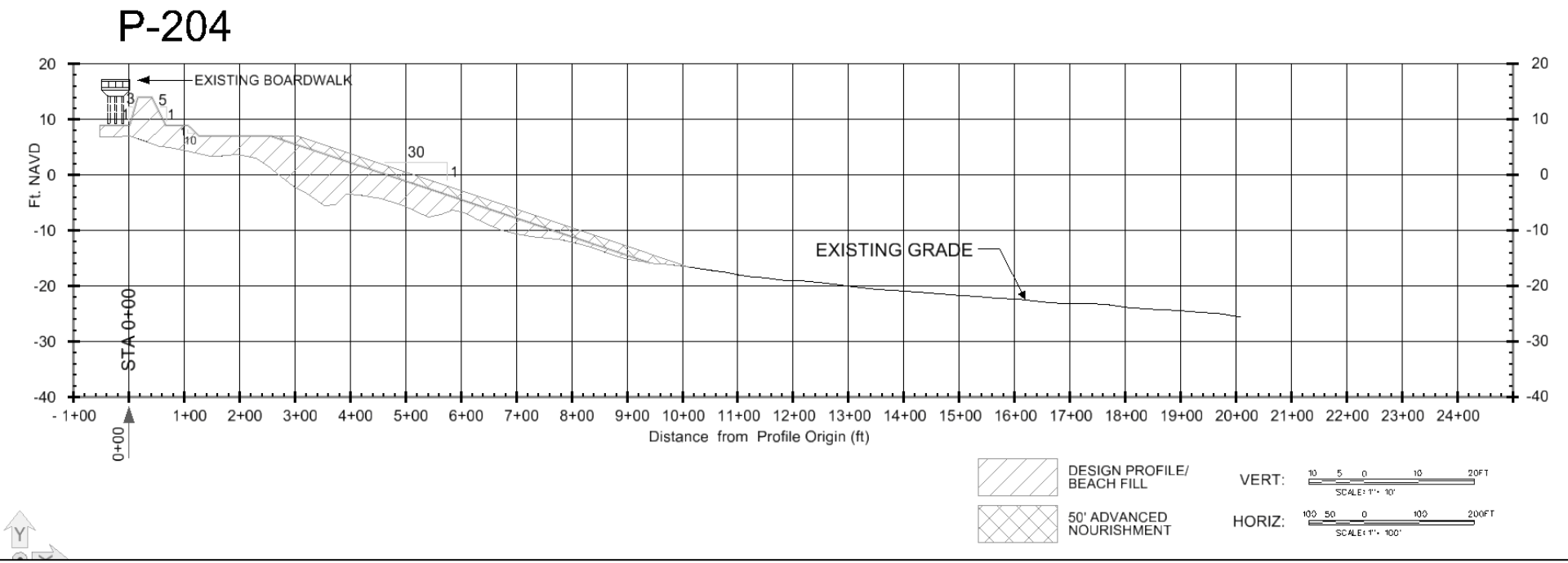
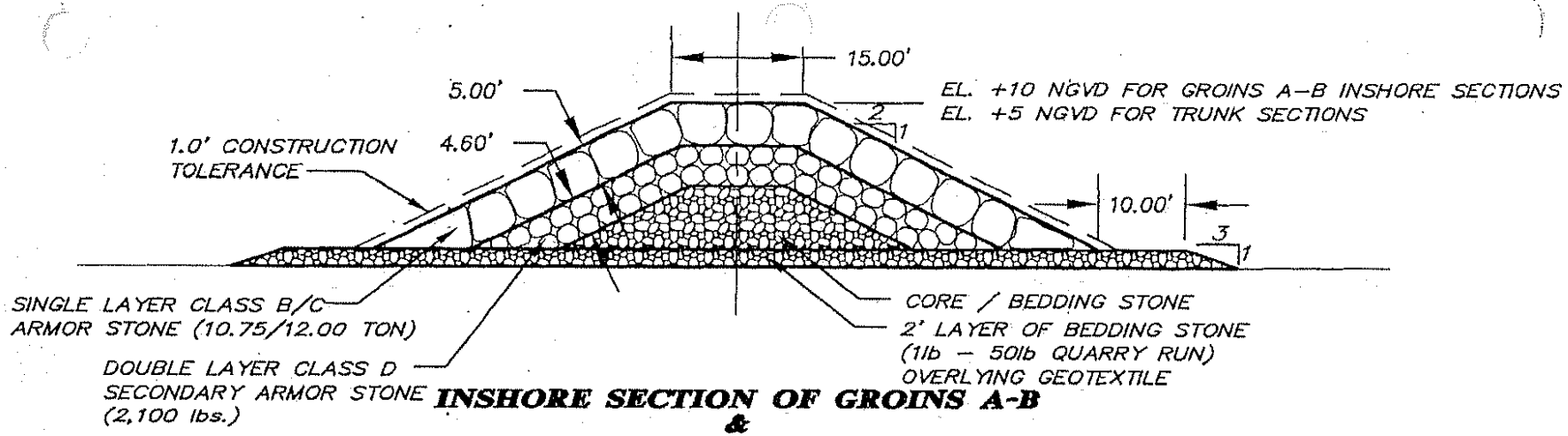
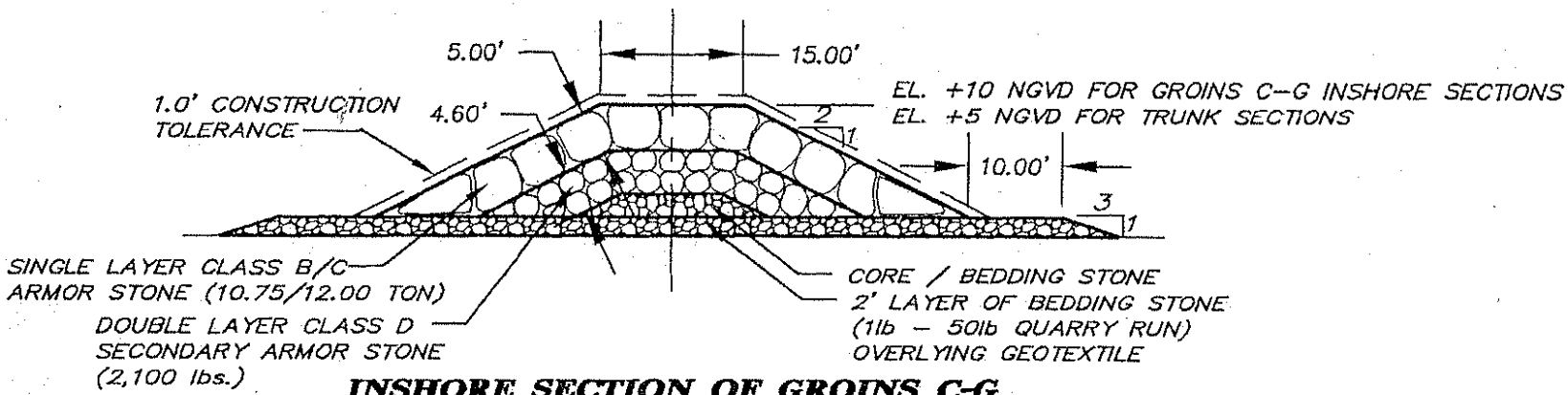


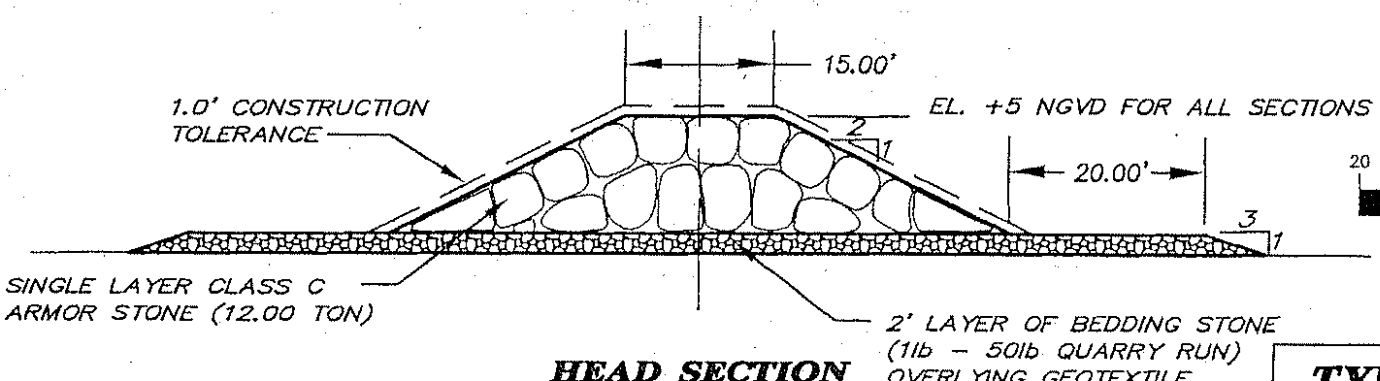
Figure 2-85: Typical Profile Long Beach/Lido Reach



INSHORE SECTION OF GROINS A-B
&
TRUNK SECTION OF GROINS A-B



INSHORE SECTION OF GROINS C-G
&
TRUNK SECTION OF GROINS C-G



HEAD SECTION

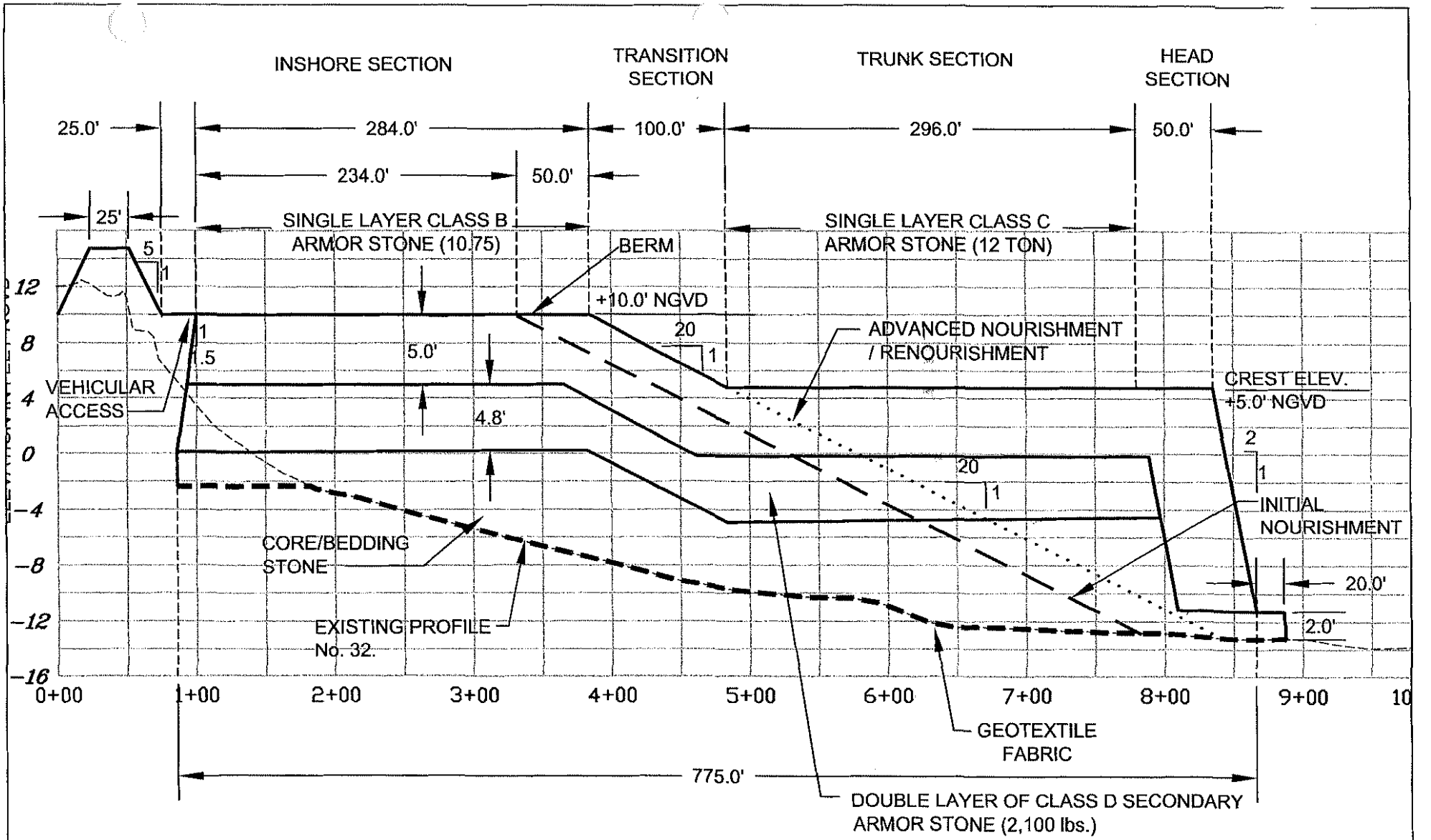
GRAPHIC SCALE

20 0 10 20

(IN FEET)
1 inch = 20 ft.

TYPICAL GROIN CROSS SECTIONS

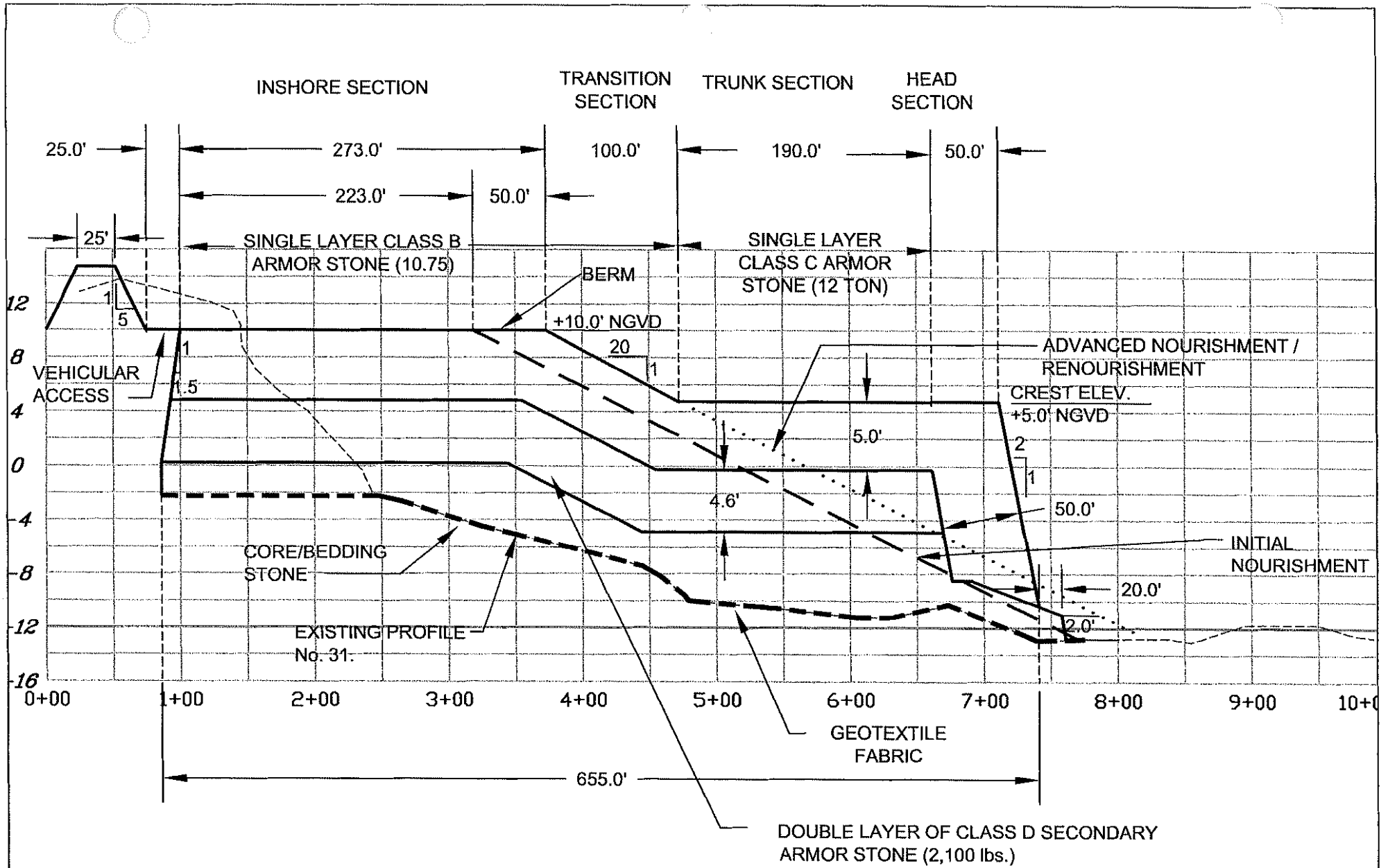
Figure 2-86



GROIN A

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

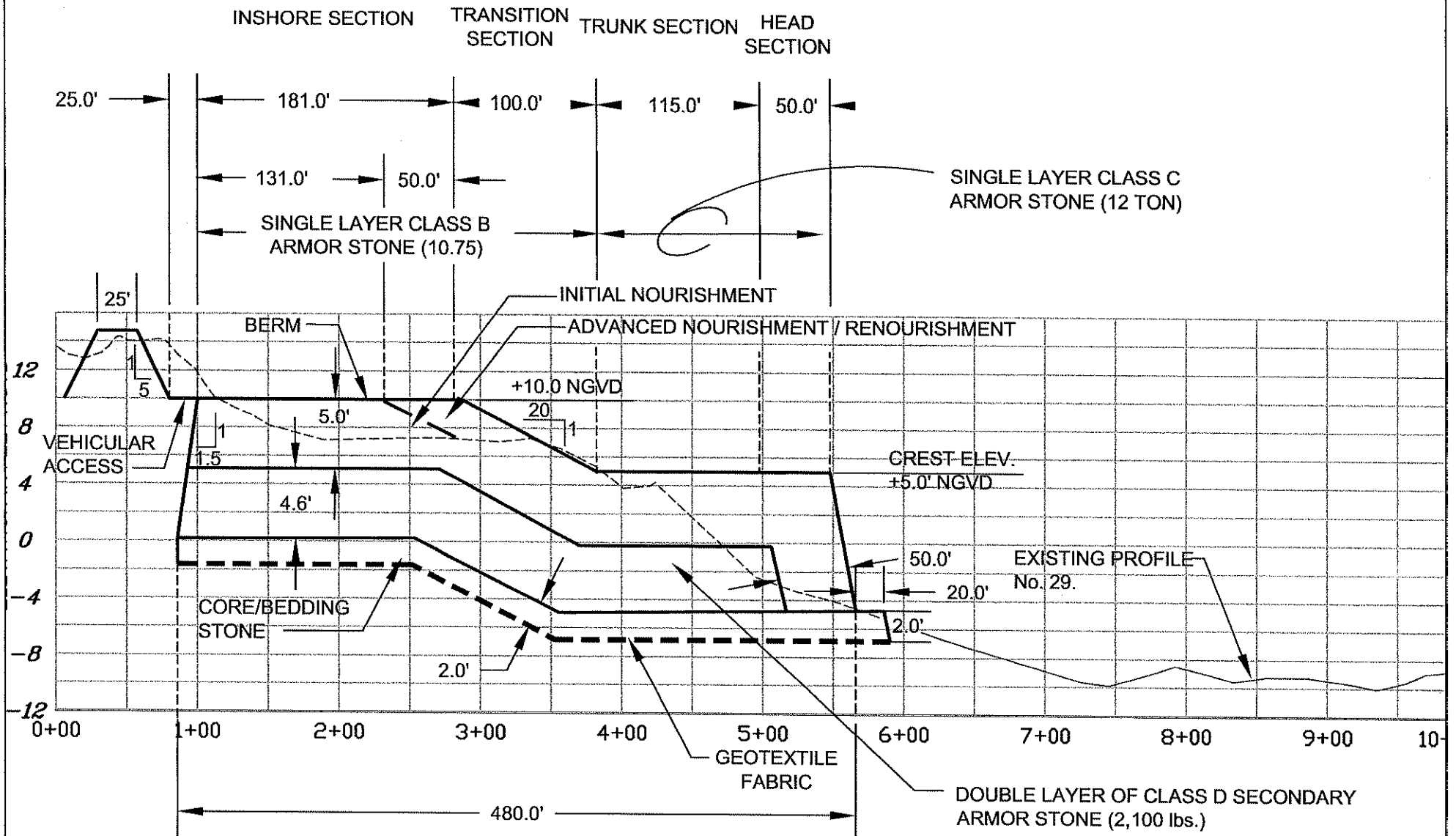
TYPICAL GROIN PROFILES
FIGURE NO. 2-87



GROIN B

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

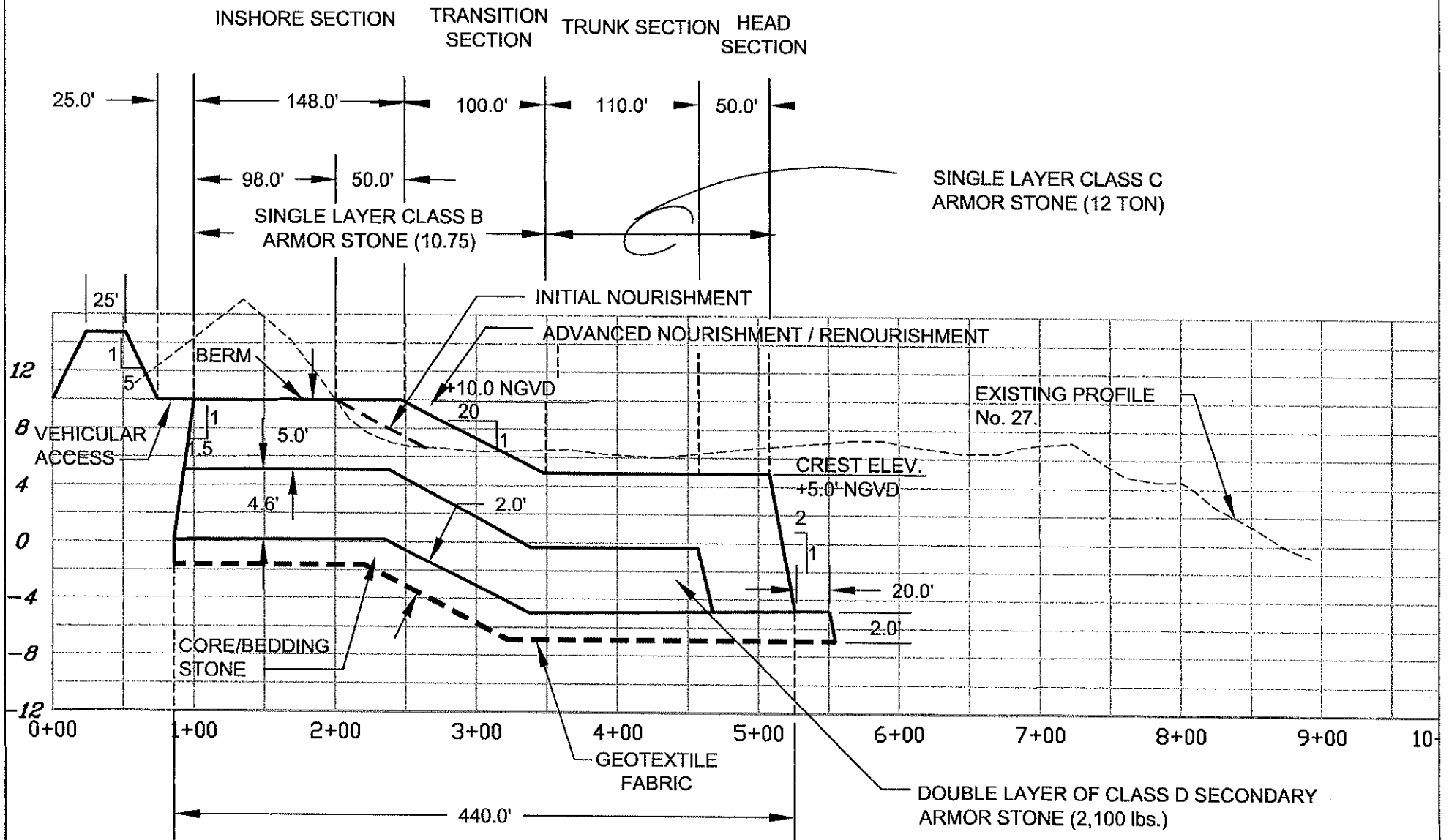
TYPICAL GROIN PROFILES
FIGURE NO. 2-88



GROIN C

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

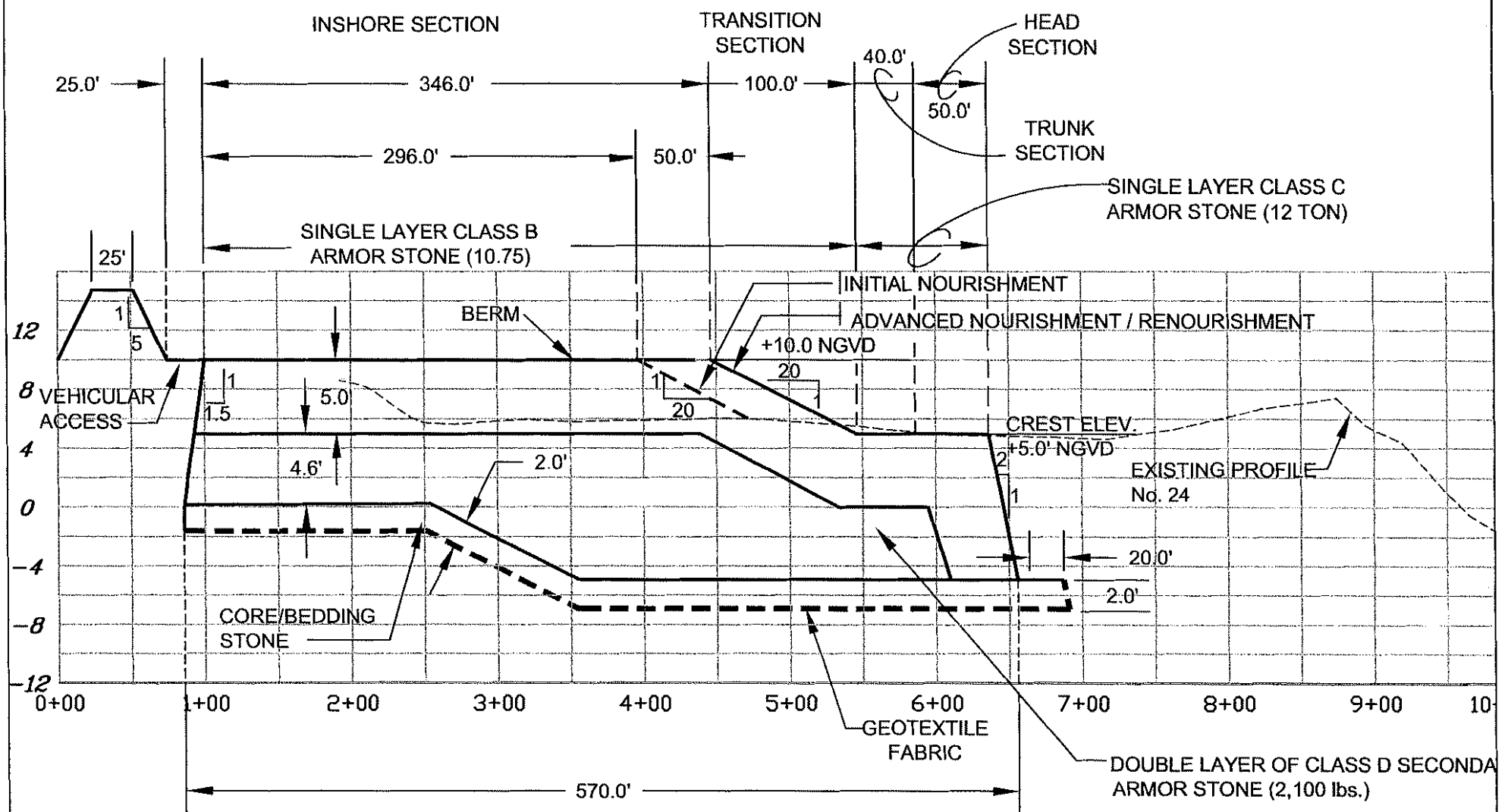
TYPICAL GROIN PROFILES
FIGURE NO. 2-89



GROIN D

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

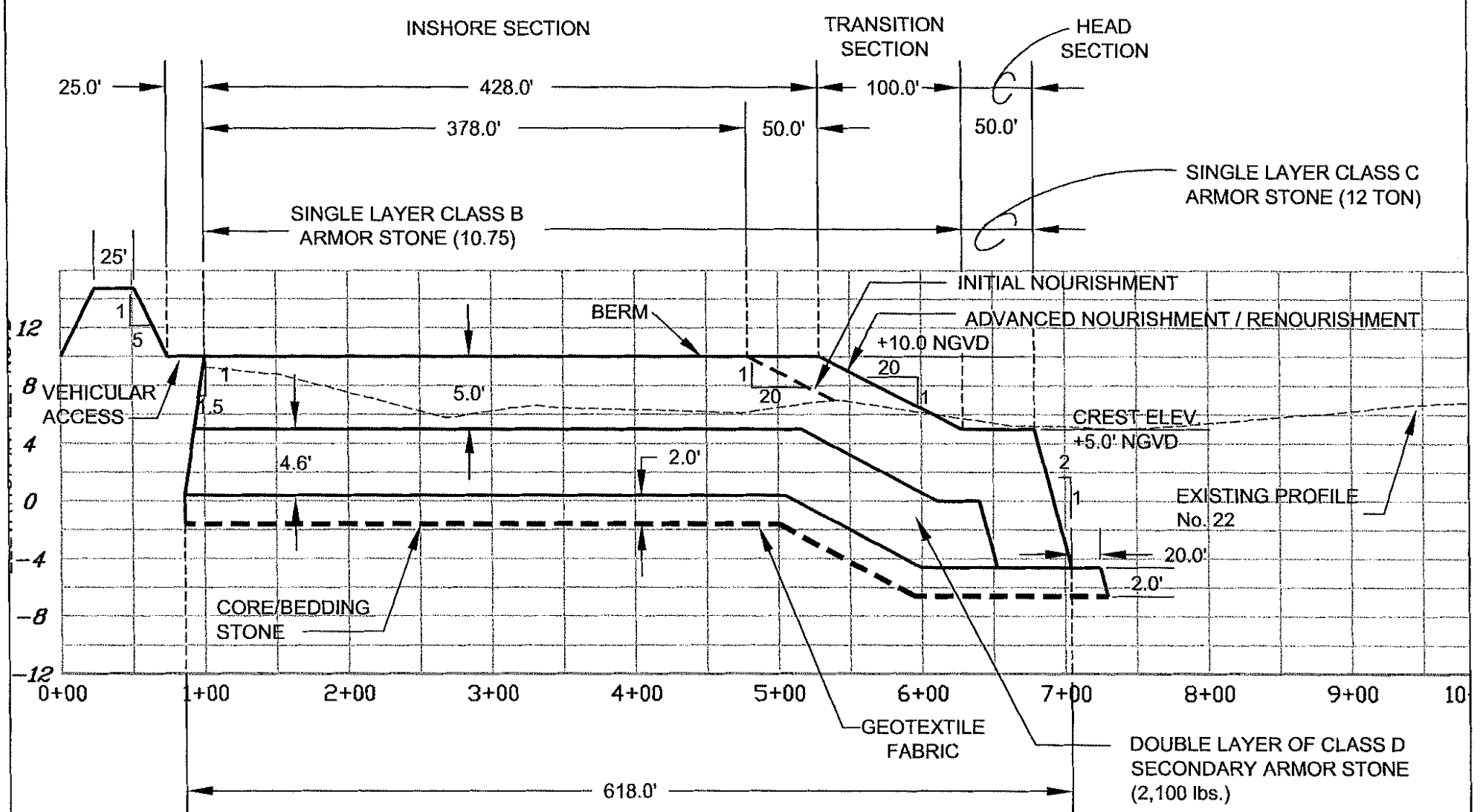
TYPICAL GROIN PROFILES
FIGURE NO. 2-90



GROIN E

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES
FIGURE NO. 2-91

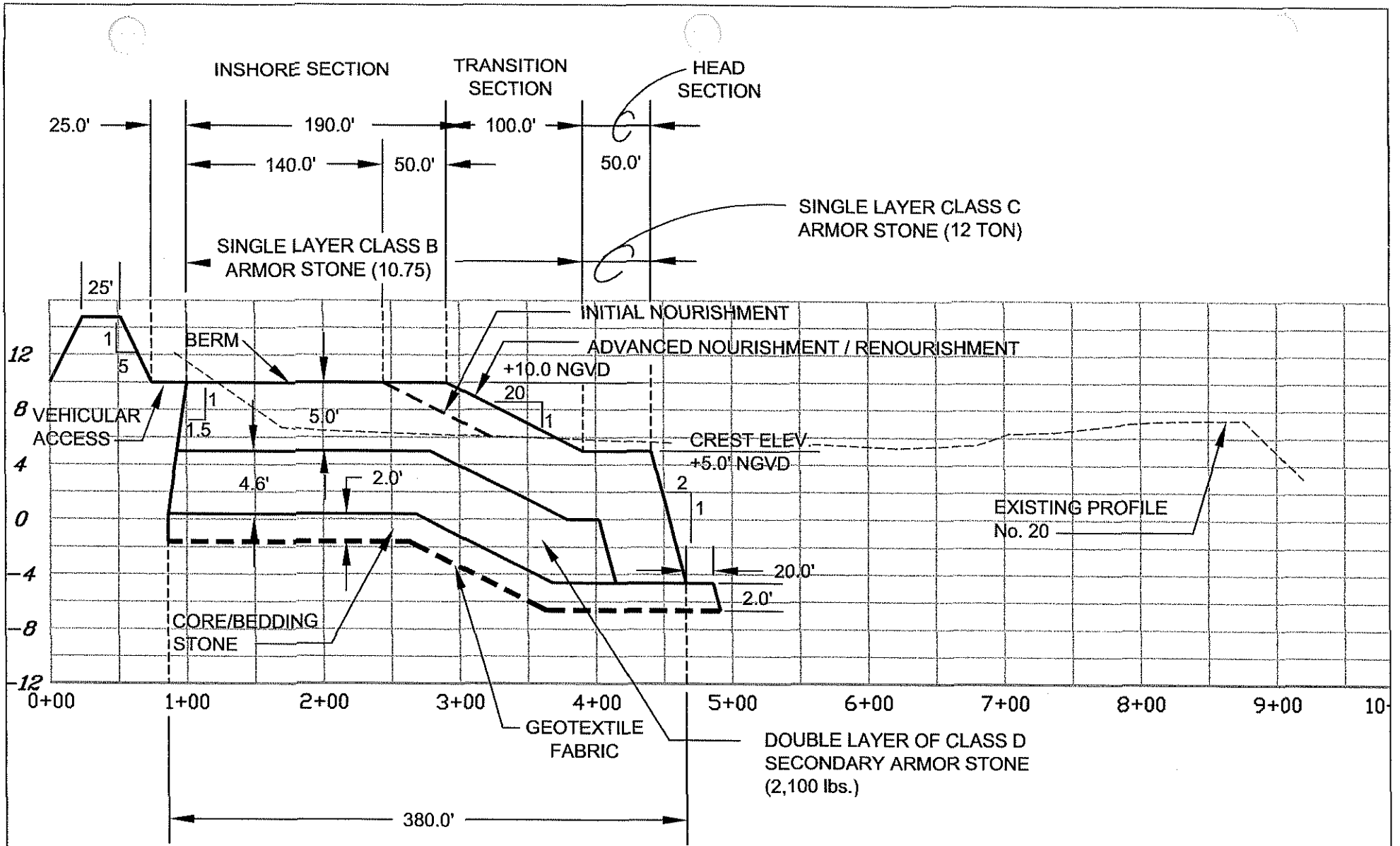


GROIN F

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES

FIGURE NO. 2-92



GROIN G

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES
FIGURE NO. 2-93

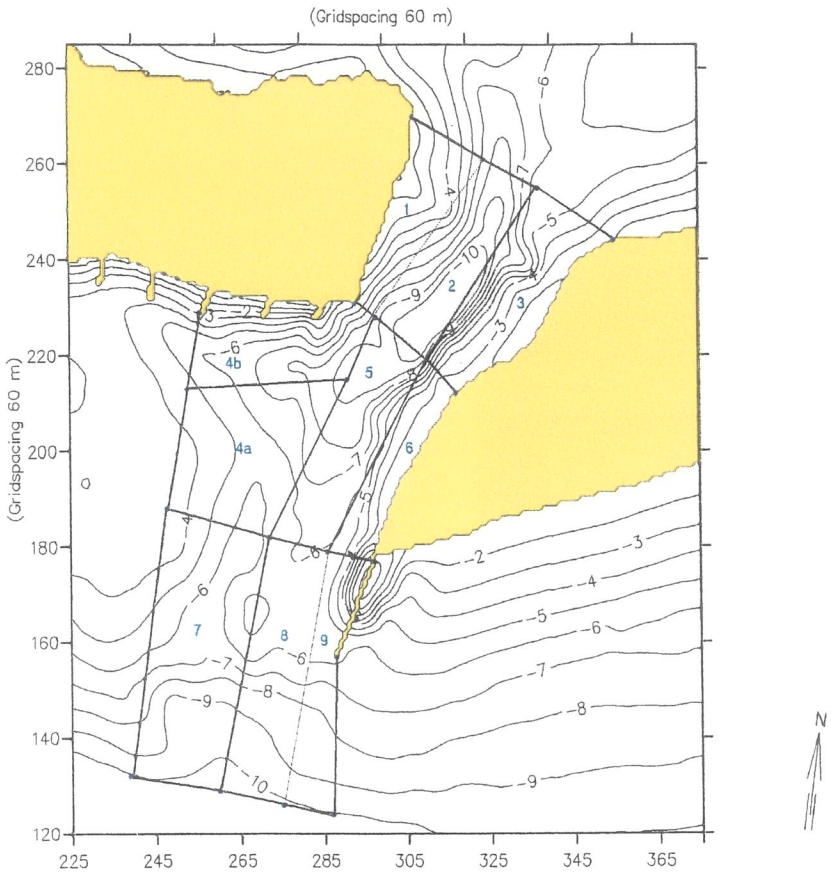


Figure 2-94 **Location of cells used at the Jones inlet. The cell numbers are indicated in blue.**

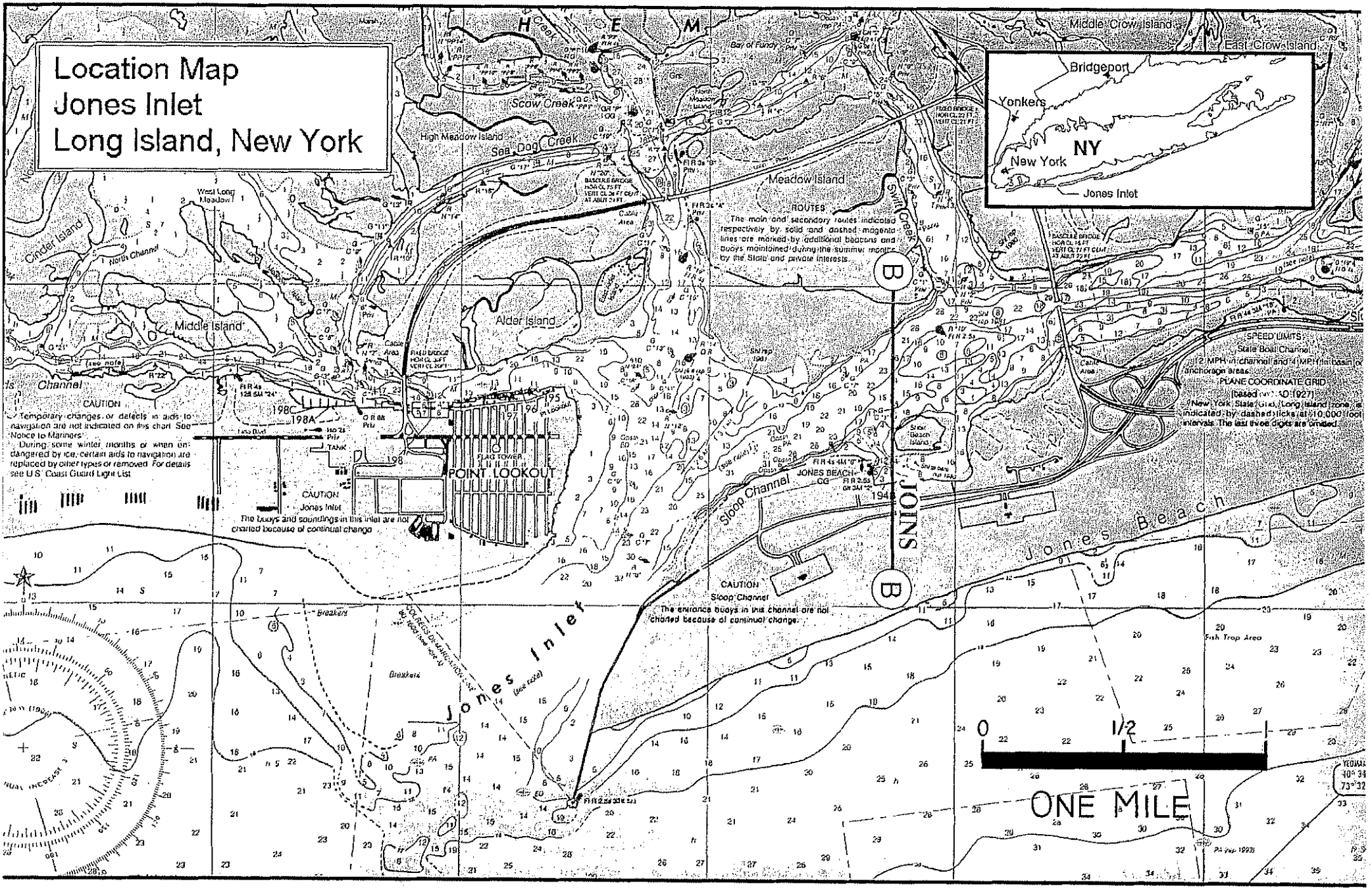
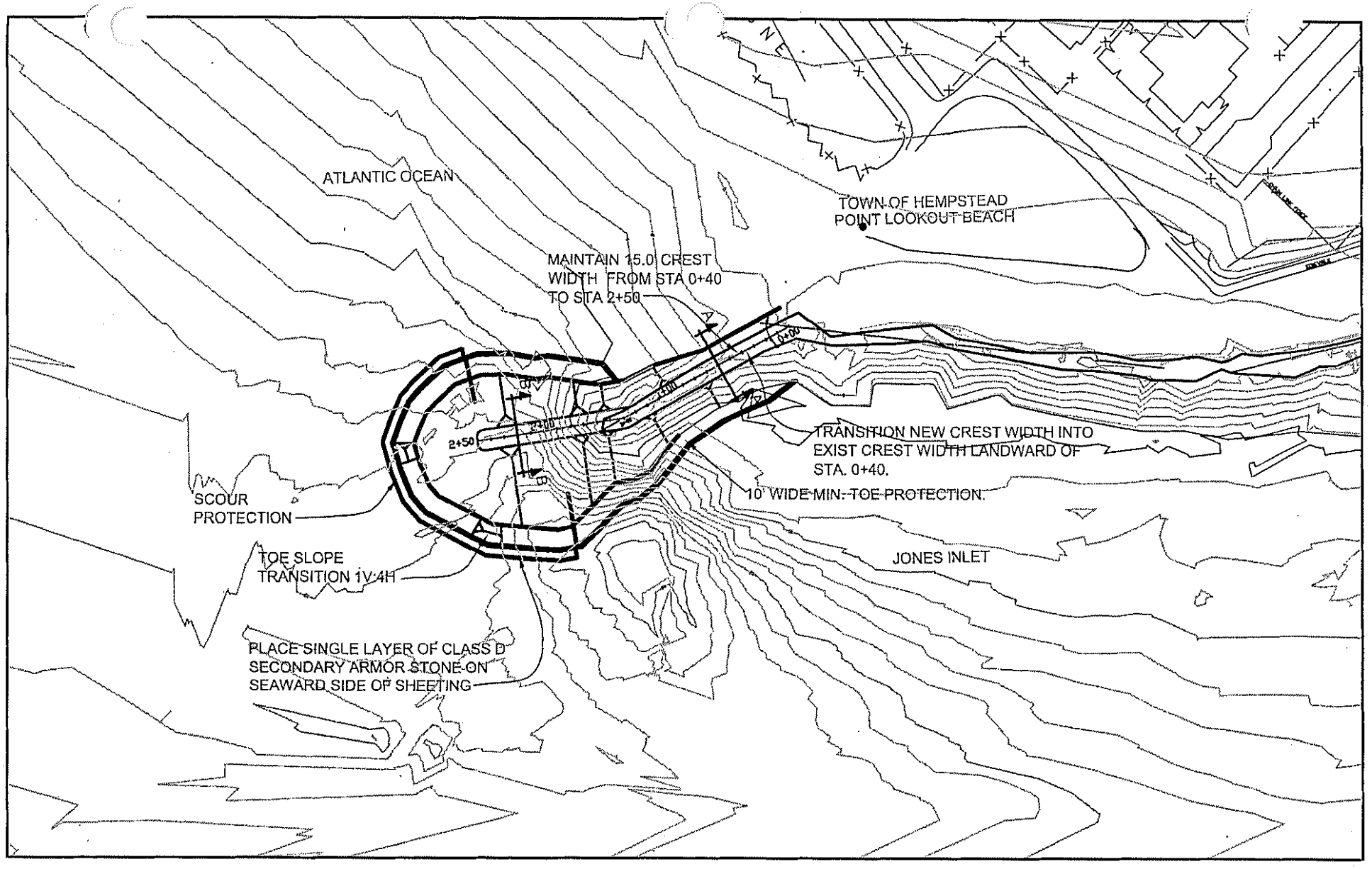

Location Map
Jones Inlet
Long Island, New York
Bridgeport
Yonkers
NY
New York
Jones Inlet
Middle Crow Island
East Crow Island
Scow Creek
High Meadow Island
Sea Dog Creek
Meadow Island
West Long Meadow
Cinder Island
North Channel
Middle Island
Alder Island
Swift Creek
ROUTES
The main and secondary routes indicated respectively by solid and dashed magenta lines are marked by additional beacons and buoys maintained during the summer months by the State and private interests.
SPEED LIMITS
State Boat Channel
2 MPH in channel and 4 MPH in basin or anchorage areas.
PLANE COORDINATE GRID
(based on NAD 1927)
New York State Grid, Long Island zone, is indicated by dashed ticks at 10,000 foot intervals. The last three digits are omitted.
Channel
CAUTION
Temporary changes or defects in aids to navigation are not indicated on this chart. See Notice to Mariners.
During some winter months or when endangered by ice, certain aids to navigation are replaced by other types or removed. For details see U.S. Coast Guard Light List
POINT LOOKOUT
FLAG TOWER
CAUTION
Jones Inlet
The buoys and soundings in this inlet are not charted because of continual change
Sloop Channel
JONES BEACH
CG
JONES
Jones Beach
CAUTION
Sloop Channel
The entrance buoys in this channel are not charted because of continual change.
Breakers
Jones Inlet
Fish Trap Area
0
1/2
ONE MILE

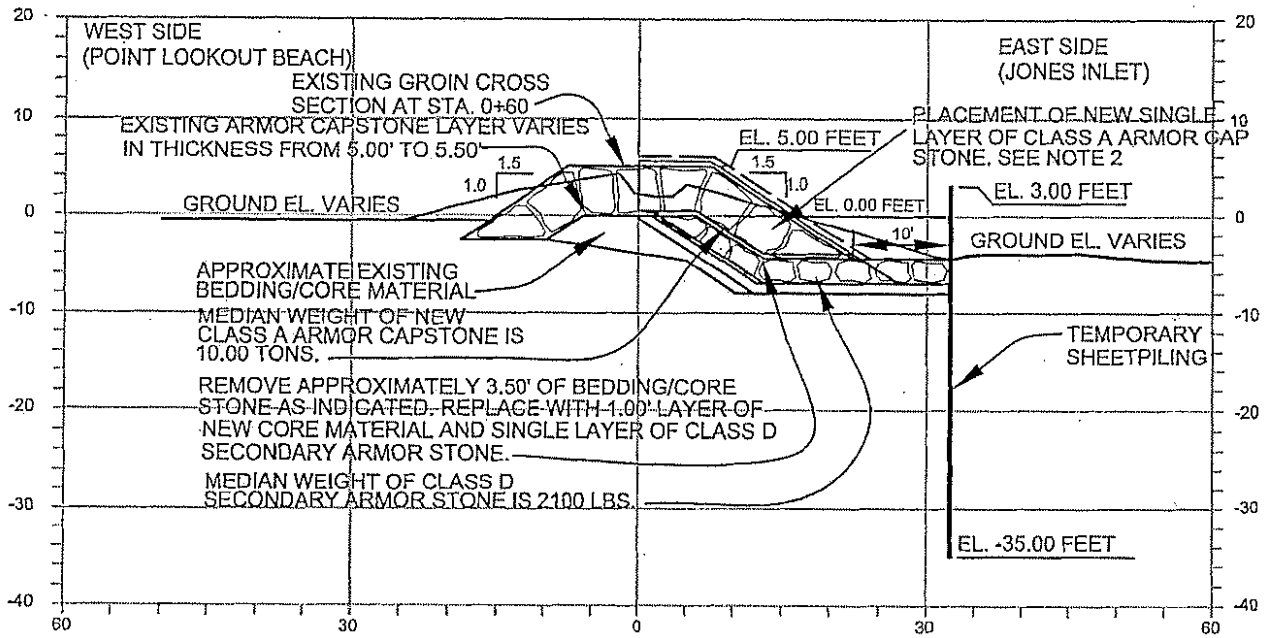
FIGURE 3-1



TERMINAL GROIN REHABILITATION AND EXTENSION AT JONES INLET

SCALE: 1" = 100'

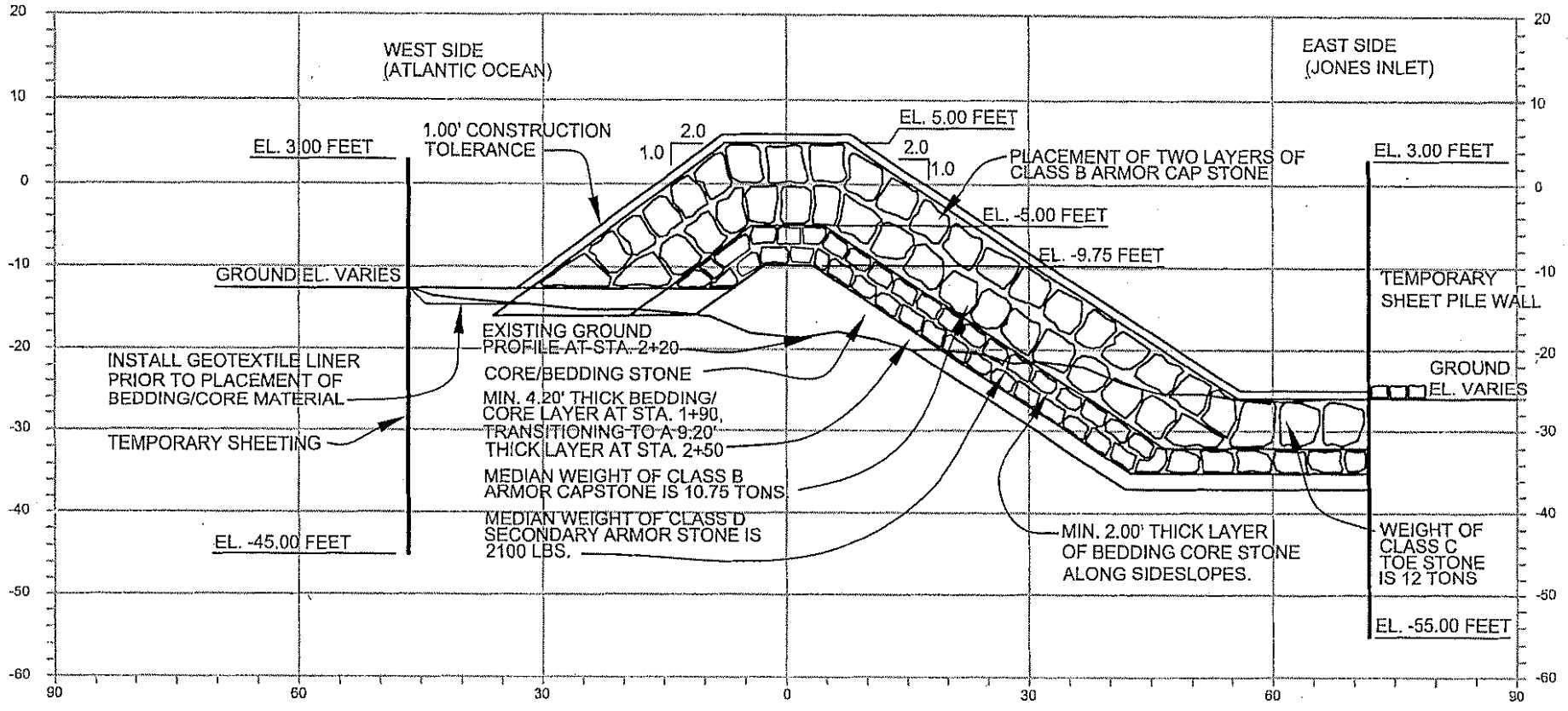
FIGURE 3-2



TERMINAL GROIN REHABILITATION SECTION (A-A)
AT JONES INLET

SCALE: 1" = 20'

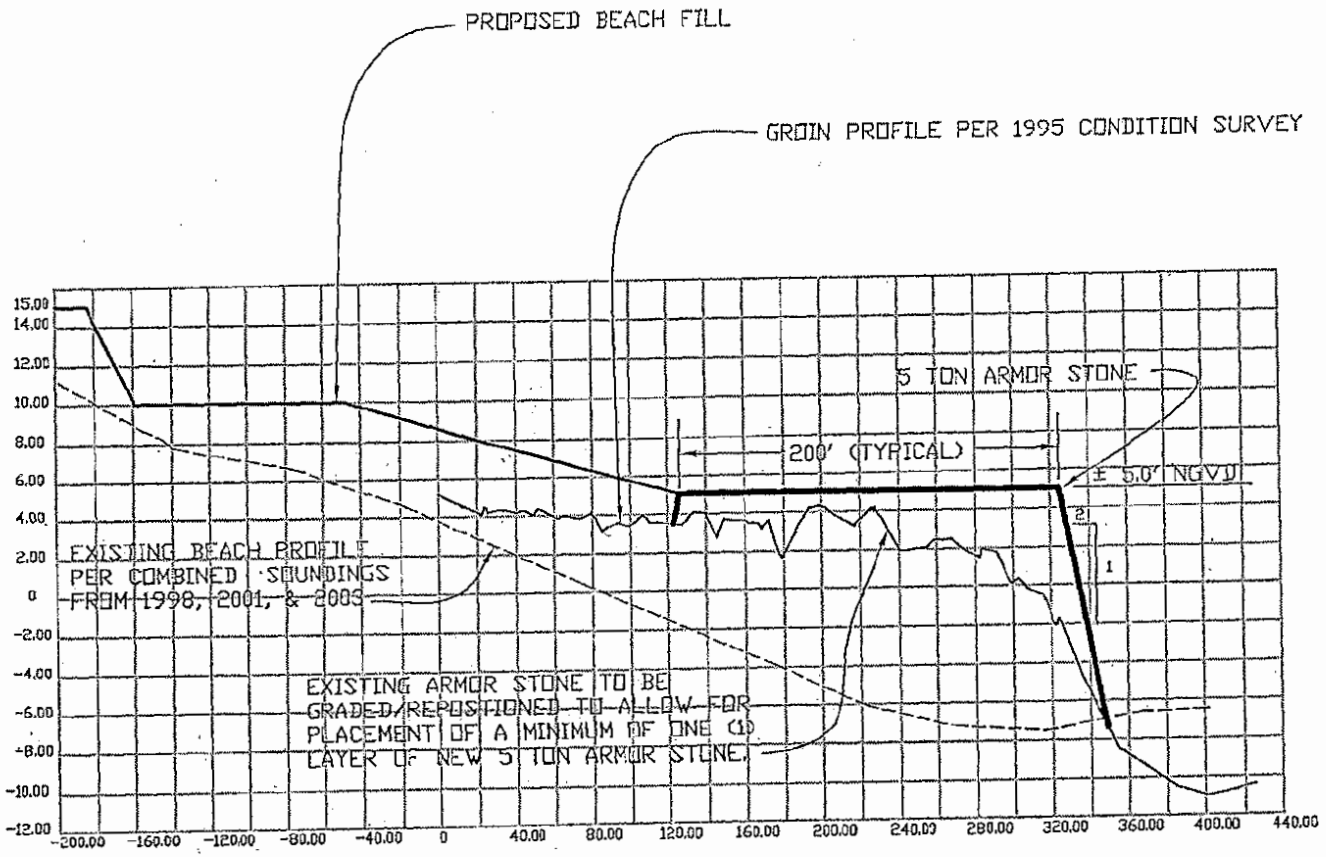
FIGURE 3-3



TERMINAL GROIN EXTENSION SECTION (B-B)
AT JONES INLET

SCALE: 1" = 20'

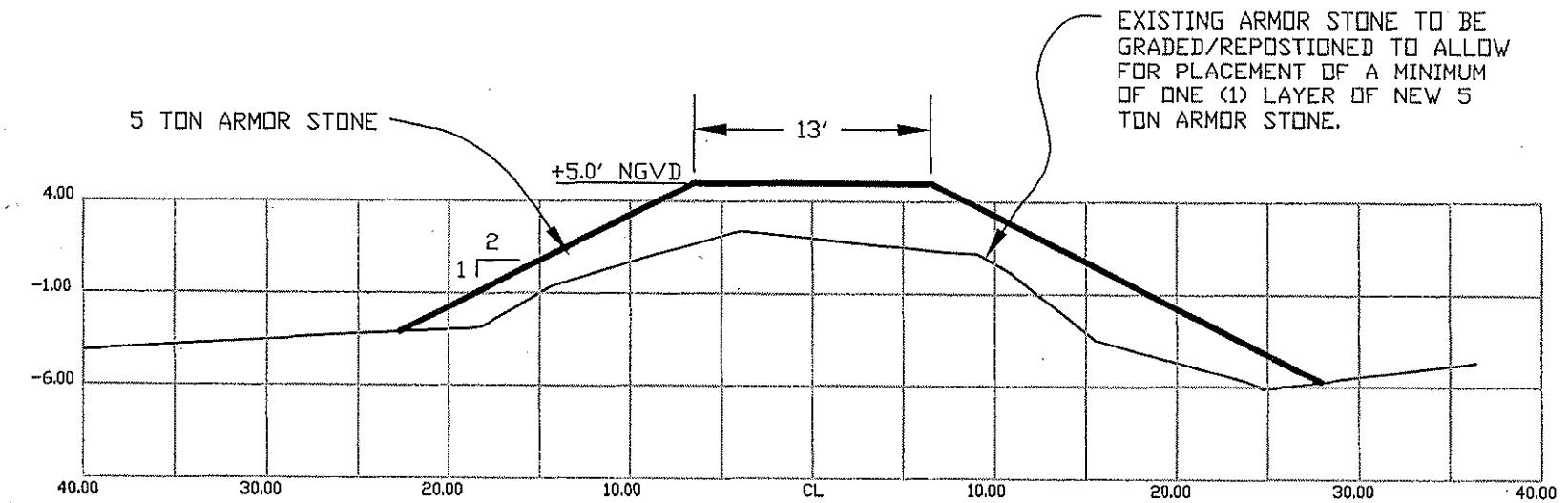
FIGURE 3-4



TYPICAL GROIN REHABILITATION

SCALE: HORZ: 1" = 100'
VERT: 1" = 10'

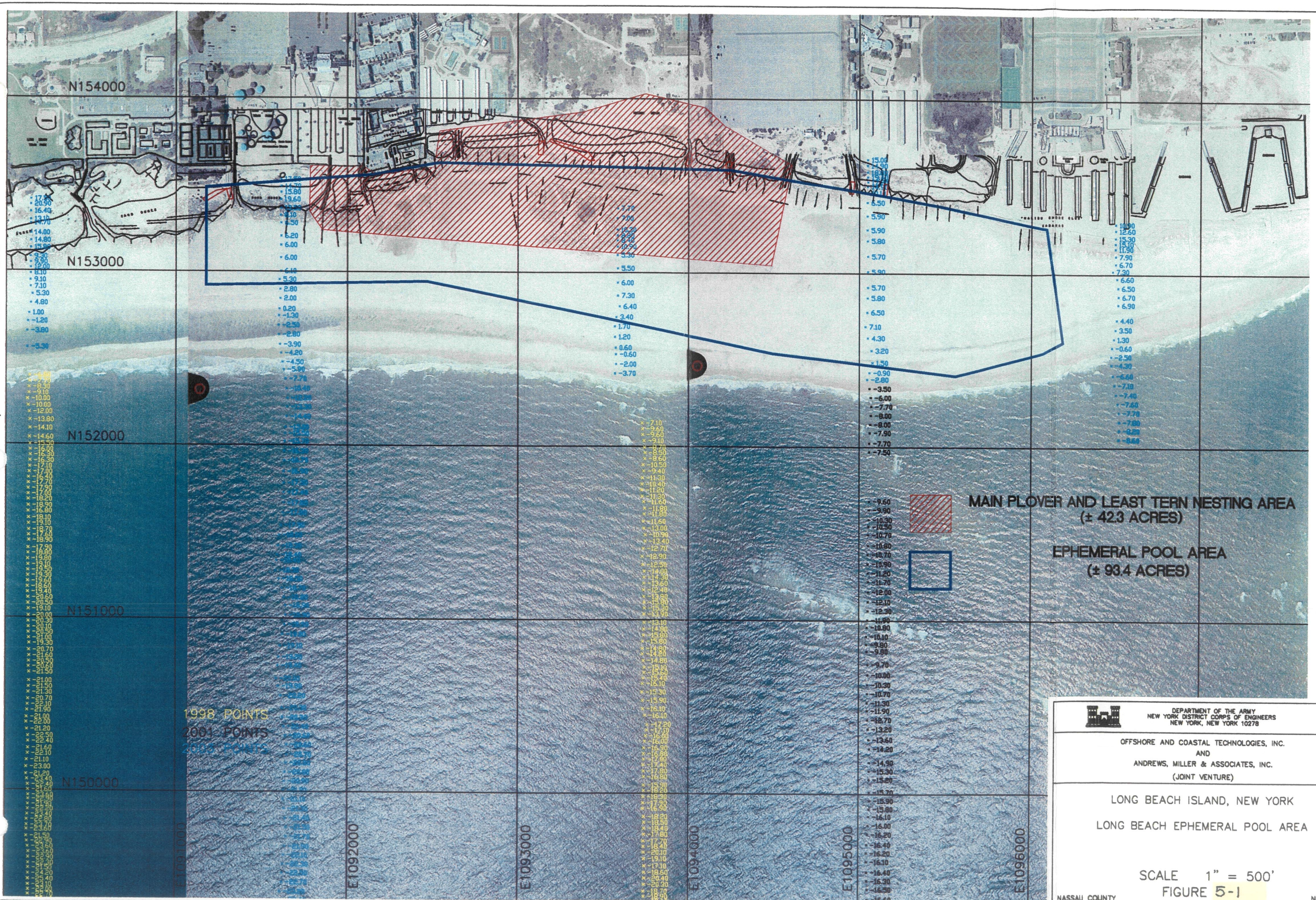
FIGURE 4–1



TYPICAL GROIN REHABILITATION SECTION

SCALE: 1" = 10'

FIGURE 4-2



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

LONG BEACH EPHEMERAL POOL AREA

SCALE 1" = 500'

FIGURE 5-1

NASSAU COUNTY NEW YORK

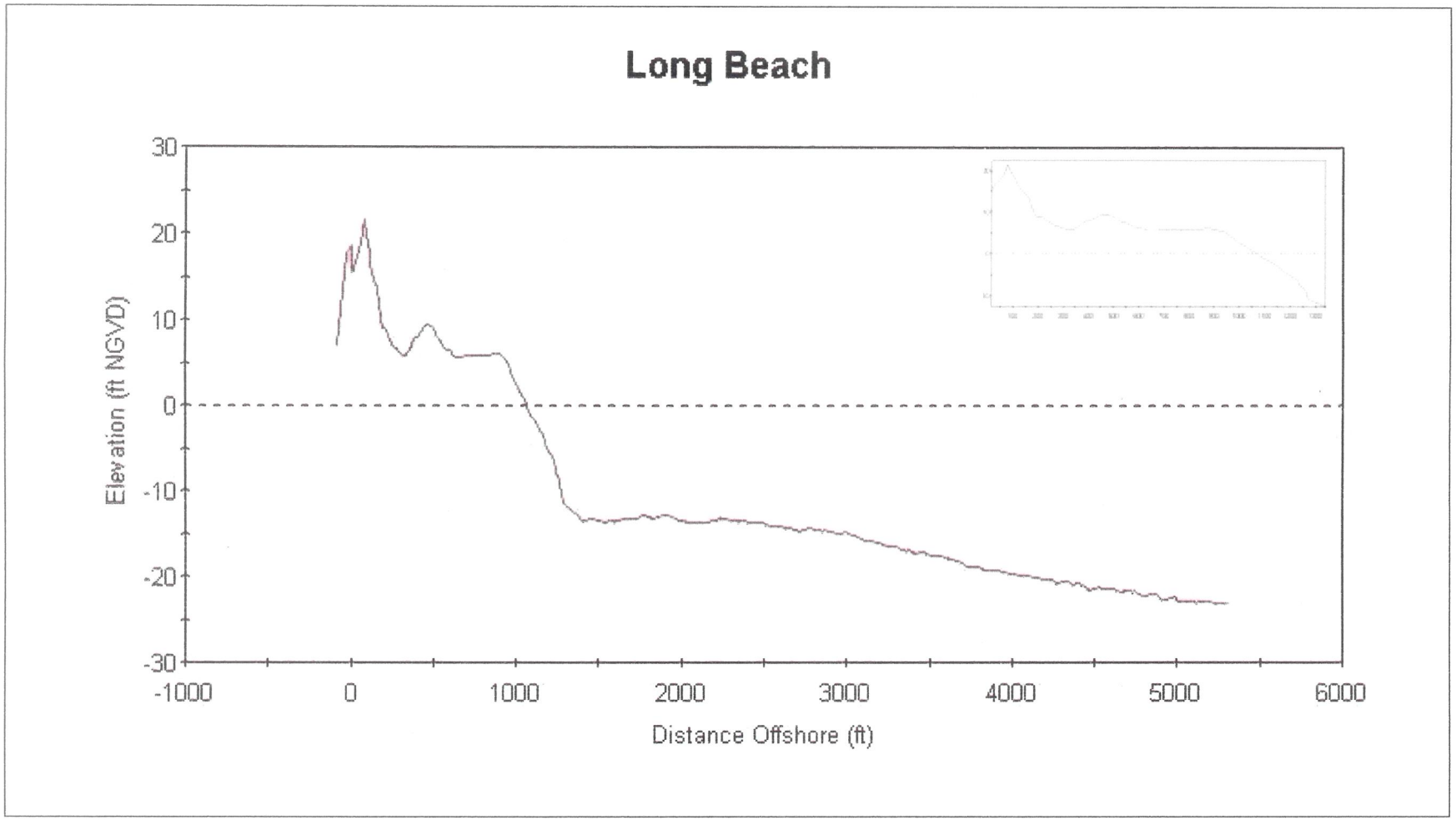


Figure 5-2. Representative beach profile for bird nesting/foraging area.

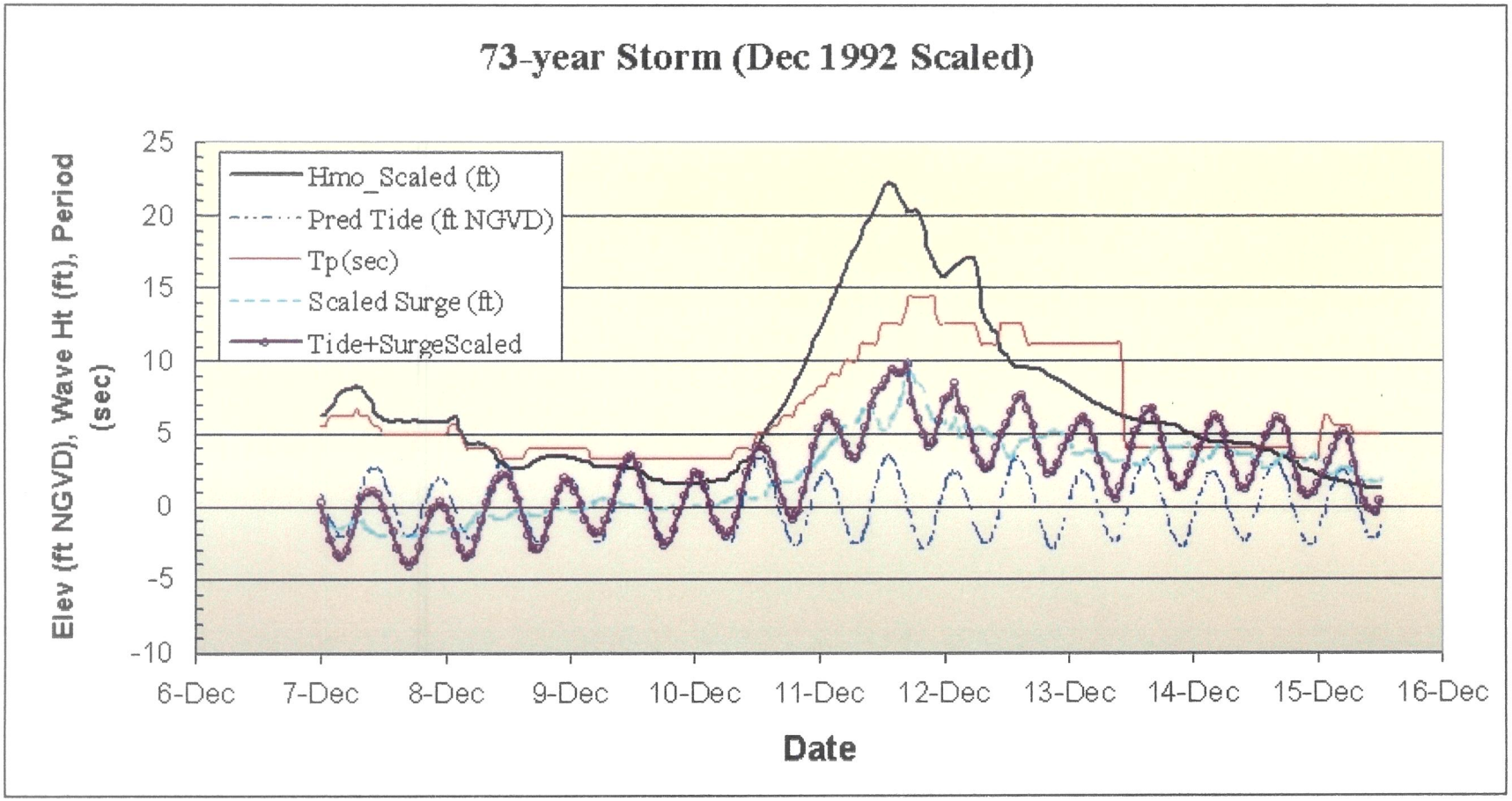


Figure 5-3 Design storm time histories (Hmo is wave height, Tp is peak wave period, Tide + Surge is scaled water level).

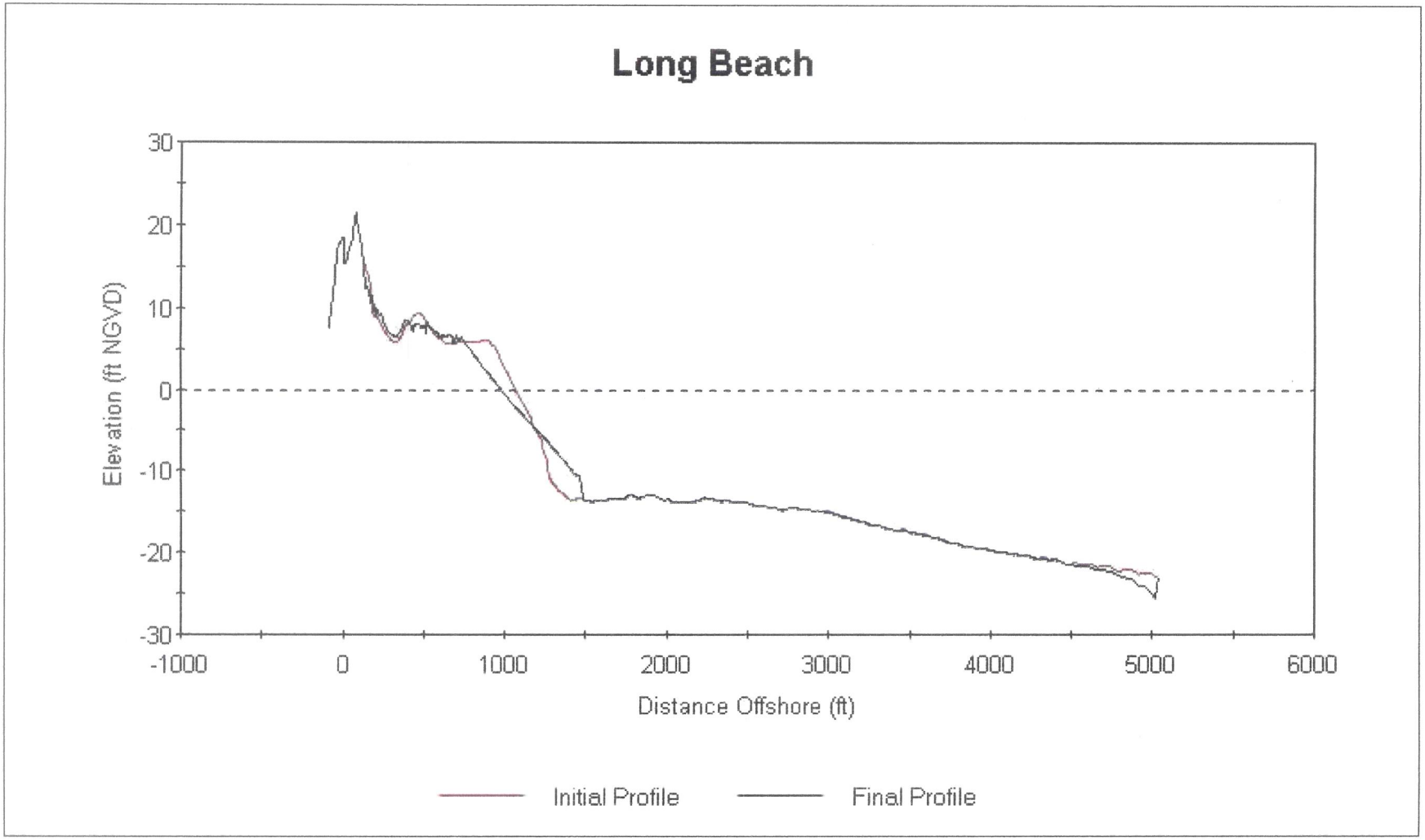
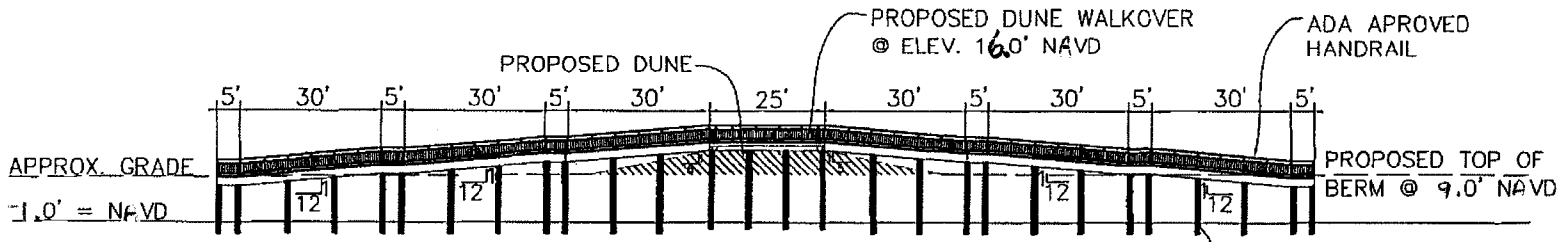
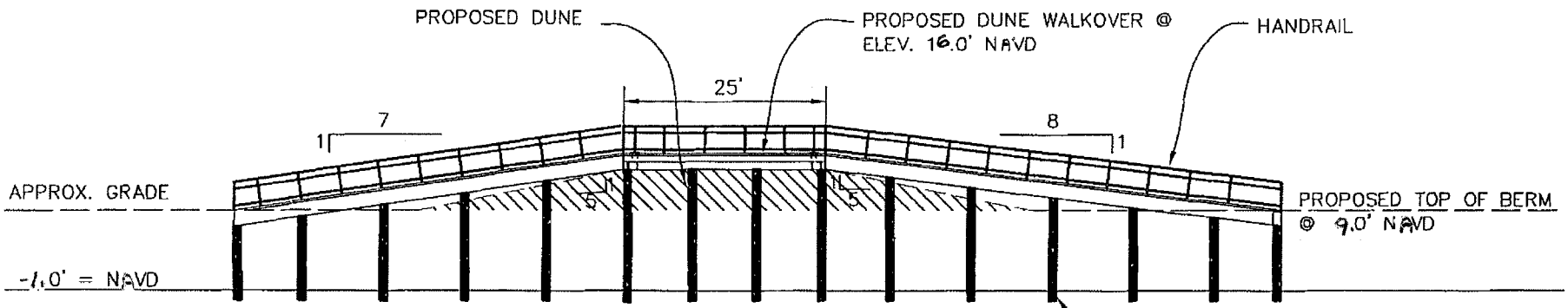


Figure 5-4 Initial and final (eroded) beach profile due to the design storm.



TYPICAL ELEVATION VIEW
(ADA COMPLIANT - 6' WIDE)
SCALE: 1" = 40'



TYPICAL ELEVATION VIEW
(NON-ADA COMPLIANT - 6' WIDE)
SCALE: 1" = 20'

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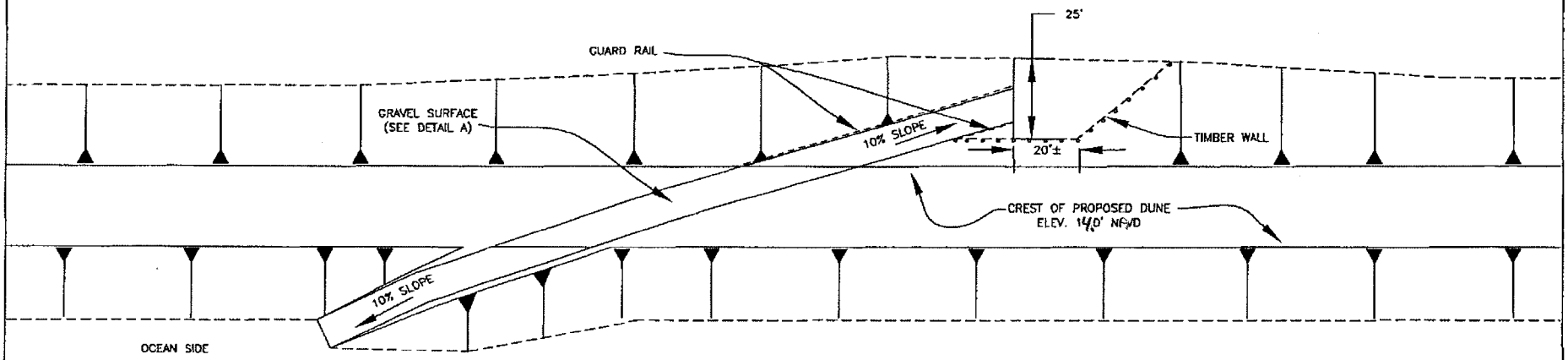
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NEW YORK 10278

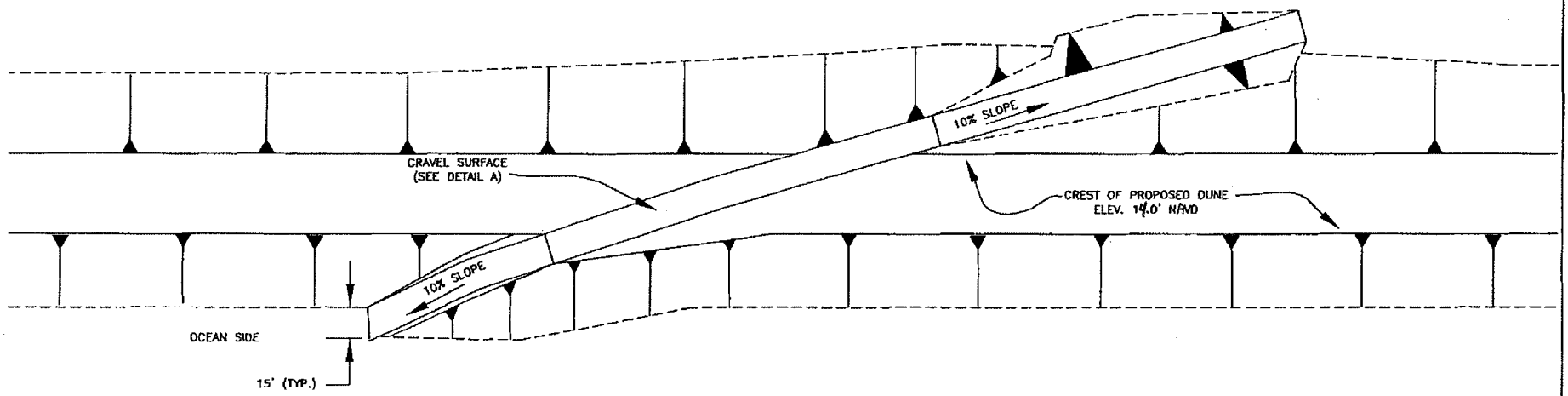
OFFSHORE AND COASTAL TECHNOLOGIES, INC.
AND
ANDREWS, MILLER & ASSOCIATES, INC.

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
TYPICAL DUNE WALKOVER

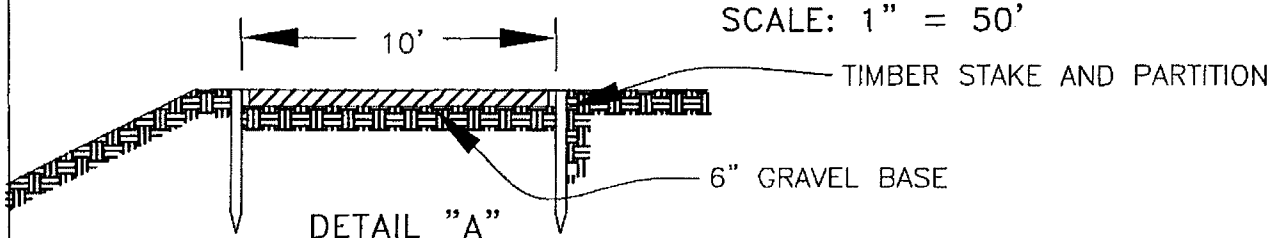
NASSAU COUNTY Figure 6-1 NEW YORK



TYPICAL PLAN VIEW @ LONG BEACH RAMPS
SCALE: 1" = 50'



TYPICAL PLAN VIEW @ LIDO BEACH RAMPS
SCALE: 1" = 50'



DETAIL "A"
SCALE: 1" = 6'

DEPARTMENT OF THE ARMY
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NEW YORK, NEW YORK 10278

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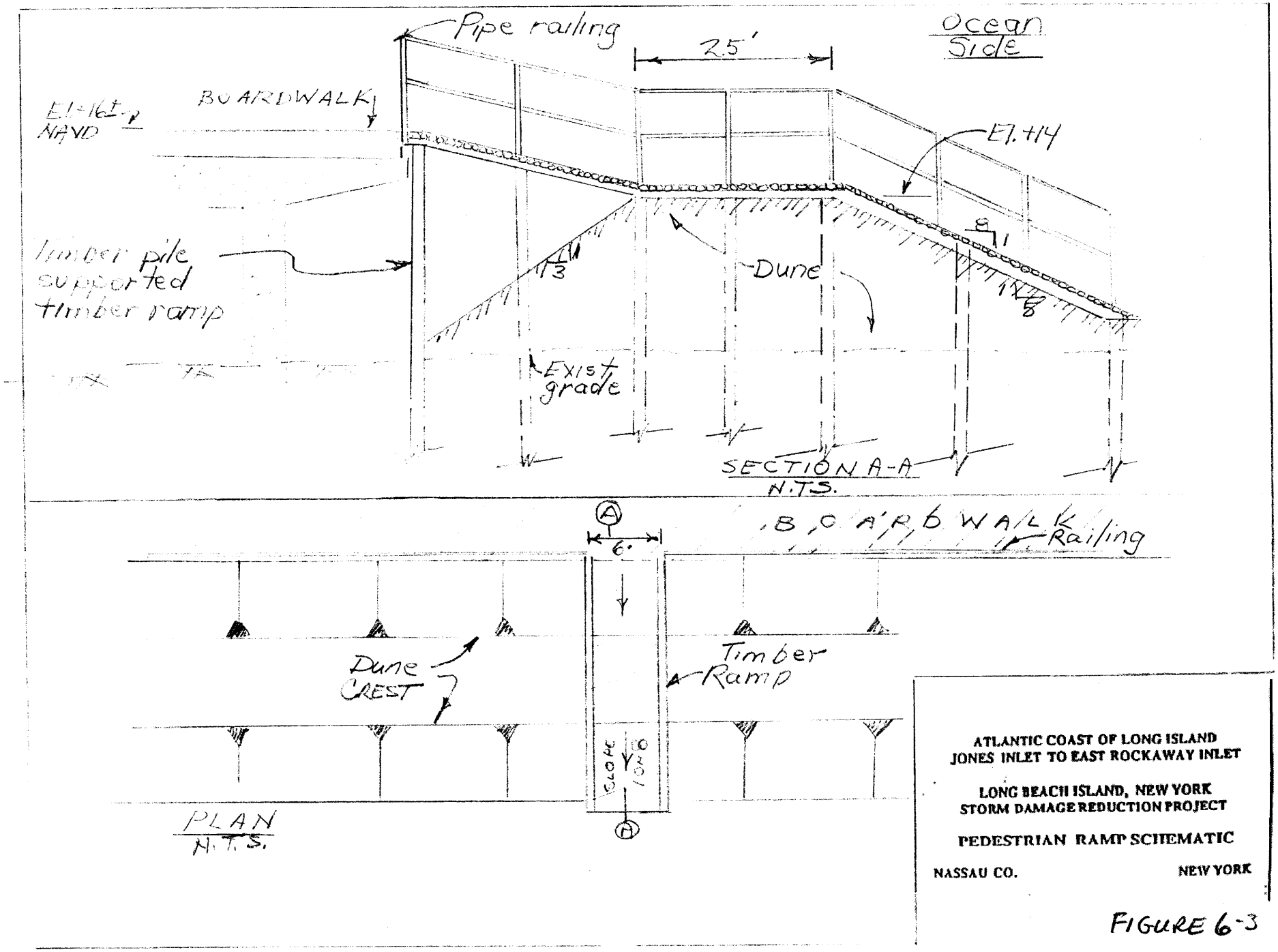
AND
ANDREWS, MILLER & ASSOCIATES, INC.

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT
VEHICULAR ACCESS RAMP

NASSAU COUNTY Figure 6-2 NEW YORK



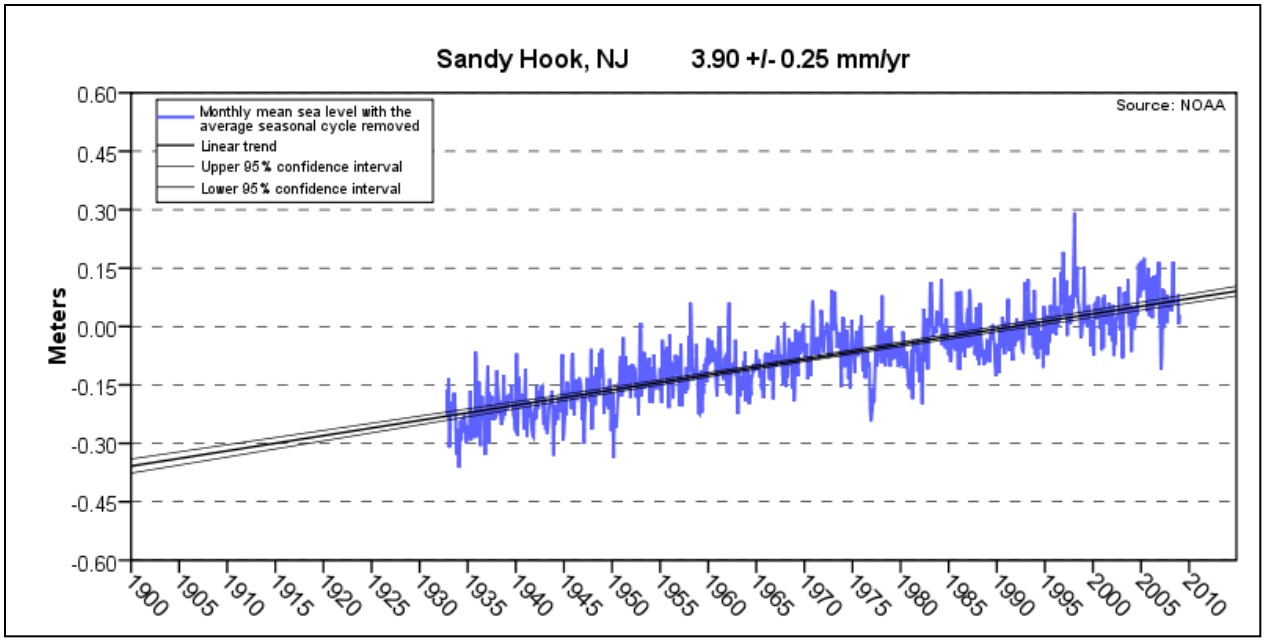
ATLANTIC COAST OF LONG ISLAND
JONES INLET TO EAST ROCKAWAY INLET

LONG BEACH ISLAND, NEW YORK
STORM DAMAGE REDUCTION PROJECT

PEDESTRIAN RAMP SCHEMATIC

NASSAU CO. NEW YORK

FIGURE 6-3



Note: The mean sea level trend is 3.90 millimeters/year with a 95% confidence interval of +/- 0.25 mm/yr based on monthly mean sea level data from 1932 to 2006 which is equivalent to a change of 1.28 ft in 100 years.

Figure 7-1: Mean Sea Level Trend - NOAA Sta.8531680 Sandy Hook, New Jersey

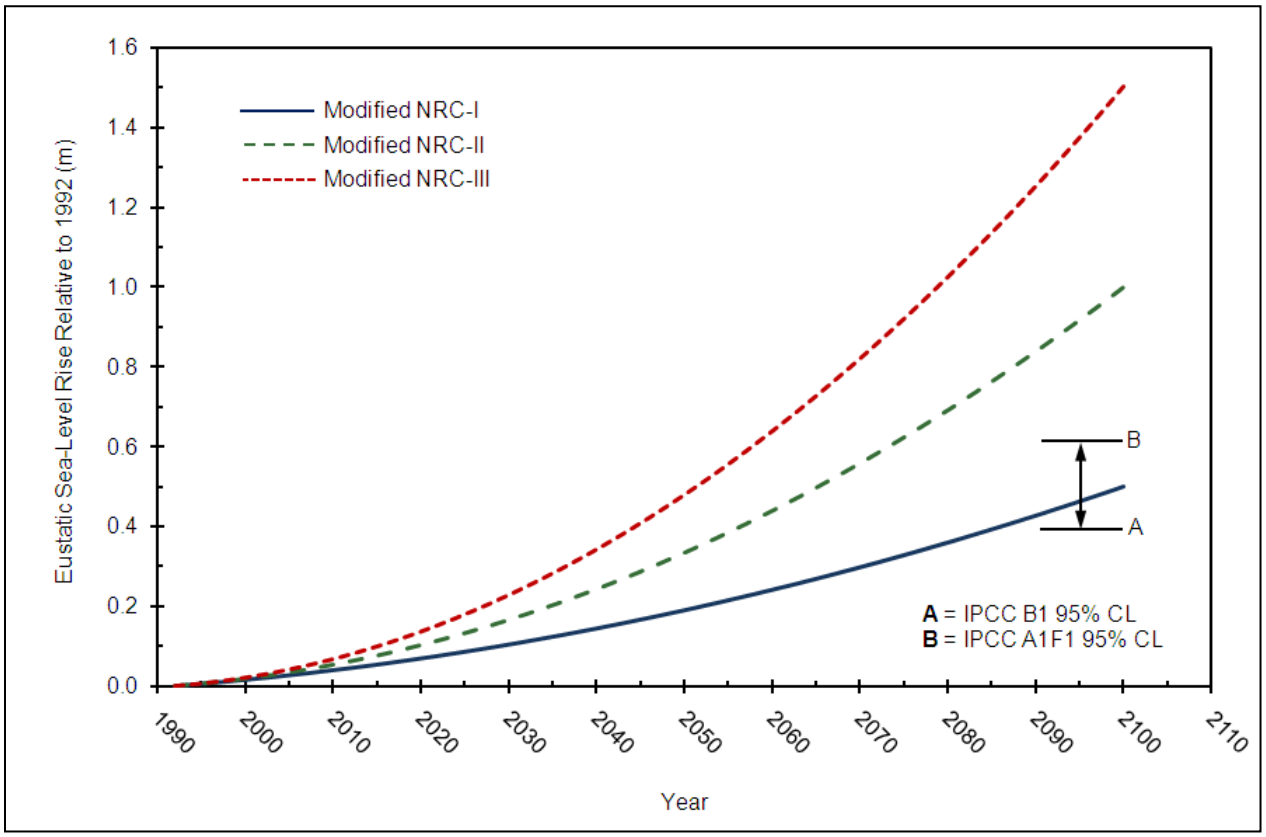


Figure 7-2: Modified NRC (1987) GMSL rise scenarios and the IPCC (2007) scenario estimates from EC 1165-2-212 (1 Oct 2011) for use in predicting future sea level rise change

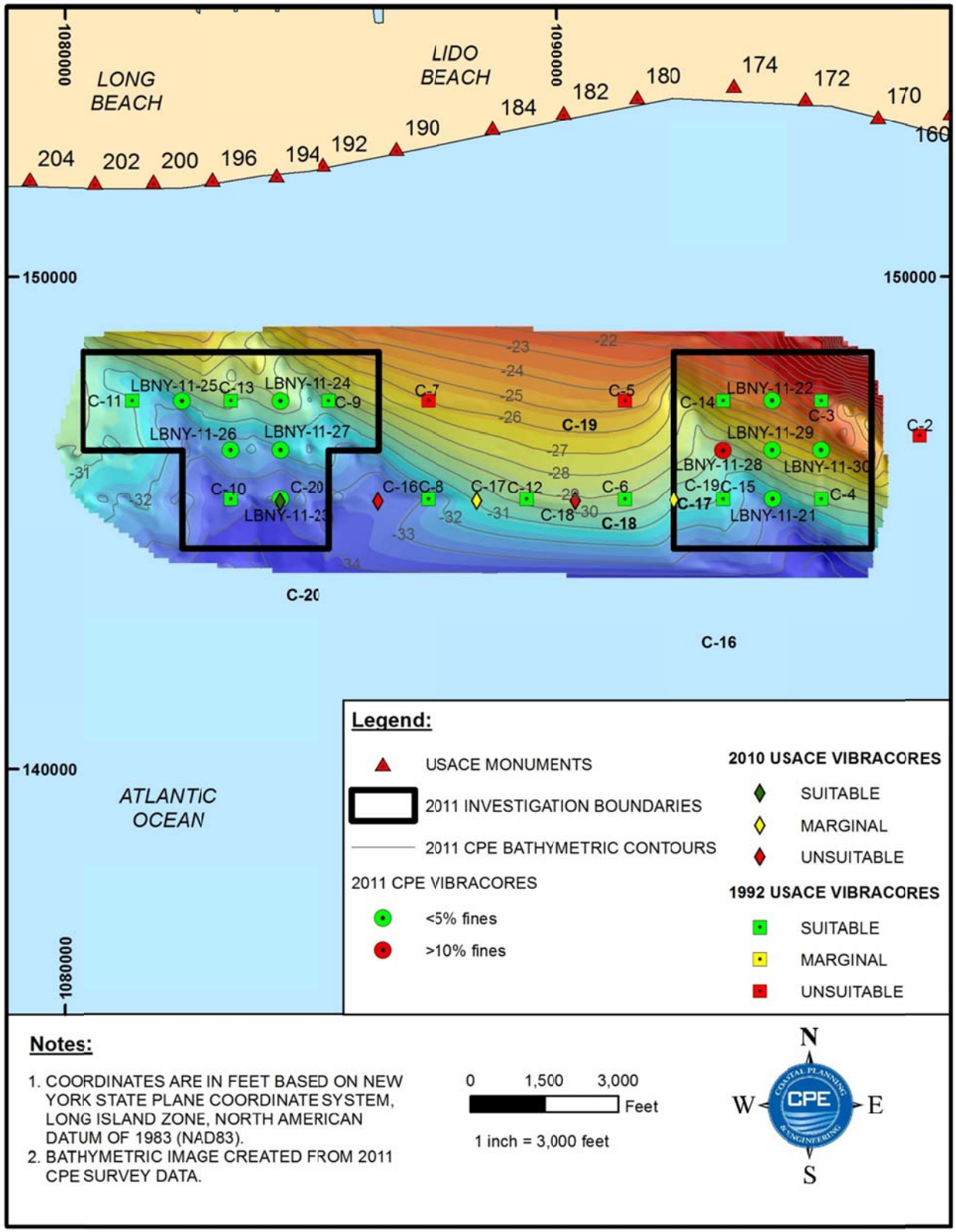
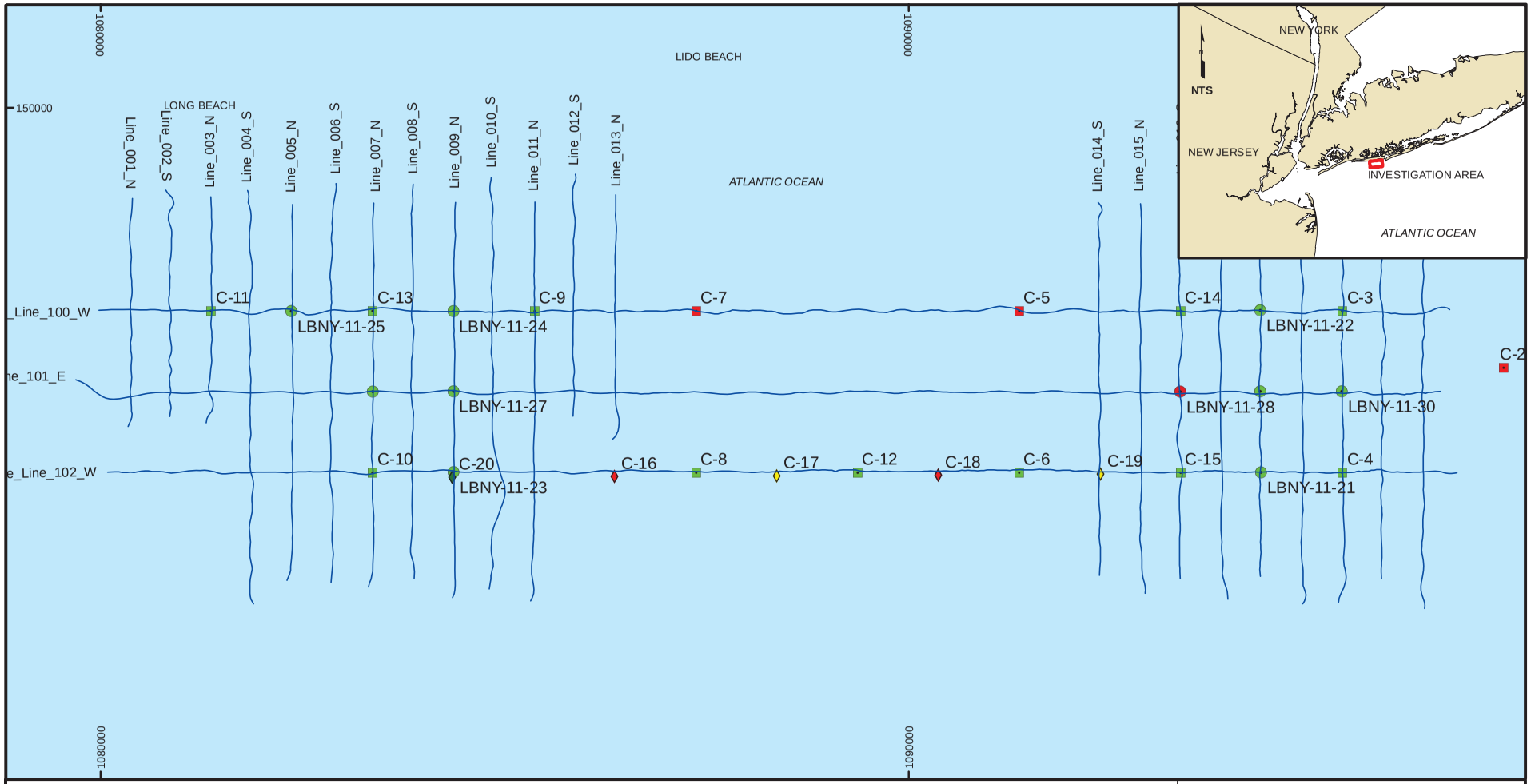


Figure 7. Color coded vibracores from the 2010 and 2011 investigations as well as vibracores collected in 1992 by the USACE. These cores are superimposed on a bathymetric surface created from the data collected by CPE in 2011.



Notes:

1. COORDINATES ARE IN FEET BASED ON NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83).

Legend:

- USACE MONUMENTS
- 2011 CPE TRACKLINES

2010 USACE VIBRACORES

- SUITABLE
- MARGINAL
- UNSUITABLE

1992 USACE VIBRACORES

- SUITABLE
- MARGINAL
- UNSUITABLE

2011 CPE VIBRACORES

- <5% fines
- >10% fines

Feet
0 750 1,500
1 inch = 1,229 feet

TITLE:

2011 SEISMIC TRACKLINE MAP

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 08/02/11 | BY: JR | COMM NO. : 7350.03

G:\NewYork\735003_LONG_BEACH_2011_GEO_MXD\LongBeach2011_TracklineMap.mxd

Figure 7-4

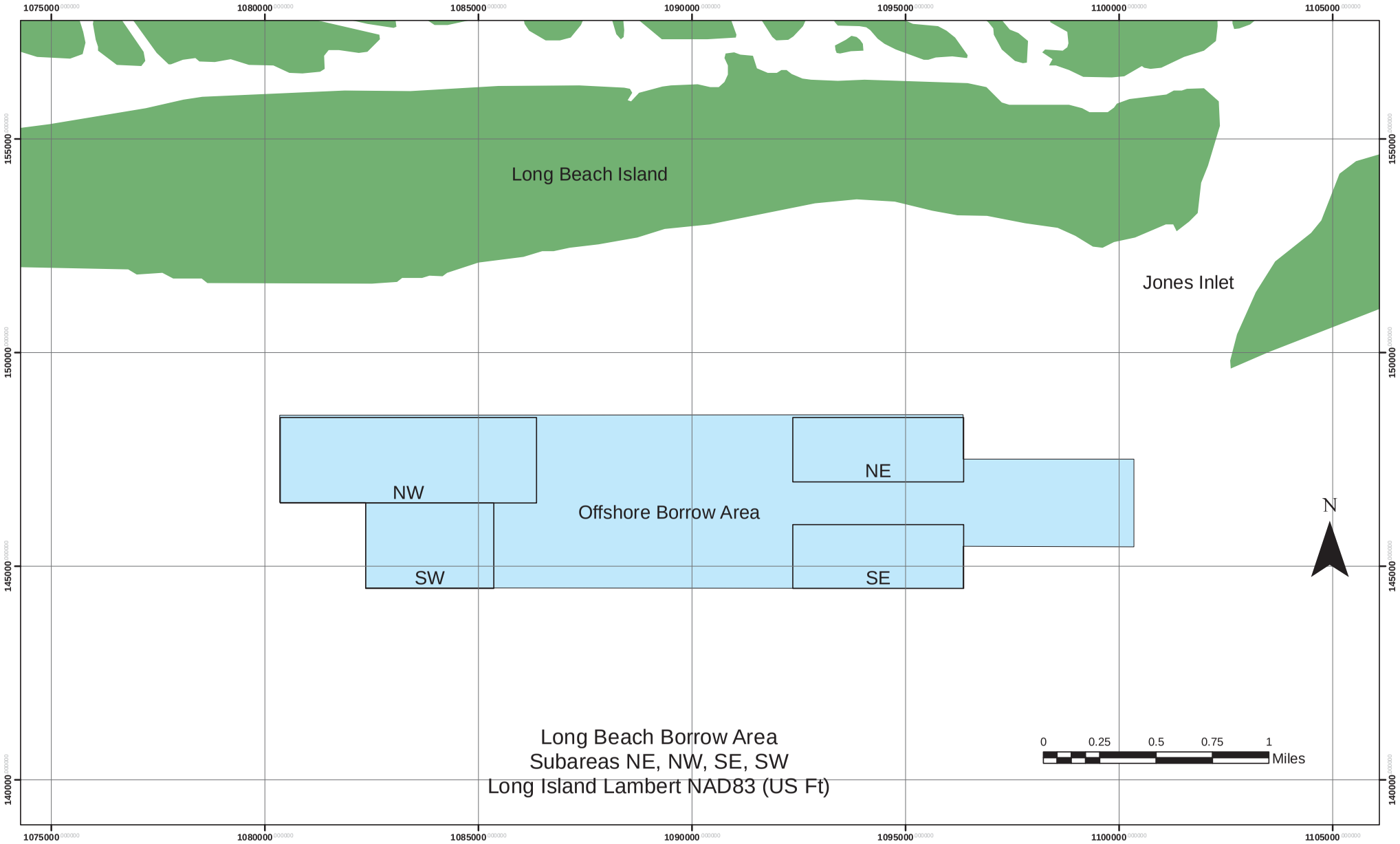
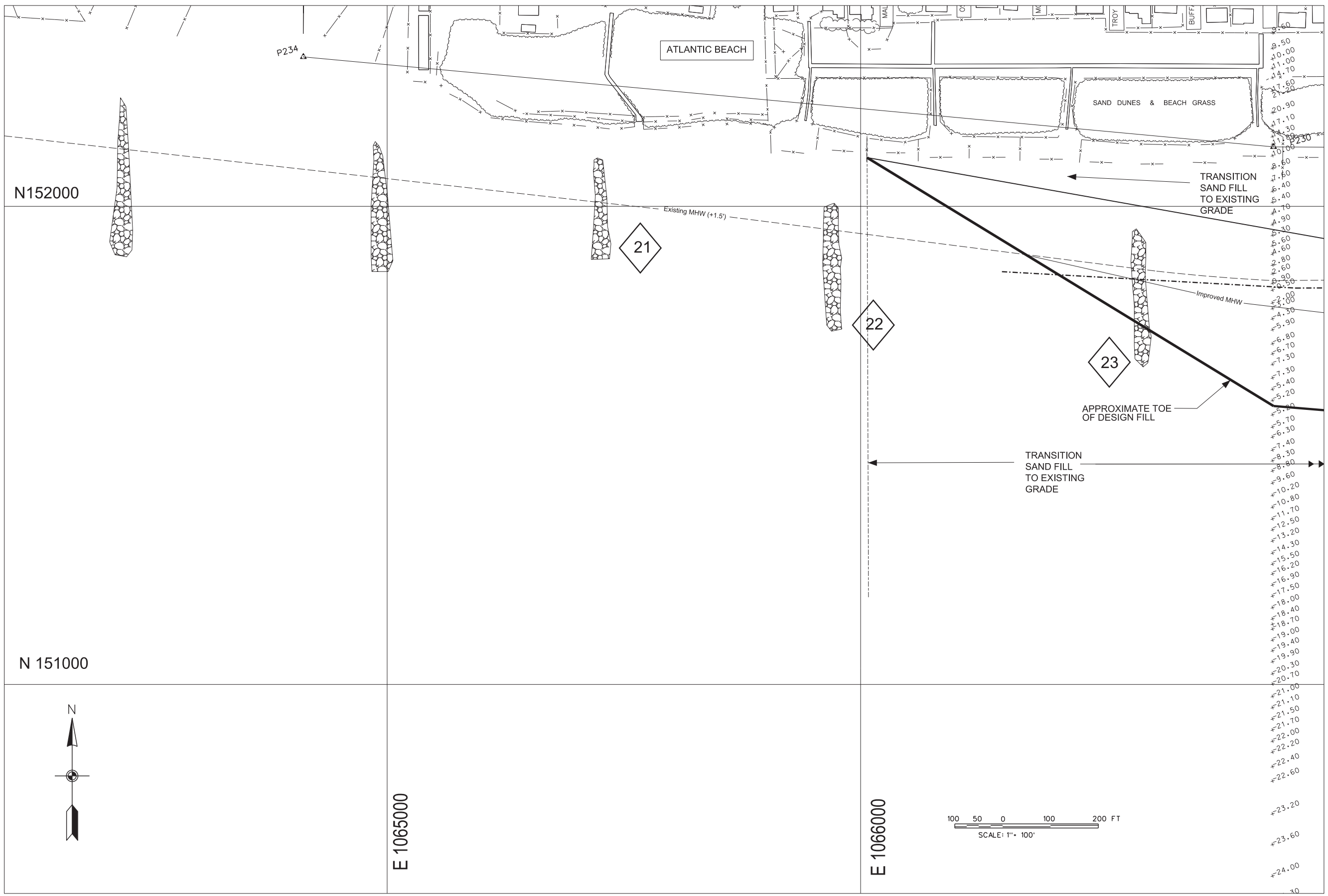

1075000
1080000
1085000
1090000
1095000
1100000
1105000
155000
150000
145000
140000
Long Beach Island
Jones Inlet
NW
SW
NE
SE
Offshore Borrow Area
N
0
0.25
0.5
0.75
1
Miles
Long Beach Borrow Area
Subareas NE, NW, SE, SW
Long Island Lambert NAD83 (US Ft)

Figure 7-5



US Army Corps of Engineers
New York District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NEW YORK, NEW YORK

EROSION CONTROL STUDY
PROPOSED
BEACH FILL PLAN
Long Beach New York

Sheet reference number: 1
Sheet 1 of 14

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Figure 8-1

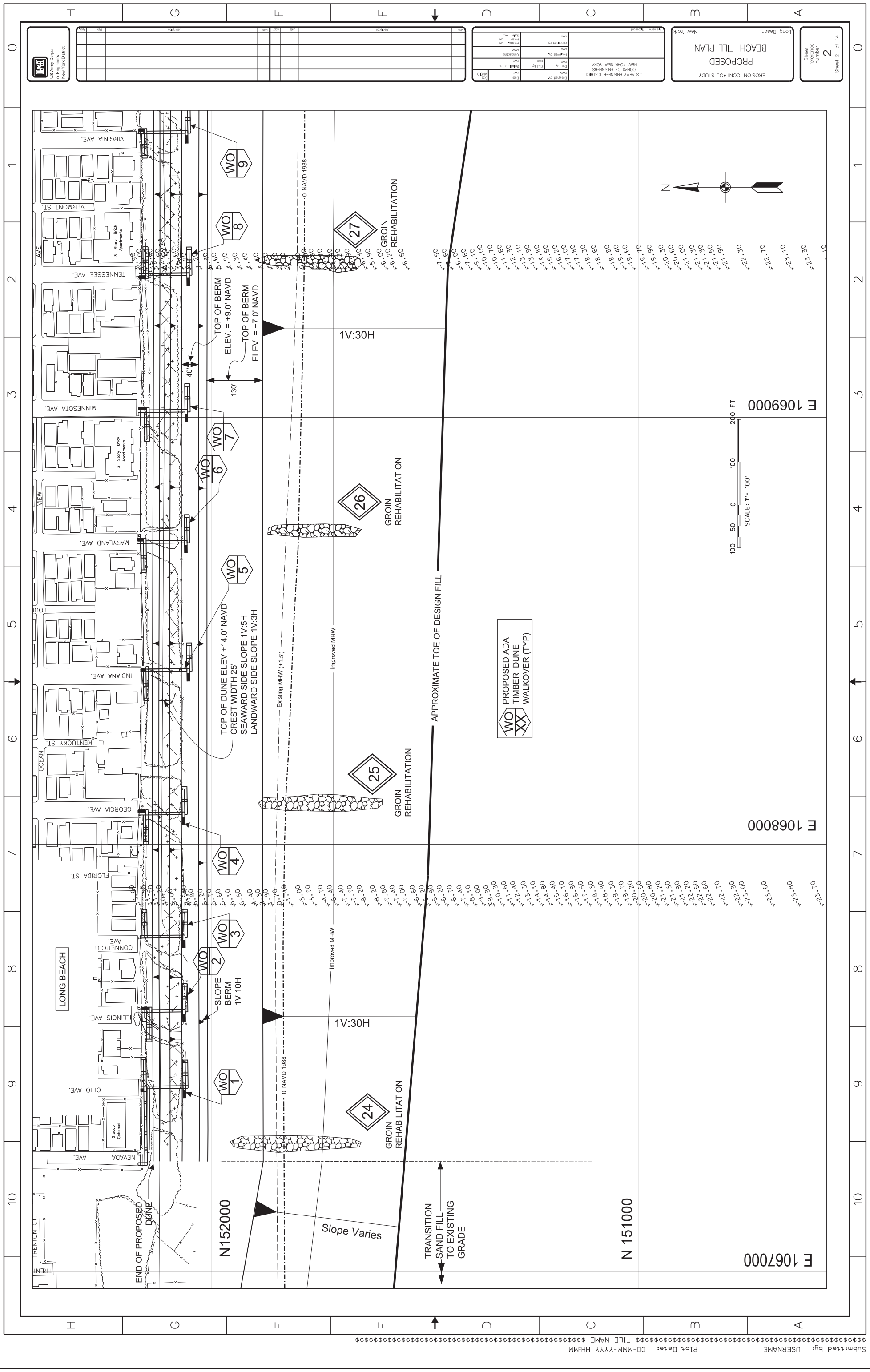
EROSION CONTROL STUDY
PROPOSED
BEACH FILL PLAN
Long Beach
New York
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NEW YORK, NEW YORK
US Army Corps of Engineers New York District
Sheet reference number: 2
Sheet 2 of 14
N
SCALE: 1" = 100'
E 1069000
E 1068000
E 1067000
N152000
N 151000
TOP OF BERM ELEV. = +9.0' NAVD
TOP OF BERM ELEV. = +7.0' NAVD
130'
40'
1V:30H
0' NAVD 1988
Improved MHW
Existing MHW (+1.5')
APPROXIMATE TOE OF DESIGN FILL
TOP OF DUNE ELEV +14.0' NAVD
CREST WIDTH 25'
SEAWARD SIDE SLOPE 1V:5H
LANDWARD SIDE SLOPE 1V:3H
SLOPE BERM 1V:10H
Slope Varies
TRANSITION SAND FILL TO EXISTING GRADE
END OF PROPOSED DUNE
GROIN REHABILITATION
PROPOSED ADA TIMBER DUNE WALKOVER (TYP)
LONG BEACH
VIRGINIA AVE.
VERMONT ST.
TENNESSEE AVE.
MINNESOTA AVE.
MARYLAND AVE.
INDIANA AVE.
KENTUCKY ST.
GEORGIA AVE.
FLORIDA ST.
CONNECTICUT AVE.
ILLINOIS AVE.
OHIO AVE.
NEVADA AVE.
TRENTON CT.
OCEAN VIEW
3 Story Brick Apartments
Stucco Cabanas

Figure 8-2

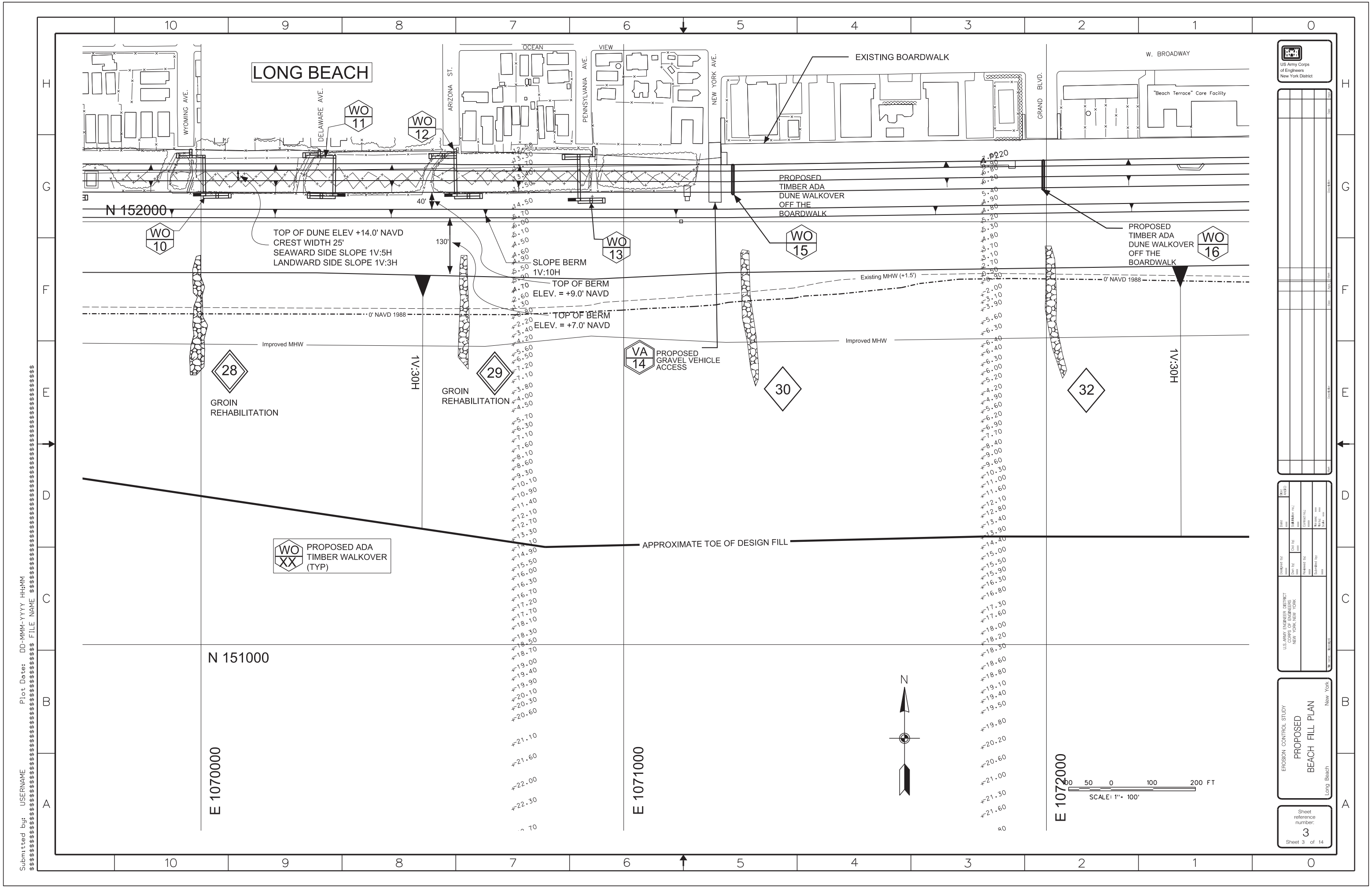
LONG BEACH
WYOMING AVE.
DELAWARE AVE.
ARIZONA ST.
OCEAN
VIEW
PENNSYLVANIA AVE.
NEW YORK AVE.
GRAND BLVD.
W. BROADWAY
"Beach Terrace" Care Facility
EXISTING BOARDWALK
WO 10
WO 11
WO 12
WO 13
WO 15
WO 16
N 152000
40'
130'
TOP OF DUNE ELEV +14.0' NAVD
CREST WIDTH 25'
SEAWARD SIDE SLOPE 1V:5H
LANDWARD SIDE SLOPE 1V:3H
SLOPE BERM
1V:10H
TOP OF BERM
ELEV. = +9.0' NAVD
TOP OF BERM
ELEV. = +7.0' NAVD
PROPOSED
TIMBER ADA
DUNE WALKOVER
OFF THE
BOARDWALK
Existing MHW (+1.5')
0' NAVD 1988
Improved MHW
1V:30H
28
GROIN
REHABILITATION
29
GROIN
REHABILITATION
VA 14
PROPOSED
GRAVEL VEHICLE
ACCESS
30
32
APPROXIMATE TOE OF DESIGN FILL
WO XX
PROPOSED ADA
TIMBER WALKOVER
(TYP)
N 151000
E 1070000
E 1071000
E 1072000
N
100 50 0 100 200 FT
SCALE: 1"= 100'
US Army Corps
of Engineers
New York District
EROSION CONTROL STUDY
PROPOSED
BEACH FILL PLAN
Long Beach
New York
Sheet
reference
number:
3
Sheet 3 of 14
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NEW YORK, NEW YORK
Plot Date: DD-MMM-YYYY HH:MM
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Figure 8-3

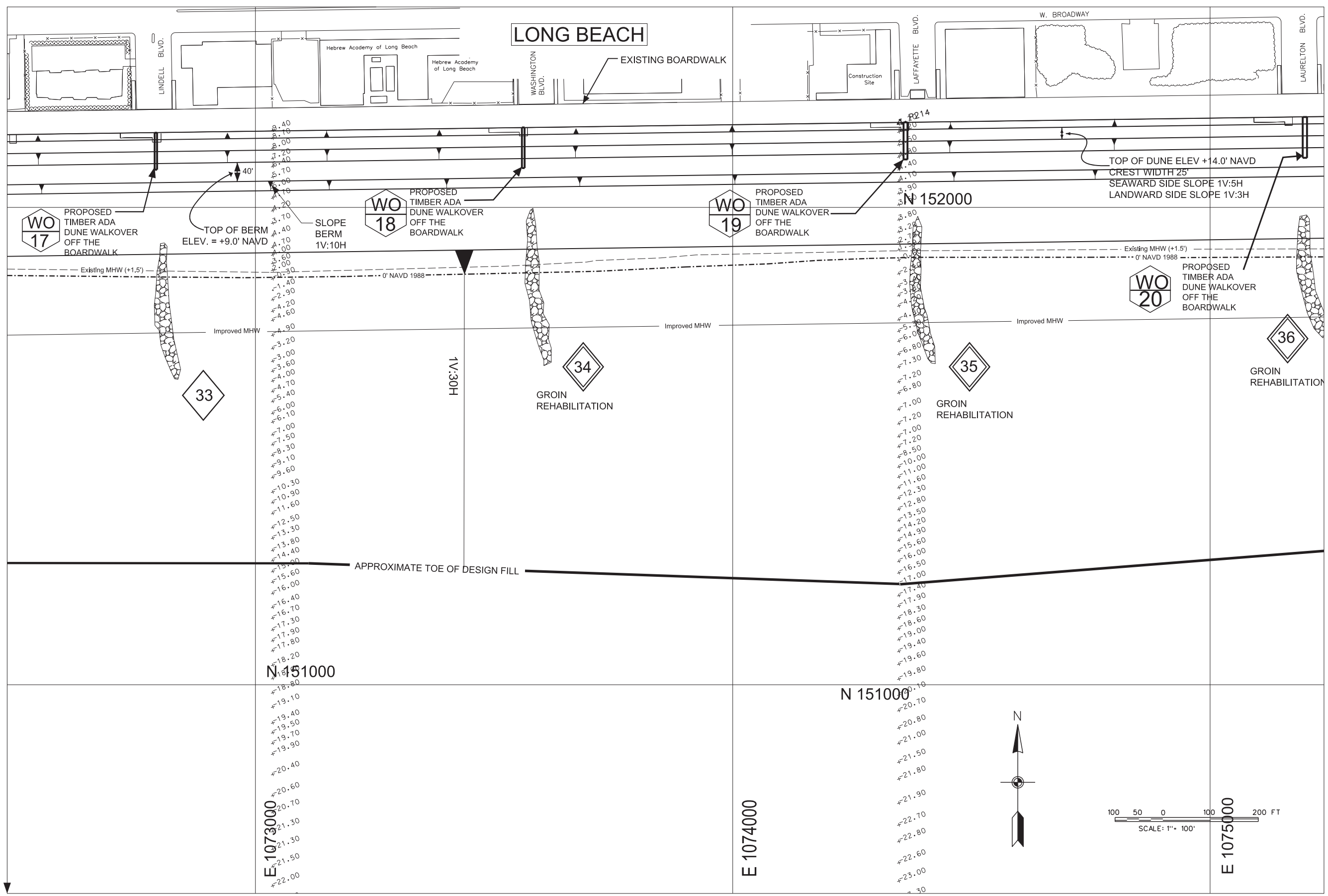
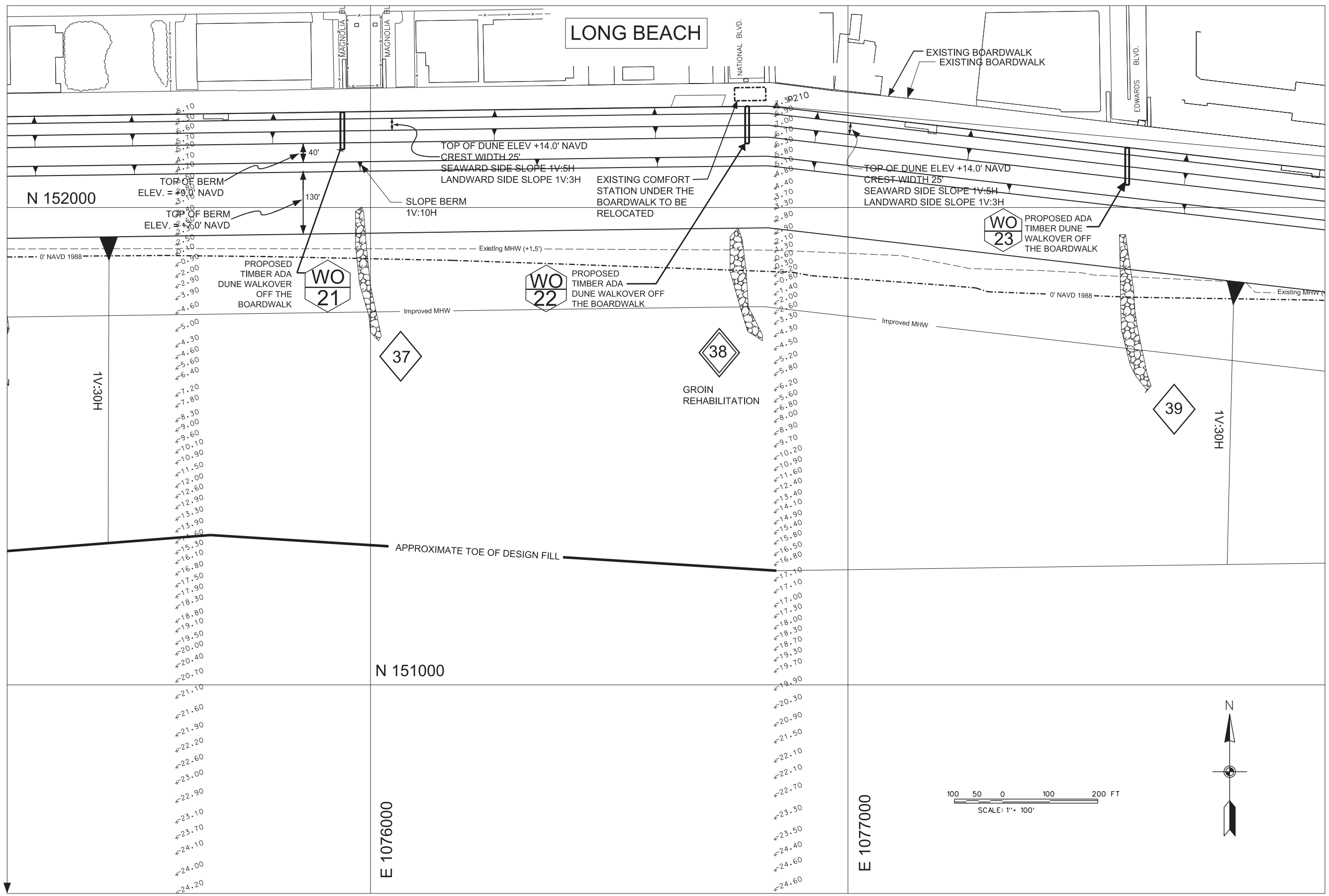

LONG BEACH
LINDELL BLVD.
Hebrew Academy of Long Beach
Hebrew Academy of Long Beach
WASHINGTON BLVD.
EXISTING BOARDWALK
Construction Site
LAFFAYETTE BLVD.
W. BROADWAY
LAURELTON BLVD.
PROPOSED TIMBER ADA DUNE WALKOVER OFF THE BOARDWALK
WO 17
TOP OF BERM ELEV. = +9.0' NAVD
40'
SLOPE BERM 1V:10H
WO 18
PROPOSED TIMBER ADA DUNE WALKOVER OFF THE BOARDWALK
WO 19
PROPOSED TIMBER ADA DUNE WALKOVER OFF THE BOARDWALK
N 152000
TOP OF DUNE ELEV +14.0' NAVD
CREST WIDTH 25'
SEAWARD SIDE SLOPE 1V:5H
LANDWARD SIDE SLOPE 1V:3H
Existing MHW (+1.5')
0' NAVD 1988
WO 20
PROPOSED TIMBER ADA DUNE WALKOVER OFF THE BOARDWALK
Improved MHW
33
1V:30H
34
GROIN REHABILITATION
35
GROIN REHABILITATION
36
GROIN REHABILITATION
APPROXIMATE TOE OF DESIGN FILL
N 151000
N 151000
E 1073000
E 1074000
E 1075000
N
100 50 0 100 200 FT
SCALE: 1"= 100'
US Army Corps of Engineers New York District
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK
EROSION CONTROL STUDY
PROPOSED BEACH FILL PLAN
Long Beach New York
Sheet reference number: 4
Sheet 4 of 14
Plot Date: DD-MMM-YYYY HH:MM
FILE NAME
USERNAME
Submitted by:

Figure 8-4



US Army Corps of Engineers
New York District

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CORPS OF ENGINEERS
NEW YORK, NEW YORK

EROSION CONTROL STUDY
PROPOSED
BEACH FILL PLAN
Long Beach New York

Sheet reference number:
5
Sheet 5 of 14

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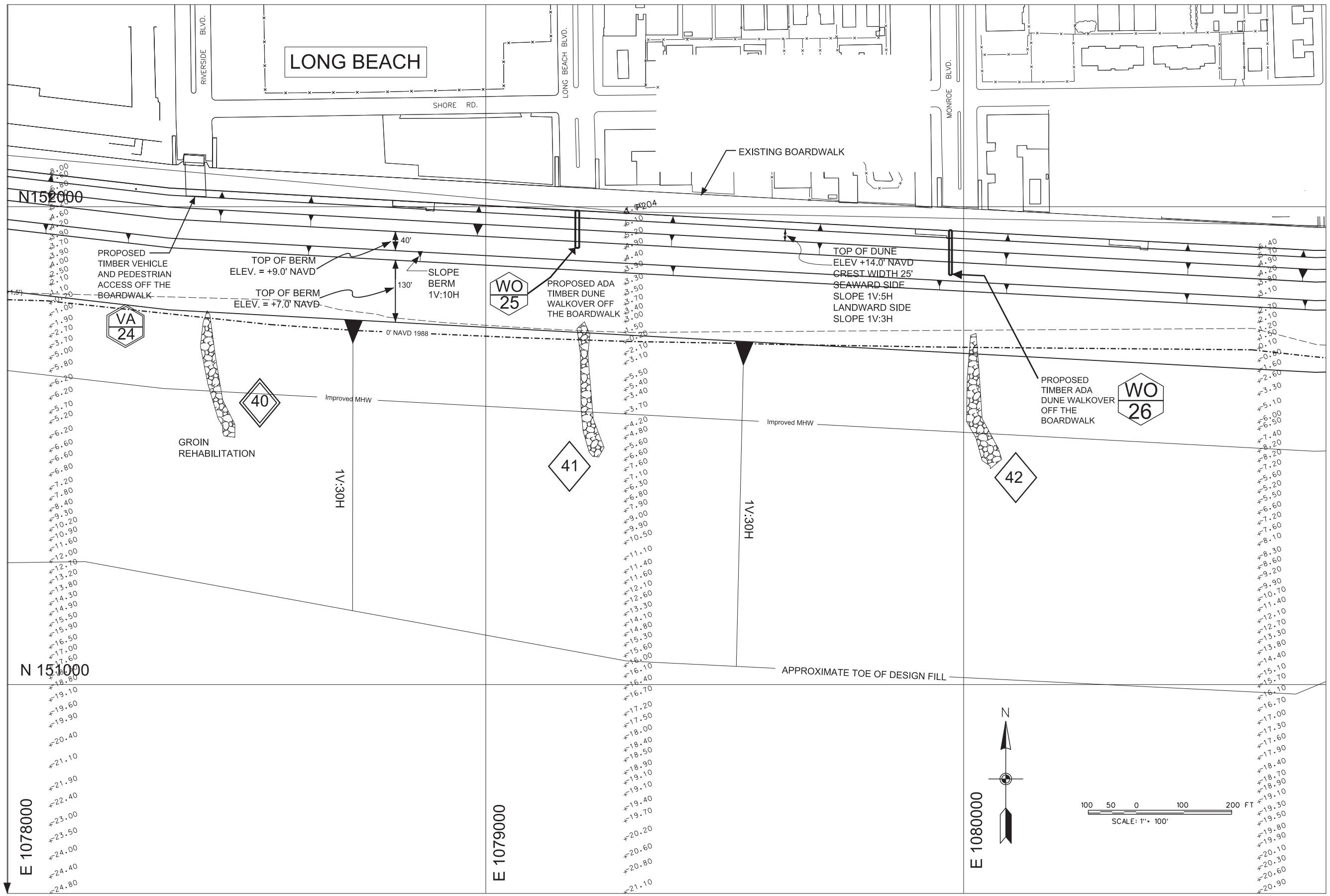
Figure 8-5



US Army Corps of Engineers New York District

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK

EROSION CONTROL STUDY
PROPOSED
BEACH FILL PLAN
Long Beach New York

Sheet reference number: 6
Sheet 6 of 14

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Figure 8-6

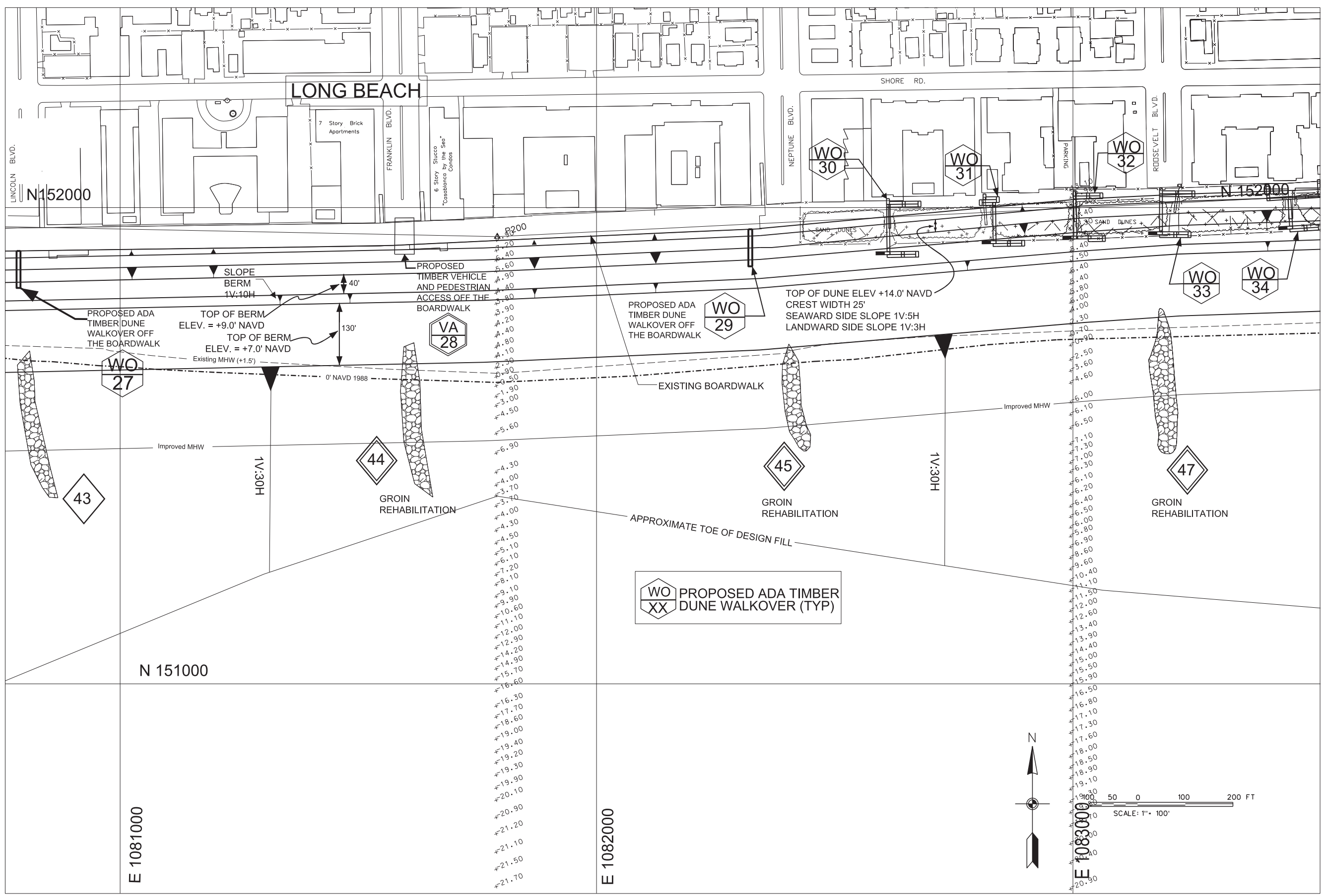
LONG BEACH
SHORE RD.
LINCOLN BLVD.
FRANKLIN BLVD.
NEPTUNE BLVD.
PARKING
ROOSEVELT BLVD.
7 Story Brick Apartments
6 Story Stucco "Casablanca by the Sea" Condos
N152000
N 151000
N 152000
E 1081000
E 1082000
E 1083000
SAND DUNES
SLOPE BERM 1V:10H
40'
130'
TOP OF BERM ELEV. = +9.0' NAVD
TOP OF BERM ELEV. = +7.0' NAVD
Existing MHW (+1.5')
0' NAVD 1988
Improved MHW
PROPOSED TIMBER VEHICLE AND PEDESTRIAN ACCESS OFF THE BOARDWALK
PROPOSED ADA TIMBER DUNE WALKOVER OFF THE BOARDWALK
EXISTING BOARDWALK
TOP OF DUNE ELEV +14.0' NAVD
CREST WIDTH 25'
SEAWARD SIDE SLOPE 1V:5H
LANDWARD SIDE SLOPE 1V:3H
1V:30H
GROIN REHABILITATION
APPROXIMATE TOE OF DESIGN FILL
WO XX PROPOSED ADA TIMBER DUNE WALKOVER (TYP)
WO 27
VA 28
WO 29
WO 30
WO 31
WO 32
WO 33
WO 34
43
44
45
47
N
SCALE: 1" = 100'
US Army Corps of Engineers New York District
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Figure 8-7

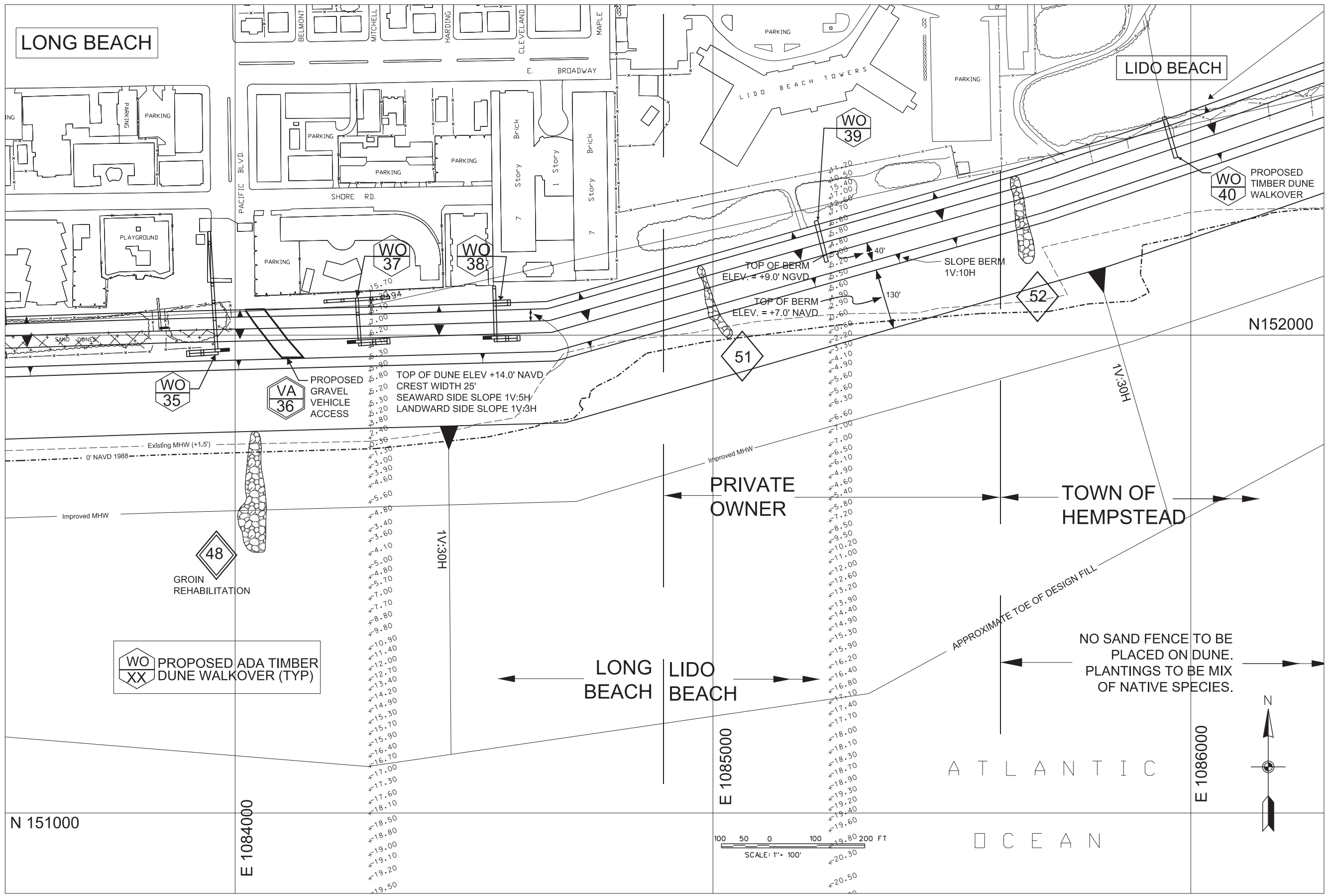

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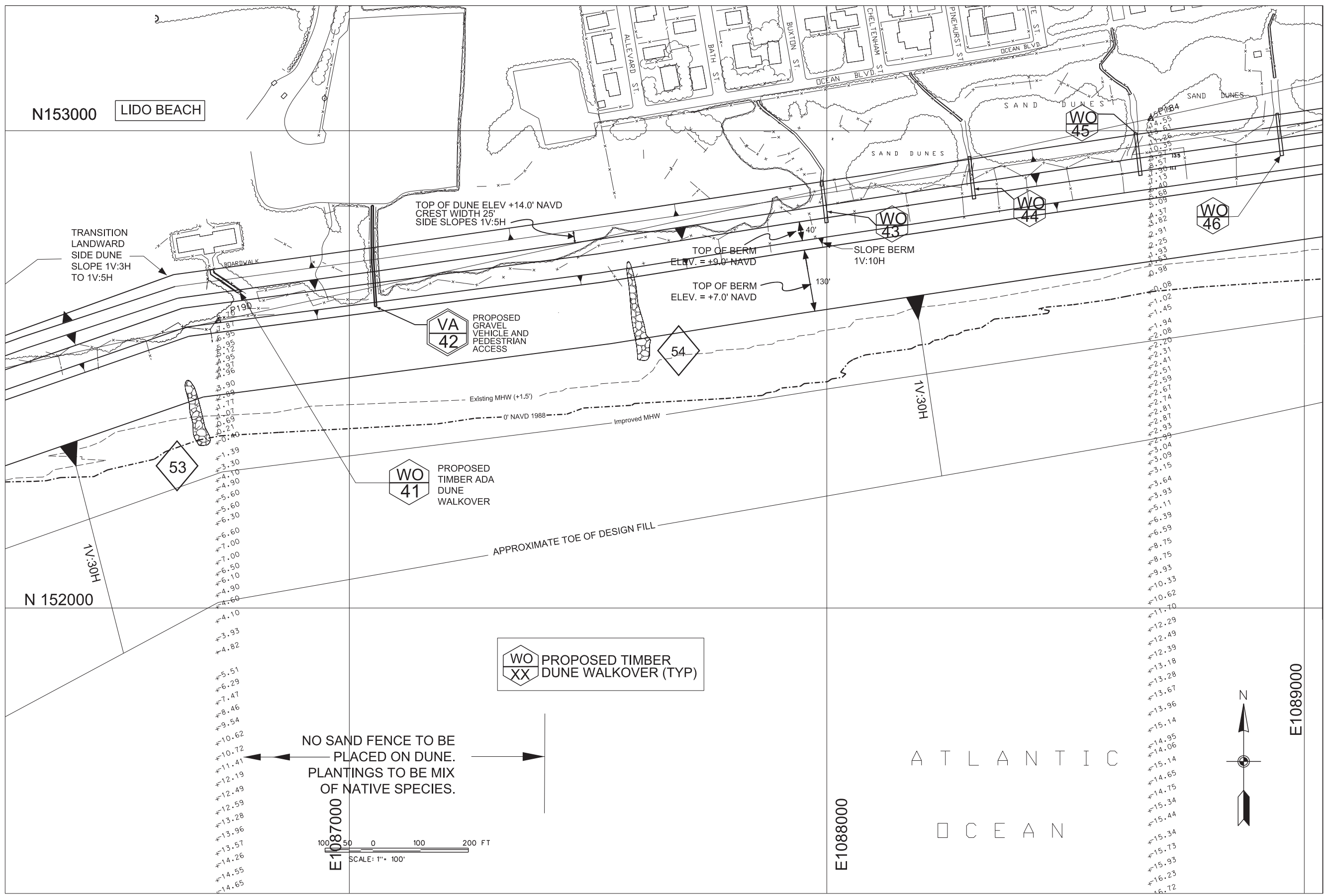
Figure 8-8



US Army Corps of Engineers
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Figure 8-9

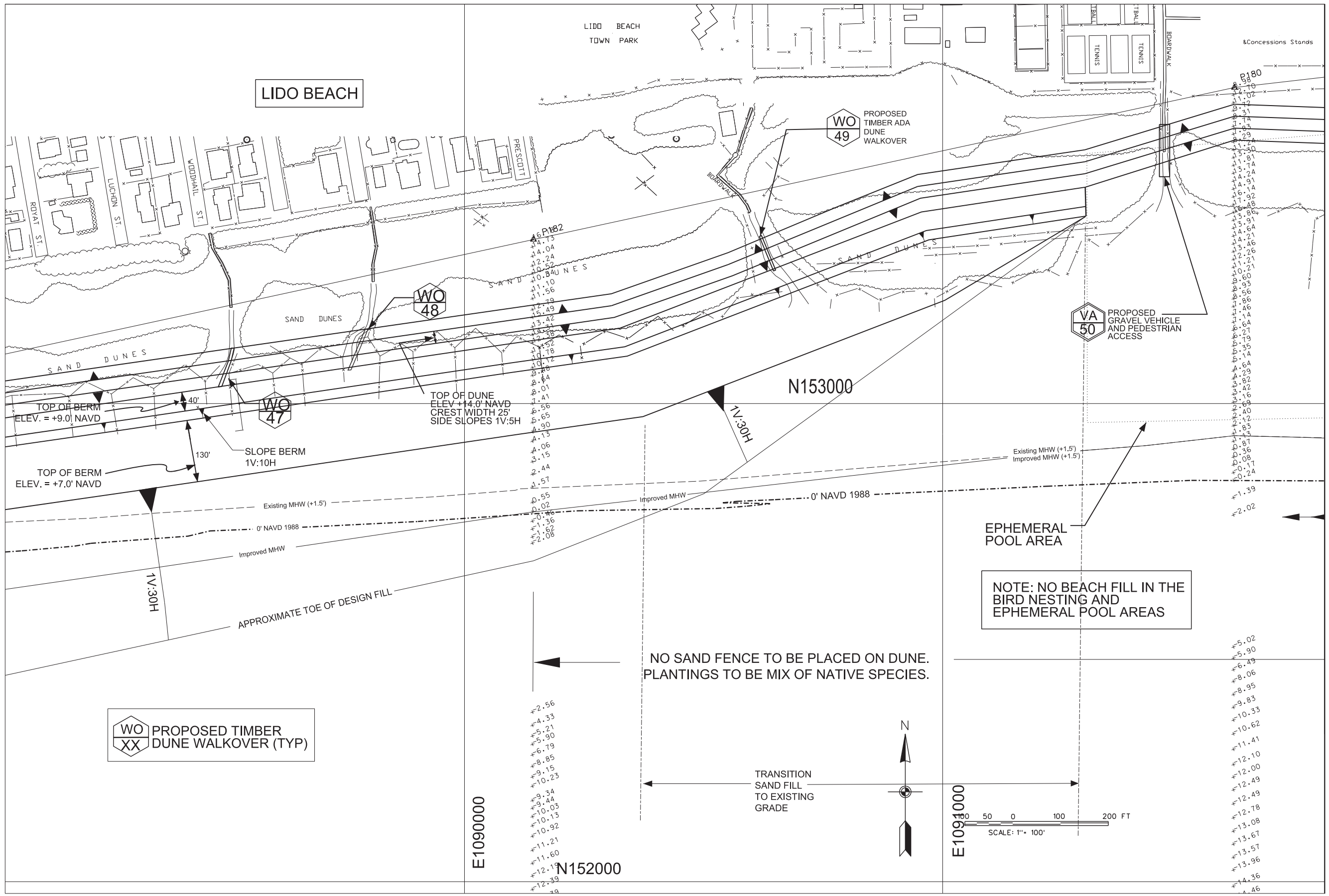
LIDO BEACH
LIDO BEACH TOWN PARK
&Concessions Stands
TENNIS
TENNIS
BOARDWALK
PRESCOTT
WOODHULL ST.
LUCKIN ST.
ROYAL ST.
SAND DUNES
WO 49
PROPOSED TIMBER ADA DUNE WALKOVER
WO 48
WO 47
VA 50
PROPOSED GRAVEL VEHICLE AND PEDESTRIAN ACCESS
TOP OF BERM ELEV. = +9.0' NAVD
40'
TOP OF DUNE ELEV +14.0' NAVD CREST WIDTH 25' SIDE SLOPES 1V:5H
SLOPE BERM 1V:10H
130'
TOP OF BERM ELEV. = +7.0' NAVD
1V:30H
N153000
Existing MHW (+1.5')
Improved MHW (+1.5')
0' NAVD 1988
Improved MHW
Existing MHW (+1.5')
0' NAVD 1988
Improved MHW
1V:30H
APPROXIMATE TOE OF DESIGN FILL
EPHEMERAL POOL AREA
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.
WO XX PROPOSED TIMBER DUNE WALKOVER (TYP)
TRANSITION SAND FILL TO EXISTING GRADE
N
E1090000
E1091000
N152000
100 50 0 100 200 FT
SCALE: 1"= 100'
US Army Corps of Engineers New York District
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Figure 8-10

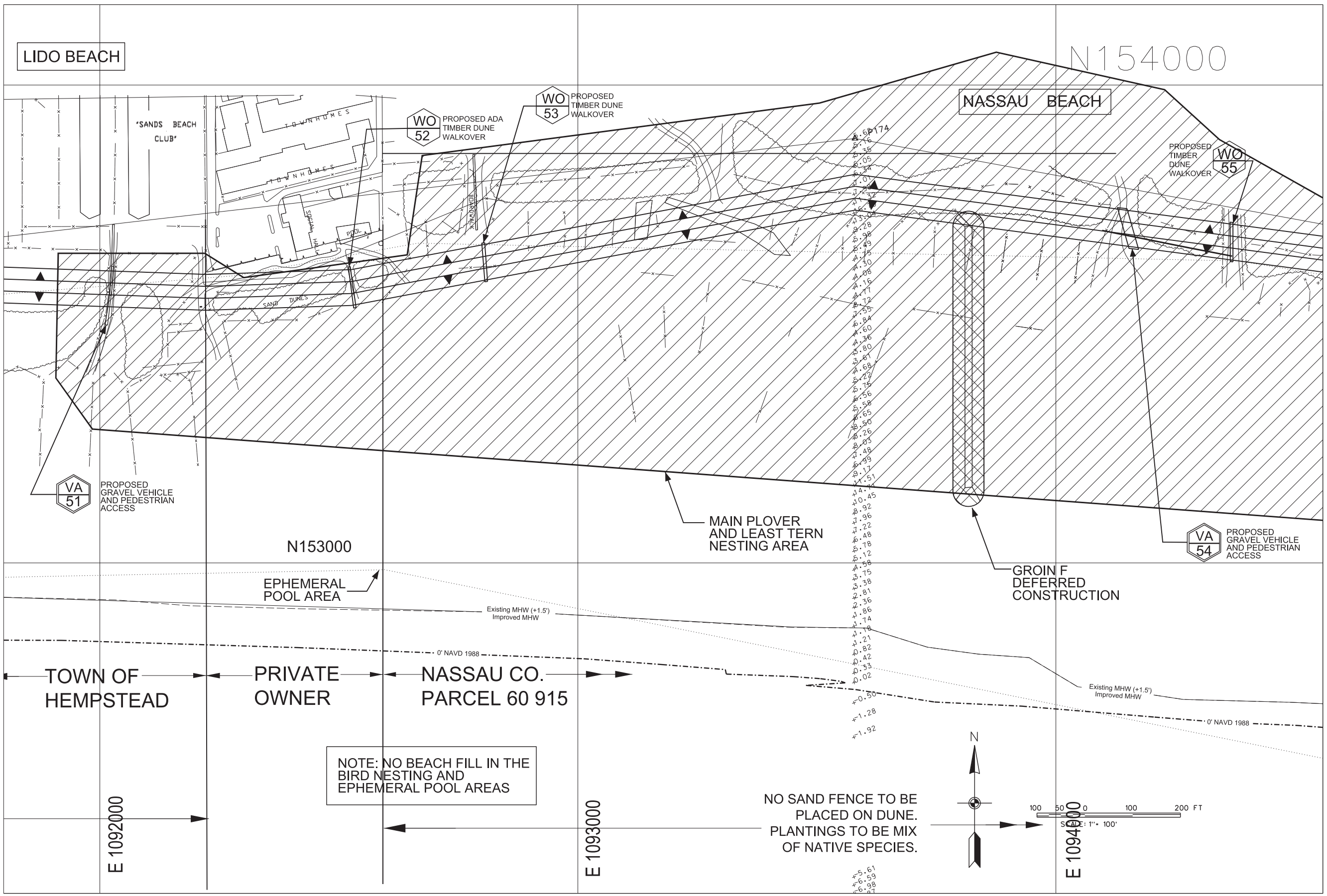

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Figure 8-11

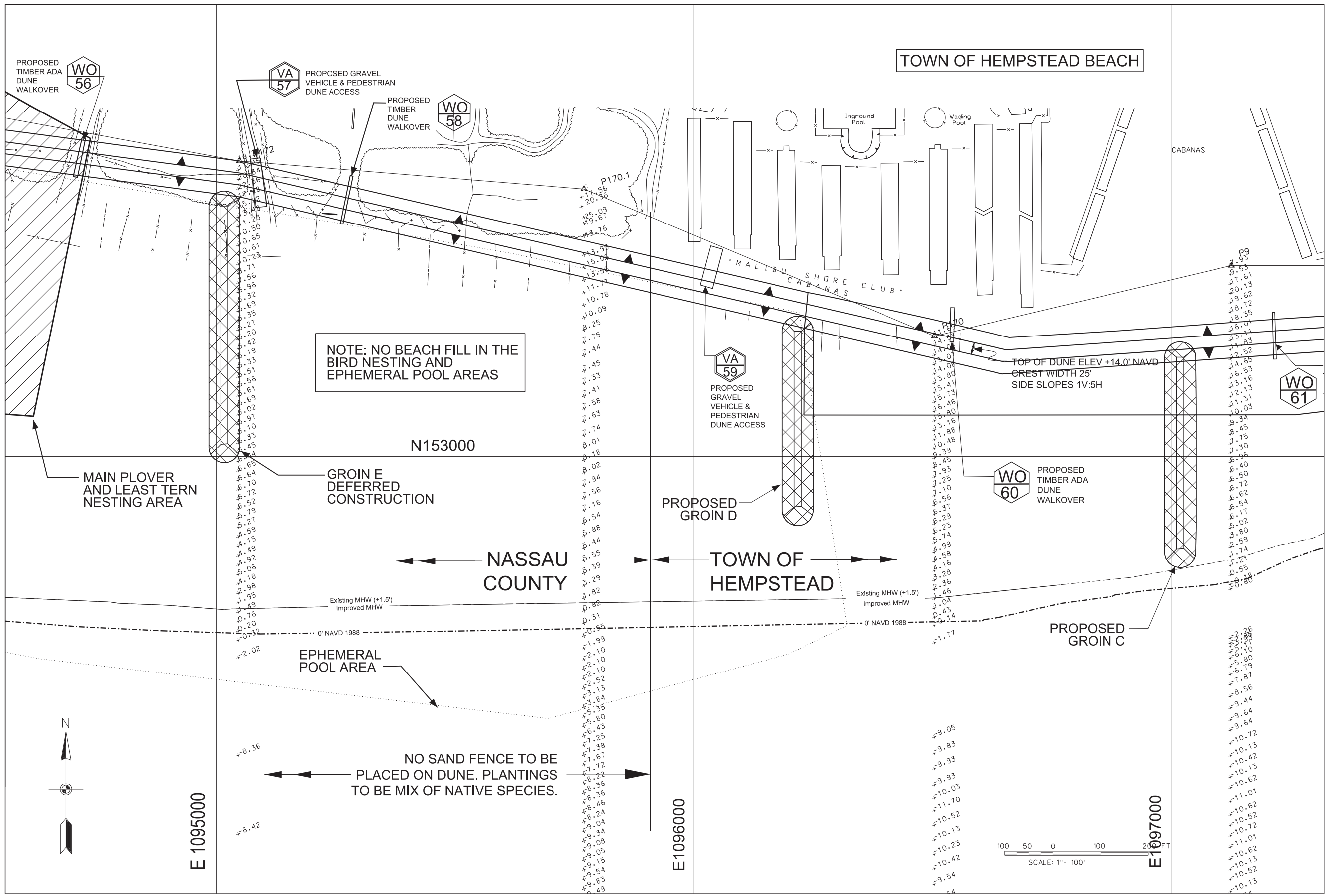
TOWN OF HEMPSTEAD BEACH
PROPOSED TIMBER ADA DUNE WALKOVER
WO 56
VA 57
PROPOSED GRAVEL VEHICLE & PEDESTRIAN DUNE ACCESS
PROPOSED TIMBER DUNE WALKOVER
WO 58
Inground Pool
Wading Pool
CABANAS
"MALIBU SHORE CLUB" CABANAS
NOTE: NO BEACH FILL IN THE BIRD NESTING AND EPHEMERAL POOL AREAS
VA 59
PROPOSED GRAVEL VEHICLE & PEDESTRIAN DUNE ACCESS
TOP OF DUNE ELEV +14.0' NAVD
CREST WIDTH 25'
SIDE SLOPES 1V:5H
WO 61
N153000
MAIN PLOVER AND LEAST TERN NESTING AREA
GROIN E DEFERRED CONSTRUCTION
PROPOSED GROIN D
WO 60
PROPOSED TIMBER ADA DUNE WALKOVER
NASSAU COUNTY
TOWN OF HEMPSTEAD
Existing MHW (+1.5') Improved MHW
0' NAVD 1988
PROPOSED GROIN C
EPHEMERAL POOL AREA
NO SAND FENCE TO BE PLACED ON DUNE. PLANTINGS TO BE MIX OF NATIVE SPECIES.
E 1095000
E1096000
E1097000
SCALE: 1"= 100'
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Figure 8-12

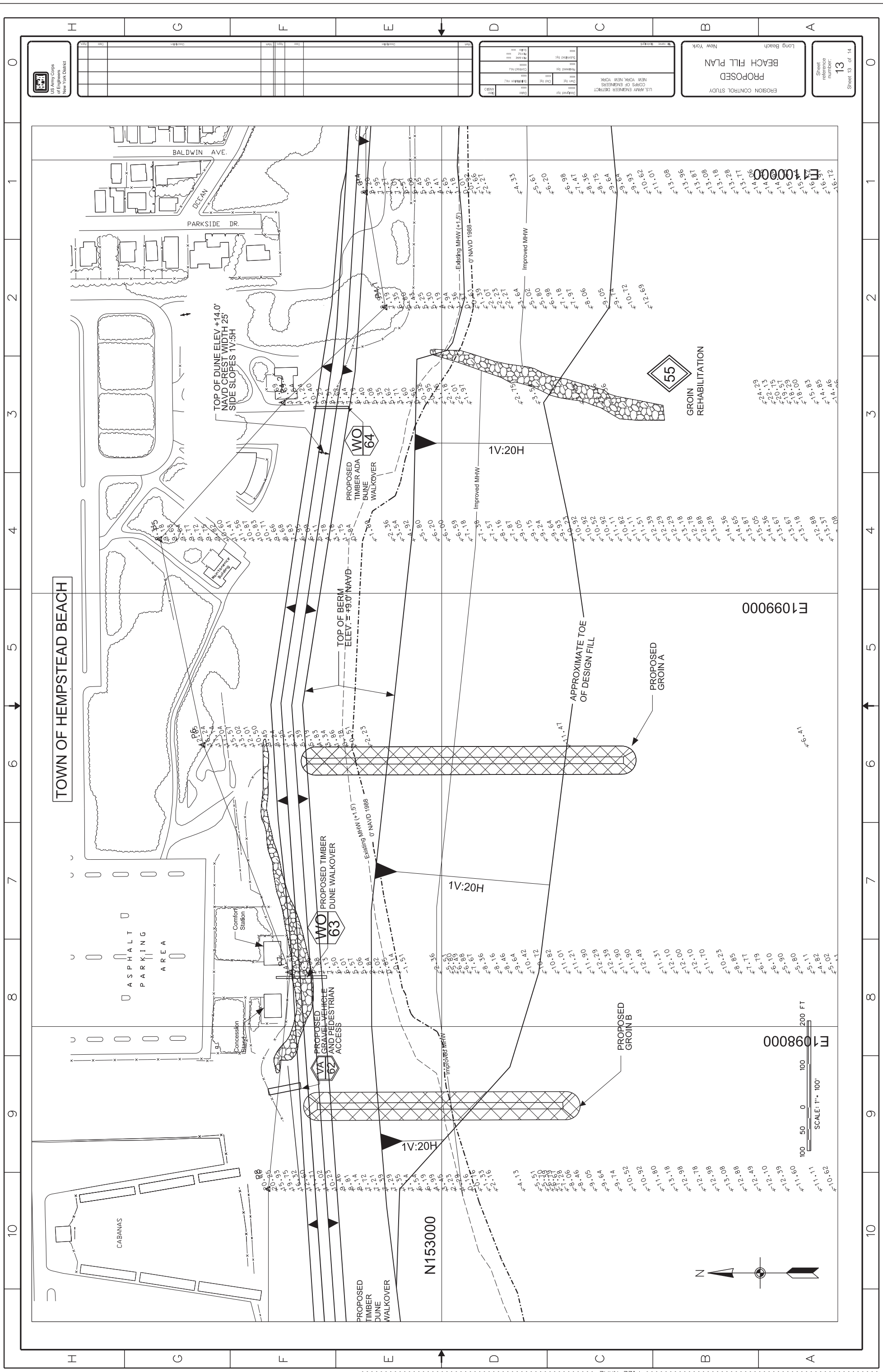
TOWN OF HEMPSTEAD BEACH
BALDWIN AVE.
OCEAN
PARKSIDE DR.
TOP OF DUNE ELEV +14.0'
NAVD CREST WIDTH 25'
SIDE SLOPES 1V:5H
PROPOSED TIMBER ADA DUNE WALKOVER
WO 64
1V:20H
Existing MHW (+1.5')
0' NAVD 1988
Improved MHW
55
GROIN REHABILITATION
TOP OF BERM ELEV. = +9.0' NAVD
APPROXIMATE TOE OF DESIGN FILL
PROPOSED GROIN A
PROPOSED TIMBER DUNE WALKOVER
WO 63
ASPHALT PARKING AREA
Comfort Station
Concession Stand
PROPOSED GRAVEL VEHICLE AND PEDESTRIAN ACCESS
VA 62
PROPOSED GROIN B
CABANAS
N153000
E1099000
E1098000
SCALE: 1" = 100'
200 FT
100
0
50
100
N

Figure 8-13

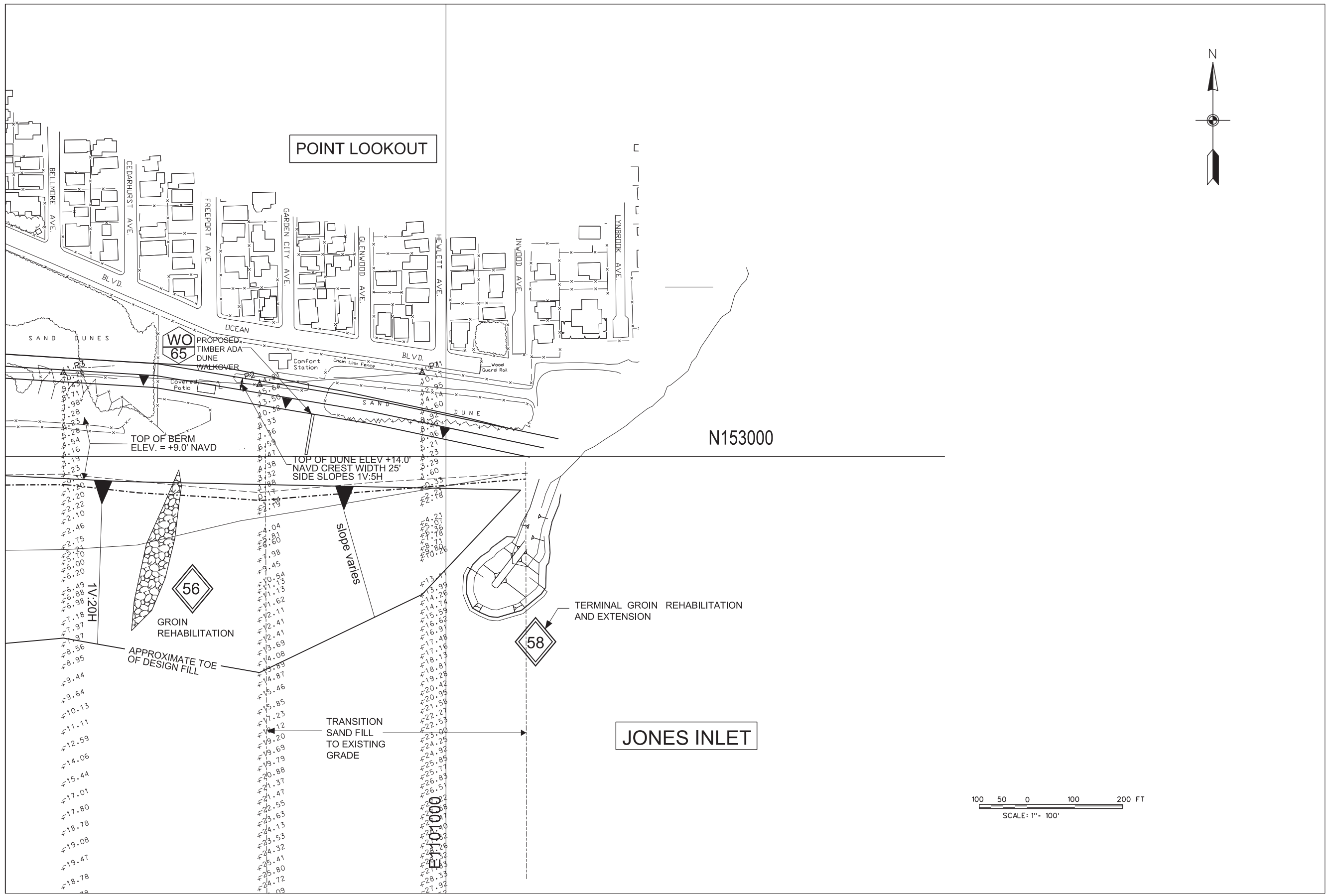

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Figure 8-14

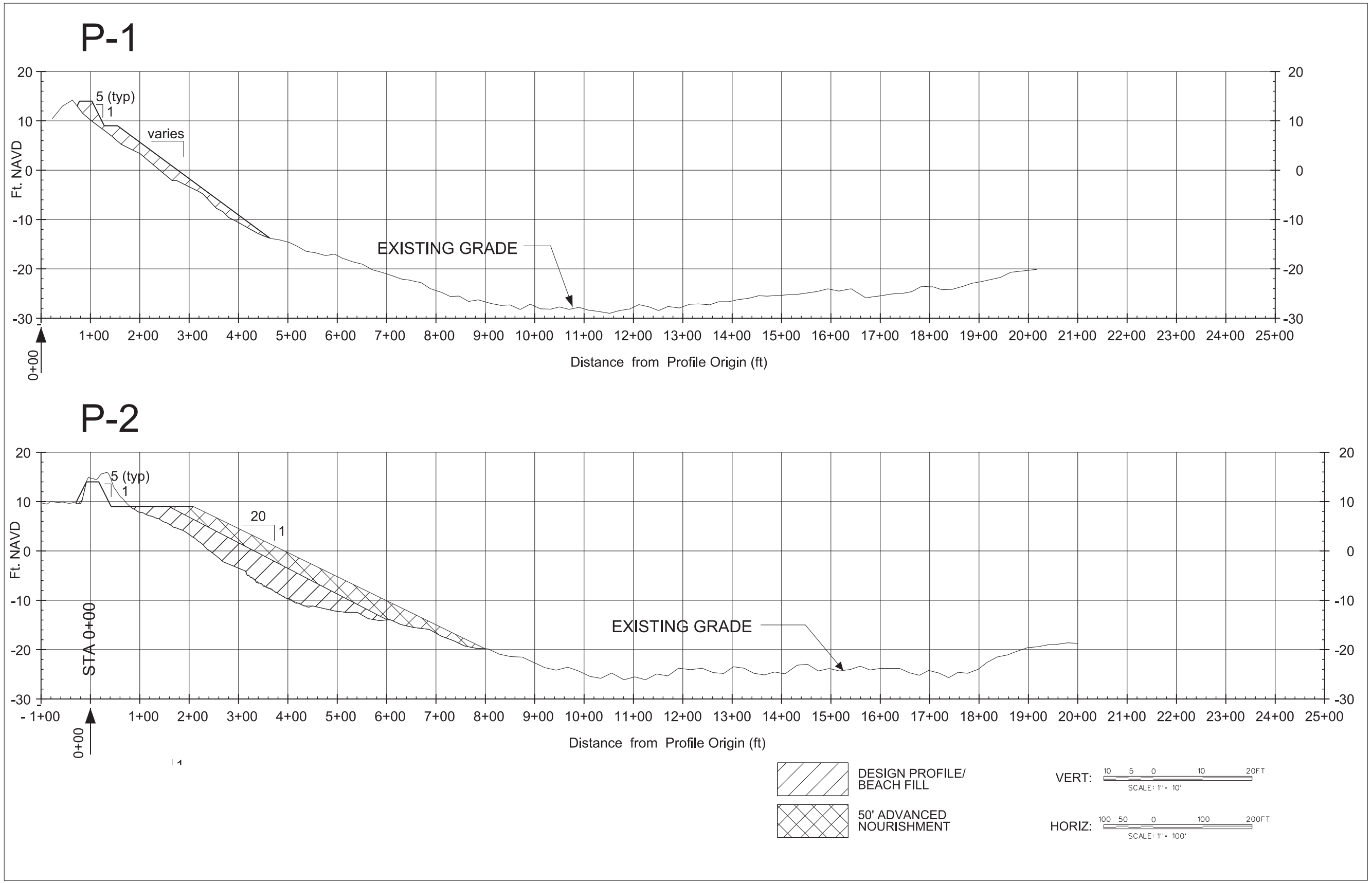

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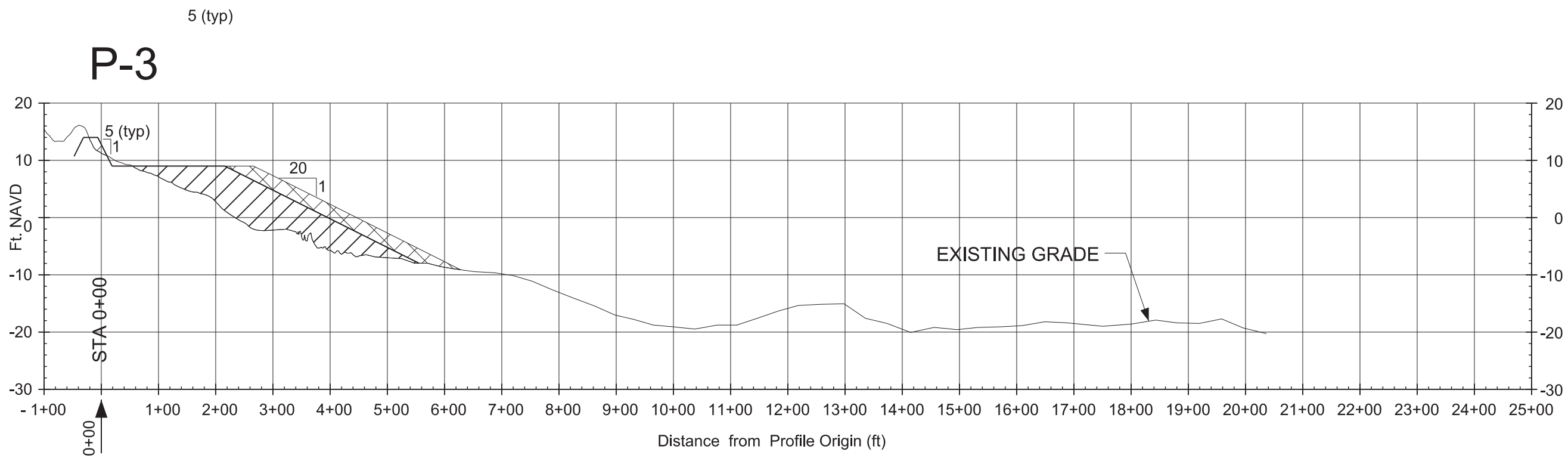
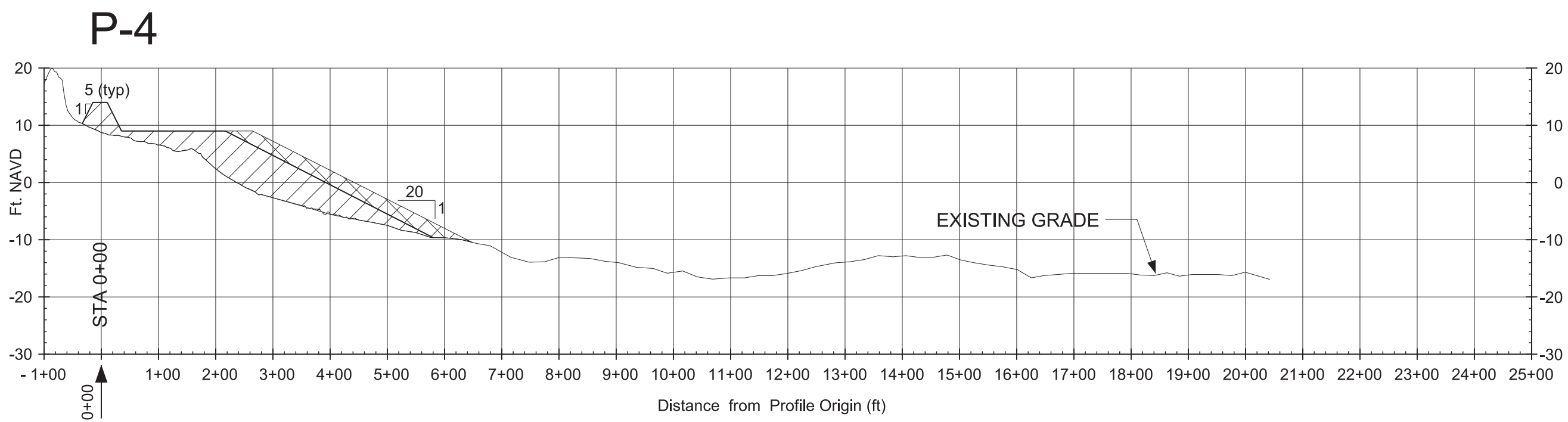
Figure 8-15





DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT SCALE: 1"= 10'

HORIZ: 100 50 0 100 200FT SCALE: 1"= 100'

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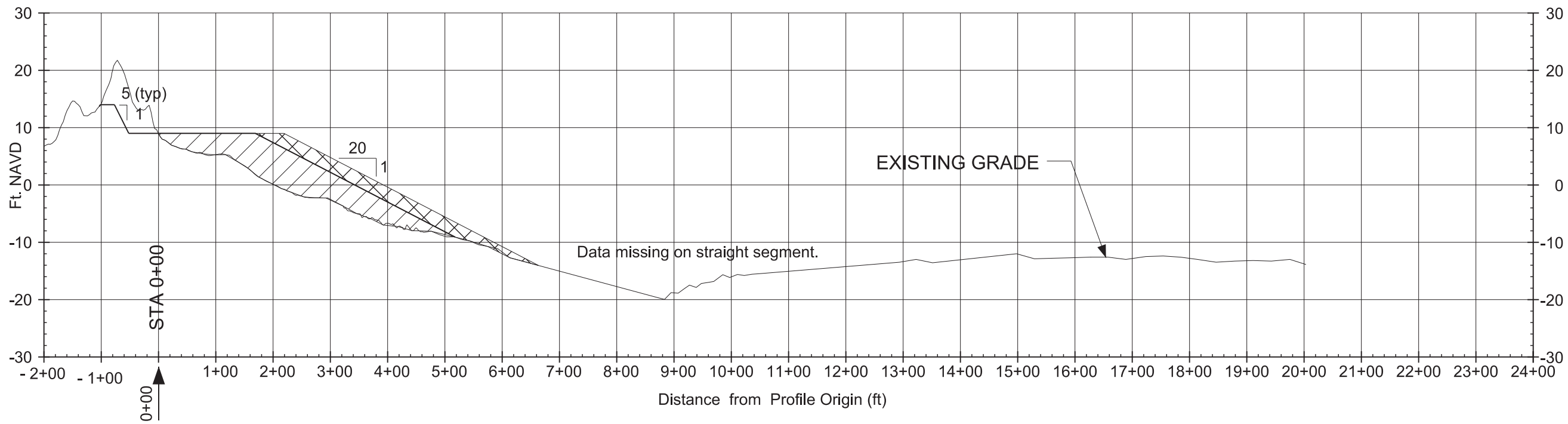
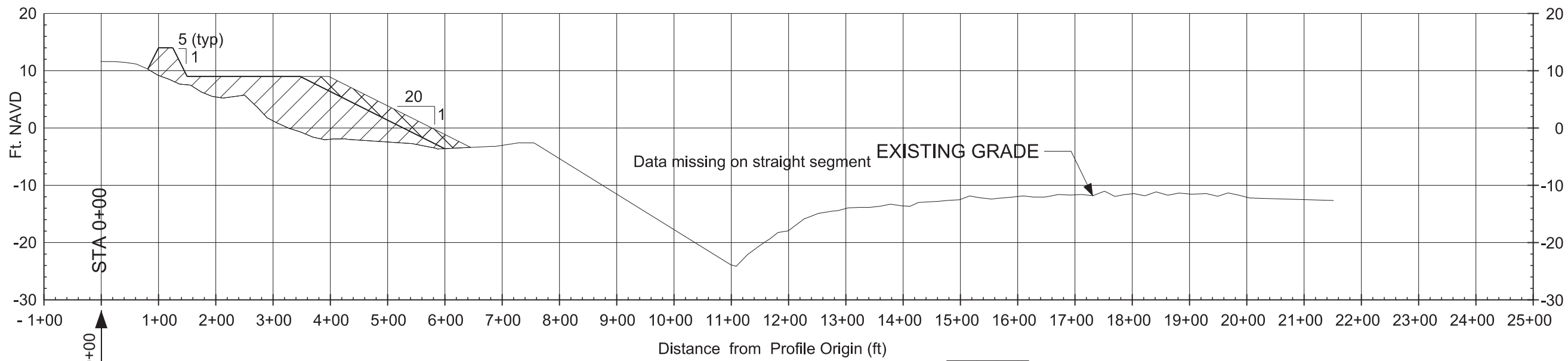
Figure 8-16

P-4.1



P-4.2



DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT SCALE: 1"= 10'

HORIZ: 100 50 0 100 200FT SCALE: 1"= 100'

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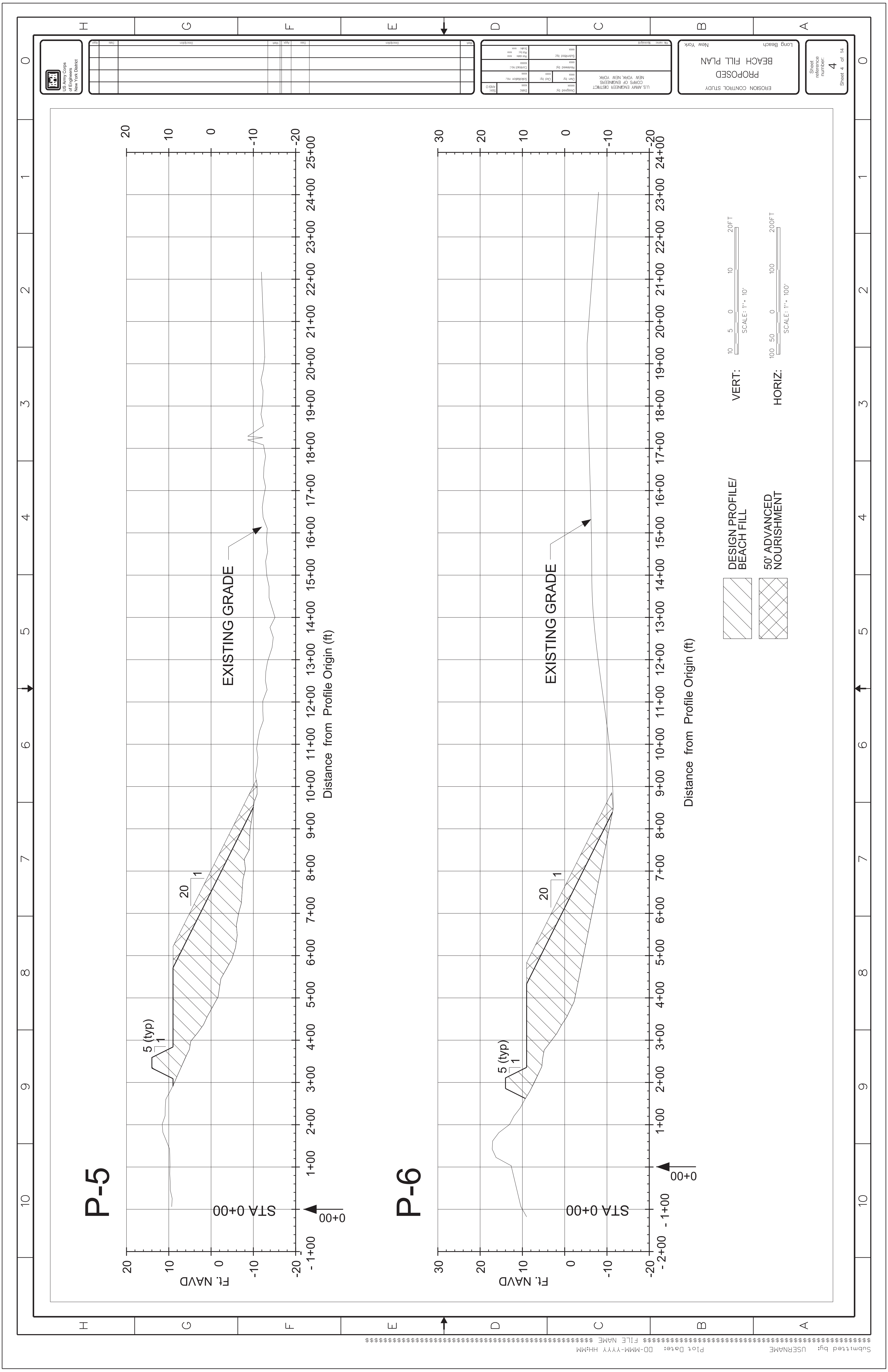
Figure 8-17



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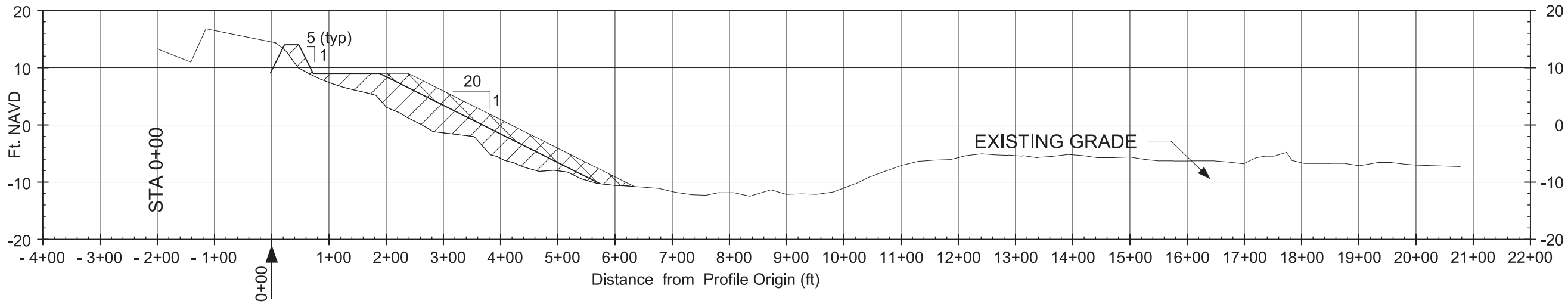
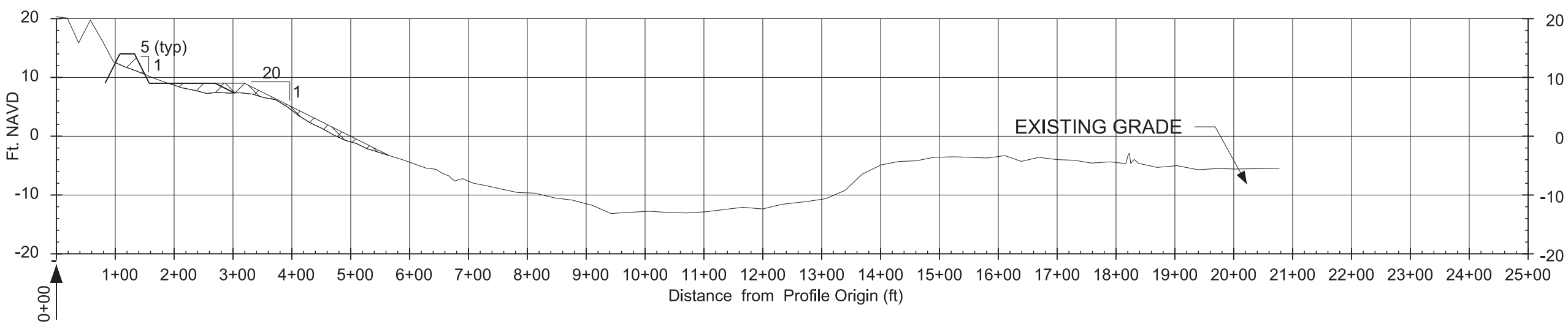
P-5
P-6
EXISTING GRADE
EXISTING GRADE
STA 0+00
0+00
Ft. NAVD
Distance from Profile Origin (ft)
5 (typ)
1
20
1
DESIGN PROFILE/
BEACH FILL
50' ADVANCED
NOURISHMENT
VERT:
SCALE: 1''= 10'
20FT
HORIZ:
SCALE: 1''= 100'
200FT
Submitted by: USERNAME
Plot Date: DD-MMM-YYYY HH:MM
FILE NAME

Figure 8-18

P-7



P-8



DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT — SCALE: 1"= 10'

HORIZ: 100 50 0 100 200FT — SCALE: 1"= 100'

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Figure 8-19

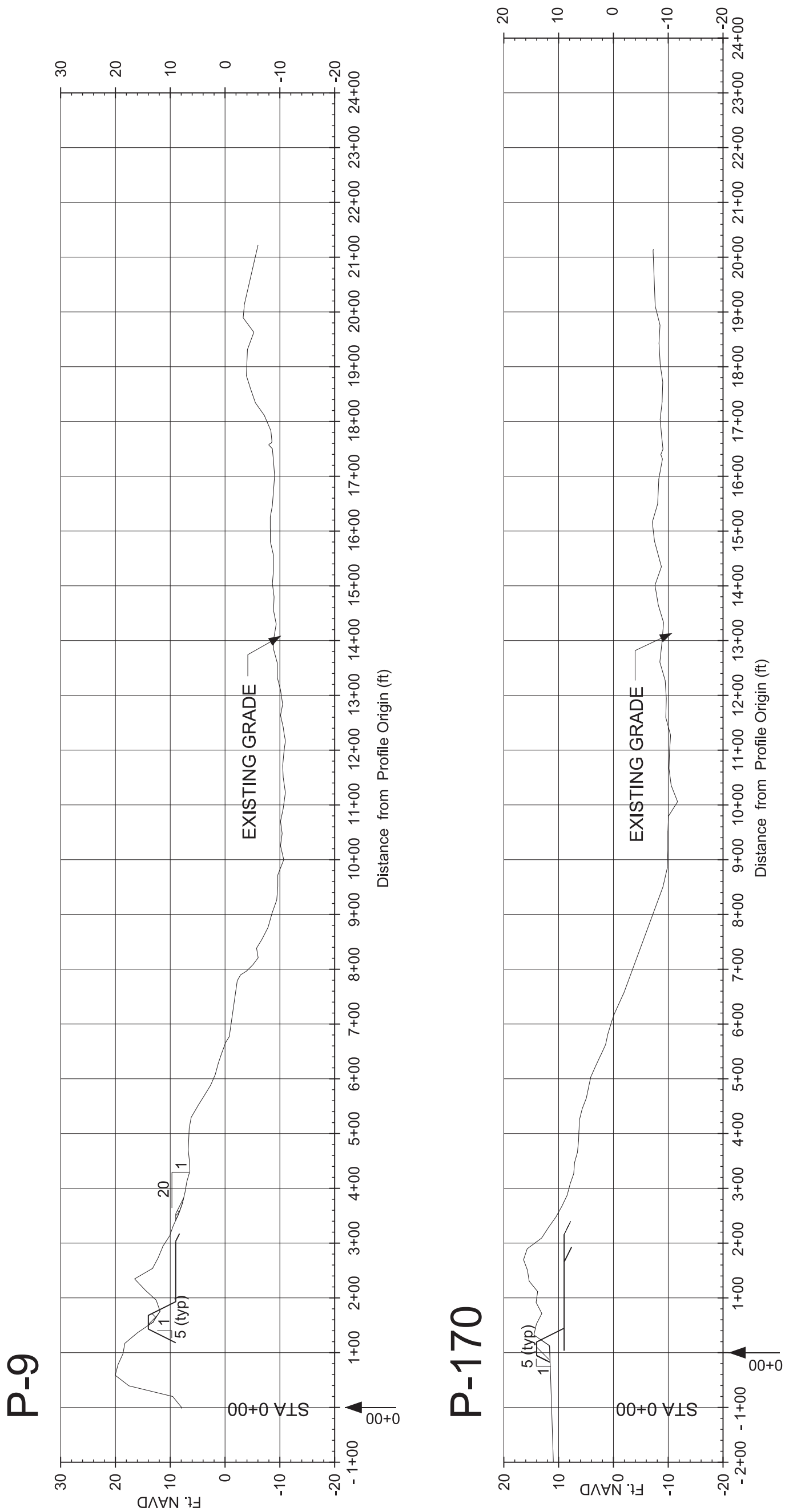
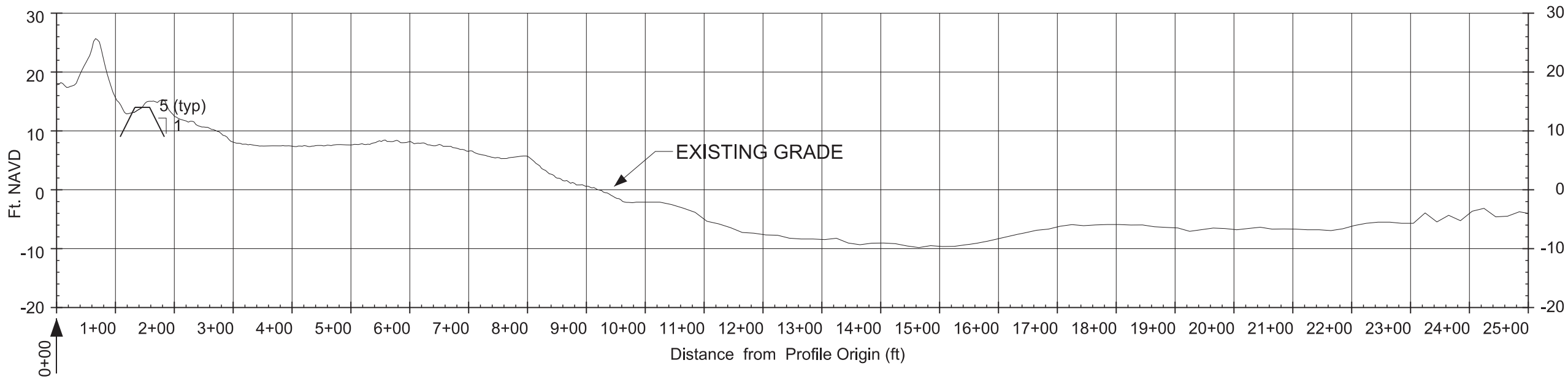
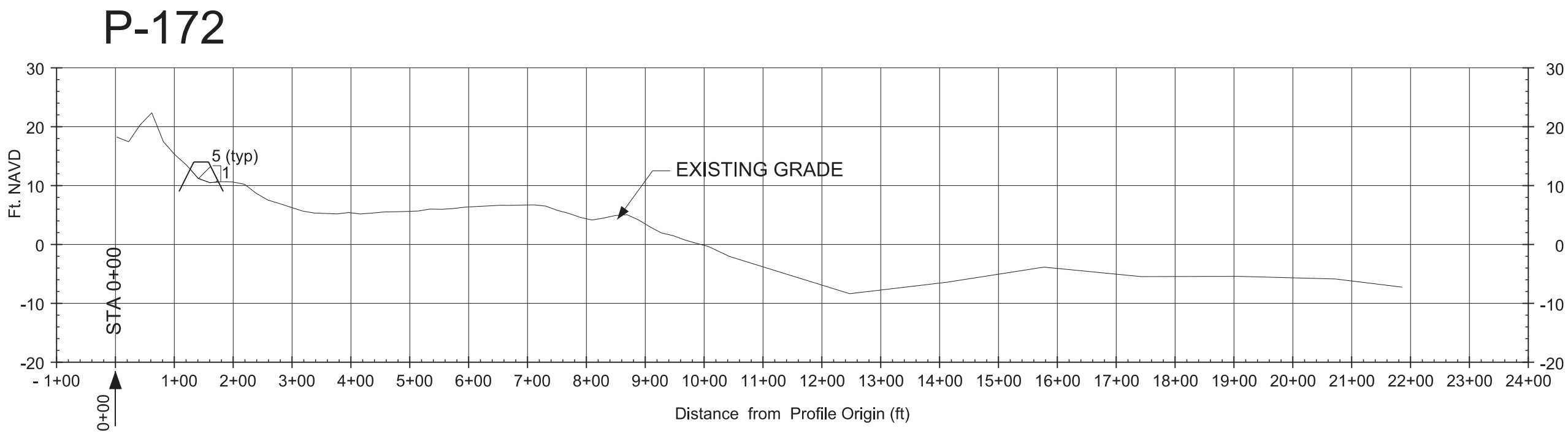

P-9
P-170
EXISTING GRADE
STA 0+00
0+00
5 (typ)
1
20
Ft. NAVD
Distance from Profile Origin (ft)
DESIGN PROFILE/
BEACH FILL
50' ADVANCED
NOURISHMENT
VERT:
SCALE: 1" = 10'
HORIZ:
SCALE: 1" = 100'

Figure 8-20





DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT
SCALE: 1"= 10'

HORIZ: 100 50 0 100 200FT
SCALE: 1"= 100'

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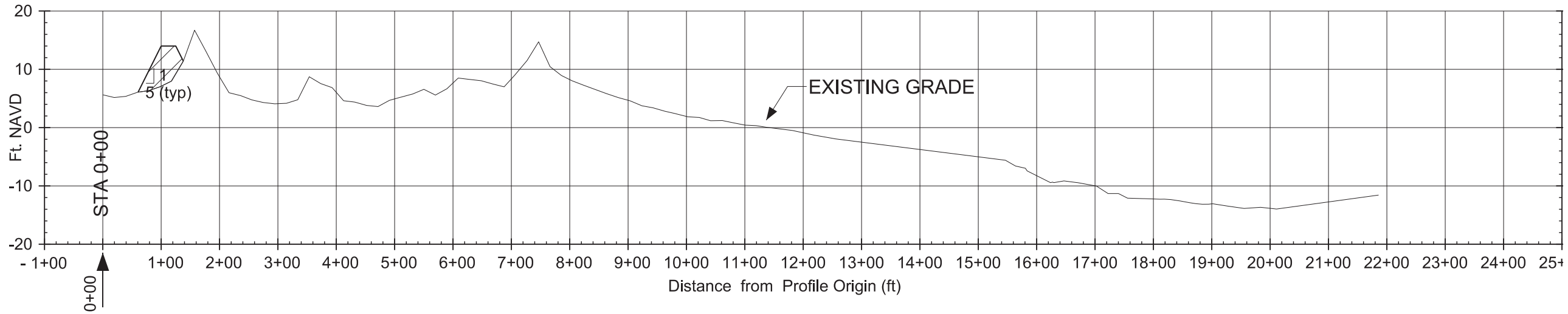
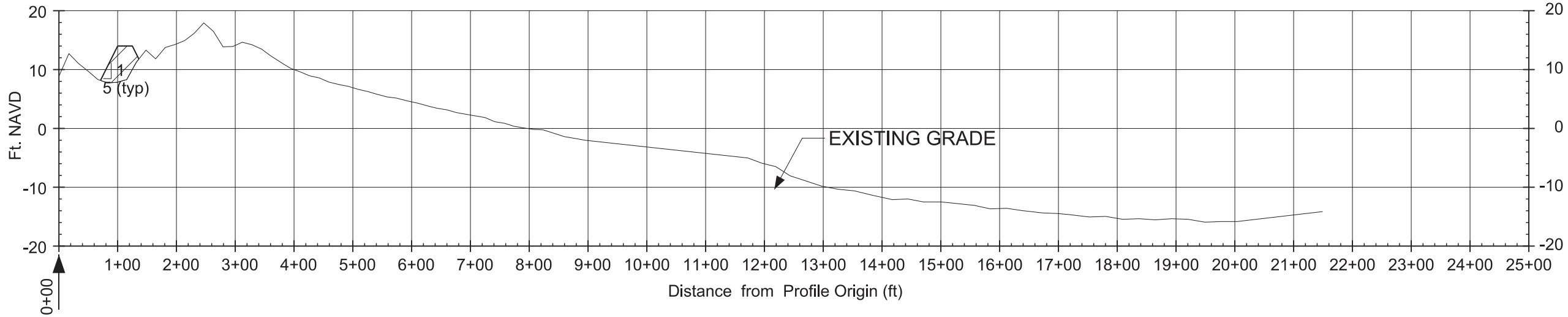
Figure 8-21

P-174



P-180



DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT
SCALE: 1"= 10'

HORIZ: 100 50 0 100 200FT
SCALE: 1"= 100'

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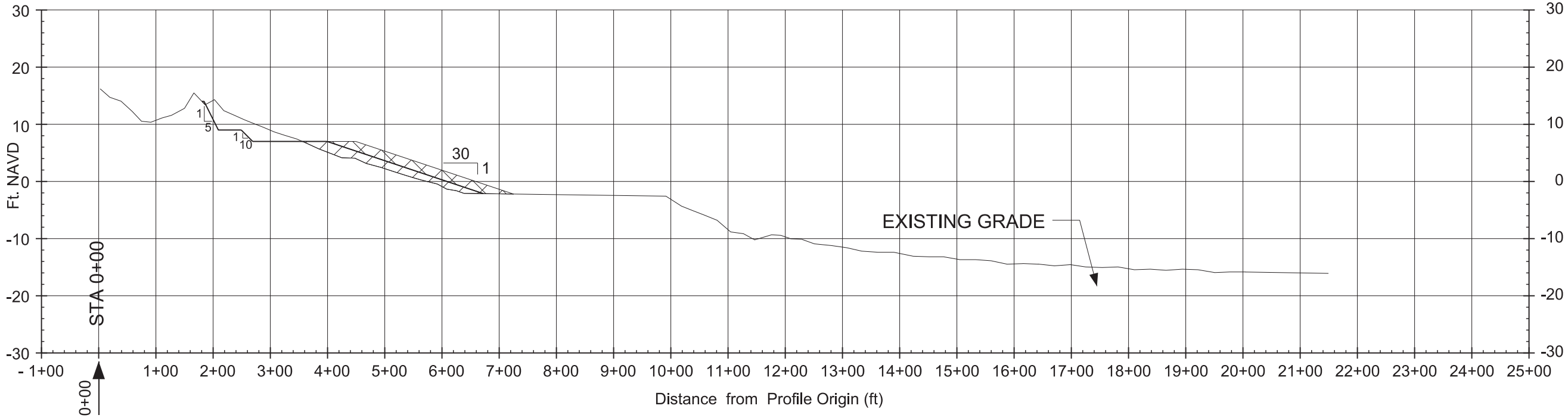
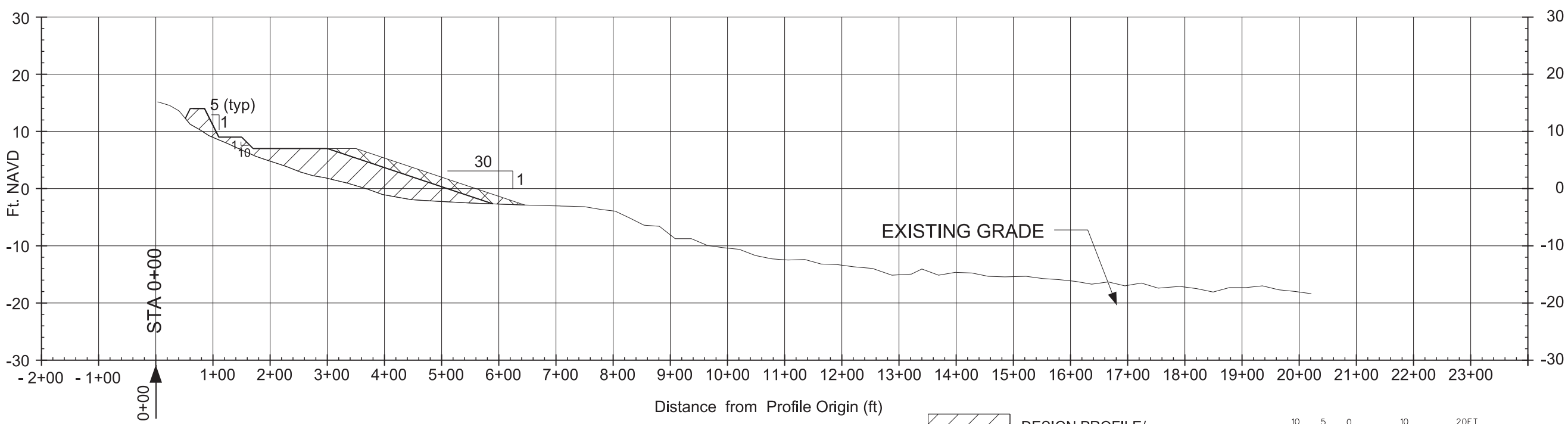
Figure 8-22





DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT
SCALE: 1"= 10'

HORIZ: 100 50 0 100 200FT
SCALE: 1"= 100'

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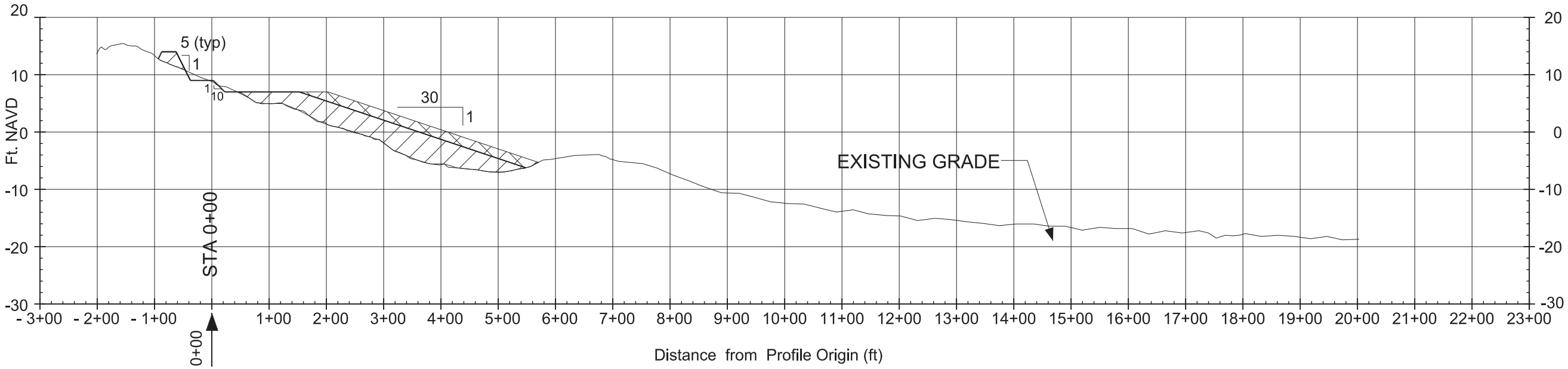
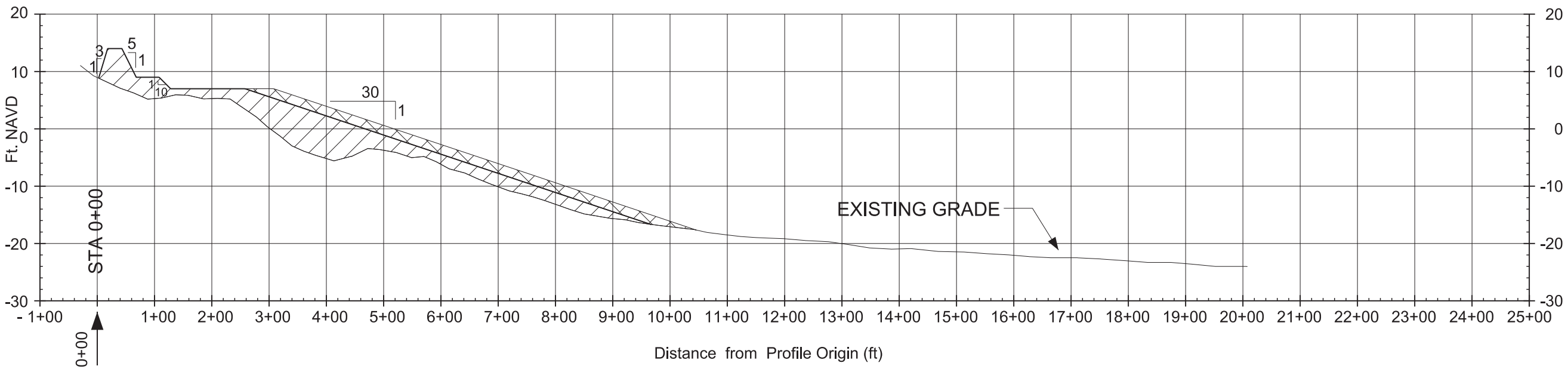
Figure 8-23

P-190



P-194



DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT
SCALE: 1" = 10'

HORIZ: 100 50 0 100 200FT
SCALE: 1" = 100'

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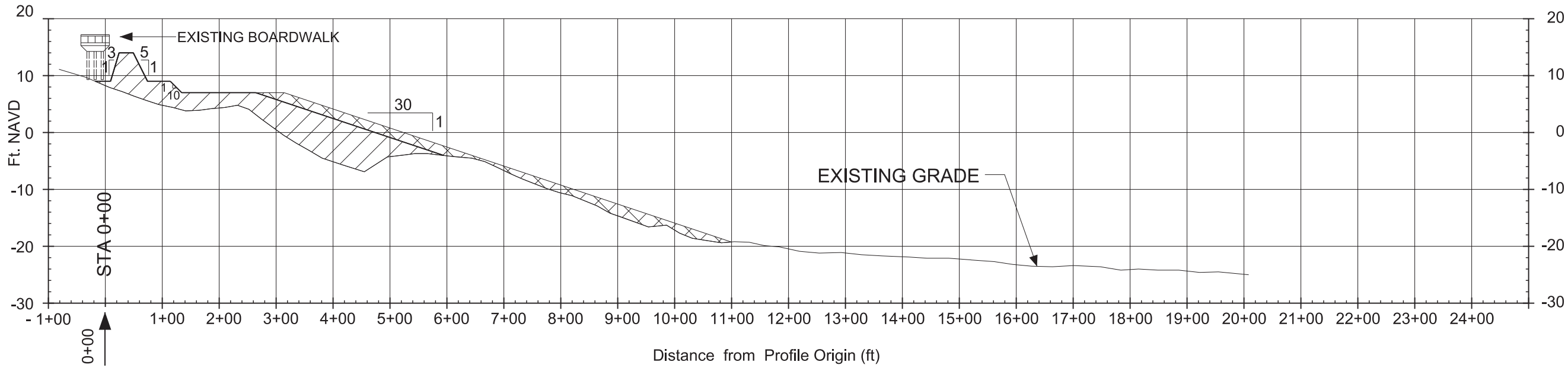
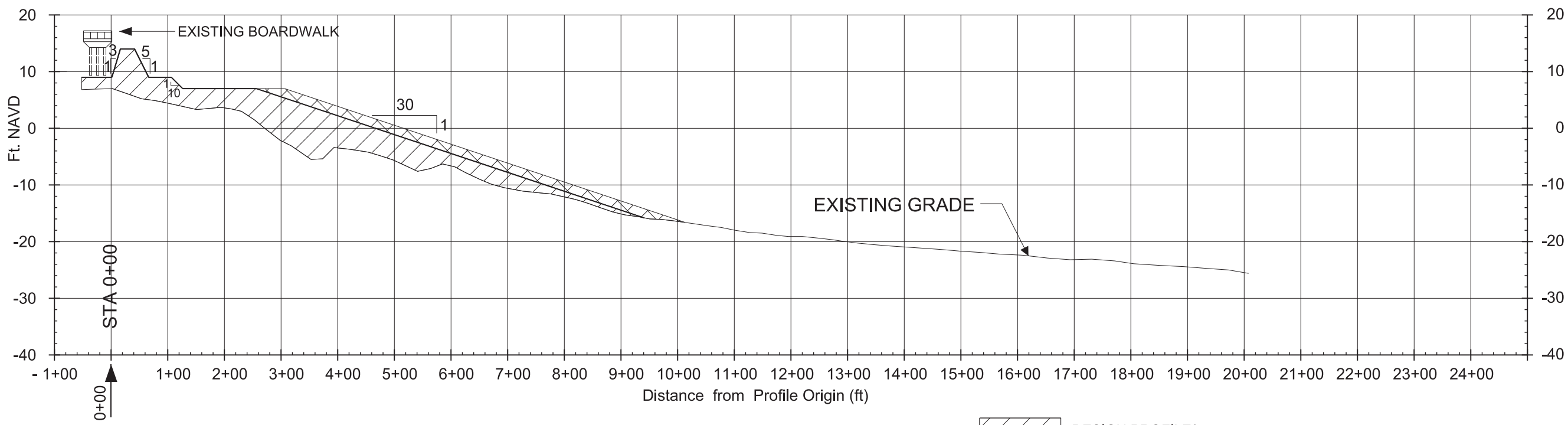
Figure 8-24

P-200



P-204



DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT — SCALE: 1" = 10'

HORIZ: 100 50 0 100 200FT — SCALE: 1" = 100'

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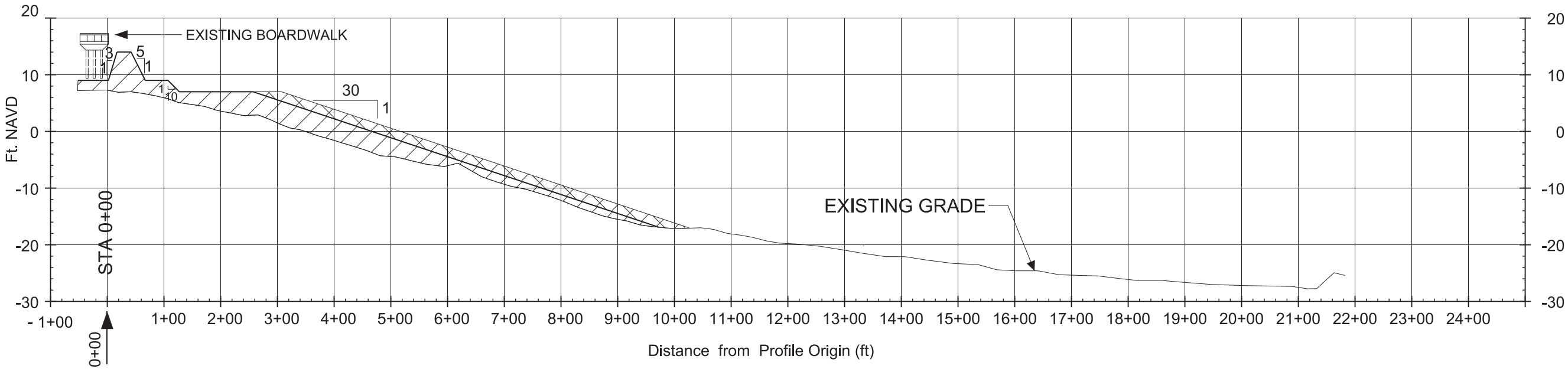
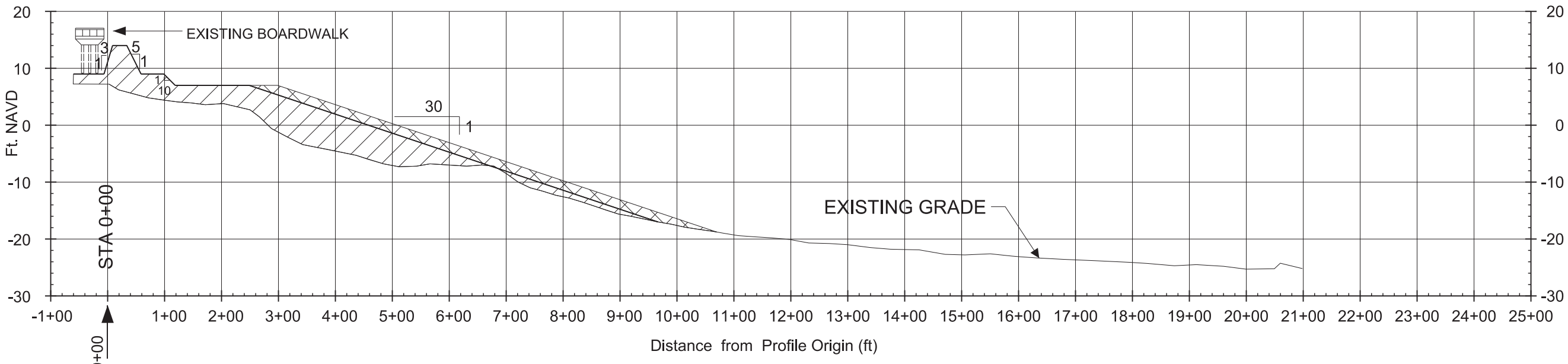
Figure 8-25

P-210



P-214



DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT
SCALE: 1" = 10'

HORIZ: 100 50 0 100 200FT
SCALE: 1" = 100'

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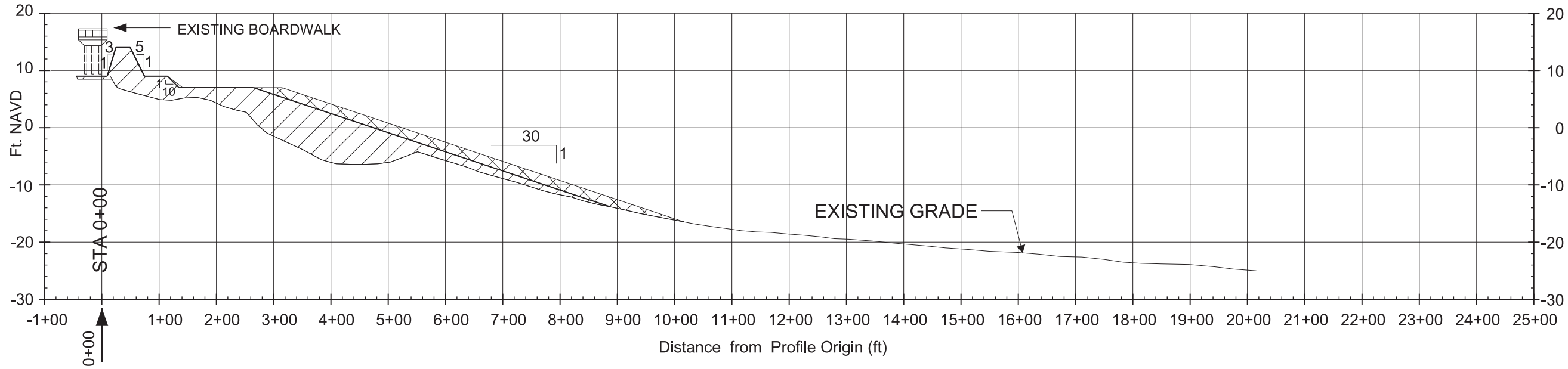
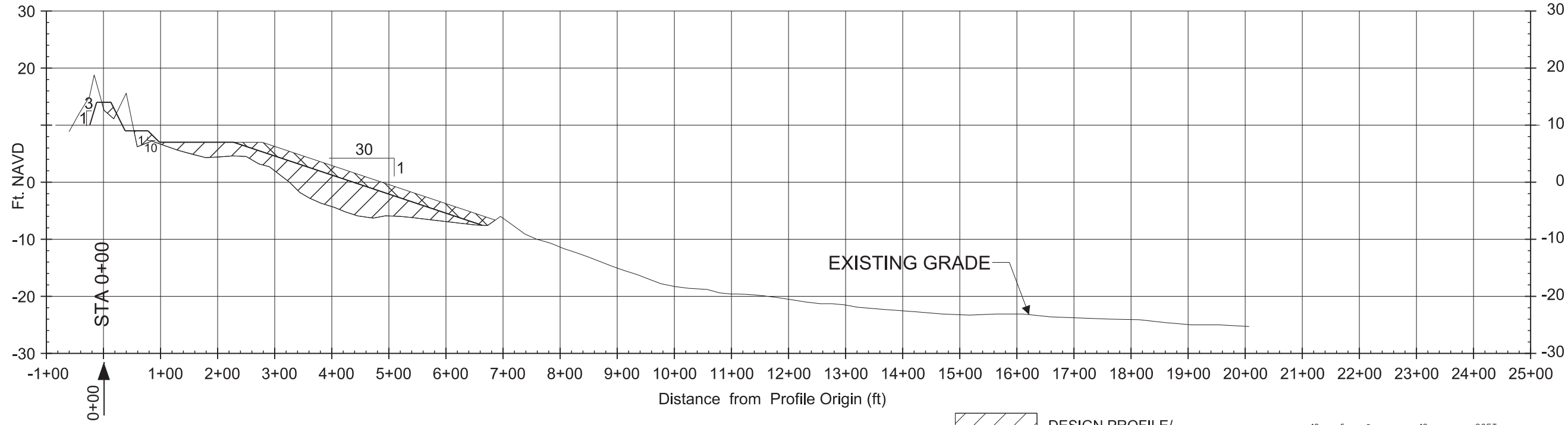
Figure 8-26

P-220



P-224



DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT
SCALE: 1" = 10'

HORIZ: 100 50 0 100 200FT
SCALE: 1" = 100'

US Army Corps of Engineers New York District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NEW YORK, NEW YORK

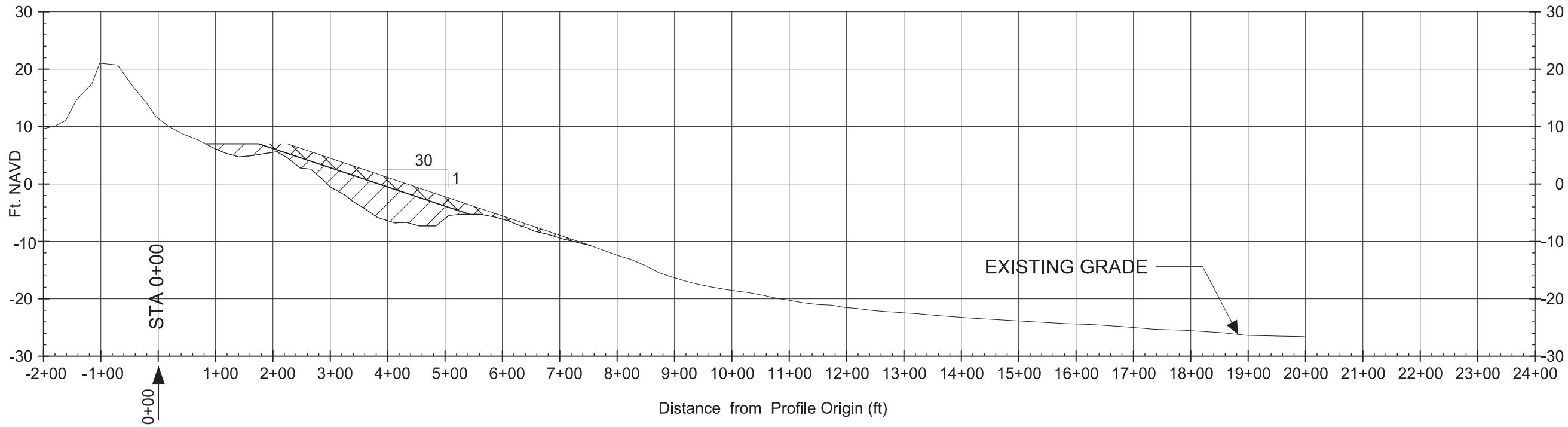
EROSION CONTROL STUDY
PROPOSED
BEACH FILL PLAN
Long Beach New York

Sheet reference number: 13
Sheet 13 of 14

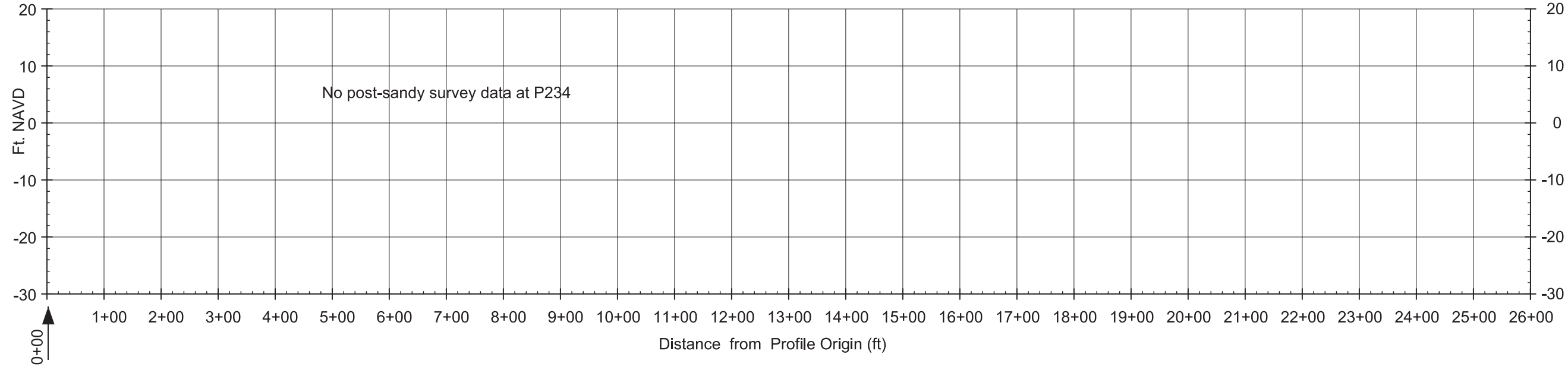
Plot Date: DD-MMM-YYYY HH:MM
FILE NAME
Submitted by: USERNAME

Figure 8-27

P-230



P-234



DESIGN PROFILE/ BEACH FILL

50' ADVANCED NOURISHMENT

VERT: 10 5 0 10 20FT
SCALE: 1" = 10'

HORIZ: 100 50 0 100 200FT
SCALE: 1" = 100'

US Army Corps of Engineers New York District

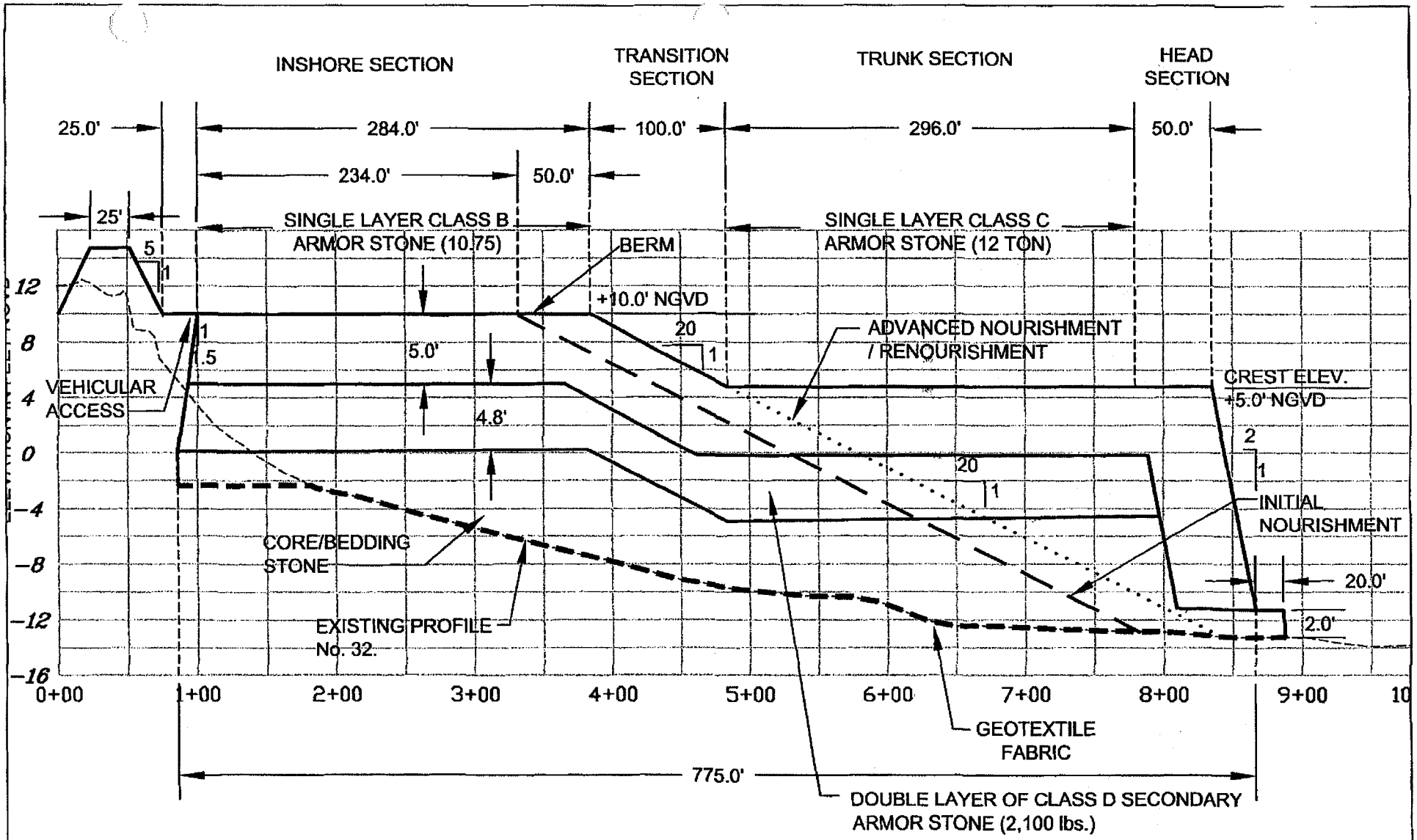
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS NEW YORK, NEW YORK

EROSION CONTROL STUDY
PROPOSED
BEACH FILL PLAN
Long Beach New York

Sheet reference number: 14
Sheet 14 of 14

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

Figure 8-28

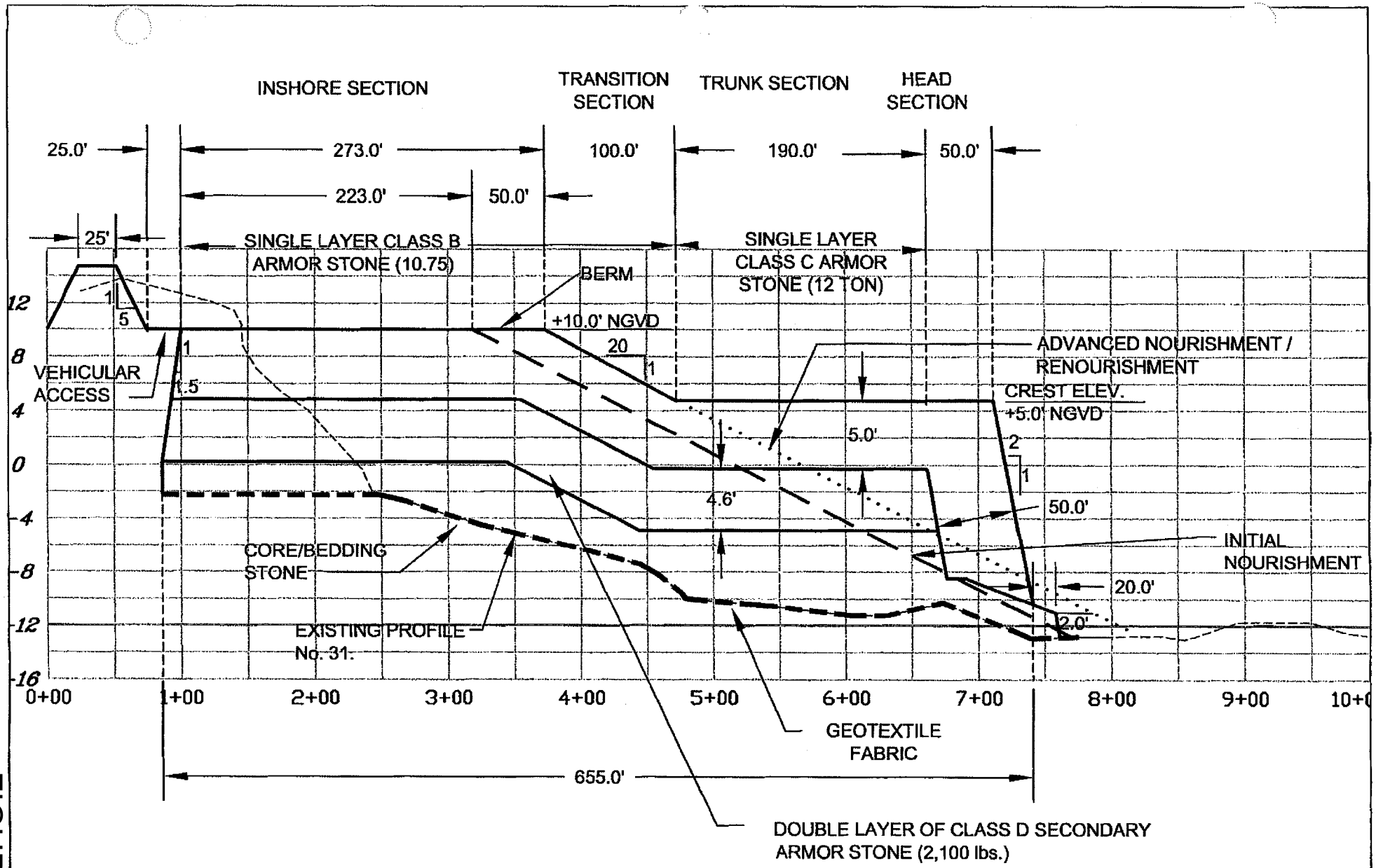


GROIN A

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES

FIGURE 8-30

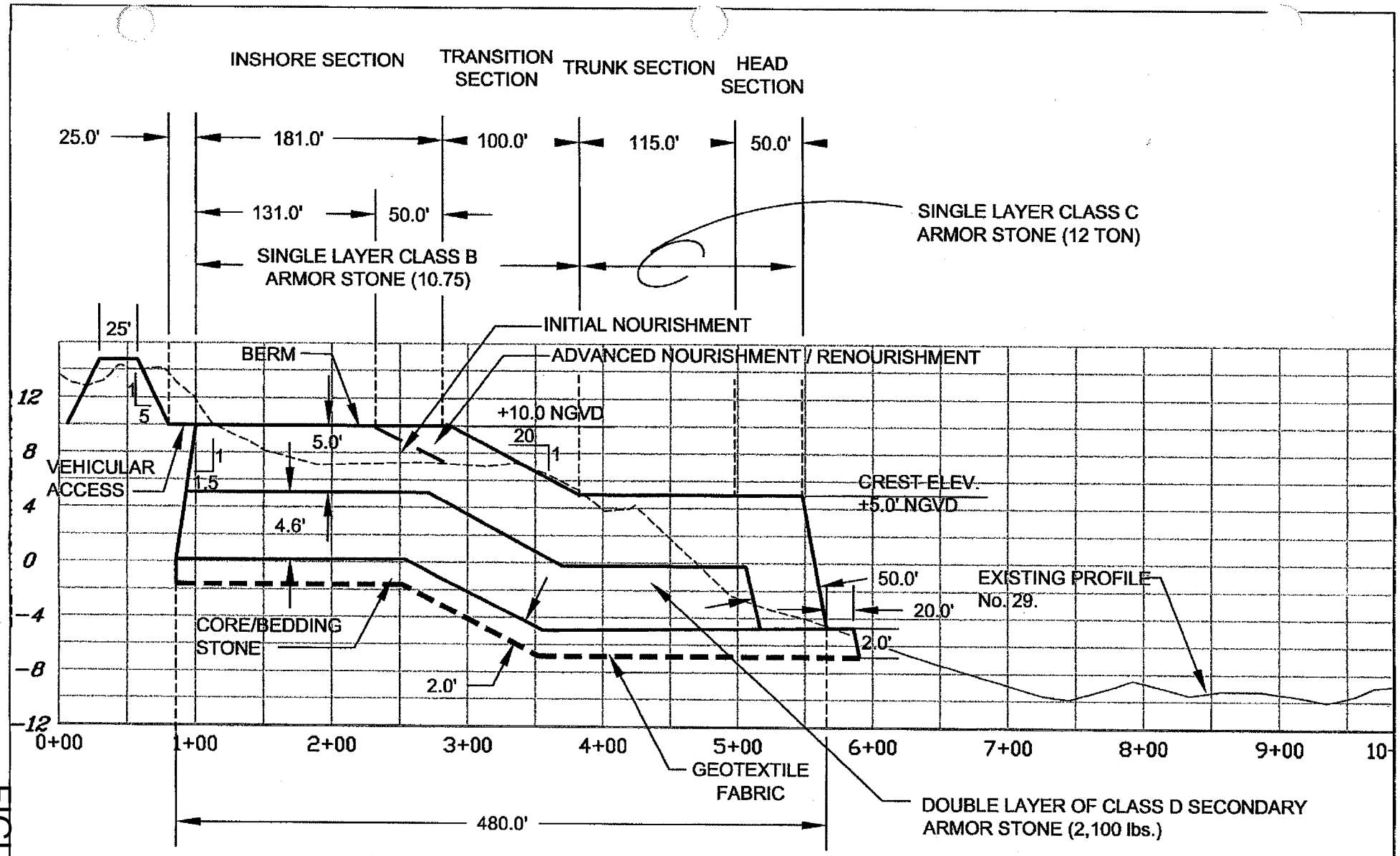


GROIN B

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES

FIGURE 8-31

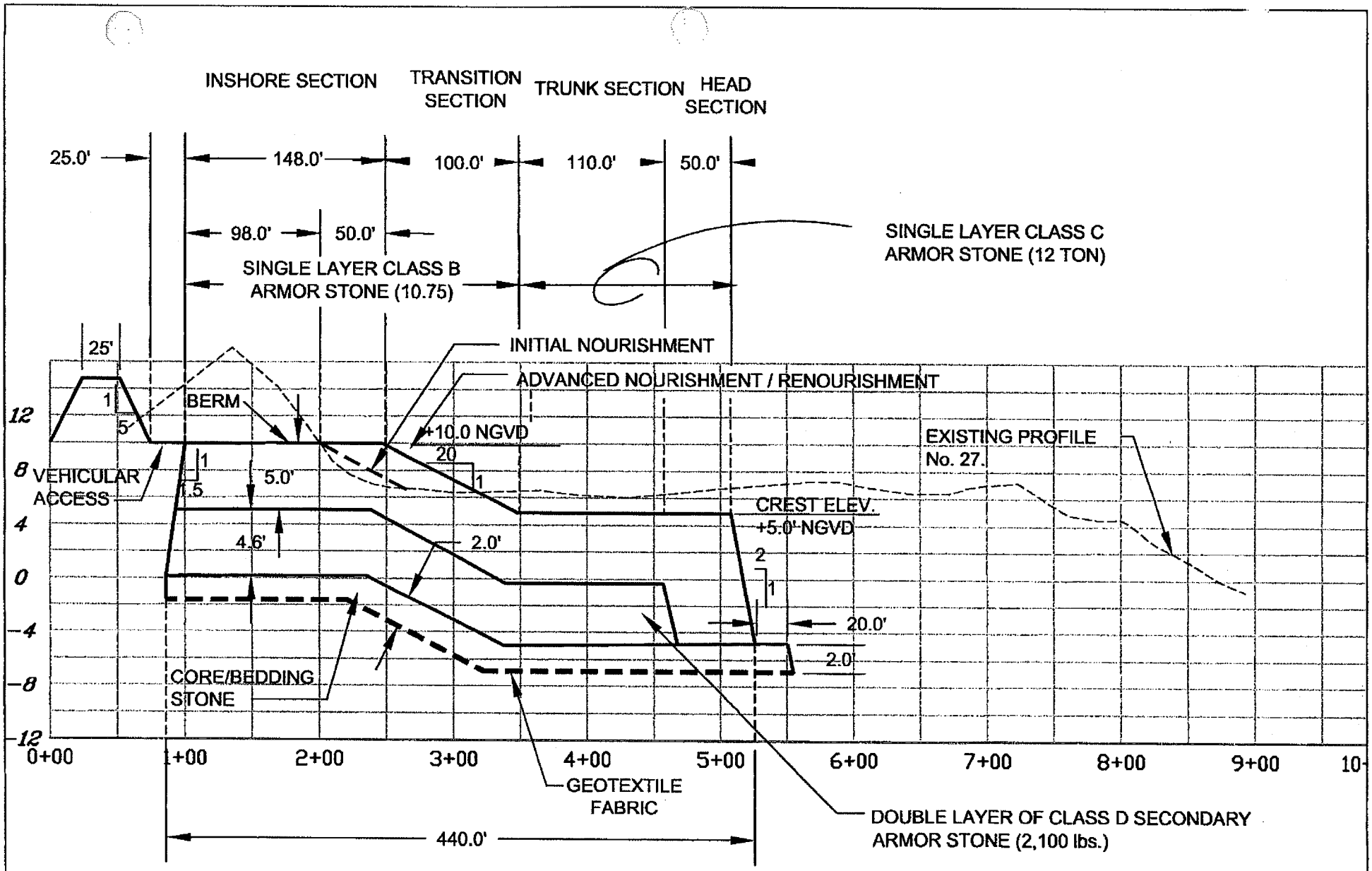


GROIN C

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES

FIGURE 8-32

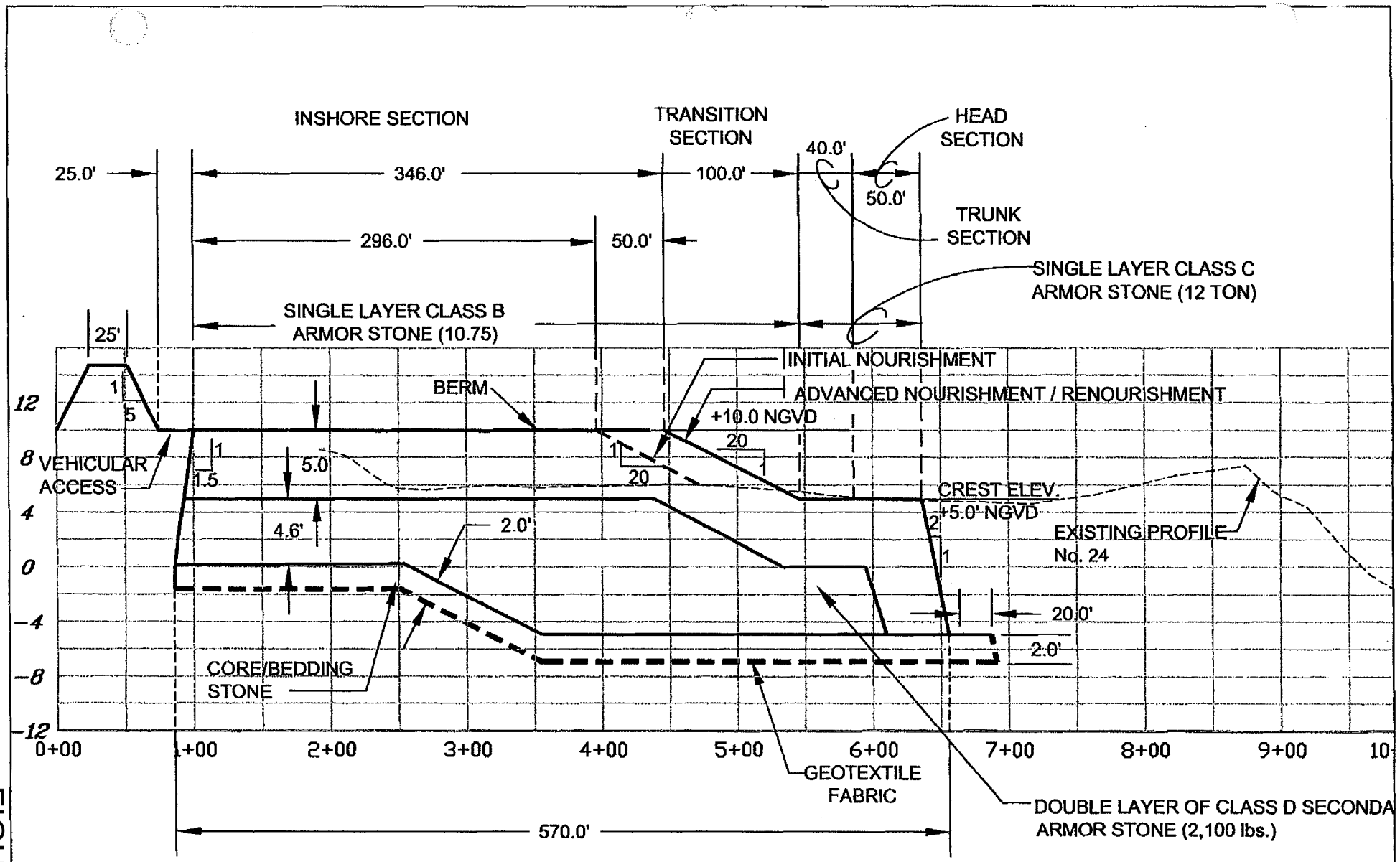


GROIN D

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES

FIGURE 8-33

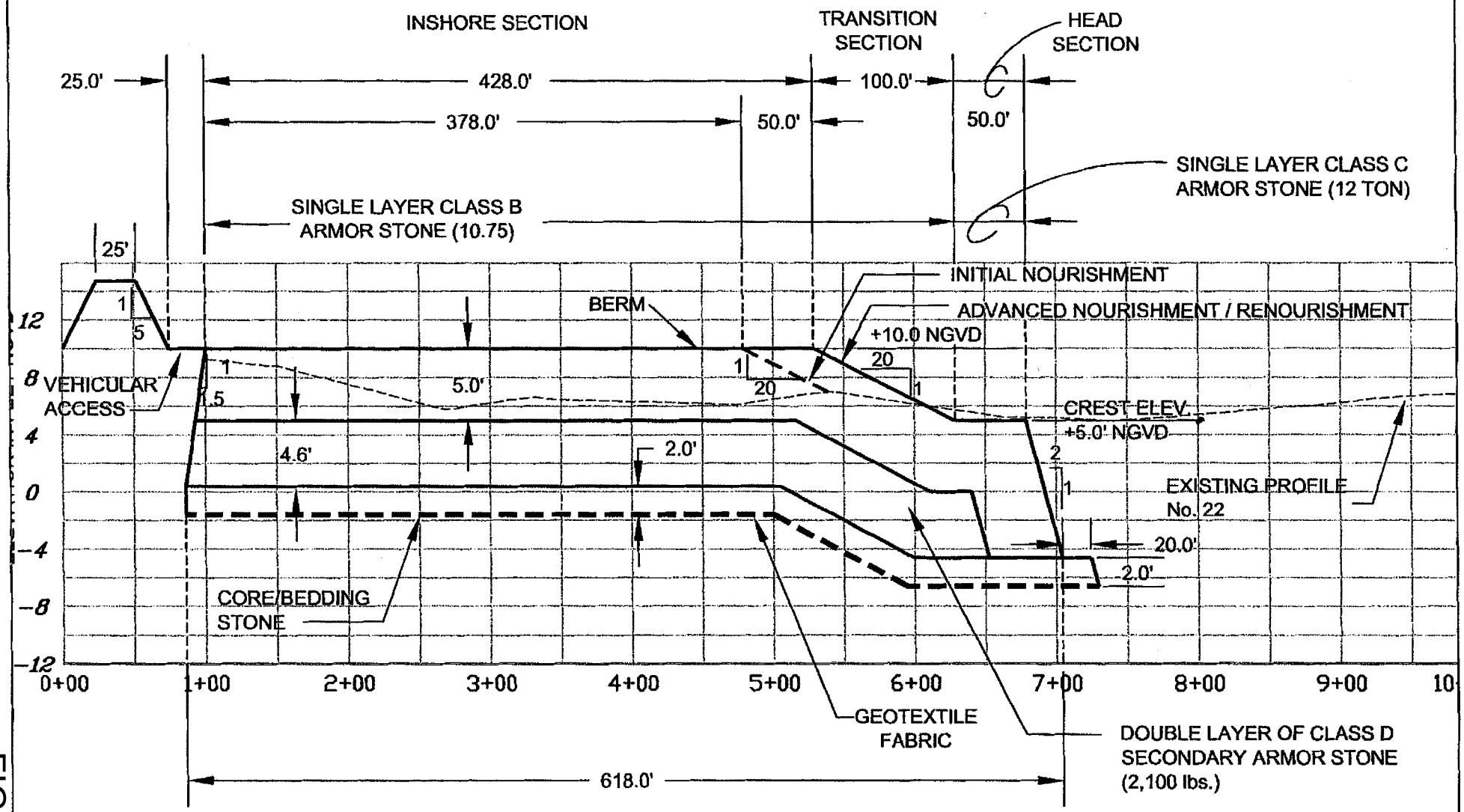


GROIN E

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES

FIGURE 8-34

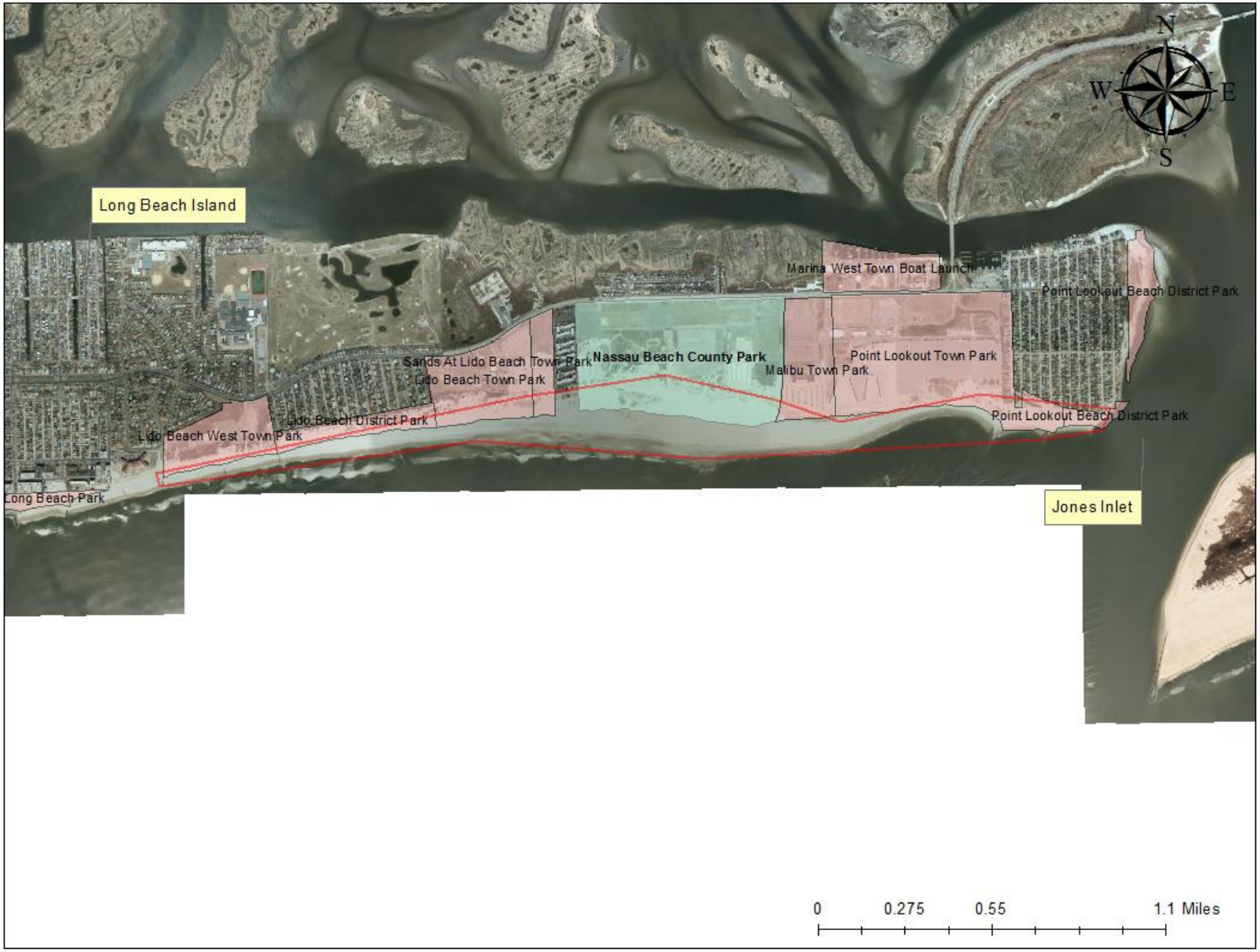


GROIN F

SCALE
HORZ. : 1" = 100'
VERT. : 1" = 10'

TYPICAL GROIN PROFILES

FIGURE 8-35



Fish & Wildlife Service Area of Interest

Figure 8-36

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

Appendix C:

Cost Engineering

U.S. Army Corps of Engineers
New York District

June 2015

Appendix C – Cost Engineering

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Introduction

This Appendix presents the detailed cost estimate and pertinent information for the recommended plan in the HSRR dated June 2015. The recommended plan primarily consists of dredging 4,720,000 CY of material from the borrow area approximately 2 miles from the shore, and extensive groin work (both new construction and rehabilitation of existing) along the shoreline, as well as shoreline structures, sand fencing, and dune grass placement. The project is assumed to go out for solicitation as 2 separate contracts:

- Contract 1 will consist of the construction of two new groins, the rehab of 4 existing groins at Point Lookout, rehab of 15 existing groins at Long Beach and 5 at Town of Hempstead, and the rehab of the Point Lookout terminal groin.
- Contract 3 will consist of the dredging/beach fill, shoreline structures, and the dune grass plantings and sand fence.

The costs for the groin construction component of the project were developed by utilizing actual construction data from ongoing and historical jobsites for similar work, as well as soliciting vendor quotes for major material costs, which included each of the stone classes (armor, underlayer, core/bedding stone), steel sheet piling, and geotextile. The material and delivery price for the stone was based on truck-hauling to the site from quarries in central New York with construction utilizing land-based equipment. Equipment rates were updated with the latest MII Region 1 Equipment Book (2014 version), labor rates were updated using Davis-Bacon rates from the project area, and current fuel costs were used from the EIA website.

The beach fill cost was developed using CEDEP with a Generic Large Hopper dredge, with an average production rate of 429,000 cy per month and historical factors, which coincide with the project area. For initial construction, beach fill placement is required to be coordinated with groin construction in order to prevent wasting material placement. If beach fill is placed in the seaward area of the groin before starting groin construction, the material must be excavated out to place the stone once construction progresses that far out. Therefore, full beach sections are to be completed at the groin locations to once the groin construction is finished. The 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. The total unit price of $11.66/CY compares well with recent bid data for large hopper jobs in the area. References:

- Long Branch, Seabright to Manasquan Reach 3B, bid date 2 Aug 13. Large hopper, 3.3M CY. IGE price $11.88/CY, avg bid price $11.80/CY.
- Seabright, NJ CT Reach 2A, bid date 11 Jun 13. Large Hopper, 2.5M CY. IGE Price $12.46/CY, avg bid price $12.35/CY.

The dune grass, sand fence, and shoreline structures cost were developed with production rates obtained from a combination of the 2012 MII cost book, RS Means and pricing from websites and vendor quotes for some of the line items. This work will be completed after the beach fill work has been completed. Table C-1 shows the initial construction costs, or ‘project first costs.’

Costs for air mitigation (Clean Air Act) were developed by Environmental based on the tons of air emissions produced by the equipment on site. The equipment list and equipment hours for each piece of equipment in the MII estimate were sent to Environmental so that they could develop a tonnage quantity of air emissions for the whole project. An offset quote from a broker was received by Environmental at a current market price of $30-40/ton. That is how the $2M number was developed.

Costs for Cultural Resources were developed based off an ongoing contract at Long Beach for a Phase I investigation for possible shipwrecks. That contract cost is roughly $180K. If the Phase I investigation turns up

a shipwreck, then a Phase II investigation for one wreck would be about $200K, based on the current NY/NJ Harbor project. This estimate assumes the possibility that 2 wrecks may be discovered. $180K + $200K + $200K = $580K, round up to $600K.

However, since these are project costs and not construction contract costs, these dollar amounts are assumed to be part of PED costs. Therefore, the $2.6M in additional costs have been added to the "Planning" PED cost, along with the 1% that was originally budgeted. The two folders originally containing these costs have been removed from the MII estimate.

Annualized costs are based on an economic project life of 50 years and an interest rate of 3.375%. The annual charges include the annualized first costs along with periodic nourishment every 5 years, major rehab costs, coastal monitoring, and dune/groin maintenance. These costs are shown in table C-2.

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 C-3.

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 beach front. 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 C-4.

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. Environmental monitoring consists of the Biological Opinion measures (to address plovers, seabeach amaranth and red knot) and biological borrow area monitoring. A detailed breakout of the costs and timing of each coastal monitoring and environmental monitoring activity can be found in Appendix C.

Table C-1 – Project 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**		**$ 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**		**$ 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**		**$ 18,118,240**	**$ 106,762,262**
	Total First Cost (WITHOUT deferred groins)				**$ 164,380,151**		**$ 33,636,400**	**$ 198,016,551**
	Total First Cost (WITH deferred groins)				**$ 173,708,315**		**$ 35,558,484**	**$ 209,266,799**

Table C-2 – Annualized Cost

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.

Table C-3 – Renourishment Cost

Long Beach Island, NY

Long Beach Periodic Nourishment Costs
Recommended Plan

(Per Renourishment)	1,770,000 CY @ $11.66/CY		$	20,646,700
	Mob & Demob		$	4,016,700
	Subtotal		$	24,664,000
	Contingency	21.92%	$	5,407,000
	E&D (incl. Contingency of 14.91%)		$	2,267,000
	Construction Management (incl. Contingency of 14.91%)		$	2,204,000
	Total Cost Per Operation		$	34,542,000
	Federal Cost Share:	65%	$	22,452,300
	Non-Federal Cost Share	35%	$	12,089,700

Construction Only - no Contingency, E&D/S&A
(Using 3 years for construction duration, so Yr 5 is 8 yrs from now)

YEAR	FUTURE WORK	PRESENT WORTH FACTOR	PRESENT WORTH
0	$0	1.00000	$0
8	$24,664,000	0.76679	$18,912,082
13	$24,664,000	0.64953	$16,019,971
18	$24,664,000	0.55020	$13,570,133
23	$24,664,000	0.46606	$11,494,934
28	$24,664,000	0.39479	$9,737,083
33	$24,664,000	0.33442	$8,248,050
38	$24,664,000	0.28328	$6,986,725
43	$24,664,000	0.23996	$5,918,287
48	$24,664,000	0.20326	$5,013,239
53	$0	0.17218	$0
SUM OF PRESENT WORTHS	$221,976,000		$95,900,504
TOTAL ANNUAL COST			**$3,997,000**

Interest Rate	3.375%
n=50 years	50

Table C-4 – Major Rehab Cost

(double-click to open in Adobe)

Long Beach Island, NY

Long Beach Major Rehabilitation Costs
Recommended Plan
Distance: 35,250 LF

Return Interval (yrs)	Frequency	Frequency Interval	Permanent Loss Factor (Stone)	Rehab Volume (Tons)	Emergency Stone Cost ($/ft)	Permanent Loss Factor (Sand)	Erosion Volume (cy/ft)	Emergency Fill (cy/ft)	Emergency Fill Cost ($/ft)	Average Emergency Fill Cost ($)	Annual Emergency Fill Cost ($)	Annual Emergency Fill Cost ($/ft)	Average Emergency Stone Cost ($)	Annual Emergency Stone Cost ($)	Annual Emergency Stone Cost ($/ft)	Annual Emergency Total Cost ($/ft)
20.00	0.050		0.100	5,400	$1,755,000	0.22	15.00	3.30	$115.50							
		0.030								$4,983,733	$149,512	$4.24	$2,632,500	$78,975	$2.24	$6.48
50.00	0.020		0.200	10,800	$3,510,000	0.27	17.70	4.78	$167.27							
		0.010								$6,999,064	$69,991	$1.99	$4,387,500	$43,875	$1.24	$3.23
100.00	0.010		0.300	16,200	$5,265,000	0.33	19.90	6.57	$229.85							
		0.005								$9,208,093	$46,040	$1.31	$7,020,000	$35,100	$1.00	$2.30
200.00	0.005		0.500	27,000	$8,775,000	0.38	22.00	8.36	$292.60							
										Subtotal Annualized Emergency Fill Cost	**$424,000**	**$7.53**			**$4.48**	**$12.01**

Subtotal Emergency Fill (every 5 year total):	**$2,120,000**
Construction Contingency:	**$465,000**
E&D (Incl. Contingency):	**$195,000**
S&A (Incl. Contingency):	**$244,000**
Total Emergency Fill Cost (every 5 year total):	**$3,024,000**
Total Emergency Fill for Project (9 Cycles):	**$27,216,000**
Total Annualized Emergency Fill Cost:	**$490,000**

Notes:

Loss Factor: This is the percent of eroded volume permanently lost to the profile. The factors are based on experience at Ocean City, Md.
Erosion Volume Maximum erosion volume landward of a given profile position computed from SBEACH (50,100 and 200 year storms extraploated from northeasters)
Emergency Fill Cost: Based on for trucked sand (cy) = $35
Emergency Fill Cost: Based on for trucked Armor Stone (Ton) = $325

Construction Only - no Contingency, E&D/S&A
(Using 3 years for construction duration, so Yr 5 is 8 yrs from now)

YEAR	FUTURE WORK	PRESENT WORTH FACTOR	PRESENT WORTH
0	$0	1.00000	$0
8	$2,120,000	0.76679	$1,625,592
13	$2,120,000	0.64953	$1,377,000
18	$2,120,000	0.55020	$1,166,424
23	$2,120,000	0.46606	$988,050
28	$2,120,000	0.39479	$836,953
33	$2,120,000	0.33442	$708,963
38	$2,120,000	0.28328	$600,546
43	$2,120,000	0.23996	$508,708
48	$2,120,000	0.20326	$430,914
53	$0	0.17218	$0
SUM OF PRESENT WORTHS	$19,080,000		$8,243,151
TOTAL ANNUAL COST			**$344,000**

Interest Rate 3.375%
n=50 years 50

Table C-5 – Monitoring Cost

Long Beach Island, NY

Long Beach Coastal Monitoring Costs

YEAR	FUTURE WORTH (Incl Contingency)	PRESENT WORTH FACTOR	PRESENT WORTH
4	$731,530	0.87566	$640,575
5	$420,630	0.84708	$356,306
6	$420,630	0.81942	$344,673
7	$420,630	0.79267	$333,420
8	$853,450	0.76679	$654,416
9	$249,940	0.74175	$185,394
10	$249,940	0.71754	$179,341
11	$249,940	0.69411	$173,486
12	$249,940	0.67145	$167,822
13	$408,440	0.64953	$265,293
14	$249,940	0.62832	$157,043
15	$249,940	0.60781	$151,916
16	$249,940	0.58797	$146,956
17	$249,940	0.56877	$142,158
18	$499,880	0.55020	$275,034
19	$249,940	0.53224	$133,027
20	$249,940	0.51486	$128,684
21	$249,940	0.49805	$124,483
22	$249,940	0.48179	$120,419
23	$408,440	0.46606	$190,358
24	$249,940	0.45085	$112,684
25	$249,940	0.43613	$109,005
26	$249,940	0.42189	$105,447
27	$249,940	0.40811	$102,004
28	$408,440	0.39479	$161,248
29	$249,940	0.38190	$95,452
30	$249,940	0.36943	$92,336
31	$249,940	0.35737	$89,321
32	$249,940	0.34570	$86,405
33	$499,880	0.33442	$167,168
34	$249,940	0.32350	$80,855
35	$249,940	0.31294	$78,215
36	$249,940	0.30272	$75,662
37	$249,940	0.29284	$73,192
38	$408,440	0.28328	$115,701
39	$249,940	0.27403	$68,491
40	$249,940	0.26508	$66,254
41	$249,940	0.25643	$64,091
42	$249,940	0.24806	$61,999
43	$408,440	0.23996	$98,008
44	$249,940	0.23212	$58,017
45	$249,940	0.22454	$56,123
46	$249,940	0.21721	$54,290
47	$249,940	0.21012	$52,518
48	$499,880	0.20326	$101,606
49	$249,940	0.19663	$49,145
50	$249,940	0.19021	$47,540
51	$249,940	0.18400	$45,988
52	$249,940	0.17799	$44,487
53	$249,940	0.17218	$43,034
Contingency %:	21.92%		
Sum of Present Worths:	$15,637,000		$7,327,090
TOTAL ANNUAL COST			**$305,000**

Long Beach Island, NY

Long Beach Coastal Monitoring Costs - Breakdown

	BEACH PROFILES	SEDIMENT SAMPLES	AERIALS	WAVE GAUGES	DATA ANALYSIS (REPORT)	BORROW AREA MONITORING	TOTAL
Year 4	$205,000	$80,000	$50,000	$190,000	$75,000		$600,000
Year 5	$205,000			$140,000			$345,000
Year 6	$205,000			$140,000			$345,000
Year 7	$205,000			$140,000			$345,000
Year 8	$205,000	$40,000		$140,000	$75,000	$240,000	$700,000
Year 9	$205,000						$205,000
Year 10	$205,000						$205,000
Year 11	$205,000						$205,000
Year 12	$205,000						$205,000
Year 13	$205,000	$40,000				$90,000	$335,000
Year 14	$205,000						$205,000
Year 15	$205,000						$205,000
Year 16	$205,000						$205,000
Year 17	$205,000						$205,000
Year 18	$205,000	$40,000			$75,000	$90,000	$410,000
Year 19	$205,000						$205,000
Year 20	$205,000						$205,000
Year 21	$205,000						$205,000
Year 22	$205,000						$205,000
Year 23	$205,000	$40,000				$90,000	$335,000
Year 24	$205,000						$205,000
Year 25	$205,000						$205,000
Year 26	$205,000						$205,000
Year 27	$205,000						$205,000
Year 28	$205,000	$40,000				$90,000	$335,000
Year 29	$205,000						$205,000
Year 30	$205,000						$205,000
Year 31	$205,000						$205,000
Year 32	$205,000						$205,000
Year 33	$205,000	$40,000			$75,000	$90,000	$410,000
Year 34	$205,000						$205,000
Year 35	$205,000						$205,000
Year 36	$205,000						$205,000
Year 37	$205,000						$205,000
Year 38	$205,000	$40,000				$90,000	$335,000
Year 39	$205,000						$205,000
Year 40	$205,000						$205,000
Year 41	$205,000						$205,000
Year 42	$205,000						$205,000
Year 43	$205,000	$40,000				$90,000	$335,000
Year 44	$205,000						$205,000
Year 45	$205,000						$205,000
Year 46	$205,000						$205,000
Year 47	$205,000						$205,000
Year 48	$205,000	$40,000			$75,000	$90,000	$410,000
Year 49	$205,000						$205,000
Year 50	$205,000						$205,000
Year 51	$205,000						$205,000
Year 52	$205,000						$205,000
Year 53	$205,000						$205,000

NOTES:

INTEREST = 3.375%
PROJ.LIFE = 50
CAPITAL RECOVERY FACTOR = 0.04168

Table C-6 – Environmental Monitoring Cost

Long Beach Island, NY

Long Beach Environmental Monitoring Costs

YEAR	FUTURE WORTH (Incl Contingency)	PRESENT WORTH FACTOR	PRESENT WORTH
4	$731,530	0.87566	$640,575
5	$731,530	0.84708	$619,662
6	$731,530	0.81942	$599,431
7	$731,530	0.79267	$579,860
8	$731,530	0.76679	$560,929
9	$146,310	0.74175	$108,526
10	$146,310	0.71754	$104,983
11	$146,310	0.69411	$101,555
12	$146,310	0.67145	$98,240
13	$731,530	0.64953	$475,150
14	$146,310	0.62832	$91,930
15	$146,310	0.60781	$88,929
16	$146,310	0.58797	$86,025
17	$146,310	0.56877	$83,217
18	$731,530	0.55020	$402,488
19	$146,310	0.53224	$77,872
20	$146,310	0.51486	$75,329
21	$146,310	0.49805	$72,870
22	$146,310	0.48179	$70,491
23	$731,530	0.46606	$340,938
24	$146,310	0.45085	$65,963
25	$146,310	0.43613	$63,810
26	$146,310	0.42189	$61,726
27	$146,310	0.40811	$59,711
28	$731,530	0.39479	$288,800
29	$146,310	0.38190	$55,876
30	$146,310	0.36943	$54,052
31	$146,310	0.35737	$52,287
32	$146,310	0.34570	$50,580
33	$731,530	0.33442	$244,636
34	$146,310	0.32350	$47,331
35	$146,310	0.31294	$45,786
36	$146,310	0.30272	$44,291
37	$146,310	0.29284	$42,845
38	$731,530	0.28328	$207,225
39	$146,310	0.27403	$40,093
40	$146,310	0.26508	$38,784
41	$146,310	0.25643	$37,518
42	$146,310	0.24806	$36,293
43	$731,530	0.23996	$175,535
44	$146,310	0.23212	$33,962
45	$146,310	0.22454	$32,853
46	$146,310	0.21721	$31,780
47	$146,310	0.21012	$30,743
48	$731,530	0.20326	$148,692
49	$146,310	0.19663	$28,768
50	$146,310	0.19021	$27,829
51	$146,310	0.18400	$26,920
52	$146,310	0.17799	$26,042
53	$146,310	0.17218	$25,191
Contingency %:	21.92%		
Sum of Present Worths:	$14,924,000		$7,404,920
TOTAL ANNUAL COST			**$309,000**

Long Beach Island, NY

Long Beach Environmental Monitoring Costs - Breakdown

	Biological Opinion Measures - Plovers	Biological Opinion Measures - Invertebrates	Biological Opinion Measures - Predator Management Program	Biological Opinion Measures - LiDAR	Biological Opinion Measures - Seabeach Amaranth	Biological Opinion Measures - Red Knot	BORROW AREA MONITORING	TOTAL
Year 4	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 5	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 6	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 7	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 8	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 9			$50,000	$50,000	$20,000			$120,000
Year 10			$50,000	$50,000	$20,000			$120,000
Year 11			$50,000	$50,000	$20,000			$120,000
Year 12			$50,000	$50,000	$20,000			$120,000
Year 13	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 14			$50,000	$50,000	$20,000			$120,000
Year 15			$50,000	$50,000	$20,000			$120,000
Year 16			$50,000	$50,000	$20,000			$120,000
Year 17			$50,000	$50,000	$20,000			$120,000
Year 18	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 19			$50,000	$50,000	$20,000			$120,000
Year 20			$50,000	$50,000	$20,000			$120,000
Year 21			$50,000	$50,000	$20,000			$120,000
Year 22			$50,000	$50,000	$20,000			$120,000
Year 23	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 24			$50,000	$50,000	$20,000			$120,000
Year 25			$50,000	$50,000	$20,000			$120,000
Year 26			$50,000	$50,000	$20,000			$120,000
Year 27			$50,000	$50,000	$20,000			$120,000
Year 28	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 29			$50,000	$50,000	$20,000			$120,000
Year 30			$50,000	$50,000	$20,000			$120,000
Year 31			$50,000	$50,000	$20,000			$120,000
Year 32			$50,000	$50,000	$20,000			$120,000
Year 33	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 34			$50,000	$50,000	$20,000			$120,000
Year 35			$50,000	$50,000	$20,000			$120,000
Year 36			$50,000	$50,000	$20,000			$120,000
Year 37			$50,000	$50,000	$20,000			$120,000
Year 38	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 39			$50,000	$50,000	$20,000			$120,000
Year 40			$50,000	$50,000	$20,000			$120,000
Year 41			$50,000	$50,000	$20,000			$120,000
Year 42			$50,000	$50,000	$20,000			$120,000
Year 43	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 44			$50,000	$50,000	$20,000			$120,000
Year 45			$50,000	$50,000	$20,000			$120,000
Year 46			$50,000	$50,000	$20,000			$120,000
Year 47			$50,000	$50,000	$20,000			$120,000
Year 48	$200,000	$100,000	$50,000	$50,000	$20,000	$30,000	$150,000	$600,000
Year 49			$50,000	$50,000	$20,000			$120,000
Year 50			$50,000	$50,000	$20,000			$120,000
Year 51			$50,000	$50,000	$20,000			$120,000
Year 52			$50,000	$50,000	$20,000			$120,000
Year 53			$50,000	$50,000	$20,000			$120,000

Table C-7 – 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

Total Project Cost Summary

PROJECT: Long Beach Island, NY
PROJECT NO: -
LOCATION: Long Beach Island, NY

DISTRICT: NAN New York
PREPARED: 6/24/2015
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

This Estimate reflects the scope and schedule in report; Long Beach NY HSLRR

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-14 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
02	RELOCATIONS	$396	$87	21.92%	$483	0.0%	$396	$87	$483	$0		$426	$93	$520
10	BREAKWATER & SEAWALLS	$67,762	$14,855	21.92%	$82,617	0.0%	$67,762	$14,855	$82,617	$0		$70,382	$15,429	$85,811
17	BEACH REPLENISHMENT	$69,515	$15,239	21.92%	$84,754	0.0%	$69,515	$15,239	$84,754	$0		$74,759	$16,389	$91,148
	CONSTRUCTION ESTIMATE TOTALS:	$137,673	$30,180	21.92%	$167,854		$137,673	$30,180	$167,854			$145,568	$31,911	$177,479
01	LANDS AND DAMAGES	$125	$25	20.00%	$150	0.0%	$125	$25	$150	$0		$127	$25	$152
30	PLANNING, ENGINEERING & DESIGN	$26,493	$3,949	14.91%	$30,442	0.0%	$26,493	$3,949	$30,442	$7,855		$28,728	$4,282	$40,865
31	CONSTRUCTION MANAGEMENT	$9,417	$1,404	14.91%	$10,821	0.0%	$9,417	$1,404	$10,821	$0		$10,475	$1,562	$12,037
		$173,708	$35,558		$209,267		$173,708	$35,558	$209,267	$7,855		**$184,898**	**$37,780**	**$230,533**
17	BEACH REPLENISHMENT (Renourishment)	$266,121	$58,343	21.92%	$324,464	0.0%	$266,121	$58,343	$324,464	$0		$494,450	$108,401	$602,851
	CONSTRUCTION ESTIMATE TOTALS:	$266,121	$58,343	21.92%	$324,464		$266,121	$58,343	$324,464			$494,450	$108,401	$602,851
30	PLANNING, ENGINEERING & DESIGN (Renourishment)	$19,287	$2,875	14.91%	$22,162	0.0%	$19,287	$2,875	$22,162	$0		$83,000	$12,373	$95,373
31	CONSTRUCTION MANAGEMENT (Renourishment)	$18,567	$2,768	14.91%	$21,335	0.0%	$18,567	$2,768	$21,335	$0		$84,948	$12,663	$97,611
	PROJECT COST TOTALS:	$303,975	$63,986		$367,961		$303,975	$63,986	$367,961	$0		**$662,398**	**$133,437**	**$795,835**

Mandatory by Regulation	CHIEF, COST ENGINEERING, Mukesh Kumar
Mandatory by Regulation	PROJECT MANAGER, Ron Pinzon
Mandatory by Regulation	CHIEF, REAL ESTATE, Noreen Dresser
	CHIEF, PLANNING,Frank Santomauro
	CHIEF, ENGINEERING, Arthur Connolly
	CHIEF, OPERATIONS, Tom Creamer
	CHIEF, CONSTRUCTION, Gerald Byrne
	CHIEF, CONTRACTING,Frank Cashman
	CHIEF, PM-PB, Anthony Ciorra
	CHIEF, DPM, Joseph Seebode

ESTIMATED FEDERAL COST:	100%	**$230,533**
ESTIMATED NON-FEDERAL COST:	0%	**$0**
ESTIMATED TOTAL PROJECT COST:		**$230,533**
ESTIMATED FEDERAL COST:	65%	**$517,293**
ESTIMATED NON-FEDERAL COST:	35%	**$278,542**
ESTIMATED RENOURISHMENT TOTAL PROJECT COST:		**$795,835**

Total Project Cost Summary (cont.)

****** CONTRACT COST SUMMARY ******

PROJECT: Long Beach Island, NY
LOCATION: Long Beach Island, NY
This Estimate reflects the scope and schedule in report; Long Beach NY HSLRR

DISTRICT: NAN New York
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 6/24/2015

Estimate Prepared: 5/18/2015
Effective Price Level: 1-Oct-14

Program Year (Budget EC): 2015
Effective Price Level Date: 1 OCT 14

WBS NUMBER	Civil Works Feature & Sub-Feature Description	ESTIMATED COST COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	PROJECT FIRST COST (Constant Dollar Basis) ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	TOTAL PROJECT COST (FULLY FUNDED) Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Contract #1													
10	BREAKWATER & SEAWALLS	$67,762	$14,855	21.92%	$82,617	0.0%	$67,762	$14,855	$82,617	2017Q1	3.9%	$70,382	$15,429	$85,811
	CONSTRUCTION ESTIMATE TOTALS:	$67,762	$14,855	21.92%	**$82,617**		$67,762	$14,855	$82,617			$70,382	$15,429	$85,811
01	LANDS AND DAMAGES	$125	$25	20.00%	$150	0.0%	$125	$25	$150	2015Q4	1.5%	$127	$25	$152
30	PLANNING, ENGINEERING & DESIGN													
2.50%	Project Management	$1,694	$253	14.91%	$1,947	0.0%	$1,694	$253	$1,947	2015Q4	2.5%	$1,736	$259	$1,994
1.00%	Planning & Environmental Compliance	$678	$101	14.91%	$779	0.0%	$678	$101	$779	2015Q4	2.5%	$695	$104	$798
7.75%	Engineering & Design	$5,272	$786	14.91%	$6,058	0.0%	$5,272	$786	$6,058	2015Q4	2.5%	$5,401	$805	$6,206
1.00%	Reviews, ATRs, IEPRs, VE	$678	$101	14.91%	$779	0.0%	$678	$101	$779	2015Q4	2.5%	$695	$104	$798
0.25%	Life Cycle Updates (cost, schedule, risks)	$169	$25	14.91%	$194	0.0%	$169	$25	$194	2015Q4	2.5%	$173	$26	$199
0.25%	Contracting & Reprographics	$169	$25	14.91%	$194	0.0%	$169	$25	$194	2015Q4	2.5%	$173	$26	$199
1.50%	Engineering During Construction	$1,016	$151	14.91%	$1,167	0.0%	$1,016	$151	$1,167	2017Q1	7.5%	$1,092	$163	$1,254
1.00%	Planning During Construction	$2,178	$325	14.91%	$2,503	0.0%	$2,178	$325	$2,503	2017Q1	7.5%	$2,340	$349	$2,689
1.00%	Project Operations	$678	$101	14.91%	$779	0.0%	$678	$101	$779	2015Q4	2.5%	$695	$104	$798
31	CONSTRUCTION MANAGEMENT													
6.85%	Construction Management	$4,645	$692	14.91%	$5,337	0.0%	$4,645	$692	$5,337	2017Q1	7.5%	$4,991	$744	$5,735
0.00%	Project Operation:	$0	$0	14.91%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.00%	Project Management	$0	$0	14.91%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$85,064	$17,440		**$102,505**		$85,064	$17,440	$102,505			$88,499	$18,136	**$106,635**

Taylor Canfield:
Includes an additional $1.5M for pre-construction monitoring and monitoring during construction per PDT - 23 Jun 15

Total Project Cost Summary (cont.)

****** CONTRACT COST SUMMARY ******

PROJECT: Long Beach Island, NY
LOCATION: Long Beach Island, NY
This Estimate reflects the scope and schedule in report; Long Beach NY HSLRR

DISTRICT: NAN New York
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 6/24/2015

Estimate Prepared: 5/18/2015
Effective Price Level: 1-Oct-14

Program Year (Budget EC): 2015
Effective Price Level Date: 1 OCT 14

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Contract #2													
02	RELOCATIONS	$396	$87	21.92%	$483	0.0%	$396	$87	$483	2018Q4	7.5%	$426	$93	$520
17	BEACH REPLENISHMENT	$69,515	$15,239	21.92%	$84,754	0.0%	$69,515	$15,239	$84,754	2018Q4	7.5%	$74,759	$16,389	$91,148
	CONSTRUCTION ESTIMATE TOTALS:	$69,911	$15,326	21.92%	**$85,237**		$69,911	$15,326	$85,237			$75,186	$16,482	$91,667
01	LANDS AND DAMAGES	$0	$0	20.00%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
2.50%	Project Management	$1,748	$261	14.91%	$2,009	0.0%	$1,748	$261	$2,009	2018Q1	11.6%	$1,952	$291	$2,242
1.00%	Planning & Environmental Compliance	$699	$104	14.91%	$803	0.0%	$699	$104	$803	2018Q1	11.6%	$780	$116	$897
7.75%	Engineering & Design	$5,418	$808	14.91%	$6,226	0.0%	$5,418	$808	$6,226	2018Q1	11.6%	$6,049	$902	$6,950
1.00%	Reviews, ATRs, IEPRs, VE	$699	$104	14.91%	$803	0.0%	$699	$104	$803	2018Q1	11.6%	$780	$116	$897
0.25%	Life Cycle Updates (cost, schedule, risks)	$175	$26	14.91%	$201	0.0%	$175	$26	$201	2018Q1	11.6%	$195	$29	$224
0.25%	Contracting & Reprographics	$175	$26	14.91%	$201	0.0%	$175	$26	$201	2018Q1	11.6%	$195	$29	$224
1.50%	Engineering During Construction	$1,049	$156	14.91%	$1,205	0.0%	$1,049	$156	$1,205	2018Q4	14.9%	$1,206	$180	$1,385
1.00%	Planning During Construction	$3,299	[illegible]	[illegible]	[illegible]	0.0%	$3,299	$492	$3,791	2018Q4	14.9%	$3,791	$565	$4,356
1.00%	Project Operations	$699	[illegible]	[illegible]	[illegible]	0.0%	$699	$104	$803	2018Q1	11.6%	$780	$116	$897
31	CONSTRUCTION MANAGEMENT													
6.83%	Construction Management	$4,772	$711	14.91%	$5,483	0.0%	$4,772	$711	$5,483	2018Q4	14.9%	$5,484	$818	$6,302
0.00%	Project Operation:	$0	$0	14.91%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.00%	Project Management	$0	$0	14.91%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$88,644	$18,118		**$106,762**		$88,644	$18,118	$106,762			$96,398	$19,644	**$116,043**

Taylor Canfield:
Includes $600K for Cultural Resources and $2M for Clean Air Act.

Total Project Cost Summary (cont.)

****** CONTRACT COST SUMMARY ******

PROJECT: Long Beach Island, NY
LOCATION: Long Beach Island, NY
This Estimate reflects the scope and schedule in report; Long Beach NY HSLRR

DISTRICT: NAN New York
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 6/24/2015

Estimate Prepared: 5/18/2015
Effective Price Level: 1-Oct-14

Program Year (Budget EC): 2015
Effective Price Level Date: 1 OCT 14

Civil Works Work Breakdown Structure			ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER	Civil Works Feature & Sub-Feature Description		COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*		*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Renourishment Activities	**Year**													
17	BEACH REPLENISHMENT	Yr 5	$32,119	$7,042	21.92%	$39,161	0.0%	$32,119	$7,042	$39,161	2024Q4	21.1%	$38,900	$8,529	$47,429
17	BEACH REPLENISHMENT	Yr 10	$29,019	$6,362	21.92%	$35,381	0.0%	$29,019	$6,362	$35,381	2029Q4	33.7%	$38,804	$8,507	$47,311
17	BEACH REPLENISHMENT	Yr 15	$29,094	$6,378	21.92%	$35,472	0.0%	$29,094	$6,378	$35,472	2034Q4	47.6%	$42,953	$9,416	$52,369
17	BEACH REPLENISHMENT	Yr 20	$29,019	$6,362	21.92%	$35,381	0.0%	$29,019	$6,362	$35,381	2039Q4	63.0%	$47,302	$10,370	$57,672
17	BEACH REPLENISHMENT	Yr 25	$29,019	$6,362	21.92%	$35,381	0.0%	$29,019	$6,362	$35,381	2044Q4	80.0%	$52,225	$11,450	$63,674
17	BEACH REPLENISHMENT	Yr 30	$29,094	$6,378	21.92%	$35,472	0.0%	$29,094	$6,378	$35,472	2049Q4	98.7%	$57,809	$12,673	$70,482
17	BEACH REPLENISHMENT	Yr 35	$29,019	$6,362	21.92%	$35,381	0.0%	$29,019	$6,362	$35,381	2054Q4	119.4%	$63,662	$13,957	$77,619
17	BEACH REPLENISHMENT	Yr 40	$29,019	$6,362	21.92%	$35,381	0.0%	$29,019	$6,362	$35,381	2059Q4	142.2%	$70,288	$15,410	$85,697
17	BEACH REPLENISHMENT	Yr 45	$29,094	$6,378	21.92%	$35,472	0.0%	$29,094	$6,378	$35,472	2064Q4	167.4%	$77,804	$17,056	$94,860
17	BEACH REPLENISHMENT	Yr 50	$1,625	$357	21.92%	$1,982	0.0%	$1,625	$357	$1,982	2068Q4	189.5%	$4,704	$1,033	$5,737
	CONSTRUCTION ESTIMATE TOTALS:		$266,121	$58,343	21.92%	**$324,464**		$266,121	$58,343	**$324,464**			$489,746	$107,368	**$597,114**
30	PLANNING, ENGINEERING & DESIGN														
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 5	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2023Q3	38.4%	$2,967	$442	$3,409
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 10	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2028Q3	70.8%	$3,661	$546	$4,207
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 15	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2033Q3	115.2%	$4,611	$687	$5,299
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 20	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2038Q3	175.4%	$5,901	$880	$6,781
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 25	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2043Q3	252.7%	$7,558	$1,127	$8,685
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 30	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2048Q3	351.7%	$9,681	$1,443	$11,124
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 35	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2053Q3	478.6%	$12,399	$1,848	$14,248
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 40	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2058Q3	641.1%	$15,881	$2,367	$18,249
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 45	$2,143	$319	14.91%	$2,462	0.0%	$2,143	$319	$2,462	2063Q3	849.2%	$20,341	$3,032	$23,373
8.00%	PED Costs - 8% of Renourish/Major Rehab Only	Yr 50	$0	$0	14.91%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT														
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 5	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2024Q4	45.7%	$3,005	$448	$3,453
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 10	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2029Q4	80.6%	$3,727	$556	$4,282
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 15	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2034Q4	128.7%	$4,719	$703	$5,422
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 20	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2039Q4	193.0%	$6,044	$901	$6,945
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 25	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2044Q4	275.2%	$7,741	$1,154	$8,895
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 30	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2049Q4	380.6%	$9,915	$1,478	$11,393
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 35	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2054Q4	515.6%	$12,699	$1,893	$14,592
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 40	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2059Q4	688.4%	$16,265	$2,425	$18,690
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 45	$2,063	$308	14.91%	$2,371	0.0%	$2,063	$308	$2,371	2064Q4	909.9%	$20,833	$3,106	$23,939
7.70%	S&A Costs - Calc'd on Renourish/Major Rehab ONLY	Yr 50	$0	$0	14.91%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:		$303,975	$63,986		**$367,961**		$303,975	$63,986	**$367,961**			$657,694	$132,404	**$790,098**

Abbreviated Risk Analysis (ARA) Results

Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

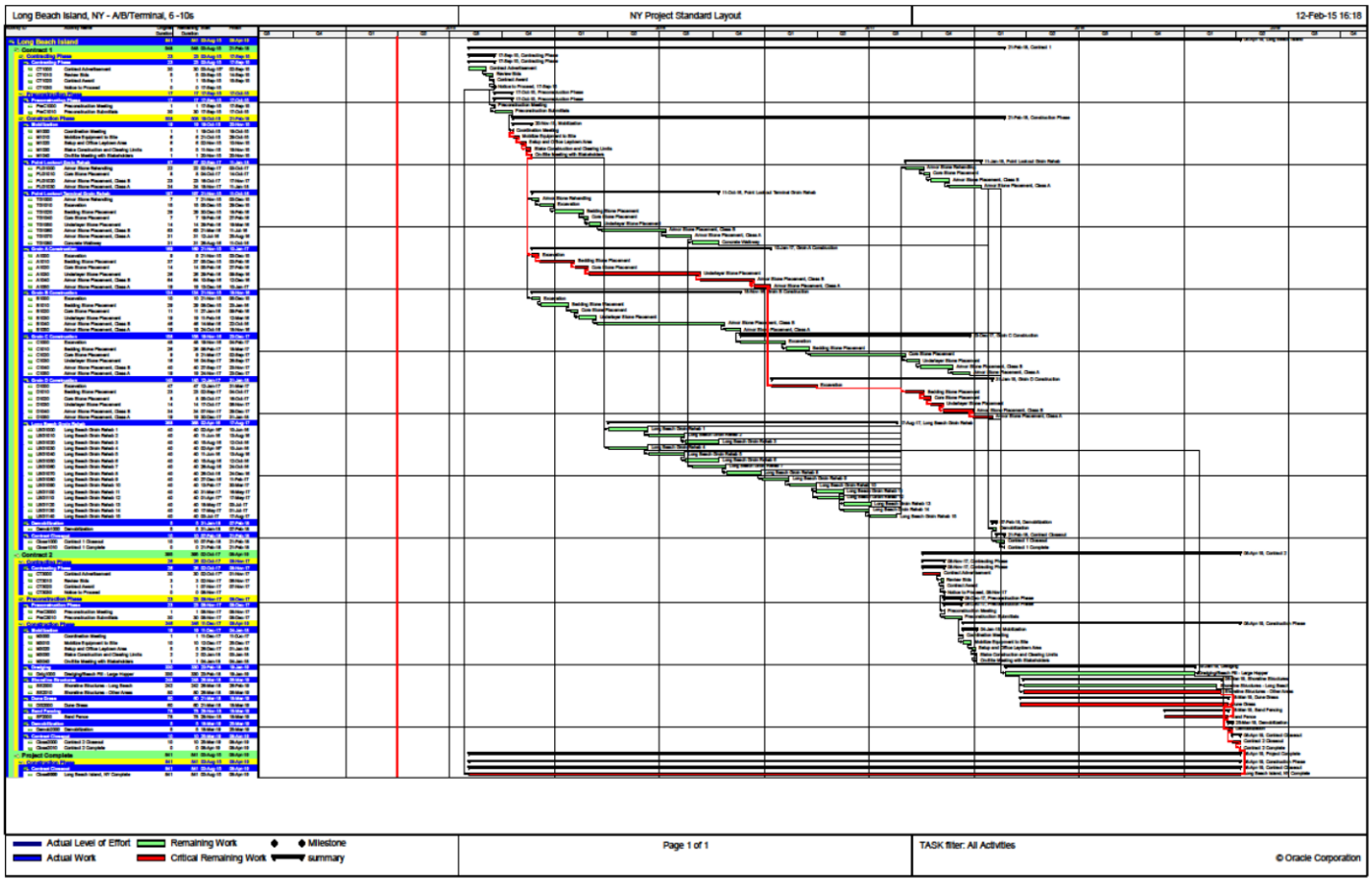
Total Construction Contract Cost = $ 137,673,305

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ 125,010		20.00%	$ 25,000	$ 150,010.00
1	17 BEACH REPLENISHMENT	Mobilization and Demobilization	$ 4,016,702		13.38%	$ 537,594	$ 4,554,296.37
2	17 BEACH REPLENISHMENT	Dredging From Borrow area	$ 39,931,200		21.59%	$ 8,620,922	$ 48,552,121.54
3	17 BEACH REPLENISHMENT	Shore Crew	$ 12,984,804		17.44%	$ 2,264,999	$ 15,249,803.29
4	10 BREAKWATERS AND SEAWALLS	Underlayer Stone (1800 to 3000 Lbs)	$ 4,245,885		24.80%	$ 1,053,131	$ 5,299,015.64
5	10 BREAKWATERS AND SEAWALLS	Type B Armor (5 to 10 Ton)	$ 20,794,920		24.80%	$ 5,157,883	$ 25,952,802.92
6	10 BREAKWATERS AND SEAWALLS	Type A Armor (10 to 15 Ton)	$ 16,658,274		24.80%	$ 4,131,847	$ 20,790,120.80
8	17 BEACH REPLENISHMENT	Timber Pedestrian Dune Walkover - ADA (	$ 6,341,256		17.58%	$ 1,114,537	$ 7,455,793.64
12		Remaining Construction Items	$ 32,700,263	*31.2%*	22.32%	$ 7,299,402	$ 39,999,665.51
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 26,493,000		14.91%	$ 3,949,360	$ 30,442,359.79
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 9,417,000		14.91%	$ 1,403,809	$ 10,820,809.35

Totals					
Real Estate	$ 125,010	20.00%	$ 25,000	$ 150,010.00
Total Construction Estimate	$ 137,673,305	21.92%	$ 30,180,315	$ 167,853,620
Total Planning, Engineering & Design	$ 26,493,000	14.91%	$ 3,949,360	$ 30,442,360
Total Construction Management	$ 9,417,000	14.91%	$ 1,403,809	$ 10,820,809
Total	$ 173,708,315		$ 35,558,484	$ 209,266,799

Schedule

(double-click to open in Adobe)



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

Appendix D:

Update of Project Benefits

U.S. Army Corps of Engineers
New York District

June 2015

Update of Project Benefits

June 2015

Long Beach Island, New York
Hurricane Sandy Limited Reevaluation Report
Benefits Update

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1. Introduction

Long Beach Island, New York, lies on the Atlantic Coast of Long Island, and was the subject of a Storm Risk Management Feasibility Study which was completed in 1995. The project resulting from the Feasibility Study would provide storm risk management for the island's highly developed communities that are subject to wave attack and flooding during major storms and hurricanes.

The principal community benefiting from the project is the City of Long Beach, Nassau County. Also benefiting are the non-incorporated communities of Point Lookout and Lido Beach, both within the Town of Hempstead, and also in Nassau County (See Figure 1). 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.

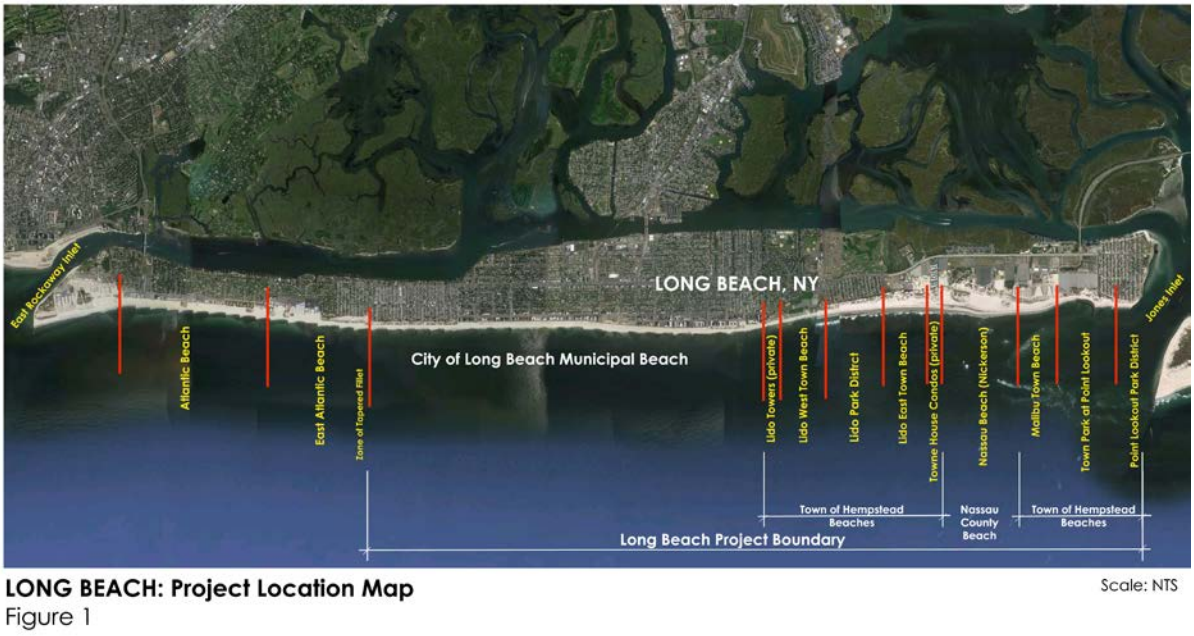

Figure 1: Long Beach Island, New York

The populations of the various communities affected by the project are presented in Table 1. Data does not indicate any clear trend in the County population figures.

Table 1: Community Populations

Census Listed Community	Population

	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)

2. Purpose of the Reevaluation Study

Subsequent to the completion of project pre-construction engineering and design work, there has been a reanalysis of the project area utilizing new modeling techniques, some updates to project design, and an update of construction quantities.

The reevaluation updates project benefits to help confirm the viability of the recommended project.

In this reevaluation, benefits have only been considered for the design alternative put forward by the Feasibility Study as the NED Plan, which was originally referred to in the Feasibility Study as Alternative 5. The NED plan generally provides a 110-foot wide berm backed by a dune system at an elevation of 15 feet above NGVD. Based on 1994 price levels, the NED Plan provided almost $17 million in annual benefits and annual net excess benefits of $8.36 million over the period of analysis of 50 years, with an overall benefit cost ratio of 2.0.

3. 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 period of analysis of 50 years and an interest 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

The first five of these categories were considered storm risk management benefits, and the original distribution of annual benefits for the NED plan is summarized in Table 2:

Table 2: Original Benefits of NED Plan (Cost Base January 1994, Discount Rate 8%)

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		
Section 933 Costs	$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%)

A cost base of October 2014, a project base year of 2018, and a 3.375% Federal Discount Rate have been used in the updating of benefits for this report.

Only those benefits considered being significant to the overall viability of the project (i.e. the major benefits) have been updated in detail. Storm risk management measures 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, whilst the other "minor" benefits have been updated by means of various update factors as appropriate.

4. 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 $ 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.

Current USACE guidance requires the use of depreciated structure value as the only proper indicator of the value of resources subject to flood damage[1]. Depreciated structure value is preferred to the current market value because it provides a direct measure of the value of the physical structure: it takes into account local construction practices and costs, is not overly sensitive to interest rate fluctuations or regional economic conditions, and does not require a separate assessment of the value of the land on which the structure is located.

Residential damages for with and without project conditions have been revised for this reevaluation report by applying an update factor based on observed changes to residential structures 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.

A cluster of structures for resurvey was identified in each project map area, the size of the cluster being approximately equal to the number of residential structures in that map area as a percentage of the overall total. The size of each cluster was adjusted to ensure a minimum of five structures in any one map area and a minimum of 30 structures in total in map areas covering the communities of Lido Beach and Point Lookout, within the Town of Hempstead.

Each cluster was identified by using a random number generating function to select an initial seed structure ID from the original printouts of SAS computer runs calculating structure values, and then taking the next structure IDs in sequence as appropriate to the size of the cluster. For each cluster, several additional structure IDs were added to allow for the possibility that structures encountered during the resurvey in the field would prove to be significantly altered. A total of 114 residential structures were resurveyed on site, of which 103 contributed to the derivation of the update factor.

Data from the resurvey was used to calculate the updated depreciated value of each structure. Each depreciated structure value was compared to its counterpart calculated for the Feasibility Study, and an update factor was calculated for use in the revision of storm risk management benefits for residential structures, based on the average change in depreciated structure value between the original study and the resurvey. Residential structure depreciation originally varied between 0% and 20% of the replacement value, with 10% being applied to the vast majority of structures. For this reevaluation it was found that depreciation in the resurvey sample currently varies between 0% and 45%, with a value of 15% for the majority of structures.

However, an update factor greater than unity can be seen as indicative that the value of new or replacement structures built since the feasibility study and of improvements or repairs to existing structures is more significant than the overall decrease in value that would be expected due to depreciation. Changes in the analysis technique may also be considered: Standard unit replacement costs for the feasibility study were based on the 1992 Means Square Foot Costs, adjusted to the regional area and verified by local building contractors, and used the original build quality of the structure as a surrogate indicator of condition and hence depreciation, whereas

1. Procedural Guidelines for Estimating Residential and Business Structure Value for Use in Flood Damage Estimations: Institute for Water Resources, 1995

current practice uses the Marshall & Swift Valuation Service, which requires a separate assessment of the current structure quality to measure deterioration or improvements to the structure.

Although an update factor calculated only for residential structures in the Town of Hempstead was found to be marginally lower than that for the whole project area, the difference was not significant enough to warrant more detailed investigation and the use of a separate update factor for this area when assessing the benefits of constructing the project in two independent elements.

In addition to the on-site re-surveying work, high resolution digital orthoimagery for Nassau County, made publicly available by the State of New York, was examined and compared to the original project mapping to assess changes to the structure inventory in areas other than those identified for detailed re-surveying. This study found that, as could be expected in a 20 year period, a small number of new residential structures had been constructed. Some of these new structures have replaced structures existent in 1993, and overall the estimated net value of new or replacement structures was not considered to be significant when compared to the overall total value of residential structures in the initial structure inventory. Hence it is assumed that updates to the residential damages are driven by the update factor resulting from the re-survey.

5. 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.

Since 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.

The predominant structural material was examined for commercial and ‘other’ structures in the inventory, following which two update factors were determined, to reflect the observation that approximately 2/3 of commercial structures were of masonry construction, whereas ‘other’ structures were evenly divided between wood frame and masonry.

In the original analysis the possibility that a particularly vulnerable structure might be lost to erosion or wave damage between the feasibility study and the base year of the project was modeled by giving the structure an existence probability of less than 1 in the base year, and adjusting the annual average damage attributable to it accordingly. The original damage calculations were reviewed to determine whether or not there were any such significant structures whose damages should be adjusted upwards to account for the intact existence of the structure in 2003. This study did not find any structures that had been lost in the last 10 years, and any consequent adjustments were considered to be negligible and thus not applied.

As with residential structures, detailed orthoimagery for Nassau County (provided by New York State) was examined to determine the presence of significant new build or replacement structures,

especially in the oceanfront area, where a large proportion of any storm damage would be expected to occur. The oceanfront is predominantly residential in character and both the study of aerial photographs and site visits did not suggest significant changes to the overall value of vulnerable non-residential structures.

6. Risk and Uncertainty

USACE Policy is to acknowledge that some of the inputs to the analysis of flood damage reflect best estimates and that actual values may vary. Studies are subject to the requirements and guidance set out in the following policy documents:

ER 1105-2-101: Risk Analysis for Flood Damage Reduction Studies
EM 1110-2-1619: Risk-Based Analysis for Flood Damage Reduction Studies

It is intended that all flood risk or storm risk management studies follow a comprehensive approach in which all key variables, parameters, and components are subject to probabilistic analyses. Key variables and parameters in the Long Beach analysis were evaluated to determine their significance in the damage and benefit estimates and approaches to incorporating uncertainty in their values. Table 3 provides a summary of the parameters for which uncertainty was considered.

Table 3: Uncertainty Distributions for Benefit Analysis

Uncertain Parameters	Distribution Type	Mean	Variance /St Dev	Lower Bound	Upper Bound
Recession Distance (ft)	Normal	Varies with frequency	2.70%		
Runup Distance	Normal	Varies with frequency	2.20%		
Runup Elevation	Normal	Varies with frequency	2.50%		
Long term Erosion (ft per year) Reach LB1 used for Example	*Triangular*	*0*		*-6.67*	*5.00*
Dune Elevation	*Normal*	*Varies by Reach*	*0.6*		
Rebuild Distance (ft)	Normal	Varies by location	20		
Weir Coefficient	Triangular	3.0		2.8	3.1
Manning Roughness	Triangular	0.04		0.013	0.070
Structure Value	Normal	Varies with structure	30%		
Content Value	Normal	Varies with structure	30%		
Wave Failure Height (Wood)	Triangular	3.0		2.7	3.3
Wave Failure Height (Masonry)	Triangular	3.3		3.0	4.0
Erosion Damage /Sq Ft undermined, High Rise	Normal	$16	20%		
Setback Distance (ft)	Normal	Varies with structure	15		

Uncertainty was applied by executing multiple iterations of lifecycle damages. Mean damages from the various lifecycles were calculated and incorporated into the damage summary tables.

7. 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 forecast 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 Nassau Beach attendance figures were received directly from County sources.

Since 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 update the simulated demand curves with the Willingness To Pay prices updated using Consumer Price Index and recent beach attendance data from the relevant local authorities. Where the attendance figures were found to show a significant deviation from the original visitation forecast, adjustments were incorporated into the future use estimator model. 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.

Table 4 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 4: Beach Attendances

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

Nassau County operates the Nickerson and Malibu Beach areas. 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. The decrease at Nickerson Beach has been offset by an increase in attendance at Malibu Beach.

Attendance at Point Lookout Beach was also found to be generally declining during the 1990's, but has recovered dramatically.

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. Daily pass attendance has continued to increase.

8. Update of Minor Benefits

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

It is sufficient for the purposes of this reevaluation study to revise these benefits simply by applying appropriate update factors to the originally calculated benefits, as presented in Table 5, which summarizes the method of updates for the full range of benefits.

Table 5: Summary of Factors Used to Update Benefits

Benefit Category	Update Factor Source	Update Factor
Infrastructure Damage		
Infrastructure	RSMeans Historical Cost Index	1.98
Boardwalk/Access		1.98
Public Emergency Costs		
Emergency Protection	Consumer Price Index	1.59
Sand/Debris Removal		1.59
Future Protection Costs		
Section933 Costs	Consumer Price Index	1.59
Existing Structure Protection		1.59
Recreation		
Recreation Enhancement	Consumer Price Index and	1.59
Recreation Maintenance	recent beach attendance data	1.59
Loss of Land	Consumer Price Index	1.59

9. Summary of Updated Benefits

All updated benefits are presented in Table 6. These benefits were calculated assuming a project base year of 2018, a 50-year period of analysis, October 2014 price levels, and a Federal Discount Rate of 3.375%.

Table 6: Summary of Updated Benefits

HSLRR Recommended Plan Benefit Categories		
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
Sub Totals	*Physical*	*$22,428,000*
	Emergency	*$4,267,000*
Sub Total Structures		**$26,695,000**
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		
	Section 933 Costs	$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%)

U.S. Army Corps of Engineers
New York District

ATLANTIC COAST OF NEW YORK, JONES BEACH TO EAST ROCKAWAY INLET, LONG BEACH ISLAND, NEW YORK, COASTAL STORM RISK MANAGEMENT PROJECT HURRICANE SANDY LIMITED REEVALUATION REPORT

APPENDIX E

REAL ESTATE PLAN

June 2015

ATLANTIC COAST OF NEW YORK, JONES BEACH TO EAST ROCKAWAY INLET, LONG BEACH ISLAND, NEW YORK, COASTAL STORM RISK MANAGEMENT PROJECT HURRICANE SANDY LIMITED REEVALUATION REPORT

JUNE 2015 REAL ESTATE PLAN

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1. Preamble

a. Introduction: Since the early 1900s, Long Beach Island has experienced damage from coastal storms. Since the late 1920's, local municipalities, Nassau County and New York State have built numerous coastal protective works. Corrective actions along the project area include the construction of timber and stone groins, timber and concrete bulkheads and jetties at the two navigation inlets (at each end of the limits of project area). Many of the coastal structures have deteriorated since their construction. The structures are becoming less effective in trapping sand, and increasingly susceptible to storm damage as the beach continues to erode and lower.

b. Project Authorization: The feasibility study for this project was authorized by the following Resolution, passed on October 1, 1986 by the Committee on Public Works and Transportation of the U.S. House of Representatives:

"*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 a 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 coastal storm risk management methods for Long Beach Island."

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 Coastal Storm Risk Management, 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."

c. Official Project Designation (Official Name): *Atlantic Coast of New York, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, Coastal Storm Risk Management Project***.** (Hereinafter, the "Project.")

d. Project Location: Long Beach Island is approximately 9 miles long and varies in width from 1,500 feet to approximately 4,000 feet. It is bounded on the east by Jones Inlet, on the south by the Atlantic Ocean, on the west by East Rockaway Inlet, and on the north by Reynolds Channel. The terrain of Long Beach Island is low-lying and flat, with elevations generally less than 12 feet above NGVD. The ocean shoreline consists of continuous sand beach. Communities on the island include Point Lookout, Lido Beach, City of Long Beach, East Atlantic Beach and the Village of Atlantic Beach. All unincorporated areas are under the jurisdiction of the Town of Hempstead. The area of the project is the south shore of Long Beach Island ranging from approximately 1,500 feet west of the western boundary of the City of Long

Beach (an incidental Project "taper" in the unincorporated community of East Atlantic Beach in the Town of Hempstead), thence from the western city limit of the City of Long Beach to the Jones Inlet on the east side of island. The entire study area is located within Nassau County, New York.

e. Non-Federal Sponsor: The non-Federal sponsor for this Project is the New York State Department of Environmental Conservation.

2. Statement of Purpose: The purpose of this Real Estate Plan ("the Plan") is to present the overall plan describing the minimum real estate requirements for the construction, operation, maintenance, repair and rehabilitation of the proposed *Atlantic Coast of New York, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, Coastal Storm Risk Management Project***.** This Plan supersedes the Plan appended to the 1995 *Feasibility Report* and is intended to serve as an Appendix to the Project's February 2014 *Hurricane Sandy Limited Reevaluation Report*.

Summary of Project Changes: There are minor design changes from the Plan of Improvement recommended in the 1995 *Feasibility Report* that are within the parameters of the authorized project. These minor changes were made post Hurricane Sandy to account for changed conditions. These changes are:

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

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	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;

	In the Nickerson Beach area in Nassau County and in the Town of Hempstead, dune only (no berm) placed along approximately 5,000 If 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
	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 If 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: • 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: • 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
In the Town of Hempstead, a total of 18 pedestrian and vehicular accessways over the dune to the berm will be provided including: • 11 timber dune walkovers • 7 vehicular accessways	In the Town of Hempstead, a total of 21 pedestrian and vehicular accessways over the dune to the berm will be provided including: • 7 timber dune walkovers – ADA • 9 timber dune walkovers – non ADA • 5 gravel surface vehicle and pedestrian accessways
Nassau county walkovers were originally included in Town of Hempstead totals.	In Nassau County, a total of 6 pedestrian and vehicular accessways over the dune to the berm will be provided including: • 1 timber pedestrian dune walkover - ADA • 3 timber pedestrian dune walkover – non ADA • 2 gravel surface vehicle and pedestrian accessways
6 new groins at the eastern end of the island	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)
Rehabilitation of 16 existing groins, including the rehabilitation of 640 ft of the existing revetment on the western side of Jones Inlet	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.
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.	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.

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.	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.
Total First Cost is $126,466,000 (updated to October 2014 Price Levels using CWICCS Index, feature account 17 – Beach Replenishment)	Total First Cost = $172,030,009
non-Federal sponsor O&M requirements are based on the project features (beach fill, stone groins, dune vegetation and walkovers/access). These O&M 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.	non-Federal sponsor O&M requirements are the same because the project features basically have not changed for the 2015 HSLRR Recommended Plan.

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

3. **Real Estate Requirements**:

Ownership: There are a total of sixteen (16) tracts of land in the projects alignment. Two (2) parcels are privately owned and situated in the Town of Hempstead's "Lido Beach" section of the Project. The existing use of these lands is primarily residential, with a recreational use component (namely, direct access by Owner/Residents to a privately-owned beach). 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*", allowing for the right to use, access, construct and maintain the project. The remaining fourteen (14) tracts of land required for the Project, including lands below the mean high water line, are owned in fee by the Non-Federal Sponsor and local partners, Nassau County, the City of Long Beach, and the Town of Hempstead, each of whom has agreed to provide the required real estate in the form of an access agreement as a condition of State sponsorship of the Project. Under New York law, conveyance of real property interests on State or municipally owned lands is restricted. Consequently, access agreements will be executed between the Corps and the public land owner containing the standard Perpetual Beach Storm Damage Reduction Easement and permitting perpetual access to required lands.

For all Federal "cost-shared" Civil Works projects in coastal areas New York State law requires lands to be owned in fee simple if there will be structures (i.e. groins) placed on those lands. For sand placement, only a Perpetual Beach Storm Damage Reduction Easement is required. The US Army Corps will be requesting The New York State Department of Environmental Conservation (NYSDEC) or its local Partner, the Town of Hempstead, to certify to the acquisition of minimum property interest required for this project. A "Perpetual Beach Storm Damage Reduction Easement", or in the case of publicly owned land, an access agreement, is the minimum property interest that is required for all 16 parcels listed below. A

total of 220.56 acres are necessary for the construction, operation, and maintenance of the project. The properties are described below:

The following is a summary of the Project land (beaches) owned in fee by the three local Governments that are "partnering" with the Non-Federal Sponsor:

• City of Long Beach:	157.04 acres	2 tracts
• Town of Hempstead:	56.43 acres	11 tracts
• Nassau County:	5.77 acres	1 tract
Sub-total:	219.24 acres	

The following is a summary of the Project land (beaches) owned in fee by private owners:

• Lido Beach Townhouses	0.64 acres	1 tract
• Lido Beach Towers:	3.67 acres	1 tract
Sub-total:	4.31 acres	

Total (rounded): **223.55 acres.** (Rounded to **224 acres**)

Required Lands Easements and Rights of Way

#	Section	Block	Lot	Description:	Perpetual Beach Storm Damage Reduction Easement Acreage:	Property Owner:
1	58	149	1		0.62 ac. or 27,007.20 square feet	Town of Hempstead
2	58	132	90		0.2 ac. or 8,712 square feet	Town of Hempstead
3	58	132	40		0.003 ac. or 130.68 square feet	Town of Hempstead
4	58	D	1		6.72 ac. or 292,723.20 sq. ft.	City of Long Beach
5	59	A	1	Beach area- Parks & Recreational &Boardwalk	150.32 ac. or 6,547,939.20 sq. ft.	City of Long Beach
6	59	66	15	2 Richmond Road, Lido Beach, NY	3.67 ac. or 159,865.20 square feet	Lido Towers Condo Assoc. (Condo ownership)
7	60	A	20		5.49 ac. or 239,144.40 square feet	Town of Hempstead
8	60	B	1		3.5 ac. or 152,460 square feet	Town of Hempstead
9	60	91	2		5.14 ac. or 223,898.40 square feet	Town of Hempstead
10	60	91	4	750 Lido Blvd., Lido Beach, NY	0.64 ac. or 27,878.40 square feet	Lido Beach Associates Inc. (Condo ownership)
11	60	91	5		5.77 or 251,341.20 square feet	County of Nassau
12	60	91	6		3.62 ac. or 157,687.20 square feet	Town of Hempstead
13	60	47	105		14.73 ac. or 641,638.80 square feet	Town of Hempstead
14	61	A	52		22.26 or 969,645.60 square feet	Town of Hempstead
15	61	14	1		0.07 or 3,049.20 square feet	Town of Hempstead
16	61	24	1		0.8 or 34,848 square feet	Town of Hempstead

Total square footage: 223.55 acres or 9,737,838.0 sq. ft.

a.) *Standard Estate*: The U.S. Army Corps' Standard Estate, ***Perpetual Beach Storm Damage Reduction Easement,*** will be use by this Project. There is a total of 223.55 acres that need to be acquired. This Standard Estate is listed below:

Perpetual Beach Storm Damage Reduction Easement
(Standard Estate No. 26)

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tract No. __) for use by the New York State Department of Environmental Conservation, its representatives, agents, contractors, and assigns, to construct; preserve; patrol; operate; maintain; repair; rehabilitate; and replace; a public beach [a dune system] and other erosion control and storm damage reduction measures together with appurtenances thereto, including the right to deposit sand; to accomplish any alterations of contours on said land; to construct berms and dunes; to nourish and renourish periodically; to move, store and remove equipment and supplies; to erect and remove temporary structures; and to perform any other work necessary and incident to the construction, periodic renourishment and maintenance of the Atlantic Coast of New York, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, Coastal Storm Risk Management Project, together with the right of public use and access; to plant vegetation on said dunes and berms; to erect, maintain and remove silt screens and sand fences; to facilitate preservation of dunes and vegetation through the limitation of access to dune areas; to trim, cut, fell, and remove from said land all trees, underbrush, debris, obstructions, and any other vegetation, structures and obstacles within the limits of the easement; reserving, however, to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns, the right to construct dune overwalk structures in accordance with any applicable Federal, State or local laws or regulations, provided that such structures shall not violate the integrity of the dune in shape, dimension or function, and that prior approval of the plans and specifications for such structures is obtained from the (designated representative of the Project Sponsor) and provided further that such structures are subordinate to the construction, operation, maintenance, repair, rehabilitation and replacement of the project; and further reserving to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns all such rights and privileges as may be used and enjoyed without interfering with or abridging the rights and easements hereby acquired; subject however to existing easements for public roads and highways, public utilities, railroads and pipelines.

b.) *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 and Access Agreements. This will provide the Corps with sufficient ingress and egress for accessing the project for construction.

c.) *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 access ramps will be constructed in the easement area which will have been previously acquired by the non-federal sponsor. The dune maintenance area landward from the landward toe of the dune is included in the Perpetual Beach Storm Damage Reduction Easement area.

d.) 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 State of New York. Access agreements from the State of New York covering these lands are sufficient for the proposed construction, rehabilitation, operation and maintenance.

e.) *Borrow Areas*: The Project does not require acquisition of real property interests for borrow or disposal areas. No disposal areas will be required for any purpose. The State of New York owns fee interest in all submerged lands from the mean high water line to three miles offshore, including the areas that are designated as borrow material sites. The NFS will be required to provide a Water Quality Certificate for use of the borrow sites affecting state-owned submerged lands.

f.) *Purpose and Features*: Long Beach Island has experienced damage from coastal storms since the early 1900's. Local municipalities, Nassau County and New York State have built numerous coastal protective works in the past. Corrective actions along the project area include the construction of timber and stone groins, timber and concrete bulkheads and jetties at the navigation inlets (Jones Inlet to the east and East Rockaway Inlet to the west).

The problems in the Long Beach project area consist of loss of sand due to storm-induced beach erosion, and the deterioration of the protective coastal structures. Erosion has reduced the width and lowered most of the beachfront areas along the project shoreline area. This continuing erosion exposes Long Beach Island to a high risk of catastrophic damage from ocean flooding and wave attack. Many of the coastal structures have deteriorated since their construction. The structures are becoming less effective in trapping sand, and increasingly susceptible to storm damage as the beach continues to erode and lower.

The principle features of the project demand a total "project length" of approximately 35,000 linear feet of dune and beach fill. 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 NAVD, then sloping at 1V:20H to intersection with existing bathymetry; In the Nickerson Beach area in the Town of Hempstead, dune only (no berm) placed along approximately 5,000 If of shoreline. The existing berm will remain undisturbed to allow for bird nesting and foraging area for piping plovers and least tern for (within the Town of Hempstead), which will have deferred berm construction; In Lido Beach and the City of Long Beach, a stepped beach berm extending 40 ft. from the seaward toe of the recommended dune at an elevation of +9 ft NAVD, a 1V:10H slope downward to +7 ft NAVD, a 130 ft flat berm at +7 ft NAVD, then sloping 1V:30H to intersection with existing bathymetry. For a description of all other project features please refer to the comparison chart listed above in the table in section1A.

g.) *Appraisal Information*: Current landowners are the following public entities (local governments): Nassau County (approx. 5.77 acres); Town of Hempstead (Nassau County) (approx. 56.43 acres); and the City of Long Beach (Nassau County) (157.04

acres); and the following private owners: Lido Beach Townhouses (approx. 0.64 acres); and Lido Beach Towers (3.67 acres).

Being that the bulk of the property is situated on public beach where it is currently unbuildable due to the physical aspect, past adverse weather conditions, questionable demand and zoning regulations (Parks & Recreational use); the fee value is considered to be nominal. With exception of the two privately owned properties the "before" and "after" values of the public owned beaches are considered to be the same, since the underlying landowners' utility will not be diminished by the Project. Instead, the Project will create a "betterment" on these lands that would otherwise not exist, namely, an improved beach affording better coastal storm risk management to owners' "upland" improvements to both public and privately owned beaches.

As a result, 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 value of the required "interests" that are to be "acquired" for both municipal owned property and privately owned lands is a nominal fee of approximately **ten ($10) dollars.** A summary of anticipated Project real estate costs is as follows:

Real Estate Cost Estimate		**Total Costs**
01 ACCOUNT – LANDS AND DAMAGES (NON FED)		
Admin (Non Federal)	$125,000.00	
Lands (Non Federal)	$10.00	
(2 Condo Ass'n. Easements)		
Subtotal		$125,000.00
20% Contingency	$25,000.00	
01 ACCOUNT TOTAL		**$150,010.00**
30 ACCOUNT – PROJECT MANAGEMENT COSTS (FED)		
Fed Review and Assistance	$20,000.00	$20,000.00
Subtotal		$20,000.00
14.91% Contingency	$2,982.00	
30 ACCOUNT TOTAL		**$22,982.00**
02 ACCOUNT - RELOCATIONS		
Fed Relocation	$250,000.00	
(National Ave. Comfort Station)		
Subtotal		$250,000.00
21.92% Contingency	$54,803.00	
02 ACCOUNT TOTAL		**$304,803.00**

The total non-Federal real estate cost and associated administrative cost, including contingency, are estimated at $150,010.00. A contingency of 20% is used because of standard risks inherent in the acquisition of private real estate. Contingencies for Project Management

and Relocation accounts are 14.91% and 21.92%, respectively as determined by Cost Engineering. See Appendix C for further detail. As discussed in the paragraph below the actual cost for the acquisition of the Perpetual Beach Storm Damage Reduction Easement areas will be reimbursed in accordance with the provisions of PL. 113-2. The relocations costs are included here as a convenience. Please see Section 17 of this Appendix for a brief description, and Engineering Appendix Section 6 for further detail.

The cost-sharing of the initial construction cost is in accordance with the provisions of P.L. 113-2. PL 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 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 in the HSLRR will show October 2013 price levels; with 100% Federal cost allocation, inclusive of real estate costs. Please note that the beach renourishment costs will be cost-shared 65/35 (renourishment at 5-year intervals).

4. <u>Non-Federal Sponsor Owned Lands</u>: The Non-Federal Sponsor, through the State of New York, owns submerged lands located below mean high water. All the remaining lands required for the Project, except for the 1.32 acres of privately-owned beachfront, are owned in fee either by Nassau County, the Town of Hempstead or the City of Long Beach. These local governments have agreed to provide access agreements to the State for the use of their lands for this Project. The Town of Hempstead will obtain required easements on the two privately-owned parcels.

5. <u>Proposed Non-Standard Estates</u>: There are no "non-standard" estates being used for this project. The Standard Estate, Perpetual Beach Storm Damage Reduction Easement, will be used for this Project and incorporated into all access agreements.

6. <u>Existing Federal Projects</u>: There is an existing Federal Project adjacent to the project area, Jones Inlet, which is a Federal Navigation Channel. The Project will have no impact on this Channel, nor will the Channel affect the Project.

7. <u>Federally-owned Lands</u>: There are no Government-owned lands within the Project area.

8. <u>Navigational Servitude</u>: Since the Project is for storm risk management purposes, not navigational purposes; the Government will not exercise its rights under the doctrine of Navigational Servitude for this Project.

9. <u>Project Maps</u>: **Exhibit "A"** depicts the complete Project alignment and the block and lots.

10. <u>Induced Flooding:</u> There will be no induced flooding as a result of the Project.

11. <u>Baseline Cost Estimates</u>: A baseline cost estimate, in *Micro Computer-Aided Cost Estimating System* ("M/CASES") format, is attached hereto as **Exhibit "B".**

12. <u>Compliance with Public Law 91-646</u>: No residences, farms, or businesses will be displaced by or for the Project. Therefore, NO Relocation Assistance will be required under the provisions of *Public Law 91-646*.

13. <u>Minerals and Timber</u>: There are no present or anticipated mineral extraction or timber harvesting activities in the Project area and/or its vicinity

14. <u>Assessment of the Non-Federal Sponsor's Land Acquisition Experience and Ability</u>: The State of New York, Department of Environmental Conservation ("NYSDEC") is the Project's non-Federal Sponsor. NYSDEC and its local partner, the Town of Hempstead, have the legal and professional capability and experience to acquire and provide the real estate for the construction, operation, and maintenance of the project. The Town of Hempstead possesses condemnation authority and quick-take capability; however, it is not anticipated that these actions will be required or used for this Project. See Exhibit C, the Non-Federal Sponsor Capability Checklist for further detail.

15. <u>Zoning</u>: Application or enactment of zoning ordinances is not anticipated for the Project.

16. <u>Acquisition Schedules</u>: It is anticipated that the Project Partnership Agreement ("PPA") will be signed by August 2015, and the contract for the first phase of construction will be "ready to advertise" by October 2015. It is anticipated that the required real estate interests will be provided by or on behalf of the Non-Federal Sponsor at least thirty (30) days prior to the solicitation for bids for the first construction contract. Please note that the real estate interests for the two private properties (Lido Towers & Lido Beach Townhouses) will be provided by the Non Federal Sponsor at least 30 days prior to bid solicitation for the 2rd contract in 2016.

17. <u>Facility and/or Utility Relocations</u>: A comfort station currently located under the boardwalk at National Ave. in the City of Long Beach will be relocated to maintain pre-project functionality. Please see Engineering Appendix Section 6 for further detail.

18. <u>Hazardous, Toxic, and Radioactive Waste (HTRW)</u>: There are no known, or potential, HTRW problems associated with this Project.

19. <u>Project Support</u>: Nassau County, the City of Long Beach, and the Town of Hempstead, local partners of the Non-Federal Sponsor, all support this Project.

20. <u>Notifications to Non-Federal Sponsor(s)</u>: With the exception of the two privately-owned parcels all other lands required for the Project are owned in fee by the Non-Federal Sponsor's local partners, Nassau County, the City of Long Beach, and the Town of Hempstead, each of whom has agreed to provide the required LERRD as a condition of State sponsorship of the Project.

Based on its past sponsorship of other Corps of Engineers water resource (Civil Works) projects and ongoing discussions during the Project's Feasibility phase, the Non-Federal Sponsor is aware of the risks of acquiring LERRD required for the Project prior to the signing of the Project Partnership Agreement ("PPA"). In accordance with Paragraph 12-31 of Chapter 5 of the Corps of Engineers Real Estate Handbook, ER 405-1-12, formal written notification of the risks of such acquisition was forwarded to the Sponsor and its local Partners (including the Town of Hempstead) in **April 2013.**

21. <u>Other Issues</u>:

a. Environmental mitigation requirements are still being determined because of air quality compliance. Please note all mitigation sites identified will require certification of a fee simple estate.

b. As discussed in *paragraph 2* above, with two exceptions, all lands required for the Project are owned in fee by the non-Federal Sponsor's local partners, Nassau County, the City of Long Beach, and the Town of Hempstead, each of whom has agreed to provide the required LERRD as a condition of State sponsorship of the Project. Aside from those discussed in *paragraph 2* above, there are no other known existing encumbrances (i.e.: easements, rights-of-way, etc) affecting the project alignment. A final determination will be made regarding the existence of Outstanding Third Party interests when the LERRD Certification document packages are submitted by the NFS for District Review and approval.

c. The non-Federal Sponsor will assume responsibility to maintain the project after construction. New York District will be supplying a manual, as prescribed in the PPA, setting forth actual practices for this type of project.

d. This Real Estate Plan has been prepared in accordance with Chapter 12 of the Corps of Engineers' *Real Estate Handbook*, Regulation ER 405-1-12.

22. Points of Contact:

The points of contact for this real estate plan are the Real Estate Project Delivery Team member Realty Specialist, Robert Vohden at (917) 790-8093 (email: Rob.Vohden@usace.army.mil) or the undersigned at (917) 790-8430 (email: Noreen.D.Dresser@usace.army.mil).

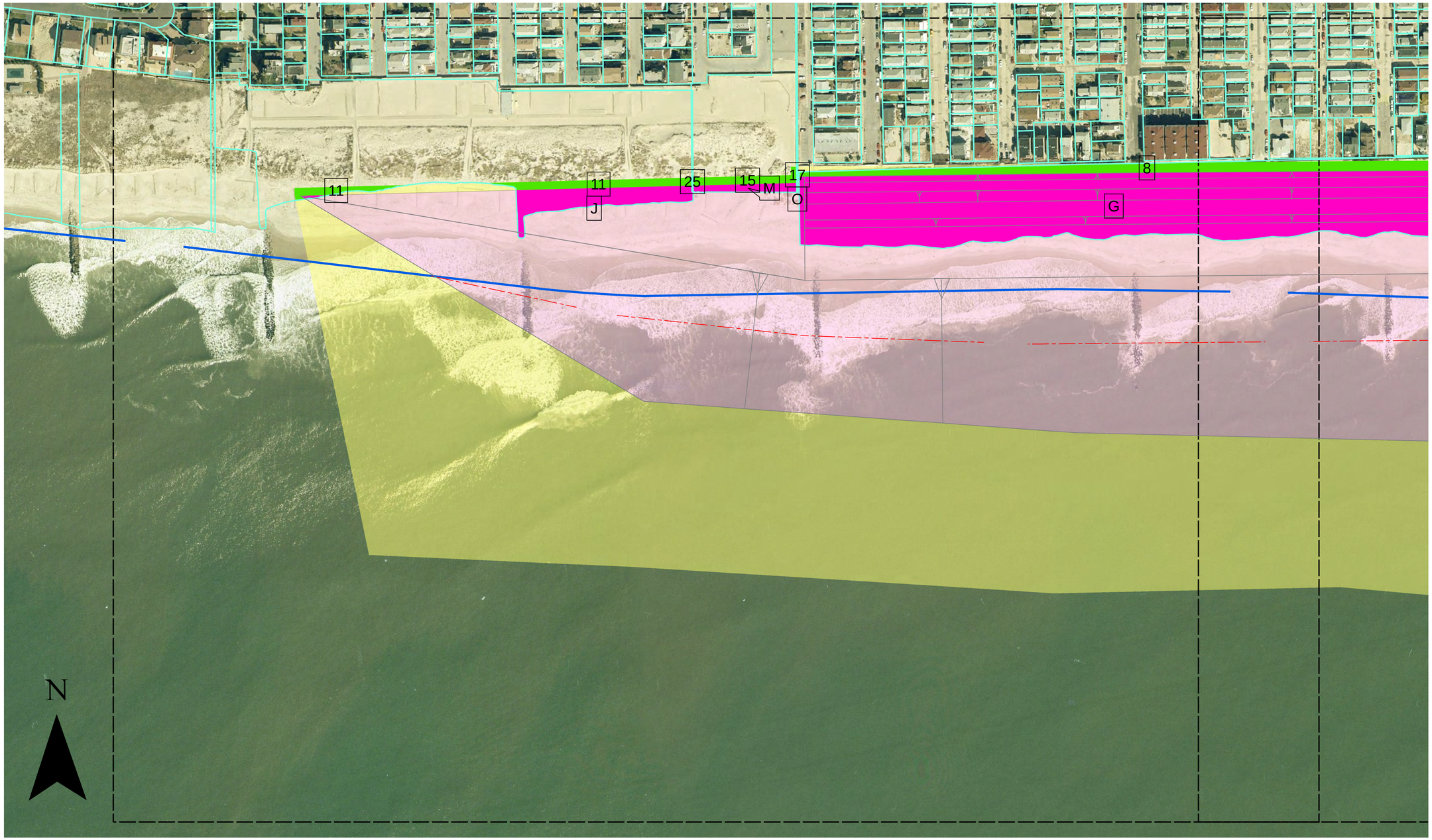
23. Recommendations:

This report has been prepared in accordance with the Corps of Engineers Regulation ER 405-1-12. It is recommended that this report be approved.

Noreen D. Dresser
Chief, Real Estate Division
Real Estate Contracting Officer

EXHIBIT “A”

REAL ESTATE MAPS



Legend

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- Permanent Easement Parcels
- Parcel Limits
- Sheet Limits
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A	60	91	5	250968.97	5.7615
B	59	A	1	6544397.37	150.2387
C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
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I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
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Total				9706253.28	222.8249

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Item	Section	Block	Lot	Square Ft	Acres
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4	59	269	22	3.65	0.0001
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6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
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9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
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12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
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22	60	47	105	27.96	0.0006
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

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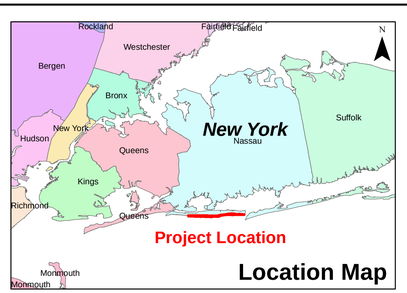
New York District

Date: 9/16/2014

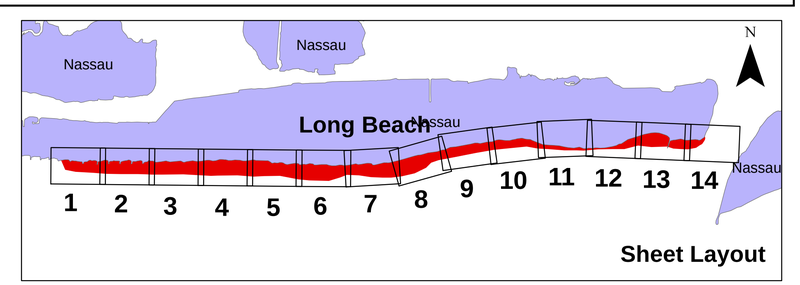


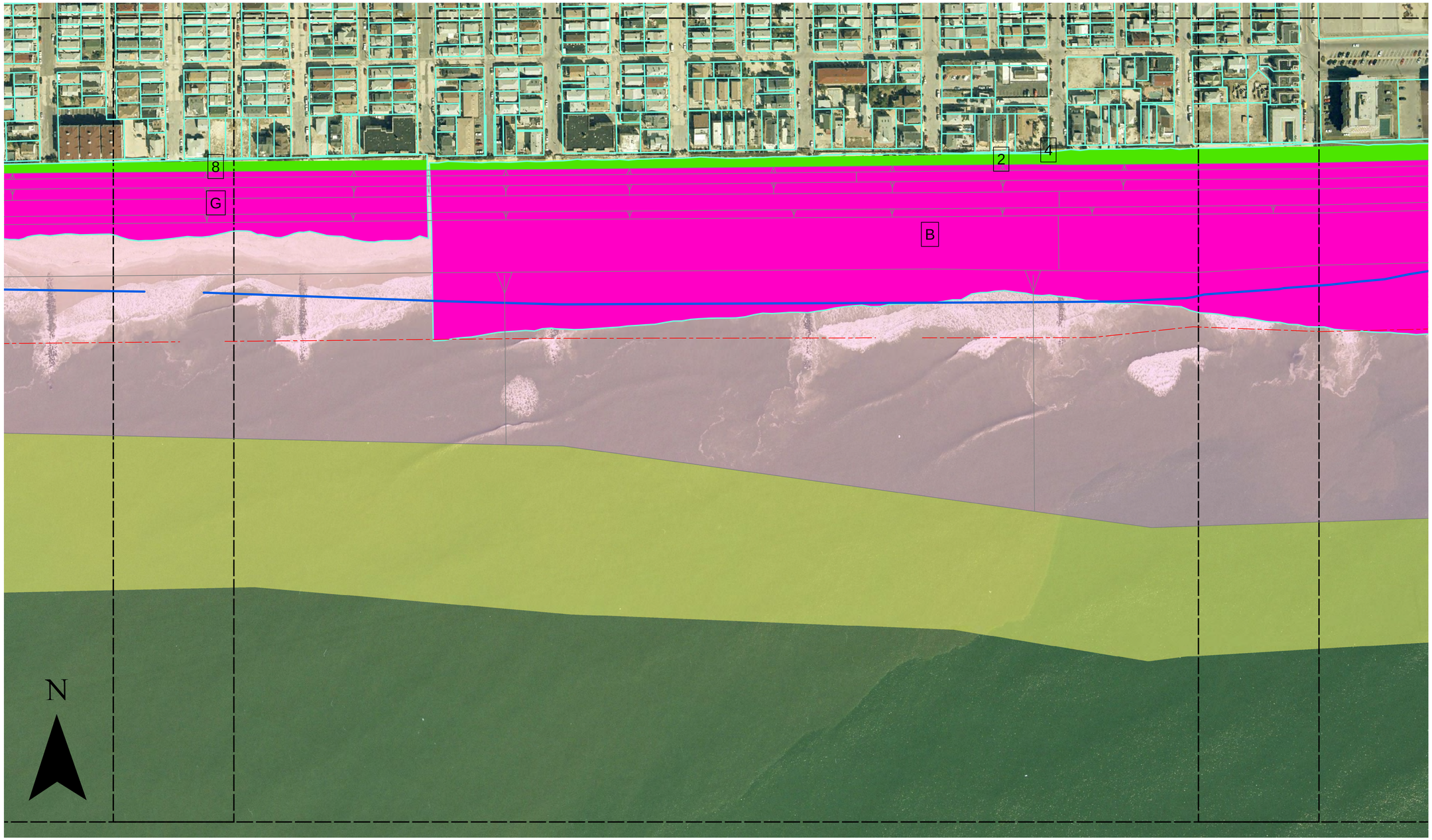
Atlantic Coast of New York,
Jones Inlet to East Rockaway Inlet,
Long Beach Island,
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 1 of 14





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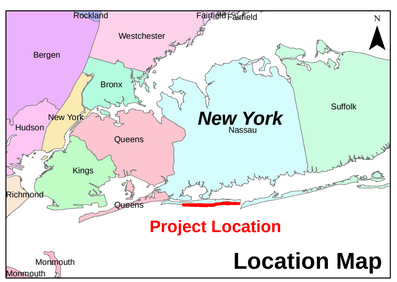

Location Map

Atlantic Coast of New York,
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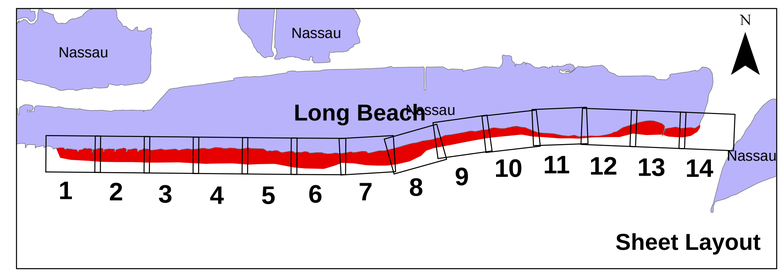
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 2 of 14



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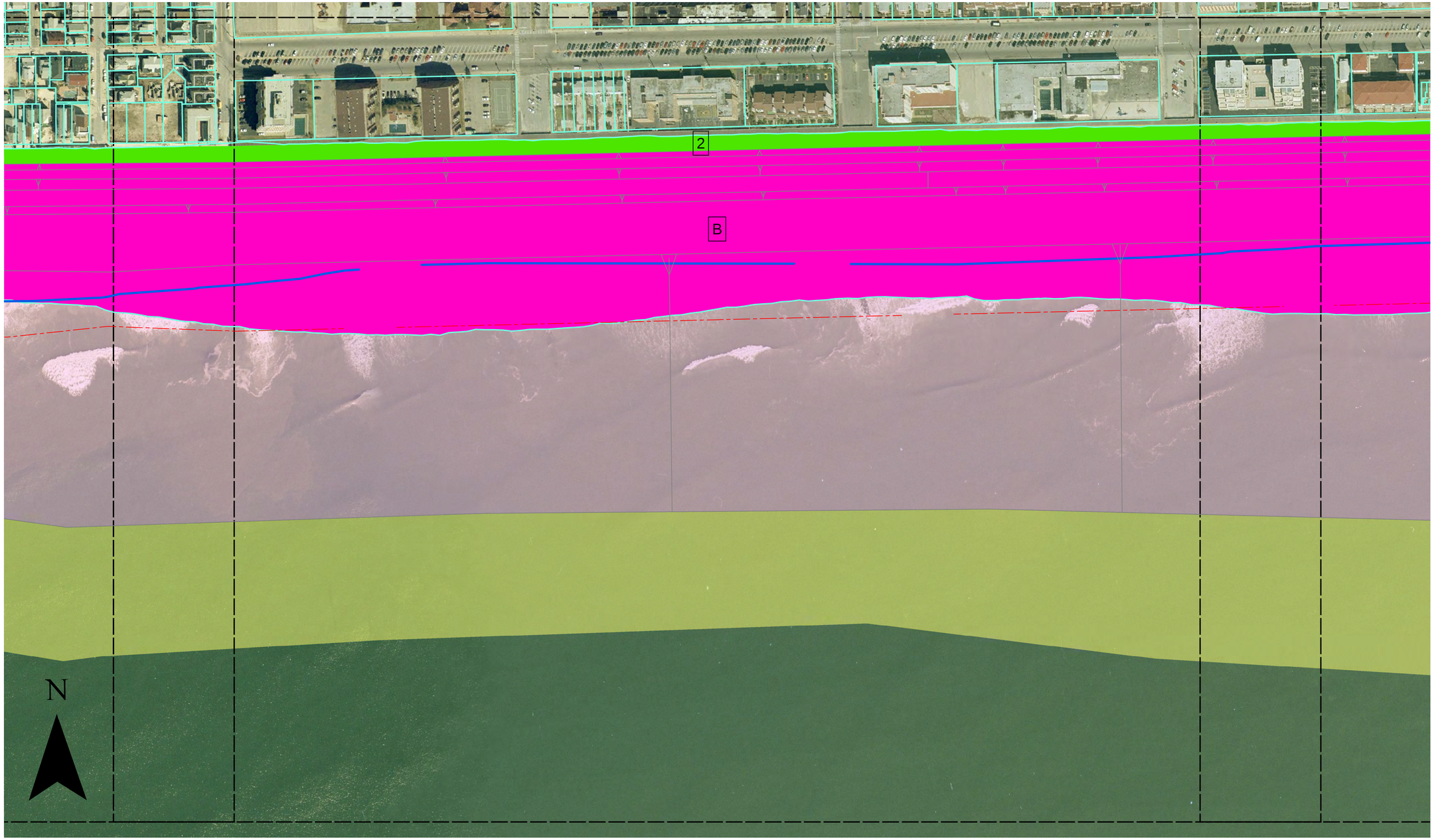

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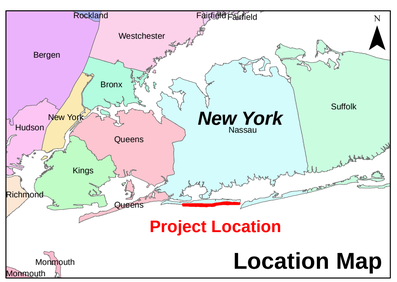
Total	11886172.92	272.8682

US Army Corps of Engineers®
New York District

Date: 9/16/2014



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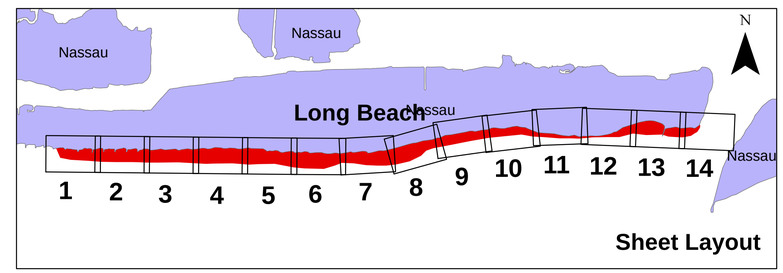

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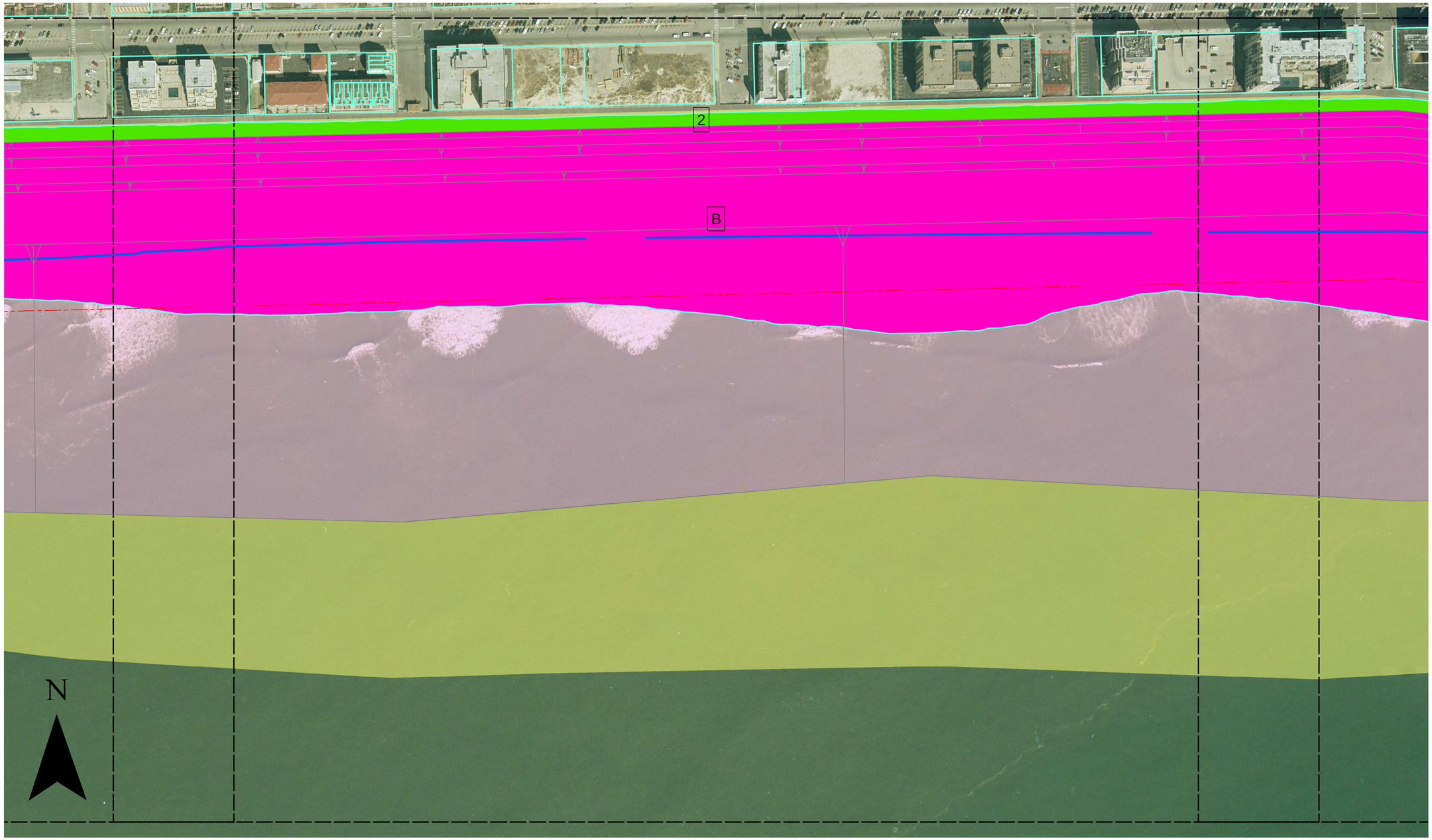

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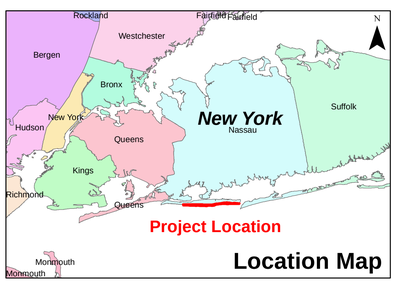
US Army Corps of Engineers®
New York District

Date: 9/16/2014



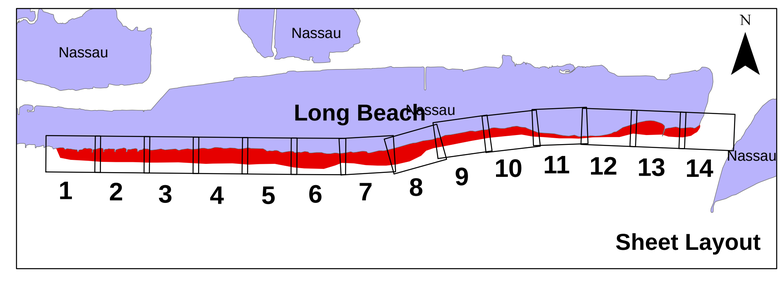
Location Map

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

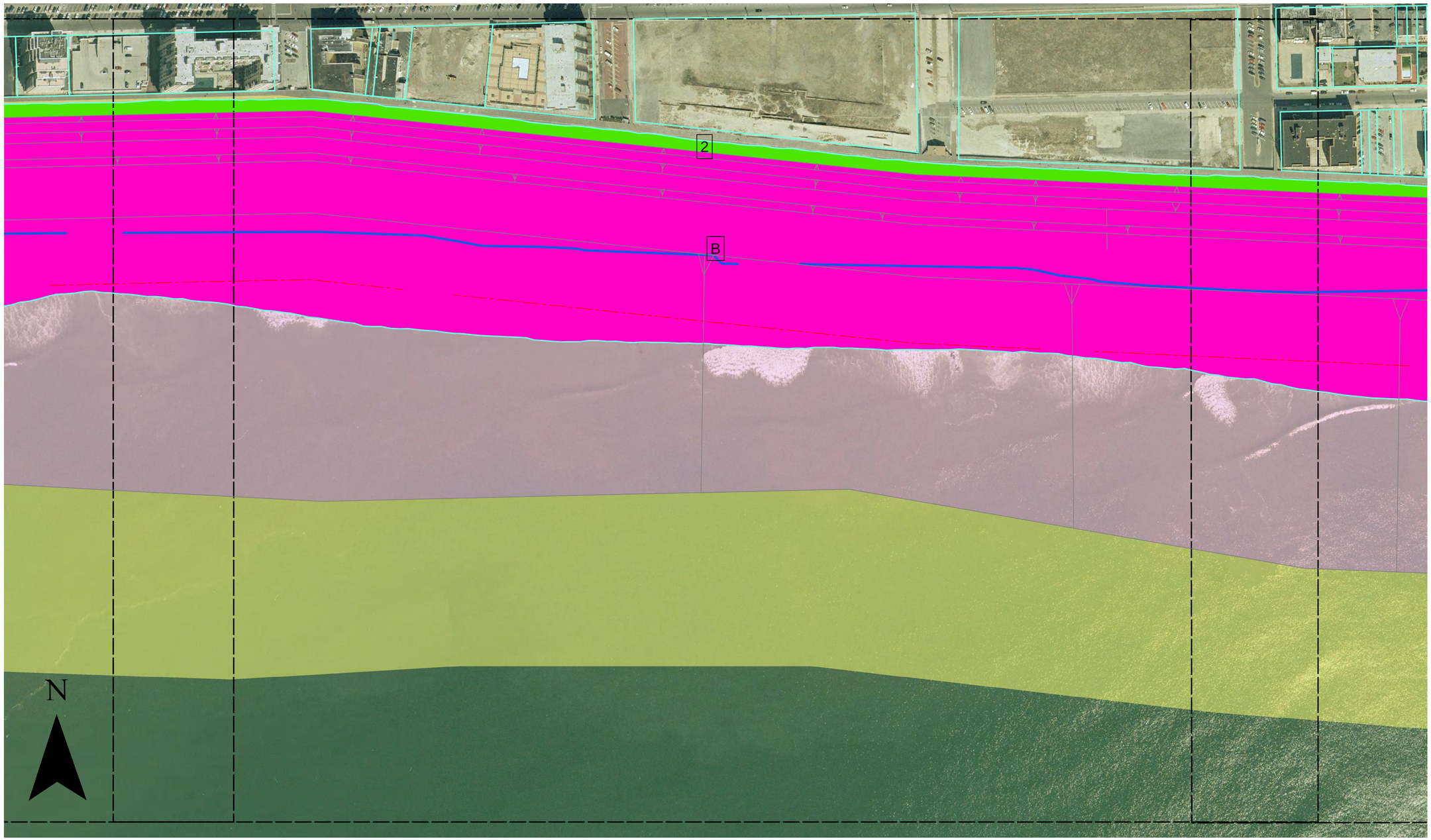
Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 4 of 14



Sheet Layout



Legend

- Dunes
- Permanent Easement
- Permanent Easement Parcels
- Parcel Limits
- Sheet Limits
- Temporary Easement Parcels
- Temporary Easements
- Improved MHW
- Existing MHW

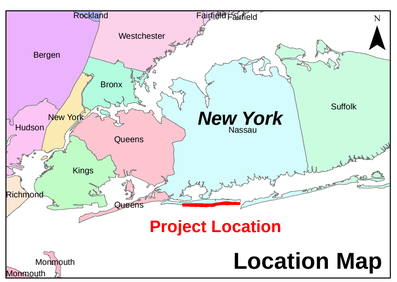
Permanent Easement Parcels					
Item	Section	Block	Lot	Shape Ft	Acres
A	60	91	5	250968.97	5.7615
B	59	A	1	6544397.37	150.2387
C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
18	60	91	6	117107.39	2.6884
19	59	A	1	2.62	0.0001
20	59	269	22	2.62	0.0001
21	0		52	27.96	0.0006
22	60	47	105	27.96	0.0006
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

US Army Corps of Engineers®
New York District

Date: 9/16/2014



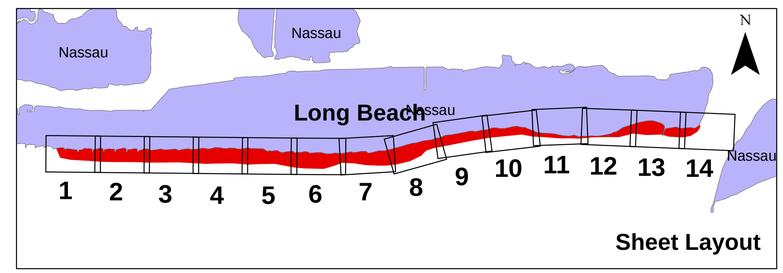
Location Map

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

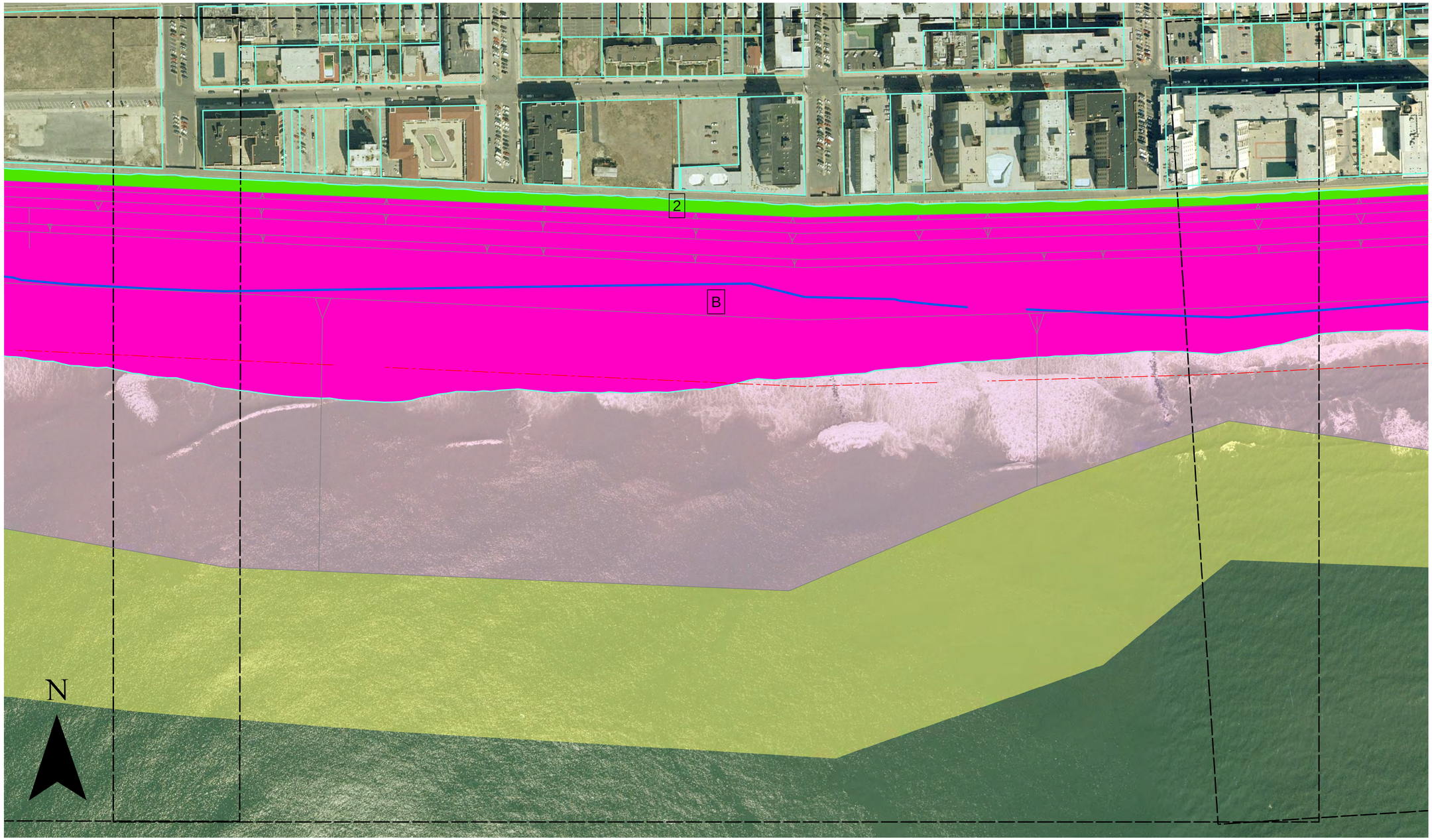
Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 5 of 14



Sheet Layout



Legend

- Dunes
- Permanent Easement
- Permanent Easement Parcels
- Parcel Limits
- Sheet Limits
- Temporary Easement Parcels
- Temporary Easements
- Improved MHW
- Existing MHW

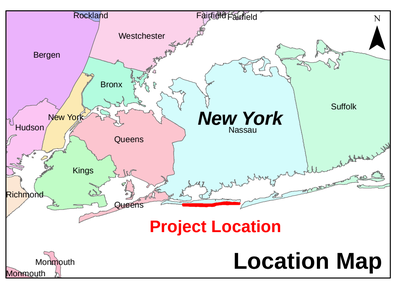
Permanent Easement Parcels					
Item	Section	Block	Lot	Shape Ft	Acres
A	60	91	5	250968.97	5.7615
B	59	A	1	6544397.37	150.2387
C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
18	60	91	6	117107.39	2.6884
19	59	A	1	2.62	0.0001
20	59	269	22	2.62	0.0001
21	0		52	27.96	0.0006
22	60	47	105	27.96	0.0006
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

US Army Corps of Engineers®
New York District

Date: 9/16/2014



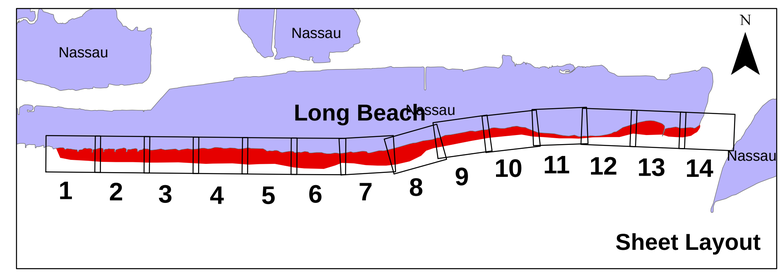
Location Map

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

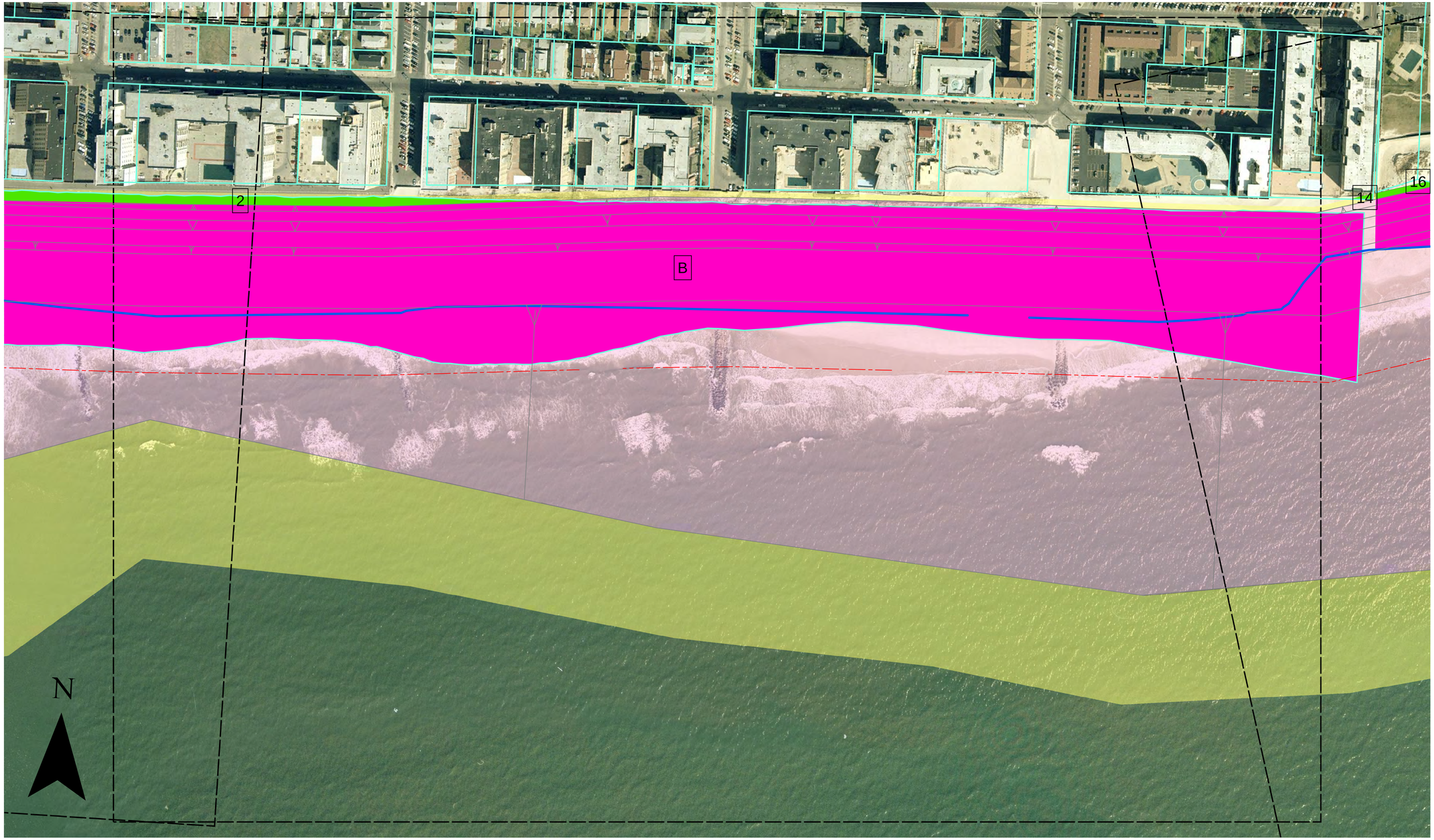
Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 6 of 14



Sheet Layout



Legend

- Dunes
- Permanent Easement
- Permanent Easement Parcels
- Parcel Limits
- Sheet Limits
- Temporary Easement Parcels
- Temporary Easements
- Improved MHW
- Existing MHW

Permanent Easement Parcels					
Item	Section	Block	Lot	Shape Ft	Acres
A	60	91	5	250968.97	5.7615
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C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
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4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
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12	60	91	4	241830.45	5.5510
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14	59	220	104	452.01	0.0104
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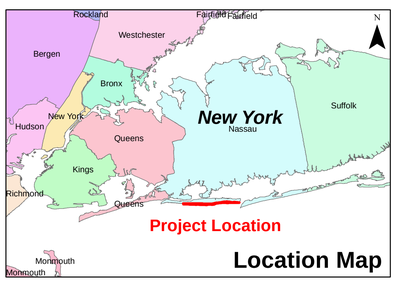
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

US Army Corps of Engineers®
New York District

Date: 9/16/2014

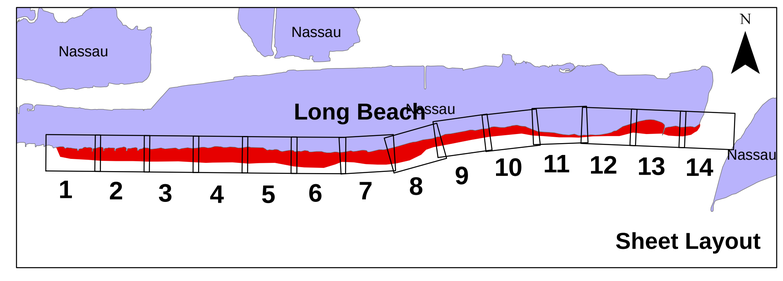


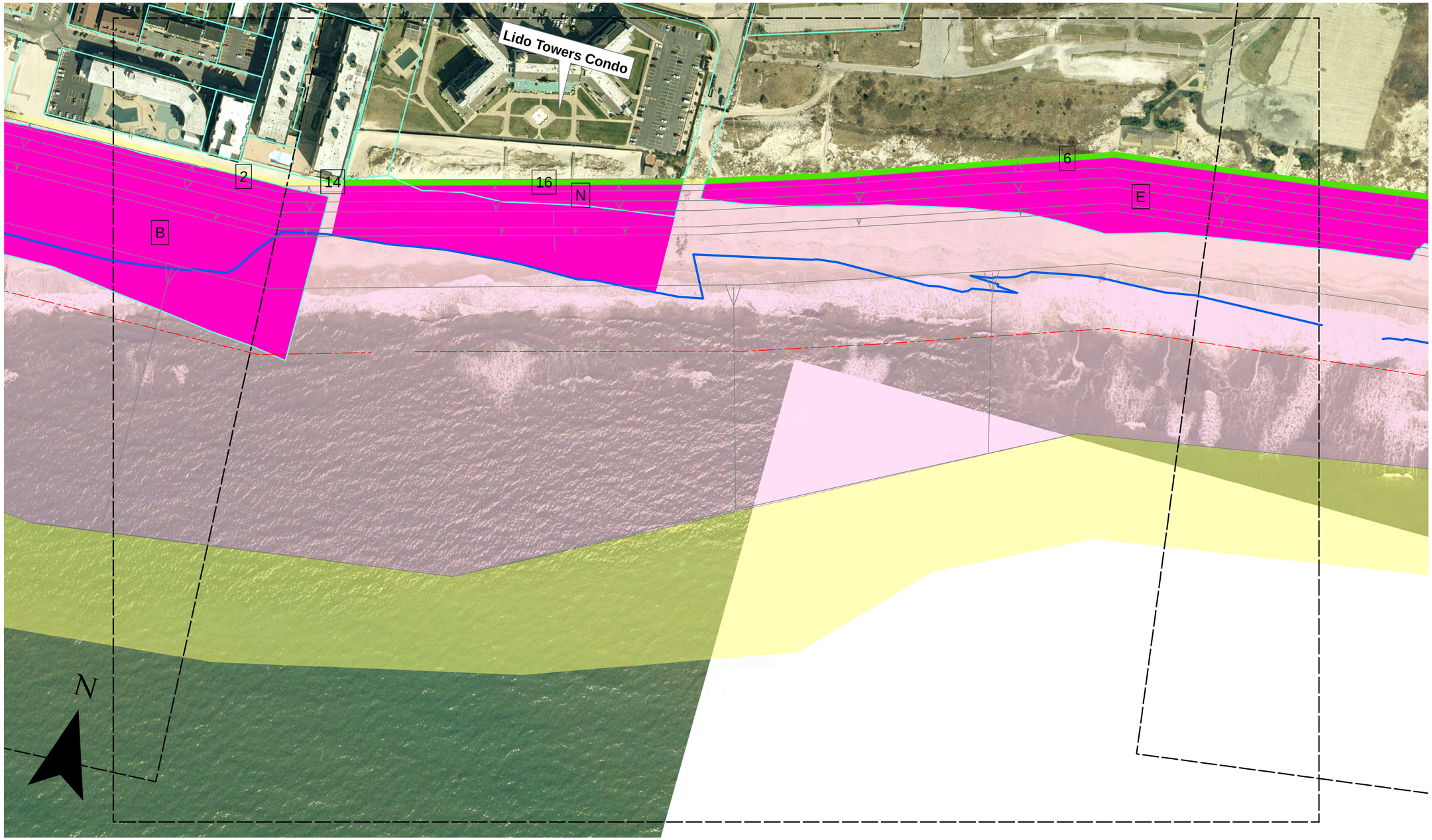
Atlantic Coast of New York,
Jones Inlet to East Rockaway Inlet,
Long Beach Island,
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 7 of 14





Legend

- Dunes
- Permanent Easement
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- Parcel Limits
- Sheet Limits
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Item	Section	Block	Lot	Shape Ft	Acres
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D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
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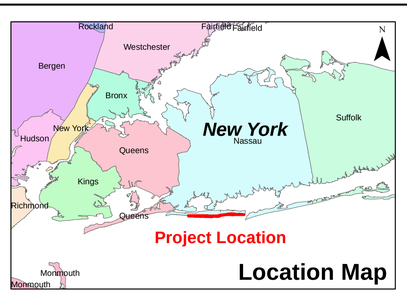
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

US Army Corps of Engineers®
New York District

Date: 9/16/2014

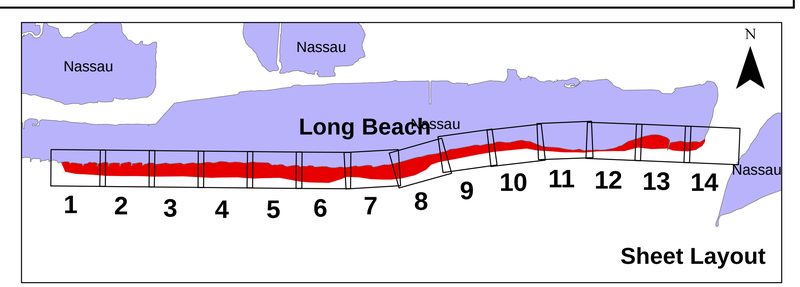


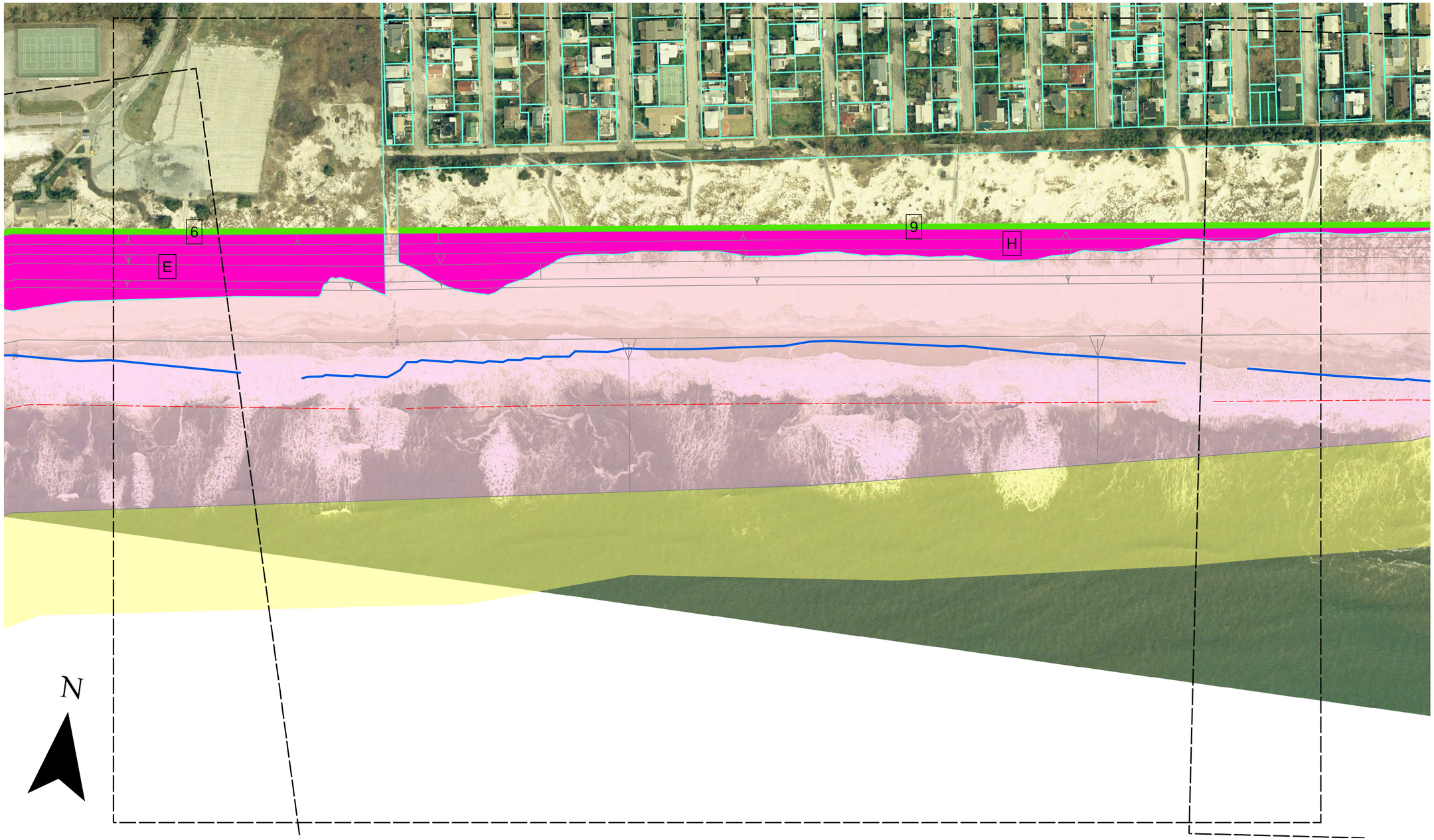
Atlantic Coast of New York,
Jones Inlet to East Rockaway Inlet,
Long Beach Island,
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 8 of 14





Legend

- Dunes
- Permanent Easement
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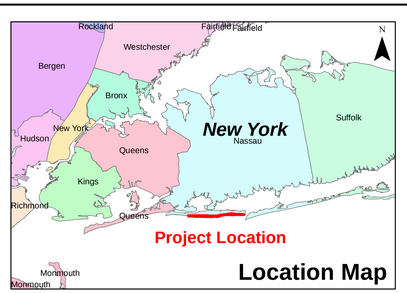
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
18	60	91	6	117107.39	2.6884
19	59	A	1	2.62	0.0001
20	59	269	22	2.62	0.0001
21	0		52	27.96	0.0006
22	60	47	105	27.96	0.0006
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

US Army Corps of Engineers®
New York District

Date: 9/16/2014

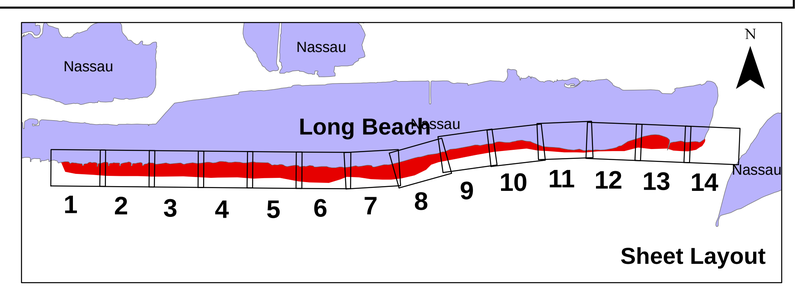


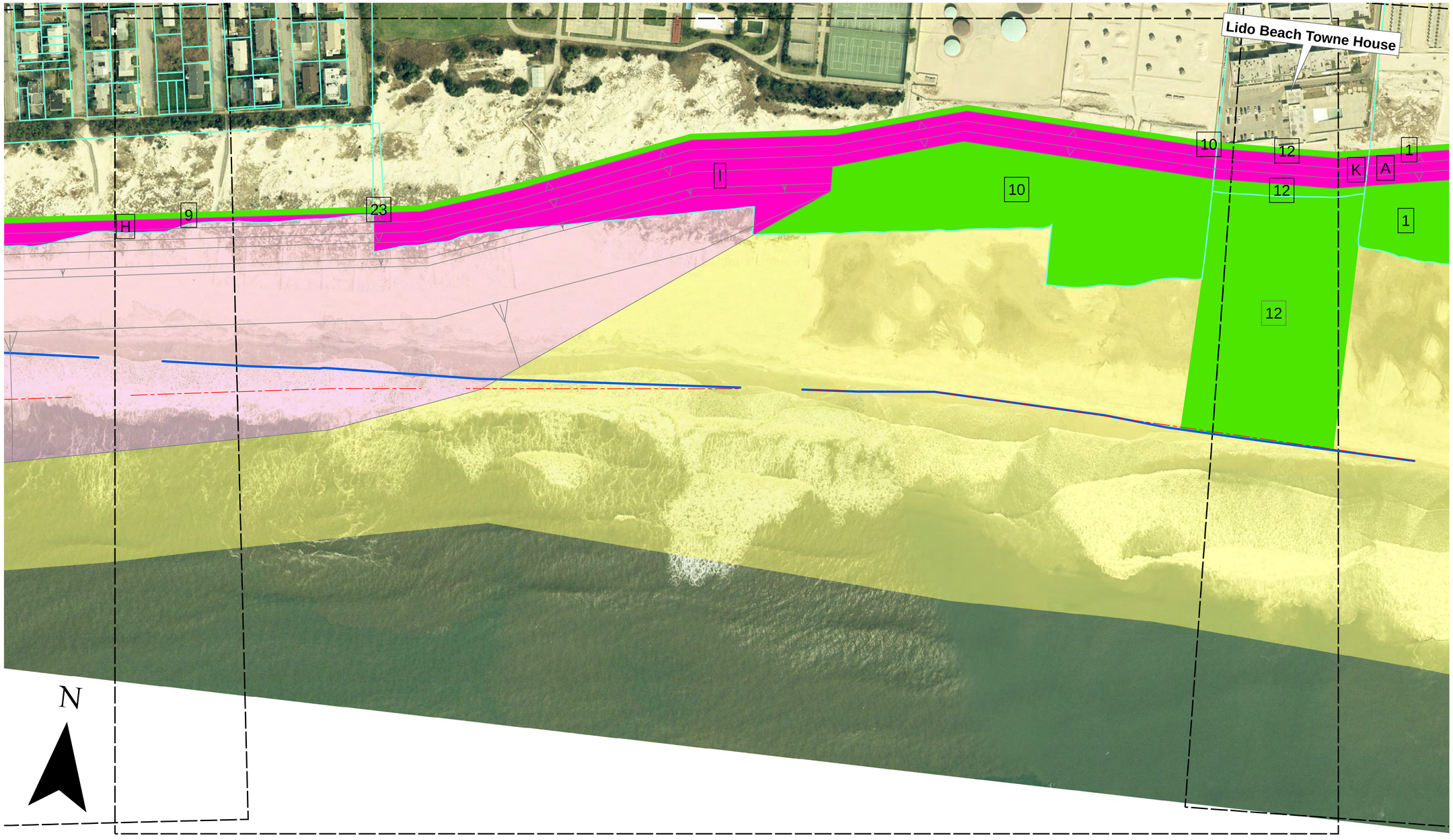
Atlantic Coast of New York,
Jones Inlet to East Rockaway Inlet,
Long Beach Island,
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 9 of 14





Legend

- Dunes
- Permanent Easement
- Permanent Easement Parcels
- Parcel Limits
- Sheet Limits
- Temporary Easement Parcels
- Temporary Easements
- Improved MHW
- Existing MHW

Permanent Easement Parcels					
Item	Section	Block	Lot	Shape Ft	Acres
A	60	91	5	250968.97	5.7615
B	59	A	1	6544397.37	150.2387
C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
18	60	91	6	117107.39	2.6884
19	59	A	1	2.62	0.0001
20	59	269	22	2.62	0.0001
21	0		52	27.96	0.0006
22	60	47	105	27.96	0.0006
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

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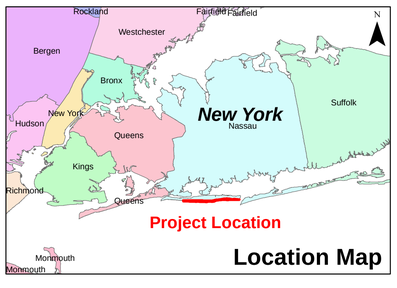
Date: 9/16/2014

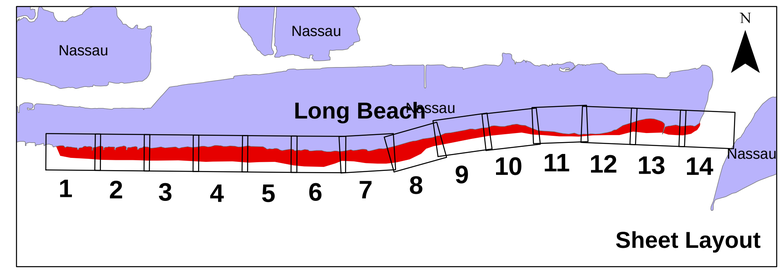


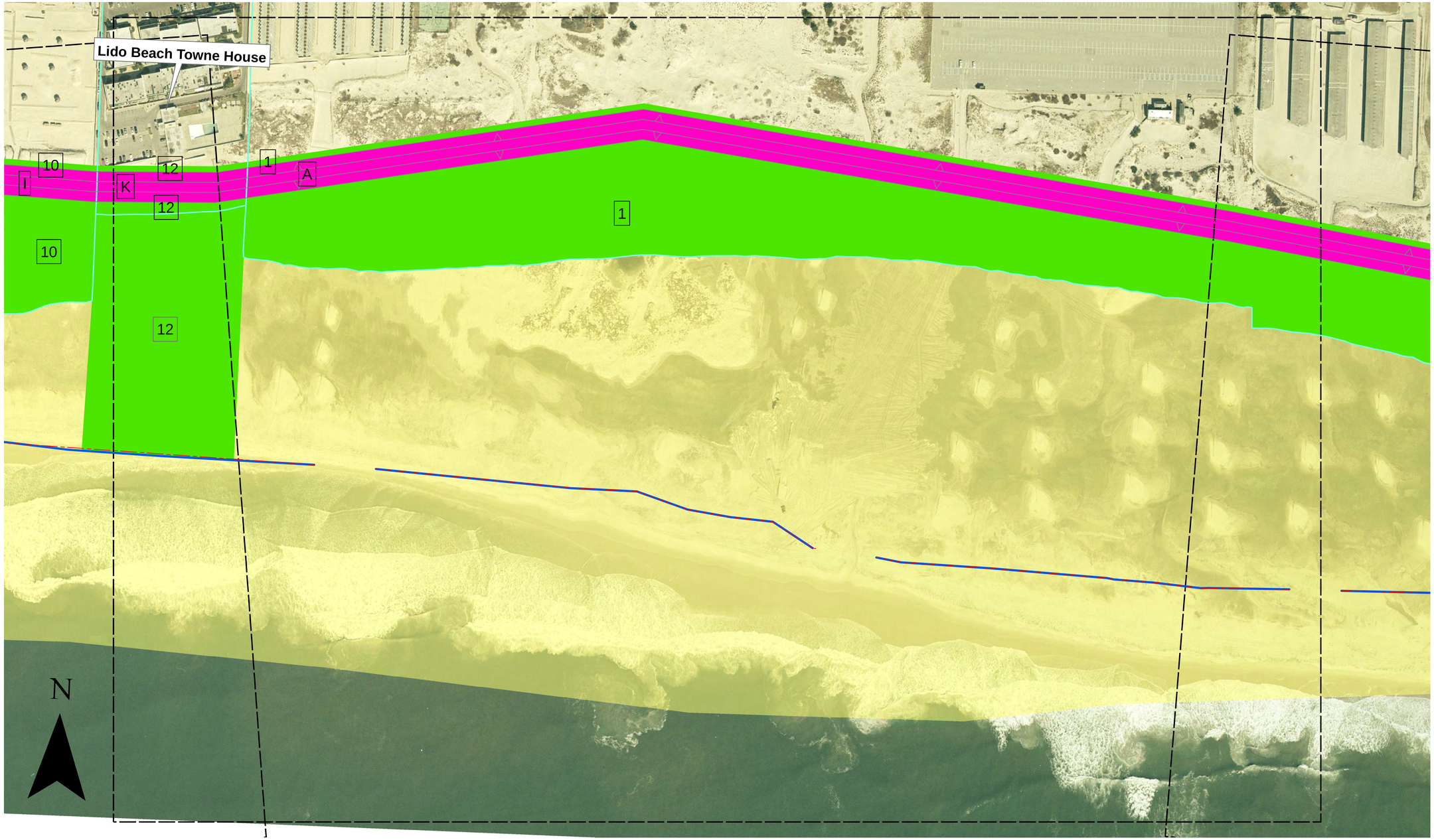
Atlantic Coast of New York,
Jones Inlet to East Rockaway Inlet,
Long Beach Island,
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 10 of 14





Legend

- Dunes
- Permanent Easement
- Permanent Easement Parcels
- Parcel Limits
- Sheet Limits
- Temporary Easement Parcels
- Temporary Easements
- Improved MHW
- Existing MHW

Permanent Easement Parcels					
Item	Section	Block	Lot	Shape Ft	Acres
A	60	91	5	250968.97	5.7615
B	59	A	1	6544397.37	150.2387
C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
18	60	91	6	117107.39	2.6884
19	59	A	1	2.62	0.0001
20	59	269	22	2.62	0.0001
21	0		52	27.96	0.0006
22	60	47	105	27.96	0.0006
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

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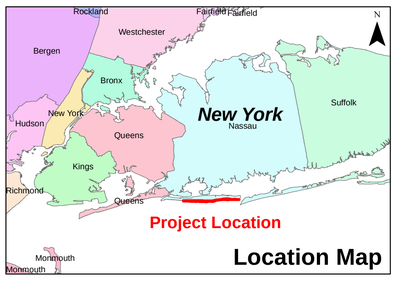
New York District

Date: 9/16/2014

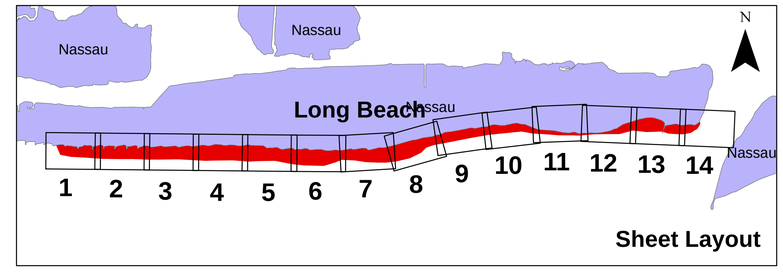


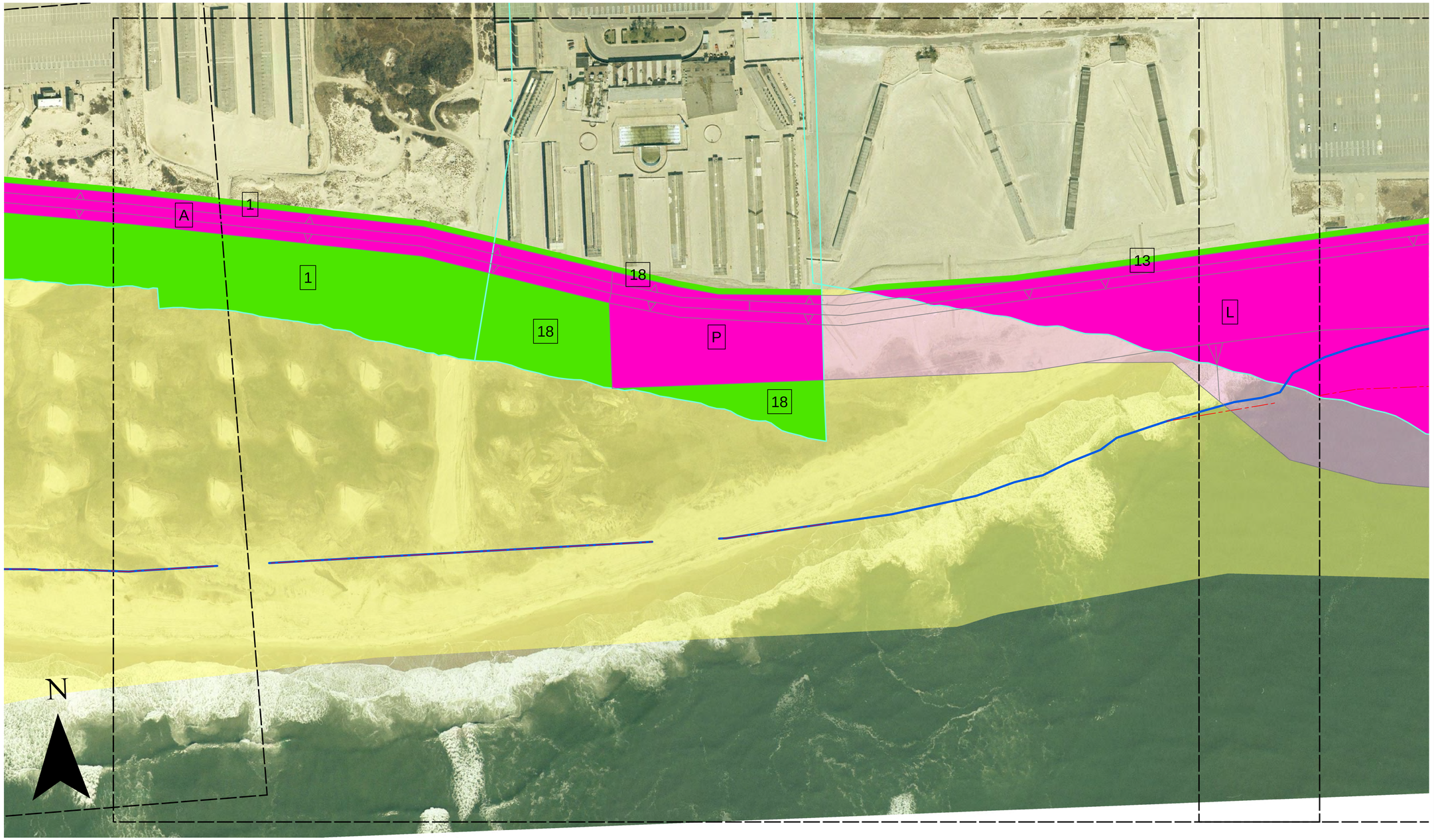
Atlantic Coast of New York,
Jones Inlet to East Rockaway Inlet,
Long Beach Island,
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 11 of 14





Legend

- Dunes
- Permanent Easement
- Permanent Easement Parcels
- Parcel Limits
- Sheet Limits
- Temporary Easement Parcels
- Temporary Easements
- Improved MHW
- Existing MHW

Permanent Easement Parcels					
Item	Section	Block	Lot	Shape Ft	Acres
A	60	91	5	250968.97	5.7615
B	59	A	1	6544397.37	150.2387
C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
18	60	91	6	117107.39	2.6884
19	59	A	1	2.62	0.0001
20	59	269	22	2.62	0.0001
21	0		52	27.96	0.0006
22	60	47	105	27.96	0.0006
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

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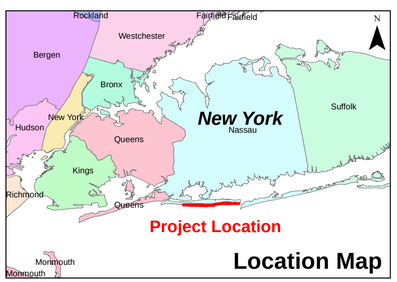
New York District

Date: 9/16/2014

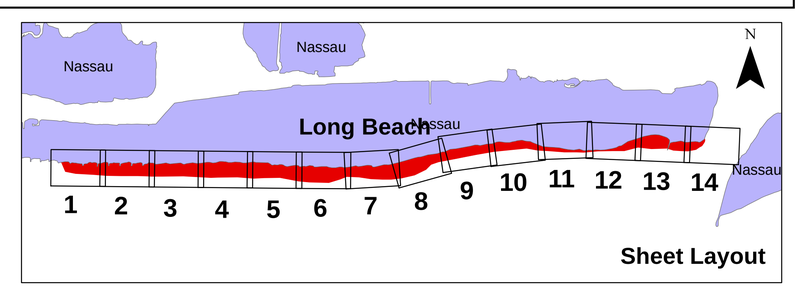


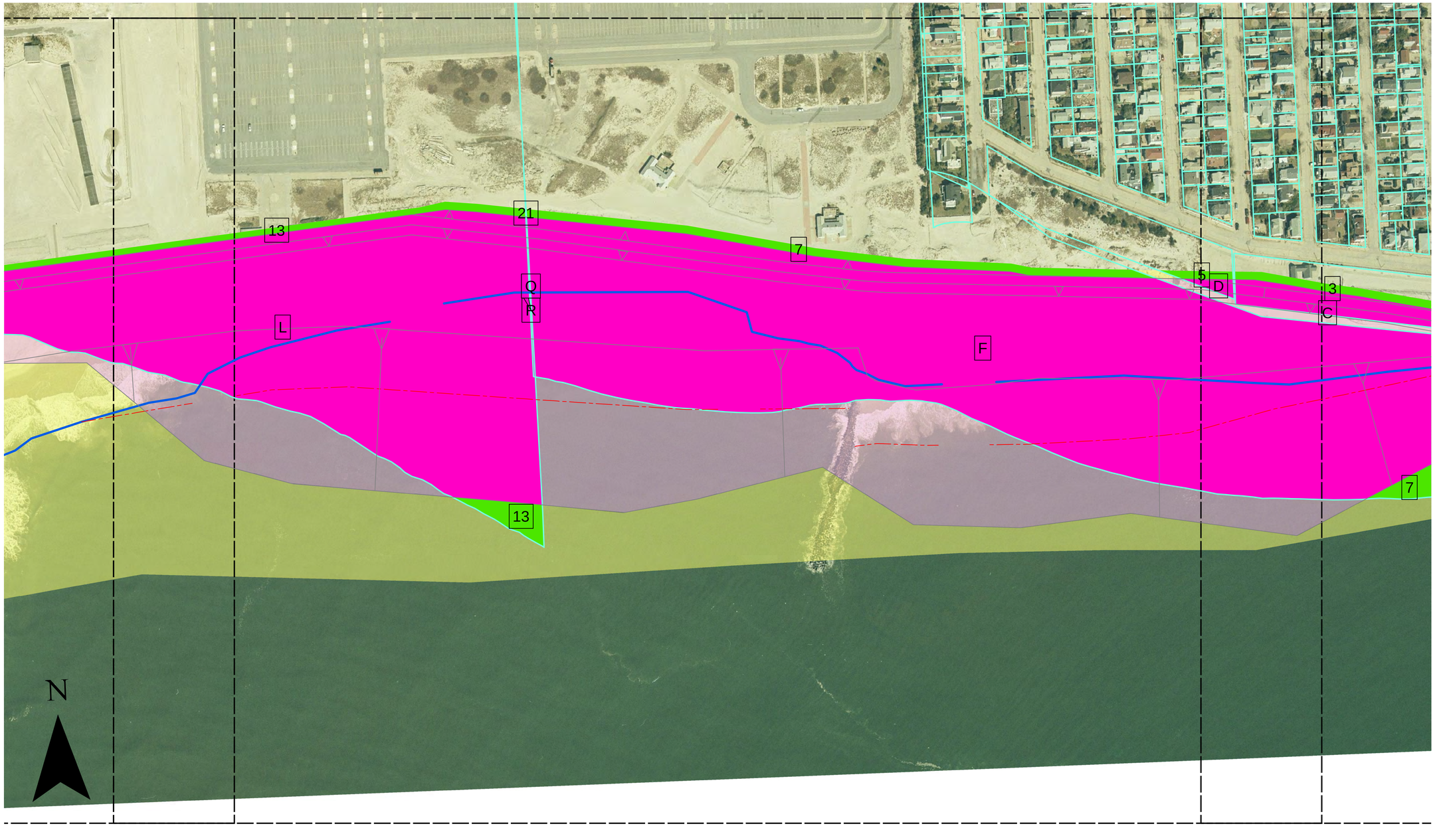
Atlantic Coast of New York,
Jones Inlet to East Rockaway Inlet,
Long Beach Island,
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 12 of 14





Legend

- Dunes
- Permanent Easement
- Permanent Easement Parcels
- Parcel Limits
- Sheet Limits
- Temporary Easement Parcels
- Temporary Easements
- Improved MHW
- Existing MHW

Permanent Easement Parcels					
Item	Section	Block	Lot	Shape Ft	Acres
A	60	91	5	250968.97	5.7615
B	59	A	1	6544397.37	150.2387
C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
18	60	91	6	117107.39	2.6884
19	59	A	1	2.62	0.0001
20	59	269	22	2.62	0.0001
21	0		52	27.96	0.0006
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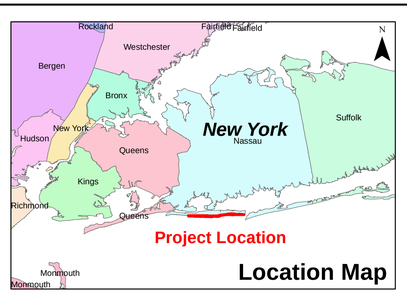
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

US Army Corps of Engineers®
New York District

Date: 9/16/2014

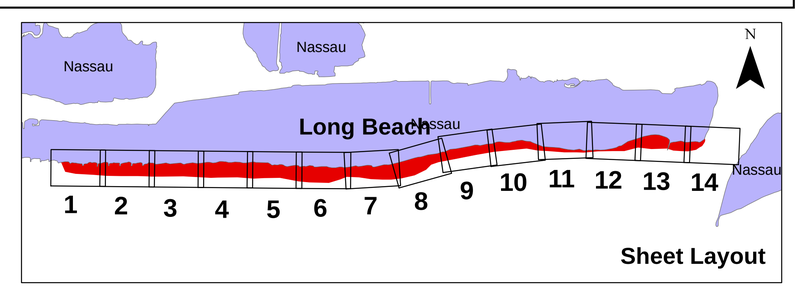


Atlantic Coast of New York,
Jones Inlet to East Rockaway Inlet,
Long Beach Island,
New York Coastal Storm Risk Management Project.

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 13 of 14



Legend

- Dunes
- Permanent Easement
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- Parcel Limits
- Sheet Limits
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- Improved MHW
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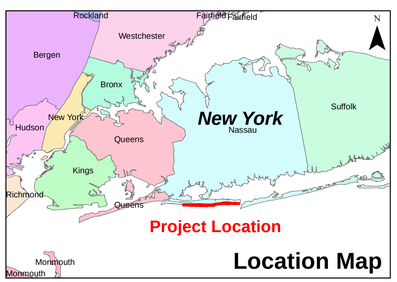
Permanent Easement Parcels					
Item	Section	Block	Lot	Shape Ft	Acres
A	60	91	5	250968.97	5.7615
B	59	A	1	6544397.37	150.2387
C	61	24	1	34884.75	0.8008
D	61	14	1	3120.65	0.0716
E	60	A	20	239558.82	5.4995
F	0	A	52	970767.47	22.2858
G	58	D	1	292739.08	6.7204
H	60	B	1	151318.36	3.4738
I	60	91	2	223281.26	5.1258
J	58	149	1	22086.46	0.5070
K	60	91	4	27906.71	0.6406
L	60	47	105	629062.89	14.4413
M	58	132	90	5071.87	0.1164
N	59	66	15A	159980.12	3.6726
O	58	132	40	69.64	0.0016
P	60	91	6	148426.06	3.4074
Q	0	A	52	1170.66	0.0269
R	60	47	105	1170.66	0.0269
S	60	B	1	93.99	0.0022
T	60	91	2	93.99	0.0022
U	58	149	1	41.74	0.0010
V	58	132	90	41.74	0.0010
Total				9706253.28	222.8249

Temporary Easement Parcels					
Item	Section	Block	Lot	Square Ft	Acres
1	60	91	5	756369.81	17.3639
2	59	A	1	419351.38	9.6270
3	61	24	1	13531.62	0.3106
4	59	269	22	3.65	0.0001
5	61	14	1	3177.69	0.0729
6	60	A	20	29215.48	0.6707
7	0	A	52	190901.55	4.3825
8	58	D	1	38507.66	0.8840
9	60	B	1	39576.63	0.9086
10	60	91	2	256216.30	5.8819
11	58	149	1	13336.49	0.3062
12	60	91	4	241830.45	5.5510
13	60	47	105	41040.73	0.9422
14	59	220	104	452.01	0.0104
15	58	132	90	5456.73	0.1253
16	59	66	15A	12749.27	0.2926
17	58	132	40	120.32	0.0028
18	60	91	6	117107.39	2.6884
19	59	A	1	2.62	0.0001
20	59	269	22	2.62	0.0001
21	0		52	27.96	0.0006
22	60	47	105	27.96	0.0006
23	60	B	1	398.33	0.0091
24	60	91	2	398.33	0.0091
25	58	149	1	58.33	0.0013
26	58	132	90	58.33	0.0013
Total				2179919.64	50.0433

Easements	Sq FT	Acres
Total Permanent	9706253.2762	222.8249
Total Temporary	2179919.64	50.0433
Total	11886172.92	272.8682

US Army Corps of Engineers®
New York District

Date: 9/16/2014



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

Scale 1: 1500

0 125 250 500 750 1,000 Feet

Sheet 14 of 14

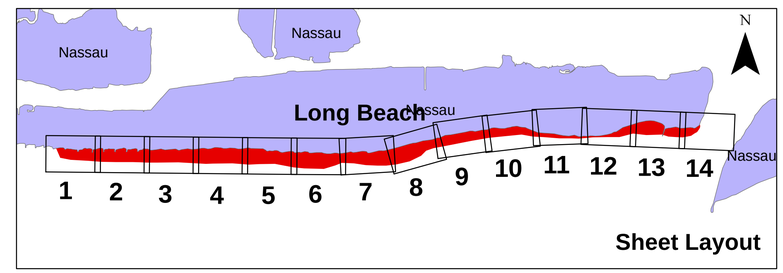


EXHIBIT "B"

BASELINE COST ESTIMATE FOR REAL ESTATE

Exhibit B

Real Estate Baseline Cost Estimate for

Hurricane Limited Reevaluation Report, Long Beach Island, New York

Coastal Storm Risk Management Project

	TOTAL PROJECT COSTS	non-Federal	Federal	Project Cost
01	**LANDS AND DAMAGES**	125,010		125,010
	20% Contingency exculding land payments	25,000		25,000
	Total (Excludes Project Planning)	150,010		**150,010**
02	**RELOCATIONS**		250,000	250,000
	21.92% Contingency		54,803	54,803
	Total			**304,803**
30	**PROJECT MANAGEMENT**		20,000	20,000
	14.91% Contingency		2,982	2,982
	Total			**22,982**
01B	**ACQUISITIONS (Admin)**	**115,000**	**17,200**	
01B10	BY GOVERNMENT			
01B20	BY LOCAL SPONSOR (LS)	115,000		
01B30	BY GOVT ON BEHALF OF LS			
01B40	REVIEW OF LS		17,200	
01E	**APPRAISAL**	**10,000**	**2,800**	
01E10	BY GOVT (IN HOUSE)			
01E20	BY GOVT (CONTRACT)			
01E30	BY LS	8,000		
01E40	BY GOVT ON BEHALF OF LS			
01E50	REVIEW OF LS		2,800	
01R1	**LAND PAYMENTS**	**10**		
01R1A	BY GOVERNMENT			
01R1B	BY LS	10		
01R1C	BY GOVT ON BEHALF OF LS			
01R1D	REVIEW OF LS			
02	**FACILITY/UTILITY RELOCATIONS**	**0**	**250,000**	

EXHIBIT "C"

NON-FEDERAL SPONSOR CAPABILITY ASSESSMENT CHECKLIST

ASSESSMENT OF NON-FEDERAL PROJECT PARTNERS'S REAL ESTATE ACQUISITION CAPABILITY

ATLANTIC COAST OF NEW YORK, JONES BEACH TO EAST ROCKAWAY INLET, LONG BEACH ISLAND, NEW YORK, COASTAL STORM RISK MANAGEMENT PROJECT HURRICANE SANDY LIMITED REEVALUATION REPORT

I. Legal Authority.

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? Yes. The Sponsor through its local partner, the Town of Hempstead, has the authority to acquire and hold title to real property for project purposes.

b. Does the sponsor have the power of eminent domain for this project? Yes. The Sponsor the through its local partner may exercise eminent domain authority if necessary.

c. Does the sponsor have "quick-take" authority for this project? Yes. The Sponsor through its local partner possesses quick-take authority for this project.

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? No.

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? No.

II. Human Resource Requirements.

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? No.

b. If the answer to II.a is "yes," has a reasonable plan been developed to provide such training?

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? Yes.

d. Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule? Yes.

e. Can the sponsor obtain contractor support, if required in a timely fashion? Yes.

f. Will the sponsor likely request USACE assistance in acquiring real estate? No.

III. Other Project Variables.

a. Will the sponsor's staff be located within reasonable proximity to the project site? Yes.

b. Has the sponsor approved the project/real estate schedule/milestones? Yes.

IV. Overall Assessment.

a. Has the sponsor performed satisfactorily on other USACE projects? Yes.

b. With regard to this project, the sponsor is anticipated to be: highly capable/fully capable/moderately capable/marginally capable/insufficiently capable. If sponsor is believed to be "insufficiently capable," provide explanation. Highly Capable.

V. Coordination.

a. Has this assessment been coordinated with the sponsor? Yes.

b. Does the sponsor concur with this assessment? Yes.

Concur:

Susan D. McCormick 5/18/15

Sue McCormick
Chief, Coastal Erosion Management Program
New York State Department of Environmental Conservation

Reviewed and approved by:

_____

Noreen Dean Dresser
Chief of Real Estate Division
Real Estate Contracting Officer
New York District Corps of Engineers

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

Appendix F:

Public Access Plan

U.S. Army Corps of Engineers
New York District

June 2015

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 (HSLRR)

Public Access Plan

The HSLRR Public Access Plan presents information the United States Army Corps of Engineers (USACE) received from the City of Long Beach, the Town of Hempstead and Nassau County. The City of Long Beach and Town of Hempstead Public Access Plans remain the same from the 1995 Feasibility Report Public Access Plan. In addition, USACE received information from Nassau County as part of this 2015 HSLRR. 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.

Cost for beach usage is dependent upon where the beachgoer lives and which beach they visit.

In the City of Long Beach, beachgoers 13 and older must have a beach pass in the summer season (Memorial Day – Labor Day). There is no charge for on street parking. City resident and non city resident beachgoers can pay for a daily per person pass to access the beach at entry points located on designated street ends and along the boardwalk. The City of Long Beach also offers season beach passes in a variety of categories. The cost of these season passes is dependent on where the beach goes lives, as shown below (2015 prices).

City of Long Beach Season Pass Type	Resident	Non-Resident
Individual (ages 18-61)	$40	$80
Family (2 adults and children ages 13-17)	$60	$120
Senior (ages 62+)	$15	$30
Child (ages 13-17)	$20	
Veteran	$15	
Physically Challenged	$15	
Economy (10 times, 10 people)	$80	

http://www.longbeachny.gov/index.asp?Type=B_BASIC&SEC={DA8E2736-5A34-4E0D-9EBD-228AB63E425C}

In the town of Hempstead, beachgoers who visit Lido Beach Town Park, Lido West Town Park, Town Park at Point Lookout and Town Park at Sands pay a fee to park their car. In the summer season (Memorial Day – Labor Day), parking fees per car for Town of Hempstead residents and non-residents is shown below (2015 prices). There is also a non-resident “walk-in” cost at Sands, Lido and Lido West beaches.

Town of Hempstead Parking Fee	Resident	Non-Resident
Daily	$8	$25

http://www.toh.li/facilities/beaches-and-pools/beaches

In Nassau County, beachgoers who visit Nickerson Beach pay a fee to park their car. The cost to park per car is dependent upon if the beachgoer has a Nassau County Leisure Pass. The Nassau County Leisure Pass identifies its holder as a Nassau County resident and provides residents with discounts to many recreational facilities, including beaches. During the summer season (Memorial Day - Labor Day), parking fees are charged as shown below (2015 prices).

Nickerson Beach Parking Fee	Leisure Pass Holder	Non-Leisure Pass Holder
Daily	$8	$30
Season Sticker	$80	$200
Season Sticker for seniors, disabled, volunteer firefighters, auxiliary policy & veterans	$40	

http://www.nassaucountyny.gov/agencies/parks/wheretogo/active/nickerson.html

Public access the beaches south of the Lido Towers and the Townhouses of Lido Beach is available to pedestrians walking along the beach from the east and west. While public parking will not be available on these private properties, access to parcel 59/66/16 will be provided through existing public parking and access provided to the immediate west on Lido Boulevard. Access to parcel 60/91/4 will be provided through existing public parking and access provided to the immediate east at Nickerson Beach Park, owned by Nassau County.

Beach User Fees and Parking fees differ for residents and non-residents in the City of Long Beach, Town of Hempstead and Nassau County. Based upon input provided by the local jurisdictions, beach fees for non-residents and parking fees for passenger cars of non-residents reflect the differential in fixed operational costs, borne by City, Town and/or County residents, to provide the continued existence of the facility for all on an equal basis; therefore, there is no issue with consistency with ER 1165-2-130, paragraph 6h(1).

ATLANTIC COAST OF LONG ISLAND
EAST ROCKAWAY INLET TO JONES INLET
STORM DAMAGE REDUCTION PROJECT

LONG BEACH ISLAND, NEW YORK

PUBLIC ACCESS PLAN

1. Background

a. Purpose

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 the proposed Long Beach Island, New York Storm Damage Reduction Project. In order for the project to conform with Federal and State regulations, public access is required. The requirement for public access shall be limited to such areas which receive beachfill for the purpose of providing storm damage protection. Public access requirements shall not be required for areas where protection and restoration is incidental to the protection of publicly owned shores or if such protection would result in public benefits.

b. Scope

The geographical scope of this public access plan includes the beachfront areas which shall be provided beachfill in accordance with the recommended storm damage protection plan for Long Beach Island, New York. The recommended plan extends from the easternmost boundary at Point Lookout to the westernmost boundary which lies approximately 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).

2. 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 Storm Damage Reduction. Land loss and recreation benefits are considered to be incidental for the storm damage reduction purpose of this project.

3. Definitions

Accessways - Public pathways or corridors which provide access from a public road to the beach. For this project, these accessways include dune walkover structures, vehicle access ramps

and boardwalk access ramps.

Conservation Areas - Locations where human uses are generally excluded because of resource sensitivity. These areas include the areas subject to a dune conservation easement, which will be appropriately fenced and vegetated to ensure the integrity of the protective dune.

Beach - The zone of unconsolidated material that extends landward from the low water lie to the place where there is marked change in material or physiographic form, or to the line of permanent vegetation.

Public Benefits - Benefits resulting from public recreational use and the prevention of damage to publicly-owned facilities.

Public Use - Available for use by any and all of the general public on equal terms.

Storm Damage Reduction Benefits - Benefits from prevention of damages to Federal and public property and facilities (i.e., lands and/or structures, except non-Federal public lands dedicated to park and conservation uses) and developed private property and facilities due to shore erosion and/or tidal inundation.

4. The Proposed Project

The proposed project for storm damage reduction generally includes a 110 ft wide beach berm backed by a dune at elevation +15 ft NGVD. The details of the plan are described in the maintext of the Long Beach Island, New York Feasibility Report dated February 1995. In order to protect the integrity and erosion protection 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 Real Estate Appendix of the project Feasibility Report. 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 Article 34 of Environmental Conservation Law and require approval from the U.S. Army Corps of Engineers.

5. Public Access Plans

The City of Long Beach and the Town of Hempstead have submitted separate plans to illustrate the public access requirements of their municipalities. These plans have been determined by the New York District to be in compliance with public access and are expected to remain in effect for the life of the project. These plans are provided as attachments to the overall Public Access Plan for the proposed project.

City of Long Beach
KENNEDY PLAZA
LONG BEACH, NEW YORK 11561
(516) 431-1000
FAX: (516) 431-1389

APR 1994
Received
Flood Protection
Bur. NYS DEC

EDWIN L. EATON
CITY MANAGER

April 20, 1994

Mr. Roman Rakoczy
N.Y.S. Department of Environmental Conservation
50 Wolf Road - Room 330
Albany, New York 12233-3507

RE: City of Long Beach Public Access Plan

Dear Roman:

Please find enclosed a copy of the City of Long Beach Public Access Plan.

As per the advice of Cliff Jones, this plan has been prepared to address that requisite section of Federal Law which Mandates that beaches receiving Federal funding possess a plan which accommodates the general public.

If you should have any questions regarding the enclosed, please do not hesitate to contact us.

Very truly yours,

Edwin L. Eaton
City Manager

ELE:jk

CC: Comm. Robert L. Raab
Public Works

G-1

CITY OF LONG BEACH PUBLIC ACCESS PLAN

1. Background

a. Purpose

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 the U.S. Army Corps of Engineer's Long Beach Renourishment and Stabilization Project. In order for the project to be consistent with New York State Coastal Management Program policies, public access is required.

b. Scope

The geographical scope of this public access plan extends for the 3.5 miles of municipally-owned Ocean Beach Park, which lies between the western-most boundary of the City at Nevada Avenue, extending to the eastern boundary line at Maple Boulevard.

2. Property Ownership

The property known as the Ocean Beach Park, the recipient of the U.S. Army Corps of Engineers project, is owned in its entirety by the City of Long Beach.

3. Public Use

As a result of an agreement executed in 1936 between the City of Long Beach and the Federal Government, the Ocean Beach Park is available, in perpetuity, for use by the general public. That is, no residency restrictions are operative.

4. Accessways and Dune Walkover Structures

a. Location of Accessways

As noted above, this plan affirms the right of access to the restored beach by all members of the public at all public accessways. All accessways are located at existing street-ends. (Please see attached.) All accessways are located on public property.

b. Number of Accessways

Accessways total 31 in number. (Please see attached.)

c. Ownership and Use of Accessways

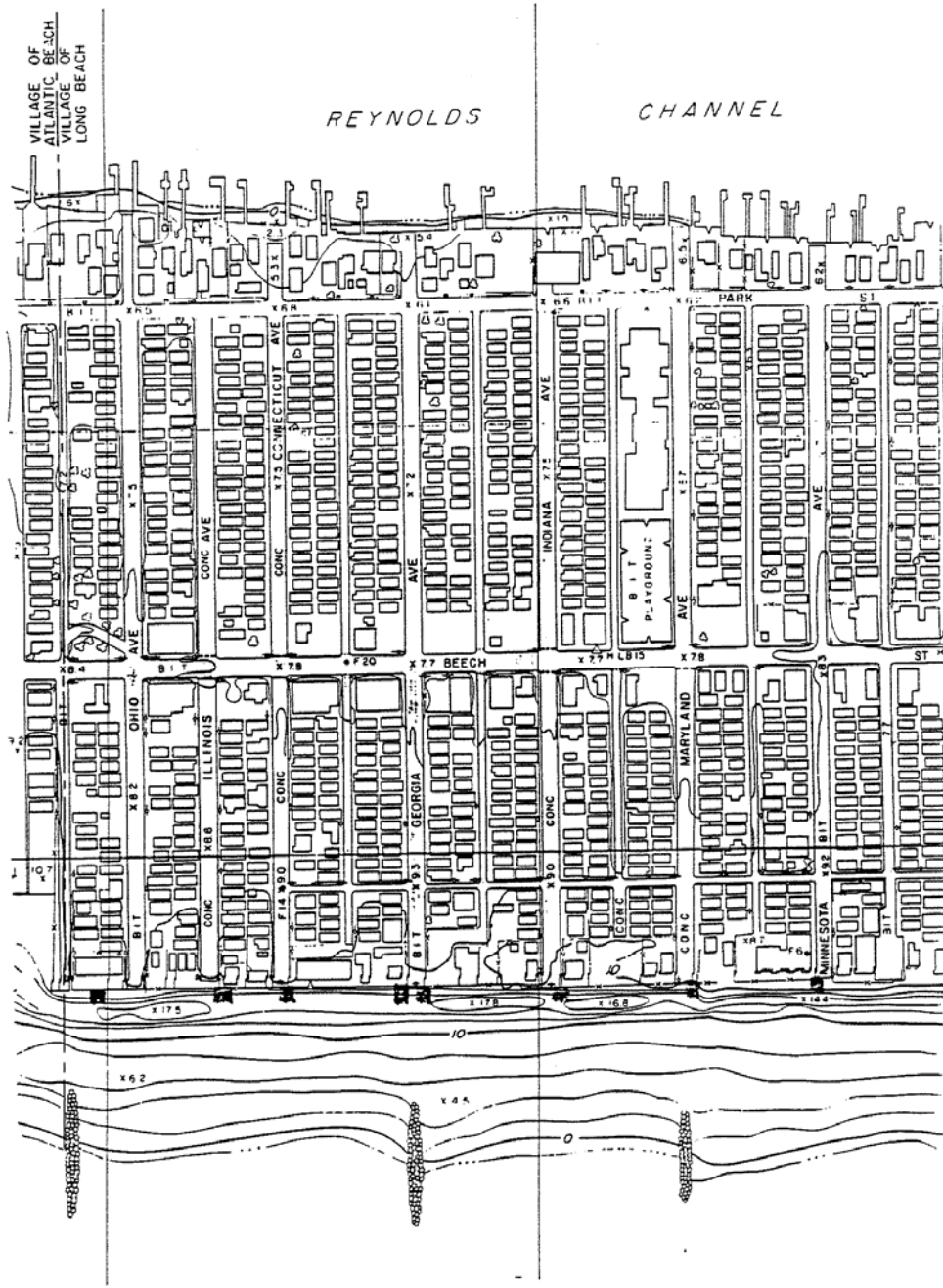
Ownership of all accessways will rest with the City of Long Beach. The use of the accessways shall be in accordance with the City of Long Beach Code of Ordinances.

d. Dune Walkover Structures

Dune walkover structures will be placed at public accessways and oriented over the dune to protect and maintain the integrity and stability of the dune. The design of the respective walkover structures will reflect the anticipated pedestrian traffic of the area in which it is located. Further, the design of the structure will encourage use of the accessway and may include overlooks and other desirable improvements.

5. Parking Accommodations

Vehicle parking is available on all municipal thoroughfares. No residency restrictions or parking fees exist.


VILLAGE OF ATLANTIC BEACH
VILLAGE OF LONG BEACH
REYNOLDS
CHANNEL
PARK
ST
CONC AVE
CONNECTICUT AVE
INDIANA AVE
BEECH
OHIO AVE
ILLINOIS
GEORGIA
MARYLAND
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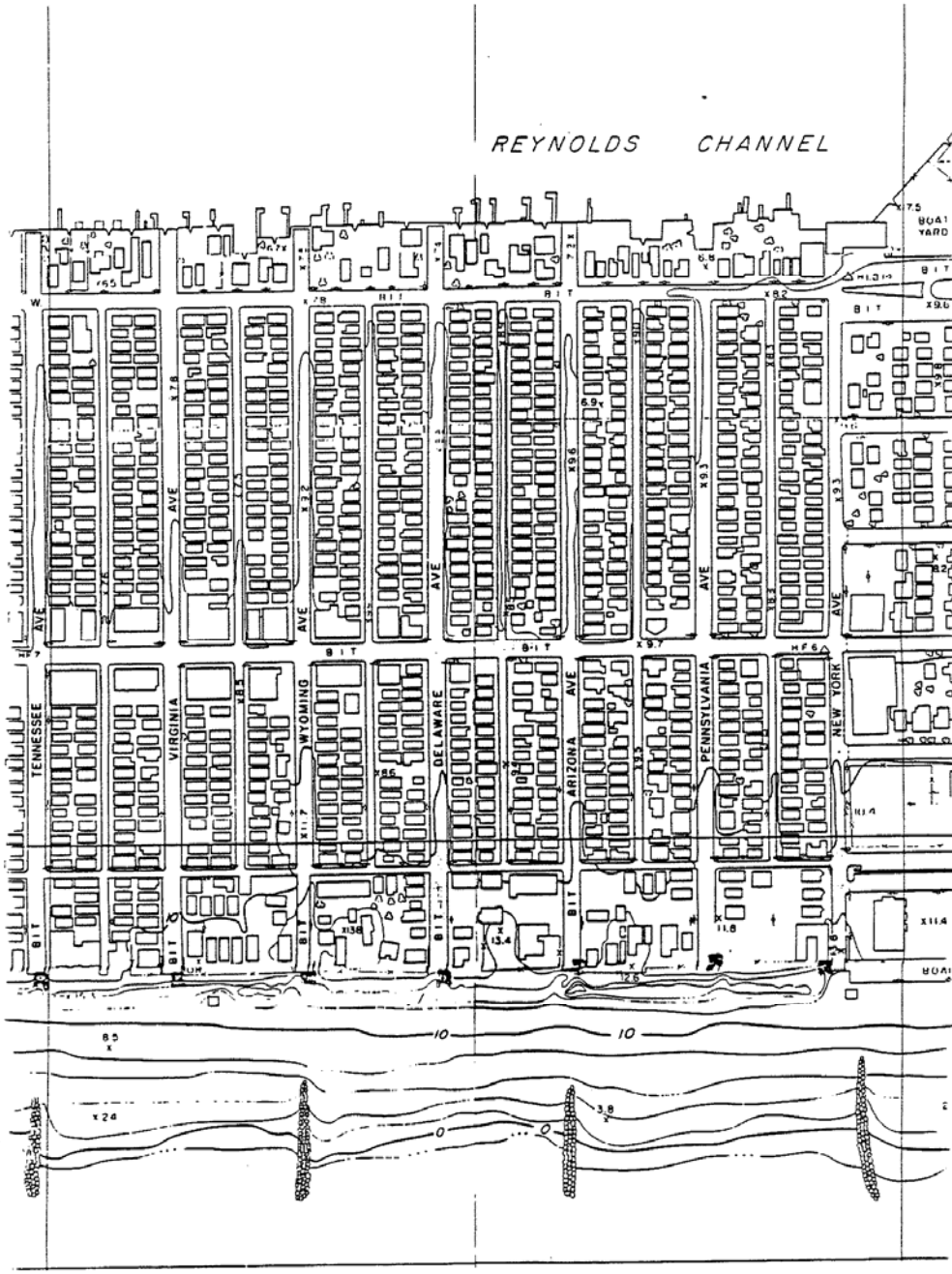
G-a


REYNOLDS CHANNEL
BOAT YARD
TENNESSEE AVE
VIRGINIA AVE
WYOMING AVE
DELAWARE AVE
ARIZONA AVE
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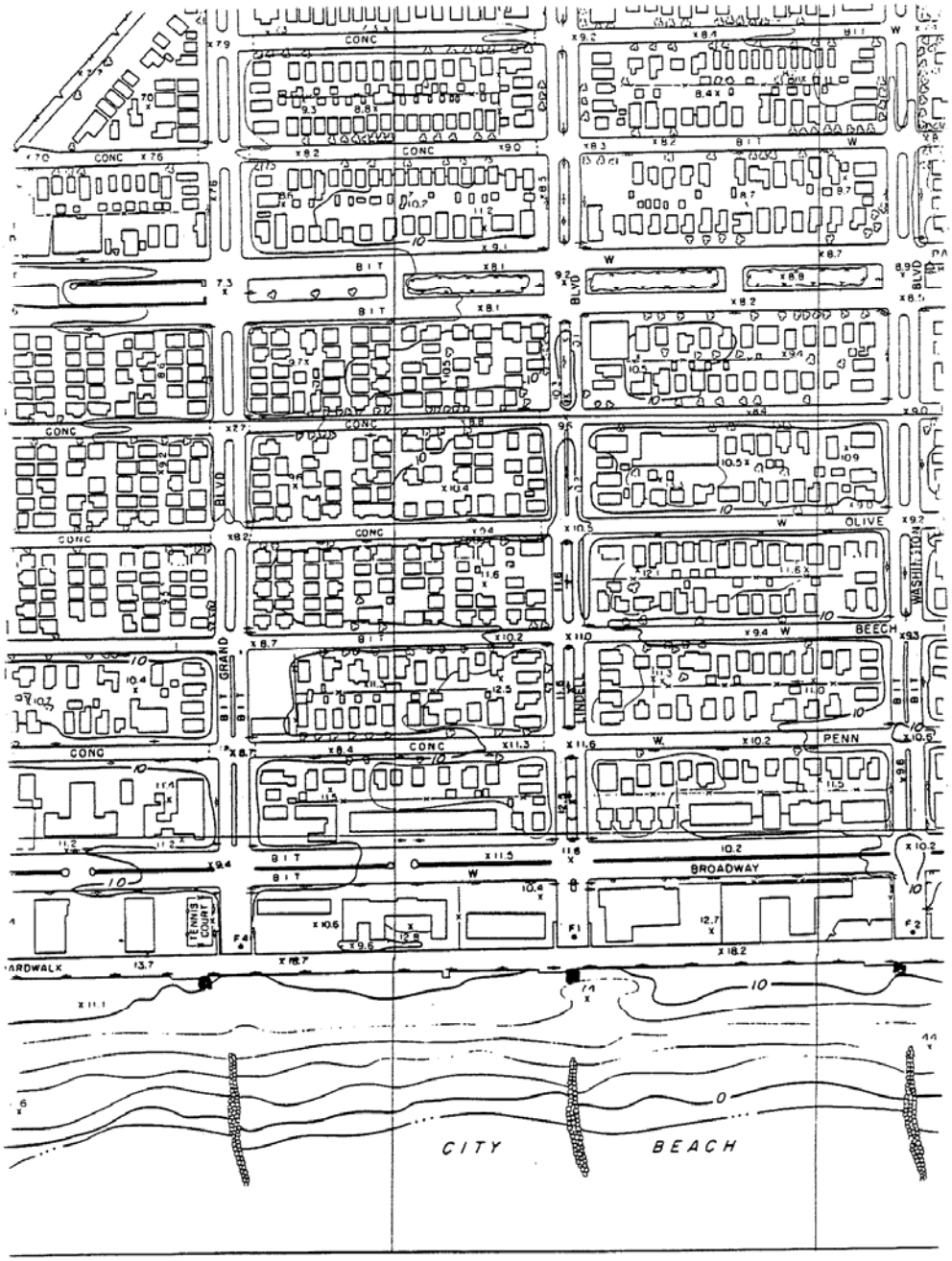
CONC
BLVD
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WASHINGTON
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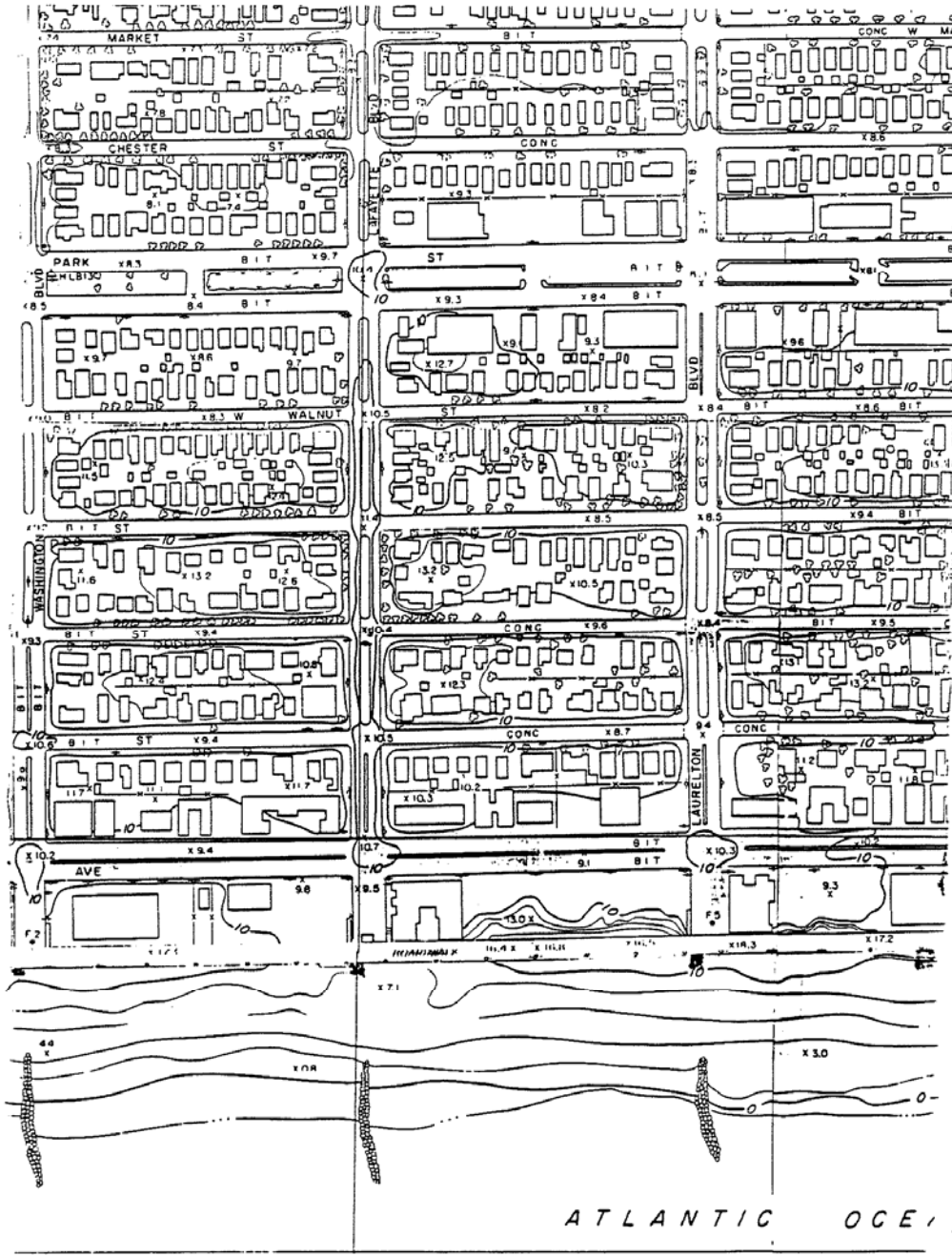
PENN
BROADWAY
TENNIS COURT
CITY
BEACH

G-c


MARKET ST
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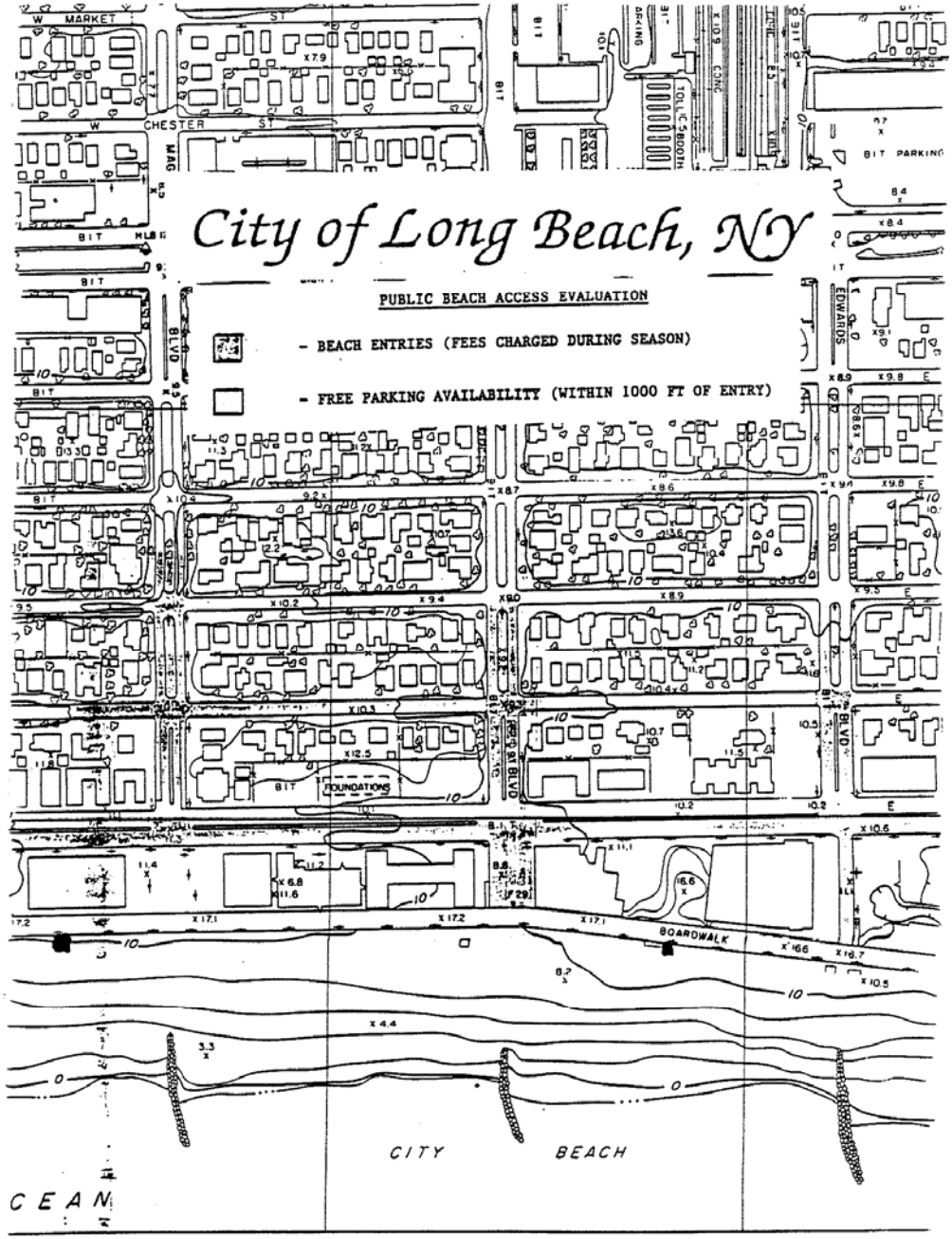
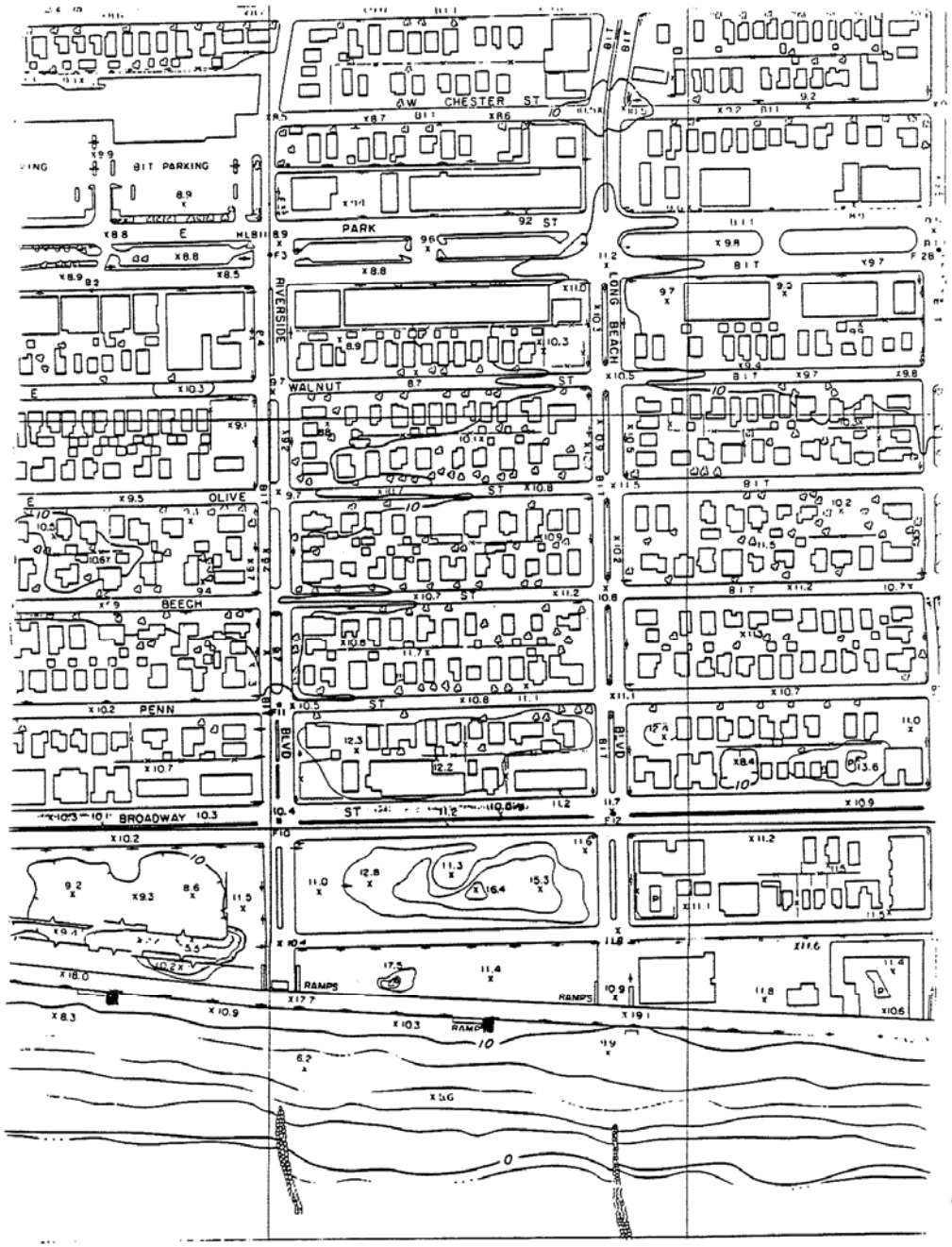

City of Long Beach, NY
PUBLIC BEACH ACCESS EVALUATION
- BEACH ENTRIES (FEES CHARGED DURING SEASON)
- FREE PARKING AVAILABILITY (WITHIN 1000 FT OF ENTRY)
W MARKET ST
W CHESTER ST
MAG BLVD
BIT
BIT PARKING
EDWARDS
FOUNDATIONS
BOARDWALK
CITY BEACH
CEAN


W CHESTER ST
BIT PARKING
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LONG BEACH
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BEECH
PENN
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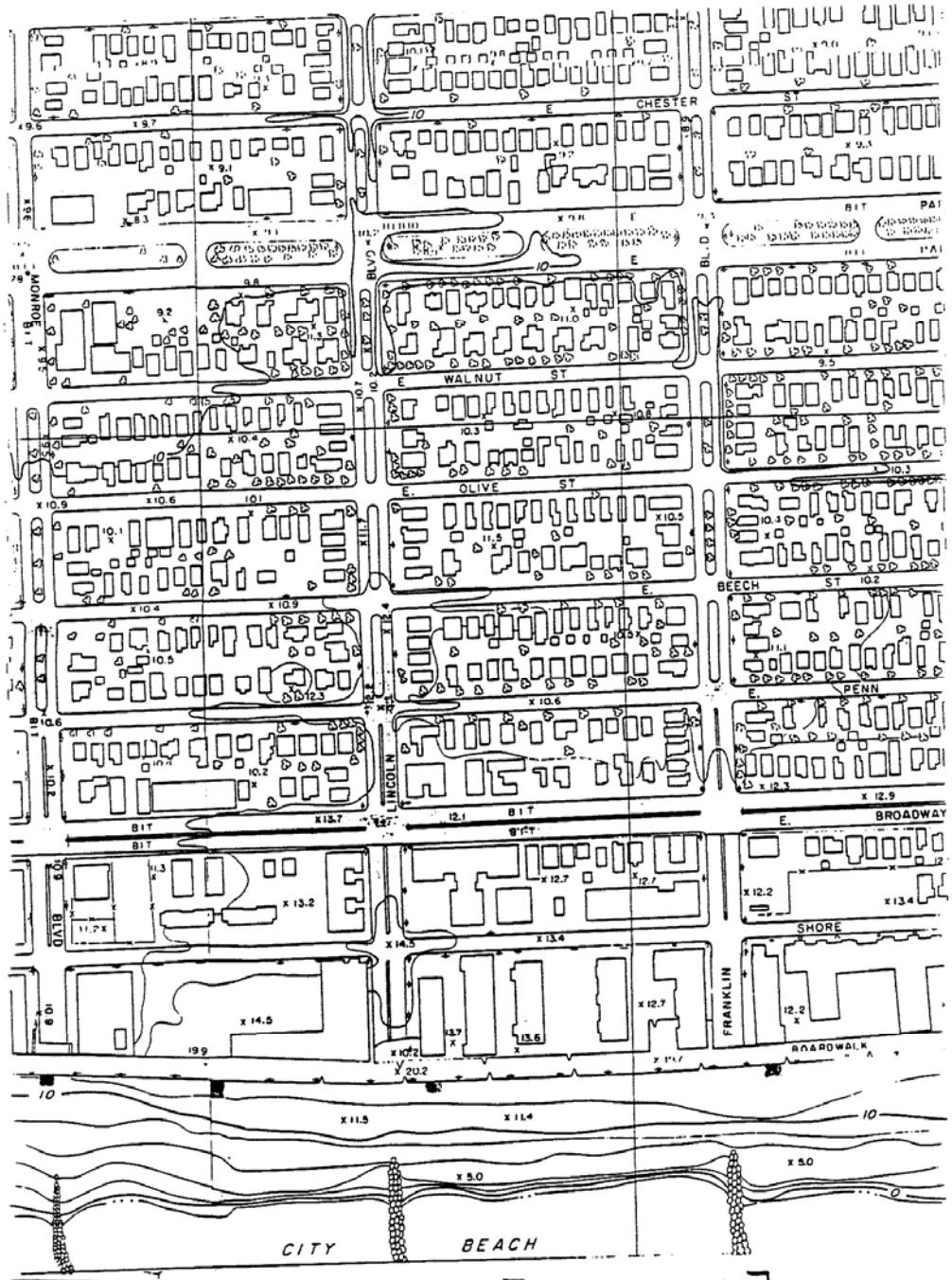
BROADWAY
RAMPS

G-F



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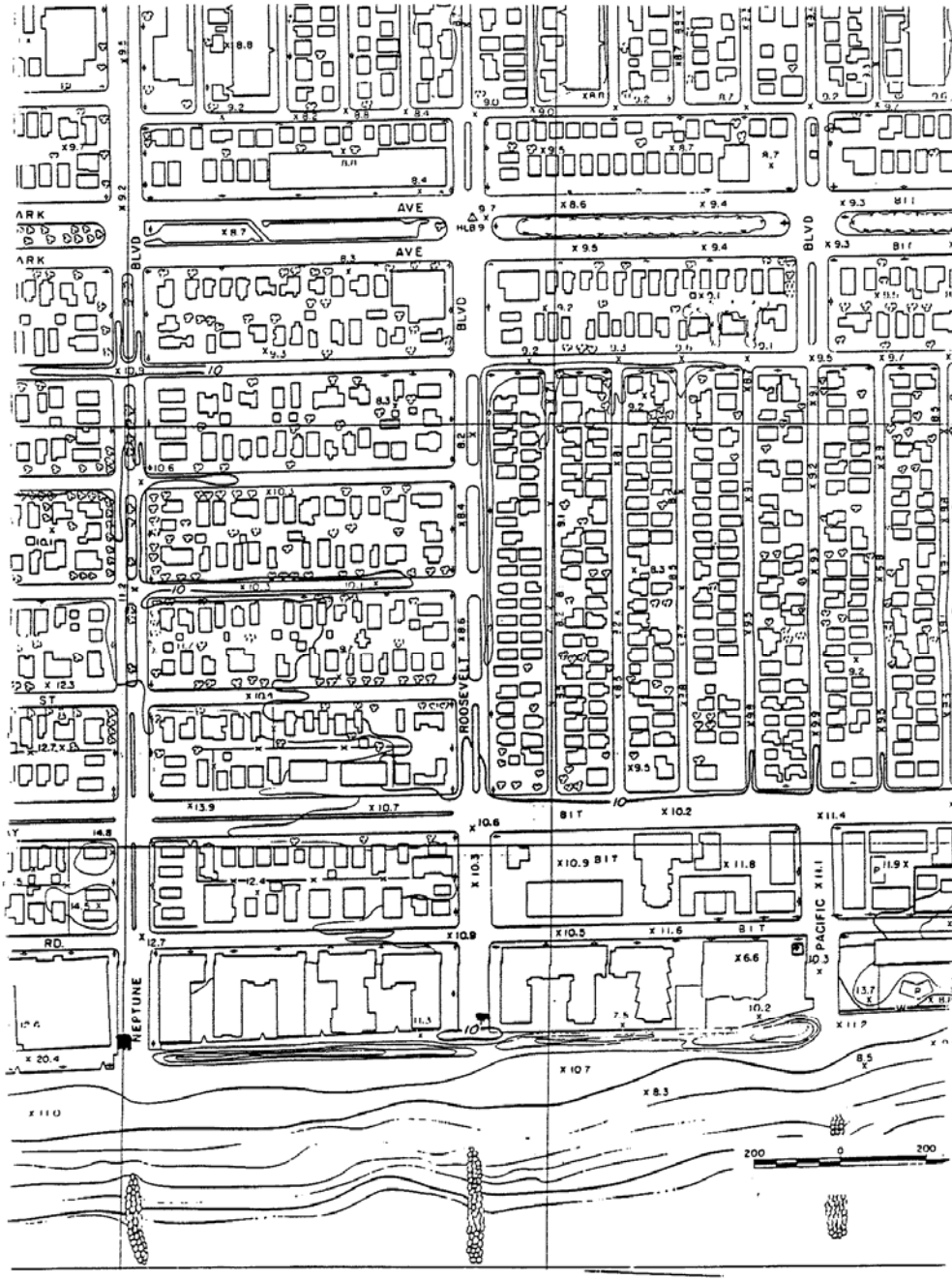
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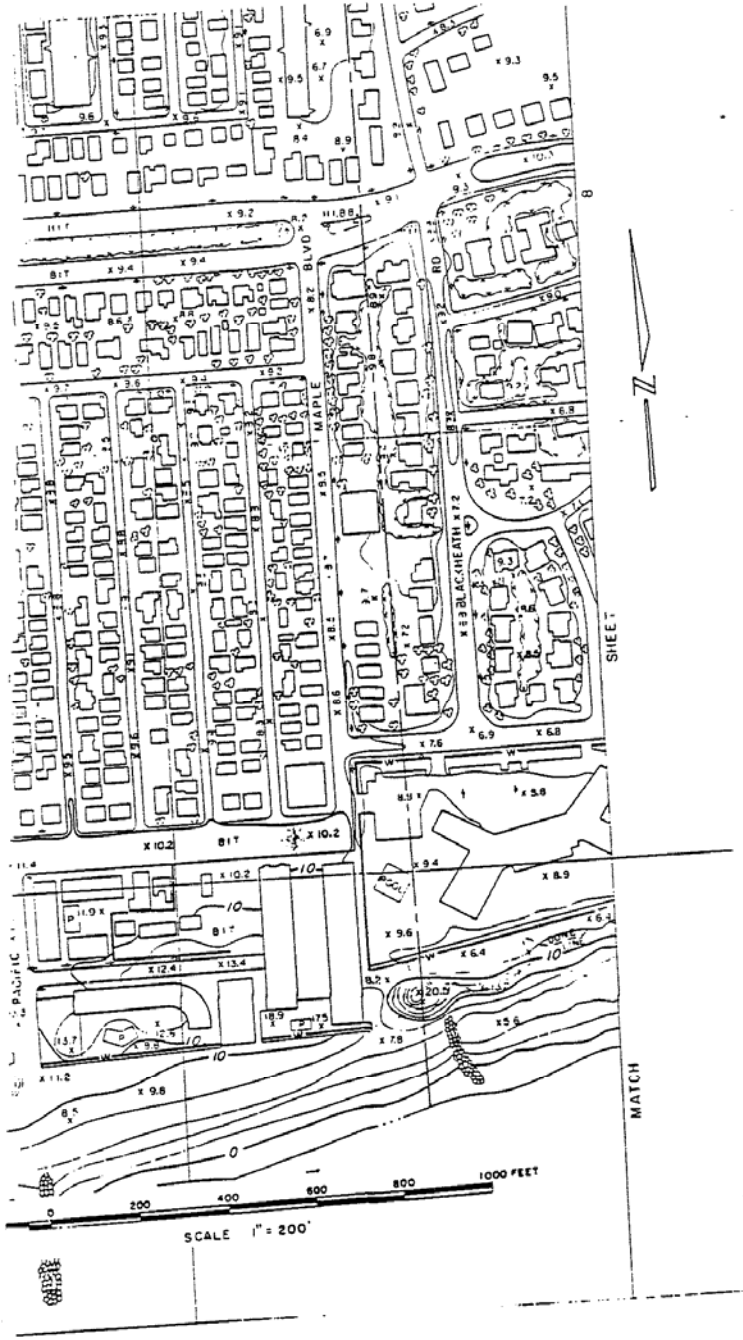
MAPLE BLVD
BLACKHEATH RD
PACIFIC
SHEET 8
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N
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400
600
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1000 FEET
SCALE 1" = 200'

G-j

Town of Hempstead
Public Access for Beach Parks

The beaches associated with designated Town Parks established at Point Lookout, Lido Beach, and West Lido Beach are open to all on an equal basis and have no admission fee attached to their use.

Admission to Town Park facilities without fee is routinely accomplished by walking, bicycling, bus or car transportation to park entrances. A train-bus link allows beachgoers from as far away as New York City to access the beach park facilities on a daily basis. There is no admission charge for parking prior to Memorial Day and after Labor Day.

The Town Parks have a passenger car parking fee associated with admission to the park facility. The parking is available to all, on an equal basis first come first served, as other limited parking facilities in New York State. The parking fee covers the vehicle only, since the Town does not have per person admission fee to use park facilities or its beaches.

Parking fees for passenger cars of non resident public reflect the differential in fixed operational costs, borne by Town residents, to provide the continued existance of the facility for all on an equal basis.

Once the parking areas are filled to capacity cars are prohibited from entering the facility, on the same equal basis, as they are admitted. The same policy is followed at state operated beach parking facilities such as Jones Beach.

List of Town Park-Beach Facilities
with Public Access (Figure 1)

1) - Town Park at Point Lookout
2) - Town Park at Lido Beach
3) - Town Park at Lido Beach-West

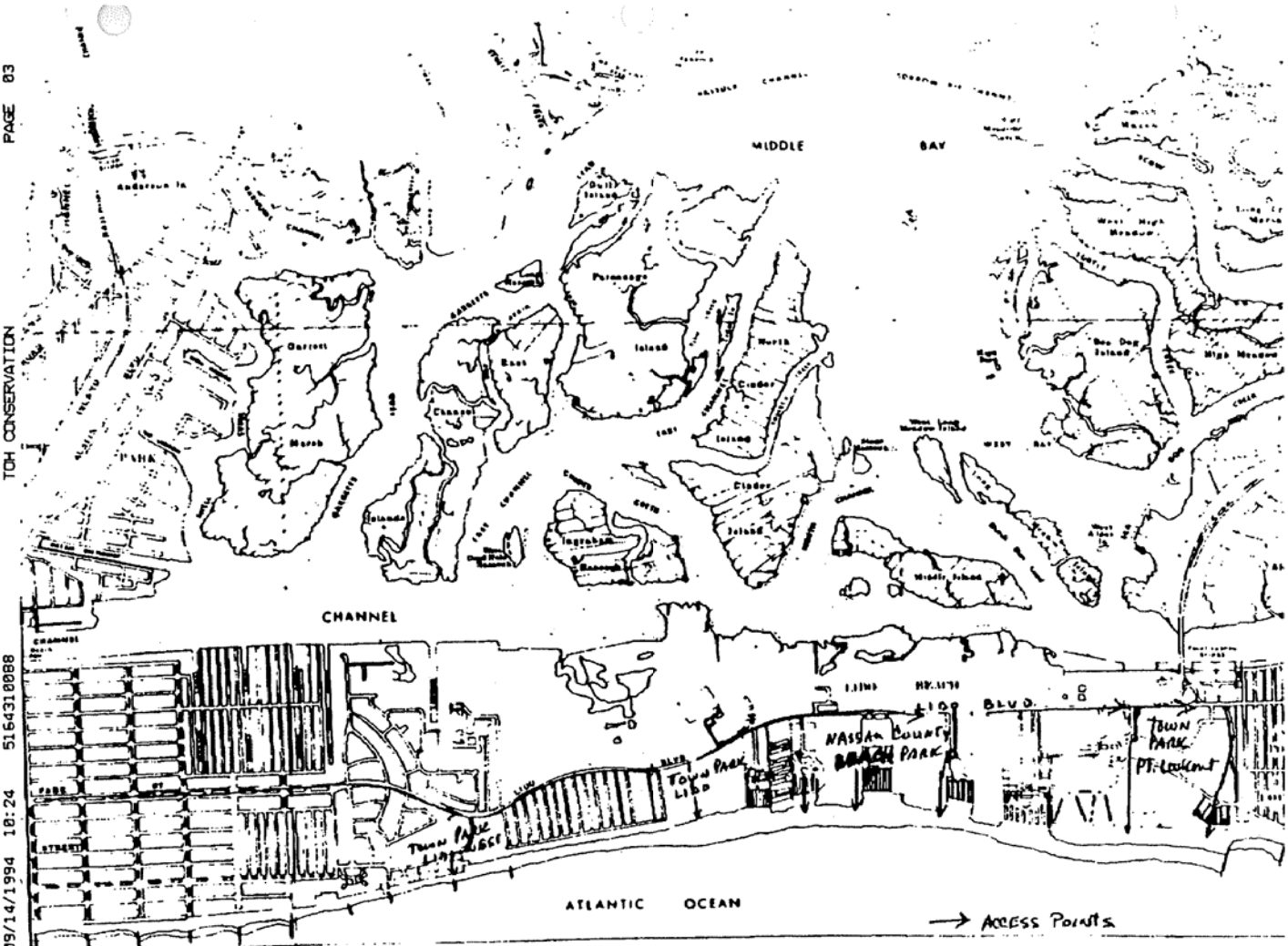
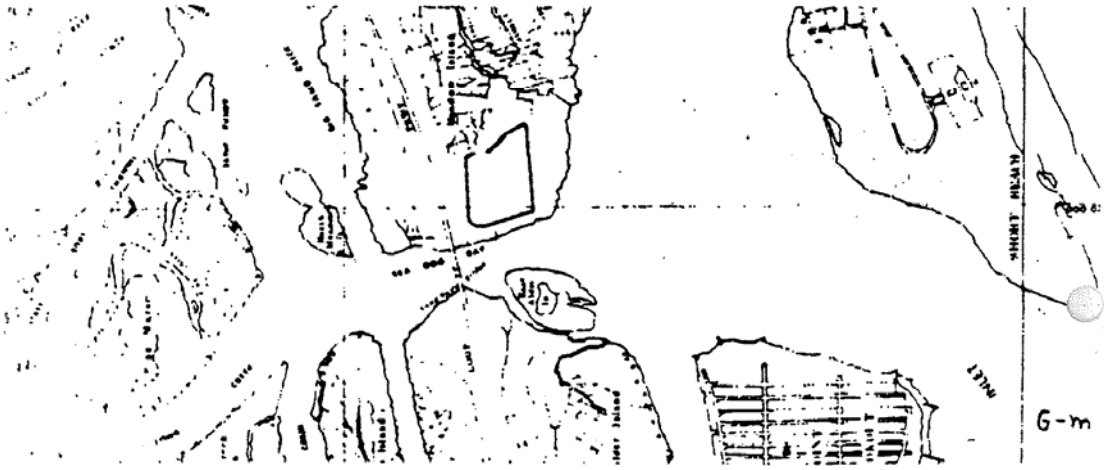

MIDDLE BAY
CHANNEL
ATLANTIC OCEAN
Town Park
Nassau County Beach Park
Town Park Pt. Lookout
→ Access Points

FIGURE 1



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County of Nassau Nickerson Beach Public Access Plan

Purpose: 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 the U. S. Army Corps of Engineers' Re nourishment and Stabilization Project. In order for the project to be consistent with New York State coastal management Program policies, public access is required.

Scope: The geographical scope of this public access plan covers the area that extends three million square feet (3800 feet x 800 feet) of owned beach front by Nassau County known as Nickerson Beach with its western terminus 300 feet west of Bay Lane, Lido Beach and eastern terminus extending to Malibu Beach Club.

Property Ownership: The property known as Nickerson Beach, the recipient of the U.S. Army Corps of Engineers Project, is owned in its entirety by the County of Nassau.

Public Use: As a result of an agreement executed in 1936 between the County of Nassau and the Federal Government, Nickerson Beach is available, in perpetuity, for the general public. That is, no residency restrictions re operative.

Access ways and Dune Walkover Structure:

Location: This plan affirms the right of access to the restored beach by all members of the public at all public access ways. All beach access ways (4) are accessible from the existing parking lots (consisting of four (4) entrances) off Lido Boulevard. All access ways are located on public property.

Number of Access ways off of Lido Boulevard: central; emergency; maintenance and westerly entrances.

Ownership and Use: Ownership of all access ways will rest with the county of Nassau. The use of the access ways shall be in accordance with the County of Nassau' Ordinance Code.

Dune walkover Structures: Snow Fence will be places at public access ways and oriented over the dune to protect and maintain the integrity and stability of the dune. The lay out of the fencing and walkways (mobi mats) will take in account the anticipated pedestrian traffic of the area. Further the design of the area will encourage use of the access way and may include other improvements.

Parking Accommodations: Vehicle parking is available in County owned parking lots accessible to the public. Parking fees are enforced by ordinance to all visitors.