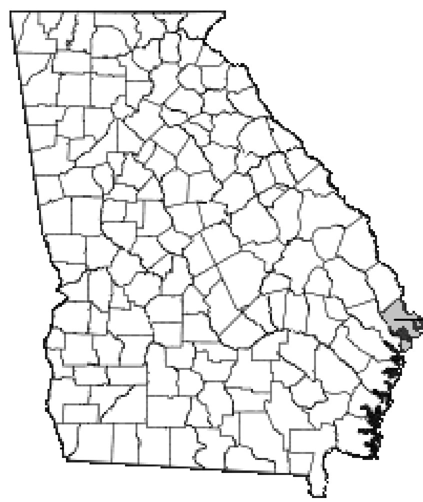
FLOOD INSURANCE STUDY

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

Revised: July 7, 2014

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
13051CV000C

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise part or all of this Flood Insurance Study (FIS) at any time. In addition, the Federal Emergency Management Agency may revise part of this Flood Insurance Study by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current Flood Insurance Study components.

This FIS report was revised on July 7, 2014. Users should refer to Section 10.0, Revisions Description, for further information. Section 10.0 is intended to present the most up-to-date information for specific portions of this FIS report. Therefore, users of this report should be aware that the information presented in Section 10.0 supersedes information in Sections 1.0 through 9.0 of this FIS report.

Initial Countywide FIS Effective Date: September 26, 2008

First Revised Countywide FIS Date: August 5, 2013

Second Revised Countywide FIS Date: July 7, 2014

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

FIGURES

TABLES

EXHIBITS

TABLE OF CONTENTS (Continued)

Exhibit 1 – Flood Profiles (continued)

FLOOD INSURANCE STUDY

CHATHAM COUNTY, GEORGIA, AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Chatham County, including the Cities of Bloomingdale, Garden City, Pooler, Port Wentworth, Savannah, and Tybee Island; the Towns of Thunderbolt and Vernonburg; and the unincorporated areas of Chatham County (referred to collectively herein as Chatham County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

The Digital Flood Insurance Rate Map (DFIRM) and FIS report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and geographic information standards and is provided in a digital format so that it can be incorporated into a local Geographic Information System (GIS) and be accessed more easily by the community.

1.2 Authority and Acknowledgments

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

Precountywide Analyses

The initial countywide FIS was prepared to include incorporated communities within Chatham County into a countywide FIS. Information on the authority and acknowledgments for each jurisdiction compiled from previous FIS reports is shown in the following paragraphs.

Bloomingdale, City of :	For the initial January 2, 1981, FIS report and the July 2, 1981 Flood Insurance Rate Map (FIRM) (FIA, 1981a), the hydrologic and hydraulic analyses were prepared by Post, Buckley, Schuh & Jernigan, Inc. (PBS&J), for the Federal Insurance Administration (FIA), under Contract No. 11-4778. The work was completed in July 1979.
Chatham County (Unincorporated Areas)	For the May 19, 1987, FIS report (FEMA, 1987a), the hydrologic and hydraulic analyses for the coastal flooding from the Atlantic Ocean were performed by PBS&J for FEMA, under Contract No. EMW-C-0947. The work was completed in February 1984. All remaining flooding information was taken from the previous Type 10 (FIA, 1971) and Type 15 (FEMA, 1983) FIS reports.
Garden City, City of:	For the May 19, 1987, FIS report (FEMA,1987b), the hydrologic and hydraulic analyses were obtained from the FIS report for Chatham County, Georgia (Unincorporated Areas) (FEMA, 1987a).
Pooler, City of:	For the March 30, 1981, FIS report (FIA, 1981b), the hydrologic and hydraulic analyses were performed by PBS&J, for the FIA, under Contract No. 11-4778. The work was completed in August 1979.
Port Wentworth, City of:	For the May 19, 1987 FIS report (FEMA, 1987c), the hydrologic and hydraulic analyses were obtained from the Type 19 (FEMA, 1987a) and Type 15 (FEMA, 1983) FIS reports for Chatham County, Georgia (Unincorporated Areas).
Savannah, City of:	For the September 4, 1987 (FEMA, 1987d) FIS report, the hydrologic and hydraulic analyses for the storm surge were obtained from the Type 19 (FEMA, 1987a) FIS report for Chatham County, Georgia (Unincorporated Areas). The riverine hydrologic and hydraulic analyses were obtained from the previous Type 19 FIS report for the City of Savannah, Chatham County, Georgia and Flood Plain Information Reports for Pipe Makers Canal, Dundee Canal and Salt Creek, Casey Canal-North, Casey Canal-South, Springfield Canal, Harmon Canal, and Wilshire Canal and Tributaries (USACE, 1968a; USACE, 1968b; USACE, 1972; USACE, 1969; USACE, 1974; USACE, 1970; USACE, 1971).
Thunderbolt, Town of:	The hydrologic and hydraulic analyses for the July 2, 1987, FIS report (FEMA, 1987e), were obtained from the Type 19 FIS report for Chatham County, Georgia

	(Unincorporated Areas) (FEMA, 1987a).
Tybee Island, City of:	The hydrologic and hydraulic analyses for the June 17, 1986, FIS report (FEMA, 1986), were obtained from the FIS report for Chatham County, Georgia (Unincorporated Areas) (FEMA, 1987a).
Vernonburg, Town of:	The hydrologic and hydraulic analyses for the July 2, 1987, FIS report (FEMA, 1987f), were obtained from the FIS report for Chatham County, Georgia (Unincorporated Areas) (FEMA, 1987a).

Initial Countywide FIS Report

For the initial countywide FIS report, PBS&J was contracted by Chatham County to complete the *Mapping Services to Update Flood Hazard Maps in Chatham County*, Contract No. QBS-06-8-4. Under this contract, PBS&J upgraded previously completed engineering reports for inclusion into the FEMA DFIRM and FIS for Chatham County. The previously completed engineering reports contained detailed hydrology and hydraulic modeling for various flooding sources within Chatham County that were submitted to and approved by Chatham County. The flooding sources and previously completed engineering reports upgraded by PBS&J under this contract are presented in the following table:

Flooding Source	Engineering Report	Engineering Company	Date of Study
Hardin Canal	Hardin Canal Re-Analysis Using ATLM Data	Thomas & Hutton Engineering Company	January 7, 2000
Kingsway Canal	Kingsway Canal Design Study Report	Thomas & Hutton Engineering Company	July 2004
Louis Mills Branch	Louis Mills Branch/Redgate Canal Engineering Analysis	Thomas & Hutton Engineering Company	March 27, 1998
Pipe Makers Canal	Pipe Makers Canal Drainage Study, Supplemental Report	EMC Engineering	April 1999
Placentia Canal	Placentia Canal Concept Design Shell Road to Tide Gate	Hussey, Gay, Bell, & DeYoung, Inc.	May 1996
Quacco Canal	Quacco/Regency Park Drainage Improvements Alternatives Report	Thomas & Hutton Engineering Company	November 2005
Rahn Dairy Canal	Redgate/Rahn Dairy Canal Design Study Report	Thomas & Hutton Engineering Company	July 2004

The hydrologic and hydraulic analyses for Black Creek and Black Creek Tributary No. 2 were reviewed and incorporated by PBS&J, for the Georgia Department of

Natural Resources (DNR), under Contract No. EMA-2005-CA5211, with FEMA. The work was completed in July 2007.

The flooding sources incorporated by PBS&J under Contract No. DR912 with the City of Savannah are listed in the following table:

Flooding Source	Study Contractor
Casey Canal	EMC Engineering
Chippewa Canal	USACE
Coffee Bluff Basin	Hussey, Gay, Bell, & DeYoung, Inc.
Colonial Oaks Canal	EMC Engineering
Colonial Oaks Canal Tributary No. 1	EMC Engineering
Colonial Oaks Canal Tributary No. 1.1	EMC Engineering
Evergreen Cemetery Tributary	USACE
Fell Street Basin	EMC Engineering
Harmon Canal	USACE
Little Ogeechee River Tributary	Kimley - Horn
Springfield Canal	Thomas & Hutton Engineering Company and PBS&J
Springfield Canal Tributary A	Thomas & Hutton Engineering Company
Tributary to Little Ogeechee River Tributary	Kimley - Horn
Wilshire Canal	Thomas & Hutton Engineering Company
Wilshire Canal Tributary A	Thomas & Hutton Engineering Company
Wilshire Canal Tributary A-1	Thomas & Hutton Engineering Company
Windsor Forest Canal East	EMC Engineering
Windsor Forest Canal Tributary	EMC Engineering
Windsor Forest Canal Tributary No. 2	EMC Engineering
Windsor Forest Canal Tributary No. 3	EMC Engineering
Windsor Forest Canal West	EMC Engineering

Base map information shown on the Flood Insurance Rate Map (FIRM) was provided for Chatham County and captured at a resolution of 1 foot per pixel. The projection used in the preparation of this map is Georgia State Plane East (FIPS zone 1001). The horizontal datum is North American Datum 1983.

First Countywide FIS Revision

For this revision, the FIS report and FIRMs incorporated Letter of Map Revisions (LOMRs) 10-04-0658P and 10-04-0425P and were prepared by BakerAECOM, LLC for FEMA, under Contract No. HSFEHQ-09-D-0368. LOMR 10-04-0658P was completed July 7, 2010. LOMR 10-04-0425P was completed July 2010. The following streams were included in these analyses: Pipe Makers Canal, S&O Canal, Tributary A1, Tributary A2, Tributary B, Tributary C and Tributary D.

1.3 Coordination

An initial Consultation Coordination Officer (CCO) meeting (also occasionally referred to as the Scoping meeting) is held with representatives of the communities, FEMA, and the study contractors to explain the nature and purpose of the FIS and to identify the streams to be studied by detailed methods. A final CCO (often referred to as the Preliminary DFIRM Community Coordination, or PDCC, meeting) is held with representatives of the communities, FEMA, and the study contractors to review the results of the study.

Precountywide Analyses

The initial and final meeting dates for previous FIS reports for Chatham County and its communities within the boundaries of Chatham County are shown in Table 1, "Historical CCO Meeting Dates."

Table 1: Historical CCO Meeting Dates

Community Name	FIS Date	Initial CCO Date	Final CCO Date
Bloomingdale, City of	January 2, 1981 May 7, 2001	May 1978 July 1, 1999*	August 27, 1980**
Chatham County and Incorporated Areas	September 26, 2008	September 29, 2004	November 27, 2007
Chatham County (Unincorporated Areas)	May 19, 1987	June 22, 1982	November 21, 1985
Garden City, City of	May 19, 1987	**	November 19, 1985
Pooler, City of	March 30, 1981	May 1978	August 27, 1980
Port Wentworth, City of	May 19, 1987	**	November 19, 1985
Savannah, City of	September 4, 1987	**	November 21, 1985

Table 1: Historical CCO Meeting Dates (Continued)

Thunderbolt, Town of	July 2, 1987	**	November 19, 1985
Tybee Island, City of	June 17, 1986	**	November 20, 1985
Vernonburg, Town of	July 2, 1987	**	November 22, 1985

*Notified by letter
**Data not available

Initial Countywide FIS

For the September 68, 2008, initial countywide FIS, the initial meeting was held on September 29, 2004, and attended by representatives of FEMA, the Georgia DNR, PBS&J, and the communities. The final meeting was held on November 7, 2007, and attended by representatives of FEMA, the Georgia DNR, PBS&J, and all the communities except for the Town of Vernonburg. All problems raised at the meeting were addressed.

First Countywide FIS Revision

For this revision of the countywide FIS, the final CCO meeting was held on April 17, 2012 to review and accept the results of this FIS. Those who attended this meeting included representatives of Georgia Department of Natural Resources, AECOM, Atkins, CDM Smith, FEMA, and the communities. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Chatham County, Georgia, including the incorporated communities listed in Section 1.1. The scope and methods of this study were proposed to, and agreed upon, by FEMA and the communities. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

Precountywide Analyses

The following streams were studied by detailed methods for FIS reports developed before the countywide FIS:

Atlantic Ocean	Pipe Makers Canal Tributary No. 2
Black Creek	Salt Creek Tributary

Black Creek Tributary No. 2	Savannah River
Casey Canal	Springfield Canal
Chippewa Canal	Springfield Canal Tributary A
Colonial Oaks Canal	St. Augustine Creek
Colonial Oaks Canal Tributary No. 1	St. Augustine Creek Tributary
Colonial Oaks Canal Tributary No. 1.1	Tributary to Little Ogeechee River Tributary
Hardin Canal	Wilshire Canal
Harmon Canal	Wilshire Canal Tributary A
Kingsway Canal	Wilshire Canal Tributary A-1
Little Ogeechee River	Windsor Forest Canal East
Little Ogeechee River Tributary	Windsor Forest Canal Tributary
Louis Mills Branch	Windsor Forest Canal Tributary No. 2
Ogeechee River	Windsor Forest Canal Tributary No. 3
Pipe Makers Canal	Windsor Forest Canal West

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

For the May 19, 1987, FIS report for Chatham County, Georgia (Unincorporated Areas), the areas studied by detailed methods were selected based on the extent and validity of available existing hydrologic and hydraulic data. A detailed coastal flooding analysis of the Atlantic Ocean was performed on the complete coastline of Chatham County.

Initial Countywide FIS

For the initial countywide FIS, the areas studied by detailed methods were selected based on the extent and validity of available existing hydrologic and hydraulic data.

The following streams were studied by detailed methods as part of the countywide analyses:

Stream	Reach Limits
Black Creek	From its confluence with Savannah River to approximately 11,540 feet upstream of Augusta Road / State Highway 30 / 21
Black Creek Tributary No. 2	From its confluence with Black Creek to approximately 2,980 feet upstream of Saussy Road
Chippewa Canal	From its confluence with Harmon Canal to approximately 1,060 feet upstream of Mall Boulevard

Stream	Reach Limits
Colonial Oaks Canal	From 420 feet downstream of Coffee Bluff Road to Briarcliff Circle
Colonial Oaks Canal Tributary No. 1	From its confluence with Colonial Oaks Canal to approximately 660 feet upstream of Rockingham Road
Colonial Oaks Canal Tributary No. 1.1	From its confluence with Colonial Oaks Canal Tributary No. 1 to approximately 310 feet upstream of Stillwood Drive
Hardin Canal	From U.S. Highway 17 / Atlantic Coastal Highway / Ogeechee Road to approximately 1,180 feet upstream of Osteen Road
Harmon Canal	From the confluence with Vernon River to approximately 600 feet upstream of West Montgomery Cross Road / State Highway 204
Kingsway Canal	From its confluence with Vernon River to approximately 1,180 feet upstream of Kings Way
Little Ogeechee River Tributary	From Little Neck Road to approximately 3,120 feet upstream of Middle Landing Road
Louis Mills Branch	From its confluence with South Springfield Canal to approximately 1,980 feet upstream of Marshall Avenue
Pipe Makers Canal	From its confluence with Savannah River to U.S. Highway 80 / State Highway 17 / 26
Placentia Canal*	From its confluence with Wilmington River to Bona Bella Avenue
Quacco Canal*	From the Atlantic Coastal Highway / State Highway 25 / U.S. Highway 17 to Quacco Road
Rahn Dairy Canal*	From its confluence with Salt Creek to Buckhalter Avenue
Tributary to Little Ogeechee River Tributary	From its confluence with Little Ogeechee River Tributary to approximately 3,300 feet upstream of Middle Landing Road
Windsor Forest Canal East	From its confluence with Windsor Forest Canal West to approximately 710 feet upstream of Deerfield Road
Windsor Forest Canal Tributary	From its confluence with Windsor Forest Canal West to approximately 2,980 feet upstream of the confluence
Windsor Forest Canal Tributary No. 2	From its confluence with Windsor Forest Canal East to approximately 390 feet upstream of Winwood Place

Stream	Reach Limits
Windsor Forest Canal Tributary No. 3	From its confluence with Windsor Forest Canal East and Colonial Oaks Canal to approximately 410 feet upstream of Windsor Road
Windsor Forest Canal West	From Thorny Bush Road to approximately 3,410 feet upstream of Roger Warlick Drive

*Flooding controlled entirely by the Atlantic Ocean

For the initial countywide FIS, reaches of streams that had been studied by detailed methods were selected for redelineation based on more recent topography. Chatham County provided PBS&J with countywide digital GIS topographic data dated August 2001 (Reference 48). The topographic data was provided as a Digital Elevation Model (DEM) in raster grid format and the elevation data in the North American Vertical Datum of 1988 (NAVD). The DEM was created from 1-foot contour data, with a vertical accuracy of 6 inches, generated from a countywide airborne LIDAR survey completed in 1999. The following streams were redelineated as part of the countywide FIS report:

Stream	Reach Limits
Casey Canal	From approximately 2,600 feet downstream of East Montgomery Cross Road to East Victory Drive / U.S. Highway 80 / State Highway 26
Coffee Bluff Basin*	From its confluence with Vernon River to approximately 1,080 feet upstream of Bordeaux Lane
Evergreen Cemetery Basin	From Mitchell Street to approximately 1,600 feet upstream of Mitchell Street
Fell Street Basin	From approximately 2,050 feet upstream of its confluence with Savannah River to approximately 500 feet upstream of Tuten Avenue
Springfield Canal	From Louisville Road to approximately 2,700 feet upstream of Derenne Avenue / Highway 516
Springfield Canal Tributary A	From its confluence with Springfield Canal to Ogeechee Road / State Highway 25 / U.S. Highway 17
Wilshire Canal	From approximately 1,220 feet downstream of White Bluff Road to just upstream of Wilshire Boulevard

*A Stillwater elevation was also developed in the basin model for the Coffee Bluff Ponding Area

For the initial countywide FIS, the FIS report and FIRM were converted to countywide format, and the flooding information for the entire county, including both incorporated and unincorporated areas, is shown. Also, the vertical datum was converted from the National Geodetic Vertical Datum of 1929 (NGVD) to NAVD. In addition, the Transverse Mercator, State Plane coordinates, previously referenced to the North American Datum of 1927, was referenced to the North American Datum of 1983.

Approximate analyses were used to study those areas having low development potential or minimal flood hazards.

First Countywide FIS Revision

This revision to the countywide FIS incorporates the determination of letters issued by FEMA resulting in Letters of Map change as shown in Table 2, "Letters of Map Revision (LOMRs) Incorporated into Current Study."

Table 2: Letters of Map Revision (LOMRs) Incorporated into Current Study

Case Number	Flooding Source(s)	Communities Affected	Effective Date
10-04-0658P	Pipe Makers Canal	Chatham County, City of Bloomingdale, City of Garden City, City of Pooler, City of Savannah	July 30, 2010
10-04-0425P	S&O Canal, Tributary A1, Tributary A2, Tributary B, Tributary C, Tributary D	Chatham County, City of Savannah	August 30, 2010

2.2 Community Description

Chatham County, approximately 438 square miles in area, is located in the southeastern portion of Georgia, bordering the Atlantic Ocean. The county is bordered by Bryan County to the southwest across the Ogeechee River; Liberty County to the south across St. Catherine's Sound; Effingham County to the northwest; Jasper County, South Carolina, to the northeast across the Savannah River; and, the Atlantic Ocean to the southeast. The Atlantic Ocean coastline accounts for approximately 30 miles of the county's border.

The 2010 population of Chatham County was reported to be 265,128 (Reference 64). Savannah, the county seat and the largest city in the county, had a population of 136,286 in 2010. The county is served by several primary highways and by one major airport.

The climate in southeast Georgia is warm and temperate to subtropical. The average temperature in January is 63 degrees Fahrenheit (°F), and is 92°F in July. The average annual precipitation is 49.6 inches, with the maximum average monthly precipitation occurring in August (Reference 69).

The county is situated on a low coastal plain with much of its area consisting of tidal marshes and swamps. Elevations range from sea level at the coast to approximately 50 feet in the northwestern portion of the county.

The Savannah River (northern boundary) and the Ogeechee River (southern boundary) have drainage areas extending far beyond the limits of Chatham County. Other streams have chiefly tidal estuaries within the county and include the Little Ogeechee River, Vernon River, Bear River, Wilmington River, Bull River, and numerous tributaries to these. Main openings to the Atlantic Ocean are Ossabaw Sound and Wassaw Sound, both of which are wide and deep.

Much of the land situated in the floodplain is undeveloped marshland, with some residential, commercial, and industrial development.

2.3 Principal Flood Problems

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 (Reference 2).

Georgia hasn’t been hit by a major hurricane 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 (Reference 23).

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.

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 of 1881 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 around Savannah. 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.

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.

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).

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 (Reference 23).

2.4 Flood Protection Measures

Some inland drainage has been improved. The seawall at Savannah Beech provides some protection from waves and flooding.

Levees exist in the study area that provides the community with some degree of protection against flooding. However, it has been ascertained that some of these levees may not protect the community from rare events such as the 1-percentannual-chance flood. The criteria used to evaluate protection against the 1- percent-annual-chance flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect against the 1-percent-annual-chance flood are not considered in the hydraulic analysis of the 1-percent-annual-chance floodplain.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 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-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, 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 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

First Countywide FIS Revision

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.

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) (Reference 66).

Peak discharge rates for Pipe Makers Canal Tributary No. 2 were calculated using the USGS urban regression equations (Reference 67).

Elevations for the Savannah River were obtained from a map provided by the USACE which showed 1-percent-annual-chance elevations (Reference 63).

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 (Reference 19).

Inundation from the Atlantic Ocean caused by passage of storms (storm surge) was determined by the Environmental Sciences Services Administration's (ESSA) joint probability method (Reference 4). The storm populations were described by probability distributions of 5 parameters that influence surge heights. These parameters were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically based on an analysis of observed storms in the vicinity of Chatham County. The National Oceanic and Atmospheric Administration (NOAA) is the primary source of hurricane data (Reference 38; Reference 42; Reference 37; and Reference 39). A summary of the parameters used for the area is presented in Table 3.

Table 3: Parameter Values for Surge Elevation Computations

	Central Pressure (millibars)	Probability	Forward Velocity of Storm (KTS)	Probability	Radius to maximum winds (nautical miles)	Probability	Direction of Storm (degrees from true North)	Probability	Distance from Shore (nautical miles)	Frequency of storm occurence (nautical mile/year)
Entering Storms	83	0.03	7	0.45	12	0.24			65[1]	0.00107
	67	0.08								
	53	0.11					327	0.51	20[1]	0.0012
	42	0.13	11	0.3	20	0.26				
	33	0.16					301	0.49	25[2]	0.00124
	23	0.29								
	9	0.2	15	0.25	28	0.5			70[2]	0.00131
Parallel Storms	83	0.03	7	0.32	12	0.24			65[1]	0.0039[3] / 0.0042[4]
	67	0.08								
	53	0.11							20[1]	0.0045[3] / 0.0048[4]
	42	0.13	11	0.3	20	0.26	35	1		
									25[2]	0.0051[3] / 0.0054[4]
	33	0.16								
	23	0.29								
	9	0.2	15	0.38	28	0.5			70[2]	0.0058[3] / 0.0061[4]
Exiting Storms	83	0.03	7	0.45	12	0.24			65[1]	0.0026
	67	0.08								
	53	0.11					54	0.75	20[1]	0.0013
	42	0.13			20	0.26				
	33	0.16					94	0.25	25[2]	0.00069
	23	0.29								
	9	0.2	13	0.55	28	0.5			70[2]	0.00056

[1] Nautical miles south of Georgia / South Carolina Boundary
[2] Nautical miles north of Georgia / South Carolina Boundary
[3] 15 Nautical miles offshore
[4] 45 Nautical miles offshore

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 (Reference 71) 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 (Reference 44). 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 (Reference 28), computer software for the existing conditions watershed, segmenting the watershed into 11 sub-watersheds. The HEC-HMS model applied the SCS hydrology methodology (Reference 44) 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 (Reference 66).

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 (Reference 48, 49, 51, 52, and 53). The hydrology for Pipe Makers Canal was adapted from a study prepared by EMC Engineering dated April 1999 (Reference 3). The hydrology for Placentia Canal was adapted from a study prepared by Hussey, Gay, Bell, & DeYoung dated May 1996 (Reference 24). 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 (Reference 44) applying a peak rate factor of 323. The National Weather Service Technical Paper 40 rainfall-depth-duration-frequency relationships (Reference 43) 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 (Reference 66).

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 (Reference 5), 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 (Reference 66) were used to determine peak discharges.

Peak discharge-drainage area relationships for 10-, 2-, 1-, and 0.2-percent-annual-chance floods for each of the flooding sources studied in detail in the county are presented in Table 4.

Table 4: Summary of Discharges

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic feet per second) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
BLACK CREEK					
At confluence with Savannah River	26.55	1,039	1,553	2,084	2,713
Just upstream of Interstate Highway 95 / State Highway 405	22.50	1,056	1,344	1,841	2,329
At confluence of Black Creek Tributary No. 2	20.49	1,059	1,347	1,845	2,333
At Augusta Road / State Highway 30 / 21	19.52	794	1,039	1,287	1,619
At confluence of Black Creek Tributary No. 1	18.54	1,018	1,345	1,799	2,249
At CSX	16.63	802	1,102	1,579	1,928
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	*	*	*	*	*
CHIPPEWA CANAL					
At confluence with Harmon Canal	1.15	1,116	1,463	1,633	2,000
COLONIAL OAKS CANAL					
Outfall at Atlantic Ocean	**	359	448	492	558
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

Table 4: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic feet per second) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
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	18.20	*	*	547	*
At Interstate Highway 16 / State Highway 404	14.40	*	*	1,224	*
At Interstate Highway 95 / State Highway 405	13.10	*	*	1,094	*
At Bloomingdale Road / State Highway 17	1.50	*	*	186	*
At Osteen Road	0.90	*	*	78	*
HARMON CANAL					
At confluence with Vernon River	3.13	2,442	3,213	3,585	4,402
Just downstream of the confluence of Chippewa Canal	2.94	2,415	3,160	3,523	4,321
KINGSWAY CANAL					
At confluence with Vernon River	0.40	*	*	355	*
At Harry Truman Parkway	0.30	*	*	187	*
LITTLE OGEECHEE RIVER					
Just upstream of Interstate Highway 16 / State Highway 404	32.6	1,530	2,530	3,020	4,280
LITTLE OGEECHEE RIVER TRIBUTARY					
At Little Neck Road	7.31	605	995	1,183	1,666
At New Hampstead Parkway	2.86	338	553	657	921

Table 4: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic feet per second) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
LITTLE OGEECHEE RIVER TRIBUTARY (continued)					
At Highgate Boulevard	0.55	122	199	235	327
LOUIS MILLS BRANCH					
At confluence with South Springfield Canal	2.85	*	*	577	*
At Louis Mills Boulevard / Chatham Parkway	0.30	*	*	281	*
OGEECHEE RIVER	*	*	*	*	*
PIPE MAKERS CANAL					
At Augusta Road	44.10	976	1,148	1,314	1,565
At Interstate Highway 95 / State Highway 405	19.70	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
Just downstream of U.S. Highway 80 / State Highway 26	0.65	166	277	336	481
SALT CREEK TRIBUTARY					
At confluence with Salt Creek	7.40	*	*	810	*
At Interstate Highway 16 / State Highway 404	6.40	*	*	720	*
SAVANNAH RIVER	*	*	*	*	*
SPRINGFIELD CANAL	*	*	*	*	*
SPRINGFIELD CANAL TRIBUTARY A	*	*	*	*	*
ST. AUGUSTINE CREEK	*	*	*	*	*
ST. AUGUSTINE CREEK TRIBUTARY	*	*	*	*	*

Table 4: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic feet per second) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
TRIBUTARY TO LITTLE OGEECHEE RIVER TRIBUTARY					
At the confluence with Little Ogeechee River Tributary	0.71	143	232	275	383
At Highgate Boulevard	0.19	62	101	119	165
WILSHIRE CANAL	*	*	*	*	*
WILSHIRE CANAL TRIBUTARY A	*	*	*	*	*
WILSHIRE CANAL TRIBUTARY A-1	*	*	*	*	*
WINDSOR FOREST CANAL EAST					
At confluence with Windsor Forest Canal West	**	436	558	615	718
Just below divergence of Colonial Oaks Canal / confluence of Windsor Forest Canal Tributary No.3	0.05	129	144	157	185
Just above divergence of Colonial Oaks Canal / confluence of Windsor Forest Canal Tributary No. 3	**	39	52	58	66
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

Table 4: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic feet per second) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
WINDSORY FOREST CANAL WEST					
Outfall at Atlantic Ocean	1.40	519	702	777	948

** Data Not Available*

***Flow split; contributing drainage area not determined*

Table 5: Summary of Stillwater Elevations

Flooding Source	Stillwater Elevation (Feet NAVD*) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Coffee Bluff Ponding Area	11.6	13.2	13.8	14.4

*North American Vertical Datum of 1988

3.2 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. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. 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 in conjunction with the data shown on the FIRM.

Users of the FIRM should also be aware that coastal flood elevations are provided in the Transect Data table in this report. If the elevation on the FIRM is higher than the elevation shown in this table, a wave height, wave run-up and/or wave setup component likely exists, in which case, the higher elevation should be used for construction and/or floodplain management purposes.

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.

First 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 cross-sections are 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.

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 (Reference 56).

Elevations for the Savannah River were obtained from a map provided by the USACE which showed 1-percent-annual-chance elevations (Reference 63).

Water surface profiles for St. Augustine Creek, St. Augustine Creek Tributary, Springfield Canal, Springfield Canal Tributary A, were taken from the Type 10 FIS (Reference 19) 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 (Reference 26).

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 step-backwater computer program (Reference 27).

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.

For areas subject to flooding directly from the Atlantic Ocean, the FEMA standard storm surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the 5 storm parameters defined previously). By performing such simulations for a large number of storms, each of known total probability, the frequency distribution of surge height can be established as a function of coastal location. These distributions incorporate the large-scale surge behavior, but do not include an analysis of the added effects associated with much fine scale wave phenomena, such as wave height or runup. As the final step in the calculations, the astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level (Reference 47).

The storm-surge elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods have been determined for Chatham County and are shown in Table 4, Transect Data. The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects and include the contributions from wave action effects.

All dunes and structures were assumed to remain intact for purposes of this analysis. The FEMA storm surge model was utilized to simulate the hydrodynamic behavior of the surge generated by the various synthetic storms. This model utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 8 by 5 nautical miles and 6,000 feet by 6,000 feet, depending on the resolution required.

Underwater depths and land heights for the model grid systems were obtained from NOAA nautical charts, USGS topographic maps, and aerial photogrammetry and field surveys conducted as part of this study (Reference 40-41; Reference 65-67; Reference 70).

Initial Countywide FIS Report

A calibrated XP-SWMM model (Reference 71) 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 (Reference 5) 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 (Reference 5).

The flow hydrographs for Black Creek and Black Creek Tributary No. 2 were imported into HEC-RAS, Version 3.0.1 (Reference 30), 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 (Reference 3). 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 (Reference 48, 49, 51, and 52). 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 (Reference 24).

A calibrated HEC-RAS, Version 3.1.1 (Reference 32), 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 (Reference 31) within ArcMap 9.1 (Reference 5) to import channel and overbank geometries into a HEC-RAS, Version 3.1.3 (Reference 33), 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-annual-chance flooding 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.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

The Manning's "n" values for all detailed studied streams included in the initial countywide analysis are listed Table 6: Summary of Roughness Coefficients table,

Table 6: Manning's "n" Values

Flooding Source	Channel	Overbanks
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	*	*
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
Placentia Canal	*	*
Quacco Canal	0.030-0.040	0.050-0.120

Table 6: Manning's "n" Values (Continued)

Rahn Dairy Canal	0.030	0.040-0.050
Salt Creek Tributary	*	*
Savannah RIver	*	*
Springfield Canal	*	*
Springfield Canal Tributary A	*	*
St. Augustine Creek	*	*
St. Augustine Creek Tributary	*	*
Tributary to Little Ogeechee River Tributary	0.040-0.040	0.030-0.100
Wilshire Canal	*	*
Wilshire Canal Tributary A	*	*
Wilshire Canal Tributary A-1	*	*
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

* Data not available

The profile baselines depicted on the FIRM represent the hydraulic modeling baselines that match the flood profiles on this FIS report. As a result of improved topographic data, the profile baseline, in some cases, may deviate significantly from the channel centerline or appear outside the Special Flood Hazard Area.

3.3 Wave Height Analysis

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding was developed by the National Academy of Sciences (NAS) (Reference 34). This method is based on the following three major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest elevation is 70-percent of the total wave height plus the stillwater elevation. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures described in the NAS report. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to the fetch length and depth.

As described in *Procedures for Applying Marsh Grass Methodology* (FEMA, 1984), a modification to the NAS Methodology (Reference 34) has been developed to analyze in detail the attenuating effect of marsh grass on waves. The rate of wave energy dissipation is dependent on the wave characteristics (e.g. height and period), and the species of marsh grass. Two conditions result from this modification depending on the initial wave height at the beginning of the marsh segment: 1) if the initial wave is relatively small, wave growth will occur but at a significantly lower rate as compared to the NAS methodology, and 2) if the initial wave is sufficiently large, a wave height reduction will occur over the marsh.

Wave heights were computed along transects (cross section lines) that were located along the coastal areas, as illustrated in the Transect Location Map (), in accordance with the *Users Manual for Wave Height Analysis* (Reference 7). These transects are also shown on the FIRM. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

TRANSECT LOCATION MAP

ATLANTIC OCEAN

The transects were continued inland until the wave was dissipated or until flooding from another source with equal or greater elevation was reached. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 1-percent-annual-chance flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. Areas with a wave height component 3-feet or greater were designated as velocity zones (VE). Other areas subject to wave action were designated as AE Zones with Base Flood Elevations (BFEs) adjusted to include wave crest elevations. Table 7 provides a listing of the transect locations and stillwater starting elevations, as well as the initial wave crest elevations.

Table 7: Transect Locations, Stillwater Starting Elevations, and Initial Wave Crest Elevations

Transect	Location	Stillwater (feet NAVD)	Wave Crest (feed NAVD)
1	Across Ossabaw Island approximately 1 mile northeast of the intersection between Bryan, Chatham, and Liberty Counties boundary line	12.1	19.2
2	Across Ossabaw Island approximately 1 mile east of the confluence of Bear River	12.1	19.2
3	Across Ossabaw Island approximately 2 miles east of the confluence of Bear River	12.1	19.2
4	Across Ossabaw Island approximately 1 mile southwest of Pelican Point	12.1	19.2
5	Across Ossabaw Island approximately 1,000 feet southwest of Pelican Point	12.1	19.2
6	Across Ossabaw Island approximately 1 mile northeast of Pelican Point	12.1	19.2
7	Across Ossabaw Island approximately 2 miles northeast of Pelican Point	12.1	19.2
8	Across Ossabaw Island approximately 2 miles southwest of Bradley Point	12.1	19.2
9	Across Ossabaw Island approximately 1,000 feet southwest of Bradley Point	12.1	19.2
10	Across Raccoon Key and continues up to approximately 1 mile south of CSX Railroad	12.1	19.2

Table 7: Transect Locations, Stillwater Starting Elevations, and Initial Wave Crest Elevations (Continued)

11	Across the western side of Wassaw Island, continuing through the western portion of Skidaway Island	12.1	19.2
12	Across Wassaw Island approximately 0.5 mile southeast of the confluence of the Odingsell River, continuing through Skidaway Island	12.1	19.2
13	Across Wassaw Island approximately 1.5 miles southeast of the confluence of the Odingsell River, continuing through Skidaway Island	12.1	19.2
14	Across Wassaw Island approximately 2.5 miles southeast of the confluence of the Odingsell River, continuing through Skidaway Island	12.1	19.2
15	Across Wassaw Island approximately 3 miles south of the confluence of the Wilmington River, continuing through Skidaway Island	12.1	19.2
16	Across the eastern portion of Wassaw Island approximately 3 miles southeast of the confluence of the Wilmington River	12.1	19.2
17	Across Cabbage Island approximately 1 mile east of the confluence of the Wilmington River	12.1	19.2
18	Across the western portion of Petit Chou Island approximately 1 miles southeast of the confluence of the Tybee River	12.1	19.2
19	Across Tybee Island approximately 2 miles southeast of the confluence of the Bull River	12.1	19.2
20	Across Tybee Island approximately 2.3 miles southeast of the confluence of the Bull River	12.1	19.2
21	Across Tybee Island approximately 2 miles southwest of the confluence of Tybee Creek	12.1	19.2
22	Across Tybee Island approximately 0.8 mile southwest of the confluence of Tybee Creek	12.1	19.2
23	Across Tybee Island approximately 0.5 mile east of the confluence of Tybee Creek	12.1	19.2
24	Across the eastern portion of Tybee Island approximately 1 mile southeast of the Tybee Island Lighthouse	12.1	19.2

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (USGS, various dates), aerial photographs (Woolpert Consultants, 1983), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

Figure 2 is a profile for a hypothetical transects showing the effects of energy dissipation on a wave as it moves inland. This figure shows the wave elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations and being increased by open, unobstructed wind fetches. Actual wave conditions may not necessarily include all of the situations shown in Figure 2.

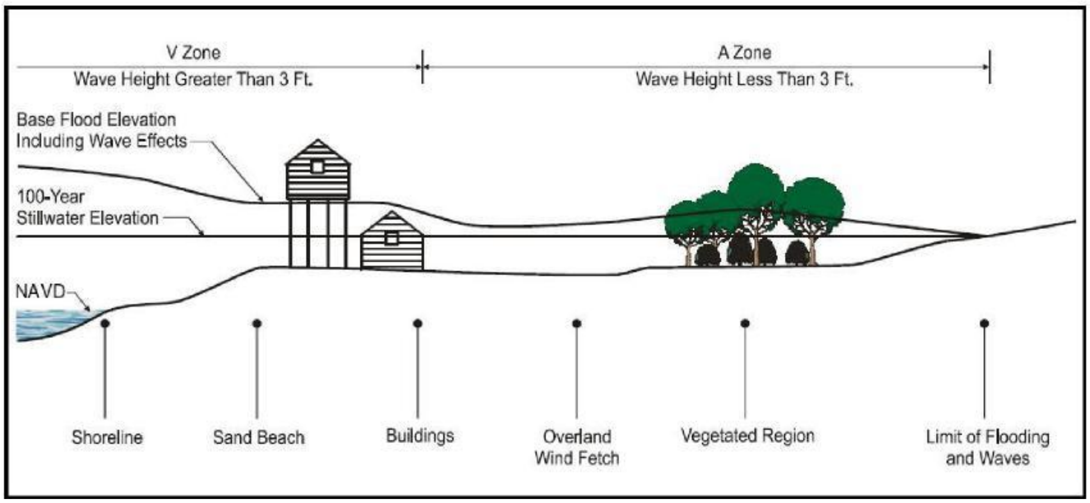


Figure 2: Transect Schematic

Results from the wave height analysis are incorporated into the information presented on the FIRM and summarized in Table 5. Computed wave elevations were based on existing topography, vegetation, and development patterns.

First Countywide FIS Revision

Analyses of the hydraulic characteristics of flooding from the sources studied by enhanced approximate and approximate methods were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Water-surface profiles were computed for detailed and approximate study streams through the use of the USACE HEC-RAS version 3.1.2 computer program (Reference 30). Cross sections were drawn every 500 feet. Water surface profiles were produced for the 1-percent-annual-chance storms for enhanced approximate and approximate studies.

The enhanced approximate and approximate study methodology used Watershed Information System (WISE) as a preprocessor to HEC-RAS. Tools within WISE allowed the engineer to verify that the cross-section data was acceptable (Reference 68). The WISE program was used to generate the input data file for HEC-RAS. Then HEC-RAS was used to determine the flood elevation at each cross section of the modeled stream. No floodway was calculated for streams studied by approximate methods.

Cross sections for the flooding source studied by detailed methods were obtained from field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the FIRM (Exhibit 2).

FLOODING SOURCE	TRANSECTS	STILLLWATER ELEVATION (FEET NAVD)				ZONE[1]	BASE FLOOD ELEVATION (FEET NAVD)[2]
		10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE		
ATLANTIC OCEAN	1-10	8.7	10.7	12.1	13.3	VE	14-19
		*	*	*	*	AE	12-14
		9.3	11.0	11.1	13.5	VE	13-16
		*	*	*	*	AE	11-13
	1-8	9.6	11.6	12.1	14.5	VE	14-19
		*	*	*	*	AE	12-14
		9.3	11.0	11.1	13.5	VE	13-16
		*	*	*	*	AE	11-13
	1-9	9.5	11.3	12.1	14.0	VE	14-19
		*	*	*	*	AE	12-14
		9.3	11.0	11.1	13.5	VE	13-16
		*	*	*	*	AE	11-13
	8-10	9.5	11.3	12.1	14.0	VE	14-19
		*	*	*	*	AE	12-14
		9.7	11.8	13.1	14.5	VE	15-17
		9.3	11.0	11.1	13.5	VE	13-16
		*	*	*	*	AE	11-13

[1] Includes the effects of wave action, where applicable
[2] Due to map scale limitations, BFEs shown on the FIRM may represent average elevation for the zone depicted
* Data not available

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

TRANSECT DATA

ATLANTIC OCEAN

FLOODING SOURCE	TRANSECTS	STILLLWATER ELEVATION (FEET NAVD) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	ZONE[1]	BASE FLOOD ELEVATION (FEET NAVD)[2]
ATLANTIC OCEAN (continued)	6-10	9.5	11.3	12.1	14.0	VE	14-19
		9.7	11.8	13.1	14.5	VE	15-17
		9.3	11.0	11.1	13.5	VE	13
		*	*	*	*	AE	11-13
	8-13	9.5	11.3	12.1	14.0	VE	14-19
		*	*	*	*	AE	14
		9.7	11.8	13.1	14.5	VE	15-17
		9.4	10.9	11.1	12.7	VE	13
		*	*	*	*	AE	11-13
	11-16	8.8	10.8	12.1	13.6	VE	14-19
		*	*	*	*	AE	12-14
		9.4	10.9	11.1	12.7	VE	13
		*	*	*	*	AE	11-13
	14-17	9.2	11.3	12.1	13.9	VE	14-19
		*	*	*	*	AE	12-14
		10.2	12.4	13.1	15.2	VE	15-17

[1] Includes the effects of wave action, where applicable
[2] Due to map scale limitations, BFEs shown on the FIRM may represent average elevation for the zone depicted
* Data not available

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

TRANSECT DATA

ATLANTIC OCEAN

FLOODING SOURCE	TRANSECTS	STILLLWATER ELEVATION (FEET NAVD) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	ZONE[1]	BASE FLOOD ELEVATION (FEET NAVD)[2]
ATLANTIC OCEAN (continued)	14-17 (continued)	8.3	10.2	11.1	13.2	VE	13-14
		*	*	*	*	AE	11-13
	13-16	9.2	11.3	12.1	13.9	VE	14-19
		*	*	*	*	AE	12-14
		10.2	12.4	13.1	15.2	VE	15-17
		8.3	10.2	11.1	13.2	VE	13-14
		*	*	*	*	AE	11-13
	17-20	9.2	11.3	12.1	13.9	VE	14-19
		*	*	*	*	AE	12-14
		10.5	12.4	13.1	14.7	VE	15-17
		*	*	*	*	AE	13-15
		8.3	10.2	11.1	13.2	VE	14-16
		*	*	*	*	AE	11-13
	17-24	9.2	11.3	12.1	13.9	VE	14-19
		*	*	*	*	AE	12-14
		10.5	12.4	13.1	14.7	VE	15-17

[1] Includes the effects of wave action, where applicable
[2] Due to map scale limitations, BFEs shown on the FIRM may represent average elevation for the zone depicted
* Data not available

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

TRANSECT DATA

ATLANTIC OCEAN

FLOODING SOURCE	TRANSECTS	STILLLWATER ELEVATION (FEET NAVD)				ZONE[1]	BASE FLOOD ELEVATION (FEET NAVD)[2]
		10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE		
ATLANTIC OCEAN (continued)	17-24 (continued)	*	*	*	*	AE	13-15
		8.3	10.2	11.1	13.2	VE	14-16
		*	*	*	*	AE	11-13
	19-24	9.4	11.6	12.1	14.6	VE	14-19
		*	*	*	*	AE	13-14
		10.5	12.4	13.1	14.7	VE	16-48
		8.3	10.2	11.1	13.2	VE	13-15
		*	*	*	*	AE	13
	21-24	9.4	11.6	12.1	14.6	VE	14-19
		*	*	*	*	AE	13-14
		10.5	12.4	13.1	14.7	VE	16-48
		8.3	10.2	11.1	13.2	VE	13-15
		*	*	*	*	AE	13
	N/A	9.1	10.4	11.1	12.6	AE	11
	N/A	8.0	9.4	9.9	11.4	AE	10
	N/A	9.4	10.9	11.5	12.7	AE	11

[1] Includes the effects of wave action, where applicable
[2] Due to map scale limitations, BFEs shown on the FIRM may represent average elevation for the zone depicted
* Data not available

3.4 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD 29). With the completion of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are now prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD 88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. It is important to note that adjacent counties may be referenced to NGVD 29. This may result in differences in base flood elevations across county lines. The average conversion factor that was used to convert the data in this FIS report to NAVD for the September 26, 2008 countywide FIS was calculated using the National Geodetic Survey's VERTCON online utility (Reference 36). The data points used to determine the conversion are listed in Table .

Table 9: Vertical Data Conversion

Quad Name	Corner	Latitude	Longitude	Conversion from NGVD to NAVD
Meldrim	SW	81.37	32.13	-0.856
Meldrim	NE	81.25	32.25	-0.915
Meldrim	SE	81.25	32.12	-0.902
Port Wentworth	NE	81.20	32.25	-0.922
Port Wentworth	SE	81.13	32.13	-0.928
Limehouse	SE	81.00	32.13	-0.919
Meldrim SE	SE	81.25	32.00	-0.892
Garden City	SE	81.13	32.00	-0.919
Savannah	SE	81.00	32.00	-0.932
Fort Pulaski	SE	80.88	32.00	-0.932
Tybee Island North	SE	80.75	32.00	-0.958
Richmond Hill	SE	81.25	31.87	-0.928
Burroughs	SE	81.13	31.87	-0.928

Table 9: Vertical Data Conversion (Continued)

Isle of Hope	SE	81.00	31.87	-0.942
Wassaw Sound	SE	80.88	31.87	-0.958
Oak Level	SE	81.12	31.75	-0.955
Raccoon Key	SE	81.00	31.75	-0.965
Meldrim	SW	81.37	32.13	-0.856
			Average:	-0.927

For more information regarding conversion between the NGVD and NAVD, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988* (Reference 36), 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

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 Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed or limited detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section.

For the Atlantic Ocean and the coastally influenced flooding sources; Ogeechee River, Salt Creek Tributary, Savannah River, St. Augustine Creek, St. Augustine Creek Tributary, Wilshire Canal, from the confluence of Wilshire Canal Tributary A to just downstream of Mercy Road, Wilshire Canal Tributary A, and Wilshire Canal Tributary A-1, the boundaries were interpolated between transects using topographic maps at a scale of 1:24,000, with a contour interval of 5 feet (Reference 65-67).

The boundaries on Pipe Makers Canal Tributary No. 2 were interpolated between cross sections, using site mapping at a scale of 1:4,800, with a contour interval of 1 foot (Reference 1), based on February 1997 aerial photography.

The boundaries on the Little Ogeechee River were interpolated between cross sections using a certified topographic survey map at a scale of 1:6,000, with a contour interval of 1 foot (Reference 24).

For Black Creek, Black Creek Tributary No. 2, Casey Canal, Chippewa Canal, Coffee Bluff Basin, Colonial Oaks Canal, Colonial Oaks Canal Tributary No. 1, Colonial Oaks Canal Tributary No. 1.1, Evergreen Cemetery Basin, Fell Street Basin, Hardin Canal, Harmon Canal, Kingsway Canal, Little Ogeechee River Tributary, Louis Mills Branch, Pipe Makers Canal, Placentia Canal, Quacco Canal, Rahn Dairy Canal, Springfield Canal, Springfield Canal Tributary A, Tributary to Little Ogeechee River Tributary, Wilshire Canal, from approximately 1,285 feet downstream of White Bluff Road to the confluence of Wilshire Canal Tributary A, 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, the boundaries were interpolated using 1-foot contours derived from LiDAR data (Reference 50).

The 1- and 0.2-percent-annual-chance floodplain boundaries for streams studied by detailed methods are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual chance floodplain boundary was delineated using the Type 15 FIS for Chatham County and Flood Hazard Boundary Map for Chatham County (Reference 8 and Reference 20).

For streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 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 this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and provided in Table 7, “Floodway Data.” The computed floodway is shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation (WSEL) of the base 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 3.

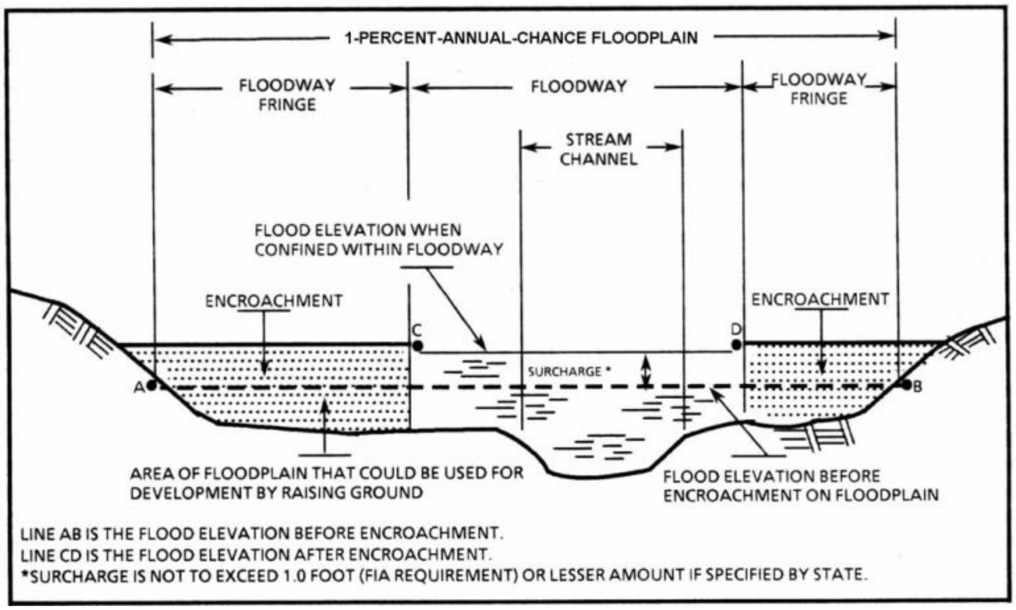


Figure 3. Floodway Schematic

No floodways were computed for Black Creek, Black Creek Tributary No. 2, Casey Canal, Chippewa Canal, Colonial Oaks Canal, Colonial Oaks Canal Tributary No. 1, Colonial Oaks Canal Tributary No. 1.1, Hardin Canal, Harmon Canal, Kingsway Canal, Little Ogeechee River, Little Ogeechee River Tributary, Louis Mills Branch, Ogeechee River, Salt Creek Tributary, Savannah River, Springfield Canal, Springfield Canal Tributary A, St. Augustine Creek, St. Augustine Creek Tributary, Tributary to Little Ogeechee River Tributary, Wilshire Canal, Wilshire Canal Tributary A, Wilshire Canal Tributary A-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.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage and heightens potential flood hazards by further increasing velocities. To reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

4.3 Base Flood Elevations

Areas within the community studied by detailed engineering methods have BFEs established in AE and VE Zones. These are the elevations of the 1- percent-annual-chance (base flood) relative to NAVD. In coastal areas affected by wave action, the maximum BFEs are generally at the normal open shoreline. These elevations generally decrease in a landward direction at a rate dependent on the presence of obstructions capable of dissipating the wave energy. Where possible, changes in BFEs have been shown in 1-foot increments on the FIRM. However, where the scale did not permit, 2- or 3-foot increments were sometimes used. BFEs shown in the wave action areas represent the average elevation within the zone. Current program regulations generally require that all new construction be elevated such that the first floor, including basement, is elevated to or above the BFE in AE and VE Zones.

4.4 Velocity Zones

The USACE has established the 3-foot wave height as the criterion for identifying coastal high hazard zones (USACE, 1975). This was based on a study of wave action effects on structures. This criterion has been adopted by FEMA for the determination of VE zones. Because of the additional hazards associated with high-energy waves, the NFIP regulations require much more stringent floodplain management measures in these areas, such as elevating structures on piles or piers. In addition, insurance rates in VE zones are higher than those in AE zones.

The location of the VE zone is determined by the 3-foot wave as discussed previously. The detailed analysis of wave heights performed in this study allowed a much more accurate location of the VE zone to be established. The VE zone generally extends inland to the point where the 1-percent-annual-chance stillwater flood depth is insufficient to support a 3-foot wave.

FLOODING SOURCE			FLOODWAY[1]			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
NODES	LINKS	DISTANCE[2]	WIDTH (FEET)	PEAK FLOW (CFS)	VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	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		1,128	1,418	1.5				
N		51,050				19.1	19.1	19.8	0.9

[1]Values represent maximum along link

[2]Feet above confluence with Savannah River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

FLOODWAY DATA

PIPE MAKERS CANAL

FLOODING SOURCE			FLOODWAY[1]			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
NODES	LINKS	DISTANCE[2]	WIDTH (FEET)	PEAK FLOW (CFS)	VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
PIPE MAKERS CANAL (CONTINUED)									
O		62,085				19.8	19.8	20.6	0.8
	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]Values represent maximum along link

[2]Feet above confluence with Savannah River

TABLE 10

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 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

FLOODWAY DATA

PIPE MAKERS CANAL TRIBUTARY NO. 2

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone VE

Zone VE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

Coastal Barrier Resources System

The FIRM for Chatham County includes areas designated by Congress as units of the Coastal Barrier Resources System (CBRS), where federally backed flood insurance is not available.

The Coastal Barrier Resources Act of 1982 and the Coastal Barrier Improvement Act of 1990 define and establish a system of protected coastal areas (including the Great Lakes) known as the CBRS. The Acts define areas within the CBRS as depositional geologic features consisting of unconsolidated sedimentary materials; subject to wave, tidal, and wind energies; and protecting landward aquatic habitats from direct wave attack. The Acts further define coastal barriers as "all associated aquatic habitats, including the adjacent wetlands, marshes, estuaries, inlets and nearshore waters, but only if such features and associated habitats contain few manmade structures and these structures and man's activities on such features, and within such habitats do not significantly impede geomorphic and ecological processes." The Acts provide protection to CBRS areas by prohibiting most expenditures of Federal funds within them. These prohibitions refer to "any form of loan, grant, guarantee, insurance, payment, rebate, subsidy or any other form of direct or indirect Federal assistance," with specific and limited exceptions. The

CBRS boundaries depicted on the FIRM for Chatham County were adopted into public law by Acts of Congress and are, therefore, considered final and not subject to appeal.

In addition to the CBRS, the Coastal Barrier Improvement Act of 1990 established Otherwise Protected Areas (OPAs). OPAs are undeveloped coastal barriers within the boundaries of an area established under Federal, State, or local law, or held by a qualifying organization, primarily for wildlife refuge, sanctuary, recreational, or natural resource conservation purposes.

Congress designated the initial CBRS areas in 1982. Subsequent modifications of the CBRS are introduced as legislation to be acted on by Congress, and originate from State and local requests, as well as recommendations made by the U.S. Fish and Wildlife Service. After Congress approves additions to the CBRS, the new areas are assigned a unique effective date, after which Federal assistance prohibitions apply. In cooperation with the U.S. Department of the Interior, FEMA transfers CBRS boundaries to FIRMs using Congressionally adopted source maps titled *Coastal Barrier Resources System*. FIRMs clearly depict the different CBRS areas and their effective dates with special map notes and symbols. It should be noted that although FEMA shows CBRS areas on FIRMs, only Congress may authorize a revision of CBRS boundaries.

Within CBRS boundaries, Federal flood insurance is not available for structures built or substantially improved on or after the date that the subject area was added to the CBRS. To assist map users in determining the correct insurance prohibition date in CBRS areas, each separate CBRS unit is clearly identified on the FIRM. It is important to note that insurance for structures in OPAs may be obtained if written documentation is provided, which certifies that the structures are used in a manner consistent with the purpose for which the area is protected.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The current FIRM presents flooding information for the entire geographic area of Chatham County. Previously, FIRMs were prepared for each incorporated and the unincorporated areas of the county community identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 8, “Community Map History.”

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Bloomingdale, City of	October 15, 1976	None	July 2, 1981	May 7, 2001
Chatham County (Unincorporated Areas)	March 5, 1976	None	August 1, 1980	September 20, 1995 September 3, 1992 May 19, 1987 October 1, 1983
Garden City, City of	March 16, 1973	None	March 16, 1973	May 19, 1987 November 21, 1980 March 19, 1976 July 1, 1974
Pooler, City of	July 25, 1975	None	September 30, 1981	None
Port Wentworth, City of	March 16, 1973	None	March 16, 1973	May 19, 1987 December 26, 1975 July 1, 1974

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Savannah, City of	September 18, 1970	None	May 21, 1971	September 4, 1987 November 21, 1980 July 1, 1974
Thunderbolt, Town of	December 23, 1977	None	July 2, 1987	None
Tybee Island, City of	November 6, 1970	None	January 14, 1972	June 17, 1986 September 5, 1976 July 1, 1974
Vernonburg, Town of	July 27, 1973	None	July 27, 1973	July 2, 1987 October 31, 1975 July 1, 1974

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

This FIS report supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting Federal Insurance and Mitigation Division, FEMA Region IV, Koger-Center – Rutgers Building, 3003 Chamblee Tucker Road, Atlanta, GA 30341.

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10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original FIS was printed. Future revisions may be made that do not result in the republishing of the FIS report. To assure that the user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data located at:

- Bloomingdale, City of
  City Hall
  8 West U.S. Route 80
  Bloomingdale, Georgia 31302

- Chatham County (Unincorporated Areas)
  Chatham County Courthouse
  124 Bull Street, Suite 200
  Savannah, Georgia 31401

- Garden, City of
  City Hall
  100 Central Avenue
  Garden City, Georgia 31405

- Pooler, City of
  City Hall
  100 Southwest Highway 80
  Pooler, Georgia 31322

- Port Wentworth, City of
  City Hall
  305 South Coastal Highway
  Port Wentworth, Georgia 31407

- Savannah, City of
  City Hall
  2 East Bay Street
  Savannah, Georgia 31402

- Thunderbolt, Town of
  Town Hall
  2821 River Drive
  Thunderbolt, Georgia 31404

- Tybee, City of
  City Hall
  403 Butler Avenue
  Tybee Island, Georgia 31328

- Vernonburg, Town of
  Town Hall
  110 East President Street, Second Floor
  Savannah, Georgia 31401

10.1 First Revision (Revised **August 5, 2013**)

This FIS incorporates LOMRs 10-04-0425P and 10-04-0658P into the countywide FIS. 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, and will now have a 1% annual-chance boundary. LOMR 10-04-0658P is a new detailed study of Pipe Makers Canal and replaces 10.5 miles of this stream in the effective FIS.

10.2 Second Revision (July 7, 2014)

a. Authority and Acknowledgments

The hydrologic and hydraulic analyses for this countywide revision were performed by Atkins North America, Inc., for the Georgia Department of Natural Resources (DNR), under Contract No. EMA-2010-GA-5087, with the Federal Emergency Management Agency (FEMA). The work was completed in August 2012.

Base map information shown on this Flood Insurance Rate Map was provided in digital format by the Chatham County Geographic Information System Department. This information was photogrammetrically compiled at a scale of 1”=200’ from aerial photography dated 2008 or later. The projection used in the preparation of this map is Georgia State Plane East (FIPS zone 1001). The horizontal datum is North American Vertical Datum 1983, Geodetic Reference System 1980 spheroid.

b. Coordination

The initial meeting was held on November 9, 2010, at 9:30 AM to 11:30 AM, at the Savannah Civic Center to introduce the project to all stakeholders involved in the process. Attendees included affected community officials from Chatham County, the City of Bloomingdale, the City of Pooler, the Georgia Coastal Regional Commission, Atkins, FEMA, and various other agencies and affected groups.

A joint Scoping Meeting was held for Bryan, Chatham, Effingham, and Liberty Counties on November 16, 2010, at the Savannah Civic Center. The meeting successfully indentified the needs of the communities affected by the proposed riverine and coastal mapping projects. This meeting was attended by representatives of Atkins, FEMA, Georgia DNR, and the Coastal Regional Commission.

The results of the study were reviewed at the final meeting held on, December 7, 2012, and attended by representatives of FEMA, Georgia DNR, Coastal Regional Commission, Atkins, and the communities. All issues and/or concerns raised at that meeting have been addressed.

c. Scope of Study

For this countywide revision, the following steams were either newly studied or revised by detailed methods.

Stream	Reach Limits
Little Ogeechee River	On Panels 0013G and 0014H; from approximately 1,400 feet downstream of Osteen Road to the Chatham / Effingham County Boundary

Stream	Reach Limits
Pipe Makers Canal Tributary No. 3	From the confluence with Pipe Makers Canal to approximately 7,800 feet upstream of Jimmy Deloach Parkway
St. Augustine Creek	On Panels 0009G and 0017G; from approximately 10,450 feet downstream of the Chatham/ Effingham County Boundary to the Chatham/ Effingham County Boundary
St. Augustine Creek Tributary	On Panels 0017G, 0019H, and 0036G; from Benton Boulevard to approximately 13,550 feet upstream of Benton Boulevard

For this countywide revision, the following detailed steams were redelineated based on updated topography.

Stream	Reach Limits
Hardin Canal	On Panel 0014H; from Ogeechee Road to the Limit of Detailed Study
Pipe Makers Canal Tributary No. 2	From the confluence with Pipe Makers Canal to approximately 50 feet upstream of Main Street to Georgia Central Railroad

For this countywide revision, all streams studied by limited detailed methods on panels 0014H, 0016G, and 0018H, were either newly studied or revised based on updated hydrologic and hydraulic models.

The following tabulation lists streams that have names in this revised countywide FIS other than those used in the previously printed FIS reports for the communities in which they are located.

Community	Old Name	New Name
Bloomingdale, City of Pooler, City of	St. Augustine Creek Tributary (from approximately 1,630 feet upstream of Dirt Road to approximately 9,500 feet upstream of Jimmy Deloach Parkway)	Pipe Makers Canal Tributary No. 3

d. Hydrologic Analyses

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 2009-5043 and 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 HEC-HMS model.

The hydrology for all streams studied by limited detailed methods, for this countywide revision, were modeled using FLO-2D, version 2009.06 Build 09-11.08.07.

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.

Peak drainage area relationships for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods are presented in Table 12.

Table 12 – Revised Summary of Discharges

		Peak Discharges (cubic feet per second)			
Flooding Source and Location	Drainage Area (square miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
LITTLE OGEECHEE RIVER Chatham/ Effingham County Boundary	26.8	1,665	2,636	3,063	3,827
PIPE MAKERS TRIBUTARY NO.3 Chatham/ Effingham County Boundary	*	67	175	282	463
ST. AUGUSTINE CREEK	*	*	*	*	*
ST. AUGUSTINE CREEK TRIBUTARY	*	*	*	*	*

* Data Not Available

e. Hydraulic Analyses

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 09-11.08.07.

The Manning's "n" values for all streams newly studied or revised, for this countywide revision, are presented in the following table.

Table 13 - Revised Manning's "n" Values

Stream	Channel "n"	Overbank "n"
Little Ogeechee River	0.025-0.070	0.025-0.100
Pipe Makers Canal Tributary No. 3	0.050-0.070	0.025-0.100
St. Augustine Creek	0.050-0.070	0.025-0.100
St. Augustine Creek Tributary	0.070	0.025-0.100

f. Floodplain Boundaries

For all streams newly studied or revised by detailed methods or redelineated, for this countywide revision, the 1- and 0.2-percent-annual-chance floodplain boundaries were delineated using one foot contours derived from LiDAR data provided by Chatham County, Georgia (Metropolitan Planning Commission, 2009).

For all streams studied by limited detailed methods, for this countywide revision, the 1-percent-annual-chance floodplain boundaries were delineated using one foot contours derived from LiDAR data provided by Chatham County, Georgia (Metropolitan Planning Commission, 2009).

g. Floodways

No new floodways were computed for this countywide revision.

h. Bibliography and References

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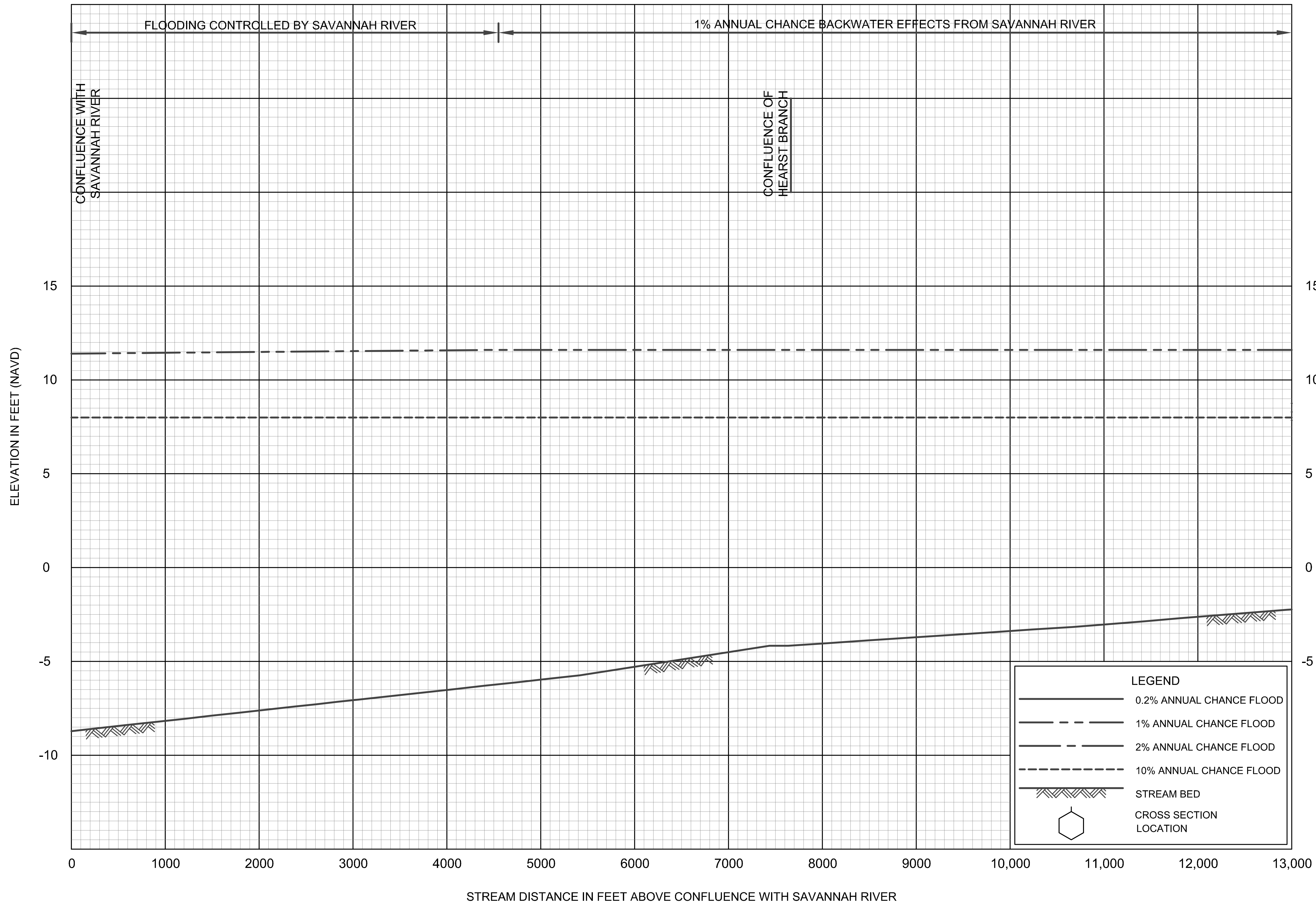


FLOOD PROFILES

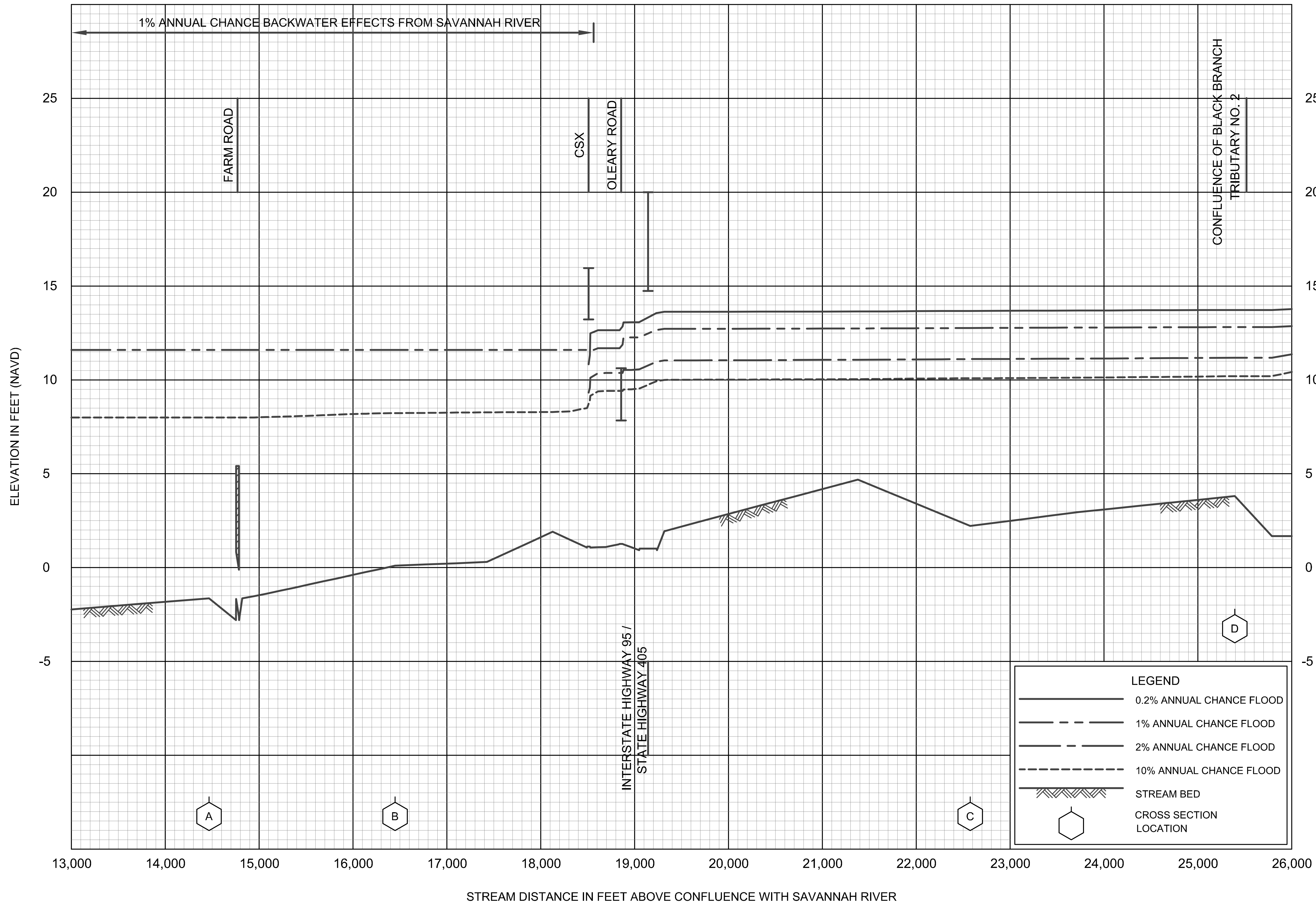
BLACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS

01P



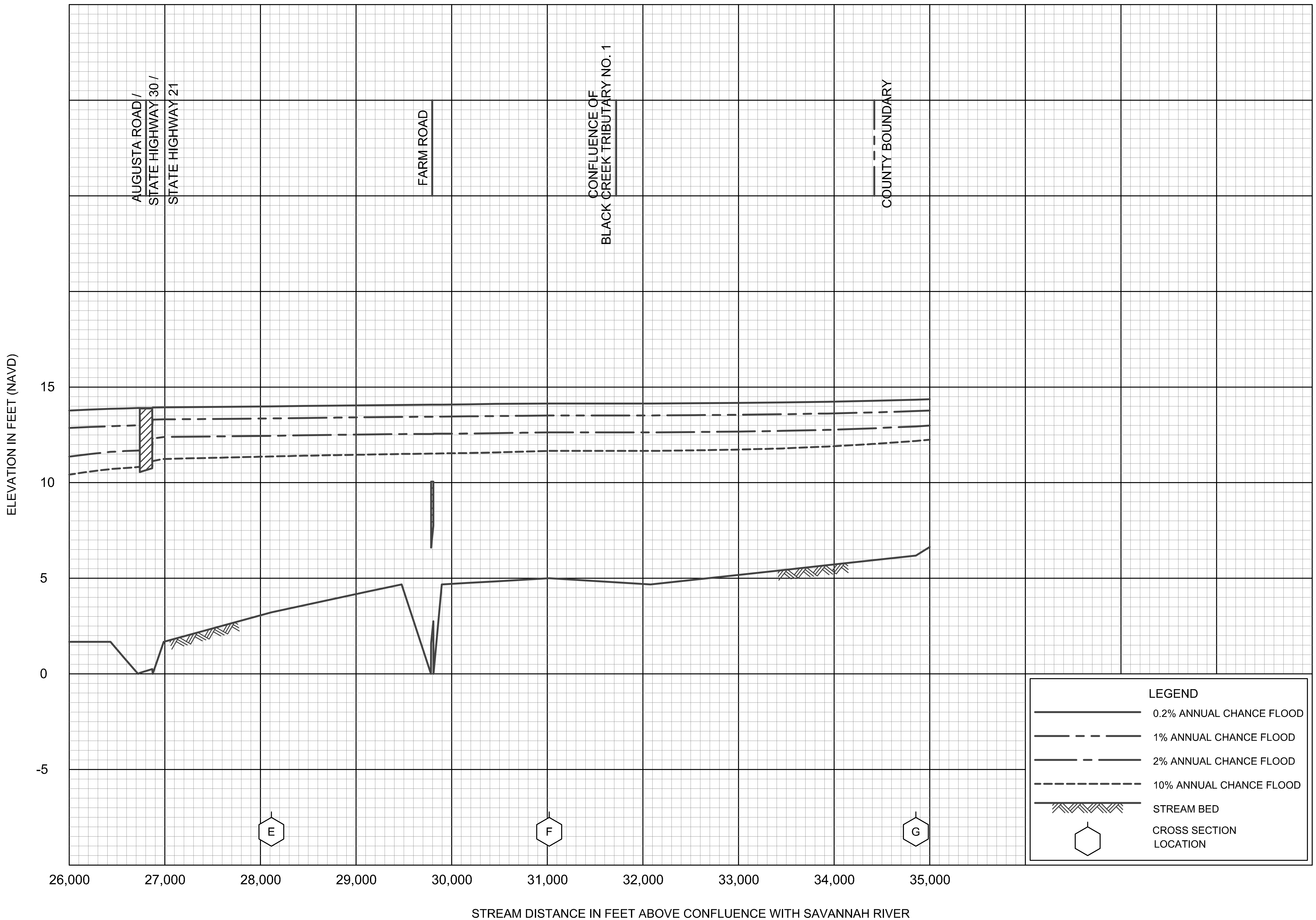
FLOOD PROFILES

BLACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



FLOOD PROFILES

BLACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS

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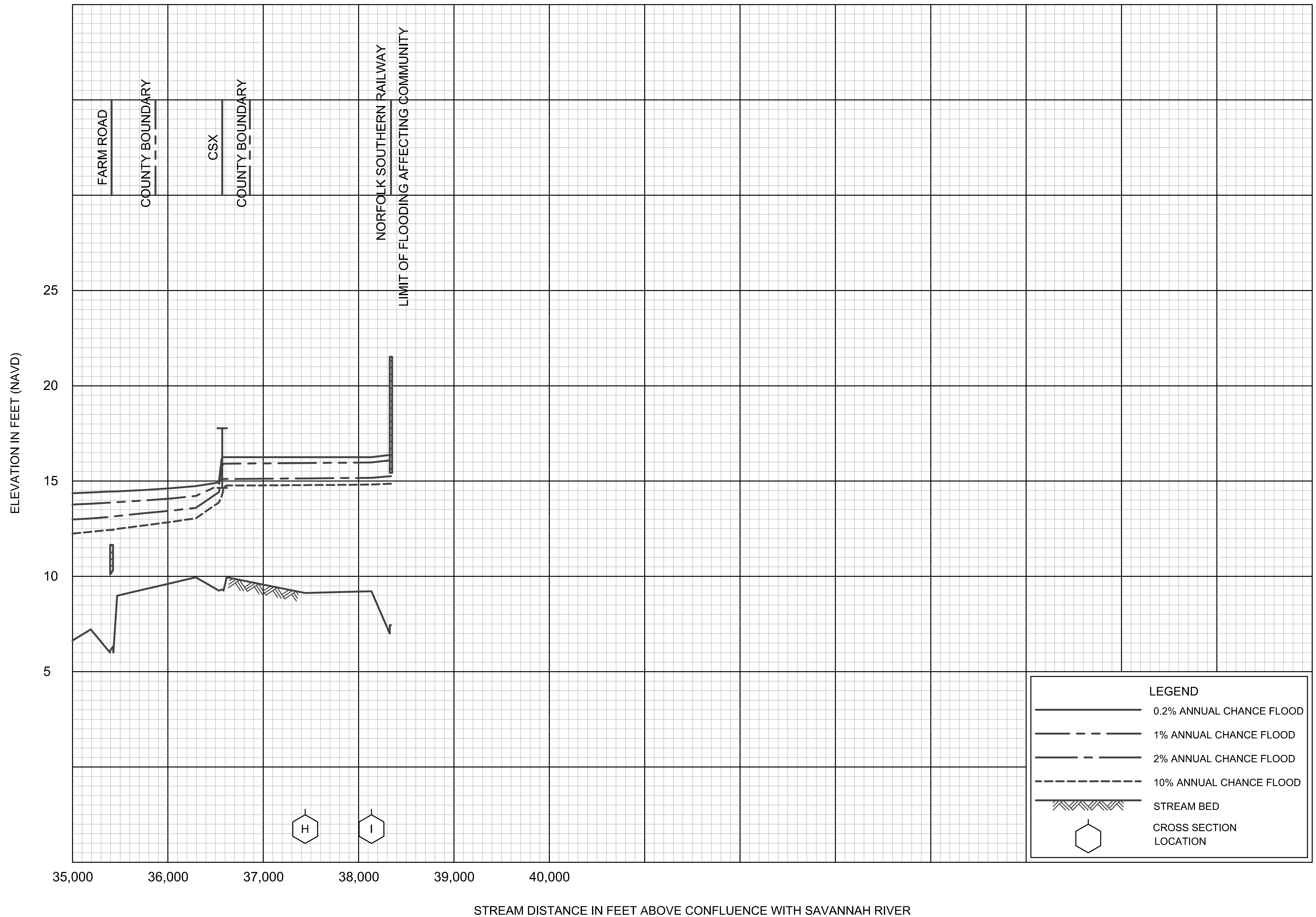


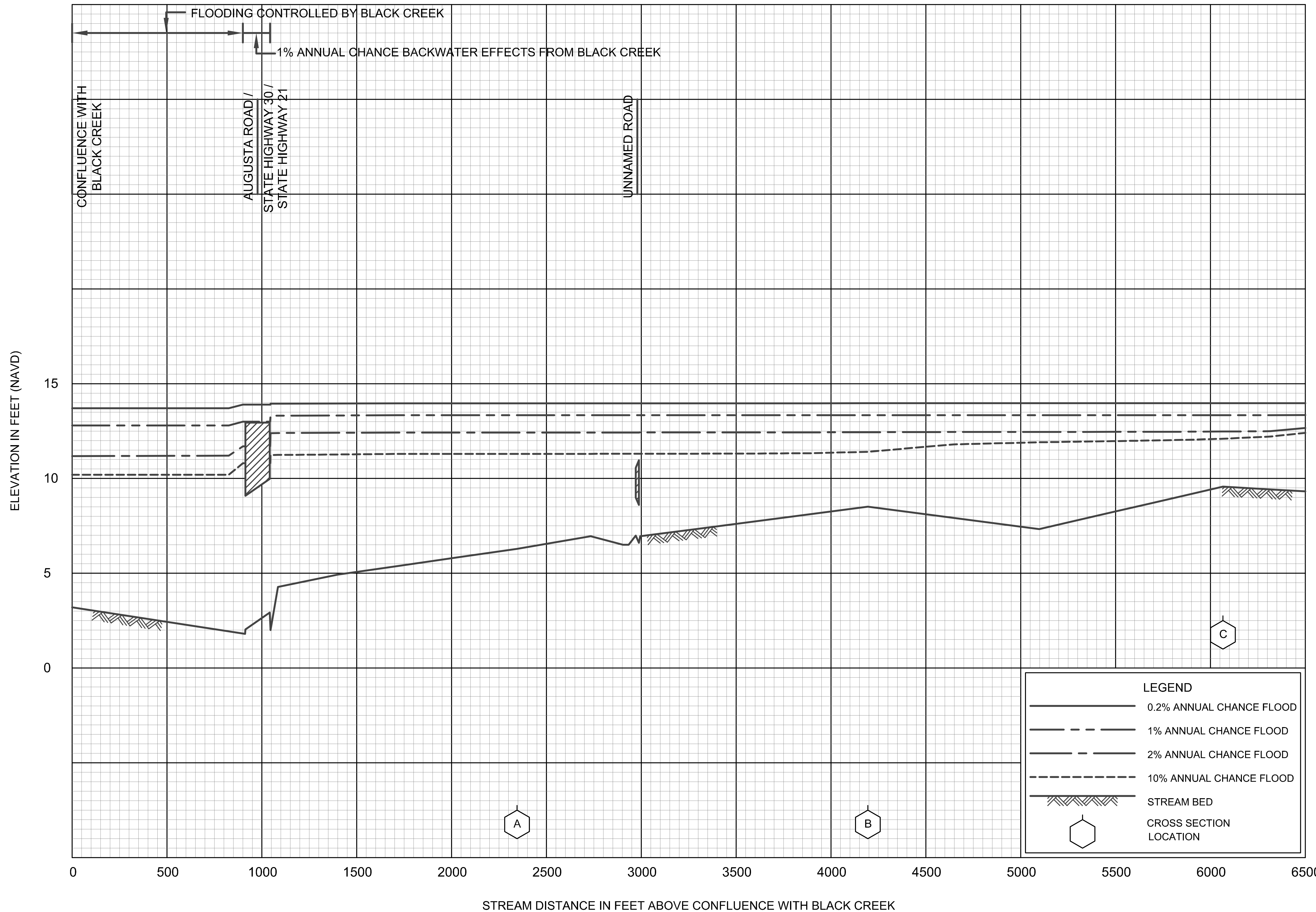
FLOOD PROFILES

BLACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



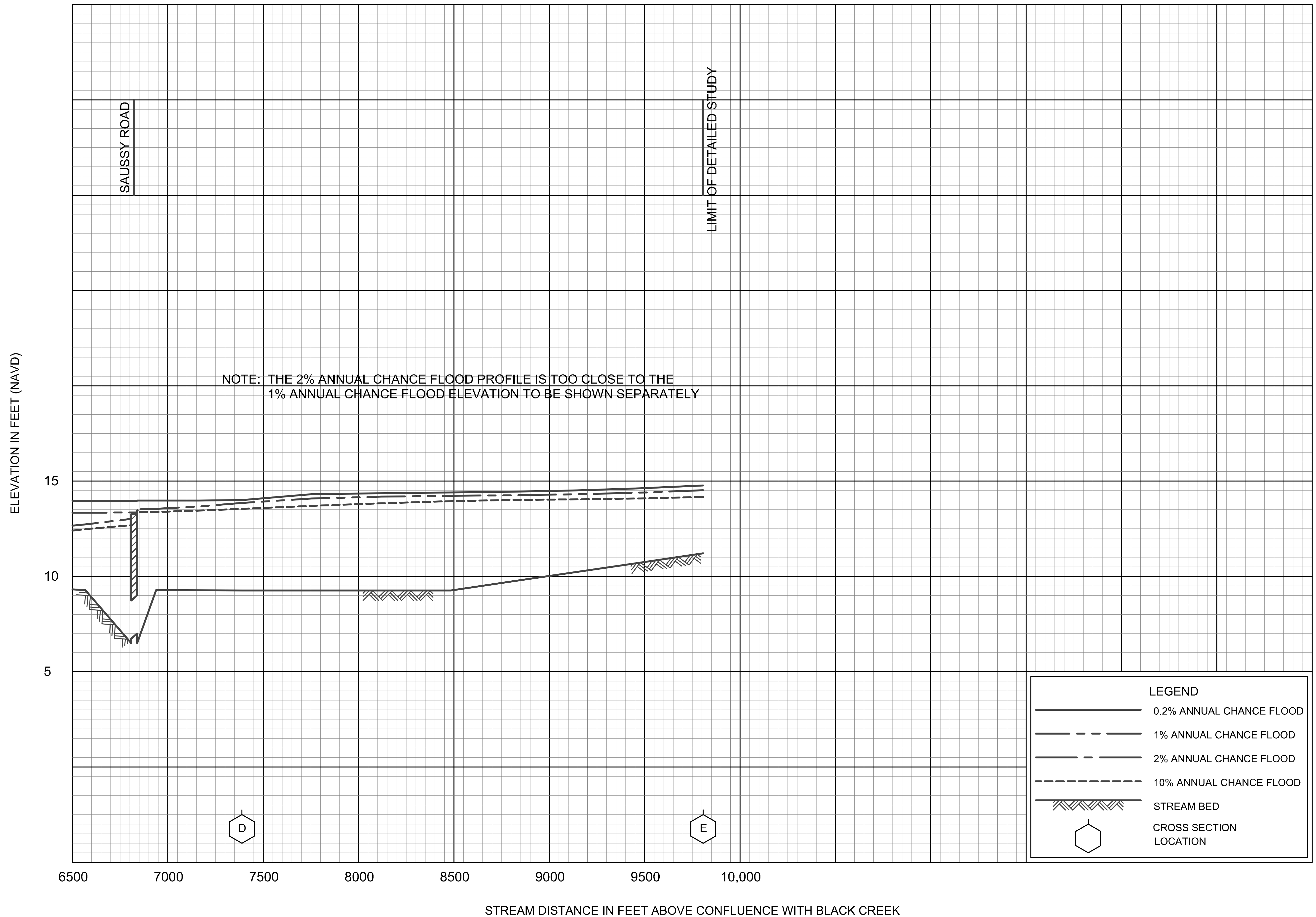
FLOOD PROFILES

BLACK CREEK TRIBUTARY NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



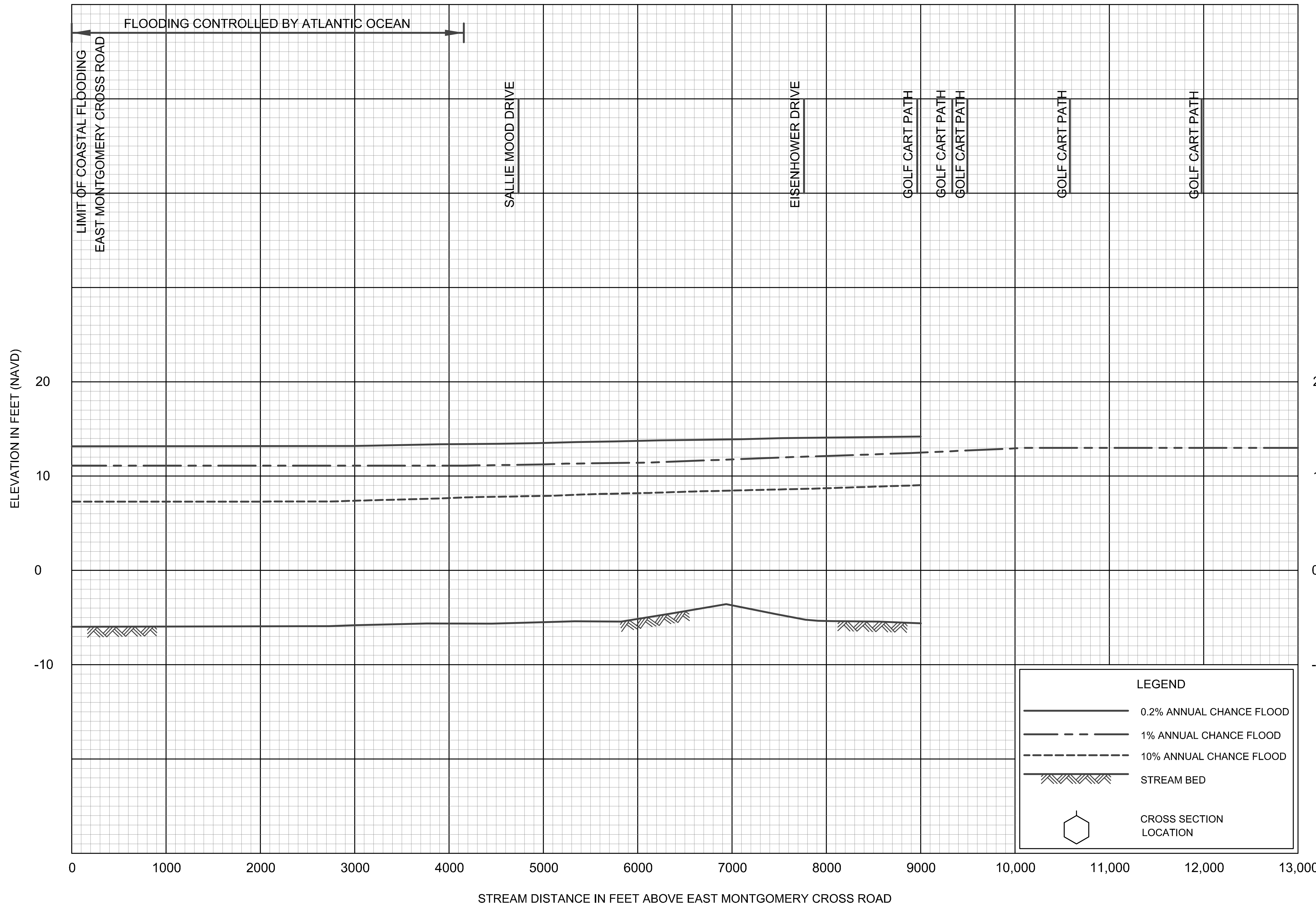
FLOOD PROFILES

BLACK CREEK TRIBUTARY NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



FLOOD PROFILES

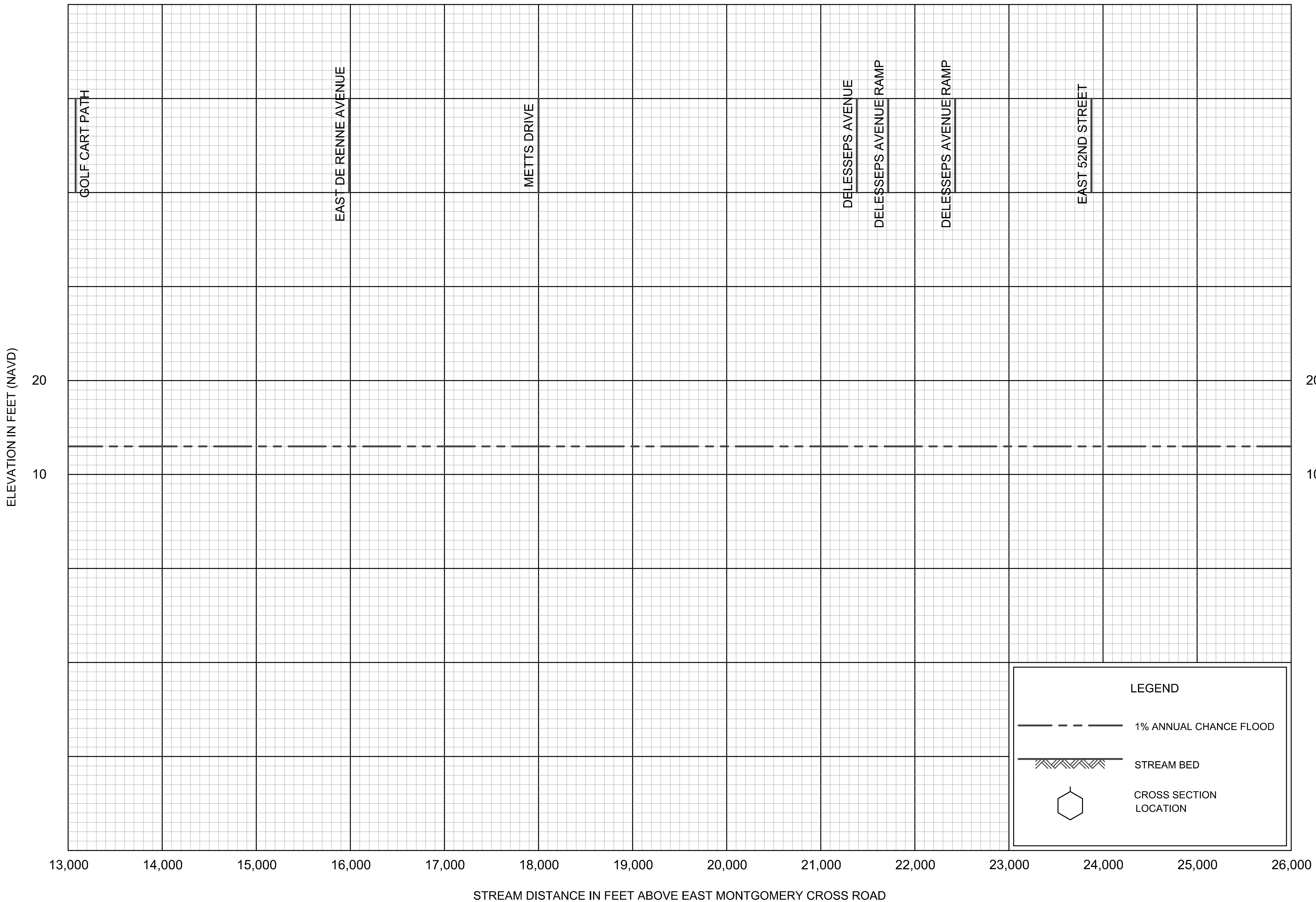
CASEY CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS

07P



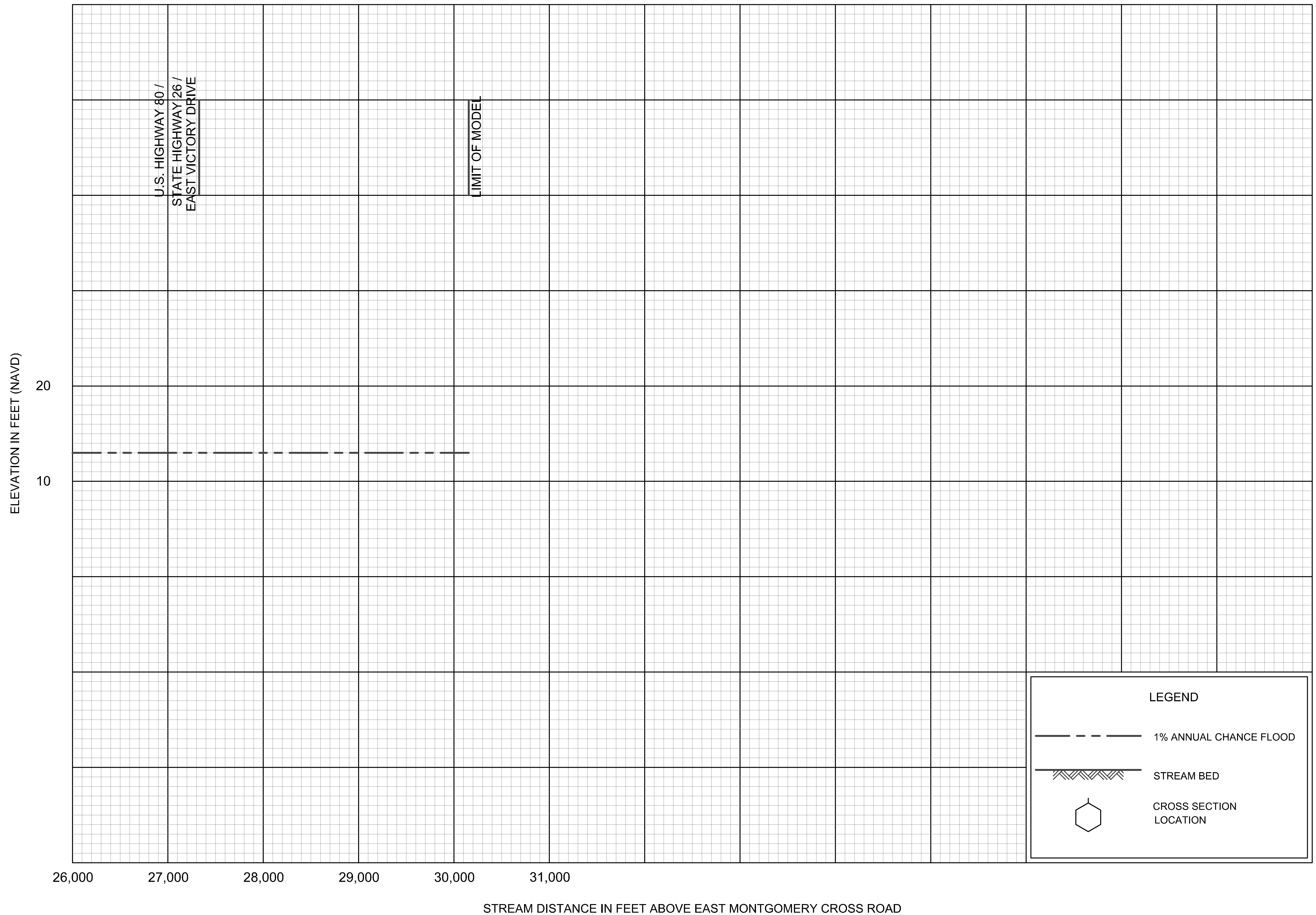
FLOOD PROFILES

CASEY CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



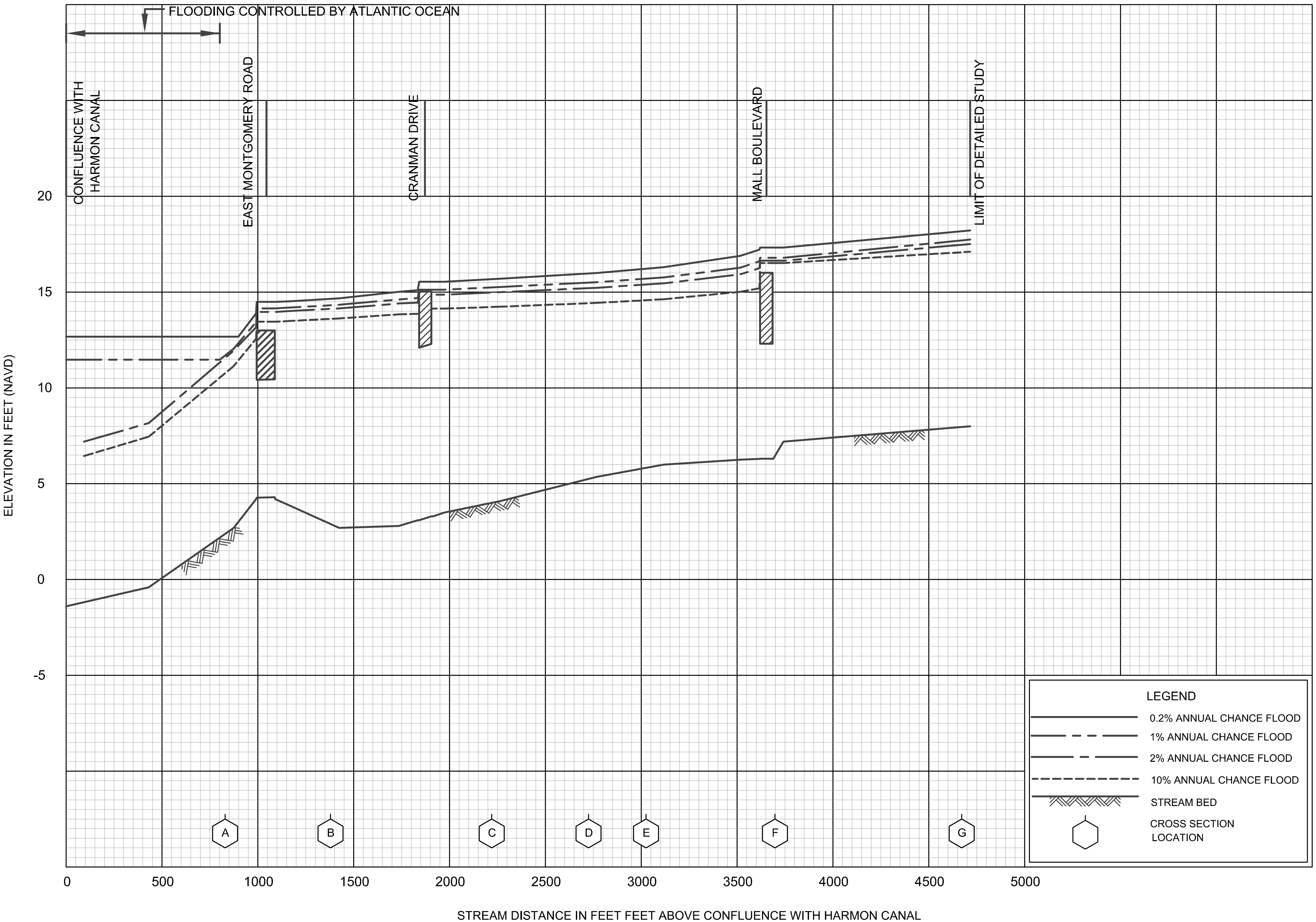
FLOOD PROFILES

CASEY CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



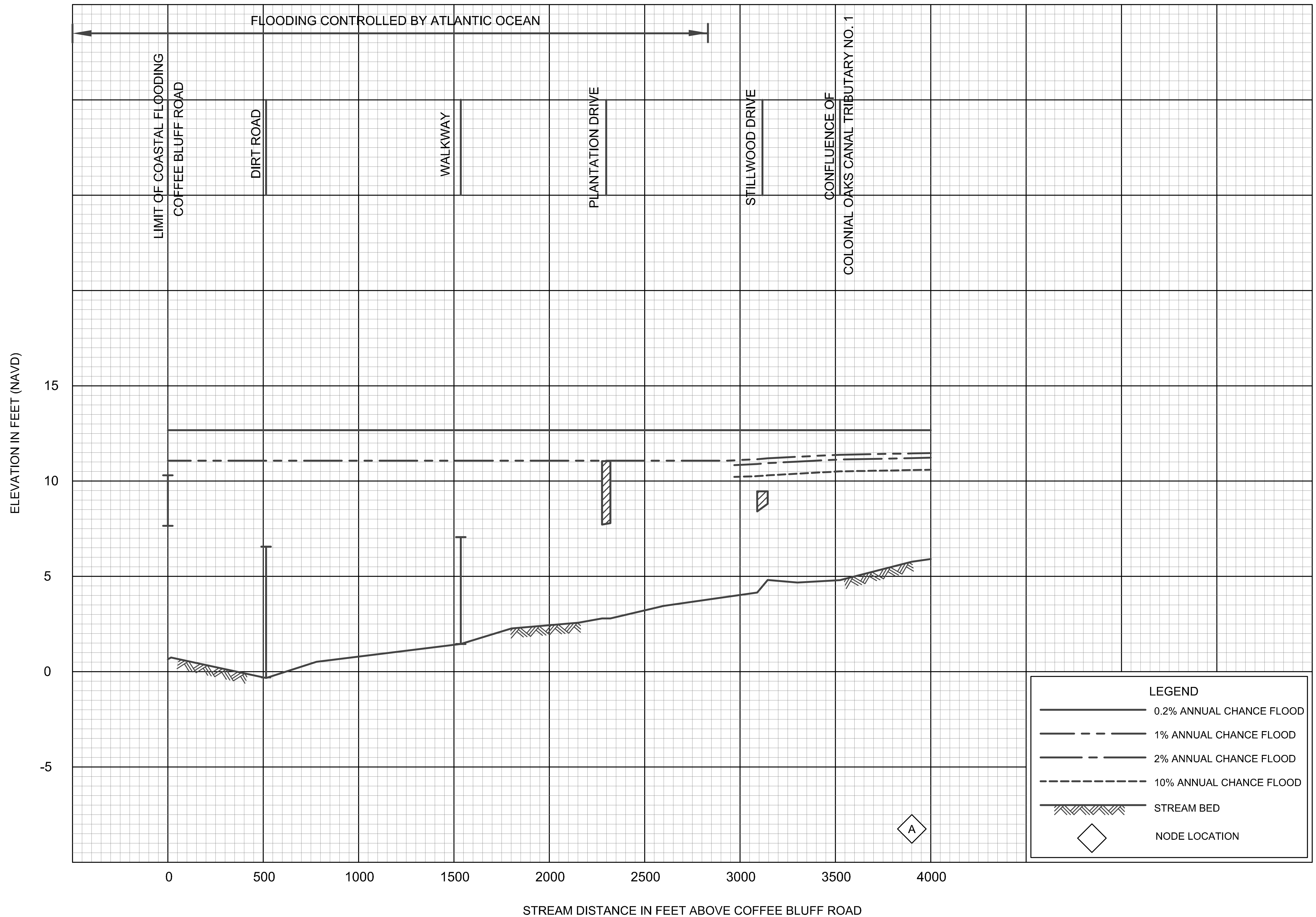
FLOOD PROFILES

CHIPPEWA CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



FLOOD PROFILES

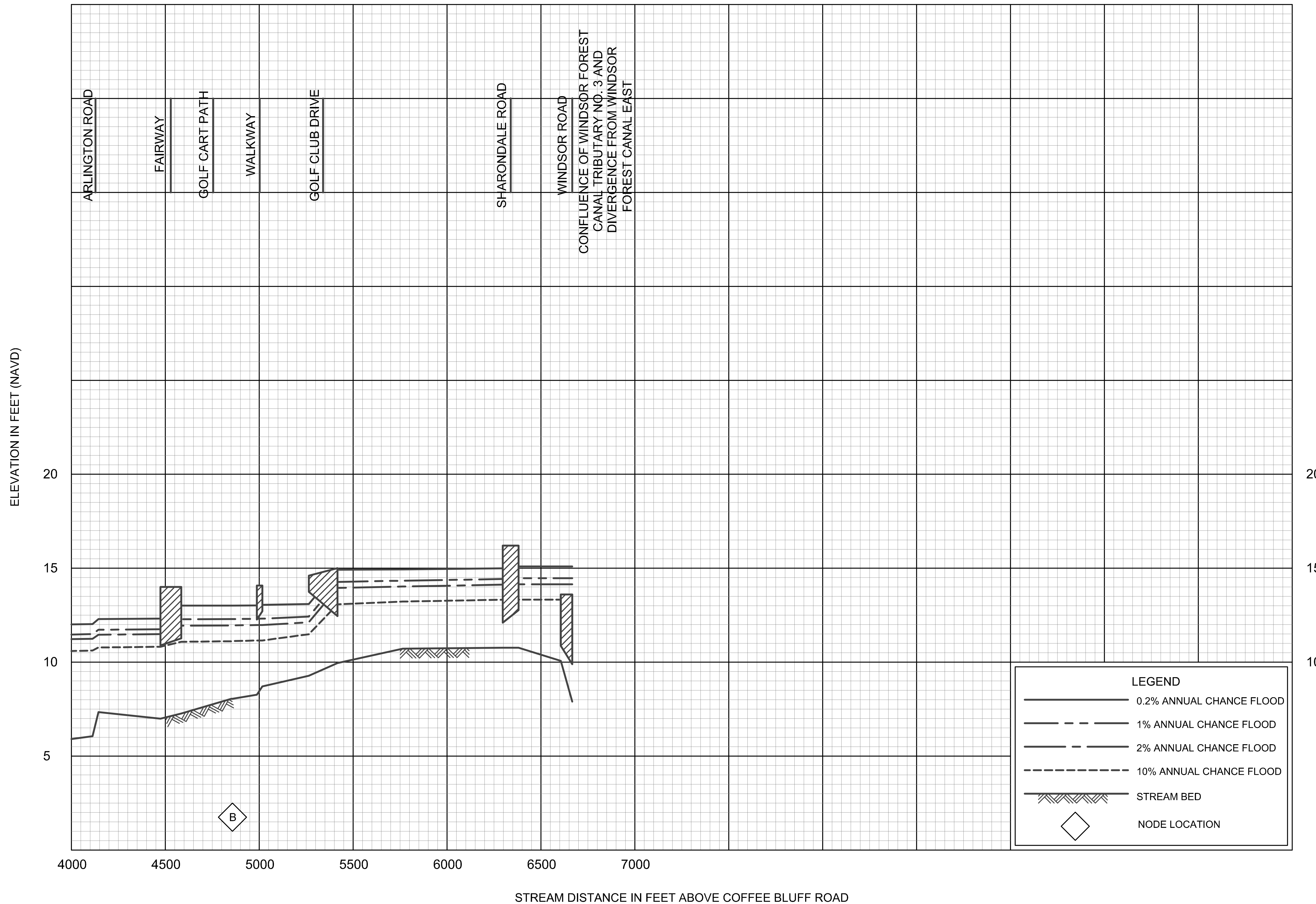
COLONIAL OAKS CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS

11P

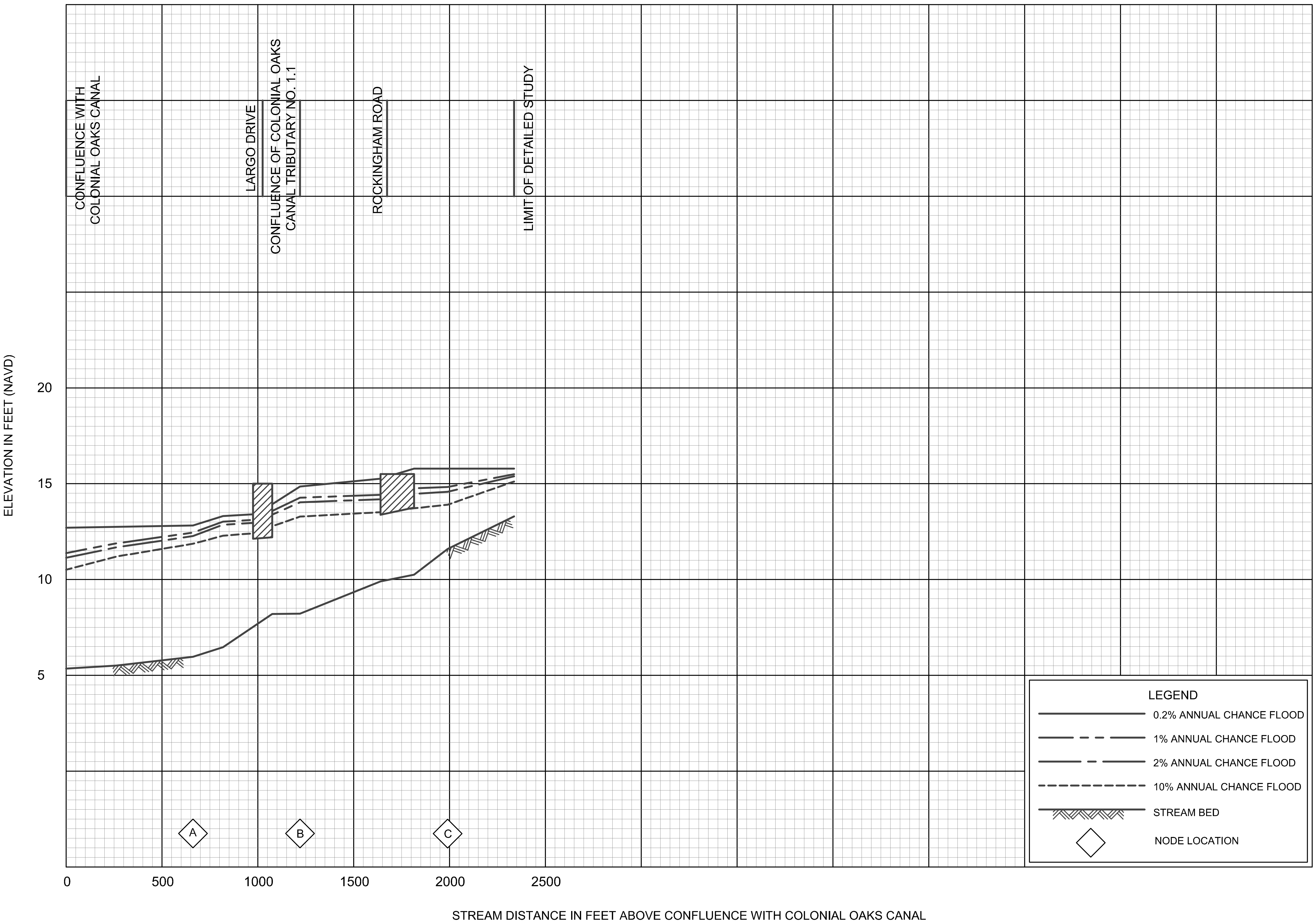


FLOOD PROFILES

COLONIAL OAKS CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA AND INCORPORATED AREAS



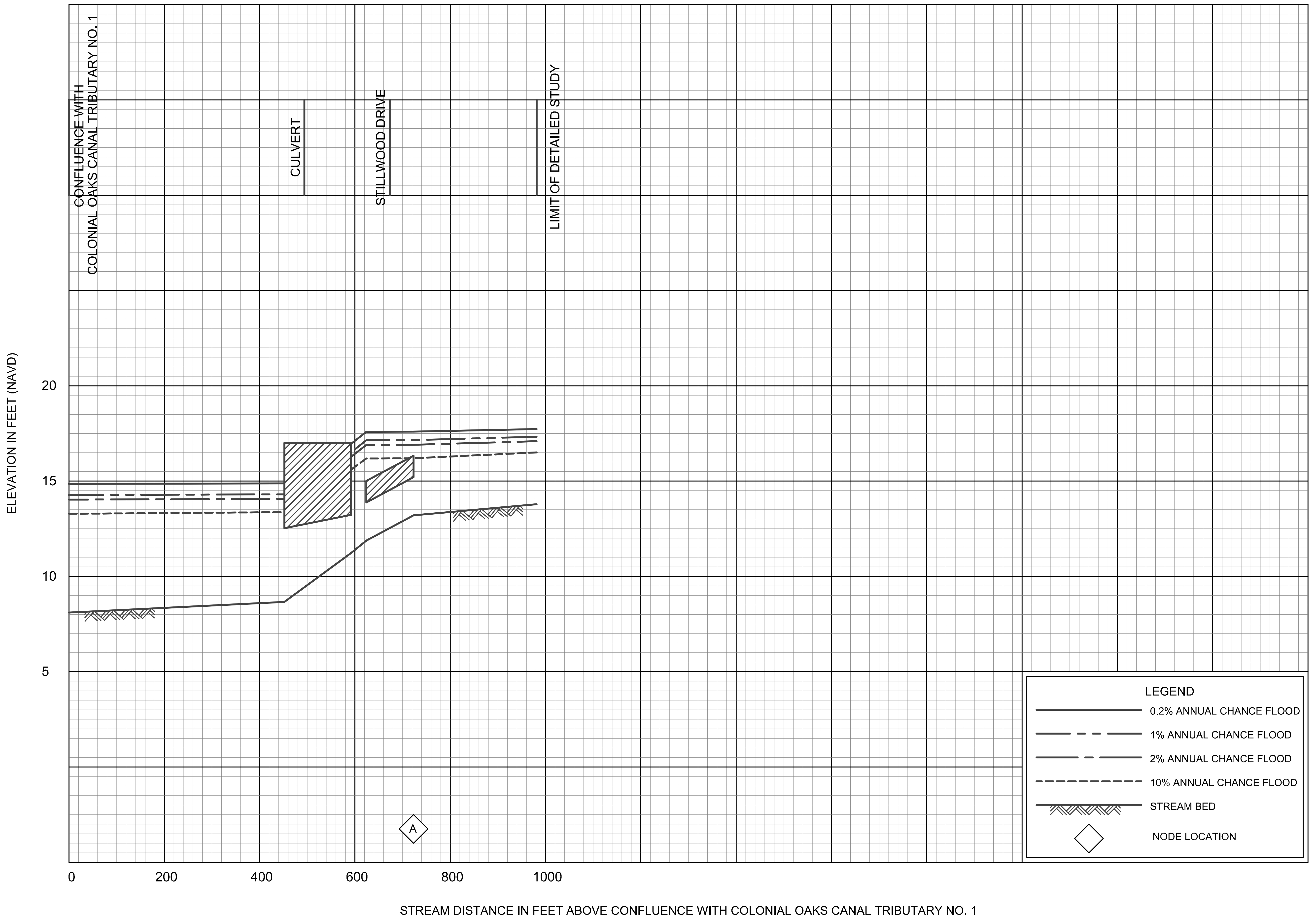
FLOOD PROFILES

COLONIAL OAKS CANAL TRIBUTARY NO. 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



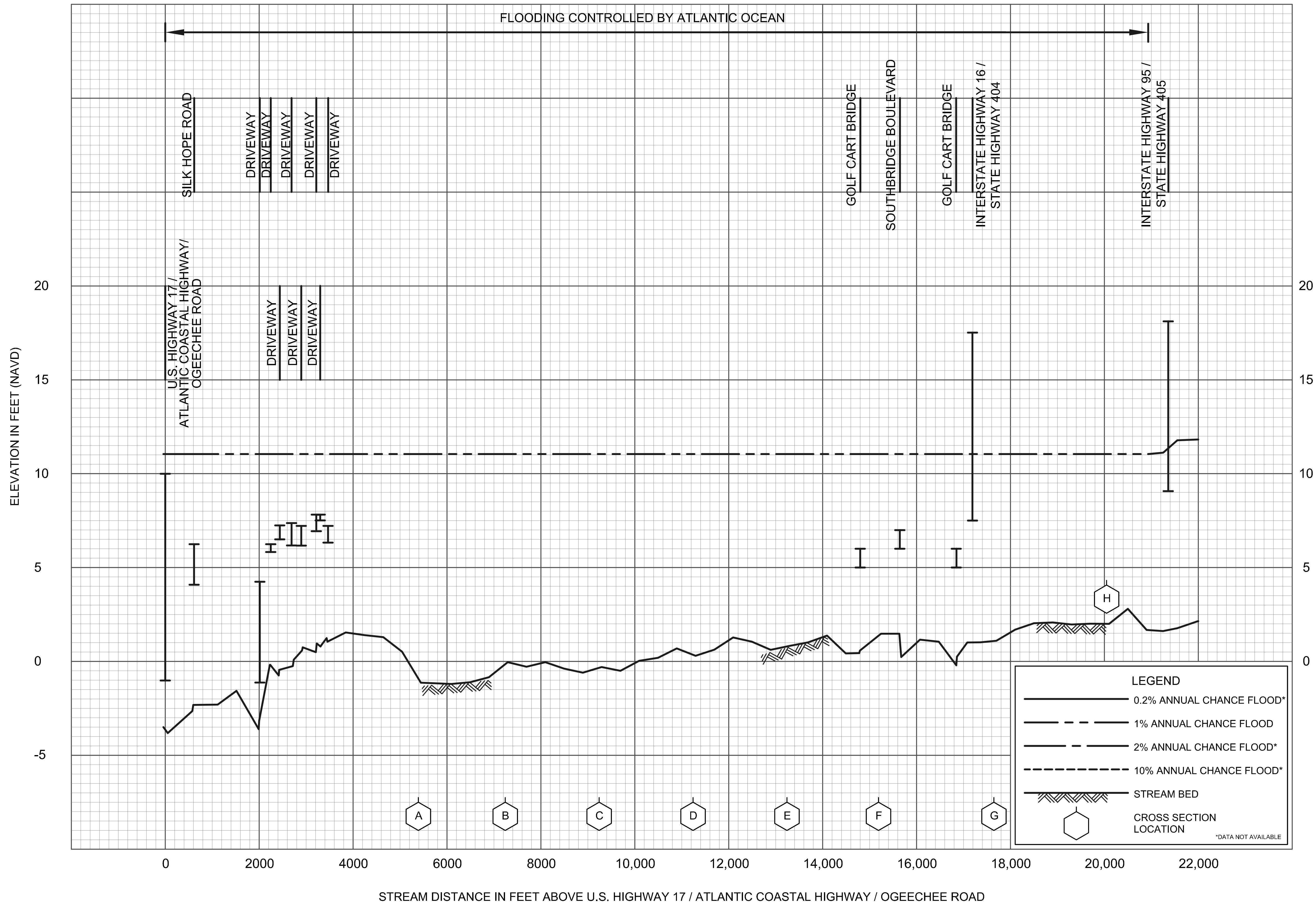
FLOOD PROFILES

COLONIAL OAKS CANAL TRIBUTARY NO. 1.1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



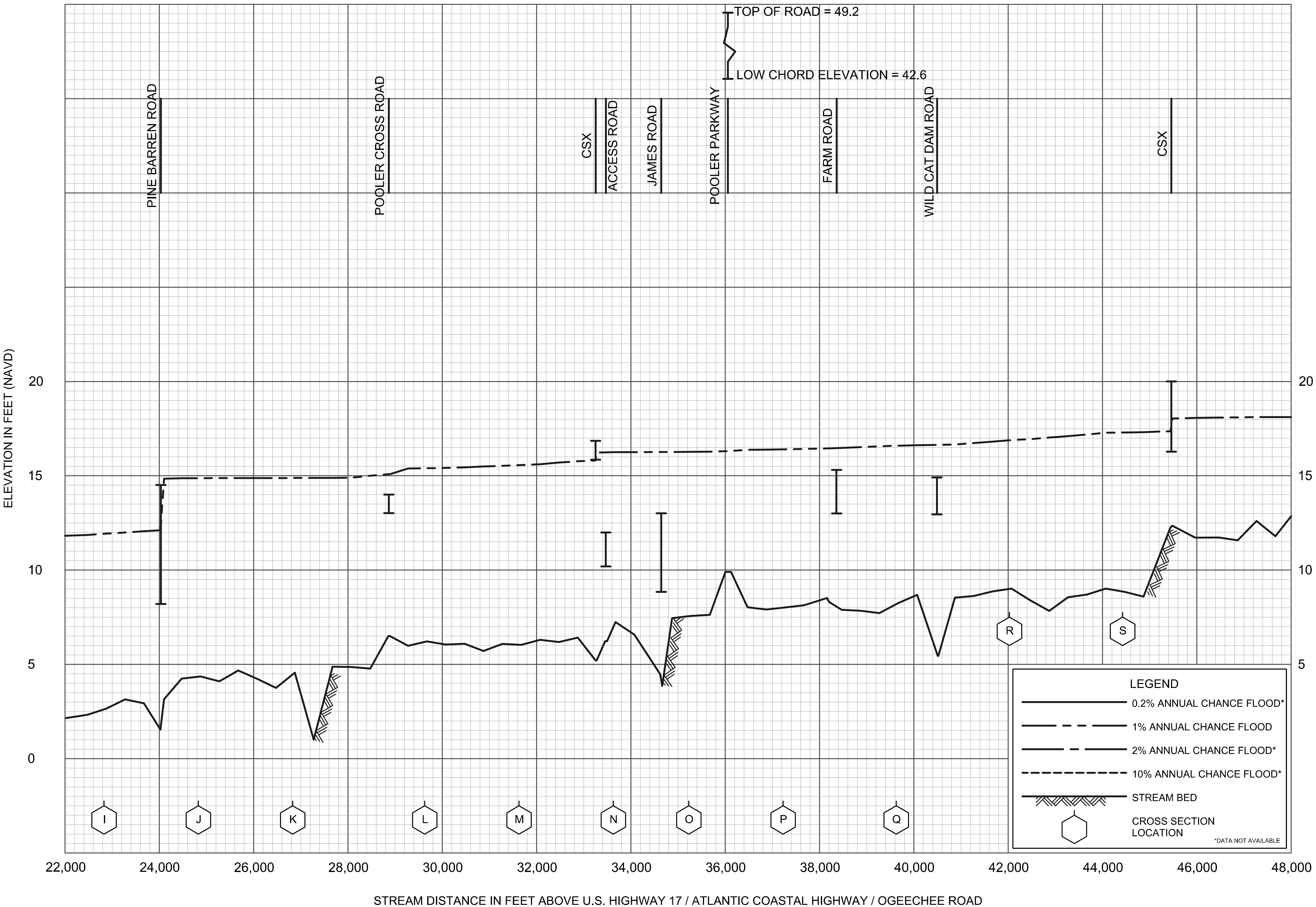
FLOOD PROFILES

HARDIN CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



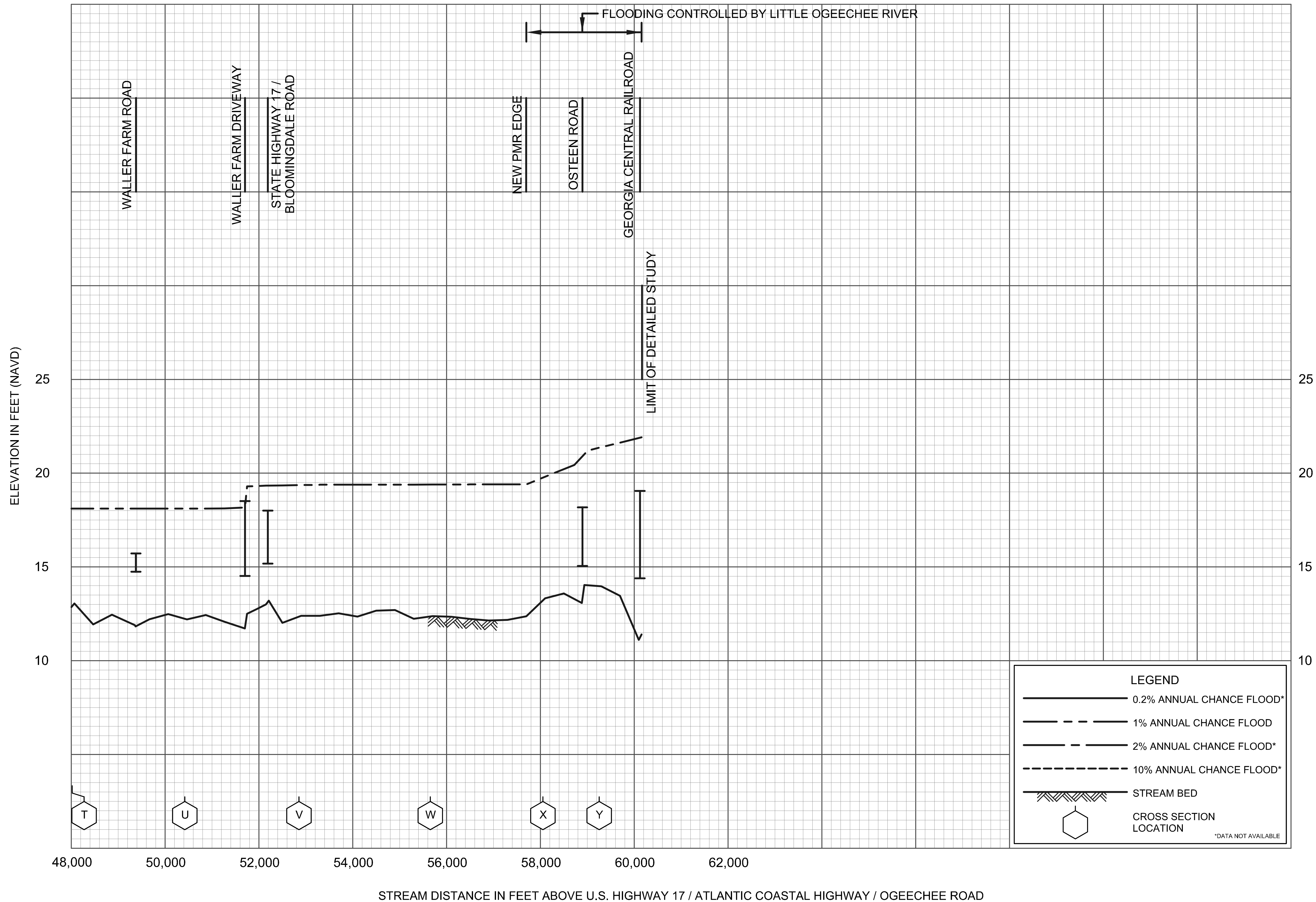
FLOOD PROFILES

HARDIN CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



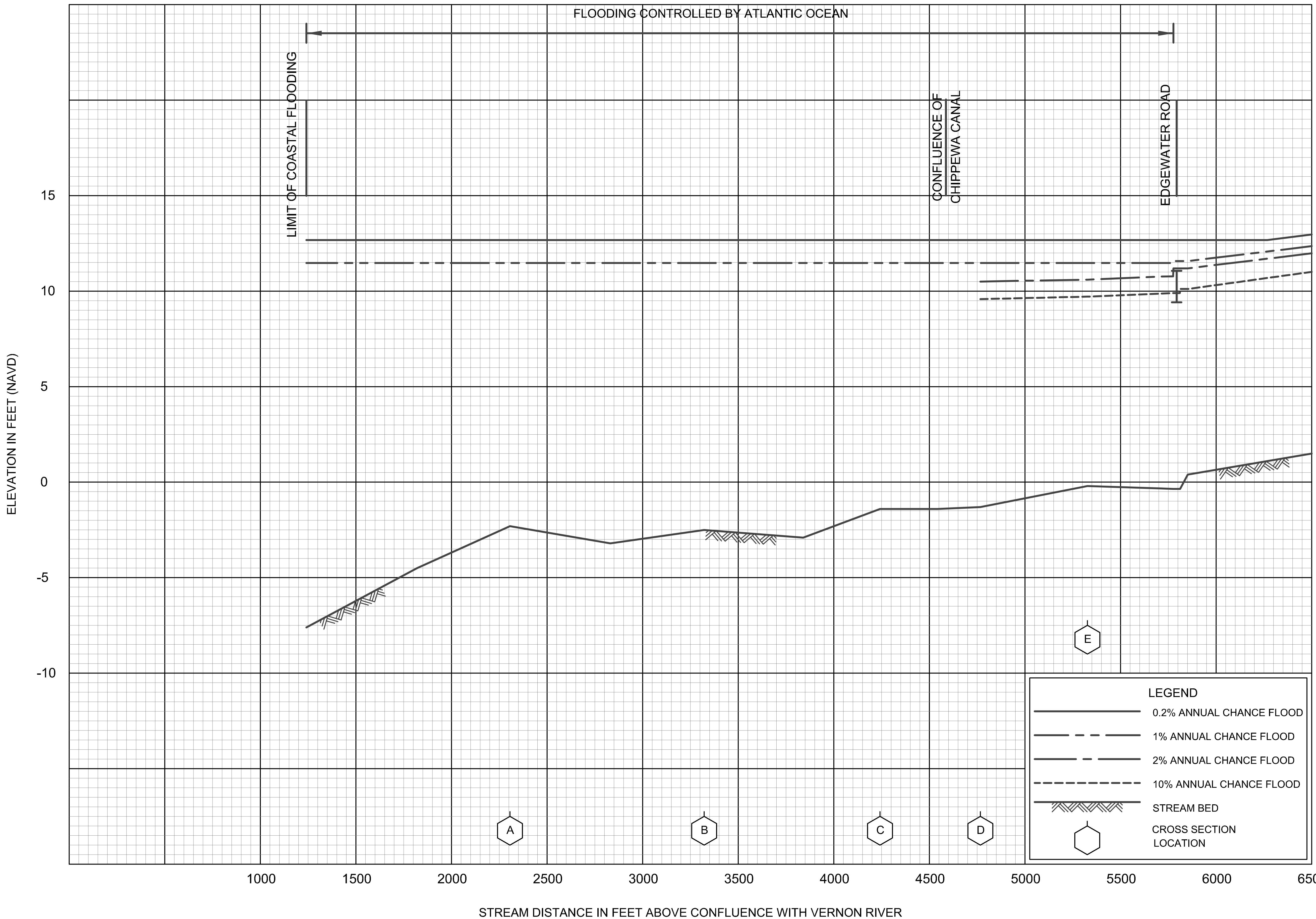
FLOOD PROFILES

HARDIN CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



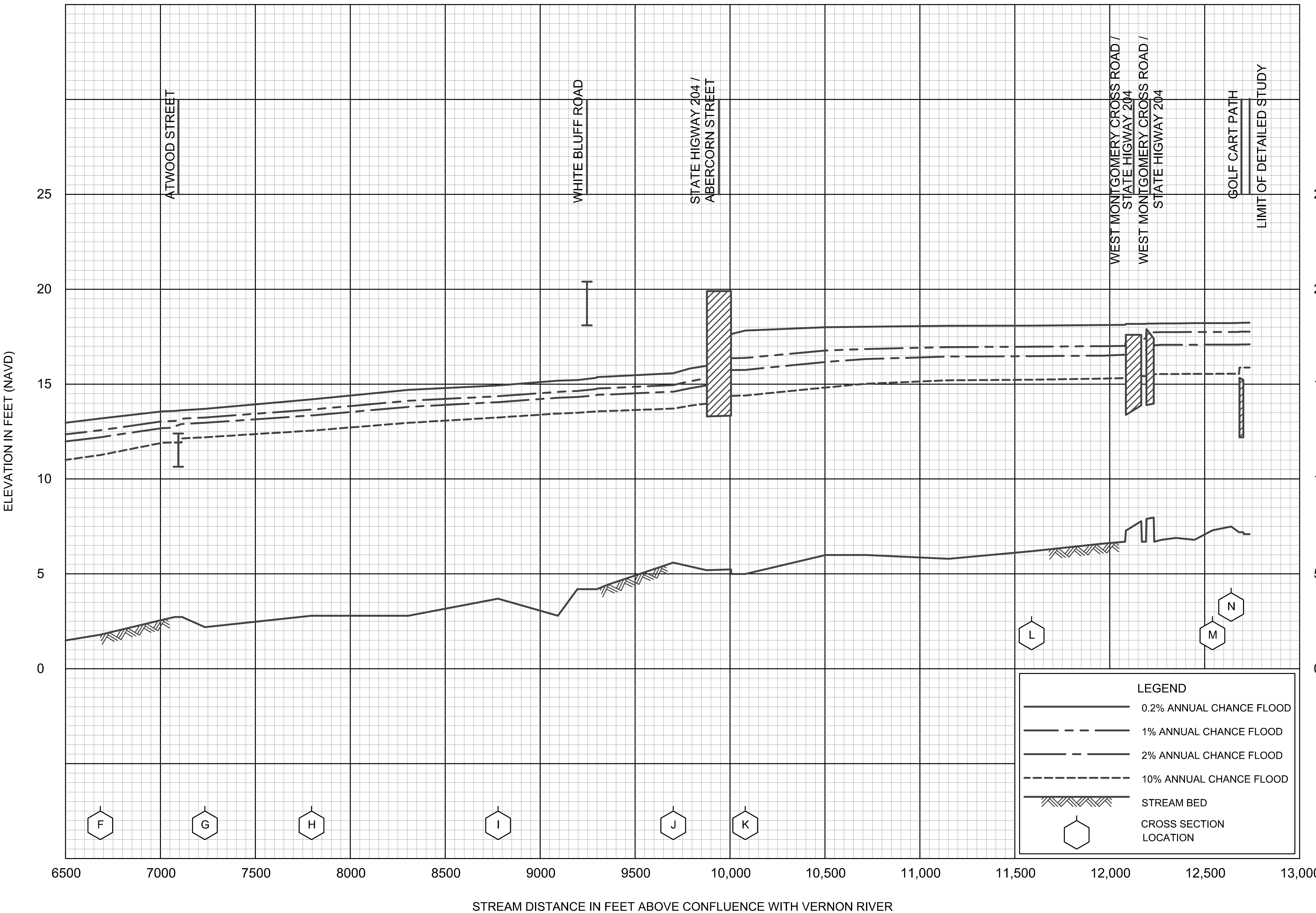
FLOOD PROFILES

HARMON CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



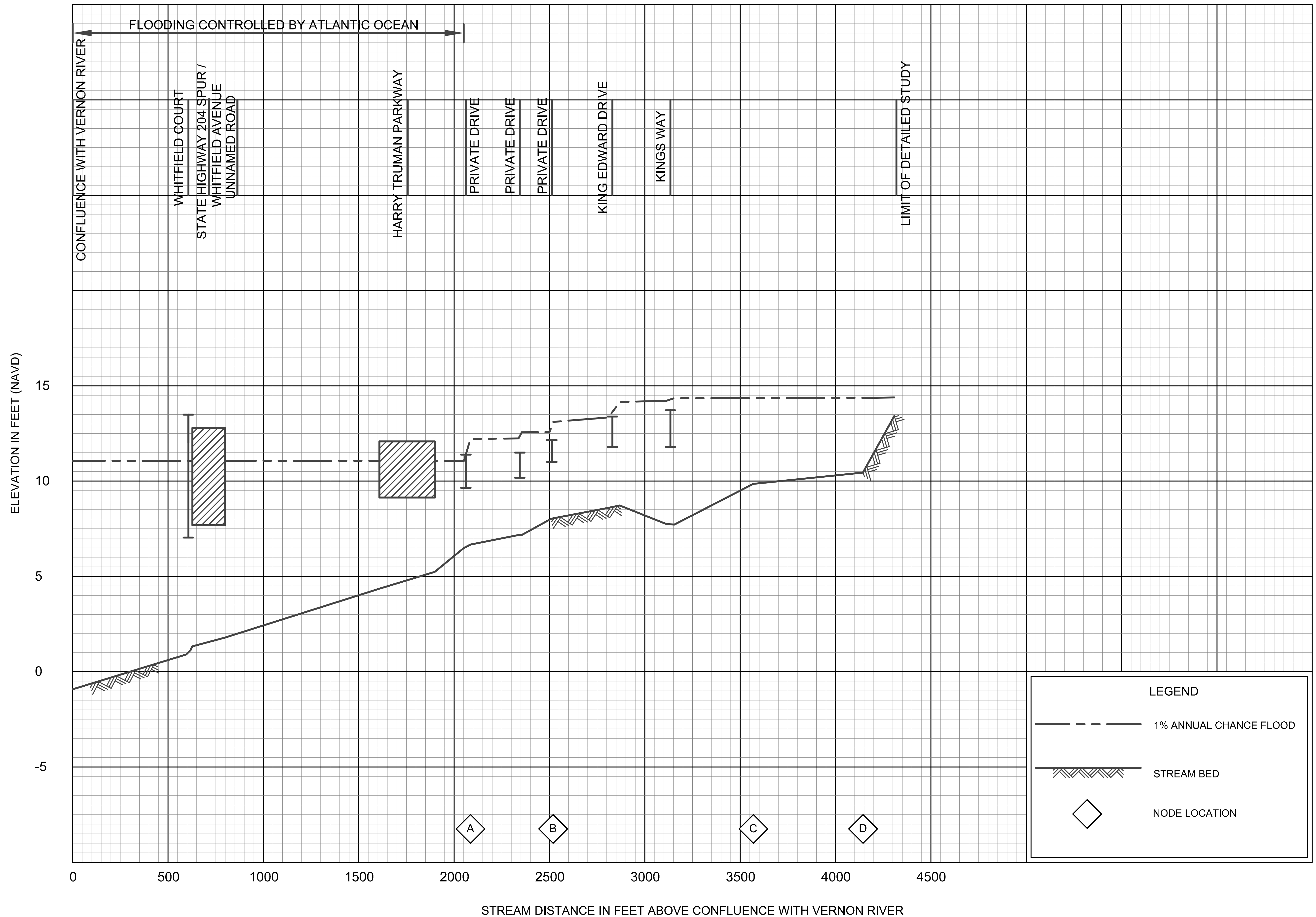
FLOOD PROFILES

HARMON CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



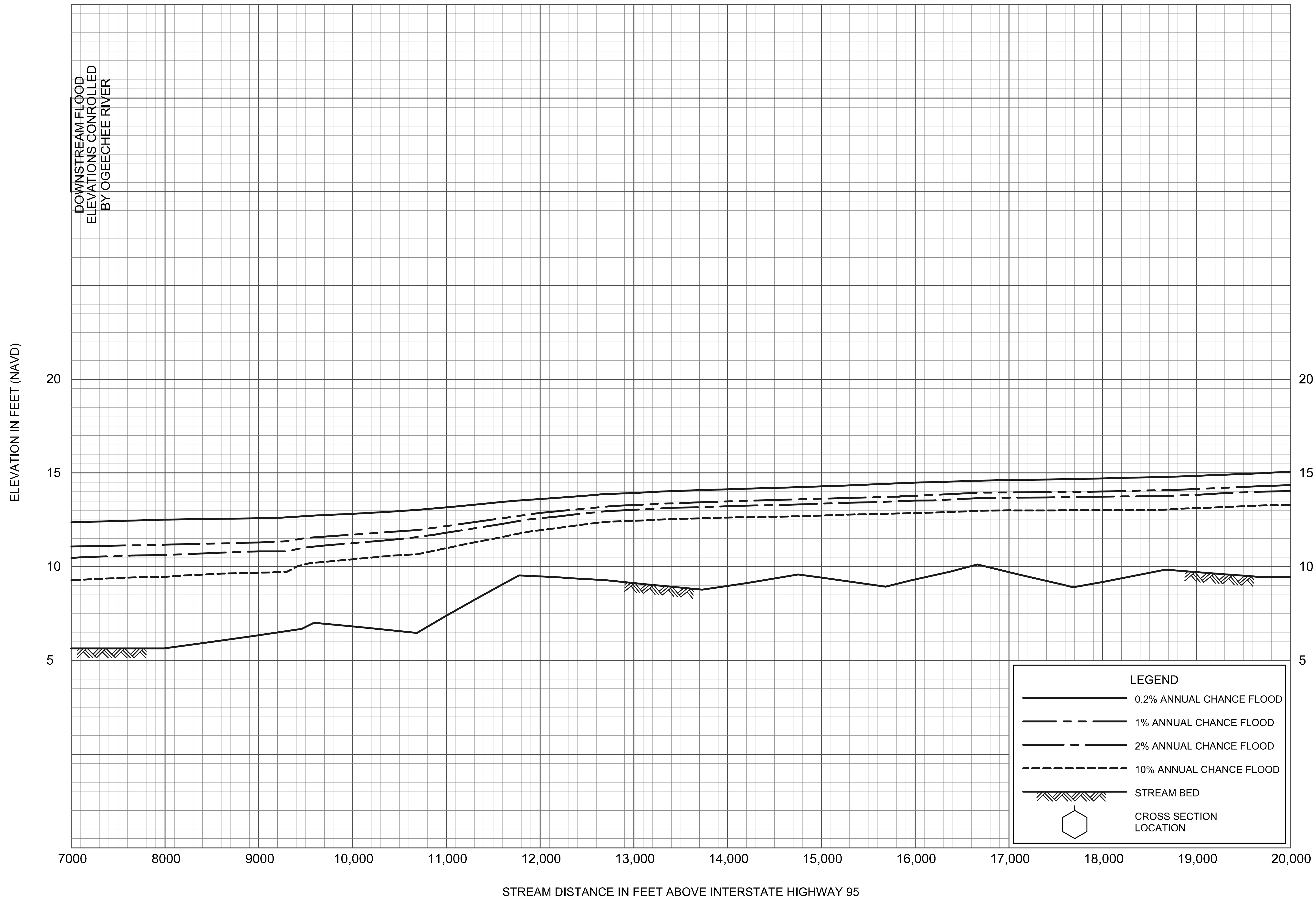
FLOOD PROFILES

KINGSWAY CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



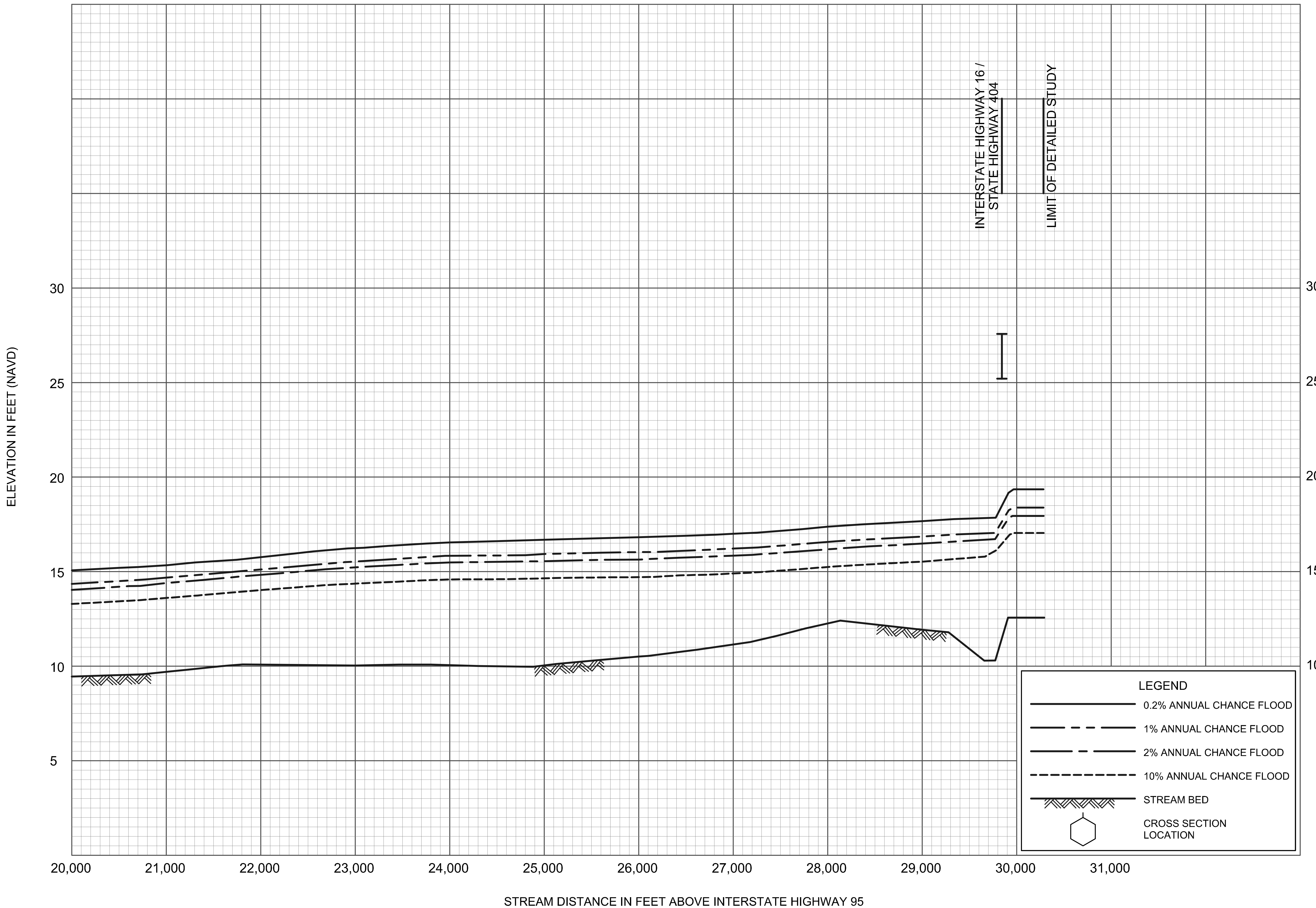
FLOOD PROFILES

LITTLE OGEECHEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



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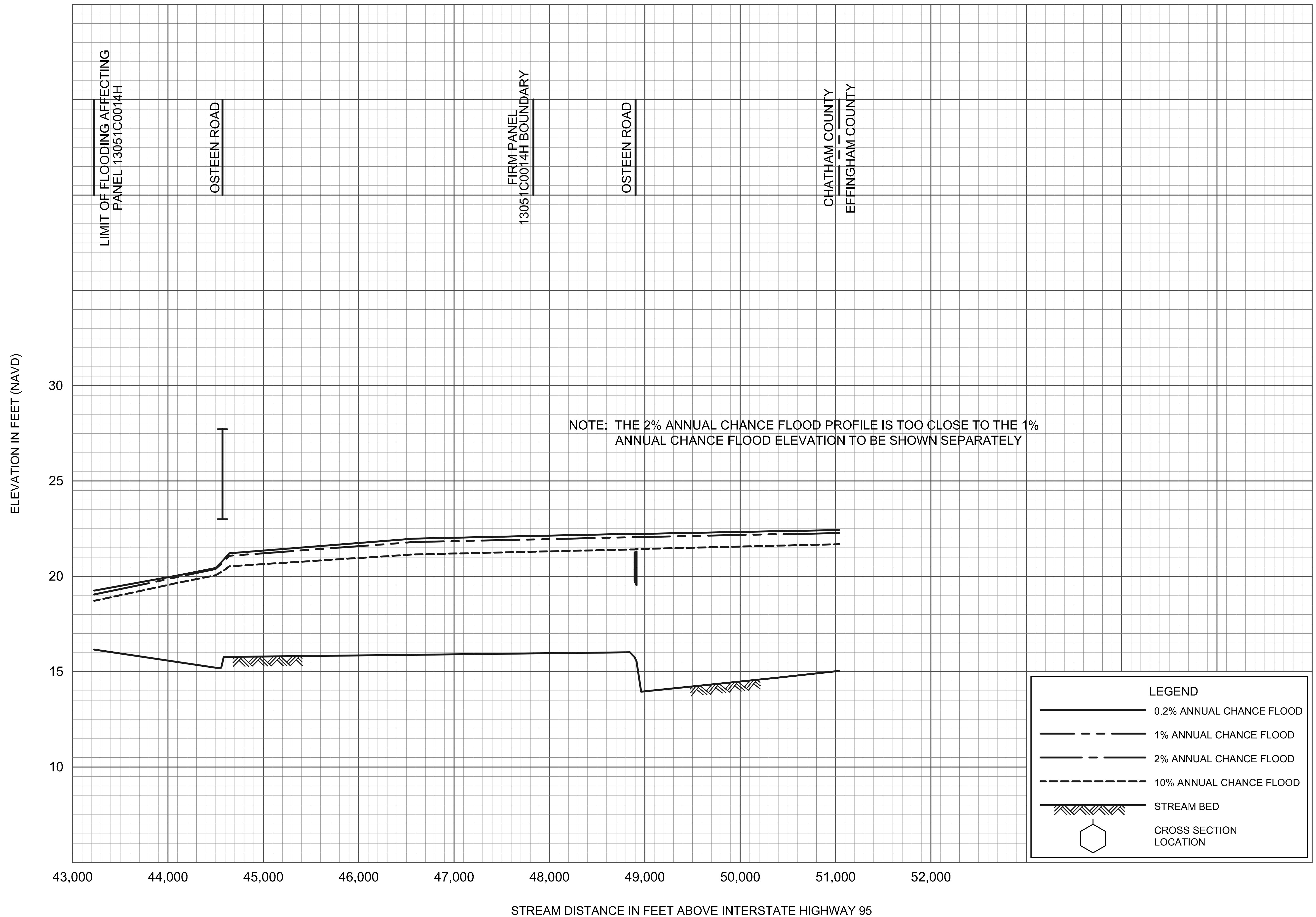
LITTLE OGEECHEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



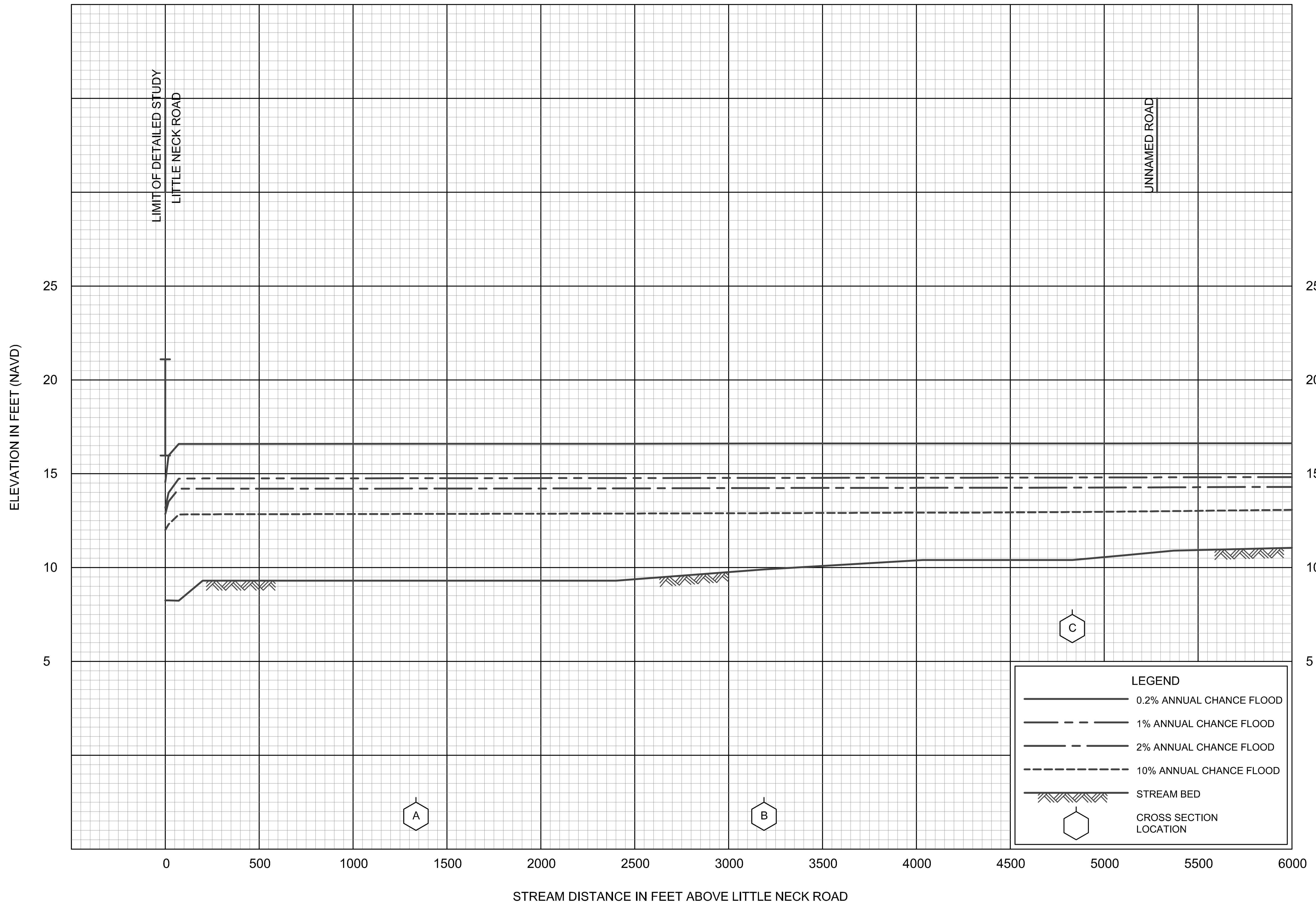
FLOOD PROFILES

LITTLE OGEECHEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



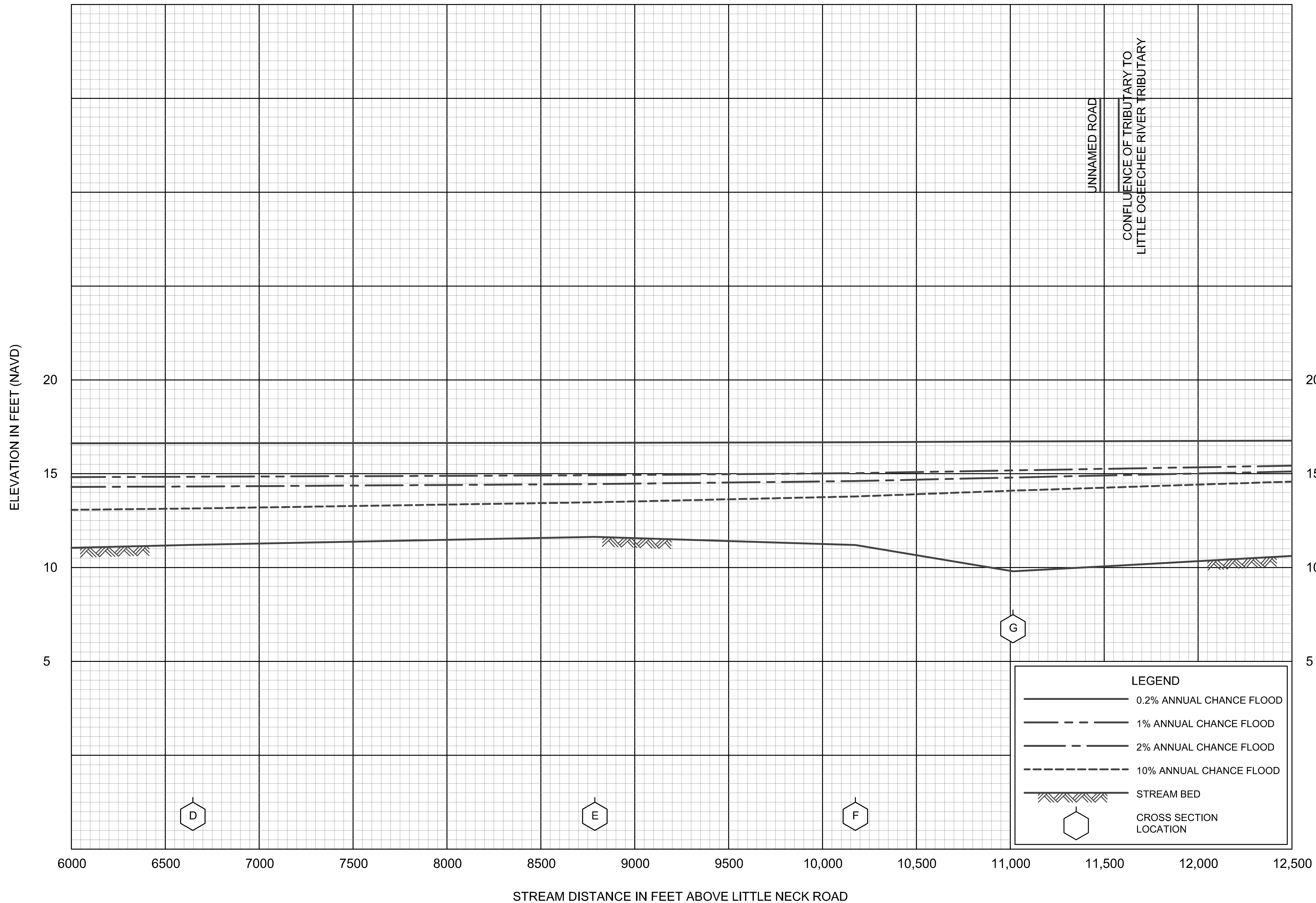
FLOOD PROFILES

LITTLE OGEECHEE RIVER TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



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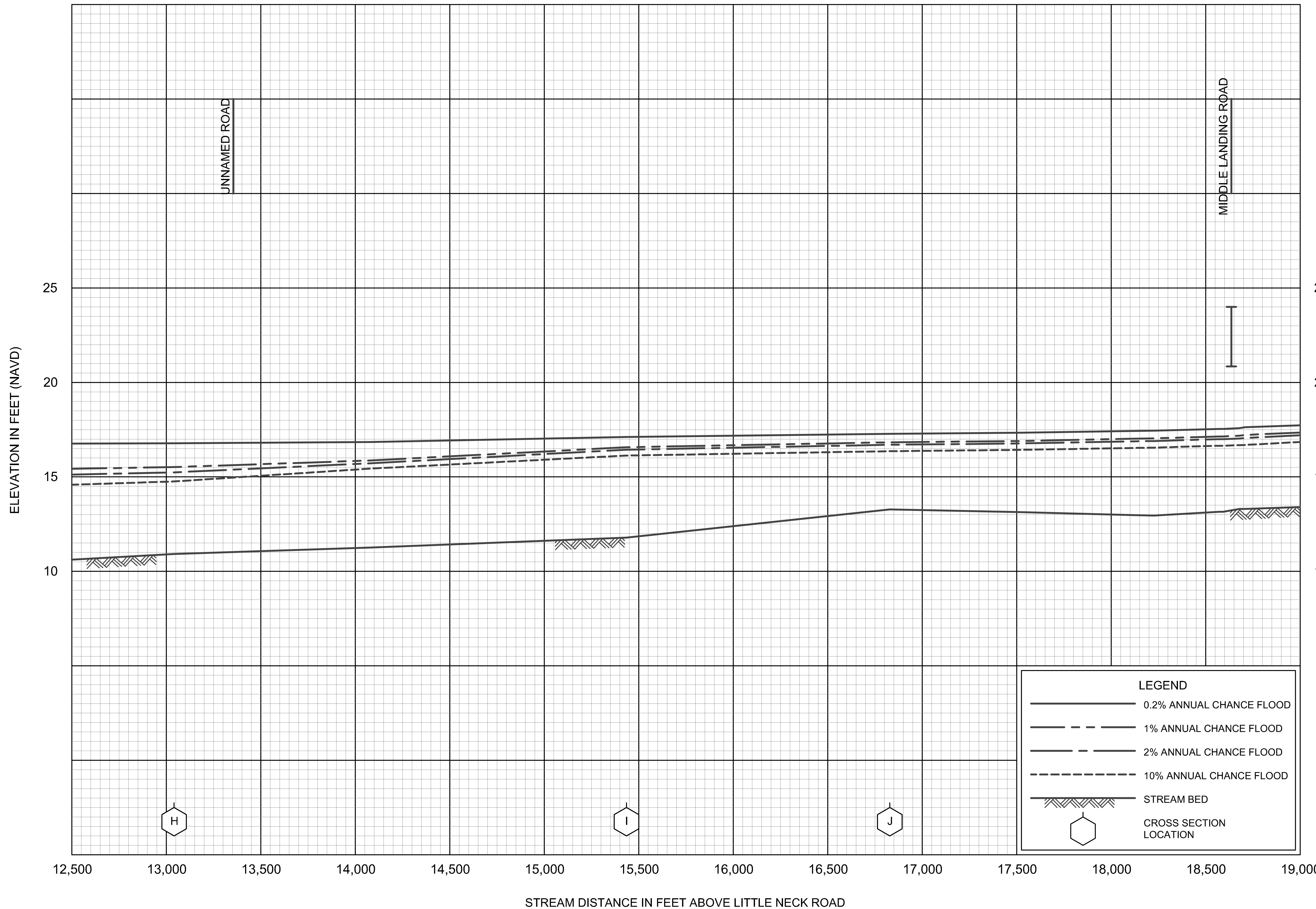
FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



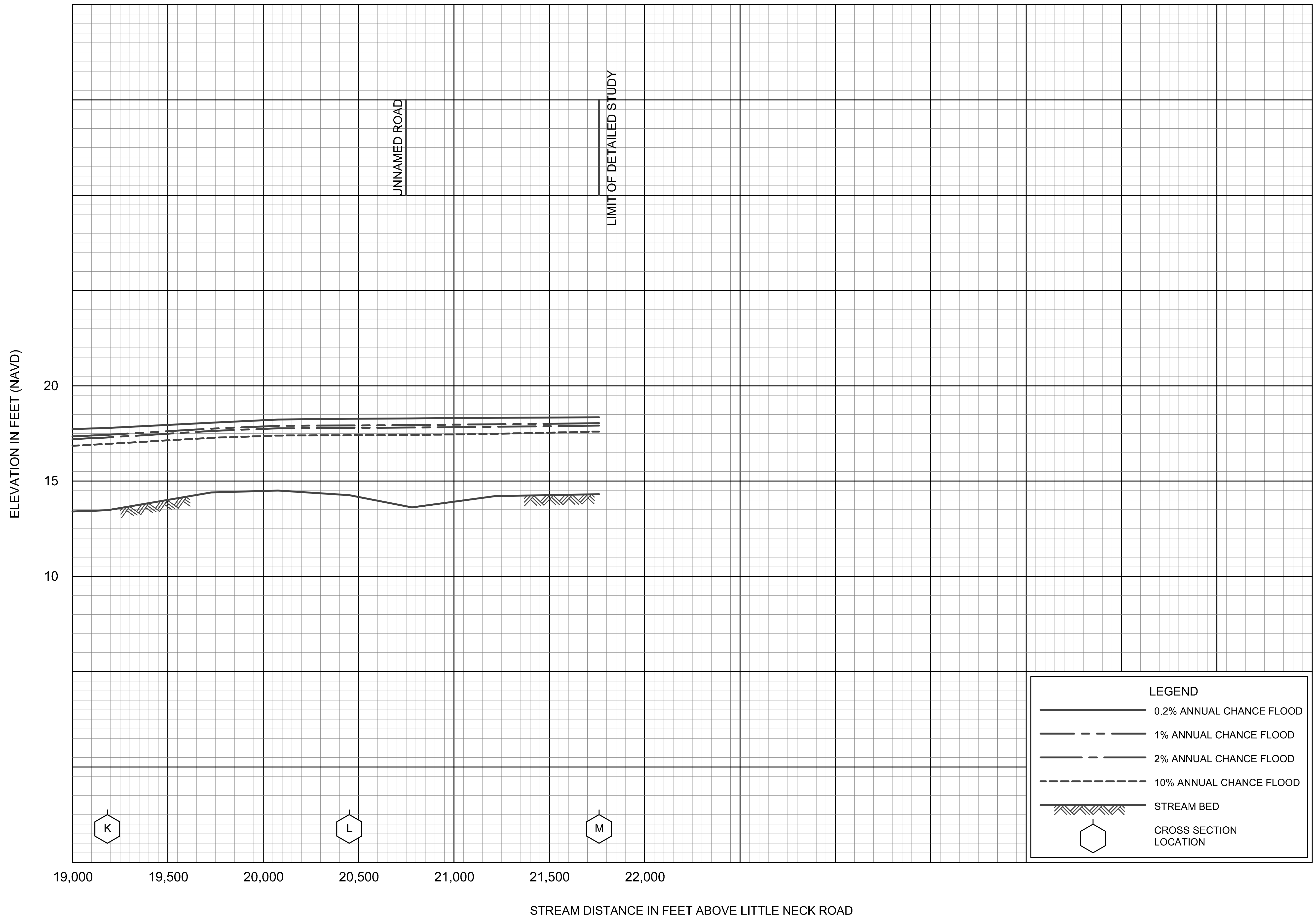
FLOOD PROFILES

LITTLE OGEECHEE RIVER TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



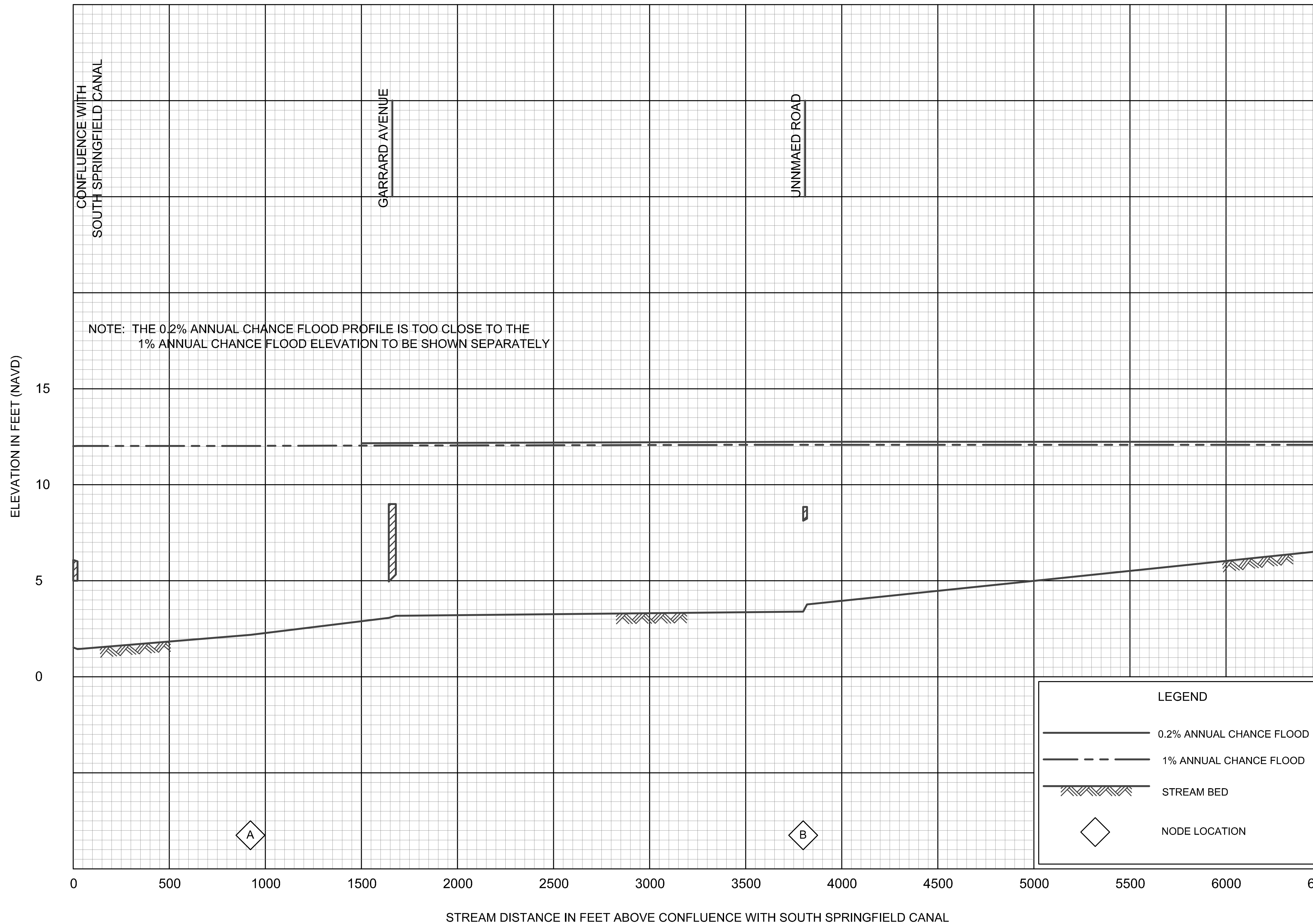
FLOOD PROFILES

LITTLE OGEECHEE RIVER TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



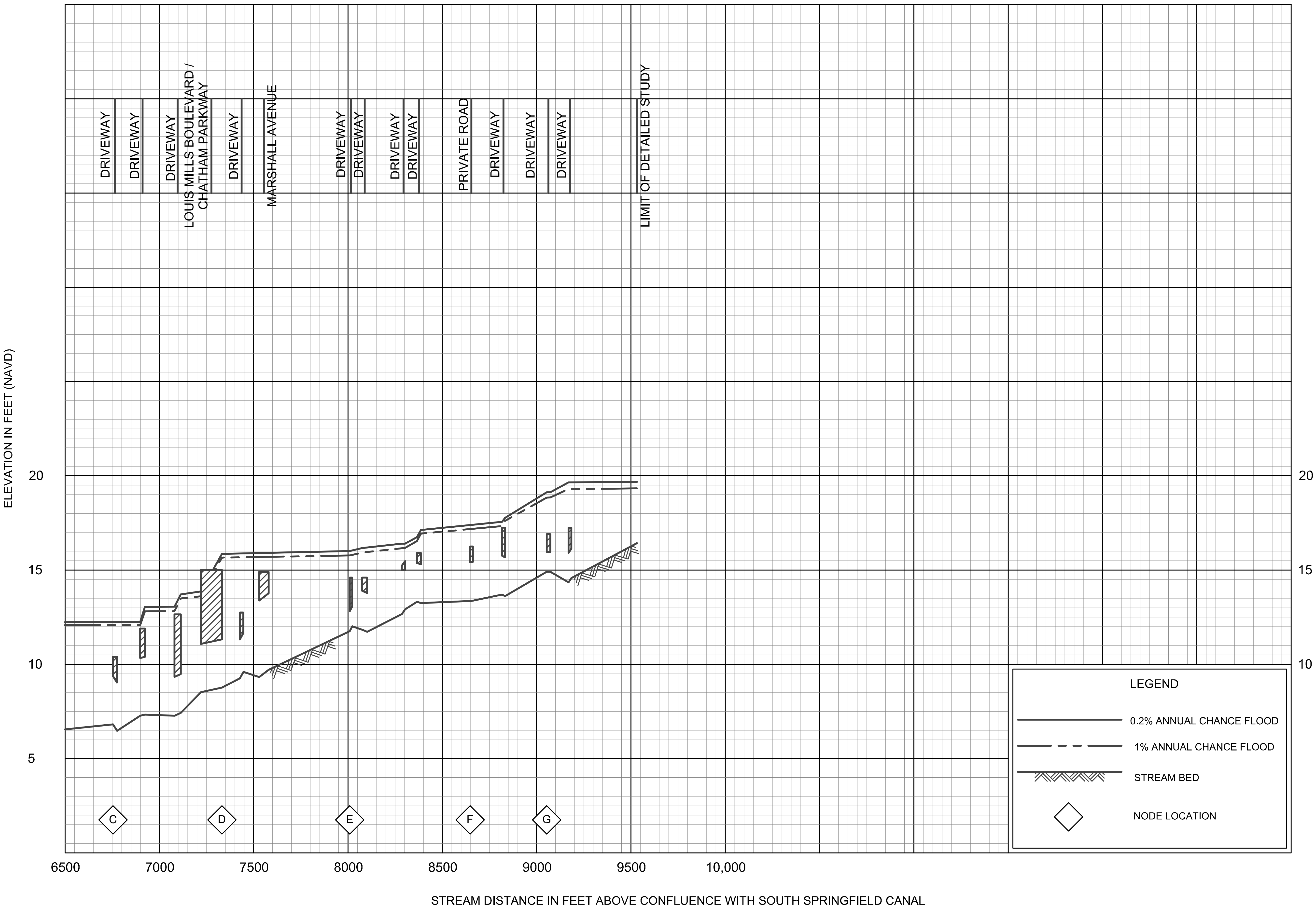
FLOOD PROFILES

LOUIS MILLS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



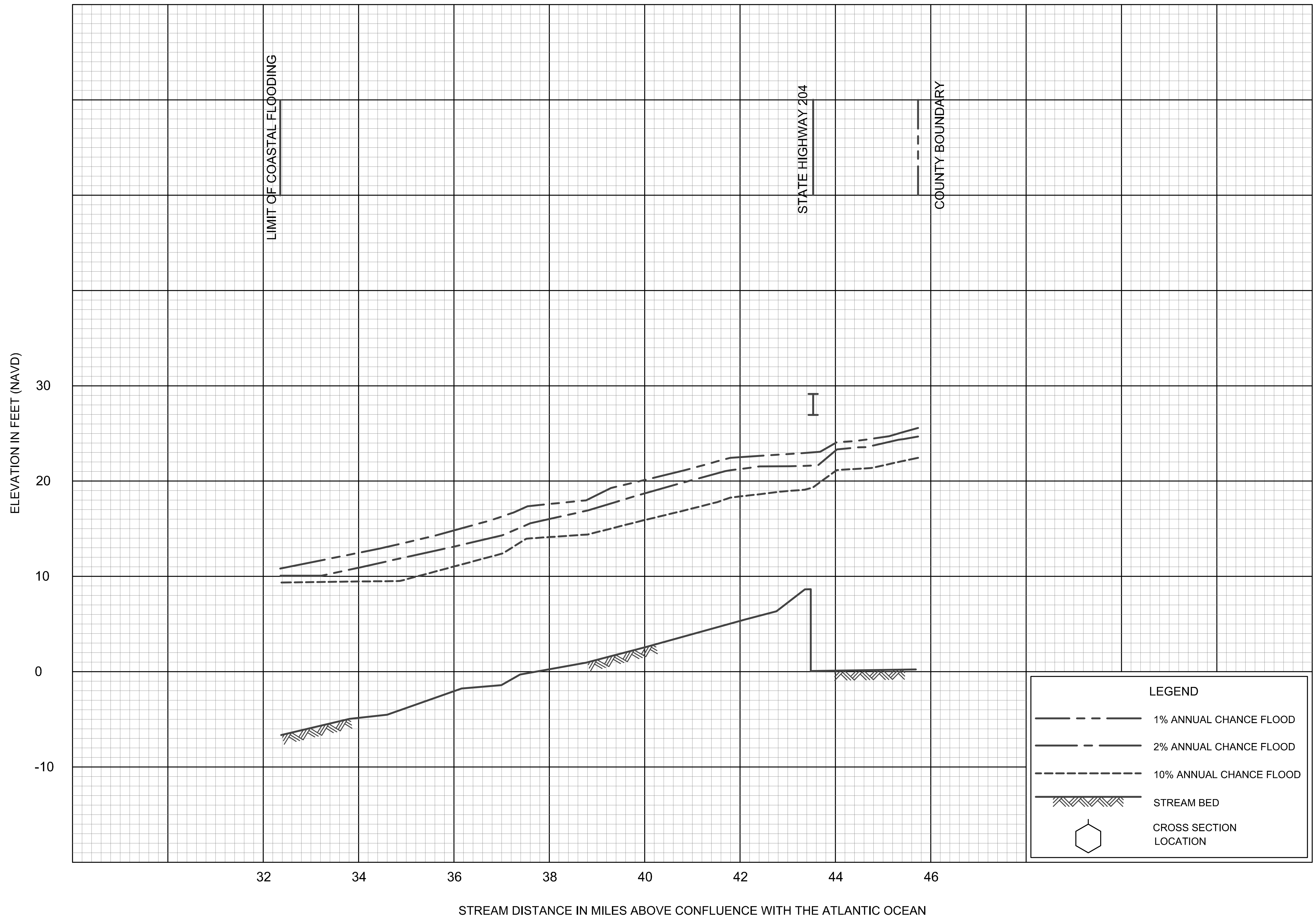
FLOOD PROFILES

LOUIS MILLS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



FLOOD PROFILES

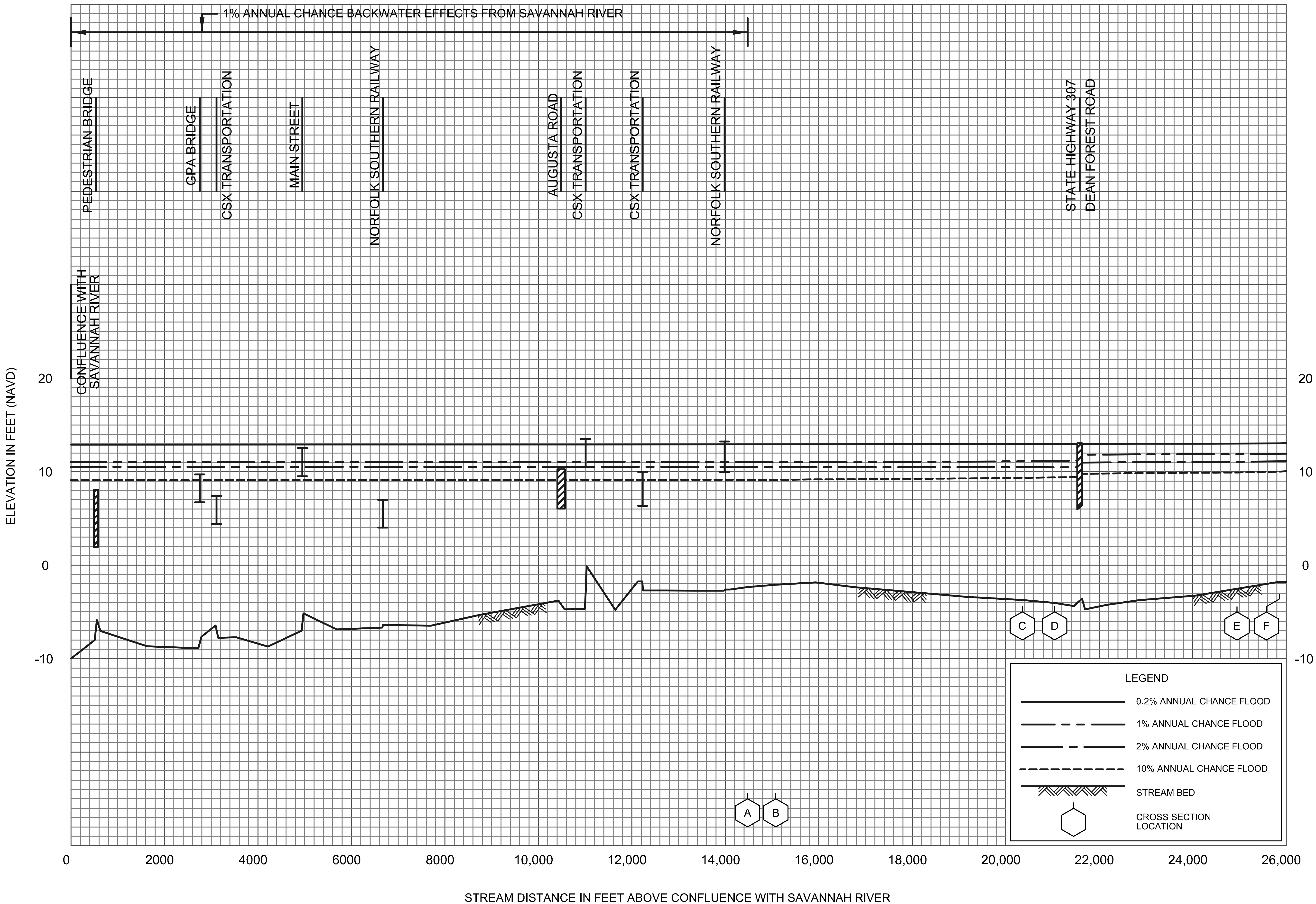
OGEECHEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS

29P



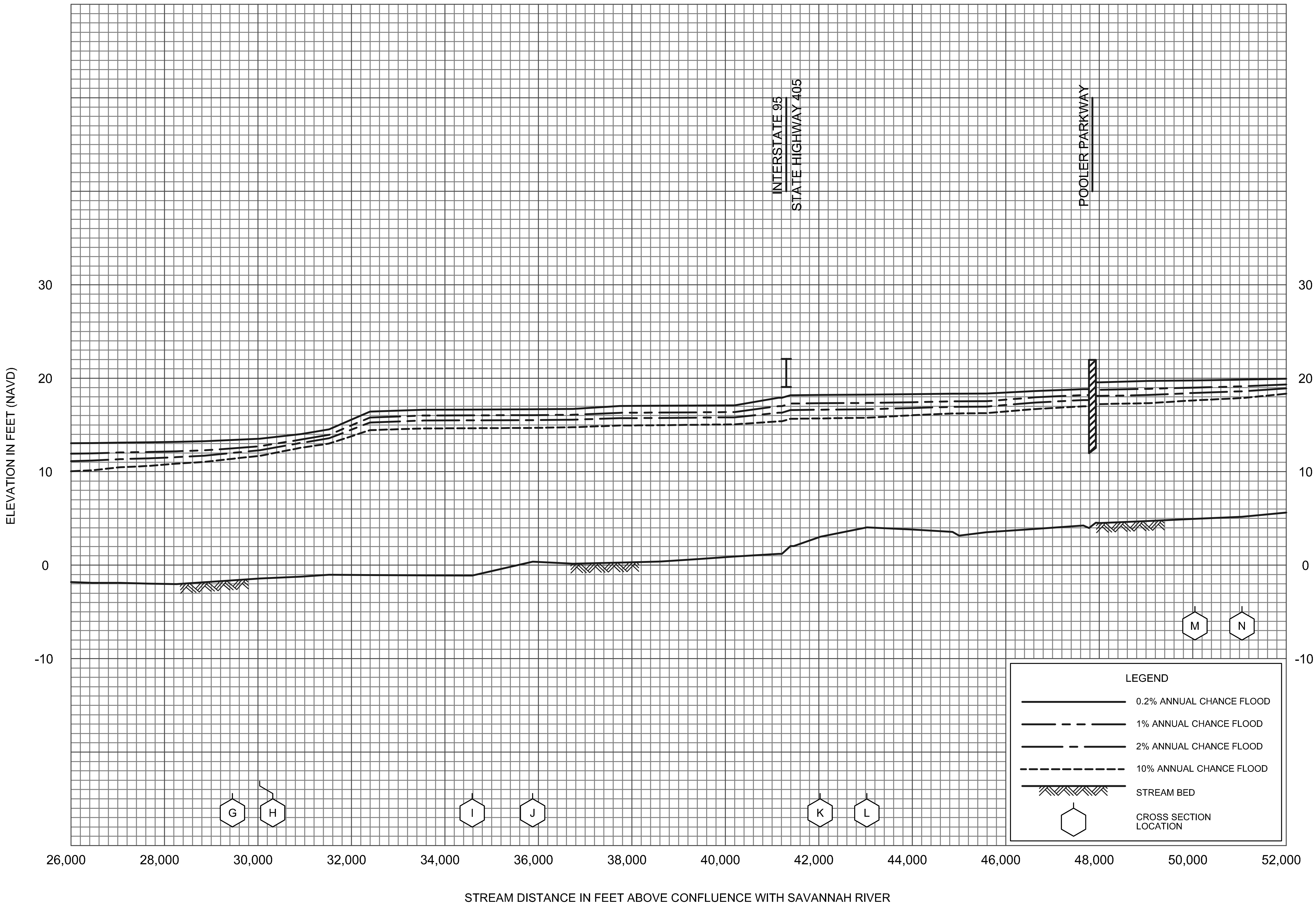
FLOOD PROFILES

PIPE MAKERS CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



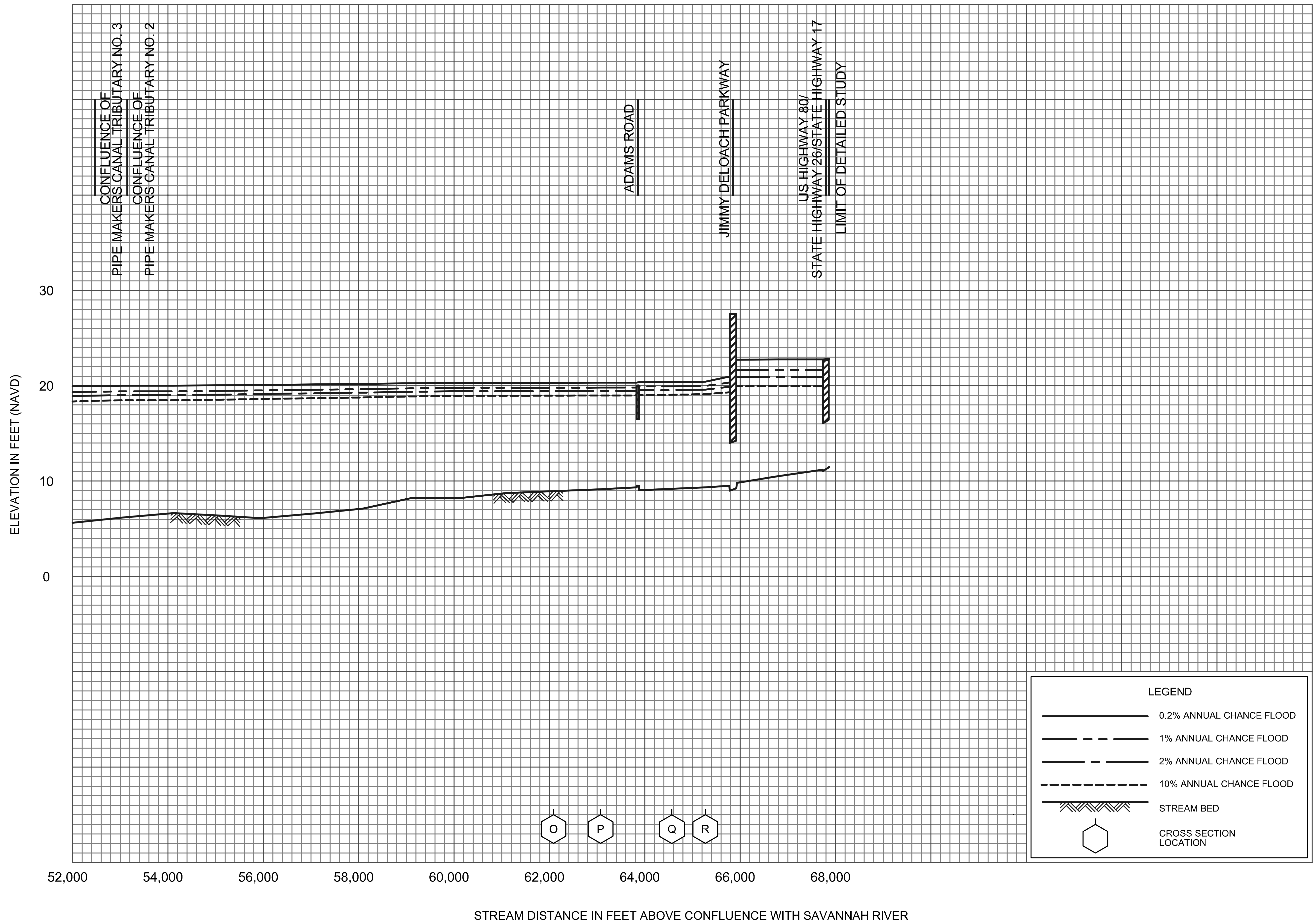
FLOOD PROFILES

PIPE MAKERS CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



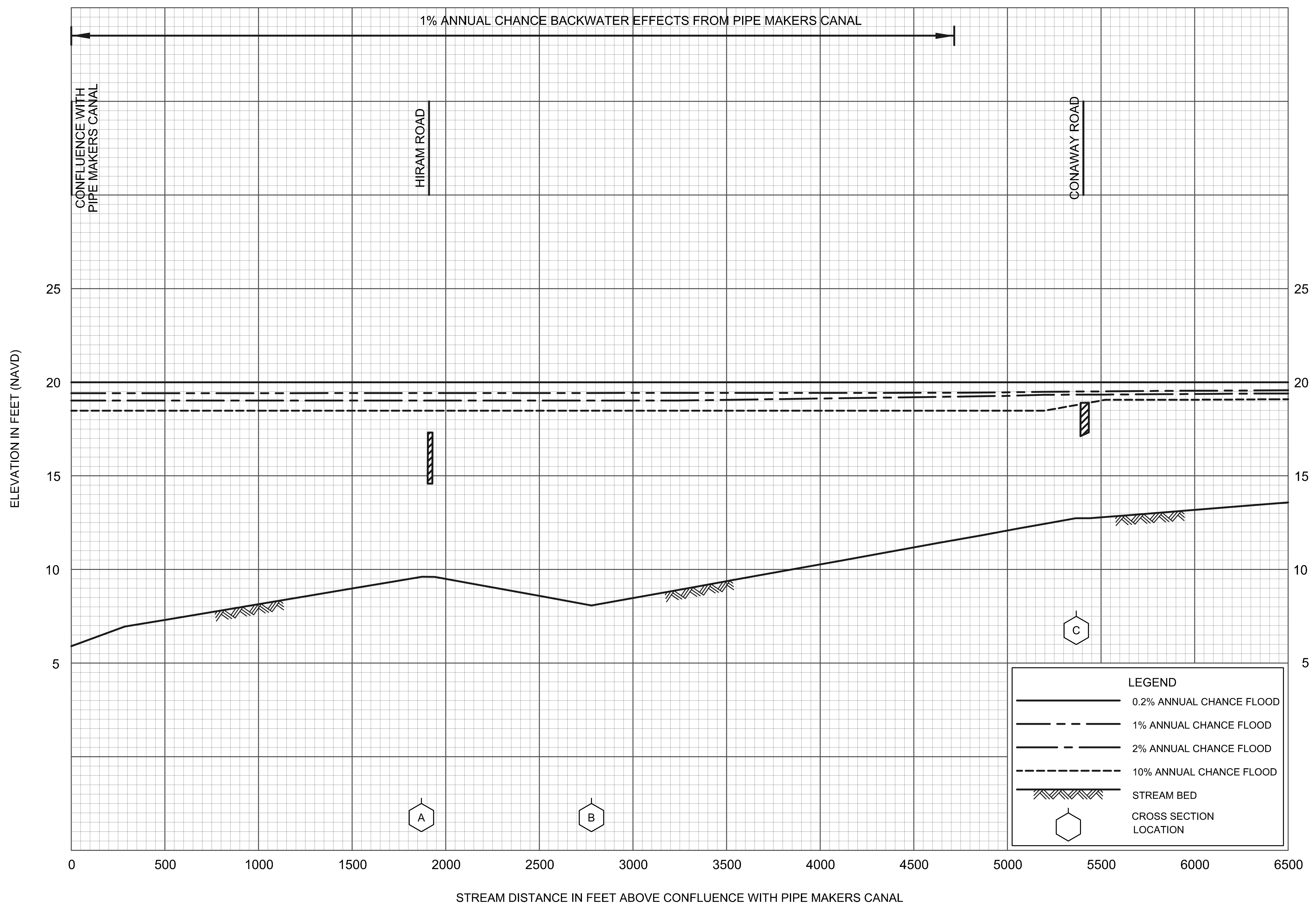
FLOOD PROFILES

PIPE MAKERS CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



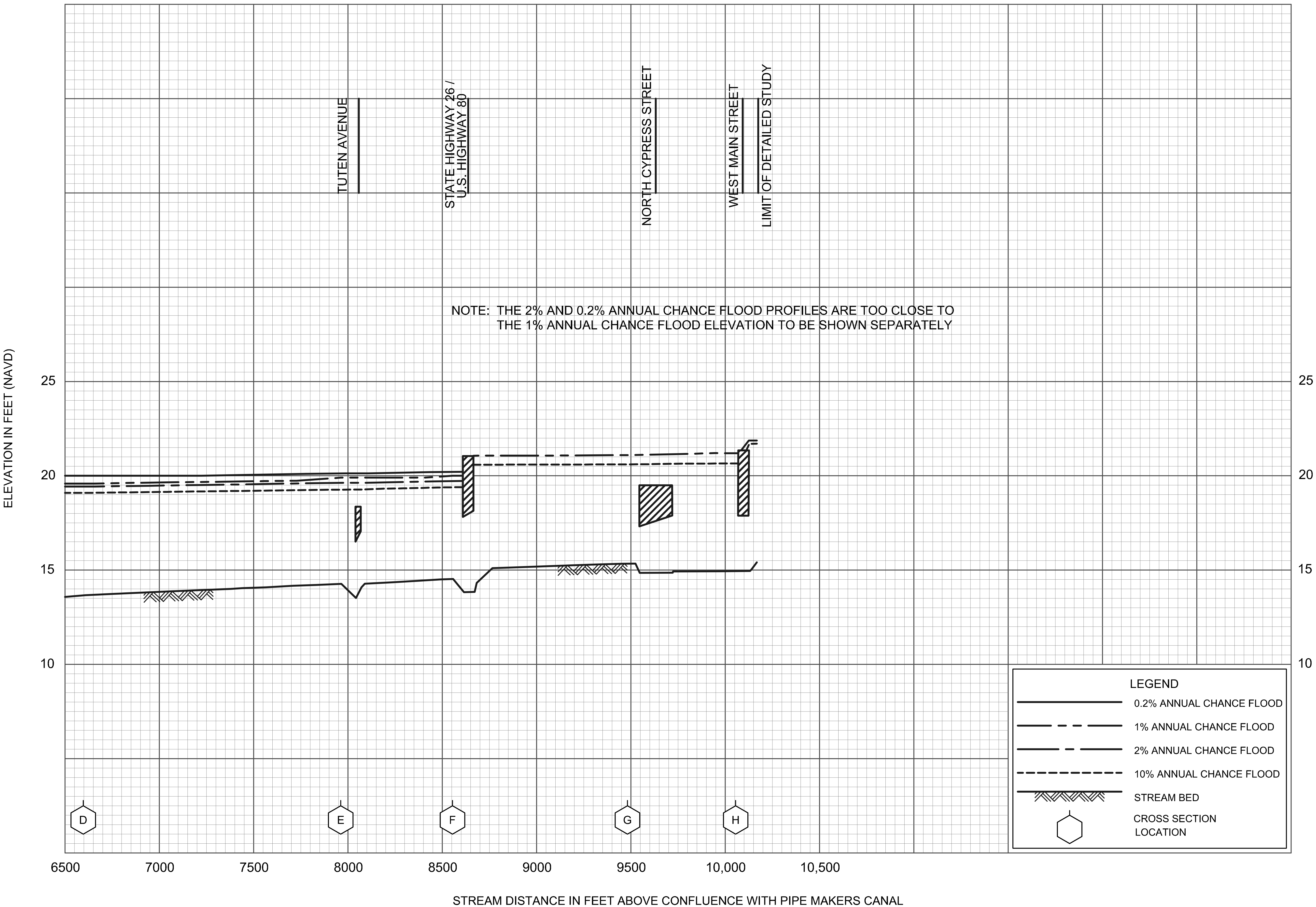
FLOOD PROFILES

PIPE MAKERS CANAL TRIBUTARY NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



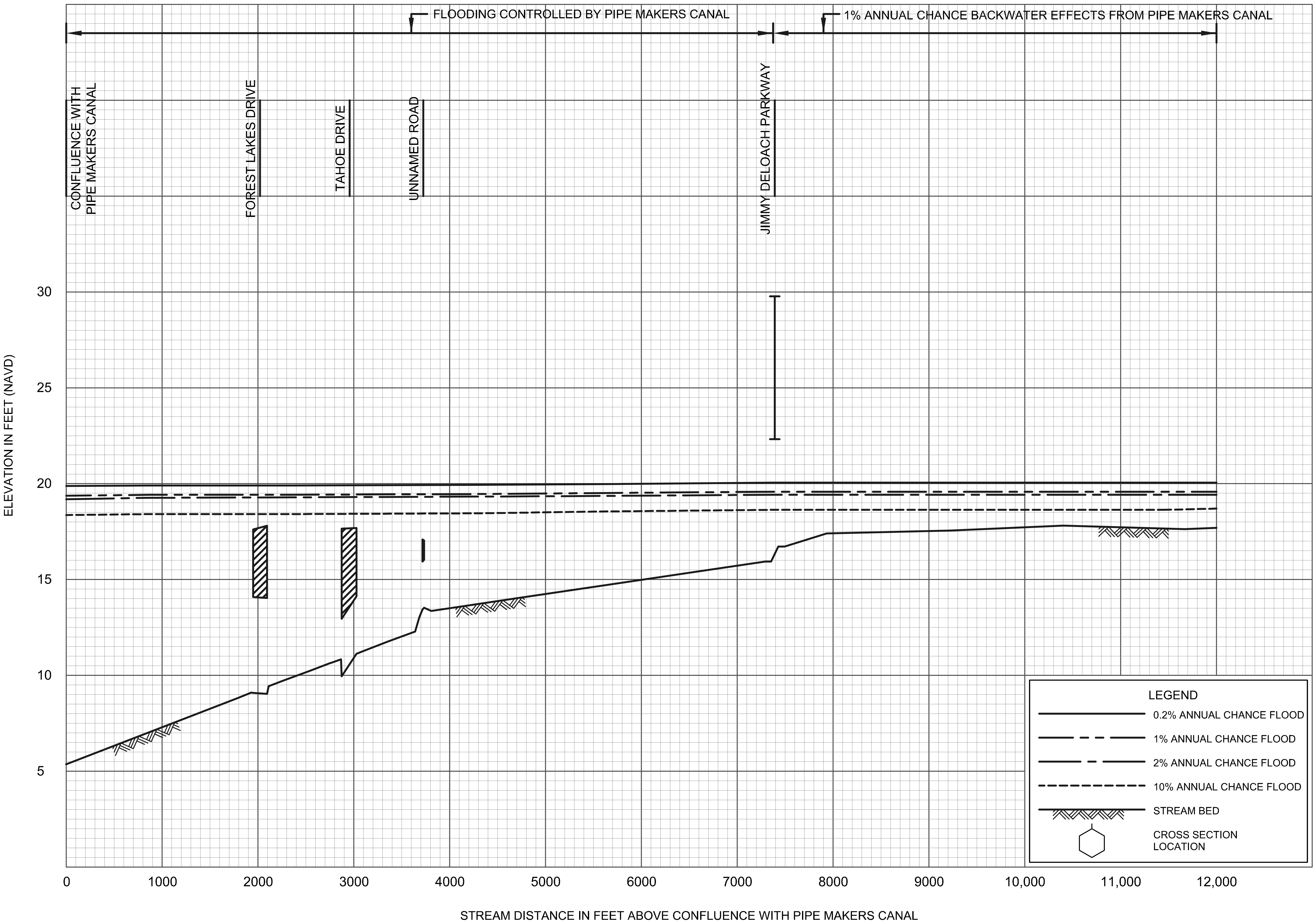
FLOOD PROFILES

PIPE MAKERS CANAL TRIBUTARY NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



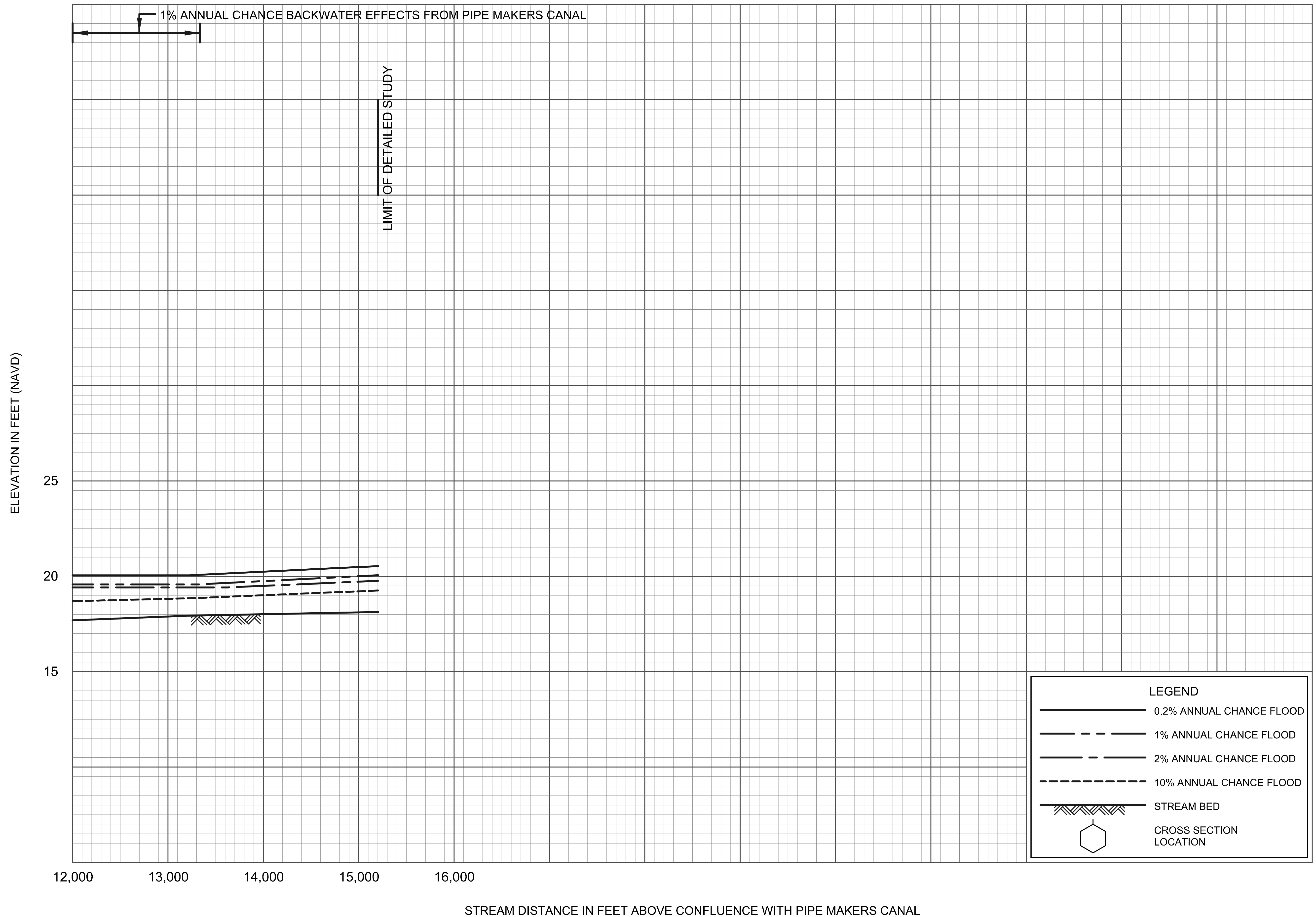
FLOOD PROFILES

PIPE MAKERS CANAL TRIBUTARY NO. 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



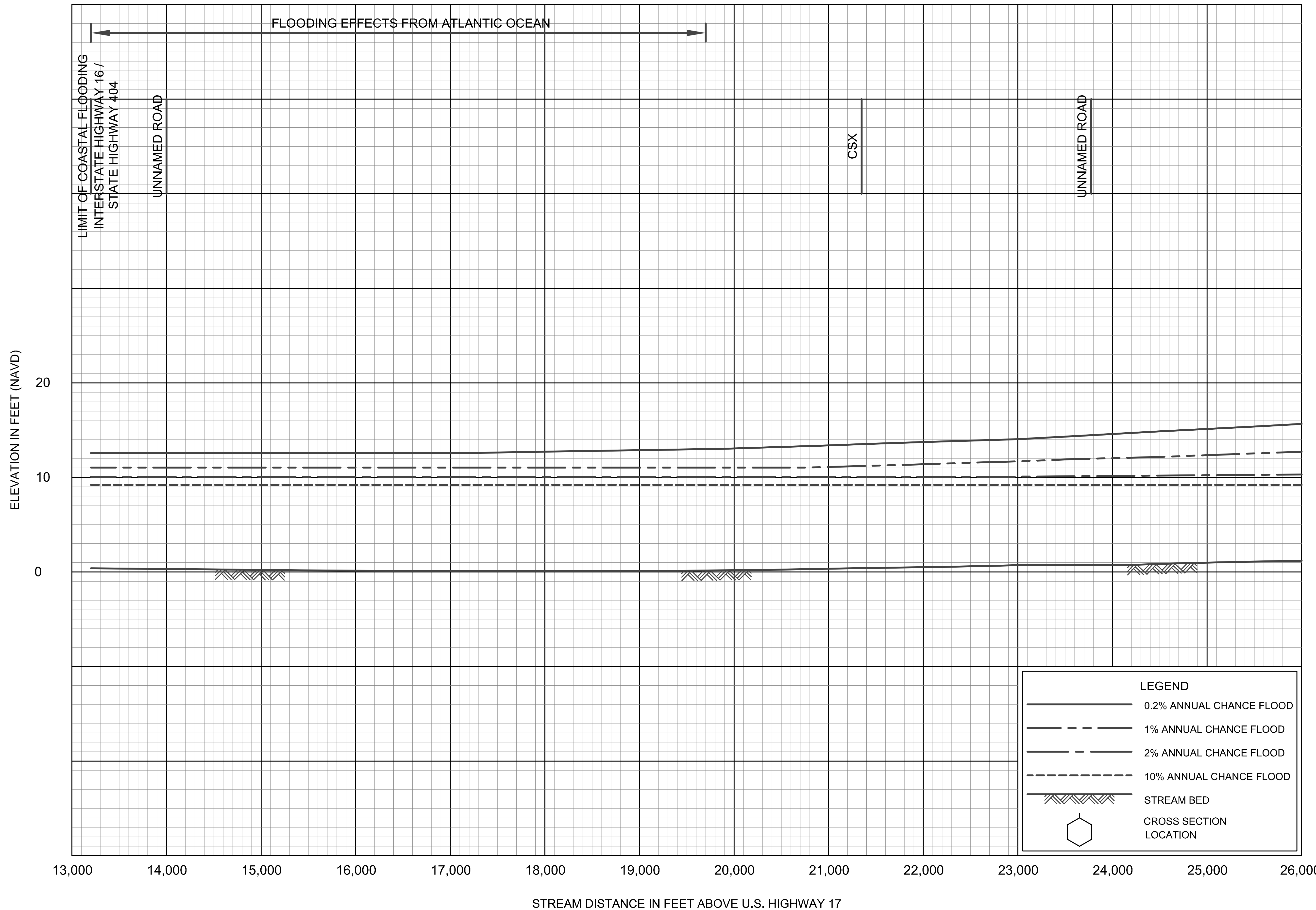
FLOOD PROFILES

PIPE MAKERS CANAL TRIBUTARY NO. 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



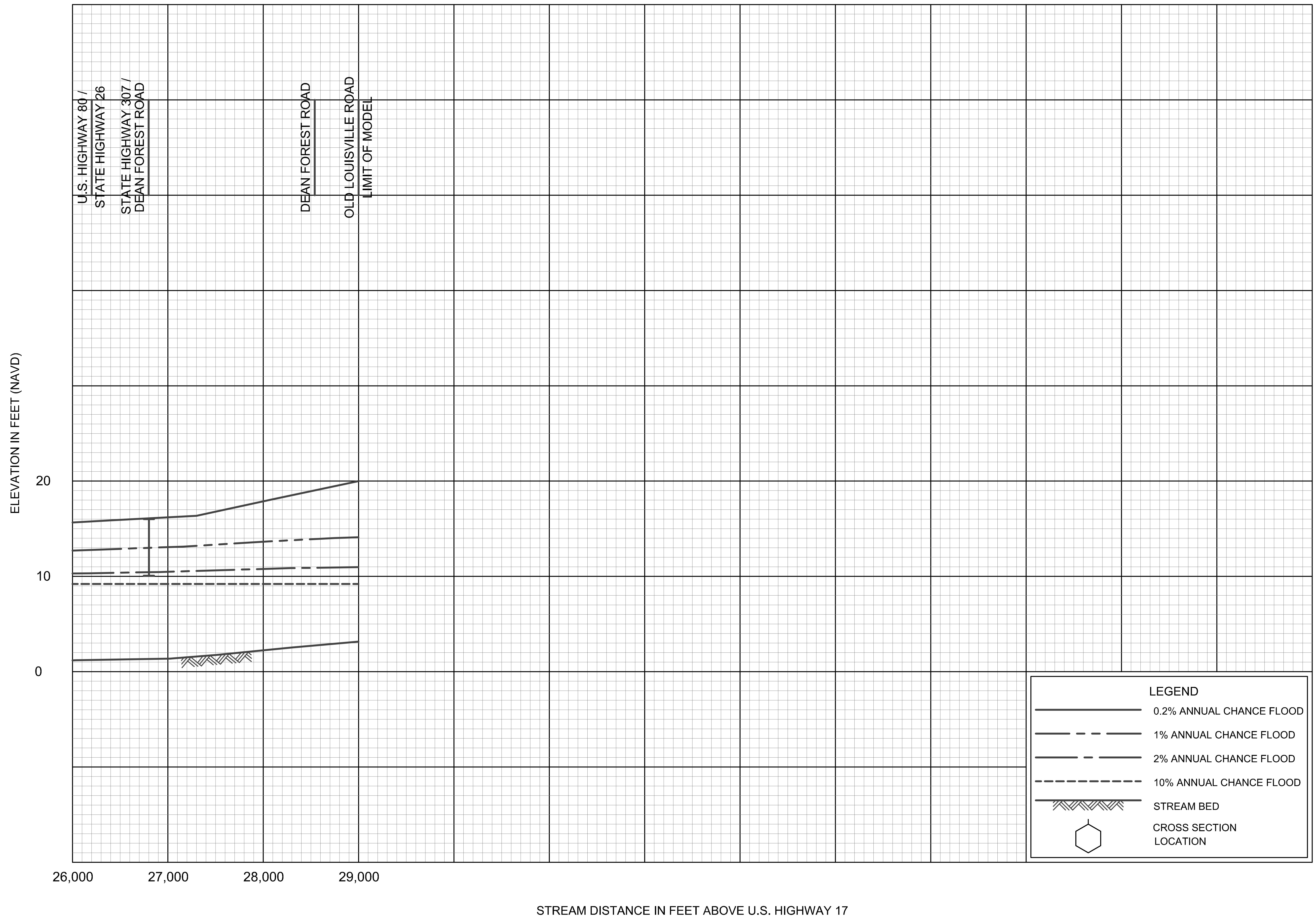
FLOOD PROFILES

SALT CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



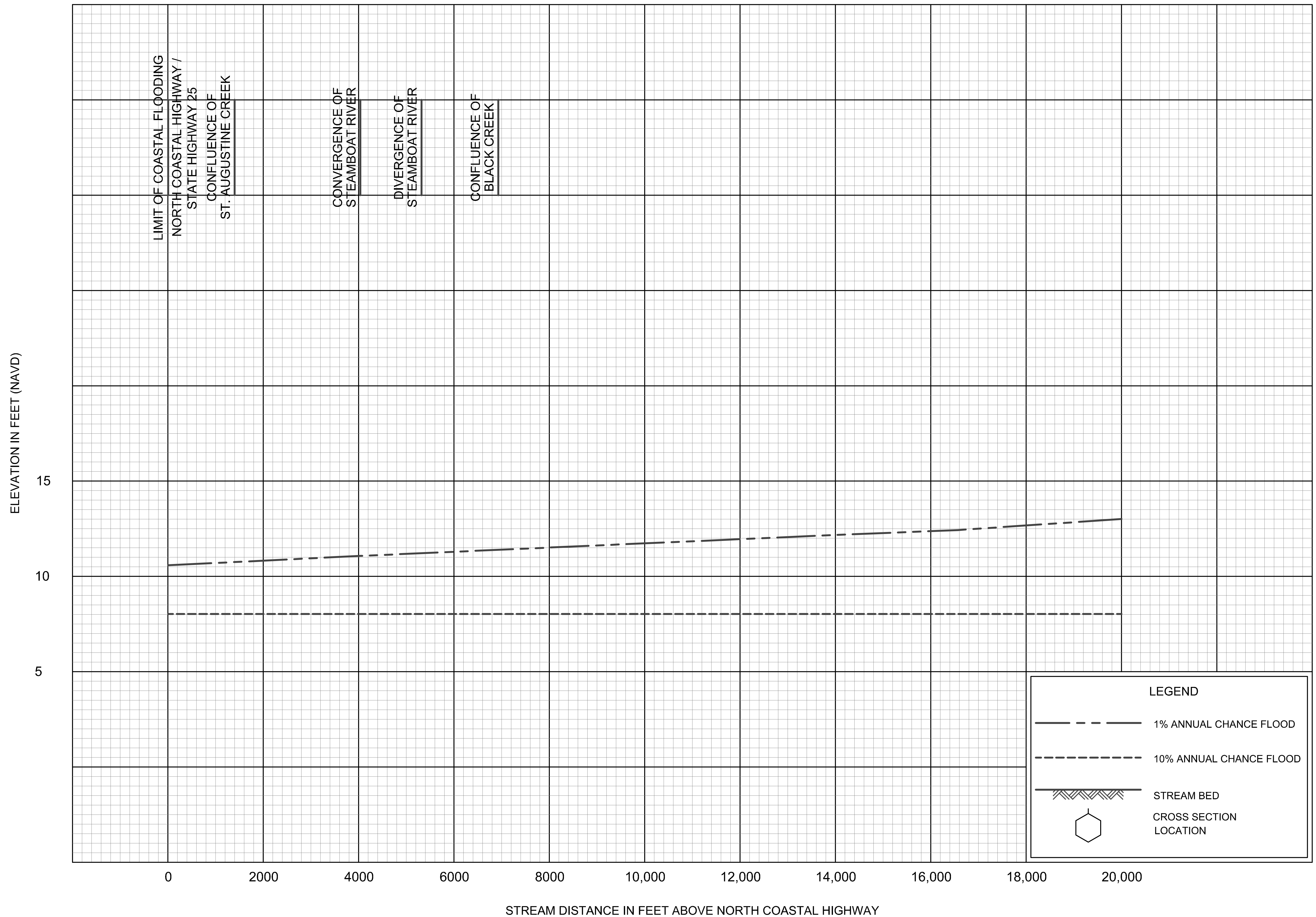
FLOOD PROFILES

SALT CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



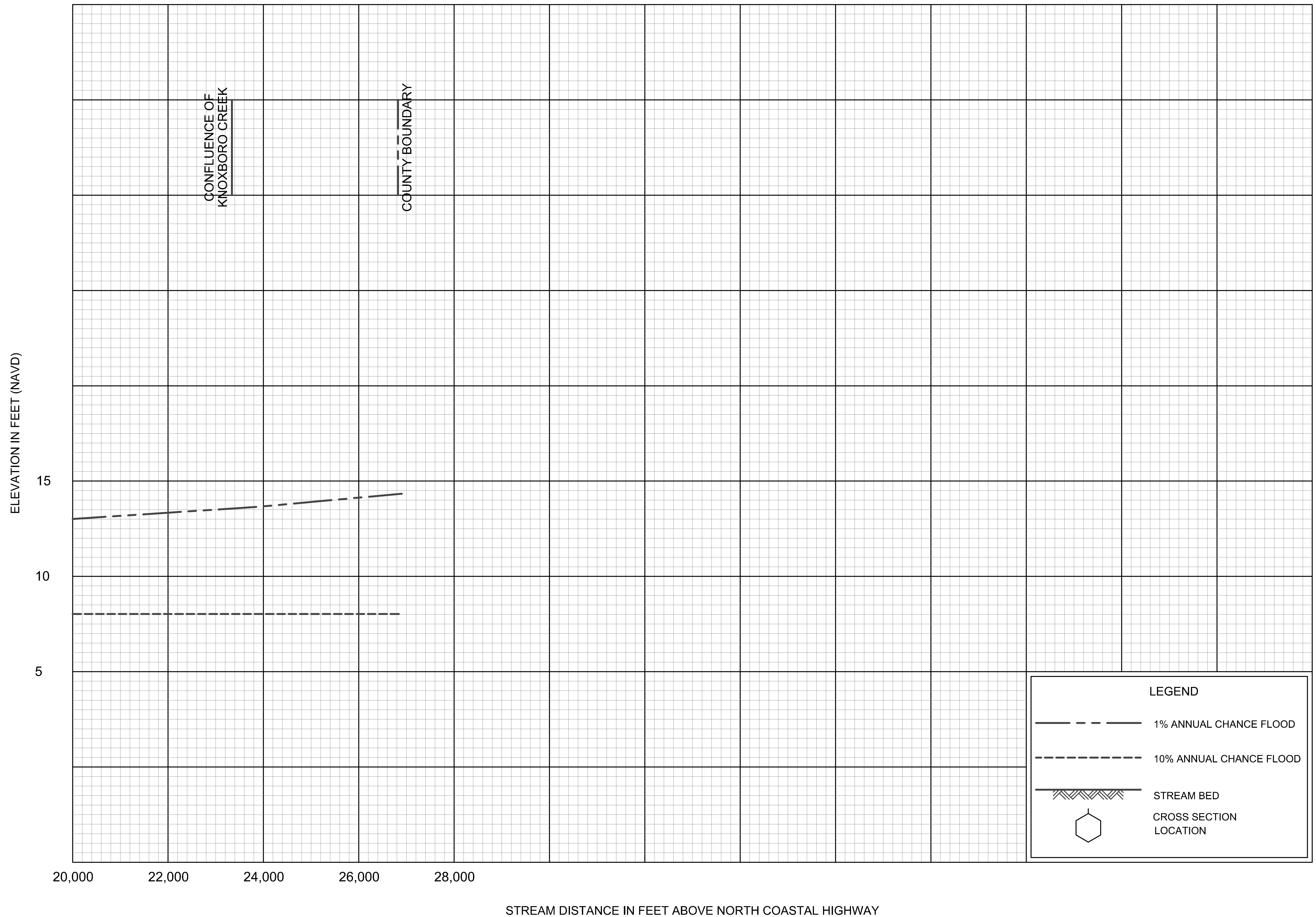
FLOOD PROFILES

SAVANNAH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



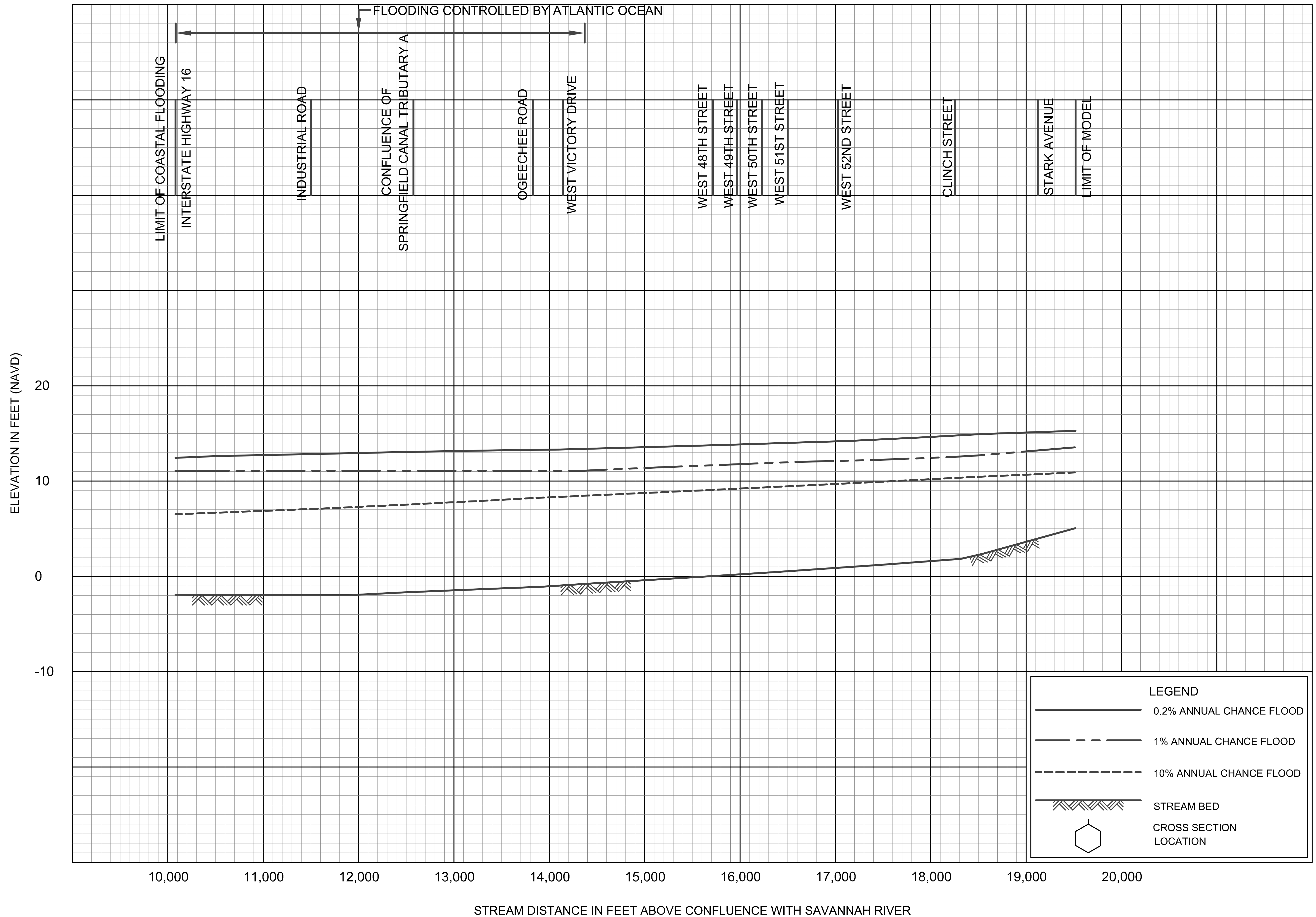
FLOOD PROFILES

SAVANNAH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



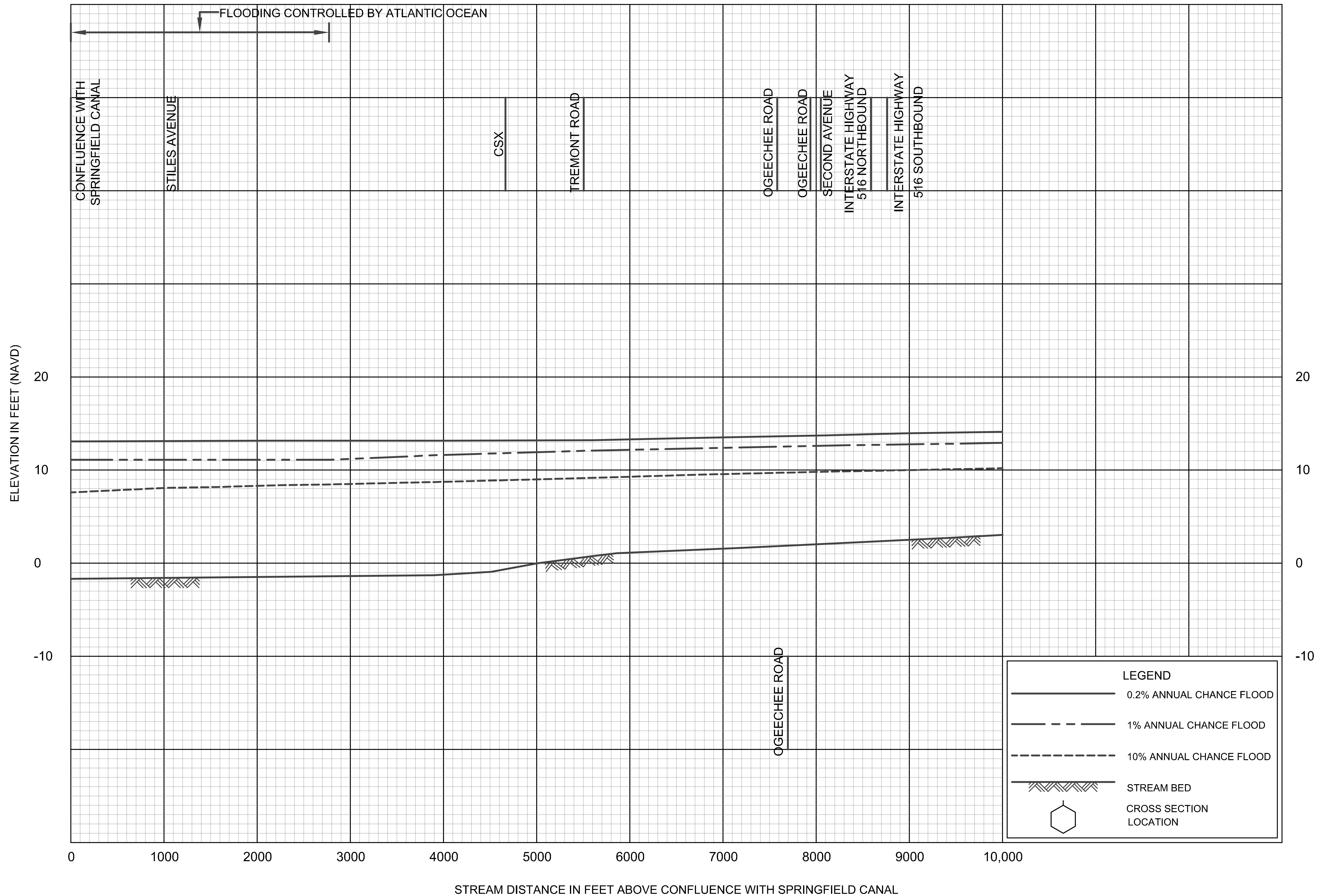
FLOOD PROFILES

SPRINGFIELD CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



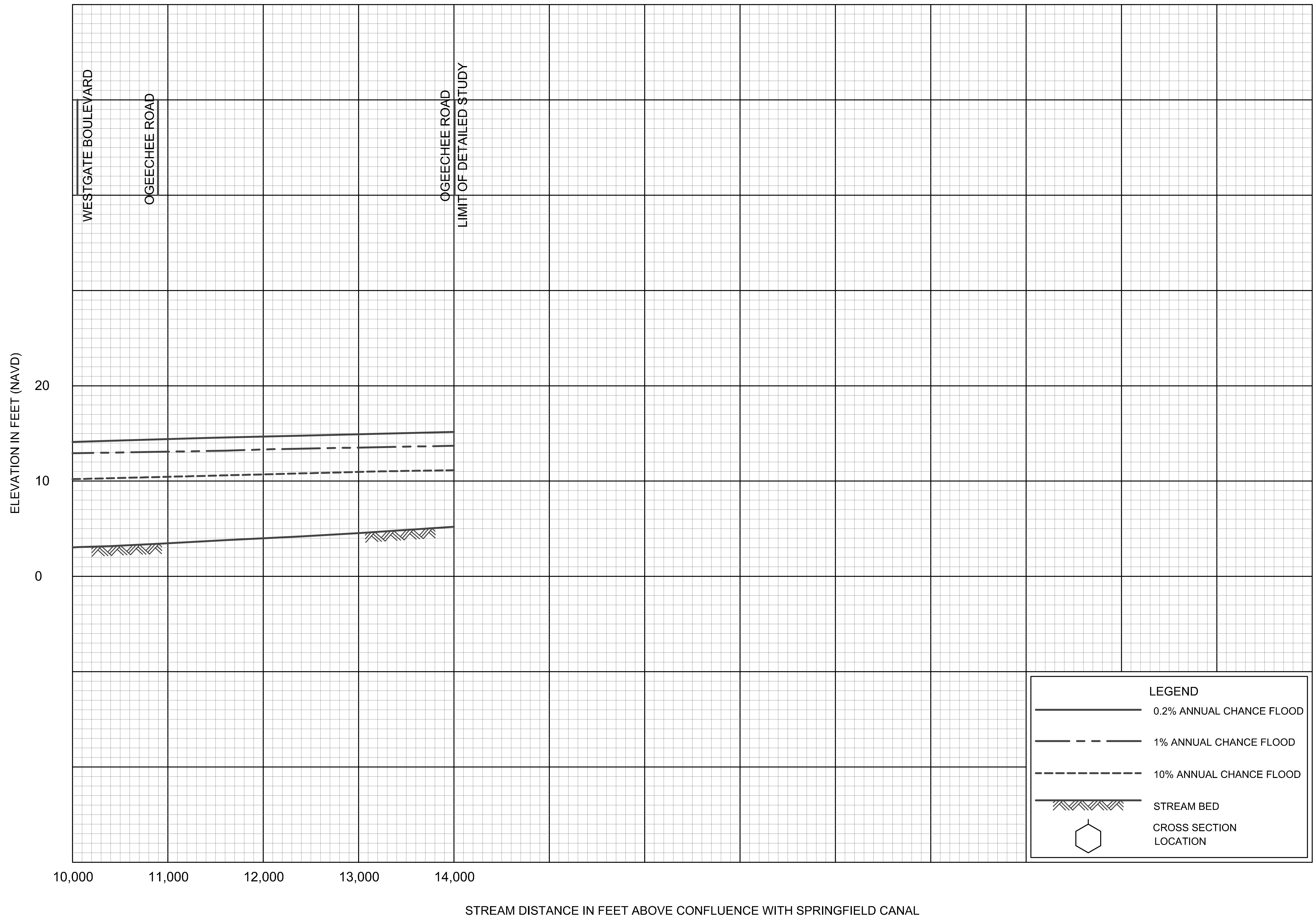
FLOOD PROFILES

SPRINGFIELD CANAL TRIBUTARY A

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



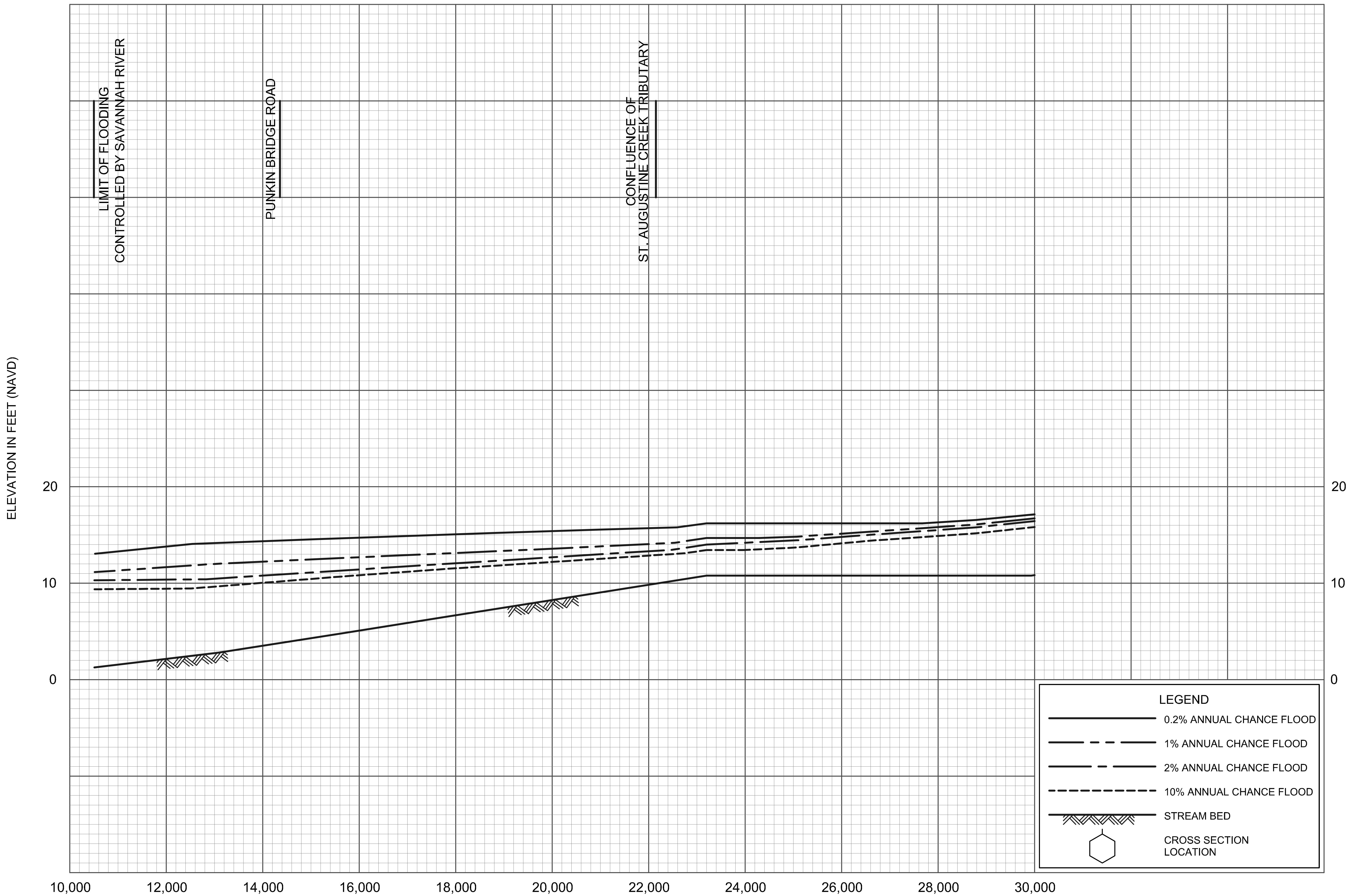
FLOOD PROFILES

SPRINGFIELD CANAL TRIBUTARY A

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



STREAM DISTANCE IN FEET ABOVE STATE HIGHWAY 21/AUGUSTA ROAD

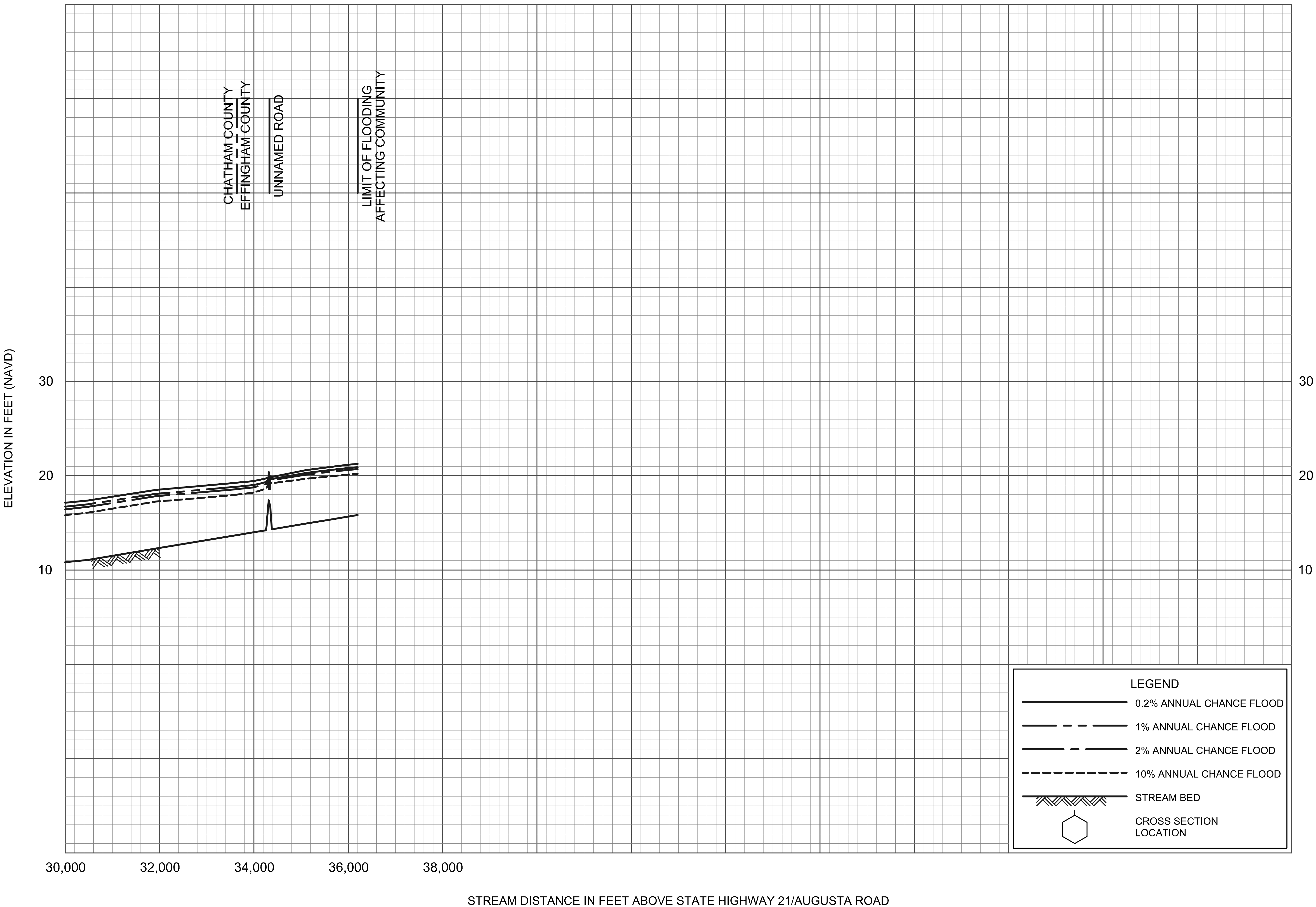
FLOOD PROFILES

ST. AUGUSTINE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



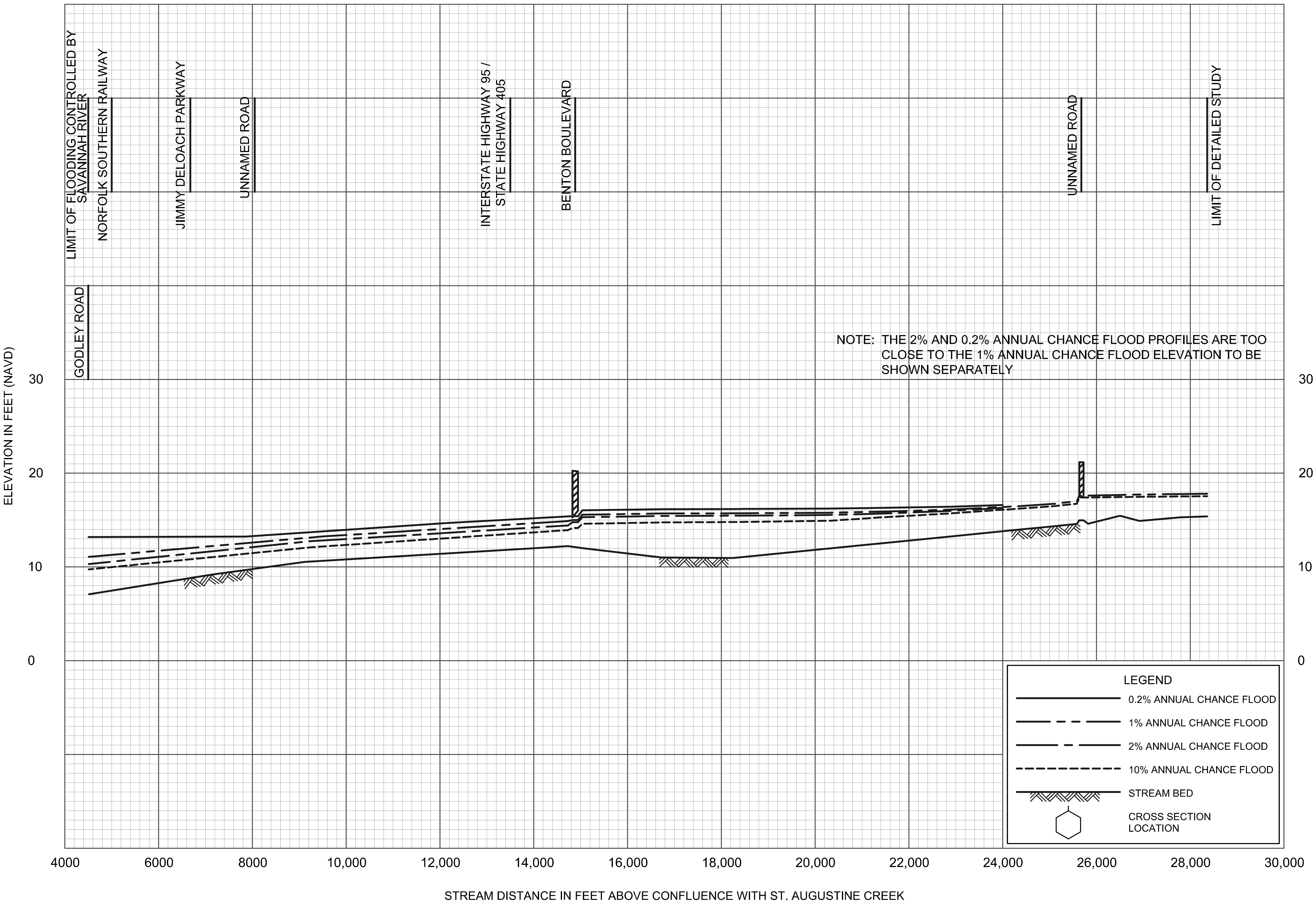
FLOOD PROFILES

ST. AUGUSTINE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



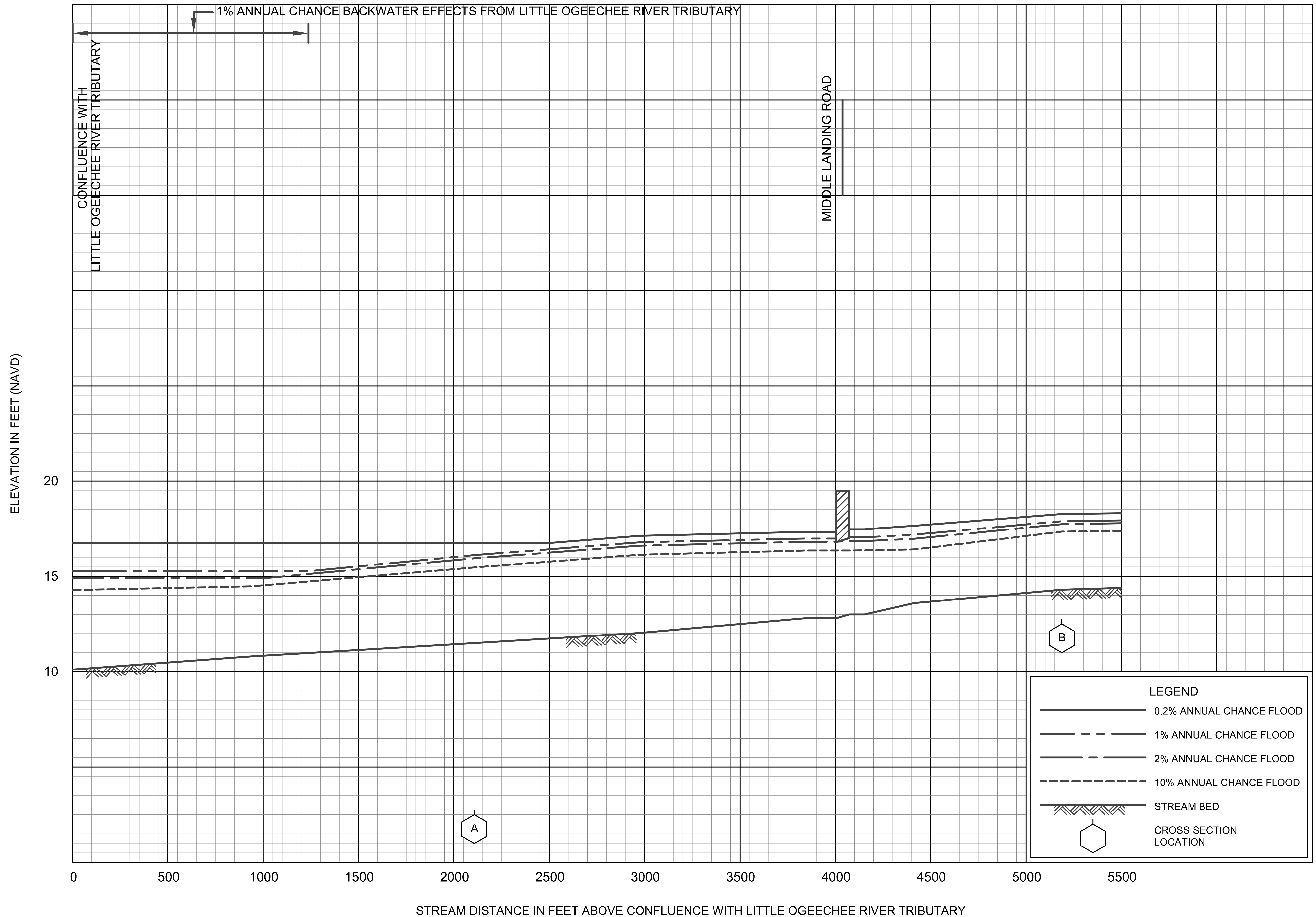
FLOOD PROFILES

ST. AUGUSTINE CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



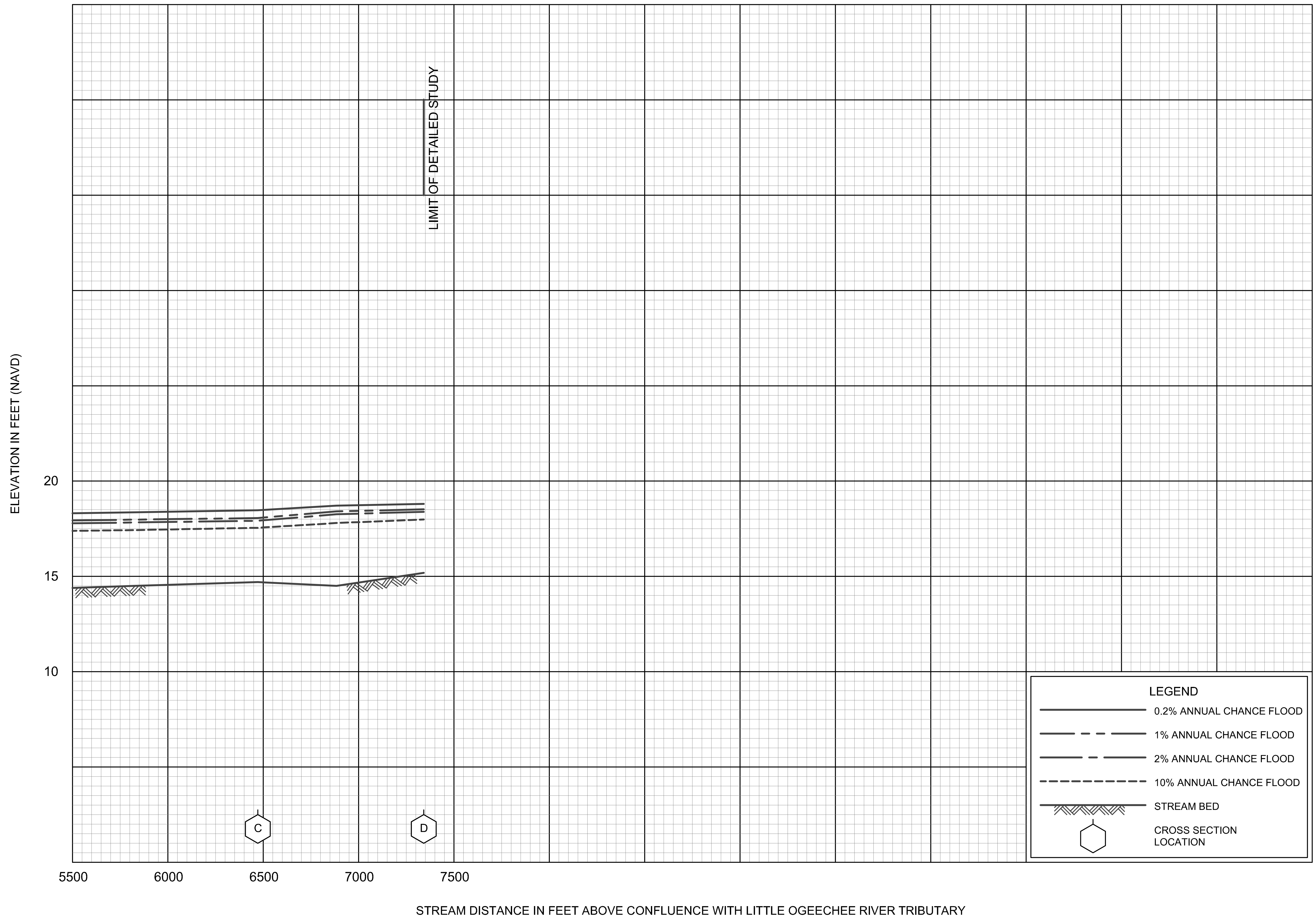
FLOOD PROFILES

TRIBUTARY TO LITTLE OGEECHEE RIVER TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



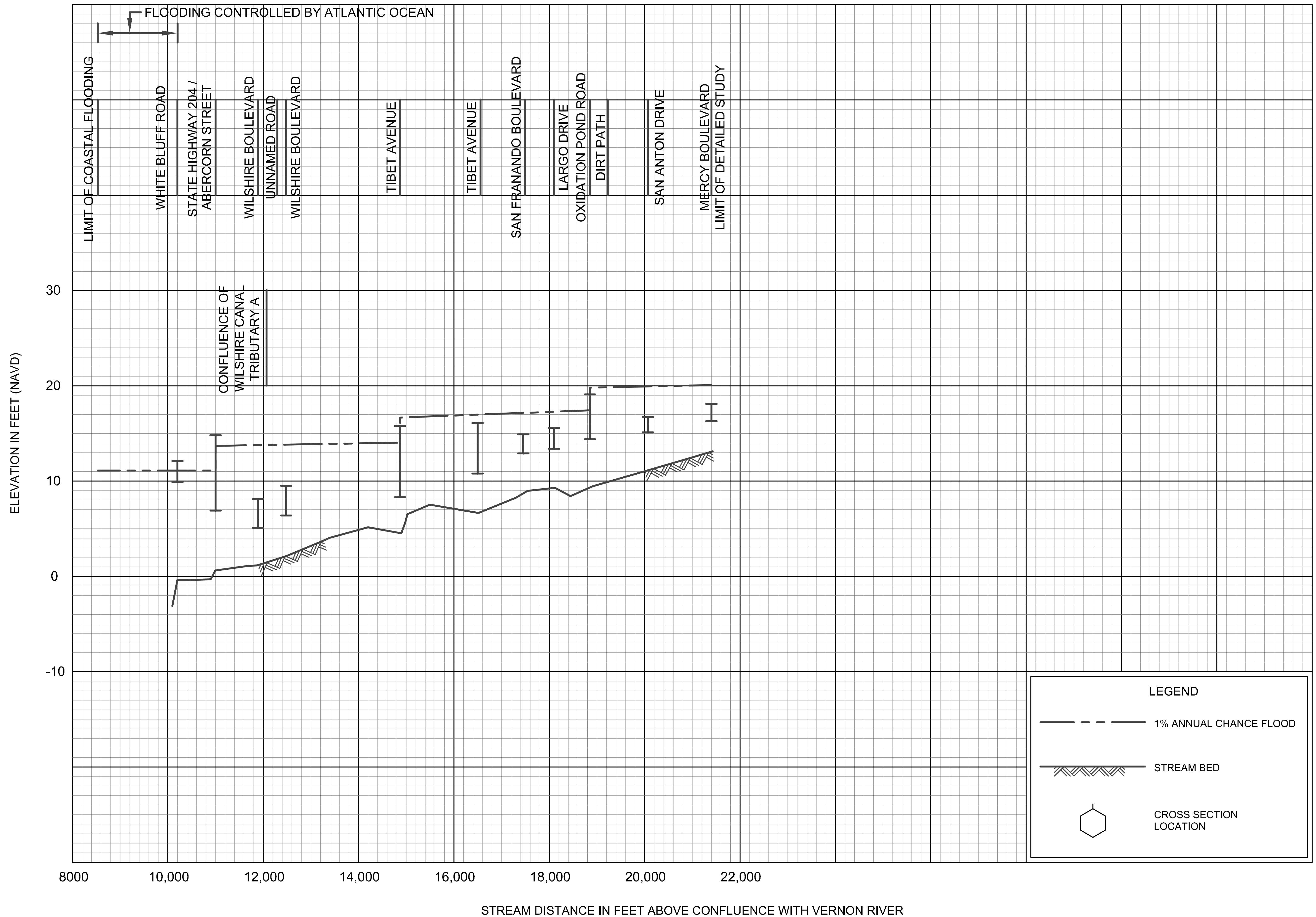
FLOOD PROFILES

TRIBUTARY TO LITTLE OGEECHEE RIVER TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



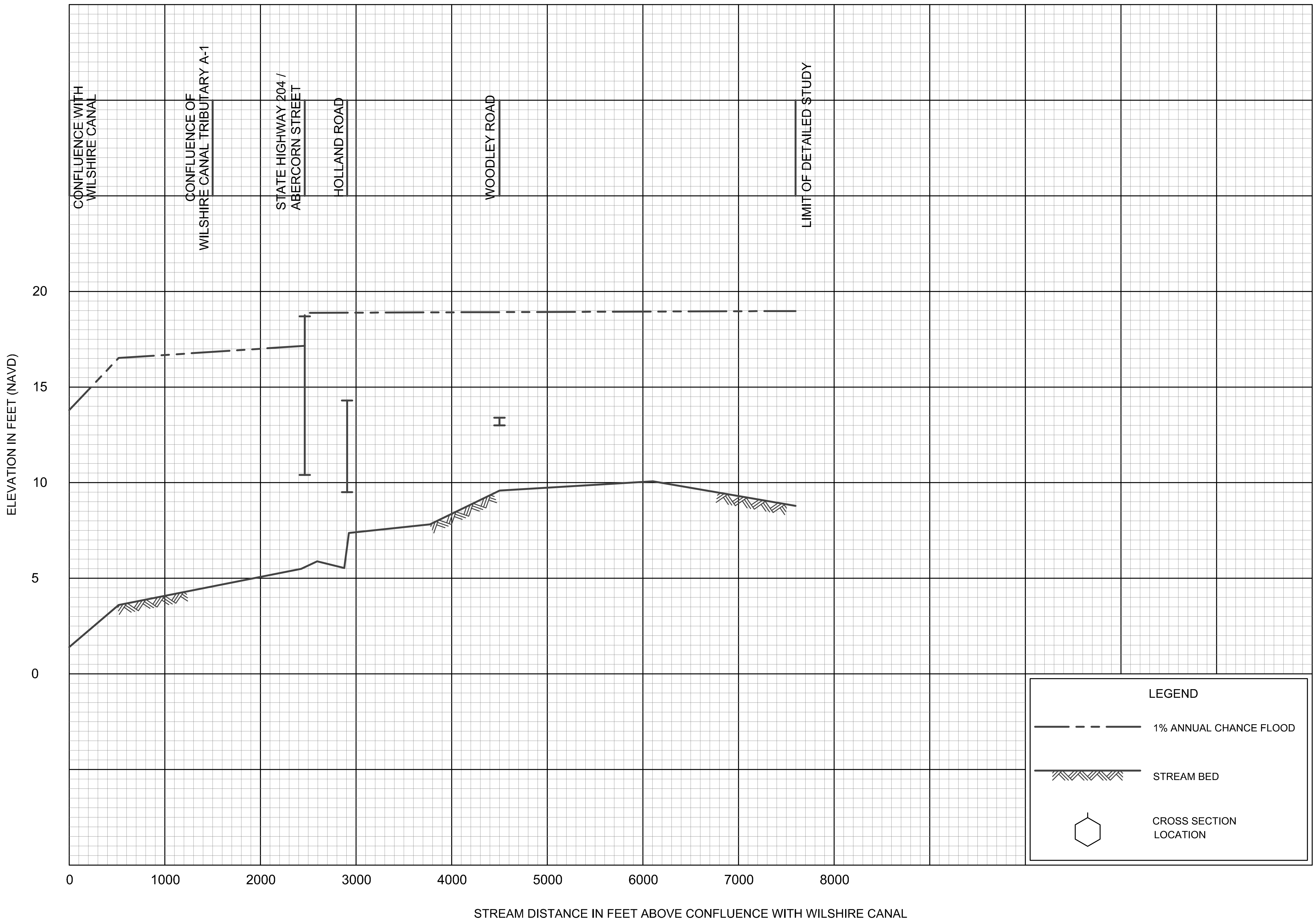
FLOOD PROFILES

WILSHIRE CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



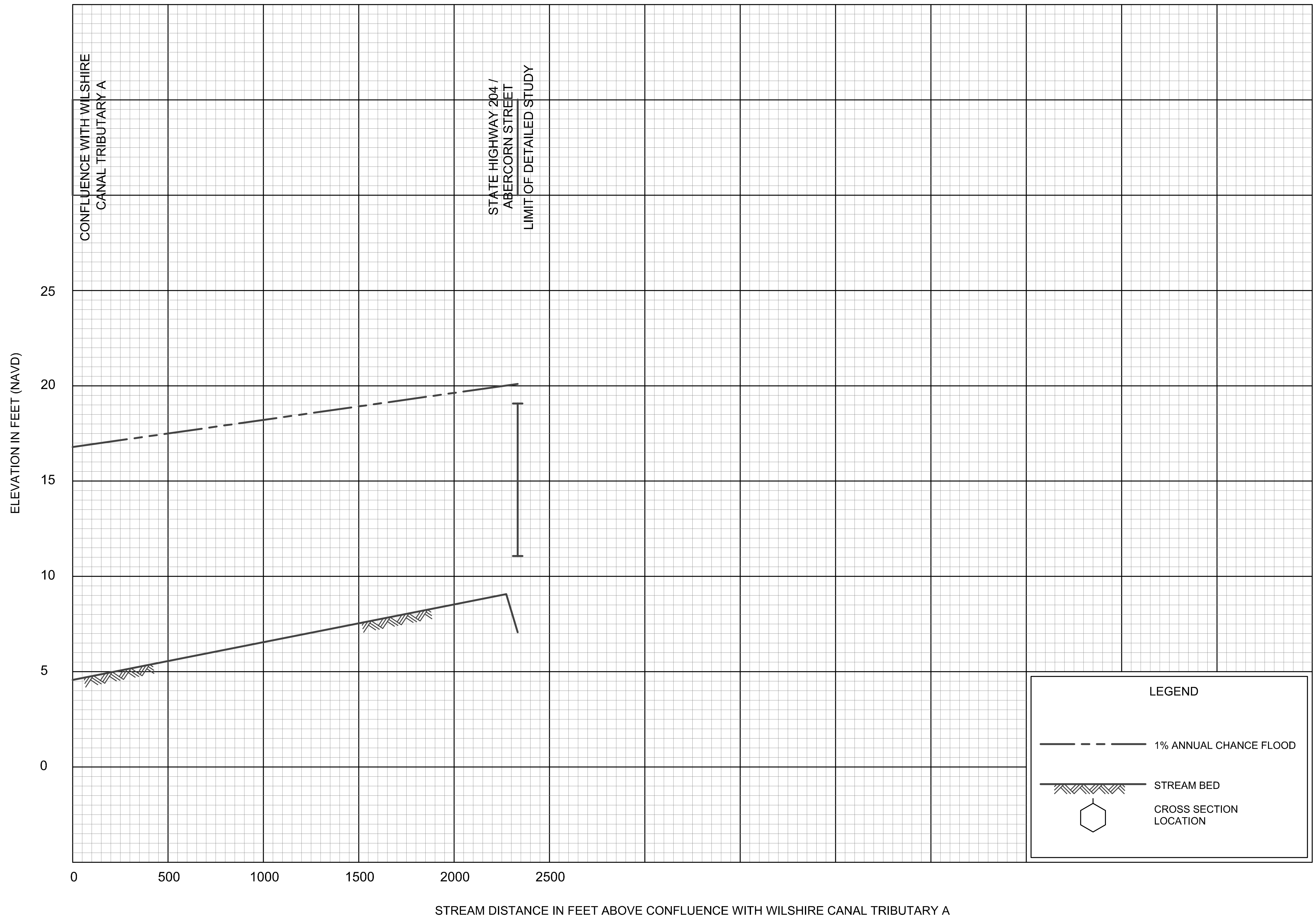
FLOOD PROFILES

WILSHIRE CANAL TRIBUTARY A

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



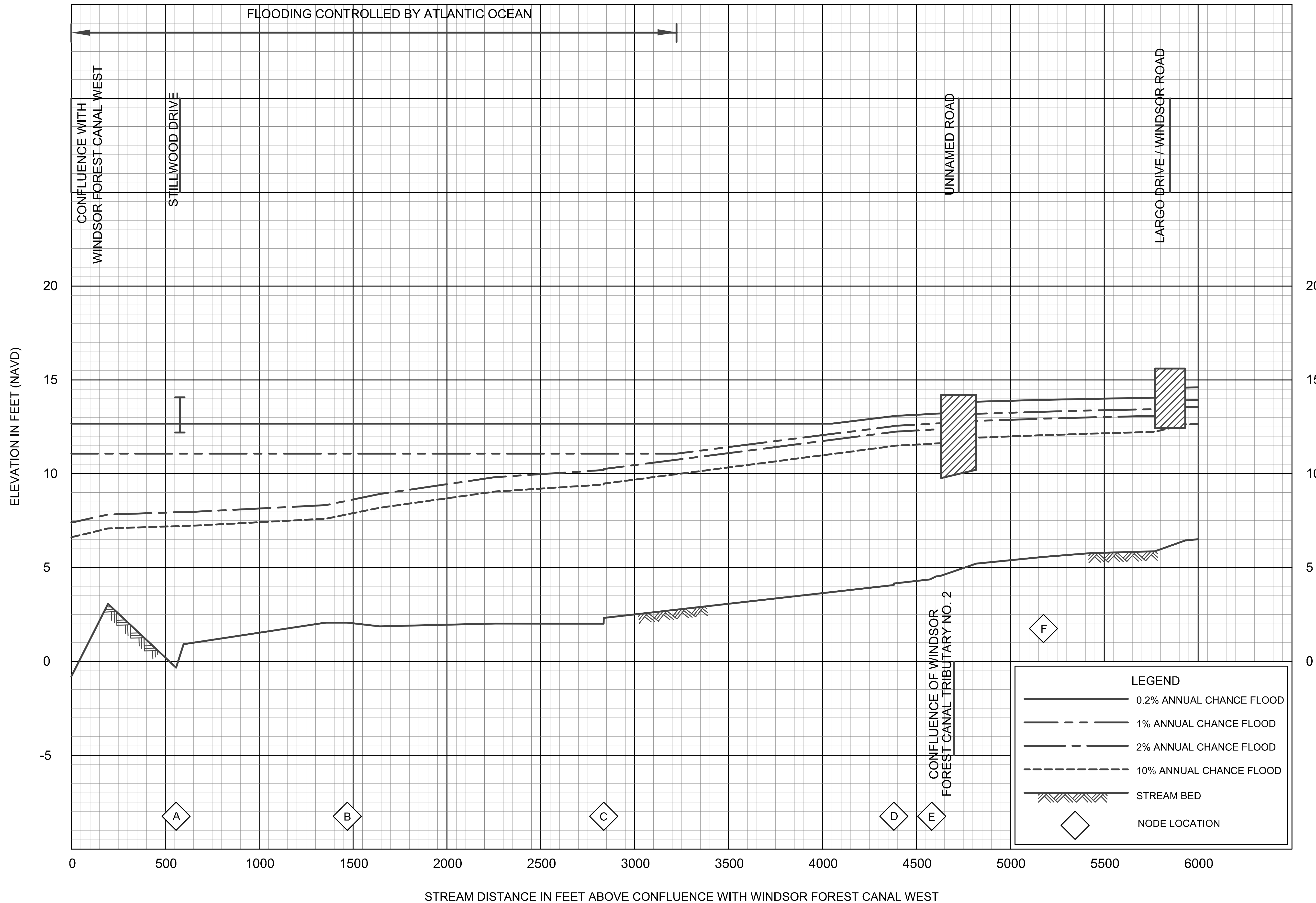
FLOOD PROFILES

WILSHIRE CANAL TRIBUTARY A-1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



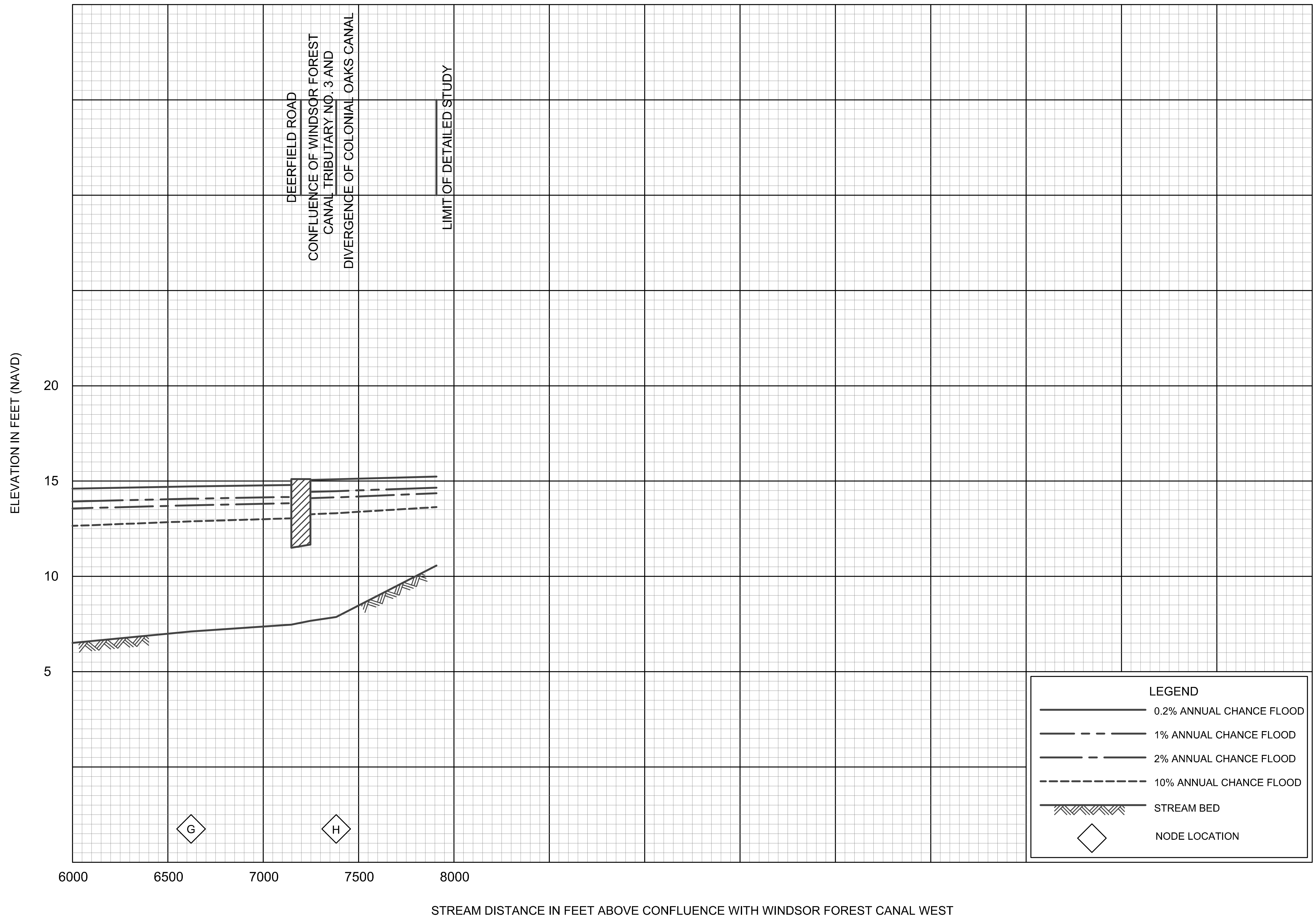
FLOOD PROFILES

WINDSOR FOREST CANAL EAST

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



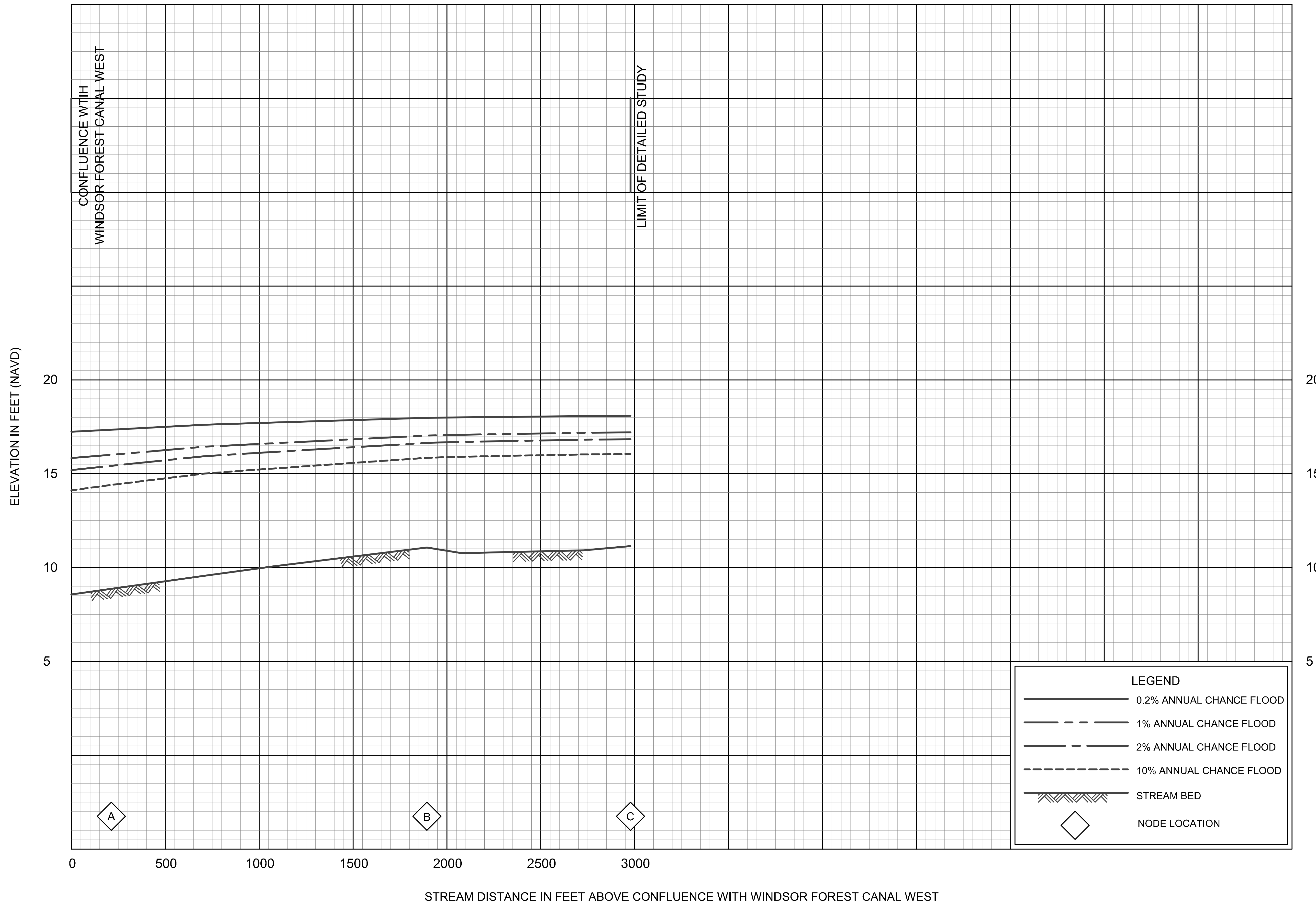
FLOOD PROFILES

WINDSOR FOREST CANAL EAST

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



FLOOD PROFILES

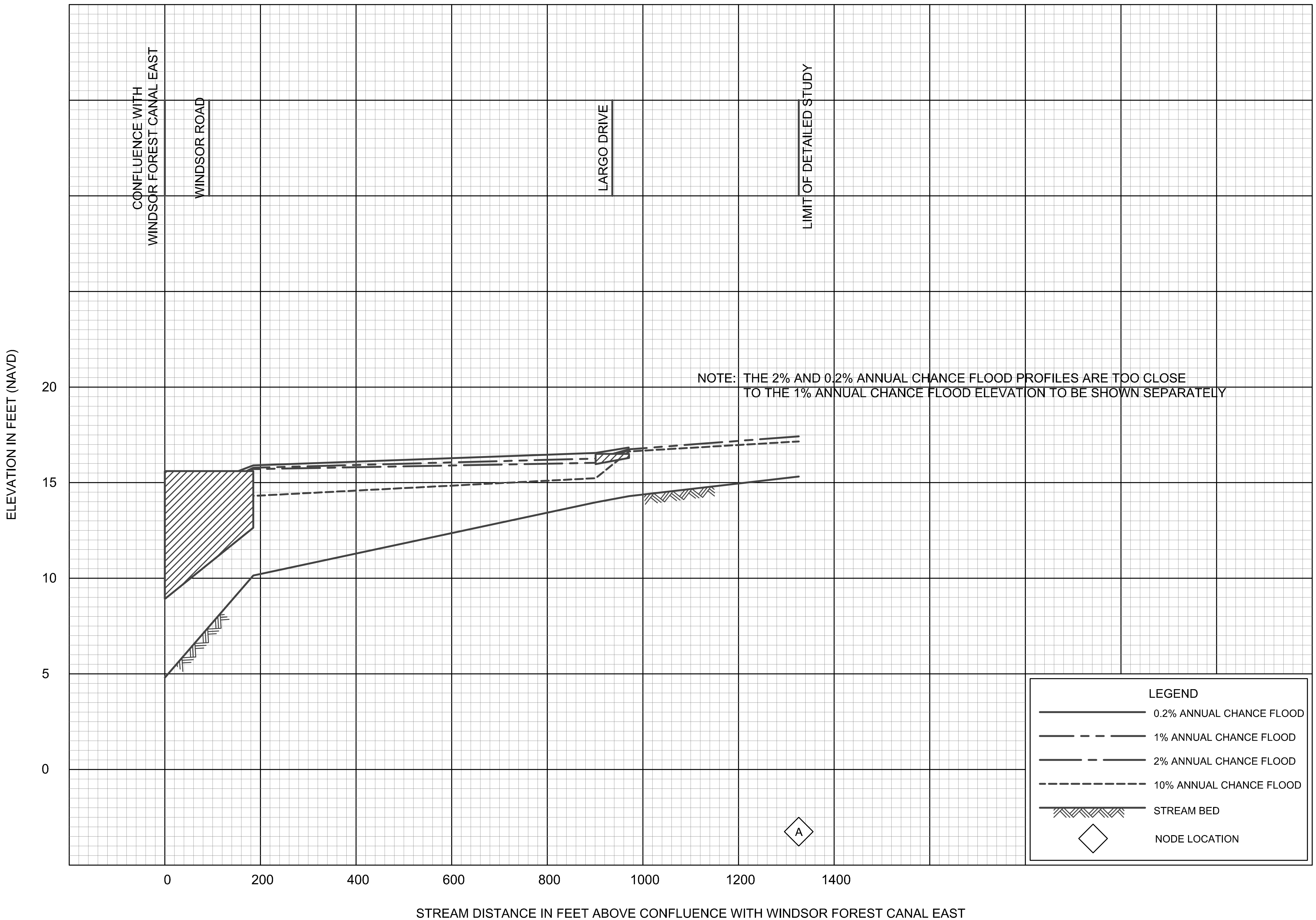
WINDSOR FOREST CANAL TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS

52P



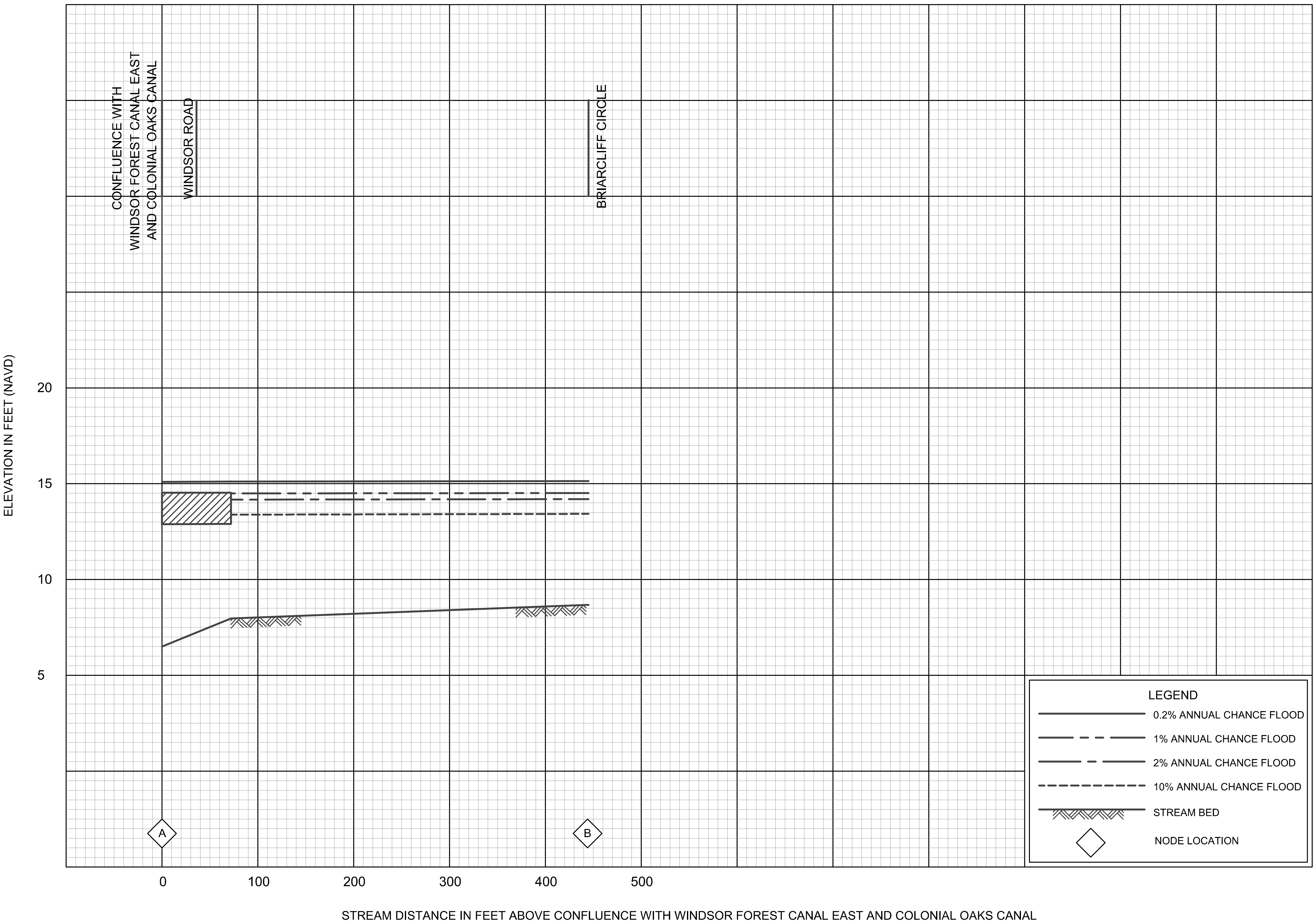
FLOOD PROFILES

WINDSOR FOREST CANAL TRIBUTARY NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



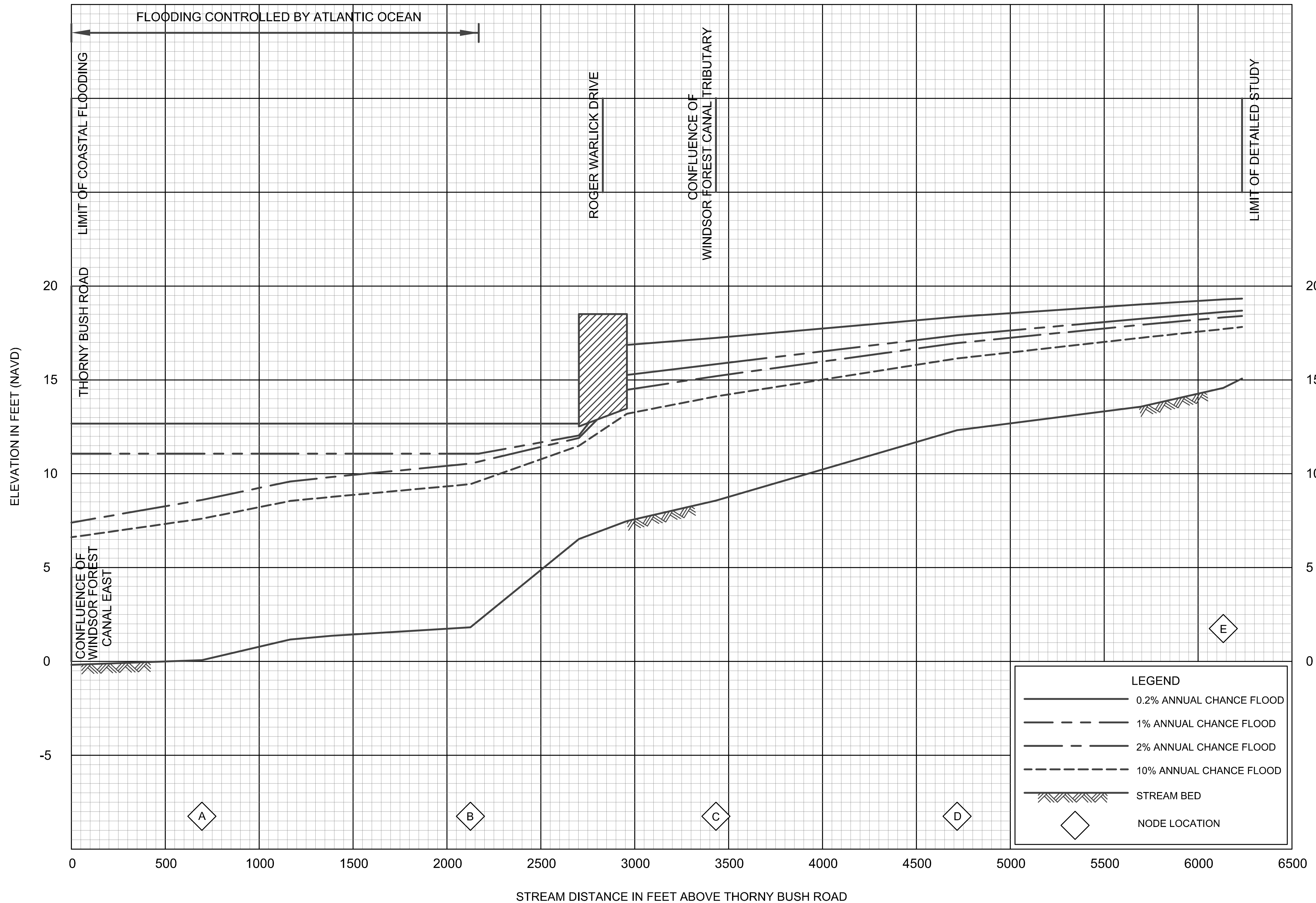
FLOOD PROFILES

WINDSOR FOREST CANAL TRIBUTARY NO. 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS



FLOOD PROFILES

WINDSOR FOREST CANAL WEST

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHATHAM COUNTY, GA

AND INCORPORATED AREAS