5-24-2011

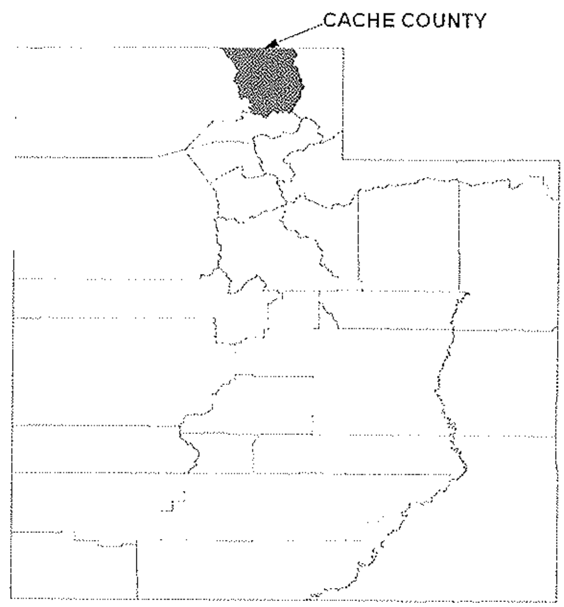
Flood Insurance Study: Cache County, Utah and Incorporated Areas

Federal Emergency Management Agency

FLOOD INSURANCE STUDY

CACHE COUNTY, UTAH
AND INCORPORATED AREAS

Community Name	Community Number
AMALGA, TOWN OF	490013
CACHE COUNTY (UNINCORPORATED AREAS)	490012
CLARKSTON, TOWN OF	490014
CORNISH, TOWN OF	490015
HYDE PARK, TOWN OF	490016
HYRUM, CITY OF	490017
LEWISTON, CITY OF	490018
LOGAN, CITY OF	490019
MENDON, CITY OF	490020
MILLVILLE, TOWN OF	490021
NEWTON, TOWN OF	490022
NIBLEY, TOWN OF	490023
NORTH LOGAN, CITY OF	490024
PARADISE, TOWN OF	490025
PROVIDENCE, CITY OF	490226
RICHMOND, CITY OF	490027
RIVER HEIGHTS, CITY OF	490240
SMITHFIELD, CITY OF	490029
TRENTON, TOWN OF	490030
WELLSVILLE, CITY OF	490031



EFFECTIVE DATE: MAY 24, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
49005CV000A

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 (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. 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 separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross sections). In addition, former flood hazard zone designations have been changed as follows:

Old Zone(s)	New Zone
A1 through A30	AE
B	X
C	X

Initial Countywide FIS Effective Date: May 24, 2011

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Exhibit 2 - Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CACHE COUNTY, UTAH, AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the geographic area of Cache County, Utah, including the Cities of Hyrum, Lewiston, Logan, Mendon, North Logan, Providence, Richmond, River Heights, Smithfield and Wellsville; the Towns of Amalga, Clarkston, Cornish, Hyde Park, Millville, Newton, Nibley, Paradise, and Trenton, and the unincorporated areas of Cache County (hereinafter referred to collectively as Cache 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 in its efforts to promote sound floodplain management. Minimum floodplain 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, flood plain 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) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

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

The original detailed and approximate hydrologic and hydraulic analyses for this study were performed by Rollins, Brown and Gunnell, Inc., for FEMA under Contract No. H-4593. This study was completed in January 1982.

The updated approximate hydrologic and hydraulic analyses for this study were performed by Michael Baker, Jr., Inc., for FEMA under Contract No. HSFEHQ-04-D-0025, task order number HSFE08-05-J-002. This study was completed in December 2009.

1.3 Coordination

Streams requiring detailed study were discussed at a meeting attended by representatives of FEMA, the study contractor, and the city on August 3, 1979. Results of the hydrologic analysis were sent to the U.S. Army Corps of Engineers (COE), the city, and FEMA for review and comment in June 1981. Copies of the work maps showing flood plain delineations were sent to FEMA and the city in February 1982, and a meeting with FEMA and the city was held on February 19, 1982, for discussion and review. The work maps were revised according to the results of the meeting. The final community coordination meeting was held on November 14, 1983, and was attended by representatives of FEMA, the study contractor, and the city. No significant problems were raised at the meeting.

The COE, the U.S. Soil Conservation Service (SCS), the U.S. Geological Survey (USGS), and the Utah Water Research Laboratory (UWRL) were contacted to obtain any information which would be helpful in flood plain delineation.

The results of this countywide study were reviewed at the final Consultation Coordination Officer (CCO) meeting held on February 18, 2010, and attended by representatives of FEMA, the State of Utah, local public entities and the study contractor. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Cache County, Utah, including the incorporated areas listed in Section 1.1.

Streams studied by detailed methods were: Logan River, from its emergence from Logan Canyon at State Dam to the Logan corporate limits at 1000 West Street; Spring Creek, from its confluence with Logan River upstream to the Logan corporate limits; and Blacksmith Fork, from its confluence with Logan River upstream to the Logan corporate limits.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected priority development or proposed construction through August 1984.

All other flood hazards within the County were studied by approximate methods.

2.2 Community Description

Cache County, with an area of 1,165 square miles, is located in north-central Utah. The population of Cache County based on the 2000 Census was 91,391 (Reference 1). The populations of the incorporated communities of Cache County are listed in Table 1.

Table 1. Populations of Incorporated Communities in Cache County

Community	1990 Census Population	2000 Census Population
Amalga, Town of	366	427
Clarkston, Town of	645	688
Cornish, Town of	205	259
Hyde Park, Town of	2,190	2,955
Hyrum, City of	4,829	6,316
Lewiston, City of	1,532	1,877
Logan, City of	32,762	42,670
Mendon, City of	684	898
Millville, Town of	1,202	1,507
Newton, Town of	659	699
Nibley, Town of	1,167	2,045
North Logan, City of	3,768	6,163
Paradise, Town of	561	759
Providence, City of	3,344	4,377
Richmond, City of	1,955	2,051
River Heights, City of	1,274	1,496
Smithfield, City of	5,566	7,251
Trenton, Town of	464	449
Wellsville, City of	2,206	2,728

The City of Logan has a population of approximately 42,670 (Reference 1), and is situated in the central portion of Cache County in Cache Valley between the Bear River and the Wasatch Mountains, in northern Utah. The communities of Smithfield and North Logan lie to the north of the city, while River Heights and Providence lie to the south. North Logan and River Heights share common borders with Logan.

Cache Valley is part of the Bear River Basin, which in turn is located in the Great Salt Lake subbasin of the Great Basin. The three major streams in the study area are Spring Creek, Blacksmith Fork, and the Logan River. Spring Creek and Blacksmith Fork are tributaries to the Logan River, while the Logan River is a tributary to the Bear River. All three streams have their headwaters in the Bear River Mountain Range to the east. The streams originate from snowfed springs in the canyons before emerging into the valley area. Blacksmith Fork and Spring Creek have drainage areas of 287 and 19.9 square miles, respectively, at their confluences with the Logan River. The Logan River has a total drainage area of 524 square miles at the Mendon Road bridge.

Elevations of the watersheds range from above 9,000 feet in the mountains down to approximately 4,500 feet in the valley. Precipitation varies from 16 inches at Logan to 50 inches annually in the high elevations. Winter precipitation usually occurs as snow with the normal annual snowpack ranging from 6 to 8 feet in the mountains. Precipitation in the summer usually originates from high-intensity thunderstorms.

Vegetation in the area varies significantly with elevation, slope, and aspect. Subalpine vegetation can be found on the highest elevations, aspen and conifer forest in the high to middle elevations, and oak and sagebrush in the middle to lower elevations. On south-facing slopes, the oak brush may extend into the higher elevations, while on north-facing slopes, the aspen and conifers may extend into the lower elevations. Many of the south-facing slopes are semiarid, while the north-facing slopes support thick stands of timber and underbrush. Native vegetation in the valley area consists of sage and native grasses with stands of cottonwoods and willows along the stream courses.

Extensive residential development has occurred along the Logan River within the corporate limits of the city; there has been some encroachment on the flood plain, particularly in what is known locally as the Island area. Development along the lower reaches of the Logan River has been limited to farmland and pasture, with a few scattered homes near the river. Past development along Blacksmith Fork and Spring Creek has been limited primarily to farmland and pasture, with scattered farmhouses and barns; however, some development of land near the lower reaches of these streams has occurred recently.

2.3 Principal Flood Problems

Flooding in the Logan area can result from heavy spring snowmelt runoff, from rain falling on snow or frozen ground, or from summer cloudburst storms. All three types of flooding have been reported in the Cache Valley area in the past. The larger floods in this century on both the Logan River and Blacksmith Fork have resulted from spring snowmelt runoff. The largest recorded flood on both occurred in the spring of 1907. The Logan River had a recorded peak discharge of 2,450 cubic feet per second (cfs) at the mouth of Logan Canyon, while Blacksmith Fork had a recorded peak discharge of 1,900 cfs just upstream from its canyon mouth. These peak discharges were no coincident peaks. The 1907 flood was equivalent to approximately the 100-year flood on both streams. A flood in the spring of 1971 on the Logan River flooded backyards of residences adjacent to the river; sandbagging was required. This flood had a recorded peak discharge of 1,680 cfs at the canyon mouth and 1,980 cfs at the Mendon Road bridge. The flood had an estimated return period of approximately 10 years. Flooding on Blacksmith Fork in 1971 was minor and caused little damage. The Logan and Blacksmith Fork Rivers most recently reached

flood stage in 2005. The peak discharge recorded at USGS Gage Station 10109000 located along the Logan River above the State Dame was 1,260 cfs. The peak discharge recorded at USGS Gage Station 10113500 for the Blacksmith Fork River for the 2005 event is 1,570 cfs. Other storm events of note are the 1983, 1984 and 1997 events.

Spring Creek is an ungaged stream and information regarding past floods on this stream is very limited. The only flood which has been documented on this stream occurred on August 19, 1959, as a result of a heavy cloudburst. The USGS (Reference 2) estimated a peak discharge of 175 cfs at the canyon mouth, which is approximately equivalent to a 15-year flood. The storm caused flooding and damage in the City of Providence, but there were no reports of damage in the City of Logan.

Cloudbursts are an important source of flooding on Spring Creek at the canyon mouth; however, since these floods generally have a small volume, much of the floodwater dissipates before reaching the corporate limits of Logan. Snowmelt or rain-on-snow is felt to be the more critical cause of floods on Spring Creek within the corporate limits.

2.4 Flood Protection Measures

There are diversion dams that have been constructed on the Logan and Blacksmith Fork Rivers, but these structures have little impact upon the flooding potential for both rivers.

Following the 1971 flood, the COE improved the channel of the Logan River from Main Street to 600 West Street. The carrying capacity of the channel was increased by removal of silt and gravel from the channel and forming low levees. These levees will contain the 1- and 0.2-percent-annual chance flood events, but with a freeboard of less than one foot in some places. FEMA guidelines require three feet of freeboard for the 1-percent-annual chance flood event for artificial levees; thus, the levees were assumed to be ineffective in the analysis. The COE and County also conducted a dredging project in 1997 on the Blacksmith Fork River to improve the conveyance of the waterway.

A levee constructed along the channel of Blacksmith Fork immediately upstream of the Union Pacific Railroad bridge protects a subdivision from the floodwaters of Blacksmith Fork. The levee was evaluated for the "with" and "without" levee condition and it was determined that the two scenarios produced nearly identical water surface elevations. The levees were assumed to be ineffective in the analysis.

There are no other flood control facilities affecting the city authorized or under investigation at the present time. However, nonstructural measures

of flood protection are being utilized to aid in the prevention of future flood damage. These are in the form of land use regulations which control building within the 1-percent-annual-chance event floodplain.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

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

Detailed Analyses

Both the Logan and Blacksmith Fork Rivers have adequate gaging records for flood-frequency analyses. Frequency analyses were conducted in accordance with the U.S. Water Resources Council Guidelines, Bulletin 17A (Reference 3). The log-Pearson Type III probability distribution was assumed and a regional skew of -0.2 was used in calculations. The Logan River above the State Dam stream gage is located at the upstream limit of the study area and has more than 100 years of record while the Logan River below Blacksmith Fork stream gage is located only a few miles downstream of the study area and has more than 25 years of record. Thus, frequency estimates for the Logan River could be obtained directly from stream gaging records. The 10-percent-chance flood event flood discharge was found to be somewhat larger at the downstream stream gage; however, the 2-, 1- and 0.2-percent-chance flood event discharges were

slightly less. This decrease in the flood peak is most likely due to the attenuating effect of the wide flood plain in the valley area.

The Blacksmith Fork above the Utah Power and Light Company dam stream gage has over 90 years of record, but is located approximately 9 miles upstream from the study area. Therefore, it was necessary to transfer the flood-frequency estimates at the stream gage downstream to the study area. A 1971 USGS open file Report (Reference 4) which provides statistical regression equations relating watershed area and mean elevation to peak discharge for streams in Utah, was used for this transfer.

Spring Creek is the only ungaged stream in the study area. Three different methods for flood-frequency estimation on ungaged streams in the Logan Region were used to estimate the 10-percent-chance flood event for Spring Creek. Two of these methods were developed by the USGS (References 4 and 5) using statistical regressions relating parameters such as area and mean elevation to peak discharge.

The third method used was recently adopted by the Federal Highway Administration (Reference 6) for the design of bridges and culverts. This method also employs statistical regression to relate parameters such as area, change in elevation, and rainfall with peak discharge.

All three regional methods result in adequate predictions of the 10-percent-annual-chance flood event and can be used to obtain estimates up to the 2-percent-chance flood event. However, predictions of the 2-percent-chance flood event vary to some extent between methods. The FHWA method is the only one which can be used to estimate floods greater than the 2-percent-chance flood event. Estimates for the 10-, 4-, and 2-percent-chance flood events as predicted by the three regional methods were plotted on log-normal probability paper along with a 100-year flood estimate obtained using only the FHWA method. A best fit curve was then drawn through the 10- and 4-percent-chance flood events using the regional skew of -0.2 for extrapolation to the 2-, 1- and 0.2-percent-chance flood events. The best fit curve followed quite closely the estimates obtained from the FHWA method for the 2- and 1-percent-chance flood events.

The peak discharge for the Dry Canyon reach was taken the "Dry Canyon Hydrologic Modeling, Sediment Yield and Sediment Transport Analyses, Logan, Utah" report dated October 2006 and prepared by Anderson Consulting Engineers (Reference 7). A HEC-HMS rainfall-runoff hydrologic model was completed to determine the 1-percent-chance-annual flood event for Dry Canyon. The result of the hydrologic modeling, 640 cfs, was then increased by 11% to accommodate for the calculated sediment transport passing through the debris basin. The resulting bulked 1-percent-chance flood event flow of 710 cfs was then

used within the hydraulic analysis for the Dry Canyon storm sewer system.

A summary of drainage area-peak discharge relationships for each stream studied using detailed analyses is shown in Table 2.

Table 2. Summary of Discharges

		Peak Discharges (Cubic Feet Per Second)			
Flooding Source and Location	Drainage Area (Square Miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Dry Creek					
At Debris Basin Inlet	3.6	--[1]	--[1]	710	--[1]
Logan River					
At State Dam	218	1,670	2,170	2,380	2,880
At Mendon Road	524	1,710	2,130	2,300	2,710
Spring Creek					
At US Highway 89-91	19.9	160	260	300	420
Blacksmith Fork					
At Confluence with Logan River	287	1,070	1,700	2,000	2,750

[1] Data not available

Approximate Analyses

Peak discharges for the streams studied by approximate methods can be found in the December 2009 hydrologic study report performed by Michael Baker, Jr., Inc. (Reference 8). The analysis was completed using regression equations derived in USGS Fact Sheet 124-98 (Reference 9). USGS topographic maps were used to create drainage basins.

3.2 Hydraulic Analyses

Detailed Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in Logan were carried out to provide estimates of the elevations of floods of selected recurrence intervals along each of the flood sources.

Cross sections used for the backwater analyses of the streams studied were obtained by actual field survey. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. Roughness values for the main channels and flood plain areas of flood sources are listed in Table 3. Values shown apply to all flood events. Additionally, the roughness values represent the values that were used in the original hydraulic analyses and do not reflect changes that may have occurred since the original studies were completed.

Table 3. Manning's "n" Values

	Roughness Factor (Manning's "n" Values)	
Flooding Source	Main Channel Values	Floodplain Values
Logan River	0.033 - 0.045	0.035 - 0.080
Spring Creek	0.024 - 0.040	0.035 - 0.060
Blacksmith Fork	0.035 - 0.043	0.045 - 0.060

Water-surface elevations of floods of the selected recurrence intervals for the detailed study streams were computed by the use of the COE HEC-2 step-backwater computer program (Reference 10). Flood profiles for the selected recurrence intervals were drawn showing the computed water-surface elevation. Starting water-surface elevations for Spring Creek and the Logan River were determined by normal depth calculations. The starting water-surface elevation for Blacksmith Fork was assumed at critical depth since normal depth calculations were in the supercritical flow regime. Elevation reference marks used in the study are shown on the maps.

Since the freeboard for the levees located between the Union Pacific Railroad and the Main Street bridge along the Logan River and immediately upstream of the Union Pacific Railroad along Blacksmith Fork do not meet FEMA standards, it was necessary to evaluate the effect of the levees on water-surface elevations for two opposing conditions. First, it was assumed that the levee would hold during a major flood and water-surface elevations were computed accordingly. Second, it was assumed the levee would not hold and water-surface elevations were computed as if the levee did not exist. Both analyses were used in mapping the flood plain in these areas. For Blacksmith Fork, the two conditions produced nearly identical water surface elevations and a

separate water surface elevation profile was not deemed to be necessary; whereas, for the Logan River water-surface elevations computed for the first condition were significantly higher than those computed for the second condition and a separate water surface elevation profile for the without consideration of the levee scenario has been included.

The hydraulic analyses for this study were based on unobstructed flow with two exceptions. A culvert on Spring Creek at a field driveway located approximately 400 feet upstream from U.S. 89-91 was assumed to be 50 percent obstructed. This culvert was obstructed at the time of the field survey and is likely to be obstructed at the time of a major flood. The second exception to the assumption of unobstructed flow was at the Union Pacific Railroad bridge over the Logan River approximately 0.3 mile upstream from 600 West Street. This bridge was assumed to be 30 percent obstructed since it is prone to the collection of debris against its piers. The flood elevations shown on the profiles are thus considered valid only if the hydraulic structures, and other than those listed above, remain unobstructed, operate properly, and do not fail.

The results from the hydraulic analysis for the Dry Canyon Watershed Improvement Project which was prepared in December 2008 by Carollo Engineers were incorporated into the DFIRM (Reference 11). The analysis included a detailed hydraulic analysis for the Dry Canyon debris basin and storm sewer within the City of Logan. The hydraulic analysis was performed using XPSWMM Version 10.6.2 and shows that the storm sewer system contains the 1%-annual-chance event the entire length of the system from the Dry Canyon Debris Basin to the outfall at the Logan River.

Approximate Analyses

An approximate hydraulic analysis was performed on approximately 250 total stream miles by Michael Baker, Jr., Inc. in December 2009 (Reference 8). USACE's HEC-RAS version 3.1.3 computer program was used to perform the hydraulic analyses. The following is a summary of the streams that were restudied by approximate methods: Wide Hollow, portions of Little Bear River, Wide Hollow Tributary 2, Wide Hollow Tributary 3, a portion of Wide Hollow Tributary 1, a portion of Spring Creek, a portion of Blacksmith Fork, Millville Canyon, Left Hand Fork, Bear River, Bear River Tributary 1, Bear River Tributary 3, Bear River Tributary 4, Cub River, Cub River Tributary 1, Cub River Tributary 2, Worm Creek, Worm Creek Tributary 1, Myler Creek, Clay Slough, Clarkston Creek, City Creek, Bear River, Al Archibald Hollow and Al Archibald Hollow Tributary 1.

The previous effective floodplain information was used for the streams that were not restudied in the new analysis.

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.

The vertical datum offset values used for this countywide study are included in Table 4, "Vertical Datum Offset Table."

Table 4. Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)
Blacksmith Fork	3.56
Logan River	3.54
Spring Creek	3.56

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community.

The 1-percent-annual-chance floodplain boundaries are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, and VE), 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 each stream studied in detail, the 1-percent-annual-chance floodplain boundary has been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:12,000, with contour intervals of 2 feet (Reference 12).

For this study, the approximate flood boundaries were taken from the Flood Hazard Boundary Maps for the unincorporated areas of Cache County (Reference 13) or from the revised approximate analyses completed by Michael Baker, Jr., Inc. in December 2009 (Reference 8).

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

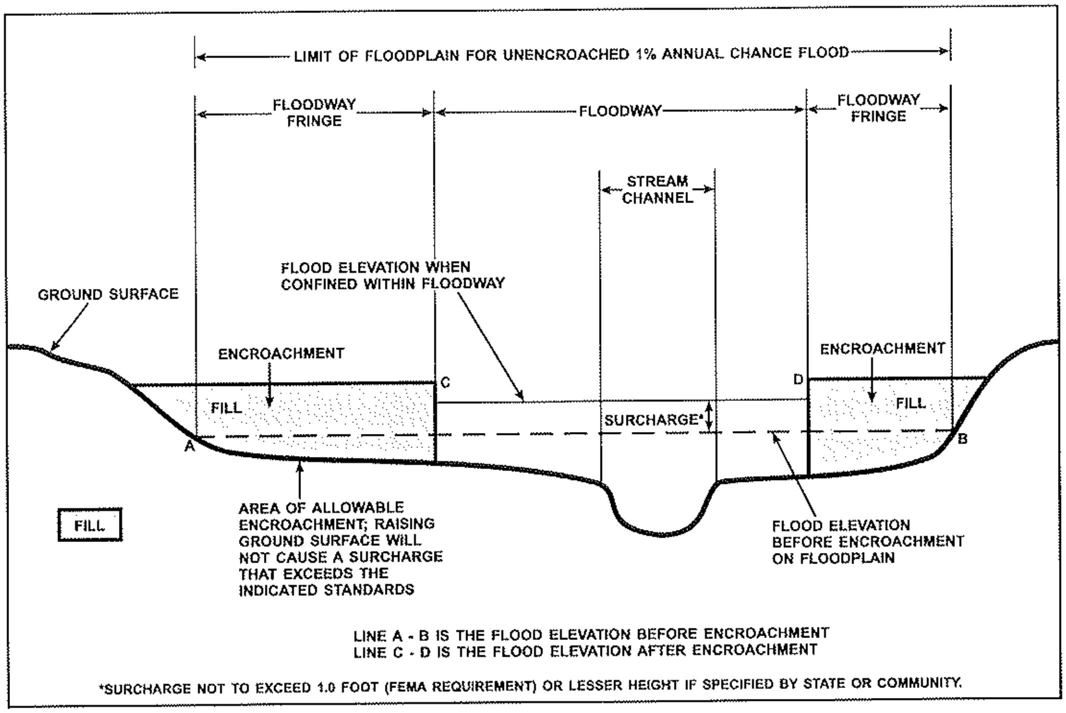
4.2 Floodways

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.

Figure 1. Floodway Schematic



FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BLACKSMITH FORK								
A	765	56	261	7.7	4,471.2	4,471.2	4,471.5	0.3
B[2]	3,525	43	103	9.3	4,476.5	4,476.5	4,477.4	0.9
C[2]	3,640	59	188	5.1	4,479.7	4,479.7	4,480.3	0.6
D[2]	7,690	127	252	3.8	4,491.2	4,491.2	4,492.2	1.0
E[2]	8,890	94	149	6.4	4,497.9	4,497.9	4,498.4	0.5
F[2]	11,390	60	210	4.5	4,511.0	4,511.0	4,511.4	0.4
G[2]	11,474	809	415	4.8	4,512.2	4,512.2	4,513.2	1.0
H[2]	11,490	1,326	1,700	1.2	4,512.6	4,512.6	4,513.6	1.0
I[2]	11,590	1,388	2,916	0.7	4,512.8	4,512.8	4,513.6	0.8
J[2]	12,590	47	182	11.0	4,517.8	4,517.8	4,517.8	0.0
K[2]	12,635	32	158	12.7	4,519.0	4,519.0	4,519.0	0.0
L[2]	12,684	32	228	8.8	4,521.1	4,521.1	4,521.1	0.0
M[2]	12,744	375	1,946	1.0	4,522.7	4,522.7	4,522.7	0.0

[1] Stream Distance in Feet Above Mouth
[2] Cross Section is not Shown on FIRM. This data is for informational purposes only.

TABLE 5	FEDERAL EMERGENCY MANAGEMENT AGENCY **CACHE COUNTY, UT (AND INCORPORATED AREAS)**	**FLOODWAY DATA** **BLACKSMITH FORK**

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
LOGAN RIVER								
A[2]	28	61	439	5.2	4,431.0	4,431.0	4,432.0	1.0
B[2]	1,440	364	843	2.7	4,432.8	4,432.8	4,433.2	0.4
C[2]	3,040	68	372	6.2	4,435.3	4,435.3	4,435.6	0.3
D[2]	4,190	78	491	4.7	4,437.2	4,437.2	4,438.0	0.8
E[2]	6,490	110	488	4.7	4,441.4	4,441.4	4,441.7	0.3
F[2]	8,490	60	347	6.6	4,446.2	4,446.2	4,446.6	0.4
G[2]	12,440	145	629	3.7	4,454.5	4,454.5	4,455.5	1.0
H[2]	13,440	87	460	5.0	4,456.8	4,456.8	4,457.3	0.5
I[2]	15,240	95	440	5.2	4,460.9	4,460.9	4,461.1	0.2
J[2]	15,340	130	617	3.7	4,461.4	4,461.4	4,461.7	0.3
K[2]	15,390	130	623	3.7	4,461.4	4,461.4	4,461.7	0.3
L	15,510	102	600	3.8	4,461.6	4,461.6	4,461.8	0.2
M	17,890	55	307	7.5	4,465.4	4,465.4	4,466.2	0.8
N	18,070	99	452	5.1	4,467.4	4,467.4	4,467.5	0.1
O	19,620	115	471	5.1	4,471.6	4,471.6	4,472.6	1.0
P	19,740	200	1,414	1.7	4,475.0	4,475.0	4,475.8	0.8
Q	23,040	88	361	6.6	4,487.6	4,487.6	4,487.6	0.0
R	24,990	68	219	10.9	4,496.1	4,496.1	4,496.1	0.0
S	27,240	52	318	7.5	4,510.4	4,510.4	4,510.4	0.0
T	27,540	52	251	9.5	4,511.3	4,511.3	4,511.4	0.1
U	28,230	80	316	7.5	4,516.4	4,516.4	4,516.4	0.0
V	28,400	53	263	9.1	4,518.0	4,518.0	4,518.0	0.0
W	30,565	67	309	7.7	4,531.6	4,531.6	4,531.8	0.2
X	30,720	114	419	5.7	4,532.6	4,532.6	4,532.8	0.2
Y	31,570	71	290	8.2	4,536.9	4,536.9	4,536.9	0.0
Z	31,716	55	377	6.3	4,539.8	4,539.8	4,539.8	0.0

[1] Stream distance in feet above Sunday Creek
[2] Cross Section is not Shown on the FIRM. This data is for informational purposes only.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT (AND INCORPORATED AREAS)

FLOODWAY DATA

LOGAN RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
LOGAN RIVER (CONTINUED)								
AA	33,540	55	199	11.9	4,552.1	4,552.1	4,552.1	0.0
AB	33,720	55	285	8.4	4,557.0	4,557.0	4,557.0	0.0
AC	34,480	54	317	7.5	4,561.7	4,561.7	4,561.7	0.0
AD	34,640	88	256	9.3	4,562.8	4,562.8	4,562.8	0.0
AE	35,600	51	249	9.6	4,572.4	4,572.4	4,572.4	0.0
AF	35,763	80	337	7.1	4,576.5	4,576.5	4,576.5	0.0
AG	36,723	57	295	8.1	4,581.8	4,581.8	4,581.9	0.1
AH	36,773	66	516	4.6	4,590.4	4,590.4	4,591.4	1.0
AI	36,913	71	536	4.4	4,590.6	4,590.6	4,591.6	1.0
AJ	38,790	98	246	9.7	4,601.2	4,601.2	4,601.2	0.0
AK	40,300	67	307	7.8	4,619.1	4,619.1	4,619.1	0.0
AL	42,730	68	198	12.0	4,645.0	4,645.0	4,645.0	0.0
AM	42,900	75	517	4.6	4,649.3	4,649.3	4,649.3	0.0
LOGAN RIVER (WITHOUT CONSIDERATION OF LEVEE)								
Q	23,040	483	866	2.7	4,485.3	4,485.3	4,486.3	1.0

[1] Stream Distance in Feet Above Mendon Road

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT (AND INCORPORATED AREAS)

FLOODWAY DATA

LOGAN RIVER, LOGAN RIVER WITHOUT CONSIDERATION OF LEVEE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
SPRING CREEK								
A	900	42	94	3.2	4,477.9	4,477.9	4,478.9	1.0
B	2,680	438	84	3.6	4,485.7	4,485.7	4,486.3	0.6
C	2,817	139	211	1.4	4,487.9	4,487.9	4,488.8	0.9
D[2]	3,035	118	338	0.9	4,491.4	4,491.4	4,491.4	0.0
E[2]	4,135	33	49	6.1	4,492.0	4,492.0	4,492.0	0.0
F[2]	4,365	31	103	2.9	4,498.2	4,498.2	4,498.2	0.0
G[2]	6,495	28	48	6.2	4,504.8	4,504.8	4,504.8	0.0
H[2]	6,855	159	306	1.0	4,508.0	4,508.0	4,508.0	0.0
I[2]	7,355	18	41	7.4	4,510.2	4,510.2	4,510.2	0.0
J[2]	9,655	62	101	3.0	4,528.2	4,528.2	4,528.3	0.1
K[2]	9,955	94	669	0.4	4,537.9	4,537.9	4,537.9	0.0

[1] Stream Distance in Feet Above Mouth
[2] Cross Section is not on the FIRM. This data is for informational purposes only.

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT (AND INCORPORATED AREAS)

FLOODWAY DATA

SPRING CREEK - LOGAN AND PROVIDENCE

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 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 AH

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

Zone AO

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

Zone X

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

6.0 FLOOD INSURANCE RATE MAP

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

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

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

The countywide FIRM presents flooding information for the entire geographic area of Cache 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 REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Amalga, Town of	September 5, 1975	N/A	July 22, 1980	N/A
Cache County (Unincorporated Areas)	September 29, 1981	N/A	February 1, 1987	N/A
Clarkston, Town of	September 5, 1975	N/A	August 19, 1980	N/A
Cornish, Town of	May 24, 2011	N/A	May 24, 2011	N/A
Hyde Park, Town of	August 2, 1974	N/A	July 29, 1980	N/A
Hyrum, City of	May 24, 1974	N/A	April 8, 1980	N/A
Lewiston, City of	August 16, 1974	N/A	July 29, 1980	N/A
Logan, City of	January 16, 1974	N/A	September 28, 1984	N/A
Mendon, City of	July 18, 1975	N/A	July 22, 1980	N/A
Millville, Town of	October 22, 1976	N/A	May 24, 2011	N/A
Newton, Town of	July 11, 1975	N/A	July 22, 1980	N/A
Nibley, Town of	July 18, 1975	N/A	August 5, 1986	N/A
North Logan, City of	June 28, 1974	N/A	March 18, 1986	N/A
Paradise, Town of	November 5, 1976	N/A	May 24, 2011	N/A
Providence, City of	May 24, 2011	N/A	May 24, 2011	N/A
Richmond, City of	April 2, 1976	N/A	August 12, 1980	N/A
River Heights, City of	May 24, 2011	N/A	May 24, 2011	N/A
Smithfield, City of	June 28, 1974	N/A	March 18, 1986	N/A
Trenton, Town of	May 24, 2011	N/A	May 24, 2011	N/A
Wellsville, City of	June 21, 1974	N/A	July 29, 1980	N/A

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

No previous Flood Insurance Studies have been conducted for the City of Logan. However, a Flood Hazard Boundary Map (Reference 13) was prepared by the Federal Insurance Administration and published in 1977. This map is superseded by the present study. The COE completed a Flood Plain Information report for the Logan River in 1973 (Reference 14) and a Flood Plain Information report for Blacksmith Fork and Spring Creek in 1976 (Reference 15). These investigations included mapping of the flood plains along the various streams for the intermediate regional and standard project floods. (l)

Significant differences were found between the water-surface elevations and flood plain boundaries computed by the COE for the intermediate regional flood and those computed in this Flood Insurance Study for the 100-year flood on the Logan River, Blacksmith Fork, and Spring Creek. Water-surface elevations computed in this study were generally lower than those computed by the COE.

The differences may be attributed mainly to the different hydrologic and hydraulic methodologies used. The peak flood discharges used in hydraulic computations for this study differed significantly from that of the COE for the Logan River below its confluence with Blacksmith Fork, for Blacksmith Fork, and Spring Creek. A report was prepared (Reference 16) outlining the rationale and computations employed to obtain the peak discharges used in this study and was submitted to the COE for review and comments. The COE indicated that the flood discharge estimates used in this study are reasonable since they were based upon more recent information than was available at the time of their studies.

More improved mapping was available for this Flood Insurance Study than was available to the COE at the time of their study. Aerial photographic maps at a scale of 1:1,200 with a contour interval of 2 feet were used for the Logan River above 1000 West Street, Blacksmith Fork below 1700 South Street, and Spring Creek below State Road 165, whereas, the COE was obliged to use USGS Quadrangle Maps at a scale of 1:24,000 with a contour interval of 10 feet.

(l)The COE defines the intermediate regional and standard project floods as follows:

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of stream flow records

available for the watershed and analyses of rainfall and runoff characteristics in the general region of the watershed.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally approximately 40 to 60 percent of the Probable Maximum Floods for the same basins. As used by the COE. Standard Project Floods are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

One specific point where the 100-year flood profile of this study differs significantly from that of the COE study is at the Union Pacific Railroad bridge over the Logan River just above the confluence of Blacksmith Fork. The difference is due to the assumption of 30 percent blockage by debris in computations made for this study, whereas the COE assumed no debris blockage. This resulted in a higher water-surface elevation upstream of bridge.

There are no other studies past or present which will significantly affect the results of this study. Flood discharges, elevations, and boundaries as computed in the Flood Insurance Study were adopted for use since it was determined that they best represent current hydrologic and hydraulic procedures and existing physical and topographic conditions.

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 VIII, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

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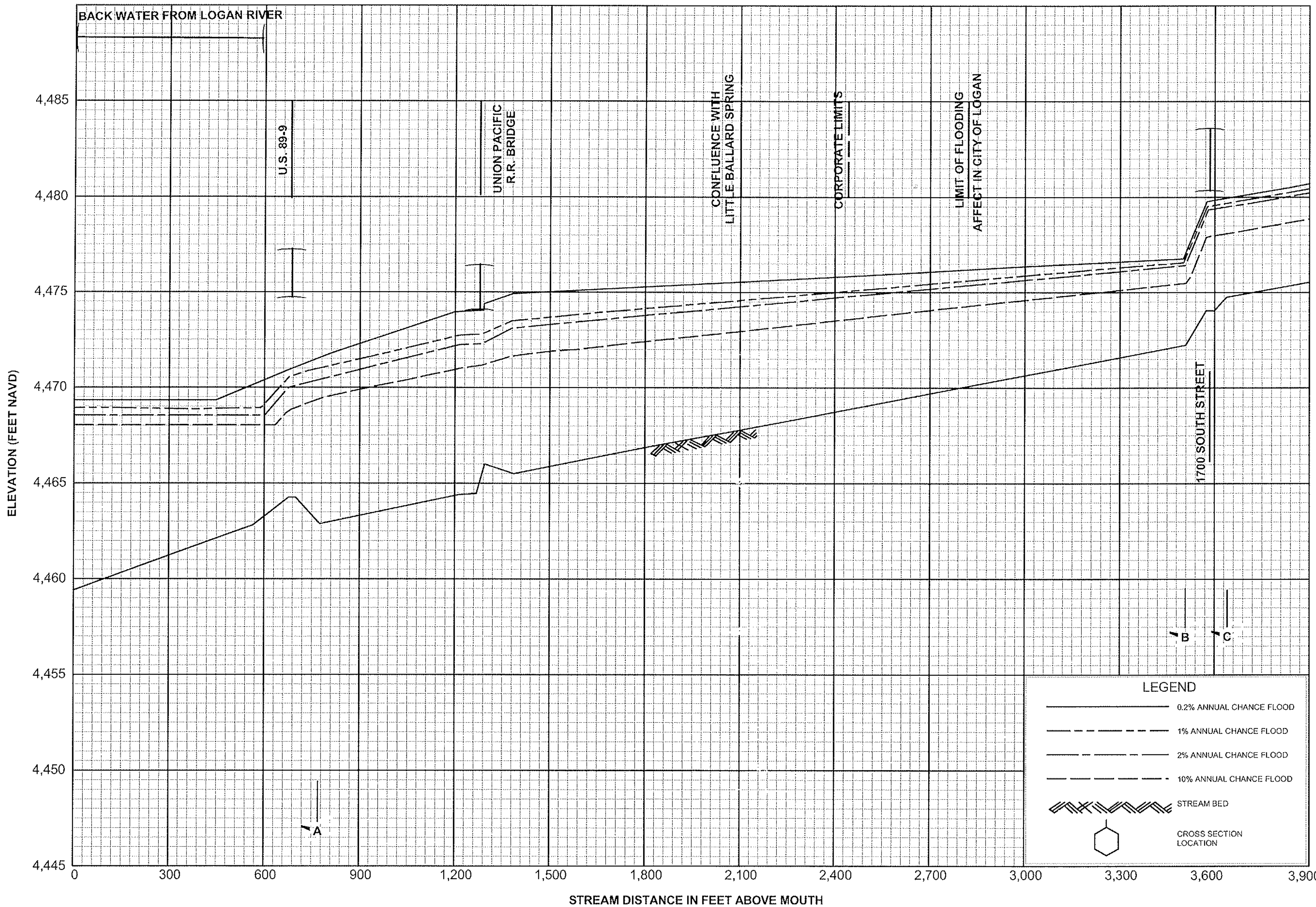

FLOOD PROFILES

BLACKSMITH FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT

AND INCORPORATED AREAS

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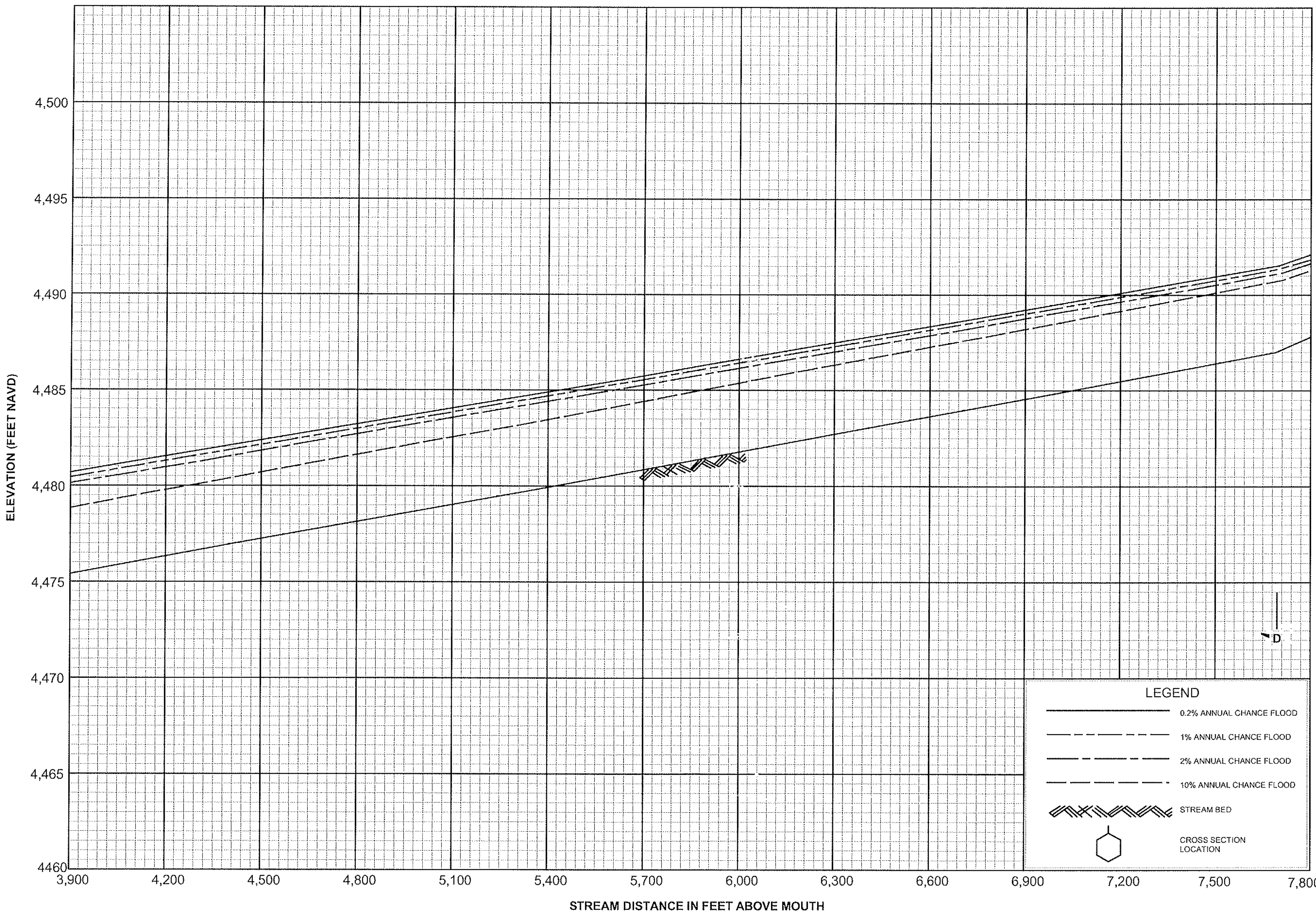

FLOOD PROFILES

BLACKSMITH FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT

AND INCORPORATED AREAS

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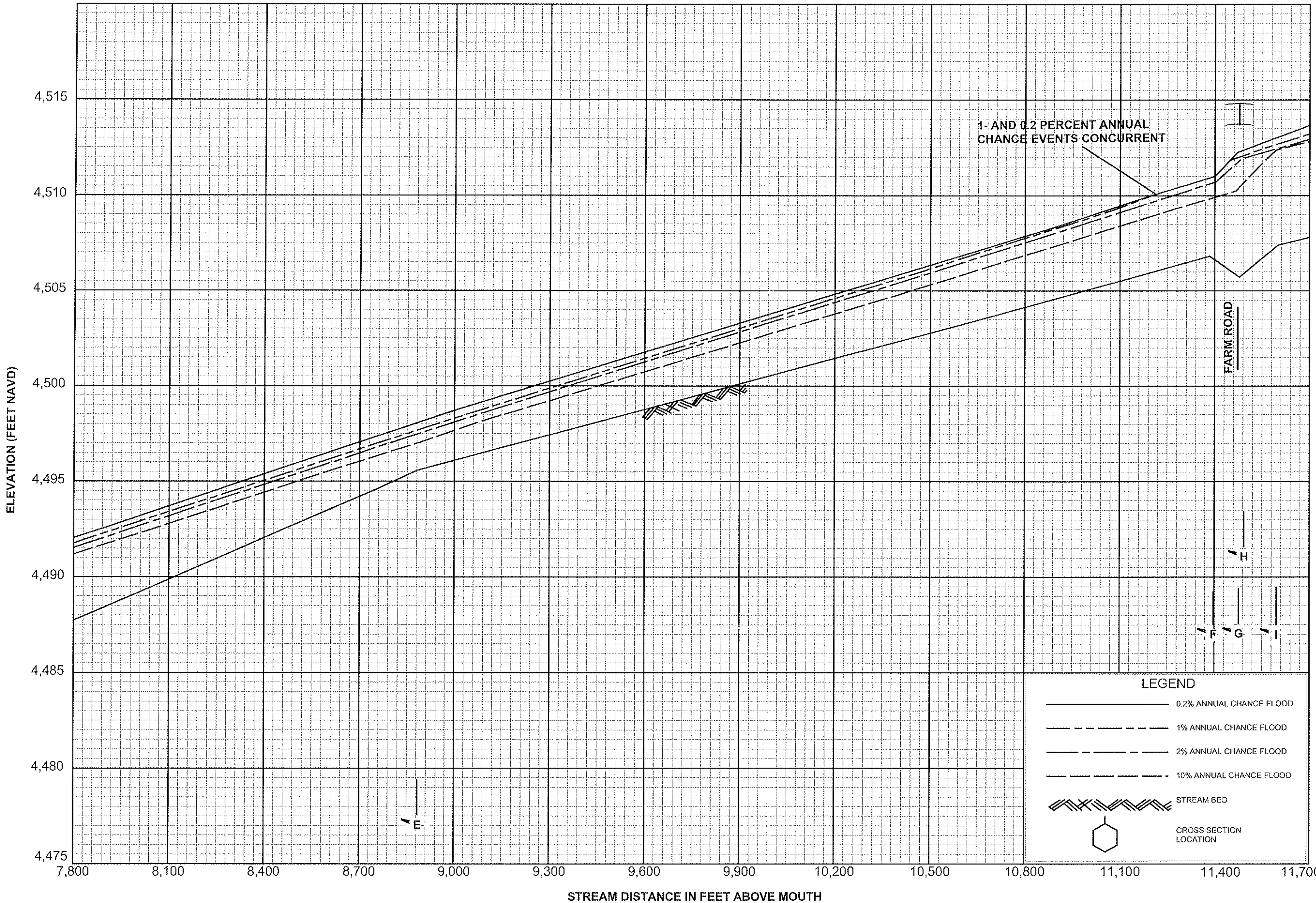


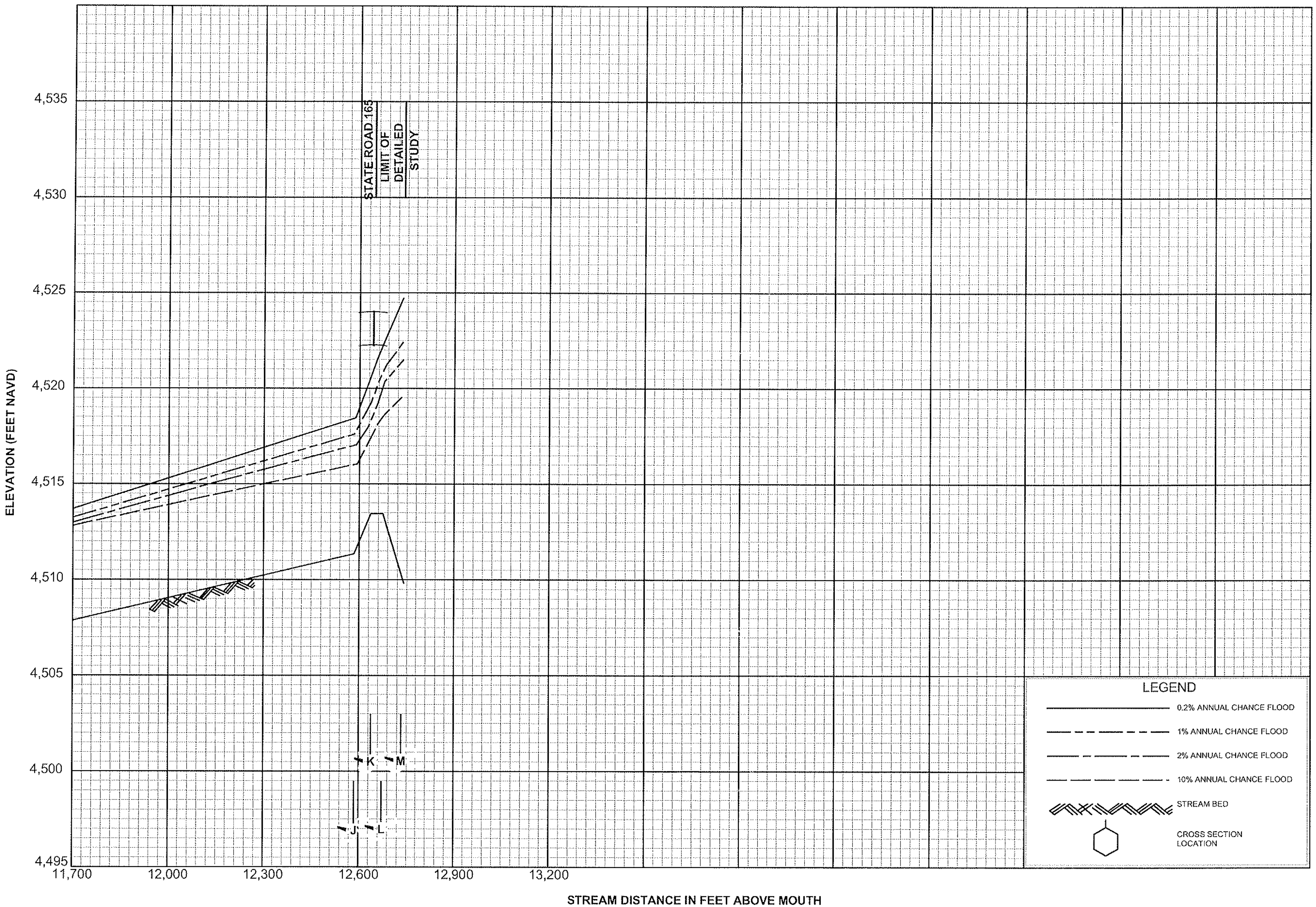
FLOOD PROFILES

BLACKSMITH FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT

AND INCORPORATED AREAS



FLOOD PROFILES

BLACKSMITH FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT

AND INCORPORATED AREAS

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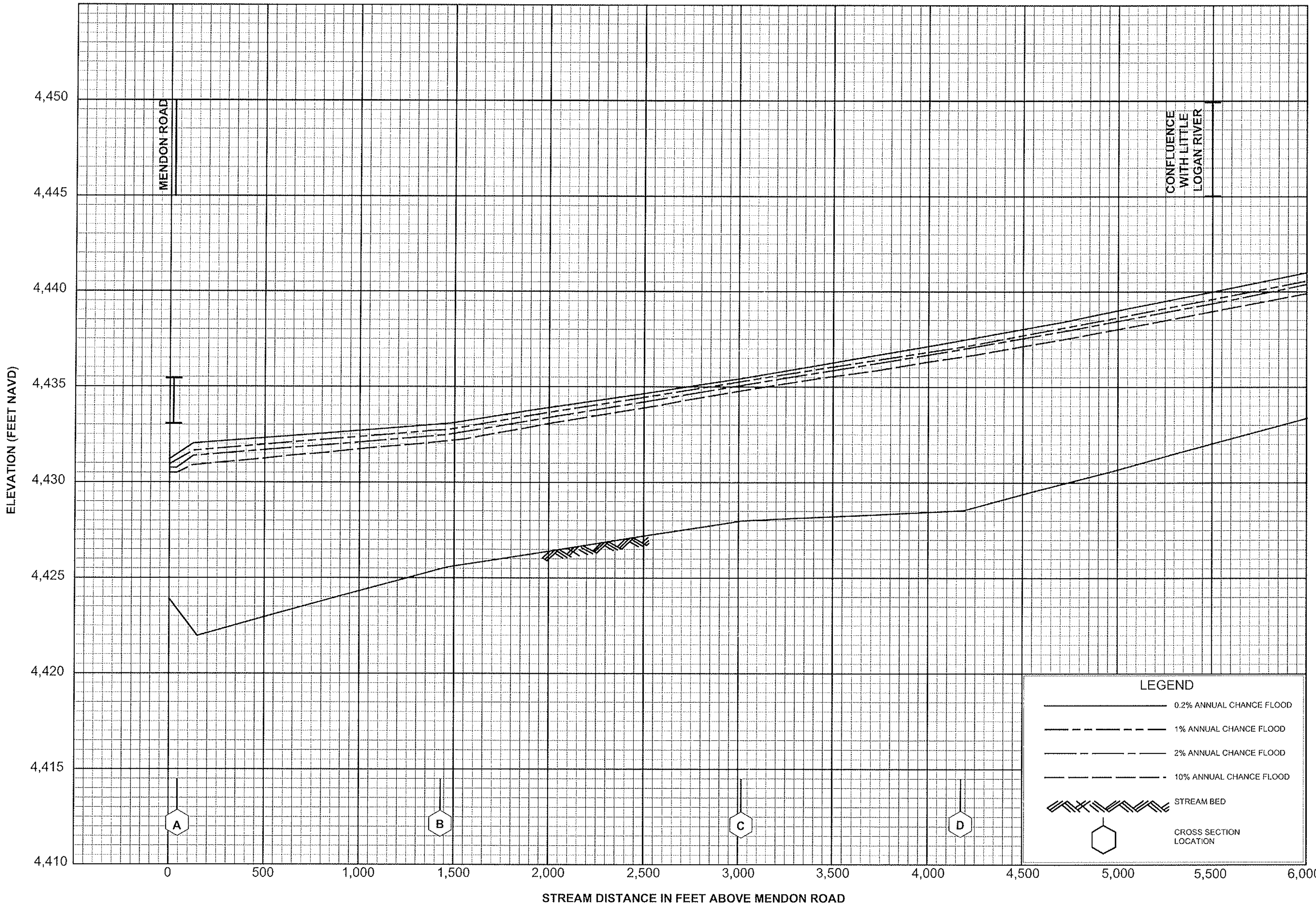


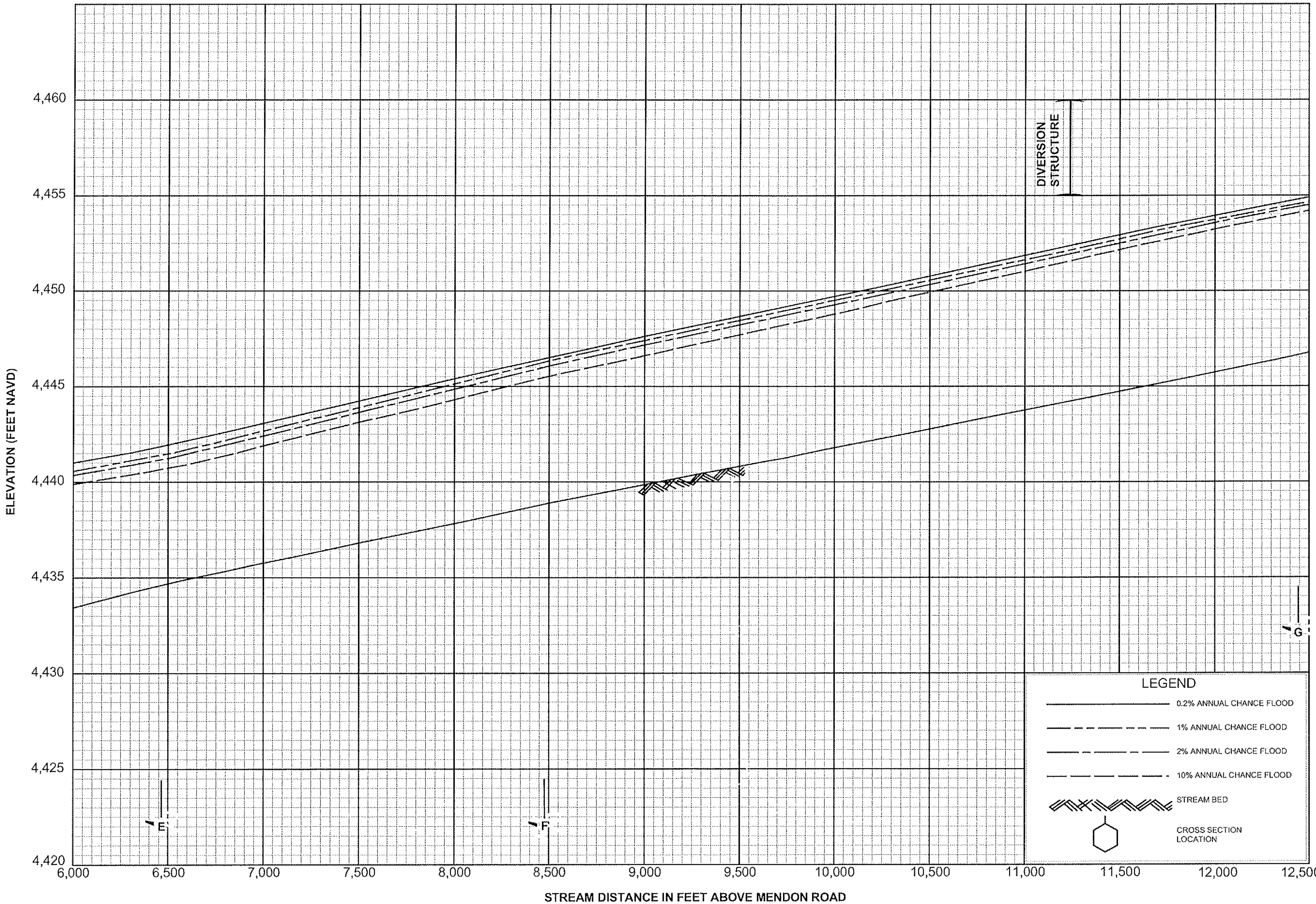
FLOOD PROFILES

LOGAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT

AND INCORPORATED AREAS

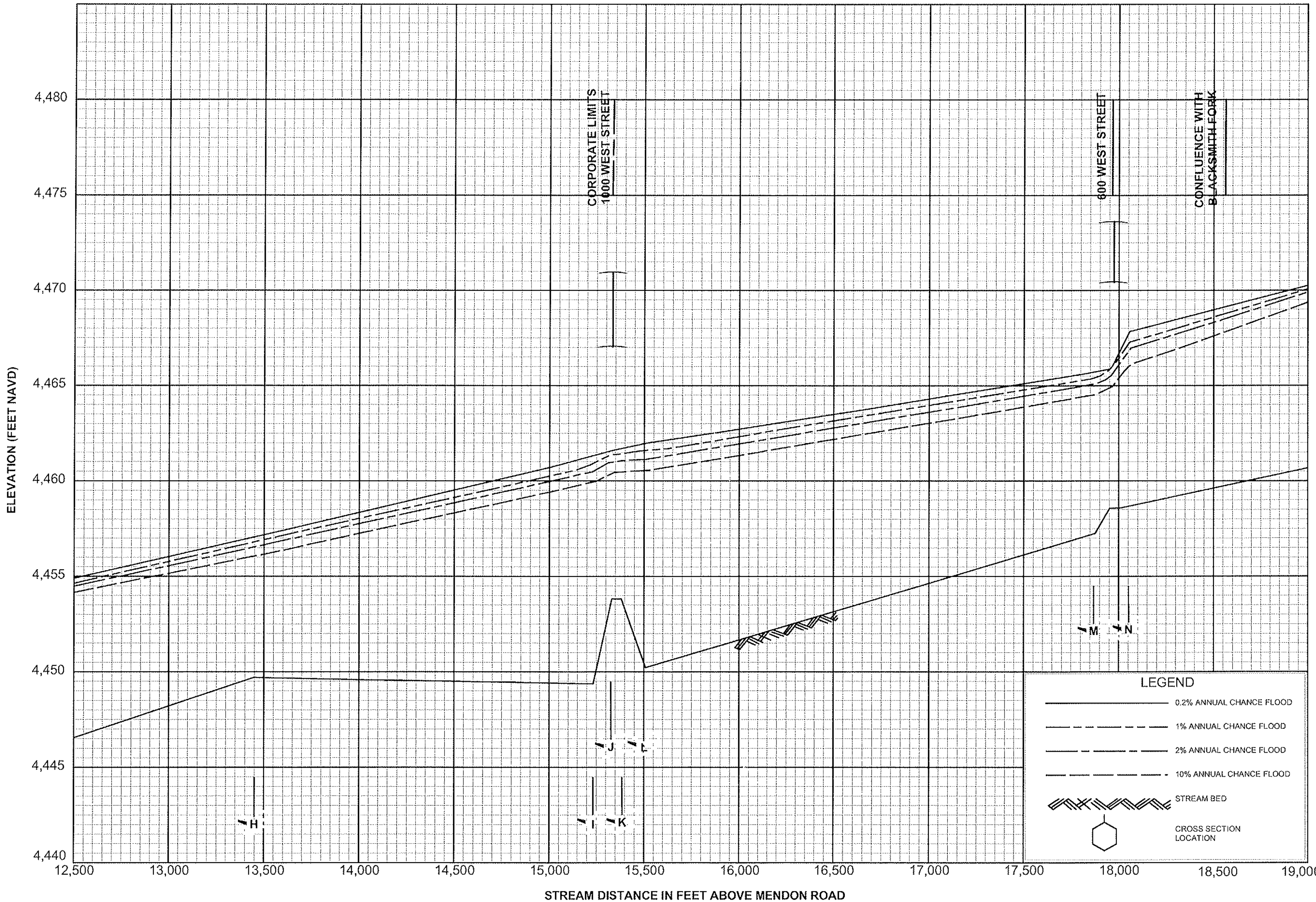


FLOOD PROFILES

LOGAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT
AND INCORPORATED AREAS



FLOOD PROFILES

LOGAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT
AND INCORPORATED AREAS

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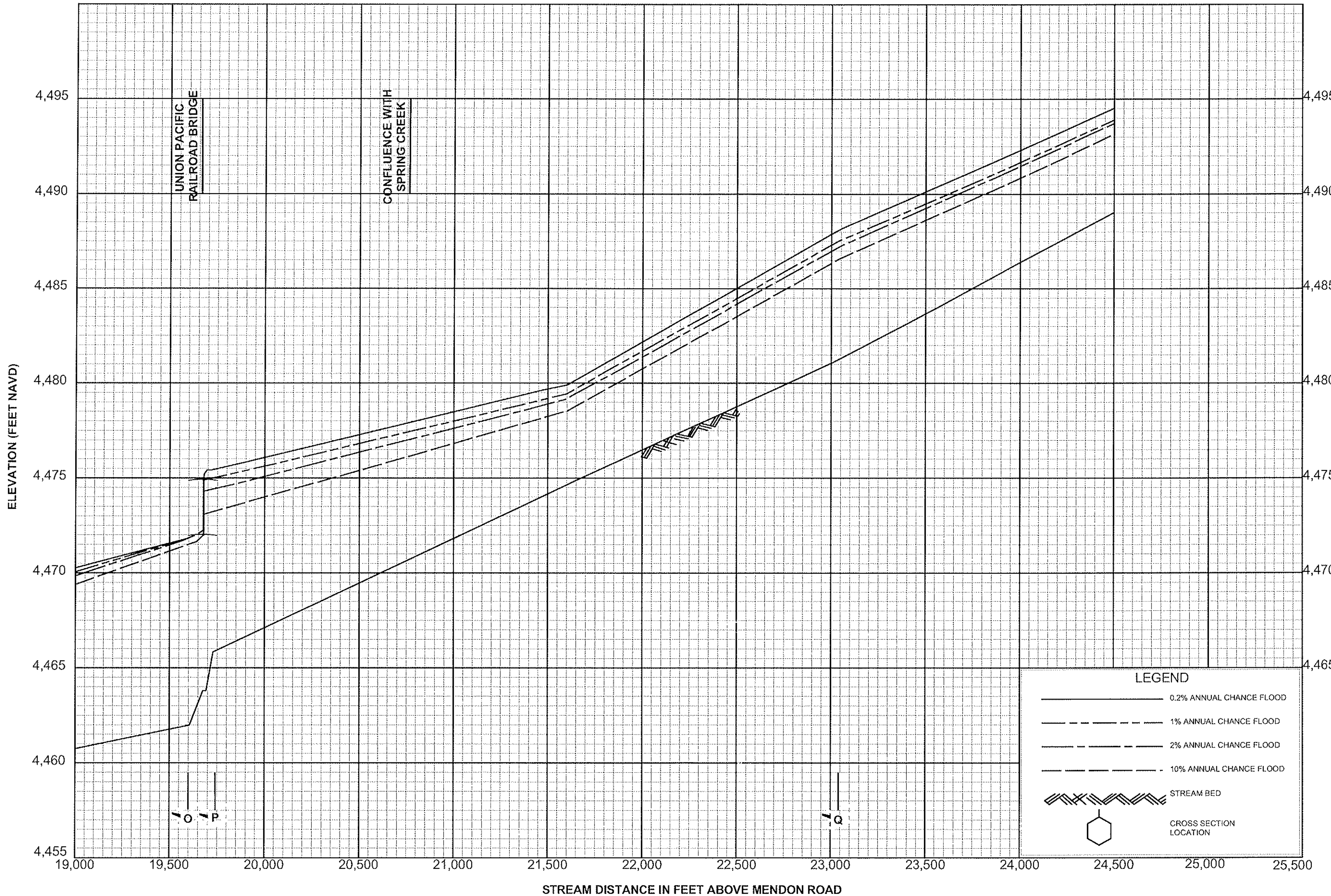
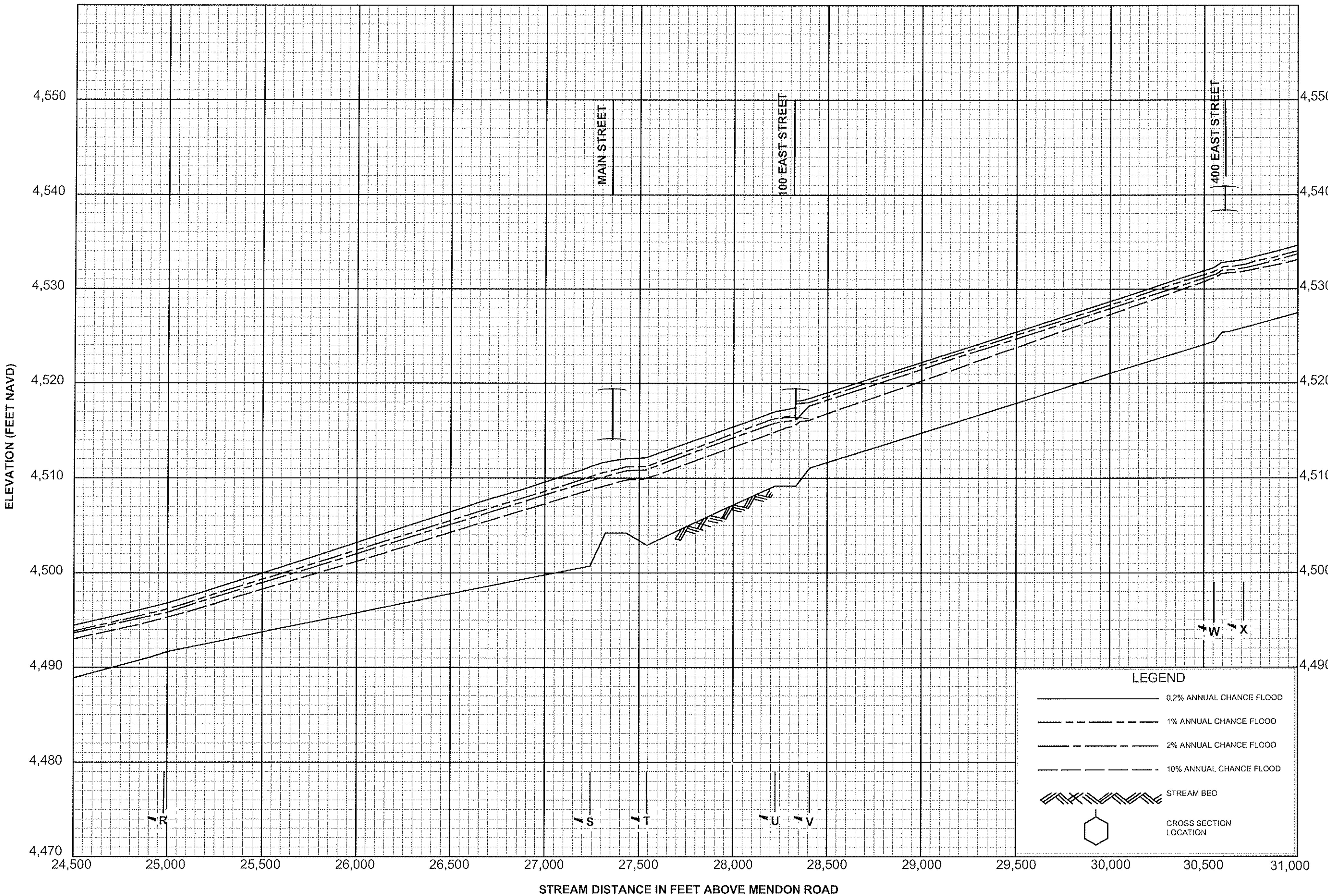


FLOOD PROFILES

LOGAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT
AND INCORPORATED AREAS



FLOOD PROFILES

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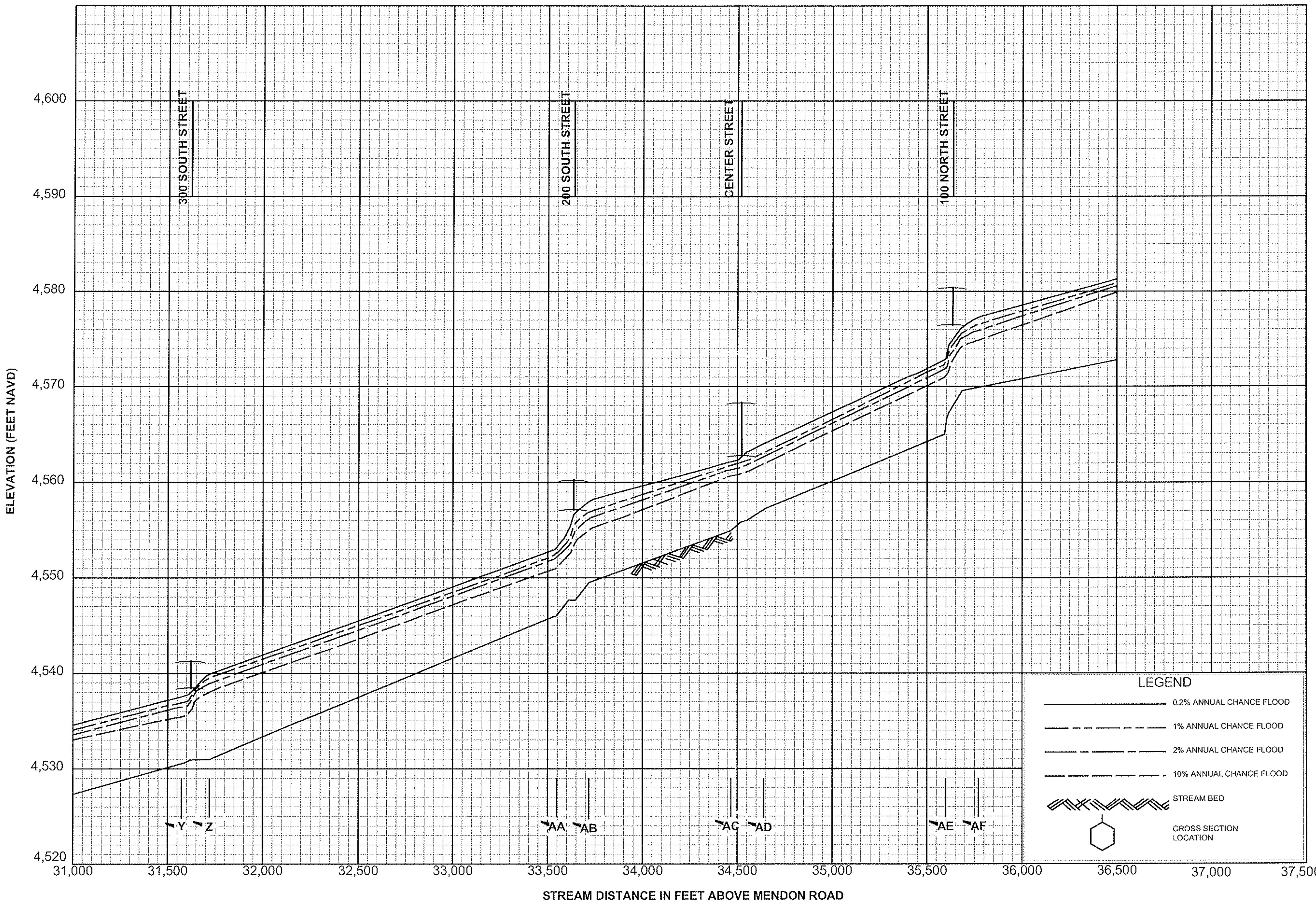
CACHE COUNTY, UT
AND INCORPORATED AREAS



FLOOD PROFILES

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CACHE COUNTY, UT

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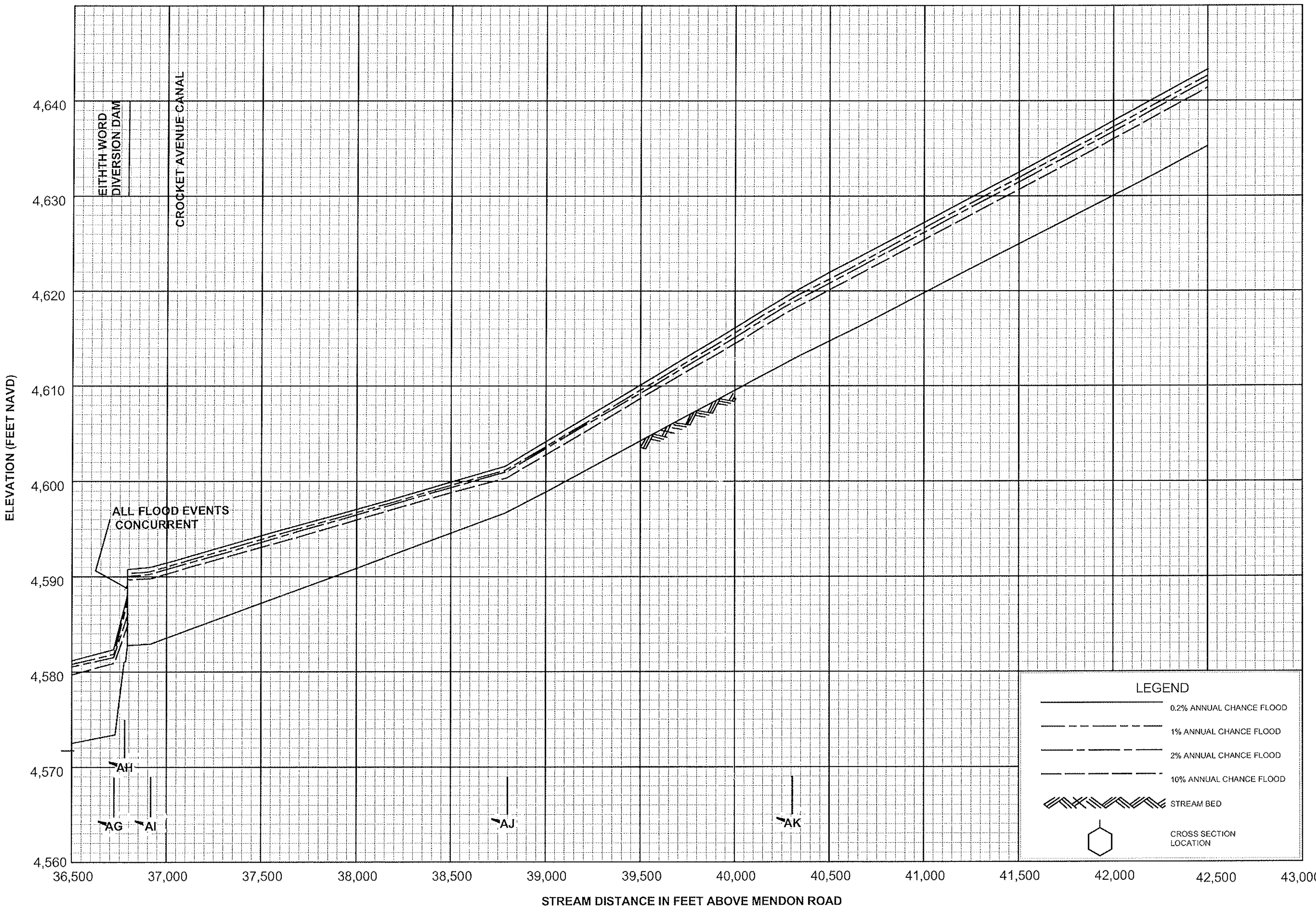

FLOOD PROFILES

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CACHE COUNTY, UT
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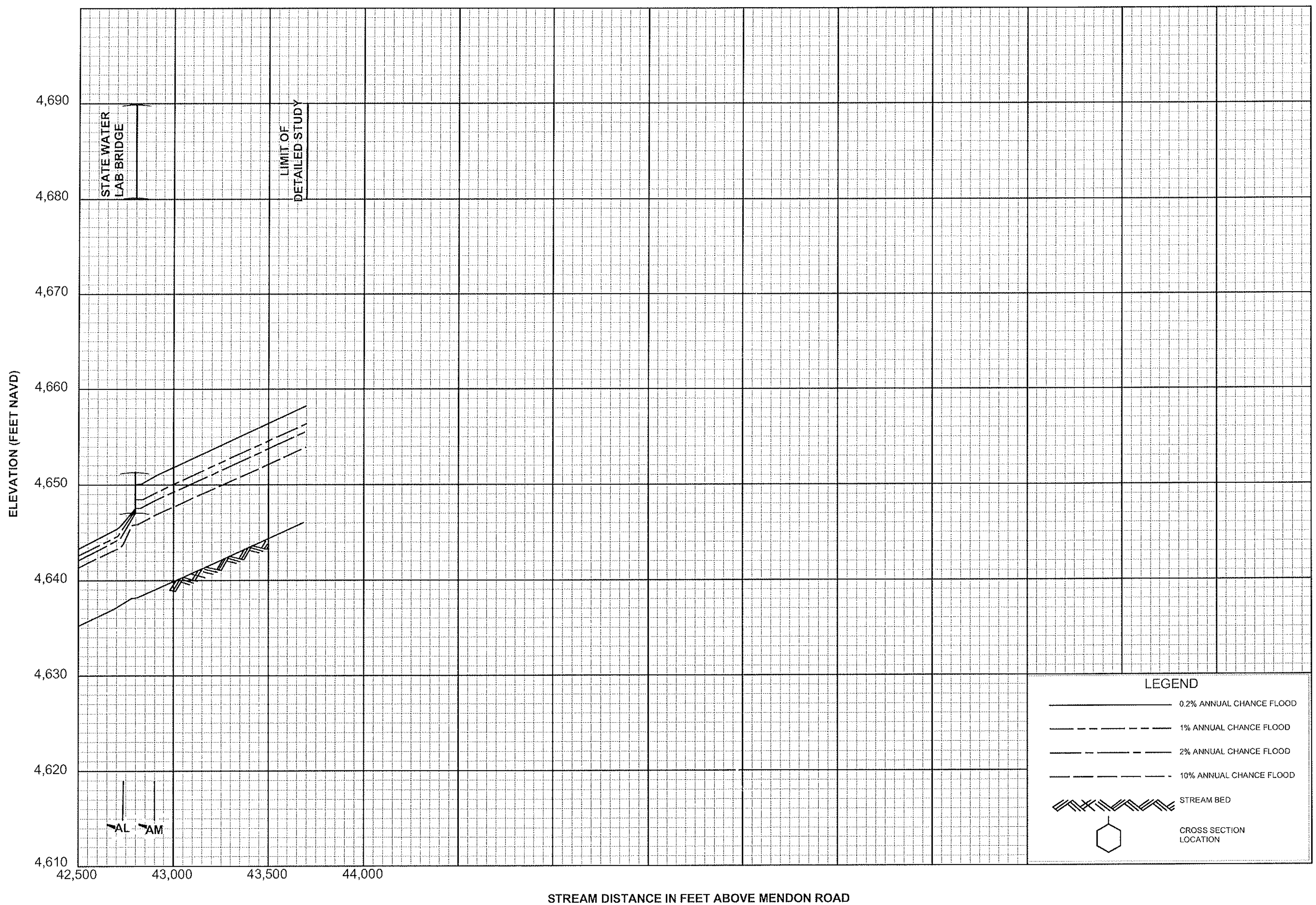

FLOOD PROFILES

LOGAN RIVER

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CACHE COUNTY, UT
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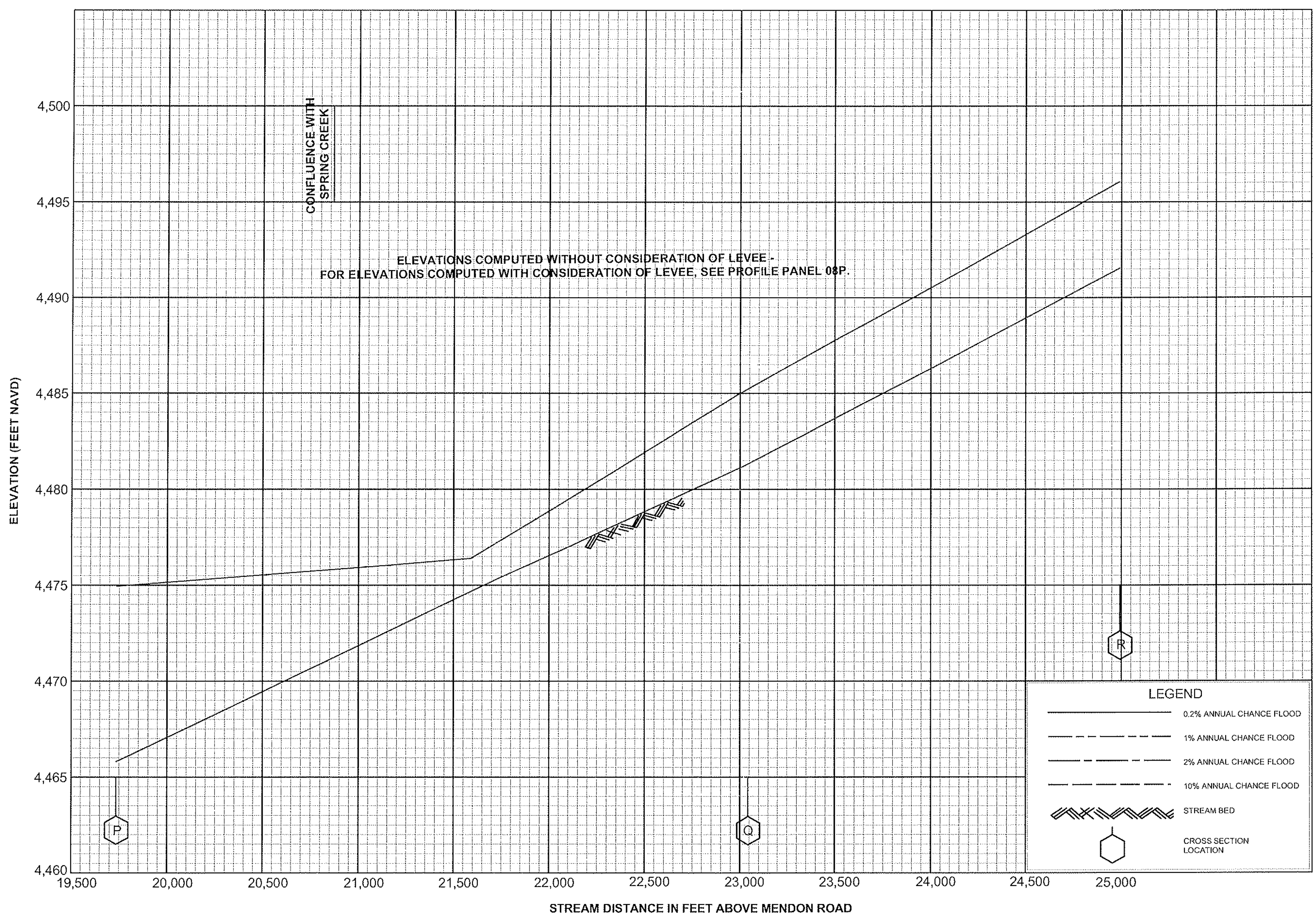


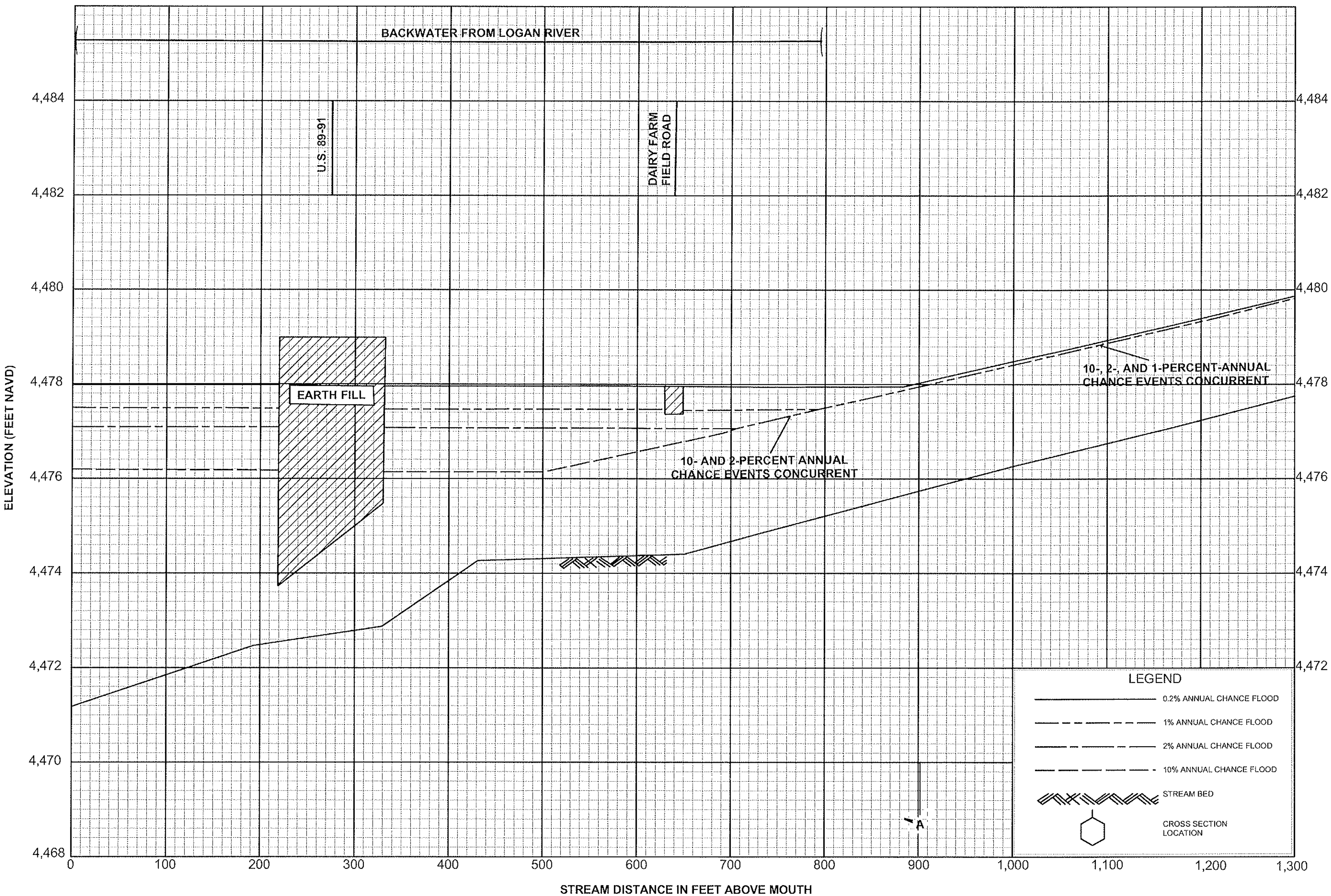
FLOOD PROFILES

LOGAN RIVER - WITHOUT CONSIDERATION OF LEVEE

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT
AND INCORPORATED AREAS

13 P



FLOOD PROFILES

SPRING CREEK - LOGAN AND PROVIDENCE

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT

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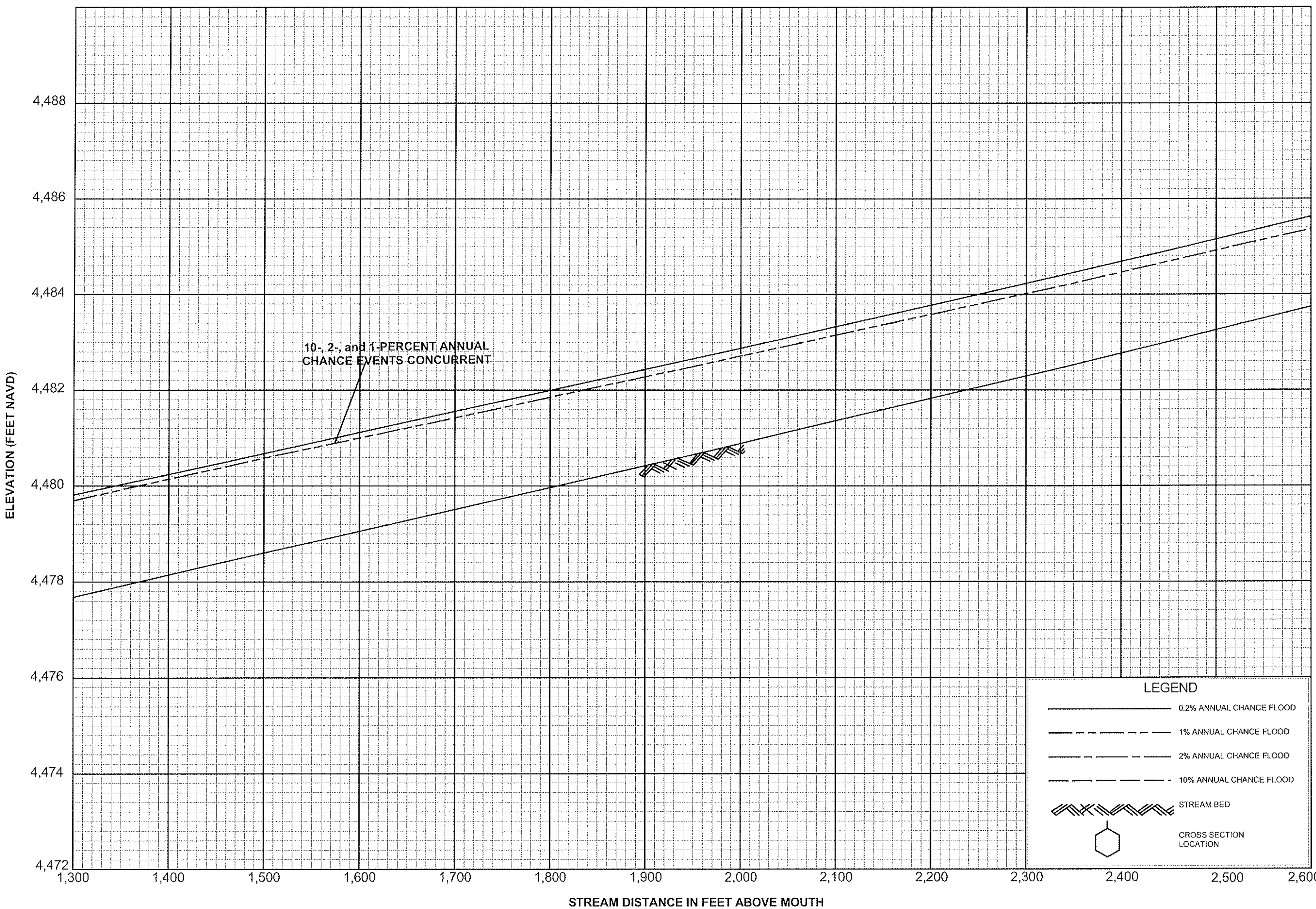

FLOOD PROFILES

SPRING CREEK - LOGAN AND PROVIDENCE

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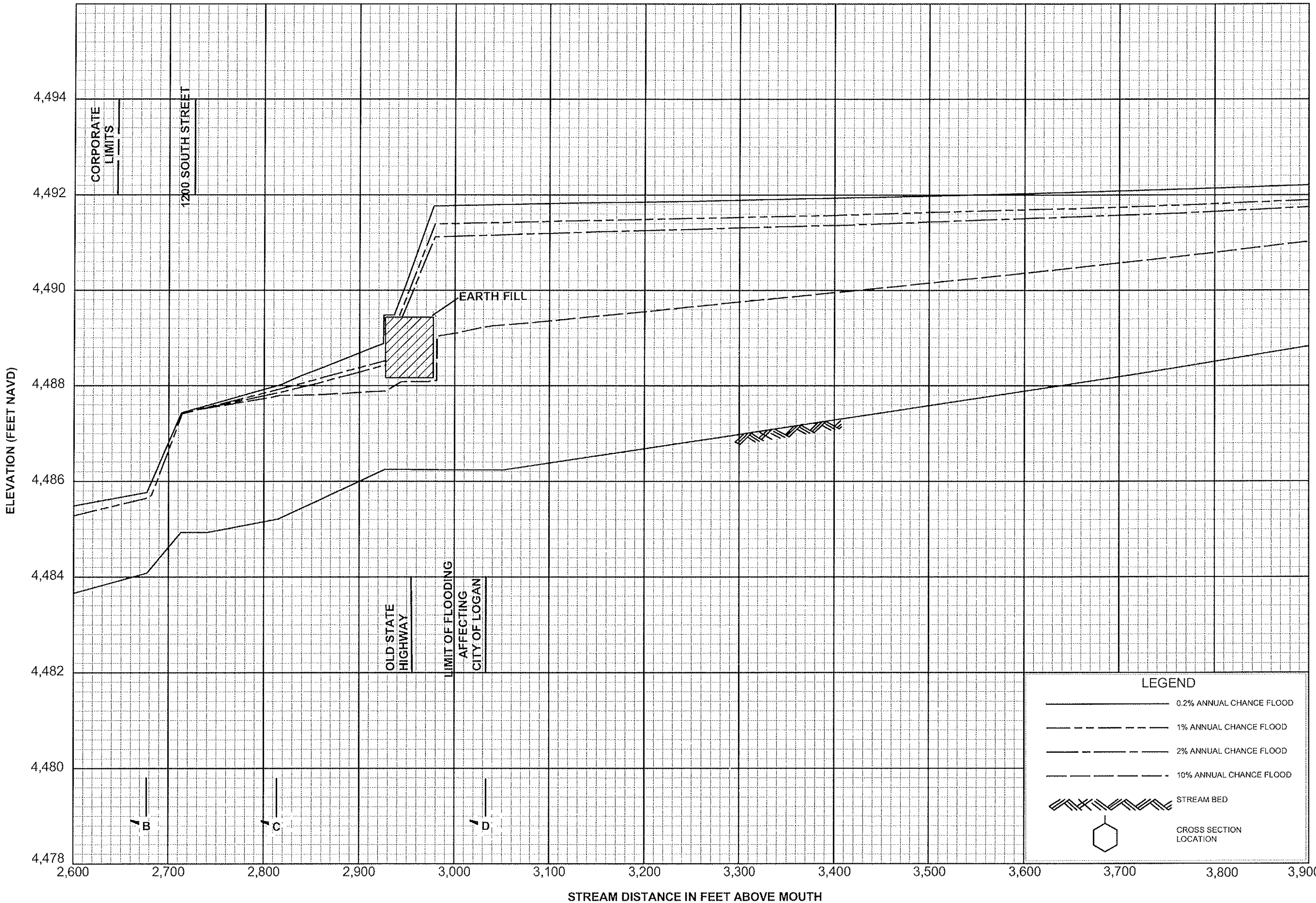

FLOOD PROFILES

SPRING CREEK - LOGAN AND PROVIDENCE

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CACHE COUNTY, UT
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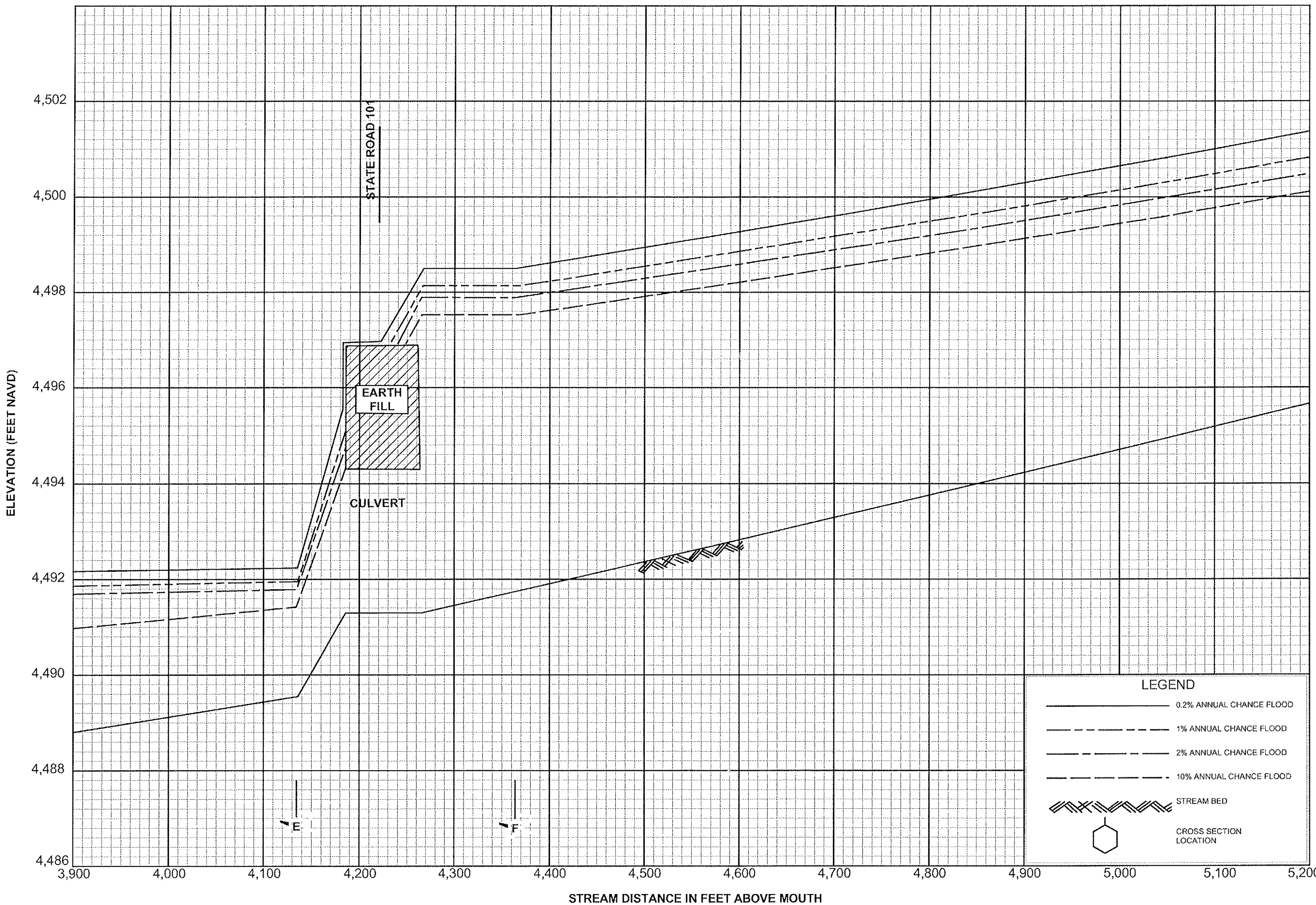

FLOOD PROFILES

SPRING CREEK - LOGAN AND PROVIDENCE

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT
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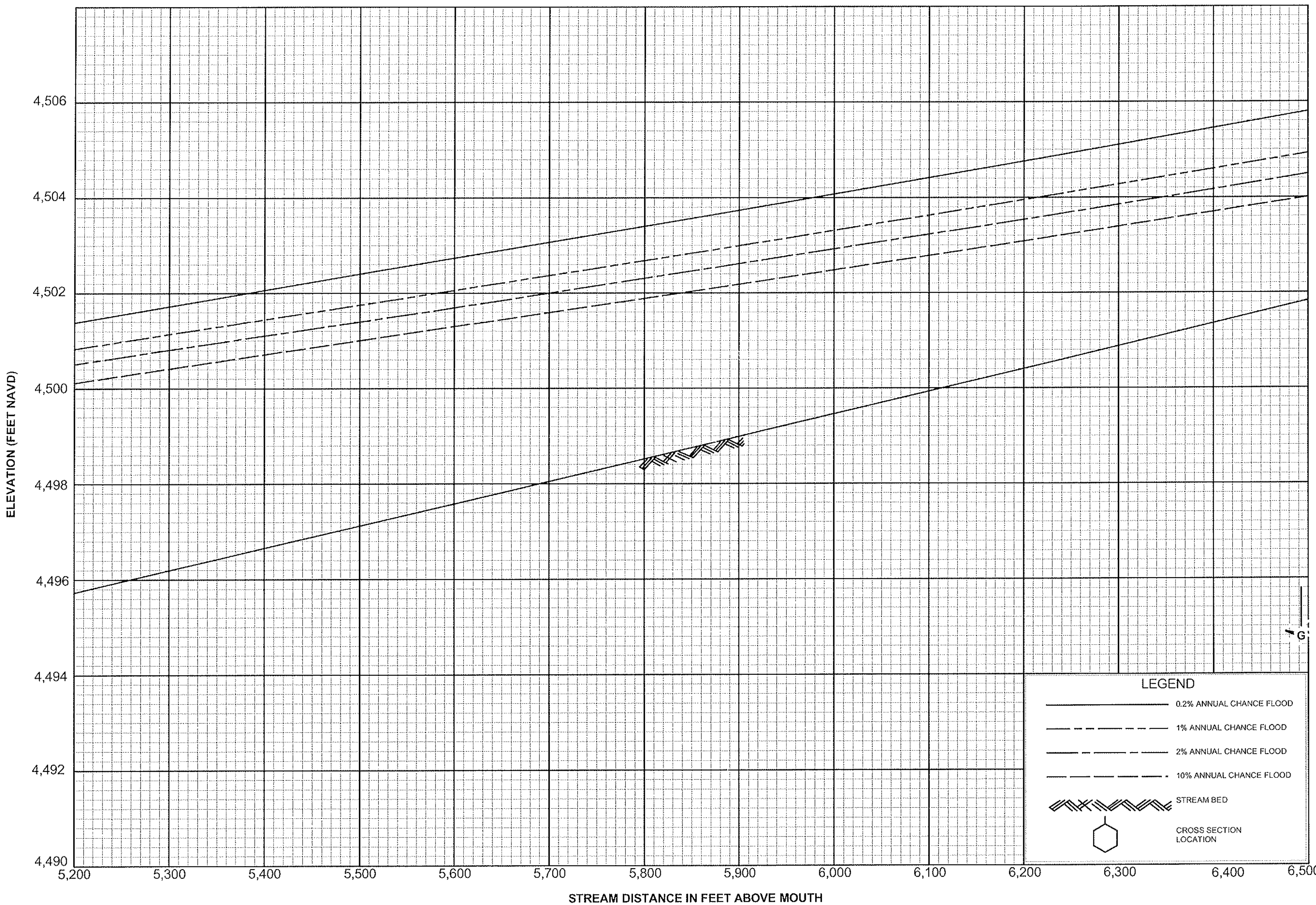

FLOOD PROFILES

SPRING CREEK - LOGAN AND PROVIDENCE

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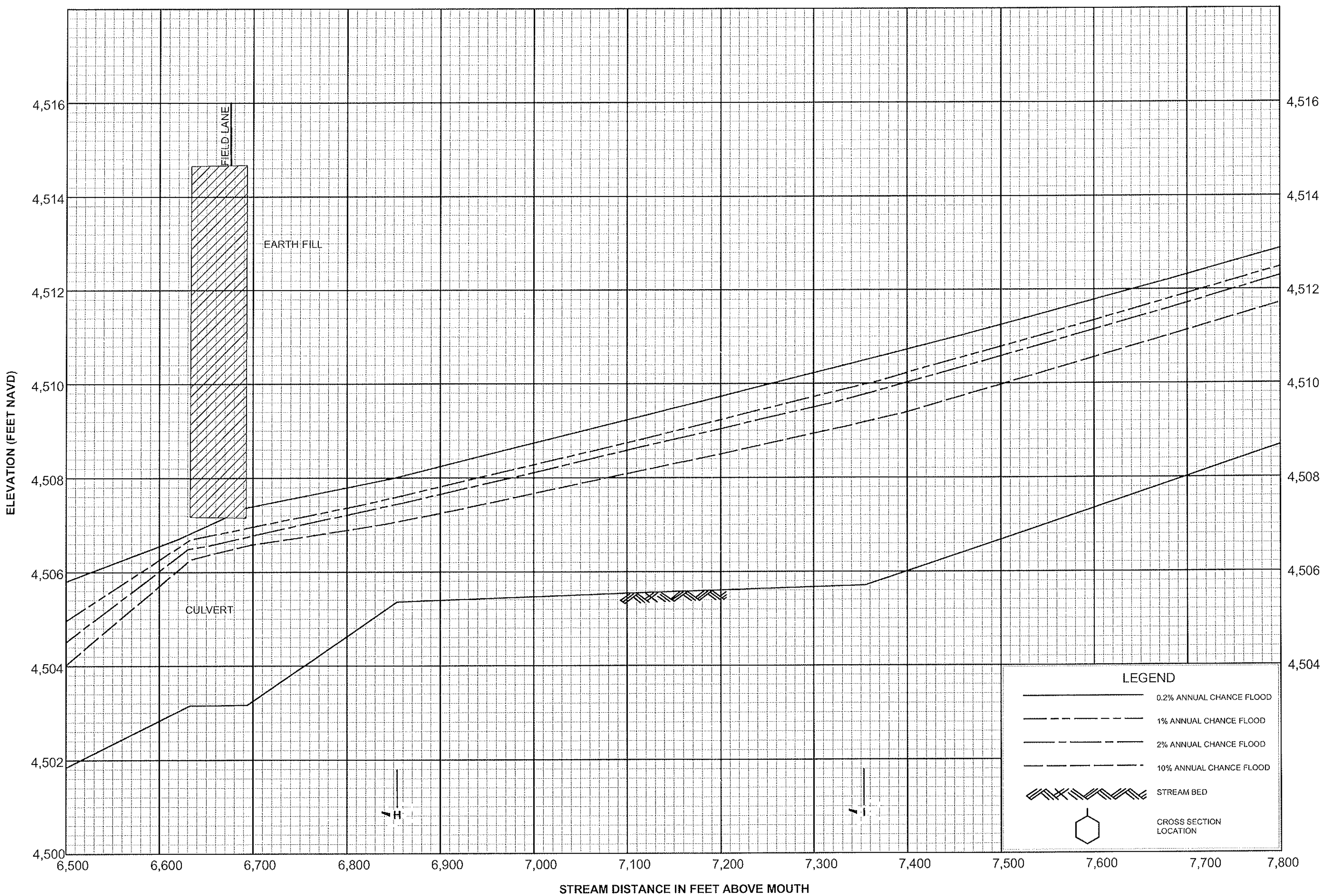

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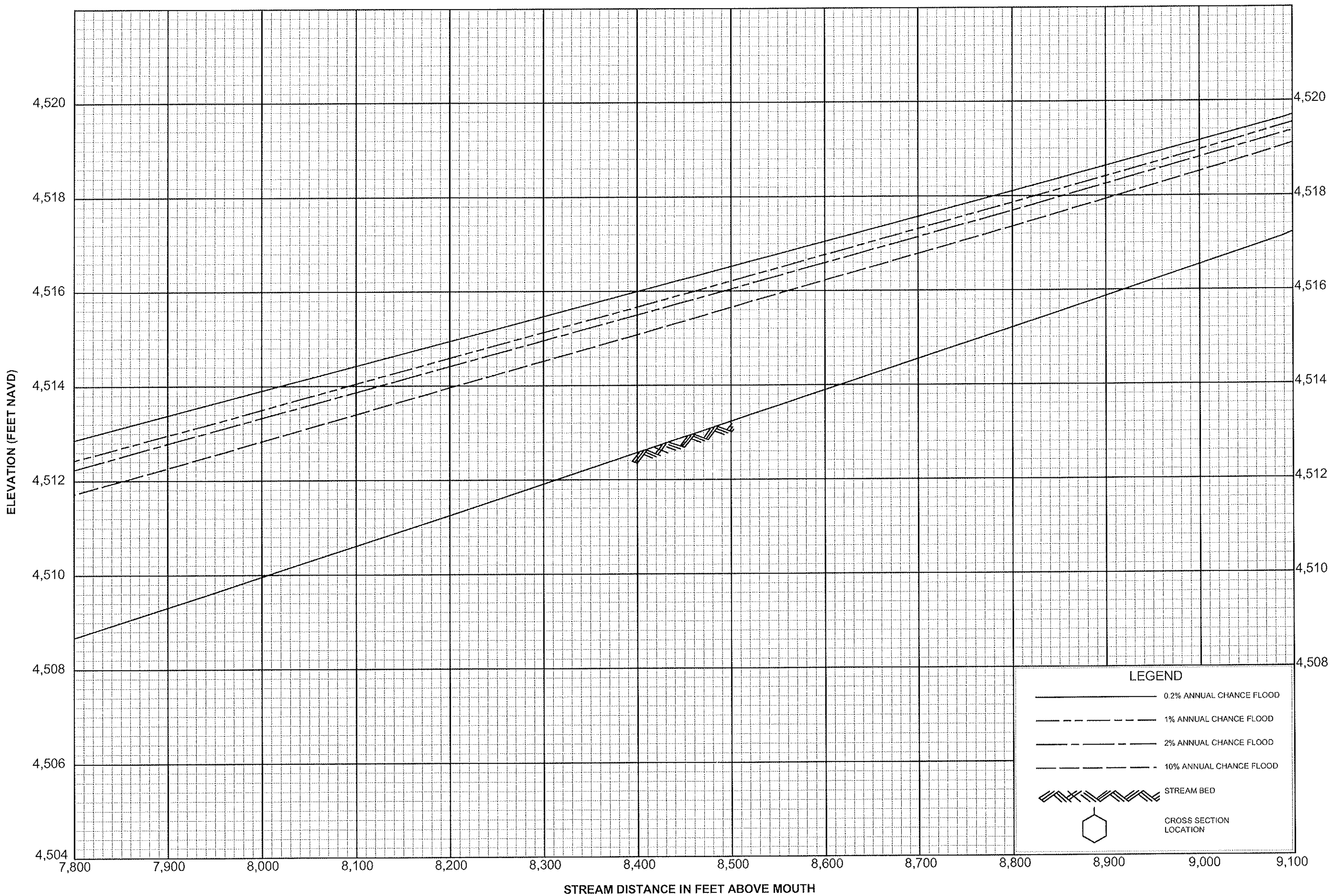

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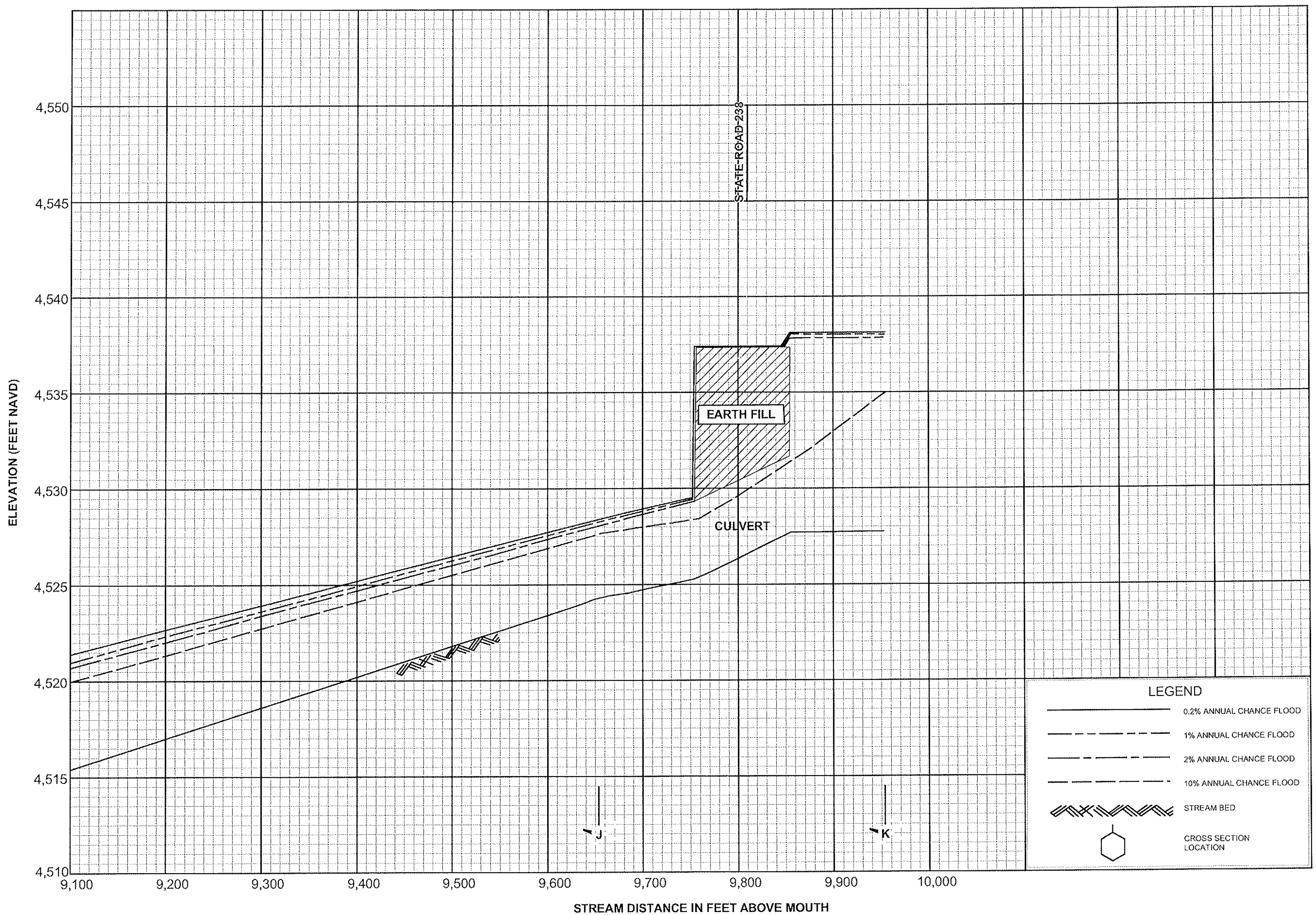

FLOOD PROFILES

SPRING CREEK - LOGAN AND PROVIDENCE

FEDERAL EMERGENCY MANAGEMENT AGENCY

CACHE COUNTY, UT

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