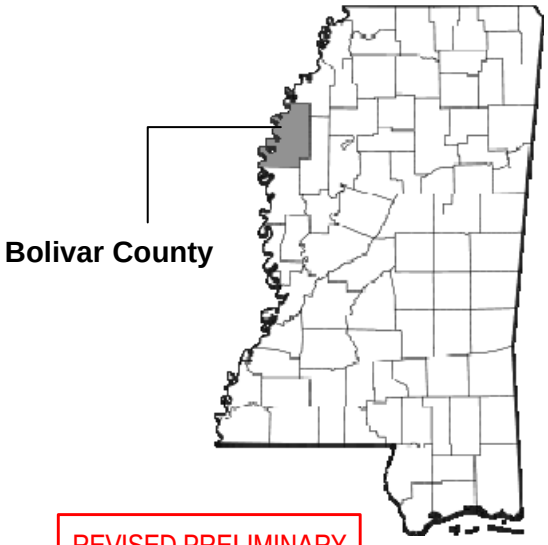
FLOOD INSURANCE STUDY

BOLIVAR COUNTY, MISSISSIPPI
AND INCORPORATED AREAS

Community Name	Community Number
ALLIGATOR, TOWN OF	280012
BENOIT, TOWN OF	280013
BEULAH, TOWN OF	280014
BOLIVAR COUNTY (UNINCORPORATED AREAS)	280011
BOYLE, TOWN OF	280015
CLEVELAND, CITY OF	280016
DUNCAN, TOWN OF	280017
GUNNISON, TOWN OF	280018
MERIGOLD, TOWN OF	280019
MOUND BAYOU, CITY OF	280020
PACE, TOWN OF	280021
RENOVA, TOWN OF	280065
ROSEDALE, CITY OF	280022
SHAW, CITY OF	280023
SHELBY, CITY OF	280024
WINSTONVILLE, TOWN OF	280025



REVISED PRELIMINARY

JULY 8 2013

EFFECTIVE:

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
28011CV000A

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.

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

Old Zone	New Zone
A1 through A30	AE
C	X

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

Initial Countywide FIS Effective Date: TBD

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FLOOD INSURANCE STUDY

BOLIVAR COUNTY, MISSISSIPPI 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 Bolivar County, including the Cities of Cleveland, Mound Bayou, Rosedale, Shaw, and Shelby; the Towns of Alligator, Benoit, Beulah, Boyle, Duncan, Gunnison, Merigold, Pace, Renova, and Winstonville; and the unincorporated areas of Bolivar County (referred to collectively herein as Bolivar 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 and is provided in a digital format so that it can be incorporated into a local 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.

This FIS was prepared to compile the unincorporated areas and incorporated communities within Bolivar County into a countywide FIS. Information on the authority and acknowledgements for each jurisdiction is included in this countywide FIS, as compiled from their previously published FIS reports. Only the Unincorporated Areas of Bolivar County and the City of Cleveland had previously printed FIS reports.

The hydrologic and hydraulic analyses for the July 17, 1989 Bolivar County Unincorporated Areas FIS were performed by the U.S. Department of the Interior, Geological Survey, Water Resources Division, the Study Contractor, for FEMA, under Inter-Agency Agreement No. EMW-85-E-1823. This study was completed in March 1986.

The hydrologic and hydraulic analyses for the July 17, 1989 City of Cleveland FIS was completed in May 1977. Supplemental information was obtained from the FIS for Bolivar County, Mississippi (Reference 1).

For this initial countywide FIS, new hydrologic and hydraulic analyses were performed by the State of Mississippi for FEMA. This study was completed in June 2010 under Contract No. EMA-2008-CA-5883.

Base map information shown on this Flood Insurance Rate Map (FIRM) was provided in digital format by the State of Mississippi. This information was photogrammetrically compiled at a scale of 1:12,000 from aerial photography dated July 2009.

The digital FIRM was produced using the State Plane Coordinate System, Mississippi West, FIPS Zone 2302. Distance was measured in feet. The horizontal datum was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

1.3 Coordination

An initial Consultation Coordination Officer (CCO) meeting (often 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. A final CCO meeting (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.

The dates of the historical initial and final CCO meetings held for the jurisdictions within Bolivar County are shown in Table 1: CCO Meeting Dates:

Table 1: CCO Meeting Dates

Community Name	Initial CCO Date	Final CCO Date
Bolivar County	*	September 9, 1987
City of Cleveland	*	September 9, 1987

*Date not available

For this countywide FIS, the initial CCO meeting was held on August 28, 2008 and attended by representatives of Mississippi Department of Environmental Quality, Mississippi Emergency Management Agency, Mississippi Geographic Information, LLC, the State study contractor, and Bolivar County and the incorporated communities within Bolivar County.

The final CCO meeting was held on December 9, 2010 to review and accept the results of this FIS. Those who attended this meeting included representatives of Mississippi

Department of Environmental Quality, Mississippi Emergency Management Agency, Mississippi Geographic Information, LLC, the State study contractor, and Bolivar County and the incorporated communities within Bolivar County. 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 Bolivar County, Mississippi, including the incorporated communities listed in Section 1.1. The scope and methods of this study were proposed to, and agreed upon, by FEMA, Bolivar County, and the State of Mississippi.

The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through November 1, 2009. The flooding sources studied by detailed methods are presented in Table 2: Flooding Sources Studied by Detailed Methods.

Table 2: Flooding Sources Studied by Detailed Methods

Flooding Source	Reach Length (miles)	Study Limits
Bear Pen Canal	2.0	From a point approximately 390 feet downstream of College Street to a point approximately 0.8 mile upstream of State Highway 8.
Jones Bayou	3.5	From a point approximately 0.2 mile upstream of Rosemary Road to Laughlin Road.
Lead Bayou	4.2	From the county boundary to a point approximately 800 feet upstream of the confluence of Lead Bayou Tributary 1.
Mississippi River	72	From the southern county boundary to the northern county boundary.
Pecan Bayou	1.5	From a point approximately 0.8 mile downstream of Yale Street to a point approximately 80 feet upstream of Maple Street.
Porter Bayou	7.7	From the county boundary to Gilbert Road.
West Main Canal	3.2	From a point approximately 0.6 mile downstream of East Sunflower Road to a point approximately 20 feet upstream of Old Highway 61.

The areas studied by enhanced approximate methods were selected for areas having low to moderate development potential or flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and Bolivar County. The flooding sources studied by enhanced approximate methods are presented in Table 3: Flooding Sources Studied by Enhanced Approximate Methods.

Table 3: Flooding Sources Studied by Enhanced Approximate Methods

Flooding Source	Reach Length (miles)	Study Limits
Holmes Lake	1.7	From a point approximately 0.85 mile downstream of Blue Cain Road to a point approximately 0.3 mile upstream of Highway 32.
Jones Bayou	2.7	From a point approximately 0.19 mile downstream of Highway 61 to a point approximately 0.15 mile upstream of Merigold-Drew Road and from Laughlin Road to a point approximately 0.5 mile downstream of Highway 446.
Mound Bayou	1.2	From a point approximately 0.25 mile downstream of confluence with Big Sunflower River to a point approximately 0.05 mile upstream of Ford Road.

Numerous streams were studied by approximate methods, as indicated in Table 4: Flooding Sources Studied by Approximate Methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

Table 4: Flooding Sources Studied by Approximate Methods

Flooding Source	Reach Length (miles)	Study Limits
Goffs Bayou	2.8	From Highway 1 to approximately 2.8 miles downstream of Highway 1.
Goffs Bayou Tributary 1	1.2	From a point approximately 0.19 mile upstream of Highway 1 to the confluence with Goffs Bayou.
Jones Bayou Tributary 9	0.9	From a point approximately 0.4 mile downstream of 2nd Street to 0.04 mile upstream of East South Street.

Table 4: Flooding Sources Studied by Approximate Methods

Flooding Source	Reach Length (miles)	Study Limits
Lanes Bayou	1.2	From Thomas Road to a point approximately 1 mile downstream of Thomas Road.
Lanes Bayou Tributary 1	1.3	From Brown Street to a point approximately 1.3 miles downstream of Brown Street.
Mound Bayou Tributary 6	4.3	From a point approximately 0.1 mile upstream of Parchman Road to a point approximately 0.5 mile downstream of Chamber Road.

Floodplain boundaries for all flooding sources within the study area have been mapped based upon the most up-to-date topographic data available.

2.2 Community Description

Bolivar County is located in the northwestern portion of Mississippi, referred to as the Delta Region, and lies alongside the Mississippi River. Bolivar County is bordered by Coahoma County to the north; Sunflower County to the east; Washington County to the south; and Desha County, Arkansas, to the west. The county encompasses an area of 906 square miles which includes 29 square miles of water. The 2009 population estimate was 36,766 (Reference 2). Bolivar County is serviced by U.S. Highway 61 and State Highways 1, 8 and 32 and by the Illinois Central Railroad.

The terrain is relatively flat, given that the county is situated in a delta and soils are basically fine-grained with low permeability. Bolivar County is located in the upper Delta region of Mississippi, along the Mississippi River. The area is characterized by humid subtropical conditions with temperate winters and long, hot summers. Normal precipitation values range from 50 to 65 inches, annually, with the wettest months being March and April and the driest months being August and September. High temperatures range from 50 degrees Fahrenheit in January to 92 degrees Fahrenheit in July and low temperatures range from 33 degrees Fahrenheit in January to 73 degrees Fahrenheit in July (Reference 3).

2.3 Principal Flood Problems

Due to Bolivar County's location in the Mississippi Delta Region, it was subjected to almost yearly flooding until the levee system was built along the Mississippi River.

In the City of Cleveland, floods are caused on Pecan Bayou and Bear Pen Canal by short, intense rainfalls, as opposed to rains of longer duration. Flooding was experienced along Pecan Bayou in March 1973 and May 1975, 1974. West Main Canal is influenced by

high water on the Big Sunflower River and an area immediately east of Cleveland was flooded in 1973.

2.4 Flood Protection Measures

A Provisionally Accredited Levee (PAL) is reflected on the FIRM panels. A PAL is a levee which is believed to meet the criteria to protect an area against a 1-percent-annual-chance flood event, but which has not been certified at the time in which the study is completed. An explanation of the impact on the area is located on the FIRM panel and a detailed description of the PAL is located in the Notes to Users section on the FIRM panel. The levee owner has agreed to submit required documentation within the 24 month FEMA mandated time period. If the levee receives accreditation, the notes on the FIRM are changed to provide appropriate explanations, if the levee does not receive accreditation, the levee notes are removed from the FIRM panel, the zone is changed to a Zone A or AE, and the levee itself remains on the FIRM panel.

The PAL levee protects all of Bolivar County from the 1-percent-annual-chance flood from the Mississippi River. This levee was built and is maintained by the USACE.

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

3.1.1 Methods for Flooding Sources with New or Revised Analyses in Current Study

For this countywide study, hydrologic analyses were carried out to establish peak elevation-frequency relationships for each flooding source studied by detailed, enhanced approximate, and/or approximate methods affecting the community.

Peak discharges for all new enhanced approximate and approximate studied streams in Bolivar County were determined using the Delta Region USGS

regression equations for Mississippi described in the USGS Water-Resources Investigations report 91-4037 (Reference 4). For the discharges calculated based on regional regression equations, the rural regression values were updated to reflect urbanization as necessary.

Peak discharges for the detailed study reach of Jones Bayou were determined by using the Hydrology Modeling System (HEC-HMS) version 3.4.0 (Reference 5). The drainage area north of McWimus Road is not included for the study reach of Jones Bayou since upstream, near the Town of Merigold, the runoff is directed to the Jones Bayou cutoff draining to the Sunflower River.The storage at low area along the stream is considered in the model.

A summary of peak discharge-drainage area relationships for streams studied by detailed methods is shown in Table 5: Summary of Discharges for Detailed Streams, and for enhanced approximate methods, Table 6: Summary of Discharges for Enhanced Approximate Streams.

Table 5: Summary of Discharges for Detailed Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (Sq.Mi.)	PEAK DISCHARGES (cfs) 10-percent	2-percent	1-percent	0.2-percent
JONES BAYOU					
At Rosemary Road	0.87	184	272	309	381
Approximately 0.6 mile upstream of W. Sunflower Road at unnamed Road	1.18	220	318	360	433
At City of Cleveland southern corporate limit	3.13	266	389	441	536

Table 6: Summary of Discharges for Enhanced Approximate Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (Sq.Mi.)	PEAK DISCHARGES (cfs) 10-percent	2-percent	1-percent	0.2-percent
HOLMES LAKE					
Approximately 0.3 mile upstream of Highway 32	9.67	*	*	2,175	*

Table 6: Summary of Discharges for Enhanced Approximate Streams

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (Sq.Mi.)	PEAK DISCHARGES (cfs) 10-percent	2-percent	1-percent	0.2-percent
JONES BAYOU North					
Approximately 0.15 mile upstream of Intersection of Merigold-Drew Road with N. Bayou Road	3.72	*	*	929	*
JONES BAYOU South					
Approximately 0.5 mile upstream of HWY 446	3.47	*	*	496	*
MOUND BAYOU					
Approximately 0.05 mile upstream of Ford Road	13.15	*	*	2,193	*

*Data not available

3.1.2 Methods for Flooding Sources Incorporated from Previous Studies

This section describes the methodology used in previous studies of flooding sources incorporated into this FIS that were not revised for this countywide study. Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

The 1-percent-annual-chance peak discharges on Porter Bayou, Lead Bayou, and West Main Canal were obtained from the USACE Detailed Project Reports (References 6, 7) on these three streams. Flood-frequency relations were developed using Snyder's synthetic unit hydrographs for existing conditions at the mouths of Lead Bayou and West Main Canal and at three locations on Porter Bayou. Flood-frequency discharges were increased to represent current conditions using an empirical procedure developed by the USACE.

In the City of Cleveland, values of the 10-, 50-, 100-, and 500-year peak discharge were obtained using the Hec-1 computer program along West Main Canal (Reference 8). The computer program computes flood hydrographs utilizing a unit hydrograph defined by Snyder's method parameters. For this

program, the initial rainfall loss, uniform loss rate, lag time, peaking coefficient "p", storm rainfall, and drainage areas were defined as input parameters.

Rainfall information for the 10-, 50-, and 100-year recurrence interval storms was obtained from Technical Paper No. 40 (Reference 9), then plotted and extrapolated to obtain the 500-year rainfall.

The drainage areas of the streams studied in detail were drawn on topographic maps (Reference 10). Drainage divides were determined by map inspection and field reconnaissance.

Checks on the logic of calculations and the results obtained for the peak discharges were deemed especially necessary due to the lack of hydrologic data in this region. Two regression analysis formulas were used. The first was found in "Flood Frequency of Mississippi Streams" (Reference 11). The second was a U.S. Geological Survey technical memorandum (Reference 12). A comparison was made between the results from HEC-1 and from each of the two regression formulas. Comparisons were made only at stations that were a simple one-basin runoff situation existed, not at stations that were the sum of two areas. The two regression formulas would usually bracket the 10-year flood, excepted on Jones Bayou, which, being a perched stream, had lower flows. The Jones Bayou flows did agree with recorded flows in order of magnitude. The 50-year flows agreed well with "Flood Frequency of Mississippi Streams," although the 100-year flows were less than predicted. The 100-year flows did exhibit a relationship to 10-, and 50-year flows similar to the relationship between 10-, 50-, and 100-year flows based on gage data on the Big Sunflower River at Sunflower.

Table 7: Summary of Discharges for Streams Studied by Detailed Methods

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (CFS) 10-percent	2-percent	1-percent	0.2-percent
BEAR PEN CANAL					
At the southern corporate limits of Cleveland	3.57	383	696	749	858
At State Highway 8	2.68	632	823	911	1,104
At northern corporate limits of Cleveland	1.20	334	432	478	578
LEAD BAYOU					
At county boundary	24.3	1,930	2,330	2,565	N/A
PECAN BAYOU					
About 9,500 feet upstream of State Highway 446	1.64	609	780	863	1,045

Table 7: Summary of Discharges for Streams Studied by Detailed Methods

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (CFS) 10-percent	2-percent	1-percent	0.2-percent
PECAN BAYOU (continued)					
At Yale Street	0.95	420	533	596	725
At Bishop Road	0.65	382	482	537	654
At Maple Street	0.3	204	256	285	348
PORTER BAYOU					
At confluence of West Prong Indian Bayou	35.8	N/A	N/A	1,600	N/A
MISSISSIPPI RIVER					
At the southern corporate limits of Memphis	932,800	1,435,000	1,810,000	1,960,000	N/A
WEST MAIN CANAL					
At mouth	9.1	725	875	960	N/A
At Sunflower Road	3.9	580	700	770	N/A
At White Street	3.2	725	875	960	N/A
Just upstream of confluence of Canal No. 8	2.6	580	700	770	N/A
At Pearman Road	2.2	335	405	445	N/A

3.2 Hydraulic Analyses

Hydraulic analyses were performed to estimate the elevation of flooding during the base flood event. 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.

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).

Roughness coefficients (Manning's "n") used in the hydraulic computations for both channel and overbank areas were based on recent digital photography. Table 8: Summary of Roughness Coefficients, shows the ranges of the channel and overbank roughness factors used in the computations for all streams revised or newly studied by Detailed Study method.

Table 8: Summary of Roughness Coefficients

Flooding Source	Channel	Overbanks
Jones Bayou	0.04	0.08

Field inspections were carried out to estimate roughness coefficients for Lead Bayou, West Main Canal, and Porter Bayou. For Pecan Bayou, Bear Pen Canal, and West Main Canal roughness coefficients ranged from 0.035 to 0.10. The overbank "n" values ranged from 0.035 to 0.065, but were generally lower than the channel roughness values.

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

3.2.1 Methods for Flooding Sources with New or Revised Analyses in Current Study

Water-surface profiles were computed through the use of the U.S. Army Corps of Engineers HEC-RAS version 4.0.0 computer program (Reference 13). Water surface profiles were produced for 1-percent-annual-chance storms for the enhanced approximate and approximate studies. Water surface profiles were produced for the 10, 2, 1, and 0.2-percnet-annual-chance storms for the detailed studies.

The detailed, enhanced approximate, and approximate methodology used Watershed Information System (WISE) (Reference 14) as a preprocessor to HEC-RAS. Tools within WISE allowed the engineer to verify that the cross section data are acceptable. The WISE program was used to input data file for HEC-RAS. Then the HEC-RAS was used to determine flood elevation at each cross section of the modeled stream. No floodway was calculated for streams studied by approximate methods.

3.2.2 Methods for Flooding Sources Incorporated from Previous Studies

In the July 17, 1989 City of Cleveland Mississippi FIS, the cross-section data for streams in the area were obtained by field measurement. All bridges and culverts were surveyed to obtain elevation data and structural geometry. In the July 17, 1989 Bolivar County Mississippi Unincorporated Areas FIS cross sections for Porter Bayou and Bear Pen Canal were taken from the work done in preparation for the Flood Insurance Study for the City of Cleveland (Reference 15). Cross sections for Lead Bayou, West Main Canal, and Porter Bayou were obtained

from field surveys and U.S. Geological Survey topographic maps (References 6, 7 and 16).

With stream characteristics determined by field observation, flood profiles for West Main Canal and Pecan Bayou were computed using the HEC-2 computer step-backwater model developed by the US Army Corps of Engineers (USACE) (Reference 17) except on Bear Pen Canal above State Highway 8. In that area, water-surface profiles were based on reservoir routing because the highway embankment creates excessive storage and makes a steady state solution inappropriate. The culvert at this location causes smaller peak discharges to occur downstream than those encountered upstream. On West Main Canal, the diversion of part of the flow to Lead Bayou above State Highway 8 was taken into account, thereby reducing flows in West Main Canal below this point. Starting elevations were determined by normal depth analysis. Elevation profiles for other flooding sources were obtained from the USACE Detailed Project Reports (References 6 and 7). Flood elevations for the Mississippi River were provided by the USACE (Reference 18).

Starting water-surface elevations for all streams were developed by the slope area method.

Profiles were determined and plotted for the 2-, 10-, 1-, and 0.2 percent-annual-chance floods to an accuracy of 0.5 foot for each stream studied in detail. For approximate study areas, calculated peak discharges, stream characteristics based on field observations, and flood plain cross sections as determined from available contour mapping, were used in Manning's equation to determine approximate flood elevations.

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 National Geodetic Vertical Datum of 1929 (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.

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. It is important to note that adjacent counties may be referenced to NGVD, which may result in differences in base flood elevations across county lines.

Ground, structure, and flood elevations may be compared and/or referenced to NGVD by adding 0.26 feet to the NAVD elevation. The -0.26 foot value is an average for the entire county. The BFEs shown on the FIRM represent whole-foot rounded values. For example, a BFE of 12.4 feet will appear as 12 feet on the FIRM and 12.6 feet as 13 feet. Users who wish to convert the elevations in this FIS report to NGVD should apply the

stated conversion factor to elevations shown on the Flood Profiles and supporting data tables in the FIS report, which are shown at a minimum to the nearest 0.1 foot.

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 19), 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. Between cross

sections, the boundaries were interpolated using a Digital Terrain Model (DTM) which was compiled at a scale 400 feet from imagery with a 2 foot ground sample distance (GSD). Part of the imagery acquisition occurred January through March, 2006 with additional acquisition occurring in January, 2007 (Reference 20). For each stream studied by approximate methods, the 1-percent-annual-chance floodplain boundaries were interpolated using the previously mentioned DTM (Reference 20).

For this study the 1- and 0.2-percent-annual-chance floodplain boundaries for streams studied by detailed methods are shown on the FIRM (Exhibit 2). 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 (Zone X). 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 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 9: Floodway Data Table. 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 is shown on the FIRM.

Near the confluence of streams studied in detail, floodway computations were made without regard to flood elevations on the receiving water body. Therefore, “Without Floodway” elevations presented in Table 9 for certain downstream cross sections are

lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

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.

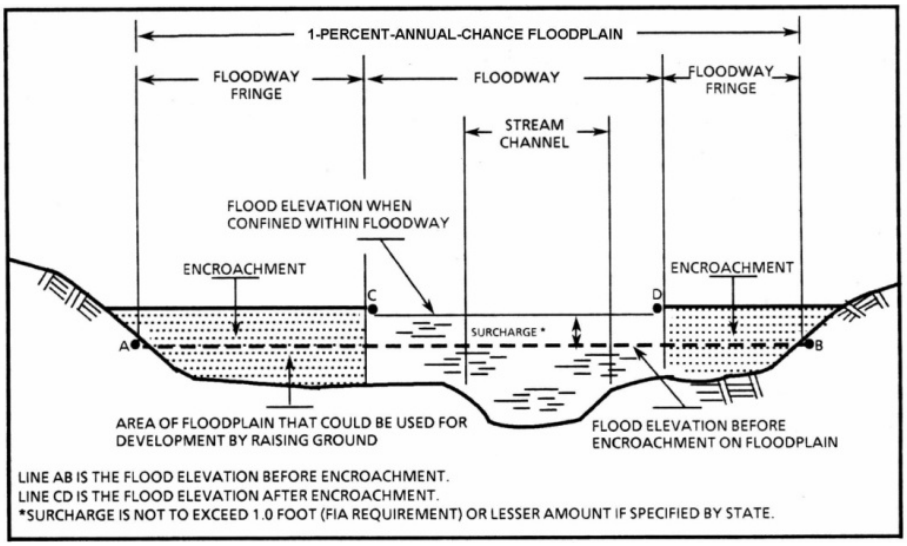

Figure 1. Floodway Schematic

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
Pecan Bayou								
A	9,500	368	532	1.6	134.1	134.1	134.2	0.1
B	11,600	177	583	1.0	134.8	134.8	135.8	1.0
C	13,430	1,024	1,688	0.4	135.1	135.1	136.1	1.0
D	14,910	38	256	2.2	135.3	135.3	136.2	0.9
E	15,060	251	1,051	0.5	135.5	135.5	136.4	0.9
F	16,020	55	300	1.9	136.0	136.0	136.8	0.8
G	16,820	74	129	2.2	136.8	136.8	137.3	0.5

[1] FEET ABOVE STATE HIGHWAY 446

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS

AND INCORPORATED AREAS

FLOODWAY DATA

PECAN BAYOU

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Bear Pen Canal								
A	370[1]	460	656	1.1	133.5	133.5	133.8	0.3
B	2,580[1]	404	772	1.0	134.7	134.7	135.6	0.9
Jones Bayou								
A	41,077[2]	152	660	0.7	135.0	135.0	135.8	0.8
B	43,362[2]	31	246	1.8	135.4	135.4	136.2	0.8
C	45,363[2]	40	332	1.3	135.9	135.9	136.7	0.8
D	46,861[2]	34	294	1.5	136.4	136.4	137.1	0.7
E	48,356[2]	72	546	0.8	136.6	136.6	137.5	0.9
F	49,856[2]	38	344	1.3	136.9	136.9	137.7	0.8
G	51,472[2]	27	261	1.7	137.1	137.1	137.9	0.8
H	52,621[2]	31	300	1.5	137.5	137.5	138.2	0.7
I	53,854[2]	69	488	0.9	137.5	137.5	138.3	0.8
J	54,854[2]	73	473	0.9	137.6	137.6	138.4	0.8
K	55,856[2]	31	293	1.2	137.7	137.7	138.5	0.8
L	56,849[2]	103	544	0.7	137.8	137.8	1386.	0.8
M	57,854[2]	80	552	0.7	137.8	137.8	138.6	0.8
N	59,348[2]	116	765	0.5	137.9	137.9	138.8	0.9

[1] FEET ABOVE CITY OF CLEVELAND CORPORATE LIMITS
[2] FEET ABOVE MOUTH

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS

AND INCORPORATED AREAS

FLOODWAY DATA

BEAR PEN CANAL – JONES BAYOU

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 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.

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 countywide FIRM presents flooding information for the entire geographic area of Bolivar County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County 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 10: Community Map History.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Alligator, Town of	October 25, 1974	July 14, 1978	September 4, 1985	---
Benoit, Town of	May 24, 1974	November 19, 1976	September 27, 1985	---
Beulah, Town of	June 7, 1974	---	June 25, 1976	---
Bolivar County (Unincorporated Areas)	December 23, 1977	---	July 17, 1989	---
Boyle, Town of	May 24, 1974	July 16, 1976	March 1, 1987	---
Cleveland, City of	May 10, 1974	---	September 1, 1978	July 17, 1989
Duncan, Town of	November 5, 1978	February 8, 1980	August 1, 1986	---
Gunnison, Town of	June 14, 1974	---	June 25, 1976	---

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Merigold, Town of	June 7, 1974	June 18,1976 February 8, 1980	September 27, 1985	---
Mound Bayou, City of	June 7, 1974	August 22, 1975	September 27, 1985	---
Pace, Town of	October 25, 1974	---	September 27, 1985	---
Renova, Town of	---	---	---	---
Rosedale, City of	June 7, 1974	July 30, 1976	September 27, 1985	---
Shaw, City of	June 7, 1974	June 25, 1976	June 3, 1986	---
Shelby, City of	October 29, 1976	---	September 27, 1985	---
Winstonville, Town of	---	---	---	---

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

A FIS report was previously prepared for the unincorporated areas of Bolivar County (Reference 1) and for the City of Cleveland (Reference 15).

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.

9.0 BIBLIOGRAPHY AND REFERENCES

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Shelby, Mississippi, 1969; Mound Bayou, Mississippi, 1966; Lake Cheatham, Mississippi-Arkansas, 1972; Rosedale, Mississippi-Arkansas, 1972; Beulah, Mississippi, 1969; Pace, Mississippi, 1969; Merigold, Mississippi, 1966; Catfish Point, Mississippi-Arkansas, 1972; Benoit, Mississippi, 1972; Lobdell, Mississippi, 1967; Skene, Mississippi, 1967; Cleveland, Mississippi, 1966; Arkansas City, Arkansas-Mississippi, 1972; Scott, Mississippi, 1972; Stringtown, Mississippi, 1967; Shaw, Mississippi, 1967.

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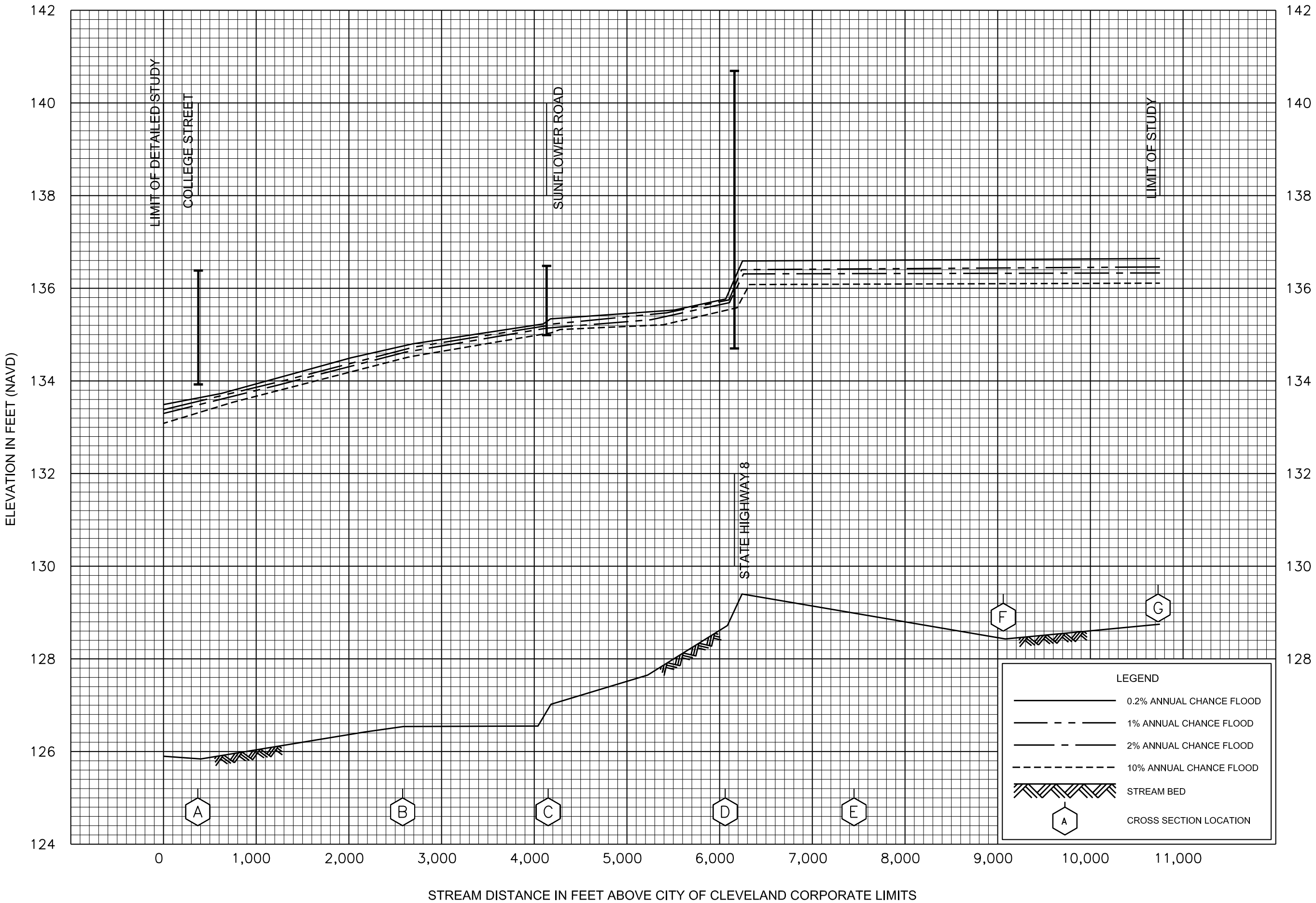


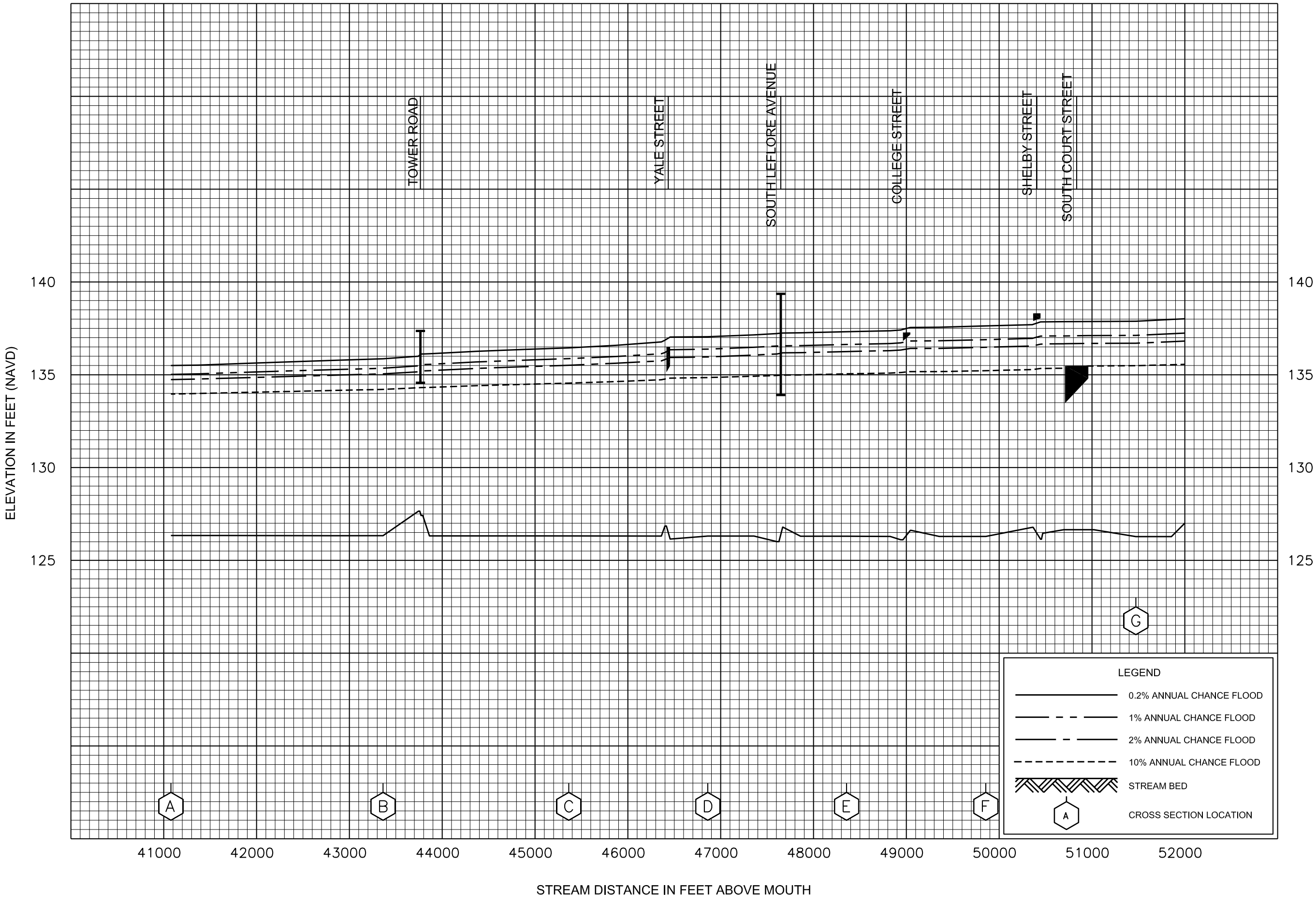
FLOOD PROFILES

BEAR PEN CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS

AND INCORPORATED AREAS



FLOOD PROFILES

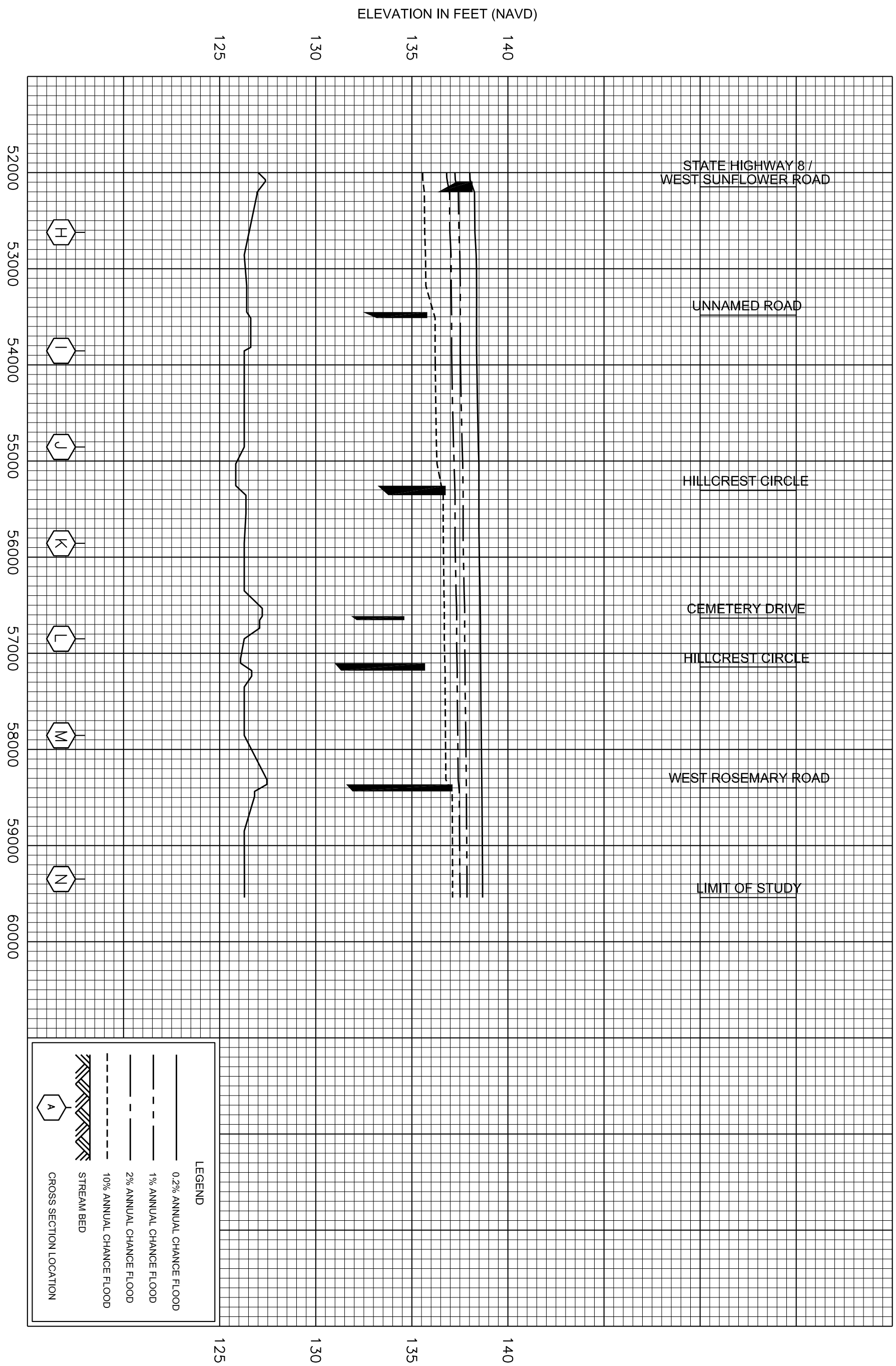
JONES BAYOU

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS

AND INCORPORATED AREAS

02P



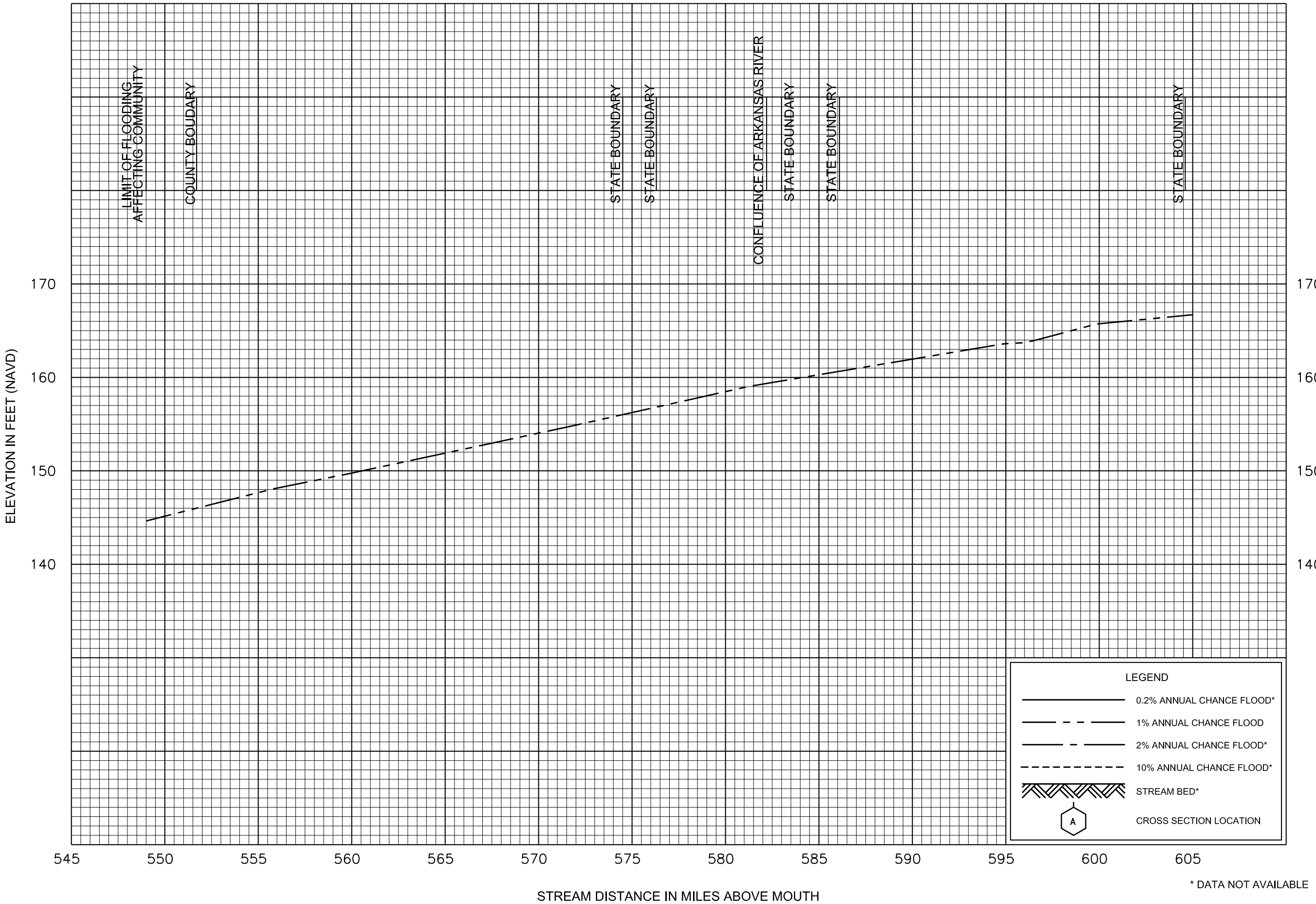
FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS
AND INCORPORATED AREAS

FLOOD PROFILES

JONES BAYOU

03P



FLOOD PROFILES

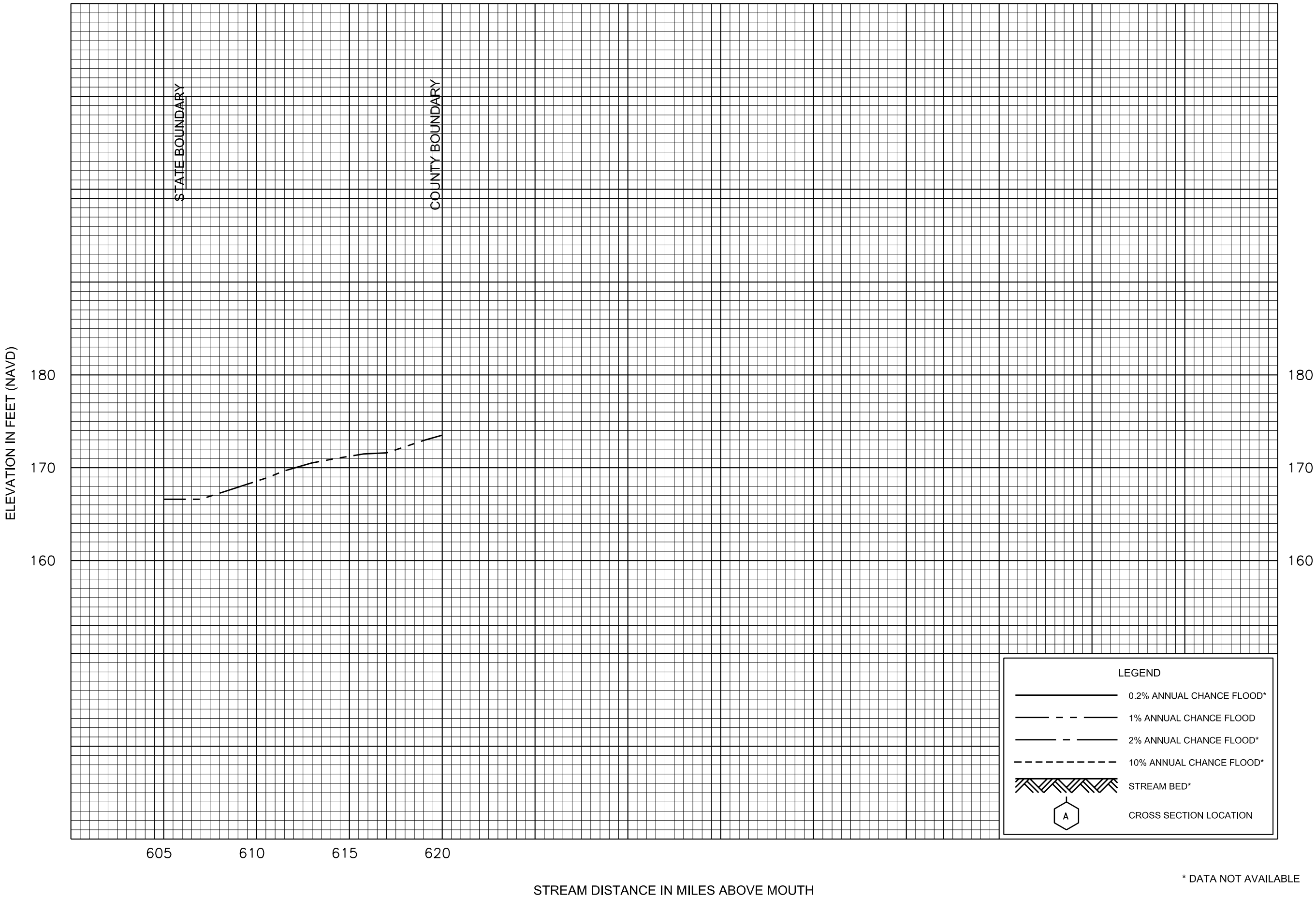
MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS

AND INCORPORATED AREAS

04P



* DATA NOT AVAILABLE

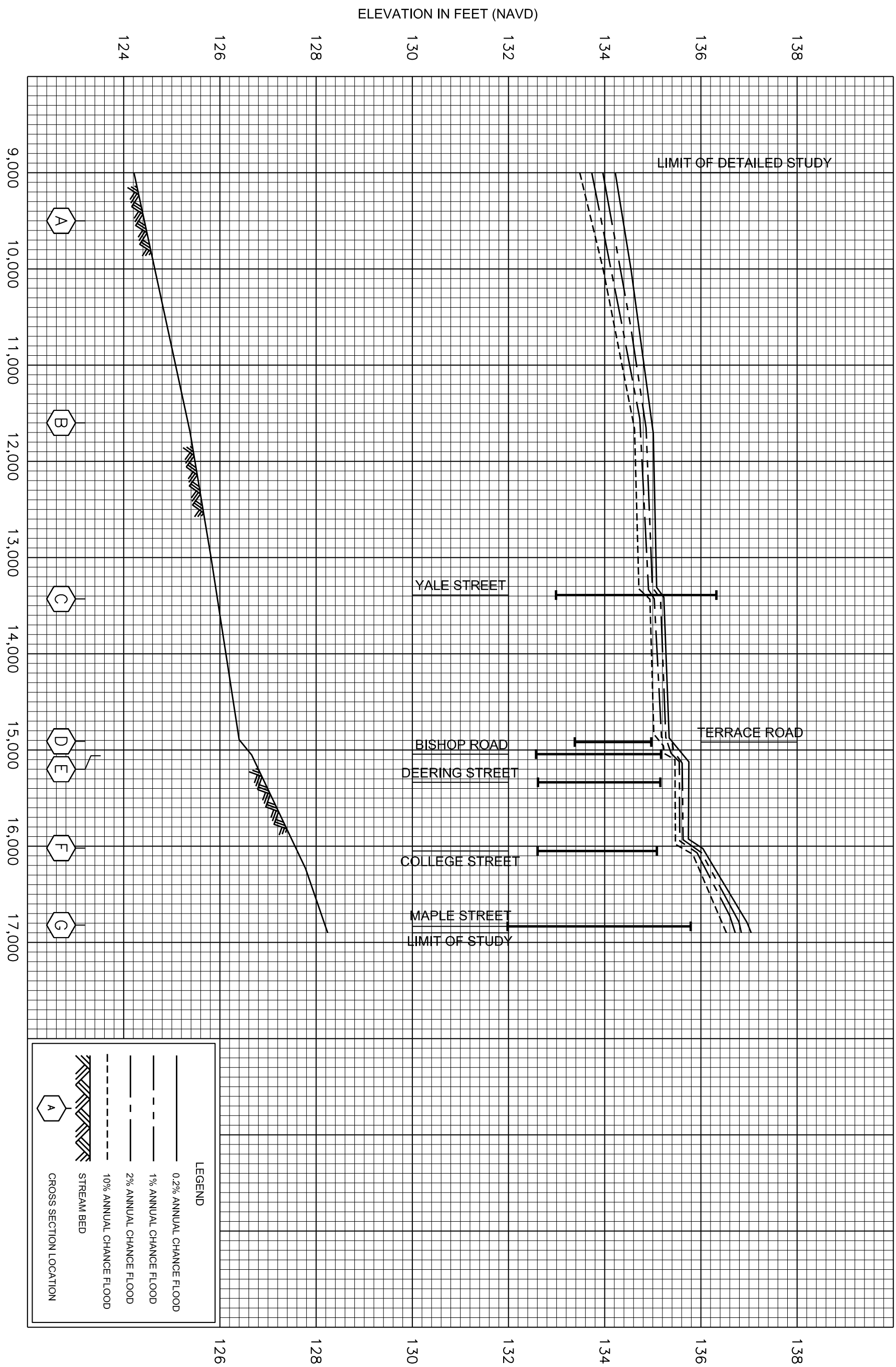
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS
AND INCORPORATED AREAS

05P



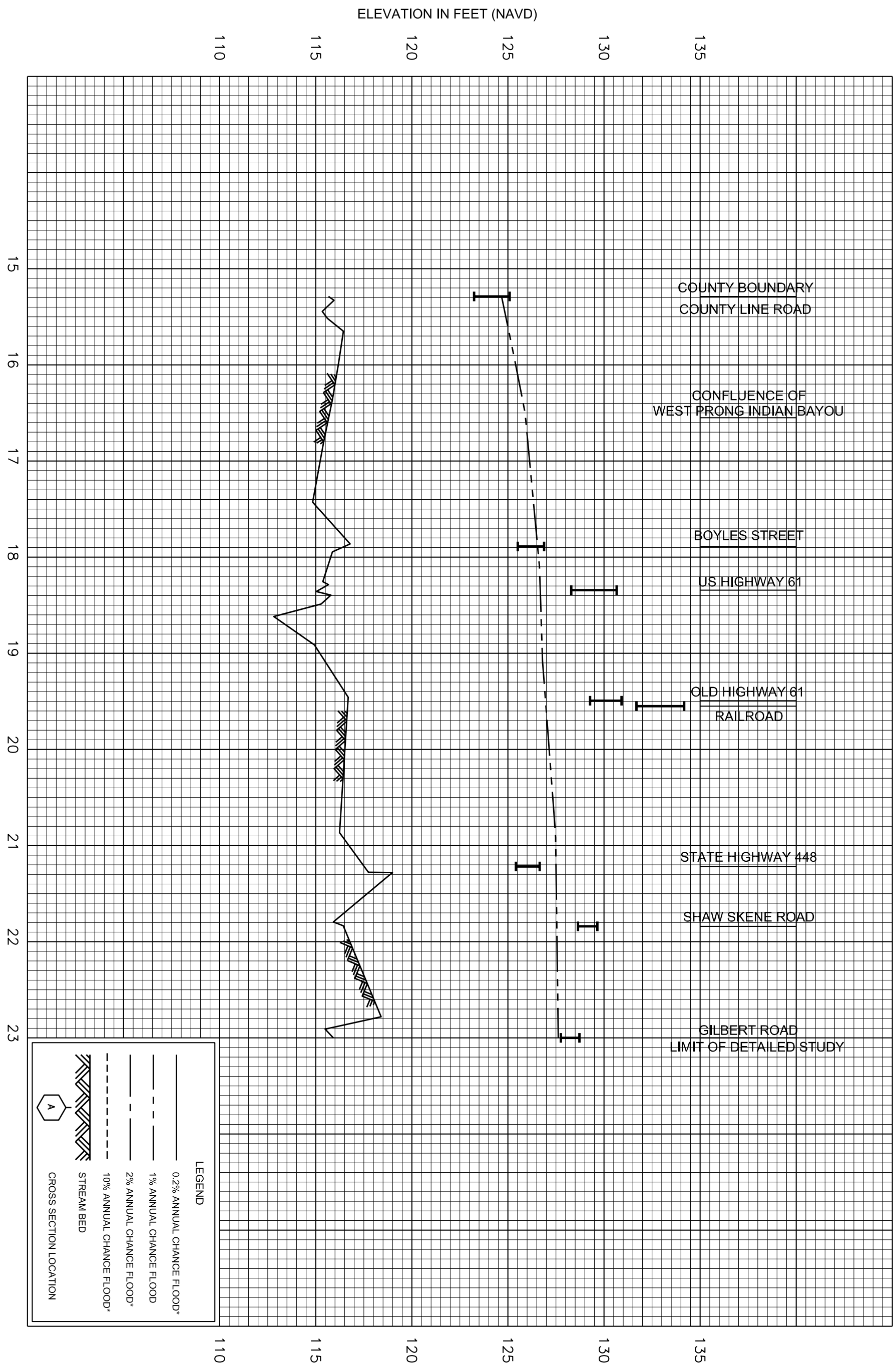
FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS
AND INCORPORATED AREAS

FLOOD PROFILES

PECAN BAYOU

06P



* DATA NOT AVAILABLE

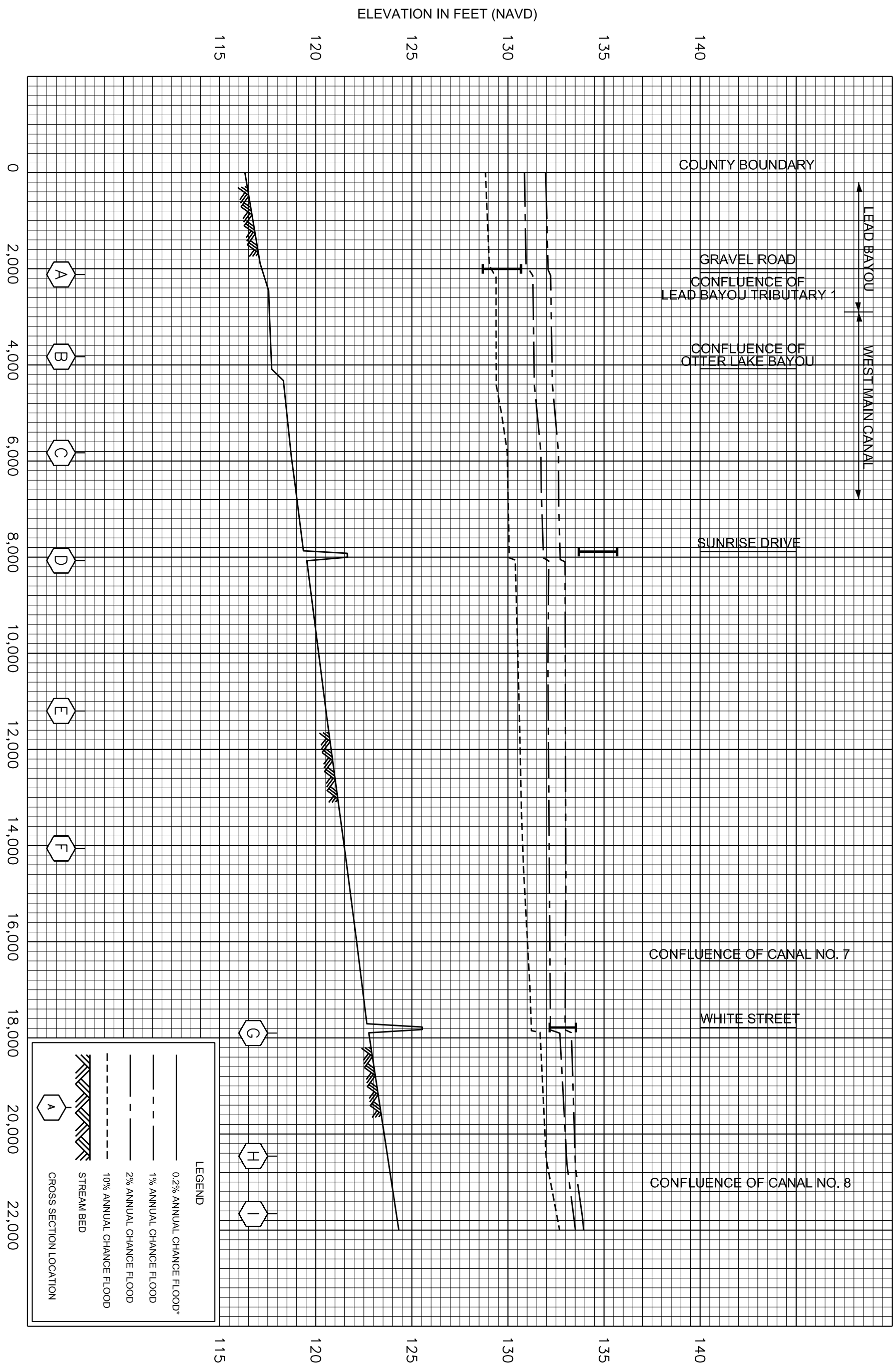
FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS
AND INCORPORATED AREAS

FLOOD PROFILES

PORTER BAYOU

07P



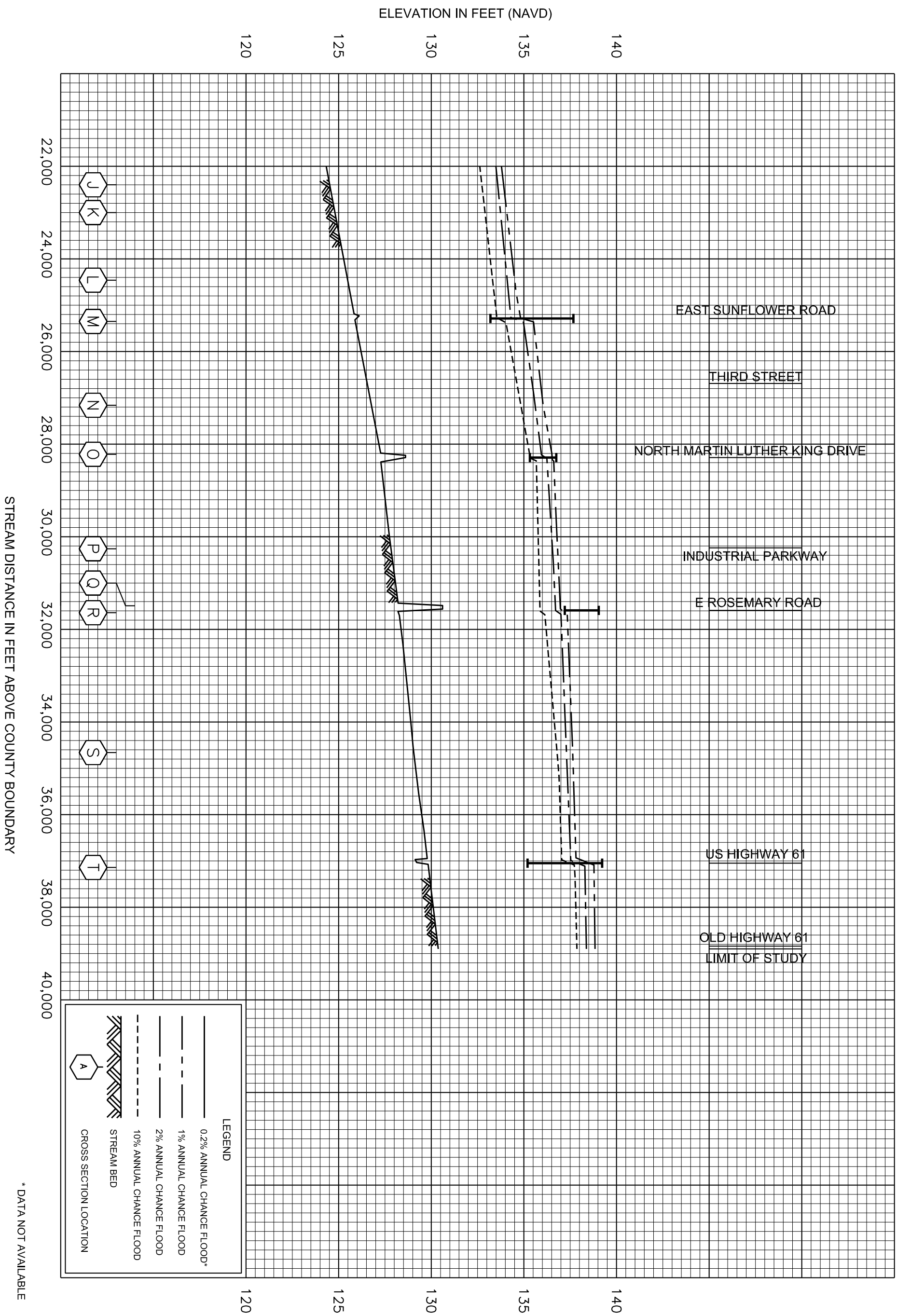
FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS
AND INCORPORATED AREAS

FLOOD PROFILES

LEAD BAYOU/WEST MAIN CANAL

08P



FEDERAL EMERGENCY MANAGEMENT AGENCY

BOLIVAR COUNTY, MS
AND INCORPORATED AREAS

FLOOD PROFILES

WEST MAIN CANAL

09P