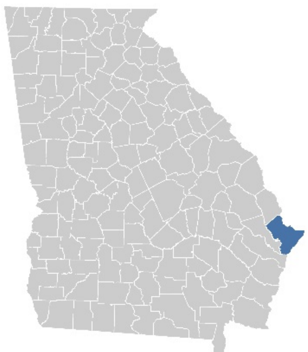
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 4



CHATHAM COUNTY, GEORGIA

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
BLOOMINGDALE, CITY OF	130452
CHATHAM COUNTY, UNINCORPORATED AREAS	130030
GARDEN CITY, CITY OF	135161
POOLER, CITY OF	130261
PORT WENTWORTH, CITY OF	135162
SAVANNAH, CITY OF	135163
THUNDERBOLT, TOWN OF	130460
TYBEE ISLAND, CITY OF	135164
VERNONBURG, TOWN OF	135165

FEMA

REVISED:

PRELIMINARY
05/23/2016

FLOOD INSURANCE STUDY NUMBER
13051CV001D

Version Number 2.3.2.1

TABLE OF CONTENTS
Volume 1

TABLE OF CONTENTS – continued

Tables

Volume 2

TABLE OF CONTENTS – continued

Volume 2 - continued

Tables

Exhibits

TABLE OF CONTENTS – continued

Volume 3

Exhibits

Volume 4

Exhibits

Published Separately

FLOOD INSURANCE STUDY REPORT
CHATHAM COUNTY, GEORGIA

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 60.3, *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 Chatham County, Georgia.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 1. The Flood Insurance Rate Map (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.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

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
Bloomingdale, City of	130452	03060109, 03060204	13051C0013H 13051C0014H 13051C0016G 13051C0018H 13051C0019H 13051C0102J 13051C0104J 13051C0105J 13051C0106J 13051C0107J 13051C0108J	

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
Chatham County, Unincorporated Areas	130030	03060109, 03060202, 03060204	13051C0013H 13051C0014H 13051C0016G 13051C0017G 13051C0018H 13051C0030J 13051C0035J 13051C0038J 13051C0040J 13051C0045J 13051C0055J 13051C0065J 13051C0085J 13051C0102J 13051C0104J 13051C0105J 13051C0108J 13051C0109J 13051C0115J 13051C0116J 13051C0117J 13051C0118J 13051C0119J 13051C0128J 13051C0129J 13051C0132J 13051C0134J 13051C0140J 13051C0142J 13051C0145J 13051C0153J 13051C0154J 13051C0155J 13051C0160J 13051C0161J 13051C0163J 13051C0164J	

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
Chatham County, Unincorporated Areas	130030	03060109, 03060202, 03060204	13051C0166J 13051C0170J 13051C0180J 13051C0190J 13051C0194J 13051C0195J 13051C0213J 13051C0214J 13051C0235J 13051C0245J 13051C0255J 13051C0256J 13051C0257J 13051C0258J 13051C0259J 13051C0265J 13051C0270J 13051C0276J 13051C0277J 13051C0278J 13051C0279J 13051C0285J 13051C0290J 13051C0295J 13051C0305J 13051C0310J 13051C0315J 13051C0320J 13051C0326J 13051C0328J 13051C0360J 13051C0370J 13051C0380J 13051C0385J 13051C0390J 13051C0395J 13051C0405J 13051C0435J 13051C0455J	

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
Garden City, City of	135161	03060109, 03060204	13051C0045J 13051C0127J 13051C0129J 13051C0132J 13051C0134J 13051C0135J 13051C0140J 13051C0145J	
Pooler, City of	130261	03060109, 03060204	13051C0016G 13051C0017G 13051C0018H 13051C0019H 13051C0036J 13051C0038J 13051C0040J 13051C0106J 13051C0107J 13051C0108J 13051C0109J 13051C0116J 13051C0117J 13051C0119J 13051C0126J 13051C0127J 13051C0128J 13051C0129J	
Port Wentworth, City of	135162	03060109	13051C0009H 13051C0017G 13051C0030J 13051C0035J 13051C0036J 13051C0040J 13051C0045J	

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
Savannah, City of	135163	03060109, 03060202, 03060204	13051C0009H 13051C0016G 13051C0017G 13051C0019H 13051C0030J 13051C0036J 13051C0038J 13051C0040J 13051C0045J 13051C0104J 13051C0105J 13051C0108J 13051C0115J 13051C0116J 13051C0118J 13051C0119J 13051C0126J 13051C0127J 13051C0128J 13051C0129J 13051C0132J 13051C0134J 13051C0135J 13051C0140J 13051C0142J 13051C0145J 13051C0153J 13051C0154J 13051C0155J 13051C0160J 13051C0161J 13051C0162J 13051C0163J 13051C0164J 13051C0166J	

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
Savannah, City of	135163	03060109, 03060202, 03060204	13051C0170J 13051C0235J 13051C0245J 13051C0255J 13051C0256J 13051C0257J 13051C0258J 13051C0259J 13051C0265J 13051C0270J 13051C0276J 13051C0277J 13051C0278J 13051C0290J	
Thunderbolt, Town of	130460	03060204	13051C0162J 13051C0166J 13051C0170J	
Tybee Island, City of	135164	N/A	13051C0194J 13051C0213J 13051C0214J 13051C0326J 13051C0327J	
Vernonburg, Town of	135165	03060204	13051C0257J 13051C0259J 13051C0276J 13051C0278J	

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 31, "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 Chatham County became effective on September 26, 2008. Refer to Table 28 for information about subsequent revisions to the FIRMs.

- Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels. In addition, former flood hazard zone designations have been changed as follows:

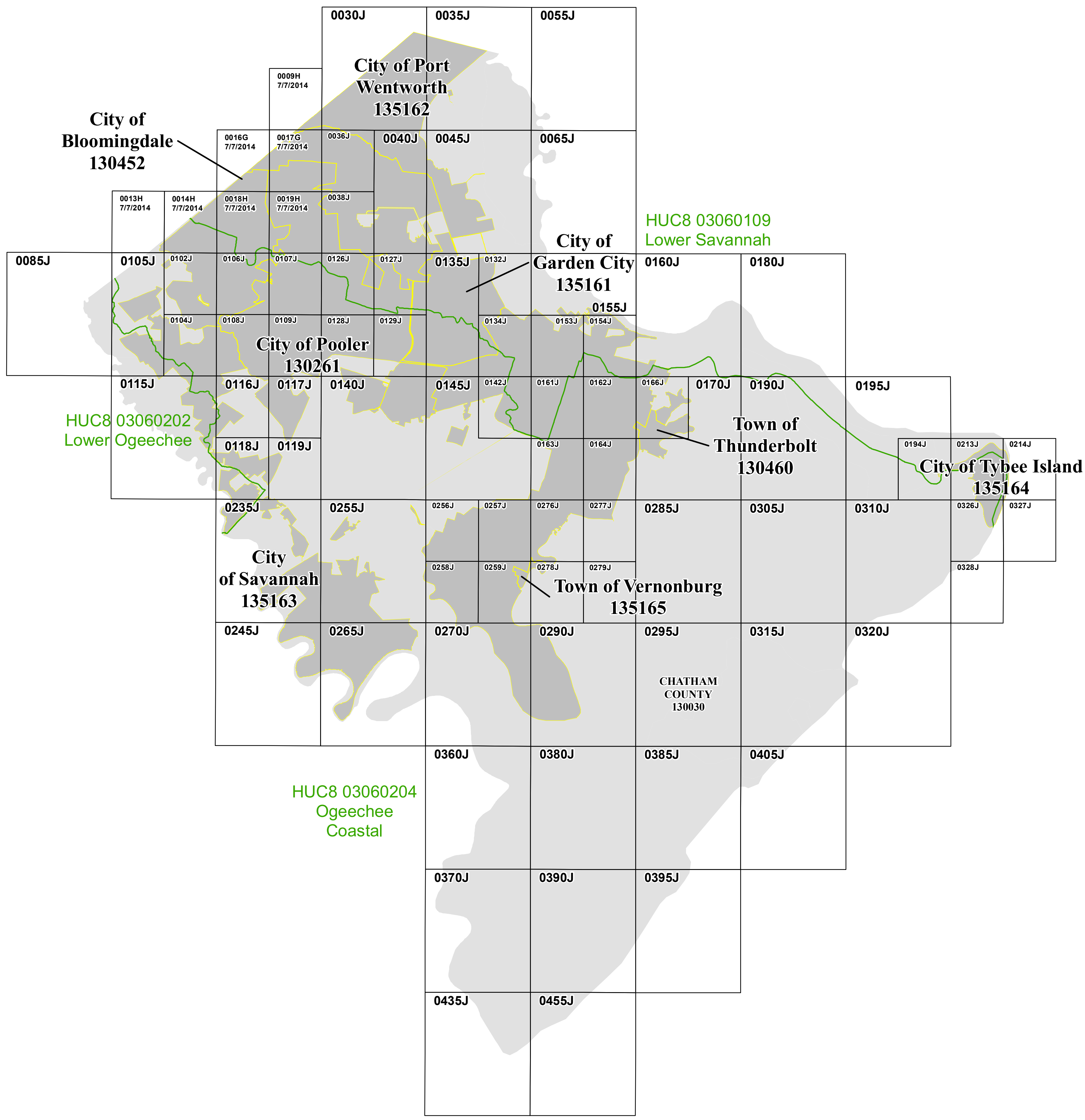
Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X (shaded)
C	X (unshaded)

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

  The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at 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 Chatham 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, and flooding sources.



1 inch = 4 miles

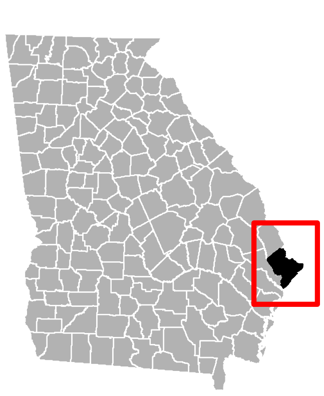
0 2 4 8 Miles

Map Projection:
Universal Transverse Mercator Zone 17 North
North American Datum 1983

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

HTTP://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

CHATHAM COUNTY, GEORGIA and Incorporated Areas

PANELS PRINTED:
0009H, 0013H, 0014H, 0016G, 0017G, 0018H, 0019H, 0030J, 0035J, 0036J, 0038J, 0040J, 0045J, 0055J, 0065J, 0085J, 0102J, 0104J, 0105J, 0106J, 0107J, 0108J, 0109J, 0115J, 0116J, 0117J, 0118J, 0119J, 0126J, 0127J, 0128J, 0129J, 0132J, 0134J, 0135J 0140J, 0142J, 0145J, 0153J, 0154J, 0155K, 0160J, 0161J, 0162J, 0163J, 0164J, 0166J, 0170J, 0180J, 0190J, 0194J, 0195J, 0213J, 0214J, 0235J, 0245J, 0255J, 0256J, 0257J, 0258J, 0259J, 0265J, 0270J, 0276J, 0277J, 0278J, 0279J, 0285J, 0290J, 0295J, 0305J, 0310J, 0315J, 0320J, 0326K, 0327J, 0328J, 0360J, 0370J, 0380J, 0385J, 0390J, 0395J, 0405J, 0435J, 0455J

FEMA

PRELIMINARY
03/30/2016

MAP NUMBER
13051CIND0C

MAP REVISED

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 28 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.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

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.

Figure 2. FIRM Notes to Users

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.

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 Coordinate System, Georgia East, FIPS 1001. The horizontal datum was 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/ or contact the National Geodetic Survey at the following address:

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

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 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was derived from digital orthophotography provided by the NAIP. This imagery was flown in 2015 and was produced at 1 meter resolution. 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.

Figure 2. FIRM Notes to Users

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Chatham County, Georgia, 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 28 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.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Chatham County, Georgia, effective March 29, 2016.

COASTAL BARRIER RESOURCES SYSTEM (CBRS): This map includes approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see www.fws.gov/cbra/, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

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 Chatham 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.
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
A	Modeled Node Label
	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
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.*	
CBRS AREA 09/30/2009	Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.
OTHERWISE PROTECTED AREA 09/30/2009	Otherwise Protected Area
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

Figure 3: Map Legend for FIRM

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
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 Chatham 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 23), 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 Chatham County, Georgia, 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 13. 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 (Flooding Controlled by the Atlantic Ocean)	Chatham County, Unincorporated Areas; Port Wentworth, City of; Savannah, City of; Thunderbolt, Town of' Tybee Island, City of; Vernonburg, Town of	Entire Coastline	Entire Coastline	03060204	42.53		N	VE, AE	2015
Belford Tract	Chatham County, Unincorporated Areas; Savannah, City of	Ogeechee River	Scottstell Road	03060202, 03060204	8.18		N	AE	2012
Black Creek	Chatham County, Unincorporated Areas; Port Wentworth, City of	Confluence with Savannah River	Approximately 11,540 feet upstream of Augusta Road/State Highway 30/21	03060109	7.28		N	AE	2007 (redelineated 2015)
Black Creek Tributary No. 2	Port Wentworth, City of	Confluence with Black Creek	Approximately 2,980 feet upstream of Saussy Road	03060109	1.83		N	AE	2007 (redelineated 2015)
Chatham Unnamed Tributary No. 7	Bloomingdale, City of	At East Main Street	Approximately 220 feet upstream of South Pine Street	03060109	0.58		N	A	2012
Chippewa Canal	Savannah, City of	Confluence with Harmon Canal	Approximately 1,060 feet upstream of Mall Boulevard	03060204	0.89		N	AE	2007
Chippewa Canal	Savannah, City of	Approximately 1,050 feet upstream of Mall Boulevard	Just downstream of Eisenhower Drive	03060204	0.37		N	AE	2012
Coffee Bluff Basin	N/A	Confluence with Vernon River	Approximately 1,080 feet upstream of Bordeaux Lane	N/A	N/A		N	AE	1996 (redelineated 2007)
Colonial Oaks Canal	Savannah, City of	From 420 feet downstream of Coffee Bluff Road	Briarcliff Circle	03060204	1.20		N	AE	2007

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
Colonial Oaks Canal Tributary No. 1	Savannah, City of	Confluence with Colonial Oaks Canal	Approximately 660 feet upstream of Rockingham Road	03060204	0.18		N	AE	2007
Colonial Oaks Canal Tributary No. 1.1	Savannah, City of	Confluence with Colonial Oaks Canal Tributary No. 1	Approximately 310 feet upstream of Stillwood Drive	03060204	0.33		N	AE	2007
Culvert Swamp	Chatham County, Unincorporated Areas; Pooler, City of	Just downstream of South Ridge Boulevard	Just downstream of Pooler Parkway	03060204	3.48		N	AE	2013
Evergreen Cemetery Tributary	N/A	Mitchell Street	Approximately 1,600 feet upstream of Mitchell Street	N/A	N/A		N	AE	precounty (redelineated 2007)
Fell Street Basin	N/A	Approximately 2,050 feet upstream of confluence with Savannah River	Approximately 500 feet upstream of Tuten Avenue	N/A	N/A		N	AE	precounty (redelineated 2007)
Hardin Canal	Bloomingdale, City of	Approximately 0.45 miles downstream of Railroad	Railroad	03060204	0.45		N	AE	2012
Hardin Canal	Chatham County, Unincorporated Areas; Bloomingdale, City of; Pooler, City of; Savannah, City of;	U.S. Highway 17/Atlantic Coastal Highway/Ogeechee Road	Approximately 1,180 feet upstream of Osteen Road	03060204	10.97		N	AE	2007 (redelineated 2012)
Harmon Canal	Savannah, City of	Confluence with Vernon River	Approximately 600 feet upstream of West Montgomery Cross Road/State Highway 204	03060204	2.40		N	AE	2007
Kingsway Canal	Chatham County, Unincorporated Areas	Harry Truman Parkway	Approximately 1,180 feet upstream of Kings Way	03060204	0.75		N	AE	2007

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
Kroger Canal	Savannah, City of	Confluence with Chippewa Canal	Approximately 1,170 feet upstream	03060204	0.20		N	AE	2012
Little Ogeechee River	Chatham County, Unincorporated Areas; Bloomingdale, City of	Approximately 1,400 feet downstream of Osteen Road	Chatham/Effingham County Boundary	03060204	0.83		N	AE	2012
Little Ogeechee River	Chatham County, Unincorporated Areas; Bloomingdale, City of	Just upstream of Interstate Highway 16	Approximately 1,400 feet downstream of Osteen Road	03060204	2.79		N	AE	2012
Little Ogeechee River	Chatham County, Unincorporated Areas; Bloomingdale, City of; Pooler, City of; Savannah, City of	State Highway 204	Just upstream of Interstate Highway 16	03060204	11.50		N	AE	1979, 1984 (redelineated 2012)
Little Ogeechee River Tributary	Chatham County, Unincorporated Areas; Savannah, City of	Little Neck Road	Approximately 3,120 feet upstream of Middle Landing Road	03060202, 03060204	3.59		N	AE	2007 (redelineated 2015)
Louis Mills Branch	Chatham County, Unincorporated Areas; Savannah, City of	Confluence with South Springfield Canal	Approximately 1,980 feet upstream of Marshall Avenue	03060204	1.79		N	AE	2007
Ogeechee River	Chatham County, Unincorporated Areas	Pintail Drive	Chatham/Bryan County Boundary	03060202	4.26		N	AE	2012
Pipe Makers Canal	Chatham County, Unincorporated Areas; Garden City, City of	Confluence with Atlantic Ocean	State Highway 307 (Dean Forrest Road)	03060109	4.21		N	AE	2012
Pipe Makers Canal	Pooler, City of; Savannah, City of	State Highway 307 (Dean Forrest Road)	Approximately 2.02 miles downstream of U.S. Highway 80/State Highway 17/26	03060109	4.44		N	AE	2012

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
Pipe Makers Canal	Bloomingdale, City of	Approximately 2.02 miles downstream of U.S. Highway 80/State Highway 17/26	U.S. Highway 80/State Highway 17/26	03060109	1.14		N	AE	2007
Pipe Makers Canal Tributary No. 2	Bloomingdale, City of; Pooler, City of	Confluence with Pipe Makers Canal	Upstream of Conaway Road	03060109	1.18		N	AE	1979 (redelineated 2012)
Pipe Makers Canal Tributary No. 2	Bloomingdale, City of; Pooler, City of	Upstream of Conaway Road	Approximately 50 feet upstream of Main Street to Georgia Central Railroad	03060109	0.79		N	AE	2012
Pipe Makers Canal Tributary No. 3	Bloomingdale, City of; Pooler, City of	Approximately 0.81 miles upstream of Jimmy Deloach Parkway	Approximately 1.47 miles upstream of Jimmy Deloach Parkway	03060109	0.66		N	AE	2012
Pipe Makers Canal Tributary No. 3	N/A	Just downstream of Tahoe Drive	Approximately 0.81 miles upstream of Jimmy Deloach Parkway	03060109	1.73		N	AE	2012
Placentia Canal	N/A	Confluence with Wilmington River	Bona Bella Avenue	N/A	N/A		N	AE	2007
Quacco Canal	Chatham County, Unincorporated Areas	Atlantic Coastal Highway/State Highway 25/U.S. Highway 17	Quacco Road	03060204	2.12		N	AE	2007
Rahn Dairy Canal	Chatham County, Unincorporated Areas	Confluence with Salt Creek	Buckhalter Avenue	03060204	1.18		N	AE	2007
Salt Creek Tributary	Garden City, City of; Pooler, City of	Interstate Highway 16	Old Louisville Road	03060204	1.27		N	AE	1979
Springfield Canal	Savannah, City of	Louisville Road	Approximately 2,700 feet upstream of Derenne Avenue/Highway 516	03060109	1.87		N	AE	precounty (redelineated 2007)

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
Springfield Canal Tributary A	Savannah, City of	Confluence with Springfield Canal	Ogeechee Road/State Highway 25/U.S. Highway 17	03060109	2.71		N	AE	precounty (redelineated 2007)
St. Augustine Creek - Walthour Swamp	Chatham County, Unincorporated Areas; Port Wentworth, City of; Savannah, City of	Confluence with Atlantic Ocean	Approximately 4.5 miles upstream of Interstate Highway 95	03060109	8.99		N	AE	2012
St. Augustine Creek Tributary	Pooler, City of; Savannah, City of	Approximately 0.86 miles downstream of Jimmy Deloach Parkway	Approximately 230 feet downstream of Tahoe Drive	03060109	5.41		N	AE	2012
St. Augustine Creek Tributary No. 1	N/A	Confluence with St. Augustine Creek - Walthour Swamp	Just upstream of Airways Avenue	03060109	3.36		N	AE	2012
Tributary to Little Ogeechee River Tributary	Chatham County, Unincorporated Areas; Savannah, City of	Confluence with Little Ogeechee River Tributary	Approximately 3,300 feet upstream of Middle Landing Road	03060202	1.91		N	AE	2007 (redelineated 2015)
Wilshire Canal	Savannah, City of	Confluence with Wilshire Canal Tributary A	Just upstream of Wilshire Boulevard	03060204	2.45		N	AE	precounty (redelineated 2007)
Wilshire Canal Tributary A	Savannah, City of	Confluence with Wilshire Canal	Approxijmately 1.43 miles upstream	03060204	1.43		N	AE	2007
Wilshire Canal Tributary A-1	Savannah, City of	Confluence with Wilshire Canal Tributary A	Approxijmately 0.40 miles upstream	03060204	0.40		N	AE	2007
Windsor Forest Canal East	Savannah, City of	Stillwood Drive	Approximately 710 feet upstream of Deerfield Road	03060204	1.42		N	AE	2007
Windsor Forest Canal Tributary	Savannah, City of	Confluence with Windsor Forest Canal West	Approximately 2,980 feet upstream of confluence	03060204	0.56		N	AE	2007

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
Windsor Forest Canal Tributary No. 2	Savannah, City of	Confluence with Windsor Forest Canal East	Approximately 390 feet upstream of Winwood Place	03060204	0.22		N	AE	2007
Windsor Forest Canal Tributary No. 3	Savannah, City of	Confluence with Windsor Forest Canal East	Approximately 410 feet upstream of Windsor Road	03060204	0.09		N	AE	2007
Windsor Forest Canal West	Savannah, City of	Science Drive	Approximately 3,410 feet upstream of Roger Warlick Drive	03060204	1.11		N	AE	2007

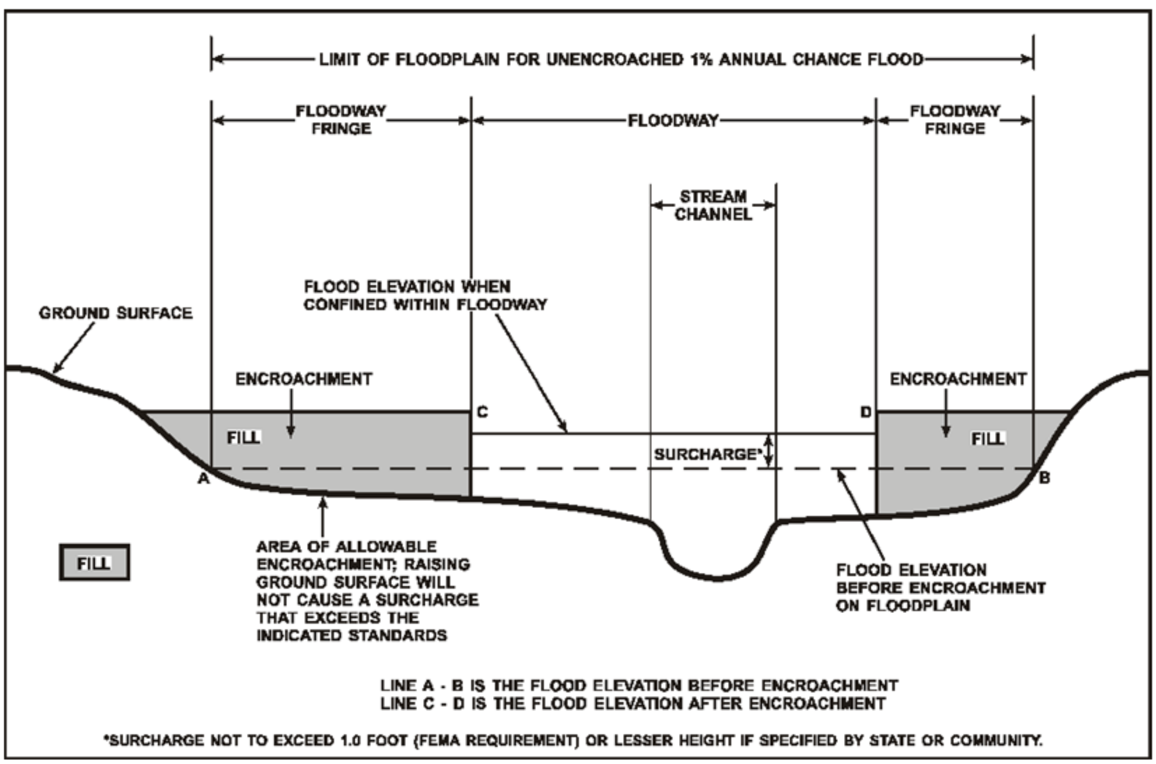
2.2 Floodways

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 24, “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 l% 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

Some States and communities use non-encroachment zones to manage floodplain development. For flooding sources with medium flood risk, field surveys are often not collected and surveyed bridge and culvert geometry is not developed. Standard hydrologic and hydraulic analyses are still performed to determine BFEs in these areas. However, floodways are not typically determined, since specific channel profiles are not developed. To assist communities with managing floodplain development in these areas, a “non-encroachment zone” may be provided. While not a FEMA designated floodway, the non-encroachment zone represents that area around the stream that should be reserved to convey the 1% annual chance flood event. As with a floodway, all surcharges must fall within the acceptable range in the non-encroachment zone.

General setbacks can be used in areas of lower risk (e.g. unnumbered Zone A), but these are not considered sufficient where unnumbered Zone A is replaced by Zone AE. The NFIP requires communities to ensure that any development in a non-encroachment area causes no increase in BFEs. Communities must generally prohibit development within the area defined by the non-encroachment width to meet the NFIP requirement.

2.5 Coastal Flood Hazard Areas

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

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

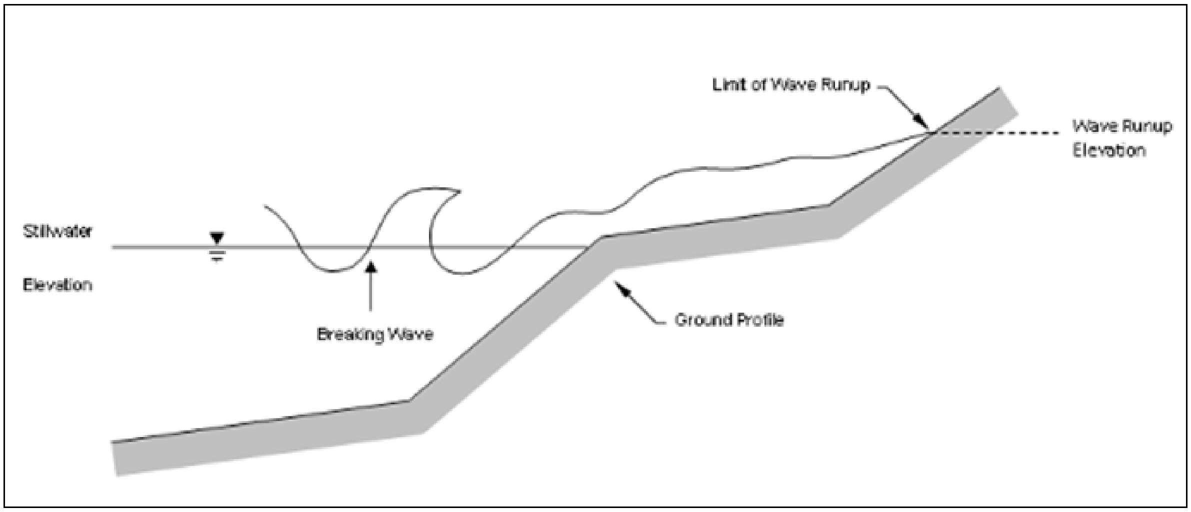
Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from 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 26 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 17, "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.

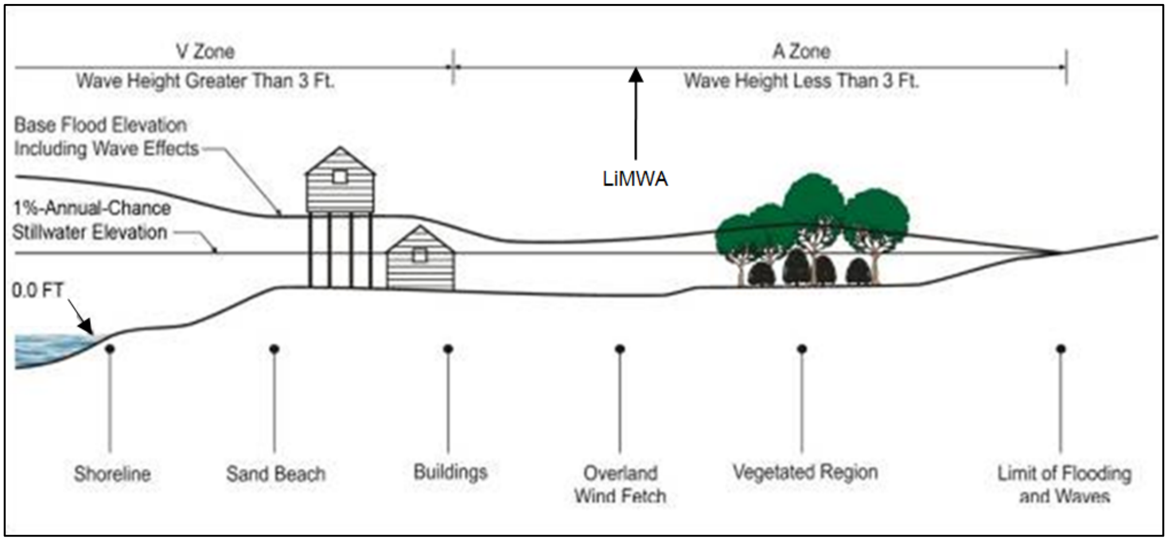
CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the 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 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

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

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

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

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

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 Chatham County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Bloomingdale, City of	A, AE, X
Chatham County, Unincorporated Areas	A, AE, VE, X
Garden City, City of	AE, X
Pooler, City of	A, AE, X
Port Wentworth, City of	A, AE, X
Savannah, City of	A, AE, VE, X
Thunderbolt, Town of	AE, X
Tybee Island, City of	AE, VE, X
Vernonburg, Town of	AE, VE, X

3.2 Coastal Barrier Resources System

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

Table 4: Coastal Barrier Resources System Information

Primary Flooding Source	CBRS/OPA Type	Date CBRS Area Established	FIRM Panel Number(s)
Atlantic Ocean (Flooding controlled by the Atlantic Ocean), Ossabaw Sound	OPA	11/16/1991	13051C0295J 13051C0315J 13051C0320J 13051C0360J 13051C0370J 13051C0380J 13051C0385J 13051C0390J 13051C0395J 13051C0405J 13051C0435J 13051C0455J
Atlantic Ocean (Flooding controlled by the Atlantic Ocean), Ossabaw Sound	CBRS	10/1/1983	13051C0315J
Atlantic Ocean (Flooding controlled by the Atlantic Ocean), Wassaw Sound	CBRS	10/1/1983	13051C0310J 13051C0320J 13051C0326J 13051C0328J
Atlantic Ocean (Flooding controlled by the Atlantic Ocean), Wassaw Sound	CBRS	11/16/1990	13051C0190J 13051C0195J 13051C0285J 13051C0305J 13051C0310J 13051C0315J 13051C0320J

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 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 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Lower Ogeechee	03060202	Ogeechee River	Smallest watershed within Chatham County along the western corner of the county along the Ogeechee River	N/A
Lower Savannah	03060109	Black Creek, Pipe Makers Canal, Savannah River,	Second largest watershed within Chatham County, emcompassing the northwest portion	N/A
Ogeechee Coastal	03060204	Atlantic Ocean (flooding controlled by Atlantic Ocean), Little Ogeechee River	Largest watershed within Chatham County, encompassing the entire coastline and extending west	N/A

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for Chatham County by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
Miscellaneous flooding sources within Chatham County	Chatham County is subject to flooding caused by hurricanes and tropical storms. Major storms and hurricanes caused flooding in 1871, 1881, 1885, 1893, 1896, 1898, 1911, 1940, 1944, 1947, 1952, 1959, and 1979 (Dunn and Miller, 1964; National Climatic Center, 1979; Tannehill, 1956). The highest surges occurred during the hurricanes of 1881 and 1893, which caused flood heights up to 15 and 18 feet NAVD, respectively, in Savannah Beach (Dunn, G.E. and B.I. Miller 1964).

Table 6: Principal Flood Problems - continued

Flooding Source	Description of Flood Problems
Miscellaneous flooding sources within Chatham County	Georgia hasn't been hit by a major hur ricane in 108 years, but hurricanes do not have to be fully developed or even make landfall in Georgia to wreak havoc. More recently, according to the Georgia Emergency Management Agency (GEMA), major storms and hurricanes caused flooding in 1989, 1994, 1996, 1999, and 2005 (GEMA 2006). The primary factors contributing to flooding in Chatham County are its openness to Atlantic Ocean surges and unfavorable bathymetry extending offshore. Many of the large streams near the coast have wide mouths and are bordered by extensive areas of low marsh. In addition, the terrain at the coast is generally too low to provide an effective barrier. The offshore ocean depths are shallow for great distances, generating a high Atlantic Ocean surge. A storm history of Chatham County and its vicinity during the past 140 years is summarized below. Damage figures are determined in dollar values at the time of the storm. No attempt has been made to adjust these figures to current dollar values. August 16 - 19, 1871 A tropical cyclone moved overland from Florida and caused damage along the Florida, Georgia, and South Carolina coasts. At Savannah, Georgia, the wind speed was 72 miles per hour (mph) from the north. August 21 - 29, 1881 This storm reached hurricane intensity northeast of Puerto Rico on August 22. The lowest barometric pressure reading was 29.08 inches. The storm center entered the coast south of Savannah on August 27. Damage in Savannah was estimated at $1.5 million. Approximately 335 people were killed in and near the city. Nearly 100 vessels were wrecked along the Atlantic coast. Damage was very heavy on Tybee Island and other coastal islands near Savannah. The highest tide observed was estimated to reach an elevation of 15.6 feet NAVD at Savannah Beach, approximating a flood of at least 1-percent-annual-chance magnitude. August 21 - 26, 1885 This storm moved inland north of Savannah on August 25. It caused heavy damage in the Carolinas. Total damage was estimated at about $1.7 million. Damage inflicted by this storm in Georgia was relatively light.

Table 6: Principal Flood Problems - continued

Flooding Source	Description of Flood Problems
Miscellaneous flooding sources within Chatham County	August 15 - September 2, 1893 This major hurricane, which originated near the Cape Verde Islands, reached the Georgia coast on August 27. It was accompanied by a tremendous storm wave that submerged the islands along the Georgia and South Carolina coasts. Between 2,000 and 2,500 people lost their lives on the coastal islands and in the lowland between Tybee Island and Charleston. Property damage along the Atlantic coast was estimated at $10 million. Nearly every building on Tybee Island was damaged and the railroad to the island was wrecked. The highest tide known to have occurred in the county was estimated to have a range of 16.1 to 18.6 feet NAVD at Savannah Beach. September 22 - 29, 1896 This hurricane entered the northwestern Florida coast near St. Mark. Its center passed through southeastern Georgia and South Carolina on September 28 and 29. Hurricane winds persisted when the hurricane moved inland. Savannah recorded maximum winds of 75 mph. Damage in Savannah was estimated at $1 million. Damage was also heavy on Tybee Island and over much of southeastern Georgia. Because the damaging hurricane wind was of a short duration near Chatham County and occurred during a low tide period, destruction caused by storm surge was relatively light compared with the hurricanes of1881 and 1893. August 30 - September 1, 1898 This hurricane entered the Georgia-South Carolina coast on August 30. Its center passed over Tybee Island. Winds on Tybee Island were estimated at 100 mph. The storm surges were not high enough to cause extensive damage; however, the hurricane was accompanied by very heavy rain, and the countryside was flooded for 100 miles aroundSavannah. Most roads and railroads were impassable because of high water. August 23 - 30, 1911 The center of this hurricane entered the coast between Savannah and Charleston on August 28. A maximum wind of 88 mph from the northwest was recorded at Savannah. Damage in the Savannah area was remarkably low; however, property on Tybee Island was heavily damaged. Excessive rains accompanied the storm and caused considerable damage to roads, crops, and other property throughout southern Georgia.

Table 6: Principal Flood Problems - continued

Flooding Source	Description of Flood Problems
Miscellaneous flooding sources within Chatham County	August 5 - 15, 1940 This was the first hurricane to affect Georgia since August 1911. Its center entered the South Carolina coast to the north of Savannah on August 11. The wind at Savannah reached 73 mph, and damage in the Savannah area was estimated at $850,000. The highest tide observed at Beaufort, South Carolina, was estimated to be 11.5 feet NAVD. High tides of 6.5 and 5.5 feet NAVD were recorded at Fort Pulaski, Georgia, and at Fort Jackson, Savannah Harbor, Georgia, respectively. October 12 - 23, 1944 This hurricane entered the gulf coast of Florida and moved northeastward across the peninsula. Its center crossed the east coast near Jacksonville, Florida, in a north-northeast direction and moved inland again near Savannah. The hurricane was downgraded to a tropical storm by the time it reached Georgia. The highest tide, 5.0 feet NAVD along the Georgia coast, was observed at Fort Pulaski, near the mouth of the Savannah River. The estimated damage in Georgia was $500,000. October 9 - 16, 1947 The center of this hurricane entered the Georgia coast just south of Savannah on October 15. At Savannah, the maximum wind speed was 77 mph, and the lowest barometric pressure was 28.77 inches. Heavy losses were sustained at Savannah and Savannah Beach, where more than 1,500 buildings were substantially damaged. Total damage in the coastal area was estimated at more than $2 million. The highest tide, 7.0 feet NAVD, was recorded at Fort Jackson. August 18 - September 2, 1952 (Hurricane Able) Hurricane Able moved inland on August 30. Its center passed near Beaufort with maximum winds of approximately 100 mph. Damage from this storm was estimated at about $2.8 million. September 20 - October 2, 1959 (Hurricane Gracie) Hurricane Gracie moved inland on September 29. Its center passed over the South Carolina coast near Beaufort. Wind gusts of hurricane force were felt in the Savannah area, and damage was inflicted over the upper Georgia coastal area. The total damage inflicted by the storm was estimated at $14 million with damage in Georgia estimated at more than $500,000. Highwater marks, which were reported near Edisto Beach, South Carolina, ranged from 6.4 to 11.0 feet NAVD.

Table 6: Principal Flood Problems - continued

Flooding Source	Description of Flood Problems
Miscellaneous flooding sources within Chatham County	August 25 - September 7, 1979 (Hurricane David) Hurricane David was the most intense storm of the century to affect the islands of the eastern Caribbean. However, the storm was not a major hurricane when it struck the United States. David struck just north of Palm Beach, Florida, on September 3 and made a second landfall about 24 hours later near Savannah Beach, Georgia. In the United States, David was responsible for five deaths and about $300 million in damages. The death toll and damage were much greater in Dominica, Cuba, and the Dominican Republic (NCC 1979). September 9 - September 25, 1989 (Hurricane Hugo) Hurricane Hugo was a destructive Category 5 hurricane that killed 82 people, left 56,000 homeless and caused $16.3 billion in damages, making it the most destructive hurricane ever recorded up to that time. Hugo was originally forecast to move toward Savannah, but instead turned north toward Charleston, South Carolina. Savannah was evacuated in anticipation of Hugo but saw no effects other than isolated showers (GEMA 2006). June 30 - July 10, 1994 (Tropical Storm Alberto) Tropical Storm Alberto made landfall in the Florida Panhandle on July 4, 1994, then moved into western Georgia, where it made a loop July 5-6, dumping 27.61 inches of rain in Americus (21 inches within 24 hours). Alberto's winds and tides did only minor damage to the Florida coast, but the excessive rains that fell in Georgia caused catastrophic flooding from Clayton County through central and southwest Georgia to the Florida border, resulting in 33 deaths, $500 billion in damage and a major disaster declaration for 55 counties (GEMA 2006). September 27 - October 6, 1995 (Hurricane Opal) After coming ashore in the Florida Panhandle on October 4, 1995, Opal swept through Georgia with high winds, heavy rain and tornadoes, killing 14 people and resulting in a major disaster declaration for 50 counties (GEMA 2006). September 7 - September 19, 1999 (Hurricane Floyd) Hurricane Floyd triggered the second largest evacuation in U.S. history when 2.6 million coastal residents of five states including around 350,000 people in Georgia, were ordered from their homes as Hurricane Floyd approached. Floyd struck the Bahamas at peak strength, causing heavy damage. It then paralleled the east coast of the U.S., causing massive evacuations and costly preparations. In total, Floyd was responsible for 57 fatalities and $5.7 billion in damage, mostly in North Carolina (GEMA 2006).

Table 6: Principal Flood Problems - continued

Flooding Source	Description of Flood Problems
Miscellaneous flooding sources within Chatham County	August 23 - August 31, 2005 (Hurricane Katrina) Hurricane Katrina was the costliest and one of the deadliest hurricanes in the history of the U.S. Katrina formed on August 23, 2005, and caused devastation along much of the north-central Gulf Coast. At least 1,836 people lost their lives in Hurricane Katrina and in the subsequent floods. It is estimated to have been responsible for $81.2 billion in damages (GEMA 2006).

Table 7 contains information about historic flood elevations in the communities within Chatham County.

Table 7: Historic Flooding Elevations

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Miscellaneous	Bloomingdale, City of; Chatham County, Unincorporated Areas; Garden City, City of; Pooler, City of; Port Wentworth, City of; Savannah, City of; Thunderbolt, Town of; Tybee Island, City of; Vernonburg, Town of	N/A	N/A	N/A	N/A

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within Chatham County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 8: Non-Levee Flood Protection Measures

[Not Applicable to this Flood Risk Project]

4.4 Levees

This section is not applicable to this Flood Risk Project.

Table 9: Levees

[Not Applicable to this Flood Risk Project]

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.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 27, "Incorporated Letters of Map Change", which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, "FIRM Revisions."

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 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Precountywide Analyses

Probability estimates for the 1-percent-annual-chance flood for Casey Canal, Salt Creek Tributary, Wilshire Canal, Wilshire Canal Tributary A, and Wilshire Canal Tributary A-1 are partially based on a statistical analysis of storm rainfall, runoff, and tide characteristics. In order to determine the 1-percent-annualchance flood, statistical studies on storm rainfall made by the Weather Bureau and storm tide records were used. On Casey Canal, flood heights were computed from the ponding that would result, assuming that the storm tide would keep the tide gate at Montgomery Cross Road closed.

Frequency curves of peak flows were constructed at selected locations along Salt Creek Tributary. These curves reflect the judgment of engineers who have studied the area and are familiar with the region.
Flood discharges for the Little Ogeechee River and the Ogeechee River were determined utilizing the regression equations developed by the U.S. Geological Survey (USGS) (USGS 1993).

Peak discharge rates for Pipe Makers Canal Tributary No. 2 were calculated using the USGS urban regression equations (USGS 1994).

Elevations for the Savannah River were obtained from a map provided by the USACE which showed 1-percent-annual-chance elevations (USACE 1976).

Flood discharges for Springfield Canal, Springfield Canal Tributary A, St. Augustine Creek, and St. Augustine Creek Tributary were determined using a regional flood frequency analysis (FEMA 1971).

Initial Countywide FIS

For Black Creek and Black Creek Tributary No. 2, the USACE Hydrologic Engineering Center's (HEC) HEC-HMS Version 2.1.2 (HEC 2001a) was used to generate flood hydrographs.

A calibrated XP-SWMM (XP Software Inc. 2006) model for Coffee Bluff Ponding Area, Colonial Oaks Canal, Colonial Oaks Canal Tributary No. 1, Colonial Oaks Canal Tributary No. 1.1, Windsor Forest Canal East, Windsor Forest Canal Tributary, Windsor Forest Canal Tributary No. 2, Windsor Forest Canal Tributary No. 3, and Windsor Forest Canal West representing as-built, existing conditions was provided by the City of Savannah. The model applied the Soil Conservation Service (SCS) unit-hydrograph methodology with a Type III rainfall distribution (USDA 1986). The unit-hydrograph peak rate factor applied in the model ranged between 200 and 300.

The hydrology for Harmon Canal and Chippewa Canal was revised by the USACE, Savannah District. The USACE study applied the HEC-HMS, Version 1.0 (HEC 1998), computer software for the existing conditions watershed, segmenting the watershed into 11 sub-watersheds. The HEC-HMS model applied the SCS hydrology methodology (USDA 1986) to estimate peak runoff. The model was calibrated to the July 15, 1996, flood, adjusting the unit hydrograph parameters to match the peak and volume of the observed flood. The modified Puls flood hydrograph routing procedure was used to model the flood peak attenuation for ponds, reservoirs, and storage features throughout the watershed. The Muskingum-Cunge method was applied to translate the flood hydrographs through stream reaches between watershed model nodes. The flood discharges computed by the model were compared to the discharges estimated by the USGS regional flood discharge-frequency relationships (USGS 1993).

The hydrology for Hardin Canal, Kingsway Canal, Louis Mills Branch, Quacco Canal, and Rahn Dairy Canal was adapted from studies prepared by Thomas & Hutton Engineering in the period between 1998 and 2004 (Thomas & Hutton Engineering Company 1998, 2000, 2001, 2004a, 2004b, 2005). The hydrology for Pipe Makers Canal was adapted from a study prepared by EMC Engineering dated April 1999 (EMC 1999). The hydrology for Placentia Canal was adapted from a study prepared by Hussey, Gay, Bell, & DeYoung dated May 1996 (Hussey, Gay, Bell & DeYoung 2000). The studies applied either the XP-SWMM or Interconnected Channel and Pond

Routing (ICPR) dynamic routing computer software (Streamline Technologies, Inc., 2002) and the SCS dimensional unit-hydrology methodology (USDA 1986) applying a peak rate factor of 323. The National Weather Service Technical Paper 40 rainfall-depth-duration-frequency relationships (NWS 1961) were used in the runoff modeling with an SCS Type III distribution. The peak runoff rates computed in the models were compared to estimates of peak discharge computed by the USGS regional regression relationships for Georgia (USGS 1993).

The report provided by Kimley-Horn and Associates for the Little Ogeechee River Tributary and the Tributary to Little Ogeechee River Tributary describes the methodology used to delineate the drainage sub-basins using a combination of ESRI ArcMap 9.1 (ESRI 2005), USGS topographic contours, survey data, and field investigations. The watershed was divided into 16 sub-basins, ranging in size from 47 acres to 1,166 acres. The USGS rural regression equations (USGS 1993) were used to determine peak discharges.

<u>August 5, 2013 Countywide FIS Revision</u>

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community. Two new LOMRs, 10-04-0425P and 10-04-0658P, have been incorporated into the countywide study revising twelve FIRM panels (0014, 0018, 0019, 0038, 0040, 0107, 0115, 0116, 0118, 0126, 0127, and 0135). LOMR 10-04-0425P is a limited detailed study of S&O Canal (and five small tributaries). This area was previously studied as Zone A. Flood profiles and floodway data tables were not developed for this LOMR. All cross-sections will be added to the FIRM database as unlettered cross-sections and base flood elevations will be included. LOMR 10-04-0658P is a new detailed study that revises 10.5 miles of Pipe Makers Canal.

<u>July 7, 2014 Countywide FIS Revision</u>

The Georgia Land Use Trends (GLUT) Land Cover of Georgia 2008, produced by the Natural Resources Spatial Analysis Laboratory (NARSAL) was used to represent the existing land conditions within Chatham County. Light Detection and Ranging (LiDAR) topographic data provided by Chatham County was used to delineate sub-basins within the county. The USGS National Hydrography Dataset streamlines and manual edits were used to hydro correct the topography for a more accurate basin delineation (USGS, 2011b).

Discharges along detailed streams were estimated from the USGS regional regression equations for the State of Georgia. Two USGS Scientific Investigation Reports were used as the basis for the analysis: USGS Scientific Investigation Report (SIR) 2009-5043, (USGS 2009); and USGS SIR Scientific Investigation Report 2011-5042, (USGS 2011a) .

Impervious surface areas for each drainage basin were identified based the on the GLUT Impervious Surface Cover of Georgia data (NARSAL, 2011). Rainfall-runoff models were developed for the new detailed study along Little Ogeechee River. The 24-hour rainfall depths were taken from the Georgia Stormwater Management Manual (GSWMM) (Atlanta Regional Commission, 2001). Soils data was obtained from the NRCS SURGO (NRCS, 2011).

For most streams studied, the main channel floodplains are broad and flat providing significant storage. The Modified Puls method was used to route flow hydrographs through the stream reach.

In some cases back water at reservoirs and Modified Puls reaches extended into nearby reaches. To avoid double counting storage and account for time delay, the Lag Method was used to route flows on reaches where storage was already accounted for in reservoirs or in neighboring Modified Puls reaches.

At some road crossings the attenuation of flows is expected to be substantial and, due to the nature of the topography, would not be well represented by Modified Puls. For these cases, reservoirs were added to the model to accurately represent storage upstream of the roadway.

The 1-percent-annual-chance peak flow from the rainfall runoff models were compared to peak flows estimated using regression equations from SIR 20095043and SIR 2011-5042 (USGS, 2009 and USGS, 2011a). The sub-basin flows were found to be reasonably close to those estimated using regression equations; no adjustment was needed for the sub-basin parameters.

The same methodology described above was used to develop the St. Augustine Creek rainfall-runoff model. However, hydrographs obtained from a FLO-2D two-dimensional hydrologic model were added to the upstream limits of the HECHMS model.

The hydrology for all streams studied by limited detailed methods, for this countywide revision, were modeled using FLO-2D, version 2009.06 Build 0911.08.07.

Flood discharges for St. Augustine Creek, and St. Augustine Creek Tributary were determined using a regional flood-frequency analysis.

Flood discharges for Pipe Makers Canal Tributary No. 3 were estimated based on a FLO-2D two-dimensional hydrologic model.

A summary of the discharges is provided in Table 10. 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 11. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 17.) Stream gage information is provided in Table 12.

Table 10: 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 Existing	1% Annual Chance Future	0.2% Annual Chance
Black Creek	At confluence with Savannah River	26.55	1,039	*	1,553	2,084	*	2,713
Black Creek	Just upstream of Interstate Highway 95/State Highway 405	22.5	1,056	*	1,344	1,841	*	2,329
Black Creek	At confluence of Black Creek Tributary No. 2	20.49	1,059	*	1,347	1,845	*	2,333
Black Creek	At Augusta Road/State Highway 30/21	19.52	794	*	1,039	1,287	*	1,619
Black Creek	At confluence of Black Creek Tributary No. 1	18.54	1,018	*	1,345	1,799	*	2,249
Black Creek	At CSX	16.63	802	*	1,102	1,579	*	1,928
Black Creek	At Norfolk Southern Railway	13.44	807	*	1,116	1,639	*	1,992
				*			*	
Black Creek Tributary No. 2	At confluence with Black Creek	0.97	246	*	303	536	*	675
Casey Canal	*	*	*	*	*	*	*	*
Culvert Swamp	At South Ridge Boulevard	2.63	*	*	*	651	*	*

Table 10: 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 Existing	1% Annual Chance Future	0.2% Annual Chance
Chippewa Canal	At confluence with Harmon Canal	1.15	1,116	*	1,463	1,633	*	2,000
Chippewa Canal	Just downstream of Eisenhower Drive	0.3	*	*	*	187	*	*
Colonial Oaks Canal	Outfall at Atlantic Ocean	**	359	*	448	492	*	558
Colonial Oaks Canal	At divergence from Windsor Forest Canal East	**	9	*	9	9	*	9
Colonial Oaks Canal Tributary No. 1	Just above confluence with Colonial Oaks Canal	0.19	139	*	159	171	*	193
Colonial Oaks Canal Tributary No. 1.1	Just above confluence with Colonial Oaks Canal Tributary No. 1	0.06	47	*	52	54	*	58
Hardin Canal	At Atlantic Coastal Highway/U.S. Highway 17/Ogeechee Road	18.2	*	*	*	547	*	*
Hardin Canal	At Interstate Highway 16/State Highway 404	14.4	*	*	*	1,224	*	*

Table 10: 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 Existing	1% Annual Chance Future	0.2% Annual Chance
Hardin Canal	At Interstate Highway 95/State Highway 405	13.1	*	*	*	1,094	*	*
Hardin Canal	At Interstate Highway 95/State Highway 17	1.5	*	*	*	186	*	*
Hardin Canal	At Osteen Road	0.9	*	*	*	78	*	*
Harmon Canal	At confluence with Vernon River	3.13	2,442	*	3,213	3,585	*	4,402
Harmon Canal	Just downstream of confluence with Chippewa Canal	2.94	2,415	*	3,160	3,523	*	4,321
Kingsway Canal	At confluence with Vernon River	0.4	*	*	*	355	*	*
Kingsway Canal	At Harry Truman Parkway	0.3	*	*	*	187	*	*
Krogers Canal	At confluence with Chippewa Canal	0.51	*	*	*	254	*	*
Little Ogeechee River	Just upstream of Interstate Highway 16/State Highway 404	32.6	1,530	*	2,530	3,020	*	4,280

Table 10: 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 Existing	1% Annual Chance Future	0.2% Annual Chance
Little Ogeechee River	Chatham/Effingham County Boundary	26.8	1,665	*	2,636	3,063	*	3,827
Little Ogeechee River Tributary	At Little Neck Road	7.31	605	*	995	1,183	*	1,666
Little Ogeechee River Tributary	At New Hampstead Parkway	2.86	338	*	553	657	*	921
Little Ogeechee River Tributary	At Highgate Boulevard	0.55	122	*	199	235	*	327
Louis Mills Branch	At counfluence with South Springfield Canal	2.85	*	*	*	577	*	*
Louis Mills Branch	At Louis Mills Boulevard/Chatham Parkway	0.03	*	*	*	281	*	*
Ogeechee River	*	*	*	*	*	*	*	*
Pipe Makers Canal	At Augusta Road	44.1	976	*	1,148	1,314	*	1,565
Pipe Makers Canal	At Interstate Highway 95/State Highway 405	19.7	860	*	1,117	1,374	*	1,698
Pipe Makers Canal Tributary No. 2	At confluence with Pipe Makers Canal	1.43	268	*	456	556	*	803

Table 10: 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 Existing	1% Annual Chance Future	0.2% Annual Chance
Pipe Makers Canal Tributary No. 2	Just downstream of U.S. Highway 80/State Highway 26	0.65	166	*	277	336	*	481
Pipe Makers Canal Tributary No. 3	Chatham/Effingham County Boundary	*	67	*	175	282	*	463
Salt Creek Tributary	At confluence with Salt Creek	7.4	*	*	*	810	*	*
Salt Creek Tributary	At Interstate Highway 16/State Highway 404	6.4	*	*	*	720	*	*
Savannah River	*	*	*	*	*	*	*	*
Springfield Canal	*	*	*	*	*	*	*	*
Springfield Canal Tributary A	*	*	*	*	*	*	*	*
St. Augustine Creek	*	*	*	*	*	*	*	*
St. Augustine Creek Triburary	*	*	*	*	*	*	*	*
Tributary to Little Ogeechee River Tributary	At confluence with Little Ogeechee River Tributary	0.71	143	*	232	275	*	383

Table 10: 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 Existing	1% Annual Chance Future	0.2% Annual Chance
Tributary to Little Ogeechee River Tributary	At Highgate Boulevard	0.19	62	*	101	119	*	165
Wilshire Canal	*	*	*	*	*	*	*	*
Wilshire Canal Tributary A	*	*	*	*	*	*	*	*
Wilshire Canal Tributary A-1	*	*	*	*	*	*	*	*
Windsor Forest Canal East	Just above confluence with Windsor Forest Canal West	**	436	*	558	615	*	718
Windsor Forest Canal East	Just below divergence of Colonial Oaks Canal/confluence of Windsor Forest Canal Tributary No. 3	0.05	129	*	144	157	*	185
Windsor Forest Canal East	Just above divergence of Colonial Oaks Canal/confluence of Windsor Forest Canal Tributary No. 3	**	39	*	52	58	*	66

Table 10: 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 Existing	1% Annual Chance Future	0.2% Annual Chance
Windsor Forest Canal Tributary	Just above confluence with Windsor Forest Canal West	1.04	182	*	239	261	*	304
Windsor Forest Canal Tributary No. 2	Just above Windsor Road	0.03	36	*	46	51	*	69
Windsor Forest Canal Tributary No. 3	Just above Windsor Road	0.09	100	*	116	121	*	128
Windsor Forest Canal West	Outfall at Atlantic Ocean	1.4	519	*	702	777	*	948

*Not calculated for this Flood Risk Project

Figure 7: Frequency Discharge-Drainage Area Curves

[Not applicable to this Flood Risk Project]

Table 11: 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
Coffee Bluff Ponding Area	Chatham County Unincorporated Areas	11.6	*	13.2	13.8	14.4

*Not calculated for this Flood Risk Project

Table 12: Stream Gage Information used to Determine Discharges

[Not applicable to this Flood Risk Project]

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.

Precountywide Analyses

Hydraulic analyses of the shoreline characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

Cross section data for Pipe Makers Canal Tributary No. 2 were obtained from field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Flood profiles for Casey Canal were computed using stream characteristics for the selected reaches as determined from observed flood profiles, topographic maps, and valley cross sections which were surveyed in 1967 (USACE 1968).

Elevations for the Savannah River were obtained from a map provided by the USACE which showed 1-percent-annual-chance elevations (USACE 1976).

Water surface profiles for St. Augustine Creek, St. Augustine Creek Tributary, Springfield Canal, Springfield Canal Tributary A, were taken from the Type 10 FIS (FEMA 1971) report performed by the SCS for Chatham County. All data are on file with the SCS.

Water surface elevations (WSELs) of floods of the selected recurrence intervals on the Ogeechee River were computed using the USACE's HEC-2 step backwater computer program (HEC 1984).

WSELs of floods of the selected recurrence intervals on the Little Ogeechee River and Pipe Makers Canal Tributary No. 2 were computed using the USACE's HEC-2 stepbackwatercomputer program (HEC 1991).

Water surface profiles for Wilshire Canal, Wilshire Canal Tributary A, and Wilshire Canal Tributary A-1 were computed using stream characteristics for the selected reaches as determined from observed conditions, topographic maps, and valley cross sections obtained in 1970.

Starting WSELs for Pipe Makers Canal Tributary No. 2 were based on the slope-area method.

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

Initial Countywide FIS

A calibrated XP-SWMM model (XP Software Inc. 2006) for Coffee Bluff Basin, Colonial Oaks Canal, Colonial Oaks Canal Tributary No. 1, Colonial Oaks Tributary No. 1.1, Windsor Forest Canal East, Windsor Forest Canal Tributary, Windsor Forest Canal Tributary No. 2, Windsor Forest Canal Tributary No. 3, and Windsor Forest Canal West representing as-built, existing 24 conditions was provided by the City of Savannah. Top of roadway elevations were estimated from the topographic data from the countywide Digital Elevation Model (DEM). A cross section was drawn perpendicular to the flow-path at each node in the XP-SWMM model. The cross sections were transferred to the DEM in the ArcGIS (ESRI 2005) platform. The WSEL was integrated with the bare earth DEM to create a flood depth grid which was transferred to the flood delineation polygon.

Flood water elevations for Louis Mills Branch were estimated using the ICPR model which uses the node-link concept to describe the connectivity between subbasins. The node-link network provides the computational framework for the ICPR model. For Louis Mills Branch, the node locations were compared to the topographic map and aerial photographs. The original node locations in the work map were digitized into ArcGIS (ESRI 2005).

The flow hydrographs for Black Creek and Black Creek Tributary No. 2 were imported into HEC-RAS, Version 3.0.1 (HEC 2001b), to use for an unsteady flow analysis. The estimated WSELs for Pipe Makers Canal were based on a XP-SWMM model study prepared by EMC Engineering (EMC 1999). Airborne Laser Terrain Mapping (ALTM) was used to estimate channel and floodplain geometry, supplemented by field surveys of culvert and bridge crossings of the canal.

The estimated WSELs for Hardin Canal, Kingsway Canal, Louis Mills Branch, Quacco Canal, and Rahn Dairy Canal were based on ICPR model studies prepared by Thomas & Hutton (Thomas & Hutton Engineering Company 1998, 2000, 2004a, 2004b). ALTM was used to estimate channel and floodplain geometry.

The estimated WSELs for Placentia Canal were based on a XP-SWMM model prepared by Hussey, Gay, Bell & DeYoung (Hussey, Gay, Bell & DeYoung 2000). A calibrated HEC-RAS, Version 3.1.1 (HEC 2003), computer model prepared by the USACE, Savannah District, was used to estimate the flood elevation profiles for Harmon Canal and Chippewa Canal.

The hydraulics for Little Ogeechee River Tributary and Tributary to Little Ogeechee River Tributary were developed using HEC-GeoRAS (HEC 2002) within ArcMap 9.1 (ESRI 2005) to import channel and overbank geometries into a HEC-RAS, Version 3.1.3 (HEC 2005), model. The City of Savannah's 2- foot contour interval topographic mapping data were used as the source for the digital terrain model, supplemented with survey data for the existing and newly built structures (Little Neck Road and Highgate Boulevard, respectively). The structure at New Hampstead Parkway was not included in the final existing model since it was not complete at the time of the report submission. Other structures seen in aerial photographs were old logging road crossings that currently have remains of rusted, flattened CMP culverts. The culverts are in the process of being removed as part of the site development and, in some cases, as mandated by the USACE.

The estimated WSELs for Coffee Bluff Basin were based on an XP-SWMM model provided by the City of Savannah. The model used a fixed backwater elevation of 3.59 feet NAVD, mean high tide.

The starting WSELs applied in the ICPR model for Hardin Canal, Kingsway Canal, and Rahn Dairy Canal was 4.4 feet NAVD. The 1-percent-annual-chance flooding for Hardin Canal is controlled by the flooding effects from the Atlantic Ocean in the stream reach from the confluence with Salt Creek to Interstate Highway 16. The 1-percent-annualchanceflooding for Kingsway Canal is controlled by the flooding effects from the Atlantic Ocean upstream of the confluence with the Vernon River.

The starting WSELs for Black Creek, Black Creek Tributary No. 2, Chippewa Canal, Harmon Canal, Little Ogeechee River Tributary, and Tributary to Little Ogeechee River Tributary were based on normal depth.

The starting WSELs for Colonial Oaks Canal, Colonial Oaks Canal Tributary No. 1, Colonial Oaks Canal Tributary 1.1, Windsor Forest Canal East, Windsor Forest Canal Tributary, Windsor Forest Canal Tributary No. 2, Windsor Forest Canal Tributary No. 3, and Windsor Forest Canal West were based on mean high tide. Initial stage, representing the starting WSEL for Louis Mills Branch, was specified at each node.

The starting WSELs applied in the XP-SWMM model for Pipe Makers Canal was 2.66 feet NAVD.

The starting WSELs applied in the XP-SWMM model for Placentia Canal was 4.4 feet NAVD.

The starting WSELs applied in the ICPR model for Quacco Canal was 5.13 feet NAVD.

The 1-percent-annual-chance flooding for Placentia Canal, Quacco Canal, Rahn Dairy Canal is controlled by the flooding effects from the Atlantic Ocean for the entire stream reaches. The 1-percent-annual-chance flood elevation from the Atlantic Ocean is 11.1 feet NAVD.

August 5, 2013 Countywide FIS Revision

Two new LOMRs, 10-04-0425P and 10-04-0658P, have been incorporated into the countywide study revising twelve FIRM panels (0014, 0018, 0019, 0038, 0040, 0107, 0115, 0116, 0118, 0126, 0127, and 0135). LOMR 10-04-0425P is a limited detailed study of S&O Canal (and five small tributaries). This area was previously studied as Zone A.

Flood profiles and floodway data tables were not developed for this LOMR. All crosssectionsare included in the database as unlettered cross-sections and base flood elevations have been established. LOMR 10-04-0658P is a new detailed study of Pipe Makers Canal and includes a revised floodway data table, flood profile, cross-sections, base flood elevations and floodplain boundaries for both the 100-year and 500-year elevations. This LOMR replaces 10.5 miles of detailed study stream in the initial countywide analysis.

July 7, 2014 Countywide FIS Revision

Field survey was performed for structures for all streams newly studied or revised for this revised countywide FIS. The field survey was conducted between November 2011 and May 2012 by

Wolverton & Associates, Inc. In addition to structures, channel cross sections were surveyed at a sufficient frequency to ensure that there was no more than approximately 2,000 feet between surveyed sections (including sections at structures) along any of the studied streams.

Water Surface Elevations (WSELs) of floods of the selected recurrence intervals for all streams newly studied or revised for this revised countywide FIS, were developed using the U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC) computer program, HEC-RAS, version 4.1 (HEC 2010).

The downstream starting WSELs for all recurrence interval event profiles in the HEC-RAS models were estimated using the slope-area method (normal depth) with the exception of those streams that tie into detailed studies at the downstream end. These were started with known WSELs based on the downstream detailed study.

For the streams studied by limited detailed methods, for this revised countywide FIS, cross section data was obtained from the topography. The studied streams were modeled using FLO-2D, version 2009.06 Build 0911.08.07.

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 on Table 24, "Floodway Data."

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. 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 13: 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
Belford Tract	Ogeechee River	Scottstell Road	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	
Black Creek	Confluence with Savannah River	Approximately 11,540 feet upstream of Augusta Road/State Highway 30/21	HEC-HMS version 2.1.2	HEC-RAS version 3.0.1	2007 (redelineated 2015)	AE	Incorporated by PBS&J
Black Creek Tributary No. 2	Confluence with Black Creek	Approximately 2,980 feet upstream of Saussy Road	HEC-HMS version 2.1.2	HEC-RAS version 3.0.1	2007 (redelineated 2015)	AE	Incorporated by PBS&J
Chatham Unnamed Tributary No. 7	At East Main Street	Approximately 220 feet upstream of South Pine Street	FLO-2D version 2009.06 Build 09-11.08.07	FLO-2D version 2009.06 Build 09-11.08.07	2012	A	
Chippewa Canal	Confluence with Harmon Canal	Approximately 1,060 feet upstream of Mall Boulevard	HEC-HMS version 1.0	HEC-RAS version 3.1.1	2007	AE	Study by USACE
Chippewa Canal	Approximately 1,050 feet upstream of Mall Boulevard	Just downstream of Eisenhower Drive	LOMR	LOMR	2012	AE	
Coffee Bluff Basin	Confluence with Vernon River	Approximately 1,080 feet upstream of Bordeaux Lane	XP-SWMM	XP-SWMM	1996 (redelineated 2007)	AE	Study by Hussey, Gay, Bell, & DeYoung, Inc. 1996
Colonial Oaks Canal	From 420 feet downstream of Coffee Bluff Road	Briarcliff Circle	XP-SWMM	XP-SWMM	2007	AE	Study by EMC

Table 13: 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
Colonial Oaks Canal Tributary No. 1	Confluence with Colonial Oaks Canal	Approximately 660 feet upstream of Rockingham Road	XP-SWMM	XP-SWMM	2007	AE	Study by EMC
Colonial Oaks Canal Tributary No. 1.1	Confluence with Colonial Oaks Canal Tributary No. 1	Approximately 310 feet upstream of Stillwood Drive	XP-SWMM	XP-SWMM	2007	AE	Study by EMC
Culvert Swamp	Just downstream of South Ridge Boulevard	Just downstream of Pooler Parkway	LOMR	LOMR	2013	AE	
Evergreen Cemetery Tributary	Mitchell Street	Approximately 1,600 feet upstream of Mitchell Street	N/A	N/A	precounty (redelineated 2007)	AE	Study by USACE
Fell Street Basin	Approximately 2,050 feet upstream of confluence with Savannah River	Approximately 500 feet upstream of Tuten Avenue	N/A	N/A	precounty (redelineated 2007)	AE	Study by EMC
Hardin Canal	Approximately 0.45 miles downstream of Railroad	Railroad	USGS regional regression	HEC-RAS version 4.1	2012	AE	
Hardin Canal	U.S. Highway 17/Atlantic Coastal Highway/Ogeechee Road	Approximately 1,180 feet upstream of Osteen Road	USGS regional regression	ICPR	2007 (redelineated in 2012 FOR 2014 FIS)	AE	Interconnected Channel and Pond Routing (ICPR) dynamic computer software. Thomas & Hutton, using ATLM Data from 2000 (Thomas & Hutton 2000)

Table 13: 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
Harmon Canal	Confluence with Vernon River	Approximately 600 feet upstream of West Montgomery Cross Road/State Highway 204	HEC-HMS version 1.0	HEC-RAS version 3.1.1	2007	AE	Study by USACE
Kingsway Canal	Harry Truman Parkway	Approximately 1,180 feet upstream of Kings Way	USGS regional regression	ICPR	2007	AE	Interconnected Channel and Pond Routing (ICPR) dynamic computer software. Thomas & Hutton 2004
Kroger Canal	Confluence with Chippewa Canal	Approximately 1,170 feet upstream	LOMR	LOMR	2012	AE	
Little Ogeechee River	Approximately 1,400 feet downstream of Osteen Road	Chatham/Effingham County Boundary	USGS regional regression	HEC-RAS version 4.1	2012	AE	
Little Ogeechee River	Just upstream of Interstate Highway 16	Approximately 1,400 feet downstream of Osteen Road	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	The flow regime is subcritical The flow is steady and the flow through and around structures is unobstructed.
Little Ogeechee River	State Highway 204	Just upstream of Interstate Highway 16	USGS regression equations	HEC-2 step-backwater	1979, 1984 (redelineated 2012)	AE	
Little Ogeechee River Tributary	Little Neck Road	Approximately 3,120 feet upstream of Middle Landing Road	USGS rural regression equations	HEC-GeoRAS	2007 (redelineated 2015)	AE	Study by Kimly-Horn
Louis Mills Branch	Confluence with South Springfield Canal	Approximately 1,980 feet upstream of Marshall Avenue	USGS regional regression	ICPR	2007	AE	Interconnected Channel and Pond Routing (ICPR) dynamic computer software. Thomas & Hutton 1998

Table 13: 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
Ogeechee River	Pintail Drive	Chatham/Bryan County Boundary	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	The flow regime is subcritical The flow is steady and the flow through and around structures is unobstructed.
Pipe Makers Canal	Confluence with Atlantic Ocean	State Highway 307 (Dean Forrest Road)	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	
Pipe Makers Canal	State Highway 307 (Dean Forrest Road)	Approximately 2.02 miles downstream of U.S. Highway 80/State Highway 17/26	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	
Pipe Makers Canal	Approximately 2.02 miles downstream of U.S. Highway 80/State Highway 17/26	U.S. Highway 80/State Highway 17/26	USGS regional regression	HEC-RAS version 4.1	2007	AE	
Pipe Makers Canal Tributary No. 2	Confluence with Pipe Makers Canal	Upstream of Conaway Road	USGS regression equations	HEC-2 step-backwater	1979 (redelineated in 2012)	AE	
Pipe Makers Canal Tributary No. 2	Upstream of Conaway Road	Approximately 50 feet upstream of Main Street to Georgia Central Railroad	USGS regional regression	HEC-RAS version 4.1	2012	AE	
Pipe Makers Canal Tributary No. 3	Approximately 0.81 miles upstream of Jimmy Deloach Parkway	Approximately 1.47 miles upstream of Jimmy Deloach Parkway	USGS regional regression	HEC-RAS version 4.1	2012	AE	

Table 13: 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
Pipe Makers Canal Tributary No. 3	Just downstream of Tahoe Drive	Approximately 0.81 miles upstream of Jimmy Deloach Parkway	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	The flow regime is subcritical The flow is steady and the flow through and around structures is unobstructed.
Placentia Canal	Confluence with Wilmington River	Bona Bella Avenue	USGS regional regression	XP-SWMM	2007	AE	Study by Hussey, Gay, Bell, & DeYoung, Inc. 1996
Quacco Canal	Atlantic Coastal Highway/State Highway 25/U.S. Highway 17	Quacco Road	USGS regional regression	ICPR	2007	AE	Study by Thomas & Hutton 2005
Rahn Dairy Canal	Confluence with Salt Creek	Buckhalter Avenue	USGS regional regression	ICPR	2007	AE	Study by Thomas & Hutton 2004
Salt Creek Tributary	Interstate Highway 16	Old Louisville Road	statistical analysis of storm rainfall, runoff, and tide characteristics	HEC-2 step-backwater	1979	AE	
Springfield Canal	Louisville Road	Approximately 2,700 feet upstream of Derenne Avenue/Highway 516	regional flood-frequency	USACE	precounty (redelineated 2007)	AE	Study by Thomas & Hutton
Springfield Canal Tributary A	Confluence with Springfield Canal	Ogeechee Road/State Highway 25/U.S. Highway 17	regional flood-frequency	USACE	precounty (redelineated 2007)	AE	Study by Thomas & Hutton
St. Augustine Creek - Walthour Swamp	Confluence with Atlantic Ocean	Approximately 4.5 miles upstream of Interstate Highway 95	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	The flow regime is subcritical The flow is steady and the flow through and around structures is unobstructed.

Table 13: 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
St. Augustine Creek Tributary	Approximately 0.86 miles downstream of Jimmy Deloach Parkway	Approximately 230 feet downstream of Tahoe Drive	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	The flow regime is subcritical The flow is steady and the flow through and around structures is unobstructed.
St. Augustine Creek Tributary No. 1	Confluence with St. Augustine Creek - Walthour Swamp	Just upstream of Airways Avenue	HEC-RAS version 4.1	HEC-RAS version 4.1	2012	AE	The flow regime is subcritical The flow is steady and the flow through and around structures is unobstructed.
Tributary to Little Ogeechee River Tributary	Confluence with Little Ogeechee River Tributary	Approximately 3,300 feet upstream of Middle Landing Road	USGS rural regression equations	HEC-GeoRAS	2007 (redelineat ed 2015)	AE	Study by Kimly-Horn
Wilshire Canal	Confluence with Wilshire Canal Tributary A	Just upstream of Wilshire Boulevard	statistical analysis of storm rainfall, runoff, and tide characteristics	stream characteristics	precounty (redelineat ed 2007)	AE	Study by Thomas & Hutton
Wilshire Canal Tributary A	Confluence with Wilshire Canal	Approxijmately 1.43 miles upstream	ASSUME SAME AS WILSHIRE CANAL?	ASSUME SAME AS WILSHIRE CANAL?	2007	AE	Study by Thomas & Hutton
Wilshire Canal Tributary A-1	Confluence with Wilshire Canal Tributary A	Approxijmately 0.40 miles upstream	ASSUME SAME AS WILSHIRE CANAL?	ASSUME SAME AS WILSHIRE CANAL?	2007	AE	Study by Thomas & Hutton
Windsor Forest Canal East	Stillwood Drive	Approximately 710 feet upstream of Deerfield Road	XP-SWMM	XP-SWMM	2007	AE	Study by EMC
Windsor Forest Canal Tributary	Confluence with Windsor Forest Canal West	Approximately 2,980 feet upstream of confluence	XP-SWMM	XP-SWMM	2007	AE	Study by EMC

Table 13: 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
Windsor Forest Canal Tributary No. 2	Confluence with Windsor Forest Canal East	Approximately 390 feet upstream of Winwood Place	XP-SWMM	XP-SWMM	2007	AE	Study by EMC
Windsor Forest Canal Tributary No. 3	Confluence with Windsor Forest Canal East	Approximately 410 feet upstream of Windsor Road	XP-SWMM	XP-SWMM	2007	AE	Study by EMC
Windsor Forest Canal West	Science Drive	Approximately 3,410 feet upstream of Roger Warlick Drive	XP-SWMM	XP-SWMM	2007	AE	Study by EMC

Table 14: Roughness Coefficients

Flooding Source	Channel “n”	Overbank “n”
Black Creek	0.060-0.100	0.100
Black Creek Tributary No. 2	0.040	0.100
Casey Canal	*	*
Chippewa Canal	0.033-0.050	0.030-0.110
Coffee Bluff Basin	0.015-0.025	0.200-0.300
Colonial Oaks Canal	0.025-0.150	0.020-0.030
Colonial Oaks Canal Tributary No. 1	0.025-0.150	0.020-0.030
Colonial Oaks Canal Tributary No. 1.1	0.025-0.150	0.200-0.300
Hardin Canal	0.040-0.050	0.100-0.150
Harmon Canal	0.033 to 0.05	0.030-0.110
Kingsway Canal	0.030-0.040	*
Little Ogeechee River	0.025-0.070	0.025-0.100
Little Ogeechee River Tributary	0.040-0.040	0.030-0.100
Louis Mills Branch	0.035-0.070	0.080-0.120
Ogeechee River	*	*
Pipe Makers Canal	0.070-0.300	0.150-0.250
Pipe Makers Canal Tributary No. 2	0.030	0.040-0.085
Pipe Makers Canal Tributary No. 3	0.050-0.070	0.025-0.100
Placentia Canal	*	*
Quacco Canal	0.030-0.040	0.050-0.120
Rahn Dairy Canal	0.030	0.040-0.050
Salt Creek Tributary	*	*
Savannah RIver	*	*
Springfield Canal	*	*
Springfield Canal Tributary A	*	*
St. Augustine Creek	0.050-0.070	0.025-0.100
St. Augustine Creek Tributary	0.070	0.025-0.100
Tributary to Little Ogeechee River Tributary	0.040-0.040	0.030-0.100
Wilshire Canal	*	*

Table 14: Roughness Coefficients - continued

Flooding Source	Channel "n"	Overbank "n"
Wilshire Canal Tributary A	*	*
Wilshire Canal Tributary A-	*	*
Windsor Forest Canal East	0.025-0.150	0.020-0.030
Windsor Forest Canal Tributary	0.025-0.150	0.020-0.030
Windsor Forest Canal Tributary No. 2	0.025-0.150	0.200-0.300
Windsor Forest Canal Tributary No. 3	0.025-0.150	0.020-0.030
Windsor Forest Canal West	0.025-0.150	0.020-0.030

5.3 Coastal Analyses

For the areas of Chatham 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 15 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 15: 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 Chatham County	Entire coastline of Chatham County	Storm Climatology Statistical Analyses	JPM-OS	11/1/2013
Atlantic Ocean	Entire coastline of Chatham County	Entire coastline of Chatham County	Storm Surge including Regional Wave Setup	ADCIRC + SWAN	10/7/2013
Atlantic Ocean	Entire coastline of Chatham County	Entire coastline of Chatham County	Stillwater Frequency Analysis	SURGESTAT (low frequency); Regional Tidal Frequency Analysis (high frequency)	11/21/2013

Table 15: 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 Chatham County	Entire coastline of Chatham County	Dune Erosion	FEMA's Erosion Assessment	04/10/2014
Atlantic Ocean	Entire coastline of Chatham County	Entire coastline of Chatham County	Overland Wave Propagation	WHAFIS	04/10/2014
Atlantic Ocean	Entire coastline of Chatham County	Entire coastline of Chatham County	Wave Runup	RUNUP2.0	04/10/2014

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1% annual chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 15. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 17, "Coastal Transect Parameters." Figure 8 shows the total stillwater elevations for the 1% annual chance flood that was determined for this coastal analysis.

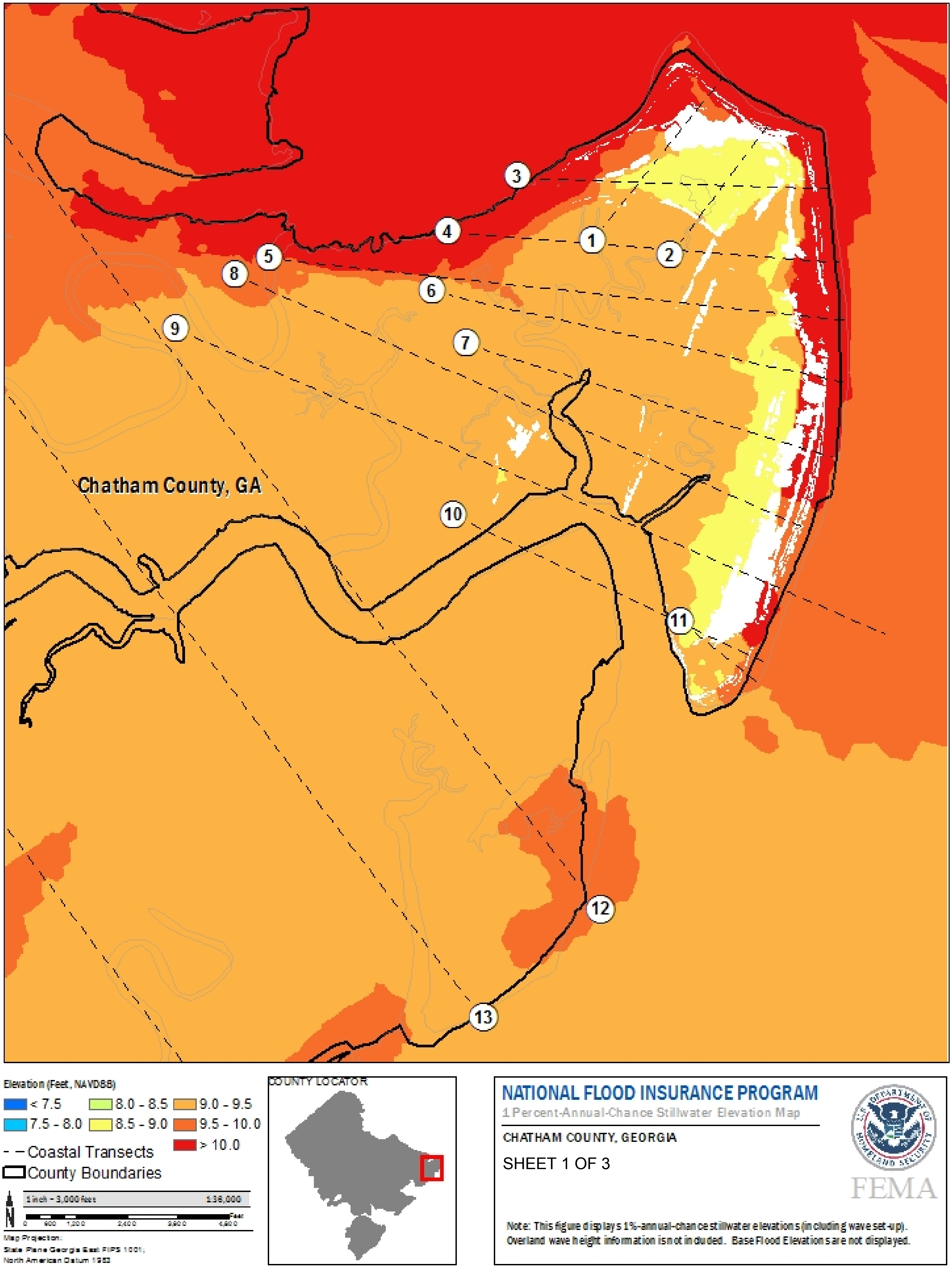


Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas

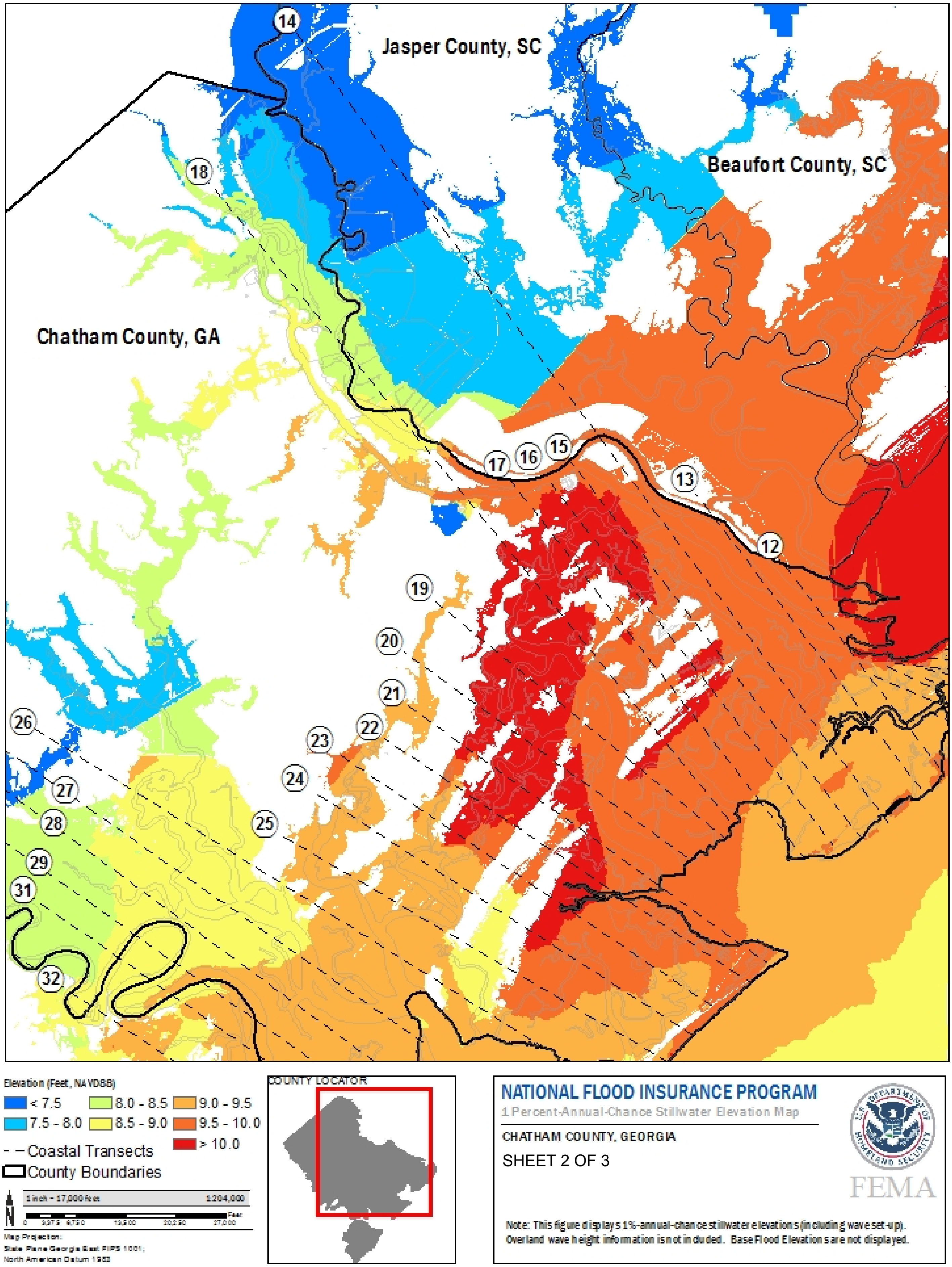


Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas

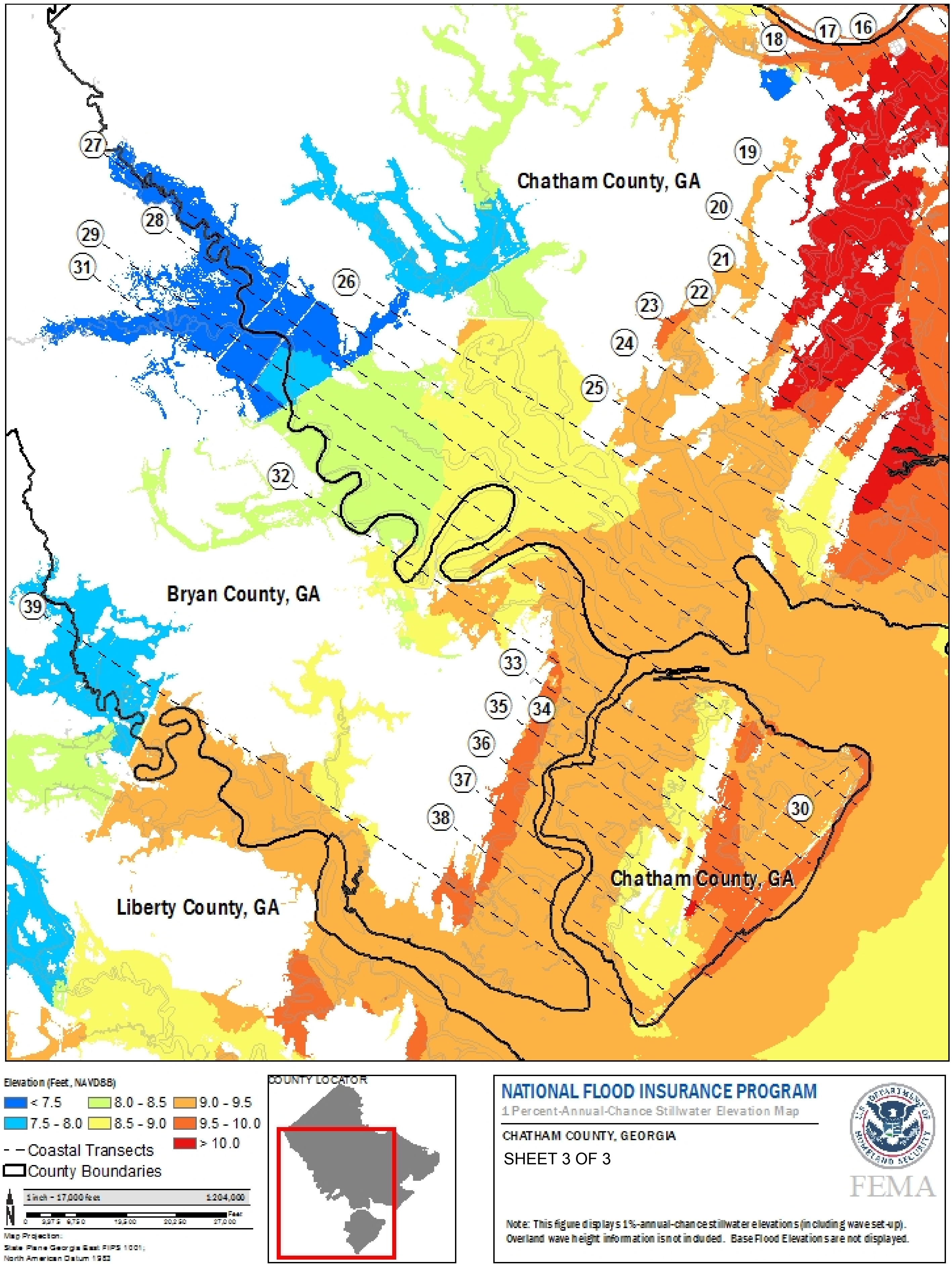


Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas

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 with hydrodynamic models to determine storm surge levels.

Statistical analyses were performed to determine the annual chance flood elevations for the GANEFL 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 representative 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.

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, which added six years of additional data to the analysis. In addition, the regionalization of the tide gages from the previous study was re-evaluated and revised using the additional data and observations of revised statistical parameters.

Table 16: 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
Fort Pulaski - 8670870	NOAA	Tide	1935	Present	L-moments, GEV

Table 16: Tide Gage Analysis Specifics - continued

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

Combined Riverine and Tidal Effects

A combined probability analysis is 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 are 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 is a greater than 1-percent-annual-chance of this flood level being equaled or exceeded. In Chatham County, combined probability calculations were performed for Chippewa Canal, Hardin Canal, Harmon Canal, Kingsway Canal, Pipemakers Canal, and Rahn Diary Canal.

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the total stillwater elevations.

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 5.4.3.

5.3.3 Coastal Erosion

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

5.3.4 Wave Hazard Analyses

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

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

Wave Height Analysis

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

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 15, "Summary of Coastal Analyses".

Wave Runup Analysis

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

Table 17: 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	0.2% Annual Chance
Atlantic Ocean	1	10.44	9.59	6.7 5.3 - 6.8	7.2 5.7 - 7.3	8.9 7.0 - 9.0	10.2 8.9 - 10.4	13.2 12.5 - 13.3
Atlantic Ocean	2	10.69	9.70	6.7 4.7 - 6.7	7.2 5.0 - 7.2	8.9 6.0 - 8.1	10.2 8.7 - 10.2	13.2 12.2 - 13.3
Atlantic Ocean	3	18.14	12.50	6.6 4.7 - 6.8	7.1 5.0 - 7.3	8.8 6.2 - 9.0	10.1 8.7 - 10.4	13.3 12.4 - 13.5
Atlantic Ocean	4	18.23	12.45	6.7 5.5 - 6.8	7.2 5.9 - 7.5	8.9 7.3 - 9.2	10.2 9.0 - 10.6	13.2 12.2 - 13.7
Atlantic Ocean	5	18.36	12.22	6.7 5.7 - 6.9	7.2 6.1 - 7.4	8.9 7.6 - 9.2	10.2 9.0 - 10.8	13.2 12.1 - 13.8
Atlantic Ocean	6	18.21	11.70	6.6 5.7 - 6.7	7.1 6.1 - 7.3	8.7 7.6 - 9.0	10.1 9.0 - 10.5	13.1 12.0 - 13.5
Atlantic Ocean	7	18.10	11.56	6.6 5.9 - 6.7	7.0 6.3 - 7.2	8.7 7.5 - 8.9	9.9 8.9 - 10.3	13.1 11.8 - 13.5
Atlantic Ocean	8	17.14	12.63	6.6 5.9 - 6.6	7.1 6.1 - 7.11	8.6 7.6 - 8.8	10.0 8.9 - 10.0	12.9 11.8 - 13.0
Atlantic Ocean	9	16.95	12.62	6.4 5.3 - 6.6	6.9 5.7 - 7.11	8.4 7.0 - 8.8	9.7 8.9 - 10.0	12.6 11.8 - 13.0
Atlantic Ocean	10	16.88	12.45	6.4 6.1 - 6.5	6.9 6.2 - 6.9	8.5 7.5 - 8.6	9.7 8.9 - 9.8	12.6 11.9 - 12.7

Table 17: Coastal Transect Parameters - continued

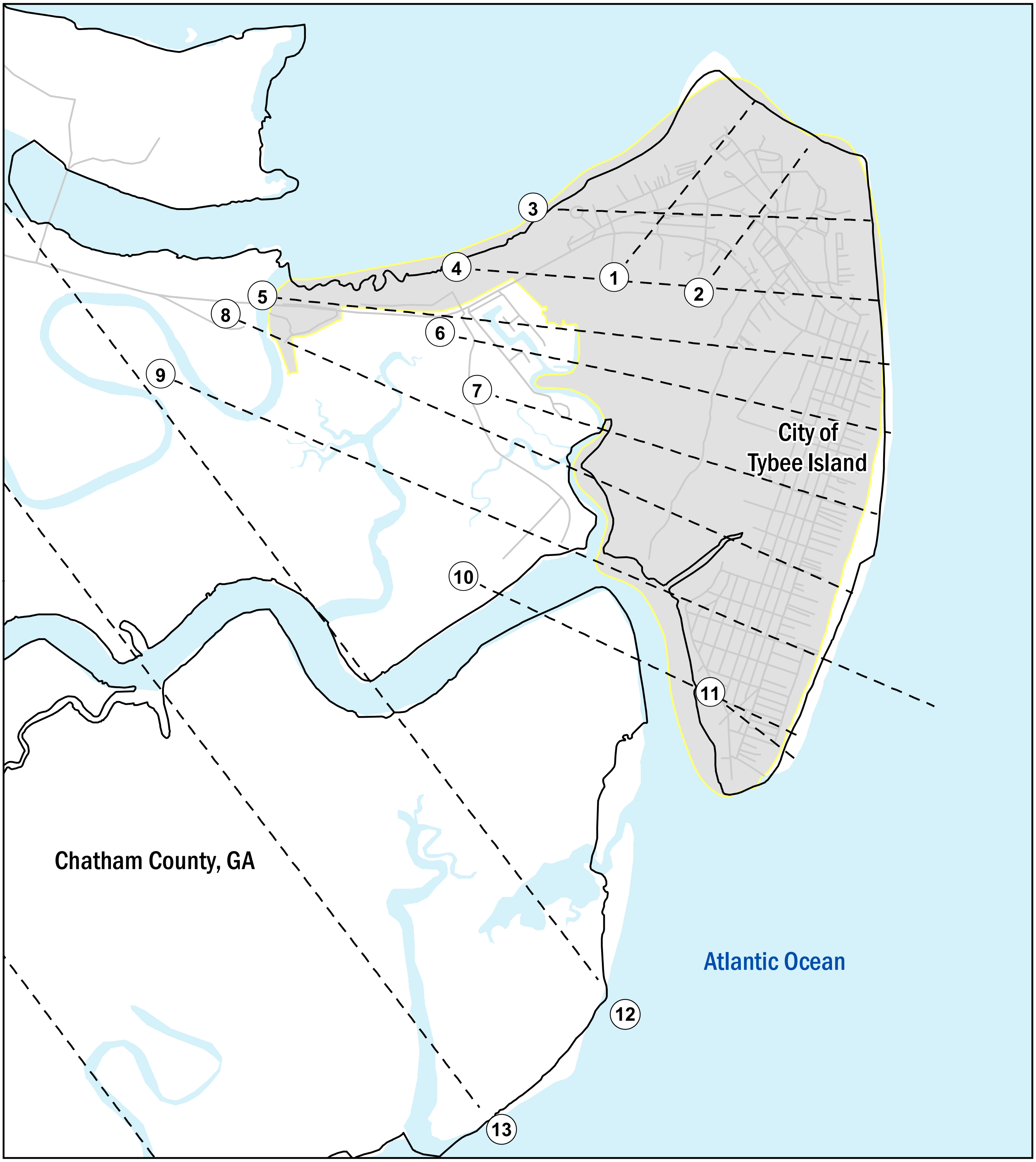
Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Atlantic Ocean	11	17.61	11.62	6.3 6.3 - 6.5	6.8 6.8 - 6.9	8.4 7.1 - 8.6	9.6 9.0 - 10.0	12.4 11.9 - 12.8
Atlantic Ocean	12	17.60	12.02	6.4 6.0 - 6.7	6.9 6.1 - 7.2	8.5 7.5 - 8.9	9.7 9.1 - 10.1	12.6 12.1 - 13.1
Atlantic Ocean	13	17.66	11.50	6.2 6.1 - 6.6	6.7 6.5 - 7.0	8.3 8.0 - 8.8	9.5 9.3 - 10.0	12.3 12.3 - 13.5
Atlantic Ocean	14	17.59	10.80	6.2 6.1 - 6.6	6.7 6.5 - 7.0	8.3 7.8 - 8.7	9.5 9.3 - 10.0	12.4 12.4 - 14.2
Atlantic Ocean	15	17.63	11.17	6.2 5.9 - 6.6	6.7 6.4 - 7.1	8.3 7.9 - 8.8	9.4 9.4 - 10.2	12.4 12.4 - 14.2
Atlantic Ocean	16	17.40	11.00	6.3 6.1 - 6.7	6.8 6.5 - 7.2	8.3 7.7 - 8.9	9.5 9.3 - 10.3	12.6 12.6 - 14.5
Atlantic Ocean	17	17.22	11.36	6.2 5.9 - 6.7	6.6 6.3 - 7.2	8.2 7.8 - 8.9	9.3 9.3 - 10.4	12.6 12.6 - 15.0
Atlantic Ocean	18	17.05	11.07	6.3 5.4 - 6.8	6.8 5.7 - 7.3	8.4 7.1 - 9.0	9.6 8.3 - 10.5	13.3 10.4 - 15.4
Atlantic Ocean	19	17.38	11.00	6.3 6.3 - 6.9	6.8 6.8 - 7.4	8.4 8.4 - 9.1	9.6 9.6 - 10.6	13.3 13.3 - 15.4
Atlantic Ocean	20	17.26	11.20	6.4 6.4 - 6.9	6.9 6.9 - 7.4	8.5 8.4 - 9.2	9.8 9.5 - 10.7	13.5 13.5 - 15.2

Table 17: 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	0.2% Annual Chance
Atlantic Ocean	21	17.05	11.03	6.2 6.1 - 6.8	6.7 6.5 - 7.3	8.3 7.9 - 9.0	9.5 9.4 - 10.4	12.8 12.8 - 14.8
Atlantic Ocean	22	17.10	10.91	6.2 5.9 - 6.7	6.7 6.3 - 7.2	8.2 7.7 - 8.9	9.5 9.4 - 10.3	12.8 12.7 - 14.6
Atlantic Ocean	23	17.11	11.53	6.2 5.9 - 6.8	6.6 6.3 - 7.3	8.2 7.5 - 9.0	9.4 9.1 - 10.3	12.8 12.5 - 14.7
Atlantic Ocean	24	16.96	11.04	6.2 5.7 - 6.6	6.6 6.0 - 7.0	8.2 7.4 - 8.7	9.4 8.9 - 10.2	12.9 12.4 - 14.8
Atlantic Ocean	25	16.69	10.97	6.2 5.7 - 6.5	6.6 6.1 - 6.5	8.2 6.9 - 8.6	9.4 8.8 - 10.0	12.9 12.4 - 14.6
Atlantic Ocean	26	17.76	11.15	6.0 5.6 - 6.2	6.5 4.9 - 6.6	8.0 6.1 - 8.2	9.2 7.5 - 9.5	13.1 11.0 - 14.0
Atlantic Ocean	27	17.86	10.96	6.0 3.5 - 6.0	6.5 3.7 - 6.5	8.0 4.6 - 8.0	9.1 6.3 - 9.2	13.2 8.8 - 13.4
Atlantic Ocean	28	17.28	11.95	6.1 4.1 - 6.1	6.5 4.4 - 6.5	8.1 5.5 - 8.1	9.2 6.7 - 9.2	13.2 8.9 - 13.6
Atlantic Ocean	29	17.45	11.55	6.1 4.1 - 6.1	6.5 4.4 - 6.5	8.1 5.0 - 8.1	9.2 6.5 - 9.3	13.5 8.8 - 13.7
Atlantic Ocean	30	8.99	7.05	6.1 5.9 - 6.4	6.5 6.3 - 6.9	8.1 7.4 - 8.6	9.3 9.2 - 9.9	12.9 12.8 - 13.3

Table 17: 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	0.2% Annual Chance
Atlantic Ocean	31	17.47	11.43	6.2 3.6 - 6.5	6.7 3.9 - 6.9	8.3 4.8 - 8.6	9.5 6.5 - 9.9	13.7 8.8 - 14.1
Atlantic Ocean	32	17.06	11.45	6.3 4.8 - 6.4	6.8 5.2 - 6.9	8.4 6.4 - 8.5	9.7 8.2 - 9.8	14.0 12.6 - 14.6
Atlantic Ocean	33	16.78	12.25	6.2 5.7 - 6.4	6.7 6.1 - 6.9	8.3 7.3 - 8.5	9.6 8.8 - 9.8	14.0 12.8 - 15.0
Atlantic Ocean	34	16.52	11.44	6.2 5.4 - 6.5	6.6 5.8 - 6.9	8.2 7.2 - 8.6	9.5 8.9 - 9.9	13.9 12.6 - 15.0
Atlantic Ocean	35	16.94	11.58	6.2 5.9 - 6.4	6.6 6.2 - 6.9	8.2 7.3 - 8.5	9.5 8.8 - 9.9	14.0 12.5 - 15.1
Atlantic Ocean	36	17.55	11.75	6.2 5.8 - 6.5	6.6 6.2 - 6.9	8.2 7.4 -8.6	9.4 8.8 -10.1	13.8 13.0 -15.2
Atlantic Ocean	37	17.57	11.37	6.1 5.6 - 6.3	6.5 6.0 - 6.8	8.1 7.1 - 8.4	9.3 8.7 - 9.7	13.6 13.1 - 15.2
Atlantic Ocean	38	17.79	11.62	6.2 5.8 - 6.2	6.6 6.2 - 6.7	8.2 7.7 - 8.3	9.4 8.9 - 9.7	13.8 12.9 - 15.2
Atlantic Ocean	39	17.63	11.40	5.9 4.7 - 6.2	6.4 5.0 - 6.7	7.9 6.2 - 8.3	9.1 7.8 - 9.7	13.1 10.7 - 15.2



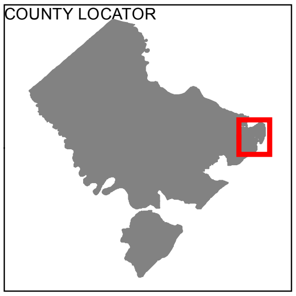
Elevation (Feet, NAVD88)

1 inch = 3,000 feet 1:36,000

0 600 1,200 2,400 3,600 4,800 Feet

Map Projection:
State Plane Georgia East FIPS 1001;
North American Datum 1983

COUNTY LOCATOR



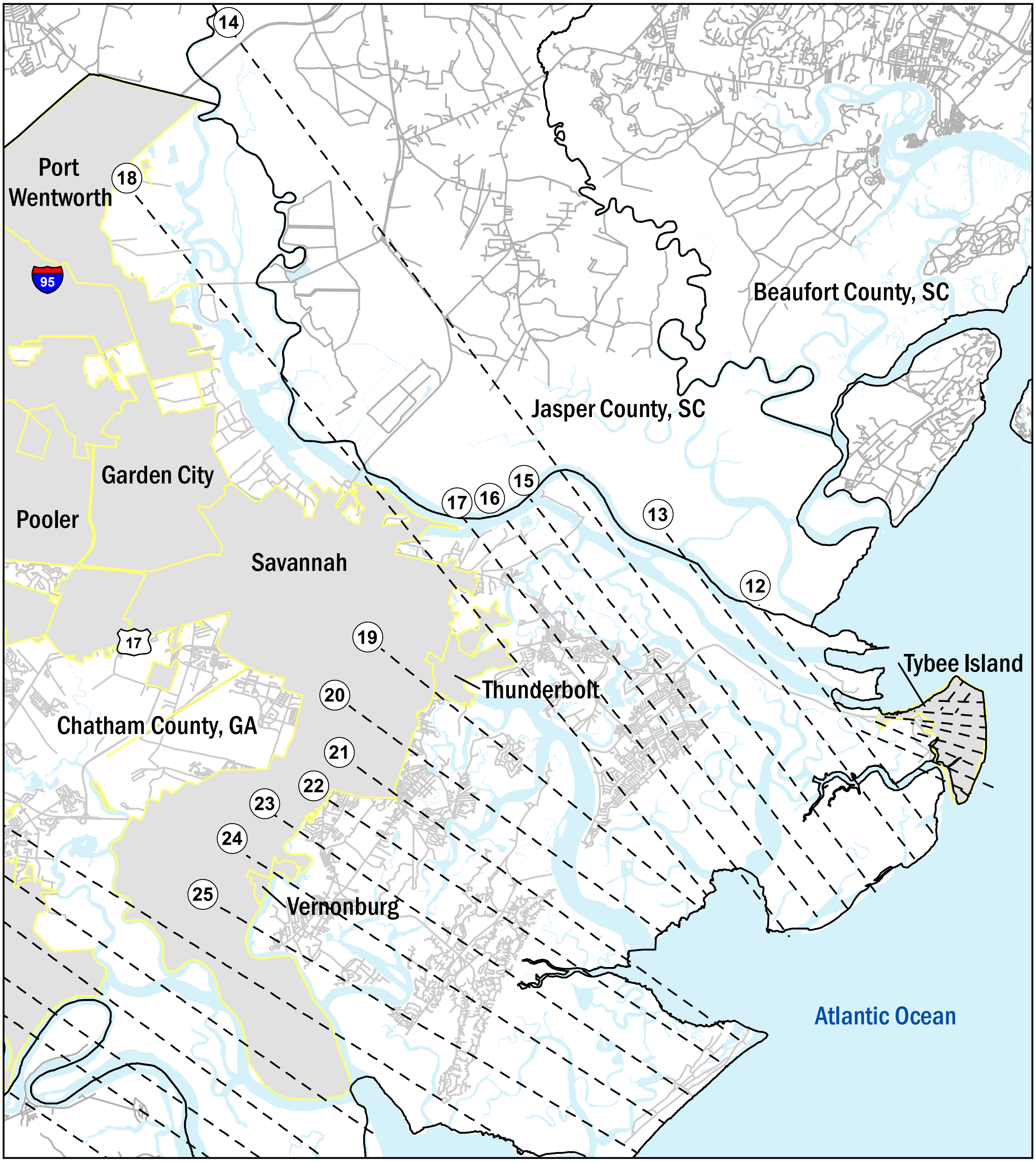
NATIONAL FLOOD INSURANCE PROGRAM
Transect Location Map

CHATHAM COUNTY, GEORGIA

SHEET 1 OF 3

FEMA

Figure 9: Transect Location Map



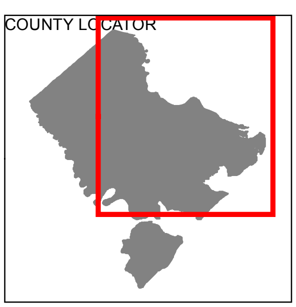
Elevation (Feet, NAVD88)

1 inch = 17,000 feet 1:204,000

N

0 3,375 6,750 13,500 20,250 27,000 Feet

Map Projection:
State Plane Georgia East FIPS 1001;
North American Datum 1983

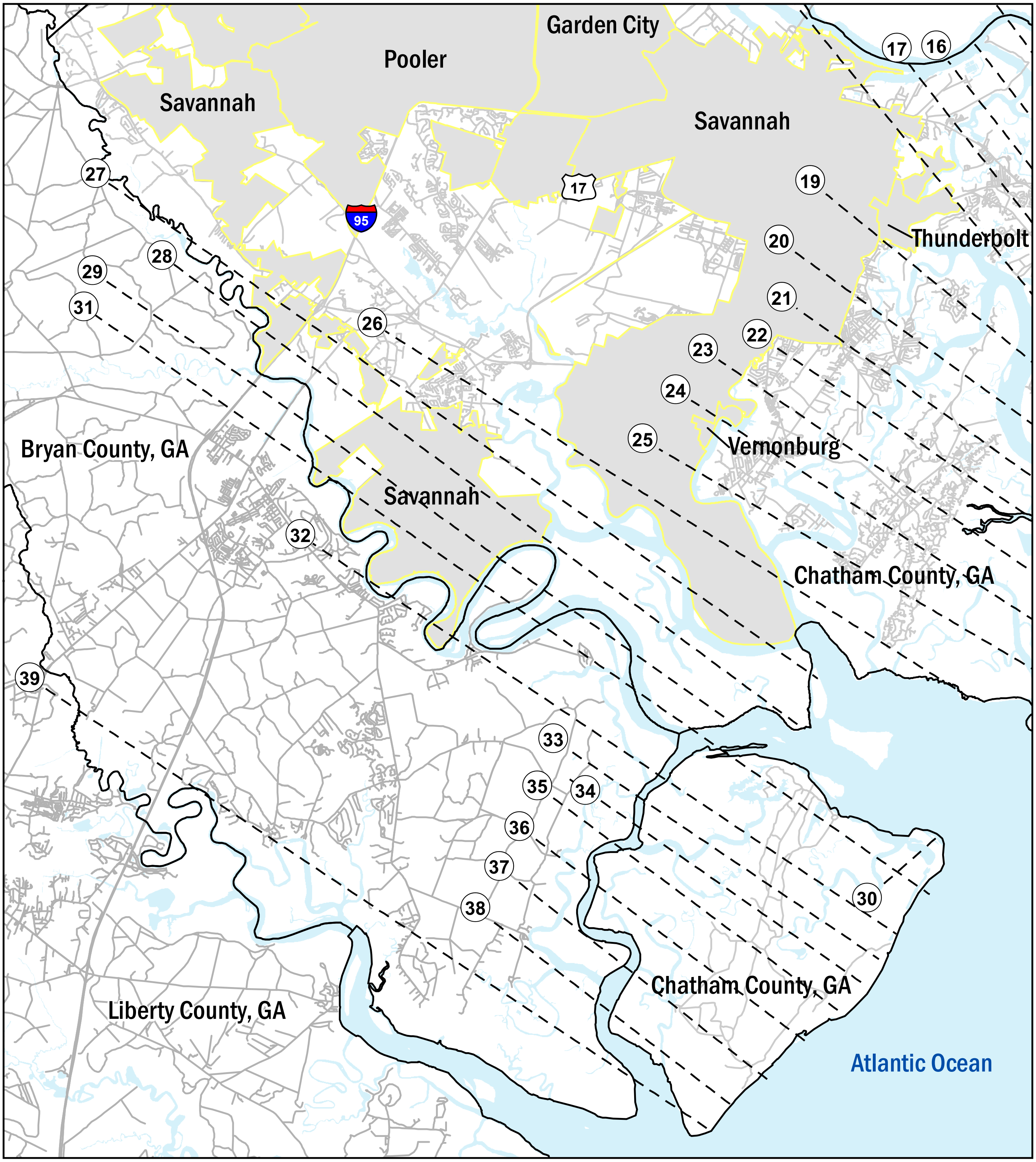


NATIONAL FLOOD INSURANCE PROGRAM
Transect Location Map

CHATHAM COUNTY, GEORGIA
SHEET 2 OF 3

FEMA

Figure 9: Transect Location Map



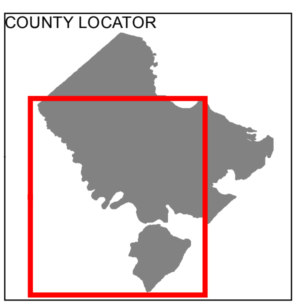
Elevation (Feet, NAVD88)

1 inch = 17,000 feet 1:204,000

N

0 3,375 6,750 13,500 20,250 27,000 Feet

Map Projection:
State Plane Georgia East FIPS 1001;
North American Datum 1983



NATIONAL FLOOD INSURANCE PROGRAM

Transect Location Map

CHATHAM COUNTY, GEORGIA

SHEET 3 OF 3

FEMA

Figure 9: Transect Location Map

5.4 Alluvial Fan Analyses

This section is not applicable to this Flood Risk Project.

Table 18: Summary of Alluvial Fan Analyses

[Not Applicable to this Flood Risk Project]

Table 19: Results of Alluvial Fan Analyses

[Not Applicable to this Flood Risk Project]

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey (NGS) at the following address:

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

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please contact information services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for Chatham County are provided in Table 20.

Table 20: Countywide Vertical Datum Conversion

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Meldrim	SW	32.13	-81.37	-0.086
Meldrim	NE	32.25	-81.25	-0.915
Meldrim	SE	32.12	-81.25	-0.902
Port Wentworth	NE	32.25	-81.20	-0.922
Port Wentworth	SE	32.13	-81.13	-0.928
Limehouse	SE	32.13	-81.00	-0.919
Meldrim SE	SE	32.00	-81.25	-0.892
Garden City	SE	32.00	-81.13	-0.919
Savannah	SE	32.00	-81.00	-0.932
Fort Pulaski	SE	32.00	-80.88	-0.932
Tybee Island North	SE	32.00	-80.75	-0.958
Richmond Hill	SE	31.87	-81.25	-0.928
Burroughs	SE	31.87	-81.13	-0.928
Average Conversion from NGVD29 to NAVD88 = -0.927 feet				

Table 21: Stream-Based Vertical Datum Conversion

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Flood Risk Analysis and Mapping*, www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping.

Base map information shown on the FIRM was derived from the sources described in Table 22.

Table 22: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
Digital Orthophoto	USDA NAIP	2015	1 meter	Digital Orthophotography
Political Boundaries	Georgia Department of Transportation	2007	1:100,000	Municipal and county boundaries
Transportation Features	Georgia Department of Transportation	2011	1:100,000	Roads
Hydrography	Georgia Department of Transportation	1996	1:100,000	Water Bodies
Stream Centerlines	GA DNR	February 2008 or later	1:10,000	Developed using 2-foot contours and aerial photographs

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 23, and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 23.

In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 24, “Floodway Data.”

Certain flooding sources may have been studied that do not have published BFEs on the FIRMs, or for which there is a need to report the 1% annual chance flood elevations at selected cross sections because a published Flood Profile does not exist in this FIS Report. These streams may have also been studied using methods to determine non-encroachment zones rather than floodways. For these flooding sources, the 1% annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. All topographic data used for modeling or mapping has been converted as necessary to NAVD88. The 1% annual chance elevations for selected cross sections along these flooding sources, along with their non-encroachment widths, if calculated, are shown in Table 25, “Flood Hazard and Non-Encroachment Data for Selected Streams.”

Table 23: Summary of Topographic Elevation Data used in Mapping

		Source for Topographic Elevation Data					
Community	Flooding Source	Description	Scale	Contour Interval	$RMSE_z$	$Accuracy_z$	Citation
Chatham County, Unincorporated Areas; Port Wentworth, City of; Savannah, City of; Thunderbolt, Town of' Tybee Island, City of; Vernonburg, Town of	Atlantic Ocean	LiDAR	N/A	N/A	9 cm	17.64 cm	LMSI 2006
Chatham County, Unincorporated Areas; Savannah, City of	Belford Tract	LiDAR	N/A	N/A	N/A	N/A	MPC 2009
Chatham County, Unincorporated Areas; Port Wentworth, City of	Black Creek	LiDAR	N/A	N/A	N/A	N/A	MPC 2009
Port Wentworth, City of	Black Creek Tributary No. 2	LiDAR	N/A	N/A	N/A	N/A	MPC 2009
Bloomingdale, City of	Chatham Unnamed Tributary No. 7	LiDAR	N/A	N/A	N/A	N/A	MPC 2009
Savannah, City of	Chippewa Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Chippewa Canal	LiDAR	N/A	N/A	N/A	N/A	MPC 2009
N/A	Coffee Bluff Basin	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001

Table 23: Summary of Topographic Elevation Data used in Mapping - continued

		Source for Topographic Elevation Data					
Community	Flooding Source	Description	Scale	Contour Interval	$RMSE_z$	$Accuracy_z$	Citation
Savannah, City of	Colonial Oaks Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Colonial Oaks Canal Tributary No. 1	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Colonial Oaks Canal Tributary No. 1.1	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Chatham County, Unincorporated Areas; Pooler, City of	Culvert Swamp	LiDAR	N/A	N/A	N/A	N/A	MPC 2009
N/A	Evergreen Cemetery Tributary	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
N/A	Fell Street Basin	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Bloomingdale, City of	Hardin Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Chatham County, Unincorporated Areas; Bloomingdale, City of; Pooler, City of; Savannah, City of;	Hardin Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Harmon Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Chatham County, Unincorporated Areas	Kingsway Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Kroger Canal	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
Chatham County, Unincorporated Areas; Bloomingdale, City of	Little Ogeechee River	LiDAR	N/A	N/A	N/A	N/A	MPC 2009

Table 23: Summary of Topographic Elevation Data used in Mapping - continued

Community	Flooding Source	Source for Topographic Elevation Data					
		Description	Scale	Contour Interval	$RMSE_z$	$Accuracy_z$	Citation
Chatham County, Unincorporated Areas; Bloomingdale, City of	Little Ogeechee River	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
Chatham County, Unincorporated Areas; Bloomingdale, City of; Pooler, City of; Savannah, City of	Little Ogeechee River	Toptographic Survey	1":500'	1 foot	N/A	N/A	Hussey, Gay, Bell, & DeYoung 2000
Chatham County, Unincorporated Areas; Savannah, City of	Little Ogeechee River Tributary	Contours	N/A	2 foot	N/A	N/A	City of Savannah
Chatham County, Unincorporated Areas; Savannah, City of	Louis Mills Branch	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Chatham County, Unincorporated Areas	Ogeechee River	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
Chatham County, Unincorporated Areas; Garden City, City of	Pipe Makers Canal	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
Pooler, City of; Savannah, City of	Pipe Makers Canal	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
Bloomingdale, City of	Pipe Makers Canal	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
Bloomingdale, City of; Pooler, City of	Pipe Makers Canal Tributary No. 2	Toptographic Survey	1":500'	1 foot	N/A	N/A	Hussey, Gay, Bell, & DeYoung 2000
Bloomingdale, City of; Pooler, City of	Pipe Makers Canal Tributary No. 2	LiDAR	N/A	N/A	N/A	N/A	MPC 2009
Bloomingdale, City of; Pooler, City of	Pipe Makers Canal Tributary No. 3	LiDAR	N/A	N/A	N/A	N/A	MPC 2009

Table 23: Summary of Topographic Elevation Data used in Mapping - continued

		Source for Topographic Elevation Data					
Community	Flooding Source	Description	Scale	Contour Interval	$RMSE_z$	$Accuracy_z$	Citation
N/A	Pipe Makers Canal Tributary No. 3	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
N/A	Placentia Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Chatham County, Unincorporated Areas	Quacco Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Chatham County, Unincorporated Areas	Rahn Dairy Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Garden City, City of; Pooler, City of	Salt Creek Tributary	Toptographic Survey	1":500'	1 foot	N/A	N/A	Hussey, Gay, Bell, & DeYoung 2000
Savannah, City of	Springfield Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Springfield Canal Tributary A	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Chatham County, Unincorporated Areas; Port Wentworth, City of; Savannah, City of	St. Augustine Creek - Walthour Swamp	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
Pooler, City of; Savannah, City of	St. Augustine Creek Tributary	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
N/A	St. Augustine Creek Tributary No. 1	LiDAR	N/A	N/A	N/A	N/A	Sanborn 2009
Chatham County, Unincorporated Areas; Savannah, City of	Tributary to Little Ogeechee River Tributary	Contours	N/A	2 foot	N/A	N/A	City of Savannah
Savannah, City of	Wilshire Canal	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001

Table 23: Summary of Topographic Elevation Data used in Mapping - continued

Community	Flooding Source	Source for Topographic Elevation Data					
		Description	Scale	Contour Interval	$RMSE_z$	$Accuracy_z$	Citation
Savannah, City of	Wilshire Canal Tributary A	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Wilshire Canal Tributary A-1	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Windsor Forest Canal East	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Windsor Forest Canal Tributary	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Windsor Forest Canal Tributary No. 2	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Windsor Forest Canal Tributary No. 3	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001
Savannah, City of	Windsor Forest Canal West	LiDAR	N/A	1 foot	N/A	N/A	Thomas & Hutton 2001

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface 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.

FLOODING SOURCE			FLOODWAY[1]			BASE FLOOD WATER SURFACE ELEVATION			
NODES	LINKS	DISTANCE[1]	WIDTH[2] (FEET)	PEAK FLOW (CFS)	VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
PIPE MAKERS CANAL									
A		14,475				11.0	11.0	11.5	0.5
	A-B		914	1,646	0.2				
B		15,078				11.0	11.0	11.6	0.6
C		20,351				11.1	11.1	11.7	0.6
	C-D		1,113	1,870	0.5				
D		21,044				11.1	11.1	11.8	0.7
E		24,944				11.9	11.9	12.6	0.7
	E-F		1,200	2,079	1.2				
F		25,853				11.9	11.9	12.7	0.8
G		29,452				12.5	12.5	13.2	0.7
	G-H		939	2,596	1.0				
H		30,036				12.7	12.7	13.3	0.6
I		34,584				16.0	16.0	16.3	0.3
	I-J		1,613	2,575	1.4				
J		35,877				16.0	16.0	16.3	0.3
K		42,029				17.3	17.3	18.0	0.7
	K-L		727	1,640	1.4				
L		43,026				17.4	17.4	18.1	0.7
M		50,048				19.0	18.9	19.8	0.8
	M-N		1128	1,418	1.5				
N		51,050				19.1	19.1	19.8	0.9
O		62,085				19.8	19.7	20.6	0.9
	O-P		722	394	0.5				
P		63,073				19.8	19.8	20.6	0.8
Q		64,568				19.9	19.9	20.6	0.7
	Q-R		595	340	0.4				
R		65,270				20.0	19.9	20.7	0.8

[1] Feet above confluence with Savannah River
[2] Values represent width at upstream node

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS

FLOODWAY DATA

PIPE MAKERS CANAL

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
PIPE MAKERS CANAL TRIBUTARY NO. 2								
A	1,870	130	385	1.4	19.4	18.8[2]	19.8	1.0
B	2,778	150	465	1.2	19.4	19.2[2]	20.2	1.0
C	5,368	240	649	0.9	19.5	19.5	20.5	1.0
D	6,597	285	798	0.7	19.7	19.7	20.7	1.0
E	7,962	195	478	1.2	19.9	19.9	20.8	0.9
F	8,554	195	443	0.8	20.0	20.0	21.0	1.0
G	9,481	165	428	0.8	21.1	21.1	21.7	0.6
H	10,055	676	1,613	0.2	21.2	21.2	21.8	0.6

[1]Feet above confluence with Pipe Makers Canal
[2]Elevation computed without consideration of backwater effects from Pipe Makers Canal

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

FLOODWAY DATA

PIPE MAKERS CANAL TRIBUTARY NO. 2

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams

[Not Applicable to this Flood Risk Project]

6.4 Coastal Flood Hazard Mapping

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

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

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

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

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

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

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

- The *high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv^2) is greater than or equal to 200 ft^3/sec^2. This zone may only be used on the Pacific Coast.

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

Table 26 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 26: Summary of Coastal Transect Mapping Considerations

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)		
1	✓	N/A	VE 12-16 AE 9-11	PFD	SWEL
2	✓	N/A	VE 12-16 AE 9-10	PFD	SWEL
3	✓	N/A	VE 12-16 AE 9-11	PFD	SWEL
4	✓	N/A	VE 12-16 AE 9-11	PFD	SWEL
5	✓	N/A	VE 12-16 AE 9-12	PFD	SWEL
6	✓	N/A	VE 12-16 AE 9-11	PFD	SWEL
7	✓	N/A	VE 12-15 AE 9-11	PFD	SWEL
8	✓	N/A	VE 12-15 AE 9-11	PFD	SWEL
9	✓	N/A	VE 12-15 AE 9-11	PFD	Wave Height
10	✓	N/A	VE 12-15 AE 9-11	PFD	SWEL
11	✓	N/A	VE 12-15 AE 9-11	PFD	SWEL
12	□	N/A	VE 12-15 AE 10-11	Wave Height	Wave Height
13	✓	N/A	VE 11-14 AE 11	Wave Height	Wave Height
14	□	N/A	VE 12-15 AE 9-12	Wave Height	Wave Height
15	✓	N/A	VE 12-15 AE 9-12	Wave Height	SWEL
16	✓	N/A	VE 12-15 AE 10-12	Wave Height	SWEL

Table 26: Summary of Coastal Transect Mapping Considerations - continued

		Wave Runup Analysis	Wave Height Analysis		
Coastal Transect	Primary Frontal Dune (PFD) Identified	Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)	Zone VE Limit	SFHA Boundary
17	✓	N/A	VE 12-15 AE 10-12	Wave Height	SWEL
18	✓	N/A	VE 13-15 AE 9-12	Wave Height	SWEL
19	✓	N/A	VE 12-15 AE 10-12	Wave Height	SWEL
20	□	N/A	VE 12-15 AE 10-12	Wave Height	SWEL
21	✓	N/A	VE 11-15 AE 10-12	PFD	SWEL
22	✓	N/A	VE 12-15 AE 10-12	PFD	SWEL
23	✓	N/A	VE 12-15 AE 9-12	PFD	SWEL
24	✓	N/A	VE 12-15 AE 9-12	PFD	Wave Height
25	✓	N/A	VE 11-15 AE 9-11	PFD	SWEL
26	□	N/A	VE 11-15 AE 8-11	Wave Height	SWEL
27	□	N/A	VE 11-15 AE 6-11	Wave Height	SWEL
28		N/A	VE 11-14 AE 7-11	Wave Height	SWEL
29	□	N/A	VE 11-14 AE 8-11	Wave Height	SWEL
30	✓	N/A	VE 11-14 AE 9-11	PFD	Wave Height
31	✓	N/A	VE 11-15 AE 9-11	PFD	SWEL
32	✓	N/A	VE 11-15 AE 9-11	PFD	SWEL
33	✓	N/A	VE 11-15 AE 9-11	Wave Height	Wave Height

Table 26: Summary of Coastal Transect Mapping Considerations - continued

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)		
34	✓	N/A	VE 11-15 AE 9-11	Wave Height	Wave Height
35	✓	N/A	VE 11-15 AE 9-11	Wave Height	Wave Height
36	✓	N/A	VE 11-15 AE 9-11	PFD	Wave Height
37	□	N/A	VE 11-14 AE 9-11	Wave Height	Wave Height
38	□	N/A	VE 11-14 AE 10-11	Wave Height	Wave Height
39	✓	N/A	VE 11-14 AE 9-10	PFD	Wave Height

A LiMWA boundary has also been added in coastal areas subject to wave action for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave.