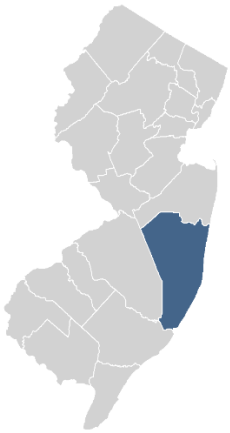
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 2



OCEAN COUNTY, NEW JERSEY

(ALL JURISDICTIONS)

COMMUNITY NAME	NUMBER	COMMUNITY NAME	NUMBER
BARNEGAT, TOWNSHIP OF	340396	MANCHESTER, TOWNSHIP OF	340382
BARNEGAT LIGHT, BOROUGH OF	345280	MANTOLOKING, BOROUGH OF	340383
BAY HEAD, BOROUGH OF	345281	OCEAN, TOWNSHIP OF	340518
BEACH HAVEN, BOROUGH OF	345282	OCEAN GATE, BOROUGH OF	340384
BEACHWOOD, BOROUGH OF	340368	PINE BEACH, BOROUGH OF	340385
BERKELEY, TOWNSHIP OF	340369	PLUMSTED, TOWNSHIP OF	340386
BRICK, TOWNSHIP OF	345285	POINT PLEASANT, BOROUGH OF	345313
EAGLESWOOD, TOWNSHIP OF	340372	POINT PLEASANT BEACH, BOROUGH OF	340388
HARVEY CEDARS, BOROUGH OF	345296	SEASIDE HEIGHTS, BOROUGH OF	340389
ISLAND HEIGHTS, BOROUGH OF	340374	SEASIDE PARK, BOROUGH OF	345319
JACKSON, TOWNSHIP OF	340375	SHIP BOTTOM, BOROUGH OF	345320
LACEY, TOWNSHIP OF	340376	SOUTH TOMS RIVER, BOROUGH OF	340392
LAKEHURST, BOROUGH OF	340377	STAFFORD, TOWNSHIP OF	340393
LAKEWOOD, TOWNSHIP OF	340378	SURF CITY, BOROUGH OF	345324
LAVALLETTE, BOROUGH OF	340379	TOMS RIVER, TOWNSHIP OF*	345293
LITTLE EGG HARBOR, TOWNSHIP OF	340380	TUCKERTON, BOROUGH OF	340395
LONG BEACH, TOWNSHIP OF	345301		

* Fomerly Township of Dover. Community name was changed in November 2006.

REVISED:

June 20, 2018

FLOOD INSURANCE STUDY NUMBER
34029CV001B
Version Number 2.3.3.2

FEMA

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: September 29, 2006

Revised Countywide FIS Date: June 20, 2018

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FLOOD INSURANCE STUDY
OCEAN COUNTY, NEW JERSEY (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) investigates the existence and severity of flood hazards in, or revises and updates previous FISs/Flood Insurance Rate Maps (FIRMs) for the geographic area of Ocean County, New Jersey, including: including the Boroughs of Barnegat Light, Bay Head, Beach Haven, Beachwood, Harvey Cedars, Island Heights, Lakehurst, Lavallette, Mantoloking, Ocean Gate, Pine Beach, Point Pleasant, Point Pleasant Beach, Seaside Heights, Seaside Park , Ship Bottom, South Toms River, Surf City, and Tuckerton and the Townships of Barnegat, Berkeley, Brick, Dover, Eagleswood, Jackson, Lacey, Lakewood, Little Egg Harbor, Long Beach, Manchester, Ocean, Plumsted, and Stafford (hereinafter referred to collectively as Ocean County).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by Ocean County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS was prepared to include the unincorporated areas of, and incorporated communities within, Ocean County in a countywide format. Information on the authority and acknowledgments for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below.

Barnegat, Township of:	The hydrologic and hydraulic analyses from the FIS report dated June 15, 1982, were performed by T & M Associates for the Federal Emergency Management Agency (FEMA), under Contract

	No. H-4807. That study was completed in August 1980.
Barnegat Light, Borough of	For the March 23, 1999, FIS, the updated coastal analysis was prepared by the U.S. Army Corps of Engineers (USACE), Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996. The wave height analyses from the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
Bay Head, Borough of:	For the June 15, 1983, Wave Height Supplement to the FIS report and the December 15, 1983, FIRM (hereinafter referred to as the 1983 FIS), the wave height analyses were prepared by Dewberry & Davis for FEMA under Contract No. EMW-C-0543. That work was completed in December 1982. For the September 7, 2000, revision, the coastal hydrologic and hydraulic analyses were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed in September 1996.
Beach Haven, Borough of:	For the March 23, 1999, FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996. The wave height analysis for the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
Beachwood, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated September 2, 1982, represent a revision of the original analyses by Tetra Tech, Inc., for FEMA, under Contract No. H-3830. The updated version was also prepared by Tetra Tech,

Inc., under agreement with FEMA. That work was completed in August 1981.

Berkeley, Township of:

For the original FIS dated November 19, 1980, and the May 19, 1981, FIRM (hereinafter referred to collectively as the 1980 FIS), the hydrologic and hydraulic analyses were performed by the USACE, for the Federal Insurance Administration (FIA), under Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 11, Amendment No. 4. That work, which was completed in July 1978, covered all significant flooding sources affecting the Township of Berkeley.

For the September 4, 1987, FIS, the hydrologic and hydraulic analyses were prepared by Dewberry & Davis for FEMA, under Contract No. EMW-85-C-2004. That work was completed in July 1986.

For the June 3, 2002, revision, the hydrologic and hydraulic analyses for the South Seaside Park area and adjoining areas of the Atlantic Ocean and Barnegat Bay were prepared by the USACE, Philadelphia District, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed in July 1996. The June 3, 2002, revision also incorporated Letters of Map Revision dated July 8, 1994, and January 25, 1999.

Brick, Township of:

For the September 1, 1983, Wave Height Analysis Supplement to the FIS report and the March 1, 1984, FIRM (hereinafter referred to as the 1984 FIS), the wave height analysis was prepared by Dewberry & Davis for FEMA under Contract No. EMW-C-0543. That work was completed in December 1982.

For the August 3, 1998, revision, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. That work was completed in March 1996.

Dover, Township of:	The FIS report was created at the June 15, 1983, revision. A wave height analysis for the June 15, 1983, revision was prepared by FEMA in conjunction with the State of New Jersey. In the August 5, 1991, revision, Dewberry & Davis prepared erosion analyses for FEMA. The work for that revision was completed in August 1989. In addition, hydrologic and hydraulic analyses for a portion of the Toms River were taken from the FIS for the Town of Manchester (FEMA, 1983).
Eagleswood, Township of:	The hydrologic and hydraulic analyses from the FIS report dated August 16, 1982, were performed by T & M Associates for FEMA, under Contract No. H-4807. That work was completed in August 1980.
Harvey Cedars, Borough of:	For the March 23, 1999, FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996. The wave height analysis for the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
Island Heights, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated November 16, 1982, represent a revision of the original analyses by Tetra Tech, Inc., for FEMA, under Contract No. H-3830.
Jackson, Township of:	The hydrologic and hydraulic analyses from the FIS report dated March 16, 1982, were prepared by the New Jersey Department of Environmental Protection (NJDEP) for FEMA under Contract No. H-4759. That work was completed in August 1980. The hydrologic and hydraulic analyses were performed by T & M Associates under subcontract to the NJDEP.
Lacey, Township of:	The hydrologic and hydraulic analyses from the FIS report dated September 1, 1977, were performed by the USACE, Philadelphia District,

for the FIA, under Inter-Agency Agreement No. IAA-H-2-73, Project Order No. 4. That work, which was completed in February 1974, covered all flooding sources affecting the Township of Lacey.

Lakehurst, Borough of:

The hydrologic and hydraulic analyses from the FIS report dated June 15, 1982, were prepared by the NJDEP for FEMA, under Contract No. H-4546. That work was completed in August 1980. The hydrologic and hydraulic analyses were conducted by T & M Associates under subcontract to the NJDEP.

Lakewood, Township of:

The hydrologic and hydraulic analyses from the FIS report dated September 1976 were performed by Pfinterer, Tor & Associates for the FIA, under Contract No. H-3737. That work, which was completed in December 1975 covered all flooding sources affecting the Township of Lakewood, New Jersey.

Lavallette, Borough of:

For the November 22, 1999, revision, the analyses were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed in July 1996.

For the July 5, 1983, Wave Height Analysis Supplement to the original FIS report and the January 5, 1984, FIRM (hereinafter referred to as the 1983 FIS), the wave height analyses were prepared by Dewberry & Davis for FEMA under Contract No. EMW-C-0543. That work was completed in December 1982.

Little Egg Harbor, Township of:

The hydrologic and hydraulic analyses from the FIS report dated March 1, 1983, were prepared by T & M Associates for FEMA, under Contract No. H-4807. That work was completed in August 1981.

Long Beach, Township of:

For the March 23, 1999, FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996.

	The wave height analysis for the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in January 1983.
Manchester, Township of:	The hydrologic and hydraulic analyses from the FIS report dated November 2, 1982, were prepared for FEMA, under Contract No. H-4759. That work was completed in August 1980. The hydrologic and hydraulic analyses for this study were performed by T & M Associates under subcontract to the NJDEP.
Mantoloking, Borough of:	For the original September 30, 1977, FIS, the hydrologic and hydraulic analyses were performed by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H-15-72, Project Order No. 13. That work was completed in April 1972. The July 5, 1983, Wave Height Analysis Supplement to the FIS report was prepared by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. That work was completed in October 1982. For the December 20, 2000, revision, the coastal hydrologic and hydraulic analyses were prepared by the USACE for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. That work was completed in March 1996.
Ocean, Township of:	The hydrologic and hydraulic analyses from the FIS report dated July 6, 1982, were performed by T & M Associates for FEMA under Contract No. H-4807. That work was completed in August 1980.
Ocean Gate, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated November 19, 1980, were prepared by the NJDEP for the FIA, under Contract No. A 14516. That work was completed in November 1979. The hydrologic and hydraulic analyses were conducted by T & M Associates under subcontract to the NJDEP.

Plumsted, Township of:	The hydrologic and hydraulic analyses from the FIS report dated March 30, 1981, were prepared by the NJDEP, Division of Water Resources, for the FIA, under Contract No. H-4623. That work was completed in April 1980. The hydrologic and hydraulic analyses were conducted by Gannett Fleming Corddry and Carpenter, Inc., under subcontract to the State of New Jersey.
Point Pleasant Beach, Borough of:	For the original August 15, 1983, FIS report and the February 15, 1984, FIRM (hereinafter referred to as the 1984 FIS), the hydrologic and hydraulic analyses were prepared by Tetra Tech, Inc., for FEMA, under Contract No. 4-3830. That work was completed in August 1981. For the June 2, 1999, revision, the analyses were prepared by the USACE for FEMA, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed in September 1996.
Seaside Heights, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated June 15, 1983, represent a revision of the original analyses by Tetra Tech, Inc., for FEMA, under Contract No. H-3830. The updated version was also prepared by Tetra Tech, Inc., under agreement with FEMA. That work was completed in August 1981.
Seaside Park, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated July 5, 1983,
Ship Bottom, Borough of:	For the March 23, 1999, FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996. The wave height analysis for the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in December 1982.
South Toms River, Borough of:	The hydrologic and hydraulic analyses from the FIS report dated July 6, 1982, were prepared by

the NJDEP for FEMA, under Contract No. H-4546. That work was completed in August 1980. The hydrologic and hydraulic analyses were performed by T & M Associates under subcontract to the NJDEP.

Stafford, Township of:

For the original March 1979 FIS report and September 14, 1979, FIRM (hereinafter referred to as the 1979 FIS), the hydrologic and hydraulic analyses were performed by the National Oceanic and Atmospheric Administration (NOAA), for the FIA, Inter-Agency Agreement No. IAA-H-5-73, Project Order No. 5. That work was completed in June 1978. The FIRM was subsequently revised on July 15, 1992.

For the May 21, 2001, revision, the updated riverine analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-95-E-4759, Project Order No. 1. That work was completed on January 27, 1997. Flooding information for Manahawkin Bay and Barnegat Bay was taken from the FISs for the Townships of Long Beach and Berkeley, respectively (FEMA, 1999; FEMA, 1992).

Surf City, Borough of:

For the March 23, 1999 FIS, the updated coastal analysis was prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-94-E-4432, Project Order Nos. 1 and 1A. This work was completed in January 1996.

The wave height analysis from the FIS report dated November 1, 1983, was prepared by Dewberry & Davis, for FEMA, under Contract No. EMW-C-0543. That work was completed in January 1983.

Tuckerton, Borough of:

The hydrologic and hydraulic analyses from the FIS report dated November 2, 1982, were prepared by T & M Associates for FEMA, under Contract No. H-4807. That work was completed in August 1981.

The authority and acknowledgments for the Boroughs of Pine Beach and Point Pleasant are not available because no FIS reports were ever published for those communities.

For this countywide FIS, no new hydrologic and hydraulic or coastal analyses were performed.

The Borough of Point Pleasant was updated to the more recent coastal studies performed for the adjacent communities.

Other minor adjustments were made to the flood elevation boundaries along community boundaries in order to produce a seamless FIRM for the entire county.

The coordinate system used for the production of this FIRM is New Jersey Stateplane FIPSZone 2900, North American Datum of 1983 (NAD 83), GRS80 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the UTM projection, NAD 83. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

Consultation Coordination Officer's (CCO) meetings may be held for each jurisdiction in this countywide FIS. An initial CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to review the results of the study.

The dates of the initial and final CCO meetings held for Ocean County and the incorporated communities within its boundaries are shown in Table 1, "Initial and Final CCO Meetings."

TABLE 1 - INITIAL AND FINAL CCO MEETINGS

Community	For FIS Dated	Initial CCO Date	Final CCO Date
Barnegat, Township of	June 15, 1982	May 11, 1978	January 26, 1982
Barnegat Light, Borough of	March 23, 1999	*	March 3, 1983
Bay Head, Borough of	December 15, 1983 September 7, 2000	* May 2, 1997[1]	February 2, 1983 *
Beachwood, Borough of	September 2, 1982	*	April 14, 1982
Beach Haven, Borough of	November 1, 1983	*	March 3, 1983

*Data not available

TABLE 1 - INITIAL AND FINAL CCO MEETINGS - continued

Community	For FIS Dated	Initial CCO Date	Final CCO Date
Berkeley, Township of	November 19, 1980 September 4, 1987 June 3, 2002	July 3, 1975 * October 6, 1995[1]	May 12, 1980 October 24, 1986 *
Brick, Township of	March 1, 1984 August 3, 1998	* August 1, 1996[1]	April 13, 1983
Dover, Township of	August 5, 1991	*	*
Eagleswood, Township of	February 16, 1983	May 22, 1978	January 26, 1982
Harvey Cedars, Borough of	March 23, 1999	*	March 3, 1983
Island Heights, Borough of	June 15, 1979	*	June 29, 1982
Lacey, Township of	September 1, 1977	*	September 23, 1976
Jackson, Township of	September 16, 1982	July 25, 1978	October 28, 1981
Lakehurst, Borough of	December 15, 1982	June 6, 1977	January 26, 1982
Lavallette, Borough of	November 22, 1999	December 31, 1996[1]	May 26, 1998
Long Beach, Township of	March 23, 1999	*	March 18, 1983
Manchester, Township of	November 2, 1982	June 6, 1977	June 17, 1982
Mantoloking, Borough of	September 30, 1977 December 20, 2000	* August 1, 1996[1]	November 29, 1976 *
Ocean, Township of	July 6, 1982	May 10, 1978	January 26, 1982
Ocean Gate, Borough of	May 19, 1981	June 25, 1978	June 3, 1980
Plumsted, Township of	September 30, 1981	*	October 28, 1980
Point Pleasant Beach, Borough of	June 2, 1999	May 2, 1997[1]	
Seaside Heights, Borough of	June 15, 1983	*	November 10, 1982

[1]Notified by letter
*Data not available

TABLE 1 - INITIAL AND FINAL CCO MEETINGS - continued

Community	For FIS Dated	Initial CCO Date	Final CCO Date
Seaside Park, Borough of	July 5, 1983	*	February 15, 1983
Ship Bottom, Borough of	March 23, 1999	*	March 3, 1983
South Toms River, Borough of	August 13, 1971	June 8, 1977	February 8, 1982
Stafford, Township of	March 1979 May 21, 2001	June 8, 1969 October 23, 1997[1]	September 14, 1978 February 9, 1998
Surf City, Borough of	March 23, 1999	*	March 3, 1983
Tuckerton, Borough of	May 2, 1983	May 22, 1978	June 16, 1982

[1]Notified by letter
*Data not available

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Ocean County, New Jersey.

All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

TABLE 2 - FLOODING SOURCES STUDIED BY DETAILED METHODS

Atlantic Ocean
Barnegat Bay
Blacks Branch
Cabinfield Branch
Cedar Creek
Colony Lakes
Crosswicks Creek
Davenport Branch
Giffords Mill Branch
Green Branch
Holiday Lake
Jakes Branch
Kettle Creek
Little Egg Harbor
Manahawkin Bay
Manahawkin Lake
Manahawkin Mill Creek
Manapaqua Brook
Mill Branch
North Branch Forked River
North Branch Metedeconk River
Old Hurricane Brook
Potter Creek
Ridgeway Branch

TABLE 2 - FLOODING SOURCES STUDIED BY DETAILED METHODS - continued

Schoolhouse Branch	Tributary to Ridgeway Branch
South Branch Metedeconk River	Tributary to Toms River
Stony Ford Brook	Union Branch
Sunken Branch	Watering Place Brook
Tarkiln Branch	Willis Creek
Toms River	Wrangel Brook

Long Swamp Creek, Manasquan River, Metedeconk River, Polhemus Branch, and Silver Bay Tributary are studied by limited detail methods and do not have flood profiles.

All or portions of numerous flooding sources in the county were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA, the local communities, and Ocean County.

2.2 Community Description

According to the 2000 census, the population of Ocean County was 510,916, with a population increase of 17.9% from 1990 to 2000. Ocean County is comprised of a total of 636 square miles.

Ocean County lies entirely within the Atlantic Coastal Plain, which extends along the east coast of the U.S. from Massachusetts to Florida. The Coastal Plan consists of unconsolidated sands, silts, clays, and marls with the Cohansey and Kirkwood sand formations being prevalent in the area.

The Coastal Plain sediments in this region are underlain by gneiss and schists. This basement complex slopes toward the Atlantic Ocean from a depth of about 1,100 feet in New Egypt to over 5,000 feet at the Atlantic Ocean (U.S. Department of the Interior, 1971; New Jersey Department of Environmental Protection, 1977). The bedrock formations were worn to a peneplain which slopes toward the Atlantic Ocean and were subsequently warped so that the Coastal Plain is depressed to the southeast. This resulted in the deposition of eroded material from the northern mountains.

Prior to 1620, the only inhabitants of New Jersey were the Lenni Lenapes, a division of the Indians of the Eastern Algonquin Confederacy. In 1620, the Dutch settled along the Hudson River and soon colonized all of New Jersey. In 1664, their colony, New Netherlands, was taken over by the English and given in proprietorship to Berkeley and Carteret. Nineteen years later, the Proprietary Assembly formed Monmouth County, named in honor of Monmouthshire, England. This county included the New Jersey coastal area north of Little Egg Harbor. In 1850, the southern townships of Monmouth County were established as Ocean County. The Toms River area, now part of Ocean County, continued to develop and within a few

years several communities were incorporated: the Township of Berkeley in 1875, Island Heights in 1887, and Seaside Park in 1898. On April 22, 1917, the Borough of Beachwood was formed from a portion of the Township of Berkeley.

Ocean County has a temperate climate with warm summers and moderate winters. The average annual temperature is approximately 53 degrees Fahrenheit (°F), with January being the coldest month (mean temperature 32°F) and July being the warmest month (mean temperature 74°F). Summer temperatures rarely exceed 100°F and winter temperatures rarely fall below 0°F. The average frost-free period is almost 200 days per year. Precipitation averages approximately 50 inches annually, with July and August being the wettest months. Snowfall, which can occur from October through May, averages almost 25 inches annually (U.S. Department of Commerce, 1961).

2.3 Principal Flood Problems

Ocean County is subject to flooding from tropical storms, extratropical cyclones and, to a lesser extent, severe thunderstorm activity. Most serious tidal flooding problems are attributed to hurricanes, which occur during the late summer and early autumn. In addition to heavy precipitation, hurricanes produce high tides and strong waves, which can result in severe damage to coastal areas. Although extratropical cyclones, referred to as northeasters, can develop at almost any time of the year, they are more likely to occur during the winter and spring. Thunderstorms are a common occurrence during the summer months.

September 14, 1944

This major hurricane struck the entire shoreline of New Jersey with wind velocities ranging from 90 miles per hour (mph) at Atlantic City to over 100 mph in New York City. During the passage of this storm, many communities reported extremely high tides.

November 25, 1950

Another severe, relatively recent flood occurred on Thanksgiving Day, 1950. This strong northeaster struck the entire shoreline of New Jersey with gale force winds and more than 3 inches of rainfall. The total damage in Ocean County exceeded 1 million dollars.

March 6-8, 1962

This northeaster was one of the most memorable storms to strike the Monmouth County shoreline in recent years. This storm struck the entire coastline of New Jersey with gale force winds, extremely high tides and heavy precipitation in the form of wet snow. Generating winds of 70 mph, this northeaster remained in the study area for 60 hours. The unusually long duration coincided with five successive high spring tides. Along the river front, many docks were under water for several days. Severe flooding conditions, not only in the study area but along

the entire coastline of New Jersey, resulted from the high storm water, waves and gale force winds.

December 11, 1992

Another northeaster struck the New Jersey shoreline with winds reaching 90 mph. Boardwalks were torn up and flooding occurred from Longport to Sea Bright.

In the Township of Barnegat, discussions with the township engineer, the county engineer, and the township clerk, as well as field reconnaissance of the community and literature research, have indicated some localized areas of problem flooding. Tidal flooding occurs along the bayfront during extreme high tides, and Yellow Dam Branch has flooded as a result of simultaneous snowmelt and extreme rainfall.

During the March 1962 storm, water from Barnegat Bay and the Manasquan River flooded extensively developed areas along the 30-mile reach between Manasquan Inlet and Barnegat Inlet. The depth of flooding reached 1.5 feet over several streets in Seaside Park and 2 feet over portions of Ortley Beach in Dover. Although the depth of flooding was not as severe as other coastal areas in New Jersey, a total of 5,759 residences and commercial establishments in this reach were damaged by inundation, of which 163 residences were structurally damaged. Much of the damage resulted from ocean water being carried by wave energy across the island and flowing to the lower inland water areas. Major damage was inflicted to the beaches, dunes, and boardwalks throughout the length of the reach (USACE, 1963).

In the Borough of Beachwood, the area is subject to fluvial flooding from Toms River and Jakes Branch and to tidal flooding from Barnegat Bay. The tide at the mouth of Toms River reaches the same height as that in Barnegat Bay, which responds to the tidal fluctuations in the Atlantic Ocean and the effects of storms over the bay. High tidal stages in the Atlantic Ocean affect the tidal stages of Toms River from its mouth to approximately 4 miles upstream. During severe storms, a combination of a high flood flow on Toms River with a high tidal surge on Barnegat Bay aggravates flooding by increasing the duration and height of the backwater in the river. Although Toms River has crested numerous times since 1929, the most disastrous flooding has resulted from a combination of the high tide surge with the high riverine flood flow. These storms occurred in 1944, 1950, and 1962 (USACE, 1960; USACE, 1972).

The Township of Berkeley is subject to flooding from the Atlantic Ocean and Barnegat Bay along its eastern border. Inland, flooding is caused by a combination of tidal flooding, hurricanes, and localized thunderstorms. Tidal conditions prevail upstream for almost the entire length of the Toms River and for a portion of Cedar Creek.

In the Township of Brick, a section is located along the Atlantic Ocean on the 30-mile reach between Manasquan Inlet and Barnegat Inlet. During the March 1962 storm, water from the Atlantic Ocean, Barnegat Bay, and the Manasquan River

flooded extensively developed areas in this reach. The depth of flooding reached 1.5 feet over several streets in Seaside Park and 2 feet over portions of Ortley Beach in Dover. Although the depth of flooding was not as severe as other coastal areas in New Jersey, a total of 5,759 residences and commercial establishments in this reach were damaged by the inundation, of which 163 residences were structurally damaged. Much of the damage resulted from ocean water being carried by wave energy across the island and flowing to the lower inland water areas. Major damage was inflicted to the beaches, dunes, and boardwalks throughout the length of the reach (USACE, 1963).

Among the more severe storm events that have affected the Township of Dover are the northeaster of November 25, 1950, and Hurricane Donna in 1960. During both of these flooding events, heavy precipitation and gale-force winds combined to cause extensive property damage. Intense precipitation, strong winds, and high tides of long duration accompanied the Great Atlantic Storm of March 1962. Hurricane Agnes, in June 1972, brought extensive rains to already saturated grounds, and resulted in flooding of low-lying areas. Tidal heights of 3 to 4 feet above normal, and a rainfall of 4 to 5 inches were generated by Hurricane Belle in 1976 (FEMA, 1983; U.S. Department of Commerce, 1978; U.S. Department of Commerce, 1971; U.S. Department of Commerce, 1971 et cetera).

In the Township of Eagleswood, during discussions with township officials, it was determined that flooding occurs on Westecunk Creek between Little Egg Harbor and U.S. Route 9. Flooding in this area has caused evacuation of residents on Bay Avenue. The flooding on Westecunk Creek is due to the tidal influence of Little Egg Harbor.

In the Borough of Island Heights, the area is subject to minimal fluvial flooding from Toms River and to tidal flooding from Barnegat Bay. The tide at the mouth of Toms River reaches the same height as that in Barnegat Bay, which responds to tidal fluctuations in the Atlantic Ocean. High tidal stages in the Atlantic Ocean affect the tidal stages of Toms River from its mouth to approximately 4 miles upstream. During severe storms, a combination of a high fluvial flow on Toms River with a high tidal surge on Barnegat Bay aggravates flooding by increasing the duration and height of the backwater on the river. Although Toms River has crested numerous times since 1929, the most disastrous flooding resulted from a combination of the high tide surge with the high riverine flood flow. These storms occurred in 1944, 1950, and 1962 (USACE, 1960; USACE, 1972).

On August 27-28, 1971, a heavy frontal storm in combination with Tropical Storm Doria produced the greatest flooding in the area. This storm caused the President to declare New Jersey a National Disaster Area. An extensive high water mark survey was conducted jointly by the State of New Jersey and the USGS following Doria. These data are on file with the Division of Water Resources.

The two most severe floods were the 1978 and 1971 events. On August 26-28, 1971, intense thunderstorm activity followed by the passage of Tropical Storm Doria brought heavy precipitation to south-central, central, and northeast New

Jersey for 32 hours. Total storm rainfall amounts during a 32-hour period ranged from about 3 to over 11 inches across New Jersey. Storm runoff increased rapidly to peak flows greater than previously experienced prior to August 1971 recorded at 47 stream gaging stations in New Jersey.

Island Beach and the broad, shallow Barnegat Bay protect the mainland of the Township of Lacey from the direct wave action of the Atlantic Ocean; however, high tides on the bay may inundate many new residential communities that have developed along the bay and mouth of the North Branch Forked River. Inundation may also be caused by fluvial flooding along the North Branch Forked River.

The Borough of Lavallette is located on the 30-mile reach between Manasquan Inlet and Barnegat Inlet. During the March 1962 storm, water from Barnegat Bay and the Manasquan River flooded developed areas in this reach.

During the March 1962 storm, Long Beach Island was breached at five locations, four of which were in the vicinity of Harvey Cedars. The fifth location was at Holgate on the southern end of the island. The deepest breach cut through the most densely developed portion of Harvey Cedars. At the areas of breaching, stormwaters completely traversed the island. The dunes were completely destroyed, beaches were eroded, and manmade structures were damaged. A total of 5,361 residences were damaged, of which 998 were structural damaged. Because of the severe breaching, portions of the island were isolated from the mainland, most of the public utility systems failed, and the general evacuation of residents was undertaken. Seven persons lost their lives on Long Beach Island as a direct result of the storm (USACE, 1963).

During severe storm conditions localized flooding occurs in numerous areas of the Township of Manchester. This flooding is due primarily to poor drainage in developed areas. Flooding has been caused by Union Branch in the area of Pine Lake and downstream from the Pine Lake dam during more severe storms. Major portions of the floodplain of the streams studied by detailed methods are undeveloped areas predominated by marshland and bogs. There is no record of flood problems in these areas.

In the Borough of Ocean Gate, discussions with the Borough Engineer and reconnaissance of the community have indicated no areas of problem flooding. Flooding due to tidal influence from Barnegat Bay occurs during severe storms.

In the Township of Plumsted, the USGS has maintained a crest-stage partial record gage (no. 01464400) on the Crosswicks Creek in New Egypt since 1968. Although there are only 11 years of record at this site, the record includes the floods of September 1, 1978, and August 28, 1971. The estimated discharges at the gage associated with these floods are estimated to be 4,500 cubic feet per second (cfs) and 1,940 cfs, respectively. These flows correspond to recurrence intervals of 125 years and 10 years, as determined from the frequency curve prepared from the gage records using Water Resources Council guidelines (Water Resources Council, 1977).

More complete records of flooding are available on Crosswicks Creek from the long-term USGS gage at Extonville, New Jersey (No. 01464500). A review of this data, which dates from 1938, indicates that flooding has occurred on September 1, 1978 (4,900 cfs), August 28, 1971 (4,800 cfs), September 22, 1938 (4,100 cfs), September 1, 1940 (3,360 cfs) and September 13, 1960 (3,200 cfs). These floods correspond to recurrence intervals of 36 years, 33 years, 20 years, 12 years, and 10 years, respectively, as determined from the frequency curve computed by using Water Resources Council guidelines from the recorded data at this site (Water Resources Council, 1977). Stony Ford Brook attained a discharge of 340 cfs at Lakewood Road during the flooding of 1978. This flow equals the estimated 1-percent annual chance (100-year) flow of Stony Ford Brook at Moorhouse Road and indicates that the flood of September 1, 1978, because of the localized nature of the storm, was more severe and had a higher recurrence interval on the smaller watersheds of the affected areas.

The two most severe floods, at each of the gage sites were the 1978 and 1971 events. As previously reported, "The August (1971) flood resulted from heavy antecedent rainfall in the morning and afternoon of August 27 followed by precipitation associated with the passage of Tropical Storm Doria across New Jersey in the evening of August 27 and early-morning hours of August 28." Total storm rainfall amounts during a 32-hour period ranged from about 3 to over 11 inches across New Jersey. On August 26-28, 1971, intense thunderstorm activity followed by the passage of Tropical Storm Doria brought heavy precipitation to south-central, central, and northeast New Jersey for 32 hours. Storm runoff increased rapidly to peak flows greater than those previously experienced at most gaging stations in the major flood-affected area with peak flows greater than any known prior to August 1971 recorded at 47 stream-gaging stations in New Jersey.

By comparison, an intense localized storm produced the flooding of 1978 in the Crosswicks Creek basin. Over 9 inches of rain were recorded at the fire tower on the Fort Dix Military Reservation within 6 hours, with 1 inch occurring in a 20-minute time span. This amount of rain is in contrast to trace amounts recorded at Burlington approximately 14 miles away (U.S. Department of Commerce, 1967 through 1977). This storm was associated with localized intense thunderstorm activity as opposed to the passing of a tropical storm.

The flooding which occurred on Crosswicks Creek in 1978 was between 3 and 4 feet higher in stage than the flooding experienced in August 1971 in the vicinity of New Egypt. High-water marks at the State Route 537 bridge over Crosswicks Creek are 65.4 feet for the crest-stage gage 30 feet upstream of State Route 528 bridge; the 1971 flood elevation was 69.8 feet and the high-water elevation of the 1978 flood was 73.7 feet. The estimated 1-percent annual chance flood elevations at these two locations are 67.9 feet and 73.2 feet, respectively.

There are descriptions of the flooding which occurred during the late evening of August 31, 1978, and the following day as recorded in newspaper accounts on Friday, September 1, 1978, and in the Saturday Times from Trenton on September 2, 1978, as well as in The Trentonian on September 2, 1978.

The official damage assessment compiled on September 5, 1978, on file at the Municipal Offices, recorded 55 persons evacuated with no injuries or deaths. Total damage to homes, businesses, and industry was estimated to be $1,636,500 while damage to public property totaled $326,800.

In the Borough of South Toms River, the borough engineer indicated that localized flooding occurs in several areas in the vicinity of Jakes Branch, particularly the area of Brook Forest Drive. This area, as well as other flood prone areas, has been recently filled for home construction.

The Township of Stafford is subject to tidal flooding from both hurricanes and winter storms. Much of the area is low marshland that is very open to tidal surge through Little Egg Inlet to the south and to a lesser extent through Barnegat Inlet to the north. Long Beach Island, approximately 13 miles long, provides only a limited barrier to direct effects of the surge because it is subject to erosion during storms.

Winter storms, though more frequent than hurricanes, are less likely to generate large surges; the storm of March 1962 produced tides to 7.2 feet and the 1950 storm, with a slightly larger surge, occurred at low water. Storm histories over this region have been outlined and analyzed in some detail in a similar flood insurance report by the National Oceanic and Atmospheric Administration (NOAA) and by a tide frequency analysis (U.S. Department of Housing and Urban Development, 1970; U.S. Department of Commerce, 1970). Storm histories were obtained from a tropical cyclone analysis, records of the U.S. Weather Bureau, and from the USACE (U.S. Department of Commerce, 1965; U.S. Department of Commerce, 1961; USACE, 1963).

2.4 Flood Protection Measures

No flood protection measures existing within the Borough of Bay Head, Borough of Beachwood, Township of Berkeley, Township of Brick, Township of Dover (along both shores of Barnegat Bay, however, there are many individual bulkheads that reduce the effects of wave action during the 1-percent annual chance event), Township of Eagleswood, Borough of Island Heights, Township of Jackson (township does provide for cleaning stream channels and drainage facilities of debris and siltation when necessary), Borough of Lakehurst (borough does provide for cleaning stream channels and drainage facilities of debris and siltation when necessary), Borough of Lavallette, Township of Little Egg Harbor, Borough of Mantoloking, Borough of Ocean Gate (borough does provide for cleaning stream channels and drainage facilities of debris and siltation when necessary), Borough of South Toms River, Township of Stafford, and Borough of Tuckerton.

There are no structural devices designed specifically for flood protection in the Township of Plumsted. The drainage area above New Egypt is relatively flat and a large percentage of the area consists of lakes and swamps and this condition provides natural storage for floodwaters of Crosswicks Creek (U.S. Department of the Interior, 1971; USGS, 1972). The dam across Crosswicks Creek forming

Oakford Lake is not a flood control structure and the lake provides negligible storage since it is a low dam and is normally maintained at full capacity.

Non-structural measures of flood protection are being utilized to aid in the prevention of future flood damage. These are in the form of land use regulations adopted from the Code of Federal Regulations which control construction within areas that have a high risk of flooding as identified by the Flood Hazard Boundary Map (U.S. Department of Housing and Urban Development, 1976).

There is a pumping station for the purpose of handling storm runoff in the area of Sea Avenue. There are no other major civil works for flood protection existing or planned in the Borough of Point Pleasant Beach.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this FIS. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the county at the time of completion of this FIS. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding sources studied in detail affecting the county.

Precountywide Analyses

Each incorporated community within, and the unincorporated areas of, Ocean County, with the exception of the Boroughs of Pine Beach and Point Pleasant, has a previously printed FIS report. The hydrologic analyses described in those reports have been compiled and are summarized below.

For Barnegat Bay within the Township of Barnegat, and the Township of Lacey the tide elevations and tide frequencies were taken from a high tide-frequency curve developed by the Philadelphia District, USACE, and based on records of the Atlantic City Tide Gage dating from 1937 to 1967.

For the Township of Barnegat, Borough of Beachwood, and the Township of Lacey, the storm surge elevations for the 10-, 2-, 1-, and 0.2-percent annual chance floods have been determined for Barnegat Bay. The analyses reported herein reflect the stillwater elevations due to tidal and wind set up effects, but do not include the contributions from wave action effects such as the wave crest height and wave runup. Nonetheless, this additional hazard due to wave action effects should be considered in the planning of future development.

The 10-, 2-, 1-, and 0.2-percent annual chance stillwater elevations for the Atlantic Ocean within the Borough of Bay Head were obtained from The New Jersey Shore Protection Study, Report of Limited Reconnaissance Study (USACE, 1990). These elevations were interpolated between the Atlantic City and Sandy Hook frequency curves.

For Long Beach Island, stillwater elevations used in the analysis for the Atlantic Ocean were taken from a set of tidal flood profiles for the open coast of New Jersey as developed by Dewberry & Davis (Dewberry, 1982). In the vicinity of Long Beach Island, the elevations for the Atlantic Ocean were determined by combining an analysis of the Atlantic City tidal gage performed by the Philadelphia District of the USACE, and historic winter storm and normal tide data (USACE, 1968). The elevations for Little Egg Harbor were developed using a NOAA analysis of records from the Atlantic City gage, and high-water mark records (NOAA, 1970).

In the Borough of Beachwood, peak discharge-frequency relationships for Jakes Branch were developed using drainage area-discharge transfer methods based on information compiled at the USGS gaging station (No. 01408500) located on Toms River near Toms River, New Jersey (U.S. Department of the Interior, 1976). The discharges at this gage were developed using a log-Pearson Type III flood flow frequency analysis with a period of record from October 1928 to 1975 (U.S. Department of the Interior, 1978).

The determination of coastal inundation caused by the passage of a hurricane storm surge was approached by the joint probability method (U.S. Department of Commerce, 1970) for the following communities: Beachwood, Bay Head (Barnegat Bay only), Brick (Kettle Creek, Metedeconk River, Manasquan, and Barnegat Bay), Dover, Island Heights, Seaside Heights, Ocean Gate, South Toms River (Barnegat Bay). The storm populations were described by probability distributions of five parameters which influence surge heights. These included central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically as based on an analysis of observed storms in the vicinity of New Jersey. The storm parameters adopted for New Jersey are shown in Table 3, "Parameter Values for Surge Evaluation, New Jersey." Primary sources of data used were U.S. Department of Commerce reports and the National Hurricane Research Project (U.S. Department of Commerce, 1975; U.S. Department of Commerce, 1965; U.S. Department of Commerce, 1957; National Hurricane Research Project No. 5, 1957). For northeasters, another report by the

U.S. Department of Commerce was adopted (U.S. Department of Commerce, 1970).

A numerical hydrodynamic model of the region was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the five storm parameters defined previously). Performing such simulations for a large number of storms—each of known total probability—permits one to establish the frequency distribution of surge height as a function of coastal location. These distributions incorporate the large-scale surge behavior but do not include an analysis of the added effects associated with much finer-scale wave phenomena such as wave height, setup, or runup. The effects of northeasters were taken from the study by Meyers (U.S. Department of Commerce, 1970). The astronomic tide for the region was then statistically combined with the computed storm surge to yield recurrence intervals of total water level. The entire procedure is detailed in Coastal Flooding Handbook, Parts I and II (Tetra Tech, Inc., 1977).

In the Township of Berkeley, for Cedar Creek, natural flood flow frequency data were derived from local regionalized frequency curves based on statistical analysis of stream flow records from 10 gages located in the area. These gages are operated by the U.S. Geological Survey (USGS) with lengths of record between 9 and 50 years (U.S. Department of the Interior, 1968). The analysis of each gage followed the standard log-Pearson Type III statistical technique recommended by the U.S. Water Resources Council (Water Resources Council, 1976). Results were regionalized through multiple-linear regression analysis of the log-log relationship for peak flows.

On Davenport Branch, Wrangel Brook, and Sunken Branch, the discharges were calculated by using regional relationships contained in Special Report 38, developed by the USGS in cooperation with the New Jersey Department of Environmental Protection (State of New Jersey, 1974). This analysis takes into consideration drainage area, main-channel slope, surface storage, and manmade impervious land cover; it was developed from a regression analysis of 103 stream gaging stations throughout New Jersey.

On Potter Creek, discharges were calculated using TR-20 hydrologic analysis (U.S. Department of Agriculture, 1965).

In the Township of Dover, the hydrologic analysis for the Toms River was taken from the FIS for the Township of Manchester (U.S. Department of Commerce, 1971 et cetera). Peak discharges for the Toms River were based on information developed using drainage area-discharge transfer methods. The methods were based on discharge values recorded at USGS gaging station No. 01408500, on the Toms River near Toms River, New Jersey, with a period of record beginning in October 1928 (U.S. Department of the Interior, 1978; U.S. Department of the Interior, 1976).

CENTRAL PRESSURE DEPRESSION (inches Hg)	27.39	27.68	27.97	28.26	28.55	28.84	29.12	29.40	29.70
ASSIGNED PROBABILITIES[1]									
Storms Over Land	0.000	0.000	0.000	0.000	0.000	0.000	0.800	0.125	0.075
Storms Over Sea	0.000	0.020	0.055	0.100	0.145	0.150	0.330	0.125	0.075
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)	37.5								
ASSIGNED PROBABILITY	1.0								
FORWARD SPEED (KNOTS)	20				30			40	
ASSIGNED PROBABILITIES:									
Storms Over Land	0.76				0.15			0.09	
Storms Over Sea	0.56				0.44			0.00	
DIRECTION OF STORM PATH (DEGREES FROM TRUE NORTH)	-11					20			
ASSIGNED PROBABILITY									
Storms Over Land	0.32					0.68			
Storms Over Sea	0.06					0.94			
SPATIAL OCCURRANCE RATE (STORM/NAUTICAL MILE/YEAR)	1.22×10^{-3} Storms Over Land 2.28×10^{-3} Storms Over Sea								

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ AND INCORPORATED AREAS

PARAMETER VALUES FOR SURGE ELEVATIONS
(ALONGSHORE HURRICANES)

In the Township of Eagleswood, a comprehensive analysis, developed by the National Oceanic and Atmospheric Administration, established peak tidal frequency relationships for tidal floods at selected recurrence intervals (U.S. Department of Housing and Urban Development, 1970). The analysis was based on gaging and high water mark records; the Atlantic City tide gage records, beginning in 1922, were included. It was presented in the FIS for the Township of Stafford, New Jersey (FEMA, 1979).

The inland variation of tidal frequency depends on a combination of many factors, including the local physiography, terrain, vegetative cover, and shape and characteristics of water areas. These factors are difficult to evaluate, and require subjective judgment.

The effect of tidal flooding on the Township of Eagleswood was determined by a review of the stage-frequency data and the total tide frequency curve. It was determined during a meeting between representatives of FEMA, NJDEP, and T & M Associates that the tidal flood elevations used for the Township of Stafford study were applicable for the Eagleswood study.

The storm surge elevations for the 10-, 2-, 1-, and 0.2-percent annual chance floods have been determined for Little Egg Harbor. The analyses reported herein reflect the stillwater elevations due to tidal and wind set up effects, but do not include the contributions from wave action effects such as the wave crest height and wave runup. Nonetheless, this additional hazard due to wave action effects should be considered in the planning of future development.

In the Township of Jackson, peak discharge-frequency relationships for the North Branch Metedeconk River were developed by using drainage area-discharge transfer methods based on discharge information compiled at the gaging station on the Toms River near Toms River, New Jersey (USGS gage number 01408500, in operation since October 1928) (U.S. Department of the Interior, 1978). Peak discharge-frequency relationships for tributary to Toms River were based on the Regional Equations outlined in USGS Special Report 38 (State of New Jersey, 1974).

The 1-percent annual chance discharges used for the analyses of the areas studied by approximate methods were determined by using the Regional Equations from Special Report 38 for the tributaries with drainage areas greater than one square mile (State of New Jersey, 1974). For tributaries with drainage areas of less than one square mile, the 1-percent annual chance discharges were determined by the Rational Method using Sandy Hook intensity curves (U.S. Department of Commerce, Sandy Hook Intensity Curves).

North Branch Metedeconk River: Discharge-frequency estimates for this stream were obtained by comparison of the 2-year gaging records (USGS, annual) published for North Branch Metedeconk River at Lakewood, New Jersey (drainage area 34.9 square miles) with the 46-year gaging records available for Toms River near Toms River, New Jersey (drainage area 124 square miles). A log-Pearson Type III analysis, adjusted by manual fit, was furnished for the Toms River gage by the USGS (USGS, Worksheets for Tidal Stage-Frequency Data). Based on physical

similarities of both drainage basins and an analysis of the concurrent flow records for North Branch Metedeconk River, a discharge of the North Branch to that of the Toms River is equal to the ratio of the respective drainage areas raised by an exponent of 0.6 ($A^{0.6}$).

Cabinfield Branch: Discharge-frequency estimates for Cabinfield Branch (drainage area 2.82 square miles) were obtained by applying the relationship that discharge varies with $A^{0.85}$ to the discharges of North Branch of Metedeconk River near Lakewood (drainage area 34.9 square miles). This relationship was derived by considering the effects of basin physical characteristics on peak flow.

Schoolhouse Branch: Discharge-frequency estimates for Schoolhouse Branch (drainage area 0.81 square miles) were obtained by applying the relationship that discharge varies with $A^{0.7}$ to the discharges of Cabinfield Branch at its mouth (drainage area 2.82 square miles).

South Branch Metedeconk River: Discharge-frequency estimates for South Branch Metedeconk River were obtained by comparison of the available two-year record at the gaging station South Branch Metedeconk River near Lakewood, New Jersey (drainage area 26.0 square miles) to the 46-year record of Toms River at the gaging station near Toms River, New Jersey (drainage area 124 square miles). A log-Pearson Type III analysis, adjusted by manual fit for the Toms River gaging station covering the 46-year period, was furnished by the USGS (USGS, Worksheets for Tidal Stage-Frequency Data). On the basis of physical similarity of both basins and analysis of concurrent flow records, the relationship that discharge varies with $A^{0.6}$ was applied to obtain discharges for the South Branch Metedeconk River.

Watering Place Brook: Discharge-frequency estimates at the mouth of Watering Place Brook (drainage area 2.01 square miles) were obtained by applying the relationship that discharge varies with $A^{0.8}$ to the discharges of South Branch Metedeconk River (drainage area 26.0 square miles).

Kettle Creek: Discharge-frequency estimates for Kettle Creek at the township line (drainage area 5.25 square miles) were obtained by applying the relationship that discharge varies with $A^{0.5}$ to the discharges of Toms River at Toms River, New Jersey (drainage area 124 square miles). The estimates derived at the township line were applied to the upstream reaches of Kettle Creek by use of different exponents according to the difference in the physical characteristics of the smaller order basins. A check with the relational method, for basins with a drainage area less than one square mile, showed good agreement with these estimates.

Green Branch: Discharge-frequency estimates for Green Branch of Kettle Creek at its confluence with Kettle Creek (drainage area 1.22 square miles) were obtained by applying the relationship that discharge varies with $A^{0.65}$ to the discharges of Kettle Creek at the township line (drainage area 5.25 square miles).

Tarkiln Branch: Discharge-frequency estimates for Tarkiln Branch of Kettle Creek (drainage area 0.48 square mile) were obtained by applying the relationship that discharge varies with $A^{0.65}$ to the discharges of Kettle Creek at the township line

(drainage area 5.25 square miles). The obtained estimates checked well with those obtained by the rational method.

Tidal frequencies were analyzed from tidal stage-frequency curves for the Atlantic Ocean at Sandy Hook and Atlantic City, and from annual maximum stages at the tidal crest stage stations on Barnegat Bay, located at Barnegat Light (eight years of record), Bay Shore (eight years of record), and Metedeconk River at Laurelton, New Jersey (six years of record). Analysis of these records shows that tidal flood stages will not affect the stream profiles established for riverine flooding on any stream within the township.

In the Township of Little Egg Harbor, peak discharge-frequency relationships for Mill Branch, Giffords Mill Branch, and Willis Creek within the community were based on the regional equations outlined in Special Report 38 (State of New Jersey, 1974). These relationships were developed through a statistical regression analysis of data collected at over 100 gages across the State of New Jersey. The analysis accounts for urban development, natural retention created by lakes and swamps, stream slope and drainage area. The relationships were extended to include the 0.2-percent annual chance storm.

The southern section of the Township of Little Egg Harbor is bounded by tidal bays and estuaries. Tidal elevations from the Atlantic ocean affecting Little Egg Harbor were determined by review of stage-frequency data developed by the National Oceanic and Atmospheric Administration for the FIS for the Township of Stafford (FEMA, 1979). Analyses of the tidal elevations for the Atlantic Ocean affecting Great Bay and the Mullica River were based on the data presented in Floodplain Information on the Tidal Lands of Cape May County, New Jersey, prepared by the Philadelphia District of the USACE (USACE, 1968). Tidal effects on the coastal areas of the township were determined by a review of the stage-frequency data developed for the FISs for the Townships of Washington (FEMA, 1981) and Mullica (FEMA, 1982), and the City of Egg Harbor City (FEMA, Flood Insurance Study, City of Egg Harbor City). Stage-discharge elevations developed by the USACE and those developed for the FISs for the Townships of Washington and Mullica and the City of Egg Harbor City, as well as other available information, were reviewed in a meeting held on June 16, 1978, with representatives of the NJDEP, FEMA, and the study contractor (USACE, 1968; FEMA, 1981; FEMA, 1982; FEMA Flood Insurance Study, City of Egg Harbor City). The elevations presented were determined applicable to the Township of Little Egg Harbor.

General tidal frequency-elevation can be defined by using an example of a 10-percent annual chance frequency storm tide. This is the tide level expected to be equaled or exceeded an average of 10 times in 100 years; a 2-percent annual chance frequency storm tide can be expected to be equaled or exceeded an average of twice in 100 years.

The storm surge elevations for the10-, 2-, 1-, and 0.2-percent annual chance floods have been determined for the Atlantic Ocean affecting Little Egg Harbor, Great Bay, and the Mullica River. The analyses reported herein reflect the stillwater elevations due to tidal and wind set up effects, but do not include the contributions from wave

action effects such as the wave crest height and wave runup. Nonetheless, this additional hazard due to wave action effects should be considered in the planning of future development.

In Long Beach Island, the 1-percent annual chance stillwater elevations for the Atlantic Ocean, Little Egg Harbor, and Manahawkin Bay were obtained from the November 1, 1983, FIS for the Township of Long Beach (FEMA, 1983). These elevations were converted to the North American Vertical Datum of 1988 (NAVD) for this revision. The 1-percent annual chance stillwater elevation for Barnegat Bay was obtained from the FIS for the Township of Berkeley (FEMA, 1987).

In the Borough of Mantoloking, the 1-percent annual chance stillwater elevations for Barnegat Bay were obtained from the Wave Height Analysis Supplement FIS dated July 5, 1983, for the Borough of Mantoloking (U.S. Department of Housing and Urban Development, 1977).

In the Borough of Ocean Gate, the storm surge elevations for the 10-, 2-, 1-, and 0.2-percent annual chance floods have been determined for Barnegat Bay. The analyses reported herein reflect the stillwater elevations due to tidal and wind set up effects, but do not include the contributions from wave action effects such as the wave crest height and wave runup. Nonetheless, this additional hazard due to wave action effects should be considered in the planning of future development.

In the Township of Plumsted, for Stony Ford Brook, the peak flood discharges were determined using USGS Special Report 38, Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization (State of New Jersey, 1974). This method of estimating peak flow was developed through a regression analysis considering flood frequency relationships for 103 gaging stations in New Jersey, using the log-Pearson Type III method of statistical analysis (Water Resources Council, 1977). The method relates basin characteristics such as drainage area, slope, storage, and impervious cover to peak discharges for various frequencies through empirical equations. The peak flows were determined for the selected frequencies by this method and adjusted by a factor related to available storage in the drainage basin.

In the Borough of Seaside Park, stillwater elevations used in this analysis for the Atlantic Ocean were taken from a set of storm surge profiles for the open coast of New Jersey as developed by Dewberry & Davis (Dewberry, 1982). In the vicinity of Seaside Park, the elevations for the Atlantic Ocean were determined by analyzing a surge-frequency study of the Sandy Hook, New Jersey, tidal gage as performed by the New York District of the USACE, and an analysis using a FEMA coastal storm surge model (USACE, 1960). The USACE used a graphical analysis of systematic records from the Sandy Hook gage (1933-1975). The FEMA coastal storm surge model is a hydrodynamic model coupled with the statistical treatment of storm data and annual, astronomic tide predictions. The FEMA coastal storm surge model was also used for the elevations on Barnegat Bay.

In the Borough of South Toms River, the storm surge elevations for the 10-, 2-, 1-, and 0.2-percent annual chance floods have been determined for Barnegat Bay. The analyses reported herein reflect the Stillwater elevations due to tidal and wind set-up

effects, but do not include the contributions from wave action effects such as the wave crest height and wave runup. Nonetheless, this additional hazard due to wave action effects should be considered in the planning of future development.

Peak discharge-frequency relationships for the portion of Jakes Branch affected by fluvial flooding were developed using drainage area-discharge transfer methods based on information compiled at the USGS gaging station No. 01408500 located on the Toms River near Toms River, New Jersey, with a period of record extending from October 1928, using a log-Pearson Type III flood flow frequency analysis (USGS, 1978; USGS, 1976).

The 1-percent annual chance discharge used for the analysis of the upstream portion of Jakes Branch which was studied by approximate methods was determined by use of the Regional Equation outlined in Special Report 38 (State of New Jersey, 1974).

In the Township of Stafford, discharge data were taken from dam inspection reports developed in accordance with analytical procedures contained in the report Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization (USACE, Holiday Lake Dam, NJ 00061, 1979; USACE, Manahawkin Lake Dam, NJ 00057, 1979; State of New Jersey, 1974).

The 1-percent annual chance stillwater elevation for Barnegat Bay was obtained from the FIS for the Township of Berkeley (FEMA, 1992). Coastal inundation in Barnegat Bay was determined from a detailed analysis of storm surge caused by passing storms using the joint probability method and hydrodynamic storm surge model described in the Berkeley FIS (U.S. Department of Commerce, 1970; Tetra Tech, Inc., 1981; FEMA, 1992). The 1-percent annual chance stillwater elevation for Manahawkin Bay was obtained from the FIS for the Township of Long Beach (FEMA, 1999).

In the Borough of Tuckerton, peak discharge-frequency relationships for Mill Branch within the community were based on the regional equations outlined in Special Report 38 (State of New Jersey, 1974). These relationships were developed through a statistical regression analysis of data collected at over 100 gages across the State of New Jersey. The analysis accounts for urban development, natural retention created by lakes and swamps, stream slope and drainage area.

The southeastern section of the Borough of Tuckerton is bounded by tidal bays and estuaries. Tidal effects on the coastal areas of the Borough of Tuckerton were determined by review of stage-frequency data developed by the NOAA for the FIS for the Township of Stafford (FEMA, 1979).

Tidal frequency-elevation can be defined by using an example of a 10-percent annual chance frequency storm tide. This is the tide level expected to be equaled or exceeded an average of 10 times in 100 years; a 2-percent annual chance frequency storm tide can be expected to be equaled or exceeded an average of twice in 100 years.

A summary of the drainage area-peak discharge relationships for all the streams studied by detailed methods is shown in Table 4, "Summary of Discharges."

TABLE 4 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BLACKS BRANCH					
At State route 70	7.1	460	534	667	742
CEDAR CREEK					
At confluence with Barnegat Bay	58.1	741	1,048	1,194	1,573
At USGS gage at Lanoka Harbor	56.0	719	1,018	1,160	1,530
Downstream of Garden State Parkway	50.5	661	940	1,073	1,420
CROSSWICKS CREEK					
At the downstream corporate limits	41.0	2,065	3,624	4,510	7,236
At USGS gage no. 01464400	36.5	1,928	3,387	4,215	6,782
At the upstream corporate limits	35.7	1,903	3,344	4,161	6,698
DAVENPORT BRANCH					
At confluence with Wrangel Brook	14.1	298	523	650	1,041
Downstream of Pinewald Keswick Road	7.7	252	447	562	920
At corporate limits	6.1	210	375	472	776
GIFFORDS MILL BRANCH					
Upstream of the confluence with Mill Branch	2.32	57	220	279	456
HOLIDAY LAKE					
At dam	*	*	*	985	*
JAKES BRANCH					
At the confluence with Toms River	9.6	359	534	620	863

*Data not available

TABLE 4 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
MANAHAWKIN LAKE					
At dam	*	*	*	1,660	*
MANAHAWKIN MILL CREEK					
At Colony Lakes	*	*	*	1,660	*
MANAPAQUA BROOK					
Upstream of the confluence with Union Branch	6.5	284	422	491	742
MILL BRANCH					
Upstream of U.S. Route 9 crossing	12.84	351	613	764	1,232
NORTH BRANCH METEDECONK RIVER					
At downstream corporate limits	18.08	500	730	850	1,180
At Bethel-Church Road	15.4	455	625	785	1,100
At Aldrich Road	11.25	390	580	670	935
At upstream corporate limits	7.2	310	465	540	750
OLD HURRICANE BROOK					
Upstream of the confluence with Union Branch	8.7	342	509	591	821
POTTER CREEK					
Approximately 3,800 feet Upstream of U.S. Route 9	0.11	*	*	117	*
Approximately 4,800 feet Upstream of U.S. Route 9	0.08	*	*	82	*
STONY FORD BROOK					
At the confluence with Crosswicks Creek	2.9	371	641	809	1,324
At Moorhouse Road	1.2	149	267	340	564

*Data not available

TABLE 4 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
SUNKEN BRANCH					
At confluence with Wrangel Brook	4.8	319	523	633	939
Upstream of Bananier Drive	3.0	167	287	348	534
At corporate limits	1.6	122	217	273	444
TOMS RIVER					
Upstream of the Dover-Manchester corporate Limits	56	877	1,306	1,516	2,108
TRIBUTARY TO TOMS RIVER					
At Cassville-Toms River Road	5.92	198	346	431	688
UNION BRANCH					
Upstream of the confluence of Manapaqua Brook	16.6	477	710	825	1,147
WILLIS CREEK					
Upstream of the golf course crossing	1.49	107	192	244	403
WRANGEL BROOK					
At confluence with Toms River	40.0	749	1,261	1,546	2,403
Downstream of confluence with Davenport Branch	35.3	743	1,252	1,535	2,386
Downstream of confluence with Sunken Branch	20.6	512	867	1,063	1,649
Downstream of confluence with Michaels Branch	11.4	221	395	494	804

The stillwater elevations have been determined for the 10-, 2-, 1-, and 0.2-percent annual chance floods for the flooding sources studied by detailed methods and are summarized in Table 5, "Summary of Stillwater Elevations."

TABLE 5 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD*) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
ATLANTIC OCEAN				
Entire shoreline within the Townships of Berkeley and Brick	5.9	**	9.2	13.3
Entire shoreline within Long Beach Island	6.1	7.3	8.3	10.6
Entire shoreline within the Borough of Lavallette	**	**	9.2	**
Entire shoreline within the Township of Dover, Boroughs of Seaside Park, and Seaside Heights	5.4	6.6	7.2	8.8
Long Beach Island shoreline within the Borough of Mantoloking	5.9	8.0	9.2	13.3
Entire shoreline within the Borough of Point Pleasant Beach	**	**	9.3	**
Entire shoreline within the Borough of Bay Head	6.0	8.1	9.3	13.4
BARNEGAT BAY				
Entire shoreline within the Borough of Point Pleasant and the Township of Brick	3.2	**	4.8	6.1
Entire shoreline within Long Beach Island, the Borough of Lavallette, the Townships of Berkeley, Stafford, Mantoloking, and Seaside Park	3.2	4.3	4.8	6.1
Entire shoreline within the Townships of Barnegat and Ocean	3.0	4.6	5.4	9.8
Entire shoreline within the Township of Dover	3.2	4.3	5.4	6.1
Portions of shoreline in Bay Head Harbor within the Borough of Bay Head	3.3	4.4	4.9	6.2
Entire shoreline within the Township of Lacey	3.0	4.7	5.5	9.8
Entire shoreline within the Borough of Seaside Heights	3.2	4.3	4.9	6.1
Entire shoreline within the Township of Ocean	3.0	4.6	5.4	9.8

*North American Vertical Datum of 1988
**Data not available

TABLE 5 - SUMMARY OF STILLWATER ELEVATIONS - continued

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD*) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
HOLIDAY LAKE				
Entire shoreline within the Township of Stafford	**	**	55.4	**
KETTLE CREEK				
Portions of the Township of Brick	3.2	4.3	4.8	6.1
LITTLE EGG HARBOR				
Entire shoreline within the Townships of Eagleswood and Little Egg Harbor, and the Borough of Tuckerton	4.3	6.2	7.2	9.8
Entire shoreline within Long Beach Island	5.1	7.3	8.3	10.6
Tidal flooding affecting entire shoreline of Great Bay and the Mullica River	4.7	6.5	7.8	12.8
MANAHAWKIN BAY				
Entire shoreline within the Township of Stafford and Long Beach Island	4.3	6.2	7.2	9.8
MANAHAWKIN LAKE				
Entire shoreline within the Township of Stafford	**	**	26.4	**
MANASQUAN RIVER				
Portions of the Township of Brick	5.4	6.6	7.2	8.8
METEDECONK RIVER				
Portions of the Township of Brick	3.2	4.3	4.8	6.1
TOMS RIVER				
Entire shoreline within the Townships of Berkeley and Dover, the Borough of Island Heights, South Toms River affecting the Toms River and Jakes Branch, and the Borough of Beachwood	3.2	4.3	4.8	6.1
Entire shorelines of Toms River and Tributary to Toms River in the Borough of Ocean Gate	3.2	4.3	4.8	5.8

*North American Vertical Datum of 1988
*Data not available

The stillwater elevation is the elevation of the water due solely to the effects of the astronomical tides, storm surge, and wave setup on the water surface. The inclusion of wave heights, which represent the distance from the trough to the crest of the wave, increases the water-surface elevations. The height of a wave is dependent upon wind speed and its duration, depth of water, and length of fetch. The wave crest elevation is the sum of the stillwater elevation and the portion of the wave height above the stillwater elevation.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Precountywide Analyses

Each incorporated community within, and the unincorporated areas of, Ocean County, with the exceptions of the Boroughs of Pine Beach and Point Pleasant, has a previously printed FIS report. The hydraulic analyses described in those reports have been compiled and are summarized below.

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The USACE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (USACE, 1975). The 3-foot wave has been determined as the minimum size wave capable of causing major damage to conventional wood frame and brick veneer structures.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the NAS report (National Academy of Sciences, 1977). This method is based on three major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth, and the wave crest is 70 percent of the total wave height above the stillwater level. Second, wave height may be diminished by the dissipation of energy due to the presence of obstructions such as sand dunes, dikes, seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstructions and is determined by procedures described in the User's Manual for Wave Height Analysis (FEMA, 1981). Third, wave height can be regenerated in open fetch areas because of the transfer of wind energy to the water. This added energy is related to fetch length and depth.

As of 1989, FEMA defines a "coastal high hazard area" as an area of special flood hazards extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action (i.e., wave heights greater than or equal to 3 feet) from storms or seismic sources. The

"primary frontal dune" is defined as a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

This FIS includes a technical wave height analysis as specified in FEMA's Guidelines and Specifications for Wave Elevation Determination and V Zone Mapping (FEMA, 1989). This FIS updates the existing FIRM on the basis of FEMA's updated definitions of "coastal high hazard area" and "primary frontal dune," field investigation, revised 1-percent annual chance storm surge elevation, wave analyses (wave height and wave runup), and development of topography and aerial photography. The USGS quadrangle maps and the New Jersey Shore Protection Study, Manasquan Inlet to Barnegat Inlet Reconnaissance Study were used to supplement the bathymetry for each transect (USACE, 1996; U.S. Department of the Interior, 1953 et cetera).

These concepts and equations were used to compute wave heights and wave crest elevations associated with 1-percent annual chance storm surge. Accurate topographic, land-use, and land-cover data are required for the wave height analysis. Maps of the shoreline areas at a scale of 1:24,000, with a contour interval of 10 feet, supplemented with field surveys taken in April 1986, were used for the topographic data (U.S. Department of the Interior, 1953 et cetera). The land-use and land-cover data were established by engineering judgment and the analysis of notes and photographs taken during field inspections and aerial photographs (Keystone Aerial Surveys of Philadelphia, Pennsylvania, 1979).

Wave heights were computed along transects (cross-section lines) located along the coastal areas, as illustrated in Figure 2, in accordance with the User's Manual for Wave Height Analysis (FEMA, 1981). The transects were located perpendicular to the shoreline, representing sections of similar characteristics. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects. Erosion and wave runup analyses were also developed in conjunction with the wave height analysis. Profile plotting sheets were developed from these analyses to identify the flood zone elevations.

For the barrier island, the FEMA erosion treatment (540 square foot method) was performed to adjust the wave transect profiles to an eroded condition before conducting the wave height or wave runup analyses using the FEMA wave height analysis models (WHAFIS 3.0 and RUNUP 2.0). For each coastal transect without overtopping by the 1-percent annual chance stillwater elevation, wave runup analyses were conducted using the FEMA wave runup model (RUNUP 2.0).

Figure 1, "Transect Location Map," illustrates the location of the transects, and Table 6, "Transect Descriptions," provides a listing of the transect locations and stillwater elevations, as well as initial wave crest elevations. In addition, Table 5 provides the Atlantic Ocean 1-percent annual chance stillwater and maximum wave crest elevations for each transect along with the corresponding bayside 1-percent chance stillwater elevation.

TABLE 6 - TRANSECT DESCRIPTIONS

		ELEVATION (feet NAVD)		
TRANSECT	LOCATION	ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
1	From the Atlantic Ocean shoreline, westward along Harvard Avenue	9.3	*	14.6
2	From the Atlantic Ocean shoreline, westward along New Jersey Avenue and New York Avenue	9.3	*	14.6
3	From the Atlantic Ocean shoreline, westward along Carter Street and Sea Avenue	9.3	*	14.6
4	From the Atlantic Ocean shoreline westward along Marge Street and Harris Street	9.3	14.6	4.9
5	From the Atlantic Ocean shoreline, westward along Howe Street and Harris Street	9.3	14.6	4.9
6	From the Atlantic Ocean shoreline, westward to Bay Head Harbor, approximately 400 feet south of Strickland Street	9.3	14.6	4.9

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

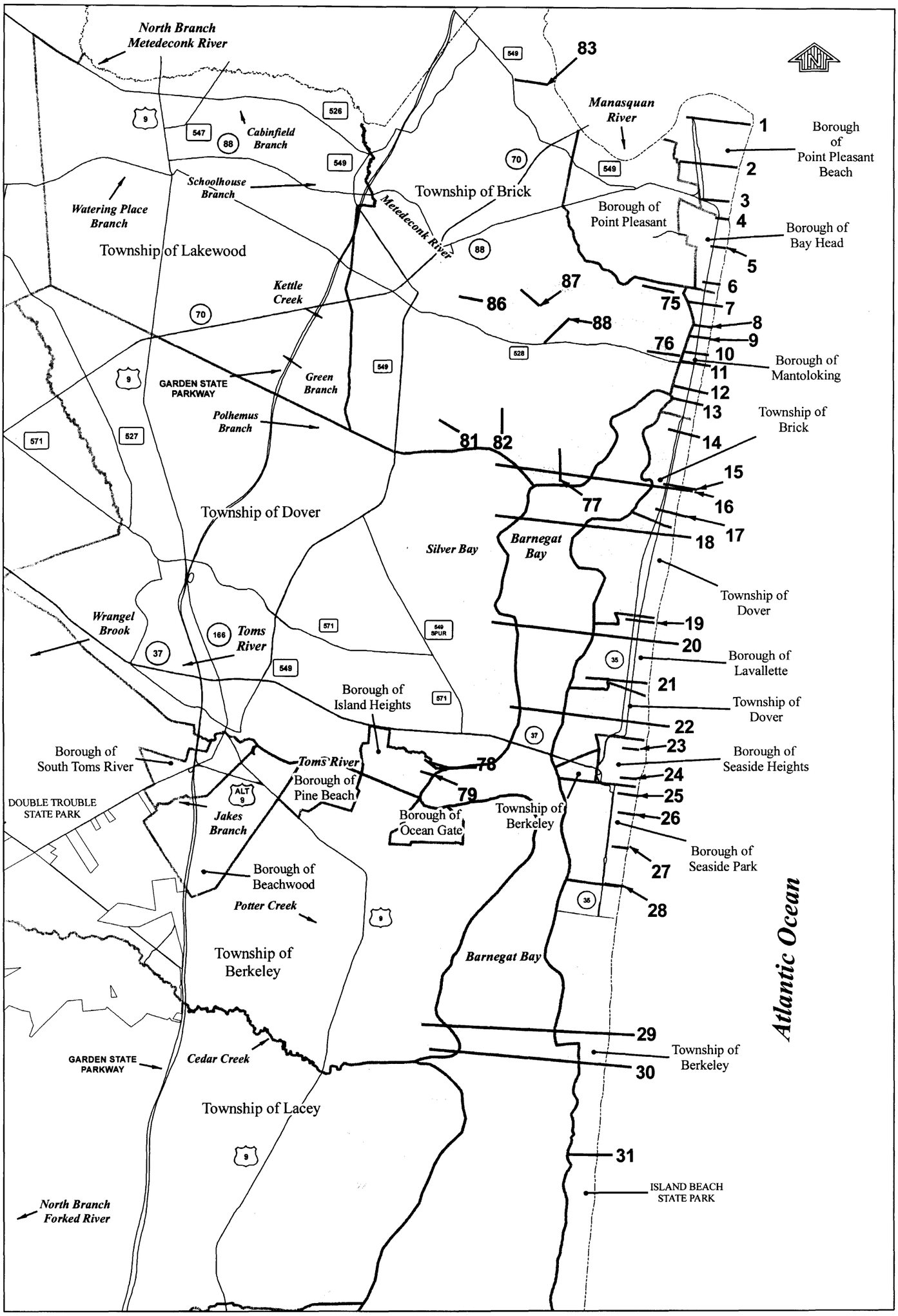


FIGURE 1a

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ
(ALL JURISDICTIONS)

APPROXIMATE SCALE
7500 0 7500 15000 22500 Feet

TRANSECT LOCATION MAP

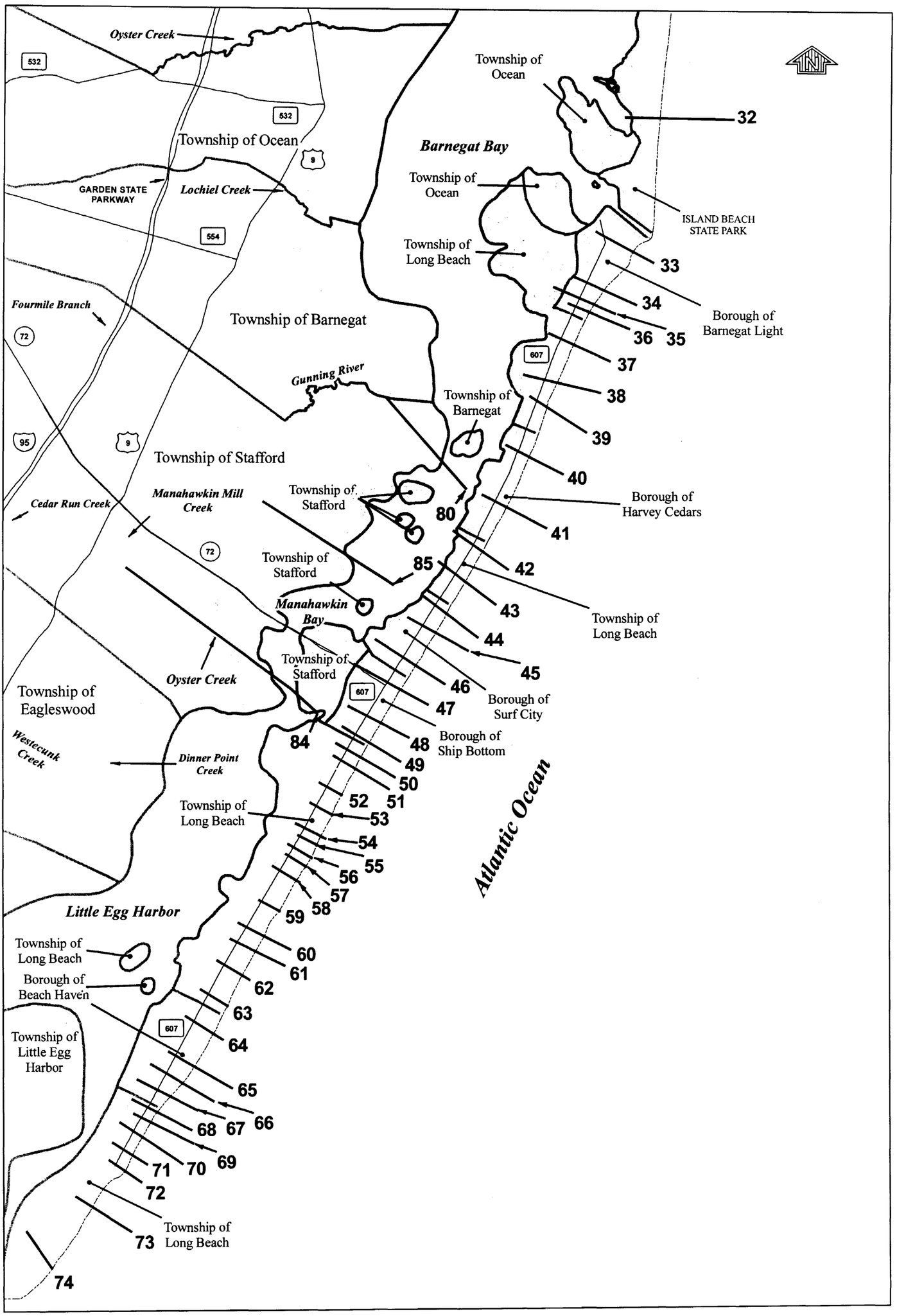


FIGURE 1b

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ
(All JURISDICTIONS)

APPROXIMATE SCALE
7500 0 7500 15000 22500 Feet

TRANSECT LOCATION MAP

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
7	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, approximately 250 feet north of the intersection of Ocean Avenue and Newman Place	9.2	14.5	4.8
8	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, approximately 500 feet south of Lyman Avenue	9.2	14.5	4.8
9	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, approximately 1,500 feet south of Lyman Avenue	9.2	14.5	4.8
10	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, approximately 1,000 feet north of Herbert Street bridge	9.2	14.5	4.8
11	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, approximately 100 feet north of Herbert Street bridge	9.2	14.5	4.8
12	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, approximately 1,000 feet north of Albertson Street	9.2	14.5	4.8
13	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, approximately 200 feet south of Albertson Street	9.2	14.5	4.8

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
14	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, along Bay Avenue South	9.2	13.1	4.8
15	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, approximately 2,400 feet north of Jeannette/Deauville Drive	9.2	13.4	4.8
16	From the northern corporate limits of the Township of Dover to a point approximately 0.9 mile north of the northern corporate limits of the Township of Dover	7.2	12	*
17	From the Atlantic Ocean shoreline northwestward to Barnegat Bay, along Jeannette/Deauville Drive	9.2	14.0	4.8
18	From the northern corporate limits of the Borough of Lavallette to the northern corporate limits of the Township of Dover	7.2	12	*
19	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, along White Avenue	9.2	13.1	4.8
20	Between the corporate limits of the Borough of Lavallette	7.2	12	*

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
21	From the Atlantic Ocean shoreline, northwestward to Barnegat Bay, along Elizabeth Avenue	9.2	13.1	4.8
22	From the northern corporate limits of the Borough of Seaside Heights to the southern corporate limits of the Borough of Lavallette	7.2	12	*
23	Northern transect for the Borough of Seaside Heights	7.2	*	*
24	Southern transect for the Borough of Seaside Heights	7.2	*	*
25	Northern corporate limits of the Borough of Seaside Park to N Street, extended	4.8-7.2	12	*
26	N Street, extended, to E Street, extended	4.8-7.2	12	*
27	E Street, extended, to Eighth Avenue, extended	4.8-7.2	12	*
28	Eighth Avenue, extended, to southern corporate limits of the Borough of Seaside Park	4.8-7.2	12	*
29	On the Atlantic Ocean shoreline from 14th Avenue to 10th Lane	9.2	14.8	*
30	On the Atlantic Ocean shoreline from 10th Lane to 24th Avenue	9.2	14.8	*

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
31	On the Atlantic Ocean shoreline in Island Beach State Park, from a point approximately 100 feet south of 24th Avenue to Barnegat Inlet	9.2	14.8	*
33	Parallel to 6th Street and approximately 315 feet north of intersection of 7th Street and Bayview Avenue and across Atlantic Ocean shoreline	8.3	12.8	4.8
34	Approximately 100 feet north of intersection of 15th Street and Long Beach Boulevard and across Sunset Boulevard	8.3	12.8	4.8
35	Approximately 315 feet north of 21st Street and parallel to 20th Street	8.3	12.8	4.8
36	Approximately 50 feet north of intersection of 26th Street and Long Beach Boulevard and across the Borough of Barnegat Light corporate limits	8.3	12.8	4.8
37	Approximately 190 feet north of intersection of Seaview Drive and Long Beach Boulevard	8.3	12.8	4.8
38	Approximately 40 feet north of intersection of intersection of Sandy Cove Lane and Long Beach Boulevard	8.3	12.8	4.8
39	Approximately 40 feet west of intersection of Oceana Drive and Long Beach Boulevard across the Township of Long Beach corporate limits	8.3	12.8	4.8

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
40	Approximately 2,165 feet south of intersection of 87th Street and Long Beach Boulevard	8.3	12.8	4.8
41	Approximately 10 feet south of intersection of Maiden Lane and Compass Street and across the Borough of Harvey Cedars corporate limits	8.3	12.8	7.2
42	Approximately 110 feet north of intersection of East Burlington Avenue and Long Beach Boulevard and across the Borough of Harvey Cedars corporate limits	8.3	12.8	7.2
43	Approximately 40 feet south of intersection of 98th Street and Long Beach Boulevard and across the Township of Long Beach corporate limits	8.3	12.8	7.2
44	Approximately 110 feet north of intersection of Private Road and Long Beach Boulevard and across the Township of Long Beach corporate limits	8.3	12.8	7.2
45	Approximately 125 feet north of intersection of North 22nd Street and Long Beach Boulevard	8.3	12.8	7.2
46	Approximately 125 feet north of intersection of 15th Street and Ocean Terrace and across the Borough of Surf City corporate limits	8.3	12.8	7.2

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
47	Approximately 155 feet south of the intersection of North 3rd Street and Central Avenue across the Borough of Surf City corporate limits	8.3	12.8	7.2
48	Approximately 155 feet south of intersection of 7th Street and Central Avenue across Borough of Ship Bottom corporate limits	8.3	12.8	7.2
49	Approximately 140 feet north of intersection of 21st Street and Central Avenue and across the Borough of Ship Bottom corporate limits	8.3	12.8	7.2
50	Approximately 185 feet north of intersection of East 33rd Street and Long Beach Boulevard and across Atlantic Ocean shoreline	8.3	12.8	8.3
51	Approximately 85 feet north of intersection of 44th Street and Long Beach Boulevard across Atlantic Ocean shoreline	8.3	12.8	8.3
52	Approximately 225 feet south of intersection of 55th Street and Ocean Boulevard and across Atlantic Ocean shoreline	8.3	12.8	8.3
53	Approximately 165 feet south of intersection of 63rd Street and Ocean Boulevard and across Atlantic Ocean shoreline	8.3	12.8	8.3

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
54	Approximately 75 feet south of intersection of 72nd Street and Ocean Boulevard, and across the Township of Long Beach corporate limits	8.3	12.8	8.3
55	Approximately 75 feet south of intersection of 77th Street and Long Beach Boulevard across the Township of Long Beach corporate limits	8.3	12.8	8.3
56	Approximately 145 feet north of intersection of Connecticut Avenue and Long Beach Boulevard	8.3	12.8	8.3
57	Approximately 20 feet north of the intersection of Sail Boat Drive and Long Beach Boulevard and parallel to Sail Boat Drive	8.3	12.8	8.3
58	Approximately 65 feet north of intersection of 97th Street and Long Beach Boulevard across the Township of Long Beach corporate limits	8.3	12.8	8.3
59	Approximately 100 feet north of intersection of 110th Street and Long Beach Boulevard	8.3	12.8	8.3
60	Approximately 35 feet south of intersection of 125th Street and Beach Avenue across the Township of Long Beach corporate limits	8.3	12.8	8.3
61	Approximately 250 feet north of intersection of 132nd Street and Beach Avenue, parallel to 131st Street	8.3	12.8	8.3

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
62	Approximately 100 feet south of intersection of 25th Street and Atlantic Avenue and across the Township of Long Beach corporate limits	8.3	12.8	8.3
63	Across Atlantic Ocean shoreline and the Township of Long Beach corporate limits, approximately 190 feet north of intersection of 13th Street and Beach Avenue	8.3	12.8	8.3
64	Approximately 120 feet north of intersection of 5th Street and Beach Avenue across Atlantic Ocean shoreline	8.3	12.8	8.3
65	Approximately 115 feet north of intersection of Norwood Avenue and Long Beach Boulevard across the Borough of Beach Haven corporate limits	8.3	12.8	8.3
66	Approximately 180 feet north of intersection of Holyoke Avenue and Long Beach Boulevard and across the Borough of Beach Haven corporate limits	8.3	12.8	8.3
67	Approximately 90 feet north of intersection of Jeffries Avenue and South West Avenue across Atlantic Ocean shoreline	8.3	12.8	8.3
68	Approximately 220 feet north of intersection of Webster Avenue and Long Beach Boulevard and parallel to Josen Avenue, across Atlantic Ocean shoreline and the Township of Long Beach corporate limits	8.3	12.8	8.3

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
69	Approximately 90 feet north of intersection of Selma Avenue and South West Avenue and parallel to Star Avenue	8.3	12.8	8.3
70	Approximately 70 feet north of intersection of Scott Drive and Long Beach Boulevard across Atlantic Ocean shoreline	8.3	12.8	8.3
71	Approximately 140 feet north of intersection of Roosevelt Avenue and Long Beach Boulevard across the Township of Long Beach corporate limits	8.3	12.8	8.3
72	Approximately 90 feet south of intersection of Cleveland Avenue and Long Beach Boulevard across Atlantic Ocean shoreline	8.3	12.8	8.3
73	Approximately 4,500 feet north of intersection of Lincoln Avenue and Long Beach Boulevard	8.3	12.8	8.3
74	Approximately 11,100 feet north of intersection of Lincoln Avenue and Long Beach Boulevard across Little Egg Harbor	8.3	12.8	8.3
75	3rd Street, extended, to North Branch Beaverdam Creek	*	14.6	6.0
76	Mantoloking Road, extended, to Herring Island	*	8	6.0

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

TABLE 6 - TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD) ATLANTIC OCEAN STILLWATER	MAXIMUM WAVE CREST[1]	BARNEGAT BAY STILLWATER
77	Long Point Island to Lawrence Boulevard, extended	*	8	6.0
78	Northern transect for the Borough of Island Heights	*	*	4.8
79	Southern transect for the Borough of Island Heights	*	*	4.8
80	At Barnegat Bay, near the Gunning River and Shell Pond	*	7.5	4.8
81	Southern corporate limits at South Branch Kettle Creek to Port Road, extended	*	6.8	4.8
82	Port Road, extended, to Long Point Island	*	6.8	4.8
83	Entire Manasquan River shoreline within community	*	6.8	7.2
84	At Manahawkin Bay, near Mill Creek Thorofare and East Mill Creek Road	*	10.4	7.2
85	At Manahawkin Bay, near Turtle Cove and Stafford Avenue	*	10.0	7.2
86	Cardinal Avenue, extended, to Island Court, extended	*	6.8	4.8
87	Island Court, extended, to 3rd Street, extended	*	6.8	4.8
88	Herring Island to Cardinal Avenue, extended	*	6.8	4.8

*Data not available
[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical or cultural features. The stillwater elevations for the 1-percent annual chance flood were used as starting elevations for these computations. Wave heights and runup depths were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The locations of the 3-foot breaking wave and runup depths for determining the terminus of the V zone (area with velocity wave action) were also computed at each transect. The results of the calculations are accurate until local topography, vegetation, or cultural development within the community undergo any major changes. The results of this analysis are summarized in Table 7, "Transect Data."

TABLE 7 - TRANSECT DATA

FLOODING SOURCE	STILLWATER ELEVATION (feet NAVD) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT	ZONE	BASE FLOOD ELEVATION (feet NAVD)
ATLANTIC OCEAN						
Transects 1-3	*	*	9.3	*	VE	13-15
					AE	9-10
Transects 4-6	6.0	8.1	9.3	13.4	VE	13-15
Transects 7-13	5.9	7.0	9.2	13.3	VE	12-15
Transects 14, 15, 17	*	*	9.0	*	VE	14
Transects 16, 18, 20, 22	5.4	*	7.2	*	VE	10-14
Transects 19, 21	*	*	9.2	*	VE	13
Transect 23	5.4	*	7.2	*	VE	10-12
					AE	7-9
Transect 24	5.4	*	7.2	*	VE	10-13
					AE	7-9

*Data not available

TABLE 7 - TRANSECT DATA - continued

FLOODING SOURCE	STILLWATER ELEVATION (feet NAVD) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT	ZONE	BASE FLOOD ELEVATION (feet NAVD)
ATLANTIC OCEAN (continued)						
Transects 25-28	5.4	6.6	7.2	8.8	VE AE	10-12 7-10
Transects 29-32	5.9	*	9.2	*	VE AO	12-15 1 foot
Transects 33-37, 59, 62	*	*	8.3	*	VE AO	10-13 1 foot
Transects 38-49, 64	*	*	8.3	*	VE AO	11-13 1 foot
Transect 50	*	*	8.3	*	VE AO	10-11 1 foot
Transect 51	*	*	8.3	*	VE AO	11-12 1 foot
Transects 57, 58, 60, 61, 63	*	*	8.3	*	VE AO	13 1 foot
Transects 52-56,	*	*	8.3	*	VE AO	11 1 foot
Transect 66	*	*	8.3	*	VE	11-13
Transects 65, 67-74	*	*	8.3	*	VE	10-13
BARNEGAT BAY						
Transects 4-6	3.3	4.4	4.9	6.2	AE	5
Transects 7-13	3.2	4.3	4.8	6.1	AE	5
Transects 14, 15, 17	*	*	4.8	*	AE	5
Transects 16, 18, 20, 22	3.2	*	4.4	*	AE	6-7

*Data not available

TABLE 7 - TRANSECT DATA - continued

FLOODING SOURCE	STILLWATER ELEVATION (feet NAVD) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT	ZONE	BASE FLOOD ELEVATION (feet NAVD)
BARNEGAT BAY (continued)						
Transects 19, 21	*	*	4.8	*	AE	5
Transect 23	3.2	*	4.8	*	AE	5-7
Transect 24	3.2	*	4.8	*	AE	5-7
Transects 25-28	3.2	4.3	4.8	6.1	AE	5-7
Transects 29-32	2.8	4.3	4.8	6.1	VE AE	7-8 5-7
Transects 33-35, 37-39,	*	*	4.8	*	AE	5-8
Transects 36, 40	*	*	4.8	*	AE	5
Transects 75- 79	*	*	4.8	*	AE	5-7
Transect 80	3.2	4.3	4.8	6.1	VE AE	7-8 5-7
LITTLE EGG HARBOR						
Transects 50, 51, 53, 58 59, 61-66, 69, 70	*	*	8.3	*	AE	8-10
Transects 52, 54-57, 60 67, 68, 71	*	*	8.3	*	AE	8-9
Transects 73, 74	*	*	8.3	*	AE	10
Transects 72	*	*	8.3	*	AE	9
KETTLE CREEK						
Transects 81, 82	*	*	4.8	*	AE	5-7
MANAHAWKIN BAY						
Transects 41-49	*	*	7.2	*	AE	7-8
Transects 84, 85	4.3	6.2	7.2	9.8	VE AE	9-11 7-9
MANASQUAN RIVER						
Transect 83	*	*	7.2	*	AE	7

*Data not available

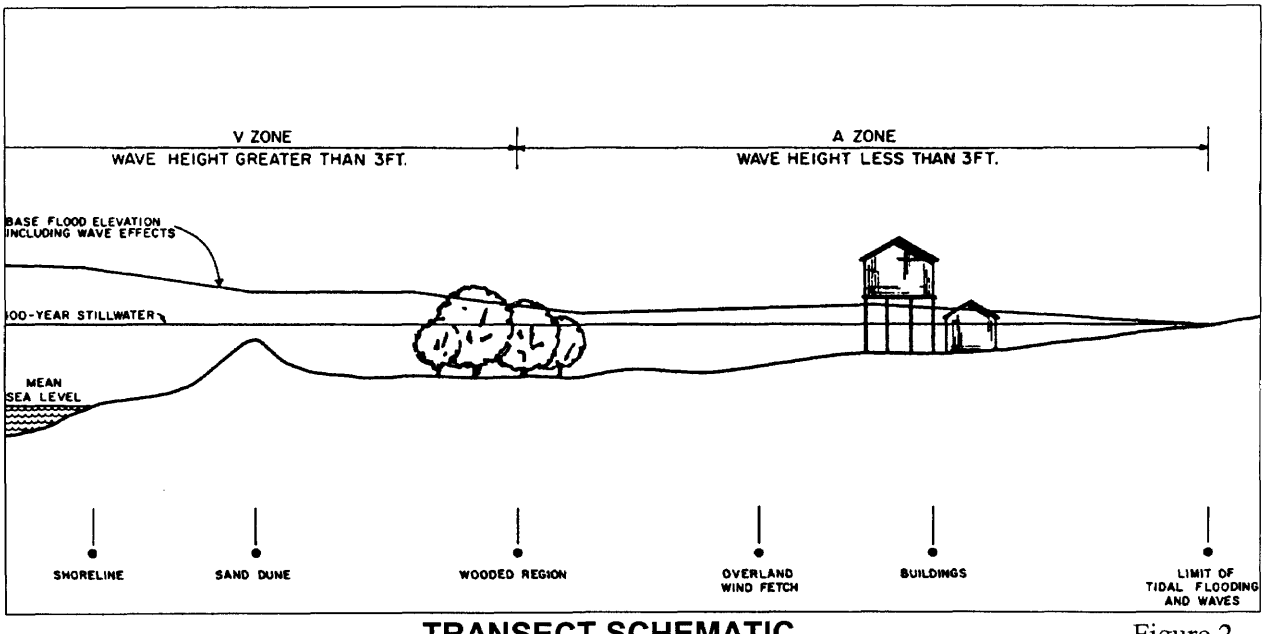
TABLE 7 - TRANSECT DATA - continued

FLOODING SOURCE	STILLWATER ELEVATION (feet NAVD) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT	ZONE	BASE FLOOD ELEVATION (feet NAVD)
METEDECONK RIVER Transects 86-88	*	*	4.8	*	AE	5-7

*Data not available

Figure 2 is a profile for a typical transect illustrating the effects of energy dissipation and regeneration on a wave as it moves inland. This figure shows the wave crest elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations, and being increased by open, unobstructed wind fetches. Actual conditions in the county may not include all of the situations illustrated in Figure 2. The USGS quadrangle and the New Jersey Shore Protection Study, Manasquan Inlet to Barnegat Inlet Reconnaissance Study were used to supplement the bathymetry for each transect.

After analyzing wave heights and the primary frontal dune for each transect, the location of the A/V zone boundary and final wave elevations were interpolated between transects. Various source data were used in interpolation, including land cover data, topographic maps, and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their position at a particular transect and their variation between transects.



TRANSECT SCHEMATIC Figure 2

The topographic and bathymetric data used for the transects were adjusted in consideration of the potential for storm-induced dune erosion. Primary frontal

dunes were evaluated for effectiveness as barriers to storm surge flooding and wave action. Dunes determined to be not effective were assumed to be completely eroded and removed from the transect. Dunes of sufficient size to be considered effective barriers during the 1-percent annual chance event were assumed to be partially eroded, and a retreated dune profile shown on the transect.

Along the beach of the coastal peninsula portion of the Township of Dover, no man-made protective structures exist. The boardwalks in Lavallette and Seaside Heights exert a minor influence on the transmission of waves (often because of the grading which accompanies them), but cannot be considered flood protective in design.

The individual bulkheads located along both shorelines of Barnegat Bay, although generally less than five feet in height, do contribute to the reduction of wave transmission and were considered in the wave height analysis.

North of the Borough of Lavallette, the Atlantic Ocean coast velocity (VE) zone of the peninsula portion of Dover was determined to extend approximately 150 feet inland from the shoreline. The beach in this area has a relatively gentle slope that allows the waves to continue inland until their depths are sufficiently decreased by the higher elevations encountered in the dunes.

Inland, beyond the point of wave dissipation, certain areas, generally to the east of State Route 35 are of an elevation higher than the 1-percent annual chance flood. Portions of these areas would be inundated by the 0.2-percent annual chance flood. To the west of these elevated areas, flooding attributable to Barnegat Bay with an average elevation of 7 feet would occur.

According to this wave height analysis, the passage of storms over Barnegat Bay would lead to the generation of wave heights in addition to the 1-percent annual chance frequency stillwater elevation of 6 feet. These wave height additions would generally be two feet or less.

The principal determinant for wave inundation of the mainland areas on the west side of Barnegat Bay is ground elevation. Wave heights generally increase with decreases in water depth until the wave height and depth interact to cause the wave to break. Consequently, as the mainland ground elevations increase, waves would terminate because of depth limitations. The ground topography of undeveloped and relatively flat areas such as Cattus Island would allow significant inundation of the mainland by waves. In contrast, the high structural density, high ground elevations, and the presence of bulkheads in the vicinity of Bay Shore Park would severely limit the inland intrusion of waves.

The inundation of the eastern shore of the bay by waves would be chiefly influenced by the ground elevations, the direction of the storm path, the structural densities, and the existence of shoreline inlets and numerous bulkheads.

Flood surges, with wave height additions generated over Barnegat Bay, would be carried beyond the mouths of Polhemus Branch, the Silver Bay Tributary, the Toms River, and Long Swamp Creek because of the tidal backwater influence. Beyond the terminus of the tidal effect, riverine flooding would occur on the above-mentioned streams.

Cross sections for the backwater analyses of the North Branch Metedeconk River and Tributary to Toms River were field surveyed and were located at close intervals upstream and downstream of bridges and culverts in order to compute the significant backwater effects of these structures.

Approximate flood elevations were either obtained from the USGS Flood-Prone Area Maps, or from hydraulic analyses conducted for this study (U.S. Department of the Interior, 1970 et cetera). For the streams requiring hydraulic analysis, the elevation of the 1-percent annual chance flood was developed using the method described in Circular No. 14 by D. M. Thomas (State of New Jersey, 1964).

Cross sections for the backwater analyses of the streams studied by detailed methods were field surveyed and were located at close intervals upstream and downstream of bridges and culverts in order to compute the significant backwater effects of these structures. Additional cross-section information for Union Branch was provided by the Philadelphia District of the USACE, as used in their report, Floodplain Information – Toms River, Union Branch, Ridgeway Branch, and Long Swamp Creek – Ocean County, New Jersey (USACE, 1972). This data was field checked to ensure its accuracy, and updated where necessary.

Starting water-surface elevations for Union Branch were taken from the FIS for the Township of Manchester, New Jersey (FEMA, Flood Insurance Study, Township of Manchester, Unpublished). Starting water-surface elevations for Blacks Branch and Old Hurricane Brook were taken from Union Branch. Starting water-surface elevations for Manapaqua Brook were determined by analysis of rating curves based on channel geometry and hydrologic information developed for the study area.

Starting water-surface elevations for Mill Branch were taken from a spillway rating curve. Starting water-surface elevations for Giffords Mill Branch were taken from the water-surface profiles for Mill Branch. Starting water-surface elevations for Willis Creek were taken from the mean annual tide.

Tidal elevations adopted from Barnegat Bay were used to delineate flood boundaries along the flooding sources studied by detailed methods in Ocean Gate. These elevations were determined by the joint probability method which provides statistical analyses of characteristics of observed storms in this area of New Jersey (U.S. Department of Commerce, 1970).

Cross sections for the backwater analyses of Crosswicks Creek and Stony Ford Brook were obtained from detailed topographic maps compiled from aerial photographs at a scale of 1:2,400 with a contour interval of 5 feet (Quinn and Associates, 1978). The below-water sections were obtained by field measurements.

Starting water-surface elevations for Crosswicks Creek were computed by the slope/area method. The hydraulic model for Crosswicks Creek was adjusted to match the high-water profile of the 1971 and 1978 floods. Starting water-surface elevations for Stony Ford Brook were based on critical depth, assuming non-coincidental flooding conditions.

Cross sections for the backwater analyses of Jakes Branch were located at close intervals upstream and downstream of bridges and culverts in order to model these structures accurately.

Water-surface elevations for floods of the selected recurrence intervals for Jakes Branch were computed through use of the USACE HEC-2 step-backwater computer program (USACE, 1977). Starting water-surface elevations for Jakes Branch were determined by analysis of rating curves based on channel geometry and hydrologic information developed for study areas. In addition, consideration was given to the influence of tidal flooding from the Toms River.

Starting water-surface elevations were taken from the following sources: Manahawkin Mill Creek, critical depth; Manahawkin Lake and Holiday Lake, 1-percent annual chance pool elevation.

Cross sections for the backwater analyses of Jakes Branch were located at close intervals upstream and downstream of bridges and culverts in order to model these structures accurately.

Water-surface elevations for floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 step-backwater computer program (USACE, 1977).

Starting water-surface elevations for Jakes Branch were determined by analysis of the rating curves based on channel geometry and hydrologic information developed for the study area.

Starting water-surface elevations for Cedar Creek and Wrangel Brook were developed from coincident analyses of tidal and fluvial events on the Toms River and Wrangel Brook. The tidal elevations for Toms River were based on tidal data for Barnegat Bay. Starting water-surface elevations for Davenport Branch and Sunken Branch were taken at their confluences with Wrangel Brook. Starting water-surface elevations for Potter Creek were determined by the slope/area method.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the FIRM (Exhibit 2).

The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88).

Qualifying bench marks within a given jurisdiction that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Bench marks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS bench marks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for bench marks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with this FIS and FIRM. Interested individuals may contact FEMA to access this data.

Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for most streams studied by detailed methods are shown in Table 8, "Manning's "n" Values."

TABLE 8 - MANNING'S "n" VALUES

Stream	Channel "n"	Overbank "n"
Blacks Branch	0.025-0.030	0.080-0.100
Cedar Creek	0.035-0.060	0.090-0.100
Crosswicks Creek	0.035-0.075	0.055-0.085
Davenport Branch	0.030-0.045	0.050-0.100

TABLE 8 - MANNING'S "n" VALUES - continued

Stream	Channel "n"	Overbank "n"
Giffords Mill Branch	0.030-0.040	0.060-0.150
Jakes Branch	0.030-0.060	0.060-0.150
Manahawkin Mill Creek	0.030	0.100
Manapaqua Brook	0.030-0.040	0.050-1.000
Mill Branch	0.030-0.080	0.080-0.100
North Branch Metedeconk River	0.050	0.450
Old Hurricane Brook	0.030-0.035	0.060-0.100
Potter Creek	0.035-0.060	0.090-0.100
Ridgeway Branch	0.030	0.040-0.160
Stony Fork Brook	0.030-0.065	0.030-0.090
Sunken Branch	0.035-0.060	0.090-0.100
Toms River	0.030	0.050-1.000
Tributary to Ridgeway Branch	0.030-0.035	0.100-0.450
Tributary to Toms River	0.011-0.030	0.040-0.100
Union Branch	0.025-0.050	0.030-1,000
Willis Creek	0.030-0.045	0.080-0.100
Wrangel Brook	0.035-0.060	0.090-0.100

3.3 Vertical Datum

All FISs and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FISs and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD 29). With the finalization of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are being prepared using NAVD 88 as the referenced vertical datum.

Prior versions of the precountywide FIS reports and FIRM were referenced to NGVD 29. When a datum conversion is effected for a FIS report and FIRM, the Flood Profiles, base flood elevations (BFEs) and ERMs reflect the new datum values. To compare structure and ground elevations to 1% annual chance (100-year) flood elevations shown in the FIS and on the FIRM, the subject structure and ground elevations must be referenced to the new datum values.

As noted above, the elevations shown in the FIS report and on the FIRM for Ocean County referenced to the North American Vertical Datum of 1988 (NAVD 88). Ground, structure, and flood elevations may be compared and/or referenced to NGVD 29 by applying a standard conversion factor. The conversion factor to NGVD 29 is +1.2 feet.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD 88. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between the communities.

For more information on NAVD 88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20910 (Internet address http://www.ngs.noaa.gov).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 100-year floodplain data, which may include a combination of the following: 10-, 50-, 100-, and 500-year flood elevations; delineations of the 100-year and 500-year floodplains; and 100-year floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance flood is employed to indicate additional areas of flood risk in the county. For the streams studied in detail, the 1- and 0.2-percent annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between transects, the boundaries were interpolated using aerial photographs at scales of 1"=400' and 1"=800', and topographic maps at a scale of 1:24,000 with a contour interval of 5 feet, supplemented with 1994 digital topography (USACE, 1995 and 1993; U.S. Department of the Interior, 1989; Killian Associates, 1994).

The 1- and 0.2-percent annual chance boundaries of the tidal flooding from Barnegat Bay were delineated using a topographic map of the study area at a scale of 1:1,200, with a contour interval of 1 foot (Borough of Beachwood, 1979). For Jakes Branch, the boundaries of the 1- and 0.2-percent annual chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400 with a contour interval of 5 feet (Midlantic Aerial Surveys, Inc., 1978).

In the Township of Berkeley, between cross sections, the boundaries were interpolated using topographic maps (U.S. Department of the Interior, 1953 et cetera; Berkeley Sewerage Authority, 1976; Ernst, Ernst and Lissenden, 1978; Leisure Technology, 1979; Township of Berkeley, 1979; Fellows, Read and Weber, Inc., 1979; Ernst, Ernst and Lissenden, 1974; Ernst, Ernst and Lissenden, 1968; Fellows, Read and Weber, Inc., 1976; U.S. Department of the Interior, 1989; USACE, 1995).

For tidal areas without wave action, the 1- and 0.2-percent annual chance boundaries were delineated using topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (FEMA, 1981). For the tidal areas with wave action, the

flood boundaries were delineated using the elevations determined at each transect; between transects, the boundaries were interpolated using engineering judgment, land-cover data, and the topographic maps referenced above. The 1-percent annual chance floodplain was divided into whole-foot elevation zones based on the average wave envelope elevation in that zone. Where the map scale did not permit these zones to be delineated at one-foot intervals, larger increments were used.

For the stream studied by approximate methods, the boundary of the 1-percent annual chance flood has been delineated using topographic maps (U.S. Department of the Interior, 1953 et cetera; Leisure Technology, 1976; Ernst, Ernst and Lissenden, 1979; Leisure Technology, 1979).

In the 1984 FIS, aerial photographs and glass aerial plotting plates (stereoscopic coverage) of the township of Brick were obtained from Keystone Aerial Surveys (Keystone Aerial Surveys of Philadelphia, Pennsylvania, 1979). The aerial plotting plates generated the topographic maps used in the wave height analysis. The aerial photographs were used to determine the type, size, and density of vegetation and physical features. The 1- and 0.2-percent annual chance floodplain boundaries were delineated using topographic maps at a scale of 1:2,400, with a contour interval of 4 feet, developed by Dewberry & Davis (Dewberry & Davis, 1982).

For this revision, the topographic maps used to delineate the floodplain boundaries were from a digital base map prepared by Greenhorne and O'Mara, Inc., under contract to the USACE, Philadelphia District, and based on a Digital Terrain Model (DTM) compiled from aerial photography (Greenhorne and O'Mara, Inc., 1995; USACE, 1995). These topographic maps are at a scale of 1"=400' with a contour interval of 4 feet.

For the area studied by approximate methods, the 1-percent annual chance floodplain boundaries were delineated using the previously printed FIS for the Township of Dover (FEMA, 1983).

For the Township of Eagleswood, the 1- and 0.2-percent annual chance boundaries were delineated using topographic maps of the study area at a scale of 1:4,800, with a contour interval of 4 feet (Digital Aerial Surveys, Inc., 1979).

For the areas studied by approximate methods, the boundary of the 1-percent annual chance flood was taken directly from the Flood Hazard Boundary Map (FHBM) for the Township of Eagleswood (U.S. Department of Housing and Urban Development, 1976).

For the Borough of Island Heights, the 1- and 0.2-percent annual chance boundaries were delineated using aerial contour maps of the study area at a scale of 1:6,000, with a contour interval of 2 feet (Abrams Aerial Survey, 1976).

For the portion of Blacks Branch studied by approximate methods, the boundary of the 1-percent annual chance flood was taken directly from the FHBM for the Borough of Lakehurst (U.S. Department of Housing and Urban Development, 1976).

For the flooding sources studied by approximate methods, the boundaries of the 1-percent annual chance floodplains were delineated using topographic maps taken from the previously printed FIS reports, FHBMs, and/or FIRMs for all of the incorporated and unincorporated jurisdictions within Ocean County.

The 1- and 0.2-percent annual chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AO, and VE), and the 0.2-percent annual chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent annual chance floodplain boundaries are close together, only the 1-percent annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent annual chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent annual chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent annual chance flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this FIS are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain.

Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 9). The computed floodways are shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent annual chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

In the Borough of Lakehurst, for Horicon Lake, which is formed on Blacks Branch, Old Hurricane Brook, and the uppermost portion of Union Branch, the floodway boundary is adjacent to the shoreline of the lake.

No floodways were computed for Long Swamp Creek, Manahawkin Mill Creek, Polhemus Branch, and Silver Bay Tributary.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cabinfield Branch								
A	285[1]	158	385	0.4	9.1	9.1	9.3	0.2
B	715[1]	58	190	0.7	9.2	9.2	9.4	0.2
C	1,525[1]	8	17	7.9	14.1	14.1	14.3	0.2
D	1,737[1]	321	612	0.2	16.9	16.9	17.1	0.2
E	2,790[1]	26	60	2.2	17.4	17.4	17.6	0.2
F	6,759[1]	37	79	1.2	23.8	23.8	23.8	0.0
G	9,100[1]	156	1,740	0.1	31.3	31.3	31.3	0.0
H	9,700[1]	15	34	2.0	32.5	32.5	32.5	0.0
I	10,783[1]	56	51	1.3	36.7	36.7	36.8	0.1
J	16,932[1]	267	264	0.2	50.0	50.0	50.1	0.1
K	18,339[1]	14	22	3.1	51.1	51.1	51.3	0.2
L	19,150[1]	42	50	0.9	54.3	54.3	54.4	0.1
Cedar Creek								
A	1,730[1]	851	2,476	0.5	4.8	2.4[3]	2.6	0.2
B	6,600[1]	437	814	1.4	6.3	6.3	6.5	0.2
C	13,780[1]	801	3,032	0.4	12.5	12.5	12.7	0.2
D	23,320[1]	392	720	1.5	17.7	17.7	17.9	0.2
Crosswicks Creek								
A	90[2]	212	2,212	2.0	66.8	66.8	67.0	0.2
B	1,820[2]	269	2,723	1.7	67.3	67.3	67.5	0.2
C	2,840[2]	372	3,786	1.2	67.5	67.5	67.7	0.2
D	4,080[2]	226	2,134	2.1	67.7	67.7	67.9	0.2
E	5,220[2]	214	2,011	2.2	68.1	68.1	68.3	0.2
F	6,080[2]	160	1,958	2.3	68.5	68.5	68.7	0.2
G	6,180[2]	135	1,751	2.6	71.2	71.2	71.4	0.2

[1] Feet above mouth
[2] Feet above Township of Plumsted/Monmouth County corporate limits
[3] Elevation computed without consideration of backwater effects from Barnegat Bay

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

CABINFIELD BRANCH – CEDAR CREEK – CROSSWICKS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Crosswicks Creek (continued)								
H	7,060[1]	175	2,644	1.7	71.5	71.5	71.7	0.2
I	7,330[1]	235	3,095	1.5	71.6	71.6	71.8	0.2
J	7,639[1]	160	1,988	2.1	72.2	72.2	72.3	0.1
K	7,919[1]	332	3,881	1.1	72.5	72.5	72.7	0.2
L	9,284[1]	341	3,263	1.3	72.5	72.5	72.7	0.2
M	10,528[1]	235	3,123	1.3	72.5	72.5	72.7	0.2
N	12,338[1]	199	2,459	1.7	72.6	72.6	72.8	0.2
Davenport Branch								
A	2,030[2]	50	143	4.5	10.8	10.8	11.0	0.2
B	7,000[2]	77	229	2.7	17.3	17.3	17.5	0.2
C	8,370[2]	36	156	3.9	20.3	20.3	20.5	0.2
D	8,421[2]	37	215	2.8	22.0	22.0	22.1	0.1
E	9,600[2]	78	271	2.3	22.7	22.7	22.9	0.2
F	13,930[2]	60	224	2.5	26.2	26.2	26.3	0.1
G	22,470[2]	181	359	1.6	36.4	36.4	36.6	0.2
H	28,170[2]	160	716	0.8	49.6	49.6	49.8	0.2
I	29,495[2]	119	392	1.4	55.1	55.1	55.1	0.0
J	29,565[2]	898	4,387	0.2	58.9	58.9	59.1	0.2
K	33,740[2]	211	333	1.7	69.9	69.9	70.1	0.2
L	425[3]	43	104	3.4	98.0	98.0	98.2	0.2
M	1,225[3]	100	192	1.9	99.0	99.0	99.2	0.2
N	1,990[3]	21	70	5.0	99.8	99.8	100.0	0.2
O	2,780[3]	65	92	3.9	104.1	104.1	104.2	0.1
P	3,580[3]	196	299	1.2	105.5	105.5	105.7	0.2

[1]Feet above Township of Plumstead/Monmouth County corporate limits
[2]Feet above mouth
[3]Feet above Townships of Lacey/Manchester corporate limits

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

CROSSWICKS CREEK – DAVENPORT BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Davenport Branch (continued)								
Q	4,380[1]	212	293	1.2	106.3	106.3	106.5	0.2
R	5,260[1]	195	210	1.1	107.3	107.3	107.5	0.2
S	6,060[1]	82	91	2.5	109.0	109.0	109.2	0.2
T	6,860[1]	105	183	1.2	110.5	110.5	110.7	0.2
U	7,670[1]	67	53	4.2	113.4	113.4	113.4	0.0
V	8,470[1]	27	70	3.2	116.9	116.9	117.0	0.1
W	9,170[1]	16	48	4.7	119.6	119.6	119.7	0.1
X	9,970[1]	69	160	1.4	121.2	121.2	121.4	0.2
Y	10,860[1]	104	407	0.6	125.5	125.5	125.6	0.1
Z	11,724[1]	70	487	0.5	130.5	130.5	130.5	0.0
Giffords Mill Branch								
A	2,040[2]	378	762	0.4	10.0	10.0	10.2	0.2
B	2,720[2]	120	95	2.9	10.8	10.8	10.8	0.0
C	4,185[2]	250	1,048	0.3	12.8	12.8	13.0	0.2
D	5,000[2]	232	940	0.3	14.1	14.1	14.2	0.1
E	6,140[2]	188	440	0.6	14.4	14.4	14.5	0.1
F	7,110[2]	84	224	1.2	17.0	17.0	17.0	0.0
Green Branch								
A	100[3]	800	1,501	0.2	34.4	34.4	34.6	0.2
B	2,000[3]	90	77	2.9	36.2	36.2	36.4	0.2
C	3,025[3]	29	70	3.1	38.1	38.1	38.3	0.2
D	3,278[3]	245	1,883	0.1	42.9	42.9	42.9	0.0

[1]Feet above Townships of Lacey/Manchester corporate limits
[2]Feet above confluence with Mill Branch
[3]Feet above mouth

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

DAVENPORT BRANCH – GIFFORDS MILL BRANCH – GREEN BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Green Branch (continued)								
E	4,200[1]	159	1,019	0.2	42.9	42.9	42.9	0.0
F	4,592[1]	269	2,058	0.1	47.7	47.7	47.7	0.0
G	5,345[1]	219	2,331	0.1	47.7	47.7	47.7	0.0
H	5,645[1]	208	2,099	0.1	48.8	48.8	48.8	0.0
I	6,450[1]	176	1,684	0.1	48.8	48.8	48.8	0.0
Jakes Branch								
A	3,320[2]	247	652	1.0	9.1	9.1	9.1	0.0
B	4,075[2]	478	379	1.6	9.3	9.3	9.3	0.0
C	5,350[2]	46	217	2.9	10.6	10.6	10.6	0.0
D	5,424[2]	205	438	1.4	10.8	10.8	10.8	0.0
E	6,580[2]	41	125	5.0	13.8	13.8	13.9	0.1
F	6,830[2]	293	503	1.2	15.0	15.0	15.1	0.1
G	7,447[2]	47	159	3.9	16.8	16.8	16.8	0.0
H	8,355[2]	166	349	1.8	17.9	17.9	18.1	0.2
I	9,360[2]	483	541	1.1	19.3	19.3	19.5	0.2
Kettle Creek								
A	28,600[1]	620	1,592	0.3	34.4	34.4	34.6	0.2
B	29,090[1]	640	6,008	0.1	40.4	40.4	40.6	0.2
C	30,150[1]	691	5,729	0.1	40.4	40.4	40.6	0.2
D	31,050[1]	348	2,666	0.2	40.4	40.4	40.6	0.2
E	31,900[1]	220	1,622	0.3	40.4	40.4	40.6	0.2
F	32,215[1]	96	304	0.3	41.1	41.1	41.3	0.2
G	35,005[1]	141	105	3.9	45.5	45.5	45.7	0.2
H	36,443[1]	95	244	0.4	51.1	51.1	51.1	0.0

[1]Feet above mouth
[2]Feet above confluence with Toms River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

GREEN BRANCH – JAKES BRANCH – KETTLE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Manapaqua Brook								
A	160[1]	50	151	3.2	51.0	51.0	51.2	0.2
B	1,185[1]	30	67	7.3	52.4	52.4	52.6	0.2
C	1,215[1]	48	127	3.9	53.4	53.4	53.5	0.1
D	2,830[1]	45	134	3.7	56.7	56.7	56.9	0.2
E	2,860[1]	52	112	4.4	56.8	56.8	57.0	0.2
F	3,945[1]	34	120	4.1	59.1	59.1	59.3	0.2
G	3,975[1]	18	60	8.2	59.2	59.2	59.3	0.1
H	5,430[1]	133	361	1.4	62.8	62.8	63.0	0.2
Mill Branch								
A	84[2]	581	5,248	0.1	10.0	10.0	10.2	0.2
B	834[2]	639	3,876	0.2	10.0	10.0	10.2	0.2
C	1,554[2]	1,371	4,175	0.2	10.0	10.0	10.2	0.2
D	2,264[2]	693	1,825	0.4	10.0	10.0	10.2	0.2
E	2,944[2]	437	1,171	0.7	10.1	10.1	10.3	0.2
F	3,884[2]	140	542	1.4	10.2	10.2	10.3	0.1
G	4,034[2]	260	1,010	0.8	11.0	11.0	11.2	0.2
North Branch Metedeconk River								
A	1,000[3]	427[4]	2,231	0.6	8.5	8.5	8.7	0.2
B	1,765[3]	208[4]	866	1.5	9.2	9.2	9.4	0.2
C	2,064[3]	344[4]	1,108	1.1	9.4	9.4	9.6	0.2
D	5,934[3]	347[4]	1,235	1.0	11.4	10.8	11.0	0.2
E	9,350[3]	300[4]	664	1.9	14.4	14.4	14.5	0.1
F	12,400[3]	179[4]	1,000	1.3	19.2	19.2	19.4	0.2

[1]Feet above confluence with Union Branch
[2]Feet above U.S. Route 9
[3]Feet above mouth
[4]This width extends beyond county boundary

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

MANAPAQUA BROOK – MILL BRANCH – NORTH BRANCH METEDECONK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
North Branch Metedeconk River (continued)								
G	14,740	162	804	1.6	23.4	23.4	23.5	0.1
H	26,310	105	362	2.2	37.1	37.1	37.3	0.2
I	26,800	262	676	1.2	39.0	39.0	39.1	0.1
J	29,900	371	1,437	0.6	44.3	44.3	44.5	0.2
K	32,390	88	446	2.0	49.0	49.0	49.2	0.2
L	34,000	115	386	2.3	51.0	51.0	51.2	0.2
M	39,685	184	1,129	0.8	59.7	59.7	59.9	0.2
N	41,800	357	2,335	0.4	63.0	63.0	63.2	0.2
O	42,700	455	2,823	0.3	63.5	63.5	63.7	0.2
P	44,445	231	557	1.5	63.5	63.5	63.7	0.2
Q	45,395	330	1,053	0.8	65.3	65.3	65.4	0.1
R	46,260	321	1,147	0.7	66.5	66.5	66.7	0.2
S	47,095	452	1,798	0.5	67.5	67.5	67.7	0.2
T	49,570	125	878	1.0	68.7	68.7	68.9	0.2
U	50,675	152	525	1.5	69.7	69.7	69.9	0.2
V	51,815	166	693	1.1	71.0	71.0	71.2	0.2
W	52,915	190	609	1.3	72.3	72.3	72.4	0.1
X	53,715	180	650	1.2	73.4	73.4	73.4	0.0
Y	54,545	131	569	1.4	74.5	74.5	74.5	0.0
Z	55,110	183	617	1.3	75.3	75.3	75.4	0.1
AA	55,805	196	819	1.0	76.5	76.5	76.6	0.1
AB	56,965	130	859	0.0	77.6	77.6	77.7	0.1
AC	57,945	110	342	2.3	78.4	78.4	78.5	0.1
AD	59,710	97	398	1.7	79.9	79.9	80.1	0.2

[1]Feet above mouth
[2]This width extends beyond county boundary

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

NORTH BRANCH METEDECONK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
North Branch Metedeconk River (continued)								
AE	60,530[1]	424[4]	1,017	0.7	80.5	80.5	80.7	0.2
AF	61,840[1]	402[4]	1,349	0.5	81.6	81.6	81.7	0.1
AG	62,845[1]	178[4]	1,012	0.7	84.5	84.5	84.6	0.1
AH	63,930[1]	99[4]	283	2.1	85.4	85.4	85.6	0.2
AI	64,480[1]	125[4]	665	0.9	87.5	87.5	87.7	0.2
AJ	65,930[1]	212[4]	890	0.7	88.3	88.3	88.5	0.2
AK	66,960[1]	194[4]	871	0.7	89.2	89.2	89.4	0.2
AL	67,960[1]	90[4]	476	1.3	90.0	90.0	90.1	0.1
AM	69,640[1]	40[4]	247	2.3	91.1	91.1	91.3	0.2
AN	70,845[1]	78[4]	424	1.3	92.0	92.0	92.2	0.2
Old Hurricane Brook								
A	3,975[2]	693	2,837	0.2	62.5	62.5	62.7	0.2
B	5,430[2]	484	1,988	0.3	62.5	62.5	62.7	0.2
Potter Creek								
A	3,200[3]	174	269	0.4	22.3	22.3	22.4	0.1
B	3,500[3]	17	19	6.1	23.2	23.2	23.2	0.0
C	4,100[3]	119	107	0.8	26.5	26.5	26.7	0.2
D	4,900[3]	34	46	1.5	29.6	29.6	29.8	0.2

[1]Feet above mouth
[2]Feet above confluence with Union Branch
[3]Feet above U.S. Route 9
[4]This width extends beyond county boundary

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

NORTH BRANCH METEDECONK RIVER – OLD HURRICANE BROOK – POTTER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Ridgeway Branch								
A	520[1]	58	273	4.2	34.2	31.4[3]	31.6	0.2
B	2,150[1]	89	355	3.2	34.2	33.8[3]	34.0	0.2
C	4,150[1]	200	918	1.2	35.9	35.9	36.0	0.1
D	7,220[1]	118	699	1.6	38.6	38.6	38.7	0.1
E	7,755[1]	86	345	3.3	39.4	39.4	39.5	0.1
F	9,700[1]	68	371	4.2	40.4	40.4	40.6	0.2
G	10,900[1]	45	345	4.5	41.5	41.5	41.7	0.2
H	12,225[1]	45	176	6.2	42.9	42.9	43.1	0.2
I	14,360[1]	56	281	3.9	46.9	46.9	47.1	0.2
J	15,620[1]	120	516	2.1	47.6	47.6	47.8	0.2
K	16,700[1]	225	589	1.9	49.3	49.3	49.5	0.2
L	17,365[1]	92	501	2.2	49.5	49.5	49.7	0.2
M	18,460[1]	52	201	5.4	49.7	49.7	49.8	0.1
N	20,450[1]	35	186	5.9	50.9	50.9	51.1	0.2
O	22,875[1]	548	1,487	0.7	55.8	55.8	56.0	0.2
P	23,140[1]	310	1,012	1.1	56.0	56.0	56.2	0.2
Schoolhouse Branch								
A	305[2]	31	70	0.9	18.0	18.2	18.2	0.2
B	2,565[2]	13	26	2.3	22.1	22.1	22.1	0.0
C	3,105[2]	22	40	1.5	22.8	23.0	23.0	0.2
D	3,743[2]	9	37	2.2	24.1	24.3	24.3	0.2
E	3,978[2]	9	45	1.3	24.2	24.4	24.4	0.2

[1]Feet above confluence with Union Branch
[2]Feet above confluence with Cabinfield Branch
[3]Elevation computed without consideration of backwater effects from Union Branch

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

RIDGEWAY BRANCH – SCHOOLHOUSE BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
South Branch Metedeconk River								
A	1,505[1]	363	1,029	1.1	8.8	8.8	9.0	0.2
B	5,200[1]	364	1,251	0.9	13.9	13.9	14.0	0.1
C	9,178[1]	149	770	1.4	17.2	17.2	17.3	0.1
D	21,980[1]	140	970	1.1	42.9	42.9	43.1	0.2
E	22,305[1]	183	1,433	0.8	42.9	42.9	42.9	0.0
F	22,775[1]	66	666	1.6	43.0	43.0	43.0	0.0
G	25,000[1]	550	3,816	0.3	43.0	43.0	43.0	0.0
H	28,100[1]	600	3,502	0.2	43.1	43.1	43.1	0.0
I	31,175[1]	448	1,237	0.8	43.2	43.2	43.4	0.2
J	34,347[1]	146	511	2.1	45.8	45.8	45.9	0.1
K	35,280[1]	83	290	3.7	46.6	46.6	46.8	0.2
Stony Ford Brook								
A	310[2]	122	1,453	0.6	71.2	71.2[3]	71.2	0.0
B	505[2]	82	827	1.0	71.2	71.2[3]	71.2	0.0
C	840[2]	138	1,229	0.7	71.2	71.2[3]	71.2	0.0
D	1,600[2]	152	617	1.1	71.2	71.2[3]	71.2	0.0
E	2,500[2]	120	463	1.1	71.2	71.3[3]	71.3	0.0
F	2,780[2]	50	117	4.2	71.2	71.3[3]	71.3	0.0
G	2,945[2]	60	315	1.6	73.2	73.2	73.2	0.0
H	3,332[2]	49	95	5.2	74.2	74.2	74.3	0.1
I	3,728[2]	81	208	1.6	75.9	75.9	76.0	0.1

[1]Feet above mouth
[2]Feet above confluence with Crosswicks Creek
[3]Elevation computed without consideration of backwater effects from Crosswicks Creek

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

SOUTH BRANCH METEDECONK RIVER – STONY FORD BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Sunken Branch								
A	1,225[1]	60	705	0.9	19.4	19.4	19.5	0.1
B	1,715[1]	65	230	2.8	21.8	21.8	21.8	0.0
C	2,820[1]	66	443	1.4	22.2	22.2	22.2	0.0
D	3,655[1]	61	377	1.7	28.0	28.0	28.0	0.0
E	4,300[1]	175	1,575	0.4	28.0	28.0	28.0	0.0
F	6,245[1]	134	660	0.6	29.8	29.8	29.8	0.0
G	9,080[1]	55	256	1.4	33.8	33.8	33.8	0.0
H	10,044[1]	125	124	2.8	37.6	37.6	37.6	0.0
I	10,295[1]	248	652	0.5	41.9	41.9	42.1	0.2
J	11,890[1]	374	150	2.3	43.2	43.2	43.2	0.0
K	13,390[1]	39	180	1.9	46.9	46.9	47.1	0.2
Tarkiln Branch								
A	100[1]	179	1,171	0.1	44.9	44.9	50.1	0.2
B	1,355[1]	212	1,114	0.1	44.9	44.9	50.1	0.2
C	1,645[1]	263	2,515	0.1	50.2	50.2	50.4	0.2
Toms River								
A	56,630[2]	53	257	5.9	20.9	20.9	21.1	0.2
B	57,830[2]	140	392	3.9	24.7	24.7	24.9	0.2
C	58,575[2]	65	299	5.1	25.8	25.8	25.9	0.1
D	60,600[2]	62	296	5.1	27.5	27.5	27.7	0.2
E	62,650[2]	127	366	4.1	31.8	31.8	32.0	0.2
F	65,600[2]	175	713	2.1	33.5	33.5	33.7	0.2
G	68,690[2]	60	384	3.9	34.4	34.4	34.6	0.2
H	71,240[2]	85	319	4.8	36.9	36.9	37.0	0.1

[1]Feet above mouth
[2]Feet above confluence with Barnegat Bay

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

SUNKEN BRANCH – TARKILN BRANCH – TOMS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Toms River (continued)								
I	74,440[1]	204	525	2.9	40.1	40.1	40.3	0.2
J	76,100[1]	313	1,048	1.4	41.5	41.5	41.7	0.2
K	76,434[1]	213	698	2.2	42.0	42.0	42.0	0.0
L	78,240[1]	156	344	4.4	43.6	43.6	43.8	0.2
M	80,170[1]	289	857	1.8	45.9	45.9	46.1	0.2
N	82,900[1]	35	238	6.4	47.7	47.7	47.9	0.2
O	87,000[1]	192	714	2.1	52.0	52.0	52.2	0.2
P	89,400[1]	128	369	4.1	53.7	53.7	53.9	0.2
Q	90,500[1]	607	1,664	0.9	55.0	55.0	55.2	0.2
Tributary to Ridgeway Branch								
A	365[2]	20	57	4.7	42.7	42.7	42.9	0.2
B	1,330[2]	138	449	0.6	54.6	54.6	54.6	0.0
C	2,230[2]	170	324	0.8	54.7	54.7	54.7	0.0
D	3,250[2]	556	2,498	0.1	58.3	58.3	58.5	0.2
Tributary to Toms River								
A	3,069[3]	323	2,133	0.2	114.8	114.8	115.0	0.2
B	3,729[3]	323	2,133	0.2	114.8	114.8	115.0	0.2
C	4,729[3]	203	711	0.6	114.8	114.8	115.0	0.2
D	5,799[3]	29	103	4.2	114.8	114.8	115.0	0.2
E	6,799[3]	28	91	4.7	116.6	116.6	116.8	0.2
F	7,649[3]	61	163	2.6	118.2	118.2	118.4	0.2
G	8,689[3]	53	108	4.0	120.0	120.0	120.2	0.2
H	9,654[3]	53	147	2.9	122.7	122.7	122.9	0.2
I	10,774[3]	122	285	1.5	124.1	124.1	124.3	0.2

[1]Feet above confluence with Barnegat Bay
[2]Feet above confluence with Ridgeway Branch
[3]Feet above confluence with Toms River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

TOMS RIVER – TRIBUTARY TO RIDGEWAY BRANCH – TRIBUTARY TO TOMS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Union Branch								
A	1,110	61	315	5.0	22.9	22.9	23.1	0.2
B	2,340	80	425	3.7	24.8	24.8	25.0	0.2
C	3,250	387	1,172	1.4	25.3	25.3	25.5	0.2
D	6,880	238	1,214	1.3	28.1	28.1	28.3	0.2
E	8,535	64	349	4.5	28.4	28.4	28.6	0.2
F	8,617	93	625	2.5	28.8	28.8	29.0	0.2
G	9,180	660	5,117	0.3	34.1	34.1	34.3	0.2
H	10,850	729	5,639	0.3	34.1	34.1	34.3	0.2
I	12,790	373	1,859	0.9	34.1	34.1	34.3	0.2
J	13,940	222	999	1.0	34.2	34.2	34.4	0.2
K	16,190	106	471	2.2	34.7	34.7	34.9	0.2
L	17,320	69	242	4.3	35.2	35.2	35.4	0.2
M	20,845	110	382	2.7	39.2	39.2	39.4	0.2
N	21,720	222	493	4.3	40.5	40.5	40.6	0.1
O	25,770	204	459	2.3	44.8	44.8	44.9	0.1
P	26,710	68	485	2.2	46.4	46.4	46.5	0.1
Q	27,330	30	30	4.3	46.5	46.5	46.6	0.1
R	28,625	30	30	4.3	47.0	47.0	47.1	0.1
S	29,460	30	196	4.2	50.2	50.2	50.4	0.2
T	30,345	101	391	2.1	51.5	51.5	51.6	0.1
U	31,310	74	276	3.0	51.9	51.9	52.0	0.1
V	31,850	49	183	4.5	52.5	52.5	52.7	0.2
W	32,415	117	294	2.8	53.6	53.6	53.7	0.1
X	32,740	47	227	3.6	54.3	54.3	54.5	0.2
Y	33,810	289	546	1.5	56.6	56.6	56.8	0.2
Z	34,040	218	788	1.0	57.0	57.0	57.2	0.2

[1]Feet above confluence with Toms River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

UNION BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Union Branch (continued)								
AA	34,900[1]	735	5,228	0.2	62.5	62.5	62.6	0.1
AB	36,495[1]	478	3,062	0.2	62.5	62.5	62.6	0.1
Blacks Branch								
AC	38,115[1]	41	124	4.3	62.6	62.6	62.7	0.1
Watering Place Branch								
A	650[2]	430	3,984	0.1	42.9	42.9	42.9	0.0
B	1,750[2]	160	1,364	0.1	43.0	43.0	43.0	0.0
C	2,685[2]	75	327	0.4	43.2	43.2	43.4	0.2
D	3,550[2]	68	148	0.9	43.6	43.6	43.8	0.2
E	6,050[2]	50	101	1.3	51.1	51.1	51.3	0.2
Willis Creek								
A	2,804[3]	86	84	2.9	12.9	12.9	13.1	0.2
B	2,881[3]	115	460	0.5	13.0	13.0	13.2	0.2
C	3,251[3]	150	767	0.3	13.1	13.1	13.3	0.2
D	4,241[3]	79	52	4.7	13.7	13.7	13.7	0.0
E	4,402[3]	80	575	0.4	19.8	19.8	19.8	0.0

[1]Feet above confluence with Toms River
[2]Feet above mouth
[3]Feet above Atlantis Boulevard

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

UNION BRANCH – BLACKS BRANCH – WATERING PLACE BRANCH – WILLIS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Wrangel Brook								
A	650	293	662	2.3	4.8	3.0[2]	3.1	0.1
B	3,230	296	1,118	1.4	7.3	7.3	7.4	0.1
C	5,090	206	1,057	1.5	8.7	8.7	8.8	0.1
D	11,140	53	204	5.2	12.6	12.6	12.7	0.1
E	12,770	90	371	2.9	15.6	15.6	15.7	0.1
F	13,140	122	623	1.7	16.6	16.6	16.8	0.2
G	16,030	80	329	3.2	19.3	19.3	19.4	0.1
H	20,480	189	550	1.9	25.3	25.3	25.3	0.0
I	23,355	433	1,253	0.5	27.1	27.1	27.3	0.2
J	25,935	277	499	1.2	30.8	30.8	31.0	0.2

[1]Feet above mouth
[2]Elevation computed without consideration of backwater effects from Barnegat Bay

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

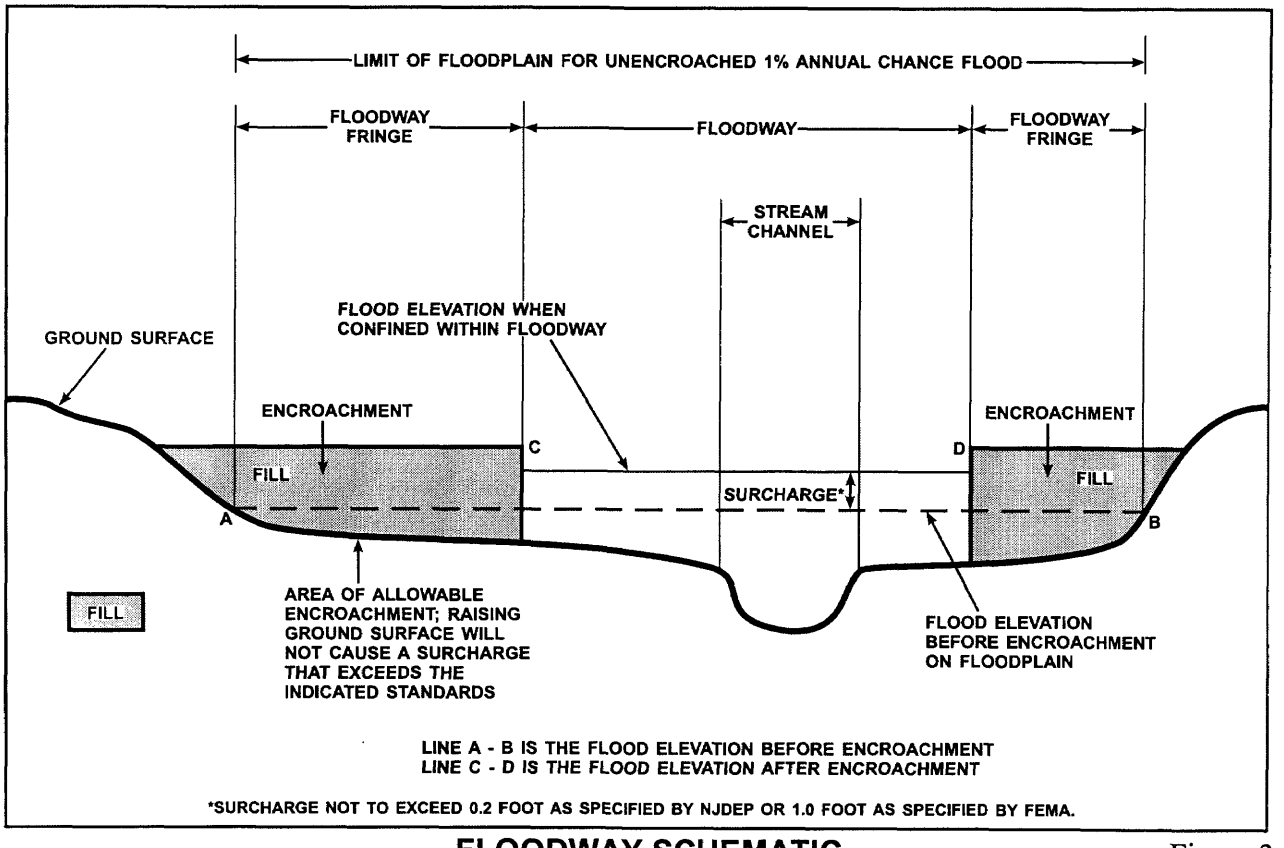
FLOODWAY DATA

WRANGEL BROOK

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 9 for certain downstream cross sections of Cedar Creek and Wrangel Brook are lower than the regulatory flood elevations in that area, which must take into account the 1-percent annual chance flooding due to backwater from other sources.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross sections is provided in Table 9, "Floodway Data." In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

The area between the floodway and 1-percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent annual chance flood by more than 0.2 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 3.



FLOODWAY SCHEMATIC Figure 3

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

Area of special flood hazard formerly protected from the 1-percent annual chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 1-percent annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 1-percent annual chance coastal floodplains that have additional hazards associated with storm

waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent annual chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent annual chance floodplain, areas within the 0.2-percent annual chance floodplain, and to areas of 1-percent annual chance flooding where average depths are less than 1 foot, areas of 1-percent annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent annual chance flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent annual chance floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent annual chance floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Ocean County. Previously, separate Flood Hazard Boundary Maps and/or FIRMs were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. This countywide FIRM also includes flood hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community, up to and including this countywide FIS, are presented in Table 10, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Barnegat Light, Borough of	June 5, 1970	None	June 5, 1970	July 1,1974 May 14, 1976 May 1, 1984 March 23, 1999 September 29, 2006
Barnegat, Township of	May 31, 1974	June 4, 1976 March 4, 1980	December 15, 1982	September 29, 2006
Bay Head, Borough of	November 6, 1970	None	August 17, 1971	July 1,1974 April 18, 1975 March 19, 1976 December 15, 1983 September 7, 2000 September 29, 2006 June 20, 2018
Beach Haven, Borough of	June 17, 1970	None	April 2, 1971	July 1, 1974 September 26, 1975 March 18, 1977 May 1, 1984 March 23, 1999 September 29, 2006
Beachwood, Borough of	June 28, 1974	None	May 1, 1979	March 2, 1983 September 29, 2006

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Berkeley, Township of	August 2, 1974	August 13, 1976	May 19, 1981	September 18, 1987 July 15, 1992 June 3, 2002 September 29, 2006
Brick, Township of	August 4, 1972	None	August 4, 1972	July 1, 1974 June 10, 1977 March 1, 1984 July 15, 1992 August 3, 1998 September 29, 2006
Dover, Township of [1]	March 22, 1972	None	March 22, 1972	July 1, 1974 April 23, 1976 June 15, 1983 August 5, 1991 September 29, 2006
Eagleswood, Township of	July 26, 1974	March 19, 1976	February 16, 1983	September 29, 2006
Harvey Cedars, Borough of	May 26, 1970	None	April 2, 1971	July 1, 1974 February 13, 1976 May 1, 1984 March 23, 1999 September 29, 2006
Island Heights, Borough of	July 19, 1974	December 19, 1975	July 15, 1979	May 16, 1983
Jackson, Township of	January 24, 1975	None	September 16, 1982	September 29, 2006

[1] The Township of Dover changed its name to the Township of Toms River in November 2006

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Lacey, Township of	January 24, 1975	None	September 1, 1977	September 29, 2006
Lakehurst, Borough of	June 28, 1974	February 6, 1976	December 15, 1982	September 29, 2006
Lakewood, Township of	January 16, 1974	None	March 15, 1977	January 18, 1989 September 29, 2006
Lavallette, Borough of	September 11, 1970	None	June 11, 1971	July 1, 1974 April 16, 1976 January 5, 1984 November 22, 1999 September 29, 2006
Little Egg Harbor, Township of	May 10, 1974	February 27, 1976	September 1, 1983	July 15, 1992 September 29, 2006
Long Beach, Township of	May 26, 1970	None	May 26, 1970	July 1, 1974 March 5, 1976 May 1, 1984 July 15, 1992 March 23, 1999 September 29, 2006
Manchester, Township of	October 18, 1974	June 4, 1976	May 2, 1983	September 29, 2006
Mantoloking, Borough of	May 31, 1974	None	September 30, 1977	January 5, 1984 December 20, 2000 September 29, 2006
Ocean Gate, Borough of	May 31, 1974	June 3, 1977	May 19, 1981	September 29, 2006

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Ocean, Township of	February 28, 1975	None	January 6, 1983	September 29, 1986 September 29, 2006
Pine Beach, Borough of	June 28, 1974	March 19, 1976	August 11, 1978	November 6, 1981 September 29, 2006
Plumstead, Township of	June 28, 1974	July 23, 1976	September 30, 1981	March 2, 1982 September 29, 2006
Point Pleasant Beach, Borough of	November 23, 1973	September 12, 1975	June 15, 1979	February 15, 1984 June 2, 1999 September 29, 2006 June 20, 2018
Point Pleasant, Borough of	July 2, 1972	None	July 2, 1972	July 1, 1974 April 9, 1976 June 13, 1980 September 29, 2006 June 20, 2018
Seaside Heights, Borough of	March 22, 1974	March 19, 1976	July 16, 1979	December 15, 1983 September 29, 2006
Seaside Park, Borough of	August 17, 1971	None	August 17, 1971	July 1, 1974 September 5, 1975 March 19, 1976 May 5, 1984 September 29, 2006

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Ship Bottom, Borough of	May 26, 1970	None	May 26, 1970	July 1, 1974 August 29, 1975 May 1, 1984 March 23, 1999 September 29, 2006
South Toms River, Borough of	July 26, 1974	July 23, 1976	January 6, 1983	September 29, 2006
Stafford, Township of	September 2, 1970	None	September 14, 1979	July 15, 1992 May 21, 2001 September 29, 2006
Surf City, Borough of	May 26, 1970	None	April 2, 1971	July 1, 1974 November 7, 1975 May 1, 1984 March 23, 1999 September 29, 2006
Tuckerton, Borough of	March 1, 1974	June 25, 1976	May 2, 1983	September 29, 2006

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

OCEAN COUNTY, NJ (ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

A FIS has been prepared for the Township of Galloway, (FEMA, 1982), Atlantic County, New Jersey. FISs have been prepared for Burlington County, New Jersey: the Townships of Bass River, (FEMA, 1982), Pemberton, (FEMA, 1979), and Woodland, (FEMA, 1981). FIRMS have been published for Burlington County, New Jersey: the Townships of New Hanover, (U.S. Department of Housing and Urban Development, 1979), and North Hanover, (U.S. Department of Housing and Urban Development, 1979). FISs have been prepared for Monmouth County, New Jersey: the Boroughs of Brielle, (FEMA, 1983), and Manasquan, (FEMA, 1983), and the Townships of Freehold, (FEMA, 1982), Howell, (FEMA, 1982), Millstone, (FEMA, 1981), and Wall (U.S. Department of Housing and Urban Development, 1976). A FIRM has been published for the Township of Upper Freehold (FEMA, 1981), Monmouth County, New Jersey.

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Ocean County has been compiled into this FIS. Therefore, this FIS supersedes all previously printed FIS Reports, FHBMs, FBFMs, and FIRMs for all of the incorporated jurisdictions within Ocean County.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this FIS can be obtained by contacting FEMA, Federal Insurance and Mitigation Division, 26 Federal Plaza, Room 1351, New York, New York 10278.

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10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the September 29, 2006, countywide Flood Insurance Study (FIS) was published. Future revisions may be made that do not result in the republishing of the FIS report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data listed on the Flood Insurance Rate Map (FIRM) Index. Please also note that as part of this revision the Community Map History table in section 6.0 has been revised, and that in November 2006, the Township of Dover changed its name to the Township of Toms River.

10.1 June 20, 2018, Revision

Authority and Acknowledgements

The June 20, 2018, revision incorporates the results of coastal analysis for the Borough of Point Pleasant Beach. This analysis was performed by Risk Assessment and Planning Partners (RAMPP) for FEMA under contract No. HSFEHQ-09-D-0369, task order HSFE0209-J-0001. This work was completed in 2012.

Base map information shown on this FIRM was provided in digital format by New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). This information was derived from digital orthophotos produced at a scale of 1:2400 (1”=200’) with a 1 foot pixel resolution from photography dated 2012.

Coordination

For the June 20, 2018, revision, an initial CCO meeting was held on December 16, 2010, and attended by representatives of NJDEP, RAMPP, FEMA, and local officials. The Flood Risk Review (FRR) meeting was held on September 29, 2013.

The results of the study were reviewed at the final CCO meeting held on September 9, 2014, and attended by representatives of NJDEP, RAMPP, and FEMA, and local officials. All concerns raised at that meeting have been addressed in this study for the Borough of Point Pleasant Beach.

Area Studied

The June 20, 2018, revision, includes a new coastal analysis and mapping for the shoreline within the Borough of Point Pleasant Beach.

Principal Flood Problems

Special consideration was given to storms which caused damages to the area in recent years, including Hurricane Floyd in 1999, Hurricane Irene in 2011, and Hurricane Sandy in 2012 (FEMA, 2013).

Hurricane Floyd originally made landfall in Cape Fear, North Carolina as a Category 2 hurricane on September 16, 1999. The storm crossed over North Carolina and southeastern Virginia, before briefly entered the western Atlantic Ocean. The storm reached New Jersey on September 17, 1999. Record breaking flooding was recorded throughout the State of New Jersey. The Raritan River basin experienced record floods of up to 4.5 ft. higher than any previous record flood crest. The areas of Bound Brook and Manville were especially hit hard. A Federal Emergency Declaration was issued on September 17, 1999. Overall damage estimates for Hurricane Floyd, in the State of New Jersey are estimated around $250 million (National Hurricane Center, 1999).

Having earlier been downgraded to an extra-tropical storm, Hurricane Irene came ashore in Little Egg Inlet in Southern New Jersey; on August 28, 2011. In anticipation of the storm Governor Chris Christy declared a state of emergency of August 25th, with President Barack Obama reaffirming the declaration on August 27th. Mandatory evacuations were ordered throughout the Ocean County Barrier Islands. Wind Speeds were recorded at 75 mph and rain totals reached over 10 inches in many parts of the state. Long Beach Boulevard, the main road on Long Beach Island, was reported under about 6 to 8 inches of water in Beach Haven. In Mantoloking, the eastern foot of the Mantoloking Bridge was completely submerged underwater. The bay has spilled out on to streets in Mantoloking, Bay Head and further south into Normandy Beach and Chadwick Beach. 45,000 customers in Ocean County had lost power during the storm. Overall damage estimates, for the State of New Jersey, came to over $1 billion; with over 200,000 homes and buildings being damaged (Associated Press, 2011).

Hurricane Sandy came ashore as an immense tropical storm in Brigantine, New Jersey, on October 29, 2012. Sandy dropped heavy rain on the area; almost a foot in some areas. Wind gust were recorded at 90 mph. A full moon made the high tides 20 percent higher than normal and amplified the storm surge. The New Jersey shore suffered the most damage. Some barrier island communities suffered severe “wash over” including the creation of two temporary inlets. NOAA’s gage #8534720 at Atlantic City, NJ recorded a high water mark (HWM), which is considered as a stillwater elevation without waves, of 8.76 ft. NAVD88 at 11:42 PM on October 29, 2012. NOAA’s gage #8531680 at Sandy Hook, NJ recoded a HWM of 9.21 ft. NAVD88 at 6:00 PM on October 29, 2012. Seaside communities were damaged and destroyed up and down the coastline. Some 252,000 households in Ocean County had lost power. Initial reports suggest that well over 24,000 homes and businesses were damaged or destroyed by the storm. Governor Chris Christy declared a state of emergency on October 31, 2012.

Flood Protection Measures

Ocean County has no levee type structure that would require analysis of levee failure and removal under Section D.2.10.3.4.1 of the Draft Atlantic Ocean and Gulf of Mexico Coastal Guidelines update.

In alignment with standard practice used in other FEMA studies, all coastal armoring structures and beach stabilization structures have been included in the analysis without adjusting the analysis to remove the structure or reduce the effects of the structure.

Coastal Analysis

The FEMA, Region II office, initiated a study in 2009 to update the coastal storm surge elevations within the states of New York and New Jersey including the Atlantic Ocean, the Barnegat Bay, the Raritan Bay, the Jamaica Bay, the Long Island Sound and their tributaries. The study replaces outdated coastal analyses as well as previously published storm surge stillwater elevations for Borough of Point Pleasant Beach, and serves as the basis for updated FIRMs. The coastal study for the New Jersey Atlantic Ocean coast and New York City coast was conducted for FEMA by RAMPP under contract HSFEHQ-09-D-0369, task order HSFE02-09-J-0001.

The region-wide storm surge modeling system includes the Advanced Circulation Model for Oceanic, Coastal and Estuarine Waters (ADCIRC) for simulation of 2-dimensional hydrodynamics. ADCIRC was dynamically coupled to the unstructured numerical wave model Simulating Waves Nearshore (unSWAN) to calculate the contribution of waves to total storm surge. The resulting model system is typically referred to as SWAN+ADCIRC (FEMA, 2010).

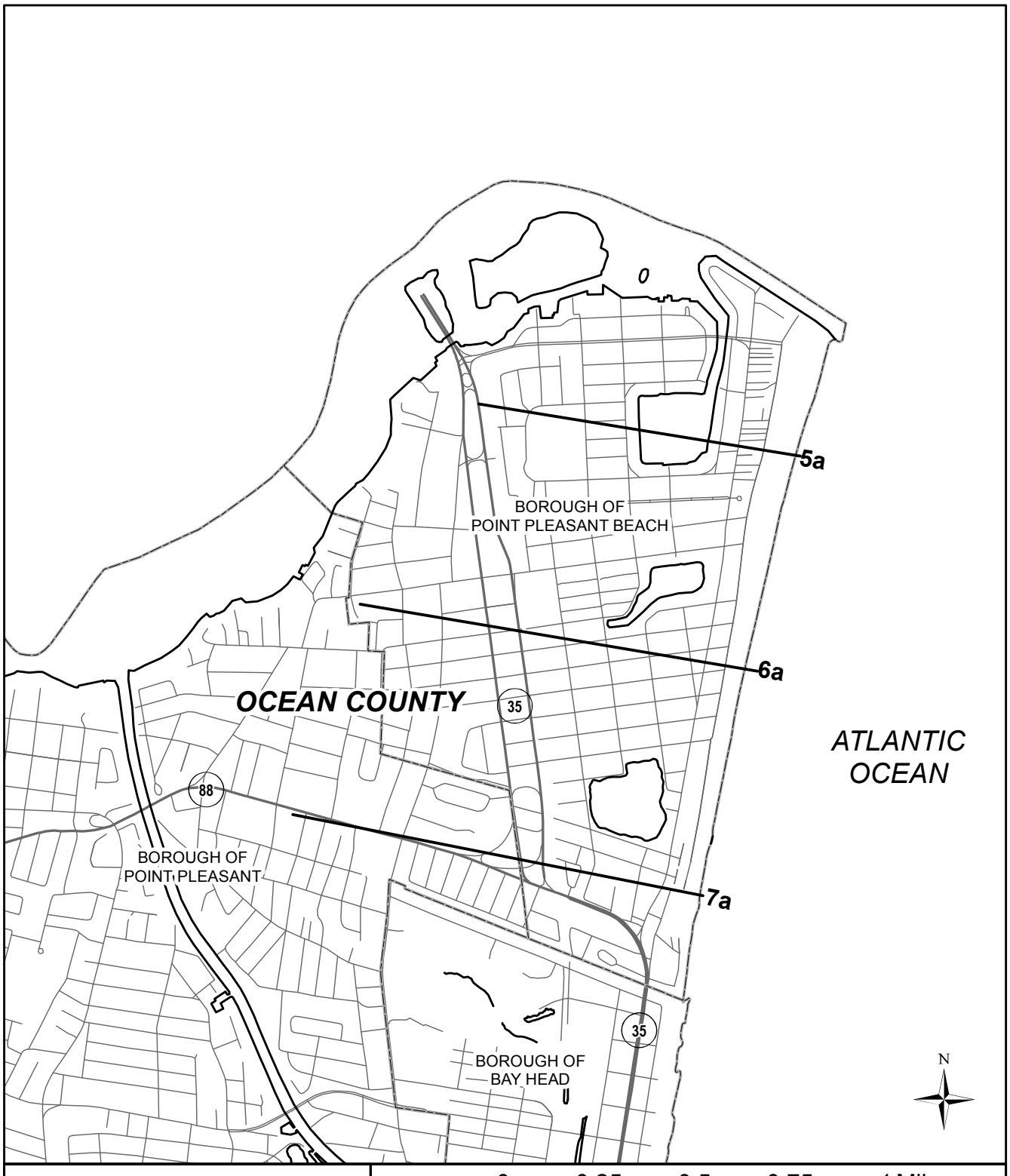
Model skill was assessed by quantitative comparison of model output to wind, wave, water level, and HWM observations. The model was then used to simulate 30 historical extra-tropical storms and 157 synthetic hurricanes to create a synthetic water elevation record from which the 10-, 2-, 1-, and 0.2- percent annual chance of exceedence elevations were determined.

For the New York and New Jersey surge study, wave setup was determined directly from the coupled wave and storm surge model. The total stillwater elevation (SWEL) including storm surge and wave setup was then used for the erosion and wave modeling.

Stillwater elevations for the 10-, 2-, 1-, and 0.2- percent annual chance floods were determined for the primary sources of flooding in Ocean County: Atlantic Ocean, Barnegat Bay, Kettle Creek, Little Egg Harbor, Manahawkin Bay, Manasquan River, Metedeconk River, and Toms River.

For the Borough of Point Pleasant Beach applicable transects in the coastal study area are Transects 5a, 6a, and 7a. The location of these transects is shown on the Revised Transect Location Map and on the FIRM panels.

For the updated coastal study the primary frontal dune (PFD) was delineated and used for erosion modeling along the Atlantic Coast. A review of the geology and shoreline type in Ocean County supported using FEMA's standard erosion methodology for PFDs, referred to as the "540 rule," (FEMA, 2007). Beach profiles collected before and after Hurricane Sandy were also used to qualitatively assess the beach response



FEDERAL EMERGENCY MANAGEMENT AGENCY

0 0.25 0.5 0.75 1 Miles

OCEAN COUNTY, NJ
(ALL JURISDICTIONS)

REVISED TRANSECT LOCATION MAP

during an extreme event and found to be in good agreement with standard erosion methodology.

In the following revised transect data table, the 10-, 2-, 1-, and 0.2-percent annual chance stillwater elevations for each transect are provided along with the starting wave height and period.

REVISED TRANSECT DATA

		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)			
Flood Source	Transect	Coordinates	Significant Wave Height Hs (ft)	Peak Wave Period	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Atlantic Ocean	5a	N 40.096041 W 74.034330	20.14	14.28	7.0 6.5 - 8.2	9.1 8.0 - 9.1	10.0 8.6 - 10.0	12.2 9.6 - 12.2
Atlantic Ocean	6a	N 40.087976 W 74.036917	19.99	14.07	7.0 6.5 - 8.1	9.1 8.2 - 9.1	9.9 8.9 - 9.9	12.2 9.8 - 12.2
Atlantic Ocean	7a	N 40.079434 W 74.039351	19.90	14.17	7.0 5.4 - 7.1	9.2 8.3 - 9.2	10.0 9.0 - 10.1	12.2 10.1 - 12.3

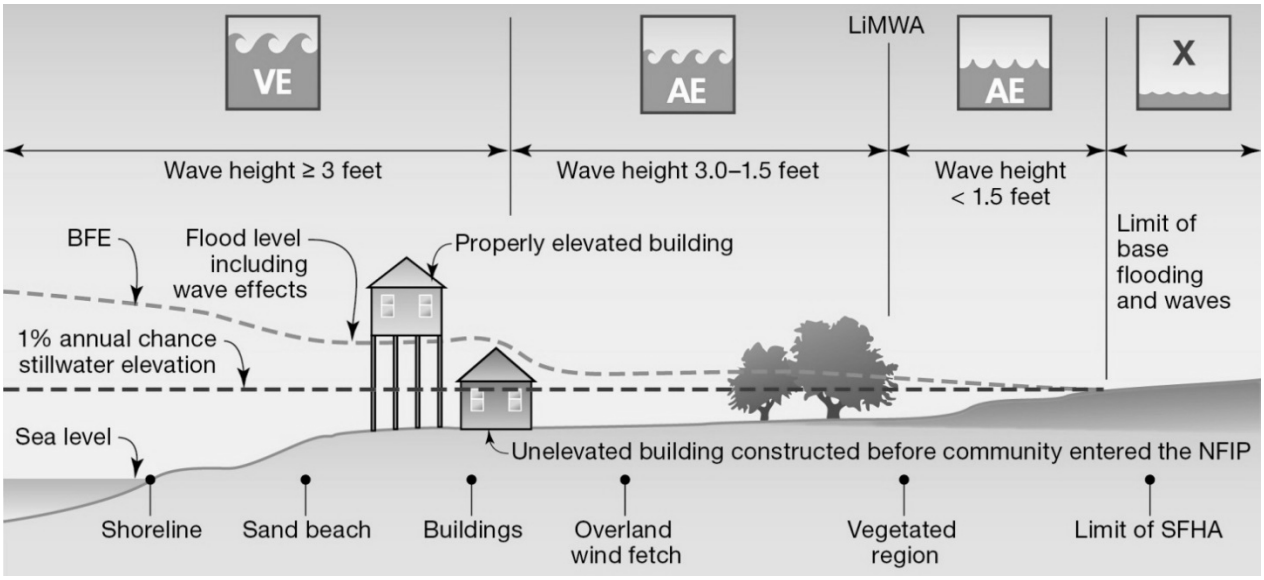
Each transect defined within the Region II study area was evaluated for the applicability of wave runup, and if necessary, the appropriate runup methodology was selected and applied to each transect. Runup elevations were then compared to WHAFIS results to determine the dominant process affecting BFEs and associated flood hazard levels. Based on wave runup rates, wave overtopping was computed following the FEMA 2007 Guidelines and Specifications (FEMA 2007).

The 3-foot wave has been determined to be the minimum size wave capable of causing major damage to conventional wood frame or brick veneer structures. The one exception to the 3-foot wave criteria is where a PFD exists. The limit of the coastal high hazard area then becomes the landward toe of the PFD or where a 3-foot or greater breaking wave exists, whichever is most landward.

Post-storm field visits and laboratory tests have confirmed that wave heights as small as 1.5 feet can cause significant damage to structures when constructed without consideration to the coastal hazards. Additional flood hazards associated with coastal waves include floating debris, high velocity flow, erosion, and scour which can cause damage to Zone AE-type construction in these coastal areas. To help community officials and property owners recognize this increased potential for damage due to wave action in the AE zone, FEMA issued guidance in December 2008 on identifying and mapping the 1.5-foot wave height line, referred to as the Limit of Moderate Wave Action (LiMWA). See Updated Transect Schematic below.

For coastal study Transects 5a-7a: Runup elevations were mapped and overtopping was calculated and mapped where applicable (AO zone mapped north of Transect 5a) along the Atlantic Coast from the Monmouth County boundary south

approximately 2,300 feet. The 1-percent annual chance boundary was delineated to the Runup elevation or PFD whichever was more conservative. Runup transition zones (between changing BFE's) offshore are mapped as perpendicular lines extending from the inland extent of the VE zone offshore. LiMWA was delineated along the 1-percent annual chance boundary.



Updated Transect Schematic

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to National Geodetic Vertical Datum of 1929 (NGVD29). Prior versions of the FIS report and FIRM were referenced to NGVD29.

The elevations shown in the FIS report and on the FIRMs for Ocean County referenced to the NAVD88. Ground, structure, and flood elevations may be compared and/or referenced to NGVD29 by applying a standard conversion factor. The conversion factor to NGVD29 is +1.2 feet. The conversion between the datums may be expressed as an equation:

NAVD88 + 1.2 feet = NGVD29

The BFEs shown on the FIRM represent whole-foot rounded values. For example, a BFE of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD 29 should apply the stated conversion factor(s) to elevations shown on the Flood Profiles and supporting data tables in the FIS report, which are shown at a minimum to the nearest 0.1 foot.

For more information on NAVD88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication

FIA20/June 1992, or contact the Spatial Reference System Division, National Geodetic Survey, NOAA, Silver Spring Metro Center, 1315 East-West Highway, Silver Spring, Maryland 20910 (Internet address http://www.ngs.noaa.gov).

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