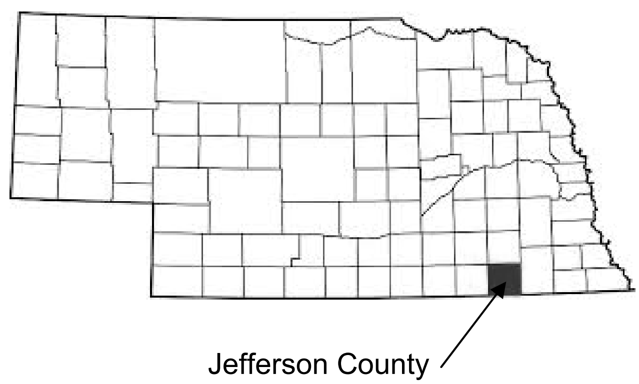
FLOOD INSURANCE STUDY

JEFFERSON COUNTY, NEBRASKA
AND INCORPORATED AREAS



COMMUNITY NAME	COMMUNITY NUMBER
DAYKIN, VILLAGE OF	310550
DILLER, VILLAGE OF	310269
ENDICOTT, VILLAGE OF	310551
FAIRBURY, CITY OF	310120
HARBINE, VILLAGE OF	310552
JANSEN, VILLAGE OF	310553
JEFFERSON COUNTY (UNINCORPORATED AREAS)	310447
PLYMOUTH, VILLAGE OF	310554
REYNOLDS, VILLAGE OF	310555
STEELE CITY, VILLAGE OF	310121

UPDATED PRELIMINARY
January 31, 2014

PRELIMINARY
June 7, 2013

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
31095CV000A

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) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

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

Old Zone(s)	New Zone
Al through A30	AE
Vl through V30	VE
B	X
C	X

Initial Countywide FIS Effective Date:

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FLOOD INSURANCE STUDY
JEFFERSON COUNTY, NEBRASKA
AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) report investigates the existence and severity of flood hazards in the geographic area of Jefferson County, Nebraska including the City of Fairbury; and the Villages of Daykin, Diller, Endicott, Harbine, Jansen, Plymouth, Reynolds and Steele City (referred to collectively herein as Jefferson County).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the county that will establish actuarial flood insurance rates and to assist the county in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State or other jurisdictional agency will be able to explain them.

The Digital Flood Insurance Rate Map (DFIRM) and FIS report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

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

This FIS was prepared to include all jurisdictions within Jefferson County into a countywide format. Information on the authority and acknowledgements for each of the previously printed FISs and Flood Insurance Rate Maps (FIRMs) for communities within Jefferson County was compiled, and is shown below.

The hydrologic and hydraulic analyses for the Little Blue River were performed by the U.S. Army Corps of Engineers (USACE), Kansas City District (the Study Contractor) for the FEMA under Inter-Agency Agreement No. EMW-88-E-27 39, Project Order No. 10. This study was completed in February 1990 (Reference 1).

The hydrologic and hydraulic analyses for Brawner Creek and Brawner Creek Bypass Floodway were performed in 1978.

There are no previous FIS reports or FIRMs published for the Villages of Daykin, Diller, Endicott, Harbine, Jansen, Plymouth, Reynolds and Steele City; therefore the previous authority and acknowledgment information for these communities are not included in this FIS. These communities may not appear in the Community Map History table (Section 6.0).

For this countywide FIS, new detailed hydraulic and hydrologic analyses were performed on Brawner Creek and Little Blue River for FEMA by STARR, a joint venture between Greenhorne & O'Mara, Inc., CDM, Stantec, and Atkins under the Joint Venture Contract No. HSFEHQ-09-D-0370, Task Order Numbers HSFE07-10-J-0003 & HSFE07-11-J-0008. New approximate hydraulic and hydrologic analyses were performed on Zone A designated study streams by the Nebraska Department of Natural Resources (NDNR) under the Cooperative Agreement EMK-2010-CA-1006.

The orthophotography base mapping was developed by the U.S. Department of Agriculture- Farm Service Agency Aerial Photography Field Office. This information was photogrammetrically compiled at a scale of 1:40,000 from photography dated 2009. The projection used for the basemap was produced in Nebraska State Plane FIPS South Zone 2602 (feet), and the horizontal datum used is the North American Datum 1983 (NAD83), Geodetic Reference System (GRS) 80 Spheroid. Differences in the datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on this FIRM.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO) meeting is to discuss the scope of the FIS. The initial and final meeting dates for the previous FIS reports for Jefferson County and its communities are listed in Table 1, "Initial and Final CCO Meetings."

Table 1 – Initial and Final CCO Meetings

COMMUNITY NAME	INITIAL MEETING	FINAL MEETING
Fairbury, City of	August 25, 1987	*

* Data Not Available

For this countywide study, the final CCO meeting was held on ______________, and attended by __________________. All problems raised at that meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Jefferson County, Nebraska, including all communities listed in Section 1.1.

Table 2 "Areas Studied by Detailed Methods" lists the streams that were studied by detailed methods. Limits of Detailed Study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

Table 2 – Areas Studied by Detailed Methods

Stream	Limits of Detailed Study
Brawner Creek	From the confluence with Little Blue River upstream to Fairbury Municipal airport
Little Blue River	From 1.8 miles upstream of 708th Road to just downstream of 714th Road

Historical FIS for the City of Fairbury included a Brawner Creek Bypass. This bypass was a result of the historical study showing the base flood overtopping Nebraska Highway 15 and the Union Pacific Railroad eventually discharging into the Little Blue River. The results of the new detailed study of Brawner Creek mapped on the high resolution topographic data did not show the base flood to overtop the highway. Therefore, the Brawner Creek Bypass was removed from this countywide study as the bypass would not occur during the base flood.

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

No Letters of Map Revision (LOMRs) were incorporated as part of this study.

2.2 Community Description

Jefferson County is bordered on the north by the Saline County, Nebraska; on the east by Gage County, Nebraska; on the south by Washington County, Kansas; on the southwest by Republic County, Kansas; on the northwest by Fillmore County, Nebraska; and to the west by the Thayer County, Nebraska. The County seat is the City of Fairbury. The City of Fairbury is located in the southeastern part of the state and is surrounded by the unincorporated areas of Jefferson County. Major transportation routes that serve Jefferson County include U.S. Highway 136; State Routes 4, 8, 15, and 103; Continental Trail ways bus service; Union Pacific Railroad and Oklahoma, Kansas, Texas Railroad; and a municipal airport, located two miles north of the City of Fairbury. The 2010 population of Jefferson County was reported to be 7,547 (Reference 2).

The average mean temperature ranges from 89 degrees Fahrenheit (ºF) in July to 14ºF in January. The highest recorded temperature was 114ºF in 1936. The lowest recorded temperature was -38ºF in 1899. Yearly precipitation averages approximately 32 inches, with the maximum monthly average occurring in May with 4.8 inches and the minimum monthly average occurring in January with 0.7 inches (Reference 3).

Factors which affect flooding include climate, soils, vegetation, topography, and drainage features. The average annual rainfall in the area surrounding the city is 29 inches. The mean annual temperature is 53 degrees Fahrenheit, and the mean frost-free period is 175 days (Reference 4). Soils in the area developed from loess parent material. Vegetation is primarily agricultural with some trees near the streams. The topography of the study area is characterized by well-drained, gently rolling loess plains. The Little Blue River flows from northwest to southeast around the west and south sides of the City of Fairbury. The average channel slope in the Fairbury area is 0.08 percent. Brawner Creek flows from north to south along the east side of the city. The average slope is 0.4 percent.

2.3 Principal Flood Problems

Flooding on the Little Blue River is caused by long periods of continuous rainfall sometimes aggravated by snowmelt. Flooding on Brawner Creek is more likely caused by high-intensity, localized thunderstorms.

The City of Fairbury has a long history of flooding from the Little Blue River. Major floods have occurred on the Little Blue River in 1935, 1941, 1949, 1951, 1957, 1960, and 1973 (Reference 5). The 1941 flood was reported in the Fairbury Journal to be the highest, at that time, since 1898. The second largest flood on record occurred on June 27, 1951, with a discharge of 36,800 cubic feet per second (cfs) and a recurrence interval of 40 years. The third largest flood occurred on March 28, 1960, with a discharge of 31,700 cfs and a recurrence interval of 25 years. This flood was caused by snowmelt runoff. It was reported in the Fairbury Journal that this was the first time in the history of the city that the city park was flooded. High-water marks for the 1960 flood include 1,298.0 feet National Geodetic Vertical Datum of 1929 (NGVD29) (Reference 5) at the State Highway 15 bridge and 1,311.0 feet NGVD29 (Reference 6) at the Frederick Street bridge. The 1-percent-annual-chance flood elevation at the State Highway 15 bridge is 1,301.2 and at the Frederick Street bridge, is 1,312.8. The largest flood of record occurred on October 12, 1973, with a discharge of 37,800 cfs and a recurrence interval of 45 years. The high-water mark at the State Highway 15 bridge was 1,301.2 (Reference 7). A levee was built by the USACE in 1968 and, as a result, no flooding occurred in the City of Fairbury due to this flood.

The city has a long history of flooding from Brawner Creek. A major flood occurred on August 18, 1968. Records show that water flowed over U.S. Highway 136 and Oklahoma, Kansas, Texas Railroad north of 14th Street, as well as across the fairgrounds. This caused people to be evacuated from their homes on Converse Street (Reference 8). No streamflow records are available for Brawner Creek to determine flooding discharge or recurrence interval.

The major factors aggravating flooding on the Little Blue River are the constrictive bridges and embankments of U.S. Highway 136, State Highway 15, the Frederick Street crossing, and Oklahoma, Kansas, Texas Railroad. Also aggravating the flooding is Lea Mill Dam just upstream of the Union Pacific Railroad bridge. Flooding on Brawner Creek is aggravated by constrictive bridges and embankments at U.S. Highway 136; Oklahoma, Kansas, Texas Railroad; State Highway 8; and Union Pacific Railroad.

2.4 Flood Protection Measures

A Federal levee built by the USACE and placed in operation in 1971 protects the City of Fairbury from the 1-percent-annual-chance frequency flood event of the Little Blue River. The levee runs along the west and south edges of the city, beginning at U.S. Highway 136 and ending at Second and E Streets. On December 11, 2012, the City of Fairbury signed a Letter of Agreement and Request for Provisionally Accredited Levee (PAL) designation and agreement to provide adequate compliance with the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10). The structure was provisionally accredited by FEMA as providing protection from a flood that has a 1-percent-annual-chance of being equaled or exceeded in any given year.

The criteria used to evaluate protection against the 1-percent-annual-chance flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance.

Two U.S. Soil Conservation Service (SCS) dams exist in the basin. These were built in the early 1960's and are in the upper reaches of the Brawner Creek watershed. They were designed for detention of a 10-percent-annual-chance storm and an emergency spillway capacity to handle a 4-percent-annual-chance storm.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 25-, 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-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2-percent-annual-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 (100-year) 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 the flooding source studied in detail affecting the community.

Pre-countywide Analyses

Flow frequencies for the Little Blue River were based on a statistical analysis of U.S. Geological Survey (USGS) gage data. These data were analyzed in accordance with criteria outlined in Bulletin No. 17B (Reference 9). Frequency-discharge data were based on the HEC-2 computer program (Reference 10). The data were obtained from the

Fairbury gage station which is located on the right bank of the river just downstream of State Highway 136 bridge about 0.75 mile south of the City of Fairbury. The frequency data were run using a historical record of 88 years (October 1923-present). Discharges were based on Bulletin No. 17B adjusted values (Reference 9).

The peak discharge-frequency relationship for Brawner Creek was determined using the SCS hydrology program as described in TR-20 (Reference 11). This program utilized rainfall-runoff relationships and the SCS dimensionless unit hydrograph. The watershed was broken down into subareas, and each frequency storm was routed through the subareas, including the east dam in the upper reach of the watershed. The following assumptions were made regarding the relationships between rainfall and runoff frequencies; the 10-percent-annual-chance discharge is produced by the 10-percent-annual-chance flood, 6-hour rainfall; the 2-percent-annual-chance discharge is produced by the 2-percent-annual-chance flood, 12-hour rainfall; and the 1-percent-annual-chance discharge is produced by the 1-percent-annual-chance flood, 24-hour rainfall. Point rainfall depths and the corresponding areal average rainfall depths of the desired frequency and duration were obtained from the National Weather Bureau Technical Paper No. 40 (Reference 12). The SCS program determines runoff from the corresponding rainfall depth using relationships based on land uses and soil conditions in the watershed and distributes the runoff using the SCS six-hour design storm distribution. Peak discharges were assumed to occur at the time of average antecedent moisture conditions.

The 0.2-percent-annual-chance discharge was determined by averaging the discharge obtained from the TR-20 hydrologic model using a precipitation extrapolated from the rainfall-frequency curve and the discharge obtained from the USGS relationship between the 2-percent-annual-chance and 0.2-percent-annual-chance discharges.

The approximate studies include one tributary to the Little Blue River, which has a drainage area of 2.2 square miles and East Fork Brawner Creek, which has a drainage area of 4.8 square miles. East Fork Brawner Creek was studied as part of the TR-20 hydrologic model for Brawner Creek. The 1-percent-annual-chance discharge at the confluence with Brawner Creek was determined to be 4,595 cfs. The 1-percent-annual-chance discharge for the tributary to the Little Blue River at the confluence with the Little Blue River was determined to be 725 cfs using the TP-149 (Reference 13) for drainage areas less than 2,000 acres.

Peak discharge-drainage area relationships for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance floods for each stream studied by detailed methods are presented in Table 3, “Summary of Discharges”.

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	PEAK DISCHARGES (cfs) 10%-ANNUAL-CHANCE	4%-ANNUAL-CHANCE	2%-ANNUAL-CHANCE	1%-ANNUAL-CHANCE	0.2%-ANNUAL-CHANCE
BRAWNER CREEK						
At confluence with Little Blue River	8.65	1,410	2,158	2,795	3,490	5,380
Just downstream of Fourth Street	7.95	1,508	2,336	3,051	3,842	6,015
At confluence of East Fork Brawner Creek	2.12	1,278	1,992	2,636	3,391	5,754
LITTLE BLUE RIVER						
1.35 miles downstream from confluence of Brawner Creek	2,416	26,206	38,163	48,577	60,277	93,001
At USGS Gage No. 06884000	2,350	25,490	37,120	47,250	58,630	90,460

Countywide Analyses

Little Blue River peak flows for 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance storm events were determined from a weighted average of discharges computed from gage records and regional regression equations. Annual peak flow data from USGS gage No. 06884000 was analyzed using the USGS PKFQWin software (Reference 14). The program estimated discharges using the Log Pearson Type III distribution found in USGS Bulletin 17B (Reference 15). 88 years of record was available for the gage.

For ungaged sites near gaged sites on the Little Blue River, the drainage area at the downstream limit of study is calculated to be well within the 50-150% of the drainage area of the gage used in this analysis. To estimate the discharges at the identified ungaged site, the Water-Resources Investigations Report 99-4032 equations were used (Reference 16). Peak flows of the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance storm events were computed utilizing a drainage area ratio such that:

$$Q_u = Q_g \left(\frac{A_u}{A_g}\right)^a$$

Where:

- Q_u = the estimated discharge for the ungaged watershed,
- Q_g = the weighted discharge (W) for the gaging station,
- A_u = the area of the ungaged watershed,
- A_g = the area of the gaged watershed, and
- a = the exponent for each regression region (a = 1 for this computation)

Since the study points are located within the range of 50-150% of two gage stations, individual weighted discharges from each stream was computed and the average was taken as a discharge for the point.

Peak flows for recurrence intervals for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance events were determined from regression equations developed for Blue River Region by Strahm and Admiral (Reference 17). This report was developed at the University of Nebraska Civil Engineering Department and sponsored by the Nebraska Department of Roads. The purpose of the study was to modify the Soenksen regional regression equations so that flows could be programmed into a GIS. Although Nebraska has about four approved regional regression equations, the above is used since it has a drainage area of less than 10 square miles. Peak flows for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance events were computed as:

$$Q_{10} = 45 * CDA^{0.193} * MCS^{0.351} * PLP^{-1.045}$$

$$Q_{25} = 75 * CDA^{0.199} * MCS^{0.406} * PLP^{-0.896}$$

$$Q_{50} = 109 * CDA^{0.196} * MCS^{0.441} * PLP^{-0.776}$$

$$Q_{100} = 154 * CDA^{0.186} * MCS^{0.473} * PLP^{-0.665}$$

$$Q_{500} = 432 * CDA^{0.134} * MCS^{0.519} * PLP^{-0.320}$$

Where:

- Q, peak discharge (cfs)
- CDA, contributing drainage area (mi^2)
- MCS, main channel slope (ft/mile)
- PLP, permeability of least permeable layer (in/hr)

While CDA and MCS were directly calculated from Light Detection And Ranging (LiDAR) digital elevation model (DEM) using ArcHydro, PLP was calculated from the STATSGO soils database. Since the bulk of the watershed has permeability between 0.16 in/hr and 0.17 in/hr, an average value of 0.16 was taken to represent the watershed.

Approximate study methods were performed on all streams that had a drainage area greater than 1 square mile, and outside of the detailed study areas for the Lower Little Blue watershed. In general, regression equations developed for Blue River Region by Strahm and Admiral (Reference 17) were used for the discharge frequency computations. However, in some areas were gage data was available an annual peak flow frequency analysis was performed. The analysis was done using the PKFQWin software (Reference 14), that uses Bulletin 17B Guidelines to run the annual peak flow frequency analysis (Reference 15). Annual peak flows from the following four USGS gaging stations were used to analyze 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flows.

Stream and Location	Gage Station Number	Period of Record
Little Blue River near Fairbury, Nebraska	06884000	1908-1915,1929-2008
Little Blue River near Alexandria (Gilead), Nebraska	06883570	1959-1992
Big Sandy Creek at Alexandria, Nebraska	06883940	1980-1993
Little Blue River at Hollenberg, Kansas	06884025	1973-2011

The discharge frequency results from the regression equation and PKFQWin stream gage analyses were used to calculate water surface elevations.

3.2 Hydraulic Analyses

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

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot 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 is computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2). Unless specified otherwise, the hydraulic analyses for these studies 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.

All elevations shown on the Flood Profiles and FIRM (Exhibits 1 and 2) are referenced to the NAVD88.

Pre-countywide Analyses

Unless otherwise noted, all bridges and culverts were surveyed to obtain elevation data and structural geometry.

Starting water-surface elevations for the Little Blue River were determined using the slope-area method. The water-surface profiles were computed using the HEC-2 step-backwater model (Reference 18).

Starting water-surface elevations for Brawner Creek and Brawner Creek Bypass Floodway were also determined using the slope-area method. The final profiles reflect backwater elevations from the Little Blue River where they exceed the profile determined using the slope-area method. Downstream of State Highway 8, Brawner Creek was analyzed as a divided-flow reach, divided by State Highway 15. The Brawner Creek Bypass Floodway profile shows only the 1-percent-annual-chance flood water-surface elevations and the streambed elevations. The 10-percent-annual-chance frequency flood is nonexistent west of State Highway 15. Because it does not overtop the .roadway, it is not shown on the profiles. The profile baseline for Brawner Creek Bypass Floodway is depicted as a stream on the map, although a stream in this area does not exist except during the 1-percent-annual-chance flood. The water-surface profiles for Brawner Creek Bypass Floodway and the lower reach of Brawner Creek were determined using a split-flow iteration process with the HEC-2 step-backwater model. Water-surface profiles for the remaining upstream reaches of Brawner Creek and the Little Blue River were also determined using the HEC-2 step-backwater model (References 19, 20, and 21).

For Little Blue River Tributary and East Fork Brawner Creek studied by approximate methods, the 1-percent-annual-chance flood boundaries were determined using cross-section data obtained from topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (Reference 22) and computations of Manning's equation. In cases in which the 2- and 1-percent-annual-chance flood elevations are close together, due to limitations of the profile scale, only the 1-percent-annual-chance profile has been shown.

Areas of the community protected by levees are subject to potential risk due to possible failure or overtopping of the levee. These areas were delineated by applying the 1-percent-annual-chance flood elevation determined from the “levee in place” analysis.

Countywide Analysis

As part of this countywide FIS, new detailed hydraulic analyses were performed, by STARR, along Brawner Creek and Little Blue River. The new detailed analyses along Brawner Creek extended from the confluence with Little Blue River upstream to Fairbury Municipal airport. The new detailed analyses along Little Blue River extended from 1.8 miles upstream of 708th Road to just downstream of 714th Road.

Water surface elevations and floodway determination was calculated using the USACE Hydrologic Engineering Center- River Analysis System (HEC-RAS) computer program

(Reference 23). A steady state flow analysis of the study reach was carried out in order to determine the water surface elevations.

Normal depth was used as the downstream boundary condition and is calculated from the stream profile.

The cross sections for these new hydraulic analyses had channel surveys completed by STARR on March 24, 2011. Surveyed points captured some area of the overbank on each side of the stream, the top of banks, toe of slopes, channels bottom, and stream centerline. Points were taken along the stream centerline between cross sections. Studied structures had cross sections surveyed up and downstream of the structure and detailed measurements taken of the structure dimensions. Surveyed points were taken at guard rails, edges of bridges, inverts of culverts, top of crowns of culverts, and other necessary aspects of the structures for proper modeling. Cross-section data was supplemented by LiDAR data provided by the Nebraska Department of Environmental Resources (Reference 24).

Main channel and overbank roughness coefficients (Manning's "n") were determined from field reconnaissance and the use of aerial photographs and engineering judgment. and based on field observation at each cross-section and adjusted with known high-water marks and stream gage rating curves where possible. Ineffective flow area placements reflect field observations. Table 4, "Manning's "n" Values," shows the channel and overbank "n" values for the streams studied by detailed methods.

Table 4 – Manning's "n" Values

STREAM	CHANNEL	OVERBANK
Brawner Creek	0.035 – 0.04	0.015 – 0.110
Little Blue River	0.040 – 0.055	0.025 – 0.100

Approximate study methods were performed on all streams that had a drainage area greater than 1 square mile, and outside of the detailed study areas for the Lower Little Blue watershed. This process was done using NDNR N-FACT (N-FACT 2005) tool, which is extension of ArcView 3.2. The streams were hand digitized, and the cross section hand drawn using 2-foot contours derived from the 2009 South Central Nebraska LiDAR (Reference 25). The N-FACT tool was used to calculate the channel slope and the station and elevations for each cross section along the streamline. N-FACT plugged in the probability discharges (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance) a standard Manning's "*n*" value of 0.05, and channel slope into the Normal Depth Equation to calculate the water depth at each cross section. The final products from the N-FACT tool is water surface elevations (for 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance probability discharges), that can be used to create approximate floodplain boundaries and depth grids for 10-, 4-, 2-, 1- and 0.2-percent-annual-chance floods.

3.3 Benchmarks

All qualifying benchmarks within a given jurisdiction that are catalogued by the NGS and entered into the National Spatial Reference System (NSRS) as First or Second Order

Vertical and have a vertical stability classification of A, B or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

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

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation (e.g. mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation (e.g. concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g. concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g. concrete monument above frost line, or steel witness post)

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

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance (100-year) flood elevations and delineations of the 1- and 0.2-percent-annual-chance (500-year) floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles and Floodway Data Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, 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 streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM.

Some areas of the community that are protected from the 1-percent-annual-chance flood by a levee have been delineated as having potential risk due to possible failure or overtopping of the levee during larger floods.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 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 FIS report and on the FIRM 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 have been tabulated for selected cross sections (Table 5, Floodway Data). The computed floodways are shown on the FIRM. In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage and heightens potentials flood hazards by further increasing velocities. A listing of stream velocities at selected cross sections is provided in Table 5, "Floodway Data Table". To reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 5 for certain downstream cross sections are lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

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 WSEL of the 1-percent-annual-chance 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".

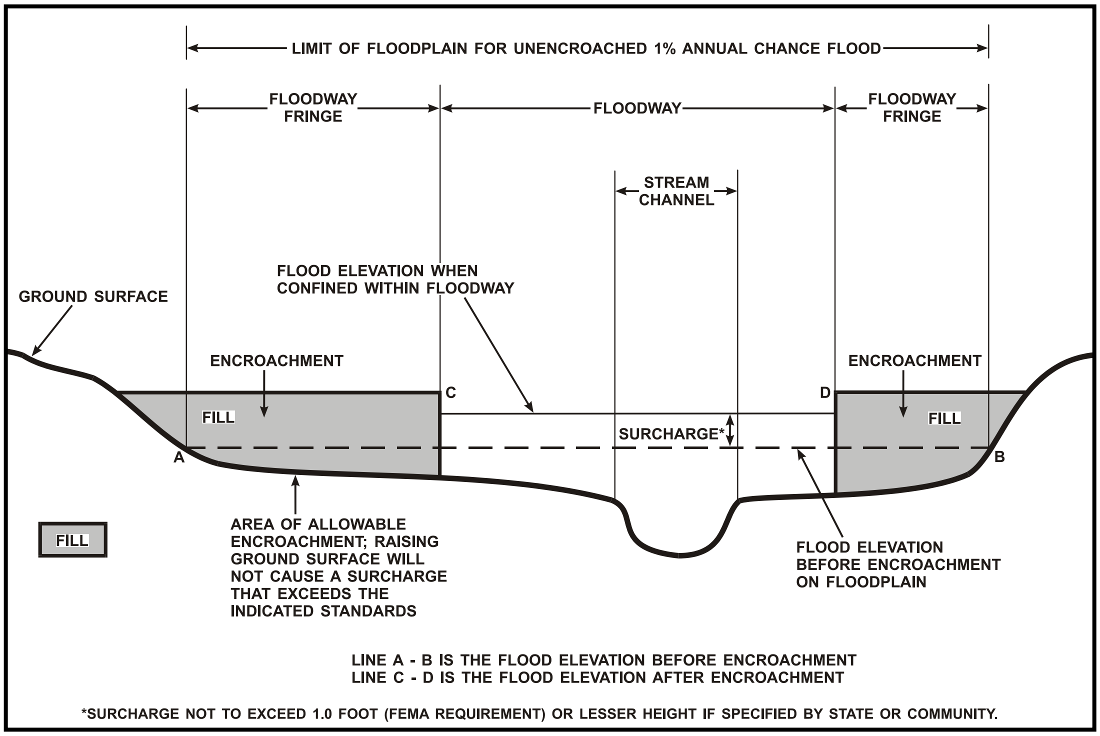

Figure 1 – Floodway Schematic

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
BRAWNER CREEK								
A	3384	250	878	4.4	1302.8	1302.8	1302.8	0.0
B	3506	562	1726	2.2	1307.3	1307.3	1307.4	0.1
C	5819	119	612	6.3	1310.6	1310.6	1311.7	1.0
D	5921	121	877	4.4	1313.7	1313.7	1313.7	0.0
E	6867	94	561	6.9	1314.6	1314.6	1314.9	0.3
F	6970	105	570	6.7	1315.5	1315.5	1315.7	0.2
G	9244	262	801	4.8	1320.7	1320.7	1321.7	1.0
H	11,121	814	1134	3.4	1326.1	1326.1	1326.3	0.2
I	11,194	767	3090	1.2	1326.6	1326.6	1327.2	0.7
J	12,389	300	1325	2.9	1330.9	1330.9	1331.8	0.9
K	12,456	320	1258	3.1	1331.7	1331.7	1332.4	0.7
L	15,365	110	450	8.5	1339.7	1339.7	1340.2	0.5
M	17,447	160	858	4.5	1348.6	1348.6	1348.6	0.0
N	17,752	260	948	4.1	1350.0	1350.0	1350.1	0.0
O	18,844	549	2003	1.9	1353.9	1353.9	1354.6	0.7
P	18,908	541	1261	3.1	1354.3	1354.3	1354.9	0.6
Q	20,687	74	648	5.9	1359.2	1359.2	1359.4	0.2
R	20,817	88	976	3.9	1361.4	1361.4	1361.6	0.2
S	22,402	284	849	4.5	1363.7	1363.7	1363.8	0.0
T	23,676	99	419	9.2	1368.7	1368.7	1368.7	0.0

[1] Feet above the confluence with Little Blue River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

AND INCORPORATED AREAS

FLOODWAY DATA

BRAWNER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
BRAWNER CREEK								
U	23,852	625	6181	0.6	1382.9	1382.9	1383.8	1.0
V	25,924	260	2351	1.6	1383.0	1383.0	1384.0	0.9
W	28,468	198	811	4.2	1389.3	1389.3	1389.8	0.5
X	28,542	209	1794	1.9	1394.4	1394.4	1395.3	0.9
Y	29,429	186	764	4.4	1394.5	1394.5	1395.4	0.9
Z	30,159	93	550	6.2	1400.7	1400.7	1401.2	0.5
AA	30,199	152	749	4.5	1400.9	1400.9	1401.7	0.9
AB	30,400	150	760	4.5	1401.2	1401.2	1402.0	0.7
AC	30,576	595	6376	0.5	1418.7	1418.7	1419.0	0.4
AD	34,051	156	504	6.7	1419.3	1419.3	1419.4	0.1
AE	35,138	85	466	7.3	1422.2	1422.2	1423.1	1.0
AF	35,216	180	1306	2.6	1427.7	1427.7	1428.6	1.0
AG	37,159	100	378	9.0	1435.5	1435.5	1436.1	0.6
AH	41,981	80	377	9.0	1475.2	1475.2	1476.0	0.8

[1] Feet above the confluence with Little Blue River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

AND INCORPORATED AREAS

FLOODWAY DATA

BRAWNER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
LITTLE BLUE RIVER								
A	601	1857	23608	2.6	1298.0	1298.0	1298.3	0.3
B	3430	1809	20472	2.9	1299.4	1299.4	1299.8	0.5
C	8115	2396	25501	2.4	1301.2	1301.2	1302.0	0.8
D	10,469	1899	19738	3.1	1302.3	1302.3	1303.2	0.9
E	11,140	2026	17560	3.4	1302.8	1302.8	1303.7	0.9
F	12,637	1817	21558	2.8	1304.7	1304.7	1305.5	0.8
G	15,531	1884	18953	3.2	1306.3	1306.3	1307.0	0.7
H	18,663	2666	21251	2.8	1308.1	1308.1	1308.8	0.7
I	18,952	2319	21507	2.8	1308.3	1308.3	1309.0	0.7
J	19,291	2770	21506	2.8	1308.5	1308.5	1309.3	0.8
K	21,154	1903	12061	5.0	1310.0	1310.0	1310.6	0.6
L	21,438	1831	12904	4.7	1310.7	1310.7	1311.6	0.9
M	22,204	2311	17116	3.5	1313.9	1313.9	1314.8	0.9
N	25,505	2882	25058	2.4	1318.7	1318.7	1319.3	0.7
O	29,527	1850	17535	3.4	1321.2	1321.2	1322.0	0.8
P	30,415	593	6295	9.3	1321.9	1321.9	1322.5	0.6
Q	32,396	1542	14957	3.9	1325.9	1325.9	1326.4	0.5

[1] Feet from 1.8 Miles Upstream of 708th Road

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE BLUE RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
LITTLE BLUE RIVER								
R	36,233	1194	13646	4.3	1327.9	1327.9	1328.6	0.7
S	36,968	1445	15348	3.8	1328.4	1328.4	1329.1	0.8
T	38,099	1279	14466	4.1	1329.4	1329.4	1330.2	0.9
U	42,955	1089	13718	4.3	1333.3	1333.3	1334.3	1.0

[1] Feet from 1.8 Miles Upstream of 708th Road

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE BLUE RIVER

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFE or base flood depths are shown within this zone.

Zone AE

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

Zone X

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or base flood 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 risk zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

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

The countywide FIRM presents flooding information for the entire geographic area of Jefferson 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, where applicable. Historical data relating to the maps prepared for each community are presented in Table 6, "Community Map History."

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Daykin, Village of	N/A	None	N/A	None
Diller, Village of	August, 29 1975	None	N/A	None
Endicott, Village of	N/A	None	N/A	None
Fairbury, City of	August 2, 1974	January 9, 1976	September 3, 1980	October 16, 1992
Harbine, Village of	N/A	None	N/A	None
Jansen, Village of	N/A	None	N/A	None
Jefferson County (Unincorporated Areas)	June 21, 1977	None	June 1, 1988	None
Reynolds, Village of	N/A	None	N/A	None
Steele City, Village of	February 21, 1975	None	June 1, 1987	None

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

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

Countywide FIS report for Fillmore County, Nebraska and Washington County, Kansas is currently underway.

Countywide FIS report for Gage County, Nebraska (2010); Republic County, Kansas (2010); Saline County, Nebraska (2010); and Thayer County, Nebraska (2004) have already gone effective (References 26, 27, 28, 29, and 30).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Flood Insurance and Mitigation Division, FEMA, Region VII, 9221 Ward Parkway, Suite 300, Kansas City, Missouri 64114-3372.

Future revisions may be made that do not result in the republishing of the FIS Report. To ensure that any user is aware of all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

9.0 BIBLIOGRAPHY AND REFERENCES

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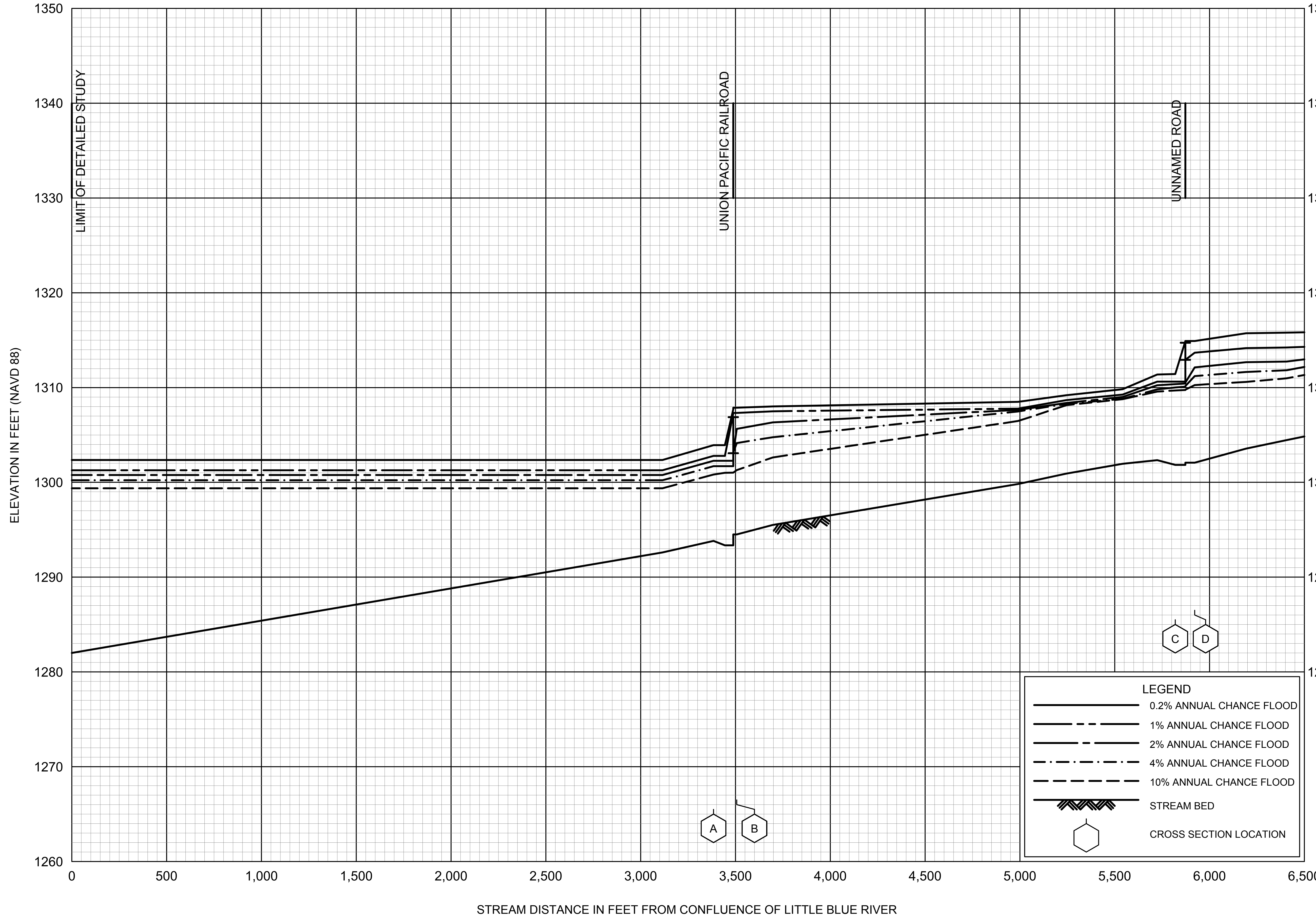


FLOOD PROFILES

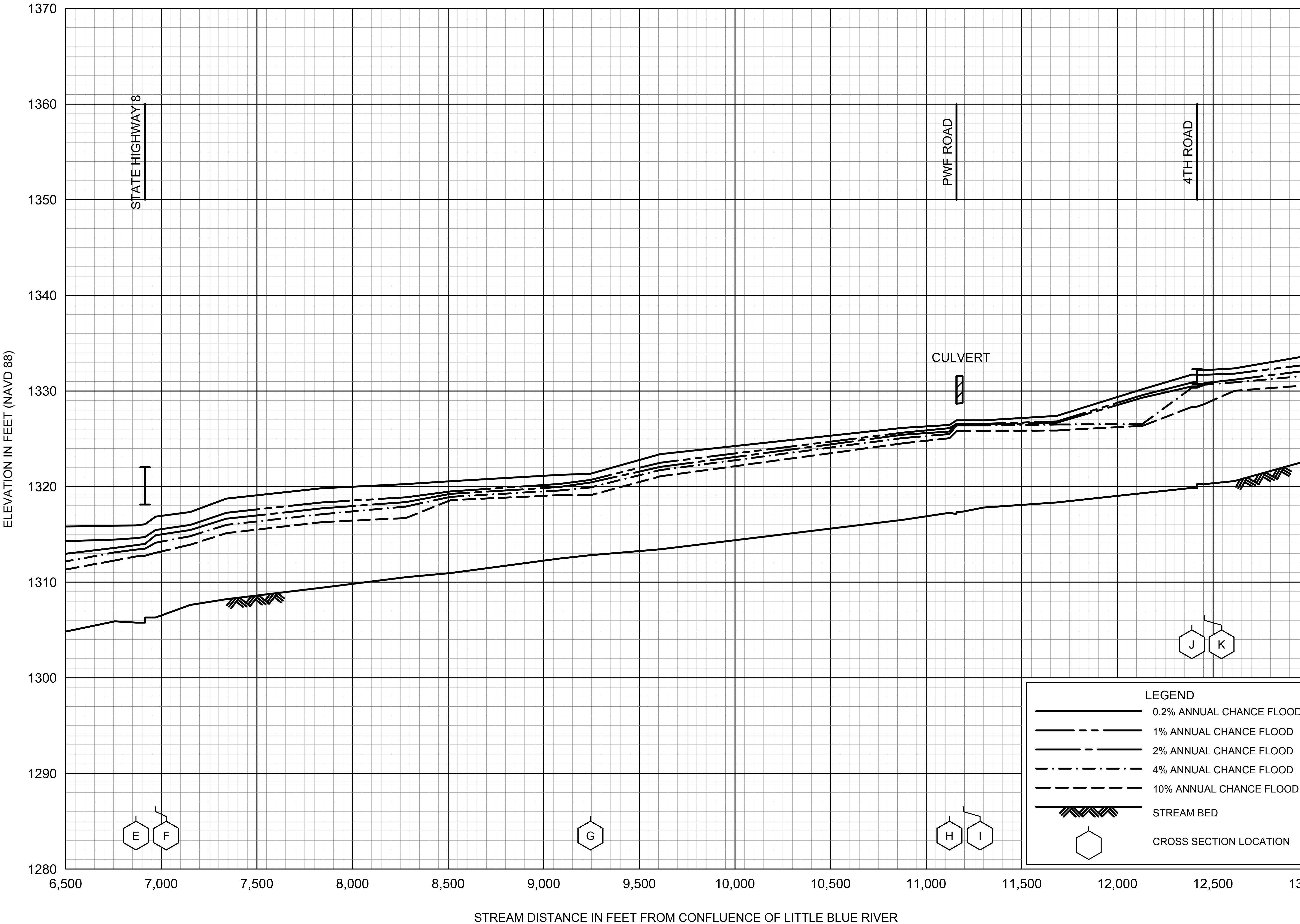
BRAWNER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

(AND INCORPORATED AREAS)

01P



FLOOD PROFILES

BRAWNER CREEK

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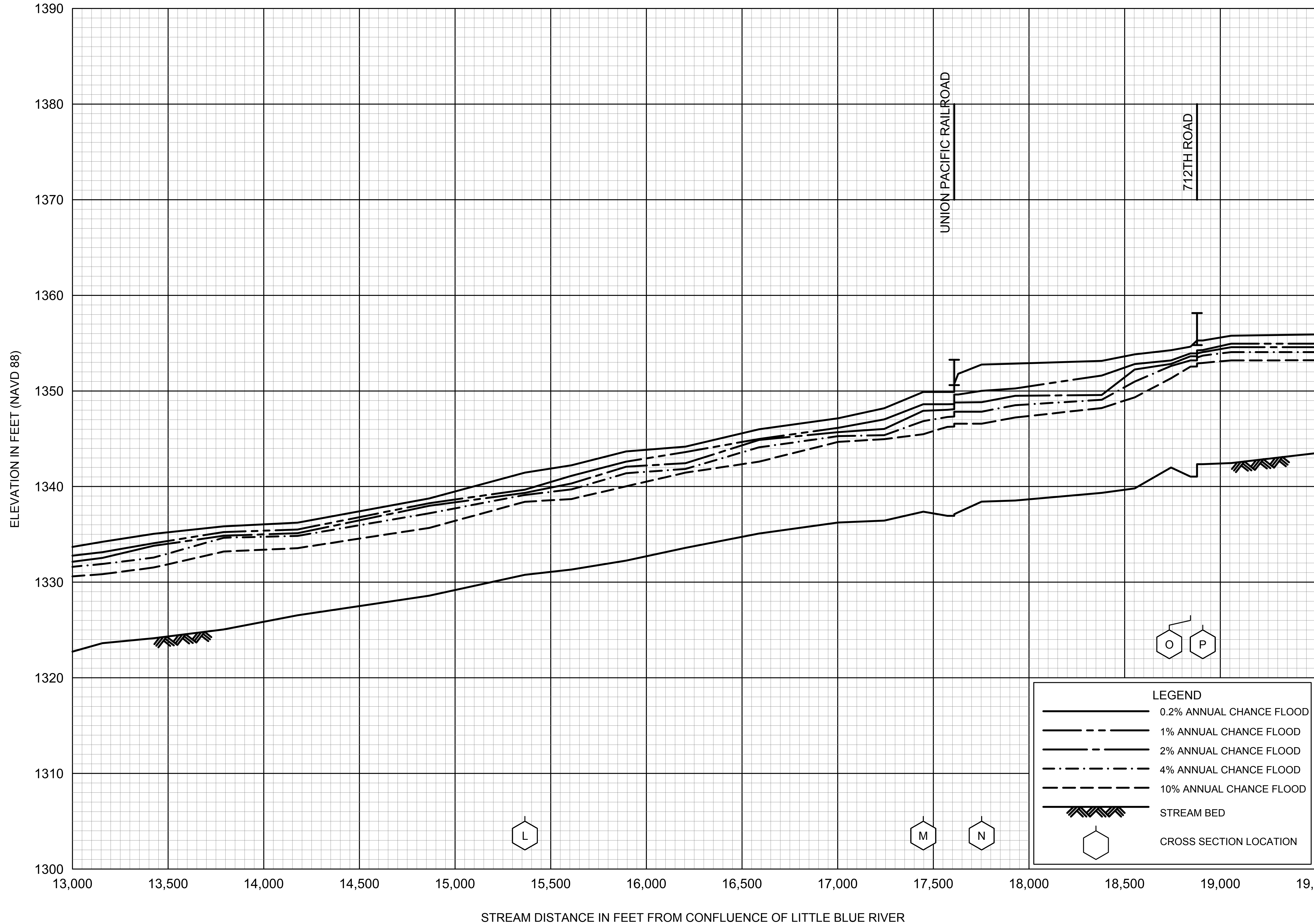

FLOOD PROFILES

BRAWNER CREEK

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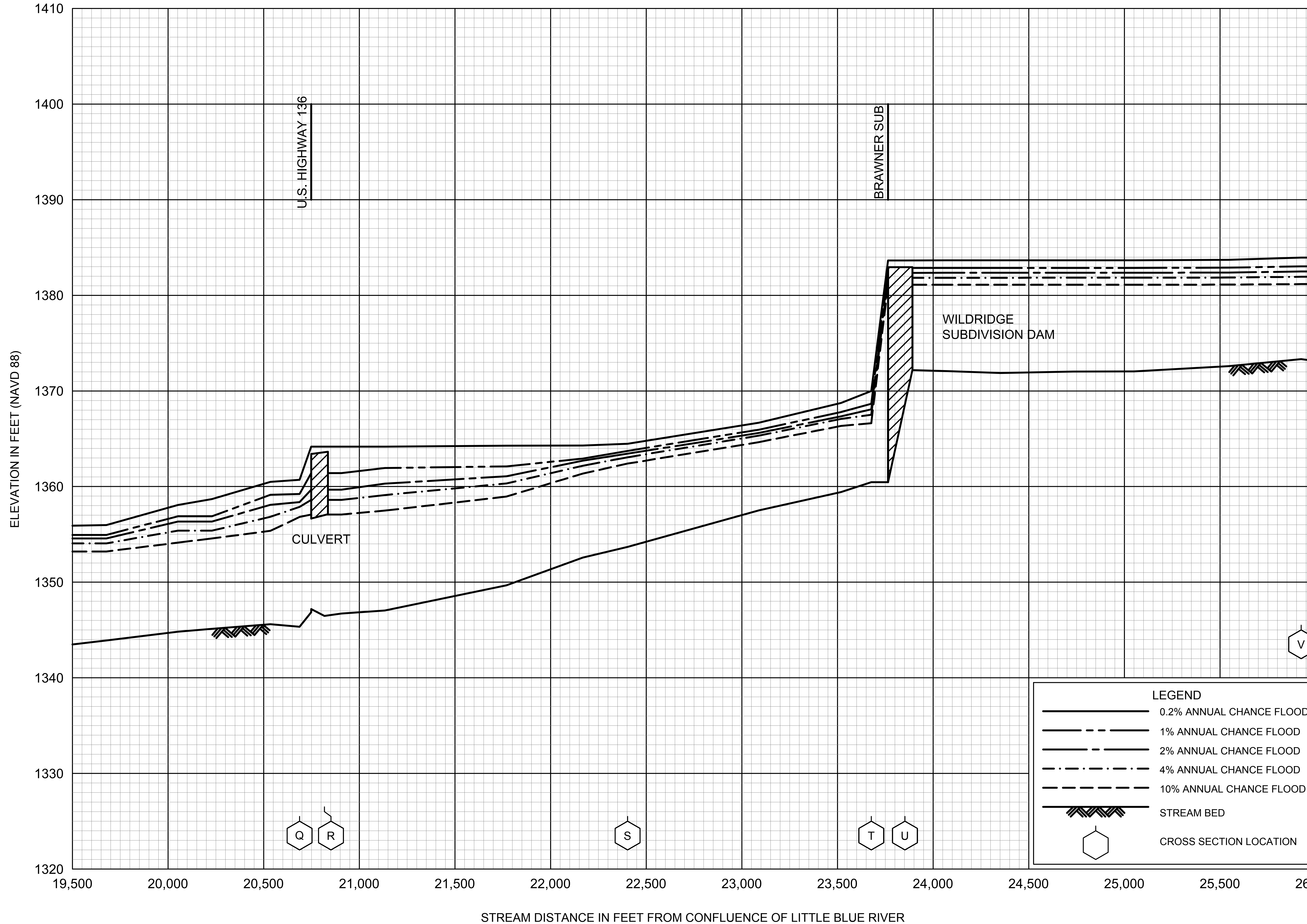

FLOOD PROFILES

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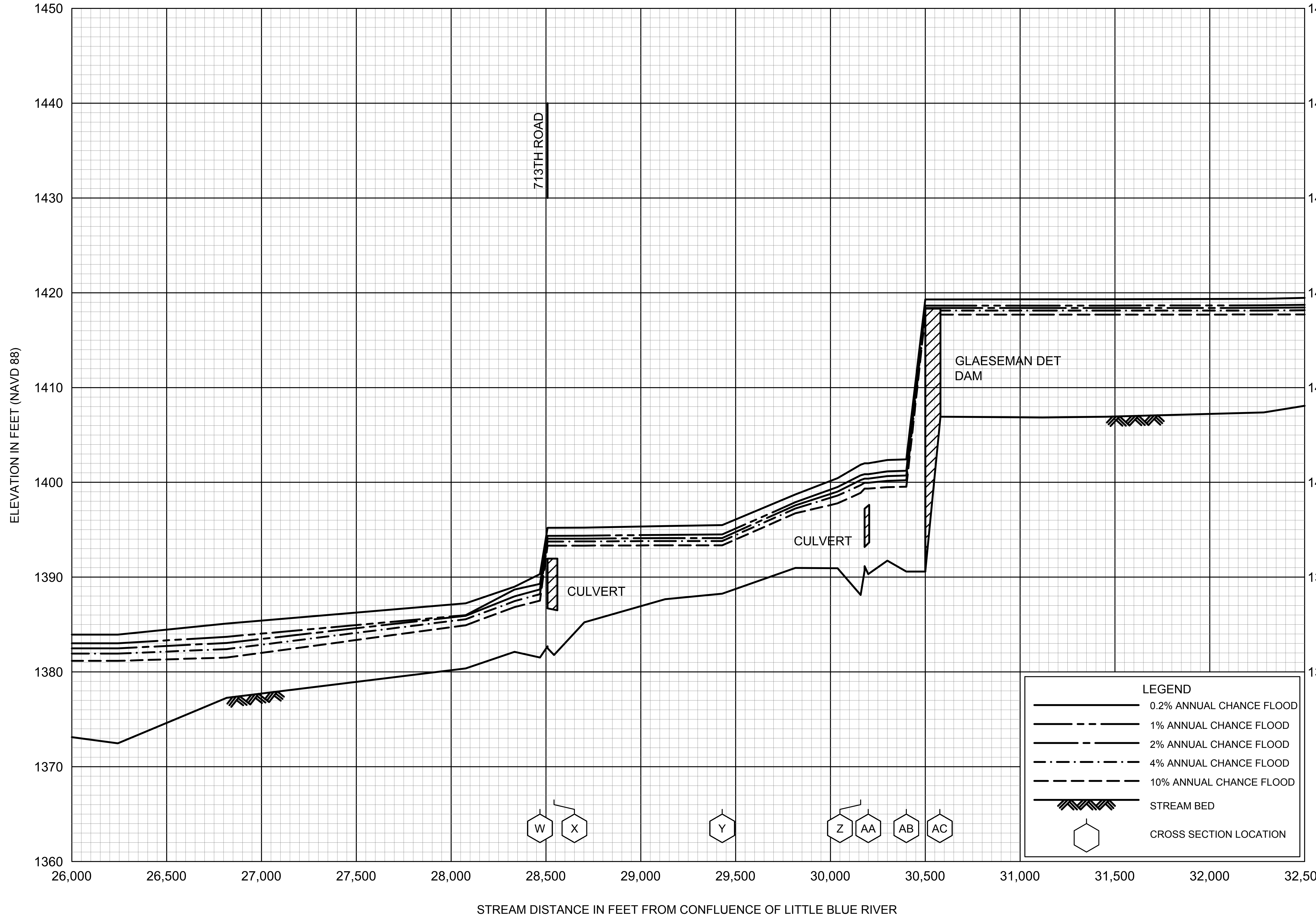


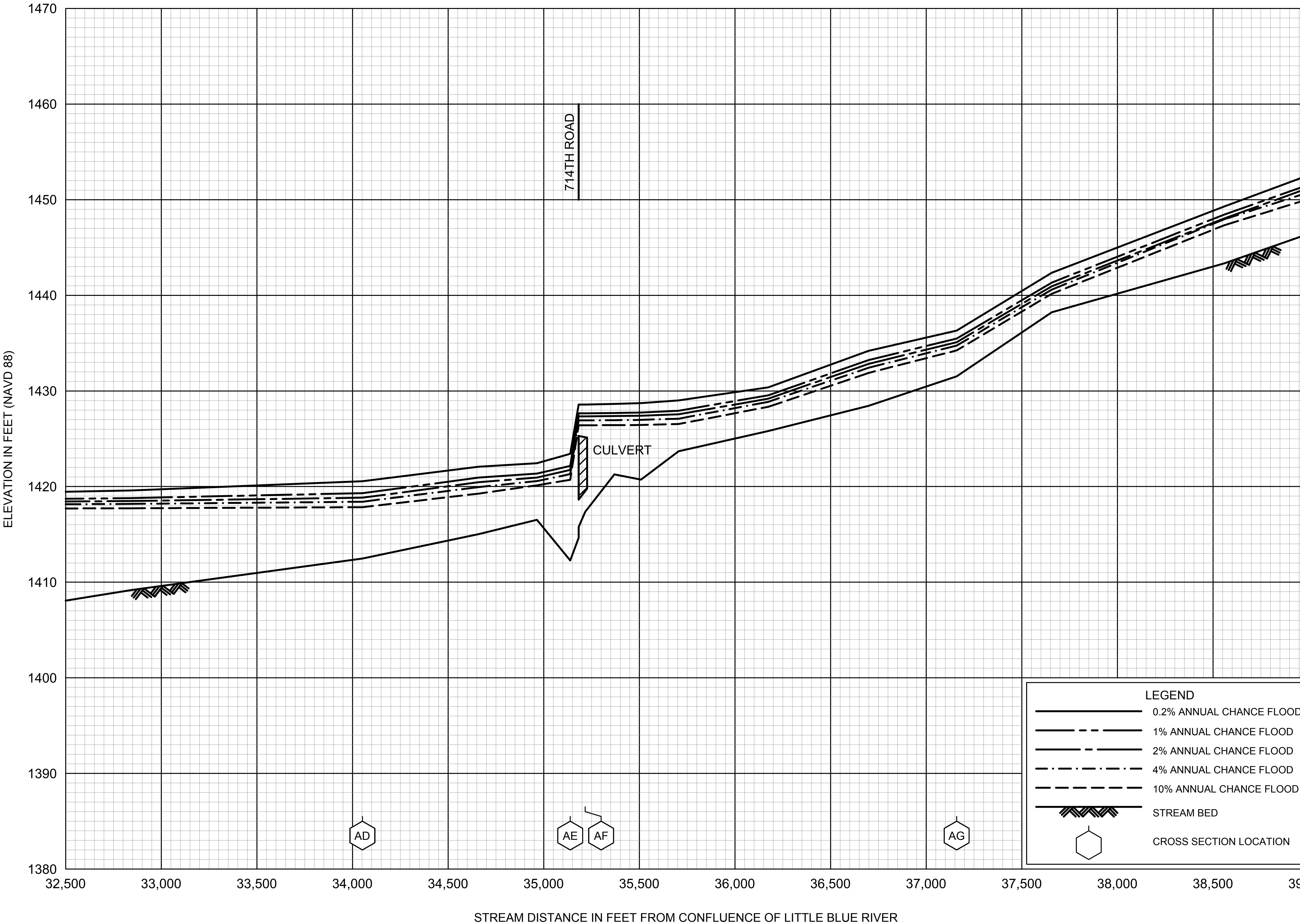
FLOOD PROFILES

BRAWNER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

(AND INCORPORATED AREAS)



FLOOD PROFILES

BRAWNER CREEK

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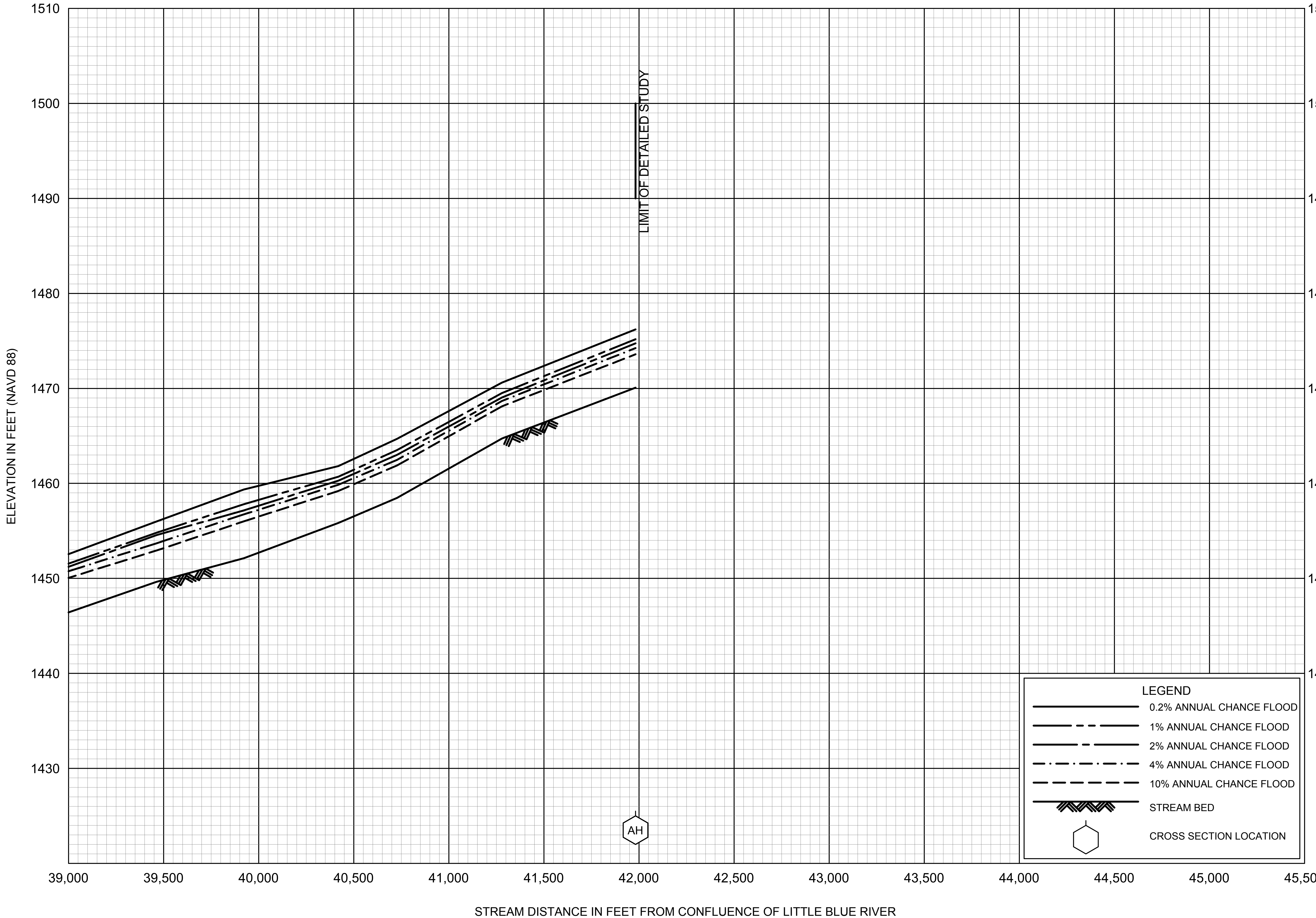
JEFFERSON COUNTY, NE

(AND INCORPORATED AREAS)



FLOOD PROFILES

BRAWNER CREEK

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JEFFERSON COUNTY, NE

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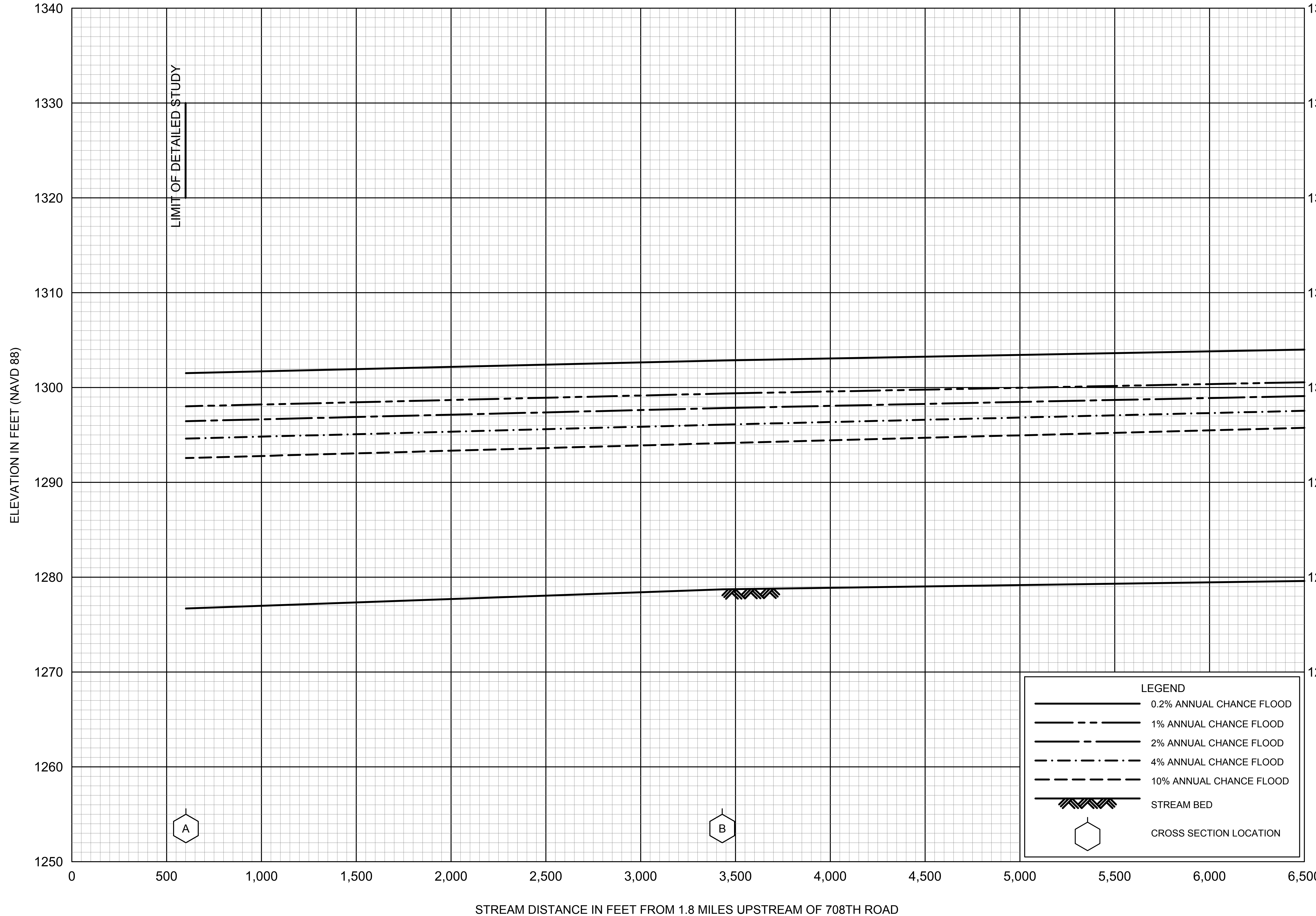


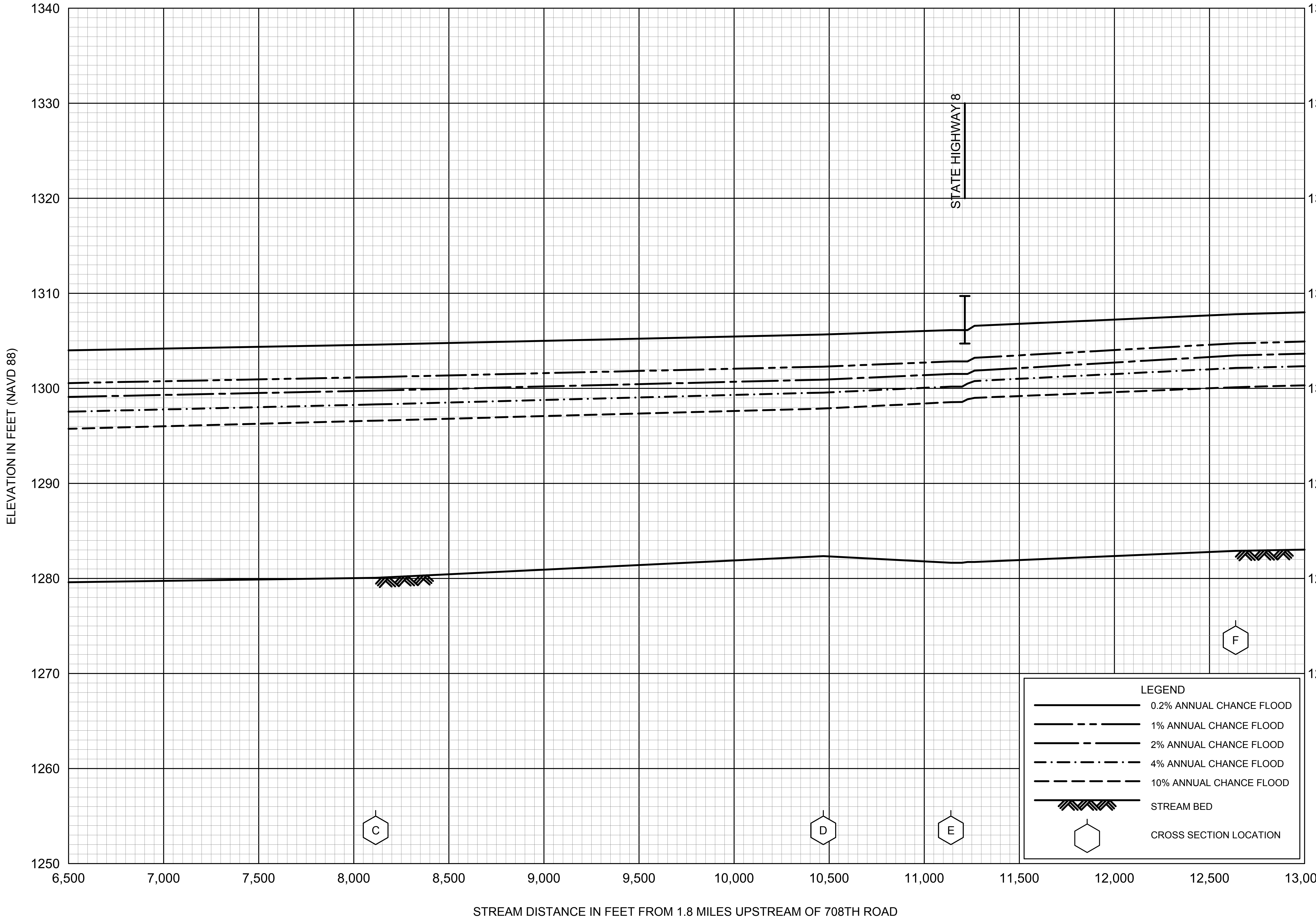
FLOOD PROFILES

LITTLE BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

(AND INCORPORATED AREAS)



FLOOD PROFILES

LITTLE BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

(AND INCORPORATED AREAS)

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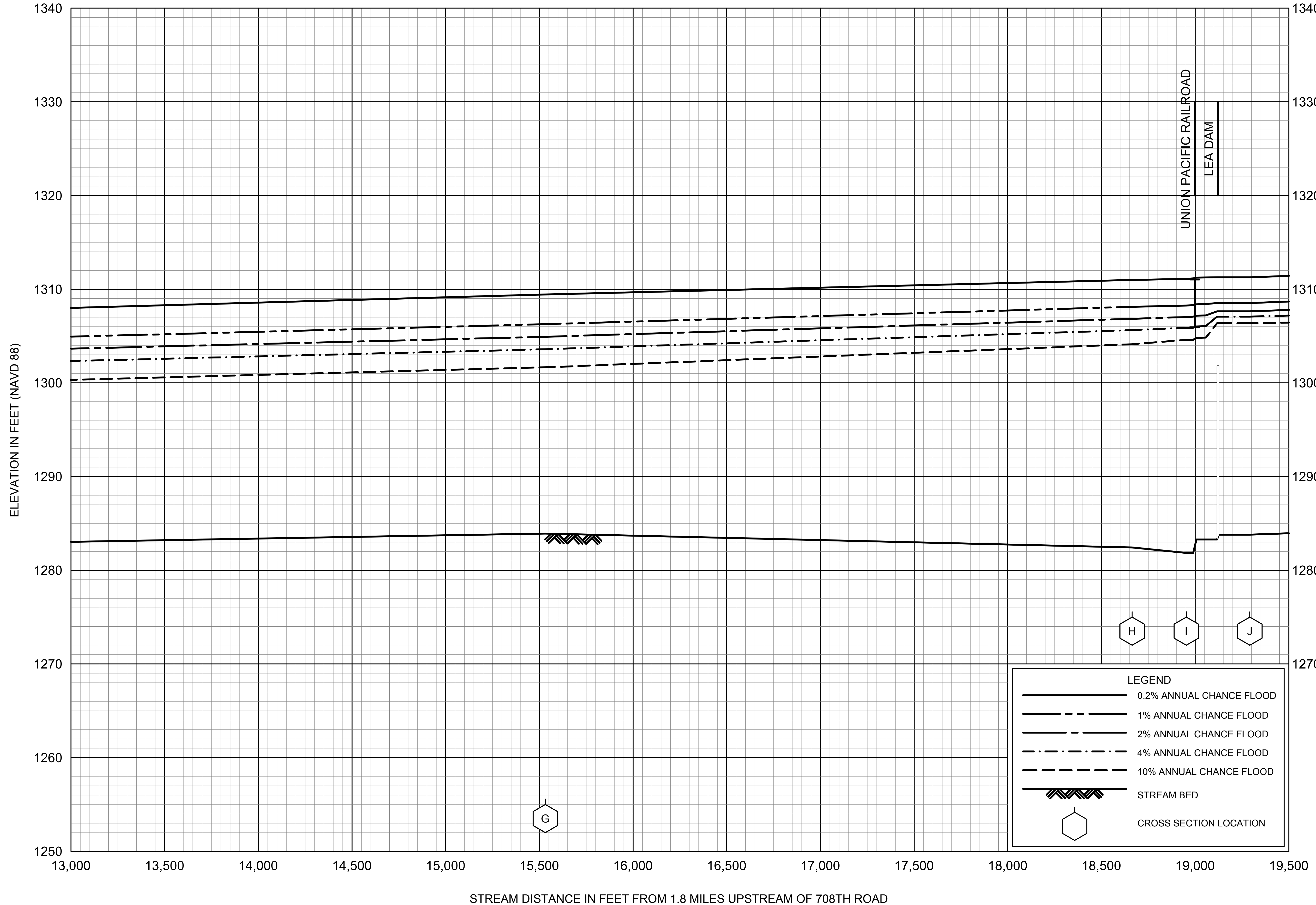

FLOOD PROFILES

LITTLE BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

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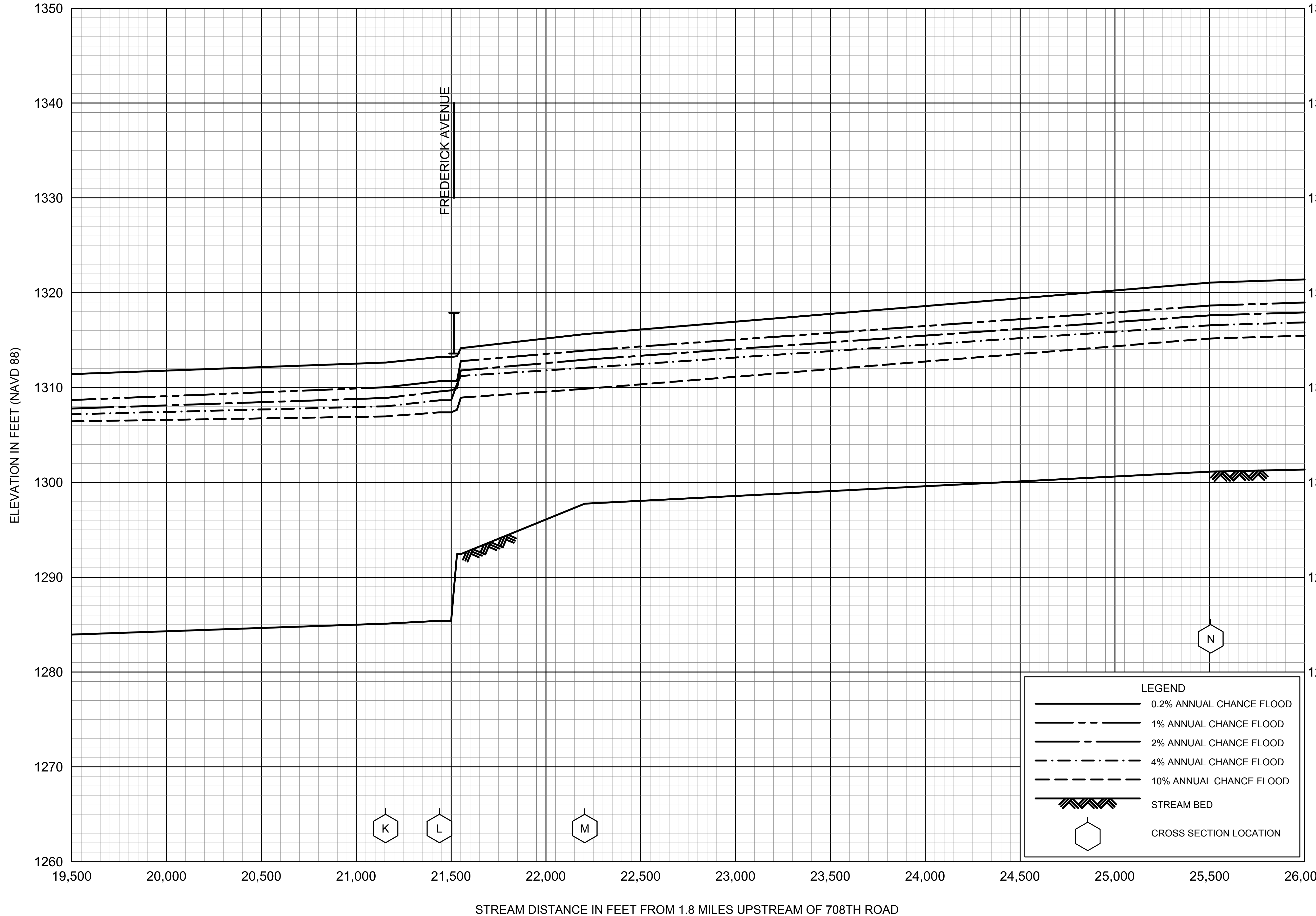

FLOOD PROFILES

LITTLE BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

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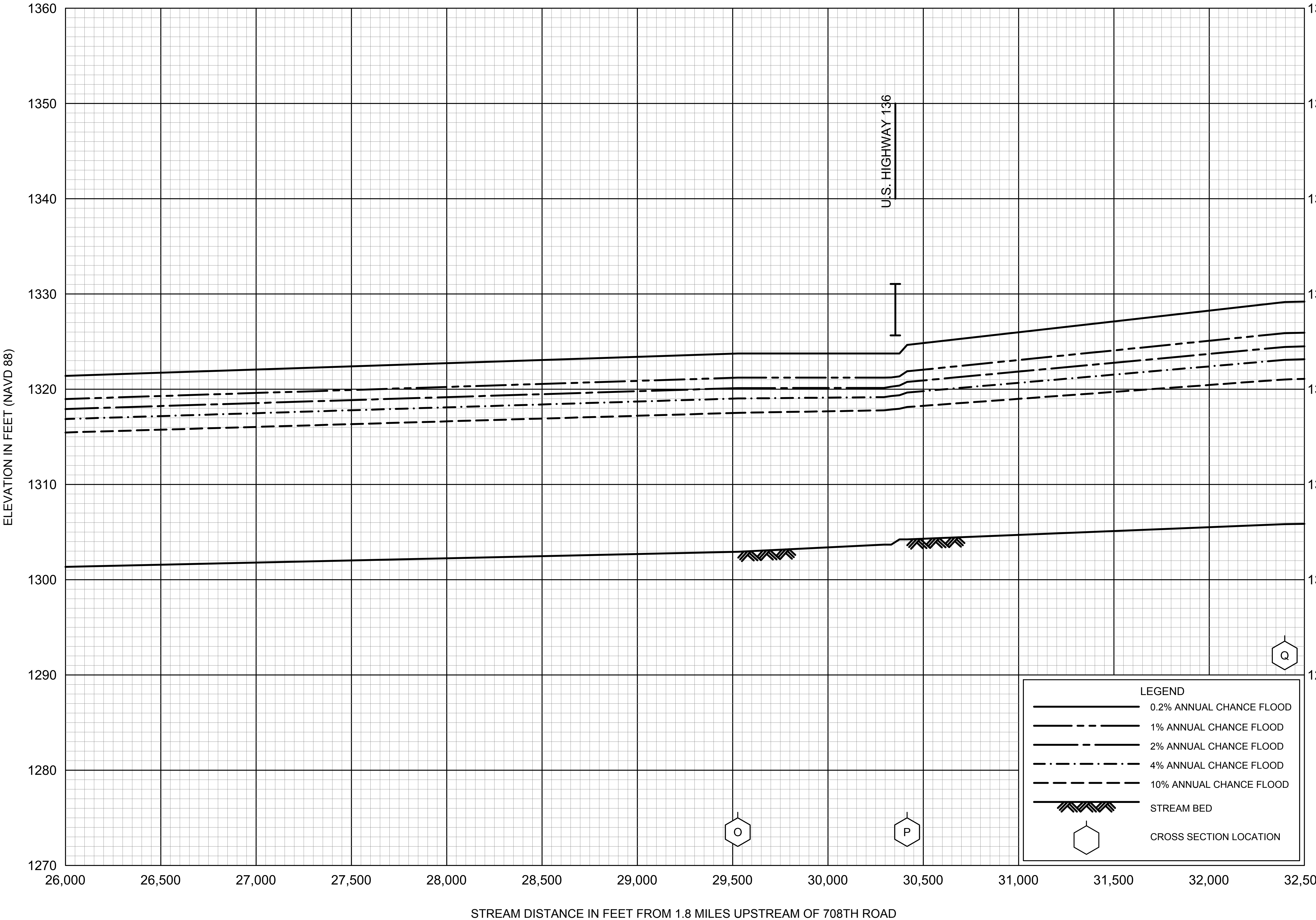

FLOOD PROFILES

LITTLE BLUE RIVER

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JEFFERSON COUNTY, NE

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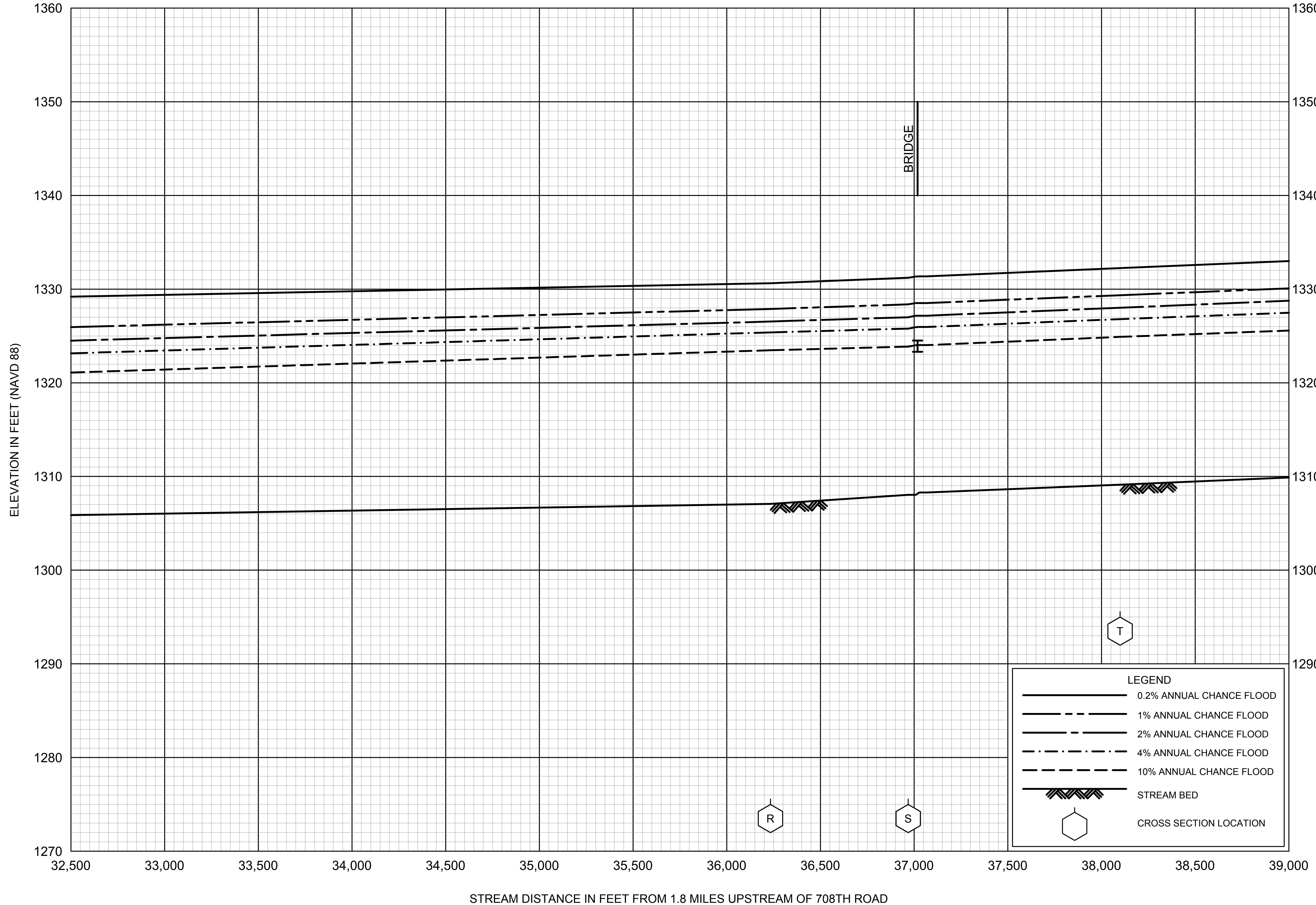

FLOOD PROFILES

LITTLE BLUE RIVER

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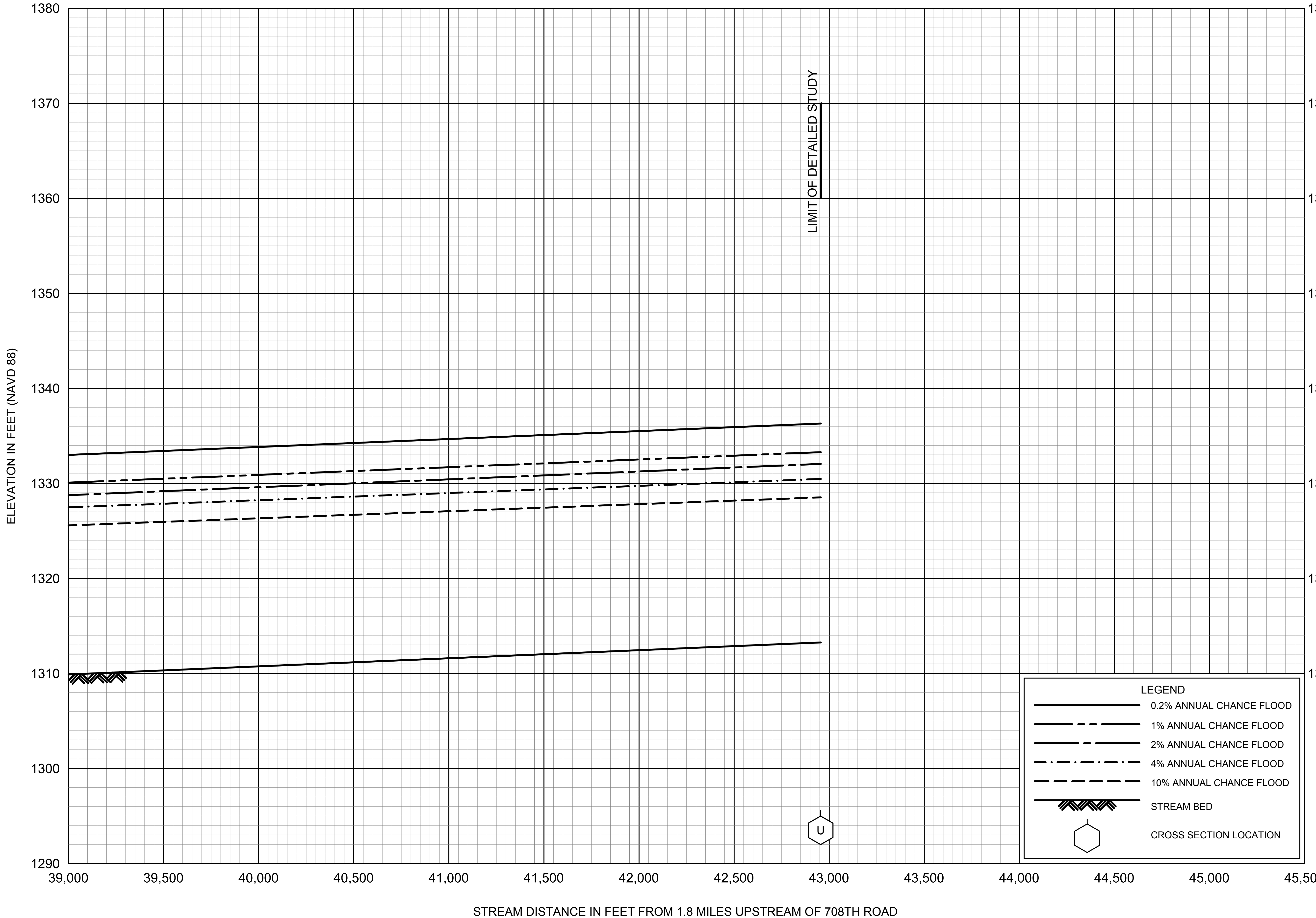
JEFFERSON COUNTY, NE

(AND INCORPORATED AREAS)



FLOOD PROFILES

LITTLE BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON COUNTY, NE

(AND INCORPORATED AREAS)