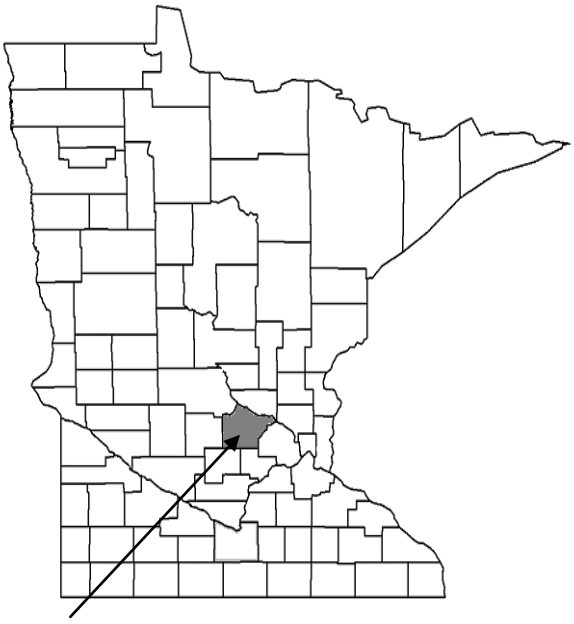
FLOOD INSURANCE STUDY

WRIGHT COUNTY, MINNESOTA

AND INCORPORATED AREAS



Community Name	*Community Number*
*ALBERTVILLE, CITY OF	275256
*ANNANDALE, CITY OF	270665
BUFFALO, CITY OF	270535
CLEARWATER, CITY OF	270536
COKATO, CITY OF	270537
DELANO, CITY OF	270539
*HOWARD LAKE, CITY OF	270397
MAPLE LAKE, CITY OF	270667
MONTICELLO, CITY OF	270541
MONTROSE, CITY OF	275257
OTSEGO, CITY OF	270747
*SOUTH HAVEN, CITY OF	275255
ST. MICHAEL, CITY OF	270543
WAVERLY, CITY OF	270666
WRIGHT COUNTY (UNINCORPORATED AREAS)	270534

Preliminary:
June 22, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
27171CV000A

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

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

Initial Countywide FIS Effective Date: To Be Determined

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Purpose of Study 1

1.2 Authority and Acknowledgments 2

1.3 Coordination 4

2.0 AREA STUDIED 5

2.1 Scope of Study 5

2.2 Community Description 6

2.3 Principal Flood Problems 6

2.4 Flood Protection Measures 8

3.0 ENGINEERING METHODS 8

3.1 Hydrologic Analyses 8

3.2 Hydraulic Analyses 13

3.3 Vertical Datum 15

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS 18

4.1 Floodplain Boundaries 18

4.2 Floodways 19

5.0 INSURANCE APPLICATIONS 36

6.0 FLOOD INSURANCE RATE MAP 37

7.0 OTHER STUDIES 37

8.0 LOCATION OF DATA 39

9.0 BIBLIOGRAPHY AND REFERENCES 39

TABLE OF CONTENTS (*Continued*)

FIGURES

Figure 1 – Floodway Schematic 36

TABLES

Table 1 – Summary of Discharges 12
Table 2 – Summary of Stillwater Elevations 13
Table 3 – Vertical Datum Conversion 16
Table 4 – Crow River Datum Conversion 16
Table 5 – Floodway Data 20
Table 6 – Community Map History 38

EXHIBITS

Exhibit 1 - Flood Profiles

Clearwater River	Panels 01P-06P
Crow River	Panels 07P-11P
Mississippi River	Panels 12P-19P
North Fork Crow River	Panels 20P-26P
Otter Creek	Panel 27P
School Lake Creek	Panel 28P
South Fork Crow River	Panels 29P-31P

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

FLOOD INSURANCE STUDY
WRIGHT 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 Wright County, Minnesota including the Cities of Albertville, Annandale, Buffalo, Clearwater, Cokato, Delano, Howard Lake, Maple Lake, Monticello, Montrose, Otsego, South Haven, St. Michael, and Waverly; and the unincorporated areas of Wright County (referred to collectively herein as Wright 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 Cities of Dayton, Hanover and Rockford are geographically located in Wright and Hennepin Counties. These cities are not included in this FIS report. Also, note that the City of Clearwater is geographically located in Wright and Stearns Counties. Only the Wright County portion of the City of Clearwater is included in this FIS report. See the separately published FIS reports and Flood Insurance Rate Maps (FIRMs) for flood hazard information.

Please note that the Cities of Albertville, Annandale, Howard Lake, and South Haven have no mapped special flood hazard areas.

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.

Precountywide Analyses

Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below:

Buffalo, City of	The hydrologic and hydraulic analyses for Buffalo Lake and Deer Lake and Lake Pulaski for the May 15, 1985, FIS report (FEMA, 1985) were performed by U.S. Geological Survey (USGS), for FEMA, under Interagency Agreement No. EMW-84-E-1548, Project Order No. 01. The work was completed in November 1984.
Clearwater, City of	The hydrologic and hydraulic analyses for Clearwater River and Mississippi River for the May 1979, FIS report were performed by Barr Engineering Co., for the Federal Insurance Administration (FIA), under Contract No. H-3799 (FIA, 1979a). The work was completed in November 1977.
Delano, City of	The hydrologic and hydraulic analyses for South Fork Crow River, FIS report (FIA, 1980) were performed by U.S. Army Corps of Engineers (USACE), for FIA, under Interagency Agreement No. IAA-H-10-77, Project Order No. 15. The work was completed in December 1977. The revised hydrologic and hydraulic analyses for South Fork Crow River for the December 2, 1988, FIS Report (FEMA, 1988a) were performed for FEMA, under Contract No. EMW-89-E-2978, Project Order No. 5. The work was completed in June 1990.

Monticello, City of	The hydrologic and hydraulic analyses for Mississippi River and Otter Creek for the May 1979, FIS report (FIA, 1979b) were performed by Barr Engineering Co., for FIA, under Contract No. H-3799. The work was completed in November 1977.
Otsego, City of	The hydrologic and hydraulic analyses for Crow River and Mississippi River for the September 30, 1992, FIS report (FEMA, 1992a) were performed by Barr Engineering Co., for FEMA, under Contract No. H3799 / Interagency Agreement No. EMW-84-E-1506, Project Order No. 01. The work was completed June 1986.
St. Michael, City of	The hydrologic and hydraulic analyses for School Lake Creek for the May 1979 FIS report (FIA, 1979c) were performed by Barr Engineering Co., for FIA, under Contract No. H-3799. The work was completed in June 1978.
Wright County (Unincorporated Areas):	The hydrologic and hydraulic analyses for Buffalo Lake, Clearwater River, Crow River, Mississippi River, North Fork Crow River, and South Fork Crow River, for the August 1988, FIS report (FEMA, 1988b) were performed by Barr Engineering Co., for FEMA, under Contract No. H3799 / Interagency Agreement No. EMW-84-E-1506, Project Order No. 01. The work was completed June 1986. The revised hydrologic and hydraulic analyses for North Fork Crow River and South Fork Crow River for the August 18, 1992, FIS Report (FEMA, 1992b) were performed for FEMA, under Contract No. EMW-89-E-2978, Project Order No. 5. The work was completed in June 1990.

The Cities of Albertville, Annandale, Cokato, Howard Lake, Maple Lake, South Haven, and Waverly, have no previously printed FIS reports.

This Countywide FIS Report

Revised hydrologic and hydraulic analyses were incorporated for the detailed portion of the Clearwater River, from County Highway 75 to approximately 200 feet downstream of Interstate Highway 94 (FEMA, 1994).

The hydrologic and hydraulic analyses for the streams studied by approximate analysis for this study were performed by Atkins for FEMA, under Contract No. HSFE05-05-D-0023, Task Order 29. The work was completed in February 2011.

Base map information shown on the FIRM was derived from six inch pixel resolution digital ortho-imagery for Wright County, dated 2008. The projection used in the preparation of this map is Universal Transverse Mercator (UTM), Zone 15, and the horizontal datum used is North American Datum 1983 (NAD83).

1.3 Coordination

An initial meeting is held with representatives from FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied or restudied. A final meeting is held with representatives from FEMA, the community, and the study contractor to review the results of the study.

Precountywide Analyses

The initial and final meeting dates for previous FIS reports for Wright County and its communities are listed in the following table:

Community	FIS Date	Initial Meeting	Final Meeting
Wright County	June 1986	March 1984	July 21, 1987
(Unincorporated Areas)	August 18, 1991	*	*
Buffalo, City of	May 15, 1985	August 1983	January 8, 1985
Clearwater, City of	May 1979	July 1977	August 23, 1978
Delano, City of	December 2, 1988	August 16, 1976	October 17, 1978
Monticello, City of	May 1979	July 1977	October 18, 1978
Otsego, City of	September 30, 1992	*	*
St. Michael, City of	May 1979	June 1977	October 19, 1978

*Data Not Available

The initial meeting was held in May 29, 2008, and attended by representatives of Atkins, Minnesota Department of Natural Resources (MNDNR), FEMA, Wright County and the Cities of Annandale, Clearwater, Delano, Monticello, and Waverly.

The results of the study were reviewed at the final meeting held on _____ and attended by _____. All issues and/or concerns raised at that meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Wright 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 through the time of the study.

The following lakes and streams are studied by detailed methods in this FIS report:

Buffalo Lake
Clearwater River
Crow River
Deer Lake
Mississippi River
North Fork Crow River
Otter Creek
School Lake Creek
South Fork Crow River

The limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

This Countywide FIS Report

Buffalo Lake, Clearwater River, Crow River, Deer Lake, Mississippi River, North Fork Crow River, Otter Creek, School Lake Creek, and South Fork Crow River were redelineated using new topographic data.

In addition, revised hydrologic and hydraulic analyses were incorporated for Clearwater River from the confluence with Mississippi River to State Highway 55, and for Mississippi River from approximately 3.7 miles downstream of U.S. Highway 169 to approximately 0.5 miles upstream of State Highway 24 (FEMA, 1994).

For this countywide FIS, the FIS report and FIRM were converted to countywide format, and the flooding information for the entire county, including both incorporated and unincorporated areas, is shown. Also, the vertical datum was converted from the National Geodetic Vertical Datum of 1929 (NGVD) to the North American Vertical Datum of 1988 (NAVD). In addition, the Universal Transverse Mercator coordinates, previously referenced to the North American Datum of 1927 (NAD 27), are now referenced to NAD83.

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

Crow River has been renamed from Main Stem Crow River, the name by which it was referred in previous studies.

2.2 Community Description

Wright County is located in the northwestern edge of the Minneapolis- St. Paul metropolitan area in central Minnesota. It is bordered by Todd and Morrison Counties to the north, Sherburne County to the northeast, Hennepin County to the east, Carver and McLeod Counties to the south, Meeker County to the west, Stearns County to the northwest.

The floodplains throughout Wright County are generally lightly developed; however, development is concentrated in lake shore areas. The county's proximity to the Minneapolis-St. Paul metropolitan area has resulted in increasing development pressure in recent years. The trend is anticipated to continue in the future, particularly in the aesthetically pleasing floodplain areas along the rivers and lakes in the county.

The climate classification of Wright County is humid continental with seasonal variations in temperature ranging from 13.5 degrees Fahrenheit (°F) in January to 74.3°F in July. The average annual temperature is 44.9°F. The average annual precipitation is approximately 24 inches; the average annual snowfall for Wright County is 45 inches (The Weather Channel, 2010).

Land use in Wright County consists primarily of agricultural cropland and meadows. Scattered woodlands occur on farms and along river bottoms. Numerous wetland areas occur throughout the county with characteristic wetland vegetation types.

The topographic relief is uniform in Wright County. The landscape can be characterized as gently rolling, with elevations varying from 900 to 1,000 feet across the county and a topographic relief of approximately 40 feet below the adjacent land surface. The Mississippi River and Clearwater River lie in valleys that gradually descend from the adjacent land surfaces.

2.3 Principal Flood Problems

The most severe flooding of lakes and rivers in Wright County occur during spring snowmelt-runoff events. Restrictive characteristics of certain man-made structures have, during larger floods of record, caused inundation of land areas. Along the Mississippi River, large floods occurred in 1897, 1950, 1952, 1965, 1969, 1972, 1975, and 1979. The 1965 flood was comparable to approximately a 1-percent-

annual-chance frequency flood on the Mississippi River. Detailed information on these floods was recorded by various agencies and by the communities along the rivers. In addition to Spring run-off events, flooding on Otter Creek has also resulted from the occurrence of short-duration, high-intensity rainstorms.

For the Clearwater River basin there are limited records of flooding events as no gaging station is available. However, a summer rain storm event in 1983 did cause flooding problems in the Clearwater River basin. Recorded rainfall amounts for the storm of June 21, 1983, averaged 9.19 inches over the watershed. This storm exceeded the 1-percent-annual-chance flood 12-hour storm of 5.1 inches.

Historic floods in Wright County have primarily damaged public services facilities such as roads and bridges in the unincorporated areas, while the majority of the structural damage has occurred within the incorporated areas along the rivers.

On Crow River, North Fork Crow River, and South Fork Crow River, the largest recorded floods occurred in 1916, 1952, 1957, 1965, and 1969. The 1965 flood was comparable to approximately a 0.5-percent-annual-chance flood along Crow River.

The low-lying areas of the City of Delano are subject to periodic overflow from the South Fork Crow River. The most severe flooding results in early spring from heavy rains or a combination of heavy rains and snowmelt. Major floods occurred in 1890, 1897, 1906, 1916, 1952, 1957, 1965, and 1969. The following available discharges and frequencies of the more recent floods were taken at the Bridge Avenue bridge. The 1965 flood had a discharge of 16,700 cubic feet per second (cfs) and an estimated 2-percent annual exceedance probability (50 years). The 1952 flood had a discharge of 10,800 cfs (based on high water marks near the site) and an estimated 5-percent annual exceedance probability (20 years). The 1957 flood had a discharge of 10,400 cfs (based on high water marks near the site) and an estimated annual exceedance probability slightly greater than 5-percent (18 years). The 1969 flood had a discharge of 9,680 cfs and an estimated annual exceedance probability slightly greater than 5-percent (17 years). It is probable that the April 1965 flood had the greatest peak discharge of the floods listed. The most recent large flood at the City of Delano reached a crest elevation of 920.35 feet NAVD with a maximum discharge of 9,680 cfs on April 11, 1969.

Buffalo Lake and Deer Lake are connected to North Fork Crow River 2.5 miles to the south through Deer Lake and the valley of Mill Creek and a large marsh. The route for floodwaters to enter Buffalo Lake and Deer Lake has sufficient capacity so that backwater flow from North Fork Crow River readily affects Buffalo Lake and Deer Lake. Flooding on North Fork Crow River occurs frequently and the level of Buffalo Lake and Deer Lake rises and falls with the river. Some of the roadways adjacent to the lake are overtopped during even a moderate flood.

2.4 Flood Protection Measures

No flood control projects exist in the unincorporated areas of Wright County. Various municipalities in Wright County, do have flood control structures within their boundaries.

There are two dams on the Clearwater River: Fairhaven Dam, located approximately 1,200 feet upstream of County Highway 2 in Wright County (Unincorporated Areas); and an unnamed dam, located just downstream of Grass Lake. There is one dam on the Crow River: Berning Mill Dam. These dams provide no flood protection for the county.

A pump/pipeline flood control project was constructed by the USACE for Lake Pulaski in late 1986. The goal of the project was to stem the long term increase in lake level that results from the gradual accumulation of surface runoff and from groundwater.

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 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

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

Precountywide Analyses

For the Clearwater River, discharge frequency relationships were determined by applying the USACE Hydrologic Engineering Center's (HEC) HEC-1 rainfall-

runoff computer model (HEC, 1970). The entire watershed above the confluence with the Mississippi River was modeled using thirteen subbasins, nine reservoir routings, and 11 combining units. To obtain Snyder's unit hydrograph parameters, Cp, a coefficient accounting for flood wave and storage conditions, and Ct, a coefficient representing variations of watershed slopes and storage, for the Clearwater River basin, the Crow River, near Regal was used as the two rivers have similar hydrologic characteristics (USACE, 1986). The parameters were determined using the optimization capability in HEC-1 for two selected historic events. A10-day storm duration was selected to insure the most critical duration of storm was modeled for the lakes. The 10-, 2-, 1-, and 0.2-percent-annual-chance flood, 10-day precipitation values were obtained from the National Weather Service's (NWS) Technical Memorandum Hydro-35, Technical Paper No. 40, and Technical Paper No. 49 (NWS, 1961, 1964, and 1977). The Soil Conservation Service (SCS) curve numbers were used to determine rainfall excess. These curve numbers were estimated from information obtained from the Minnesota Land Management Information Center. The HEC-1 model was calibrated to a USGS peak discharge estimated based on a discharge measurement made on the Clearwater River upstream of the State Highway 75 Bridge following the June 21, 1983 storm. This value is believed to be within 0.2 foot of the peak stage with an estimated peak discharge of 2,610 cfs. This storm produced an average rainfall over the watershed of 9.19 inches (USGS, 1985). Three methods were used to validate the peak flow values. The first method used a USACE Open-File report for the City of Clearwater, in which a USGS regression analysis was performed (HEC, 1977 and USACE, 1985). The equations used accounted for basin area, slope, and storage. The second method used updated regression equations that took into account basin area, storage, mean annual runoff, and forest cover (USGS, 1985). The third method used in the final analysis of the Clearwater River was the generalized SCS Technical Release No. 20 model (SCS, 1965). Based on these comparisons, the HEC-1 values were adopted.

On the Crow River, discharges were developed at the City of Rockford and at its confluence with the Mississippi River. For the South Fork Crow River, discharges were developed at the Wright County boundary with Carver County and at the confluence of the Crow River. Discharges for Crow River and South Fork Crow River were determined by a statistical analysis of gage information. The discharge-frequency curves at USGS gages on Crow River and South Fork Crow River were developed using USGS Water Resources Council (WRC) Bulletin 17B and the USACE Flood Flow Frequency Analysis (HEC, 1982 and WRC, 1982).

For North Fork Crow River, 53 years of USGS gage records were used to define the discharge-frequency relationships. The coordinated discharge-frequency relationship used was based on the discharge-frequency relationship at the confluence of the North Fork Crow River and was transferred upstream using the 0.6 power of the drainage area ratio.

For Otter Creek, discharges were calculated with a regression analysis using Regional Flood Frequency Equations for Minnesota (USGS, 1977).

For School Lake Creek, hydrographs were developed for its subwatersheds using the 24-hour duration rainfall event and the unit hydrograph methods of the TR-20 computer program (SCS, 1965). Times of concentration and curve numbers were computed following procedures from the SCS National Engineering Handbook (SCS, 1972), using USGS topographic maps (USGS, 1958), aerial photographs (Mark Hurd Aerial Surveys, Inc., 1975), soil maps (SCS, 1968), field survey data, and field inspection data. Precipitation intensities for the 10-, 2-, and 1-percent-annual-chance flood events were obtained from the Weather bureau TP-40 (NWS, 1961). The 0.2-percent-annual-chance precipitation intensity was estimated by extrapolating the 10-, 2-, and 1-percent-annual-chance intensities on probability paper.

Storage-discharge relationships for School Lake Creek were developed using USGS topographic maps (USGS, 1958), field survey data, the U.S. Department of Transportation (USDOT), Bureau of Public Roads culvert nomographs (USDOT, 1965), and the USACE HEC-2 backwater computer program (HEC, 1977).

The hydrology of the Mill Creek basin from Buffalo Lake downstream is overshadowed by backwater from flooding on North Fork Crow River. The normal low level of Buffalo Lake is well below flood level on North Fork Crow River where it passes 2.5 miles to the south. The valley of Mill Creek between Buffalo Lake and the river is large, being approximately 0.25 miles wide between banks of the 920 foot NAVD level. The channel of Mill Creek is below elevation 910.4 feet NAVD through that reach. Thus, floodwaters from North Fork Crow River are readily conveyed up the valley of Mill Creek, through Deer Lake, and into Buffalo Lake. A dam at the county road bridge at the outlet of Deer Lake maintains the low level of Deer Lake and Buffalo Lake at approximately 913.4 feet NAVD. However, floodwaters submerge the dam crest 5 feet during a 10-percent-annual-chance flood and more than 8 feet during the 1-percent-annual-chance flood. Significant differences in elevation between Buffalo Lake and North Fork Crow River cannot develop when the river is in flood because the conveyance of the connecting valley is so large.

Lake Pulaski represents the opposite extreme in hydrologic conditions in that it has no outlet and there is no evidence to indicate that overflow has ever occurred (MNDNR, 1981 and USACE, 1984). The total area of the basin of Lake Pulaski is about 4.2 square miles. With the lake comprising 1.2 square miles of the basin, it has been estimated that the area supplying runoff is not large enough to maintain a lake in Minnesota's climate and there must be a significant groundwater contribution (MNDNR, 1984). The opposite argument maintains that if the lake received significant groundwater inflow from a large aquifer, the fluctuation in lake level over the years would not have been as great as has been observed. Nevertheless, the fluctuation in lake level since the area was settled precludes an

analysis from which to estimate the 1-percent-annual-chance flood level. The peak level reached in any year is largely dependent upon precipitation and average climate over the basin for the past several years, which determined the elevation at the beginning of the year.

To estimate a 1-percent-annual-chance flood level for Lake Pulaski, it was assumed that the lake was at the natural ordinary high-water level of 969.2 feet NAVD and a 1-percent-annual-chance, 10-day rainfall occurred. This results in a rise of 2.2 feet from direct rainfall on the lake and from runoff from the surrounding basin. The resulting elevation for the 1-percent-annual-chance flood on Lake Pulaski is 971.4 feet NAVD. This elevation is used to delineate flooding even though the study method for Lake Pulaski is approximate and flood levels for other recurrence intervals are not estimated (FEMA, 1985).

This Countywide FIS Report

For the Mississippi River, data for flow-frequency analyses were derived from USGS gaging station records, from a gage located at the downstream side of Parrish Avenue NE in the City of Otsego. Those records were from a time period of July 1915 to October 1956. It was then taken over by the USACE, which continues to obtain miscellaneous peak data at that site.

Flood-flow frequency-discharge values were obtained from the USGS for the Mississippi River above and below its confluence with the Elk River. These discharges represent an administrative agreement between USGS and the USACE reached April 5, 1973. WRC Bulletin No. 17 analysis of 45 years of gage data for the Mississippi River at Elk River showed the administrative discharges to fall within 95-percent confidence limits required by FEMA (HEC, 1977 and WRC, 1982). Further, drainage-area-frequency-discharge curves were constructed from discharges obtained from the USGS for six points along the Mississippi River. From these curves, the average drainage area ratio exponent was found to equal 0.64, from the following equation:

$$Q_2 = Q_1 (A_1/A_2)\ x$$

However, the Mississippi River detailed study reaches are located immediately upstream and downstream of the confluence with the Elk River.

For the approximate analyses streams, peak discharges were estimated using the published USGS regional regression equations (Lorenz, 2009). Regression equations estimate peak discharges for ungaged streams based on characteristics of nearby gauged streams. Drainage areas were developed from USGS 30-meter Digital Elevation Models (DEMs).

Peak discharge-drainage area relationships for each flooding source studied in detail are shown in Table 1.

Table 1 – Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
CLEARWATER RIVER					
At confluence with Mississippi River	171.4	740	1310	1,560	2,340
At 140th Street NW	160.2	730	1,280	1,530	2,290
Approximately 8,880 feet downstream of Pittman Avenue NW	94.0	670	1,110	1,320	2,020
At Fairhaven Dam	91.2	640	1,070	1,280	1,940
At State Highway 55	81.5	610	1,010	1,190	1,790
CROW RIVER					
Approximately 2.32 miles downstream of State Highway 101	2,760	11,000	22,900	29,500	48,300
Approximately 5.02 miles upstream of County Highway 22	2,590	9,800	16,600	19,900	27,700
Just upstream of State Highway 55	2,404	9,370	15,900	19,000	26,500
MISSISSIPPI RIVER					
Just downstream of confluence of Elk River	14,500	39,300	57,600	66,000	85,500
Just upstream of confluence with Elk River	13,800	36,400	53,300	61,000	79,000
Approximately 7.5 miles upstream of State Highway 25	13,694	35,800	52,500	60,200	77,900
Approximately 1.9 miles downstream of State Highway 24	13,616	35,460	52,000	59,570	77,100
NORTH FORK CROW RIVER					
At confluence Crow River	1,250	4,650	8,400	10,300	16,700
Approx 600 ft downstream of State Highway 8	1,028	4,140	7,470	9,160	14,800
OTTER CREEK					
At West River Street	12.3	220	360	420	520
SCHOOL LAKE CREEK					
At confluence with Crow River	10.9	390	465	500	565
SOUTH FORK CROW RIVER					
At confluence with Crow River	1,134	6,380	11,800	14,400	21,100
At Wright-Carver county boundary	1,080	6,260	11,600	14,100	20,700

Stillwater elevations for Wright County are shown in Table 2.

Table 2 – Summary of Stillwater Elevations

Flooding Source	Water Surface Elevations (Feet NAVD)			
	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
BUFFALO LAKE	918.6	921.2	922.1	926.0
DEER LAKE	918.6	921.2	922.1	926.0

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.

Precountywide Analyses

Cross sections for the channel and overbank portions of Clearwater River, Crow River, and South Fork Crow River were field surveyed. They were located at close intervals upstream and downstream of bridges, culverts, and other structures in order to compute significant backwater effects of these structures.

For Otter Creek and School Lake Creek, cross sections used in the analyses were located at close intervals upstream and downstream of bridges and other hydraulic structures to allow computation of the significant backwater effects of these structures. Other cross sections were located along the streams to provide a typical representation of stream valley topography. Data for cross sections on Otter Creek and dimensions and elevations of bridges, culvers, and other obstructions on Otter Creek were obtained by field survey. Starting WSELs were determined using a drainage area ratio of Otter Creek to the Mississippi River of less than 1:50, and the 20-percent-annual chance frequency WSEL was determined for the Mississippi River at the confluence with Otter Creek (MNDNR, 1976).

For Crow River, South Fork Crow River, and North Fork Crow River, effective flow areas of the floodplain cross sections, loss coefficients for bridges and other channel obstructions, and channel and overbank roughness coefficients were initially assigned to each cross section based on field inspection. Adjustments were made to the coefficients until the computed high-water profile using HEC-2

step-backwater program matched the historic high-water profile of the April 1965 flood on the Mississippi River (HEC, 1977).

Starting WSELs for Crow River were derived from a discharge-elevation rating curve from the City of Dayton (FIA, 1978). For South Fork Crow River, they were taken from elevations at the confluence with the Crow River. For Clearwater River, they were derived from a rating curve of discharges versus elevations from the FIS for the City of Clearwater (FIA, 1979a). In that report, the starting water-surface elevation for the 1-percent-annual-chance flood was the 20-percent-annual-chance flood elevation of the Mississippi River (MNDNR, 1976). The 10-, 50-, and 0.2-percent-annual-chance WSELs were determined from corresponding flood elevations on the Mississippi River.

The flood level for Buffalo Lake and Deer Lake was estimated based on the detailed study flood levels on the North Fork Crow River.

The hydraulic analysis of flow controlling the response of Buffalo Lake to floods of North Fork Crow River was based on area of the constricted opening at the outlet of Deer Lake and observations of flow and water levels during the floods of April and June 1984.

Fountain Lake and Pelican Lake have no natural outlets. Therefore, flood levels for the approximate studies of these lakes were estimated based on approximate storage curves and consideration of various runoff events. Flood levels for the approximate studies of Lake Martha and Lake Charlotte were estimated based on an approximate storage-outflow relationship developed for each lake with consideration of various runoff events.

No hydraulic analysis of flow was necessary for Lake Pulaski as no channels or stream flow are involved.

This Countywide FIS Report

During the 1997 analysis, the effective HEC-2 models for the Mississippi River from the Sherburne and Anoka County boundary to the confluence with Clearwater River were revised and the floodway alignment was added (FEMA, 1994). Cross sections for the Mississippi River were obtained from aerial photographs at a scale of 1:12,000 and field surveys (Mark Hurd Aerial Surveys, Inc., 1975). Water-surface elevations of floods of the selected recurrence intervals for the Mississippi River were computed using the USACE, HEC-2 step-backwater computer program (HEC, 1982).

For the streams studied by approximate methods, cross section data was obtained from the topography. Roads were modeled as bridges with cross-sections upstream and downstream of the structure. The studied streams were modeled using the USACE, HEC computer program HEC-RAS, version 4.1.0 (HEC, 2010).

Channel roughness factors (Mannings "n") used in the hydraulic computations were chosen using field inspection data, USGS topographic maps and aerial photography. The Manning's "n" values for all detailed studied streams are listed in the following table:

Manning's "n" Values

Stream	Channel "n"	Overbank "n"
Clearwater River	0.036-0.044	0.072-0.088
Crow River	0.030-0.040	0.050-0.150
Mississippi River	0.033-0.036	0.070-0.083
North Fork Crow River	0.020-0.150	0.020-0.150
Otter Creek	0.033-0.100	0.035-0.160
School Lake Creek	0.032-0.580	0.035-0.150
South Fork Crow River	0.030-0.040	0.050-0.150

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the FIRM (Exhibit 2).

The profile baselines depicted on the FIRM represent the hydraulic modeling baselines that match the flood profiles on this FIS report. As a result of improved topographic data, the profile baseline, in some cases, may deviate significantly from the channel centerline or appear outside the Special Flood Hazard Area.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was NGVD. With the finalization of NAVD, many FIS reports and FIRMs are being prepared using NAVD as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM, unless otherwise noted, are referenced to NAVD. Structure and ground elevations in the community must, therefore, be referenced to NAVD. It is important to note that adjacent communities may be referenced to NGVD. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between the communities. Some of the data used in this study were taken from the prior effective FIS reports and adjusted to NAVD. The average conversion factor that

was used to convert the data in this FIS report to NAVD was calculated using the National Geodetic Survey's (NGS) VERTCON online utility (NGS, 2009). The data points used to determine the conversion are listed in Table 3.

Table 3 – Vertical Datum Conversion

Quad Name	Corner	Latitude	Longitude	Conversion from NGVD to NAVD
Albion Center	SE	45.125	-94.000	0.312
Annandale	SE	45.250	-94.000	0.361
Big Lake	SE	45.250	-93.625	0.384
Buffalo East	SE	45.125	-93.750	0.308
Buffalo West	SE	45.125	-93.875	0.322
Clear Lake	SE	45.375	-93.875	0.397
Clearwater	SE	45.375	-94.000	0.384
Cokato	SE	45.000	-94.125	0.364
Dassel	SE	45.000	-94.250	0.397
Delano	SE	45.000	-93.750	0.259
Elk River	SE	45.250	-93.500	0.371
French Lake	SE	45.125	-94.125	0.305
Howard Lake	SE	45.000	-94.000	0.315
Kimball	SE	45.250	-94.250	0.518
Kingston	SE	45.125	-94.250	0.358
Monticello	SE	45.250	-93.750	0.328
Saint Augusta	SE	45.375	-94.125	0.427
Silver Creek	SE	45.250	-93.875	0.331
South Haven	SE	45.250	-94.125	0.427
Waverly	SE	45.000	-93.875	0.295
			Average:	**0.358**

For the Crow River, , datum conversions were calculated at the location of each lettered cross section using the National Geodetic Survey's VERTCON online utility (NGS, 2009). This results in a rolling conversion factor for the Crow River as listed in Table 4.

Table 4 – Crow River Datum Conversion

Cross Section	Latitude	Longitude	NGVD to NAVD Elevation Change(feet)
A	45.244	-93.522	0.377
B	45.243	-93.521	0.377
C	45.238	-93.520	0.377
D	45.234	-93.521	0.377
E	45.231	-93.526	0.377
F	45.225	-93.526	0.377
G	45.222	-93.529	0.377

Table 4 – Crow River Datum Conversion *(continued)*

Cross Section	Latitude	Longitude	NGVD to NAVD Elevation Change(feet)
H	45.226	-93.534	0.381
I	45.231	-93.536	0.381
J	45.230	-93.545	0.381
K	45.227	-93.548	0.381
L	45.225	-93.557	0.381
M	45.223	-93.563	0.381
N	45.219	-93.571	0.377
O	45.219	-93.575	0.377
P	45.218	-93.578	0.374
Q	45.215	-93.594	0.367
R	45.209	-93.595	0.364
S	45.208	-93.600	0.361
T	45.212	-93.603	0.364
U	45.210	-93.609	0.361
V	45.203	-93.624	0.348
W	45.203	-93.631	0.344
X	45.210	-93.638	0.348
Y	45.205	-93.643	0.341
Z	45.201	-93.645	0.338
AA	45.199	-93.648	0.335
AB	45.199	-93.655	0.335
AC	45.195	-93.658	0.331
AD	45.189	-93.657	0.331
AE	45.181	-93.649	0.328
AF	45.179	-93.646	0.328
AG	45.179	-93.644	0.328
AH	45.150	-93.684	0.315
AI	45.144	-93.689	0.312
AJ	45.131	-93.703	0.305
AK	45.124	-93.710	0.305
AL	45.118	-93.717	0.302
AM	45.110	-93.722	0.299

For Clearwater River, a datum conversion of +0.553 was used to be consistent with data presented in the FIS for Stearns County, Minnesota and Incorporated Areas.

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

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

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control.

Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. 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. Between cross sections, the boundaries were interpolated using topographic maps, with a contour interval of 2 feet, derived from Light Detection and Ranging (LIDAR), provided by MNDNR (MNDNR, 2008).

For School Lake Creek, from approximately 1,700 feet downstream of Meadowlark Road SE, to approximately 275 feet upstream of Lincoln Drive, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated between cross sections using photogrammetric methods with aerial photographs taken in May 1975 (Mark Hurd Aerial Surveys, Inc., 1975).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE) and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-

percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (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 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. In Minnesota, however, floodplain encroachment is limited by Minnesota Regulations to that which would cause a 0.5-foot increase in flood heights above pre-floodway conditions at any point (MNDNR, 1977). Floodways having no more than 0.5-foot surcharge were delineated for this FIS. The floodway 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 in Table 5. 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.

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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CLEARWATER RIVER									
A	925	340/197[3]	403	3.9		948.9	939.8[5]	949.4	0.4
B	1,315	220/150	2,259	0.7		955.4	955.4	955.9	0.5
C	1,785	314/93	2,435	0.6		955.4	955.4	955.9	0.5
D	2,625	200/145	1,431	1.1	124	955.4	955.4	955.9	0.5
E	3,830	194/121	1,681	0.9	136	955.9	955.9	956.4	0.5
F	4,855	142/24	819	1.9		956.3	956.3	956.8	0.5
G	5,900	118/58	538	2.9		957.2	957.2	957.7	0.5
H	6,800	220/80	770	2.0		959.2	959.2	959.7	0.5
I	7,410	20/10	180	8.5		960.9	960.9	961.1	0.2
J	8,690	302/171[4]	*	1.8		963.2	963.2	963.3	0.1
K	11,480	95/51[4]	*	6.4	75	965.5	965.5	965.5	0.0
L	12,960	304/204[4]	*	3.2		968.3	968.3	968.8	0.5
M	14,170	60/30	360	4.3		969.8	969.8	970.2	0.4
N	16,570	322/74[4]	*	2.2	190	972.9	972.9	972.9	0.0
O	18,830	88/51[4]	*	0.8	590	973.9	973.9	973.9	0.0
P	20,890	220/160	590	2.7		974.7	974.7	974.7	0.0
Q	22,300	125/38[4]	*	1.4	270	975.7	975.7	976.1	0.4
R	24,760	420/50	1,270	1.2		976.7	976.7	977.1	0.4
S	26,610	570/192	1,150	1.4		977.7	977.7	977.9	0.2
T	28,005	570/61	1,420	1.1		979.0	979.0	979.2	0.2

*Data not computed
[1]Feet above confluence with Mississippi River
[2]Total width / Width within county boundary
[3]Floodway widened to contain open channel
[4]Administrative Floodway
[5]Elevation computed without consideration of backwater effects from Mississippi River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

CLEARWATER 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CLEARWATER RIVER (CONTINUED)									
U	31,075	110/35	400	3.9		981.4	981.4	981.5	0.1
V	32,995	420/50	1,470	1.1		982.7	982.7	983.1	0.4
W	34,875	555/435	1,110	1.4		983.6	983.6	984.0	0.4
X	36,925	500/312	1,250	1.3	50	985.4	985.4	985.5	0.1
Y	38,675	560/110	1,200	1.3		986.5	986.5	986.5	0.0
Z	39,965	640/497	1,170	1.3		987.4	987.4	987.4	0.0
AA	42,345	250/70	700	2.2		989.0	989.0	989.0	0.0
AB	43,705	230/160	760	2.0		990.0	990.0	990.1	0.1
AC	44,975	258/114[3]	*	3.1		991.1	991.1	991.5	0.4
AD	45,545	120/20	420	3.7		992.4	992.4	992.8	0.4
AE	47,545	390/244	1,570	1.0		993.9	993.9	994.1	0.2
AF	48,525	90/90	450	3.4		994.1	994.1	994.3	0.2
AG	49,485	180/90	980	1.6		994.8	994.8	995.1	0.3
AH	50,375	190/25	1,040	1.5		995.0	995.0	995.4	0.4
AI	53,005	820/60	4,490	0.3		995.2	995.2	995.6	0.4
AJ	56,605	720/139	3,540	0.4		995.3	995.3	995.7	0.4
AK	57,765	720/264	3,860	0.4		995.3	995.3	995.7	0.4
AL	59,975	490/80	2,660	0.6		995.4	995.4	995.8	0.4
AM	62,565	100/50	570	2.7		995.6	995.6	995.9	0.3
AN	62,565	280/98	870	1.8		996.1	996.1	996.4	0.3

*Data not computed

[1]Feet above confluence with Mississippi River

[2]Total width / Width within county boundary (unless otherwise noted)

[3]Administrative Floodway

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

CLEARWATER 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CLEARWATER RIVER (CONTINUED)									
AO	76,505	460/60	2,070	0.6		996.8	996.8	997.3	0.5
AP	77,875	430/250	2,390	0.6		997.0	997.0	997.5	0.5
AQ	80,735	1,344/497[3]	14,580	0.1		997.0	997.0	997.5	0.5
AR	82,605	320/130	1,890	0.7		997.0	997.0	997.5	0.5
AS	85,285	340/220	1,970	0.7		997.1	997.1	997.5	0.4
AT	87,945	150/80	1,450	0.9		997.2	997.2	997.6	0.4
AU	89,715	120/3	1,340	1.0		997.2	997.2	997.6	0.4
AV	91,965	340/190	3,640	0.4		997.3	997.3	997.7	0.4
AW	96,365	1,200/386[4]	*	0.2	85	997.3	997.3	997.7	0.4
AX	97,435	220/100	620	2.1		997.3	997.3	997.7	0.4
AY	98,285	70/30	370	3.6		998.5	998.5	998.6	0.1
AZ	98,750	130/110	380	3.4		1,000.1	1,000.1	1,000.1	0.0
BA	99,485	210/165	910	1.5		1,001.7	1,001.7	1,001.7	0.0
BB	100,185	190/100	1,580	0.8		1,009.4	1,009.4	1,009.4	0.0
BC	102,865	437/125[3]	2,960	0.4		1,009.5	1,009.5	1,009.5	0.0
BD	106,215	390/130	2,940	0.4		1,009.5	1,009.5	1,009.5	0.0
BE	106,975	300/100	1,830	0.7		1,009.5	1,009.5	1,009.5	0.0
BF	110,225	560/290	9,880	0.1		1,009.5	1,009.5	1,009.5	0.0
BG	112,665	860/308	5,740	0.2		1,009.5	1,009.5	1,009.5	0.0

*Data not computed

[1]Feet above confluence with Mississippi River

[2]Total width / Width within county boundary

[3]Floodway widened to contain open channel

[4]Administrative Floodway

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

CLEARWATER 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CLEARWATER RIVER (CONTINUED)									
BH	115,915	694/405[2,3]	1,330	1.0		1,009.5	1,009.5	1,009.5	0.0
BI	116,815	180	450	2.9		1,010.4	1,010.4	1,010.6	0.2
BJ	117,455	100	330	4.0		1,012.3	1,012.3	1,012.7	0.4
BK	118,945	80	320	4.1		1,016.3	1,016.3	1,016.3	0.0
BL	122,365	550[4]	*	2.7		1,021.3	1,021.3	1,021.4	0.1
BM	124,545	130	550	2.4		1,024.5	1,024.5	1,024.5	0.0
BN	126,065	350	1,330	1.0		1,025.1	1,025.1	1,025.1	0.0
BO	127,165	50	310	4.2		1,025.5	1,025.5	1,025.5	0.0
BP	128,345	300	1,020	1.3		1,026.4	1,026.4	1,026.5	0.1
BQ	129,345	80	480	2.7		1,027.2	1,027.2	1,027.6	0.4
BR	131,465	350	1,570	0.8		1,027.9	1,027.9	1,028.3	0.4
BS	133,135	130	680	1.9		1,028.2	1,028.2	1,028.5	0.3
BT	134,520	80	420	3.2		1,029.1	1,029.1	1,029.4	0.3
BU	135,065	110[4]	*	3.4		1,030.4	1,030.4	1,030.6	0.2
BV	136,465	225[3]	1,370	1.0		1,030.7	1,030.7	1,031.0	0.3

*Data not computed
[1]Feet above confluence with Mississippi River
[2]Total width / Width within county boundary
[3]Floodway widened to contain open channel
[4]Administrative Floodway

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

CLEARWATER 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CROW RIVER									
A	767	304/171	5,158	3.9	112	858.3	858.3	858.8	0.5
B	1,477	446/213	5,593	3.6	16	858.5	858.5	858.9	0.4
C	5,007	883/106[3]	8,289	2.4		859.3	859.3	859.7	0.4
D	6,767	752/260	6,123	3.3		859.7	859.7	860.0	0.3
E	8,507	475/106	5,022	4.0		860.2	860.2	860.5	0.3
F	10,547	649/500	5,254	3.8		861.0	861.0	861.3	0.3
G	12,037	732/669	5,179	3.9	289	861.6	861.6	861.9	0.3
H	13,777	224/176	3,388	5.9		862.4	862.4	862.7	0.3
I	16,267	480/154	3,487	5.7	108	863.8	863.8	864.1	0.3
J	19,277	936/241	9,264	2.1	31	865.6	865.6	865.7	0.1
K	20,747	850/634	7,379	2.7		866.0	866.0	866.1	0.1
L	23,457	450/349	4,884	4.1		867.0	867.0	867.1	0.1
M	26,817	595/471	5,410	3.7		868.5	868.5	868.7	0.2
N	29,357	422/287	5,381	3.7		869.5	869.5	869.7	0.2
O	30,327	339/118	6,250	3.2	71	869.7	869.7	869.9	0.2
P	31,317	284/208	5,585	3.5	17	869.8	869.8	870.0	0.2
Q	35,267	392/0	4,899	4.0		871.0	871.0	871.3	0.3
R	37,462	215/117	3,083	6.4	26	871.9	871.9	872.1	0.2
S	38,802	859/589	11,745	1.7		873.0	873.0	873.2	0.2
T	40,662	1,018/141	11,983	1.7		873.1	873.1	873.4	0.3
U	43,412	2,500/1,420	33,354	0.6		873.2	873.2	873.5	0.3
V	52,702	1,900/1,718	10,356	1.9		875.2	875.2	875.2	0.0
W	54,582	1,378/1,256	4,972	4.0		875.6	875.6	875.6	0.0

[1]Feet above confluence with Mississippi River

[2]Total width / Width within county boundary, unless otherwise noted

[3]Total width / Width within county boundary, excluding City of Dayton (area not included)

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

CROW 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CROW RIVER (CONTINUED)									
X	57,842	508/140	4,123	4.8		878.4	878.4	878.5	0.1
Y	60,462	663/566	4,298	4.6		880.5	880.5	880.5	0.0
Z	62,402	372/225	3,712	5.3		881.8	881.8	881.9	0.1
AA	63,102	243/189	3,282	6.0	3	882.2	882.2	882.5	0.3
AB	64,892	707/113	6,400	3.1	17	883.4	883.4	883.7	0.3
AC	66,532	664/180	4,998	3.9		883.9	883.9	884.1	0.2
AD	69,122	404/283	4,447	4.4		885.1	885.1	885.2	0.1
AE	72,822	367/175	3,740	5.2	44	886.8	886.8	886.9	0.1
AF	73,662	600/89	6,493	3.0		887.5	887.5	887.6	0.1
AG	74,262	653/308	5,617	3.5		887.6	887.6	887.7	0.1
AH	93,468	890/311	6,929	2.8		901.0	901.0	901.0	0.0
AI	96,428	676/286	5,218	3.7		901.8	901.8	901.9	0.1
AJ	102,528	732/197	5,851	3.3		903.8	903.8	903.8	0.0
AK	105,608	258/68	3,009	6.4		904.7	904.7	904.8	0.1
AL	108,708	266/176	3,100	6.2		906.5	906.5	906.6	0.1
AM	111,828	327/161	4,489	4.3	104	908.0	908.0	908.1	0.1

[1]Feet above confluence with Mississippi River
[2]Total width / Width within county boundary

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

CROW 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MISSISSIPPI RIVER									
A	2,550	1,184/309	14,388	4.6		857.4	857.4	857.8	0.4
B	4,260	2,024/1,342	27,389	2.4		858.0	858.0	858.4	0.4
C	6,100	2,221/1,608	23,559	2.8		858.2	858.2	858.6	0.4
D	8,420	857/416	12,168	5.4		858.5	858.5	858.8	0.3
E	10,490	716/323	10,432	6.3		859.1	859.1	859.4	0.3
F	12,600	778/408	10,585	6.3		860.0	860.0	860.2	0.2
G	14,800	1,366/292	14,335	4.6		861.0	861.0	861.2	0.2
H	17,520	964/525	12,036	5.4		861.6	861.6	861.8	0.2
I	19,980	724/252	11,606	5.7		862.3	862.3	862.5	0.2
J	21,580	1,183/454	15,422	4.3		862.8	862.8	863.0	0.2
K	22,570	732/226	11,519	5.7	42	863.4	863.4	863.5	0.1
L	24,240	643/259	9,890	6.7		863.9	863.9	864.0	0.1
M	25,640	806/462	12,056	5.5		864.7	864.7	864.8	0.1
N	27,130	414/223	8,376	7.9		864.9	864.9	865.0	0.1
O	28,640	1,121/876	17,755	3.7		866.4	866.4	866.5	0.1
P	32,130	2,852/832	23,392	2.6		867.0	867.0	867.3	0.3
Q	34,270	2,942/1,422	22,681	2.7		867.6	867.6	868.0	0.4
R	35,760	2,170/670	21,396	2.9		868.0	868.0	868.3	0.3
S	36,940	2,223/769	15,762	3.9		868.2	868.2	868.5	0.3
T	38,320	974/257	11,821	5.2		868.6	868.6	869.0	0.4

[1]Feet above Anoka / Sherburne County boundary
[2]Total width / Width within county boundary

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MISSISSIPPI RIVER (CONTINUED)									
U	40,300	619/179	8,877	6.9		869.5	869.5	869.8	0.3
V	42,450	645/352	8,313	7.3		870.6	870.6	870.9	0.3
W	44,630	734/452	10,334	5.9	188	872.3	872.3	872.5	0.2
X	45,895	1,927/1,265	19,255	3.2		873.3	873.3	873.4	0.1
Y	47,885	828/591	9,389	6.5		873.8	873.8	873.9	0.1
Z	49,425	660/194	8,426	7.2		874.4	874.4	874.5	0.1
AA	51,245	933/363	8,739	7.0	44	875.5	875.5	875.6	0.1
AB	53,485	668/318	7,553	8.1		876.7	876.7	876.7	0.0
AC	55,225	1,460/232	13,276	4.6		878.6	878.6	878.6	0.0
AD	57,305	1,881/381	13,851	4.4	130	880.3	880.3	880.3	0.0
AE	59,695	616/294	7,921	7.7		882.2	882.2	882.2	0.0
AF	61,625	539/147	7,291	8.4		884.4	884.4	884.4	0.0
AG	66,645	719/150	9,588	6.4	47	888.3	888.3	888.4	0.1
AH	70,145	1,814/1,019	13,864	4.4		891.1	891.1	891.1	0.0
AI	73,145	756/393	9,649	6.3	1	892.9	892.9	892.9	0.0
AJ	78,145	731/335	8,330	7.3	16	895.4	895.4	895.4	0.0
AK	82,945	563/165	6,185	9.8		899.3	899.3	899.3	0.0
AL	87,945	523/120	7,122	8.5		904.2	904.2	904.2	0.0
AM	90,045	590/275	6,986	8.7		905.8	905.8	905.8	0.0
AN	92,045	927/537	11,173	5.4		907.6	907.6	907.6	0.0

[1]Feet above Anoka / Sherburne County boundary
[2]Total width / Width within county boundary

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MISSISSIPPI RIVER (CONTINUED)									
AO	129,205	490/87	9,514	6.4		933.5	933.5	933.7	0.2
AP	130,995	550/133	10,054	6.0		934.3	934.3	934.5	0.2
AQ	133,215	611/198	11,003	5.5		935.2	935.2	935.4	0.2
AR	135,015	605/355	12,743	4.7	122	935.9	935.9	936.1	0.2
AS	137,255	1,062/317	18,448	3.3		936.5	936.5	936.7	0.2
AT	138,305	835/483	13,433	4.5		936.6	936.6	936.8	0.2
AU	139,675	1,114/510	16,706	3.6		937.1	937.1	937.3	0.2
AV	141,565	670/309	11,116	5.4		937.4	937.4	937.6	0.2
AW	143,275	555/248	8,512	7.1		938.0	938.0	938.2	0.2
AX	145,255	889/421	13,779	4.4	55	939.4	939.4	939.6	0.2
AY	146,925	1,135/222	14,114	4.3		939.8	939.8	940.0	0.2
AZ	148,675	1,000/232	12,273	4.9		940.3	940.3	940.6	0.3
BA	151,125	1,923/1,401	24,720	2.4	20	941.2	941.2	941.5	0.3
BB	152,945	818/530	13,040	4.6		941.4	941.4	941.7	0.3
BC	154,195	713/285	13,052	4.6	20	941.8	941.8	942.1	0.3
BD	155,945	720/189	11,904	5.1		942.2	942.2	942.5	0.3
BE	157,735	748/355	11,820	5.1	122	942.7	942.7	943.0	0.3
BF	159,535	786/431	13,571	4.4		943.4	943.4	943.7	0.3
BG	161,285	669/322	12,648	4.8		943.8	943.8	944.1	0.3

[1]Feet above Anoka / Sherburne County boundary
[2]Total width / Width within county boundary

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MISSISSIPPI RIVER (CONTINUED)									
BH	163,085	861/542	15,564	3.9	207	944.3	944.3	944.6	0.3
BI	164,685	1,146/938	14,145	4.2		944.6	944.6	944.9	0.3
BJ	165,935	1,093/422	19,239	3.1		945.1	945.1	945.4	0.3
BK	168,365	2,656/2,060	23,305	2.6		945.3	945.3	945.6	0.3
BL	170,465	2,200/832	19,960	3.0		945.6	945.6	945.9	0.3
BM	172,415	1,732/592	16,188	3.7	68	946.0	946.0	946.3	0.3
BN	174,315	1,488/441	16,752	3.6		946.6	946.6	947.0	0.4
BO	176,145	1,250/895	16,798	3.6		947.0	947.0	947.4	0.4
BP	177,345	900/676	13,129	4.5		947.2	947.2	947.6	0.4
BQ	179,175	783/691	13,440	4.4		947.6	947.6	948.0	0.4
BR	180,535	784/784	15,260	3.9	20	948.4	948.4	948.8	0.4
BS	182,235	646/383	11,490	5.2	58	948.5	948.5	948.9	0.4

[1]Feet above Anoka / Sherburne County boundary
[2]Total width / Width within county boundary

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NORTH FORK CROW RIVER									
A	686	1,890	21,240	0.5		914.9	914.5[2]	914.5[2]	0.0
B	4,936	718	4,619	2.2		914.9	914.5[2]	914.5[2]	0.0
C	8,036	763	8,580	1.2		914.9	914.8[2]	914.8[2]	0.0
D	9,336	760	9,553	1.1		914.9	914.8[2]	914.9[2]	0.1
E	10,836	530	6,120	1.7		914.9	914.9	914.9	0.0
F	11,722	398	3,774	2.7	23	914.9	914.9	915.0	0.1
G	14,097	855	9,641	1.1		915.3	915.3	915.4	0.1
H	19,197	508	6,135	1.7		915.5	915.5	915.6	0.1
I	21,197	870	10,150	1.0		915.6	915.6	915.7	0.1
J	22,847	2,087	23,363	0.4		915.7	915.7	915.8	0.1
K	26,097	4,880	55,574	0.2		915.7	915.7	915.8	0.1
L	29,597	3,900	33,933	0.3		915.7	915.7	915.8	0.1
M	36,023	4,500	39,259	0.3		915.7	915.7	915.8	0.1
N	40,873	941	7,896	1.3		915.7	915.7	915.8	0.1
O	47,273	3,069	16,852	0.6		916.2	916.2	916.4	0.2
P	50,773	643	3,444	2.9		916.6	916.6	916.7	0.1
Q	55,413	430	3,803	2.6		918.4	918.4	918.7	0.3
R	57,588	1,250	9,937	1.0		919.0	919.0	919.3	0.3
S	60,338	1,340[3]	9,946	1.0		919.2	919.2	919.6	0.4
T	74,253	807[3]	2,145	4.4		923.6	923.6	923.7	0.1

[1]Feet above confluence with Crow River
[2]Elevation computed with consideration of backwater effects from Crow River
[3]Floodway widened to contain open channel

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NORTH FORK CROW RIVER (CONTINUED)									
U	79,053	1,670[2]	14,203	0.7		924.1	924.1	924.4	0.3
V	83,903	5,150	40,916	0.2		924.1	924.1	924.4	0.3
W	90,353	4,100	22,601	0.4		924.2	924.2	924.4	0.2
X	93,853	3,325	13,066	0.7		924.7	924.7	924.9	0.2
Y	99,053	1,185	1,393	6.8	273	924.7	924.7	924.9	0.2
Z	105,521	399	2,969	3.2		932.4	932.4	932.5	0.1
AA	110,321	2,650	22,103	0.4		933.1	933.1	933.4	0.3
AB	118,321	2,300	13,928	0.7		933.1	933.1	933.6	0.5
AC	121,621	1,920	9,053	1.0		933.3	933.3	933.7	0.4
AD	126,371	1,490	6,138	1.5		933.9	933.9	934.4	0.5
AE	134,659	1,555	5,284	1.7		935.6	935.6	935.9	0.3

[1]Feet above confluence with Crow River
[2]Floodway widened to contain open channel

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
OTTER CREEK									
A	80	70	245	1.7		910.3	904.3[2]	904.8[2]	0.5
B	250	30	75	5.6		910.3	904.3[2]	904.8[2]	0.5
C	610	30	60	7.0		910.3	910.0[2]	910.0[2]	0.0
D	1,440	70	300	1.4		913.7	913.7	914.2	0.5
E	1,850	70	225	1.9		914.2	914.2	914.7	0.5
F	2,290	70	165	2.5		915.6	915.6	916.1	0.5
G	2,730	50	175	2.4		917.1	917.1	917.6	0.5
H	3,510	40	170	2.5		920.4	920.4	920.6	0.2
I	3,990	40	140	3.0		921.0	921.0	921.5	0.5
J	4,200	50	180	2.3		921.4	921.4	921.9	0.5
K	4,480	60	220	1.9		922.1	922.1	922.6	0.5
L	4,710	90	315	1.3		922.3	922.3	922.8	0.5
M	5,110	170	565	0.7		922.5	922.5	923.0	0.5
N	5,350	134[3]	205	2.0		922.8	922.8	923.3	0.5
O	5,860	70	175	2.4		923.6	923.6	924.0	0.4

[1]Feet above confluence with Mississippi River
[2]Elevation computed without consideration of backwater effects from Mississippi River
[3]Floodway widened to contain open channel

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

OTTER 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)
SCHOOL LAKE CREEK								
A	1,980	30	85	5.9	885.4	885.4	885.5	0.1
B	2,485	60	125	4.1	888.4	888.4	888.5	0.1
C	3,170	40	85	5.9	893.1	893.1	893.1	0.0
D	4,180	30	140	3.5	898.5	898.5	898.6	0.1
E	4,925	25	80	6.2	900.3	900.3	900.4	0.1
F	6,695	30	95	5.3	909.4	909.4	909.4	0.0
G	8,415	30	160	3.1	917.7	917.7	918.0	0.3
H	8,620	40	450	1.1	926.1	926.1	926.2	0.1
I	10,045	60	225	2.2	926.2	926.2	926.4	0.2
J	10,880	90	530	0.9	926.2	926.2	926.7	0.5
K	11,620	130	460	1.1	926.4	926.4	926.9	0.5

[1]Feet above confluence with Crow River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SCHOOL LAKE 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK CROW RIVER									
A	686	1,530/844[2]	12,899	1.1		914.9	914.9	914.9	0.0
B	1,436	1,245/1,183[2]	12,536	1.1		914.9	914.9	914.9	0.0
C	6,188	1,130/504[2]	11,391	1.3		915.0	915.0	915.0	0.0
D	8,886	1,283/1,165[2]	10,281	1.4		915.2	915.2	915.2	0.0
E	12,635	1,209/1,148[2]	4,815	3.0	121	915.7	915.7	915.8	0.1
F	15,138	1,040	6,362	2.3		916.8	916.8	916.9	0.1
G	18,459	479	3,843	3.7	88	918.0	918.0	918.1	0.1
H	19,705	880	7,072	2.0		918.7	918.7	918.8	0.1
I	21,606	2,409	12,223	1.2		919.0	919.0	919.1	0.1
J	25,106	2,572	19,015	0.8	25	919.2	919.2	919.3	0.1
K	28,105	1,319	9,277	1.5	57	919.3	919.3	919.4	0.1
L	28,805	231	2,412	6.0	37	919.4	919.4	919.5	0.1
M	30,175	171	2,712	5.3	19	921.2	921.2	921.2	0.0
N	30,430	187	2,323	6.2		921.7	921.7	921.8	0.1
O	30,835	185	2,150	6.7		922.0	922.0	922.0	0.0
P	31,340	158	2,212	6.5	31	922.4	922.4	922.4	0.0
Q	31,830	230	2,606	5.5		922.7	922.7	922.7	0.0
R	32,240	180	2,777	5.2	95	923.0	923.0	923.0	0.0
S	32,530	230	2,713	5.3		923.0	923.0	923.1	0.1
T	32,880	289	3,773	3.8		923.4	923.4	923.5	0.1

[1]Feet above confluence with Crow River
[2]Total width / Width within county

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH FORK CROW RIVER (CONTINUED)									
U	33,020	294	3,754	3.8		923.6	923.6	923.6	0.0
V	33,970	336	3,530	4.1		923.8	923.8	923.9	0.1
W	35,608	925	6,282	2.3		924.4	924.4	924.8	0.4
X	37,208	903	10,668	1.3		924.9	924.9	925.3	0.4
Y	38,708	1,051	9,116	1.6		925.1	925.1	925.4	0.3
Z	40,007	1,216	8,958	1.6		925.2	925.2	925.7	0.5
AA	40,608	1,278	10,158	1.4		925.3	925.3	925.8	0.5
AB	45,107	1,725	12,607	1.1	75	926.0	926.0	926.4	0.4
AC	46,807	1,870	16,162	0.9		926.2	926.2	926.6	0.4
AD	48,307	2,160	15,205	0.9		926.4	926.4	926.7	0.3
AE	53,824	1,077	9,443	1.5		928.3	928.3	928.6	0.3
AF	55,825	1720	12,075	1.2		928.6	928.6	928.9	0.3
AG	59,527	770	4,743	3.0		929.1	929.1	929.3	0.2
AH	61,327	677	4,515	3.1		930.2	930.2	930.3	0.1
AI	62,626	344	2,982	4.7		930.7	930.7	930.8	0.1

[1]Feet above confluence with Crow River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK CROW RIVER

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.

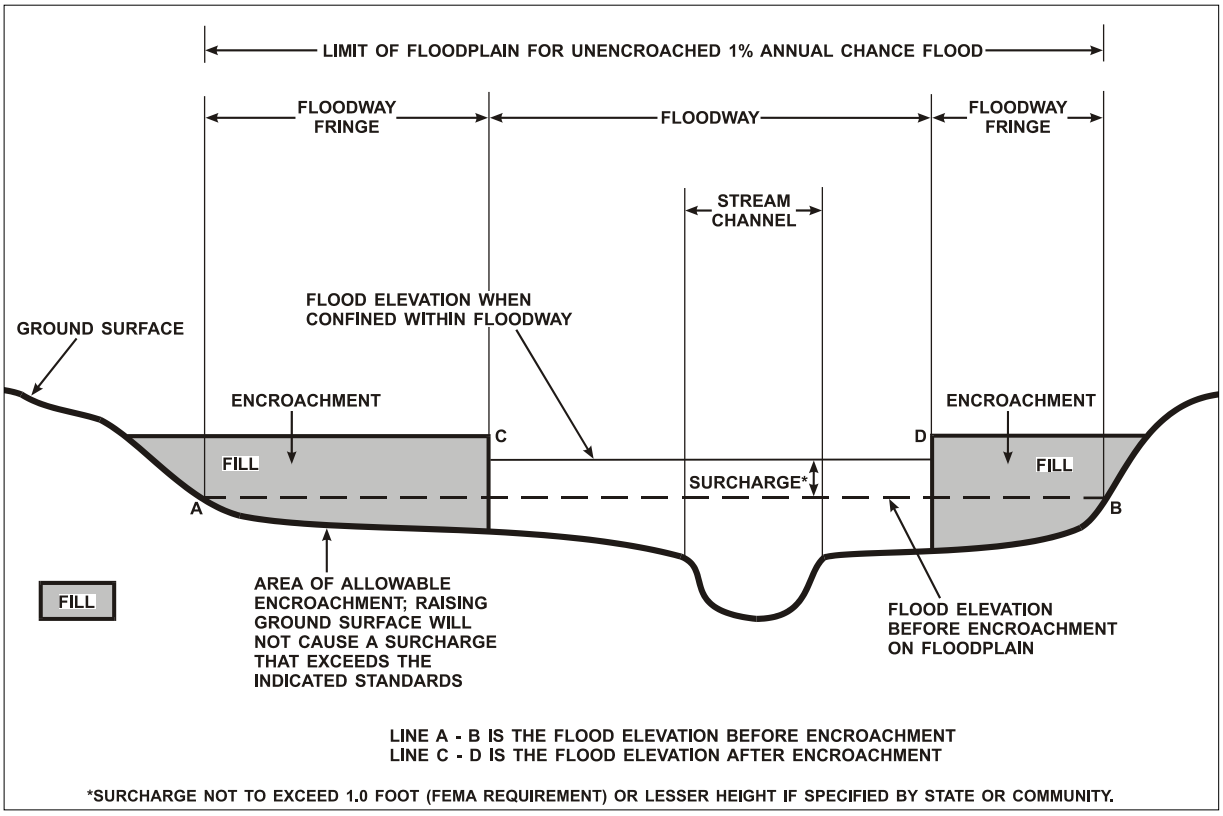


Figure 1 – Floodway Schematic

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 BFEs or base flood depths are shown within this zone.

Zone AE

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

Zone 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 Wright 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.

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.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
*Albertville, City of	N/A	None	N/A	None
*Annandale, City of	N/A	None	N/A	None
Buffalo, City of	May 8, 1974	May 28, 1976	May 15, 1985	None
Clearwater, City of	August 23, 1974	May 28, 1976	November 1, 1979	None
Cokato, City of	May 24, 1974	November 14, 1975	August 19, 1985	None
Delano, City of	May 24, 1974	May 14, 1976	April 1, 1980	December 2, 1988
*Howard Lake, City of	N/A	None	N/A	None
Maple Lake, City of	January 10, 1975	None	To Be Determined	None
Monticello, City of	May 24, 1974	March 26, 1976	November 1, 1979	None
Montrose, City of	To Be Determined	None	To Be Determined	None
Otsego, City of	May 1, 1978	None	May 1, 1978	August 4, 1988 September 30, 1992
*South Haven, City of	N/A	None	N/A	None
St. Michael, City of	May 17, 1974	August 20, 1976	November 1, 1979	July 2, 1982
Waverly, City of	January 17, 1975	None	To Be Determined	None
Wright County (Unincorporated Areas)	May 1, 1978	None	May 1, 1978	August 4, 1988 August 18, 1992

*No special flood hazard areas identified

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

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

Federal Emergency Management Agency, Flood Insurance Study, City of Buffalo, Wright County, Minnesota, May 15, 1985.

Federal Emergency Management Agency, Flood Insurance Study, City of Delano, Wright County, Minnesota, December 2, 1988a.

Federal Emergency Management Agency, Flood Insurance Study, Wright County (Unincorporated Areas), Minnesota, August 1988b.

Federal Emergency Management Agency, Flood Insurance Study, City of Otsego, Wright County, Minnesota, December 2, 1992a.

Federal Emergency Management Agency, Flood Insurance Study, Wright County (Unincorporated Areas), Minnesota, December 2, 1992b.

Federal Emergency Management Agency, Flood Insurance Study, Stearns County (Unincorporated Areas), Minnesota, November 16, 1994.

Federal Insurance Administration, Flood Insurance Study, City of Dayton, Hennepin County, Minnesota, February 1, 1978.

Federal Insurance Administration, Flood Insurance Study, City of Clearwater, Wright County, Minnesota, November 1, 1979a.

Federal Insurance Administration, Flood Insurance Study, City of Monticello, Wright County, Minnesota, November 1, 1979b.

Federal Insurance Administration, Flood Insurance Study, City of St. Michael, Wright County, Minnesota, Flood Insurance Study report, May 1979c.

Federal Insurance Administration, Flood Insurance Study, City of Delano, Wright County, Minnesota, April 1, 1980.

Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, U.S. Army Corps of Engineers, Davis, California, 1970.

Hydrologic Engineering Center, HEC-2 Water Surface Profiles, U.S. Army Corps of Engineers, Davis, California, May 1977.

Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, U.S. Army Corps of Engineers, Davis, California, April 1982.

Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 4.1.0, U.S. Army Corps of Engineers, Davis, California, January 2010.

Lorenz, David L., Chris A. Sanocki and Matthew J. Kocian, Techniques for Estimating the Magnitude and frequency of the Peak Flow on Small Streams in Minnesota Based on Data through Water Year 2005, U.S. Geological Survey, Scientific Investigations Report 2009-5250, U.S. Department of the Interior, 2009.

Mark Hurd Aerial Surveys, Inc., Aerial Photographs, Scale 1:12,000, City of St. Michael, Minnesota, May 1975.

Minnesota Department of Natural Resources, LIDAR Data, Wright County, 2008.

Minnesota Department of Natural Resources, Minnesota Flood Plain Management Newsletter, Volume 2, Issue 3, Division of Waters, August 1984.

Minnesota Department of Natural Resources, Natural Ordinary High Water Level Determination for Lake Pulaski, Division of Water, 1981.

Minnesota Department of Natural Resources, Technical Procedures of Floodway Analysis, Division of Water, October 1976.

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

National Geodetic Survey, VERTCON-North American Vertical Datum Conversion Utility. Retrieved March 18, 2009, from http://www.ngs.noaa.gov.

National Weather Service, Rainfall Frequency Atlas of the United States, 30-Minute to 24-Hour Durations, 1- to 100-Year Return Periods, Technical Paper No. 40, U.S. Department of Commerce, 1961.

National Weather Service, Two to Ten-day Precipitation for Return Periods of 2 to 100 years in the Contiguous United States, Technical Paper No. 49, U.S. Department of Commerce, 1964.

National Weather Service, Five to Sixty Minute Precipitation Frequency for Eastern and Central United States, Technical Memorandum NWS Hydro-35, U.S. Department of Commerce, June 1977.

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

Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, U.S. Department of Agriculture, August 1972.

Soil Conservation Service, Soil Survey, Wright County Minnesota, U.S. Department of Agriculture, June 1968.

U.S. Army Corps of Engineers, St. Paul District, Flood Control Appraisal Report, Lake Pulaski, City of Buffalo and Wright County , Minnesota, Memorandum Report, 1984.

U.S. Army Corps of Engineers, St. Paul District, Interim Hydrology Report for Stearns County Flood Insurance Study, July 1985.

U.S. Army Corps of Engineers, St. Paul District, Interim Hydrology Report for Stearns County Flood Insurance Study, May 1986.

U.S. Department of Transportation, Bureau of Public Roads, Hydraulic Charts for the Selection of Highway Culverts, December 1965.

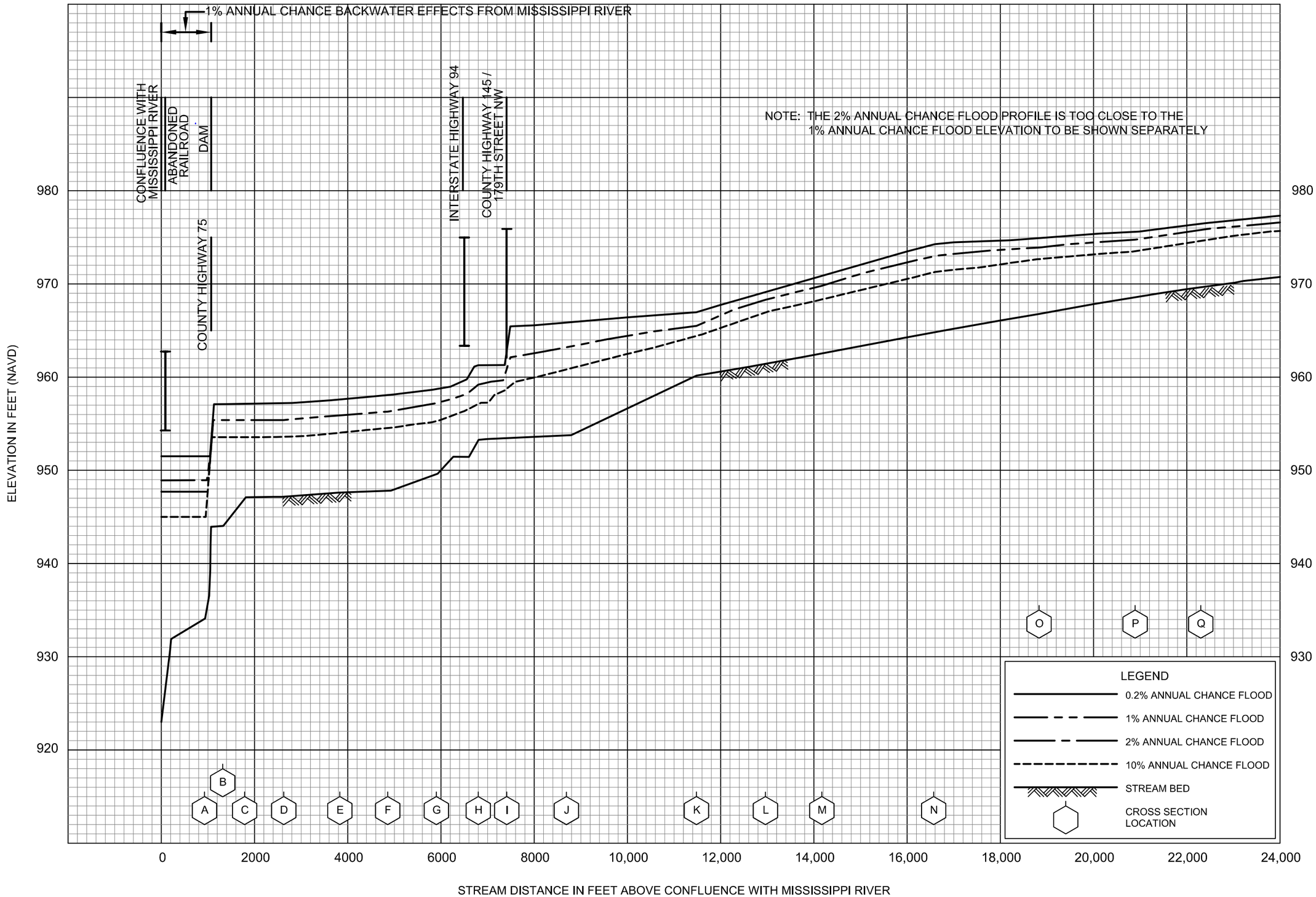
U.S. Geological Survey, Hydrologic Data and Analysis for the Clearwater River Flood of June 23, 1983 in Stearns, Meeker, and Wright Counties, Water Resources Investigation Report 85, U.S. Department of the Interior, 1985.

U.S. Geological Survey, Techniques for Estimating Magnitude and Frequency of Floods in Minnesota, U.S. Department of the Interior, 1977.

U.S. Geological Survey, 15 Minute Series Topographic Maps for Minnesota, Scale 1:62,500, Contour Interval 20 feet: Rockford, Minnesota, 1958.

Water Resources Council, Hydrology Committee, Guidelines for Determining Flood Flow Frequency, Bulletin #17B, Revised September 1981, Editorial corrections March 1982.

The Weather Channel, Monthly Averages for Clearwater, MN. Retrieved December 1, 2010, from http://www.weather.com.



FLOOD PROFILES

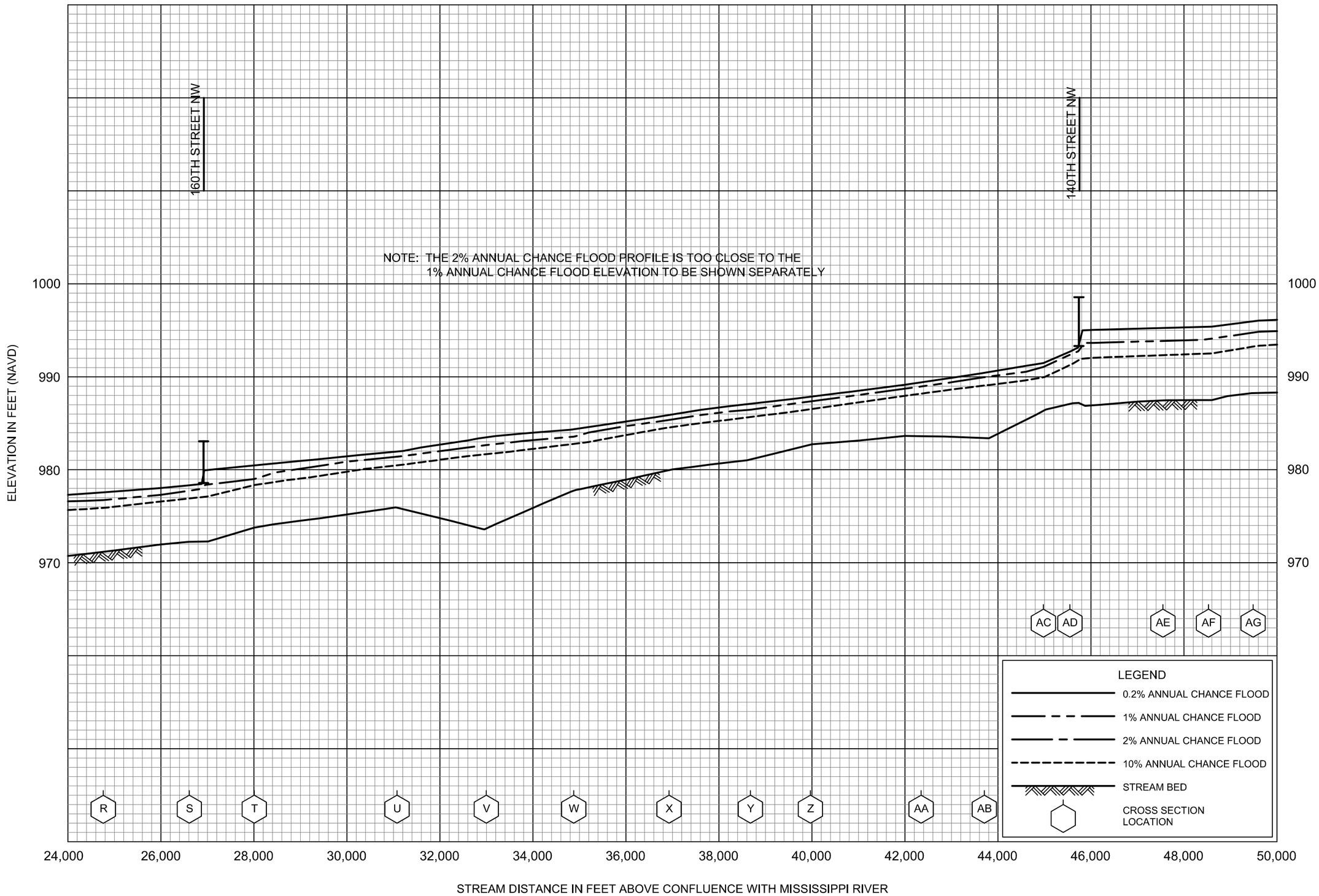
CLEARWATER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS

01P



FLOOD PROFILES

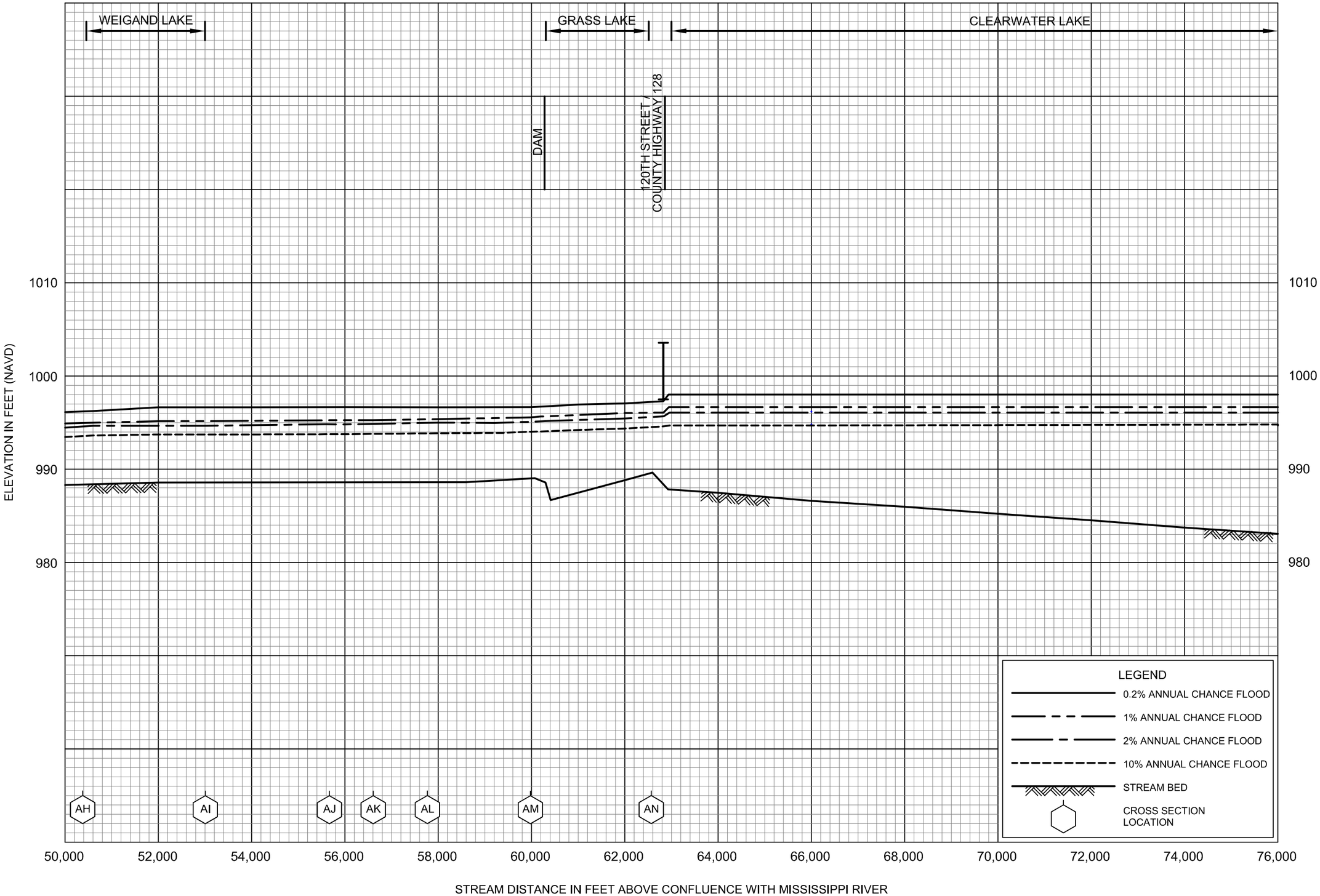
CLEARWATER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS

02P



FLOOD PROFILES

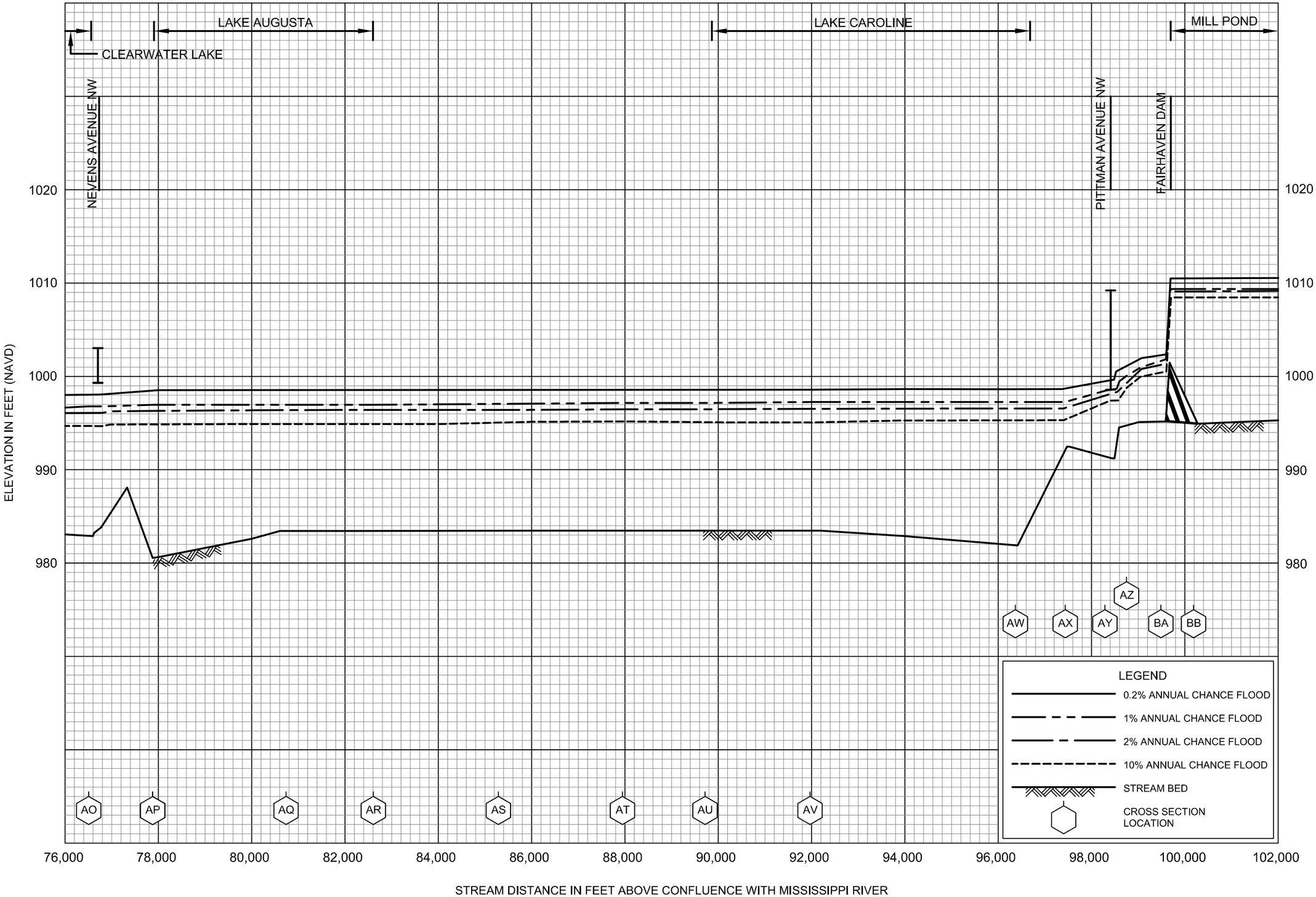
CLEARWATER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS

03P



FLOOD PROFILES

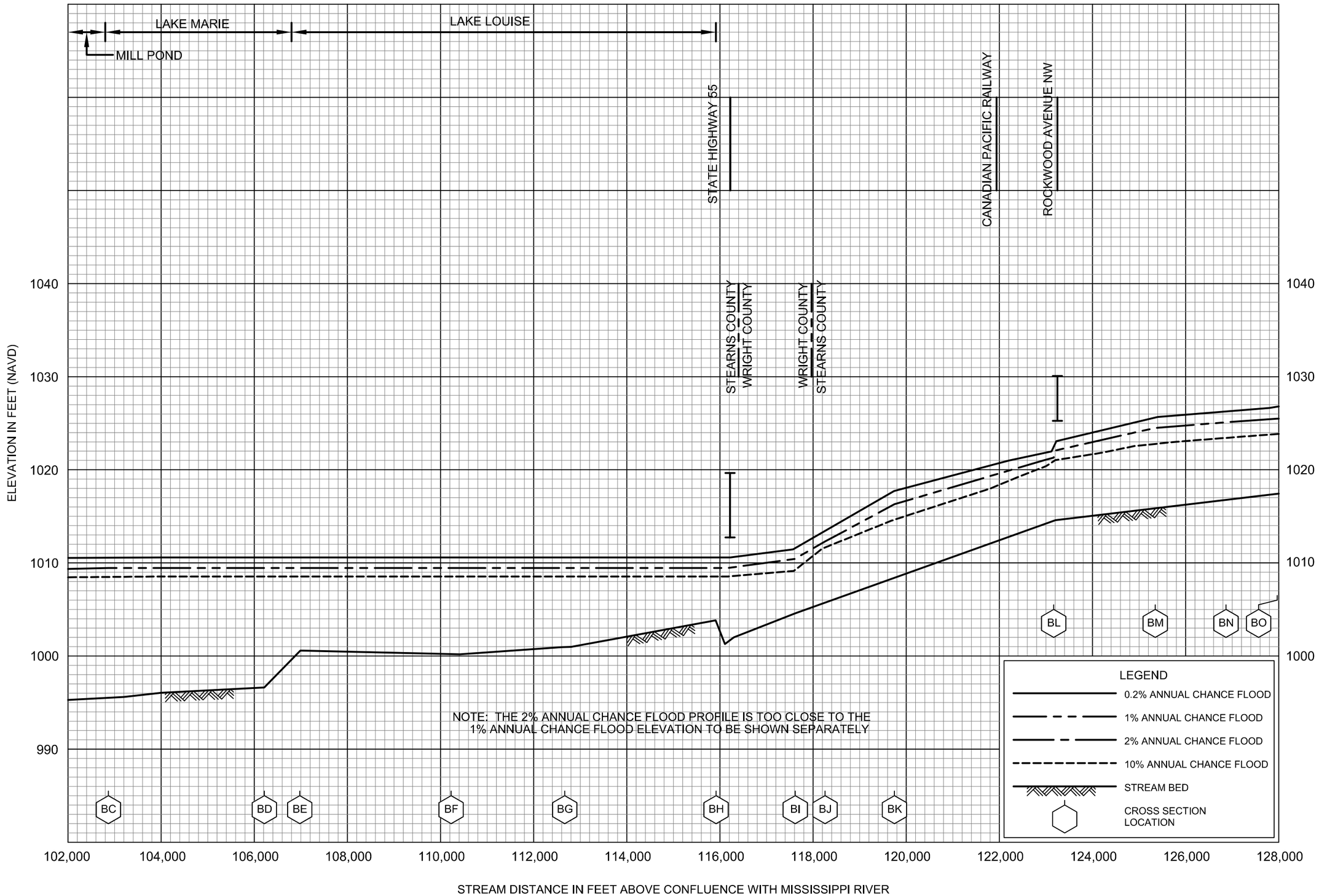
CLEARWATER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS

04P



FLOOD PROFILES

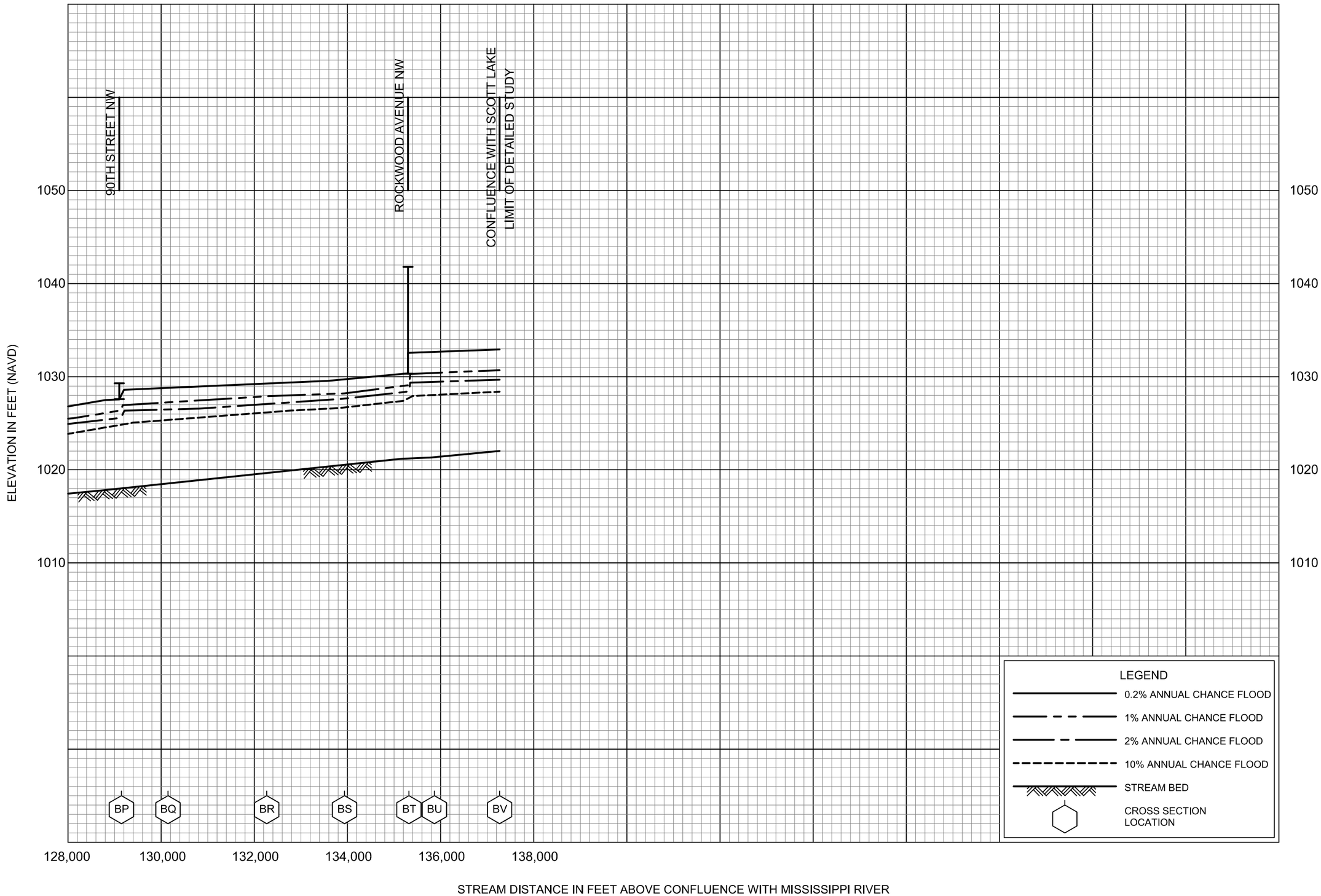
CLEARWATER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS

05P



FLOOD PROFILES

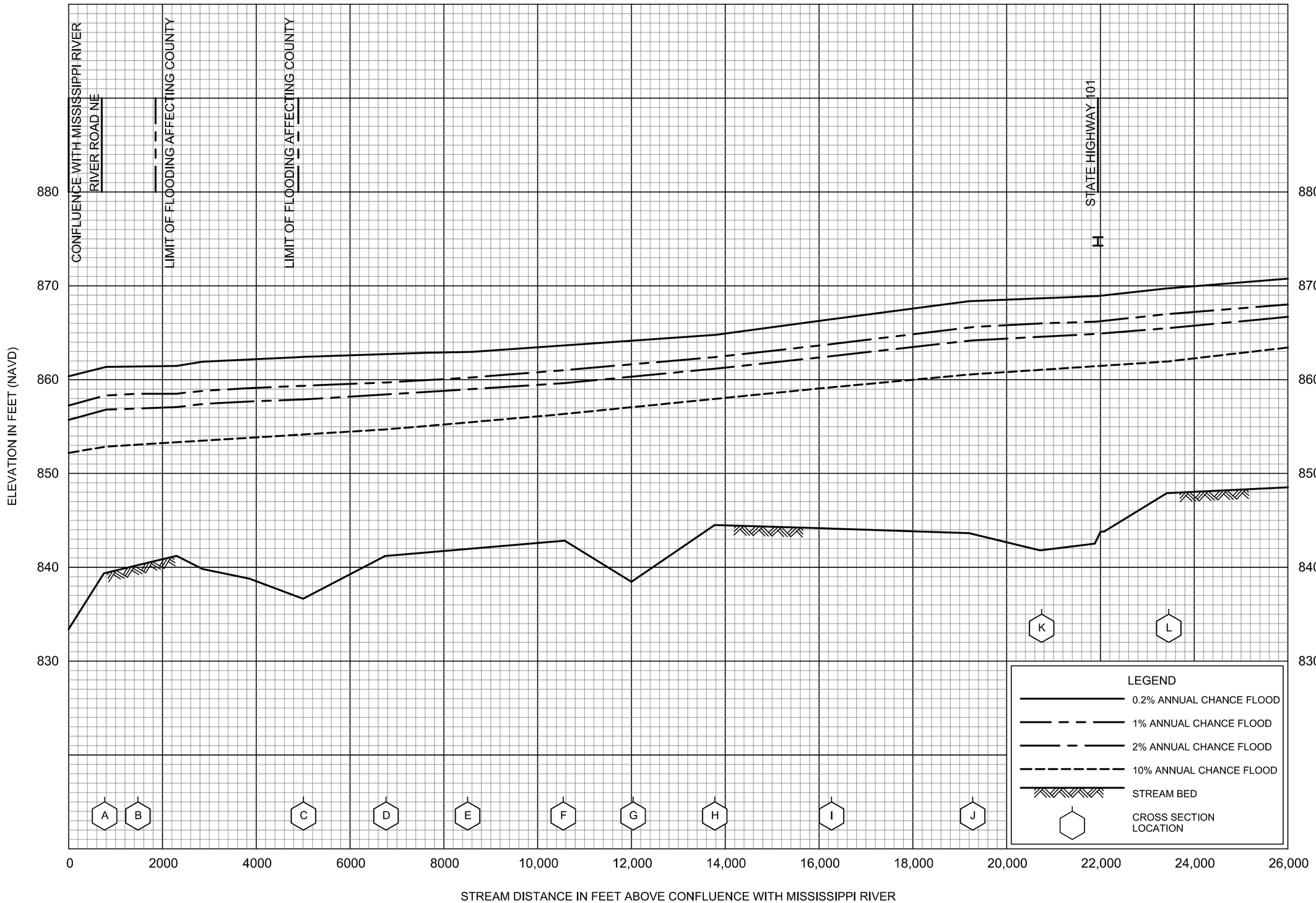
CLEARWATER RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

STEARNS COUNTY, MN

AND INCORPORATED AREAS

06P



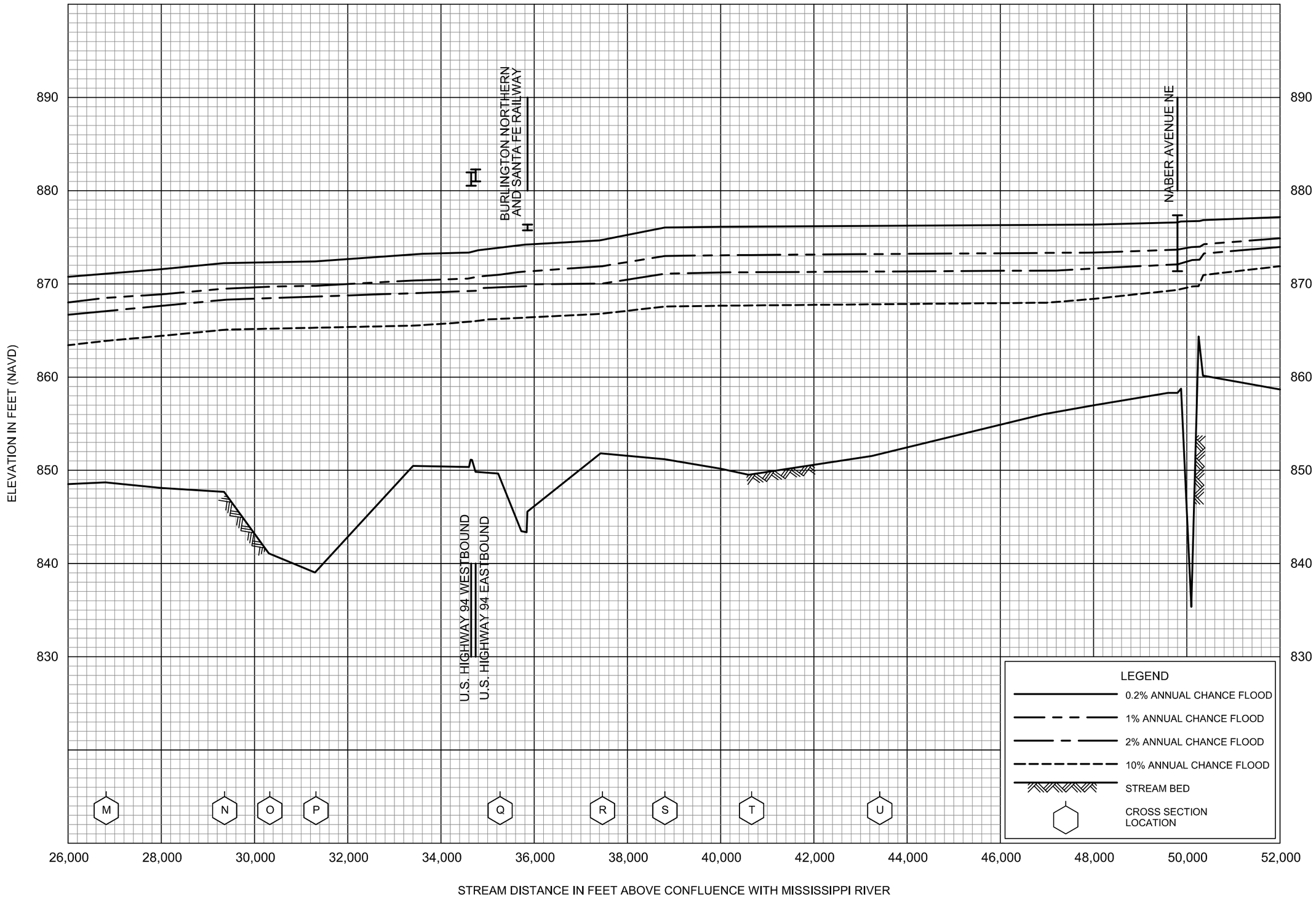
FLOOD PROFILES

CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

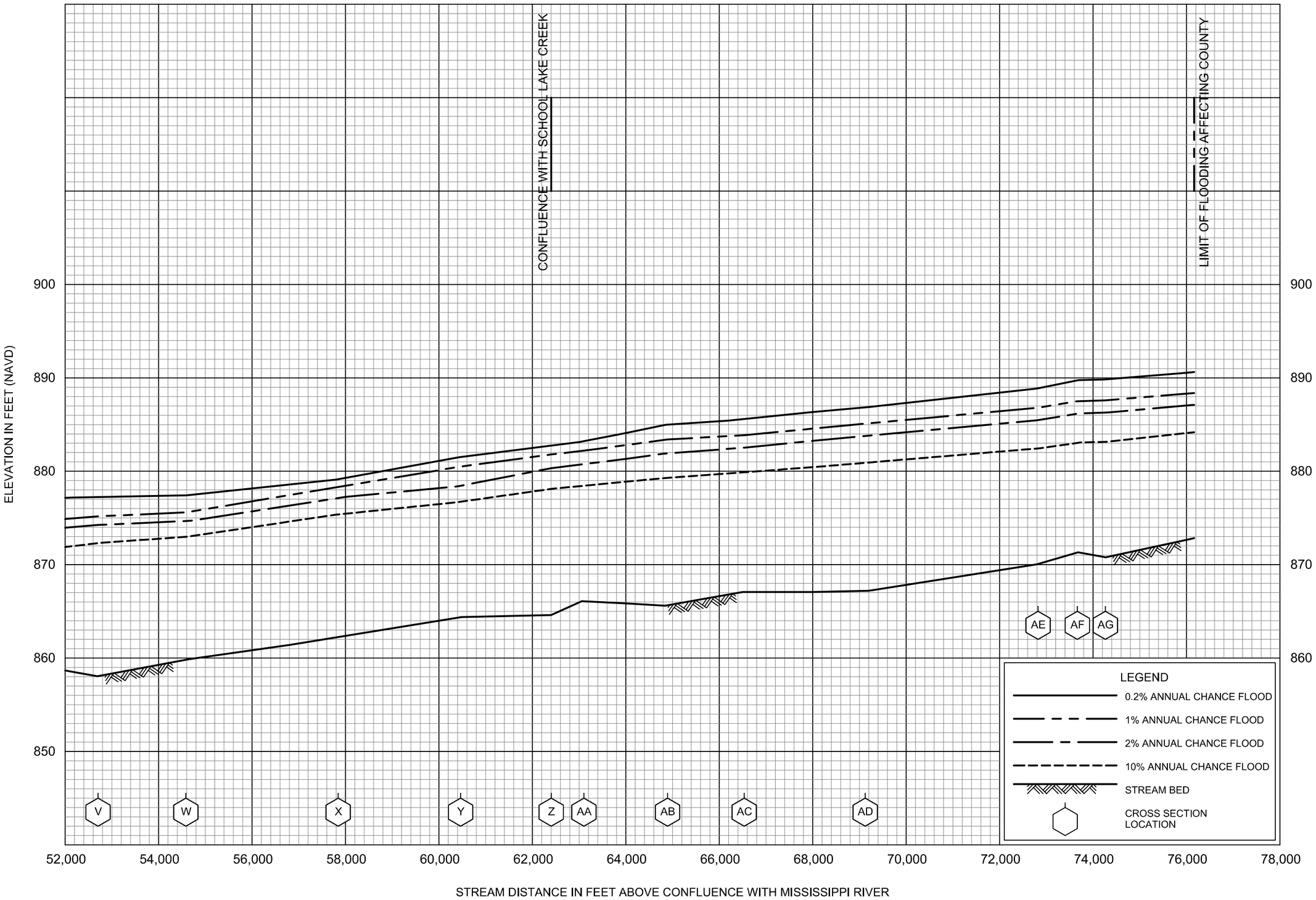
CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS

08P



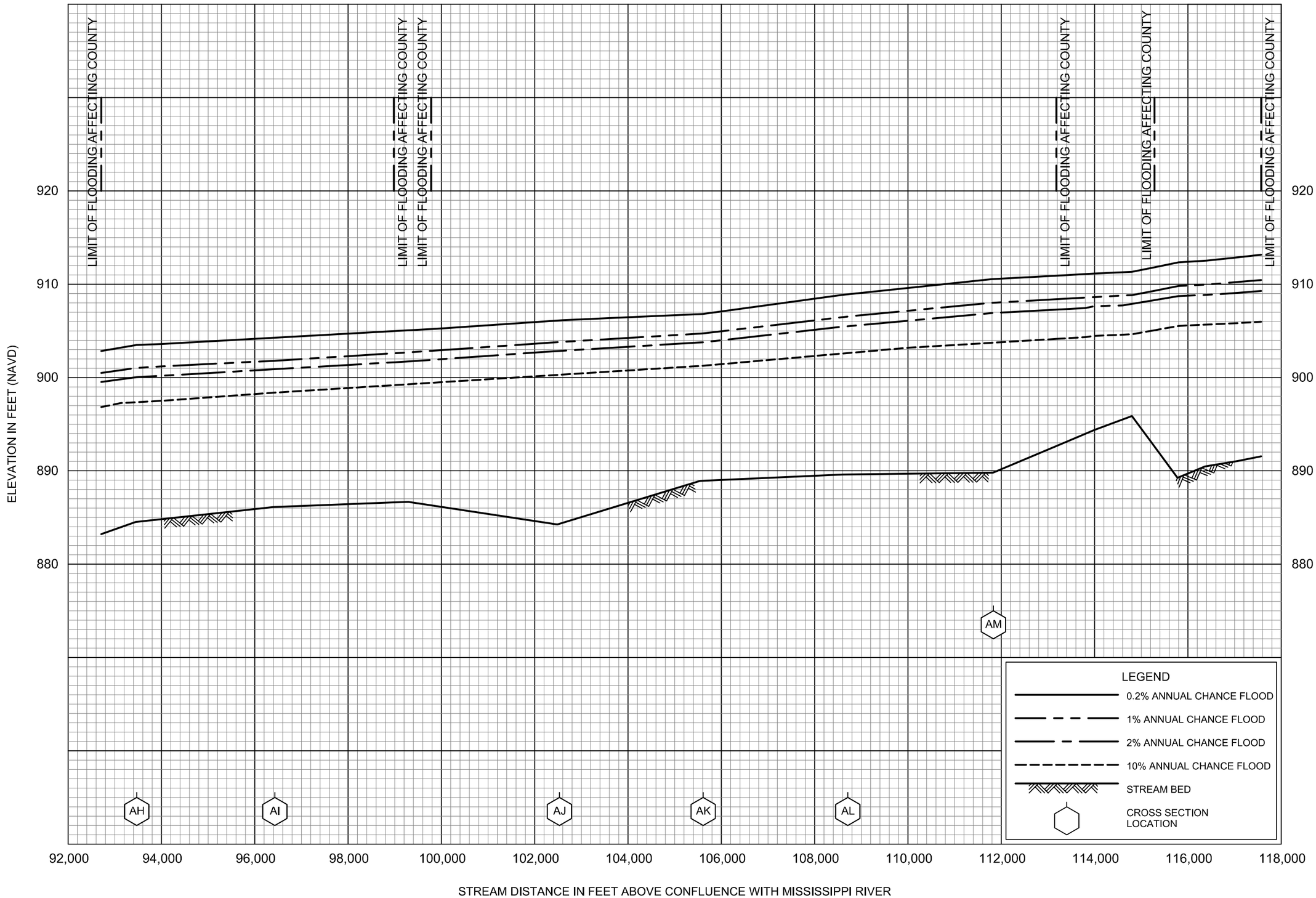
FLOOD PROFILES

CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



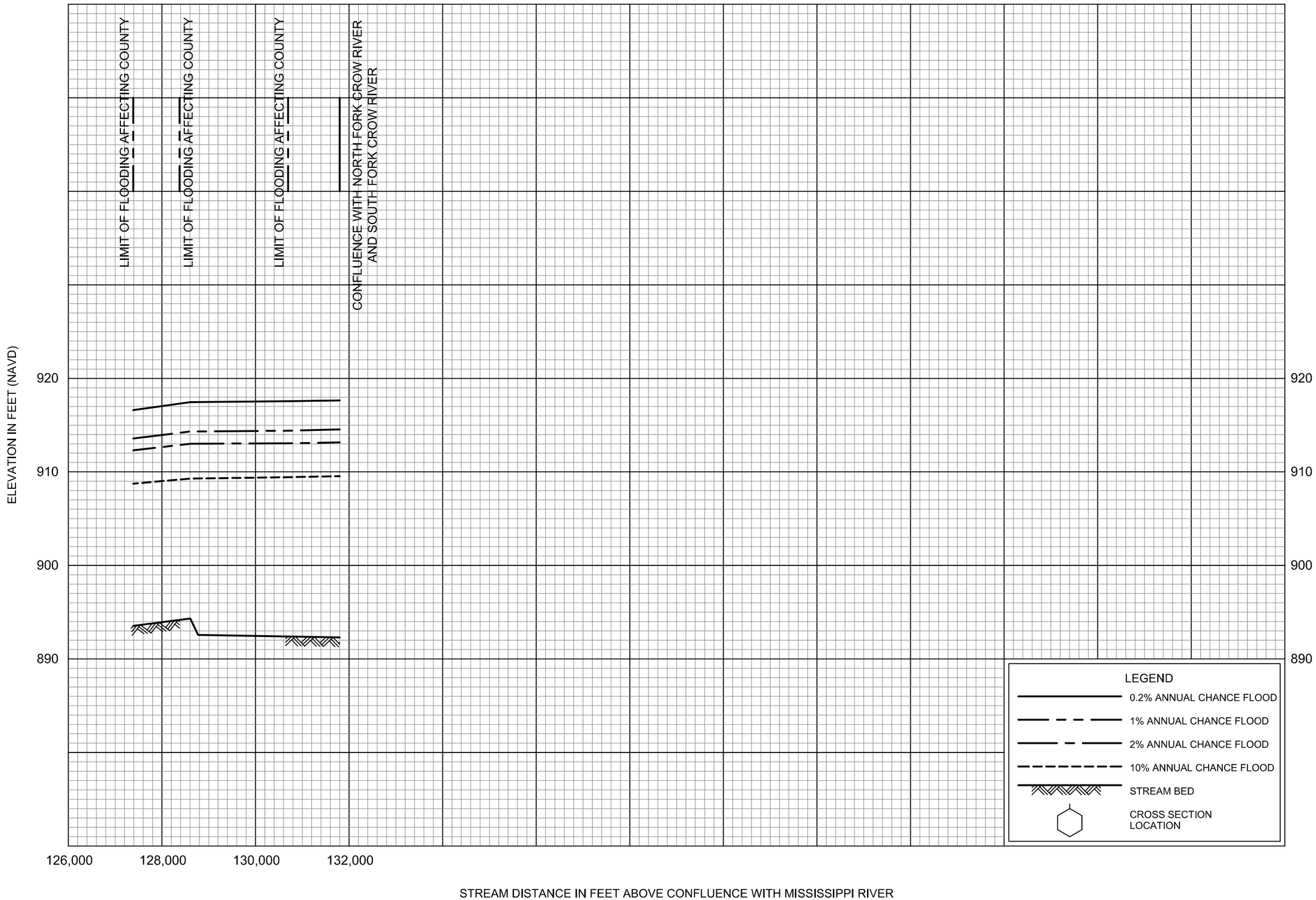
FLOOD PROFILES

CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



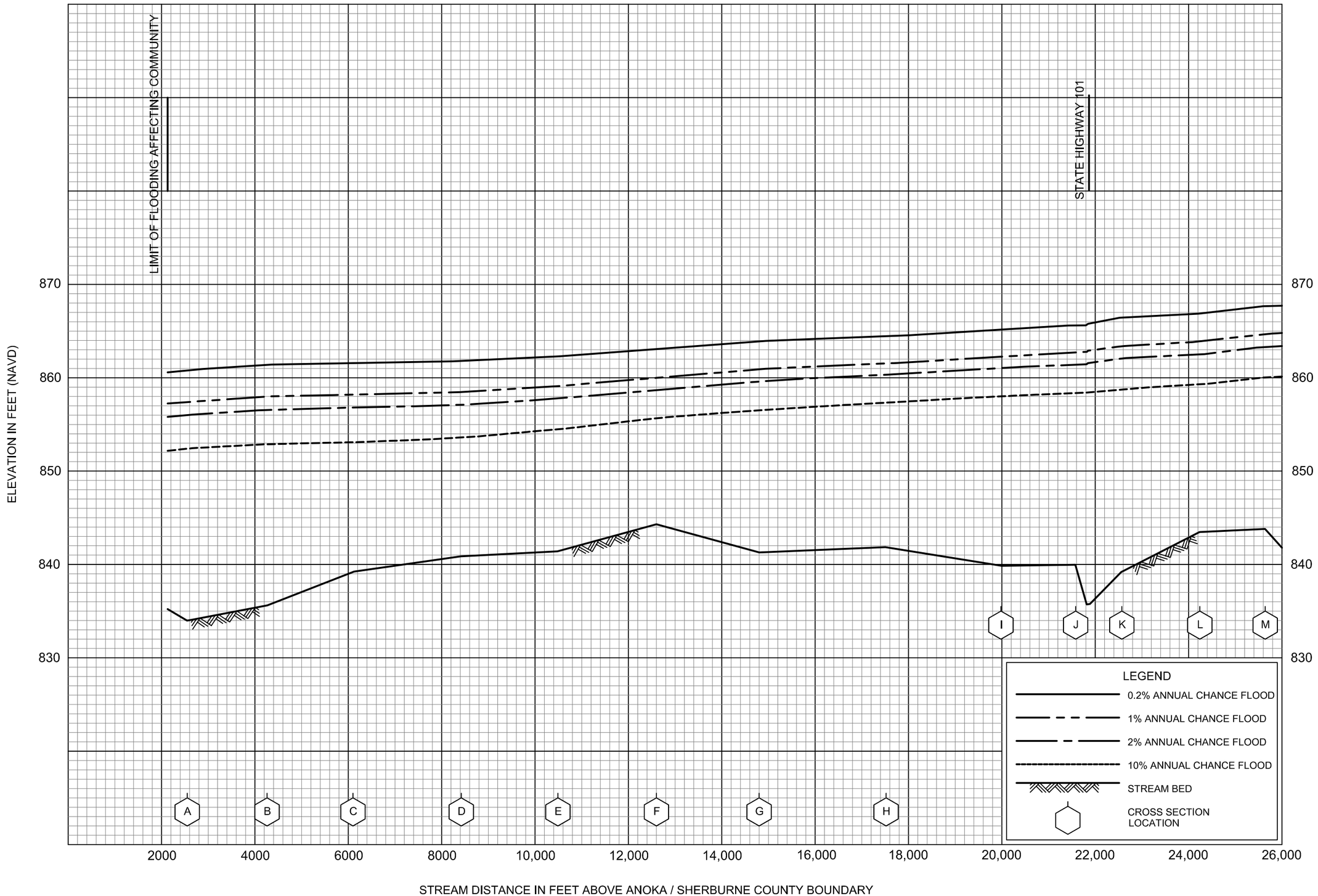
FLOOD PROFILES

CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



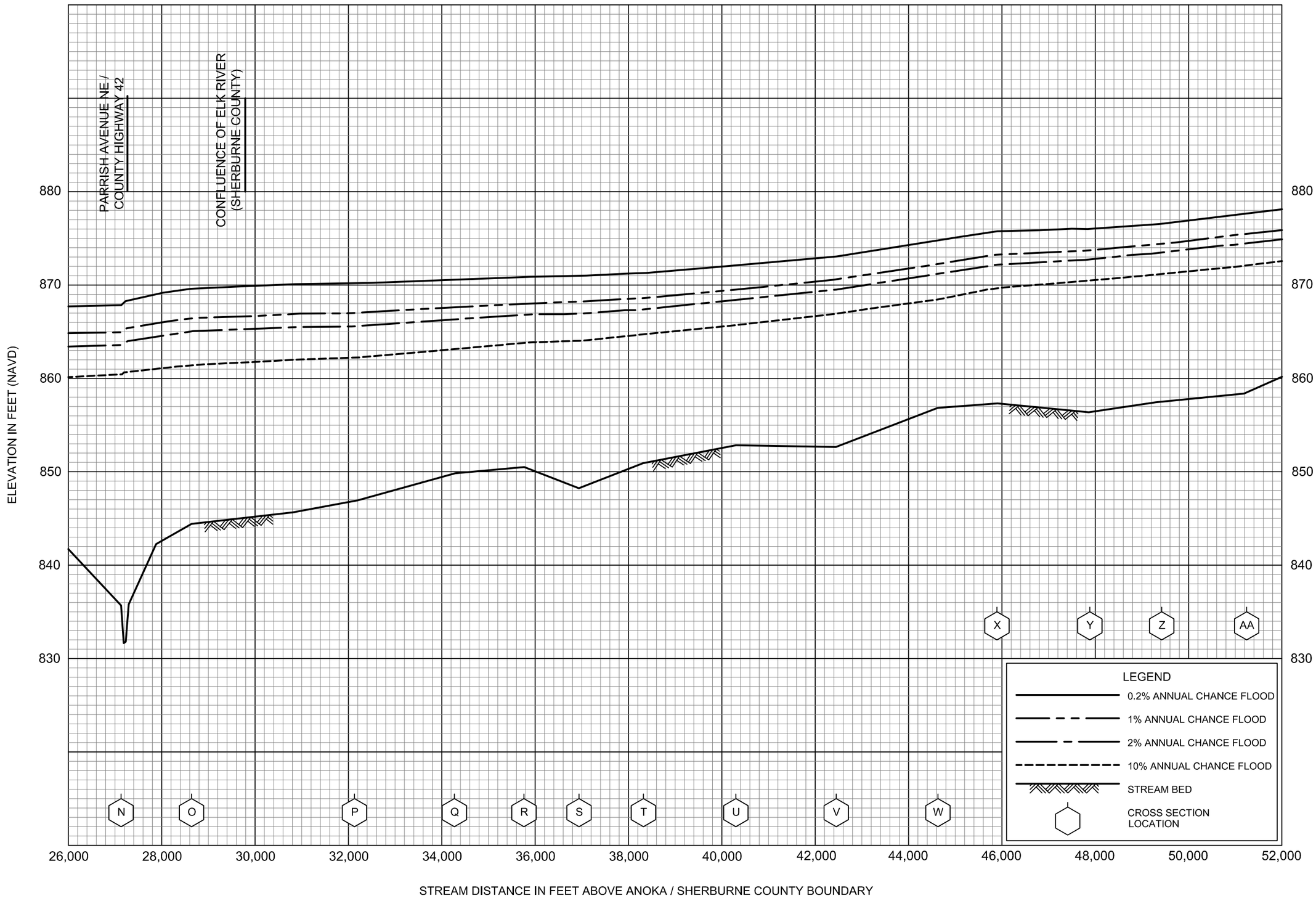
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



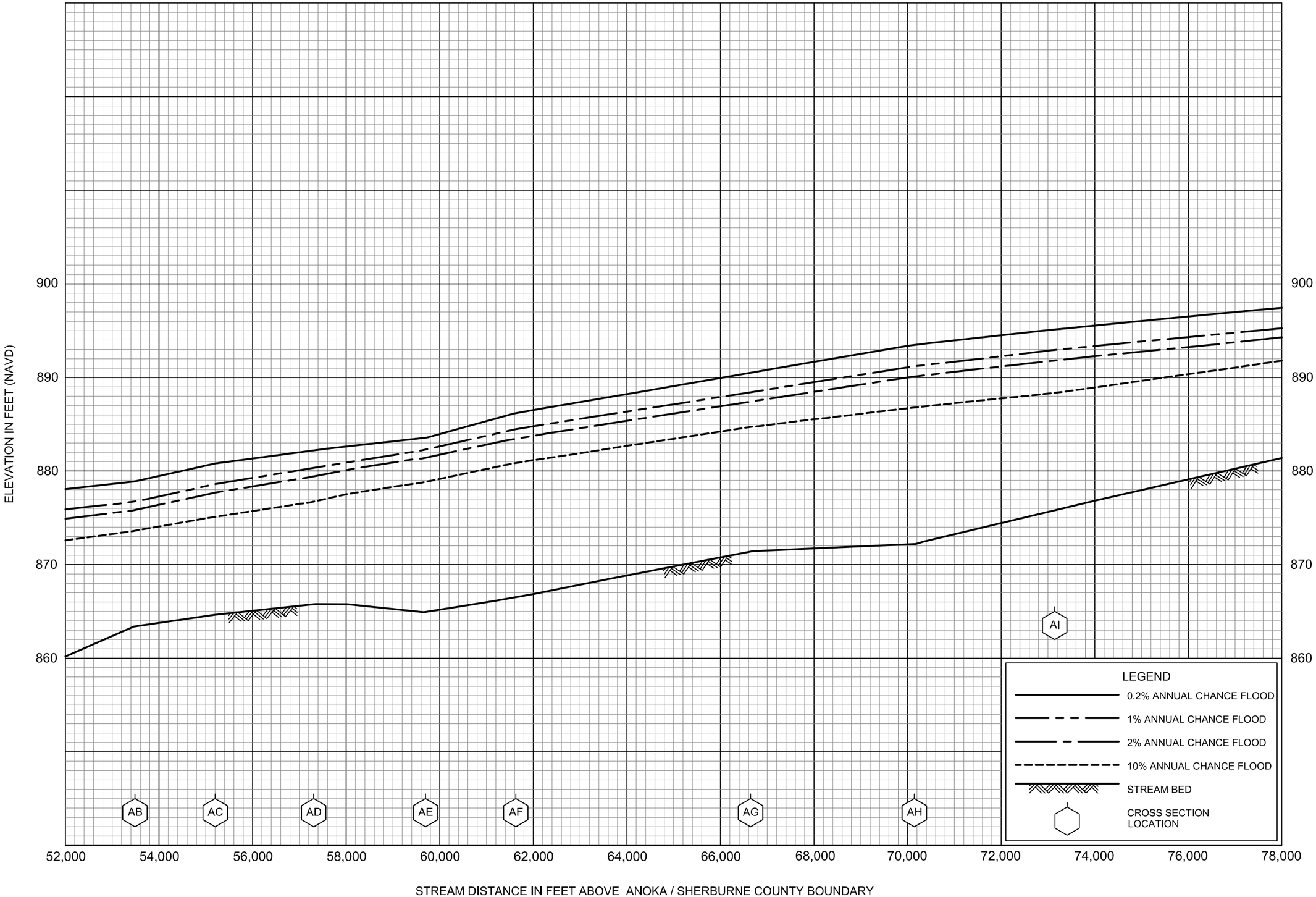
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



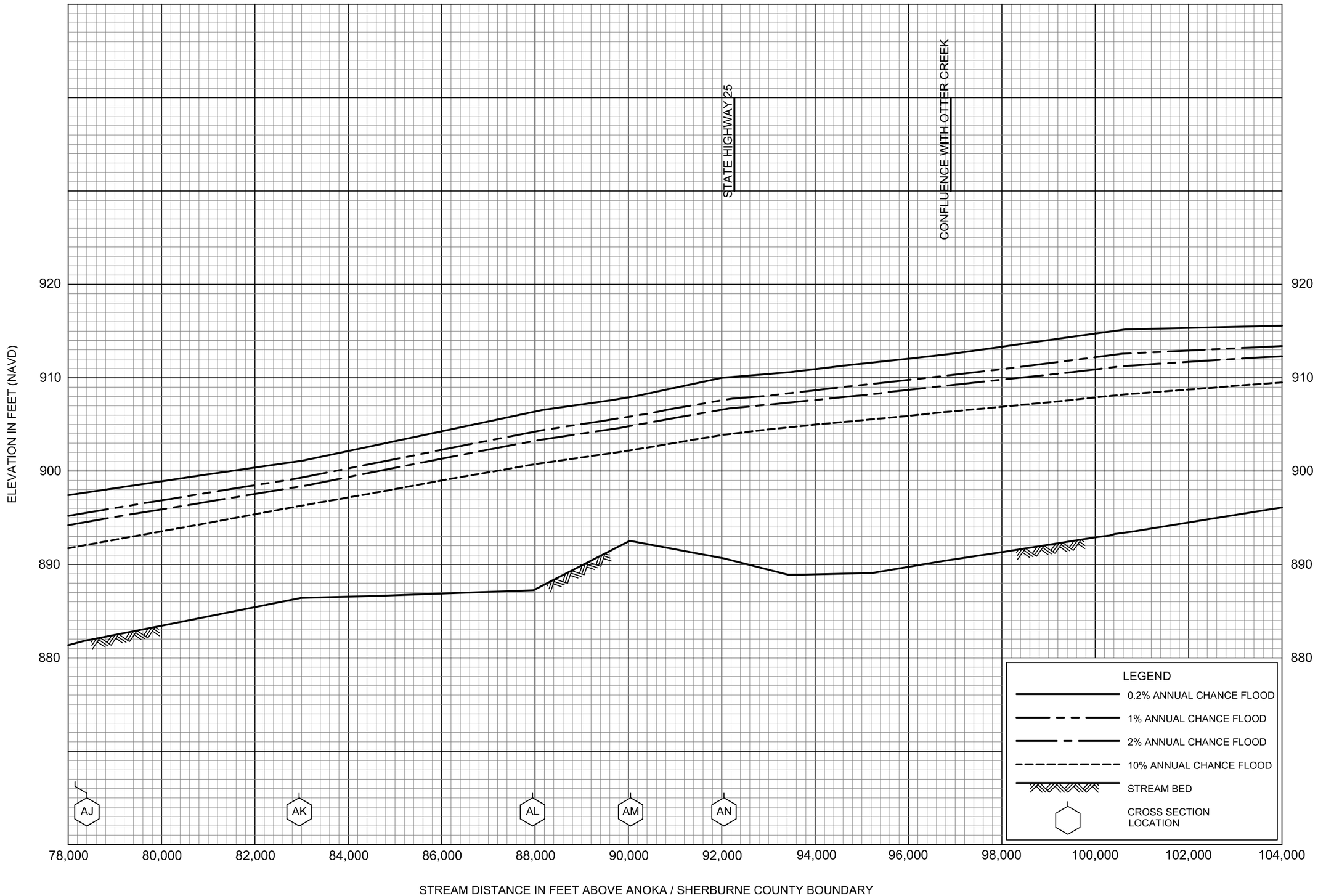
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



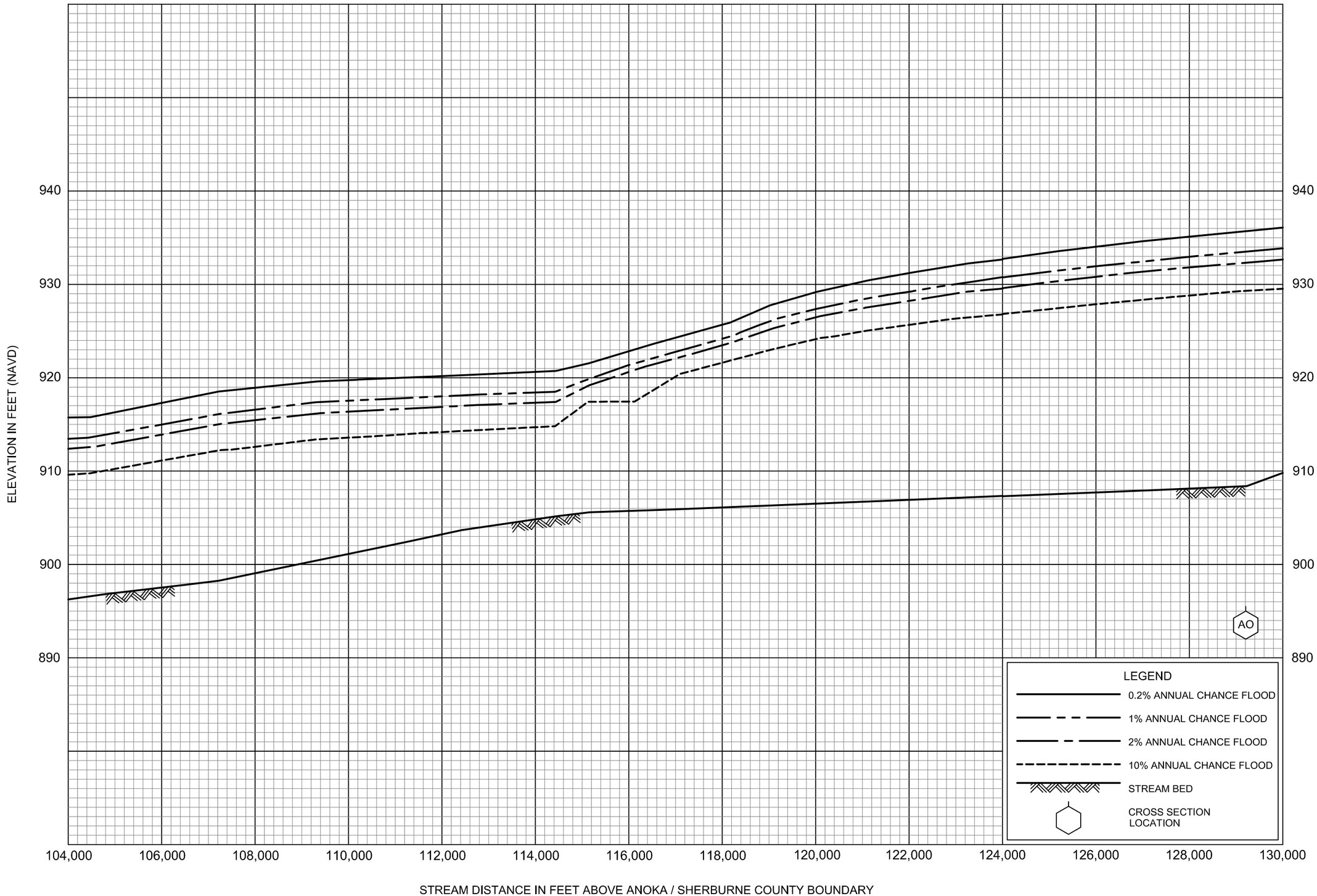
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



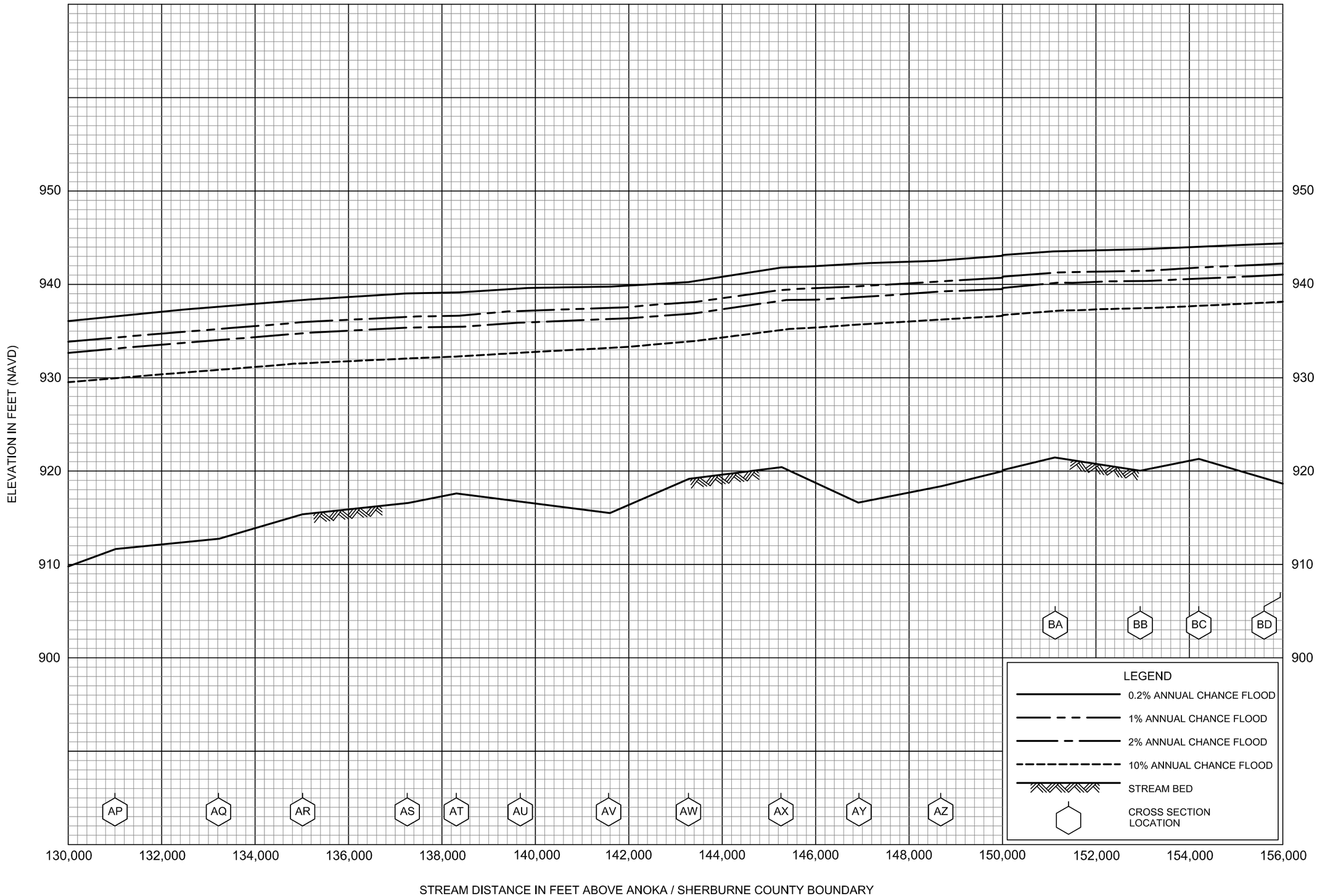
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



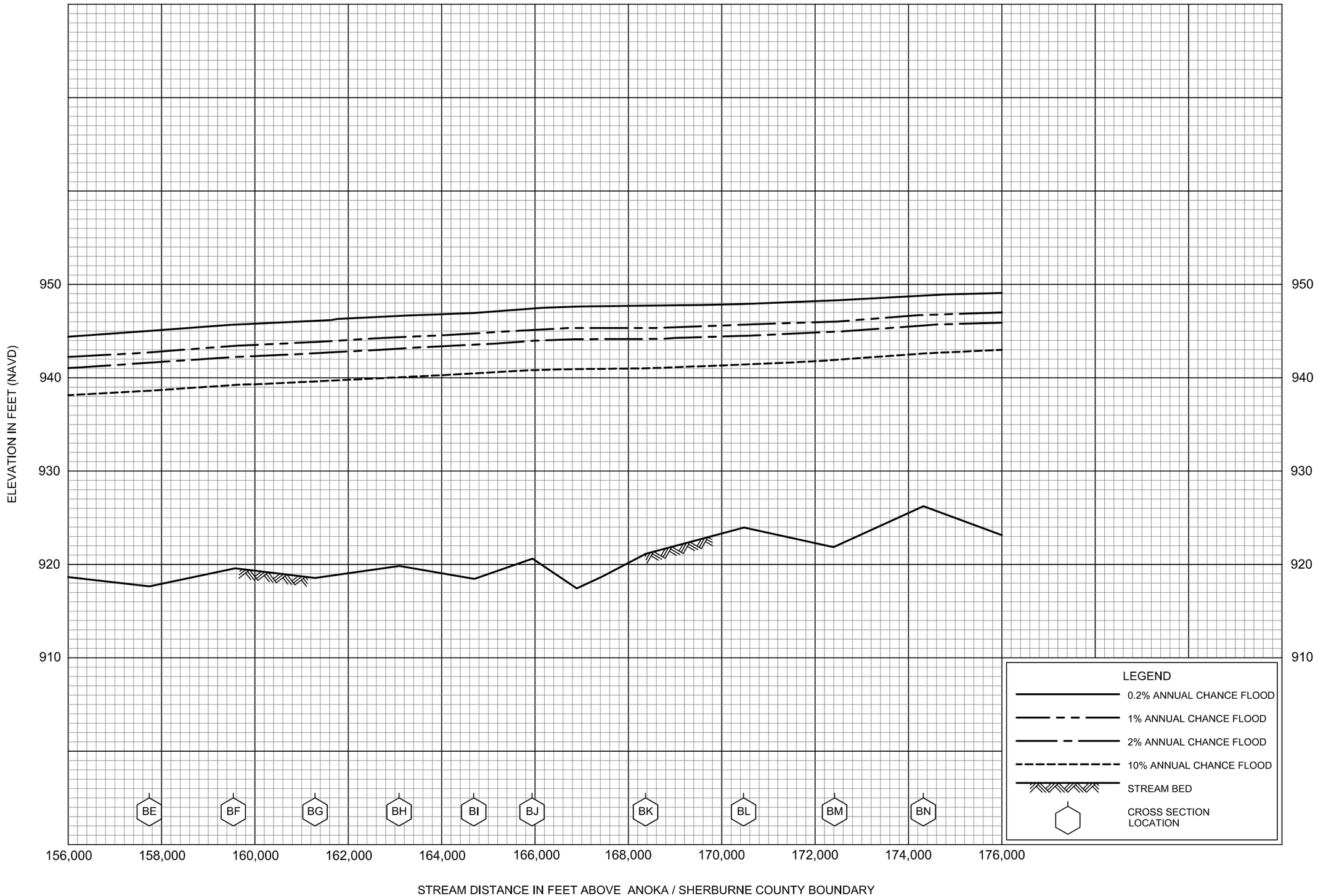
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



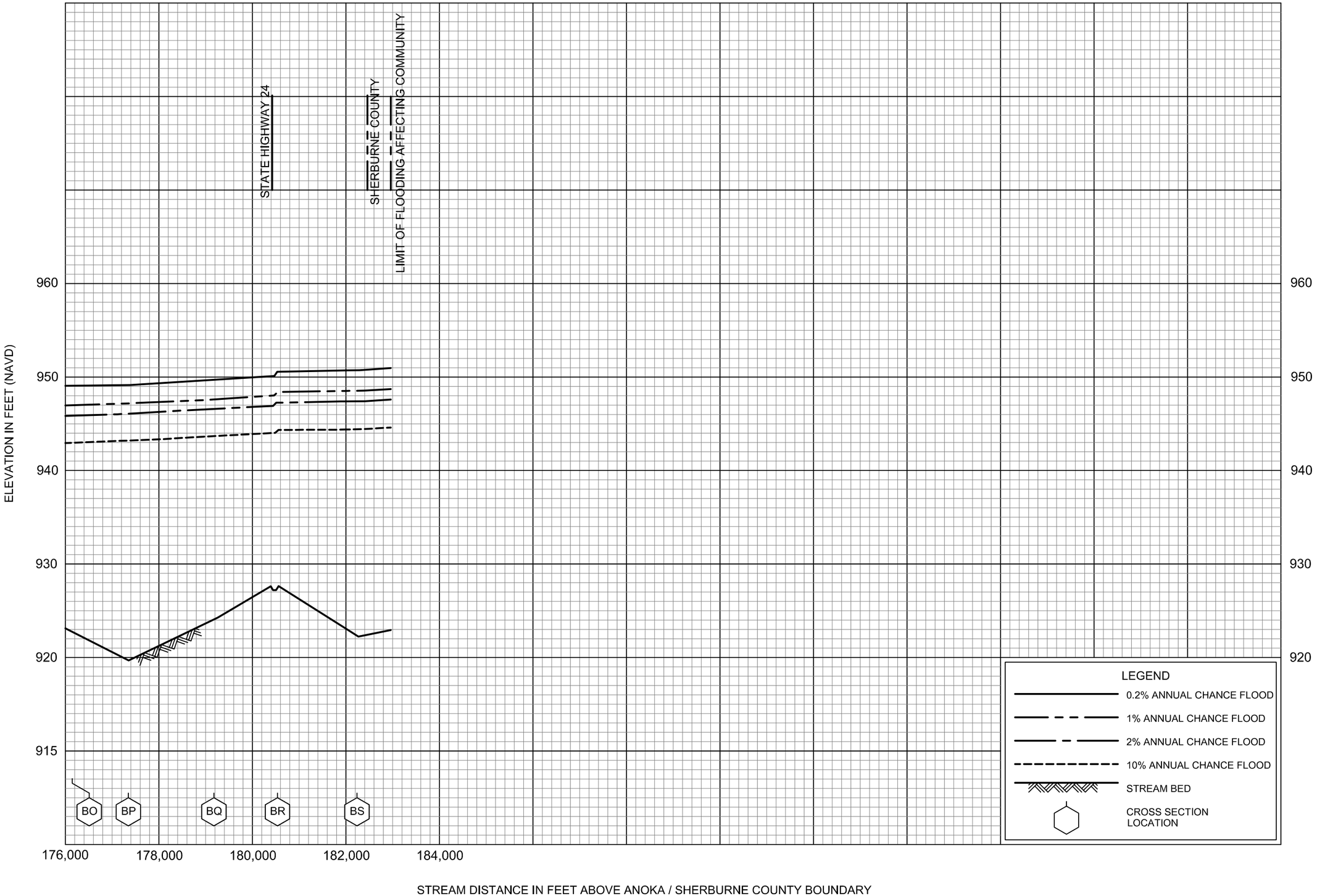
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



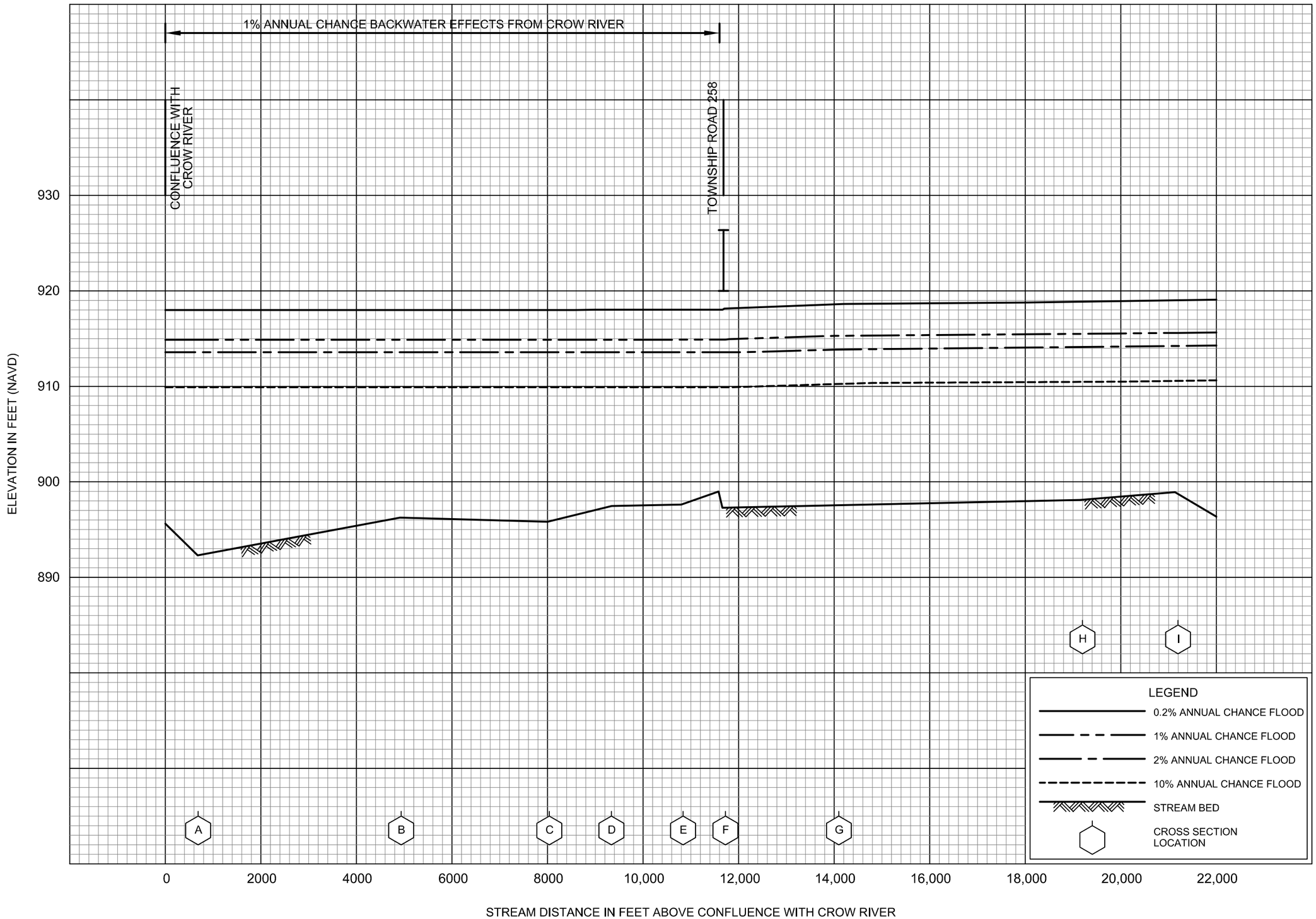
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



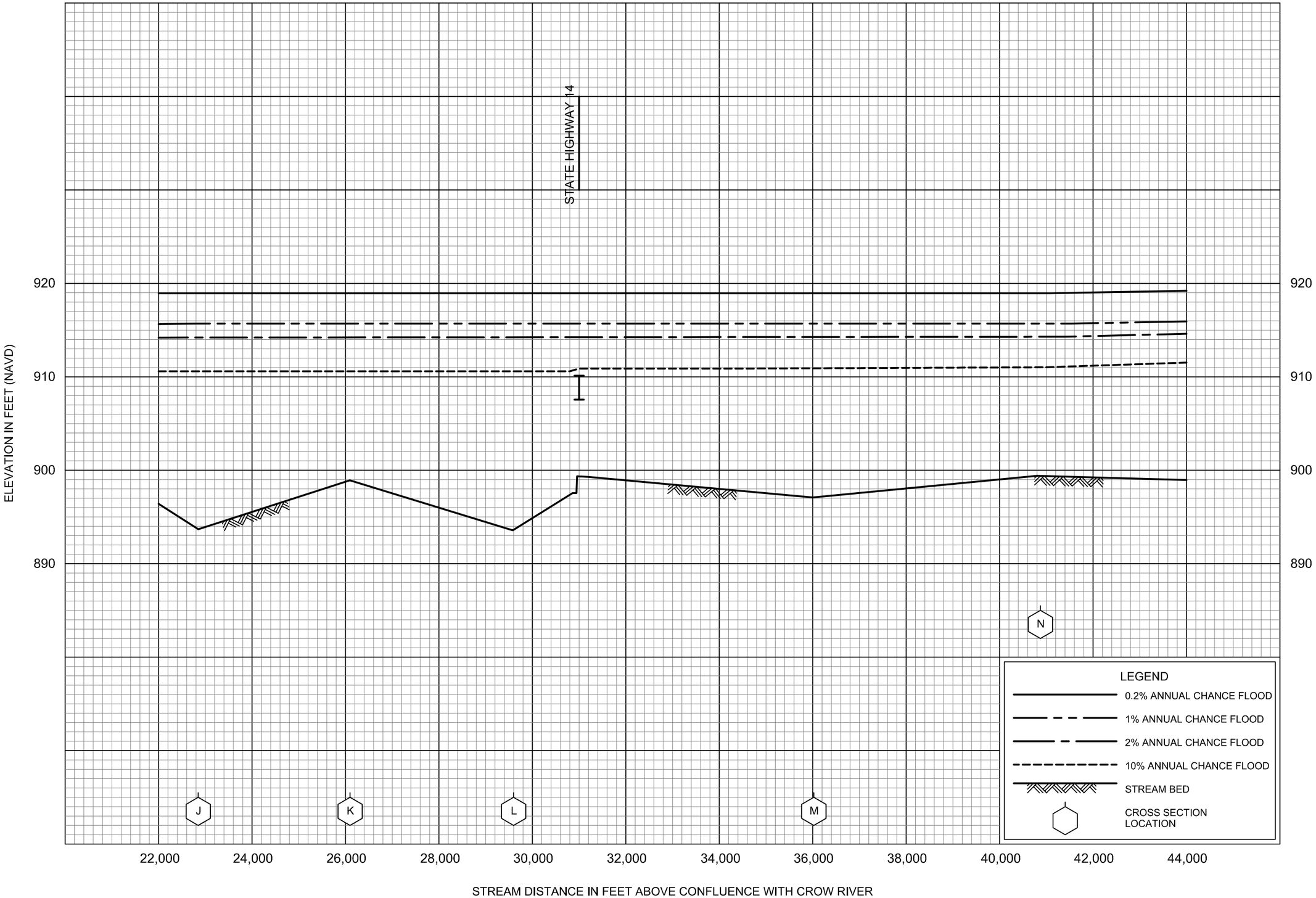
FLOOD PROFILES

NORTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



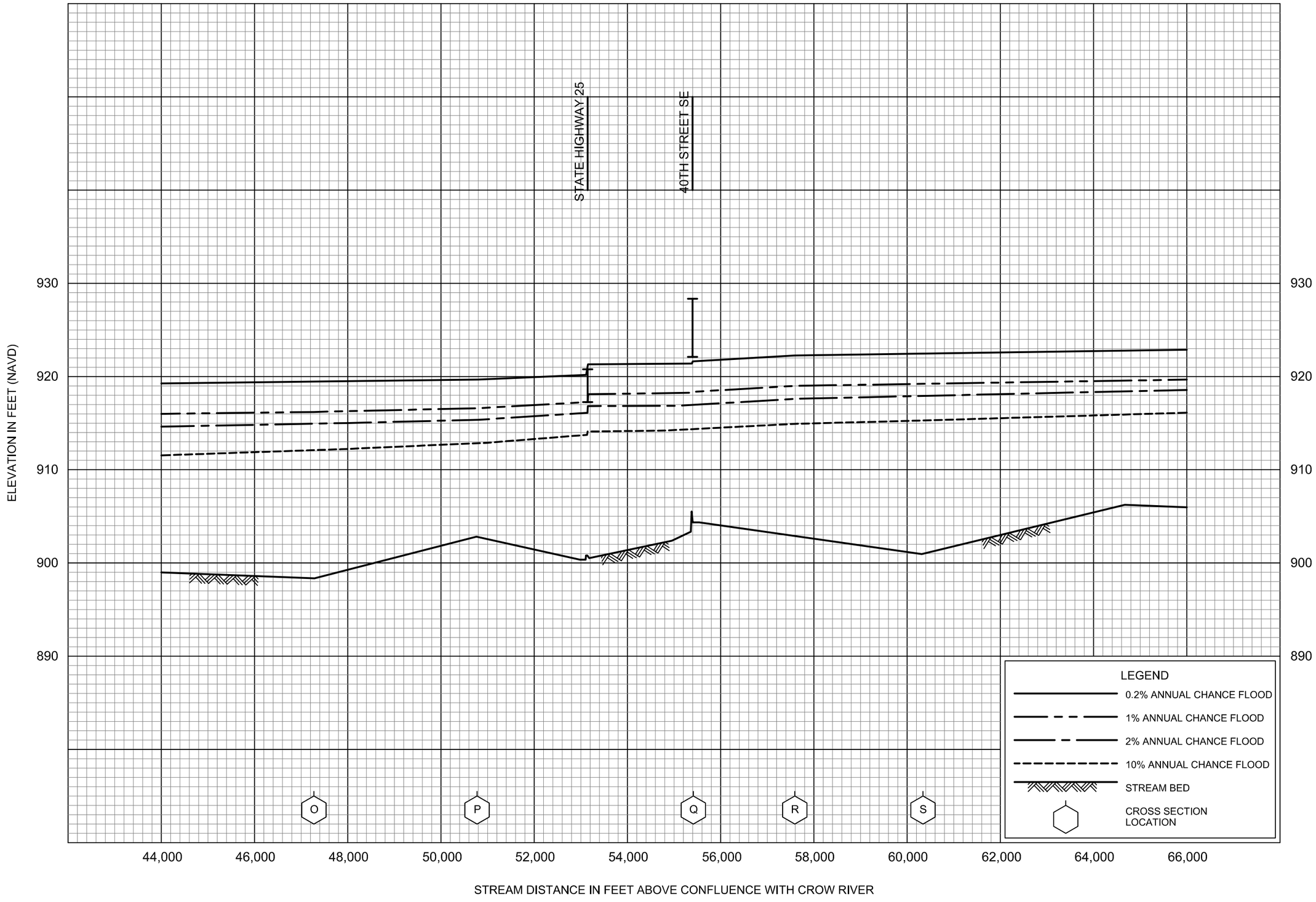
FLOOD PROFILES

NORTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



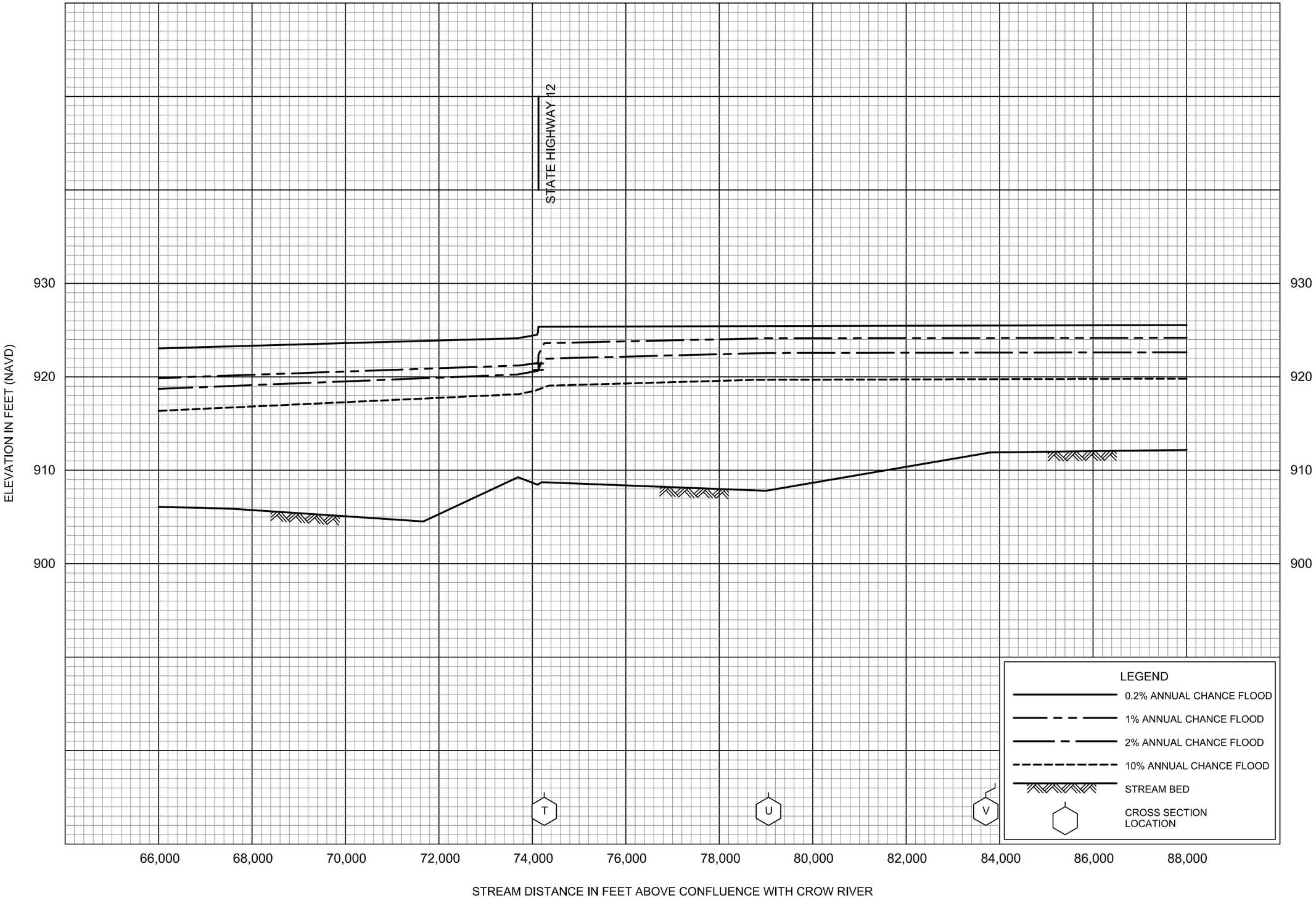
FLOOD PROFILES

NORTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



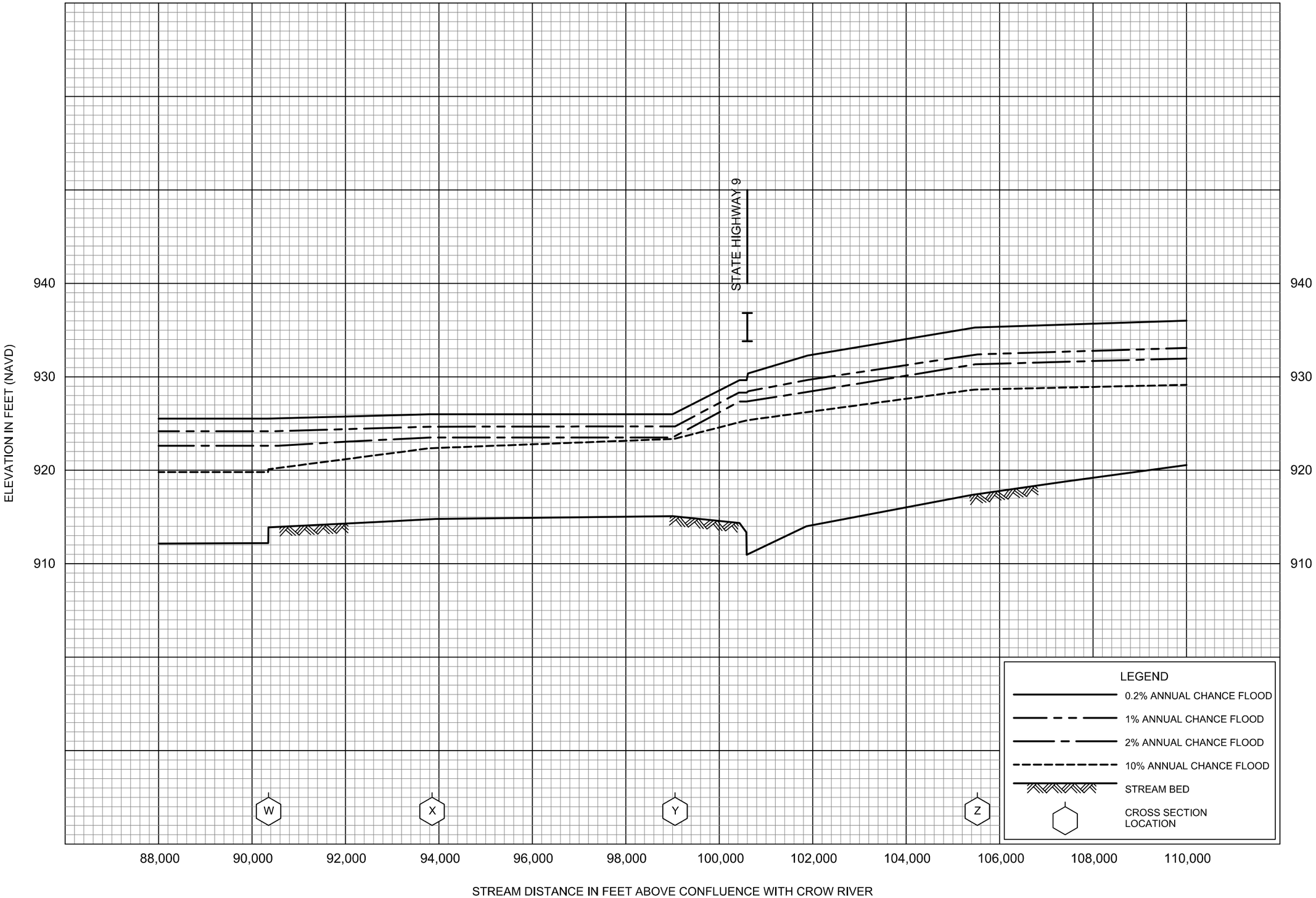
FLOOD PROFILES

NORTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



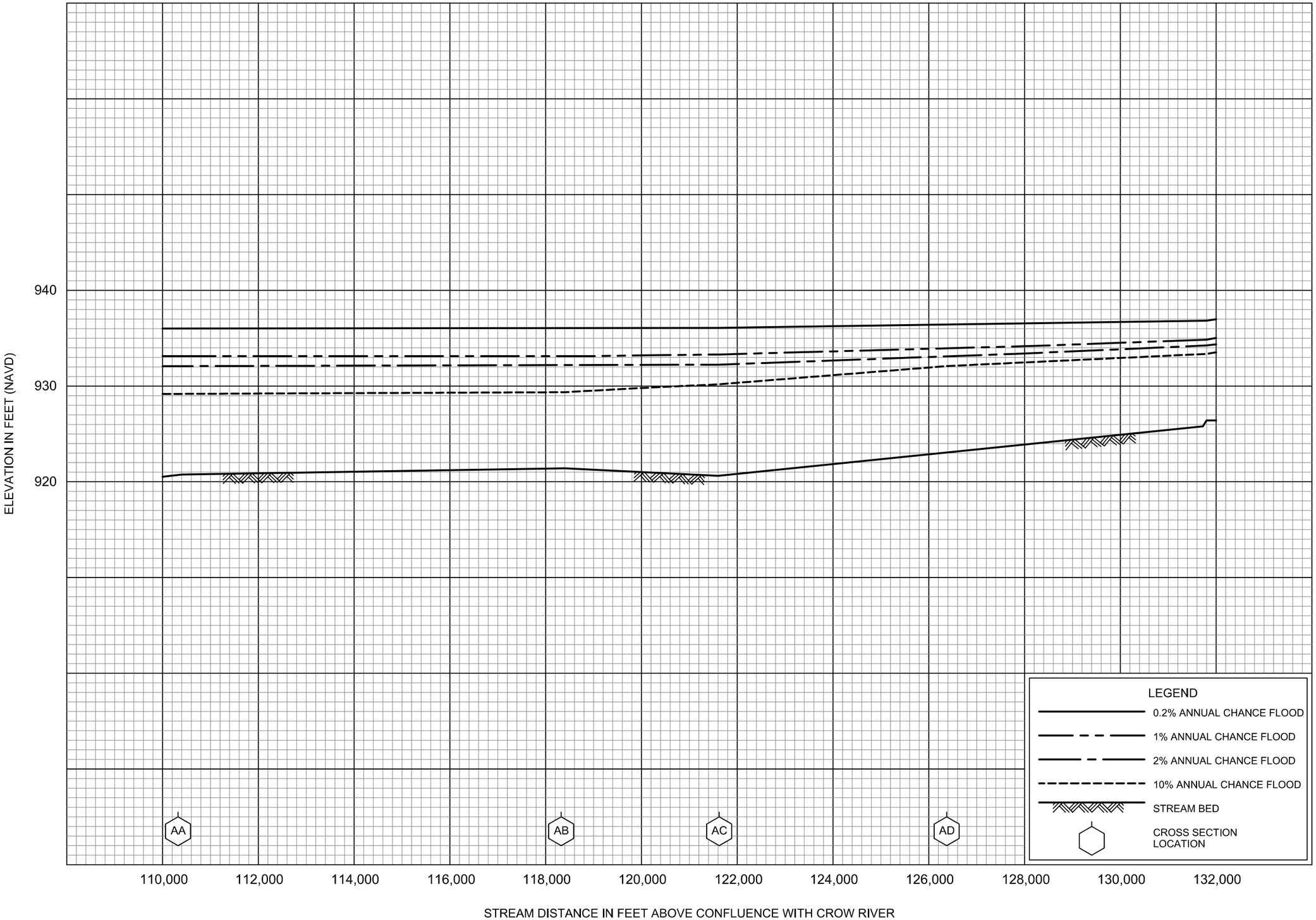
FLOOD PROFILES

NORTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



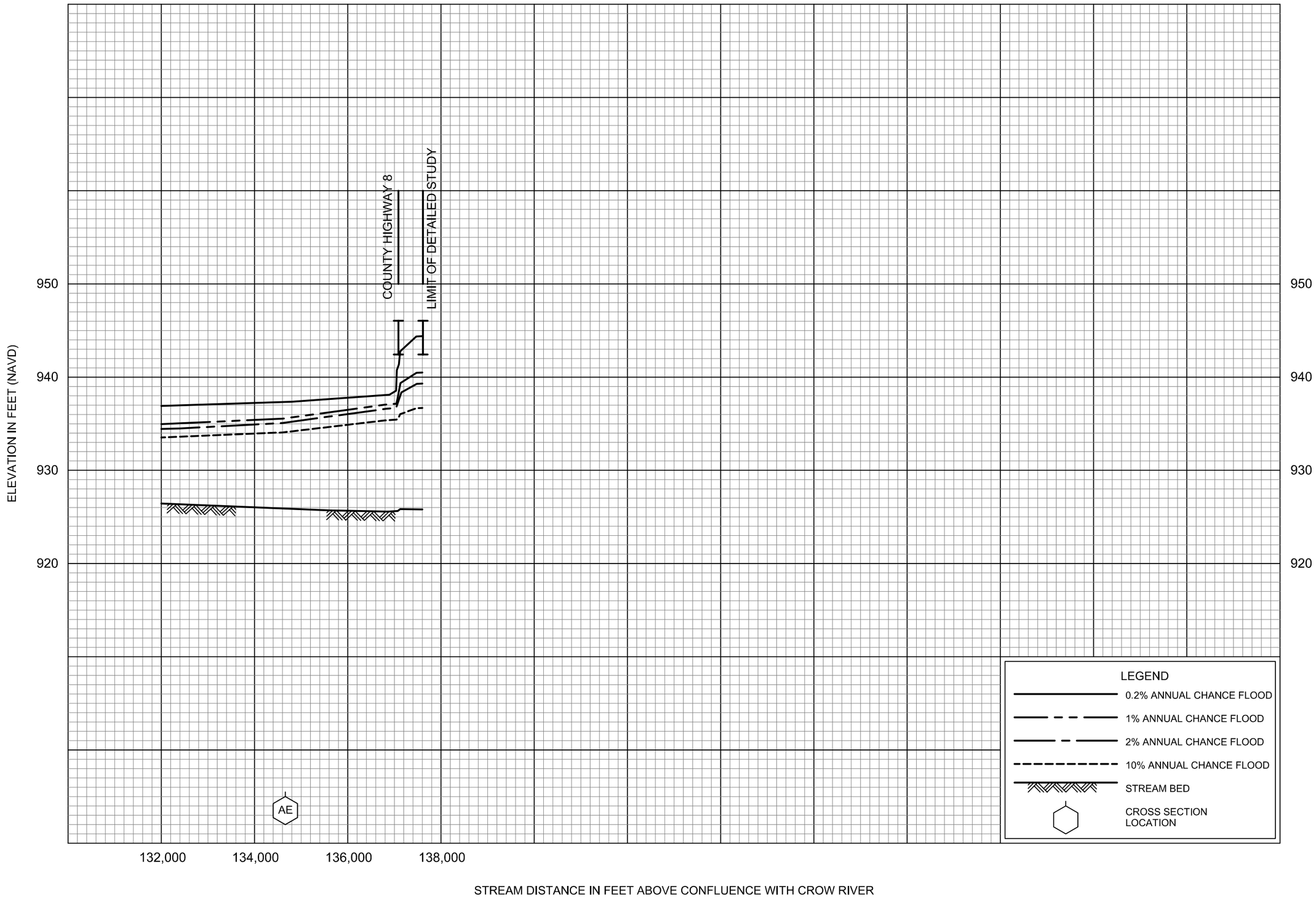
FLOOD PROFILES

NORTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



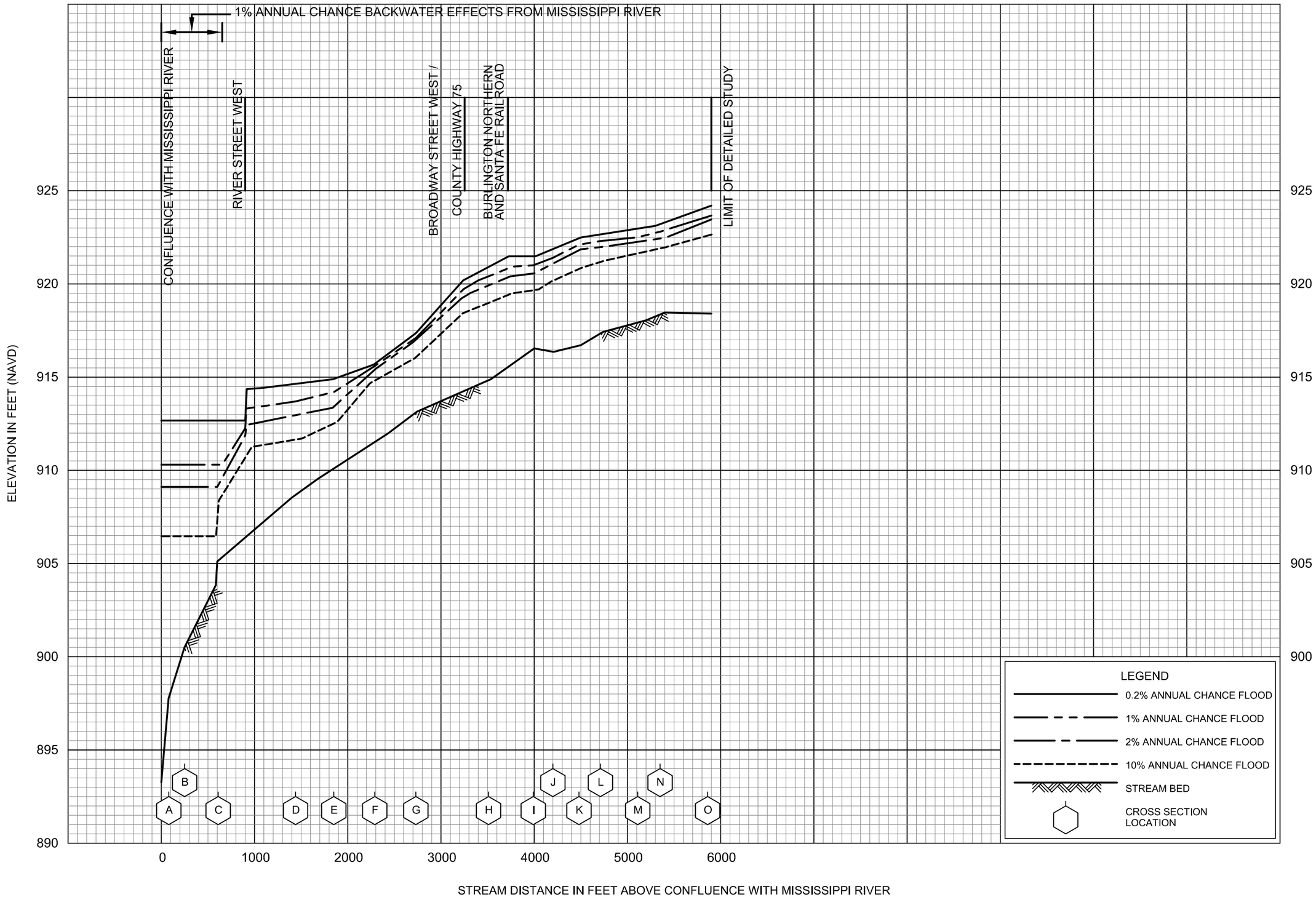
FLOOD PROFILES

NORTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



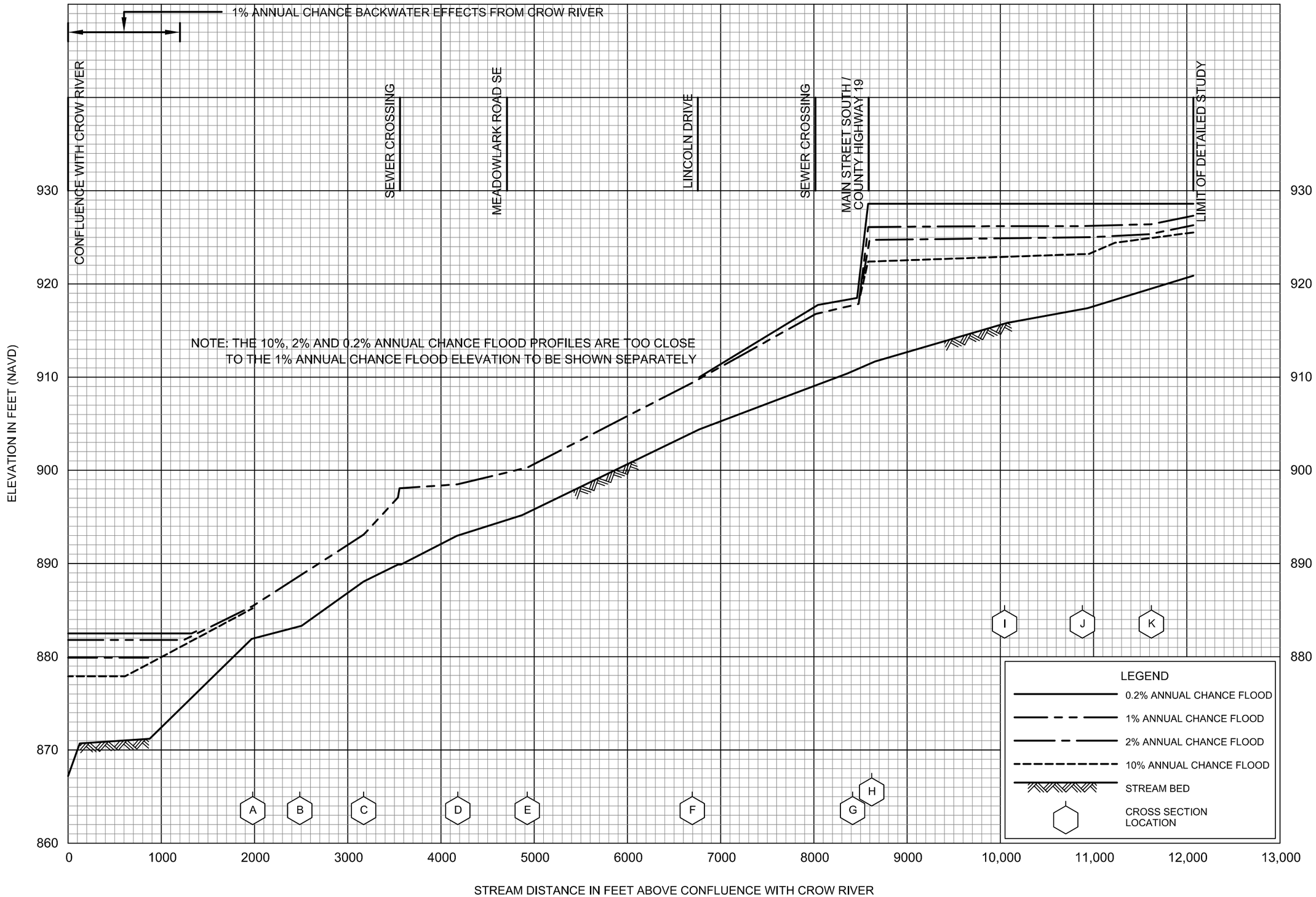
FLOOD PROFILES

OTTER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



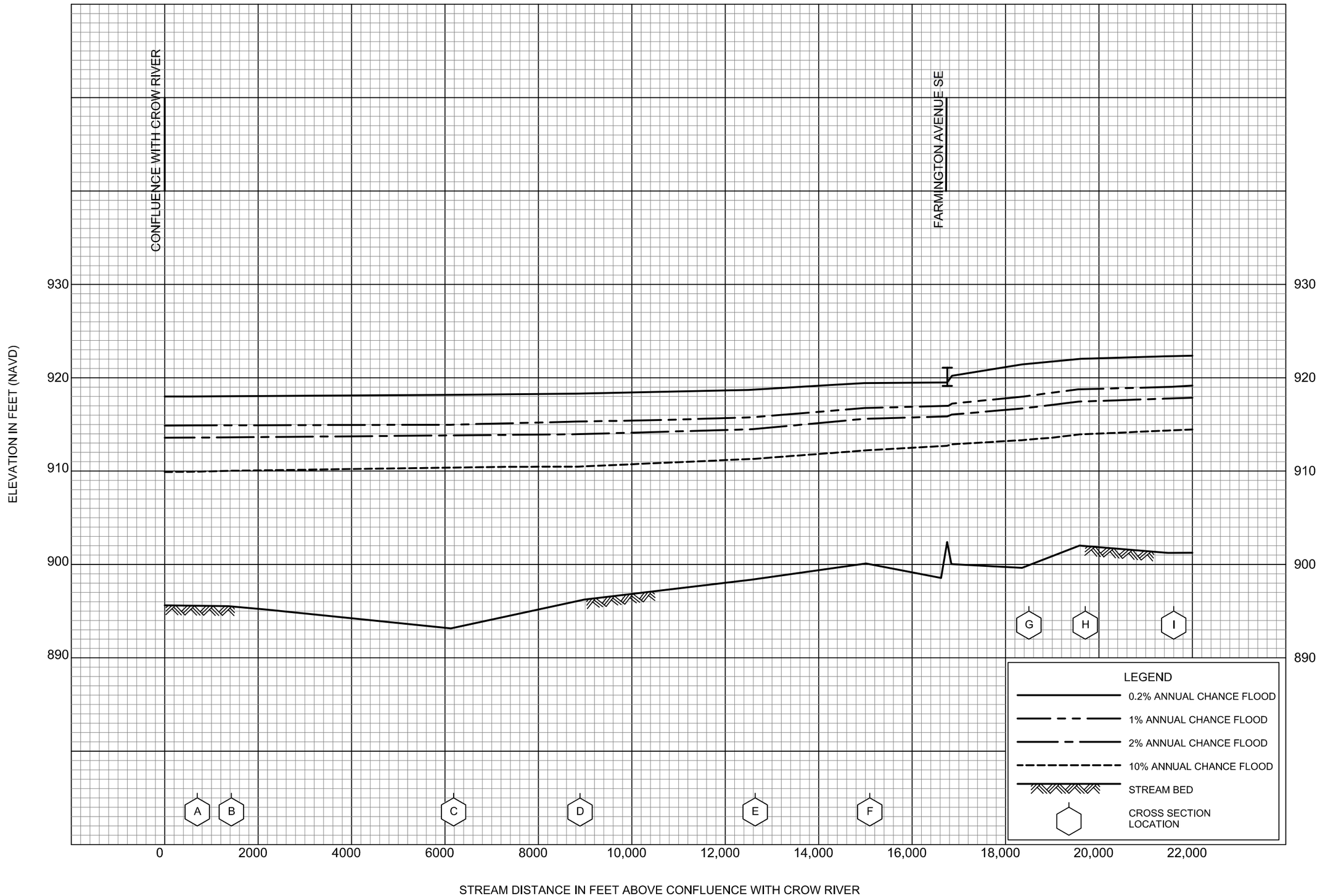
FLOOD PROFILES

SCHOOL LAKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



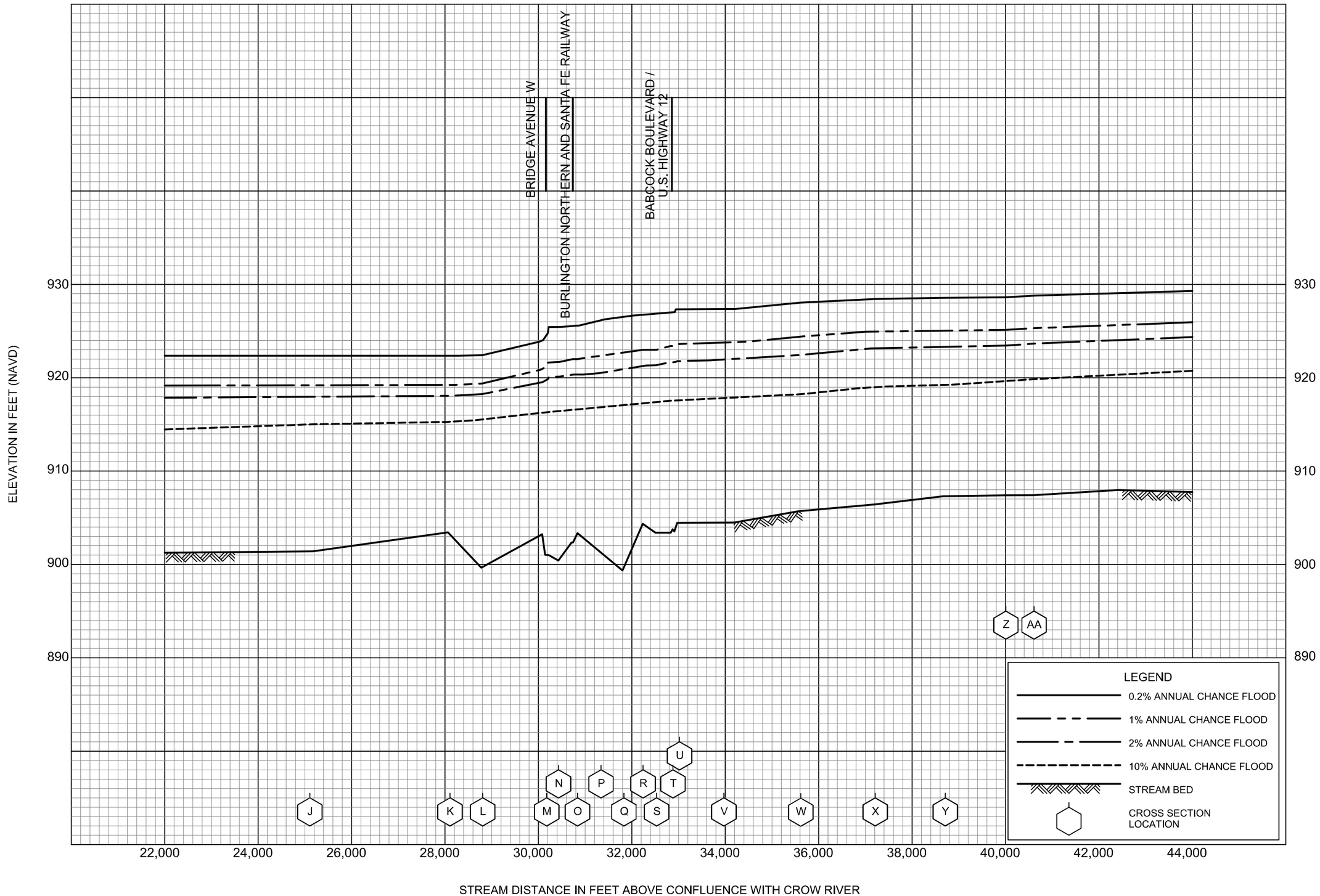
FLOOD PROFILES

SOUTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



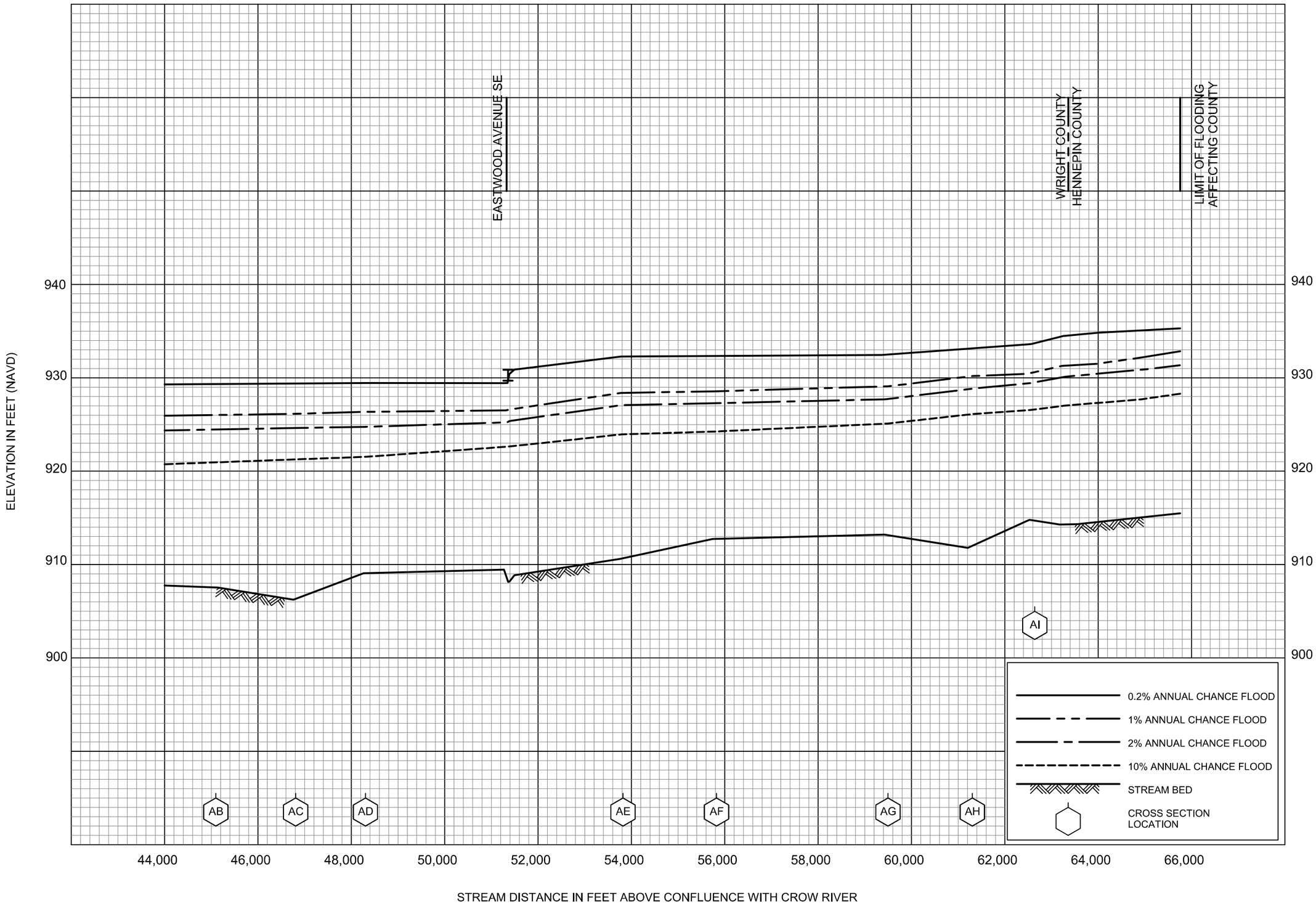
FLOOD PROFILES

SOUTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

SOUTH FORK CROW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WRIGHT COUNTY, MN

AND INCORPORATED AREAS