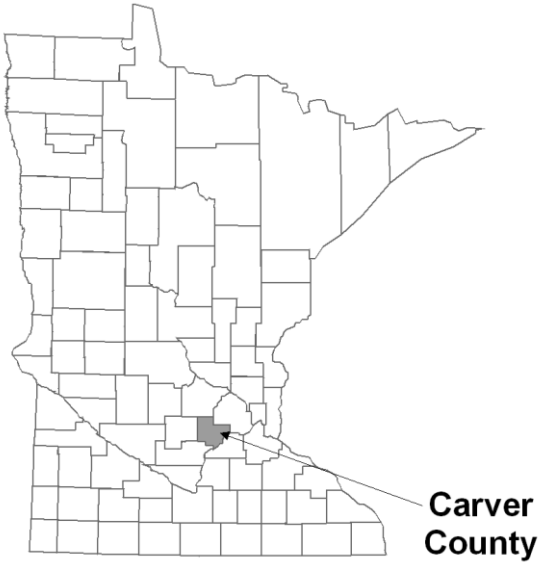
FLOOD INSURANCE STUDY

CARVER COUNTY, MINNESOTA
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
CARVER COUNTY (UNINCORPORATED AREAS)	270049
CARVER, CITY OF	275233
CHANHASSEN, CITY OF	270051
CHASKA, CITY OF	275234
COLOGNE, CITY OF	270562
*HAMBURG, CITY OF	270939
MAYER, CITY OF	270053
NEW GERMANY, CITY OF	270938
NORWOOD YOUNG AMERICA CITY OF,	270593
VICTORIA, CITY OF	270054
WACONIA, CITY OF	270055
WATERTOWN, CITY OF	270056



* NO SPECIAL FLOOD HAZARD AREAS IDENTIFIED

PRELIMINARY

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
27109CV000

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 panels for communities in this county 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 Zones	New Zones
A1 through A19	AE
B	X
C	X

Initial Countywide FIS Effective Date: To Be Determined

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Chaska Creek	Panel 01P
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Mapes Creek	Panels 04P-05P
Minnesota Creek	Panels 06P-16P
Riley Creek	Panels 17P-20P
South Fork Crow River	Panels 21P-29P

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

FLOOD INSURANCE STUDY
CARVER COUNTY, MINNESOTA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Carver County, including the Cities of Carver, Chanhassen, Chaska, Cologne, Hamburg, Mayer, New Germany, Norwood Young America, Victoria, Waconia, and Watertown; and the unincorporated areas of Carver County (referred to collectively herein as Carver County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the City of Hamburg has no mapped special flood hazard areas.

Please note that the City of Chanhassen is geographically located in Hennepin and Carver Counties. Only the Carver County portion of the City of Chanhassen is included in this FIS report. See the separately published FIS report and Flood Insurance Rate Map (FIRM) for flood-hazard information.

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

1.2 Authority and Acknowledgments

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

The majority of the revised hydrologic and hydraulic analyses for this study were performed by Barr Engineering, for Carver County, under a grant from the Minnesota Department of Natural Resources (Minnesota DNR) through the Federal Emergency Management Agency (FEMA) Cooperating Technical Partner grant EMC-2006-CA-7012. This grant also included redelineation of previous hydraulic analyses performed for the City of Chaska 1998 FIS (FEMA,1998) and the City of Chanhassen 1979 FIS (Flood Insurance Administration (FIA) ,1979). The revised analyses and redelineation work was completed in September 2009.

The Minnesota River lower reach hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (USACE). This work was completed in 2004.

The Minnesota River reach upstream of the USACE analysis was revised by the Minnesota DNR to be consistent with the lower reach analyses. This work was completed in 2007.

Base map information shown on the FIRM was provided to Carver County by Aero-Metric, Inc. dated April 2005. The projection used in the preparation of this map is Universal Transverse Mercator (UTM) Zone 15, and the horizontal datum used is National American Datum (NAD) 83, Geographic Reference System (GRS) 1980 spheroid.

1.3 Coordination

The initial Consultation Coordination Office (CCO) meeting was held on August 10, 2006, and attended by representatives of FEMA, Carver County, The Cities of Waconia, Victoria, Watertown, Chanhassen, and Chaska, and the Minnesota DNR. The purpose of an initial CCO meeting is to discuss the scope of the FIS.

The results of the study were reviewed at the final CCO meeting held on _____, and attended by representatives of _____. 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 Carver County, Minnesota, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

Limited detailed analyses were used to study those areas having minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and Carver County. The streams and lakes studied using limited detailed analyses are listed in Section 3.1 of the FIS, along with the methods of study used.

The streams listed in Table 1 were studied using detailed methods in this revision. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (FIRM) panels (Exhibit 2).

TABLE 1 – STREAMS STUDIED BY DETAILED METHODS

Stream Name	Limits of Revised Detailed Study
Mapes Creek	From the confluence with South Fork Crow River to approximately 2.4 miles upstream of the confluence with South Fork Crow River

TABLE 1 - STREAMS STUDIED BY DETAILED METHOD (Continued)

Stream Name	Limits of Revised Detailed Study
Minnesota River	From the eastern county boundary to the western county boundary
South Fork Crow River	From the northern county boundary to the western county boundary

In the City of Chaska July 1998 FIS (FEMA,1998), the following streams were studied by detailed methods:

- Chaska Creek
- East Creek

In the City of Chanhassen 1979 FIS (FIA,1979), the following streams and lakes were studied by detailed methods:

- Lake Ann
- Lake Lucy
- Lake Minnewashta
- Lotus Lake
- Riley Creek

In the City of Waconia March 1977 FIS (FIA, 1977), Lake Waconia was studied by detailed methods.

All lakes and streams previously studied by detailed methods were redelineated for this countywide study.

The study of Mapes Creek included both a limited detailed and a detailed analysis. The detailed study area of Mapes Creek is from approximately 11,924 feet upstream from the confluence with South Fork Crow River to the confluence with South Fork Crow River. The limited detail study area is from approximately 21,754 feet upstream of the confluence with the South Fork Crow River to approximately 11,924 feet upstream of the confluence with the South Fork Crow River.

Approximate studied streams were digitally captured in the City of Chanhassen.

The Limited Detail study included Bevens Creek and one tributary. Bevens Creek is located in the south portion of Carver County, Minnesota. Two flooding sources were identified, named, and modeled in the area – Bevens Creek and Tributary 1 to Bevens Creek.

The Bevens Creek study begins approximately 0.2 miles downstream of Tacoma Avenue in the south portion of Carver County and ends approximately 0.2 miles upstream of County Road 153. There is approximately 89 square miles of contributing drainage area to Bevens Creek. The Tributary 1 study begins at the confluence with Bevens Creek and continues approximately

1.8 miles upstream to County Road 41. There is approximately 4 square miles of drainage area to Tributary 1.

The Limited Detail study includes the north portion of Bevens Creek and one tributary. The North portion of Bevens Creek is located in the southwest portion of Carver County. Two flooding sources were identified, named, and modeled in the area – North Bevens Creek and Tributary 1 to North Bevens Creek.

The north portion of Bevens Creek study begins approximately 20.8 miles upstream from the confluence with Silver Creek and ends approximately 0.2 miles downstream of Tacoma Avenue in Carver County. There is approximately 8 square miles of contributing drainage area to the North Bevens Creek study area. The Tributary 1 study begins at the confluence with Bevens Creek and continues approximately 0.9 miles upstream to Salem Avenue in Carver County. There is approximately 4 square miles of drainage area to Tributary 1.

The Limited Detail study area includes the mainstem of Carver Creek as well as three tributary reaches (Tributary 1, Tributary 1A, and Tributary 2). The mainstem of Carver Creek study area flows from the outlet of Benton Lake at Benton Street (State Highway 284) in Carver County, to the Carver Bluffs Parkway crossing, approximately 5,555 feet upstream of the confluence with the Minnesota River in the City of Carver. The Carver Creek mainstem study area has a total contributing area of approximately 83 square miles.

Tributary 1 of Carver Creek study area begins just south of the intersection of Wood Duck Road and Gold Finch Drive in the City of Waconia, approximately 22,454 feet upstream of the confluence with the mainstem of Carver Creek, and flows to the confluence with the mainstem of Carver Creek. Tributary 1 of Carver Creek has a total contributing area of approximately 33 square miles. Tributary 1A of Carver Creek study area flows from the outlet of Reitz Lake to the confluence with Tributary 1 of Carver Creek. The total contributing area to Tributary 1A of Carver Creek is approximately 7 square miles. Tributary 2 of Carver Creek Study area begins at the crossing of State Highway 284, just north of the intersection with 118th Street in Carver County, to the confluence with the mainstem of Carver Creek in the City of Carver. The contributing area to Tributary 2 is approximately 24 square miles.

The Limited Detail study included Silver Creek and tributaries within the limits of Carver County, Minnesota. Silver Creek is located in the southern part of Carver County. A total of 3 flooding sources were identified, named, and modeled in the area – Silver Creek, Bevens Creek, and Tributary 2. The Silver Creek study begins approximately 1.9 miles upstream from Minnesota River and continues to the Carver County-Sibley County line. There is approximately 133 square miles of contributing drainage area to Silver Creek. The Bevens Creek study begins at the confluence with Silver Creek and continues approximately 0.7 miles upstream in Carver County. There is approximately 89 square miles of drainage area to Bevens Creek. The Tributary 2 study begins at the confluence with Silver Creek and continues approximately 2.3 miles upstream in Carver County. There is approximately 14 square miles of drainage area to Tributary 2.

The Limited Detail study includes West Chaska Creek and tributaries within the limits of Carver County, Minnesota. West Chaska Creek is located in the southern part of Carver County. A total of 3 flooding sources were identified, named, and modeled in the area – West Chaska Creek, Tributary 1, and Tributary 2. The limited detail study portion of West Chaska Creek extends from approximately 8,743 feet upstream of the confluence of the Minnesota River to Gaystock Lake in Carver County. There is approximately 14 square miles of contributing drainage area to West Chaska Creek. The Tributary 1 study begins at the confluence with West Chaska Creek and continues approximately 2.8 miles upstream in Carver County. There is approximately 3.5 square miles of drainage area to Tributary 1. The Tributary 2 study begins at the confluence with West Chaska Creek and continues approximately 1.8 miles upstream. There is approximately 2.6 square miles of drainage area to Tributary 2.

This revision of the FIS also incorporates the determinations of letters issued by FEMA resulting in map changes including the Letters of Map Revision (LOMR) shown in Table 2.

TABLE 2 – LETTER OF MAP REVISIONS (LOMRs) INCORPORATED IN THIS REVISION

Community	Flooding Source/Project Description	Date Issued	Type
Chaska	Chaska Creek	9/1/2000	LOMR (00-05-129P)

2.2 Community Description

Carver County is situated in east-central Minnesota. The county is located on the southwestern edge of the Minneapolis-St. Paul metropolitan area. The population of Carver County based on the 2010 Census is 91,042 (U.S. Census Bureau, 2011). It is primarily agriculture, but the population growth rate is the fourth highest in the state for the last census. State Highways 5 and 212 provide access to the metropolitan area. State Highways 41, 45, and 101 cross the Minnesota River and provide access for Scott County to the metropolitan area.

The climate is moderate, characterized by large seasonal variations in temperature, normally sufficient rainfall for crops, and moderate snowfall. Summers are warm and moderately humid and winters are usually cold and moderately humid.

The Minnesota River, which forms the southern boundary of the county, occupies a wide floodplain, which in geological time formed the outlet for glacial drainage from Glacial Lake Agassiz in the Red River of the North Basin. The South Fork Crow River flows through the northwestern portion of the county.

2.3 Principal Flood Problems

Many of the flood problems within city and residential areas include siltation, debris accumulation, inundated structures, wet basements and serious disruption of community

activities and services. The East Creek, running through the City of Chaska, provides localized risk for runoff within the areas protected by levees. Flooding along Lakeview Terrace and shoreline areas of Lake Waconia in the City of Waconia, are caused by high water elevations along the lake. Flooding within the City of Watertown is caused by a combination of rapid spring snowmelt and heavy rainfall. In the past decade, 19 flood events were reported to the National Climatic Data Center (NCDC) for Carver County. Three to six inches of rain fell within four hours in August of 2002. Some streets were flooded with two to three feet of water from the Cities of Waconia and Victoria to the Cities Chaska and Norwood Young America. Ditches overflowed in the City of Chaska, and a few roads partially washed out. Numerous basements were flooded, and some sandbagging was necessary in Chaska (University of Minnesota Duluth, GISL, 2011). The Minnesota River flooded in the spring of 1952, 1959, 1965, 1969, 1993, 1997, 2001, 2010, and 2011. Minnesota River flooding disrupts transportation flow in the Minneapolis-St.Paul metropolitan area because of the closure of State Highways 41, 45 and 101.

2.4 Flood Protection Measures

The City of Chaska has a USACE Flood Control Project along the Minnesota River, Chaska Creek and East Creek. Please refer to the corresponding Flood Insurance Rate Map panels for the protection status of the levee system.

The project consists of approximately 1.1 miles of upgraded levee and 1.5 miles of new levee with appropriate landward drainage facilities and a storm water pumping station. Creek diversion and bypass channels were constructed on Chaska Creek (1.1 miles) and East Creek (1 mile). Several bridges were removed and/or replace. Approximately 2.9 miles of paved recreation trails on top of the levee and around Courthouse Lake are also included in the project.

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 are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance (100-year) flood in any 50-year period is approximately 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

Description of Detailed Analyses

The Chaska and East Creek hydrologic analyses were completed as part of the City of Chaska, Minnesota flood control project as reported in the 1998 Chaska, Minnesota FIS (FEMA,1998). The flood control project included diversion of high flows from these two creeks. The detailed study discharges were determined with a USACE, Hydrologic Engineering Center (HEC),

HEC-1 model (HEC, 1990) developing Soil Conservation Service (SCS) Technical Release 55 runoff hydrographs (SCS, 1975) for each interior watershed downstream of the point of diversion.

The study of Mapes Creek included both a limited detailed and a detailed analysis. The detailed study area of Mapes Creek is from approximately 11,924 feet upstream from the confluence with the South Fork Crow River to the confluence with the South Fork Crow River. The limited detail study area is from approximately 21,754 feet upstream of the confluence with the South Fork Crow River to approximately 11,924 feet upstream of the confluence with the South Fork Crow River. Flows in Mapes Creek were calculated using the Transfer Method and verified using the Regression Equations because the gaged stream characteristics closely match the Mapes Creek characteristics. USGS Station 05305200, Spring Creek near the City of Montevideo, Minnesota, was used in the Transfer Method.

The Minnesota River hydrology was updated in October 2001 (USACE,2001). The USACE produced the report "Section 22 Study: Minnesota River Main Stem Hydrologic Analysis", which presents the hydrologic analyses for development of a consistent set of frequency distributions for discharge frequency for the main stem of the Minnesota River from the City of Ortonville, Minnesota to its confluence with the Mississippi River at the City of Mendota Heights, Minnesota. These analyses were performed as part of a joint funding effort between the Minnesota DNR and the USACE. Past analyses on the Minnesota River main stem had been conducted on a fragmentary basis as part of the FIS program for individual communities and counties throughout the watershed and had resulted in inconsistent frequency distribution when viewing the river in its entirety. Also, some of the currently published FIS reports were based on obsolete study methods and at some locations did not include flood events that occurred during the last thirty years. The methodology used in the study is a flood frequency analysis for the gage near the City of Jordan (USGS Gage 05330000 for 1935-1999) adjusted using the two-station comparison method. The second gage station was the Minnesota River at City of Mankato (USGS Gage 05325000 for 1881,1903-1999). Although the analyses were conducted before the spring runoff event of 2001, subsequent analyses performed demonstrated that the frequency distributions were not sensitive to the inclusion of peak flow data for 2000 and 2001. This report has been reviewed and approved by the State of Minnesota.

The Riley Creek hydrologic analysis was completed for the 1979 City of Chanhassen, Minnesota FIS (FIA,1979). The creek discharges and stillwater elevations for Lake Susan and Rice Marsh Lake were determined using the SCS Technical Release 20 computer program (SCS, 1965).

The South Fork Crow River mapping used the hydrologic analysis from LOMR 02-05-0831P. Flow frequency analyses were conducted for the South Fork Crow River near the City of Mayer (USGS Gage 05279000 continuous record 1934-1979, high flow partial record station 1979-2000) and Buffalo Creek near the City of Glencoe (USGS Gage 05278930). This report has been reviewed and approved by the State of Minnesota (Barr Engineering Company, 2001).

The Summary of the Detailed Study Discharges are presented in Table 3.

Description of Limited Detailed Analyses

For this revision, new discharges were calculated for the Mapes Creek detailed study reach and the limited detailed study areas including Bevens Creek (from approximately 117,226 feet upstream of its confluence with Silver Creek to County Road 41) and its tributaries, Mapes Creek (from approximately 11,616 feet to approximately 22,605 feet upstream of the its confluence with the South Fork Crow), Carver Creek (from Benton Lake to Carver Bluffs Parkway) and its tributaries, Silver Creek (from the Carver County line to the confluence with the Minnesota River) and its tributaries, and West Chaska Creek (from Gaystock Lake to approximately 8,743 feet upstream of the confluence with the Minnesota River) and its tributaries. New 1-percent-annual-chance flood elevations were established for the following lake basins: Lake Bavaria, Berliner Lake, Goose Lake, Oak Lake, Swede Lake, Lippert Lake, Young America Lake, Barnes Lake, Brand Lake, Benton Lake, Meuwissen Lake, Reitz Lake, Miller Lake, Turbid Lake, Auburn Lake, Stieger Lake, Wasserman Lake, Marsh Lake, Carl Krey Lake, and Piersons Lake (Barr Engineering Company,2010).

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

Flow values for North Bevens, Bevens, Silver, and West Chaska Creeks were computed for the 1-percent-annual-chance flood event using Regional Regression Methods, taken from the USGS publication, *Techniques for Estimating Peak Flow on Small Streams in Minnesota*, 1997 (USGS,1997).

TABLE 3 - SUMMARY OF DETAILED STUDY DISCHARGES

Flooding Source and Location	Drainage Area (sq mi)	10% annual chance	2% annual chance	1% annual chance	0.2% annual chance
Chaska Creek					
At the confluence with Minnesota River	15	1,250	2,130	2,700	4,000
East Creek					
At the confluence with Minnesota River	11.8	579	880	1,044	1,220
At Chaska Boulevard/County Highway 61	*	479	732	866	1,106
At Crosstown Boulevard	*	324	527	633	753
At Engler Boulevard/County Highway 10	*	170	232	274	327
At Brandon Boulevard	*	170	172	176	189
Mapes Creek					
Approximately 2,500 ft upstream of State Highway 25	18.4	470	939	1,178	1,656
At State Highway 25	18.6	480	958	1,202	1,691
At County Highway 27	19.4	463	921	1,154	1,622
At the confluence with South Fork Crow River	19.5	461	916	1,148	1,613
Minnesota River					
At State Highway 25	16,068	48,000	84,000	101,000	145,000
Riley Creek					
At the outlet of Lake Ann	1.73	15	21	23	29
At State Highway 5/Arboretum Boulevard	1.88	39	54	60	74
At Twin Cities and Western Railroad	2.42	77	106	118	145
South Fork Crow River					
At Carver/McLeod County boundary	637.6	3,979	7,288	8,975	12,777
Approximately 1,850 downstream of County Highway 33	1,131	6,272	11,466	14,434	20,549
At County Highway 30/First Street Northwest	1,164	6,415	11,728	14,434	20,549
At Carver/Wright County boundary	1,193	6,544	11,963	14,723	20,959

* Data not available

Regression analyses are based on historic data at nearby gauged sites and are typically used as a rough prediction of flows and for verification of predicted modeled flows. The regression equations are based on watershed characteristics such as watershed area, the slope of the watershed, and the percentage of lake area in the watershed. The regression equations for Region D were used:

$$Q10 = 19.8DA^{0.794}SL^{0.488}(LK+1)^{-0.414}$$
$$Q50 = 35.1DA^{0.791}SL^{0.513}(LK+1)^{-0.416}$$
$$Q100 = 42.5DA^{0.790}SL^{0.522}(LK+1)^{-0.416}$$

where

QT = T-year flood magnitude estimate for the ungaged site
DA = drainage area of ungaged site (square miles)
SL = Slope of watershed of ungaged site (ft/mile)
LK = Area covered by lakes in ungaged watershed, as a percent of DA

Q500 was extrapolated using the 10-, 2-, and 1-percent-annual-chance discharge results.

The Transfer Method was used to verify the flows estimated by the Regression Method. This method transfers discharges for a gauged watershed to an ungauged watershed assuming hydrologic similarity. Discharge for the ungauged site is computed using a ratio of the ungauged and gauged watershed area, channel slopes, and percentage of lake area, regional regression coefficients, and the gauged discharge. The following equation is used:

$$Q_{T,u} = Q_{T,g}\,(A_u/A_g)^B$$

where

$Q_{T,u}$ = T-year flood magnitude estimate for ungaged site
$Q_{T,g}$ = T-year flood magnitude estimate for the gaged site
A_u = Drainage area for the ungaged site
A_g = Drainage area for the gaged site
B = Drainage area exponent for the T-year flood obtained from the regression equation for region in which the site is located.

Flows in Mapes Creek were calculated using the Transfer Method and verified using the Regression Equations because the gaged stream characteristics closely match the Mapes Creek characteristics. USGS Station 05305200, Spring Creek near the City of Montevideo, Minnesota, was used in the Transfer Method.

Flows in Carver Creek were estimated using a combination of Regional Regression (also verified using the Transfer Method) as well as hydrologic and hydraulic modeling. Regression was used for the majority of flows along the length of Carver Creek and its tributaries. However, there are several lakes included as part of this limited detail study area, forming the headwaters of Carver Creek and some of its tributaries. These lakes include Meuwissen, Benton, and Reitz Lakes.

For the Meuwissen, Benton, and Reitz Lake systems, the United States Environmental Protection Agency's (US EPA) Storm Water Management Model (SWMM) (US EPA, 2004), with a computerized graphical interface provided by XP Software (XP-SWMM), was chosen as the floodplain computer-modeling verification package for this study. The SCS Curve Number Method was used in XP-SWMM to generate runoff that is routed simultaneously through complicated pipe, channel, and overland flow networks. The XP-SWMM models were used to estimate flood elevations as well as the associated discharges from the lakes which were then used in place of the flows estimated by the Regional Regression Method as the initial flows to the study reaches for the hydraulic modeling of Carver Creek and Tributary 1A. See the *Description of the Hydrologic Method for Lakes* within this section for additional details on the lakes' hydrologic methods.

Description of the Hydrologic Methods for Lakes

Detailed Analyses

The stillwater elevations were determined for Lake Susan, Rice-Marsh Lake, Lake Ann, Lake Lucy, Lake Minnewashta, Lake Waconia, and Lotus Lake were determined using the SCS Technical Release 20 computer program (SCS, 1965). Stillwater elevations for Courthouse Lake and Old Hole Lake were determined in the interior drainage analysis for the City of Chaska, Minnesota flood control project.

For the Interior Drainage Ponds, a hydrologic analysis were provided by the USACE St. Paul District as part of their Chaska Levee certification. The USACEs Hydrologic Engineering Center Modeling System (HEC-HMS) was used to establish the Base Flood Elevations (BFE) for the area behind the levee.

Stillwater elevations for Carver County are shown in Table 4, "Summary of Detailed Study Stillwater Elevations."

TABLE 4 –SUMMARY OF DETAILED STUDY STILLWATER ELEVATIONS

Elevations in NAVD (feet)

Flooding Source	10% annual chance	2% annual chance	1% annual chance	0.2% annual chance
Courthouse Lake	*	*	703.6	703.7
Interior Drainage Ponds	*	*	718.6	*
Lake Ann	956.2	956.9	957.2	957.7
Lake Lucy	956.2	956.9	957.2	957.5
Lake Minnewashta	944.4	944.8	945.0	945.3
Lake Susan	883.1	884.0	884.5	885.2
Lake Waconia	962.6	963.2	963.5	964.0
Lotus Lake	897.2	897.6	897.8	898.2
Old Hole Lake	*	*	728.7	729.1
Rice-Marsh Lake	877.7	878.1	879.1	879.5

*Data not available

Limited Detailed Analyses

Hydrologic analysis was completed using several methods for lakes in Carver County for which no detailed study existed. The following lakes, given with their approximate locations, were included in this study:

- Lake Bavaria in the Minnesota River watershed in the Southeastern part of the county
- Berliner Lake, Goose Lake, Oak Lake, Swede Lake, and Lippert Lake in the South Fork Crow River watershed in the Northern part of the county
- Young America Lake, Barnes Lake, and Brand Lake in the Bevens Creek watershed near the City of Norwood Young America
- Benton Lake, Meuwissen Lake, Reitz Lake, and Miller Lake in the Carver Creek watershed in the central part of the county
- Turbid Lake, Auburn Lake, Stieger Lake, Wassermann Lake, Marsh Lake, and Carl Krey Lake, Piersons Lake in the Minnehaha Creek watershed west of Lake Minnetonka and in the Eastern part of the county

Where sufficient observations were available, 1-percent-annual-chance water surface elevations (WSELs) were determined by flood frequency analysis using a graphical fit for stage-frequency curves as recommended by the USACE. These lakes include Goose Lake, Berliner Lake, Swede Lake, Oak Lake, Lake Auburn, Stieger Lake, Wasserman Lake, Lake Bavaria, Piersons Lake, and Turbid Lake. The maximum WSEL from every year was selected from the observed record available from the MnDNR. The compiled data series is referred to as the annual maxima series. The annual maxima series for Auburn, Berliner, Oak, and Swede Lakes had at least 15 years of recorded data. For lakes that did not have 15 years of recorded information the observed WSELs that were available were correlated with WSELs from one of the four lakes listed above that did have 15 years of recorded water elevations. The regression equation with the strongest correlation was then used to add additional high water elevation levels to the water elevations for each lake that had less than 15 years of recorded data. For all of these lakes an XP-SWMM model was also developed to verify the results of the flood frequency analysis. Lakes with fewer than five years of WSEL observations were not considered.

The annual maxima series for each lake was analyzed using the median plotting position and was used to assign an exceedence probability (the probability of the annual maximum water surface elevation being greater than or equal to a value). The probabilities were then plotted on semi-log paper and a trendline was graphically fit to the data. This trendline was used to estimate the water surface elevation that would be expected to occur with a 1-percent annual probability of exceedence, or the 1-percent-annual-chance WSEL.

For lakes without a sufficient record of observation, an XP-SWMM model (US EPA, 2004) was developed.

The lakes in the Minnehaha Creek watershed are part of a network of wetlands that outflow to Lake Minnetonka via Six Mile Creek. For these lakes, an existing XP-SWMM model, developed by the Minnehaha Creek Watershed District (MCWD) and provided by the MnDNR, was modified to create a single model to estimate 1-percent-annual-chance WSEL in all of the lakes included in this system. The SWMM Runoff Method with Green-Ampt infiltration was used to generate runoff that is routed simultaneously through complicated pipe, channel, and overland flow networks. All but one of the 40 watersheds in the model contained (lake or wetland storage) areas. They were modeled in the hydraulics layer of the XP-SWMM model as a series of storage nodes connected by culverts or channels. Since detailed hydraulics were included in the XP-SWMM model provided, the model hydraulics were not modified except at the downstream boundary condition. This model was used to estimate the 1-percent-annual-chance WSEL for Marsh Lake and Carl Krey Lake.

All other lakes (Lake Bavaria, Brand Lake, Barnes Lake, Young America Lake, Benton Lake, Meuwissen Lake, and Reitz Lake) are located near the headwaters of their respective watersheds. A single watershed was delineated for each lake and an individual XP-SWMM model was created using surveyed data of the lake outlets. Since Young America Lake is situated just upstream from Barnes Lake, both lakes were included in a single model. The SCS method was used in XP-SWMM to generate runoff that is routed through the lakes.

An XP-SWMM model was also created for Lippert Lake. However, Lippert Lake flood levels are controlled by the South Fork Crow River, which is located just downstream from the lake. The 1-percent-annual-chance WSEL resulting from the XP-SWMM model were much lower than those that would result from water backing-up from the South Fork Crow River. The USACE HEC-RAS model that was developed for the South Fork Crow River was used to estimate the 1-percent-annual-chance WSEL in Lippert Lake.

Miller Lake is located along Carver Creek, with the creek flowing into and out of the lake. The 1-percent-annual-chance WSEL for Miller Lake was estimated using the HEC-RAS model that was developed for Carver Creek. The stillwater elevations for limited detailed studies are presented in Table 5.

TABLE 5-STILLWATER ELEVATIONS FOR LIMITED DETAILED STUDIES

Elevations in NAVD (ft)

Flooding Source and Location	1-Percent-Annual-Chance
Stieger Lake	946.0
Lake Auburn	942.7
Carl Krey Lake	945.8
Turbid Lake	970.8
Piersons Lake	963.5
Marsh Lake	960.4
Wassermann Lake	946.4

TABLE 5-STILLWATER ELEVATIONS FOR LIMITED DETAILED STUDIES (Continued)

Elevations in NAVD (ft)

Flooding Source and Location	1-Percent-Annual-Chance
Lake Bavaria	973.8
Reitz Lake	941.9
Benton Lake	942.5
Meuwissen Lake	940.6
Goose Lake	970.4
Young America Lake	974.0
Barnes Lake	971.8
Brand Lake	982.5
Berliner Lake	964.4
Swede Lake	973.8
Oak Lake	962.0

3.2 Hydraulic Analyses

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

Water surface profiles for East Creek and Riley Creek were computed through use of the USACE, HEC computer program, HEC-2 (HEC, 1991). The starting WSELs for East Creek were based on HEC-1 analysis of the pond level at the East Creek outlet durng the peak flow in East Creek and the peak pond elevation that would occur at a flow less than the peak (HEC, 1990).

The hydraulic analyses for Chaska Creek was taken from the FIS for the City of Chaska (FEMA, 1998).

Detailed HEC-RAS models were created as part of this FIS analysis for the South Fork Crow River and Mapes Creek from the confluence with the South Fork Crow River to approximately 11,616 feet upstream of the confluence. Survey data was combined with data from previous FIS studies, and the County's Light Detection and Ranging (LiDAR) data, to create a master digital elevation model (DEM) of the entire county. The Carver County LiDAR data, provided to Carver County by Aero-Metric, Inc. (Aero-Metric, Inc., 2007), was certified to meet photogrammetric and aerial mapping standards. The surveyed sections were used to develop an approximate stream bed profile for the un-surveyed areas along the reaches since the channel bottom is often not reflected in the LiDAR data. Cross-sections were placed

approximately every 1000 feet, or less where it was necessary to correctly define the channel geometry. Bridge geometry was obtained by field survey methods, or incorporated in from previous studies where available. Geometric data for the HEC-RAS models were created using GIS applications within the USACE, HEC computer program, HEC-GeoRAS, Version 4.1.1 (HEC, 2006).

Known WSELs were used for the downstream boundary condition in South Fork Crow River. These elevations correspond to the flood elevations in the Wright County FIS for the Crow River. The 10-percent-annual-chance flood elevation for the South Fork Crow River was used as the starting water surface elevation for the Mapes Creek Detailed Model. The 10-percent-annual-chance flood elevation was selected because the drainage area ratio between the South Fork Crow River and Mapes Creek is roughly 30:1.

Detailed hydraulic modeling for the Minnesota River began with converting the existing HEC-2 models into HEC-RAS. Because the 1-percent-annual-chance flood profile developed as part of the 1973 study (USGS,1973) represents the "base" flood profile (the profile used to assess the effect of the floodway), base-flood conditions were recreated in the HEC-RAS model. This involved removing the Interstate 494 bridge, the new Cedar Avenue bridge, and a number of fill areas along the south side of the Minnesota River between the Cedar Avenue bridge and Shakopee in the Unincorporated Areas of Carver County. Creating base-flood conditions also involved including the now removed railroad bridge just downstream of State Highway 41 at the City of Chaska. The limits of effective flow were set based on conditions that existed in the spring of 1972 (the 1973 report used conditions in the spring of 1972 as "base" conditions). The recreated base-flood profile is within 0.1 ft of the 1-percent-annual-chance flood profile published in the 1973 report except between cross-sections 22 and 50, where it is up to 0.3 ft lower. The recreated base-flood-conditions model was not adjusted to better match the 1973 profile between cross-sections 22 and 50 because of what was learned during the calibration effort. This will be described in a following paragraph.

After recreating the base-flood-conditions model, an existing conditions HEC-RAS model was developed. The new bridges and fill areas were added to the model and the railroad bridge just downstream of State Highway 41 at the City of Chaska was removed. The limits of effective flow were adjusted to account for these changes. The existing conditions model also includes updated channel topography from USACE sounding data (cross-sections 1 – 42) and updated channel and overbank topography from USGS surveys conducted in 2000 (cross-sections 43-91). The USGS and USACE identified areas with significant changes in vegetation since the spring of 1972 and used that information to adjust the existing condition model's roughness coefficients (Manning's "n" values). In some areas the changes in vegetation have increased the profile slightly, while in other areas the changes have decreased the profile slightly. The changes have the greatest influence on small to moderate floods with a maximum profile difference of about 0.15 ft. For the 1-percent-annual-chance flood, the maximum profile difference caused by changes in vegetation is less than 0.10 ft. The changes in channel geometry also have had a minor impact on flood profiles. For small, moderate, and large floods, the maximum profile difference was found to be less than 0.10 ft. The removal of the railroad bridge just downstream of State Highway 41 at the City of Chaska had the greatest impact on flood profiles. Without the

bridge, the upstream profile of a moderate to large flood (where the water is above the elevation of the old bridge's low chord, but not too much above the approaches) is 0.2 to 0.3 ft lower.

The calibration effort involved getting the base-flood-conditions model to generally reproduce the 1969 flood high water marks and getting the existing conditions model to reproduce the 1993, 1997, and 2001 flood high water marks. The 1973 report indicates that flood plain changes between the flood of 1969 and the spring of 1972 would have increased the 1969 flood elevations nearly 0.5 ft in the City of Savage. With the base-flood-conditions model calibrated to be 0.5 ft higher than the 1969 high water marks in and just upstream of the City of Savage, the existing conditions model was noticeably (0.3 to 0.5 ft) higher than the 1993, 1997, and 2001 high water marks. Therefore, the models were adjusted so that the base-flood-conditions model is only 0.2 to 0.3 ft higher than the 1969 high water marks in and just upstream of Savage. This resulted in a base-flood conditions model that produces a slightly lower profile between cross-sections 22 and 50 than what was published in the 1973 report. The base-flood-conditions model was not calibrated to the 1965 flood due to changes that occurred in the Minnesota River flood plain between the 1965 and 1969 floods. The most significant change was the placement of fill that inhibited flow over the south approach of the U.S. Highway 35 bridge. This issue is also discussed in the 1973 report.

The results of the St. Paul FIS Mississippi River HEC-2 model at the confluence of the Minnesota River (cross-section 135) were used to get the starting WSELs. Updated hydrology resulted in a 10,000 cfs reduction in the 1-percent-annual-chance discharge on the Mississippi River which caused about a 1.1 ft lower 1-percent-annual-chance flood starting WSEL on the Minnesota River.

The floodway follows the currently published floodway with minor changes to accommodate existing development and to remove a couple of small areas obviously outside the limits of effective flow. As was the case for the 1973 report, the floodway is set at the 1-percent-annual-chance floodplain boundary for much of the study area. Because of the reduction in the 1-percent-annual-chance flood profile due to the reduction in the 1-percent-annual-chance discharges on the Mississippi River and the Minnesota River, the floodway stage increase is assessed against a revised base-flood profile generated by using the base-flood-conditions geometry and the current 1-percent-annual-chance discharge and starting WSEL for the Minnesota River.

The Minnesota River reach upstream of the updated USACE model was converted from HEC-2 to HEC-RAS by the Minnesota DNR. The Minnesota River profiles were updated using the HEC-RAS model and the updated USACE hydrology.

The hydraulic analysis for the Chaska Levee Interior Drainage were provided by the USACE St. Paul District.

It should be noted that due to changes in the channel centerline and more accurate tools for measuring the distance along a curved line, the distances in the profile do not coincide with historic river mile markers. The Minnesota River floodplains were delineated using the Carver County LiDAR data.

Limited detail HEC-RAS models were created for Bevens Creek (from approximately 117,226 feet upstream of its confluence with Silver Creek to County Road 41) and its tributaries, Mapes Creek (from approximately 11,616 feet to approximately 22,605 feet upstream of the its confluence with the South Fork Crow River), Carver Creek (from Benton Lake to Carver Bluffs Parkway) and its tributaries, Silver Creek (from the Carver County line to the confluence with the Minnesota River) and its tributaries, and West Chaska Creek (from Gaystock Lake to approximately 8,743 feet upstream of the confluence with the Minnesota River) and its tributaries. The HEC-RAS models were created for these areas using the same methods as the detailed analyses described above.

The downstream boundary condition used for each of the limited detailed analyses was the normal water level. The higher flood elevation between the reach and the backwater of the receiving waters was used to map the flood elevation.

Manning's "n" used in the hydraulic computations were based on field observations. Table 6 shows the channel and overbank "n" values for the streams studied by detailed and limited detailed methods.

TABLE 6 –SUMMARY OF MANNING'S "N" VALUES

Streams	Channel "n"	Overbank "n"
Bevens Creek and Tribs Limited	0.030	0.040 - 0.100
Carver Creek Mainstem Limited	0.030 - 0.040	0.030 - 0.100
Tributaries 1 and 2 to Carver Creek	0.035	0.030 - 0.100
Tributary 1A to Carver Creek	0.030 - 0.035	0.030 - 0.100
Chaska Creek	0.035 - 0.045	0.035 - 0.150
East Creek	0.050 - 0.080	0.080 - 0.150
Mapes Creek Detailed	0.040	0.020 - 0.100
Mapes Creek Limited	0.040 - 0.070	0.030 - 0.100
Minnesota River Detailed	0.038 - 0.042	0.028-0.150
Riley Creek	0.035 - 0.045	0.055 - 0.060
Silver Creek Limited	0.030	0.040 - 0.100
Tributary 1 to Silver Creek	0.030	0.060 - 0.100
Tributary 2 to Silver Creek	0.030	0.040 - 0.100
South Fork Crow River Detailed	0.035 - 0.100	0.030 - 0.100
West Chaska Creek and Tribs Limited	0.035	0.040 - 0.100

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

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in the FIS report and on the FIRM are referenced to NAVD88. It is important to note that structural elevation data and adjacent communities' FIRMs may be referenced to NGVD29. This may result in differences in BFEs across the corporate limits between communities.

For more information on NAVD88, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988* (FEMA, 1992), or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20910 (Internet address http://www.ngs.noaa.gov).

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

The data conversion for the Minnesota River and its tributaries is 0.13 ft. For the rest of the county the average conversion for the entire county was applied. The average conversion was computed as 0.24 ft.

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, Floodway Data Table, and Summary of Stillwater Elevations Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-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 Flood Insurance Rate Map (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using LiDAR provided by Aero-Metric, Inc. (Aero-Metric, Inc., 2007).

For all streams studied by limited detailed methods, the 1-percent-annual-chance floodplain boundaries were delineated using LiDAR provided by Aero-Metric, Inc. (Aero-Metric, Inc., 2007).

For all streams studied by approximate methods, in the City of Chanhassen, the 1-percent-annual-chance floodplain boundaries were delineated using 2-foot contours (McCombs/Kunston Associates, Inc., 1976; Urban Scope, Inc. 1977).

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the

1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Minnesota standards limit such increases to 0.5 foot, provided that hazardous velocities are not produced (Minnesota DNR, 1977).

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 7). 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.

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 WSELs 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.

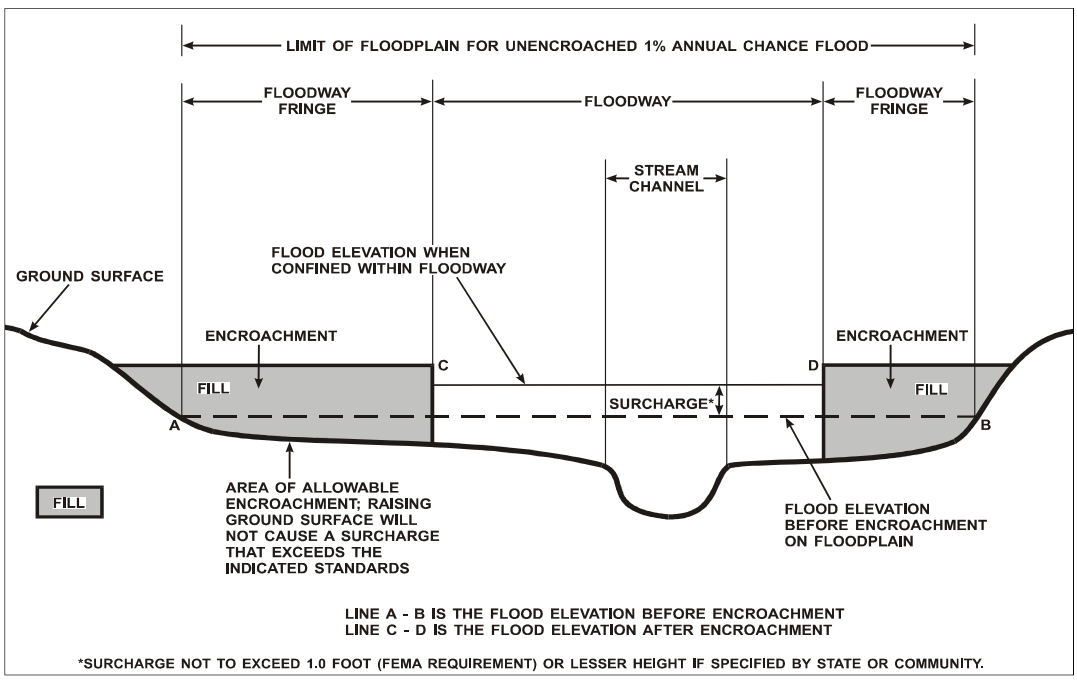


Figure 1 - Floodway Schematic

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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CHASKA CREEK								
A	8,070	125	758	5.4	757.1	757.1	757.1	0.0
B	9,070	149	415	12.0	763.0	763.0	763.0	0.0

[1]FEET ABOVE CONFLUENCE WITH MINNESOTA RIVER

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

CHASKA 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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
EAST CREEK								
A	3,085	196	517	2.0	712.5	712.5	712.5	0.0
B	3,915	37	154	6.2	717.5	717.5	717.5	0.0
C	4,295	42	204	4.7	721.0	721.0	721.0	0.0
D	4,625	53	179	5.3	722.8	722.8	722.8	0.0
E	5,460	40	171	5.1	728.0	728.0	728.0	0.0
F	6,040	65	160	5.4	732.3	732.3	732.3	0.0
G	6,440	100	227	3.8	735.0	735.0	735.0	0.0
H	6,740	150	237	3.7	736.5	736.5	736.5	0.0
I	7,265	50	227	3.8	738.7	738.7	738.7	0.0
J	7,890	92	244	3.5	743.6	743.6	743.6	0.0
K	8,950	42	184	3.4	749.4	749.4	749.4	0.0
L	9,850	47	127	2.1	754.4	754.4	754.4	0.0
M	10,475	34	100	2.7	756.7	756.7	756.7	0.0
N	11,150	42	112	2.4	758.6	758.6	758.6	0.0
O	11,990	50	122	2.3	767.9	767.9	767.9	0.0
P	12,195	27	54	3.2	768.4	768.4	768.4	0.0
Q	12,690	22	44	4.0	773.3	773.3	773.3	0.0

[1]FEET ABOVE CONFLUENCE WITH MINNESOTA RIVER

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

EAST 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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MAPES CREEK								
A	4,070	210	1,533	0.8	932.9	932.9	932.9	0.0
B	4,518	350	2,329	0.5	932.9	932.9	933.0	0.1
C	5,425	490	2,951	0.4	932.9	932.9	933.0	0.1
D	6,163	350	1,772	0.7	933.0	933.0	933.0	0.0
E	6,935	141	514	2.3	933.0	933.0	933.1	0.1
F	7,234	126	502	2.4	933.3	933.3	933.4	0.1
G	7,860	110	748	1.6	936.1	936.1	936.1	0.0
H	8,401	230	1,224	1.0	936.2	936.2	936.3	0.1
I	9,310	260	1,313	0.9	936.3	936.3	936.4	0.1
J	9,920	200	1,266	0.9	938.3	938.3	938.4	0.1
K	10,368	415	2,735	0.4	938.3	938.3	938.4	0.1
L	10,943	830	6,759	0.2	938.3	938.3	938.4	0.1
M	11,338	640	4,811	0.2	938.3	938.3	938.4	0.1
N	11,616	610	5,318	0.2	938.3	938.3	938.4	0.1
O	12,615	890	7,837	0.2	938.3	938.3	938.4	0.1

[1]FEET ABOVE CONFLUENCE WITH SOUTH FORK CROW RIVER

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MAPES CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MINNESOTA RIVER								
A	132,318	5,634/3,624	101,113	1.0	720.7	720.7	721.0	0.3
B	133,105	5,385/3,234	95,834	1.1	720.7	720.7	721.0	0.3
C	133,340	5,406/3,110	99,250	1.0	720.8	720.8	721.1	0.3
D	136,294	4,563/2,087	73,360	1.4	720.9	720.9	721.1	0.2
E	137,972	5,323/5,026	84,327	1.2	721.1	721.1	721.3	0.2
F	142,098	5,355/2,807	84,926	1.2	721.4	721.4	721.6	0.2
G	144,109	5,892/2,930	105,333	1.0	721.5	721.5	721.7	0.2
H	146,581	5,651/1,606	100,579	1.0	721.6	721.6	721.8	0.2
I	148,912	4,155/182	71,545	1.4	721.6	721.6	721.9	0.3
J	152,051	4066/2,490	71,744	1.4	721.8	721.8	722.0	0.2
K	153,023	3,899/2,742	65,372	1.6	721.9	721.9	722.1	0.2
L	153,172	4,110/3,132	70,537	1.6	722.1	722.1	722.3	0.2
M	156,327	3,742/415	71,562	1.4	722.4	722.4	722.6	0.2
N	157,788	4,578/225	83,116	1.3	722.6	722.6	722.8	0.2
O	157,938	4,615/229	79,179	1.4	722.7	722.7	722.9	0.2
P	162,060	5,424/3,846	101,174	1.0	722.9	722.9	723.1	0.2
Q	163,720	6,421/4,664	119,332	0.9	722.9	722.9	723.1	0.2
R	165,278	6,478/3,912	124,203	0.8	723.0	723.0	723.2	0.2
S	168,352	6,809/1,767	128,704	0.8	723.0	723.0	723.2	0.2
T	169,666	7,163/1,719	120,535	1.0	723.0	723.0	723.2	0.2

[1]FEET ABOVE CONFLUENCE WITH MISSISSIPPI RIVER [2]TOTAL WIDTH / WIDTH WITHIN COUNTY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MINNESOTA RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MINNESOTA RIVER (CONTINUED)								
U	170,082	7,746/1,672	110,472	1.1	723.1	723.1	723.3	0.2
V	170,241	6,316/364	88,181	1.2	723.2	723.2	723.4	0.2
W	175,528	6,352/5,348	106,971	1.0	723.4	723.4	723.5	0.1
X	176,369	5,583/5,282	81,899	1.3	723.4	723.4	723.6	0.2
Y	182,794	5,469/3,593	88,055	1.2	723.6	723.6	723.8	0.2
Z	185,921	4,605/1,612	89,962	1.2	723.8	723.8	723.9	0.1
AA	189,211	6,967/3,477	116,037	0.9	723.9	723.9	724.1	0.2
AB	191,685	8,465/3,187	147,786	0.7	724.0	724.0	724.1	0.1
AC	195,085	6,443/1,102	90,162	1.1	724.1	724.1	724.2	0.1
AD	197,505	8,258/540	118,164	0.9	724.2	724.2	724.3	0.1
AE	198,925	7,219/1,842	105,764	1.0	724.2	724.2	724.4	0.2
AF	202,465	7,934/3,530	114,324	0.9	724.3	724.3	724.5	0.2
AG	204,485	5,817/3,223	81,271	1.3	724.4	724.4	724.6	0.2
AH	207,445	7,214/3,819	106,592	1.0	724.5	724.5	724.7	0.2
AI	209,885	5,462/4,583	77,870	1.3	724.6	724.6	724.8	0.2
AJ	211,635	4,563/3,561	63,030	1.6	725.3	725.3	725.4	0.1
AK	214,315	3,693/3,330	52,780	2.0	725.6	725.6	725.7	0.1
AL	218,915	3,545/331	49,810	2.1	726.2	726.2	726.3	0.1
AM	221,495	3,424/225	50,361	2.0	726.4	726.4	726.5	0.1
AN	223,915	4,533/1,412	65,747	1.6	726.6	726.6	726.8	0.2

[1]FEET ABOVE CONFLUENCE WITH MISSISSIPPI RIVER [2]TOTAL WIDTH / WIDTH WITHIN COUNTY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MINNESOTA RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MINNESOTA RIVER (CONTINUED)								
AO	226,375	3,422/1,631	48,333	2.1	726.8	726.8	726.9	0.1
AP	229,055	3,381/2,422	47,965	2.2	727.1	727.1	727.2	0.1
AQ	231,435	3,495/2,562	46,907	2.2	727.3	727.3	727.4	0.1
AR	234,195	3,476/1,712	52,464	2.0	727.7	727.7	727.8	0.1
AS	236,315	3,350/532	51,304	2.0	727.9	727.9	728.0	0.1
AT	238,355	3,560/227	56,346	1.8	728.3	728.3	728.4	0.1
AU	242,975	3,864/3,089	58,129	1.7	728.5	728.5	728.6	0.1
AV	244,815	3,770/1,993	55,401	1.8	728.6	728.6	728.7	0.1
AW	247,275	4,122/1,715	56,218	1.8	728.7	728.7	728.8	0.1
AX	249,755	5,050/2,024	69,472	1.5	728.9	728.9	729.0	0.1
AY	252,255	4,818/1,381	66,782	1.5	729.0	729.0	729.1	0.1
AZ	254,875	4,350/719	56,859	1.8	729.2	729.2	729.3	0.1
BA	260,755	2,303/1,228	32,839	3.1	729.5	729.5	729.6	0.1
BB	262,275	745/0	15,608	6.5	729.5	729.5	729.5	0.0
BC	263,065	785/0	17,158	5.9	730.4	730.4	730.5	0.1

[1]FEET ABOVE CONFLUENCE WITH MISSISSIPPI RIVER [2]TOTAL WIDTH / WIDTH WITHIN COUNTY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MINNESOTA 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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
RILEY CREEK								
A	7,598	43	56	2.1	884.5	884.5	884.5	0.0
B	8,136	340	293	0.4	884.6	884.6	884.6	0.0
C	9,007	254	52	2.3	888.9	888.9	888.9	0.0
D	9,947	36	51	2.3	894.8	894.8	894.8	0.0
E	10,792	16	99	1.2	899.4	899.4	899.4	0.0
F	11,843	7	10	6.0	903.2	903.2	903.2	0.0
G	12,650	172	67	0.9	909.1	909.1	909.1	0.0
H	13,453	4	8	0.8	914.7	914.7	914.7	0.0
I	14,646	29	31	1.9	923.9	923.9	923.9	0.0
J	15,565	4	8	7.5	934.8	934.8	934.8	0.0
K	15,378	8	5	4.6	939.3	939.3	939.3	0.0
L	15,901	16	14	1.6	943.9	943.9	943.9	0.0
M	18,495	18	22	1.0	956.8	956.8	956.8	0.0

[1]FEET ABOVE COUNTY BOUNDARY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

RILEY 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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK CROW RIVER								
A	428	490	3,717	4.0	931.1	931.1	931.5	0.4
B	1,765	421	5,042	2.9	932.2	932.2	932.7	0.5
C	3,781	1,050	11,094	1.3	932.9	932.9	933.4	0.5
D	4,435	826	6,832	2.2	933.1	933.1	933.5	0.4
E	5,308	599	6,247	2.4	933.4	933.4	933.9	0.5
F	6,082	504	3,440	4.3	933.6	933.6	934.1	0.5
G	6,832	515	4,600	3.2	934.3	934.3	934.6	0.3
H	9,842	497	6,001	2.5	938.5	938.5	938.8	0.3
I	10,692	819	9,037	1.6	938.6	938.6	939.0	0.4
J	12,005	1,307	13,280	1.1	938.7	938.7	939.1	0.4
K	13,575	1,309	16,086	0.9	938.8	938.8	939.1	0.3
L	15,032	661	7,036	2.1	938.9	938.9	939.3	0.4
M	15,748	825	9,349	1.6	939.1	939.1	939.5	0.4
N	16,635	746	8,174	1.8	939.2	939.2	939.6	0.4
O	17,314	559	6,027	2.4	939.3	939.3	939.7	0.4
P	18,091	357	4,252	3.5	939.5	939.5	939.8	0.3
Q	20,343	505	6,946	2.1	941.1	941.1	941.6	0.5
R	21,222	800	9,648	1.5	941.4	941.4	941.8	0.4
S	22,740	1,121	12,698	1.2	941.6	941.6	942.0	0.4
T	23,584	1,174	11,693	1.3	941.7	941.7	942.1	0.4

[1]FEET ABOVE COUNTY BOUNDARY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK CROW 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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK CROW RIVER (CONTINUED)								
U	24,752	1,279	10,605	1.4	941.8	941.8	942.3	0.5
V	25,970	859	7,405	2.0	942.0	942.0	942.5	0.5
W	26,981	1,087	9,581	1.5	942.2	942.2	942.7	0.5
X	27,919	663	5,859	2.5	942.4	942.4	942.8	0.4
Y	28,884	329	4,316	3.4	942.7	942.7	943.2	0.5
Z	29,774	634	5,869	2.5	943.3	943.3	943.7	0.4
AA	30,585	525	5,449	2.7	943.6	943.6	944.1	0.5
AB	31,637	430	5,312	2.8	944.1	944.1	944.5	0.4
AC	32,637	440	6,138	2.4	944.7	944.7	945.1	0.4
AD	33,770	875	11,688	1.3	944.9	944.9	945.3	0.4
AE	35,030	1,325	16,727	0.9	945.0	945.0	945.4	0.4
AF	36,099	606	7,101	2.1	945.0	945.0	945.4	0.4
AG	36,826	585	7,640	1.9	945.1	945.1	945.5	0.4
AH	38,921	1,522	19,194	0.8	946.4	946.4	946.9	0.5
AI	43,070	1,575	17,045	0.9	946.5	946.5	946.9	0.4
AJ	44,408	1,620	16,401	0.9	946.5	946.5	947.0	0.5
AK	45,327	1,454	13,980	1.1	946.6	946.6	947.0	0.4
AL	48,359	632	7,412	2.0	947.4	947.4	947.9	0.5
AM	49,341	858	9,551	1.5	947.6	947.6	948.0	0.4
AN	50,213	614	6,095	2.4	947.6	947.6	948.1	0.5

[1]FEET ABOVE COUNTY BOUNDARY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK CROW 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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK CROW RIVER (CONTINUED)								
AO	51,537	516	5,976	2.5	947.9	947.9	948.3	0.4
AP	52,632	468	4,184	3.5	948.1	948.1	948.5	0.4
AQ	53,693	550	5,572	2.6	948.7	948.7	949.2	0.5
AR	54,662	674	5,959	2.5	949.1	949.1	949.6	0.5
AS	55,451	422	4,653	3.2	949.4	949.4	949.8	0.4
AT	58,063	501	6,504	2.2	952.2	952.2	952.6	0.4
AU	59,045	721	7,724	1.9	952.4	952.4	952.8	0.4
AV	60,079	328	3,631	4.0	952.5	952.5	953.0	0.5
AW	60,392	584	7,029	2.1	952.9	952.9	953.3	0.4
AX	61,125	816	8,016	1.8	953.0	953.0	953.5	0.5
AY	62,085	859	7,541	1.9	953.2	953.2	953.6	0.4
AZ	63,295	1,413	18,050	0.8	953.4	953.4	953.9	0.5
BA	65,970	971	13,511	1.1	953.6	953.6	954.0	0.4
BB	67,366	819	9,792	1.5	953.7	953.7	954.2	0.5
BC	69,030	527	6,071	2.4	953.9	953.9	954.3	0.4
BD	70,076	422	5,436	2.7	954.1	954.1	954.5	0.4
BE	70,372	447	5,689	2.5	954.3	954.3	954.7	0.4
BF	72,264	2,433	24,203	0.6	954.5	954.5	954.9	0.4
BG	75,072	2,156	12,224	1.2	954.5	954.5	955.0	0.5
BH	76,719	2,306	23,927	0.6	954.6	954.6	955.0	0.4

[1]FEET ABOVE COUNTY BOUNDARY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK CROW 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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK CROW RIVER (CONTINUED)								
BI	78,543	3,282	29,180	0.5	954.6	954.6	955.1	0.5
BJ	81,154	2,329	20,541	0.7	954.6	954.6	955.1	0.5
BK	83,826	2,156	17,170	0.8	954.7	954.7	955.1	0.4
BL	86,634	1,134	7,397	1.9	954.8	954.8	955.3	0.5
BM	87,264	719	5,443	2.6	955.0	955.0	955.5	0.5
BN	87,941	438	3,936	3.6	955.4	955.4	955.8	0.4
BO	88,870	518	4,976	2.8	956.0	956.0	956.5	0.5
BP	91,176	481	5,348	2.6	958.4	958.4	958.8	0.4
BQ	92,254	591	5,430	2.6	958.8	958.8	959.2	0.4
BR	93,591	520	5,596	2.5	959.3	959.3	959.8	0.5
BS	94,993	712	8,135	1.7	959.6	959.6	960.1	0.5
BT	96,349	921	9,248	1.5	959.9	959.9	960.3	0.4
BU	98,663	1,195	11,063	1.3	960.1	960.1	960.6	0.5
BV	100,453	440	4,155	3.4	960.3	960.3	960.7	0.4
BW	102,396	476	5,083	1.9	961.5	961.5	961.9	0.4
BX	104,153	1,516	14,317	0.7	961.7	961.7	962.1	0.4
BY	106,726	1,698	15,460	0.6	961.7	961.7	962.2	0.5
BZ	109,127	1,116	9,126	1.0	961.8	961.8	962.2	0.4
CA	110,158	760	5,743	1.6	962.0	962.0	962.4	0.4
CB	112,251	1,550/1,230[2]	11,906	0.8	962.2	962.2	962.7	0.5

[1]FEET ABOVE COUNTY BOUNDARY [2]TOTAL WIDTH/WIDTH WITHIN COUNTY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK CROW 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 SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK CROW RIVER (CONTINUED)								
CC	113,258	920	6,075	1.6	962.3	962.3	962.8	0.5
CD	114,562	697	4,882	1.9	962.5	962.5	963.0	0.5
CE	115,190	1,194	7,250	1.3	962.7	962.7	963.2	0.5
CF	116,358	1,355/1,175[2]	8,248	1.1	962.9	962.9	963.4	0.5

[1]FEET ABOVE COUNTY BOUNDARY [2]TOTAL WIDTH/WIDTH WITHIN COUNTY

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK CROW 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 Base (1-percent-annual-chance) Flood Elevations (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 Carver County. Previously, Flood Insurance Rate Maps were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide Flood Insurance Rate Map 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 8.

7.0 OTHER STUDIES

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

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Federal Insurance and Mitigation Division, 536 South Clark Street, Sixth Floor, Chicago, Illinois 60605.

9.0 BIBLIOGRAPHY AND REFERENCES

Aero-Metric, Inc., LiDAR for Carver County, May 22, 2007.

Barr Engineering Company, LOMR, Carver County, South Fork Crow River, Prepared for FEMA, 2001.

Barr Engineering Company, Carver County DFIRM TSDN, December 2010.

Federal Emergency Management Agency, Flood Insurance Study, City of Chaska, Carver County, Minnesota, July 20, 1998.

Federal Emergency Management Agency, Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, Guidelines for Community Officials, Engineers, and Surveyors, June 1992.

Federal Insurance Administration, Flood Insurance Study, City of Waconia, Carver County, Minnesota, March 1977.

Federal Insurance Administration, Flood Insurance Study, City of Chanhassen, Carver County, Minnesota, January 1979.

Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, U.S. Army Corps of Engineers, Davis, California, September 1990.

Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, U.S. Army Corps of Engineers, Davis, California, May 1991.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Carver County (Unincorporated Areas)	February 1, 1978	None	February 1, 1978	October 8, 1982 January 6, 1988
Carver, City of	September 12,1972	July 1, 1974	March 26, 1976	
Chanhassen, City of	November 9, 1973	July 2, 1976	July 2, 1979	
Chaska, City of	September 8, 1972	None	September 8, 1972	July, 1 1974 March 26, 1976 April 22,1977 July 20, 1998
Cologne, City of	November 1, 1974	None	N/A	
*Hamburg, City of	N/A	None	N/A	
Mayer, City of	November 23, 1973	April 16, 1976	April 16, 1976	
New Germany, City of	N/A	None	N/A	
Norwood Young America, City of	N/A	None	N/A	
Victoria, City of	June 7, 1974	None	N/A	
Waconia, City of	June 7, 1974	None	January 5, 1978	
Watertown, City of	November 5, 1976	None	November 1, 1978	November 20, 1981 August 18, 1992

*No special flood hazard areas identified

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

Hydrologic Engineering Center, HEC-GeoRAS, Version 4.1.1., U.S. Army Corps of Engineers, Davis, California, January 2006.

McCombs/Knuston Associates, Inc., Residential Sketch F, Scale 1" = 30', Contour Interval: 2 feet, 1976.

Minnesota Department of Natural Resources, Technical Report No. 6, The Regulatory Floodway in Floodplain Management, Division of Water, September 1977.

Soil Conservation Service, Technical Release No. 20, Computer Program for Project Formulation-Hydrology, U.S. Department of Agriculture, 1965.

Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds, U.S. Department of Agriculture, 1975.

University of Minnesota Duluth, GISL, Minnesota Statewide Flood Risk Assessment Report, January 2011.

Urban Scope Inc., Lake Susan Hills, Scale 1" = 100; Contour Interval: 2 feet, 1977.

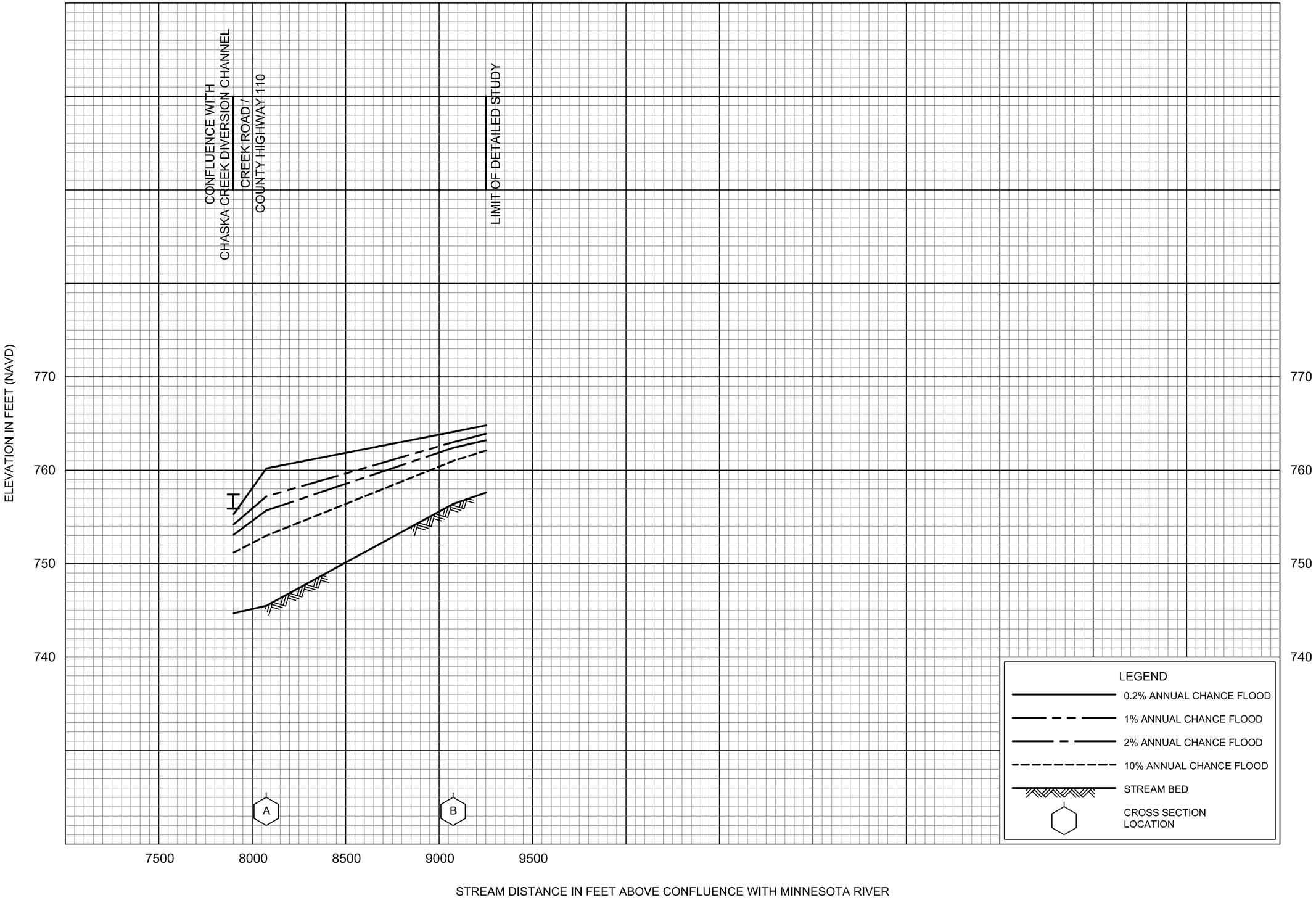
U.S. Army Corps of Engineers, Section 22 Study: Minnesota Main Stem Hydrologic Analysis, October 2001.

U.S. Census Bureau, American Fact Finder, Carver County, Minnesota, 2010. Retrieved September 19, 2011, from http://www.factfinder.census.gov.

U.S. Environmental Protection Agency, Storm Water Management Model, Version 5.0, Cincinnati, Ohio, November, 2004.

U.S. Geological Survey, Flood Plain Areas of the Lower Minnesota River, 1973.

U.S. Geological Survey, Water Resources Investigations Report 97-4249, Techniques for Estimating Peak Flows on Small Streams in Minnesota, June 1997.



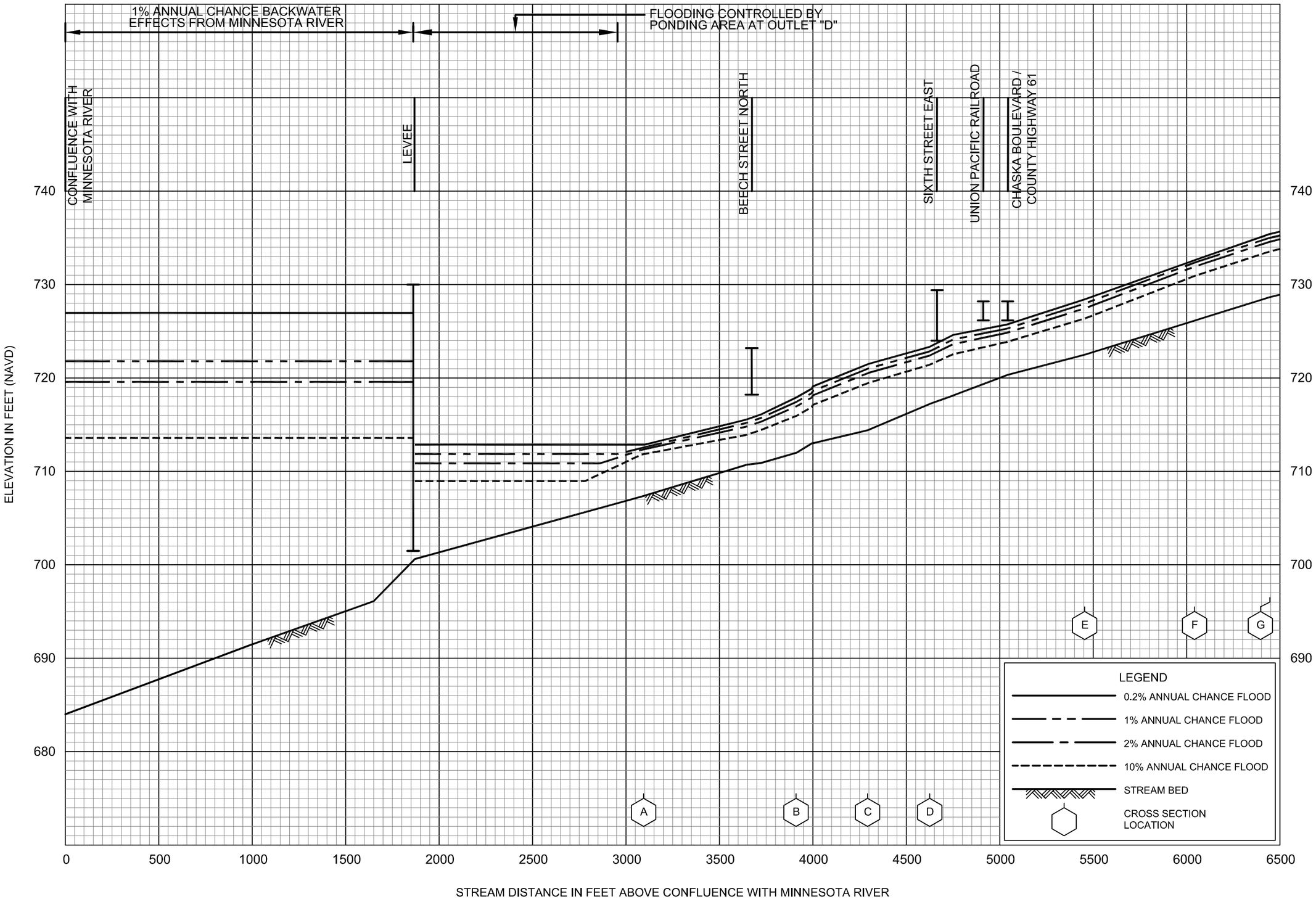
FLOOD PROFILES

CHASKA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

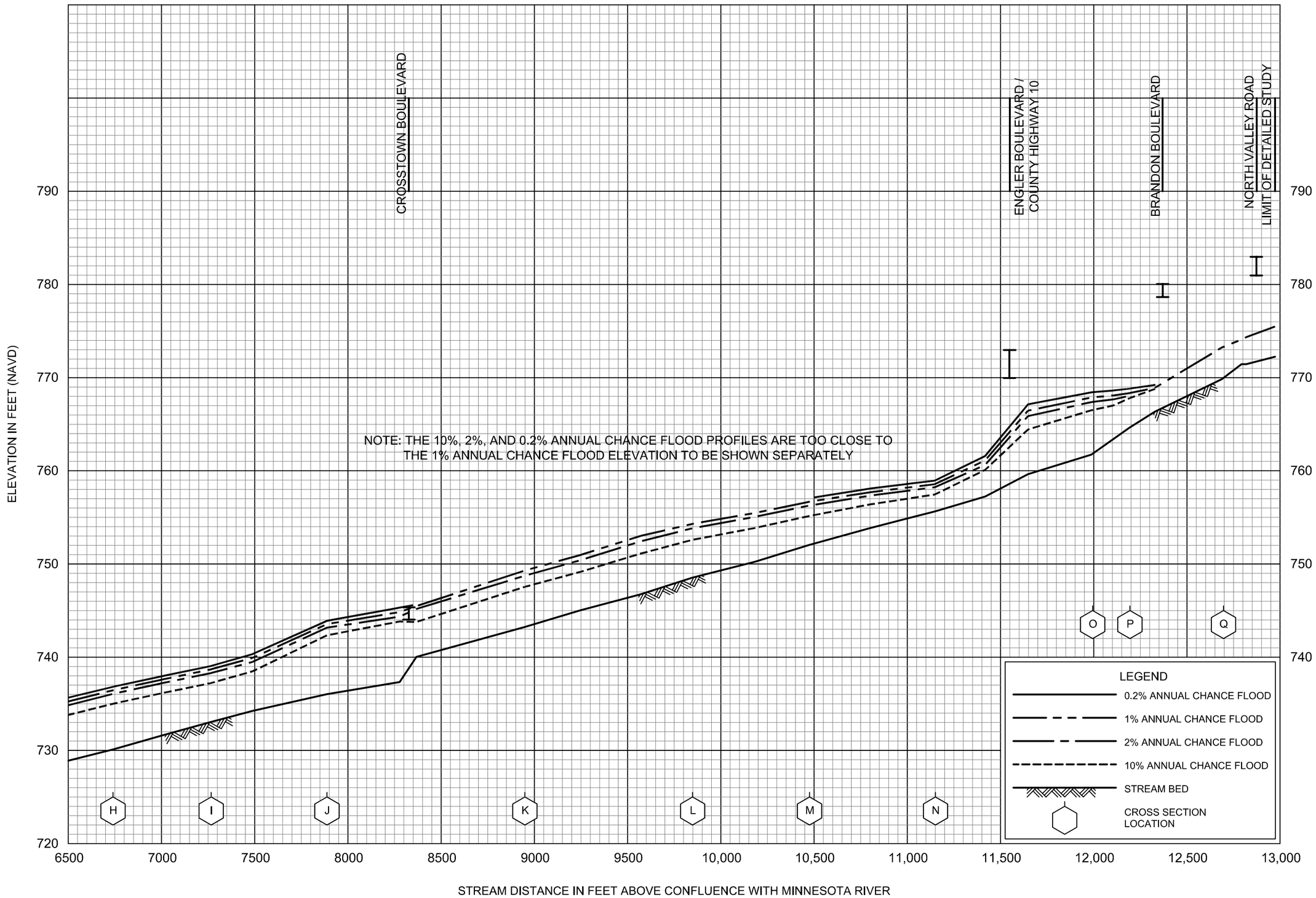
EAST CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS

02P



FLOOD PROFILES

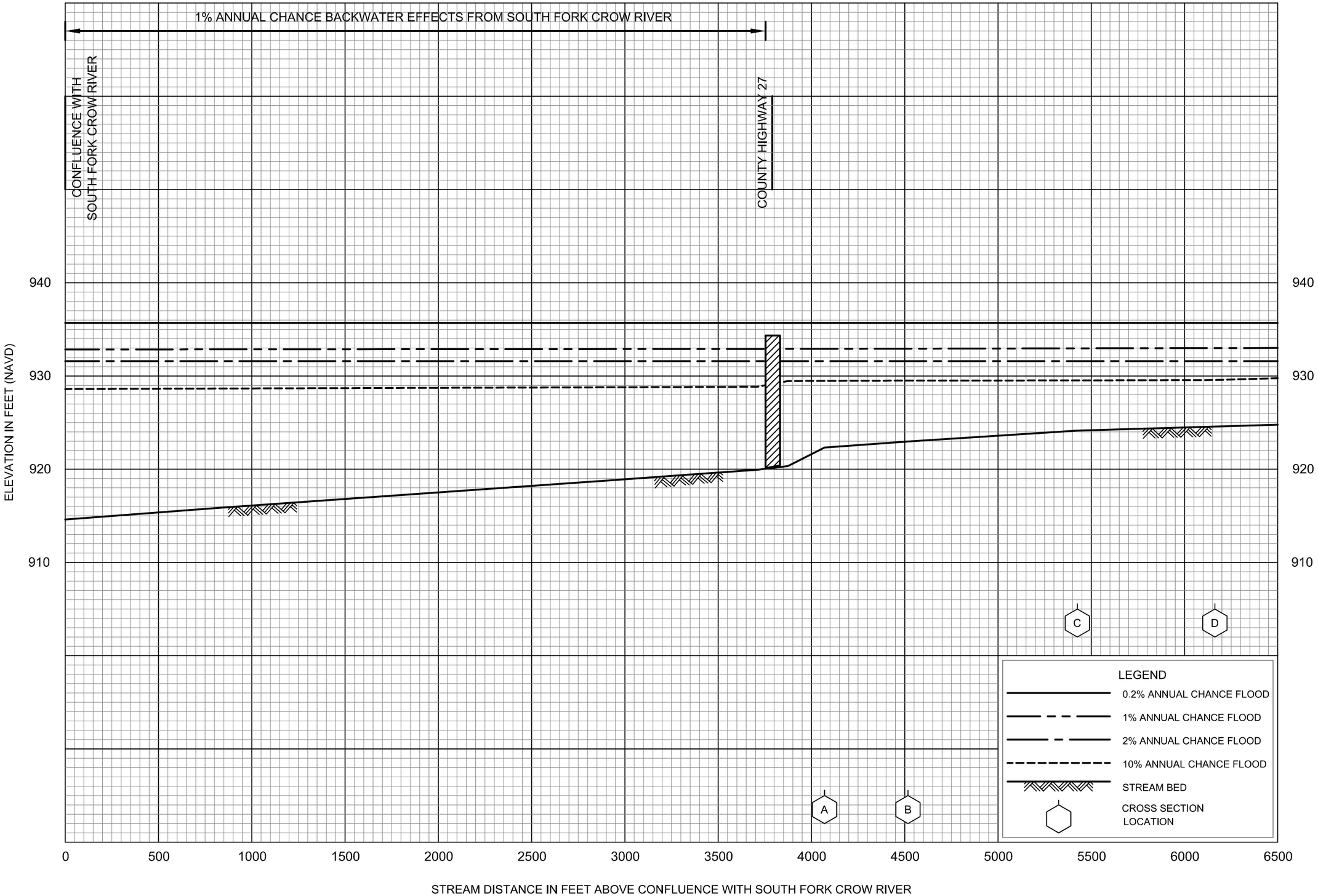
EAST CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS

03P



FLOOD PROFILES

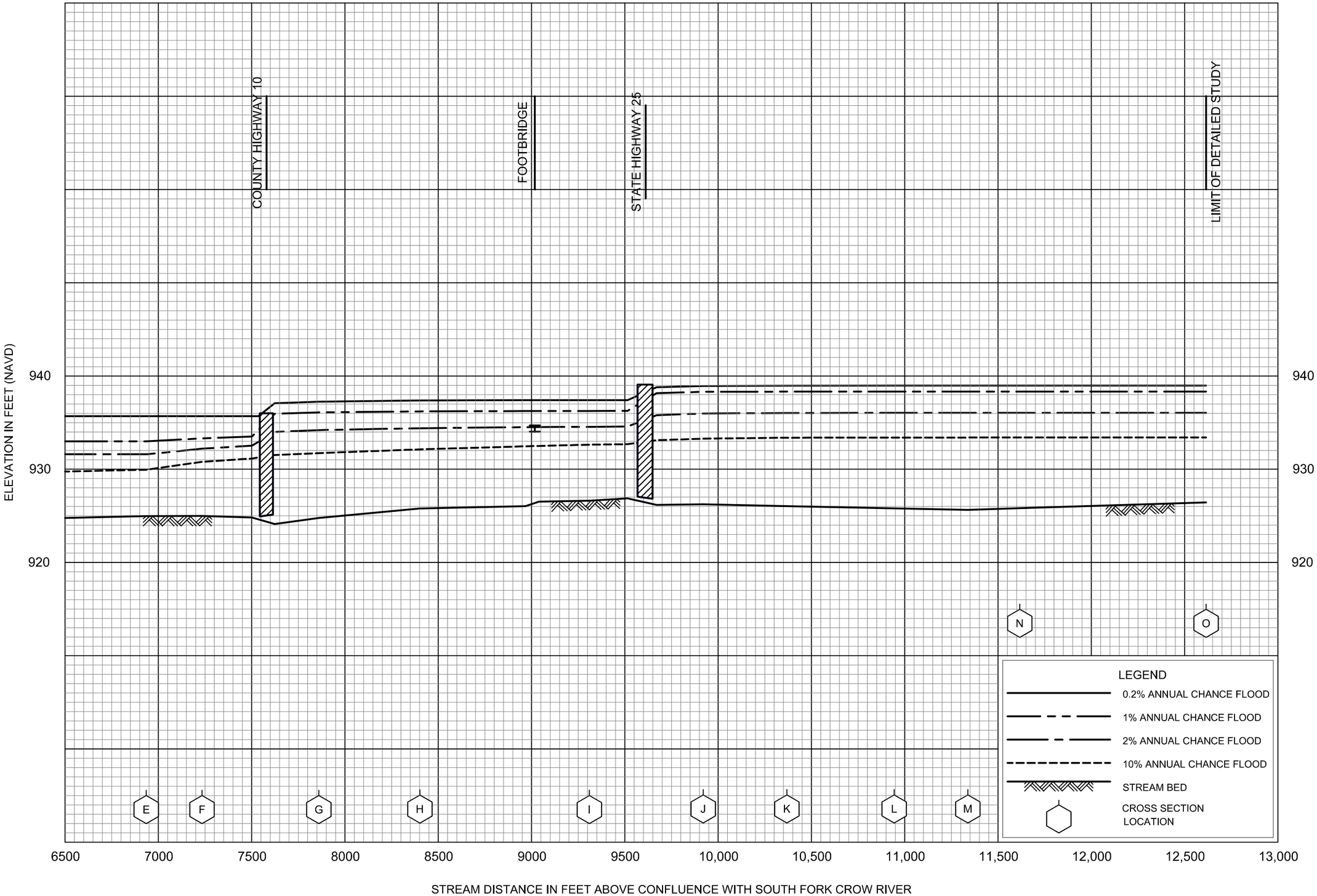
MAPES CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS

04P



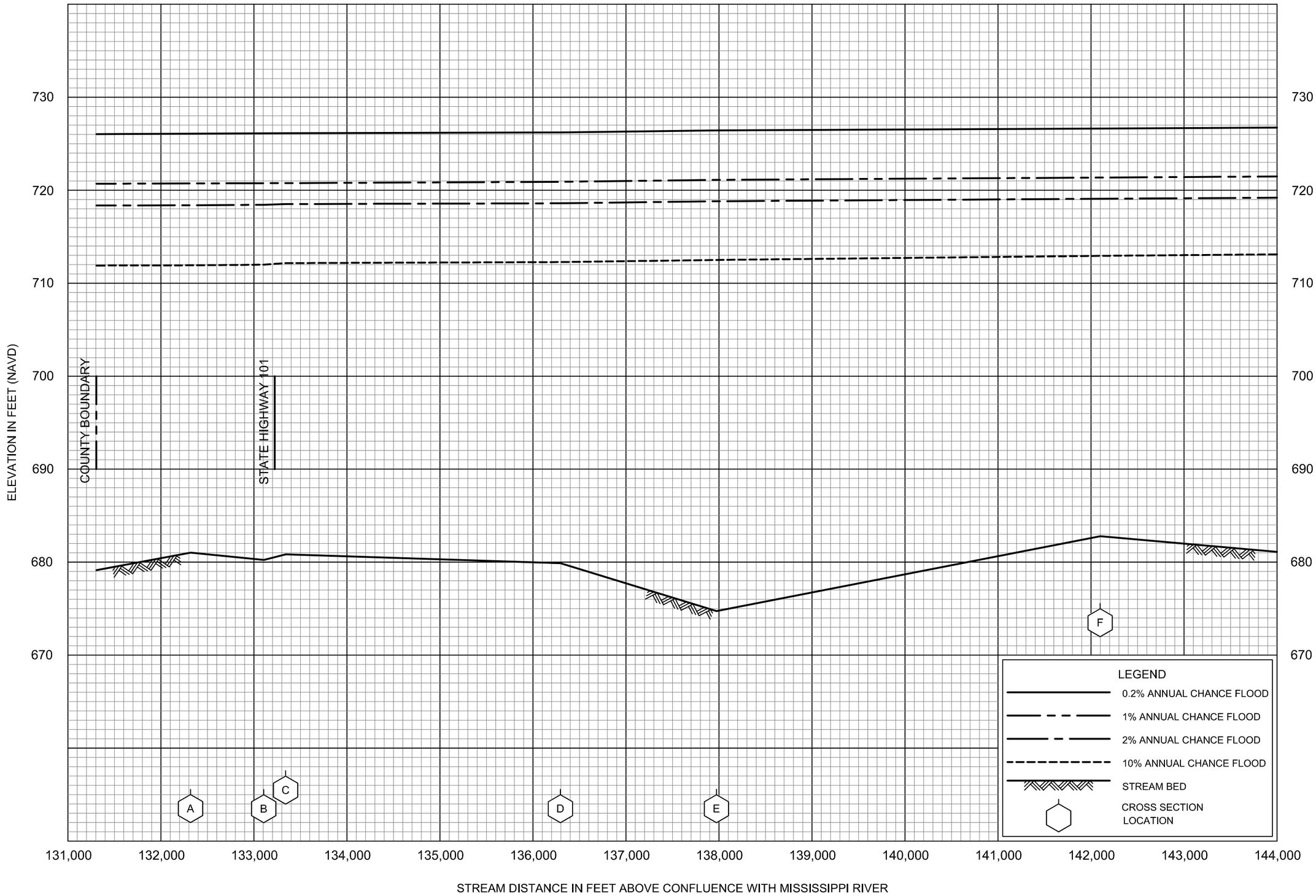
FLOOD PROFILES

MAPES CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS



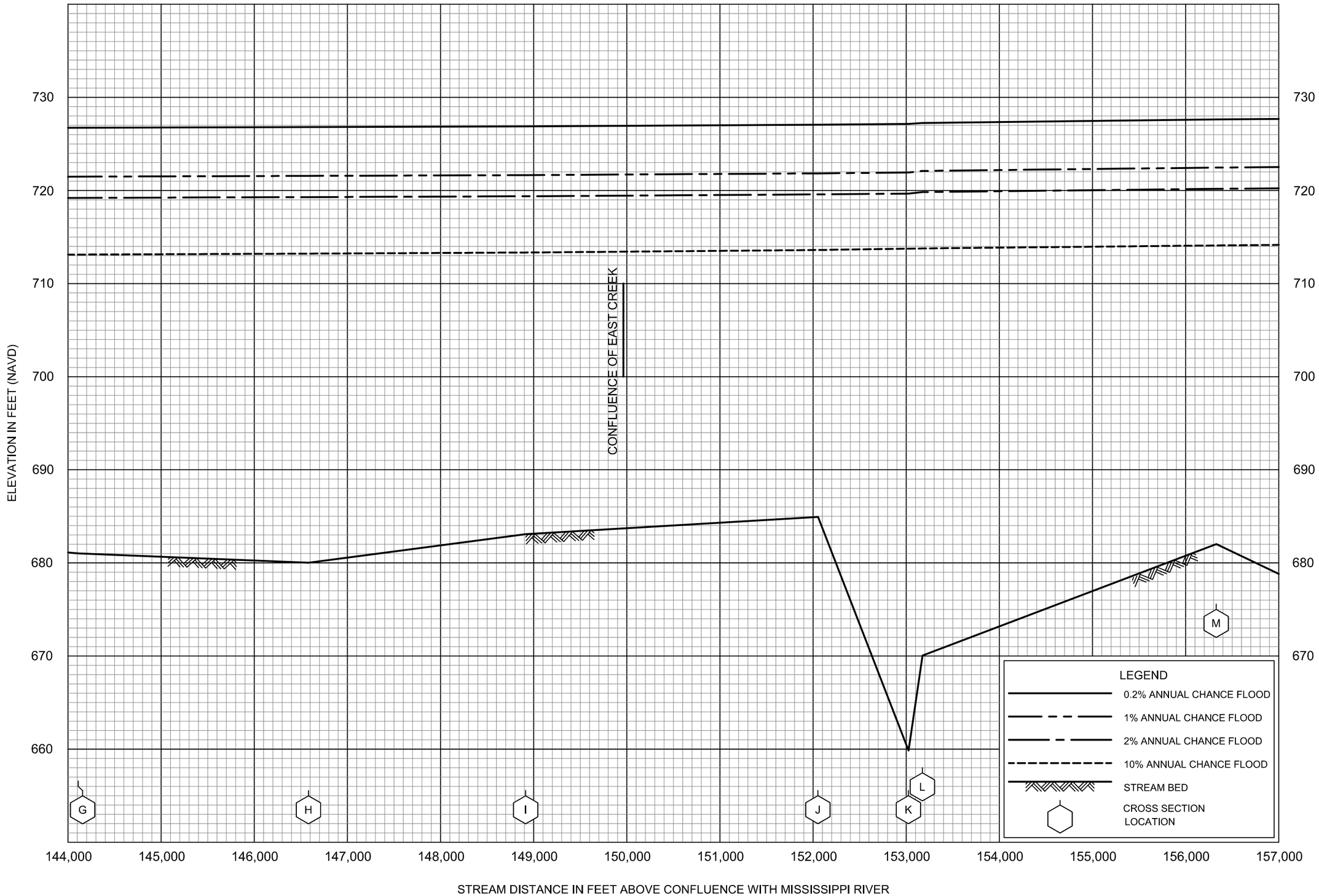
FLOOD PROFILES

MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

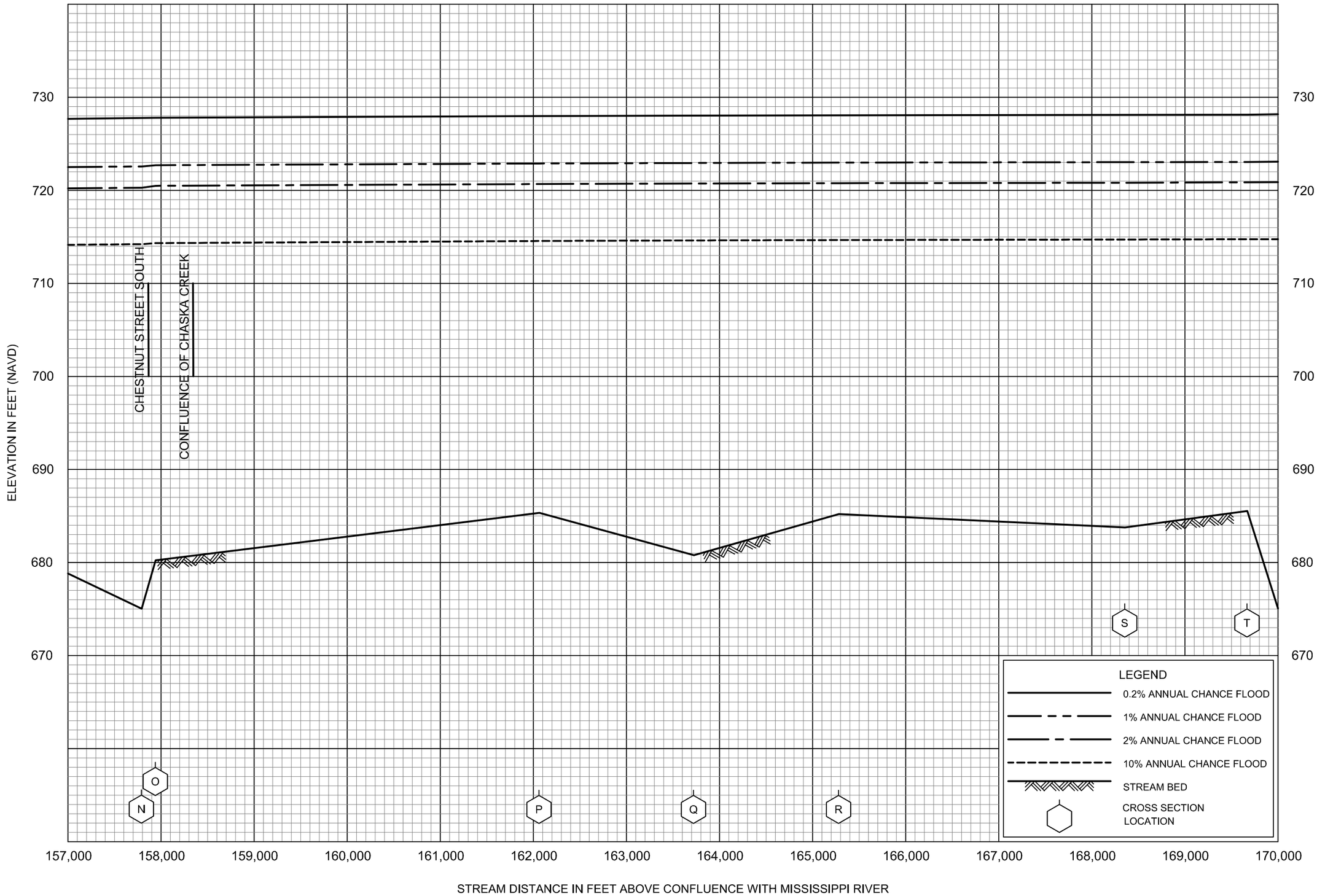
MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS

07P



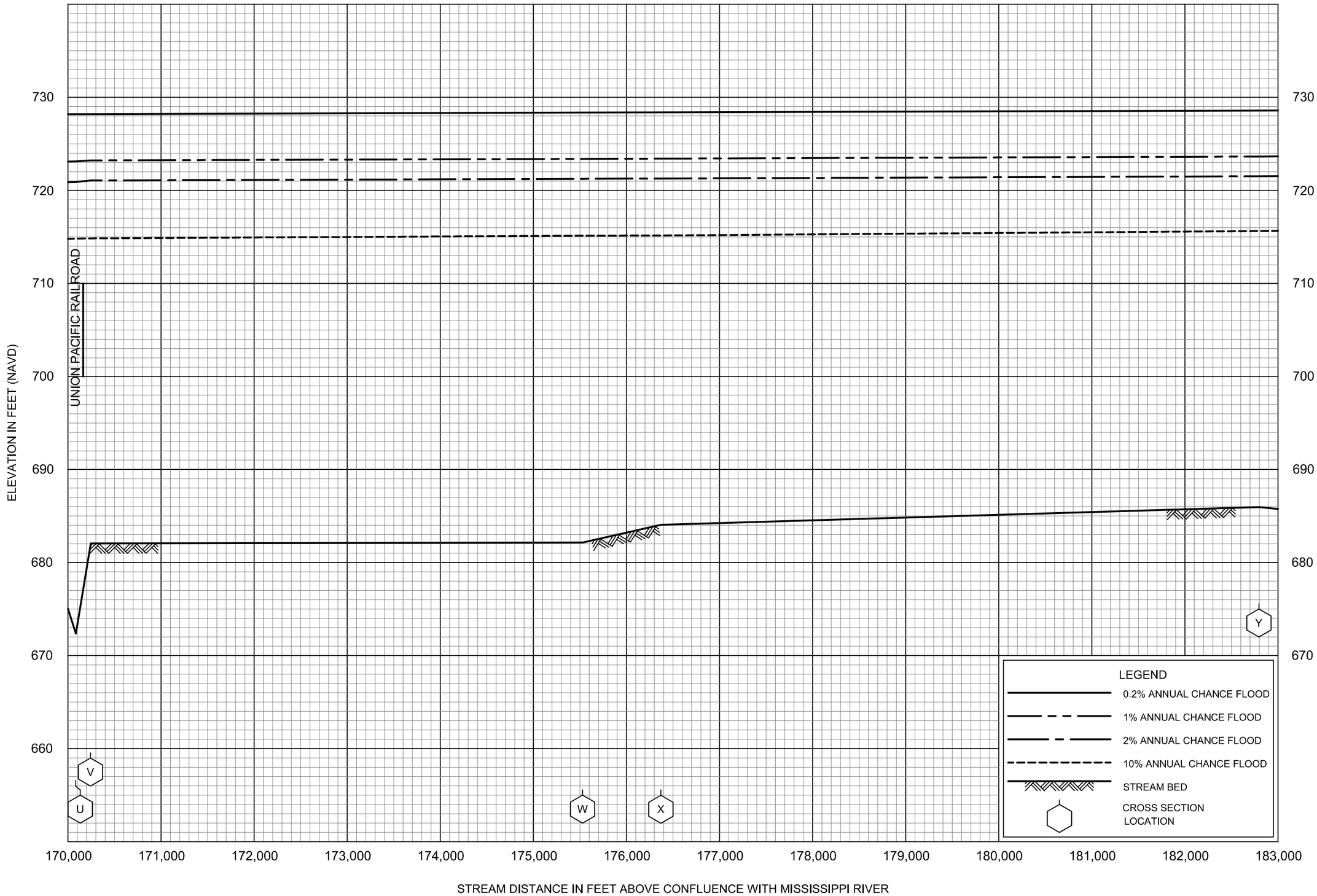
FLOOD PROFILES

MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

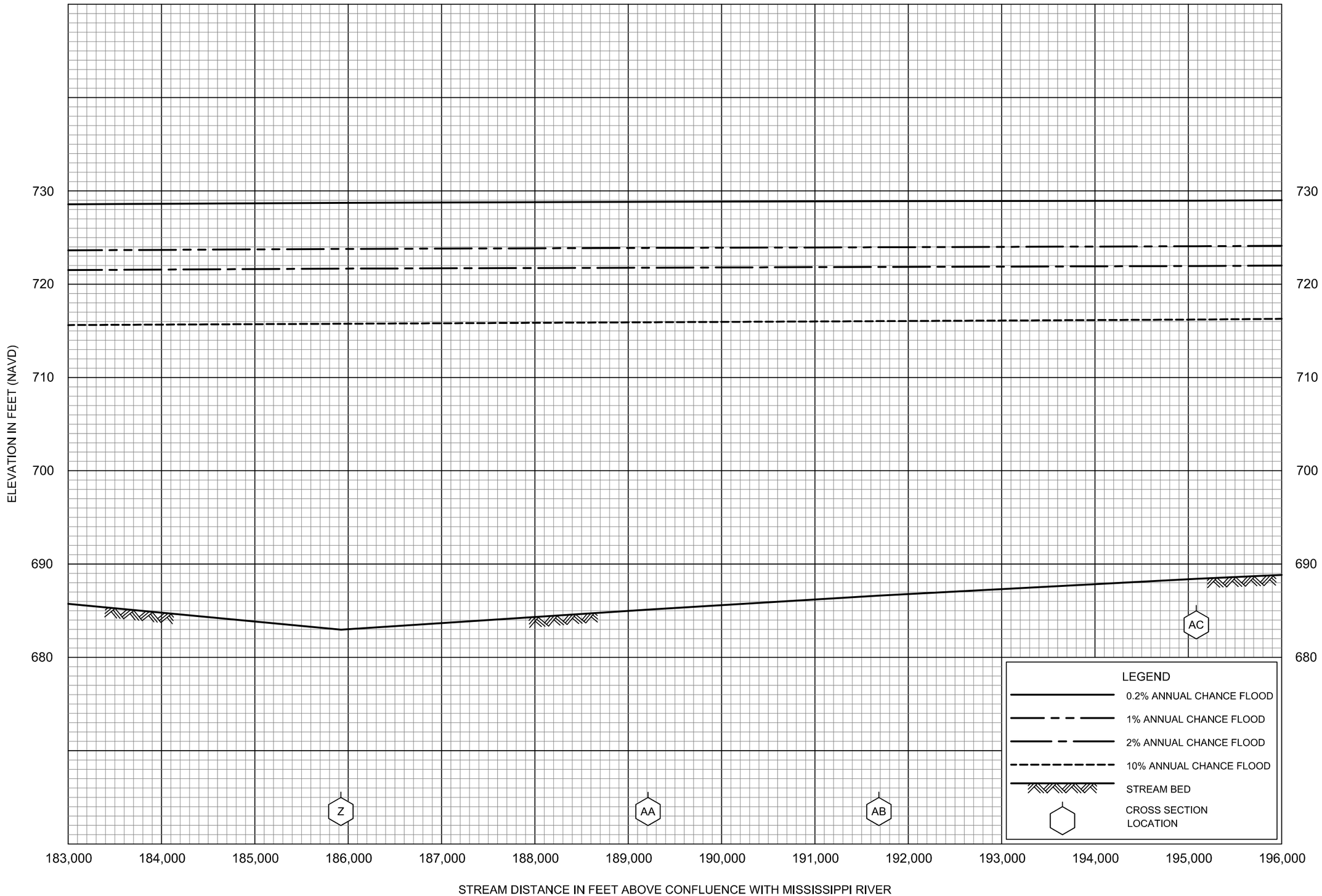
MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS

09P



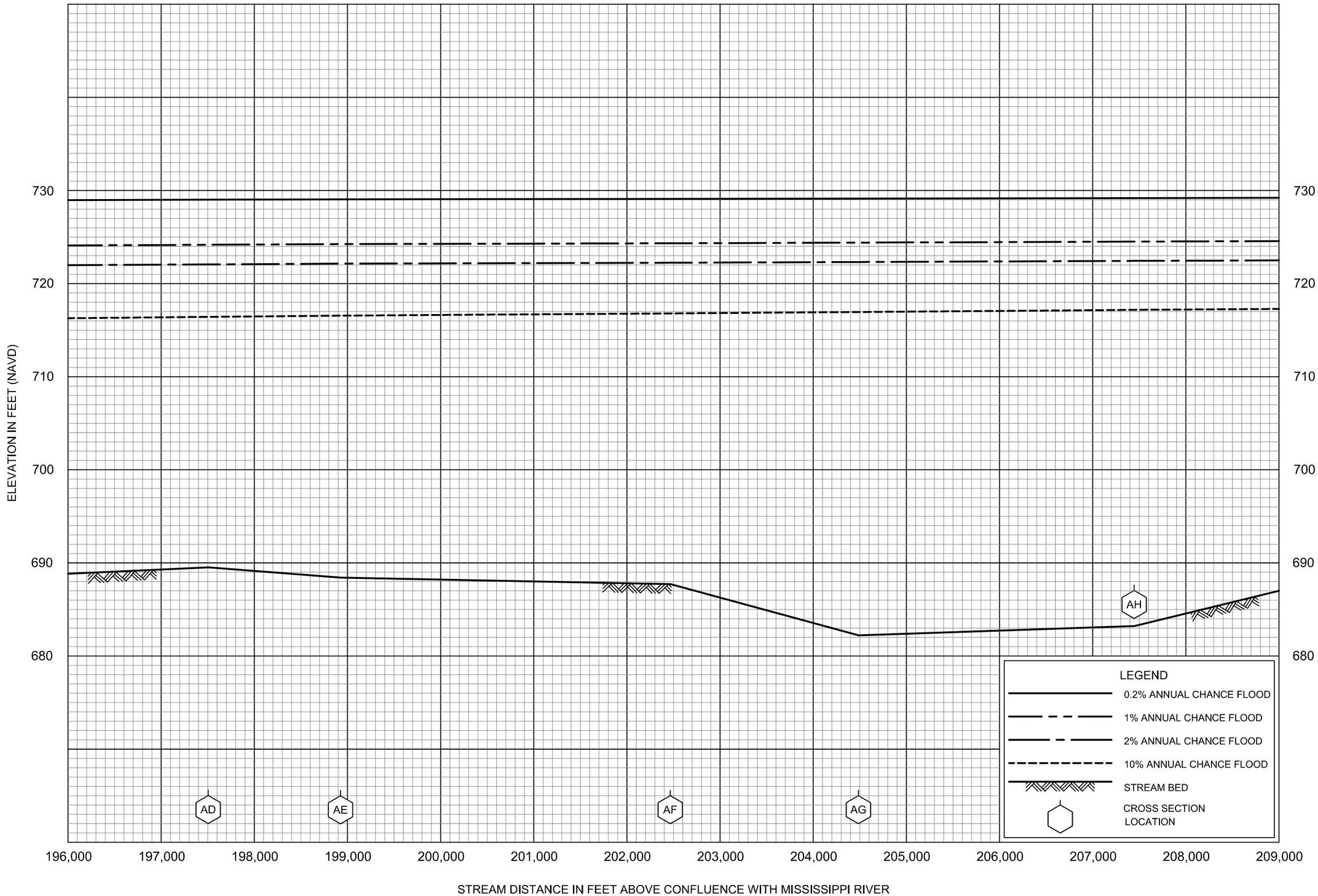
FLOOD PROFILES

MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

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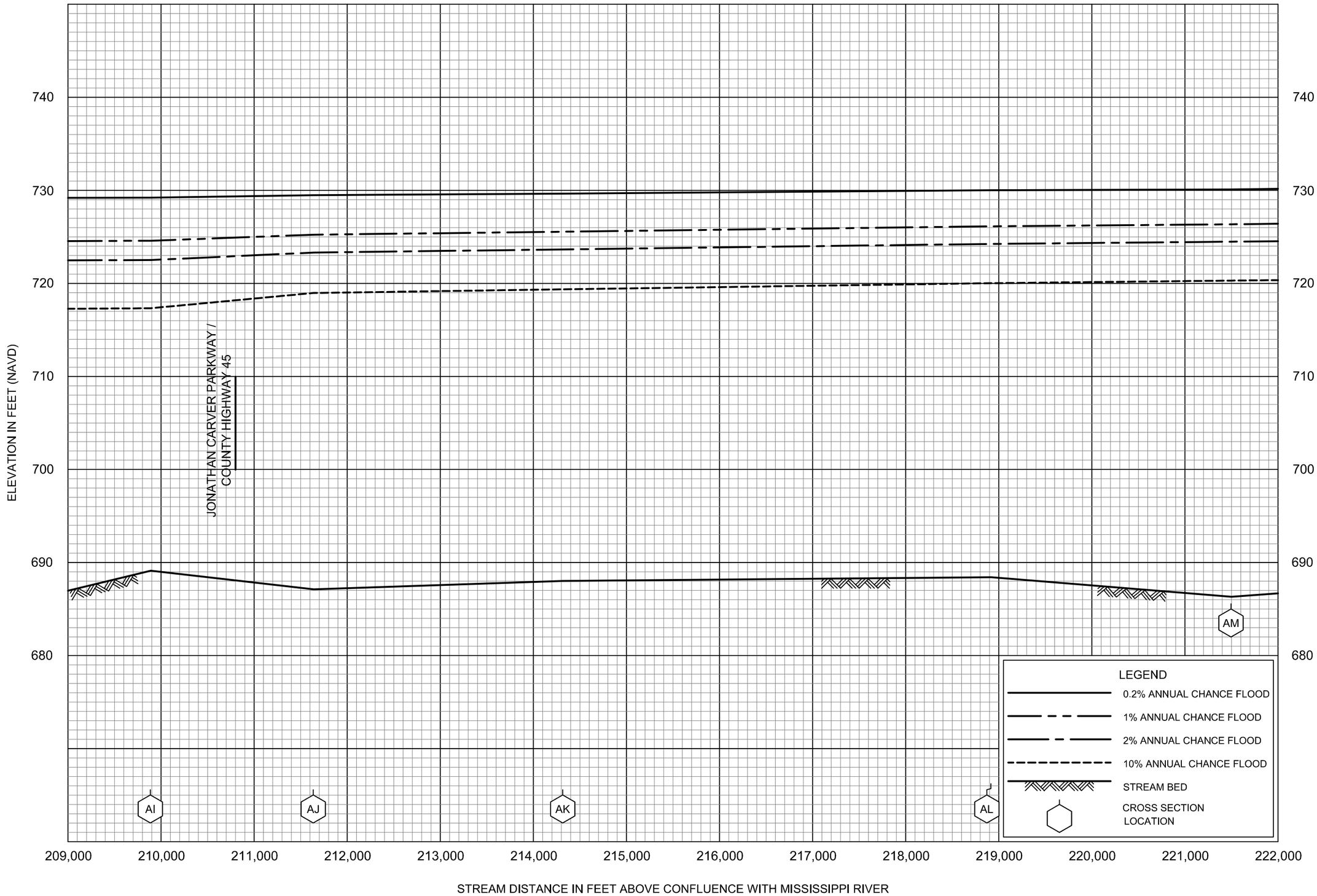

FLOOD PROFILES

MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

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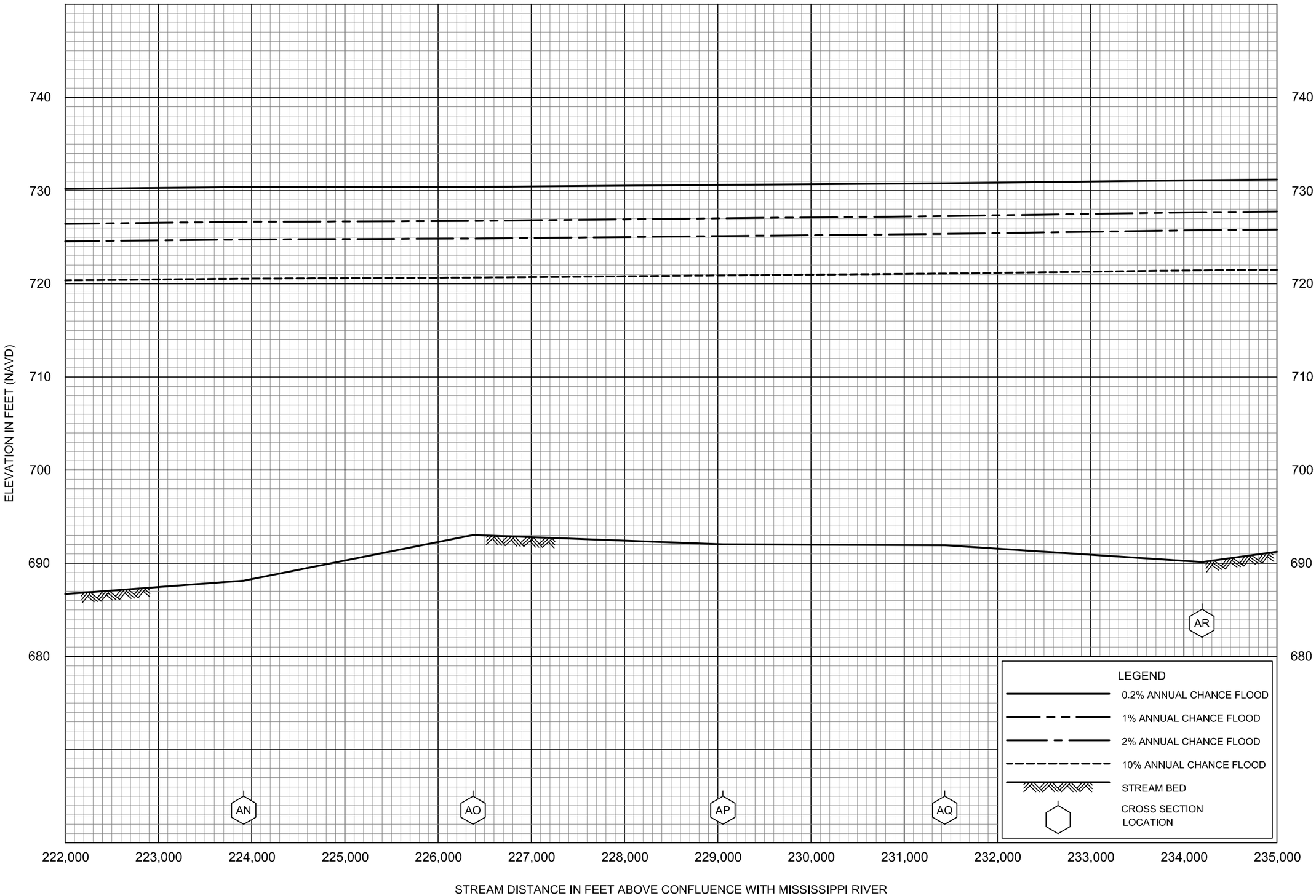

FLOOD PROFILES

MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

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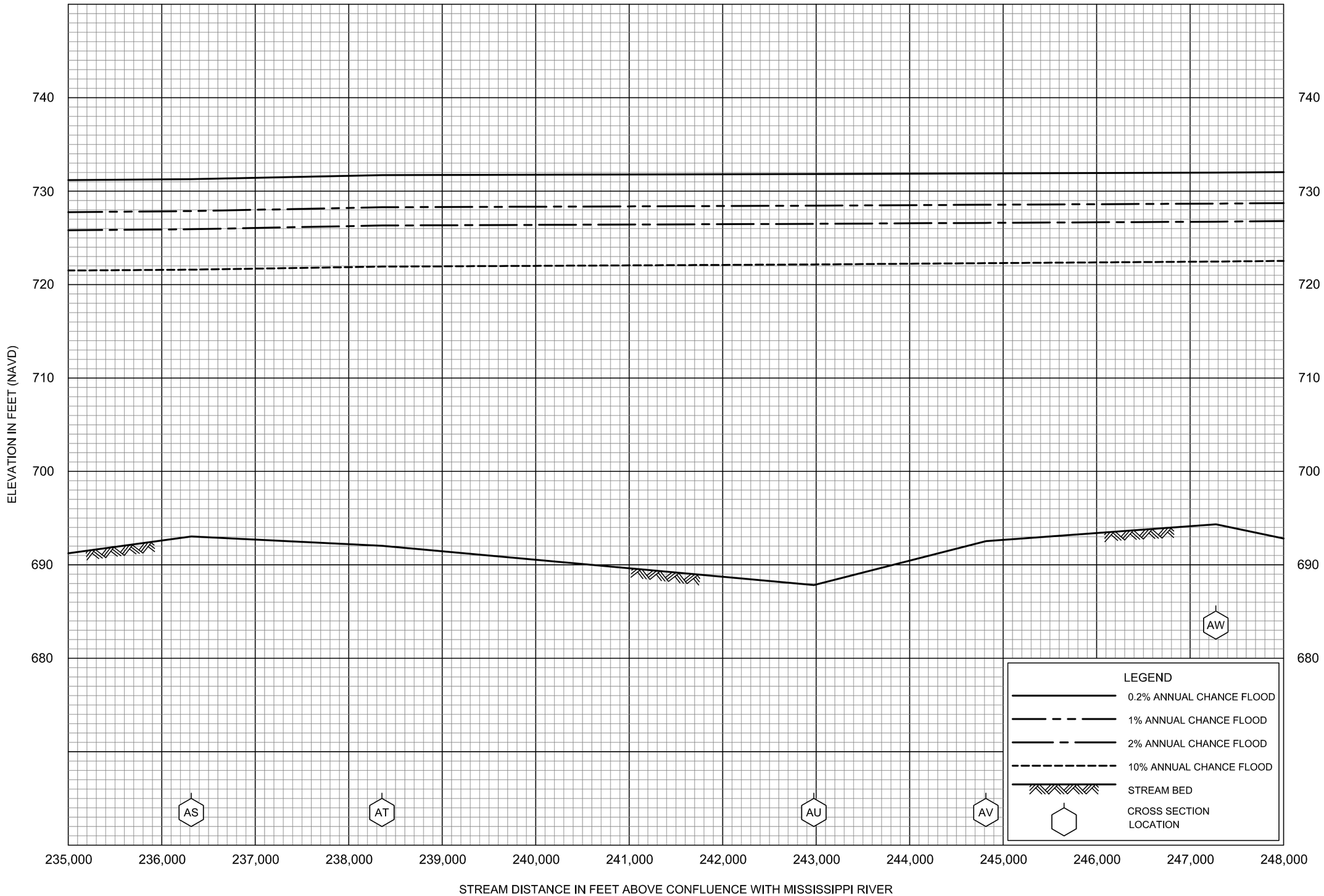

FLOOD PROFILES

MINNESOTA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

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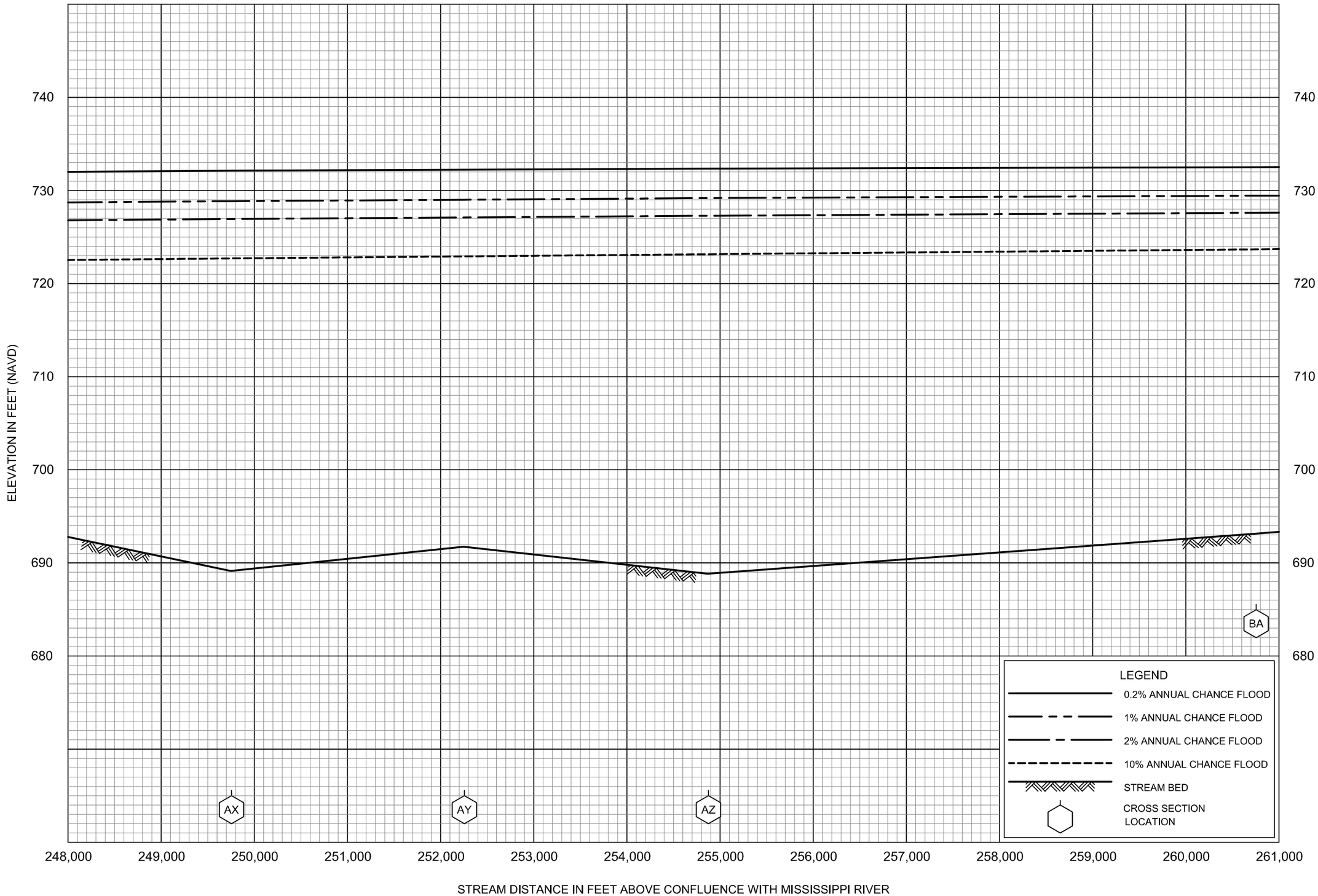

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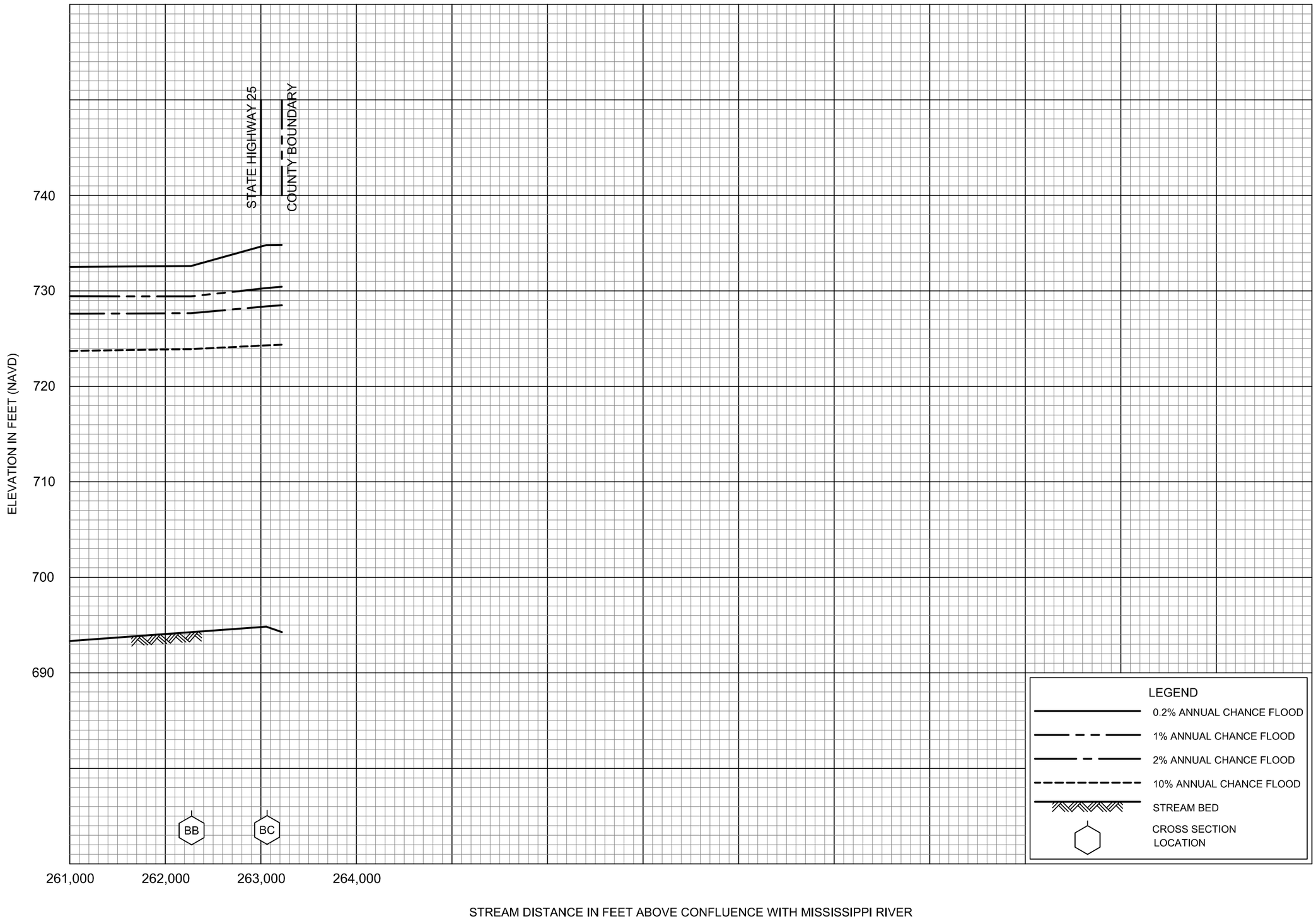

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CARVER COUNTY, MN

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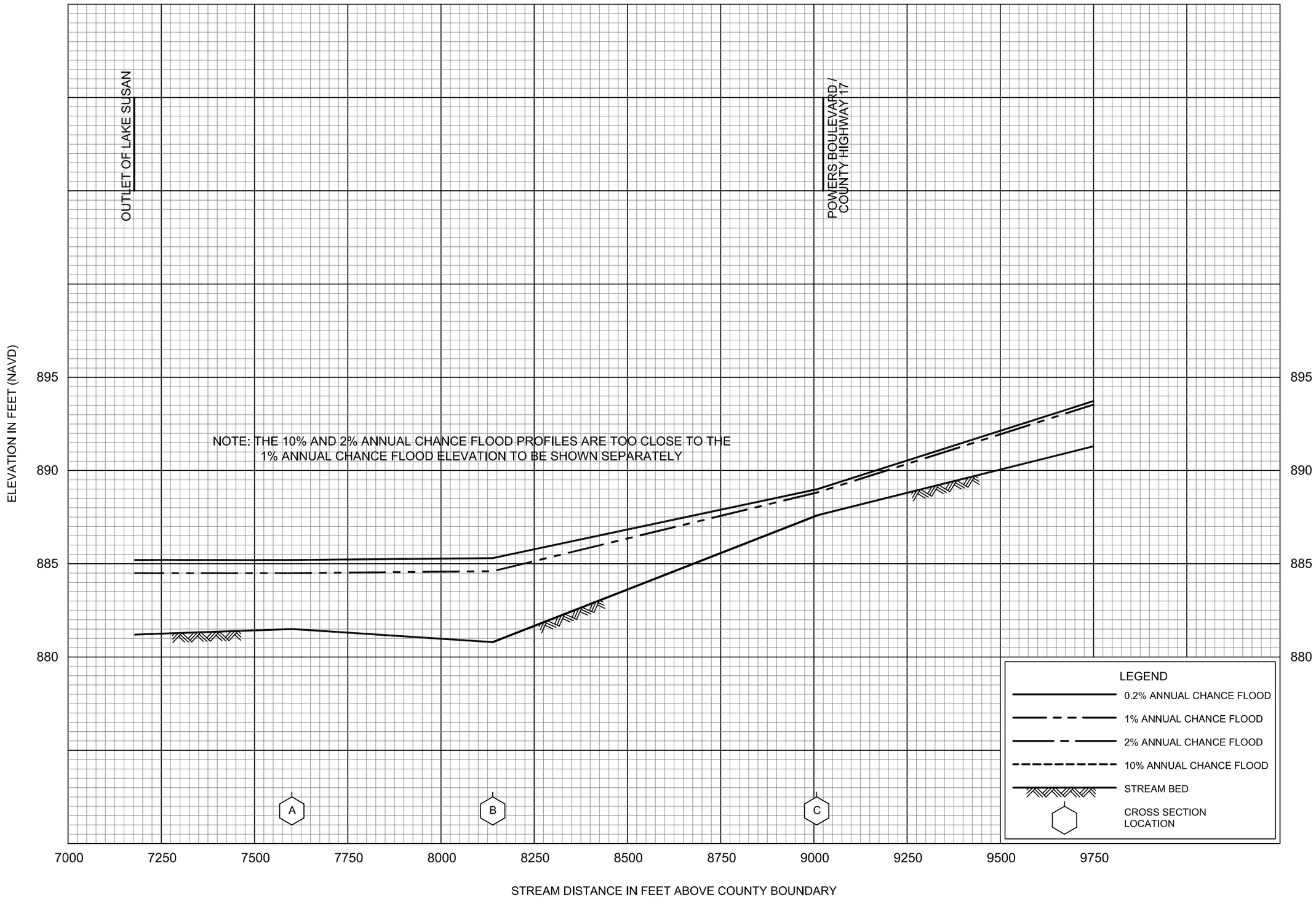


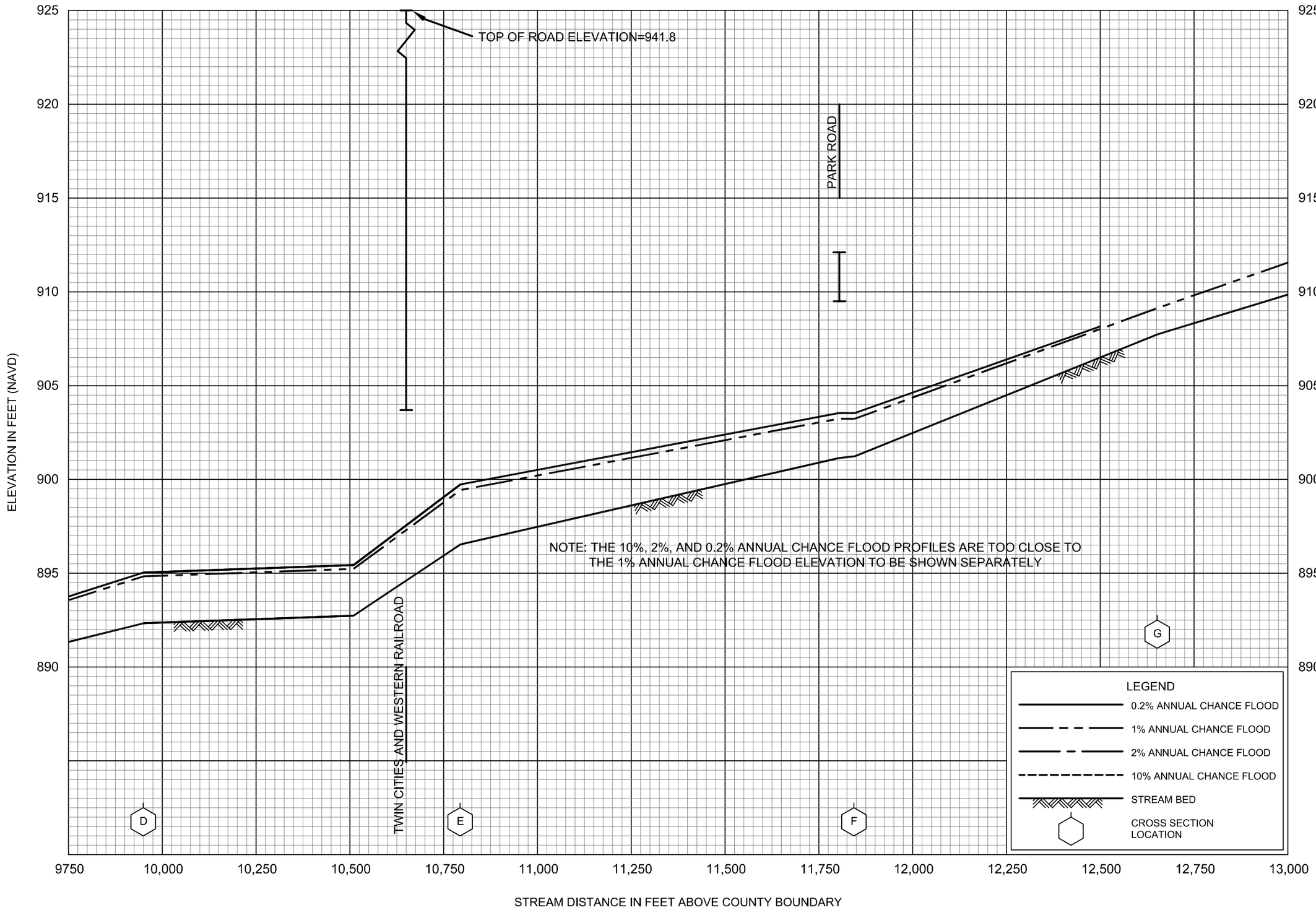
FLOOD PROFILES

RILEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

RILEY CREEK

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CARVER COUNTY, MN

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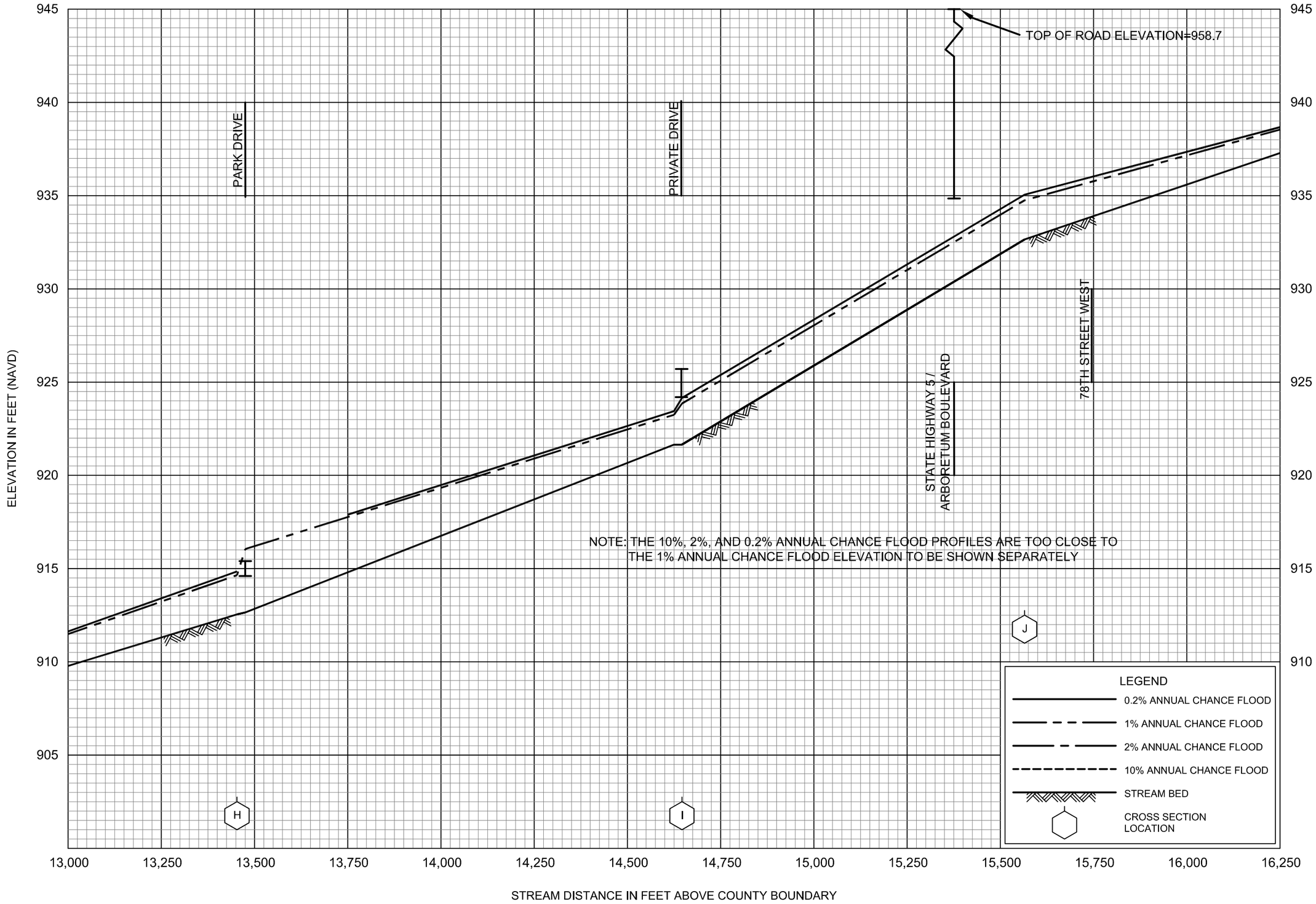

FLOOD PROFILES

RILEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

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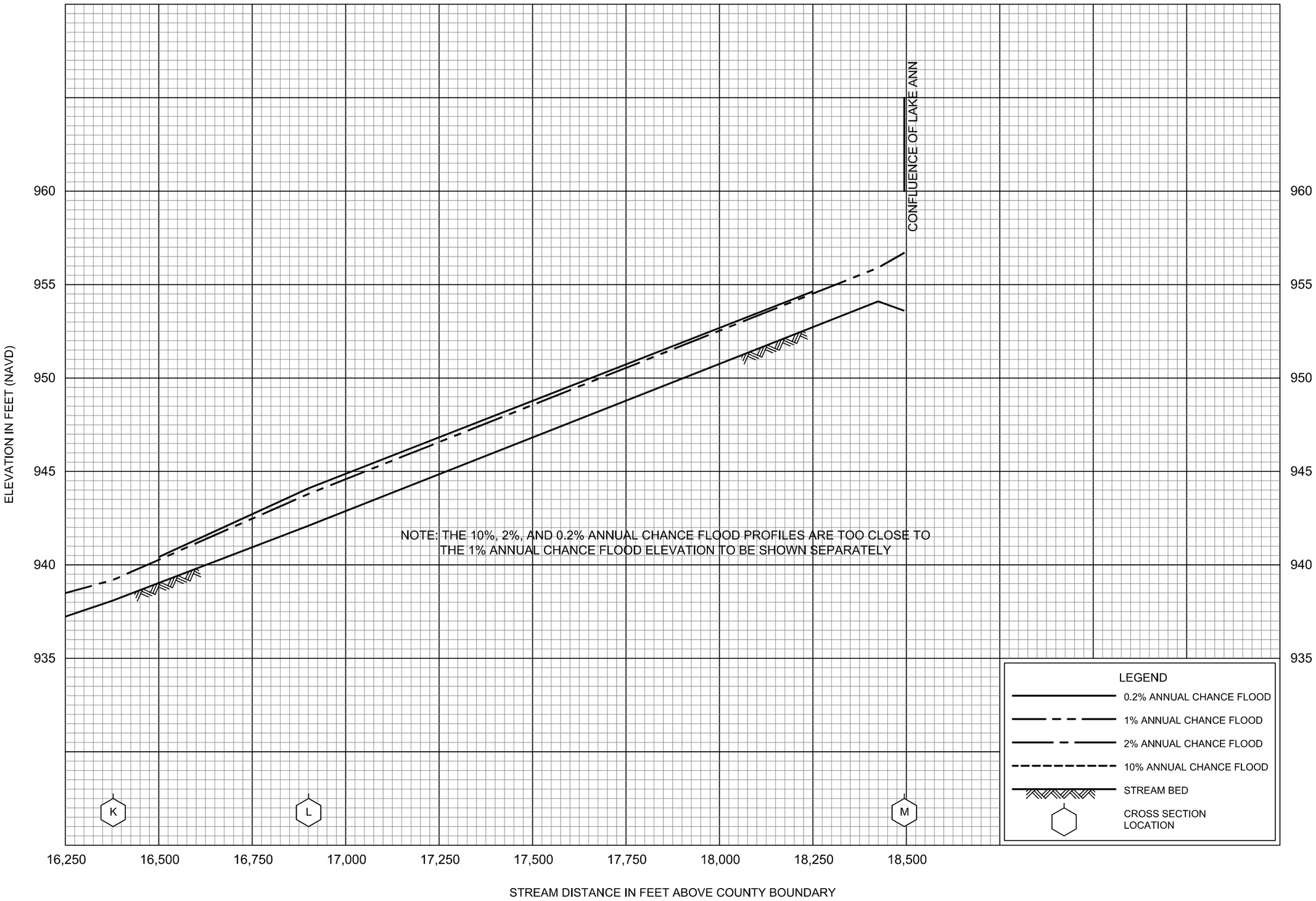

FLOOD PROFILES

RILEY CREEK

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CARVER COUNTY, MN

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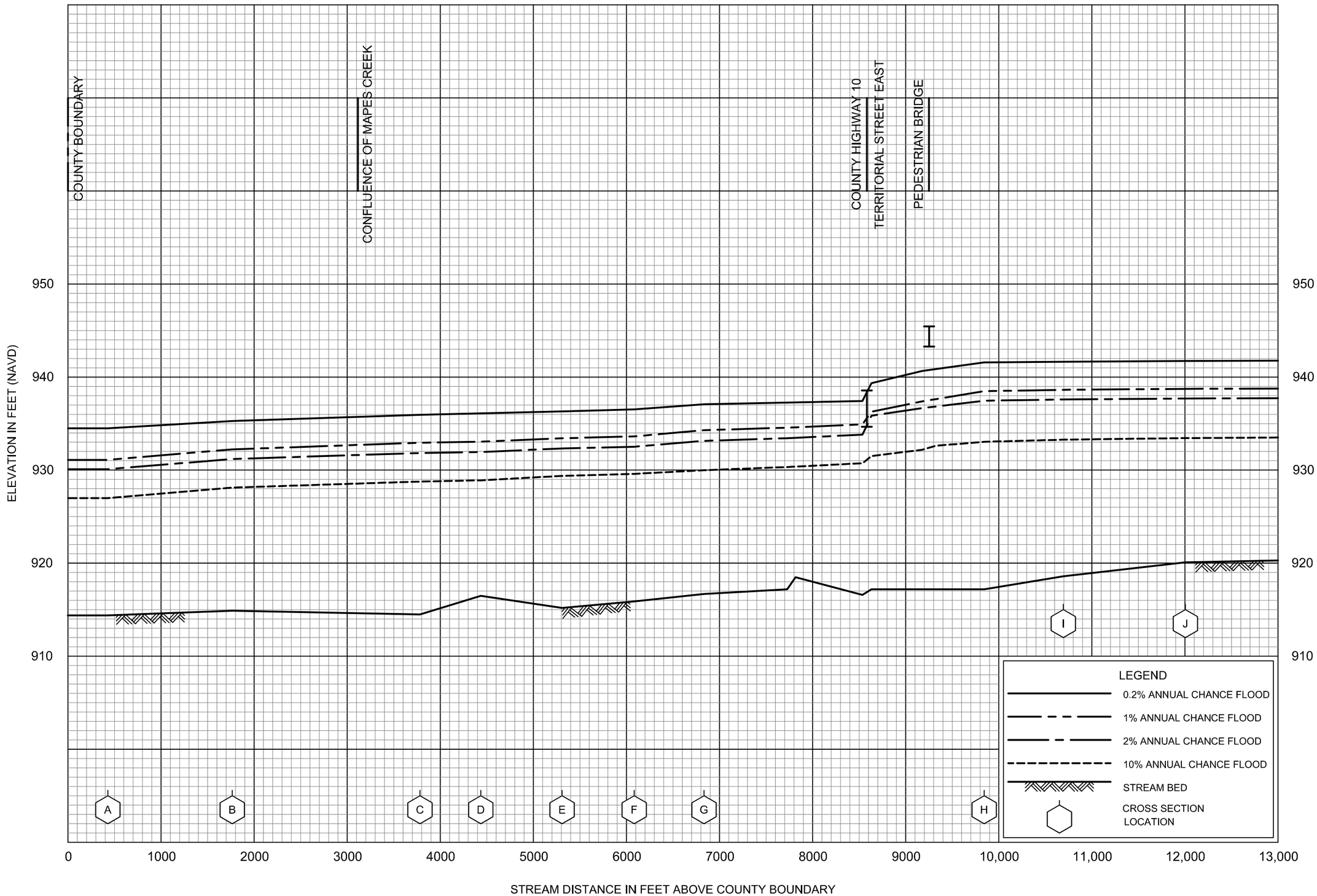


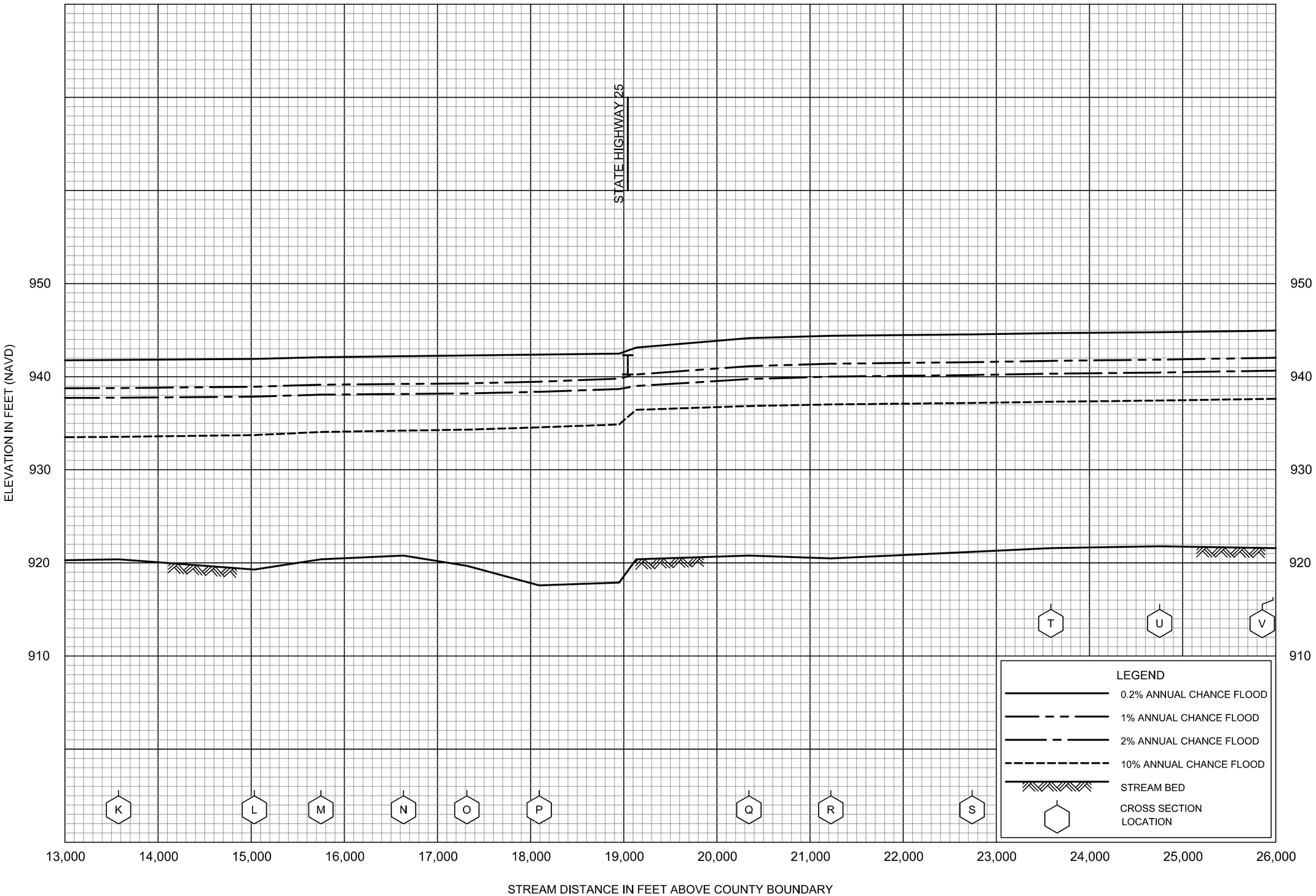
FLOOD PROFILES

SOUTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARVER COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

SOUTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

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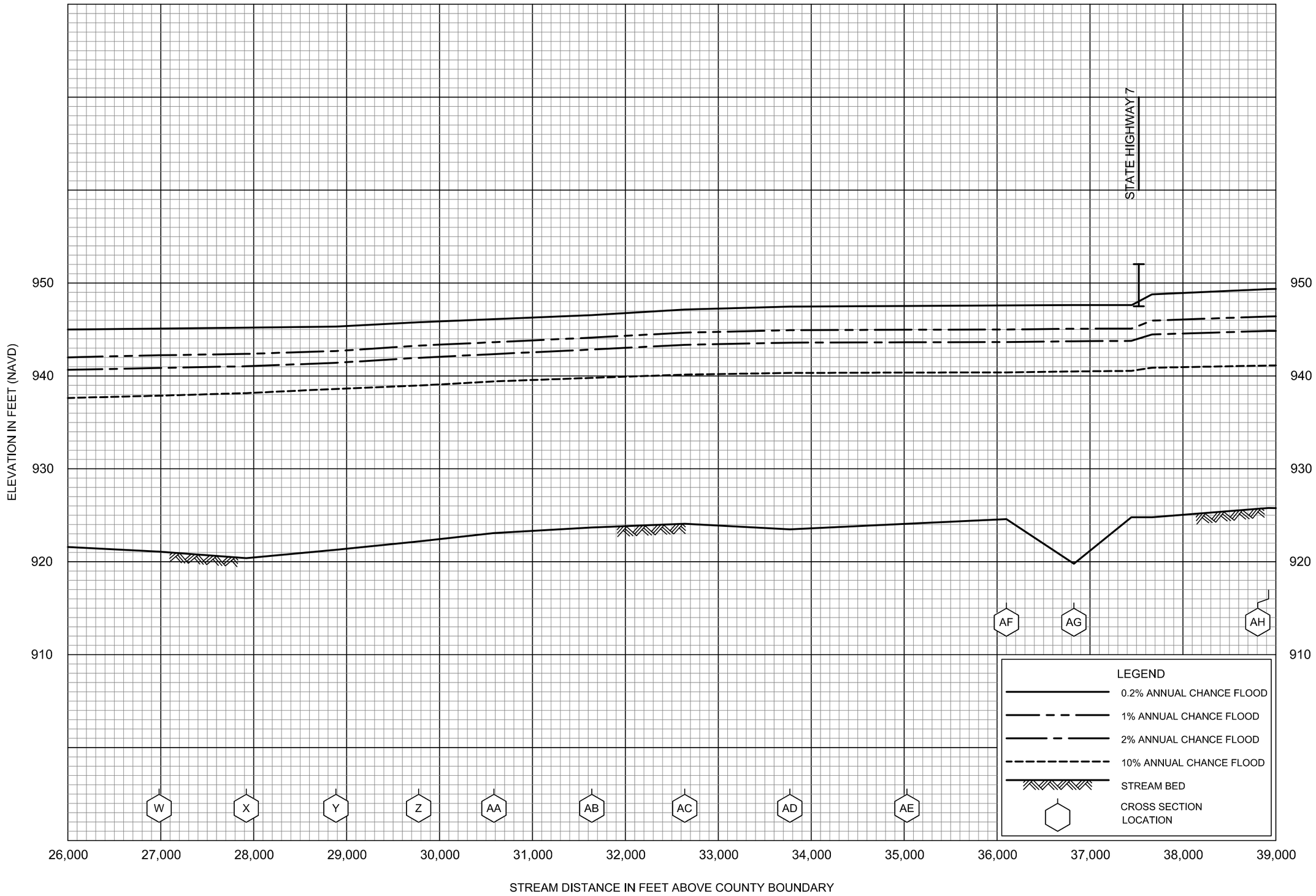

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SOUTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

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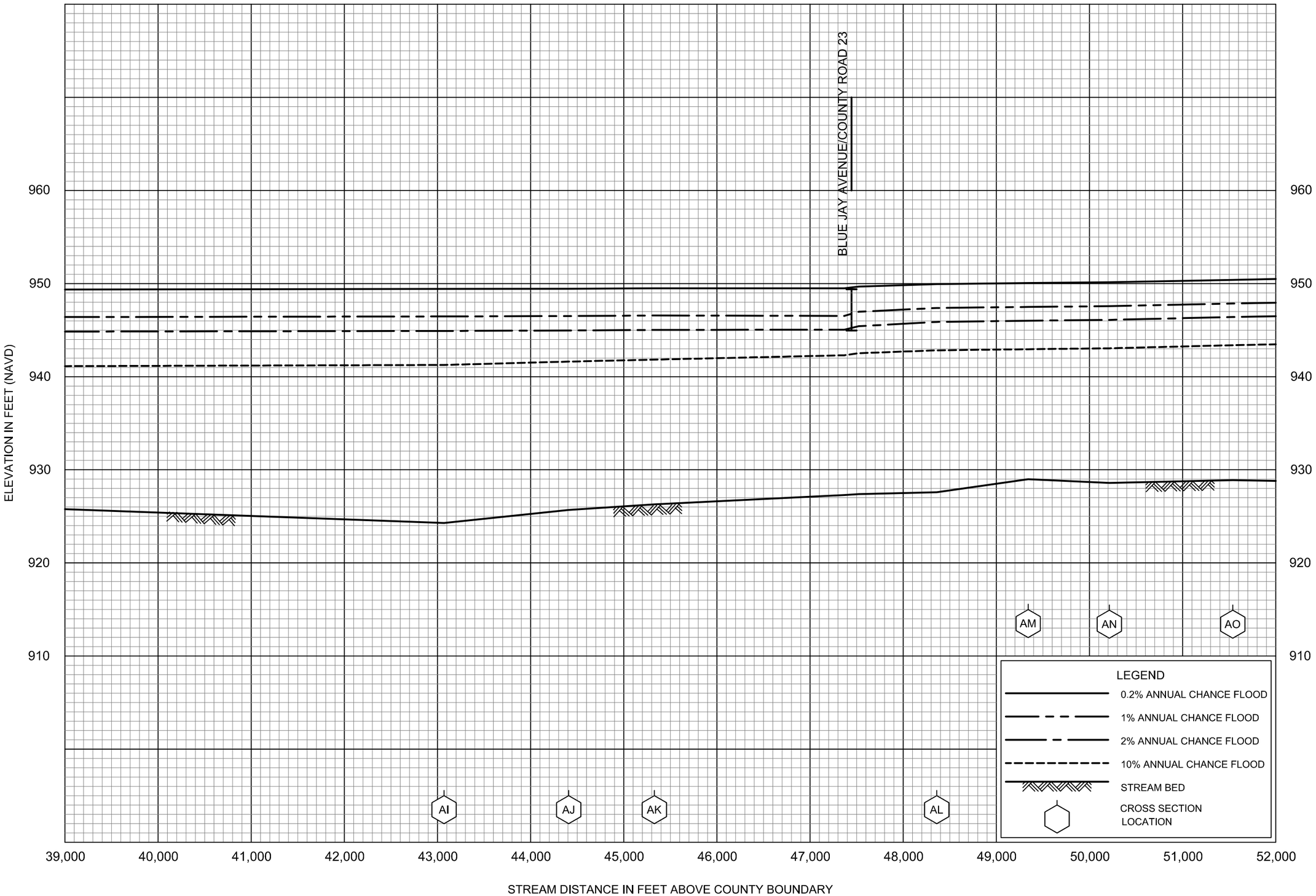

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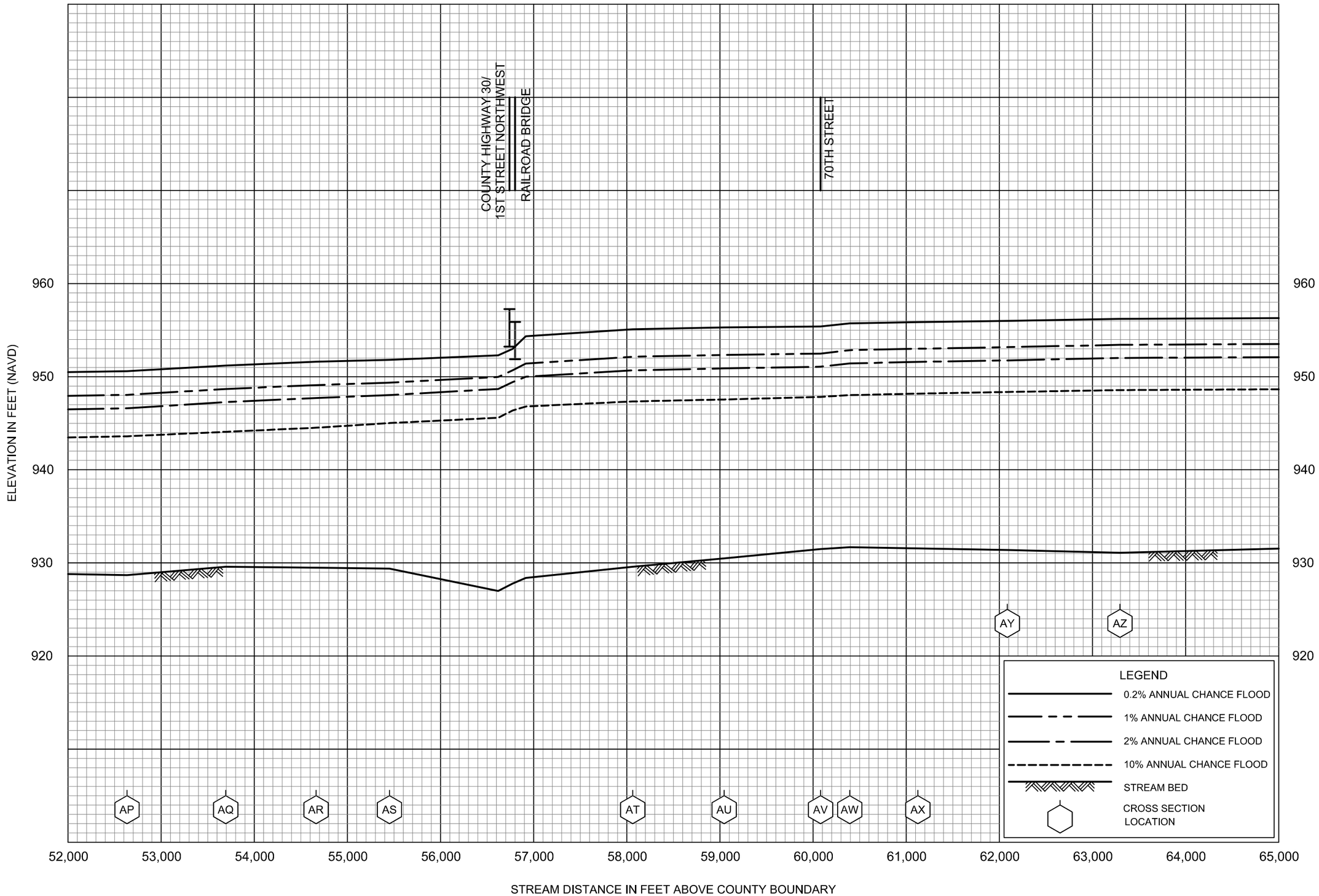

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SOUTH FORK CROW RIVER

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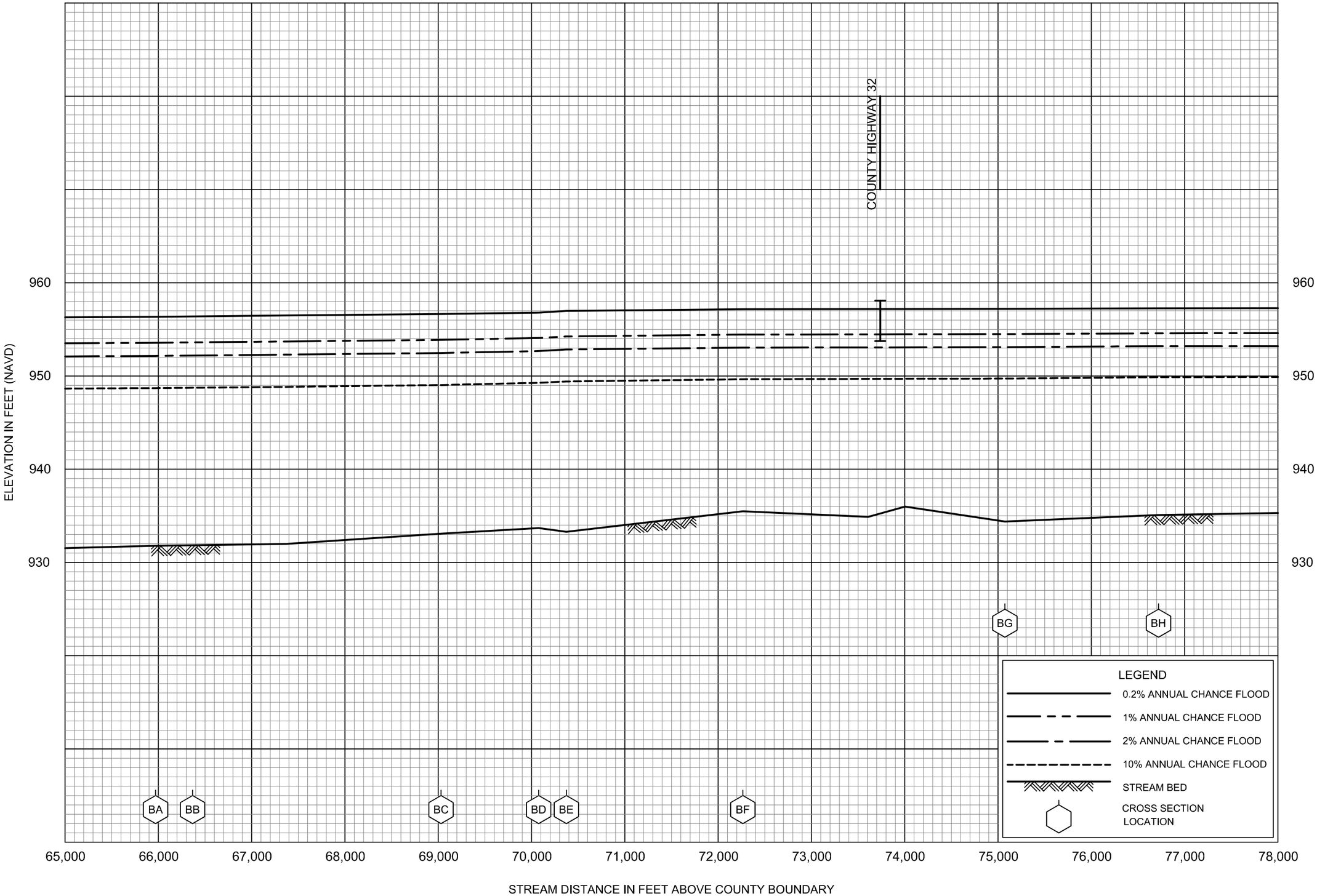

FLOOD PROFILES

SOUTH FORK CROW RIVER

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CARVER COUNTY, MN

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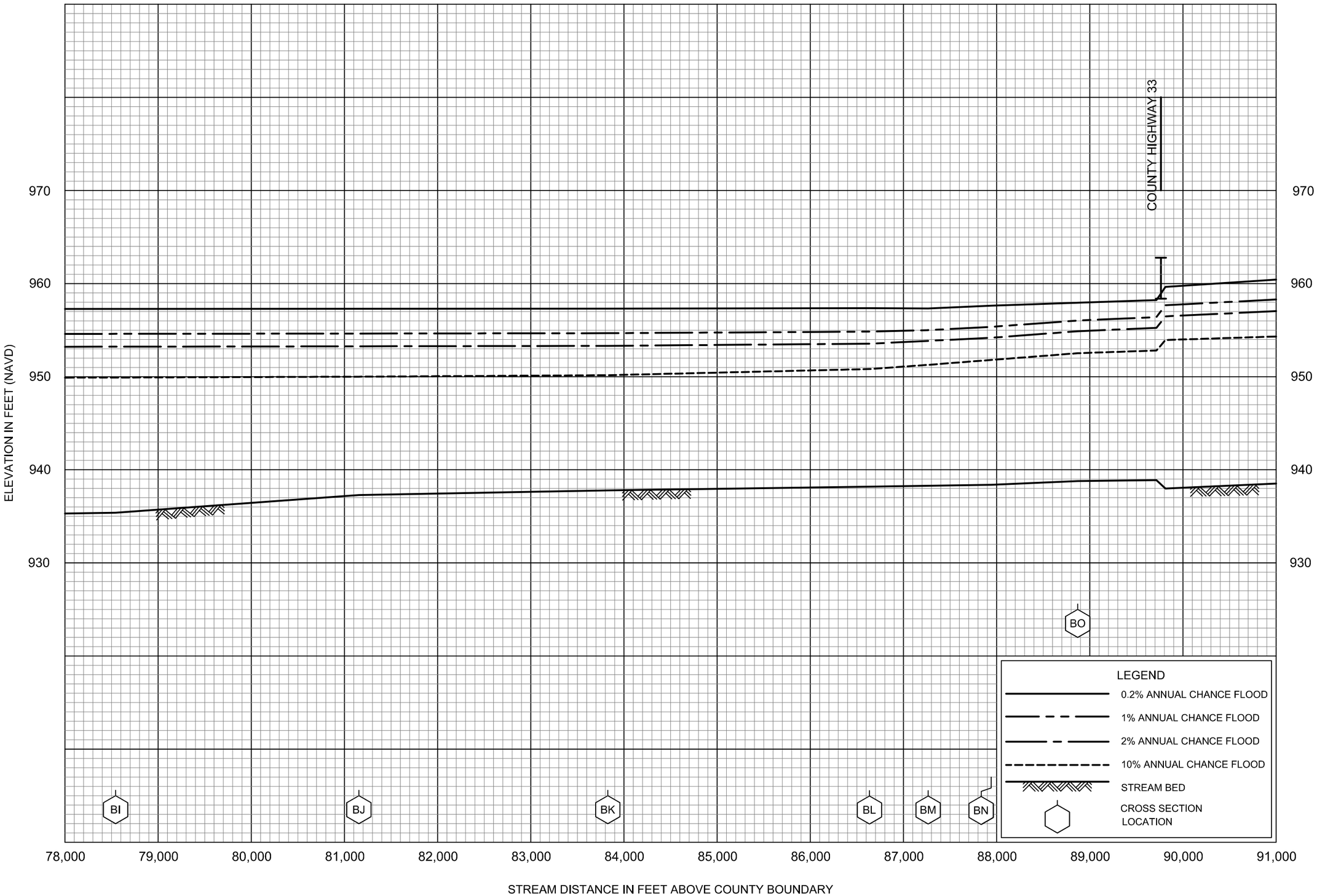

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SOUTH FORK CROW RIVER

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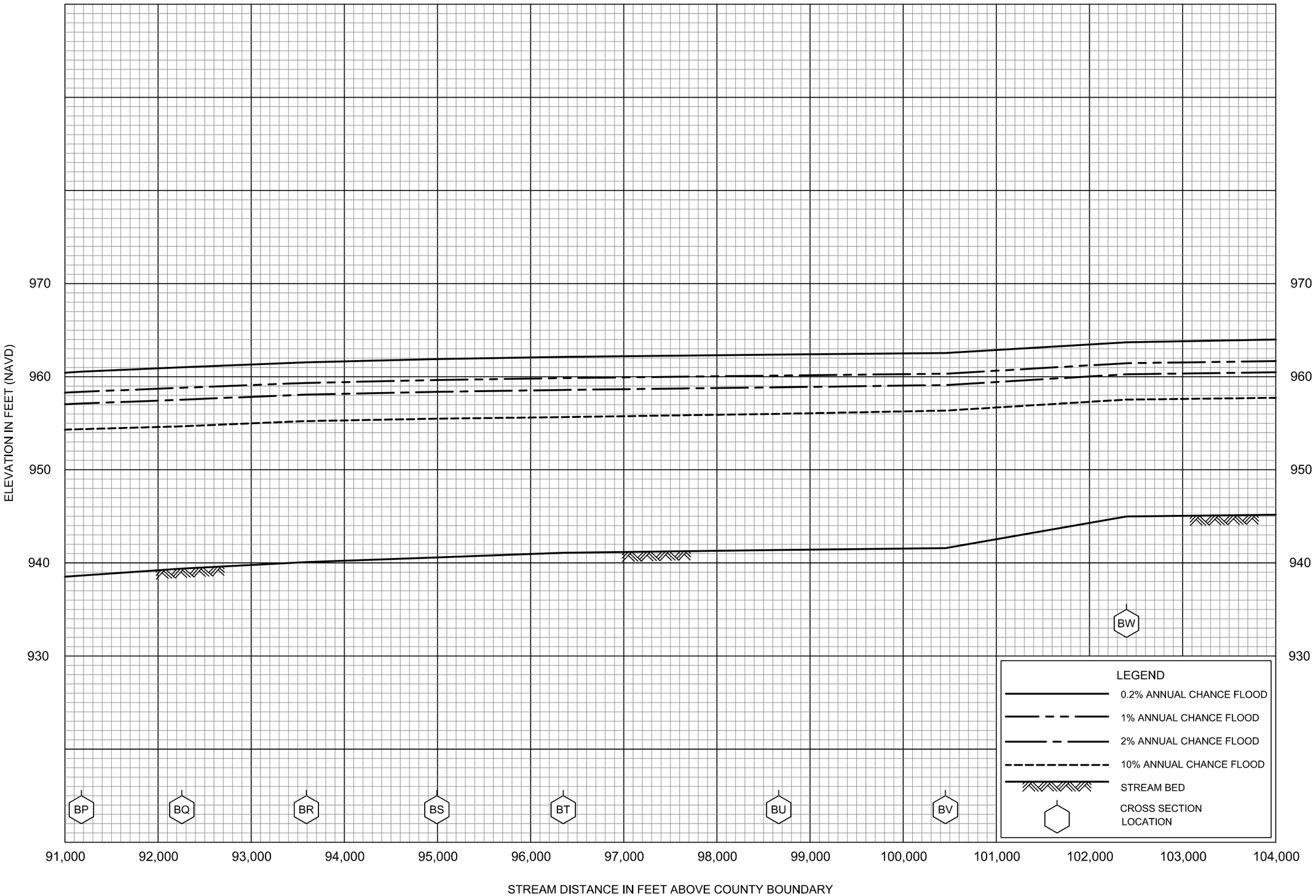

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SOUTH FORK CROW RIVER

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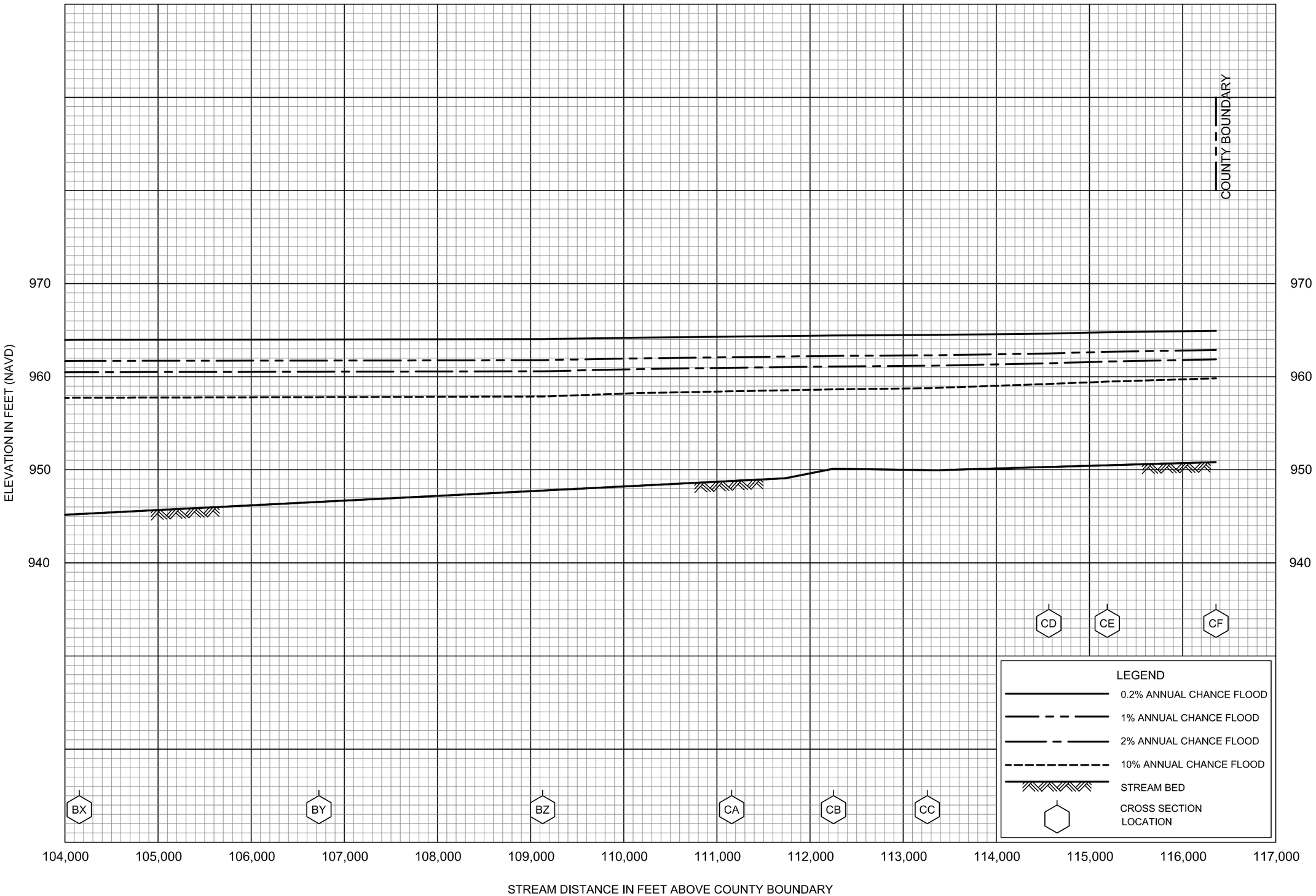

FLOOD PROFILES

SOUTH FORK CROW RIVER

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CARVER COUNTY, MN

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