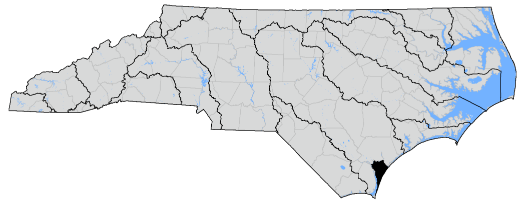
PRELIMINARY FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in

NEW HANOVER COUNTY, NORTH CAROLINA AND INCORPORATED AREAS



Community Name	Community Number
CITY OF WILMINGTON	370171
NEW HANOVER COUNTY	370168
TOWN OF CAROLINA BEACH	375347
TOWN OF KURE BEACH	370170
TOWN OF WRIGHTSVILLE BEACH	375361

NORTH CAROLINA
Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

PRELIMINARY: 8/29/2014

REVISED: 8/29/2014

Federal Emergency Management Agency

State of North Carolina

Flood Insurance Study Number

37129CV000

www.fema.gov and www.ncfloodmaps.com

FOREWORD

This countywide Flood Insurance Study (FIS) Report was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long-term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map floodplain areas at the state level. As a part of this effort, the State of North Carolina has joined with FEMA in a Cooperating Technical State (CTS) agreement to produce and maintain this FIS Report and the accompanying digital Flood Insurance Rate Map (FIRM) for North Carolina.

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.

The following is a list of the publication dates of this Countywide FIS Report starting with the initial Report accompanying the North Carolina Statewide FIRM:

Date	Reason
4/3/2006	Initial Countywide FIS Report Effective Date

This FIS has been produced as part of the North Carolina Floodplain Mapping Program. New Hanover County, North Carolina, falls under the administrative jurisdiction of Region IV of the Federal Emergency Management Agency (FEMA). Questions concerning this FIS may be directed to the North Carolina Floodplain Mapping Program at www.ncfloodmaps.com, the FEMA Map Assistance Center by calling the toll-free information line at 1-877-FEMA MAP (1-877-336-2627), or by contacting the FEMA Regional Office at the following address:

FEMA, Federal Insurance and Mitigation Administration
Koger Center - Rutgers Building
3003 Chamblee Tucker Road
Atlanta, Georgia 30341
(770) 220-5400

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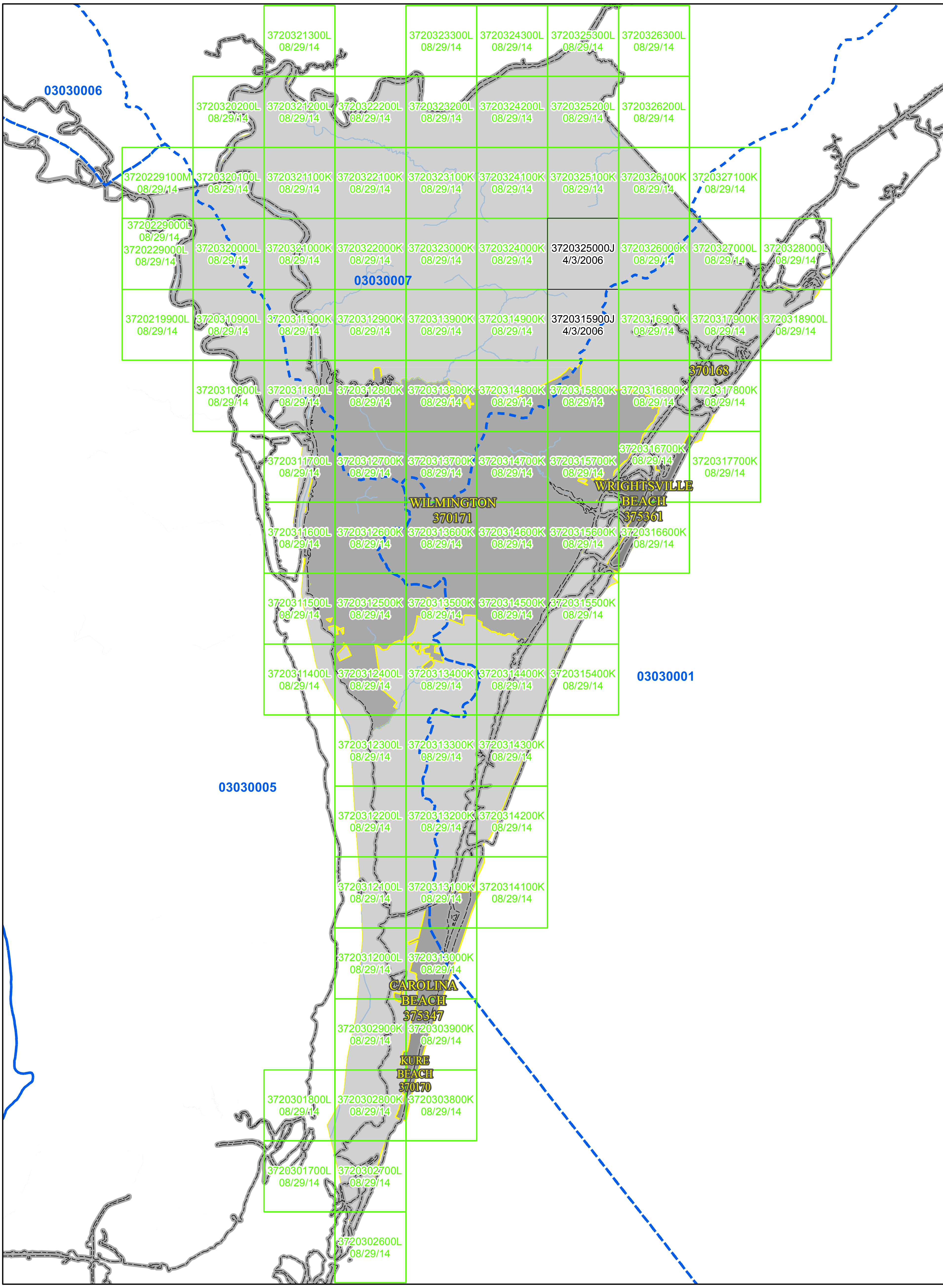

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1 in = 3 miles

0 0.5 1 2 3 Miles

Map Projection:
Lambert Conformal Conic
North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

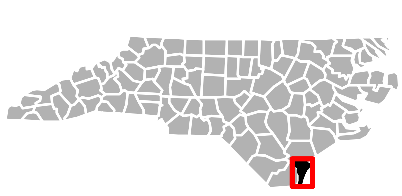
HTTP://FRIS.NC.GOV/FRIS

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

PRELIMINARY

08/29/2014

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

NEW HANOVER COUNTY, NORTH CAROLINA And Incorporated Areas

PANELS PRINTED:
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FEMA

MAP NUMBER
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1.0 Introduction

1.1 The National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods. The NFIP makes federally backed flood insurance available in communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage. Federally backed flood insurance is available in more than 19,000 communities across the United States and its territories.

The NFIP is managed by the Federal Insurance and Mitigation Administration of the Federal Emergency Management Agency (FEMA). The Federal Insurance and Mitigation Administration manages the insurance component of the NFIP and oversees the flood hazard mapping and the floodplain management aspects of the program.

The NFIP, through involvement with communities, the insurance industry, and the lending industry, helps reduce flood damage by nearly $800 million a year. Further, buildings constructed in compliance with NFIP building standards suffer approximately 80% less damage annually than those not built in compliance. In addition, every $3 paid in flood insurance claims saves $1 in disaster assistance payments. The NFIP is self-supporting for the average historical loss year, which means that operating expenses and flood insurance claims are not paid by the taxpayer, but through premiums collected for flood insurance policies.

Additional information of interest to homeowners, community officials, insurance companies, lenders, and study contractors is available in Section 9.0 of this FIS Report and on the NFIP Internet homepage at http://www.fema.gov/business/nfip/.

1.2 Purpose of this Flood Insurance Study

Flood Insurance Studies (FISs) are one of the primary means by which the NFIP administers the National Flood Insurance Act of 1968, the Flood Disaster Protection Act of 1973, and the National Flood Insurance Reform Act of 1994. FISs develop flood risk data that are used to establish actuarial flood insurance rates. The information in this FIS Report will also be used by New Hanover County and the jurisdictions therein (hereinafter referred to collectively as New Hanover County) to facilitate the adoption and maintenance of floodplain management ordinances, which form the basis of communities' continued participation in the NFIP. Minimum requirements for participation in the NFIP are set forth in Title 44, Part 60, Section 3 of the Code of Federal Regulations (44 CFR 60.3). In some States and/or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. In such cases, the more restrictive criteria will take precedence, and the State and/or community (or other jurisdictional agency) will be able to explain them.

This FIS investigates the existence and severity of flood hazards in, or revises and updates previous FISs for, the geographic area of New Hanover County, North Carolina, including the jurisdictions listed in Table 1.

Table 1 - Jurisdictions in New Hanover County

Community	Included in this FIS	If Not Included, Location of Flood Hazard/Flood Insurance Rate Data
CITY OF WILMINGTON	Yes	*
NEW HANOVER COUNTY	Yes	*
TOWN OF CAROLINA BEACH	Yes	*
TOWN OF KURE BEACH	Yes	*
TOWN OF WRIGHTSVILLE BEACH	Yes	*

1.3 FIS Components

A Flood Insurance Study (FIS) is an analysis of flood hazards, typically presented as a set of Flood Insurance Rate Map (FIRM) panels and the FIS Report, which includes a set of Flood Profiles and/or Water-surface elevation rasters.

Flood Insurance Study Report

The FIS Report provides a context for the information shown on the FIRM, as well as a summary of the data upon which the analyses are based. It also includes an index of sources of additional information on the NFIP.

1.4 Considerations for Using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 27, “Map Repositories,” within this FIS Report.

New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

The Initial Countywide FIS Report for New Hanover became Effective on 4/3/2006. Refer to Table XX for information about subsequent revisions to FIRMs.

Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels. 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 (shaded)
C	X (unshaded)

FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at http://www.fema.gov or contact your appropriate FEMA Regional Office for more information about this program.

Previous FIS Reports and FIRMs may have included levees that were accredited as reducing the risk associated with the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems.

Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database. For all other levees, the user is encouraged to contact the appropriate local community.

FEMA has developed a Guide to Flood Maps (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at http://www.fema.gov.

2.0 Floodplain Management Applications

Flood events of a magnitude expected to occur with a 10%, 2%, 1%, or 0.2% annual chance have been selected as having special significance for developing sound floodplain management programs. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10%, 2%, 1%, and 0.2% chance, respectively, of being equaled in any given year. Therefore, FIS Reports typically determine water-surface elevations for floods with these probabilities. The FIRM delineates 1% and 0.2% annual chance floodplains and 1% annual chance floodway boundaries, and depicts 1% annual chance flood elevations, rounded to the nearest foot, to assist in developing floodplain management measures.

2.1 Floodplains

To provide a national standard without regional discrimination, the 1% annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes. A 1% annual chance flood, or base flood, is defined as that having a 1% chance of being equaled or exceeded in any given year. The 1% annual chance floodplains shown on the FIRM identify areas that are expected to be inundated by the 1% annual chance flood. This 1% annual chance floodplain is also called a Special Flood Hazard Area (SFHA), where the NFIP's floodplain management regulations must be enforced by the community as a condition of participation in the NFIP. The 0.2% annual chance floodplain is employed to indicate additional areas of flood risk associated with exceptionally severe floods.

2.2 Floodways

Encroachment on floodplains such as that caused by placement of 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, floodways are provided as a tool to assist local communities in this aspect of floodplain management. Under this concept, the 1% annual chance riverine 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% annual chance flood can be carried without substantial increases in flood heights. Figure 1, "Floodway Schematic," illustrates this principle. 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 a minimum standard that can be adopted directly or that can be used as a basis for additional encroachment studies.

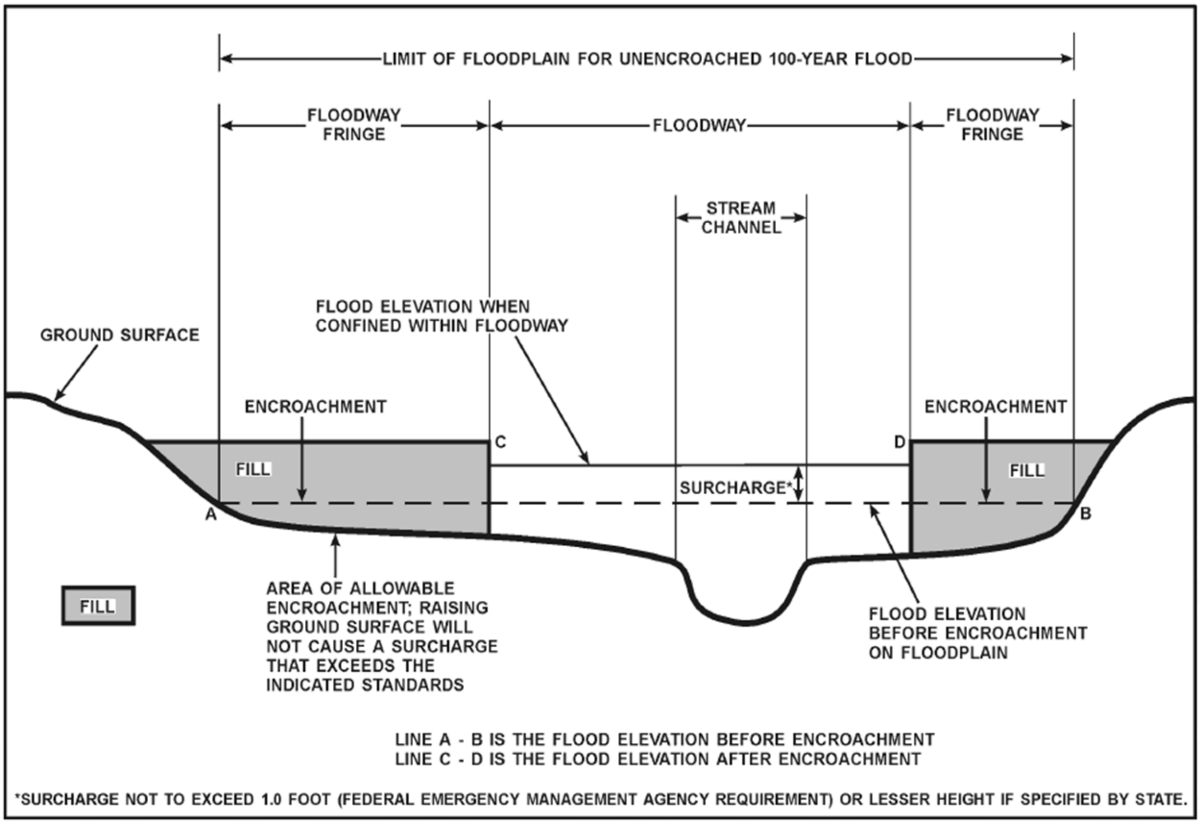

Figure 1- Floodway Schematic

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM. Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

Coastal flood elevations are provided in the Summary of Coastal Stillwater Elevations table 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.

2.4 Watershed Characteristics

Because a FIS is a probability analysis that may not account for some of the factors listed below, communities are strongly encouraged to consider adopting more restrictive or higher floodplain management criteria or ordinances than the minimum Federal requirements. Communities may also increase the validity of their flood hazard data by investing in continuous maintenance of river gages (see the Data Validity and Reliability paragraph below). If the U.S. Geological Survey (USGS) or other agencies do not maintain gages on the flooding sources of interest, partnerships with the USGS may be pursued, or local gages may be installed. For more information, see Section 9.0 of this report.

This flood hazard study represents an analysis of certain watershed characteristics, some of which are summarized as follows:

Drainage Area
In general, streams that drain larger areas have greater flood hazards. FISs, in North Carolina, do not typically analyze flood hazards in places with rural drainage areas of less than one square mile and within urban drainage areas of less than ½ square mile.

Soil Permeability and Infiltration
Differences in the types of soil and the amount of vegetation in a watershed have a significant effect on the amount of water that the soil can absorb; soils with a high sand content absorb much more water than soils with a high clay content. The presence of vegetation increases infiltration; the presence of pavement decreases infiltration and also speeds runoff to receiving waters. As soil permeability and infiltration decrease, the volume and rate of overland flow increases.

Soil Moisture Conditions
In addition to soil permeability and infiltration, the level of the water table helps determine the saturation point, beyond which no water is absorbed. As rainfall duration increases, the height of the water table increases.

Channel and Floodplain Geometry
The geometric contour of a streambed, termed channel geometry, and the geometric contour of a floodplain determine the volume of water that a channel can hold and partially determine the rate at which water flows through it.

Channel and Floodplain Roughness
The roughness of a surface affects the characteristics of runoff whether the water is on the surface of the watershed or in the channel.

FIS Reports include analyses of how these factors will combine to produce overland flow patterns during floods that have a certain probability of occurring in any given year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at shorter intervals or even within the same year. The risk of experiencing a rare flood increases when longer periods are considered. For example, the risk of having a flood which equals or exceeds the 1% annual chance flood (1% chance of annual exceedence) in any 50-year period is approximately 40% (4 in 10), but for any 90-year period, the risk increases to approximately 60% (6 in 10).

It is important to note that the 1% annual chance flood is used as the national standard to allow a consistent approach to floodplain management, flood hazard assessment, and flood hazard mapping. In any given community, a number of factors may result in flooding characteristics that do not conform to predicted conditions. Therefore, the determination that an area is not shown on the FIRM as being within a Special Flood Hazard Area is no guarantee that it will not flood during a 1% annual chance flood. Examples of these factors include Data Validity and Reliability; Developmental and Topographic Changes Over Time; Erosion, Deposition, and Debris Flow; and Meandering and Lateral Migration.

Data Validity and Reliability
Certain types of analysis methods yield more justifiable characterizations of flood hazards. For example, a gage analysis, to determine peak discharges, is based on actual measurements of watershed conditions over time and, therefore, is typically considered the most accurate method of hydrologic analysis. However, it is not feasible to install enough gages to gather data on every stream. In addition, for many of the gage sites that do exist, there are interruptions in the period of record. The usefulness of gage data for the purpose of predicting flooding behavior decreases with interruptions in the period of record; predicted flooding conditions over a 100-year period based on 20 years of measurements spread over a 35-year period are less valid than those based on 30 years of continuous measurements. A regression analysis is typically considered the best method in the absence of gage data, as it uses gage data from watersheds with similar characteristics to estimate flood frequency and magnitude in an ungaged watershed. Regression equations reflect average conditions for a region; therefore, the results will not exactly match the results of a gage analysis at a particular location. The standard errors of the North Carolina rural regression equations range from 44 to 51 percent for estimates of the 1% annual chance flood. That means the difference between the results of the regression equation and the gage analysis for approximately two-thirds of the locations that gage data exists are within 44 to 51 percent of the gage analysis results. A rainfall-runoff hydrologic analysis may be used for gaged or ungaged watersheds, and can estimate the effects of storage areas and flood control structures and measures. This method is most valid when calibrated against historical data.

Developmental and Topographic Changes Over Time
A FIRM is based on the best topographic and planimetric information available to FEMA and the State of North Carolina at the time the

study is produced. In time, however, development and/or natural phenomena can alter the physical characteristics of a watershed and its drainage channels, resulting in changes in the flood hazards in those areas. For example, constructing a housing subdivision reduces the amount of soil that is available to absorb water; this in turn causes an increase in the volume of surface water that flows into the channel.

Erosion, Deposition, and Debris Flow

The flood hazards shown on a FIRM are based on the assumption of unobstructed flow. The FIRM does not reflect an analysis of areas that are subject to erosion caused by the increased water-surface elevations and velocities that occur during flooding. In addition to the risks of landslides or a weakening of the ground underneath roads or structures, any sediment that is removed from one location will be deposited in another; accumulated deposits may have a pronounced effect on flood hazards in those areas. Similarly, debris such as fallen trees or branches, litter, or other items may obstruct stream channels or hydraulic structures, increasing water-surface elevations, velocities, and floodplain width.

Meandering and Lateral Migration

FISs are based on the assumption that channel geometry will remain stable during normal drainage and during flood events. This assumption is valid for most streams, which flow over bedrock or between bedrock outcroppings that form non-alluvial channels. However, alluvial streams change the channel geometry with time, significantly so during flood events. Alluvial streams are subject to erosion and deposition, which may result in braided or meandering channels. Streams of this type may be characterized by lateral migration, or channel shifting, in which the stream may change course entirely during a flood. Whenever clear evidence is available, a FIRM will identify the alluvial nature of a studied flooding source and designate wider floodways to allow for potential migration. However, these floodways are based on qualitative assessments and not on quantitative geomorphic and engineering analyses.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this Flood Risk Project are shown in Table XX.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.

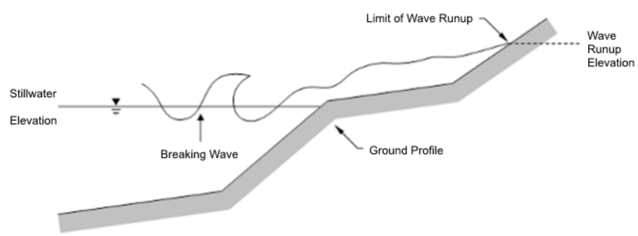

Figure 5: Wave Runup Transect Schematic

2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 5, “1% Annual Chance Total Stillwater Levels for Coastal Areas.

In some areas, the 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1% annual chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 26 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 20, “Coastal Transect Parameters.” The locations of transects are shown in the Appendix, “Transect Location Map.” More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.
- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

CHHAs are designated as “V” zones (for “velocity wave zones”) and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as “A” zones on the FIRM.

Figure 6, “Coastal Transect Schematic,” illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

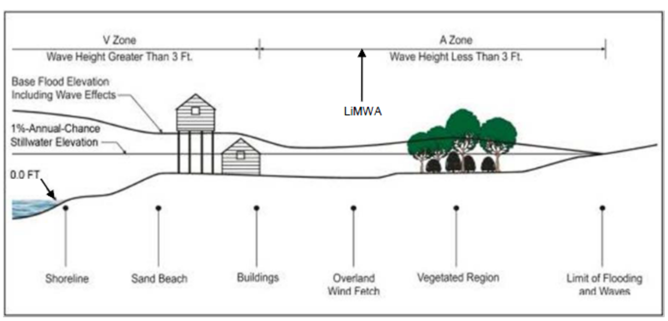

Figure 6: Coastal Transect Schematic

Methods used in coastal analyses in this Flood Risk Project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM. In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

Laboratory tests and field investigations have shown that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE building construction. Wood-frame, light gage steel, or masonry walls on shallow footings or slabs are subject to damage when exposed to waves less than 3 feet in height. Other flood hazards associated with coastal waves (floating debris, high velocity flow, erosion, and scour) can also damage Zone AE construction.

Therefore, a LiMWA boundary may be shown on the FIRM as an informational layer to assist coastal communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The location of the LiMWA relative to Zone VE and Zone AE is shown in Figure 6.

The effects of wave hazards in Zone AE between Zone VE (or the shoreline where Zone VE is not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot or greater breaking waves are projected to occur during the 1% annual chance flooding event. Communities are therefore encouraged to adopt and enforce more stringent floodplain management requirements than the minimum NFIP requirements in the LiMWA. The NFIP Community Rating System provides credits for these actions.

Where wave runup elevations dominate over wave heights, there is no evidence to date of significant damage to residential structures by runup depths less than 3 feet. Examples of these areas include areas with steeply sloped beaches, bluffs, or flood protection structures that lie parallel to the shore. In these areas, the FIRM shows the LiMWA immediately landward of the VE/AE boundary. Similarly, in areas where the zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA is delineated immediately landward of the Zone VE/AE boundary.

3.0 Insurance Applications

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones and, in 1% 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. Table 2, "Flood Zone Designations," includes a description of each type of flood hazard zone.

Table 2 - Flood Designations

Zone	Description
A	Zone A is the flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined in the FIS Report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone.
AE	Zone AE is the flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined in the FIS Report 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.
AH	Zone AH is the flood insurance rate zone that corresponds to the areas of 1% 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.
AO	Zone AO is the flood insurance rate zone that corresponds to the areas of 1% 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.
AR	Zone AR is the flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood 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.
A99	Zone A99 is the flood insurance rate zone that corresponds to areas of the 1% 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.

V	Zone V is the flood insurance rate zone that corresponds to the 1% 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.
VE	Zone VE is the flood insurance rate zone that corresponds to the 1% 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.
X	Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2% annual chance floodplain, areas within the 0.2% annual chance floodplain, and to areas of 1% annual chance flooding where average depths are less than 1 foot, areas of 1% annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1% annual chance flood by levees. No Base Flood Elevations or depths are shown within this zone.
X (Future)	Zone X (Future Base Flood) is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined based on future-conditions hydrology. No BFEs or base flood depths are shown within this zone.
D	Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

3.2 Coastal Barrier Resources System

The Coastal Barrier Resources Act (CBRA) of 1982 was established by Congress to create areas along the Atlantic and Gulf coasts and the Great Lakes, where restrictions for Federal financial assistance including flood insurance are prohibited. In 1990, Congress passed the Coastal Barrier Improvement Act (CBIA), which increased the extent of areas established by the CBRA and added “Otherwise Protected Areas” (OPA) to the system. These areas are collectively referred to as the John. H Chafee Coastal Barrier Resources System (CBRS). The CBRS boundaries that have been identified in the project area are in Table 4: Coastal Barrier Resource System Information.

Table 4: “Coastal Barrier Resources System Information” is not applicable in New Hanover County.

4.0 Area Studied

New Hanover County is found in the Coastal Plain region of North Carolina. It is surrounded by Pender County to the north and the Atlantic Ocean to the east.

4.1 Basin Description

Table 3, “Basin Description” contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its area.

Table 3 - Basin Description

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description	HUC Area (square miles)
Lower Cape Fear	03030005	Cape Fear River	The Lower Cape Fear River Basin begins in Cumberland County, southeast of Fayetteville, North Carolina. The basin then drains southeast through Bladen, Brunswick, Columbus, New Hanover, and Pender Counties.	1,122
New River	03020302	New River	The New River Basin begins above the northwestern corner of Onslow County. The basin also includes coastal regions of Brunswick, New Hanover, Pender, and Onslow Counties.	891
Northeast Cape Fear	03030007	Northeast Cape Fear River	The Northeast Cape Fear River Basin begins in the northeastern region of Sampson County and along the Wayne/Duplin County boundary. The basin then drains south through Pender County, ending at the Cape Fear River in New Hanover County.	1,741

4.2 Principal Flood Problems

Table 4, “Principal Flood Problems” is not applicable in New Hanover County.

4.3 Historic Flood Elevations

Hurricane Floyd
(9/16/1999)
Hurricane Floyd made landfall near Wilmington with category two winds of 105 to 110 mph. Rainfall totals from Floyd were as high as 15 to 20 inches over portions of eastern North Carolina; with a record of 23.45 inches of rain falling in the month of September at Wilmington, NC. This breaks the previous record of 21.12 inches set in July 1886. These rains combined with saturated ground from previous rain events, including Hurricane Dennis, to produce an inland flood disaster. There were 74 deaths in the United States, including 52 in North Carolina, due to drowning from flood waters. This makes Floyd the deadliest U.S. hurricane since Agnes in 1972. Data from the USGS indicate that eleven of their stream gage monitoring sites in North Carolina (Ahoskie, Rocky Mount, Hilliardston, White Oak, Enfield, Tarboro, Lucama, Hookerton, Trenton, Chinquapin, and Freeland) exceeded 0.2% annual chance flood levels due to Floyd. Total losses in North Carolina approach $5 billion with an estimated $3.5 billion in damages to North Carolina homes, businesses, roads, and infrastructure. Floyd passed relatively close to the entire U.S. east coast, justifying hurricane warnings from Florida to Massachusetts and requiring an estimated two million people to evacuate. The last hurricane to require warnings for as large a stretch of coastline was Hurricane Donna in 1960.

Hurricane Bonnie
(8/26/1998)
The landfall location of Bonnie was in southern North Carolina near Cape Fear very close to landfall of both Hurricanes Bertha and Fran in 1996. Even though a powerful storm, damage from Bonnie was much less than Fran, which was also Category 3. Winds gusted up to 100 knots and storm tides of 5 to 8 feet above normal were reported mainly in eastern beaches of Brunswick County, while a storm surge of 6 feet was reported at Pasquotank and Camden Counties in the Albemarle Sound.

Hurricane Fran
(9/5/1996)
The landfall location of Fran near the city of Wilmington and its progression into the Raleigh-Durham area caused an estimated $1.275 billion in damage in North Carolina alone. Fran hit with gusts up to 105 mph and a storm surge of approximately 16 feet. Over $1 billion in damage was reported in North Topsail Beach and Surf City and 23 people were killed.

Tropical Storm Arthur, Hurricane Bertha, Hurricane Fran
(7/12/1996)
1996 was a damaging year in the hurricane history of North Carolina. Tropical Storm Arthur, Hurricane Bertha, and Hurricane Fran all made direct landfall on the North Carolina coastline. It was the most active tropical cyclone season in the state since 1955, when Hurricanes Connie, Diane, and Ione all hit the coast. Bertha entered North Carolina in North Topsail Beach with 105 mph gust and a storm surge of approximately 5 feet.

Hurricane Gloria
(9/26/1985)
The landfall location of Gloria was Cape Hatteras, with 90 knot winds and a storm surge of approximately 6-8 feet.

Hurricane Diana
(9/13/1984)
The landfall location of Diana was 38 miles south of Wilmington with 90 mph winds at its closest approach to Wilmington. Diana had 115 mph sustained winds before landfall. Storm surge was approximately 5-6 feet.

Hurricane Donna
(8/29/1960)
Hurricane Donna crossed the North Carolina coast between Wilmington and Morehead City of September 11, 1960. The center of the storm passed a few miles east of Wrightsville Beach, although Wilmington and Wrightsville Beach were each in the eye for about an hour. The lowest barometric pressure recorded during this storm was 962 mb at Wilmington. High tides, 6 to 8 feet above normal, together with high winds, caused severe damage at many points. Winds of hurricane force, up to 97 mph, were reported from Wilmington. During the night of September 11, the storm center moved northward, parallel, and slightly east of a line drawn between

Wilmington and Norfolk. Wind gusts were in excess of 97 mph and tides were 4 to 8 feet above normal. High tides of 10.3 and 8.3 feet NGVD were reported at Atlantic Beach and Wrightsville Beach, respectively. Coastal communities from Wilmington to Nags Head suffered heavy structural damage and considerable beach erosion. Eight deaths and approximately 100 injuries were attributed to the storm. Damages were estimated at millions of dollars.

Hurricane Helene
(9/21/1958)

Hurricane Helene was one of the most powerful storms of recent history. Fortunately for the people of North Carolina, the storm center was well out at sea as it moved north on September 26 and 27. Nevertheless, high winds were recorded at Wilmington, with the highest winds measured at 85 mph and peak gusts recorded at 135 mph. The lowest reported central pressure of the storm was 932 mb; this measurement was recorded south-southeast of Cape Fear early on the morning of September 27. There was some beach erosion due to seas and tides, but this erosion was minimized by the fact that the storm occurred at the time of low astronomical tides. High tides were estimated at 3 to 5 feet above normal; a high tide of 5.1 feet NGVD was reported at Wrightsville Beach. Tides were higher on the southern edge of Pamlico Sound, when the wind shift as the storm center passed brought the tides 7 to 8 feet above normal.

Hurricane Ione
(9/10/1955)

Hurricane Ione moved up from the south and crossed the North Carolina coast near Salter Path, 10 miles west of Morehead City, at about 5 a.m. on September 19. It then slowly curved to the northeast and went out to sea near the Virginia border early on September 20. When Ione entered North Carolina, winds gusted to over 100 mph. Wind speeds of 75 mph with gusts to 107 mph were recorded at Cherry Point. The minimum barometric pressure recorded over North Carolina during this storm was 960 mb. Heavy rains also accompanied Ione. At the same time, prolonged easterly winds drove tidal water onto beaches and into sounds and estuaries to heights of 3 to 10 feet above normal. The result was the largest inundation of eastern North Carolina ever known to have occurred. At New Bern, the depth of the flood was the greatest ever recorded, about 10.5 feet above mean low water; forty city blocks were flooded, several hundred homes were washed away, and thousands more were flooded with up to 4 feet of water. A high tide of 6.9 feet NGVD was reported at Atlantic Beach, North Carolina, and an estimated 5.3 feet NGVD at Wrightsville Beach.

Hurricane Diane
(8/7/1955)

Five days after Hurricane Connie, and before the damage from that storm could be estimated, Hurricane Diane struck the coast near Carolina Beach about 6 a.m. on August 17. The highest wind speed reported during this storm was 74 mph at Wilmington Airport. Storm tides ranged from 5 to 9 feet above mean low water on the beaches (6.8 feet NGVD at Wrightsville Beach), and in some areas of sounds and rivers emptying into sounds, estimated water levels were 5 to 9 feet above normal. Water was 3 feet above flood level in the business district of Belhaven and “waist deep” in parts of Washington and New Bern. Diane caused severe beach erosion along the North Carolina coast. The total damage caused in North Carolina by both Connie and Diane was estimated to be in excess of $90 million. No deaths or injuries in North Carolina were attributed to either of the storms.

Hurricane Connie
(8/3/1955)

Hurricane Connie entered North Carolina close to Cape Lookout at about 8:30 a.m. on August 12. The prolonged pounding of high waves against the coast caused tremendous beach erosion, probably worse than that caused by Hazel in 1954. Storm tides along the coast from Southport to Nags Head were reported to be about 7 feet NGVD (6.9 feet NGVD at Wrightsville Beach and 7.5 feet NGVD at Kure Beach). Water in sounds and near the mouths of rivers was 5 to 8 feet above normal. At Wilmington, winds were reported at 72 mph, gusting to 83 mph. At Fort Macon, winds of 75 mph, gusts of 100 mph, and barometric pressure of 962 mb were reported. The storm also brought torrential rains with the maximum rainfall, around 12 inches in 48 hours, occurring near Morehead City. Total damage throughout the state was estimated at $50 million.

Hurricane Hazel
(10/5/1954)

Hurricane Hazel was the most destructive storm in the history of North Carolina. The storm crossed the coast just north of Myrtle Beach, South Carolina, as hurricane winds hit the Atlantic coast between Georgetown, South Carolina, and Cape Lookout, North

Carolina. Storm tides (i.e., hurricane surge) devastated the immediate ocean front of this stretch of coast. Every fishing pier along 170 miles of coast, from Myrtle Beach to Cedar Island, North Carolina, was destroyed. The waterfront between the South Carolina/North Carolina state boundary and Cape Fear was destroyed. Beach homes, which had been built in a continuous line five miles long behind and along grass-covered dunes (some of which were 20 feet high), simply disappeared – dunes, houses, and all. From Cape Fear to Cape Lookout, the degree of devastation was not as great, but oceanfront property was damaged an average of 50 percent along this entire stretch. To the north of Cape Lookout, the damage was relatively light. Storm surges of 16.6 feet above NGVD were observed at Holden Beach Bridge and Calabash, North Carolina. The highest tide of record was observed during Hurricane Hazel, when ocean tide levels reached approximately 10 feet NGVD at Wrightsville Beach and 11 feet NGVD at Carolina Beach. The lowest recorded barometric pressure of the storm was 938 millibars (mb), reported at Little River Inlet on the North Carolina/South Carolina border. Maximum wind speeds were 83 miles per hour (mph), with gusts recorded at 98 mph at Wilmington, North Carolina, 106 mph at Myrtle Beach, South Carolina, and an estimated 150 mph at Cape Fear. The storm continued inland through North Carolina, causing widespread damage due to high winds and record rainfalls. Nineteen people were killed and 200 injured during this storm.

Table 5, “Historic Flood Elevations”, lists selected flooding sources in New Hanover County with records of past stages. The table shows the historic peak, a location description, approximate stream station, the date of the historic peak, and approximate recurrence interval of the flood elevation. The approximate recurrence interval for a flood is often estimated based on an analysis of rainfall amounts from a storm and /or stream gage data.

Table 5 - Historic Flood Elevations

Flooding Source/Tropical Storm	Location Description	Approx. Stream Station	Historic Peak (Feet NAVD 88)	Date	Approximate Recurrence Interval (in years)
Northeast Cape Fear River / Hurricane Floyd	Deep Bottom Road	433108	32.8	9/1/1999	500
Northeast Cape Fear River / Hurricane Floyd	Approximately 5.3 miles downstream of Deep Bottom Road	404913	35.2	9/1/1999	500
Northeast Cape Fear River / Hurricane Floyd	Window	455062	41.4	9/1/1999	500
Northeast Cape Fear River / Hurricane Floyd	At NC Highway 24 Westbound	532819	49.5	9/1/1999	500
Northeast Cape Fear River / Hurricane Floyd	At NC Highway 11	600379	68.3	9/1/1999	500
Northeast Cape Fear River / Hurricane Floyd	John Grady Road	624313	77.3	9/1/1999	500
Northeast Cape Fear River / Hurricane Floyd	Outlaw Road	640381	84.1	9/1/1999	500

* Data Not Available

4.4 Flood Protection Measures

Flood protection measures may be structural (such as levees, dams, and reservoirs) or non-structural (such as land-use management ordinances, policies, or practices).

Table 6, “Non-Levee Flood Protection Measures”, lists the flood protection measures undertaken to mitigate flood damage in New Hanover County.

Table 6 - Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Atlantic Ocean	Berm/Sand Dunes	OTHER / MISC STRUCTURE	extends from the northern end of Carolina Beach to the southern end of Kure Beach.	A 50-foot berm, 12 feet above mean low water in front of a 25-foot dune, 15 feet above mean low water extends from the northern end of Carolina Beach to the southern end of Kure Beach.
Atlantic Ocean	Sand Beach Restoration Project	OTHER / MISC STRUCTURE	extends the length of the island in the Town of Wrightsville Beach	A sand beach restoration project has been implemented consisting of a 50-foot berm, 12 feet above mean low water, which extends the length of the island in the Town of Wrightsville Beach
Burnt Mill Creek	Stream Channelization	CHANNEL	portions of Burnt Mill Creek.	Local drainage and flood control projects involving stream channelization have been constructed by the City of Wilmington for portions of Burnt Mill Creek.

N/A - Not Applicable

Table 7, “Levees” is not applicable in New Hanover County.

4.5 Scope of Study

For this map maintenance revision, a scoping meeting was held in New Hanover County to present the results of initial research to the county and communities within the county and to discuss their floodplain mapping needs. The county and communities were asked to provide input on proposed study priorities and analysis methods. These meetings resulted in the identification of flooding sources having a floodplain mapping need. Map Maintenance Plans were developed based on the results of the scoping meetings and were both mailed to each jurisdiction within New Hanover County and posted to the State’s website at www.ncfloodmaps.com.

Draft basin plans were developed based on the results of the initial scoping meetings. Final scoping meetings were held by the State and FEMA to provide counties and communities an overview of the draft basin plans, including the proposed scope and schedule for the project, and to provide an opportunity for additional county and community input. After the final scoping meeting was held, the Final Basin Plans were produced.

This FIS covers the geographic area of New Hanover County, North Carolina, and all jurisdictions therein. 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 and/or Water-surface elevation rasters and/or the FIRM.

Table 8P, “Scope of Revisions: Revised or New Detailed Study -Preliminary”, lists flooding sources that were newly studied by detailed methods or were previously studied by detailed methods and had a change in backwater elevation due to flooding effects from a newly studied flooding source.

Table 8P - Scope of Revisions: Revised or New Detailed Study - Preliminary

Source	Riverine Sources		Affected Communties
	From	To	
Bradley Creek	Approximately 1,800 feet upstream of Atlantic Ocean	Approximately 0.6 mile upstream of Mallard Street	City Of Wilmington
Bradley Creek Tributary 1	The confluence with Bradley Creek	Approximately 1,300 feet upstream of U.S. Highway 74	City Of Wilmington
Burnt Mill Creek[1]	The confluence with Smith Creek	Approximately 0.19 mile downstream of Independence Blvd	City Of Wilmington
Cape Fear River	Approximately 2.6 miles downstream of the confluence with Black River	Approximately 15.6 miles upstream of the confluence of Hood Creek	New Hanover County
Greenfield Lake North Branch	Approximately 1,000 feet downstream of Lee Drive	Approximately 260 feet upstream of South 16th Street	City Of Wilmington
Greenfield Lake North Branch Tributary	The confluence with Greenfield Lake North Branch	Approximately 230 feet upstream of South 17th Street	City Of Wilmington
Island Creek	Approximately 150 feet upstream of confluence with Island Creek Tributary	Approximately 1 mile upstream of Sidbury Road	New Hanover County
Island Creek	The confluence with Northeast Cape Fear River	Approximately 150 feet upstream of confluence with Island Creek Tributary	New Hanover County
Kings Grant Tributary	The confluence with Smith Creek	Approximately 250 feet upstream of Gordon Road	New Hanover County
Mott Creek	Approximately 1.1 miles downstream of Carolina Beach Road	Approximately 890 feet upstream of Junction Circle	New Hanover County
Mott Creek Tributary 1[1]	The confluence with Mott Creek	Approximately 345 feet upstream of Beamon Lane	New Hanover County
Murrayville Tributary	The confluence with Smith Creek	Approximately 1.1 miles upstream of College Street	New Hanover County
Ness Creek[1]	The confluence with Northeast Cape Fear River	Approximately 200 feet downstream of Castle Hayne Road	New Hanover County
Ness Creek Tributary 1	The confluence with Ness Creek	Approximately 320 feet upstream of Rockhill Road	New Hanover County
Northeast Cape Fear River	Approximately 900 feet downstream of NC Highway 210	Approximately 2.2 miles upstream of Crooms Bridge Road	New Hanover County
Prince George Creek[1]	The confluence with Cape Fear River	Approximately 250 feet upstream of Railroad	New Hanover County
Prince George Creek Tributary 3	The confluence with Prince George Creek	Approximately 0.6 mile upstream of Sidbury Road	New Hanover County
Smith Creek[1]	Approximately 1,150 feet downstream of the confluence of Spring Branch	Approximately 400 feet downstream of Interstate 40	New Hanover County
Spring Branch[1]	The confluence with Smith Creek	Approximately 1,350 feet downstream of Martin Luther King Jr. Parkway	City Of Wilmington New Hanover County
Wildcat Branch	The confluence with Cape Fear River	Approximately 0.5 mile upstream of Castle Hayne Road	New Hanover County

Table 8P - Scope of Revisions: Revised or New Detailed Study - Preliminary

Source	Riverine Sources		Affected Communties
	From	To	

[1]Revised to reflect backwater effects from new detailed study

Table 9P, “Scope of Revisions: Redelineated - Preliminary” is not applicable in New Hanover County.

Table 10P, “Scope of Revisions: Limited Detailed - Preliminary” is not applicable in New Hanover County.

Table 8, “Flooding Sources Studied by Detailed Methods”, lists all flooding sources within the county that were studied by detailed methods for this FIS and previous FISs.

Table 8 - Flooding Sources Studied by Detailed Methods: Revised or Newly Studied

Source	Riverine Sources		Affected Communties
	From	To	
Bradley Creek	Approximately 1,800 feet upstream of Atlantic Ocean	Approximately 0.6 mile upstream of Mallard Street	City Of Wilmington
Bradley Creek Tributary 1	The confluence with Bradley Creek	Approximately 1,300 feet upstream of U.S. Highway 74	City Of Wilmington
Burnt Mill Creek	The confluence with Smith Creek	Approximately 1,425 feet upstream of Varsity Drive	City Of Wilmington
Cape Fear River	Approximately 2.6 miles downstream of the confluence with Black River	Approximately 15.6 miles upstream of the confluence of Hood Creek	New Hanover County
Greenfield Lake North Branch	Approximately 1,000 feet downstream of Lee Drive	Approximately 260 feet upstream of South 16th Street	City Of Wilmington
Greenfield Lake North Branch Tributary	The confluence with Greenfield Lake North Branch	Approximately 230 feet upstream of South 17th Street	City Of Wilmington
Island Creek	Approximately 370 feet upstream of Holy Shelter Road	Approximately 4.6 miles upstream of Holy Shelter Road	New Hanover County
Island Creek	The confluence with Northeast Cape Fear River	Approximately 0.6 mile upstream of confluence with Island Creek Tributary	New Hanover County
Kings Grant Tributary	The confluence with Smith Creek	Approximately 250 feet upstream of Gordon Road	New Hanover County
Mott Creek	Approximately 1.1 miles downstream of Carolina Beach Road	Approximately 890 feet upstream of Junction Circle	New Hanover County
Mott Creek	Just upstream of South College Road	Approximately 925 feet upstream of Lone Eagle Court	New Hanover County
Mott Creek Tributary 1	The confluence with Mott Creek	Approximately 350 downstream of Carolina Beach Road	New Hanover County
Murrayville Tributary	The confluence with Smith Creek	Approximately 1.1 miles upstream of College Street	New Hanover County
Ness Creek	The confluence with Northeast Cape Fear River	Approximately 1,900 feet upstream of Todd Avenue	New Hanover County
Ness Creek Tributary 1	The confluence with Ness Creek	Approximately 320 feet upstream of Rockhill Road	New Hanover County
Ness Creek Tributary 2	Confluence with Ness Creek	Just upstream of Caladan Road	New Hanover County
Northeast Cape Fear River	Approximately 900 feet downstream of NC Highway 210	Approximately 2.2 miles upstream of Crooms Bridge Road	New Hanover County
Prince George Creek	The confluence with Cape Fear River	Sidbury Road	New Hanover County
Prince George Creek Tributary 3	The confluence with Prince George Creek	Approximately 0.6 mile upstream of Sidbury Road	New Hanover County
Pumkin Creek	Confluence with Prince George Creek	Approximately 50 feet upstream of Juvenile Center Road	New Hanover County
Smith Creek	Approximately 1,150 feet downstream of the confluence of Spring Branch	Approximately 300 feet upstream of Dove Field Drive	New Hanover County
Spring Branch	The confluence with Smith Creek	Approximately 1,425 feet upstream of Martin Luther King Jr Parkway	City Of Wilmington New Hanover County
Wildcat Branch	The confluence with Northeast Cape Fear River	Approximately 0.5 mile upstream of Castle Hayne Road	New Hanover County

Table 9, “Flooding Sources Studied by Detailed Methods: Redelineated” is not applicable in New Hanover County.

Table 10, “Flooding Sources Studied by Detailed Methods: Limited Detailed” is not applicable in New Hanover County.

Table 11, “Stream Name Changes” is not applicable in New Hanover County.

Table 12, “Letters of Map Revision” is not applicable in New Hanover County.

5.0 Engineering Methods

For the flooding sources 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 that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 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-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual 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 that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 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.

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. For details on the county’s hydrologic analyses, the hydrologic report is available by request.

A summary of the drainage area-peak discharge relationships for the flooding sources studied by detailed methods is shown in Table 13, “Summary of Discharges”.

Table 13 - Summary of Discharges

Flooding Source		Discharges (cfs)				
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	1% Annual Future Annual Chance	0.2% Annual Chance
Bradley Creek						
At mouth	5.50	840	1600	2020	*	3200
At Wrightsville Avenue	3.59	1004	1705	1962	*	2712
Approximately 0.75 mile upstream of Wrightsville Avenue	3.13	958	1627	1870	*	2576
Just upsream of confluence with Bradley Creek Tributary 1	1.36	638	1116	1284	*	1772
Approximately 775 feet downstream of Mallard Street	1.05	588	1027	1178	*	1613
Approximately 1,075 feet upstream of Mallard Street	0.85	561	976	1115	*	1514
Bradley Creek Tributary 1						
Just upsream of confluence with Bradley Creek	1.74	600	1084	1264	*	1797
Approximately 200 feet upstream of Eastwood Road	0.93	414	777	910	*	1312
Burnt Mill Creek						
Approximately 1.2 miles downstream of New Hanover/Pender County boundary	7055.00	*	*	131000	*	*
At confluence with Smith Creek	7.20	2090	3170	3530	3730	4550
Approximately 0.4 mile downstream of Princess Place Drive	5.50	1780	2750	3080	3240	3980
Approximately 140 feet downstream of Market Street	5.10	1710	2650	2970	3110	3840
Approximately 0.2 mile upstream of Metts Avenue	4.20	1510	2370	2660	2790	3460
Approximately 0.4 mile upstream of Colonial Drive	3.50	1360	2160	2420	2540	3170
Approximately 0.9 mile upstream of Colonial Drive	2.50	1100	1780	2010	2120	2650
Approximately 0.3 mile downstream of Mill Creek Ct.	1.90	942	1550	1760	1850	2330

Table 13 - Summary of Discharges

Flooding Source		Discharges (cfs)				
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	1% Annual Future Annual Chance	0.2% Annual Chance
Approximately 0.1 mile downstream of Mill Creek Ct.	1.40	771	1300	1470	1520	1960
Approximately 220 feet downstream of Varsity Drive	1.10	669	1140	1300	1360	1740
Greenfield Lake North Branch						
Approximately 1,185 feet downstream of Lake Shore Drive	1.33	531	968	1127	*	1602
Approximately 100 feet upstream of confluence with Greenfield Lake North Branch Tributary	1.01	394	752	887	*	1296
Greenfield Lake North Branch Tributary						
At confluence with Greenfield Lake North Branch	0.22	243	461	535	*	751
At South 16th Street	0.10	110	236	283	*	427
Island Creek						
Just upstream of confluence with Northeast Cape Fear River	18.60	1345	2516	3155	*	5047
Approximately 0.56 mile upstream of confluence with Northeast Cape Fear River	18.28	1331	2491	3123	*	4997
Approximately 1.5 miles upstream of confluence with Northeast Cape Fear River	16.49	1249	2341	2938	*	4705
At Holly Shelter Road	16.25	1239	2331	2928	*	4689
Approximately 0.85 mile downstream of Island Creek Road	15.98	1225	2297	2883	*	4619
Just upstream of Island Creek Road	14.19	1138	2139	2686	*	4310
Approximately 0.9 mile upstream of Holly Shelter Road	11.77	1016	1921	2417	*	3885
Approximately 1 mile upstream of Island Creek Road	8.81	848	1607	2024	*	3264
Approximately 1.45 mile upstream of Holly Shelter Road	7.97	799	1521	1918	*	3096
Approximately 0.46 mile downstream of Sidbury Road	5.81	657	1257	1589	*	2574
Approximately 0.9 miles upstream of Sidbury Road	3.14	450	870	1103	*	1799
Kings Grant Tributary						
Just upstream of confluence with Smth Creek	3.67	1083	1810	2073	*	2834
Approximately 1,115 feet upstream of Interstate 40	3.12	1008	1692	1937	*	2645
Approximately 0.9 mile upstream of Interstate 40	2.65	958	1606	1835	*	2495
Approximately 0.6 mile downstream of Gordon Road	1.67	601	1083	1261	*	1786
Just upstream of Gordon Road	1.32	508	934	1091	*	1562
Long Creek						
At confluence with Northeast Cape Fear River	141.40	4702	8499	10527	*	16468
Mott Creek						
At River Road	4.50	740	1330	1690	*	2650
Approximately 2,200 feet upstream of River Road	2.53	1161	1855	2087	*	2736
Approximately 275 feet upstream of Normandy Drive	2.20	1064	1716	1934	*	2544
Approximately 1,680 feet upstream of Normandy Drive	1.40	705	1208	1381	*	1877
Just upstream of South College Road	1.06	592	1033	1185	*	1623
Approximately 120 feet upstream of South College Road	0.57	451	799	915	*	1249
Mott Creek Tributary 1						
At confluence with Mott Creek	0.60	414	756	873	*	1210
Murrayville Tributary						
Approximately 670 feet upstream of confluence with Smith Creek	3.08	682	1251	1474	*	2148
Approximately 250 feet upstream of Murrayville Road	1.95	541	1010	1191	*	1740
Approximately 990 feet upstream of College Road	1.17	267	564	689	*	1089

Table 13 - Summary of Discharges

Flooding Source		Discharges (cfs)				
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	1% Annual Future Annual Chance	0.2% Annual Chance
Ness Creek						
At the confluence with Northeast Cape Fear River	2.60	560	1080	1350	*	2200
At Castle Hayne Road	0.80	330	700	900	*	1500
Ness Creek Tributary 1						
Just upstream of confluence with Ness Creek	0.92	165	295	363	*	525
Just upstream of Rockhill Road	0.59	125	224	277	*	402
Northeast Cape Fear River						
At Pender/New Hanover County boundary	1682.81	21675	37560	45836	*	69776
At confluence with Long Creek	1534.04	20472	35531	43383	*	66110
At confluence with Turkey Creek	1519.05	20348	35322	43131	*	65733
At Interstate 40	1493.61	20137	34966	42701	*	65089
At confluence with Island Creek	1462.70	19879	34530	42174	*	64300
Prince George Creek						
At Castle Hayne Road	10.90	900	1670	2040	*	3200
Just upstream of the confluence of Pumkin Creek	5.60	690	1280	1600	*	2520
At Sidbury Road	1.60	400	800	1020	*	1670
Prince George Creek Tributary 3						
At confluence with Prince George Creek	0.95	309	621	744	*	1129
Approximately 1,250 feet downstream of Dairy Farm Road	0.71	289	577	688	*	1031
Approximately 1,675 feet upstream of Sidbury Road	0.55	282	556	658	*	970
Pumkin Creek						
At Mouth	2.30	440	880	1120	*	1810
At State Road 1335	2.10	420	830	1080	*	1270
Smith Creek						
At confluence of Spring Branch	17.20	2540	3950	4480	5590	5980
Just upstream of North Kerr Avenue	16.20	2390	3740	4260	5360	5720
Approximately 0.2 mile upstream of North Kerr Avenue	14.30	2230	3520	4000	4900	5380
Approximately 480 feet upstream of confluence of Smith Creek Tributary 1	9.60	1460	2470	2850	3860	4000
Approximately 710 feet downstream of confluence of Murrayville Tributary	5.40	981	1730	2030	2670	2900
At Brittany Road	4.50	781	1430	1690	2380	2480
At Mouth	3.80	580	1110	1410	*	2250
Approximately 740 feet downstream of Dove Field Drive	3.60	529	1050	1260	2080	1940
Spring Branch						
At confluence with Smith Creek	3.00	1210	1950	2200	2300	2900
Approximately 0.6 mile upstream of confluence with Smith Creek	2.50	1090	1770	2000	2060	2630
Approximately 0.9 mile upstream of confluence with Smith Creek	1.90	911	1510	1710	1770	2270
Approximately 270 feet upstream of North College Road	1.20	685	1170	1330	1400	1790
Approximately 400 feet upstream of Albemarle Drive	0.80	516	908	1040	1130	1410
Turkey Creek						
Just upstream of confluence with Northeast Cape Fear River	14.64	1160	2180	2737	*	4389
Wildcat Branch						
At confluence with Northeast Cape Fear River	1.96	477	918	1093	*	1632

Table 13 - Summary of Discharges

Flooding Source		Discharges (cfs)				
Location	Drainage Area (square miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	1% Annual Future Annual Chance	0.2% Annual Chance
Approximately 1.25 miles upstream of confluence with Northeast Cape Fear River	1.41	460	870	1026	*	1501
Approximately 800 fett upstream of Castle Hayne Road	0.50	305	587	688	*	993

Table 14, “Summary of Stillwater Elevations” is not applicable in New Hanover County.

Table 15, “Gage Information” is not applicable in New Hanover County.

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the flood elevations for the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and/or Water-surface elevation rasters. For stream segments for which BFEs were computed, selected cross-section locations are also shown on the FIRM. Flood Profiles and/or Water-surface elevation rasters were developed showing computed water-surface elevations for 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 and/or Water-surface elevation rasters 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 the FIS in conjunction with the data shown on the FIRM.

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

For details on the county’s hydraulic analyses, the hydraulic report is available by request.

For the streams studied by detailed methods, water surface elevations of floods of the selected recurrence intervals were computed through use of the Army Corps of Engineers' HEC RAS step backwater computer program . The hydraulic analyses were based on unobstructed flow. The flood elevations shown on the Profiles and/or Water-surface elevation rasters are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. The computer models were calibrated using historic high water data collected during field investigations.

The cross section geometries were obtained from a combination of digital elevation data obtained by Light Detection and Ranging (LIDAR) and field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry. Natural floodplain cross sections were surveyed approximately every 4000 feet along the detail study reaches to obtain the channel geometry between bridges and culverts. Overbank cross section data for the backwater analyses were obtained from recently flown LIDAR data.

Channel roughness factors (Manning’s “n”) used in the hydraulic computations were made in the field by an engineer where stream access was possible, with orthophotos used to supplement areas that could not be accessed. The channel and overbank “n” values for all of the streams studied by detailed methods are shown in Table 16, “Roughness Coefficients”.

Table 16 - Roughness Coefficients

Stream	Channel "n"	Overbank "n"
Bradley Creek	0.042 to 0.048	0.035 to 0.150
Bradley Creek Tributary 1	0.030 to 0.070	0.035 to 0.500
Burnt Mill Creek	0.040 to 0.160	0.060 to 0.200
Cape Fear River	0.030 to 0.059	0.050 to 0.666
Greenfield Lake North Branch	0.040 to 0.042	0.030 to 0.150
Greenfield Lake North Branch Tributary	0.042 to 0.045	0.030 to 0.150
Island Creek	0.030 to 0.090	0.070 to 0.500
Kings Grant Tributary	0.049 to 0.050	0.030 to 0.150
Mott Creek	0.030 to 0.070	0.030 to 0.500

Table 16 - Roughness Coefficients

Stream	Channel "n"	Overbank "n"
Mott Creek Tributary 1	0.040	0.100 to 0.150
Murrayville Tributary	0.030 to 0.070	0.030 to 0.500
Ness Creek	-8888.000	-8888.000
Ness Creek Tributary 1	0.042 to 0.055	0.045 to 0.150
Northeast Cape Fear River	0.030 to 0.090	0.035 to 0.240
Prince George Creek	0.050	0.150
Prince George Creek Tributary 3	0.045 to 0.055	0.040 to 0.150
Smith Creek	0.030 to 0.070	0.100 to 0.500
Spring Branch	0.040	0.060 to 0.150
Wildcat Branch	0.040 to 0.050	0.030 to 0.140

For flooding sources studied by limited detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this report and the FIRM panels. This method entails developing a HEC-RAS hydraulic model, resulting in the calculation of BFEs and the delineation of the 1% annual chance floodplain (designated as Zone AE). Cross sections for the flooding sources studied by limited detailed methods were obtained using digital elevation data obtained with LIDAR technology developed as part of the North Carolina Statewide Floodplain Mapping Program. The hydraulic model is prepared using this digital elevation data, without surveying bathymetric or structural data. Where bridge or culvert data are readily available, such as from the North Carolina Department of Transportation, these data have been reflected in the hydraulic model. If these structural data are not readily available, field measurements of these structures were made to approximate their geometry in the hydraulic models. In addition, this method does not include field surveys that determine specifics on channel and floodplain characteristics. A limited detailed study is a “buildable” product that can be upgraded to a fully detailed study at a later date by verifying stream channel characteristics, bridge and culvert opening geometry, and by analyzing multiple recurrence intervals.

The results of the HEC-RAS computations are tabulated for all cross sections (Table 17, “Limited Detailed Flood Hazard Data”). Flood Profiles have not been developed for streams studied by limited detailed methods. Water-surface elevation rasters were developed for steams studied by limited detailed methods. In addition, floodways for streams studied by limited detailed methods are not delineated on the FIRM. However, the 1% annual chance water-surface elevations, flood discharges, and non-encroachment widths from the limited detailed studies for every modeled cross section are given in Table 17. The non-encroachment widths given at modeled cross sections can be used by communities to enforce floodplain management ordinances that meet the requirement defined in 44 CFR 60.3(c)(10).

Between cross sections for streams studied by limited detailed methods, 1% annual chance water-surface elevations can be calculated by mathematical interpolation using the distance along the stream centerline. Non-encroachment widths and, therefore, the location of a non-encroachment area boundary between cross sections should be determined based on either 1) mathematical interpolation, or 2) the non-encroachment width at the upstream or downstream cross section, whichever is larger. If the width determined by this second method is wider than the Special Flood Hazard Area (SFHA) or the 1% annual chance floodplain delineated on the FIRM for this location along the stream, the non-encroachment area shall be considered to be coincident with the SFHA. A full detailed study incorporating field survey data in the HEC-RAS hydraulic model may be submitted for a Letter of Map Revision (LOMR) request to map a regulatory floodway along a section of a stream in lieu of applying the non-encroachment widths listed in Table 17.

Table 17, “Limited Detailed Flood Hazard Data” is not applicable in New Hanover County.

5.3 Coastal Analyses

For the areas of New Hanover County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for the FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 15 summarizes the methods and/or models used for each of the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

Table 18P, “Summary of Coastal Analyses - Preliminary: Revised or Newly Studied”

Table 18P - Summary of Coastal Analyses - Preliminary: Revised or Newly Studied

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis Was Completed	Study Type
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	ADCIRC	1/22/2013	DETAILED STUDY
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	CHAMP / RUNUP 2.0 (2007)	12/10/2013	DETAILED STUDY
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	CHAMP 2.0	12/10/2013	DETAILED STUDY
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	removal/ retreat	12/10/2013	DETAILED STUDY
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	WHAFIS 4.0	12/10/2013	DETAILED STUDY
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	ADCIRC	1/22/2013	DETAILED STUDY
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	CHAMP / RUNUP 2.0 (2007)	11/13/2013	DETAILED STUDY
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	CHAMP 2.0	11/13/2013	DETAILED STUDY
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	Removal / Retreat	11/13/2013	DETAILED STUDY
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	WHAFIS 4.0	11/13/2013	DETAILED STUDY

Table 18, “Summary of Coastal Analyses”

Table 18 - Summary of Coastal Analyses

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis Was Completed
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	ADCIRC	1/22/2013
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	CHAMP / RUNUP 2.0 (2007)	12/10/2013
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	CHAMP 2.0	12/10/2013
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	removal/ retreat	12/10/2013
Atlantic Ocean	From Brunswick / Columbus county boundary	The Pender/ NewHanover/ Brunswick county boundaries	*	WHAFIS 4.0	12/10/2013
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	ADCIRC	1/22/2013
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	CHAMP / RUNUP 2.0 (2007)	11/13/2013
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	CHAMP 2.0	11/13/2013
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	Removal / Retreat	11/13/2013
Atlantic Ocean	From Coastline on Atlantic Ocean	Just downstream of U.S. Highway 17	*	WHAFIS 4.0	11/13/2013

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1% annual chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table

15. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 20, “Coastal Transect Parameters.”

Astronomical Tide

Astronomical tidal statistics were generated directly from local tidal constituents by sampling the predicted tide at random times throughout the tidal epoch.

Storm Surge Statistics

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms or by statistical study of tidal gages.

When historic records are used to calculate storm surge, characteristics such as the strength, size, track, etc., of storms are identified by site. Storm data was used in conjunction with numerical hydrodynamic models to determine the corresponding storm surge levels. An extreme value analysis was performed on the storm surge modeling results to determine a stillwater elevation for the 1% annual chance event.

Tidal gages can be used instead of historic records of storms when the available tidal gage record for the area represents both the astronomical tide component and the storm surge component. Table 16 provides the gage name, managing agency, gage type, gage identifier, start date, end date, and statistical methodology applied to each gage used to determine the stillwater elevations. For areas between gages, peak stillwater elevations for selected recurrence intervals were estimated by combining interpolation between gages and observed high water marks during major storms. A regionalized statistical approach was applied to the gage data so that stillwater elevations in areas between gages could be identified.

Table 19, “Tide Gage Analysis Specifics” is not applicable in New Hanover County.

Combined Riverine and Tidal Effects

Riverine and surge rates for the lower reaches of the Inundation River were combined by developing curves for rate of occurrence vs. flood level for each flood source.

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the total stillwater elevations. The oscillating component of wave setup, dynamic wave setup, was calculated for areas subject to wave runup hazards.

5.3.2 Waves

A coastal wave model (Coastal State University 2007) was used to calculate the nearshore wave fields required for the addition of wave setup effects. Three nested grids were used to obtain sufficient nearshore resolution to represent the radiation stress gradients required as ADCIRC inputs. Radiation stress fields output from the inner grids are used by ADCIRC to estimate the contribution of breaking waves (wave setup effects) to the total stillwater elevation.

5.3.3 Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated to determine the modification to existing topography that is expected to be associated with flooding events. Erosion was evaluated using the methods listed in Table 15. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.

5.3.4 Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation and wave runup. These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1% annual chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, “Transect Location Map,” are also depicted on the FIRM. Table 17 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, “starting” indicates the parameter value at the beginning of the transect.

Wave Height Analysis

Wave height analyses were performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 6 for a schematic of a coastal transect evaluated for overland wave propagation hazards.

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 18, “Summary of Coastal Analyses”.

Wave Runup Analysis

Wave runup analyses were performed to determine the height and extent of runup beyond the limit of stillwater inundation for the 1% annual chance flood. Wave runup elevations were modeled using the methods and models listed in Table 15.

Table 20, “Coastal Transect Parameters”

Table 20: Coastal Transect Parameters

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
Atlantic Ocean		**From Brunswick / Columbus county boundary**			**To The Pender/ NewHanover/ Brunswick county boundaries**		
111	18.1	10.7	*	*	*	10.4	13.5
			*	*	*	8.7 - 10.4	11.4 - 13.5
Atlantic Ocean		**From the New Hanover/ Brunswick County boundary**			**To The Pender/ New Hanover County boundary**		
1	19.1	11.2	*	*	*	10.2	13.4
			*	*	*	8.6 - 10.4	11.4 - 13.5
3	19.1	11.2	*	*	*	10.1	13.2
			*	*	*	8.7 - 10.9	11.4 - 13.4
5	19.1	11.2	*	*	*	10.3	13.4
			*	*	*	8.6 - 10.3	11.4 - 13.5
7	19.1	11.2	*	*	*	*	13.4
			*	*	*	8.5 - 10.2	11.2 - 13.4
9	19.1	11.2	*	*	*	10.1	13.4
			*	*	*	8.6 - 10.1	11.4 - 13.4
11	19.1	11.2	*	*	*	10.2	13.4
			*	*	*	8.7 - 10.2	11.5 - 13.4
13	19.1	11.2	*	*	*	10.2	13.5
			*	*	*	8.7 - 10.2	11.6 - 13.5
15	19.1	11.2	*	*	*	10.2	13.4
			*	*	*	10.2 - 10.2	13.4 - 13.4
17	19.1	11.2	*	*	*	10.2	13.6
			*	*	*	8.9 - 10.2	11.7 - 13.6
19	19.1	11.2	*	*	*	10.2	13.6
			*	*	*	10.2 - 10.3	13.6 - 14.0
21	19.1	11.2	*	*	*	10.1	13.6
			*	*	*	10.1 - 10.4	13.6 - 14.0
23	19.1	11.2	*	*	*	10.2	13.8
			*	*	*	8.7 - 10.4	11.5 - 14.1
25	19.1	11.2	*	*	*	10.3	13.8
			*	*	*	10.3 - 10.5	13.8 - 14.1
27	19.1	11.2	*	*	*	10.3	13.7
			*	*	*	10.2 - 10.5	13.7 - 14.2
29	19.1	11.2	*	*	*	10.6	13.9

Table 20: Coastal Transect Parameters

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
			*	*	*	9.0 - 10.6	11.8 - 14.2
31	19.4	15.2	*	*	*	*	*
			*	*	*	10.5 - 10.9	13.9 - 14.6
33	19.4	15.2	*	*	*	*	*
			*	*	*	10.5 - 11.1	13.9 - 14.8
35	19.4	15.2	*	*	*	11.1	*
			*	*	*	11.1 - 11.4	*
37	19.4	15.2	*	*	*	10.8	14.2
			*	*	*	10.8 - 11.8	14.2 - 15.4
39	19.4	15.2	*	*	*	10.8	14.3
			*	*	*	10.8 - 11.7	14.3 - 15.3
41	20.6	10.8	*	*	*	10.8	14.3
			*	*	*	10.4 - 11.8	14.3 - 15.5
43	20.6	10.8	*	*	*	10.8	14.3
			*	*	*	9.9 - 11.8	14.3 - 15.5
45	20.6	10.8	*	*	*	10.7	14.3
			*	*	*	10.6 - 11.9	14.2 - 15.6
47	20.6	10.8	*	*	*	10.7	14.4
			*	*	*	10.7 - 11.6	14.3 - 15.3
49	20.6	10.8	*	*	*	10.7	14.3
			*	*	*	10.7 - 12.2	14.2 - 16.3
51	20.6	10.8	*	*	*	10.7	14.3
			*	*	*	9.4 - 12.3	12.6 - 16.2
53	20.6	10.8	*	*	*	10.8	14.4
			*	*	*	9.8 - 11.4	12.9 - 15.3
55	19.7	12.6	*	*	*	10.7	14.5
			*	*	*	10.7 - 12.5	14.4 - 16.7
57	19.7	12.6	*	*	*	10.7	14.4
			*	*	*	10.7 - 11.6	14.3 - 15.5
59	19.7	12.6	*	*	*	10.7	14.4
			*	*	*	10.7 - 11.9	14.3 - 15.8
61	19.7	12.6	*	*	*	10.7	14.4
			*	*	*	10.7 - 11.7	14.3 - 15.6
63	19.7	12.6	*	*	*	10.8	14.5
			*	*	*	10.7 - 11.8	14.4 - 15.8
65	19.7	12.6	*	*	*	*	*
			*	*	*	10.9 - 11.8	14.6 - 15.7
67	19.7	12.6	*	*	*	10.8	14.6
			*	*	*	10.8 - 11.8	14.6 - 15.7
69	19.7	12.6	*	*	*	10.9	14.6
			*	*	*	10.8 - 12.6	14.6 - 16.7
71	19.7	12.6	*	*	*	10.8	14.6
			*	*	*	8.5 - 11.7	11.2 - 15.7
73	19.7	12.6	*	*	*	10.7	14.5
			*	*	*	10.7 - 11.9	14.4 - 15.9
75	19.7	12.6	*	*	*	*	*
			*	*	*	10.6 - 11.9	11.2 - 15.9
77	19.7	12.6	*	*	*	*	*
			*	*	*	10.9 - 12.8	11.2 - 16.9
79	2.0	2.6	*	*	*	8.5	11.3
			*	*	*	8.5 - 8.5	11.3 - 11.3
81	2.0	2.6	*	*	*	8.7	11.5
			*	*	*	8.7 - 8.7	11.5 - 11.6
83	2.0	2.6	*	*	*	8.9	11.8
			*	*	*	*	11.7 - 11.8
85	2.0	2.6	*	*	*	9.0	11.8
			*	*	*	8.9 - 9.0	11.7 - 11.8
87	2.0	2.6	*	*	*	9.0	11.8
			*	*	*	9.0 - 9.0	11.8 - 11.8

Table 20: Coastal Transect Parameters

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
89	2.0	2.6	*	*	*	9.0	11.8
			*	*	*	9.0 - 9.0	11.8 - 11.8
91	2.0	2.6	*	*	*	9.0	11.7
			*	*	*	9.0 - 9.0	11.7 - 11.8
93	2.0	2.6	*	*	*	9.1	11.7
			*	*	*	9.1 - 9.1	11.7 - 11.7

6.0 Mapping Methods

6.1 Vertical and Horizontal Control

Vertical Datum

All FISs 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. With the finalization of the North American Vertical Datum of 1988 (NAVD 88), all North Carolina FISs have been prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown on the FIRM for New Hanover County are referenced to NAVD 88. Structure and ground elevations in the county must, therefore, be referenced to NAVD 88. It is important to note that FISs for adjacent communities in neighboring states may be referenced to NGVD 29. This may result in BFE differences across political boundaries between the communities.

As noted above, the elevations shown in this FIS are referenced to 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 for New Hanover County is # feet. The locations used to establish the conversion factor were USGS quadrangle corners that fell within the county, as well as those that were within 2.5 miles outside the county. The benchmarks are referenced to NAVD 88. Table 21, “Datum Conversion Locations and Values,” is shown below.

Table 21, “Datum Conversion Locations and Values.”

Table 21 - Datum Conversion Locations and Values

Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
34.25	-77.88	-0.95
34.25	-77.75	-0.97
34.12	-77.87	-0.92
34.00	-77.88	-0.93
Average conversion in New Hanover County from NGVD 29 to NAVD 88 = -0.94 feet		

The vertical datum conversion factor for all flooding sources which run along a county boundary are in accordance with the conversion factor used in those contiguous counties.

BFEs shown on the FIRM represent whole-foot rounded values. For example, a 1% annual chance water-surface elevation of 102.4 feet will appear as 102 on the FIRM and 102.6 feet will appear as 103. Therefore, users who 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/or Water-surface elevation rasters and supporting data tables in the FIS Report, which are shown, at a minimum, to the nearest 0.1 foot.

For more information on NAVD 88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and

Atmospheric Administration, Rockville, Maryland 20910 (http://www.ngs.noaa.gov).

Vertical Control Monuments

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

The National Geodetic Survey establishes precisely located monuments on the North Carolina Grid System and Bench Marks referenced to a vertical datum (NGVD 1929 and NAVD 1988).

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)

Monuments with a Stability D classification may be used as Elevation Reference Marks (ERMs) when a Stability C or better monument is not an option. These ERMs must be approved by NCGS and can be set and used as elevation bench marks to establish vertical control and produce NC DFIRMs. Including such ERMs will greatly augment North Carolina's useable vertical control network.

In addition, when local jurisdictions have established their own vertical monument network, these monuments may also be shown on the FIRM with the appropriate designations. Local monuments will be placed on the FIRM if the community has requested that they be included and if the monuments meet the aforementioned criteria.

North Carolina Geodetic Survey (NCGS) and contractor surveyed vertical control monuments will be shown on the FIRM panels. Those cataloged by NCGS meet similar requirements to the NGS monuments as described above. Most monuments that have been cataloged by NCGS have been established to NGS standards, but have not been submitted to NGS for inclusion into the NSRS. The qualifying criteria for depicting bench marks established by the State's contractors on the new digital FIRM panels include:

- GPS surveying of permanent 3-D survey monuments to 5-centimeter or better local network accuracy guidelines, in accordance with NOAA Technical Memorandum NOS NGS-58 "Guidelines for Establishing GPS-Derived Ellipsoid Heights (Standards: 2 cm and 5 cm)," and conversion to NAVD 88 orthometric heights using NGS' latest geoid mode;

- Requiring a stability classification of "C" or better; and

- Submitting GPS files and station descriptions to NCGS.

To obtain current information for cataloging local bench marks in the NSRS, please visit the Data Sheet page of the NGS website at http://www.ngs.noaa.gov/cgi-bin/datasheet.prl, or contact the NGS Information Services Branch at:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-32822
(301) 713-3242

Information regarding the NCGS or State contractor bench marks can be obtained through the NCGS website at www.ncgs.state.nc.us, or by phone at (919) 733-3836.

It is important to note that temporary vertical monuments, sometimes called Elevation Reference Marks, 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, interested individuals may contact FEMA to access this information.

Horizontal Datum and Control

The digital files that comprise the FIRM are georeferenced to an established coordinate system. The coordinate system used for the production of this FIRM is North Carolina State Plane (FIPSZONE 3200) referenced to the North American Datum of 1983 (NAD83), GRS80 ellipsoid.

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features.

The projection used in the preparation of this map was the North Carolina State Plane Coordinate System. The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, or projection used in the production of FIRMs for adjacent states may result in slight positional differences in map features across the state boundary. These differences do not affect the accuracy of this FIRM.

As part of the North Carolina CTS Initiative, North Carolina digital FIRM panel numbers are consistent with the North Carolina Land Records Management Program (LRMP).

The 11-digit digital FIRM panel numbering system for North Carolina is: SS MM LLLL PP X, where SS = State Federal Information Processing Code (37); MM = Easting-Northing (EN) 1,000,000-foot coordinates; LLLL = LRMP map numbers to include the EN 100,000-foot coordinates, and the EN 10,000-foot coordinates; PP = place holders for additional EN 1,000-foot coordinates; and X = suffix ("J" for the initial edition). North Carolina's State Plane Coordinate System origin is outside the State boundary to the southwest (in Georgia), the eastings range from approximately 0,404,000 (Tennessee border) to 3,040,000 (Atlantic Ocean); and the northings range from approximately 0,045,000 (South Carolina border) to 1,043,000 (Virginia border). Digital FIRM panels were compiled at either 1"=1,000', covering an area of 20,000 feet x 20,000 feet (20" x 20" panels); or at 1"=500', covering an area of 10,000 feet x 10,000 feet (20" x 20" panels). An additional 2 digits (both zeros) are held in reserve as a "place holder" in the event that future FIRMs are printed at a larger scale; e.g., 1"=250', covering an area of 5,000 feet x 5,000 feet for which the 1,000-foot coordinates would either be 0 or 5.

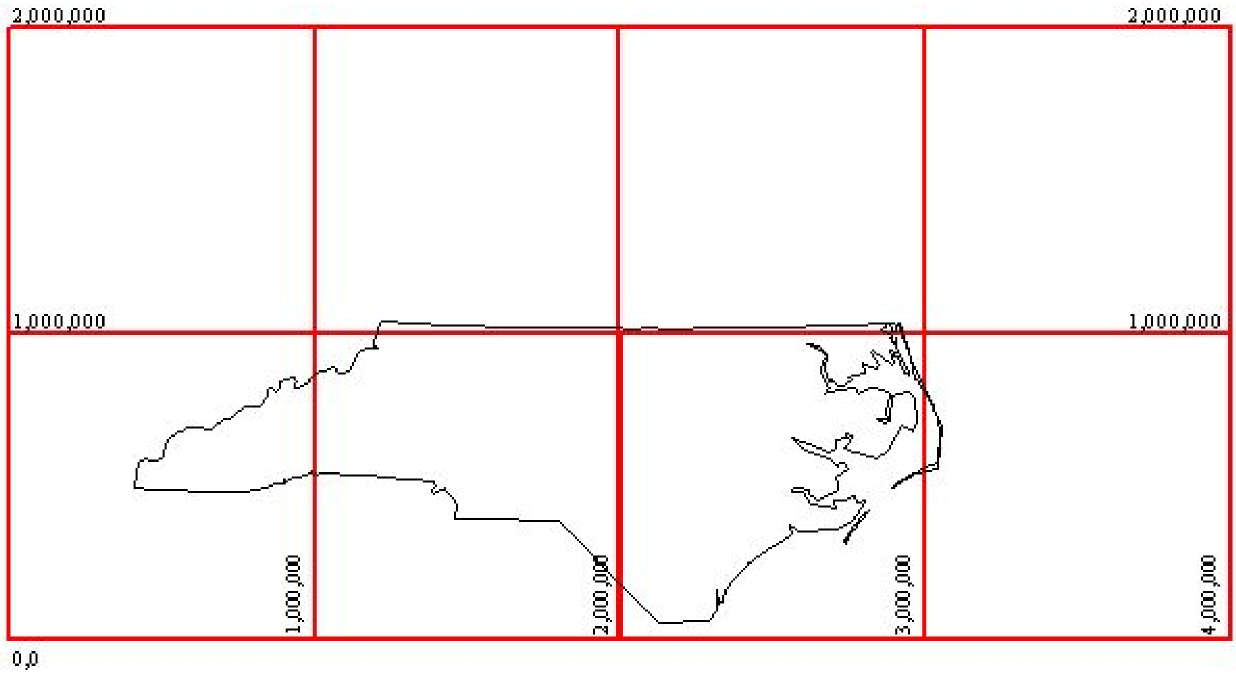

Figure 3 - North Carolina's State Plane Coordinate System

6.3 Floodplain and Floodway Delineation

Floodplain Boundaries

For streams restudied by detailed and limited detailed methods, the 1% and 0.2% annual chance floodplains were delineated using flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic data acquired using airborne Light Detection and Ranging (LIDAR). This LIDAR data was acquired during the (insert date from basin plan and update for map maintenance, if necessary) flying season.

The topographic data satisfies a vertical root-mean-square error (RMSE) accuracy standard of 20 cm (1.3 feet accuracy at the 95% confidence limit) for the Outer Banks and 25 cm (1.6 feet accuracy at the 95% confidence limit) for those portions of the basin lying west of the Outer Banks. These data could be contoured at roughly a 2-foot vertical contour interval. All elevations were referenced to the NAVD 88 and reflect orthometric heights. Variably spaced, bare-earth digital topographic data in ASCII point file format were combined with imagery (either flown concurrently with the LIDAR data or using existing digital orthophotos) to establish a Triangulated Irregular Network (TIN) of digital elevation points, which include selected breaklines to be used for hydraulic modeling. Furthermore, a uniformly spaced sampling of the TIN resulted in uniformly spaced Digital Elevation Models (DEMs), with 20 ft x 20 ft post spacing, which was generated in multiple file formats.

For coastal floodplains, after analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic data described above. Controlling features affecting the elevations were identified and considered in relation to their positions at particular transect and their variation between transects. •

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones VE, AO, AH, A99, AR, A, and AE), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundaries have been shown.

Floodway Delineation

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 22, “Floodway Data”). The computed floodway is shown on the FIRM. In cases where the floodway and 1% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown. In areas where the top of the bridge or road is higher than the 1.0-percent annual chance (100-year) flood, the FIRM will show the flood discharge as contained within the structure for emergency management purposes. It is important to note that FEMA and community floodway regulations still apply in and around those areas.

Table 22 - Floodway Data

Floodway Source		Floodway			Water Surface Elevation				
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
Bradley Creek									
151	15,064	73	403	5.7	12.6	*	12.6	12.0	-0.6
157	15,702	67	408	6.3	13.5	*	13.5	13.8	0.3
165	16,485	79	594	3.9	18.4	*	18.4	18.8	0.4
170	17,025	45	286	7.2	19.0	*	19.0	19.7	0.7
175	17,545	120	546	5.6	22.5	*	22.5	23.0	0.5
179	17,940	44	164	12.9	24.7	*	24.7	24.9	0.2
Bradley Creek Tributary 1									
019	1,917	46	302	6.9	13.5	*	13.5	12.8	-0.7
027	2,718	39	291	4.6	14.4	*	14.4	14.8	0.4
034	3,399	43	306	5.4	16.2	*	16.2	16.4	0.2
044	4,436	188	988	1.6	18.7	*	18.7	19.5	0.9
052	5,249	180	913	2.9	18.7	*	18.7	19.7	1.0
Burnt Mill Creek									
044	4,407	182	2,000	1.5	9.9	*	9.9	9.7	-0.2
064	6,350	446	3,326	0.9	10.0	*	10.0	10.1	0.1
065	6,486	478	3,789	0.8	10.0	*	10.0	10.1	0.1
079	7,905	170	1,674	1.8	10.2	*	10.2	10.4	0.2
089	8,905	295	2,768	1.1	11.2	*	11.2	12.0	0.8
097	9,650	255	2,588	1.2	11.6	*	11.6	12.3	0.7
114	11,405	220	1,919	1.6	11.9	*	11.9	12.8	0.9
129	12,905	110	951	2.8	12.4	*	12.4	13.4	1.0
142	14,208	77	696	3.5	14.0	14.5	14.0	14.7	0.8
159	15,905	77	505	4.8	16.3	*	16.3	17.3	1.0
178	17,754	545	4,007	0.5	18.2	*	18.2	18.4	0.2
193	19,349	47	189	7.8	18.8	*	18.8	18.9	0.1
214	21,390	225	803	1.6	30.1	*	30.1	30.9	0.8
224	22,426	46	198	6.6	31.9	*	31.9	32.1	0.2
231	23,078	31	135	9.6	36.8	*	36.8	37.0	0.2
Cape Fear River									
2014	201,429	4,550	32,577	4.0	8.1[1]	*	6.7	6.8	0.1
2053	205,291	4,400	39,130	3.3	9.5	*	9.5	9.5	0.0
Greenfield Lake North Branch									
021	2,050	236	1,845	1.9	13.1	*	13.1	14.0	0.9
029	2,946	75	417	4.8	13.5	*	13.5	14.2	0.7
041	4,091	97	502	3.3	16.4	*	16.4	17.4	1.0
Greenfield Lake North Branch Tributary									
000	14	63	241	3.5	13.9[2]	*	12.7	13.6	0.8
005	518	39	258	2.5	14.2[1]	*	13.0	13.9	0.9
007	723	61	259	2.2	15.9	*	15.9	16.0	0.1
009	883	*	*	*	16.0	*	16.0	*	*

Table 22 - Floodway Data

Floodway Source		Floodway			Water Surface Elevation				
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
014	1,449	31	118	2.5	24.0	*	24.0	24.4	0.5
019	1,873	35	108	4.6	28.3	*	28.3	28.3	0.0
Island Creek									
013	1,303	800	1,991	3.5	8.4[3]	*	8.4	2.3	-6.1
075	7,481	950	4,456	2.4	8.4[3]	*	8.4	4.6	-3.8
124	12,424	800	4,195	2.5	8.4[1]	*	8.4	6.2	-2.2
165	16,472	750	3,545	2.7	8.4	*	8.4	7.5	-0.9
186	18,640	620	3,673	2.2	8.4	*	8.4	7.9	-0.5
201	20,113	546	3,478	1.8	8.4	*	8.4	8.2	-0.2
211	21,086	550	3,320	1.2	8.4	*	8.4	8.3	-0.1
215	21,530	294	1,725	3.4	8.4	*	8.4	8.6	0.2
227	22,691	430	2,688	2.2	8.4	*	8.4	9.3	0.9
242	24,215	399	2,430	2.5	9.1	*	9.1	10.0	0.9
253	25,250	372	2,122	2.4	9.7	*	9.7	10.6	0.9
264	26,417	223	1,265	3.7	10.5	*	10.5	11.5	1.0
281	28,146	230	1,252	3.9	12.4	*	12.4	13.3	0.9
291	29,051	310	1,668	3.1	13.3	*	13.3	14.3	0.9
302	30,202	200	1,034	3.6	14.5	*	14.5	15.5	1.0
313	31,287	330	1,799	2.2	15.3	*	15.3	16.3	1.0
322	32,203	290	1,437	2.6	15.9	*	15.9	16.9	1.0
335	33,527	376	2,800	1.4	20.7	*	20.7	21.5	0.8
347	34,696	346	2,020	1.9	20.9	*	20.9	21.7	0.8
358	35,844	248	1,407	2.4	21.2	*	21.2	22.1	0.9
368	36,809	179	955	3.2	21.5	*	21.5	22.5	1.0
387	38,712	66	529	2.4	22.6	*	22.6	23.6	1.0
398	39,792	66	469	2.7	23.2	*	23.2	24.2	1.0
Kings Grant Tributary									
004	379	372	1,857	3.2	10.3[4]	*	9.9	10.5	0.6
020	2,045	306	2,352	2.1	17.9	*	17.9	18.8	0.8
035	3,500	183	1,369	3.8	18.5	*	18.5	19.4	0.9
049	4,915	211	1,201	2.0	19.2	*	19.2	20.2	1.0
064	6,403	269	1,239	4.7	22.5	*	22.5	23.3	0.8
079	7,863	83	328	6.4	24.8	*	24.8	25.8	1.0
089	8,905	31	235	5.7	28.7	*	28.7	29.3	0.6
094	9,428	29	253	5.1	30.2	*	30.2	30.5	0.3
101	10,135	26	214	6.3	32.2	*	32.2	32.8	0.6
106	10,624	70	441	5.3	36.7	*	36.7	37.7	1.0
Mott Creek									
087	8,706	60	453	7.2	10.3	*	10.3	9.8	-0.5
091	9,147	97	839	5.2	11.0	*	11.0	11.0	0.0
095	9,450	84	559	5.2	11.2	*	11.2	11.3	0.1
095	9,503	90	690	4.3	11.6	*	11.6	12.3	0.7
098	9,820	175	1,764	2.9	11.9	*	11.9	12.7	0.8
102	10,244	335	1,558	4.0	12.0	*	12.0	12.7	0.7

Table 22 - Floodway Data

Floodway Source		Floodway			Water Surface Elevation				
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
109	10,927	480	3,913	1.4	12.2	*	12.2	13.0	0.8
118	11,798	420	2,124	2.0	12.3	*	12.3	13.1	0.8
127	12,653	230	837	2.7	12.4	*	12.4	13.3	0.9
134	13,365	161	817	2.8	12.8	*	12.8	13.7	0.9
140	13,971	77	307	5.5	13.2	*	13.2	14.2	1.0
141	14,150	60	592	3.1	17.7	*	17.7	18.6	0.9
143	14,301	95	521	3.9	17.9	*	17.9	18.7	0.8
144	14,431	160	1,067	2.0	18.0	*	18.0	18.9	1.0
145	14,514	174	1,129	2.3	18.0	*	18.0	19.0	1.0
148	14,820	148	844	3.2	18.1	*	18.1	19.1	1.0
151	15,126	180	747	2.1	18.3	*	18.3	19.2	0.9
152	15,224	173	1,637	0.7	19.5	*	19.5	20.5	1.0
152	15,232	173	1,588	0.7	19.5	*	19.5	20.5	1.0
154	15,419	170	996	1.2	22.3	*	22.3	23.0	0.7
155	15,537	90	684	1.2	22.3	*	22.3	23.0	0.7
157	15,671	90	748	1.1	22.3	*	22.3	23.0	0.8
158	15,768	90	681	1.3	22.3	*	22.3	23.0	0.8
162	16,189	110	705	2.3	22.3	*	22.3	23.1	0.8
166	16,589	70	314	4.3	22.3	*	22.3	23.3	1.0
170	16,962	70	403	2.8	23.1	*	23.1	23.8	0.7
208	20,842	222	465	1.7	24.1	*	24.1	24.8	0.7
221	22,054	219	571	1.4	25.5	*	25.5	26.4	0.8
225	22,524	296	1,278	0.6	25.7	*	25.7	26.6	0.9
229	22,854	356	1,136	0.7	25.8	*	25.8	26.7	0.9
237	23,654	140	500	1.6	26.4	*	26.4	27.2	0.8
241	24,054	140	491	1.6	26.6	*	26.6	27.5	0.9
Mott Creek Tributary 1									
015	1,488	225	1,934	0.4	12.8	*	12.8	13.8	1.0
018	1,808	190	1,307	0.7	12.9	*	12.9	13.8	0.9
021	2,063	173	918	1.0	12.9	*	12.9	13.9	1.0
025	2,491	54	234	3.7	13.1	*	13.1	14.0	0.9
030	2,979	54	287	3.0	14.6	*	14.6	15.6	1.0
Murrayville Tributary									
017	1,745	330	3,990	0.7	32.5	*	32.5	32.5	0.0
020	1,982	640	5,386	0.6	35.2	*	35.2	36.1	0.9
033	3,330	325	3,125	0.9	35.2	*	35.2	36.1	0.9
053	5,331	300	2,076	1.7	35.3	*	35.3	36.2	0.9
071	7,050	851	4,631	0.3	35.3	*	35.3	36.3	1.0
087	8,662	851	3,642	0.4	35.3	*	35.3	36.3	1.0
107	10,708	460	1,000	1.4	35.4	*	35.4	36.4	1.0
115	11,532	170	525	2.2	35.8	*	35.8	36.6	0.8
Ness Creek									
073	7,320	430	1,496	0.9	9.2	*	9.2	4.4	-4.8
082	8,200	210	1,028	1.4	9.2	*	9.2	5.3	-3.9

Table 22 - Floodway Data

Floodway Source		Floodway			Water Surface Elevation				
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
088	8,800	300	1,420	1.0	9.2	*	9.2	6.0	-3.2
098	9,770	170	849	1.6	9.2	*	9.2	7.0	-2.2
107	10,740	100	639	2.2	9.9	*	9.9	9.6	-0.3
112	11,170	150	996	1.4	10.3	*	10.3	10.4	0.1
119	11,900	180	1,071	1.3	10.9	*	10.9	11.3	0.4
128	12,800	110	599	2.3	12.2	*	12.2	12.9	0.7
135	13,470	180	764	1.2	13.9	*	13.9	14.7	0.8
140	14,000	120	472	1.9	15.1	*	15.1	15.8	0.7
143	14,250	120	415	2.1	16.1	*	16.1	16.7	0.6
146	14,550	100	460	1.9	25.4	*	25.4	25.7	0.3
150	15,030	100	820	1.1	25.4	*	25.4	25.8	0.4
153	15,320	80	787	1.1	25.5	*	25.5	25.9	0.4
156	15,640	80	507	1.8	25.5	*	25.5	26.0	0.5
159	15,940	80	511	1.7	26.8	*	26.8	27.1	0.4
164	16,400	80	298	3.0	27.2	*	27.2	27.4	0.2
169	16,870	80	367	2.4	28.9	*	28.9	29.0	0.1
175	17,480	80	333	2.7	30.4	*	30.4	30.5	0.2
178	17,800	70	246	3.6	32.3	*	32.3	32.5	0.2
Ness Creek Tributary 1									
001	149	27	87	4.5	13.3[5]	*	10.4	10.5	0.1
005	520	85	323	2.2	13.2[1]	*	12.6	12.7	0.1
010	967	26	83	5.6	13.3	*	13.3	13.7	0.4
015	1,496	26	111	4.0	15.4	*	15.4	16.0	0.5
019	1,950	25	106	4.0	16.6	*	16.6	17.0	0.5
026	2,610	34	111	3.5	18.0	*	18.0	18.2	0.2
032	3,203	30	115	2.6	20.9	*	20.9	21.0	0.1
Ness Creek Tributary 2									
001	100	60	215	2.4	25.6[1]	*	18.9	19.5	0.6
006	560	60	187	2.7	25.6[1]	*	20.9	21.5	0.6
009	880	60	283	1.8	25.6[1]	*	25.2	25.7	0.5
012	1,240	60	208	2.4	25.6	*	25.6	26.1	0.5
016	1,560	60	163	1.9	26.4	*	26.4	26.7	0.3
016	1,609	60	166	1.9	26.5	*	26.5	26.7	0.2
019	1,850	60	179	1.8	29.9	*	29.9	30.3	0.4
021	2,095	60	170	1.9	30.9	*	30.9	31.2	0.3
024	2,370	60	199	1.6	30.9	*	30.9	31.2	0.3
Northeast Cape Fear River									
1140	114,000	591	16,682	2.6	8.0	*	8.0	6.2	-1.8
1155	115,500	509	13,241	3.3	8.0	*	8.0	6.2	-1.8
1165	116,479	420	13,734	3.1	8.0	*	8.0	6.3	-1.7
1195	119,507	419	12,849	3.4	8.0	*	8.0	6.4	-1.6
1210	121,001	341	9,837	4.4	8.0	*	8.0	6.4	-1.6
1219	121,894	565	9,982	4.3	8.0	*	8.0	6.6	-1.4
1225	122,463	641	9,206	4.7	8.0	*	8.0	6.8	-1.2

Table 22 - Floodway Data

Floodway Source		Floodway			Water Surface Elevation				
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
1230	123,046	629	9,797	4.4	8.0	*	8.0	7.0	-1.0
1255	125,515	482	11,528	3.7	8.0	*	8.0	7.4	-0.6
1275	127,500	521	12,981	3.3	8.0	*	8.0	7.6	-0.4
1289	128,931	512	12,576	3.4	8.0	*	8.0	7.7	-0.3
1306	130,555	508	12,158	3.5	8.0	*	8.0	7.8	-0.2
1321	132,082	512	12,326	3.5	8.0	*	8.0	7.9	-0.1
1335	133,500	486	11,592	3.7	8.0	*	8.0	8.0	0.0
1349	134,943	536	12,783	3.3	8.0	*	8.0	8.2	0.2
1359	135,889	580	13,443	3.2	8.0	*	8.0	8.2	0.2
1382	138,248	510	11,224	3.8	8.0	*	8.0	8.4	0.4
1395	139,505	543	10,619	4.0	8.1	*	8.1	8.4	0.4
1424	142,415	810	16,547	2.6	8.3	*	8.3	8.8	0.5
1450	145,009	1,280	15,719	2.7	8.3	*	8.3	8.9	0.6
Prince George Creek									
261	26,090	350	2,523	0.8	10.6	*	10.6	10.8	0.2
279	27,916	36	561	4.4	11.8	*	11.8	12.0	0.2
302	30,180	520	4,704	0.4	13.3	*	13.3	14.2	0.9
333	33,250	530	4,042	0.5	13.5	*	13.5	14.4	0.9
361	36,080	250	2,020	0.9	17.7	*	17.7	18.0	0.3
376	37,620	320	1,659	0.9	18.3	*	18.3	18.9	0.6
407	40,730	300	1,255	1.0	22.2	*	22.2	22.5	0.3
434	43,430	202	803	1.5	27.2	*	27.2	27.9	0.7
440	44,000	*	*	*	27.7	*	27.7	*	*
Prince George Creek Tributary 3									
022	2,186	33	204	4.2	22.2	*	22.2	22.8	0.6
025	2,481	31	179	5.1	23.0	*	23.0	23.4	0.4
028	2,812	33	168	4.7	24.0	*	24.0	24.3	0.3
034	3,375	31	130	6.1	25.8	*	25.8	26.0	0.2
037	3,741	171	477	3.2	28.8	*	28.8	29.5	0.8
042	4,184	212	958	2.4	31.7	*	31.7	32.6	1.0
051	5,103	206	1,251	1.5	33.4	*	33.4	34.4	1.0
066	6,646	236	1,285	0.6	33.4	*	33.4	34.4	1.0
077	7,728	263	1,373	0.5	33.5	*	33.5	34.5	1.0
Pumkin Creek									
010	950	100	550	2.5	14.3[1]	*	13.4	14.1	0.7
015	1,450	100	523	2.7	14.7	*	14.7	15.4	0.7
020	1,970	120	484	2.9	16.8	*	16.8	17.5	0.7
029	2,850	125	748	1.8	19.3	*	19.3	20.2	0.9
041	4,130	160	876	1.6	21.3	*	21.3	22.2	0.9
045	4,530	100	559	2.4	22.0	*	22.0	22.9	0.9
047	4,665	160	1,023	1.3	23.7	*	23.7	24.4	0.7
051	5,080	205	1,035	1.3	23.9	*	23.9	24.6	0.7
057	5,700	140	768	1.8	24.3	*	24.3	25.1	0.8
061	6,100	100	592	2.3	24.7	*	24.7	25.5	0.8

Table 22 - Floodway Data

Floodway Source		Floodway			Water Surface Elevation				
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
063	6,340	100	500	2.7	25.2	*	25.2	25.8	0.6
067	6,712	170	897	1.5	25.8	*	25.8	26.4	0.6
069	6,889	170	1,603	0.9	30.1	*	30.1	30.5	0.4
077	7,710	240	1,696	0.4	30.1	*	30.1	30.6	0.5
085	8,500	230	1,582	0.4	30.1	*	30.1	30.6	0.5
094	9,420	150	712	0.9	30.2	*	30.2	30.7	0.5
097	9,730	160	545	1.1	30.3	*	30.3	30.8	0.5
099	9,910	160	466	1.3	30.6	*	30.6	31.0	0.4
Smith Creek									
389	38,851	485	2,832	1.4	9.3	*	9.3	8.8	-0.6
394	39,351	489	2,737	1.5	9.4	*	9.4	9.1	-0.3
399	39,851	429	2,261	1.8	9.6	*	9.6	9.6	0.0
404	40,351	499	2,785	1.4	9.8	*	9.8	10.2	0.4
409	40,851	446	2,761	1.4	10.1	*	10.1	10.6	0.4
419	41,851	534	3,071	0.9	10.5	*	10.5	11.2	0.7
424	42,351	576	2,836	1.0	10.7	*	10.7	11.4	0.7
438	43,840	67	566	5.0	14.4	17.6	14.4	15.1	0.7
446	44,644	103	1,009	2.8	16.4	20.2	16.4	17.1	0.6
459	45,851	256	2,302	1.2	18.8	21.9	18.8	19.4	0.6
463	46,319	246	2,170	1.3	18.9	22.0	18.9	19.5	0.7
469	46,851	80	680	4.2	18.8	22.0	18.8	19.6	0.8
474	47,351	276	2,031	1.4	19.4	22.2	19.4	20.3	0.8
479	47,851	279	1,988	1.4	19.6	22.3	19.6	20.5	0.8
484	48,351	330	2,266	1.3	19.8	22.4	19.8	20.7	0.9
489	48,898	245	1,137	2.5	20.0	22.5	20.0	20.9	0.9
504	50,373	318	1,938	1.0	20.9	23.0	20.9	21.8	0.9
509	50,873	350	1,571	1.3	21.1	23.1	21.1	22.0	0.9
512	51,153	275	1,114	1.8	21.4	23.2	21.4	22.2	0.8
518	51,799	250	1,351	1.5	22.2	23.6	22.2	23.2	1.0
524	52,373	172	956	2.1	23.4	24.4	23.4	24.3	0.9
529	52,873	149	727	2.8	24.1	25.1	24.1	25.0	0.9
534	53,373	141	610	3.3	25.1	25.9	25.1	26.0	0.9
539	53,873	225	1,115	1.8	26.2	26.9	26.2	27.2	1.0
543	54,284	223	1,250	1.6	26.7	27.4	26.7	27.6	1.0
549	54,873	195	771	2.2	27.2	28.0	27.2	28.1	0.9
554	55,373	215	1,078	1.6	28.2	29.0	28.2	29.1	1.0
559	55,873	121	433	3.9	28.9	29.8	28.9	29.7	0.8
564	56,373	114	627	2.7	30.8	31.6	30.8	31.7	0.9
569	56,873	114	605	2.8	32.1	33.0	32.1	32.9	0.8
574	57,373	141	690	2.4	33.4	34.4	33.4	34.1	0.7
579	57,873	101	552	3.1	34.3	35.3	34.3	35.3	1.0
584	58,373	75	361	3.5	35.8	36.7	35.8	36.5	0.7
588	58,834	99	646	2.0	36.7	38.1	36.7	37.6	0.8
593	59,278	315	2,382	0.5	37.9	38.6	37.9	38.0	0.1

Table 22 - Floodway Data

Floodway Source		Floodway			Water Surface Elevation				
Cross Section	Distance (Feet Above Mouth)	Width (Feet)	Section Area (Square Feet)	Mean Velocity (Feet Per Second)	Regulatory	1% Annual Chance Future Water-Surface Elevation	Without Floodway	With Floodway	Increase
Spring Branch									
030	2,977	103	610	3.6	9.3	*	9.3	9.0	-0.3
035	3,463	104	577	3.5	9.7	*	9.7	9.9	0.2
040	3,963	125	653	3.1	10.3	*	10.3	10.9	0.6
045	4,468	158	723	2.8	11.1	*	11.1	11.9	0.8
050	4,960	81	364	4.7	11.9	*	11.9	12.8	0.9
055	5,460	126	635	2.7	13.1	*	13.1	14.0	0.9
060	5,960	141	687	2.5	14.0	*	14.0	14.8	0.8
068	6,777	139	486	3.5	17.4	*	17.4	17.6	0.1
075	7,468	180	1,487	0.9	24.4	*	24.4	25.2	0.8
080	7,962	54	445	3.0	24.4	*	24.4	25.2	0.8
085	8,450	173	1,422	0.9	25.2	*	25.2	26.0	0.8
098	9,771	46	235	4.4	27.8	*	27.8	28.5	0.7
105	10,460	87	319	3.3	30.8	*	30.8	30.8	0.0
Wildcat Branch									
074	7,437	123	431	4.8	9.4	*	9.4	8.8	-0.6
083	8,289	113	433	5.6	11.8	*	11.8	12.0	0.2
094	9,376	67	268	5.3	16.9	*	16.9	17.4	0.5
105	10,458	95	404	3.7	21.3	*	21.3	21.4	0.2
112	11,181	78	385	4.2	24.9	*	24.9	25.2	0.2
118	11,800	200	447	4.2	26.5	*	26.5	26.8	0.3
128	12,754	285	943	1.4	26.9	*	26.9	27.2	0.3
142	14,155	133	240	4.7	27.0	*	27.0	28.0	0.9

[1] **Elevation includes backwater effects**

[2] **Greenfield Lake North Branch**

[3] **Northeast Cape Fear River**

[4] **Smith Creek**

[5] **Ness Creek**

* Future conditions not computed for this stream

* Values not computed for this station

6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Table 23.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1% annual chance flood condition):

- *The primary frontal dune* zone is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

- *The wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

- *The wave overtopping splash zone* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.

- *The breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).

- *The high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv2) is greater than or equal to 200 ft3/sec2. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either “V” zones or “A” zones.

Table 23: Summary of Coastal Transect Mapping Considerations

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
Atlantic Ocean	1	X	*	AE 2-4 VE 10 AE 8 VE 3-11	PFD	*
	2	X	VE 16	AE 2-4 VE 10 VE 3-11	PFD	*
	3	X	*	AE 1-4 VE 10	PFD	SWEL
	4	X	*	AE 1-4 VE 10	PFD	*
	5	X	*	AE 7 VE 10	PFD	SWEL
	6	X	AE 16 VE 14	AE 0-11 VE 11	PFD	*
	7	*	AE 14 AO 14-14 VE 14	AE 2 AO 0-3 VE 10	RUNUP EXTENT	RUNUP EXTENT
	8	X	AE 16-16 VE 16	AE 0 VE 10	RUNUP EXTENT	RUNUP EXTENT
	9	X	AE 16 VE 16	AE 0-1 VE 10	RUNUP EXTENT	RUNUP EXTENT

Table 23: Summary of Coastal Transect Mapping Considerations

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	1	X	*	AE 2-4 VE 10 AE 8 VE 3-11	PFD	SWEL
	2	*	VE 16	AE 2-4 VE 10 VE 3-11	WHAFIS	SWEL
	10	X	AE 13-13 VE 13	VE 10	PFD	PFD
	11	X	AE 16-16 VE 16	VE 10	PFD	PFD
	12	X	AE 17-17 VE 17	VE 10	RUNUP EXTENT	RUNUP EXTENT
	13	X	AE 17-17 VE 17	VE 10	RUNUP EXTENT	RUNUP EXTENT
	14	X	AE 17-17 VE 17	VE 10	PFD	PFD
	15	X	VE 19-19	VE 10	PFD	PFD
	16	X	VE 18	VE 7	PFD	PFD
	17	X	AE 16-16 VE 16	VE 10	PFD	PFD
	18	X	AE 15 VE 15-15	AE 2 VE 10	PFD	PFD
	19	X	AE 16 VE 16-16	AE 2 VE 10	PFD	PFD
	20	X	AE 17 VE 17-17	AE 0-4 VE 10	PFD	PFD
	21	X	AE 16 VE 16-16	AE 0-2 VE 10	PFD	PFD
	22	X	AE 16 VE 16	AE 2 VE 10	PFD	PFD
	23	X	AE 16 VE 16-16	AE 0-7 VE 10	PFD	PFD
	24	X	AE 16 VE 16-16	AE 0-5 VE 10	PFD	PFD
	25	X	AE 16 VE 16-16	AE 5 VE 10	PFD	PFD
	26	X	AE 13 VE 13	AE 5 VE 10	PFD	PFD
	27	X	AE 14 VE 14-14	AE 0-6 VE 10	PFD	PFD

Table 23: Summary of Coastal Transect Mapping Considerations

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	28	X	*	AE 6 VE 10	PFD	SWEL
	29	*	*	AE 6 VE 10	WHAFIS	SWEL
	30	X	*	AE 6 VE 11	PFD	SWEL
	31	X	*	AE 0-5 VE 11	PFD	SWEL
	32	X	*	AE 0-6 VE 11	PFD	SWEL
	33	X	*	AE 0-6 VE 10	PFD	SWEL
	34	*	*	AE 4 VE 11	WHAFIS	SWEL
	35	*	*	AE 0-3 VE 9	WHAFIS	SWEL
	36	X	*	AE 1-5 VE 11	WHAFIS	SWEL
	37	X	*	AE 6 VE 11	WHAFIS	SWEL
	38	X	*	AE 2-6 VE 8	WHAFIS	SWEL
	39	X	*	AE 2-4 VE 11	WHAFIS	SWEL
	40	X	*	AE 2-6 VE 11	WHAFIS	SWEL
	41	X	*	AE 0-6 VE 11	WHAFIS	SWEL
	42	X	*	AE 6 VE 11	WHAFIS	SWEL
	43	X	*	AE 0-10 VE 11	WHAFIS	SWEL
	44	X	*	AE 3-6 VE 11	WHAFIS	SWEL
	45	X	*	AE 0-4 VE 11	WHAFIS	SWEL
	46	X	*	AE 5 VE 11	PFD	SWEL
	47	X	*	AE 0-5 VE 11	PFD	SWEL

Table 23: Summary of Coastal Transect Mapping Considerations

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	48	X	*	AE 0-5 VE 11	PFD	SWEL
	49	X	*	AE 6 VE 11	PFD	SWEL
	50	X	*	AE 6 VE 11	PFD	SWEL
	51	X	*	AE 6 VE 11	PFD	SWEL
	52	*	*	AE 5 VE 11	WHAFIS	SWEL
	53	X	*	AE 8 VE 11	PFD	SWEL
	54	X	AE 17 VE 17	AE 0-6 VE 11	PFD	SWEL
	55	X	AE 16 VE 16	AE 5 VE 11	PFD	SWEL
	56	X	AE 13 VE 13	AE 0-6 VE 11	PFD	SWEL
	57	X	*	AE 1-5 VE 11	PFD	SWEL
	58	X	*	AE 0-6 VE 11	PFD	SWEL
	59	X	AE 17 VE 17	AE 6 VE 11	PFD	SWEL
	60	X	*	AE 1-6 VE 11	PFD	SWEL
	61	X	AE 16 VE 16	AE 0-6 VE 11	PFD	SWEL
	62	X	*	AE 1-5 VE 11	PFD	SWEL
	63	X	AE 14 VE 14	AE 6 VE 11	PFD	SWEL
	64	X	*	AE 1-5 VE 3-11	PFD	SWEL
	65	X	*	AE 2-6 VE 3-11	PFD	SWEL
	66	X	*	AE 1-7 VE 11	PFD	SWEL
	67	X	AE 15 VE 15	AE 0-6 VE 11	PFD	SWEL

Table 23: Summary of Coastal Transect Mapping Considerations

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	68	X	*	AE 1-8 VE 11	PFD	SWEL
	69	X	*	AE 0-6 VE 11	PFD	SWEL
	70	X	*	AE 1-6 VE 11	PFD	SWEL
	71	X	VE 14	AE 1-5 VE 11	PFD	SWEL
	72	X	AE 15 AO 15-15 VE 15	AE 6 AO 0-10 VE 11	PFD	SWEL
	73	X	AE 15 VE 15	AE 6 VE 11	PFD	SWEL
	74	X	AE 15 VE 15	AE 0-5 VE 11	PFD	SWEL
	75	X	AE 16 VE 16	AE 0-5 VE 11	PFD	SWEL
	76	X	*	AE 6 VE 11	PFD	SWEL
	77	X	*	AE 8 VE 11	PFD	SWEL
	78	*	*	VE 11	WHAFIS	SWEL
	111	*	*	AE 1-6 VE 10	WHAFIS	*
Cape Fear River	79	*	*	AE 1-4 VE 3-4	WHAFIS	SWEL
	80	*	*	AE 1-3 VE 3-4	WHAFIS	SWEL
	81	*	*	AE 0-3 VE 3-4	WHAFIS	SWEL
	82	*	*	AE 4 VE 3-4	WHAFIS	SWEL
	83	*	*	AE 0-3 VE 3-4	WHAFIS	SWEL
	84	*	*	AE 1-4 VE 3-4	WHAFIS	SWEL
	85	*	*	AE 0-3 VE 3-4	WHAFIS	SWEL
	86	*	*	AE 4 VE 3-5	WHAFIS	SWEL

Table 23: Summary of Coastal Transect Mapping Considerations

Source	Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
			Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
	87	*	*	AE 4 VE 3-4	WHAFIS	SWEL
	88	*	*	AE 4 VE 3-4	WHAFIS	SWEL
	89	*	*	AE 0-4 VE 3-4	WHAFIS	SWEL
	90	*	*	AE 1-4 VE 3-4	WHAFIS	SWEL
	91	*	*	AE 0-4 VE 3-4	WHAFIS	SWEL
	92	*	*	AE 0-4 VE 3-4	WHAFIS	SWEL
	93	*	*	AE 4 VE 3-4	WHAFIS	SWEL

A LiMWA boundary has also been added in coastal areas subject to wave action for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. In areas where the Zone VE designation is based on the presence of a primary frontal dune the LiMWA was not delineated.

7.0 Revising the FIS

7.1 Letters of Map Amendment and Letters of Map Revision - Based on Fill

LOMAs and LOMR-Fs are documents issued by FEMA that officially remove a property and/or a structure from a Special Flood Hazard Area (SFHA), if data supporting the removal are submitted. LOMAs and LOMR-Fs are generally determinations regarding areas that are too small to be shown on a FIRM panel; consequently, the changes they describe become official without revising the FIRM or the FIS Report.

NFIP regulations require that the lowest adjacent grade (the lowest ground touching the structure) be at or above the 1% annual chance flood elevation for a LOMA to be issued. Currently, there is no fee for FEMA’s review of a LOMA request, but the requester of a LOMA is responsible for providing all the information needed for the review, which may include structure and/or property elevations certified by a licensed land surveyor or professional engineer. Therefore, LOMA requesters may need to retain the services of a land surveyor or engineer.

A LOMA cannot be used for property on which fill has been placed. For those situations, a LOMR-F must be used. As a participant in the NFIP, a local government must adopt ordinances that meet the minimum Federal floodplain management standards, which are outlined in Section 60.3 of the NFIP regulations. For a number of reasons, these ordinances generally vary from community to community. Nonetheless, because the placement of fill within the floodplain can affect flood hazards in the surrounding area, additional information is needed before FEMA can process a LOMR-F request. Among the data required for a LOMR-F is the community acknowledgment form. This form is FEMA’s assurance that all appropriate Federal, State, and local floodplain management requirements have been met. Furthermore, NFIP regulations require that the lowest adjacent grade (the lowest ground touching the structure) be at or above the 1% annual chance flood elevation for a LOMR-F to be issued removing the structure from the floodplain.

Because LOMR-F requests are the result of changed physical conditions rather than limitations of scale or topographic definition, FEMA charges a fee for the review of a LOMR-F request. As with the LOMA, the requester of a LOMR-F is responsible for providing all supporting information, including structure and/or property elevation data.

In cases where property owners plan to add fill in the SFHA, NFIP regulations require plans and technical information to be submitted for review by FEMA before construction takes place. FEMA will issue a conditional LOMR-F stating how flood hazards would change and what portions of the property, if any, would remain in the SFHA if the project were built according to the submitted plans.

The issuance of a LOMA or LOMR-F ends the property owner's obligation to purchase flood insurance as a condition of Federal or federally backed financing. However, the property owner's mortgage company maintains the prerogative to require flood insurance as a condition of providing financing. Before attempting to obtain a LOMA or LOMR-F, property owners are advised to consult their mortgage companies regarding this policy. Even if the mortgage company indicates that it will require flood insurance if a LOMA or LOMR-F is issued, it may be advantageous for property owners to request a LOMA or LOMR-F because flood insurance premiums are lower for properties removed from the SFHA than for properties that remain within the SFHA.

For additional information regarding LOMAs, LOMR-Fs, conditional LOMR-Fs, or current application fees, please call the FEMA Map Information eXchange (FMIX) toll-free information line at 1-877-FEMA MAP (1-877-336-2627).

7.2 Letters of Map Revision

A Letter of Map Revision (LOMR) is a document issued by FEMA and the NCFMP that revises an FIS Report and/or FIRM. A LOMR is used to change flood risk zones, floodplain and/or floodway delineations, flood elevations, or planimetric features such as road systems or corporate limits. A LOMR provides FEMA and the NCFMP with a cost-effective means of revising the FIS information without physically changing and reprinting the map or report itself. A portion of the FIRM panel or FIS Report showing the revised information is issued with the LOMR. The LOMR is sent to all affected communities and is archived in the communities' NFIP map repository for public reference.

In cases where a proposed project (such as construction in the 1% annual chance floodplain) would result in a significant rise in 1% annual chance water-surface elevations, NFIP regulations require the community to submit plans and technical information for review by FEMA and the NCFMP before construction takes place. This assures communities participating in the NFIP that proposed projects meet minimum NFIP requirements. The result of FEMA and the NCFMP reviews is documented in a conditional LOMR.

For additional information regarding LOMRs, conditional LOMRs, or current application fees, please call the FEMA Map Assistance Center toll-free information line at 1-877-FEMA MAP (1-877-336-2627) or the NCFMP at 919-715-5711.

7.3 Physical Map Revisions

Physical Map Revisions (PMRs) are processed to incorporate information concerning conditions present in the community that are not reflected in the FIS, and involve distributing republished FISs that supersede the most current NFIP data in the community repository. PMRs may be initiated by a request from a community resident or agency, or FEMA may initiate a PMR to incorporate one or more LOMRs, to reflect significant changes in corporate limits, to correct errors, or to update flood hazards to match new information from an adjacent community's FIS. Due to the costs associated with updating and distributing FISs, map revisions will be processed as LOMRs rather than PMRs whenever possible. For more information regarding PMRs, please contact the FEMA Map Information eXchange (FMIX) toll-free information line at 1-877-FEMA MAP (1-877-336-2627), the FEMA Regional Office at the address listed on the Notice to Flood Insurance Study Users page at the front of this report, or the NCFMP at 919-715-5711.

7.4 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards in a given community. FEMA accomplishes this through a national mapping needs assessment process that assigns priorities and allocates funds to sponsor or subsidize new flood hazard analyses used to update FIS Reports. For map maintenance restudies within the state of North Carolina, scoping will be performed by county approximately 2.5-3.5 years after the previous effective date. Scoping will focus on streams with restudy needs within those previously effective counties rather than on full countywide restudies. A restudy refers specifically to updating or reevaluating engineering analyses that were performed for a flood mapping project that directly impact BFEs and/or flood hazard boundary extents or analysis of previously unstudied flood prone areas. Restudy project evaluation triggers and prioritization values are an essential component of the map maintenance program. For more information regarding NCFMP-contracted restudies, please contact the NCFMP at 919-715-5711 or at www.ncfloodmaps.com. For more information regarding FEMA-contracted restudies, please contact the FEMA Map Information eXchange (FMIX) toll-free information line at 1-877-FEMA MAP(1-877-336-2627) or the FEMA Regional Office at the address listed on the Notice to Flood Insurance Study Users page at the front of this report.

7.5 Map Revision History

The current FIRM is a subset of the Statewide FIRM, showing flood hazard information for the entire geographic area of New Hanover County. Previously, separate Flood Hazard Boundary Maps (FHBMs), Flood Boundary and Floodway Maps (FBFMs), and/or FIRMs were prepared for each identified flood prone jurisdiction within the county. Historical data relating to the NFIP maps prepared for each community prior to and including the 4/3/2006 North Carolina Statewide FIRM, which includes New Hanover County, are presented in Table 22, “Community Map History.”

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

Table 24 - Map Revision History

Community	Initial Identification Date	Initial FIRM Effective Date	FIS Revision Date
CITY OF WILMINGTON	3/1/1974	4/17/1978	04/03/2006
NEW HANOVER COUNTY	7/17/1978	7/17/1978	04/03/2006
TOWN OF CAROLINA BEACH	5/26/1972	5/2/1975	04/03/2006
TOWN OF KURE BEACH	2/15/1974	1/6/1982	04/03/2006
TOWN OF WRIGHTSVILLE BEACH	6/12/1970	6/12/1970	04/03/2006

8.0 Study Contracting and Community Coordination

8.1 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 revises and updates the previous countywide FIS for the geographic area of New Hanover County and Incorporated Areas. Table 25, “Authority and Acknowledgments,” includes information for the previous countywide FIS and for this revision. This table also includes information for the single-jurisdiction FISs published for each community included in this countywide FIS (if available) as compiled from their previously printed FIS Reports

Table 25 — Authority and Acknowledgments

Community	FIS Dated	Study Contracted By	Data Source	Contract or IAA Number	Work Completed In
CITY OF WILMINGTON	4/3/2006	NCFMP	NCFMP	286-000022	2/5/2014
CITY OF WILMINGTON	4/3/2006	NCFMP	NCFMP	286-0000-23	8/8/8888
NEW HANOVER COUNTY	4/3/2006	NCFMP	NCFMP	286-000022	2/5/2014
NEW HANOVER COUNTY	4/3/2006	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF CAROLINA BEACH	4/3/2006	NCFMP	NCFMP	286-000022	2/5/2014
TOWN OF CAROLINA BEACH	4/3/2006	NCFMP	NCFMP	286-0000-23	8/8/8888
TOWN OF KURE BEACH	4/3/2006	NCFMP	NCFMP	286-000022	2/5/2014
TOWN OF KURE BEACH	4/3/2006	NCFMP	NCFMP	286-0000-23	8/8/8888

Table 25 — Authority and Acknowledgments

Community	FIS Dated	Study Contracted By	Data Source	Contract or IAA Number	Work Completed In
TOWN OF WRIGHTSVILLE BEACH	4/3/2006	NCFMP	NCFMP	286-000022	2/5/2014
TOWN OF WRIGHTSVILLE BEACH	4/3/2006	NCFMP	NCFMP	286-0000-23	8/8/8888

This FIS Report was produced through a unique cooperative partnership between the State of North Carolina and FEMA. The State of North Carolina, through FEMA's Cooperating Technical Partner (CTP) Initiative, has become the first Cooperating Technical State (CTS) and will assume primary ownership of the NFIP FIRM panels for all North Carolina communities. This role has traditionally been fulfilled by FEMA. The North Carolina Floodplain Mapping Program is conducting flood hazard analyses and producing updated, digital FIRM panels. The hydrologic and hydraulic analyses and the FIRM panels for the initial statewide mapping for New Hanover County were produced by NCFMP under contract with the State of North Carolina and issued on effective 8/29/2014. For this revision, the hydrologic and hydraulic analyses and the FIRM panels were produced by NCFMP, under contract with the State of North Carolina.

8.2 Consultation Coordination Officer's Meetings/Scoping Meetings

In general, for each FIS an initial Consultation Coordination Officer's (CCO) meeting is held with representatives from FEMA, the communities, and the study contractors to explain the nature and purpose of the FIS and to identify the streams to be studied by detailed methods. A final CCO meeting is held with representatives from FEMA, the communities, and the study contractors to review the results of the study

The dates of the initial and final CCO meetings held for New Hanover County and Incorporated Areas were compiled from the previous countywide FIS Report and are shown in Table 26, "Consultation Coordination Officer's Meetings

Table 26 — Consultation Coordination Officer's Meetings

Community	For FIS Dated	Initial CCO Date	Attended By	Final CCO Date	Attended By
CITY OF WILMINGTON	11/4/1987	12/5/1974	Representatives of the FIA, the community, and local residents	5/15/1985	Representatives of the study contractor, FEMA, and the community
NEW HANOVER COUNTY	4/15/1986	12/5/1974	FEMA, the U.S. Army Corps of Engineers, community officials and local residents	5/15/1985	Representatives of the study contractor, FEMA, and the community

For each FIS produced during the initial phase of statewide, an Initial Scoping Meeting was held with representatives from FEMA, the county, the incorporated communities, and the State of North Carolina. A Final Scoping meeting was held to review the Draft Basin Plan and finalize the streams to be studied by detailed methods. This information was then used to create the Final Basin Plan.

For map maintenance revisions, only one scoping meeting was held to identify the streams to be newly studied by detailed methods, redelineated, or to be studied by limited detailed methods. This information was then used to create the Map Maintenance Plan.

The historical dates of the Initial and Final Scoping Meetings held during the first round of statewide mapping for New Hanover County are shown in Table 27, "Scoping Meetings." Meetings held for the map maintenance revision are also included below for New Hanover County.

Table 27 — Scoping Meetings

Community	Riverbasin	Initial Scoping Date	Attended By	Final Scoping Date	Attended By
CITY OF WILMINGTON	CAPE FEAR	12/5/2000	County Officials, FEMA, NCDOT, U.S.A.C.E, Wilmington District, NC Sea Grant, and Dewberry	3/8/2001	County Officials, FEMA, NCDOT, U.S.A.C.E, Wilmington District, NC Sea Grant, and Dewberry
NEW HANOVER COUNTY	CAPE FEAR	12/5/2000	County Officials, FEMA, NCDOT, U.S.A.C.E, Wilmington District, NC Sea Grant, and Dewberry	3/8/2001	County Officials, FEMA, NCDOT, U.S.A.C.E, Wilmington District, NC Sea Grant, and Dewberry
TOWN OF KURE BEACH	CAPE FEAR	12/6/2000	County Officials, FEMA, NCDOT, U.S.A.C.E, Wilmington District, NC Sea Grant, and Dewberry	3/8/2001	County Officials, FEMA, NCDOT, U.S.A.C.E, Wilmington District, NC Sea Grant, and Dewberry

Table 27 — Scoping Meetings

Community	Riverbasin	Initial Scoping Date	Attended By	Final Scoping Date	Attended By
TOWN OF WRIGHTSVILLE BEACH	CAPE FEAR	12/6/2000	County Officials, FEMA, NCDOT, U.S.A.C.E, Wilmington District, NC Sea Grant, and Dewberry	3/8/2001	County Officials, FEMA, NCDOT, U.S.A.C.E, Wilmington District, NC Sea Grant, and Dewberry

Preliminary Meetings are held in each county to disseminate and review the FIS Report and FIRM panels. This meeting is required by FEMA. Public Participation Meetings are not required by FEMA, but provide an opportunity to review and discuss the FIS Report and FIRM panels for each jurisdiction in a public setting. The dates for the preliminary and public participation meetings are shown in Table 28, "Preliminary and Public Participation Meetings."

Table 28 — Preliminary and Public Participation Meetings

Community	For FIS Dated	Meeting Location	Preliminary Meeting Date	Attended By	Public Meeting Date	Attended By
CITY OF WILMINGTON	4/3/2006	City of Wilmington	5/12/2005	NCFMP, New Hanover County Officials, Study Contractor, USACE Wilmington, Kure Beach, Carolina Beach	6/15/2005	The Public

9.0 Guide to Additional Information

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see http://www.fema.gov.

The Map Repositories table below lists locations where FIRMs for New Hanover County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 27 — Map Repositories

Community	Address	City	State	Zip Code
New Hanover County	New Hanover County Development Services Office, 230 Government Center Drive, Suite 110	Wilmington	NC	28403
Town of Carolina Beach	Carolina Beach Town Hall, Planning Department, 1121 North Lake Park Blvd	Carolina Beach	NC	28428
Town of Kure Beach	Kure Beach Town Hall, Building Inspections, 117 Settlers Lane	Kure Beach	NC	28449
City of Wilmington	Wilmington Planning, Development, and Trans. Dept., Planning Division, 305 Chestnut Street	Wilmington	NC	28401
Town of Wrightsville Beach	Wrighstville Beach Town Hall, Planning and Parks Department, 321 Causeway Drive	Wrightsville Beach	NC	28480

9.1 Additional Information

All FIRM panels created for the State of North Carolina are produced in a seamless statewide format; however, FIS Reports are produced for individual counties.

Copies of FIRM panels are available for a nominal fee. To obtain a copy of the current flood map for a specific community, contact the FEMA Map Service Center at 1-800-358-9616. To facilitate the processing of your request, please review the current flood map on file at your local community repository and obtain the panel number in which you are interested. If necessary, users may also order a FIRM Index from the Map Service Center to determine the appropriate panel numbers. The Map Service Center also accepts orders for the Community Status Book and the Flood Insurance Manual. The FIS Report, FIRM panels, and digital data used to produce the FIRM panels are available online at www.ncfloodmaps.com.

Information concerning the data used in the preparation of this FIS, contained in an Engineering Study Data Package, may be obtained by contacting the FEMA Regional Office at the address listed on the Notice to Flood Insurance Study Users page at the front of this report.

Table 28, “Additional Information” is not applicable in New Hanover County.

10.0 Appendix

10.1 Bibliography

All bibliography and reference information associated within this Flood Insurance Study are maintained and accessible within the geodatabase structure and associated metadata. Users requiring more specific information should contact the North Carolina Floodplain Mapping Program (NCFMP) at www.ncfloodmaps.com under the Contacts menu