US ARMY CORPS
OF ENGINEERS
NEW YORK DISTRICT

RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
FEASIBILITY REPORT
FOR
HURRICANE AND
STORM DAMAGE REDUCTION
PORT MONMOUTH, NJ

VOLUME I

FINAL FEASIBILITY REPORT
FINAL ENVIRONMENTAL IMPACT STATEMENT
APPENDIX I PERTINENT CORRESPONDENCE

June 2000

U.S. Army Corps of Engineers
New York District

ADDENDUM
TO
FINAL FEASIBILITY REPORT
RARITAN BAY AND SANDY HOOK BAY
HURRICANE AND STORM DAMAGE REDUCTION PROJECT
PORT MONMOUTH, NEW JERSEY
(NOVEMBER 17, 2000)

Purpose: To provide information concerning changes to the final report as a result of the policy review for the final report.

Rationale for Changes: During the conduct of the final policy review of the report, four issues were identified that required correction and clarification. The first issue concerns the statement of current Administration policy regarding hurricane and storm damage reduction projects with long-term beach nourishment commitments. The second issue concerns the Recommendations, which should stress that no benefits are being claimed for preventing loss of land. The third issue is related to stipulating that there are five proposed dune walkover access points and that 236 parking spaces would be required to provide adequate parking for the 126,000 annual visits included in the benefit estimate. The fourth issue is focused on a price level update of the benefits and costs to the October 1999 price level.

Changes:

a. Main Report--Add the following to Executive Summary and Recommendations Section:

The Administration position on funding support for hurricane and storm damage reduction projects is as follows:

> "The Office of Management and Budget advises that while the Water Resources Development Act of 1999 (WRDA 99) changed the cost-sharing formula for the long-term sand renourishment component of certain future shore protection projects, these changes did not go far enough considering the long term cost of most of these projects. Further, because WRDA 99 delayed the effect of the change in cost sharing for up to a decade or more, it did not address current constraints on Federal spending. The Administration intends to work with Congress to address these problems. However, until these issues are satisfactorily resolved, the Administration will not support authorization of new shore protection projects that involve significant long-term Federal investments beyond the initial construction of these projects, and will give new shore protection projects that are already authorized low priority for funding."

b. Main report, Volume I, page 102, Par 321, add a prefatory statement to the recommendations concerning cost sharing. Also, page 95, Par 296, add text as follows before the sentence that begins "In accordance with Section 103…": "Cost apportionment is based upon hurricane and storm damage reduction features. The cost sharing is based on the fact that benefits are not claimed for protecting park facilities or park land, and no benefits are claimed for preventing land loss."

c. Technical Appendices, Volume III, Appendix J, Exhibit E. Replace the paragraph on "Accessways" with the following:

"Accessways – ER 1165-2-130, Par 6h(3) indicates that reasonable public access must be provided in accordance with recreational use objectives for the area. Five wooden dune overwalk structures will be provided as part of the project to ensure integrity of the protective dune. These overwalks are spread over a dune length interval of about 2,640 feet. Access points will not be separated by more than one quarter of a mile. As such, public access will be ensured."

Also, add text to revise the "Public Use" paragraph as follows:

"Public Use – Available for use by any and all of the general public on equal terms. As part of the development of the Bayshore Waterfront Park, Monmouth County has constructed four parking lots with a current capacity of 165 cars. County plans include a forecast expansion to accommodate 100 additional cars for a planned capacity of 265 cars. The local Sponsor will be required to ensure that at least 236 parking spaces would be provided for the 126,000 annual visits included in the benefit estimate."

d. Replace text with regard to first cost, project ultimate cost, annual costs, annual benefits, net excess benefits, and benefit to cost ratio to reflect the following:

October 1999 price levels

First cost	$32,914,000
Ultimate cost	$46,377,700
Annual cost	$3,000,100
Annual benefits	$3,310,100
Net Excess Benefits	$310,000
Benefit-Cost Ratio	1.1 to 1

RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
FEASIBILITY REPORT
FOR
HURRICANE AND
STORM DAMAGE REDUCTION
PORT MONMOUTH, NJ

US ARMY CORPS
OF ENGINEERS
NEW YORK DISTRICT

U.S. Army Corps of Engineers
New York District

June 2000

SYLLABUS

This report presents the results of a feasibility phase study to determine an implementable solution and the extent of Federal participation in a combined hurricane and storm damage reduction project for Port Monmouth, New Jersey. This Feasibility Study is prepared based on the recommendations of a Reconnaissance Study completed in 1993, which identified a possible solution to the flooding problems facing the community, determined that such a solution was in the Federal interest and identified the non-Federal sponsor. The Feasibility Study was cost shared between the Federal Government and the New Jersey Department of Environmental Protection (NJDEP), and was conducted under the provision of the Feasibility Cost Sharing Agreement executed in February 1994. The Feasibility Study was initiated in February 1994 upon receipt of initial study funds.

Port Monmouth is a residential community extending along 7,000 feet of Sandy Hook Bayshore west of Sandy Hook. The area has been subject to major tidal inundation during storms, causing damage to structures throughout the low-lying community. Most of the flooding has been the result of overflow from Pews and Compton Creeks, which border the area on the west and east. However, over the years, continued erosion has resulted in a reduction of the height and width of the bayshore dune, which has increased the potential for storm damage.

During the Feasibility Study, various alternative plans of improvement were considered. Many of the possible alternatives were ruled out early in the plan formulation process due to various factors such as relatively high cost or adverse environmental impacts. Of the remaining alternatives considered, the most cost effective design was similar to the recommended solution presented in the Reconnaissance Report. The investigations conducted during the Feasibility Study indicated that the greatest net benefits over cost would be provided by a beach berm and dune system along the Sandy Hook Bayshore, with a system of levees and floodwalls provided along both the study area creeks. The selected plan calls for this protection to extend continuously from the adjacent East Keansburg, NJ levee, across Pews Creek, along the bayshore, and thence along undeveloped lands adjoining Compton Creek to higher existing elevation. The plan details levees and floodwalls featuring a peak elevation of +14 feet NGVD, with a beach fill featuring a berm of width 50 feet at an elevation of +9 feet NGVD backed by a dune of crest width 25 feet at an elevation of +16 feet NGVD. In order to accommodate this design, the selected plan includes a storm gate across Pews Creek, three local road closure gates, one raising of Port Monmouth Road, and pedestrian dune walkovers. The bayshore protection requires 378,500cubic yards of initial fill to be placed from a designated offshore borrow site including 125,000 cubic yards of periodic nourishment, and 127,300 cubic yards of fill every 10 years thereafter for 50 years. The construction of the levees requires 107,800 cubic yards of fill.

The plan selection is based on May 1998 price levels and the 2000 Federal interest rate of 6-5/8 %. The economic analysis of the selected plan indicates that the proposed plan will provide annual benefits of $ 3,239,830 which, when compared to the total annual cost of the proposed plan of $ 2,931,010, yields a benefit to cost ratio of 1.1 with $308, 820 in net excess benefits. The selected plan is the NED plan.

The first cost of the initial project construction including the advance nourishment is currently estimated to be $ 31,383,000 at May 1998 price levels ($32,064,000 at October 1999 price levels). The Federal share of this first cost is $20,398,950 (65%), and the non-Federal share $ 10,984,050 (35%), with $ 9,586,050 being the total required non-Federal cash contribution and the balance is the estimated creditable cost for real estate and relocations. The annualized cost for scheduled periodic nourishment is currently estimated to be $ 169,000, which will be cost shared at a rate of 50% Federal and 50% non-Federal.

The local sponsor, the NJDEP, has indicated their support for the selected plan and are willing to enter into a Project Cooperation Agreement with the Federal Government for the implementation of the plan. Local municipalities intend to cost share the non-Federal share with the State. These include Monmouth County and Middletown Township, which are supportive of the selected plan.

RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
FEASIBILITY REPORT
FOR
HURRICANE AND STORM DAMAGE REDUCTION
PORT MONMOUTH, NJ

PERTINENT DATA

DESCRIPTION

The identified plan provides for a storm protective dune, beach, and levees at Port Monmouth, NJ.

LOCATION

Port Monmouth
Middletown Township

FLOOD PROTECTION

Levee	
Length	7,070 ft.
Top Elevation	14 ft. NGVD
Crest Width	10 ft.
Slopes	2.5:1
Fill Volume	107,800 c.y.
Interior Drainage	
Outlet Structures	4 primary, 11 secondary
10 @ 18" Concrete Pipe (Secondary)	574 Feet
1 @ 24" Concrete Pipe (Secondary)	58 Feet
4 @ 48" Concrete Pipe (Primary)	250 Feet
2 @ 36" Concrete Pipe (Diversion and Drainage Pipes)	810 Feet
2@ 48" Gravity Outlets	10 Feet
Floodwall	
Length	3,585 Feet
Top Elevation	14 ft. NGVD
Road Raising	550 Feet
Road Closure Gates (Mitre)	3
Pews Creek Storm (Sector) Gate	1
Pews Creek Sector Gate Width Opening	40 Feet
Pews Creek Sector Gate Height	21 Feet
Pews Creek Pump Station Capacity	120 cfs
Compton Creek (C3) Pump Station Capacity	60 cfs

RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
FEASIBILITY REPORT
FOR
HURRICANE AND STORM DAMAGE REDUCTION
PORT MONMOUTH, NJ

PERTINENT DATA
(cont.)

SHORE PROTECTION

Length of Beach and Dune (including taper section; dune is 2,640 feet)	4,640 ft.
Volume of Beach and Dune	262,000 c.y.
Width of Dune	25 ft.
Width of Beach	50 ft.
Elevation of Dune	16 ft. NGVD
Elevation of Beach	9 ft. NGVD
Dune Slopes	
Landward	1 on 5
Seaward	1 on 10
Beach Slope	1 on 15
Renourishment	
For first 10 years (by dredging)	125,000 c.y.
Every 10 years thereafter (by trucking)-including sea level rise	127,300 c.y.
Total Initial Fill	
Includes design, advance, overfill, and tolerance fill	378,500 c.y.

REAL ESTATE REQUIREMENTS

Permanent Easements	42.07 Acres
Temporary Easements	6.8 Acres

ENVIRONMENTAL CONSIDERATIONS

Wetland Mitigation	12.80 Acres
Mitigation Acquisition	12.80 Acres

ECONOMICS

Initial Project Cost	$ 31,383,000
Annual Project Cost (Discounted at 6.625% over a 50-year period)	$2,931,010

RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
FEASIBILITY REPORT
FOR
HURRICANE AND STORM DAMAGE REDUCTION
PORT MONMOUTH, NJ

PERTINENT DATA
(cont.)

Average Annual Benefits (Discounted at 6.625% over a 50-year period)	
Damage Reduction	$2,903,330
Reduced Maintenance	145,000
Recreation	191,500
Total	$3,239,830
Net Excess Benefits	$308,820
Benefit to Cost Ratio	1.1

COST APPORTIONMENT (FIRST COST)

Federal (65%)	$20,398,950
Non-Federal (35%)	
Cash	$9,586,050
Other	$1,398,000

PHYSICAL CONDITIONS

Tides

(1) Semi-Diurnal

(2) Tide range* Mean 4.7 ft.
Spring 5.2 ft.

Surge

(1) Maximum Storm: 10.5 ft. NGVD (Keyport, September 12, 1960)

Climatology	High	Low	Average
(1) Temperature (EF)	110	-31	52
(2) Precipitation (inches)	61.7	29.94	44
(3) Relative Humidity (%)			70
(4) Wind			
a. Prevailing	Northwest		
b. Maximum Velocity	78 mph (6/11/53)		

Note: Tide data is interpolated from NOAA values at Atlantic Highlands and Way Cake Creek.

RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
FEASIBILITY REPORT
FOR
HURRICANE AND STORM DAMAGE REDUCTION
PORT MONMOUTH, NJ

PERTINENT DATA
(cont.)

ECONOMICS (Updated to October 1999 price levels)

Initial Project Cost	$ 32,064,000

COST APPORTIONMENT (FIRST COST- Updated to October 1999 price levels)

Federal (65%)	$20,841,600
Non-Federal (35%)	
Cash	$9,794,100
Other	$1,428,300

RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
FEASIBILITY REPORT
FOR
HURRICANE AND STORM DAMAGE REDUCTION
PORT MONMOUTH, NJ

TABLE OF CONTENTS

List of Tables

List of Figures

List of Photos

List of Appendices

List of Volumes

I. INTRODUCTION

1. The Port Monmouth project area is located in Middletown Township, Monmouth County, New Jersey (Figure 1). The community extends along the shoreline of Raritan Bay and Sandy Hook Bay, between Pews Creek and Compton Creek. The purpose of this feasibility phase study is to evaluate the improvements considered in the Raritan Bay and Sandy Hook Bay Combined Flood Control and Shore Protection Reconnaissance Study. This report evaluates hurricane and storm damage reduction alternatives and provides details on the selected plan and environmental impacts.

Study Authority

2. In a letter dated 6 January 1955, the Department of Conservation and Economic Development, State of New Jersey, requested a beach erosion control study through an amendment of the State's basic application of 22 September 1952 to include a study of the Raritan Bay and Sandy Hook Bay shorefronts. On 15 August 1955 the Chief of Engineers approved a supplemental agreement dated 25 June 1955 amending the basic application in accordance with Section 2 of Public Law 520 (River and Harbor Act), 71st Congress, approved 3 July 1930, as amended and supplemented pertaining to cooperative beach erosion control investigations. State of New Jersey authority to participate in the study was established by Chapter 258, N.J.L. 1946 and Chapter 448, N.J.L. 1948 and appropriation acts of the State. Section 2 of PL 520, 71st Congress, approved July 3, 1930 as amended and supplemented pertaining to cooperative beach erosion control investigations:

> *"The Chief of Engineers of the United States Army, under the direction of the Secretary of War, is authorized and directed to cause investigations and studies to be made in cooperation with the appropriate agencies of various States on the Atlantic, Pacific, and Gulf Coasts and on the Great Lakes, and the Territories, with a view to devising effective means of preventing erosion of the shores of coastal and lake waters by waves and currents; and any expenses incident and necessary thereto may be paid from funds appropriated for examinations, Surveys and Contingencies for Rivers and Harbors: Provided, That the War Department may release to the appropriate State agencies information obtained by these investigations and studies prior to the formal transmission of reports to Congress: Provided further That no money shall be expended underauthority of this section in any State which does not provide for cooperation with the agents of the United States and contribute to the project such funds and/or services as the Secretary of war may deem appropriate and require; that there shall be organized under the Chief of Engineers, United States Army, by detail from time to time from the Corps of Engineers and from the engineers of State agencies charged with beach erosion and shore protection, a board of seven members, of whom four shall be officers of the Corps of Engineers and three shall be selected with regard to their special fitness by the Chief of Engineers from among the*

> *State agencies cooperating with the War Department. The board will furnish such technical assistance as may be directed by the Chief of Engineers in the conduct of such studies as may be undertaken and will review the reports of the investigations made. In the consideration of such studies as may be referred to the board by the Chief of Engineers, the board shall, when it considers it necessary and with the sanction of the Chief of Engineers, make, as a board or through its members, personal examinations of localities under investigation: Provided further, That the salary of the civilian members shall be paid by their respective States, but the traveling and other necessary expenses connected with their duties on the board shall be paid in accordance with the law and regulations governing the payment of such expenses to civilian employees of the Engineer Department."*

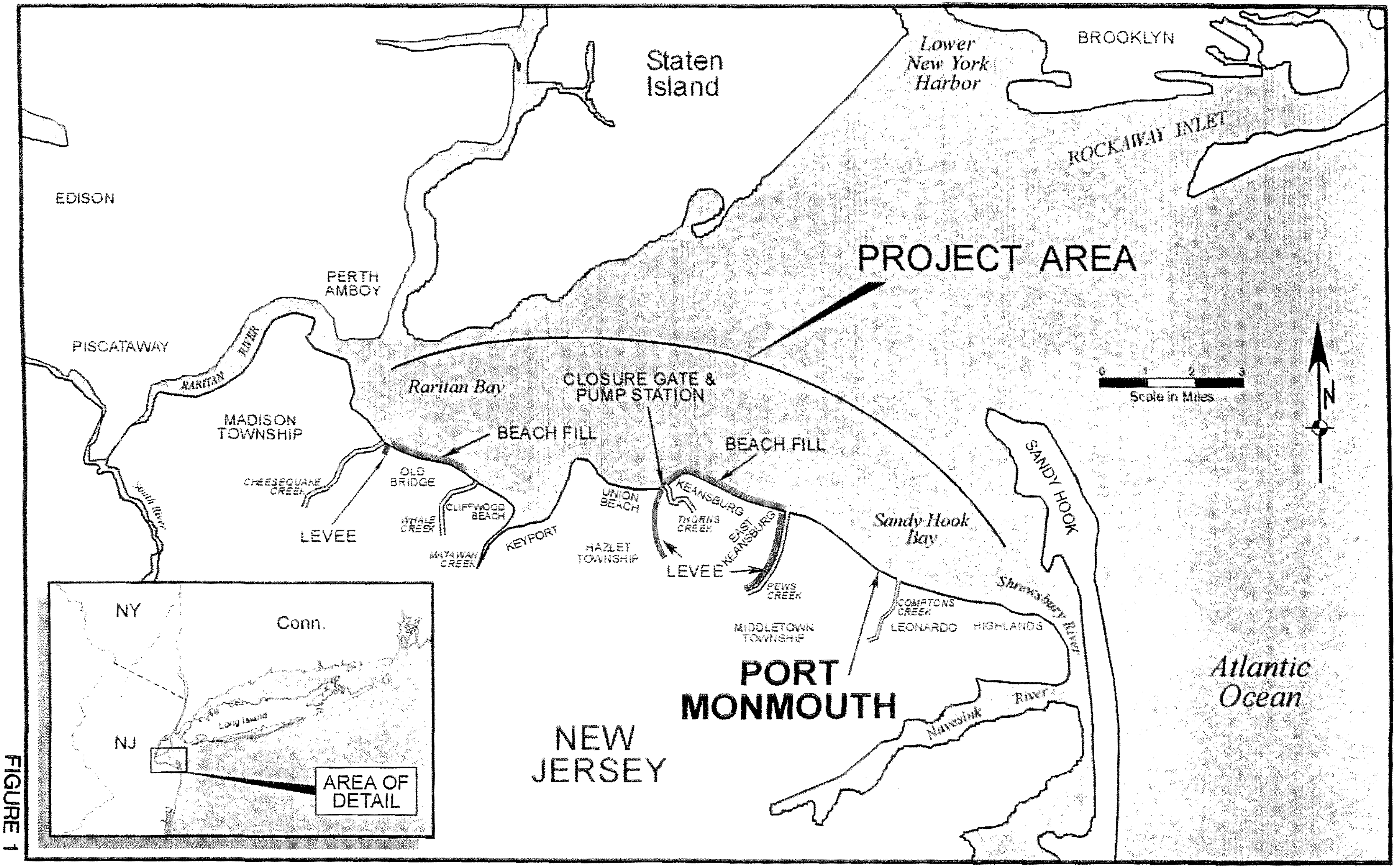
3. A hurricane protection study was authorized by Public Law 71, 84th Congress, 1st Session on June 16, 1955, in response to severe damage to coastal and tidal areas of the eastern and southeastern United States, from the hurricanes of August 31, 1954 and September 11, 1954 in New England, New York and New Jersey, and the damages caused by other hurricanes in the past. Funds for a hurricane survey of Raritan Bay and Sandy Hook Bay from Highlands to South Amboy, New Jersey were allotted by the Chief of Engineers by letter, dated 1 October 1957. A combined report covering the cooperative beach erosion control study and the hurricane survey was approved by the Chief of Engineers on 12 February 1960. Public Law 71, 84th Congress, 1st Session, approved June 15, 1955, pertaining to hurricane investigations of the eastern and southern seaboard of the United States.

> *This reads "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That: In view of the severe damage to the coastal and tidal areas of the eastern and southern United States from the occurrence of hurricanes, particularly the hurricanes of August 31, 1954, and September 11, 1954, in the New England, New York, and New Jersey coastal and tidal areas, and the hurricane of October 15, 1954, in the coastal and tidal areas extending south to South Carolina, and in view of the damages caused by other hurricanes in the past, the Secretary of the Army, in cooperation with the Secretary of Commerce and other Federal agencies concerned with hurricanes, is hereby authorized and directed to cause an examination and survey to be made of the eastern and southern seaboard of the eastern and southern seaboard of the United States with respect to hurricanes, with particular reference to areas where severe damages have occurred."*

4. The existing Federal Project, Raritan Bay and Sandy Hook Bay, New Jersey, was authorized by the Flood Control Act of 12 October 1962 in accordance with House Document No. 464, 87th Congress, 2nd Session.

US Army Corps
of Engineers
New York District

Raritan Shoreline - Port Monmouth, New Jersey



GENERAL LOCATION MAP

FIGURE 1

The project provides for: combined shore and hurricane protection at Old Bridge Township (formerly Madison Township), shore protection at Aberdeen Township (formerly Matawan Township) and Union Beach, and shore and hurricane protection at Keansburg and East Keansburg.

The recommendations include:

a. Madison Township: A combined shore and hurricane protection improvement providing for about 1.7 miles of beach fill at an elevation of 5.5, 10 and 15 ft above mean sea level; about .4 mile of levees at an elevation of 15 ft above mean sea level; and interior drainage facilities.

b. Matawan Township: A shore protection improvement providing for about .9 mile of beach fill at an elevation of 5.5 and 10 ft above mean sea level.

c. Borough of Union Beach: A shore protection improvement providing for about .6 mile of beach fill at an elevation of 5.5 ft above mean sea level.

d. Borough of Keansburg and East Keansburg: A hurricane protection improvement providing for about 2.7 miles of beach fill at an elevation of 15 ft above mean sea level; three groins; about 2.5 miles of levees at an elevation of 15 ft above mean sea level; and interior drainage facilities.

While this project resulted in improvements elsewhere in the study area, improvements in Port Monmouth were not recommended. The project including uncompleted construction was reauthorized by the Water Resource Development Act of 1996.

5. The present study of the Raritan Bay and Sandy Hook Bay shorefront areas was authorized by a resolution of the Committee of Pubic Works and Transportation of the U.S. House of Representatives adopted 1 August 1990, which states:

> *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 requested to review the report of the Chief of Engineers on Raritan Bay and Sandy Hook Bay, New Jersey, published as House Document 464, Eighty-seventh Congress, Second Session, and other pertinent reports, to determine the advisability of modifications to the recommendations contained therein to provide erosion control and storm damage prevention for the Raritan Bay and Sandy Hook Bay.*

Study Purpose

6. The existing Combined Beach Erosion and Hurricane Protection Project for Raritan Bay and Sandy Hook Bay is a Federally authorized project which is intended to provide

beach erosion and hurricane protection improvements. The purpose of this report is to evaluate at Port Monmouth, NJ, all reasonable solutions to the problems identified in the Reconnaissance Study (USACE, 1993). These problems include tidal flooding and shoreline erosion. This report documents the Feasibility Study and provides the basis for the selected hurricane and storm damage reduction plan. This document is prepared in accordance with Engineer Regulation ER-1105-2-100 (Guidance for Conducting Civil Works Planning Studies), Engineer Regulation ER-1110-2-1407 (Hydraulic Design for Coastal Shore Protection Projects), Engineer Manual EM-1110-2-1413 (Hydrologic Analysis of Interior Areas) and Engineer Regulation ER-1110-2-1150 (Engineering & Design for Civil Works Projects). This report is a progressive response to the study authorized for the Port Monmouth, and the Raritan Bay and Sandy Hook Bay shore communities.

Prior Studies and Reports

7. Under the current study authorization, a Reconnaissance Study Report was completed in March 1993 (USACE). For Port Monmouth, this study identified a 2,600 foot long beach berm, 50-ft. wide with an elevation of +5.0 ft. NGVD backed by a dune with a 40-ft. wide crest at elevation +15 ft. NGVD with suitable advanced and continuing nourishment, and an approximately 10,000-ft. length of levee with a crest width of 10 ft. at elevation +13 ft. NGVD, with suitable interior drainage structures, as a potentially implementable plan. Based on the Reconnaissance Study findings, the Army Corps of Engineers and the State of New Jersey entered into an agreement to perform a cost-shared Feasibility Study for the Port Monmouth area and preliminary feasibility investigations for Union Beach, Leonardo, Keyport, Highlands and Cliffwood Beach.

Description of Study Area

8. The Port Monmouth project area is located in Middletown Township, Monmouth County, New Jersey. The year round suburban community has a bayshore exposure of approximately 7,000 feet extending along the shoreline of Raritan Bay and Sandy Hook Bay (Photo No.1 and Figure 2). Pews Creek and Compton Creek are waterways that represent the western and eastern limits of the project area, respectively. The southern limit of the study area is generally considered to be in the vicinity of NJ State Route 36, and was subsequently refined during problem identification and formulation to the

existing inland 15 foot NGVD contour line, which lies a short distance south of Route 36, approximately 6,000 feet from the bayshore. To the west of the study area are the communities of Keansburg and East Keansburg, the site of an existing Federal beach erosion and hurricane protection project. To the east is Belford, with Belford Harbor at the mouth of Compton Creek, the site of a Federal navigation project.

9. At Port Monmouth the drainage basins of Pews and Compton Creeks, cover a combined area of 5.0 square miles. To the west of Pews Creek is a levee with a nominal crest elevation of 15 feet which runs south or inland, from the mouth of the creek for a distance of 6,000 feet. The levee is part of the Raritan Bay and Sandy Hook Bay Beach Erosion and Hurricane Federal project for Keansburg. From its 7,000 foot maximum east-west dimension at the shoreline, the width of Port Monmouth reaches a minimum of about 5,000 feet, as defined by the separation between the bordering creeks. The shoreline consists of a small beach and dune system fronting an extensive low-lying marshland. Approximately 160 acres of jurisdictional wetlands occur within the Compton Creek Basin Area (CCBA) which is bounded by Port Monmouth Road to the north, NJ State Route 36 to the south, and Main Street to the east and west. The Pews Creek Basin Area (PCBA) contains approximately 180 acres of State and Federal jurisdictional wetlands and is bounded by Port Monmouth Road to the north, NJ State Route 36 to the south, Wilson Avenue to the east and the Keansburg levee to the west.

10. Port Monmouth is composed of mostly residential structures. There are about 940 residential structures and 60 commercial structures in the study area (which surrounds the marshlands), totaling about 1000 structures, nearly all affected by extreme coastal storm events. Small homes along the shoreline itself, which were formerly summer residences, have been converted to year-round homes. Many year-round homes were constructed on fill within the marsh. A small pleasure boat marina is located near the entrance of Pews Creek and a large commercial marina known as Shoal Harbor is located at the mouth of Compton Creek (Figures 2A and 2B). The commercial marina contains storage buildings and a fish market. The fish market is located on the west side of Shoal Harbor, on the site of a former fish processing factory. Nearly all of the shorefront residences have recently been bought by Monmouth County to enhance public access to the bayshore. One remaining structure along the bayshore is the Seabrook-Wilson House (Spy House) which is listed on the National Register of Historical Places (NRHP). A recreational fishing pier is located near the Spy House. (Figure 2A depicts some of the major study area characteristics).

11. While continued development along the Port Monmouth shoreline section is minimal, significant changes in ownership are underway. Monmouth County has acquired much of the land adjacent to the Spy House (Figure 2A) for the development of a County park and recreational area. This purchase will include the Port Monmouth shoreline in a park system extending along the shoreline of both Sandy Hook and Raritan Bays (Sardonia, 1996). Currently, seaward of Port Monmouth Road, a significant portion of the land is already publicly held, and little development exists. Near Pews Creek a

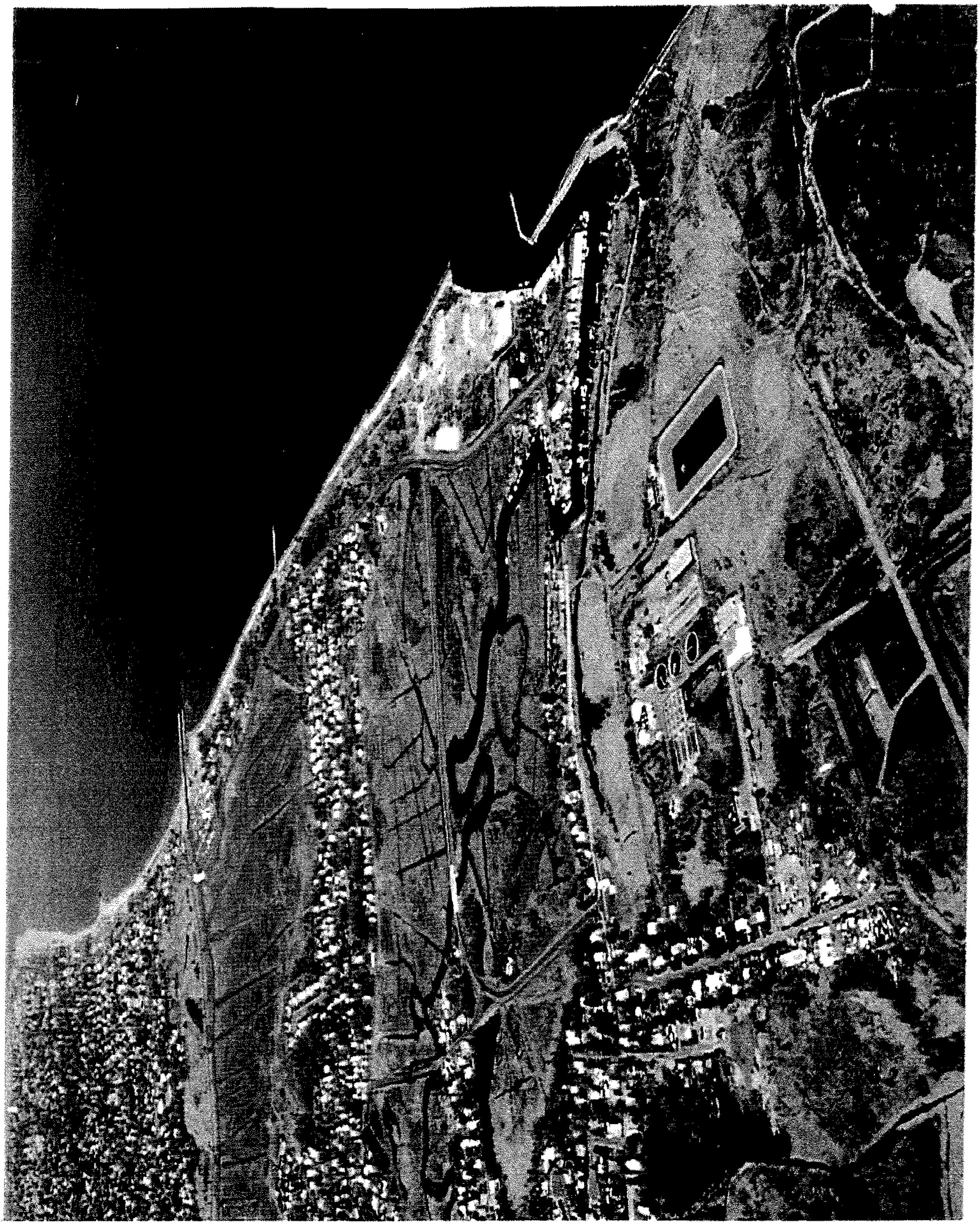


PHOTO NO. 1 -PORT MONMOUTH (APRIL 1998)

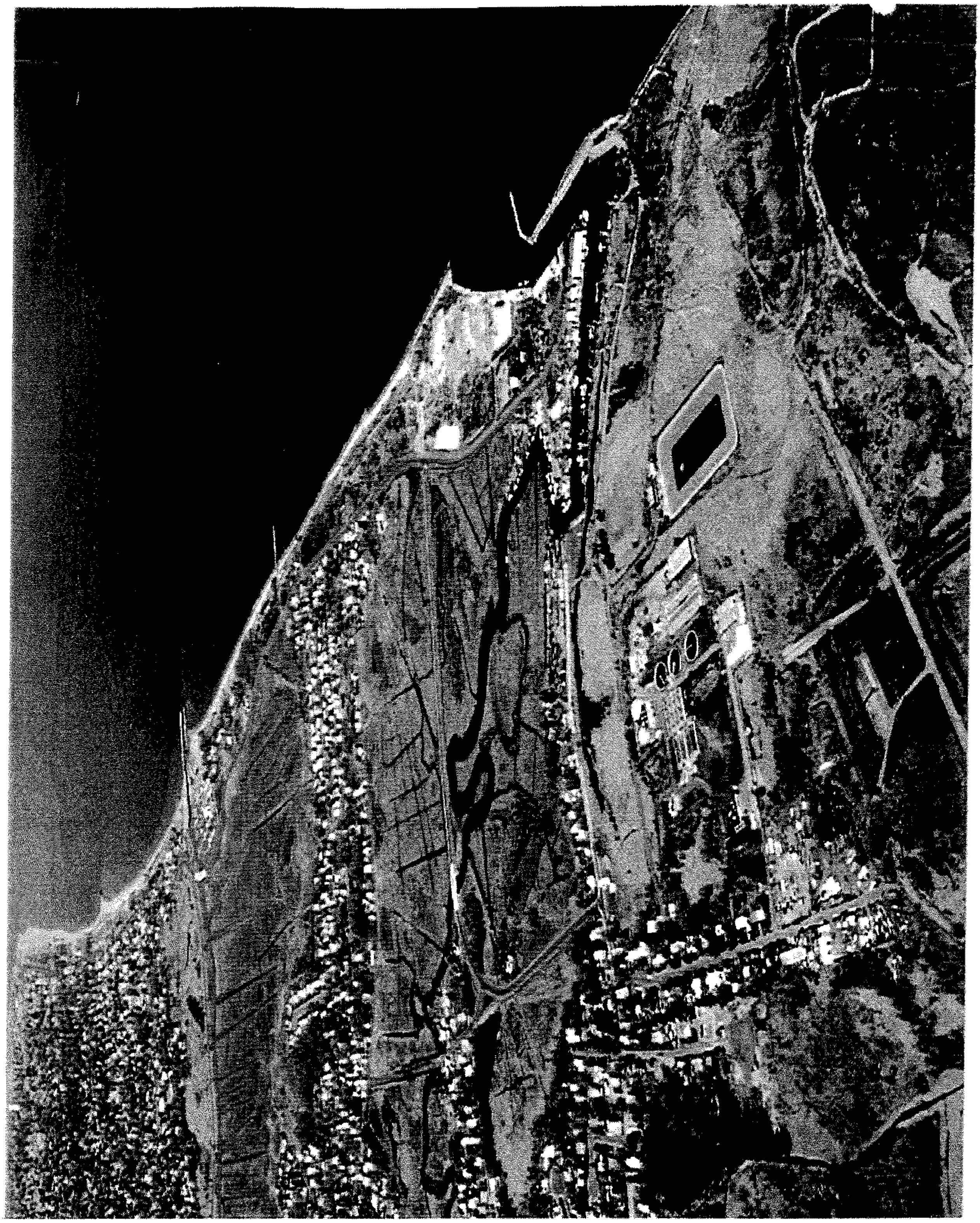
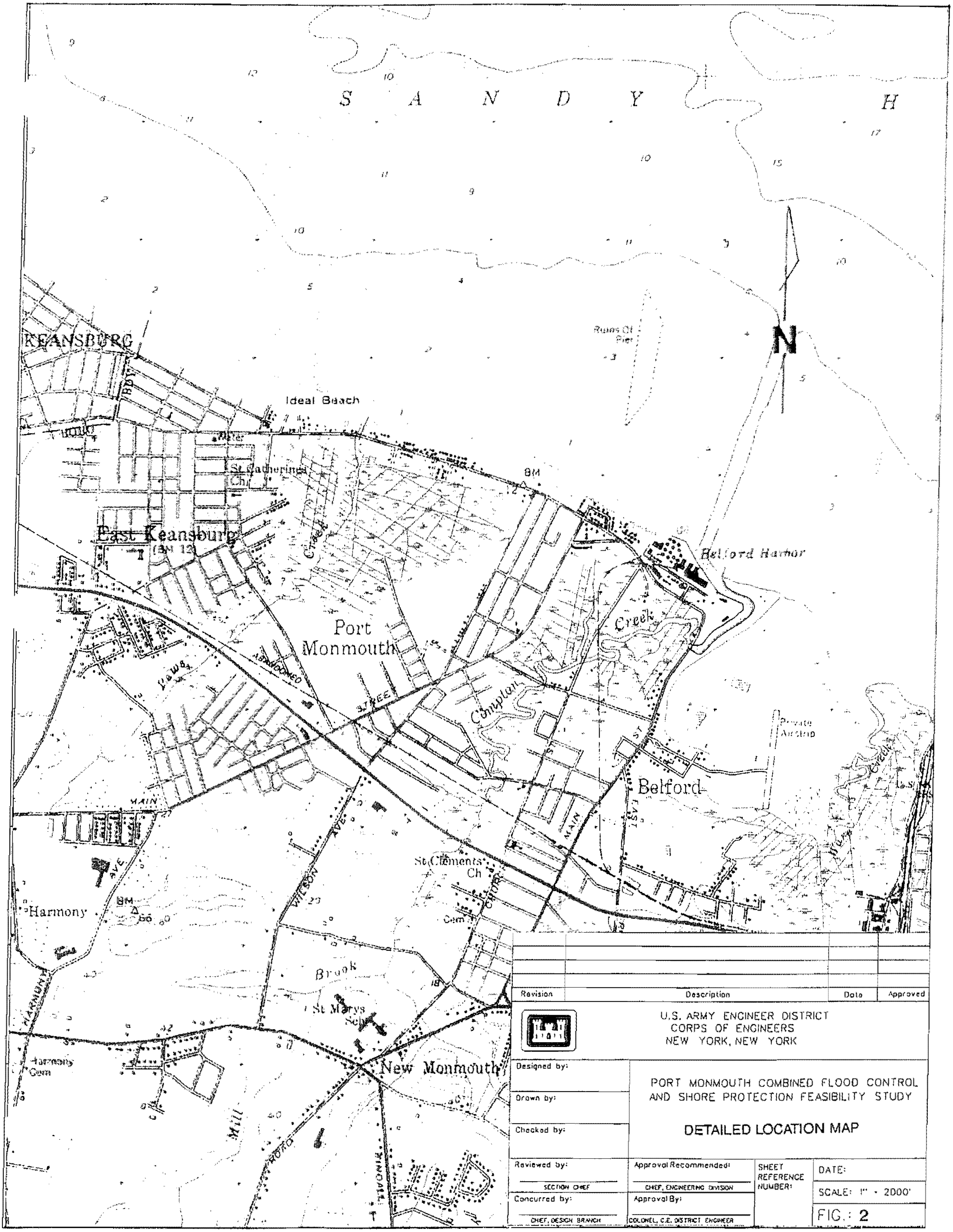


PHOTO NO. 1 –PORT MONMOUTH (APRIL 1998)



Revision	Description	Date	Approved

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

Designed by:

Drawn by:

Checked by:

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

DETAILED LOCATION MAP

Reviewed by:
SECTION CHIEF

Approval Recommended:
CHIEF, ENGINEERING DIVISION

Concurred by:
CHIEF, DESIGN BRANCH

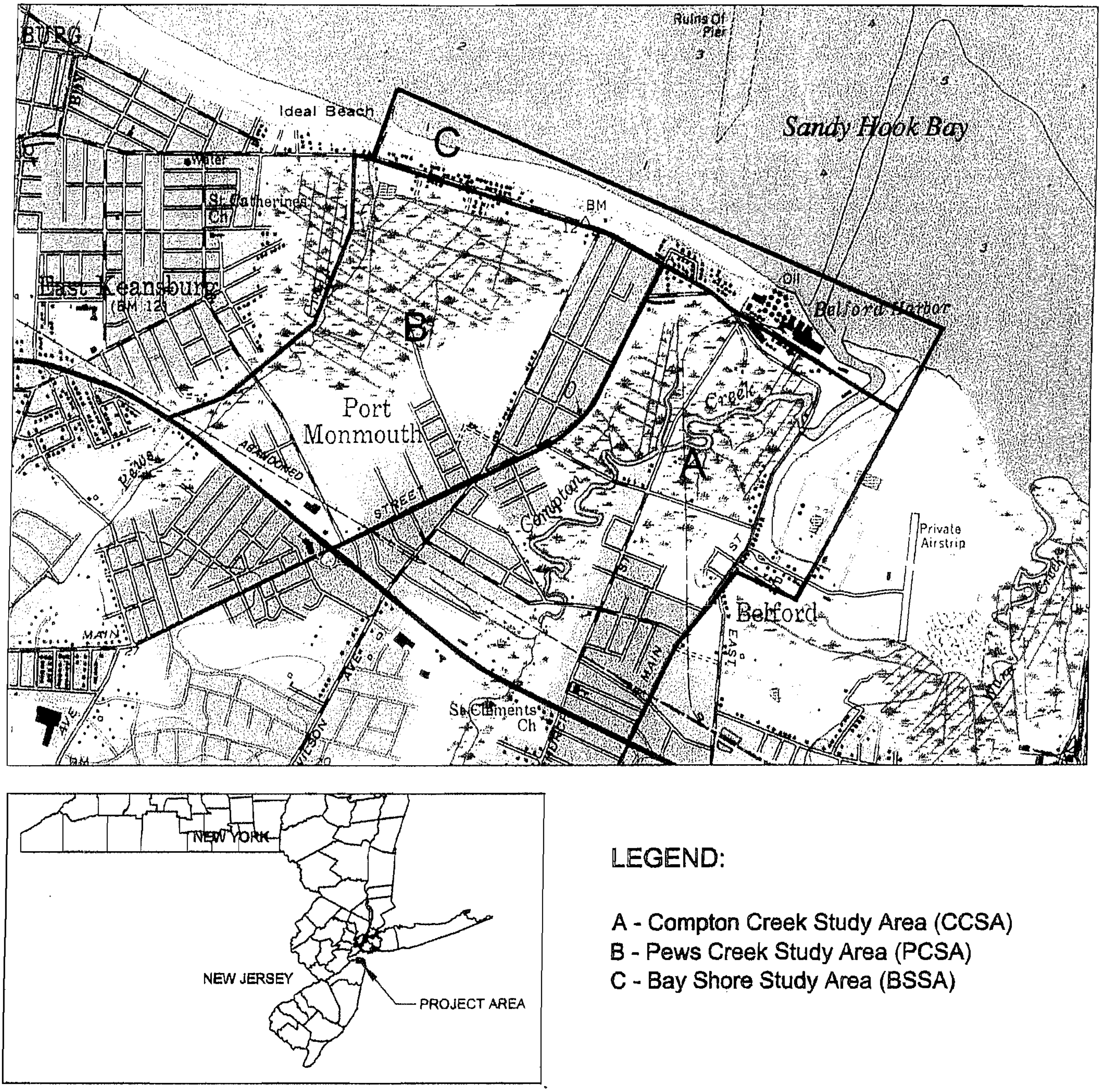
Approval By:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:

SCALE: 1" - 2000'

FIG.: 2



LEGEND:

A - Compton Creek Study Area (CCSA)
B - Pews Creek Study Area (PCSA)
C - Bay Shore Study Area (BSSA)

SOURCE:

U.S.G.S. 7.5 Minute Series
Sandy Hook NJ-NY 1954
Photorevised 1981

SCALE:

1" = 2,000'

N

DEIS FIGURE 1

SITE LOCATION MAP -
PORT MONMOUTH PROJECT AREA

Draft Environmental Impact Statement
Raritan Bay and Sandy Hook Bay
Combined Flood Control and Shore Protection Project
Port Monmouth, New Jersey

Figure 2A

few small residences remain. Landward of Port Monmouth Road is a mixture of private development and undeveloped lands.

12. Pews Creek divides Port Monmouth and East Keansburg and is maintained by local interests. Its mouth is dredged periodically for navigation. The navigation project consists of a channel to the Monmouth Cove Marina, a County Marina. Stone jetties stabilize the bay entrance. Parallel bulkheads approximately 425 feet long stabilize the channel from the bay shoreline to the marina.

13. Historically dredge spoils were stockpiled east of the creek for later use or final disposal. The coarsest sand dredged from the channel was stockpiled adjacent to the bay shoreline east of the channel. Some of this material was being used to support County projects, such as the 1996 construction on the Port Monmouth Road.

14. The County has plans to improve navigation in the inlet. The high shoaling rate in the inlet is thought to be caused by the location of the coarse sand disposal site and the lack of a western jetty. The county plans to dispose of all future coarse sand on the west (Keansburg) side of the inlet.

15. Compton Creek separates Belford and Port Monmouth and is a Federal navigation project (Figure 2B). A rock rubble jetty stabilizes the east side of the inlet. A concrete seawall protects the south side of the east channel bank. The west side of the inlet is protected by a timber terminal groin along the shoreline, and a wooden bulkhead landward. In areas, the bulkhead is backed by rock rubble. The project depth inside the mouth of the creek is 8 feet mean low water (MLW) with a width of 75 feet. Outside of the mouth the project depth is 12 feet MLW with a width of 150 feet. The outer channel extends 1.3 miles into Sandy Hook Bay.

16. The shoreline of Port Monmouth has been protected by a variety of measures, some of which continue to provide limited coastal protection. For example, the beach fill and dune project constructed in 1966 by the State of New Jersey still provides some material and associated protection in the dune area.

17. Dredged fill from Pews Creek has been placed on the beach in the vicinity of the historic "Spy House" near the center of Port Monmouth at the end of Wilson Avenue. The latest fill project occurred in or near the time 1992, involving the placement of approximately 20,000 cubic yards of sand from Pews Creek. Along the beach, a total of 12 timber groins were concentrated along the central to eastern length of shoreline. The groins featured a typical length of 150 feet, in fair to poor physical condition. Private, state, and municipal interests had constructed all of the groins prior to 1943.

18. Middletown Township and Monmouth County are presently implementing plans to enhance and improve the Port Monmouth area. In addition to the planned shoreline park, the Monmouth County Planning Board has indicated in its 1987 Bayshore Waterfront Access Plan that the County could benefit from the revitalization of the

historic Shoal Harbor district at the mouth of Compton Creek. Monmouth County has replaced the Pews Creek bridge. In addition, Port Monmouth Road, Church Street, and Broadway were raised by Monmouth County to a minimum elevation of +9.0 ft. NGVD to improve emergency access for residents of Port Monmouth during most flooding events.

Description of the Problem

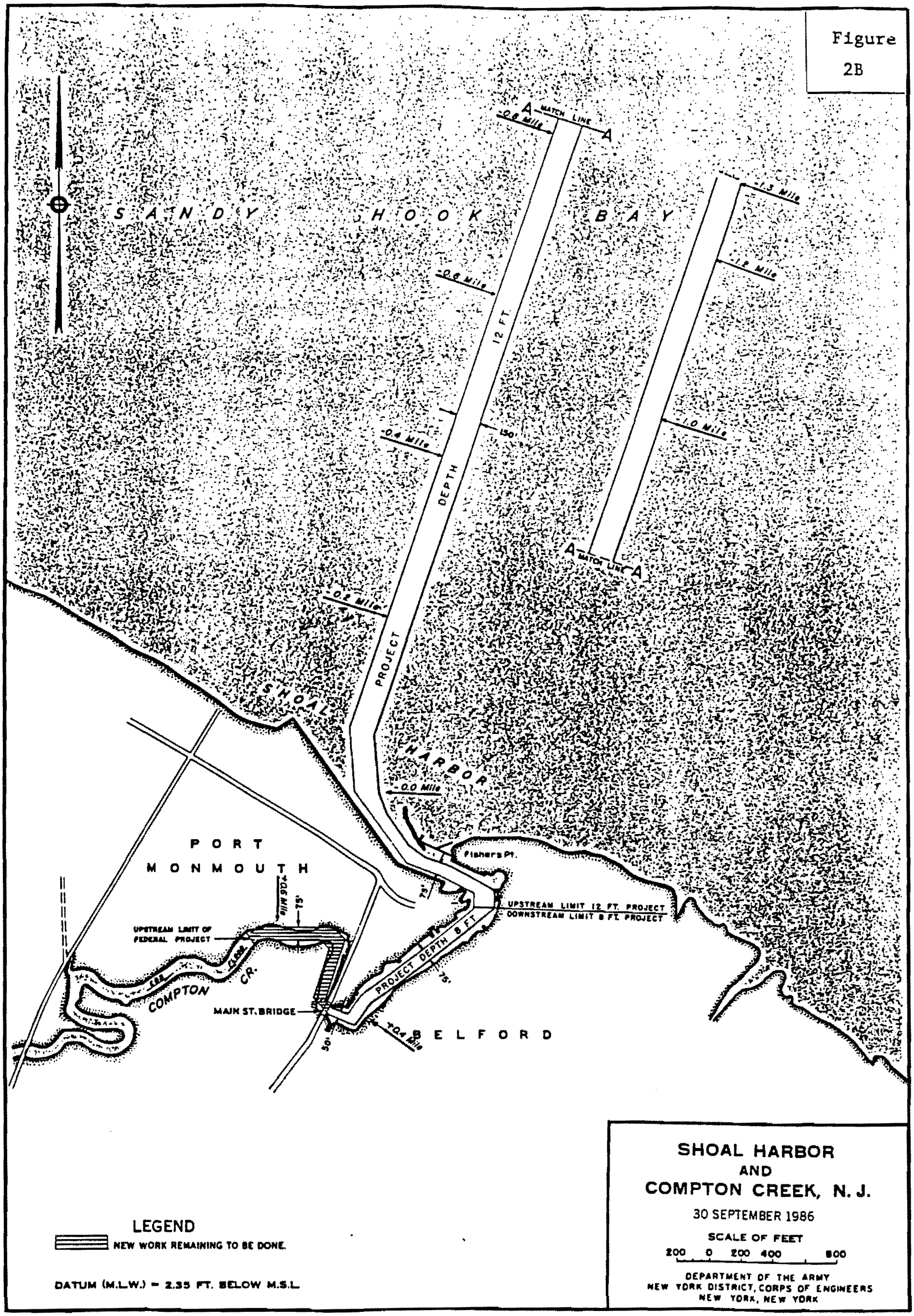
19. Extratropical storms, northeasters, and hurricanes historically impact the Raritan and Sandy Hook Bayshore areas. These storms produce storm surges and waves that cause extensive flooding and erosion to the study area. The shoreline composition has been greatly altered with time. Storm-induced erosion has removed much of the beachfront and has accelerated deterioration of any existing coastal protection and drainage structures. In addition to physical alterations, storm surges often block existing storm drainage systems along Pews and Compton Creeks and, as tides rise, cause indirect overland flooding, resulting in prolonged and extensive flooding to the low lying areas throughout the study area. These storms result in damages to homes and commercial properties, utility lines, shore structures, roads and bridges. Approximately 800 structures would be inundated by a 100 year storm event.

20. Major storms impacting the area include the September 14, 1944 hurricane, extratropical storms of November 25, 1950 and November 6-7, 1953, Hurricane Donna (1960), March 6-8, 1962 northeaster, March 12, 1984 northeaster, and most recently the December 11, 1992 northeaster. These storms resulted in damage of homes and commercial properties; transportation problems such as damaged roads and bridges; and damage or destruction of shoreline structures, utility lines and sewers. Overall, these problems have resulted in extensive financial losses to both shorefront and upland properties, with numerous evacuations during storms.

21. Historically, the Port Monmouth area experiences most of its problems from tidal inundation from Pews Creek and Compton Creek. During even moderate storms tidal floodwaters enter the creeks and quickly spread over the broad low-lying floodplain from both the east and the west. A storm stage of ten feet NGVD results in flooding so severe that most residents north of Route 36 are stranded. Extensive damage to hundreds of structures has been recorded in the Port Monmouth area during such storms. Even moderate storms such as those that occurred several times in the past 1997-1998 northeaster season, caused flooding of roads and damage to residences with openings as low as six feet NGVD. Residents became stranded with limited access to emergency vehicles.

22. Environmental degradation is also a concern for the Pews Creek basin area as the wetlands are deemed to be subject to continuing habitat losses in the without project future condition. Natural filling in of the wetlands due to sedimentation would have

Figure 2B



SHOAL HARBOR
AND
COMPTON CREEK, N. J.

30 SEPTEMBER 1986

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

deleterious effects on productive habitat species in the absence of any project implementation.

Improvements Desired

23. In Port Monmouth there is great local interest in hurricane and storm damage reduction projects within the region. The State of New Jersey, Monmouth County and Middletown Township have indicated a willingness to continue storm protection investigations, and have proven to be supportive of the adjacent East Keansburg Flood Control and Hurricane Protection project. For Port Monmouth, local interests desire protection against tidal inundation from severe coastal storms, as well as protection against frequent flooding, which leaves residents stranded from emergency services, prevents people from getting to work, prevents children from getting to and from school, and disrupts businesses in the area.

II. EXISTING CONDITIONS

Physical Conditions

24. Astronomical Tides. Tides at Port Monmouth are semi-diurnal and have a mean range of 4.6 feet and a spring range of 5.6 feet. The maximum recorded storm water elevation at Port Monmouth was observed during Hurricane Donna; the water level reported was 9.9 feet National Geodetic Vertical Datum (NGVD) on September 12, 1960. In the adjacent towns of Morgan and Keyport, the storm water elevations were reported at 8.9 ft NGVD and 10.5 ft NGVD respectively. Storm surge elevations can vary significantly depending on the locality. Items impacting storm water elevations include bathymetry and topography on inundated area and the physical properties of the storm.

25. Sea Level Rise. Sea level rise is a factor contributing to coastal erosion and the extent of tidal inundation. Based on NOAA tide gauge readings between 1933 and 1986 at Sandy Hook, sea level has been increasing by an average of approximately 0.014 ft. per year. Tidal inundation is expected to increase in severity in direct relation to this 0.7 foot increase over a 50-year planning period. Sea level rise will increase the future frequency and level of flooding in the study area.

26. Currents. Currents in the project area are predominately tidal, with contributions from waves and creek discharges. In the Raritan Bay navigation channel north of Keansburg, the maximum average flood and ebb currents are 0.6 knots and 0.4 knots respectively (NOAA, 1995). Bay currents in the vicinity of Port Monmouth are weaker, except under storm conditions.

27. The current in Pews Creek was measured on July 13, 1993 and was used to predict average current velocities in a study conducted by Stevens Institute of Technology (Harrington, 1994). Under spring tidal conditions, the average peak flood and ebb currents were approximately 1.7 fps (1.0 knots) and 1.8 fps (1.1 knots) respectively at the critical cross section. Neap tide conditions produced flood and ebb current speeds of 0.5 fps and 0.4 fps.

28. Waves. Shallow water effects limit the impact of such waves on Port Monmouth. The highest waves in the study area are generated by winds from the north and northeast quadrant, which is the direction of longest and deepest fetch for wave generation. Waters near the study area are also affected by ocean swells from this direction, which enter the bays between Rockaway Point and Sandy Hook. Ocean swells are reduced to a height not in excess of 6 feet in the area of the Navy piers near Leonardo.

29. Wave heights for Port Monmouth hindcast from wind data indicate the 100 year return value (6.4 feet) compares well with the maximum values reported at Leonardo Naval Pier (6.0 feet).

30. Bay Storm Stage. Two distinct classes of storms that affect the study area are northeasters (extratropical) and hurricanes (tropical). Northeasters, named after the predominant direction of winds, are large-scale low pressure disturbances which usually occur from November through March. The severity of a northeaster is not as great as that of a hurricane. Although wind gusts can reach hurricane strength in a very severe northeaster, sustained wind speeds are rarely greater than 50 knots. The flood damage caused by the typical northeaster is often more a function of its duration rather than its intensity, as the longer storms have more opportunity to destroy both natural and engineered protectionfeatures. Also, as northeasters typically last two to three days, it is possible for the storm to act during several periods of high astronomical tide. Hurricanes are a rarer occurrence in the study area than northeasters. By the time hurricanes approach the latitudes of the north New Jersey coast, they are usually in a state of energy loss and are beginning to decay into the category of tropical storm. The average period between hurricanes is about 5.7 years, or 0.175 hurricanes per year. Despite their infrequency and short duration, hurricanes have the potential to be devastating in the study area because of their high wind speed and high surge.

31. Flooding in the study area is typically caused by the combination of waves with storm-induced water levels and astronomical tide. Stage-frequency curves relate the elevation of flood waters to the probability of recurring floods of equal or greater severity. A storm surge curve was developed by the Corps of Engineers Coastal Engineering Research Center (CERC,1996). The combined hurricane and northeaster curve was used for design purposes in this investigation. The combined storm stage in the study area is approximately 8.4 ft and 12.2 ft NGVD for a 10-year and 100-year return period event respectively (Table 1 and Figure 3). Wave setup values were calculated by applying the representative wave climate values to the predictions contained in the *Shore Protection Manual* (USACE, 1984) for monochromatic waves. Between the 2- and 250-year storm events, the predicted contribution of wave setup ranges from 0.6 to 1.0 feet.

TABLE 1
STAGE FREQUENCY (FEET, NGVD)
PORT MONMOUTH, NJ
SOUTH HARBOR NODE (LAT 40.48N, LONG 74.19W)

	STORM TYPE					
RETURN	TROPICAL	EXTRA-	COMBINED			
PERIOD		TROPICAL	WATER	CONFIDENCE LIMIT		WITH WAVE
(YEARS)			LEVEL	LOWER	UPPER	SETUP
	(1)	(1)	(1)	(1)	(1)	(3)
2	(2)	6.3	**6.5**	6.5	6.5	**7.1**
5	(2)	7.4	**7.6**	7.5	7.8	**8.4**
10	(2)	8.0	**8.4**	8.2	8.6	**9.3**
15	(2)	8.4	**8.9**	8.7	9.1	**9.8**
20	7.5	8.6	**9.2**	8.0	10.5	**10.1**
25	8.2	8.8	**9.6**	8.3	10.9	**10.5**
44	9.6	9.3	**10.4**	8.9	11.8	**11.3**
50	9.9	9.4	**10.5**	8.9	12.1	**11.5**
100	11.7	10.1	**12.2**	9.8	14.6	**13.2**
150	13.5	10.3	**13.8**	10.5	17.1	**14.8**
200	14.4	10.5	**14.7**	10.7	18.7	**15.7**
250	15.1	10.6	**15.5**	10.8	20.2	**16.5**

NOTES:
(1): MTL VALUES CALCULATED BY USACE (1996)
(2): USACE (1996) PREDICTS NEGLIGIBLE SURGE DUE TO HURRICANES
(3): WAVE SETUP VALUES CALCULATED BY SHORE PROTECTION MANUAL (USACE, 1984)

32. Winds. Wind data is not available within the project limits, but is available for the Sandy Hook area, east of the project area. Data covering a 10-year period between 1924 and 1934 indicates that the prevailing winds are from the northwest, occurring 19 percent of the time. Winds from the north, northeast and south occur more than 15 percent of the time. Winds from the east and southeast occur approximately 10 percent of the time. The northeast accounts for most occurrences greater than 50 mph. The maximum sustained wind reported in the area was 79 mph measured at Long Branch, NJ on June 11, 1953 (Bruno, 1991).

33. Wind information is also available in the Wave Information Study data base (WIS, 1993). This data base provides hindcast winds at 3 hour intervals for the 1956-1975 period. The wind data represents the 10 minute averaged wind at 10 meters above open water. The maximum wind velocity in WIS database is 56 mph. Winds of such

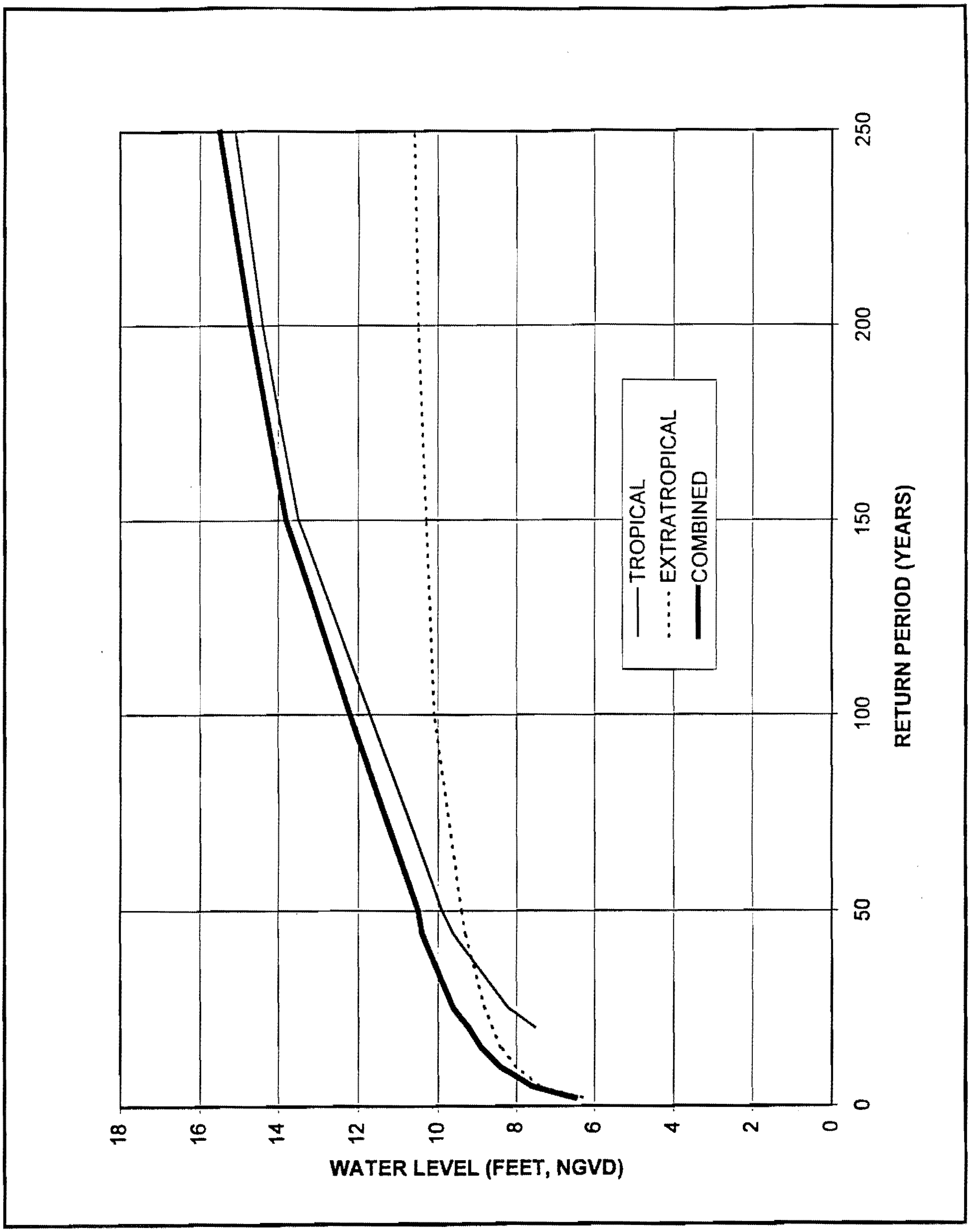


FIGURE 3

COMBINED STAGE FREQUENCY CURVE

(USACE, 1996)

velocity are primarily oriented from the north. This maximum velocity and direction is similar to the Sandy Hook 1924-34 wind rose.

34. Bayshore Characteristics. Dimensions of the Port Monmouth beach were taken from the November 1995 onshore and offshore survey. This survey was conducted on 12 profile lines (PL-210 to PL-221). Qualities of the beach that are consistent throughout the study area include the dramatic slope change from the steep beach and dune slopes to the nearly flat offshore slope. This slope change, occurring at a point identified as the beach toe, is found between elevations -2.4 and -3.9 feet NGVD. An additional feature consistent along the study area is the nearly complete lack of a beach berm. The beach extends from the shoreline along a nearly uniform slope to a point identified as the dune toe, from which the slope is more steep. Dune crest elevations are relatively high except in the area's easternmost length.

Economic Conditions

35. Transportation. The study area is convenient to major population centers through a network of modern highways. The Garden State Parkway and Route 9 run northward to New York State and southward to Cape May, New Jersey. Route 287 extends westward beyond Middlesex County and the New Jersey Turnpike provides additional north-south access. Direct access from these major corridors to the Bayshore is provided by Route 35 and Route 36 (Figure 3A). The communities are also serviced by the shore line of New Jersey Transit which provides passenger rail access to Newark and New York City, and by ferry service to downtown Manhattan.

36. Significant, but limited, improvements in access to Port Monmouth were recently completed by Monmouth County. These include reconstruction of Church Street and Port Monmouth Road and construction of relocated bridges over Pews and Compton Creeks. These roadways were rebuilt to a minimum elevation of +9 NGVD, improving emergency access during all but the most severe storms. Primary routes from Route 36 to the shorefront are Wilson Avenue and Main Street. These two roadways have stretches with elevations under 6.0 feet NGVD.

37. Population. Population in Monmouth County increased by 219,000 persons between 1960 and 1990. While this represents a 65% increase in 30 years, the recent trend shows a reduced growth rate, going downward from 38% between 1960 and 1970 to 9% between 1970 and 1980. Census data for 1990 indicates a continued growth of 10% since 1980 with an increase of 50,000 people, suggesting a stabilization of the growth rate over the last twenty years. Changes in population of Middletown Township have closely mirrored the county trend. Population increased 38% between 1960 and 1970, 15% between 1970 and 1980, and 9% between 1980 and 1990. The population of Middletown Township was 68,183 in 1990.

38. Land Use and Economy. The majority of land in the immediate project area contains residential development with commercial development concentrated along Route 36.

The Belford fish co-op at the mouth of Compton Creek represents an important regional commercial resource.

39. Historically, the Bayshore played a role as a market and distribution center for the agricultural goods produced on the fertile soils of the County's interior. Later the Bayshore's local commercial resources were developed. These included shellfish, clay (used in brick and tile manufacturing) and the waterfront as a tourist attraction.

40. The economy of Monmouth County has undergone extensive growth in recent years with much of the development concentrated along the major transportation routes. The majority of non-residential development has been for office and research facilities, probably due to the availability of comparatively inexpensive land with good access to the Northern New Jersey - New York City markets. Economic development within the Township of Middletown has been extremely strong in recent years, including an extensive expansion of the ATT business campus currently underway. Within the Port Monmouth section of Middletown there has been little new commercial or residential development. New development has generally been limited to large public projects, including the reconstruction of Port Monmouth Road and Church Street, replacement of the Port Monmouth road bridge, modification of the Pews Creek Channel, and the acquisition and development of a county park along the Bayshore. The majority of development within Port Monmouth is more than 25 years old, and was constructed prior to implementation of the Flood Insurance Program and adoption of the associated Flood Plain Management Regulations.

Environmental Resources

41. In terms of the environmental setting, the Port Monmouth study area was divided into three major sub areas: the Pews Creek Study Area (PCSA), the Bay Shoreline Study Area (BSSA), and the Compton Creek Study Area (CCSA). Figure 4 depicts the relative locations of these areas.

42. Pews Creek Study Area. The approximately 405 acre Pews Creek Study Area (PCSA) is located in the western portion of the Port Monmouth study area. About 57% of the area is comprised of undeveloped land. The PCSA is bounded to the north by Port Monmouth Road, to the east by the western limit of residential development along Wilson Avenue, to the south by NJ State Route 36, and to the west by the existing Keansburg levee. The PCSA includes the Pews Creek channel, a tidal creek that drains to the north into the Raritan Bay and Sandy Hook Bay.

43. Bay Shore Study Area. The approximately 205 acre Bay Shoreline Study Area (BSSA) is located along a 1.5 mile stretch of shoreline along Raritan Bay and Sandy Hook Bay. Approximately 60% of the area is developed land. The BSSA is bounded to the east by an abandoned fish processing plant located immediately west of Compton Creek, to the west by the mouth of Pews Creek and to the south by Port Monmouth Road.

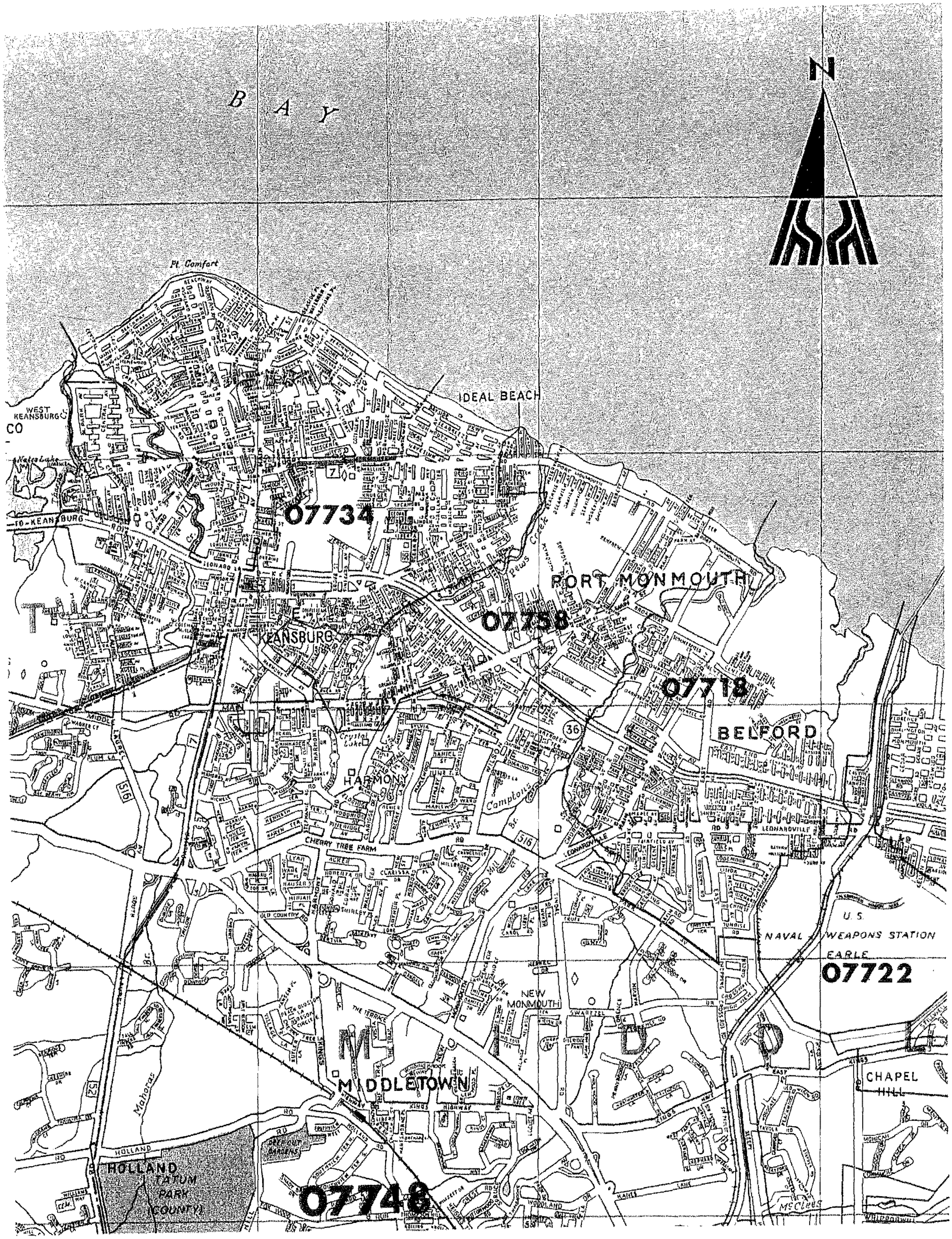
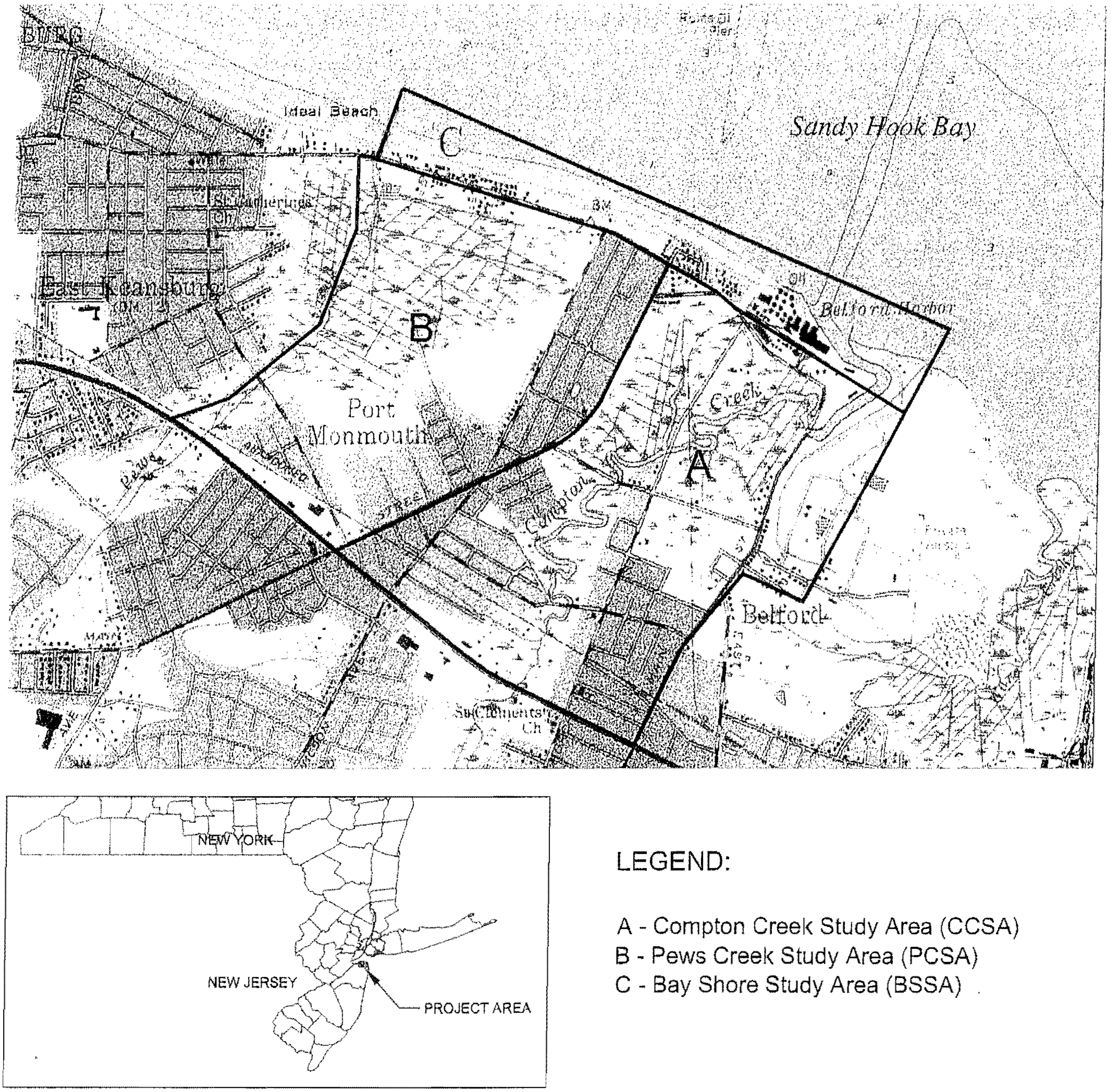


FIGURE 3A – DETAILED ROAD MAP



SOURCE:

U.S.G.S. 7.5 Minute Series
Sandy Hook NJ-NY 1954
Photorevised 1981

CALE:

1" = 2,000'

N

FIGURE 4

SITE LOCATION MAP -
PORT MONMOUTH PROJECT AREA

Draft Environmental Impact Statement
Raritan Bay and Sandy Hook Bay
Combined Flood Control and Shore Protection Project
Port Monmouth, New Jersey

44. Compton Creek Study Area. The approximately 493 acre Compton Creek Study Area (CCSA) is located in the eastern portion of the Port Monmouth study area. The CCSA includes about 42% of its area as undeveloped land. The CCSA is bounded to the north by Port Monmouth Road, to the east and west by Main Street, and to the south by NJ State Route 36. The majority of the CCSA is bordered by residential development. The CCSA includes the Compton Creek channel, a tidal creek that drains to the north into Belford Harbor.

45. Raritan Bay - Sandy Hook Bay Area. In general, vegetation in the Raritan Bay-Sandy Hook Bays is typical of coastal dune, intertidal marsh, and deciduous forested upland plant communities common in the mid-Atlantic region. However, due to human development and ongoing shoreline erosion, the bayshore area is narrow and lacks natural plant diversity relative to fully developed New Jersey coastal dune systems. Based on site investigations, the bayshore contains plant species typical of dune grass communities and shrub-thicket plant communities; the Pews Creek wetlands (Photo No.2) contain plant species typical of successional upland, low salt marsh, high salt marsh and brackish tidal marsh plant communities; and, the Compton Creek (Photo No.3) wetlands contain species typical of successional upland, and low and high salt marsh communities.

46. The types and quality of wildlife habitats in the Raritan Bay-Sandy Hook Bay region are suitable for a diverse group of migratory and resident species of fish and wildlife. These habitats include deepwater habitats, tidal creeks and wetlands, and natural and artificial dunes. In particular, the three study areas support a variety of fish such as the menhaden, American shad, white perch, and American eel; reptiles such as the diamondback terrapin, spotted turtle, and eastern painted turtle; birds such as the great blue heron, great egret, black duck, marsh wren, clapper rail, as well as numerous other songbirds and waterfowl; and, mammals such as the raccoon, eastern cottontail rabbit, muskrat, and red fox. For further discussion regarding the environmental setting, refer to the EIS, Section 3.

47. With the exception of the occasional transient bald eagle, no Federally-listed endangered or threatened species are known to occur in the Project area.

48. A Hazardous, Toxic and Radioactive Waste (HTRW) preliminary assessment (PA) was conducted by the District to identify potential HTRW concerns. The PA concluded that there were no HTRW concerns (see USACE, Baltimore District [CENAB] letter dated October 19, 1995 in the EIS).

Cultural Resources Baseline

49. The goal of cultural resources activities has been to bring the plans proposed as part of the Feasibility Study into compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended through 1992. Documentary research, field investigations, report preparation, and consultation with agencies, including the

New Jersey Historic Preservation Office and the Monmouth County Parks System have been undertaken by the New York District's cultural resources staff as specified by the Advisory Council on Historic Preservation's regulations for implementing the NHPA (36 CFR Part 800). These statutes and regulations ensure that federal agencies consider the effects of their undertakings upon properties that are listed (or are eligible for listing) on the National Register of Historic Places.

50. Investigative efforts have focused upon terrain that may be affected as a result of the construction of project elements. Such locations are termed Areas of Potential Effect (APEs). Research and fieldwork has thus sought to identify above ground or archaeological cultural resources within APEs. More detailed descriptions of the investigation, as well as assessments of the projects effects upon cultural properties, can be found in the cultural resources appendix to this report, and in the draft report that the New York District has prepared and provided to agencies entitled Cultural Resources Investigation, Port Monmouth Combined Flood Control and Shore Protection Feasibility Study (June 1998). These documents contain figures, appendices, and bibliographic references.

51. Setting. The project area and its general vicinity contain cultural resources associated with both Native American and historic period Euro-American occupations. Native American occupation is divided into three cultural periods based upon differences in technologies and in responses to regional environmental and social changes through time. These periods are: Paleo-Indian (circa 12,000 - 8500 Before Present or B.P.), Archaic (8500 B.P. - 5000 B.P.), and Woodland (5000 B.P. - 400 B.P.).The Archaic and Woodland Periods are further divided into Early, Middle, and Late Archaic sub-periods.

52. The Paleo-Indian and Archaic Periods are represented in archaeological sites located along the county's Raritan Bay and Atlantic Ocean shorelines and associated drainages. Evidence of Paleo-Indian occupation include Clovis-like points discovered at the Earle Naval Weapon Station and at several locations within the Manasquan drainage. A large Late Archaic Site, the Red Valley Site, on Ivanhoe Creek in Freehold Township, contained over 2200 stone artifacts. Woodland Period sites, marked by the presence of ceramics, are rarer. However, the collection of an avocational archaeologist active in Atlantic Highlands, contained large quantities of ceramic shards, believed to have originated from prehistoric sites close to the project area.

PHOTO NO. 2 - PEWS CREEK STUDY AREA WETLANDS

PHOTO NO. 3 - COMPTON CREEK STUDY AREA WETLANDS

53. Middletown Township is one of Monmouth County's oldest townships. European settlement of the project area vicinity dates to the late 17th century. The first recorded owner of property here, was Thomas Whitlock, who in 1676 was recognized by the Proprietors of East Jersey as having rights to lands in Middletown, including acreage at what was was then known as "Shoal Harbor." A road connecting Whitlock's bayshore property to King's Highway was opened in 1687, occupying the general corridor of Wilson Avenue. Sometime between 1687 and 1688, Whitlock built a residence on his Shoal Harbor property. It is unknown whether this is the present Whitlock/Seabrook Wilson House (known locally as the Spy House) which today stands between the shoreline and the intersection of Wilson Avenue and Port Monmouth Road. The latter structure dates to this period, and appears to have been constructed no later than the first two decades of the eighteenth century.

54. The Whitlock/Seabrook Wilson House remained the "dominant cultural feature" within this section of the bayshore from the 18th century until the mid-19th century. An 1844/5 United States Coast and Geodetic Survey Map shows the area between Pews and Compton Creek as virtually uninhabited. Although the fields immediately surrounding the Whitlock/Seabrook Wilson House are shown as under cultivation, the remainder of the terrain is composed of forest, grasslands, and salt marsh.

55. The first major changes to this landscape occurred during the early 1850s when a series of critical transportation features were introduced. The first of these was the construction of the Port Monmouth Steamboat and Sloop Transportation Company Pier, a structure that extended from the northern end of the present Church Street more than 2000 feet into the bay in order to provide access to vessels moored in deep water. Company vessels carried produce and passengers from Monmouth County to the New York City waterfront. Another significant feature was the plank road constructed at the base of the pier by the Port Monmouth and Middletown Plank Road Company. Running within the corridor of what is today Church Street, it provided an important connection between the new port facilities and the interior farms and villages. Perhaps the most important transportation related development here was the 1856 construction of a rail line extending from Raritan Bay to Delaware Bay by the Raritan and Delaware Railroad Company. After the Civil War, rail-based and maritime shipping, as well as a nascent commercial fish industry centered at Comptons Creek, supported the economies of the growing communities of Port Monmouth and Belford.

56. Areas of Sensitivity - Archaeological. The APEs of several project elements are known to contain or adjoin several cultural resources and areas of archaeological sensitivity associated with the Native American and historic period Euro-American occupations described above. These are delineated within maps and tables that appear in the EIS Cultural Appendix and in the Cultural Resources Investigation, Port Monmouth Combined Flood Control and Shore Protection Feasibility Study (June 1998).

57. Sensitivity rankings of high, moderate and low probability for the presence of Native American and historic period archaeological sites (i.e. archaeological sensitivity) were determined following review of earlier investigations, analysis of historic maps and pedestrian reconnaissance of the entire project area. Areas of high ground adjacent to Pews and Compton Creeks are clearly locations where there is a high potential for Native American prehistoric sites. Within such environments the likelihood of finding buried historic period remains is also high. Proximity to structures depicted on historic maps is a factor favoring the presence of historic period archaeological materials. Areas of moderate probability for Native American and historic sites include higher dry ground, not necessarily bordering waterways, but indicated on historic maps such as the 1844/45 Coastal and Geodetic Survey Map. Low-lying areas, especially within tidal salt marshes, and areas where land modification activities (filling or grading) have occurred are considered less likely to contain cultural materials. Areas subjected to subsurface testing during previous investigations and in which no buried cultural material was found, were also determined to be low probability areas.

58. Areas of Sensitivity - Historic Period Structures. In addition to areas of Native American and historic period Euro-American archaeological sensitivity, several historic structures are located within and adjoining project element APEs. Coordination with agencies and local historians resulted in the identification of one property that is National Register listed and one property that is National Register eligible. Several other properties were identified that will require further evaluation in order to determine whether they are eligible.

59. The Whitlock/Seabrook Wilson House adjoins the APEs of several elements of the Shoreline Protection project component. It is located near the shoreline, on Port Monmouth Road, to the north of its intersection with Wilson Avenue. The structure was listed on the National Register of Historic Places in 1974. Its construction dates to the late 17th or early 18th century. The property's grounds are also archaeologically significant.

60. Small sections of the Raritan and Delaware Railroad embankment fall within the APE of the levee element of the Compton Creek project component, in the vicinity of Park Avenue. Several of the railway features, including the former fill embankment, have been determined eligible for listing on the National Register of Historic Places. The railway line, constructed between 1856 and 1860, originally extended south from the bayshore. A spur was added in 1944, breaking off from the Main line slightly to the south of Park Avenue and curving towards the east.

61. In addition to National Register listed and National Register eligible properties, two properties located on Wilson Avenue are listed in the New Jersey Historic Sites Inventory. These do not directly adjoin any project elements. They include 119 Wilson Avenue (Historic Sites Inventory Number 1331-110) and 94 Wilson Avenue (Historic Sites Inventory Number 1331-109). The former is located on the eastern side of the street. Constructed in 1860-1873, it is classified in the inventory as a "5-bay with

Italianate elements." According to the state inventory form, "this large but stylistically simple house is the dominant feature of the village of Port Monmouth." It is depicted in the 1873 Beers Atlas as belonging to "J. Jiles." The latter structure is located on the western side of the street. Its construction date is 1870-1880. Classified as a "vernacular Victorian," it is described in the state inventory form, as "illustrat[ing] the use of relatively expensive building materials (terra-cotta and brick) on a simple house form."

62. A number of dwellings are located on nearby streets and although not listed on the State Inventory, may be of historic significance and should be further evaluated. Among them are 108 Wilson Avenue and 128 Main Street. The former is on the western side of the street. It has been known as "the Taylor Cottage" and is said to have been occupied by a Wilson who was a potter. 128 Main Street is located on the western side of Main Street, immediately south of its intersection with Wilson. Dating to the late nineteenth century, it is depicted in the 1873 Beers Atlas.

Without Project Future Conditions

63. The without project future conditions at Port Monmouth are identified as continuing erosion of the shoreline with periodic placement of sand by local interests to minimize losses to the beach and dune.

64. Tidal inundation is expected to increase in severity in direct relation to the anticipated rise in relative sea level. Based on long-term trends measured at the Sandy Hook Gage, a rate of 0.014 foot per year increase is anticipated, resulting in a 0.7 foot increase over the analysis period.

65. Environmental degradation is also a concern for the Pews Creek Basin Area (PCBA) as the wetlands are deemed to be subject to continuing losses of Habitat Units of the Black Duck and Marsh Wren in the without project future condition. Natural filling in of the wetlands would have deleterious effects on productive habitat species in the absence of any project implementation.

66. Monmouth County is currently developing a major recreation facility along the Bayshore. In conjunction with this plan, as structures between Port Monmouth Road and the shorefront have been or will be removed as part of the recreation program, the County has acquired the marina at Pews Creek. There are extensive efforts underway to improve navigation and reduce future sedimentation. These efforts have included widening the inlet, constructing a west jetty and raising the east jetty and existing bulkheads. Potential activities as stated in the Bayshore Waterfront Access Plan are: nature interpretation, boating, saltwater swimming, sunbathing, educational program in cooperation with fishing industry, wetlands preservation, and active recreation. Usage is and will continue to be available to all without restriction.

67. A controversial ferry terminal at Belford Harbor providing high-speed access to New York City is under consideration.

III. PROBLEM IDENTIFICATION

Description of the Problem

68. The primary problem encountered in the study area is tidal inundation associated with elevated water levels. Although nuisance flooding can occur during periods of high astronomical tides or minor storms, severe flooding damage results from northeasters and hurricanes (Photos 4 and 5). Due to Port Monmouth's location within the Lower Bay network, the surge elevations during these severe storms can be extreme. The flooding generally results from the surge elevations propagating up the adjacent creeks and spreading over the adjacent marshes. This effort is compounded as storm drainage systems are blocked. By contrast, following the construction of a protective dune in 1966, flooding resulting from overtopping along the Port Monmouth shoreline has been minimal. However, due to ongoing shoreline recession, much of the dune's protective berm has been lost.

Storm History

69. Hurricane of 14 September 1944. This hurricane caused losses estimated at over $2,500,000 (1944 dollars) in the bayshore area. Peak tide height reached 8.4 ft NGVD in the area from Highlands to Keyport and 12.0 inches of rain were recorded in New Brunswick. Boardwalks and several homes in Port Monmouth were destroyed by waves. Tidal stages which exceeded bulkhead heights resulted in washed-out roads, walks and pavements along with the flooding of homes and hotels in Middletown Township.

70. Extratropical Storm of 25 November 1950. This storm, which produced tides of 9.1 feet at Keyport, caused over $2,000,000 (1950 dollars) of damage in the Bayshore area. According to newspaper accounts, there were two deaths, one in Union Beach and another in Keansburg. Rainfall totals were approximately 2.5 inches. The accompanying tides in the New York Harbor area were about one to two feet above the previous maximums recorded during the 1944 hurricane.

71. Adjacent to Port Monmouth at Keansburg, where floodwaters extended almost a mile inland, was placed under martial law. About 1200 residents were evacuated from their homes with the aid of troops and equipment from Fort Monmouth. A section of the eastern end of the boardwalk for a distance of about 150 feet was washed away, and most of the beach concessions and amusement stands were destroyed or severely damaged. A number of homes and business establishments near the beachfront were inundated and damaged.

PHOTO NO. 4 - FLOODING ALONG MOMOUTH AVENUE,
DECEMBER 1992 STORM

PHOTO NO. 5 - FLOODING ALONG MOMOUTH AVENUE,
DECEMBER 1992 STORM

72. Extratropical Storm of 6-7 November 1953. This storm caused damage estimated at $1,630,000 (1953 dollars) with peak tides of 8.9 feet. At Long Branch (Atlantic coast), the strongest wind was measured as 78 miles per hour from the east. Total rainfall was estimated at 1.25 inches. At Port Monmouth damage to bulkheads and jetties was severe. The fish factory at Port Monmouth suspended operations for seven days due to damaged buildings, supplies and other property. Fifteen homes at Port Monmouth were damaged and seven were destroyed by water and wind.

73. As a result of severe damages caused by this storm, the State Legislature of New Jersey organized the "Legislative Commission to Study Sea Storm Damage." The Commission found that direct damage to public property in the Bayshore area was $374,000 (1953 dollars).

74. Hurricane of 12 September 1960 (Donna). Tides produced by Hurricane Donna reached 8.9 feet NGVD at Morgan, 9.9 ft NGVD at Port Monmouth, and 10.5 ft NGVD at Keyport. Tidal damages were estimated at about $6,000,000 (1960 dollars).

75. The western portion of Middletown experienced severe damage. The beaches in East Keansburg were overtopped and many homes were damaged. Near Pews Creek, two homes were totally destroyed and the bridge was washed out. Over 400 persons were evacuated from homes in East Keansburg and Port Monmouth. In Port Monmouth and Belford, where many homes were severely damaged, looting prevention became a major police problem. In Leonardo, the jetties at the State marina were damaged and the homes along the shore suffered minor damage due to flooding.

76. Northeaster of 6-8 March 1962. The storm of 6-8 March produced unusually high wind driven tides and very high waves which battered the shore for three successive days. Public and private damages consisted mainly of beach and dune erosion and damages to the bulkhead, seawalls, groins, boardwalks, buildings and roads along the New Jersey coast. Peak tides at Perth Amboy were 8.1 feet. Damage estimates for the entire Raritan Bay and Sandy Hook area were estimated to be $6,400,000 (1962 dollars).

77. At Port Monmouth, the county bridge over Pews Creek was damaged and made unsafe for traffic. The beach was eroded and cottages on the beach were displaced and damaged by wave action. Roads were eroded and blocked by sand and several homes and schools were evacuated.

78. Northeaster of 12 March 1984. The storm of 12 March produced a mixture of snow, sleet, hail and hurricane force winds. A peak stage of +7.0 ft. MSL was reported at Keansburg. Erosion of the beaches included dune escarpment in Port Monmouth with scarps measuring five to nine feet near Main Street. In Leonardo, erosion of the beaches and dune escarpment accompanied street and property inundation near Wagner Creek. Retaining walls were undermined by high water removing sand. Extensive beach erosion occurred east of the harbor to the harbor light.

79. Northeaster Storm of 11-12 December 1992. The storm caused extensive tidal inundation along the coastal communities of Raritan Bay and Sandy Hook Bay. Extensive wave and erosion damage was also reported. The high tide recorded in the bay was +9.8 ft. NGVD at Luppatatong Creek in Keyport.

80. As a result of this storm, the entire study area was included in a disaster area declaration. Residents, businesses and public organizations were therefore eligible for aid under a variety of Federal disaster assistance programs. Major Federal programs include:

- Individual Financial Assistance (IFA) to provide emergency aid for temporary housing. Data indicates that within the study area 71 applicants received $127,250 in assistance.
- Individual Financial Grants (IFG) to provide assistance to eligible applicants in repairing uninsured damages. Data for the study area indicates 25 grants totaling $55,310 were issued.
- Small Business Administration (SBA) low interest loans to provide individual residents or businesses assistance in restoring properties. Within the study area 103 SBA applications were provided.

81. The Port Monmouth side of Pews Creek had previously experienced one section of failed bulkhead before the storm. The storm caused that failure to become more severe, and caused another section to fail. The stockpile of dredge spoil from Pews Creek was severely eroded. The newly constructed fishing pier located approximately 1000 feet north of the Spy House Museum sustained approximately 20% damage. The dunes fronting the Spy House were destroyed. Dunes to the east and west of the museum were severely eroded with a remaining vertical scarp of approximately 15 feet. Severe flooding occurred throughout the community (Photos 4 and 5).

Shoreline Erosion

82. Landward shoreline retreat seems the dominant trend, as three of the four time periods feature an almost exclusive shoreline loss. The period 1836-1957 experienced retreat of 1.1 ft/yr over nearly the entire shoreline length, but particularly severe at Pews Creek and at the central length of the shoreline. Shoreline data from the following period show the effect of the post-1962 Northeaster beach fill and dune project that the state of New Jersey constructed in 1966. Shoreline width increases as great as 365 feet contributed to an average shoreline growth of 240 feet. During the years 1970/76 to 1988, the shoreline experienced a return to the pre-project trend. In recent years, the dune along the center of the study area in the vicinity of the Spy House has experienced additional erosion (Photos No. 6 and No.7).

PHOTO NO. 6 - RECENT DUNE EROSION
ALONG CENTER OF STUDY AREA SHORELINE

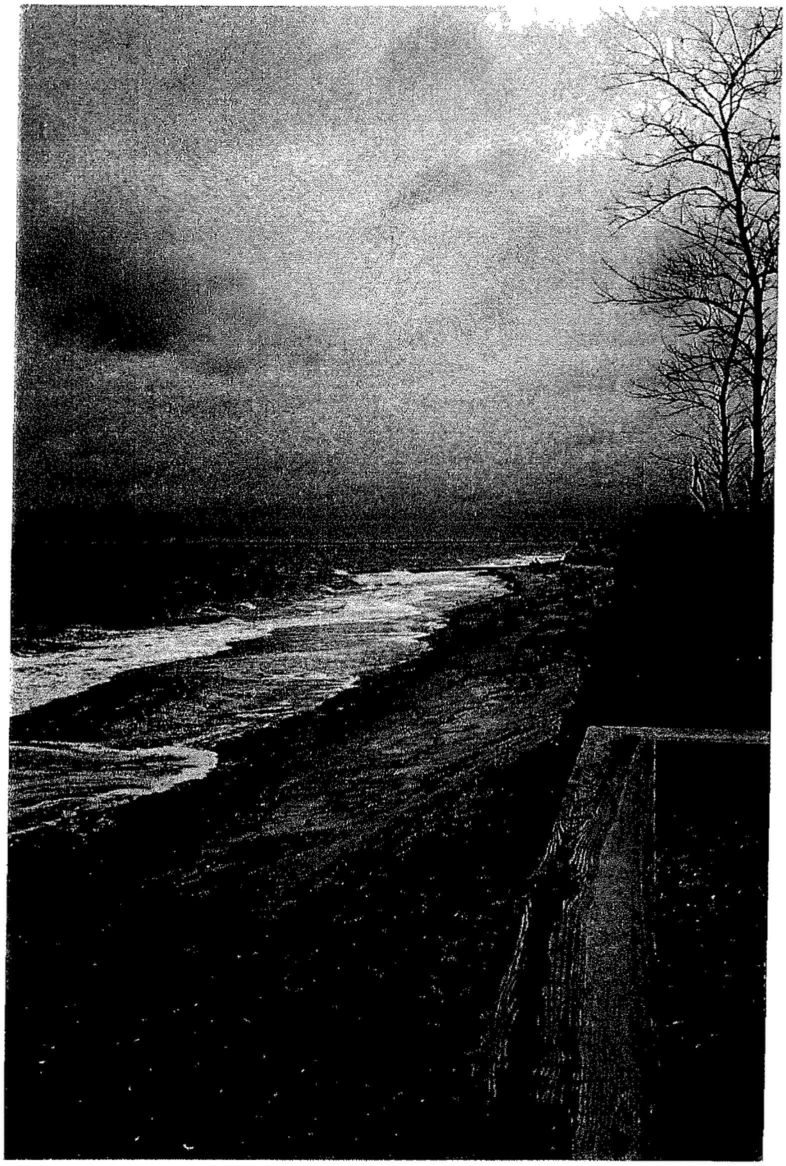


PHOTO NO. 7 - RECENT DUNE EROSION
ALONG CENTER OF STUDY AREA SHORELINE

83. A volumetric analysis indicates that the shoreline experiences a mild volumetric erosion rate (Appendix A), which is greatest in the area's central reach. From 1836 to 1957, 323,000 cubic yards (-2,700 c.y. annually) eroded from the project area. The next period, 1957 to 1970/76, saw the shoreline gain 592,000 cubic yards due to the 1966 beach fill project (NJ, 1966). From 1970/76 to 1988, the shoreline returned to its previous erosional trend, but with accretion near the creeks; total losses were 135,000 cubic yards, or -9,000 cubic yards per year. The next period, 1988 to 1995 has seen a trend toward reduced erosion, with losses totaling 51,000 cubic yards, or 6,500 cubic yards per year.

Reach Designation

84. To assist in determining the impacts of plans of protection, flood damages are analyzed relative to spatial floodplain reaches. The reach designation is used to define the initial source of flooding for any structure, 'C' for Compton Creek and 'P' for Pews Creek and whether the structure is located on the left or right bank of the creek (looking downstream). An additional numerical designation was assigned to allow damages to be aggregated relative to the impacts or anticipated protection plans. This procedure yielded the ten reaches shown in Figure 5. Table 2 provides a summary of development within each of the reaches. This data was used to develop detailed estimates of storm damage.

Quantification of Storm Damage

85. Storm damage was evaluated for the full range of possible storm elevations using the following basic steps:

- Inventory flood plain development
- Estimate depreciated replacement costs
- Assign generalized damage functions
- Calculate aggregate stage vs. damage relationships

86. The damage calculations were performed using the HEC-FDA Flood Damage Analysis computer program. This program applies Monte Carlo Simulation to calculate expected damage values while explicitly accounting for uncertainty in the input data.

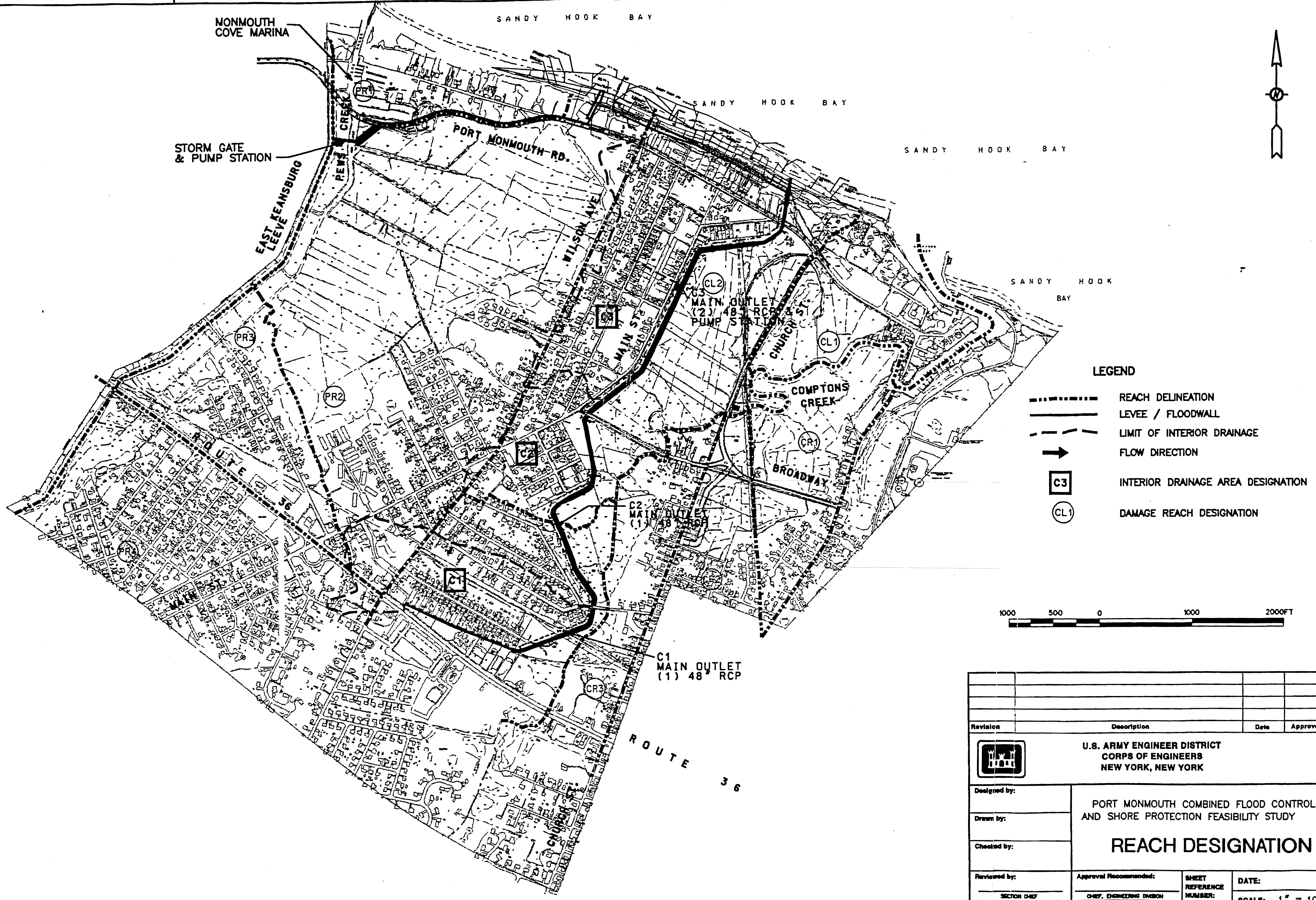
87. Under current Corps guidance, risk and uncertainty must be incorporated in flood damage reduction calculations. The following areas of uncertainty were incorporated into the calculation of damage:

- First floor elevation
- Structure value
- Content-to-structure value
- Other-to-structure value

USAGE/REACH	CL1	CL2	CL3	CR1	CR2	CR3	PR1	PR2	PR3	PR4*	TOTAL
Non-Residential Structures:											
21-Art Gallery							4				*4*
22-Auto Sales					2						*2*
23-Auto Service		1			2			1			*4*
24-Bank								1			*1*
25-Bar					2			1			*3*
26-Bathhouse								1			*1*
27-Church		1				1					*2*
28-Clothing Store						1		1			*2*
30-Diner		1			1		1	4			*7*
31-Drug Store								1			*1*
32-Dry Cleaning								1			*1*
33-Food Store			1					1	1		*3*
34-Funeral Home					1						*1*
35-Hair Salon								2			*2*
36-Hardware			1		1			1	1		*4*
40-Jewelers								1			*1*
41-Liquors			1								*1*
42-Marina				2			1				*3*
44-Office					1	1		2			*4*
45-Office Warehouse	1										*1*
47-Restaurant				1							*1*
49-Small Retail			3					4			*7*
51-Vacant	5		1	1	1			2			*10*
71-Food/Kindred Prods.	4										*4*
77-Printing/Publishing					1						*1*
82-Electrical					1						*1*
86-Light Industry					1						*1*
150-Garage			1					1			*2*
160-Parking Lot											*0*
201-Fire House					1			1			*2*
202-Storage Garage					2						*2*
206-Schools						1					*1*
207-Rescue Squad								1			*1*
208-Library								1			*1*
209-Post Office								1			*1*
210-General Storage			1								*1*
Subtotal, Non-Residential	**10**	**3**	**9**	**4**	**17**	**4**	**6**	**29**	**2**	**4**	***88***
Residential Structures:											
1-Colonial		61	48	5	93	23	3	75	6		*314*
2-Cape Cod		55	63	1	61	6	3	81	21		*291*
3-Ranch		92	54	1	38	9	1	68	25		*288*
4-Split Level		2			1			7	3		*13*
5-BiLevel		16	6	3	8	2	1	14	5		*55*
6-Raised Ranch		6	8		6		1	10	1		*32*
7-Bungalow		14		1	2		7	5			*29*
9-Mobile Home							2				*2*
10-Two Family		2			4			2			*8*
11-Duplex					2		2	2			*6*
12-Multi Family		2						2	1		*5*
13-Garden Apartment		3						12			*15*
Subtotal, Residential	**0**	**253**	**179**	**11**	**215**	**40**	**20**	**278**	**62**	**117**	*1,175*
TOTAL	**10**	**256**	**188**	**15**	**232**	**44**	**26**	**307**	**64**	**121**	***1,263***

*Note: Detailed distribution of structure types not available for Reach PR4

TABLE 2 - SUMMARY OF DEVELOPMENT WITHIN EACH REACH



Revision	Description	Date	Approved

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

Designed by:

Drawn by:

Checked by:

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

REACH DESIGNATION

Reviewed by:
SECTION CHIEF

Concurred by:
CHIEF, DESIGN BRANCH

Approval Recommended:
CHIEF, ENGINEERING DIVISION

Approval By:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:

SCALE: 1" = 1000'

FIG.: 5

bnd1000.dgn Jun 11 1998 16:03:40

88. The initial step in determining damage was the development of a structural database. The building data was obtained through a windshield survey of the area using topographic mapping with a scale of 1" = 100' with a 2-foot contour interval.

89. The data collected was used to categorize the structure population into groups having common physical features. Data pertaining to structure usage, size, and stories assisted in the stratification of the building population. For each building, data was also gathered pertaining to damage potential including ground and main floor elevations, lowest opening, size, construction material and the condition as related to structure value depreciation. The value of each building in the flood plain was calculated using standard building costs estimating procedures from Means & Marshall & Swift.

90. Generalized damage functions for structure damage, content damage and other damage were applied to the residential and non-residential structures. All of the damage functions used for this investigation were developed from on-site surveys conducted during the Passaic River Study. The damage functions reflect damages as a percent of structural value over a full range of water depths and were applied on a structure by structure basis to determine damages at one-foot increments of flood stage.

91. Based on the type, usage and size of each structure inventoried, damage was calculated relative to the main floor of the structure. Using structure and ground elevation data these depth vs. damage relationships were converted to corresponding stage (NGVD) vs. damage relationships.

92. The stage vs. damage data was combined with the stage vs. frequency data using the simulation routines of the HEC-FDA computer program. The HEC-FDA program quantifies uncertainty in discharge-frequency, stage-discharge, and stage-damage functions and incorporates it into economic and performance analyses of alternatives. The process applies a procedure (Monte Carlo Simulation) that computes the expected value of damage while accounting for uncertainty in the basic value. The expected equivalent annual damages for each reach are presented in Table 3.

TABLE 3
SUMMARY OF EQUIVALENT ANNUAL DAMAGE
(50-YEAR PERIOD, 6-5/8% DISCOUNT RATE)
BY DAMAGE CATEGORIES & DAMAGE REACHES

	Damage Categories						
Damage Reach	Residential	Apartment	Commercial	Industrial	Municipal	Public Emergency	Total
PR1	$80,180	$0	$42,150	$0	$0	$1,670	**$124,000**
PR2	$419,510	$19,200	$6,650	$0	$1,800	$5,450	**$452,620**
PR3	$336,690	$0	$16,490	$0	$0	$4,250	**$357,430**
PR4	$460,710	$0	$13,810	$0	$0	$0	**$474,520**
Subtotal Pews Creek	$1,297,090	$19,200	$79,100	$0	$1,800	$11,380	**$1,408,570**
CR1	$68,780	$0	$43,960	$0	$0	$1,520	**$114,250**
CR2	$136,980	$0	$13,290	$5,510	$1,900	$1,750	**$159,430**
CR3	$106,700	$0	$24,350	$0	$5,810	$1,550	**$138,410**
CL1	$0	$0	$87,960	$282,690	$0	$4,580	**$375,230**
CL2	$1,809,870	$8,640	$27,380	$0	$13,280	$22,810	**$1,881,970**
CL3	$277,610	$0	$50,370	$0	$200	$4,440	**$332,630**
Subtotal Compton Creek	$2,399,940	$8,640	$247,290	$288,200	$21,200	$36,650	**$3,001,910**
TOTAL	**$3,697,030**	**$27,840**	**$326,390**	**$288,200**	**$23,000**	**$48,030**	**$4,410,480**

IV. PLANNING NEEDS, OBJECTIVES AND CONSTRAINTS

Current Needs

93. The greatest need in the study area is for an effective storm damage reduction program that provides acceptable levels of protection from the impacts of tidal inundation. Due to the low elevations of the land along the area's creeks, an effective barrier against high bay surges from both the bay and its adjoining creeks is a necessary component of a comprehensive plan of protection.

94. In addition, along some portions of the study area, storm-driven waves have resulted in erosion of beaches and dunes. Stabilization of these areas is needed to ensure the integrity and effectiveness of any storm surge barrier as well as to protect upland structures from damaging waves and storm recession.

Planning Objectives

95. Planning objectives are identified based on the needs and opportunities, as well as on existing physical and environmental conditions present in the project area. In general, the prime Federal objective is to contribute to the National Economic Development (NED) account consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders and other Federal planning requirements. Accordingly, the following objectives have been identified:

96. General

- Meet the specified needs and concerns of the general public within the study area.
- Respond to expressed public desires and preferences.
- Be flexible to accommodate changing economic, social and environmental patterns and changing technologies.
- Integrate with and be complementary to other related programs in the study area.
- Establish and document financial and institutional capabilities and public consensus.

97. Specific

- Reduce the threat of potential future damages due to the effects of inundation and storm recession and related processes.
- Prevent or mitigate the effect of the long-term erosion that is now being experienced.
- Enhance the recreational potential of the area.
- Enhance the function of significant environmental resources.

Planning Constraints

98. The formulation and evaluation of alternative plans are constrained by technical, environmental, economic, regional, social and institutional considerations. These are:

99. Technical

- Plans must represent sound, safe, acceptable engineering solutions.
- Plans must be in compliance with good engineering practice.
- Plans must be realistic and state-of-the-art. They must not rely on future research and development of key components.
- Plans must provide inundation damage and storm damage protection.
- Plans must provide features to minimize the effect of shoreline erosion processes.

100. Economic

- Plans must be efficient, representing optimal use of resources.
- Accomplishment of one economic purpose cannot unreasonably impact another economic system.
- The economic justification of the proposed project must be determined by comparing the average annual tangible economic benefits which would be realized over the project life with the average costs. The average annual benefits must equal or exceed the annual costs.

101. Environmental

- Plans cannot unreasonably impact environmental resources.
- Where a potential impact is established, plans must first consider avoidance and minimization of impacts before compensatory mitigation.
- Where opportunities exist to enhance significant environmental resources, the plan should incorporate all justified measures.

102. Regional and Social

- All reasonable opportunities for development within the study scope must be weighed one against the other. The views of State and local public interests regarding the opportunities must be solicited.
- The needs of other regions must be considered; one area cannot be favored to the unacceptable detriment of another.

103. Institutional

- Plans must be consistent with existing Federal, State and local laws.
- Plans must be locally supported to the extent that local interests must, in the form of a signed local cooperation agreement, guarantee all items of local cooperation including cost sharing.
- Local interests must agree to provide public access to the beach in accordance with all requirements of federal and state, laws and regulations.
- The plan must be fair and find overall support in the region and state.

V. PLAN FORMULATION

Identification of Protection Components

104. The alternative plans have been formulated both overall and as four separate protection components, all of which are necessary to provide protection from storm damage and flooding. Separate discussions are included of plans for the Raritan Bay shorefront, Pews Creek, Compton Creek and interior drainage. Each of these components has been formulated with consideration of avoiding or minimizing environmental impacts. The planning also included development of a fifth component, environmental mitigation, to meet planning requirements in addressing environmental impacts.

Screening of Protection Features

105. The following sections briefly describe the objectives for and the evaluation of potential planning alternatives.

106. No Action. This plan means no additional Federal actions would be taken to provide for storm damage protection. This plan fails to meet any of the objectives or needs for the project, but it provides the base against which the project benefits are measured. Additionally, this plan would be implemented if project costs exceed project benefits thus indicating that protection measures are not in the Federal interest under current NED guidelines.

Non-Structural Measures

107. Buy-out Plan. Permanent evacuation of existing areas subject to erosion and/or inundation involves the acquisition of this land and its structures either by purchase or by exercising the powers of eminent domain. Following this action, all development in these areas is either demolished or relocated. Since the depreciated replacement cost of structures in the 100 year flood plain is estimated to be $88,000,000, the cost of this plan, including land and relocation would be prohibitively expensive and was dropped from consideration as a comprehensive solution. Limited buy-outs may be an effective means to enhance or supplement protection provided by other alternatives.

108. Zoning. Through proper land use regulation, floodplains can be managed to insure that their use is compatible with the severity of a flood hazard. Several means of regulation are available, including zoning ordinances, subdivision regulations, and building and housing codes. Their purpose is to reduce losses by controlling the future use of floodplain lands, and would not be effective in mitigating the existing hazard.

109. Floodproofing. Floodproofing, by definition, is a body of techniques for preventing damages due to floods; requiring adjustments both to structures and to building contents. It involves keeping water out as well as reducing the effects of water entry. Such adjustments can be applied by an individual or as part of a collective action either

when buildings are under construction or during remodeling or expansion of existing structures. Floodproofing, like other methods of preventing flood damages, has its limitations. It can generate a false sense of security and discourage timely evacuations. Indiscriminately used, it can tend to increase the uneconomical use of floodplains resulting from unregulated floodplain development. Floodproofing including raising structures can reduce damages but would still leave residents stranded and separated from emergency services.

Structural Measures

110. The following sections briefly describe various structural protection techniques considered as elements of a comprehensive solution.

111. Channelization. Channelizing creeks would not be effective, as the controlling water surface is the storm surge in the bays. Channelization usually is a desirable choice if the flooding is due to rain water, as it allows for a larger escape facility, however in the case with Port Monmouth this would allow a larger and deeper opening for the storm surge to cause flooding. Removal of accumulated silt or shoals can assist in promoting local drainage for frequent storm events.

112. Floodwalls and Levees Floodwalls and levees are intended to provide protection against coastal and riverine flooding in the absence of waves. These structures can be cost-effective measures against tidal flooding when placed landward of direct wave exposure. Used in this manner, floodwalls and levees provide flood protection to interior structures. While floodwalls and levees provide a cost-effective means to prevent flooding of low-lying areas, runoff trapped behind the structure may affect the hydrology and drainage of interior areas. This may alter tidal wetlands and require additional drainage facilities.

113. Closure/Store Gates. As tidal surges enter Pews Creek, existing levees at +15 NGVD along the left bank protect the communities of East Keansburg and Keansburg. This protection could be extended to Port Monmouth by constructing a tidal closure gate across Pews Creek in the vicinity of the Port Monmouth Road bridge. During tidal flood events the gates would be closed and high flows in Pews Creek would be pumped across the closure. Additionally, road closure gates would be required at levee and floodwall road crossing locations.

114. The lack of high ground on the right bank of Compton Creek precludes reliable or efficient implementation of a closure gate at that location.

115. Beach Nourishment. Beach nourishment involves the placement of sand on an eroding shoreline to restore its form and to provide adequate protection. A beach fill design typically includes a berm backed by a dune and both elements combine to prevent erosion and inundation damages to leeward areas. Beach nourishment represents a more natural-like method for reducing storm damages. Beach nourishment requires a long-

term commitment to offset long-term shoreline erosion, and may be costly along highly eroded shorelines. Federal participation in periodic nourishment would be limited to a period of 50 years from completion of project construction.

116. Beach Nourishment With Structures. Structures such as terminal groins placed at the east and west end of a beach nourishment project would reduce erosion rates. This would reduce the long-term maintenance requirement while providing for erosion and inundation protection.

117. Shore Stabilization. Shore stabilization measures offer both flooding and erosion protection for shorefront structures, and reduce flooding of low-lying interior areas. Structure types include bulkheads, seawalls/floodwalls, and revetments. Shore stabilization measures limit landward movement of the shoreline and minimize overtopping floodwaters. In combination with beach nourishment, these structures can provide long-term storm damage reduction. Costs can be high depending on the extent and severity of existing shoreline problems.

118. Results of First Phase Screening: Features for Further Analysis. Each plan of protection for the Port Monmouth area requires the use of a combination of protective features to address the variety of conditions, which exist along the site. The following elements are applicable to a comprehensive plan:

(1) Floodwalls and Levees
(2) Beach Nourishment
(3) Shore Stabilization
(4) Closure Gates
(5) Floodproofing (Non-Structural Measure)
(6) Limited Buy-outs
(7) Storm gates

119. Initial screenings provided the following insights:

No Action – Does not meet project goals

Non-structural Measures:
Buy-outs- Susceptible development would be demolished and relocated. This was deemed very costly
Zoning- This would curtail future use of floodplain lands but does little to mitigate present hazards

Floodproofing –Adjustments to structures. Can induce use of floodplains. Induce false sense of security and discourages evacuation. Initial indications showed that this measure may not be as feasible for the nearly 1000 structures within the 100 year floodplain that are subject to main floor flooding, with continued stranding of residents. But localized floodproofing still deemed to have potential for application.

Structural Measur :
Floodwalls/Levees – Protects structures against riverine and coastal flooding but traps interior water
Closure gates – A necessary ancillary project feature at road crossings where road transitioning limited
Storm gate – Initial concerns over operability and maintenance related to division of responsibilities between local jurisdictional entities and associated logistics.
Beach nourishment – Some long term costs but provides erosion and inundation control in accord with CZM
Beach Nourishment with Shore structures– Reduce erosion and long term maintenance but could be m costly initially.

Secondary Screening of Alternatives

120. As part of the formulation and NEPA process, the Corps screened alternatives a looked at arrays of potential solutions. The principal elements considered in t evaluation of the alternatives included engineering feasibility, environmental impacts, economic implications, and social consequences:

(1) Engineering Feasibility - Consideration was given to several flood control measures, including non-structural and structural solutions. Sound engineering judgment was utilized in selecting the structural components for each alternate. Existing topography, wetlands, buildings, roadways and drainage patterns were some of the constraints which had to be accommodated in the design process. The structural alternatives were designed to provide protection from tidal inundation for several possible levels of protection, including the 100-year storm event.

(2) Environmental Impacts - Each alternate involves different amounts of long-term tidal wetland impact in the Port Monmouth area ranging from almost 0 to nearly 90 acres. These assessments were made based upon preliminary delineations of wetlands which were later more rigorously refined. Some wildlife may be affected as a result of construction along with temporary noise and traffic pollution.

(3) Economic Implications - Construction costs were estimated for each alternative. It should be noted that these costs are for screening purposes only and do not reflect the results of detailed design and environmen ssessments.

(4) Social Consequences - The public will experience the negative impacts of property acquisitions, environmental impacts, visual aesthetics (floodwalls or levees) and inconvenience due to construction, but minimization of flooding will greatly improve the quality of life in the Port Monmouth area.

121. During the second phase analysis, the four principal elements (mentioned above) in evaluating hurricane and storm damage reduction were considered in the initial development of three primary alignment components for Compton Creek, the Bay Shorefront and Pews Creek:

Compton Creek ('C' array alternatives -C1, C2, C3 and C4)
Bay Shore ('S' shorefront array alternatives-S1, S2, S3 and S4)
Pews Creek ('P' array alternatives-P1, P2, P3 and P4)

122. Permutations of plans resulted in 64 distinct combined alternative alignments. Additionally, 3 non-structural plans were investigated for a total of 67 preliminary plans. Primary features and impacts for each of these alternatives have been assessed. The combination of C4-S1-P4 alignment is comparable to the plan recommended at the Reconnaissance level updated to reflect new survey and hydraulic model results.

123. Preliminary evaluation screenings were based on a cost of $150,000 for property acquisitions per structure and $100,000 per acre for direct wetlands disturbance and $50,000 per acre for indirect wetland disturbance.

124. The benefits provided by such a project include the protection of human life and property. In addition, the inconveniences and costs of nuisance flooding will be avoided.

125. Alternative plans were developed to provide protection from impacts of tidal inundation associated with a 100 year return period storm. This type of event would result in a combined stage frequency of 12.2 feet NGVD. The line of protection top elevation of +14 ft NGVD was used for the comparison of the alternatives. The +14 ft NGVD elevation would provide nearly a 90% reliability of protection against a 100 year storm event.

Alternatives Considered

126. Compton Creek Alternatives. Protection along Compton Creek considered four alternative levee/floodwall alignments with closure structures at Campbell Road and Main Street. Table 4 presents a summary of the four alternatives. Alternative C1 is

TABLE 4
PORT MONMOUTH FEASIBILITY
SUMMARY OF IMPACTS OF COMPTON CREEK ALTERNATIVES

Alternative Plan Components	Directly Impacted Wetlands (acres)	Total Impacted Wetlands (acres)	Number of Buyouts Required	Additional Impacts	Plan Elements
C1	10.07	43.60	0	600 ft elevated roads (2 roads) 2 road closure gates 35 parcels require temp. or perm. easements	Levee length = 7,300 ft 2 roadway closure gates Elevated road length = 600 ft
C2	10.97	11.95	0	600 ft elevated roads (2 roads) 2 road closure gates 30 parcels require temp. or perm. easements	Levee length = 8,100 ft 2 roadway closure gates Elevated road length = 600 ft
C3	0.14	2	4	600 ft elevated roads (2 roads) 2 road closure gates 30 parcels require temp. or perm. easements	Levee length = 1,500 ft Floodwall length = 7,300 ft Elevated road length = 600 ft 2 road closure gates
C4	6.41	9.63	0	600 ft elevated roads (2 roads) 2 road closure gates 25 parcels require temp. or perm. easements	Levee length = 5,000 ft Floodwall length = 3,100 ft Elevated road length = 600 ft 2 road closure gates

comprised of an earthen levee commencing at the intersection of Wilson Ave. and Route 36 and proceeding easterly along the properties on the south side of Willow Ave., continuing north paralleling the westerly side of Compton Creek, crossing Port Monmouth Road and terminating at the dunes along the northern limits of Port Monmouth. Approximately 53 acres of tidal wetlands are impacted; 10 due to the levee footprint and 43 due to potential changes in wetland hydrology.

127. Alternative C2 is also comprised of earthen levees, however this alternative is slightly longer than C1 because it follows a more circuitous path to avoid more wetlands areas. The levee commences near the intersection of Wilson Ave. and Route 36 and proceeds easterly along the properties northerly and follows the eastern edge of the developed upland area through the wetlands and eventually ties into the dunes along Sandy Hook Bay. Approximately 23 acres of wetlands are impacted; 11 due to the levee itself and 12 due to the potential changes in wetland hydrology.

128. Alternative C3 is comprised of earthen levees and floodwalls. The increased use of floodwalls was intended to minimize the direct impacts to the wetland areas. The levee alignment commences near the intersection of Wilson Ave. and Route 36 and proceeds easterly along the rear yards of properties on the south side of Willow Avenue to the eastern terminus of Willow Ave. The alignment proceeds northerly as a sheet pile floodwall with a concrete cap following the upland side of the wetlands to limit line. The alignment proceeds northerly as a floodwall along the eastern right-of-way of Main Street. The levee section continues from this point to Port Monmouth Rd. and terminates at the dunes along Sandy Hook Bay. Approximately 2 acres of tidal wetlands will be impacted due to the interruption of tidal inundation and altering its hydrology. Four property acquisitions are required for this alternative.

129. Alternative C4 is also comprised of an earthen levee and floodwall. The alignment follows the same path as alternative C2. Approximately 16 acres of tidal wetlands will be impacted; 9.6 acres due to the levee/floodwall footprint and 6.4 acres due to potential changes in hydrology. Table 4 provides a summary of these details.

130. Shorefront Alternatives. Protection along the bay shoreline considered various dune/berm systems or seawall/floodwall system with periodic nourishment to stabilize the design. The design was developed based primarily on hurricane storm damage reduction features, and secondly on flood control features. Limits of protection along the bay were adjusted as necessary to provide closure for protection along Pews and Compton Creeks. Alternative S1 utilizes a 40 foot wide dune at elevation 16 feet NGVD, sloping gently to the bay. The dune elevation was 2 feet higher than the levee elevation to provide protection against wave runup. Alternative S2 has a beach and dune section as in alternative S1, however to reduce erosion rates the beach fill would be stabilized by terminal groins at the east and west limits of the fill. Alternative S3 provides protection via construction of a vertical floodwall which would tie into the adjacent flood control structures. Alternative S4 utilizes a relocated dune similar to alternative S1 but located at a more landward location with the exception of the location

from the Spy House to the fishing pier. The historical site would be protected by a sheetpile floodwall. Table 5 provides a summary of alternatives.

131. Pew Creek. Protection along Pews Creek considered four levee alignments which are summarized in Table 6. Alternative P1 consists of an earthen levee from the Keansburg Beach Erosion/Hurricane Protection Improvement Levee, southwest of the Monmouth Cove Marina, and proceeds east towards Pews Creek where a tidal gate and pump station will span the creek to control flooding from tidal as well as fluvial flows. A combination of levee and floodwalls continues from the crossing of the creek easterly then northerly crossing Port Monmouth Rd. and finally terminating at the dune along Sandy Hook Bay. About 2 acres of tidal wetlands will be impacted by the levee, tide gate, and pump station.

132. Alternative P2 consists of earthen levees commencing near the intersection of Bray Ave. and Main Street then proceeding in a northwest direction continuing along the eastern edge of the wetland area and tying off at the dunes located along Sandy Hook Bay. Approximately 33.1 acres of wetlands will be impacted; 8.3 due to the levee itself and 24.8 due to the change of the area's hydrology and tidal inundation.

133. Alternative P3 consists of earthen levees and sheet pile floodwalls. The levee alignment starts near the intersection of Bray Ave. and Main St. and proceeds northerly towards the wetlands area, continues northerly at the wetlands limit boundary as a floodwall, thence northeasterly to the western terminus of Gordon Court, where it becomes a levee again. Near the western terminus of Plymouth Ave. the alignment follows the wetland limit line, crosses Lydia Place and along the western side of Wilson Ave. The alignment turns west along the upland side of the wetland limit line to Port Monmouth Rd. and terminates at the dunes along Sandy Hook Bay. There are no wetlands estimated to be impacted by this alignment. Approximately 10 property acquisitions are required.

134. Alternative P4 is a combination of alignments P2 and P3 and consists of earthen levees and sheet pile floodwalls with a concrete cap. The alignment commences near the intersection of Bray Avenue and Main Street and proceeds in a northwesterly direction to the wetland limit line, follows the upland side of the wetland limit line in a northeasterly direction until it reaches the northern terminus of Gordon Court and proceeds in a northerly direction into the tidal wetlands. The route heads in a northerly direction along the eastern edge of the wetlands until it crosses Port Monmouth Rd. and proceeds north terminating at the dunes along Sandy Hook Bay. Approximately 26.4 acres of wetlands are impacted; 6.5 due to the levee/floodwall itself and 19.9 due to

TABLE 5
PORT MONMOUTH FEASIBILITY
SUMMARY OF SHOREFRONT ALTERNATIVES

Alternative Plan Components	Additional Impacts	Plan Elements
S1	Dune x-sect & footprint made larger Beachface widened Beach veg. impacted during const. Fill not stabilized, no reduction in beach erosion, need future nourishment Amount sand transport to Compton and Pew Creeks unchanged	Dune length = 3,700 ft with alternative P1 Dune length = 2,500 ft with alternatives P2-P4 2-3 dune overwalks Dune vegetation
S2	Dune x-sect & footprint made larger Beachface widened Beach veg. impacted during const. Fill stabilized to reduce erosion, less future nourishment Amount sand transport to Compton and Pews Creeks reduced	Dune length = 3,700 ft with alternative P1 Dune length = 2,500 ft with alternatives P2-P4 Two rock groins 2-3 dune overwalks Dune vegetation
S3	Dune x-sect & footprint may be reduced Beachface may be reduced Beach veg. not impacted during const. Fill not stabilized, no reduction in beach erosion, need future nourishment Least construction impacts of shorefront alternatives Amount sand transport to Compton and Pews Creeks unchanged	Seawall length = 3,900 ft with alternative P1 Seawall length = 2,700 ft with alternatives P2-P4
S4	New, larger dune created Dune veg. impacted during const. No reduction in beach erosion, need future nourishment Amount sand transport to Compton and Pews Creeks unchanged	Floodwall length = 600 ft Dune length = 3,100 ft with alternative P1 Dune length = 1,800 ft with alternatives P2-P4 Dune overwalk and vegetation

potential changes in hydrology. Table 6 provides a summary of details for the Pews Creek alternatives.

135. Non-Structural. Three non-structural alternatives were considered so as to minimize the environmental impacts. Table 7 provides a summary of the impacts of the alternatives. Alternative N1 considered providing protection to a stage of 14.0 ft. NGVD, the same level of protection as the structural alternatives. This alternative includes 571 raisings, 232 floodproofings (including the fire station, rescue squad, and part of Bayshore Village Apartment) and 12 ringwalls (including Shoal Harbor Museum building, a day care facility, and part of Bayshore Village Apartments). Buy outs would be required for 67 residential and 1 commercial properties. Shoal Harbor Live Lobster, the Seafood Corp., the Fish Co-op, and the county marina were excluded from the plan due to their unique configuration and shorefront access needs.

136. Secondary environmental impacts may result as displaced owners will require new housing in a community where developable land is limited. Relocation of residents will create a significant social hardship and may prove to be entirely unfeasible. This plan would not provide complete protection since many locations, including the fire station, rescue squad and a daycare facility would remain inaccessible during the design storm. Accordingly this plan is not effective in eliminating threats to public safety.

137. Alternative N2 consists of non-structural flood protection against the 100 year event with only 1 ft. of freeboard would require protection to 12.8 ft. NGVD. Preliminary assessment indicates 479 raisings, 157 floodproofings (including the fire station and a daycare facility), and 7 ringwalls would be required. Buy outs would be required at 37 residential and 1 commercial properties. As with Alternative N1 the Shoal Harbor Live Lobster, the Seafood Corp., the Fish Co-op and the county marina would not be protected.

138. Similarly to alternative N1, secondary environmental impacts, significant disruption and hardship may result from relocation of displaced residents. The fire station and the daycare facility, would remain inaccessible during the design storm presenting a threat to public safety.

139. A third non-structural alternative was developed which would not require buy outs and relocation. Construction of non-structural flood protection against the 25 year event with 1 ft. freeboard would require protection to 10.2 ft. NGVD for 433 buildings. Preliminary assessment indicates 268 raisings, 161 flood proofings, and 4 ringwalls would be required. As with Alternative N1 and Alternative N2, the Shoal Harbor Live Lobster, the Seafood Corp., the Fish Co-op and the marina will be excluded from the plan due to their operational needs.

TABLE 6
PORT MONMOUTH FEASIBILITY
SUMMARY OF PEWS CREEK ALTERNATIVES

Alternative Plan Components	Directly Impacted Wetlands (acres)	Total Impacted Wetlands (acres)	Number of Buyouts Required	Additional Impacts	Plan Elements
P1	2.45	2.45	0	Storm gate employed only during storm tides Pump station 650 ft elevated road Closure gate on marina access road 7 parcels require temp. or perm. easements	Levee/floodwall length = 1900 ft 1 storm gate Pump station Elevated road length = 650 ft
P2	8.33	33.11	0	450 ft elevated roads 42 parcels require temp. or perm. easements	Levee length = 6,600 ft Elevated road length = 450 ft
P3	0	0	10	450 ft elevated roads (2 roads) 59 parcels require temp. or perm easements	Levee length = 3,100 ft Floodwall length = 4,300 ft Elevated road length = 450 ft
P4	6.52	26.41	0	450 ft elevated road 59 parcels require temp. or perm. Easements	Levee length = 6,000 ft Floodwall length = 1,100 ft Elevated road length = 450 ft

TABLE 7
PORT MONMOUTH FEASIBILITY
SUMMARY OF NONSTRUCTURAL ALTERNATIVES

Alternative Plan Components	Directly Impacted Wetlands (acres)	Total Impacted Wetlands (acres)	Number of Buyouts Required	Number of Raisings Required	Number of Floodproofings Required	Number of Ringwalls Required	Additional Impacts
N1 (1)	0	0	68	571	232	12	• Protection to stage 14.0 ft NGVD • Environmental impacts limited • Secondary env. impacts may result from relocation of displaced residents • Fire station, rescue squad, and daycare facility inaccessible during design storm • Not effective in eliminating threats to public safety
N2 (2)	0	0	38	479	157	7	• Protection to stage 12.8 ft NGVD • Environmental impacts limited • Secondary env. impacts may result from relocation of displaced residents • Fire station & daycare facility inaccessible during design storm • Not effective in eliminating threats to public safety
N3 (3)	0	0	0	268	161	4	• Protection to stage 10.2 ft NGVD • Environmental impacts limited • Low level of design would result in greater than a 1 in 3 chance design storm exceeded at least once over any 10 year period • Not effective in eliminating threats to public safety

(1) Non-structural alternative N1 provides protection to a stage of 14.0 ft NGVD, the same level of protection as the structural alternatives. The 14.0 feet represents one standard deviation above the mean 100-year flood elevation.

(2) Non-structural alternative N2 provides protection against a 100-year event with 1 ft of freeboard (stage of 12.8 ft NGVD)

(3) Non-structural alternative N3 provides protection against a 25-year event with 1 ft of freeboard (stage of 10.2 ft NGVD)

140. While this plan would not require relocation of any floodplain residents, the flood protection provided would be highly unreliable. The low level of design would result in greater than a 1 in 3 chance that the design storm would be exceeded at least once over any 10 year period. There is only a 13% chance that the design would be successful over the 50 year period of analysis. Details of the non-structural alternative are presented in Table 7.

141. N3 would be the only plan comparable to structural solutions in terms of cost but would not provide reliable protection. N1 and N2, although technically feasible, were significantly more costly than comparable structural solutions. Therefore, these three plan alternatives were dropped from further consideration; however, elements of N3 were considered for localized application.

Summary: Secondary Screening

142. With the exception of non-structural alternative plan N3, all the plans represented technically feasible solutions. The most severe negative impacts identified in the analysis are the direct destruction of wetlands due to construction activities; the indirect impacts to wetlands due to changes in hydrology; and the disruption of community and personal lives due to buyouts and relocations.

143. In general, plans which minimize socially disruptive buyouts result in the most significant wetland disturbance, and conversely plans with the largest wetland disturbances tend to have the lowest implementation cost. This indicated that the decision as to the most desirable plan would represent a tradeoff of social, environmental and economic concerns, requiring input from the local sponsor and environmental review agencies.

Intermediate Plans: Plan Comparisons and Local Coordination

144. Preliminary investigations documented preliminary costs and impacts for an array of possible levee, storm gate, and non-structural plans. Based upon findings of the initial and secondary screening of alternatives, the preferred alternative appeared to be *C2,* S4, and P4 as generally described above.

145. The following paragraphs describe further the rationale for making the initial intermediate plan selection, coordination with the local interests and the formulation progression to the selected alternative for NED optimization. These preliminary results were coordinated with the Local Sponsor, New Jersey Department of Environmental Protection (NJDEP), which expressed several preferences for specific features. From a land use and environmental perspective the agency expressed a preference for a storm gate at Pews Creek which would minimize direct footprint impacts. From an operations and maintenance (O&M) perspective, however, there was significant

concern that the use of a storm closure gate at Pews Creek could require a long term commitment to increase agency staff and may not be a supportable alternative. These concerns were taken into account in conducting the screening of plans for more detailed development.

146. For the Compton Creek segment of the project, the alignment identified as C2 was selected as the preferred alternative. This alignment minimized the impact of levees on the wetlands, without relying on extensive lengths of floodwalls. Extensive areas of floodwalls, such as proposed in alternatives C3 and C4, would be prohibitively expensive and could create a graffiti nuisance. Alternative C1 was not selected due to unacceptable levels of environmental disturbance.

147. The selections of the shorefront element attempted to reduce costs and to minimize or avoid future beachfill renourishments while providing the desired level of protection. One bayshore protection layout that was examined was the alignment featuring an upland dune layout, with a sheet pile floodwall protecting the Spy House property with minimal footprint (S4). However, in comments pertaining to the preliminary layout, the Monmouth County Board of Recreation Commissioners expressed opposition because the dune footprint conflicted with the local plan for the shoreline park development. Since the parkland was purchased as dedicated recreation land with Green Acres funding, a change or diversion in the use of the land would require in kind replacement at costs in excess of $100,000 per acre for comparable shorefront land. Given the unique nature of the site, blending active recreation with interpretative historic facilities, such replacement was not viable. Therefore, the dune layout over upland features presented in the S4 alignment is not considered implementable on a practical level since additional mitigation costs would result in S4 having a higher total cost than alternative S1. In order to maintain consistency with public usage of the shorefront, alternative S1 consisting of beach and dune fill was thus selected. Alternative S2 was not selected, however since the costs for S1 and S2 are similar, further evaluation will occur during PED. The S3 alignment is cost prohibitive for the same level of protection.

148. The screening of protection alternatives along Pews Creek attempted to minimize impacts to the environment without creating severe social impacts due to numerous structure acquisitions. Since the local sponsor, NJDEP, indicated that they may not support the use of a closure gate at Pews Creek, alternative P1 was not selected for continued development. Alternative P2 was not selected due to excessive impacts to the tidal wetlands. While alternative P3 would avoid wetland impacts, it was not selected due to the need for numerous structure acquisitions. Alternative P4 was initially identified as the Pews Creek alternative which provided the best balance in minimizing environmental and social impacts.

149. The comparison of plans and coordination with the local sponsor generally confirmed at this point the preference for the alternative C2-S1-P4.

150. The findings of the screening process were subsequently further coordinated with representatives of Middletown Township and various County agencies. In an effort to expand the geographic extent of coverage and protection, Township officials indicated a clear preference for storm closure gates at Pews Creek, and if possible, Compton Creek. In response to the Local Sponsor's reluctance to make a long term commitment of State manpower for security and O&M for such closure gates, the Township officials suggested possible solutions. Currently the Town maintains a staff for the O&M of the nearby East Keansburg Storm Water Pump Station which could possibly service a station at Pews Creek. In addition, by locating the gate adjacent to the Monmouth County marina vandalism and security concerns would be significantly reduced. Based on the reduction of environmental impacts, the more inclusive protection to an additional 211 structures over the P4 alternative, and the availability of local resources to support the maintenance of a closure facility and pump station, the Local Sponsor indicated a willingness to support a storm closure structure at Pews Creek.

151. Subsequent to the local coordination meeting additional economic investigations were undertaken to identify if gate structures could be supported as components of the National Economic Development (NED) Plan which normally establishes the limit for Federal cost sharing. Based on the preliminary screening information the initial estimate of total annual costs for a gate and pump station at Pews Creek indicated that the annualized cost of the gate alternative would be $223,000/year higher than the originally preferred Pews Creek Levee alignment (P4). This increase in cost compares to a preliminary estimate of a $280,000 increase in annual benefits (excluding residual interior damage) due to the protection of approximately 90 additional structures in the Bray Avenue area. Additional benefits to 121 structures upstream of the previously defined study area, which ended at Route 36, would total approximately $413,000 annually. Accordingly the gate at Pews Creek would yield an additional $470,000 in annual net benefits and was considered as a possible element of the NED Plan. The storm closure gate alternative also represented a plan that would avoid much of the direct wetland impacts from the footprint of the levee alignment P4.

152. Whereas the levee alignment P4 could also affect the tidal inundation patterns of wetlands located on the protected side of the levee, the use of a normally open closure gate alternative at Pews Creek would reduce this effect as well as the extent of the permanent project footprint within the wetlands. The gate alignment and opening would have to be developed to allow tidal inundation of the wetlands to continue with minimal disruption of existing depths and frequency. The size and configuration of the gate required to maintain the existing tidal flow conditions would be established as part of a 2-dimensional hydro-dynamic modeling effort. The storm gate closure elevation point would have to be at a high enough elevation to maintain normal tidal exchange so that the wetland areas would continue to receive tidal inundation.

153. Based on the request of Township officials to consider a more comprehensive protection alignment than the levee alignment (C2) favored in the initial screening, a levee/gate alignment extending further east over Compton Creek was examined. This preliminary levee/gate alignment would follow the new Port Monmouth Road, extending protection to the west bank of this creek. The alignment could provide protection to approximately 12 ft. NGVD as this is the elevation of high ground within a reasonable distance of the extended line of protection. This extension of the alignment would provide protection to 276 structures not protected by the C2 levee alignment. Since structures in this area do not suffer significant damage as frequently as structures in other portions of the study area only limited additional protection would be provided by a gate on Compton Creek. Economic analysis indicated that the use of a storm closure gate and levee at elevation 12 ft. NGVD will only provide 20% and 50% reductions respectively, in equivalent annual damage in the two additional reaches protected by the gate at Compton Creek. The preliminary estimate of damage reduction benefits for a gate protecting these areas totals $77,000 annually with the added annual cost exceeding these benefits. Therefore, a gate at Compton Creek was not considered an economically viable element and the levee alternative (C2) was reaffirmed and selected.

154. In view of the above coordination and evaluation, the plan, C2,S1,P1, which most fully satisfied the planning objectives was further evaluated based on additional technical, economic, environmental and cultural resource analyses. These analyses were focused on plans incorporating dune/beach fill improvements along Raritan Bay, combined with levees/floodwalls along Compton Creek and the storm closure gate at Pews Creek. These improvements, combined with necessary mitigation and interior drainage features, have been identified as the most efficient means to achieve the planning objectives. Following more detailed design of the levee, gate and drainage requirements, this decision was verified through a comparison of the resulting costs and benefits. This assessment indicated that the actual increase in cost for using the gate rather than the levee at Pews Creek would be approximately $335,000 annually. After adjusting for residual interior damages of nearly $50,000, the additional benefits of the gate alignment would total approximately $640,000. This assessment verified that the use of a closure gate at Pews Creek *(the P1 alignment)* provides an additional $305,000 of annual benefits in excess of costs and represents the NED plan alignment.

Evaluation of Selected Alternative Alignment

155. The preferred storm damage protection system is comprised of levees, floodwalls, seawalls, relocated dunes, storm gates and pump station described earlier as consisting of segments C2,S1,P1. The alignment will span from State Highway 36 near Willow Avenue to Sandy Hook Bay then west along the shoreline to Port Monmouth Road and tie into the existing Keansburg levee by way of a storm gate across Pews Creek. The following sections describe the facilities for each of the major plan components;

Compton Creek, the exposed bay shoreline, Pews Creek, and drainage behind the levees.

156. Plan components consist of the following features: levees, floodwalls, road raisings, road closure gates, pump stations, a Sector gate across Pews Creek, drainage outlets, gravity outlets, a reconstructed dune, initial beach fill, periodic renourishment, and mitigation. The alignment spans from Pews Creek as a sector gate in combination with levees and floodwalls up to the Bayshore area at which point the alignment ties into a reconstructed dune which runs east to the vicinity of Park Avenue and Main Street where the alignment ties into a series of levees, floodwalls and road closure gates that terminate near Willow Avenue and Route 36.

Design Criteria

157. The plans of protection for the Port Monmouth area have been developed in accordance with the Corps of Engineers guidance using the latest Engineering Regulations, circulars, manuals, and technical letters. Designs of the storm gate and interior drainage facilities will require future detailing as features move into the PED phase.

158. Engineering Feasibility. Consideration was given to several hurricane and storm damage reduction measures, including non-structural and structural solutions. Sound engineering judgment was utilized in selecting the structural components for each alternate. Existing topography, wetlands, buildings, roadways and drainage patterns were some of the constraints which had to be accommodated in the design process. The structural alternatives were designed to provide protection from tidal inundation up to the 100-year storm event over a 50-year period of economic analysis. Federal participation in periodic nourishment would be limited to a period of 50 years from completion of project construction.

159. The line of protection design is based on geotechnical and structural analyses of selected sections for typical features such as the levees and floodwalls. Special features, such as bridges, closure gates and spillways were considered on an individual basis. Once the line of protection was set, interior drainage facilities were analyzed.

160. The determination of interior facilities, discussed later, was conducted using the guidance from Engineer Manual 1110-2-1413 (Hydrologic Analysis of Interior Areas). The strategy outlined under this guidance follows the premise that interior facilities would be planned and evaluated separately from the line of protection, and should provide adequate drainage at least equal to that of the existing infrastructure. This initial plan represents the minimum interior facilities required to implement the line of protection plan. The minimum facility plan is the starting point against which additional interior facilities are compared.

161. The purpose of this level of design is to provide a sound basis for project costing to determine if a Federal interest in the project exists, to economically optimize the degree of protection and to provide the local sponsor with potential cost sharing apportionments.

Line of Protection Design Criteria

162. Levee Embankment Design. The levee design was developed in accordance with the published standards of the Office of the Chief of Engineers. Seepage and slope stability analyses were conducted for typical sections. Seepage analysis included the use of an impermeable core in the center of the levee to provide a seepage cutoff. Side slopes would be 1/2.5 due to stability concerns(see typical schematic) . Soil used in levee construction will be silty fine sand. Drain material will be uniform sands. Core material will be uniform silt. Design parameters are typical values for the material. The levees were designed for Steady State - Seepage and rapid drawdown with flood at maximum specified height with factors of safety of 1.5 and 1.0, respectively. The conditions are described under Case II and Case IV in Engineer Manual EM1110-2-1913 (Design & Construction of Levees). The critical gradients were established utilizing methods outlined in Engineer Manual EM-1110-2-1901 (Seepage Analysis & Control for Dams). The minimum factor of safety for the seepage escape gradient was 2.4. The seepage under the levee is controlled using a horizontal stone drain. Migration of finer levee material into this drain will be prevented using geotextile fabric. Geotextiles were identified as the most cost effective means to prevent the migration of fine materials into the toe drain. Wave impacts on the proposed levees were not a significant design concern. Waves threatening to impact the north-south levee from the east would be blocked by two features: (1) the existing dune extending east to Compton Creek, which features elevations exceeding 10 feet NGVD, and (2) relative high land (with peak elevations of 10-13 feet NGVD) just east of the levee location, extending several hundred feet inland from the frontal dunes. In addition, the entrance to Compton Creek is protected by a substantial revetment. The conclusion that the wave activity will be effectively blocked is also based on the complete lack of any indication of prior wave activity or profile changes in the area. At the western terminus of the design dune, the levee/floodwall extends hundreds of feet inland from the existing dune, and then extends parallel to the shoreline. This segment of the design lies hundreds of feet behind a substantial existing dune whose dimensions are similar to the dimensions of the design dune. No records indicate historical wave activity at the locations of the levee/floodwall, so no significant future wave activity is assumed. The design features extend to the Pews Creek flood gate, where wave activity is also assumed to be minimal. The analysis considered crest splashover and the statistical spectrum of wave heights but determined that the effects would be negligible. The assumptions used to perform the levee analysis were the design parameters of the materials used in levee construction, and the underlying soils. Flow nets were

constructed and exit gradients were calculated. The properties of the soil used in construction will vary, but in general, assuming the gradation of the material utilized is comparable to the design assumptions, the net results will have no significant impact to either seepage or slope stability analysis. Additional borings will be taken and a more complete verification of seepage findings would be further addressed during the DM phase. Permeability tests (falling head) in individual borings will also be performed during the DM phase to verify and confirm permeability constants used in the seepage analysis.

163. The aforementioned conclusions are also based in part on the performance of the adjacent Keansburg levee, which has not indicated erosion or damages from waves since its construction. If waves had propagated as far (approximately 600 feet) up the narrow creek at the location of the floodgate, diffraction would have resulted in damage to the Keansburg Levee. Therefore, the potential for wave activity at the location is considered to be minimal. The levee top elevations will be finalized during the Preconstruction Engineering Design (PED) phase. The final design will consider levee superiority and design overtopping.

164. Floodwall. Two types of floodwalls are recommended; I-type and T-type floodwalls. The flood walls basically consist of vertically driven sheet pile foundation (I-type) or timber pile foundation (T-type) driven to a specified depth and capped with concrete which transitions to a concrete wall above the existing ground line. A sheetpile foundation is used to provide stability and to resist overturning for I-type walls. The T - type floodwalls adjacent to the Keansburg levee will be supported on piles as the soils adjacent to Pews Creek consist of soft, organic, compressible silts and clays. The floodwalls were designed in accordance with EM 1110-2-2502. An I-type flood wall was used where water heights above existing ground are less than ten (10) feet. T-type floodwalls were used adjacent to the storm gate at Pews Creek where water heights above existing grades exceed ten (10) feet in height. The soil conditions for the proposed flood walls were based on data obtained in borings adjacent to those areas. This data established soil type, stratum limits (both horizontal and vertical), and soil design parameters. For the I-Type flood wall designs, the pressure distribution acting on the sheet pile and the pile length so that the sum of the horizontal forces and the sum of the moments about the pile tip are zero were calculated. A safety factor was applied to the pile embedment length of 1.3. The resulting embedment length would be comparable to factoring the passive pressure coefficients by factors of safety between 1.3 and 1.6 as discussed in Engineer Manual EM 1110-2-2504 (Design of Sheet Pile Walls), Section 5. The T-Type flood walls were designed using loads as described in Inland Flood Walls Case I1 and Coastal Flood Walls Case C1 as described in Engineer Manual EM 1110-2-2906 (Design of Pile Foundations) for unusual loading conditions. The set-back locations of the walls and gates result in no hydrodynamic loading nor impact loading conditions. Seismic analyses for this geographic region were not required based upon loading conditions criteria discussed above. Additional design

details will be provided during the PED phase.

165. Geotechnical. The geotechnical analysis was based on subsurface soils information and laboratory analysis of samples obtained from sixteen (16) borings taken in the vicinity of the project between 1990 and 1997. The soil properties used in the design for a major section of the walls were based on soil borings spaced approximately 1500 feet apart. In addition, the soil boring used in the analysis of the T-wall section in the vicinity of Pews Creek was performed approximately 175 feet from the proposed wall location.

166. The soils within the project limits belong to two separate geologic associations (MTM and AM-23 pi based upon soil survey report in Rutgers University Engineering Soil Survey of New Jersey, Rpt #19). MTM soils are mainly found along the relocated Port Monmouth Road. They are representative of a marine tidal marsh, with a soil profile made up of a decomposed organic mat underlain by organic sand, silt, clayey silt and clay at varying depths. This material's nature requires a detailed subsurface investigation prior to construction of the various flood control components. The remainder of the study area lies in AM-23 pi. These soils consist of sand and silty sand becoming coarser with depth and is underlain by stratified deposits of silt and silty fine sand. Local suppliers which were contacted concerning the availability of impervious material for the levee. The following suppliers are within a 50 mile radius, a reasonable distance to the proposed project site: R.W. Vogel; Amboy Aggregates; Stavola Contracting Co., Inc.; Minkrun Construction; Middlesex Materials; and Phoenix Pinelands Corp.

167. Settlement of levees placed on sands are expected to be rapid and occur progressively during levee construction. For sections founded on plastic soils, settlement was based on the increased effective stresses. Consolidation test data from selected recent borings, as well as testing performed by local jurisdictions for the Port Monmouth Road relocation were collectively utilized to evaluate settlement magnitude and duration. Preliminary analysis indicates an anticipated maximum levee settlement of four to nine inches over a one to two year period in the vicinity of Pews Creek.

168. Road Closure Gates. The project includes a total of three (3) closure structures. The gate type (mitre) and clear openings were selected based on the existing topography, the width and use of the existing road corridor, sight distance provisions and space constraints. The following paragraphs discuss the design considerations for each closure gate.

169. Campbell Avenue and Broadway (2). The existing roadways are about 30 ft. ± wide, and there are no sidewalks in these areas. A gate is necessary at these locations since the roadways could not be elevated to the design height while maintaining traffic design speeds. The gate will have a 40-foot wide opening with a total length of 50 feet and be

approximately 8 feet in height. The support structure will be set back from the roadway five feet on either side, which will reduce the potential for impact by vehicles and provide space for pedestrian passage.

170. Marina Access Ramp (1). The existing roadway is 30 ft. + wide, and there are no sidewalks in this area. The roadway presently provides access to the County marina from the new Port Monmouth Road. A gate is necessary at this location due to the short roadway length. The gate will have a 40-foot wide opening with a total length of 58 feet and be about 4.0 feet in height. The support structure will be set back from the roadway five feet on either side, which will reduce the potential impact by vehicles and provide space for pedestrian passage.

171. Dune and Beach Design. Design of the bayshore dune and beach fill was conducted using guidance from Engineer Manual EM 1110-2-3301 (Design of Beach Fills), Engineer Regulation ER 1110-2-1407 (Hydraulic Design for Coastal Shore Protection Projects), Engineer Regulation ER 1105-2-100 (Guidance for Conducting Civil Works Planning Studies),and the *Shore Protection Manual*. The design dune crest width of 25 ft., and beach berm width of 50 ft. was based on the EDUNE storm recession model. The dune height of 16 ft. NGVD, the beach berm elevation of 9 ft. NGVD and the dune and beach slopes were based on existing conditions. Beach fill tapers are required at the east and west ends of the project area to provide long term stability to the beach berm adjacent to the design dune and to offer protection to the design dune itself. The tapers are necessary in order to duplicate the natural taper angle in the project area, which is about 6 degrees. The volume of material contained in the design section is approximately 275,000 cubic yards, while the volume of material in the eastern taper is about 15,000 cubic yards and the volume of material contained in the western taper is about 35,000 cubic yards. Due to existing shoreline orientations, eastern and western taper lengths may be markedly different. The tapers are not designed for recreational purposes.

Design Criteria for Storm Gate

172. Pews Creek was analyzed for both tidal hydraulic impacts and runoff from upstream areas. Tidal hydraulics were analyzed to determine what impact the storm gate would have on the wetlands. It is considered critical that construction of the gate does not significantly reduce tidal inundation during either normal or high astronomic tide conditions. Fluvial runoff was analyzed in order to determine the drainage and pumping facilities needed to control interior flooding when the storm gate is closed. The purpose of this analysis was to evaluate the impact to astronomic tides for alternative storm gate configurations at Pews. Periodic tidal inundation of the estuary is important for the marsh to maintain itself.

173. The numerical modeling system used in this study is the US Army Corps of Engineers

hydrodynamic RMA-2 model, which is part of the TABS-2 system. This modeling system is capable of simulating wetting and drying of marsh and intertidal area of the estuarine tem. The version used in this study is called FASTTABS, which is the personal computer (PC) version of the main-frame based TABS-2.

174. The hydrodynamic model was operated using measured tide gage data for existing conditions with a quarter hour time step for a 55 hour time period. The simulation was performed for a total of four tide cycles, which allowed for an initial "spin up" of the model. A few minor discrepancies exist between the simulations and measurements. For example, the simulated tide at Bray Street slightly lags and has a slightly lower range than the measured tide. Overall, however, the agreement between the simulated and recorded tides was judged to be satisfactory.

175. Selection of the type of gate for Pews Creek incorporated reviews of US Army Corps of Engineers Manuals and discussions with the New Orleans District, where gates are used extensively on navigation and flood control projects. Engineering Manual 1110-2-2703 (Engineering and Design, Lock Gates and Operating Equipment), was specifically reviewed for information on various gate types and associated advantages a disadvantages both in gate operation and construction.

176. Based on a review of Engineering Manual EM 1110-2-2703 (Engineering and Design, Lock Gates and Operating Equipment), it appeared that a Sector Gate would be the most appropriate gate type for use at the Pews Creek site. Though Sector gates have generally higher construction cost due to the need for larger recesses in the gate monolith, they have operational and maintenance advantages over other types of gates. Coordination with the New Orleans District confirmed that Sector Gates operate well under high sediment conditions since they can divert sediment during closing and opening operations. In addition, Sector gates can be closed under flow conditions which could be experienced under a storm surge. Other types of gates, such as miter gates, do not perform as well under conditions that may generate a differential hydraulic head. Sector gates also provide maintenance advantages since they can be removed and replaced from the gate monolith in the wet. Other types of gates require cofferdaming and dewatering for gate removal and maintenance.

177. In summary, aside from the sector gate, there are three major gate types that could be used at the Pews Creek location based on EM 1110-2-2703, i.e.: the miter gate, the vertical-lift gate and the tainter gate. These three gate types were screened from further consideration based on inherent operability concerns. The disadvantage of the miter gate is its inability to close against hydraulic head differentials associated with incoming storm surges. In addition, the miter gate does not generate the thrust required to overcome an accumulation of silt in the gate's path, which can prevent the gate from closing. As with the miter gate, the vertical-lift and tainter gates would have difficulty closing against a silted bottom, which could compromise the gate's

effectiveness in cutting off the storm surges to the protected side of the gate. The vertical lift gate will have trouble achieving a positive seal against storm surges with a significant reversed head against the backside of the gate. The tainter gate's foundation is not supported in rock; it is pile supported. Due to its pile foundation and skewed high center of gravity, long and short term alignment problems can develop from slight differential settlements causing the gate to lose its effectiveness. These disadvantages interfere with the gate's operability and increase the risk of closure failure. The sector gate was selected because none of these disadvantages are inherent in its operation. The risk of inoperability is extremely low based on an extensive track record.

Interior Drainage Design Criteria

178. The analysis is based on the concepts and guidelines contained in U.S. Army Corps of Engineers' Engineer Manual EM 1110-2-1413 (Hydrologic Analysis of Interior Areas). The interior areas drain toward two different watersheds, Compton Creek and Pews Creek. Each of the two main watersheds were analyzed separately, as described below.

179. For Pews Creek, because the size and complexity of the drainage area impacting the proposed interior drainage facility as a result of the tide gate preventing the free drainage of the entire watershed, the rainfall runoff computer program HEC-I was used to simulate runoff. The output of the HEC-1 runoff model subsequently provided the inflow hydrograph to the computer program HEC-IFH which is used to route the interior flows through the line of protection against the varying tailwater associated with the tidally influenced receiving waters. Based upon the results of the with- and without-project stage/frequency analysis (see Appendix F – Interior Drainage) for Pews Creek, there are no adverse impacts of the Port Monmouth project on the existing drainage facilities of the adjacent Keansburg project.

180. For the Compton Creek watershed the primary water course is outside the line of protection and only a portion of the overall drainage area must be handled by the proposed interior drainage facilities. The HEC-IFH computer program was used to both generate the rainfall runoff and to route the flows through the line of protection.

181. Basic input parameters developed for the hydrologic models include: surface area; rainfall generated for a series of hypothetical (2- to 500-year return period) and historical storm events, runoff curve numbers developed per the methods described in Soil Conservation Services Technical Release No. 55 "Urban Hydrology for Small Watersheds" (TR-55), and times of concentration. These input parameters are described in more detail in Appendix F-Interior Drainage.

182. For both watersheds numerous outlet structures are required to pass drainage through the line of protection to the receiving stream. Each structure comprises an inlet

structure including debris rack on the protected side, an outlet structure including a flap valve at the channel side, and a central manhole including a sluice gate adjacent to the top of the levee embankment.

183. Of the three primary and eleven secondary outlet pipes required for minimum facility in the Compton Creek interior area, only four will not discharge to existing drainage ditches: secondary outlet at C1; primary outlet at C2; and a secondary and primary outlet at C3. For the Pews Creek interior area, once the storm gate is closed, there are basically two outlets: the pump discharge pipe and the adjacent gravity outlets, which allow gravity flow when tidal tailwater conditions are favorable.

184. Plan alternatives examined include the use of excavated ponds, pump stations and the use of pump stations in conjunction with ponds. The excavated pond alternatives were developed for interior drainage areas by using a procedure designed to create the largest possible pond for each location. The criteria used in developing the ponds consist of the following:

- No pond was to be excavated below elevation 3.5 feet NGVD to avoid or minimize standing water conditions (The Geotechnical Draft Appendix shows groundwater at elevation 3 feet next to levee)
- Pond side slopes were set at 3:1 to allow easy maintenance and not pose a safety hazard

185. As the existing wetlands areas along Pews Creek already provide extensive storage, no ponding alternatives were evaluated in this interior area. In order to evaluate the storage capacity at the line of protection, elevation-storage relationships were developed. Using the topographic maps, and commencing with the lowest elevation at the proposed ponding site and continuing up to elevation of 8 feet NGVD, the planimetric area enveloped by a particular elevation was estimated. For consecutive elevations evaluated, HEC-IFH program uses the conic method to compute the volume. The program then sums the volumes between elevations to generate an overall elevation-volume relationship for a particular ponding site. Based on District assessments, it does not appear that the interior flood elevations are highly sensitive to changes in interior storage. Ponds and flowage easements were investigated but are not identified as plan components that require real estate interests. The existing regulatory controls on fill placement within wetlands and floodplains will be adequate to prevent any significant increase in interior flood elevations. This will be verified in the PED phase when more detailed levee layout and topographic data is available. If the PED phase assessments identify the need for additional easements it is anticipated that they will be located within the existing wetlands or other areas of limited commercial value.

186. Interior pump station designs are based on the use of typical submersible pump stations developed for the Green Brook Flood Control Project.

Environmental Criteria

187. Habitat Evaluation Procedures Overview. The U.S. Fish and Wildlife Service (USFWS) developed the Habitat Evaluation Procedure (HEP) as a method for quantifying the quality and

quantity of existing habitat and making predictions about future habitat conditions. The HEP methodology may be used to 1) assess the impacts of various project-related activities to habitat; 2) design mitigation options; and, 3) evaluate the success of mitigation activities and/or management strategies.

188. Port Monmouth Project. The HEP methodology has been used for the Port Monmouth Project to assist with both impact analysis and mitigation planning. The HEP was determined to be applicable to this project due to the well-defined communities/habitats in the project area; the availability of acceptable Habitat Suitability Index models that have been developed by the USFWS and require little modification; and, the ability to collect the required information and perform the necessary analyses in one field season.

189. Impacts for the Port Monmouth Project (direct and indirect) have been expressed in terms of wetland acreage, upland acreage, and Habitat Units (HU's) for the black duck, clapper rail, and marsh wren. All impacts were calculated using the footprints of the proposed project, hydrodynamic models, HU values, and cover type maps. The results of the impact determination enabled the Project Team to quantify the impacts to the vegetation and wildlife, and design appropriate mitigation measures that meet the requirements of the involved regulatory agencies and document decision-making processes. HEP also permits a quantitative assessment of the success of the mitigation activities and, if necessary, will provide a guide for modifying mitigation activities to meet project goals.

190. Criteria for Conceptual Wetland Mitigation Plan Development and Selection. According to the memorandum of agreement (MOA) between the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (USACE), compensatory mitigation is regarded as a last step after attempts to avoid or minimize impacts, or repair damage have proven unsuccessful (EPA/USACE 1990). The MOA also recommends restoration over creation due to the uncertainty of successfully creating functions of impacted habitats.

191. Development of the Conceptual Wetland Mitigation Plans for the Port Hurricane and Storm Damage Reduction Project included an evaluation of restoring the wetland and habitat functions that were both directly and indirectly impacted by the project. Functions considered in development of the Conceptual Wetland Mitigation Plans include:

- wildlife habitat;
- threatened and endangered species;
- fish and shellfish habitat;
- flood storage;
- flood conveyance;
- sediment control;

- recreation; and,
- open space and aesthetic [illegible]s.

192. Wildlife Habitat. Mitigating i[illegible]cts to the wildlife habitat function of the Project Area was the primary objective in developing the Conceptual Wetland Mitigation Plans. The quality of the existing cover types present in the Project Area was quantified using the Habitat Evaluation Procedure (HEP) (USFWS 1980). Habitat Suitability Index Models for black duck (*Anas rubripes*), marsh wren (*Cistothorus palustris*), and clapper rail (*Rallus longirostris*) developed by the USFWS (Lewis and Garrison 1983, Lewis and Garrison 1984, Gutzwiller and Anderson 1987) were used. Baseline and with-project habitat units (HUs) were calculated and used to determine habitat restoration and enhancement options. Two conditions included in each Conceptual Wetland Mitigation Plan that were shown in the HEP analysis to increase HUs for the selected evaluation species were conversion of wetlands dominated by common reed (*Phragmites communis*) to low and high emergent saltmarsh and improving tidal flushing of open water areas (*i.e.* ditches, tidal pools).

193. Threatened and Endangered Species. The New Jersey Department of Environmental Protection (NJDEP) does not specifically identify any rare species or communities in the Project Area. However, the USFWS reports occasional transient occurrences of the bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*) in the Project Area, and the NJDEP considers habitat for rare species and communities to be a priority site (USACE 1997). Habitat enhancement for state- and federally-listed rare species was considered in the development of the Conceptual Wetland Mitigation Plans.

194. Fish and Shellfish Habitat. Although no aquatic species were included in the HEP study, actions to improve habitat for the evaluation species could also result in significant gains in the quality of fish and shellfish habitat. Habitat for fish and shellfish can be enhanced by conversion of common reed stands to saltmarsh and improving tidal flushing of open water areas. Both of these activities are included in the Conceptual Wetland Mitigation Plans to varying degrees.

195. Flood Storage and Flood Conveyance. Improvements to the flood storage capacity beyond those included in the project design would be realized through excavation activities as well as through the widening and deepening of selected existing ditches. The additional flood storage capacity varies between Conceptual Wetland Mitigation Plans. The conveyance of floodwater also varies between plans. Although conveyance of floodwater into areas located near residences is less desirable than diverting water from residences, the proximity of substantial quantities of degraded habitat adjacent to residences required less than optimum floodwater conveyance to restore wetland functions, particularly in the Pews Creek basin.

196. Sediment Control. Saltmarsh systems require sediment inputs from both landward and seaward sources to counteract the effects of subsidence and sea level rise (Stumpf 1983). The dense roots of saltmarsh species such as *Spartina alterniflora* and *S. patens* also stabilize substrate in the marsh and on the banks of various watercourses (Lorenz *et al.* 1991). Increases in sediment control functions in the Compton Creek study area would be minor as a dense vegetation layer already occurs over most of these basins. Some additional sediment deposition may occur that can be attributed to improvements in tidal flushing. However, there is insufficient information available on the changes in sediment inputs in the Pews Creek study area due to project activities. Consequently this function was not used in the development of the Conceptual Wetland Mitigation Plans.

197. Recreation, Open Space, and Aesthetics. The Project Area is located in a densely-populated area, and represents a significant portion of the undeveloped land in the Port Monmouth area. Improvements to recreational opportunities, and aesthetics considered during development of the Conceptual Wetland Mitigation Plans include improved viewscapes and wildlife observation. Also ditch improvements would decrease the opportunities for local residents to dispose of household and construction waste in the Project Area.

198. Mitigation. In addition to wetland functions, the likelihood of success, potential public reactions, maintenance requirements, and cost were considered in development of the Conceptual Wetland Mitigation Plans. Saltmarshes are complex and dynamic systems and creating a self-perpetuating system is difficult (Niering 1987). The success rate of replacing common reed-dominated stands with Low Emergent Marsh (LEM) is higher than the rate associated with replacement with High Emergent Marsh (HEM) in New Jersey due to the inhibition of common reed encroachment (Shilsler and Charette 1984, Charette *et al.* 1985). In addition to the low success rate associated with converting common reed stands to HEM, the quantity of herbicides and the frequency of application is higher than with stands associated with LEM conversion. This leads to an increased frequency of maintenance and increased negative public reaction to herbicide treatments. Advantages to HEM restoration include lower cost and ease of access due to reduce equipment requirements, compared to LEM restoration. The excavation, spoil disposal, and planting associated with LEM restoration are expensive relative to regular herbicide applications. In order to balance cost concerns with reduced maintenance, public perception, and overall success, any Conceptual Wetland Mitigation Plans involving unreasonable amounts of earthmoving were avoided.

Conceptual Wetland Mitigation Plans for Port Monmouth included the following:

Plan 1 - Compton Creek LEM Restoration
Plan 2 - Compton Creek LEM and HEM Restoration
Plan 3 - Pews Creek LEM and HEM Restoration

Plan 4 - Pews Creek and Compton Creek LEM Restoration
Plan 5 - Biodiversity Enhancement

The above cited five conceptual plans were combined into various arrays, totaling 31 alternatives for mitigation.

Economic Criteria

199. Federal participation in the project requires a demonstration of economic feasibility, which is established by determining whether the benefits to the national economy exceeded the annual economic costs. Benefits were determined from the results of a detailed investigation of the economic impacts of flooding. Annual charges were based on the application of economic principles to all the costs of constructing, operating and maintaining the project.

200. All benefits and costs are at May 1998 price levels. Benefits will accrue for a period of 50 years following the completion of construction. Computations used the fiscal year 2000 Federal discount rate of 6-5/8%.

201. Costs. The detailed cost basis and summary cost tables of various improvement alternatives are presented in Appendix C-Quantities and Costs. Costs presented are NED costs and do not necessarily reflect the financial costs. Contingencies, Engineering & Design and Supervision & Administration are included in the cost analysis.

202. Interest During Construction. Interest during construction is a time value adjustment of money invested before completion of the project. It is added to the construction cost to determine the total investment in the project and is calculated by computing interest at the applicable project discount rate on the monthly expenditures from the start of Preconstruction, Engineering and Design (PED) to the completion of initial construction of the project. The combined PED and construction time frame is currently estimated to take about 6 years to complete, at which time a functioning project would exist. This value is simply an economic time value adjustment and does not require monetary expenditures.

203. Periodic Nourishment. Nourishment fill will be placed at 10-year intervals to compensate for anticipated beach erosion. This fill is required to maintain the integrity of the dune and beach design cross-section. Periodic maintenance fill will be constructed by trucking sand from an upland source. Federal participation in periodic nourishment would be limited to a period of 50 years from completion of project construction.

204. Operation, Maintenance and Replacements. Charges attributed to the operation and maintenance (O&M) of the project consists of annualized replacement costs, anticipated energy charges, and the cost of routine maintenance. Project components requiring routine care include levees, floodwalls, and the interior drainage facilities, outlets, closure structures, gate structures and pump stations.

205. The major mechanical equipment within the storm gate and interior drainage pump stations have anticipated life expectancies of 30 years. The cost of periodic equipment replacement has been estimated, annualized over the 50-year period of analysis and incorporated into the O&M estimate. In addition, electric power requirements based on anticipated frequency of pump station and storm gate operation have been added to the project's annual operation charge.

206. Rehabilitation. Significant portions of the overall project's components such as levees are subject to damage from storms exceeding design levels. The cost of repair after various flood events was weighted by their expected probability of occurrence to determine average annual major repair and rehabilitation costs.

207. Benefits. Project benefits are equal to the gains to the National Economic Development (NED) as determined by the differences between conditions with and without project. Tidal inundation benefits are based primarily on the damages that will be prevented by the project and averaged over the 50-year period of analysis. Damage reduction estimates were based on historical floods, current development of the floodplain, and statistical analysis to account for risk and uncertainty in major damages variables.

208. This effort provided site-specific data for major floodplain structures and verified that general flood damage relationships established for the nearby Passaic River Basin are also applicable. These "damage functions" established specific relationships between depth of flooding and the resulting damage for various types of buildings. Assessments of the value and flood vulnerability of every floodplain structure were used to develop aggregate relationships between flood conditions and damages.

209. Flood risks under both the with and without project conditions were evaluated. The annual cost of damage for both with and without project conditions was calculated using risk and uncertainty simulation techniques. This approach to calculating annual damages allows the analysis to reflect uncertainty in various parameters, such as flood stage or the building values.

210. Additional benefits attributable to the project are a reduction in flood insurance administrative costs, a reduction in beach maintenance costs, and an increase in the value of recreation use.

VI. NED PLAN SELECTION

211. The National Economic Development (NED) plan is defined as the plan which maximizes beneficial contributions to NED while meeting planning objectives. The NED plan provides the maximum net excess benefits over costs. The following sections address selection of the NED plan based upon design criteria formulation. Optimization focuses on the line of protection and interior drainage components separately.

Interior Facilities

212. The minimum facility plan is the starting point against which additional interior facilities are compared. The benefits accrued from other alternative plans are attributable to the reduction in the residual flooding and damages which would have remained under the minimum facility condition. For an alternative facility to be justified and become a component of the NED plan, it must be implementable and reasonably maximize benefits vs. the additional cost required for its construction, operation, and maintenance. Plan alternatives to be examined include the use of excavated ponds, pump stations and the use of pump stations in conjunction with ponds. The following is a brief summary of the preliminary interior drainage plan for Compton Creek.

213. Drainage Area C1. Interior drainage area C1 is located along the left (west) bank of Compton Creek from south of Route 36 area near Chestnut Street to the north between Campbell and Collins Avenues. The area extends west beyond Wilson Avenue to Main Street in the New Street area. The interior drainage area of C1 is comprised of 47.65 acres of developed urban land, with minimal wetlands. The lowest buildings are located at elevation 7 ft. NGVD while Willow Street may start to flood at elevation 6.5 ft. NGVD.

214. Minimum Facility. Minimum facility for sub-basin C1 has a 48" RCP primary outlet and one 18" RCP secondary outlet. Both the primary and secondary outlets are being provided with a sluice gate and trash rack. The outlets will also be provided with flap gates to prevent tidal surges from entering the protected area. Ditches will be constructed along the landward side of the levee to direct runoff toward either the primary or secondary outlet.

215. Additional Facilities Considered. Additional analyses investigated the need for additional facilities including possible pump stations or ponds. Due to the large existing ditch capacity and the high significant damage elevation, additional facilities for sub-basin C1 were not incrementally justified.

216. Drainage Area C2. Interior drainage area C2 is located along the left (west) bank of Compton Creek from sub-basin area C1 extending north just beyond Broadway. A

segment of proposed levee and Wilson Avenue form the east and west boundaries of the interior drainage area. The interior drainage area of C2 totals 50.84 acres of predominantly residential development with limited wetlands areas. The lowest buildings are located at elevation 7 ft. NGVD while flooding of Creek Road and Main Street will start at 4.7 and 5.7 ft. NGVD, respectively.

217. Minimum Facility. The minimum facility for sub-basin C2 will have a 48" RCP primary outlet and four 18" RCP and one 24" RCP secondary outlets. Both the primary and secondary outlets are being provided with a flap gate, sluice gate, and trash rack. Drainage ditches will direct runoff along the protected side of the levee to a nearby outfall.

218. Additional Facilities Considered. Further analyses investigated the cost effectiveness of additional ponding facilities. Pump stations were not considered since the residual damage is clearly insufficient to support the cost. Two potential sites for excavated ponds were identified. One site is located near the intersection of Broadway and Main Street resulting in triangular shaped pond. A smaller second possible site includes an irregular shaped pond located adjacent to Creek Road and the levee. The analysis of interior damages and costs indicated that the Minimum Facility is the most cost effective plan at this location. The second most cost effective plan was the smaller (0.46 acre) pond.

219. Drainage Area C3. The C3 interior drainage area is also located on the left (west) bank of Compton Creek. Main Street and Wilson Avenue from the east and west boundaries of the area with the dune/berm forming the north boundary and C2 (just south of Lydia Place) forming the south boundary. The interior drainage area C3 is comprised of 78.74 acres, the majority of which is residential. The area near Monmouth Avenue is subject to some of the most frequent flooding in the area. Street elevations in this area are as low as 4.4 ft. NGVD. The lowest buildings are located at elevation 5 ft. NGVD.

220. Minimum Facility. The minimum facility for sub-basin C3 includes a twin 48" RCP primary outlet and five 18" RCP secondary outlets. Both the primary and secondary outlets are being provided with a flap gate, sluice gate, and trash rack. The 36-inch storm water diversion pipe will be approximately 750 feet long. Ditches are included on the protected side for the levee to direct runoff to primary or secondary outlets.

221. Additional Facilities Considered. Further analyses investigated the addition of additional facilities including pump station and ponds. One possible site for an excavated pond is north of Renfrew Place between Main Street and Brainard Avenue. The combination of extremely low damage elevations and high groundwater elevations made the ponding alternatives ineffective. A variety of possible stormwater pump stations were investigated to control flooding in this area. The most cost effective

interior facility at this location was identified as a pump station with a total capacity of 60 cfs. The annual interior damage reduced (NED benefits) for this alternative exceeded the annual cost by approximately $14,000. The next most cost effective alternative was identified as a larger pump station with a capacity of 80 cfs. This alternative has net annual NED benefits of $13,300.

222. Pews Creek Interior Drainage. The Line of Protection works include the construction of a storm gate across Pews Creek, about 300 feet upstream of the recently completed New Port Monmouth Road bridge. Based upon the results of the with- and without-project stage/frequency analysis (see Appendix F - Interior Drainage) for Pews Creek, there are no adverse impacts of the Port Monmouth project on the existing drainage facilities of the adjacent Keansburg project.

223. Minimum Facility. Minimum facility consists of two 48-inch diameter pipes through the floodwall located between the storm gate and existing Keansburg Levee just west of Pews Creek. The diversion channel constructed during installation of the storm gate will be utilized as the inlet and outlet channel for the pipes. Each pipe will be equipped with a flap gate. No ditch is provided along the levee toe as it directly abuts the marshes of Pews Creek. Thus, there are no secondary outlets.

224. Additional Facilities Considered. Further analyses investigated the use of additional facilities in additional to the minimum facility. No ponding alternatives were considered since the extensive low-lying wetlands area along Pews Creek behind the line of protection offer significant storage capacity. Pump stations, however, were considered as a means of displacing accumulated surface runoff from the interior watershed.

225. Pump station sizes of 60,100,120,150 and 180 cfs were evaluated. The most cost-effective interior facility at this location was identified as a pump station with a total capacity of 120 cfs. The annual interior damage reduced (NED benefits) for this alternative exceeded the annual cost by approximately $105,000.

226. Summary. The selected NED interior drainage facilities and the associated residual damages are summarized in Table 8. These facilities represent the most cost effective method of controlling interior flooding in accordance with Federal planning requirements.

TABLE 8
SUMMARY OF SELECTED INTERIOR FEATURE COSTS & BENEFITS
(1998 PRICE LEVEL, 50 YEAR ANALYSIS PERIOD)

Creek	Interior Drainage Facility	Total Annual Cost*	(Residual) Equivalent Annual Damage	(Benefits) Annual Damage Reduction	Incremental Cost Above Minimum Facility	Annual Net Benefit
Pews Creek	120 cfs Pump Station	$182,650	$47,750	$271,400	$166,350	$105,050
Compton Creek	Minimum Facility	$14,800	$8,800	$0	$0	$0
	Minimum Facility	$31,800	$14,980	$0	$0	$0
	60 cfs Pump Station	$179,860	$20,210	$145,330	$126,560	$18,770

*Pump station costs include minimum facility cost.

Line of Protection Optimization

227. The selected line of protection alignment was evaluated at different design levels to establish the optimum NED plan. In general, the alignments for each design level are similar except that the highest level considered, 15.2 feet NGVD, would require a nine-inch raising of a portion of Route 36 and a low floodwall (2.5 - 3 ft.) along the entire road to the A&P, tying into high ground at Wilson Ave.

228. Annual Benefits. Table 9 provides a summary of average annual benefits for the three alternative design levels, including the separately optimized interior flood protection, periodic beach fill nourishment requirements and the selected environmental mitigation plan.

TABLE 9
SUMMARY OF BENEFITS
(1998 PRICE LEVEL, 50-YEAR ANALYSIS PERIOD, INTEREST RATE 6-5/8%)

Line of Protection Design Elevation	13 Ft.NGVD	14 Ft.NGVD	15.2 Ft.NGVD
Net Damage Reduction Benefits*	$2,784,680	$2,903,330	$3,116,960
Reduced Maintenance	$145,000	$145,000	$145,000
Recreation	$191,500	$191,500	$191,500
Total Benefits	$3,121,180	$3,239,830	$3,453,460

*Excludes residual interior damage.

229. Annual Costs. Annual NED costs were calculated using the current discount rate of 6-5/8 %. The costs include all expenses necessary to implement, maintain, and operate the improvements over the 50-year period of analysis. Details of the cost estimate are presented in Appendix C.

230. Benefit Cost Comparison. Benefits and costs including the selected interior facilities were compared as shown in Table 10. The 14 ft. NGVD line of protection design elevation was selected as the NED plan since it provides the maximum net benefit excess of costs. Since the NED plan has a design elevation of 14 feet NGVD, it is anticipated that the project area levees will not meet the freeboard requirements necessary to be certified under NFIP requirements. Therefore property owners within the project area will still be required to maintain Flood Insurance policies as a condition of their federally backed mortgages.

TABLE 10
SUMMARY OF PLAN ECONOMICS
(1998 PRICE LEVEL, 50-YR PERIOD OF ANALYSIS, 6-5/8% INT. RATE)

Line of Protection Design Elevation	**13 FT. NGVD**	**14 FT. NGVD**	**15.2 FT. NGVD**
Annual Benefits	$3,121,180	$3,239,830	$3,453,460
Annual Costs	$2,838,767	$2,931,010	$3,172,625
Net Excess Benefits	$282,413	$308,820	$280,835
BCR	1.1	1.1	1.1

231. Residual Damage – With the proposed plan in place, the study area will remain subject to flood damage from several sources. For reaches outside the proposed line of

protection, damage will remain as presented in Appendix B Tables B-15 through B-17. This includes the right bank of Compton Creek (Reaches CR1, CR2 and CR3), the left bank of Compton Creek at the mouth of the stream (Reach CL1), and the right bank of Pews Creek at its mouth (Reach PR1).

232. Within the line of protection, residual damage may occur due to either ponding of interior runoff or overtopping of the levee during extreme events. Interior damage, based on the anticipated depth and frequency of flooding is expected to average $91,740 on an equivalent annual basis.

233. Residual damage, due to tidal storms which overtop the line of protection, is summarized in Table 11. Future increases in damage are due to the projected rise in sea level.

TABLE 11
RESIDUAL TIDAL STORM DAMAGE
(1998 PRICE LEVEL, 50-YEAR PERIOD, 6-5/8% INT.)

Reach	Base Year	Future (2050)	Equivalent Annual
P2	$111,750	$139,730	$119,320
P3	$70,140	$87,580	$74,860
P4	$54,500	$67,880	$58,120
Cl2	$158,920	$197,750	$169,420
Cl3	$77,160	$96,480	$82,390
Total	**$472,470**	**$589,420**	**$504,110**

234. Uncertainty. In order to evaluate the impact of potential uncertainty in flood damages, the uncertainty in benefit estimates was analyzed to evaluate the impact of possible outcomes on the BCR. As seen in Table 12, there is a 75% chance that the BCR is greater than 0.98 and a 25% chance that it is greater than 1.23.

TABLE 12
BENEFIT UNCERTAINTY
(1998 PRICE LEVEL, 50-YEAR PERIOD, 6-5/8% INT.)

	Expected Value	**75th Percentile**	**50th Percentile**	**25th Percentile**
Annual Benefits	$3,239,830	$3,594,240	$3,227,340	$2,884,930
Annual Costs	$2,931,010	$2,931,010	$2,931,010	$2,931,010
Net Annual Benefits	$308,820	$663,230	$296,330	$-46,080
BCR	1.11	1.23	1.10	0.98

235. The plan with the greatest net excess benefits is by definition the NED plan. The local interests also prefer the NED plan; therefore it is the selected plan. The plan avoids to the extent possible, environmental impacts, promotes public access, affords incidental recreation, etc. The selected plan alignment is presented in Figures 6-12. The levee profile is presented in Figures 13-19 and the dune profile is presented in Figure 20.

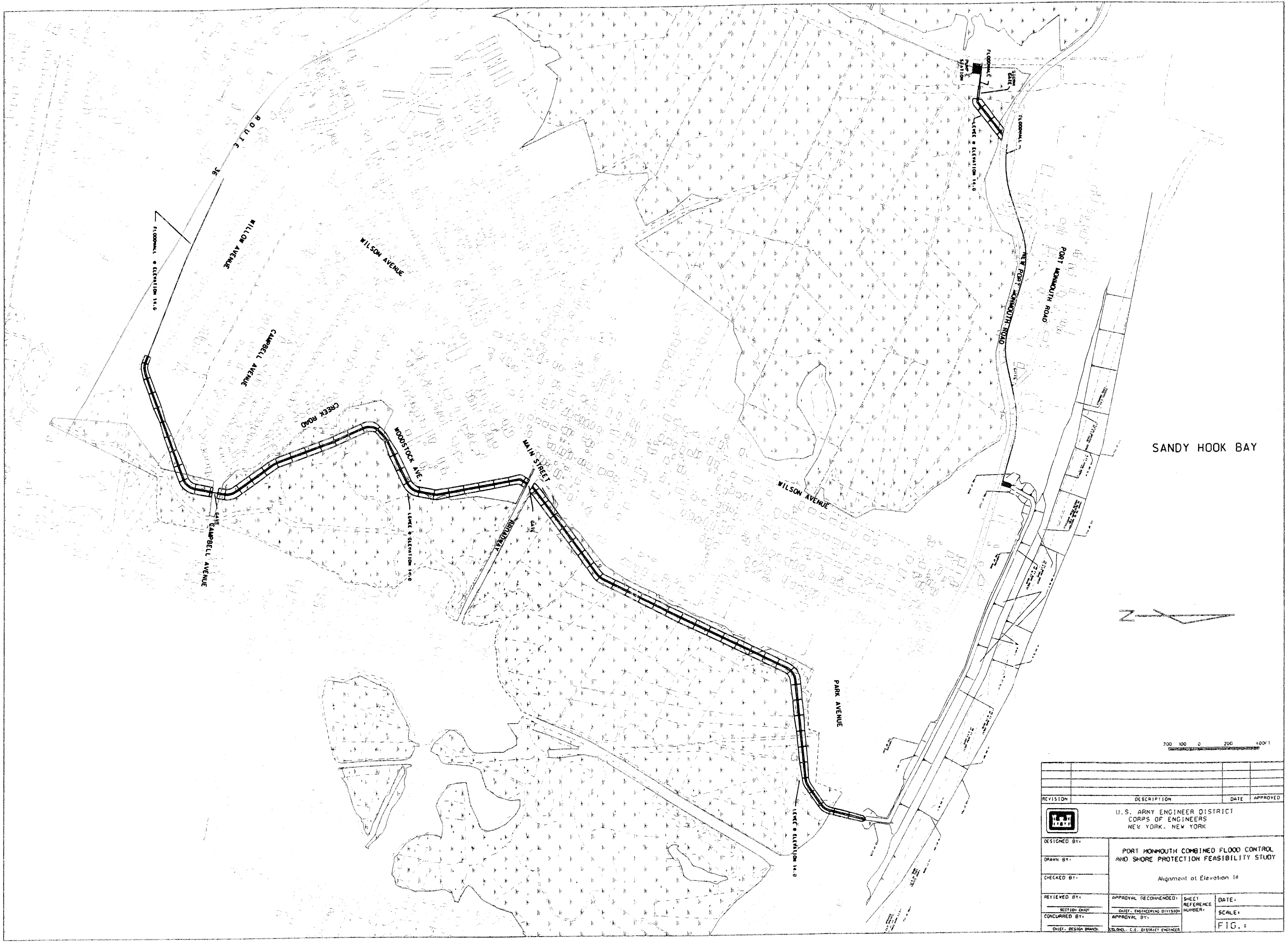
VII. SELECTED PLAN

Description of Selected Plan

236. Compton Creek The alignment for flood protection from Compton Creek starts out as an I type floodwall (Figure 21) approximately 250 feet southeast of the intersection of Wilson Avenue and State Highway 36 and proceeds easterly along the rear property line of the homes fronting Willow Avenue. The I wall will span approximately 1250 feet to the last rear yard of Willow Avenue at an elevation of +14 ft NGVD. This floodwall section ranges from one-half to six feet above existing grade. The I-type floodwall minimizes property acquisition and easement widths.

237. The alignment transitions from an I-type floodwall to an earthen levee (Figure 22) and proceeds easterly for about 600 feet where it crosses an existing drainage ditch located between Campbell Avenue and Willow Avenue. The levee then turns north and approaches Campbell Avenue perpendicularly about 100 feet east of the intersection of Campbell Avenue and Creek Road. A road closure swing gate is proposed for the Campbell Avenue crossing. The gate will be approximately 40 feet wide and 8.5 feet high to provide flood protection to elevation +14 ft NGVD (Figure 23).

238. The levee then continues from the Campbell Avenue crossing in a northerly direction through the wetlands nearly parallel to Creek Road for approximately 1,100 feet. The levee height for this reach varies between 10 feet and 11 feet above existing grade. The levee then continues northeast, paralleling Woodstock Avenue for 400 feet and then



REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:

DRAWN BY:

CHECKED BY:

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

Alignment at Elevation 14

REVIEWED BY:
SECTION CHIEF

CONCURRED BY:
CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION

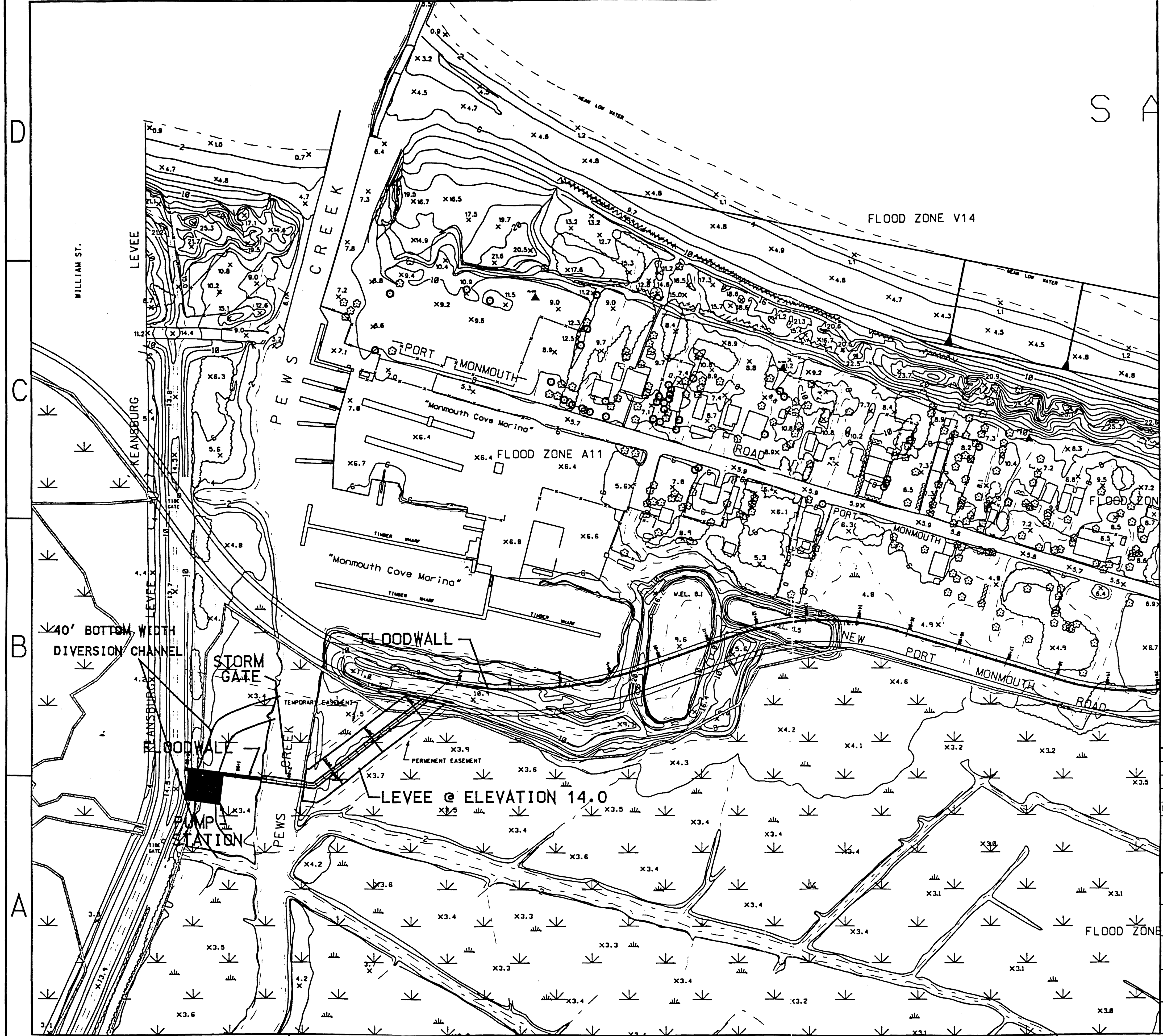
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:

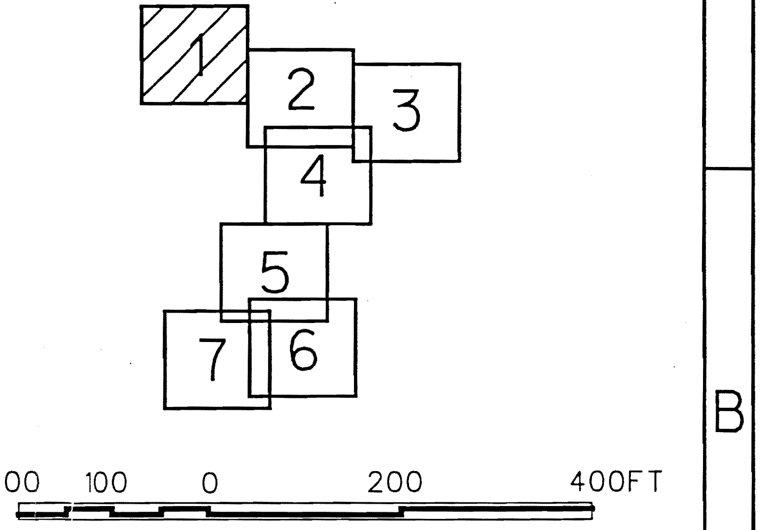
SCALE:

FIG. :



SHEET LEGEND

- BUILDING
- ROAD, PARKING AREA
- FENCE
- WOODED AREA
- STANDARD LEVEE
- ROAD RAISING
- STANDARD FLOODWALL
- Ⓒ2 INTERIOR DRAINAGE AREA DESIGNATION
- PUMP STATION
- INTERIOR DRAINADE OUTLET
- DRAINAGE SWALE
- CLOSURE GATE



REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:

DRAWN BY:

CHECKED BY:

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY
LEVEL OF PROTECTION @ ELEVATION 14.0

REVIEWED BY:
SECTION CHIEF

CONCURRED BY:
CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION

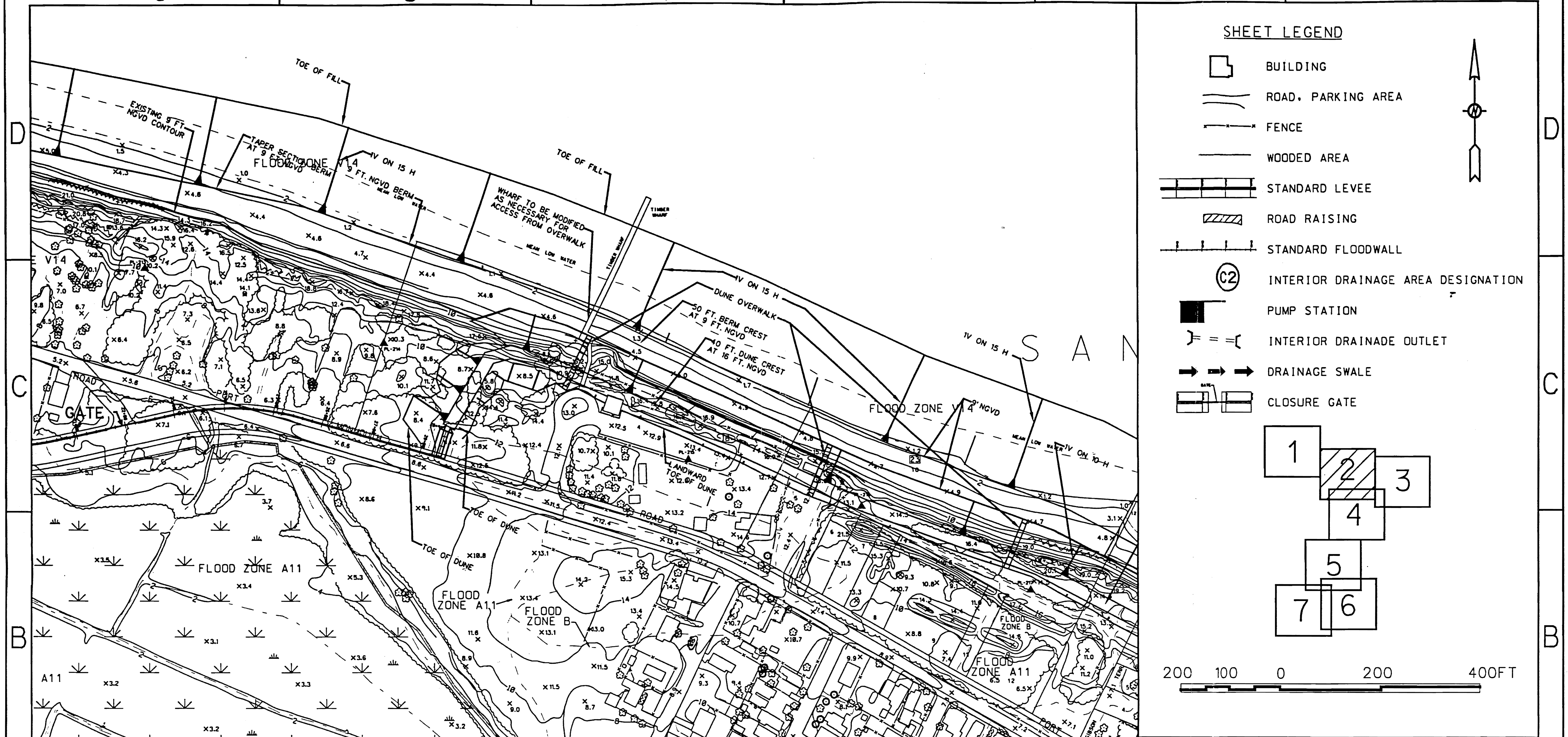
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:

SCALE: 1" = 200'

FIG.: 6



REVISION	DESCRIPTION	DATE	APPROVED

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

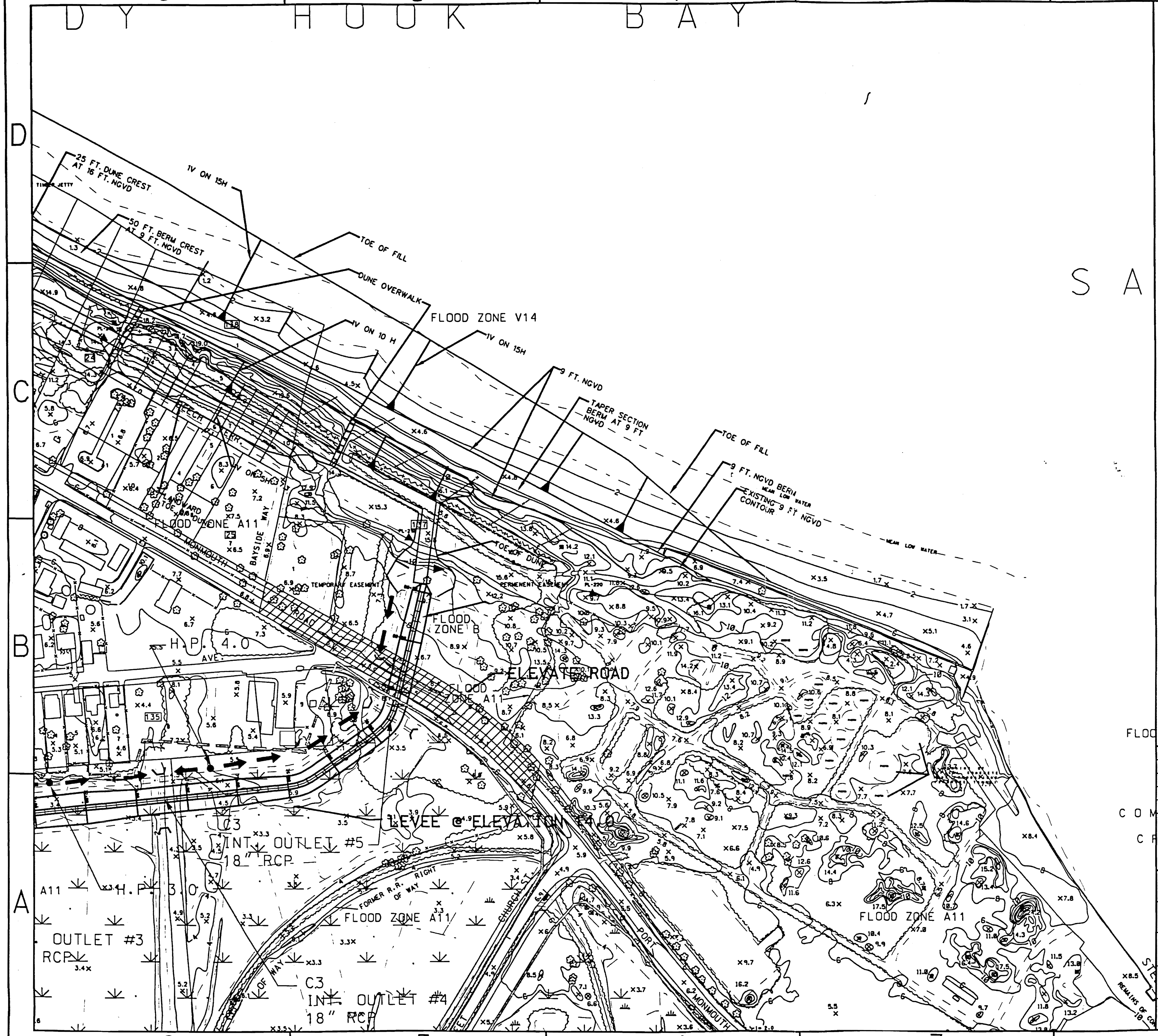
DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY
LEVEL OF PROTECTION @ ELEVATION 14.0

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

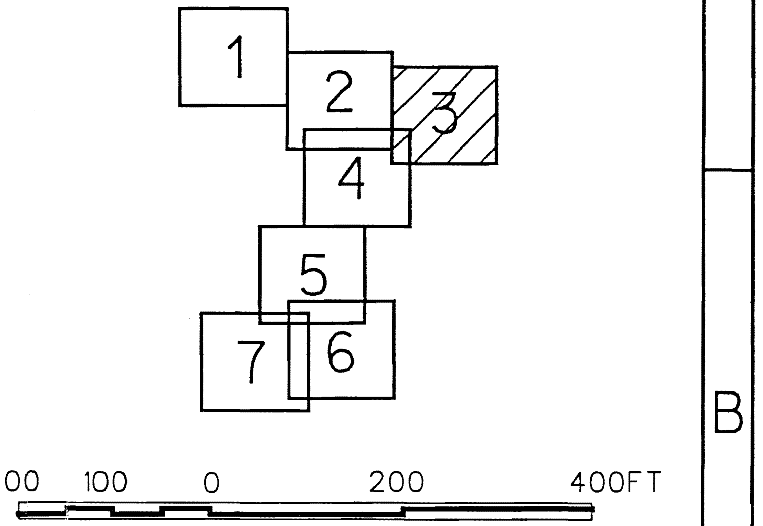
SHEET REFERENCE NUMBER:

DATE:
SCALE: 1" = 200'
FIG.: 7



SHEET LEGEND

- BUILDING
- ROAD, PARKING AREA
- FENCE
- WOODED AREA
- STANDARD LEVEE
- ROAD RAISING
- STANDARD FLOODWALL
- (C2) INTERIOR DRAINAGE AREA DESIGNATION
- PUMP STATION
- INTERIOR DRAINADE OUTLET
- → → → DRAINAGE SWALE
- CLOSURE GATE



REVISION	DESCRIPTION	DATE	APPROVED

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

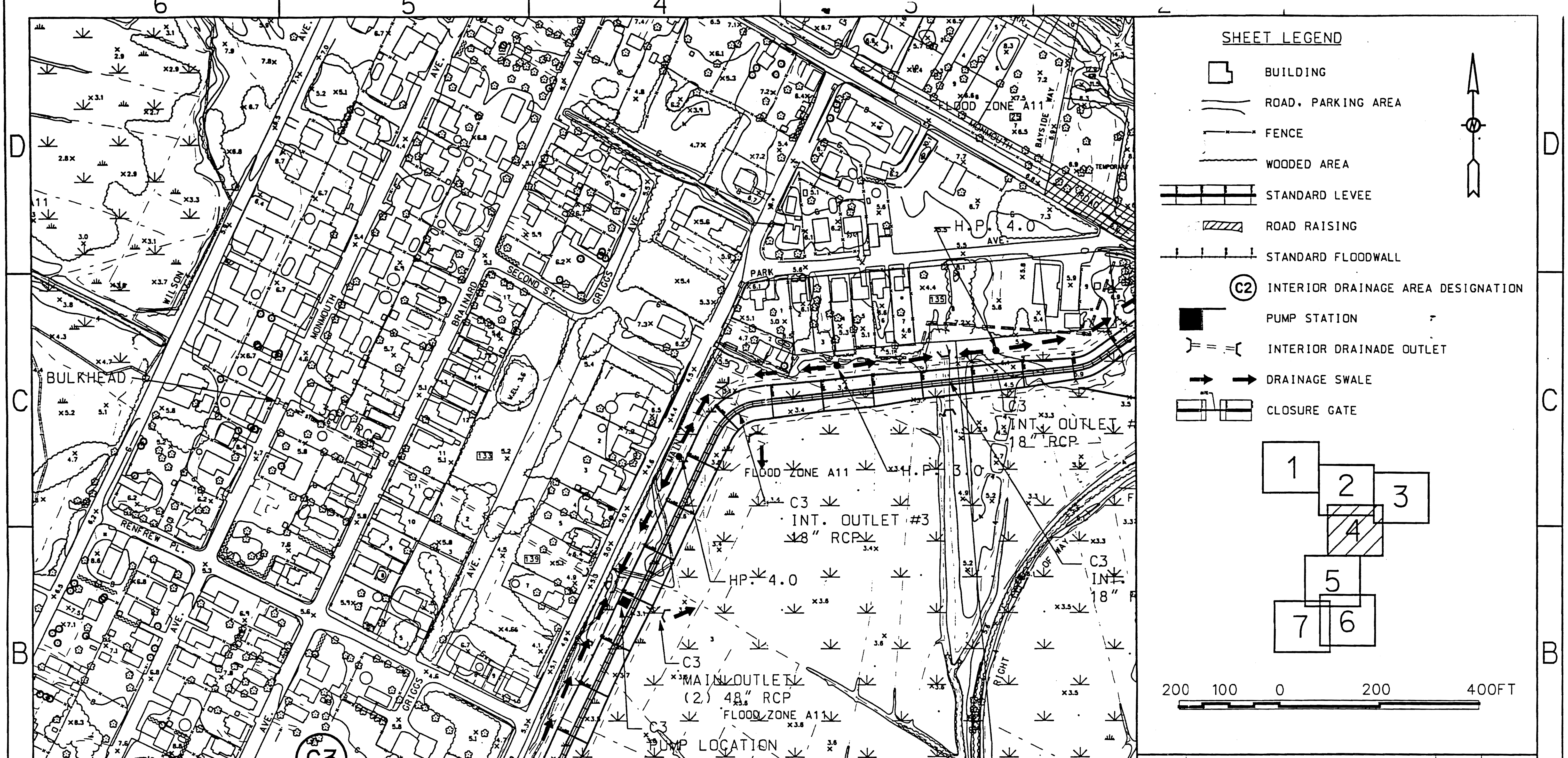
DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL AND SHORE PROTECTION FEASIBILITY STUDY
LEVEL OF PROTECTION @ ELEVATION 14.0

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:
SCALE: 1" = 200'
FIG.: 8



REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:

DRAWN BY:

CHECKED BY:

REVIEWED BY:

SECTION CHIEF

CONCURRED BY:

CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY
LEVEL OF PROTECTION @ ELEVATION 14.0

APPROVAL RECOMMENDED:

CHIEF, ENGINEERING DIVISION

APPROVAL BY:

COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

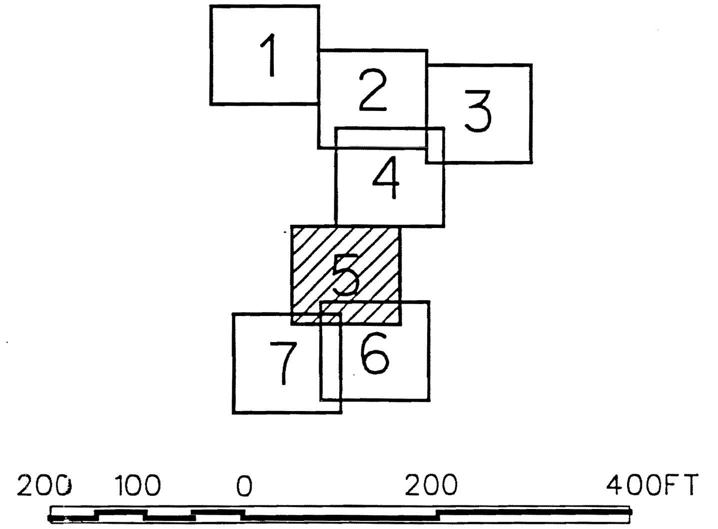
DATE:

SCALE: 1" = 200'

FIG.: 9

SHEET LEGEND

BUILDING
ROAD, PARKING AREA
FENCE
WOODED AREA
STANDARD LEVEE
ROAD RAISING
STANDARD FLOODWALL
(C2) INTERIOR DRAINAGE AREA DESIGNATION
PUMP STATION
INTERIOR DRAINADE OUTLET
DRAINAGE SWALE
CLOSURE GATE



REVISION	DESCRIPTION	DATE	APPROVED

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

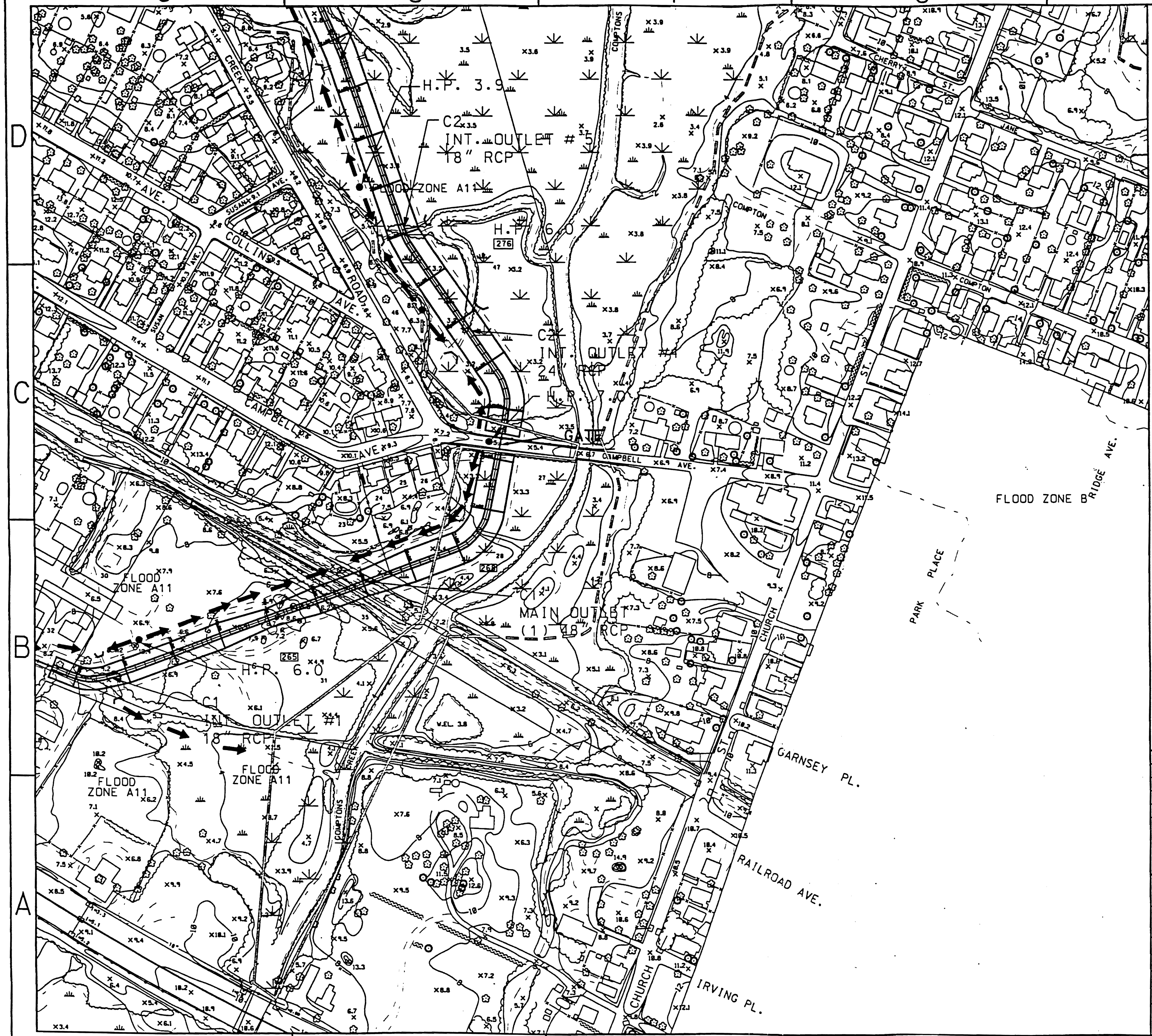
DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY
LEVEL OF PROTECTION @ ELEVATION 14.0

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

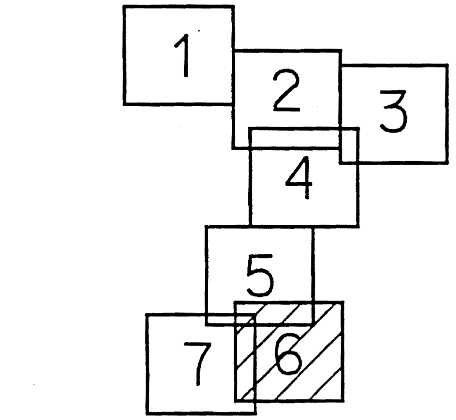
SHEET REFERENCE NUMBER:

DATE:
SCALE: 1" = 200'
FIG.: 10



SHEET LEGEND

- BUILDING
- ROAD, PARKING AREA
- FENCE
- WOODED AREA
- STANDARD LEVEE
- ROAD RAISING
- STANDARD FLOODWALL
- (C2) INTERIOR DRAINAGE AREA DESIGNATION
- PUMP STATION
- INTERIOR DRAINADE OUTLET
- DRAINAGE SWALE
- CLOSURE GATE



REVISION	DESCRIPTION	DATE	APPROVED

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

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY
LEVEL OF PROTECTION @ ELEVATION 14.0

DESIGNED BY:

DRAWN BY:

CHECKED BY:

REVIEWED BY:
SECTION CHIEF

CONCURRED BY:
CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION

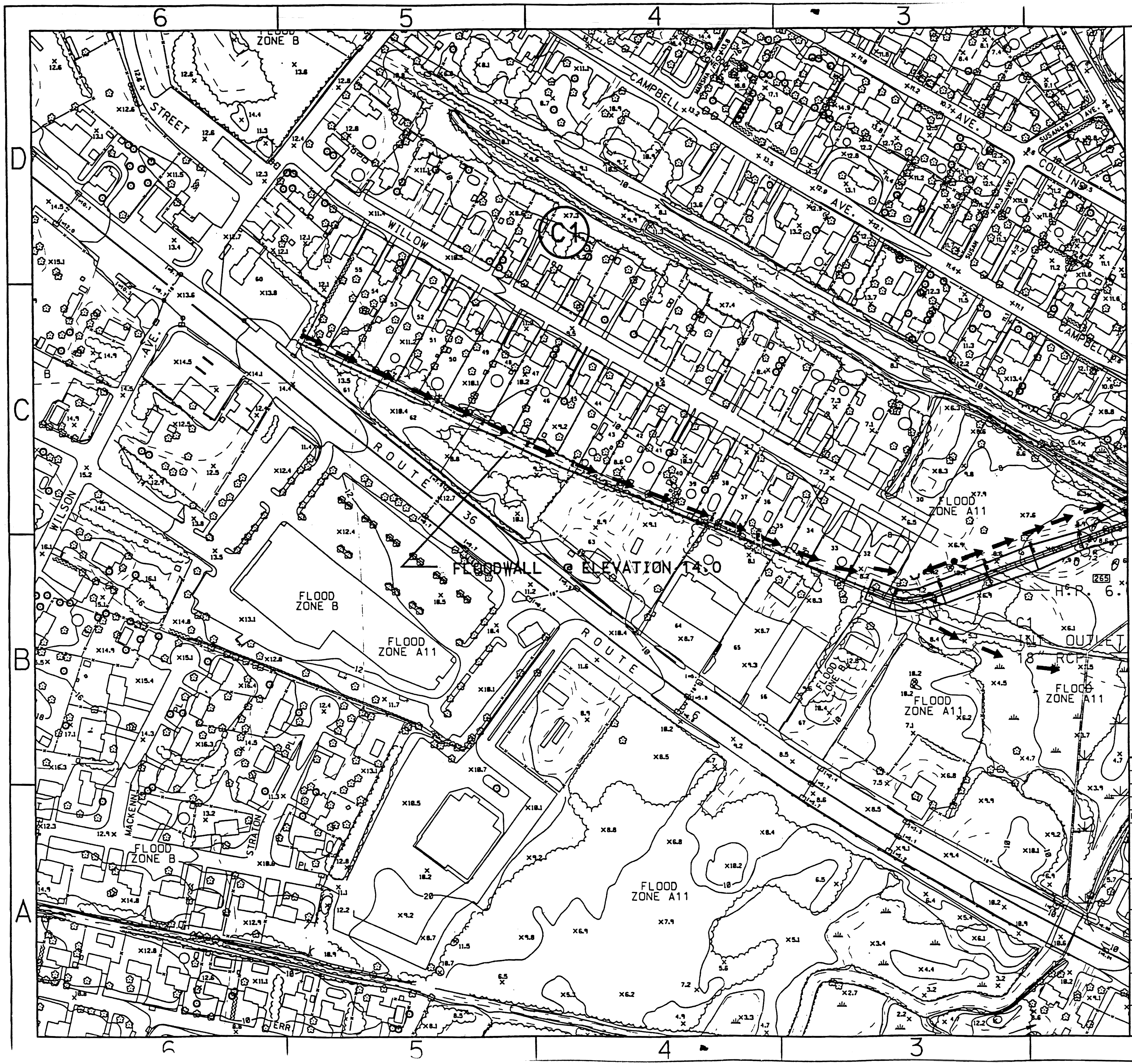
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:

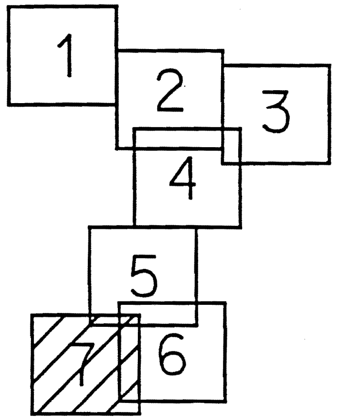
SCALE: 1" = 200'

FIG.: 11



SHEET LEGEND

BUILDING
ROAD, PARKING AREA
FENCE
WOODED AREA
STANDARD LEVEE
ROAD RAISING
STANDARD FLOODWALL
(C2) INTERIOR DRAINAGE AREA DESIGNATION
PUMP STATION
INTERIOR DRAINADE OUTLET
DRAINAGE SWALE
CLOSURE GATE



200 100 0 200 400FT

REVISION	DESCRIPTION	DATE	APPROVED

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

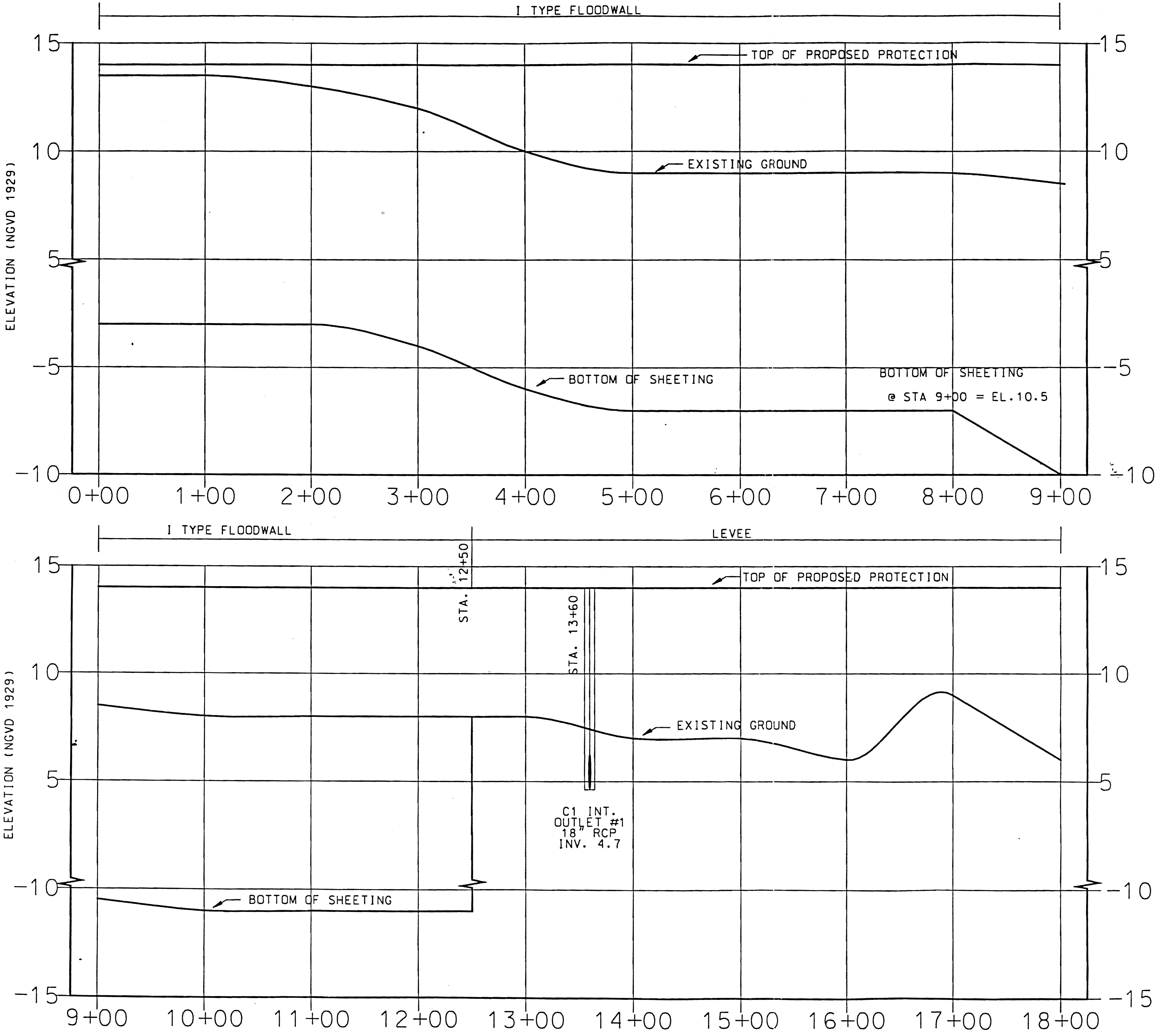
DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY
LEVEL OF PROTECTION @ ELEVATION 14.0

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:
SCALE: 1" = 200'
FIG.: 12



HORIZ. 1" = 100'
VERT. 1" = 5'

REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

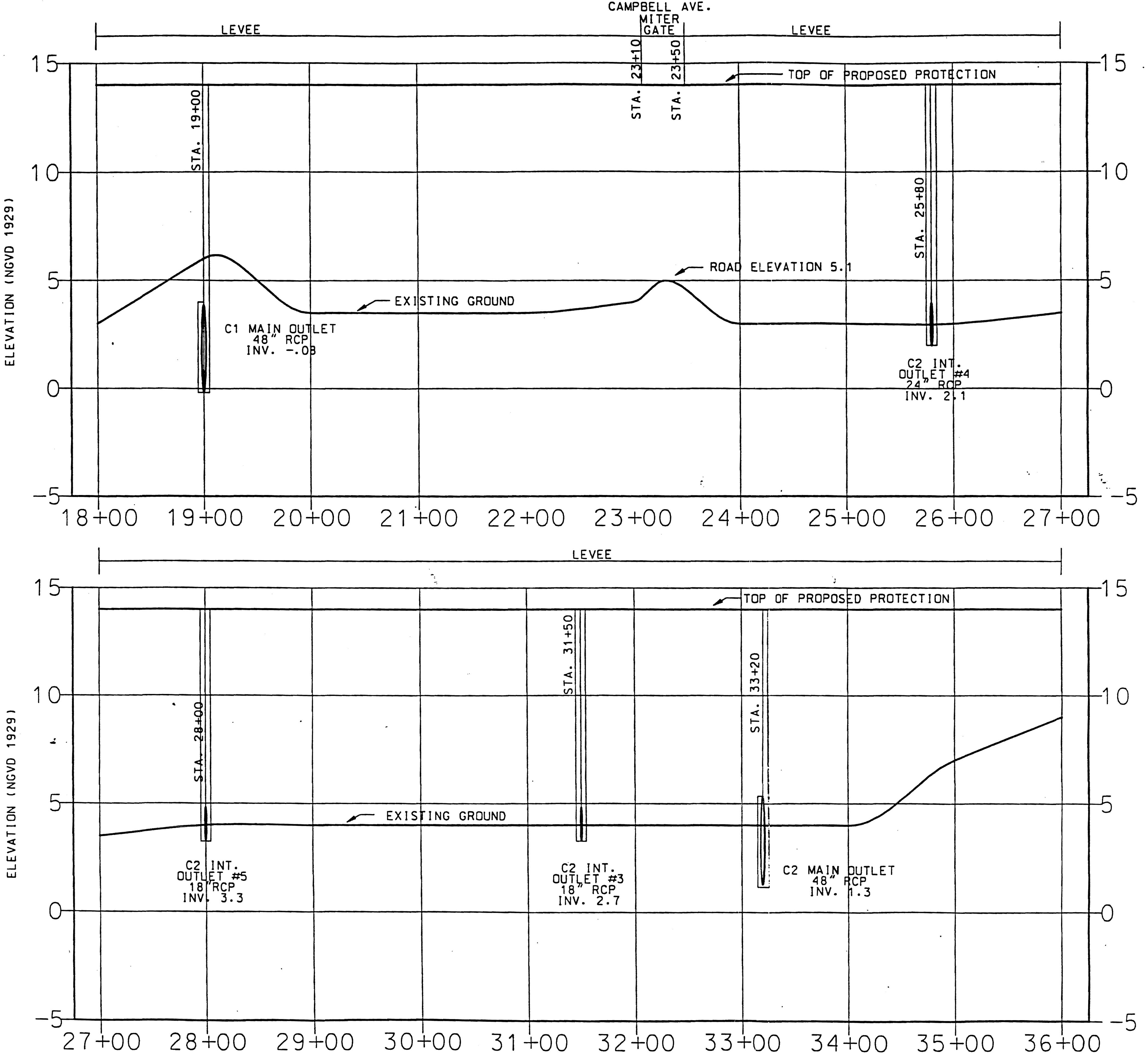
PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

COMPTONS CREEK ALIGNMENT
FLOOD PROTECTION ELEVATION 14.0
STA. 0+00 TO 18+00

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:
SCALE: AS SHOWN
FIG.: 13



HORIZ. 1" = 100'
VERT. 1" = 5'

REVISION	DESCRIPTION	DATE	APPROVED

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

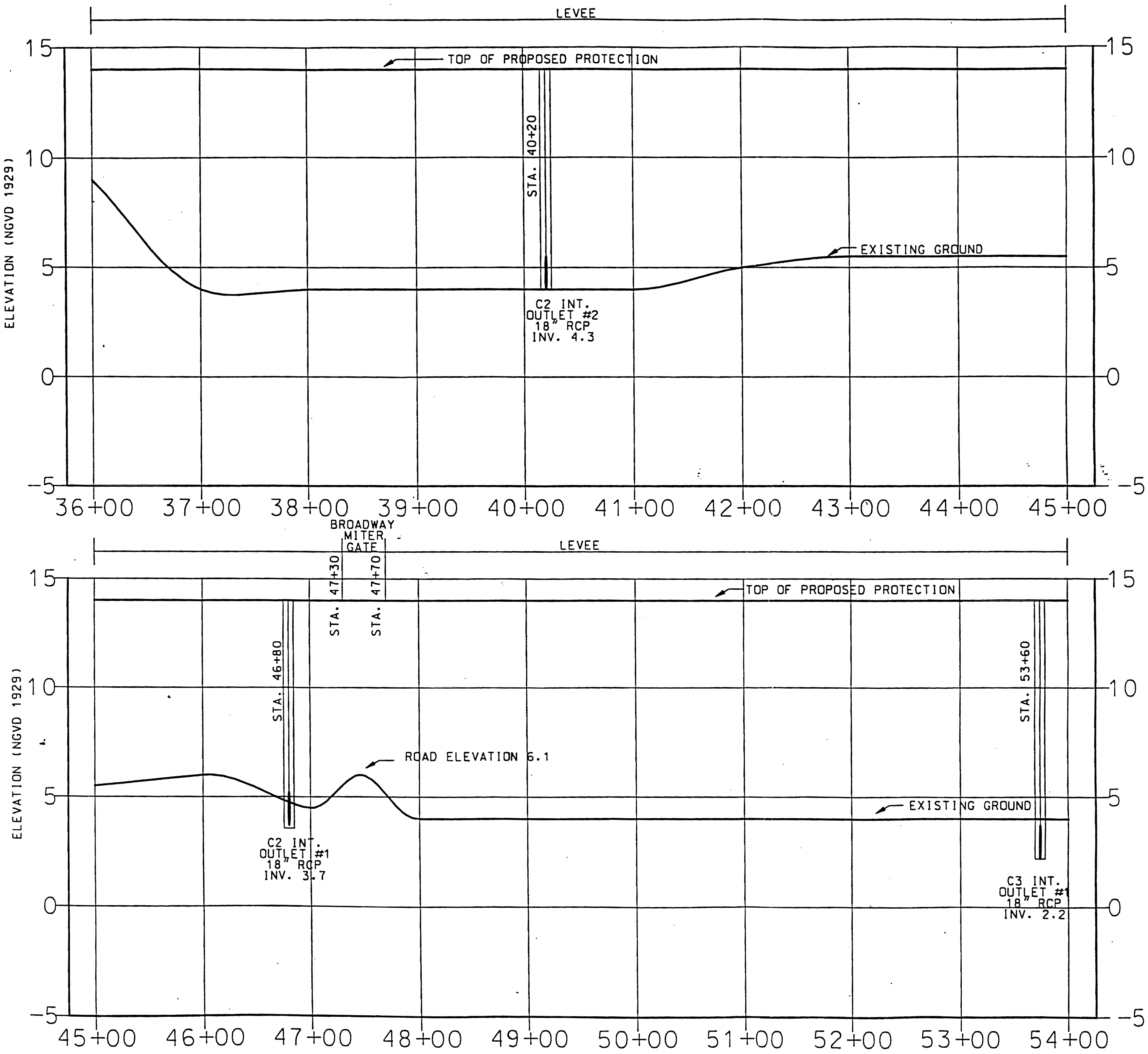
DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

COMPTONS CREEK ALIGNMENT
FLOOD PROTECTION ELEVATION 14.0
STA. 18+00 TO 36+00

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:
DATE:
SCALE: AS SHOWN
FIG.: 14



HORIZ. 1" = 100'
VERT. 1" = 5'

REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

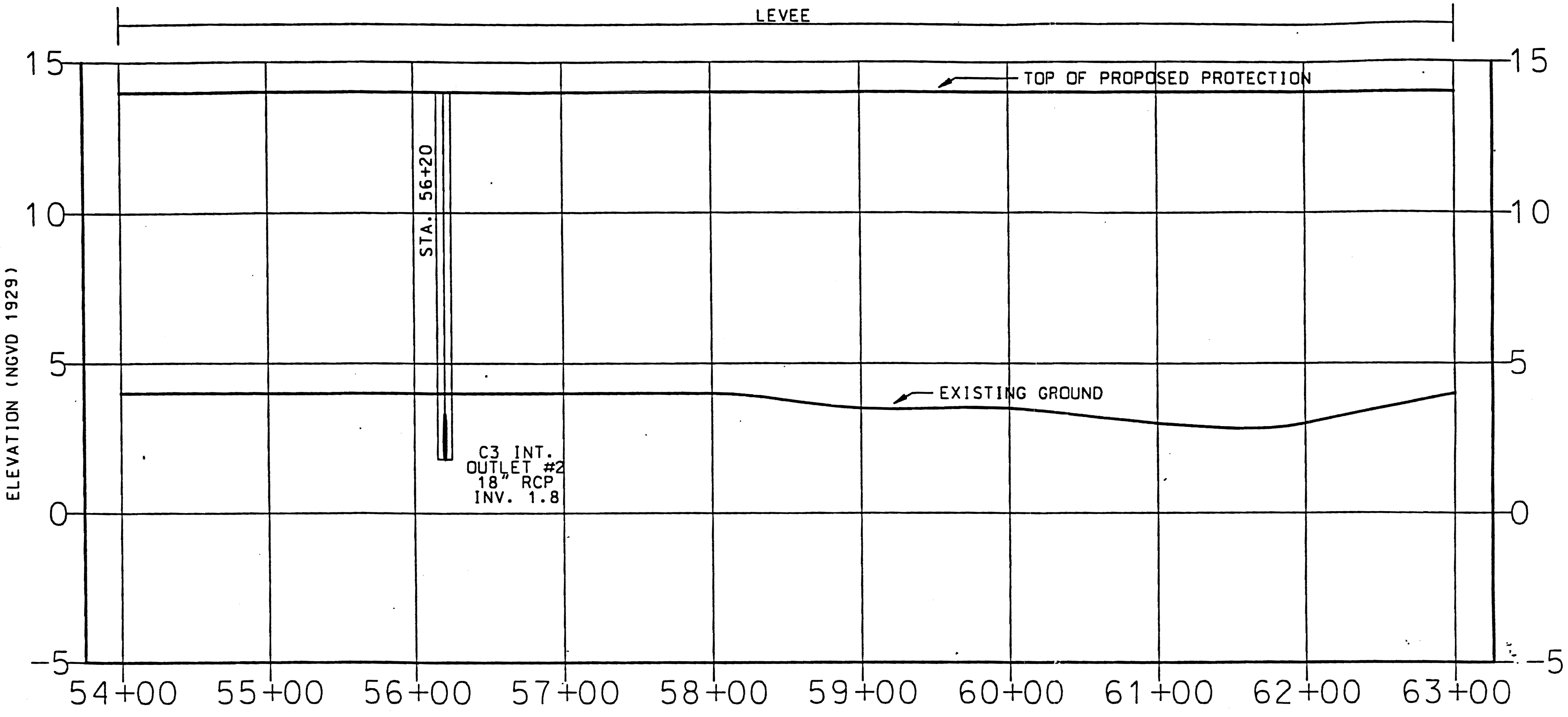
PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

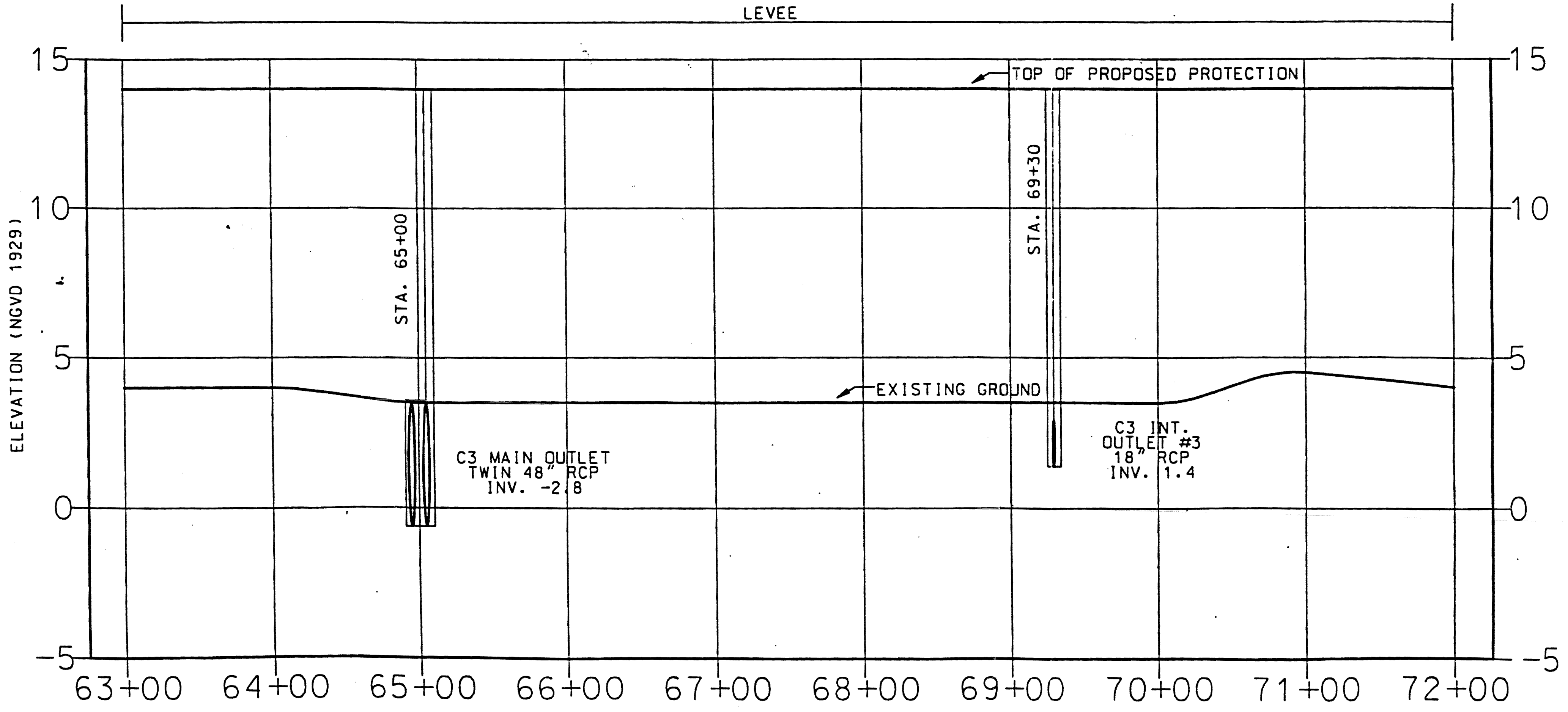
COMPTONS CREEK ALIGNMENT
FLOOD PROTECTION ELEVATION 14.0
STA. 36+00 TO 54+00

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:
SCALE: AS SHOWN
FIG.: 15





HORIZ. 1" = 100'
VERT. 1" = 5'

REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

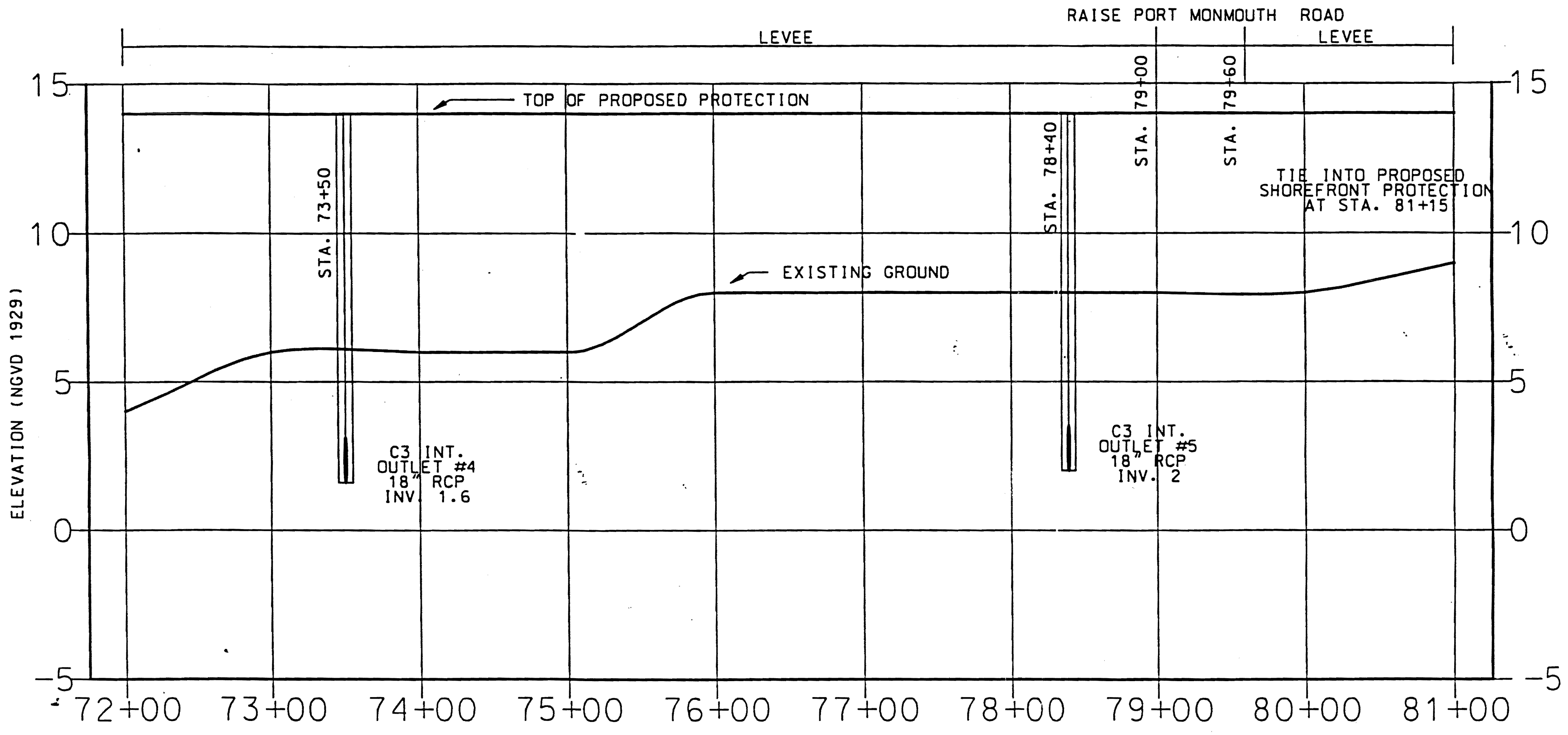
PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

COMPTONS CREEK ALIGNMENT
FLOOD PROTECTION ELEVATION 14.0
STA. 54+00 TO 72+00

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:
SCALE: AS SHOWN
FIG. :16



HORIZ. 1" = 100'
VERT. 1" = 5'

REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:

DRAWN BY:

CHECKED BY:

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

COMPTONS CREEK ALIGNMENT
FLOOD PROTECTION ELEVATION 14.0
STA. 72+00 TO 81+00

REVIEWED BY:
SECTION CHIEF

CONCURRED BY:
CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION

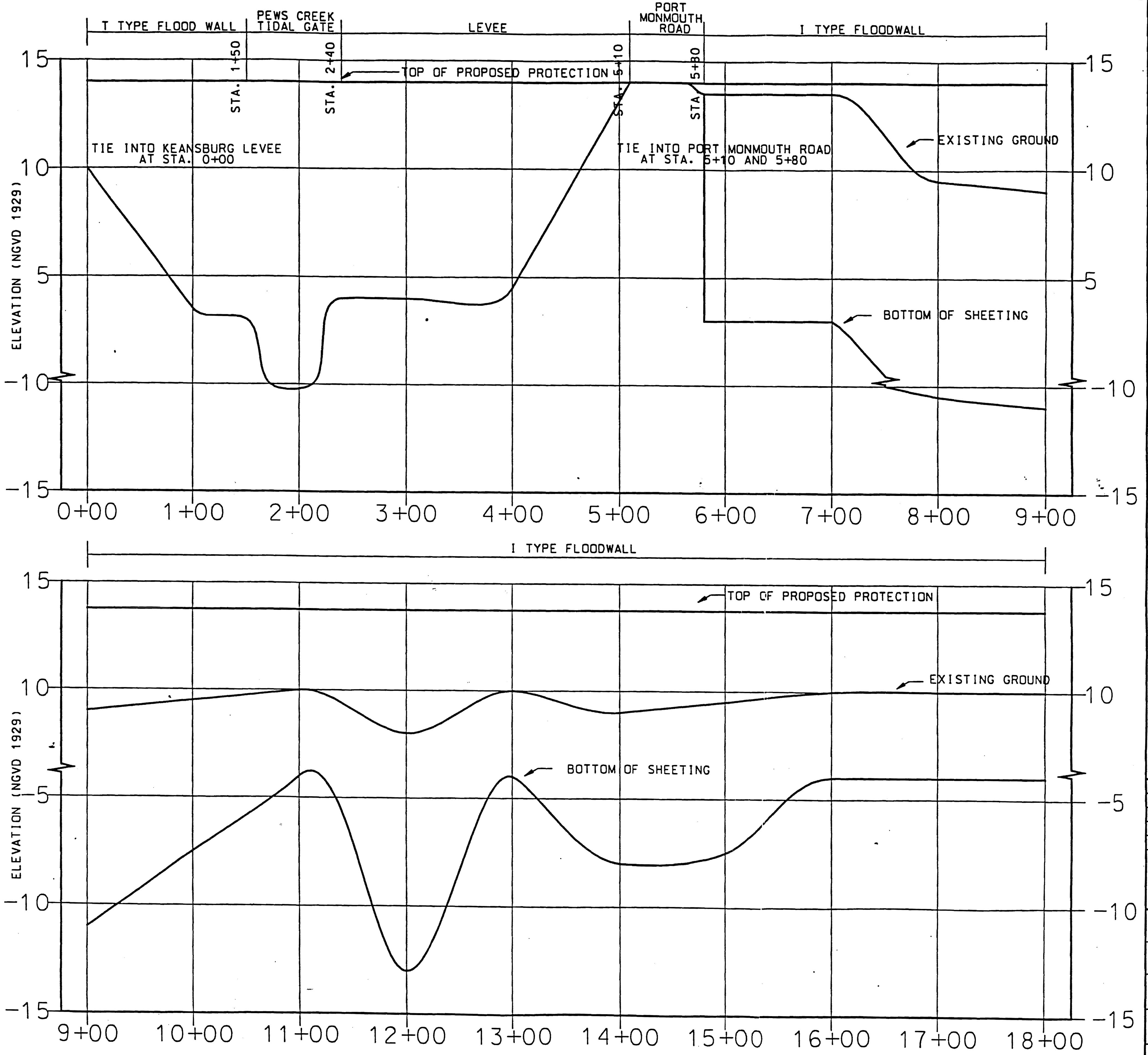
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:

SCALE: AS SHOWN

FIG.: 17



HORIZ. 1" = 100'
VERT. 1" = 5'

REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

PEWS CREEK ALIGNMENT
FLOOD PROTECTION ELEVATION 14.0
STA. 0+00 TO 18+00

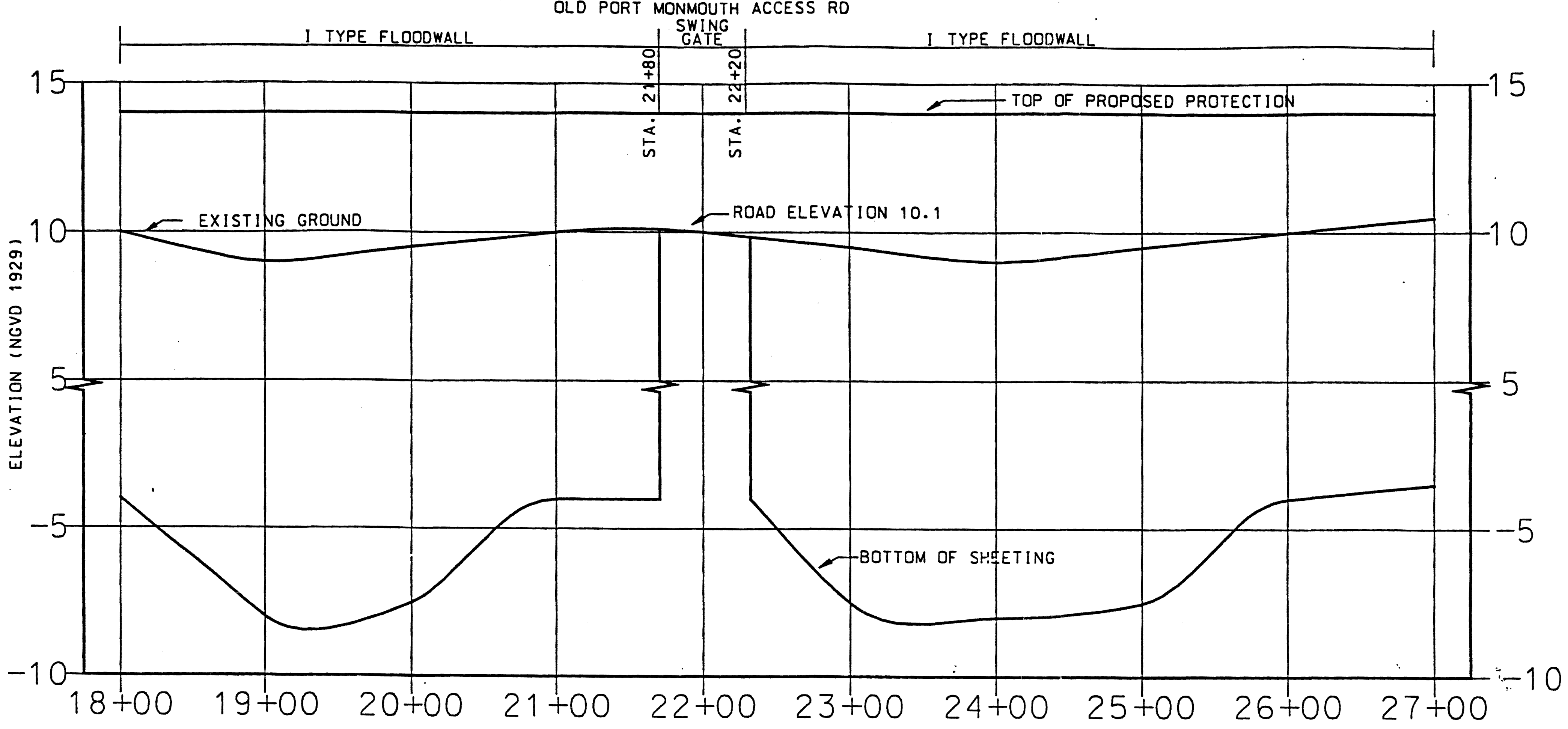
APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

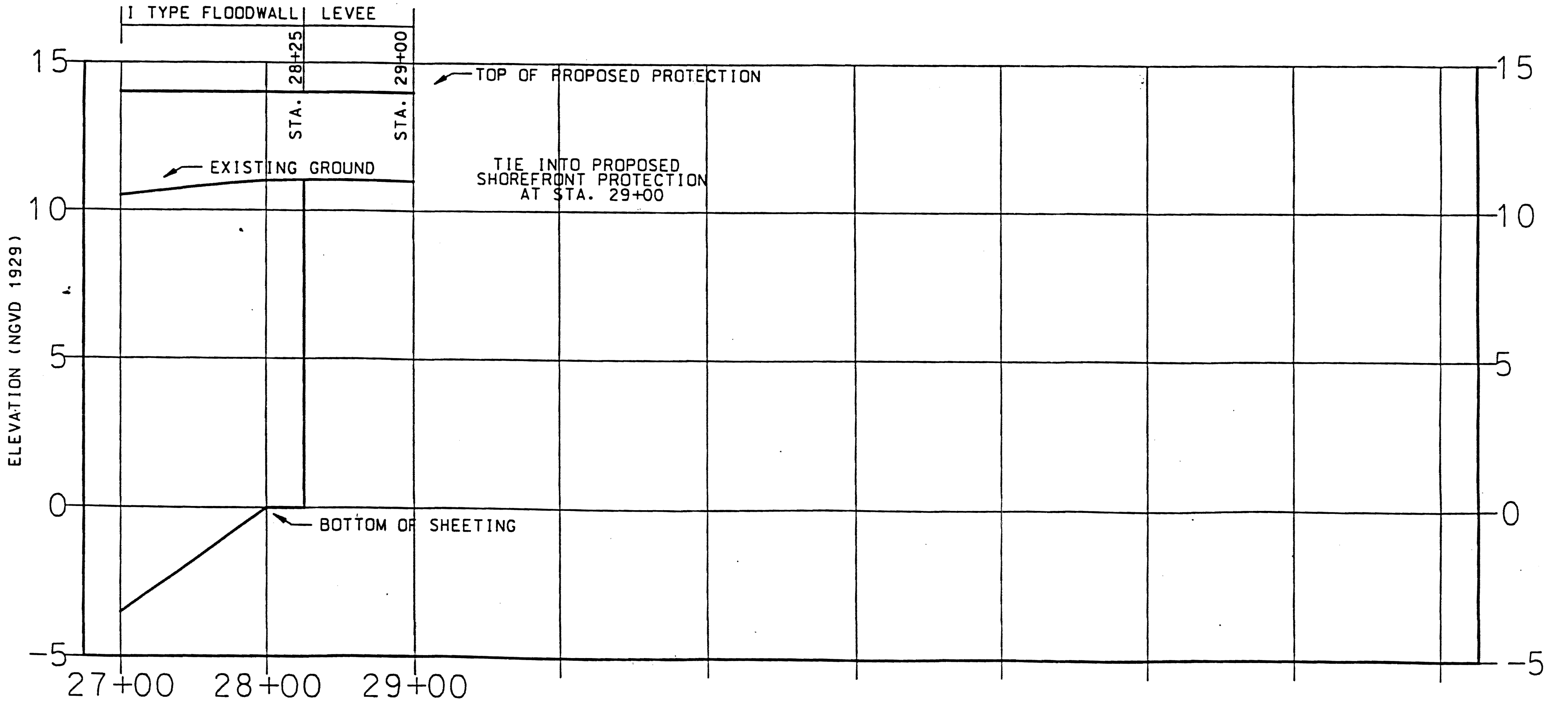
SHEET REFERENCE NUMBER:

DATE:

SCALE: AS SHOWN

FIG.: 18





HORIZ. 1" = 100'
VERT. 1" = 5'

REVISION	DESCRIPTION	DATE	APPROVED

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

DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
SECTION CHIEF
CONCURRED BY:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

PEWS CREEK ALIGNMENT
FLOOD PROTECTION ELEVATION 14.0
STA. 18+00 TO 29+00

APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVAL BY:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE:

SCALE: AS SHOWN

FIG.: 19

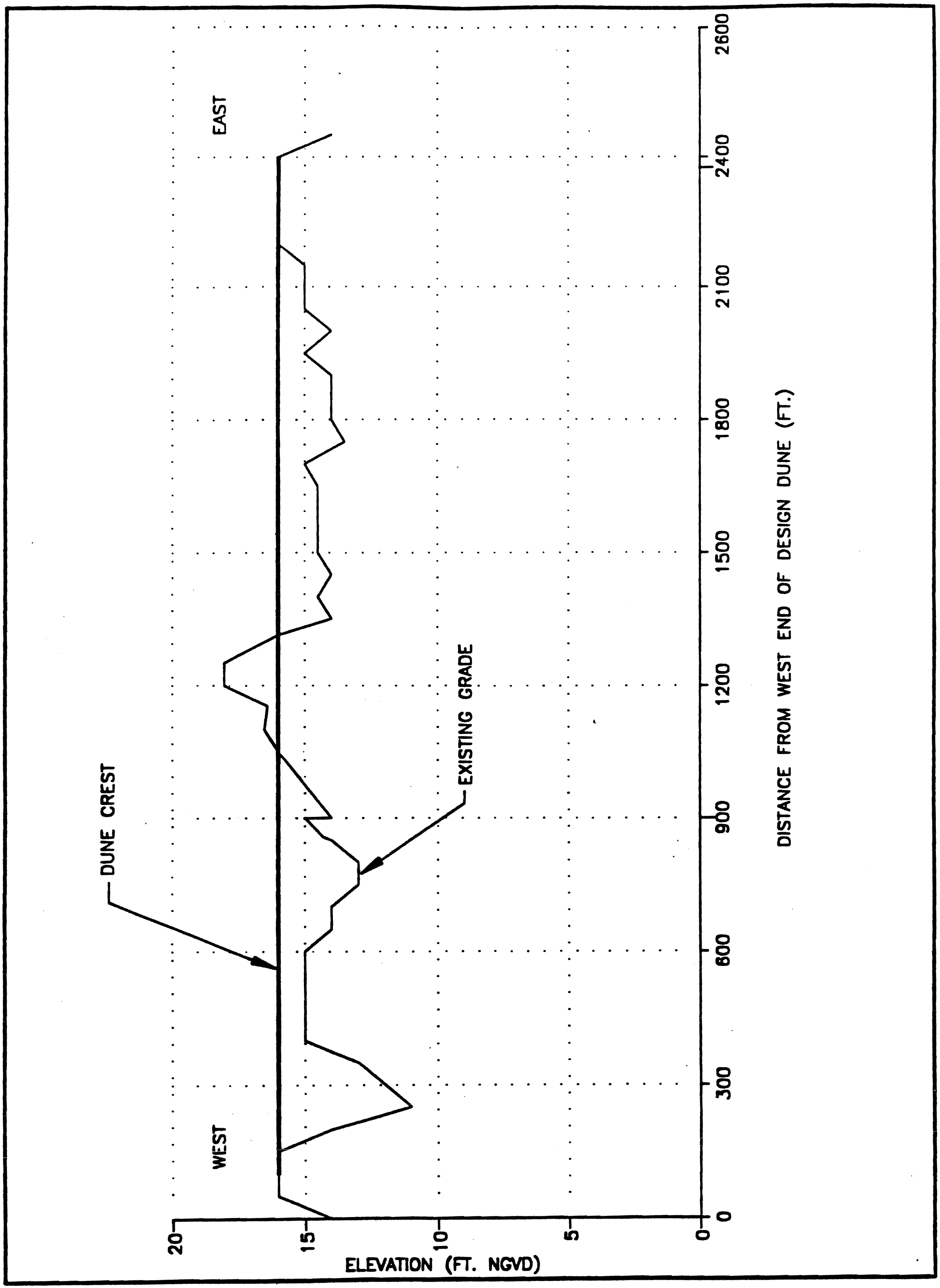
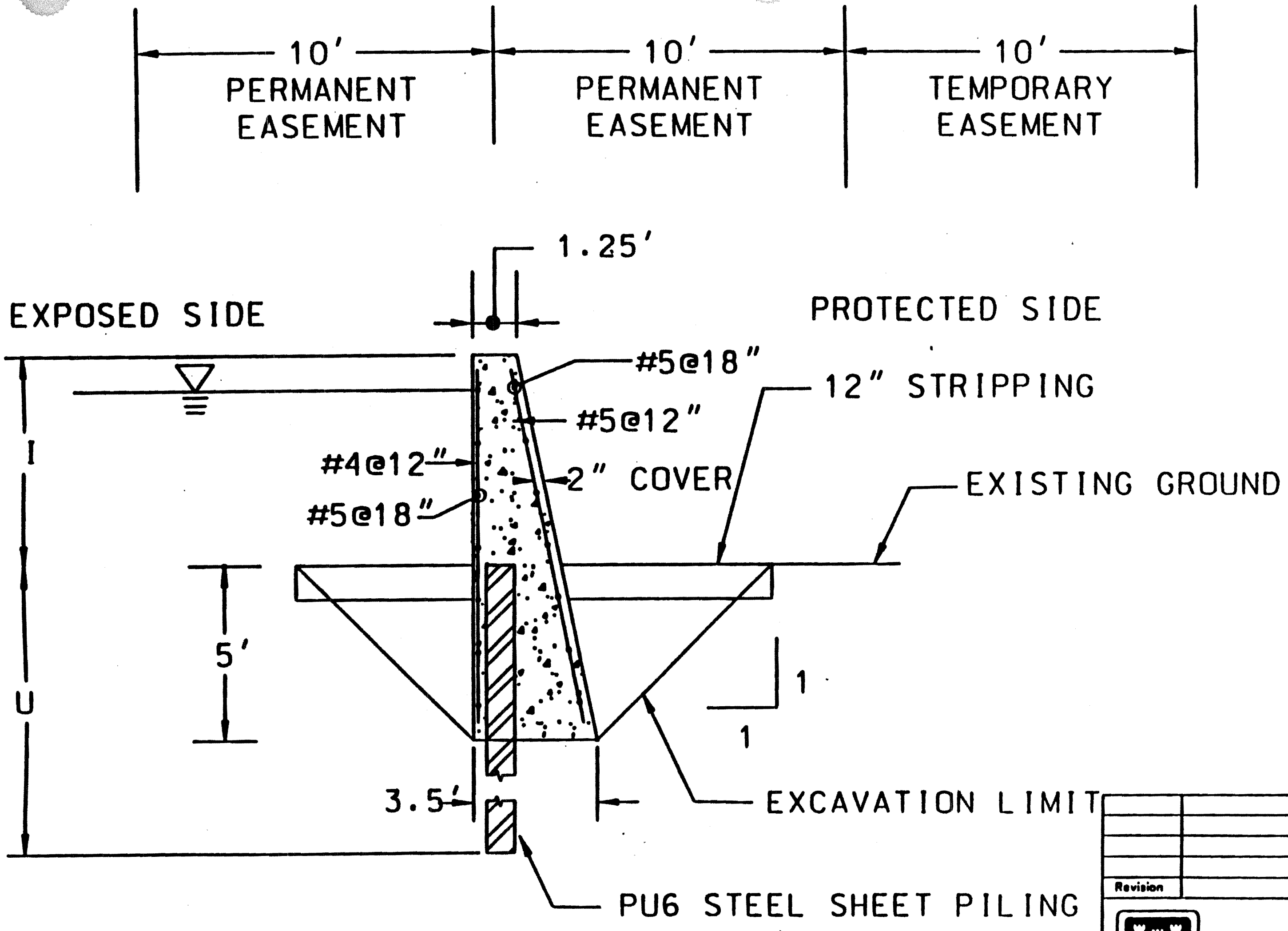


FIGURE 20

PORT MONMOUTH
FEASIBILITY STUDY
DUNE CROSS SECTION



I-S TYPE FLOODWAL

I - HEIGHT OF FLOODWAL
ABOVE GRADE

U - LENGTH OF SHEET PIL

TYPICAL FLOODWALL SECTION

Revision	Description	Date	Appr

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

Designed by:

Drawn by:

Checked by:

Reviewed by:
SECTION CHIEF

Concurred by:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTR
AND SHORE PROTECTION FEASIBILITY STUD

TYPICAL FLOODWALL SECTION

Approval Recommended:
CHIEF, ENGINEERING DIVISION

Approval By:
COLONEL, C.E. DISTRICT ENGINEER

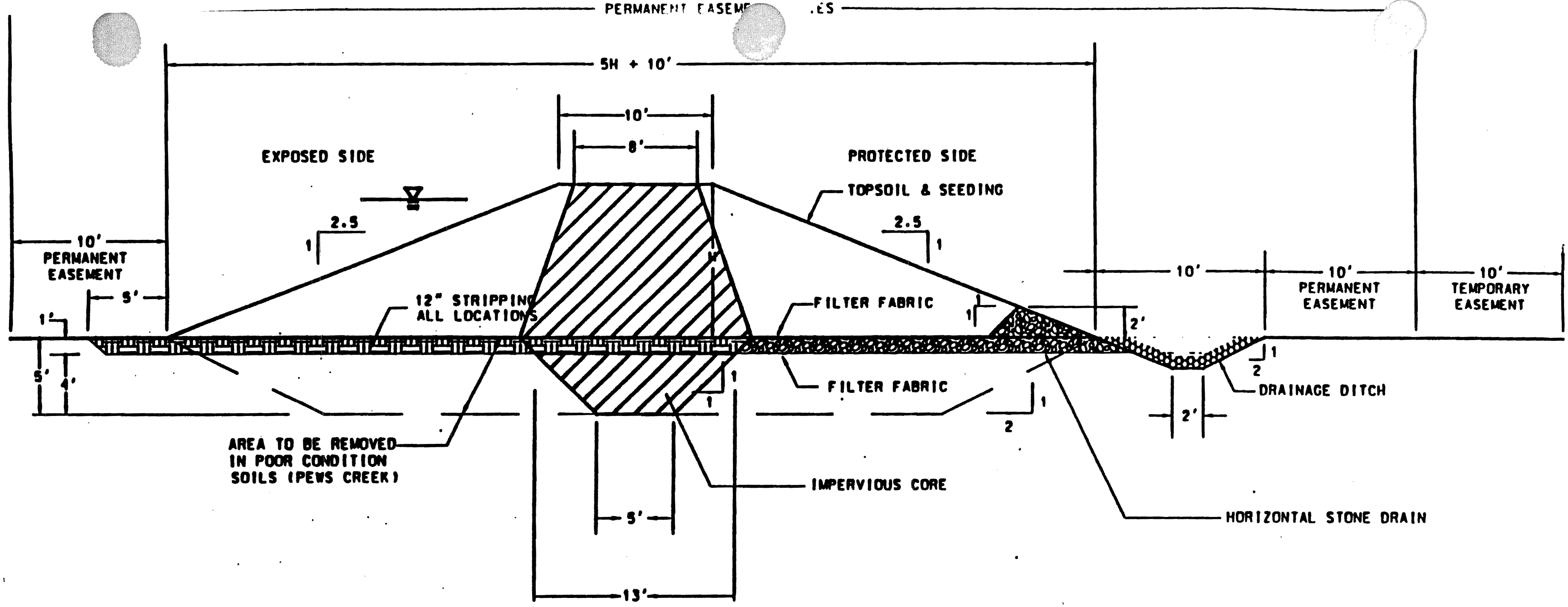
SHEET REFERENCE NUMBER:

DATE:

SCALE: 1" = 5'

FIG.: 21

basemaps\pmsec14.dgn Jun 24, 1998 17:44:48



TYPICAL LEVEE SECTION

Revision	Description	Date	Approved

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

Designed by:

Drawn by:

Checked by:

Reviewed by:
SECTION CHIEF

Concurred by:
CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

TYPICAL LEVEE SECTION
PEWS CREEK
COMPTONS CREEK

Approval Recommended:
CHIEF, ENGINEERING DIVISION

Approval By:
COLONEL, C.E. DISTRICT ENGINEER

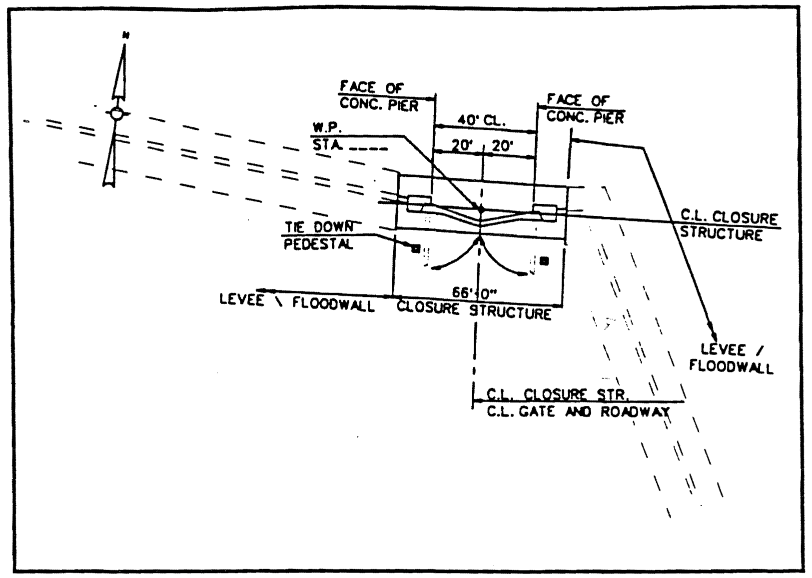
SHEET REFERENCE NUMBER:

DATE:

SCALE: 1" = 10'

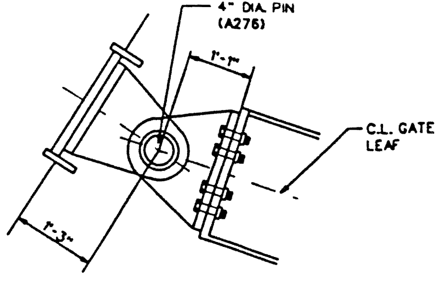
FIG.: 22

\00020\basemaps\pmsect4.dgn Jun. 17, 1998 07:34:00



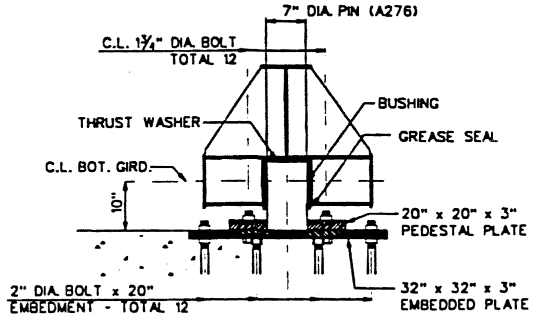
PLAN VIEW

0 10 20 30



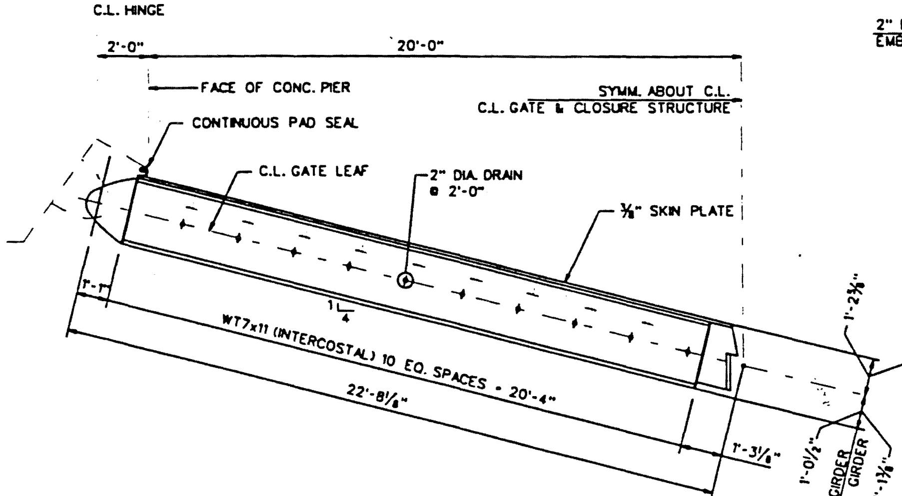
PLAN OF TOP HINGE

NOT TO SCALE



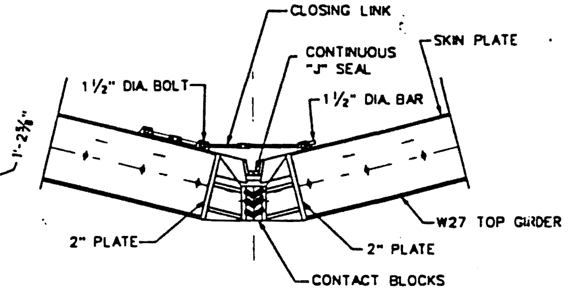
SECTION THRU BOTTOM HINGE

NOT TO SCALE



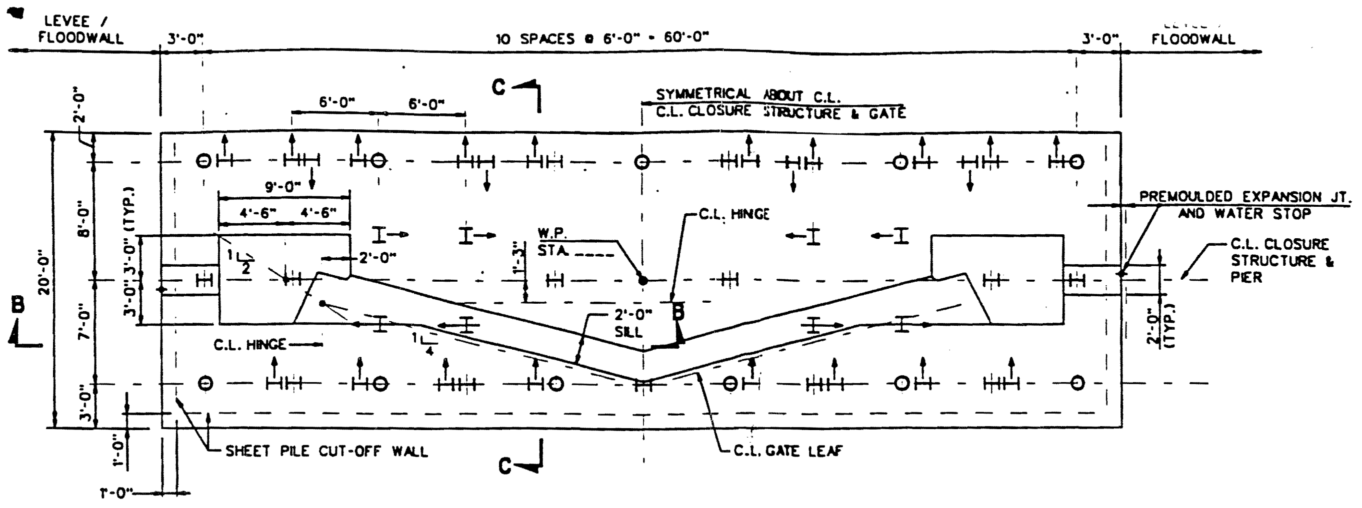
PLAN - GATE LEAF

0 1 2 3



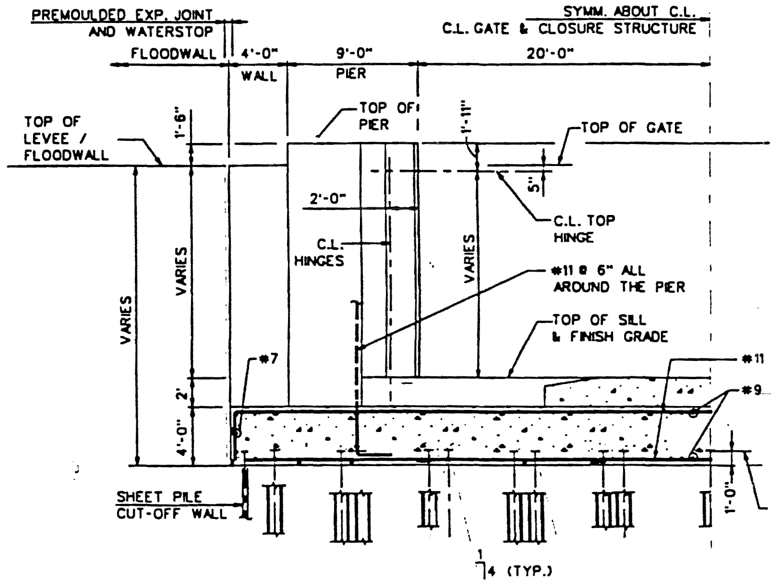
PLAN OF MITER DETAIL

NOT TO SCALE



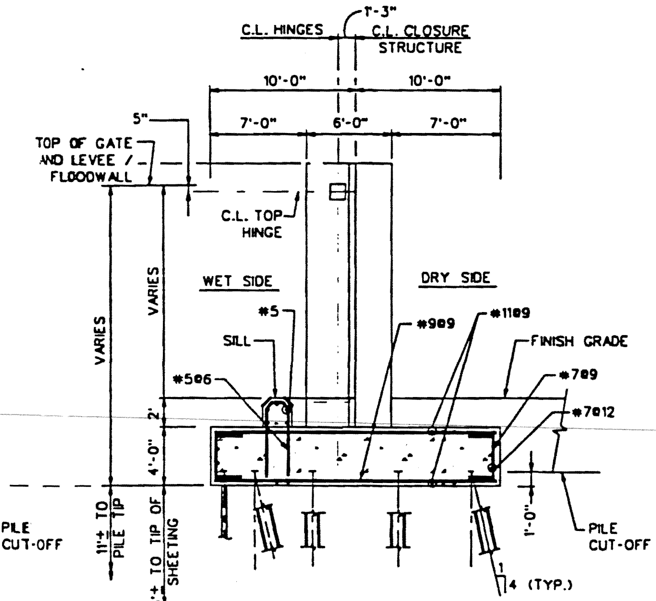
PLAN - SUBSTRUCTURE

0 2 4 6



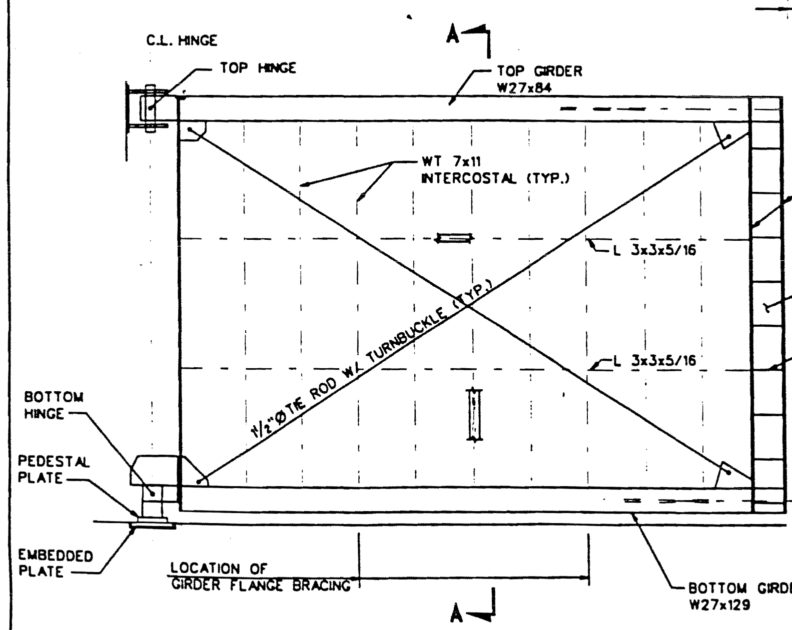
SECTION B-B

0 2 4 6



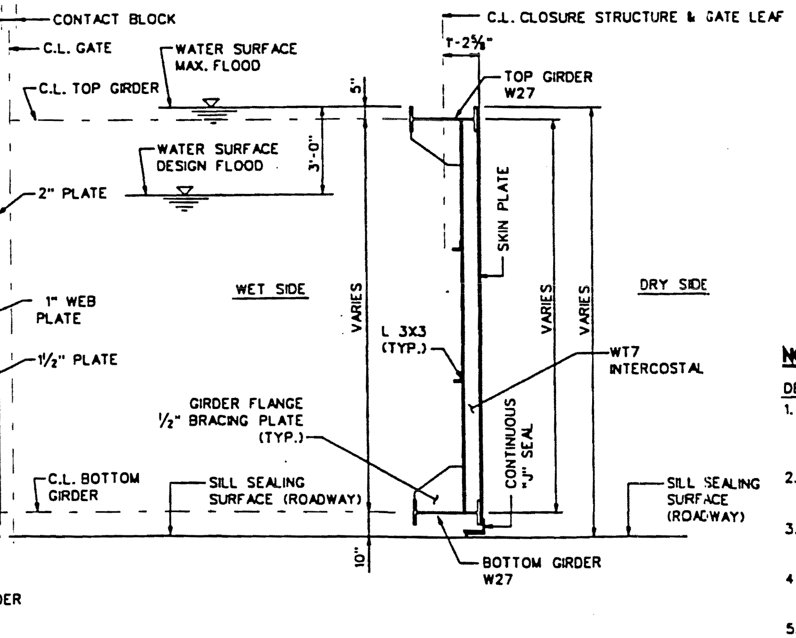
SECTION C-C

0 2 4 6



ELEVATION - GATE LEAF

0 1 2 3



SECTION A-A

0 1 2 3

LEGEND:

○	— ANCHORED PILE (ASTM A252 GRADE 2, 14"Ø x½" WALL) 90 TON TENSION AND COMPRESSION
I	— PLUMB PILE (ASTM A36, HP 12x63) 90 TON COMPRESSION
I→	— BATTER PILE, BATTERED 1H:4V (ASTM A36, HP 12x63) 90 TON COMPRESSION

LOCATION	EL. 14.00 HEIGHT OF GATE
MARINA ACCESS DRIVE	4.0'
CAMPBELL AVENUE	9.0'
BROADWAY	8.0'

NOTES:

DESIGN CRITERIA:

1. EM 1110-2-2705, 31 MARCH 1994, "STRUCTURAL DESIGN OF CLOSURE STRUCTURE FOR LOCAL FLOOD PROTECTION PROJECTS"
2. EM 1110-2-2105, 31 MARCH 1993, "DESIGN OF HYDRAULIC STEEL STRUCTURES"
3. EM 1110-2-2502, 29 SEPT. 1989, "RETAINING AND FLOOD WALLS"
4. ACI 318 "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE"
5. MANUAL OF STEEL CONSTRUCTION: "ALLOWABLE STRESS DESIGN" 1989, AND "LOAD AND RESISTANCE FACTOR DESIGN" 1994

1. CONCRETE f'c =3,000 psi
2. REINFORCED STEEL f_y =60,000 psi
3. STRUCTURAL STEEL f_y =36,000 psi (ASTM A36)

HYDRAULIC CRITERIA AND LOAD CASES:

PER EM 1110-2-2705 "STRUCTURE DESIGN OF CLOSURE STRUCTURES FOR LOCAL FLOOD PROTECTION PROJECTS":

CASE I1. DESIGN FLOOD LOADINGS
CASE I2. MAXIMUM FLOOD LOADINGS
CASE I3. EARTHQUAKE LOADING
CASE I4. SHORT DURATION LOADINGS

N:\UFSC\00020\ACOE\DWGS\DWG\GATE.DGN
May 28, 1998 15:18:31 Scale 1:5

Revision	Description	Date	Approved

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

Designed by:
Drawn by:
Checked by:
Reviewed by: SECTION CHIEF
Concurred by: CHIEF, DESIGN BRANCH

PORT MONMOUTH COMBINED FLOOD CONTROL AND SHORE PROTECTION FEASIBILITY STUDY

TYPICAL MITER GATE DETAILS

Approval Recommended: CHIEF, ENGINEERING DIVISION
Approval By: COLONEL, C.E. DISTRICT ENGINEER
SHEET REFERENCE NUMBER:
DATE:
SCALE: AS SHOWN
FIG.: 23

proceeds northward for 800 feet to meet Broadway about 100 feet east of the intersection of Main Street and Broadway, at which point there will be a road closure swing gate to span across Broadway. The gate will be approximately 40 feet wide and 8 feet high to provide flood protection to elevation +14 ft NGVD.

239. The alignment continues as an earthen levee in a northeasterly direction parallel to Main Street for about 2,100 feet, at which point it changes course and proceeds east for approximately 700 feet along the rear property lines of the homes which front Park Avenue. The levee then proceeds northerly meeting Port Monmouth Road about 800 feet southeast of the intersection of Main Street and Port Monmouth Road. Port Monmouth Road will be elevated to design elevation +14 ft NGVD where the levee meets the road. Modifications are anticipated to be within existing road rights of way. The levees will be covered with a layer of topsoil and then seeded with grass. The replanting plan would include shrubbery for selected areas of floodwall based upon local coordination for aesthetics. The levee picks up again at the north side of Port Monmouth Road and proceeds north towards the bay front where it will tie into the dune.

240. Bayshore. The selected plan for tidal inundation along the bay shore consists of a fortified dune, which generally follows the layout of the existing dune. The design dune crest extends landward from the crest of the seaward most existing dune. The eastern limit of the fortified dune ties into the Compton Creek alignment near the intersection of Park Avenue and Port Monmouth Road. From its eastern terminus, the dune extends about 2,640 feet to the west to join the Pews Creek alignment west of the Spy House and fishing pier.

241. Gradual transition zones are required in order to preserve the beach and dune design sections. The western taper is approximately 1500 feet long and the eastern taper is approximately 500 feet long. The design section of the beachfill is approximately 2600 feet long. The volume of material contained in the design section is approximately 275,000 cubic yards, while the volume of material in the eastern taper is about 15,000 cubic yards and the volume of material contained in the western taper is about 35,000 yards.

242. The taper is a technical requirement and not for recreation purposes. The portion of the fill at the west end, combined with a similar, less lengthy portion beyond the eastern dune terminus is included to provide long term stability to the beach berm adjacent to the design dune and to provide protection to the design dune itself. Ongoing research by the USACE Research Center indicates that the stability of a beach fill project is severely compromised if the beach fill layout includes any sharp angles. Therefore, Corps practice indicates that taper sections in question create angle changes of 6 degrees or less to the tie-in on the existing shoreline. Due to existing shoreline orientation, the western taper section is designed to be longer than the eastern taper

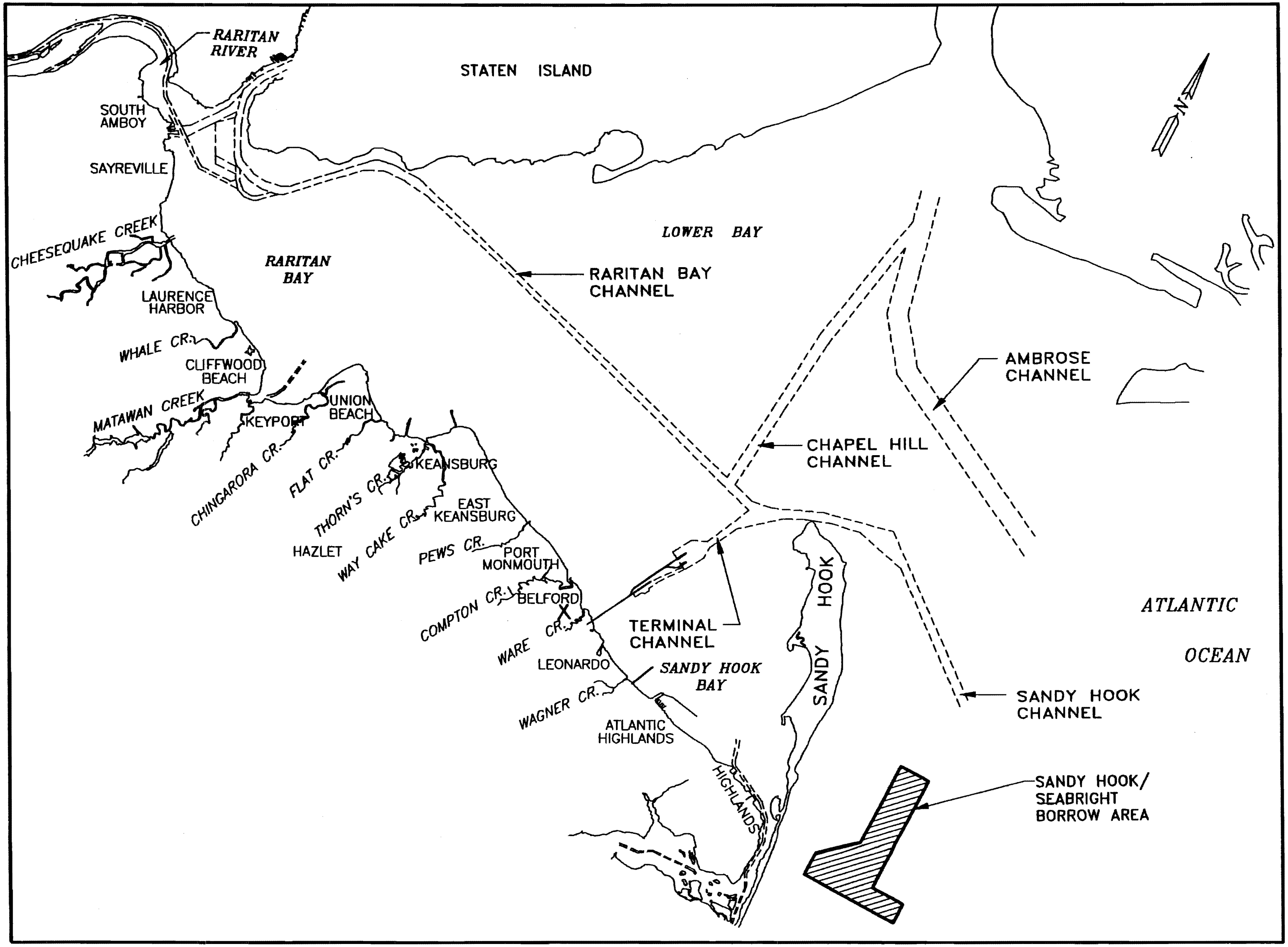
section. While these taper lengths appear large along such a short project, research indicates that the inherent instability of short beach fill projects means that the importance of such taper sections is particularly acute in order to reduce elements of risk. The taper also tends to duplicate the natural taper angle in the project area, which is about 6 degrees.

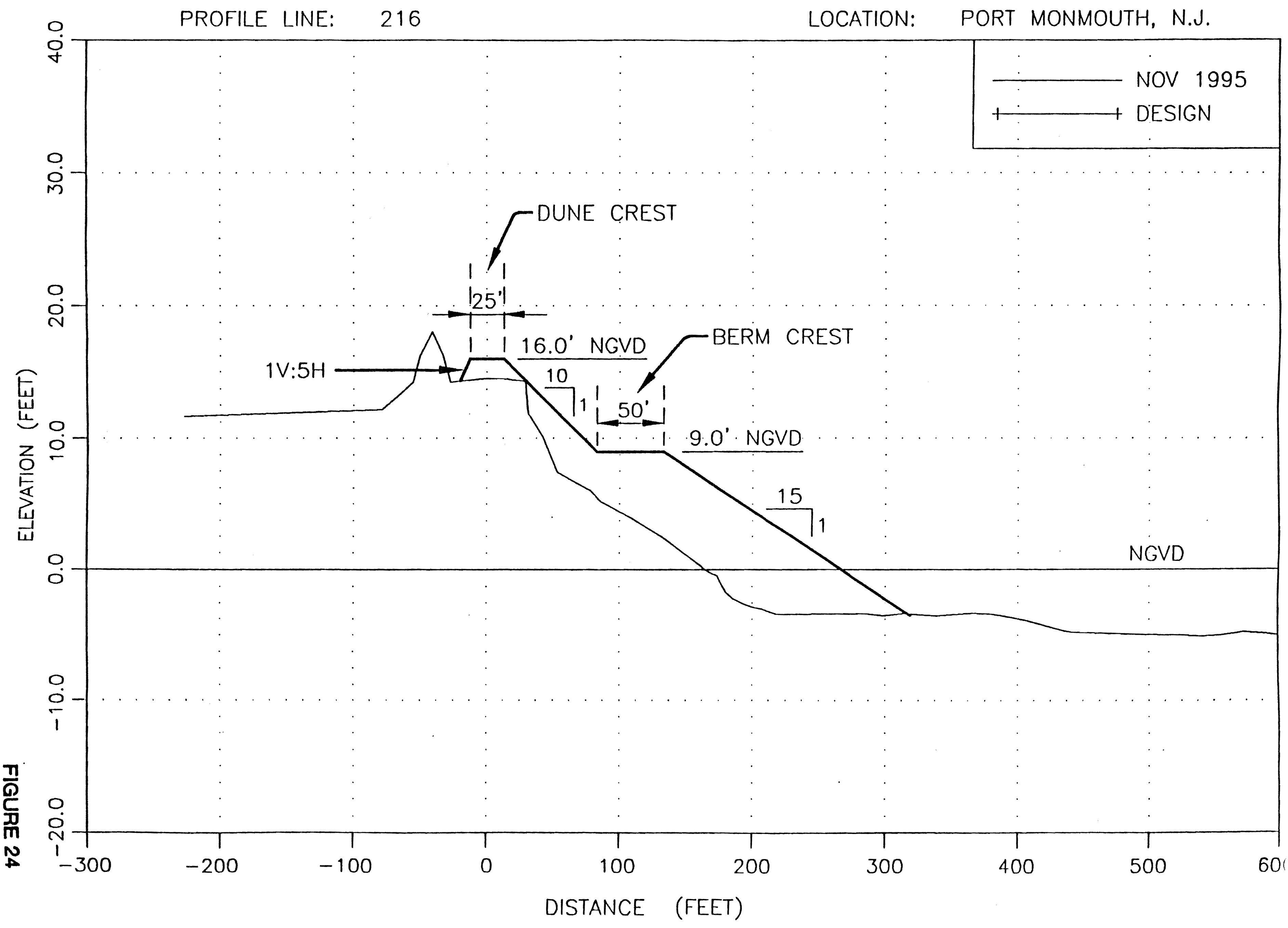
243. To provide the desired storm protection, a dune crest of 25 feet to a design height of +16 ft NGVD was designed (Figure 24). The landward dune slope is 1 vertical on 5 horizontal whereas the bayside slope is 1 vertical on 10 horizontal down to the +9 ft NGVD elevation. Thence a 50 ft wide berm will extend seaward to be followed by a 1 vertical on 15 horizontal slope to existing bay bottom (approximately -3 ft NGVD). Advance fill will be placed with initial construction, with periodic nourishment to follow approximately 10 years after construction and continue at a 10 year cycle. Total initial fill would be approximately 378,500 cy. Material would be utilized from the Sea Bright borrow source (Figure 24-A) for initial construction and an upland source for subsequent renourishment.

244. The dune section will be stabilized with dune grass and fencing. Five wood overwalks will be provided to protect dune vegetation from pedestrian damage. The integrity of the dune will be ensured by placement of 45 feet of advance fill during initial construction and by 127,300 cubic yards of periodic nourishment beginning approximately 10 years after the initial construction. The periodic nourishment design meets both the long-term erosion needs as well as storm survivability requirements.

245. Pews Creek. From the terminus of the improved dune approximately 700 feet northwest of the intersection of Wilson Avenue and Port Monmouth Road a levee section will span between the dune and Port Monmouth Road. The levee section will abut the beginning of the proposed floodwall along the north side of Port Monmouth Road. . This floodwall will be approximately four feet high at a design elevation of 14.0 ft. NGVD. The floodwall continues at a design elevation of +14 ft NGVD westerly along the northern portion of Port Monmouth Road for about 600 feet until it reaches the intersecting ramp to the Monmouth County Marina. A closure structure approximately 40 feet long by 4 feet high will bridge this gap. The alignment then continues for about 1500 feet as a floodwall along Port Monmouth Road. The floodwall is an I-type floodwall and continues up to a point perpendicular to an area of the new Port Monmouth Road (that becomes an elevated highway bridge) which is at design height. A transition earthen levee will be placed between the floodwall and the roadway to bridge the gap. Placement of the floodwall along the north side of Port Monmouth Road will allow the roadway to remain accessible during floods and provide access from Keansburg to Port Monmouth. The alignment incorporated a section of Port Monmouth Road that is at or above design height and connects to a proposed levee south of the new Port Monmouth Road. The levee proceeds about 300 feet southwest up to the east bank of Pews Creek.

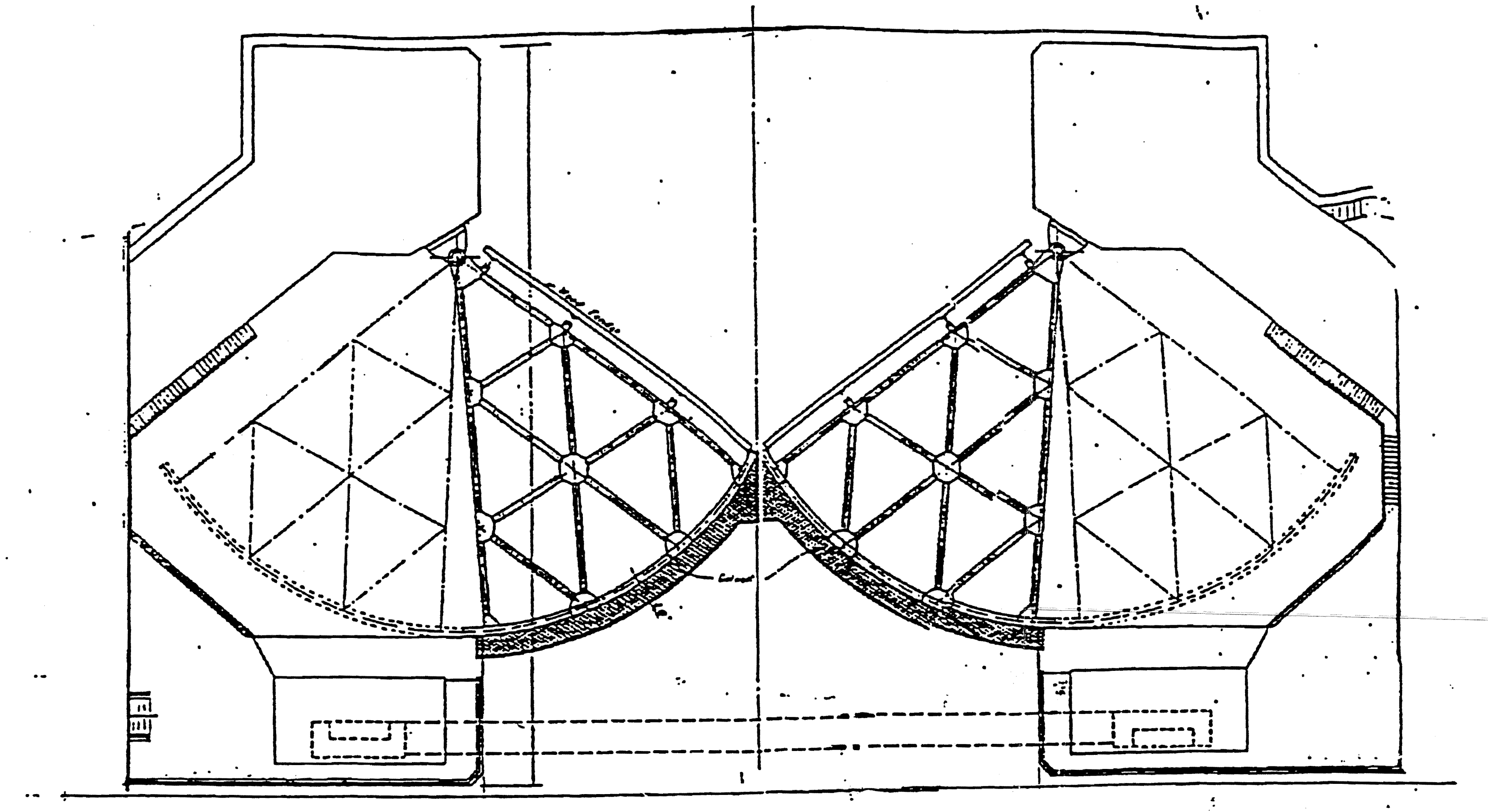
LOCATION OF SEA BRIGHT BORROW AREA





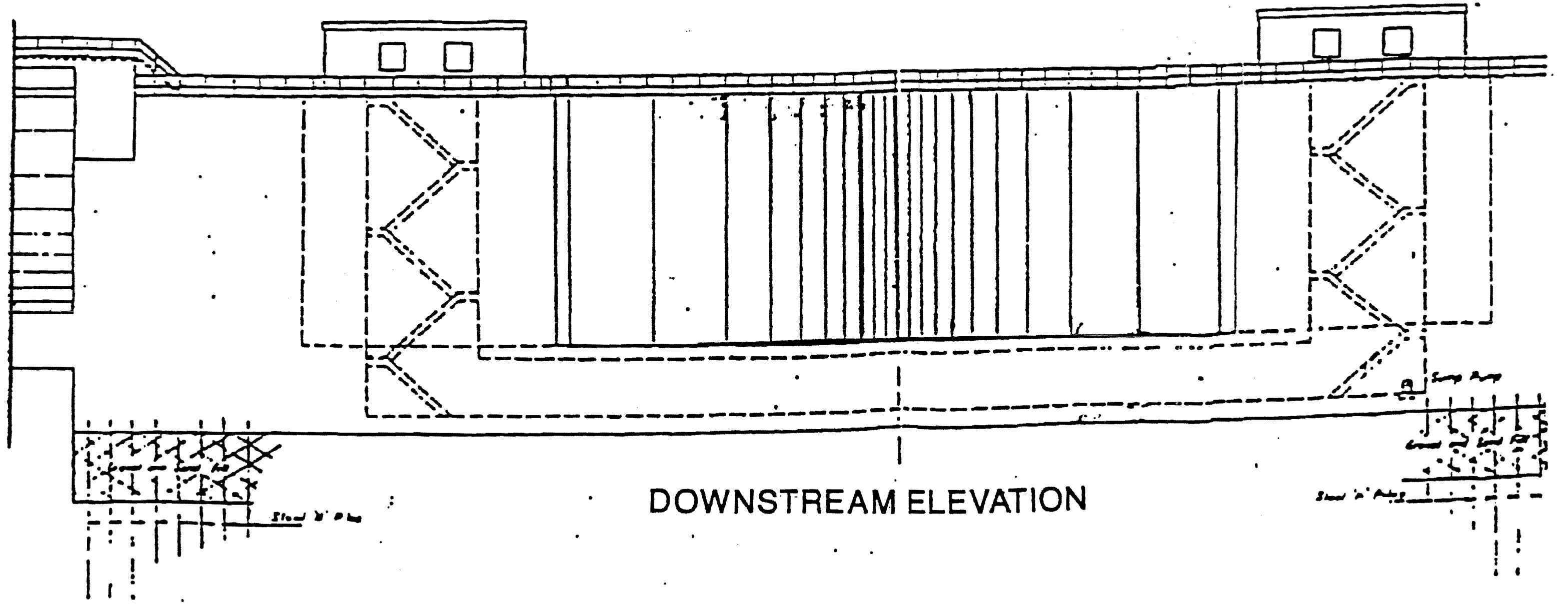
SELECTED DUNE – CROSS SECTION

FIGURE 24



40' GATE

PLAN



DOWNSTREAM ELEVATION

Revision	Description	Date	Approved

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

Designed by:

Drawn by:

Checked by:

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

SECTOR GATE

Reviewed by:
SECTION CHIEF

Concurred by:
CHIEF, DESIGN BRANCH

Approval Recommended:
CHIEF, ENGINEERING DIVISION

Approval By:
COLONEL, C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE: JUNE, 1998

SCALE:

FIG.: 25

h:\32216\draft\blnkbrds.dgn Jun. 24, 1998 13:56:56

246. A storm gate is to be constructed across Pews Creek about 300 feet south of the Pews Creek Bridge. The sector gate (Figure 25) size opening will be 40 feet wide and 21 feet high. The storm gate will connect to a concrete pile supported T-wall (Figure 26) on the east side of Pews Creek for about 150 feet where it will join the existing Keansburg levee. A pump station (Figure 27) is an integral part of this hurricane and storm damage reduction system and will be located adjacent to the east side of the East Keansburg levee and will incorporate the concrete wall between the East Keansburg levee and the storm gate at its north wall. This location will provide accessibility to the pump station from the East Keansburg levee via Port Monmouth Road. The pump station is a necessary feature of the alignment because it provides the means necessary to control damaging interior water elevations when the storm gate is in the closed position and there is fluvial flow from upland runoff into Pews Creek.

Interior Drainage

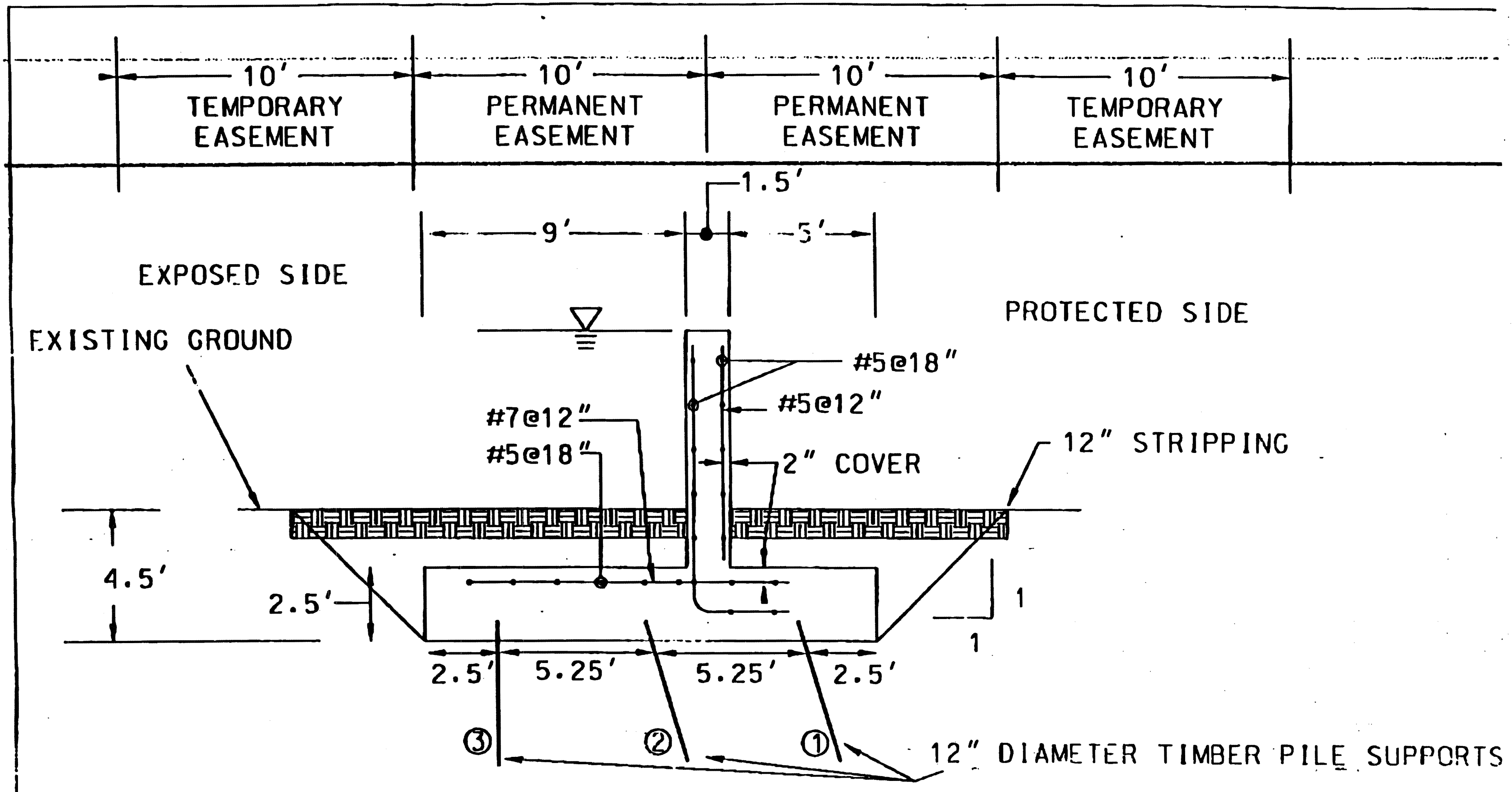
247. Pews Creek – A 120 cfs pump station will be located in direct vicinity of the Creek on the left bank for interior pumping conditions for the gate closed position (Figure 27). The 120 cfs pump station would be utilized along with 2 gravity outlets. The storm gate would have an opening size of about 40 feet. The gate would close at elevations between 5 and 5.5 ft NGVD.

248. Compton Creek sub basins C1, C2, and C3 (Figure 5) were analyzed for interior drainage requirements.

249. The selected facility for sub-basin C1 consists of a primary outlet and secondary outlet as noted below. Both the primary and secondary outlets are being provided with a sluice gate and trash rack. The outlets will also be provided with flap gates to prevent tidal surges from entering the protected area. Ditches will be constructed along the landward side of the levee to direct runoff toward either the primary or secondary outlet.

OUTLET STRUCTURES FOR DRAINAGE AREA C1

Outlet	Location	Size
Primary	300' N. of Willow Street	48" RCP
Secondary	100' S. of Willow Street	18" RCP



T-TYPE FLOOD WALL A

WOOD PILES 23′ LONG

ROW	SPACING
①	4′
②	4′
③	12′

Revision	Description	Date	Approved

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

Designed by:

Drawn by:

Checked by:

Reviewed by:

SECTION CHIEF

Concurred by:

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

TYPICAL FLOODWALL SECTION
T-TYPE FLOODWALL A

Approval Recommended:

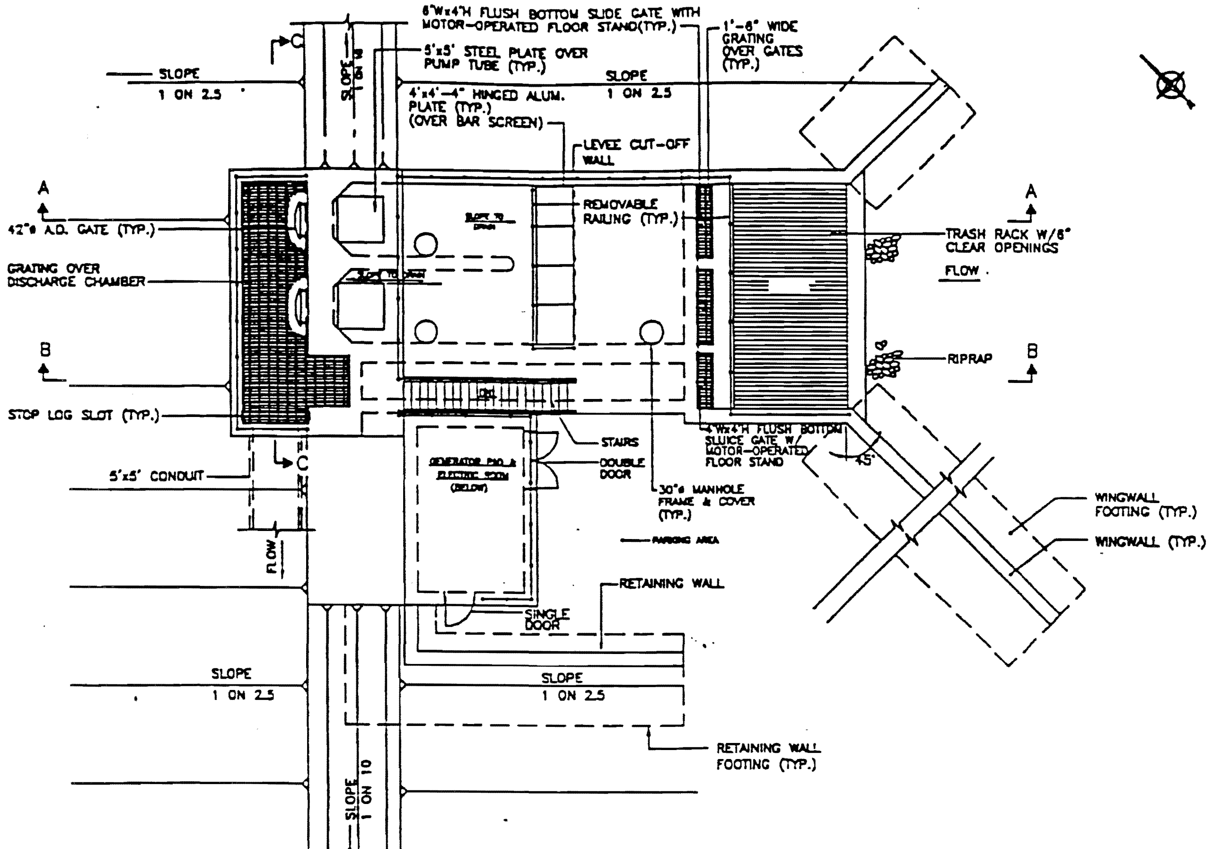
CHIEF, ENGINEERING DIVISION

Approved By:

SHEET REFERENCE NUMBER:

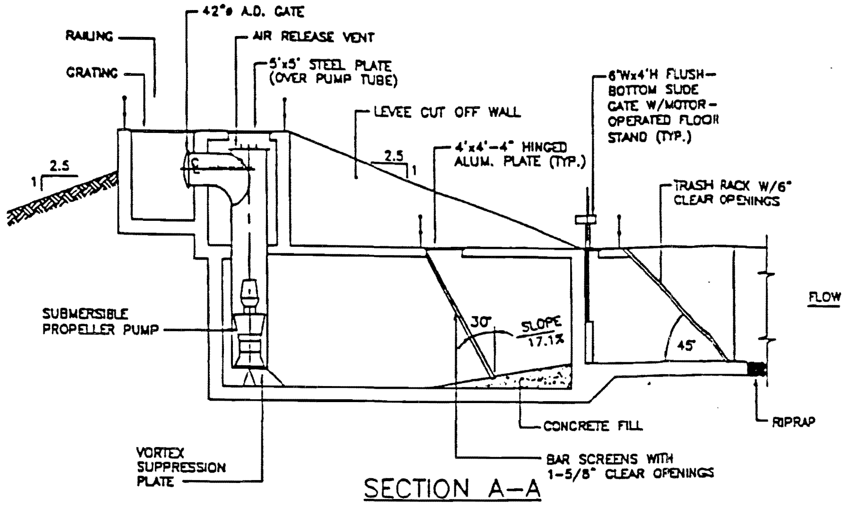
Figure 26

SCALE: 1″ = 5′



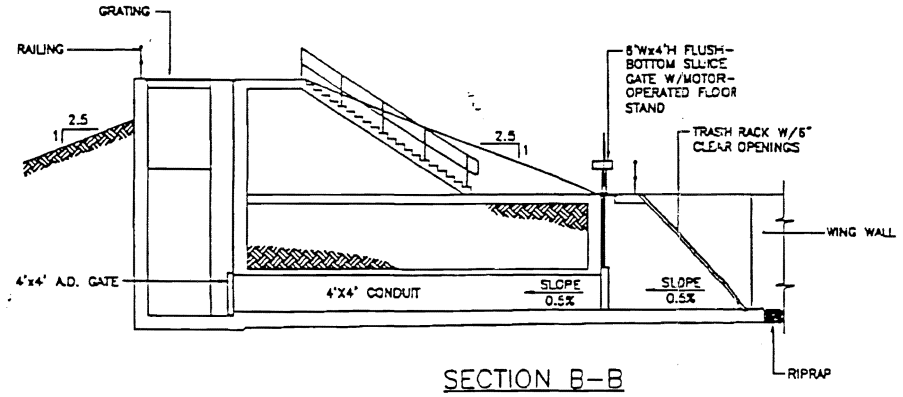
UPPER PLAN

0 4 8 12



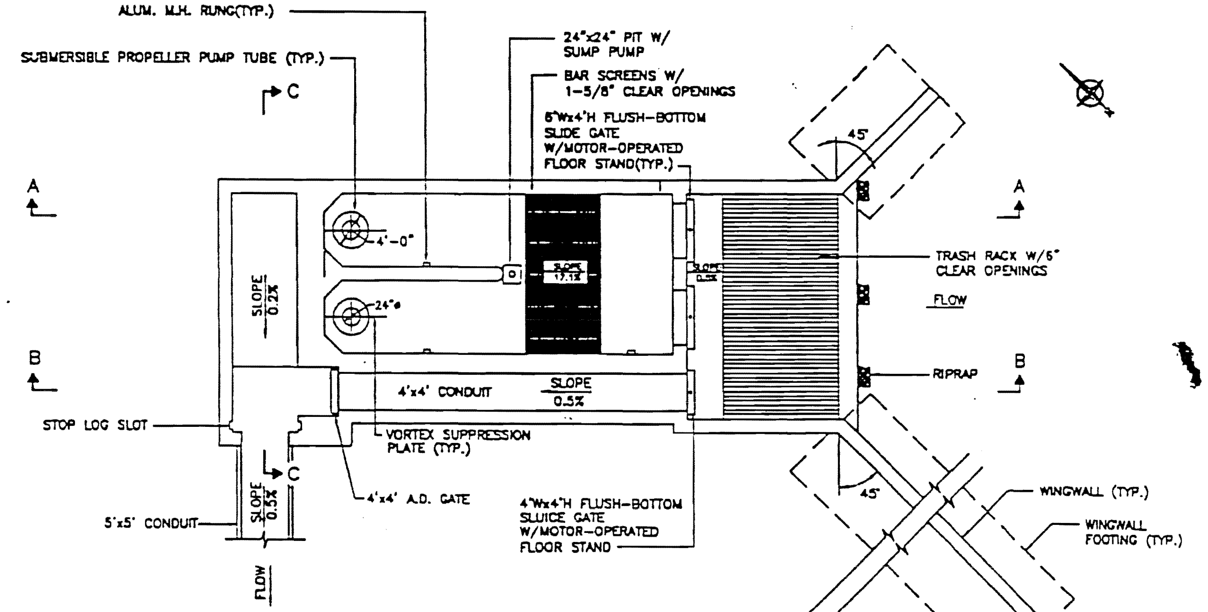
SECTION A–A

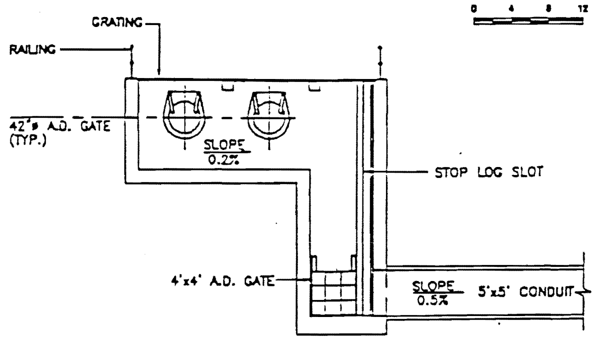
0 4 8 12



SECTION B–B

0 4 8 12

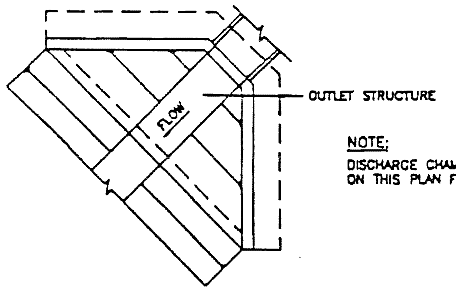




SECTION C–C

LOWER PLAN

0 4 8 12



NOTE:
DISCHARGE CHAMBER SHOWN
ON THIS PLAN FOR CLARITY.

Revision	Description	Date	Approved

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

Designed by:
Drawn by:
Checked by:

PORT MONMOUTH COMBINED FLOOD CONTROL
AND SHORE PROTECTION FEASIBILITY STUDY

TYPICAL PUMP STATION

Reviewed by:
SECTION CHIEF
Concurred by:
CHIEF, DESIGN BRANCH

Approval Recommended:
CHIEF, ENGINEERING DIVISION
Approval By:
COLONEL C.E. DISTRICT ENGINEER

SHEET REFERENCE NUMBER:

DATE: JUNE 1998
SCALE: AS SHOWN
FIG.: 27

250. The selected facility for basin C2 consists of a primary outlet and five secondary outlets as noted below. Both the primary and secondary outlets are being provided with a flap gate, sluice gate, and trash rack. Drainage ditches will direct runoff along the protected side of the levee to a nearby outfall.

OUTLET STRUCTURES FOR DRAINAGE AREA C2

Outlet	Location	Size
Primary	100' S. of Broad Street	48" RCP (Extension of existing outlet)
Secondary #1	Broadway near Main St. Int.	18" RCP (Extension of existing outlet)
Secondary #2	150' S. of Pinehurst Ave.	18" RCP
Secondary #3	200' N. of Creek Road	18" RCP
Secondary #4	Near Creek Rd. Collins Ave Int.	24" RCP (Extension of existing outlet)
Secondary #5	100' N. of Collins Ave.	18" RCP

251. Drainage facilities for sub-basin C3 include a primary outlet and five secondary outlets as noted below. Both the primary and secondary outlets will be provided with a flap gate, sluice gate, and trash rack. A 36-inch storm water diversion pipe approximately 750 feet long will redirect from low lying areas. Ditches are included on the protected side for the levee to direct runoff to primary or secondary outlets.

OUTLET STRUCTURES FOR DRAINAGE AREA C3

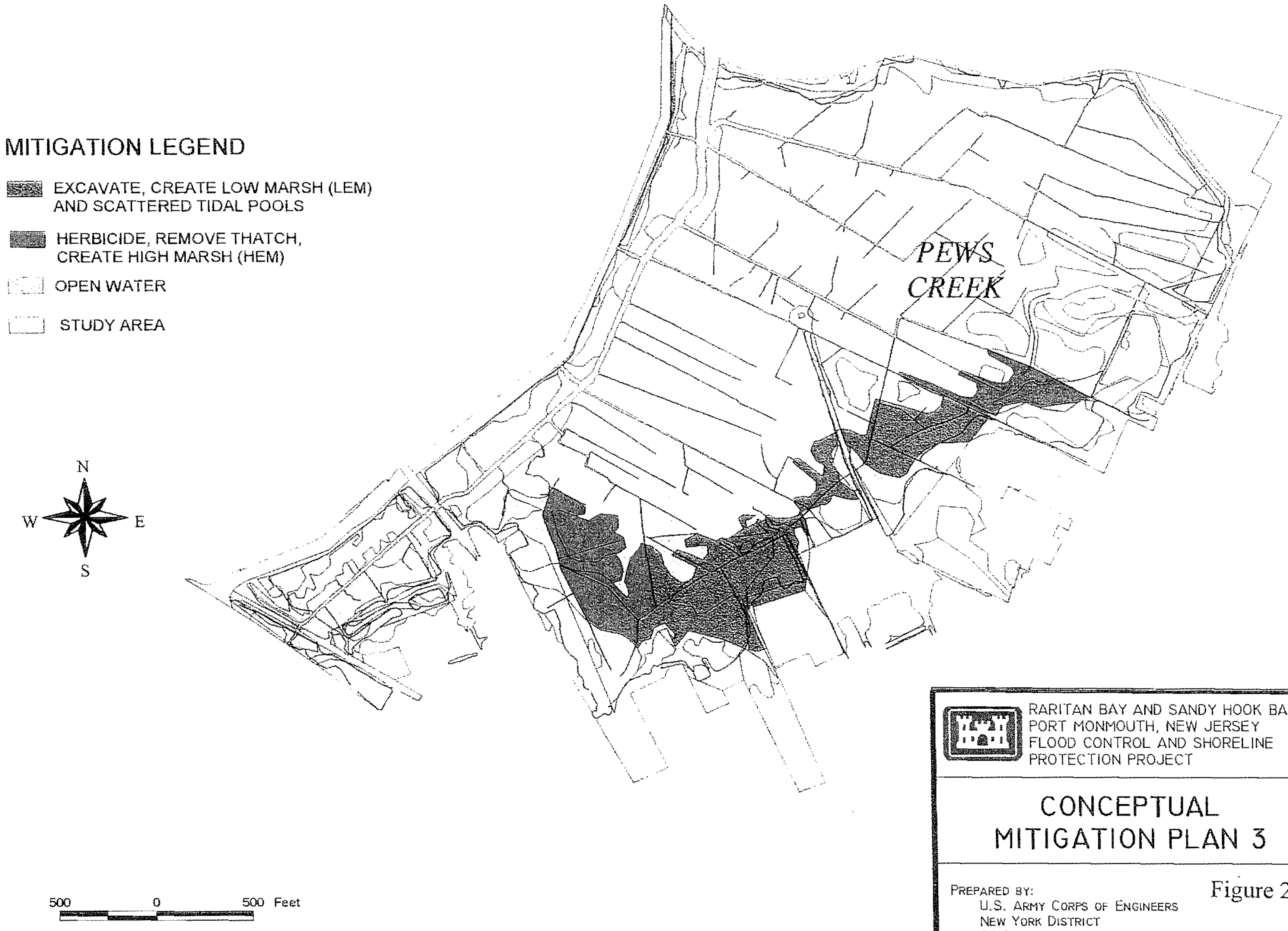
Outlet	Location	Size
Primary	300' N of Renfrew Pl.	2x48" RCP
Secondary #1	Lydia Pl.	18" RCP (Extension of existing outlet)
Secondary #2	Main St. (500' S. of Renfrew Pl. Int.)	18" RCP (Extension of existing outlet)
Secondary #3	Main St. (250' S. of Park Ave. Int)	18" RCP (Extension of existing outlet)
Secondary #4	400' E. of Main St./Park Ave. Int.	18" RCP (Extension of existing outlet)
Secondary #5	Pt. Monmouth Rd., 100' E. of Park Ave. & Pt Monmouth Rd. Int.	18" RCP

252. The analysis of additional facilities indicated that a 60 cfs pump station would be justified for implementation at the C3 basin area because of high residual damages.

253. Of the three primary and eleven secondary outlet pipes required for minimum facility in the total Compton Creek interior area, only four will not discharge to existing drainage ditches: secondary outlet at C1; primary outlet at C2; and a secondary and primary outlet at C3. For the Pews Creek interior area, once the storm gate is closed, there are basically two outlets: the pump discharge pipe and the adjacent gravity outlets, which allow gravity flow when tidal tailwater conditions are favorable.

Mitigation

254. Although the selected plan was designed and further refined to avoid and minimize ecological impacts, there are still unavoidable impacts to wildlife resources and wetlands. These unavoidable impacts must be mitigated pursuant to the NEPA, Clean Water Act and USACE's Engineering Regulations ER 1105-2-100 (Guidance for Conducting Civil Works Planning Studies). The goals of the mitigation effort were coordinated with the interagency HEP Team and a consensus was reached to replace the number of HUs lost for the evaluation species impacted the most, restore salt marsh by eradicating Phragmites habitat, and minimize costs. Based upon an incremental cost analysis, Alternative 3, of an array of 31 mitigation alternatives developed from 5



RARITAN BAY AND SANDY HOOK BAY
PORT MONMOUTH, NEW JERSEY
FLOOD CONTROL AND SHORELINE
PROTECTION PROJECT

CONCEPTUAL MITIGATION PLAN 3

PREPARED BY:
U.S. ARMY CORPS OF ENGINEERS
NEW YORK DISTRICT
26 FEDERAL PLAZA
NEW YORK, NY 10278-0090

6/98

Figure 28

conceptual plans, was initially selected as the mitigation plan (USACE 1998).

255. Based upon the areas of disturbance of the selected plan, the District in coordination with the interagency HEP Team was able to quantify impacts to wildlife resources and wetlands. The District, in consultation with the USFWS, NMFS and NJDEP, discussed the development of mitigation plans using HEP protocols. The District determined that 12.76 acres of impacted wetlands would be fully offset by the restoration of 12.80 acres of Phragmites-dominated wetland habitat to salt marsh. The 12.80 acres was then used as the base for the development of six additional mitigation alternatives. The six mitigation alternatives were based upon 200, 125, 100, 80, 50 and 30 percent ratios of the 12.80 acres, where 25.60, 16.00, 12.80, 10.24, 6.40 and 3.84 acres correspond to the respective percentages. These six mitigation alternatives were again subjected to an incremental cost analysis to identify which of the six mitigation alternatives is the most cost effective and efficient mitigation alternative. This incremental cost analysis consisted of comparing the cost of each mitigation alternative to the number of wetland acres restored and HUs generated. The results of the incremental cost analysis concluded that the selected mitigation plan is the most cost effective and efficient mitigation alternative (USACE 2000a).

256. The selected mitigation plan proposes to restore approximately 12.80 acres of wetland Phragmites-dominated habitat to salt marsh habitat. When compared to the No-Action alternative, implementation of the selected project plan with the selected mitigation plan would increase black duck habitat quality by 0.78 HUs and marsh wren habitat quality by 0.96 HUs at the year of construction (year 2002). Through the year 2052, black duck and marsh wren habitat quality would increase by 157.83 and 106.55 Cumulative Habitat Units (CHUs). In addition, black duck and marsh wren Average Annual Habitat Units (AAHUs) would increase by 3.16 and 2.13 over the 50-year period of analysis when compared to the No-Action alternative (USACE 2000).

Operation and Maintenance (O&M) of Flood Control Systems

257. Beyond the initial construction of authorized project components, operation and maintenance support features of flood control systems are integral for plan success. Non-federal interests are responsible for O&M of these project support features after initial construction. The following information is provided concerning flood control system requirements and may be subject to refinements during the Preconstruction, Engineering and Design Phase.

258. The flood control system will be activated by dedicated personnel from the local municipality. The municipality will have one assigned individual who will act as chief of operations for the system. This individual will be responsible for checking weather forecasts and warnings by accessing the National Weather Service website for the New York area at http://www.nws.noaa.gov/er/okx/ . In the event that a severe storm is

forecast, the assigned individual will contact all of the personnel responsible for implementing the plan and instruct them to convene at a predetermined meeting location where they will await warning signals that signify further action to be taken. There will be two possible warnings at two locations. A "yellow" alert and a "red" alert will be received from the location of the Pews Creek sector gate and also from the location of the Comptons Creek pump station. The "yellow" alert signifies that although the critical water surface elevations have not yet been reached they are impending. At that point, all personnel should be in place and prepared to implement the flood control plan. The "red" alert signifies that the critical water surface elevations have been reached and that the implementation of the flood control plan is required in order to prevent damages. All personnel will commence operating their respective components of the flood control plan. NOTE: The following elevations are to be confirmed during the final design phase. For the Pews Creek sector gate the "yellow" alert occurs at elevation +4.5 NGVD and the "red" alert occurs at +5.25 NGVD. There is expected to be 45 minutes between the two alerts. For the Comptons Creek pump station the "yellow" alert occurs at interior ponding elevation +3.0 NGVD and the "red" alert occurs at elevation +3.5 NGVD. In the event that the personnel involved are not alerted in advance of a "yellow" alert or if any alert is not acknowledged in a specified amount of time, automatic telephone dialers will be incorporated with the alarm systems to insure that all of the appropriate personnel are notified. The following paragraphs describe a recommended schedule of personnel required for the most efficient implementation of the flood control system based on the operational requirements of the system components. This plan will require six (6) road closure gate operators, one (1) sector gate operator, two (2) pump station operators and one (1) monitor/chief of operations.

259. Road Closure Gates. There are three road closure gates. Each gate requires a two-man crew to close the gate. The expected time required for each crew to perform their task is approximately 20 minutes. This time includes unlocking and swinging the leafs of the gate into place, locking the gate and finally placing sand bags on the protected side at the seal with the road surface. The road closure gate crews will deploy at the time of a "yellow" alert from the Pews Creek sector gate. Once at their respective road gate locations, they will await further notification via two-way radio from the chief of operations that a "red" alert has been received at which time they will proceed to close the gates. It is the road gate crew's responsibility to use discretion and insure that by closing their gate they are not preventing the evacuation of citizens from unprotected areas.

260. Sector Gate. The sector gate can be operated by a single individual. At a "yellow" alert from the Pews Creek sector gate, the individual will deploy to the gate structure. The operator will visually inspect the channel to insure that it is free from obstruction and at a "red" alert, the operator will activate the gate closing mechanism. The sector gate is operated by an electric motor which requires no warm up. The operator will be

at the gate structure and ready to close the gate prior to a "red" alert. Once a "red" alert sounds, the gate can be in the fully closed position in less than ten minutes.

261. Pews Creek Pump Station. The pump station located at the Pews Creek site will be switched on once the sector gate has been completely closed. Due to the fact that the pump station sump interfaces with the stream, very little time is required to prime the pumps once the pump intake gates are opened. Therefore, there is no lead time required. One individual will deploy to the pump station at a "yellow" alert, make an inspection of the pump intakes and await further instruction from the sector gate operator. The sector gate operator will notify the pump crew via two-way radio when the gate is fully closed, at which time the pump crew will engage the pumps. The pumps can be in operation immediately upon notification of sector gate closure.

262. Comptons Creek Pump Station. The pump station at the Comptons Creek location will require one operator to deploy to the site once a "yellow" alert is received. At a "red" alert, the operator will close the intake to the gravity drains, open the intakes to the pump station and switch on the pumps. Once the pump intake gates are opened there will be several minutes of lead time to prime the pumps prior to actually starting operation. There are two pumps in the station which have staggered start elevations. The first pump will start at an interior ponding elevation of +3.5 NGVD, the second will start at elevation +3.7 NGVD. NOTE: The unprotected area adjacent to the pump station is subject to flooding from high tides during non-storm conditions. This will cause the backflow valves at the gravity drains to close making drainage from even a small rainfall accumulate on the protected side of the levee. Therefore, a small, automatically operated lift station, enclosed in an adjacent manhole, will be incorporated to evacuate any drainage during non-storm conditions. In the event that a storm occurs requiring the implementation of the flood control plan, the lift station will be taken out of service by the pump operators prior to engaging the pumps. The lift station will be included in the final design phase.

263. Operation, Maintenance, Repair, Rehabilitation and Replacement Plan. As per ER 1110-2-1150 (8/99) Paragraph 13.8, ER 1110-2-1407 and ER 1110-2-2902; the following is presented to cover the operation, maintenance, replacement, and rehabilitation plan for the project:

(a) Pertaining to flood control features:

(1) Levees and floodwalls require maintenance to assure continued required performance levels such as vegetation maintenance, control of earthen settlements and sloughs, piping, animal borrows, repair of concrete spalling and damaged joints, repair of concrete cracking (primary and secondary) and maintenance of drainage ditching adjacent to levees and walls by repairing cracked areas.

(2) Maintenance of all drainage structure chambers and flap and sluice gates, including cleanout, concrete repair, pipe repair, gate performance with required repair maintenance and operation and replacement (every 25 years).

(3) Pump stations require trash removal, cleanout, testing of pumping system 4 times/year plus storm occurrences, repair and replacement (every 20 years) of pumps and controls, gate repair and replacement (every 25 years).

(4) Closure gate (roadways) - operation and maintenance includes pertinent lubrication, testing, periodic painting and replacement of gate buildup and seals and plate, truss concrete and repair.

(5) Sector gate requires testing 4 times per year plus use during storm occurrences, repair of electrical/mechanical systems including gate members and gate and equipment replacement (approximately 25 years).

(6) Rehabilitation (repair) of flood control features based on the impacts of major storm events for levees, walls, pump stations and gates are included and are detailed in paragraph C51 of the Cost Appendix C.

(b) Pertaining to the Shore Protection Beach Fill Features:

(1) As per the requirement to establish a minimum profile below which the integrity of the shore protection is in jeopardy (ER 1110-2-1407, Paragraph 9(b)(5)) for maintenance purposes, the following design profile is noted: a minimum 50 ft wide dune at el. +16 NGVD fronted by a 50 ft wide berm at minimum el. of +9 NGVD allowing for a 1V:10H dune slope between the dune crest and dune toe behind the berm.

(2) To check that this minimum profile is maintained, as per ER 1110-2-2902, a complete survey of profiles is required by the locals each year prior to the storm season (March-April).

(3) In addition, the dry beach above normal high tide (el. +3.2 NGVD) is to be measured four times a year plus after major storms to determine seasonal changes and storm induced sand deficiencies.

(4) If the beach berm fails to naturally build back to the minimum cross section within 14 days after the passage of a storm, local attempts are to be made to regrade the beach by moving accreted nearby sand into the areas of deficiency. If this still leaves the beach below the minimum profile, then beach renourishment in the form of major storm rehabilitation is to be initiated with Federal participation to be solicited.

(5) Sand stockpiles and other resources and equipment required for flood fighting, storm warnings and evacuations are adequate and maintained in serviceable conditions.

(6) Measures (i.e. sand fence and dune grass) shall be taken to prevent sand from blowing off the berm or dune into nearby streets or yards.

(7) For the protective dune, sand fence and dune grass constructed as an initial construction feature shall be properly maintained and repaired as needed.

(8) Encroachments are to be prohibited on the dune right of way.
(9) Unauthorized pedestrians or vehicular traffic is prohibited on the dune; authorized access crossovers are to remain functional.
(10) Abrupt variations in berm grade from scarping, etc. shall be smoothed out and beach berm and foreshore area are to be kept free of trash and hazardous debris during periods of recreational use. Hazardous conditions which cannot be reasonably removed shall be clearly marked and isolated from public access to the maximum extent possible.

(c) Pertinent costs for all OMRR&R items above are displayed in Table 14.

Environmental Impacts

264. This section provides a summary of principal or primary environmental effects that would result from the proposed project without mitigation. The environmental impacts of the project would primarily be concentrated in the footprint of the project, with some indirect effects.

265. In general, the primary impacts would involve the conversion of native habitat types to reconstructed dune and maintained (grass-covered) levees. Projections by the hydrodynamic model for the selection of the storm gate size conclude a negligible (0.72inch) difference in elevation of spring high-tide inundation when comparing the with and without project scenarios. Finally, the project also would temporarily impact herbaceous, scrub/shrub, *Phragmites* wetlands, and high saltmarsh habitats due to clearing and equipment operation in temporary work areas.

266. The District conducted a Habitat Evaluation Procedures (HEP) analysis to assess the impacts of the selected plan. This HEP analysis concluded that impacts associated with the construction of the selected plan (without mitigation) will result in the loss of 2.04 black duck (Anas rubripes) and 3.14 marsh wren (Cistothorus palustris) habitat units (HUs) at the year of construction (Year 2002). Through the year 2052, black duck and marsh wren habitat quality would be reduced by 49.94 and 136.71 cumulative habitat units (CHUs). Similarly, black duck and marsh wren AAHUs would be decreased by 1.00 and 2.73 over the 50-year analysis period. In addition, the HEP analysis determined that 2.13 acres of upland habitat would be impacted, 7.13 acres of wetlands would be converted to upland, and an additional 5.63 acres of wetland habitat would be indirectly impacted by the selected plan. Indirect impacts involve the conversion, not the loss, of non-Phragmites wetlands to Phragmites-dominated wetlands (USACE 2000a).

267. The District, in consultation with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and NJDEP, developed an array of mitigation plans using HEP protocol (USACE 1998). The selected mitigation plan

proposes to restore approximately 12.80 acres of wetland Phragmites-dominated habitat to salt marsh habitat. When compared to the No-Action alternative, implementation of the selected plan and selected mitigation plan would increase black duck habitat quality by 0.78 HUs and marsh wren habitat quality by 0.96 HUs at the year of construction (year 2002). Through the year of 2052, black duck and marsh wren habitat quality would increase by 157.83 and 106.55 CHUs. In addition, black duck and marsh wren AAHUs would increase by 3.16 and 2.13 over the 50-year period when compared to the No-Action alternative.

268. The selected plan is expected to have a direct, short-term impact on benthic resources. Beach nourishment is expected to smother benthic organisms causing mortality. However, once buried, some mobile shellfish species and polycheate (segmented) worms have the ability to burrow upwards and survive. The recovery of benthic resources to pre-construction conditions should occur shortly after construction (USACE 1995). A benthic monitoring plan will be implemented to determine recovery rates. During each renourishment process, a temporary impact is expected throughout the impact area. However, all subsequent recolonization within the Project area would be similar to that following the initial beach nourishment activities.

269. Temporary construction activities for the Pews Creek storm gate and pump house would require removal of streamside vegetation and temporary stream containment. These activities would temporarily affect water quality during construction. Such conditions should dissipate shortly following the completion of in-stream activities. The implementation of sediment and erosion control plans would aid in minimizing impacts to water quality during construction. Refer to the DEIS Section 4 for a more detailed discussion of the direct and indirect impacts and wildlife benefits associated with the proposed project.

270. Environmental impacts are addressed by mitigation plans that compensate for natural resource losses associated with project implementation. The study team, in close coordination with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and New Jersey Department of Environmental Protection, has developed a plan to mitigate for environmental impacts associated with the project. Specifically, a Habitat Evaluation Procedures (HEP) investigation was conducted to quantify the habitat units within the project area and to identify potential mitigation sites that could be used to replace habitat impacted by the project. In addition, a Wetland Mitigation Plan was developed to restore degraded wetlands located in the project area and to create and/or replace wildlife habitat.

271. Based upon a Phragmites Encroachment Model (PEM) developed by the District specifically for the assessment of future impacts, the construction of the selected plan and selected mitigation plan would reduce the loss of about 15.27 acres of salt marsh habitat (USACE 2000b) when compared to the No-Action alternative for the 50-year

analysis period of the Project. In summary, the comparison of the selected plan to the No-Action alternative suggests that implementation of the selected plan will provide long-term benefits to wildlife resources of the coastal marsh ecosystem at Port Monmouth. No rare, threatened or endangered species or their critical habitat would be adversely affected by the selected plan.

Cultural Impacts

272. Project Effects upon Native American Archaeological Sites. Prior to the present field investigations, no Native American archaeological sites were known to exist within any or adjoining Areas of Potential Effect (APEs) of project components. Earlier investigations by other agencies found prehistoric material in the vicinity of Church Street/Compton Creek Bridge and Broadway. However this material was in a disturbed context and was not considered to constitute an archaeological site warranting further evaluation. Present project efforts were thus directed towards identifying unknown sites.

273. During subsurface testing conducted for this project, evidence of Native American occupation was found in an area that crosscuts the APE of the portions of the Compton Creek levee that parallels it, extending southeast from the intersection of Main Street and Broadway. These project elements were evaluated as high and moderate probability areas, respectively. The artifacts recovered included lithic material and several sherds of sand-tempered pottery. The presence of pottery suggests that this may be a Woodland Period site. Such sites are rare in coastal New Jersey.

274. The site's extent is unknown. Further evaluation would be required in order to assess its size and significance. Construction of a levee at this location would adversely affect the site. All further work at this location will be coordinated with the New Jersey Historic Preservation Office, as part of Section 106 compliance for the project.

275. Project Effects Upon Historic Period Structures and Archaeological Sites. Cultural resources investigations were directed towards identifying previously unknown sites and structures. These efforts also sought to evaluate known sites and structures located within the APEs of project components. The latter included the National Register listed Whitlock/Seabrook Wilson House and a segment of the Delaware and Raritan Railroad.

276. The most recent plans developed by the New York District have eliminated a previously considered seawall element of the shore protection plan. The new plan includes a reconstructed dune located beachward of the northern limits of the Whitlock/Seabrook Wilson House's yard. The western limit of the reconstructed dune includes a north/south aligned segment that ties into a levee associated with the Port Monmouth Road floodwall. This portion of the shore protection plan is located more than 200 feet west of the fishing pier parking lot. Adverse effects are thus not

anticipated here. The eastern limit of the reconstructed dune also includes a north/south aligned segment that ties into the northern terminus of the Compton Creek levee. This element is located more than 1600 feet east of the Whitlock/Seabrook Wilson House. No adverse effects are anticipated.

277. A small segment of the National Register eligible Delaware and Raritan Railroad main line fill embankment falls within the APE of a section of the Compton Creek levee. The latter extends along the rear property lines of a series of homes located on the southern edge of Park Avenue. In its entirety, the railroad embankment is a uniform linear feature measuring approximately 4500 feet. It has been subject to archaeological excavation in the course of Section 106 compliance for projects conducted by other agencies. Above ground features have been the subject of HABS/HAER level mitigation recordation. Therefore no further investigations of this property are being required.

Project Costs

278. Basis of Costs. The cost estimates presented herein are based on May 1998 price levels. Quantities for levee construction are based on topographic mapping. Quantities for beach fill are based on beach profiles. The levee alignment is estimated to span approximately 405 l.f. of poor foundation based on analysis of marsh areas indicated on the topographic mapping. Fill material would be imported from existing borrow areas. All of the material excavated from good foundation areas is estimated to be reusable as levee embankment fill. The material excavated in poor foundation areas is assumed to be poor quality and to be disposed off site within 20 miles of the project area. All beachfill (both initial construction and advance fill) is to be taken from the Sea Bright borrow source. Renourishment quantities would be trucked to the site from upland borrow areas in Old Bridge or Jackson, NJ. The pumps for the pumping station are submersible propeller pumps and each station is equipped with an emergency backup power supply. Pumping costs are developed from a submersible pump station cost curve generated for the Green Brook Flood Control Project. The storm closure gate costs were based on bid abstracts for construction of a similar flood gate. Mitigation costs include all necessary costs, such as: excavation, disposal, planting, drainage, and monitoring. Costs for engineering and design include the cost of developing detailed designs, plans and specifications and environmental monitoring during preconstruction and construction phases.

279. Real Estate Requirements. The proposed real estate requirements will be flood protection levee and floodwall easements, temporary work area easements, and fee acquisitions (mitigation), in addition to severance damages and administrative costs that will be incurred through project implementation.

280. Perpetual or permanent easements, as defined in Engineering Regulations ER 405-1-12

(Real Estate Handbook), are required for construction, maintenance, repair, operation, patrol and replacement of levee and floodwall features and appurtenances.

281. Temporary work area easements, as defined in Engineer Regulation ER 405-1-12 (Real Estate Handbook), are generally rights of access to lands for specified periods of time for use as work areas, including the right to move, store, and remove equipment and supplies, and erect and remove temporary structures on the land with performance of all work necessary and incidental to the project construction including such site clearing as may be deemed necessary.

282. The following requirements were identified for the selected plan (exclusive of mitigation and administrative costs):

Temporary Easement	Permanent Easement	Fee	Severance
6.80 Ac	42.07 Ac	12.80 Ac	$58,000
$40,000	$488,000	$65,000	

283. Contingency costs of 25% were utilized for all levels, and administrative costs were assessed and added to overall numbers.

284. Mitigation - Real Estate Requirements. Mitigation real estate requirements involve acquisition of approximately 12.8 acres of parcels for restorative purposes. The areas are within the wetland boundary line and are situated west of Wilson Avenue. These properties would be considered fee acquisitions, totaling $65,000.

285. Total real estate project costs would thus be $946,000 for the selected 14 ft optimum line of protection elevation and associated mitigation, including $106,000 in administrative costs.

286. Additional Real Estate Issues. Monmouth County in conjunction with the Green Acres Program has been actively acquiring properties along the Raritan bayshore. Based upon available information the coastal component and renourishment would be centered on all publicly owned lands. The County has indicated that it may take 2 to 3 years to finalize all remaining buyouts and demolition of structures. Since proposed construction would not be until at least the year 2002, these actions would have already occurred by the base year; therefore, property acquisitions along Port Monmouth Road are not factored into real estate acquisition costs. Real estate valuations are deemed to be $0. The County will provide public access to the bayshore area. Public access dune walkovers (5) are included as project costs.

287. Several commercial properties near the southern end of the alignment in proximity to Willow Avenue were deemed to have potential for severance damages because of lost access to storage space. These costs are factored in as real estate project costs but are not significant.

288. Along the Pews Creek or western project alignment the floodwall which would flank the northern portion of Port Monmouth Road will remain in the road right of way. Therefore real estate considerations are minimized.

289. First Costs. First costs for the recommended plan of improvement are shown in Table 13. A contingency of 10% to 25% was utilized to account for inaccuracies in quantities due to the level of design, and for the concept stage of interior drainage design for gate, pump stations and drainage structures. Interest during construction was included at a 6-5/8% interest rate for the Preconstruction, Engineering and Design (PED) and construction periods. The MCACES cost summary section is shown in Appendix C.

290. Annual Costs. Annual costs for the recommended plan of improvement are shown on Table 14 as $2,931,010. Annual costs include annualization of first cost and interest during construction at an interest rate of 6-5/8%. Annualized renourishment costs are based on trucked material of 127,300 c.y. at 10-year intervals over the 50-year period of analysis, annualized monitoring costs, annual maintenance of beach fill area and levees, and operation and maintenance of pump stations, tide gate and drainage structures and replacement of equipment throughout the project life.

TABLE 13
TOTAL FIRST COST – SELECTED PLAN
RARITAN BAY & SANDY HOOK BAY COMBINED HURRICANE AND STORM DAMAGE REDUCTION FEASIBILITY STUDY
LEVEE/FLOODWALL ELEVATION 14.0; DUNE ELEVATION 16.0

ACCOUNT CODE	DESCRIPTION	AMOUNT (Rounded)	CONTINGENCY AMOUNT	CONT. %	TOTAL
01	LANDS AND DAMAGES				
01.03	Real Estate Costs - Local	$672,000	$168,000	25%	
01.04	Real Estate Costs - Administration	$85,000	$21,000	25%	
	SUBTOTAL	$757,000			
	CONTINGENCY		$189,000		
	LANDS AND DAMAGES TOTAL				$946,000
02	RELOCATIONS				
02.01	Raise Port Monmouth Road				
02.01.01	Site Work	$22,000	$3,000	15%	
02.01.13	Traffic Control	$9,000	$1,000	15%	
02.01.19	Construct Approaches to Subgrade	$52,000	$8,000	15%	
02.01.39	Road Surfacing	$106,000	$16,000	15%	
02.01.99	Associated General Items	$4,000	$1,000	15%	
02.02	Drainage				
02.02.01	36" Outlet Diversion Pipe	$119,000	$18,000	15%	
02.02.39	Road Surfacing	$6,000	$1,000	15%	
02.03	Port Monmouth Pier Extension	$75,000	$11,000	15%	
	SUBTOTAL	$393,000			
	CONTINGENCY		$59,000		
02	RELOCATIONS TOTAL				$452,000
06	FISH AND WILDLIFE FACILITIES				
06.03	Wildlife Facilities & Sanctuaries				
06.03.06	Wetland Mitigation	$1,535,000	$154,000	10%	
06.03.07	Wetland Monitoring	$15,000	$2,000	16%	
	SUBTOTAL	$1,550,000			
	CONTINGENCY		$156,000		
06	FISH AND WILDLIFE TOTAL				$1,706,000

TABLE 13
TOTAL FIRST COST – SELECTED PLAN
RARITAN BAY & SANDY HOOK BAY COMBINED HURRICANE AND STORM DAMAGE REDUCTION FEASIBILITY STUDY
LEVEE/FLOODWALL ELEVATION 14.0; DUNE ELEVATION 16.0

ACCOUNT CODE	DESCRIPTION	AMOUNT (Rounded)	CONTINGENCY AMOUNT	CONT. %	TOTAL
11	LEVEES AND FLOODWALLS				
11.01	Levees				
11.01.01	Mob, Demob & Preparatory Work				
11.01.01.01	Mob. & Demob.	$124,000	$19,000	15%	
11.01.01.02	Erosion & Sediment Controls	$19,000	$2,000	10%	
11.01.01.04	Temp. Access Road	$20,000	$2,000	10%	
11.01.05	Site Work				
11.01.05.01	Clear & Grub	$220,000	$22,000	10%	
11.01.05.02	Excavation Common	$246,000	$25,000	10%	
11.01.05.04	Embankment Common	$1,228,000	$123,000	10%	
11.01.05.05	Riprap / Ditch Lining	$233,000	$23,000	10%	
11.01.05.06	Embankment Impervious	$1,014,000	$101,000	10%	
11.01.05.07	Embankment Pervious	$158,000	$16,000	10%	
11.01.05.08	Stripping	$140,000	$14,000	10%	
11.01.05.09	Topsoil and Seeding	$424,000	$42,000	10%	
11.01.05.15	Fabric (Geotextile)	$123,000	$12,000	10%	
11.01.06	Storm Gate				
11.01.06.01	Storm Gate Structure @ Pews Creek	$3,914,000	$783,000	20%	
11.02	Floodwalls				
11.02.02	Site Work				
11.02.02.01	Excavation @ Base	$28,000	$3,000	10%	
11.02.02.02	Steel Sheeting	$1,576,000	$158,000	10%	
11.02.02.03	Timber Piles	$78,000	$8,000	10%	
11.02.02.04	Dewatering	$22,000	$2,000	10%	
11.02.03	Floodwall Construction				
11.02.03.01	Formwork	$334,000	$33,000	10%	
11.02.03.02	Reinforcing Steel	$516,000	$52,000	10%	
11.02.03.03	Place Concrete	$577,000	$58,000	10%	
	SUBTOTAL	$10,994,000			
	CONTINGENCY		$1,497,000		
11	TOTAL LEVEES AND FLOODWALLS:				$12,492,000

TABLE 13
TOTAL FIRST COST - SELECTED PLAN
RARITAN BAY & SANDY HOOK BAY COMBINED HURRICANE AND STORM DAMAGE REDUCTION FEASIBILITY STUDY
LEVEE/FLOODWALL ELEVATION 14.0; DUNE ELEVATION 16.0

ACCOUNT CODE	DESCRIPTION	AMOUNT (Rounded)	CONTINGENCY AMOUNT	CONT. %	TOTAL
13	PUMPING PLANT				
13.01	Comptons Creek (C3) 60 CFS	$1,127,000	$169,000	15%	
13.02	Pews Creek 120 CFS Pump Station	$1,367,000	$205,000	15%	
	SUBTOTAL	$2,494,000			
	CONTINGENCY		$374,000		
13	TOTAL PUMPING PLANT:				$2,869,000
15	FLOODWAY CONTROL DIVERSION STRUCTURES				
15.01	Road Closure Gates				
15.01.01	4' x 40' Closure Gate (Marina Road)	$243,000	$49,000	20%	
15.01.02	9' x 40' Closure Gate (Campbell Avenue)	$546,000	$109,000	20%	
15.01.03	8' x 40' Closure Gate (Broadway)	$485,000	$97,000	20%	
15.02	Drainage Structures				
15.02.00	Site Work				
15.02.00.02	Excavation	$15,000	$0		
15.02.00.10	Seeding	$11,000	$2,000	15%	
15.02.03	Outlet Pipes				
15.02.03.03	Reinforced Concrete Pipe	$47,000	$7,000	15%	
15.02.04	Drainage Structures				
15.02.04.01	Drainage Inlet and Outlet Structures	$400,000	$60,000	15%	
15.02.05	Metals				
15.02.05.06	Gates and Trash Racks	$368,000	$55,000	15%	
15.02.39	Road Surfacing				
15.02.39.01	Restore Road Surface	$5,000	$1,000	15%	
	SUBTOTAL	$2,120,000			
	CONTINGENCY		$379,000		
15	TOTAL FLOODWAY CONTROL DIVERSION STRUCTURES				$2,498,000

TABLE 13
TOTAL FIRST COST – SELECTED PLAN
RARITAN BAY & SANDY HOOK BAY COMBINED HURRICANE AND STORM DAMAGE REDUCTION FEASIBILITY STUDY
LEVEE/FLOODWALL ELEVATION 14.0; DUNE ELEVATION 16.0

ACCOUNT CODE	DESCRIPTION	AMOUNT (Rounded)	CONTINGENCY AMOUNT	CONT. %	TOTAL
17	Beach Replenishment				
17.00	Beach Replenishment				
17.00.01	Mob, Demob for Dredging	$450,000	$68,000	15%	
17.00.02	Mob, Demob for Associated Work	$23,000	$3,000	15%	
17.00.16	Pipeline Dredging				
17.00.16.01	Dredging & Placement	$2,706,000	$406,000	15%	
17.00.99	Associated General Items				
17.00.99.01	Dune Grass	$47,000	$7,000	15%	
17.00.99.02	Sand Fence	$18,000	$3,000	15%	
17.00.99.03	Dune Overwalk	$70,000	$10,000	15%	
	SUBTOTAL	$3,313,000			
	CONTINGENCY		$497,000		
17	TOTAL BEACH REPLENISHMENT:				$3,810,000
	Sub-Total Construction Cost				$24,773,000
30	Engineering & Design	$4,400,000	$450,000	10.2%	$4,850,000
31	Construction Management	$1,537,000	$223,000	14.5%	$1,760,000
	TOTAL PROJECT FIRST COST				$31,383,000

TABLE 14
TOTAL ANNUAL COST – SELECTED PLAN
RARITAN BAY & SANDY HOOK BAY COMBINED HURRICANE AND STORM DAMAGE REDUCTION FEASIBILITY STUDY
LEVEE/FLOODWALL ELEVATION 14.0; DUNE ELEVATION 16.0

Total First Cost	$31,383,000
Interest During Construction (a)	$3,654,000
Total Investment Cost	$35,037,000

Annualized Investment Cost (b)	$2,419,100
Annualized Renourishment (c)	$169,000
Annual Federal Inspection Cost	$3,000
Annualized Emergency Beach Fill Costs	$29,300
Annual Dune Maintenance	$5,600
Annual Levee\Floodwall Maintenance (d)	$24,600
Potential Increase in Channel Maintenance, Dredging	$40,000
Monitoring	$103,200
Annual Rehabilitation Costs	$33,600
Interior Drainage O&M and Replacement Equipment	$17,300
Area No.C3 Pump Station O&M	$17,760
Storm Gate O&M	$34,100
Pews Creek Pump Station O&M	$34,450
Subtotal O&M	$133,810
Total Annual Cost	$2,931,010

(a) I = 6 5/8% for all funds expended

(b) For 50 yr.period of analysis.
(c) 127000 c.y. every 10 years for the 50 year
period of analysis; @15/cy; $25,000 mob/demob; 10% contingency; 12% E&D, S&A.
(d) Based on $2.29 / l.f.

VIII. LOCAL COOPERATION

291. In accordance with Section 105 (a)(1) of WRDA 1986, the Feasibility Study of Raritan and Sandy Hook Bay, NJ - Port Monmouth was cost shared 50% between the Federal Government and the State of New Jersey. The contributed funds of the local sponsor, the New Jersey State Department of Environmental Protection, and the local municipalities have shown the intent to support a project for Port Monmouth, New Jersey.

292. A fully coordinated Project Cooperation Agreement (PCA) package (to include sponsor's financing plan) will be prepared subsequent to the approval of the feasibility phase which will reflect the recommendations of the Feasibility Study. The non-Federal sponsor, the New Jersey State Department of Environmental Protection, has indicated support of the recommendations presented in this Feasibility Report and the desire to execute a PCA for the recommend plan. Other non-Federal interests, such as the Town of Middletown, Monmouth County have indicated their support of the project. The local sponsor shall be required to:

Comply with all applicable Federal laws and policies and other requirements, including but not limited to:

a. Provide non-Federal costs assigned to hurricane and storm damage reduction as further specified below:

    (1) Enter into an agreement which provides, prior to construction, 25 percent of pre-construction engineering and design (PED) costs;
    (2) Provide, during construction, any additional funds needed to cover the non-federal share of PED costs;
    (3) Provide all lands, easements, and rights-of-way, including suitable borrow areas, and perform or ensure the performance of any relocations determined by the Federal Government to be necessary for the initial construction, periodic nourishment, operation, and maintenance of the project; in addition, real estate rights will need to be procured to tie the Port Monmouth project into the existing East Keansburg Levee.
    (4) Provide, during construction, any additional amounts as are necessary to make its total contribution equal to 35 percent of initial project costs assigned to hurricane and storm damage reduction plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits.
    (5) Provide, during construction of each periodic nourishment 50 percent of periodic nourishment costs assigned to hurricane and storm damage reduction plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits.

b. For so long as the project remains authorized, operate, maintain and repair the completed project, or functional portion of the project, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the Non-Federal Sponsor of responsibility to meet the Non-Federal Sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

d. Hold and save the United States free from all damages arising from the initial construction, periodic nourishment, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;

e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

f. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction;

g. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;

h. Agree that the Non-Federal Sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the project in a manner that will not cause liability to arise under CERCLA;

i. If applicable, comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

j. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army, and Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of flood plain management plans;

k. Provide 35 percent of that portion of total historic preservation mitigation and data recovery costs assigned to initial construction of hurricane and storm damage reduction, 50 percent of those costs assigned to periodic nourishment and 100 percent of those costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits that are in excess of 1 percent of the total amount authorized to be appropriated for the project;

l. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

m. Within 1 year after the date of signing a project cooperation agreement, prepare a floodplain management plan designed to reduce the impact of future flood events in the project area. The plan shall be prepared in accordance with guidelines developed by the Federal Government and must be implemented not later than 1 year after completion of construction of the project;

n. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder future periodic nourishment and/or the operation and maintenance of the project;

o. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

p. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

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

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

s. Recognize and support the requirements of Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element; and

t. At least twice annually and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and advance nourishment section and provide the results of such surveillance to the Federal Government.

u. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

293. The Town of Middletown and Monmouth County have expressed support for a potential project. The cooperation between the various governments indicate a strong willingness to proceed with a potential solution to the flood and storm damage problems facing the Community of Port Monmouth.

294. In an effort to keep the sponsor and interested local municipalities informed, coordination throughout the feasibility phase was maintained. Meetings were held periodically between representatives of the Corps, NJDEP, Town and the County. Coordination efforts shall continue, including coordination of this report with other State and Federal agencies.

Project Implementation

295. The NJDEP must sign a Preconstruction, Engineering and Design Agreement that will carry the project through the remaining design phases, preparation of plans and specifications, and construction. Funds must be budgeted by the Federal government and Non-Federal sponsor, NJDEP to support these activities. The NJDEP must sign a project cooperation agreement to support the Corps' budget request. A project schedule will be established based on reasonable assumptions on the construction schedule.

Cost Apportionment

296. The cost apportionment between Federal and non-Federal total first cost of the selected plan is shown in Table 15. The selected plan has been shown to be economically justified on benefits associated with storm damage reduction. There are no separable recreation features included with this project. The value of recreation benefits anticipated as a result of the project are minimal and not required for project justification. Therefore, all recreational benefits are assumed to be incidental to the project. In accordance with Section 103 of the Water Resource Development Act of 1986 and appropriate Federal regulations, such as Engineering Regulations ER 1165-2-130 (Federal Participation in Shore Protection), Federal participation in a project formulated for hurricane and storm damage reduction is 65 percent of the estimated total project first costs, including Lands, Easements, Rights-of-way, Relocations, and Disposal areas (LERRD) assigned to this purpose. All of the proposed project shoreline is categorized as publicly owned and affords public benefits.

297. Relocations include costs for relocations of access ways due to the configuration of the dune, which would otherwise impede beach access. Relocations include dune walkovers (and removal of existing beach access ramps), vehicle access ramps, and raising of one timber deck due to dune positioning.

298. The Federal share of the project's total first cost is $20,398,950. This represents 65% of the total. The Federal Government will design the project, prepare detailed plans/specifications and construct the project, exclusive of those items specifically required of non-Federal interests.

299. The non-Federal share of the estimated total first cost of the proposed project is $10,984,050. The non-Federal cost consists of a number of components including lands, easements, rights-of-way, relocations, disposals and PED cost sharing. The non-

the total project first costs.

TABLE 15
COST APPORTIONMENT

Cost Sharing	Federal Share	Non-Federal Share	Total
Cash Contribution	$20,398,950	$9,586,050	$29,985,000
Real Estate Lands & Damages	-----	$946,000	$946,000
Relocations, (Walkovers, Accessways)	-----	$452,000	$452,000
Total First Cost	$20,398,950	$10,984,050	$31,383,000
Periodic Nourishment Cost (per cycle)	$1,192,050	$1,192,050	$2,384,100
Annualized Nourishment Cost, Scheduled Emergency, Post-Storm Rehabilitation*	$99,150	$99,150	$198,300
Annual Dune Maintenance	-----	$5,600	$5,600
Annual Federal Inspection Costs	$3,000	-----	$3,000
Monitoring, Environmental	$33,865	$18,235	$52,100
Monitoring, Coastal*	$25,550	$25,550	$51,100
Rehabilitation of Storm Damage Reduction Features	-----	$33,600	$33,600
Operation and Maintenance of Levee, Floodwall, & Drainage Features	-----	$128,210	$128,210
Potential Increase in Channel Maintenance Dredging	-----	$40,000	$40,000
Total Annual Nourishment, O&M, and Rehabilitation Costs	$161,550	$350,350	$511,900

*Renourishment consists of three sub-items: (a) Annualized Nourishment- $84,500 (b) Emergency Post-Storm Rehabilitation- $14,650 (c) Coastal Monitoring- $25,550.

Construction and Funding Schedule

300. The annual funding schedule is based on the project construction schedule and cost estimate. Due to the difference in timing between the Federal government's and the non-Federal sponsor's fiscal years, the schedule is provided in terms of calendar years. The Preconstruction Engineering and Design Phase coupled with project construction is estimated to take up to six years to complete. The project construction schedule anticipates a construction start date of September 2002. The completion date is estimated at September 2006. The schedule for the project broken into construction elements is shown in Figure 29. The fully funded project cost for initial construction, including inflation, is estimated at $37,141,000. The Ultimate Construction Cost, which includes the escalated costs for initial construction and four periodic nourishment operations, is estimated to be $70,198,000. The periodic nourishment costs are based upon escalated costs that include nourishment cycles estimated to be $26,471,000, an escalated cost for emergency post storm rehabilitation estimated to be $274,000, and an escalated cost for annual coastal monitoring estimated to be $6,312,000. The total periodic nourishment costs are to be cost-shared equally with the Non-Federal sponsor.

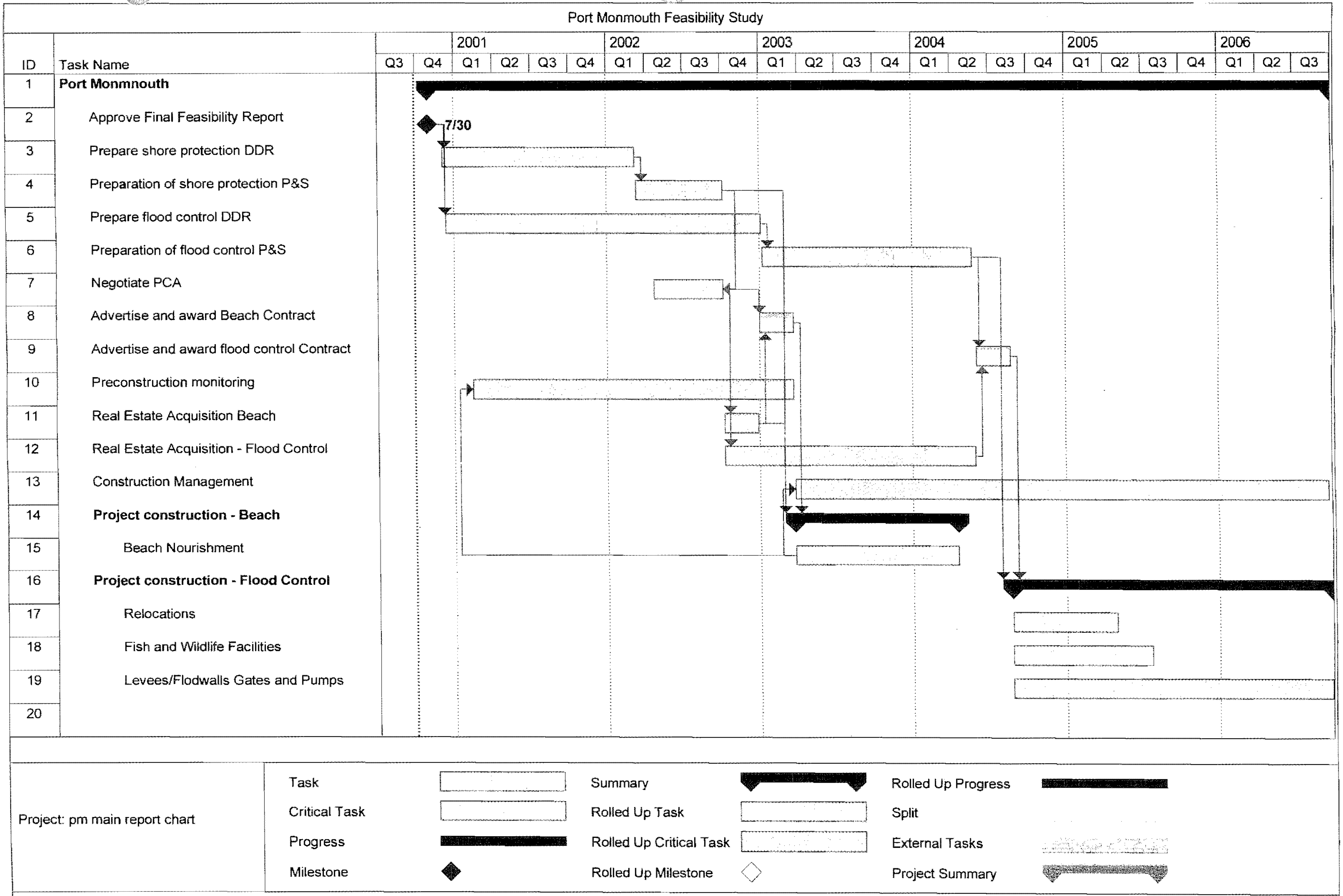

Port Monmouth Feasibility Study
ID
Task Name
2001
2002
2003
2004
2005
2006
Q3
Q4
Q1
Q2
Q3
Q4
1 Port Monmouth
2 Approve Final Feasibility Report
7/30
3 Prepare shore protection DDR
4 Preparation of shore protection P&S
5 Prepare flood control DDR
6 Preparation of flood control P&S
7 Negotiate PCA
8 Advertise and award Beach Contract
9 Advertise and award flood control Contract
10 Preconstruction monitoring
11 Real Estate Acquisition Beach
12 Real Estate Acquisition - Flood Control
13 Construction Management
14 Project construction - Beach
15 Beach Nourishment
16 Project construction - Flood Control
17 Relocations
18 Fish and Wildlife Facilities
19 Levees/Flodwalls Gates and Pumps
20
Project: pm main report chart
Task
Critical Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Critical Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary

Figure 29

IX. CONCLUSIONS

301. The Feasibility Study data gathering and analysis revealed that the study area experiences significant problems due to flooding caused primarily by tidal inundation. An array of preliminary alternatives were screened with due consideration given to plan formulation criteria including such factors as costs, benefits, reliability, environmental impacts, real estate valuations, planning guidelines and local preferences. Planning objectives were evaluated relative to technical, economic, environmental, regional and social and institutional constraints.

302. Alternatives were assessed for the Bayshore, Pews Creek, Compton Creek and for mitigation measures. Plan formulation identified an alignment P1-S1-C2 as the NED plan. This plan was also deemed to be the locally preferred plan and was selected for optimization. The plan provides for high priority hurricane and storm damage reduction benefits which may be attributed to protecting nearly 1000 structures in the study area. Recreation benefits are included in the total annual benefits but comprise less than 10% of the total.

303. The P4 alignment which consists of levees and floodwalls west of Wilson Avenue was initially considered to be more favorable. However, additional screening showed that the gate, P1 alternative, across Pews Creek would provide greater net excess benefits. This is due to several reasons. An approximate 270 structures would be protected above and beyond the P4 alternative. Direct wetland footprint impacts with the shorter P1 alignment would be much less significant, requiring less mitigation. Operation and Maintenance costs would not be as high, since local interests, due to their proximity at the marina and facilities at Keansburg, would be able to participate more efficiently in these activities. Real estate project valuation costs would also be minimized with the P1 alternative as existing rights of way would be utilized for a significant portion of the alignment. The P1 alignment, as it would extend through disturbed areas, would also have less likely cultural resources potential impacts than the P4 alternative.

304. The P1 alignment includes a storm gate across Pews Creek, along with floodwalls and levees that flank the existing Port Monmouth Road and tie into the shorefront alignment. The S1 alignment consists of a fortified dune structure and beach berm with periodic nourishment that extends along the Raritan Bayshore. The S1 alignment joins the C2 alignment near Park Avenue and Port Monmouth Road. The C2 alignment, after an initial road raising at Port Monmouth Road, consists of levees, floodwalls and road closure gates (at Campbell Avenue and Broadway). The alignment ends in the vicinity of Willow Avenue and Route 36.

305. Local preferences aimed at providing additional protection measures for areas in the eastern study area near Compton Creek were also investigated but were found to be significantly less cost effective. These alternatives included tide gates, levees and

floodwalls east of Main Street.

306. For the selected plan of improvement, several levels of protection (+13 ft, +14 ft and +15 ft NGVD heights) were investigated leading to the determination that the 14 ft NGVD height for the (selected alignment) line of protection was optimum, with due consideration for residual damages. The selected optimum level of protection would afford 89% reliability, utilizing risk and uncertainty, against a 100 year storm event. Risk of exceedance is 27% over a 50 year period. Seepage and slope stability analyses were conducted for typical levee sections which were designed with side slopes of 1/2.5. Floodwalls were designed in accordance with Engineer Manual EM 1110-2-2502 (Retaining and Floodwalls).

307. The dune and beach design was based upon guidelines contained in Engineer Manual EM 1110-2-3301 (Design of Beach Fills), Engineer Regulation ER 1110-2-1407 (Hydraulic Design for Coastal Shore Protection Projects), and Engineer Regulation ER 1105-2-100 (Guidance for Conducting Civil Works Planning Studies). To maintain the level of protection, dune heights are required to be higher than the levees due to additional wave considerations. This resulted in an additional 2 feet, or a +16 ft NGVD required dune height. Existing dune heights are close to +16 ft NGVD in many locations; therefore, additional cost savings were realized. A 2,640 foot long, 25 ft wide dune crest with 50 ft beach berm was developed in conjunction with EDUNE model simulations as the most optimum, reliable and cost effective design. The design length, with taper section, is approximately 4,640 feet. The design section includes advance fill and rerquires initial placement of approximately 378,500 CY of material. The landward slope would be 1 vertical on 5 horizontal, followed by a 25 ft dune top width, and 1 vertical on 10 horizontal slope down to +9 ft NGVD at which point there is a 50 foot berm, followed by a 1 vertical on 15 horizontal slope to existing bay contour. Possible renourishment scenarios were examined, and the 10 year cycle was selected. It was determined that a one time large initial fill volume would not adequately nor effectively provide protection over the project life and would cause excessive sedimentation in the adjacent navigation channels. Renourishment quantities are estimated at about 127,000 CY every 10 years. Five public access overwalks are included in project costs.

308. The storm gate screening process was in accordance with Engineer Manual EM 1110-2-2703 (Lock Gates and Operating Equipment). A sector gate was determined to be the appropriate closure structure. A hydrodynamic model was utilized to determine optimum gate size opening to avoid adverse indirect wetlands impacts. The 40 foot opening was found to have negligible effects and was thus selected. The gate is assumed to close at elevations generally not lower than 5 ft NGVD. This serves to protect against flooding while minimizing indirect wetlands impacts.

309. Interior drainage features were analyzed and designed in accordance with Engineering Manual EM 1110-2-1413 (Hydrologic Analysis of Interior Areas). Plan formulation for

interior drainage was accomplished separately from the line of protection. Alternatives were examined for defined drainage basin areas and consisted of minimum facility considerations, ponding areas, pump stations and associated combinations of these measures. At Pews Creek, along the western project area, the plan for interior drainage includes a 120 cfs pump station and two gravity outlets. For the Compton Creek or eastern portion of the study area, basins C1, C2, and C3 were investigated. It was determined that at C3, a 60 cfs pump station would be most cost effective in conjunction with a primary outlet, five secondary outlets, one diversion pipe and one drainage pipe. The pump station was justified because of high residual damages above the minimum facility. For the C1 and C2 areas, the minimum facility was the only feasible plan based on NED criteria. C1 includes one primary and one secondary outlet. C2 consists of one primary outlet and five secondary outlets.

310. The District conducted a Habitat Evaluation Procedures (HEP) analysis to assess the impacts of the selected plan. This HEP analysis concluded that impacts associated with the construction of the selected plan (without mitigation) will result in the loss of 2.04 black duck (Anas rubripes) and 3.14 marsh wren (Cistothorus palustris) habitat units (HUs) at the year of construction (Year 2002). At the year of 2052, black duck and marsh wren habitat quality would be reduced by 49.94 and 136.71 cumulative habitat units (CHUs). Similarly, the average annual habitat unit (AAHU) of the black duck and marsh wren would decrease by 1.00 and 2.73 over the 50-year design life of the Project. In addition, the HEP analysis determined that 2.13 acres of upland habitat would be impacted, 7.13 acres of wetlands would be converted to upland, and an additional 5.63 acres of wetland habitat would be indirectly impacted by the selected plan. Indirect impacts to wetlands involve the conversion, not the loss, of non-Phragmites wetlands to Phragmites-dominated wetlands.

311. The District, in consultation with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and NJDEP, developed an array of mitigation plans using HEP protocol. The selected mitigation plan proposes to restore approximately 12.80 acres of wetland Phragmites-dominated habitat to salt marsh habitat. When compared to the No-Action alternative, implementation of the selected plan and selected mitigation plan would increase black duck habitat quality by 0.78 HUs and marsh wren habitat quality by 0.96 HUs at the year of construction (year 2002). At the year of 2052, black duck and marsh wren habitat quality would increase by 157.83 and 106.55 CHUs. In addition, the AAHU of the black duck and marsh wren would increase by 3.16 and 2.13 over the Project's 50-year design life when compared to the No-Action alternative.

312. Based upon a Phragmites Encroachment Model (PEM) developed by the District specifically for the assessment of future conditions and impacts, the construction of the selected plan and selected mitigation plan would prevent the loss of about 15.27 acres of salt marsh habitat when compared to the No-Action alternative for the 50-year design-life of the Project. In summary, the comparison of the selected plan to the No-Action

alternative determined that implementation of the selected plan will provide long-term benefits to wildlife resources of the coastal marsh ecosystem at Port Monmouth. No federal or state listed threatened or endangered species or their critical habitats will be impacted.

313. The selected plan is expected to have a direct, short-term impact to benthic resources. Beach nourishment is expected to smother benthic organisms causing their mortality. However, once buried, some mobile shellfish species and polycheate worms have the ability to burrow upwards and survive. The recovery of benthic resources to pre-construction conditions is expected to occur shortly after construction. A benthic monitoring plan will be conducted to quantify benthic recovery rates and the composition of the recolonized benthic community.

314. There will be Land, Easement and Right-of-Way (LER) requirements associated with project implementation. The estimated total acreage required for the Project is approximately 61.67 acres, consisting of approximately 12.80 acres in fee; approximately 48.87 acres of perpetual and temporary easements: consisting of a Flood Protection and Levee Easement (16.22 acres), a Perpetual Beach Nourishment Easement (13.14 acres), a Perpetual Restrictive Dune Easement (12.50 acres)); a pipeline easement (0.21 acres and a temporary work area easement (6.80 acres). All of the foregoing is situated in Middletown Township. Access to the Project LER will be via existing public roads.

315. In summary, the Raritan Bay and Sandy Hook Bay area has had a history of prior Federal involvement. The community of Port Monmouth is characterized by year round permanent residences and commercial properties that are subject to flooding from tidal inundation. Emergency vehicle access is another issue of concern during storm events as major access routes flood and strand local residents and emergency services. A 100-year storm event would result in damages to nearly 1000 structures in the study area. Benefits are predominantly high priority hurricane and storm damage reduction benefits.

316. The evaluation of project benefits and costs has demonstrated that the selected, NED plan meets planning objectives and constraints, is economically and environmentally acceptable, is locally implementable and is marked by a Federal interest. Avoidance and minimization of environmental and cultural resources impacts was an important factor in the plan formulation process. The recommended plan addresses unavoidable impacts and includes mitigation measures. The plan is also supported by the non-Federal sponsor. The selected plan affords approximately $308,820 in net excess benefits and has an associated BCR of 1.1. The plan has a total first cost of $31,383,000 of which $20,938,950 is Federal and $10,984,050 is non-Federal, with annualized nourishment costs at $169,000.

X. RECOMMENDATIONS

Prefatory Statement

317. In making the following recommendations, I have given consideration to all significant aspects in the overall public interest, including environmental, social and economic effects, engineering feasibility and compatibility of the project with the policies, desires and capabilities of the State of New Jersey and other non-Federal interests.

Recommendations

318. I recommend authorization of the selected hurricane and storm damage reduction plan for Port Monmouth, with such modifications thereof as in the discretion of the Commander, HQUSACE, as may be advisable. The recommended plan consists of a system of levees and floodwalls provided along the two study area creeks, with a beach berm and dune system along the Sandy Hook Bayshore. This plan provides for hurricane and storm damage protection extending continuously from the adjacent East Keansburg, NJ levee, across Pews Creek, along the bay shore, and thence along undeveloped lands adjoining Compton Creek to higher existing elevation. Plan components consist of the following features: levees, floodwalls, road raisings, road closure gates, pump stations, a sector gate across Pews Creek, drainage outlets, gravity outlets, a reconstructed dune, initial beach fill, periodic renourishment, real estate interests and mitigation.

319. The selected mitigation plan proposes to restore approximately 12.80 acres of wetland Phragmites-dominated habitat to salt marsh habitat. The mitigation site is situated in the Pews Creek basin area and compensates for direct and indirect impacts.

320. The project first cost (May 1998) is approximately $31,383,000. Annualized project costs are (Discounted 6-7/8%) $2,931,010, with average annual benefits of $3,239,830. The project has a benefit cost ratio of 1.1 to 1.

321. Project cost apportionment would be as follows:

Cost Apportionment of the Hurricane and Storm Damage Reduction Features

Federal (65.0%)	$20,398,950
Non-Federal (35.0%)	$10,984,050

322. I further recommend that Federal participation in the cost of the project, including renourishment, for a total period of 50 years from the date of initial fill be carried out for the purposes of hurricane and storm damage reduction with a view toward any ecosystem restoration opportunities. These recommendations are made with the provisions that local interests will:

a. Provide to the United States all necessary lands, easements, rights-of-way, relocations, and suitable borrow and/or disposal areas deemed necessary by the United States for initial construction and subsequent maintenance of the project, including that required for periodic nourishment.

b. Hold and save the United States free from claims for damages which may result from construction and subsequent maintenance, operation, and public use of the project, except damages due to the fault or negligence of the United States or its contractors.

c. Maintain continued public ownership and public use of the shorefront areas upon which the amount of Federal participation is based during the economic life of the project.

d. Maintain, repair, rehabilitate, and replace the protective measures and/or structures during the economic life of the project as required to serve the intended purposes at their design levels of storm damage protection and in accordance with regulations prescribed by the Secretary of the Army.

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

f. Contribute the local share of non-Federal costs for initial construction, and periodic beach nourishment over the economic life of the project, as required to serve the intended purposes.

g. Upon completion of each project feature, acquire, rehabilitate, repair, replace, operate and maintain easements for public access to areas created or enhanced by the project. The cost of the operation, and maintenance of these easements will be the responsibility of the non-Federal sponsor;

h. Provide an acceptable Public Access Plan, and provide all lands, easements and rights-of-way necessary for conformity with public access.

Disclaimer

323. The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of highest review levels within the Executive Branch. Consequently, the recommendations may be modified (by the Chief of Engineers) before they are transmitted to the Congress as proposals for authorization and implementing funding. However, prior to transmittal to Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

William H. Pearce
Colonel, Corps of Engineers
District Engineer

References

Birkemeier, William A. 1985. "Field Data on Seaward Limit of Profile Change," *Journal of Waterway, Port, Coastal and Ocean Engineering*, American Society of Civil Engineers.

Bokuniewicz, H. J. and C. T. Gray, 1979. *The Volume of Sand and Gravel Resources in the Lower Bay of New York Harbor*, Marine Sciences Research Center, State University of New York, Stony Brook, NY.

Bruno, Dr. Michael S., 1991. "Design Analysis of the Beachfill and Groin Outfall Protection at Old Bridge, NJ." Stevens Institute of Technology.

Harrington, Thomas O., 1994. “An Analysis of the Sedimentation Problem at Monmouth Cove Marina, Monmouth County, New Jersey,” Technical Report SIT-DL-94-9-2683, Stevens Institute of Technology, Hoboken, NJ.

Hubertz, Jon M., Rebecca M. Brooks, Willie A. Brandon and Barbara A. Tracy, 1993. *Hindcast Wave Information for the US Atlantic Coast*, U.S. Army Corps of Engineers Waterways Experiment Station, WIS Report 30.

Kobayashi, Nobuhisa, 1990. *Wave Reflection and Overwash of Dunes*. Journal of Waterway, Port, Coastal, and Ocean Engineering.

Kobayashi, Nobuhisa; Tega, Yukiko, and Hancock, Mark W., 1996. Wave Reflection and Overwash of Dunes, *Journal of Waterway, Port, Coastal, and Ocean Engineering*, Vol. 122, No. 3.

Kriebel, David L., 1989. Dune Erosion Model EDUNE Users Manual.

NOAA, 1987. Tidal Datums and Bench Mark Elevation Sheet.

NOAA, 1995. *Tide Tables 1995 High and Low Water Predictions East Coast of North and South America Including Greenland*. U.S. Department of Commerce.

Pilarczyk, Krystian W., 1990. Dike Height: Wave Runup and Overtopping. Proceedings of the Short Course on Coastal Protection Delft University of Technology.

Pilarczyk, Krystian W., 1990. Runup and Overtopping Predictive Equations, *In*: *Proceedings of the Short Course on Coastal Protection*, Delft University of Technology, A.A. Balkema/Rotterdam/Brookfield.

Pile Buck Software, Inc., 1991. Users Guide, Analysis of Cantilevered or Anchored Sheet Pile Walls by the Free Earth Support Method (SPW911).

Rogers Surveying, 1995. "Combined Flood Control and Shore Protection Study at Port Monmouth, New Jersey - Beach Profiles with Sediment Sampling Analysis," Phase I, Book 1 of 1. Staten Island, NY.

Sardonia, 1996. Personal communication.

U.S. Army, Coastal Engineering Research Center, 1992. Automated Coastal Engineering System (ACES).

U.S. Army Corps of Engineers, 1996. Preliminary CERC Surge Results (unpublished).

U.S. Army Corps of Engineers, New York, 1977. "Raritan Bay and Sandy Hook Bay, New Jersey, General Design Memorandum No. 2, Matawan Township."

U.S. Army Corps of Engineers, 1984. *Shore Protection Manual Volume 1*, Coastal Engineering Research Center, Department of the Army, Vicksburg, MS.

U.S. Army Corps of Engineers, New York District, 1993. "Reconnaissance Study, Raritan Bay to Sandy Hook Bay, New Jersey."

U.S. Army Corps of Engineers, June 1995. Aerial Photographs.

U.S. Army Corps of Engineers, 1996. Sandy Hook Bay Storm Stage Elevations, Waterways Experiment Station, Coastal Engineering Research Center.

U.S. Army Corps of Engineers, New York District, 1998. "Cultural Resources Investigation, Port Monmouth Combined Flood Control and Shore Protection Feasibility Study."

U.S. Army Corps of Engineers (USACE), New York District. 2000a. Project Habitat Evaluation Report. Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey. Combined Flood Control and Shore Protection Project.

U.S. Army Corps of Engineers (USACE), New York District. 2000b. Project Mitigation Report. Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey. Combined Flood Control and Shore Protection Project.

U.S. Army Corps of Engineers (USACE), New York District. 1998. Draft Project Mitigation Report. Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey. Combined Flood Control and Shore Protection Project.

U.S. Army Corps of Engineers (USACE), New York District. 2000. Project Mitigation Report. Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey. Combined Flood Control and Shore Protection Project.

U.S. Army Corps of Engineers (USACE), New York District. 1998. Draft Project Mitigation Report. Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey. Combined Flood Control and Shore Protection Project.

RARITAN BAY AND SANDY HOOK BAY
HURRICANE AND STORM DAMAGE REDUCTION PROJECT
PORT MONMOUTH, NEW JERSEY

FINAL ENVIRONMENTAL IMPACT STATEMENT

JUNE 2000

Prepared by: U.S. Army Corps of Engineers
New York District
Planning Division
26 Federal Plaza
New York, New York 10278-0090

Final Environmental Impact Statement

Raritan Bay and Sandy Hook Bay
Hurricane and Storm Damage Reduction Project
Port Monmouth, New Jersey
Middletown Township, Monmouth County

Abstract: The responsible lead Federal agency is the U.S. Army Corps of Engineers (USACE), New York District (District).

Flooding and shore erosion are historical problems in the Raritan Bay and Sandy Hook Bay (RBSHB) area, especially in the community of Port Monmouth, New Jersey. In 1993, the District completed a Reconnaissance study of the area located between Pews Creek and Compton Creek that provided justification to proceed with a feasibility study to develop a comprehensive hurricane and storm damage reduction plan. The plans were formulated for three areas: Pews Creek, Compton Creek, and the Bay Shoreline that is located between the two creeks (FEIS Figure 1). The District's selected plan provides full protection for all three areas.

During the feasibility study, 68 alternative plans of improvement were considered. Many of the possible alternatives were eliminated early in the plan formulation process due to various factors such as relatively high cost or unacceptable adverse environmental impacts. The selected plan, which is also the environmentally preferred plan, calls for flood control and shore protection to extend continuously from the adjacent Keansburg, New Jersey levee, across Pews Creek, along the Bay Shoreline, and thence along undeveloped lands adjoining Compton Creek to higher existing elevation. The selected plan includes levees and floodwalls featuring a peak elevation of +14 feet National Geodetic Vertical Datum (NGVD), fortification of an existing dune that features a berm width of 50 feet at an elevation of +9 feet NGVD backed by a dune with a crest width of 25 feet at an elevation of +16 feet NGVD. The selected plan also includes a storm gate across Pews Creek, two local road closure gates, one raising of Port Monmouth Road, and pedestrian dune walkovers. The Bay Shoreline protection requires the initial placement of approximately 378,500 cubic yards of sand and subsequent renourishment of about 125,000 cubic yards of sand every 10 years thereafter for 50 years. The sand used to fortify the dune and berm will initially come from an existing permitted and authorized offshore borrow area known as the Sea Bright borrow area. However, the District is currently investigating other potential offshore borrow areas. The characterization of the existing resources and impacts to other potential offshore sand sources will be addressed under a separate NEPA document. The construction of the levees requires approximately 107,800 cubic yards of material. This material will come from an existing facility that is fully permitted and authorized to provide the appropriate volume of clean material needed for levee construction.

The cost for the selected plan is based on May 1998 price levels and the FY 2000 Federal interest rate of 6-5/8%. The economic analysis of the selected plan will provide annual benefits of $3,239,830 which, when compared to the total annual cost of the selected plan of $2,931,010 yields a benefit to cost ratio of 1.1 with $308,820 in net excess benefits. The selected plan is the National Economic Development (NED) plan.

The initial cost for the construction of the selected plan, including the advance nourishment, is estimated at $31,383,000 (May 1998 price levels). The Federal share of this first cost is $20,398,950 (65%), and the non-Federal share is $10,984,050 (35%). The annualized cost for periodic nourishment is currently estimated at $169,000 that will be cost shared at a rate of 50% Federal and 50% non-Federal. The non-Federal sponsor, the New Jersey Department of Environmental Protection (NJDEP), has indicated general support for the selected plan and would be willing to enter into a Project Cooperation Agreement with the USACE for the implementation of the selected plan. Local municipalities would cost share the non-Federal share with the State. These include Monmouth County and Middletown Township, which are also supportive of the selected plan.

The District conducted a Habitat Evaluation Procedures (HEP) analysis to assess the impacts of the selected plan. This HEP analysis concluded that impacts associated with the construction of the selected plan (without mitigation) will result in the loss of 2.04 black duck (*Anas rubripes*) and 3.14 marsh wren (*Cistothorus palustris*) habitat units (HUs) at the year of construction (Year 2002). At the year of 20[illegible], black duck and marsh wren habitat quality would be reduced by 49.94 and 136.71 cumulative habitat units (CHUs), respectively. Similarly, the average annual habitat unit (AAHU) of the black duck and marsh wren would decrease by 1.00 and 2.73 over the 50-year design life of the Project. In addition, the HEP analysis determined that 2.13 acres of upland habitat would be impacted, 7.13 acres of wetlands would be converted to upland, and an additional 5.63 acres of wetland habitat would be indirectly impacted by the selected plan. Indirect impacts to wetlands involve the conversion, not the loss, of non-*Phragmites* wetlands to *Phragmites*-dominated wetlands.

As part of the HEP process, the District selected the black duck, marsh wren, and clapper rail as the evaluation species for the Port Monmouth Project. The black duck, marsh wren, and clapper rail are three species commonly associated with wetland habitats, and certain combinations of wetland habitat characteristics outlined within their respective HSI models will determine their abundance and distribution (USFWS 1980). Due to the selected species' preference of wetland habitats and the characteristics of the habitat variables used in the HEP process, the District believes that an overall assessment of wetland functions and values is an inherent part of the HEP assessment. Specifically, the habitat variables associated with the evaluation species used at Port Monmouth can be directly and indirectly related to some common wetland functions and values used in other assessment techniques such as the Wetland Evaluation Techniques (WET [Adamus *et al.* 1987]) and the Evaluation for Planned Wetlands (EPW [Bartoldus *et al.* 1994]).

Based upon a *Phragmites* Encroachment Model (PEM) developed by the District specifically for the assessment of future conditions and impacts, the construction of the selected plan and selected mitigation plan would prevent the loss of about 15.27 acres of salt marsh habitat when compared to the No-Action alternative for the 50-year design-life of the Project. In summary, the comparison of the selected plan to the No-Action alternative determined that implementation of the selected plan will provide long-term benefits to wildlife resources of the coastal marsh ecosystem at Port Monmouth. No federal or state listed threatened or endangered species or their critical habitats will be adversely impacted.

The District, in consultation with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and NJDEP, developed an array of mitigation plans using HEP protocol. The District through habitat modeling using the PEM and HEP calculations determined that the conversion of 12.8 acres of wetland *Phragmites* to salltmarsh would be needed to offset the impacts associated with the project by the year 2052. In order to select the appropriate mitigation effort, the District implemented a step-wise procedure to determine the level of mitigation needed to offset impacted HUs. Using a range of mitigation acreages, the District calculated the available HUs at year 2052 for six mitigation scenarios: 25.60 acres (200%), 16.00 acres (125%), 12.80 acres (100%), 10.24 acres (80%), 6.40 acres (50%), and 3.84 acres (30%). The District determined that at year 2052, marsh wren HUs were almost (-0.33) compensated for with 6.40 acres of mitigation and that a net gain of 1.87 black duck HUs was still observed at the lowest level of 3.84 acres. Based on this evaluation, the District determined that at the year 2052 in terms of HUs the marsh wren is mitigated for at approximately 2:1 ratio (12.80 acres instead of the minimum required 6.40 acres) and the black duck is mitigated for at a greater than 3:1 ratio (12.80 acres instead of the minimum required <3.24 acres). In addition, at year 2052, there is a net gain of 5.49 black duck and 3.57 marsh wren HUs resulting from the selected mitigation effort. Similarly, black duck and marsh wren habitat quality would increase by 157.83 and 106.55 CHUs, respectively. Also, the AAHUs of the black duck and marsh wren would increase by 3.16 and 2.13 over the Project's 50-year design life when compared to the No-Action alternative.

The selected plan is expected to have a direct, short-term impact to benthic resources. Beach nourishment is expected to smother benthic organisms causing their mortality. However, once buried, some mobile shellfish species and polycheate worms have the ability to burrow upwards and survive. The recovery of benthic resources to pre-construction conditions is expected to occur shortly after construction. A benthic monitoring plan will be conducted to quantify benthic recovery rates and the composition of the recolonized benthic community.

The District developed a tidal hydrodynamic model to compare the effects of a storm gate in Pews Creek to ambient conditions. The model projected that the selected 40-ft storm gate in the open position would lower the mean spring high tide by only 0.72 inches and all other normal tidal events would be unaffected. Accordingly, the effects to the daily tidal exchange are expected to be minute. A monitoring plan is proposed to support the prediction of the model. In addition, the storm gate is anticipated to increase peak ebb tidal velocities potentially allowing more suspended sediments to be transported out of the salt marsh into the RBSI . As a result, the sedimentation rate of the salt marsh may be reduced.

In addition, the implementation of the selected plan can provide benefits to horseshoe crabs (*Limulus polyphemus*), migratory birds, wintering waterfowl and the federally threatened Piping plover (*Charadrius melodus*). A wider sandy beach and improved intertidal habitat conditions will provide more suitable spawning habitat for the horseshoe crab, thus potentially increasing prey resources available for consumption by migratory birds. It is well documented that the timing of the spring migration for many avian species is linked to the spawning activity of the horseshoe crab. Finally, a much larger and wider sandy beach created by the construction of the selected plan should provide more roosting habitat for wintering waterfowl and increase the amount of suitable nesting habitat for shorebirds and seabirds including the Federally- and state-listed threatened piping plover, the state-listed endangered least tern (*Sterna antillarum*) and the state-listed endangered black skimmer (*Rynchops niger).*

Subsurface testing was performed and evidence of Native American occupation was found in the vicinity of the selected plan's footprint. Further evaluation will be conducted and coordinated with the New Jersey Historic Preservation Office, as part of Section 106 of the National Historic Preservation Act compliance. Short-term negligible impacts to air quality and traffic are expected only during construction.

For further information regarding this Final Environmental Impact Statement, please contact:

Mr. Mark H. Burlas
Project Environmental Manager
CENAN-PL-EA
26 Federal Plaza
New York, New York 10278-0090
Phone: 212-264-4663
Fax: 212-264-0961
E-mail: mark.h.burlas@nan02.usace.army.mil

FEIS TABLE OF CONTENTS

FEIS TABLE OF CONTENTS

FEIS Section **FEIS Page**

FEIS TABLE OF CONTENTS

FEIS Section **FEIS Page**

FEIS TABLE OF CONTENTS

FEIS TABLE OF CONTENTS

FEIS Section **FEIS Page**

LIST OF FEIS APPENDICES

LIST OF FEIS TABLES

FEIS Page

FEIS ABBREVIATIONS AND ACRONYMS

ac	Acre
ACHP	Advisory Council on Historic Preservation
APE	Areas of Potential Effect
B-2	Business Zone
B-3	Business Zone
BP	Before Present
BSSA	Bay Shoreline Study Area
CAFRA	Coastal Area Facility Review Act
CCSA	Compton Creek Study Area
CENAB	United States Army Corps of Engineers, Baltimore District
CERC	Coastal Engineering Research Center
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CHU	Cumulative Habit Units
Corps	New York District Corps of Engineers
dB	Decibel
DDT	Dichlorodiphenyltrichloroethane
DEIS	Draft Environmental Impact Statement
District	United States Army Corps of Engineers, New York District
EC&MP	Environmental Construction and Management Plan
FEIS	Final Environmental Impact Statement
ft	Foot or Feet
NexGen HEC-FDA	Hydrologic Engineering Center's Next Generation Flood Damage Analysis
HABS/HAER	Historic American Bridge Structures/Historic American Engineering Record
HEP	Habitat Evaluation Procedures
HRE	Hudson Raritan Estuary
HTRW	Hazardous, Toxic, and Radioactive Waste
HU	Habitat Units
HwB	Hooksan sand
KUA	Klej loamy sand
Ldn	Day-night noise level
Main Report	Interim Feasibility Report and Draft Environmental Impact Statement for Port Monmouth Combined Flood Control and Shore Protection Feasibility Study (see USACE June 1998 in Reference section for complete citation)
MC	Marine Commercial
MCPB	Monmouth County Planning Board
MCPS	Monmouth County Parks System
MHW	Mean High Water
MSL	Mean Sea Level
N/A	Not Applicable
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
NGVD	National Geodetic Vertical Datum
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
N.J.L.	New Jersey Law
NJNHP	New Jersey Natural Heritage Program
N.J.S.A.	New Jersey State Act
NJSH	New Jersey State Highway
NJHPO	New Jersey Historic Preservation Office
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHP	National Register of Historic Places
O&M	Operation and Maintenance

FEIS ABBREVIATIONS AND ACRONYMS

PA	Preliminary Assessment
PAH	Polynucleararomatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCSA	Pews Creek Study Area
PEM	*Phragmites* Encroachment Model
Project	Port Monmouth Combined Flood Control and Shore Protection Project
R-5	High density, single family residence zone
R-7	High density, single family residence zone
RBSHB	Raritan Bay and Sandy Hook Bay
RHA	Multi-family mid-rise apartment residence zone
SS	Sulfaquents and Sulfihemists
TuB	Tinton loamy sand
UA	Udorthents
USCGS	United States Coastal and Geodetic Survey
UD	Udorthents-Urban Land Complex
USACE	U.S. Army Corps of Engineers
USDA NRCS	United States Department of Agriculture Natural Resource Conservation Service
USDI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

FEIS KEYWORDS INDEX*

FEIS KEYWORDS INDEX*

Note: This index refers to the various report sections/appendices where the keyword is discussed informatively in greatest detail, and is not intended to provide a complete list of all sections that contain the keywords.

SUMMARY

S.1 PROJECT DESCRIPTION

This document is a Final Environmental Impact Statement (FEIS) for the Raritan Bay and Sandy Hook Bay (RBSHB), Hurricane and Storm Damage Reduction Project, Port Monmouth New Jersey (Project), proposed by the U.S. Army Corps of Engineers (USACE), New York District (District). The purpose of this document is to evaluate the Project as required pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (Pub, L. 91-190, 42 U.S.C 4321 *et seq.*). NEPA requires Federal agencies to prepare a detailed statement (*i.e.*, an Environmental Impact Statement) for major Federal actions that may significantly affect the quality of the human environment, prior to commencement of the action. In accordance with NEPA, this FEIS provides a full and fair discussion of significant environmental impacts to inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment (The Council on Environmental Quality Regulations, Section 1502.1).

The 1.8-square-mile Project area is located in Port Monmouth, Middletown Township, Monmouth County, New Jersey, along the RBSHB, bounded by Compton Creek to the east, Pews Creek to the west, and New Jersey State Highway (NJSH) 36 to the south. The Project was divided into three study areas for plan formulation and impact assessment purposes: the Bay Shoreline Study Area (BSSA), the Pews Creek Study Area (PCSA), and the Compton Creek Study Area (CCSA). FEIS Figure 1 depicts the relative locations of these study areas within the Project area. The BSSA is located along the RBSHB, and comprises a shorefront, beach, and dune complex that has historically experienced significant erosion, and consequently provides limited tidal surge and flood protection to the adjacent Port Monmouth community. The PCSA is located in the western portion of the Project area, and is situated in a highly developed, residential portion of Middletown Township. The PCSA includes the Pews Creek channel, a tidal creek that drains to the north into the RBSHB, and is mostly tidal wetlands. The CCSA is located in the eastern portion of the Project area, and is associated with a highly developed, residential portion of Middletown Township. The CCSA includes the Compton Creek channel, a tidal creek that drains to the north into RBSHB, and is mostly tidal wetlands.

The selected plan is comprised of levees, floodwalls, a storm gate, road closure gates, fortification of an existing dune, pump stations, stormwater retention basins, beach nourishment, periodic beach renourishment, environmental mitigation, and an offshore borrow area. The selected plan, which is the environmentally preferred plan, was determined to be the National Economic Development (NED) Plan. A NED Plan is one that is consistent with the objectives of contributing to NED through the reduction of flood hazards and associated flood damages while protecting the Nation's natural, cultural, biological, historic, and social resources.

The District determined that interior drainage facilities were required to safely store and discharge storm water runoff that would collect on the protected side of the CCSA levee. Three stormwater retention basins along Compton Creek (C1, C2, and C3) were designed in accordance with Engineering Manual 1110-2-1413 guidance dated January 15, 1987. Specifically, these facilities were planned and evaluated separately from the line of protection (levees and floodwalls) and would provide adequate drainage at least equal to that of the existing infrastructure.

Throughout the planning process, the District formulated alternative plans to meet general and specific planning objectives while considering the preferences of various interested parties with regard to plan selection and design. The District has consulted and coordinated its planning efforts with the New Jersey Department of Environmental Protection (NJDEP), the non-Federal sponsor, and representatives of the Middletown Township and various Monmouth County agencies. The plan formulation process emphasized the avoidance and minimization of environmental impacts, and then mitigation was included to compensate for unavoidable habitat loss.

S.2 MAJOR FINDINGS AND CONCLUSIONS

This section provides a summary of principal or primary environmental effects that would result from the implementation of the selected plan. The environmental effects from the selected plan would be concentrated in and along the streambed and banks, and floodplain of the tidal creeks, and the Bay Shoreline's intertidal zone and dune. The selected plan consists of approximately: 7,000 linear feet (ft) of earthen levees averaging +14 ft National Geodetic Vertical Datum (NGVD); 3,600 ft of concrete floodwalls averaging about +8 ft NGVD; a 40-ft wide storm gate across Pews Creek with a flood water pump house; initial beach nourishment of about 357,000 cubic yards of sand, with periodic renourishment of approximately 127,300 cubic yards of sand at 10-year intervals; and, three interior drainage ponding areas each with primary and secondary drainage outlets.

The selected plan without mitigation would directly and indirectly impact approximately 14.89 acres (ac) of wetland and upland areas. The majority of these impacts would involve the conversion of native habitat types to maintained (grass-covered) levees, permanent floodwalls, and storm gate. Specifically, the selected plan would permanently impact several vegetation cover types (see FEIS Table 9). Finally, the selected plan would temporarily impact herbaceous, scrub/shrub, *Phragmites* wetlands, and high salt marsh habitats due to clearing and equipment operation in temporary work areas.

Less mobile aquatic and terrestrial wildlife species within the footprint of the selected plan would experience mortality due to construction. Furthermore, a short-term decrease in reproductive success of these species could occur due to construction activities. In the long-term, following habitat conversion, wildlife species would lose or gain habitat resources based on their habitat requirements. No rare, threatened, or endangered species or their critical habitats would be adversely affected by the selected plan.

The District conducted a Habitat Evaluation Procedures (HEP) analysis to assess the impacts of the selected plan (USACE 2000a). Through the use of the HEP process, the District was able to quantify project impacts and develop an appropriate mitigation plan. The black duck, marsh wren, and clapper rail are three species commonly associated with wetland habitats, and certain combinations of wetland habitat characteristics outlined within their respective HSI models will determine their abundance and distribution (USFWS 1980). Due to the selected species' preference of wetland habitats and the characteristics of the habitat variables used in the HEP process, the District believes that an overall assessment of wetland functions and values is an inherent part of the HEP assessment.

The HEP analysis concluded that impacts associated with the construction of the selected plan (without mitigation) will result in the loss of 2.04 black duck (*Anas rubripes*) and 3.14 marsh wren (*Cistothorus palustris*) habitat units (HUs) at the year of construction (Year 2002). At the year of 2052, black duck and marsh wren habitat quality would be reduced by 49.94 and 136.71 cumulative habitat units (CHUs). Similarly, the AAHU of the black duck and marsh wren decrease by 1.00 and 2.73 over the 50-year design life of the Project. In addition, the HEP analysis determined that 2.13 acres of upland habitat would be impacted, 7.13 acres of wetlands would be converted to upland, and an additional 5.63 acres of wetland habitat would be indirectly impacted by the selected plan. Indirect impacts to wetlands involves the conversion, not the loss, of non-*Phragmites* wetlands to *Phragmites*-dominated wetlands.

The selected plan is expected to have a direct, short-term impact on benthic resources. Beach nourishment is expected to smother benthic organisms causing their mortality. However, once buried, some mobile shellfish species and polycheate worms have the ability to burrow upwards and survive. The recovery of benthic resources to pre-construction conditions should occur shortly after construction. A benthic monitoring plan will be conducted to quantify benthic recovery rates and the composition of the recolonized benthic community.

Potential beneficial cumulative impacts to horseshoe crabs and migratory shorebirds and seabirds may result from implementation of the selected plan. The proposed beach fill and nourishment, in conjunction with similar projects along the RBSHB shoreline, may increase the overall value of the bay to both horseshoe crabs and migratory shorebirds, including the Federally- and state-listed threatened piping plover, the state-listed endangered least tern and the state-listed endangered black skimmer. Data gathered during the proposed monitoring program will contribute to the overall knowledge of the project area, including benthic, intertidal, and subtidal ecosystems that function in RBSHB. The implementation of the selected plan may contribute to a cumulative benefit to existing dunes around RBSHB by acting as a buffer against wave attack, which will reduce the impact of waves to existing dunes, thereby preserving their existing condition.

The construction of the selected plan will significantly benefit the local residents by increasing storm protection and reducing the amount of damage due to flooding caused by tidal surges, and will contribute to a more stable environment for planned growth and development as a result of reduced regional flooding concerns. The implementation of the selected plan, combined with other flood and shore protection and recreational development projects in the area, is expected to increase recreational opportunities. In addition, the construction of levees and floodwalls can reduce the spread of *Phragmites*, because they can function like a barrier across which the rhizomes that propagate *Phragmites* cannot spread.

The District developed a tidal hydrodynamic model to compare the effects of a storm gate in Pews Creek to the existing conditions. The model projected that the selected 40-ft storm gate in the open position would lower the mean spring high tide by only 0.72 inches and all other normal tidal events would be unaffected (USACE 1998c). Accordingly, the effects to the daily tidal exchange are expected to be minute. A monitoring plan is proposed to support the prediction of the model. In addition, the storm gate is anticipated to increase peak ebb tidal velocities potentially allowing more suspended sediments to be transported out of the salt marsh into the RBSHB. As a result, the sedimentation rate of the salt marsh may be reduced.

Potential impacts may result from implementation of the selected plan in conjunction with local and regional projects around RBSHB. Specifically, the overall impact to aesthetic resources in the region resulting from implementation of several similar projects, and the construction of multiple flood control structures may impact the viewshed from the water and landward sides of the structures.

Potential impacts to natural resources and navigation resulting from implementation of the selected plan may occur as a result of increased sedimentation. The placement of sand from the borrow area onto the beach is expected to increase the amount of sand that is available to be transported along the shoreline, and potentially into navigation channels. The implementation of the selected plan in conjunction with similar projects in the RBSHB area may contribute to sedimentation and disturbance of intertidal and subtidal communities in the Bay.

No areas were identified as containing potential environmental contamination, or were considered to pose a great risk to human health. Subsurface testing was performed and evidence of Native American occupation was found in the vicinity of the selected plan's footprint. Further evaluation will be conducted and coordinated with the New Jersey Historic Preservation Office, as part of Section 106 of the National Historic Preservation Act (NHPA) compliance. Short-term negligible impacts to air quality and traffic are expected only during construction.

S.3 MITIGATION

The District, in consultation with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and NJDEP, developed an array of mitigation plans using HEP protocol (USACE 2000b). The selected mitigation plan proposes to restore approximately 12.80 acres of wetland *Phragmites*-dominated habitat to salt marsh habitat. As compared to the No-Action alternative, implementation of the selected plan and selected mitigation plan would increase black duck habitat quality by 0.78 HUs and marsh wren habitat quality by 0.96 HUs at the year of construction. At the year of 2052, black duck and marsh wren habitat quality would increase by 157.83 and 106.55 CHUs. In addition, the AAHU of the black duck and marsh wren would increase by 3.16 and 2.13 over the Project's 50-year design life when compared to the No-Action alternative.

The District through habitat modeling using the *Phragmites* Encroachment Model (PEM) and HEP calculations determined that the conversion 12.80 acres of wetland *Phragmites* to saltmarsh would be needed to offset the impacts associated with the project by the year 2052. In order to select the appropriate mitigation effort, the District implemented a step-wise procedure to determine the level of mitigation needed to offset impacted HUs. Using a range of mitigation acreages, the District calculated the available HUs at year 2052 for six mitigation scenarios: 25.60 acres (200%), 16.00 acres (125%), 12.80 acres (100%), 10.24 acres (80%), 6.40 acres (50%), and 3.84 acres (30%). The District determined that at year 2052, marsh wren HUs were almost (-0.33) compensated for with 6.40 acres of mitigation and that a net gain of 1.87 black duck HUs was still observed at the lowest level of 3.84 acres. Based on this evaluation, the

District determined that at the year 2052 in terms of HUs the marsh wren is mitigated for at approximately 2:1 ratio (12.80 acres instead of the minimum required 6.40 acres) and the black duck is mitigated for at a greater than 3:1 ratio (12.80 acres instead of the minimum required <3.24 acres). In addition, at year 2052, there is a net gain of 5.49 black duck and 3.57 marsh wren HUs resulting from the selected mitigation effort. Based on the HEP study (USACE 2000a) and mitigation report (USACE 2000b), the implementation of the selected plan and selected mitigation plan would improve the overall wildlife value (*i.e.*, species diversity and abundance) of the existing salt marsh habitats over the 50-year design life of the Project.

Based upon a PEM developed by an interagency HEP team specifically for the assessment of future impacts, the construction of the selected plan and selected mitigation plan would prevent the loss of about 15.27 acres of salt marsh habitat when compared to the No-Action alternative for the 50-year design-life of the Project (USACE 2000b). In summary, the comparison of the selected plan to the No-Action alternative suggests that implementation of the selected plan and selected mitigation plan will provide long-term benefits to wildlife resources of the coastal marsh ecosystem at Port Monmouth.

Mitigation measures for cultural resources will be developed in conjunction with the New Jersey Historic Preservation Office, the Advisory Council on Historic Preservation (ACHP), and interested parties.

S.4 AREAS OF CONTROVERSY

Based on coordination with other federal and state agencies, an area of controversy has been identified. A consensus to determine the appropriate level of compensatory mitigation to offset environmental impacts has not been reached. As the lead federal agency, the USACE believes that the selected mitigation plan is appropriate and accurately represents the Federal position. The District will continue to coordinate with the non-Federal sponsor and other concerned agencies regarding the development of a locally-preferred mitigation plan.

No other areas of controversy are known at this time.

S.5 UNRESOLVED ISSUES

Based on coordination with other federal and state agencies, an unresolved issue has been identified. A consensus to determine the appropriate level of compensatory mitigation to offset environmental impacts has not been reached. As the lead federal agency, the USACE believes that the selected mitigation plan is appropriate and accurately represents the Federal position. The District will continue to coordinate with the non-Federal sponsor and other concerned agencies regarding the development of a locally-preferred mitigation plan.

No other areas of controversy are known at this time.

S.6 STATUS REGARDING COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

FEIS Table 1.0 in Section 1 indicates the permits and approvals required by the selected plan.

1.0 PURPOSE AND NEED OF ACTION

1.1 INTRODUCTION

A primary mission of the USACE is to provide solutions to reduce damages caused by floods and storm events. Flood control and storm damage protection measures usually include structures such as levees, floodwalls, storm gates, storm water retention basins, dunes, beach nourishment, and road closure gates. Non-structural methods of flood control may include flood proofing or the purchase of homes or businesses affected by flooding. This document addresses flood control and shore protection measures and their impacts. The District evaluated an array of structural and non-structural flood control and shore protection measures to provide comprehensive flood and storm protection for the Port Monmouth community.

1.2 PROJECT AUTHORIZATION

This FEIS was prepared pursuant to:

a) A January 6, 1955 amendment to the State of New Jersey, Department of Conservation and Economic Development basic application of September 22, 1952 requesting a beach erosion control study;

b) Chief of Engineers August 15, 1955 approval of a supplemental agreement dated June 22, 1955 amending the basic application in accordance with Section 2 of Public Law 520 (River and Harbor Act), 71st Congress, approved July 3, 1930, as amended and supplemented pertaining to cooperative beach erosion control investigations;

c) State of New Jersey authority to participate in a study established by Chapter 258, New Jersey Law (N.J.L.) 1946 and Chapter 448, N.J.L. 1948 and appropriation acts of the State;

d) A hurricane study authorized by Public Law 71, 84th Congress, 1st Session on June 16, 1955, funded by Chief of Engineers allocation letter dated October 1, 1957, and approved on February 12, 1960;

e) The existing Federal Project, RBSHB, New Jersey, authorized by the Flood Control Act of October 12, 1962 in accordance with House Document No. 464, 87th Congress, 2nd Session; and,

f) RBSHB shorefront area study resolution authorized by the U.S. House of Representatives, Committee of Public Works and Transportation, adopted August 1, 1990, which states "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 requested to review the report of Chief of Engineers on RBSHB, New Jersey, published as House Document 464, Eighty-seventh Congress, Second Session, and other pertinent reports, to determine the advisability of modifications to the recommendations contained therein to provide erosion control and storm damage prevention for the RBSHB".

1.3 CAUSES OF SHORE EROSION AND FLOODING

Hurricanes, northeasters, and extratropical storms historically have impacted homes, roads, commercial structures, shorefronts, beaches, and dunes located within the Port Monmouth Project area. These severe storms include: the September 14, 1944 hurricane; extratropical storms of November 25, 1950, and November 6-7, 1953; Hurricane Donna in 1960; and, northeasters of March 6-8, 1962, March 12, 1984, and December 11, 1992. Storms such as these generate tides and waves that result in extensive flooding and shoreline erosion. Shoreline erosion and flooding have been particularly significant within the Project area (see FEIS Figure 1) especially along the Bay Shoreline and properties adjacent to Pews Creek and Compton Creek.

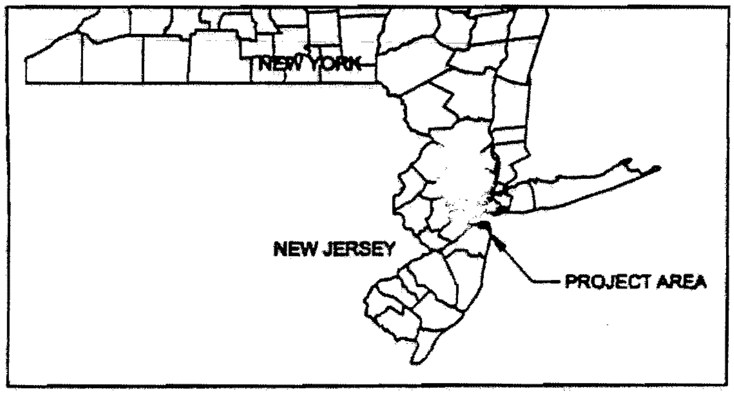
Numerous evacuations of the Project area have been required during severe storm events (Coastal Planning and Engineering Inc. *et al.* 1993). Transportation problems also have occurred during severe storms as a result of damaged roads and bridges. Tidal stages of 10 ft above mean sea level (MSL) result in flooding so severe that most residents north of NJSH 36 are stranded.

1.3.1 Bay Shoreline

Over time, storm events have significantly altered the composition of the Port Monmouth Bay Shoreline. Significant erosion has removed much of the natural beachfront and dune complexes that provide coastal protection to the Port Monmouth community (USACE 1993a). The Bay Shoreline historically has eroded at an annual beach retreat rate of approximately 2.7 ft per year (USACE 1993a). In addition, severe storms periodically damage or destroy structures (USACE 1993a).

1.3.2 Pews Creek and Compton Creek

The severe storm events also cause tidal surges that enter Pews Creek and Compton Creek and quickly spread over the floodplain from both the east (Compton Creek) and the west (Pews Creek). These tidal surges often block existing municipal storm drainage systems that outlet into the Pews Creek and Compton Creek channels and their associated tidal wetlands. Flooded storm sewers have induced extensive flooding that has damaged or destroyed numerous man-made structures located between Pews Creek and Compton Creek during severe storms (USACE 1993a). Significant damage has occurred to homes, commercial properties, building contents, and community infrastructure such as roads, bridges, utility lines, and storm sewers. This damage has resulted in extensive financial losses and is considered a significant constraint to commerce and regional economic development.



LEGEND:

A - Compton Creek Study Area (CCSA)
B - Pews Creek Study Area (PCSA)
C - Bay Shoreline Study Area (BSSA)

SOURCE:

U.S.G.S. 7.5 Minute Series
Sandy Hook NJ-NY 1954
Photorevised 1981

SCALE:

1" = 2,000'

N

FEIS FIGURE 1

SITE LOCATION MAP -
PORT MONMOUTH PROJECT AREA

Final Environmental Impact Statement
Raritan Bay and Sandy Hook Bay
Hurricane and Storm Damage Reduction Project
Port Monmouth, New Jersey

1.4 STUDY AREA DESCRIPTION

The 1.8 square-mile study area (see FEIS Figure 1) is located along the RBSHB in the Town of Port Monmouth, in northern Middletown Township, Monmouth County, New Jersey. In general, the study area is approximately 1,224 acres, including approximately 1,118 acres of land and 106 acres of water. The study area can be characterized as a complex of coastal marsh and coastal dune plant communities located within the Inner Coastal Plain of New Jersey (Collins and Anderson 1994). Undeveloped dune and marsh systems are interspersed and surrounded by residential and commercial properties.

The Project area is bounded by Compton Creek to the east, Pews Creek to the west, and RBSHB to the north. The southern limit of the Project area is generally considered to be in the vicinity of NJSH 36, and was subsequently refined during problem identification and formulation to the existing inland +15-ft NGVD contour line, which lies a short distance south of NJSH 36, approximately 6,000 ft from the Bay Shoreline. In order to more thoroughly characterize the existing environment and accurately calculate potential impacts, the Project area was subdivided into three substudy areas. The three substudy areas include the BSSA, PCSA, and CCSA as described below (see FEIS Figure 1).

1.4.1 Bay Shoreline

The BSSA is located along the RBSHB shoreline and includes developed land and coastal dune. The BSSA is bounded on the east by an abandoned fish processing plant located immediately west of Compton Creek, the west by the mouth of Pews Creek, and the south by Port Monmouth Road. The BSSA comprises a shorefront, beach, and dune complex that historically has experienced significant erosion, and provides limited tidal surge and flood protection to the Port Monmouth community. The BSSA's shoreline is characterized by an approximately 50-ft-wide beach at low tide with a few wooden groins and jetties, and an almost vertical, severely eroded dune face.

The BSSA primarily serves as recreational open space. The BSSA contains portions of the Bayshore Waterfront Park, including several beach access trails and gravel/sand parking lots, and a wooden fishing pier. The central portion of the BSSA contains the historic Whitlock/Seabrook Wilson House (commonly referred to as the Spy House Museum), associated surrounding grounds, historic buildings, lookout wooden pier, restroom facility, and gravel/sand parking lot. The Spy House Museum and surrounding grounds are dedicated to permanent recreation and open space use as part of the Green Acres Local Assistance Program, sponsored by the NJDEP. Finally, the BSSA contains the Monmouth Cove Marina, located adjacent to the mouth of Pews Creek and just north of Port Monmouth Road.

1.4.2 Pews Creek

The PCSA is located in the western portion of the Project area, and includes residential properties, salt marsh, and Pews Creek that drains into the RBSHB. The PCSA is bounded on the north by Port Monmouth Road, on the east by residential development along Wilson Avenue, on the south by the +15-ft NGVD contour line and on the west by the existing Keansburg Levee.

The PCSA is traversed by two roads (Bray Avenue and NJSH 36) and an abandoned railroad embankment.

1.4.3 Compton Creek

The CCSA is located in the eastern portion of the Project area, and includes residential and commercial properties, salt marsh, and Compton Creek, which drains into the RBSHB. The CCSA is bounded on the north by Port Monmouth Road, on the west by Port Monmouth Main Street, on the east by Belford Main Street and on the south by the +15-ft NGVD contour line. The CCSA is traversed by three roads (Broadway, Church Street, and Campbell Avenue) and an abandoned railroad embankment.

1.5 PLANNING OBJECTIVES

Planning objectives are identified based on the needs and opportunities, as well as the existing physical and environmental conditions present in the Project area. In general, the prime Federal objective is to contribute the NED account consistent with protecting the Nation's environment, pursuant to national environmental statues, applicable executive orders and other Federal planning requirements. For additional discussion regarding planning objectives please see Section IV of the Main Report.

FEIS Table 1. Environmental Compliance Regulations.

PERMITS AND APPROVALS	STATUS	AGENCY
Federal		
Clean Water Act of 1977, as amended	Full	USACE, NJDEP, EPA
Coastal Zone Management Act of 1972 N.A., as amended	Pending	NOAA, NJDEP
Endangered Species Act of 1973 N.A., as amended	Full	USFWS, NMFS
Fish and Wildlife Coordination Act, as amended	Full	USFWS, USACE
National Historical Preservation Act of 1966, as amended	Full	ACHP, NJSHPO
Executive Order 11988, Floodplain Management	Full	USACE
Executive Order 11990, Protection of Wetlands	Full	USACE
Analysis of Impacts on Prime and Unique Farmland	Full	NRCS
Water Resources Planning Act of 1965, as amended	Full	USACE
Wild and Scenic Rivers Act, as amended	N/A	USDI, USDA
National Environmental Policy Act, as amended	Full	USACE (Lead Agency)
Archeological and Historic Preservation Act of 1974, as amended	Full	ACHP, NJSHPO

FEIS Table 1. Environmental Compliance Regulations (Continued).

PERMITS AND APPROVALS	STATUS	AGENCY
Estuary Protection Act, as amended	Full	EPA, NMFS
Rivers and Harbors Appropriation Act of 1899, as amended	Full	USACE
Hazardous, Toxic and Radioactive Waste Guidance	Full	USACE
Magnuson - Stevenson Fishery Conservation and Management Act	Full	NMFS
Safe Drinking Water Act	Full	EPA
<u>State and Local</u>		
Nongame and Endangered Species Act of 1973, as amended	Full	NJDEP
Floodplain Management Act of 1976, as amended	Full	NJDEP
Water Quality Certification	Pending[1]	NJDEP
Soil Erosion Sediment Control Act	Pending[2]	NJDEP

[1]: Review of the Project's DEIS and FEIS is required before the issuance of permits.
[2]: Will be obtained during the Planning, Engineering and Design Phase

2.0 ALTERNATIVES

The District developed an array of 68 different Project Alternatives. These included No-Action, three non-structural, and 64 structural protection alternatives designed to evaluate socioeconomic benefits, costs and environmental impacts. To accomplish this, the District identified the causes of shore erosion and flooding, developed general evaluation criteria (*i.e.*, completeness, effectiveness, efficiency, and acceptability), analyzed specific evaluation criteria (*i.e.*, technical, economic, and environmental), formulated planning objectives, and considered planning constraints. A more detailed discussion of the alternatives evaluated is provided in Section V of the Main Report.

2.1 NO-ACTION ALTERNATIVE

The No-Action Alternative would avoid any short- or long-term environmental impacts associated with construction and operation of the shore stabilization and flood control structures. However, both negative socioeconomic and environmental consequences would result if the Project is not constructed. Socioeconomic impacts associated with storm tidal surges and subsequent flood events would include extensive local economic loss to housing, personal property, and community infrastructure (*i.e.*, storm sewers and outfalls, roadways, and utilities). Environmental impacts would include continued erosion of the bay shoreline, beach, and dune areas, and the subsequent reduction of dune vegetation, wildlife habitat, recreational capability and use, and future tidal surge and flood protection provided to the local communities by the existing dunes. The No-Action Alternative therefore would not meet the Project objectives of stabilizing the Bay Shoreline, beach, and dune areas, or minimizing damages caused by storm surge and wave attack resulting in economic loss to the Port Monmouth communities. For further discussion please refer to Section V in the Main Report.

2.2 NON-STRUCTURAL ALTERNATIVES

The three non-structural alternatives analyzed included various combinations of flood protection measures, including property buy-out, structure raising, and flood proofing. This section provides a brief description of the three non-structural protection alternatives. For further discussion please refer to Section V in the Main Report.

2.2.1 Alternative N1

This alternative would provide flood protection against the 100-year storm to a stage of +14.0 ft NGVD, the same level of protection provided by the structural alternatives. This alternative would involve 571 raisings, 232 flood proofings (including the fire station, rescue squad, and part of Bayshore Village Apartments), and 67 residential and one commercial property buy-outs. For further discussion please refer to Section V in the Main Report.

2.2.2 Alternative N2

This alternative would provide flood protection against the 100-year storm with only 0.6-ft of freeboard to a stage of +12.8 ft NGVD. This alternative would require 479 raisings, 157 flood proofings (including the fire station and a day care facility), and 37 residential and one commercial property buy-outs. For further discussion please refer to Section V in the Main Report.

2.2.3 Alternative N3

This alternative would provide flood protection against the 25-year storm with only a 1-ft of freeboard to a stage of +10.2 ft NGVD. This alternative would require 268 raisings, 161 flood proofings, and no property buy-outs. For further discussion please refer to Section V in the Main Report.

2.2.4 Comparison of Non-Structural Alternatives

Alternative N1 would provide the greatest level of protection, Alternative N2 would provide a moderate level of protection, and Alternative N3 would provide the lowest level of protection among the three non-structural alternatives. In general, none of the three non-structural Alternatives would be economically practicable because protection against the 100-year flood would result in an annual cost in excess of $5,000 per structure. Furthermore, these alternatives would not adequately mitigate emergency access and public safety concerns. For further discussion please refer to Section V in the Main Report.

2.3 STRUCTURAL ALTERNATIVES

The District analyzed a total of 64 possible combinations of the different structural protection alternatives. This analysis focused on the evaluation and selection of the alternative that best maximized socioeconomic benefits and avoided and/or minimized potential impacts to the environment. As a result of the District's sequential mitigation analysis to avoid and minimize impacts to wetlands, four different approaches to providing storm and flood protection were developed for each of the three substudy areas within the Project. These approaches included various combinations of flood control and shore protection measures such as, floodwalls, levees, storm gates, shore stabilization, channelization, beach nourishment, beach nourishment with structures, and dune fortification. For further discussion please refer to Section V in the Main Report.

2.3.1 Bay Shoreline Study Area Alternatives

Four design alternatives were considered to counteract and stabilize the existing shore, beach, and dune erosion along the Bay Shoreline. These alternatives involved various combinations and designs of periodic beach nourishment, periodic beach nourishment with structures, floodwalls/seawalls, and new dune construction. All four Bay Shoreline alternatives would involve construction of dune/floodwalls to an elevation of +16 ft NGVD and would provide protection against the 100-year storm. The limits of protection along the Bay Shoreline were adjusted as necessary when combined with the Pews Creek and Compton Creek areas alternatives to provide complete protection for the entire Port Monmouth Project area. For further discussion please refer to Section VII in the Main Report.

2.3.1.1 Bay Shoreline Study Area Alternative Descriptions

- Alternative S1 would involve construction of the beach and dune sections with periodic nourishment. This alternative would include a 40-ft-wide dune that would slope gently into the bay.

- Alternative S2 would be identical to Alternative S1 with the addition of terminal groins, constructed of rock, installed at the eastern and western limits of fill.

- Alternative S3 would involve construction of a vertical seawall/floodwall that would tie into adjacent flood control structures at Pews Creek and Compton Creek. The seawall would be constructed of coated steel sheet piles and scour protection rock.

- Alternative S4 would involve construction of a new dune setback in the landward area of the existing primary dune, combined with a sheet-pile seawall/floodwall located along the shore between the Spy House Museum and fishing pier.

2.3.1.2 Comparison of Bay Shoreline Study Area Alternatives

In general, the District determined that the most cost-effective alternative involves a protective dune with future renourishment (Alternative S1). The cost for protection using a sheet-pile, seawall, and terminal groins is significantly greater than the costs for the other alternatives. The use of Alternative S1 would also be most compatible with County public use plans. For further discussion please refer to Section VII in the Main Report.

2.3.2 Pews Creek Study Area Alternatives

Four design alternatives were considered to control tidal surges and flooding within the PCSA. These alternatives involved various combinations and designs of levee alignments, storm gates, and pump stations. All four PCSA alternatives were analyzed using the Hydrologic Engineering Center's Next Generation Flood Damage Analysis computer program (NexGen HEC-FDA). This program was used to estimate the amount of equivalent annual damages, over the 50-year economic life of the alternatives, by providing protection against different flood stages of +13, +14, and +15.0 ft NGVD. For further discussion please refer to Section V in the Main Report.

2.3.2.1 Pews Creek Study Area Alternative Descriptions

- Alternative P1 consists of an earthen levee, storm gate, and pump station. The earthen levee would begin at the existing Keansburg Beach Erosion/Hurricane Protection Improvement Levee, located southwest of the Monmouth Cove Marina, and proceed easterly toward Pews

Creek. A storm gate and pump station would span the creek to control flooding caused by tidal and fluvial flows. The levee would then continue from the storm gate easterly, then northerly, across Port Monmouth Road, and terminate at the dunes located along RBSHB.

- Alternative P2 consists of an earthen levee that would begin near the intersection of Bray Avenue and Main Street. The levee would proceed northwest along the eastern edge of the PCSA tidal wetlands, and terminate at the dune located along RBSHB.

- Alternative P3 consists of an earthen levee and sheet-pile floodwall. This Alternative alignment would begin near the intersection of Bray Avenue and Main Street, proceed northerly toward the PCSA tidal wetlands, continue northerly at the wetland/upland boundary, and proceed northeasterly to the western terminus of Gordon Court. Near the western terminus of Plymouth Avenue, the alignment would follow the wetland/upland boundary, cross Lydia Place, and parallel the western side of Wilson Avenue. The alignment would then turn west along the upland side of the wetland/upland boundary to Port Monmouth Road, and terminate at the dune located along RBSHB.

- Alternative P4 consists of a combination of Alternative P2 and P3 alignments and would consist of an earthen levee and sheet-pile floodwall with concrete cap. This Alternative would begin near the intersection of Bray Avenue and Main Street, proceed northwesterly to the wetland/upland boundary, continue northeasterly following the upland side of the boundary to the northern terminus of Gordon Court, and proceed northerly into the tidal wetlands. The Alternative P4 alignment would then continue northerly along the eastern edge of the wetland, cross Port Monmouth Road, proceed north, and terminate at the dune located along RBSHB.

2.3.2.2 Comparison of Pews Creek Study Area Alternatives

Initially, the District determined that levees and floodwalls could provide the most effective and efficient structural flood control and storm protection in PCSA, especially in view of the State's concerns about operation and maintenance, and initially preferred the Alternative P4 alignment. However, at the request of County and Town officials, the District investigated a storm gate alternative. The District concluded that the use of a storm gate to prevent tidal surges from entering Pews Creek is technically feasible, although it would be more expensive than levee/floodwall alternatives considered. The District selected the storm gate alternative because it has less direct environmental impacts compared to Alternative P4, and would yield greater net annual benefits such that it would be identified as a component of the NED Plan. For further discussion please refer to Section V in the Main Report.

2.3.3 Compton Creek Study Area Alternatives

Four design alternatives were considered to control tidal surges and flooding from Compton Creek. These alternatives involved various combinations and designs of levee alignments. All four CCSA alternatives were analyzed using the (NexGen HEC-FDA) computer program. This program was used to estimate the cost of equivalent annual damages, over the 50-year economic life of the Project, by providing protection against different flood stages of +13, +14, and +15.0 ft NGVD. For further discussion please refer to Section VII in the Main Report.

2.3.3.1 Compton Creek Study Area Alternative Descriptions

- Alternative C1 would consist of an earthen levee. This levee alignment would begin at the intersection of Wilson Avenue and NJSH 36, proceed eastward along the properties on the south side of Willow Avenue, continue northerly and parallel to the west side of Compton Creek, cross Port Monmouth Road, and end at the dunes located along the northern limits of the Project area.

- Alternative C2 also would consist of an earthen levee that is longer and follows a more circuitous route than Alternative C1 to avoid more wetland areas. This Alternative alignment would begin near the intersection of Wilson Avenue and NJSH 36, proceed easterly along the northern property boundaries, follow the eastern edge of the developed upland area, and terminate at the dunes along the Bay Shoreline.

- Alternative C3 consists of an earthen levee and floodwall. This Alternative alignment would begin as a levee near the intersection of Wilson Avenue and NJSH 36, and proceed easterly along the back yards of properties on the south side of Willow Avenue to the eastern terminus of Willow Avenue. A sheet pile floodwall with concrete cap would then proceed northerly and follow the eastern right-of-way of Main Street. A levee alignment would continue from this point to Port Monmouth Road, and terminate at the dunes along RBSHB.

- Alternative C4 also consists of an earthen levee and floodwall that would follow the same path as Alternative C2.

2.3.3.2 Comparison of Compton Creek Study Area Alternatives

The District determined that levees, floodwalls, and road gate closures would provide the most effective and efficient flood control and storm protection within the CCSA, and selected the Alternative C2. The use of a storm gate to prevent tidal surges from entering Compton Creek would be impractical due to the lack of high ground along the east bank of the creek. For further discussion please refer to Section V in the Main Report.

2.4 SELECTED PROJECT PLAN

As summarized in FEIS Sections 2.2 and 2.3, the District performed a detailed quantitative evaluation of each of the 68 non-structural and structural alternatives by ranking each combination of alternative plans according to annual cost, direct wetland impacts, total wetland impacts, and number of property buy-outs required. As a result of this analysis and a coordinated review with NJDEP regulatory personnel, the District selected the most practicable overall alternative plan that met the planning objectives, maximized socioeconomic benefits, and avoided or minimized environmental impacts. The selected plan comprises the most practicable combination of flood control and shore protection alternatives for each of the three substudy areas (see FEIS Figure 2). The selected plan specifically includes the following Sections.

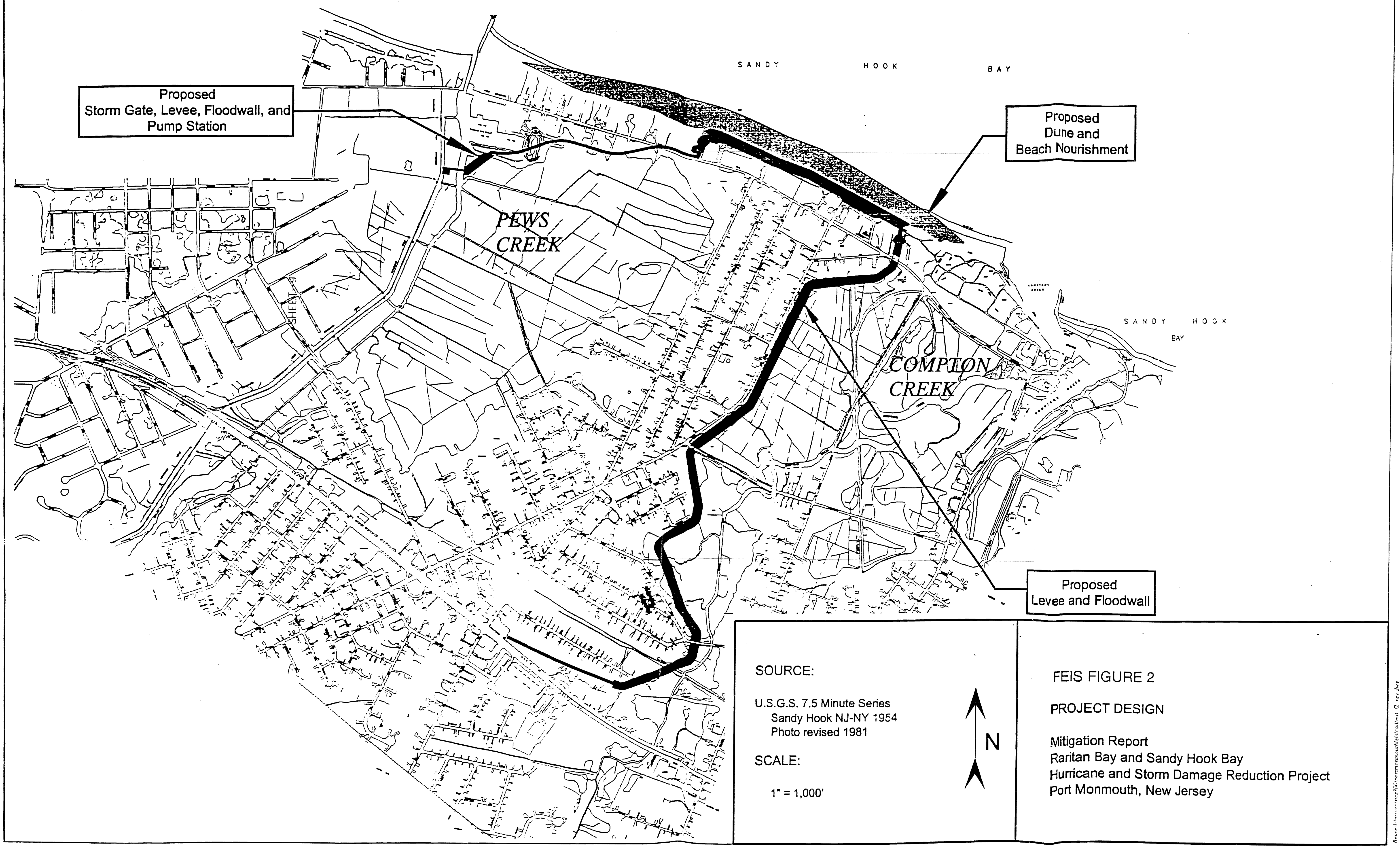
2.4.1 Bay Shoreline Study Area Selected Plan

The selected plan for flood control and storm protection along the Bay Shoreline was alternative S1, which consists of a fortified dune that generally follows the layout of the exiting dune. The eastern limit of the fortified dune ties into the Compton Creek levee alignment near the intersection of Park Avenue and Port Monmouth Road. From its eastern terminus, the dune extends about 2,640 ft to the west to link with the Pews Creek floodwall alignment west of the Spy House.

A dune crest of 25 ft to elevation +16 ft NGVD was designed. The landward dune slope is 1 vertical on 5 horizontal whereas the bayside slope is 1 vertical on 10 horizontal down to the +9 ft NGVD elevation. Thence a 50-ft wide berm will extend into the bay to be followed by a 1 vertical on 15 horizontal slope to existing bay bottom (approximate elevation –3 ft NGVD). The dune section will be stabilized with dune grass and fencing, and wood walkovers will be provided. Advance fill will be placed with initial construction, with periodic renourishment to follow approximately 10 years after construction and continue at a 10-year cycle for 50 years. Total initial fill would be approximately 357,000 cubic yards. The sand used to fortify the dune and berm initially will come from an existing permitted and authorized offshore borrow area known as the Sea Bright borrow area. However, the District is currently investigating additional offshore borrow areas as potential sources for sand. Impacts associated with dredging in future potential offshore borrow areas, other then the existing Sea Bright borrow area, will be assessed in a separate NEPA document. For further discussion please refer to Section VII in the Main Report.

2.4.2 Pews Creek Study Area Selected Plan

The selected plan for the PCSA was alternative P1. From the terminus of the improved dune approximately 700-ft northwest of the intersection of Wilson Avenue and Port Monmouth Road a levee section will span between the dune and Port Monmouth Road. The levee section will abut the beginning of the proposed floodwall along the north side of Port Monmouth Road. The floodwall continues at a design elevation of +14 ft NGVD westerly along the northern portion of Port Monmouth Road for about 600 ft until it reaches the intersection of the ramp to the Monmouth County Marina. A closure structure approximately 40 ft long by 4 ft high will bridge the ramp to the County marina. The alignment then continues for about 1500 ft as a floodwall along Port Monmouth Road. The floodwall is an I-type floodwall and continues up to a point perpendicular to an area of the new Port Monmouth Road (that becomes an elevated highway bridge) that is at design height. A transition earthen levee will be placed between the floodwall and the roadway to bridge the gap. The alignment incorporated a section of Port Monmouth Road. The levee proceeds about 300 ft southwest to the east bank of Pews Creek. A storm gate is to be constructed across Pews Creek at a point about 300 ft south of the Pews Creek Bridge. The storm gate size opening will be 40 ft wide and 21 ft high. The storm gate will connect to a concrete pile supported T-wall on the west side of Pews Creek for about 150 ft where it will join



SOURCE:

U.S.G.S. 7.5 Minute Series
Sandy Hook NJ-NY 1954
Photo revised 1981

SCALE:

1" = 1,000'

FEIS FIGURE 2

PROJECT DESIGN

Mitigation Report
Raritan Bay and Sandy Hook Bay
Hurricane and Storm Damage Reduction Project
Port Monmouth, New Jersey

the existing East Keansburg levee. For further discussion please refer to Section VII in the Main Report.

2.4.3 Compton Creek Study Area Selected Plan

The selected plan for the CCSA was alternative C2. The alignment for flood protection from Compton Creek starts out as an I-type floodwall approximately 250 ft southeast of the intersection of Wilson Avenue and NJSH 36 and proceeds easterly along the rear property line of the homes fronting Willow Avenue. The I-type floodwall will span approximately 1,250 ft at an elevation of +14 ft NGVD.

The alignment proceeds in the same easterly direction along the rear property lines of the houses fronting Willow Avenue until it reaches the last rear yard of Willow Avenue where it will connect to an earthen levee. This floodwall section ranges from one-half to six ft above existing grade. The I-type floodwall was selected instead of a levee because it minimizes property acquisition, easement widths, and the overall amount of disturbance by its footprint.

The alignment transitions from an I-type floodwall to an earthen levee and proceeds easterly for about 600 ft where it crosses an existing drainage ditch located between Campbell Avenue and Willow Avenue. The levee then turns north and approaches Campbell Avenue perpendicularly about 100 ft east of the intersection of Campbell Avenue and Creek Road. A road closure swing gate is proposed for the Campbell Avenue crossing. The gate will be approximately 40 ft wide and 8.5 ft high to provide flood protection to elevation +14 ft NGVD.

The levee then continues from the Campbell Avenue crossing in a northerly direction through the wetlands nearly parallel to Creek Road for approximately 1,100 ft. The levee height for this reach varies between 10 ft and 11 ft above existing grade. The levee then continues northeast, paralleling Woodstock Avenue for 400 ft and then proceeds northward for 800 ft to meet Broadway about 100 ft east of the intersection on Main Street and Broadway, at which point there will be a road closure swing gate to span across Broadway. The gate will be approximately 40 ft wide and 8 ft high to provide flood protection to elevation +14 ft NGVD. The alignment continues as an earthen levee in a northeasterly direction parallel to Main Street for about 2,100 ft, at which point it changes course and proceeds east for approximately 700 ft along the rear property lines of the houses which front Park Avenue. The levee then proceeds northerly meeting Port Monmouth Road about 800 ft southeast of the intersection of Main Street and Port Monmouth Road. Port Monmouth Road will be elevated to design elevation +14 ft NGVD where the levee meets the road. The levees will be covered with a layer of topsoil and then seeded with grass. The replanting plan would include shrubbery for selected areas of floodwall based upon local coordination for aesthetics. For further discussion please refer to Section VII in the Main Report.

2.4.4 Interior Drainage

The features for ponding area C1 consist of a primary outlet and secondary outlet as noted below. Both the primary and secondary outlets are being provided with a sluice gate and trash

rack. The outlets will also be provided with flap gates to prevent tidal surges from entering the protected area. Ditches will be constructed along the landward side of the levee to direct runoff toward either the primary or secondary outlet.

The features for ponding area C2 consist of a primary outlet and five secondary outlets as noted below. Both the primary and secondary outlets are being provided with a flap gate, sluice gate, and trash rack. Drainage ditches will direct runoff along the protected side of the levee to a nearby outfall.

The features for ponding area C3 consist of a primary outlet and five secondary outlets as noted below. Both the primary and secondary outlets are being provided with a flap gate, sluice gate, 60 cubic feet per second (cfs) pump station, and trash rack. The 36-inch storm water diversion pipe will be approximately 750 ft long. Ditches are included on the protected side for the levee to direct runoff to primary or secondary outlets.

The three primary and eleven secondary outlet pipes required for the total Compton Creek interior area will discharge into existing drainage ditches. For the Pews Creek interior area, once the storm gate is closed, there are basically two outlets: the pump discharge pipe and the adjacent gravity outlets, which allows gravity flow when tidal tailwater conditions are favorable.

2.4.5 Environmentally Preferred Alternative

The District evaluated an array of 68 alternative plans and ranked them sequentially according to their costs, benefits, and impacts to the environment, especially to wetlands. The selected plan ranked 49 of 68 in costs and 26 of 68 in impacts to the environment. Based upon an analysis of compromises between costs and impacts, as well as coordination efforts with resource and regulatory agencies, the selected plan was identified as the environmentally-preferred alternative.

2.5 IMPACT AVOIDANCE AND MINIMIZATION

Throughout the planning process, the District formulated alternative plans to meet study objectives, including the avoidance and minimization of environmental impacts, while considering the preferences of various interested parties with regards to the selected plan. The District has consulted and coordinated its study planning efforts with the non-Federal sponsor (the NJDEP), as well as representatives of Middletown Township and various Monmouth County agencies. This section provides a brief chronological summary of the District's plan formulation process to avoid and minimize impacts.

During the initial stages of the Project feasibility phase in October 1996, the NJDEP expressed a preference for a storm gate at Pews Creek to minimize direct footprint impacts to land use and environmental resources. However, the NJDEP also expressed significant concern that it would not be able to support increased staff to operate and maintain the storm gate. The District considered NJDEP's concerns and concluded that future analysis of possible PCSA designs would be limited to levees and floodwalls. Subsequent to this determination, Middletown Township officials indicated a clear preference for a storm gates at Pews Creek and, if possible, Compton Creek. To alleviate NJDEP's staffing concerns, Township officials suggested that the Town's Operation and Maintenance (O&M) staff assigned to the nearby East Keansburg Storm Water Pump Station could possibly service the Pews Creek storm gate. Township officials further suggested that locating the Pews Creek storm gate adjacent to the Monmouth Cove Marina would reduce vandalism and security concerns. The NJDEP indicated a willingness to support a storm gate at Pews Creek because of the reduced environmental impacts, more inclusive protection, and available local O&M support staff associated with this facility.

Subsequent to the local coordination meeting additional economic investigations were undertaken to identify if gate structures could be supported as components of the NED Plan that normally establishes the limit for Federal cost sharing. Based on the preliminary screening information the initial estimate of total annual costs for a gate and pump station at Pews Creek indicated that the annualized cost of the gate alternative would be $223,000/year higher than the originally preferred Pews Creek Levee alignment (P4). This increase in cost compares to a preliminary estimate of a $280,000 increase in annual benefits (excluding residual interior damage) due to the protection of approximately 90 additional structures in the Bray Avenue area. Additional benefits to 121 structures upstream of the previously defined study area, which ended at Route 36, would total approximately $413,000 annually. Accordingly the gate at Pews Creek would yield $470,000 in annual net benefits and was considered as a possible element of the NED Plan. The storm closure gate alternative also represented a plan that would avoid much of the direct wetland impacts from the footprint of the levee alignment P4.

In addition, the District determined that environmental impacts associated with the PCSA storm gate would be reduced compared to the PCSA levee/floodwall alignment (Alternative P4) originally preferred by the District. First, the storm gate would have a minimal impact on tidal inundation patterns by allowing normal tidal flows, except during severe storm events. Second, the storm gate footprints would require significantly less direct and permanent fill than the Alternative P4 levee. Third, the size and configuration of the storm gate would maintain existing tidal inundation conditions as established by a detailed two-dimensional hydrodynamic modeling effort performed by the District. Finally, potential impacts on water quality and tidal inundation patterns would be reduced during construction of the storm gate by installing temporary cofferdams and/or channel diversions to dewater the foundation footprint.

At the request of Township officials, the District considered a more comprehensive CCSA protection alignment than the Alternative C2 levee alignment. The District specifically evaluated a more extensive levee/storm gate alignment that would follow the new Port Monmouth Road, and extend further east, traverse Compton Creek, and extend protection to the west bank of Compton Creek. This alignment would provide protection to approximately +12 ft NGVD, and protect 276 structures not protected by the Alternative C2 levee alignment. However, a storm gate at Compton Creek would provide only limited additional protection because most structures in the CCSA do not suffer significant damage at flood stages below +12.0 ft NGVD. The District performed an economic analysis of the Township proposed alignment and determined that the use of a levee at +12.0 ft NGVD would only provide 20% and 50% reductions in equivalent annual damage in additional reaches protected by a storm gate at CCSA. The corresponding damage reduction benefits would total $77,000/year, and the additional annual cost would exceed these benefits. Accordingly, the District determined that a storm gate at CCSA was not an economically viable element of the NED Plan, and selected the Alternative C2 levee alignment.

Following selection of the most practicable alternative plan for each study area, the District continued its analysis to comprehensively integrate the three components of the plan. Specifically, the District continued its systematic and iterative engineering design approach using the NexGen HEC-FDA computer program to estimate annual storm damage costs, as well as to incorporate wetland mitigation costs. The objectives of these continued economic and environmental impact analyses were to further maximize socioeconomic benefits, and avoid and minimize environmental impacts. For a more detailed discussion please refer to Section V in the Main Report.

2.6 PROJECT MITIGATION

Although the selected plan was designed and further refined to avoid and minimize ecological impacts, there are still unavoidable impacts to wildlife resources and wetlands. These unavoidable impacts must be mitigated as a requirement pursuant to the Clean Water Act and USACE's ER 1105-2-100. The goals of the mitigation effort were coordinated with the interagency HEP Team and a consensus was reached to replace the number of HUs lost for the evaluation species impacted the most, restore salt marsh by eradicating *Phragmites* habitat, and minimize costs based on an incremental cost analysis. Alternative 3, of an array of 31 mitigation alternatives developed from 5 conceptual mitigation plans, was selected as the mitigation plan, and is associated with the conversion of wetland *Phragmites* to salt marsh habitat (USACE 1998a).

Based on the areas of disturbance of the selected plan, the District in coordination with the interagency HEP Team was able to quantify impacts to wildlife resources and wetlands. The number of HUs lost and the total acreage of wetland impacts are the basis for the development of mitigation plans. The District, in consultation with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and NJDEP, discussed the development of mitigation plans using HEP protocol. The District through habitat modeling using the PEM and HEP calculations determined that the conversion of 12.80 acres of wetland *Phragmites* to saltmarsh would be needed to offset the impacts associated with the project by the year 2052. In order to select the appropriate mitigation effort, the District implemented a step-wise procedure to determine the level of mitigation needed to offset impacted HUs. Using a range of mitigation acreages, the District calculated the available HUs at year 2052 for six mitigation scenarios: 25.60 acres (200%), 16.00 acres (125%), 12.80 acres (100%), 10.24 acres (80%), 6.40 acres (50%), and 3.84 acres (30%). The District determined that at year 2052, marsh wren HUs were almost (-0.33) compensated for with 6.40 acres of mitigation and that a net gain of 1.87 black duck HUs was still observed at the lowest level of 3.84 acres. Based on this evaluation, the District determined that at the year 2052 in terms of HUs the marsh wren is mitigated for at approximately 2:1 ratio (12.80 acres instead of the minimum required 6.40 acres) and the black duck is mitigated for at a greater than 3:1 ratio (12.80 acres instead of the minimum required

<3.24 acres). In addition, at year 2052, there is a net gain of 5.49 black duck and 3.57 marsh wren HUs resulting from the selected mitigation effort.

Another incremental cost analysis of the six mitigation alternatives was conducted to identify the most efficient and effective mitigation alternative. The incremental cost analysis consisted of comparing the cost of each mitigation alternative to the number of wetland acres restored, and the black duck and marsh wren HUs generated. The results of the incremental cost analysis concluded that the selected mitigation plan is the most cost-effective mitigation alternative (USACE 2000b).

The selected mitigation plan proposes to restore approximately 12.80 acres of wetland *Phragmites*-dominated habitat to salt marsh habitat. When compared to the No-Action alternative, implementation of the selected plan and selected mitigation plan would increase black duck habitat quality by 0.78 HUs and marsh wren habitat quality by 0.96 HUs at the year of construction (year 2002). At the year of 2052, black duck and marsh wren habitat quality would increase by 157.83 and 106.55 CHUs. In addition, the AAHU of the black duck and marsh wren would increase by 3.16 and 2.13 over the Project's 50-year design life when compared to the No-Action alternative (USACE 2000b).

The District is unaware of any existing process or rationale that is uniformly accepted, used and/or agreed upon by regulatory and resource agencies that justifies an acreage based compensatory mitigation ratio. The results of the Mitigation Report (USACE 2000) and the rationale as discussed above, provide a quantitative assessment of habitat values that determine the appropriate acreage needed to offset direct and indirect wetland habitat impacts. Accordingly, the District believes that immediate and long-term impacts to the quality and quantity of wetland habitats values are fully compensated through implementation of the selected mitigation plan.

As the lead Federal agency, the USACE believes that the selected mitigation plan is appropriate and accurately represents the Federal position. The District will continue to coordinate with the non-Federal sponsor and other concerned agencies regarding the development of a locally preferred mitigation plan.

2.7 PROJECT MONITORING

Monitoring of the dune and levee planting be conducted to ensure a high percentage of vegetation success. The mitigation area will be monitored determine the effectiveness of mitigation and ensure a high percentage of vegetation success. In addition, the District proposes to monitor the recovery of intertidal and subtidal resources, the effects (none are expected) of the storm gate to the Pews Creek marsh and piping plovers. The following sections provide a brief description of the District's proposed monitoring programs.

2.7.1 Dune Monitoring Plan

The purpose of the post-construction dune monitoring is to document the stability of the constructed dune and to record annual changes in vegetation. The program is intended to identify changes in the structure and composition of vegetation over time, and to provide mitigation criteria in case of dune failure due to extrinsic factors such as blowouts and overwash. The District proposes to conduct post-construction monitoring of the success of planting for the three years following construction.

2.7.2 Levee Monitoring Plan

The District has developed a post-construction levee monitoring plan to assess the immediate and long-term success of the revegetation effort. Specifically, the plan will provide quantitative and qualitative measurements of the vegetative communities along the newly constructed levee. The plan is intended to identify changes in the structure and composition of vegetation over time, and to identify areas where supplemental planting may be required. The District proposes to conduct post-construction monitoring of the success of planting for the three years following construction.

2.7.3 Mitigation Monitoring Plan

The District has developed a post-construction monitoring plan for the selected wetland mitigation area. In particular, the plan is intended to ensure that the District's mitigation goals and objectives are fulfilled through documentation of the success/failure of the planting effort. The intent of the plan is to quantify the change in habitat conditions through the sampling of vegetation and hydrology over time. In addition, the post-construction monitoring program will identify potential problem areas and ensure that corrective actions are implemented in a timely manner (USACE 2000b). The District proposes to conduct post-construction monitoring of the success of planting for the three years following construction.

2.7.4 Intertidal and Subtidal Monitoring Plan

Monitoring of intertidal and subtidal habitats will be performed to provide information on impacts to shallow water faunal assemblages resulting from the selected plan. Currently, there is a lack of specific knowledge about the affects of beach nourishment activities on intertidal and subtidal resources in the RBSHB region. Accordingly, the results of the intertidal and subtidal monitoring effort would provide data to quantify impacts and recovery of benthic resources, as well as characterize the recolonized benthic community. Data obtained through intertidal and subtidal monitoring for the selected plan would help to provide a firm technical base upon which to plan future nourishment projects in the RBSHB.

The District proposes to conduct sampling and analysis according to the following times and frequencies:

- The District will conduct benthic sampling in the spring and fall in the two years prior to construction and the two years following construction. During the year of construction the District will perform monthly benthic sampling in addition to the spring and fall efforts.
- The District will sample finfish in the intertidal zone six times per year (once per month from May to October) for the two years prior to construction, and during construction, and two years following construction.
- The District will sample water quality (*i.e.*, dissolved oxygen, temperature, salinity, and turbidity) during each benthic and finfish sampling event.
- The District will sample grain size during each benthic sampling event.
- The District will analyze stomach contents of benthic feeding fish.

2.7.5 Pews Creek Tidal Marsh Monitoring Plan

The purpose for post-construction monitoring of the tidal marsh associated with Pews Creek is to substantiate the projections of the hydrodynamic model that the placement of a storm gate is expected to have minimal effect on the daily tidal cycle. Tide gages will be placed throughout the tidal marsh to ascertain tidal levels before and after placement of the storm gate. In addition, other water quality parameters may be measured and sampling of vegetation conducted. The District proposes to record data for one year pre-construction in order to establish a baseline, and then for two years following construction to evaluate potential Project impacts.

2.7.6 Piping Plover Monitoring Plan

The construction of the selected plan will expand the existing beach potentially creating more suitable piping plover nesting habitat. The monitoring plan will utilize the existing protocols as established along the Atlantic coast of New Jersey's Piping Plover Monitoring Plan. In addition, this is a recommendation of the USFWS pursuant to their Fish and Wildlife Coordination Act 2(b) Report (see FEIS Appendix E).

3.0 EXISTING ENVIRONMENT

3.1 BAY SHORELINE STUDY AREA

3.1.1 Topography, Geology, Sand Source, and Soils

The Port Monmouth Project area is located in the Coastal Plain Physiographic Province, which forms the eastern margin of the North American continent. Its surface has a gentle slope to the southeast that generally does not exceed 5 or 6 feet to the mile (Wilber and Johnson 1940).

The major rock unit in the Port Monmouth Project area consists of the Englishtown Sand of the Cretaceous (NJDEP 1999). This unit consists of white or yellow quartz sand with some mica and is sparingly glauconitic. Some beds of this unit have been cemented by iron oxide into massive stone. Thin laminae of fine clay can also be found in some locals. The thickness of the unit decreases from 140 feet near the Atlantic Highlands to less than 20 feet thick in southern portions of the state (Wilber and Johnson 1940).

The sand used to fortify the dune and berm initially will come from an existing permitted and authorized offshore borrow area known as the Sea Bright borrow area. However, the District is currently investigating other potential offshore sand sources. The characterization of the existing resources at other potential offshore sand sources will be documented under a separate NEPA document. The material to construct the levees will come from an existing facility that is fully permitted and authorized to provide the appropriate clean material.

The Bay Shoreline dune is composed of Hooksan sand (HwB), Udorthents (UA)-Urban land complex (UD), UA, and Sulfaquents and Sulfihemists (SS) soils. HwB soil has a 0 to 5% slope and is of no significant state or local importance (United States Department of Agriculture Natural Resource Conservation Service [USDA NRCS] 1990). The hydric HwB soil exhibits rapid permeability, sand consistency, and excessive drainage creating a severe erosion hazard potential. The low available water capacity makes the soil unsuitable for farming (USDA NRCS 1989). UD and UA soils occur on 0 to 3% slopes and exhibit variable drainage ability. They are neither hydric nor of state or local importance. Erosion hazards are minimal because UD and UA soils are typically covered by concrete or roads (USDA NRCS 1989). SS soil is characteristic of frequently flooded tidal wetlands. The high organic matter content, poor slope and poor permeability renders the soil unsuitable for farming. The SS soil is hydric and of no state or local importance (USDA NRCS 1989). No prime, unique, or important farmland exists within the BSSA, therefore the Farmlands Protection Policy Act does not apply to the selected plan (Curtin 1992) (see FEIS Appendix D, Pertinent Correspondence).

3.1.2 Water Resources

3.1.2.1 Regional Hydrogeology and Groundwater Resources

The BSSA is located directly above the Coastal Plain aquifer system, which is a Nationally Designated Sole Source Aquifer (U.S. Environmental Protection Agency [USEPA] 1999). This aquifer is a complex, multi-layered system comprised of five major aquifers, one unconfined and four confined (NJDEP 1990a) (see FEIS Table 2), that outcrop in irregular bands trending northeast to southwest. The Project area is underlain by two of these five major aquifers, the Englishtown Formation and the Potomac-Raritan-Magothy system, whereas the remaining major aquifers outcrop to the south of the site.

Although groundwater is contained in many of the formations of the Coastal Plain, not all are drinking water sources. Groundwater in the Coastal Plain is generally considered to be naturally good (NJDEP 1994b). Groundwater held in storage within the aquifers is transmitted by hydraulic gradients toward points of discharge. Fluctuations in groundwater levels may occur as a result of recharge from precipitation, interflow to streams, changes in atmospheric pressure, evapotranspiration, groundwater withdrawals, and tidal fluctuations.

Infiltration of precipitation on outcrop areas, seepage from overlying surface waters, and vertical seepage from adjacent aquifers typically recharge aquifers. Based on records of fluctuations in the water table, a small amount of recharge occurs from precipitation to aquifers during the growing season in the Coastal Plain (Jablonski 1968).

3.1.2.2 Tidal Influences

The Bay Shoreline coastline tends to be sheltered from direct ocean waves by Sandy Hook. East and east-northeast winds, which is the direction of the longest fetch for wave generation, tend to exacerbate coastal flooding and erosion. The tides at Bay Shoreline are semi-diurnal, have mean spring tide levels of +3.46 ft NGVD. The highest recorded water level is +9.9 ft NGVD, measured on September 12, 1960 (Coastal Planning & Engineering, Inc. *et al.* 1993). The Bay Shoreline within the project area is relatively uniform with direct exposure to RBSHB. Shore features have been influenced to some extent by historical fill projects and coastal structures.

The Bay Shoreline is prone to high rates of erosion when fill is not added to the beach. An expanse of coastline encompassing the project area to the Highlands consists of approximately 7 miles of relatively straight shore that has historically been subject to extensive coastal erosion. To evaluate the potential for shore erosion, data were examined on long-term shore erosion from the Project area to the Highlands. Over the entire recording period, only Belford and Leonardo showed a net loss of shoreline, wherein the Project area showed a gain that was primarily a result of a 1967 State dune construction project (Coastal Planning & Engineering, Inc. *et al.* 1993). In spite of the net gain of shore at the project area from 1836 to 1988, this section of the coastline is prone to excessive erosion due to wave attack caused by storms. For example, from 1836 to 1957 the Bay Shoreline in the Project area retreated at a rate of 1.3 ft per year (Coastal Planning & Engineering, Inc. *et al.* 1993).

FEIS Table 2. Summary of Hydrogeologic Units (Aquifers) in the Port Monmouth Project Area.

Hydrogeologic Unit (Aquifer)	Confinement	Depth[1]	Geologic Unit	Hydrologic Characteristics
Kirkwood-Cohansey Aquifer system	Unconfined	N/A	Bridgeton Formation	
			Beacon Hill Gravel	No known wells.
			Cohansey Sand	Major aquifer; water table conditions.
			Kirkwood Formation	Includes major and minor aquifer.
Atlantic City 800 ft Sand	Confined	N/A	Kirkwood Formation	A major aquifer along the coast.
Wenonah-Mount Laurel aquifer	Confined	N/A	Mount Laurel Sand	Major aquifer; sand unit within 2 formations forms
			Wenonah Formation	Wenonah-Mount Laurel aquifer.
Englishtown aquifer system	Confined	0–50 ft above MSL	Englishtown Formation	Major Aquifer
Potomac-Raritan-Magothy aquifer system	Confined	300-400 ft below MSL	Magothy Formation	Upper aquifer referred to as Old Bridge aquifer.
			Raritan Formation	Major confining layer (Woodbridge clay Member of Raritan Formation). Middle aquifer referred to as Farrington aquifer.
		500-700 ft below MSL	Potomac Group	Most productive groundwater resource in the region, accounting for 72% of withdrawals from Coastal Plain resources in Monmouth County.

Sources: Walker (1983), Jablonski (1968), Zapecza (1984)

[1] MSL = Mean Sea Level depth of aquifer in Project area

N/A: Not Applicable

Some of the fill placed along the Bay Shoreline has, at times, originated from the dredging of Pews and Compton Creeks. For example, one beach Project involved at least 90,000 cubic yards of material from Pews and Compton Creeks, which accounted for approximately 20% of the total fill (453,000 cubic yards) used to fill the Bay Shoreline. The long-term net erosion rate in the Project area has averaged 3,000 cubic yards per year and the central half of the Bay Shoreline was recently discovered to have a loss rate of 4,600 cubic yards per year. Studies suggest that a nodal point for littoral drift exists at the Bay Shoreline and exacerbates erosion in this area (Coastal Planning & Engineering, Inc. *et al.* 1993).

3.1.2.3 Surface Water

The Bay Shoreline area is an element of the RBSHB, which is part of the Hudson-Raritan Estuary Complex. The Project area is located within the Raritan Bay Shoreline Watershed, which is part of the RBSHB Drainage Basin. Specifically, the study site is within the Pews and Compton Creek sub-watersheds, which both discharge directly into RBSHB. Several studies have documented the chemical and biological quality of the RBSHB ecosystem (Wilk *et al.* 1996).

The waters within the Hudson-Raritan Estuary Complex have been classified by NJDEP as fresh water-2/SE1 (NJDEP 1994c). Designated uses under this classification include shellfish harvesting (in accordance with New Jersey Administrative Code [N.J.A.C.] 7:12), maintenance, migration and propagation of natural and established biota, primary and secondary contact recreation, and other reasonable uses (NJDEP 1994c).

The macrobenthic community of the RBSHB has been described as impoverished because of low concentrations of dissolved oxygen (McGarth 1974). A number of other studies have documented environmental impacts to the RBSHB attributable to a variety of pollutants, including heavy metals, polynucleararomatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), excessive nutrient and organic carbon loading, and pathogenic bacteria and viruses (Breteler 1985, NJDEP 1983, NJDEP 1993a and 1993b). RBSHB water and sediments have been documented to have levels of environmental concern for heavy metals, chlorinated pesticides, total dichlorodiphenyltrichloroethane (DDT), total PCBs and total PAHs. For example, the highest lead concentration in the nation was reported at a RBSHB station (Squibb *et al.* 1991). Other problems that have been documented in the RBSHB, just off the shoreline of the Project area, include diseased fish, turbid and oily waters, noxious odors, beach and shellfish bed closings and restricted shellfish harvesting (U.S. Department of the Interior [USDI] 1992).

Of all of the water quality problems that have been experienced along the shoreline of the Project area, phytoplankton blooms have been the most visible and appear to have had the most substantial impact. For the past 10 years, large algae blooms have plagued the coastal waters of RBSHB (NJDEP 1987, 1988a, 1989, 1990a, 1991, 1994a, and 1995). Through the late 1980s and into the 1990s, phytoplankton samples collected from the Hudson-Raritan Estuary (Lower New York Bay) to Delaware Bay reported samples from Sandy Hook to have some of the highest coastal nutrient and algal concentrations in New Jersey (NJDEP 1987, 1988a, 1989, 1990a, 1991, 1994a and 1995).

Depending on the specific algal species, green, brown or red tides are frequently experienced during the spring and summer seasons. In addition to the aesthetic problems associated with such blooms, densities become high enough to create hypoxic conditions (depletion of dissolved oxygen) that in turn have led to fish kills. Although to date the bloom-producing algae in the Sandy Hook region have not been species/strains known to produce acute toxins, a few blooms have been associated with complaints of mild irritation by bathers. Based on the available data, it appears that the blooms observed in the RBSHB area originate in the Hudson-Raritan Estuary (Lower New York Bay) (Monmouth County Health Department 1999).

3.1.3 Vegetation

Historically, the BSSA was composed of a relatively narrow beach and dune. Erosive forces acting on the shore from RBSHB, which have been documented from as early as 1836 (USACE 1993a), and the extensive coastal salt marshes associated with Pews and Compton Creeks immediately landward of the shore, limited the extent to which mature dune systems could develop. More recently, increasing human development has encroached on the narrow dune. The predominant cover types at BSSA are sand, upland disturbed, and upland herbaceous scrub shrub with significant areas supporting upland herbaceous and upland beachgrass (USACE 2000a). Non-native and "weed" species such as mugwort (*Artemisia annua*), crabgrass (*Digitaria sanguinalis*), and Japanese knotweed (*Polygonum cuspidatum*) are commonly found in the BSSA. The foredune vegetated with a variety of herbaceous species including: beachgrass (*Ammophila breviligulata*), common reed (*Phragmites australis*), seaside goldenrod (*Solidago sempervirens*), and sandbur (*Cenchrus spp.*).

There are no Federally-listed threatened or endangered vascular plant species within the PCSA (Staples 1998). In addition, no state-listed endangered or threatened species were identified during field investigations.

3.1.3.1 Wetlands

The Bay Shoreline contains no jurisdictional wetlands (USACE 1997b). Due to development near the beach and dune area, the narrow dune along the Bay Shoreline lacks any wetland swales, which are often found in fully developed dune systems.

3.1.3.2 Uplands

The dune system in the Bay Shoreline consists of beachgrass and a dune shrub-thicket/woodland community. The vegetation of the primary dune is dominated by beachgrass, and the plant communities between Port Monmouth Road and the primary dune consist of a mosaic of successional back dune woodlands interspersed with patches of successional herbaceous vegetation. The remaining BSSA consists of unvegetated sand and developed land.

The plant species composition of the Bay Shoreline reflects its history of erosion and disturbance. Non-native, weedy plant species are common in the shoreline shrub thicket community.

3.1.4 Wildlife

The types and quality of habitats in the RBSHB region are suitable for a diverse group of migratory and resident wildlife species. These habitats include deepwater habitats, tidal creeks and wetlands, and natural and artificial dunes that provide habitat for many species of fish and wildlife in and near Port Monmouth. Furthermore, fish and shellfish play an important role in the local economy and can effectively act as an indicator of the overall health of the ecosystem in the relatively developed Project area.

3.1.4.1 Fish and Shellfish

Like many estuarine systems, the RBSHB supports a diverse assemblage of fish and shellfish. The National Marine Fisheries Services (NMFS), National Oceanic Atmospheric Administration (NOAA), NJDEP Bureau of Shellfish, and the Northeast Fisheries Science Center have collected a wide variety of species throughout the RBSHB system. FEIS Table 3 provides a list of fish and shellfish most commonly encountered in the RBSHB.

Finfish

Many studies have characterized seasonal distribution and abundance of fish species within the RBSHB area (Wilk and Silverman 1976, Zich 1978, Woodhead 1991). In 1982 and 1983, the NJDEP Bureau of Marine Fisheries conducted beach seine surveys near the Study area. Striped killifish and Atlantic silverside dominated the overall catch at the Whale Creek station, while mummichog and bay anchovy were present in large numbers during spring and summer sampling. Fall collections included Atlantic silverside, striped killifish, and a large number of bluefish (NJDEP 1984). No anadromous fish spawning areas were identified in the Study area (USACE 1993a). Recent beach seine surveys conducted by the District at nearby Cliffwood and Union Beach (USACE 1996b) were dominated by alewife, blueback herring, Atlantic silverside and weakfish. Recreational fish species (*e.g.*, bluefish, winter and summer flounder, and striped bass) were also captured in significant quantities during these surveys (USACE 1996b).

Fish species diversity and abundance in the RBSHB system typically changes seasonally as migratory and resident species use the bay as a nursery ground, spawning, and feeding area. Migratory species such as striped bass are found to be present in the RBSHB system throughout the year (Woodhead 1991, USACE 1996b). Anadromous species such as alewife, blueback herring, American shad, and hickory shad use the bay as a migratory pathway to freshwater rivers and creeks to spawn (Zich 1978).

Shellfish

The primary shellfish of concern in the RBSHB area are the surf clam, blue mussel, oyster, softshell clam, hardshell clam, blue crab, horseshoe crab, and American lobster. Pollution of the RBSHB system has caused a significant decline in once abundant molluscan fisheries, but has had a nominal effect on mobile crustaceans (*i.e.*, American lobster and blue crab). Primary commercial shellfish include blue crab, American lobster, and hard- and softshell clams (NJDEP 1984).

Surf clam and blue mussel beds are present in the RBSHB system, but are not located in the vicinity of the Study area. Similarly, there are no oyster beds located in the Study area (NJDEP 1984).

Softshell clam beds are widely distributed throughout the RBSHB system, and were identified along inshore areas between Keansburg and Port Monmouth as well as offshore from Whale Creek (NJDEP 1984). Based on organisms collected from certain stations, McCloy (1988) concluded that these areas are capable of producing significant populations of softshell clams.

Hardshell clams are the most abundant shellfish in the RBSHB area, with their greatest concentration located near the eastern portion of the RBSHB region (NJDEP 1984). However, McCloy (1988) determined that hardshell clam densities in the Study area were low (*i.e.*, occurrence only).

Active commercial fisheries for the blue crab and American lobster currently exist in RBSHB. Blue crab dredge areas are found in the deeper waters off Keyport Harbor and Whale Creek outside of the Study area (Figley 1998). Lobster fisheries are typically located in deep water areas, and are not expected to occur in the Study area (USACE 1993b).

The narrow width of the existing beach suggests that either minimal or no horseshoe crab mating presently occurs in the Project area. Accordingly, a timing restriction is not warranted. The District does acknowledge that implementation of the selected plan may improve the mating and spawning habitat of the horseshoe crab.

Larger invertebrates were collected near the Cliffwood Beach Study area during beach seine surveys conducted by the NJDEP Bureau of Marine Fisheries (1994a) in Laurence Harbor, Whale Creek, and Keansburg. The NJDEP documented the presence of four species: the black-fingered mud crab, blue crab, mud crab, and white-fingered crab. Lady crab, rock crab, spider crab, and horseshoe crab are also common in RBSHB (MacKenzie 1990).

3.1.4.2 Benthic Resources

Benthos can be described as the complex community of plants and animals that live on or in bottom sediments of oceans, streams, and wetlands. The benthic community in the RBSHB area has historically been rich but unevenly distributed (McCormick *et al.* 1984), and can be characterized as transitional due to changes in water quality and pollution (Steimle and Caracciolo-Ward 1989).

FEIS Table 3. Common Fish and Shellfish Found in the Raritan Bay and Sandy Hook Bay Area.

Common Name	Scientific Name
Finfish	
Blueback Herring	*Alosa aestivalis*
Alewife	*Alosa pseudoharengus*
American Shad	*Alosa sapidissima*
Bay Achovy	*Anchoa mitchilli*
Americal Eel	*Anguilla rostrata*
Atlantic Menhaden	*Brevoortia tyrannus*
Black Sea Bass	*Centropristis striata*
Atlantic Herring	*Clupea harengus*
Weakfish	*Cynoscion regalis*
Mummichog	*Fundulus heteroclitus*
Striped Killifish	*Fundulus majalis*
Spot	*Leiostomus xanthurus*
Atlantic Silverside	*Menidia menidia*
Silver Hake	*Merluccius bilinearis*
White Perch	*Morone americana*
Striped Bass	*Morone saxatilis*
Summer Flounder	*Paralichthys dentatus*
Butterfish	*Peprilus triacanthus*
Winter Flounder	*Pseudopleuronectes americanus*
Bluefish	*Pomatomus saltatrix*
Striped Searobin	*Prionotus evolans*
Northern Searobin	*Prionotus carolinus*
Clearnose Skate	*Raja eglanteria*
Little Skate	*Raja erinacea*
Winter Skate	*Raja ocellata*
Windowpane	*Scophthalmus aquosus*
Scup	*Stenotomus chrysops*
Red Hake	*Urophycis chuss*
Spotted Hake	*Urophycis regia*
Shellfish	
Forbes' Asterias	*Asterias forbesii*
Channeled Whelk	*Busycon canaliculatum*
Knobbed Whelk	*Busycon carica*
Blue Crab	*Callinectes sapidus*
Atlantic Rock Crab	*Cancer irroratus*
Common Oyster	*Crassostrea virginica*
Thick-lipped Oyster Drill	*Eupleura caudata*
American Lobster	*Homarus americanus*
Common Spider Crab	*Libinia emarginata*
Atlantic Horseshoe Crab	*Limulus polyphemus*
Common Periwinkle	*Littorina littorea*
Longfin Squid	*Loligo pealei*
Northern Moon Shell	*Lunatia heros*
Hardshell Clam	*Mercenaria mercenaria*
Softshell Clam	*Mya arenaira*
Blue Mussel	*Mytilus edulis*

FEIS Table 3. Common Fish and Shellfish Found in the Raritan Bay and Sandy Hook Bay Area (Continued).

Common Name	Scientific Name
Shellfish (continued)	
Mud Dog Whelk	*Nassarius obsoletus*
Lady Crab	*Ovalipes ocellatus*
Black-fingered Mud Crab	*Panopeus herbstii*
Lobed Moon Shells	*Polinices duplicatus*
White-fingered Mud Crab	*Rhithropanopeus harrisii*
Surf Clam	*Spisula solidissima*
Common Oyster Drills	*Urosalpinx cinerea*

Source: Northeast Fisheries Science Center Reference Document 98-10, October 1998; Compiled by Northern Ecological Associates, Inc. 1999.

Cerrato *et al.* (1989) stated that the lower portion of RBSHB is the most extensively studied area in the Hudson-Raritan Estuary (HRE). However, limited data is available for benthic macrofauna at nearshore and intertidal beach areas specific to the Study Area (USACE 1996a). Blue crab dominated the recent seine sampling efforts conducted by the District in near by Cliffwood and Union Beach (USACE 1996b).

Benthic invertebrate composition and abundance is highly dependent on sediment type and grain size distribution (Diaz and Boesch 1982, McGrath 1974). McGrath (1974) noted that powerful storms have the ability to shift sediments, thereby causing distributional changes in communities dependent on a specific sediment type. Localized benthic communities can also exhibit large fluctuations between seasons.

In 1994, sampling of Port Monmouth shorelines revealed the soft-shell clam and capitellid thread worm to be the most abundant macroinvertebrate species (USACE 1996c). In 1995, sampling of Port Monmouth shorelines revealed the gem shell and fringed worm to be the most abundant macroinvertebrate species (USACE 1996c) (see FEIS Table 4).

Preliminary results from a recent survey conducted by the District (USACE 1996b), confirmed the predominance of polychaetes (bristle) and turbellarian (flat) worms in inter-tidal locations, and amphipods, gastropods, and polychaetes in subtidal locations within the Project vicinity. Specifically, *Polydora cornuta* and *Pygospio elegans* dominated intertidal areas, and *Ampelisca abdita* dominated subtidal areas.

Although no recent phytoplankton studies have been conducted in RBSHB, studies conducted by Jeffries (1962), Patten (1962), Walker (1967), O'Reilly *et al.* (1976), and Brinkhuis (1980), show that the bay has historically supported a high diversity and density of plankton. The USFWS (1992) speculated that the rich nutrient supplies, from natural and domestic sources, support dense plankton populations in the HRE. Dominant phytoplankton taxa have historically been diatoms, dinoflagellates, and *Mannocloris atomis* (Patten 1962), whereas dominant zooplankton includes typical estuarine copepods such as *Acartia tonsa* and *Eurytemora americana* (Jeffries 1962, Brinkhuis 1980).

3.1.4.3 Reptiles and Amphibians

No species of reptiles or amphibians were observed in the Bay Shoreline portion of the Project area during field surveys conducted between October and November 1997. Based on historical records, four species of reptiles are known to occur in similar habitat at the nearby Sandy Hook National Park, including diamondback terrapin (*Malaclemys terrapin*), eastern painted turtle (*Chrusemys picta*), northern brown snake (*Storeria dekayi*), and spotted turtle (*Chemmys guttata*) (USDI 1989a). Fowler's toad (*Bufo woodhousei*) is the only amphibian known to historically occur at Sandy Hook National Park where it is reported as extirpated (USDI 1989a). The lack of wetlands for breeding and/or nesting in the shoreline may be a limiting factor resulting in the rarity of reptiles and amphibians along the Bay Shoreline.

FEIS Table 4. Benthic Macroinvertebrates in the RBSHB Area.

Taxon (Scientific Name)	Percent Composition
Data Collected at Port Monmouth Shoreline during 1994	
Mya arenaria	46.9
Heteromastus filiformis	16.4
Caulleriella killariensia	8.0
Leitoscojoploa sp.	5.7
Gemma gemma	2.8
Tharyx acutus	0.9
Data Collected at Port Monmouth Shoreline during 1995	
Gemma gemma	61.1
Tharyx acutus	13.6
Heteromastus filiformis	1.4
Mya arenaria	0.6

Source: USACE May 1996

3.1.4.4 Birds

Over 275 species of birds have been documented at nearby Sandy Hook National Park (Eastern National Park and Monument Association undated), and 187 bird species are known to use Cheesequake State Park (New Jersey Division of Parks and Forestry undated). Based on the habitat similarity of these areas and the Port Monmouth Project area, many of the species could potentially use the Project area for breeding, nesting, or as a staging area during migration.

A total of 27 bird species were observed in the shoreline during field surveys conducted between October and November 1997 (USACE 2000a). The primary habitat for birds in the shoreline consisted of scrub-shrub upland interspersed with areas of forest and herbaceous cover. Common bird species that were observed foraging in the scrub-shrub areas include black-capped chickadee (*Parus atricapillus*), yellow-rumped warbler (*Dendroica coronata*), song sparrow (*Melospiza meloida*), and dark-eyed junco (*Junco hyemalis*). Additionally, crows (*Corvus* spp.) and gulls (*Larus* spp.) were often present in the area.

3.1.4.5 Mammals

There are 13 species of mammals that would potentially utilize the Project area, based on their historical presence at nearby Sandy Hook (USDI 1989b). Of these 13 species, four were observed in the shoreline of the Project area during field surveys conducted between October and November 1997 (USACE 2000a). The eastern cottontail rabbit (*Sylvilagus floridanus*) and raccoon (*Procyon lotor*) were the most commonly observed species of mammal in the Bay Shoreline area, although observations were confined to upland communities, often near disturbed areas and residential homes.

3.1.5 Threatened and Endangered Species/Communities

3.1.5.1 Federal Species of Concern

The federally-listed threatened Loggerhead turtle (*Caretta caretta*), endangered Kemp's ridley (*Lepidochelys kempi*) and green (*Chelonia mydas*) turtles and endangered shortnose sturgeon (*Acipenser brevirostrum*) historically have occurred in the RBSHB area (Bigford 1992). There is currently no available information regarding the distribution of the turtle species listed above (Bigford 1992). Additionally, the federally listed threatened piping plover (*Charadrius melodus*) and the federally listed endangered peregrine falcon (*Falco peregrinus*) are known to nest within 6 and 10 miles of the Project area, respectively (Staples 1998) (see FEIS Appendix D). With the exception of the occasional migrating bald eagle (*Haliaeetus leucocephalus*), no other additional federally listed threatened or endangered species are known to occur within the vicinity of the Project area (Staples 1998). None of the above mentioned species were observed during field surveys conducted between October and November 1997.

3.1.5.2 State Species of Concern

Habitat for four state-listed endangered species, including black skimmer (*Rynchops niger*), least tern (*Sterna antillarum*), pied-billed grebe (*Podilymbus podiceps*), and piping plover, may occur within the BSSA (Breden 1992). Additionally, one state-listed threatened species, osprey (*Pandion haliaetus*) may occur within the BSSA (Breden 1992). None of the above state listed endangered or threatened species were observed in the BSSA during field surveys conducted between October and November 1997.

3.1.6 Socioeconomics

Hurricanes, northeasters, and extratropical storms have caused extensive and costly damage in the RBSHB region. Flood-induced damages in the Project area have included damaged roads and bridges, destruction or failure of Bay Shoreline structures (including dunes, bulkheads, and boardwalks), damage to utility lines, sewers, commercial and industrial properties, and numerous homes; destruction of at least nine homes; and suspension of work schedules at businesses. In addition, looting of evacuated homes has been a major security problem during some storms. Overall, severe storm effects have resulted in numerous evacuations, costly repairs to personal and public properties, and constraints to commerce and regional economic development.

3.1.6.1 Demographic Characterization

The Project area is located in the Township of Middletown in Monmouth County, New Jersey. Port Monmouth is one of several communities within Middletown, all of which are governed by the township's municipal government.

Approximately 7% of New Jersey's population of 7.7 million resides in Monmouth County. Of the 553,124 people whom live in Monmouth County, approximately 68,183 (12%) live in Middletown Township, which comprises 8% of the county's total land area. Of the total population in Middletown, 3,558 people reside within the Port Monmouth community (U.S. Bureau of the Census 1992).

The average population density in Middletown Township is 1,660 residents per square mile, which is slightly higher than the county average of 1,173 residents per square mile. However, population density in the predominantly residential Port Monmouth community is significantly higher than both the township and the county averages, at 2,740 people per square mile (Coastal Planning and Engineering 1993).

Population growth in Monmouth County was up to 48% increase per decade during the 1950s and 1960s, but has leveled off to approximately 9% per decade since the 1970s. Current population projections predict a similar moderate pattern of growth in the county for the next decade (U.S. Bureau of the Census 1992 and Monmouth County Planning Board [MCPB] undated).

Similar to Monmouth County, Middletown Township also experienced a population boom during the 1950's and 1960's, with the population increasing in each decade by 38% and 145%, respectively. However, similar to patterns in the county, this growth has tapered off since the 1970s to between 9 and 15% per decade. Current population projections for Middletown predict a more conservative pattern of growth of 3 to 4% for the next decade. (U.S. Bureau of the Census 1992 and MCPB undated). The majority of the projected growth and development is expected to occur in areas outside the selected plan area, due to the current, almost fully-developed condition of the Port Monmouth area.

3.1.6.2 Economy and Income

The economy of Monmouth County has undergone extensive growth over the past several decades, with much of the development concentrated along the major transportation routes. However, the local economy has been burdened to an extent by property damage and accessibility issues resulting from frequent, storm-induced flooding in the coastal areas.

Historically, the Bay Shoreline area played a role as a market and distribution center for the agricultural goods produced in Monmouth County. Later the Bay Shoreline's local commercial resources were developed, which included clay used for brick and tile manufacturing, and the waterfront has developed as a tourist attraction. In addition, the RBSHB contribute to the regional economy as a commercial fishery. In 1991, the Bay Shoreline area provided over one hundred million live pounds of commercial finfish and shellfish, valued at approximately $23.5 million (Coastal Planning and Engineering, Inc. *et al.* 1993). In Port Monmouth, the Belford Fish Co-operative represents an important regional commercial resource related to this fishery. The largest employers in the Bay Shoreline area are International Flavor and Fragrances Company in Union Beach, and Naval Weapons Station Earle in Middletown (MCPB 1997). Other important industries in the county focus on electronics, resort and tourism, chemicals, apparel, farming, horse breeding, and nursery stock (MCPB 1994).

The net valuation (total taxable value) of property (excluding tax exempt properties) in Middletown Township is $4,751,312. The taxable value of residential property in the township represents a significant portion of this total (approximately 84%), while commercial properties account for approximately 13%. Vacant lands, apartments, farmland, and industrial properties account for only a small portion of the taxable land values in Middletown Township.

In 1989, per capita income in Middletown Township was $21,882, which was slightly higher than the Monmouth County average of $20,565. Per capita income in the Port Monmouth community in 1989 ($13,610) was substantially lower than the county and township averages and was also lower than the statewide per capita income of $18,714. In 1989, 3.9% of the total population of Port Monmouth had incomes that were classified below the poverty level.

3.1.6.3 Housing

During the 1980's, housing prices in Monmouth County experienced a high degree of appreciation. Then in the latter part of the decade, there was a substantial increase in the construction of new residential housing units. These increases in price and development were attributed to the increase in demand caused by the population growth, where migration of residents from other areas of the state and country to Monmouth County was responsible for 70% of the county's population increase from 1980 to 1988 (MCPB 1989).

In 1990 there were approximately 218,408 housing units in Monmouth County, including the 23,495 units located in Middletown Township. Of these, 1,281 were located in the Port Monmouth community. Approximately 12% of the houses in Port Monmouth were built during the construction boom of the 1980's; 59% were built between 1940 and 1980 and the remainder were built prior to 1940 (U.S. Bureau of the Census 1992).

A major objective of the Project is to reduce the cost of future flood and storm damage to existing properties within the Project area. In 1996, an inventory of the existing structures located in the selected plan area was conducted. The limits of the survey area corresponded to the anticipated geographic limits of protection afforded by the flood control and shore protection Project. A total of 1,142 structures were identified along Pews and Compton Creeks; of these, 1,058 structures were residences and 84 supported non-residential uses (*e.g.*, related to commercial, business, industrial or public uses) (URS Grenier 1997).

Due to incomplete historical data on the costs associated with past flood and storm damage to properties in the Project area, a computer model was utilized to calculate expected annual damages associated with future flooding and storm events. Using the base year 2002, the annual damages estimated to occur if no new flood control and storm protection actions or programs were implemented was approximately $3,183,550 (URS Grenier 1997).

3.1.7 Cultural Resources

3.1.7.1 Introduction

The goal of cultural resources activities undertaken by the Corps has been to bring the plans proposed as part of the Port Monmouth Combined Flood Control and Shore Protection Feasibility Study into compliance with the National Historic Preservation Act of 1966 (NHPA), as amended through 1992. Documentary research, field investigations, and consultation have been undertaken by the Corps' cultural resources staff as specified by the Advisory Council on Historic Preservation's regulations for implementing the NHPA (36 CFR Part 800). A detailed account of the investigations appear in "Cultural Resources Investigation: The Port Monmouth Combined Flood Control and Shore Protection Feasibility Study, Port Monmouth, Town of Middletown, Port Monmouth, New Jersey" (1999). The latter document (on file at the Corps' New York City office, the New Jersey Historic Preservation Office [NJHPO] in Trenton, and the Monmouth County Parks System [MCPS] office in Lincroft.

The selected plan consists of four separate components: dune/beach fill improvements and a seawall along the Raritan Bay shorefront, levee/floodwalls along Pews Creek, levee/floodwalls along Comptons Creek, and interior drainage features along Comptons Creek. A fifth component, environmental mitigation, is being refined for the FEIS. Investigative efforts have focused upon terrain that may be affected as a result of the construction of these selected plan elements. Such locations are termed Areas of Potential Effect (APEs). Research and fieldwork has thus sought to identify above ground or buried cultural resources within APEs.

3.1.7.2 Native American Prehistory: Overview

Cultural resources within the Project vicinity may include archaeological sites containing cultural material associated with Native American occupations. These occupations are divided into three cultural periods based upon differences in their technologies and in their responses to regional environmental and social changes through time. These periods are: Paleo-Indian (circa 12,000 – 8500 Before Present or B.P.), Archaic (8500 B.P. – 5000 B.P.), and Woodland (5000 B.P. – 400 B. P.). The Archaic and Woodland Periods are further divided into Early, Middle, and Late sub-periods.

Thorough overviews of New Jersey prehistory with special emphasis upon the Project area and Monmouth County appear in a number of previous reports including Harris and Reyes (1991:12-

18), Porter and Cavallo (1992:3/1-3/5) and Porter *et al.*. (1994:13-16). The Paleo-Indian and Archaic Periods are represented in archaeological sites located along the county's Raritan Bay and Atlantic Ocean shorelines and associated drainages. Evidence of Paleo-Indian occupation includes Clovis-like points discovered at the Earle Naval Weapon Station and at several locations within the Manasquan drainage. A large Late Archaic Site, the Red Valley Site, on Ivanhoe Creek in Freehold Township, contained over 2200 stone artifacts. Woodland Period sites, marked by the presence of ceramics, are rarer. However, the collection of an avocational archaeologist, active in Atlantic Highlands, contained large quantities of ceramic sherds, believed to have originated from prehistoric sites close to the Project Area (Porter *et al.*.1994:13-16). Site 28-Mo-272, discovered within the Project area near Compton Creek during the present investigation, contained ceramic sherds, and thus may date to the Woodland Period.

3.1.7.3 Historic Period: Overview

The cultural resources of the Project area also include archaeological sites and above-ground structures dating to the historic period. Details of this history can be found in a chronology of the Project area compiled by Porter and Cavallo (1992:4/1- 4/22). A narrative account appears in Porter *et al.* (1994:18-42)

Middletown Township is one of Monmouth County's oldest townships. European settlement of the Project area vicinity dates to the late 17th century. The first recorded owner of property here, was Thomas Whitlock, who in 1676 was recognized by the Proprietors of East Jersey as having rights to lands in Middletown, including acreage at what was then known as "Shoal Harbor." A road connecting Whitlock's bayshore property to King's Highway was opened in 1687, occupying the general corridor of Wilson Avenue. Sometime between 1687 and 1688, Whitlock built a residence on his Shoal Harbor property. It is unknown whether this is the present Seabrook-Wilson House (known locally as the Spy House) which today stands between the shoreline and the intersection of Wilson Avenue and Port Monmouth Road. The latter structure dates to this period, and appears to have been constructed no later than the first two decades of the eighteenth century (Hartwick and Madrigal 1996: 9-11).

As noted in Porter *et al.* (1992:18), the Seabrook-Wilson House remained the "dominant cultural feature" within this section of the bayshore from the 18th century until the mid-19th century. An 1844/45 United States Coast and Geodetic Survey Map shows the area between Pews and Compton Creek as virtually uninhabited. Although the fields immediately surrounding the Seabrook-Wilson House are shown as under cultivation, the remainder of the terrain is composed of forest, grasslands, and salt marsh.

The first major changes to this landscape occurred during the early 1850s when a series of critical transportation features were introduced. The first of these was the construction of the Port Monmouth Steamboat and Sloop Transportation Company Pier, a structure that extended from the northern end of the present Church Street more than 2000 feet into the bay in order to provide access to vessels moored in deep water. Company vessels carried produce and passengers from Monmouth County to the New York City waterfront. Another significant feature was the plank road constructed at the base of the pier by the Port Monmouth and Middletown Plank Road

Company. Running within the corridor of what is today Church Street, it provided an important connection between the new port facilities and the interior farms and villages. Perhaps the most important transportation related development here was the 1856 construction of a rail line extending from Raritan Bay to Delaware Bay by the Raritan and Delaware Bay Railroad Company. After the Civil War, rail-based and maritime shipping, as well as a nascent commercial fish industry centered at Compton Creek, supported the economies of the growing communities of Port Monmouth and Belford (Porter *et al.* 1994:18-26).

3.1.7.4 Project Area Cultural Resources

The earlier cultural resource investigations cited above evaluated large portions of Port Monmouth and Belford, including much of the terrain adjacent to and containing the floodwall, seawall, levee, and ponding area/interior drainage facilities APEs (Harris and Reyes 1991; Mounier and Kalb 1976; Porter and Cavallo 1992; Porter *et al.* 1994). In addition to documentary research, these researchers also conducted two pedestrian surveys (Mounier and Kalb 1976; Porter and Cavallo 1992) and one survey that included subsurface testing (Porter *et al.* 1994). As a result of the latter investigation, mitigation-level archaeological excavations were undertaken at the National Register-listed Seabrook-Wilson House on Port Monmouth Road (Hartwick and Madrigal 1996).

Because of these investigations, it was possible for the Corps to identify known National Register listed or National Register eligible cultural resources within the Project's APEs prior to initiating its own field investigations. These earlier investigations also provided information that became the basis for evaluating areas not examined during the previous surveys. Using data from earlier reports, and supplementing the data with additional research, it was possible to predict overlaps between Project APEs and areas sensitive for Native American or historic period archaeological sites or areas that might contain historic structures.

Coordination with state and county agencies and with local historians provided further background information on cultural resources that might fall within or adjoin Project APEs. The NJHPO and the MCPS advised the Corps concerning potential impacts to the National Register-listed Seabrook-Wilson House. Randall Gabrielan, a local historian based in Middletown, contributed important information on historic structures.

3.1.7.5 Archaeologically Sensitive Areas: Identification and Evaluation Methodologies

As discussed in the Introduction, the Port Monmouth Combined Flood Control and Shore Protection Project (Project) consists of four separate components: dune/beach fill improvements and a seawall along the Raritan Bay shorefront, levee/floodwalls along Pews Creek, levee/floodwalls along Compton Creek, and interior drainage features along Compton Creek. In evaluating the archaeological sensitivity of each Project component's APE, the present investigation follows the methodology and criteria presented by Porter and Cavallo (1992: 1-2) for ranking areas as low, moderate and high as to the probability of encountering buried evidence of Native American or historic period occupations. The rankings were determined following a review of earlier investigations, analysis of historic maps including the U.S. Coastal and

Geodetic Survey 1845, Beers 1873, U.S. Coastal and Geodetic Survey 1875, and Wolverton 1889, as well as pedestrian reconnaissance of the entire Project area.

Areas of high ground adjacent to Pew's and Compton Creeks are clearly locations where there is a high to moderate potential for Native American prehistoric sites. Within these areas, "undisturbed soils adjacent to productive habitat settings," have been selected for subsurface testing (Porter and Cavallo 1992:6/1. Within such environments the likelihood of finding buried historic period remains is also high to moderate. Proximity to structures depicted on historic maps is a factor favoring the presence of historic period archaeological materials. Areas of moderate probability for Native American and historic sites include higher dry ground, not necessarily bordering waterways, but indicated on historic maps such as the 1844/45 Coastal and Geodetic Survey Map. These areas have also been the subjects of subsurface testing.

Several areas characterized as highly to moderately sensitive for historic period archaeological sites fell within or adjoined the APEs of Project components. The remains of former outbuildings and buried 18th century ground surfaces associated with the National Register listed Seabrook-Wilson House adjoined the APEs of Shoreline Protection Project components. These were initially selected for subsurface testing (Porter *et al.* 1994.: Appendix A). Portions of these deposits were previously the subjects of data recovery/mitigation level efforts (Hartwick and Madrigal 1996). However, following consultation with the NJHPO and MCPS, a proposed seawall was replaced with a reconstructed dune and shifted beachward in order to avoid impacts to the structure and its grounds. The NJHPO has issued a determination of "no effect," thus eliminating the need for testing (see NJHPO correspondence, 8/7/98).

Low-lying areas, especially within tidal salt marshes and areas where land modification activities (filling or grading) have occurred are considered less likely to contain cultural materials. Such low probability areas have not been subjected to subsurface testing. Areas subjected to subsurface testing during previous investigations and in which no buried cultural material was found, were also determined to be low probability areas. These areas were not tested during the present investigation. The various Project components and their rankings appear in FEIS Table 5.

3.1.7.6 Subsurface Testing Methodology

Subsurface testing was conducted by archaeologists on the staff of the Corps. In areas of moderate and high probability, testing consisted of shovel tests excavated to sterile subsoil. In many cases it was not possible to excavate below the water table or levels of impenetrable fill and debris. Soils were excavated in accordance with natural stratigraphy and screened through a ¼ inch mesh screen. Cultural material was bagged separately by stratum. Modern materials and construction debris were noted, sampled, and discarded in the field. Each test was recorded on a separate provenience sheet that described stratigraphy, field conditions, and artifacts encountered.

Moderate probability areas were tested at intervals of 100 feet, with the provision that should cultural material of possible historic significance occur, the interval would be decreased to 50 feet. High probability areas were tested at intervals of 50 feet between shovel tests. When cultural material suggestive of an archaeological site occurred, the interval was modified to 25 feet between shovel tests.

3.1.7.7 Historic Structures

In addition to identifying and ranking archaeologically sensitive areas, research and fieldwork were also directed towards evaluating historic structures within and adjoining Project component APEs were evaluated. Coordination with agencies and local historians resulted in the identification of one property that is National Register listed and one property that is National Register eligible. Several other properties were identified that will require further evaluation in order to determine whether they are eligible.

The Seabrook-Wilson House adjoins the APEs of several elements of the Shoreline Protection Project component. It is located near the shoreline, on Port Monmouth Road, to the north of its intersection with Wilson Avenue. The structure was listed on the National Register of Historic Places in 1974. Its construction dates to the late 17th or early 18th century. The property's history is discussed above in the overview of the Project area's historic period cultural resources. Detailed accounts of the Seabrook-Wilson House appear in Appendix A of Porter *et al.* (1994) and in Hartwick and Madrigal (1996). The property is also archaeologically significant (Hartwick and Madrigal 1996; Porter *et al.* 1994: Appendix A).

Small sections of the Raritan and Delaware Bay Railroad embankment fall within the APE of the levee element of the Compton Creek Project component, in the vicinity of Park Avenue. Several of the railway features, including the former fill embankment, have been determined eligible for listing on the National Register of Historic Places (Porter *et al.* 1994:i). The railway line, constructed between 1856 and 1860, originally extended south from the bayshore. A spur was added in 1944, breaking off from the Main line slightly to the south of Park Avenue and curving towards the east. A detailed account of the railway's history appears in Porter at al. (1996:34-45). Subsurface archaeological investigations of portions of the mainline embankment, slightly to the south of Park Avenue, were conducted by Porter *et al.* (1996:75). A data recovery effort, consisting of a HABS/HAER recordation has also been conducted (National Park Service [NPS]-Project #1530, HAER No. NJ-117).

In addition to National Register listed and National Register eligible properties, two properties located on Wilson Avenue are listed in the New Jersey Historic Sites Inventory. These do not directly adjoin any Project elements. They include 94 Wilson Avenue Historic Sites Inventory Number 1331-109) and 119 Wilson Avenue (Historic Sites Inventory Number 1331-110). The former structure is located on the western side of the street. Its construction date is 1870-1880. Classified as a "vernacular Victorian," it is described in the state inventory form, as "illustrat[ing] the use of relatively expensive building materials (terra-cotta and brick) on a simple house form." The latter is located on the eastern side of the street. Constructed in 1860-1873, it is classified in the inventory as a "5-bay with Italianate elements." According to the state inventory form, "this large but stylistically simple house is the dominant feature of the village of

FEIS Table 5. Description of Archaeological Sensitivity of Project Components.

Project Components/Elements	Archaeological Sensitivity/Comments
Shoreline protection elements: Levee adjoining Pews Creek, floodwall alignment located on north side of Port Monmouth Road and extending from Pews Creek east to beginning of shoreline protection elements.	**Low Probability**. Wetlands and fill. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate vast areas of salt marsh. Mounier and Kalb (1976:6-7) evaluation indicates dredging and filling. Subsurface testing by Porter *et al.* yielded no cultural material.
Shoreline protection elements: Reconstructed dune and levee segment located to west of fishing pier parking lot.	**Low probability**. Beachfront, wooded area and fill associated with new Port Monmouth road embankment. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate fast land under cultivation. Limited subsurface testing by Porter *et al.*. (1994:5) in this vicinity yielded no cultural material.
Shoreline protection elements: reconstructed dune at northern (bayshore) edge of Seabrook-Wilson House property.	**Low probability**. Beachfront and fill . Although alignment adjoins National Register-listed Seabrook-Wilson House property, elements relocated beachward so as to not impact buried 18th century ground surfaces.
Shoreline protection elements: reconstructed dune extending along bayshore from eastern edge of Seabrook/Whitlock Wilson House property to northern terminus of Compton Creek alignment.	**Low Probability.** Beachfront and wooded area with some visible surface disturbance dunes. Subsurface testing by Porter *et al.*. (1994:56,57) in this vicinity indicated disturbance and yielded no cultural material.
Compton Creek alignment: northern terminus of levee extending across Port Monmouth Road, levee running along rear of Park Ave. homes to northern terminus of levee that parallels Main St.	**Low Probability (with exception of Raritan and Delaware Bay Railroad associated features).** Wetlands. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate salt marsh. Subsurface testing by Porter *et al.*. (1994:56) in this vicinity indicated disturbance and yielded no cultural material. Previous impacts to railway features have been mitigated by Monmouth County (NPS Project #1530, HAER NO. NJ-117)
Compton Creek alignment: levee paralleling west side of Main St. between intersection with Park Avenue and intersection with Broadway.	**Low Probability.** Wetlands. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate salt marsh. Possible historic houses along east side of Main St.
Compton Creek alignment: levee extending from Main Street and Broadway intersection, paralleling northernmost C2 ponding area/interior drainage facility, extending southeast to vicinity of southernmost C2 ponding area/interior drainage facility, near the southeast terminus of Broad Street.	**Moderate Probability.** Southwest margin of alignment is fast land with grass cover. Interior of alignment is wetlands. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate fast land/saltmarsh margin.
Compton Creek alignment: levee extending from southernmost C2 ponding area/interior drainage facility, parallel to Creek Locks Road, to intersection with Campbell Avenue.	**Low Probability.** Wetlands with possible historic house located on Creek Locks Road, to southwest of alignment. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate saltmarsh
Compton Creek alignment: levee extending from Campbell Avenue to eastern terminus of floodwall, paralleling C1 ponding area/interior drainage facility, in the vicinity of eastern terminus of Willow Street.	**Low Probability.** Mixed disturbance and wetlands. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate mixed fast land and salt marsh.

FEIS Table 5. Description of Archaeological Sensitivity of Project Components (Continued).

Project Components/Elements	Archaeological Sensitivity/Comments
Compton Creek alignment: floodwall running to rear of homes on southern side of Willow Avenue.	**Low Probability.** Visible surface disturbance. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate fast land.
C3 ponding area/interior drainage facility (between Brainard and Main Streets, north of Renfew Place).	**Low Probability.** Visible surface disturbance. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate fast land.
Northernmost C2 ponding area/interior drainage facility (adjoins Compton Creek levee that extends from Main Street and Broadway intersection).	**High Probability.** Fast land with grass cover. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate fast land.
Southernmost C2 ponding area/interior drainage facility (adjoins Comp- tons Creek levee that extends from Main Street and Broadway intersection, in the vicinity of southern terminus of Woodstock Avenue).	**Moderate Probability.** Wooded with some visible surface disturbance. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate fast land.
C1 ponding area/interior drainage facility (adjoins Compton Creek levee that extends south from Campbell Avenue to eastern terminus of floodwall, in the vicinity of eastern terminus of Willow Street).	**Low Probability.** Visible surface disturbance. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate fast land.
Pews Creek alignment: northern terminus of levee/floodwall, immediately south of Port Monmouth Road and opposite the Seabrook-Wilson House property, extending diagonally from west to east across Greg W. Butler Park towards Wilson Avenue.	**High Probability.** Fast land with grass cover. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate fast land.
Pews Creek Alignment: levee/floodwall paralleling Wilson Avenue, extending to west of western ends of Lydia Place, Suffolk Avenue, Plymouth Avenue, Gordon Court, Shoal Harbor Court, and terminating in the vicinity of the intersection of Bray and Main Street.	**Moderate to Low Probability.** Mixture of wetlands, fast land, and areas of visible surface disturbance. Nineteenth century maps (U.S. Coastal and Geodetic Survey 1844/5, Beers 1873, U.S. Coastal and Geodetic Survey 1875, Wolverton 1889) indicate mixture of salt marsh, deciduous forest, and grass lands. Adjoining streets contain historic houses.

Port Monmouth." It is depicted in the 1873 Beers Atlas as belonging to "J. Jiles." A 1915 photograph of the structure appears in Gabrielan (1995, Vol. II: 89). In the 1873 Beers Atlas it is labeled "W.V. Wilson." a local clergyman. Wilson was linked by marriage to the Seabrook family, and is known to have purchased the Seabrook-Wilson House in 1855. He was also active in local shipping. Wilson died in 1908 (Newsletter of the Middletown Township Historical Society III[2]: 2; IV [2]: 2).

A number of dwellings are located on nearby streets and although not listed on the State Inventory, may be of historic significance and should be further evaluated. Among them are 108 Wilson Avenue and 128 Main Street. The former is on the western side of the street. It has been known as "the Taylor Cottage" and is said to have been occupied by a Wilson who was a potter. The structure's terra-cotta decorative elements may be evidence of this (Gabrielan 1995:85). An undated late nineteenth/early twentieth photograph of the structure appears in Gabrielan's book. 128 Main Street is located on the western side of Main Street, immediately south of its intersection with Wilson. Dating to the late nineteenth century, it is depicted in the 1873 Beers Atlas (plate 33).

3.1.8 Land Use and Zoning

Land use in the study area primarily consists of residential and undeveloped tidal wetlands, with business and commercial/industrial areas of smaller size located along NJSH 36 and the navigable waterfront areas, respectively.

The study area historically was a summer vacation destination for part-time residents, but since the 1960s, the small homes along the shore have been converted to year-round homes, and many newer year-round homes have been constructed in the marsh areas between Pews Creek and Compton Creek. Virtually all of the homes in the study area are located within the 500-year flood zone, and a majority of these homes are within the 100-year flood zone (URS Grenier 1997).

The land use in the BSSA consists of a continuous public and private beach, with several right-of-way easements that provide public access from roadside parking areas to the beach. A public fishing pier is located near the middle section of the Bay Shoreline, and is adjacent to the historic Whitlock/Seabrook Wilson House, commonly referred to as the Spy House Museum. A small residential area is situated between the dunes and Port Monmouth Road at the west end of the area. In the middle portion of the BBSA there are scattered residences and undeveloped land parcels situated between the shore and Port Monmouth Road. In the eastern portion of the BSSA, a commercial/industrial area supports the local fishing industry and recreational boating activities.

The Town of Middletown has established two zoning Districts in the BSSA: high-density, single family residential (R-7) and marine commercial (MC) (Middletown Township 1994). In the R-7 District, the standard interior residential lot size is 7,500 square ft with 75 ft of road frontage. The MC District supports facilities and activities associated with fishing and boating use, including outdoor storage of fishing-related equipment, seafood unloading and processing facilities, and boat repair service (Middletown Township 1994).

3.1.9 Floodplain Issues

3.1.9.1 Flooding Events

Periodic severe storm events have historically caused severe flooding and extensive damage to the housing, property, and community infrastructure in the Project area (USACE 1993a). In particular, severe flooding occurred as a result of a September 14, 1944 hurricane; extratropical storms of November 25, 1950, and November 6-7, 1953; Hurricane Donna in 1960; and northeasters of March 6-8, 1962, March 12, 1984, and December 11, 1992 (USACE 1997a). The Project area has experienced the most extensive flood damage in the region between South

Amboy (located at the mouth of the Raritan River) and the Highlands (located near Sandy Hook) (USACE 1993a).

Based on modeling conducted at the Coastal Engineering Research Center (CERC), located at the USACE Waterways Experiment Station in Vicksburg, Mississippi, the flood stage associated with a 100-year storm event is +12.2 ft NGVD (USACE 1997a). A tidal stage of +10 ft NGVD results in severe flooding that strands most residents north of NJSH 36 (USACE 1993b). The mean spring high tide at the Project area is +3.46 ft NGVD. Based on a 1972 USACE storm surge study of the Monmouth County Bay area, the highest water level recorded at Port Monmouth was +9.9 ft NGVD in September 1960, which is equivalent to water levels with a 24-year return interval. The 100-year fluvial flood stage for Compton Creek is +7.0 ft NGVD, more than 4 ft below the 100-year tidal flood stage (USACE 1993b).

Shore erosion is prominent in the middle of the Bay Shoreline beach, where the highest shore retreat rate (-1.3 ft/year) and greatest rate of volume loss (-3,100 cubic yards/year) in the Project area was recorded from 1836 to 1933 (USACE 1993b). Historic losses have been offset by a 1967 state dune construction Project, and deposition of beach quality sand dredged from the harbors located at the mouths of Pews and Compton creeks (USACE 1993a). However, the Bay Shoreline beach has been identified as a littoral drift nodal point, from which net littoral drift moves outward (USACE 1997a).

3.1.9.2 Floodplain Values

As previously described, in FEIS Section 3.1.9.1, the Bay Shoreline portion of the Project is subject to frequent storm surges and tidal inundation. It presently buffers inland areas against moderate storm surges and serves as a community recreational area. However, these values are diminished by ongoing erosion of the beach and dune. In addition, the value of the Bay Shoreline to wildlife is limited because of frequent human disturbance and development.

3.1.10 Coastal Zone Management

Pursuant to the Coastal Zone Management Act of 1972 and the Coastal Zone Reauthorization Act Amendments of 1990, New Jersey has defined its coastal zone boundaries and developed policies to be utilized to evaluate and issue permits for Projects located within the designated coastal zone, as set forth in New Jersey's Rules on Coastal Zone Management (N.J.A.C. 7:7, 7:7E, dated July 18, 1996 and addenda [illegible] 7:7E-5 and 7:7E-8.7, dated August 19, 1996).

The NJDEP administers the coastal permit program through the Coastal Area Facility Review Act (CAFRA, New Jersey State Act [N.J.S.A.] 13:19-1 *et seq.*), the Wetlands Act of 1970 (N.J.S.A. 13:9A-1 *et seq.*), and the Waterfront Development Law (N.J.S.A. 12:5-3). Each of these acts provides a slightly different definition of the coastal zone; therefore, the designated coastal zone consists of the cumulative total of these three definitions.

In the study area, the coastal zone boundary defined by CAFRA extends from the ocean shore to NJSH 36. The Wetlands Act of 1970 defines the coastal zone as all tidally influenced wetlands, which includes the wetlands in the Project area associated with Pews and Compton Creeks. The Waterfront Development Law defines the coastal zone as any tidal waterway within the coastal area defined by CAFRA, up to and including the high water line. Based on these definitions, the entire Project area is located within the designated coastal zone. Therefore, a Federal consistency determination is required for the selected plan (see FEIS Appendix C, New Jersey Coastal Zone Management Consistency Statement).

3.1.11 Hazardous, Toxic, and Radioactive Wastes (HTRW)

Various pollutants are present in the HRE, including: heavy metals, PAHs, PCBs, excessive nutrient and carbon loadings, and pathogenic bacteria and viruses (Breteler 1985). Hudson-Raritan Bay complex sediments contain the following sediment contamination: antimony, arsenic, cadmium, chromium, copper, mercury, lead, silver, tin, zinc, total chlorinated pesticides, total DDT, total PCBs, and total PAHs in concentrations that rank in the top 20 contaminated estuaries in the country (Squibb *et al.* 1991).

A HTRW preliminary assessment (PA) was conducted by the District to identify potential HTRW concerns. The PA concluded that there were no HTRW concerns (see USACE, Baltimore District [CENAB] letter dated October 19, 1995 in FEIS Appendix D).

3.1.12 Navigation

Navigation in the RBSHB along the Bay Shoreline portion of the Project primarily consists of recreational and small commercial crafts associated with marinas at the mouths of Pews and Compton Creeks. Pews and Compton Creeks empty into Sandy Hook Bay at the west and east ends of the Project area, respectively. The Bay Shoreline is not located immediately adjacent to waters of the Intracoastal Waterway, which is an important waterway that runs from the mouth of the Hudson River to the Gulf Coast of Texas and is used by recreational and small commercial vessels. A portion of the Intracoastal Waterway is located approximately 6 miles northeast of the Project area.

According to the Monmouth County *Bayshore Waterfront Access Plan* (MCPB 1993), the county plans to construct a mixed-use development and a ferry terminal on the Bay Shoreline near the mouth of Compton Creek.

3.1.13 Aesthetics and Scenic Resources

Aesthetics and scenic resources in the BSSA influence the feasibility of future development of this area as a prime public recreation area of the Bayshore Waterfront Park, as described in the Bayshore Waterfront Access Plan (MCPB 1993). As a result of this future role, the Project area will be subject to higher-intensity public use. To this end, the Bayshore Waterfront Access Plan has resolved to prevent visual obstructions to views of the water as part of its Bayshore Trail proposal, as well as resolving to maximize existing scenic views of New York Bay, wetlands, Belford fishing boats and activities, Leonardo Site Marina, and New York Harbor (MCPB 1993).

The Monmouth County Parks and Recreation Department has identified the scenic quality of the Bay Shoreline as extremely sensitive (Wickham 1997a and 1997b), and is concerned with the visual impacts of the proposed shore stabilization aspect of the selected plan. The Monmouth County Parks and Recreation Department is particularly concerned with the infringement of shore protection structures along the beach that may infringe on the scenic quality of the BSSA.

3.1.14 Recreation

Recreational opportunities are plentiful within the BSSA, due to the recent and ongoing expansion of the Monmouth County park system pursuant to the *Bayshore Waterfront Access Plan*. This county plan provides the framework for the preservation, enhancement, and expansion of public access to Monmouth County's Bayshore waterfront. and the county has focused substantial efforts on the beach front and the tidal wetland areas in the Project area. The plan seeks to provide continuous visual, pedestrian, and bicycle access to and along the entire Bayshore waterfront for the general public. The Bayshore Trail and Bikeway is a major component of this plan, which provides a linear park system designed to link recreation areas, preservation areas, open space, and specific points of interest. In addition, Port Monmouth is one of five areas in the region selected for establishment of a Regional Park and Preservation Area under the plan (Monmouth County Planning Department 1987).

As part of the regional *Bayshore Waterfront Access Plan*, over the past 10 years the county has been acquiring a significant amount of beachfront property in Port Monmouth for beachfront access and public recreational use. Currently the county owns or is acquiring virtually every parcel along the shore from Pews Creek to Main Street in Port Monmouth (Wickham 1997a and 1997b). In addition, the Whitlock/Seabrook Wilson House historical museum (the Spy House) was recently transferred from the Town of Middletown to Monmouth County ownership.

The Whitlock/Seabrook Wilson House and the county-owned fishing pier located just west of the museum are integral components of the Bayshore Waterfront Park. Three public parking areas will be located intermittently along Port Monmouth Road to provide access to the beach and waterfront areas, and the remainder of the public Bay Shoreline will be accessible via a continuous pedestrian trail across the dunes, known as the Bayshore Trail. In addition, Port Monmouth Road is designated as a bike trail in the *Bayshore Waterfront Access Plan* (MCPB 1987).

A portion of the beachfront located between Wilson Avenue and Main Street in Port Monmouth is intended to become the most intensively used public area of the Bayshore Waterfront Park in Port Monmouth. Here, the existing historical museum, fishing pier, and public restrooms will be supplemented with nature interpretation displays and park offices (Wickham 1997a and 1997b).

3.1.15 Transportation

In general, the Project area is geographically linked to surrounding population centers through local roads and a network of arterial and collector streets and highways. The majority of roads in the Project area are classified as local streets, which primarily function to provide access to abutting residential properties and serve as easements for various public utilities.

Collector streets such as Broadway, Church Street, and Wilson Avenue provide access from local residential streets to primary and secondary arterial roads. Secondary arterial roads in the Project area, Port Monmouth Road, Thompson Avenue, and two Main Streets (one in Port Monmouth, the other in Belford), provide transition between smaller collector streets and primary arterial roads. NJSH 36, located along the southern edge of the Project area, is one of four primary arterial roads in Middletown Township, and functions as a primary feeder road to the Garden State Parkway and is a conductor of major traffic movement in the region.

In addition, Middletown Township is served by passenger rail provided by New Jersey Transit Corporation, which provides access to Newark and New York City from the local station on Middletown-Lincroft Road, approximately 3 miles from Port Monmouth. New Jersey Transit also provides the local bus service and the regional commuter bus service to northern New Jersey and New York. In Port Monmouth, regional and/or local bus lines run along NJSH 36, Main Street (Belford), Campbell Avenue, and Bray Avenue. In addition, there are two privately-owned commuter ferry lines that operate between New York City and ports in Atlantic Highlands and Highlands, east of Port Monmouth.

Port Monmouth Road runs parallel to the Bay Shoreline, and functions as the main arterial transportation route in this portion of the Project area. This road crosses both Pews and Compton creeks, and was recently reconstructed and raised in elevation to approximately +5 ft NGVD (Mercantante 1997). In addition, Port Monmouth Road was realigned toward the southwest in the western portion of the Bay Shoreline area near Pews Creek. The realigned section of Port Monmouth Road is discussed in FEIS Section 3.2.15 (Pews Creek, Transportation).

3.1.16 Air Quality

Monmouth County is within the New York-New Jersey-Long Island Air Quality Control Region, which is designated as a severe ozone nonattainment area. Monmouth County is designated as an attainment area for carbon monoxide, sulfur dioxide, respirable particulate matter, lead, and nitrogen dioxide (USEPA 1997).

3.1.17 Noise

Noise is generally defined as unwanted sound. The day-night noise level (Ldn) is the most widely used descriptor of community noise levels. The unit of measurement of the Ldn is the A-weighted decibel (dB) that closely approximates the frequency responses of human hearing.

The primary source of noise in the Project area is vehicular traffic on local roadways. Noise level measurements have not been obtained in the Project area. In lieu of measurement, the noise levels in the Project area can be approximated based on the existing land uses. The USEPA document Protective Noise Levels (1978) lists typical day-night sound levels at various locations. The primary land use in the Project area is residential. Typical day-night sound levels in residential areas range from 39 to 59 dB (A) (USEPA 1978). Therefore, it can be assumed that the existing sound levels in the Project area are within this range. Similarly, it can be assumed that sound levels in the BSSA are at the lower end of this range due to the lack of development in the area.

3.2 PEWS CREEK STUDY AREA

3.2.1 Topography, Geology, and Soils

Topography and geology in this area are similar to those discussed in FEIS Section 3.1.1. Soils underlying the PCSA include SS, UD, Klej loamy sand (KUA), and Tinton loamy sand (TuB). Refer to FEIS Section 3.1.1 for descriptions of the SS and UD soils. The KUA loamy sand soil occurs on 0 to 3% slopes and is moderately well-drained to somewhat poorly-drained. The KUA soil is typical of coastal plain sediments in acidic and sandy environments. The TuB soil exhibits 0 to 5% slopes typical of coastal plain sediments on uplands. Neither KUA nor TuB are classified as hydric soils or soils of state or local importance. No prime, unique, or important farmland exists within the PCSA, therefore the Farmlands Protection Policy Act does not apply to the selected plan (Curtin 1992). It is anticipated that the materials used for the construction of the levee, which links the storm gate to the floodwall along Port Monmouth Road, will be obtained from local commercial sources.

3.2.2 Water Resources

3.2.2.1 Regional Hydrogeology and Groundwater Resources

The hydrogeologic framework and groundwater resources of the PCSA are expected to be similar to those described previously for the BSSA due to their proximity to each other. For further discussion please see FEIS Section 3.1.2.1.

3.2.2.2 Tidal Influences

Pews Creek is a tidal creek that discharges into RBSHB. The tides at Pews Creek are semi-diurnal, having a mean spring high tide at +3.46 ft NGVD.

There are five tidal bench mark stampings in Pews Creek along Port Monmouth Road. The tide gauge and staff are located on the wharf of the Gateway Marina. The Mean High Water (MHW) for each benchmark stamping is provided in FEIS Table 6. The control station for these stampings is located in Keyport, New Jersey (USACE 1998b).

FEIS Table 6. Mean High Water for the Bench Mark Stamping at Pews Creek.

Bench Mark Stamping	Elevation Above MHW (ft)
1591 A 1976	5.04
1591 B 1976	1.09
1591 C 1976	2.59
1591 D 1976	2.70
1591 E 1976	2.96

Source: Coastal Planning and Engineering, Inc. *et al.* 1993

Pews Creek is located west of Port Monmouth and east of Keansburg. Long-term shoreline and volumetric changes from Pews Creek to Shrewsbury River, which include the shoreline immediately adjacent to Port Monmouth, were previously identified in FEIS Section 3.1.2.2. However, to obtain a more complete idea on these long-term shoreline changes within the Project area, similar data were briefly reviewed for shoreline stretches from Matawan Creek to Pews Creek. Shoreline changes within this area have been strongly impacted by a large beach protection Project at Keansburg and the installation of some protective structures at Union Beach and Keyport. For example, from 1836 to 1973, Keansburg displayed an average advance of 0.9 ft per year (Coastal Planning & Engineering, Inc. *et al.* 1993).

Historically, the town of Port Monmouth experiences most of its flooding problems as a result of tidal inundation caused by severe storms. Extratropical storms, northeasters, and hurricanes have all been well documented to substantially impact the RBSHB. Tidal floodwaters enter the creek and quickly spread over the floodplain. A tidal stage of +10 ft MSL results in flooding so severe that most residents north of NJSH 36 are temporarily stranded (URS Greiner 1997). Extensive damage to numerous structures has been recorded in the Port Monmouth area during such storms.

In addition to the tides, other factors contributing to the flooding problems of the Project area include an increase in water levels from storm events and a decrease in barometric pressure. Tidal surges compound flooding caused by storms, contributing to the overall hydrologic load and inundating the existing stormwater infrastructure, that reduces the flow carrying capacity of these infrastrucures, therefore increasing flooding.

In addition to the prolonged and extensive flooding within the Project area, storm-induced tidal surges have resulted in other local problems. These include, shore erosion along the beachfront; transportation inconveniences from loss of rail service and damaged roads and bridges; damage or destruction of shore structures such as dunes, jetties, and bulkheads; damage to utility lines and sewers; and the damage and destruction of homes and commercial properties (URS Greiner 1997). All of these problems place a significant strain on commerce and regional economic development within and around the Project area.

3.2.2.3 Surface Water

The PCSA is part of the RBSHB watershed. Pews Creek is one of several tidal creeks that discharge directly into RBSHB. Surface water resources within the PCSA consist primarily of Pews Creek and surface waters associated with the salt marsh. Stormwater runoff flows through the salt marsh via the ditches into Pews Creek and then enters the RBSHB. Pews Creek currently receives drainage from 29 outlets (Coastal Planning & Engineering, Inc. *et al.* 1993).

Annual surface water reports (NJDEPs 1988b, 1990b, and 1994b) indicate the study site is located within the Coastal Monmouth County Drainage. No specific water quality data were available for Pews Creek. In addition, there are no point discharge sources that discharge into for Pews Creek.

Significant phytoplankton blooms have been prevalent in the RBSHB. The movement of blooms into the tidal creeks has been well documented from wind, waves, and tides. Brown tides have been reported for Pews Creek through the spring and summer seasons, with the most severe conditions experienced in August and September (Monmouth County Health Department 1999).

3.2.3 Vegetation

Based on site investigations, the PCSA contains plant species typical of successional upland, low salt marsh, high salt marsh and brackish tidal marsh plant communities (Collins and Anderson 1994). The Pews Creek vegetation communities show evidence of disturbance such as, housing and road construction, the placement of the levee, and the maintenance of an extensive network of man-made ditches. There are no Federally-listed threatened or endangered vascular plant species within the PCSA (Staples 1998). In addition, no state-listed endangered or threatened species were identified during field investigations (USACE 2000a and 2000b).

3.2.3.1 Wetlands

Approximately 135 acres of jurisdictional wetlands occur within the PCSA. Most of these wetlands are classified as estuarine, intertidal, emergent wetland. The PCSA is influenced by daily tidal flows and contains a tidal salt marsh vegetation community. The salt marsh community is fragmented by an extensive network of man-made ditches for the purpose of mosquito control. The ditches are regularly maintained.

The State of New Jersey Natural Heritage Program (NJNHP) has identified salt marsh complexes and brackish tidal marshes as being rare in New Jersey and has included these wetland communities on the *Priority Wetland List* (USEPA 1989).

3.2.3.2 Uplands

Upland areas in the PCSA are typically associated with development such as houses, recreational facilities, and roads. In non-developed areas, the vegetation is dominated by common early successional plant species (USACE 2000a and 2000b).

3.2.4 Wildlife

3.2.4.1 Fish and Shellfish

Tidal creeks are important to many species of anadromous fish for feeding and spawning purposes. A lack of published data that is site-specific to Pews Creek prevents a listing of species that can be found there. Two species of fish, American eel (*Anguilla rostrata*) and silverside (*Menidia* spp.), were observed in the Pews Creek basin during field surveys conducted between October and November 1997. The general lack of shallow pools may prevent some species of fish from using the basin for spawning or feeding. Due to stream bed exposure during low tide, no shellfish are likely to occur in the PCSA.

3.2.4.2 Benthos

Typical benthic organisms in a salt marsh ecosystem range from microinvertebrates to crustaceans. A total of three species of benthic invertebrates were identified in the Pews Creek basin during field surveys conducted between October and November 1997 (USACE 2000a). High densities of eastern melampus snails (*Melampus bidentatus*) and Atlantic ribbed mussels (*Geukensia demissa*) were normally located near the high-tide level in high emergent salt marsh vegetation dominated by *Spartina patens* and *Distichilus spicata*. The eastern mud snail (*Ilynassa obsoleta*) was another common invertebrate that was typically found on creek bottoms at low tide.

3.2.4.3 Reptiles and Amphibians

As discussed in FEIS Section 3.1.4.3, only four species of reptiles and one species of amphibian have been documented to potentially use the Project area. One species of reptile and no species of amphibians were observed in the Pews Creek basin during field surveys conducted between October and November 1997 (USACE 2000a). During HEP data collection, a single diamondback terrapin shell was found in a high emergent salt marsh dominated by *Spartina patens* and *Distichilus spicata*.

3.2.4.4 Birds

As discussed in FEIS Section 3.1.4.4, many species of birds that inhabit or use Sandy Hook National Park or Cheesequake State Park may potentially use the Project area. A total of 43 species of birds were observed in the PCSA during field surveys conducted between October and November 1997 (USACE 2000a). Wading birds and waterfowl were quite numerous within salt marsh dominated areas. Species such as great blue heron (*Ardea herodias*), black-crowned night heron (*Nycticorax nycticorax*), mallard (*Anas platyrhynchos*), and American black duck (*Anas rubripes*) were observed in and around open water and on creek banks throughout the basin. Upland areas dominated by scrub-shrub and herbaceous vegetation attracted songbirds such as the gray catbird (*Dumetella carolinensis*), common grackle (*Quiscalis quiscula*), and American goldfinch (*Carduelis tristis*). Fish crows (*Corvus ossifragus*) and American crows (*Corvus brachyrhynchos*) were common in both wetland and upland areas where they would feed and roost, respectively.

3.2.4.5 Mammals

The abundance of mussels, eggs from nesting waterfowl, and other food resources provides productive habitat for several species of mammals in the PCSA. Historic records from Sandy Hook National Park reveal the known presence of 13 species of mammals that could potentially occur within the Project area (USDI 1989b). Only four mammal species were observed in the PCSA during field surveys conducted between October and November 1997 (USACE 2000a). Muskrat (*Ondatra zibethicus*), red fox (*Vulpes vulpes*), and raccoon signs were observed along creek banks and in upland areas of PCSA. Eastern cottontail rabbits inhabit some of the upland fringe areas where scrub-shrub vegetation is dominant.

3.2.5 Threatened and Endangered Species

3.2.5.1 Federal Species of Concern

With the exception of the occasional transient bald eagle, no Federally-listed endangered or threatened species are known to occur in the Project area (Bigford 1992 and Staples 1998) (see FEIS Appendix D).

3.2.5.2 State Species of Concern

Two state-listed endangered or threatened species, including the pied-billed grebe (*Podilymbus podiceps*) and Cooper's Hawk (*Accipiter cooperii*) (NJNHP 1997), were observed during field surveys conducted between October and November 1997. Besides the two species listed above, the PCSA may provide habitat for the state-listed threatened osprey (Breden 1992).

3.2.6 Socioeconomics

3.2.6.1 Demographic Characterization

The demographic characterization of the PCSA is identical to the characterization provided for the BSSA discussed in FEIS Section 3.1.6.1.

3.2.6.2 Economy and Income

The local economy and income of the PCSA is identical to the general characterization provided for the BSSA discussed in FEIS Section 3.1.6.2.

3.2.6.3 Housing

The housing conditions of the PCSA are identical to the general characterization provided for the BSSA discussed in FEIS Section 3.1.6.3.

3.2.7 Cultural Resources

Cultural resources associated with the PCSA is described in FEIS Section 3.1.7.

3.2.8 Land Use and Zoning

The land uses surrounding the PCSA consist primarily of undeveloped tidal wetlands and residential areas. In addition, the Monmouth Cove Marina, (formerly the Gateway Marina), a county-owned pleasure boat marina, is located near the mouth of Pews Creek. At the southern edge of the PCSA, business and commercial uses occupy a narrow zone concentrated along NJSH 36.

Zoning in the PCSA includes two high-density single family residential zones, High density, single family residence zone (R-5) and R-7, where standard minimum lot sizes are established at 5,000 and 7,500 square ft, respectively (Middletown Township 1994). However, the two Districts exhibit similar actual densities of development in the Project area, where the typical residential lot size in both areas is approximately 50 ft wide and 100 ft deep. In addition, there is one multi-family mid-rise apartment residence zone (RHA) on the east side of Pews Creek, which provides housing for senior citizens. Other zoning Districts in this area are business zones (B-2 and B-3) associated with NJSH 36.

3.2.9 Floodplain Issues

3.2.9.1 Flooding Events

The PCSA is composed of residential structures that are subject to floods and storm damage. Within the PCSA there are 37 non-residential and 360 residential structures that are prone to flooding (USACE 1997a). In general, the same frequency and intensity of storms and flooding that impact the Bay Shoreline impact the PCSA. For additional discussion please refer to FEIS Section 3.1.9.1.

3.2.9.2 Floodplain Values

Nearly the entire PCSA is located within the 100-year floodplain. The floodplain possesses natural and beneficial values that include flood storage, nutrient and sediment removal, and wildlife habitat. The tidal salt marshes located along Pews Creek form the floodplain that buffers inland areas against storm surges.

Development surrounding Pews Creek has encroached onto the floodplain, and has resulted in frequent property damage during severe storm events (USACE 1997a). The floodplain of Pews Creek also filters sediment and nutrients from freshwater runoff, and thereby improves the water quality of runoff entering RBSHB. The floodplain also has value to fish and wildlife that breed in or utilize the salt marsh habitats. In addition, the floodplain of Pews Creek contains salt marsh wetlands, which the NJNHP has identified as being rare in New Jersey, and has included these wetland communities in the *Priority Wetland List* (USEPA 1989).

3.2.10 Coastal Zone Management

Relevant coastal zone management regulations in the PCSA are identical to those provided in FEIS Section 3.1.10. See FEIS Appendix C for a detailed discussion regarding coastal zone regulations.

3.2.11 Hazardous, Toxic, and Radioactive Wastes

As described in FEIS Section 3.1.11, hazardous waste contamination is present in the Hudson-Raritan Estuary. Contamination transport may occur during tidal fluctuations and severe flooding events that may occur in Pews Creek (Squibb *et al.* 1991).

A HTRW PA was conducted by the District to identify potential HTRW concerns. The PA concluded that there were no HTRW concerns (see USACE, CENAB letter dated October 19, 1995 in FEIS Appendix D).

3.2.12 Navigation

The Monmouth Cove Marina is located at the mouth of Pews Creek and is maintained by Monmouth County for recreational boating. The upstream limit of navigation for small, recreational vessels is the newly relocated Port Monmouth Road bridge over Pews Creek. In 1988, a total of 20,796 cubic yards of dredged material was removed from the Pews Creek Navigation Project (USACE 1993b), truck-hauled, and placed on the Port Monmouth shore near the Spy House Museum.

3.2.13 Aesthetics and Scenic Resources

Currently the aesthetic and scenic resources within the PCSA consist mainly of an open salt marsh ecosystem. Individuals currently experience an unimpeded view of the salt marsh.

3.2.14 Recreation

In the PCSA, existing recreational facilities include the Monmouth Cove Marina (formerly the Gateway Marina), and a recreational field and bike/walking path. The Monmouth Cove Marina has the capacity to berth 100 recreational vessels and to store 80 vessels. In addition, the salt marsh provides birding enthusiasts the opportunity to enjoy birding. The majority of the tidal wetlands surrounding Pews Creek are owned by either Monmouth County or the Town of Middletown for the purpose of recreation and conservation (Wickham 1997a and 1997b).

Mapped bike trails associated with the Bayshore Bikeway System traverse the Pews Creek area along Port Monmouth Road and Bray Avenue (MCPB 1987). Although the existing Keansburg Levee is not formally designated or mapped as a recreational trail, it is heavily used by local residents for walking, jogging and biking. In addition, since the Henry Hudson Bike Trail was established as a paved, regional recreation trail on the abandoned railroad bed parallel to NJSH 36, the Keansburg levee's recreational function as a connector from the Hudson Trail northward to the Bay Shoreline has become well established.

There are two town recreation areas located adjacent to the tidal wetlands associated with Pews Creek. One is a baseball field located east of the wetlands, on the south side of Port Monmouth Road near Wilson Avenue. The other area consists of a baseball field, basketball courts, and playground facilities on the southeast side of the tidal wetlands, near Gordon Court.

3.2.15 Transportation

The recently realigned section of Port Monmouth Road proceeds to the southwest from the original road, and crosses Pews Creek and the existing Keansburg levee. Recent improvements to this section of Port Monmouth Road include construction of a new bridge over Pews Creek, adjacent and south of Monmouth Cove Marina. The Port Monmouth Road intersects Thompson Avenue on the west side of the existing Keansburg Levee, which leads directly to NJSH 36.

Other roads that cross the existing levee in the PCSA include Bray Avenue, NJSH 36, and the Henry Hudson Bike Trail that is on the abandoned railroad right-of-way north of NJSH 36.

3.2.16 Air Quality

A general description of the existing air quality for the Project area is provided in FEIS Section 3.1.16.

3.2.17 Noise

A general discussion of the existing noise conditions for the Project area is provided in FEIS Section 3.1.17.

3.3 COMPTON CREEK STUDY AREA

3.3.1 Topography, Geology, and Soils

Geology and topography for the Compton Creek Project area is described in FEIS Section 3.1.1. The CCSA is composed of KUA, SS, UD, and UA soils. These soils are described in FEIS Sections 3.1.1 and 3.2.1. No prime, unique, or important farmland exists within the CCSA, therefore the Farmlands Protection Policy Act does not apply to the selected plan (Currin 1992).

3.3.2 Water Resources

3.3.2.1 Regional Hydrogeology and Groundwater Resources

The hydrogeologic framework and groundwater resources of the CCSA are similar to that described for the BSSA due to their proximity. For further discussion please see FEIS Section 3.1.2.1.

3.3.2.2 Tidal Influences

Compton Creek is one of two major creeks located adjacent to Port Monmouth, the other being Pews Creek. Both are tidal creeks that discharge into the RBSHB. The tides at Compton Creek are semi-diurnal, having a mean spring high tide at +3.46 ft NGVD.

There are five tidal bench mark stampings along Compton Creek. The MHW for each benchmark stamping is provided in FEIS Table 7. The control station for these stampings is located in Keyport, New Jersey. For further discussion please see FEIS Appendix H.

Many year-round dwellings are located within the tidal marshes between the banks of Pews Creek and Compton Creek. All of the homes from the shore south are located within the boundary of the 500-year flood zone, and the majority also are located within the 100-year flood boundary. The 100-year fluvial flood stage for Compton Creek is more than 4 ft below the 100-year tidal flood stage (Coastal Planning & Engineering, Inc. *et al.* 1993).

FEIS Table 7. Mean High Water for the Bench Mark Stamping at Compton Creek.

Bench Mark Stamping	Elevation Above MHW (ft)
1630 A 1976	4.64
1630 B 1976	7.28
1630 C 1976	6.61
1630 D 1976	4.17
1630 E 1976	7.06

Source: Coastal Planning and Engineering Inc. *et al.* 1993

3.3.2.3 Surface Water

The 5,363-acre Compton Creek sub-watershed is part of the RBSHB Watershed. Compton Creek is one of several tidal creeks that discharge directly into RBSHB. The creek receives drainage from 85 outlets that were constructed along Compton Creek for temporary storage of stormwater runoff for flood control (Coastal Planning & Engineering, Inc. *et al.* 1993). For further discussion see FEIS Section 3.2.2.3.

Similar to Pews Creek, algal blooms appear to be the most substantial, and easily recognizable, water quality problem in Compton Creek. The tidal exchange with the creek transports estuarine algal blooms from the coastal waters to Compton Creek (Monmouth County Health Department 1997). Water quality samples recently collected in Compton Creek revealed relatively low nutrient concentrations (Monmouth County Health Department 1997), while historical data on RBSHB indicate that nutrient concentrations were relatively high (NJDEP 1987).

3.3.3 Vegetation

Based on site investigations, the CCSA contains plant species typical of successional upland, low salt marsh, high salt marsh, and brackish tidal marsh plant communities (Collins and Anderson 1994). The Compton Creek vegetation communities show evidence of disturbance such as, housing construction and the maintenance of an extensive network of man-made ditches (USACE 2000a). There are no Federally-listed threatened or endangered vascular plant species within the wetland and non-wetland CCSA (Staples 1998). In addition, no state-listed endangered or threatened species were identified during field investigations.

3.3.3.1 Wetlands

Approximately 147 acres of jurisdictional wetlands and open water occur within the Compton Creek portion of the Project area. Most of the wetland area, 99 acres, is classified as estuarine, intertidal, emergent wetland. The tidal marshes of Compton Creek are influenced by daily tidal flows and are dominated by a high marsh plant community. The remaining wetlands in the Compton Creek area include *Phragmites*-dominated areas along the southern and peripheral portions of the marsh (48 acres). The NJNHP has identified salt marsh complexes and brackish tidal marshes as being rare in New Jersey, and has included these wetland communities in the *Priority Wetland List* (USEPA 1989). The salt marsh community is fragmented by an extensive network of man-made ditches that are regularly maintained for the purpose of mosquito control (USACE 2000a and 2000b).

3.3.3.2 Uplands

Approximately 36 acres (23%) of the CCSA is composed of upland vegetation types (USACE 2000a). These upland areas are typically associated with the limits of residential development along the marsh borders. They contain successional communities typical of human disturbance, as well as regularly mown lawns and fields (USACE 2000a).

3.3.4 Wildlife

3.3.4.1 Fish and Shellfish

Compton Creek supports spawning runs of several species of anadromous fish. Alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) spawning runs were confirmed by Zich (1978) and Byrne (1988). In a study conducted for the USACE, striped bass (*Morone saxatilis*), menhaden (*Brevootia tyrannus)*, and white perch (*Morone americana*) were also confirmed to be present in Compton Creek in sufficient numbers for spawning (USACE 1993b). No fish were identified in Compton Creek during the field surveys conducted between October and November 1997. Due to stream bed exposure during low tide, no shellfish are likely to occur in the PCSA.

3.3.4.2 Benthos

The benthic community of the Compton Creek basin is nearly identical to that of Pews Creek, which is discussed in FEIS Section 3.2.4.2. Atlantic ribbed mussels, eastern melampus snails and eastern mud snails were frequently observed during field surveys conducted between October and November 1997 (USACE 2000a).

3.3.4.3 Reptiles and Amphibians

As discussed in FEIS Section 3.1.4.3, four species of reptiles may exist in the Project area. No species of reptiles or amphibians were observed during field surveys conducted between October and November 1997.

3.3.4.4 Birds

As discussed in FEIS Section 3.1.4.4, many species of bird that inhabit or use Sandy Hook National Park or Cheesequake State Park may potentially use the Port Monmouth site. A total of 44 bird species were observed in the Compton Creek basin during field surveys conducted between October and November 1997 (USACE 2000a). The species composition and spatial distribution of birds in Compton Creek was similar to that of Pews Creek, as discussed in FEIS Section 3.2.4.4.

3.3.4.5 Mammals

Due to the similar habitats of nearby Sandy Hook National Park and the Project area, 13 mammal species that have been confirmed at Sandy Hook have the potential to occur within the Project area (USDI 1989b). A total of three mammal species were observed in the Compton Creek basin during field surveys conducted between October and November 1997 (USACE 2000a). The species composition and spatial distribution of mammals in Compton Creek was similar to that of Pews Creek, as discussed in FEIS Section 3.2.4.5.

3.3.5 Threatened and Endangered Species/Communities

3.3.5.1 Federal Species of Concern

With the exception of the occasional transient bald eagle, no Federally-listed endangered or threatened species are known to occur in the Project area (Bigford 1992 and Staples 1998) (see FEIS Appendix D).

3.3.5.2 State Species of Concern

One state listed endangered or threatened species was observed during field surveys conducted between October and November 1997. An adult Cooper's hawk (*Accipiter cooperii*), listed as state-endangered (NJNHP 1997), was observed hunting over the salt marsh portion of Compton Creek on numerous occasions. The Project area may also provide habitat for the state-listed endangered pied-billed grebe and state-listed threatened osprey (Breden 1992).

3.3.6 Socioeconomics

3.3.6.1 Demographic Characterization

The demographic characterization of the CCSA is identical to the characterization provided for the Project area discussed in FEIS Section 3.1.6.1.

3.3.6.2 Economy and Income

The local economy and income of the CCSA are identical to the general characterization provided for the Project area discussed in FEIS Section 3.1.6.2.

3.3.6.3 Housing

The housing conditions of the CCSA are identical to the general characterization provided for the Project area discussed in FEIS Section 3.1.6.3.

3.3.7 Cultural Resources

Cultural resources associated with the CCSA are described in FEIS Section 3.1.7.

3.3.8 Land Use and Zoning

Land uses in the CCSA consist primarily of undeveloped tidal wetlands, residential areas, and a waterfront commercial/industrial area located at the mouth of Compton Creek. A commercial marina, associated storage, and marine service facilities located at the mouth of Compton Creek, support the local Belford Fisherman's Co-op as well as recreational boating activities. In addition, business and commercial uses occupy a narrow zone centered around NJSH 36. On the eastern edge of the Project area, there is an operating sewage treatment plant and a formerly-used landfill that is in the process of being capped.

The point of land on the east side of Compton Creek where it flows into the bay is the site of a future commuter ferry service to Manhattan, to be developed by Monmouth County within the next two years. In addition, the town has approved the preliminary site plan for a large, privately-owned mixed use development located in the MC area on the west side of the mouth of Compton Creek. This proposal includes condominiums, retail establishments, and a new marina, situated between the proposed levee and the creek. Construction of this development, which was introduced in 1990, has not yet commenced (Mercantante 1997).

Zoning Districts in the CCSA consist of R-7, where the density of existing development is similar to the residential areas described for the Pews Creek area. In addition, the MC District encompasses most of the land area adjacent to Compton Creek from the RBSHB upstream a distance of approximately 0.5 mile. Zoning along NJSH 36 consists of B-3 and B-2.

3.3.9 Floodplain Issues

3.3.9.1 Flooding Events

The CCSA is composed of residential structures that are subject to floods and storm damage. Within the CCSA there are 47 non-residential and 698 residential structures that are prone to flooding (USACE 1997a). In general, the same frequency and intensity of storms and flooding that impact the Bay Shoreline impact the CCSA. In addition, a large commercial marina, Shoal Harbor, is located at the mouth of Compton Creek (USACE 1997a). All of the structures located south of the shore are within the 500-year flood zone, and a majority is located within the 100-year flood boundary. Emergency access to the area has been enhanced through recent road improvements by Middletown Township to Port Monmouth Road, Church Street, and Broadway.

3.3.9.2 Floodplain Values

The floodplain values associated with Compton Creek are similar to those associated with the Pews Creek, as discussed in FEIS Section 3.2.9.2. However, the floodplain of Compton Creek contains 84 acres of jurisdictional, salt marsh wetlands, which the NJNHP has identified as being rare in New Jersey, and has included these wetland communities in the *Priority Wetland List* (USEPA 1989).

3.3.10 Coastal Zone Management

A discussion of relevant coastal zone management regulations in CCSA is provided in FEIS Section 3.1.10.

3.3.11 Hazardous, Toxic, and Radioactive Waste

As described in FEIS Section 3.1.11, hazardous waste contamination is present in the Hudson-Raritan Estuary. Contamination transport may be enhanced during tidal fluctuations and severe flooding events that may occur in Compton Creek (Squibb *et al.* 1991).

A HTRW PA was conducted by the District to identify potential HTRW concerns. The PA concluded that there were no HTRW concerns (see USACE, CENAB letter dated October 19, 1995 in FEIS Appendix D).

3.3.12 Navigation

The Shoals Harbor Marina is located at the mouth of Compton Creek, as described above in FEIS Section 3.1.12. The practical, upstream limits of navigation for small, recreational vessels is the Church Street bridge at high tide.

The mouth of Compton Creek is a Federal Navigation Project (USACE 1993a). Between 1937 and 1990, 1,336,812 cubic yards of dredged material were removed from Compton Creek, most of which was deposited offshore (USACE 1993a).

3.3.13 Aesthetics and Scenic Resources

Currently the aesthetic and scenic resources within the CCSA consist mainly of an open salt marsh ecosystem. Individuals currently experience an unimpeded view of the salt marsh.

3.3.14 Recreation

In the CCSA, the majority of the tidal wetlands surrounding Compton Creek are owned by either Monmouth County or the Town of Middletown for the purpose of recreation and conservation/preservation use (Wickham 1997a and 1997b). In addition, although the marina located on Compton Creek supports primarily commercial fishing vessels, it also provides facilities for some recreational boating use.

The Bayshore Trail diverts from the beach area southward to cross Compton Creek along Main Street in Belford. This segment of the trail incorporates views of Belford fishing boats and other marine-related activities in the Shoal Harbor historic District, which are highlighted points of interest in the Bayshore Waterfront Access Plan. In addition, a bike trail associated with the Bayshore Bike Trail system crosses Compton Creek along an abandoned railroad right-of-way near the Church Street bridge, and the Henry Hudson Bike Trail crosses the creek further south along another abandoned railroad bed (Monmouth County Planning Department 1989).

The closest town park to the CCSA is located on Griggs Avenue, and includes a baseball field and open space play areas approximately 300 ft west of the creek's tidal wetlands.

3.3.15 Transportation

The main transportation routes in the CCSA include Port Monmouth Road, Broadway, Church Street, and two Main Streets (one west of Compton Creek in Port Monmouth, the other east of the creek in Belford).

Roads that would cross the proposed levee include Port Monmouth Road, Broadway, Campbell Avenue, and the Henry Hudson Bike Trail.

3.3.16 Air Quality

A general description of the existing air quality for the Project area is provided in FEIS Section 3.1.16.

3.3.17 Noise

A general description of the existing noise conditions for the Project area is provided in FEIS Section 3.1.17.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 BAY SHORELINE STUDY AREA

4.1.1 Topography, Geology, Sand Source, and Soils

Impacts on geology, topography, and soils as a result of dune fortification and maintenance at the BSSA would be minimal, whereas periodic beach nourishment would represent a minor, long-term impact on topography and soils. No impacts on geology would occur because bedrock elevations would be below the depth of proposed fill and periodic beach nourishment at the BSSA.

Topography at the BSSA would be permanently impacted by refortification of the existing dune and berm as the placement of sand, during initial nourishment, would increase the current elevation to +16 ft NGVD along the approximately 2,640-foot-long line of protection. Sand will be placed on top of the existing dune and in the surf-zone and intertidal area. Beach renourishment would involve the periodic placement of sand on the BSSA beach. Sand initially will come from an existing permitted and authorized offshore borrow area known as the Sea Bright borrow area. Impacts that are associated with the removal of sand located in the Atlantic Ocean have been addressed under a separate NEPA document. However, the District is currently investigating other potential offshore sand sources and impacts associated with these potential offshore sand sources will be assessed under a separate NEPA document. The material to construct the levees will come from an existing facility that is fully permitted and authorized to provide the appropriate clean material. Appropriately, impacts have been fully addressed to obtain the necessary permits.

Soil erosion and sedimentation would be minimized during construction through the use of a soil erosion and sediment control plan. No significant or long-term impacts would occur on native soil grain size, structure, nutrient status, or organic matter content, because only clean sand will be used for dune and berm replenishment and floodwall construction. Dune and berm maintenance would result in a long-term reduction in soil erosion along the Bay Shoreline, and periodic beach renourishment would offset the long-term beach retreat rate of about 2.7 ft per year.

4.1.2 Water Resources

4.1.2.1 Regional Hydrogeology and Groundwater Resources

Fortification and maintenance of the BSSA dune, as well as periodic beach nourishment, would have no impact on regional hydrogeology and groundwater resources.

4.1.2.2 Tidal Influences

Fortification and maintenance of the BSSA dune, as well as periodic beach renourishment, would have no impact on tidal influences.

4.1.2.3 Surface Water

Fortification and maintenance of the BSSA dune, as well as periodic beach renourishment, are expected to have minimal short-term impacts on surface water during the placement of sand. It is anticipated that increased turbidity will be limited to the immediate placement site.

4.1.3 Vegetation

The restoration of the existing dune and associated shore protection measures will temporarily impact approximately 18.46 acres along the bay shoreline. However, the majority of these impacts (12.76 acres) involve the placement of sand on the existing beach. The remaining 5.70 acres of impacted areas consist of disturbed and developed areas, and upland vegetation. Following construction of the selected plan, the District will revegetate the fortified dune with native plant species (USACE 1998b). Therefore, no long-term impacts to vegetation in the BSSA are anticipated.

4.1.3.1 Wetlands

No jurisdictional wetlands were located in the BSSA (USACE 1997b), as a result, there will be no impacts to wetlands in the BSSA.

4.1.3.2 Uplands

Approximately 5.70 acres of upland vegetation would be temporarily disturbed during construction. Impacts would include removal of existing vegetation and the placement of sand to restore the dune. Following construction, these upland areas would be stabilized and revegetated with native plant species.

4.1.4 Wildlife

The effects of the selected plan on wildlife resources in the study area would include both short and long-term direct and indirect impacts. The primary short-term direct impact to wildlife would be temporary displacement of mobile species and possible mortality of less mobile species during construction. Long-term effects to wildlife would be related to the conversion of the existing upland habitat to dune and berm habitat.

4.1.4.1 Fish and Shellfish

The selected plan is expected to have an indirect, short-term, impact on fish species in the immediate Study area. Motile species would likely avoid burial during beach nourishment by relocating outside of the placement area. However, the potential for some fish mortality may exist. Demersal fishes (*e.g.*, winter flounder, windowpane, summer flounder) would be temporarily displaced until appropriate invertebrate species return to the area. Resident fish are expected to feed in surrounding areas, and therefore be relatively unaffected by temporary, localized, reductions in available benthic food sources. The District is in the process of preparing Essential Fish Habitat Assessment to characterize finfish utilization of the nearshore areas and to identify potential impacts associated with the implementation of the selected plan. The District intends to forward the EFH report the NMFS upon its completion, which is expected to be in the very near future.

The selected plan is expected to have a direct, short-term, impact on shellfish within the placement area. Sessile benthic shellfish that are present in the immediate placement area during construction activities (such as Razor clam (*Ensis directus*), blue mussel, and coquina) would potentially be buried during initial beach nourishment and subsequent renourishments. However, no shellfish with significant commercial or recreational importance were identified in the placement area. Motile shellfish would avoid the placement area during active nourishment and therefore would not be impacted.

Long-term beneficial impacts to horseshoe crabs in the Bay Shore area are expected to result from the construction of the selected plan. The USFWS's Horseshoe Crab Habitat Suitability Index Model, identifies four habitat variables necessary for horseshoe crab spawning: depth of sand over peat, sediment moisture, beach slope, and grain size (Brady 1997). The implementation of the selected plan will maintain or improve the value of each variable for the horseshoe crab and will therefore increase suitability of the area for horseshoe crab spawning. Preliminary research conducted by the Delaware Coastal Management Program on beaches in the Delaware Bay indicates that almost no horseshoe crabs will spawn in the Project area during the first season after fill placement, but that spawning may be moderate in the second season, and maximized by the third season (Carter 2000). This improvement will lead to increased utilization by crabs, and result in an increased number of eggs available for consumption by migratory shorebirds.

Placement of beach sand will cause a short-term increase in turbidity, and will relocate the subtidal and intertidal zones further offshore. Sessile shellfish, such as razor calm and blue mussel, have been documented to rapidly recolonize the new substrate from surrounding areas (Wilber and Clarke 1998). Accordingly, any short-term reduction in feeding efficiency and localized mortality should be offset by the rapid recolonization in the new substrate, and there may be benefits associated with placement of a higher quality benthic substrate material.

No long-term adverse effects to fish and shellfish are expected from the selected plan.

4.1.4.2 Benthos

The selected plan is expected to have a direct, short-term impact on benthic resources. Beach nourishment is expected to smother benthic organisms causing their mortality. However, once buried, some mobile shellfish species and polycheate (segmented) worms have the ability to burrow upwards and survive. The recovery of benthic resources to pre-construction conditions should occur shortly after construction (USACE 1995). A benthic monitoring plan will be implemented to quantify impacts, determine recovery rates, and characterize the recolonized benthic community during each renourishment. Impacts are expected to be similar to impacts of initial nourishment. Appropriately, subsequent recolonization rates would be similar to that following the initial beach nourishment.

Benthic resources would begin to recolonize along the placement area immediately following the completion of each construction reach, and populations are expected to revert to pre-construction levels. Infaunal organisms are likely to recolonize the area from nearby communities and should re-establish to a similar pre-construction community. However, it is possible that the benthic community species composition might be slightly different than the pre-construction composition (USACE 1996a). For some pioneer species, initial nourishment and subsequent renourishments present an opportunity to move into the area and colonize available space. The softshell clam and blue mussel are two opportunistic species that are expected to disperse into open spaces created by beach nourishment.

In order to quantify the impacts to benthic resources in the Project area, the District proposes to conduct seasonal benthic surveys to characterize benthic communities before, during, and after construction. In addition, the survey data will be used to document the rate of recolonization and the composition of the benthic community in the Project area at various points in time.

4.1.4.3 Reptiles and Amphibians

Fortification of the dune is not expected to affect any reptile and amphibian habitat in the BSSA.

4.1.4.4 Birds

Birds in the BSSA would be temporarily affected by the selected plan. During construction, increased noise and heavy machinery activity could cause displacement of individuals and nesting failure or disruption in the vicinity of construction. Species that use the existing dune, such as common terns (*Sterna hirundo*) and sanderlings (*Calidris alba*), may be permanently displaced if the habitat is allowed to continually erode, therefore the wider beach would increase the available habitat.

Benefits to birds are anticipated from the expansion of the existing dune by increasing potential habitat for species that require dense, low growing shrubs. In addition, the implementation of the selected plan will create a much wider beach, that can provide more roosting space for wintering waterfowl and increase the amount of potential nesting habitat for shorebirds and seabirds such as the Federally- and state-listed threatened piping plover, the state-listed endangered least tern (*Sterna antillarum*) and the state-listed endangered black skimmer (*Rynchops niger). In* addition, the wider beach and enhanced intertidal habitat is likely to improve horseshoe crab spawning, resulting in an increased number of eggs available for consumption by migratory shorebirds.

4.1.4.5 Mammals

Fortification of the dune could directly result in displacement and mortality of individuals of less mobile species of small mammals, but impacts are expected to be minimal.

The effects of cover type conversion would benefit mammals, such as red fox and eastern cottontail, which require the type of cover that the new vegetation would provide.

4.1.5 Threatened and Endangered Species/Communities

4.1.5.1 Federal Species of Concern

There would be no impacts to any Federally-listed endangered or threatened species from construction and maintenance of the dune and beach nourishment at the BSSA (Staples 1998). Qualified sea turtle monitors will be present if a hopper dredge is used between June 15 and November 15.

Beneficial, long-term impacts to the Federally-threatened piping plover (*Charadrius melodus*) may result from the expansion of the existing dune and beach habitat. For example, the conversion of grass/herbaceous cover type to dune habitat, and the addition of several acres of sand, as outlined in FEIS Section 4.1.3, could provide substantial nesting habitat for this particular species (USFWS 1997).

4.1.5.2 State Species of Concern

There would be no impacts to any state listed endangered or threatened species from fortification and maintenance of the dune at the BSSA (Breden 1992).

Beneficial, long-term affects to the state-endangered least tern (*Sterna antillarum*) may result from the expansion of the existing dune and beach habitat. For example, the conversion of 2.57 acres of grass/herbaceous cover type to 6.75 acres of dune habitat and the addition of 12.6 acres of sand, as outlined in FEIS Section 4.1.3, could provide substantial nesting habitat for this particular species (USFWS 1997).

4.1.6 Socioeconomics

4.1.6.1 Demographic Characterization

The selected plan will neither induce growth nor inhibit growth of existing or future demographic characteristics in the BSSA because the area is almost completely developed, with no real potential for significant expansion. Furthermore, the selected plan will have no impact on the number, density, or racial composition of residents living within the Project area.

4.1.6.2 Economy and Income

The selected plan will have a positive direct economic impact on existing business in the Project area, due to reduced potential for future flood damages and due to improved accessibility to businesses during storm events. There also will be a minor, indirect beneficial economic impact on the local economy during construction of the selected plan as a result of the introduction of construction workers and the resulting purchase of supplies and food during the construction phase.

4.1.6.3 Housing

The selected plan will have a direct positive impact on housing and structures in the BSSA due to a reduction in potential flood damage to existing properties, and the subsequent reduction in associated costs to repair such damages. The selected plan also will have an indirect positive impact on residential property values in the Project area due to the increase in flood protection.

4.1.7 Cultural Resources

4.1.7.1 Cultural Resources Identification Process

As described in preceding sections that discuss cultural resources, one goal of activities undertaken by the Corps has been to bring the plans proposed as part of the Port Monmouth Combined Flood Control and Shore Protection Feasibility Study into compliance with the NHPA. Documentary research, field investigations, and consultation were undertaken as specified by the Advisory Council on Historic Preservation's regulations for implementing the NHPA (36 CFR Part 800).

As a preliminary step in the identification process, the Corps cultural resources staff reviewed all earlier cultural resources investigations conducted within and in areas adjoining the study area. It was then possible for the Corps to identify many known National Register listed or National Register eligible cultural resources within the Project's APEs prior to initiating its own field investigations. These investigations also provided information that became the basis for evaluating areas not examined during the previous surveys. Using data from earlier reports, and supplementing the data with additional map and documentary research and pedestrian reconnaissance of the entire Project area, it was possible to predict overlaps between Project APEs and areas sensitive for Native American or historic period archaeological sites, or areas that might contain historic structures. Further information was obtained by coordinating with state and county agencies and with local historians.

An intermediate identification step was to compile sensitivity rankings of each Project component's APE. Each APE was ranked as low, moderate or high for the probability of encountering buried evidence of Native American or historic period occupations. Following this, areas of moderate to high archaeological sensitivity were subjected to a program of subsurface testing. Low probability areas were not tested.

As a result of the research described above, historic structures have been identified, photographed, and described in narrative text. These include structures that are listed on the National Register, structures that are considered eligible for listing on the National Register as a result of formal determination procedures, and structures that have not been formally evaluated but appear to be of historic interest.

Agency coordination to date has focused on the Seabrook-Wilson House, which is listed on the National Register of Historic Places and on Site 28-Mo-272, a Native American Woodland Period archaeological site Details of this coordination are described below.

4.1.7.2 Project Effects upon Native American Archaeological Sites

Prior to the present field investigations, no Native American archaeological sites were known to exist within any or adjoining APEs of Project components. Porter *et al.* (1994:46,56, 66-69) found prehistoric material in the vicinity of Church Street/Compton Creek Bridge and Broadway. However this material was in a disturbed context and was not considered to constitute an archaeological site warranting further evaluation. Present Project efforts were thus directed towards identifying unknown sites.

During subsurface testing conducted for this Project, evidence of Native American occupation was found in an area that crosscuts the APEs of the northernmost C2 ponding area/interior drainage facility and the portion of the Compton Creek levee that parallels it, extending southeast from the intersection of Main Street and Broadway. These Project elements were evaluated as high and moderate probability areas, respectively. The artifacts recovered included lithic material and several sherds of sand-tempered pottery. The presence of pottery suggests that this site, assigned Smithsonian Site Registration program number 28-Mo-272, may be a Woodland Period site. Such sites are rare in Monmouth County (Porter *et al.* 1994:16). The site's extent is unknown. Further evaluation is required in order to assess its size and National Register eligibility. Construction of a levee or ponding area at this location would adversely affect the site. At the present time, the Corps has replaced the C2 ponding area with an interior drainage facility. The effect of temporarily impounded water upon the site has yet to be determined. However, the Compton Creek levee is still in place. All further work at this location will be coordinated with the NJHPO, as part of Section 106 compliance for the Project.

4.1.7.3 Project Effects upon Historic Period Structures and Archaeological Sites

Cultural resources investigations were directed towards identifying previously unknown sites and structures. These efforts also sought to evaluate known sites and structures located within the APEs of Project components. The latter included the National Register listed Seabrook-Wilson House and a segment of the Raritan and Delaware Bay Railroad.

Initially, the shore protection component of the Project called for the construction of a seawall in the vicinity of the Seabrook-Wilson House. Early versions of the Project proposed a seawall that would crosscut the rear yard of the house approximately 25 feet from the structure's northern wall. The seawall would also have enclosed the western and eastern boundaries of the property. Such plans, it was recognized, would adversely affect archaeological deposits associated with the historic occupation of the house, as well as the historic landscape. As part of Section 106 compliance, these plans were forwarded by the Corps to the NJHPO and to Gail Hunton, Historic Preservation Specialist, MCPS, for review and comment (see copies of Section 106 correspondence which are included in Appendix F). Correspondence accompanying the plans explained that the Corps was considering revising the plans in order to minimize impacts to cultural resources.

Comments were received from the NJHPO and from the MCPS. The former was dated April 21, 1998. In their comments, the NJHPO concurred that "construction of the floodwall in the rear yard of the house would affect character defining features of the historic setting and would be likely to affect contributing archaeological deposits." Furthermore, the NJHPO supported the Corps' proposed revision of the original plan, which, in their words, would entail "a shift of the segment of the levee and floodwall/seawall that extend through the rear yard to a location beyond the yard and into the current beach zone." They also supported the Corps' plan to "consider shifting adjacent eastern and western segments further away from the house [because] these shifts would result in avoiding effects to contributing archaeological deposits, and minimizing visual effects to this historic property."

The MCPS's comments were in the form of a memorandum drafted by Gail Hunton, Historic Preservation Specialist, dated April 3, 1998. Her concerns were similar to those of the NJHPO. She also recommended shifting the alignment of the seawall to a point north of the existing fishing pier parking lot. This revision, she explained, would minimize impacts to both the archaeological deposits and the historic landscape. Her letter contained comments on the appearance of proposed seawall. She stated that these were based upon a description of a structure "constructed of steel sheet piles and poured concrete encased in sand, with a footprint not to exceed 3 feet and a typical wall height of 4 to 5 feet above existing grade." Because the structure would be "sand-encased" with "dune stabilization plantings," she concluded that it would "represent a naturalistic dune in its finished appearance." Ms. Hunton requested that the overwalks' locations be coordinated with the Parks System's plans. She cautioned that "impacts on the landscape cannot be fully evaluated until additional information is provided." The requested items include "a sectional view at the house, extending from the road to the beach, showing existing/proposed elevations and construction details of the seawall and reconstructed dune."

The plan now selected by the Corps has eliminated the seawall element of the shore protection plan. This plan includes a reconstructed dune located beachward of the northern limits of the Seabrook-Wilson House's yard. The western limit of the reconstructed dune includes a north/south aligned segment that ties into a levee associated with the Port Monmouth Road floodwall. This portion of the shore protection plan is located more than 200 feet west of the fishing pier parking lot. Adverse effects are thus not anticipated here. The eastern limit of the reconstructed dune also includes a north/south aligned segment that ties into the northern terminus of the Compton Creek levee. This element is located more than 1600 feet east of the Seabrook-Wilson House. No adverse effects are anticipated. In correspondence dated August 7, 1998, the NJHPO concurred with this finding.

A small segment of the National Register eligible Raritan and Delaware Bay Railroad main line fill embankment falls within the APE of a section of the Compton Creek levee. The latter extends along the rear property lines of a series of homes located on the southern edge of Park Avenue. In its entirety, the railroad embankment is a uniform linear feature measuring approximately 4500 feet. It has been subject to archaeological excavation in the course of Section 106 compliance for Projects conducted by other agencies (Porter *et al.* 1994:69-82). Above ground features have been the subject of HABS/HAER level mitigation recordation (NPS Project #1530, HAER No. NJ-117). No adverse effects are anticipated. In correspondence dated August 7, 1998, the NJHPO concurred with this finding.

4.1.7.4 Further Analysis of Project Affects

It is recommended that additional excavations be conducted within the portion of the Compton Creek levee and northernmost C2 ponding area/interior drainage facility APEs located immediately to the south of the intersection of Main and Broadway. The area contained evidence of a prehistoric site (Smithsonian Site Registration Program Number 28-Mo-272). The presence of pottery among the artifacts recovered suggests that the site may date to the Woodland Period and may thus be significant because of the paucity of such sites within coastal New Jersey. Data generated as a result of the additional excavations must be sufficient to evaluate site's eligibility for listing on the National Register of Historic Places. In a letter dated August 7, 1998, the NJHPO concurred with this recommendation, stating that " [t]his site should be the subject of Phase II archaeological work sufficient to determine the site limits and enable a well founded assessment of the National Register eligibility." It is also recommended that shovel testing be conducted to the south of this area, within the APEs of the southernmost C2 ponding area/interior drainage facility and the portion of the Compton Creek levee that adjoins it, areas that were not tested during the present investigation.

As stated above, several APEs of the Pews Creek levee/floodwall Project element adjoined historic houses and contained areas that were archaeologically sensitive. The element was eliminated from the Project design after the investigations had been initiated. If any further revisions to the Project design occur, or if these elements or components are reincorporated, additional studies will be conducted.

Results of the present investigation have been presented in a detailed report submitted to the NJHPO office in Trenton and to the MCPS. All outstanding issues, including more detailed evaluation of resources, will be addressed during upcoming Project phases.

4.1.8 Land Use and Zoning

Construction, operation, and maintenance of the dune and berm and periodic dune renourishment will not have any direct or indirect impacts on the existing land use and zoning in the BSSA. The proposed dune fortification and beach nourishment will involve a total of approximately 16.22 acres in permanent easements, but the existing land use in the area will not change as a result of the selected plan. Zoning designations will not be changed, nor will any homes or businesses be removed or displaced.

Because much of the beach front associated with the BSSA is owned by Monmouth County, the dune restoration plan must be submitted to the county for review and approval prior to construction of the selected plan, as well as to the NJDEP and the CAFRA (Mercantante 1997).

4.1.9 Floodplain

4.1.9.1 Flooding Events

The construction of the dune and berm will result in both temporary and permanent benefits. Temporary benefits will include the replacement of dune material lost due to wave action and storm surges by the application of about 357,000 cubic yards of sand for initial dune restoration.

Permanent benefits will include the reduction in the frequency and severity of flooding due to storm surges. The estimated 100-year storm event flood stage calculated by CERC models is +12.2 ft NGVD (USACE 1997a). Accordingly, the proposed dune elevation of +16 ft NGVD would absorb the energy and reduce the flood damage associated with a 100-year storm event. Limited renourishment of the dune and berm will take place every 10 years after dune and berm construction. This activity will result in minor disturbance to the existing vegetation with subsequent dune stabilization and revegetation.

4.1.9.2 Floodplain Values

The restoration of the dune will result in both temporary and permanent impacts to floodplain values. The temporary impacts will include the displacement of wildlife habitat, loss of recreational opportunities during the construction period, and the potential for erosion and sedimentation should a flood event occur during the construction period. The impact to wildlife habitat is low because existing wildlife habitat within the BSSA is of low value, as it is fragmented and subject to relatively high levels of disturbance. Public access to the beach would be temporarily impeded during the construction period because public parking areas could be used as staging areas for construction equipment.

Restoration of the dune and construction of the berm would permanently enhance certain floodplain values, including storm surge protection, recreational opportunities, and wildlife habitat. Increased storm surge protection will result through the initial dune restoration and berm construction through periodic dune renourishment. Recreational opportunities will be enhanced due to increased public access to a wider recreational beach. Wildlife habitat will improve as a result of planting vegetation beneficial to wildlife.

4.1.10 Coastal Zone

In conformance with the established policies of New Jersey's Coastal Zone Management Program, the District has determined that the selected plan is consistent with *New Jersey's Rules on Coastal Zone Management*. For further discussion see FEIS Appendix C.

4.1.11 Hazardous, Toxic, and Radioactive Wastes

There are no impacts to HTRW (see USACE, CENAB letter dated October 19, 1995 in FEIS Appendix D).

4.1.12 Navigation

Long term impacts of dune fortification and beach nourishment have a potential to increase sedimentation due to erosion and longshore transport of beach nourishment material. The District evaluated the longshore transport of dune, berm, and beach material and concluded that no impacts to the Federal Navigation channel at Compton Creek would result from the selected plan. Based on the New York Harbor Chart (NOAA 1990), the selected plan would be constructed landward of all navigational aids.

The fortified dune and beach nourishment will not interfere with any recreational or commercial boat traffic. In addition, neither the existing marinas and docking structures (USACE 1993a), nor the proposed mixed-use development and ferry terminal near the mouth of Compton Creek (MCPB 1993) would be impaired by the initial restoration of the dune, subsequent dune renourishment, and berm construction.

4.1.13 Aesthetics and Scenic Resources

The BSSA has two areas of potential impact on aesthetic and scenic resources from the selected plan: visual impacts to scenic views of New York Bay and Harbor, along with associated fishing and boating activities along the Bay Shoreline; and visual impacts to the Spy House, a National Registry of Historic Places (NRHP) listed property. Visual impacts in both areas will be from inward- and outward-facing perspectives.

The Monmouth County Parks and Recreation Department has requested that shore protection structures preserve visual resources to be compatible with current and planned recreational use of the Project area (Wickham 1997a and 1997b). Fortification of the existing dune will be consistent with landform, vegetation, color, and scenery of the existing dune and beach landscape. This Project design will preserve aspects of the existing aesthetic and scenic qualities of the shore for visual enjoyment from both an outward-looking perspective across the water, and from an inland perspective from the shore. Dune restoration is also consistent with local concerns for preserving the aesthetic and scenic quality of the BSSA as identified by the MCPB (1993) and the Monmouth County Parks and Recreation Department (Wickham 1997a and 1997b). Access to the shore front will continue to be maintained by stairs and walkways across the dune, ensuring continuous availability of the shore for aesthetic and scenic enjoyment of the shore front area.

4.1.14 Recreation

A substantial portion of the BSSA from Wilson Avenue to Main Street is owned by Monmouth County specifically for recreational purposes as described in FEIS Section 3.1.14. In addition to general public recreational use of the beach front in this area, Monmouth County plans to develop the historic Whitlock/Seabrook Wilson House (*e.g.*, Spy House) Museum and adjacent areas into an intensively-used public recreation area as part of the Bayshore Waterfront Park. Recognizing the need to reduce damage caused by storms, impacts to recreational uses will be both short-term and long-term.

Long-term, permanent benefits to recreational uses will occur as a result of the protection of the Bay Shoreline from future potential storm-induced damages. Short-term impacts to recreational uses include limiting and/or blocking access to the beach front during construction activities. However, walkways will be constructed to provide permanent access across the restored dune to the beach. The restored dune and beach will ensure the long-term existence of the Bay Shoreline, and appropriately help to preserve future recreational uses (Coastal Planning & Engineering, Inc. 1993). Dune restoration will also provide protection for the continued recreational use of the historic Spy House Museum and adjacent areas. FEIS Section 3.1.13 also discusses this aspect of the Project.

4.1.15 Transportation

Restoration of the dune and construction of the berm will result in minor, temporary impact on traffic flow and volume associated with periodic use of area roads by construction equipment and workers' vehicles. In addition, if future renourishment involves transporting sand via trucks, there will be a temporary impact on local traffic resulting from a high frequency of truck traffic. Port Monmouth Road functions as the main arterial transportation route in this portion of the Project area. Three public Bayshore Waterfront Park access points (public parking areas) will most likely become staging areas during construction. The increase in vehicles due to the reduction in public parking, coupled with the introduction of large, slow moving construction vehicles will likely reduce traffic flow speed and increase volume. To help alleviate the impact from the construction phase of the selected plan, flagmen could be available and construction signs would be posted. Upon the completion of construction, the local transportation system is expected to return to pre-construction conditions.

Over the long term, the effect of the selected plan will improve transportation conditions during storms, including routine and emergency access to and from residences and businesses. Finally, the selected plan will reduce the incidence and cost of road damage caused by tidal flooding.

4.1.16 Air Quality

Construction and maintenance to fortify the dune and periodic beach renourishment would have no impact on air quality. A Clean Air Act, Statement of Conformity been signed by the District Engineer (see FEIS Appendix G). No short-term and long-term impacts to air quality will occur as a result of the implementation of the selected plan.

4.1.17 Noise

Construction to fortify the dune, and periodic beach renourishment activities would result in a temporary, but minor increase in noise generation as a result of the use of construction equipment. Construction of the selected plan would have no impact on noise.

4.1.18 Environmental Justice

In accordance with Executive Order 12898 (dated February 11, 1994) Federal agencies are required to identify and address the potential for disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations.

The neighborhoods within the Project area are not considered to be minority neighborhoods. According to the 1990 Census, only 2 % of the population residing within the Port Monmouth community consists of racial minorities. Therefore, the selected plan would not disproportionately affect minority populations.

Per capita income in this small community is lower than the county and state averages, and approximately 3.9 % of the population had incomes below the poverty level in 1989. However, the selected plan would have a beneficial impact on this low-income community by reducing future storm damages and their subsequent repair costs, and could potentially increase property values.

No adverse human health impacts are anticipated to result from the implementation of the selected plan. The selected plan would provide an increased level of flood protection to the Port Monmouth community, and residents would experience beneficial impacts in terms of protection of property and life. In addition, the selected plan would allow for improvement of the business and recreational amenities in the community. Therefore, no mitigation measures are required to address disproportionately high and adverse impacts to minority and low-income populations.

4.1.19 Unavoidable Adverse Environmental Effects and Considerations that Offset Adverse Effects

Dune restoration and beach nourishment would result in certain unavoidable adverse impacts on the environmental resources located within the BSSA. Temporary and localized adverse environmental effects that may occur in the BSSA during dune fortification and beach nourishment include: an increase in traffic volume, an increase in noise levels, an increase of sedimentation, disturbance of habitat and loss of less mobile wildlife, disturbance of existing vegetation, and disruption of aesthetic resources and recreational activities.

The implementation of the selected plan would result in numerous long-term beneficial impacts that would offset temporary adverse environmental impacts. These long-term beneficial impacts include an increase in property values due to reduced flooding concerns, a decrease in the cost of flood insurance, an increase in available recreational area, a decrease in significant tidal flood damages, and the restoration of a recreational beach and dune habitat for wildlife. Implementation of the dune and levee planting plans would offset direct impacts to wildlife habitat resources associated with installation of permanent flood control and shore protection structures.

4.1.20 Relationship Between Short-Term Uses of the Environment and Enhancement of Long-Term Productivity

The selected plan will entail a short-term commitment of resources, including construction equipment; construction materials; labor; public monies to fund the Project; and, equipment necessary for minimization and mitigation of environmental, ecological, and cultural resource impacts.

Areas within the BSSA will be subject to the removal of vegetation, disruption of natural habitat, and ground disturbance during construction activities. There will be a short-term disruption of transportation systems and infrastructure along roads in the Project area during construction and mitigation. There also will be a temporary disruption of the availability of recreational uses. These disruptions will preclude the use of local recreational facilities and transportation routes for local residents and tourists, and habitats by indigenous animal species. There may be a short-term loss of revenue as a result of decreased attraction for tourism, and a loss of business as a result of the use of alternate routes around the area.

To contrast this short-term commitment of resources, there are several long-term enhancements in productivity that will result from the selected plan. There will be beneficial impacts on the local economy such as decreased costs to local businesses as a result of reduced flood damages. There may also be an increase in scenic/recreational value and attraction to the area as a result of an enhanced beach and dune area and a decreased potential for flooding.

In the long-term, the selected plan is anticipated to facilitate a more economically and environmentally stable community, both in the immediate Project area and in the surrounding municipalities. Therefore, the long-term productivity of the overall region may experience benefits from this short-term use of the environment.

4.1.21 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resources would be committed to the BSSA by the District, the USACE, Monmouth County, and any involved local agencies and municipalities. Resources committed include construction and mitigation materials and costs; labor costs for planning the selected plan; natural resources such as soil, water, air; energy resources such as fossil fuels (gasoline, petroleum products, and lubricants) and electricity; and, land to accommodate the necessary flood control and shore protection structures.

Not all of these resources are irretrievable. The monies committed to the Project will be offset through savings in municipal, residential, and commercial flood damage costs in the future, and potentially through increased commercial success for the community as a result of a more safe and secure business area. This may also result in an increase in the revenues of the local municipalities in the event of increasing property tax values.

Investments of materials and disposable goods for the dune and berm, and associated environmental mitigation, will be an irretrievable commitment of resources. This commitment will enhance the success and diversity of wildlife and vegetation in the BSSA.

4.1.22 Cumulative Impacts

The implementation of the selected plan and other similar planned projects will significantly benefit the local residents by increasing storm protection throughout the RBSHB and reducing the amount of damage due to flooding and tidal surges. As a result, community costs associated with evacuations during flooding events and home repair will be reduced in the Port Monmouth area and emergency vehicle access will be improved. In addition, the construction of the selected plan, in conjunction with similar projects planned along the RBSHB shoreline are expected to facilitate the advancement of the Bayshore Waterfront Access Plan (MCPB 1993). The restoration of sandy beaches, where there is currently either no or minimal beach, will provide new and improved recreational opportunities, such as sunbathing and surf-fishing

Based on the HEP study (USACE 2000a) and mitigation report (USACE 2000b), the implementation of the selected plan and selected mitigation would improve the overall wildlife value (*i.e.*, species diversity and abundance) of the existing salt marsh habitats over the 50-year design life of the Project. The selected plan will result in approximately 15.27 more acres of salt marsh in the Year 2052 when compared to the No-Action alternative. Furthermore, the implementation of the selected plan and selected mitigation plan would increase black duck habitat quality by 0.78 HUs and marsh wren habitat quality by 0.96 HUs at the year of construction (year 2002). At year of 2052, black duck and marsh wren habitat quality would increase by 157.83 and 106.55 CHUs, respectively. In addition, black duck and marsh wren AAHUs values would increase by 3.16 and 2.13, respectively, at year 2052 when compared to the No-Action alternative. The selected plan is expected to have minimal impacts to natural resources in the regional area.

Potential beneficial cumulative impacts to horseshoe crabs and migratory shorebirds and seabirds may result from implementation of the selected plan. The initial beach restoration and renourishment, in conjunction with similar projects along the RBSHB shoreline, should increase the overall value of the bay to both horseshoe crabs and migratory shorebirds, including the Federally- and state-listed threatened piping plover, the state-listed endangered least tern and the state-listed endangered black skimmer. All three of these species prefer sandy shoreline for roosting, nesting, and breeding. The overall effects of beach nourishment projects along the RBSHB will add large areas of beach suitable for these species. Horseshoe crabs also prefer sandy beach for spawning, and the increased beach areas resulting from the implementation of the selected plan, as well as similar planned projects throughout RBSHB, should result in an overall added attraction to and utilization of the Bay for their spawning. Numerous species of migratory shorebirds utilize horseshoe crab eggs as a food source during migration. Accordingly, migratory shorebird and seabird use of the RBSHB may also increase.

Data collected during the District's proposed monitoring programs would contribute to the overall knowledge of the estuary, to include intertidal, and subtidal ecosystems that function in RBSHB. In conjunction with data gathered in other areas of the Bay from other projects, the level of knowledge is expected to contribute significantly to the overall understanding of the synergy among aquatic resources in the estuary. This knowledge may assist the development of sustainable management, preservation, and harvest planning for various stocks in the RBSHB.

The extent of proposed housing or other proposed structural development in the vicinity of the Study area has not been formally identified. However, based on the current land development practices, building construction is not permitted on the beach or dune areas where the selected plan will be constructed. Therefore, there are no known or expected cumulative impacts to dunes and beaches as a result of the implementation of the selected plan combined with other local development projects.

The construction of the selected plan and similar planned projects will contribute to a cumulative benefit to existing dunes around the RBSHB by acting as a buffer against wave attack, which will reduce the impact of waves to existing dunes. The addition of beach fill and the resulting expansion of beach width from this and similar projects in the RBSHB area will contribute to the overall stability and preservation of dune habitat around the RBSHB, and the protection of the natural resources that occur in the dune habitat.

Potential impacts to natural resources and navigation resulting from implementation of the selected plan may occur as a result of increased sedimentation. Placement of sand from the borrow area onto the beach will increase the amount of sand that is available to be transported along the shoreline, and potentially into navigation channels. Also, initial beach fill and subsequent renourishments will involve accelerated erosion during sediment sorting. Although the amount of additional sand being transported is not expected to be significant, there is a possibility that the combined effects of sand transported from the Port Monmouth project area and other similar projects may contribute to increased sedimentation in and around navigation channels. In the event that the selected plan contributes to impacts affecting navigation in the Bay channels, additional operation and maintenance (O and M) costs may be incurred.

The implementation of the selected plan in conjunction with similar projects in the RBSHB area may contribute to sedimentation and disturbance of intertidal and subtidal resources. Some mortality to fauna and epifauna will occur, but is expected to be minimal and take place only during construction. Cumulative impacts for the removal of sand from the Sea Bright borrow area were addressed in a separate NEPA document.

4.2 PEWS CREEK STUDY AREA

4.2.1 Topography, Geology, and Soils

Impacts on geology, topography, and soils as a result of storm gate, pump station, floodwall, and levee construction and maintenance at the PCSA are expected to be minimal. No impacts on geology will occur because bedrock elevations would be below the depth of proposed fill and structure foundations.

A change in topography would occur, but is expected to be minimal. Levee construction would involve the placement of 357,000 cubic yards of clean upland soil. The levee would be constructed to +14 ft NGVD. In addition, implementation of the selected mitigation plan would lower the surface elevation of approximately 12.80 acres 1 to 2 ft to establish salt marsh communities. These would be the only alterations to the existing topography within the PCSA.

Soil erosion and sedimentation would be minimized during construction through the use of a soil erosion and sediment control plan. In addition, erosion is expected to be minimal during construction because the surrounding topography is flat, reducing stormwater runoff capability. No significant or long-term impacts would occur on native soil grain size, structure, nutrient status, or organic matter content, because only clean material will be used for levee construction.

4.2.2 Water Resources

4.2.2.1 Regional Hydrogeology and Groundwater Resources

Storm gate closure is anticipated to have two beneficial impacts on the regional hydrogeology and groundwater resources of the site. First, storm gate closure may temporarily reduce the probability of saltwater contamination of groundwater. One of the most widespread water quality problems within the study site is saltwater intrusion into coastal aquifers (NJDEP 1995). Closing the storm gate at Pews Creek during heavy storm events could provide a temporary physical barrier to tidal surges, that may prevent or minimize the extent of saltwater intrusion into adjacent freshwater wetlands.

Second, temporarily holding storm water runoff within Pews Creek during heavy storm events could increase the freshwater recharge capacity of the Englishtown aquifer. Storm water retention on a temporary basis, may allow more freshwater to infiltrate into groundwater sources instead of discharging into coastal waters.

Construction and maintenance of the proposed storm gate, pump station, floodwall, and levee at the PCSA would have no adverse impact to regional hydrogeology and groundwater resources.

4.2.2.2 Tidal Influences

The District developed a tidal hydrodynamic model that compared the effects of a storm gate to the existing conditions. The model projected that the selected 40-ft storm gate in the open position would lower the mean spring high tide by only 0.72 inches and all other normal tidal events would be unaffected (USACE 1998c). Therefore, the effects of daily tidal exchange are expected to be minute. In addition, the storm gate will increase peak ebb tidal velocities potentially allowing more suspended sediments to be transported out of the salt marsh and into the RBSHB. As a result, the sedimentation rate of the salt marsh may be reduced.

Storm gate closure will have a direct impact on damage caused by flooding and storm events. The frequency and magnitude of tidal flooding within the PCSA and in adjacent local residential areas would significantly decrease.

The only indirect impact could be a localized reduction in the salinity of tidal water behind the storm gate when it is closed. However, the storm gate will be closed only during unusually heavy coastal storms, when the tide reaches +5 ft NGVD. For a more detailed discussion of storm gate closure procedures refer to Sections VI and VII in the Main Report. The potential alteration in salinity associated with the salt marsh is expected to be minute and short-term. Once the storm gate is open, normal circulation and tidal inundation patterns will be re-established at the next tidal exchange. The District proposes to monitor the tidal flow to acknowledge the predictions of the hydrodynamic model.

4.2.2.3 Surface Water

Surface water quality will be temporarily impacted during construction of the pump station, floodwall, storm gate, and levee because of increased suspended sediments in the water column. However, implementation of soil erosion and sediment control measures will minimize any adverse impacts. When the storm gate is closed, temporary impacts to salinity are expected to be minimal. See FEIS Section 4.2.2.2 for additional discussion.

4.2.3 Vegetation

The construction of the proposed levee, floodwall, pump station, and storm gate will directly impact 0.51 acres of vegetation (USACE 2000a). Following the construction, impacted areas would be stabilized and revegetated.

4.2.3.1 Wetlands

The construction of the selected plan will permanently impact a total of 0.42 acres of wetland habitat consisting of 0.27 acres of saltmarsh and 0.09 acres of wetland *Phragmites*. Implementation of the selected mitigation plan will restore approximately 12.80 acres of low emergent salt marsh habitat, of which 12.74 acres is currently dominated by *Phragmites* (USACE 2000b).

Through the use of the HEP process, the District was able to quantify project impacts and develop an appropriate mitigation plan. The black duck, marsh wren, and clapper rail are three species commonly associated with wetland habitats, and certain combinations of wetland habitat characteristics outlined within their respective HSI models will determine their abundance and distribution (USFWS 1980). Due to the selected species' preference of wetland habitats and the characteristics of the habitat variables used in the HEP process, the District believes that an overall assessment of wetland functions and values is an inherent part of the HEP assessment.

The habitat variables associated with the evaluation species used at Port Monmouth can be directly and indirectly related to some common wetland functions and values used in other assessment techniques such as the Wetland Evaluation Techniques (WET [Adamus *et al.* 1987]) and the Evaluation for Planned Wetlands (EPW [Bartoldus *et al.* 1994]). FEIS Table 8 outlines the various habitat variables measured and their relationships to common wetland functions and values. In addition to the variable description, the relationship between the variable and the resulting suitability index is indicated. This relationship can be used to demonstrate that the model interpretation of the

FEIS Table 8. HEP Species Habitat Variables and Their Relationship With Common Wetland Functions and Values.

Species/ Variable	Variable Description	HSI Model Relationship	Wetland Function or Value	Function and Value Relationship
Black Duck V5	Percent of each emergent and forested wetland cover types occupied by open water	Positive/Negative*	Sediment stabilization and nutrient retention	Positive/Negative*
Black Duck V6	Percent of open water substrate occupied by submergent vegetation	Positive	Primary production and nutrient retention	Positive
Black Duck V7	Percent of non–forested wetlands that supports > 750 snails/m^2	Positive	Water quality	Positive
Black Duck V8	Percent of total land and water area occupied by salt marsh	Positive/Negative*	Sediment stabilization and nutrient retention	Positive/Negative*
Marsh Wren V1	Growth form class of emergent hydrophytes	NA	Primary production and sediment stabilization	NA
Marsh Wren V2	Percent herbaceous canopy cover	Positive	Primary production and sediment stabilization	Positive
Marsh Wren V3	Mean water depth	Positive	Hydrology and sediment stabilization	Positive
Marsh Wren V4	Percent shrub canopy cover	Negative	Sediment stabilization	Positive
Clapper Rail V1	Percent of emergent and scrub-shrub wetland shoreline that borders flat to gently sloping banks or tidal flats exposed at low tide	Positive	Shoreline bank erosion control and sediment stabilization	Positive
Clapper Rail V2	Percent of the total land and water area that is emergent or scrub-shrub wetland	Positive	Sediment stabilization and nutrient retention	Positive
Clapper Rail V3	Percent of emergent or scrub-shrub wetlands that is within 15 m of tidally influenced waterbodies	Positive	Shoreline bank erosion control and sediment stabilization	Positive

* a threshold value is reached where the relationship is inversed

NA not applicable

relationship between the habitat variable's value to the particular species is equal to the interpretation of the relationship between the variable and a particular wetland function and/or value.

For example, Black Duck V6 is a positively correlated variable; habitat quality is increased in areas when the percent cover of submergent vegetation is increased. The function that submergent vegetation is playing on primary production also represents a positive correlation, since it is assumed that as submergent vegetation abundance increases so does the value of a wetland as a primary producer.

4.2.3.2 Uplands

Effects on the existing upland vegetation communities that occur in the PCSA are expected to be minimal, because only 0.09 acres of upland vegetation will be permanently converted to a maintained upland grass cover type. In addition, construction of the levee will create 0.40 more acres of upland. Temporary impacts will occur in areas that are used for construction work areas, access roads, and equipment staging.

4.2.4 Wildlife

4.2.4.1 Fish and Shellfish

Daily or seasonal migratory patterns of fish could be impacted by construction of the storm gate if anadromous species use Pews Creek. However, Pews Creek is not designated as a passageway used by anadromous fish. Long-term effects may include impacts to fish located on the protected side of the storm gate. Fish trapped on the protected side of the storm gate may experience mortality by being drawn through the pump intake during periods of operation. Impacts to shellfish are expected to be negligible, because shellfish are unlikely to occur in substantial numbers in Pews Creek and adjacent ditches.

4.2.4.2 Benthos

Impacts to benthic resources are expected to be minimal, because only 0.4 acres of suitable wetland habitat would be permanently converted to upland habitat due to the selected plan's construction. In addition, the benthic community may be impacted as a result of dredging activities in the storm gate area; however, recolonization of the area from adjacent undisturbed areas is anticipated. Temporary impacts also will occur as a result of construction in the adjacent wetland areas, but these areas will be stabilized, revegetated, and allowed to revert to their original cover.

In general, salt marsh communities support a greater diversity and abundance of benthic organisms than areas dominated by *Phragmites*. Accordingly, implementation of the selected mitigation plan will directly benefit benthic communities in the study area by restoring approximately 12.80 acres of low emergent salt marsh habitat, of which 12.74 acres is currently dominated by *Phragmites*.

4.2.4.3 Reptiles and Amphibians

The installation of the storm gate, pump station, floodwall, and levee in the PCSA may disrupt terrestrial migration patterns of reptiles and amphibians. However, this effect is expected to be minimal.

4.2.4.4 Birds

The construction of the storm gate, pump station, floodwall, levee, and mitigation is expected to provide long-term benefits to birds in the PCSA. According to the HEP study (USACE 2000a), there would be a decrease of 0.13 black duck and 0.26 marsh wren HUs in the PCSA during the year of construction (projected year 2002). However, the implementation of the selected project and selected mitigation plan will result in 2.69 more black duck HUs and 3.84 more marsh wren HUs in the PCSA during the year of construction.

The HEP analysis was completed using the District's PEM-projected future habitat conditions over the 50-year design life of the Project for the No-Action alternative, selected plan without mitigation, and the selected plan with mitigation. The PEM illustrates that long-term benefits to the black duck and marsh wren are expected. In particular, the District through habitat modeling using the PEM and HEP calculations determined that the conversion of 12.80 acres of wetland *Phragmites* to saltmarsh would be needed to offset the impacts associated with the project by the year 2052. In order to select the appropriate mitigation effort, the District implemented a step-wise procedure to determine the level of mitigation needed to offset impacted HUs. Using a range of mitigation acreages, the District calculated the available HUs at year 2052 for six mitigation scenarios: 25.60 acres (200%), 16.00 acres (125%), 12.80 acres (100%), 10.24 acres (80%), 6.40 acres (50%), and 3.84 acres (30%). The District determined that at year 2052, marsh wren HUs were almost (-0.33) compensated for with 6.40 acres of mitigation and that a net gain of 1.87 black duck HUs was still observed at the lowest level of 3.84 acres. Based on this evaluation, the District determined that at the year 2052 in terms of HUs the marsh wren is mitigated for at approximately 2:1 ratio (12.80 acres instead of the minimum required 6.40 acres) and the black duck is mitigated for at a greater than 3:1 ratio (12.80 acres instead of the minimum required <3.24 acres). In addition, at year 2052, there is a net gain of 5.49 black duck and 3.57 marsh wren HUs resulting from the selected mitigation effort. The selected plan with mitigation generated 103.08 black duck HUs and 100.85 marsh wren HUs in Year 2052; whereas, the No-Action alternative produced 98.17 black duck HUs and 95.23 marsh wren HUs. The PEM output and HEP calculations clearly illustrate that implementation of the selected plan with the selected mitigation benefits future wildlife habitat value in the PCSA.

Impacts to bird species may occur if construction activities are scheduled during the breeding season and are located near nests, resulting in either nest abandonment or clutch failure.

4.2.4.5 Mammals

Temporary disturbances, such as noise and increased construction traffic, would temporarily displace mammals from the construction work areas, but these individuals would return once construction activities cease provided suitable habitat exists.

Long-term effects of the Project include changes to vegetation cover types once construction is complete. Vegetation changes (see FEIS Section 4.2.3) would result in a loss of habitat for species that utilize *Phragmites* habitat and an increase in habitat for species that utilize salt marsh habitat.

4.2.5 Threatened and Endangered Species/Communities

4.2.5.1 Federal Species of Concern

There would be no impacts to any Federally listed endangered or threatened species from construction and operation of the storm gate, levee, or pump station at the PCSA (Staples 1998).

4.2.5.2 State Species of Concern

There would be no impacts to any state listed endangered or threatened species from construction and operation of the storm gate, levee, or pump station at the PCSA (Breden 1992).

4.2.6 Socioeconomics

4.2.6.1 Demographic Characterization

The selected plan will neither induce growth nor inhibit growth of existing or future demographic characteristics in the PCSA because the area is almost completely developed, with no real potential for significant expansion. Furthermore, the selected plan will have no impact on the number, density, or racial composition of residents living within the Project area.

4.2.6.2 Economy and Income

The selected plan will require a long-term commitment of agency staff to support O&M at the storm gate on Pews Creek. The Town of Middletown has indicated that O&M support staff at the Keansburg levee also could possibly support O&M at the proposed storm gate, potentially eliminating the need for the sponsoring agency to provide additional O&M staff.

The selected plan will have a direct positive economic impact on existing business in the PCSA due to reduced potential for future flood damages and to improved accessibility to businesses in the area during storm events. There also will be a minor, indirect beneficial economic impact on the local economy during construction of the Project as a result of the introduction of construction workers and the resulting purchase of supplies and food during the construction phase.

4.2.6.3 Housing

The selected plan will have a direct positive impact on housing and structures in the PCSA due to a reduction in the potential for future flood damage to existing properties, and the subsequent reduction in associated costs to repair such damages. The selected plan is also expected to have an indirect positive impact on residential property values due to the increase in flood protection.

4.2.7 Cultural Resources

Cultural resources impacts associated with the PCSA are discussed in FEIS Section 4.1.7.

4.2.8 Land Use and Zoning

Construction, operation, and maintenance of the storm gate, pump station, and levee is consistent with existing land uses, which include existing flood control, marina, and residential uses.

The Town of Middletown requires a town building permit for the construction and operation of the proposed storm gate and pump station. The proposed levee is exempt from the Town of Middletown requirement for formal review under the town zoning ordinance because the State of New Jersey will have a long-term, controlling interest in the properties affected by the selected plan (either through purchase of land or easements through properties). However, the Project's non-Federal sponsors (the State of New Jersey, Monmouth County, and Middletown Township) will be required to appear before the town zoning board to present the selected plan at a town meeting (Mercantante 1997).

4.2.9 Floodplain

4.2.9.1 Flooding Events

The construction of the storm gate, levee, and pump station will result in both temporary and permanent effects on the frequency and severity of tidal flood events. Temporary impacts would include short-term, direct elimination of flooding within temporary work areas due to the use of cofferdams and other dewatering measures. Following construction, these areas will be stabilized and seeded (USACE 2000b). In the absence of any additional disturbance, these areas will revert to their preconstruction condition.

Permanent effects associated with the operation of the storm gate and pump station will include long-term, direct reduction in the frequency and severity of tidal and fluvial flooding events and an increase in the duration of standing water in the central portion of the basin during storm events. The estimated 100-year storm event flood stage calculated by CERC models is +12.2 ft NGVD (USACE 1997a). The elevation of the closed storm gate would be +14 ft NGVD, with actual closure of the storm gate when the tidal elevation exceeds +5 ft NGVD. At this elevation non-residential and residential structures would be protected from flooding associated with a 100-year storm event.

4.2.9.2 Floodplain Values

The construction of the storm gate, levee, and pump station will result in minor, temporary and permanent direct impacts to wetlands, vegetation, and wildlife habitat. Minor, temporary direct impacts will include loss of wildlife habitat and salt marsh in construction work areas and access roads. Following construction, these areas will be stabilized and revegetated.

Permanent indirect impacts also would include a loss of flood storage capacity associated with the encroachment of the proposed development. In addition, the vegetation cover type conversion associated with changes in volume, salinity, and frequency of tidal flushing, will affect wildlife by reducing habitat quantity and quality for species that use *Phragmites* habitat, and increasing habitat quantity and quality for species that use salt marsh habitat.

4.2.10 Coastal Zone

Please refer to FEIS Section 4.1.10 for comments on Coastal Zone.

4.2.11 Hazardous, Toxic, and Radioactive Wastes

There are no impacts to HTRW (see USACE, CENAB letter dated October 19, 1995 in FEIS Appendix D).

4.2.12 Navigation

Impacts of the construction and operation of the storm gate and associated levee would include both temporary and permanent impacts. Temporary impacts would include the potential for a temporary increase in sedimentation due to erosion during construction of the storm gate and associated levee, and changes in sediment deposition. The implementation of the sediment erosion control plan during construction would reduce any potential impacts from erosion and sedimentation. Permanent impacts on the seaward side of the storm gate would include a potential increase of sediment deposition from seaward sources and a potential decrease in sediment deposition from landward sources. These changes would only occur during periods when the storm gate is closed to provide flood protection and fluvial stormwater storage.

Based on the New York Harbor Chart (NOAA 1990), the storm gate and associated levee would be constructed landward of all navigational aids in the PCSA. The selected plan will not interfere with any recreational or commercial boat traffic within the practical upstream limits of small recreational or commercial vessels. In addition, the existing marina and docking structures described by USACE (1993) would not be impaired by the construction of the storm gate and associated levee.

4.2.13 Aesthetics and Scenic Resources

Aesthetic and visual impacts resulting from the construction of the pumping station, storm gate, and earthen levee are expected to be of minimal significance to the surrounding natural and manmade landscape. The storm gate and pumping station structures will be consistent with existing man-made structures in the general vicinity and will result in very low levels of change in the surrounding landscape that will not attract undue attention.

The earthen levee will create a raised, curving, linear landscape element that is different from the surrounding natural environment, but resembles the raised linear landscape of the existing Keansburg Levee structure. Consistent with the visual appearance of the existing levee in the PCSA, the vegetation cover for the earthen levee will be different from the tidal wetland vegetation, creating a butt edge effect in both color and texture at the toe of the levee. This butt edge effect can be seen in photographs appended to *Wetland Delineation Report* (USACE 1997b). The differences in the form, line, color and texture of the levee will also serve to visually encapsulate the natural tidal wetlands landscape from certain isolated viewsheds or visual vantage points. However, the visual prominence and contrast of the levee with aesthetic and scenic views from panoramic perspectives will decrease as viewing distance from the levee increases.

Depending on negotiation strategies with local interested parties such as the MCPB and the Monmouth County Parks and Recreation Department, the new levee could also be used for walking and biking activities similar to those that currently take place on the existing levee. These activities would comply with the intent of the *Bayshore Waterfront Access Plan* by enhancing the use of the aesthetic and scenic qualities of tidal wetland vegetation and wildlife habitats in the PCSA through increasing the number of visual vantage points (along the top of the levee) from which to view these unique natural environments (MCPB 1993).

4.2.14 Recreation

The recreational use will be limited to short-term impacts in the direct vicinity of the existing Keansburg levee during construction of the storm gate and the pump station. There may also be temporary noise and visual impacts to recreational users of the Monmouth Cove Marina, which is located adjacent to the construction site.

There will be no long-term direct or indirect impacts to existing or planned recreational uses after construction of the proposed PCSA levee, floodwall, storm gate, and pump station. The storm gate will be located upstream from the Monmouth Cove Marina, thereby eliminating the potential for physical or visual obstructions to navigation between the marina and the RBSHB.

4.2.15 Transportation

The construction activities will result in minor, temporary impacts to traffic flow and volume. The proposed floodwall runs parallel to Port Monmouth Road, which functions as the main arterial transportation route in this portion of the study area. An increase in large slow-moving construction vehicles needed for construction will decrease traffic flow and may increase traffic volume in the area. To help alleviate the impact from the construction, flagmen could be available and construction signs will be posted. Upon completion of construction, no adverse impacts to local transportation systems would occur.

Conversely, the proposed floodwall along the north side of Port Monmouth Road will allow the roadway to remain accessible during storm and flood events, including routine and emergency access to and from residences and businesses. Access to the proposed storm gate for routine maintenance will be via the existing Keansburg and proposed levees. The proposed levees will serve as their own access. In addition, the selected plan will reduce the incidence and cost of road damage due to flooding.

4.2.16 Air Quality

The construction, operation, and maintenance of the storm gate, pump station, levee, and floodwalls is expected to have no impact on air quality. A Clean Air Act, Statement of Conformity has been signed by the District Engineer (see FEIS Appendix G). No short-term and long-term impacts to air quality will occur as a result implementation of the selected plan.

4.2.17 Noise

The construction of the storm gate, pump house, and levee would result in a temporary, but minor increase in noise generation as a result of the use of construction equipment. Maintenance and operation of the proposed storm gate, pump house, levee, and floodwalls is expected to have no impact on noise.

4.2.18 Environmental Justice

Refer to FEIS Section 4.1.18 for comments on Environmental Justice.

4.2.19 Unavoidable Adverse Environmental Effects and Considerations that Offset Adverse Effects

The construction of a storm gate, levee, floodwall, and pump station would result in certain unavoidable adverse impacts on the environmental resources. Initial construction activities primarily involve ground disturbance to accommodate permanent flood protection structures and an increase in elevation from the installation of levee and floodwalls. Temporary and localized adverse environmental effects that may occur during construction include: an increase in traffic, an increase in noise levels due to construction equipment, the temporary diversion and confinement of Pews Creek, an increase of sedimentation into Pews Creek during construction, loss of habitat and less mobile wildlife, disturbance of existing vegetation, disturbance of existing wetland ecosystems, and disruption of aesthetic, visual, and recreational resources. The implementation of the selected mitigation plan would minimize the severity of temporary adverse environmental impacts that may result from the construction of the selected plan.

The implementation of the selected plan would result in numerous long-term beneficial impacts that would offset temporary adverse environmental impacts. These long-term beneficial impacts include an increase in property value due to reduced flooding concerns, a decrease in the cost of flood insurance, an increase in available recreational area, an increase in viewing attraction of the salt marsh, a significant decrease in flood damage impacts, and the restoration of salt marsh ecosystem/vegetation that would subsequently provide valuable habitat for wildlife. The implementation of the levee planting plan and selected mitigation plan would offset direct impacts to wetland and wildlife habitat resources associated with the installation of permanent flood control structures.

4.2.20 Relationship Between Short-Term Uses of the Environment and Enhancement of Long-Term Productivity

The selected plan will entail a short-term commitment of resources, including construction equipment, construction materials; labor; public monies to fund the Project and to buy-out local properties; and, equipment necessary for minimization and mitigation of environmental impacts.

Areas within the PCSA will be subject to the removal of vegetation, disruption of natural habitat, and ground disturbance during construction. There will be a short-term temporary disruption of transportation systems and infrastructure along roads during construction. There also will be a disruption of the availability of recreational and scenic uses. These disruptions may temporarily preclude the use of local recreational facilities and transportation routes by local residents and visitors.

To contrast this short-term commitment of resources, there are several long-term enhancements in productivity that will result from the selected plan. After construction is completed, biodiversity is expected to increase as a result of implementing the selected mitigation plan. There also will be beneficial impacts on the local economy such as decreased costs to local businesses as a result of decreased damages due to flooding. There may be a greater attraction to the community, commensurate with a decreased potential for flooding. In addition, implementation of the selected mitigation plan (USACE 2000b) will increase the acreage of salt marsh in the PCSA, which will result in an increased diversity of wetland vegetation and wildlife resources.

In the long-term, the selected plan is anticipated to result in a more economically and environmentally stable community, both in the immediate Project area and in the surrounding municipalities. Therefore, the long-term productivity of the overall region may experience benefits from this short-term use of the environment.

4.2.21 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resources would be committed to the PCSA by the District, the USACE, Monmouth County, and any involved local agencies and municipalities. Resources committed include construction and mitigation materials and costs; labor costs for planning the Project; natural resources such as soil, water, air; energy resources such as fossil fuels (*i.e.*, gasoline, petroleum products, and lubricants) and electricity; and, land to accommodate the necessary flood control and shore protection structures.

Not all of these resources are irretrievable. The monies committed to the Project will be offset through savings in municipal, residential, and commercial flood damage costs in the future, and potentially through increased commercial success for the community as a result of a more safe and secure business area. This may also result in an increase in the revenues of the local municipalities in the event of increasing property tax values.

Investments of materials and disposable goods for the levee, floodwall, and storm gate associated environmental mitigation, will be an irretrievable commitment of resources. This commitment will enhance the success and diversity of wildlife and vegetation in the PCSA, and an increase in the amount of salt marsh in the area.

4.2.22 Cumulative Impacts

The implementation of the selected plan and similar projects will significantly benefit the local residents by increasing storm protection and reducing the amount of damage cause by flooding and tidal surges. As a result, community costs associated with evacuations during flooding events and home repair will be reduced in the Port Monmouth area as well as other communities along the RBSHB shoreline. In addition, properties that benefit from reduced flood damage are expected to increase in value.

The implementation of the selected plan, in conjunction with other projects in the area, is expected to benefit wetlands. The construction of flood control structures such as levees and flood walls are likely to reduce the spread of *Phragmites*, because they can function like a barrier across which the rhizomes that propagate *Phragmites* cannot spread. This will limit the encroachment of *Phragmites* into shoreline wetlands and salt marsh, and will facilitate the maintenance of more diverse and sustainable wetland ecology on the seaward side of the flood control structures. In addition, mitigation plans to offset impacts to wetlands would likely involve the conversion of wetland *Phragmites* to salt marsh. The implementation of several mitigation plans that involve the conversion of wetland *Phragmites* to salt marsh could improve the overall quality and value of wetlands in the region.

Overall, this project and similar flood protection projects along the RBSHB, can contribute to a more stable environment for planned growth and development as a result of reduced regional flooding concerns and expenses. Improvements to roads, culverts, and stormwater drainage systems should result from reduced flood damage to infrastructure. This may provide an opportunity for limited development that will yield increased commercial and residential revenues from taxes and reduced damage costs to infrastructure. Reduced regional flooding may increase emergency vehicle access, and overall efficiency of community emergency preparedness and response by creating a more stable infrastructure and minimizing delays due to flooded roads. Additionally, the construction of the flood control structures should reduce or inhibit development on the unprotected side of the structures, providing opportunities for permanent open space and the preservation of wetlands. This would contribute to the stated goal of the Bayshore Waterfront Access Plan, specifically the preservation of wetlands adjacent to Pews and Compton Creek (MCPB 1987)

The implementation of the selected plan and other similar projects in the area, may contribute to increased recreational opportunities. The construction of levees may provide additional areas for running, walking, and biking, which also complements the Bayshore Waterfront Access Plan

(MCPB 1987). Additionally, enhanced bird habitat may create additional attraction to the area for birdwatching. Overall, the interaction of multiple flood control projects in the area may contribute to an enhanced recreational value of the RBSHB.

Potential impacts may result from implementation of the selected plan in conjunction with local and regional projects. Specifically, the overall impact to aesthetic resources in the region resulting from implementation of several similar projects, and the construction of multiple flood control structures may impact the viewshed from the water and from the landward side of the structures. Impacts to wetlands on the protected side of levees and floodwalls result in *Phragmites* encroachment due to reduced tidal flushing. Significant cumulative adverse impacts to wetlands are not anticipated because mitigation to offset adverse impacts to wetlands is required. Additionally, potential impacts to some aquatic resources may result if access to Pews Creek, Compton Creek, or other local waterbodies is limited by flood control structures during storm events.

4.3 COMPTON CREEK STUDY AREA

4.3.1 Topography, Geology, and Soils

The construction and maintenance of the levee and floodwall would have minimal impacts on topography, geology, and soils. Refer to FEIS Section 4.2.1 for further discussion.

4.3.2 Water Resources

4.3.2.1 Regional Hydrogeology and Groundwater Resources

The construction and maintenance of the levee and floodwall would have no direct impacts on regional hydrogeology and groundwater resources.

4.3.2.2 Tidal Influences

As a result of the proposed installation of the levee drainage infrastructure installed within the interior drainage system flooding on the protected, residential side of the levee will be prevented. The levee drainage infrastructure will also temporarily prevent saltwater intrusion to areas on the protected side of the levee. More details are provided in FEIS Section 4.2.2.2.

4.3.2.3 Surface Water

The implementation of the levee and floodwall would reduce the frequency and severity of tidal flooding of residential areas on the protected side of the levee. In addition, construction and use of the interior drainage infrastructure will improve stormwater control and movement on the protected side of the levee. In addition, the levee and floodwall will significantly reduce the frequency and severity of water quality impacts currently experienced.

The overall hydraulic retention time of the Compton Creek interior drainage area would increase substantially if some potential sites are excavated as stormwater retention ponds. Constructed ponds would provide temporary storage for a greater volume of incoming stormwater than under current conditions, and thereby aid in flood control.

4.3.3 Vegetation

The construction of the proposed levee and floodwall will directly impact 8.75 acres of vegetation. In addition, the selected plan will indirectly impact 5.63 acres of wetland vegetation by isolating the areas on the landward side of the levee. The selected plan will impact a total of 14.38 acres of vegetation (see FEIS Table 9).

4.3.3.1 Wetlands

The construction of the proposed levee and floodwall will impact 12.34 acres of wetland. Although the isolated wetlands will lose their current salt water influence, these areas are low-lying depressions that are expected to collect surface water runoff from adjacent upland areas. Therefore, impacts associated with these areas include a change in vegetative cover type but not wetland function. The selected plan will involve the permanent conversion of 6.71 acres of wetland habitat into upland grass.

Beneficial impacts associated with the selected plan include the removal of 4.42 acres of *Phragmites*-dominated areas. In addition, the levee is expected to prevent the encroachment of *Phragmites* located on the landward side into the salt marsh. This expectation has been observed at the existing Keansburg levee located along Pews Creek.

Through the use of the HEP process, the District was able to quantify project impacts and develop the appropriate mitigation plan. The black duck, marsh wren, and clapper rail are three species commonly associated with wetland habitats, and certain combinations of wetland habitat characteristics outlined within their respective HSI models will determine their abundance and distribution (USFWS 1980). Due to the selected species' preference of wetland habitats and the characteristics of the habitat variables used in the HEP process, the District believes that an overall assessment of wetland functions and values is an inherent part of the HEP assessment.

The habitat variables associated with the evaluation species used at Port Monmouth can be indirectly related to some common wetland functions and values used in other assessment techniques such as the Wetland Evaluation Techniques (WET [Adamus *et al.* 1987]) and the Evaluation for Planned Wetlands (EPW [Bartoldus *et al.* 1994]). FEIS Table 8 (Section 4.2.3.1) outlines the various habitat variables measured and their relationships to common wetland functions and values. For example, Black Duck V6 is a positively correlated variable; habitat quality is increased in areas when the percent cover of submergent vegetation is increased. The function that submergent vegetation is playing on primary production also represents a positive correlation, since it is assumed that as submergent vegetation abundance increases so does the value of a wetland as a primary producer.

FEIS Table 9. Direct and Indirect Impacts to Vegetation Cover Types in the CCSA.

Cover Type	Abbreviations	Direct Impact (acres)	Indirect Impact (acres)	Total Impact (acres)
Wetlands				
Open Water	OW	0.10	0.38	0.48
Disturbed Wetland	WDST	0.01	0.41	0.42
Phragmites Wetland	WPH	3.58	2.97	6.55
Phragmites/Scrub-Shrub Wetland	WPHS	0.66	0.55	1.21
Salt Marsh	SM	2.26	1.06	3.32
Scrub-Shrub/Herbaceous Wetland	WSSH	0.02	0.02	0.04
Scrub-Shrub Wetland	WSS	0.08	0.24	0.32
Wetland Total		**6.71** [1]	**5.63** [2]	**12.34**
Uplands				
Disturbed Upland	UDST	0.22	0.00	0.22
Upland *Phragmites*/Scrub-Shrub	UPHS	0.24	0.00	0.24
Phragmites Upland	UPH	1.28	0.00	1.28
Forest/Scrub-Shrub Upland	UFSS	0.01	0.00	0.01
Scrub-Shrub/Herbaceous Upland	USSH	0.21	0.00	0.21
Herbaceous Upland	UHRB	0.08	0.00	0.08
Upland Total		**2.04**	**0.00**	**2.04**
CCSA Total		**8.75**	**5.63**	**14.38**

Source: Compiled by Northern Ecological Associates, Inc. 1998

1: Permanently lost wetlands

2: These wetlands will not be permanently lost and are expected to maintain wetland characteristics

The District is unaware of any existing process or rationale that is uniformly accepted, used, and/or agreed upon by regulatory and resource agencies that justifies an acreage based compensatory mitigation ratio. The results of the Mitigation Report (USACE 2000) and the rationale as discussed above, provide a quantitative assessment of habitat values that determine the appropriate acreage needed to offset direct and indirect wetland habitat impacts. Accordingly, the District believes that immediate and long-term impacts to the quality and quantity of wetlands habitats are fully compensated through implementation of the selected mitigation plan.

4.3.3.2 Uplands

The impacts on existing upland vegetation are expected to be minimal, because only 2.04 acres of upland vegetation will be permanently converted to a maintained upland grass cover type. In addition, construction of the levee will create 6.71 more acres of upland habitat in the wetland areas that are located in the proposed levee's footprint. Temporary impacts will occur in areas that are used for construction work areas, access roads, and equipment staging areas.

4.3.4 Wildlife

4.3.4.1 Fish and Shellfish

The footprint of the levee would convert a few mosquito ditches to upland, which would be unavailable to fish or shellfish. Relatively deep channels that provide drainage for storm gates associated with the levee would support open water habitat for a variety of fish. The bayward side of the levee would experience higher flood levels, which would increase flood depths and leave more pools of water once water recedes. This may trap some fish in the pools, providing a readily available food source for herons and shorebirds. However, only a minor number of fish are expected to be trapped in this manner, compared to the total population present in the area.

4.3.4.2 Benthos

Impacts to benthic resources are expected to be minimal, because only 6.7 acres of suitable wetland habitat would be permanently converted to upland habitat due to construction. Temporary impacts will also occur as a result of construction in the adjacent wetland areas, but these areas will be stabilized, revegetated, and allowed to revert to their original cover.

In general, salt marsh communities support a greater diversity and abundance of benthic organisms than areas dominated by *Phragmites*. Therefore, the reduction of *Phragmites* encroachment into the salt marsh over time will directly benefit benthic communities in the Project area. In particular, the implementation of the selected plan will result in 7.0 more acres of salt marsh habitat in the Year 2052 than the No-Action Alternative (USACE 2000a).

4.3.4.3 Reptiles and Amphibians

The primary impact the levee would have on reptiles and amphibians is the long-term conversion of habitat resulting from altered hydrology. Temporary displacement of individuals to nearby undisturbed areas may occur during construction. In addition, the installation of the floodwall and levee may disrupt terrestrial migration patterns of reptiles and amphibians. However, this effect is expected to be minimal.

4.3.4.4 Birds

The construction of the proposed levee and floodwall is expected to provide long-term benefits to bird species that favor salt marsh habitat because approximately 8.75 acres of *Phragmites* (wetland and upland) will be removed or isolated by levee construction, thus reducing its encroachment into the adjacent salt marsh ecosystem.

In addition the HEP analysis was completed using the District's PEM-projected future habitat conditions over the 50-year design life of the Project for the No-Action alternative, selected plan without mitigation, and the selected plan with mitigation. The PEM illustrates that long-term benefits to the black duck and marsh wren are expected. In particular, the District through habitat modeling and HEP calculations determined that 12.80 acres of mitigation would be needed to offset the impacts associated with the project by the year 2052. In order to select the appropriate mitigation effort, the District implemented a step-wise procedure to determine the level of mitigation needed to offset impacted HUs. Using a range of mitigation acreages, the District calculated the available HUs at year 2052 for six mitigation scenarios: 25.60 acres (200%), 16.00 acres (125%), 12.80 acres (100%), 10.24 acres (80%), 6.40 acres (50%), and 3.84 acres (30%). The District determined that at year 2052, marsh wren HUs were almost (-0.33) compensated for with 6.40 acres of mitigation and that a net gain of 1.87 black duck HUs was still observed at the lowest level of 3.84 acres. Based on this evaluation, the District determined that at the year 2052 in terms of HUs the marsh wren is mitigated for at approximately 2:1 ratio (12.80 acres instead of the minimum required 6.40 acres) and the black duck is mitigated for at a greater than 3:1 ratio (12.80 acres instead of the minimum required <3.24 acres). In addition, at year 2052, there is a net gain of 5.49 black duck and 3.57 marsh wren HUs resulting from the selected mitigation effort. The selected plan with selected mitigation generated 80.40 black duck HUs and 64.51marsh wren HUs in Year 2052; whereas, the No-Action alternative produced 79.82 black duck HUs and 66.56 marsh wren HUs.

Impacts to bird species may occur if construction activities are scheduled during the breeding season and are located near nests, resulting in either nest abandonment or clutch failure.

4.3.4.5 Mammals

During construction, mammals may be temporarily displaced as a result of increased construction traffic and noise. Temporary disturbance of vegetation in the construction work areas also would disrupt mammal use of these areas.

A long-term benefit of increased salt-tolerant vegetation, such as *Spartina alterniflora*, may create more suitable foraging habitat for species such as raccoon and fox. In addition, once the levee is completed and the construction area is restored, the levee would provide a suitable travel corridor for nocturnal species such as raccoons and striped skunks (*Mephitis mephitis*).

4.3.5 Threatened and Endangered Species/Communities

4.3.5.1 Federal Species of Concern

There would be no impacts to any Federally listed endangered or threatened species from construction and maintenance of the levee and floodwalls at the CCSA (Staples 1998).

4.3.5.2 State Species of Concern

There would be no impacts to any state listed endangered or threatened species from construction and maintenance of the levee and swing gates at the CCSA (Breden 1992).

4.3.6 Socioeconomics

4.3.6.1 Demographic Characterization

The selected plan may have an indirect positive impact on population growth in the CCSA. A large mixed-use development (condominiums, retail establishments, and a new marina) is proposed in the MC zoning district located on the west side of Compton Creek. Although this development has been in the proposal stage for nearly a decade, renewed interest may occur due to increased flood protection that will result from the selected plan. However, the selected plan will have no significant impact on the number, density, or racial composition of residents living within the Project area.

4.3.6.2 Economy and Income

Economic and income impacts for CCSA are similar to those described in FEIS Section 4.2.6.2.

4.3.6.3 Housing

Impacts to housing in the CCSA are similar to those discussed in FEIS Section 4.2.6.3.

4.3.7 Cultural Resources

Cultural resource impacts associated with the CCSA are discussed in FEIS Section 4.1.7.

4.3.8 Land Use and Zoning

The implementation of the levee and floodwall will have a direct positive impact on the existing residential areas, located adjacent to the CCSA and the Shoal Harbor District, by reducing the potential for future flood damages (USACE 1997a). The selected plan will have no impact on future development in the area of the proposed levee footprint because of the restrictions associated with current land use in the Project area. Existing wetlands already restrict extensive development in those areas that border Compton Creek. Construction of the levee and the resulting increase in flood protection would not significantly induce future development in residential areas adjacent to the CCSA, because these areas are currently almost fully developed.

The selected plan will not displace or remove any residences in the CCSA. However, the approximately 7,975-ft-long levee and floodwall footprint will be located in a residential area, and will require the acquisition of about 13.9 acres of easements for the levee and floodwall footprint.

The proposed levee is exempt from the Town of Middletown requirement for formal review under the town zoning ordinance because the USACE is a Federal agency that will have a long-term, controlling interest in the properties involved in the Project (either through purchase of, or easements through, properties). However, the Project's non-Federal sponsors will be required to appear before the town zoning board to present the selected plan at a town meeting (Mercantante 1997).

4.3.9 Floodplain

4.3.9.1 Flooding Events

Levee and floodwall construction and the diversion of stormwater runoff will result in both temporary and permanent impacts to the frequency and severity of tidal flood events. Permanent impacts associated with the operation of the levee will include long-term, direct reduction in the frequency and severity of tidal and fluvial flooding damages. At the proposed levee elevation of +14 ft NVGD, non-residential and residential structures located in the 283.2-acre developed portion of the CCSA would be protected from flooding associated with a 100-year storm event.

4.3.9.2 Floodplain Values

The construction of the storm gate, levee, and pump station will result in minor, temporary and permanent direct impacts to wetlands, vegetation, and wildlife habitat. Minor, temporary direct impacts will include loss of wildlife habitat and salt marsh in construction work areas and access roads. Following construction, these areas will be stabilized and revegetated.

Permanent indirect impacts would include a loss of flood storage capacity associated with the encroachment of residential and commercial development on the landward side of the levee and the loss of tidal wetland area.

4.3.10 Coastal Zone

Please refer to FEIS Section 4.1.10 for comments on Coastal Zone.

4.3.11 Hazardous, Toxic, and Radioactive Wastes

There are no impacts to HTRW (see USACE, CENAB letter dated October 19, 1995 in FEIS Appendix D).

4.3.12 Navigation

Impacts to navigation associated with the CCSA are discussed in FEIS Section 4.2.12.

4.3.13 Aesthetics and Scenic Resources

The Shoal Harbor District, a NRHP-eligible District located adjacent to the CCSA, introduces the potential for additional aesthetic and scenic impacts. The exact description of this District will be provided in the cultural resource investigation report for the selected plan. Depending on the nature of the Historic District and its proximity to the proposed levee, visual impacts are expected to be similar to those of the natural landscape described in FEIS Section 4.2.1, an apparent, but not necessarily dominant or intrusive, landscape element. For further discussion see FEIS Section 4.3.13.

Finally, the proposed levee would have no significant aesthetic or scenic impacts to the proposed future development of the CCSA by Monmouth County as described by Wickham (1997a and 1997b). The primarily business-oriented focus of these development efforts will direct attention locally and internally within these areas. Depending on proximity of these future development areas, the levee will be apparent in, but not visually dominant in or intrusive on, the surrounding natural and manmade landscapes.

4.3.14 Recreation

The proposed levee and floodwall will cross three designated recreation trails (see discussion in FEIS Section 3.3.14), including the Bayshore Trail, the Bayshore Bike Trail System, and the Henry Hudson Bike Trail (MCPB 1993). Short-term, direct impacts to recreational use of these trails will result from restricted access across construction work areas during construction activities. There will be no long-term direct or indirect impacts to recreational uses because the levee and floodwall have been designed to accommodate these recreational trails. Access along these trails will be fully restored to existing recreational uses after construction is completed.

A beneficial impact to recreational use may occur after construction of the levee by providing a recreational walking and biking trail, and therefore may provide an additional recreational amenity to the community.

4.3.15 Transportation

Construction of the floodwall and levee will result in a minor, temporary impact on traffic flow and volume during the construction period. The proposed levee/floodwall alignment parallels several roads (Willow Avenue, Creek Road, Woodstock Avenue, Main Street, and Park Avenue) which will be used as access roads during construction. Two 30-ft-wide by 8- to 8.5-ft-high swing closure gates will be built along the alignment, to control water in the event of a flood. To help alleviate the impact from the construction equipment, flagmen could be available and construction signs would be posted. Upon completion of construction, no adverse impacts to local transportation systems are anticipated unless a flood situation is encountered. In this case, the swing closure gates will close, thereby preventing traffic flow on Campbell Avenue and Broadway, which would be limited anyway due to their flooded condition. Accordingly, alternate access and evacuation routes of higher elevation will be used.

Conversely, construction of the selected plan will improve transportation conditions in the Project area during storm and flood events, including routine and emergency access to and from residences and businesses. In addition, the selected plan will reduce the incidence and cost of road damage due to flooding.

4.3.16 Air Quality

The construction and maintenance of the CCSA levee and floodwall would have no impact on air quality. A Clean Air Act, Statement of Conformity has been signed by the District Engineer (see FEIS Appendix G). No short-term and long-term impacts to air quality will occur as a result of implementation of the selected plan.

4.3.17 Noise

The construction of the levee and floodwall would result in a temporary, but minor increase in noise generation as a result of the use of construction equipment. After construction, maintenance and operation of the proposed levee and floodwall at CCSA would have no impact on noise.

4.3.18 Environmental Justice

Please refer to FEIS Section 4.1.18 for comments on the Environmental Justice.

4.3.19 Unavoidable Adverse Environmental Effects and Considerations that Offset Adverse Effects

The construction of the selected plan would result in certain unavoidable adverse impacts on the environmental resources located within the CCSA. Initial construction activities primarily involve ground disturbance to accommodate permanent flood protection structures and an increase in elevation from the installation of levee and floodwalls. Temporary and localized adverse environmental effects that may occur during construction include: an increase in traffic, an increase in noise levels due to construction equipment, an increase of sedimentation into Compton Creek during construction, loss of habitat and less mobile wildlife, disturbance of existing vegetation, disturbance of existing wetland ecosystems, and disruption of aesthetic, visual, and recreational resources.

The implementation of the selected plan is expected to generate numerous long-term beneficial impacts that would offset temporary adverse environmental impacts. These long-term beneficial impacts include a potential increase in property values due to reduced flooding concerns, a potential reduction in the cost of flood insurance, an increase in available recreational area, aesthetic enhancement of the salt marsh, a significant decrease in flood damage impacts, and the reduction of common reed encroachment into the CCSA salt marsh ecosystem.

4.3.20 Relationship Between Short-Term Uses of the Environment and Enhancement of Long-Term Productivity

The selected plan will entail a short-term commitment of resources, including construction equipment; construction materials; labor; public monies to fund the Project and to buy-out local properties; and, equipment necessary for minimization and mitigation of environmental impacts.

Areas within the CCSA will be subject to the removal of vegetation, disruption of natural habitat, and ground disturbance during construction and mitigation. There will be a short-term temporary disruption of transportation systems and infrastructure along roads in the study area during construction. There also will be a disruption of the availability of recreational and scenic uses in the CCSA. These disruptions will preclude the use of local recreational facilities and transportation routes by local residents and tourists, and habitats by indigenous animal species.

To contrast this short-term commitment of resources, there are several long-term enhancements in productivity that will result from the selected plan. There will be beneficial impacts on the local economy, such as decreased costs to local businesses as flood damages are reduced. There may also be a greater attraction to the community, commensurate with a decreased potential for flooding. In the long-term, the selected plan is anticipated to result in a more economically and environmentally stable community, both in the immediate Project area and in the surrounding municipalities. Therefore, the long-term productivity of the overall region may experience benefits from this short-term use of the environment.

4.3.21 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resources would be committed to the CCSA by the District, the USACE, Monmouth County, and any involved local agencies and municipalities. Resources committed include construction and mitigation materials and costs; labor costs for planning the Project; natural resources such as soil, water, air; energy resources such as fossil fuels (*i.e.*, gasoline, petroleum products, and lubricants) and electricity; and, land to accommodate flood control and shore protection structures.

Not all of these resources are irretrievable. The monies committed to the Project will be offset through savings in municipal, residential, and commercial flood damage costs in the future, and potentially through increased commercial success for the community as a result of a more safe and secure business area. This may also result in an increase in the revenues of the local municipalities in the event of increasing property tax values.

Investments of materials and disposable goods associated with construction of the levee and floodwall, and associated environmental mitigation, would be an irretrievable commitment of resources. This commitment will enhance success and diversity of wildlife and vegetation in the CCSA.

4.3.22 Cumulative Impacts

The implementation of the selected plan and similar projects will significantly benefit the local residents by increasing storm protection and reducing the amount of damage cause by flooding and tidal surges. As a result, community costs associated with evacuations during flooding events and home repair will be reduced in the Port Monmouth area as well as other communities along the RBSHB shoreline. In addition, properties that benefit from reduced flood damage are expected to increase in value.

The implementation of the selected plan, in conjunction with other projects in the area, is expected to benefit wetlands. The construction of flood control structures such as levees and flood walls are likely to reduce the spread of *Phragmites*, because they can function like a barrier across which the rhizomes that propagate *Phragmites* cannot spread. This will limit the encroachment of *Phragmites* into shoreline wetlands and salt marsh, and will facilitate the maintenance of more diverse and sustainable wetland ecology on the seaward side the flood control structures. In addition, mitigation plans to offset impacts to wetlands would likely involve the conversion of wetland *Phragmites* to salt marsh. The implementation of several mitigation plans that involve the conversion of wetland *Phragmites* to salt marsh could improve the overall quality and value of wetlands in the region.

Overall, this project and similar flood protection projects along the RBSHB, can contribute to a more stable environment for planned growth and development as a result of reduced regional flooding concerns and expenses. Improvements to roads, culverts, and stormwater drainage systems should result from reduced flood damage to infrastructure. This may provide an opportunity for limited development that will yield increased commercial and residential revenues from taxes and reduced damage costs to infrastructure. Reduced regional flooding may increase emergency vehicle access, and overall efficiency of community emergency preparedness and response by creating a more stable infrastructure and minimizing delays due to flooded roads. Additionally, the construction of the flood control structures should reduce or inhibit development on the unprotected side of the structures, providing opportunities for permanent open space and the preservation of wetlands. This would contribute to the stated goal of the Bayshore Waterfront Access Plan, specifically the preservation of wetlands adjacent to Pews and Compton Creek (MCPB 1987)

The implementation of the selected plan and other similar projects in the area, may contribute to increased recreational opportunities. The construction of levees may provide additional areas for running, walking, and biking, which also complements the Bayshore Waterfront Access Plan (MCPB 1987). Additionally, enhanced bird habitat may create additional attraction to the area for birdwatching. Overall, the interaction of multiple flood control projects in the area may contribute to an enhanced recreational value of the RBSHB.

Potential impacts may result from implementation of the selected plan in conjunction with local and regional projects. Specifically, the overall impact to aesthetic resources in the region resulting from implementation of several similar projects, and the construction of multiple flood control structures may impact the viewshed from the water and from the landward side of the structures. Impacts to wetlands on the protected side of levees and floodwalls result in *Phragmites* encroachment due to reduced tidal flushing. Significant cumulative adverse impacts to wetlands are not anticipated because mitigation to offset adverse impacts to wetlands is required. As stated above, flood control structures can impede the encroachment of *Phragmites* into estuarine wetlands, preserving and maintaining more diverse and valuable coastal salt marshes on the seaward side of the flood control structures. Potential impacts to some aquatic resources may result if access to Pews Creek, Compton Creek, or other local waterbodies is limited by flood control structures during storm events.

5.0 REFERENCES

Beers, F.W. 1873. Atlas of Monmouth County. Comstock and Cline, New York, New York.

Bigford, T.E. 1992. Letter communication on November 6 from T.E. Bigford, Division Chief, National Marine Fisheries Service Habitat and Protected Resources Division to Mark Burlas, U.S. Army Corps of Engineers.

Brady, John T. and Schrading, Eric R. 1997. Habitat Suitability Index Models: Horseshoe Crab (Spawning Beaches) – Delaware Bay, New Jersey and Delaware. U.S. Fish and Wildlife Service. Pleasantville, New Jersey.

Breden, T.F. 1992. Letter communication on May 27 from T.F. Breden, Coordinator/Ecologist, State of New Jersey Natural Heritage Program to Mark Burlas U.S. Army Corps of Engineers Environmental Analysis Branch.

Breteler, R.J. (ed.). 1985. Chemical Pollution of the Hudson-Raritan Estuary. NOAA Tech. Memo. NOS OMA 7. Rockville, Maryland. 72 pp.

Brinkhuis, B.H. 1980. Biological Effects of Sand and Gravel Mining in the Lower Bay of New York Harbor: An Assessment from the Literature. MSRC Special Report 34, Sea Grant reference no. 80-1. 193 pp.

Byrne, D.M. 1988. Unpublished 1982-1983 Beach Seine Data from Raritan Bayshore. New Jersey Department of Environmental Protection, Bureau of Marine Fisheries, Nacote Research Station, Port Republic, NJ.

Carter, Dave. June 1, 2000. Personal Communication between Dave Carter, Delaware Coastal Management Program and Chris Carlton, Northern Ecological Associates, Inc.

Cerrato, R.M., H.J. Bokuniewicz, and M.H. Wiggins. 1989. A Spatial and Seasonal Study of the Benthic Fauna for the Lower Bay of New York Harbor. Prepared by the Marine Sciences Research Center of the State University of New York at Stony Brook for the U.S. Army Corps of Engineer New York District. Special Report 85, Reference 89-1.

Coastal Planning & Engineering, Inc., URS Consultants, Inc., and T & M Associates. 1993 (March). Raritan Bay and Sandy Hook, New Jersey Combined Flood Control and Shore Protection Reconnaissance Study. Prepared for U.S. Army Corps of Engineers, New York District.

Collins, B.R. and K.H. Anderson. 1994. Plant Communities of New Jersey, a Study in Landscape Diversity. Rutgers University Press, New Brunswick, NJ. 287 pp.

Curtin, C.B. 1992. Letter communic n on October 28 from C.B. Curtin, State Conservationist, United States Dep ent of Agriculture, Soil Conservation Service, Somerset, New Jersey to B.A. Be a, Environmental Assessment Branch, United States Army Corps of Engineers, Ne rk District, New York, New York.

Diaz, R.J. and D.F. Boesch. 1982. The Macrobenthos of the Hudson-Raratin Estuary. In D.B. Boesch (ed.). The Ecology of Macrobenthos of the New York Bight Region. NOAA Technical Report.

Eastern National Park and Monument Association. Undated. Birds of Sandy Hook.

Figley, W. 1988 New Jersey's Recreational and Commercial Fishing Grounds of Raritan Bay, Sandy Hook Bay and Delaware Bay. Prepared for the New Jersey Department of Environmental Protection. Technical Series 88-1.

Gabrielan, Randall. 1995. Middletown nship: Images of America Vol. II. Arcadia Publishing, Dover, New Jersey.

Harris, Wendy, and Eugene Reyes. 1991. Cultural Resources Investigation – Compton Creek and Shoal Harbor. Belford, Monr uth County, New Jersey. On file, New Jersey Historic Preservation Office, Trento New Jersey.

Hartwick, Carolyn L. and T. Cregg Madrigal. 1996. Archaeologic Data Recovery Within The Front Yard Of The Whitlock/Seabrook/Wilson House, Middletown Township, Monmouth County, New Jersey. On file, New Jersey Historic Preservation Office, Trenton, New Jersey.

Jabonski, L.A. 1968. Ground-water Resources of Monmouth County, New Jersey. U.S. Geological Survey. Special Report No. 23. Trenton, NJ.

Jeffries, H.P. 1962. Environmental Characteristics of Raritan Bay, a Polluted Estuary. Limnol. Oceanography 7:21-31.

MacKenzie, C.L. 1990. History of the fishes of Raritan Bay, New York and New Jersey. Marine Fisheries Review, Vol. 52, No. 4.

McCloy, Y. 1988. The Shellfish Resources of Raritan Bay and Sandy Hook Bay. Prepared for the New Jersey Department of Environmental Protection. Technical Series 88-1.

McCormick, J.M., H.G. Multer, and D.M. Stainken. 1984. A Review of Raratin Bay Research. Bull. New Jersey Acad. Sci., 29(2):47-58.

McGarth, R.A. 1974. Benthic Microfaunal Census of Raritan Bay - Preliminary Results, Benthos of Raritan Bay. Hudson River Environ. Soc., Proc. 3rd Symp. Hudson River Ecol., Paper 24.

Mercantante, Tony. 1997. Telephone communication on September 24 between Mr. Tony Mercantante, Town of Middletown Planning Department, Director, Middletown, New Jersey, and Sandra Lare, Northern Ecological Associates, Inc.

Middletown Township. 1994. Middletown Township Zoning Ordinance. Middletown Township, New Jersey.

Middletown Township Historical Society. 1988. Henry Murphy Remembers. Newsletter of the Middletown Township Historical Society, April 1988, IV[2]: 2.

Middletown Township Historical Society. 1987. A Study of a Historic House. Newsletter of the Middletown Township Historical Society, April 1987, III[2]: 2.

Monmouth County Health Department. 1999. Personal Communication: Telephone conversation on September 29, 1999, between Becky Cosgrove, Monmouth County Health Department and Chris Carlton, NEA.

Monmouth County Health Department. 1997. Personal Communication: Telephone conversation between USACE and Health Department personnel.

Monmouth County Planning Board. December 1997. Bayshore Waterfront Access Plan - An Element of the Monmouth County Growth Management Guide. Freehold, NJ.

Monmouth County Planning Board. Undated (c. 1995 or 1996). Monmouth County At a Glance. Freehold, NJ.

Monmouth County Planning Board. 1994. Monmouth County, New Jersey 1994 Official Map and Guide.

Monmouth County Planning Board. 1993. Bayshore Waterfront Access Plan. Monmouth County Planning Board, Hall of Records Annex, Freehold, New Jersey, 86 pp.

Monmouth County Planning Board. November 1989. Monmouth County Housing Market Statistics. Freehold, NJ.

Monmouth County Planning Board. December 1987. Bayshore Waterfront Access Plan. Prepared by Monmouth County Planning Board with the Trust for Public Land. Freehold, NJ.

Mounier, R. Alan, and Kurt R. Kalb. 1976. An Archaeological Survey of Pew's Creek, Port Monmouth, Monmouth County, New Jersey. On file, New Jersey Historic Preservation Office, Trenton, New Jersey.

New Jersey Department of Environmental Protection (NJDEP). 1999. GIS Resource Data Series 1- Volume 2. New Jersey Department of Environmental Protection, Bureau of Geographic Information & Analysis, Office of Information Resources Management.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1995. Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters Summer of 1994. NJDEP, Division of Water Resources. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1994a. Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters Summers of 1992 and 1993. NJDEP, Division of Water Resources. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP). 1994b. Ground Water Quality Standards NJAC 7:9-6.2.

New Jersey Department of Environmental Protection and Energy. 1994c. New Jersey 1994 State Water Quality Inventory Report. Trenton, NJ.

New Jersey Department of Environmental Protection and Energy, Division of Water Resources. 1993a. Dioxins in Tissues from Crabs from the Raritan/Newark Bay Systems. NJDEPE, Division of Science and Research. Trenton, NJ.

New Jersey Department of Environmental Protection and Energy, Division of Water Resources. 1993b. Polychlorinated Biphenyls (PCBs), Chlordane, and DDTs In Selected Fish and Shellfish from New Jersey Waters, 1988-1991: Results From New Jersey's Toxics in Biota Monitoring Program. NJDEPE, Division of Science and Research. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1991. Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters Summer of 1991. NJDEP, Division of Water Resources. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1990a. Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters Summer of 1990. NJDEP, Division of Water Resources. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources 1990b. New Jersey 1990 State Water Quality Inventory Report: A Report on the Status of Water Quality in New Jersey. NJDEP, Division of Water Resources, Bureau of Water Quality Planning. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1989. Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters Summer of 1989. NJDEP, Division of Water Resources. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1988a. Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters Summer of 1988. NJDEP, Division of Water Resources. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1988b. New Jersey 1988 State Water Quality Inventory Report: A Report on the Status of Water Quality in New Jersey. NJDEP, Division of Water Resources, Bureau of Water Quality Planning. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1987. Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters Summer of 1987. NJDEP, Division of Water Resources. Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), Division of Fish, Game, and Wildlife, Bureau of Shellfisheries. 1984. Draft Report of the Shellfish Resources of the Raritan Bay Complex. April 1984.

New Jersey Department of Environmental Protection (NJDEP), Division of Water Resources. 1983. PCBs in Selected Finfish Caught Within New Jersey Waters 1981-1982 (With Limited Chlordane Data). NJDEP, Office of Science and Research. Trenton, NJ.

New Jersey Division of Parks and Forestry. Undated. Birds of Cheesequake State Park.

New Jersey Natural Heritage Program. 1997. Monmouth County Rare Species and Natural Communities Presently Recorded in the New Jersey Natural Heritage Database.

NOAA. 1990. New York Harbor Chart. US Department of Commerce, National Oceanic and Atmospheric Administration, Washington, D.C. Corrected from Notice to Mariners December 29, 1990, US Coast Guard.

Northeast Fisheries Science Center. October, 1998. Reference Document 98-10. Compiled by Northern Ecological Associates, Inc. 1999.

O'Reilly, J.E., J.P. Thomas, and C. Evans. 1976. Annual Primary Production (Nannoplankton, Net Plankton, Dissolved Organic Matter) in the Lower New York Bay. Paper No. 19, *In* W.H.Mckeon and G.J. Lauer, (eds.), 4th Symposium on Hudson River Ecology, Hudson River Environmental Society, New York.

Patten, B.C. 1962. Species Diversity in Net Phytoplankton of Raritan Bay. Journal of Marine Resources 20:57-75.

Porter, Richard L., John A. Cavallo, Jean Howson, and Carolyn L. Hartwick. 1996. Phase ½ Cultural Resource Survey Pews Creek/Comptons Creek Replacements and Roadway Improvements Project, Middletown Township, Monmouth County, New Jersey. On file New Jersey Historic Preservation Office, Trenton, New Jersey.

Porter, Richard L., John A. Cavallo, Jean Howson, and Carolyn L. Hartwick. 1994. Phase ½ Cultural Resource Survey Pews/Compton Creek Replacements and Roadway Improvement Project, Middletown Townsip, Monmouth County, New Jersey. On file New Jersey Historic Preservation Office, Trenton.

Porter, Richard L., and John A. Cavallo. 1992. A Phase 1A Cultural Resources Survey of the Proposed Pews Creek/Compton Creek Bridge Replacements and Roadway Improvement Project, Middletown Township, Monmouth County, New Jersey. On file, New Jersey Historic Preservation Office, Trenton, New Jersey.

Squibb, K.S., J.M. O'Conner, and T.J. Kneip. 1991. New York/New Jersey Harbor Estuary Program, Module 3.1: Toxics Characterization Report. Institute of Environmental Medicine, New York University Medical Center, Tuxedo, New York. 186 pp.

Staples, J.C. 1998. Letter communication on February 9 from J.C. Staples Assistant Supervisor, United States Department of the Interior Fish and Wildlife Service to Mark Burlas, U.S. Army Corps of Engineers.

Steimle, F.W. and J. Caracciolo-Ward. 1989. A reassessment of the status of the benthic macrofauna of the Raritan Estuary. Estuaries, Vol. 12, No. 3.

U.S. Army Corps of Engineers (USACE). 2000a. Habitat Evaluation Procedures (HEP) Report. Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey, Hurricane and Storm Reduction Project.

U.S. Army Corps of Engineers (USACE). 2000b. Mitigation Report. Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey, Hurricane and Storm Reduction Protection Project.

U.S. Army Corps of Engineers (USACE), New York District. 1998b. Dune Planting Report, Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey, Hurricane and Storm Reduction Protection Project.

U.S. Army Corps of Engineers (USACE), New York District. 1998c. Modeling of Tidal Hydrodynamics for a Proposed Storm Gate on Pews Creek, Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey, Hurricane and Storm Reduction Protection Project.

U.S. Army Corps of Engineers (USACE), New York District. 1997a (June). Interagency Scoping Document, Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey, Hurricane and Storm Reduction Protection Project.

U.S. Army Corps of Engineers (USACE), New York District. 1997b (December). Wetland Delineation Report, Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey, Hurricane and Storm Reduction Protection Project.

U.S. Army Corps of Engineers (USACE). May 1996a. Raritan Bay & Sandy Hook Bay, Cliffwood Beach, New Jersey: Beach Erosion Control and Storm Damage Protection Reconnaissance Study. US Army Corp of Engineers, New York District.

U.S. Army Corps of Engineers (USACE), New York District. 1996b. Union and Cliffwood Beach Fish and Benthic Sampling Results.

U.S. Army Corps of Engineers (USACE), New York District. 1996c (May). Raritan Bay – Sandy Hook Bay Section 934 Re-Evaluation Study, Result of 1994 and 1995 Benthic Macroinvertebrate Sampling.

U.S. Army Corps of Engineers (USACE). 1995. South River, Raritan River Basin, New Jersey Multipurpose Reconnaissance Study. USACE New York District.

U.S. Army Corps of Engineers (USACE), New York District. 1993a. RBSHB, New Jersey Combined Flood Control and Shore Protection Reconnaissance Study.

U.S. Army Corps of Engineers (USACE). 1993b. Raritan Bay and Sandy Hook Bay, New Jersey, Combined Flood Control and Shore Protection Pre-feasibility Study.

U.S. Bureau of the Census. 1992. 1990 Census of Population and Housing - New Jersey. Washington, D.C.

U.S. Coast and Geodetic Survey Chart. 1875. New York Entrance, United States Coast Survey. C. Patterson, Scale 1/40,000.

U.S. Coast and Geodetic Survey Chart. 1844/45. Map of New York Bay and the Environs , Survey of the Coast of the United States. Triangular Survey Under the Direction of F.R. Hassler, Sheets 1 – 6. Scale: 1/30,000.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1990. New Jersey Important Farmlands Inventory, Prime Farmland (Monmouth County).

U.S. Department of Agriculture, Natural Resources Conservation Service. 1989. Survey of Monmouth County New Jersey.

U.S. Department of Interior. 1992. Raritan Bay – Sandy Hook Bay Reconnaissance Study. U.S. Department of the Interior. Washington, D.C.

U.S. Department of Interior, National Park Service. 1989a. Amphibians and Reptiles. Gateway National Area.

U.S. Department of Interior, National Park Service. 1989b. Mammals. Gateway National Area.

U.S. Environmental Protection Agency (USEPA). 1999. US EPA Region 2: Sole Source Aquifer [Online]. Available: http://www.epa.gov/region02/water/fr_coast.htm [November 1999].

U.S. Environmental Protection Agency (USEPA). 1997. Office of Air Quality Planning and Standards. Nonattainment Areas for All Criteria Pollutants. Green Book Homepage. http://www.epa.gov/oar/oaqps/greenbk/ancl.html.

U.S. Environmental Protection Agency (USEPA). 1989. Priority Wetland List for the State of New Jersey. U.S. Environmental Protection Agency, Region 2.

U.S. Environmental Protection Agency (USEPA). 1978. Protective Noise Levels. Office of Noise Abatement and Control, Washington, D.C.

U.S. Fish and Wildlife Service. 1997. Piping Plover (*Charadrius melodus*) Interim Survey Report, Sandy Hook to Monmouth Beach, Monmouth County, New Jersey. United States Department of the Interior, Fish and Wildlife Service. Washington, D.C.

U.S. Fish and Wildlife Service. 1992. Planning Aid Report: Raritan Bay and Sandy Hook Bay Reconnaissance Study-Fish and Wildlife Resources. United States Department of the Interior, Fish and Wildlife Service. Washington, D.C. pp. 15-24.

URS Grenier. June 1997. Port Monmouth Combined Flood Control and Shore Protection Feasibility Study Interim Report - Estimated Storm Damages. Paramus, New Jersey.

Walker, K.H. 1967. Analytical Results, in Proc. Conf. Pollution Raritan Bay and Adjacent Interstate Waters, 3rd Session, New York, New York. Federal Water Pollution Control Administration: 97-202.

Walker, R.L. 1983. Evaluation of Water Levels in Major Aquifers of the New Jersey Coastal Plain, 1978. U.S. Geological Survey Water Resources Investigations Report 82-4077. U.S. Geological Survey, Trenton, NJ. Prepared in cooperation with the New Jersey Department of Environmental Protection, Division of Water Resources.

Wickham, S. 1997a. Telephone conversation on November 24 between S. Wickham, Monmouth County Parks and Recreation Department, Freehold, New Jersey, and S. Lare, Northern Ecological Associates, Inc., Portland, Maine.

Wickham, S. 1997b. Telephone communication on September 24 between Mr. Spence Wickham, Monmouth County Park System, Chief of Acquisition and Design, Lincroft, New Jersey, and Sandra Lare, Northern Ecological Associates, Inc.

Wilber, C.P. and M.E. Johnson. 1940. The Geology of New Jersey. Department of Conservation and Development, State of New Jersey, Geologic Series, Bulletin 50. Trenton, NJ. 203 pp.

Wilber, D.H. and D.G. Clarke. 1998. Estimating Secondary Production and Benthic Consumption in Monitoring Studies: A Case Study of the Impacts of Dredge Material Disposal in Galveston Bay, Texas. *Estuaries*. 21:2:230-245.

Wilk, S.J., E.M. MacHaffie, D.G. McMillan, A.J. Pacheco, R.A. Pikanowski, and L.L. Stehlik. 1996. Fish, Megainvertebrates, and Associated Hydrographic Observations Collected in the Hudson-Raritan Estuary, January 1992 - December 1993. National Marine Fisheries Science Center Reference Document 96-14. Highlands, NJ.

Wilk, S.J. and M.J. Silverman. 1976. Summer Benthic Fish Faunas of Sandy Hook Bay, New Jersey. U.S. Department of Commerce, NOAA Tech. Rep., NMFS. PB-256 088.

Wolverton, Chester and Forsey Breou. 1889. Part of Middletown Township, Wolverton's Atlas of Monmouth County, Plate 30. Scale: 3 inches = 1 mile.

Woodhead, P.M.J. 1991. Inventory and Characterization of Habitat and Fish Resources, and Assessment of Information on Toxic Effects in the New York-New Jersey Harbor Estuary. A report to the New York-New Jersey Harbor Estuary Program Concerning Work in Tasks 3.2, 5.1 and 5.3.

Zapecza, O.S. 1984. Hydrogeologic Framework of the New Jersey Coastal Plain. U.S. Geological Survey. Open-File Report 84-730. Trenton, NJ.

Zich, H. 1978. New Jersey Anadromous Fish Inventory. New Jersey Department of Environmental Protection. Miscellaneous Report No. 41.

6.0 LIST OF PREPARERS

Draft Environmental Impact Statement Prepared By:

U.S. Army Corps of Engineers New York District

Name	Position	Role in FEIS Preparation
Mark Burlas	Senior Wildlife Biologist, Planning Division, Environmental Analysis Branch	Project Environmental Manager Principal FEIS Manager
Wendy Harris	Senior Archaeologist, Planning Division, Environmental Analysis Branch	Project Archeologist
Jay Hecht	Office of Counsel	Counsel Review
Paul Sabalis	Civil Engineer, Planning Division, Plan Formulation Branch	Project Study Manager Principal Main Report Author

Support Provided By:

Northern Ecological Associates, Inc.

Name	Position	Role in FEIS Preparation
David J. Santillo	Principal	Program Manager, Principal Review
Robin Dingle	Senior Environmental Scientist	Project Manager, Principal Review, Wetlands, HEP, and Mitigation
Stephen A. Compton	Senior Project Manager	FEIS Manager, Summary, Introduction, Purpose and Need, Alternatives, and Principal Review
Alexander Chmielewski	Senior Environmental Scientist	Vegetation, Wildlife, Wetlands, Navigation, Floodplains, HEP, and Mitigation
Scott Sheeley	Associate Scientist	Vegetation, Navigation, and Floodplains
Sandra Lare	Senior Environmental Planner	Land Use, Socioeconomics, Recreation, Transportation, Environmental Justice, Coastal Zone Management

Brad Schaeffer	Environmental Scientist	HEP, Mitigation Report
Jack Wu	Environmental Scientist	HEP, Mitigation Report
Natasha Snyder	Cultural Resource Specialist	Aesthetics and Scenic, Land Use, Socioeconomics, Recreation
Heather Storlazzi	Environmental Scientist	DEIS distribution list
Brandon Mann	Environmental Scientist	FEIS, HEP and Mitigation Reports
Pat Fellion	Environmental Scientist	Wildlife and Threatened and Endangered Species
Lauren Malone	Environmental Scientist	Topography, Geology, and Soils; Hazardous Waste
Christopher Carlton	Associate Environmental Planner	Relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity
Susan Hardin	Environmental Scientist	Fish and Shellfish, Benthos, Coastal Zone Management, Transportation
Matt Kim	Associate Scientist	Air Quality, Noise

Coastal Planning & Engineering, Inc.

Name	Position	Role in FEIS Preparation
Norman H. Beumel	Vice President	Description of bay shoreline protection plans
Thomas H. Copps	Coastal Engineer	Description of bay shoreline protection plans

Coastal Environmental Services, Inc.

Name	Position	Role in FEIS Preparation
Fred Lubnow	Senior Scientist	Water Resources
Mark Gallagher	Senior Scientist	Wetlands and Mitigation

Source: Complied by Northern Ecological Associates, Inc.

June 2000

RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
FEASIBILITY REPORT
FOR
HURRICANE AND STORM DAMAGE REDUCTION
PORT MONMOUTH, NEW JERSEY

APPENDIX I

PERTINENT CORRESPONDENCE

Table of Contents

Table of Contents (Continued)

Table of Contents

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

June 22, 1998

Planning Division

Mr. Theodore A. Giannechini, P.E., P.L.S., P.P.
County Engineer
County of Monmouth
P.O. Box 1255
Freehold, New Jersey 07728

Dear Mr. Giannechini:

Thank you for your letter dated May 8 1998 concerning the Port Monmouth feasibility study. We recognize the importance of implementing a plan of protection for this community that meets both project goals and local preferences to the extent practical and possible. There is often a delicate balance that must address economic, environmental and social factors in formulation. Your input and support is integral to successful implementation of a locally acceptable project.

My staff has reviewed your comments, along with those which you attached from Mr. Spencer Wickham and Ms. Gail Hunton regarding the draft plans which had been forwarded to your office. Based upon your expressed concerns, additional plan modifications have been made. Enclosed please find a package which contains responses to your collectively submitted comments. The most significant revision to the plans is the realignment of the bayshore dune to allow for full public access in accordance with County plans.

I appreciate the cooperation of Monmouth County in helping to formulate suitable plans to alleviate the flood problems in the Port Monmouth community. We look forward to working with your office further in order to progress the project and continue to foster a positive working relationship.

If you have any questions, please contact Mr. Paul Sabalis of my staff at (212) 264-9078.

Sincerely,

Frank Santomauro

Enclosures

Frank Santomauro, P.E.
Chief, Planning Division

cc:
Bernard J. Moore, NJDEP, Div. of Engineering and Construction
Theodore A. Giannechini, Monmouth County Engineer
Linda Brennen, Monmouth County Planning Board
Spencer H. Wickham, Monmouth County Park System, Chief, Acquisition and Design
Gail Hunton, Monmouth County, Board of Recreation Commissioners, Principal Historic Preservation Specialist

ATTACHMENT I-1

Raritan Bay and Sandy Hook Bay, NJ – Port Monmouth – Comment Responses

Theodore Giannechini, County Engineer

Comment 1: "At the time of the most recent public meeting, the crest elevation proposed for the levee and flood wall was still undetermined. Since this elevation will establish the ultimate level of protection from major storm surges, and because this elevation will directly determine the degree of impact to adjacent County and Township facilities, I request that this elevation be provided to the County as soon as the decision is made."

Response 1: The optimization of levee and floodwall heights is ongoing. The heights being investigated include: 13, 14 and 15.2 ft NGVD. The selected height information will be provided to your office along with the final report. At the present time, the 14 ft elevation appears to be the most viable.

Comment 2: "At present, a decision has not been made regarding the tidal elevation at which the various tide gates will be closed. This is an important issue since it will directly determine the degree to which more routine tidal flooding can be reduced, and also because the closing of the currently proposed gate at old Port Monmouth Road would completely block off access to and from the Monmouth Cove Marina, for the full duration of the closure."

Response 2: Closure stage is being evaluated for protection and also for environmental impacts within the delineated wetlands in the vicinity of Pews Creek. Elevations and operating scenarios are being optimized. The timing of the closure of the storm gate at Pews Creek will be more critical than the road closure gate along Port Monmouth Road, since the road itself is at elevation +10 NGVD and would be closed only for relatively severe storms. Closure scenarios for the Pews Creek gate would generally range from 1 to 2 closures per month to approximately once every 2-3 months with outer stage elevations between 5 and 5.5 ft NGVD. Additional information will be provided with the draft report.

Comment 3: "Every attempt should be made to reduce or eliminate the more routine tidal flooding now experienced within the proposed enclosure area. Such flooding causes property damage, reduces property values, and poses a threat to public safety. Once the key decisions noted above have been made, I request that the Corps specifically address the degree to which such flooding will be reduced by the final proposed project."

Response 3: In general, the Corps formulates plans based upon high priority storm damage reduction benefits, and seeks to optimize net excess benefits. Plans that would be more costly relative to benefits achieved could also be implemented but excess costs would be borne by non-Federal entities. Nuisance flooding could be classified under such a scenario. Flooding however, that poses a threat to public safety by severing critical access roads and locations from fire, medical and emergency services constitutes a rationale for formulating levels of protection that would not normally be warranted under strict application of economic criteria. Significant flooding would be reduced by this project, and residual damages should be low. We will continue to coordinate with you regarding any residual road flooding.

Comment 4: As stated previously, the County and Township have recently completed a major project which resulted in the reconstruction of Port Monmouth Road throughout the proposed flood control project area. As part of this work, the Port Monmouth Bridge over Pews Creek was also replaced. Because such work was intended to improve transportation mobility in this area, the County is concerned that the current level of mobility not be diminished, and that any revisions to such facilities, as may be needed to advance the flood control project, be kept to a minimum."

Response 4: Increased elevations near a levee/floodwall crossing would require a transition from the current 10 ft NGVD road elevation at the new Port Monmouth Road. Proper transitioning will assume no loss in mobility even to trailored vehicles. Along the western end of the shorefront section of the project in the vicinity of Wilson Avenue, a road crossing will not be required as the dune and levee will join a floodwall along the northern embankment on Port Monmouth Road and will closely follow this road right of way toward Pews Creek.

Comment 5: Because of the potential impacts of the flood control project on County and Township facilities, I request that you provide this office with the following information as soon as it becomes available:

1. Details of the proposed floodwall and levee along Port Monmouth Road for the full length between Pews Creek and the proposed crossing of Port Monmouth Road east of Park Avenue, including sections perpendicular to the roadway.
2. Proposed centerline profile and road sections for Port Monmouth Road at the proposed levee crossing east of Park Avenue.
3. Proposed details of revisions to existing drainage facilities along Port Monmouth Road.
4. Proposed details of any construction staging which could affect the use of County or Township facilities within the project area.

Response 5: The details requested will be provided to your office shortly. Specific detail sections for interior drainage facilities would be refined during the Preconstruction, Engineering and Design Phase.

Spencer Wickham, Chief of Acquisition and Design

Concerns:

Concern 1: "Much of the affected property along the bay front was purchased with Green Acres funding. The property was preserved for the express purpose of assuring public access to the waterfront and also to provide adjacent space for associated support being parking, shelters and or restrooms. The existing beachfront is already encumbered with the state designed dune line. To further encumber this area, with, in effect, a second dike having a +-66 ft footprint would, all but, prohibit public access and the need of providing access support facilities. This proposed dike must therefore be combined with the existing dune to provide protection from flooding and yet preserve area for the County's intended use of public access. As the property values in this area of the waterfront were over $100,000 per acre and any change in use requires the approval of the County Board of Recreation Commissioners, County Board of Chosen Freeholders and also the NJ State House Commission. As these lands are dedicated for park and recreational use the loss of any lands must be mitigated. The issue of mitigation must be raised and resolved as a condition of any approval."

Response 1: Changes have been effected that result in the plan being comprised of a fortified existing dune along the bayshore. This will be consistent with the public access and the support facilities. These plan modifications should result in full CZM consistency, and the safeguarding of existing land use. As every effort has been made to optimize plan efficiency consistent with current and proposed uses and with integrity of the line of protection, Green Acres mitigation is not considered necessary.

Concern 2: "How will the loss of wetlands along the east side of Main Street to build these dikes be mitigated?"

Response 2: The Corps of Engineers employs a Habitat Evaluation Procedure (HEP) in order to determine specific impacts and required mitigation measures. Several arrays of mitigation alternatives have been screened for suitability. Most alternatives involve restorative measures to degraded wetlands. The procedure involves careful scrutiny of the different present cover types within the existing wetlands locations east of Main Street and also west of Wilson Avenue. Most mitigation sites would fall within existing delineated wetland areas on the Pews Creek side of the study area, west of Wilson Avenue. These interior sites will be further coordinated with the Township and County.

Concern 3: "How will the dike gate, when closed, effect the potential flooding at the Monmouth Cove Marina?"

Response 3: This is a sheltered area. As such, any reflected waves, and changes from wave set-up and storm surges would be negligible with a closed gate. There would be no induced additional damages or deleterious effects. The effects on stage would be negligible.

Concern 4: "How will this project effect the just completed Pt. Monmouth Road project in terms of elevation?"

Response 4: The newly completed Port Monmouth Road is graded to the approximate elevation of +10 ft NGVD. The modifications for the required level of protection would require raising the road an additional approximate 4 ft at the levee crossover location. The crossing would be transitioned gradually in the vicinity of Park Avenue.

Concern 5: "Will, when the gates are closed, there be a greater potential of flooding those remaining private homes along the old Port Monmouth Road left outside the dike?"

Response 5: The homes outside the ring of protection would be subject to continued risk of storm damages as compared to structures within the line of protection. The closure gate to the Marina would be at +10 NGVD, and the properties north of the closure are below this elevation. There would be minimal, if any, induced risk of flooding as compared to those areas back of the storm damage protection system. The residents should be evacuated prior to closure of the Port Monmouth road closure gate crossing as they would not be accessible to emergency vehicles. Events which would require closure of the gate would already have seriously jeopardized the structures, and the existing Port Monmouth Road would likely be impassable anyway.

Concern 6: "How, for emergency purposes, will the County or Township gain access to the Marina or private homes when the gates are closed?"

Response 6: The road closure gate at Port Monmouth Road would not require closure very often. This is due to the existing fairly high grade elevation of +10 NGVD of the road itself. It is assumed that with a warning system in place, evacuation of the Marina and facilities would take place well prior to closure. A walkover staircase could be provided in that vicinity for pedestrians. It is assumed that no private homes would remain in this area as the Corps in conjunction with the local sponsor would consider buyouts for remaining property owners. At flood elevation +10 NGVD, the road to the marina would be flooded and likely impassable.

Concern 7: "How will the aesthetics of the area be affected by these dikes?"

Response 7: The construction of the levee and floodwalls will result in a permanent change regarding visual aesthetics by impeding the current uninterrupted view of the tidal marsh. To offset this effect, the District plans to vegetate the levee with herbaceous plants similar to the natural setting, and plant shrubs and vines in front of the floodwalls. In addition, the view of the tidal marsh from the top of the levee would provide birding enthusiasts with an expanded viewing opportunity because they can search a larger area without relocating due to the height of the levee.

Concern 8: "As a result of the gates being closed, will there be an increase in erosion along Pews Creek resulting in greater sedimentation deposits?"

Response 8: No additional erosion would be induced by the project as the velocity increase in the gate area would be minor. There could be potential for sedimentation deposits in direct vicinity of the gate. Flow through the creek would keep the entranceway clear for flows through the wetlands and drainage ditches. Preliminary indications are that significant shoals would not be realized. Storm events in which gate closure will be maintained are anticipated to be limited in nature, but some transport build-up may not be precluded at these times, particularly in direct vicinity of the gate. Additional concerns also arise due to the shorefront beach fill and renourishment component of the plan. The location of additional beach fill material seaward poses the potential for a small increase in shoaling at the nearby inlets due to long shore sediment transport, which can be removed during existing operation and maintenance practices at a small cost.

Concern 9: "Who will be responsible for the opening or closing of the gates and or the maintenance of them?"

Response 9: The State and local jurisdictions are responsible for maintaining and operating project elements. The State as the primary sponsor would likely ask for significant assistance from the County and Township in gate operation as part of local project sub-agreements.

Concern 10: "Regarding concerns of the Seabrook Wilson House see attached memo from Gail Hunton, Principal Historic Preservation Specialist"

Response 10: See responses below.

Concern 11: "How will the integrity of the Henry Hudson Trail be maintained where it is crossed by the proposed dike?"

Response 11: An access ramp will be proposed to grade up to the levee which may itself serve as an extension of the trail toward the Spy House and bayshore area. Costs and operation and maintenance of such recreation features would be generally classified a local responsibility.

Concern 12: "Has the State Fish and Game reviewed the dike in regard to the potential loss of salt water habitat area?"

Response 12: The State Fish and Game, as well as the USFWS and the NMFS are part of an interagency team that have evaluated the impacts of the levee to tidal wetlands. An array of mitigation plans has been developed and the District is currently coordinating with the State and Federal agencies with regard to the selected mitigation plan that involves restoration of degraded tidal wetlands.

Spencer Wickham, Chief of Acquisition and Design

Comments:

Comment 1: "The proposed dike should be made available as a pedestrian trail linking the Henry Hudson Trail to the waterfront.

Response 1: Proposed plans could potentially include this as an aesthetic/public access feature.

Comment 2: "The proposed dike along the bayshore should be incorporated into the existing state dune line thus reducing the amount of non-public accessible area.
2A : "By incorporating the two areas we will maintain the area available and needed to provide for parking in the area of Main Street and Pt. Monmouth Road and around the Seabrook Wilson House, adjacent restroom and fishing pier."

Response 2/2A: The above modifications were incorporated in the plans. The existing dune is to be reconstructed, with additional beach fill to be placed seaward of the existing dune. Impacts to any planned facilities would thus be minor. Additionally, in vicinity of the Spy House, the seawall is replaced by the reconstructed dune, which now extends along the entire length of shoreline between levee tie-offs. In vicinity of the Spy House, the western extent has been elongated to connect with the levee about 150 ft west of the edge of the existing parking lot.

Comment 3: "The proposed dike west of the fishing pier should be moved north to incorporate it with the existing dune line thus allowing for a parking lot expansion west of the fishing pier along Pt. Monmouth Road.

Response 3: See response 2/2A.

Raritan Bay and Sandy Hook Bay, NJ – Port Monmouth – Comment Responses

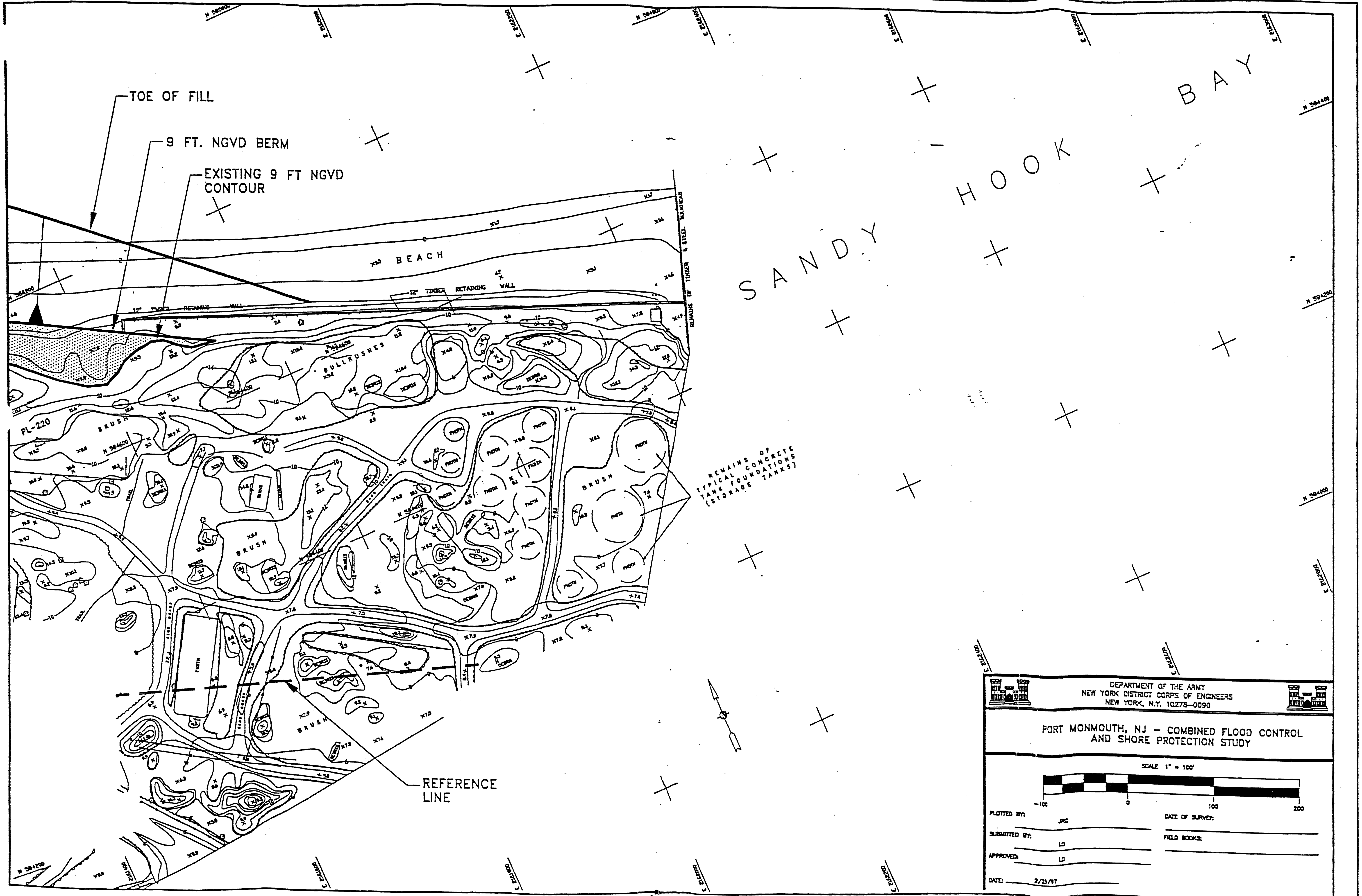
Gail Hunton, Principal Historic Preservation Specialist

Comment 1: "Impacts on Archaeological Resources – If the proposed seawall is to be constructed, it should be located north of the existing fishing pier parking lot to minimize disturbance of potential archaeological resources associated with the house. The alternative alignment of the proposed seawall, cross cutting the rear yard of the house, is objectionable because of disturbance to archaeological resources, as well as costly investigation and potential mitigation."

Response 1: The alignment has been modified along the bayshore, such that there would be no seawall at the Spy House. The existing dune will be reconstructed to join a levee section approximately 150 ft west of the edge of the fishing pier parking lot. There should be negligible adverse impact and the Spy House area will be protected.

Comment 2: "Impacts on historical landscape – Although the landscape setting of the Seabrook Wilson House has been altered over time, a seawall across the rear yard is objectionable because of adverse impacts on the historic character of the house and its remaining historic landscape. As the imminent owner of the Seabrook Wilson House, the Monmouth County Park System will be making a significant investment in the preservation and enhancement of the site in the years to come; visitors will come to not only see the house but also to enjoy its setting and views. A seawall across the back yard of the site would undermine these preservation objectives. The revised location of the seawall generally along the north side of the fishing pier parking lot, would appear to minimize adverse impacts on the historic landscape. My understanding is that the seawall is to be constructed of steel sheetpiles and poured concrete encased in sand, with a footprint not to exceed 3 feet and a typical wall height of 4 to 5 feet above existing grade. In general, the sand encased seawall, with dune stabilization plantings, should represent a naturalistic dune in its finished appearance. Also, the location of overwalks should be coordinated with the Park System's plans for use of the site and park. However, impacts on the landscape cannot be fully evaluated until additional information is provided. A sectional view at the house, extending from the road to the beach, showing existing/proposed elevations and construction details of the seawall and reconstructed dune, is requested from the Corps of Engineers in order to complete this review."

Response 2: Significant plan modifications in vicinity of the Spy House have been reflected in the current plan which allows for greater lateral clearances and eliminates the seawall. A reconstructed dune at the location of the existing dune will now span the reach between levee tie-offs. A plan view and a sectional view will be provided.



DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278–0090

PORT MONMOUTH, NJ – COMBINED FLOOD CONTROL AND SHORE PROTECTION STUDY

SCALE 1" = 100'

−100 0 100 200

PLOTTED BY: JRC

SUBMITTED BY: LD

APPROVED: LD

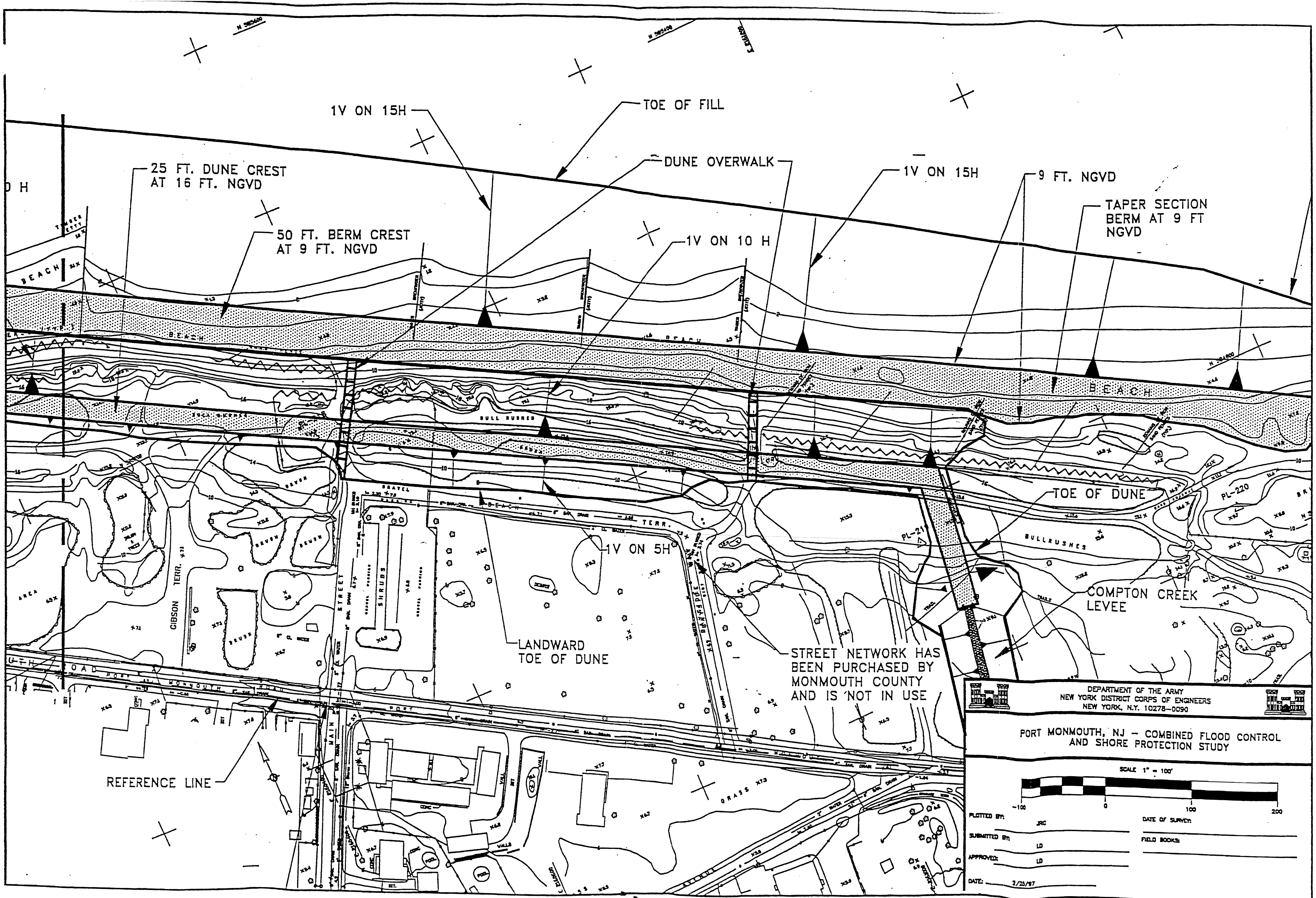
DATE: 2/25/97

DATE OF SURVEY:

FIELD BOOKS:

pg I-7

FIGURE A–36



DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

PORT MONMOUTH, NJ – COMBINED FLOOD CONTROL AND SHORE PROTECTION STUDY

SCALE 1" = 100'

-100 0 100 200

PLOTTED BY: JRC

SUBMITTED BY: LD

APPROVED: LD

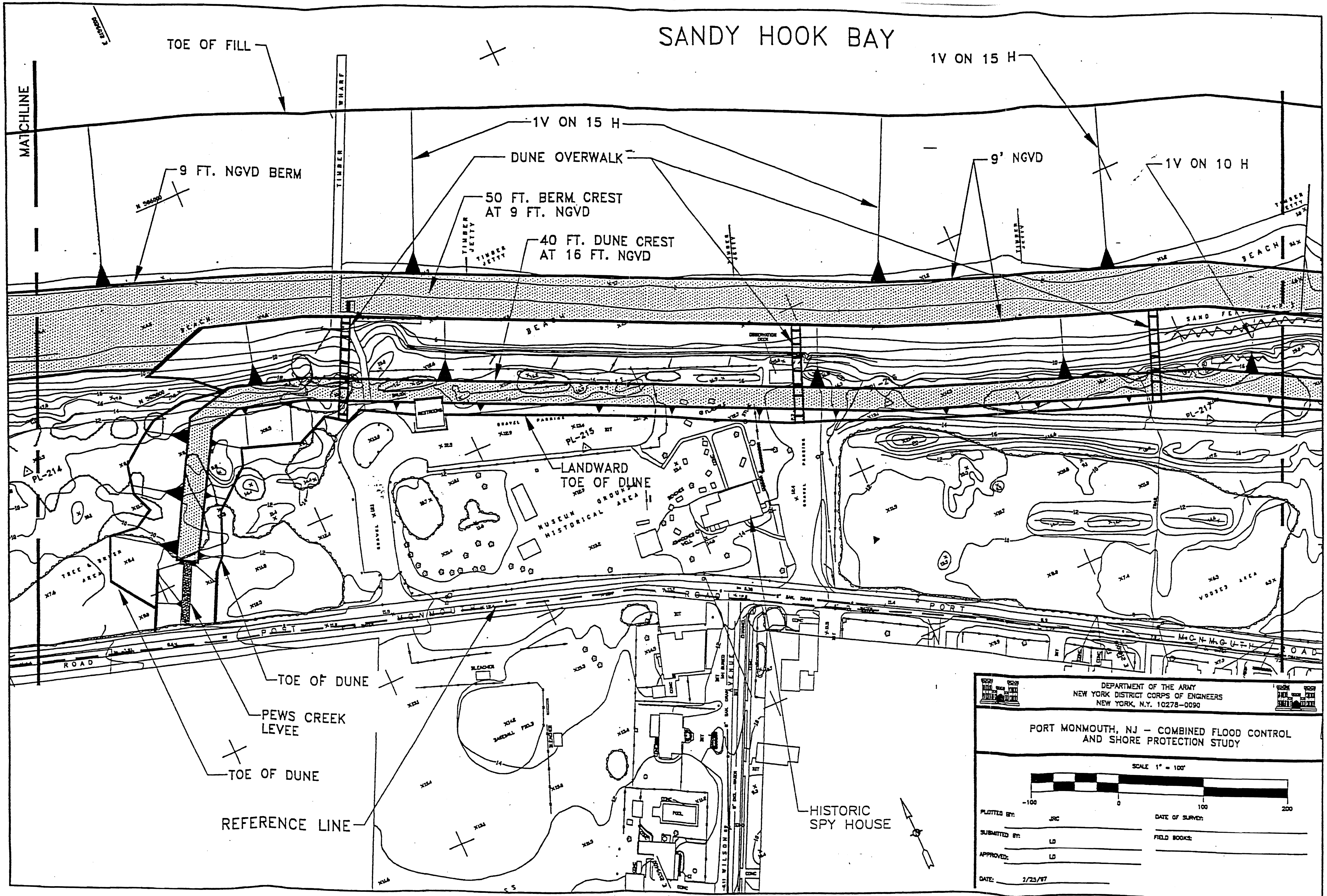
DATE: 2/23/97

DATE OF SURVEY:

FIELD BOOKS:

pg I-8

FIGURE A-36



DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

PORT MONMOUTH, NJ – COMBINED FLOOD CONTROL AND SHORE PROTECTION STUDY

SCALE 1" = 100'

-100 0 100 200

PLOTTED BY: JRC

DATE OF SURVEY:

SUBMITTED BY: LD

FIELD BOOKS:

APPROVED: LD

DATE: 2/25/97

FIGURE A-36

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278–0090

PORT MONMOUTH, NJ – COMBINED FLOOD CONTROL AND SHORE PROTECTION STUDY

SCALE 1" = 100'

-100 0 100 200

PLOTTED BY: JRC

SUBMITTED BY: LD

APPROVED: LD

DATE: 2/21/97

DATE OF SURVEY:

FIELD BOOKS:

FIGURE A-36

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

May 19, 1998

Mr. Kurt R. Kalb
Land Use Regulation Program
New Jersey Department of Environmental Protection
P.O. Box 439
501 East State, 2nd Floor
Trenton, NJ 08625-0439

Dear Mr. Kalb:

Thank you for participating in the coordination meeting with my staff on 11 March 1998 and for your letter dated 2 April 1998 in which you provided my office with preliminary comments on the Raritan Bay, Sandy Hook Bay, NJ feasibility study plans and findings.

Enclosed please find a package that addresses your comments. As discussed at the coordination meeting, we are scheduled to prepare a draft feasibility report in June 1998. At that time we will forward your office a copy of the report for further comment as part of the NEPA process.

I appreciate the cooperation of your staff in helping to formulate suitable plans to alleviate the flood problems in the Port Monmouth community. Your preliminary concerns and comments will assist in arriving at a plan that meets its required functional goals with avoidance and minimization of environmental and cultural resources impacts, and with acceptable consensus on mitigation.

We look forward to working with your office further in order to progress the project and continue to foster a positive working relationship as we strive to maintain the critical balance between project purposes and environmental resource stewardship.

If you have any questions, please contact Mr.Mark Burlas of my staff at (212) 264-4663.

Sincerely,

Frank Santomauro

Frank Santomauro, P.E.
Chief, Planning Division

Enclosures

cc:
Bernard J. Moore, NJDEP, Div. of Engineering and Construction
Theodore A. Giannechini, Monmouth County Engineer
Spencer H. Wickham, Monmouth County Park System, Chief, Acquisition and Design
Joseph Leo, Middletown Township Administrator

pg I-11

ATTACHMENT I-2

The Board of Chosen Freeholders
of the County of Monmouth

THEODORE A. GIANNECHINI, P.E., L.S., P.P.
County Engineer

P. O. Box 1255
Freehold, New Jersey 07728
Telephone (732) 431-7760
Fax (732) 431-7765

May 8, 1998

U.S. Army Corps of Engineers
New York District, Planning Division
26 Federal Plaza
New York, NY 10278

Attention: [illegible] Santamauro
Chief, Planning Division

RE: Port Monmouth Combination Flood Control and Shorefront Protection Project, Township of Middletown, Monmouth County, New Jersey

Dear Mr. Santamauro:

Please accept this correspondence as confirmation that the County of Monmouth supports the overall concept of the flood control and shorefront protection project now under design by the U.S. Army Corps of Engineers. As expressed by ACOE representatives at a recent public meeting in Middletown Township, the primary purpose of this project is to protect properties within the project area from flooding associated with major storm surges. However, the project would also result in a secondary benefit of diminishing more frequent tidal flooding associated with more routine high tide events. Such events, as represented by area residents, have become more frequent and severe, and continue to be the source of property damage and a cause of concern for public safety.

The proposed project would impact various properties under the jurisdiction of the Monmouth County Parks Commission, and would also affect various County and Township facilities, some of which were just improved by way of a major reconstruction project which was jointly funded by Monmouth County and Middletown Township.

Specific concerns and questions voiced by the County Parks Commission are contained in the attached correspondence from Spencer H. Wickham dated April 9, 1998, and also from Gail Hunton dated April 3, 1998. In addition to these, I offer the following:

- At the time of the most recent public meeting, the crest elevation proposed for the levy and flood wall was still undetermined. Since this elevation will establish the ultimate level of protection from major storm surges, and because this elevation will directly determine the degree of impact to adjacent County and Township facilities, I request that this elevation be provided to the County as soon as the decision is made.

- At present, a decision has not been made regarding the tidal elevation at which the various tide gates would be closed. This is also an important issue since it will directly determine the degree to which more routine tidal flooding can be reduced, and also because the closing of the currently proposed gate at old Port Monmouth Road would completely block off access to and from the Monmouth Cove Marina, for the full duration of the closure.

- Every attempt should be made to reduce or eliminate the more routine tidal flooding now experienced within the proposed enclosure area. Such flooding causes property damage, reduces property values, and poses a threat to public safety. Once the key decisions noted above have been made, I request that the Corps specifically address the degree to which such flooding will be reduced by the final proposed project.

- As stated previously, the County and Township have recently completed a major project which resulted in the reconstruction of Port Monmouth Road throughout the proposed flood control project area. As part of this work, the Port Monmouth bridge over Pews Creek was also replaced. Because such work was intended to improve transportation mobility in this area, the County is concerned that the current level of mobility not be diminished, and that any revisions to such facilities, as may be needed to advance the flood control project, be kept to a minimum.

- Because of the potential impacts of the flood control project on County and Township facilities, I request that you provide this office with the following information as soon as it becomes available:

    1. Details of the proposed flood wall and levy along Port Monmouth Road for the full length between Pews Creek and the proposed crossing of Port Monmouth Road east of Park Avenue, including sections perpendicular to the roadway.

    2. Proposed centerline profile and road sections for Port Monmouth Road at the proposed levy crossing east of Park Avenue.

    3. Proposed details of revisions to existing drainage facilities along Port Monmouth Road.

    4. Proposed details of any construction staging which could affect the use of County or Township facilities within the project area.

In anticipation that these concerns will be satisfactorily addressed, the Monmouth County Board of Freeholders is supportive of sharing in the local share of the cost of these improvements when this project is advanced. Such participation assumes satisfactory resolution of the various items of concern identified herein.

In conclusion, your proposed flood control and shorefront protection project has the potential to provide major benefits to the residents of the project area. Monmouth County supports this project on this basis. However, we also recognize that the proposed project will significantly impact existing County and Township facilities and it is therefore essential that the details of the final project be worked out through the cooperation of all involved parties. This office is available to assist as may be necessary in this regard.

Please advise if you have any questions or require any additional information.

Very truly yours,

Theodore A. Giannechini, P.E., P.L.S., P.P.
County Engineer

TAG:bab
Enc.
cc: All the Board
Robert J. Collins, County Administrator
Richard C. Wenner, Clerk of the Board
Mark E. Acker, Director of Finance
Daniel J. Wolfe, Director of Public Works & Engineering
Joseph Leo, Middletown Township Administrator
William Farrell, Middletown Township Engineer
James J. Truncer, Director, Monmouth County Parks Commission
Spencer H. Wickham, Chief of Acquisition and Design

Recreation
Commissioners

805 Newman Springs Road, Lincroft, NJ 07738-1695. Phone: (732) 842-4000
FAX: Administration (732) 842-4162, Acquisition & Design (732) 842-3640

MEMORANDUM

Orig - New Fn, behind

	FREEHOLDER
	ADMINISTRATOR
	ATTORNEY
	DIR PUBLIC WKS, B&G
	HWY SUPERVISOR
	BR SUPERVISOR
✓	RPK
✓	JME
✓	GDB
	RN
	JM
	GAF
✓	TAG
	FROM COUNTY ENGINEER

TO: THEODORE A. GIANNECHINI
COUNTY ENGINEER

FROM: SPENCER H. WICKHAM
CHIEF OF ACQUISITION & DESIGN

DATE: APRIL 9, 1998

RE: PORT MONMOUTH FLOOD CONTROL PROJECT

We have reviewed the proposed project and present the following concerns and or comments:

Concerns:

1. Much of the effected property along the bay front was purchased with Green Acres funding. The property was preserved for the express purpose of assuring public access to the waterfront and also to provide adjacent space for associated support being parking, shelters and or restrooms. The existing beachfront is already encumbered with the state designed dune line. To further encumber this area with, in effect, a second dike having a ± 66' footprint would, all but, prohibit public access and the need of providing access support facilities. This proposed dike must therefore be combined with the existing dune to provide protection from flooding and yet preserve area for the County's intended use of public access. As the property values in this area of the waterfront were over $100,000 acre and any change in use requires the approval of the County Board of Recreation Commissioners, County Board of Chosen Freeholders and also the N.J. State House Commission. As these lands are dedicated for park and recreational use the loss of any lands must be mitigated. The issue of mitigation must be raised and resolved as a condition of any approval.
2. How will the loss of wetlands along the east side of Main Street to build these dikes be mitigated?

C:a&d/439/swmtgpmfcp

3. How will the dike gate, when closed, effect the potential of flooding at the Monmouth Cove Marina?
4. How will this project effect the just completed Pt. Monmouth Road Project in terms of elevation?
5. Will, when the gates are closed, there be a greater potential of flooding those remaining private homes along the old Pt. Monmouth Road left outside the dike?
6. How, for emergency purposes, will the County or township gain access to the Marina or private homes when the gates are closed?
7. How will the aesthetics of the area be effected by these dikes?
8. As a result of the gates being closed, will there be an increase in erosion along Pews Creek resulting in greater sedimentation deposits?
9. Who will be responsible for the opening or closing of the gates and or the maintenance of them?
10. Regarding concerns of the Seabrook Wilson House see attached memo from Gail Hunton, Principal Historic Preservation Specialist.
11. How will the integrity of the Henry Hudson Trail be maintained where it is crossed by the proposed dike?
12. Has the State Fish & Game reviewed the dike in regard to the potential loss of salt water habitat area?

Comments:

1. The proposed dike should be made available as a pedestrian trail linking the Henry Hudson Trail to the Waterfront.
2. The proposed dike along the Bayshore should be incorporated into the existing state dune line thus reducing the amount of non-public accessible area.
   - 2A. By incorporating the two areas we will maintain the area available and needed to provide for parking in the area of Main Street and Pt. Monmouth Road and around the Seabrook Wilson House, adjacent restroom and fishing pier.
3. The proposed dike west of the fishing pier should be moved north to incorporate it with the existing dune line thus allowing for a parking lot expansion west of the fishing pier along Pt. Monmouth Road.

Please keep me informed of future meetings so as our concerns can be resolved.

Thanks.

enc.
SHW:fl
pc: J.J. Truncer, MCPS
B. Gollnick, MCPS
A. Coeyman, MCPS
G. Hunton, MCPS

Board of
Recreation
Commissioners

805 NEWMAN SPRINGS ROAD, LINCROFT, NJ 07738-1695, PHONE: (732) 842-4000
FAX: ADMINISTRATION (732) 842-4162, ACQUISITION & DESIGN (732) 842-3640

MEMORANDUM

TO: Spence Wickham, Chief, Land Acquisition
Theodore Giannechini, County Engineer

FROM: Gail Hunton, Principal Historic Preservation Specialist

DATE: April 3, 1998

RE: **Port Monmouth Flood Control Project**
Impacts on Seabrook Wilson House

The Environmental Analysis Branch of the Army Corps of Engineers requested my review of the proposed seawall at Port Monmouth for impacts on the Seabrook Wilson House, which is listed on the State and National Registers of Historic Places. In order to coordinate the County's comments to Corps of Engineers, I am addressing this review to you. Below are my preliminary comments, subject to receipt of more complete information on the seawall profiles and construction design at the Seabrook Wilson House.

Impacts on Archaeological Resources. Previous investigations (*Archaeological Data Recovery within the Front Yard of the Whitlock/Seabrook Wilson House*, Rutgers, 1996) indicate that the Seabrook Wilson House is "surrounded by a zone of archaeological sensitivity." If the proposed seawall is to be constructed, it should be located north of the existing fishing pier parking lot (roughly as shown on a recent undated draft ACOE plan) to minimize disturbance of potential archaeological resources associated with the house. The alternative alignment of the proposed seawall, cross-cutting the rear yard of the house, is objectionable because of disturbance to archaeological resources, as well as costly investigation and potential mitigation.

Impacts on Historical Landscape. Although the landscape setting of the Seabrook Wilson House has been altered over time, a seawall across the rear yard of the house is objectionable because of adverse impacts on the historic character of the house and its remaining historic landscape. As the imminent owner of the Seabrook Wilson House, the Monmouth County Park System will be making a significant investment in the preservation and enhancement of the site in the years to come; visitors will come to not only to the see the house but also to enjoy its shoreline setting and views. A seawall across the back yard of the site would undermine these preservation objectives. The revised location of the seawall, generally along the north side of the fishing pier parking lot, would appear to minimize adverse impacts on the ~~historic landscape.~~ My understanding is that the seawall is to be constructed of steel sheet piles and poured concrete encased in sand, with a footprint not to exceed 3 feet and a typical wall height of 4 to 5 feet above existing grade. In general, the sand-encased seawall, with dune stabilization plantings, should represent a naturalistic dune in its finished appearance. Also, the location of overwalks should be coordinated with the Park System's plans for use of the site and park. However, impacts on the landscape can not be fully evaluated until additional information is provided. A sectional view at the house, extending from the road to the beach, showing existing/proposed elevations and construction details of the seawall and reconstructed dune, is requested from the Corps of Engineers in order to complete this review.

c: John Sassi, P.E., Chief, Planning Division, ACOE
Wendy Harris, Project Archaeologist, ACOE
Mike Gregg, Historic Preservation Office, NJDEP

C:A&D/439/ghmswtg.doc

MARK BURLAS 4/2/98
2 Pages
K. KARB

Sassi

State of New Jersey
Department of Environmental Protection

Christine Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

Land Use Regulation Program
PO Box 439
501 East State, 2nd Floor
Trenton, NJ 08625-0439
Tel. # (609) 292-1235 Fax # (609) 292-8115

2 April 1998

John Sassi, Chief of Planning Division
U.S. Army Corps of Engineers, New York District
Jacob Javits Federal Building
26 Federal Plaza
New York, New York 10278-0090

Re: Port Monmouth Combined Flood Control and Shore Protection
Middletown Township, New Jersey

Dear Mr. Sassi:

Thank you for providing us with an opportunity to review the plan selection information on the referenced project. Following our 11 March 1998 meeting with you, we discussed the information and have several comments and questions concerning the project.

Our comments and requests are as follows:

- at the 11 March meeting, you referred to a plan that differs from the November 1997 "Preliminary Plan Layout" previously furnished to us by your office. For instance, the dune location on the plan at our disposal differs from the location of the dune shown on your plan you brought to the meeting. Please provide us with a plan that reflects the current design.

- provide information on the relative costs of installing a floodwall vs. a levee for several representative heights under consideration for this project.

- provide the reasons why the levee crest is designed to be ten feet wide.

- provide a contour map of the tidal wetlands and show the extent of tidal inundation at spring high tide and for various storm events to the stage that the entire tidal wetlands are inundated. Based on this information and the elevation chosen for flood gate closure and estimated closure frequency, review the effects of floodgate closure on the tidal wetlands.

- we accept the conceptual flood gate aspect of the project. When the design is finalized, please provide justification for the gate and associated levee location (i.e. how environmental impacts are minimized at the site of the floodgate).

- provide a theoretical ecological discussion of the application of and utility of the habitat unit procedure (HEP) and how the procedure is used in developing mitigation alternatives.

ATTACHMENT I-4

- we disagree that the proposed use of sheetpile seawall/floodwall at the Spy House Historic Site and public fishing pier property would be consistent with the New Jersey Coastal Management Program. The preferred alternative that would be consistent with the Coastal Management Program, would involve beachfill in the vicinity of these properties. Creation of a secondary dune could supplement the beachfill, as long as the dune creation did not involve the disturbance of the existing primary dune.

If you have any questions regarding this request, please contact me at the above address, by telephone at (609) 984-0184 or by email: KKALB@dep.state.nj.us.

Sincerely,

Kurt R. Kalb

Kurt R. Kalb
Section Chief

pg I-20

THE TOWNSHIP OF MIDDLETOWN

Township Hall, 1 King's Highway
Middletown, NJ 07748-2594

RICK BRODSKY
Mayor
JOAN A. SMITH
Deputy Mayor
RAYMOND J. O'GRADY
Committee Member
PATRICK W. PARKINSON
Committee Member
ROSEMARIE D. PETERS
Committee Member

Organized December 14, 1667
"Pride in Middletown"

JOSEPH P. LEO
Township Administrator
ELAINE M. WALLACE, CMC, CPM
Township Clerk

Tel: (732) 615-2000
Fax: (732) 957-9090

February 10, 1998

Mr. Tom Pfeifer
Chief, Coastal Section
United States Army Corps of Engineers
26 Federal Plaza
New York, N.Y. 10278-0090

Dear Mr. Pfeifer:

This will confirm our conversation in which the Township has invited you and members of your staff to participate in an informational meeting with local residents and officials.

Mayor Rick Brodsky has designated Monday, March 23 at 7 p.m. for this session.

We are scheduling the meeting for Croydon Hall, at the Recreation Complex of the Township, located off Leonardville Road in Leonardo. We are inviting both Congressman Frank Pallone and Congressman Mike Pappas, who represent sections of Middletown Township, to participate in this meeting. In addition, we have invited Bernard J. Moore, Administrator of the New Jersey Division of Engineering and Construction in the Department of Environmental Protection to participate. The local and county engineer will attend.

I would appreciate your determining which members of your staff might be most effective in assisting in the answers to the questions from our residents.

We appreciate your continuing support and interest in expediting relief to the flood-troubled areas of Middletown Township. Thank you in advance for your cooperation.

Very truly yours,

Joseph P. Leo
Administrator

JPL:rf
cc: Mayor & Township Committee
Congressman Frank Pallone
Congressman Mike Pappas
Theodore Giannechini, County Engineer
William Farrell, T&M
Bernard J. Moore, DEP

ATTACHMENT I-5

pg I-21

State of New Jersey
Department of Environmental Protection

Christine Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

January 21, 1998

Mr. John Sassi, P.E.
Chief, Planning Division
New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278-0090

Dear Mr. Sassi:

This letter is reaffirming the State of New Jersey's continued interest in the Feasibility Study for Raritan Bay, Sandy Hook Bay, NJ at Port Monmouth.

The State is in general support of the feasibility phase methodology and formulation of plan components as described in the "Plan Selection Memorandum" prepared through your office, including the concept of a storm gate at Pews Creek. The State acting as non-Federal liason to other local jurisdictions concerned believes that the approach and plan components seek to adequately address non-Federal concerns and preferences to the extent possible. We concur with pursuing the more detailed investigations for the selected alternative.

My office will assist your staff in further coordinating the proposed improvements with environmental resource agencies and in coordinating these formulation concepts and design with the regulatory branch of the NJDEP. Unequivocal, overall State support of the identified plan will require and be subject to the satisfactory completion of the NEPA process and assessment of environmental impacts, with due regard for the modeling results, wetland impacts, mitigation potential, and operability and maintenance concerns.

This Agency will continue to actively support this effort, and provide input critical to the conduct of the study, particularly given the forecast date of June 1998 for completion of a draft feasibility report. The State will continue to act as the non-Federal Sponsor, on behalf of the State and local governments, to cost-share the feasibility study phase.

Sincerely,

Bernard J. Moore
Administrator

ATTACHMENT I-6

New Jersey is an Equal Opportunity Employer
Recycled Paper

ASBURY PARK PRESS

Corps devising flood-protection plans for Middletown's bayshore

Published in the Asbury Park Press 12/19/97

By JAMES A. BRODERICK
CORRESPONDENT

MIDDLETOWN TOWNSHIP -- The Army Corps of Engineers is in the early stages of a project to provide protection against flooding from coastal storms in the Port Monmouth area.

That was the report last night by Township Committeewoman Joan A. Smith and County Engineer Theodore A. Giannechini during a meeting with area residents in the Port Monmouth First Aid squad building.

Smith said the the Army corps will have completed a feasibility study by September 1998, which will then go to Congress for a cost evaluation. If the $30 million project is funded, Smith said, work could start in 2001 or 2002 on a system of levees, flood walls, storm gates and berms.

Giannechini said a meeting between residents and corps officials, being arranged by Rep. Frank J. Pallone Jr., D-N.J., may help to speed up progress on the project.

Residents of the area say they are suffering property losses following each storm.

Claudia Eastmond, Creek Road, said the problems have increased in recent years. She said her property suffered flood damage during nor'easters in 1992 and 1996 and during a heavy rainstorm last October.

Martin V. Lawlor, Montana Avenue, a former township committeeman, and others with property south of Route 36 in a supposedly "dry area," said they were flooded for the first time in 1992 and again in 1996.

The residents said they believe recent road work along Port Monmouth Road and new bridges over Pews Creek and Comptons Creek may have contributed to the new flooding, although officials deny that.

Posted: 12/18/97 11:45:29 PM

pg I-23

ATTACHMENT I-7

State of New Jersey
Department of Environmental Protection
Natural and Historic Resources
Division of Engineering and Construction

Christine Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

May 21, 1997

Mr. Gene Brickman
New York Dist. Corps of Engineers
26 Federal Plaza
New York, NY 10278

Subject: Project 4015 - Port Monmouth Feasibility Study

Dear Mr. Brickman:

I am writing to you concerning the Feasibility Study at Port Monmouth, Raritan Bay, New Jersey. As you know, the potential formulation solution to the storm damage problems affecting this community is quite complex. The primary issue focuses upon environmental concerns, mitigation requirements, construction costs, potential for variations of affordable protection, local preferences and plan acceptance by various resource agencies.

Local coordination efforts are generally critical in identifying those projects that may be implemented with a view toward non-federal preferences. We have jointly explored various situations of all encompassing alternatives. Noting that a specific period of time has elapsed in the pursuit of this pivotal local input and that this has proven to be beneficial, I believe it would be prudent to continue with the required environmental studies and additional public involvement and to work closely with local agencies through the completion of this Feasibility phase.

Recognizing that the Feasibility report is due in November of 1997 and referencing my above noted concerns as well as the environment assessment regulations associated with NEPA, I hereby

Phone
(908) 255-0770

1510 Hooper Avenue, Toms River, NJ 08753

Fax
(908) 255-0774

New Jersey is an Equal Opportunity Employer
Recycled Paper

pg I-24

ATTACHMENT I-8

request that we defer this completion date by approximately six (6) months in order to insure that federal, state and local interests are in accordance with the final Feasibility Report.

Please be assured of our continued support of this project and if you have any additional questions, please give me a call.

Sincerely,

Bernard J. Moore
Administrator

mm

CENAN-PL-FC 21 March 1997

MEMORANDUM FOR RECORD

SUBJECT: Port Monmouth, New Jersey

1. On 14 March 1997, a meeting was held with Mayor O'Grady of Middletown Township, and representative members of the Mayor's staff, New Jersey Department of Environmental Protection (NJI[illegible] T&M Associates, URS Consultants, and the USACE (see attached attendance list). The meeting began at approximately 1030 hours once all were assembled in the Middletown Township Mayor's office. The primary purpose of the meeting was to discuss the alternatives to the Port Monm[illegible] Combined [illegible]d Control and Shore Protection Study, current focus, progress, and execu[illegible] strategy.

2. The meeting began with Mayor O'Grady's description of the various upcoming projects and investments which the Township expects for the bayshore of Port Monmouth, including improvements to the Spy House Marina, a 3,000 seat Playhouse (Arts Center), and a substantial amount of road work. In general, it was noted that the Township expends $4M to $6M every year on road projects. Paul Sabalis, Study Manager, then briefly described the proposed, potential improvement plan alternatives, as described in the P-7 Formulation Alternatives Report.

3. A major topic of discussion was centered upon the Pews Creek levee alignment. Mayor O'Grady expressed interest in reevaluating the P1 alternative, which includes a gate structure across Pews Creek that would tie into the existing Keansburg levee. This alignment scenario would theoretically protect a larger area; however, there are certain risk factors, operability constraints, and environmental issues concerning regulated flow that would require rigorous examination. Originally, Mr. Moore (NJDEP) did not support the P1 alternative because he deemed the maintenance of the required tide gate and pump station to be too costly and time consuming in terms of future State commitments. In response, Mayor O'Grady indicated the town and possibly the County would significantly assist the NJDEP in maintaining the tide gate and pump station and defraying associated costs; current road rasing activities in proximity to the Keansburg levee would allow for more convenient local maintenance access to future facilities at Pews Creek. Mayor O'Grady also expressed interest in extending the protection to cover development along Bray Avenue and for a small area located just south of State Route 36. Both areas are not protected by the current alignments.

4. The Mayor is also concerned over the proposed Compton Creek alignments where the current protection is at a 100 year level, with associated levee and floodwall heights of 15 feet NGVD. Mayor O'Grady suggested that the Corps extend the current levee alignment east, along Broadway where there is currently an ongoing municipal road raising project. This would serve to broaden the area of protection. Mr. Rooney (T & M Associates), pointed out the difficulty in tying off the levee to the appropriate high ground, based upon the topography going further east. Mayor O'Grady then suggested investigations to provide lower levels of protection corresponding to a height of 12 feet NGVD, since the Bayshore Outfall Authority, located in the eastern portion of

ATTACHMENT I-9

Port Monomouth will flood at that level. Mr. Rooney stated that a tie off for 12 feet may still be difficult to locate, but will be examined in more detail.

5. The local officials expressed concerns about the future of the Port Monmouth study area and inquired as to the timeframe for execution of a project. Mr. Thomas Pfeifer, Chief, Coastal Section, addressed Township queries concerning the schedule and Administration shore protection policy. Extending to the next phase beyond feasibility, into the Preconstruction Engineering and Design (PED) phase could be a challenging transition given the current political climate in Washington. However, the feasibility phase is scheduled for completion in 1998. Mr. Moore indicated that there are no guarantees for continued Federal involvement, but the NJDEP has pledged continued support on a year by year basis (as required in some cases) for many Corps projects. He indicated that strong local support is still critical for these ongoing endeavors. Mr. Moore mentioned that if the Corps were unable to pursue final portions of the project, the State and local entities could utilize the designs developed and engage in the execution themselves, in a worst case scenario, subject to funding constraints.

6. As a result of these discussions, Mayor O'Grady and his staff will send a letter to Mr. Moore of NJDEP stating their concerns and suggestions for the Port Monmouth alternatives. This shall be based upon a review of the Formulation report information. Mr. Moore will contact the County in order to schedule a follow up meeting to ensure that all local parties are apprised of and in accord with the latest ongoing activities and the study execution strategy and are able to reach accord as to local needs and preferences and express their general support of the NED or selected plan of improvement. In the interim, the Corps, in cooperation with the A/E will begin investigating concerns and issues discussed at the meeting, particularly the P1 alignment and possibilities to vary levee heights, and additional areas of coverage.

Prepared by: Jason Shea
Civil Engineer/Study Manager

Paul Sabalis

Concurred by: Paul Sabalis
Civil Engineer/Study Manager

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

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

4 OCT 1994

District Engineer

Honorable Frank Pallone, Jr.
Representative in Congress
540 Broadway - Suite 118
Long Branch, N.J. 07740

Dear Mr. Pallone:

I am replying to your letter dated September 16, 1994, which enclosed letters from Mr. Paul Linder, Township of Middletown - Department of Public Works and the Monmouth Avenue Association concerning flooding at Port Monmouth, New Jersey.

The Corps and New Jersey Department of Environmental Protection finalized a Feasibility Cost-Sharing Agreement (FCSA) for the Port Monmouth feasibility study which was initiated in April 1994 (a copy of the Public Notice is enclosed). This feasibility study is part of a multi-year study in which long-term storm damage reduction plans would be developed and evaluated to determine whether the plans meet the criteria for Federal participation in construction. At present, this is the only current authority in which Port Monmouth can be addressed. During the design process, besides providing for storm damage reduction protection along the Port Monmouth shoreline, plans will also be formulated for providing levees with appropriate tiebacks, at both Pews and Compton Creeks. These levees would reduce interior flooding conditions at Port Monmouth.

If you need any additional information, please contact me at (212) 264-0100 or Mr. Larry Cocchieri, project manager, at (212) 264-9077.

Sincerely,

Thomas A. York
Colonel, Corps of Engineers
District Engineer

Enclosures

pg I-28

ATTACHMENT I-10

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

REPLY TO
ATTENTION OF
CENAN-PL-FN

July 1994

PORT MONMOUTH, NEW JERSEY FEASIBILITY STUDY

This notice announces the initiation of a feasibility phase study for shoreline protection at Port Monmouth, New Jersey. Port Monmouth is located in northern Middletown Township, Monmouth County. It is bordered on the north by Raritan Bay, Pews Creek on the west, Compton Creek on the east, and New Jersey State Route 36 on the south. This study is being conducted under the authority of a resolution adopted by the Committee of Public Works and Transportation of the U.S. House of Representatives on August 1, 1990. The U.S. Army Corps of Engineers completed a reconnaissance report entitled "Raritan Bay and Sandy Hook Bay, NJ" in March 1993. The reconnaissance investigation recommended further study to identify the economically optimum plan that is environmentally and socially acceptable.

The Raritan Bay and Sandy Hook bayshore is a 21 mile stretch located between Sandy Hook and the mouth of the Raritan River. The reconnaissance study included the communities of Highlands, Atlantic Highlands, Leonardo, Belford, Port Monmouth, Union Beach, Keyport, Cliffwood Beach, Sayreville and South Amboy. The area has been subject to storm damage and major flooding in September 1944, November 1950, November 1953, September 1960, March 1963, March 1984 and December 1992. Continued erosion of the bayshore is expected in the future which will increase the potential for storm damage.

The community of Port Monmouth was selected first for further plan development since the storm damage potential is clearly severe and because useful information, though limited, was available. Several storm damage reduction and shore protection alternatives, each providing similar levels of protection, were investigated based on local needs and desires, comparative costs and implementation constraints. The plan considered for the reconnaissance report includes a 2600 ft. shore protection section with a 40 ft. wide dune crest at +15 ft. NGVD, a 50 ft. wide beach berm at +5 ft. NGVD, dune grass, sand fencing and two dune overwalks. The plan provides storm damage reduction along Pews Creek and Compton Creek by means of two (2) levees each having a crest elevation of +13 ft. NGVD and a width of 10 ft. Drainage structures would be incorporated every 400 feet along the levee alignment.

The local sponsor, the State of New Jersey, Department of Environmental Protection and Energy, has indicated their support and their willingness to share the cost of the feasibility study for Port Monmouth. In view of the non-Federal support and favorable results of the economic, environmental and technical analysis, the District Engineer recommends that the necessary planning and engineering studies to provide storm protection works at Port Monmouth proceed to a cost-shared Feasibility Study.

Additionally, the reconnaissance study identified potential Federal interest in providing protective works for the communities of Union Beach, Highland, Leonardo and Keyport. A determination will be made during the Port Monmouth feasibility study if any or all of the four identified communities are worthy of recommendation for feasibility study. Furthermore the reconnaissance study identified that there is no Federal interest at this time for the following communities: Atlantic Highlands, Sayreville, Belford and South Amboy. Although the entire study area is generally subject to similar physical damage processes, each of the ten identified communities exhibits some variation in the specific nature of the problems and attendant needs. In order to verify Federal interest as defined by economic viability, the anticipated benefits and costs for various communities were compared relative to the Port Monmouth area. Relative benefits and costs were determined through an evaluation of indicators considered to have a significant impact on benefits or costs. The process also compared the needs, opportunities and planning constraints for shore protection and flood control associated with each area. Therefore, for the four (4) communities listed above, protection does not appear economically viable based on the findings of the reconnaissance report.

We request any pertinent information about the Port Monmouth area from Federal, State and local agencies, as well as the private sector. The information provided will be used to the greatest extent possible to define the nature and severity of the erosion problems and to determine potential Federal interest in providing protective measures. We also welcome any assistance and suggestions pertaining to the conduct of this study. All comments should be directed to the above address, ATTN: Mr. Larry Cocchieri, CENAN-PL-FN.

Thomas A. York
Colonel, Corps of Engineers
District Engineer

COMMITTEES:
ENERGY AND COMMERCE
MERCHANT MARINE
AND FISHERIES
AGING

REPLY TO:
WASHINGTON OFFICE:
CANNON HOUSE OFFICE BUILDING
INGTON, DC 20515-3006
EPHONE: (202) 225-4671

FRANK PALLONE, JR.
6TH DISTRICT, NEW JERSEY

Congress of the United States
House of Representatives
Washington, DC 20515-3006

REPLY TO:
DISTRICT OFFICES:
☑ 540 BROADWAY (SUITE 118)
LONG BRANCH, NJ 07740
(908) 571-1140
☐ 67/69 CHURCH ST.
KILMER SQUARE
NEW BRUNSWICK, NJ 08901
(908) 249-8892
☐ I.E.L. AIRPORT PLAZA
(ROOM 33) HIGHWAY 36
HAZLET, NJ 07730-1701
(908) 264-9104

September 16, 1994

S: PPMD-CW

Attn: ~~Mr. Joseph J. Seebode~~
Army Corps of Engineers
Department of the Army
NY District Corps of Engineers
Jacob K. Javits Federal Building
New York City, NY 10278-0090

Dear Mr. Seebode:

RE: Mr. & Mrs. James Pipitone
618 Monmouth Avenue
Port Monmouth, NJ

I have recently been contacted by the above named.

I am enclosing a copy of the related correspondence for your perusal. After your review please advise me of your findings.

If you have any further questions or concerns, please do not hesitate to contact my Long Branch district office. In advance, I would like to thank you for your cooperation with myself as well as my constituent.

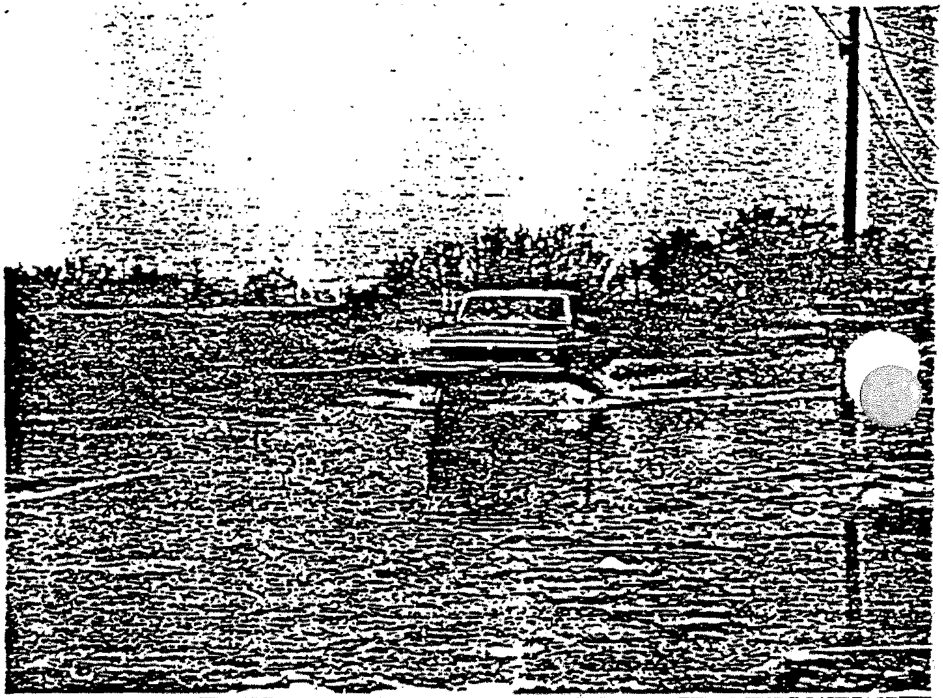
With best regards, I am

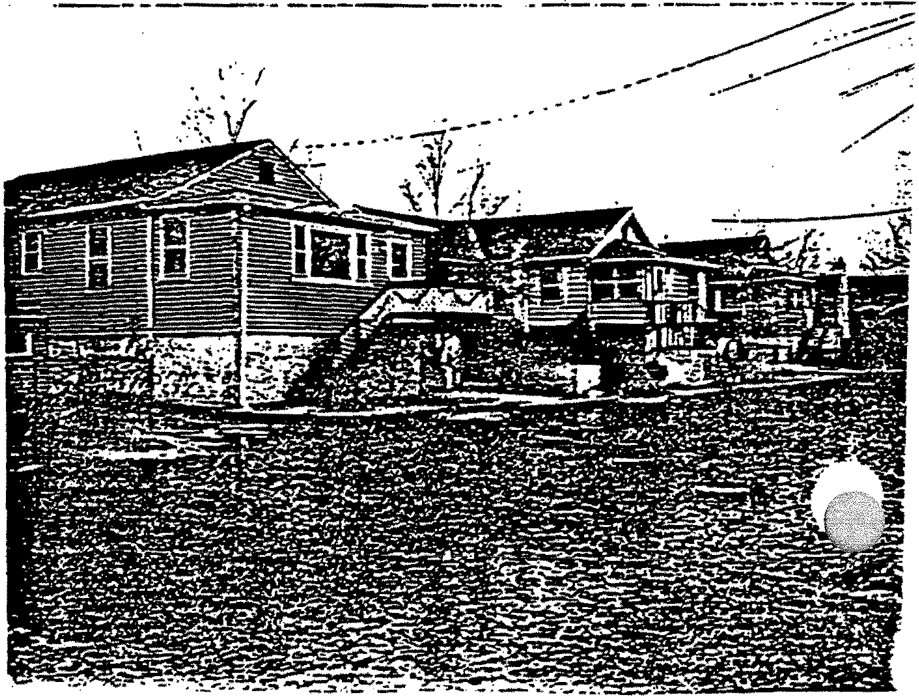
Sincerely,

Frank Pallone Jr.

Frank Pallone JR.
Member of Congress

FP/kid
Enclosure





ed December 14, 1667
ide In Middletown"

Kanes Lane
Middletown, NJ 07748-3517
Tel: (908) 615-2109
(908) 615-2110
Fax: (908) 671-0039

P.A. LINDER
Director of Public Works
LAWRENCE M. WERGER
Assistant Director of Public Works

FEB 14 1994

February 7, 1994

Honorable Frank Pallone, Jr., Congressman
540 Broadway, Suite 118
Long Branch, NJ 07740

Re: Mr. & Mrs. [redacted]

Dear Congressman Pallone:

We share the Pipitone's concern over the flooding problems they face. With the assistance of our engineers, we have worked to improve drainage in the areas of Monmouth and Wilson Avenues. A project to improve drainage along Wilson Avenue was under taken this summer.

As the Pipitones point out, the main issue is tidal flooding. At times the tide exceeds the height of our storm drain system and overflows into their yards. The solution to their problem would be to build a dam across the entire area and provide pumping facilities to control the volume of water. Such a project would cost millions of dollars and is currently outside the scope of this Township. We would need assistance from the Army Corp of Engineers and federal financial aid to undertake such a project.

The Township of Middletown is not reluctant to send street sweepers to clean Monmouth Avenue. When they requested this service our sweepers were put away for the winter. They had to be brought out storage and be serviced before cleaning up their roads. [redacted]

It is a shame that real estate sales people misrepresent conditions in this area. If prospective buyers were told the truth, they wouldn't sell any homes. As a member of the local planning board, I favor a notation in the deed that prospective buyers are purchasing property in flood prone areas.

Public Works resources are limited, but we are available to assist our residents wherever possible.

Sincerely,

Paul Linder

Paul Linder
Director of Public Works

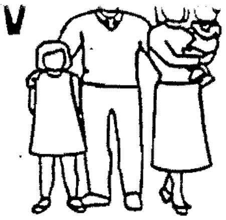
PAL/ad

cc: Joseph Leo, Administrator

attachments

pg I-34

MONMOUTH AVENUE ASSOCIATION



Dear Sir/Madam:

We, the residents of Port Monmouth, N.J. are filing a complaint against Middletown Township and T&M Engineering for failure to correct the existing problem of street flooding on Monmouth Avenue.

Since April of 1993 nine (9) Noreasters have hit and devastated our community. Many residents were literally held hostage in their homes causing them to miss work, school, appointments, etc. The people of Monmouth Avenue fear for the safety of their families and property. It has become so bad that you cannot even entertain in your own home fearing that flooding will prevent your guests from leaving or arriving.

We are aware that Noreasters occur when an Extratropical Cyclone develops in the Metropolitan area. On an average, forty (40) Noreasters are formed each year in these latitudes and longitudes between September and April. Noreasters are known to develop with the events of full and new moons. When combined it has devastating effects upon our community. The over flooding of our streets is caused by the flooding of the marshlands between Wilson Avenue and Pews Creek. Theoretically, a one way valve is supposed to prevent the rising marsh waters from entering a storm drain which is intended to relieve Monmouth Avenue of rain water. Instead of relieving water, the valve allows sea water in and causes flooding through two storm drains. This valve, Rubber Boot, continues to be used even though it has been proven consistently ineffective. This valve is not intended to be used in this present capacity.

During 1993 residents of Monmouth Avenue have personally brought these problems to the attention of various officials. Although meetings have been held, no action has yet been taken to correct the present situation. Many promises were made by officials in the homes on Monmouth Avenue, and nothing has been done. We are demanding some action be taken to correct the situation. We cannot go on living day to day fearing the next Noreaster. We strongly feel that this problem can be resolved if we all work together. We, the residents of Monmouth Avenue, are proud of our community and would appreciate something being done to solve our problems.

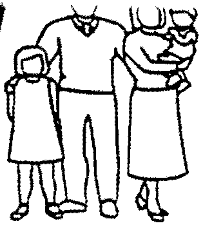
It is an embarrassment to your township. Zoning for these homes should not have been approved if there was even a slight chance that the problems we are now having were possible. We are taxpayers like the rest of Middletown and are sick of being treated like second class citizens. We do not appreciate this lackadaisical attitude. We are the People who make Port Monmouth a nicer community to live in, and we would like to continue living here.

Thank You,
MONMOUTH AVENUE ASSOCIATION

P.O. BOX 350.PORT MONMOUTH,NEW JERSEY 07758

pg I-35

MONMOUTH AVENUE ASSOCIATION



cc:
Mayors Office Middletown Township
Public Works Middletown Township
T&M Engineering
Senator Joseph Kyrillos
Senator Frank Lautenberg
Congressman Frank Pallone Jr.
Asbury Park Press
The Courier
NJN News
Channel 2 "Shame on You" - Arnold Diaz

P.O. BOX 350.PORT MONMOUTH,NEW JERSEY 07758

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

22 FEB 1994

District Engineer

Honorable Frank Pallone, Jr.
Representative in Congress
I.E.I. Airport Plaza
(Room 33) Highway 36
Hazlet, N.J. 07730-1701

Dear Mr. Pallone:

I am replying to your letter dated January 25, 1994, which enclosed letters from Ms. Manuela C. Vieira-DaPonte and Mr. and Mrs. Joseph Repp concerning flooding at Port Monmouth, New Jersey.

The Corps and New Jersey Department of Environmental Protection and Energy are currently finalizing a Feasibility Cost-Sharing Agreement (FCSA) for the Port Monmouth feasibility study which is expected to be initiated in spring 1994. This feasibility study is part of a multi-phase, multi-year study in which long-term storm damage reduction plans would be developed for Port Monmouth that would also provide flood control. At present, this is the only current authority in which Port Monmouth can be addressed.

If you need any additional information, please contact me at (212) 264-0100 or Mr. Larry Cocchieri, project manager, at (212) 264-9077.

Sincerely,

Thomas A. York
Colonel, Corps of Engineers
District Engineer

Pg I-37

ATTACHMENT I-11

COMMITTEES:
ENERGY AND COMMERCE
MERCHANT MARINE
AND FISHERIES
AGING
REPLY TO:
WASHINGTON OFFICE:
420 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515–3006
TELEPHONE: (202) 225–4671

FRANK PALLONE, JR.
6TH DISTRICT, NEW JERSEY

Congress of the United States
House of Representatives
Washington, DC 20515–3006

☐ 540 BROADWAY (SUITE 118)
LONG BRANCH, NJ 07740
(908) 571–1140

☐ 67/69 CHURCH ST.
KILMER SQUARE
NEW BRUNSWICK, NJ 08901
(908) 249–8892

☑ I.E.L. AIRPORT PLAZA
(ROOM 33) HIGHWAY 36
HAZLET, NJ 07730–1701
(908) 264–9104

January 25, 1994

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

Dear Colonel York:

As you will note from the attached, I have been contacted by several residents in the Port Monmouth section of Middletown, N.J., who are concerned with a flooding problem in their neighborhood.

The problems they have experienced as a result of the flooding are outlined in the enclosed correspondences. I would appreciate your looking into this matter to determine if the Army Corps of Engineers could provide them any assistance.

Please provide my Hazlet district office with a written summary of your findings.

Sincerely,

Frank Pallone, Jr.

FRANK PALLONE, JR.

FP/kb

11 1994

, December 1993
37 Monmouth Avenue
t Monmouth, NJ 07758

Congressman Frank Pallone
Room 119
540 Broadway
Long Branch, NJ 07740

Dear Congressman Pallone,

I live in the Port Monmouth section of Middletown, NJ and have resided there for the past ten years. I am writing to you about a problem that has been occurring since the time I purchased my home. Unfortunately for me I was not made aware of the problem when I bought my house; otherwise I would not be living there.

The problem I am writing about is flooding. When I purchased my home, it was my first home and it was a Veterans Administration repossession sale. At no time did the realtor (Bander Agency, Oakhurst, NJ) inform me that there was a water problem in the area. When I applied for my mortgage there was no requirement for flood insurance, which would have alerted me. Imagine my surprise, when shortly after having moved in, there was a full moon and the street filled up with water. I could not believe what I was seeing. After watching this flooding happen with almost every new and full moon, and hearing of a hurricane coming, I made attempts to purchase flood insurance on my own. I was told by Prudential Insurance Company that I lived in a Class B flood zone and that it was inconceivable and unbelievable that I had been allowed to purchase the home without having to purchase flood insurance. But, that is exactly what happened, and I did purchase the insurance after the fact for my own protection.

Little did I know at that time how severe the flooding problem in Port Monmouth really was. Everytime there is a coastal storm, the water fills the street and remains there for quite some time. Most of the time my yard is either partially or totally submerged. Township vehicles and other privately owned vehicles insist on driving through the flood waters with little or no regard for the damage that they are causing. I have had trucks make such big waves as to actually drive the water right into my garage. These same waves wash away the mulch and top soil in my flower beds. I am the most unfortunate person on my street as my house is a bi-level which is built on a slab. I do not have a flood foundation or a basement and am located only about 100 feet from the storm drains through which the flood waters rise.

Over the past ten years I have had my yard and landscaping continually destroyed. I have raked up pounds and pounds of debris, shoveled and hosed down mud and slime, not to mention being trapped inside my house for hours as it is completely surrounded by water. Other times I have been unable to get in to the house until the waters recede. The worst by far was last December 11th when I had three and a half feet of ater in the brand new downstairs of my house. It was an unbelievable ghtmare, and one that I certainly do not ever want to experience again.

It has now gotten to the point that my mental and emotional ealth are being adversely affected. Each time I hear a weather forecast dvising "coastal flooding" or unusually high tides, etc. I become a ervous wreck, sure that once again my house will become flooded. I am ow on "Xanax", an anti-anxiety medication, that given the choice, I ertainly do not want to be taking; but it has gotten to the point that my ear of the flooding renders me unable to function normally.

Approximately three years ago, the Township of Middletown installed a flapper" valve, and for a while the full moon flooding did abate. ately, however, the problem has resurfaced. Of course, in any kind of oastal storm, the "flapper" valve is of no value. About a year ago, the ownship engineers informed us that the valve was broken and that they ould devise a temporary fix until a new one could be installed. I have alled the township and inquired but have not yet been able to determine if the new valve has been installed or not.

I know that Keansburg and North Middletown have had similar flooding problems in the past but this has been remedied by the installation of a pumping station. I would like to see the same thing happen in Port onmouth, and Belford where I think it is also necessary. I know that in he past the Army Corps of Engineers did a multi million dollar study which determined that there was not enough money in the area to warrant the building of a berm, pumping station, etc. I have heard mention of another such study being conducted. Instead of wasting all that money on a study, why not just use the money to remedy the situation? Perhaps there is the possibility of some other alternatives, ie., dredging the current creeks that cause the overflowing and making them deeper, thus able to contain more water, or installing a check valve and a berm (one of my neighbors suggested something to this effect to the head of the township Public Works Department and he said it sounded feasible). A lot of new homes have been built in our area, therefore there must be a significant increase in tax dollars, warranting an improvement of this type. Otherwise, I cannot see why the Township of Middletown continually allows development in an area such as this. I cannot understand how anyone was ever granted the permission to build the house that I now own since everyone that has been affiliated with the township for any length of time knows that in 1964 my property (no house was built on it until 1973) was under six feet of water! I really would like an answer to this question almost as much as I would like to see the flooding stopped.

To add insult to injury, the Township of Middletown is extremely uncooperative when it comes to requests for them to clean up the mess after one of our floods. The people in my neighborhood pay their taxes just like in any other neighborhood. The inconvenience and trauma that we are forced to live with year round should certainly afford us some cooperation from the very township that allowed this situation to exist in the first place (building where no building should be).

As for myself, you may say "why doesn't she just move", but it's not as simple as that. I have a lien against my house (from my husband's first wife) which precludes me from selling at the present time and we have not finished remodelling the entire house, which was our plan before attempting to sell. I also ask myself, that unlike Middletown Township, could I sell my house with a clear conscience to an unsuspecting person? I don't think so. When looking at the area, one would never think of such extensive flooding or water problems, as the bay is far enough away that the water would probably never come "rolling" down the street. Who would think that such incredible amounts of water (over four and a half feet in the street on December 11, 1992) could come rising up out of storm drains?

Needless to say, the conditions that I and my neighbors are forced to live with are most stressful. Mothers cannot get their children to school - my next door neighbor had to lift her children up over their fence and then climb it herself to get to their car. Alarm clocks are set for every two hours during the night when there is a storm warning to see if the water is coming up yet. Cars are moved and parked down the street. Plans with family and friends are made according to the forecast on the weather channel. I once had to get a person from down the street to drive my mother and sisters in his pickup truck to the end of my driveway. I then had to lay planks so that they could get into my house without stepping in ice cold water and ruining their shoes. We get all this for only $3,000 plus in taxes a year. What a bargain!

Please do not think that you are the only person I have ever written to regarding this problem. In the past I have written to the Township of Middletown Committee and the Mayor - my letters were totally and rudely ignored. At one point in time we had a neighborhood committee and Senator Van Wagner came to our meeting and said he would help us. I have also had a letter printed in the Middletown Democrat Newsletter (copy enclosed) and they said they would help - again, I have heard nothing. It greatly upsets me whenever I see storm coverage in the Asbury Park Press. Port Monmouth looks like the houses are little islands in a huge ocean, yet we never receive any type of coverage which maybe, just maybe would get us some help. And, I have called the newspaper, again to no avail. It sort of makes me wonder if someone is trying to cover up.

Although I think I could keep writing page after page about this intolerable mess, I will close here and ask you to please, please look into this matter and see what you can get done to help us. Any effort on your part would be most greatly appreciated and I thank you in advance for your time and effort on the behalf of the residents of Port Monmouth.

Sincerely,

Manuela C. Vieira-DaPonte

Manuela C. Vieira-DaPonte

◆ The Middletown Democrat ◆

Volume 2 Issue 2 CHUCK FALLON, EDITOR July 1993

WHAT REALLY MATTERS IN MIDDLETOWN?

TO WHOM IT MAY CONCERN:

I am extremely disappointed with Middletown Township. No one told me, when I purchased my home, that there was a "water" problem in Port Monmouth, and specifically on my street. As you may already know, water comes up from the storm drains on Monmouth and Brainard Avenues quite frequently and causes flooding. My house, unfortunately, is located very close to the storm drains and is built on a slab. It was built before there were any regulations or laws concerning flood foundations. I was not even aware that I had purchased a home in a "flood zone" until I did some research on my own after witnessing the first full moon flood.

Although previous floods never damaged my home, they destroyed my yard, killed my trees and shrubs and made a mess out of the sidewalks and roads. In all the times that Monmouth Avenue has flooded over the past nine years, the township cleaned up the street only two or three times. Usually I have to shovel the debris, mud and slime and then rinse the street myself with a hose.

During the December 11, 1992 storm, I lost the entire downstairs to my house, and my car. My husband lost his truck and our yard was totally destroyed. I saw township trucks driving around, but never once did they come into my neighborhood to remove debris or clean the streets. Why am I paying taxes that are constantly being increased? I know that in Keansburg they installed flood gates which have done wonders in improving the flooding problems there. I would like to know why nothing is done in Port Monmouth.

Over the years I have written letters to the Mayor and the Township Committee. The letters have never once been acknowledged.

I am writing this letter to ask you if there is anything you can do to surface this problem. Are we expected to just sit and wait for the next big storm to hit? I question why the township is allowing even more new homes to be built on my street. Have they no conscience or simply no concern? I do not understand the political machine that is in existence in Middletown Township.

Thank you for your time.

Manuela C. Vieira-DaPonte

Calendar

June 30 - Middletown Democratic Executive Committee track day at Monmouth Park - contact Marilyn Maguire 741-1945

July 7 - 8 PM Meeting - Middletown Democratic Organization Buck Smiths - all welcome

July 11 - 2PM - 4PM Cruise aboard "The Sandy Hook Lady" - refreshments and entertainment - for reservations call Marilyn Maguire - Cost $20 - Seniors Citizen discount rate

Democratic candidates Michael Spaeth, Len Socol, Sara Stewart, Colleen Philips and Pat Healy with Middletown Chairman Marilyn Maguire

More taxes - Less service

The new Middletown budget projects a 5.8 cent tax hike to 48.6 cents per $100 of assessed valuation. Although our mayor claims the raise is due to "extraordinary items" such as funding the 1.2 million for last years safety busing, services in town have definitely been drastically reduced.

In a time when protection and safety are paramount, our police department has been cut from 105 to 91 officers and the training budgets have been all but eliminated. Lack of manpower translates to setting priorities for calls to which the department can respond.

Continued on page 2 "Budget"

Candidates announced

At the Democratic meeting on March 21, Len Socol and Mike Spaeth were declared as candidates for township committee.

Len Socol, a successful businessman has lived in Middletown for the past 8 years. As CEO and President of Airport Check Cashing Management Corp, he is committed to bringing his business and financial acumen to Middletown.

Michael Spaeth, a nine year resident has an MPA degree from Seton Hall University and was a former research assistant for Senator Frank Lautenberg. He is eager to implement his administrative training in Middletown.

mes have been built, and this surely has increased not only the influx of tax dollars but also the value of the property. Another study by the Army Corps of Engineers is supposedly in the works; why not just use that money to correct the problem. Another study is not needed -- action is.

We appreciate any efforts on your behalf to finally do something about this problem. It is a terrible way to live and unfortunately, not everyone can move or sell their home. Thank you in advance for your time and attention to this most urgent matter.

Sincerely yours,

Marianne Repp
Joseph Repp

Mr + Mrs. J. Repp
[illegible] Monmouth Ave
Port Monmouth, NJ 0

19 January 1994

Dear Honorable Frank Pallone,

We live in the Port Monmouth section of Middletown Township, New Jersey. We are writing this letter in the hope that you can help bring about a solution to the flooding problem that we have been living with since moving here. People buying the new homes in our area were told by the builder that it has not flooded in 100 years. The reality is that it floods on the average of once a month or more. Certainly, no one would suspect that the flood waters rise up out of the storm drains. On December 11, 1992 the water in our neighborhood was 3 to 4 and 1/2 feet high, and it did not come directly down the streets from the Raritan Bay. Homes directly across the street from the bay were left dry and intact. Homes quite a distance from the bay were flooded because of the water coming from the storm drains.

When tides run high, such as during a new moon, full moon or other astronomical conditions, and/or if there is any type of an easterly wind (be it northeast, southeast or just east), the creeks overflow and the excess water is somehow directed to flow up out of the storm drains. This, as you can imagine, causes many problems. Mothers are unable to take their children to school or pick them up, depending on what time of the day the flooding occurs. Cars must routinely be moved several blocks away in anticipation of a storm. Mail cannot be delivered and visitors cannot come to people's homes. After the water subsides, the Township of Middletown seems to be extremely reluctant to clean up the mess that is left behind. The streets and sidewalks are covered with sludge and debris which is carried into cars and homes via shoes. It also smells terrible and although many of the homes are new, it makes the neighborhood look like a slum.

We are aware that there are solutions to this flooding problem - it was rectified in two neighboring towns via installation of a pumping station - however, the Township of Middletown says that there is no money. We are tired of living this way. As taxpayers and concerned citizen/citizens we would like to see the same type of action that was taken in North Middletown and Keansburg taken in Port Monmouth. If a pumping station is totally out of the question, perhaps another type of diversionary measure can be taken. In the past, the Army Corps of Engineers was paid an exhorbitant sum to do a study determining if it would be cost effective to correct the flooding problem from Port Monmouth to Highlands, NJ. At that time it was determined not to take any action as there was "not enough money in the area". Since that time, many new

COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C.

RESOLUTION

Raritan Bay and Sandy Hook Bay, New Jersey
Docket 2357

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 requested to review the report of the Chief of Engineers on Raritan Bay and Sandy Hook Bay, New Jersey, published as House Document 464, Eight-seventh Congress, Second Session, and other pertinent reports, to determine the advisability of modifications to the recommendations contained therein to provide erosion control and storm damage prevention for the Raritan Bay and Sandy Hook Bay.

A[illegible]ted: August 1, 1990

ATTEST: Glenn M Anderson
GLENN M. ANDERSON, Chairman

(Requested by Representative Frank Pallone)

pg I-45

ATTACHMENT I-12

State of New Jersey
Department of Environmental Protection
Natural and Historic Resources
Division of Engineering and Construction

Christine Todd Whitman
Governor

Robert C. Shinn,
Commissioner

February 16, 2000

Mr. Frank Santomauro, P. E.
Chief, Planning Division
New York Dist. Corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Mr. Santomauro:

I have reviewed the Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey Draft Feasibility Report and Draft Environmental Statement, and support your recommendation to proceed with this project into the Plans and Specifications and Construction Phases.

I concur with the recommended plan, which consists of constructing levees and floodwalls, placement of beachfill, construction of pedestrian dune walkovers, installation of a storm gate across Pews Creek, installation of three road closure gates and the raising of a section of Port Monmouth Road. The New Jersey Department of Environmental Protection intends to participate fully in partnership with the Corps and understand all non-federal responsibilities in accordance with the standard requirements for Storm Damage Reduction Projects.

I believe, that, subject to agency and public review, it is in the best interests of the State of New Jersey, Monmouth County, and Middletown Township that this project be advanced to construction as soon as possible.

Please be assured of our interest and support in this matter and desire to get this project to completion.

Sincerely,

Bernard J. Moore
Administrator

mm

Attachment I-13

Phone
(732) 255-0770

1510 Hooper Avenue, Toms River, NJ 08753

Fax
(732) 255-0774

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

March 3, 2000

Planning Division

Dear Reviewer:

Enclosed are copies of Volume I, II and III for the proposed Raritan Bay, Sandy Hook Bay, Hurricane and Storm Damage Reduction Project, Port Monmouth, New Jersey, Middletown Township, Monmouth County. Volume I contains the Draft Feasibility Report and the Draft Environmental Impact Statement (DEIS). Volumes II and III are appendices that provide supporting documentation. The DEIS will be filed with the U.S. Environmental Protection Agency, pursuant to the National Environmental Policy Act (NEPA) of 1969 and the President's Council on Environmental Quality (40 CFR parts 1500 – 1508). Your written comments to the DEIS are due forty-five (45) days from the date the Notice of Availability appears in the Federal Register. Your written comments can be directed to:

Mr. Mark H. Burlas
Senior Wildlife Biologist
CENAN-PL-EA
26 Federal Plaza
New York, New York 10278-0090
212-264-4663
mark.h.burlas@nan02.usace.army.mil

The DEIS is expected to be published in the Federal Register on or about March 10, 2000. All questions can be addressed to Mr. Burlas at the address above.

Sincerely,

Frank Santomauro

Frank Santomauro, P.E.
Chief, Planning Division

Enclosures

Attachment I-14

Tel: (732) 787-6260
Fax: (732) 787-0313

J. CRAWFORD COMPTON, INC.

Real Estate Since 1922

732 Route 36 • P.O. Box 206
Belford, New Jersey 07718

Suburban and Country Residences

COMMERCIAL AND INVESTMENT PROPERTIES
MORTGAGES • APPRAISALS • MANAGEMENT

April 26, 2000

Paul Sabalis
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278-0090

Dear Mr. Sabalis,

As a lifelong resident of the Middletown, NJ bayshore area and member of the area's oldest Real Estate firm I applaud the efforts in engineering the Port Monmouth storm damage reduction program.

The project falls short, though, in accomplishing what the prior work of the East Keansburg leeve did for homeowners protected by that "Hurricane Berm". Specifically that is to have removed those homes from the need to purchase flood protection insurance. These insurance premiums result in an average monthly expense of $40. per household. Not knowing the cost of raising the height of the project berm sufficiently to offer such flood protection I can only pose the question: Why can't the project be built so as to relieve the protected homes from having to buy flood insurance?

I'll appreciate a response and your suggestions as to appropriate contacts to communicate this issue.

Sincerely,

Brian T. Compton

Attachment I-15

page I-48

State of New Jersey
Department of Environmental Protection
Natural and Historic Resources
Division of Engineering and Construction

ne Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

June 5, 2000

Mr. Paul Sabalis
Project Manager
New York Dist. Corps of Engineers
26 Federal Plaza
New York, NY 10278

Subject: Project 4015-Federal Shore Protection Project
Port Monmouth Section

Dear Mr. Sabalis:

I have reviewed the public access plan for the above subject project. I find the access plan complete and acceptable to this office. As this project moves forward, please be assured of our continued support for this vital project.

If you have any questions or concerns, please feel free to give me a call.

Sincerely,

Bernard J. Moore
Administrator

mm
Encl.

Attachment I-16

State of New Jersey
Department of Environmental Protection

hristine Todd Whitman
overnor

Robert C. inn, Jr.
Commissioner

Natural and Historic Resources
Division of Engineering and Construction

June 14, 2000

Mr. Frank Santomauro, P. E.
Chief, Planning Division
New York Dist. Corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Mr. Santomauro:

I have reviewed the draft feasibility report for Raritan Bay and Sandy Hook Bay, Port Monmouth, New Jersey. I generally support the findings and recommendations and plan for project authorization.

I also support the initiation of the Pre-construction, Engineering and Design (PED) phase. This agency has the capability to participate and will act as the non-Federal sponsor for the PED phase and project construction.

Recognizing the problems afflicting this study area, I look forward to continuing work with your office in an expeditious manner to advance this effort toward construction of an implemental plan. Furthermore, we are aware of risks associated with any advance acquisition costs and the land, easement and right-of-way credits that would be incurred by the State prior to execution of a Project Cooperation Agreement.

If you have any questions concerning issues of local support, please feel free to call me. Please be assured of our continued concern and support for this project.

Sincerely,

Bernard J. Moore
Administrator

mm

Attachment I-17

Phone (732) 255-0770
1510 Hooper Avenue, Toms River, NJ 08753
Fax (732) 255-0774