FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

A Report of Flood Hazards in

DARE COUNTY, NORTH CAROLINA AND INCORPORATED AREAS

Community Name	Community Number
DARE COUNTY	375348
TOWN OF DUCK	370632
TOWN OF KILL DEVIL HILLS	375353
TOWN OF KITTY HAWK	370439
TOWN OF MANTEO	375355
TOWN OF NAGS HEAD	375356
TOWN OF SOUTHERN SHORES	370430

NORTH CAROLINA
Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

REVISED: 6/19/2020

Federal Emergency Management Agency

State of North Carolina

Flood Insurance Study Number

37055CV000B

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.

Flood Insurance Study (FIS) means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations, flood hazard risk zones, and other flood data in a community issued by the North Carolina Floodplain Mapping Program (NCFMP). The Flood Insurance Study (FIS) is comprised of the following products used together: the Digital Flood Hazard Database, the Water Surface Elevation Rasters, the digitally derived, autogenerated Flood Insurance Rate Map and the Flood Insurance Survey Report. A Flood Insurance Survey is a compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. This report contains detailed flood elevation data, data tables and FIRM indices. When a flood study is complete for the National Flood Insurance Program (NFIP), the digital information, reports and maps are assembled into a FIS. Information shown on in the FIS is provided in digital format by the NCFMP.

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 North Carolina Floodplain Mapping Program. It is advisable to use www.fris.nc.gov/fris or 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
9/20/2006	Initial Statewide FIS Report Effective Date
6/19/2020	A Portion of the County Received New H&H Analysis

This FIS has been produced as part of the North Carolina Floodplain Mapping Program. Dare 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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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 Dare County and the jurisdictions therein (hereinafter referred to collectively as Dare 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 Dare County, North Carolina, including the jurisdictions listed in Table 1.

Table 1 - Jurisdictions in Dare County

Community	Included in this FIS	If Not Included, Location of Flood Hazard/Flood Insurance Rate Data
DARE COUNTY	Yes	
TOWN OF DUCK	Yes	
TOWN OF KILL DEVIL HILLS	Yes	
TOWN OF KITTY HAWK	Yes	
TOWN OF MANTEO	Yes	
TOWN OF NAGS HEAD	Yes	
TOWN OF SOUTHERN SHORES	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 Dare became Effective on 9/20/2006. Refer to Table 24 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)

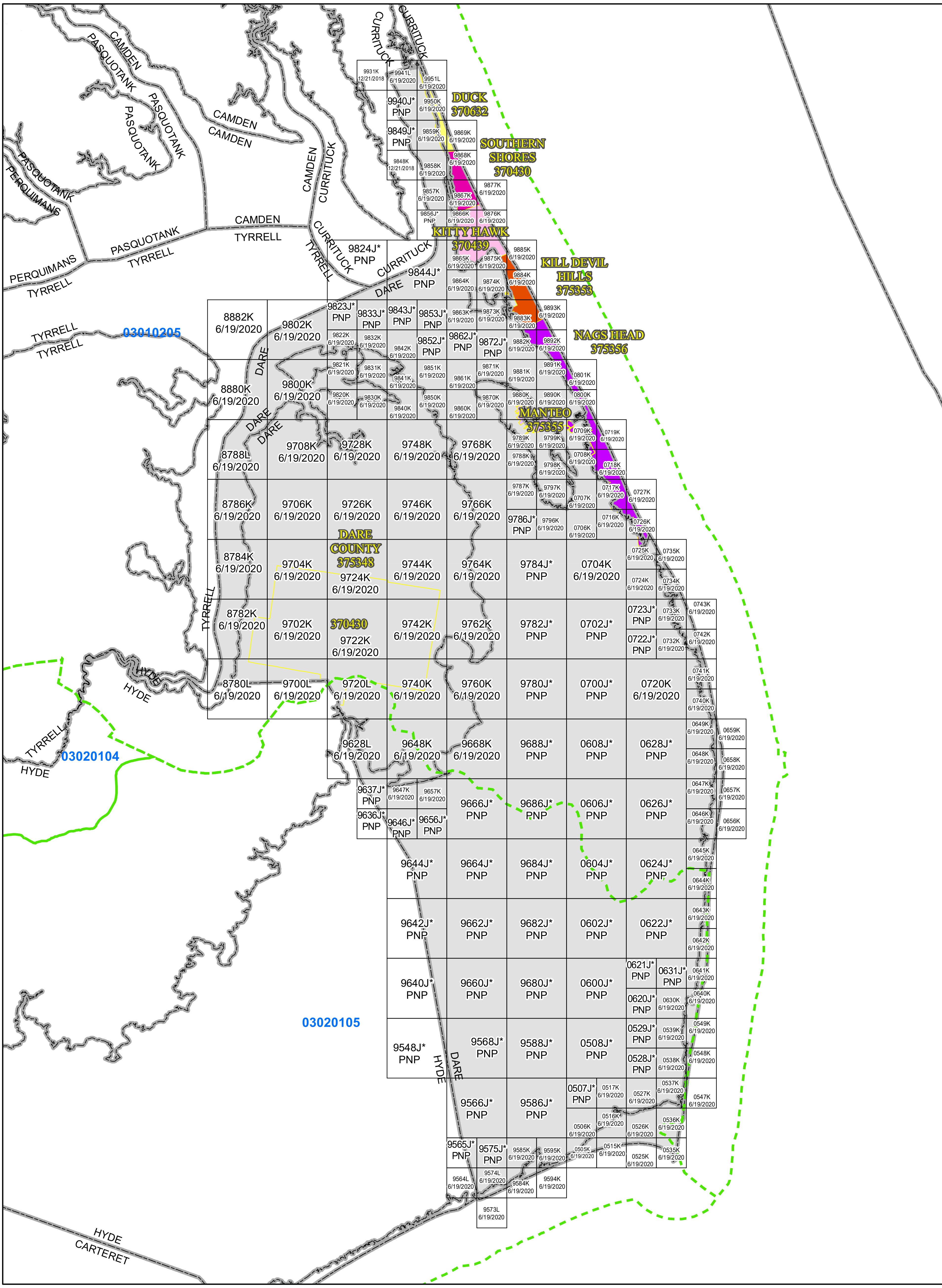
FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by 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.



1 in = 6 miles

0 0.5 1 2 3 Miles

Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

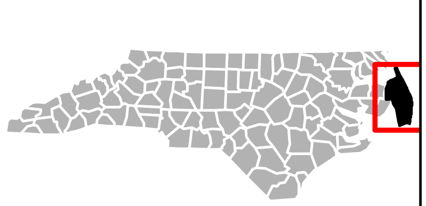
The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels previously issued under the North Carolina Seamless paneling scheme

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

HTTPS://FRIS.NC.GOV/FRIS
HTTPS://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION
*PANEL NOT PRINTED

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

DARE COUNTY, NORTH CAROLINA And Incorporated Areas

PANELS PRINTED:
0505, 0506, 0515, 0516, 0517, 0525, 0526, 0527, 0535, 0536, 0537, 0538, 0539, 0547, 0548, 0549, 0630, 0640, 0641, 0642, 0643, 0644, 0645, 0646, 0647, 0648, 0649, 0656, 0657, 0658, 0659, 0704, 0706, 0707, 0708, 0709, 0716, 0717, 0718, 0719, 0720, 0724, 0725, 0726, 0727, 0732, 0733, 0734, 0735, 0740, 0741, 0742, 0743, 0800, 0801, 8780, 8782, 8784, 8786, 8788, 8880, 8882, 9564, 9573, 9574, 9584, 9585, 9594, 9595, 9628, 9647, 9648, 9657, 9668, 9700, 9702, 9704, 9706, 9708, 9720, 9722, 9724, 9726, 9728, 9740, 9742, 9744, 9746, 9748, 9760, 9762, 9764, 9766, 9768, 9787, 9788, 9789, 9796, 9797, 9798, 9799, 9800, 9802, 9820, 9821, 9822, 9830, 9831, 9832, 9840, 9841, 9842, 9844, 9848, 9850, 9851, 9857, 9858, 9859, 9860, 9861, 9863, 9864, 9865, 9866, 9867, 9868, 9869, 9870, 9871, 9873, 9874, 9875, 9876, 9877, 9880, 9881, 9882, 9883, 9884, 9885, 9890, 9891, 9892, 9893, 9931, 9941, 9950, 9951

FEMA

MAP NUMBER
37055CIND0B

MAP REVISED
June19,2020

Figure 1 - FIRM Index

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 2, "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.

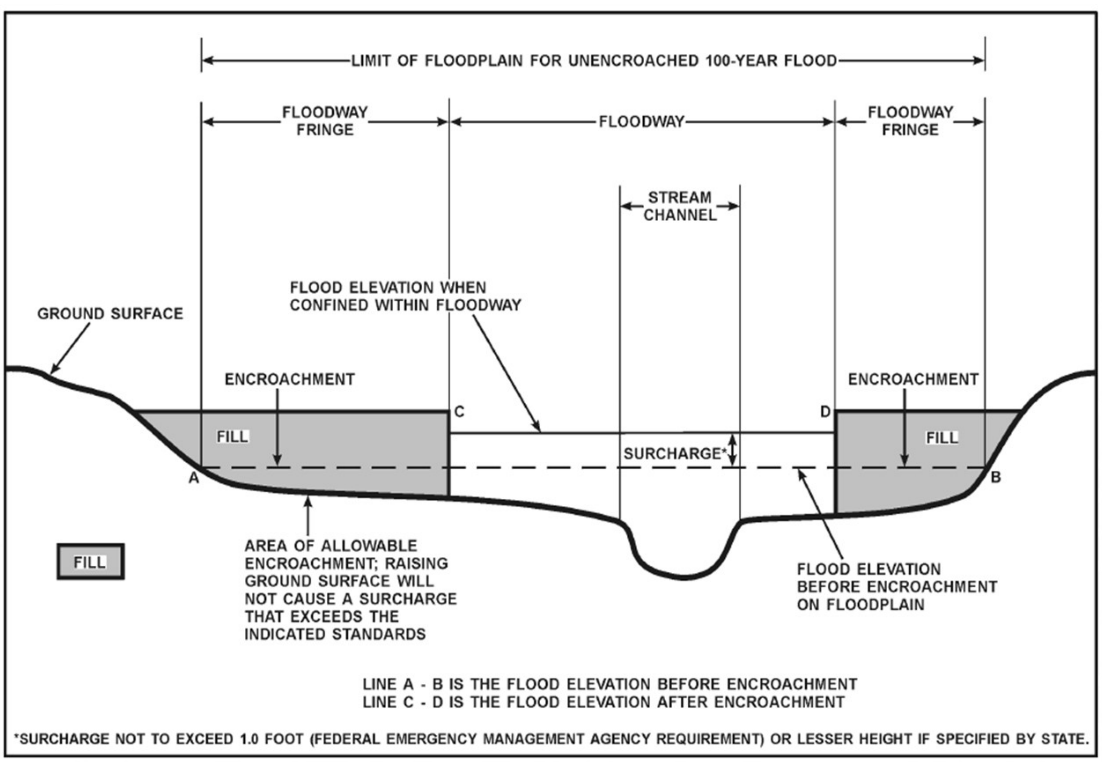


Figure 2- Floodway Schematic

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 exceedance) 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 18.

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.

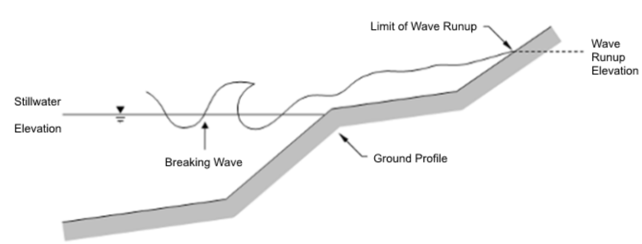


Figure 3: Wave Runup Transect Schematic

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.

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 18 and 18P presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Coastal BFE's are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

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 Figure 5, "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 4, “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.

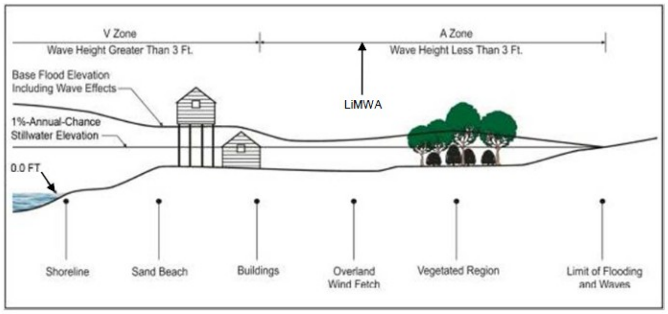


Figure 4: Coastal Transect Schematic

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.

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 4.

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.

4.0 Area Studied

Dare County is found in the Coastal Plain region of North Carolina. It is surrounded by Currituck County to the north, Atlantic Ocean to the east and south, and Hyde and Tyrrell Counties to the west.

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)
Albemarle	03010205	Albemarle Sound	The Albemarle Basin covers the Albemarle Sound and surrounding drainage areas along the northeast North Carolina coast and into southeastern Virginia. The Albemarle Sound begins where Roanoke River and Chowan River join in eastern Bertie County.	4,323
Pamlico Sound	03020105	Pamlico Sound	The Pamlico Sound Basin includes coastal regions of Carteret, Dare, Hyde, and Pamlico Counties. The Neuse River and Pamlico River both end in the Pamlico Sound.	1,952

4.2 Principal Flood Problems

Table 4, "Principal Flood Problems" contains a list of principal flooding problems in Dare County.

Table 4 - Principal Flood Problems

Flooding Source	Problem
All Sources	North Carolina experiences hurricanes, tropical storms, and severe extratropical cyclones, usually referred to as "northeasters." Unlike a hurricane, which may pass over a coastal location in a fraction of a day, a northeaster may blow from the same dir
All Sources	North Carolina experiences hurricanes, tropical storms, and severe extratropical cyclones, usually referred to as "northeasters." Unlike a hurricane, which may pass over a coastal location in a fraction of a day, a northeaster may blow from the same direction and over long distances for several days (Simon Baker, 1978). The contribution from northeasters to the overall storm-surge elevation in the Dare County area was found to be significant. The dominant source of flooding in Dare County is storm surge generated in the Atlantic Ocean by tropical storms and hurricanes. In addition, this surge propagates into Pamlico Sound and Albemarle Sound and further propagates into the Alligator River, Croatan Sound, Currituck Sound, Davis Channel, East Lake, Old House Channel, Roanoke Sound, and South Lake, where high winds associated with tropical storms may produce high waves. The wave action associated with storm surge can be more damaging than the higher water level. Not all storms which pass near the study area produce extremely high surge. Similarly, storms which produce flooding conditions in one area may not necessarily produce flooding conditions in other parts of the study area.

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.

Hurricane Bertha
(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" is not applicable in Dare County.

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" is not applicable in Dare County.

Table 7, "Levees" is not applicable in Dare County.

4.5 Scope of Study

For this map maintenance revision, a scoping meeting was held in Dare 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 Dare 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 Dare 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 8, “Flooding Sources Studied by Detailed Methods: Revised or Newly Studied” is not applicable in Dare County.

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

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

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

Table 12, "Letters of Map Revision” is not applicable in Dare 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.

Table 13, "Summary of Discharges" is not applicable in Dare County.

Table 14, "Summary of Stillwater Elevations" is not applicable in Dare County.

Table 15, "Gage Information" is not applicable in Dare 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.

Table 16, "Roughness Coefficients" is not applicable in Dare County.

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 Dare County.

5.3 Coastal Analyses

For the areas of Dare 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 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	Approximately 10.5 south of southern end of Oregon Inlet	Approximately 1,300 ft south of intersection of Bodie Island Lighthouse Road and NC State Road 12	*	*	*
Atlantic Ocean	Currituck, Dare County Border	Dare, Hyde County Border	*	2D WAVE MODEL	12/16/2011
Atlantic Ocean	Currituck, Dare County Border	Dare, Hyde County Border	*	ADCIRC	12/6/2011
Atlantic Ocean	Currituck, Dare County Border	Dare, Hyde County Border	*	CHAMP	*
Atlantic Ocean	Currituck, Dare County Border	Dare, Hyde County Border	*	RUNUP 2.0	8/19/2015
Atlantic Ocean	Currituck, Dare County Border	Dare, Hyde County Border	*	WHAFIS 4.0	8/19/2015
Atlantic Ocean	Hyde/Dare county line	Approximately 10.5 south of southern end of Oregon Inlet	*	*	*
Atlantic Ocean	The entire shoreline within the Pasquotank River Basin	The entire shoreline within the Pasquotank River Basin	*	*	*
Pamlico Sound	The entire shoreline within the Tar Pamlico river basin	The entire shoreline within the Tar Pamlico river basin	*	*	*

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 18. 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 Dare 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 5, “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 4 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 Approximately 10.5 south of southern end of Oregon Inlet**			**To Approximately 1,300 ft south of intersection of Bodie Island Lighthouse Road and NC State Road 12**		
Atlantic Ocean		**From Currituck, Dare County Border**			**To Dare, Hyde County Border**		
62	21.5	13.3	*	*	*	6.8	*
			*	*	*	3.8 - 6.7	4.8 - 8.0
67	22.3	11.5	*	*	*	6.7	*
			*	*	*	3.8 - 6.8	4.8 - 8.1

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
76	21.8	8.8	*	*	*	6.8	*
			*	*	*	3.8 - 6.8	4.8 - 8.1
82	21.5	8.6	*	*	*	6.8	*
			*	*	*	3.4 - 3.4	*
349	4.3	4.3	*	*	*	3.4	*
			*	*	*	3.3 - 3.5	4.2 - 4.4
351	4.5	4.5	*	*	*	3.4	*
			*	*	*	3.3 - 3.4	4.2 - 4.3
353	3.2	3.4	*	*	*	3.4	*
			*	*	*	3.3 - 3.4	4.2 - 4.3
344	1.4	2.5	*	*	*	3.4	*
			*	*	*	3.3 - 3.5	4.2 - 4.4
346	3.0	3.9	*	*	*	3.4	*
			*	*	*	3.6 - 3.7	4.6 - 4.6
304	2.9	3.7	*	*	*	3.7	*
			*	*	*	3.7 - 3.7	4.7 - 4.7
314	1.3	2.2	*	*	*	3.7	*
			*	*	*	3.6 - 3.6	4.6 - 4.6
319	3.2	3.6	*	*	*	3.6	*
			*	*	*	3.6 - 3.6	4.5 - 4.5
321	3.3	3.6	*	*	*	3.5	*
			*	*	*	3.5 - 3.5	4.5 - 4.5
323	3.1	3.8	*	*	*	3.6	*
			*	*	*	3.3 - 3.4	4.2 - 4.3
325	3.2	3.4	*	*	*	3.4	*
			*	*	*	3.3 - 3.4	4.2 - 4.3
348	2.5	3.0	*	*	*	3.5	*
			*	*	*	3.5 - 6.9	4.5 - 8.4
8	18.1	8.2	*	*	*	7.0	*
			*	*	*	3.5 - 7.0	4.5 - 8.4
10	18.8	9.8	*	*	*	7.0	*
			*	*	*	3.6 - 7.0	4.6 - 8.4
12	19.5	11.5	*	*	*	6.9	*
			*	*	*	3.6 - 8.4	4.6 - 8.5
21	22.2	17.5	*	*	*	7.0	*
			*	*	*	3.6 - 7.0	4.6 - 8.5
23	22.3	17.7	*	*	*	7.0	*
			*	*	*	3.6 - 7.0	4.6 - 8.4
25	22.3	17.7	*	*	*	7.0	*
			*	*	*	3.6 - 7.0	4.6 - 8.4
27	22.4	17.7	*	*	*	6.9	*
			*	*	*	3.6 - 7.0	4.6 - 8.4
29	22.4	17.7	*	*	*	6.9	*
			*	*	*	3.6 - 6.9	4.6 - 8.3
32	22.5	17.7	*	*	*	6.9	*
			*	*	*	3.6 - 6.9	4.7 - 8.3
34	22.5	17.7	*	*	*	6.9	*
			*	*	*	3.7 - 8.2	4.7 - 8.2
37	22.6	17.7	*	*	*	7.0	*
			*	*	*	3.6 - 7.0	4.7 - 8.3
41	23.1	16.8	*	*	*	7.0	*
			*	*	*	0.3 - 7.5	4.9 - 8.1
71	22.4	10.1	*	*	*	6.7	*
			*	*	*	6.7 - 8.0	8.0 - 8.0
73	22.1	9.2	*	*	*	6.7	*
			*	*	*	3.9 - 6.7	4.9 - 8.0
78	21.7	8.6	*	*	*	6.8	*
			*	*	*	3.9 - 6.5	4.9 - 7.8
162	21.2	13.1	*	*	*	5.4	*
			*	*	*	3.7 - 6.4	4.7 - 8.0

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
196	22.4	12.9	*	*	*	6.3	*
			*	*	*	3.6 - 6.3	4.6 - 8.0
198	22.9	12.7	*	*	*	6.4	*
			*	*	*	3.7 - 6.3	4.6 - 8.0
200	23.1	12.9	*	*	*	6.2	*
			*	*	*	3.7 - 6.2	4.7 - 8.0
223	22.4	9.9	*	*	*	6.4	*
			*	*	*	3.4 - 6.4	4.3 - 8.3
225	22.4	9.8	*	*	*	6.4	*
			*	*	*	3.4 - 6.4	4.3 - 8.2
227	22.3	9.8	*	*	*	6.4	*
			*	*	*	3.4 - 6.5	4.4 - 8.3
255	21.9	11.5	*	*	*	6.3	*
			*	*	*	3.3 - 5.6	4.3 - 8.2
262	20.1	14.4	*	*	*	5.6	*
			*	*	*	3.3 - 5.7	4.2 - 8.1
264	20.2	14.7	*	*	*	5.9	*
			*	*	*	3.3 - 6.0	4.2 - 8.1
266	20.4	14.8	*	*	*	6.0	*
			*	*	*	3.3 - 6.1	4.2 - 8.1
268	20.8	15.0	*	*	*	6.2	*
			*	*	*	3.4 - 6.3	4.2 - 8.1
270	21.2	15.0	*	*	*	6.3	*
			*	*	*	3.3 - 6.3	4.2 - 8.2
272	21.8	14.8	*	*	*	6.3	*
			*	*	*	3.4 - 6.3	4.2 - 8.2
274	21.9	14.6	*	*	*	6.3	*
			*	*	*	3.3 - 6.3	4.2 - 8.3
276	22.1	14.3	*	*	*	6.3	*
			*	*	*	3.2 - 6.4	4.1 - 8.3
278	22.1	14.2	*	*	*	6.4	*
			*	*	*	3.2 - 6.4	4.0 - 8.3
280	22.2	14.0	*	*	*	6.4	*
			*	*	*	3.2 - 6.5	4.0 - 8.4
282	22.4	13.9	*	*	*	6.6	*
			*	*	*	3.2 - 6.6	4.1 - 8.6
291	22.6	14.3	*	*	*	6.6	*
			*	*	*	3.3 - 6.7	4.1 - 8.6
293	22.8	14.4	*	*	*	6.7	*
			*	*	*	3.3 - 8.6	4.1 - 8.6
295	23.1	14.8	*	*	*	6.7	*
			*	*	*	3.2 - 6.7	4.1 - 8.7
297	23.5	15.1	*	*	*	6.7	*
			*	*	*	3.2 - 7.0	4.0 - 8.9
301	24.7	15.6	*	*	*	7.0	*
			*	*	*	3.2 - 7.2	4.0 - 9.1
327	3.4	3.5	*	*	*	3.3	*
			*	*	*	3.2 - 3.4	4.2 - 4.4
329	3.8	3.9	*	*	*	3.4	*
			*	*	*	3.3 - 3.4	4.2 - 4.4
331	4.3	3.9	*	*	*	3.4	*
			*	*	*	3.3 - 3.5	4.2 - 4.4
333	4.8	3.9	*	*	*	3.4	*
			*	*	*	3.3 - 3.5	4.2 - 4.4
335	5.5	4.4	*	*	*	3.4	*
			*	*	*	3.4 - 3.5	4.4 - 4.5
337	1.9	2.6	*	*	*	3.5	*
			*	*	*	3.5 - 3.5	4.4 - 4.5
339	5.4	5.0	*	*	*	3.4	*
			*	*	*	3.4 - 3.4	4.3 - 4.4

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
341	6.1	5.2	*	*	*	3.4	*
			*	*	*	3.4 - 3.4	4.4 - 4.4
343	2.7	2.8	*	*	*	3.4	*
			*	*	*	3.9 - 6.6	4.9 - 8.0
92	21.9	10.2	*	*	*	6.7	*
			*	*	*	3.8 - 6.7	4.9 - 8.0
94	22.9	10.1	*	*	*	6.7	*
			*	*	*	3.9 - 6.6	4.9 - 8.0
110	22.0	10.1	*	*	*	6.7	*
			*	*	*	3.8 - 3.8	4.7 - 4.7
307	2.1	2.6	*	*	*	3.8	*
			*	*	*	3.8 - 3.8	4.7 - 4.7
309	1.5	2.8	*	*	*	3.8	*
			*	*	*	3.8 - 3.8	4.7 - 4.7
311	1.1	1.9	*	*	*	3.8	*
			*	*	*	3.6 - 3.8	4.5 - 4.7
313	1.7	2.6	*	*	*	3.7	*
			*	*	*	3.7 - 3.7	4.6 - 4.7
316	1.4	2.6	*	*	*	3.7	*
			*	*	*	3.6 - 3.7	4.6 - 4.6
1	16.9	7.3	*	*	*	7.0	*
			*	*	*	3.5 - 7.1	4.5 - 8.5
3	17.4	7.4	*	*	*	7.0	*
			*	*	*	3.5 - 7.0	4.5 - 8.4
5	17.6	7.4	*	*	*	7.0	*
			*	*	*	3.5 - 6.9	4.5 - 8.4
13	19.8	12.2	*	*	*	6.9	*
			*	*	*	3.6 - 6.9	4.6 - 8.4
15	20.5	13.8	*	*	*	7.0	*
			*	*	*	3.6 - 7.0	4.6 - 8.4
17	21.1	15.3	*	*	*	7.0	*
			*	*	*	3.6 - 7.0	4.6 - 8.5
19	21.8	16.7	*	*	*	7.0	*
			*	*	*	3.6 - 6.9	4.6 - 8.3
36	22.6	17.7	*	*	*	7.0	*
			*	*	*	3.6 - 6.9	4.7 - 8.3
40	23.0	17.1	*	*	*	6.9	*
			*	*	*	3.6 - 7.0	4.7 - 8.3
43	23.4	15.3	*	*	*	7.0	*
			*	*	*	3.6 - 6.9	4.7 - 8.3
45	23.3	14.3	*	*	*	6.9	*
			*	*	*	3.6 - 6.9	4.7 - 8.3
47	23.1	13.4	*	*	*	6.9	*
			*	*	*	3.6 - 6.9	4.7 - 8.2
49	22.7	12.2	*	*	*	6.9	*
			*	*	*	3.6 - 6.9	4.7 - 8.2
51	22.2	11.8	*	*	*	6.9	*
			*	*	*	3.7 - 6.9	4.7 - 8.2
53	21.7	12.0	*	*	*	6.8	*
			*	*	*	3.7 - 6.9	4.7 - 8.3
55	21.6	12.2	*	*	*	6.9	*
			*	*	*	3.7 - 6.9	4.7 - 8.2
57	21.7	12.7	*	*	*	6.9	*
			*	*	*	3.8 - 6.8	4.7 - 8.2
59	21.5	13.2	*	*	*	6.8	*
			*	*	*	3.8 - 6.8	4.8 - 8.2
61	21.5	13.3	*	*	*	6.8	*
			*	*	*	3.8 - 6.8	4.8 - 8.1
64	21.9	12.8	*	*	*	6.7	*
			*	*	*	3.8 - 6.8	4.8 - 8.1

Table 20: Coastal Transect Parameters

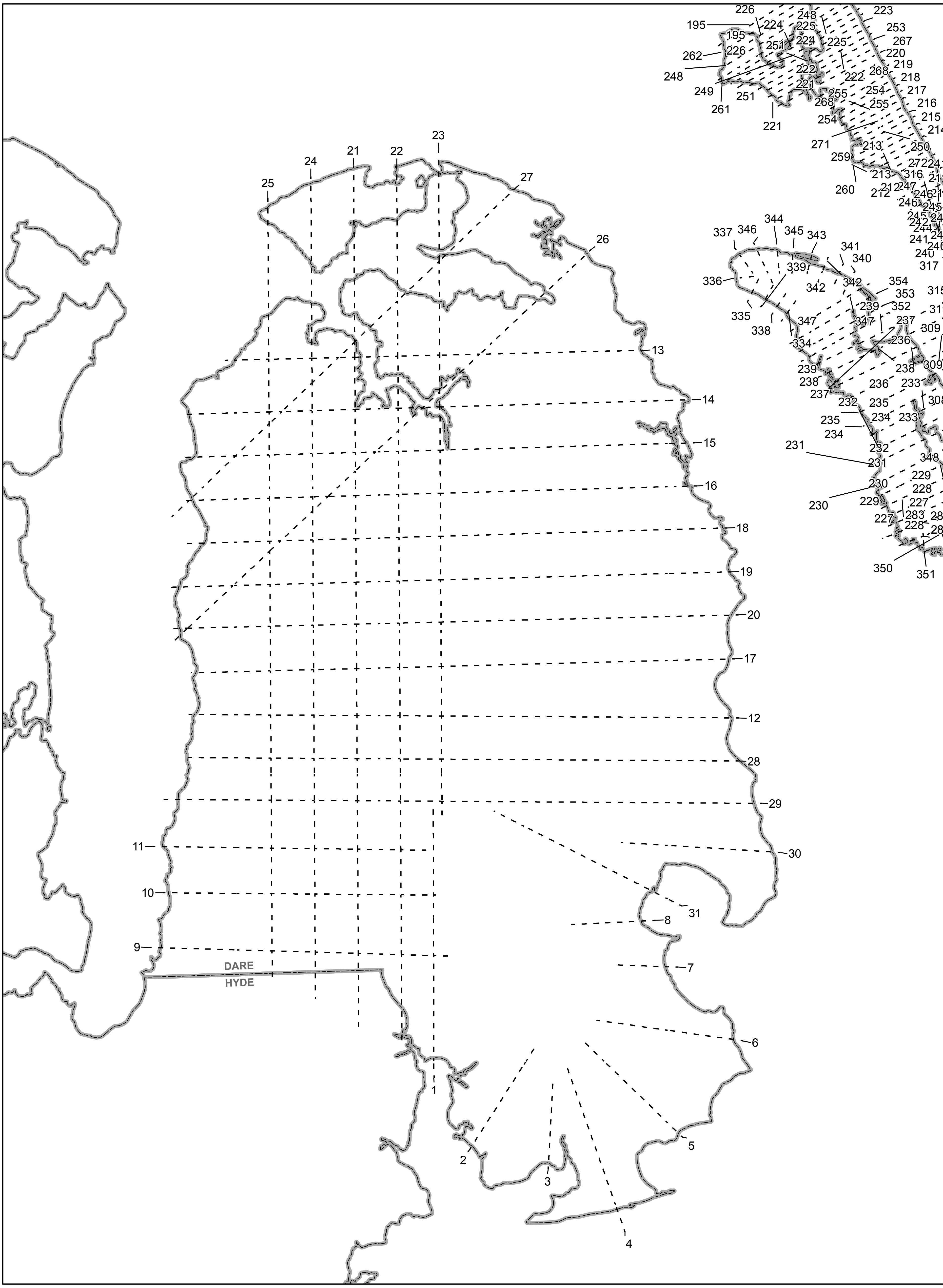
Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
69	22.4	10.8	*	*	*	6.7	*
			*	*	*	3.9 - 6.7	4.9 - 8.0
79	21.7	8.5	*	*	*	6.8	*
			*	*	*	3.7 - 6.8	4.7 - 8.1
81	21.7	8.4	*	*	*	6.8	*
			*	*	*	3.7 - 6.8	4.7 - 8.1
84	21.2	9.1	*	*	*	6.7	*
			*	*	*	3.8 - 6.7	4.8 - 8.0
86	21.1	9.5	*	*	*	6.7	*
			*	*	*	3.8 - 6.7	4.8 - 8.0
88	21.2	10.0	*	*	*	6.7	*
			*	*	*	3.9 - 6.6	4.9 - 8.0
91	21.5	10.2	*	*	*	6.7	*
			*	*	*	3.9 - 6.6	4.9 - 8.0
97	23.7	10.0	*	*	*	6.6	*
			*	*	*	3.9 - 6.6	4.9 - 7.9
99	24.0	9.8	*	*	*	6.6	*
			*	*	*	3.9 - 6.7	4.9 - 8.0
101	23.5	9.9	*	*	*	6.6	*
			*	*	*	3.9 - 6.6	4.9 - 8.0
103	23.1	10.0	*	*	*	6.6	*
			*	*	*	3.9 - 6.6	4.9 - 7.9
105	22.8	9.9	*	*	*	6.6	*
			*	*	*	3.9 - 6.6	4.9 - 8.0
107	22.4	10.0	*	*	*	6.7	*
			*	*	*	3.9 - 6.6	4.9 - 8.0
109	22.0	10.0	*	*	*	6.6	*
			*	*	*	3.9 - 6.8	4.9 - 8.1
112	21.9	10.2	*	*	*	6.7	*
			*	*	*	3.9 - 6.6	4.9 - 8.0
114	21.9	10.4	*	*	*	6.6	*
			*	*	*	3.9 - 6.6	4.9 - 7.9
116	21.9	10.5	*	*	*	6.5	*
			*	*	*	3.9 - 6.5	4.9 - 7.9
118	21.8	10.4	*	*	*	6.6	*
			*	*	*	3.8 - 6.7	4.8 - 8.0
120	21.7	10.1	*	*	*	6.7	*
			*	*	*	3.8 - 6.7	4.8 - 8.0
122	21.4	9.6	*	*	*	6.7	*
			*	*	*	3.6 - 6.6	4.5 - 8.0
124	21.2	9.2	*	*	*	6.7	*
			*	*	*	3.6 - 6.8	4.5 - 8.1
126	21.1	9.0	*	*	*	6.8	*
			*	*	*	3.6 - 6.7	4.6 - 8.1
128	21.0	8.9	*	*	*	6.7	*
			*	*	*	3.6 - 6.6	4.6 - 8.0
130	21.0	8.9	*	*	*	6.6	*
			*	*	*	3.6 - 6.5	4.6 - 7.9
132	21.1	9.0	*	*	*	6.6	*
			*	*	*	3.7 - 6.6	4.6 - 8.0
134	21.2	9.1	*	*	*	6.6	*
			*	*	*	3.6 - 6.6	4.6 - 8.0
136	21.2	9.4	*	*	*	6.6	*
			*	*	*	3.6 - 6.6	4.6 - 7.9
138	21.2	9.9	*	*	*	6.7	*
			*	*	*	3.6 - 6.7	4.6 - 8.0
140	21.1	10.5	*	*	*	6.7	*
			*	*	*	3.6 - 6.6	4.5 - 7.9
142	21.2	10.9	*	*	*	6.6	*
			*	*	*	3.6 - 6.6	4.5 - 7.9

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
144	21.4	11.4	*	*	*	6.7	*
			*	*	*	3.6 - 6.7	4.5 - 8.0
146	21.8	11.8	*	*	*	6.6	*
			*	*	*	3.6 - 6.6	4.5 - 7.9
148	22.4	12.2	*	*	*	6.6	*
			*	*	*	3.6 - 6.7	4.5 - 8.0
150	23.0	12.5	*	*	*	6.6	*
			*	*	*	3.6 - 6.5	4.5 - 8.0
152	23.3	12.6	*	*	*	6.6	*
			*	*	*	3.6 - 6.7	4.5 - 8.1
154	23.5	12.6	*	*	*	6.7	*
			*	*	*	3.8 - 6.6	4.8 - 7.9
156	23.3	12.5	*	*	*	6.6	*
			*	*	*	3.9 - 6.6	5.0 - 7.9
158	22.0	9.7	*	*	*	6.5	*
			*	*	*	4.0 - 6.6	5.1 - 8.0
160	23.7	10.6	*	*	*	6.8	*
			*	*	*	3.7 - 6.1	4.7 - 7.7
164	23.1	10.7	*	*	*	6.5	*
			*	*	*	3.7 - 6.4	4.6 - 7.9
166	22.0	12.1	*	*	*	6.4	*
			*	*	*	3.6 - 6.3	4.6 - 7.7
168	22.8	12.9	*	*	*	6.3	*
			*	*	*	3.6 - 6.1	4.7 - 7.5
170	23.3	11.6	*	*	*	6.2	*
			*	*	*	3.7 - 6.2	4.6 - 7.6
172	23.9	10.5	*	*	*	6.1	*
			*	*	*	3.7 - 6.2	4.7 - 7.6
174	24.7	12.9	*	*	*	6.1	*
			*	*	*	3.6 - 6.2	4.6 - 7.8
176	25.6	14.2	*	*	*	6.2	*
			*	*	*	3.7 - 6.1	4.7 - 7.6
178	24.6	13.9	*	*	*	6.1	*
			*	*	*	3.7 - 6.1	4.7 - 7.6
180	23.9	14.0	*	*	*	6.0	*
			*	*	*	3.8 - 6.0	4.7 - 7.6
182	23.1	14.2	*	*	*	6.1	*
			*	*	*	3.8 - 6.1	4.8 - 7.6
184	22.1	14.3	*	*	*	6.1	*
			*	*	*	3.9 - 6.0	4.8 - 7.6
186	21.8	14.3	*	*	*	5.5	*
			*	*	*	3.9 - 6.1	4.8 - 7.7
188	21.6	14.4	*	*	*	6.1	*
			*	*	*	3.8 - 6.1	4.8 - 7.8
190	21.4	14.4	*	*	*	6.2	*
			*	*	*	3.7 - 6.1	4.7 - 7.8
192	21.6	14.0	*	*	*	6.2	*
			*	*	*	3.7 - 6.3	4.7 - 7.9
194	22.0	13.3	*	*	*	6.3	*
			*	*	*	3.7 - 6.3	4.6 - 8.0
203	23.7	12.9	*	*	*	6.3	*
			*	*	*	3.6 - 6.3	4.5 - 8.1
205	23.9	12.8	*	*	*	6.3	*
			*	*	*	3.6 - 6.3	4.6 - 8.0
207	24.1	12.8	*	*	*	6.3	*
			*	*	*	3.6 - 6.4	4.6 - 8.2
209	24.1	12.8	*	*	*	6.4	*
			*	*	*	3.5 - 6.3	4.5 - 8.1
211	23.5	12.1	*	*	*	6.4	*
			*	*	*	3.5 - 6.5	4.5 - 8.3

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
213	24.0	11.6	*	*	*	6.4	*
			*	*	*	3.5 - 6.3	4.5 - 8.1
215	24.7	11.2	*	*	*	6.3	*
			*	*	*	3.6 - 6.3	4.5 - 8.2
217	25.0	11.0	*	*	*	6.3	*
			*	*	*	3.4 - 6.3	4.4 - 8.1
219	24.2	11.1	*	*	*	6.3	*
			*	*	*	3.4 - 6.4	4.4 - 8.1
221	23.0	10.2	*	*	*	6.1	*
			*	*	*	3.4 - 6.3	4.4 - 8.2
229	22.4	9.9	*	*	*	6.5	*
			*	*	*	3.5 - 6.5	4.4 - 8.2
231	22.5	10.1	*	*	*	6.4	*
			*	*	*	3.5 - 6.4	4.4 - 8.2
233	22.6	10.3	*	*	*	6.4	*
			*	*	*	3.5 - 6.4	4.4 - 8.2
235	22.6	10.7	*	*	*	6.4	*
			*	*	*	3.5 - 6.4	4.4 - 8.2
237	22.6	10.8	*	*	*	6.3	*
			*	*	*	3.4 - 6.3	4.4 - 8.1
239	22.6	11.1	*	*	*	6.3	*
			*	*	*	3.4 - 6.3	4.3 - 8.1
241	22.5	11.4	*	*	*	6.3	*
			*	*	*	3.4 - 6.3	4.3 - 8.1
243	22.5	11.7	*	*	*	6.3	*
			*	*	*	3.4 - 6.4	4.4 - 8.2
245	22.5	11.9	*	*	*	6.4	*
			*	*	*	3.5 - 6.4	4.4 - 8.2
247	22.3	11.4	*	*	*	6.4	*
			*	*	*	3.5 - 6.4	4.4 - 8.1
249	22.2	11.3	*	*	*	6.4	*
			*	*	*	3.4 - 6.5	4.4 - 8.0
251	21.9	11.0	*	*	*	6.4	*
			*	*	*	3.4 - 6.3	4.4 - 8.1
253	21.9	11.2	*	*	*	6.3	*
			*	*	*	6.2 - 6.3	4.3 - 8.1
256	21.8	11.7	*	*	*	6.3	*
			*	*	*	6.3 - 6.4	8.1 - 8.2
258	21.1	11.6	*	*	*	6.3	*
			*	*	*	5.5 - 6.3	7.3 - 8.1
260	20.2	14.1	*	*	*	5.5	*
			*	*	*	3.2 - 6.6	4.1 - 8.5
284	22.6	14.0	*	*	*	6.6	*
			*	*	*	3.2 - 6.5	4.0 - 8.5
286	22.6	14.0	*	*	*	6.6	*
			*	*	*	3.1 - 6.6	4.0 - 8.5
288	22.7	14.0	*	*	*	6.6	*
			*	*	*	3.2 - 6.6	4.1 - 8.6
298	23.6	15.2	*	*	*	6.9	*
			*	*	*	3.2 - 6.9	4.1 - 8.9
Atlantic Ocean		**From Hyde/Dare county line**			**To Approximately 10.5 south of southern end of Oregon Inlet**		
Atlantic Ocean		**From The entire shoreline within the Pasquotank River Basin**			**To The entire shoreline within the Pasquotank River Basin**		
Pamlico Sound		**From The entire shoreline within the Tar Pamlico river basin**			**To The entire shoreline within the Tar Pamlico river basin**		



1 in = 2.5 miles

0 0.5 1 2 3 Miles

Map Projection:
Lambert Conformal Conic
North American Datum 1983

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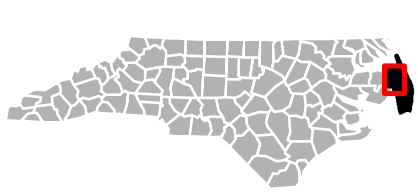
COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP

DARE COUNTY, NORTH CAROLINA

PANELS WITH TRANSECTS:

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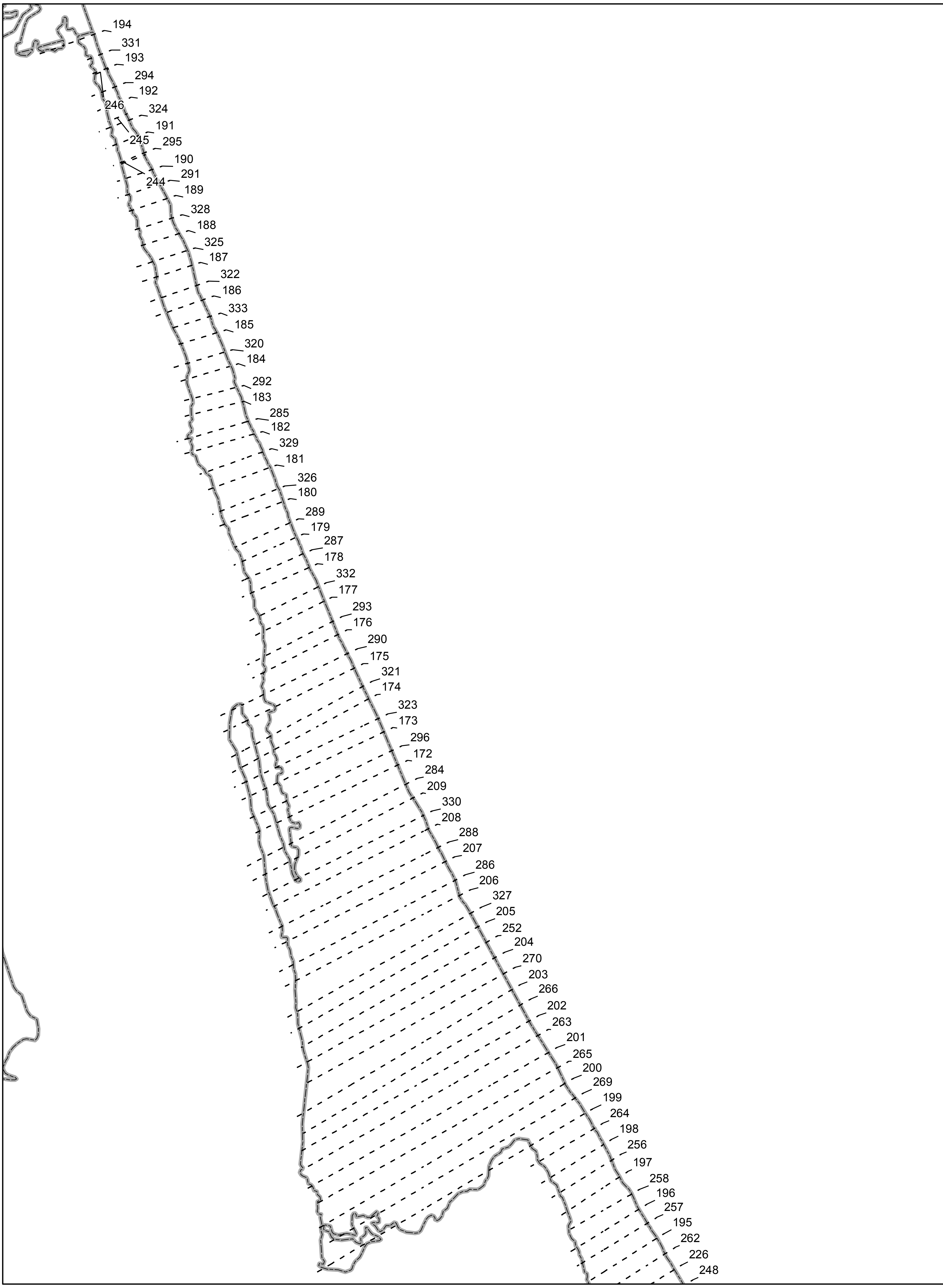
Figure 5- Coastal Transect Map



N

1 in = 1 miles

0 0.25 0.5 1 1.5 Miles

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North American Datum 1983

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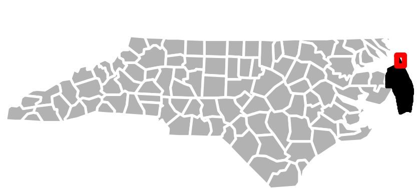
Figure 5- Coastal Transect Map

COUNTY LOCATOR



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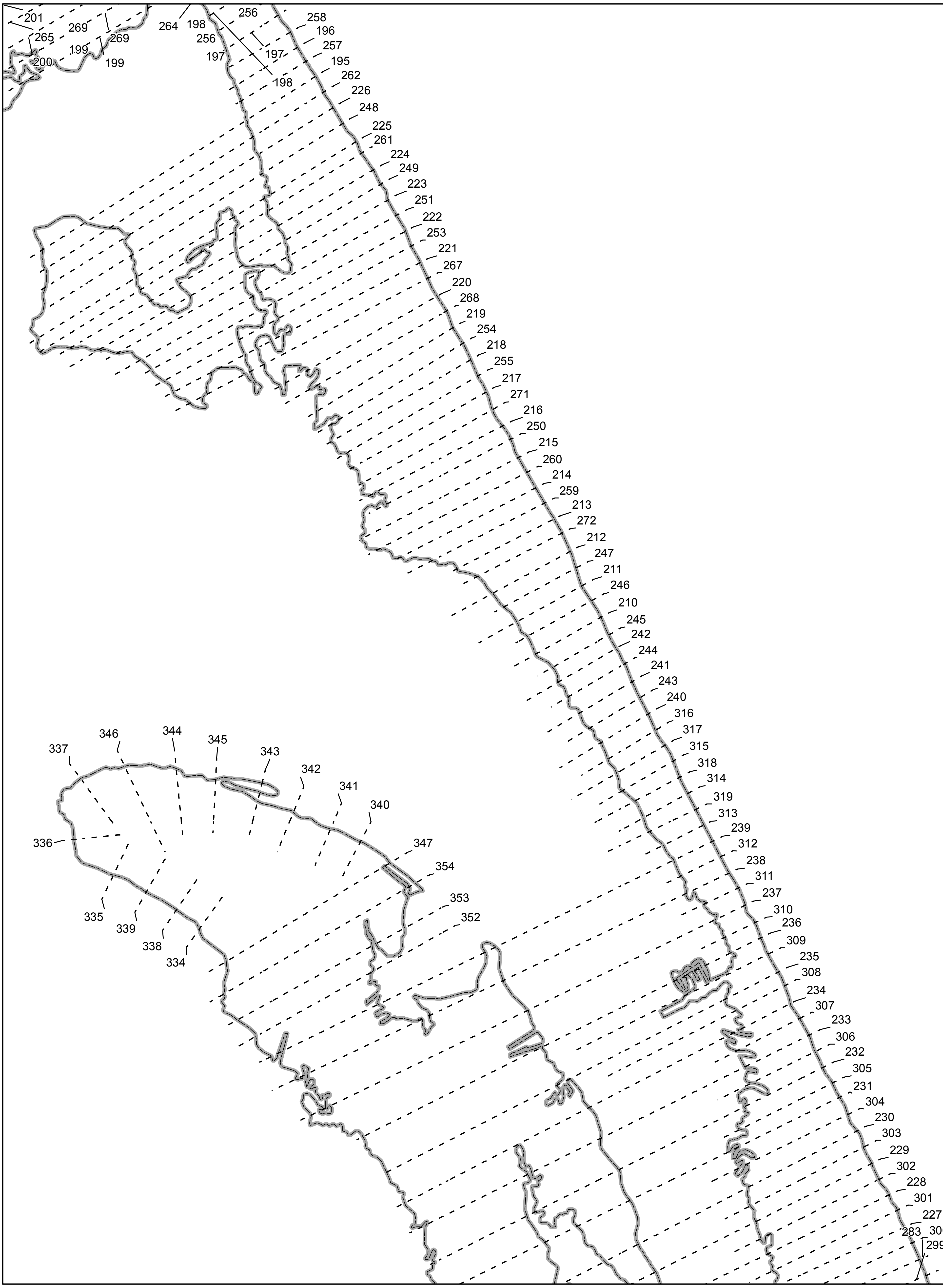

N

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0 0.25 0.5 1 1.5 Miles

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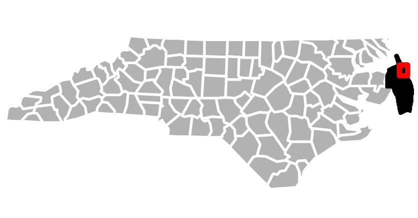
COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP

DARE COUNTY, NORTH CAROLINA
PANELS WITH TRANSECTS:

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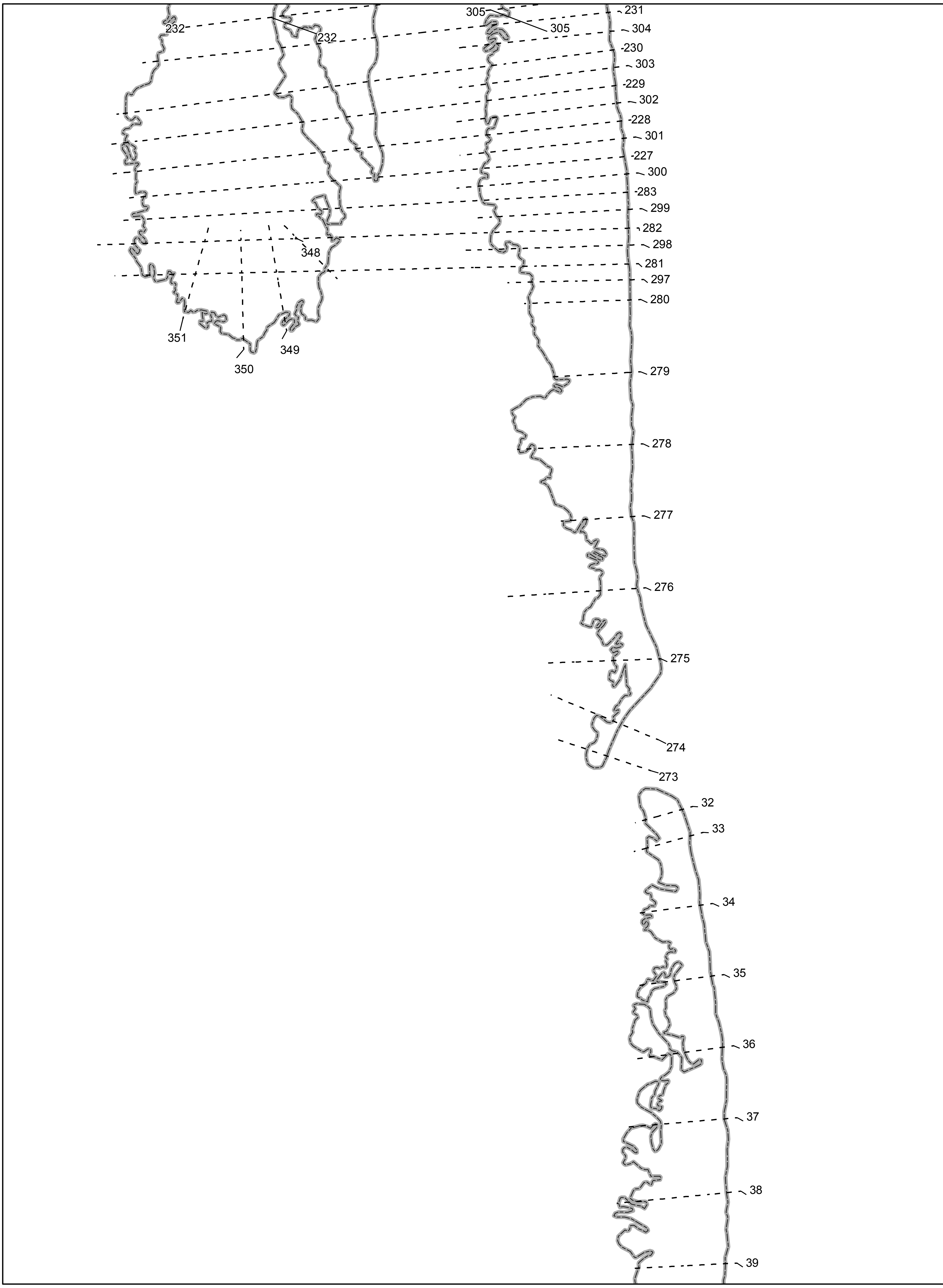

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0 0.25 0.5 1 1.5 Miles

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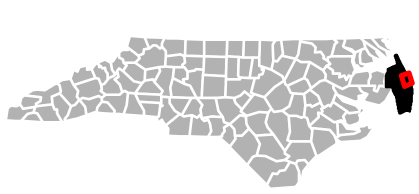
COUNTY LOCATOR



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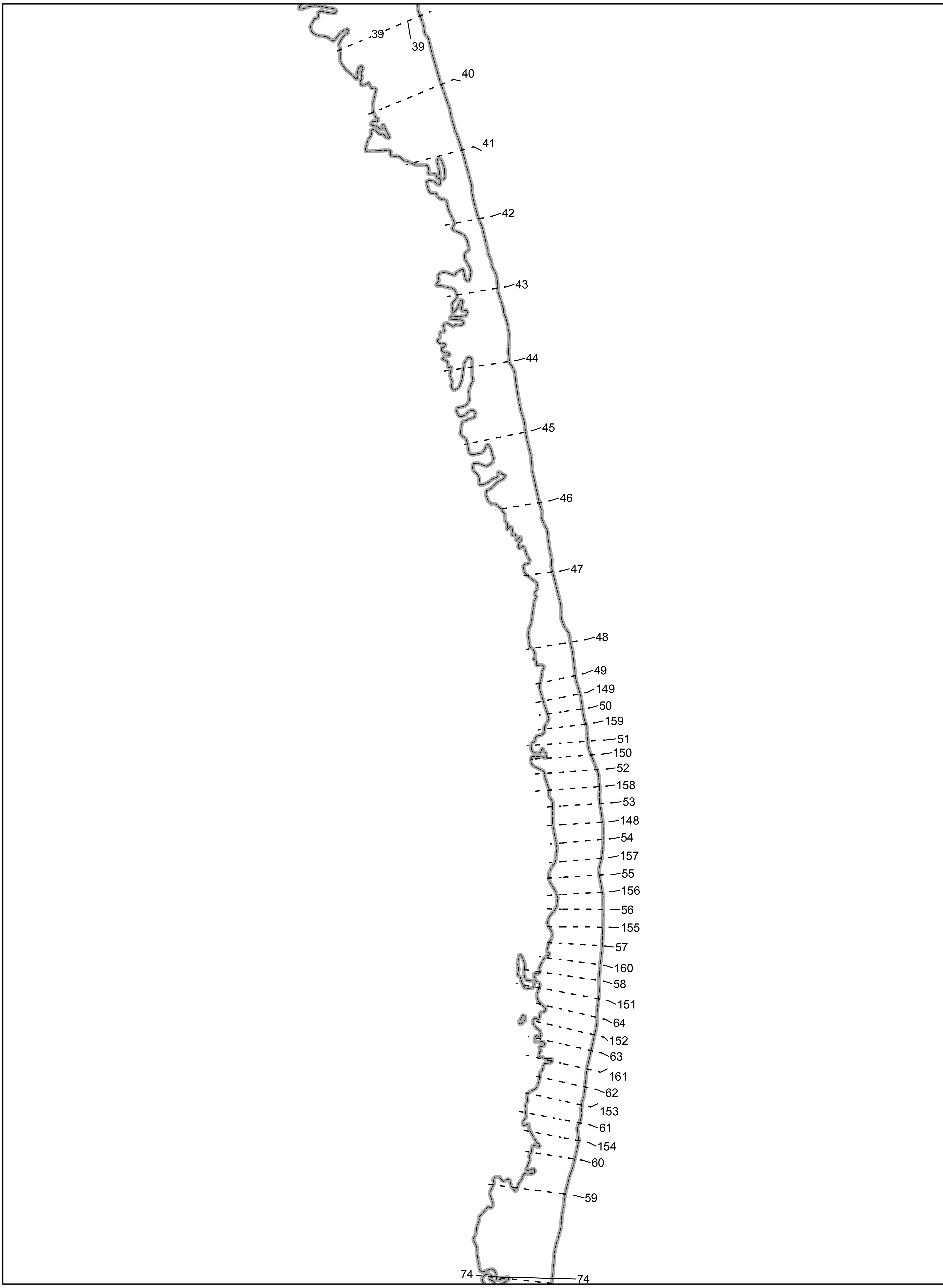

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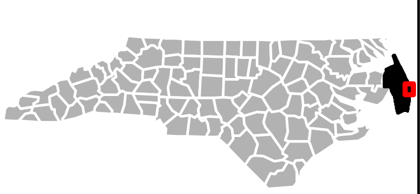

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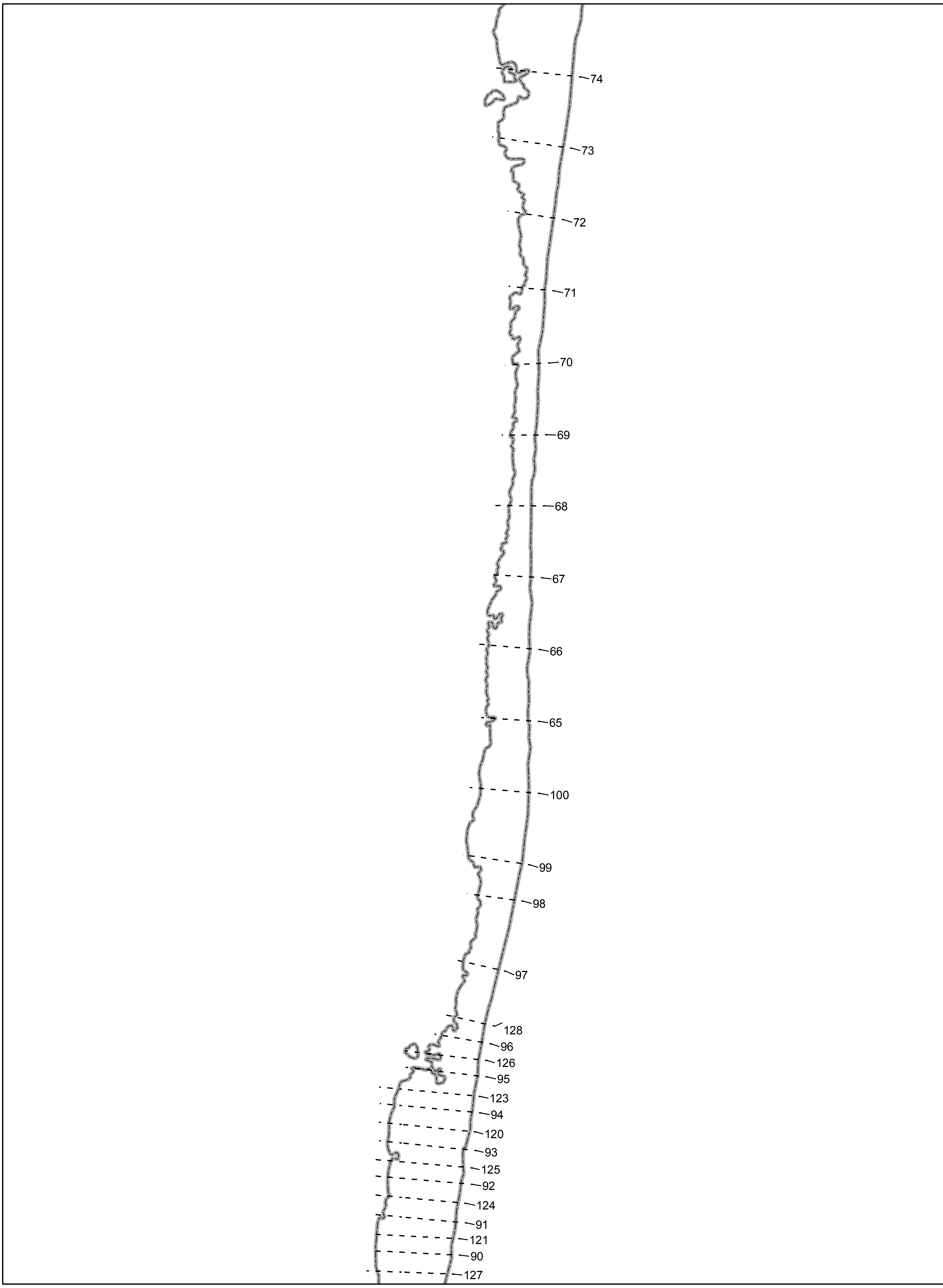
Figure 5- Coastal Transect Map



N

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0 0.25 0.5 1 1.5 Miles

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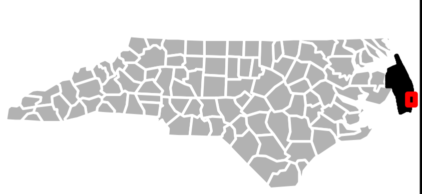

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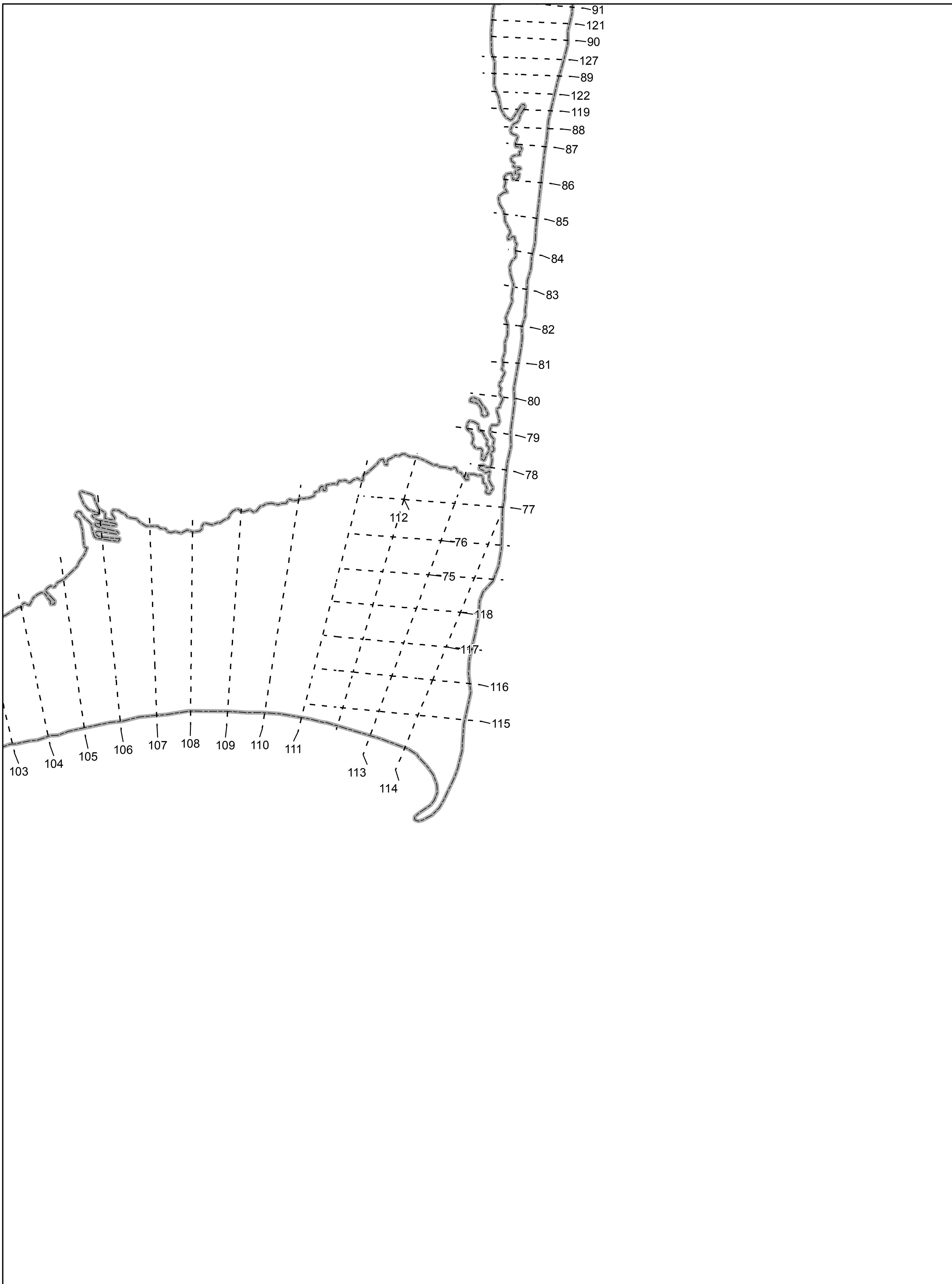
Figure 5- Coastal Transect Map



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N

0 0.25 0.5 1 1.5 Miles

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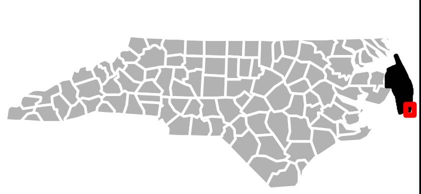
COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

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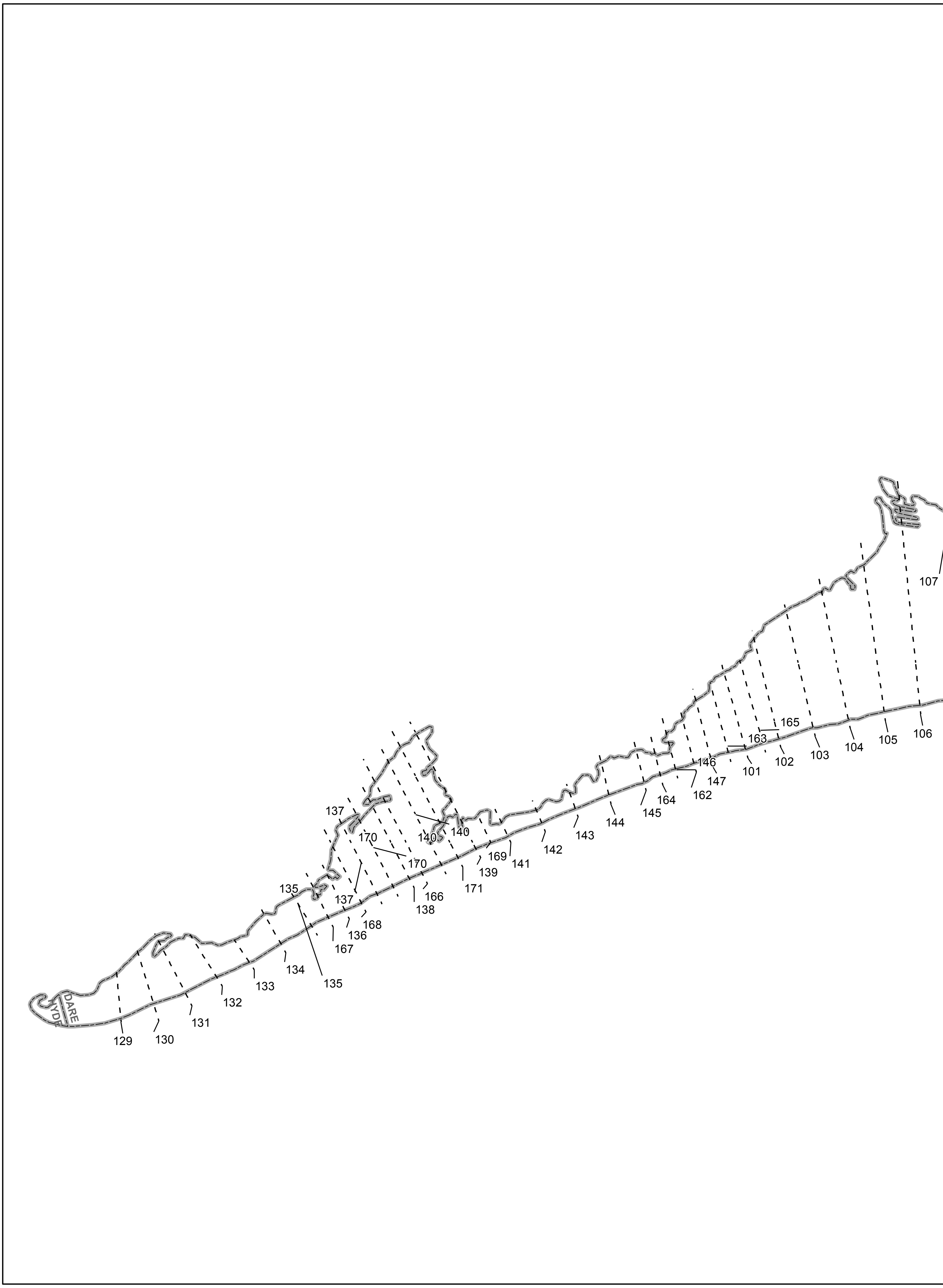

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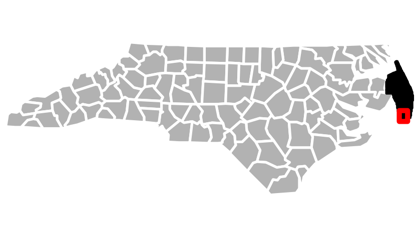
COUNTY LOCATOR



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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 Dare 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 Dare 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)
36.12	-75.75	-0.95
36.00	-75.87	-0.95
36.00	-75.75	-0.96
35.88	-76.00	-1.01
35.87	-75.88	-0.80
35.88	-75.75	-0.95
35.87	-75.63	-0.98
35.75	-76.00	-0.99
35.75	-75.88	-0.94
35.75	-75.75	-1.03
35.62	-75.88	-0.98
35.63	-75.75	-1.01
35.62	-75.50	-1.03
35.50	-75.50	-1.04
35.37	-75.50	-1.05
35.25	-75.63	-1.07
Average conversion in Dare County from NGVD 29 to NAVD 88 = -0.98 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 Dare 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.

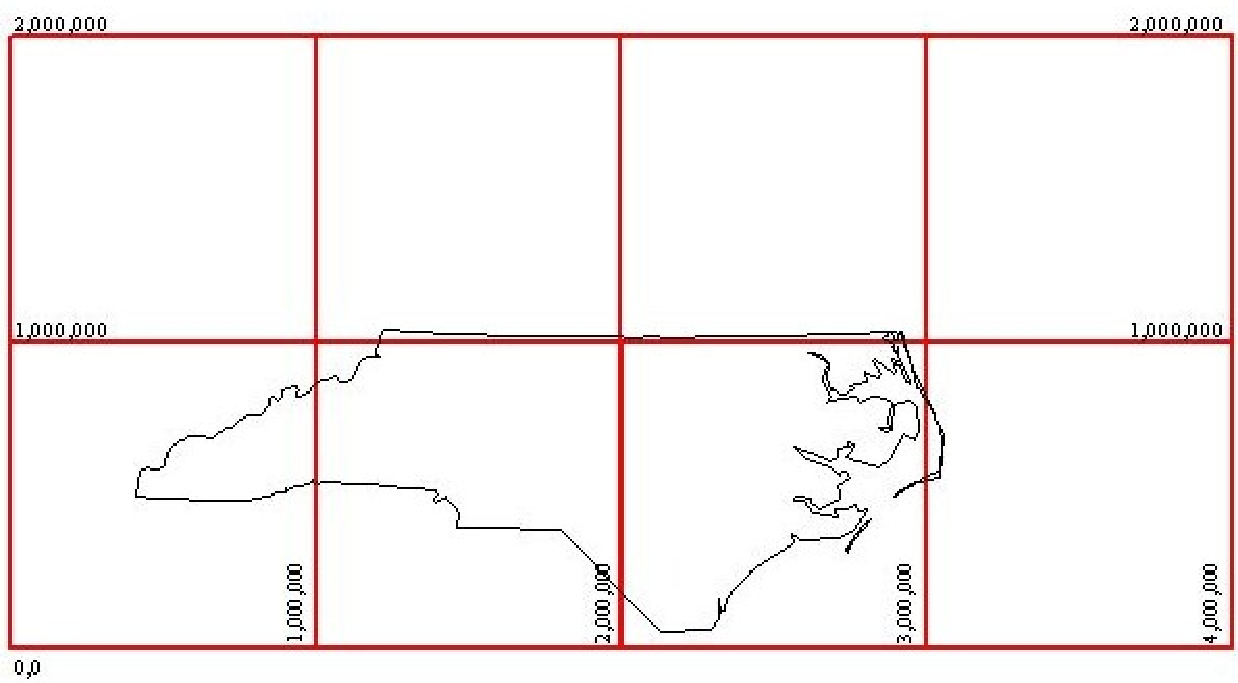

Figure 6 - North Carolina's State Plane Coordinate System

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).

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” is not applicable in Dare County.

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.

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.

Table 23, "Summary of Coastal Transect Mapping Considerations".

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)		
37046052	350	*	*	AE 5-5	*	WHAFIS
	349	*	*	AE 4-4	*	WHAFIS
	347	*	*	AE 4-4	*	WHAFIS
	351	*	*	AE 4-5	*	WHAFIS
	352	*	*	AE 3-4	*	WHAFIS
	353	*	*	AE 3-3	*	WHAFIS
	354	*	*	AE 3-3	*	WHAFIS
	75	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS
	67	X	AO 12-12 VE 12	AE 22-24 AO 24-24 VE 22-24	PFD	WHAFIS
	77	X	VE 12-12	AE 22-24 VE 22-24	PFD	WHAFIS
	82	X	VE 11-12	AE 22-24 VE 22-24	PFD	WHAFIS
	76	X	VE 13	AE 22-24 VE 22-24	PFD	WHAFIS
	62	X	VE 11-12	AE 22-24 VE 22-24	PFD	WHAFIS
	66	X	AO 12-12 VE 12	AE 22-24 AO 24-24 VE 22-24	PFD	WHAFIS
37046544	344	*	*	AE 1-3	*	WHAFIS

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)		
	345	*	*	AE 2-3	*	WHAFIS
	346	*	*	AE 2-3	*	WHAFIS
37046788	324	*	*	AE 3-4	*	WHAFIS
	325	*	*	AE 3-4	*	WHAFIS
	326	*	*	AE 3-4	*	WHAFIS
	319	*	*	AE 3-4	*	WHAFIS
	322	*	*	AE 3-4	*	WHAFIS
	323	*	*	AE 3-4	*	WHAFIS
	303	*	*	AE 4-5	*	WHAFIS
	320	*	*	AE 3-3	*	WHAFIS
	321	*	*	AE 3-3	*	WHAFIS
	305	*	*	AE 3-3	*	WHAFIS
	304	*	*	AE 3-3	*	WHAFIS
	318	*	*	AE 5-6	*	WHAFIS
	314	*	*	AE 1-2	*	WHAFIS
37046805	348	*	*	AE 2-3	*	WHAFIS
37046819	343	*	*	AE 3-3	*	WHAFIS
	342	*	*	AE 2-2	*	WHAFIS
	341	*	*	AE 6-7	*	WHAFIS
	340	*	*	AE 5-6	*	WHAFIS
	339	*	*	AE 5-5	*	WHAFIS
	338	*	*	AE 5-5	*	WHAFIS
	337	*	*	AE 2-2	*	WHAFIS
	332	*	*	AE 5-5	*	WHAFIS
	327	*	*	AE 3-4	*	WHAFIS
	331	*	*	AE 4-5	*	WHAFIS
	328	*	*	AE 4-4	*	WHAFIS
	329	*	*	AE 4-4	*	WHAFIS
	330	*	*	AE 4-5	*	WHAFIS
	333	*	*	AE 5-5	*	WHAFIS
	334	*	*	AE 5-5	*	WHAFIS
	335	*	*	AE 5-5	*	WHAFIS
	336	*	*	AE 5-5	*	WHAFIS
	196	X	VE 11	AE 22-23 VE 22-23	PFD	WHAFIS
	198	X	VE 11	AE 23-23 VE 23-23	PFD	WHAFIS

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)		
	200	X	VE 11	AE 23-24 VE 23-24	PFD	WHAFIS
	255	X	VE 12	AE 22-23 VE 22-23	PFD	WHAFIS
	227	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	225	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	223	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS
	274	X	VE 10-11	AE 22-23 VE 22-23	PFD	WHAFIS
	272	X	VE 11	AE 22-23 VE 22-23	PFD	WHAFIS
	271	X	VE 11	AE 22-23 VE 22-23	PFD	WHAFIS
	270	X	VE 11	AE 21-22 VE 21-22	PFD	WHAFIS
	269	X	VE 11	AE 21-22 VE 21-22	PFD	WHAFIS
	268	X	VE 11	AE 21-21 VE 21-21	PFD	WHAFIS
	267	X	VE 11	AE 21-21 VE 21-21	PFD	WHAFIS
	266	X	VE 12	AE 20-21 VE 20-21	PFD	WHAFIS
	265	X	VE 12	AE 20-21 VE 20-21	PFD	WHAFIS
	264	X	VE 12	AE 20-21 VE 20-21	PFD	WHAFIS
	263	X	VE 14	AE 20-21 VE 20-21	PFD	WHAFIS
	262	X	VE 12	AE 20-20 VE 20-20	PFD	WHAFIS
	261	X	VE 10	AE 20-20 VE 20-20	PFD	WHAFIS
	228	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	226	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	224	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS

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)		
	302	X	VE 10	AE 23-24 VE 23-24	PFD	WHAFIS
	301	X	VE 10	AE 24-25 VE 24-25	PFD	WHAFIS
	300	X	AE 11 VE 11	AE 25-25 VE 25-25	PFD	WHAFIS
	297	X	VE 13	AE 24-25 VE 24-25	PFD	WHAFIS
	296	X	VE 13	AE 23-24 VE 23-24	PFD	WHAFIS
	294	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	292	X	AO 12 VE 10-12	AE 23-24 AO 23-24 VE 23-24	PFD	WHAFIS
	290	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	282	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS
	281	X	VE 10-13	AE 22-24 VE 22-24	PFD	WHAFIS
	280	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	278	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	276	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS
	199	X	VE 11	AE 23-23 VE 23-23	PFD	WHAFIS
	201	X	VE 11	AE 23-24 VE 23-24	PFD	WHAFIS
	195	X	VE 11	AE 22-23 VE 22-23	PFD	WHAFIS
	197	X	VE 11	AE 23-23 VE 23-23	PFD	WHAFIS
	277	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	275	X	VE 12	AE 22-23 VE 22-23	PFD	WHAFIS
	279	X	VE 10-12	AE 22-24 VE 22-24	PFD	WHAFIS

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)		
	273	X	VE 9-11	AE 22-23 VE 22-23	PFD	WHAFIS
	295	X	VE 12	AE 23-25 VE 23-25	PFD	WHAFIS
	293	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	291	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	41	X	AO 14-14 VE 11-14	AE 23-23 AO 23-23 VE 23-23	PFD	WHAFIS
	37	X	VE 11-12	AE 23-24 VE 23-24	PFD	WHAFIS
	35	X	VE 14	AE 23-24 VE 23-24	PFD	WHAFIS
	33	X	VE 11-13	AE 23-24 VE 23-24	PFD	WHAFIS
	31	X	AO 12 VE 11-12	AE 22-24 AO 24-24 VE 22-24	PFD	WHAFIS
	29	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS
	27	X	AO 14-14 VE 11-14	AE 22-24 AO 24-24 VE 22-24	PFD	WHAFIS
	25	X	VE 11-14	AE 22-24 VE 22-24	PFD	WHAFIS
	23	X	VE 13	AE 22-24 VE 22-24	PFD	WHAFIS
	21	X	VE 13	AE 22-24 VE 22-24	PFD	WHAFIS
	11	X	VE 12-14	AE 19-24 AO 19-19 VE 19-24	PFD	WHAFIS
	9	X	VE 12-14	AE 19-24 VE 19-24	PFD	WHAFIS
	7	X	VE 13	AE 18-23 VE 18-23	PFD	WHAFIS
	73	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS
	71	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS

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)		
	78	X	VE 11-12	AE 22-24 VE 22-24	PFD	WHAFIS
	74	X	VE 11-12	AE 22-24 VE 22-24	PFD	WHAFIS
	72	X	VE 9-12	VE 22-24	PFD	WHAFIS
	68	X	VE 11-13	AE 22-24 VE 22-24	PFD	WHAFIS
	162	X	*	AE 21-22 VE 21-22	PFD	WHAFIS
	161	X	*	AE 21-22 VE 21-22	PFD	WHAFIS
	24	X	VE 14	AE 22-24 VE 22-24	PFD	WHAFIS
	32	X	VE 11	AE 23-24 VE 23-24	PFD	WHAFIS
	38	X	VE 11-13	AE 23-23 VE 23-23	PFD	WHAFIS
	10	X	VE 12-14	AE 19-24 VE 19-24	PFD	WHAFIS
	22	X	VE 14	AE 22-24 VE 22-24	PFD	WHAFIS
	8	X	VE 14	AE 18-23 VE 18-23	PFD	WHAFIS
	20	X	VE 13	AE 22-24 VE 22-24	PFD	WHAFIS
	28	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS
	12	X	VE 13-14	AE 20-24 VE 20-24	PFD	WHAFIS
	26	X	VE 11-14	AE 22-24 VE 22-24	PFD	WHAFIS
	34	X	VE 11-14	AE 23-24 VE 23-24	PFD	WHAFIS
37046826	95	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	93	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	110	X	VE 12-12	AE 22-25 VE 22-25	PFD	WHAFIS
	92	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS

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)		
	94	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	90	X	VE 12	AE 21-24 VE 21-24	PFD	WHAFIS
	310	*	*	AE 1-1	*	WHAFIS
	309	*	*	AE 1-1	*	WHAFIS
	308	*	*	AE 2-2	*	WHAFIS
	307	*	*	AE 2-2	*	WHAFIS
	306	*	*	AE 2-3	*	WHAFIS
	311	*	*	AE 1-1	*	WHAFIS
	315	*	*	AE 2-2	WHAFIS	WHAFIS
	316	*	*	AE 1-2	*	WHAFIS
	317	*	*	AE 2-2	*	WHAFIS
	313	*	*	AE 2-2	*	WHAFIS
	312	*	*	AE 1-1	*	WHAFIS
37104036	163	X	*	AE 23-24 VE 23-24	PFD	WHAFIS
	164	X	VE 8-10	AE 23-24 VE 23-24	PFD	WHAFIS
	165	X	VE 11	AE 22-23 VE 22-23	PFD	WHAFIS
	166	X	VE 11	AE 22-23 VE 22-23	PFD	WHAFIS
	167	X	VE 11	AE 22-23 VE 22-23	PFD	WHAFIS
	168	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	169	X	VE 10-11	AE 23-24 VE 23-24	PFD	WHAFIS
	170	X	VE 10-11	AE 23-26 VE 23-26	PFD	WHAFIS
	171	X	VE 10	AE 24-27 VE 24-27	PFD	WHAFIS
	172	X	VE 9-11	AE 24-29 AO 24-29 VE 24-29	PFD	WHAFIS
	173	X	VE 9-12	AE 24-29 AO 24-29 VE 24-29	PFD	WHAFIS

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)		
	174	X	VE 12	AE 25-30 VE 25-30	PFD	WHAFIS
	175	X	VE 12	AE 25-29 VE 25-29	PFD	WHAFIS
	176	X	VE 12	AE 26-29 VE 26-29	PFD	WHAFIS
	177	X	VE 12	AE 25-28 VE 25-28	PFD	WHAFIS
	178	X	VE 10-12	AE 25-26 AO 25-26 VE 25-26	PFD	WHAFIS
	179	X	VE 11	AE 24-25 VE 24-25	PFD	WHAFIS
	180	X	VE 11	AE 24-25 VE 24-25	PFD	WHAFIS
	182	X	VE 11-12	AE 23-24 VE 23-24	PFD	WHAFIS
	184	X	VE 10-11	AE 22-23 VE 22-23	PFD	WHAFIS
	186	X	VE 9-10	AE 22-22 AO 22-22 VE 22-22	PFD	WHAFIS
	188	X	VE 10-12	AE 22-22 VE 22-22	PFD	WHAFIS
	190	X	VE 10-11	AE 21-22 AO 21-22 VE 21-22	PFD	WHAFIS
	192	X	VE 12	AE 22-22 VE 22-22	PFD	WHAFIS
	194	X	VE 11	AE 22-22 VE 22-22	PFD	WHAFIS
	209	X	VE 11	AE 24-25 VE 24-25	PFD	WHAFIS
	208	X	VE 12	AE 24-24 VE 24-24	PFD	WHAFIS
	206	X	VE 11	AE 24-24 VE 24-24	PFD	WHAFIS
	204	X	VE 12	AE 24-24 VE 24-24	PFD	WHAFIS
	202	X	VE 11	AE 24-24 VE 24-24	PFD	WHAFIS

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)		
	219	X	VE 12	AE 24-25 VE 24-25	PFD	WHAFIS
	218	X	VE 11	AE 25-26 VE 25-26	PFD	WHAFIS
	217	X	VE 9-11	AE 25-26 VE 25-26	PFD	WHAFIS
	216	X	VE 11	AE 25-27 VE 25-27	PFD	WHAFIS
	215	X	VE 9-11	AE 25-26 VE 25-26	PFD	WHAFIS
	214	X	VE 11	AE 24-26 VE 24-26	PFD	WHAFIS
	213	X	VE 9-12	AE 24-26 VE 24-26	PFD	WHAFIS
	212	X	VE 12	AE 24-26 VE 24-26	PFD	WHAFIS
	211	X	VE 12	AE 24-25 VE 24-25	PFD	WHAFIS
	210	X	VE 12	AE 24-25 VE 24-25	PFD	WHAFIS
	254	X	VE 10-14	AE 22-23 VE 22-23	PFD	WHAFIS
	253	X	VE 11-14	AE 22-23 VE 22-23	PFD	WHAFIS
	252	X	VE 12	AE 22-23 VE 22-23	PFD	WHAFIS
	251	X	VE 12	AE 22-23 VE 22-23	PFD	WHAFIS
	250	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS
	249	X	VE 10	AE 22-24 VE 22-24	PFD	WHAFIS
	248	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS
	247	X	VE 11	AE 22-24 VE 22-24	PFD	WHAFIS
	246	X	VE 12	AE 22-23 VE 22-23	PFD	WHAFIS
	245	X	VE 13	AE 23-24 VE 23-24	PFD	WHAFIS

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)		
	244	X	VE 15	AE 23-24 VE 23-24	PFD	WHAFIS
	243	X	VE 13	AE 22-24 VE 22-24	PFD	WHAFIS
	242	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	239	X	VE 11	AE 23-24 VE 23-24	PFD	WHAFIS
	237	X	VE 11	AE 23-24 VE 23-24	PFD	WHAFIS
	235	X	VE 10	AE 23-24 VE 23-24	PFD	WHAFIS
	233	X	VE 11	AE 23-24 VE 23-24	PFD	WHAFIS
	231	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	229	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	222	X	VE 8-11	AE 23-25 VE 23-25	PFD	WHAFIS
	221	X	VE 8-10	AE 23-25 VE 23-25	PFD	WHAFIS
	220	X	VE 11	AE 24-25 VE 24-25	PFD	WHAFIS
	260	X	VE 11	AE 20-20 VE 20-20	PFD	WHAFIS
	259	X	VE 10	AE 21-21 VE 21-21	PFD	WHAFIS
	258	X	VE 12	AE 21-22 VE 21-22	PFD	WHAFIS
	257	X	VE 12	AE 22-22 VE 22-22	PFD	WHAFIS
	256	X	VE 12	AE 22-22 VE 22-22	PFD	WHAFIS
	241	X	VE 13	AE 23-24 VE 23-24	PFD	WHAFIS
	230	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	236	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS

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)		
	240	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	234	X	VE 13	AE 23-24 VE 23-24	PFD	WHAFIS
	232	X	VE 10	AE 23-24 AO 24-24 VE 23-24	PFD	WHAFIS
	238	X	VE 11	AE 23-24 VE 23-24	PFD	WHAFIS
	299	X	AE 11 VE 8-11	AE 24-25 VE 24-25	PFD	WHAFIS
	298	X	VE 13	AE 24-25 VE 24-25	PFD	WHAFIS
	286	X	AE 10 AO 10 VE 10-10	AE 23-24 AO 23-24 VE 23-24	PFD	WHAFIS
	288	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	284	X	VE 10	AE 23-24 VE 23-24	PFD	WHAFIS
	283	X	VE 9-10	AE 22-24 VE 22-24	PFD	WHAFIS
	189	X	AE 10 AO 10 VE 10-11	AE 21-22 AO 21-22 VE 21-22	PFD	WHAFIS
	181	X	VE 11	AE 24-25 VE 24-25	PFD	WHAFIS
	185	X	VE 10-11	AE 22-22 VE 22-22	PFD	WHAFIS
	205	X	VE 12	AE 24-24 VE 24-24	PFD	WHAFIS
	207	X	VE 12	AE 24-24 VE 24-24	PFD	WHAFIS
	193	X	VE 12	AE 22-22 VE 22-22	PFD	WHAFIS
	191	X	VE 10-11	AE 21-22 VE 21-22	PFD	WHAFIS
	187	X	VE 9-11	AE 22-22 AO 22-22 VE 22-22	PFD	WHAFIS

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)		
	183	X	VE 14	AE 23-23 VE 23-23	PFD	WHAFIS
	203	X	VE 11	AE 24-24 VE 24-24	PFD	WHAFIS
	289	X	VE 12	AE 23-24 VE 23-24	PFD	WHAFIS
	285	X	VE 11	AE 23-24 VE 23-24	PFD	WHAFIS
	287	X	VE 10-12	AE 23-24 AO 24-24 VE 23-24	PFD	WHAFIS
	45	X	VE 12	AE 22-23 VE 22-23	PFD	WHAFIS
	43	X	VE 14	AE 22-23 VE 22-23	PFD	WHAFIS
	39	X	AO 13-13 VE 11-13	AE 23-23 AO 23-23 VE 23-23	PFD	WHAFIS
	19	X	AO 13-13 VE 11-13	AE 22-24 AO 24-24 VE 22-24	PFD	WHAFIS
	17	X	VE 11	AE 21-24 VE 21-24	PFD	WHAFIS
	15	X	VE 13-14	AE 21-24 VE 21-24	PFD	WHAFIS
	13	X	VE 13	AE 20-24 VE 20-24	PFD	WHAFIS
	5	X	VE 14	AE 18-23 VE 18-23	PFD	WHAFIS
	3	X	VE 11-14	AE 17-23 AO 23-23 VE 17-23	PFD	WHAFIS
	1	X	VE 12	AE 17-22 VE 17-22	PFD	WHAFIS
	69	X	VE 10-12	AE 22-24 VE 22-24	PFD	WHAFIS
	65	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS
	63	X	VE 13-13	AE 22-24 VE 22-24	PFD	WHAFIS

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)		
	61	X	VE 11-13	AE 21-24 VE 21-24	PFD	WHAFIS
	59	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS
	57	X	VE 12-12	AE 22-24 VE 22-24	PFD	WHAFIS
	55	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS
	53	X	VE 12-12	AE 22-24 VE 22-24	PFD	WHAFIS
	51	X	VE 12-13	AE 22-23 VE 22-23	PFD	WHAFIS
	49	X	VE 15	AE 22-23 VE 22-23	PFD	WHAFIS
	47	X	VE 15	AE 22-23 VE 22-23	PFD	WHAFIS
	109	X	VE 11-13	AE 22-25 VE 22-25	PFD	WHAFIS
	107	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS
	105	X	VE 11-13	AE 23-24 VE 23-24	PFD	WHAFIS
	103	X	AO 13-13 VE 10-13	AE 23-24 AO 24-24 VE 23-24	PFD	WHAFIS
	101	X	VE 12	AE 24-24 VE 24-24	PFD	WHAFIS
	99	X	VE 12	AE 24-24 VE 24-24	PFD	WHAFIS
	97	X	VE 10-12	AE 24-24 VE 24-24	PFD	WHAFIS
	91	X	VE 12	AE 21-24 VE 21-24	PFD	WHAFIS
	89	X	VE 12	AE 21-24 VE 21-24	PFD	WHAFIS
	87	X	VE 12	AE 21-24 VE 21-24	PFD	WHAFIS
	85	X	VE 13	AE 21-24 VE 21-24	PFD	WHAFIS
	83	X	VE 12	AE 21-24 VE 21-24	PFD	WHAFIS

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)		
	81	X	VE 11-13	AE 22-24 VE 22-24	PFD	WHAFIS
	79	X	VE 13	AE 22-24 VE 22-24	PFD	WHAFIS
	147	X	VE 11	AE 22-25 VE 22-25	RUNUP EXTENT	WHAFIS
	145	X	VE 11	AE 22-25 VE 22-25	RUNUP EXTENT	WHAFIS
	143	X	VE 11	AE 21-25 VE 21-25	RUNUP EXTENT	WHAFIS
	141	X	VE 11	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	139	X	VE 12	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	137	X	VE 12	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	135	X	VE 12	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	133	X	VE 11	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	131	X	VE 11	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	129	X	VE 13	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	127	X	VE 11	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	125	X	AE 12 AO 12-12 VE 12	AE 21-24 AO 24-24 VE 21-24	RUNUP EXTENT	WHAFIS
	123	X	VE 12	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	115	X	VE 11-12	AE 22-25 VE 22-25	PFD	WHAFIS
	113	X	VE 11-13	AE 22-25 VE 22-25	PFD	WHAFIS
	111	X	VE 10-12	AE 22-25 AO 25-25 VE 22-25	PFD	WHAFIS
	114	X	VE 11-12	AE 22-25 AO 22-25 VE 22-25	PFD	WHAFIS

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)		
	112	X	VE 10-12	AE 22-25 VE 22-25	PFD	WHAFIS
	108	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS
	106	X	VE 11-13	AE 23-24 VE 23-24	PFD	WHAFIS
	98	X	VE 10-12	AE 24-24 VE 24-24	PFD	WHAFIS
	84	X	VE 13	AE 21-24 VE 21-24	PFD	WHAFIS
	56	X	VE 13-13	AE 22-24 VE 22-24	PFD	WHAFIS
	86	X	VE 12-12	AE 21-24 VE 21-24	PFD	WHAFIS
	70	X	VE 12	AE 22-24 VE 22-24	PFD	WHAFIS
	102	X	VE 11-13	AE 23-24 AO 24-24 VE 23-24	PFD	WHAFIS
	100	X	VE 12-14	AE 24-24 VE 24-24	PFD	WHAFIS
	80	X	VE 12-13	AE 22-24 VE 22-24	PFD	WHAFIS
	64	X	VE 13-13	AE 22-24 VE 22-24	PFD	WHAFIS
	60	X	VE 12-13	AE 21-24 VE 21-24	PFD	WHAFIS
	88	X	VE 12	AE 21-24 VE 21-24	PFD	WHAFIS
	58	X	VE 11-12	AE 22-24 VE 22-24	PFD	WHAFIS
	96	X	VE 10	AE 23-24 VE 23-24	PFD	WHAFIS
	104	X	VE 12-12	AE 23-24 VE 23-24	PFD	WHAFIS
	160	X	AE 10 VE 10	AE 24-25 VE 24-25	PFD	WHAFIS
	159	X	VE 11	AE 23-25 VE 23-25	PFD	WHAFIS
	158	X	VE 11	AE 22-25 VE 22-25	PFD	WHAFIS

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)		
	157	X	VE 11	AE 22-25 VE 22-25	PFD	WHAFIS
	156	X	VE 11	AE 23-25 VE 23-25	PFD	WHAFIS
	155	X	VE 9-11	AE 24-25 VE 24-25	PFD	WHAFIS
	153	X	VE 11	AE 23-25 AO 25-25 VE 23-25	RUNUP EXTENT	WHAFIS
	151	X	VE 11	AE 23-25 VE 23-25	RUNUP EXTENT	WHAFIS
	149	X	AO 12-12 VE 12	AE 23-25 AO 25-25 VE 23-25	RUNUP EXTENT	WHAFIS
	46	X	VE 11-15	AE 22-23 VE 22-23	PFD	WHAFIS
	52	X	VE 12-12	AE 22-23 VE 22-23	PFD	WHAFIS
	50	X	VE 14	AE 22-23 VE 22-23	PFD	WHAFIS
	30	X	AO 14-14 VE 11-14	AE 22-24 AO 24-24 VE 22-24	PFD	WHAFIS
	36	X	AO 12-12 VE 11-12	AE 23-24 AO 24-24 VE 23-24	PFD	WHAFIS
	4	X	VE 11-13	AE 18-23 VE 18-23	PFD	WHAFIS
	44	X	VE 15	AE 22-23 VE 22-23	PFD	WHAFIS
	154	X	VE 11	AE 23-25 VE 23-25	PFD	WHAFIS
	152	X	VE 10-11	AE 23-25 VE 23-25	PFD	WHAFIS
	150	X	VE 10-11	AE 23-25 VE 23-25	PFD	WHAFIS
	148	X	VE 10-11	AE 22-25 VE 22-25	PFD	WHAFIS
	146	X	AO 11 VE 10-11	AE 22-25 AO 22-25 VE 22-25	PFD	WHAFIS

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)		
	144	X	AO 11-11 VE 10-11	AE 21-25 AO 25-25 VE 21-25	PFD	WHAFIS
	142	X	VE 11	AE 21-24 VE 21-24	PFD	WHAFIS
	140	X	VE 9-11	AE 21-24 VE 21-24	PFD	WHAFIS
	138	X	VE 11-11	AE 21-24 VE 21-24	PFD	WHAFIS
	136	X	VE 12-13	AE 21-24 VE 21-24	PFD	WHAFIS
	134	X	VE 11	AE 21-24 VE 21-24	PFD	WHAFIS
	132	X	VE 12	AE 21-24 VE 21-24	RUNUP EXTENT	WHAFIS
	130	X	VE 11-11	AE 21-24 VE 21-24	PFD	WHAFIS
	128	X	VE 10-12	AE 21-24 VE 21-24	PFD	WHAFIS
	126	X	AO 12-12 VE 10-12	AE 21-24 AO 24-24 VE 21-24	PFD	WHAFIS
	124	X	VE 12-12	AE 21-24 VE 21-24	PFD	WHAFIS
	122	X	VE 11-12	AE 21-24 AO 24-24 VE 21-24	PFD	WHAFIS
	120	X	VE 11-12	AE 22-25 VE 22-25	PFD	WHAFIS
	118	X	VE 13	AE 22-25 VE 22-25	PFD	WHAFIS
	116	X	VE 11-12	AE 22-25 VE 22-25	PFD	WHAFIS
	117	X	VE 13	AE 22-25 VE 22-25	PFD	WHAFIS
	119	X	VE 12	AE 22-25 VE 22-25	PFD	WHAFIS
	121	X	VE 12	AE 21-24 VE 21-24	PFD	WHAFIS
	40	X	VE 11-14	AE 23-23 VE 23-23	PFD	WHAFIS

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)		
	16	X	VE 13-13	AE 21-24 VE 21-24	PFD	WHAFIS
	42	X	AO 14-14 VE 11-14	AE 22-23 AO 22-22 VE 22-23	PFD	WHAFIS
	6	X	VE 11	AE 18-23 VE 18-23	PFD	WHAFIS
	14	X	VE 13-14	AE 20-24 VE 20-24	PFD	WHAFIS
	54	X	VE 11-12	AE 22-24 VE 22-24	PFD	WHAFIS
	48	X	VE 14	AE 22-23 VE 22-23	PFD	WHAFIS
	2	X	VE 14	AE 17-23 VE 17-23	PFD	WHAFIS
	18	X	VE 11-13	AE 22-24 VE 22-24	PFD	WHAFIS
Pamlico Sound	92	*	*	AE 3	WHAFIS	WHAFIS

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 Dare 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 9/20/2006 North Carolina Statewide FIRM, which includes Dare County, are presented in Table 24, "Map Revision History."

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Dare 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 Dare County.

Table 24 - Map Revision History

Community	Initial Identification Date	Initial FIRM Effective Date	FIS Revision Date
DARE COUNTY	4/8/1971	10/6/1978	9/20/2006
DARE COUNTY	4/8/1971	10/6/1978	12/21/2018
DARE COUNTY	4/8/1971	10/6/1978	6/19/2020
TOWN OF DUCK	4/8/1971	10/6/1978	9/20/2006
TOWN OF DUCK	4/8/1971	10/6/1978	6/19/2020
TOWN OF KILL DEVIL HILLS	5/4/1973	5/4/1973	9/20/2006
TOWN OF KILL DEVIL HILLS	5/4/1973	5/4/1973	6/19/2020
TOWN OF KILL DEVIL HILLS	5/4/1973	5/4/1973	04/02/1993
TOWN OF KITTY HAWK	10/1/1983	10/1/1983	9/20/2006

Table 24 - Map Revision History

Community	Initial Identification Date	Initial FIRM Effective Date	FIS Revision Date
TOWN OF KITTY HAWK	10/1/1983	10/1/1983	6/19/2020
TOWN OF KITTY HAWK	10/1/1983	10/1/1983	04/02/1993
TOWN OF MANTEO	1/12/1973	1/12/1973	9/20/2006
TOWN OF MANTEO	1/12/1973	1/12/1973	6/19/2020
TOWN OF NAGS HEAD	11/10/1972	11/10/1972	9/20/2006
TOWN OF NAGS HEAD	11/10/1972	11/10/1972	6/19/2020
TOWN OF SOUTHERN SHORES	5/13/1972	5/13/1972	9/20/2006
TOWN OF SOUTHERN SHORES	5/13/1972	5/13/1972	6/19/2020

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 Dare 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
DARE COUNTY	9/20/2006	NCFMP	NCFMP	N/A	January 2005
DARE COUNTY	6/19/2020	NCFMP	NCFMP	EMA-2009-CA5933	July 2014

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 Dare County were produced by NCFMP under contract with the State of North Carolina and issued on effective 9/20/2006. 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

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 Dare County are shown in Table 26, “Scoping Meetings.” Meetings held for the map maintenance revision are also included below for Dare County.

Table 26 — Scoping Meetings

Community	River Basin	Initial Scoping Date	Attended By	Final Scoping Date	Attended By
DARE COUNTY	PASQUOTANK	11/14/2000	Representatives of the State, FEMA, Dewberry, Beaufort County and incorporated communities	5/18/2001	Representatives of the State, FEMA, Dewberry, Beaufort County and incorporated communities

Consultation Coordination Officer's 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 consultation coordination officer's and public participation meetings are shown in Table 27, "Consultation Coordination Officer's and Public Participation Meeting.

Table 27 — Preliminary and Public Participation Meetings

Community	For FIS Dated	Meeting Location	Final CCO Meeting Date	Attended By	Public Meeting Date	Attended By
DARE COUNTY	5/5/2003	Manteo	5/6/2005	Representatives of the State, FEMA, study contractor, Dare County and incorporated communities	6/23/2005	The Public
DARE COUNTY	6/19/2020	Manteo	6/20/2016	Representatives of the State, FEMA, study contractor, Daret County and incorporated communities	1/10/2017	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 Dare 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 28 — Map Repositories

Community	Address	City	State	Zip Code
Town of Manteo	Town Hall, 407 Budleigh Street	Manteo	NC	27954
Dare County	Dare County GIS, Administration Building, 954 Marshall C. Collins Drive	Manteo	NC	27954
Town of Duck	Administrative Office, 1200 Duck Road	Duck	NC	27949
Town of Kill Devil Hills	Planning and Inspections, 102 Town Hall Drive	Kill Devil Hills	NC	27948
Town of Kitty Hawk	Town Hall, 101 Veterans Memorial Drive	Kitty Hawk	NC	27949
Town of Nags Head	Planning Department, 5401 S Croatan Hwy	Nags Head	NC	27959
Town of Southern Shores	Town Hall, 5375 North Virginia Dare Trail	Southern Shores	NC	27949

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 29, “Additional Information” is not applicable in Dare 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:

NC Floodplain Mapping Program
4218 Mail Service Center
Raleigh, NC 27699-4218
Phone: 919-715-5711
Fax: 919-715-0408
Email: frishelp@ncdps.gov