FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 5

MARTIN COUNTY, FLORIDA

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
JUPITER ISLAND, TOWN OF	120162
MARTIN COUNTY, UNINCORPORATED AREAS	120161
OCEAN BREEZE, TOWN OF	120163
SEWALL’S POINT, TOWN OF	120164
STUART, CITY OF	120165

REVISED:

FEBRUARY 19, 2020

FLOOD INSURANCE STUDY NUMBER
12085CV001C

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TABLE OF CONTENTS

Volume 1 – February 19, 2020

Figures

Tables

Page

Volume 2 – February 19, 2020

Page

Tables

Exhibits

Exhibits

Volume 3 – February 19, 2020

Exhibits

Volume 4 – February 19, 2020
Exhibits

Volume 5 – February 19, 2020
Exhibits

Published Separately

FLOOD INSURANCE STUDY REPORT
MARTIN COUNTY, FLORIDA

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60, *Criteria for Land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal

Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as “Post-FIRM” buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) Report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community’s regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of Martin County, Florida.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the United States Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC-8) sub-basins affecting each, are shown in Table 1. The FIRM panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Jupiter Island, Town of	120162	03090206	12085C0307H 12085C0309H 12085C0328H 12085C0336H 12085C0338H 12085C0339H 12085C0527H	
Martin County, Unincorporated Areas	120161	03090102, 03090201, 03090206	12085C0020G 12085C0038H 12085C0039H 12085C0043F[1] 12085C0075G 12085C0100G[1] 12085C0125G[1] 12085C0130H	

Table 1: Listing of NFIP Jurisdictions, continued

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Martin County, Unincorporated Areas (continued)	120161	03090102, 03090201, 03090206	12085C0131H 12085C0132H 12085C0133H 12085C0134H 12085C0140H 12085C0141H 12085C0142H 12085C0143H 12085C0144H 12085C0151H 12085C0152H 12085C0153H 12085C0154H 12085C0156H 12085C0158H 12085C0159F[1] 12085C0161H 12085C0162H 12085C0163H 12085C0164H 12085C0166H 12085C0167H 12085C0168H 12085C0169H 12085C0200F[1] 12085C0205F[1] 12085C0210G 12085C0215F[1] 12085C0220G 12085C0240G 12085C0250G[1] 12085C0265G 12085C0275G[1] 12085C0280G[1] 12085C0281H 12085C0282H 12085C0283G 12085C0284H 12085C0290G[1] 12085C0295G[1] 12085C0301H 12085C0302G[1] 12085C0303H 12085C0304G[1] 12085C0307H 12085C0309H 12085C0310H 12085C0315G[1]	

Table 1: Listing of NFIP Jurisdictions, continued

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Martin County, Unincorporated Areas (continued)	120161	03090102, 03090201, 03090206	12085C0317H 12085C0320H 12085C0326F[1] 12085C0328H 12085C0336H 12085C0337F[1] 12085C0338H 12085C0339H 12085C0375F[1] 12085C0400F[1] 12085C0425G 12085C0430G 12085C0435G[1] 12085C0475G[1] 12085C0500G[1] 12085C0505G[1] 12085C0506H 12085C0507H 12085C0508H 12085C0509H 12085C0526H 12085C0527H	
Ocean Breeze, Town of	120163	03090206	12085C0151H	
Sewall's Point, Town of	120164	03090206	12085C0151H 12085C0152H 12085C0153H 12085C0154H 12085C0158H 12085C0162H 12085C0166H	
Stuart, City of	120165	03090206	12085C0132H 12085C0134H 12085C0142H 12085C0151H 12085C0153H 12085C0154H 12085C0161H 12085C0162H 12085C0163H 12085C0164H	

[1] Panel Not Printed

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).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  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 30, "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 Martin County became effective on October 4, 2002. Refer to Table 27 for information about subsequent revisions to the FIRMs.

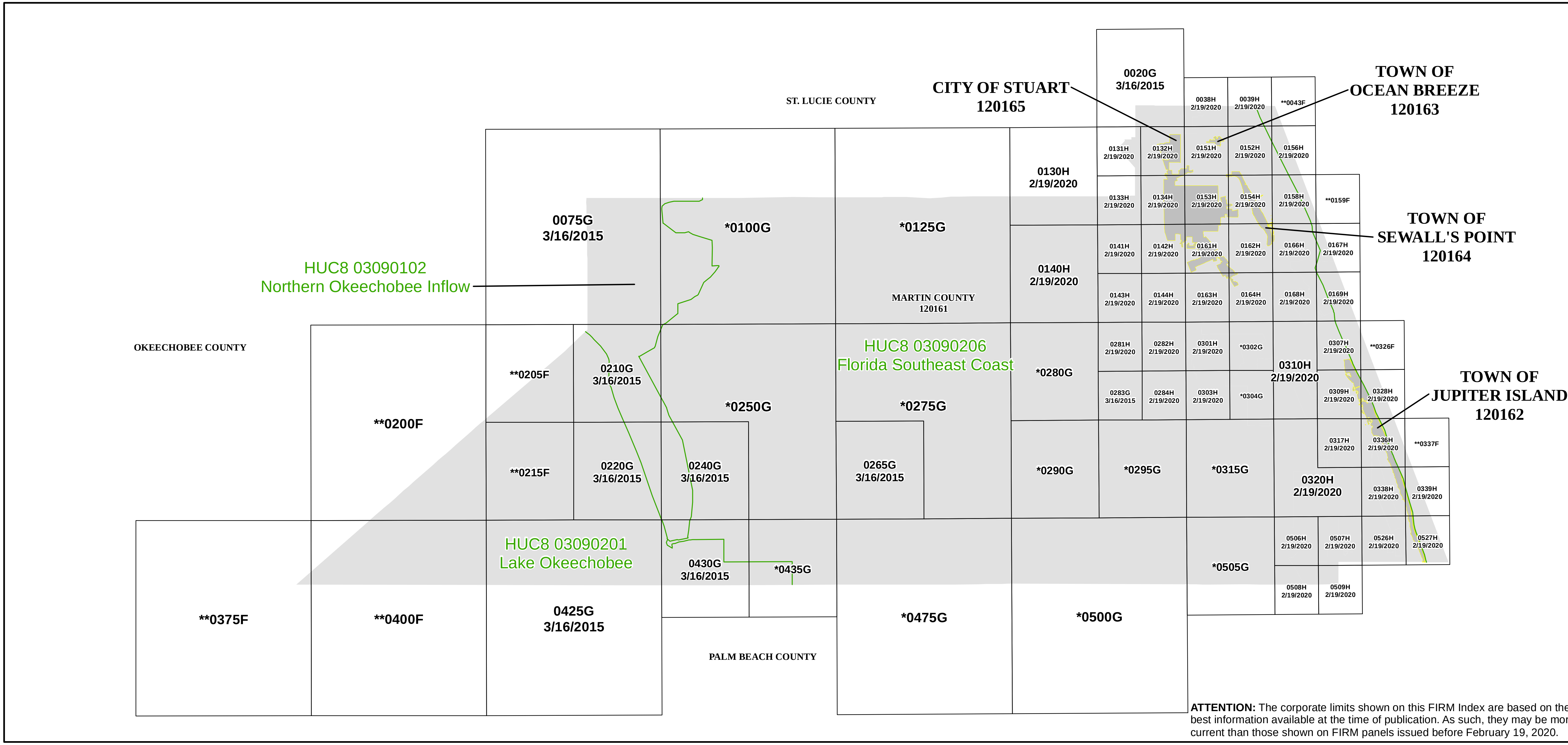
- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by 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 www.fema.gov/national-flood-insurance-program-community-rating-system or contact your appropriate FEMA Regional Office for more information about this program.

- 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 www.fema.gov/online-tutorials.

The FIRM Index in Figure 1 shows the overall FIRM panel layout within Martin County, and also displays the panel number and effective date for each FIRM panel in the county. Other information shown on the FIRM Index includes community boundaries, watershed boundaries, and USGS HUC-8 codes.

Figure 1: FIRM Index



1 inch = 22,917 feet 1:275,000

0 6,500 13,000 26,000 39,000 52,000 feet

Map Projection:
State Plane Transverse Mercator, Florida East Zone 0901; North American Datum 1983

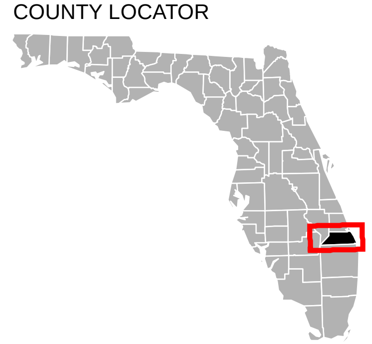
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS
** PANEL NOT PRINTED - OPEN WATER AREA

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

MARTIN COUNTY, FLORIDA and Incorporated Areas

PANELS PRINTED:

0020, 0038, 0039, 0075, 0130, 0131, 0132, 0133, 0134, 0140, 0141, 0142, 0143, 0144, 0151, 0152, 0153, 0154, 0156, 0158, 0161, 0162, 0163, 0164, 0166, 0167, 0168, 0169, 0210, 0220, 0240, 0265, 0281, 0282, 0283, 0284, 0301, 0303, 0307, 0309, 0310, 0317, 0320, 0328, 0336, 0338, 0339, 0425, 0430, 0506, 0507, 0508, 0509, 0526, 0527

FEMA

MAP NUMBER
12085CIND0C

MAP REVISED
FEBRUARY 19, 2020

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on that map. However, the FIRM panel does not contain enough space to show all the notes that may be relevant in helping to better understand the information on the panel. Figure 2 contains the full list of these notes.

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Flood Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 27 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Non-Coastal Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Coastal flood elevations are also provided in the Coastal Transect Parameters table in the FIS Report for this jurisdiction. Elevations shown in the Coastal Transect Parameters table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

Figure 2. FIRM Notes to Users

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was State Plane Transverse Mercator, Florida East Zone. The horizontal datum was the North American Datum of 1983 (NAD83), GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov.

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 30 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was provided in digital format by the Martin County Information Technology Services Department, dated 2003, 2012 and 2015; the Florida Department of Transportation, dated 2014, 2015 and 2016; the U.S. Geological Survey, dated 2006; and the U.S. Department of Agriculture, dated 2016. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Martin County, Florida, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 27 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

Figure 2. FIRM Notes to Users

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Martin County, Florida, effective February 19, 2020.

LIMIT OF MODERATE WAVE ACTION: Zone AE has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between Zone VE and the LiMWA (or between the shoreline and the LiMWA for areas where Zone VE is not identified) will be similar to, but less severe than, those in Zone VE.

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in Martin County.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. 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. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone.
Zone AH	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 BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	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 hydraulic analyses are shown within this zone.
Zone AR	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.
Zone A99	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 flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
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. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.

Figure 3: Map Legend for FIRM

	Regulatory Floodway determined in Zone AE.
OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood.
	Area with Flood Risk due to Levee: Areas where a non-accredited levee, dike, or other flood control structure is shown as providing protection to less than the 1% annual chance flood.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.
NO SCREEN	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
(ortho) (vector)	Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
Aqueduct Channel Culvert Storm Sewer	Channel, Culvert, Aqueduct, or Storm Sewer
Dam Jetty Weir	Dam, Jetty, Weir

Figure 3: Map Legend for FIRM

	Levee, Dike, or Floodwall
Bridge	Bridge
REFERENCE MARKERS	
22.0	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
B 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
5280 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
8	Coastal Transect
	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
513	Base Flood Elevation Line
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity
BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway

Figure 3: Map Legend for FIRM

234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}E$	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and Martin County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 22), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, “Map Legend for FIRM”, describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Martin County, respectively.

Table 2, “Flooding Sources Included in this FIS Report,” lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 12. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Atlantic Ocean	Jupiter Island, Town of; Martin County, Unincorporated Areas	Entire Coastline	Entire Coastline	03090206	22.0		N	VE, AE	2016
Bessey Creek	Martin County, Unincorporated Areas	Confluence with County Line Canal	Approximately 40 feet downstream of SW Andrews Drive	03090206	1.9		N	AE	2016
Bessey Creek	Martin County, Unincorporated Areas	Approximately 40 feet downstream of SW Andrews Drive	84th Avenue	03090206	4.6		N	AE	1997
Bessey Creek Zone AE Tributaries	Martin County, Unincorporated Areas	Not provided	Not provided	03090206	5.9		N	AE	1997
Connector Channel	Martin County, Unincorporated Areas	Not provided	Not provided	03090206	3.0		N	AE	1997
Coral Gardens Canal	Martin County, Unincorporated Areas; Stuart, City of	Confluence with South Fork St. Lucie River	Approximately 940 feet downstream of SE Norfolk Boulevard	03090206	0.8		Y	AE	2016
Coral Gardens Canal	Martin County, Unincorporated Areas	Approximately 940 feet downstream of SE Norfolk Boulevard	Downstream face of Willoughby Boulevard	03090206	1.0		Y	AE	2012
Danforth Creek	Martin County, Unincorporated Areas	Confluence with South Fork St. Lucie River	Approximately 1,535 feet downstream of SW Sunset Trail	03090206	0.8		N	AE	2016
Danforth Creek	Martin County, Unincorporated Areas	Approximately 1,535 feet downstream of SW Sunset Trail	Approximately 1.1 miles upstream of SW 48th Avenue	03090206	4.2		N	AE	2012
Danforth Creek Zone AE Tributaries	Martin County, Unincorporated Areas	Not provided	Not provided	03090206	2.5		N	AE	1997

Table 2: Flooding Sources Included in this FIS Report, continued

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
East Fork Creek	Martin County, Unincorporated Areas	Confluence with Manatee Creek	Approximately 60 feet downstream of Florida Eastcoast Trailroad	03090206	1.0		N	AE	2016
East Fork Creek	Martin County, Unincorporated Areas	Approximately 60 feet downstream of Florida Eastcoast Trailroad	Approximately 950 feet upstream of SE Constitution Boulevard	03090206	3.6		N	AE	2012
Fern Creek	Martin County, Unincorporated Areas	Confluence with South Fork St. Lucie River	Approximately 1,150 feet upstream of confluence with Old Fern Creek	03090206	1.0		N	AE	2016
Fern Creek	Martin County, Unincorporated Areas	Approximately 1,150 feet upstream of confluence with Old Fern Creek	Downstream face of SE Salerno Road	03090206	0.8		N	AE	2012
Indian River	Martin County, Unincorporated Areas; Sewall's Point, Town of	Not provided	Not provided	03090206	7.4		N	AE, VE	2016
Lake Okeechobee	Martin County, Unincorporated Areas	Not provided	Not provided	03090201 03090102	12.3		N	AE, VE	1997
Loxahatchee River	Martin County, Unincorporated Areas	Approximately 4.3 miles upstream from county boundary	County boundary	03090206	2.8		Y	AE	2016
Manatee Creek	Martin County, Unincorporated Areas	Confluence with Manatee Pocket	Approximately 140 feet upstream of SE Primrose Way	03090206	0.3		Y	AE	2016
Manatee Creek	Martin County, Unincorporated Areas	Approximately 140 feet upstream of SE Primrose Way	Approximately 70 feet downstream of SE Federal Highway	03090206	1.3		Y	AE	2012
Manatee Pocket	Martin County, Unincorporated Areas	Not provided	Not provided	03090206		0.2	N	AE, VE	2016

Table 2: Flooding Sources Included in this FIS Report, continued

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
North Fork Loxahatchee River	Martin County, Unincorporated Areas	Not provided	Not provided	03090206	3.5		N	AE	2016
North Fork Loxahatchee River	Martin County, Unincorporated Areas	Not provided	Not provided	03090206	0.1		N	A	1997
North Fork St. Lucie River	Martin County, Unincorporated Areas; Stuart, City of	Not provided	Not provided	03090206	2.5		N	AE, VE	2016
Old Fern Creek	Martin County, Unincorporated Areas	Not provided	Not provided	03090206	0.2		N	AE	2016
Old Fern Creek	Martin County, Unincorporated Areas	Not provided	Not provided	03090206	0.2		N	AE	2012
Roebuck Creek	Martin County, Unincorporated Areas	Confluence with St. Lucie Canal Okeechobee Waterway	Approximately 60 feet downstream of SW Buckskin Trail	03090206	1.1		Y	AE	2016
Roebuck Creek	Martin County, Unincorporated Areas	Approximately 60 feet downstream of SW Buckskin Trail	Approximately 0.8 mile upstream of SW 96th Street	03090206	3.2		Y	AE	2012
Rowland Canal	Martin County, Unincorporated Areas	Confluence with St. Lucie Canal Waterway	Approximately 0.6 mile upstream of SW 150th Street	03090206	2.5		N	AE	2012
South Fork St. Lucie River	Martin County, Unincorporated Areas; Stuart, City of	Confluence with St. Lucie Canal Okeechobee Waterway	Approximately 0.7 mile downstream of county boundary	03090206	7.5		Y	AE, VE	2016
South Fork St. Lucie River	Martin County, Unincorporated Areas	Approximately 0.7 mile downstream of county boundary	County boundary	03090206	0.7		Y	AE	1997
South Fork St. Lucie River	Martin County, Unincorporated Areas	Not provided	Not provided	03090206	1.3		N	A	1997

Table 2: Flooding Sources Included in this FIS Report, continued

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
St. Lucie River	Martin County, Unincorporated Areas; Stuart, City of	Not provided	Not provided	03090206	7.2		N	AE, VE	2016
Unnamed Tributary 1 to Roebuck Creek	Martin County, Unincorporated Areas	Confluence with Roebuck Creek	Approximately 105 feet upstream of SW Old Royal Drive	03090206	0.4		N	AE	2012
Warner Creek	Martin County, Unincorporated Areas	Confluence with St. Lucie River	Approximately 40 feet upstream of NE Tropicalial Lane	03090206	0.8		N	AE	2016
Warner Creek	Martin County, Unincorporated Areas	Approximately 40 feet upstream of NE Tropicalial Lane	Downstream face of NE Jensen Beach Boulevard	03090206	1.8		N	AE	2012

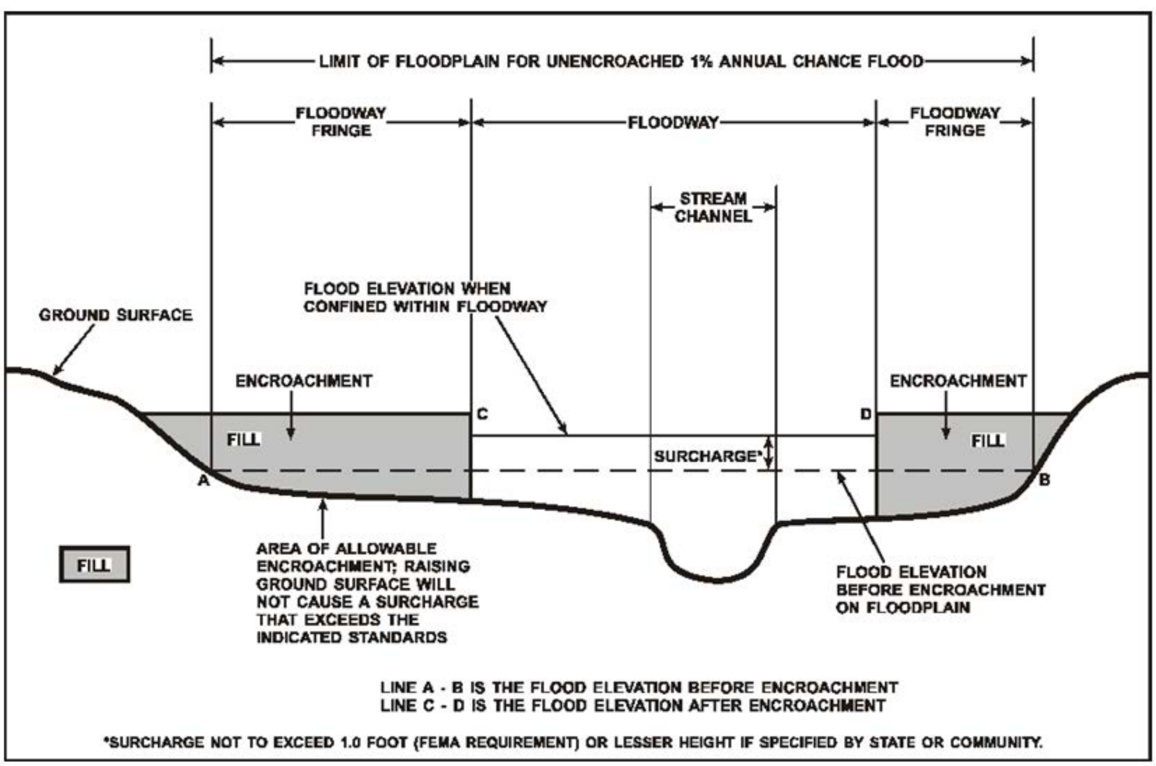
2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 23, "Floodway Data."

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and 1% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

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.

2.4 Non-Encroachment Zones

This section is not applicable to this Flood Risk Project.

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.

Coastal flooding sources that are included in this Flood Risk Project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

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

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

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

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

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

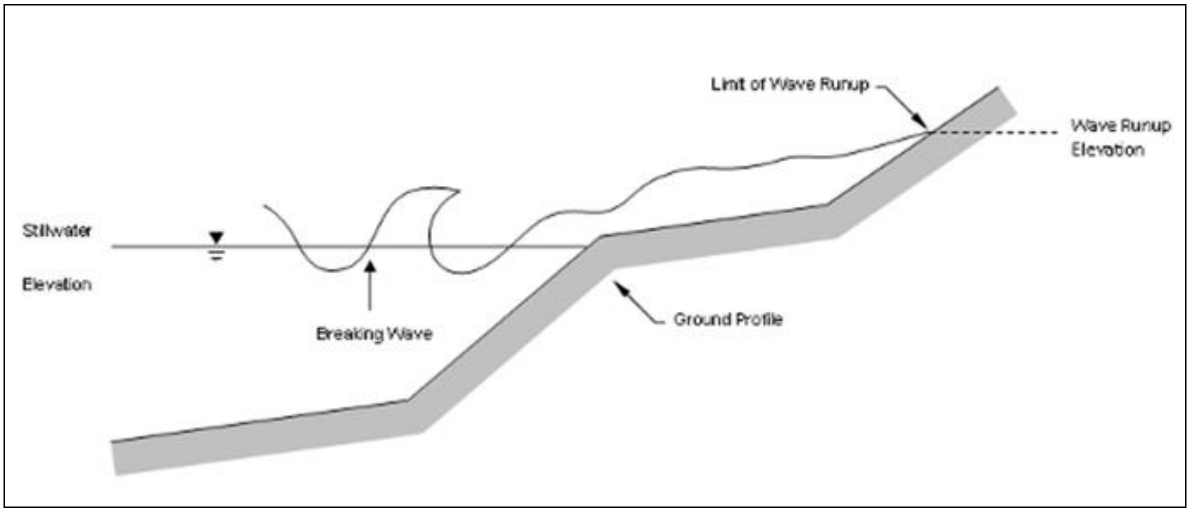
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

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

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

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

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

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

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

Floodplain Boundaries
In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 8, “1% Annual Chance Total Stillwater Levels for Coastal Areas.”

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

Table 25 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs
Coastal BFEs 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 16, “Coastal Transect Parameters.” The locations of transects are shown in Figure 9, “Transect Location Map.” More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

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

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

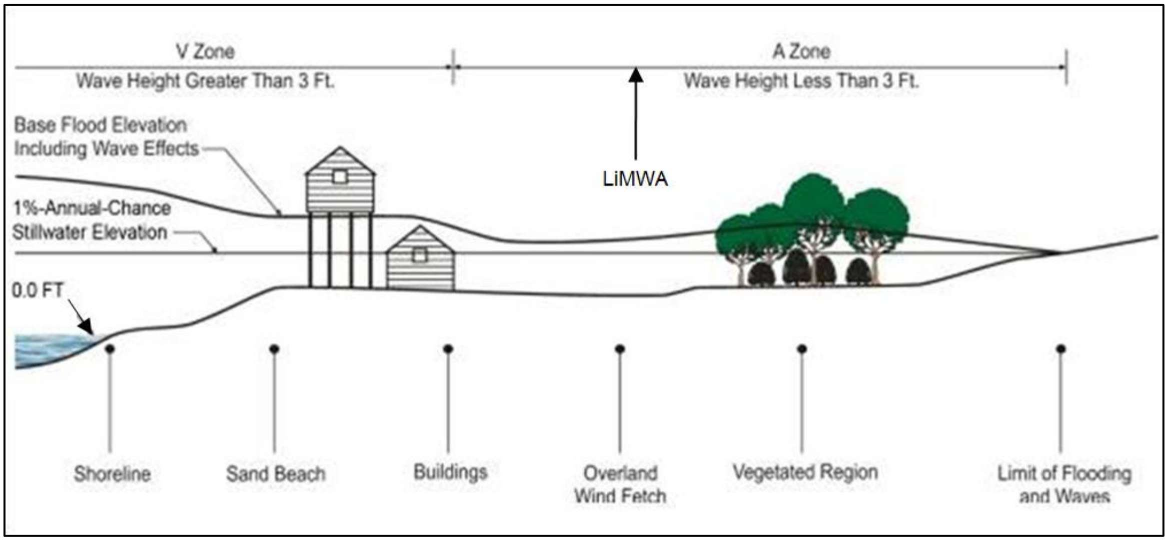
CHHAs are designated as “V” zones (for “velocity wave zones”) and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the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

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

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

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

Figure 6: Coastal Transect Schematic



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

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM." In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 16 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

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

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

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

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in Martin County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Jupiter Island, Town of	AE, AO, VE, X
Martin County, Unincorporated Areas	A, AE, AH, AO, VE, X
Ocean Breeze, Town of	AE, VE, X
Sewall's Point, Town of	AE, VE, X
Stuart, City of	AE, VE, X

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 4 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 drainage area.

Table 4: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Florida Southeast Coast	03090206	Atlantic Ocean	Runs along the eastern coast of Florida in St. Lucie, Martin, Palm Beach, Broward, Miami-Dade and Monroe Counties.	3,126

Table 4: Basin Characteristics, continued

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Lake Okeechobee	03090201	Lake Okeechobee	Located primarily in Okeechobee County and on the western side of Martin County.	865
Northern Okeechobee Inflow	03090102	Lake Okeechobee	Located primarily in Okeechobee County and on the western side of Martin County.	305

4.2 Principal Flood Problems

Table 5 contains a description of the principal flood problems that have been noted for Martin County by flooding source.

Table 5: Principal Flood Problems

Flooding Source	Description of Flood Problems
All Flooding Sources in Martin County	Flooding in Martin County results from tidal surge associated with a northeaster, hurricane, or tropical storm activity and from overflow of streams and swamps associated with rainfall runoff. Major rainfall events occur from hurricanes, tropical storms, and thundershowers associated with frontal systems. Some of the worst area floods were the result of high intensity rainfall during hurricanes or tropical storms. In the eastern portion of the county, most of the flood-prone areas feature poorly drained soil, a high water table, and flat terrain. These characteristics contribute significantly to flooding problems. Furthermore, the flat slopes and heavily vegetated floodplains promote backwater effects and aggravate the flood problems by preventing the rapid drainage of floodwaters.
Atlantic Ocean	The coastal areas of Martin County are subject to flooding from tidal surges associated with hurricanes and northeasters. Waves, associated with high wind-generated surges, can exacerbate flooding, erode shorelines, and produce high forces which can further damage structures, particularly along the open coastline. Interior areas are also subject to surge flooding and wave damage due to the close proximity of three ocean inlets. Having a relatively short time of concentration, the smaller streams tend to reach peak flood flow concurrently with elevated tailwater conditions associated with the coastal storm surge. This greatly increases the likelihood of inundation of low lying areas along the coast.

Table 6 contains information about historic flood elevations in the communities within Martin County.

Table 6: Historic Flooding Elevations

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Danforth Creek	Leighton Farms Road	16.1	2008	*	HWM
South Fork St. Lucie River	*	7.65	1995	*	HWM
St. Lucie Canal	Allapattah Marsh area	*	1960	5	FEMA 2015

*Data not available

4.3 Non-Levee Flood Protection Measures

Table 7 contains information about non-levee flood protection measures within Martin County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 7: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Atlantic Ocean	N/A	Seawalls and bulkheads	Various locations	Along the shorelines, there are numerous individual seawalls and bulkheads that provide protection for private property but do not provide a 1-percent-annual chance flood protection capacity.
Lake Okeechobee	Herbert Hoover Dike	Dike	Lake Okeechobee	The Herbert Hoover Dike system and its associated flood gates which were designed and constructed in the 1950's to provide protection from hurricane surge and high water-surface levels on Lake Okeechobee. The Herbert Hoover Dike and floodgate system is operated and maintained by the USACE.
Lake Okeechobee	N/A	Canals, locks, and pump stations	Various locations	Flood control canals near Lake Okeechobee and numerous other locations within Martin County which are operated and maintained by the SFWMD.

4.4 Levees

For purposes of the NFIP, FEMA only recognizes levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with comprehensive floodplain management criteria. The Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) describes the information needed for FEMA to determine if a levee system reduces the risk from the 1% annual chance flood. This information must be supplied to FEMA by the community or other party when a flood risk study or restudy is conducted, when FIRMs are revised, or upon FEMA request. FEMA reviews the information for the purpose of establishing the appropriate FIRM flood zone.

Levee systems that are determined to reduce the risk from the 1% annual chance flood are accredited by FEMA. FEMA can also grant provisional accreditation to a levee system that was previously accredited on an effective FIRM and for which FEMA is awaiting data and/or documentation to demonstrate compliance with Section 65.10. These levee systems are referred to as Provisionally Accredited Levees, or PALs. Provisional accreditation provides communities and levee owners with a specified timeframe to obtain the necessary data to confirm the levee's certification status. Accredited levee systems and PALs are shown on the FIRM using the symbology shown in Figure 3 and in Table 8. If the required information for a PAL is not submitted within the required timeframe, or if information indicates that a levee system not longer meets Section 65.10, FEMA will de-accredit the levee system and issue an effective FIRM showing the levee-impacted area as a SFHA.

FEMA coordinates its programs with USACE, who may inspect, maintain, and repair levee systems. The USACE has authority under Public Law 84-99 to supplement local efforts to repair flood control projects that are damaged by floods. Like FEMA, the USACE provides a program to allow public sponsors or operators to address levee system maintenance deficiencies. Failure to do so within the required timeframe results in the levee system being placed in an inactive status in the USACE Rehabilitation and Inspection Program. Levee systems in an inactive status are ineligible for rehabilitation assistance under Public Law 84-99.

FEMA coordinated with the USACE, the local communities, and other organizations to compile a list of levees that exist within Martin County. Table 8, "Levees," lists all accredited levees, PALs, and de-accredited levees shown on the FIRM for this FIS Report. Other categories of levees may also be included in the table. The Levee ID shown in this table may not match numbers based on other identification systems that were listed in previous FIS Reports. Levees identified as PALs in the table are labeled on the FIRM to indicate their provisional status.

Please note that the information presented in Table 8 is subject to change at any time. For that reason, the latest information regarding any USACE structure presented in the table should be obtained by contacting USACE and accessing the USACE National Levee Database. For levees owned and/or operated by someone other than the USACE, contact the local community shown in Table 30.

Table 8: Levees

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)
Martin County, Unincorporated Areas	Lake Okeechobee	Right Bank	South Florida Water Management District	Yes	12085	No	12085C0210G 12085C0220G 12085C0240G 12085C0430G

SECTION 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. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 12. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 9. Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 10. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 16.) Stream gage information is provided in Table 11.

Table 9: Summary of Discharges

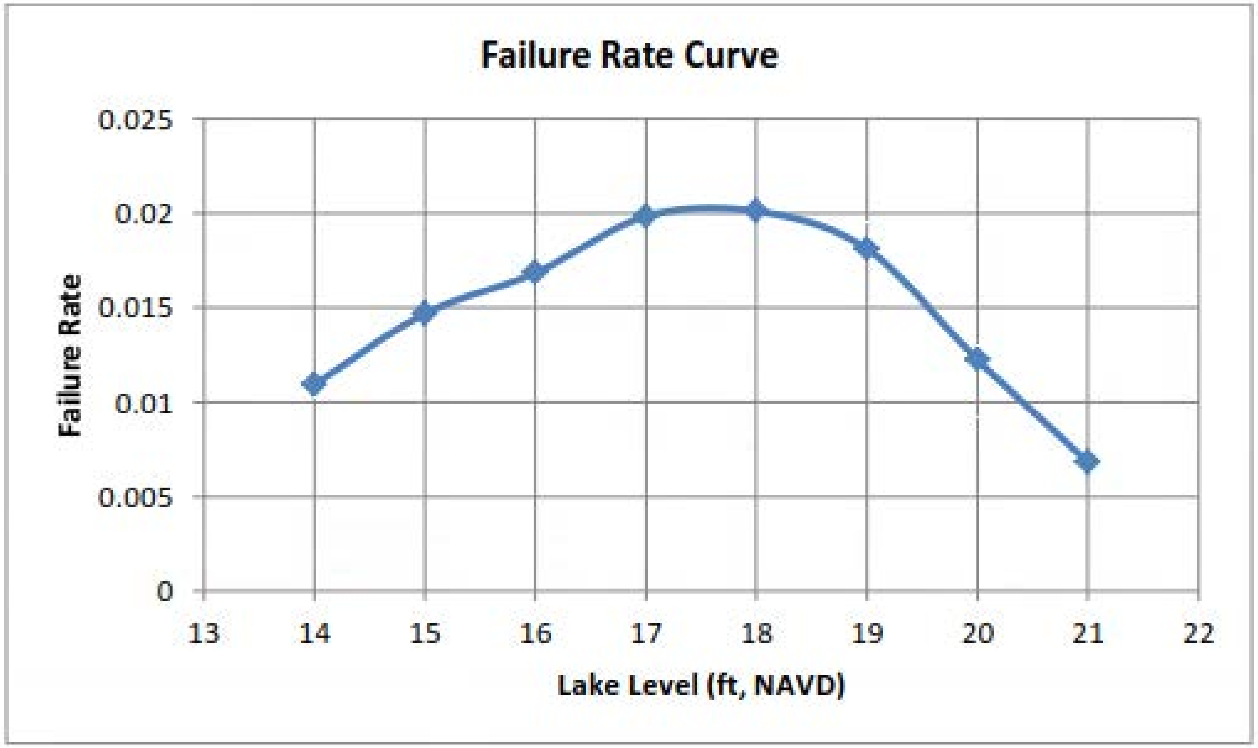
Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Bessey Creek	At Murphy Road	10.39	*	*	*	2,441	3,276
Bessey Creek	At Boast Ramp Avenue	4.93	*	*	*	1,114	1,729
Bessey Creek	At SE Norfolk Boulevard	2.83	226	*	428	537	818
Bessey Creek	At Willoughby Road	2.44	203	*	398	497	714
Coral Gardens Canal	Confluence with South Fork St. Lucie River	3.44	263	*	533	665	1,000
Coral Gardens Canal	At SE Norfolk Boulevard	2.83	226	*	428	537	818
Coral Gardens Canal	At Willoughby Road	2.44	203	*	398	497	714
Danforth Creek	At confluence with South Fork St. Lucie River	6.00	832	*	1,232	1,391	1,761
Danforth Creek	At State Highway 714	5.21	653	*	805	864	1,022
Danforth Creek	At SW 48th Avenue	2.92	355	*	440	516	690
East Fork Creek	At State Route A1A	3.48	487	*	696	802	1,133
East Fork Creek	At Mariners Sand Drive	2.65	888	*	1,288	1,480	2,124
East Fork Creek	At Heritage Ridge Boulevard	0.79	501	*	732	819	1,094
Fern Creek	At State Highway 76	1.86	286	*	417	453	595
Fern Creek	At SE Salerno Road	0.69	144	*	183	190	210

Table 9: Summary of Discharges, continued

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Loxahatchee River	At County Boundary	55.0	2,857	*	4,189	4,771	6,155
Manatee Creek	At SE Dixie Highway	1.25	288	*	448	505	621
Manatee Creek	At SE Highway 1	0.74	142	*	194	517	273
Roebuck Creek	At confluence with St. Lucie Canal	3.01	460	*	750	868	1,142
Roebuck Creek	At SW Locks Road	1.91	344	*	539	619	767
Roebuck Creek	At SW Mary Drive	0.61	138	*	212	221	252
Rowland Canal	At confluence with St. Lucie Canal	4.07	*	*	*	1,393	*
Rowland Canal	At State Highway 710	3.24	*	*	*	1,142	*
South Fork St. Lucie River	At State Route 76	33.4	1,970	*	2,899	3,314	4,515
Unnamed Tributary 1 to Roebuck Creek	Confluence with Roebuck Creek	0.38	49	*	80	97	135
Warner Creek	At confluence with St. Lucie River	8.02	564	*	843	900	1,110
Warner Creek	At NE Pinelake Village Boulevard	7.28	470	*	670	711	867
Warner Creek	At NE Jensen Beach Boulevard	5.48	290	*	369	380	444

*Not calculated for this Flood Risk Project

Figure 7: HDD Failure Rate (Events per Year) for Various Lake Okeechobee Lake Levels



Note the calculated failure rates in the figure apply to the total dike system (i.e., the total dike failure rate at a given lake level represents the combined failure rate of all reaches). Each dike reach around the circumference of the lake must receive a portion of the total failure rate. Because the dike comprises 11 reaches with an established fragility curve for each reach based on characteristic geotechnical conditions for that reach, the failure probability of each reach provides the basis to allocate (through Equation 1) the total failure rate.

$$Rate_{i,j} = \frac{P_{i,j}}{\sum_{i=1A..}^{8} P_{i,j}} \times TotalRate_j \tag{1}$$

Here, i denotes the reach number from 1A to 8; j denotes the lake level from 14ft to 21ft; Rate i,j is occurrence rate of each breach; $TotalRatej$ is the total dike failure rate.

The table below shows the rate for each breach simulation. Note the MRR fragility curves indicate a 100 % chance of failure at a lake level of 20 feet NAVD somewhere along HHD; therefore, the allocated rates for all reaches at 21 feet (from Equation 1) are combined into the allocated rates at 20 feet in Table 4, and the allocated rates for 21 feet are set to zero.

Allocated Failure Rate (Events per Year) for each Breach Simulation

Lake Level (NAVD Datum)								
Reach	14 feet	15 feet	16 feet	17 feet	18 feet	19 feet	20 feet	21 feet
1A	0.000117	0.000157	0.000181	0.000266	0.001551	0.001585	0.001925	0
1B	0.000117	0.000157	0.000181	0.000266	0.001351	0.001375	0.001724	0
1C	0.003464	0.004644	0.005321	0.007578	0.004713	0.003815	0.003712	0
2	0.003892	0.00523	0.006028	0.004256	0.00377	0.003318	0.003389	0
3	0.002997	0.004027	0.004642	0.004965	0.004271	0.003737	0.003761	0
4	3.89E-05	5.23E-05	6.03E-05	8.87E-05	0.000184	0.000179	0.000209	0
5	3.89E-05	5.23E-05	6.03E-05	8.87E-05	0.000184	0.000179	0.000209	0
6A	1.56E-05	2.09E-05	3.01E-06	4.61E-05	7.54E-05	7.21E-05	8.36E-05	0
6B	2.34E-05	3.14E-05	4.52E-06	7.09E-05	0.000117	0.000112	0.000131	0
7	0.000195	0.000261	0.000301	0.002114	0.003701	0.003562	0.003728	0
8	3.89E-05	5.23E-05	6.03E-05	8.87E-05	0.000184	0.000179	0.000209	0

Applied to the breach flooding simulation results, the statistical analysis yielded a statistical flood surface, which represents flood levels at every computational node for a given flood frequency, in this case the 1-percent-annual chance. The statistical surface then became the basis for work maps that show the extent of 1 percent-annual chance flooding, proposed Base Flood Elevations, and proposed Special Flood Hazard Area zones. A detailed report (FEMA 2012) documents the study approach and results. Engineering and mapping products are consistent with FEMA's Guidelines and Specifications and the study's scope of work.

Revised Zone AEs, from the above results, were mapped where appropriate. In areas that do not reach the 1 percent-annual chance flood level, Zone X-Shaded was mapped using the simulated flood inundation from a breach with an initial lake level of 20 feet NAVD. Also, some Special Flood Hazard Areas remained unchanged depending on the location and flooding source, and Zone A's were mapped where the 1-percent-annual chance flood level was not determined due to lack of modeling data (breach location limitations).

The study also included coordination with stakeholders, specifically the USACE, South Florida Water Management District, and local communities. Leveraging existing studies and reports, including the USACE's HHD breach model and MRR, also proved critical to the cost-effective and timely completion of this scope of work. The USACE authorized the use of its HHD hydrodynamic breach model in May 2011 as the foundation for this study and provided other supporting insight, information, and clarification about the MRR data, Lake Okeechobee water levels and regulation, and ongoing HHD improvements.

Table 10: Summary of Non-Coastal Stillwater Elevations

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Lake Okeechobee	Okeechobee County limits to north of Chancey Bay	20.0	*	22.4	23.3	24.6
Lake Okeechobee	Chancey Bay Area	19.6	*	21.9	22.7	23.9
Lake Okeechobee	Confluence of St. Lucie Canal	19.3	*	21.3	22.1	23.3
Lake Okeechobee	Confluence of St. Lucie Canal to Palm Beach County limits	19.2	*	21.3	21.9	23.3

*Not calculated for this Flood Risk Project

Table 11: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Loxahatchee River	265906080093500	USGS	At mile 9.1 near Jupiter, FL	*	1971	Present

*Data not available

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM 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. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed in Table 23, “Floodway Data.”

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 12. Roughness coefficients are provided in Table 13. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 12: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Atlantic Ocean	Entire coastline	Entire coastline	ADCIRC + SWAN	JPM-OS	2016	AE, VE	Offshore starting wave conditions are required for 1-D transect-based wave hazard analyses. As part of the JPM-OS ADCIRC+SWAN regional hydrodynamic and wave modeling significant wave heights and peak wave periods were produced at each node contained in the ADCIRC mesh. These results provided valuable information on the wave conditions that can be expected to occur during the types of extreme storm events that would produced storm surge elevations with 1- and 0.2-percent-annual-chance probabilities of occurrence. Results from the ADCIRC+SWAN modeling were used to develop starting wave conditions for the coastal hazard analyses within the study area.
Bessey Creek	Confluence with County Line Canal	Approximately 40 feet downstream of SW Andrews Drive	*	Combined probability calculation spreadsheet	2016	AE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Bessey Creek	Approximately 40 feet downstream of SW Andrews Drive	84th Avenue	HEC-1	UNET and HEC-2	1997	AE	
Bessey Creek Zone AE Tributaries	Not provided	Not provided	*	*	1997	AE	
Connector Channel	Not provided	Not provided	*	*	1997	AE	
Coral Gardens Canal	Confluence with South Fork St. Lucie River	Approximately 940 feet downstream of SE Norfolk Boulevard	*	Combined probability calculation spreadsheet	2016	AE w/ Floodway	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.

Table 12: Summary of Hydrologic and Hydraulic Analyses, continued

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Coral Gardens Canal	Approximately 940 feet downstream of SE Norfolk Boulevard	Downstream face of Willoughby Boulevard	HEC-HMS	HEC-RAS	2012	AE w/ Floodway	A portion of this stream was redelineated on the 2007 LiDAR data (3001 Inc. 2007).
Danforth Creek	Confluence with South Fork St. Lucie River	Approximately 1,535 feet downstream of SW Sunset Trail	*	Combined probability calculation spreadsheet	2016	AE	Combined probability analysis was calculated for each riverine node that intersected the coastal surge.
Danforth Creek	Approximately 1,535 feet downstream of SW Sunset Trail	Approximately 1.1 miles upstream of SW 48th Avenue	ICPR	ICPR	2012	AE	A portion of this stream was redelineated on the 2007 LiDAR data (3001 Inc. 2007).
Danforth Creek Zone AE Tributaries	Not provided	Not provided	*	*	1997	AE	
East Fork Creek	Confluence with Manatee Creek	Approximately 60 feet downstream of Florida Eastcoast Trailroad	*	Combined probability calculation spreadsheet	2016	AE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
East Fork Creek	Approximately 60 feet downstream of Florida Eastcoast Trailroad	Approximately 950 feet upstream of SE Constitution Boulevard	HEC-HMS	HEC-RAS	2012	AE	
Fern Creek	Confluence with South Fork St. Lucie River	Approximately 1,150 feet upstream of confluence with Old Fern Creek	*	Combined probability calculation spreadsheet	2016	AE	Combined probability analysis was calculated for each riverine node that intersected the coastal surge.
Fern Creek	Approximately 1,150 feet upstream of confluence with Old Fern Creek	Downstream face of SE Salerno Road	ICPR	ICPR	2012	AE	
Indian River	Not provided	Not provided	*	*	2016	AE, VE	

Table 12: Summary of Hydrologic and Hydraulic Analyses, continued

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Lake Okeechobee	Not provided	Not provided	Joint Probability	*	1997	AE, VE	
Loxahatchee River	Approximately 4.3 miles upstream from county boundary	County boundary	*	Combined probability calculation spreadsheet	2016	AE w/ Floodway	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Manatee Creek	Confluence with Manatee Pocket	Approximately 140 feet upstream of SE Primrose Way	*	Combined probability calculation spreadsheet	2016	AE	Combined probability analysis was calculated for each riverine node that intersected the coastal surge.
Manatee Creek	Approximately 140 feet upstream of SE Primrose Way	Approximately 70 feet downstream of SE Federal Highway	ICPR	ICPR	2012	AE w/ Floodway	
Manatee Pocket	Not provided	Not provided	*	*	2016	AE, VE	
North Fork Loxahatchee River	Not provided	Not provided	*	*	2016	AE	
North Fork Loxahatchee River	Not provided	Not provided	*	*	1997	A	
North Fork St. Lucie River	Not provided	Not provided	*	*	2016	AE, VE	
Old Fern Creek	Not provided	Not provided	*	Combined probability calculation spreadsheet	2016	AE	Combined probability analysis was calculated for each riverine node that intersected the coastal surge.
Old Fern Creek	Not provided	Not provided	ICPR	ICPR	2012	AE	
Roebuck Creek	Confluence with St. Lucie Canal Okeechobee Waterway	Approximately 60 feet downstream of SW Buckskin Trail	*	Combined probability calculation spreadsheet	2016	AE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.

Table 12: Summary of Hydrologic and Hydraulic Analyses, continued

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Roebuck Creek	Approximately 60 feet downstream of SW Buckskin Trail	Approximately 0.8 mile upstream of SW 96th Street	ICPR	HEC-RAS	2012	AE w/ Floodway	A portion of this stream was redelineated on the 2007 LiDAR data (3001 Inc. 2007).
Rowland Canal	Confluence with St. Lucie Canal Waterway	Approximately 0.6 mile upstream of SW 150th Street	HEC-HMS	HEC-RAS	2012	AE	
South Fork St. Lucie River	Confluence with St. Lucie Canal Okeechobee Waterway	Approximately 0.7 miles downstream of county boundary	*	Combined probability calculation spreadsheet	2016	AE w/ Floodway, VE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
South Fork St. Lucie River	Approximately 0.7 miles downstream of county boundary	County boundary	HEC-1	HEC-2	1997	AE w/ Floodway	
South Fork St. Lucie River	Not provided	Not provided	*	*	1997	A	
St. Lucie River	Not provided	Not provided	*	*	2016	AE	
Unnamed Tributary 1 to Roebuck Creek	Confluence with Roebuck Creek	Approximately 105 feet upstream of SW Old Royal Drive	ICPR	ICPR	2012	AE	
Warner Creek	Confluence with St. Lucie River	Approximately 40 feet upstream of NE Tropicalial Lane	*	Combined probability calculation spreadsheet	2016	AE	Combined probability analysis was calculated for each riverine node that intersected the coastal surge.
Warner Creek	Approximately 40 feet upstream of NE Tropicalial Lane	Downstream face of NE Jensen Beach Boulevard	ICPR	ICPR	2012	AE	A portion of this stream was redelineated on the 2007 LiDAR data (3001 Inc. 2007).

*Data not available

Table 13: Roughness Coefficients

Flooding Source	Channel "n"	Overbank "n"
Bessey Creek	0.035-0.05	0.12-0.2
Coral Gardens Canal	0.04	0.06-0.15
Danforth Creek	0.035-0.04	*
East Fork Creek	0.03	0.05
Fern Creek	0.022-0.05	*
Loxahatchee River	0.035	0.1
Manatee Creek	0.035	0.1
Roebuck Creek	0.04-0.06	0.06-0.1
Rowland Canal	0.03	0.05-0.15
South Fork St. Lucie River	0.035-0.04	0.1
Unnamed Tributary 1 to Roebuck Creek	0.045-0.06	0.08-0.1
Warner Creek	0.02-0.045	*

*Data not available

5.3 Coastal Analyses

For the areas of Martin 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 this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 14 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

Table 14: Summary of Coastal Analyses

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Atlantic Ocean	Entire coastline of Martin County	Entire coastline of Martin County	Storm Climatology Statistical Analyses	JPM-OS	01/06/2014
Atlantic Ocean	Entire coastline of Martin County	Entire coastline of Martin County	Storm Surge including Regional Wave Setup	ADCIRC + SWAN	12/02/2015

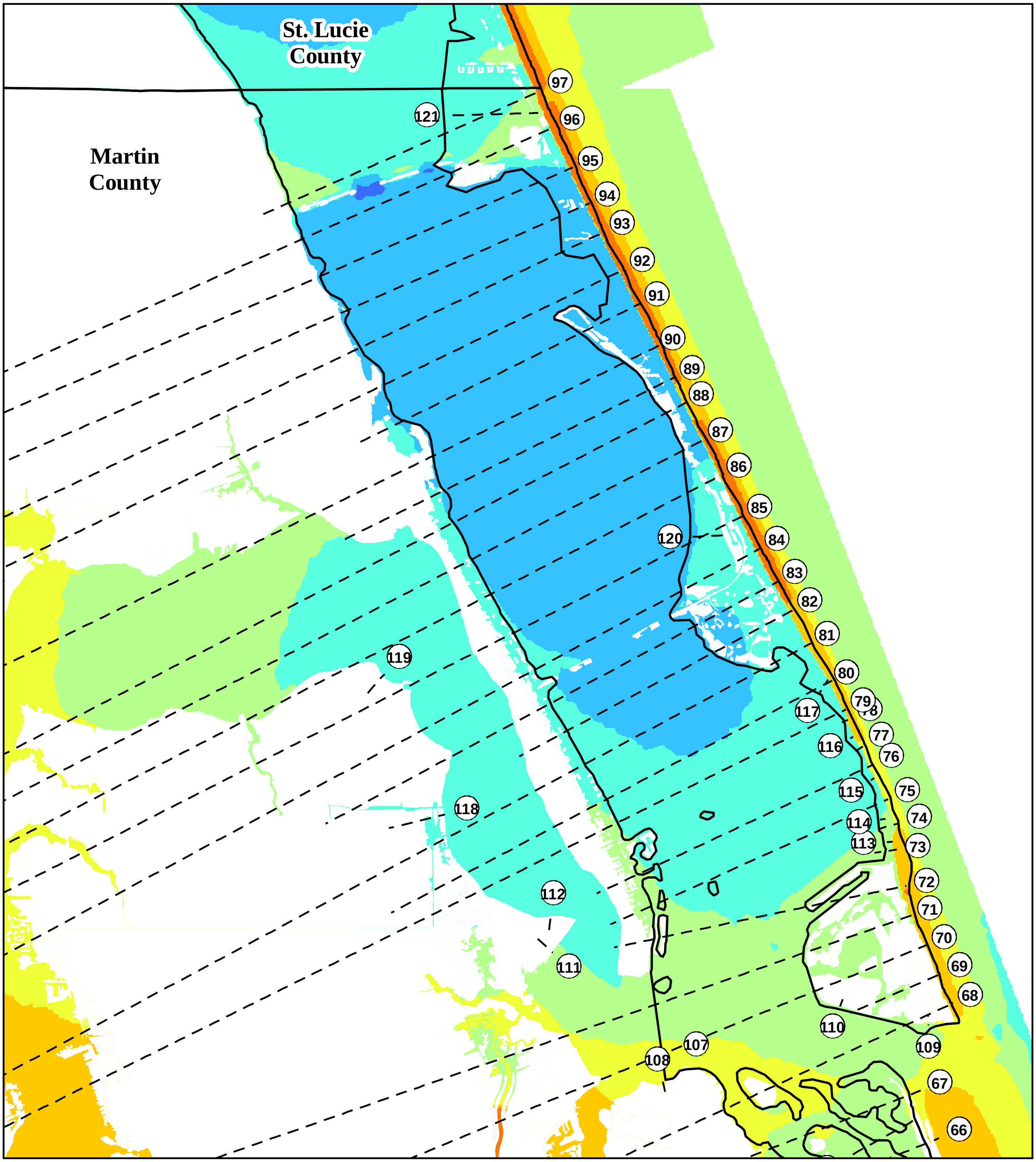
Table 14: Summary of Coastal Analyses, continued

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Atlantic Ocean	Entire coastline of Martin County	Entire coastline of Martin County	Stillwater Frequency Analysis	SURGESTAT (low frequency); Regional Tidal Frequency Analysis (high frequency)	04/12/2016
Atlantic Ocean	Entire coastline of Martin County	Entire coastline of Martin County	Dune Erosion	FEMA's Erosion Assessment	11/29/2016
Atlantic Ocean	Entire coastline of Martin County	Entire coastline of Martin County	Overland Wave Propagation	WHAFIS	11/29/2016
Atlantic Ocean	Entire coastline of Martin County	Entire coastline of Martin County	Wave Runup	TAW, SPM, RUNUP 2.0	11/29/2016
Indian River	Entire coastline of Martin County	Entire coastline of Martin County	Overland Wave Propagation	WHAFIS	11/29/2016
Intracoastal Waterway	Entire coastline of Martin County	Entire coastline of Martin County	Overland Wave Propagation	WHAFIS	11/29/2016
Lake Okeechobee	Entire coastline of Martin County	Entire coastline of Martin County	Statistical Analysis	JPM	8/1997
St. Lucie River	Entire coastline of Martin County	Entire coastline of Martin County	Overland Wave Propagation	WHAFIS	11/29/2016

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 14. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 16, "Coastal Transect Parameters." Figure 8 shows the total stillwater elevations for the 1% annual chance flood that was determined for this coastal analysis.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas



Elevation (Feet, NAVD88)

- 3.5 - 3.75
- 3.75 - 4.0
- 4.0 - 4.25
- 4.25 - 4.5
- 4.5 - 4.75
- 4.75 - 5.0
- 5.0 - 5.25
- 5.25 - 5.5
- 5.5 - 5.75

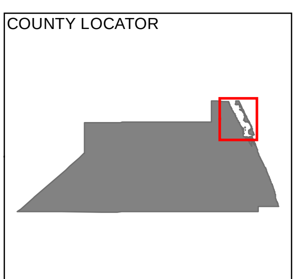
- - Coastal Transects

County Boundaries

1 inch = 5,000 feet 1:60,000

0 1,000 2,000 4,000 6,000 8,000 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983



NATIONAL FLOOD INSURANCE PROGRAM

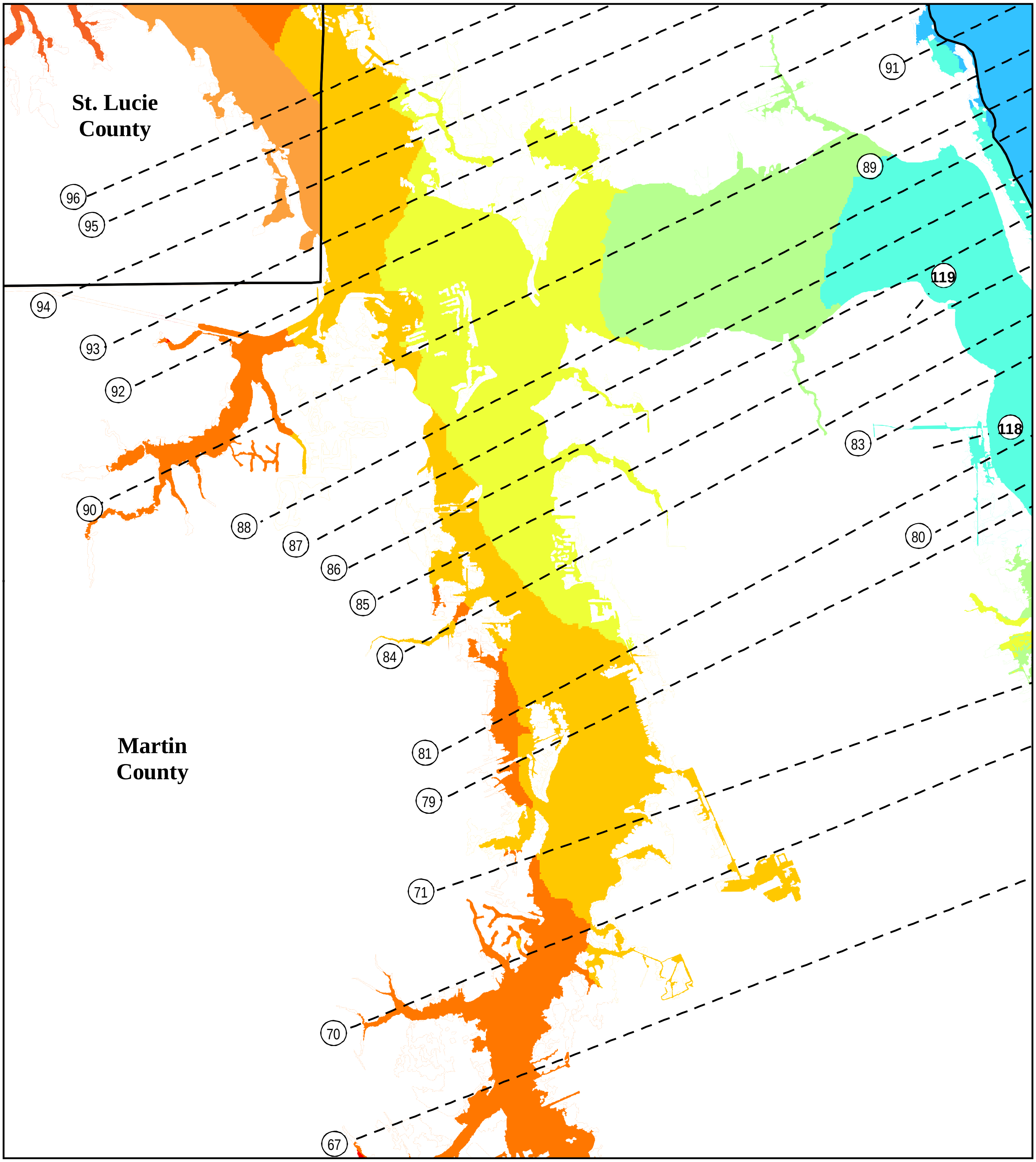
1 Percent-Annual-Chance Stillwater Elevation Map

MARTIN COUNTY, FLORIDA

FEMA

Note: This figure displays 1%-annual-chance stillwater elevations (including wave set-up). Overland wave height information is not included. Base Flood Elevations are not displayed.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas, continued



Elevation (Feet, NAVD88)

3.5 - 3.75
3.75 - 4.0
4.0 - 4.25
4.25 - 4.5
4.5 - 4.75
4.75 - 5.0
5.0 - 5.25
5.25 - 5.5
5.5 - 5.75

- - Coastal Transects

County Boundaries

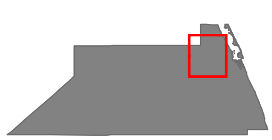
1 inch = 5,000 feet 1:60,000

N

0 1,000 2,000 4,000 6,000 8,000 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

1 Percent-Annual-Chance Stillwater Elevation Map

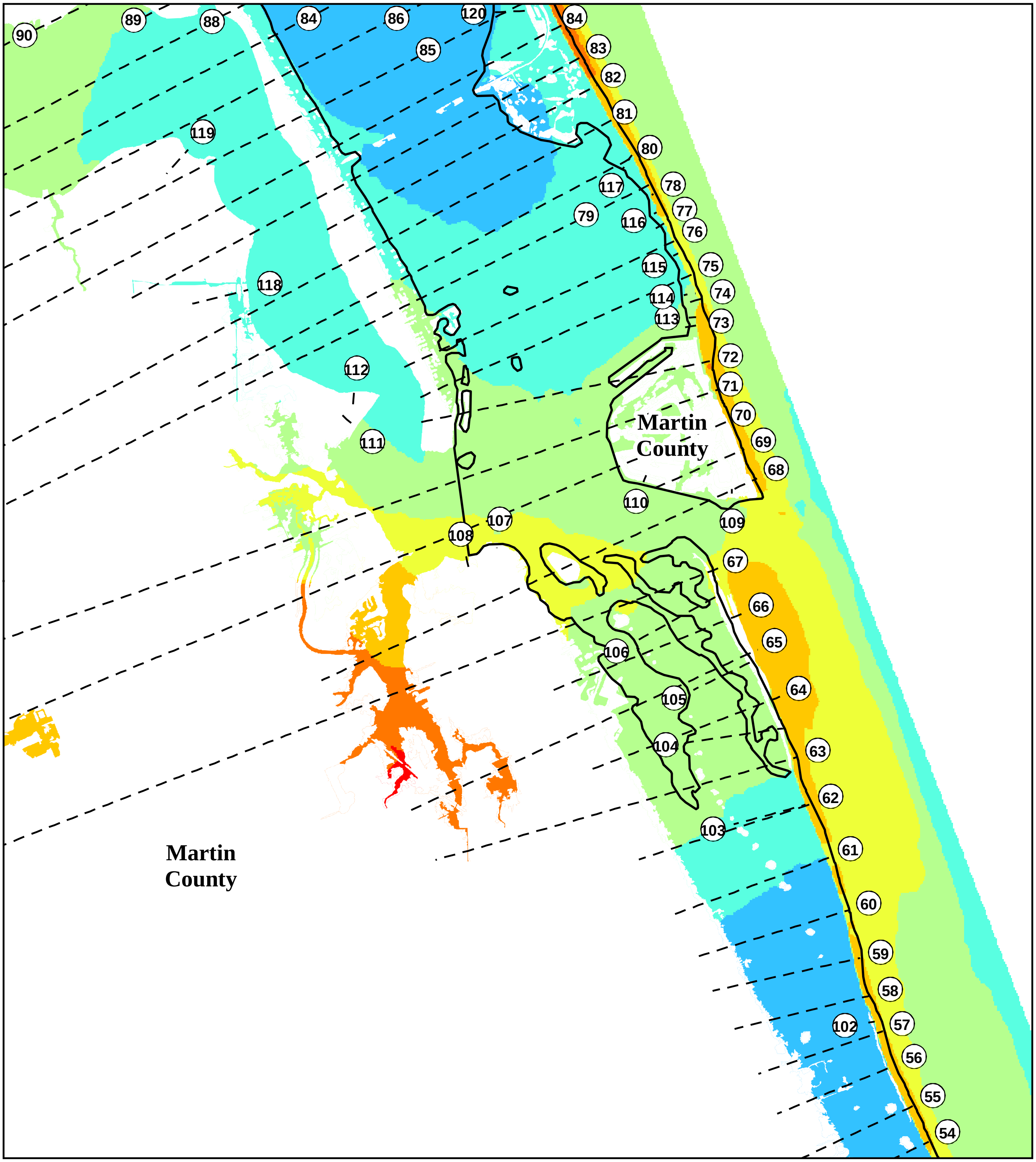
MARTIN COUNTY, FLORIDA

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

Note: This figure displays 1%-annual-chance stillwater elevations (including wave set-up). Overland wave height information is not included. Base Flood Elevations are not displayed.

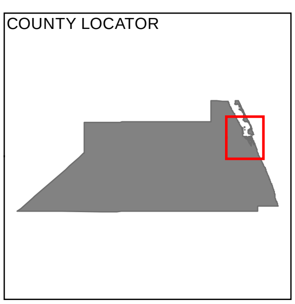
Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas, continued



Elevation (Feet, NAVD88)
3.5 - 3.75
3.75 - 4.0
4.0 - 4.25
4.25 - 4.5
4.5 - 4.75
4.75 - 5.0
5.0 - 5.25
5.25 - 5.5
5.5 - 5.75
Coastal Transects
County Boundaries

1 inch = 5,000 feet 1:60,000
0 1,000 2,000 4,000 6,000 8,000 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

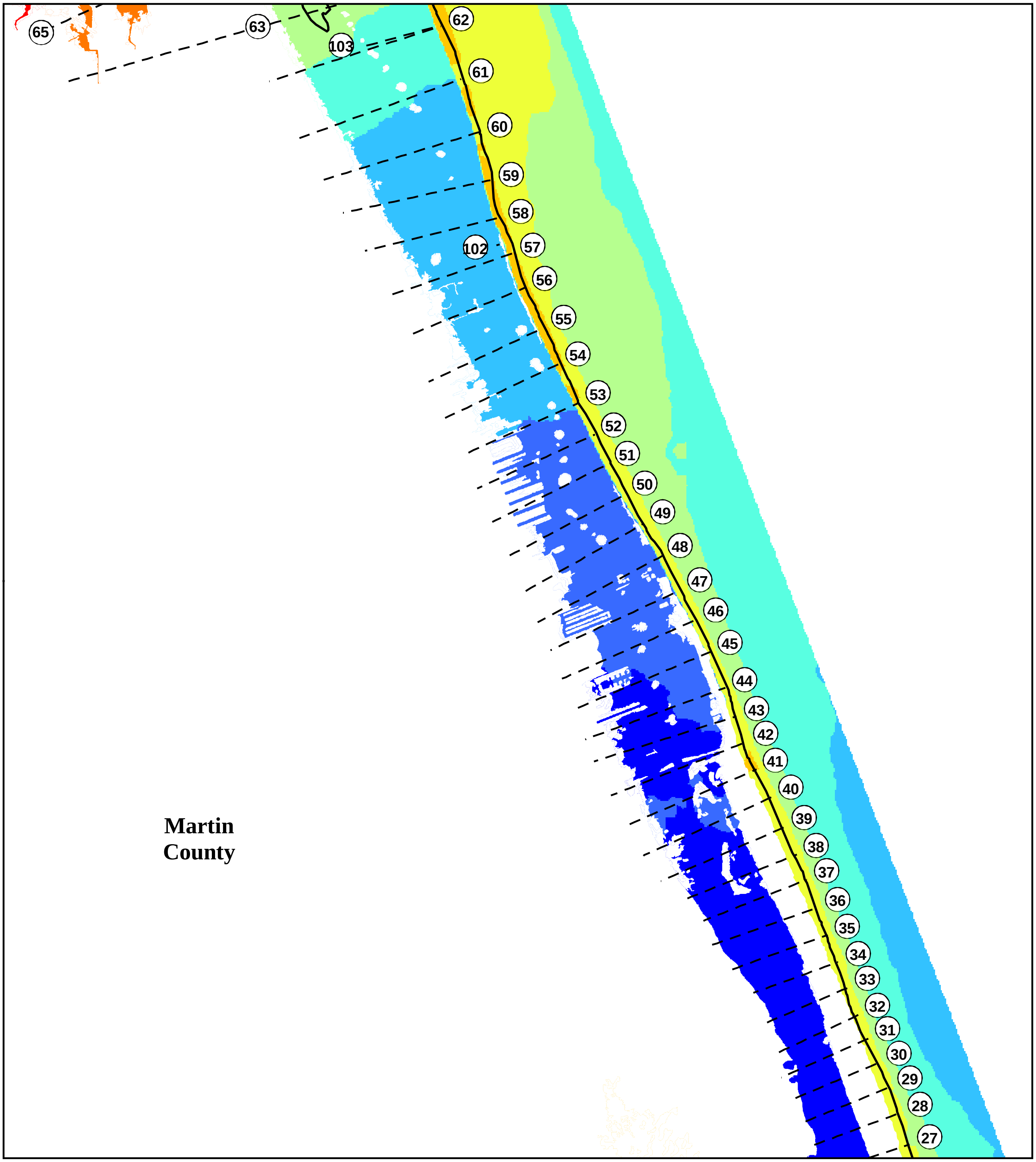


NATIONAL FLOOD INSURANCE PROGRAM
1 Percent-Annual-Chance Stillwater Elevation Map
MARTIN COUNTY, FLORIDA

FEMA

Note: This figure displays 1%-annual-chance stillwater elevations (including wave set-up). Overland wave height information is not included. Base Flood Elevations are not displayed.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas, continued



Elevation (Feet, NAVD88)

3.5 - 3.75
4.25 - 4.5
5.0 - 5.25
3.75 - 4.0
4.5 - 4.75
5.25 - 5.5
4.0 - 4.25
4.75 - 5.0
5.5 - 5.75

Coastal Transects

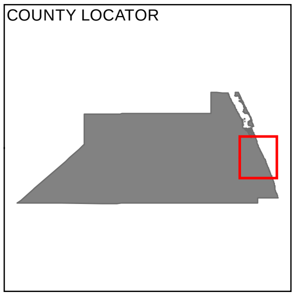
County Boundaries

1 inch = 5,000 feet 1:60,000

0 1,000 2,000 4,000 6,000 8,000 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR



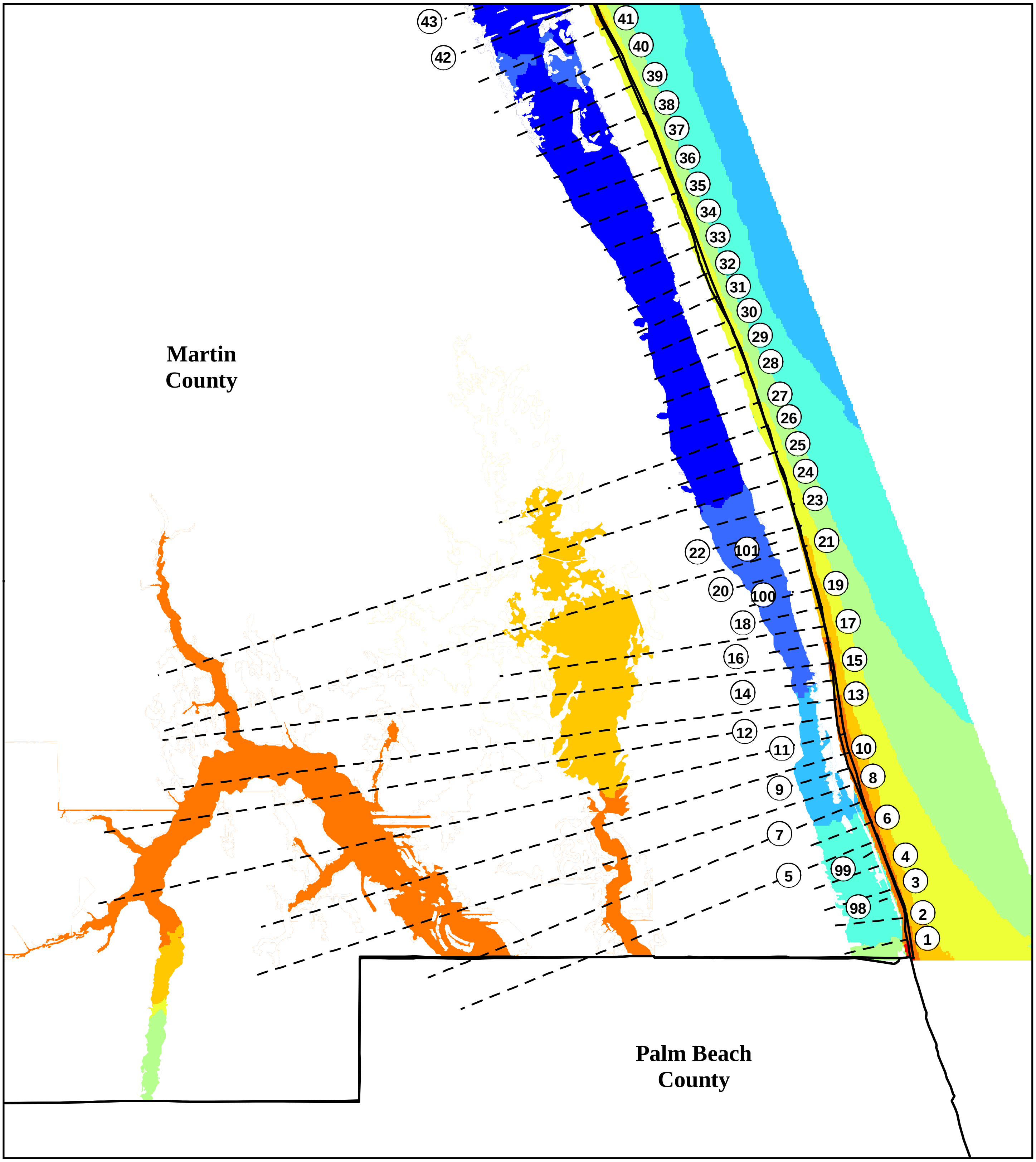
NATIONAL FLOOD INSURANCE PROGRAM
1 Percent-Annual-Chance Stillwater Elevation Map

MARTIN COUNTY, FLORIDA

FEMA

Note: This figure displays 1%-annual-chance stillwater elevations (including wave set-up). Overland wave height information is not included. Base Flood Elevations are not displayed.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas, continued



Elevation (Feet, NAVD88)

3.5 - 3.75 | 4.25 - 4.5 | 5.0 - 5.25

3.75 - 4.0 | 4.5 - 4.75 | 5.25 - 5.5

4.0 - 4.25 | 4.75 - 5.0 | 5.5 - 5.75

Coastal Transects

County Boundaries

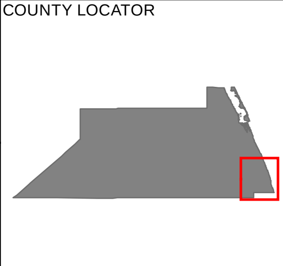
1 inch = 5,000 feet 1:60,000

0 1,000 2,000 4,000 6,000 8,000 Feet

N

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

1 Percent-Annual-Chance Stillwater Elevation Map

MARTIN COUNTY, FLORIDA

FEMA

Note: This figure displays 1%-annual-chance stillwater elevations (including wave set-up). Overland wave height information is not included. Base Flood Elevations are not displayed.

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.

Statistical analyses were performed to determine the annual chance flood elevations for the ECCFL study. The study considered both high frequency (i.e., 50-, 25-, 10-, and 4-percent-annual-chance) events as well as low frequency (i.e., 2-, 1-, and 0.2-percent-annual-chance) events.

Flood estimates for the low frequency events were derived by simulating a large number of storm events using a coupling of hydrodynamic and wave models (i.e., the ADCIRC-ADvanced CIRCulation model and the SWAN-Simulating Waves Nearshore model). Key storm parameters (central pressure deficit, radius to maximum winds, forward speed, track heading, and the Holland's B parameter) were used to represent a population of historic and synthetic storm events. The Joint Probability Method with Optimal Sampling (JPM-OS), developed by Resio (2007) and Toro et. al. (2010), was applied to compute Stillwater Elevations (SWELs), which include the storm surge component and the wave setup component.

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 15 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. High frequency events were computed based on the approach described in the report "Tide Gage Analysis for the Atlantic and Gulf Open Coast" dated December 2, 2008 (Federal Emergency Management Agency, 2008). The methods from this previous study were applied to updated tide records, through the end of 2012. As much as six years of additional data, from 2007 to 2012, were added to the analysis where available. In addition, the regionalization of the tide gages from the previous study was reviewed and re-evaluated in light of the additional available data and observation of revised L-moment parameters that characterize the regionalization.

Table 15: Tide Gage Analysis Specifics

Gage Name	Managing Agency of Tide Gage Record	Gage Type	Start Date	End Date	Statistical Methodology
Charleston – 8665530	NOAA	Tide	1899	Present	L-moments, GEV
Daytona Beach Shores - 8721120	NOAA	Tide	1966	1984	L-moments, GEV
Fernandina Beach - 8720030	NOAA	Tide	1898	Present	L-moments, GEV
Fort Pulaski - 8670870	NOAA	Tide	1935	Present	L-moments, GEV
Lake Worth Pier - 8722670	NOAA	Tide	1970	Present	L-moments, GEV
Mayport Ferry Depot - 8720220	NOAA	Tide	1928	2008	L-moments, GEV
Miami Beach - 8723170	NOAA	Tide	1931	1981	L-moments, GEV
St. Augustine - 8720587	NOAA	Tide	1992	2004	L-moments, GEV
Trident Pier – 8721604	NOAA	Tide	1994	Present	L-moments, GEV
Virginia Key - 8713214	NOAA	Tide	1994	Present	L-moments, GEV

Combined Riverine and Tidal Effects

A combined rate of occurrence analysis was conducted to compute a 1-percent-annual-chance BFE for areas subject to flooding by both coastal and riverine flooding mechanisms. Since riverine and coastal analyses were based on independent events, the resulting combined BFE would be higher than that of their individual occurrence. In other words, at the location where the computed 1-percent-annual-chance coastal flood level equals the computed 1-percent-annual-chance riverine flood level, there was a greater than 1-percent-annual-chance of this flood level being equaled or exceeded.

In Martin County, combined rate of occurrence calculations were performed for Bessey Creek, Coral Garden, Danforth Creek, East Fork Creek, South Fork St Lucie, Roebuck Creek, Fern Creek, Warner Creek, Manatee Creek and the Loxahatchee River.

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 14 and included in the frequency analysis for the determination of the total stillwater elevations.

5.3.2 Waves

Offshore wave conditions were modeled as part of the regional hydrodynamic and wave modeling (ADCIRC + SWAN). The regional model results provided valuable information on the wave conditions that could be expected to occur during the types of extreme storm events that would produce storm surge elevations with 1- and 0.2-percent-annual-chance probabilities of occurrence. Wave heights and periods derived from the SWAN model results were used as inputs to the wave hazard analyses described in Section 5.3.4.

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 14. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.

5.3.4 Wave Hazard Analyses

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

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, “Transect Location Map,” are also depicted on the FIRM. Table 16 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, “starting” indicates the parameter value at the beginning of the transect.

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

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 14, "Summary of Coastal Analyses". For the 0.2-percent-annual-chance event, wave profiles were created to indicate the results of the wave height analysis at each transect (FEMA, 2007). Such wave profiles may show greater detail than the mapping product, due to limitations of the map scale and smoothing tolerances applied during boundary cleanup. Wave runup analysis for the 0.2-percent-annual-chance event was not performed for this study and is not included in the profiles.

Data for the 1983 Supplement-Wave Height Analysis were used for the 2002 study (FEMA 2002). This data provided flood hazard mapping for interior bays and estuaries. Unfortunately, the interior data for WHAFIS models and transect locations were unavailable. The 10-, 2-, 1-, and 0.2-percent-annual chance stillwater elevations, zone designation, and base flood elevation for Lake Okeechobee were taken from the October 2002 FIS Report (FEMA 2002) and are shown in the table below.

Lake Okeechobee Transect Data

Elevation (feet NAVD)						
Flooding Source	Transect	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	Zone Designation and BFE
Lake Okeechobee	16	20.0	22.4	23.3	24.6	VE 29-31 AE 17
Lake Okeechobee	17	19.6	21.9	22.7	23.9	VE 29-31 AE 17
Lake Okeechobee	18	19.6	21.9	22.7	23.9	VE 29-31 AE 17
Lake Okeechobee	19	19.3	21.3	22.1	23.3	VE 27-29 AE 22

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 14.

Table 16: Coastal Transect Parameters

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	1	25.1	13.8	2.5 2.0 - 2.5	3.0 2.4 - 3.0	3.7 2.9 - 3.7	5.5 4.5 - 5.5	7.0 5.8 - 7.0
Atlantic Ocean	2	25.3	13.9	2.5 2.0 - 2.5	2.9 2.4 - 2.9	3.6 2.9 - 3.6	5.3 4.4 - 5.3	6.8 5.7 - 6.8
Atlantic Ocean	3	24.3	13.7	2.5 2.0 - 2.5	3.0 2.4 - 3.0	3.7 2.9 - 3.7	5.3 4.4 - 5.3	6.8 5.7 - 6.8
Atlantic Ocean	4	23.7	13.8	2.5 2.0 - 2.5	2.9 2.3 - 2.9	3.6 2.9 - 3.6	5.3 4.3 - 5.3	6.9 5.6 - 6.9
Atlantic Ocean	5	23.3	13.8	2.5 2.0 - 2.5	3.0 2.3 - 3.0	3.7 2.9 - 3.7	5.4 4.3 - 5.4	6.9 5.6 - 7.1
Atlantic Ocean	6	23.2	13.8	2.6 2.0 - 2.6	3.1 2.3 - 3.1	3.8 2.9 - 3.8	5.4 4.3 - 5.4	7.0 5.5 - 7.0
Atlantic Ocean	7	23.2	13.9	2.7 2.0 - 2.7	3.2 2.3 - 3.2	4.0 2.9 - 4.0	5.5 4.1 - 5.5	7.0 5.5 - 7.4

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	8	23.2	13.9	2.8 1.9 - 2.8	3.2 2.2 - 3.2	4.0 2.8 - 4.0	5.4 4.2 - 5.4	7.0 5.4 - 7.6
Atlantic Ocean	9	23.0	13.9	2.8 2.0 - 2.8	3.3 2.3 - 3.3	4.1 2.9 - 4.1	5.4 4.2 - 5.4	7.0 5.4 - 7.0
Atlantic Ocean	10	22.9	13.9	2.8 1.8 - 2.8	3.3 2.1 - 3.3	4.1 2.7 - 4.1	5.4 4.1 - 5.4	7.0 5.4 - 7.5
Atlantic Ocean	11	22.9	13.9	2.8 1.3 - 2.8	3.3 1.6 - 3.3	4.1 1.9 - 4.1	5.4 4.1 - 5.4	7.0 5.3 - 7.5
Atlantic Ocean	12	22.9	13.9	2.7 1.4 - 2.7	3.2 1.7 - 3.2	4.0 2.1 - 4.0	5.3 4.0 - 5.4	6.9 5.2 - 7.5
Atlantic Ocean	13	22.8	13.9	2.7 1.5 - 2.7	3.2 1.7 - 3.2	4.0 2.2 - 4.0	5.3 4.0 - 5.4	6.8 5.2 - 7.6
Atlantic Ocean	14	22.8	13.9	2.7 1.9 - 2.7	3.1 2.3 - 3.1	3.9 2.8 - 3.9	5.2 4.0 - 5.3	6.8 5.2 - 6.8

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	15	22.5	13.9	2.8 1.6 - 2.8	3.3 1.9 - 3.3	4.1 2.3 - 4.1	5.3 3.9 - 5.4	6.9 5.2 - 7.6
Atlantic Ocean	16	22.7	14.0	2.8 1.9 - 2.8	3.3 2.3 - 3.3	4.1 2.8 - 4.1	5.3 3.9 - 5.3	6.8 5.1 - 6.8
Atlantic Ocean	17	22.8	14.0	2.8 1.6 - 2.8	3.3 1.9 - 3.3	4.0 2.3 - 4.1	5.2 3.9 - 5.2	6.7 5.1 - 7.4
Atlantic Ocean	18	22.7	14.2	2.7 1.9 - 2.7	3.2 2.3 - 3.2	4.0 2.8 - 4.0	5.2 3.9 - 5.2	6.7 5.1 - 6.7
Atlantic Ocean	19	23.0	14.2	2.7 1.9 - 2.7	3.1 2.3 - 3.1	3.9 2.8 - 3.9	5.1 3.9 - 5.1	6.6 5.1 - 6.6
Atlantic Ocean	20	23.5	14.3	2.7 1.9 - 2.7	3.1 2.3 - 3.1	3.9 2.8 - 3.9	5.0 3.8 - 5.1	6.6 5.0 - 6.6
Atlantic Ocean	21	23.7	14.4	2.8 1.6 - 2.8	3.3 1.9 - 3.3	4.1 2.3 - 4.1	5.1 3.8 - 5.4	6.7 5.0 - 7.6

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance: Significant Wave Height H_s (ft)	Starting Wave Conditions for the 1% Annual Chance: Peak Wave Period T_p (sec)	Starting Stillwater Elevations (ft NAVD88) / Range of Stillwater Elevations (ft NAVD88): 10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	22	23.2	14.4	2.7 2.0 - 2.7	3.2 2.3 - 3.2	3.9 2.8 - 3.9	5.0 3.8 - 5.0	6.5 5.0 - 6.5
Atlantic Ocean	23	24.0	14.2	2.7 2.0 - 2.6	3.1 2.3 - 3.1	3.8 2.8 - 3.8	4.9 3.8 - 4.9	6.4 5.0 - 6.4
Atlantic Ocean	24	25.9	14.0	2.7 2.0 - 2.7	3.1 2.3 - 3.1	3.9 2.9 - 3.9	4.9 3.7 - 5.4	6.4 4.9 - 7.5
Atlantic Ocean	25	26.9	14.1	2.7 2.0 - 2.7	3.1 2.3 - 3.1	3.9 2.9 - 3.9	4.8 3.7 - 4.8	6.4 4.9 - 6.4
Atlantic Ocean	26	27.3	14.2	2.6 2.0 - 2.6	3.1 2.3 - 3.1	3.8 2.9 - 3.8	4.8 3.7 - 5.2	6.3 4.9 - 7.4
Atlantic Ocean	27	27.4	14.2	2.6 2.0 - 2.6	3.1 2.3 - 3.1	3.8 2.9 - 3.8	4.7 3.7 - 4.8	6.3 4.9 - 6.3
Atlantic Ocean	28	27.6	14.2	2.8 2.0 - 2.8	3.2 2.3 - 3.2	4.0 2.9 - 4.0	4.8 3.6 - 4.8	6.3 4.9 - 6.4

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	29	27.8	14.2	2.8 2.0 - 2.8	3.3 2.3 - 3.3	4.0 2.9 - 4.0	4.8 3.6 - 4.9	6.4 4.8 - 6.5
Atlantic Ocean	30	27.7	14.2	2.8 2.0 - 2.8	3.3 2.4 - 3.3	4.0 2.9 - 4.0	4.8 3.6 - 4.8	6.4 4.8 - 6.4
Atlantic Ocean	31	27.9	14.1	2.8 2.0 - 2.8	3.3 2.4 - 3.3	4.0 2.9 - 4.0	4.8 3.6 - 4.8	6.3 4.8 - 6.3
Atlantic Ocean	32	27.6	14.3	2.8 2.0 - 2.8	3.2 2.4 - 3.2	4.0 2.9 - 4.0	4.8 3.6 - 4.8	6.3 4.8 - 6.3
Atlantic Ocean	33	27.9	14.2	2.7 2.0 - 2.7	3.2 2.4 - 3.2	4.0 3.0 - 4.0	4.8 3.6 - 4.8	6.3 4.8 - 6.4
Atlantic Ocean	34	27.9	14.2	2.9 2.0 - 2.9	3.4 2.4 - 3.4	4.2 3.0 - 4.2	4.9 3.6 - 4.9	6.5 4.9 - 6.5
Atlantic Ocean	35	28.0	14.2	2.8 2.0 - 2.8	3.2 2.4 - 3.2	4.0 3.0 - 4.0	4.8 3.6 - 4.9	6.4 4.9 - 6.4

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	36	28.1	14.2	2.8 2.1 - 2.8	3.3 2.4 - 3.3	4.1 3.0 - 4.1	4.9 3.6 - 4.9	6.4 5.0 - 6.5
Atlantic Ocean	37	27.8	14.1	2.9 2.1 - 2.9	3.4 2.4 - 3.4	4.2 3.0 - 4.2	4.9 3.7 - 4.9	6.5 5.0 - 6.5
Atlantic Ocean	38	28.1	14.0	2.9 2.1 - 2.9	3.4 2.4 - 3.4	4.2 3.0 - 4.2	5.0 3.7 - 5.0	6.6 5.0 - 6.6
Atlantic Ocean	39	27.7	14.1	2.8 2.1 - 2.8	3.3 2.4 - 3.3	4.1 3.0 - 4.1	4.8 3.7 - 4.9	6.5 5.1 - 6.6
Atlantic Ocean	40	27.4	14.1	2.9 2.1 - 2.9	3.4 2.5 - 3.4	4.2 3.0 - 4.2	5.0 3.7 - 5.0	6.6 5.1 - 6.6
Atlantic Ocean	41	27.2	14.1	2.9 2.1 - 2.9	3.4 2.4 - 3.4	4.2 3.0 - 4.2	5.0 3.7 - 5.0	6.6 5.1 - 6.6
Atlantic Ocean	42	27.0	14.1	2.8 2.1 - 2.8	3.3 2.5 - 3.3	4.1 3.1 - 4.1	4.9 3.7 - 4.9	6.5 5.1 - 6.5

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	43	27.1	14.1	2.7 2.1 - 2.7	3.2 2.5 - 3.2	3.9 3.1 - 3.9	4.8 3.7 - 4.8	6.4 5.0 - 6.4
Atlantic Ocean	44	26.3	14.0	2.7 2.1 - 2.7	3.2 2.5 - 3.2	3.9 3.1 - 3.9	4.8 3.7 - 4.8	6.4 5.0 - 6.4
Atlantic Ocean	45	25.2	14.1	2.6 2.1 - 2.6	3.1 2.5 - 3.1	3.8 3.1 - 3.8	4.8 3.7 - 4.8	6.4 5.0 - 6.4
Atlantic Ocean	46	24.2	14.0	2.7 2.1 - 2.7	3.2 2.5 - 3.2	4.0 3.1 - 4.0	4.8 3.8 - 4.8	6.4 5.0 - 6.4
Atlantic Ocean	47	23.4	14.0	2.7 2.1 - 2.7	3.2 2.5 - 3.2	4.0 3.1 - 4.0	4.8 3.8 - 4.8	6.4 5.1 - 6.5
Atlantic Ocean	48	22.6	14.0	2.7 2.2 - 2.7	3.2 2.5 - 3.2	3.9 3.2 - 3.9	4.9 3.8 - 4.9	6.5 5.1 - 6.5
Atlantic Ocean	49	21.9	14.0	2.7 2.2 - 2.7	3.2 2.6 - 3.2	3.9 3.2 - 3.9	4.9 3.8 - 4.9	6.6 5.1 - 6.6

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	50	21.7	14.0	2.7 2.2 - 2.7	3.2 2.6 - 3.2	4.0 3.2 - 4.0	5.0 3.9 - 5.0	6.7 5.1 - 6.7
Atlantic Ocean	51	21.4	14.0	2.7 2.2 - 2.7	3.1 2.6 - 3.1	3.9 3.2 - 3.9	5.0 3.9 - 5.0	6.7 5.2 - 6.7
Atlantic Ocean	52	21.3	14.0	2.7 2.3 - 2.7	3.2 2.6 - 3.2	3.9 3.3 - 3.9	5.0 3.9 - 5.0	6.7 5.3 - 6.7
Atlantic Ocean	53	21.1	14.0	2.7 2.3 - 2.7	3.2 2.7 - 3.2	3.9 3.3 - 3.9	5.0 4.0 - 5.0	6.7 5.4 - 6.7
Atlantic Ocean	54	20.9	14.1	2.7 2.3 - 2.8	3.2 2.7 - 3.2	4.0 3.3 - 4.0	5.0 4.0 - 5.0	6.8 5.5 - 6.8
Atlantic Ocean	55	20.5	14.1	3.0 2.3 - 3	3.5 2.7 - 3.5	4.3 3.4 - 4.3	5.1 4.1 - 5.1	6.8 5.6 - 6.8
Atlantic Ocean	56	20.4	14.1	2.8 2.4 - 2.8	3.3 2.8 - 3.3	4.1 3.4 - 4.1	5.1 4.2 - 5.1	6.8 5.7 - 6.8

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	57	20.4	14.1	2.8 2.4 - 2.8	3.3 2.8 - 3.3	4.0 3.4 - 4.0	5.0 4.2 - 5.0	6.7 5.7 - 6.7
Atlantic Ocean	58	20.4	14.1	2.9 2.4 - 2.9	3.4 2.8 - 3.4	4.2 3.4 - 4.2	5.1 4.2 - 5.1	6.8 5.7 - 6.8
Atlantic Ocean	59	20.3	14.1	2.8 2.4 - 2.8	3.3 2.8 - 3.3	4.0 3.4 - 4.0	5.0 4.2 - 5.0	6.7 5.7 - 6.8
Atlantic Ocean	60	20.1	14.1	2.8 2.4 - 2.8	3.3 2.8 - 3.3	4.1 3.5 - 4.1	5.0 4.2 - 5.0	6.7 5.7 - 6.7
Atlantic Ocean	61	19.5	14.1	2.7 2.4 - 2.7	3.1 2.8 - 3.1	3.9 3.5 - 3.9	4.9 4.2 - 5.0	6.6 5.8 - 6.7
Atlantic Ocean	62	19.2	14.0	2.8 2.5 - 2.8	3.3 2.9 - 3.3	4.1 3.6 - 4.1	5.1 4.4 - 5.1	6.8 6.1 - 6.8
Atlantic Ocean	63	19.0	13.9	2.8 2.5 - 2.8	3.3 3.0 - 3.3	4.1 3.7 - 4.1	5.1 4.5 - 5.4	6.8 6.3 - 7.8

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	64	20.3	14.1	2.9 2.6 - 2.9	3.4 3.0 - 3.4	4.2 3.7 - 4.2	5.1 4.6 - 5.1	6.9 6.3 - 6.9
Atlantic Ocean	65	20.7	14.1	2.9 2.6 - 2.9	3.4 3.1 - 3.4	4.3 3.8 - 4.3	5.2 4.6 - 5.5	7.0 6.3 - 8.1
Atlantic Ocean	66	20.9	14.1	3.0 2.6 - 3.0	3.5 3.1 - 3.5	4.3 3.8 - 4.3	5.2 4.6 - 5.2	7.0 6.3 - 7.0
Atlantic Ocean	67	20.9	14.0	2.9 2.7 - 3.0	3.4 3.1 - 3.5	4.2 3.9 - 4.4	4.9 4.7 - 5.5	6.6 6.3 - 7.9
Atlantic Ocean	68	21.3	14.0	3.0 2.7 - 3.0	3.5 3.2 - 3.5	4.4 3.9 - 4.4	5.2 4.6 - 5.3	6.8 6.2 - 7.7
Atlantic Ocean	69	21.1	13.9	2.9 2.7 - 2.9	3.4 3.2 - 3.4	4.2 3.9 - 4.2	5.0 4.6 - 5.1	6.7 6.0 - 6.7
Atlantic Ocean	70	21.3	14.0	2.9 2.6 - 3.0	3.4 3.1 - 3.5	4.2 3.8 - 4.3	5.1 4.5 - 5.3	6.8 6.0 - 7.6

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	71	21.4	14.0	2.9 2.6 - 2.9	3.4 3.1 - 3.5	4.3 3.8 - 4.3	5.1 4.5 - 5.3	6.8 5.9 - 7.3
Atlantic Ocean	72	21.4	14.0	3.0 2.6 - 3.0	3.5 3.0 - 3.6	4.4 3.7 - 4.4	5.2 4.4 - 5.2	6.9 5.9 - 6.9
Atlantic Ocean	73	21.2	14.0	2.8 2.6 - 2.8	3.3 3.1 - 3.3	4.1 3.8 - 4.1	5.2 4.5 - 5.2	6.9 6.0 - 6.9
Atlantic Ocean	74	21.2	13.9	2.8 2.6 - 2.8	3.3 3.1 - 3.3	4.1 3.8 - 4.1	5.0 4.5 - 5.0	6.6 6.0 - 6.7
Atlantic Ocean	75	21.2	13.8	2.8 2.5 - 2.8	3.3 3.0 - 3.3	4.0 3.7 - 4.0	4.9 4.4 - 5.0	6.6 5.8 - 6.6
Atlantic Ocean	76	21.4	13.8	2.8 2.5 - 2.8	3.2 2.9 - 3.2	4.0 3.6 - 4.0	5.0 4.3 - 5.0	6.7 5.7 - 6.7
Atlantic Ocean	77	21.0	13.8	2.8 2.5 - 2.8	3.2 3.0 - 3.2	4.0 3.7 - 4.0	5.0 4.4 - 5.0	6.7 5.8 - 6.7

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	78	20.9	13.8	2.7 2.5 - 2.8	3.2 3.0 - 3.2	4.0 3.7 - 4.0	5.0 4.4 - 5.0	6.7 5.8 - 6.7
Atlantic Ocean	79	21.1	13.8	2.8 2.5 - 2.9	3.2 2.9 - 3.4	4.0 3.6 - 4.2	5.0 4.3 - 5.3	6.7 5.6 - 7.3
Atlantic Ocean	80	21.0	13.6	2.8 2.5 - 2.8	3.3 2.9 - 3.3	4.0 3.6 - 4.0	5.1 4.2 - 5.1	6.8 5.6 - 6.8
Atlantic Ocean	81	21.1	13.7	2.9 2.4 - 2.9	3.4 2.9 - 3.4	4.2 3.6 - 4.3	5.2 4.2 - 5.4	6.9 5.5 - 7.3
Atlantic Ocean	82	21.2	13.7	3.0 2.4 - 3.0	3.5 2.9 - 3.5	4.3 3.5 - 4.3	5.2 4.2 - 5.2	7.0 5.5 - 7.0
Atlantic Ocean	83	21.4	13.6	3.0 2.4 - 3.0	3.6 2.8 - 3.6	4.4 3.5 - 4.4	5.3 4.2 - 5.3	7.1 5.5 - 7.1
Atlantic Ocean	84	21.4	13.6	3.0 2.4 - 3.0	3.6 2.8 - 3.6	4.4 3.5 - 4.4	5.4 4.2 - 5.4	7.2 5.5 - 7.2

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	85	21.4	13.5	3.1 2.4 - 3.1	3.6 2.8 - 3.6	4.4 3.5 - 4.4	5.4 4.2 - 5.4	7.1 5.5 - 7.6
Atlantic Ocean	86	20.8	13.4	3.0 2.4 - 3.0	3.5 2.8 - 3.5	4.4 3.5 - 4.4	5.3 4.2 - 5.3	7.1 5.5 - 7.6
Atlantic Ocean	87	20.8	13.4	3.0 2.4 - 3.0	3.5 2.8 - 3.5	4.3 3.5 - 4.3	5.3 4.1 - 5.3	7.1 5.4 - 7.6
Atlantic Ocean	88	21.1	13.6	3.0 2.4 - 3.0	3.5 2.8 - 3.5	4.3 3.5 - 4.3	5.2 4.1 - 5.4	7.1 5.4 - 7.8
Atlantic Ocean	89	21.4	13.7	2.9 2.4 - 2.9	3.4 2.8 - 3.4	4.2 3.5 - 4.2	5.3 4.1 - 5.3	7.1 5.4 - 7.1
Atlantic Ocean	90	21.2	13.6	2.9 2.4 - 2.9	3.4 2.8 - 3.4	4.3 3.5 - 4.3	5.3 4.1 - 5.4	7.2 5.4 - 7.8
Atlantic Ocean	91	21.6	13.5	3.0 2.4 - 3.0	3.5 2.8 - 3.5	4.3 3.5 - 4.3	5.3 4.1 - 5.3	7.2 5.4 - 7.2

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Atlantic Ocean	92	22.1	13.6	3.0 2.4 - 3.0	3.5 2.8 - 3.5	4.3 3.4 - 4.3	5.3 4.1 - 5.5	7.2 5.5 - 7.8
Atlantic Ocean	93	22.2	13.7	3.0 2.4 - 3.0	3.5 2.8 - 3.5	4.3 3.4 - 4.3	5.3 4.1 - 5.5	7.2 5.5 - 7.7
Atlantic Ocean	94	22.3	13.8	2.9 2.4 - 2.9	3.4 2.8 - 3.4	4.2 3.5 - 4.2	5.3 4.1 - 5.8	7.2 5.5 - 7.7
Atlantic Ocean	95	22.5	13.9	2.9 2.4 - 2.9	3.4 2.8 - 3.4	4.2 3.4 - 4.2	5.3 4.1 - 5.8	7.2 5.6 - 8.4
Atlantic Ocean	96	22.3	14.1	3.0 2.3 - 3.0	3.5 2.8 - 3.5	4.4 3.4 - 4.4	5.3 4.1 - 5.8	7.2 5.5 - 8.4
Atlantic Ocean	97	22.2	14.2	2.9 2.5 - 2.9	3.4 2.9 - 3.4	4.2 3.6 - 4.2	5.3 4.3 - 5.3	7.2 5.9 - 7.2
Intracoastal Waterway	98	2.6	2.6	2.0 2.0 - 2.1	2.4 2.4 - 2.5	2.9 2.9 - 3.1	4.4 4.4 - 4.4	5.7 5.7 - 6.3

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Intracoastal Waterway	99	2.6	2.6	2.0 2.0 - 2.0	2.4 2.4 - 2.4	2.9 2.9 - 2.9	4.3 4.3 - 4.3	5.6 5.6 - 6.4
Intracoastal Waterway	100	2.1	2.4	2.1 2.1 - 2.2	2.4 2.4 - 2.6	3.0 3.0 - 3.2	3.9 3.9 - 3.9	5.1 5.1 - 5.1
Intracoastal Waterway	101	2.1	2.4	2.0 2.0 - 2.2	2.3 2.3 - 2.5	2.9 2.9 - 3.1	3.8 3.8 - 3.8	5.0 5.0 - 5.0
Intracoastal Waterway	102	2.7	2.6	2.4 2.4 - 2.6	2.8 2.8 - 3.1	3.5 3.5 - 3.8	4.2 4.2 - 4.9	5.7 5.7 - 6.6
Intracoastal Waterway	103	1.8	2.5	2.5 2.5 - 2.6	3.0 2.9 - 3.1	3.7 3.6 - 3.8	4.4 4.4 - 4.7	6.1 6.1 - 6.5
Intracoastal Waterway	104	3.2	2.8	2.7 2.6 - 2.7	3.1 3.0 - 3.2	3.9 3.7 - 4.0	4.7 4.6 - 4.7	6.5 6.3 - 6.5
Intracoastal Waterway	105	3.2	2.8	2.6 2.6 - 2.8	3.1 3.1 - 3.2	3.8 3.8 - 4.0	4.6 4.6 - 4.6	6.3 6.3 - 6.6

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Intracoastal Waterway	106	2.9	2.5	2.6 2.6 - 2.8	3.1 3.1 - 3.2	3.8 3.8 - 4.0	4.6 4.6 - 4.8	6.3 6.3 - 6.6
St. Lucie River	107	5.2	3.5	2.7 2.7 - 2.7	3.2 3.2 - 3.2	4.0 4.0 - 4.0	4.8 4.8 - 4.8	6.5 6.5 - 6.6
St. Lucie River	108	4.9	3.4	2.8 2.8 - 2.8	3.3 3.3 - 3.3	4.0 4.0 - 4.0	4.9 4.9 - 4.9	6.7 6.7 - 6.7
Atlantic Ocean	109	6.0	14.7	2.8 2.8 - 2.8	3.3 3.3 - 3.3	4.0 4.0 - 4.1	4.7 4.6 - 4.7	6.2 6.2 - 6.3
St. Lucie River	110	5.4	10.9	2.7 2.7 - 2.7	3.1 3.1 - 3.1	3.9 3.9 - 3.9	4.6 4.6 - 4.6	6.1 6.1 - 6.1
St. Lucie River	111	4.7	3.3	2.6 2.6 - 2.6	3.1 3.0 - 3.1	3.8 3.8 - 3.8	4.6 4.6 - 4.7	6.2 6.1 - 6.2
St. Lucie River	112	4.2	3.5	2.5 2.5 - 2.6	3.0 3.0 - 3.0	3.7 3.7 - 3.8	4.4 4.4 - 4.5	5.9 5.9 - 6

Table 16: Coastal Transect Parameters, continued

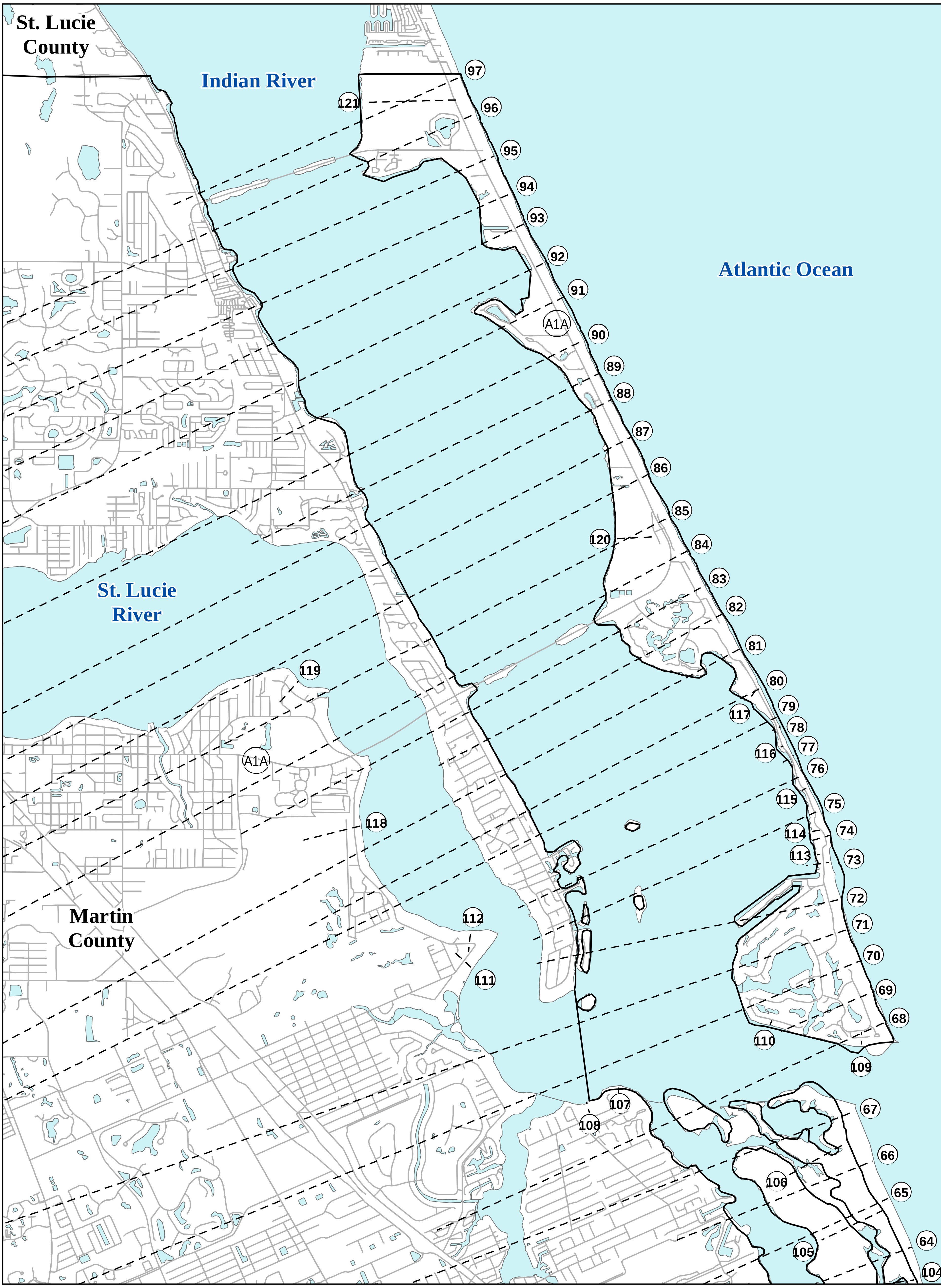
Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Indian River	113	3.2	3.2	2.6 2.6 - 2.7	3.1 3.1 - 3.2	3.8 3.8 - 4.0	4.5 4.5 - 5.0	6.0 6.0 - 6.6
Indian River	114	3.2	3.2	2.6 2.6 - 2.7	3.1 3.0 - 3.2	3.8 3.8 - 3.9	4.5 4.5 - 4.6	6.0 6.0 - 6.6
Indian River	115	3.2	3.2	2.6 2.6 - 2.7	3.0 3.0 - 3.2	3.7 3.7 - 3.9	4.4 4.4 - 5.0	6.0 6.0 - 6.7
Indian River	116	3.9	3.2	2.6 2.6 - 2.7	3.0 3.0 - 3.1	3.7 3.7 - 3.9	4.4 4.4 - 4.4	6.0 6.0 - 6.7
Indian River	117	3.9	3.2	2.5 2.5 - 2.7	2.9 2.9 - 3.2	3.6 3.6 - 4.0	4.3 4.3 - 4.8	5.7 5.7 - 6.8
St. Lucie River	118	4.4	3.6	2.5 2.5 - 2.5	3.0 3.0 - 3.0	3.7 3.7 - 3.7	4.4 4.4 - 4.4	5.8 5.8 - 5.8
St. Lucie River	119	3.8	3.4	2.5 2.5 - 2.5	3.0 3.0 - 3.0	3.7 3.7 - 3.7	4.4 4.4 - 4.4	5.9 5.9 - 5.9

Table 16: Coastal Transect Parameters, continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance[1]	0.2% Annual Chance[1]
Indian River	120	3.4	3.1	2.5 2.5 - 2.6	2.9 2.9 - 3.0	3.6 3.6 - 3.7	4.2 4.2 - 4.3	5.6 5.6 - 5.6
Indian River	121	4.2	3.6	2.5 2.5 - 2.8	3.0 3.0 - 3.3	3.7 3.7 - 4.1	4.5 4.5 - 4.6	6.1 6.1 - 6.2

[1]Total Stillwater Elevation inclusive of wave setup

Figure 9: Transect Location Map



COUNTY LOCATOR

1 inch = 3,333 feet 1:40,000

N

0 900 1,800 3,600 5,400 7,200 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

NATIONAL FLOOD INSURANCE PROGRAM

Transect Location Map

PANELS WITH TRANSECTS

0038H, 0039H, 0151H, 0152H,
0153H, 0154H, 0156H, 0158H,
0161H, 0162H, 0163H, 0164H,
0166H, 0167H, 0168H, 0169H

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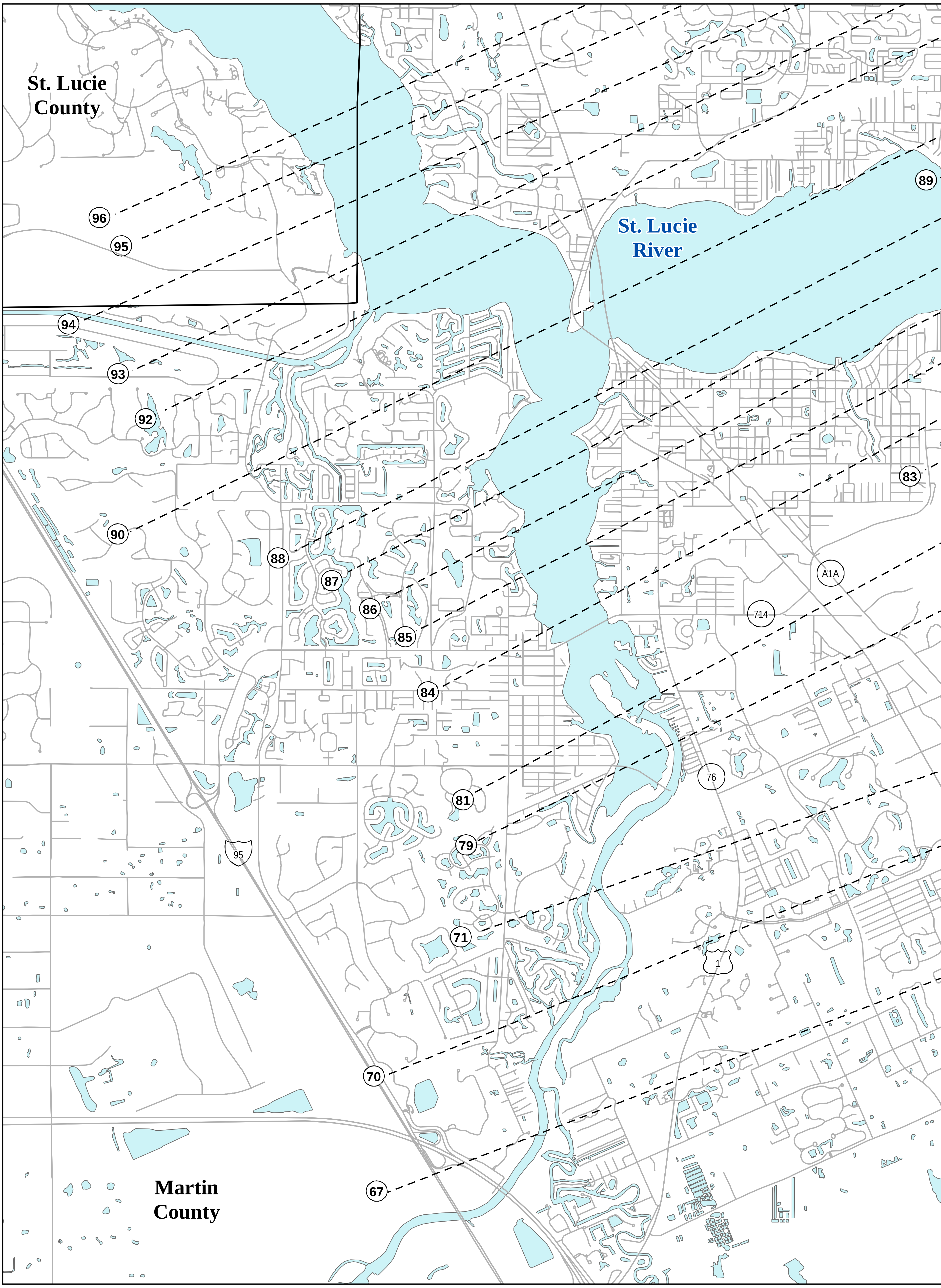
Figure 9: Transect Location Map, continued

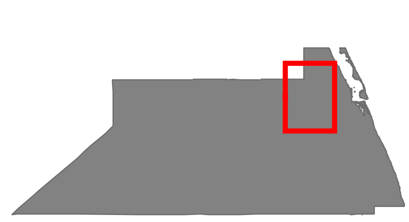


1 inch = 3,333 feet 1:40,000

0 900 1,800 3,600 5,400 7,200 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR



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Transect Location Map

PANELS WITH TRANSECTS

0130H, 0131H, 0132H, 0133H, 0134H,
0141H, 0142H, 0143H, 0144H, 0151H,
0153H, 0161H, 0163H, 0281H, 0282H

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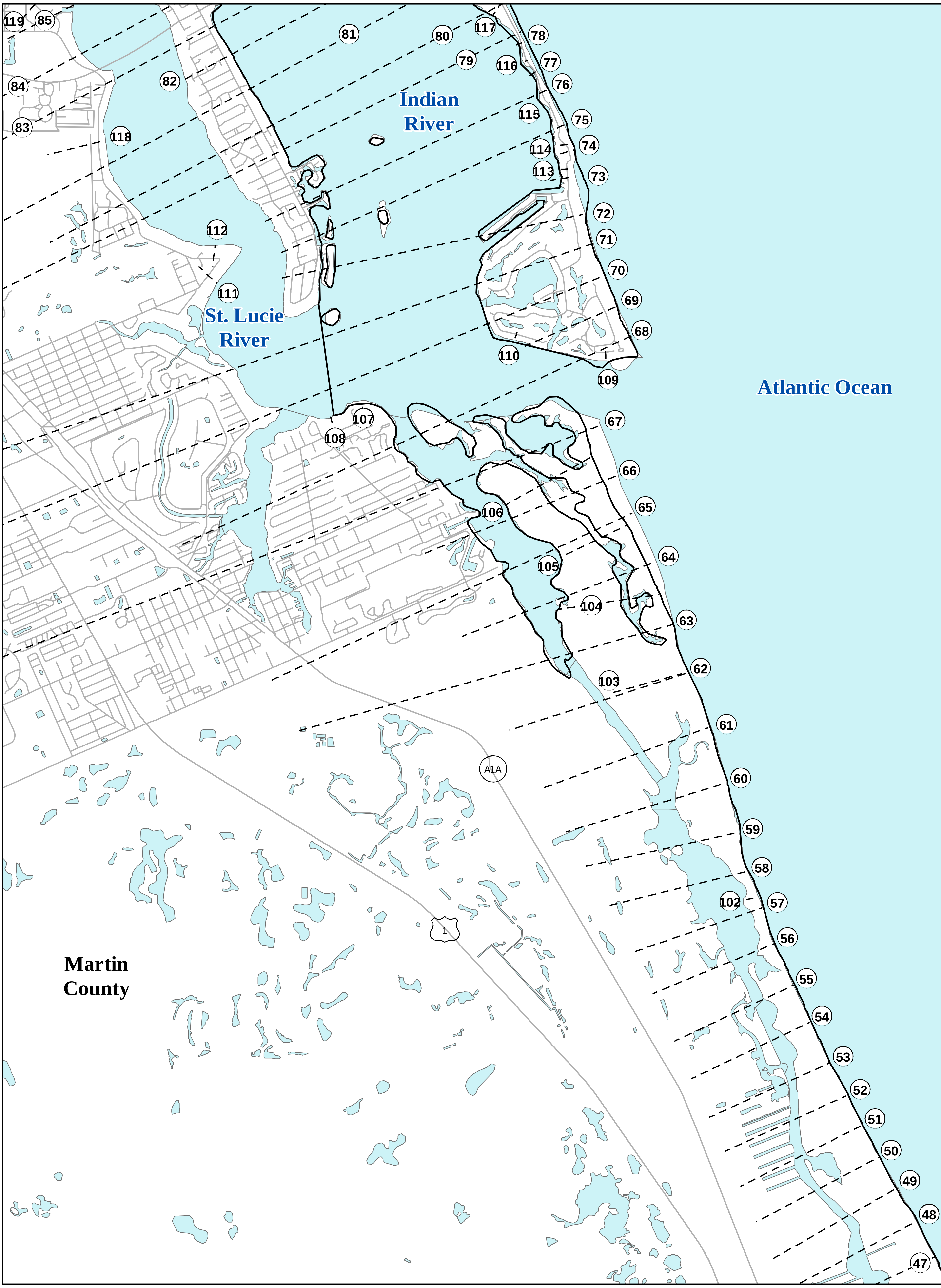


1 inch = 3,333 feet 1:40,000

0 900 1,800 3,600 5,400 7,200 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR

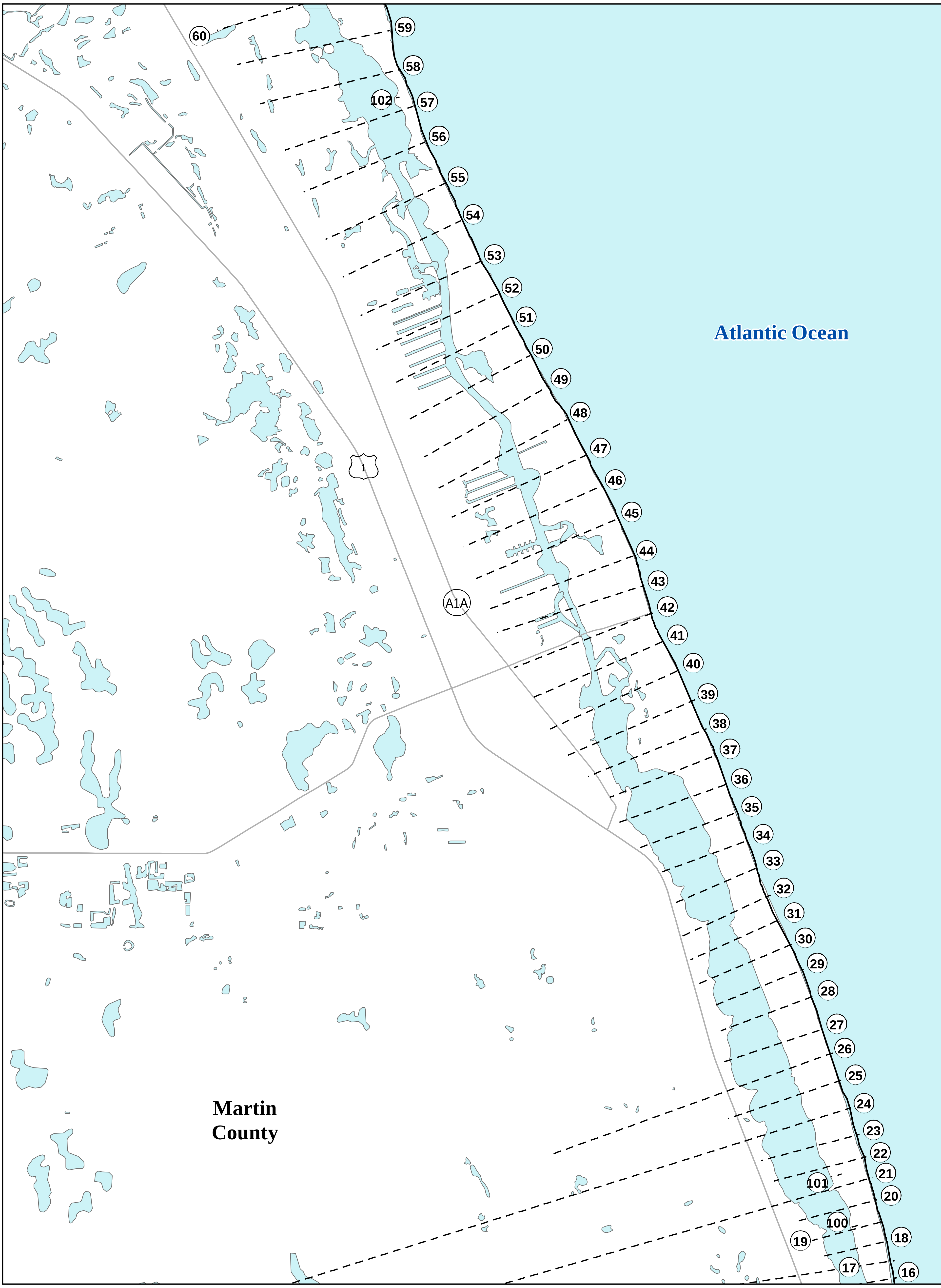
NATIONAL FLOOD INSURANCE PROGRAM

Transect Location Map

PANELS WITH TRANSECTS

0153H, 0154H, 0158H, 0161H, 0162H,
0163H, 0164H, 0166H, 0167H, 0168H,
0169H, 0307H, 0309H, 0310H, 0328H

Figure 9: Transect Location Map, continued



1 inch = 3,333 feet 1:40,000

0 900 1,800 3,600 5,400 7,200 Feet

N

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

Transect Location Map

PANELS WITH TRANSECTS

0168H, 0169H, 0307H, 0309H,
0310H, 0317H, 0320H, 0328H,
0336H, 0338H, 0339H

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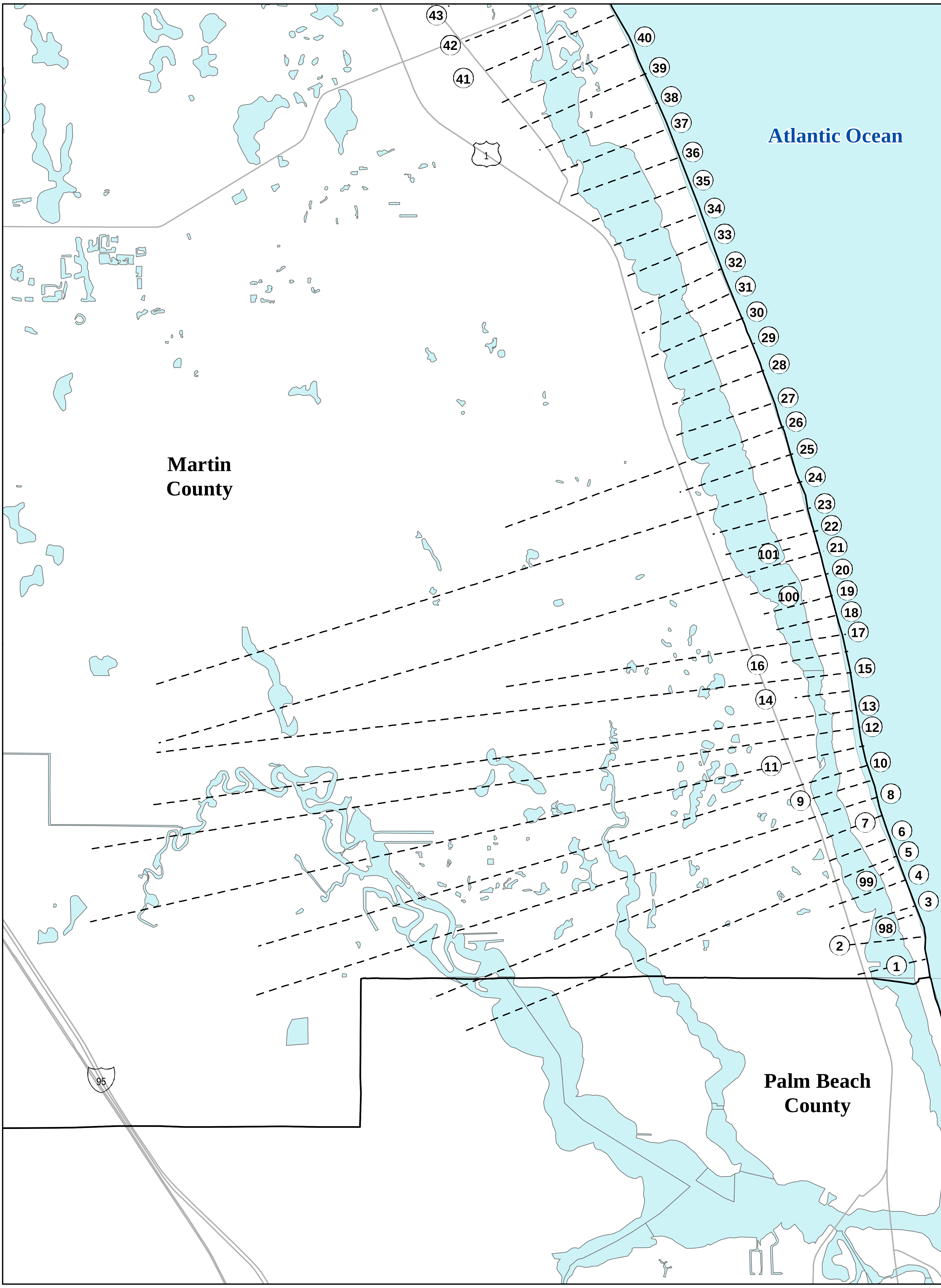
Figure 9: Transect Location Map, continued



1 inch = 3,333 feet 1:40,000

Feet

0 900 1,800 3,600 5,400 7,200

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

Transect Location Map

PANELS WITH TRANSECTS

0309H, 0317H, 0320H, 0328H, 0336H,
0338H, 0339H, 0506H, 0507H, 0508H,
0509H, 0526H, 0527H

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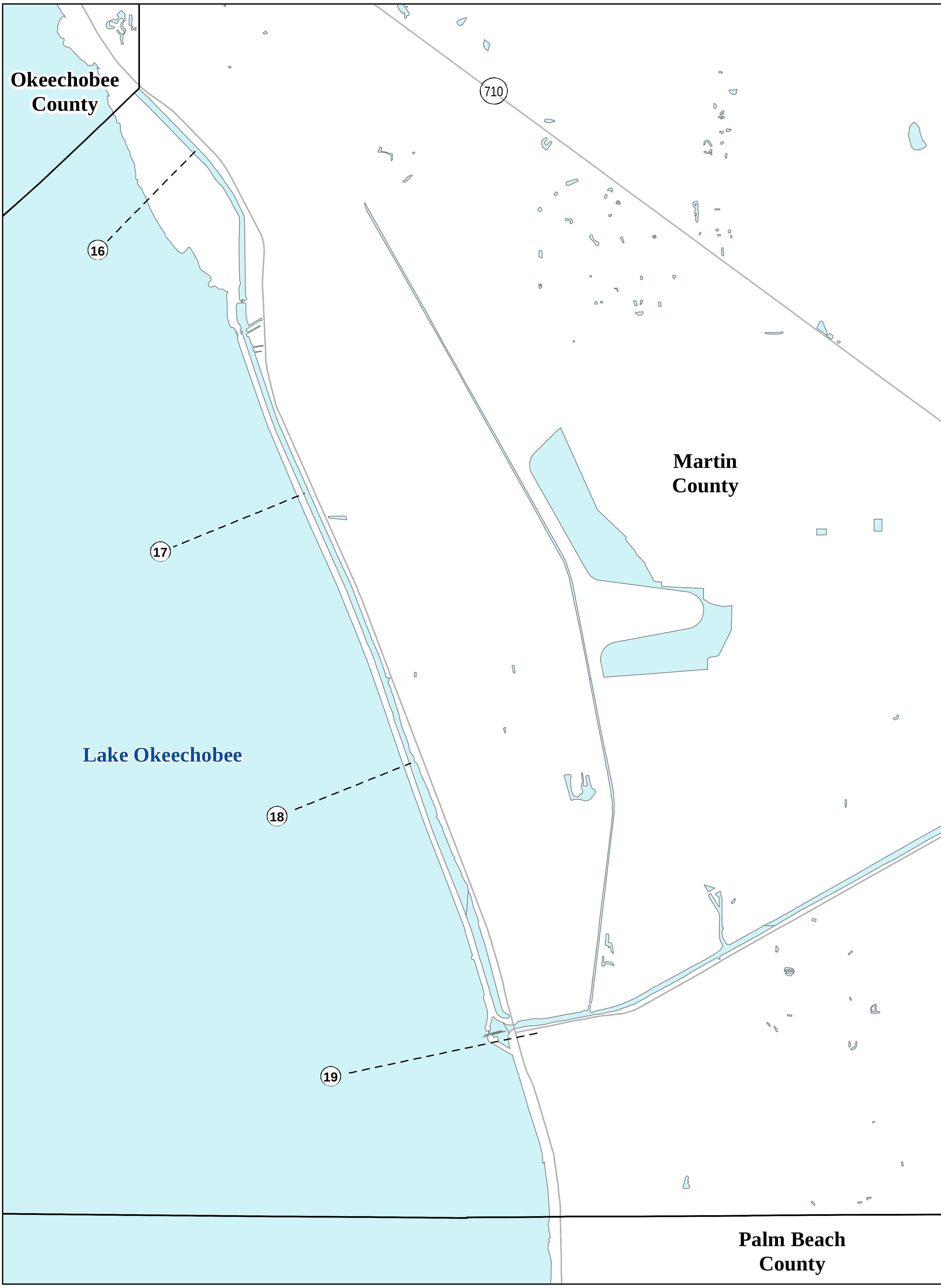
Figure 9: Transect Location Map, continued



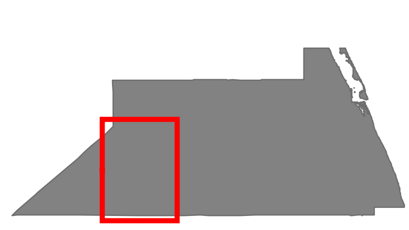
1 inch = 5,000 feet 1:60,000

N

0 1,375 2,750 5,500 8,250 11,000 Feet

Map Projection:
State Plane Florida East FIPS 0901;
North American Datum 1983

COUNTY LOCATOR



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Transect Location Map

PANELS WITH TRANSECTS

0210G, 0220G, 0425G, 0430G

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5.4 Alluvial Fan Analyses

This section is not applicable to this Flood Risk Project.

Table 17: Summary of Alluvial Fan Analyses
[Not Applicable to this Flood Risk Project]

Table 18: Results of Alluvial Fan Analyses
[Not Applicable to this Flood Risk Project]