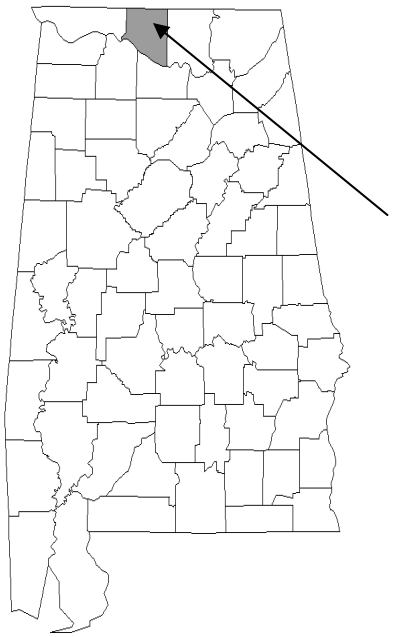
FLOOD INSURANCE STUDY

LIMESTONE COUNTY, ALABAMA

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
Ardmore, City of	010306
Athens, City of	010146
*Elkmont, Town of	010453
*Lester, Town of	010454
Limestone County, (Unincorporated Areas)	010307
Mooresville, Town of	010455

* Non-flood prone community



July 7, 2009

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
01083CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

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

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: July 7, 2009

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FLOOD INSURANCE STUDY
LIMESTONE COUNTY, ALABAMA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide-format Flood Insurance Study (FIS) investigates the existence and severity of flood hazards in, or revises previous FISs/Flood Insurance Rate Maps (FIRMs) for, the geographic area of Limestone County, Alabama, including: the City of Athens, the Towns of Ardmore, Elkmont, Lester, and Mooresville, and the unincorporated areas of Limestone County (hereinafter referred to collectively as Limestone County).

Please note that the Town of Ardmore is located in Limestone County, Alabama, and Lincoln and Giles County, Tennessee. Only the portion of the Town of Ardmore located in Limestone County is included in this FIS.

The City of Decatur is located in Limestone and Morgan Counties. It is shown entirely in the Morgan County FIS.

The Cities of Huntsville and Madison are located in Limestone and Madison Counties. They are shown in their entirety in the Madison County FIS.

Please note that the Towns of Lester and Elkmont are non-flood prone.

This FIS 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. This information will also be used by the communities within Limestone County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the 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.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This study was prepared to include all jurisdictions within Limestone County into a countywide FIS. Information on the authority and acknowledgments for each jurisdiction included in the countywide FIS, as compiled from their previously printed FIS reports, is shown below.

City of Athens:	The hydrologic and hydraulic analyses for this study were performed by the Tennessee Valley Authority (TVA) for the Federal Insurance Administration (FIA), under Interagency Agreement No. IAA-H-II-76, Project Order No. 9 and 1AA-H-77, Project Order No. 1. This work which was completed in December 1977 covered all significant flooding sources in the City of Athens.
Unincorporated Areas:	The hydrologic and hydraulic analyses for this study were performed by TVA for FIA, under Interagency Agreement No. IAA-H- 15-78, project order Nos. I and Al. This study was completed in September 1979.

The authority and acknowledgments for the Towns of Ardmore, Elkmont, Lester, and Mooresville are not listed because an FIS report was never published for these communities.

For this countywide FIS, no new hydrologic and/or hydraulic analyses were performed. Floodplain boundaries were redelineated based on more up to date topography provided by the USGS and the City of Athens.

Base map information shown on this FIRM was provided in digital format by the Limestone County Engineering department. This information was photogrammetrically compiled from aerial photography dated March 2005. Users of this FIRM should be aware that minor adjustments may have been made to specific base map features.

The coordinate system used for the production of this FIRM is Universal Transverse Mercator (UTM) Zone 16, North American Datum of 1983 (NAD 83), GRS 80 spheroid, NAVD88.

1.3 Coordination

An initial Consultation Coordination Officer's (CCO) 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 meeting is held with representatives of the communities, FEMA, and the study contractors to review the results of the study.

The dates of the initial and final CCO meetings held for Limestone County and the incorporated communities within its boundaries are shown in Table 1, "Initial and Final CCO Dates."

TABLE 1—Initial and Final CCO Dates

Community	Initial CCO Date	Final CCO Date
City of Athens	April 8, 1976	October 19, 1978
Unincorporated Areas	December 13, 1977	August 5, 1980

For this countywide FIS, an initial CCO meeting was held on January 23, 2007, and a final CCO meeting was held on July 28, 2008. The initial meetings were attended by representatives of Limestone County; AMEC Earth and Environmental, Inc.; the Alabama Department of Economic and Community Affairs, Office of Water Resources; and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Limestone County, Alabama.

All or portions of the flooding sources listed in Table 2, "Streams Studied by Detailed Methods," were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the Flood Insurance Rate Map (FIRM).

TABLE 2 - STREAMS STUDIED BY DETAILED METHODS

Panther Branch
Piney Creek
Round Island Creek
Swan Creek
Town Creek
Tributary to Swan Creek Mile 9.74
Tributary to Town Creek Mile 2.21
Tributary to Town Creek Mile 3.91

Numerous streams were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and representatives of Limestone County, AMEC Earth & Environmental Inc., the Alabama Department of Economic and Community Affairs, Office of Water Resources, and Michael Baker Corporation.

2.2 Community Description

Limestone County is located in northern Alabama approximately 11 miles west of Huntsville and due north of Decatur, Alabama. According to U.S. Census data, the 2000 population was 65,676 (Reference 1).

The county is older than the State of Alabama. It was created by an act of the Alabama Territorial Legislature on February 6, 1818, from lands ceded by the Cherokee Nation in 1806 and by the Chickasaw Nation in 1816. The first migration settled mainly along Limestone Creek. The city of Athens was incorporated on November 19, 1819.

Limestone County is bordered by the State of Tennessee to the north, Madison County to the east, the Tennessee River to the south, and Lauderdale County to the west. It has an aggregate area of 568 square miles.

The county is part of the Highland Rim section of the Interior Low Plateau. It lies in the Tennessee Valley and is comprised of three physiographic subdivisions: the Limestone Valley, the Plateau, and the Alluvial Plains (Reference 2).

The Limestone Valley, locally called the red lands, is located in the southeastern quarter of the county. The area has an undulating to rolling relief. The surface is generally more rolling near the Tennessee River.

The Plateau, locally called the grey lands, is located in the northern part of Limestone County. This area varies from level to gently sloping in the north and northeast to rough terrain to the west.

Most of Limestone County is agricultural and forest land, with the majority of the population centered in and around Athens. The forest cover consists mostly of yellow poplar, beech, oak, and pine. The grey lands are less productive for farming than the red lands, where the major crops are cotton and soybeans.

Since most of the county is rural, the commercial, residential, and industrial development is located between Athens and Decatur and along U.S. Highway

72 between Florence and Huntsville. Interstate Highway 65 between Nashville and Birmingham bisects the county. Presently there is an industrial part north of the Tennessee River between U.S. Highway 3 and Interstate Highway 65 outside the Swan Creek floodplain.

The Swan Creek watershed is part of the Highland Rim area and includes low rolling hills and broad valleys. The watershed lies entirely within Limestone County. It originates in the north central portion of the county near the Alabama-Tennessee line, follows a southerly course, and empties into Wheeler Reservoir (Tennessee River). The Swan Creek drainage area at Wheeler Reservoir is 55 square miles. Below Athens, Alabama, Swan Creek flows through rural farmland (Reference 2).

Piney Creek drainage area at Wheeler Reservoir is 97.3 square miles and 42.6 square miles at U.S. Highway 31. Like Swan Creek, Piney Creek flows through undeveloped land. The creek's headwaters are south of Ardmore, Alabama, at elevation 880 and it flows south by Athens and empties into the Tennessee River (Reference 3).

Panther Branch, a tributary of Piney Creek, has a drainage area of 10.5 square miles at its mouth. It flows southward from Alabama Route 251 through undeveloped land before entering Piney Creek at mile 20.90.

Round Island Creek flows through the northwest section of Athens and then through rural Limestone County before entering the Tennessee River. The drainage area of Round Island Creek at Wheeler Reservoir (Tennessee River) is 38 square miles.

Temperatures in Limestone County range from a high of about 108 degrees F to a low of about minus 12 degrees F. The average temperature is 61.8 degrees F, and the average annual precipitation is 48.72 inches.

2.3 Principal Flood Problems

The principal sources of flooding in Limestone County are Piney Creek, Swan Creek, Round Island Creek, Town Creek, Panther Branch, two unnamed tributaries to Town Creek at miles 2.21 and 3.91, and an unnamed tributary to Swan Creek at mile 9.74.

Piney Creek

The largest flood known to have occurred on Piney Creek since August 1959 was that of March 1973. No discharge estimate is available. This flood occurred mostly in agricultural areas which prevented any homes from flooding, but Alabama State Highway 20 was submerged for a distance of 1/3 mile (Reference 4).

The largest recorded discharge at the gage at mile 19.3 was 12,900 cubic feet per second (cfs) and occurred on March 12, 1963. It reached an elevation of 668.38 feet (NGVD) with an estimated recurrence interval of 170 years.

Swan Creek

Flood conditions on Swan Creek have been altered by channelization from mile 12.72 to mile 1.10 by the Natural Resource Conservation Service (NRCS) in 1977. Prior to the completion of the improved channel, floods occurred on March 14, 1964, and on March 12, 1963, which covered bottomlands but caused little damage to the sparse development in the floodplain. The January 21, 1954, flood had an estimated discharge of 7,300 cfs at elevation 647.3 feet (NGVD), at mile 9.9 with an estimated recurrence interval of 28 years (Reference 5).

Round Island Creek

No flood elevation or damage data are available.

Panther Branch

No flood elevation or damage data are available.

Town Creek

The highest flood known on Town Creek at Athens occurred on March 11, 1963. It reached an elevation of 678.0 feet (NGVD) at mile 2.47 with an estimated recurrence interval of 80 years. This flood caused extensive damage to streets, utilities, homes, and business places within the floodplain. What was known as the Crutcher Shopping Center at the time of the flooding had up to 2 feet of flooding in all the stores (Reference 6).

A major flood occurred on Town Creek on March 14, 1964 with an elevation of 676.0 feet (NGVD) at mile 2.47 and an estimated recurrence interval of 12 years. Town Creek flooded a large section of the City with most of the damage occurring on West Washington, West Market, South Houston, and South Jefferson Streets (Reference 7).

Another major flood occurred on March 16, 1973. Neither discharges nor elevations were available for this flood. Industries, businesses, and homes were flooded. The Crutcher Shopping Center on South Jefferson sustained the most damage. All stores in the center were damaged to some degree. Thirty persons were evacuated from their homes in the City, and a total of 50 residences and 19 businesses were damaged by the flood (Reference 4).

2.4 Flood Protection Measures

The TVA system of upstream main river and tributaries dams provides flood protection for Limestone County from Tennessee River flooding.

The NRCS completed the Swan Creek project in 1977. This included channel widening, straightening, and slope protection from mile 1.10 and ending in Athens at mile 12.72. The level of protection is mainly for agricultural lands.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail 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 which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals) have been selected as having special significance for floodplain management and for flood insurance premium 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 one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here 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

Precountywide Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in Limestone County.

For Piney Creek, flood flow frequency data were based on statistical analysis of discharge records covering an 11-year period from 1960 to 1970 at USGS gaging station No. 3576400 near Athens, Alabama. This analysis was made using the procedure outlined in Bulletin 17A (Reference 8) including the skew map, plate I, and adjustment for available historic flood information.

No formal stream gaging stations have been maintained on Swan Creek, Panther Branch, and Round Island Creek. Discharge-frequency relationships for these streams were estimated using relationships of peak discharge and

drainage area developed from analysis of records at nearby gaging stations listed in Table 3. Frequency curves for the gaged locations used to define regional relationships were computed using the procedure outlined in Bulletin 17A (Reference 8) including the skew map, plate I, and adjustment for historic flood information where available.

TABLE 3—STREAM GAGES

Location	Gage Number	Drainage Area (Sq. Miles)	Period of Record	Agency
Straight Ditch at Huntsville, Alabama	03574872	0.20	1971-1975	USGS
Walker Branch near Huntsville, Alabama	03574796	0.44	1971-1974	USGS
Bluewater Creek Tributary near Leoma, Tennessee	03587200	0.49	1955-1983	USGS
Little Flat Creek near Ralley Hill, Tennessee	03599400	0.63	1955-1975	USGS
Vest Creek near Baldwin, Alabama	02451750	1.64	1964-1972	USGS
Big Huckleberry Creek near Belvedere, TN	03574700	2.18	1955-1974	USGS
Flat Branch near Jasper, Alabama	02045340	2.47	1958-1969	USGS
Glover Cove Creek near Huntsville, Alabama	03575340	3.50	1971-1974	USGS
Weakly Creek near Rover, Tennessee	0359820	9.46	1955-1983	USGS
Dorsey Creek near Arkadelphia, Alabama	02450200	13.0	1959-1974	USGS
Big Bixby Creek at Sandy Hook, Tennessee	03060050	17.5	1953-1976	USGS
Weakly Creek near Bodenham, Tennessee	03583500	24.4	1955-1968	USGS
Bear Creek at Posey Mill, Alabama	03591700	26.8	1964-1975	USGS
Shoal Creek above Little Shoal Creek at Lawrenceburg,Tennessee	03587500	27.0	1955-1982	USGS
W.F. Mulberry Creek at Mulberry, Tennessee	03581500	41.2	1954-1984	USGS
Bradley Creek at Prairie Plains, Tennessee	03578500	41.3	1952-2006	USGS
Chisholm Creek at West Point, Alabama	03588400	43.0	1963-1975	USGS
Shoal Creek at				

Lawrenceburg, Tennessee	03588000	55.4	1968-1998	USGS
Piney Creek near Athens, Alabama	03576400	55.8	1960-1990	USGS
Elk River near Pelham, Tennessee	03578000	65.6	1952-2006	USGS
Little Bear Creek near Halltown, Alabama	03592300	78.6	1958-1977	USGS
Flint Creek near Falkville, Alabama	03576500	86.3	1953-1999	USGS
West Flint Creek near Oakville, Alabama	03577000	87.6	1953-1969	USGS
Short Creek near Albertville, Alabama	03573000	91.6	1946-1969	USGS
Limestone Creek near			1940-1966	TVA
Athens, Alabama	03576250	119	1966-2004	USGS
Cotaco Creek at Florette, Alabama	03576148	136	1966-1975	USGS
Town Creek near Geraldine, Alabama	03572900	141	1958-1990	USGS
Bear Creek near Hackleburg, Alabama	03591800	143	1957-1981	USGS
West Flint Creek near Hartselle, Alabama	5771.1	158	1941-1958	TVA
Big Nance Creek at Courtland, Alabama	03586500	161	1946-1975	USGS
Cypress Creek near Florence, Alabama	03590000	209	1935-1955	USGS
Paint Rock River near Woodville, Alabama	03574500	320	1936-2004	USGS
Flint River near Chase, Alabama	03575000	342	1929-1994	USGS
Shoal Creek at Iron City, Tennessee	03585000	348	1925-1976	USGS

Sources of information in Table 3 are References 9, 10, 11, 12, and 13.

The adopted flow estimates were compared with results obtained using applicable USGS relationships (References 14 and 15). USGS flow estimates were 6 percent to 22 percent smaller than the adopted estimates. This difference occurred because the USGS study was limited to the State of Alabama and did not include records on nearby similar watersheds in the Tennessee Valley. The state was not divided into regions.

Currently there is not sufficient urbanization of the Swan Creek watersheds to alter flood peaks. The increased flows on Swan Creek due to channelization were computed using the equation $Q_{pc} = (\delta_n/\delta_c)^x Q_{pn}$, developed from work by

Espey and Winslow (Reference 16) where:

Q_{pc} = discharge for selected probability, p, for channelized conditions
Q_{pn} = discharge for selected probability, p, for natural channel conditions
δ_n = a channel vegetation factor for natural channel conditions
δ_c = a channel improvement factor
x = an exponent varying with flood probability, p

Peak discharge rates for Town Creek and unnamed tributaries to Town Creek at miles 2.21 and 3.91 where sufficient urbanization has occurred to alter flood peaks were estimated using the relationship

$Q_{pu} = I^x Q_{pn}$ where:

Q_{pu} = discharge for selected probability, p, for urban conditions
I = percent imperviousness for urban area
x = a factor which varies with flood probability
Q_{pn} = discharge for selected probability, p, for natural channel conditions

The relationships and values of x were developed from equations by Espey and Winslow (Reference 16) which relate discharge at selected frequencies to watershed and climatic factors and percent imperviousness (I). The relationships and x values were compared and found to be consistent with studies by others. Percent imperviousness was estimated using ratios of imperviousness to urban area (Reference 17) and urban areas determined from 7.5-minute topographic maps.

Countywide Analyses

For this countywide FIS, no new hydrologic and/or hydraulic analyses were performed.

Peak discharge-drainage area relationships for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods of each flooding source studied in detail in the community are shown in Table 4, "Summary of Discharges."

TABLE 4 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-Percent Annual-Chance	2-Percent Annual-Chance	1-Percent Annual-Chance	0.2-Percent Annual-Chance
PANTHER BRANCH					
Mile 0.4	10.10	2,250	3,400	3,800	5,000
Mile 1.4	8.99	2,100	3,150	3,400	4,500
Mile 2.2	3.87	1,100	1,700	1,850	2,400
PINEY CREEK					
Mile 8.7	84.8	10,300	15,500	18,000	24,000
Mile 14.1	77.1	9,600	14,000	17,000	22,500
Mile 16.7	64.0	8,300	12,500	14,900	19,000
Mile 20.9	42.9	6,300	9,200	11,000	14,500
ROUND ISLAND CREEK					
Mile 8.4	15.6	3,100	4,650	5,300	6,900
Mile 12.0	8.47	2,000	3,000	3,400	4,400
Mile 14.9	3.24	1,000	1,450	1,700	2,100
SWAN CREEK					
Mile 0.0	55.1	10,500	17,500	19,500	28,000
Mile 2.9	52.0	9,900	16,400	18,300	26,100
Mile 4.9	47.9	9,100	15,000	16,800	23,700
Mile 5.34	42.5	8,000	12,000	14,500	21,000
Mile 5.34	42.5	8,000	12,000	14,500	21,000
Mile 8.13,below Town	40.4	7,700	11,600	14,000	19,000
Mile 8.13,above Town	30.6	5,800	8,700	10 000	14,000
Mile 9.97	28.1	5,500	8,000	9,500	12,800
Mile 12.70	18.9	3,600	5,400	6,200	7,800
TOWN CREEK					
Mouth	9.79	3,100	4,450	4 950	5,950
Mile 1.2	7.93	2,700	3,900	4,400	5,300
Mile 2.9	4.92	1,950	2,750	3,100	3,600
Mile 4.6	2.14	700	1,050	1,200	1,500
Mile 5.2	1.47	520	800	900	1,200
Mile 6.3	0.62	270	420	480	620
TRIBUTARY TO SWAN CREEK MILE 9.74					
Mile 1.30	1.69	580	870	1,000	1,300
TRIBUTARY TO TOWN CREEK MILE 2.21					
Mile 0.13	2.25	1,050	1,500	1,700	2,000
Mile 0.91	1.32	700	950	1,100	1,350
TRIBUTARY TO TOWN CREEK MILE 3.91					
Mouth	1.26	700	1,000	1,100	1 350

3.2 Hydraulic Analyses

Precountywide 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.

Locations of all 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), select cross section locations are shown on the FIRM.

Water-surface elevations of floods for the selected recurrence intervals were computed through use of the U.S. Army Corps of Engineers (USACE) HEC-2 backwater program (Reference 18). Cross sections for Swan Creek, Piney Creek, and Round Island Creek were field surveyed at bridges and other strategic locations and supplemented with valley cross sections taken by photogrammetric methods at sufficiently close intervals to accurately compute water-surface elevations. All cross sections on Panther Branch were field surveyed.

Some cross sections on Town Creek and Swan Creek were obtained from previous studies performed by TVA (Reference 5). The SCS provided additional field data and construction drawings for Swan Creek and its tributary at mile 9.74 where channel changes would affect hydraulic conditions.

Channel roughness factors (Manning's "n") for these computations were determined on the basis of field inspection of channel and floodplain areas, on previous studies by TVA, and computed coefficients based on known flood profiles. The range in values for Manning's "n" is in Table 5, "Manning's "n" Values."

TABLE 5 – MANNING'S "N" VALUES

Stream	Channel	Overbank
Panther Branch	0.045-0.055	0.075-0.100
Piney Creek	0.050-0.055	0.050-0.120
Round Island Creek	0.045-0.055	0.060-0.110
Swan Creek	0.035-0.045	0.061-0.100
Town Creek	0.030-0.060	0.045-0.100
Tributary to Swan Creek Mile 9.74	0.035-0.055	0.060-0.085
Tributary to Town Creek Mile 2.21	0.045-0.064	0.065-0.100
Tributary to Town Creek Mile 3.91	0.040-0.050	0.060-0.070

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). Starting elevations for Swan Creek and Piney Creek were obtained by matching the slope of the March 1978 flood. Starting elevations for Round Island Creek were obtained by matching the slope of surveyed floodmarks for which the date of occurrence was not known. Starting elevations for Panther Branch were obtained by matching the slope of the streambed. Starting elevations for Town Creek were obtained by slope area computations using the April 1977 flood in the HEC-2 program. The slope of the October 1976 flood was matched to determine starting elevations for the tributaries to Town Creek at miles 2.21 and 3.91.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed (i.e. free of debris), operate properly, and do not fail.

Countywide Analyses

For this countywide FIS, no new hydrologic and/or hydraulic analyses were performed.

3.3 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 NGVD. With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced

vertical datum.

To accurately convert flood elevations for Limestone County from the current NGVD29 datum to the newer NAVD88 datum, the following procedure was implemented. The vertical datum shift was calculated for each corner of the USGS 7.5-minute topographic quadrangle maps located inside or within 2.5 miles of the County boundary using the National Geodetic Survey conversion program, VertCon 2.1. A resulting average conversion factor of 0.15 ft was applied to all components of the FIS that display flood elevations.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD and NAVD, 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
(301) 713-4172 (fax)

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.

To obtain current elevation, description, and/or location information for benchmarks, 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 Flood 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 purposes of floodplain management measures. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated photogrammetrically with aerial photographs at a scale of 1" = 800'. The flooded area was plotted at a scale of 1" = 500' and traced on enlarged 7.5-minute series topographic maps of the same scale with contour interval of 10 feet (Reference 19). Recent mapping to a scale of 1" = 200' and contour interval of 2 feet in Athens, Alabama, was used to tie the county study with the city (Reference 20).

The 1- and 0.2-percent-annual-chance floodplain boundaries 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 (Zone A or 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 the 0.2-percent-annual-chance flood boundaries are close together, only the 1-percent-annual-chance flood 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 is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as artificial fill, reduces the floodcarrying capacity, increases the flood heights of streams, 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 National Flood Insurance Program, the concept of 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 flood 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 in order that the 1-

percent-annual-chance flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional 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 in Table 6, "Floodway Data". In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

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. A listing of stream velocities at selected cross sections is provided in Table 6, "Floodway Data." 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.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplains will not cause more than a 1.0-foot increase in the BFEs at any point within the community.

The area between the floodway and the boundary of the 1-percent-annual-chance flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent-annual-chance flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1, "Floodway Schematic."

FLOODING SOURCE		FLOODWAY			1-PERCENT ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Panther Branch								
A	0.37	410	1,465	2.6	683.0	683.0	684.0	1.0
B	1.08	220	1,103	3.2	693.2	693.2	694.2	1.0
C	1.44	200	1,085	3.1	700.3	700.3	700.4	0.1
D	2.17	60	425	4.5	713.6	713.6	714.2	0.6
Piney Creek								
A	9.68	1,350	9,696	1.8	601.0	601.0	602.0	1.0
B	10.86	1,500	9,125	1.9	607.4	607.4	608.4	1.0
C	11.60	2,300	10,611	1.6	615.4	615.4	615.7	0.3
D	12.89	1,400	6,926	2.5	623.7	623.7	624.7	1.0
E	14.87	850	5,810	2.7	636.3	636.3	637.0	0.7
F	15.80	650	5,346	2.8	643.9	643.9	644.4	0.5
G	16.45	600	4,549	3.3	648.4	648.4	649.0	0.6
H	18.02	1,240	9,149	1.6	656.9	656.9	657.5	0.6
I	19.28	500	5,278	2.5	667.9	667.9	667.9	0.0
J	20.42	550	3,310	3.8	676.5	676.5	677.2	0.7
K	21.62	1,000	6,391	1.7	685.9	685.9	686.7	0.8

[1] Miles above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOODWAY DATA

PANTHER BRANCH—PINEY CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Round Island Creek								
A	8.38	250	2,040	2.6	637.2	637.2	637.2	0.0
B	9.06	250	951	5.4	648.1	648.1	648.4	0.3
C	9.64	320	2,201	1.9	659.6	659.6	660.2	0.6
D	10.27	220	953	4.2	666.2	666.2	667.0	0.8
E	10.90	180	1,273	3.0	685.5	685.5	685.7	0.2
F	11.22	180	1,020	3.6	691.7	691.7	691.8	0.1
G	11.98	300	915	3.7	704.4	704.4	704.5	0.1
H	13.00	500	2,023	1.3	710.5	710.5	711.4	0.9
I	13.42	350	1,093	2.2	712.7	712.7	713.5	0.8
J	14.39	350[2]	942	1.9	724.5	724.5	724.9	0.4
K	14.72	140	813	2.1	730.0	730.0	730.7	0.7
L	14.88	140	723	2.4	730.3	730.3	731.2	0.9

[1] Miles above mouth
[2] Measured perpendicular to flow

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOODWAY DATA

ROUND ISLAND CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Swan Creek								
A	0.35	800	8,704	2.2	567.1	567.1	568.1	1.0
B	1.14	1,550	11,021	1.7	576.4	576.4	576.4	0.0
C	1.39	1,350	9,434	2.0	576.8	576.8	577.0	0.2
D	2.21	800	4,595	4.1	586.3	586.3	586.3	0.0
E	3.69	1,100	5,536	3.2	596.1	596.1	597.1	1.0
F	4.45	1,050	4,327	3.9	602.5	602.5	603.4	0.9
G	5.34	750	5,052	2.9	611.5	611.5	611.9	0.4
H	5.88	750	3,264	4.4	617.2	617.2	618.1	0.9
I	6.53	750	4,119	3.5	624.0	624.0	624.9	0.9
J	7.30	1,500	2,978	4.7	631.4	631.4	632.3	0.9
K	7.72	600	5,126	2.8	637.8	637.8	638.0	0.2
L	8.27	550	2,494	4.0	639.7	639.7	640.7	1.0
M	9.17	500	3,476	2.8	657.1	657.1	657.1	0.0
N	9.42	500	2,885	3.3	657.4	657.4	658.3	0.9
O	9.97	800	3,670	2.6	664.9	664.9	665.0	0.1
P	10.12	720	2,076	4.5	665.7	665.7	665.8	0.1
Q	10.52	700	3,068	2.8	672.0	672.0	673.0	1.0
R	11.06	400	2,493	3.0	682.4	682.4	682.5	0.1
S	11.46	400	2,235	3.0	690.0	690.0	690.0	0.0
T	11.76	400	2,863	2.3	695.1	695.1	695.1	0.0
U	11.98	400	1,820	3.6	695.3	695.3	695.7	0.4
V	12.32	400	1,622	3.9	699.8	699.8	700.7	0.9
W	12.72	400	2,265	2.7	709.7	709.7	709.9	0.2

[1] Miles above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOODWAY DATA

SWAN CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tributary to Swan Creek Mile 9.74								
A	0.58	70	567	2.3	672.9	672.9	673.8	0.9
B	0.87	75	314	3.7	675.9	675.9	676.7	0.8
C	1.06	70	428	2.6	682.3	682.3	683.0	0.7
D	1.24	185	721	1.4	683.9	683.9	684.9	1.0
E	1.28	185	692	1.5	684.1	684.1	685.1	1.0
F	1.62	130	1,266	3.3	691.8	691.8	692.4	0.6
G	2.01	100	112	6.3	706.1	706.1	706.1	0.0

[1] Miles above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY TO SWAN CREEK MILE 9.74

FLOODING SOURCE		FLOODWAY			1-PERCENT ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Town Creek								
A	0.12	100	759	6.5	643.6	643.6	644.6	1.0
B	0.57	280	1,583	2.8	652.0	652.0	652.4	0.4
C	1.23	300	2,083	2.1	660.8	660.8	661.3	0.5
D	1.62	300	1,309	3.4	663.8	663.8	664.5	0.7
E	2.21	260	1,658	2.7	670.6	670.6	671.5	0.9
F	2.23	260	1,217	3.0	672.3	672.3	672.8	0.5
G	2.47	130	665	5.2	678.4	678.4	678.4	0.0
H	2.65	120	784	4.2	680.5	680.5	680.7	0.2
I	2.74	120	789	4.1	681.6	681.6	682.2	0.6
J	2.83	130	648	4.9	682.5	682.5	683.2	0.7
K	2.87	140	580	5.3	682.6	682.6	683.6	1.0
L	2.96	140	461	6.7	684.2	684.2	684.7	0.5
M	3.02	150	684	4.5	685.6	685.6	686.3	0.7
N	3.17	180	1,118	2.8	687.8	687.8	688.5	0.7
O	3.25	160	919	3.4	688.4	688.4	689.4	1.0
P	3.36	130	686	4.5	690.0	690.0	690.8	0.8
Q	3.59	130	906	2.5	694.0	694.0	694.8	0.8
R	3.78	140	687	2.6	696.0	696.0	696.9	0.9
S	3.90	140	558	2.5	697.1	697.1	697.8	0.7
T	4.30	140	444	2.9	705.0	705.0	705.6	0.6
U	4.60	160	499	2.4	708.2	708.2	708.9	0.7
V	4.80	170	593	1.9	710.4	710.4	711.4	1.0
W	5.20	160	503	1.8	713.3	713.3	714.3	1.0
X	5.76	140	179	3.9	720.9	720.9	721.6	0.7

[1] Miles above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOODWAY DATA

TOWN CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tributary to Town Creek Mile 2.21								
A	0.14	100	608	2.8	675.9	675.9	676.6	0.7
B	0.42	90	368	4.0	683.7	683.7	684.4	0.7
C	0.56	100	453	3.0	688.7	688.7	689.5	0.8
D	0.91	100	500	2.2	698.7	698.7	699.0	0.3
Tributary to Town Creek Mile 3.91								
A	0.15	75	333	3.0	702.7	702.7	703.6	0.9
B	0.34	70	347	2.4	708.9	708.9	709.7	0.8
C	0.37	100	439	1.8	708.9	708.9	709.8	0.9
D	0.47	130	375	1.9	709.1	709.1	710.1	1.0

[1] Miles above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY TO TOWN CREEK MILE 2.21-
TRIBUTARY TO TOWN CREEK MILE 3.91

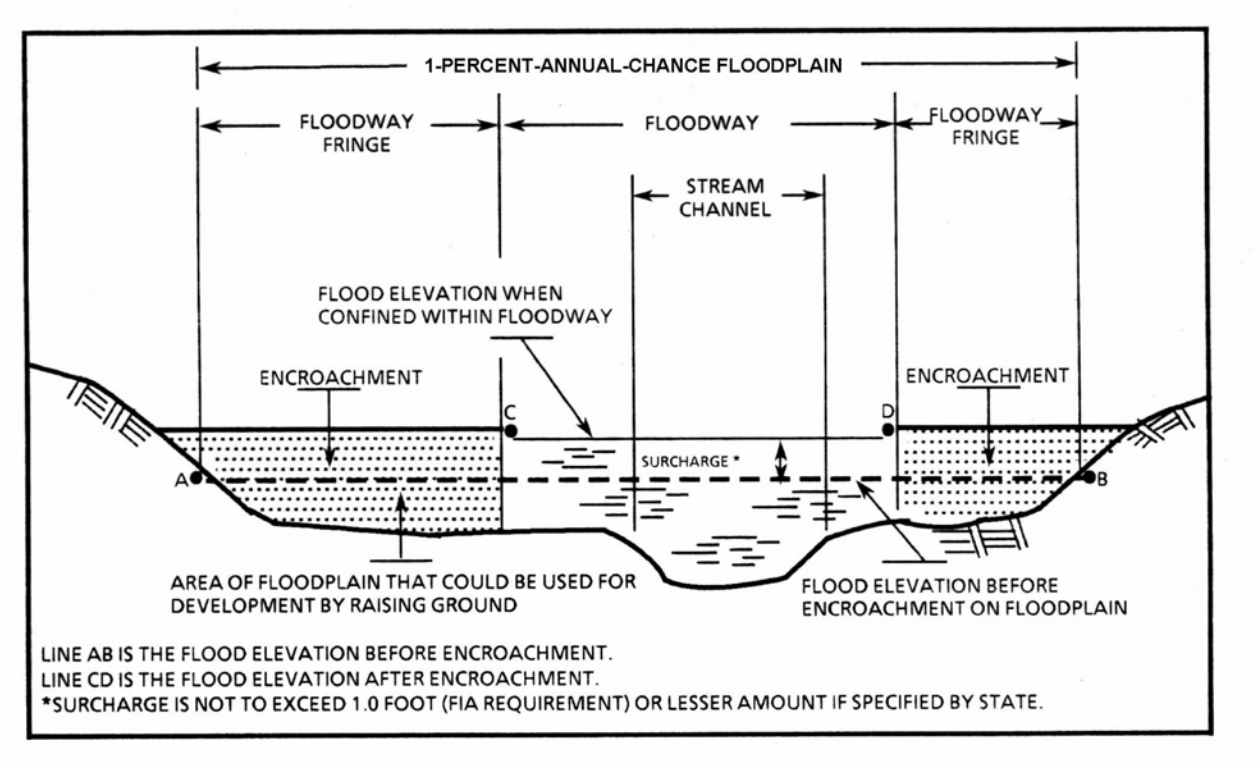


FIGURE 1 – FLOODWAY SCHEMATIC

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The 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 by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations 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 by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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, and 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, and areas protected from the 1-percent-annual-chance flood by levees. No base flood elevations or depths are shown within this zone.

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 base flood elevations or average depths. Insurance agents use the zones and base flood elevations 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 are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Limestone County. Previously, separate Flood Hazard Boundary Maps and/or FIRMs were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 7, “Community Map History.”

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Ardmore, Town of	12/17/1976	None	04/15/1986	
Athens, City of	03/08/1974	08/20/1976	09/28/1979	
Elkmont, Town of*	None	None	None	
Lester, Town of*	None	None	None	
Mooresville, Town of	07/07/2009	None	07/07/2009	
Limestone County, Unincorporated Areas	03/18/1977	None	07/16/1981	04/20/1998; 05/02/1999

*Non-flood prone

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

This FIS report either 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.

In 1959 TVA published a flood study for the City of Athens entitled "Floods on Town and Swan Creeks in the Vicinity of Athens, Alabama" (Reference 5). The purpose of this report was to provide basic information on floods that have occurred or may occur that would be helpful in state and local programs of planning and development in the region of Athens.

The Athens, Alabama, FIS was performed by TVA in 1978. No problems arise between city and county studies.

The city hired a private engineering firm with financial assistance from TVA to develop a comprehensive drainage program. The city and parts of the county surrounding Athens have been mapped by a good quality, 2-foot contour interval map. The map provides better control in developing the floodplain inside the city and in the fringe area shown in the county (Reference 20.)

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

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.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U.S. Bureau of the Census, Census of Population, 2000 Census, 2000.

2. Soil Conservation Service, Soil Survey - Limestone County, Alabama, Series 1941 No. 5, Washington, D. C., Issued March 1953.

3. Tennessee Valley Authority, Drainage Areas for Streams in Tennessee River Basin, Report No. 0-5829-R2, March 1970.

4. Tennessee Valley Authority, Floods of March 1973 in the Tennessee River Basin, Division of Water Control Planning, Report No. 0-7129, Knoxville, Tennessee, June 1974.

5. Tennessee Valley Authority, Floods on Town and Swan Creeks in Vicinity of Athens, Alabama, Division of Water Control Planning, Report No. 0-5864, Knoxville, Tennessee, February 1959.

6. Federal Insurance Administration, Flood Insurance Study, City of Athens, Alabama, March 1979.

7. Tennessee Valley Authority, "Floods of 1963 in Tennessee River Basin." Division of Water Control Planning Report No. 0-6425, Knoxville, Tennessee, January 1964.

8. U.S. Water Resources Council, Guidelines for Determining Flood Flow Frequency, Bulletin 17A of the Hydrology Committee, June 1977.

9. Speer, Paul R., and Gamble, Charles R., Magnitude and Frequency of Flood in the United States, Part 3-B, Cumberland and Tennessee River Basis, U.S. Geological Survey, Water Supply Paper 1676, 1974.

10. U.S.G.S., "Surface Water Supply of the United States, 1961-65," U.S. Geological Survey, Water Supply Paper 1910, Part 3, Volume 4, "Ohio River Basin below Wabash River," 1971.

11. U.S.G.S., "Surface Water Supply of the United States, 1966-70," U.S. Geological Survey, Water Supply Paper 2110, Part 3, Volume 4, "Ohio River Basin below Wabash River," 1973.

12. U.S.G.S. "Water Resources Data for Alabama," U.S. Geological Survey, Supply Papers - Annual Report, Water Years 1971-75 and 1957-60, 1976.

13. Tennessee Valley Authority, Daily Discharges at TVA Stream Gages on The Tennessee River Basin, Report 1940-1975.

14. U.S. Geological Survey, "Floods in Alabama - Magnitude and Frequency," Alabama Highway Department, 1973.

15. U.S. Geological Survey, "Flood Frequency of Small Streams in Alabama," Alabama Highway Department, August 1977.

16. Espey, W.H., Jr., and Winslow, D.E., Urban Flood Frequency Characteristics Proceeding of American Society of Civil Engineers Journal, Hydraulics Division, Volume 100, 100 Hy 2, pages 279-293, February 1974.

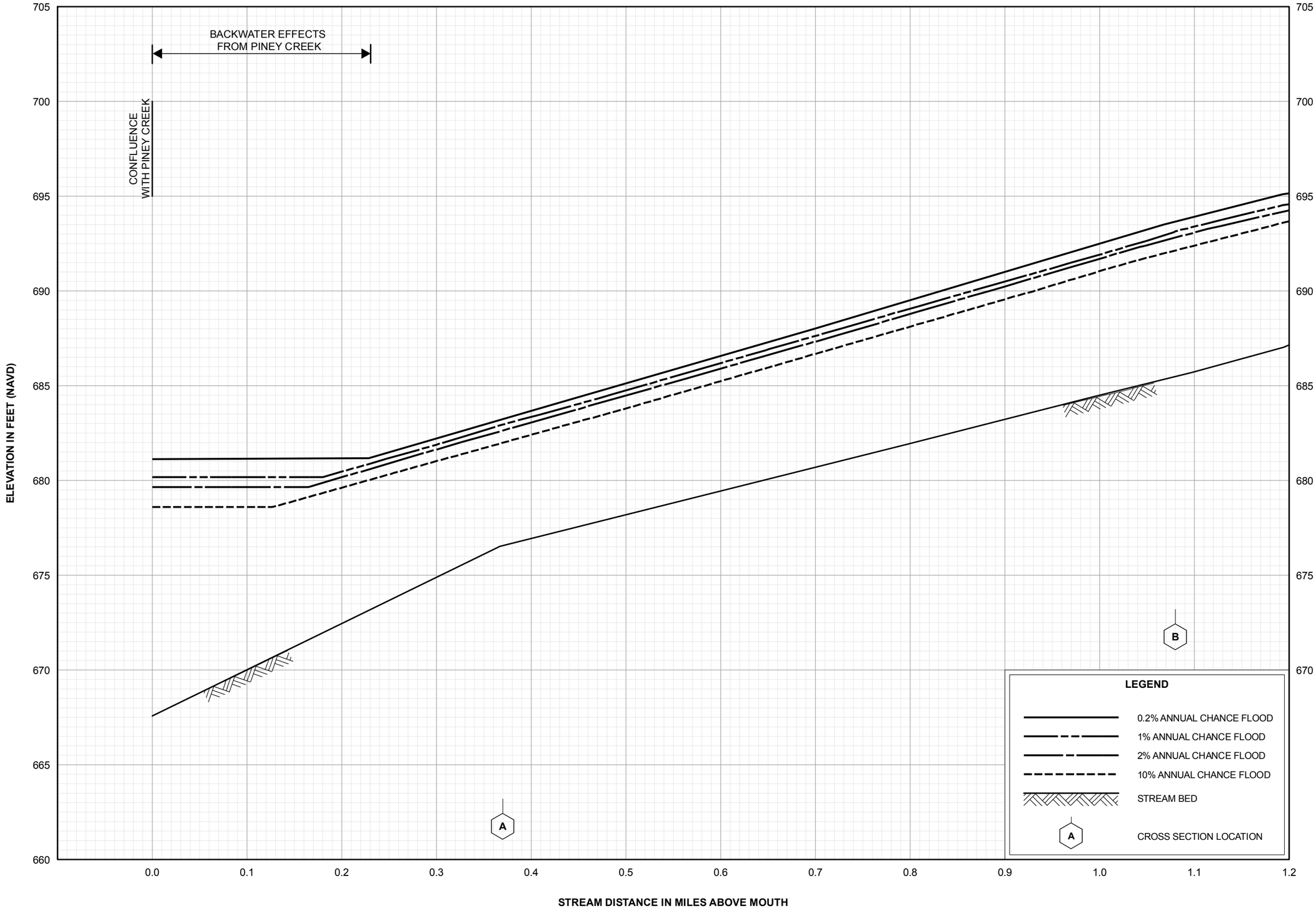
17. Tennessee Valley Authority. "Precipitation in Tennessee River Basin." Division of Water Control Planning Report No. 0-6425, Knoxville, Tennessee, January 1964.

18. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC 2N Water Surface Profiles, Generalized Computer Program, Davis, California, November 1976, updated August 1977.

19. U.S. Geological Survey, 7.5 Minute Series Topographic Maps,, Scale 1:24,000, Contour Interval 10 Feet: Ripley (1951); Athens - photorevised 1975; Tanner - photorevised 1974; Cupshaw - photorevised 1973.

20. City of Athens, Master Stream and Drainage Plan - Barge, Waggoner, Sumner, and Cannon--Engineers, Huntsville, Alabama. Scale 1:2400, Contour Interval 2 feet, February 1978.

21. Stamper, William G., "Flood Mapping in Charlotte and Mecklenburg County, North Carolina," U.S. Geological Survey open file report, 1975.



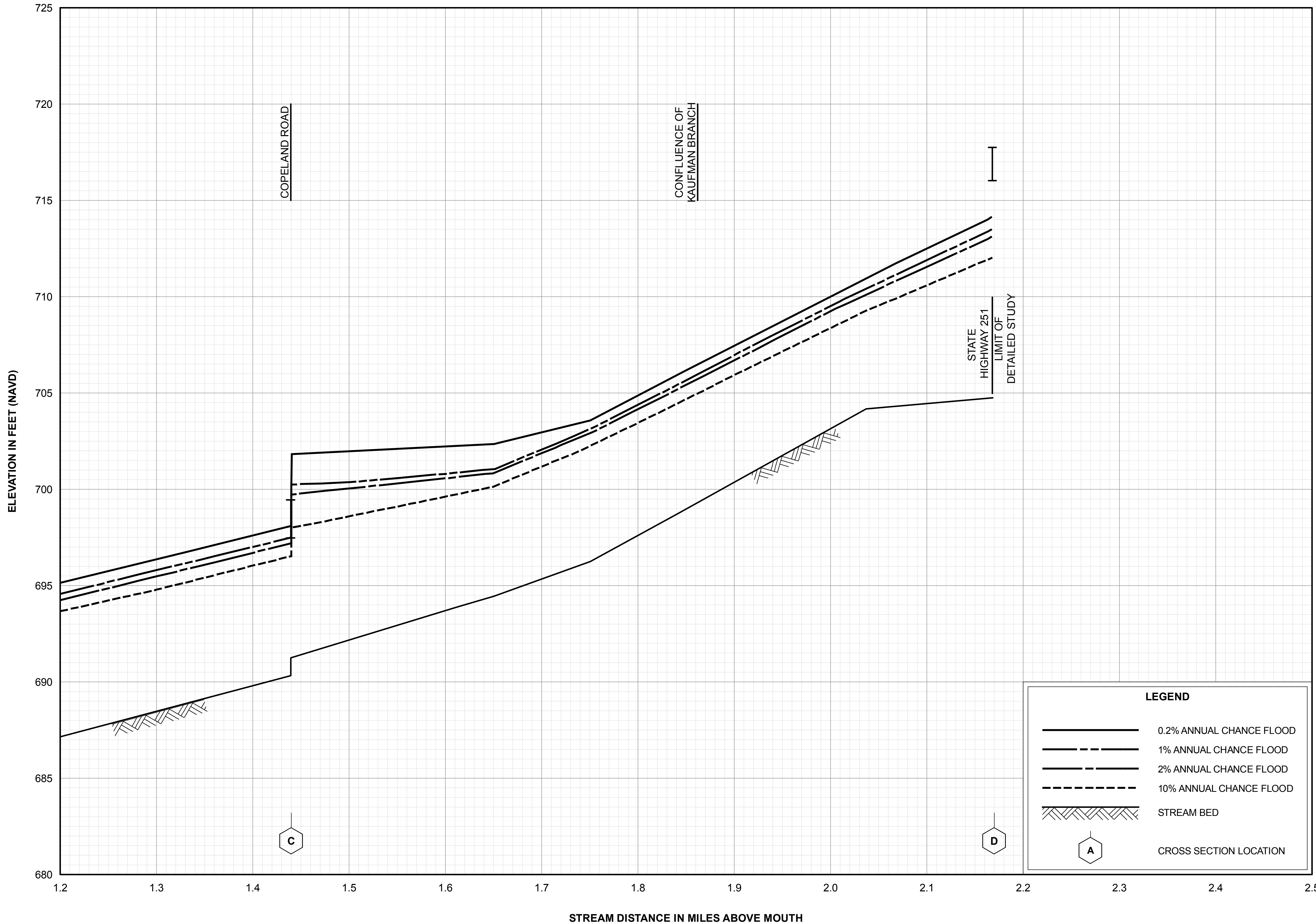
FLOOD PROFILES

PANTHER BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

01P



FLOOD PROFILES

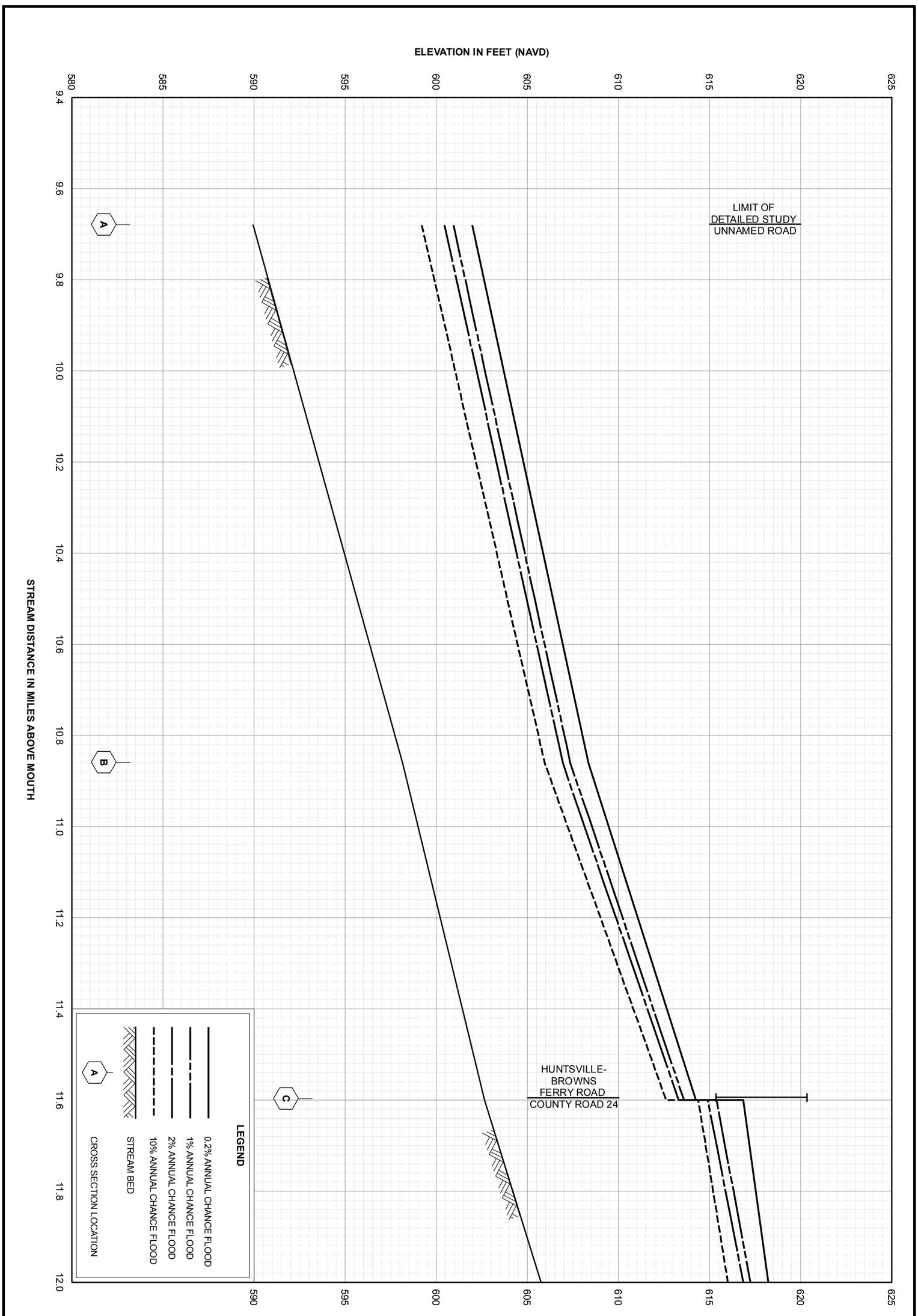
PANTHER BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL

AND INCORPORATED AREAS

02P



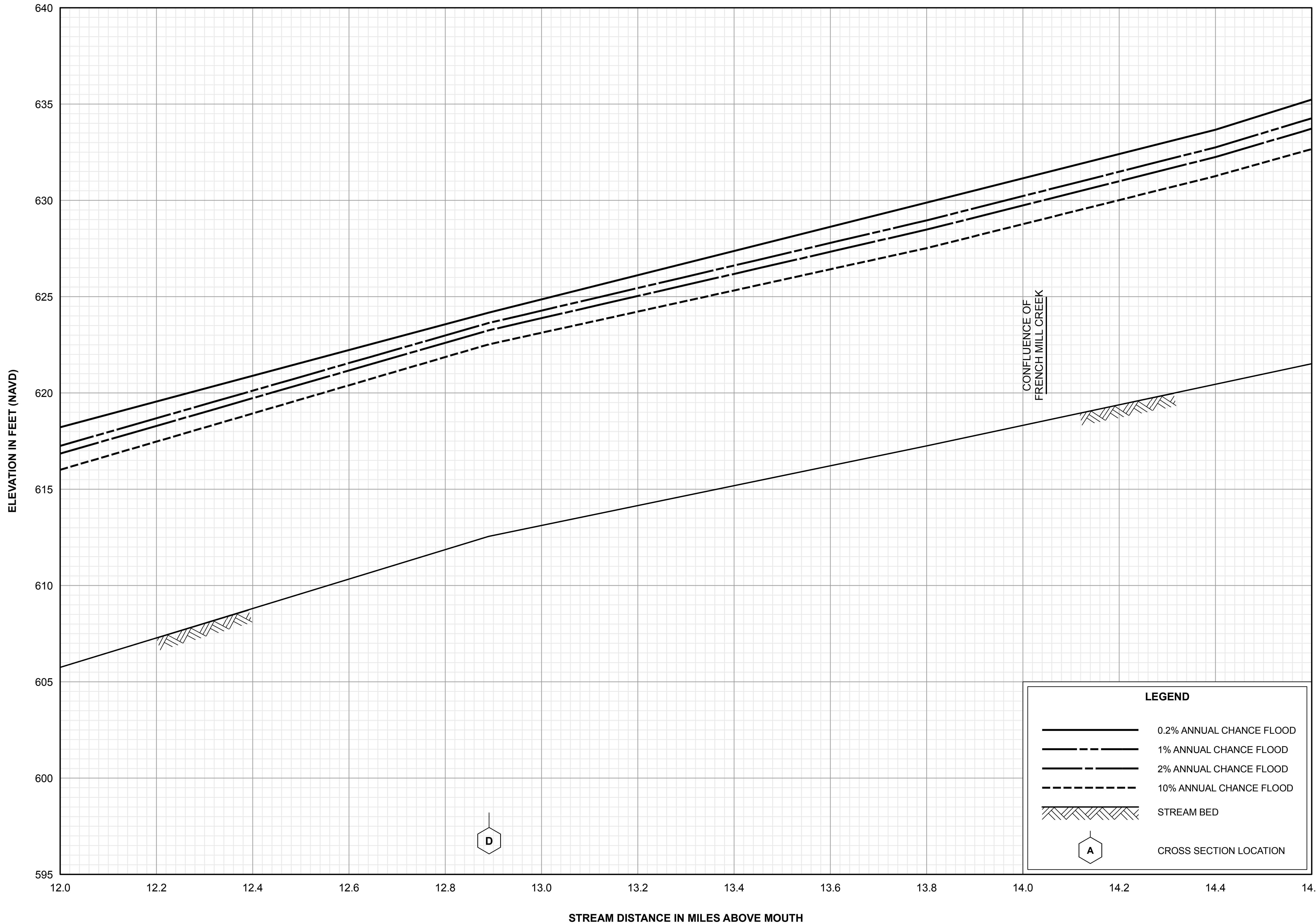
FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

PINEY CREEK

03P



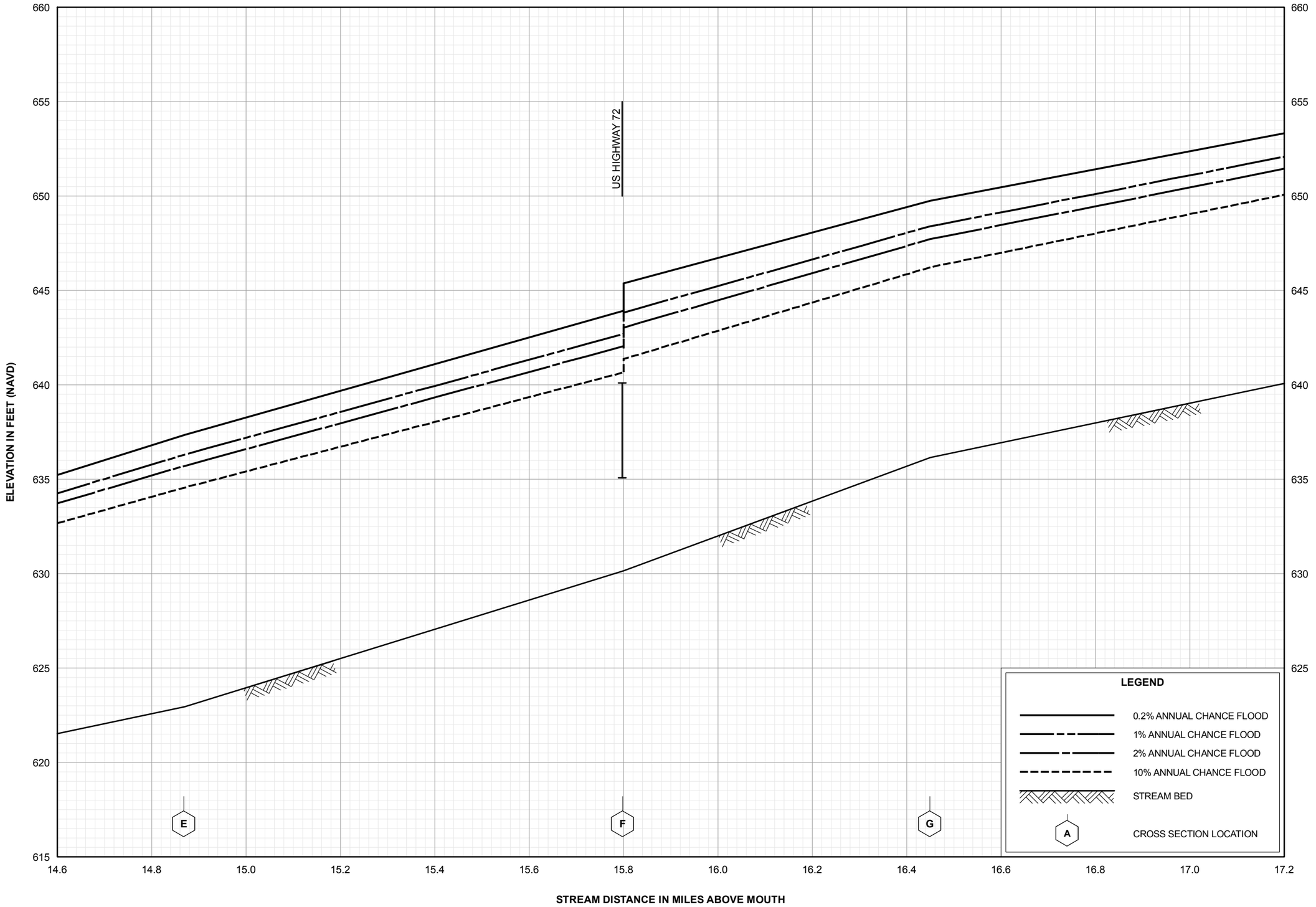
FLOOD PROFILES

PINEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

04P



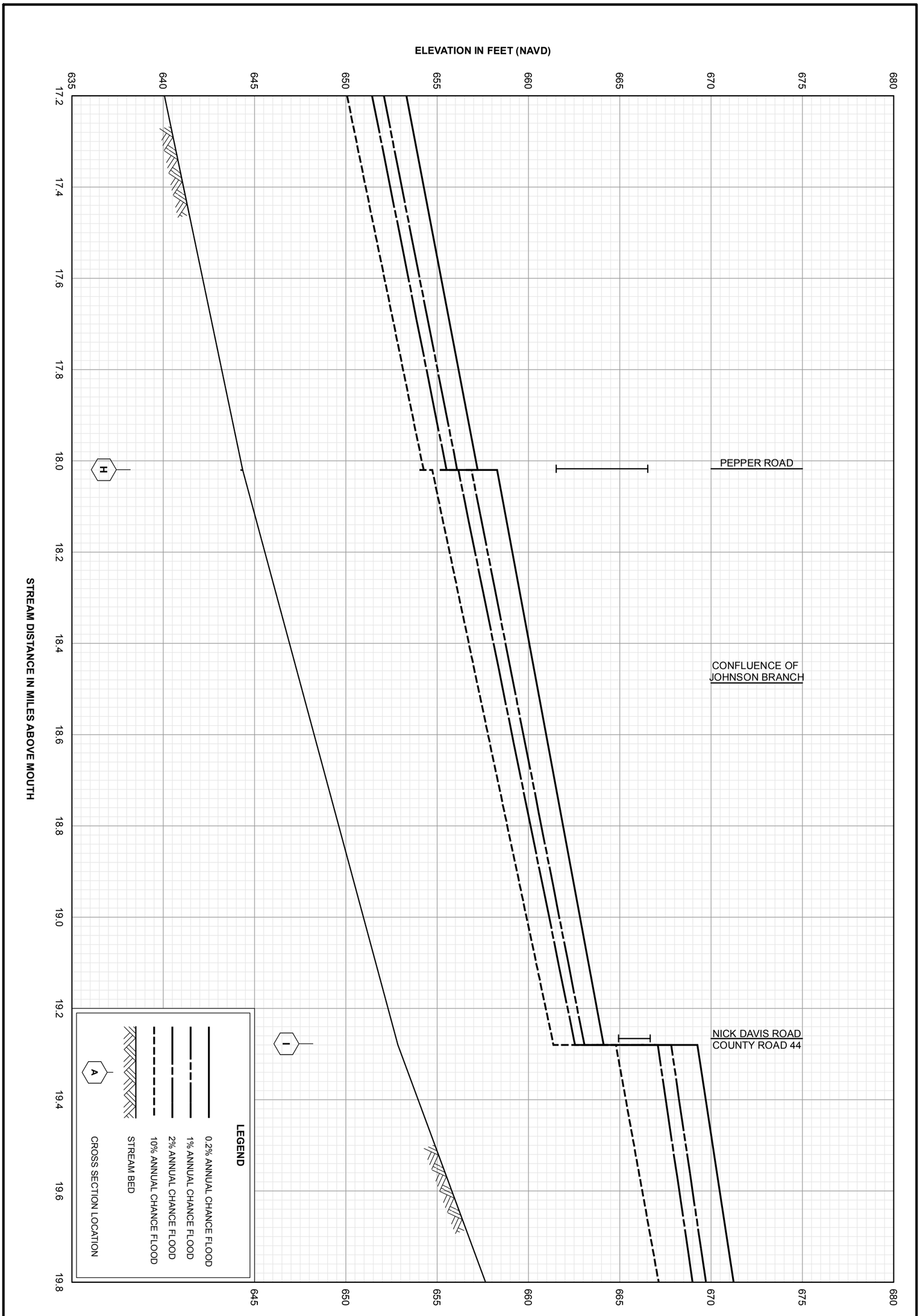
FLOOD PROFILES

PINEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

05P



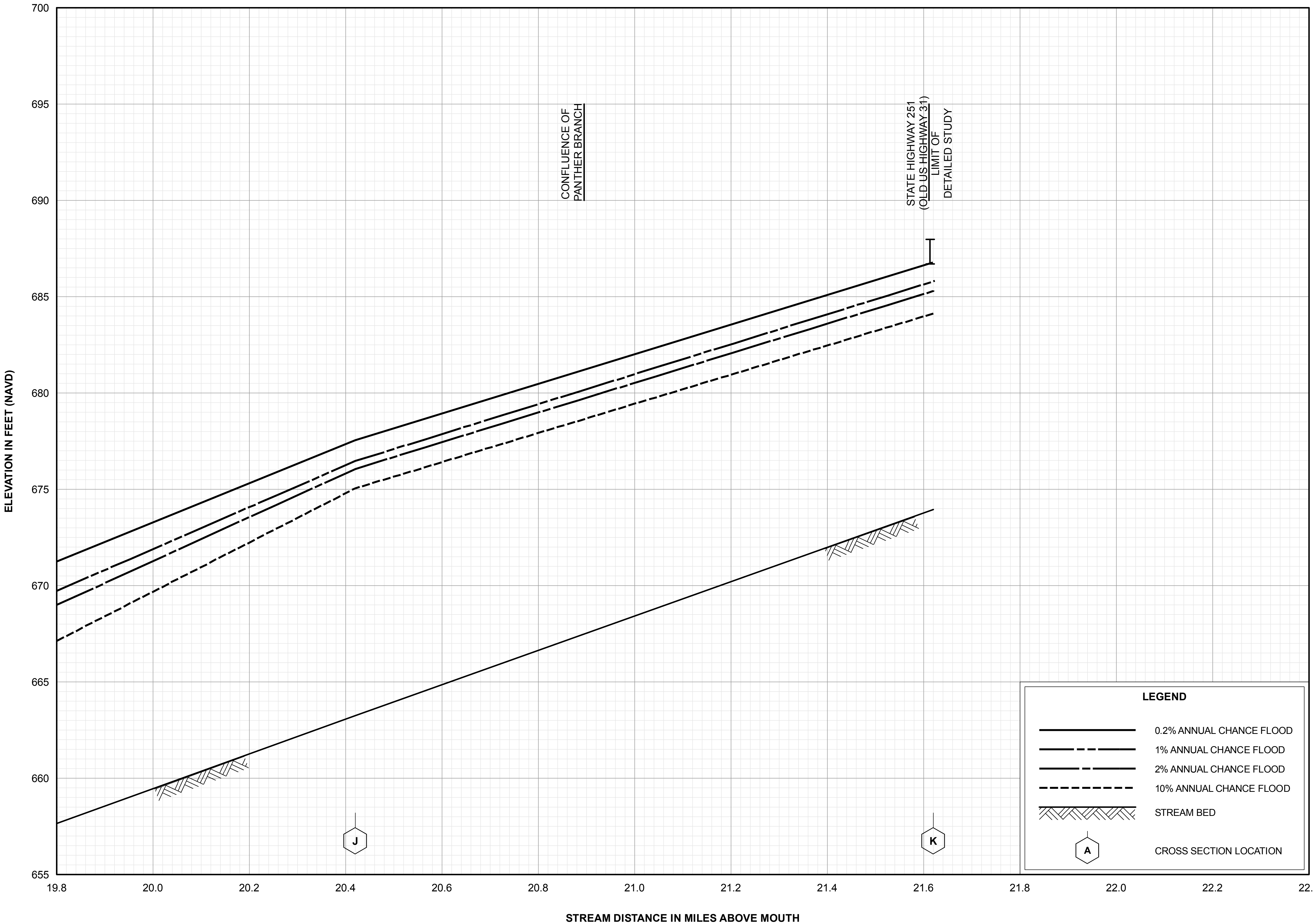
06P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

PINEY CREEK



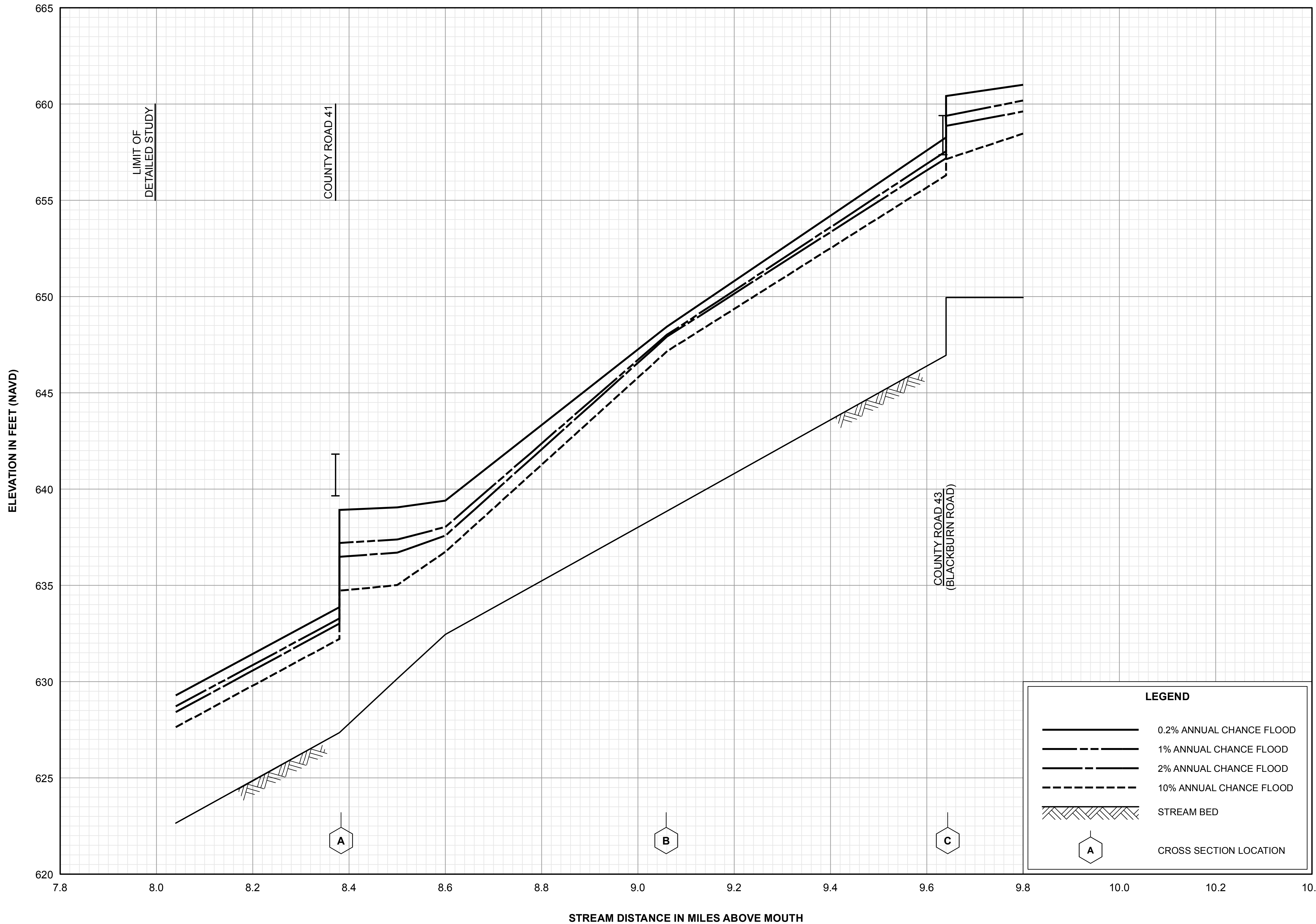
FLOOD PROFILES

PINEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

07P



FLOOD PROFILES

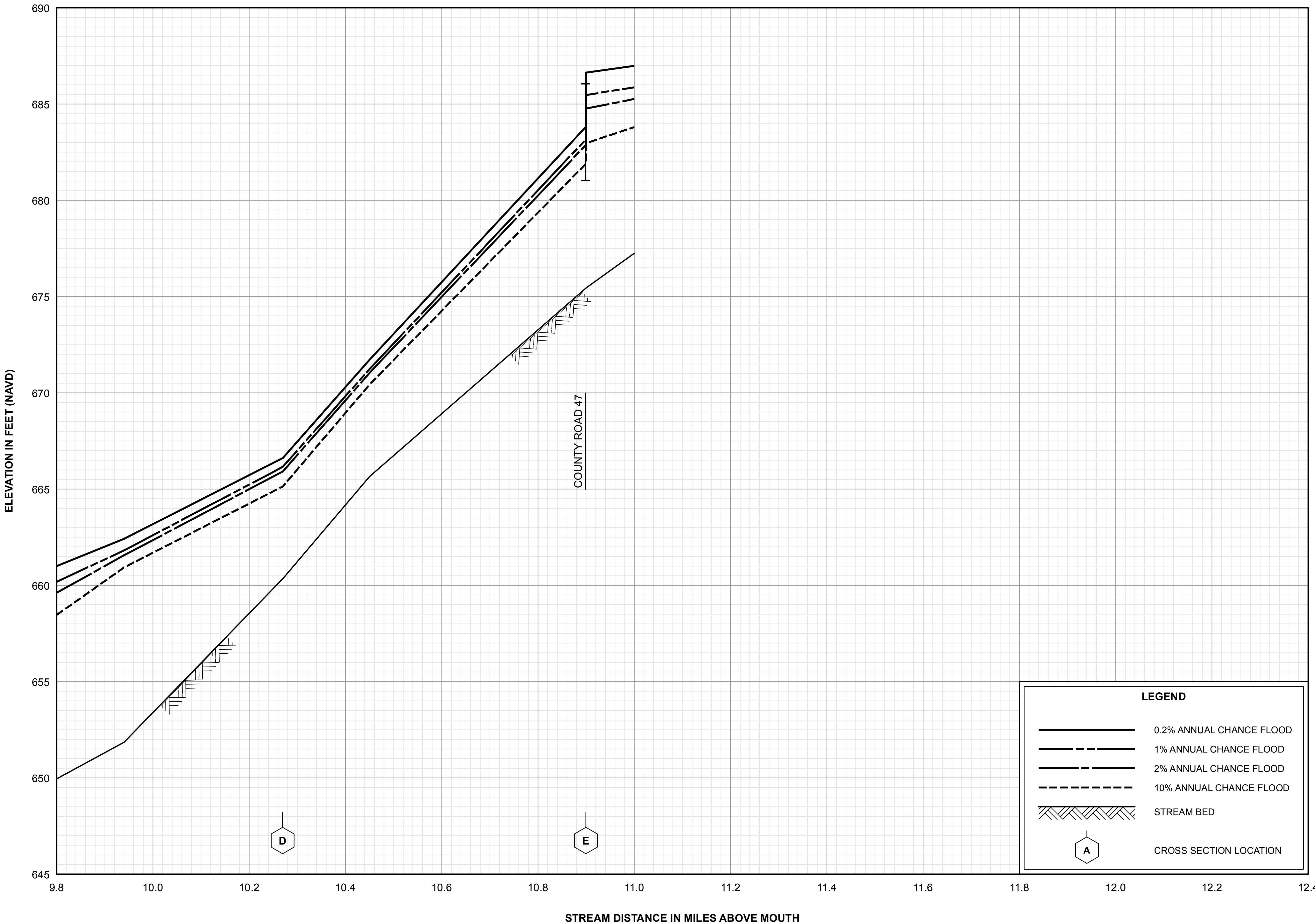
ROUND ISLAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL

AND INCORPORATED AREAS

08P



FLOOD PROFILES

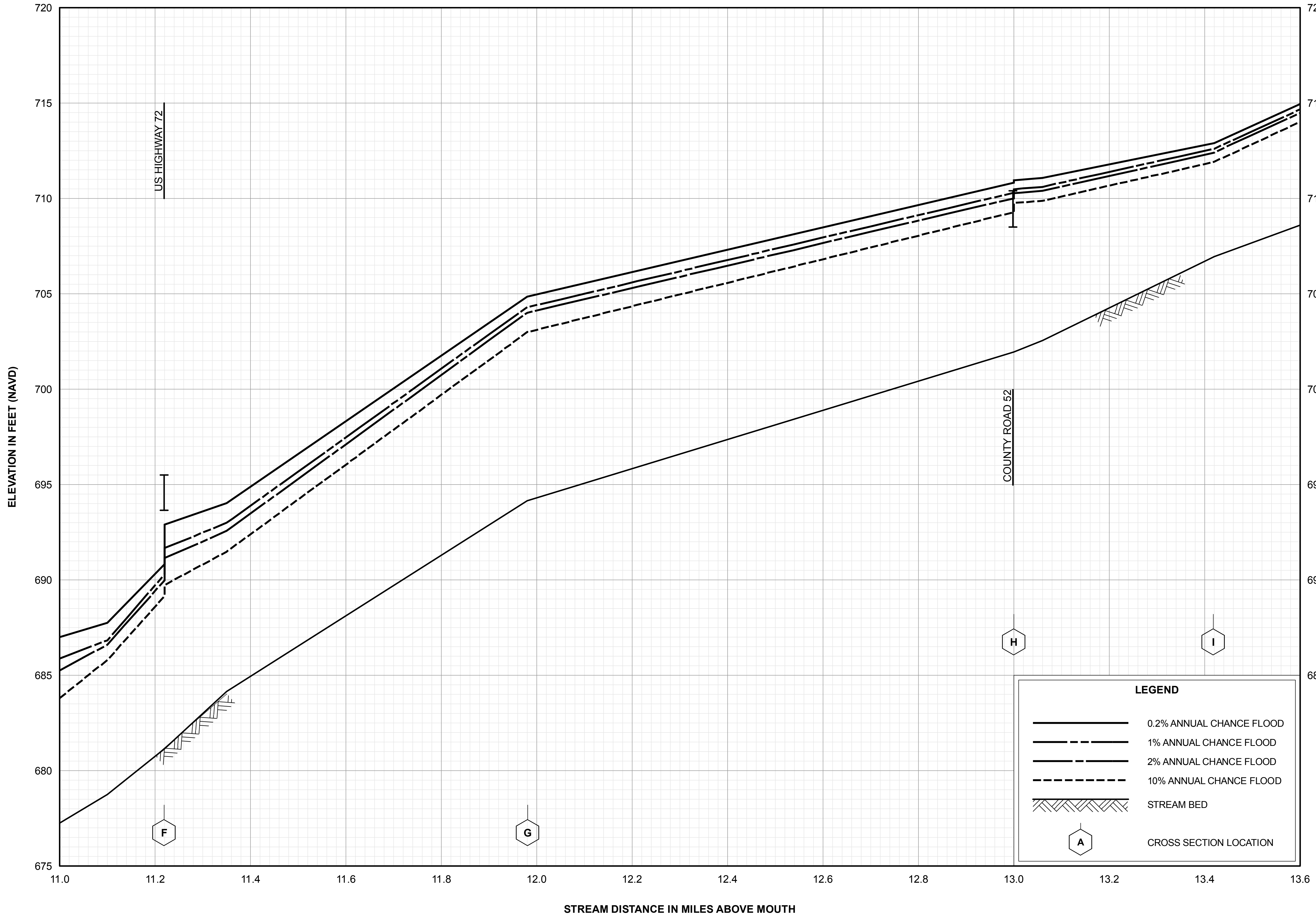
ROUND ISLAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL

AND INCORPORATED AREAS

09P



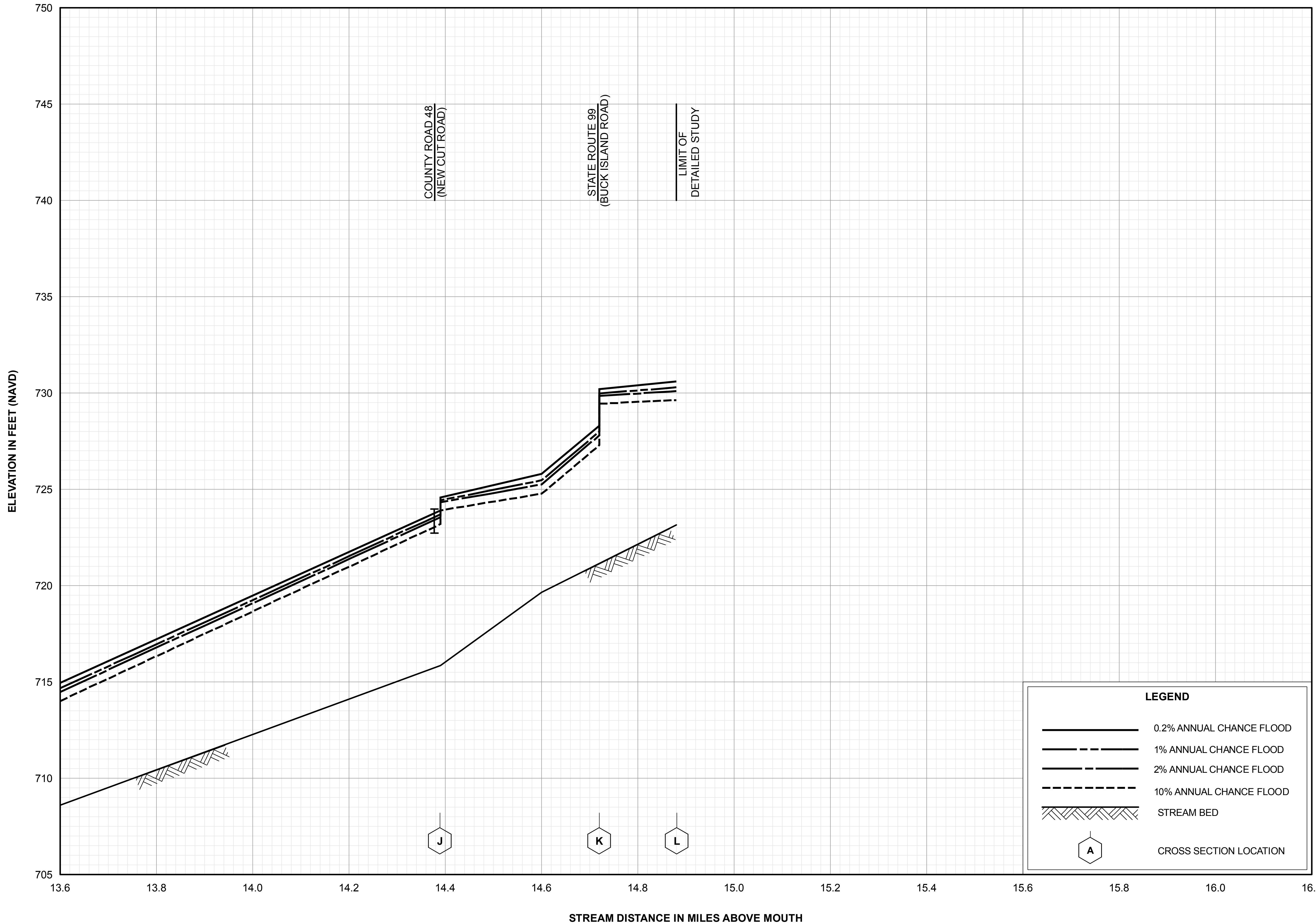
FLOOD PROFILES

ROUND ISLAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

10P



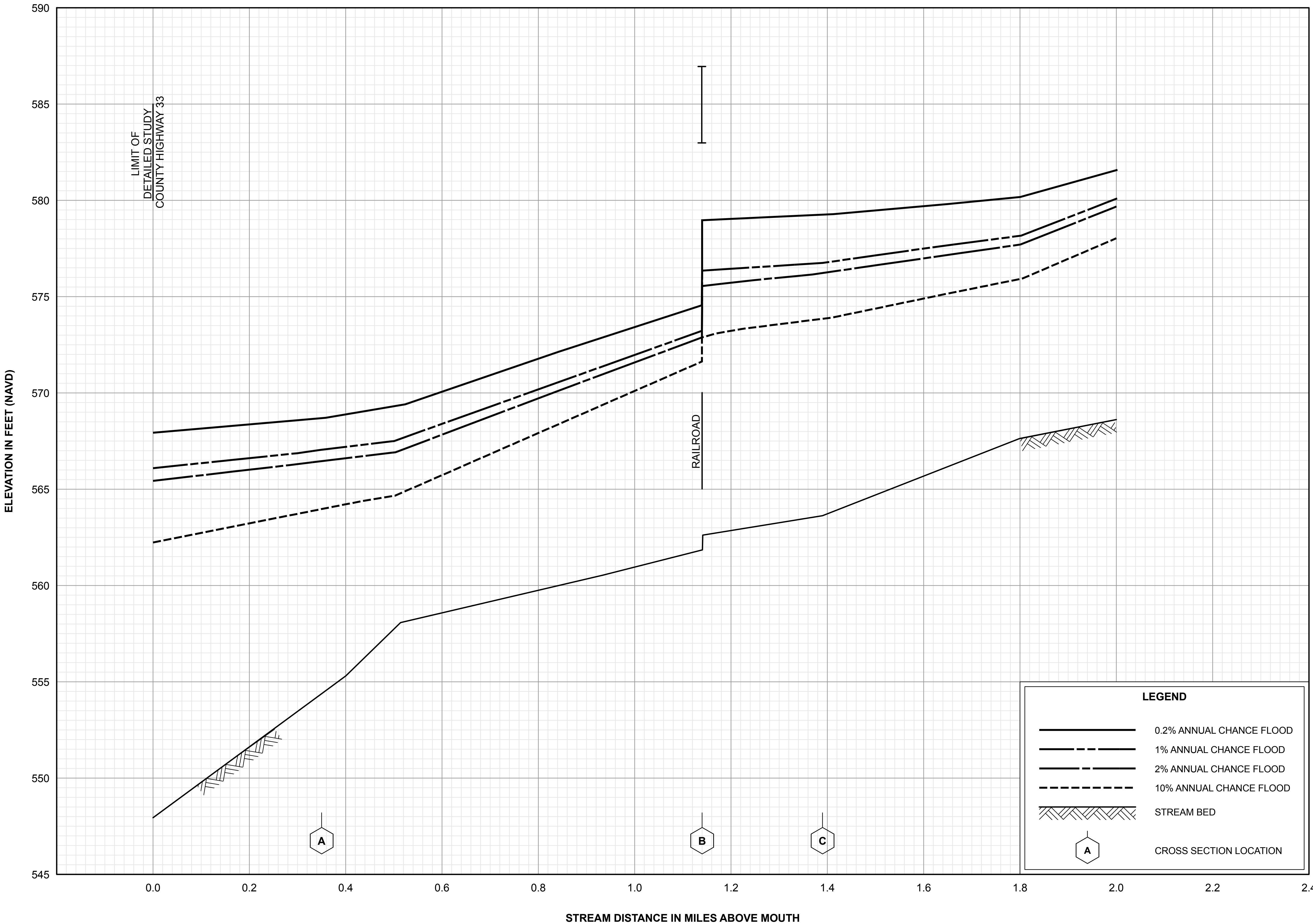
FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

ROUND ISLAND CREEK

11P



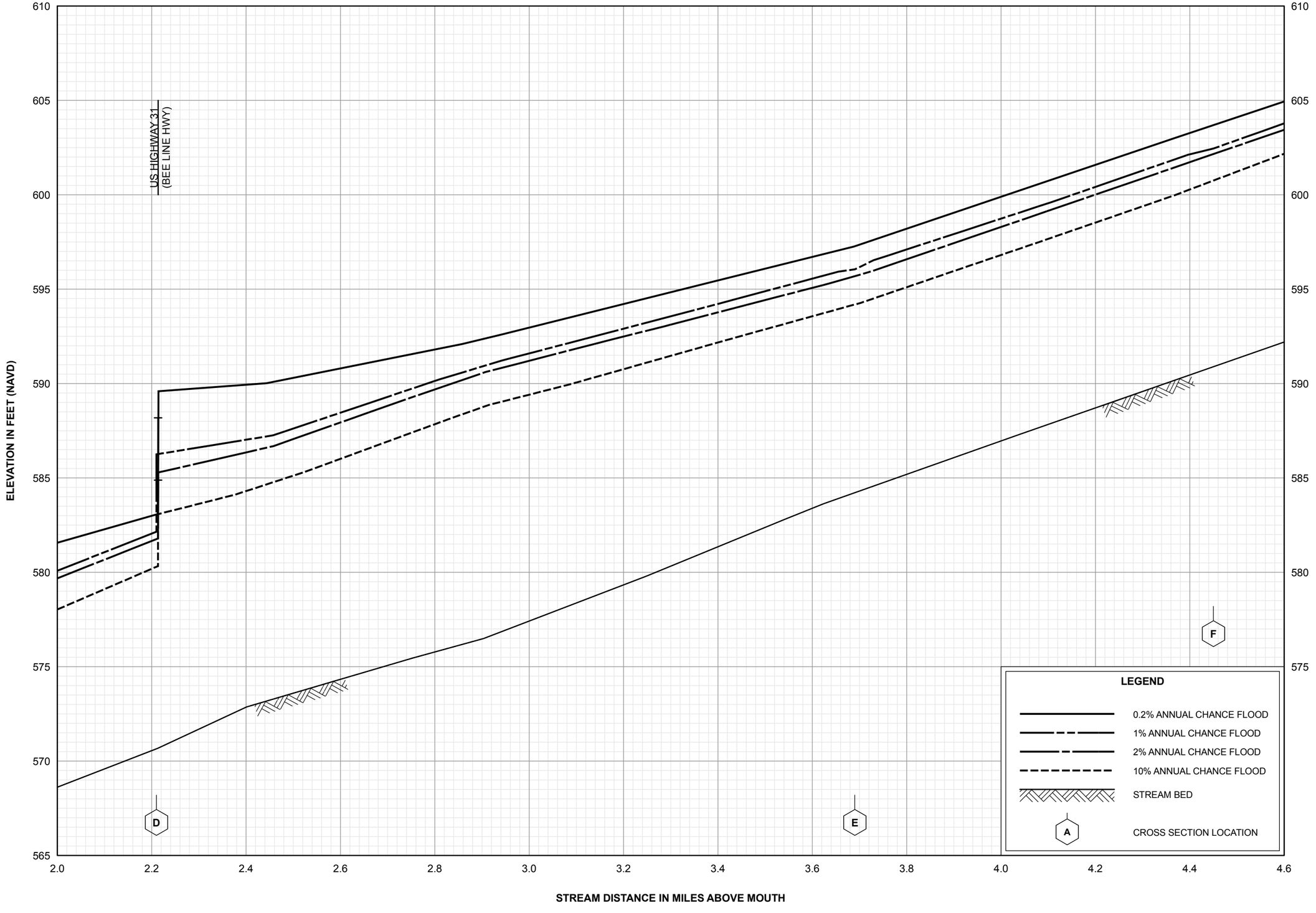
FLOOD PROFILES

SWAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

12P



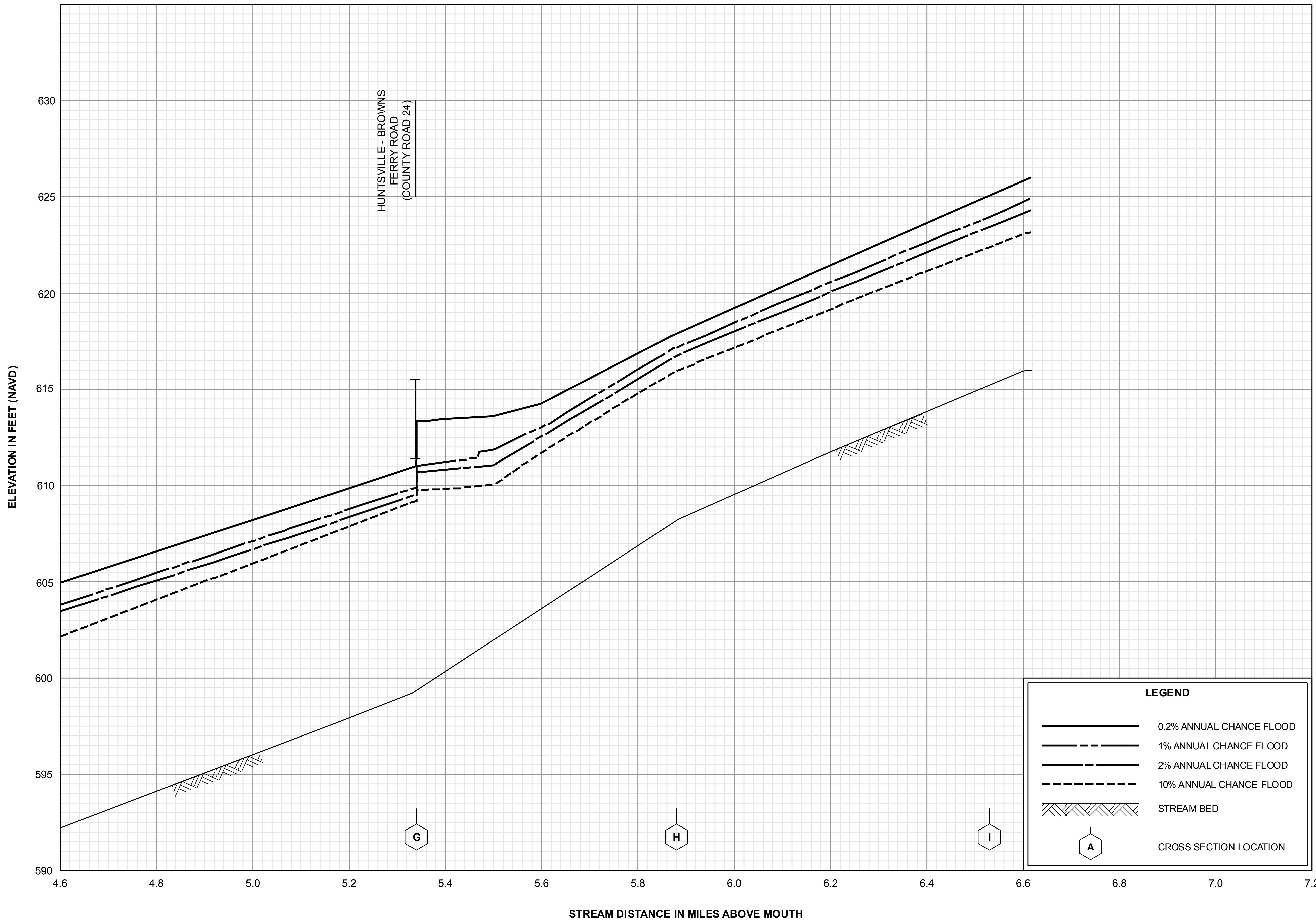
FLOOD PROFILES

SWAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

13P

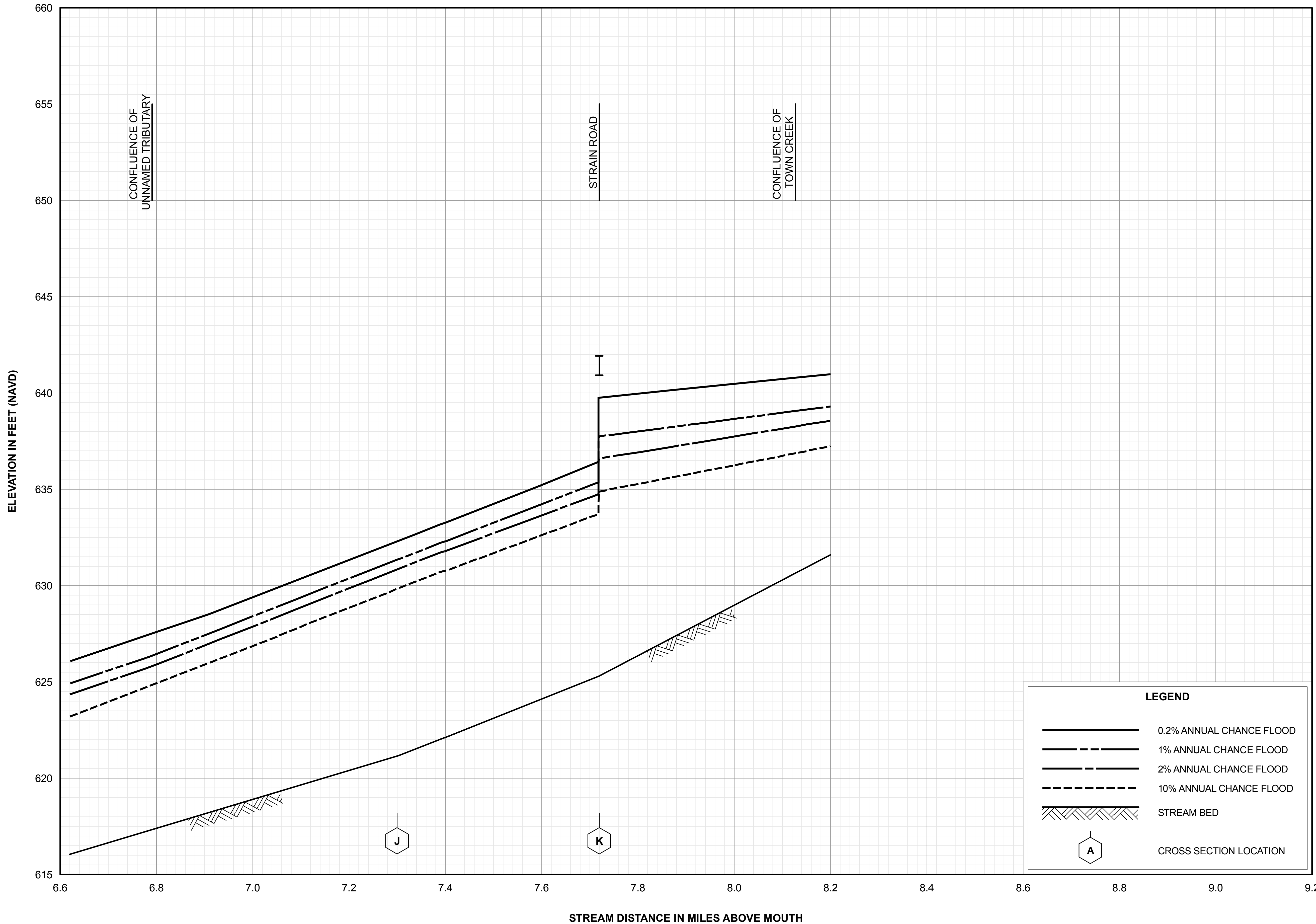


FLOOD PROFILES

SWAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS



FLOOD PROFILES

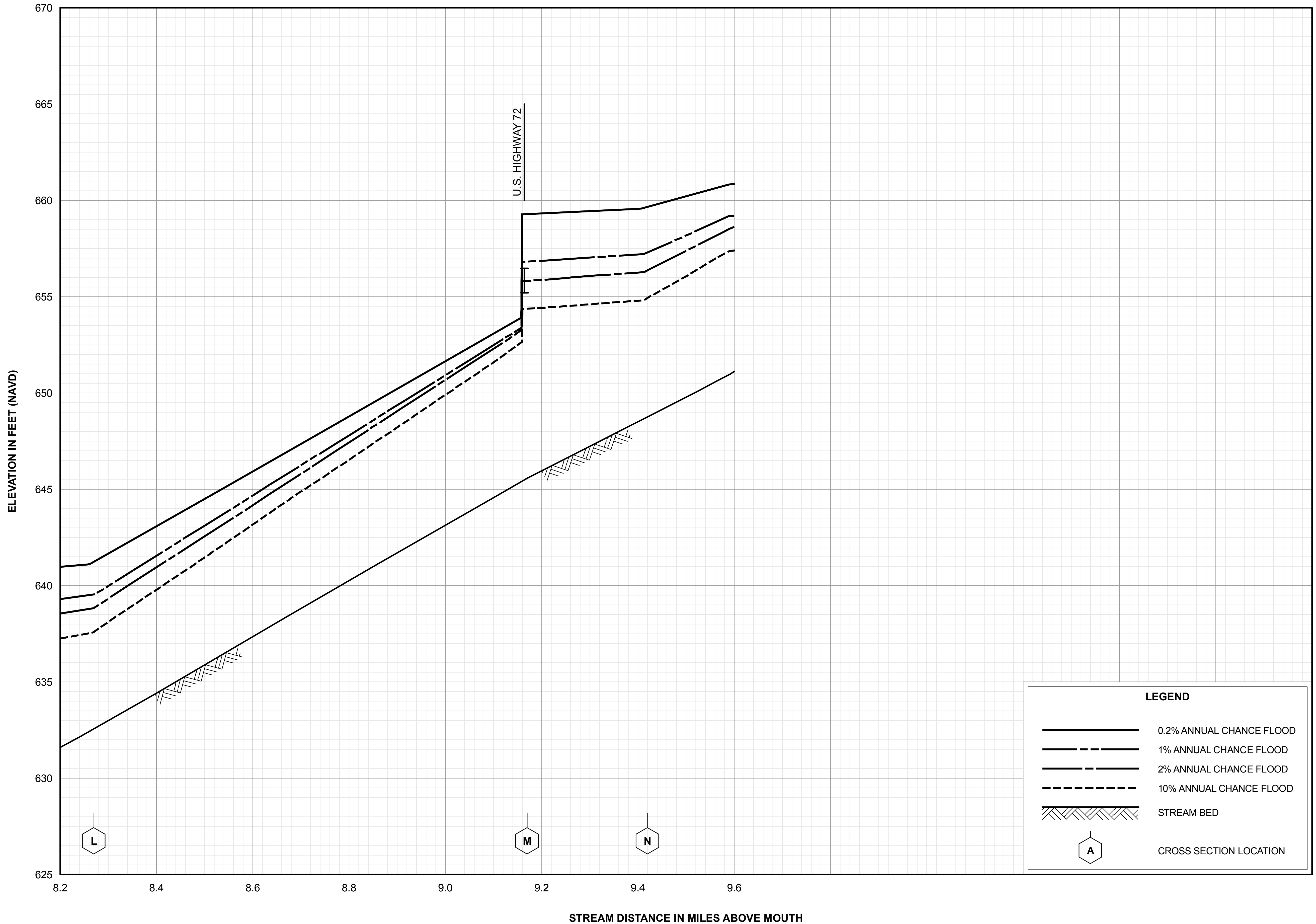
SWAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL

AND INCORPORATED AREAS

15P



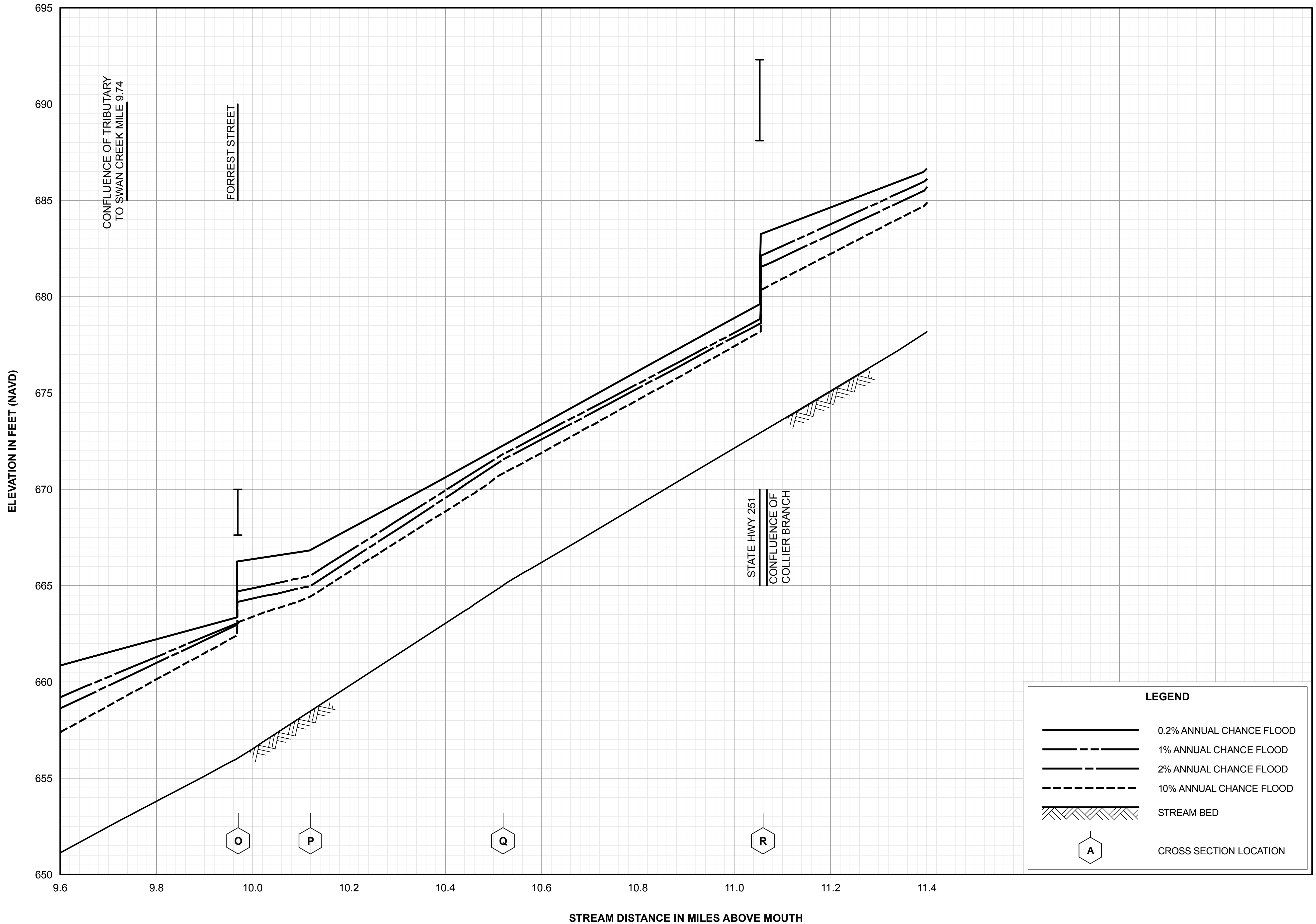
FLOOD PROFILES

SWAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL

AND INCORPORATED AREAS



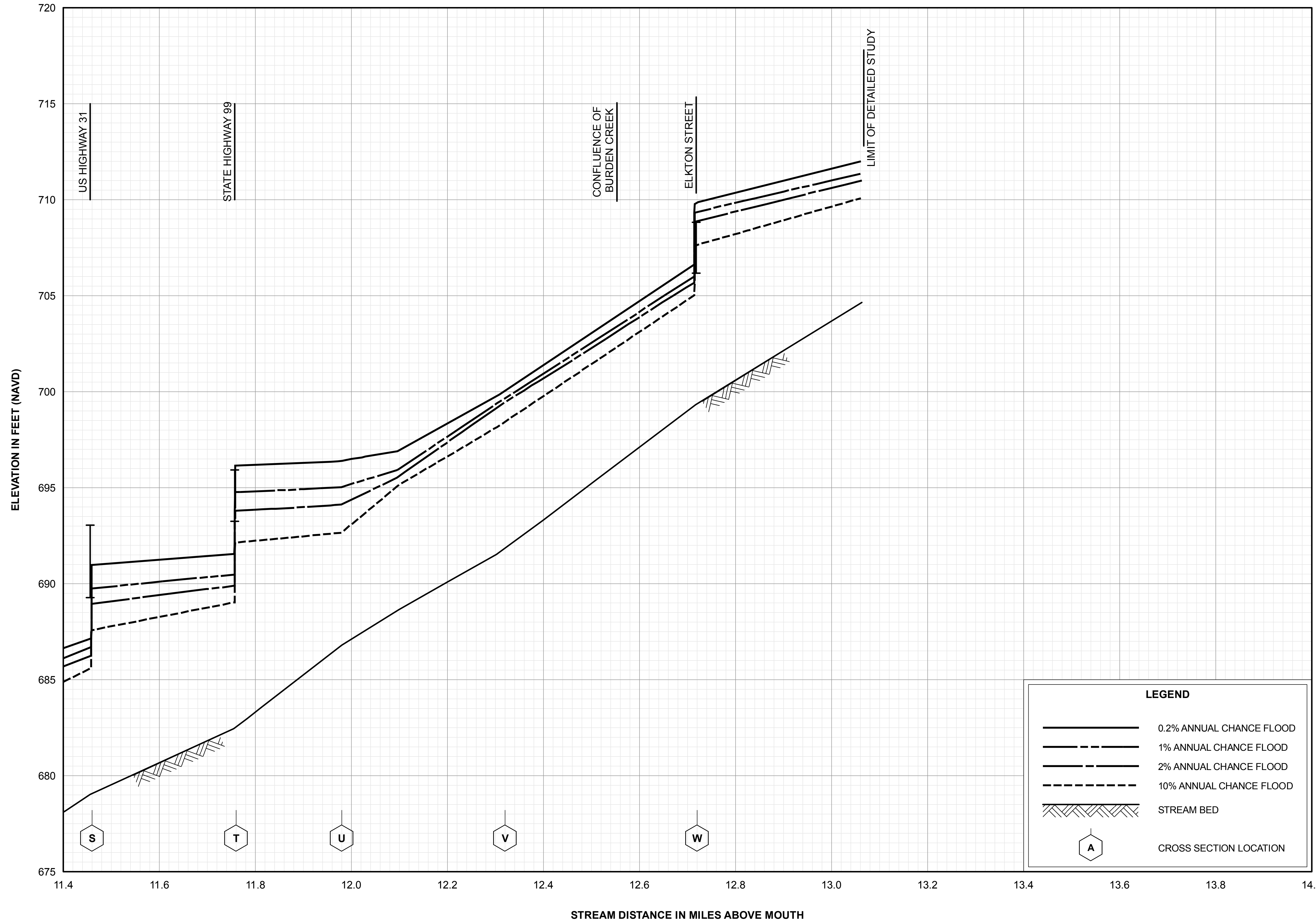
FLOOD PROFILES

SWAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL

AND INCORPORATED AREAS

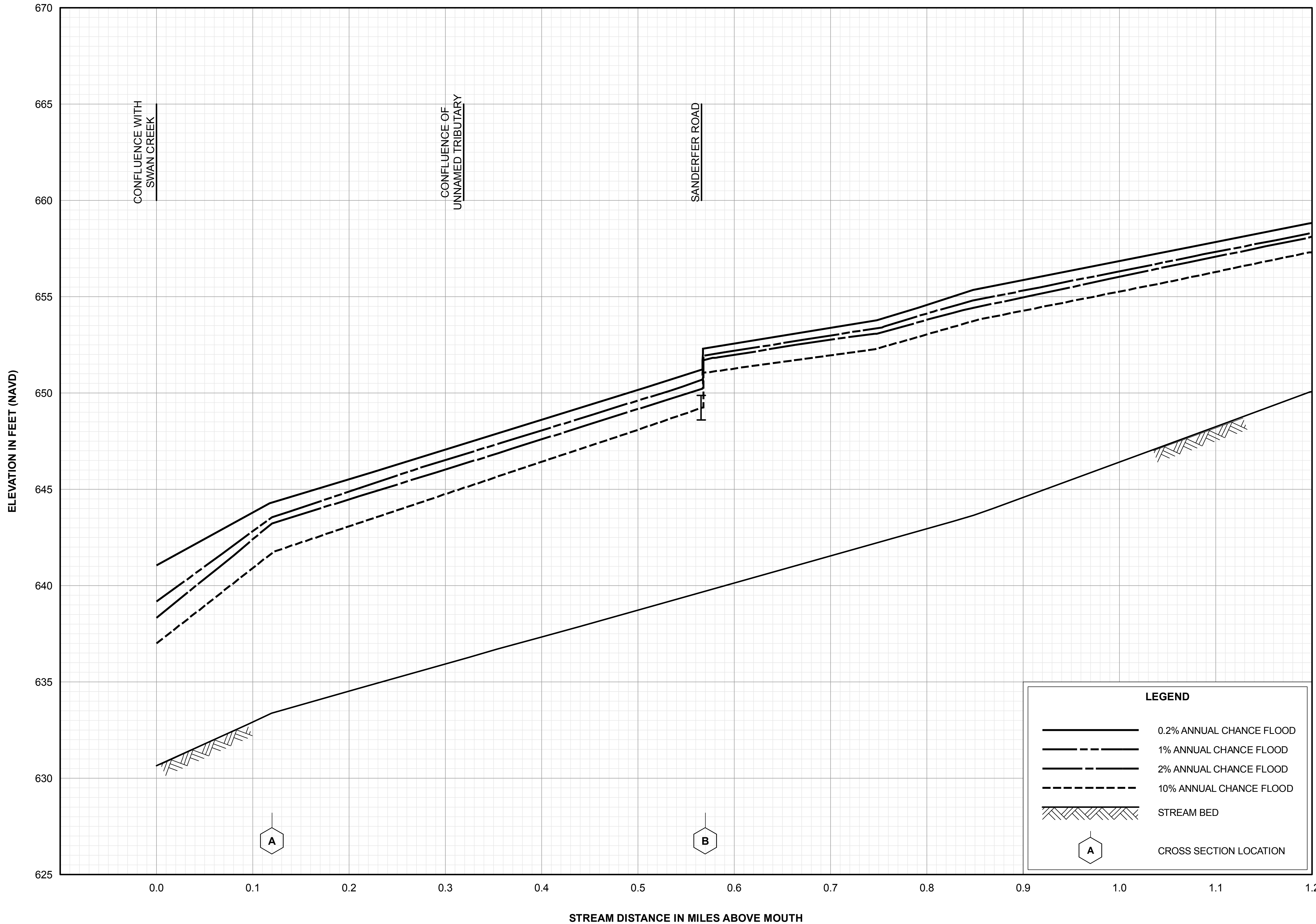


FLOOD PROFILES

SWAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS



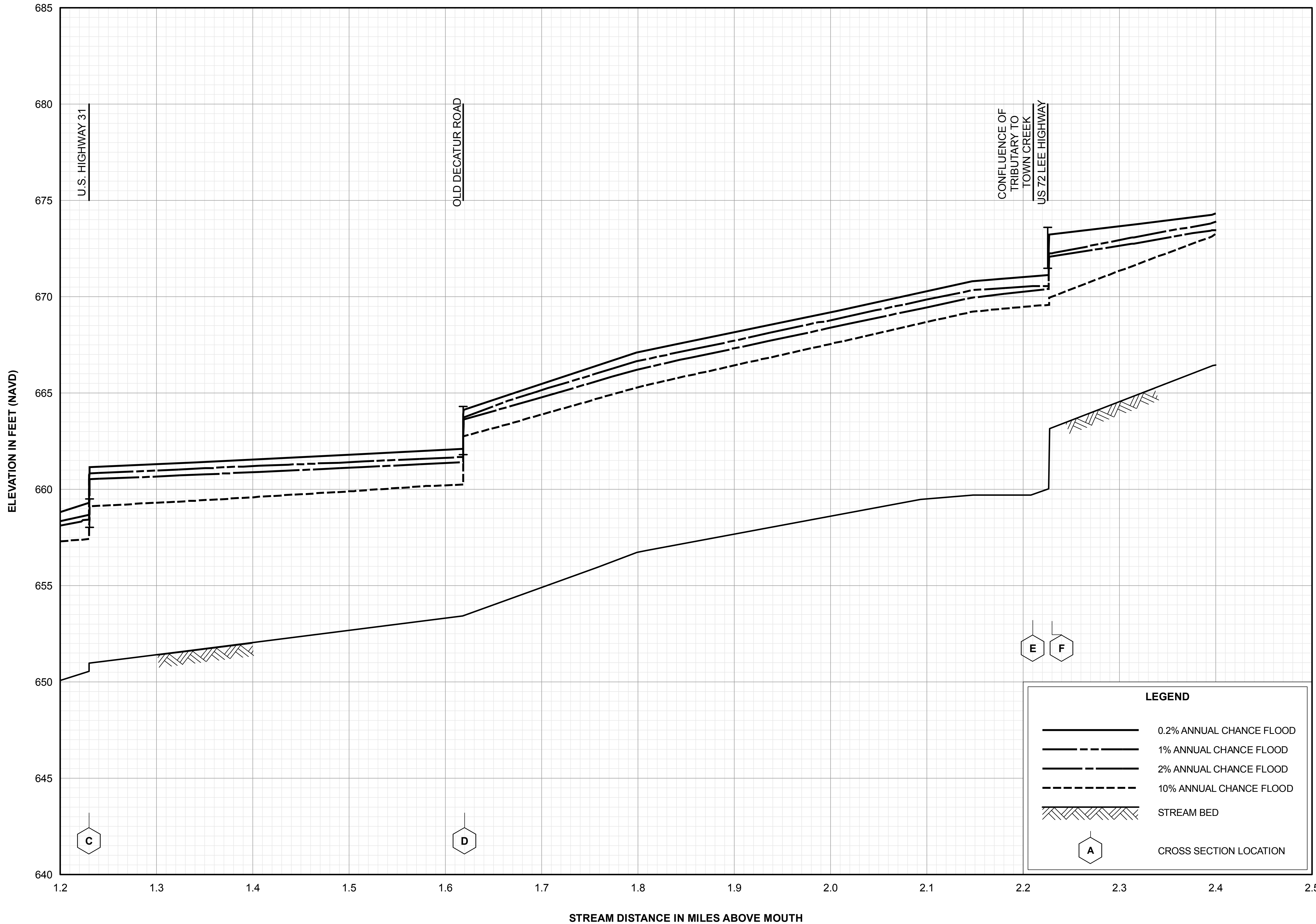
FLOOD PROFILES

TOWN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

19P



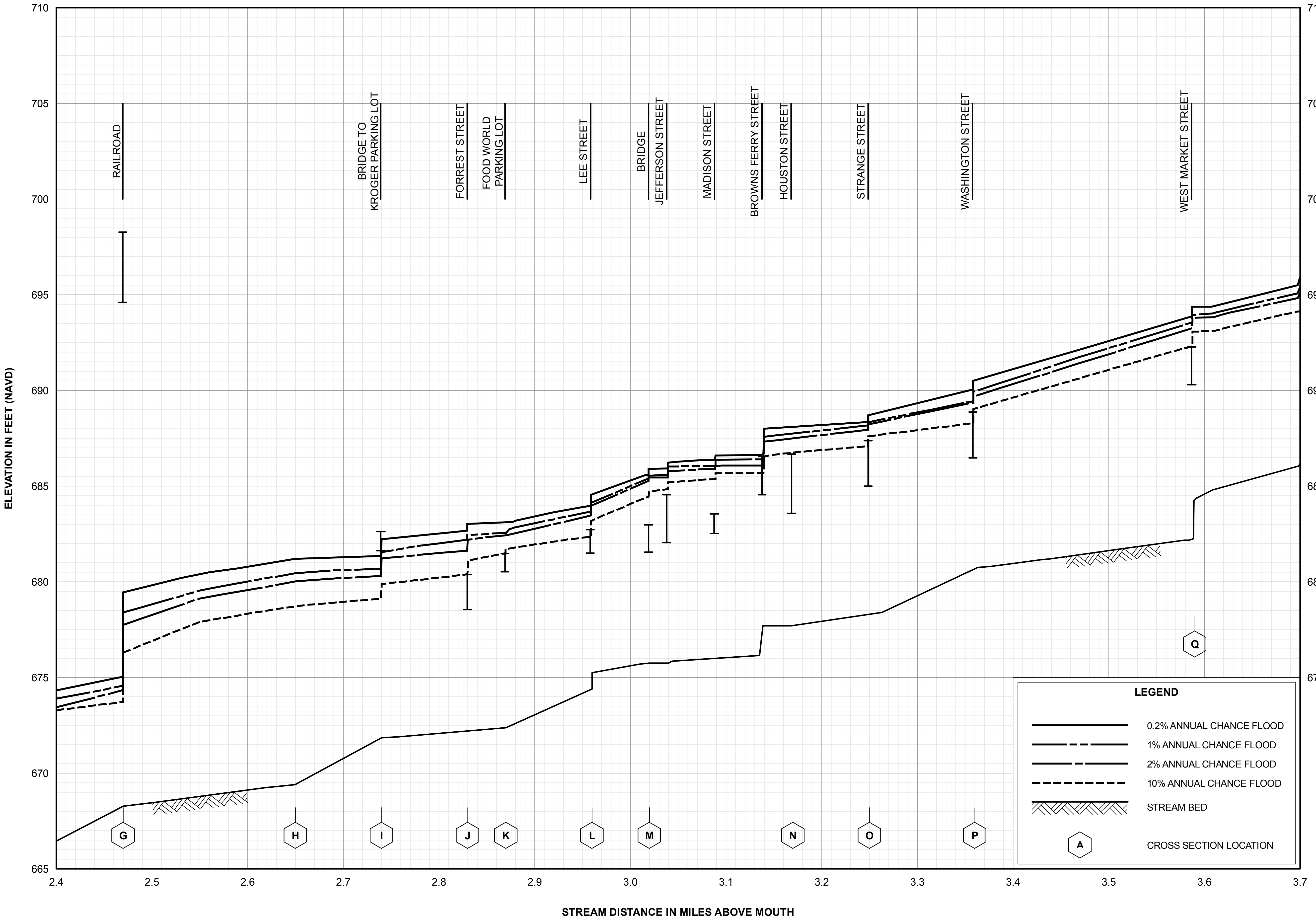
FLOOD PROFILES

TOWN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

20P

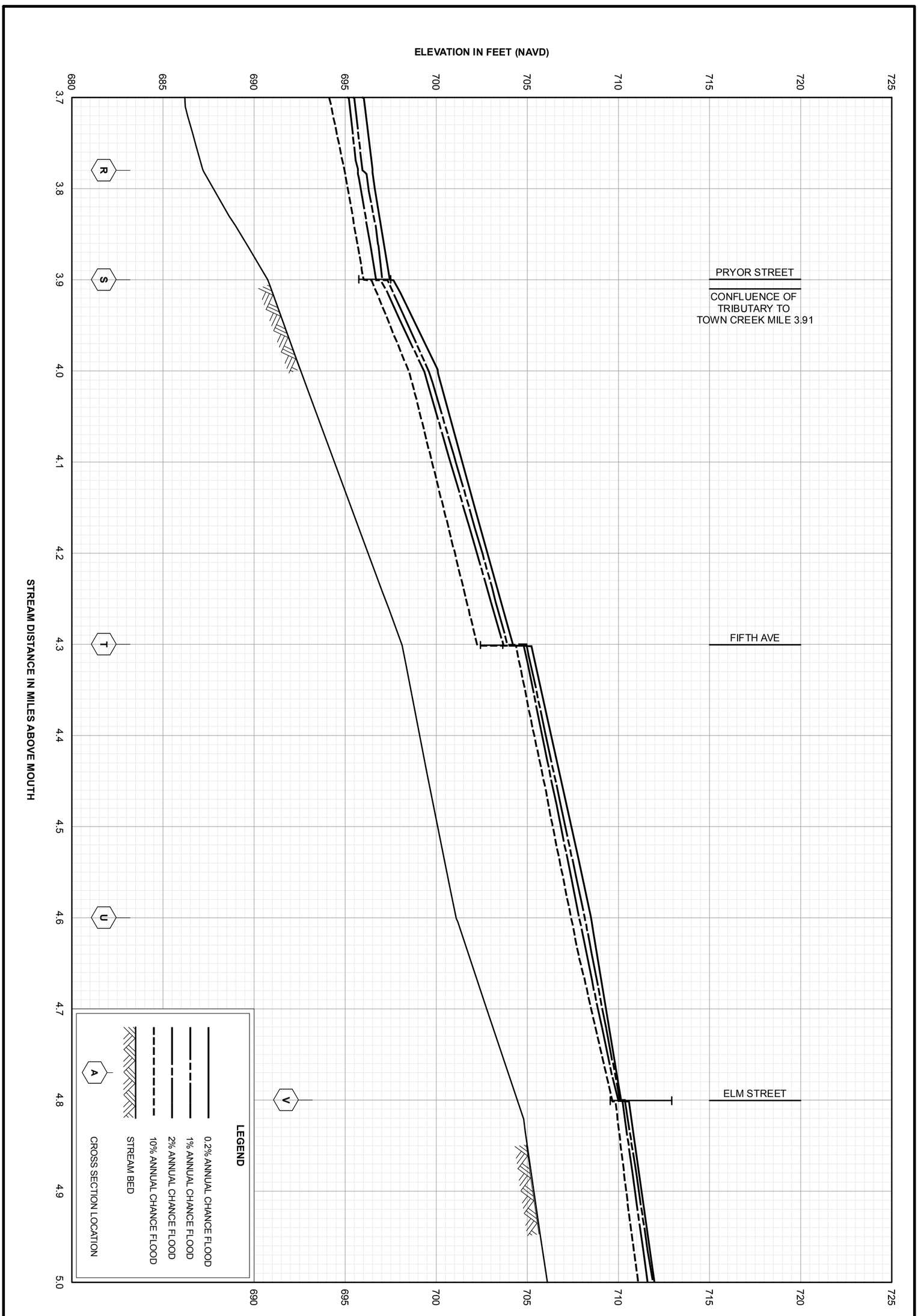


FLOOD PROFILES

TOWN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS



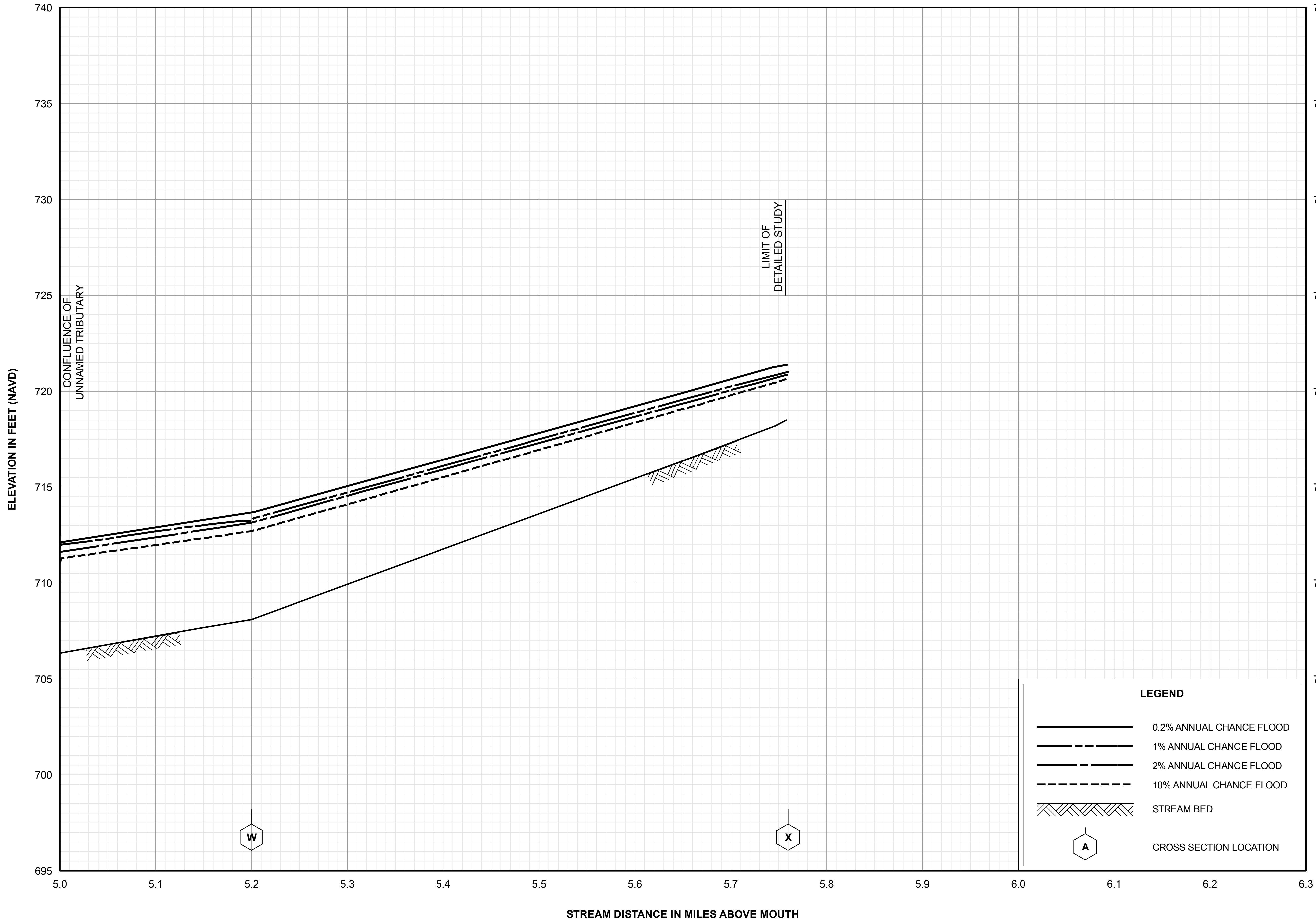
22P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

TOWN CREEK



FLOOD PROFILES

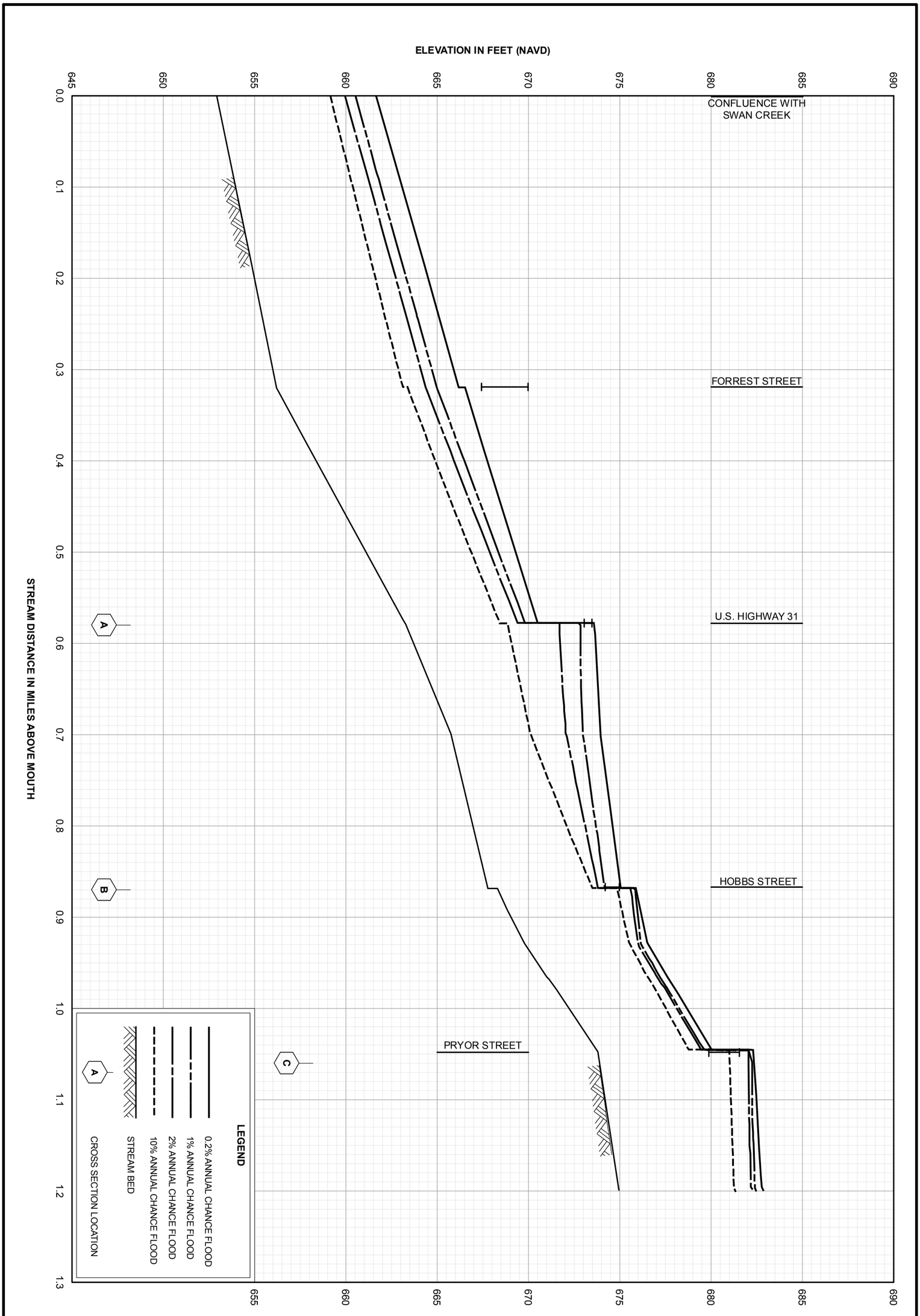
TOWN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL

AND INCORPORATED AREAS

23P



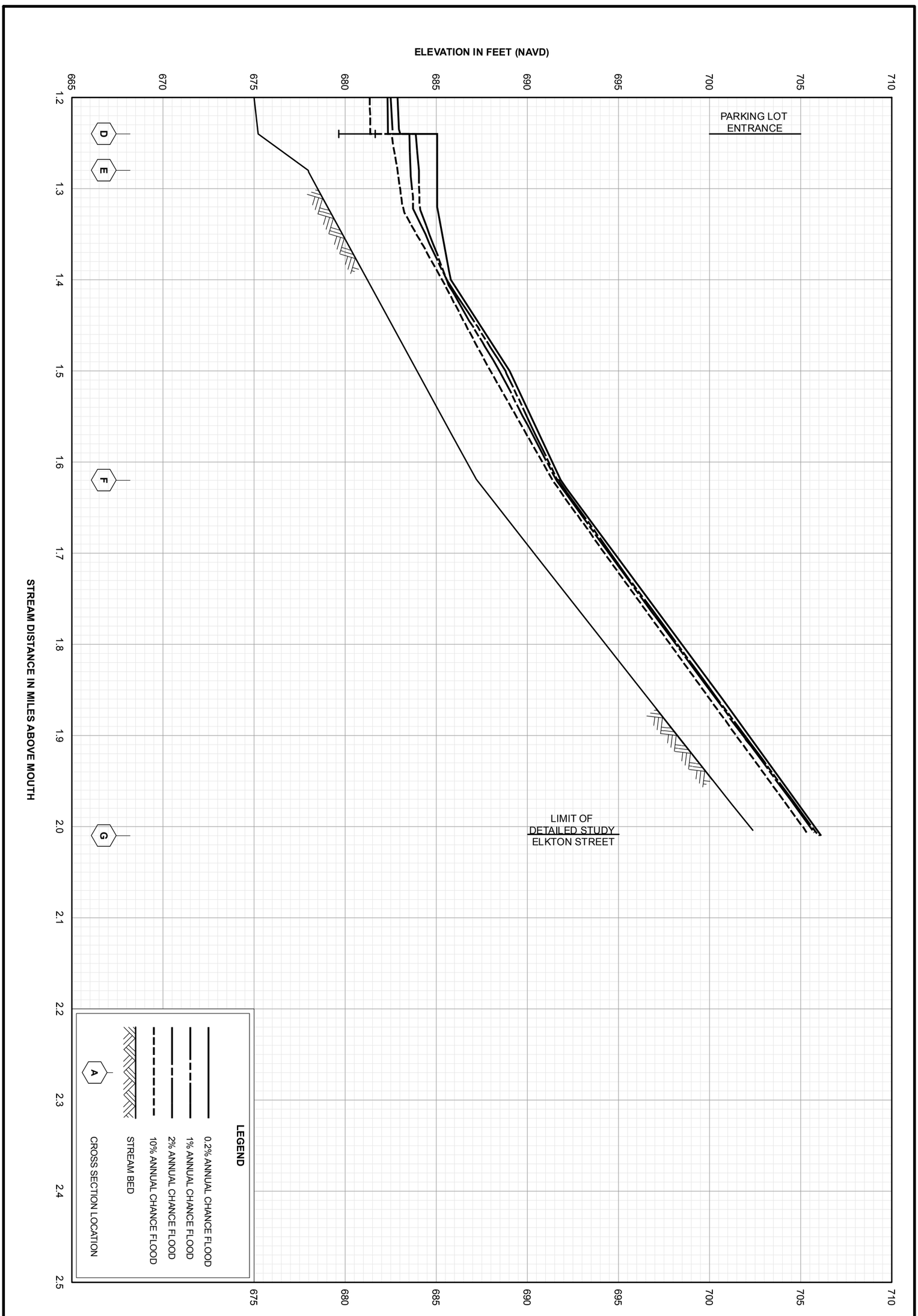
24P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

TRIBUTARY TO SWAN CREEK MILE 9.74



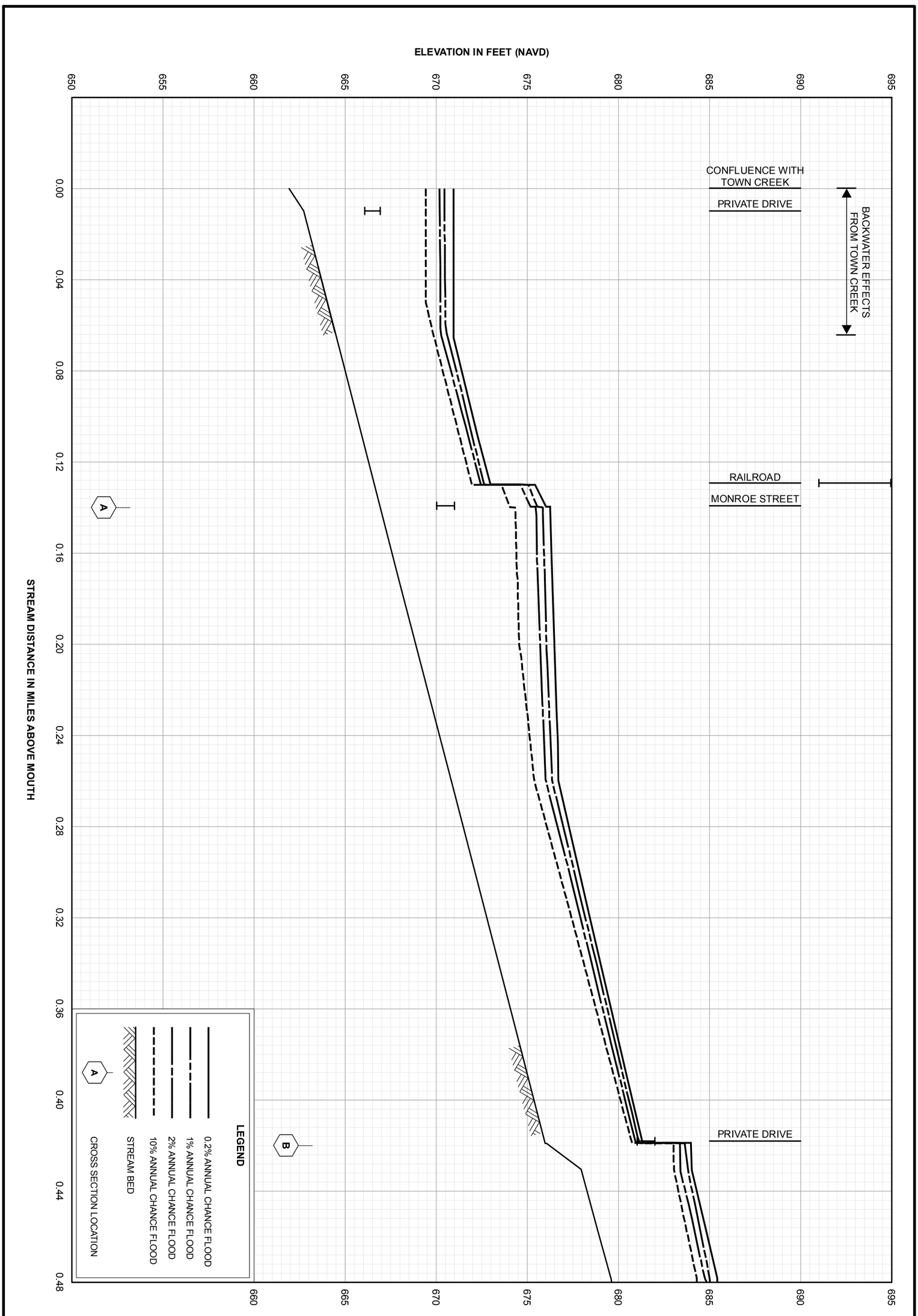
25P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

TRIBUTARY TO SWAN CREEK MILE 9.74



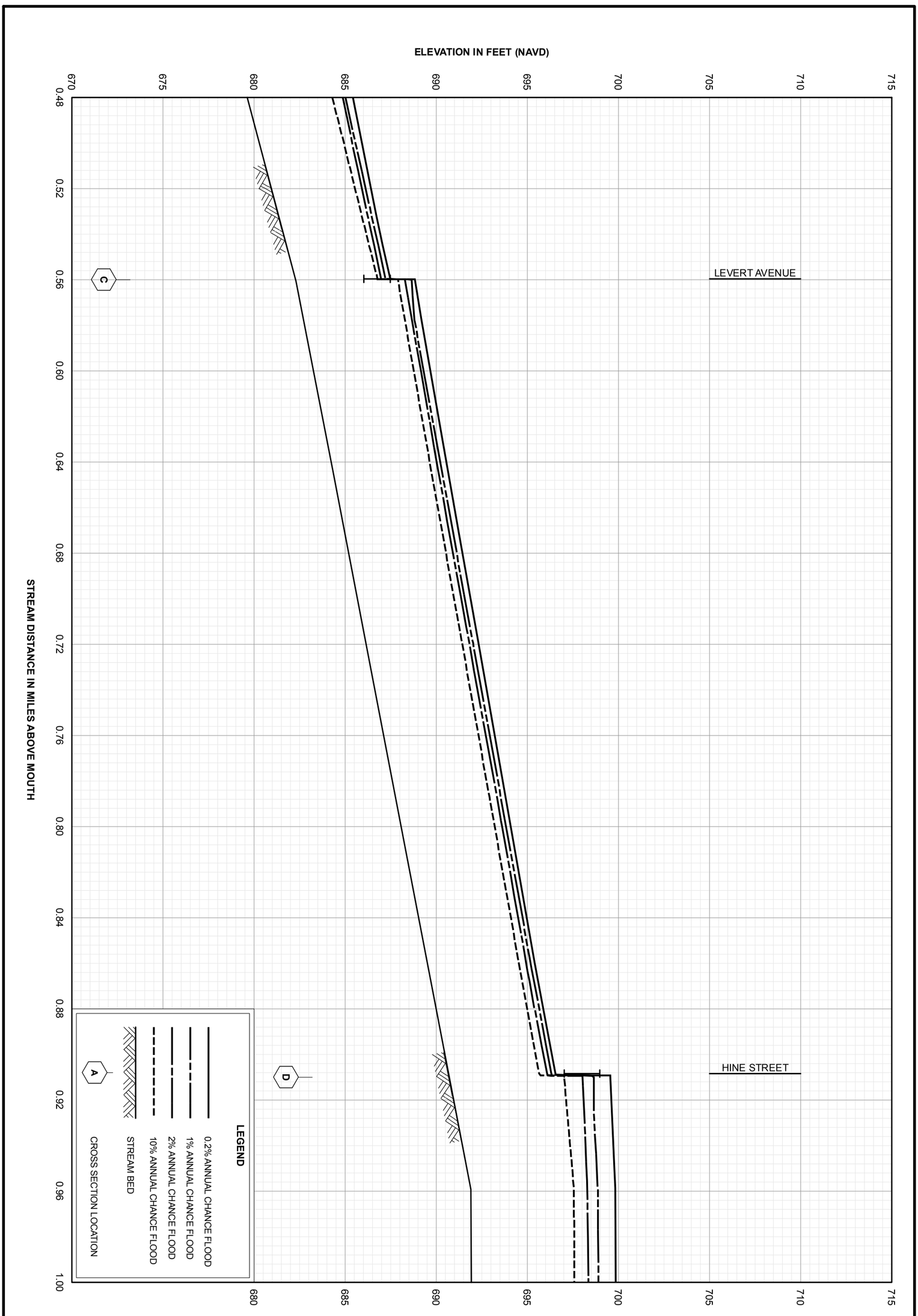
26P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

TRIBUTARY TO TOWN CREEK MILE 2.21



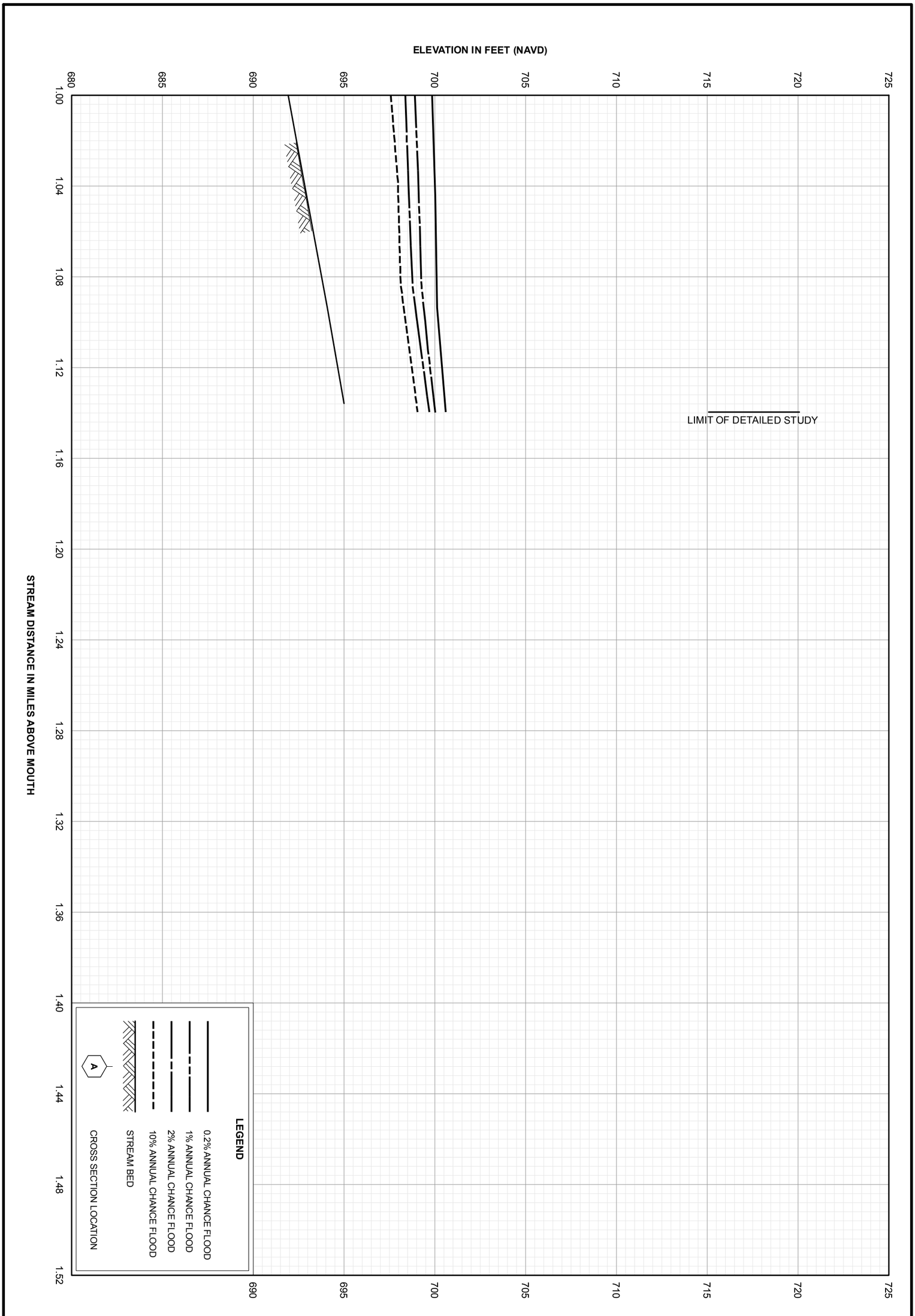
27P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

TRIBUTARY TO TOWN CREEK MILE 2.21



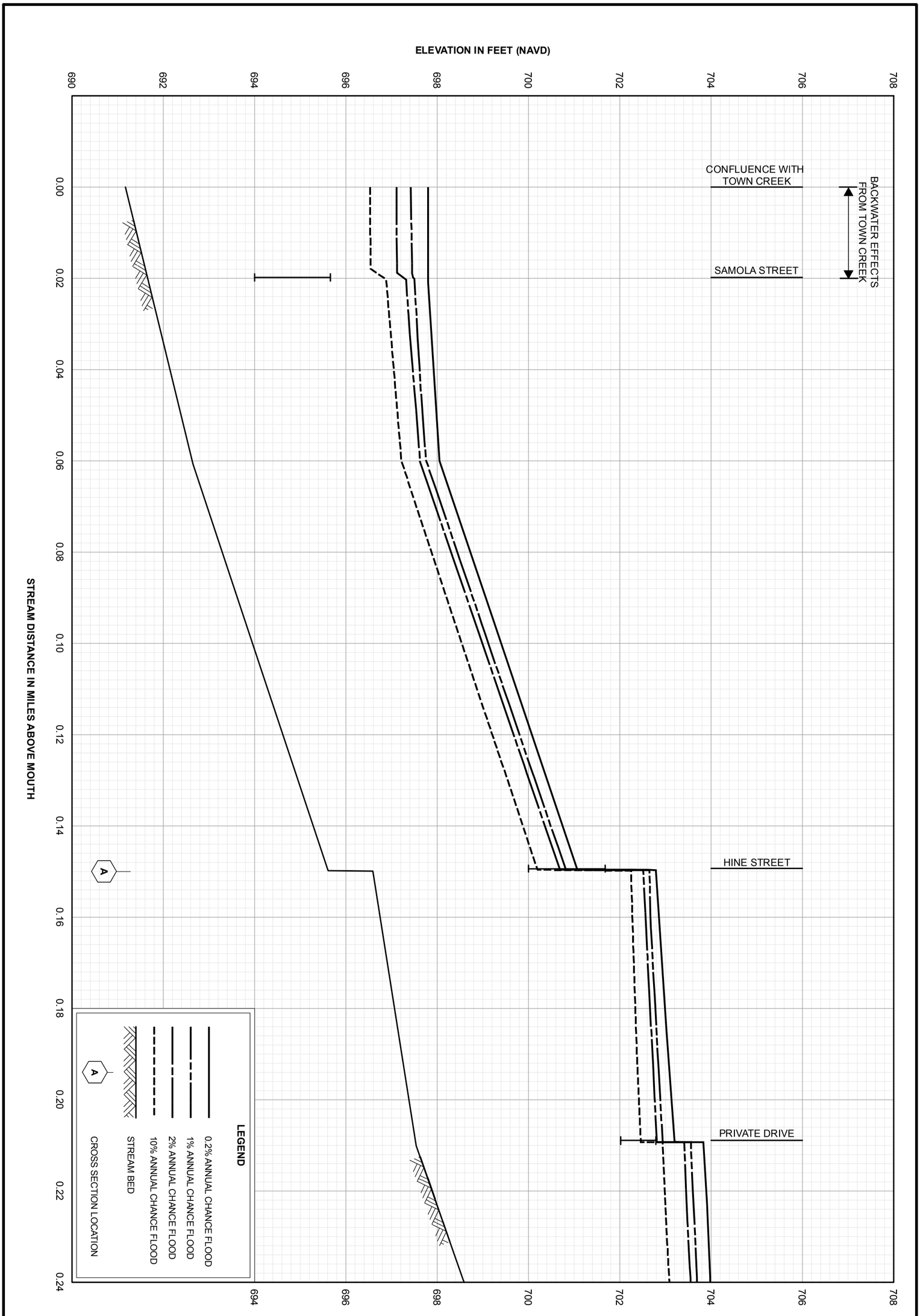
28P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

TRIBUTARY TO TOWN CREEK MILE 2.21



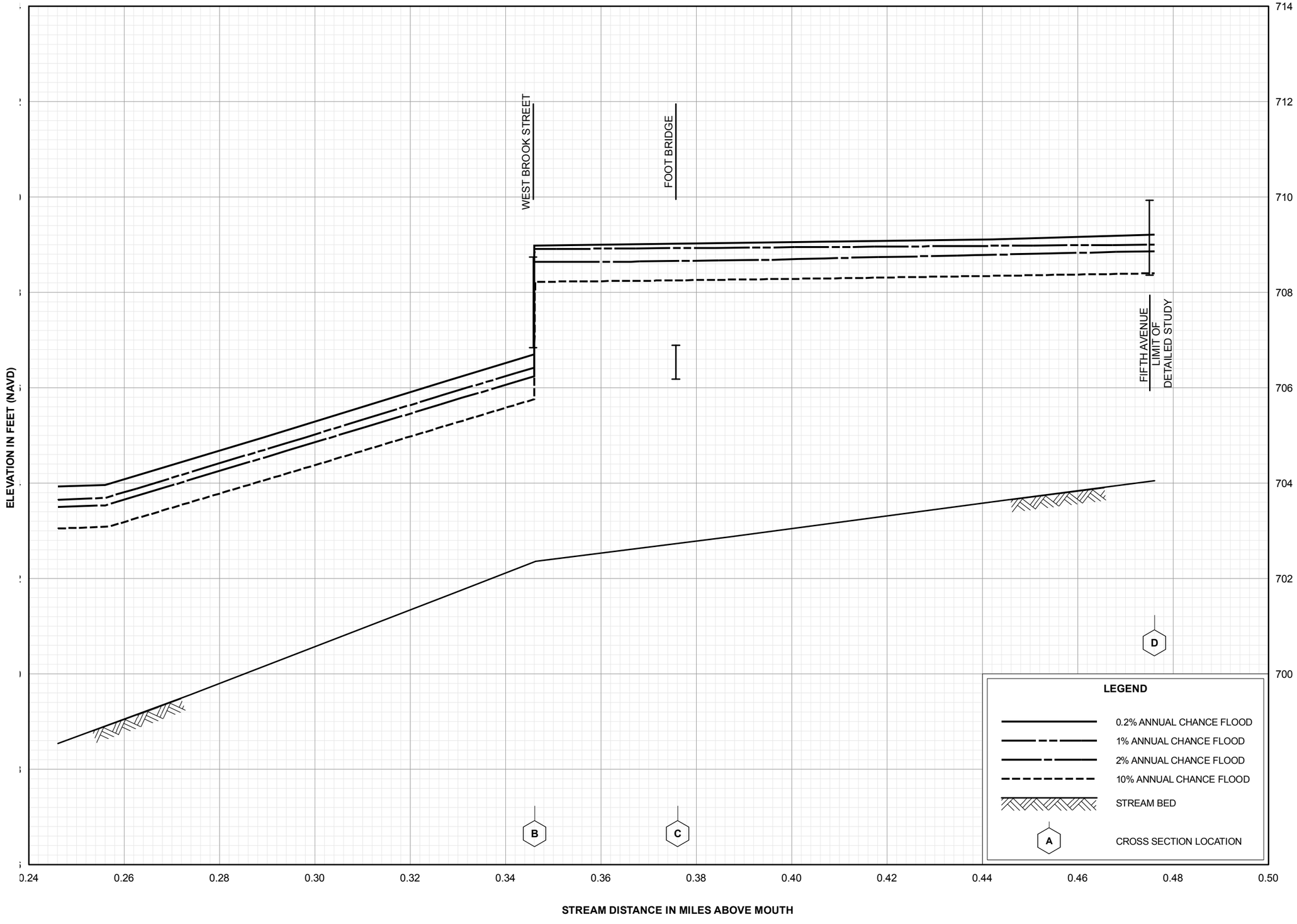
29P

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS

FLOOD PROFILES

TRIBUTARY TO TOWN CREEK MILE 3.91



FLOOD PROFILES

TRIBUTARY TO TOWN CREEK MILE 3.91

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIMESTONE COUNTY, AL
AND INCORPORATED AREAS