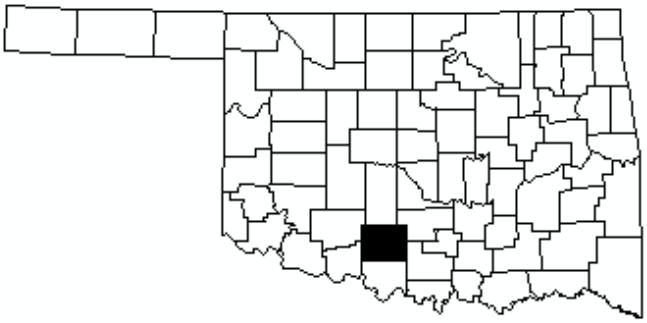
FLOOD INSURANCE STUDY

STEPHENS COUNTY, OKLAHOMA
AND INCORPORATED AREAS

Community Name	Community Number
BRAY, TOWN OF	400536
COMANCHE, CITY OF	405376
DUNCAN, CITY OF	400202
EMPIRE CITY, CITY OF	400520
LOCO, CITY OF	400521
MARLOW, CITY OF	400203
STEPHENS COUNTY, UNINCORPORATED AREAS	400498
VELMA, CITY OF	400447



REVISED: September 29, 2010

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
40137CV000A

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.

Part of 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. A listing of the Community Map Repositories can be found on the Map Index.

Initial Countywide FIS Effective Date: December 15, 1990

First Revised Countywide FIS Revision Date: January 16, 1992

Second Revised Countywide FIS Revision Date: September 29, 2010

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FLOOD INSURANCE STUDY
STEPHENS COUNTY, OKLAHOMA, 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 Stephens County, including the Cities of Comanche, Duncan, Empire City, Loco, Marlow, Velma; the Town of Bray; and the unincorporated areas of Stephens County (referred to collectively herein as Stephens 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.

1.2 Authority and Acknowledgments

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

The hydrologic and hydraulic analyses for this study were performed by Watershed VI Alliance, for the Federal Emergency Management Agency (FEMA), under Contract No. EMT-2002-CO-0048, Task Order HSTO049. This study was completed in December, 2008.

Information on the authority and acknowledgments for the previously printed FIS and FIRMs, dated January 16, 1992, is listed below.

Flood hazard information for Salt Creek in the City of Comanche and the City of Marlow were previously shown on a FIRM, and no FIS report texts were prepared for those communities; therefore, information on the authority and acknowledgments for those studies is not available.

The hydrologic and hydraulic analyses for Claridy Creek, Cow Creek, Holiday Inn Fork, Willow Creek, Tributary B, Tributary D, Tributary E, and Tributary F in the City of Duncan were prepared by the U.S. Geological Survey (USGS), for FEMA, under Interagency Agreement No. IAA-H-8-76, Project Order No. 1. That work was completed in January 1977.

The hydrologic and hydraulic analyses for Armstrong Creek, Stage Stand Creek, Walker Creek, Walker Creek Tributary, and Waurika Lake were prepared by the U.S. Army Corps of Engineers (USACE), Tulsa District, under Interagency Agreement No. EMW-860E-2226, Project Order No. 17. That work, which was completed in May 1988, was performed for the original countywide study.

In the 1992 revision, the hydrologic analyses for Cow Creek (Lower Reach) in the City of Comanche was prepared by the USACE, Tulsa District, and the hydraulic analyses was prepared by the USACE, Fort Worth District, for FEMA, under Interagency Agreement No. EMW-88-E-2768, Project Order No. 5. That work was completed in November 1989.

1.3 Coordination

The initial Consultation Coordination Officer (CCO) meeting was held in June 2007 and attended by representatives of FEMA; Stephens County; the Cities of Comanche, Duncan, and Marlow; the Town of Velma; the Oklahoma Water Resources Board (OWRB); and the study contractor.

The results of the study were reviewed at the final CCO meeting held on December 3, 2008, and attended by representatives of the Cities of Comanche, Duncan, Marlow, and Velma; OWRB; FEMA; and the study contractor. All problems raised in that meeting have been addressed in this study.

Information on previous CCO meetings for Stephens County is presented below.

There was an initial CCO meeting held in December 1974 to identify the streams to be studied by detailed methods in the City of Duncan, and a final CCO meeting held on July 27, 1977 to review the results of the study. Both meetings were attended by representatives of the City of Duncan, FEMA, and the study contractor.

For the first countywide study, there was an initial CCO meeting held on December 10, 1985 to discuss the streams to be studied by detailed methods, and was attended by representatives of the unincorporated areas of Stephens County, FEMA, and the study contractor. A final CCO meeting was held on January 12, 1990 to review the results of the study, and was attended by representatives of FEMA, the study contractor, the unincorporated areas of Stephens County, and the Cities of Bray, Comanche, Loco, Marlow, and Velma.

2.0 AREA STUDIED

2.1 Scope of Study

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

Corporate limits information has been updated to reflect annexations and deannexations of land by the Cities of Comanche, Duncan, Empire City, Loco, and Marlow.

Streams studied by detailed methods are provided in Table 1, “Streams Studied by Detailed Methods.” The stream study types are identified as being either Detail or Redelineation. Detailed streams are those streams that were newly studied within the County. Redelineation streams are those streams previously studied and had elevations and flood boundaries adjusted to conform to the new maps’ datum and topographic data.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by FEMA and the study contractor.

The appropriate Letters of Map Revision within Stephens County and Incorporated Areas have been incorporated into the revised FIRMs.

Table 1. Streams Studied by Detailed Methods

Stream	Study Type	Reach Length (miles)	Study Area
Armstrong Creek	Redelineation	5.37	From the Stephens County-Comanche County boundary to the Stephens County-Grady County boundary
Beaver Creek	Redelineation	5.32	From approximately 6,800 feet downstream of Walker Creek to the Stephens County-Cotton County boundary
Claridy Creek	Redelineation	6.77	From approximately 2,400 feet upstream of Willow Creek to approximately 400 feet upstream of W. Plato Road
Cow Creek (Lower Reach)	Redelineation	2.87	From approximately 700 feet downstream of the Chicago Rock Island and Pacific Railroad to 9,700 feet upstream of the Chicago Rock Island and Pacific Railroad
Cow Creek	Redelineation	4.12	From approximately 1,700 feet downstream of Tributary F to approximately 300 feet upstream of Breech Road
Holiday Inn Fork	Redelineation	0.53	From the confluence with Claridy Creek to approximately 200 feet upstream of W. Elk Avenue
Salt Creek	Redelineation	1.32	From the confluence with Cow Creek to North Avenue
Stage Stand Creek	Redelineation	7.20	From approximately 3,200 feet upstream of Little Beaver Creek to approximately 400 feet upstream of Plato Road
Tributary B	Redelineation	3.09	From the confluence with Claridy Creek to approximately 4,600 feet upstream of W. Beech Avenue
Tributary D	Redelineation	0.79	From the confluence with Willow Creek to approximately 500 feet upstream of Park Avenue
Tributary E	Redelineation	0.88	From the confluence with Willow Creek to approximately 300 feet upstream of W. Elm Avenue
Tributary F	Redelineation	2.31	From the confluence with Cow Creek to approximately 300 feet downstream of State Highway 7
Unnamed Stream 1	Redelineation	1.41	From the confluence with Armstrong Creek to approximately 2,800 feet upstream of N2730 Road
Unnamed Stream 2	Redelineation	1.03	From the confluence with Walker Creek to E1840 Road
Walker Creek	Redelineation	6.75	From the confluence with Beaver Creek to Dr. Pepper Road
Walker Creek Tributary	Redelineation	1.80	From the confluence with Walker Creek to E1850 Road
Willow Creek	Redelineation	6.65	From approximately 400 feet upstream of the Chicago Rock Island and Pacific Railroad to E. Plato Road

2.2 Community Description

Stephens County is located in south central Oklahoma, approximately 60 miles south-southwest of Oklahoma City. It has a land area of approximately 2,308 square miles, with 44 square miles of water and 2,264 square miles of land (Reference 1). Stephens County is part of the Wildhorse Creek basin, and the major streams flowing through the county are Armstrong Creek, which flows through the northwest corner of the county; Black Bear Creek, a left-bank tributary to Wildhorse Creek in the eastern portion of the county; Claridy Creek, a right-bank tributary to Cow Creek in the western portion of the county; Cow Creek, which flows north to south in the central portion of the county; Little Beaver Creek, which flows through the northwest portion of the county; and Wildhorse Creek, which flows from the north central portion of the county to the east toward Carter County.

Armstrong Creek flows toward the south and has streambed slopes ranging from 13.9 to 19.9 feet per mile (fpm). Stage Stand Creek flows toward the southwest and has streambed slopes ranging from 7.5 to 11.6 fpm. Walker Creek flows toward the south into Waurika Lake and has streambed slopes ranging from 5.3 to 14.2 fpm. Walker Creek Tributary flows toward the west into Waurika Lake and has a streambed slope of approximately 19.7 fpm (Reference 2).

The City of Duncan, which serves as the county seat, is located in the west central portion of the county. Stephens County is bordered by the unincorporated areas of Grady County to the north, Garvin County to the northeast, Carter County to the southeast, Jefferson County to the south, Cotton County to the southwest, and Comanche County to the northwest. The major roads in the area are U.S. Highway 81, and State Highways 7 and 53.

The climate of Stephens County is typically subhumid. The average annual temperature is about 73° F, with ranges of 27° F in January to 94° F in July; average annual precipitation of the region is 36 inches, and snowfall is about 4 inches (Reference 3).

2.3 Principal Flood Problems

All of the streams studied by detailed methods have demonstrated flooding potential. Most of the structural damage has been in the form of washed-out bridges and highways. The most recent flooding recorded in Stephens County and the incorporated areas occurred in late May and early June 1987. Major flooding also occurred in October 1983. As a result of that flood, the county was declared a national disaster area. The flood damages were estimated to be 1.5 million dollars. No frequency estimate was made for that flood. Armstrong Creek, Stage Stand Creek, Walker Creek, and Walker Creek Tributary are tributaries for inflow to Waurika Lake. During the 1983 flood, Waurika Lake rose from a normal pool elevation of 951.4 feet to a record peak of 964.14 feet.

The greatest potential for flood damage in the City of Duncan exists along Claridy and Willow Creeks between Elk and Bois d'Arc Avenues. Extensive development along the floodplains of these streams, combined with backwater effects caused by undersized bridges and debris-laden channels and culvert openings, tend to magnify potential flood elevations.

The most severe historical flood damage in the City of Duncan occurred in May 1950. In a 30-hour time period from May 9-10, 1950, 9.57 inches of rainfall were recorded by the U.S. Weather Bureau in the City of Duncan. This rainfall occurred during two storms and produced the largest flood known to have occurred in the City of Duncan since 1910. A peak runoff rate of 1,500 cubic feet per second (cfs) was indicated in the Willow Creek basin by an indirect measurement from surveyed flood marks just south of Fair Park Boulevard near the municipal airport. Rainfall and runoff of this magnitude is considered to have a 1-percent-annual-chance recurrence interval (Reference 2).

2.4 Flood Protection Measures

There are several private Natural Resource Conservation Service (NRCS) reservoirs in Stephens County. The small reservoirs in the county offer limited flood control. Waurika Reservoir on Beaver Creek was constructed by the USACE, Tulsa District, for the purposes of flood control, water supply, and recreation. The flood control provided is outside the area of Stephens County.

Nonstructural measures of flood control include zoning ordinances, subdivision regulations, and building permit requirements as part of the county's program to reduce the losses caused by flooding and to ensure land use in the floodplains. Stephens County entered the Emergency Phase of the NFIP on March 19, 1985 (Reference 2).

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

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

No hydrologic information is available for Salt Creek.

Peak discharges for the 1-percent-annual-chance flood on Armstrong Creek, Stage Stand Creek, Walker Creek, and Walker Creek Tributary were computed using regression analysis equations as described in USGS Water Resources Investigation Report (WRIR) 84-4358 (Reference 4). The parameters of this regression equation are drainage area, channel slope, and average annual rainfall.

Peak discharges for Cow Creek (Lower Reach) in the City of Comanche were computed using the USACE HEC-1 Flood Hydrograph Package (Reference 5).

For the remaining streams studied by detailed methods, a regional relationship relating basin characteristics to streamflow characteristics, outlined in WRIR 52-73 and WRIR 76-2, provided the principal method used to determine discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods (References 6 and 7). Modification of flow-frequency data for the effects of urbanization followed procedures outlined in WRIR 23-74 and WRIR 77 for urban areas in Oklahoma (References 8 and 9).

Peak discharge-drainage area relationships for the streams studied by detailed methods are shown in Table 2, "Summary of Discharges."

Table 2. Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-percent	2-percent	1-percent	0.2-percent
ARMSTRONG CREEK					
At county boundary	15.60	*	*	9,600	*
At Denton Church Road	6.50	*	*	5,900	*
CLARIDY CREEK					
Just downstream of the confluence of Tributary B	17.70	4,040	8,230	10,100	16,000
At Cedar Avenue	5.13	1,960	3,960	4,810	7,550
At Peach Avenue	3.74	1,810	3,690	4,490	7,040
At Elk Avenue	2.11	1,360	2,780	3,370	5,260
COW CREEK					
At Bois d'Arc Avenue	15.21	3,660	7,440	9,120	14,500
COW CREEK (LOWER REACH)					
At most downstream crossing of Chicago Rock Island and Pacific Railroad	78.61	*	*	34,720	64,660
HOLIDAY INN FORK					
At Jones Avenue	0.62	690	1,390	1,670	2,580
STAGE STAND CREEK					
Approximately 2.24 miles upstream of the confluence with Little Beaver Creek	24.00	*	*	12,300	*
TRIBUTARY B					
At the confluence with Claridy Creek	6.60	2,370	4,800	5,860	9,220
At Main Street	1.26	1,035	2,100	2,530	3,940

* Data Not Available.

Table 2. Summary of Discharges (cont)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-percent	2-percent	1-percent	0.2-percent
TRIBUTARY D					
At Fair Park Boulevard	0.32	428	813	962	1,460
TRIBUTARY E					
At Sycamore Avenue	0.23	386	698	818	1,210
WALKER CREEK					
At the confluence with Waurika Lake	21.00	*	*	10,800	*
Approximately 1.3 miles upstream of State Highway 53	13.20	*	*	8,200	*
WALKER CREEK TRIBUTARY					
At the confluence with Waurika Lake	3.70	*	*	4,100	*
WILLOW CREEK					
At Main Street	3.02	1,470	2,960	3,600	5,610
At Elder Avenue	1.38	1,000	2,000	2,420	3,760

* Data Not Available.

The 1-percent-annual-chance stillwater elevation for Waurika Lake was taken from the Waurika Lake Report and is shown in Table 3, "Summary of Stillwater Elevations" (Reference 10).

The 1-percent-annual-chance flood elevations for the streams delineated by approximate methods within the City of Duncan were determined according to USGS WRIR 52-73 for estimating flood depths for Oklahoma streams (Reference 6).

Table 3. Summary of Stillwater Elevations

	Elevation (Feet)			
Flooding Source and Location	10-percent	2-percent	1-percent	0.2-percent
WAURIKA LAKE				
Entire shoreline within county	*	*	961.5	*

* Data Not Computed.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

No information concerning the hydraulic analyses for Salt Creek is available.

For Armstrong Creek, Stage Stand Creek, Walker Creek, and Walker Creek Tributary, cross sections were surveyed or taken from USGS and aerial topographic maps. Bridge dimensions were determined by field reconnaissance. For the remaining streams studied by detailed methods, cross sections were marked on aerial photographs following field inspection of all streams. Cross sections were located at uniform intervals except near highways, railroad fills, bridges, and culverts, where they were closely spaced in order to compute the significant backwater effects of these structures. Cross-section geometry was obtained using aerial photographs and a digital plotter.

For Armstrong Creek, Stage Stand Creek, Walker Creek, Walker Creek Tributary, and Cow Creek (Lower Reach), water-surface elevations of floods of the selected recurrence interval were determined using the USACE HEC-2 step-backwater computer program (Reference 11). Bridges were modeled using the normal bridge and special bridge routines of HEC-2.

For the remaining streams studied by detailed methods, water-surface elevations of floods of the selected recurrence intervals were determined using the USGS step-backwater computer program (Reference 12). A continuous peak discharge was routed upstream, with no attempt being made to account for distortions of the flood hydrograph due to ponding, except for the portion of Tributary D downstream from the railroad fill. At this site, a combination of a high railroad fill and an undersized culvert created an unrealistic water-surface elevation when the dampening effect of storage was not considered.

Therefore, backwater elevations above the railroad fill were reduced by computation of head losses resulting from significant storage.

The starting water-surface elevations for Armstrong Creek, Cow Creek (Lower Reach), and Stage Stand Creek were computed using the slope-area method. Starting water-surface elevations for Walker Creek and Walker Creek Tributary were taken from the 1-percent-annual-chance pool elevation for Waurika Lake. Starting water-surface elevations for Claridy Creek, Cow Creek, and Willow Creek were determined by the method outlined in USGS WRIR 76-2 and were verified by computing conveyance profiles for these flooding sources (Reference 7). Starting water-surface elevations for the remaining streams studied by detailed methods were obtained from the step-backwater computation. This was done by starting in the larger stream at a cross section common to both streams with flood elevations previously determined for the main stream. Discharges were reduced to those computed for the first section in the tributary, hydraulically connecting both profiles. Flood profiles were drawn showing 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).

Channel roughness factors (Manning's "n" values) used in the hydraulic computations were chosen by engineering judgment and based on field observations of the channel and floodplain areas. Manning's "n" values used for this study are shown in Table 4, "Manning's "n" Values."

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

Table 4. Manning's 'n' Values

	Manning's 'n'	
Flooding Source	Channel	Overbank
Armstrong Creek	0.050	0.080
Claridy Creek	0.022-0.090	0.028
Cow Creek (Lower Reach)	0.050	0.055-0.075
Holiday Inn Fork	0.022-0.090	0.028
Stage Stand Creek	0.050	0.080
Tributary B	0.022-0.090	0.028
Tributary D	0.022-0.090	0.028
Tributary E	0.022-0.090	0.028
Tributary F	0.022-0.090	0.028
Walker Creek	0.050	0.080
Walker Creek Tributary	0.050	0.080
Willow Creek	0.022-0.090	0.028

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 FIRMs are referenced to the NAVD. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Some of the data used in this revision were taken from the prior effective FIS reports and FIRMs and adjusted to NAVD. The datum conversion factor from NGVD to NAVD in Stephens County is positive 0.304 feet.

For additional information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey (NGS) at the following address:

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

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook (TSDN) 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 areas of flood risk in the community. For each stream studied by 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, for Armstrong Creek, Stage Stand Creek, Walker Creek, Cow Creek (Lower Reach), and Walker Creek Tributary, the boundaries were interpolated using topographic maps at scales of 1:24,000 and 1:62,500 with a contour interval of 10 feet (References 13 and 14). In the City of Duncan, boundaries were interpolated using topographic maps with a contour interval of 2 feet (Reference 15). For the remaining streams, between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (Reference 16).

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

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

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 (see Table 5, Floodway Data). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

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

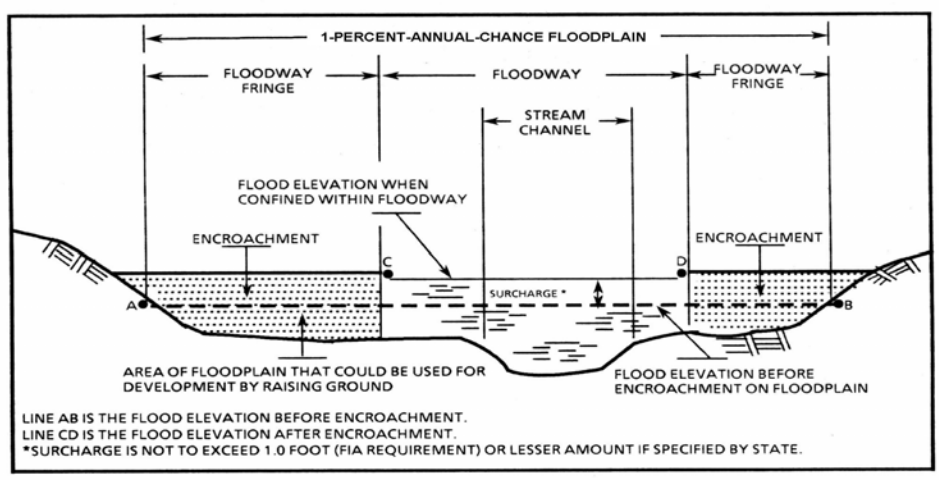

Figure 1. Floodway Schematic

In the City of Duncan, no floodway was prepared for Claridy Creek, from a point approximately 400 feet upstream of Elder Avenue to the upstream side of Ward Mall; and for the lower reach of Holiday Inn Fork, from its confluence with Claridy Creek to a point approximately 550 feet upstream. Substantial encroachment is already present along these reaches, and further encroachment would induce hazardous velocities. A reach of Willow Creek from above Fair Park Boulevard upstream of State Highway 7 was not encroached upon because of near-critical velocities and ponding. Encroachment was terminated short of a 1.0-foot surcharge along most stream reaches to avoid excessive velocities. Also, floodways were not interpolated across road or railroad fills wherever a floodplain constriction results from such fills.

Due to the scope of study, no floodways were calculated for Armstrong Creek, Stage Stand Creek, Walker Creek, and Walker Creek Tributary.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Claridy Creek								
A	4,985	559	3,317	3.04	1,050.7	1,050.7	1,051.7	1.0
B	6,815	510	2,295	4.40	1,051.8	1,051.8	1,052.8	1.0
C	11,415	830	3,370	3.00	1,063.0	1,063.0	1,063.0	0.0
D	11,730	346	1,423	7.10	1,063.3	1,063.3	1,064.2	0.9
E	13,490	120	860	5.60	1,068.2	1,068.2	1,069.2	1.0
F	15,380	187	672	7.16	1,074.0	1,074.0	1,075.0	1.0
G	17,100	345	1,585	3.04	1,083.6	1,083.6	1,083.6	0.0
H	17,760	210	1,492	3.22	1,084.3	1,084.3	1,084.4	0.1
I	18,000	610	2,832	1.70	1,087.9	1,087.9	1,087.9	0.0
J	18,620	310	1,075	4.48	1,088.3	1,088.3	1,088.6	0.3
K	19,020	115	1,241	3.87	1,089.0	1,089.0	1,089.9	0.9
L	19,770	125	782	6.15	1,091.1	1,091.1	1,091.6	0.5
M	20,460	150	647	7.44	1,093.9	1,093.9	1,094.6	0.7
N	21,310	55	663	7.25	1,100.1	1,100.1	1,100.5	0.4
O	21,800	260	1,656	2.90	1,102.3	1,102.3	1,102.5	0.2
P	22,578	520	1,656	2.91	1,104.9	1,104.9	1,104.9	0.0
Q	23,690	170	561	8.57	1,108.5	1,108.5	1,108.5	0.0
R	24,450	170	721	6.23	1,111.8	1,111.8	1,112.4	0.6
S	25,032	300	572	7.85	1,112.7	1,112.7	1,113.0	0.3
T	26,240	560	2,330	0.71	1,123.9	1,123.9	1,123.9	0.0
U	26,660	185	1,137	2.96	1,123.9	1,123.9	1,123.9	0.0

[1] Feet above limit of detailed study approximately 0.5 miles upstream of confluence with Willow Creek.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

CLARIDY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Claridy Creek								
V	27,220	120	547	6.16	1,124.3	1,124.3	1,124.9	0.6
W	28,190	175	725	4.65	1,130.7	1,130.7	1,131.5	0.8
X	28,890	200	791	4.26	1,131.6	1,131.6	1,132.5	0.9
Y	30,090	305	594	5.67	1,138.8	1,138.8	1,138.8	0.0
Z	31,160	170	435	7.74	1,147.5	1,147.5	1,148.4	0.9
AA	31,680	110	475	7.09	1,149.4	1,149.4	1,150.4	1.0
AB	32,730	185	361	9.35	1,152.8	1,152.8	1,153.7	0.9
AC	33,250	220	564	5.97	1,158.5	1,158.5	1,158.5	0.0
AD	34,100	170	209	8.38	1,165.3	1,165.3	1,165.3	0.0

[1] Feet above limit of detailed study approximately 0.5 miles upstream of confluence with Willow Creek.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

CLARIDY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Cow Creek								
A	4,510	492	1,630	5.6	1,056.4	1,056.4	1,057.3	0.9
B	6,710	400	2,024	4.5	1,061.4	1,061.4	1,061.7	0.3
C	7,900	250	1,322	6.9	1,063.3	1,063.3	1,064.2	0.9
D	10,640	1,773	7,442	1.2	1,065.9	1,065.9	1,066.8	0.9
E	11,200	2,575	--[2]	--[2]	1,071.1	1,071.1	1,071.2	0.1
F	14,400	1,126	6,749	1.4	1,082.6	1,082.6	1,082.6	0.0
G	15,500	1,437	4,207	2.2	1,082.8	1,082.8	1,082.8	0.0

[1] Feet above limit of detailed study approximately 0.21 mile downstream of the confluence of Tributary F.
[2] Data not available.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

COW CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Cow Creek (Lower Reach)								
A	1,910	780	7,576	4.6	977.6	977.6	978.4	0.8
B	3,750	2,275	16,716	2.1	979.3	979.3	980.2	0.9
C	7,080	1,175	8,133	4.3	981.9	981.9	982.9	1.0
D	8,630	810	9,042	3.8	986.2	986.2	986.7	0.5
E	12,000	975	7,317	4.7	989.4	989.4	990.3	0.9

[1] Feet above limit of detailed study approximately 350 feet downstream of the Oklahoma Kansas Texas Railroad.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

COW CREEK (LOWER REACH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Holiday Inn Fork								
A	820	180	528	3.2	1,121.7	1,121.7	1,121.7	0.0
B	1,210	200	322	5.2	1,125.1	1,125.1	1,125.1	0.0
C	1,520	100	222	7.5	1,130.7	1,130.7	1,130.7	0.0
D	2,180	150	271	6.2	1,141.9	1,141.9	1,142.9	1.0

[1] Feet above confluence with Claridy Creek.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

HOLIDAY INN FORK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Tributary B								
A	2,235	250	1,716	3.42	1,068.4	1,068.4	1,069.4	1.0
B	4,175	225	1,061	5.52	1,072.0	1,072.0	1,072.6	0.6
C	4,875	347	1,593	3.68	1,073.2	1,073.2	1,073.9	0.7
D	5,730	370	1,840	3.18	1,079.1	1,079.1	1,079.2	0.1
E	6,315	210	1,579	3.71	1,079.3	1,079.3	1,079.5	0.2
F	8,165	260	811	7.23	1,082.6	1,082.6	1,083.6	1.0
G	9,685	160	757	5.29	1,087.9	1,087.9	1,088.8	0.9
H	11,115	155	692	5.78	1,093.7	1,093.7	1,094.6	0.9
I	11,725	180	778	5.14	1,095.1	1,095.1	1,095.8	0.7
J	13,485	210	459	5.51	1,103.1	1,103.1	1,103.8	0.7
K	15,285	140	495	5.11	1,111.9	1,111.9	1,112.9	1.0
L	16,865	105	261	9.68	1,120.8	1,120.8	1,121.6	0.8

[1] Feet above confluence with Claridy Creek.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY B

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Tributary D								
A	1,500	64	70	5.7	1,084.6	1,084.6	1,085.4	0.8
B	1,858	131	1,089	0.9	1,090.6	1,090.6	1,091.6	1.0
C	2,098	149	978	1.0	1,090.6	1,090.6	1,091.6	1.0
D	2,498	34	103	9.3	1,092.0	1,092.0	1,093.0	1.0
E	2,818	130	423	2.3	1,094.4	1,094.4	1,095.3	0.9
F	3,488	28	92	10.5	1,099.8	1,099.8	1,099.9	0.1
G	3,950	63	124	7.7	1,104.9	1,104.9	1,105.4	0.5

[1] Feet above confluence with Willow Creek.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY D

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Tributary E								
A	1,000	26	1,061	5.5	1,091.3	1,091.3	1,092.2	0.9
B	1,270	180	1,593	3.7	1,095.1	1,095.1	1,095.1	0.0
C	2,260	82	1,840	3.2	1,097.0	1,097.0	1,097.0	0.0
D	2,510	55	67	8.6	1,100.2	1,100.2	1,100.5	0.3
E	3,760	60	80	7.2	1,112.7	1,112.7	1,113.6	0.9
F	4,460	40	72	8.0	1,117.4	1,117.4	1,118.4	1.0

[1] Feet above confluence with Willow Creek.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY E

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Tributary F								
A	4,240	331	386	7.8	1,061.3	1,061.3	1,061.3	0.0
B	4,700	490	1,076	2.8	1,062.3	1,062.3	1,062.5	0.2
C	5,455	87	333	9.0	1,064.4	1,064.4	1,064.6	0.2
D	5,935	90	477	6.3	1,069.8	1,069.8	1,070.7	0.9
E	6,935	109	506	5.9	1,074.6	1,074.6	1,075.3	0.7
F	8,705	274	916	3.3	1,083.1	1,083.1	1,084.1	1.0
G	9,735	123	627	4.8	1,085.2	1,085.2	1,085.9	0.7
H	11,415	45	206	10.3	1,090.2	1,090.2	1,091.2	1.0

[1] Feet above confluence with Cow Creek.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY F

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Willow Creek								
A	8,150	175	1,154	4.56	1,062.7	1,062.7	1,063.6	0.9
B	11,100	504	1,824	2.88	1,075.7	1,075.7	1,076.7	1.0
C	12,500	216	903	5.82	1,078.1	1,078.1	1,078.8	0.7
D	15,000	727	3,341	1.57	1,090.1	1,090.1	1,090.1	0.0
E	16,147	448	1,446	2.97	1,094.7	1,094.7	1,094.7	0.0
F	16,700	376	1,122	3.83	1,095.2	1,095.2	1,095.2	0.0
G	17,260	255	1,781	2.41	1,100.9	1,100.9	1,101.9	1.0
H	18,170	350	1,827	2.35	1,101.2	1,101.2	1,102.2	1.0
I	18,820	380	1,485	2.90	1,104.7	1,104.7	1,104.7	0.0
J	19,390	350	1,680	2.56	1,105.3	1,105.3	1,105.3	0.0
K	20,130	195	1,320	2.73	1,105.9	1,105.9	1,105.9	0.0
L	20,690	280	1,311	2.75	1,109.7	1,109.7	1,109.7	0.0
M	21,430	310	865	4.16	1,112.9	1,112.9	1,112.9	0.0
N	22,060	105	408	8.81	1,114.7	1,114.7	1,114.7	0.0
O	22,540	160	549	6.55	1,116.4	1,116.4	1,117.4	1.0
P	23,420	140	444	8.11	1,119.9	1,119.9	1,120.9	1.0
Q	24,300	95	334	10.78	1,122.8	1,122.8	1,123.1	0.3
R	24,980	130	332	7.30	1,126.1	1,126.1	1,126.6	0.5
S	25,820	40	677	3.57	1,128.1	1,128.1	1,128.8	0.7
T	26,560	40	290	8.56	1,129.6	1,129.6	1,130.2	0.6
U	27,270	75	400	6.06	1,132.1	1,132.1	1,132.7	0.6

[1] Feet above limit of detailed study approximately 300 feet upstream of Oklahoma Texas Kansas Railroad.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

WILLOW CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD 88)	WITHOUT FLOODWAY (FEET NAVD 88)	WITH FLOODWAY (FEET NAVD 88)	INCREASE (FEET)
Willow Creek								
V	27,900	110	209	11.59	1,136.5	1,136.5	1,136.5	0.0
W	28,940	102	365	6.63	1,145.9	1,145.9	1,146.6	0.7
X	30,170	70	253	9.57	1,154.1	1,154.1	1,154.8	0.7
Y	31,050	80	296	8.18	1,162.7	1,162.7	1,163.6	0.9
Z	32,300	75	301	8.04	1,173.8	1,173.8	1,174.8	1.0
AA	33,250	80	304	7.95	1,182.6	1,182.6	1,183.5	0.9

[1] Feet above limit of detailed study approximately 300 feet upstream of Oklahoma Texas Kansas Railroad.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOODWAY DATA

WILLOW CREEK

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 analysis. 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 base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

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

The countywide FIRM presents flooding information for the entire geographic area of Stephens 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 6, “Community Map History.”

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISIONS DATE
Bray, Town of	September 29, 2010	None	September 29, 2010	
Comanche, City of	March 6, 1971	None	March 6, 1971	July 1, 1974 July 25, 1974 September 26, 1975
Duncan, City of	May 24, 1974	August 20, 1976	August 1, 1979	January 12, 1982
Empire City, City of	September 29, 2010	None	September 29, 2010	
Loco, City of	December 15, 1990	None	December 15, 1990	
Marlow, City of	December 28, 1973	April 9, 1976	September 1, 1987	
Stephens County, Unincorporated Areas	May 20, 1982	None	December 15, 1990	
Velma, City of	February 11, 1977	None	December 15, 1990	

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

A FIS has been prepared for the unincorporated areas of Grady County (Reference 17). Because it is based on more up-to-date analyses, the FIS dated January 16, 1992 superseded the previously printed FIS for Stephens County and incorporated areas (Reference 18).

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

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA Region VI, Federal Insurance and Mitigation Division, 800 North Loop 288, Denton, Texas 76209.

9.0 BIBLIOGRAPHY AND REFERENCES

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15. City of Duncan, Public Works Department, 2 Foot Contour Data, 2003.

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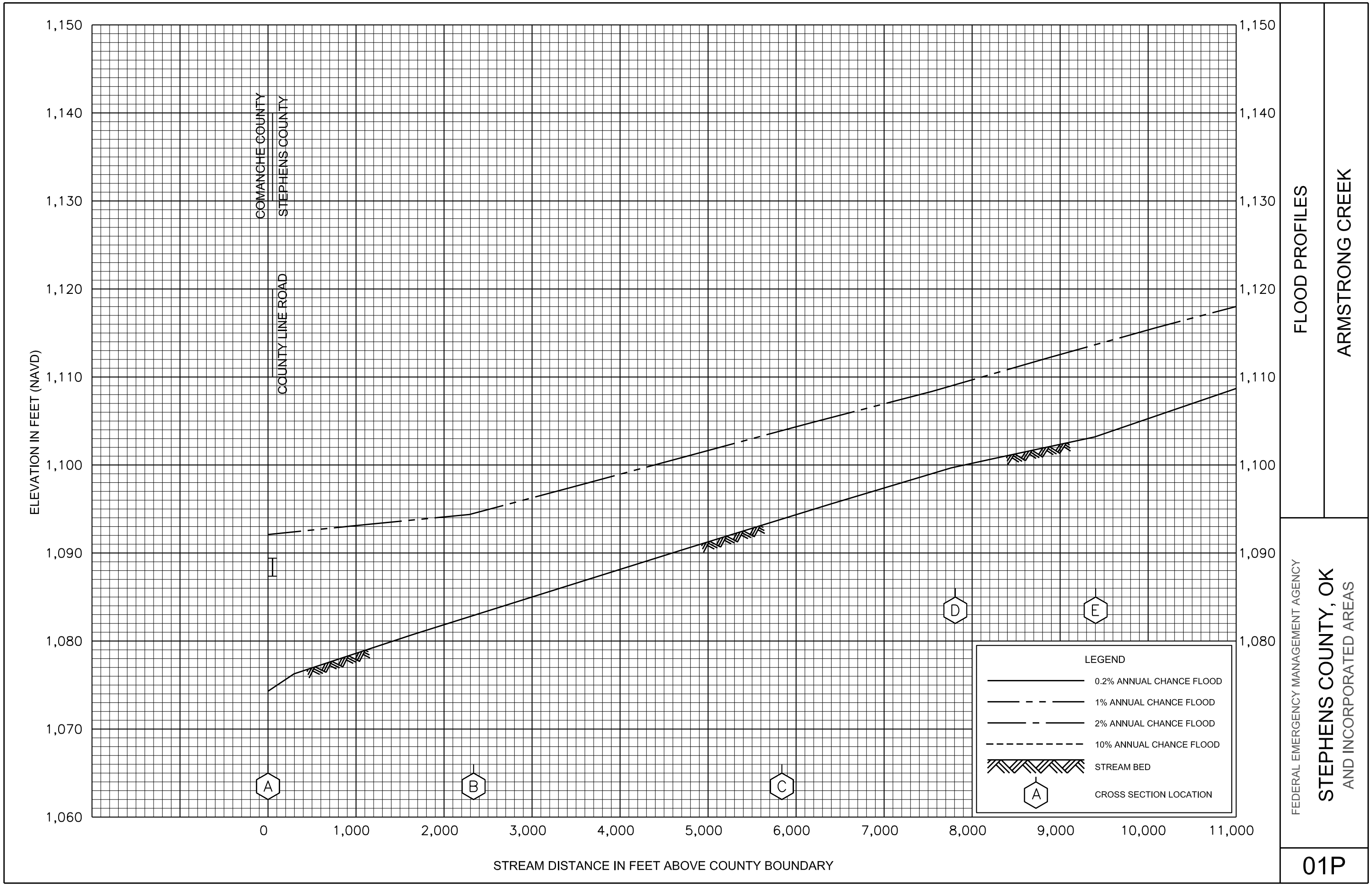
17. Federal Emergency Management Agency, Flood Insurance Study, Grady County Unincorporated Areas, Oklahoma, Washington, D.C., September 1, 1987.

18. Federal Emergency Management Agency, Flood Insurance Study, Stephens County and Incorporated Areas, Oklahoma, Washington, D.C., December 15, 1990.



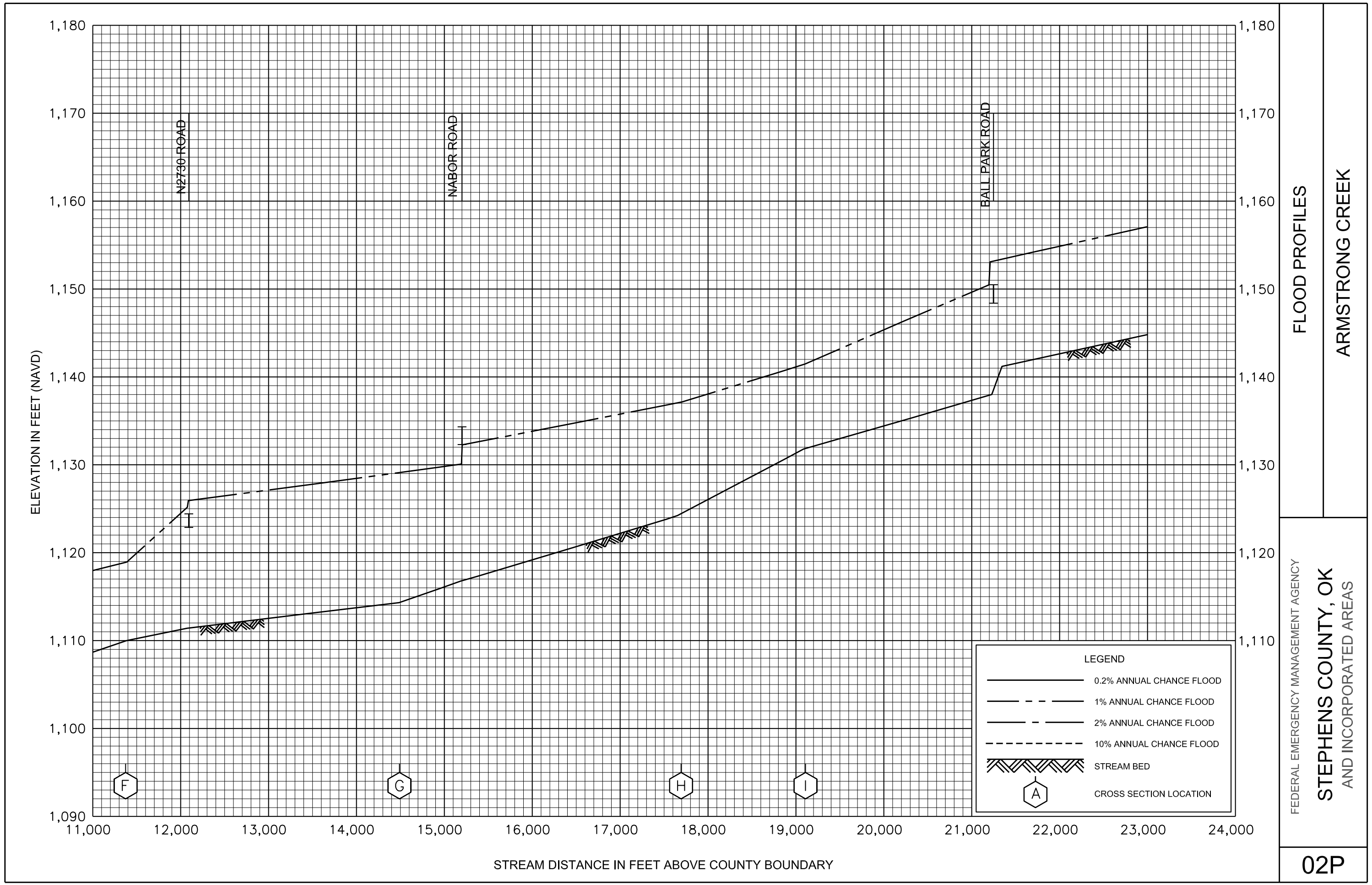
FLOOD PROFILES

ARMSTRONG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

01P



FLOOD PROFILES

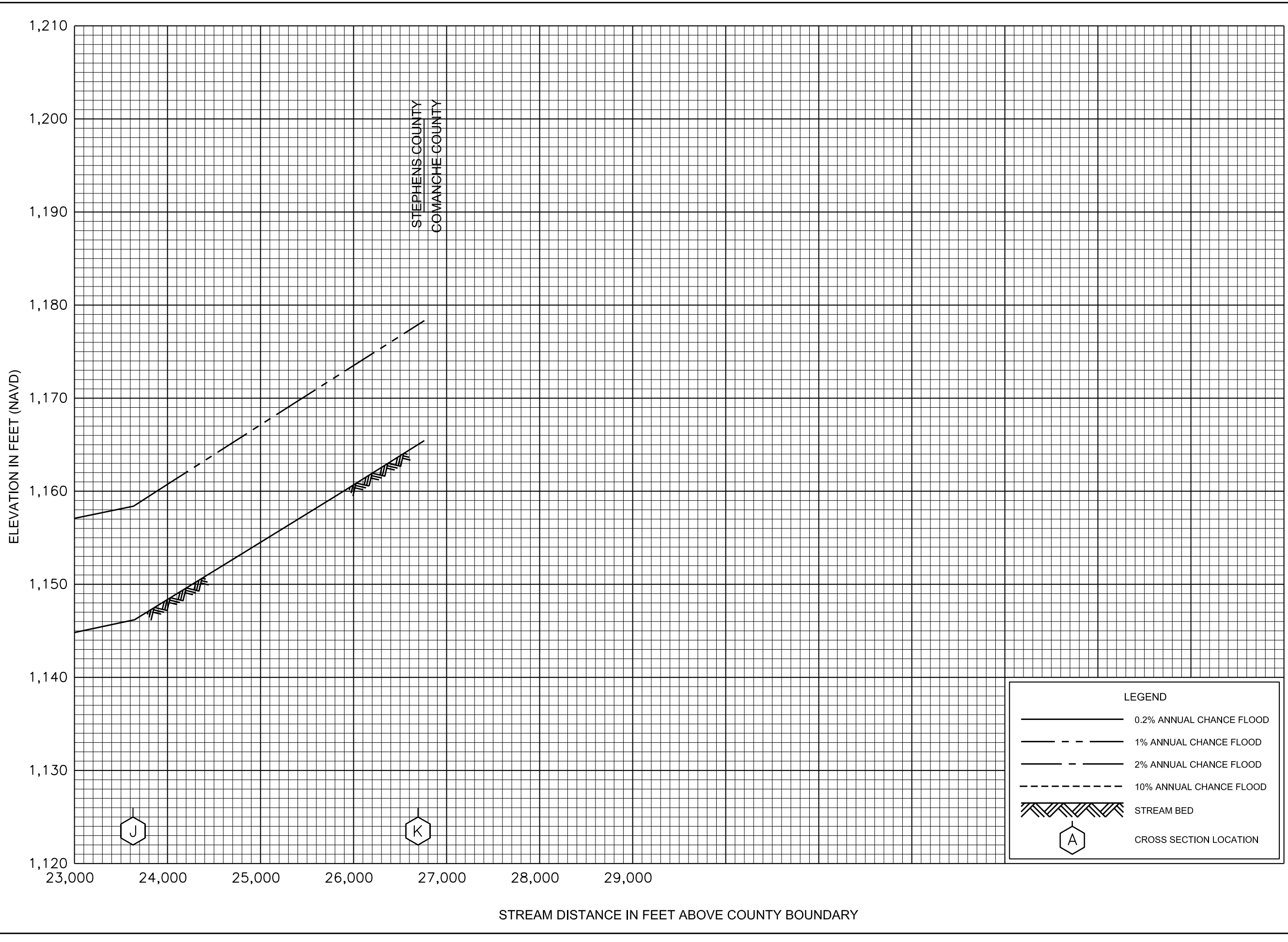
ARMSTRONG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

02P



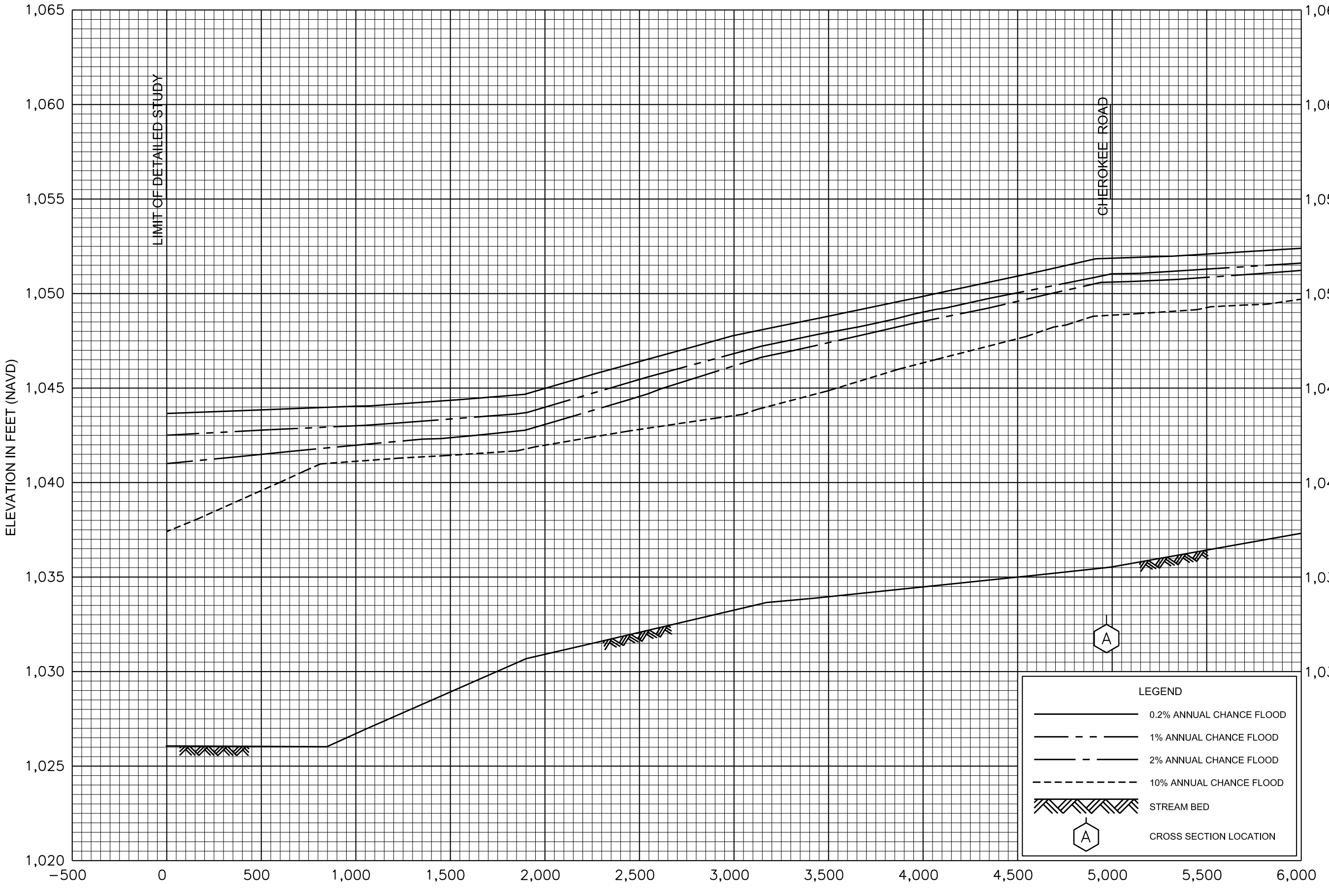
FLOOD PROFILES

ARMSTRONG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

03P



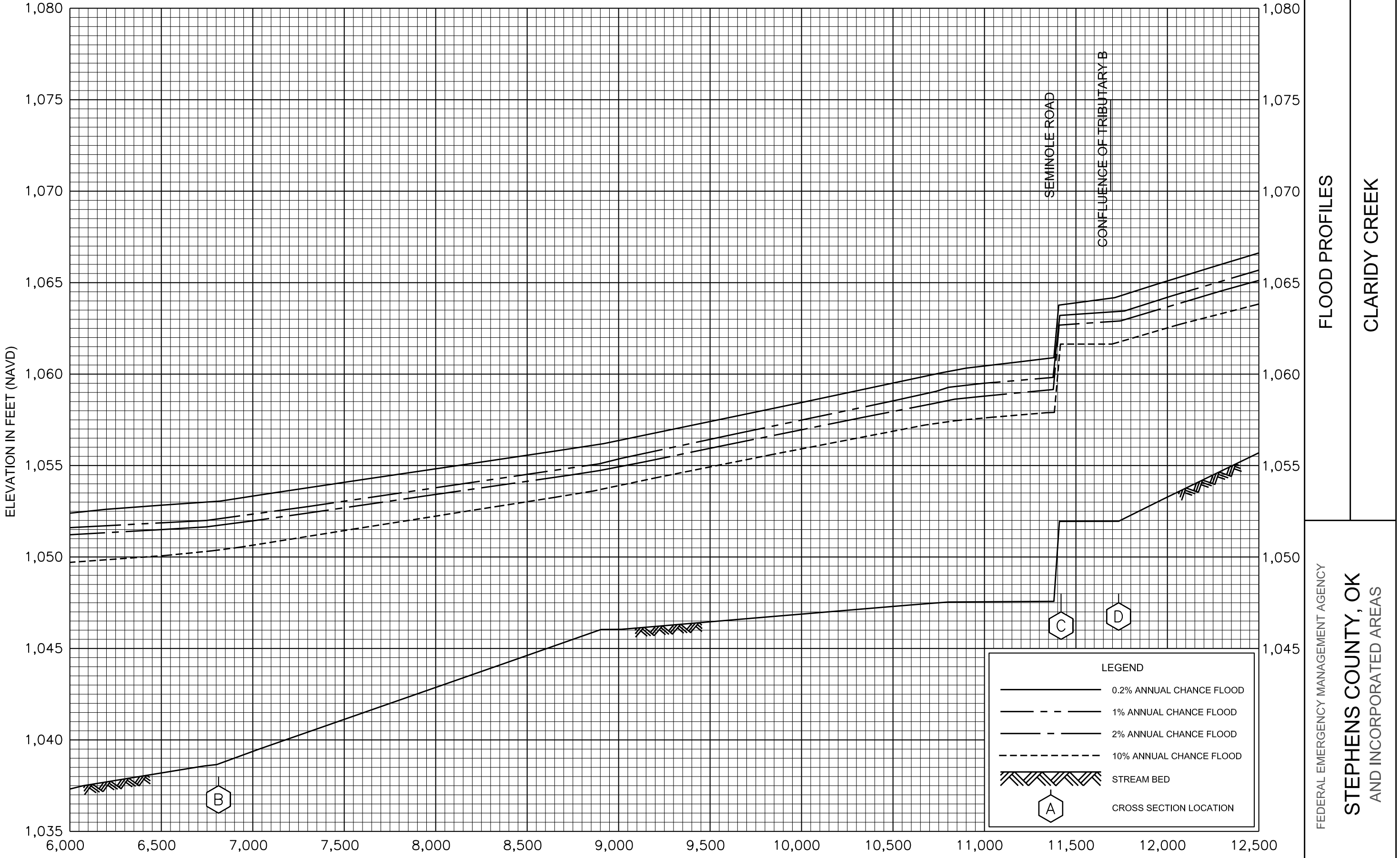
FLOOD PROFILES

CLARIDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

04P



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 0.5 MILES UPSTREAM OF CONFLUENCE WITH WILLOW CREEK

FLOOD PROFILES

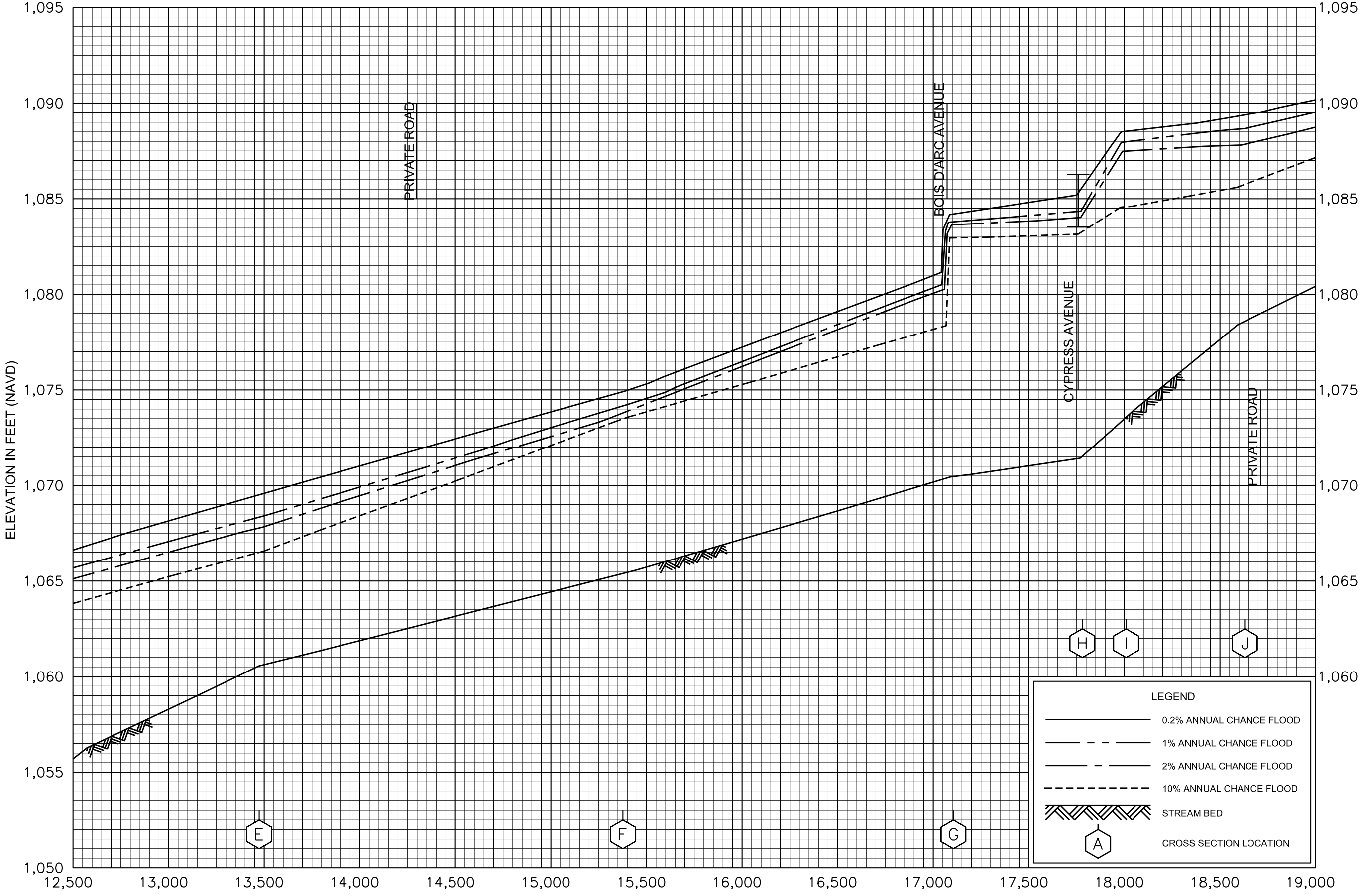
CLARIDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

05P



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 0.5 MILES UPSTREAM OF CONFLUENCE WITH WILLOW CREEK

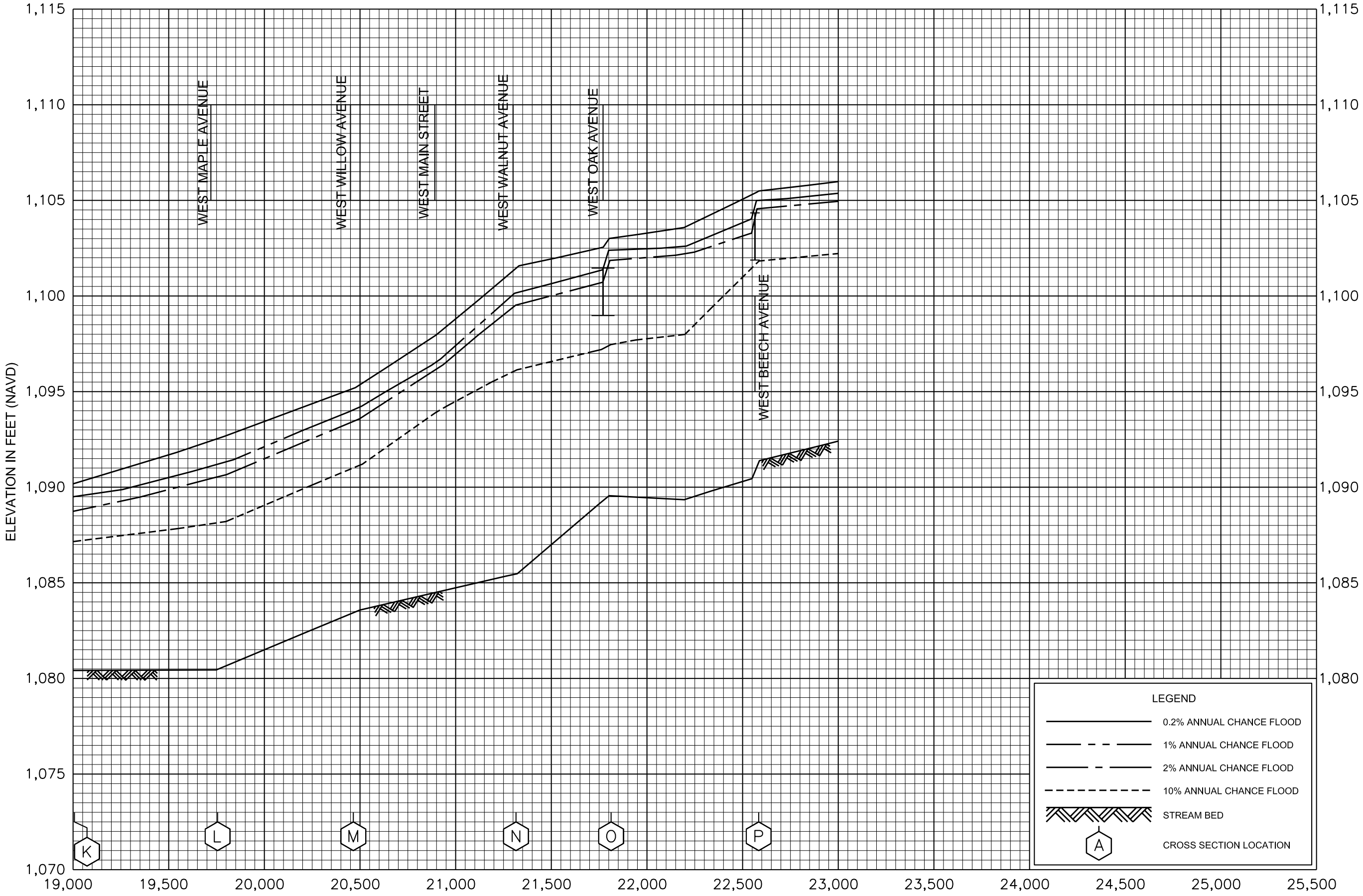
FLOOD PROFILES

CLARIDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

06P



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 0.5 MILES UPSTREAM OF CONFLUENCE WITH WILLOW CREEK

FLOOD PROFILES

CLARIDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

07P

ELEVATION IN FEET (NAVD)

1,135
1,130
1,125
1,120
1,115
1,110
1,105
1,100
1,095
1,090

PINE AVENUE
WEST ELDER AVENUE
CONFLUENCE OF HOLIDAY INN FORK
US ROUTE 81
WARD MALL
CULVERT

Q R S T U V

23,000 23,500 24,000 24,500 25,000 25,500 26,000 26,500 27,000 27,500 28,000 28,500 29,000 29,500

STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 0.5 MILES UPSTREAM OF CONFLUENCE WITH WILLOW CREEK

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- A — CROSS SECTION LOCATION

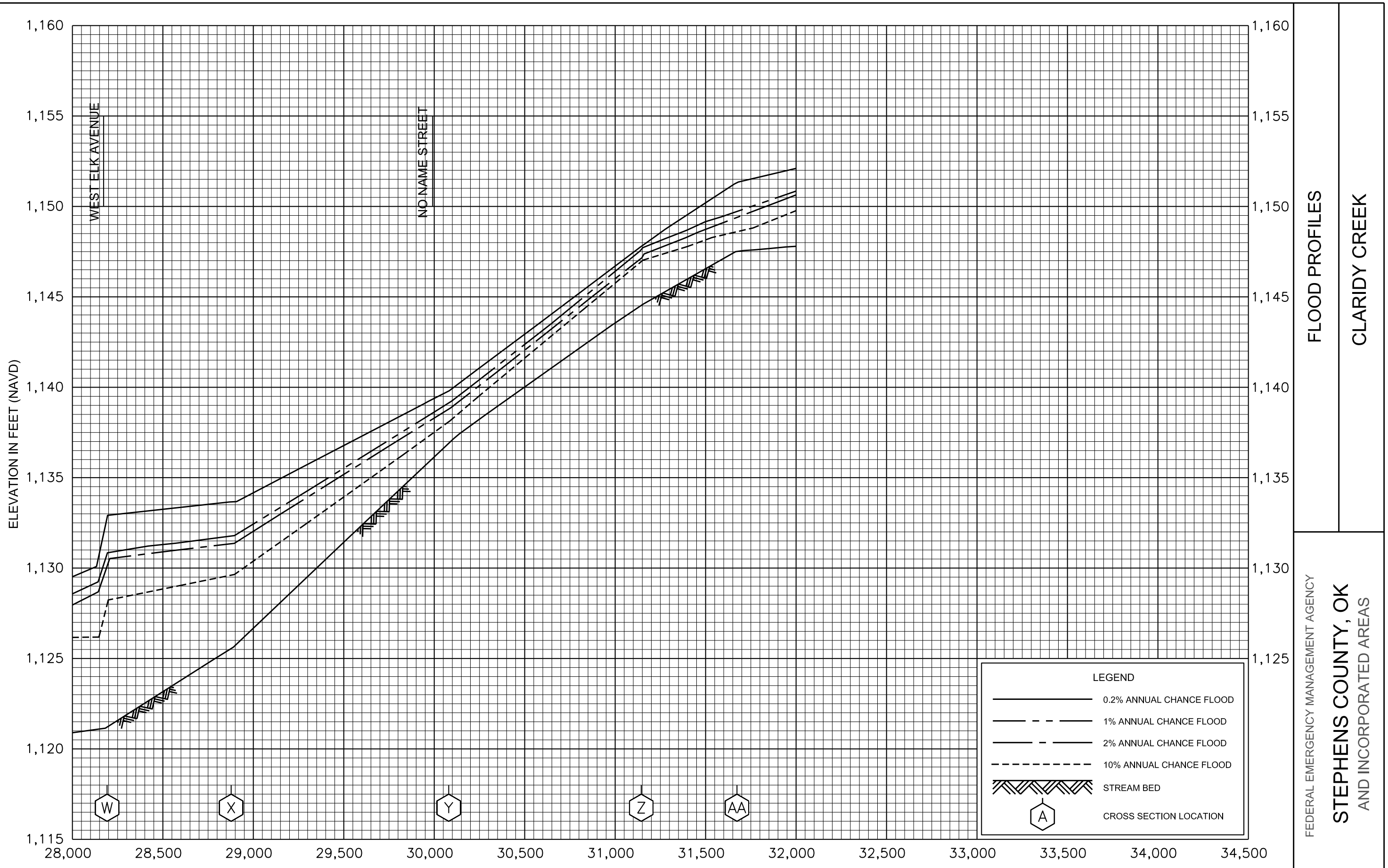
FLOOD PROFILES

CLARIDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

08P



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 0.5 MILES UPSTREAM OF CONFLUENCE WITH WILLOW CREEK

FLOOD PROFILES

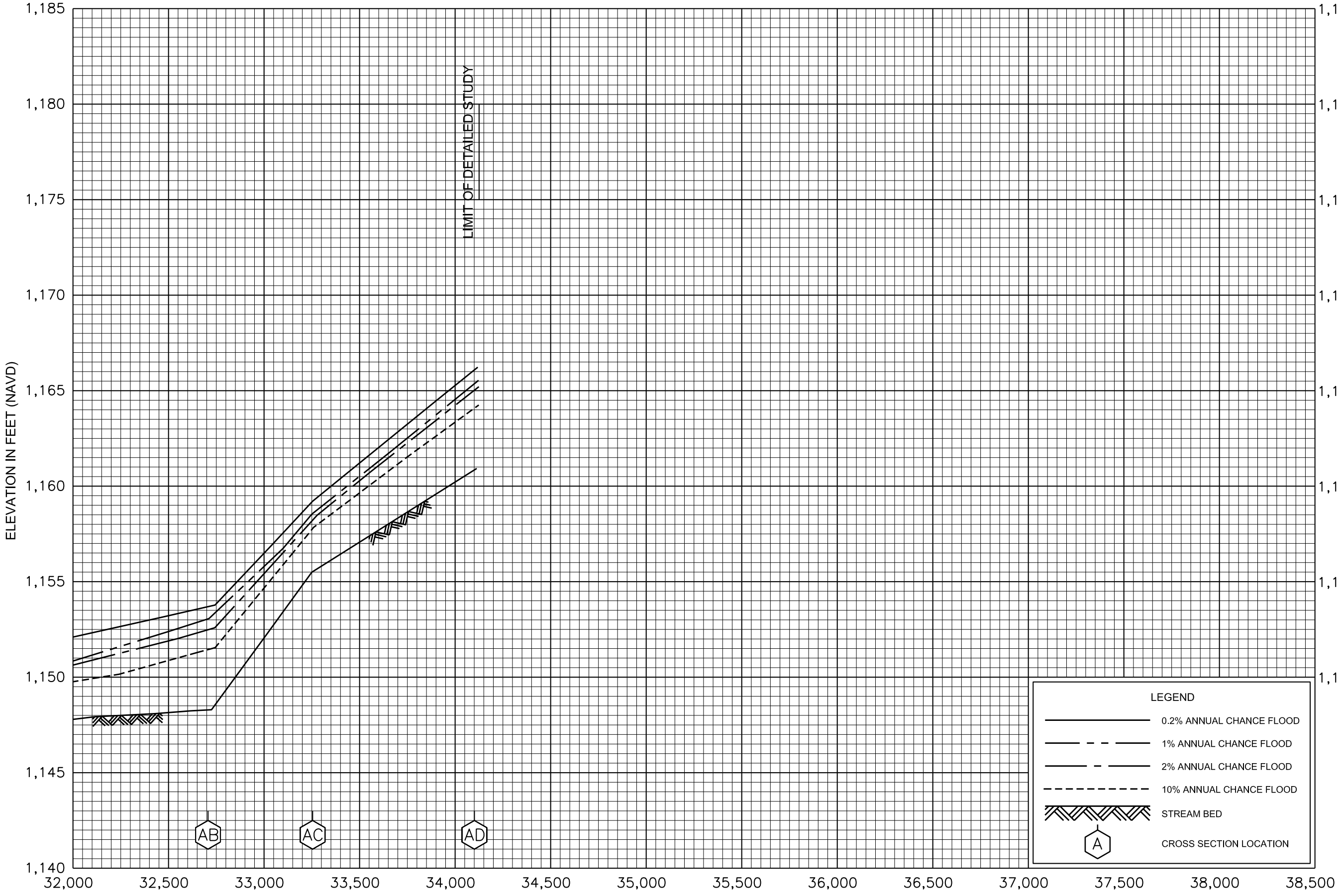
CLARIDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

09P



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 0.5 MILES UPSTREAM OF CONFLUENCE WITH WILLOW CREEK

FLOOD PROFILES

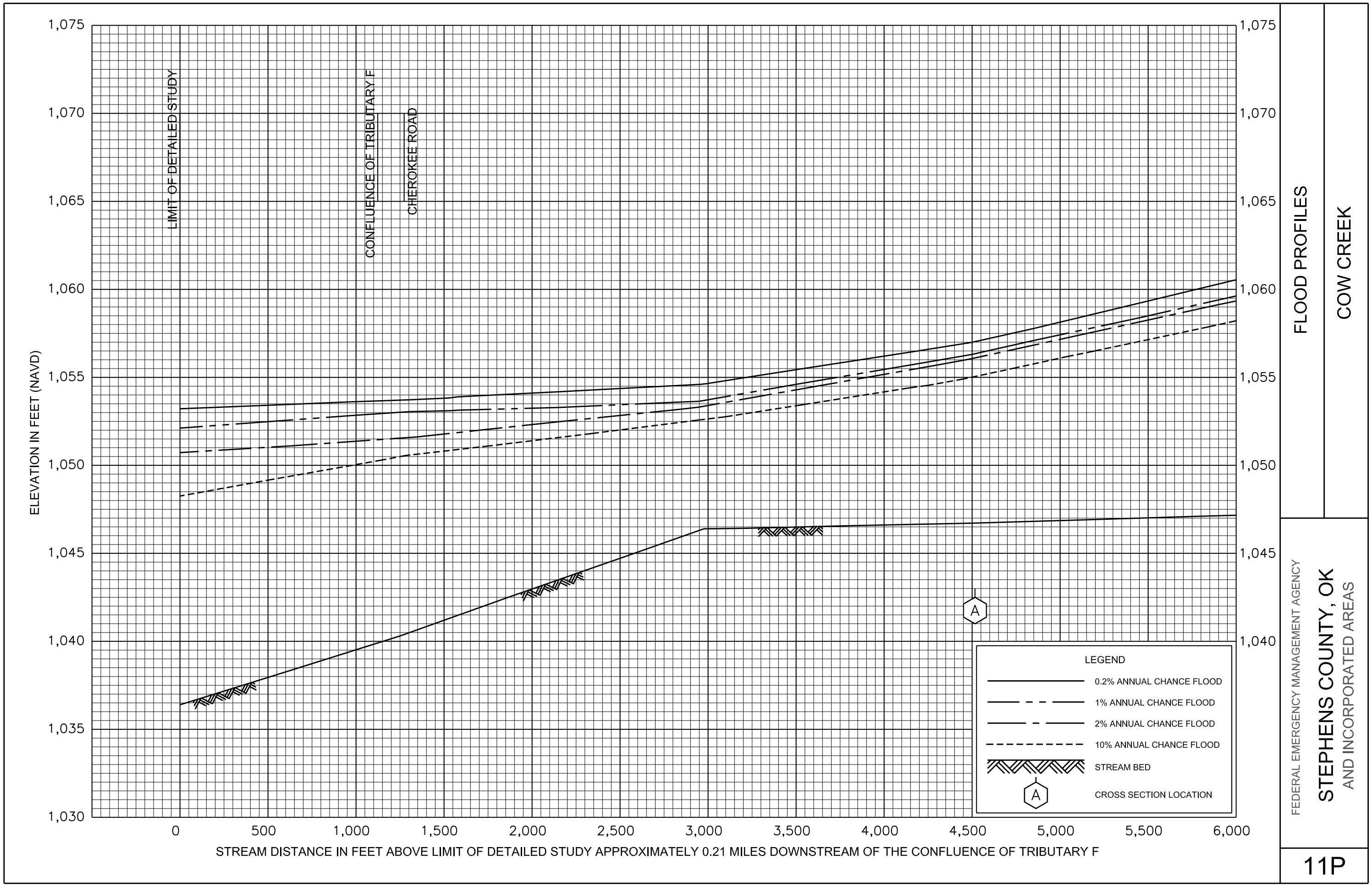
CLARIDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

10P



FLOOD PROFILES

COW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

ELEVATION IN FEET (NAVD)

1,045 1,050 1,055 1,060 1,065 1,070 1,075 1,080 1,085 1,090

6,000 6,500 7,000 7,500 8,000 8,500 9,000 9,500 10,000 10,500 11,000 11,500 12,000 12,500

STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 0.21 MILES DOWNSTREAM OF THE CONFLUENCE OF TRIBUTARY F

MEADOWBROOK ROAD

STATE HIGHWAY 7
CULVERT

A B C D E

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- A CROSS SECTION LOCATION

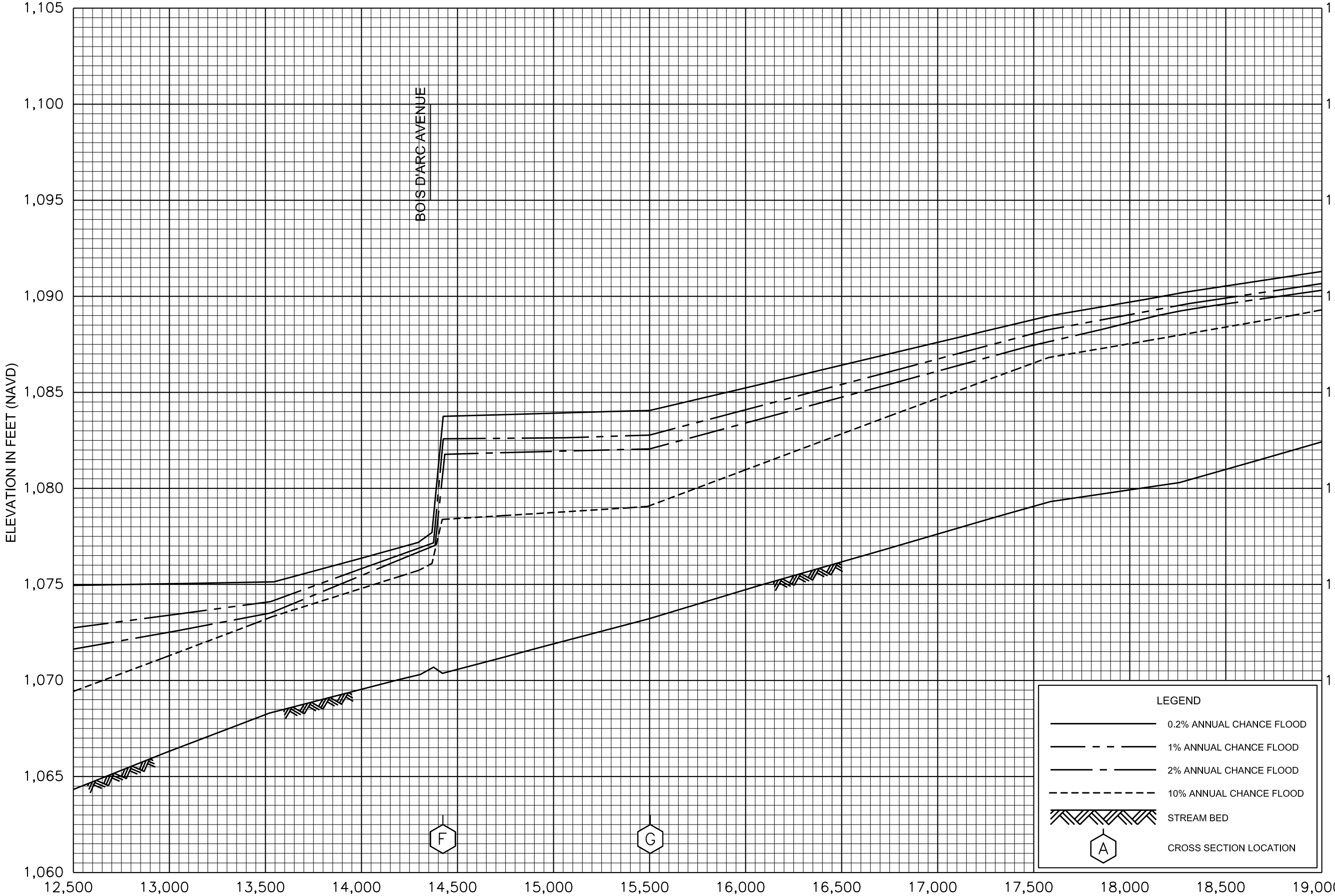
FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

FLOOD PROFILES

COW CREEK

12P



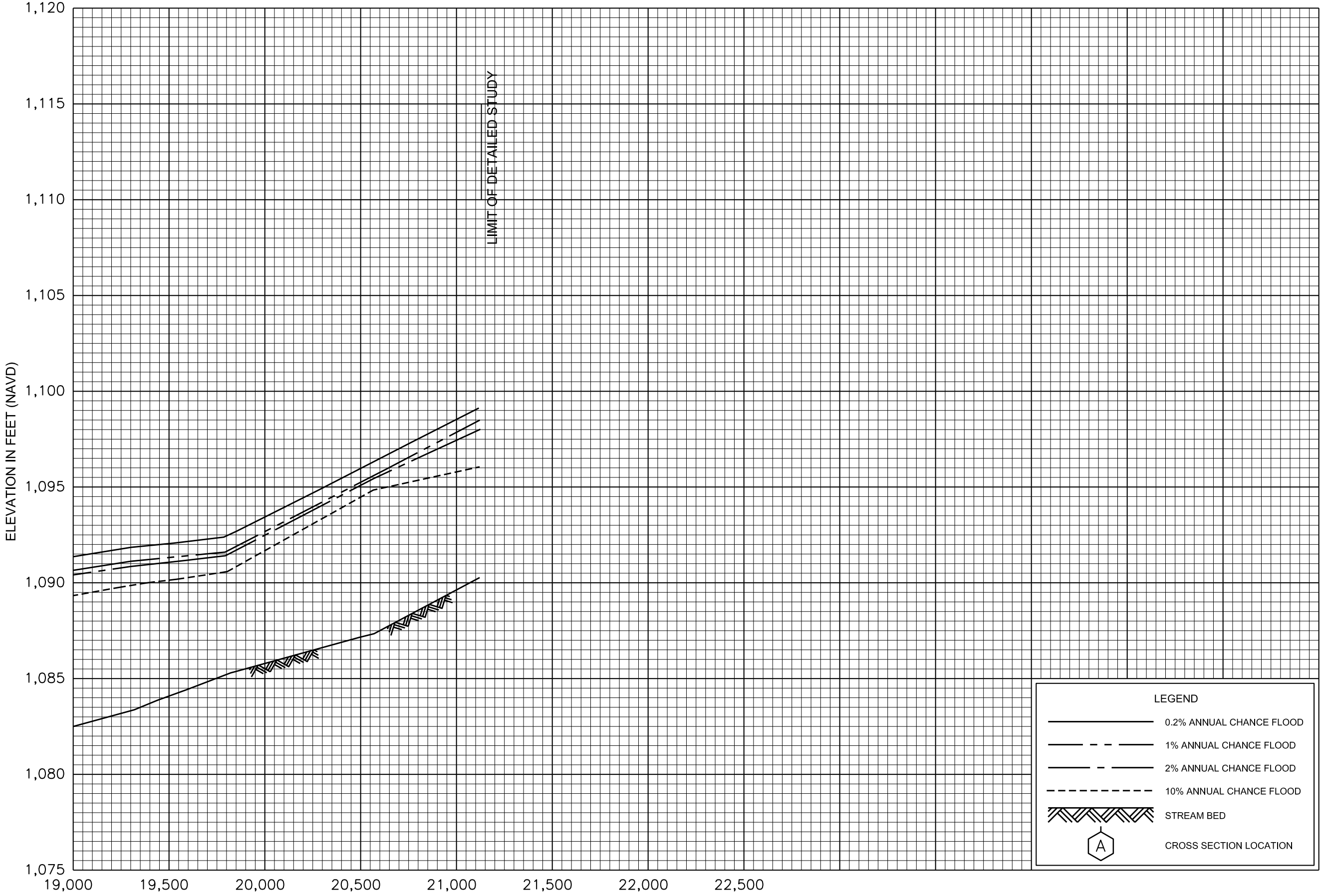
STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 0.21 MILES DOWNSTREAM OF THE CONFLUENCE OF TRIBUTARY F

FLOOD PROFILES

COW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

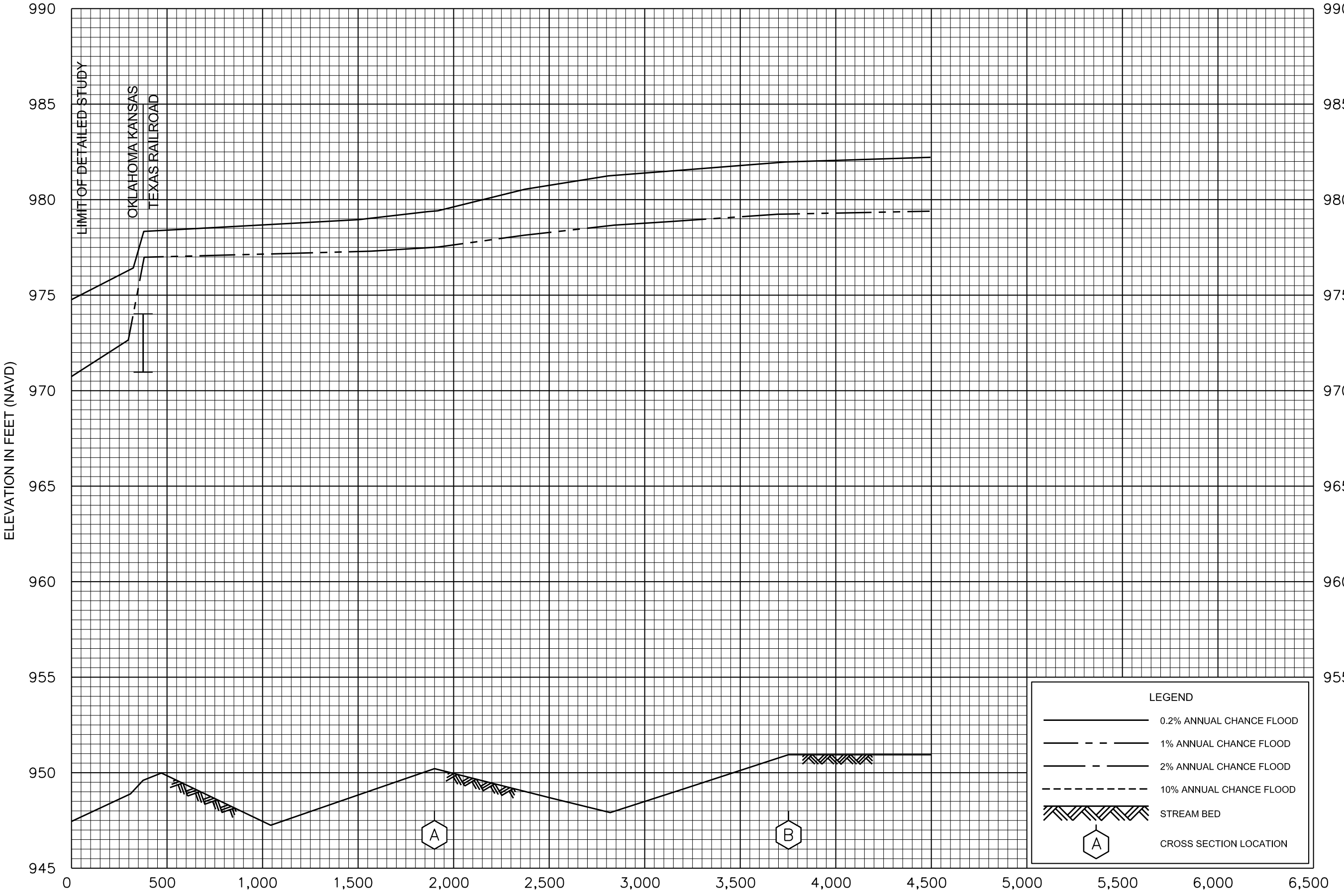


FLOOD PROFILES

COW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS



ELEVATION IN FEET (NAVD)

STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 350 FEET DOWNSTREAM OF OKLAHOMA KANSAS TEXAS RAILROAD

FLOOD PROFILES

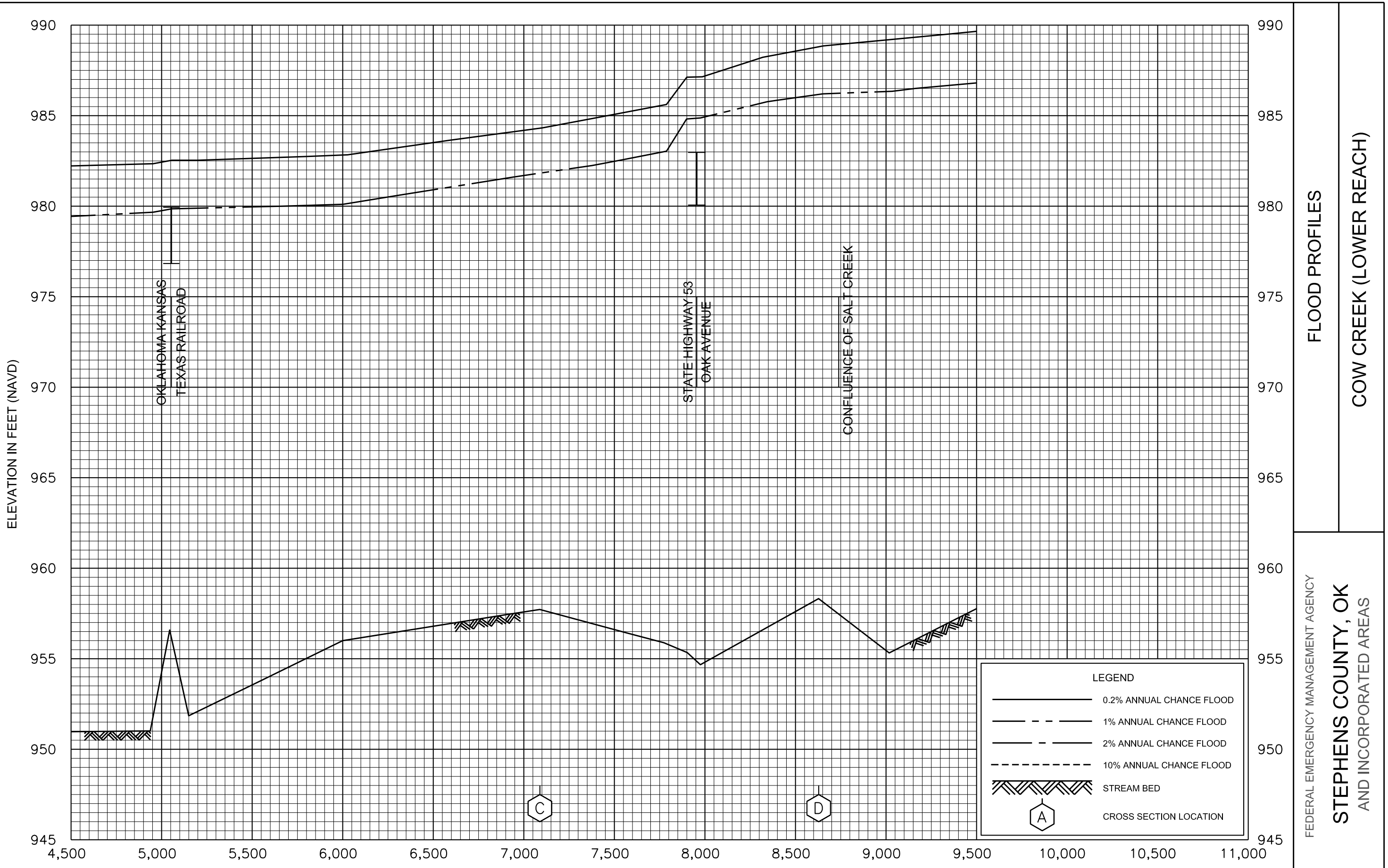
COW CREEK (LOWER REACH)

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

15P



FLOOD PROFILES

COW CREEK (LOWER REACH)

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

16P

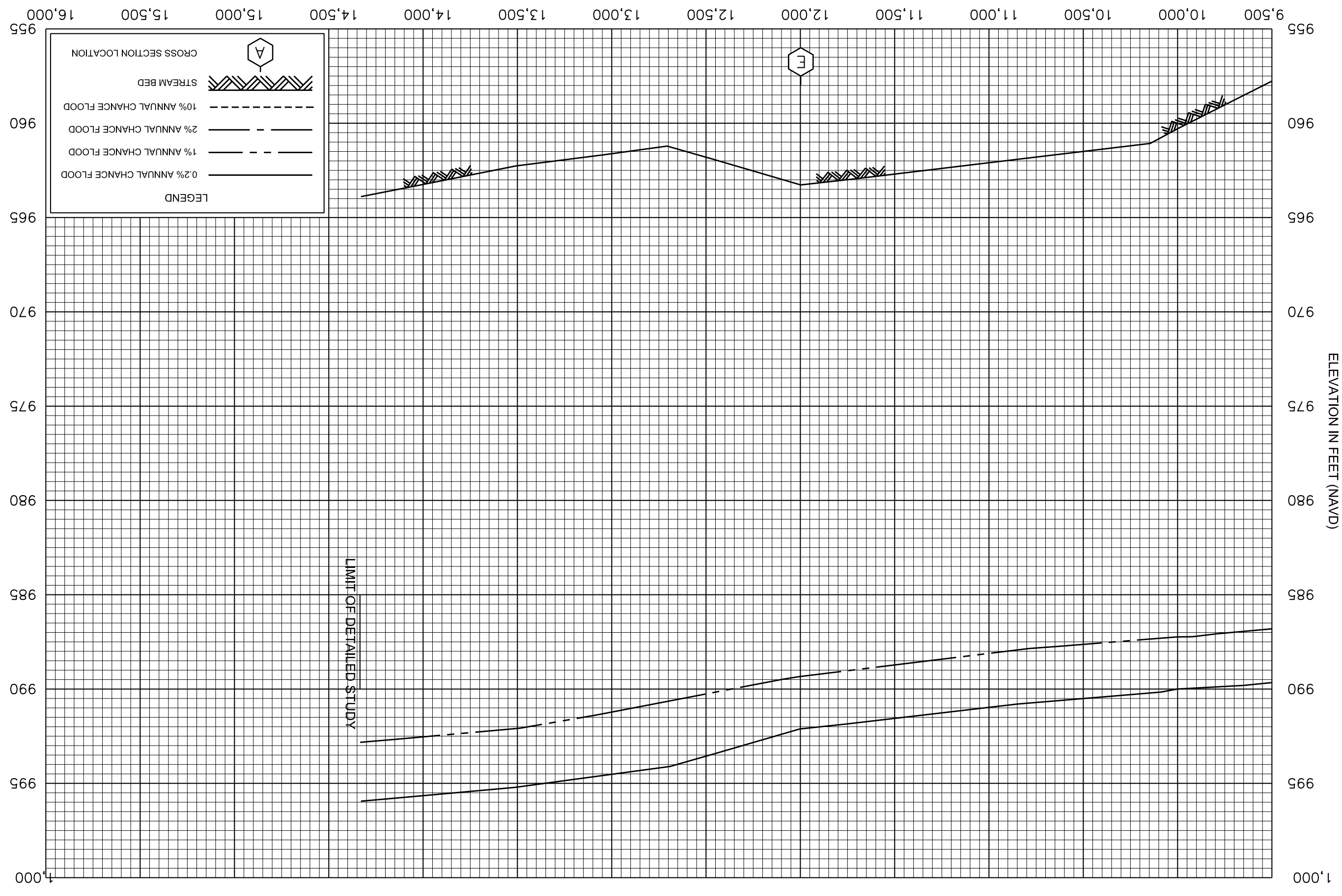
FEDERAL EMERGENCY MANAGEMENT AGENCY

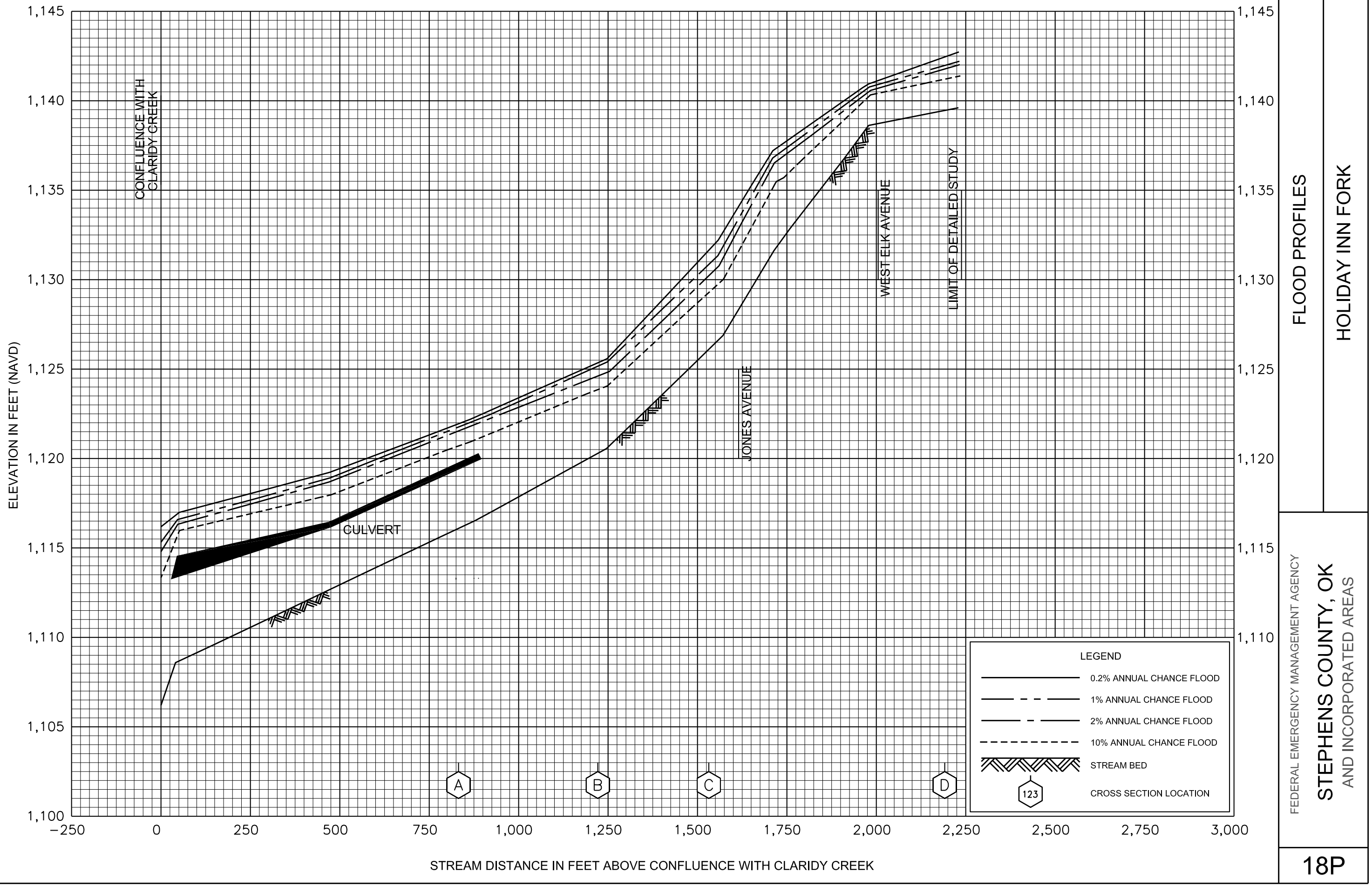
STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOOD PROFILES

COW CREEK (LOWER REACH)





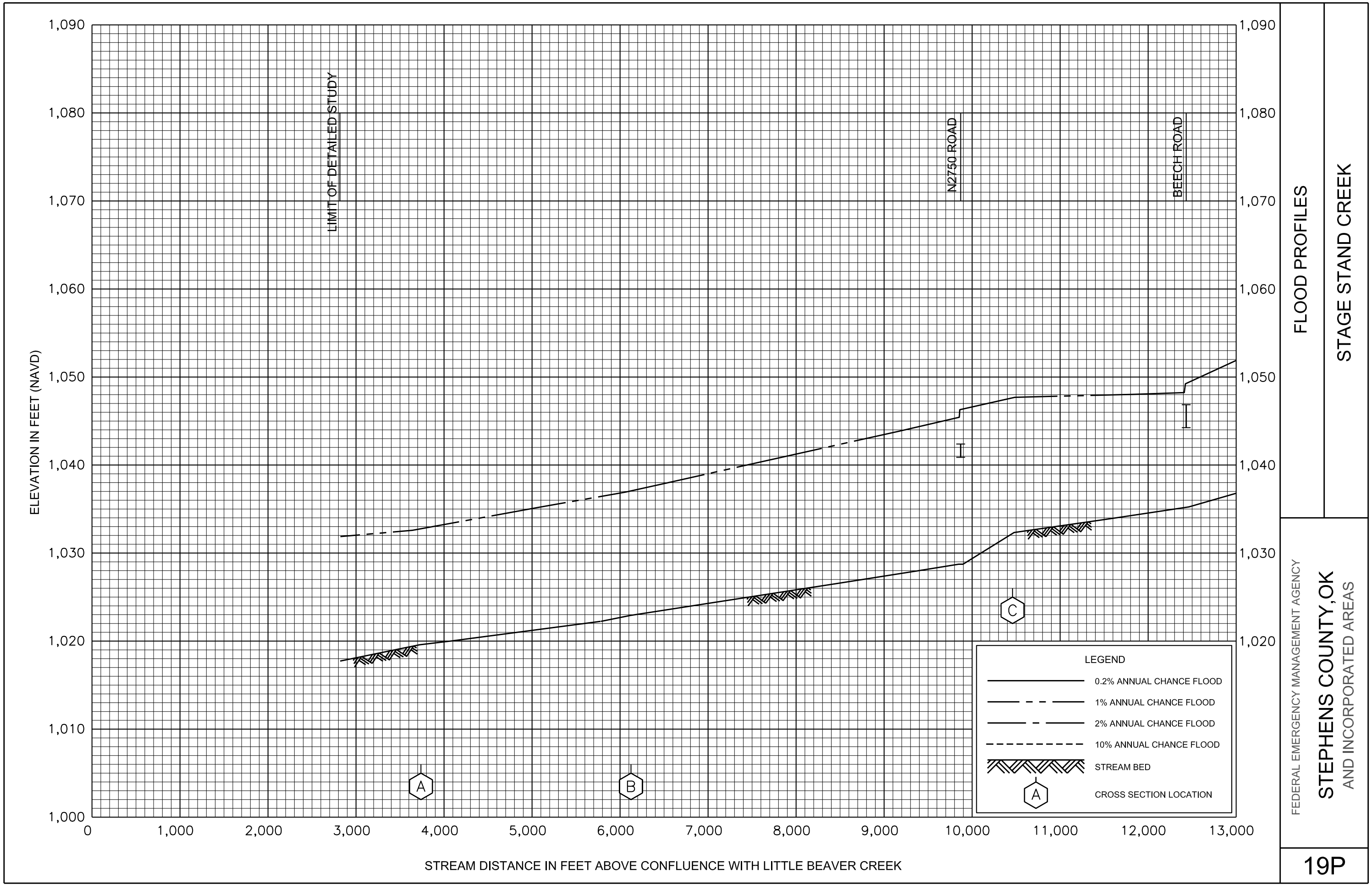
FLOOD PROFILES

HOLIDAY INN FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

18P



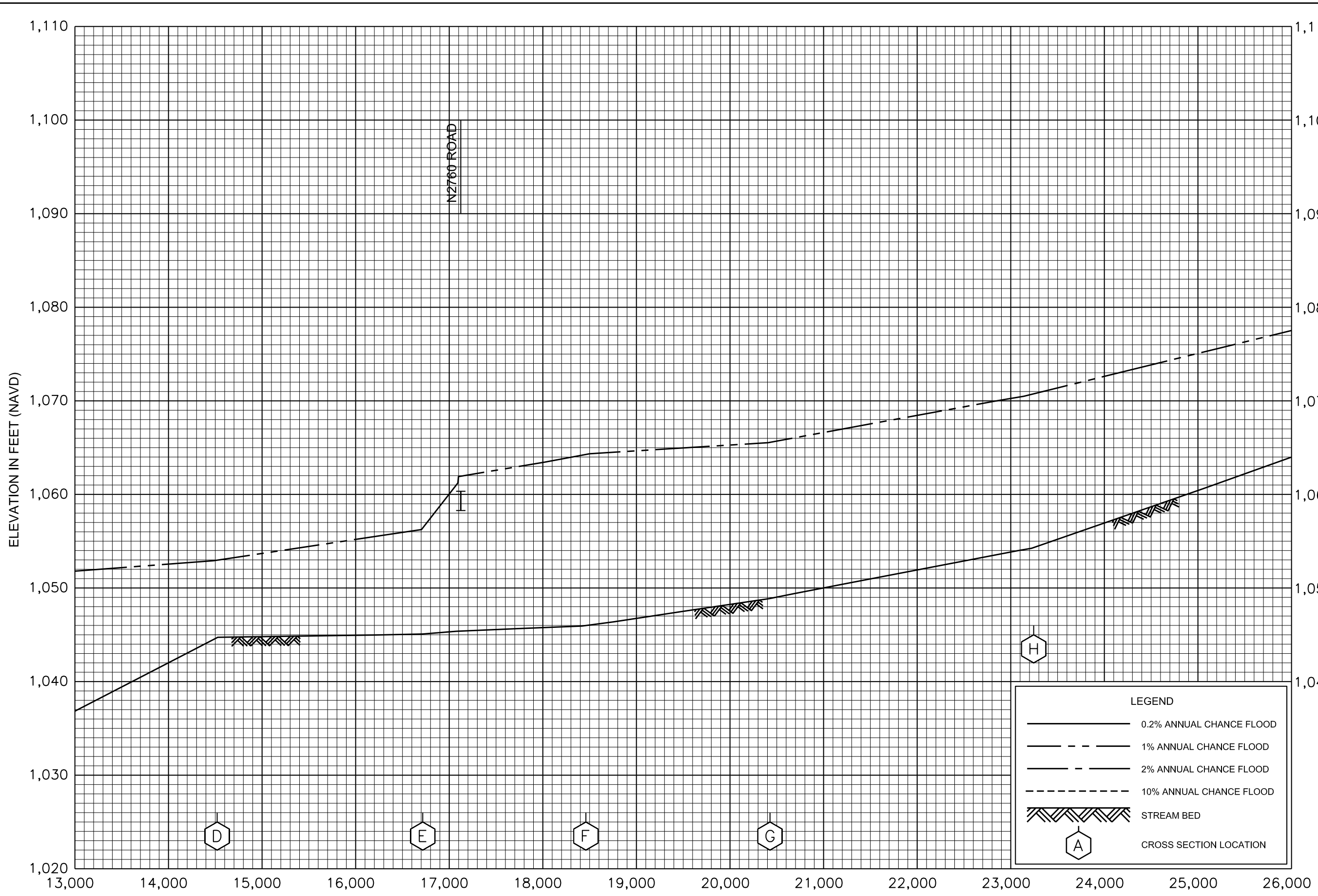
FLOOD PROFILES

STAGE STAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

19P

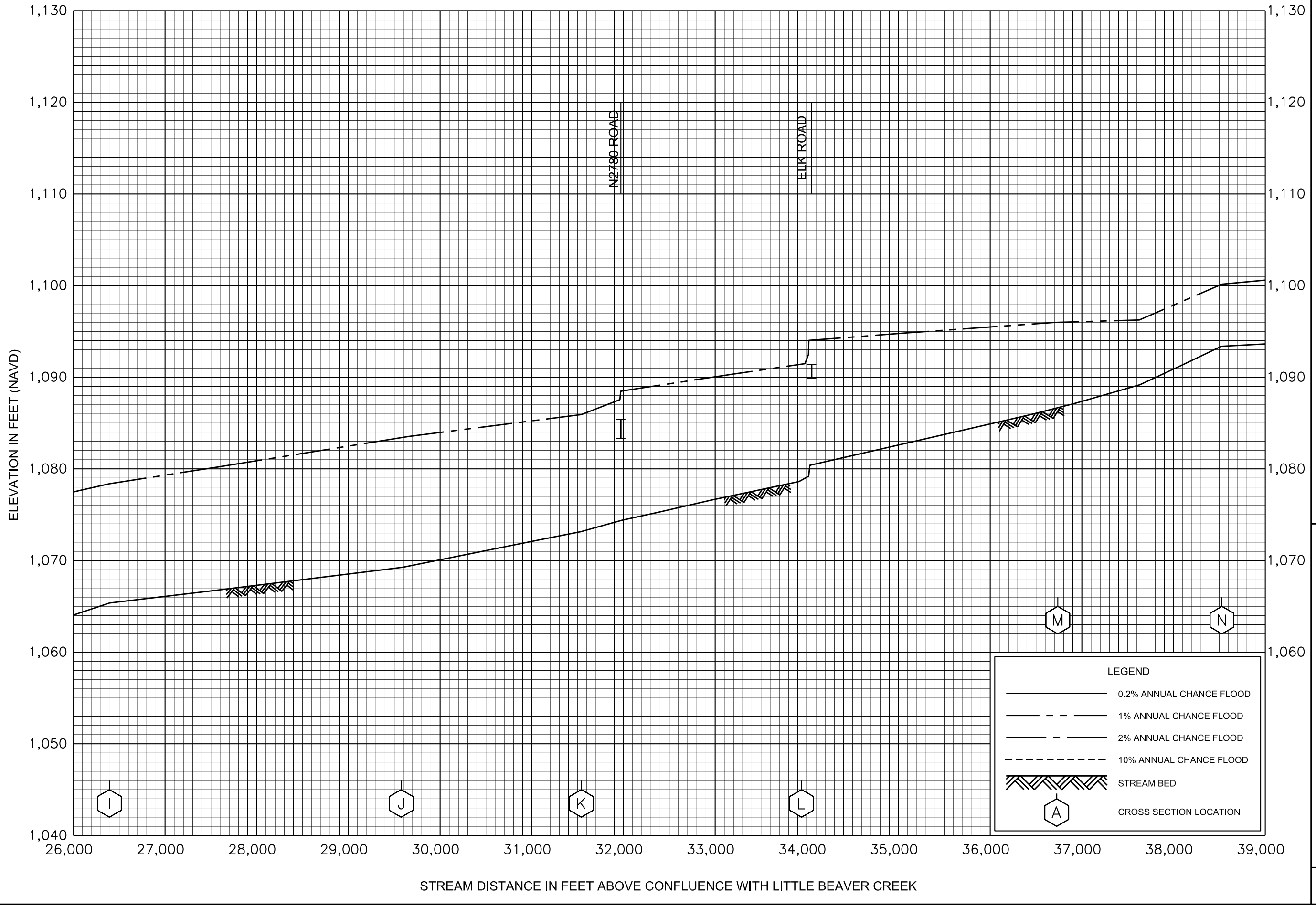


FLOOD PROFILES

STAGE STAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS



FLOOD PROFILES

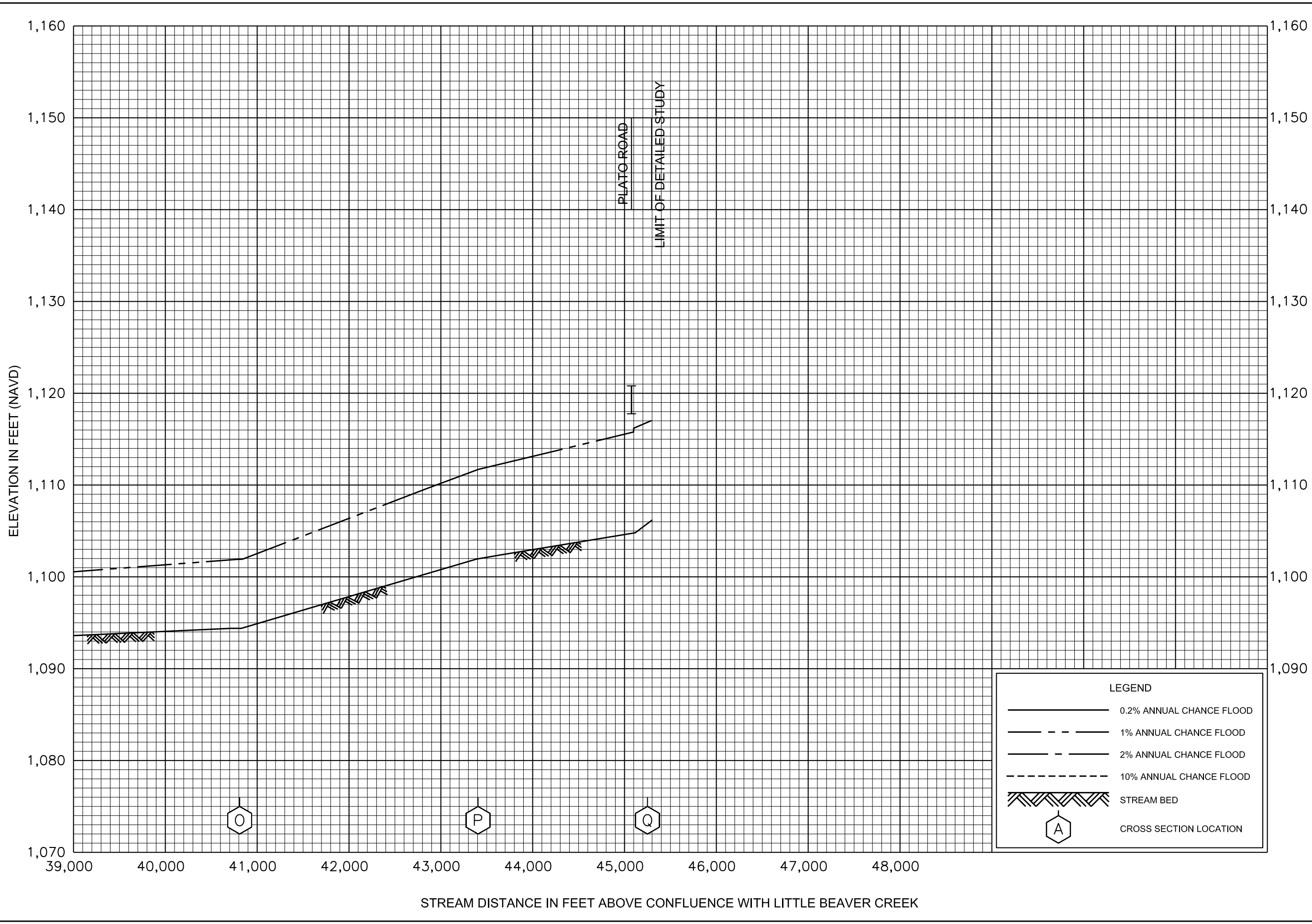
STAGE STAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

21P



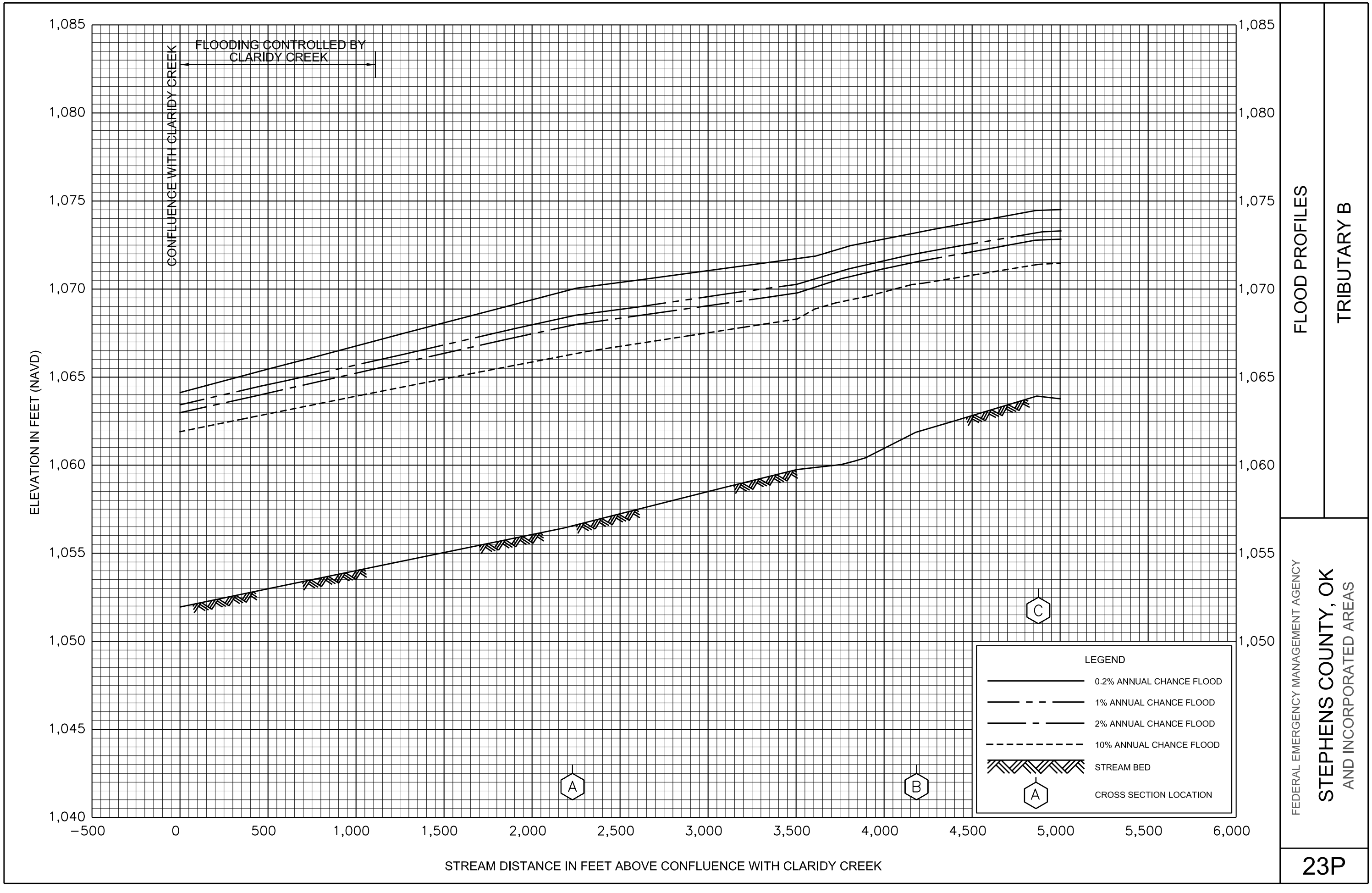
FLOOD PROFILES

STAGE STAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

22P



FLOOD PROFILES

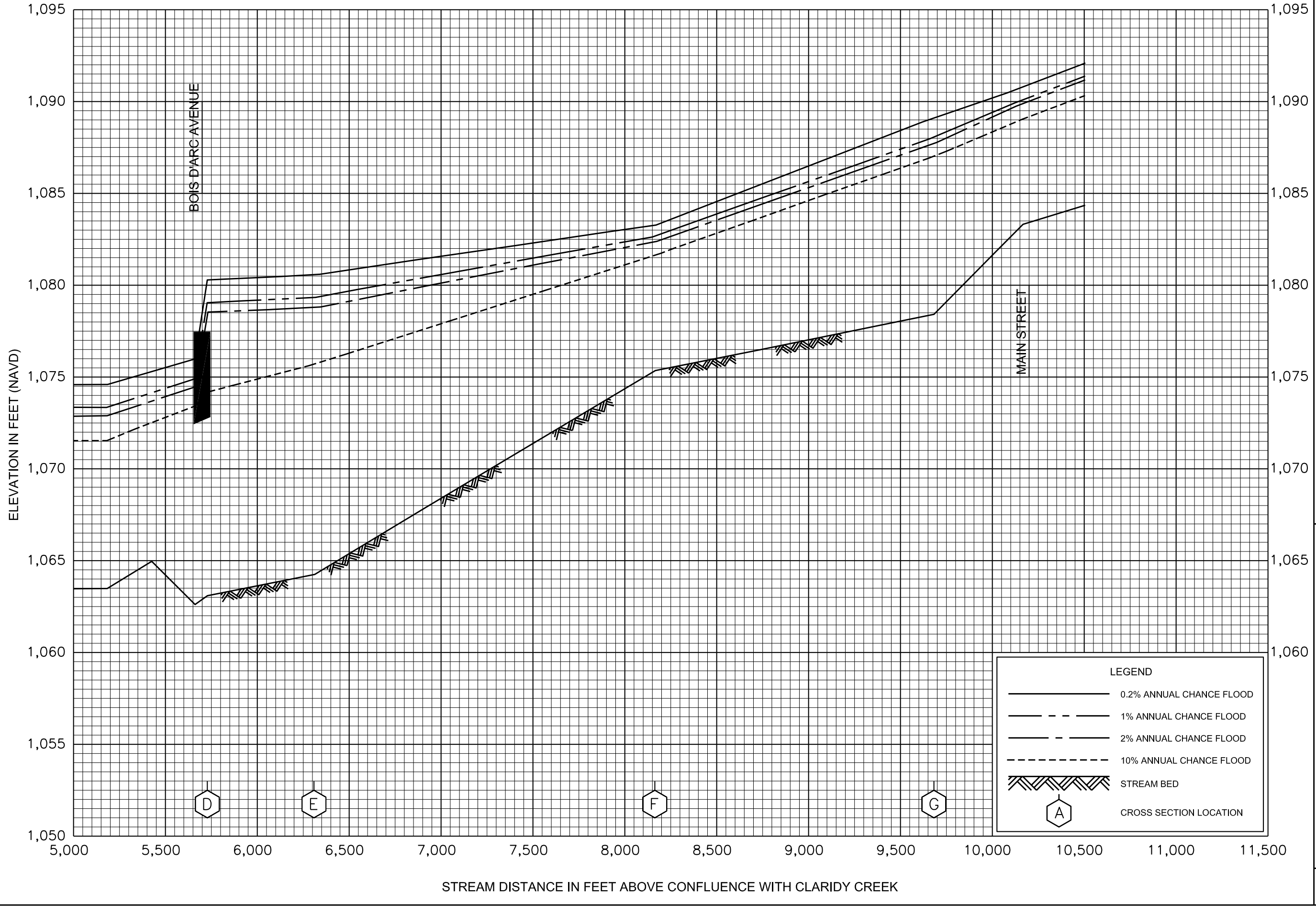
TRIBUTARY B

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

23P



FLOOD PROFILES

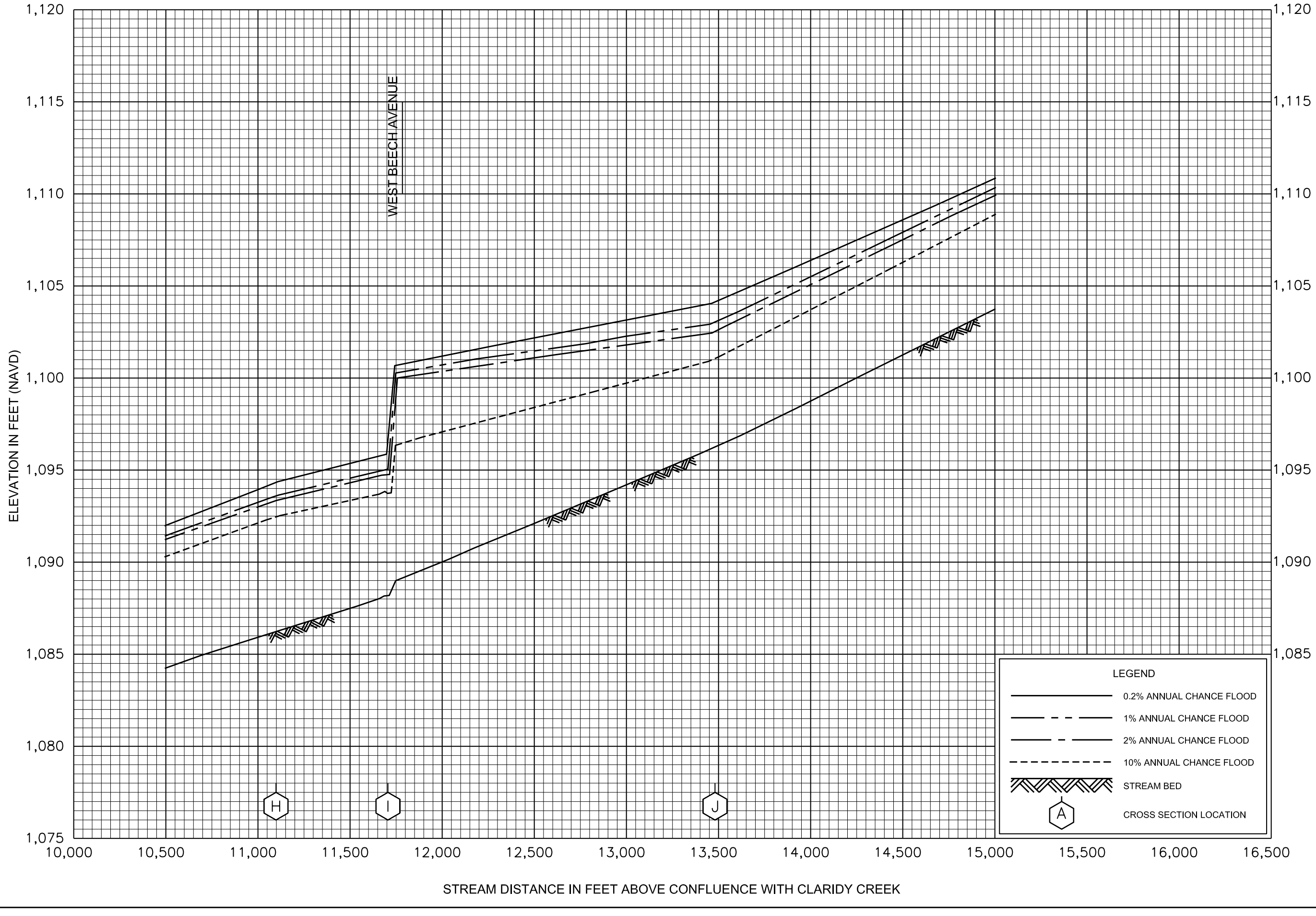
TRIBUTARY B

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

24P



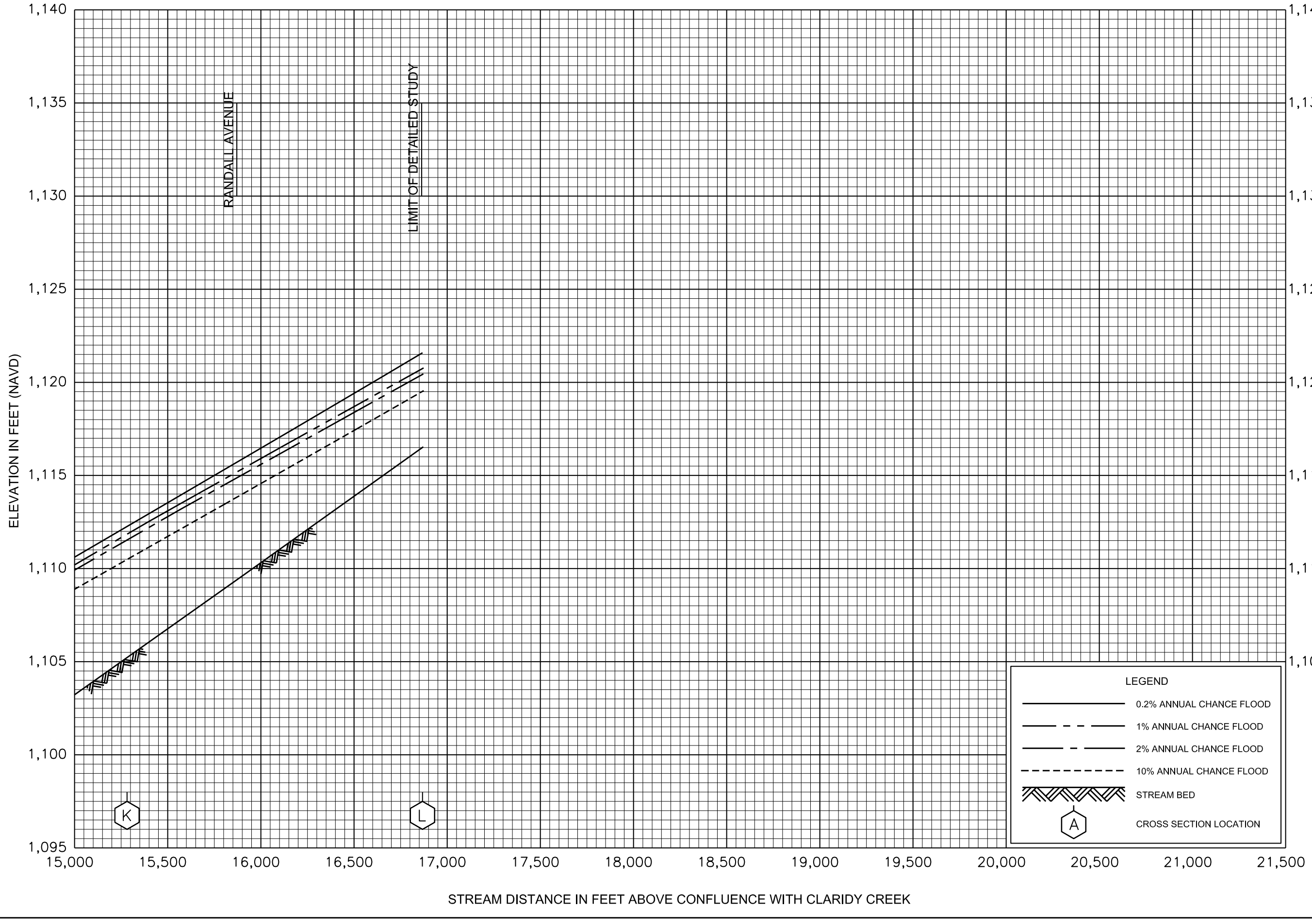
FLOOD PROFILES

TRIBUTARY B

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

25P



FLOOD PROFILES

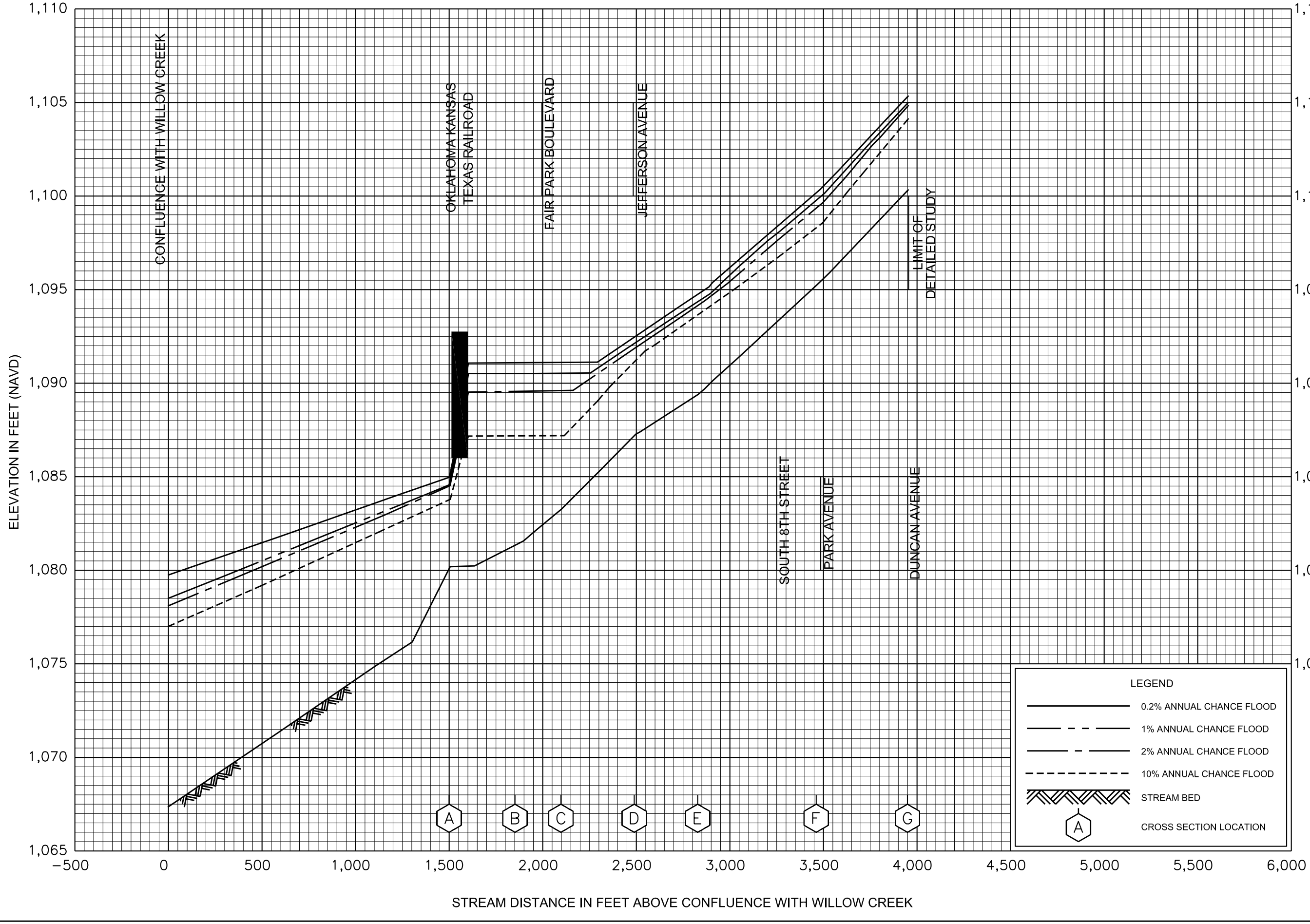
TRIBUTARY B

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

26P

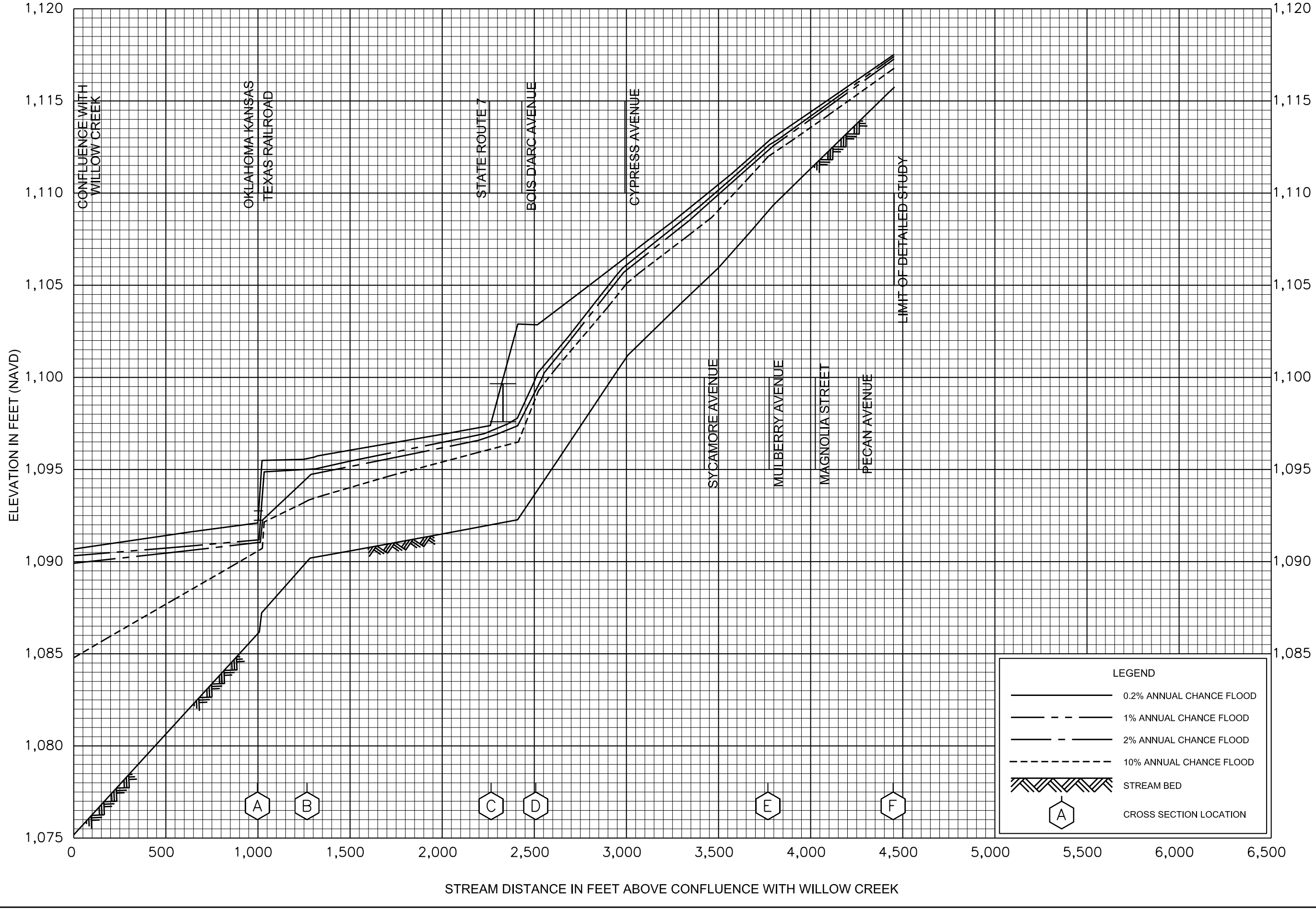


FLOOD PROFILES

TRIBUTARY D

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

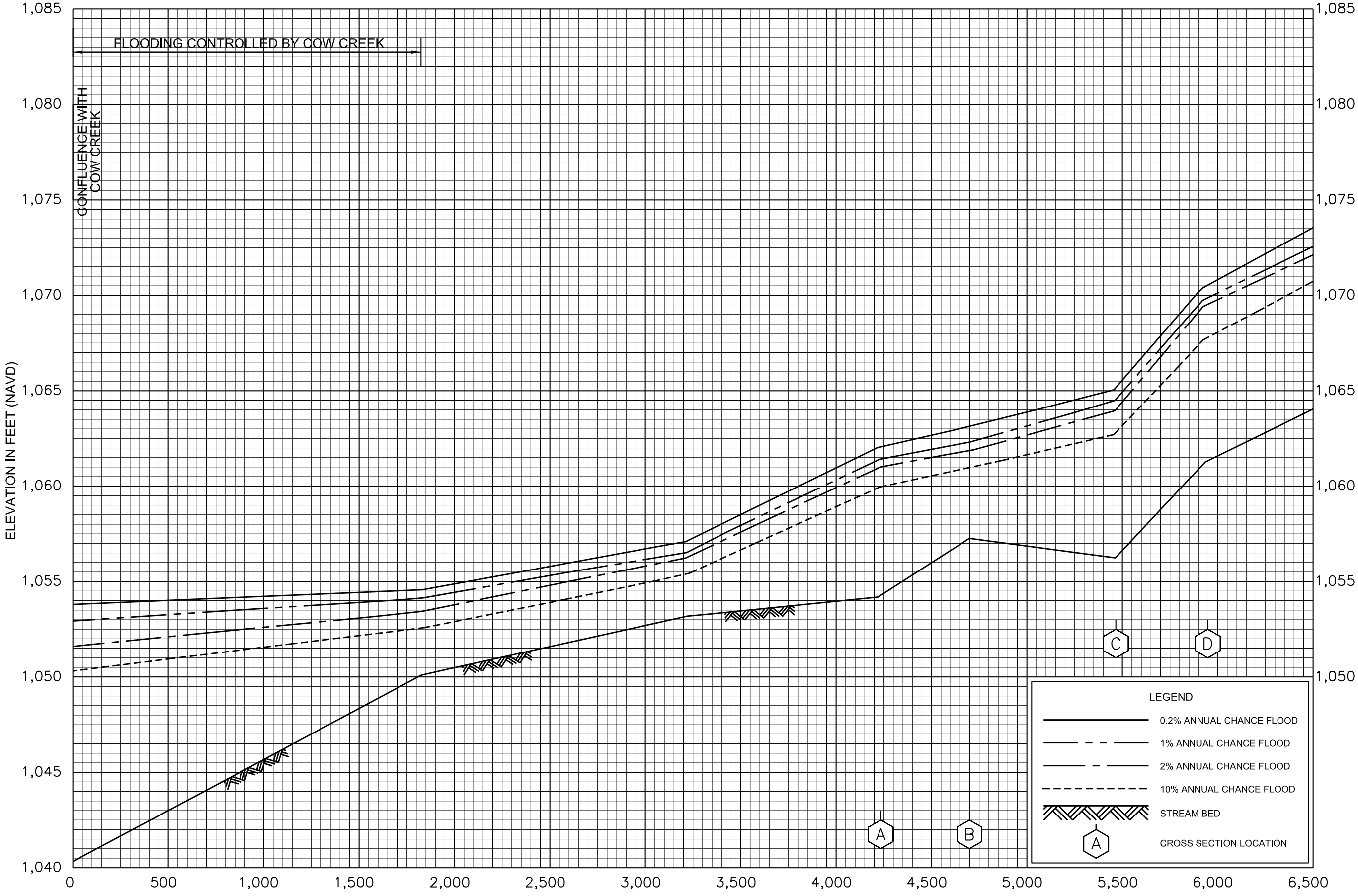


FLOOD PROFILES

TRIBUTARY E

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS



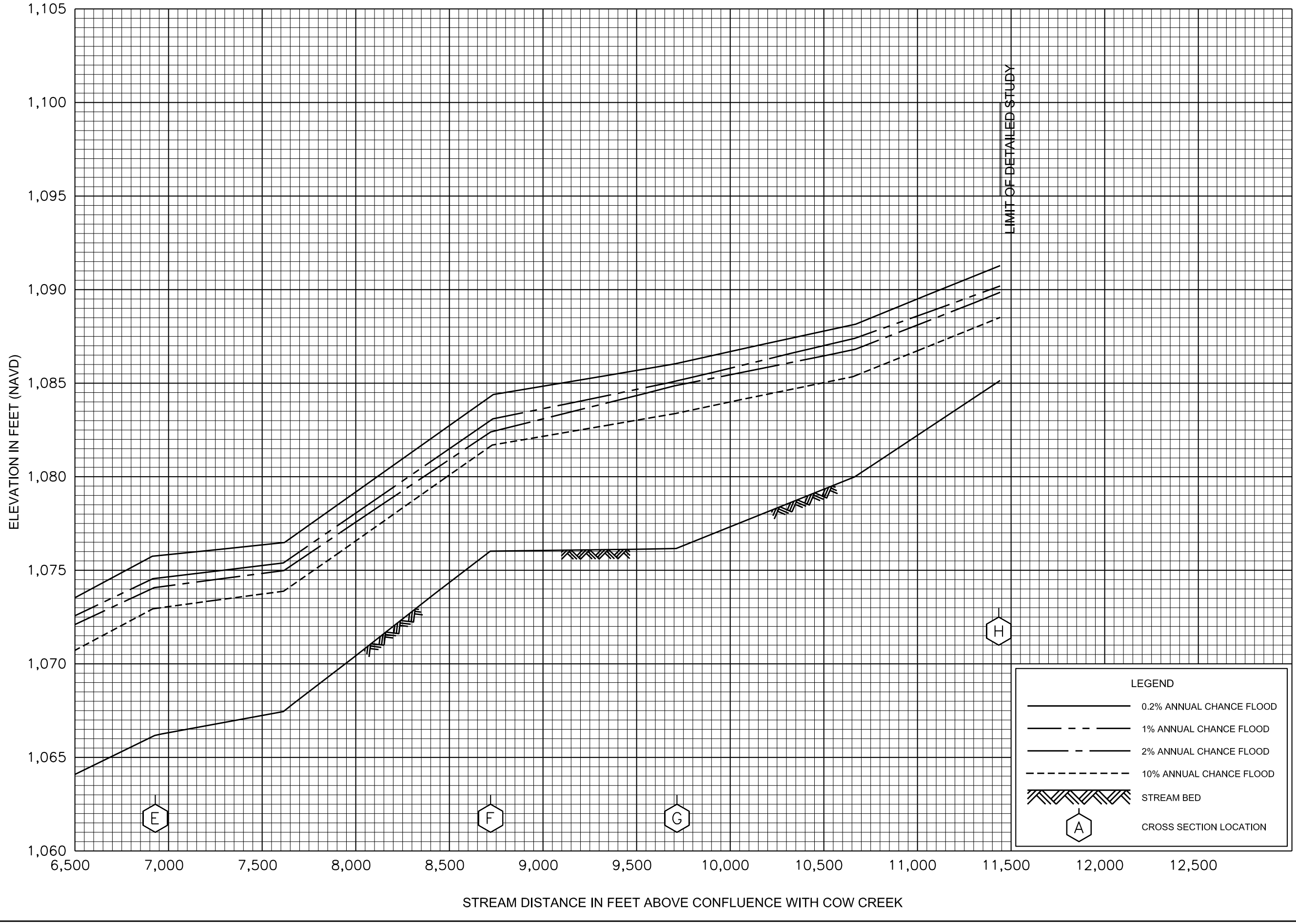
FLOOD PROFILES

TRIBUTARY F

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

29P



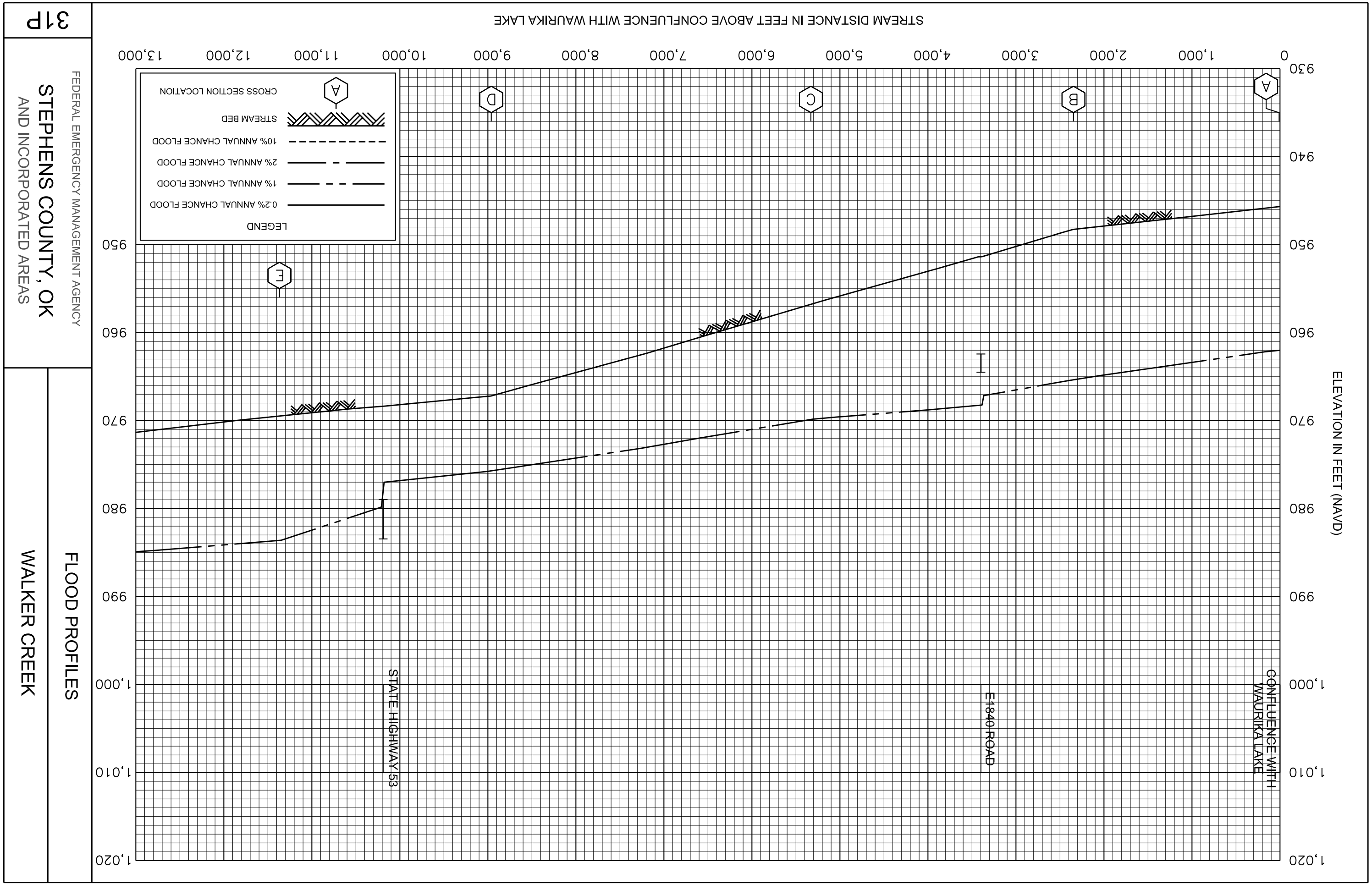
FLOOD PROFILES

TRIBUTARY F

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS



FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOOD PROFILES

WALKER CREEK

31P

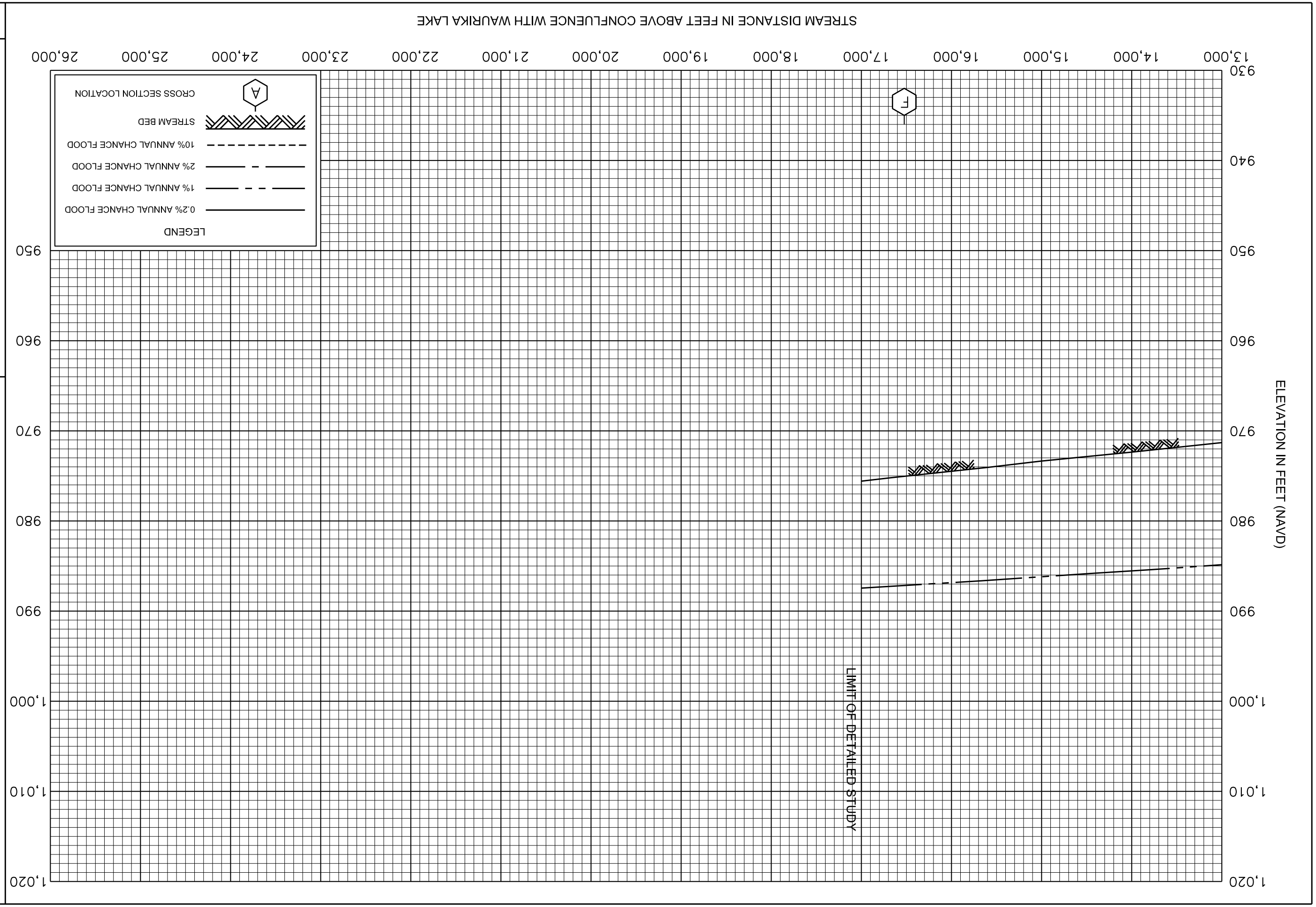
FEDERAL EMERGENCY MANAGEMENT AGENCY

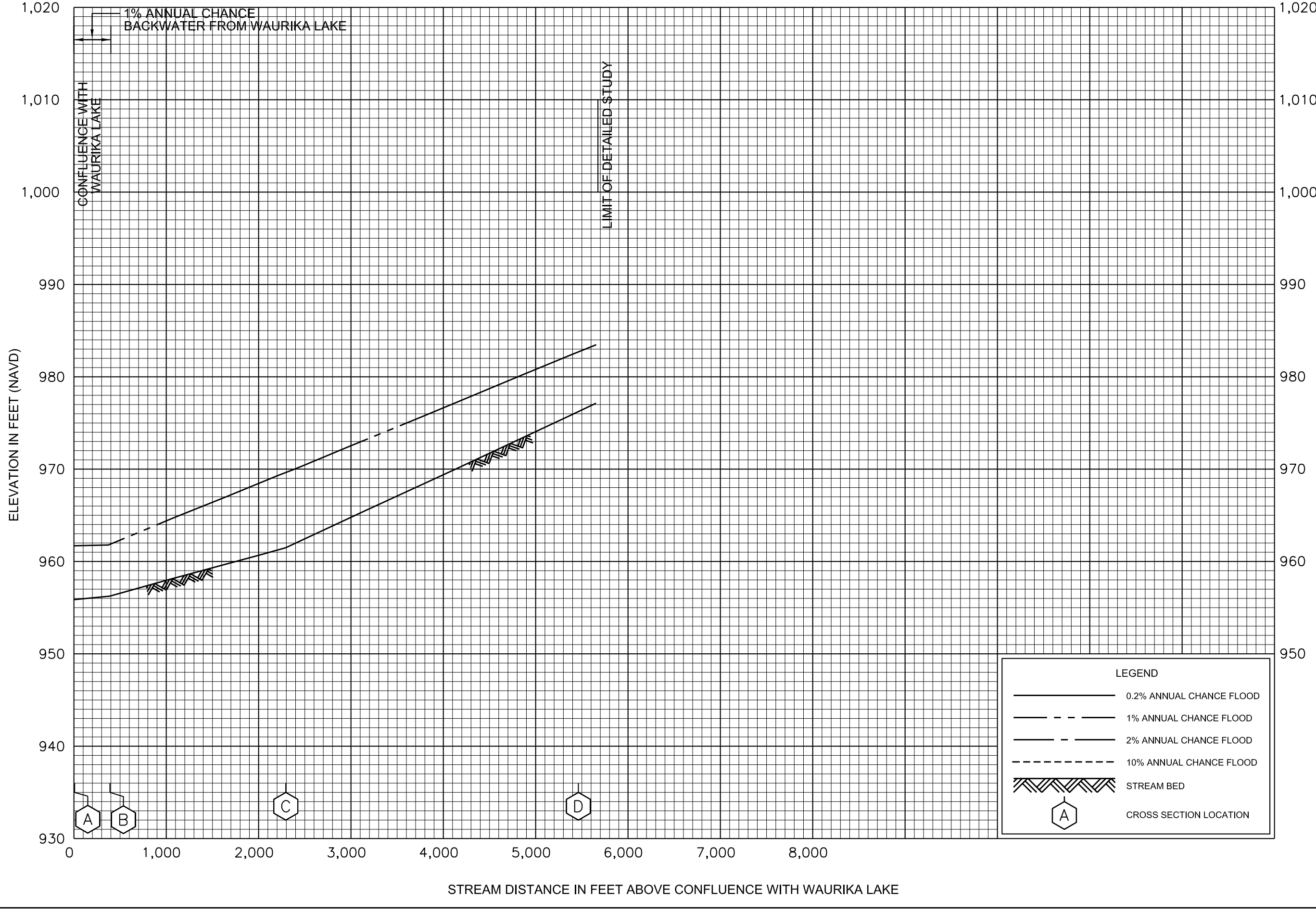
STEPHENS COUNTY, OK

AND INCORPORATED AREAS

WALKER CREEK

FLOOD PROFILES





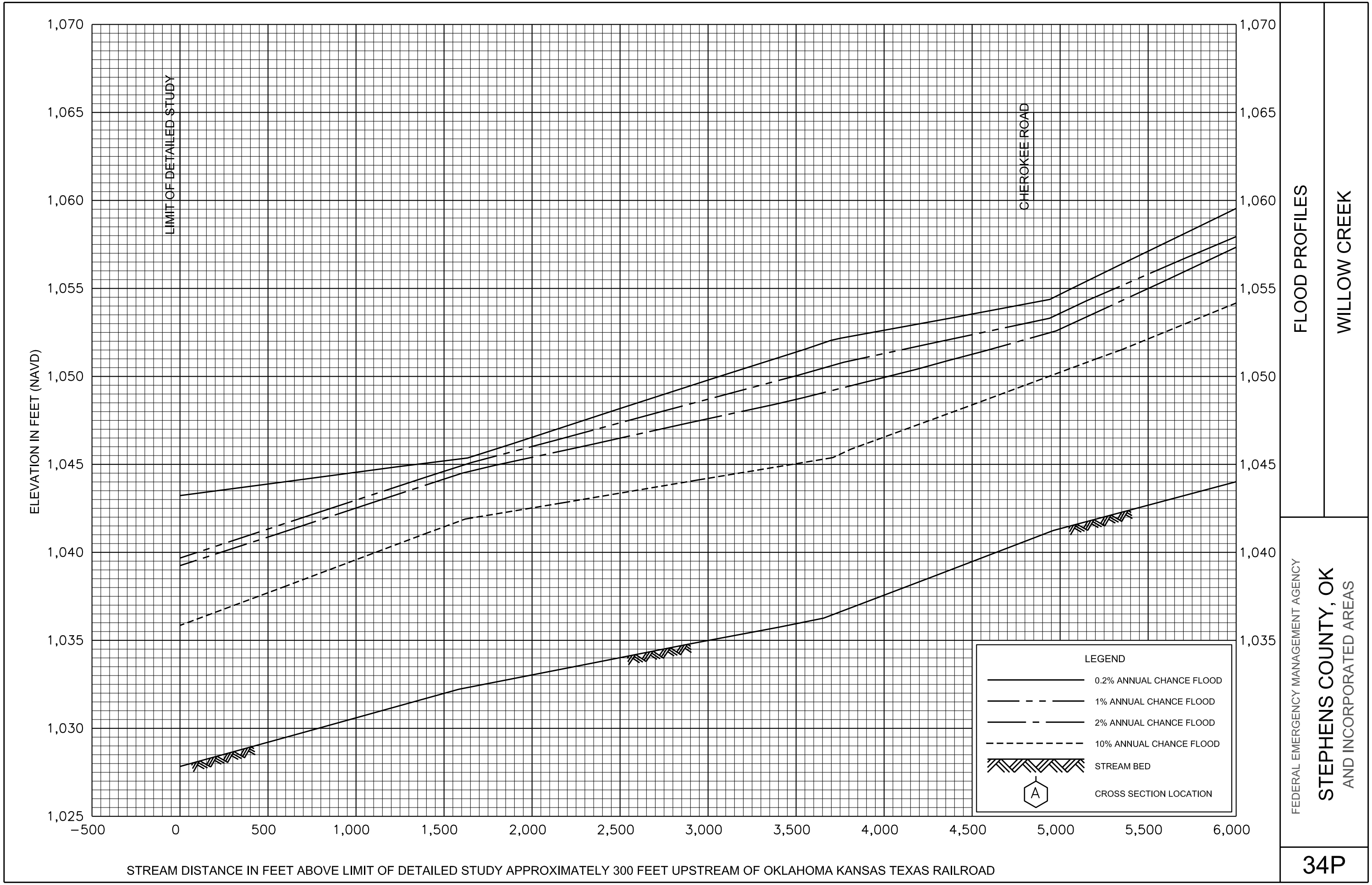
FLOOD PROFILES

WALKER CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

33P



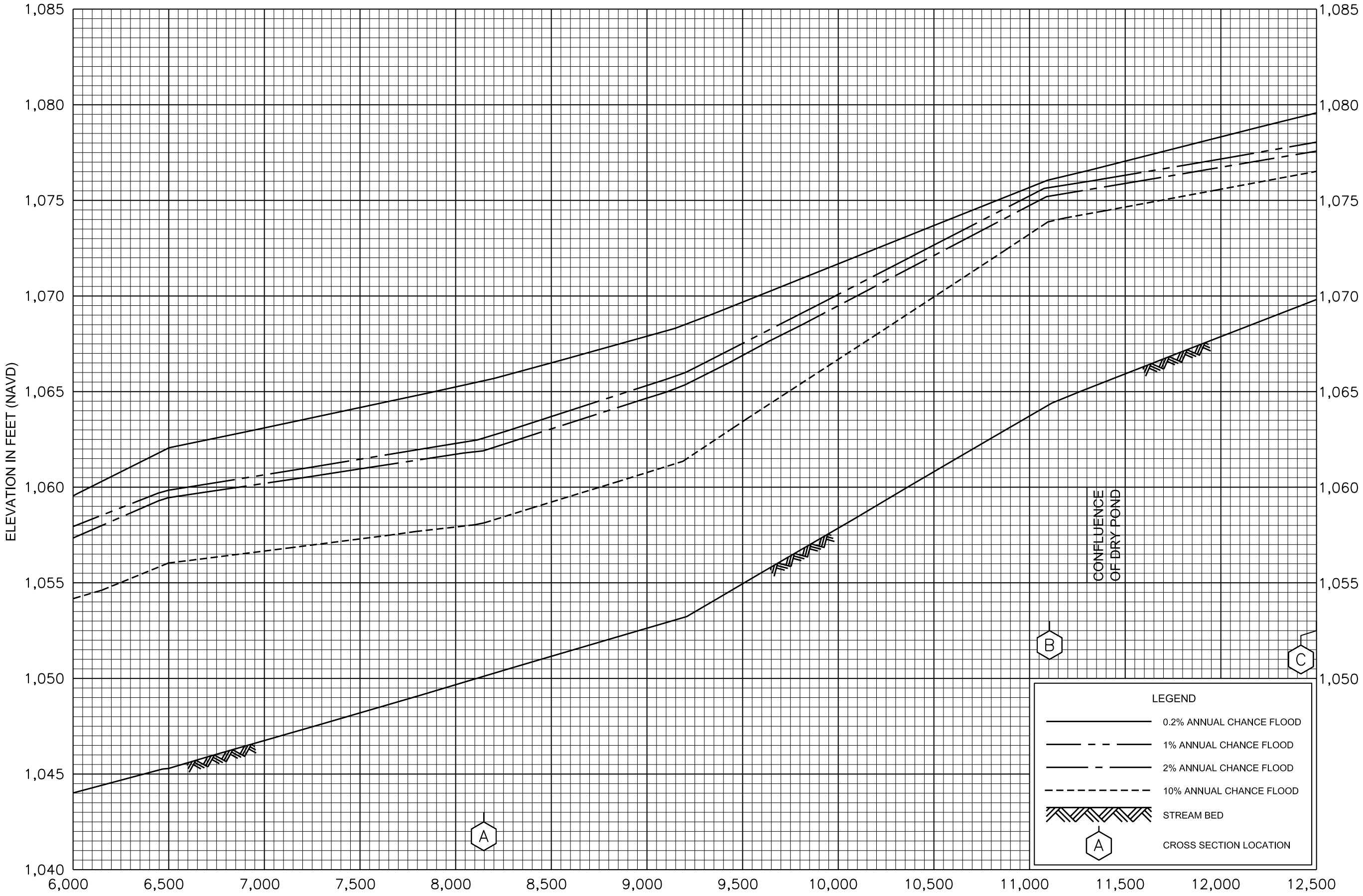
FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

34P



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 300 FEET UPSTREAM OF OKLAHOMA KANSAS TEXAS RAILROAD

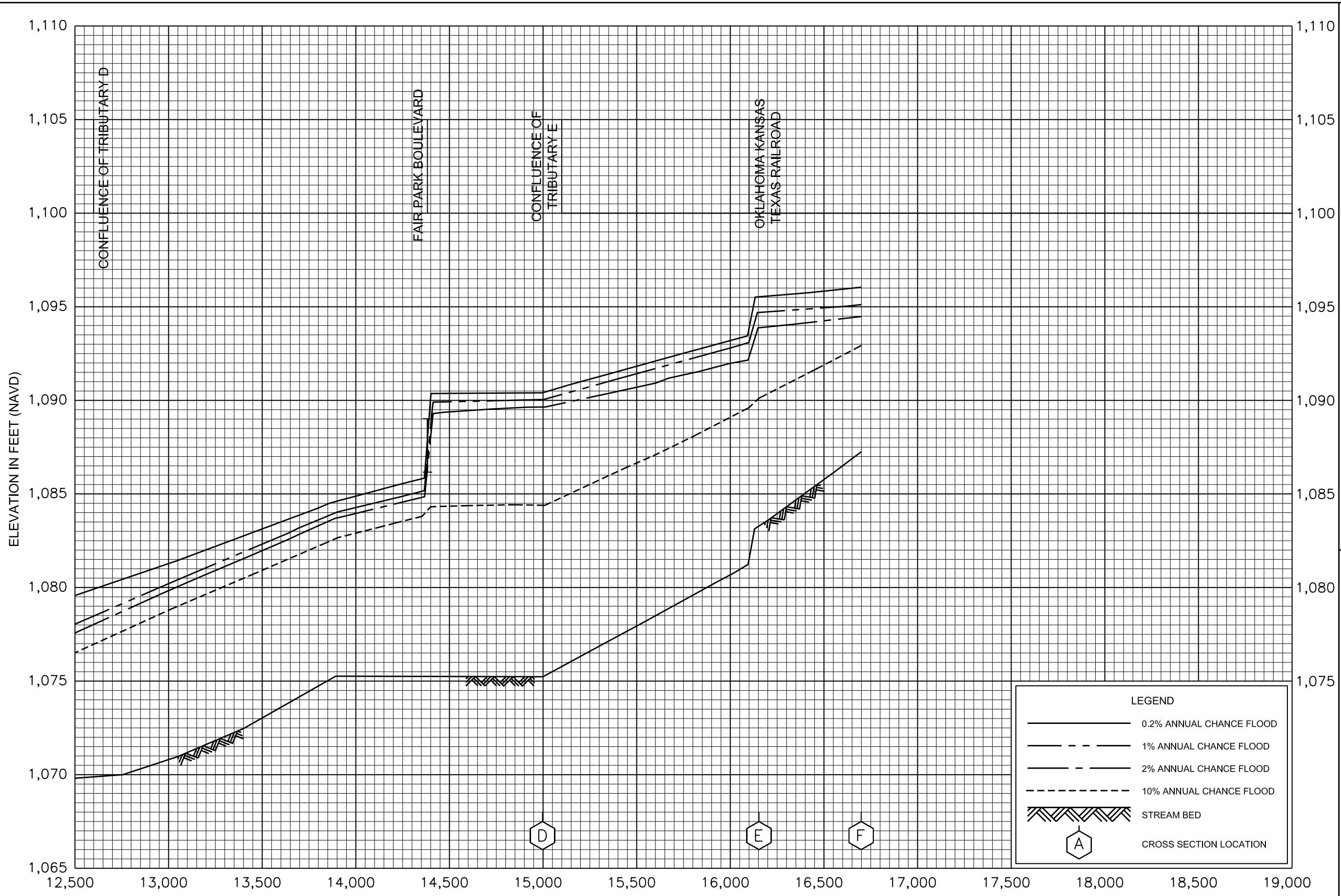
FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

35P



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 300 FEET UPSTREAM OF OKLAHOMA KANSAS TEXAS RAILROAD

FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

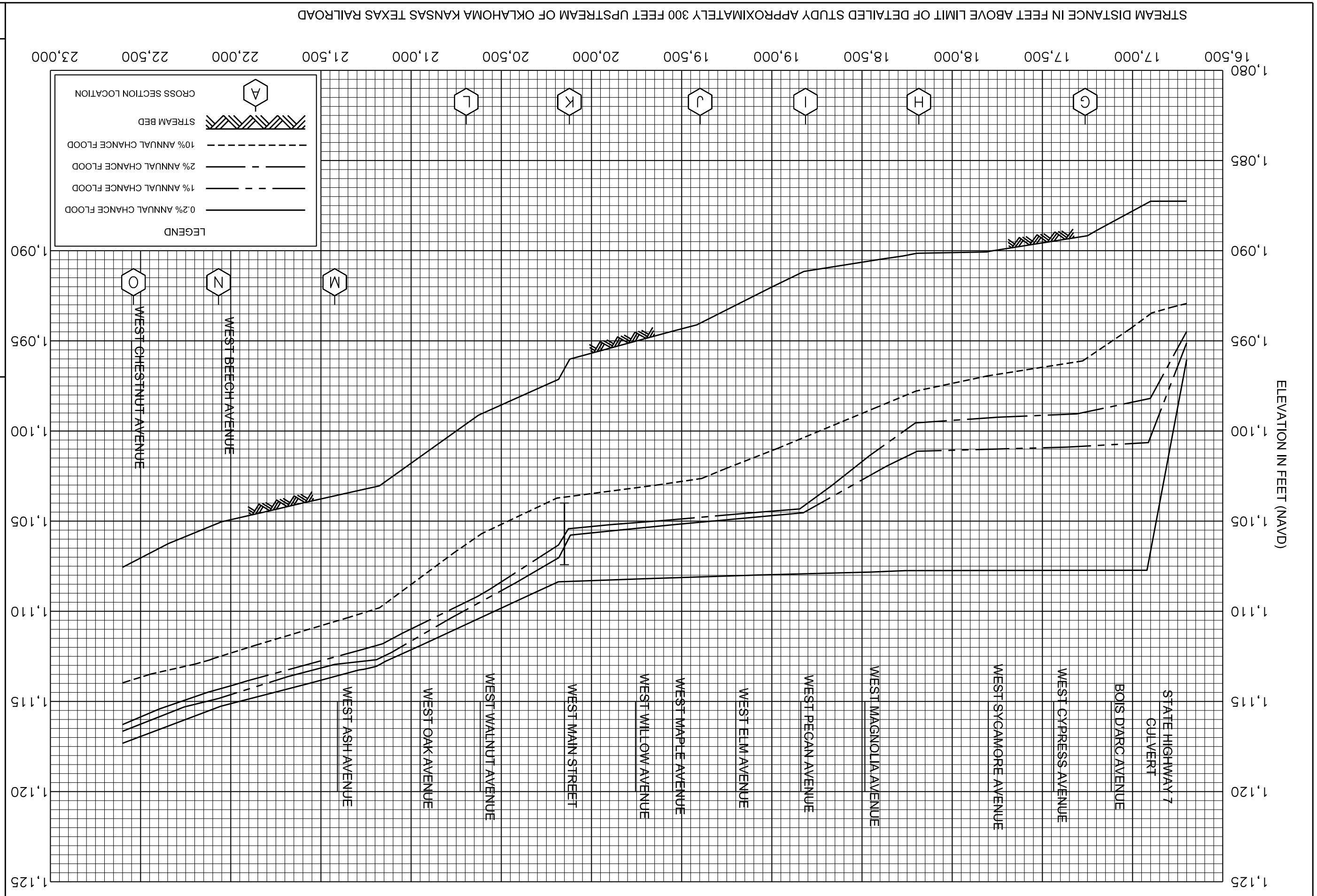
FEDERAL EMERGENCY MANAGEMENT AGENCY

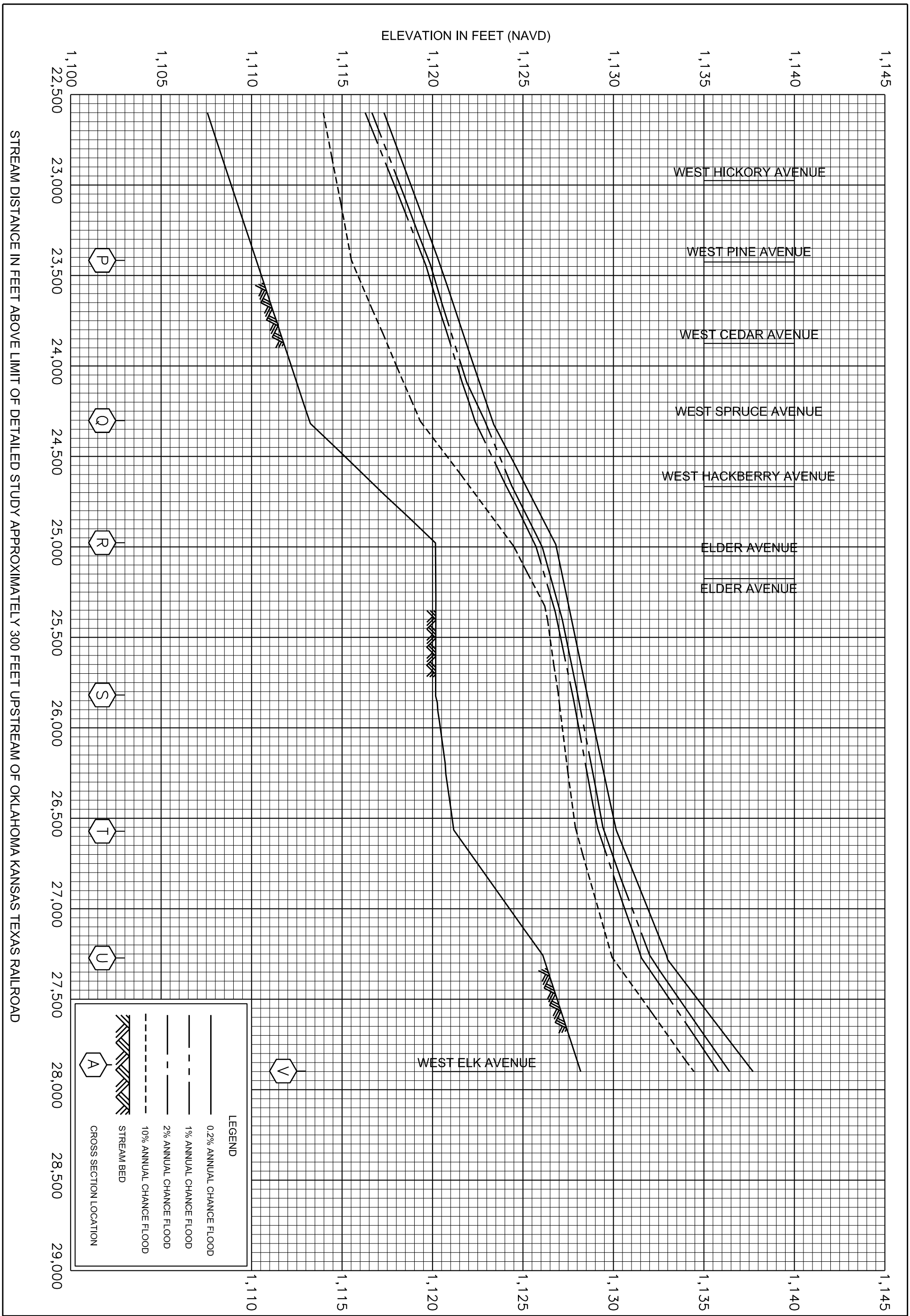
STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOOD PROFILES

WILLOW CREEK





FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK

AND INCORPORATED AREAS

FLOOD PROFILES

WILLOW CREEK

38P

ELEVATION IN FEET (NAVD)

1,170
1,165
1,160
1,155
1,150
1,145
1,140
1,135
1,130
1,125

27,500 28,000 28,500 29,000 29,500 30,000 30,500 31,000 31,500 32,000 32,500 33,000 33,500 34,000

W X Y

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- A — CROSS SECTION LOCATION

STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY APPROXIMATELY 300 FEET UPSTREAM OF OKLAHOMA KANSAS TEXAS RAILROAD

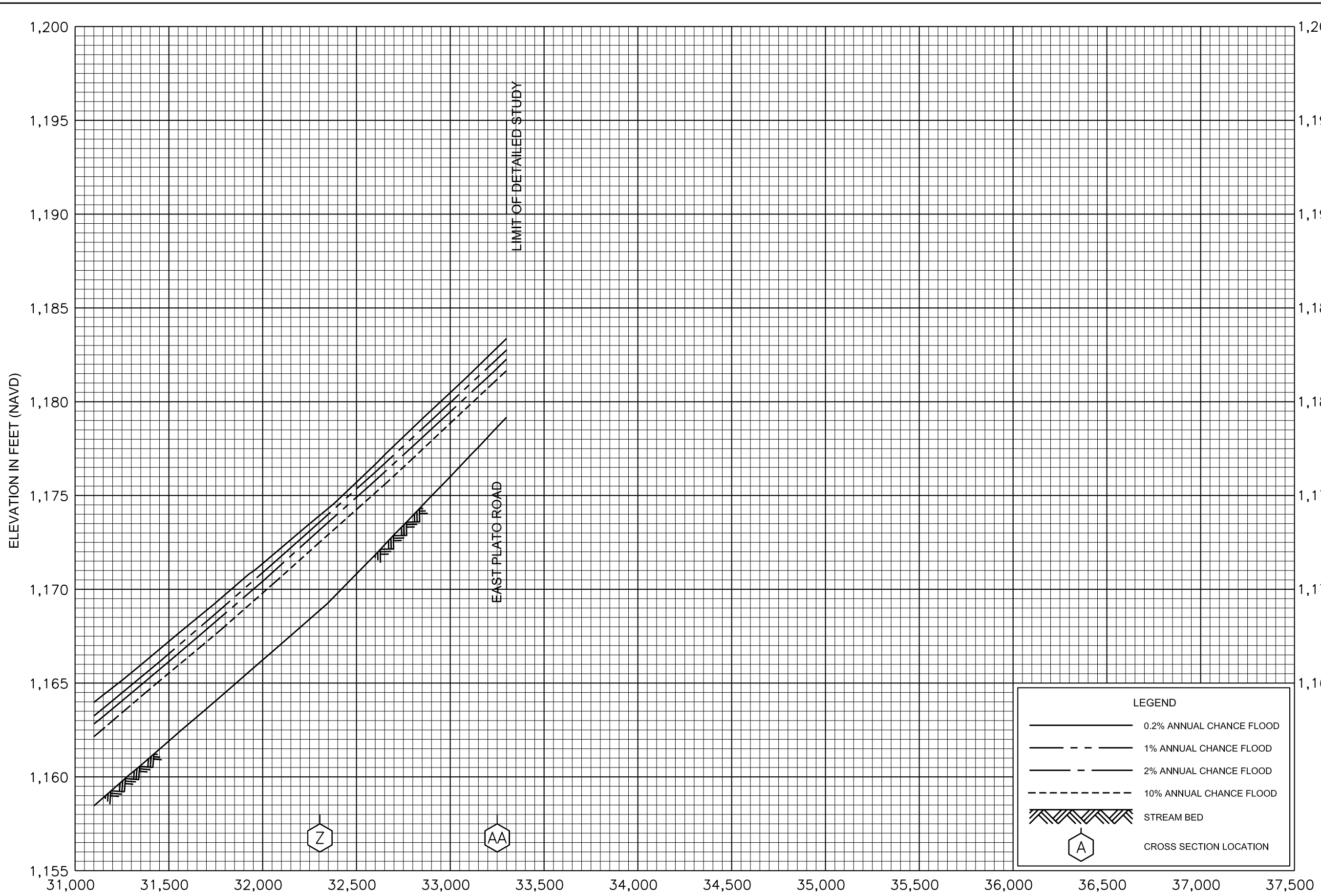
FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

39P



FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEPHENS COUNTY, OK
AND INCORPORATED AREAS

40P