FLOOD INSURANCE STUDY

WASHINGTON COUNTY, MISSISSIPPI
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
ARCOLA, TOWN OF	280178
GREENVILLE, CITY OF	280179
HOLLANDALE, CITY OF	280180
LELAND, CITY OF	280181
METCALFE, TOWN OF	280355
WASHINGTON COUNTY (UNINCORPORATED AREAS)	280177

EFFECTIVE:

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
28151CV000A

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) report 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 report may be revised and republished at any time. In addition, part of this FIS report 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 report components.

Selected Flood Insurance Rate Map panels for this community contain information that was previously shown 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(s)	New Zone
A1 – A30	AE
B	X
C	X

Initial Countywide FIS Report Effective Date:

Revised Countywide FIS Report Dates:

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FLOOD INSURANCE STUDY
WASHINGTON COUNTY, MISSISSIPPI AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and supersedes the FIS reports and/or Flood Insurance Rate Maps (FIRMs) in the geographic area of Washington County, Mississippi, including the Cities of Greenville, Hollandale, and Leland, the Towns of Arcola and Metcalfe, and unincorporated areas of Washington County (hereinafter referred to collectively as Washington County).

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 Washington 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 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.

March 1980, Washington County (Unincorporated Areas) FIS

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (USACE), Vicksburg District, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-16-75, Project Order No. 21, and Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 1. This work, which was completed in September 1977, covered all significant flooding sources affecting the unincorporated areas of Washington County.

February 1979, City of Greenville FIS

The hydrologic and hydraulic analyses for this study were performed by the USACE, Vicksburg District, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-16-75, Project Order No. 21, and Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 1. This work, which was completed in May 1977, covered all significant flooding sources affecting the City of Greenville.

August 1978, City of Leland FIS

The hydrologic and hydraulic analyses for this study wee performed by the USACE, Vicksburg District, for the Federal Insurance Administration, No. IAA-H-7-76, Project Order No. 6. This work, which was completed in May 1977, covered all significant flooding sources affecting the City of Leland.

This Countywide FIS

The hydrologic and hydraulic analyses for this countywide FIS were performed by the State of Mississippi for the Federal Emergency Management Agency (FEMA), under Contract No. EMA-2008-CA-5883. This study was completed in July 2010.

The digital base map information files were provided by the State of Mississippi. The digital orthophotography was acquired in March 2006, with the imagery processed to a 2-foot pixel resolution.

The digital FIRM was produced using the Mississippi State Plane Coordinate System, West Zone, FIPS ZONE 2302. The horizontal datum was the North American Datum of 1983, GRS 1980 spheroid. Distance units were measured in U.S. feet.

1.3 Coordination

An initial Consultation Coordination Officer's (CCO) meeting is held with representatives from FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held with representatives from FEMA, the community, and the study contractor to review the results of the study.

March 1980, Washington County (Unincorporated Areas) FIS

Streams requiring detailed study were originally identified in a meeting held on January 9, 1975, attended by representatives of the study contractor, the Federal Insurance Administration, the Mississippi Research and Development Center, and officials of the Washington County Board of Supervisors.

The March 1980 FIS was coordinated with the Mississippi State Highway Department.

A final coordination meeting attended by representatives of the study contractor, the Federal Insurance Administration, and the Washington County Board of Supervisors was held on March 3, 1978. No problems with the Flood Insurance Study were raised at the meeting.

February 1979, City of Greenville FIS

Streams requiring detailed study were originally identified in meetings attended by representatives of the USACE, the Federal Insurance Administration, the Mississippi Research and Development Center, and officials of the City of Greenville on January 9, 1975.

The work done by the USACE was coordinated with the Greenville-Washington County Planning Commission, the Greenville Chamber of Commerce, the City Engineer's office, and various other community officials.

A final coordination meeting attended by representatives of the USACE, the Federal Insurance Administration, and the City of Greenville was held on March 23, 1978. No additional corrections were necessary as a result of this meeting.

August 1978, City of Leland FIS

Streams requiring detail study were originally identified in a meeting attended by personnel of the USACE, the FIA, and the Mississippi Research and Development Center, and officials of the City of Leland on April 10, 1975.

Further coordination was made by contacting the city government of Leland, the Leland Chamber of Commerce, and the Washington County Engineer.

During the course of the work done by the USACE, the results of the study were reviewed with community officials.

A final coordination meeting was held in Leland on August 4, 1977, and was attended by personnel of the USACE, FIA, and the City of Leland. As a result of the meeting, minor changes in the flood delineations were made and are reflected in this study.

This Countywide FIS

For this countywide FIS, the Project Scoping Meeting was held on August 18, 2008 in Greenville, MS. Attendees for these meetings included representatives from the Mississippi Department of Environmental Quality, Mississippi Emergency Management Agency, FEMA National Service Provider, Washington County, the City of Natchez, and the Study Contractor. Coordination with county officials and Federal, State, and regional agencies produced a variety of information pertaining to floodplain regulations, available community maps, flood history, and other hydrologic data. All problems raised in the meetings have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Washington County, Mississippi, and its incorporated communities listed in Section 1.1 Several flooding sources within the county were studied by approximate methods. Approximate analyses are 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 the State of Mississippi.

March 1980, Washington County (Unincorporated Areas) FIS

Although Washington County contains a number of small and large streams subject to frequent flooding, only some of these flooding sources were studied by detailed methods.

All other flooding sources were studied by approximate methods due to lack of development.

The following flooding sources were studied by detailed methods:

Mississippi River, between river miles 507.5 to 551.5

Main Canal, between its mouth at Swan Lake and stream mile 30.0
Black Bayou, between its mouth at Swan Lake and the fork in Main Canal at stream mile 35.0

Ditch No. 6, from its mouth at Main Canal to mile 5.9 at U.S. Highway 82 bridge

Bowman Boulevard Ditch, from its mouth, through the City of Greenville upstream to mile 3.58

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1982.

Some of the major streams studied by approximate methods included Bogue Phalia Creek, Murphy Bayou, Ditch 8A-8B, and portions of Big Sunflower River.

February 1979, City of Greenville FIS

The following areas were chosen to be studied by detailed methods:

Main Canal (also known as Canal No. 9), between the corporate limits (River Miles 21.1 to 25.7)

Bowman Boulevard Ditch (also known as Ditch No. 5), from the southeastern corporate limits (River Mile 0.4) to the upstream corporate limits (River Mile 2.3) upstream to River Mile 3.58, upstream of Goodrich Street.

Robert Shaw Boulevard Ditch, from its mouth at Main Canal to River Mile 1.26, upstream of Fairview Avenue.

Park Ditch, from the eastern corporate limits (just west of its confluence with Main Canal) to River Mile 1.23.

Horseshoe Ditch, form the eastern corporate limits (just west of its confluence with Main Canal) to River Mile 1.52.

Lake Ferguson was studied with the Mississippi River in detail for the Washington County Flood Insurance Study, parts of which are included in the study.

The areas flooded due to inadequate drainage facilities and the areas on Park Ditch and Horseshoe Ditch above the limit of detailed study were studied by approximate methods.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1982.

August 1978, City of Leland FIS

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1982. The areas studied by detailed methods are as follows:

Deer Creek within the corporate limits (stream miles 17.18 and 20.15)

A ditch on the northeast corner of the study area, originating near Huddleston Street

A ditch on the southwest corner of the study area partly running parallel to U.S. Highway 82

A tributary of the Highway 82 Ditch originating near California Avenue

This Countywide FIS

For this countywide FIS, several flooding sources within the county were studied by approximate methods. Approximate analyses are used to study those areas having a low developmental potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and the State of Mississippi.

Floodplain boundaries of streams that have been previously studied by detailed methods were redelineated based on best available topographic information.

The Steele Bayou Control Structure 1.0-percent annual-chance stillwater elevation was calculated.

2.2 Community Description

Washington County is in northwestern Mississippi and is bordered on the west by the Mississippi River and Chicot County Arkansas; on the south by Issaquena and Sharkey Counties, Mississippi; on the north by Bolivar County, Mississippi; and on the east by Humphreys and Sunflower Counties, Mississippi. Washington County is served by U.S. Highway 61, 82, and 278; State Highways 1, 12, and 454; and the Columbus and Greenville Railway. Washington County consists of 761 square miles. The 2009 population was reported to be 54,616 (U.S. Census Bureau, 2010).

The climate of Washington County is influenced mainly by its subtropical latitude, the huge landmass to the north, its proximity to the warm waters of the Gulf of Mexico, and the prevailing southerly winds. The minimum mean temperature is 42.3 ^{o}F in January, and the maximum mean temperature is 82.5 ^{o}F in July. Moisture is ample throughout the year, often with prolonged rainfall in the winter and spring due to warm air from the Gulf of Mexico overriding cooler air masses near the ground surface. The mean annual precipitation is 54 inches (National Oceanic and Atmospheric Administration, 2010).

2.3 Principal Flood Problems

Principal flood problems in Washington County result from the nature of the terrain. A very large portion of the county lies in the flat, extremely broad delta region which is confined between the Mississippi River levees on the western side and Deer Creek Ridge

on the eastern side. The area east of Deer Creek Ridge is also flat. Flows in this region occur over alluvial fans and over broad areas. Watercourses, including Main Canal and Black Bayou, have minimal capacity. Flows commonly cross the individual drainage divides, and the direction of overflow is generally variable, unpredictable, or difficult to determine.

In September 2008, over 11 inches of precipitation fell on Washington County from Hurricane Gustav (NOAA, 2008). Widespread flooding occurred within the county, especially in the City of Greenville. The Washington County Emergency Management agency concluded that approximately 1,450 homes were damaged during the event (MS Levee Board, 2009).

2.4 Flood Protection Measures

The levees along the Mississippi River protect the study area against the headwater flooding from all floods, up to the Mississippi River Project Flood.

The Flood Control Act of December 22, 1944, authorized approximately 100 miles of channel improvements in the Steele Bayou basin, including work in Steele Bayou, Main Canal, and Black Bayou, to be accomplished by the USACE. These improvements have been completed. Additional improvements were authorized in 1970 and include of additional channel enlargement of Steele Bayou and Main Canal, improvement of Black Bayou, and a closure fill on Main Canal at mile 27.2 to divert waters from approximately 21,000 acres of land north of Greenville down Black Bayou.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the communities, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded 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

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

March 1980, Washington County (Unincorporated Areas) FIS Analyses

For the Mississippi River, flood frequencies were developed on the basis of statistical analysis (U.S. Water Resources Council, 1976), historical flood routings, and model studies. The 0.2-percent annual chance frequency flood discharges and corresponding flood elevations on the Mississippi River within the study area were not determined due to the difficulty in analyzing a specified flood frequency of this magnitude in such a large, unique drainage basin. The sequence and severity of meteorological and hydrologic events, which could reasonably be expected to occur and cause a major flood such as a 0.2-percent annual chance frequency flood, would involve the consideration of storm transpositions, storm adjustments, seasonal variations, storm mechanics, and the determination of the feasibility of the occurrence of the events, as well as the determination of flows under natural conditions and as regulated by reservoirs at key stations on the tributaries and on the main Mississippi River. Mississippi River Project Flood was used in the report as an alternative to the 0.2-percent annual chance flood. Although no specific return period is assigned to a project flood, it is typically greater than the 1.0-percent annual chance flood.

For Ditch No. 6 and Bowman Boulevard Ditch, a synthetic unit hydrograph method (Snyder's method) was used to develop flood-flow frequency relationships (USACE, 1959). This method relates U.S. Weather Service rainfall records to the physiographic and climatological characteristics of a drainage basin through applying proper quantitative emphasis on various factors. These factors are drainage area and shape of the basin; transmission and retention capacities of the soils in the basin; type, amount, and density of soil cover; and evapotranspiration rates of the vegetation within the basin.

Discharge frequencies relationships could not be determined accurately for the Mississippi River, Main Canal, and Black Bayou.

February 1979, City of Greenville FIS Analyses

For Park Ditch, Horseshoe Ditch, Bowman Boulevard Ditch, and Robert Shaw Boulevard Ditch, a synthetic unit hydrograph method, sometimes referred to as Snyder's Method, was used to develop flood-flow frequency relationships (USACE, 1959). This method involves relating National Weather Service rainfall records to the physiographic and climatological characteristics of a drainage basin. This is done by applying proper quantitative emphasis on various factors, such as the drainage area and the shape of the basin; transmission and retention capacities of the soils in the basin; type, amount, and density of soil cover in the basin; and, evapotranspiration rates of the vegetation within the basin. Frequency discharge, drainage area relationships for Bowman Boulevard Ditch and Robert Shaw Boulevard Ditch are shown in Figure 1.

Discharge-frequency relationships cannot be determined accurately for the Mississippi River, the Lake Ferguson flooding source, and the Main Canal.

High-water discharges were taken from a gaging station on the Main Canal. The gaging station record covers 21 years.

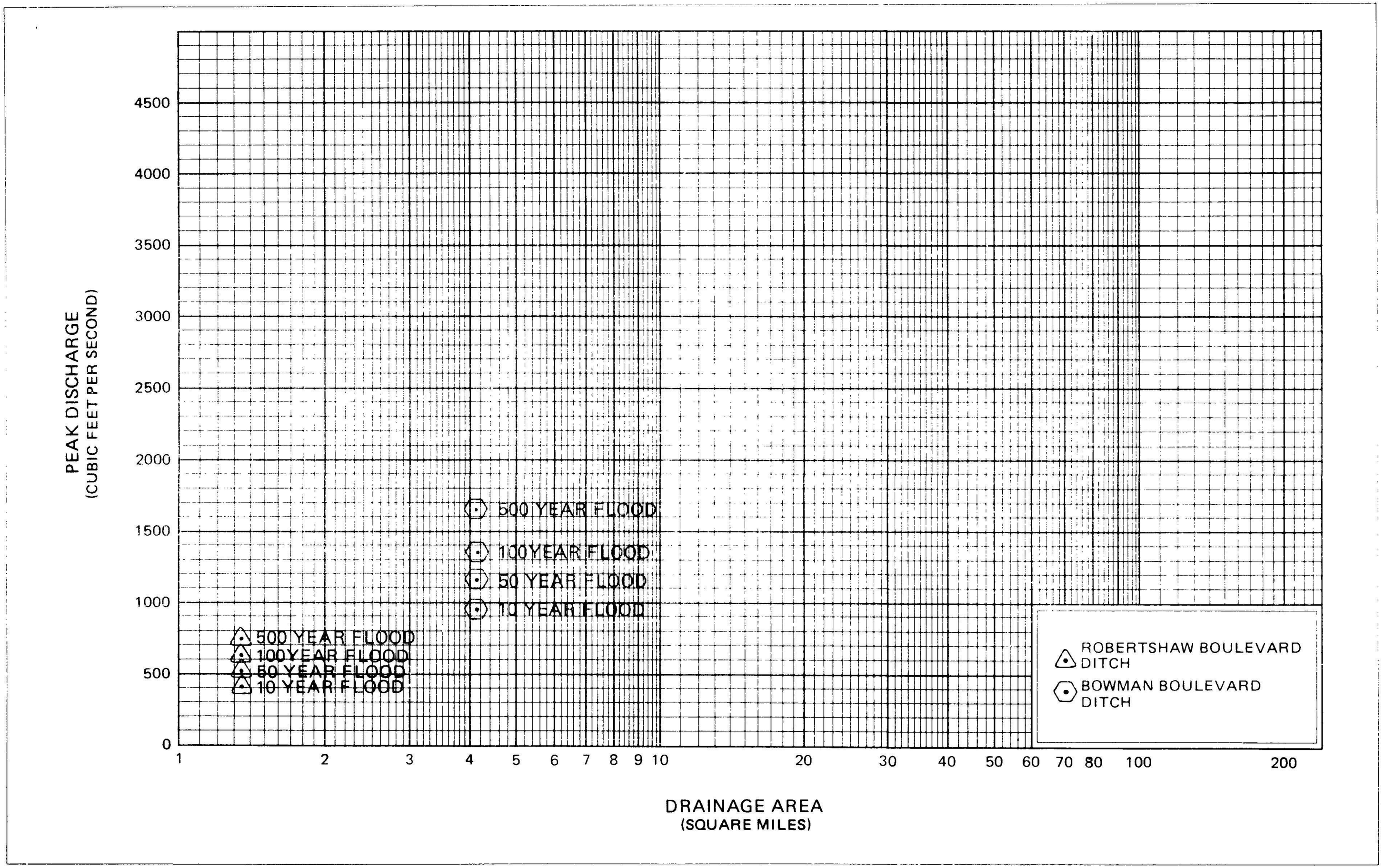


FIGURE 1

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

CITY OF GREENVILLE, MS
(WASHINGTON CO.)

FREQUENCY DISCHARGE, DRAINAGE AREA CURVES

ROBERTSHAW BOULEVARD DITCH -BOWMAN BOULEVARD DITCH

August 1978, City of Leland FIS Analyses

A gaging station on Deer Creek, located near Hollandale, approximately 28 miles downstream from Leland, was the principal source of data for defining discharge-frequency relationships for the creek. The gage has been operated since 1945 by the USACE. Values of the 10-, 2.0-, 1.0-, and 0.2-percent annual chance peak discharges at the gage site were obtained from a log-Pearson Type III distribution of annual peak flow data (U.S. Water Resources Council, 1967). Flows thus derived at the gage, where the drainage area is 09 square miles of drainage area at the U.S. Highway 82 bridge in Leland because of the characteristics of the basin. With no appreciable increase in the drainage area, and with the available storage in this 28-mile segment of Deer Creek, flows are expected to remain fairly constant between Leland and the gage site.

Because of shallow flooding or inadequate drainage-type conditions, peak flood-flows were not appreciable for other streams in the study area. However, approximate volume-frequency relationships for the 1.0-percent annual chance flood in shallow flooding areas was established by assuming that all the water from rainfall over these areas, barring some losses, will be retained in the area until the capacity of the area to hold water is exhausted.

This Countywide FIS Analysis

Peak discharges were calculated based on USGS regional regression equations (U.S. Department of the Interior, 1991). For the discharges calculated based on regional regression equations, the rural regression values were modified to reflect stream gage weighting and/or urbanization as necessary.

The 1-percent annual chance flood elevation was calculated for Steele Bayou using gage data provided by the USACE (USACE, 2009).

A summary of the drainage area-peak discharge relationships for all the streams is shown in Table 1, "Summary of Discharges."

TABLE 1. SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. mi.)	PEAK DISCHARGES (cfs) 10-percent	2-percent	1-percent	0.2-percent
Bowman Boulevard Ditch					
At Mouth	4.19	960	1160	1,350	1,550
Deer Creek					
At U.S. Highway 82	81	256	1064	1,205	1,537
Ditch No. 6					
At mouth	5.20	630	810	900	1,120

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data table 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 report in conjunction with the data shown on the FIRM.

March 1980, Washington County (Unincorporated Areas) FIS Analyses

Hydraulic analyses on the Mississippi River for floods of selected recurrence intervals were made in conjunction with studies to update the Mississippi River Project flowline. Channel and overbank cross sections were surveyed in 1973. Channel roughness coefficients (Manning's "n") were determined by computer modeling of the 1973 flood high-water profile. The "n" value for the channel was 0.030 and for the overbank 0.140. Flowlines were computed using the HEC-2 computer program (USACE, 1973) for backwater computations and adjusted according to physical model test. Model tests were run on the Mississippi River basin model located in Clinton, Mississippi.

For the hydraulic analyses for Ditch No. 6 and Bowman Boulevard Ditch, cross sectional data were obtained by field survey. All bridges and culvers were surveyed in order to obtain elevation data and structural geometry. Roughness coefficients (Manning's "n") for these streams were estimated by field inspection and published literature (Cowan, 1956). The roughness values for the channels of these streams range from 0.045 to 0.075 and from 0.10 to 0.15 for the overbank areas.

Water-surface profiles were developed using the HEC-2 computer program (USACE, 1973). Profiles were determined for the 10-, 2.0-, 1.0-, and 0.2-percent annual chance floods for the Mississippi River, Ditch No. 6, and Bowman Boulevard Ditch. Starting water-surface elevations for all detailed-study streams were developed by using the slope-area method.

After numerous attempts to develop flood profiles through HEC-2, it was concluded that the mathematical models for backwater calculations give erroneous results for shallow flooding areas because of poorly defined flood plains and unpredictable flow patterns. The 10- and 1.0-percent annual chance flood profiles for Main Canal and Black Bayou developed for the 1971 Flood Plain Information Report (USACE, 1971), were reviewed and found to be satisfactory for use in the study. Therefore, the 2.0- and 0.2-percent annual chance flood profiles were not shown. These profiles were based on backwater calculations and adjusted according to analysis of the September 1958 flood profile.

February 1979, City of Greenville FIS Analyses

All bridges and culverts were field surveyed to obtain elevation data and structural geometry. Roughness coefficients (Manning's "n") for these streams were estimated by field inspection and published literature (Cowan, 1956). The roughness value for the channel of these streams is form 0.045 to 0.075 and 0.15 for the overbank areas.

Water-surface profiles were developed using the HEC-2 computer program (USACE, 1973). Profiles were determined for the 10-, 2.0-, 1.0-, and 0.2-percent annual chance floods. Starting water-surface elevations were developed by the slope-area method.

After numerous attempts to develop flood profiles through HEC-2, it was concluded that the mathematical models for backwater calculations give erroneous results for shallow flooding areas because of poorly defined flood plains and unpredictable flow patterns. The 10- and 1.0-percent annual chance flood profiles for Main Canal and Black Bayou developed for the 1971 Flood Plain Information Report (USACE, 1971), were reviewed and found to be satisfactory for use in the study. Therefore, the 2.0- and 0.2-percent annual chance flood profiles were not shown. These profiles were based on backwater calculations and adjusted according to analysis of the September 1958 flood profile.

Headwater flooding along Horseshoe Ditch and Park Ditch is mostly confined to the channels. Therefore, shallow backwater flooding from Main Canal governs the flooding along these two streams, as well as a downstream portion of Robert Shaw Boulevard Ditch.

The area flooded due to inadequate drainage facilities and the areas on Park Ditch and Horseshoe Ditch above the limit of detailed study were studied by approximate methods and delineated through field inspections, photographs, and local accounts of past flooding.

Water-surface elevations for the Lake Ferguson profile were derived from River Mile station 538 on the Mississippi River (U.S. Housing and Urban Development). This point denotes the confluence of Lake Ferguson with the Mississippi River. Lake Ferguson is an isolated meander separated from the Mississippi River by a levee system and is inundated by the backwater of the Mississippi River.

August 1978, City of Leland FIS Analyses

Cross section data for Deer Creek were obtained by field measurement. All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Roughness coefficients (Manning's "n") for Deer Creek were estimated by field inspection and from published literature (Woody Cowan, 1956). The roughness value for the main channel of Deer Creek is estimated at 0.045 to 0.100 for the floodplain.

Water-surface profiles were developed using the HEC-2 computer program USACE, 1973). Profiles were determined for the 10-, 2.0-, 1.0-, and 0.2-percent annual chance floods. Starting water-surface elevations were developed by the slope-area method.

The elevation for the 1.0-percent annual chance flood, within the shallow flooding area, was determined by correlating the volume-frequency relationships of the 1.0-percent annual chance flood with the stage-volume relationships for these areas.

The elevation for the approximate 1.0-percent annual chance flood in the area of inadequate drainage was determined by calculating the approximate water-surface elevation on the downstream side of the drainage structure and adding to it the head loss through the drainage structure.

This Countywide FIS Analysis

Cross section geometries were obtained from a combination of terrain data and field surveys. Bridges and culverts located within the limited detailed study limits were field surveyed to obtain elevation data and structural geometry.

Downstream boundary conditions for the hydraulic models were set to normal depth using a starting slope calculated from values taken from topographic data, or where applicable, derived from the water-surface elevations. Water-surface profiles were computed through the use of the USACE HEC-RAS version 4.0.0 computer program (USACE, 2008). The model was run for the 1-percent-annual-chance storm for the limited detail and approximate studies.

The 1.0-percent annual-chance flood elevation for the Steele Bayou Control Structure was determined by analysis of historical gage records. Much of the county north of the Control Structure is below the computed flood elevation. This elevation is presented in Table 3 – Summary of Stillwater Elevations.

Table 2 summarizes water-surface elevations for floods of the 10-, 2.0-, 1.0-, and 0.2-percent annual-chance floods.

TABLE 2. SUMMARY OF STILLWATER ELEVATIONS

	ELEVATION (Feet) NAVD			
FLOODING SOURCE AND LOCATION	10-percent	2-percent	1-percent	0.2-percent
Lake Ferguson				
At Greenville Corporate Limits	129.8	136.8	139.8	151.1
Steele Bayou				
At Control Structure	*	*	100.1	*

* Data Not Available

The hydraulic analyses for this countywide FIS 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.

Qualifying bench marks within a given jurisdiction that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Benchmarks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

> Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)

Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)

Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monuments below frost line)

Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monument established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

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

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. Interested individuals may contact FEMA to access this data.

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 in use for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between the communities.

Ground, structure, and flood elevations may be compared and/or referenced to NGVD29 by applying a conversion factor. To convert elevations from NAVD88 to NGVD29, add 0.23 feet to the NAVD88 elevation. The -0.23 feet value is an average for the entire county. The adjustment value was determined using the USACE Corpscon 6.0.1 computer program (USACE, 2004) and topographic maps (U.S. Department of the Interior, 1965). The BFE's 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 NGVD29 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 the NAVD, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988* or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20910 (Internet address http://www.ngs.noaa.gov).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance flood elevations and delineations of the 1- and 0.2-percent-annual-chance floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data Table and Summary of Stillwater Elevations Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local 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 methods, the 1- and 0.2-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using 5-foot contour intervals developed from the March 2006 digital orthophotography provided by the State of Mississippi.

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

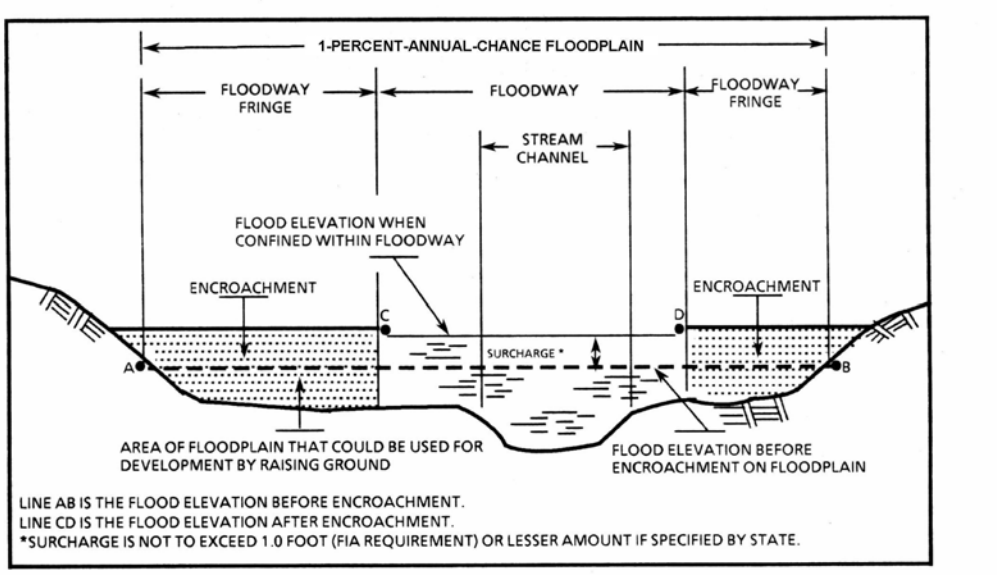
For the streams studied by limited detailed and approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2). Floodplain boundaries for these streams, as well as those streams that have been previously studied by detailed methods, were generated using 5-foot contour intervals developed from the March 2006 digital orthophotography provided by the State of Mississippi.

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 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 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 area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation 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.

No floodways were computed for streams within Washington County.



FLOODWAY SCHEMATIC Figure 2

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. These zones are as follows:

Zone A

Zone A is the flood insurance risk 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 (1-percent-annual-chance) flood elevations (BFEs), or base flood depths are shown within this zone.

Zone AE

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

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within the zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where the average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within the zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 1-percent floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 1-percent coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent coastal floodplains that have additional hazards associated with storm waves. 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 risk 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, and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

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 risk 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 the 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 Washington 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, up to and including this countywide FIS are presented in Table 3, “Community Map History.”

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Town of Arcola	June 7, 1974	July 9, 1976	August 1, 1986	--
City of Greenville	November 16, 1973	May 21, 1976	August 1, 1979	--
City of Hollandale	May 31, 1974	July 23, 1976	January 14, 1983	--
City of Leland	May 31, 1974	--	February 15, 1979	--
Town of Metcalfe	--	--	--	--
Washington County (Unincorporated Areas)	October 18, 1974	December 16, 1977	September 3, 1980	--

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Washington 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 jurisdictions within Washington County and should be considered authoritative for 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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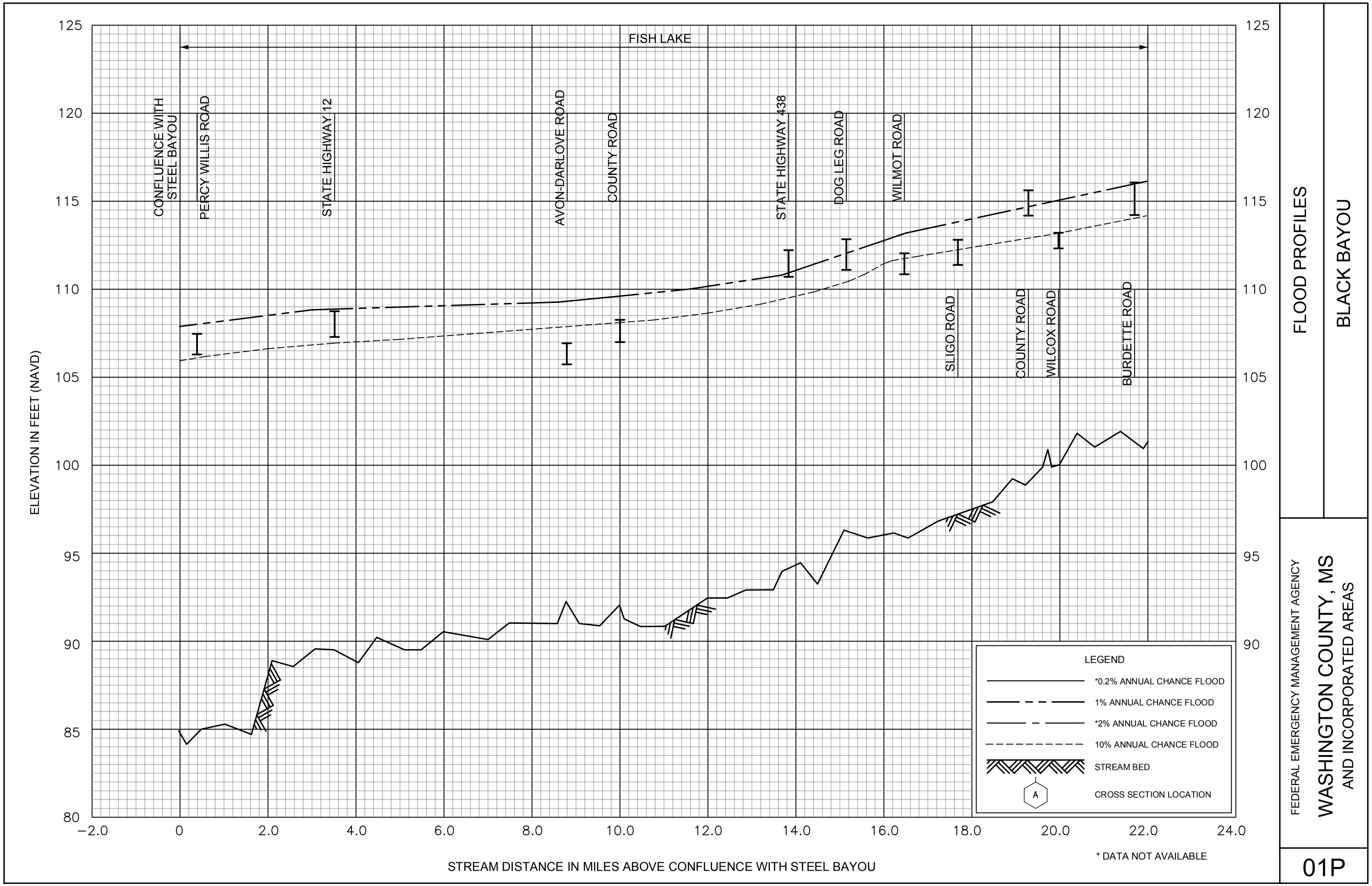


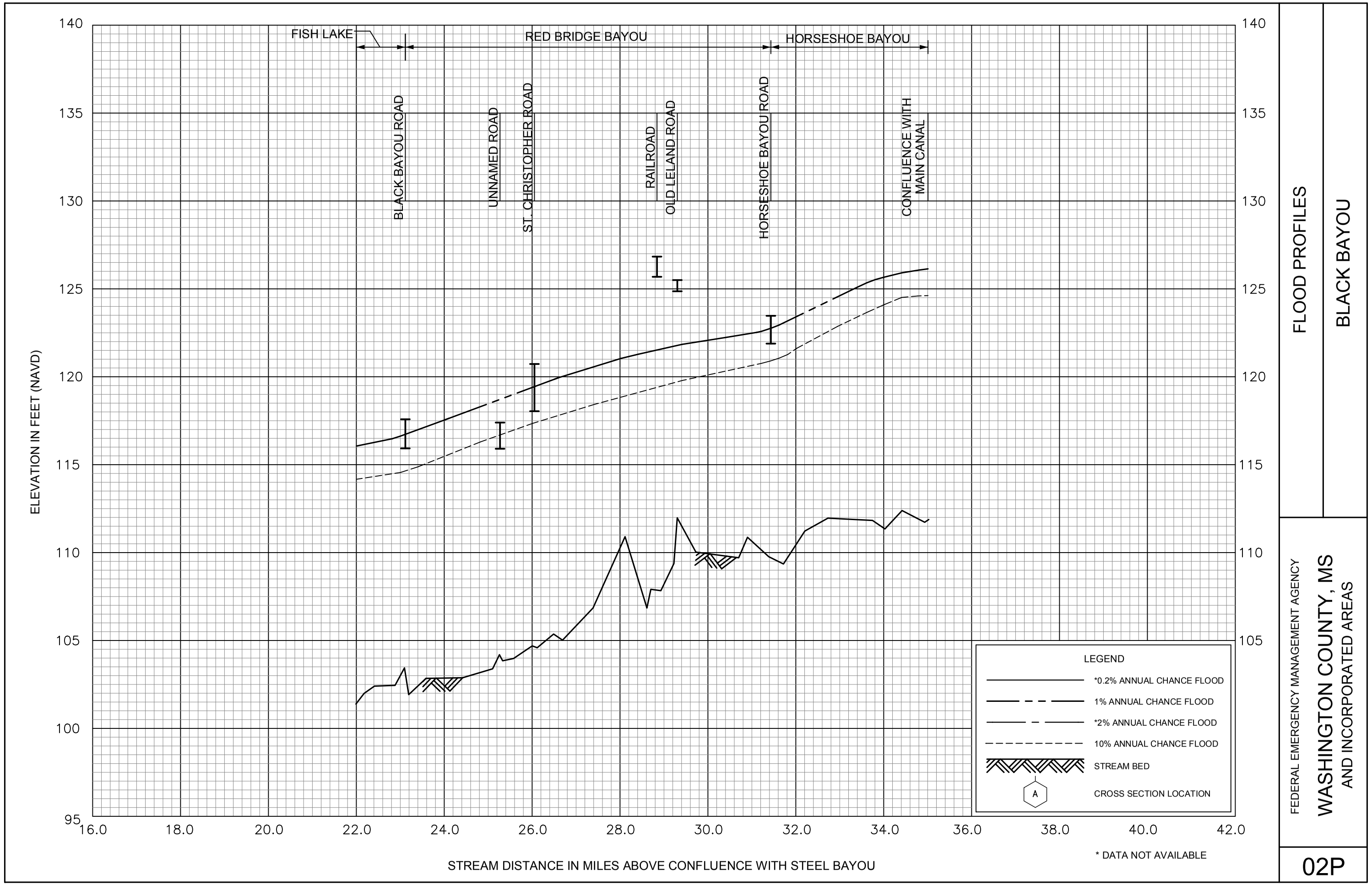
FLOOD PROFILES

BLACK BAYOU

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

01P



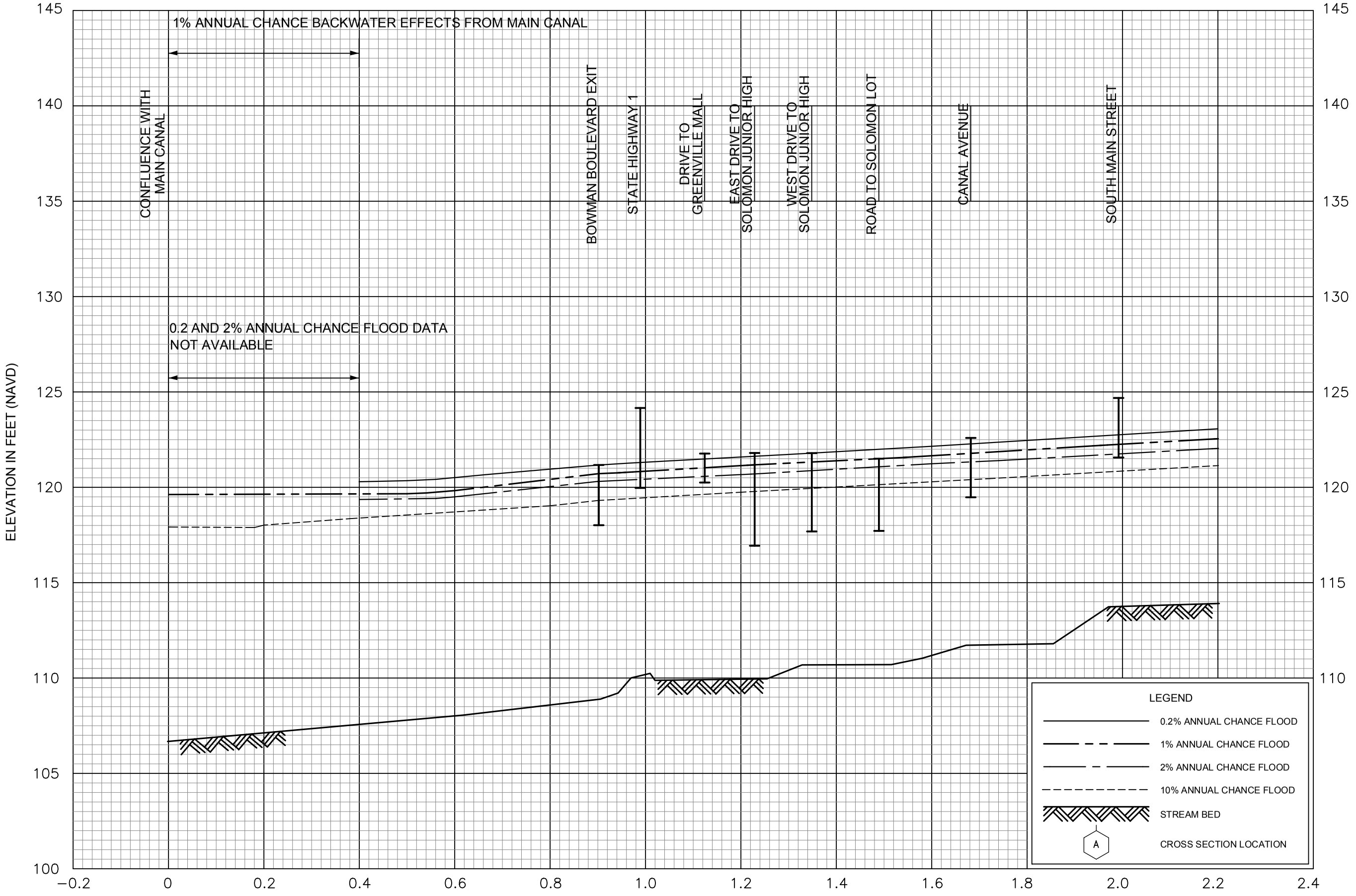
FLOOD PROFILES

BLACK BAYOU

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

02P



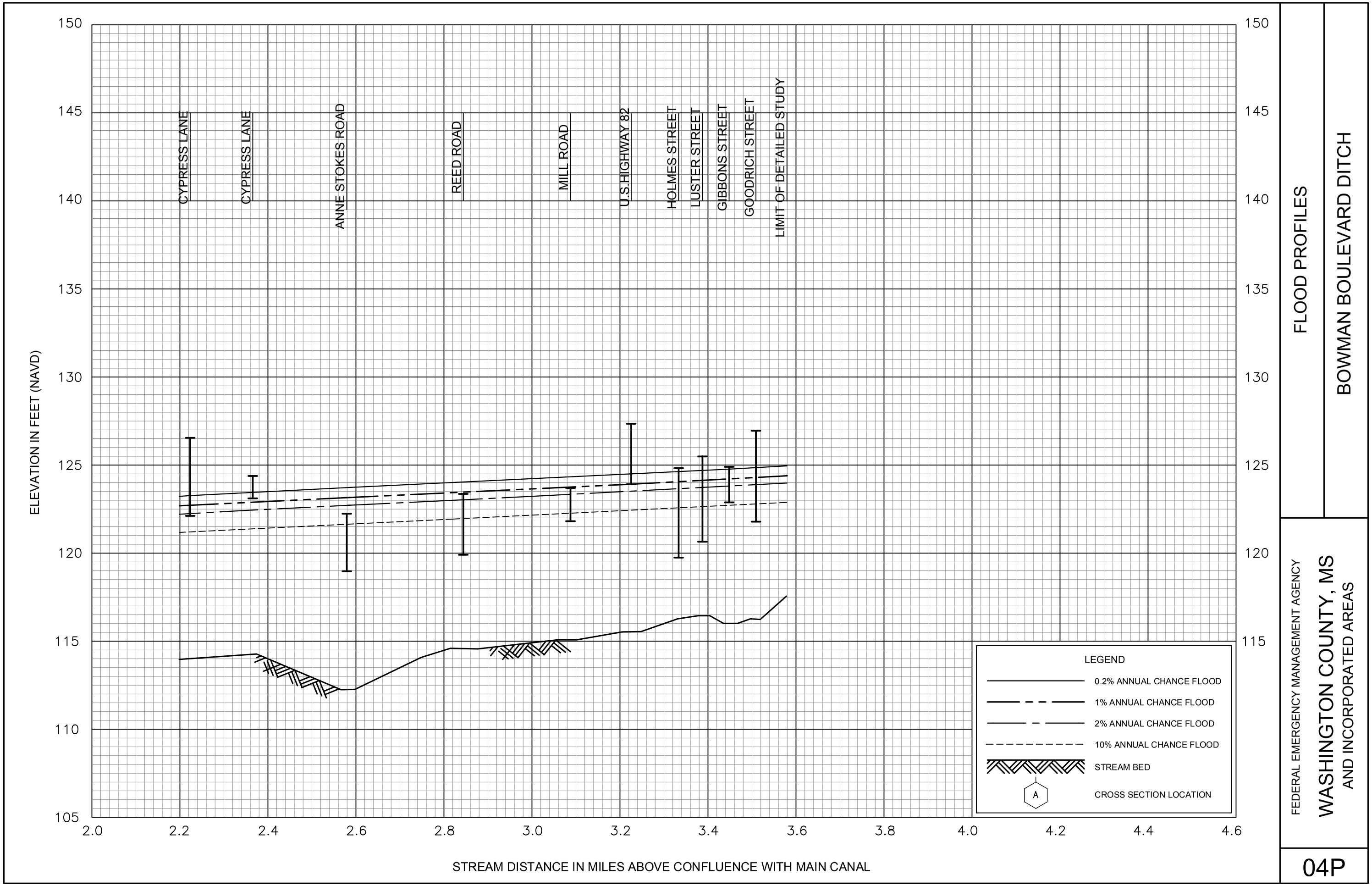
FLOOD PROFILES

BOWMAN BOULEVARD DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

03P



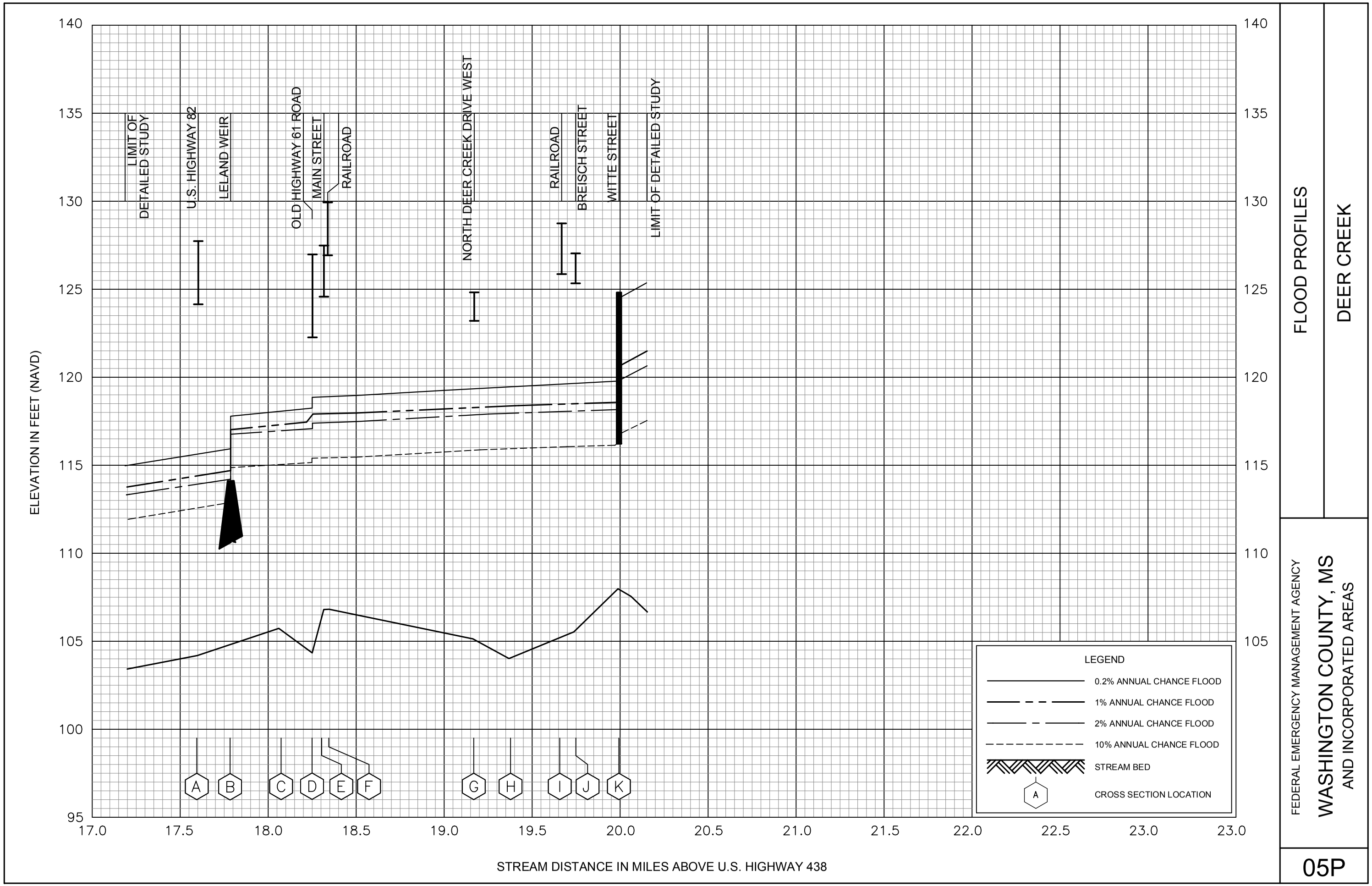
FLOOD PROFILES

BOWMAN BOULEVARD DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

04P



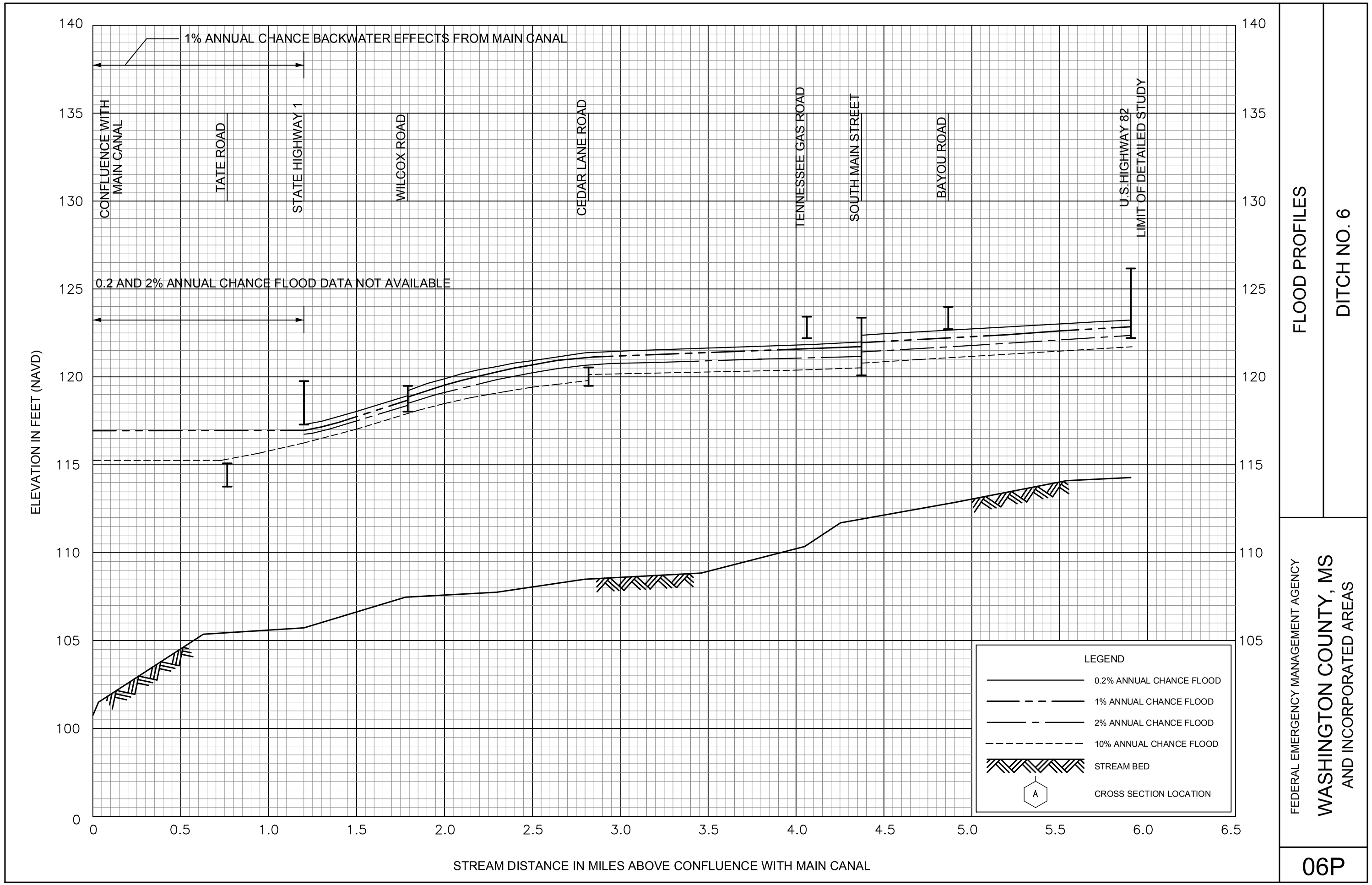
FLOOD PROFILES

DEER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

05P



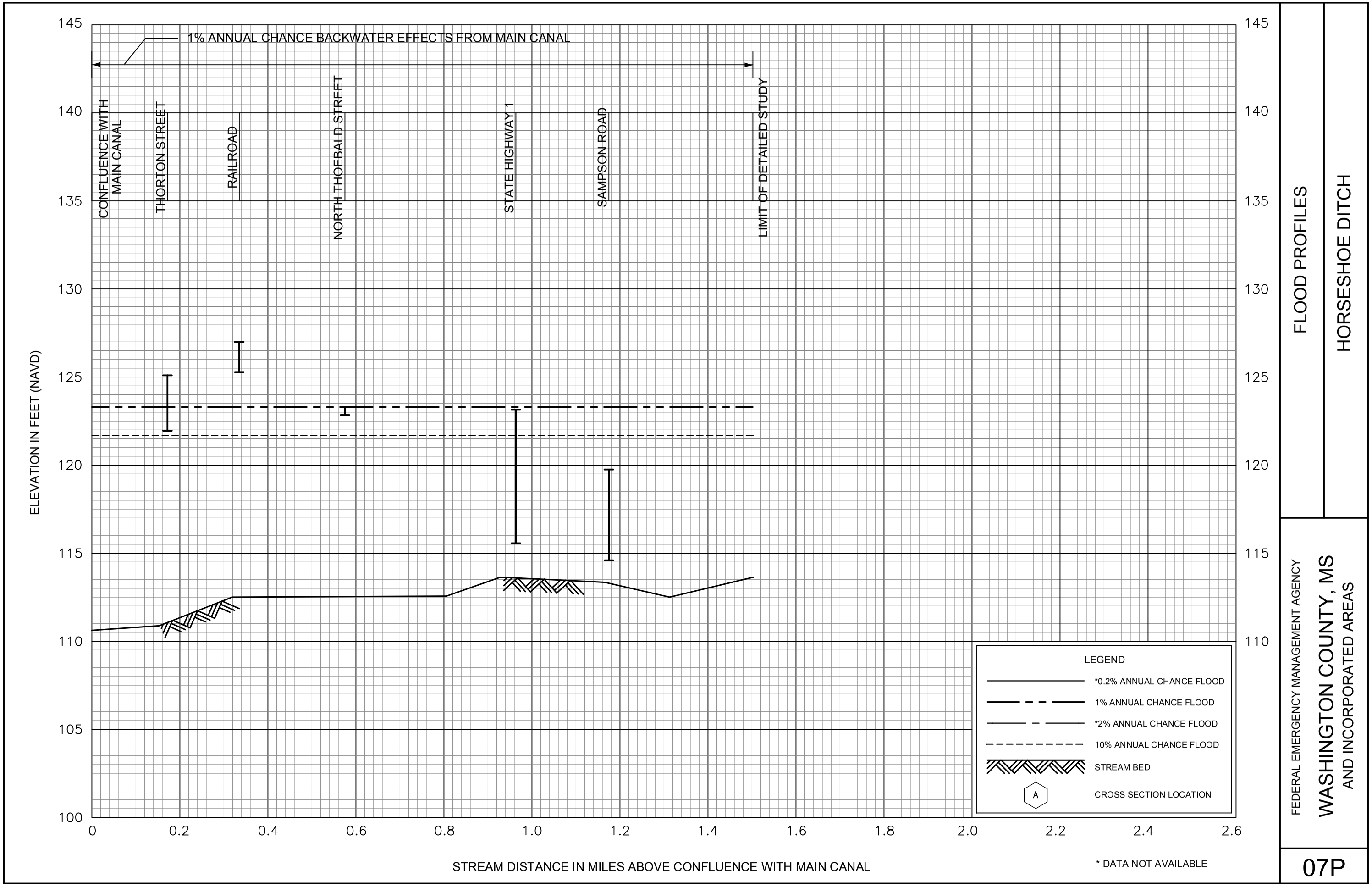
FLOOD PROFILES

DITCH NO. 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

06P



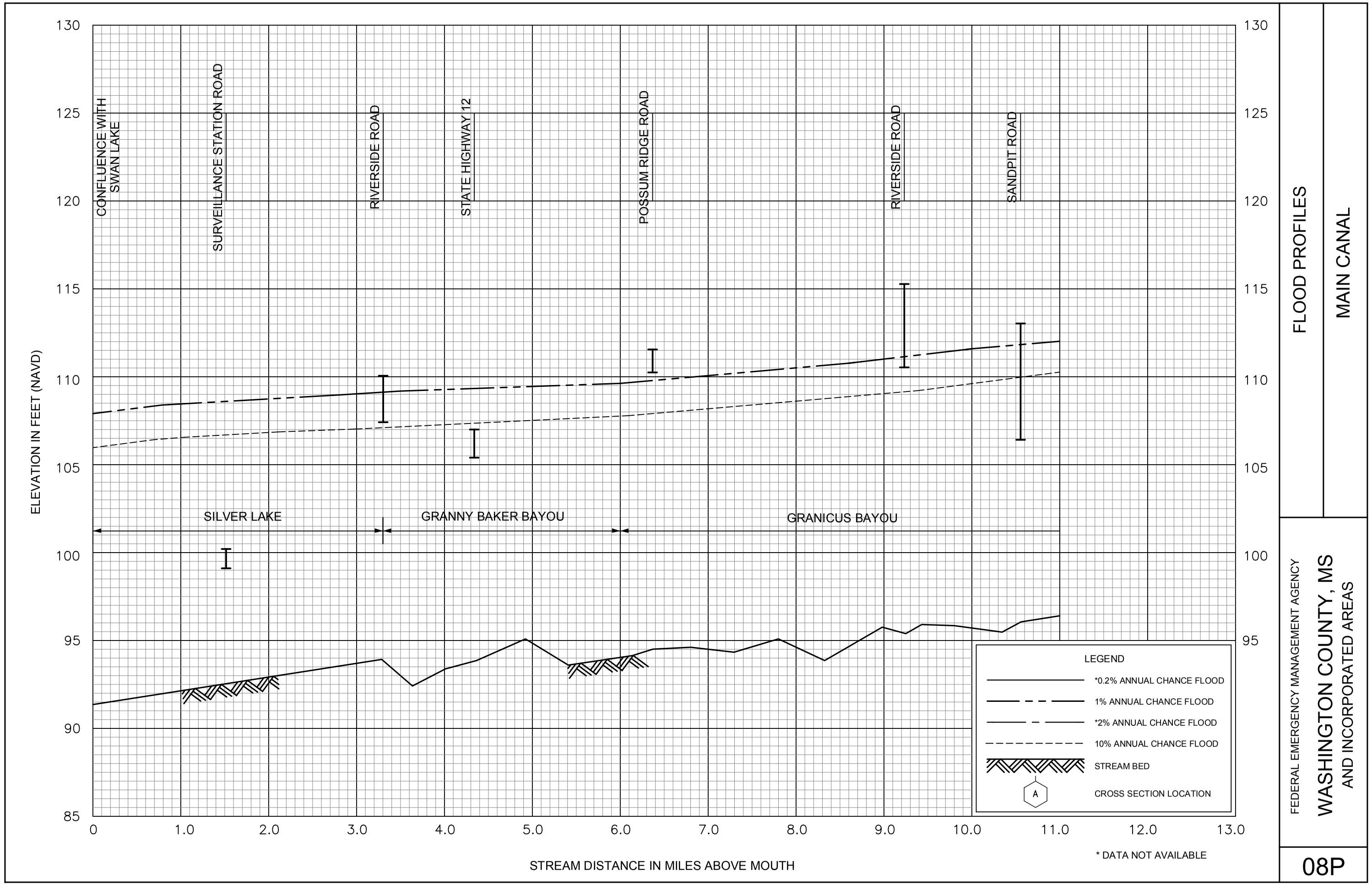
FLOOD PROFILES

HORSESHOE DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

07P



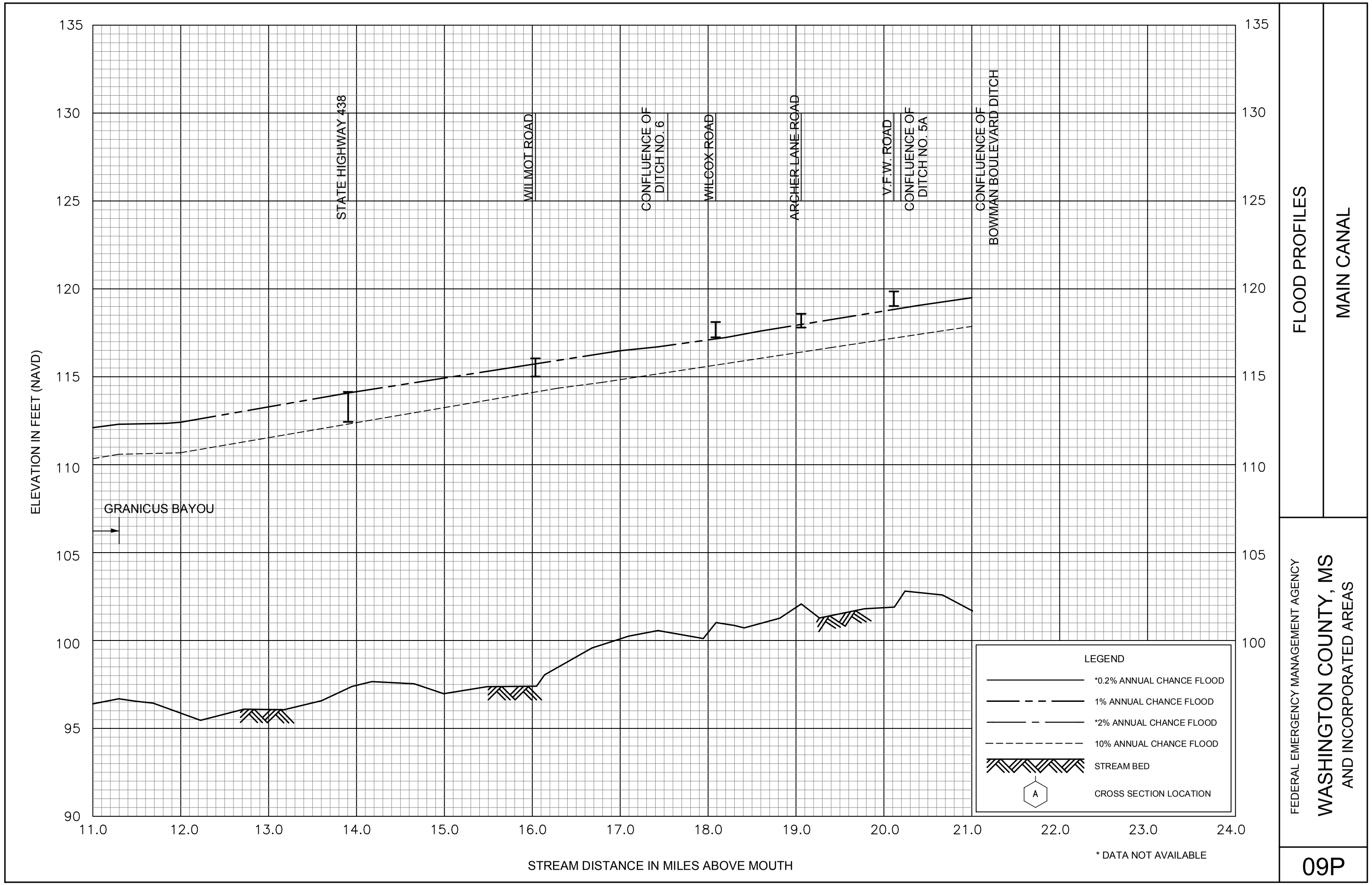
FLOOD PROFILES

MAIN CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

08P



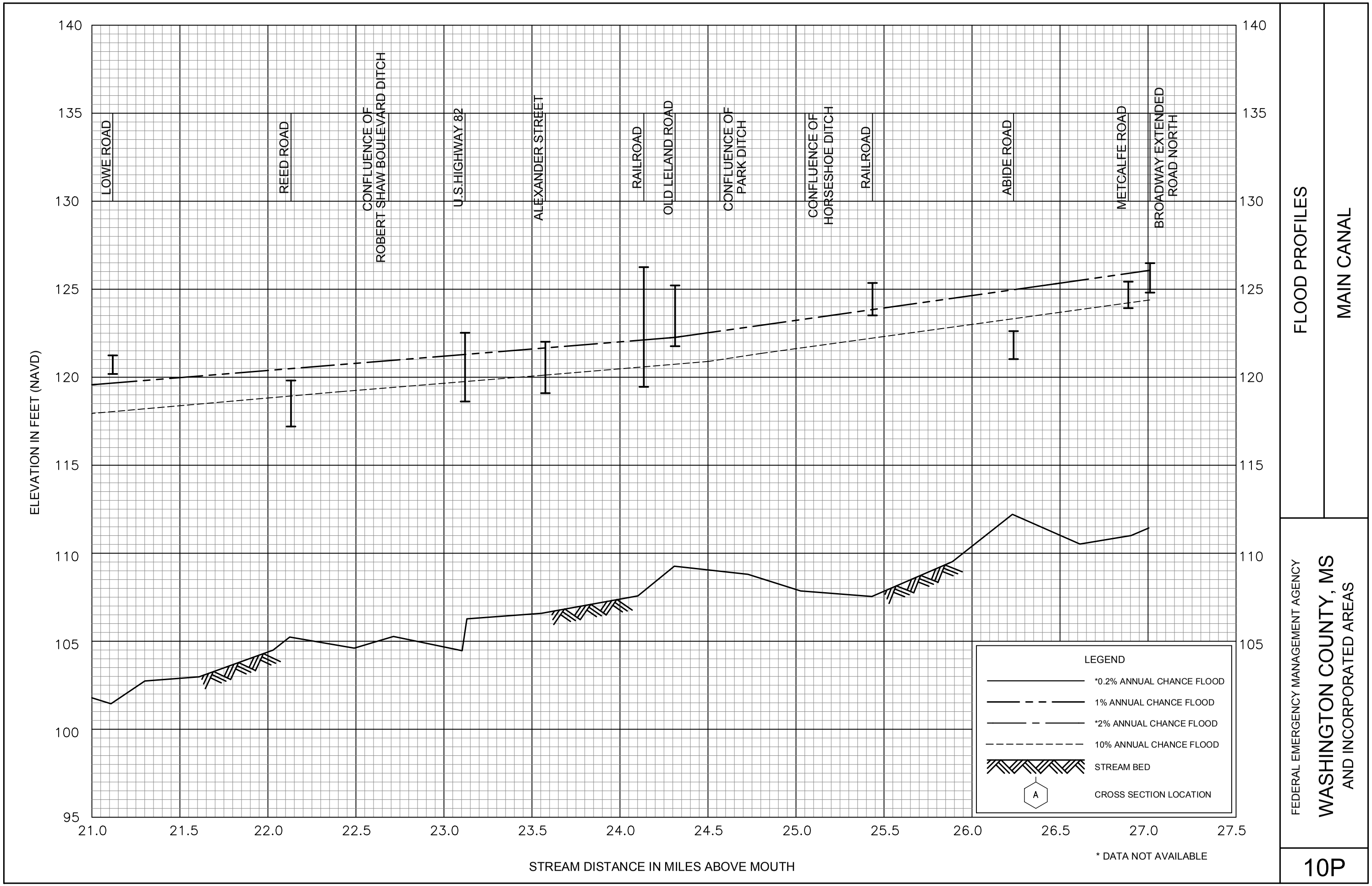
FLOOD PROFILES

MAIN CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

09P



FLOOD PROFILES

MAIN CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

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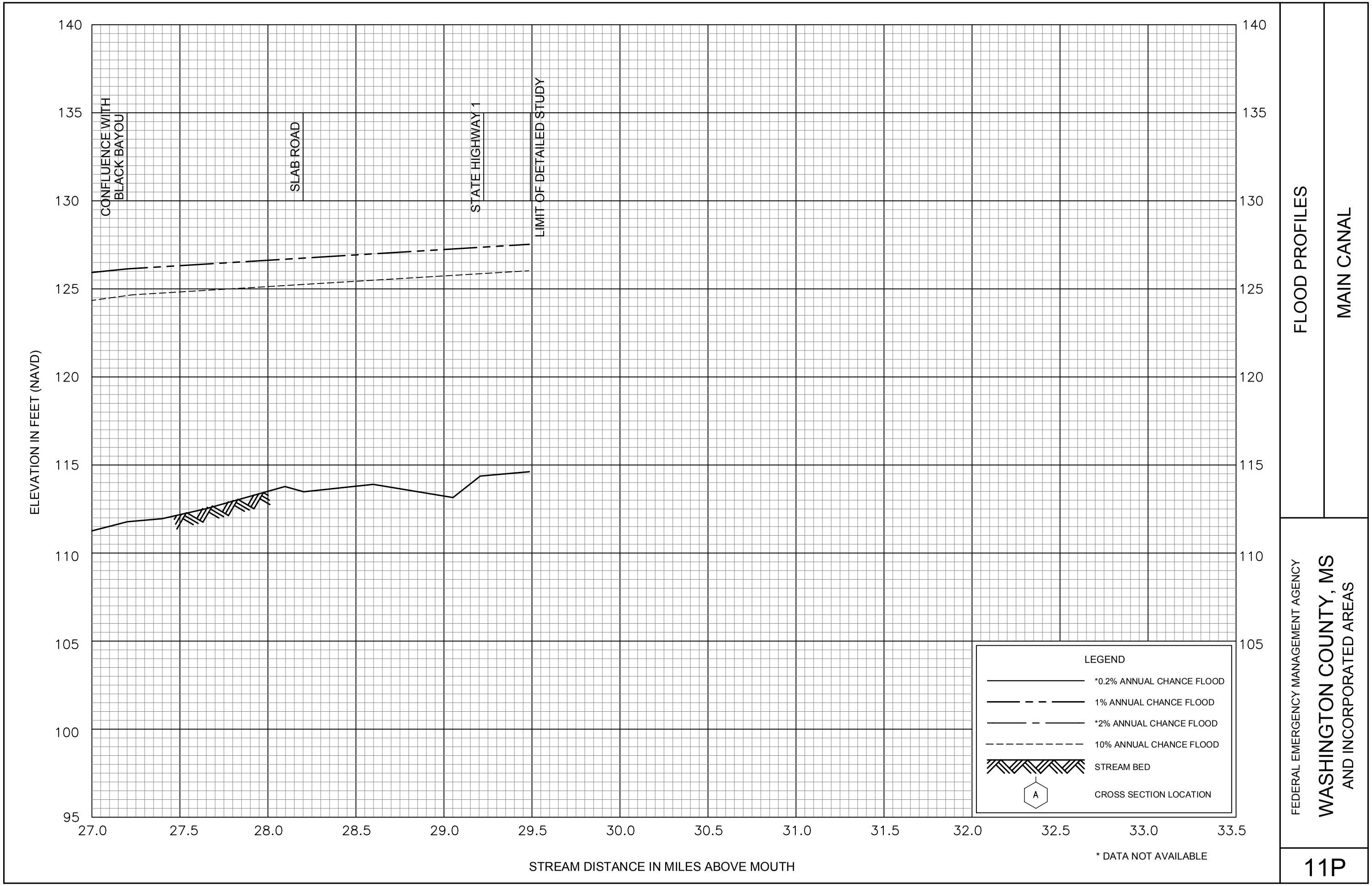


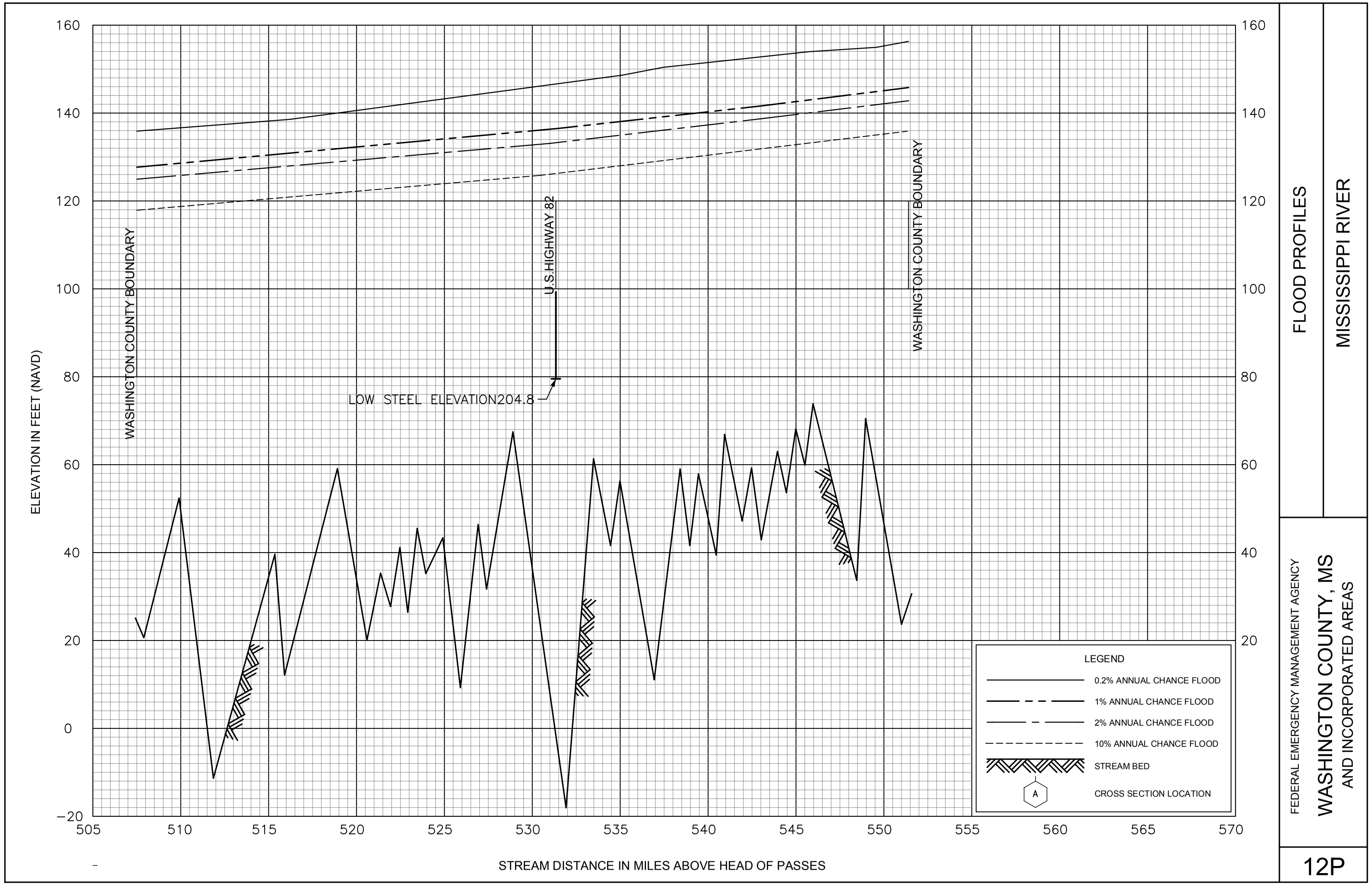
FLOOD PROFILES

MAIN CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

11P



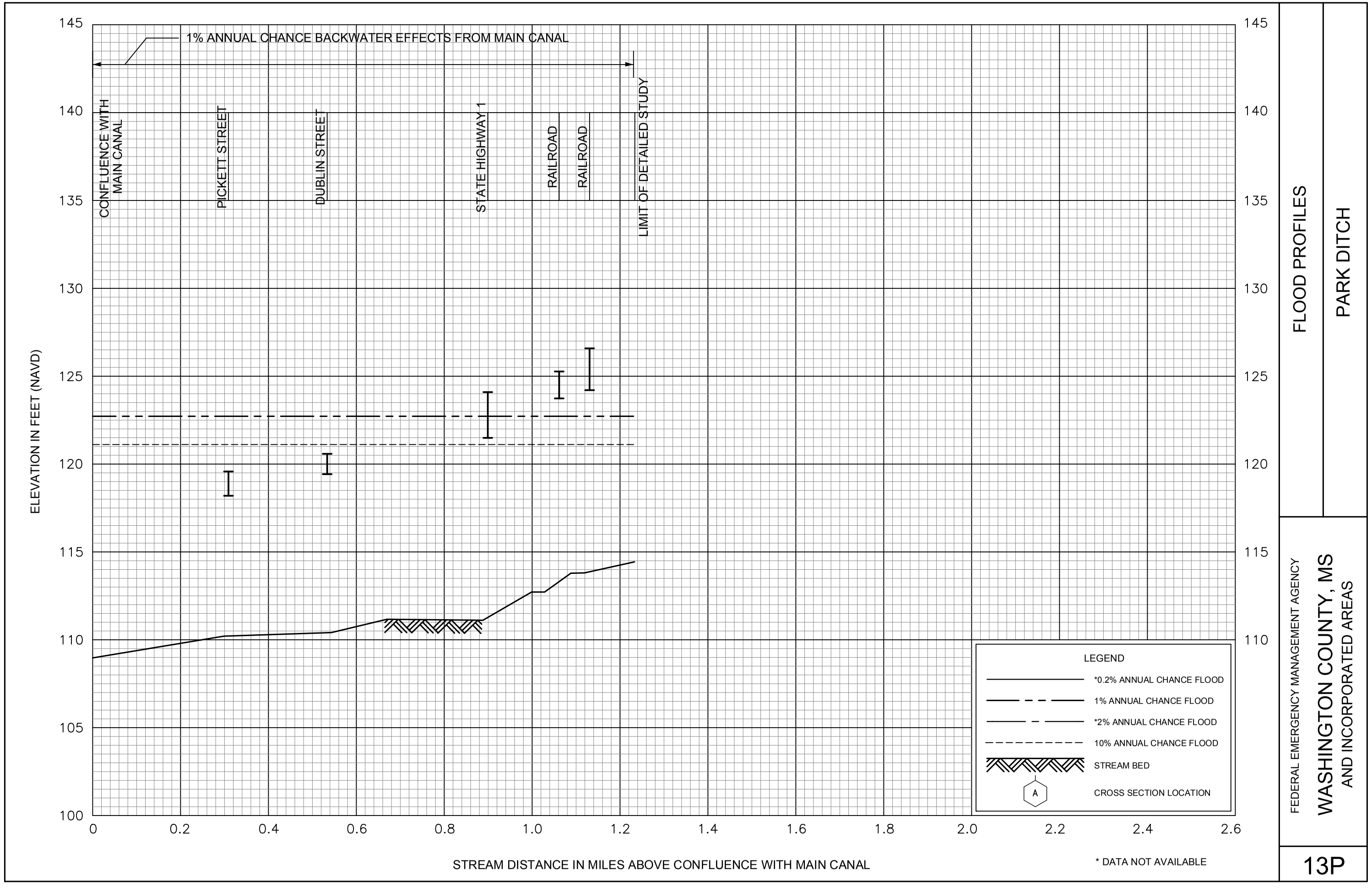
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

12P



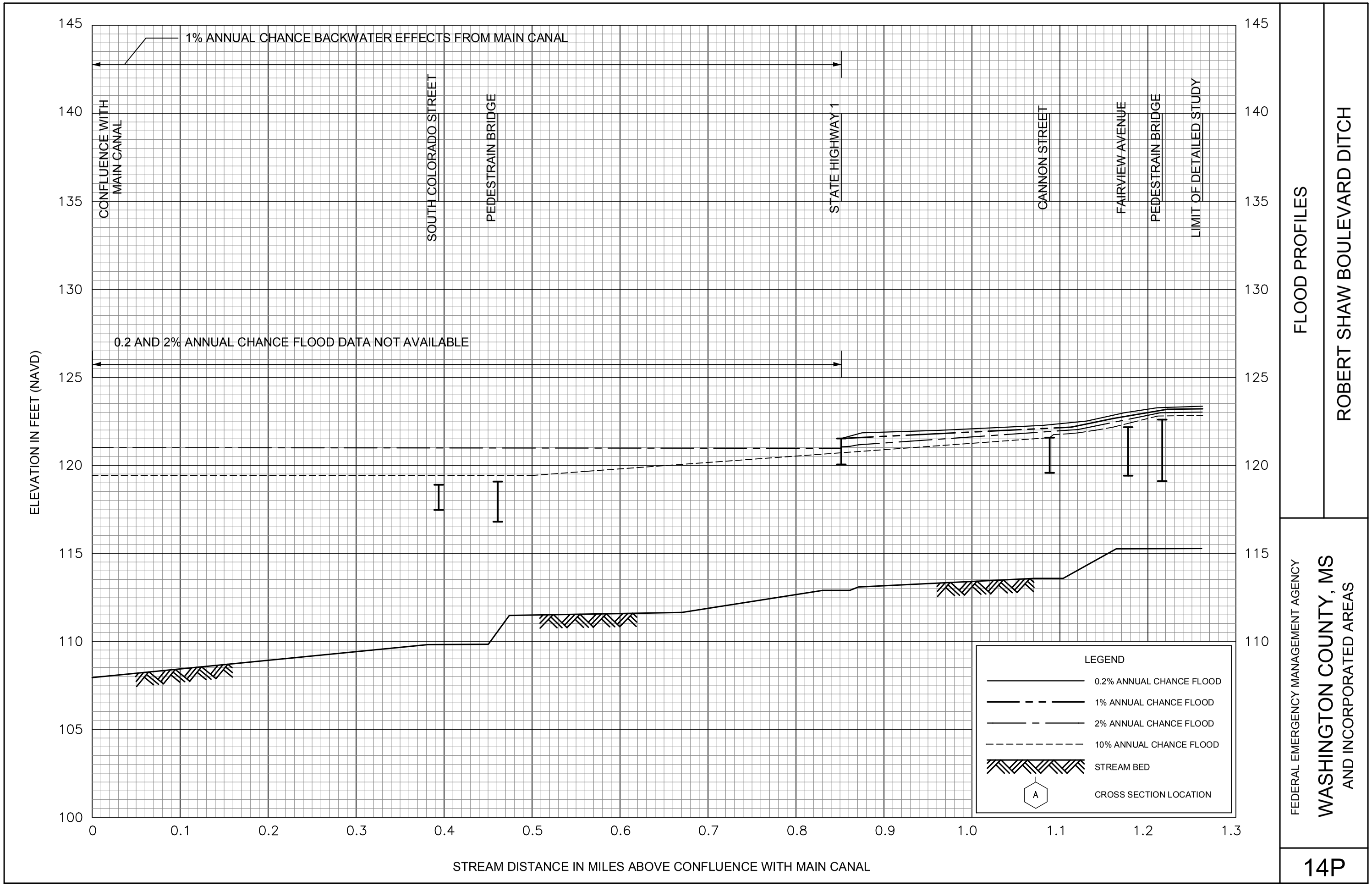
FLOOD PROFILES

PARK DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

13P



FLOOD PROFILES

ROBERT SHAW BOULEVARD DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

WASHINGTON COUNTY, MS
AND INCORPORATED AREAS

14P