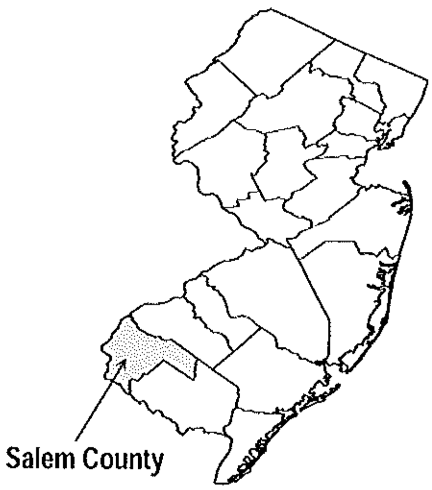
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 1



SALEM COUNTY, NEW JERSEY

(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
TOWNSHIP OF ALLOWAY	340413
TOWNSHIP OF CARNEYS POINT	340424
BOROUGH OF ELMER	340414
TOWNSHIP OF ELSINBORO	340415
TOWNSHIP OF LOWER ALLOWAYS CREEK	340416
TOWNSHIP OF MANNINGTON	340417
TOWNSHIP OF OLDMANS	340418
BOROUGH OF PENNS GROVE	340419
TOWNSHIP OF PENNSVILLE	340512
TOWNSHIP OF PILESGROVE	340420
TOWNSHIP OF PITTSGROVE	340421
TOWNSHIP OF QUINTON	340422
CITY OF SALEM	340423
TOWNSHIP OF UPPER PITTSGROVE	340425
BOROUGH OF WOODSTOWN	340426

FEMA

Preliminary:

APRIL 30, 2014

FLOOD INSURANCE STUDY NUMBER
34033CV000A
Version Number 1.0.0.0

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.

Selected Flood Insurance Rate Map panels for the communities within Salem County contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross-sections). In addition, former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X
C	X

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: TBD

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

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Salem County, New Jersey, including the Boroughs of Elmer, Penns Grove, and Woodstown; the City of Salem; and the Townships of Alloway, Carneys Point, Elsinboro, Lower Alloways Creek, Mannington, Oldmans, Pennsville, Pilesgrove, Pittsgrove, Quinton, and Upper Pittsgrove.

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (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 Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS was prepared to include all communities within Salem County in a countywide format. Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed community FIS reports, is shown below.

Carneys Point, Township of: The hydrologic and hydraulic analyses for this study were prepared by the New Jersey Department of Environmental Protection, Division of Water Resources, Bureau of Flood Plain Management, for the Federal Emergency Management Agency, under Contract No. S-90022. This work was completed in October 1980. The hydrologic and hydraulic analyses for this study were conducted by Tippetts-Abbett-McCarthy-Stratton, under subcontract to the New Jersey Department of Environmental Protection (Reference 7).

Elsinboro, Township of:	The hydrologic and hydraulic analyses for this study were prepared by the New Jersey Department of Environmental Protection, Division of Water Resources, Bureau of Flood Plain Management, for the Federal Emergency Management Agency, under Contract No. S-90022. This work was completed in September 1980. The hydrologic and hydraulic analyses for this study were conducted by Tippetts-Abbett-McCarthy-Stratton, under subcontract to the New Jersey Department of Environmental Protection (Reference 8).
Lower Alloways Creek, Township of:	The hydrologic and hydraulic analyses for this study were prepared by the New Jersey Department of Environmental Protection, Division of Water Resources, Bureau of Flood Plain Management, for the Federal Emergency Management Agency, under Contract No. S-90022. This work was completed in October 1980. The hydrologic and hydraulic analyses for this study were conducted by Tippetts-Abbett-McCarthy-Stratton, under subcontract to the New Jersey Department of Environmental Protection, Division of Water Resources, Bureau of Flood Plain Management (Reference 9).
Penns Grove, Borough of:	The hydrologic and hydraulic analyses for this study were prepared by the New Jersey Department of Environmental Protection, for the Federal Emergency Management Agency, under Contract No. S-90022. This work was completed in September 1980, covered all significant flooding sources in the Borough of Penns Grove. The hydrologic and hydraulic analyses for this study were conducted by Tippetts-Abbett-McCarthy-Stratton, under subcontract to the New Jersey Department of Environmental Protection (Reference 5).
Pennsville, Township of:	The hydrologic and hydraulic analyses for this study were prepared by the New Jersey Department of Environmental Protection, Division of Water Resources, Bureau of Flood Plain Management, for the Federal Emergency Management Agency, under Contract No. S-90022. This work was completed in October 1980. The hydrologic and

hydraulic analyses for this study were conducted by Tippetts-Abbett-McCarthy-Stratton, under subcontract to the New Jersey Department of Environmental Protection, Division of Water Resources, and Bureau of Flood Plain Management (Reference 10).

Salem, City of: The hydrologic and hydraulic analyses for this study were prepared by the New Jersey Department of Environmental Protection, Division of Water Resources, Bureau of Flood Plain Management, for the Federal Emergency Management Agency, under Contract No. S-90022. This work was completed in September 1980. The hydrologic and hydraulic analyses for this study were conducted by Tippetts-Abbett-McCarthy-Stratton, under subcontract to the New Jersey Department of Environmental Protection (Reference 6).

The authority and acknowledgements for the Boroughs of Elmer and Woodstown, and Townships of Alloway, Mannington, Oldmans, Pilesgrove, Pittsgrove, Quinton, and Upper Pittsgrove are not available because no FIS reports were published for those communities.

For the [date] countywide FIS, an analysis was performed to establish updated peak elevations for coastal flooding in Salem County. In 2008, FEMA Region III initiated a study to update the coastal storm surge elevations, within the states of Virginia, Maryland, and Delaware, and the District of Columbia, including the Atlantic Ocean, the Chesapeake Bay (including its tributaries), and the Delaware Bay. This study replaces outdated coastal storm surge stillwater elevations for all FISs in the study area, including Salem County, NJ. The storm surge study was conducted for FEMA by the U.S. Army Corps of Engineers (USACE) and its project partners: the Coastal Processes Branch (HF-C) of the Flood and Storm Protection Division (HF), U.S. Army Engineer Research and Development Center – Coastal & Hydraulics Laboratory (ERDC-CHL). This work was completed in 2012.

Coastal analyses involving transect layout, field reconnaissance, erosion analysis, and overland wave modeling including wave setup, wave height analysis and wave runup for the Delaware Bay and River were performed by Risk Assessment, Mapping, and Planning Partners (RAMPP), a joint venture of Dewberry, URS, and ESP, under its Risk MAP phase of the National Flood Insurance Program. This work was completed in February 2013.

Detailed hydrologic analyses for portions of Salem River and Chestnut Run were prepared by the New Jersey Department of Environmental Protection (NJDEP). This work was completed in September 2012. The detailed hydraulic analyses for the corresponding reaches of Salem River and Chestnut Run were performed by Michael Baker Jr., Inc. (Baker) for the NJDEP under Contract No. TC-007, P1066-00. This work was completed in May 2013.

Approximate method hydraulic analyses were prepared by RAMPP and its subcontractor Sun Engineers for FEMA under Contract No. HSFEHQ-09-D-0369-D021, TO# HSFE02-09-J-0001. This work was completed in March 2013.

Base map information shown on the FIRM was provided in digital format by the New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). The aerial photography was captured in March and April of 2012 at a scale of 1:2,400 with a 1 foot pixel resolution.

The coordinate system used in the preparation of this FIRM was New Jersey State Plane FIPS Zone 2900. The horizontal datum was NAD83, GRS80 spheroid. Flood elevations on this FIRM are referenced to the North American Vertical Datum of 1988. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences across jurisdiction boundaries. These differences do not affect the accuracy of 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 the communities in Salem County are shown in Table 1, " CCO Meeting Dates for Precountywide FISs."

TABLE 1 – CCO MEETING DATES FOR PRECOUNTYWIDE FISs

Community Name	For FIS Dated	Initial CCO Date	Final CCO Date
Alloway, Township of	1	1	1
Carneys Point, Township of	12/01/1981	12/01/1977	07/10/1981
Elmer, Borough of	1	1	1
Elsinboro, Township of	02/02/1982	11/18/1977	09/21/1981
Lower Alloways Creek, Township of	10/18/1982	11/10/1977	05/26/1982
Mannington, Township of	1	1	1
Oldmans, Township of	1	1	1
Penns Grove, Borough of	01/05/1982	11/29/1977	08/04/1981
Pennsville, Township of	06/15/1982	12/01/1977	12/15/1981
Pilesgrove, Township of	1	1	1
Pittsgrove, Township of	1	1	1
Quinton, Township of	1	1	1
Salem, City of	02/02/1982	11/10/1977	09/21/1981
Upper Pittsgrove, Township of	1	1	1
Woodstown, Borough of	1	1	1

[1]Data not available

For the [date] countywide FIS, an initial CCO meeting was held on February 22, 2011 with representatives of FEMA, NJDEP, Dewberry, and Salem County and its communities.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the geographic area of Salem County, New Jersey, including the incorporated communities listed in Section 1.1.

All or portions of the riverine flooding sources listed in Table 2, "Streams Studied by Detailed Methods for the 1982 Community FISs," were previously studied by detailed methods. Please note the portion of Salem River studied in

Table 2 is located at the mouth of the river within the City of Salem, Township of Elsinboro, and Township of Pennsville.

TABLE 2 – STREAMS STUDIED BY DETAILED METHODS FOR THE 1982 COMMUNITY FISs

Alloways Creek
Fenwick Creek
Keasbeys Creek
Salem River

Portions of the riverine flooding sources listed in Table 3, "Streams Studied by Detailed Methods for the [date] Countywide FIS," were studied by detailed methods from 2012-2013. Please note the portions of Salem River and Chestnut Run studied in Table 3 are located within the Borough of Woodstown and for small distances within the Township of Pilesgrove. Figure 1, "New Riverine Studies Location Map," illustrates the location of these new studies.

TABLE 3 – STREAMS STUDIED BY DETAILED METHODS FOR THE [DATE] COUNTYWIDE FIS

Chestnut Run
Salem River

The Delaware Bay has been restudied in its entirety and the resultant coastal flood hazards have been remapped as part of this [date] countywide FIS. Flood profiles for Alloways Creek, Fenwick Creek, Keasbeys Creek, and Salem River were included in the 1982 community FISs, however all or portions of these profiles have been omitted from this countywide FIS because the tidal flooding from the Delaware Bay and River controls these riverine flooding reaches.

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. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

All or portions of numerous flooding sources in the county were studied by approximate methods for this [date] countywide FIS. 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, NJDEP, and municipalities of Salem County.

This revision of the countywide FIS supersedes one previous determination of letters issued by FEMA, resulting in map changes. The Letter of Map Revision [LOMR] on Alloway Lake in the Township of Alloway (95-02-107P) was superseded by the new approximate analyses that include updated methodology (hydraulics and hydrology), and topography.

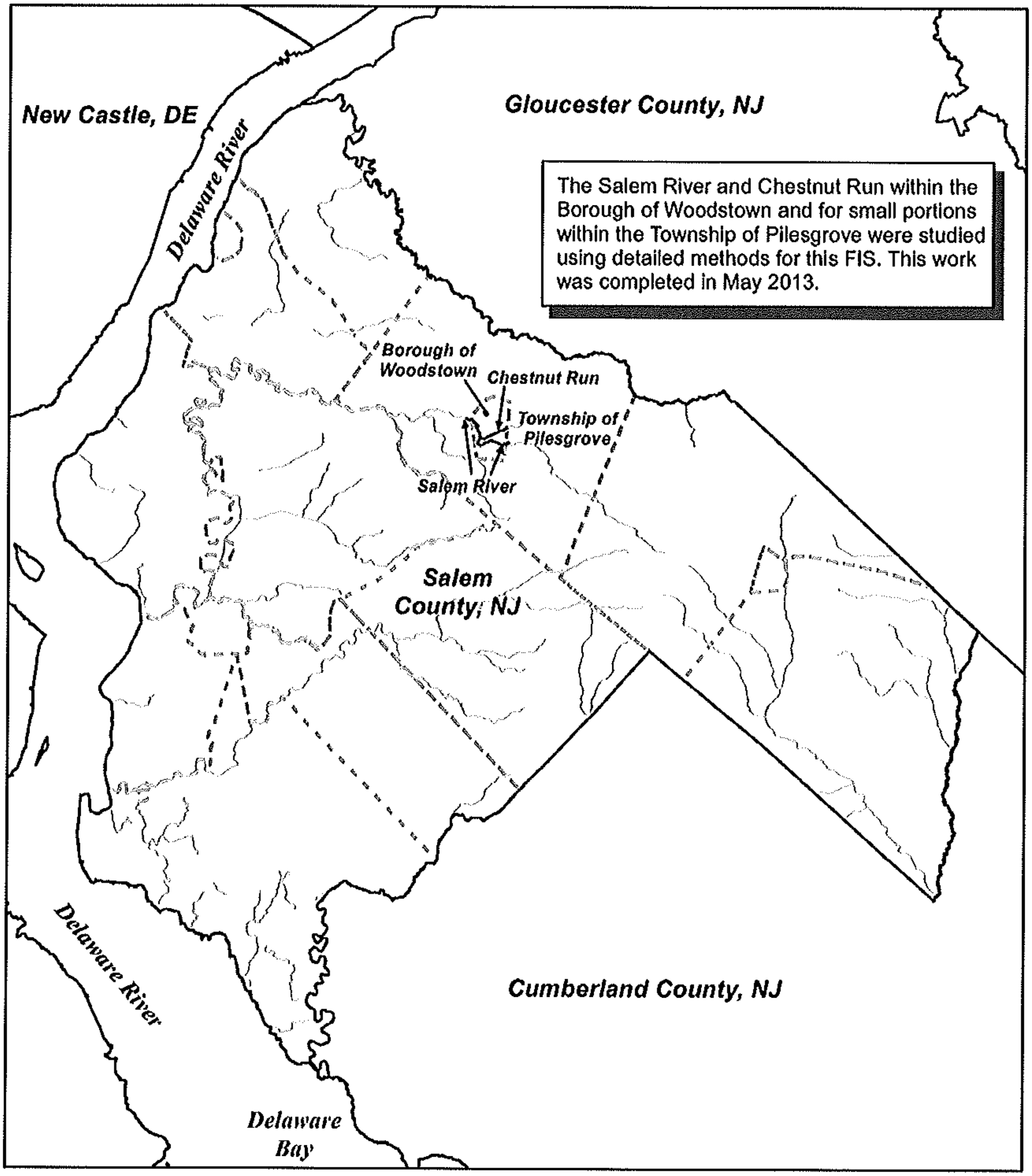

FIGURE 1	FEDERAL EMERGENCY MANAGEMENT AGENCY **SALEM COUNTY, NEW JERSEY** (ALL JURISDICTIONS)	Approximate Scale 0 2.5 5 Miles NEW RIVERINE STUDIES LOCATION MAP

2.2 Community Description

Salem County encompasses approximately 373 square miles in the southwest portion of New Jersey, 332 square miles of land area and 41 square miles of water. It is considered part of the Delaware Valley area. It is bounded on the north and east by Gloucester County, on the southeast by Cumberland County, and on the south and west by the Delaware River/Delaware Bay.

According to the U.S. Census Bureau, in 2010 the population estimate for Salem County was 66,083 (Reference 31), making it New Jersey's least populous county.

The topography of the county is flat coastal plain, with minimal relief. The lowest points in the county are at the Delaware River/Delaware Bay, while the highest points in the county are in Upper Pittsgrove Township at approximately 160 feet (48.7 m) above sea level.

Average annual rainfall is approximately 45.9 inches, with the months of March through September averaging 4.1 inches and October through February averaging 3.5 inches. Average temperatures vary from a low of approximately 24 degrees Fahrenheit (°F) in January to a high of 88 degrees Fahrenheit (°F) in July. (Reference 37)

Vegetation in the county consists of several species of marsh grasses, with large areas of meadow and grasslands, woodlands, brush, tilled fields and fence row, which are commonly associated with terrestrial and wetland ecosystems.

2.3 Principal Flood Problems

The history of flooding within the county indicates that major floods may occur during any season of the year; particularly in the late summer and early fall when high tides are generated in the Delaware Bay and River by hurricanes and tropical storms moving up the Atlantic coast.

There have been major floods on the Delaware River associated with hurricanes occurring in 1933, 1950, and a nor'easter in 1962. The high tide of the November 25, 1950 storm was recorded at 7.5 feet (NAVD88) on the Delaware River at the mouth of the Cohansey River in Cumberland County, New Jersey (Reference 6).

The storm of March 6, 1962 had a duration which exceeded 60 hours and caused damage to beaches, dunes and shore communities. The high tide from the 1962 storm inundated marshlands, flooded highways and streets and interrupted communications. A high tide of 6.9 feet (NAVD88) was recorded at Lewes, Delaware for this storm (Reference 9).

Hurricane David produced flooding in the Laurel Street and Ives Avenue area of Carney's Point in September 1979 (Reference 23).

More recently, Salem County has been affected by hurricanes and tropical storms in 1985 (Gloria), 1999 (Floyd), 2003 (Henri & Isabel), 2011 (Irene), and 2012 (Sandy). A high tide of 6.1 feet (NAVD88) was recorded at Lewes, Delaware during Hurricane Sandy.

Figure 2, "Delaware River and Bay Tidal Gage Locations," illustrates the location of these gages.

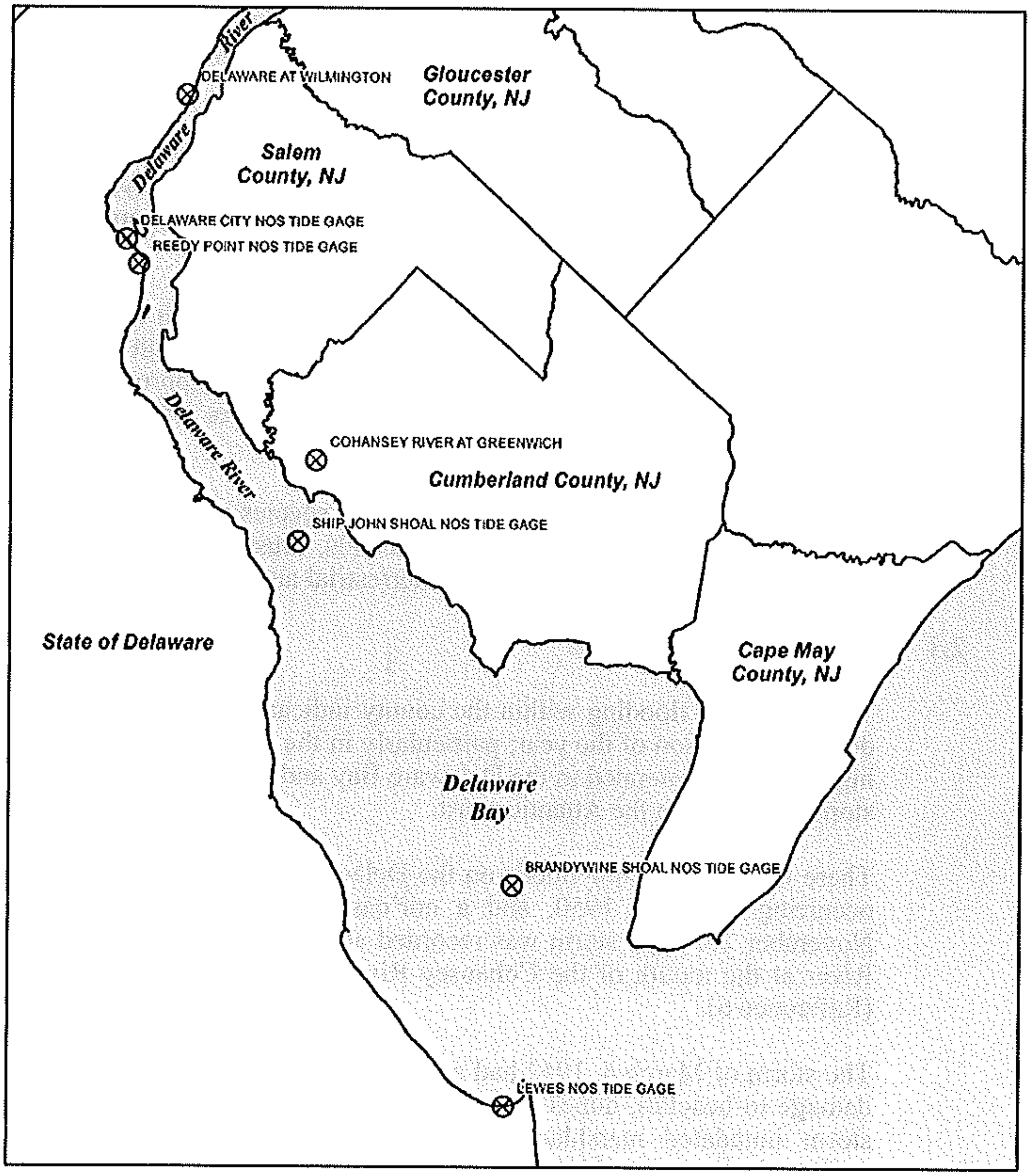

FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
SALEM COUNTY, NEW JERSEY
(ALL JURISDICTIONS)

Approximate Scale 0 5 10 Miles

DELAWARE RIVER AND BAY TIDAL GAGE LOCATIONS

2.4 Flood Protection Measures

Seawalls, stone revetments, bulkheads, dikes, and pumping plants have been employed to prevent flooding in the developed shoreline areas from high tides generated in the Delaware River and Bay throughout Salem County. These structures, and those described below, are not known to provide protection from the 1-percent-annual-chance flood.

Non-structural protection measures employed throughout the county include discouraging development in floodprone areas except when the development proposal is properly protected against flood damage, and does not aggravate a flooding problem.

In Lower Alloways Creek Township, the following structural measures have been utilized to aid in the prevention of future flood damage (Reference 9). The following have been proposed or are being undertaken:

1. An existing tide gate on Alloways Creek, just east of Salem-Hancocks Bridge Road, was repaired by the Soil Conservation Service.

2. An earth bank was constructed along the southern side of Alloways Creek extending west from Salem-Hancocks Bridge Road to the confluence of Bass Creek. The bank would serve as protection for the Village of Hancocks Bridge.

3. The construction of a pumping station, with a capacity of 3,200 gallons per minute (GPM), in the vicinity of the Poplar Street – Main Street intersection. This station would pump water impounded in the low area behind a proposed dike.

4. The construction of an embankment south of Silver Lake Meadow, extending west to east from Alloways Creek Neck Road to Fogg Road, with a gate at the north end of the Silver Lake Fork tributary, located approximately 2,800 feet southwest of the Silver Lake Road – Fogg Road intersection.

5. The original tide gates at Stow Neck Road still protect the areas upstream from Stow Neck Road along the tributary to Stow Creek running south from Maskells Mill Pond.

Non-structural protection measures are also being utilized in Lower Alloways Creek Township to aid in the prevention of future flood damage. These are in the form of land use regulations adopted from the township's zoning ordinance, in which the floodplain is described as "the limits of those areas subject to intermediate regional tidal flood, as defined by the U.S Army Corps of Engineers, and as delineated on the zoning map" (Reference 24). Wetlands have been zoned for floodplain conservation and will serve as a wide buffer zone to reduce the impact of coastal storms.

In Pennsville Township, protection is provided in the form of a series of pumping plants with a capacity range of 4,000 to 6,000 gallons per minute. These pumps, located along the shoreline at various points from Industrial Park Road to the Memorial Bridge, will remove water impounded in the low areas behind the seawalls and revetments (Reference 10).

Pennsville Township also employs land use regulations and land development control, adopted from the township's Zoning Ordinance of 1971, to aid in the prevention of future flood damage.

In an effort to reduce impacts from flooding, the NJDEP, Division of Land Use Regulation (DLUR) has created regulations for development within floodplains. The most recent regulations can be found on the NJDEP website at www.state.nj.us/dep/landuse/fha_main.html.

No other special flood protection measures were taken into account for this countywide FIS.

A number of man-made structures commonly called agricultural or salt-hay levees have been identified in this county. The inventory of these structures is detailed in a report (South Jersey Levee Inventory, 2010) developed by the United States Department of Agriculture (USDA), National Resource Conservation Service (NRCS) for the NJDEP (Reference 34).

These structures do not meet the definition of a levee (Code of Federal Regulations, Title 44, Section 59.1 (CFR 44§59.1)) for the purpose of the NFIP. These structures were studied and found to not provide protection from the 1-percent-annual-chance flood or base flood elevations (BFEs). There is a potential that these structures may increase local flood hazard due to higher velocity flows during a large flood event as they overtop, and may lead to increased time of inundation by retaining flood waters for an extended period. Local conditions should be assessed for this potential for increased flood hazard and appropriate mitigation measures are recommended.

More information on the non-levee structures located in this county may be found in the "South Jersey Levee Inventory" published in November, 2010 by the NRCS and the NJDEP, Bureau of Dam Safety and Flood Control.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 2-, 1-, and 0.2-percent-annual-chance flood 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, probabilistic 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 that equals or exceeds the 1 percent annual chance flood in any 50-year period is approximately 40 percent (4 in 10); 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 community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Riverine Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the communities within Salem County.

For each community within Salem County that had a previously printed FIS report, the riverine hydrologic analyses described in those reports prior to the [date] countywide FIS, have been compiled and are summarized below.

Elsinboro, Township of:

For the February 2, 1982 FIS, peak discharges for the selected recurrence intervals at the gaging station near Woodstown, New Jersey, were estimated from discharge-frequency data computed for Salem River by the USACE according to the standard log-Pearson Type III procedure, as outlined by the Water Resources Council, and published in the USACE Special Projects Memo No. 480 (References 35 and 28). The gage has continuous records covering a period of 36 years, from 1940 through 1975. The peak discharge-frequency values were then transposed downstream to ungaged points within the basin, using the discharge-drainage area relationship, $Q=kA^{0.5}$, where Q is the discharge, k is a constant of proportionality and A is the drainage area. Peak discharges on the tributary streams of Fenwick Creek and Keasbeys Creek (which contribute to the total flows of Salem River in Elsinboro) were estimated for the selected recurrence intervals using the discharge-drainage area relationship, $Q=kA^{0.81}$, and the weighted discharges obtained for the nearby gage on Alloways Creek at Alloway, New Jersey.

Flood-flow frequency data for Alloways Creek were based on (i) statistical analysis of stream flow records following the standard log-Pearson Type III procedure as outlined by the Water Resources Council; and (ii) regional flow equations which relate basin characteristics to peak flood discharges as presented in the U.S. Geological Survey (USGS) Special Report 38 (References 35 and 22). Both of these methods were applied to stream flow records and other pertinent data obtained at the gaging station located on Alloways Creek at Alloway, New Jersey. This gage has records from 1953 through 1978, covering a period of 26 years, which is a relatively short period. Therefore, the discharges obtained using the log-Pearson Type III method was weighted with Special Report 38 values. The weighted data represent peak discharge-frequency for floods of the 10-, 50- and 100-year recurrence intervals and were plotted on log-probability paper. The 500-year peak discharge was estimated by a straight line extrapolation of this graph. Peak discharge-frequency values at various points downstream of the gaging station were obtained by transposing the weighted data, using the discharge-drainage area relationship, $Q=kA^{0.81}$.

<u>Lower Alloways Creek, Township of:</u>

For the October 18, 1982 FIS flood-flow frequency data for Alloways Creek were based on statistical analysis of streamflow records following the standard log-Pearson Type III procedure as outlined by the Water Resources Council, and regional flow equations which relate basin characteristics to peak flood discharges as presented in Special Report 38 (References 35 and 22). Both methods were applied to streamflow records and other pertinent data obtained at the gaging station located on Alloways Creek at Alloways, New Jersey. This gage has a relatively short period of record, from 1953 through 1978. Therefore, the discharges obtained using the log-Pearson Type III methods were weighted with values from Special Report 38 (Reference 22). The weighted data represent the peak discharge-frequency for floods with recurrence intervals of 10-, 50-, and 100-years and were plotted on log-probability paper. The 500-year peak discharge was estimated by a straight-line extrapolation of the previously mentioned graph.

Peak discharge-frequency values at various points of interest downstream of the gaging station were obtained by transposing the weighted data, using the discharge-drainage area relationship, $Q=kA^{0.81}$, where Q is the discharge in cubic feet per second (cfs), k is the constant of proportionality, and A is the drainage area in the square miles.

<u>Pennsville, Township of:</u>

For the June 15, 1982 FIS discharge-frequency data for the Salem River was computed by the USACE and published in their Special Projects Memo No. 480 entitled <u>Generalized Skew Study for the State of New Jersey</u>, dated 1977 (Reference 28). The data was computed at the gaging station on the Salem River near Woodstown, New Jersey, and was used to estimate peak discharges for the selected recurrence intervals. This gage has continuous records covering a period of 36 years from 1940 through 1975. These peak discharge-frequency values for floods of the 10-, 50-, 100- and 500-year recurrence intervals were transposed downstream to ungaged points on the Salem River using the discharge-drainage area relationship: $Q=kA^{0.5}$, where Q is the discharge, A is the drainage area and k is a constant of proportionality.

City of Salem:

For the February 2, 1982 FIS discharge-frequency data computed for Salem River by the USACE and published in their Special Projects Memo No. 480, entitled Generalized Skew Study for the State of New Jersey, dated 1977, at the gaging station on the river near Woodstown, New Jersey, was used to estimate peak discharges for the selected recurrence intervals. This gage has continuous records covering a period of 36 years from 1940 through 1975 (Reference 28).

These peak discharge-frequency values for floods of the 10-, 50-, 100- and 500-year recurrence intervals were transposed downstream to ungaged points on Salem River using the discharge-drainage area relationship: $Q=kA^{0.5}$, where Q is the discharge, A is the drainage area and k is a constant of proportionality.

Flood flow frequency data for Fenwick Creek and Keasbeys Creek were based on a statistical analysis of stream flow records following the standard log-Pearson Type III procedure outlined by the Water Resources Council, and on regional flow equations which relate basin characteristics to peak flood discharges as presented in USGS Special Report 38 (References 35 and 22). Both of these methods were applied at the nearby gage located on Alloways Creek at Alloway, New Jersey. The discharges obtained using the log-Pearson Type III procedure were weighted with Special Report 38 values since the gage has records covering a period of only 20 years. Peak discharge-frequency values at various points on Fenwick Creek and Keasbeys Creek were obtained by transposing the weighted data, using the same formula used for Salem River, with the area raised to the power of 0.81.

For the [date] countywide FIS, discharges for the 10-, 4-, 2-, 1-, and 0.2-percent annual chance peak recurrence intervals were calculated for stream reaches included in new detailed studies for the Salem River and Chestnut Run within the Borough of Woodstown and for small distances within the Township of Pilesgrove (see Figure 1), and discharges for the 1-percent-annual-chance recurrence interval were calculated for stream reaches studied by approximate methods throughout the county.

For the above noted portions of the Salem River and Chestnut Run, detailed hydrologic analyses were performed by the New Jersey Department of Environmental Protection (NJDEP). NJDEP determined the 10-, 4-, 2-, 1-, and 0.2-percent annual chance peak discharges using updated USGS statewide regression equations (Reference 36), flood frequency gage analysis, and gage transfer methods. The hydrologic analysis of peak-flow gage data was performed in accordance to the guidelines published by the Interagency Advisory Committee on Water Data in its Bulletin 17B. The flow rates at the gaging stations were determined using Log Pearson Type III frequency distribution methodology implemented in the USGS computer program PeakFQ (Reference 20). These gage discharges were weighted with regional flood-estimating equations, and were then applied to non-gaged locations using gage transfer methods. In addition, the New Jersey Flood Hazard Area Design Flood (NJFHADF) was computed for the USGS gaging station and the additional flow locations. The NJFHADF is equal to the 1-percent-annual-chance flow plus an additional 25% in flow, and not to exceed the 0.2-percent-annual-chance flood. NJFHADF boundary is to regulate disturbance to the land and vegetation within flood hazard area of a water body. This regulation is set forth by the State of New Jersey Flood Hazard Area Control Act Rules N.J.A.C. 7:13, and is administered by the NJDEP.

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

For stream reaches studied by approximate methods, discharges for the 1-percent-annual-chance recurrence interval were calculated using USGS regression equation SIR 2009-5167 "Method for Estimation of Flood Magnitude and Frequency for New Jersey Streams, Version 2.0", gage analysis, and drainage area transposition, as appropriate (Reference 36).

TABLE 4 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-percent-annual-chance peak flow (cfs)	2-percent-annual-chance peak flow (cfs)	1-percent-annual-chance peak flow (cfs)[1]	0.2-percent-annual-chance peak flow (cfs)
ALLOWAYS CREEK					
At confluence with Delaware River	59.6	2,740	4,520	5,450	7,800
At Salem - Hancocks Bridge Road	51.6	2,440	4,020	4,850	6,600
At gaging station at Alloway (No. 01483500)	21.9	1,220	2,010	2,420	3,490
CHESTNUT RUN					
At the confluence with Salem River	1.91	291	485	582/728	817
FENWICK CREEK					
At confluence with Salem River	9.9	740	1,210	1,450	2,090
At confluence of Keasbeys Creek	8.8	670	1,100	1,320	1,900
KEASBEYS CREEK					
At confluence with Fenwick Creek	4.3	330	540	650	930
At Grant Street	2.3	200	320	390	560
SALEM RIVER					
At confluence with the Delaware River	105.0	7,940	18,910	26,250	52,890
At the confluence with Fenwick Creek	95.1	7,200	17,700	24,800	50,800
Approximately 4,000 feet downstream of US Route 40	17.2	2,552	5,727	7,766/9,708	14,819
Upstream of Memorial Lake Dam at gaging station (No. 01482500)	14.6	2,290	5,140	6,970/8,713	13,300

[1] 1-percent annual chance discharge / New Jersey Flood Hazard Area Design Flood (NJFHADF) discharge; the NJFHADF discharge is equal to the 1-percent-annual-chance flow plus an additional 25% in flow, and not to exceed the 0.2-percent annual chance flow.

3.2 Riverine Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the riverine sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that riverine 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.

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

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 study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen based on field observations of the stream and overbank areas and on engineering judgment.

For each community within Salem County that had a previously printed FIS report, the riverine hydraulic analyses described in those reports prior to the [date] countywide FIS, have been compiled and are summarized below.

<u>Township of Elsinboro</u>

For the February 2, 1982 FIS analyses of the hydraulic characteristics of Salem River and Alloways Creek, along with the hydraulic analyses of the shoreline characteristics of the Delaware River studied in detail, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Cross sections for the backwater analysis of Salem River and Alloways Creek were obtained from aerial photographs and field survey measurements (Reference 21 and 1).

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (Reference 26). Starting water-surface elevations for Salem River were calculated using the slope/area method. The starting water-surface elevation for Alloways Creek was mean sea level.

Township of Lower Alloways Creek:

For the October 18, 1982 FIS analyses of the hydraulic characteristics of Alloways Creek along with the hydraulic analyses of the shoreline characteristics of the Delaware River and Bay were carried out to provide estimate of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses of Alloways Creek were obtained from aerial photographs and field survey measurements (References 21 and 1). They were located at close intervals above and below bridges in order to compute the significant backwater effects of the structures.

Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 step-backwater computer program (Reference 26). Mean sea level was used as the starting water-surface elevation for Alloways Creek.

Township of Pennsville:

For the June 15, 1982 FIS analyses of the hydraulic characteristics of the Salem River along with the hydraulic analyses of the shoreline characteristics of the Delaware River were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (Reference 26). Cross sections for the backwater analysis of the Salem River were obtained from aerial photographs and field survey measurements (Reference 21). Cross sections were located at close intervals above and below bridges, in order to compute the significant backwater effects of the structures. Starting water-surface elevations for the Salem River were calculated using the slope/area method.

City of Salem:

For the February 2, 1982 FIS analyses of the hydraulic characteristics of Salem River, Fenwick Creek and Keasbeys Creek, along with the hydraulic analyses of the shoreline characteristics of the Delaware River studied in detail, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analysis of the streams studied were obtained from aerial photographs and field survey measurements (Reference 21). Cross sections were located at close intervals upstream and downstream of bridges in order to compute the significant backwater effects of the structures.

Water-surface elevations for floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (Reference 26). Starting water-surface elevations for Salem River, Fenwick Creek and Keasbeys Creek were calculated using the slope/area method.

Detailed Analyses for the [date] countywide FIS

Hydraulic analyses on Chestnut Run and Salem River within the Borough of Woodstown and for small distances within the Township of Pilesgrove (see Figure 1), was performed for the 10%-, 4%-, 2%-, 1%-, 0.2%-annual-chance flood and NJFHADF events using the HEC-RAS Version 4.1.0 hydraulic model (Reference 32), developed by the USACE.

A one-dimensional, fixed bed, and steady state hydraulic model scenario was assumed for both streams using HEC-RAS. The hydraulic models were executed under the assumption of subcritical flow to produce the most conservative water surface elevations. Manning's 'n' roughness values were determined by a mixture of values from other effective hydraulic models, aerial imagery and Cowan's Method, as applicable. Channel roughness factors for all reaches are provided below in Table 5, "Manning's 'n' Values."

TABLE 5 - MANNING'S "n" VALUES

Flooding Source	Channel "n"	Overbanks "n"
Alloways Creek**	0.023-0.035	0.075-0.08
*Chestnut Run	0.03	0.024-0.1
Fenwick Creek**	0.03	0.07-0.08
Keasbeys Creek**	0.03	0.08-0.1
*Salem River	0.016-0.035	0.035-0.1

*Calculated and used for the [date] countywide FIS
**Calculated and previously used as part of the 1982 community FISs

The downstream starting water surface elevations (WSELs) for all profiles in the HEC-RAS model were calculated using normal depth method. Cross section geometries were a combination of field surveyed information and data extracted from LIDAR topographic data using HEC-GeoRAS 10 (Reference 33). More information can be found in the Chestnut Run & Salem River Hydraulic Analyses Technical Support Data Notebook (TSDN).

Approximate Analysis

For the roughly 170 miles of stream in Salem County studied by approximate methods, the hydraulic analysis includes redefining the limits of 1-percent-annual-chance flood event based upon new hydrology data, improved aerial and topographic information. To achieve this purpose, all rivers and streams in the existing Zone A approximate floodplains were identified based on aerial imagery, USGS quadrangles, and LIDAR topographic data. Cross section geometries were extracted from the LIDAR topographic data and incorporated into the HEC-RAS model (Reference 27). The 1-percent-annual-chance water surface elevation was determined for each of the cross sections assuming 1-dimensional steady flow condition. The Manning's roughness coefficient values were estimated for main channel and the surrounding flood-prone area based on land use data provided by NJDEP. The downstream starting WSELs for all profiles in the HEC-RAS model were calculated using normal depth method with the exceptions of the rivers under tidal influence or downstream detailed studies. For the streams under tidal influence mean monthly high water elevation from Marcus Hook Tidal, PA tide gauge was used. Known water surface elevations available from downstream detailed studied streams were used for the streams with downstream detailed studies.

3.3 Coastal Analysis

Coastal analysis, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations for the 10-, 2-, 1-, and 0.2-percent annual chance floods along the shoreline. Users of the FIRM should be aware that coastal flood elevations are provided in Table 6, "Summary of Coastal Stillwater Elevations" in this report. If the elevation on the FIRM is higher than the elevation shown in this table, a wave height, wave runup, and/or wave setup component likely exists, in which case, the higher elevation should be used for construction and/or floodplain management purposes.

An analysis was performed to establish the frequency peak elevation relationships for coastal flooding in Salem County. The FEMA Region III office initiated a study in 2008 to update the coastal storm surge elevations, within the states of Virginia, Maryland, and Delaware, and the District of Columbia, including the Atlantic Ocean, the Chesapeake Bay (including its tributaries), and the Delaware Bay. The study replaces outdated coastal storm surge stillwater elevations for all FISs in the study area, including Salem County, and serves as the basis for the updated FIRMs. Study efforts were completed in 2012.

The storm surge study was conducted for FEMA by the USACE and its project partners: the Coastal Processes Branch (HF-C) of the Flood and Storm Protection Division (HF), U.S. Army Engineer Research and Development Center – Coastal & Hydraulics Laboratory (ERDC-CHL).

The end-to-end storm surge modeling system includes the Advanced Circulation Model for Oceanic, Coastal and Estuarine Waters (ADCIRC) for simulation of 2-dimensional hydrodynamics (Luettich et. al, 2008). ADCIRC was dynamically coupled to the unstructured numerical wave model Simulating WAves Nearshore (unSWAN) to calculate the contribution of waves to total storm surge (USACE, 2012). The resulting model system is typically referred to as SWAN+ADCIRC (USACE, 2012). A seamless modeling grid was developed to support the storm surge modeling efforts. The modeling system validation consisted of a comprehensive tidal calibration followed by a validation using carefully reconstructed wind and pressure fields from three major flood events for the Region III domain: Hurricane Isabel (2003), Hurricane Ernesto (2006), and extra-tropical storm Ida (2009). Model skill was assessed by quantitative comparison of model output to wind, wave, water level and high water mark observations.

The tidal surge for those estuarine areas of the Delaware Bay affects the entire shoreline of Salem County. The entire open coastline, from the confluence with the Stow Creek to Hope Creek, is more prone to damaging wave action during high wind events due to the significant fetch over which winds can operate.

The storm-surge elevations for the 10-, 2-, 1-, and .2- percent annual chance floods were determined for Delaware Bay and are shown in Table 6, "Summary of Coastal Stillwater Elevations." The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects.

TABLE 6 – SUMMARY OF COASTAL STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (ft NAVD88)			
	10-percent chance	2-percent chance	1-percent chance	0.2-percent chance
DELAWARE RIVER/BAY				
Stow Creek to Hope Creek	3.5-7.2	4.1-8.2	4.1-8.8	9.4-11.3
Alloways Creek to Oldmans Creek	2.8-7.0	3.7-8.0	4.0-8.5	6.9-11.1

The coastal analysis involved transect layout, field reconnaissance, erosion analysis, and overland wave modeling including wave setup, wave height analysis and wave runup.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (NAS, 1977). This method is based on three major concepts. First, depth-limited waves in shallow water reach maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in

NAS Report. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed across transects that were located along coastal and inland bay areas of Salem County, as illustrated on the FIRMs. The transects were located with consideration given to existing transect locations and to the physical and cultural characteristics of the land so that they would closely represent conditions in the locality.

Each transect was taken perpendicular to the shoreline and extended inland to a point where coastal flooding ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for a 1% annual chance event were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the Zone VE (area with velocity wave action) was computed at each transect. Along the open coast, the Zone VE designation applies to all areas seaward of the landward toe of the primary frontal dune system. The primary frontal dune toe is defined as the point where the ground profile changes from relatively steep to relatively mild.

Dune erosion was taken into account along the Delaware Bay coastline. A review of the geology and shoreline type in Salem County was made to determine the applicability of standard erosion methods, and FEMA's standard erosion methodology for coastal areas having primary frontal dunes, referred to as the "540 rule," was used (FEMA, 2007a). This methodology first evaluates the dune's cross-sectional profile to determine whether the dune has a reservoir of material that is greater or less than 540 square feet above 1-percent stillwater elevation. If the reservoir is greater than 540 square feet, the "retreat" erosion method is employed and approximately 540 square feet of the dune is eroded using a standardized eroded profile, as specified in FEMA guidelines. If the reservoir is less than 540 square feet, the "remove" erosion method is employed where the dune is removed for subsequent analysis, again using a standard eroded profile. The storm surge study provided the return period stillwater elevations required for erosion analyses. Each cross-shore transect was analyzed for erosion, when applicable. For erodible low bluffs, the eroded beach profile is determined from use of the 540 SF methodology, if applicable local bluff recessions assessments or historic measurement of storm induced erosion have been considered to edit the 540 SF. In this regard, erosion volume of less than 540 square feet were used for some transects to achieve reasonable retreat distance as described in Region 2 Dune and Bluff Erosion Methodology prepared by RAMPP.

Wave height calculations used in this study follow the methodologies described in the FEMA guidance for coastal mapping (FEMA, 2007a). Wave setup results in an increased water level at the shoreline due to the breaking of waves and transfer of momentum to the water column during hurricanes and severe storms. For the Salem County study, total stillwater elevation was determined directly from the coupled wave and storm surge model The total stillwater elevation (SWEL) was then used for simulations of inland wave propagation conducted using FEMA's Wave Height Analysis for Flood Insurance Studies (WHAFIS) model Version 4.0 (FEMA, 2007b). WHAFIS is a one-dimensional model that was applied to each transect in the study area. The model uses the specified SWEL and the starting wave conditions as input. Simulations of wave transformations were then conducted with WHAFIS taking into account the storm-induced erosion and overland features of each transect. Output from the model includes the combined SWEL and wave height along each cross-shore transect allowing for the establishment of base flood elevations (BFEs) and flood zones from the shoreline to points inland within the study area.

Wave runup is defined as the maximum vertical extent of wave uprush on a beach or structure. FEMA's "Atlantic Ocean and Gulf of Mexico Coastal Guidelines" require the top 2% of 1% storm wave runup level be computed for the coastal feature being evaluated (cliff, coastal bluff, dune, or structure) (FEMA, 2007a). The runup level is the highest 2 percent of wave runup affecting the shoreline during the 1-percent-annual-chance flood event. Each transect defined within the study area along the Delaware River/Delaware Bay 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 FEMA's "Atlantic Ocean and Gulf of Mexico Coastal Guidelines".

Computed starting wave heights at the shoreline range from 2.62 feet at the northern end of the county where the fetch is short to 5.90 feet at the southern end where the fetch is longer. The dune along the coast serves to reduce wave height transmitted inland, but the large areas of low-lying marshes which are inundated by the tidal surge allow regeneration of the waves as they proceed inland. In general, the relatively shallow depth of water in the marshes along with the energy dissipating effects of vegetation allows only minor regeneration of the waves.

Figure 3, "Transect Location Map," illustrates the location of each transect. Along each transect, wave envelopes were computed considering the combined effects of changes in ground elevation, vegetation and physical features. Between transects, base flood elevations were interpolated using topographic maps, land-use and land-cover data, and engineering judgment to determine the aerial extent of flooding. The results of the calculations are accurate until local topography, vegetation, or cultural development within the community undergoes major changes. The transect data for the county are presented in Table 7, "Transect Data," which describes the flood hazard zone and base flood elevations for each transect flooding source, along with the 10-, 2-, 1-, and 0.2-percent annual chance stillwater elevations for the respective flooding source.

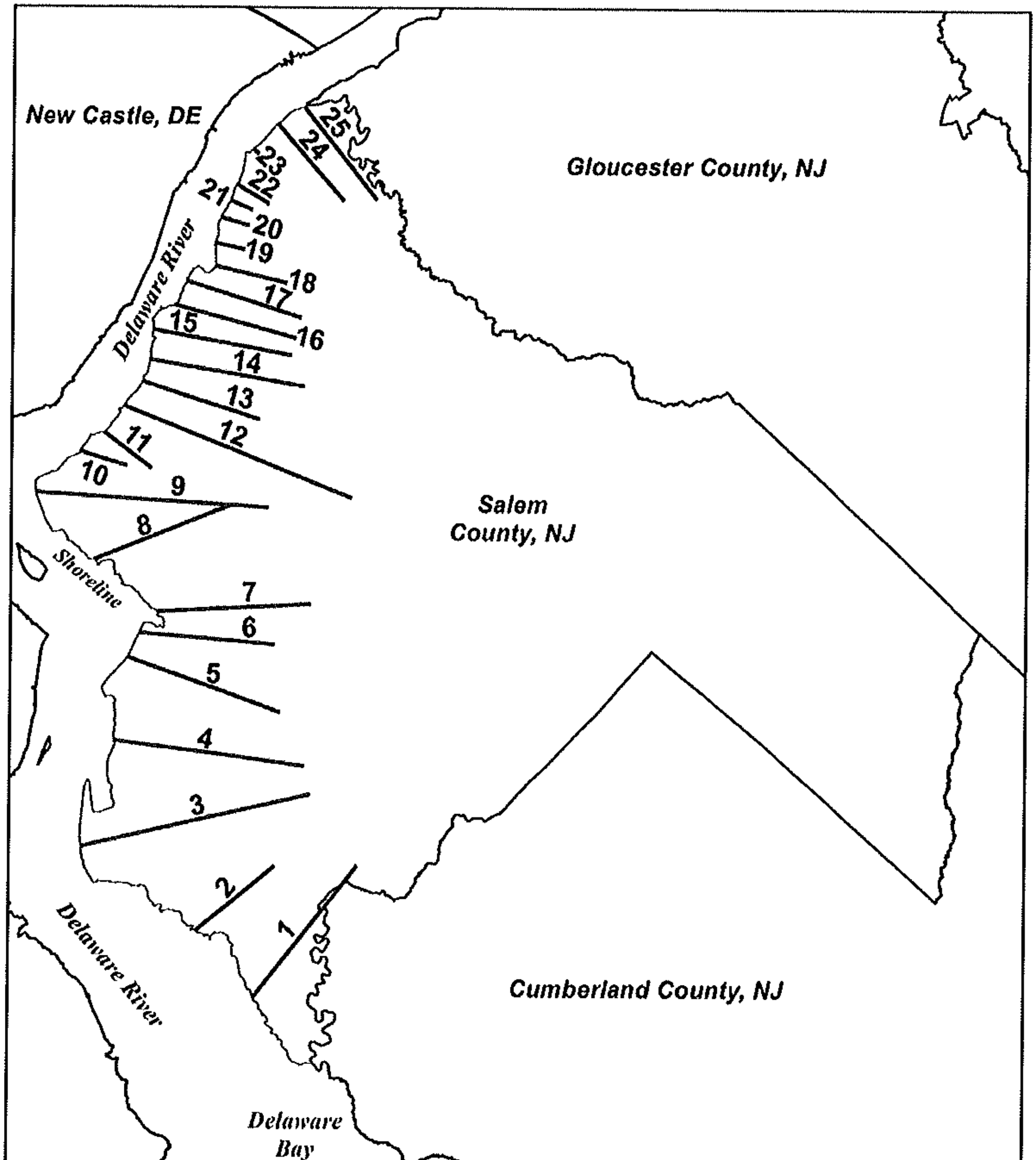

FIGURE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NEW JERSEY

(ALL JURISDICTIONS)

Approximate Scale

0 2.5 5 Miles

TRANSECT LOCATION MAP

TABLE 7 - TRANSECT DATA

Flood Source	Transect	Coordinates	Starting Wave Conditions for the 1% Annual Chance: Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	Starting Stillwater Elevations[1] (ft NAVD88) / Range of Stillwater Elevations[2] (ft NAVD88): 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Delaware River/Bay	1	N 39.4212 W -75.4266	5.7	5.5	7.1 3.6-7.1	8.1 4.8-8.2	8.7 5.7-8.8	11.1 10.6-11.1
Delaware River/Bay	2	N 39.4687 W -75.4361	5.2	5.5	6.8 3.9-7.2	7.8 4.8-8.3	8.4 4.8-8.8	11 9.8-11.2
Delaware River/Bay	3	N 39.4595 W -75.5063	5.1	5.1	6.9 3.5-7.1	8 4.1-8.2	8.5 4.6-8.7	10.6 9.6-10.8
Delaware River/Bay	4	N 39.5206 W -75.5093	3.4	3.4	6.8 3.6-7.0	7.9 4.1-8.1	8.5 4.6-8.5	10.7 9.9-10.7
Delaware River/Bay	5	N 39.5541 W -75.5196	3.5	3.5	6.8 3.5-7.0	7.8 4.0-8.0	8.2 4.6-8.5	10.7 9.2-10.8
Delaware River/Bay	6	N 39.5641 W -75.5139	3.3	3.4	6.5 3.4-6.9	7.5 4.0-8.0	8.1 4.5-8.5	10.5 8.1-10.8
Delaware River/Bay	7	N 39.5821 W -75.4811	2.8	3.2	5.9 3.2-6.9	6.8 3.9-8.0	7.4 4.4-8.6	10.3 7.6-10.9
Delaware River/Bay	8	N 39.6115 W -75.5202	4.1	3.8	6.7 2.9-6.9	7.8 3.8-8.0	8.4 4.2-8.6	11 7.3-11.0
Delaware River/Bay	9	N 39.6283 W -75.5537	4.3	4.1	6.9 2.9-6.9	7.9 3.8-7.9	8.4 4.2-8.4	10.7 7.4-10.8
Delaware River/Bay	10	N 39.6395 W -75.5471	2.6	3.1	6.9 5.5-6.9	7.8 6.5-7.9	8.4 7.0-8.4	10.8 9.7-10.8

[1]Stillwater elevations include the contribution from wave setup.

[2]For transects with a constant Stillwater elevation, only one number is provided to represent both the starting value and the range.

TABLE 7 - TRANSECT DATA (continued)

Flood Source	Transect	Coordinates	Starting Wave Conditions for the 1% Annual Chance: Significant Wave Height H_s (ft)	Starting Wave Conditions for the 1% Annual Chance: Peak Wave Period T_p (sec)	Starting Stillwater Elevations[1] (ft NAVD88) / Range of Stillwater Elevations[2] (ft NAVD88): 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Delaware River/Bay	11	N 39.6468 W -75.5348	2.7	3	6.8 4.6-6.8	7.8 5.5-7.8	8.4 5.9-8.4	10.7 8.9-10.8
Delaware River/Bay	12	N 39.6573 W -75.5246	2.6	2.9	6.8 2.9-6.8	7.8 3.8-7.8	8.4 4.2-8.4	10.8 7.4-10.8
Delaware River/Bay	13	N 39.6679 W -75.5138	2.6	3	6.8 3.1-6.8	7.8 4.0-7.8	8.3 4.5-8.4	10.8 7.8-10.8
Delaware River/Bay	14	N 39.6773 W -75.5116	2.6	3.1	6.8 3.9-6.8	7.8 4.8-7.8	8.3 5.3-8.4	10.8 8.3-10.8
Delaware River/Bay	15	N 39.6893 W -75.5093	2.8	3.3	6.9 4.5-6.9	7.8 5.4-7.8	8.3 5.9-8.3	10.7 8.9-10.8
Delaware River/Bay	16	N 39.6992 W -75.4998	2.8	3.1	6.9 4.9-6.9	7.8 5.7-7.8	8.3 6.2-8.3	10.7 9.2-10.7
Delaware River/Bay	17	N 39.7062 W -75.4938	2.6	3.1	6.9 5.4-6.9	7.8 6.2-7.8	8.3 6.8-8.3	10.8 9.6-10.8
Delaware River/Bay	18	N 39.7172 W -75.4763	2.4	3	6.9 6.8-6.9	7.7 7.6-7.8	8.3 8.3-8.4	10.8 10.7-10.8
Delaware River/Bay	19	N 39.7251 W -75.4766	2.7	3.1	6.9	7.7	8.3	10.9 10.8-10.9
Delaware River/Bay	20	N 39.7358 W -75.4732	2.7	3.2	6.9	7.7	8.3	10.8 10.8-10.9

[1]Stillwater elevations include the contribution from wave setup.

[2]For transects with a constant Stillwater elevation, only one number is provided to represent both the starting value and the range.

TABLE 7 - TRANSECT DATA (continued)

Flood Source	Transect	Coordinates	Starting Wave Conditions for the 1% Annual Chance: Significant Wave Height H_s (ft)	Starting Wave Conditions for the 1% Annual Chance: Peak Wave Period T_p (sec)	Starting Stillwater Elevations[1] (ft NAVD88) / Range of Stillwater Elevations[2] (ft NAVD88): 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Delaware River/Bay	21	N 39.7421 W -75.4696	2.6	3.2	6.9	7.7	8.3	10.9 10.8-10.9
Delaware River/Bay	22	N 39.7507 W -75.4502	2.6	3.2	6.9	7.7	8.3	10.9
Delaware River/Bay	23	N 39.7553 W-75.4414	2.6	2.9	6.9	7.7	8.3	10.8 10.8-10.9
Delaware River/Bay	24	N 39.7647 W -75.4293	2.6	2.9	6.9	7.7 7.6-7.7	8.3	10.9 10.8-10.9
Delaware River/Bay	25	N 39.7647 W -75.4293	2.6	2.9	6.9	7.7 7.6-7.7	8.3	10.9 10.8-10.9

[1]Stillwater elevations include the contribution from wave setup.

[2]For transects with a constant Stillwater elevation, only one number is provided to represent both the starting value and the range.

Areas of coastline subject to significant wave attack are referred to as Coastal High Hazard Areas (CHHA). The USACE has established the 3-foot breaking wave as the criterion for identifying the limit of Coastal High Hazard Areas (USACE, 1975). 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 primary frontal dune exists. The limit of the Coastal High Hazard Area then becomes the landward toe of the primary frontal dune or where a 3-foot or greater breaking wave exists, whichever is most landward. The Coastal High Hazard Area is depicted on the FIRMs as Zone VE, where the delineated flood hazard includes wave heights equal to or greater than three feet. Zone AE is depicted on the FIRMs where the delineated flood hazard includes wave heights less than three feet. A depiction of how the Zones VE and AE are mapped is shown in Figure 4, "Transect Schematic."

Post-storm field visits and laboratory tests have confirmed that, in Zone AE, wave heights as small as 1.5 feet can still cause 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). While FEMA does not impose floodplain management requirements based on the LiMWA, the LiMWA is provided to help communicate the higher risk that exists in that area. The LiMWA also identifies a specific regulatory area for users of the International Building Code. Consequently, it is important to be aware of the area between this inland limit and the Zone VE boundary as it still poses a high risk, though not as high of a risk as Zone VE (see Figure 4).

References 2, 3, 4, 11 to 19, 25, 29 and 30 were used to compile this section.

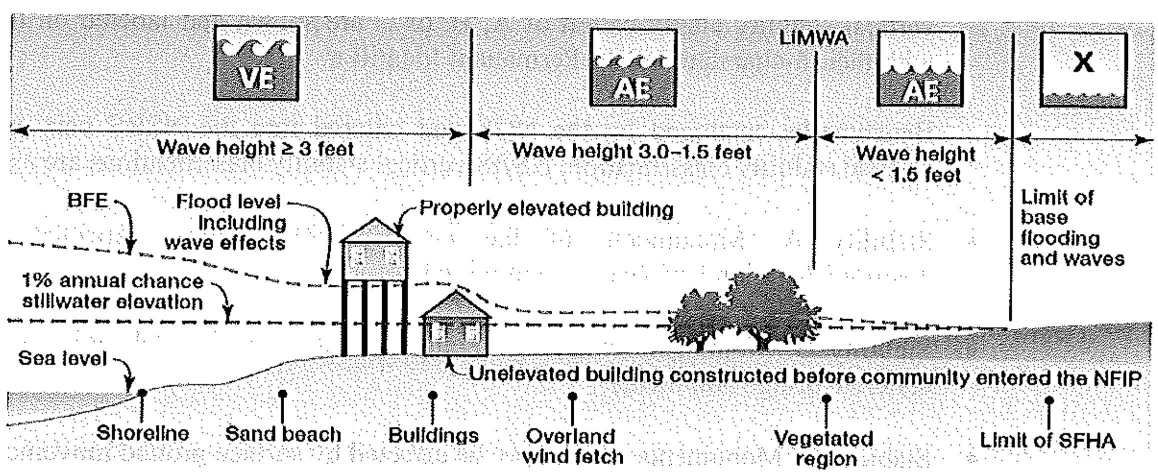

FIGURE 4: TRANSECT SCHEMATIC

3.4 Vertical Datum

All FIS reports 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 used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. The datum conversion from NGVD29 to NAVD88 in Salem County can be expressed as the following equation:

NGVD29 – 1.04 feet = NAVD88

For additional information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services,
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Qualifying benchmarks 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 Survey Control Points 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.

Benchmarks 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 benchmarks, 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 benchmarks 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.

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 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent annual chance flood elevations; delineations of the 1- and 0.2-percent annual chance floodplains; and 1-percent-annual-chance 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 community. For each stream studied by detailed methods, the 1- and 0.2-percent annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic data.

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, 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 [date] countywide FIS, new floodplain boundaries were developed and mapped for the Delaware Bay coastal study, the detailed riverine reaches of Chestnut Run and Salem River, and for streams studied by approximate methods.

The floodplain boundaries for the Delaware Bay coastal study were mapped using 2-foot contours generated from Digital Elevation Models (DEMs). The DEMs were created from 2008 LiDAR acquired from USGS.

The floodplain boundaries for the detailed riverine reaches of Chestnut Run and Salem River were delineated using HEC-GeoRAS (Reference 33) to post-process the model data from HEC-RAS and generate draft floodplain boundaries based on the 2008 LiDAR topography. The draft floodplain boundaries were reviewed by an engineer and model modifications were made where appropriate. Final floodplain boundaries were derived from manual adjustment of automated floodplain output using engineering judgment.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). The water surface elevations generated by the HEC-RAS model was used to delineate the floodplain using the 2008 LIDAR topographic data.

New Jersey Flood Hazard Area Design Flood

For portions of Chestnut Run and Salem River, the New Jersey Flood Hazard Area Design Flood (NJFHADF) floodplain boundary was delineated in addition to the 1- and 0.2-percent-annual-chance boundaries. The State of New Jersey, Department of Environmental Protection (the Department) is mandated to delineate and regulate flood hazard areas pursuant to N.J.S.A. 58:16A-50 et seq., the Flood Hazard Area Control Act. This Act authorizes the Department to adopt land use regulations for development within the flood hazard areas, to control stream encroachments and to integrate the flood control activities of the municipal, county, State and Federal Governments.

The State's Flood Hazard Area delineations are defined by the New Jersey Flood Hazard Area Design Flood. In 1974, the Water Policy and Supply Council passed a resolution stating that the New Jersey Flood Hazard Area Design Flood shall be equal to a design flood discharge 25% greater in flow than the 1-percent-annual chance flood.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the 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, however, the State of New Jersey standards limit such increases to 0.2 feet, provided that hazardous velocities are not produced. The floodways in this study 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 study 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 in Table 8, "Floodway Data." In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The floodways presented in this study for Alloways Creek and the downstream part of the Salem River (through the City of Salem to the Delaware River) were not computed by any of the standard encroachment methods, since the computed 1-percent-annual-chance flood is contained in the main channel, and already represented the maximum possible encroachment. Therefore, the floodway boundaries were established at the channel bank stations at cross sections.

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 8. 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.

Near the mouths of streams studied in detail, floodway computations were made without regard to flood elevations in the receiving water body. Therefore, "Without Floodway" elevations presented in Table 8 for certain downstream cross sections may be lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flood due to backwater from other sources.

The 1-percent-annual-chance flood stream flow water-surface elevations (WSELs) for Alloways Creek, Fenwick Creek, Keasbeys Creek, and Salem River (through City of Salem) were computed without consideration of tidal flooding. Therefore, the elevations are below rather than above the 1-percent-annual-chance flood elevations as determined by the Delaware River and Bay tidal flooding.

The area between the floodway and the 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe thus encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation (WSEL) of the flood by more than 0.2 feet at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 5.

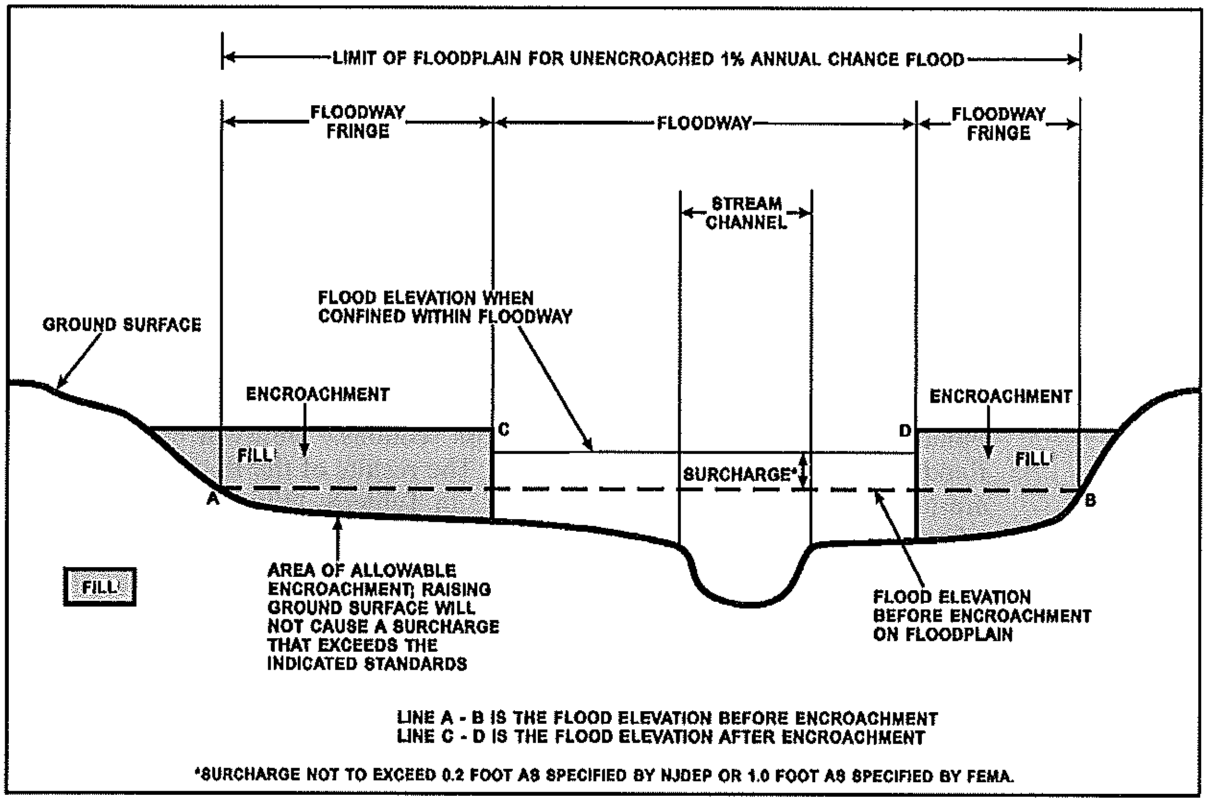

Figure 5 - FLOODWAY SCHEMATIC

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Alloways Creek								
A	230	910	12,151	0.5	*	-1.0[2]	-1.0	0.0
B	2,020	305	6,318	0.9	*	-1.0[2]	-1.0	0.0
C	3,835	370	6,529	0.8	*	-1.0[2]	-1.0	0.0
D	7,905	295	4,824	1.1	*	-1.0[2]	-1.0	0.0
E	9,990	420	5,071	1.1	*	-0.9[2]	-0.9	0.0
F	11,740	375	4,025	1.4	*	-0.9[2]	-0.9	0.0
G	16,235	300	2,902	1.8	*	-0.8[2]	-0.8	0.0
H	19,665	315	2,440	2.1	*	-0.6[2]	-0.6	0.0
I	22,398	320	2,417	2.1	*	-0.4[2]	-0.4	0.0
J	24,038	285	2,258	2.3	*	-0.3[2]	-0.3	0.0
K	25,770	255	2,091	2.5	*	-0.1[2]	-0.1	0.0
L	26,855	225	2,077	2.5	*	0.0[2]	0.0	0.0
M	27,015	265	2,884	1.8	*	0.1[2]	0.1	0.0

[1] Feet above confluence with Delaware River
[2] Elevation computed without consideration of backwater effects from Delaware River/Delaware Bay
* Controlled by coastal flooding – see Flood Insurance Rate Map for regulatory base flood elevation

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

ALLOWAYS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Chestnut Run								
A	850	45	102	5.7	30.9	25.5[2]	25.6	0.1
B	1,280	47	67	8.7	30.9	28.1[2]	28.1	0.0
C	1,775	94	339	1.7	32.1	32.1	32.1	0.0
D	2,160	68	277	2.1	32.3	32.3	32.3	0.0
E	2,900	122	603	1.0	39.6	39.6	39.6	0.0
F	3,380	145	458	1.3	39.7	39.7	39.7	0.0
G	4,000	58	251	2.3	40.6	40.6	40.7	0.1
H	4,600	37	141	4.1	41.5	41.5	41.7	0.2
I	5,118	31	237	2.5	47.2	47.2	47.2	0.0
J	5,390	89	300	1.9	47.3	47.3	47.3	0.0

[1] Feet above confluence with Salem River

[2] Elevation computed without consideration of backwater effects from Salem River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

CHESTNUT RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Fenwick Creek								
A	1,750[1]	215	722	2.0	*	1.1[3]	1.1	0.0
B	3,730[1]	255	1,213	1.2	*	1.6[3]	1.6	0.0
C	4,230[1]	430	3,226	0.4	*	1.6[3]	1.6	0.0
Keasbeys Creek								
A	1,290[2]	195	204	3.2	*	-0.6[3]	-0.6	0.0
B	3,120[2]	90	261	1.5	*	2.4[3]	2.4	0.0

[1] Feet above confluence with Salem River
[2] Feet above confluence with Fenwick Creek
[3] Elevation computed without consideration of backwater effects from Delaware River/Delaware Bay
* Controlled by coastal flooding – see Flood Insurance Rate Map for regulatory base flood elevation

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

FENWICK CREEK AND KEASBEYS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Salem River								
A	4,180	770	4,183	6.3	*	-11.1[2]	-11.1	0.0
B	14,450	440	6,005	4.4	*	-5.2[2]	-5.2	0.0
C	16,500	425	7,229	3.6	*	-3.2[2]	-3.2	0.0
D	135,766	552	3,535	2.2	22.2	22.2	22.4	0.2
E	136,216	437	2,364	3.3	22.5	22.5	22.7	0.2
F	137,516	642	3,538	2.2	23.9	23.9	24.1	0.2
G	138,346	279	3,252	2.4	30.4	30.4	30.4	0.0
H	139,116	336	3,040	2.6	30.7	30.7	30.7	0.0
I	139,876	278	2,575	3.0	31.1	31.1	31.1	0.0
J	140,716	494	3,059	2.5	31.7	31.7	31.8	0.1
K	141,216	452	3,659	1.9	34.1	34.1	34.2	0.1
L	141,816	338	2,674	2.6	34.2	34.2	34.3	0.1
M	142,116	327	3,512	2.0	37.5	37.5	37.7	0.2
N	142,726	466	4,969	1.4	37.6	37.6	37.8	0.2
O	143,216	472	7,262	1.0	44.4	44.4	44.4	0.0
P	144,026	399	6,168	1.1	44.4	44.4	44.4	0.0
Q	144,596	459	6,531	1.1	44.4	44.4	44.4	0.0
R	145,501	476	6,330	1.1	44.5	44.5	44.5	0.0
S	146,146	579	7,516	0.9	44.5	44.5	44.6	0.1

[1] Feet above confluence with Delaware River
[2] Elevation computed without consideration of backwater effects from Delaware River/Delaware Bay
* Controlled by coastal flooding – see Flood Insurance Rate Map for regulatory base flood elevation

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NJ (ALL JURISDICTIONS)

FLOODWAY DATA

SALEM RIVER

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-percent 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 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 BFEs or average depths. Insurance agents use the zones and BFEs 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. The NJFHADF line is also shown for portions of Chestnut Run and Salem River.

The countywide FIRM presents flooding information for the entire geographic area of Salem County, New Jersey. Previously, FIRMs were prepared for each incorporated community identified as floodprone. 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 are presented in Table 9, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Alloway, Township of	June 28, 1974	July 23, 1976	June 15, 1979	
Carneys Point, Township of	October 18, 1974[1]	November 5, 1976	June 1, 1982	
Elmer, Borough of	June 28, 1974	March 19, 1976	April 8, 1983	
Elsinboro, Township of	July 19, 1974	September 26, 1975	August 2, 1982	
Lower Alloways Creek, Township of	September 13, 1974	May 28, 1976	April 18, 1983	
Mannington, Township of	October 25, 1974	April 23, 1976	November 18, 1983	
Oldmans, Township of	August 2, 1974	July 9, 1976	January 7, 1983	
Penns Grove, Borough of	June 28, 1974	March 5, 1976	July 5, 1982	
Pennsville, Township of	September 13, 1974	December 10, 1976	December 15, 1982	
Pilesgrove, Township of	November 29, 1974	November 14, 1975	October 21, 1983	
Pittsgrove, Township of	July 19, 1974[2]	None	November 18, 1983	
Quinton, Township of	August 9, 1974	July 9, 1976	April 15, 1983	
Salem, City of	September 20, 1974	April 9, 1976	August 2, 1982	
Upper Pittsgrove, Township of	July 19, 1974	July 23, 1976	January 21, 1983	
Woodstown, Borough of	October 22, 1976	None	May 11, 1979	

[1] Initial NFIP Map Date is March 3, 1975
[2] Initial NFIP Map Date is December 3, 1976

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NJ
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Salem County has been compiled into this FIS. Therefore, this FIS supersedes all previously printed FIS reports, FIRMs, and/or FBFMs for all jurisdictions within Salem County, and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this FIS can be obtained by contacting the Flood Insurance and Mitigation Division of the Federal Emergency Management Agency, Region II Office, 26 Federal Plaza, Room 1337, New York, New York 10278.

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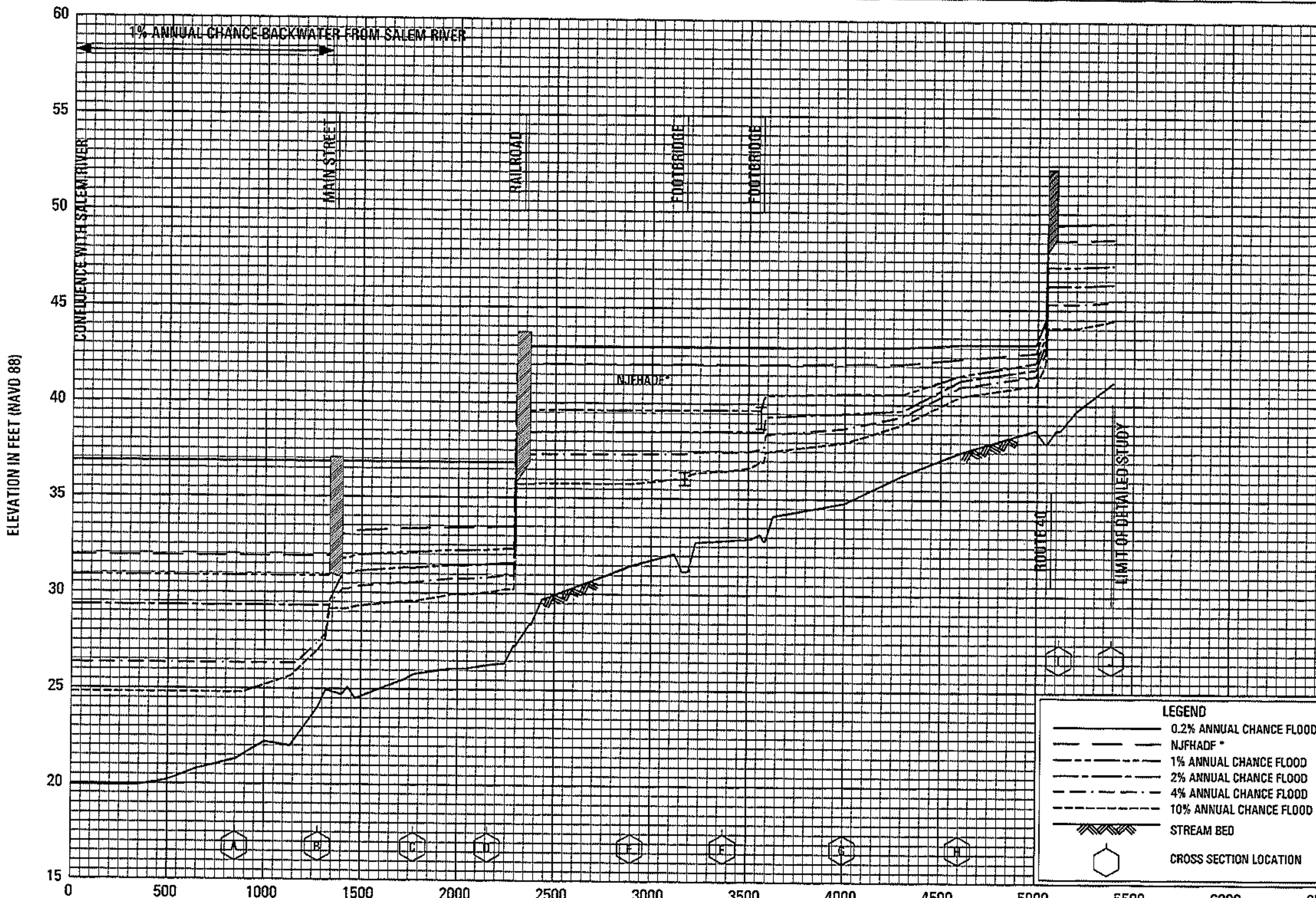


* NEW JERSEY FLOOD HAZARD AREA DESIGN FLOOD (NJFHADF) IS EQUAL TO THE 1-PERCENT-ANNUAL CHANCE FLOOD PLUS AN ADDITIONAL 25% IN FLOW, AND NOT TO EXCEED THE 0.2-PERCENT-ANNUAL CHANCE FLOOD.

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH SALEM RIVER

FLOOD PROFILES

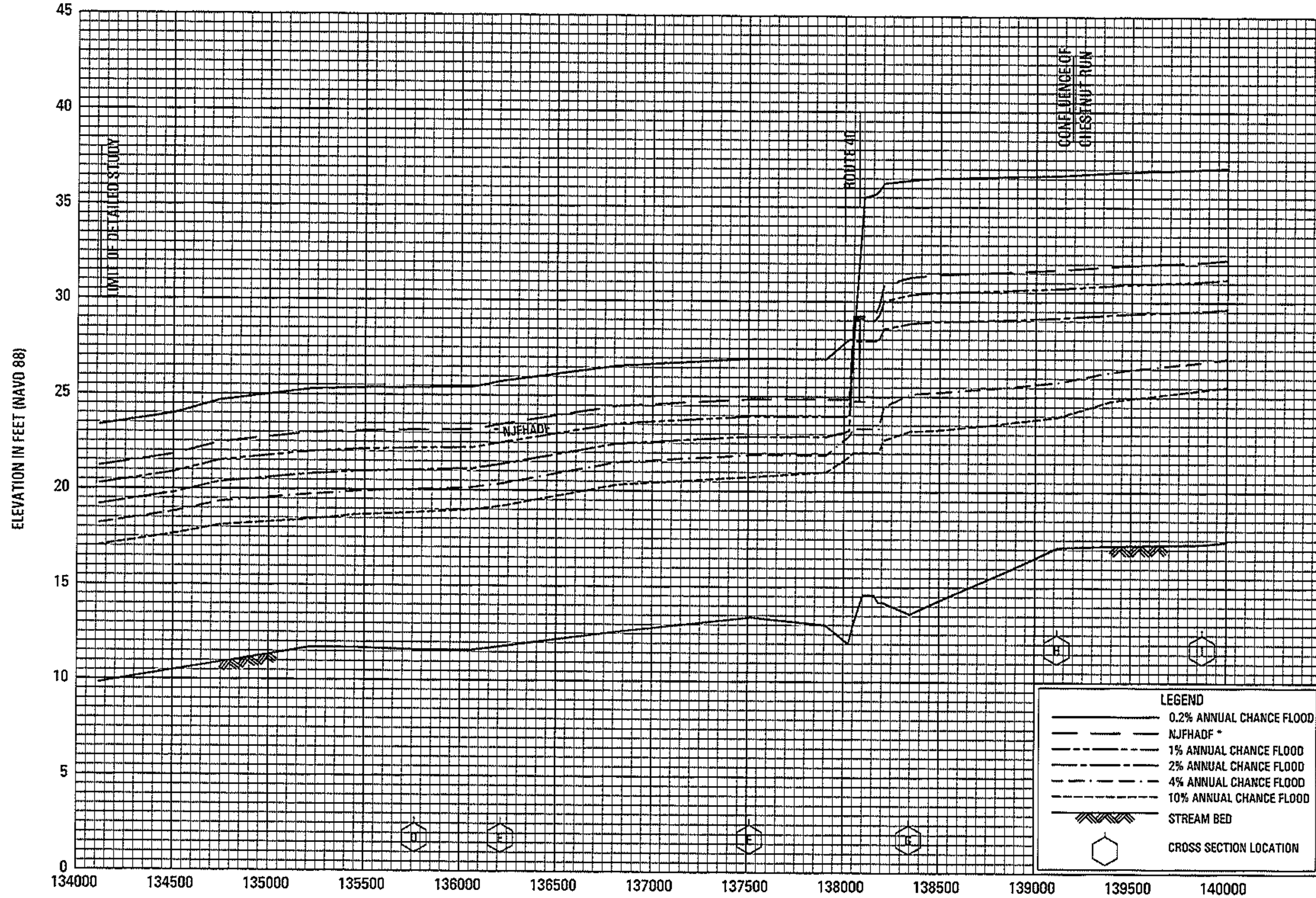
CHESTNUT RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NJ

(ALL JURISDICTIONS)

01P



* NEW JERSEY FLOOD HAZARD AREA DESIGN FLOOD (NJFHADF) IS EQUAL TO THE 1-PERCENT-ANNUAL CHANCE FLOOD PLUS AN ADDITIONAL 25% IN FLOW, AND NOT TO EXCEED THE 0.2-PERCENT-ANNUAL CHANCE FLOOD.

FLOOD PROFILES

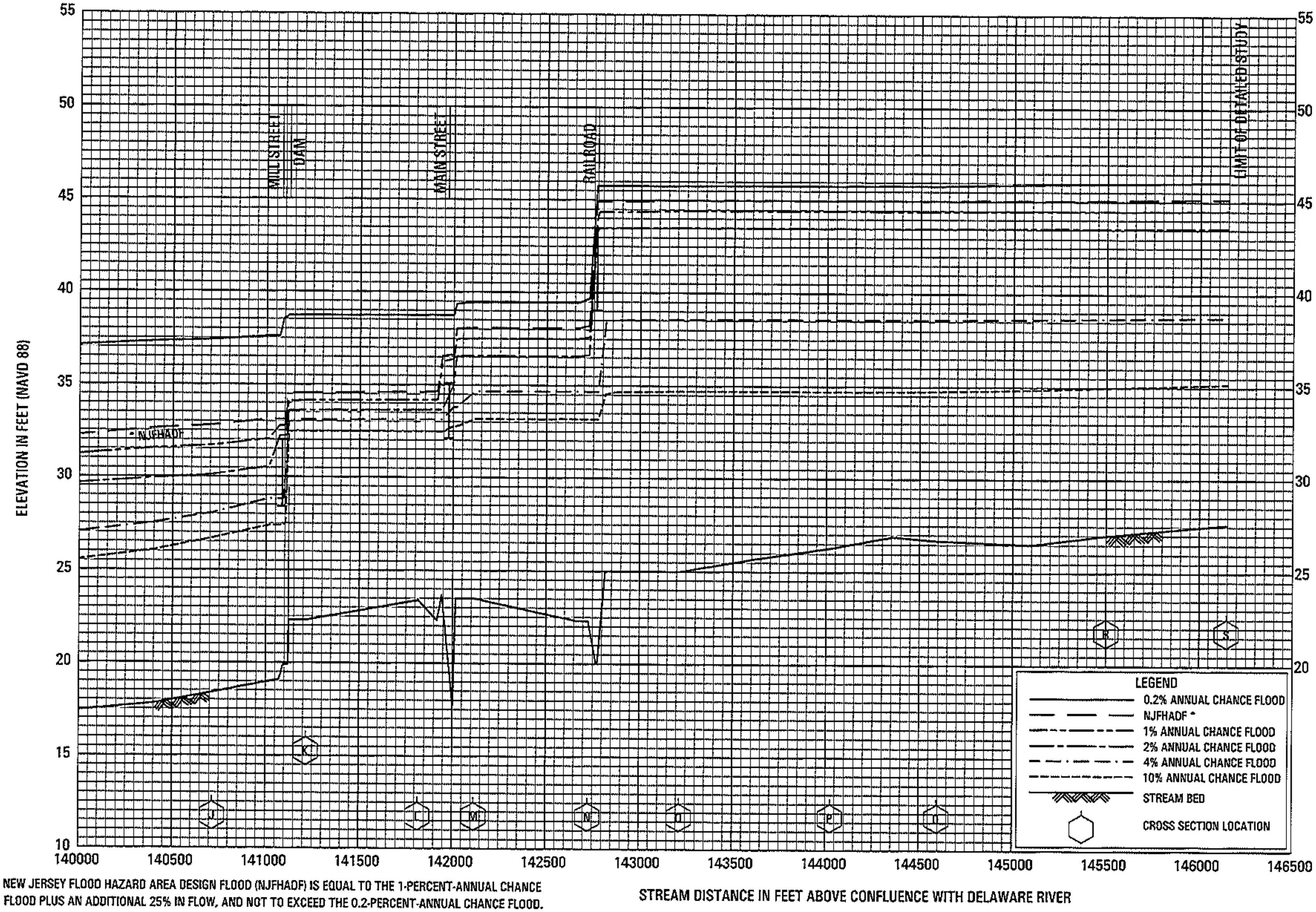
SALEM RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NJ

(ALL JURISDICTIONS)

02P



* NEW JERSEY FLOOD HAZARD AREA DESIGN FLOOD (NJFHADF) IS EQUAL TO THE 1-PERCENT-ANNUAL CHANCE FLOOD PLUS AN ADDITIONAL 25% IN FLOW, AND NOT TO EXCEED THE 0.2-PERCENT-ANNUAL CHANCE FLOOD.

FLOOD PROFILES

SALEM RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SALEM COUNTY, NJ

(ALL JURISDICTIONS)

03P