

FLOOD INSURANCE STUDY



PIERCE COUNTY, WISCONSIN AND INCORPORATED AREAS

Community Name	Community Number
Bay City, Village of	555543
Ellsworth, Village of	550325
Elmwood, Village of	550326
Maiden Rock, Village of	550327
Pierce County (Unincorporated Areas)	555571
Plum City, Village of	550328
Prescott, City of	555574
River Falls, City of	550330
Spring Valley, Village of	550331



REVISED:
December 30, 2020



Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
55093CV000B

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this Preliminary FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult community officials and check the Community Map Repository to obtain the most current FIS 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 and cross sections). In addition, former flood hazard zone designations have been changed as follows.

<u>Old Zone(s)</u>	<u>New Zone</u>
A1 through A30	AE
B	X
C	X

Initial Countywide FIS Effective Date: November 16, 2011
Revised Countywide FIS Date: December 30, 2020

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Mines Creek	Panels	14P
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Rocky Branch	Panel	21P
Rush Coulee	Panels	22P - 23P
South Fork Kinnickinnic River	Panels	24P - 29P
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Exhibit 2 - Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
PIERCE COUNTY 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 Pierce County, including the cities of Prescott and River Falls; the villages of Bay City, Ellsworth, Elmwood, Maiden Rock, Plum City, Spring Valley; and the unincorporated areas of Pierce County (referred to collectively herein as Pierce County). Note that the City of Prescott did not have a previous FIS report.

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood-risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by the communities of Pierce County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the City of River Falls and the Village of Spring Valley are geographically located in Pierce and St. Croix counties. Only the portions in Pierce County have been incorporated into this FIS and the accompanying Flood Insurance Rate Map (FIRM).

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

1.2 Authority and Acknowledgments

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

This FIS was prepared to include the unincorporated areas of, and incorporated communities within, Pierce County in a countywide format. Information on the authority and acknowledgments for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below.

- Bay City, Village of: For the September 4, 2002 FIS, hydrologic and hydraulic analyses for the Bay City Creek were prepared by Owen Ayres and Associates, Inc., for the Village of Bay City. This work was completed in December 1998. The hydraulic and hydraulic analyses for the Mississippi River (Lake Pepin) were obtained using water-surface profiles prepared by the U.S. Army Corps of Engineers (USACE) for the Upper Mississippi River (Reference 1).
- Ellsworth, Village of: For the May 4, 1989 FIS report, the hydrologic and hydraulic analyses for this study were performed by the U.S. Geological Survey (USGS) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-1823. This study was completed in June 1987 (Reference 2).
- Elmwood, Village of: The hydrologic and hydraulic analyses for this study were performed by the USGS for FEMA, under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 14. This study was completed in July 1987 (Reference 3).
- Maiden Rock, Village of: The hydrologic and hydraulic analyses for this study were performed by the USACE under the Limited Map Maintenance Program, Inter-Agency Agreement No. E-W-88-E-2768 (Reference 4).
- Pierce County
(Unincorporated Areas): The hydrologic and hydraulic analyses for the South Fork Kinnickinnic River were performed by the Globetrotters Engineering Corporation for FEMA, under Contract No. EMW-90-C-3096. This study was completed in August 1991. Hydrologic and hydraulic analyses for the Mississippi River were performed by the USACE in November 1979. Hydrologic and hydraulic analyses for the St. Croix River were taken from the Washington County, Minnesota FIS (Reference 5).
- Plum City, Village of: The hydrologic and hydraulic analyses for the January 3, 1990 FIS were performed by USGS for FEMA under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 14. This study was completed in July 1987 (Reference 6).
- River Falls, City of: For the August 20, 2002 FIS report, the hydrologic and hydraulic analyses for the Kinnickinnic River, Rocky Branch, the South Fork Kinnickinnic River, and the South Fork Kinnickinnic River Tributary No. 2 were prepared by Short Elliott Hendrickson (SEH), Inc. for the City of River Falls. Data for the study was collected in 1996 and 1997 and the work was completed in September 1997 (Reference 7).

Spring Valley, Village of For the September 15, 1983 FIS report, the hydrologic and hydraulic analyses were obtained from the “Flood Hazard Study, Village of Spring Valley” of December 1981 (Reference 8).

For the November 2016 countywide FIS, redelineation and digital conversion of special floodhazard areas were performed by CDM Federal Programs Corporation (CDM). CDM also incorporated the impacts of the structures built on Bay City and Plum creeks. This work was performed for FEMA under Contract No. HSFE05-05-D-0027/TO010 and completed in August 2009. The dam break analyses on Bay City Creek and Plum Creek were performed by Owen Ayres and Associates, Inc.

Hydrologic and hydraulic analysis of Upper Mississippi River was performed by USACE for FEMA under contract No. EMW-2002-IS-0114. This study was completed in June 2004.

The digital base mapping information was provided in digital format by Pierce County. This information was derived from data compiled in 2007. These data meet or exceed National Mapping Accuracy Standards. Users of this FIS should be aware that minor adjustments may have been made to specific FIRM base map features.

For this Physical Map Revision, December 30, 2020, STARR completed the hydraulic analysis task for the portion of Mines Creek along the Spring Valley Levee in the Village of Spring Valley, under Contract HSFEHQ-09-D-0370. This task consisted of the development of a hydraulic model in order to determine flood elevations for the detailed reach of Mines Creek under natural valley conditions, with data generated during hydraulic analysis used to redelineate the floodplain along a 0.6 mile portion of Mines Creek. During this revision, the provisionally-accredited status of the Spring Valley Levee was removed from the FIRM. This work was completed in June of 2014.

The coordinate system used for the production of this FIRM is Universal Transverse Mercator (UTM) Zone 15 North, North American Datum of 1983 (NAD 83), GRS 80 spheroid. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

An initial Consultation Coordination Officer (CCO) meeting is held typically with representatives of FEMA, USACE and the community to explain the nature and purpose of a FIS and to identify the streams to be studied by detailed methods. A final CCO meeting is held typically with representatives of FEMA, USACE and the community to review the results of the FIS.

The dates of the initial and final CCO meetings held for previous FIS jurisdictions within Pierce County are shown in Table 1, “Initial and Final CCO Meetings.”

TABLE 1 - INITIAL AND FINAL CCO MEETINGS

<u>Community</u>	<u>Initial CCO Date</u>	<u>Final CCO Date</u>
Bay City, Village of (2002 FIS)	*	June 18, 2001
Ellsworth, Village of	*	June 14, 1988
Elmwood, Village of	*	January 25, 1989
Maiden Rock, Village of	*	November 3, 1992
Pierce County, Unincorporated Areas	June 27, 1989	November 3, 1992
Plum City, Village of	*	November 10, 1988
River Falls, City of (2002 FIS)	April 1, 1997	*
Spring Valley, Village of	*	February 1, 1983

* Information Not Available

Initial Countywide FIS Report

For the initial countywide FIS, the initial CCO meeting was held on June 27, 2007, and attended by representatives of FEMA, Wisconsin Department of Natural Resources (WDNR), CDM, and the communities in Pierce County.

The results of the study were reviewed at the final CCO meeting held on December 3, 2009, and attended by representatives of FEMA, WDNR and the communities.

This Physical Map Revision

The CCO meeting was held on November 29, 2018, and attended by representatives of FEMA, WDNR, and the Village of Spring Valley. All issues and/or concerns raised at that meeting have been addressed.

1.4 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of Pierce County, Wisconsin (All Jurisdictions).

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 2. The Flood Insurance Rate Map (FIRM) panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

TABLE 2 - LISTING OF NFIP JURISDICTIONS

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Bay City, Village of	555543	07040001	55093C0404E	
Ellsworth, Village of	550325	07040001	55093C0165E, 55093C0301E, 55093C0302E, 55093C0305E	
Elmwood, Village of	550326	07050005	55093C0216E, 55093C0217E, 55093C0218E, 55093C0219E	
Maiden Rock, Village of	550327	07040001	55093C0429E, 55093C0435E, 55093C0437E, 55093C0441E	
Pierce County (Unincorporated Areas)	555571	07030005, 07040001, 07050005	55093C0085E, 55093C0095E, 55093C0107E, 55093C0109E, 55093C0125E, 55093C0126E, 55093C0127E, 55093C0130E, 55093C0131E, 55093C0132E, 55093C0150E, 55093C0155E, 55093C0160E, 55093C0165E, 55093C0170E, 55093C0180E, 55093C0185F, 55093C0190E, 55093C0195E, 55093C0205F, 55093C0210E, 55093C0215E, 55093C0216E, 55093C0217E, 55093C0218E, 55093C0219E, 55093C0231E, 55093C0232E, 55093C0251E, 55093C0252E, 55093C0253E, 55093C0254E, 55093C0260E, 55093C0262E, 55093C0266E, 55093C0267E, 55093C0269E, 55093C0288E, 55093C0300E, 55093C0301E, 55093C0302E, 55093C0305E, 55093C0325E, 55093C0350E, 55093C0364E, 55093C0368E, 55093C0375E, 55093C0376E, 55093C0377E, 55093C0381E, 55093C0382E, 55093C0383E, 55093C0384E, 55093C0403E, 55093C0404E, 55093C0405E, 55093C0408E, 55093C0409E, 55093C0410E, 55093C0412E, 55093C0416E, 55093C0417E, 55093C0428E, 55093C0429E, 55093C0430E, 55093C0435E, 55093C0436E, 55093C0437E, 55093C0441E, 55093C0445E, 55093C0452E, 55093C0456E, 55093C0475E	
Plum City, Village of	550328	07050005	55093C0364E, 55093C0368E, 55093C0452E, 55093C0456E	

TABLE 2 - LISTING OF NFIP JURISDICTIONS *(continued)*

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Prescott, City of	555574	07030005, 07040001	55093C0095E, 55093C0231E, 55093C0232E	
River Falls, City of	550330	07030005	55093C0107E, 55093C04109E, 55093C0126E, 55093C0127E, 55093C0130E, 55093C0345E, 55093C0363E, 55093C0482E, 55093C0501E	
Spring Valley, Village of	550331	07050005	55093C0185F, 55093C0205F	

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on the map. However, the FIRM panel does not contain enough space to show all notes that may be relevant in helping to better understand the information on the panel. Figure 1 contains the full list of these notes.

Figure 1: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Flood Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 8 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Non-Coastal Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was Universal Transverse Mercator (UTM) Zone 15N. The horizontal datum was the North American Datum of 1983. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Figure 1: FIRM Notes to Users (Continued)

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov. Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 8 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was provided by various sources.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Randolph County, Illinois and Incorporated Areas, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 8 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Pierce County, Wisconsin, effective: December 30, 2020.

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Each FIRM panel contains an abbreviated legend for features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 2 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in Pierce County.

Figure 2: Map Legend for FIRM



SPECIAL FLOOD HAZARD AREAS: The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.	
	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.
	Regulatory Floodway determined in Zone AE.

Figure 2: Map Legend for FIRM (Continued)





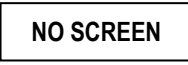







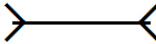
OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood. See Notes to Users for important information.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.
	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
 (ortho) (vector)	Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
 <i>Aqueduct Channel Culvert Storm Sewer</i>	Channel, Culvert, Aqueduct, or Storm Sewer
 <i>Dam Jetty Weir</i>	Dam, Jetty, Weir
	Levee, Dike, or Floodwall
 <i>Bridge</i>	Bridge

Figure 2: Map Legend for FIRM (Continued)


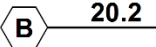
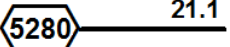
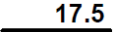














REFERENCE MARKERS	
	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Coastal Transect
	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
	Base Flood Elevation Line
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity

Figure 2: Map Legend for FIRM (Continued)

BASE MAP FEATURES	
 <i>Missouri Creek</i>	River, Stream or Other Hydrographic Feature
	Interstate Highway
	U.S. Highway
	State Highway
	County Highway
MAPLE LANE 	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
 RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
4276⁰⁰⁰mE	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16' 52.5"	Corner Coordinates (Latitude, Longitude)

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Pierce County, Wisconsin, including the incorporated communities listed in Section 1.4. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

All or portions of the flooding sources listed in Table 3, "Flooding Sources Studied by Detailed Methods," were previously studied by detailed methods. The limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

TABLE 3 - FLOODING SOURCES STUDIED BY DETAILED METHODS

<u>Flooding Source</u>	<u>Limits of Detailed Study</u>
Bay City Creek	From the Village of Bay City corporate limits to the confluence with Mississippi River.
Burkhart Creek	From approximately 1,100 feet upstream of Park Drive to confluence with the Eau Galle River.
Burro Lane Tributary	From approximately 700 feet upstream of Bahr Street to confluence with Eau Galle River.
Eau Galle River	From approximately 500 feet upstream of Fourth Street to approximately 400 feet downstream from Wagon Trail Road; and from approximately 200 feet upstream of the confluence with Eau Galle River Tributary A to the county boundary with Dunn County.
Isabelle Creek	From approximately 400 feet upstream of 670th Street to approximately 800 feet downstream of US Highway 10 (Main Street).
Isabelle Creek Tributary	From Pleasant Avenue to confluence with Isabelle Creek.
Kinnickinnic River	From County Highway M (Division Street) to the City of River Falls western corporate limit.
Mines Creek	From approximately 1,100 feet upstream of the dam near Herb Avenue to the confluence with Eau Galle River.
Mississippi River	From confluence with St Croix River to southern county boundary with Pepin County.
Plum Creek	From approximately 700 feet upstream of U.S. Highway 10 to approximately 200 feet downstream of the confluence with Rush Coulee.
Rocky Branch	From approximately 2,200 feet upstream to 800 feet upstream of the confluence with Kinnickinnic River confluence.
Rush Coulee	From approximately 1,500 feet upstream of the County Highway S (Maple Avenue) to the confluence with Plum Creek.
South Fork Kinnickinnic River	From approximately 3,000 feet upstream of State Highway 29 to confluence with Kinnickinnic River.

TABLE 3 - FLOODING SOURCES STUDIED BY DETAILED METHODS –
(continued)

<u>Flooding Source</u>	<u>Limits of Detailed Study</u>
South Fork Kinnickinnic River Tributary 2	From approximately 900 feet downstream of the county boundary with St. Croix County to the confluence with South Fork Kinnickinnic River.
St. Croix River	From the county boundary with St. Croix County to confluence with Mississippi River.
Unnamed Coulee	From approximately 50 feet upstream of County Highway S Bridge to confluence with Mississippi River.

As part of this countywide FIS, updated analysis was included for the Mississippi River. This updated analysis superseded any areas previously studied by detailed methods.

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letter of Map Revision [LOMR], Letter of Map Revision-based on Fill [LOMR-F], and Letter of Map Amendment [LOMA]) as shown in Table 4, "Letters of Map Correction."

TABLE 4 - LETTERS OF MAP CHANGE

<u>Community</u>	<u>Flooding Source(s)/Project Identifier</u>	<u>Date Issued</u>	<u>Type</u>
Pierce County (Uninc. Areas)	South Fork Kinnickinnic River	April 21, 2003	LOMR
Pierce County (Uninc. Areas)	Isabelle Creek	June 27, 2001	LOMR
Plum City, Village of	Rush Coulee	November 23, 2006	LOMR
Prescott, City of	St. Croix River	April 6, 1987	LOMR

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

All or portions of Barkley Coulee, Bay City Creek, Big River and tributaries, Bremenington Coulee, Brush Creek and tributaries, Burkhart Creek, Cady Creek, Cave Creek, Crystal Springs Coulee, Dry Run Coulee, Eau Galle River and tributaries, Foley Branch, Gilman Creek, Goose Creek and tributaries, Hope Coulee, Isabelle Creek and tributaries, Jackson Bluff Creek, Kinnickinnic River and

tributaries, Little Trimbelle Creek and tributaries, Lost Creek and tributaries, Mines Creek, Missouri Creek, Morgan Coulee, North Branch Pine Creek, Pine Creek and tributaries, Plum Creek and tributaries, Rock Elm Creek, Rocky Branch and tributaries, Rush Coulee, Rush River and tributaries, South Fork Kinnickinnic River, South Fork Kinnickinnic River Tributary 2, Spring Creek and tributaries, Stony Coulee, Tributary A, Trimbelle River and tributaries, Unnamed Stream to Mississippi River and tributaries, Warrentown Coulee, Wind River were studied by approximate methods. The impacts of recently built dams (Structure 1 on Bay City Creek and Structures 2, 3 and 19 on Plum Creek) were also incorporated.

2.2 Community Description

Pierce County is located in the west-central Wisconsin and bordered by St. Croix County on the north, Dunn and Pepin counties on the east, Goodhue and Dakota counties, Minnesota, on the south, and Washington County Minnesota, on the west. The county seat, Village of Ellsworth, is 41 miles southeast of St. Paul, Minnesota, 51 miles southeast of Minneapolis, Minnesota, 195 miles northwest of Madison, Wisconsin, and 255 miles northwest of Milwaukee, Wisconsin. 60-percent of the total land area is agricultural. The population of the county was 36,804 in 2000, 32,765 in 1990, 31,149 in 1980, and 41,019 in 2010 (Reference 9).

The climate in west-central Wisconsin is characterized by wide variations in temperatures. Summers are short, and July is the warmest month of the year, with average high temperatures of 83.6 degrees Fahrenheit (°F) and average low temperatures of 60.3°F. Winters are cold and long. January is the coldest month, with an average high temperature of 23.1°F and an average low temperature of 2.8°F. Average annual rainfall is about 25 inches, and snowfall about 35.1 inches (Reference 5).

Pierce County is characterized by broad, deep valleys which are flanked by bluffs. The bluffs often expose the limestone and sandstone bedrocks, which are more resistant to the forces of erosion than the covering of soils. Much of Pierce County has experienced little glaciation during the most recent intrusions of ice cover, and the valleys often contain sediments and lake deposits of clay (Reference 5).

2.3 Principal Flood Problems

The history of flooding on the South Fork Kinnickinnic River indicates that the major floods have occurred in early spring and generally caused by intense rainstorms and/or spring snow melts. About once every 15 year, flood levels overtop South Fork Road and Saddle Club Road.

Flooding problems in the Village of Ellsworth are due primarily to the overflow of Isabelle Creek and Isabelle Creek Tributary. The major flooding problem in the Village of Elmwood is the overflow of the Eau Galle River. Flooding problems in Plum City are due primarily to the overflow of Plum Creek and Rush Coulee. The area of most serious potential flooding in the City of River Falls is the South Fork Kinnickinnic River Tributary No. 1 that runs north to south through the east side of

the city. The flood in early April 1934 was the largest flood that can be remembered by local people and would probably establish the 1-percent-chance-annual flood elevations for the city. Flooding in the Village of Spring Valley occurs on the Eau Galle River, Burkhart Creek, Mines Creek, and smaller streams which flow through the village.

The Village of Spring Valley historically has had flooding problems. Three floods in 1942 caused \$1.5 million damage. Nine inches of rain fell in 36 hours on September 15 and 16. This flood initiated efforts to minimize flood conditions. Efforts were successful and construction of a dam was begun by the USACE in 1965. Other storms of significance occurred in 1954 and 1980. The June 7, 1980 storm is noteworthy because the area affected did not include the Eau Galle River. The damage occurred along Burkhart Creek, Mines Creek, and smaller streams which flow through the village.

The Mississippi River is monitored at the City of Hastings and Red Wing, Minnesota from the intersection with the St. Croix River south to Lake Pepin. The river reached flood stage around April 4, 1997 and crested around April 13. The peak crest measured at Red Wing was 17.2 feet which was the third highest crest ever measured. US Highway 63 between Red Wing and Hager City kept open due to slightly lower than expected crests and tenacious Wisconsin and Minnesota Department of Transportation workers building sand and gravel dikes. Water reached roofs in Bay City (Reference 10).

More recently in April 1, 2001 Pierce County and adjacent areas had a flood event. Heavy snow fall during winter remained on the ground through the end of March and then rapidly melted, resulting in river stages close to record levels along Wisconsin's western border. Water began to gush through drainage ditches, streams and into the mainstem rivers during midday April 1. Two to four inches of rain in April 7 through April 9 prolonged the high water and also added about one foot to the crest during mid-April. Another two to three inches of rain April 22 and 23 caused a second crest in late April. Both the St. Croix and Mississippi Rivers remained well above flood stage into May. The crest at Stillwater, Minnesota on the St. Croix River was the second highest crest, only 1.8 feet lower than in 1965. The crest at Hastings, Minnesota and Red Wing, Minnesota on the Mississippi River was the third highest level, lower only than during the floods of 1965 and 1969. A few homes and businesses in the City of Prescott had water in basements (Reference 10).

2.4 Flood Protection Measures

The Eau Galle Reservoir on the Village of Spring Valley offers considerable flood protection measures. The reservoir reduces the 1-percent-annual-chance flood discharge from about 34,000 cubic feet per second (cfs) to less than 5,000 cfs.

The levee in the Spring Valley, located along the Mines Creek, was previously provisionally accredited and therefore mapped as providing protection from the 1-percent-annual-chance flood on the initial countywide FIRM. During this physical map revision, it was determined that using a natural valley procedure would be more appropriate for this area, and the Village of Spring

Valley provided a signed concurrence letter to FEMA in 2017 as acknowledgment of this determination. Based on the revised modeling approach, the levee is no longer considered to be providing protection from the 1-percent-annual-chance flood and natural valley flooding is depicted on the FIRM. Portions of the levee may however still be shown on the FIRM, in the Village of Spring Valley.

In the City of River Falls, the Greenwood Detention Basin located north of Division Street on South Fork Kinnickinnic River Tributary No. 1 was constructed by the city to provide flood protection to a residential area in the northern portion of the city. This basin is capable of containing the 1-percent-annual-chance frequency flood.

In the City of River Falls, the South Fork Kinnickinnic River Tributary No. 1, drains in a southern direction and continues downstream through a constructed waterway on the public school property and enters a conduit at Ninth Street. The length of the waterway from Division Street to Ninth Street is about 2,560 feet, while the length of the conduit is about 1,260 feet. This conduit ends just downstream of Spring Street. There is about 400 feet of open channel to Cascade Avenue where the waterway enters a second conduit. The second conduit ends at an open channel about 1,300 feet downstream from Cascade Avenue before it drains to the South Fork Kinnickinnic River.

Following the 1966 flood, the Pierce County Soil and Water Conservation District initiated a feasibility study as a potential Public Law 566 project for watershed protection and flood prevention. The project was turned down by the State Soil Conservation Board on March 26, 1968, because of lack of floodplain zoning regulation and implementation of their earlier board recommendations. A Public Law 566 project was feasible in the tributary area of the South Fork Kinnickinnic River where increased residential building has occurred. Solutions including an outlet channel, two floodwater retarding structures, and a diversion-conduit system were proposed.

In July 1971, the City of River Falls Council and the City Utilities Commission directed the City Engineer to study the sanitary sewer and storm sewer problems on the east side of the city. A sanitary sewer was proposed on Division Street to handle the increasing sewage from that area. To solve the storm sewer problem, it was suggested that the proposed bypass for State Route 35 be used as a retaining dam to temporarily pond stormwater. Because of the location and proposed grade, the embankment could retain flood flows. A six-foot diameter emergency overflow conduit was proposed as part of the outlet system for the pond. The primary outlet is an 18-inch RCP, which greatly reduces the flows to South Fork Kinnickinnic River Tributary No. 2 during 1- and 0.2-percent-annual-chance events. The Cernohouse Detention Basin on South Fork Kinnickinnic River Tributary No. 2 (Reference 11) was constructed by the city to provide flood protection for a residential area located in the eastern portion of the city. This detention basin is capable of containing the 1-percent-annual-chance frequency flood.

Flood protection measures in the City of River Falls have focused on a combination of structural and non-structural measures. The two major dams on the Kinnickinnic River are the Powell Falls (Lake Louise) and Junction Falls (Lake George). Both have large fixed crest spillways which pass the flows over the dam in a run-of-the-river operation mode without any flood protection to the downstream system. There are no other major control structures on the Main Branch of the Kinnickinnic or South Branch except culverts and bridges under roadways.

Several non-structural methods have been developed for flood protection in the City of River Falls including changes in agricultural practice, revised aerial topography, and ordinances. Improved agricultural practices such as terracing, conservation tillage, set-aside lands have reduced flooding potential in the watersheds. Also, limited pasturing has reduced the upper watershed runoff response.

In 1996, the City of River Falls purchased up-to-date aerial topographic maps to provide greater detail and to illustrate the existing built conditions of the city. From these custom maps, more detailed cross sections were developed to better refine the hydraulic model and allow for more accurate hydrologic calculations of the ponding areas and contributing watersheds area.

The City of River Falls has an effective Floodplain Management Ordinance (Chapter 22) and Erosion Control Ordinance (Chapter 18). Both of these ordinances control future development, assuring that development does not cause any future flooding problems or aggravate current ones (Reference 7).

The normal flow of Plum Creek is regulated by the Nugget Lake retention structure upstream of the Village of Plum City.

3.0 **ENGINEERING METHODS**

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

3.1 Hydrologic Analyses

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

Each incorporated community within, and the unincorporated areas of, Pierce County, with the exception of the City of Prescott, have a previously printed FIS report. The hydrologic analyses described in those reports have been compiled and summarized below.

Pre-Countywide Analysis:

Flood flow discharges for Bay City Creek in the Village of Bay City were determined using the current USGS empirical equations, at the time of the original FIS, based on a regression analysis of stream gage data. The equation results were then compared to similar USGS stream gage sites and other available hydrologic information. The Mississippi River (Lake Pepin) flood stage for the Village of Bay City was obtained from the USACE flood profiles for the Mississippi River (Reference 12).

For the Village of Ellsworth, regression equations have been developed by the USGS, "Techniques for Estimating Magnitude and Frequency of Floods for Wisconsin Streams" (Reference 13), were used. The 1-percent-annual-chance flood discharge equation for streams in northwestern Wisconsin was used to estimate the 1-percent-annual-chance peak discharge.

The 1-percent-annual-chance discharge at the Village of Elmwood was determined by adding the 1-percent-annual-chance peak discharge from the Eau Galle Reservoir Dam and the 1-percent-annual-chance discharge for the area between the Village of Elmwood and the dam. Discharges for the segment downstream of the dam were calculated using regression equations contained in "Techniques for Estimating Magnitude and Frequency of Floods for Wisconsin Streams" (Reference 13). The discharge just downstream of the Eau Galle Reservoir Dam was provided by the WDNR.

In the Village of Maiden Rock, peak discharge-frequencies for Unnamed Coulee were determined using USGS regression equations (Reference 13) and the general relations method (References 14 and 15). The mean values of these two methods were computed and used as the peak discharge-frequencies.

In absence of any gauging station in the unincorporated areas of Pierce County, peak discharges of the South Fork Kinnickinnic River for the selected frequencies were estimated using regression equations which included consideration of drainage area, main channel slope, storage, and soil permeability (Reference 13). These discharges were compared and verified with the discharge data available from the floodplain repository (Reference 16) and Wisconsin Floodplain Management Community Status Report for Pierce County (Reference 17).

In the Village of Plum City, equations were developed by the USGS for estimating the magnitude and frequency of floods for streams in Wisconsin (Reference 13). The 1-percent-annual-chance flood discharge equation for streams in northern Wisconsin was used to estimate the 1-percent-annual-chance of peak discharges of Plum Creek and Rush Coulee.

For the City of River Falls 1982 FIS, the peak discharge was determined for the 10-percent-annual-chance frequency at the USGS stream gage downstream from 1-percent-annual-chance gage No. 5-3420 (Reference 18). This stream gage, having a drainage area of 146 square miles, has a period of record of four years. This analysis was made by the USGS. Discharges beyond the 10-percent-annual-chance event were not made because of the limited record. The lower frequency events from the USGS report agreed with discharges computed using Soil Conservation Service (Natural Resources Conservation Service - NRCS) procedures.

For the Kinnickinnic River and the South Fork Kinnickinnic River in the City of River Falls, peak discharges for the selected frequencies were estimated using parametric hydrology methods which included consideration of precipitation, soils, vegetative cover, drainage area and hydraulic characteristics of the watershed (Reference 19). For South Fork Kinnickinnic River Tributary No. 1, peak discharges for the 1-percent-annual-chance frequency were estimated using the same parametric hydrology methods used for the Kinnickinnic River and the South Fork Kinnickinnic River. The 10- and 0.2-percent-annual-chance year discharges were estimated from the 1-percent-annual-chance discharges for South Fork Kinnickinnic River Tributary No. 1 by inspection of basin characteristics. Computer modeling techniques were used for the South Fork Kinnickinnic River and the 1-percent-annual-chance discharge for South Fork Kinnickinnic River Tributary No. 1 (Reference 20). There was a decrease in discharges for the 0.2-percent-annual-chance year flood on South Fork Kinnickinnic River due to storage in the floodplain.

In the City of River Falls, since the construction of Cernohouse Detention Basin on South Fork Kinnickinnic River Tributary No. 2 reduced the discharge to only 46 cfs, which would be due to a spillway failure during the Probable Maximum Flood, the flooded area is designated as Zone X due to depths less than 1.0 foot (Reference 18). The upper reach of South Fork Kinnickinnic River Tributary No. 1, where the drainage area becomes less than 1.0 square mile (upstream of Division Street), has also been designated as Zone X flooding. Due to upstream ponding and maintenance of the outlet culvert system, the impacts of the 1966 flood have been eliminated. The drainage from the detention basins, to the confluence with South Fork Kinnickinnic River, will be contained in a series of defined ditches and culverts.

For the August 20, 2002 City of River Falls FIS, the peak discharge was determined for all frequencies of Kinnickinnic River, South Fork Kinnickinnic River, South Fork Kinnickinnic River Tributary No. 2, and Rocky Branch using NRCS methodology and the computer program HEC-HMS (Reference 21). In 1995, the City of River Falls completed a detailed hydrologic analysis of a 64-square-mile

study area, centered about River Falls using NRCS methodology (Reference 22). The hydrological model for this study did not include detailed calculations for the Kinnickinnic River. The computer model for the Water Management Plan (Reference 22) did account for reduced peak discharge rates that have occurred due to several detention ponds and small dams. For the 2002 FIS, the model was expanded to include the entire Kinnickinnic River drainage basin upstream of River Falls.

The City of River Falls HEC-HMS model (Reference 21) required curve number, time of concentration, and contributing area data for each subwatershed. Curve number calculations were based on the Water Management Plan (Reference 22). The values were derived from detailed land use and soils maps. For areas outside of the basin, curve numbers are estimated based on general soil patterns from soil maps, land use practices typical of the region (mostly agricultural), and the USGS maps. All time of concentration calculations are derived from methods described in TR-55 (Reference 23) and the channel velocity charts in the Minnesota Hydrology Guide (Reference 24).

The assumed rainfall amounts used in the River Falls model were based on TP-40 (Reference 25). The storm events chosen for design are 24-hour duration storms, distributed using the NRCS Type II distribution, with normal antecedent moisture conditions. Since TP-40 (Reference 25) does not include a rainfall amount for the 0.2-percent-annual-chance, 24-hour rain, it was interpolated from extreme-value probability paper using the rainfall amounts for the 100-, 50-, 20-, 10-, 2-, and 1-percent-annual-chance.

Peak discharge rates from the City of River Falls model were compared against previously calculated rates used for areas contributing to bridges over the Kinnickinnic River and tributaries. The flow rates in the model compared favorably at the bridges located at State Routes 35 and 65. Flow rates were slightly lower than those used at the downtown area bridges.

The flows of water for the frequencies desired in the Village of Spring Valley were determined by dividing the drainage basins into smaller sub-basins to provide flow figures at selected locations. The physical data for each basin, such as size, slope, type of land use, soils, and channel length, were modeled into the NRCS TR-20 computer program (Reference 20). Four rainfalls were used in the model. The 10-, 2-, 1-, and 0.2-percent-annual-chance return frequencies were obtained from the U.S. Weather Bureau Technical Paper No. 40 (Reference 25). The flows were compared to USGS gauged watersheds of similar characteristics and previous work done on the streams. The outflow from the Eau Galle Dam was very close to the measured outflow from the storm on June 7, 1980, of equivalent rainfall.

Initial Countywide Analysis - November 16, 2011:

The hydrologic information for the Mississippi River used in this countywide study was obtained from the Upper Mississippi River System Flow Frequency study (Reference 26). Upper Mississippi River Basin Flow Frequency study began in

1998 as the Upper Mississippi, Lower Missouri, and Illinois Rivers Flow Frequency Study and was completed in 2003. The study addresses the Illinois River from Lockport to the mouth, the Missouri River from Gavins Point to the mouth, and the Mississippi River from St. Paul to the confluence with the Ohio River.

In Upper Mississippi River System Flow Frequency study, annual peak flows and peak stages from the period of record run of the calibrated UNET model (Reference 27) were used to develop rating curves for each cross section location. Using these station rating curves and the station frequency flows developed during the hydrology phase, frequency elevation points were obtained for each cross section location. Connecting the corresponding points resulted in flood frequency profiles. These profiles were coordinated among the computational teams and appropriate adjustments were made to assure consistency. The discharges for each cross-section determined by this approach were later imported into a HEC-RAS model in 2004 by USACE (Reference 28).

The hydrologic analyses for Plum Creek and the Unnamed Tributary of Plum Creek consisted of a flood frequency analysis and development of an inflow hydrograph for the 1-percent-annual-chance flood. The inflow hydrograph is required for the dam failure analysis. USGS regression equations were used and drainage basin comparisons with similar USGS-gauged watersheds in the Driftless Region to perform the flood frequency analysis for the Plum Creek. NRCS TR-20 rainfall-runoff model (Reference 20) was used to calculate additional flood frequency values and to develop an inflow hydrograph for the 1-percent-annual-chance flood. The peak discharge at the dam was calculated in accordance with Wisconsin Administrative Code NR 333 and NR 116 requirements. The flood-frequency results varied with the method of analysis, and the final decision was to use the rainfall-runoff model results for both the flood frequencies and the 1-percent-annual-chance flood hydrograph (Reference 29 and 30).

For this Physical Map Revision, a new detailed hydrologic analysis was completed for Mines Creek. The 10-, 2-, 1-, and 0.2-percent-annual-chance flood events were determined using the USACE HEC-HMS software, version 3.5 (Reference 45).

Precipitation values for different recurrence intervals were obtained from the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14, Volume 8: Precipitation-Frequency Atlas of the United States (Reference 46) and applied over subbasins delineated using United States Geological Survey (USGS) Quadrangle Maps. Current land use data was obtained from the USGS National Land Cover Database (NLCD) and current soils data was obtained from the National Resources Conservation Service (NRCS). This data was used with the NRCS Curve Number method to determine abstractions and runoff. The SCS Unit Hydrograph was used to generate runoff hydrographs for each of the delineated subbasins and the Modified Puls method was used for hydrologic routing to account for attenuation. Peak discharge-drainage area relationships for Mines Creek are shown in Table 5, "Summary of Discharges".

TABLE 5 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES(cfs)			
		10-PERCENT ANNUAL- CHANCE	2-PERCENT ANNUAL- CHANCE	1-PERCENT ANNUAL- CHANCE	0.2-PERCENT ANNUAL- CHANCE
BAY CITY CREEK At Confluence with Mississippi River	8.46	950	1,500	1,750	2,400
BURKHART CREEK					
At McKay Ave Upstream of Cleveland St	2.66	1,018	1,614	1,936	2,483
	2.30	820	1,300	1,650	2,000
BURRO LANE TRIBUTARY					
At State Highway 29	0.38	168	264	316	400
EAU GALLE RIVER					
At Public Avenue	99.8	*	*	8,000	*
At Wagon Road	71.4	2,521	3,842	4,263	6,004
At Eau Galle Road	67.5	1,638	2,496	3,003	3,900
At Spring Valley	64.1	*	*	4220	*
ISABELLE CREEK					
Approximately 800 feet downstream of Main Street	2.85	*	*	1,160	*
ISABELLE CREEK TRIBUTARY					
Near Broadway Avenue	0.48	*	*	354	*
KINNICKINNIC RIVER					
Downstream of Powell Falls dam at confluence of Rocky Branch	128.44	8,900	14,600	16,900	22,500
Downstream of Powell Falls dam at confluence of Mann Valley	117.86	7,700	12,500	14,600	19,400
Downstream and Upstream of Powell Falls Dam	109.66	6,800	11,000	12,800	16,900
Upstream of Junction Falls dam	89.96	3,350	7,050	8,700	13,000

TABLE 5 - SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES(cfs)			
		10-PERCENT ANNUAL- CHANCE	2-PERCENT ANNUAL- CHANCE	1-PERCENT ANNUAL- CHANCE	0.2-PERCENT ANNUAL- CHANCE
KINNICKINNIC RIVER					
Upstream of State Route 35	77.53	3,050	6,450	8,000	11,900
MINES CREEK					
Confluence with Eau Galle River	3.2	830	1,770	2,340	3,930
Confluence with Mines Creek Tributary 1	2.0	810	1,695	2,230	3,690
MISSISSIPPI RIVER					
Just downstream of the confluence of St.Croix River	45,843	113,500	168,000	192,500	252,500
Just downstream of the confluence of Rush River	47,905	119,000	174,000	199,000	259,000
PLUM CREEK AT US HWY 10	14.5	*	*	3,630 ¹	*
ROCKY BRANCH					
At the confluence with Kinnickinnic River	10.35	1,900	2,800	3,400	5,500
At the confluence of Unnamed Tributary No. 4	8.00	1,900	2,800	3,400	5,500
RUSH COULEE					
At Mouth	5.99	*	*	1,840	*
SOUTH FORK KINNICKINNIC RIVER					
At the confluence with Kinnickinnic River	19.25	3,000	5,400	6,400	8,700
At State Route 35	15.84	3,000	5,400	6,400	8,700
At South Fork Road	8.40	1,980	3,460	4,200	4,690
At State Route 29	3.50	860	1,470	1,770	2,040

¹ Adjusted for discharge from dam at Nugget Lake

TABLE 5 - SUMMARY OF DISCHARGES (continued)

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (sq. miles)</u>	<u>PEAK DISCHARGES(cfs)</u>			
		<u>10-PERCENT ANNUAL-CHANCE</u>	<u>2-PERCENT ANNUAL-CHANCE</u>	<u>1-PERCENT ANNUAL-CHANCE</u>	<u>0.2-PERCENT ANNUAL-CHANCE</u>
At County Boundary	1.38	410	700	840	970
SOUTH FORK KINNICKINNIC RIVER					
TRIBUTARY NO. 2					
At confluence with South Fork Kinnickinnic River	4.00	750	1,400	1,640	2,250
At State Route 65	3.38	750	1,400	1,640	2,250
UNNAMED COULEE					
At confluence with Mississippi River	1.35	*	*	520	*
At County Highway S	0.98	*	*	390	*

3.2 Hydraulic Analyses

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

Each incorporated community within, and the unincorporated areas of, Pierce County, with the exception of the City of Prescott, have a previously printed FIS report. The hydraulic analyses described in those reports have been compiled and summarized below.

Pre-Countywide Analysis:

Cross sections for Bay City Creek were obtained from field surveys. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry. All cross section and structure data for Bay City Creek was field surveyed in 1996. Water-surface elevations (WSELs) of floods of the selected

recurrence intervals for Bay City Creek were computed using the USACE HEC-2 step-backwater computer program (Reference 31). The starting WSEL for Bay City Creek is the 10-percent-annual-chance flood stage for the Mississippi River (Lake Pepin). Flood profiles were drawn showing computed WSELs for floods of the selected recurrence intervals.

The WSELs and profile for the Mississippi River (Lake Pepin) at Bay City were obtained from the USACE. Profiles for the Mississippi River were adjusted from the 1912 mean sea-level datum (Reference 12). Flood hazard data were not included in the FIS for Isabelle Creek.

Cross sections in the Village of Ellsworth for the backwater analysis were obtained from field survey and additional cross sections were estimated from adjacent cross sections and topographic maps (Reference 32). Structural geometry for bridges and culverts were also obtained from the field survey. WSELs for the 1-percent-annual-chance flood were computed using WSPRO, a step-backwater computer program (Reference 33). The starting WSELs for Isabelle Creek were determined by the slope-conveyance method.

Cross section data for the Eau Galle River in the Village of Elmwood was obtained from field survey. Structural geometry and elevations for bridges were obtained from the Wisconsin Department of Transportation. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map. WSELs for the 1-percent-annual-chance flood were computed using WSPRO, a step-backwater computer program (Reference 33).

In the Village of Maiden Rock, cross-section data and structural geometry and elevation data for bridges within the study reaches were obtained from field surveys. The profiles for the selected recurrence interval floods were computed using the HEC-2 step-backwater computer program (Reference 34). Starting WSELs for Unnamed Coulee were obtained with the slope-area method. Flood profiles were drawn showing the computed WSELs for floods of the selected recurrence intervals. Profiles for the Mississippi River, furnished by the USACE (Reference 12), were adjusted from the 1912 mean sea level datum.

Because of the complex hydraulic aspects of Unnamed Coulee in the Village of Maiden Rock, the analysis was divided into four separate reaches. Reach one extends from the upstream limit of the study downstream to the entrance of the tunnel that carries floodwaters to the Mississippi River. The supercritical flow option on the HEC-2 program was used to analyze this reach. Reach two consists of the portion of the flood flow which enters the tunnel and travels through the tunnel to a point just downstream of the railroad. A rating curve was developed in order to evaluate the capacity of the tunnel. Reach three is the portion of the 1-percent-annual-chance flood flow which does not enter the tunnel and thus flows overland along and within County Highway S. The HEC-2 supercritical flow option was used to determine flood elevations in this reach. Reach four extends from just downstream of the railroad to the confluence with the Mississippi River. At the railroad, and overland flow is reunited with the tunnel flow by way of a swale and

drop structure and two 60-inch reinforced concrete culverts. A rating curve was developed in order to determine how much overland flow can be routed through the drop structure. Analysis showed that the small amount of flow which cannot go through the structure could seep through the ballast of the railroad tracks.

In the unincorporated areas of Pierce County, cross section data and structural geometry and elevation data for bridges within the study reaches were also obtained from field surveys. The profiles for the selected recurrence interval floods were computed using the HEC-2 step-backwater computer program (Reference 34). Starting WSELs for the South Fork Kinnickinnic River were obtained from the Flood Insurance Study for the City of River Falls, Wisconsin (Reference 5).

For the backwater analyses of Plum Creek and Rush Coulee at the Village of Plum City, cross sections were obtained from field survey as well. Additional sections were estimated from adjacent surveyed sections and topographic maps (Reference 35). Structural geometry and elevations for bridges were also obtained from field survey. WSELs for the 1-percent-annual-chance flood were computed using WSPRO, a step-backwater computer program (Reference 33). The starting WSELs for Plum Creek and Rush Coulee were determined using the slope-conveyance method.

For the City of River Falls FIS report, cross sections for the backwater analyses of the Kinnickinnic River, Rocky Branch, the South Fork Kinnickinnic River, and South Fork Kinnickinnic River Tributary No. 2 in the City of River Falls were taken from GPS surveys, bridge plans, two-foot contour interval mapping (Reference 36) and the FIS hydraulic model completed for the 1982 FIS (Reference 7) as revised for the 1995 Water Management Plan (Reference 22). These cross sections were taken at close intervals above and below bridges and culverts to compute the significant backwater effects of these structures in the highly urbanized areas. For South Fork Kinnickinnic River Tributary No. 1, the SEH study demonstrated that the concrete channels and culverts downstream of the two detention basins are sized to carry the entire 1-percent-annual-chance flood. Therefore, no floodplain is being shown on the map panels and the profile has been removed.

Flood elevations upstream of the Junction Falls (Lake George) and Powell Falls (Lake Louise) dams were based on the HEC-HMS model (Reference 21). The model uses the storage indication method to calculate high-water elevation based on the hydrographs generated in the model. Rating curves for the dams were based on information in the River Falls Municipal Hydroelectric Facilities, FERC Project No. 10489-000, City of River Falls, Wisconsin (Reference 37).

For the City of River Falls starting WSELs for backwater analysis were made using critical depth analysis of the Kinnickinnic River for the reach below Powell Falls (Lake Louise) dam. Between the Powell Falls (Lake Louise) dam and Junction Falls (Lake George) dam, the flood elevation was based on the hydrology model results. Upstream of the Junction Falls (Lake George) dam, the starting WSEL was based on the elevation of the dam from the hydrologic model. Based on the review

of the hydrologic model, there is little attenuation of the peak flow during flood events and thus the elevation of the pool will be at or near its peak when the flow rates used for the backwater analysis arrive.

On the South Fork Kinnickinnic River in the City of River Falls, critical flow was assumed in the natural rock chute upstream of its confluence with the Kinnickinnic River. The starting WSEL for the South Fork Kinnickinnic River Tributary No. 2 just upstream of the South Wasson Lane bridge, was the elevation at its confluence with the main reach of South Fork Kinnickinnic River. For the beginning of the Rocky Branch main channel, the starting WSEL was assumed to be critical depth.

For the Village of Spring Valley the hydraulic models of Burkhart Creek, Burro Lane Tributary, Mines Creek, and the Eau Galle River in the Village of Spring Valley were put together utilizing cross section survey and topographic data obtained from the St. Paul District, USACE and supplemented with additional survey data. The SCS (NRCS) WSP-2 Computer Program, Technical Release No. 61 (Reference 38) was used to compute the depth of water at each of the selected cross sections for a given flow. The flood flows were inserted into the water-surface profile model producing the WSELs at each cross section and bridge.

The computed 1-percent-annual-chance flood profile compared with the high water marks from the June 7, 1980 flood indicated the profiles to be accurate. The flooding from Mines Creek was caused by sediment and vegetation in the constructed channel below a drop spillway. The village is under agreement with the USACE to clean out and maintain the channel; however, cleanout operations have not been maintained and therefore the profile and the Flood Insurance Rate Maps show the existing channel condition.

Initial Countywide Analysis - November 16, 2011:

Development of the hydraulic analysis of the Upper Mississippi River began with converting the Upper Mississippi River System Flow Frequency Study UNET model (Reference 27) to HEC-RAS Version 3.1.1 (Reference 28). The study limits were from Hastings, Minnesota to Cairo, Illinois. The project's quality control plan stated that the steady flow HEC-RAS model would be calibrated to the 1-percent-annual-chance Upper Mississippi River System Flood Frequency Study profile. The UNET model produced unique values of discharge at each cross-section. The discharge value for each cross-section was imported into the HEC-RAS model. The calibrated 1-percent-annual-chance HEC-RAS profile is generally within 0.1 foot of the Upper Mississippi River System Flow Frequency Study 1-percent-annual-chance profile. Near some bridges differences of more than 0.1 foot occur, but this was expected and is considered acceptable. Manning's n values are typically lower near the locks and dams where the channel is deeper and a greater percentage of the floodplain is continuously inundated by the pool.

Besides adjusting Manning's n values, calibration depended on setting good flow limits. Setting effective flow limits was also very important because with Wisconsin's zero allowable floodway stage increase, the limit of effective flow becomes the floodway boundary, unless the already existing Wisconsin floodway boundary is riverward of the limit of effective flow (existing Wisconsin floodway boundaries riverward of the effective flow limits were maintained even though they caused minor stage increases).

The floodway analysis began with running HEC-RAS's method of equal reduction in conveyance using each state's maximum allowable floodway stage increase criteria (1.0 foot for Iowa, 0.5 foot for Minnesota, and 0 for Wisconsin). The floodway limits generated from this model run were exported to ArcGIS (Reference 40).

For the Plum Creek Watershed study as well as the Bay City study, the hydraulic analysis was performed with the National Weather Service DAMBRK (Reference 39) according to the following three conditions in accordance with Wisconsin Administrative Code NR 333 criteria: dam nonexistent, dam in place with no failure, and dam in place with failure. The 1-percent-annual-chance flood levels were determined using the "dam nonexistent" model and the hydraulic shadow was defined by comparing the "dam nonexistent" model with the "dam in place with failure" model. Elevations used in the models are referenced to USGS datum. The survey datum is based on a USGS benchmark located approximately two miles to the south of the dam at USH 10. The channel cross sections used in the modeling are from a topographic survey of selected stream cross sections and the USGS 7 1/2 minute quadrangle maps.

This Physical Map Revision:

A new detailed analysis was conducted for Mines Creek within Spring Valley, Wisconsin, to model the natural valley analysis along the Spring Valley Levee. Surveys were conducted on channel cross-sections and at all significant structures, including the Spring Valley Levee. HEC-GeoRAS v.10 was used to convert the stream centerline and additional cross-section data created in ArcGIS v.10 for use in HEC-RAS v. 4.1 HEC-GeoRAS utilized the 2-meter Digital Elevation Model (DEM) (Reference 47) for the Spring Valley area to develop the overbank portions of the model cross-sections.

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.

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.

Roughness factors (Manning's "n" values) used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 6, "Manning's "n" Values."

TABLE 6 - MANNING'S "N" VALUES

<u>Stream</u>	<u>Channel "n"</u>	<u>Overbank "n"</u>
Bay City Creek	0.035-0.04	0.07-0.08
Burkhart Creek	*	*
Burro Lane Tributary	*	*
Eau Galle River	0.030	0.030-0.090
Isabelle Creek	0.020-0.060	0.020-0.060
Isabelle Creek Tributary	0.030-0.060	0.030-0.060
Kinnickinnic River	0.030-0.040	0.045-0.120
Mines Creek	0.045-0.060	0.045-0.150
Mississippi River	0.028-0.035	0.04-0.12
Plum Creek	0.025-0.060	0.025-0.060
Rocky Branch	0.030-0.040	0.045-0.120
Rush Coulee	0.025-0.060	0.025-0.060
South Fork Kinnickinnic	0.030-0.040	0.045-0.120
South Fork Kinnickinnic Tributary 2	0.030-0.040	0.045-0.120
Unnamed Coulee	0.014	0.060
*Data not available		

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Some of the data used in this revision were taken from the prior effective FIS reports and FIRMs and adjusted to NAVD88. The datum conversion factor from NGVD29 to NAVD88 in Pierce County is 0.1 feet (NGVD+0.1=NAVD).

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

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

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

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

4.0 **FLOODPLAIN MANAGEMENT APPLICATIONS**

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

4.1 Floodplain Boundaries

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

In the Village of Bay City, boundaries were interpolated using topographic maps at a scale of 1" = 200' with contour intervals of 4 and 8 feet. In the Village of Ellsworth, between cross sections, the boundaries were interpolated using

topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 32). In the Village of Elmwood, boundaries were interpolated using topographic maps at a scale of 1:6,000 with a contour interval of 20 feet as well (Reference 41). In the unincorporated areas of Pierce County, and the Village of Spring Valley the boundaries were interpolated using topographic maps enlarged to a scale of 1:12,000, with a contour interval of 20 feet (Reference 42). In the Village of Plum City, between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 35). In the City of River Falls, the Kinnickinnic River and South Fork Kinnickinnic River, within the city limits, electronic topographic maps with a contour interval of 2 feet were used (Reference 36). For the remaining streams, the boundaries were interpolated between cross sections using digital line graphs at scales of 1:24,000 and 1:100,000. For the Village of Spring Valley, between cross sections, the boundaries were interpolated using USGS quadrangle maps at a scale of 1:24,000 enlarged to a scale of 1:4,800 with a contour interval of 20 feet (Reference 43). Approximate areas were delineated using the Flood Hazard Boundary Map (Reference 44). The St. Croix River from the confluence with the Mississippi River to just south of the confluence of Barklee Coulee was redelineated with two foot contour maps.

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

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

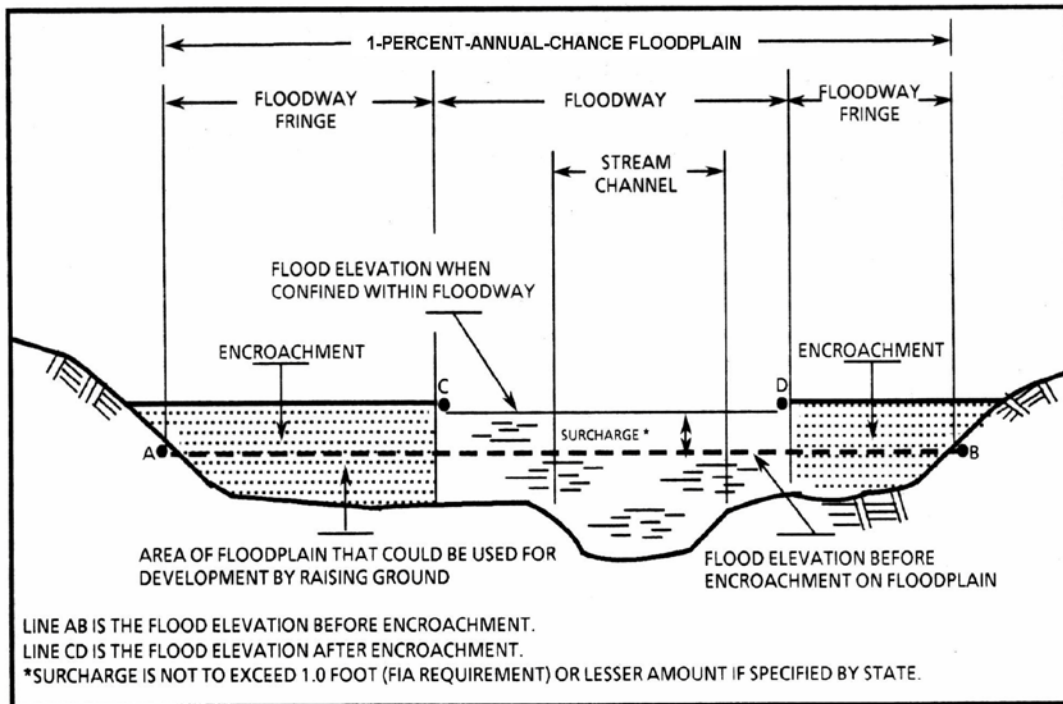
4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (see Table 7, Floodway Data). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 1 percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the WSEL of the base flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 3.

FIGURE 3 - FLOODWAY SCHEMATIC



FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BAY CITY CREEK									
A	2,240 ¹	58	255	6.9	0	682.8	682.8	682.8	0.0
B	2,485 ¹	114	493	3.6	0	684.3	684.3	684.3	0.0
C	2,650 ¹	63	255	6.9	0	684.4	684.4	684.4	0.0
D	2,703 ¹	60	406	4.3	0	686.0	686.0	686.0	0.0
E	2,967 ¹	120	419	4.2	0	686.5	686.5	686.5	0.0
F	3,167 ¹	87	255	6.9	0	687.1	687.1	687.1	0.0
G	3,747 ¹	137	371	4.7	0	690.9	690.9	690.9	0.0
EAU GALLE RIVER									
A	114,900 ²	555	2,030	3.9	0	833.3	833.3	833.3	0.0
B	115,950 ²	712	3,061	2.6	0	835.7	835.7	835.7	0.0
C	117,080 ²	457	1,914	4.2	0	836.7	836.7	836.7	0.0
D	118,840 ²	469	1,059	7.6	0	838.9	838.9	838.9	0.0
E	120,390 ²	971	3,269	2.5	0	842.7	842.7	842.7	0.0
ISABELLE CREEK									
A	79,985 ¹	116	235	4.9	0	1029.5	1029.5	1029.5	0.0
B	82,440 ¹	56	170	4.7	0	1046.5	1046.5	1046.5	0.0
C	83,340 ¹	59	170	4.5	0	1054.5	1054.5	1054.5	0.0
D	84,860 ¹	126	185	4.1	0	1062.3	1062.3	1062.3	0.0
ISABELLE CREEK TRIBUTARY									
A	210 ³	43	159	2.3	0	1046.1	1046.1	1046.1	0.0
B	555 ³	15	42	8.5	0	1048.2	1048.2	1048.2	0.0

¹FEET ABOVE CONFLUENCE WITH MISSISSIPPI RIVER, ²FEET ABOVE CONFLUENCE WITH CHIPPEWA RIVER, ³FEET ABOVE CONFLUENCE WITH ISABELLE CREEK

TABLE 7

**FEDERAL EMERGENCY MANAGEMENT AGENCY
PIERCE COUNTY
AND INCORPORATED AREAS**

FLOODWAY DATA

**BAY CITY CREEK - EAU GALLE RIVER - ISABELLE CREEK -
ISABELLE CREEK TRIBUTARY**

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
ISABELLE CREEK TRIBUTARY (CONTINUED)									
C	1,090 ¹	29	60	5.9	0	1057.0	1057.0	1057.0	0.0
D	1,700 ¹	105	268	1.3	0	1066.5	1066.5	1066.5	0.0
E	1,965 ¹	99	78	4.6	0	1069.4	1069.4	1069.4	0.0
F	2,630 ¹	19	48	7.5	0	1082.7	1082.7	1082.7	0.0
KINNICKINNIC RIVER									
A	806 ²	342	2,359	6.2	0	807.4	807.4	807.4	0.0
B	1,373 ²	215	1,720	8.5	0	808.9	808.9	808.9	0.0
C	3,300 ²	162	1,966	6.5	0	815.7	815.7	815.7	0.0
D	7,610 ²	232	1,492	5.8	0	872.4	872.4	872.4	0.0
E	8,089 ²	169	1,127	7.7	0	873.0	873.0	873.0	0.0
MISSISSIPPI RIVER									
A	780 ³	5,642 ⁴ /10,474 ⁵	317,616	0.6	0	681.5	681.5	681.5	0.0
B	781 ³	6,014 ⁴ /11,754 ⁵	350,862	0.6	0	681.5	681.5	681.5	0.0
C	783 ³	5,042 ⁴ /10,399 ⁵	272,055	0.7	0	681.5	681.5	681.5	0.0
D	784 ³	4,305 ⁴ /8,295 ⁵	157,482	1.3	0	681.6	681.6	681.6	0.0
E	786 ³	7,232 ⁴ /10,911 ⁵	177,792	1.1	0	681.7	681.7	681.7	0.0
F	787 ³	7,605 ⁴ /8,076 ⁵	123,268	1.6	0	681.8	681.8	681.8	0.0
G	789 ³	6,584 ⁴ /7,059 ⁵	125,294	1.6	0	682.5	682.5	682.5	0.0
H	790 ³	5,814 ⁴ /6,293 ⁵	102,805	1.9	0	683.4	683.4	683.4	0.0
I	791 ³	9,314 ⁴ /4,025 ⁵	90,204	2.9	0	684.1	684.1	684.1	0.0
J	793 ³	2,977 ⁴ /11,114 ⁵	168,842	1.2	0	684.7	684.7	684.7	0.0

¹FEET ABOVE CONFLUENCE WITH ISABELLE CREEK, ²FEET ABOVE CORPORATE LIMITS, ³MILES ABOVE CONFLUENCE OF OHIO RIVER, ⁴WIDTH WITHIN PIERCE COUNTY, ⁵TOTAL WIDTH

TABLE 7

**FEDERAL EMERGENCY MANAGEMENT AGENCY
PIERCE COUNTY
AND INCORPORATED AREAS**

FLOODWAY DATA

**ISABELLE CREEK TRIBUTARY - KINNICKINNIC RIVER -
MISSISSIPPI RIVER**

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MISSISSIPPI RIVER (CONTINUED)									
K	794 ¹	803 ² /12,550 ³	160,468	1.2	0	685.1	685.1	685.1	0.0
L	796 ¹	5,041 ² /13,783 ³	188,092	1.0	0	685.8	685.8	685.8	0.0
M	798 ¹	7,381 ² /8,841 ³	130,711	1.2	0	686.4	686.4	686.4	0.0
N	799 ¹	3,353 ² /7,430 ³	120,838	1.3	0	686.7	686.7	686.7	0.0
O	800 ¹	369 ² /6,560 ³	118,326	1.4	0	686.9	686.9	686.9	0.0
P	802 ¹	1,196 ² /7,928 ³	113,835	1.4	0	687.2	687.2	687.4	0.2
Q	804 ¹	466 ² /7,557 ³	119,901	1.4	0	687.6	687.6	687.6	0.0
R	805 ¹	637 ² /9,241 ³	134,046	1.2	0	688.0	688.0	688.0	0.0
S	807 ¹	540 ² /8,583 ³	144,215	1.3	0	688.3	688.3	688.3	0.0
T	809 ¹	534 ² /6,288 ³	100,766	1.9	0	689.4	689.4	689.4	0.0
U	811 ¹	867 ² /5,822 ³	93,715	2.1	0	690.6	690.6	690.6	0.0
V	811 ¹	478 ² /6,377 ³	99,782	1.9	0	691.2	691.2	691.2	0.0
PLUM CREEK									
A	730 ⁴	390	895	4.1	0	799.4	799.4	799.4	0.0
B	1,980 ⁴	522	1,506	2.4	0	802.8	802.8	802.8	0.0
C	3,280 ⁴	273	822	4.4	0	805.7	805.7	805.7	0.0
D	3,560 ⁴	113	664	5.5	0	806.6	806.6	806.6	0.0
E	4,110 ⁴	254	1,161	3.1	0	808.6	808.6	808.6	0.0
F	4,810 ⁴	154	896	4.1	0	810.2	810.2	810.2	0.0
G	5,610 ⁴	253	1,989	1.8	0	810.8	810.8	810.8	0.0
ROCKY BRANCH									
A	1,276 ⁵	201	784	4.3	0	808.2	808.2	808.2	0.0

¹MILES ABOVE CONFLUENCE OF OHIO RIVER, ²WIDTH WITHIN PIERCE COUNTY, ³TOTAL WIDTH, ⁴FEET ABOVE VILLAGE OF PLUM CITY CORPORATE LIMITS,

⁵FEET ABOVE CONFLUENCE WITH KINNICKINNIC RIVER

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY
PIERCE COUNTY
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER - PLUM CREEK - ROCKY BRANCH

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
RUSH COULEE									
A	1,950 ¹	193	547	3.4	0	806.5	806.5	806.5	0.0
B	2,450 ¹	58	255	7.2	0	808.2	808.2	808.2	0.0
C	2,838 ¹	71	279	6.6	0	810.9	810.9	810.9	0.0
D	2,885 ¹	57	182	10.1	0	811.3	811.3	811.3	0.0
E	3,275 ¹	452	753	2.4	0	818.9	818.9	818.9	0.0
F	4,450 ¹	130	293	6.3	0	826.9	826.9	826.9	0.0
G	5,650 ¹	225	407	4.2	0	833.9	833.9	833.9	0.0
H	5,797 ¹	210	387	4.4	0	835.1	835.1	835.1	0.0
I	6,087 ¹	210	484	3.5	0	836.0	836.0	836.0	0.0
J	6,287 ¹	235	445	3.8	0	837.0	837.0	837.0	0.0
K	6,637 ¹	265	487	3.5	0	839.7	839.7	839.7	0.0
L	6,857 ¹	200	363	4.7	0	841.5	841.5	841.5	0.0
M	7,057 ¹	275	444	3.8	0	843.3	843.3	843.3	0.0
SOUTH FORK KINNICKINNIC RIVER									
A	292 ²	133	852	7.5	0	832.2	832.2	832.2	0.0
B	1,550 ²	75	493	13.0	0	874.9	874.9	874.9	0.0
C	2,337 ²	307	1,964	3.3	0	881.4	881.4	881.4	0.0
D	5,235 ²	456	1,973	3.2	0	883.2	883.2	883.2	0.0
E	6,895 ²	274	1,350	4.7	0	886.4	886.4	886.4	0.0
F	9,448 ²	312	1,815	3.5	0	893.3	893.3	893.3	0.0
G	10,896 ²	180	1,201	5.3	0	901.4	901.4	901.4	0.0
H	11,599 ²	717	2,601	2.5	0	905.7	905.7	905.7	0.0
I	13,559 ²	569	1,018	4.6	0	908.1	908.1	908.1	0.0

¹FEET ABOVE CONFLUENCE WITH PLUM CREEK, ²FEET ABOVE CONFLUENCE WITH KINNICKINNIC RIVER

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY
PIERCE COUNTY
AND INCORPORATED AREAS

FLOODWAY DATA

RUSH COULEE - SOUTH FORK KINNICKINNIC RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
SOUTH FORK KINNICKINNIC RIVER (CONTINUED)									
J	18,709 ¹	849	1,567	2.7	0	922.1	922.1	922.1	0.0
K	21,509 ¹	30	326	11.0	58	929.4	929.4	929.4	0.0
L	25,709 ¹	390	880	3.4	0	950.5	950.5	950.5	0.0
M	29,209 ¹	742	826	2.9	0	972.7	972.7	972.7	0.0
N	33,209 ¹	49	169	10.5	0	996.0	996.0	996.0	0.0
O	36,309 ¹	199	322	2.6	0	1,018.1	1,018.1	1018.1	0.0
SOUTH FORK KINNICKINNIC RIVER TRIBUTARY NO. 2									
A	235 ²	606	1,505	0.9	0	906.1	906.1	906.1	0.0
B	696 ²	381	1,546	0.9	0	906.2	906.2	906.2	0.0
C	1,323 ²	277	424	3.3	35	907.6	907.6	907.6	0.0
D	2,266 ²	398	825	1.7	21	911.4	911.4	911.4	0.0
E	3,563 ²	426	573	2.4	0	915.8	915.8	915.8	0.0
F	4,239 ²	471	742	1.9	8	919.6	919.6	919.6	0.0
G	5,588 ²	235	269	5.2	277	926.4	926.4	926.4	0.0
H	7,453 ²	395	825	1.7	0	940.5	940.5	940.5	0.0
UNNAMED COULEE									
A	820 ³	22	14	9.7	0	684.7	684.7	684.7	0.0
B	960 ³	50	21	6.7	0	689.2	689.2	689.2	0.0
C	1,110 ³	44	11	12.4	0	692.0	692.0	692.0	0.0

¹FEET ABOVE CONFLUENCE WITH KINNICKINNIC RIVER, ²FEET ABOVE CONFLUENCE WITH SOUTH FORK KINNICKINNIC RIVER, ³FEET ABOVE CONFLUENCE WITH MISSISSIPPI RIVER

TABLE 7

**FEDERAL EMERGENCY MANAGEMENT AGENCY
PIERCE COUNTY
AND INCORPORATED AREAS**

FLOODWAY DATA

**SOUTH FORK KINNICKINNIC RIVER - SOUTH FORK KINNICKINNIC
RIVER TRIBUTARY NO. 2 - UNNAMED COULEE**

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED COULEE (CONTINUED)									
D	1,205	43	15	9.1	0	697.6	697.6	697.6	0.0
E	1,425	47	12	11.2	0	706.8	706.8	706.8	0.0
F	1,555	65	14	9.8	0	715.7	715.7	715.7	0.0
G	1,810	18	17	22.4	0	722.1	722.1	722.1	0.0
H	1,910	16	16	23.8	0	726.3	726.3	726.3	0.0
I	2,130	16	16	23.7	0	738.0	738.0	738.0	0.0
J	2,285	16	16	24.6	0	745.7	745.7	745.7	0.0
K	2,520	15	17	22.6	0	758.3	758.3	758.3	0.0
L	2,690	16	22	17.6	0	767.9	767.9	767.9	0.0
M	2,941	22	18	21.8	0	778.5	778.5	778.5	0.0
N	2,982	13	20	19.7	0	781.2	781.2	781.2	0.0

¹FEET ABOVE CONFLUENCE WITH MISSISSIPPI RIVER

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY
PIERCE COUNTY
AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED COULEE

5.0 **INSURANCE APPLICATION**

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

Zone A

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

Zone AE

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

Zone X

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

6.0 **FLOOD INSURANCE RATE MAP**

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

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

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

The countywide FIRM presents flooding information for the entire geographic area of Pierce County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 8, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Bay City, Village of	July 31, 1970	None	July 31, 1970	July 1, 1974 October 17, 1975 September 4, 2002
Ellsworth, Village of	April 12, 1974	May 14, 1976	May 4, 1989	None
Elmwood, Village of	May 31, 1974	April 23, 1976 January 11, 1980	March 5, 1990	None
Maiden Rock, Village of	July 19, 1974	May 21, 1976	September 30, 1988	January 19, 1994
Pierce County (Unincorporated Areas)	July 18, 1972	None	July 18, 1972	July 1, 1974 January 9, 1976 November 3, 1993 September 2, 1994
Plum City, Village of	July 19, 1974	June 4, 1976 May 9, 1980	January 3, 1990	None
Prescott, City of	July 10, 1971	None	July 10, 1971	July 1, 1974 February 27, 1976
River Falls, City of (Dual County Community St. Croix County)	October 12, 1973	None	December 15, 1982	August 20, 2002
Spring Valley, Village of (Dual County Community St. Croix County)	June 14, 1974	July 18, 1975 March 12, 1982	March 15, 1984	None

T A B L E 8	FEDERAL EMERGENCY MANAGEMENT AGENCY PIERCE COUNTY, WI AND INCORPORATED AREAS	COMMUNITY MAP HISTORY
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7.0 **OTHER STUDIES**

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

8.0 **LOCATION OF DATA**

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

9.0 **BIBLIOGRAPHY AND REFERENCES**

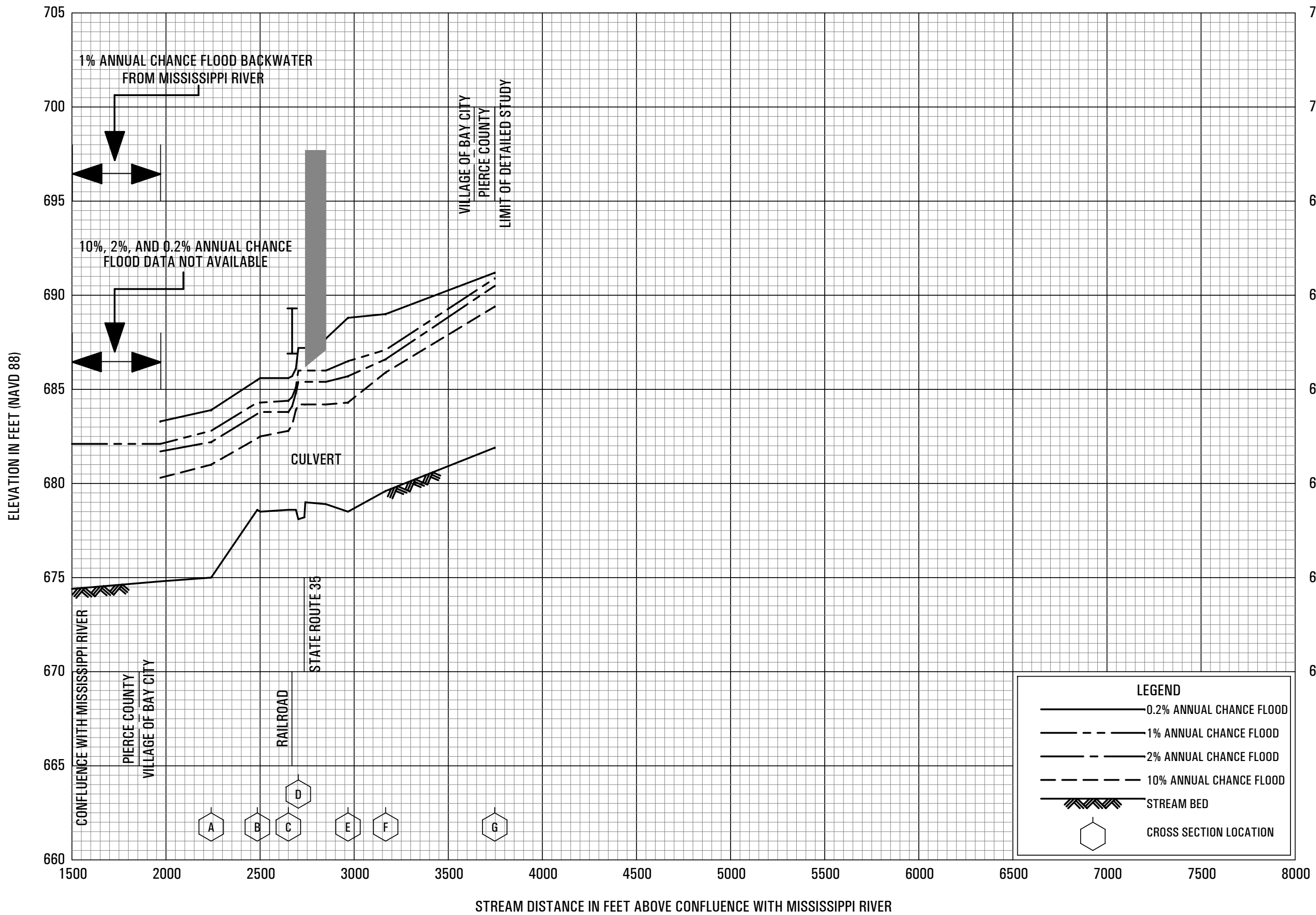
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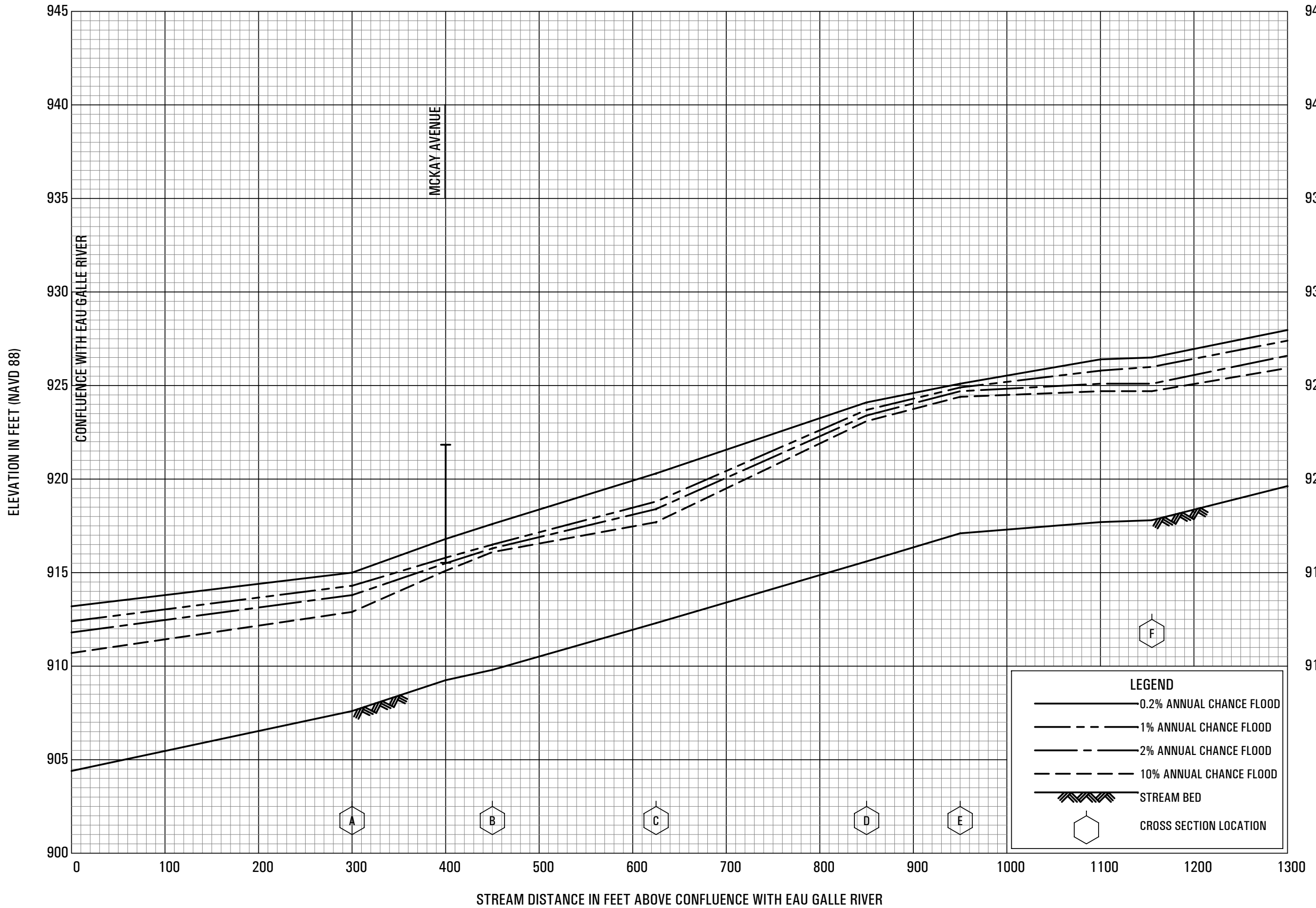


FLOOD PROFILES

BAY CITY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

**PIERCE COUNTY, WI
AND INCORPORATED AREAS**

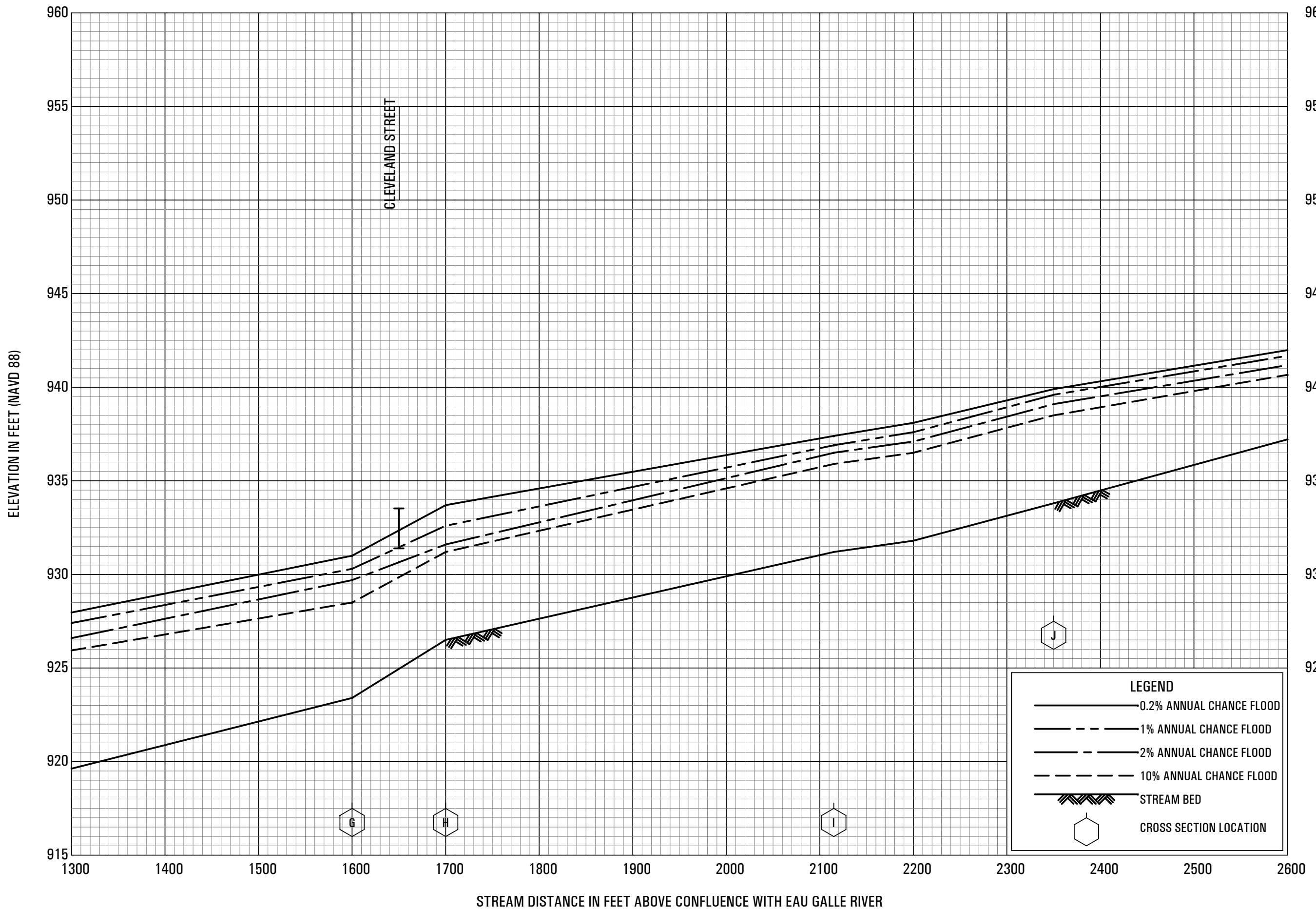


FLOOD PROFILES

BURKHART CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

**PIERCE COUNTY, WI
AND INCORPORATED AREAS**



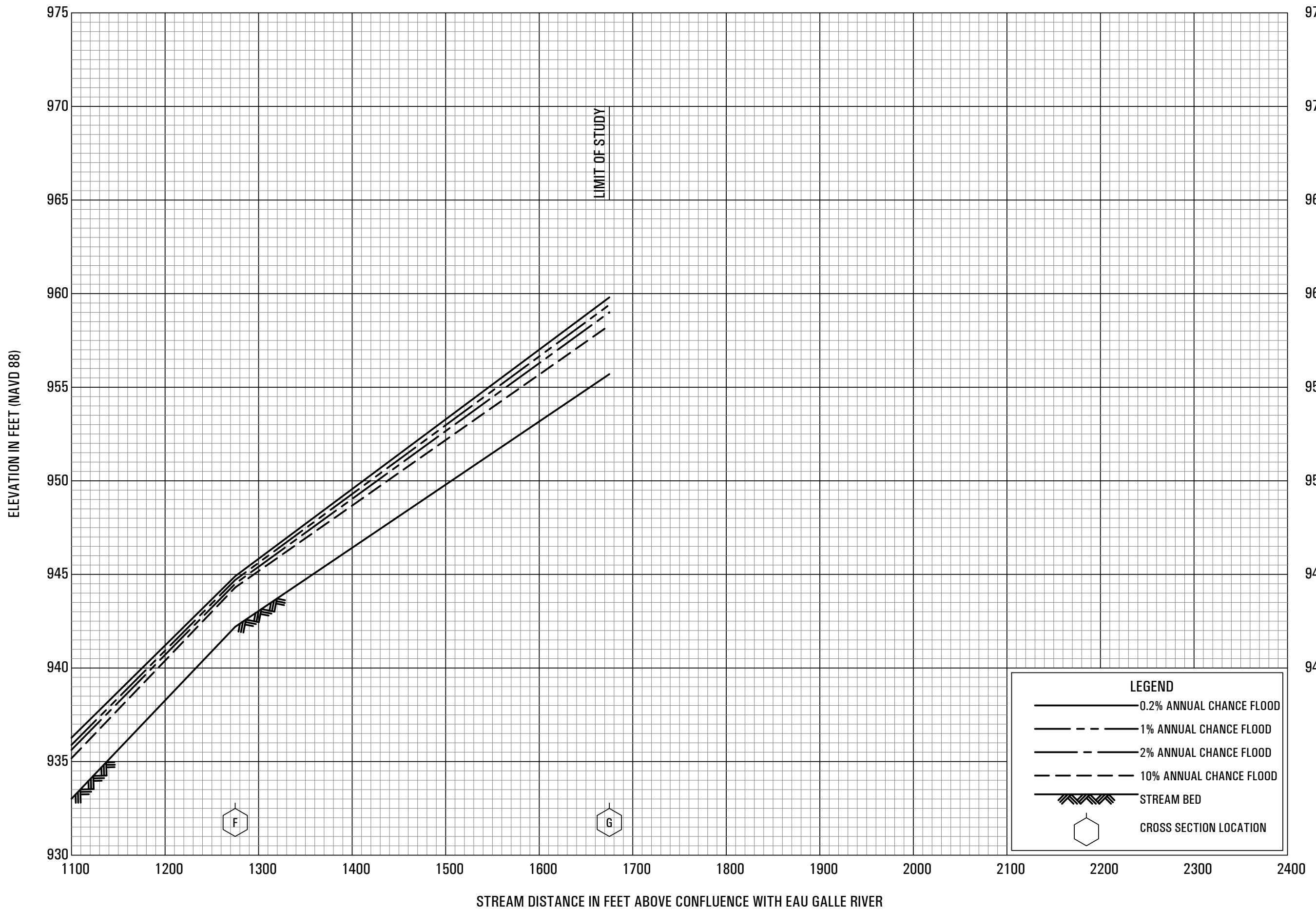
FLOOD PROFILES

BURKHART CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

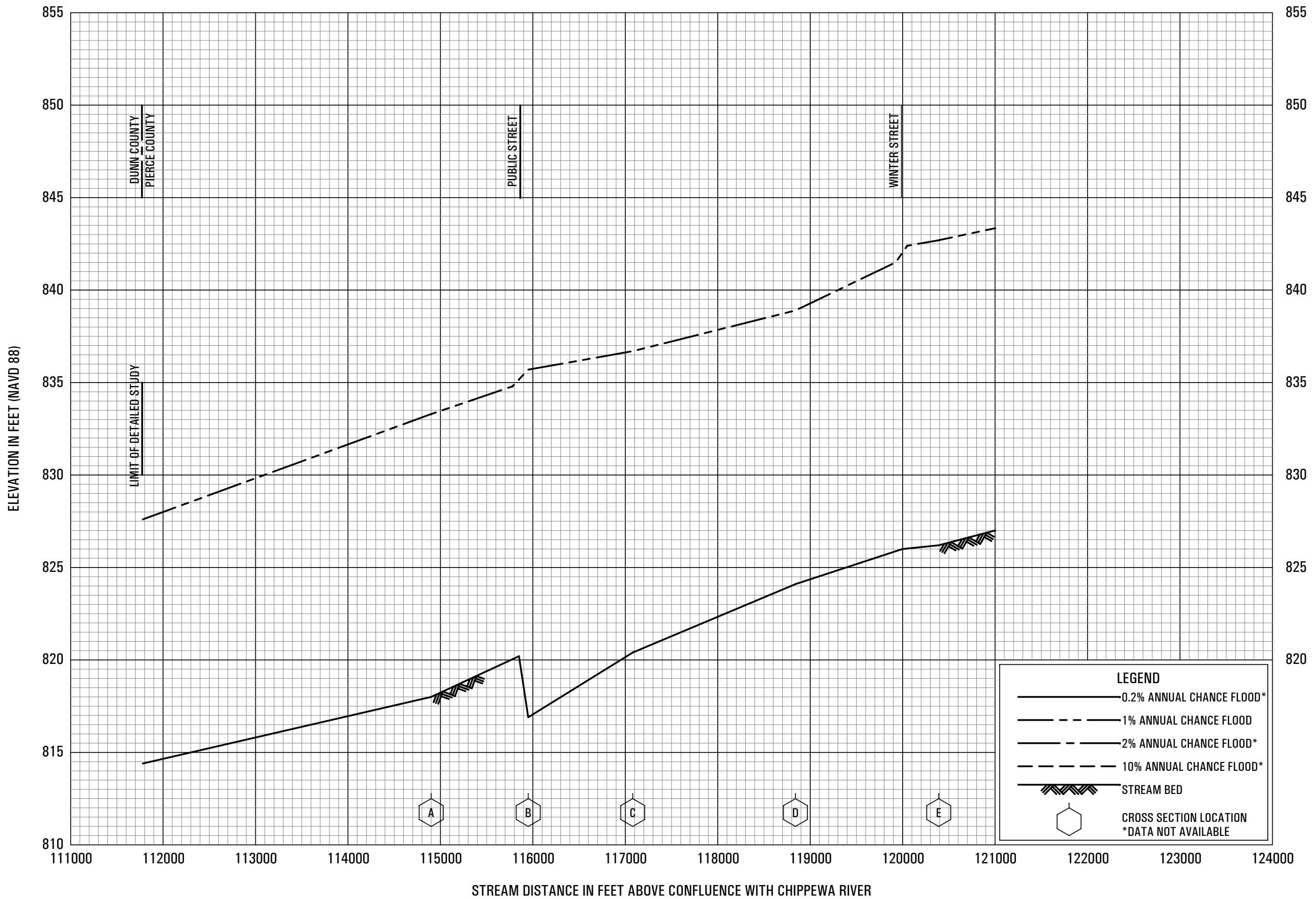
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FLOOD PROFILES
BURRO LANE TRIBUTARY

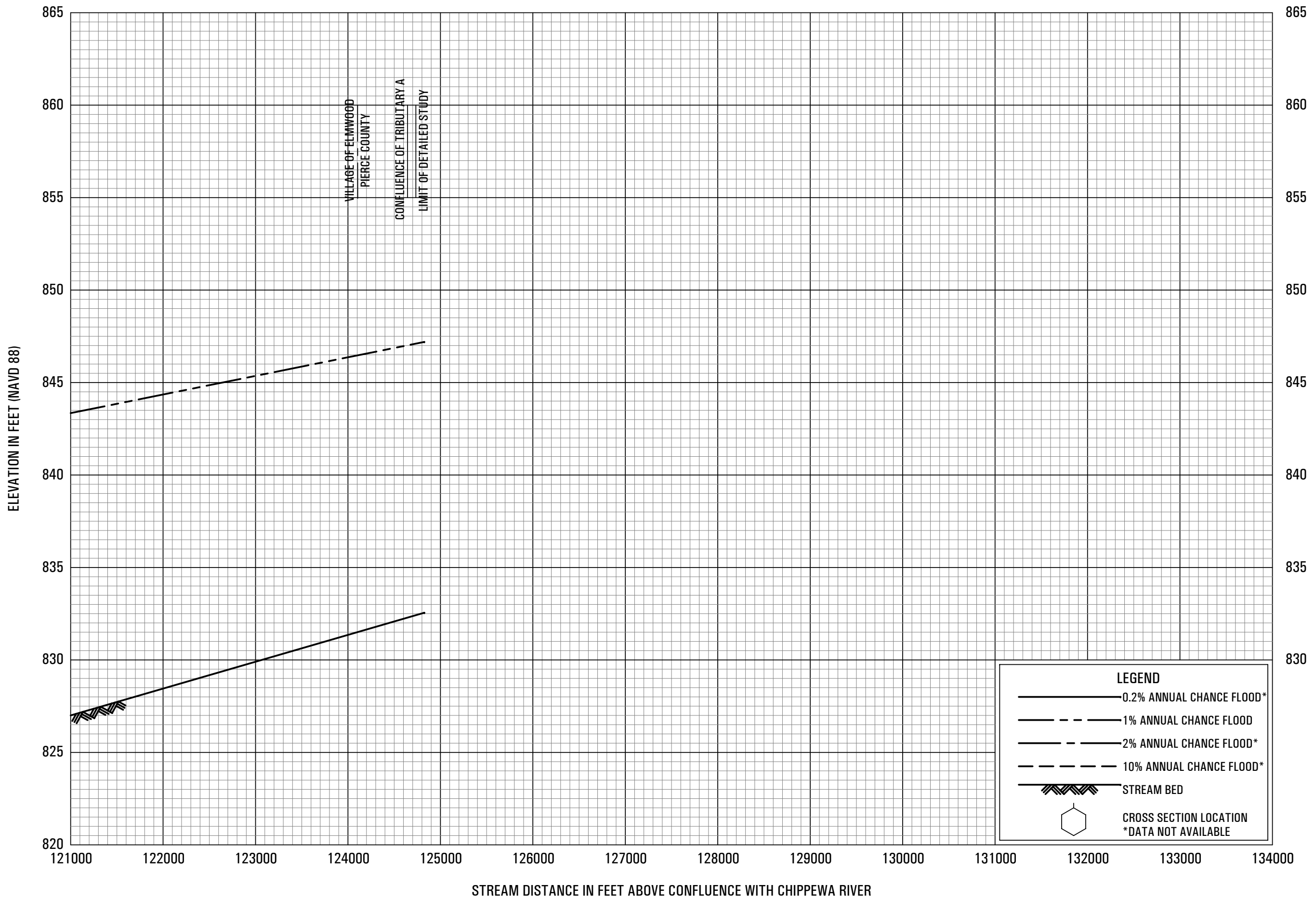
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FLOOD PROFILES

EAU GALLE RIVER

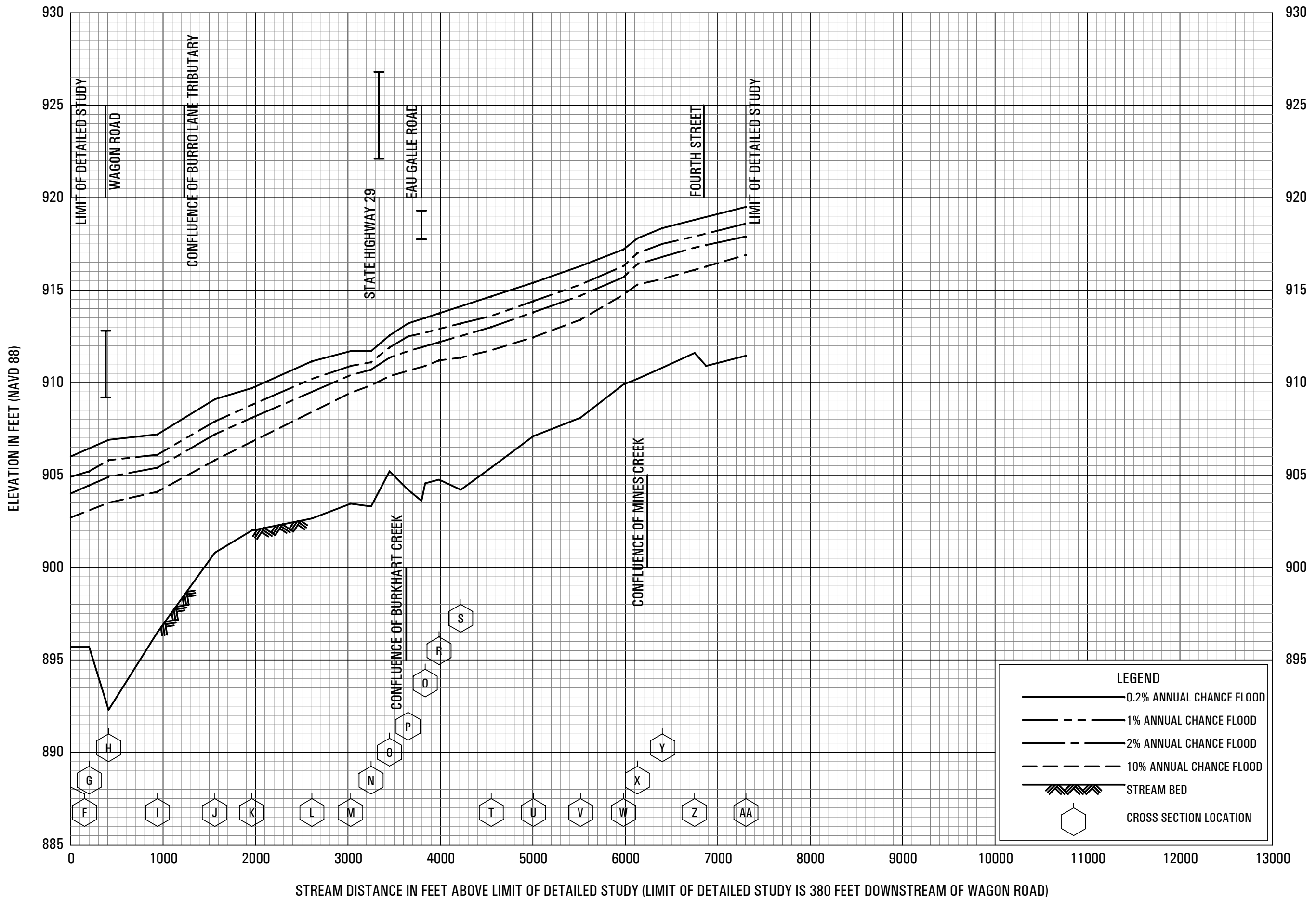
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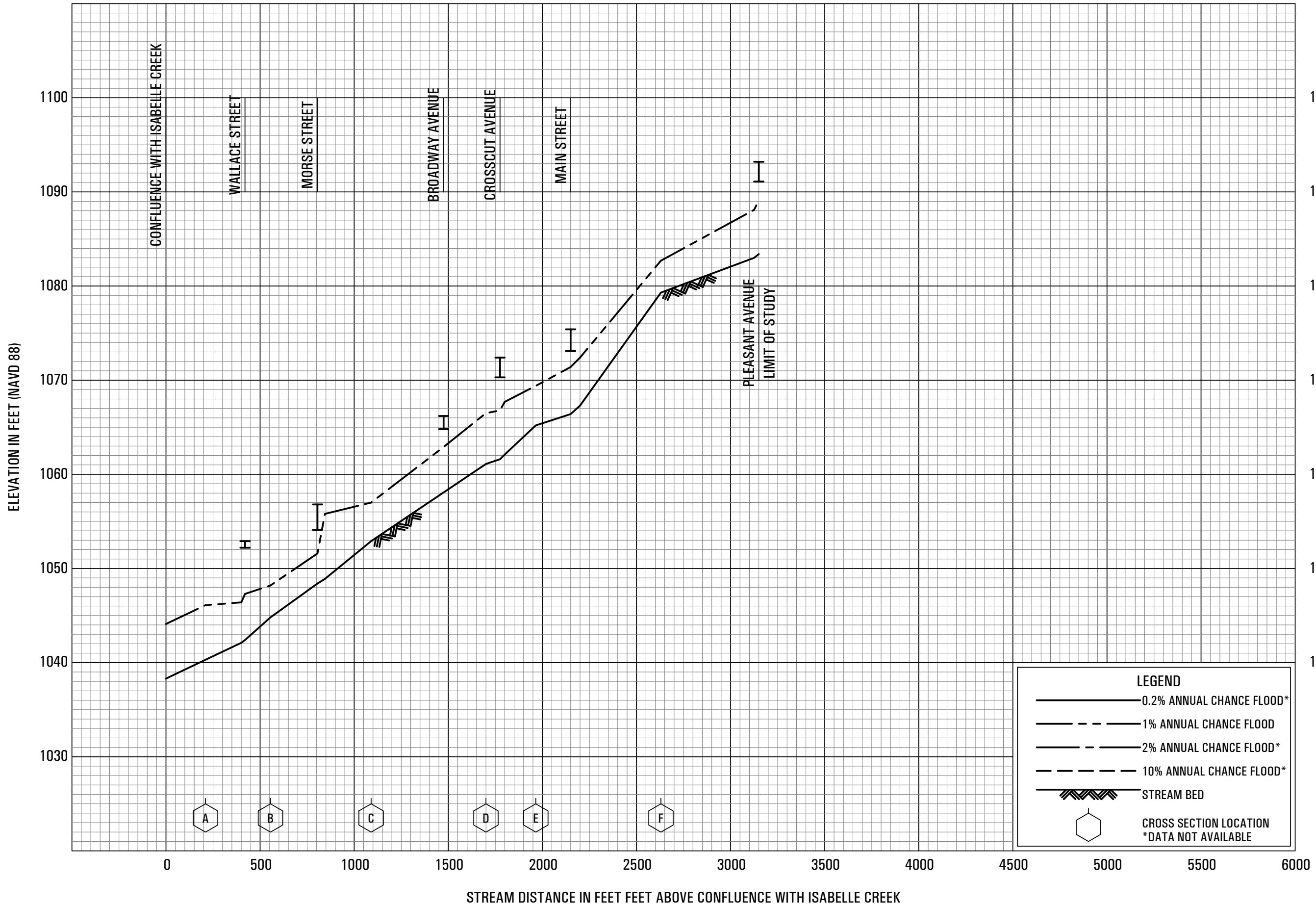
FLOOD PROFILES

EAU GALLE RIVER

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 EAU GALLE RIVER
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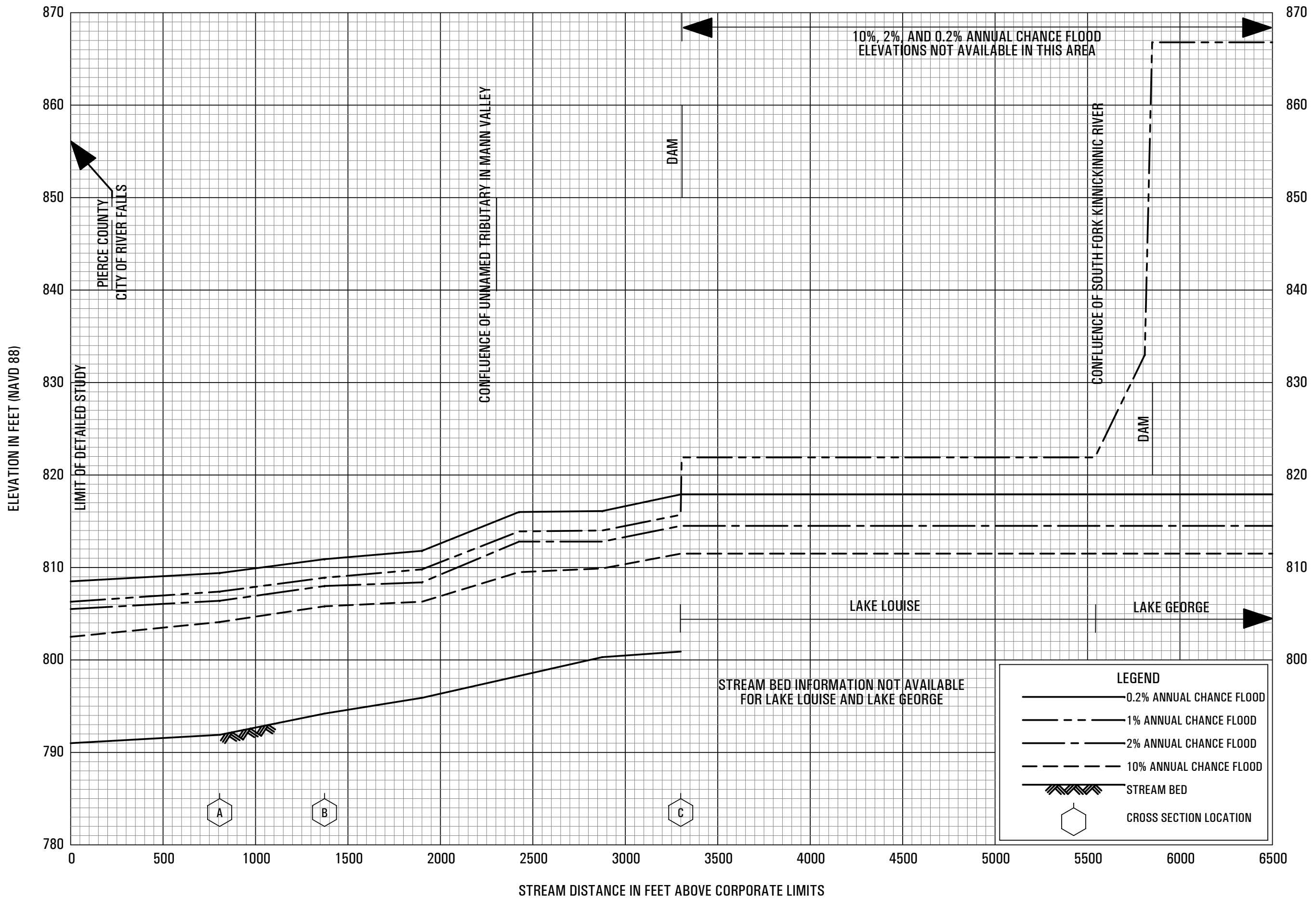


FLOOD PROFILES

ISABELLE CREEK TRIBUTARY

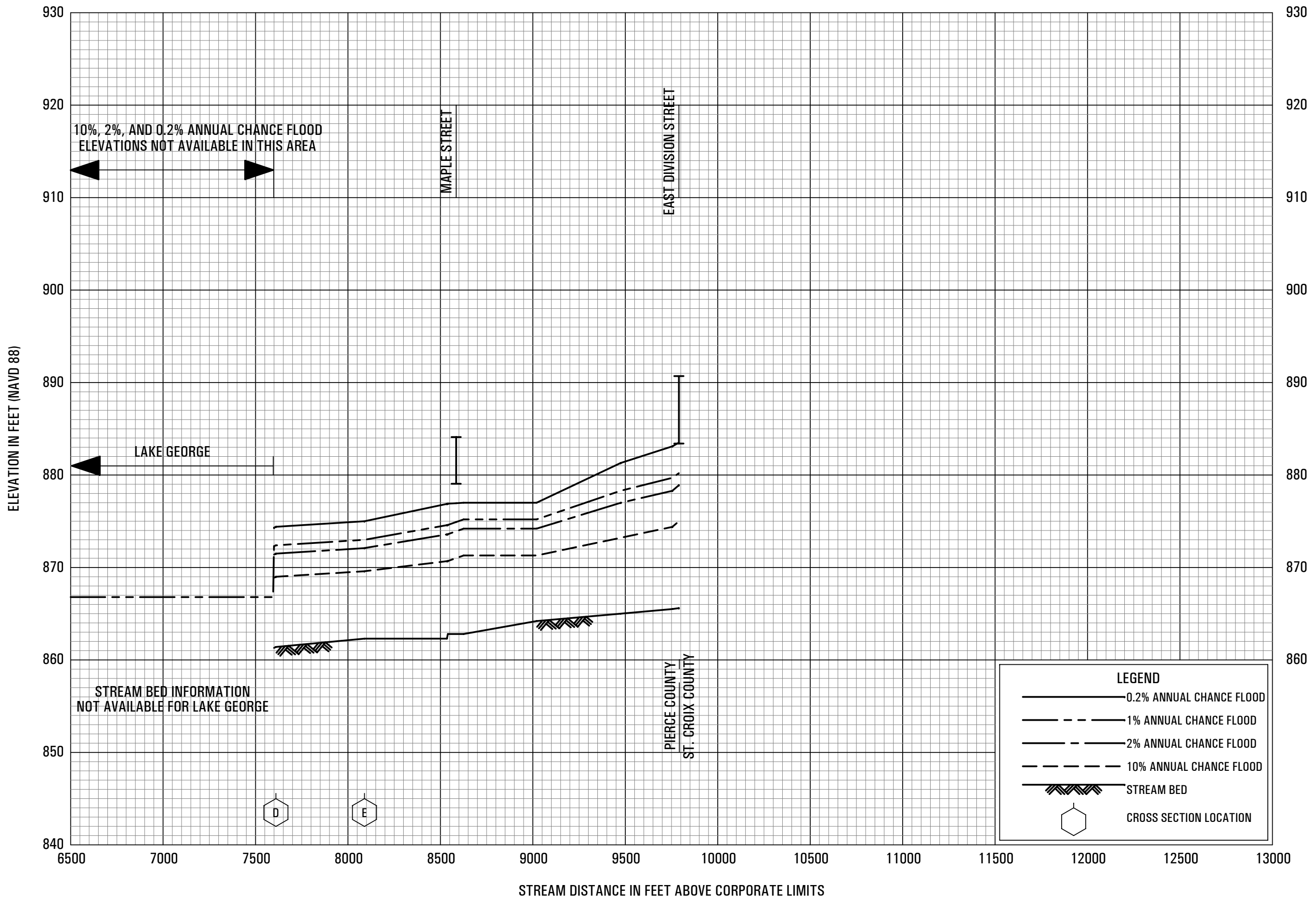
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PIERCE COUNTY, WI
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FLOOD PROFILES
KINNICKINNIC RIVER

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PIERCE COUNTY, WI
 AND INCORPORATED AREAS

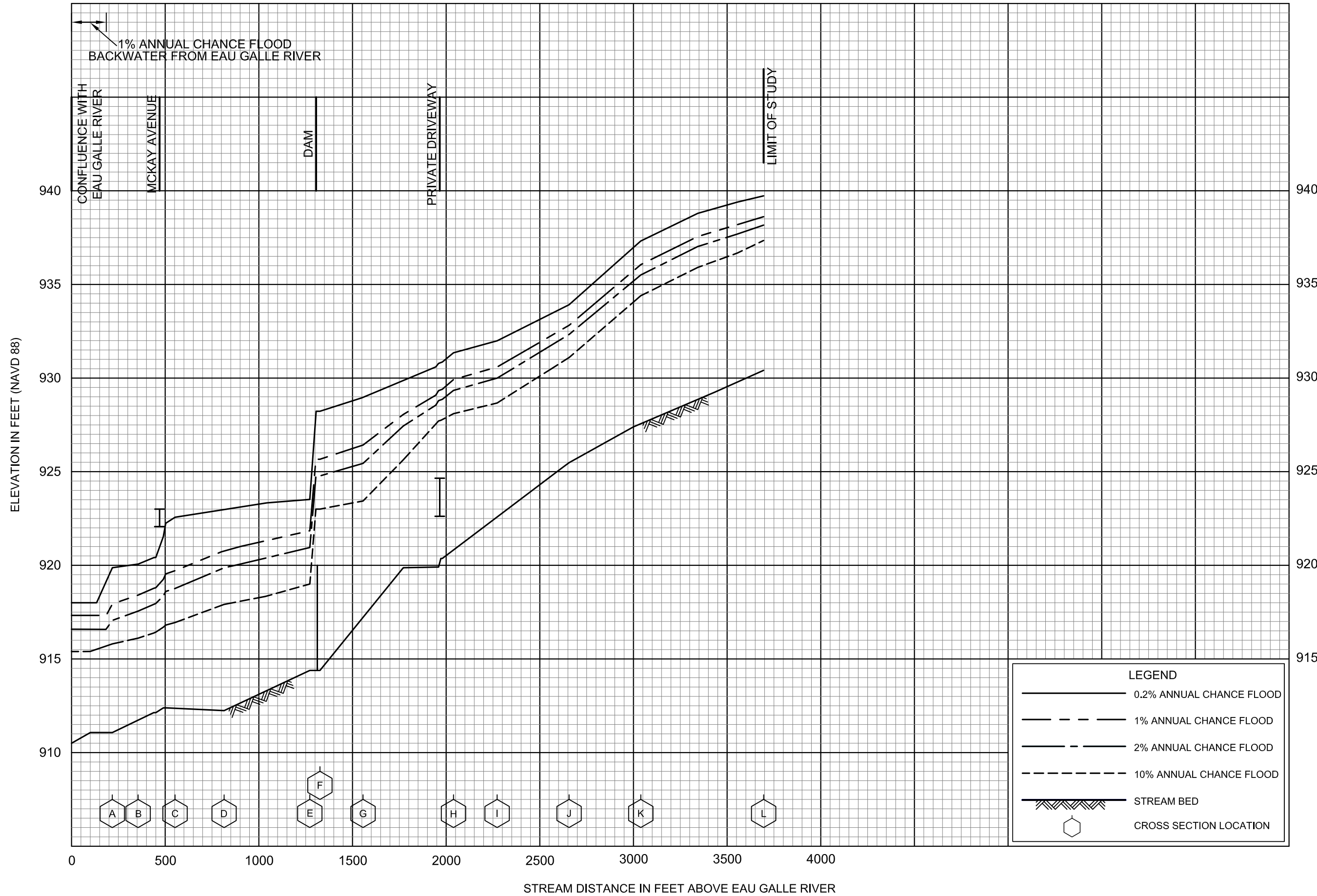


FLOOD PROFILES

KINNICKINNIC RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

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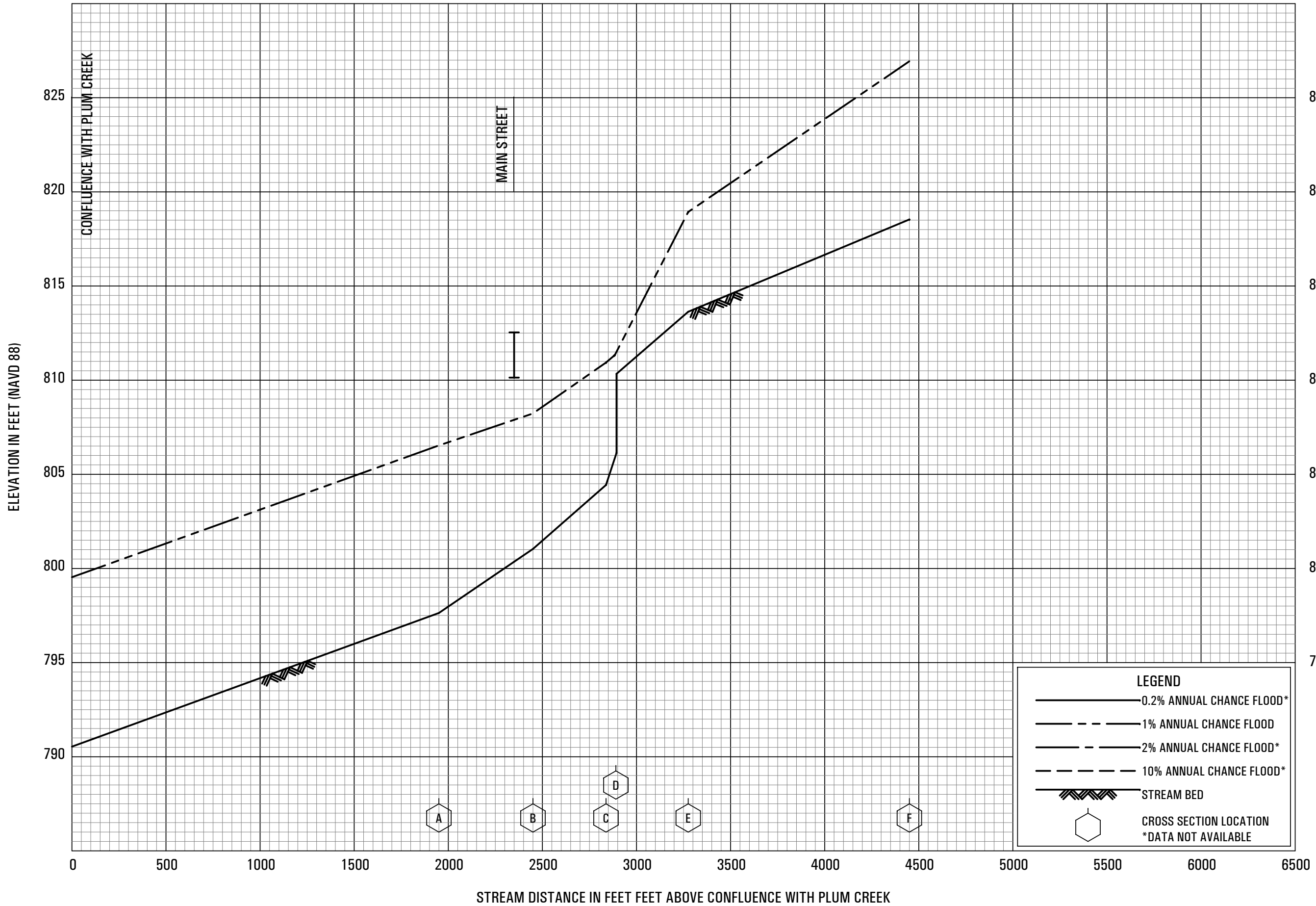


FLOOD PROFILES

MINES CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

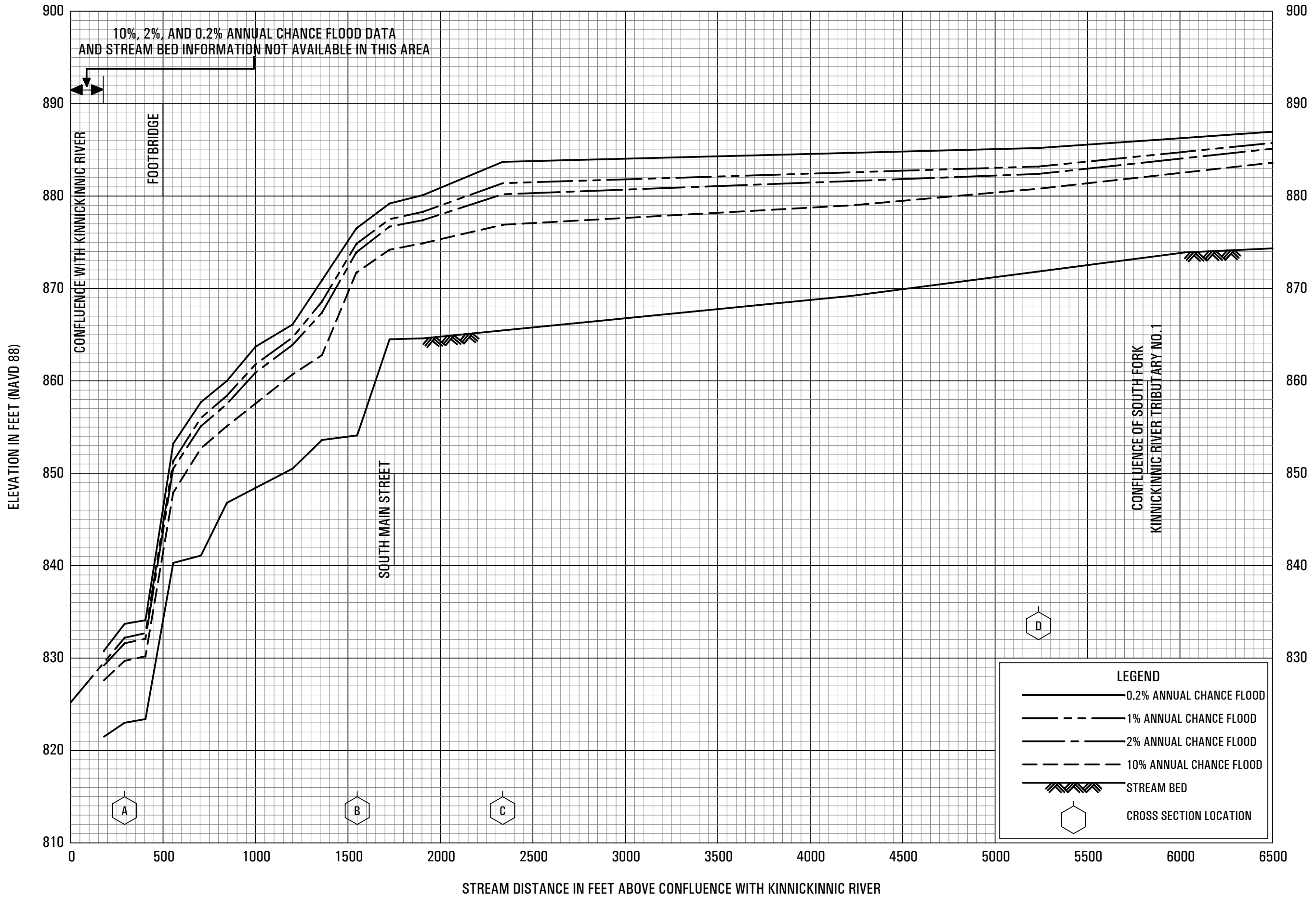
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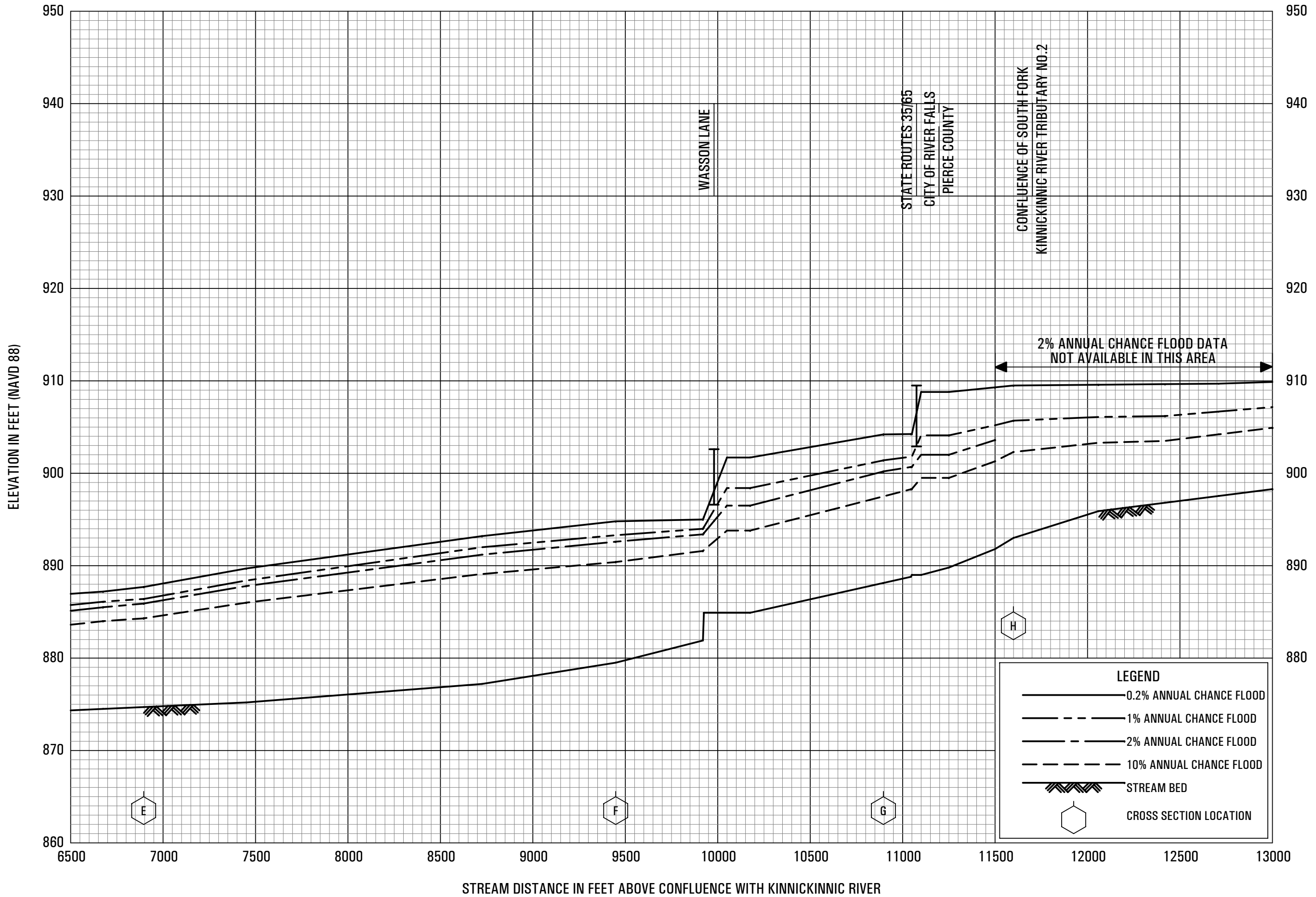


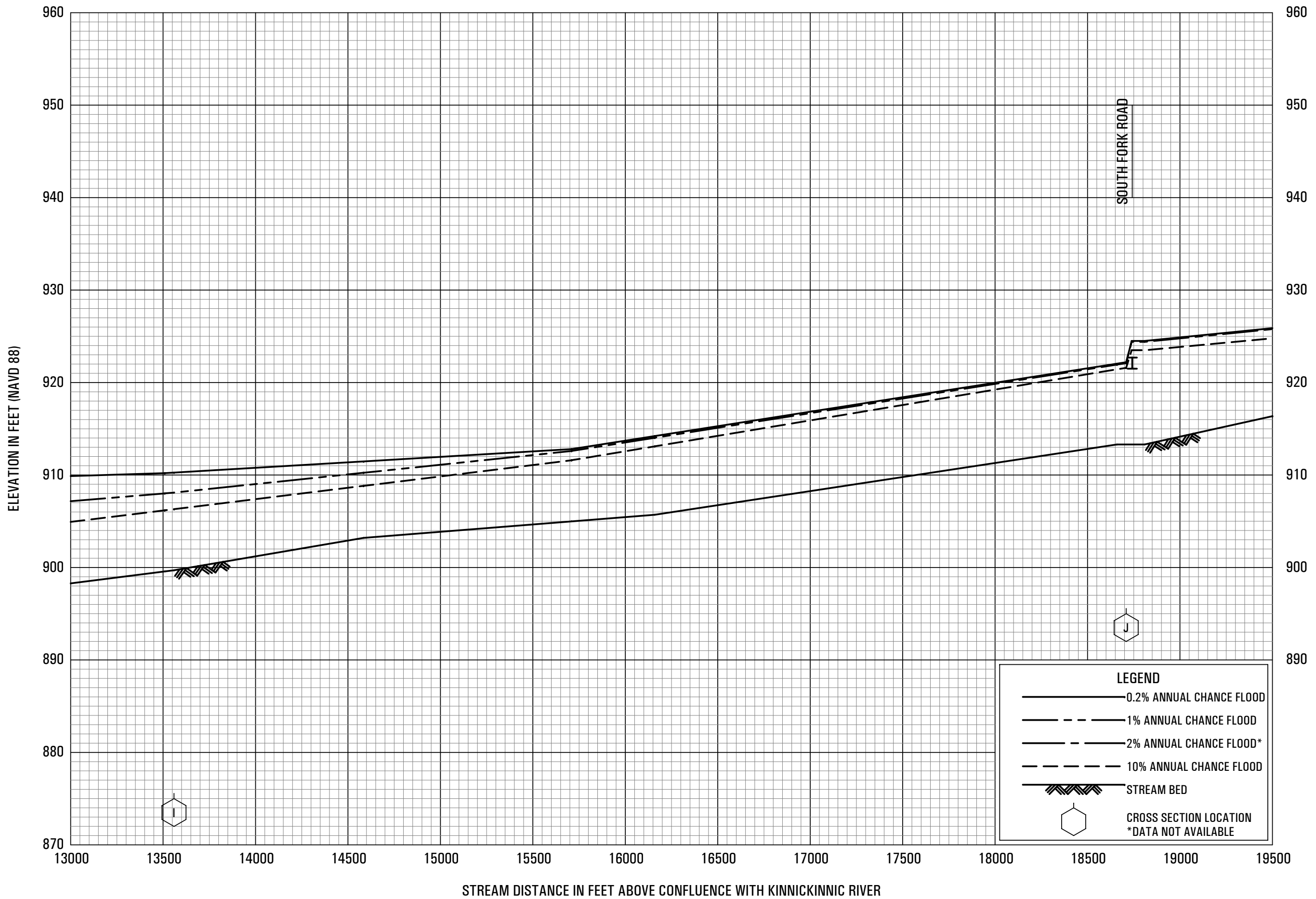
FLOOD PROFILES

RUSH COULEE

FEDERAL EMERGENCY MANAGEMENT AGENCY
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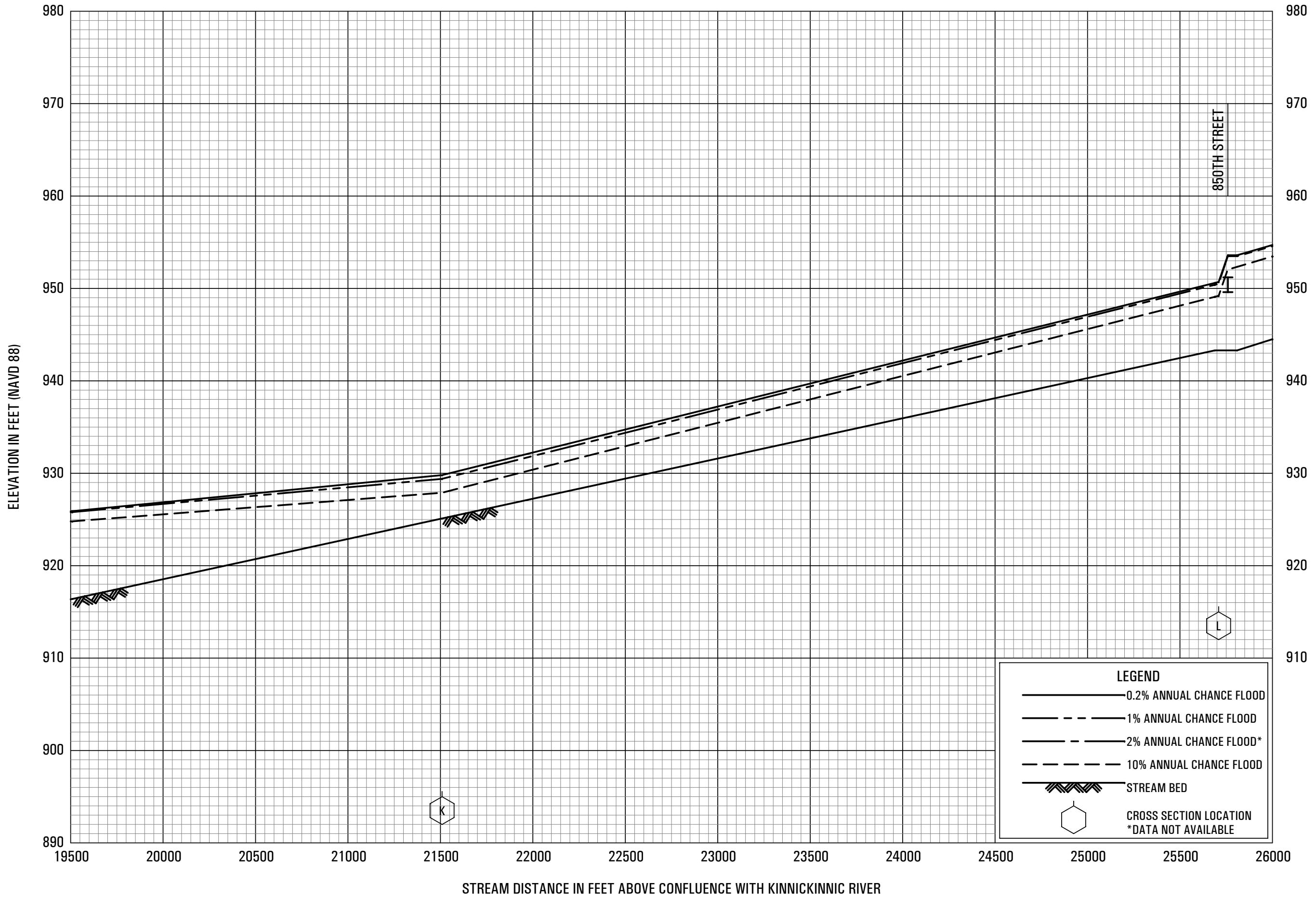




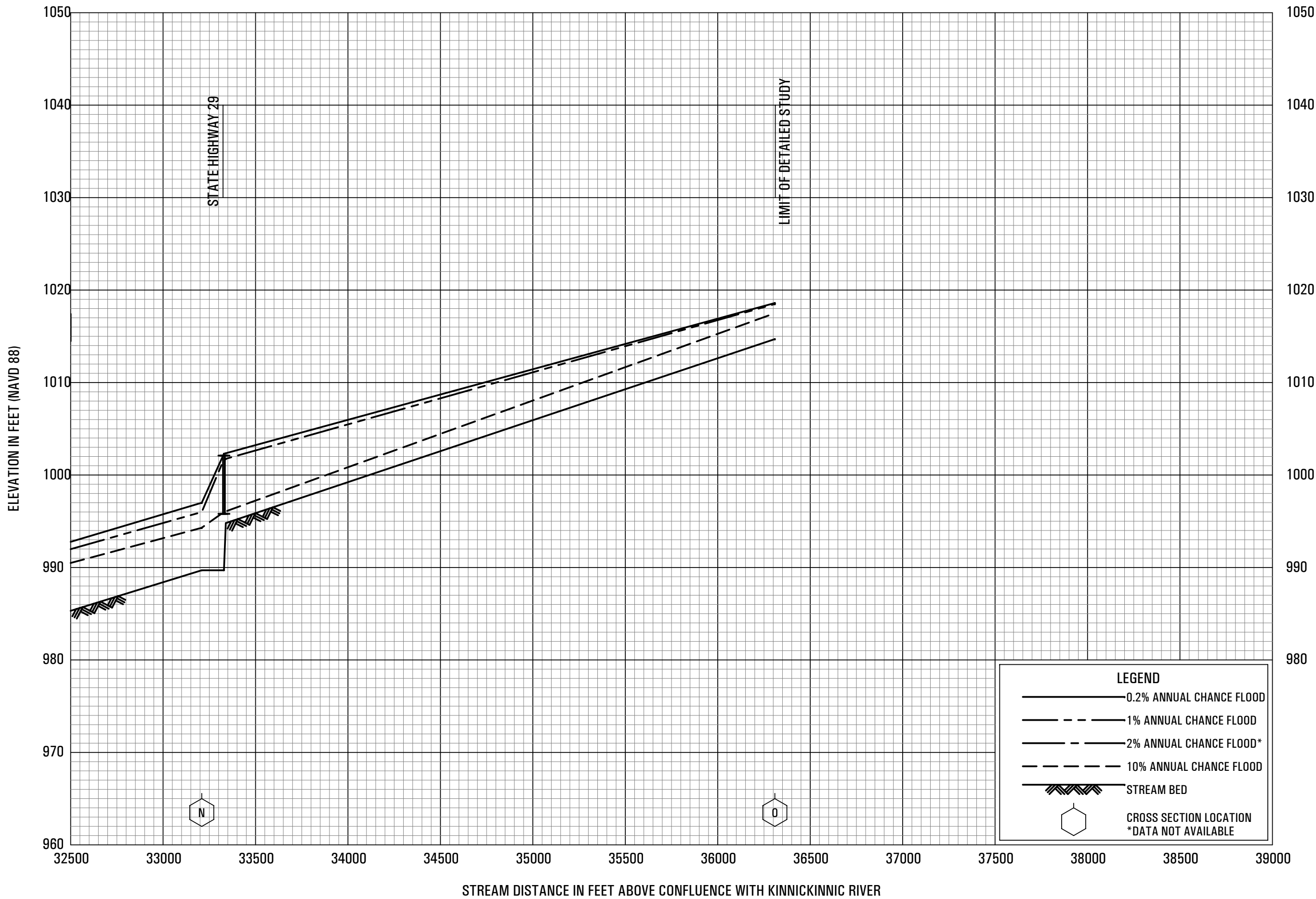
FLOOD PROFILES

SOUTH FORK KINNICKINNIC RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
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 AND INCORPORATED AREAS



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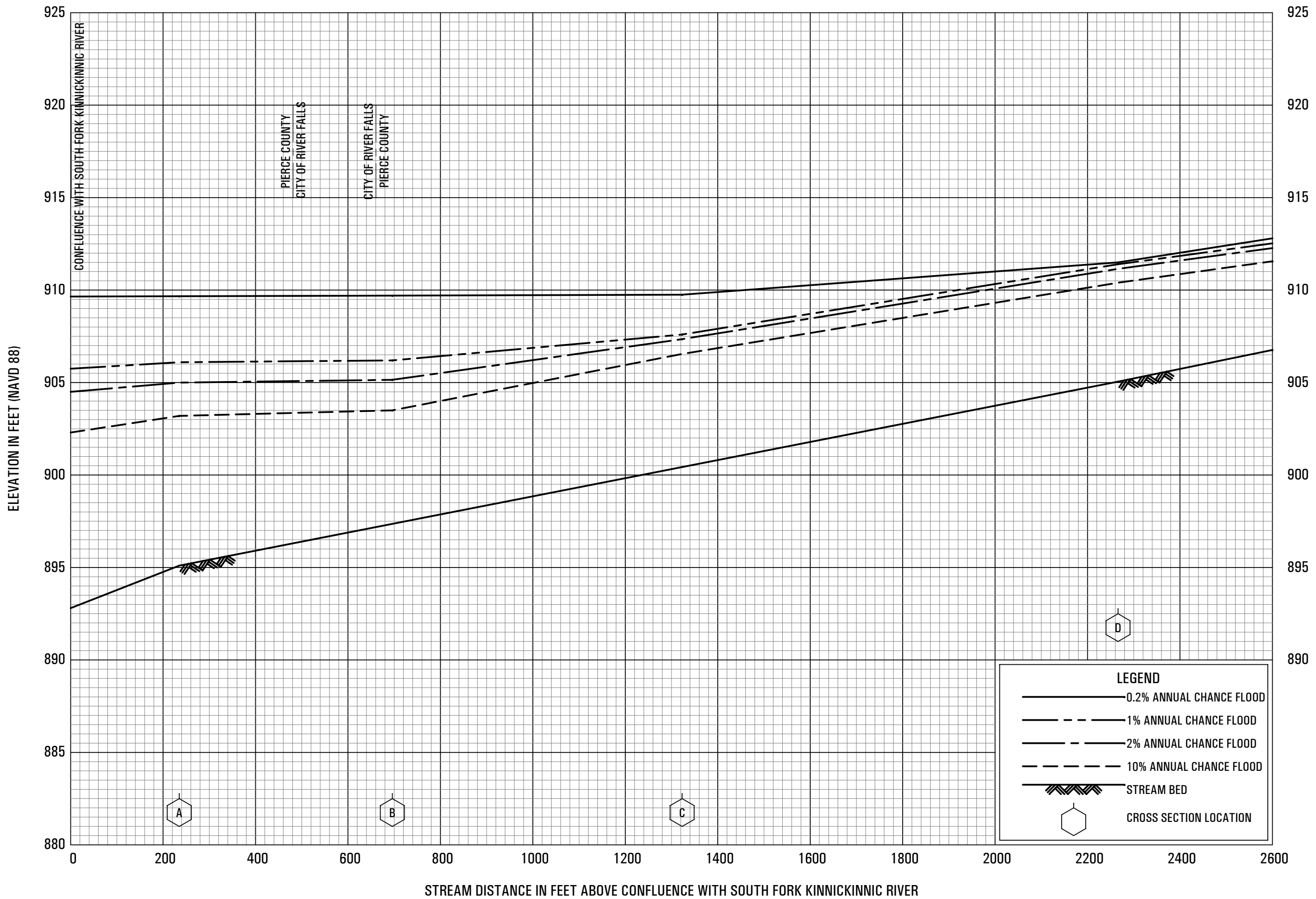


FLOOD PROFILES

SOUTH FORK KINNICKINNIC RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

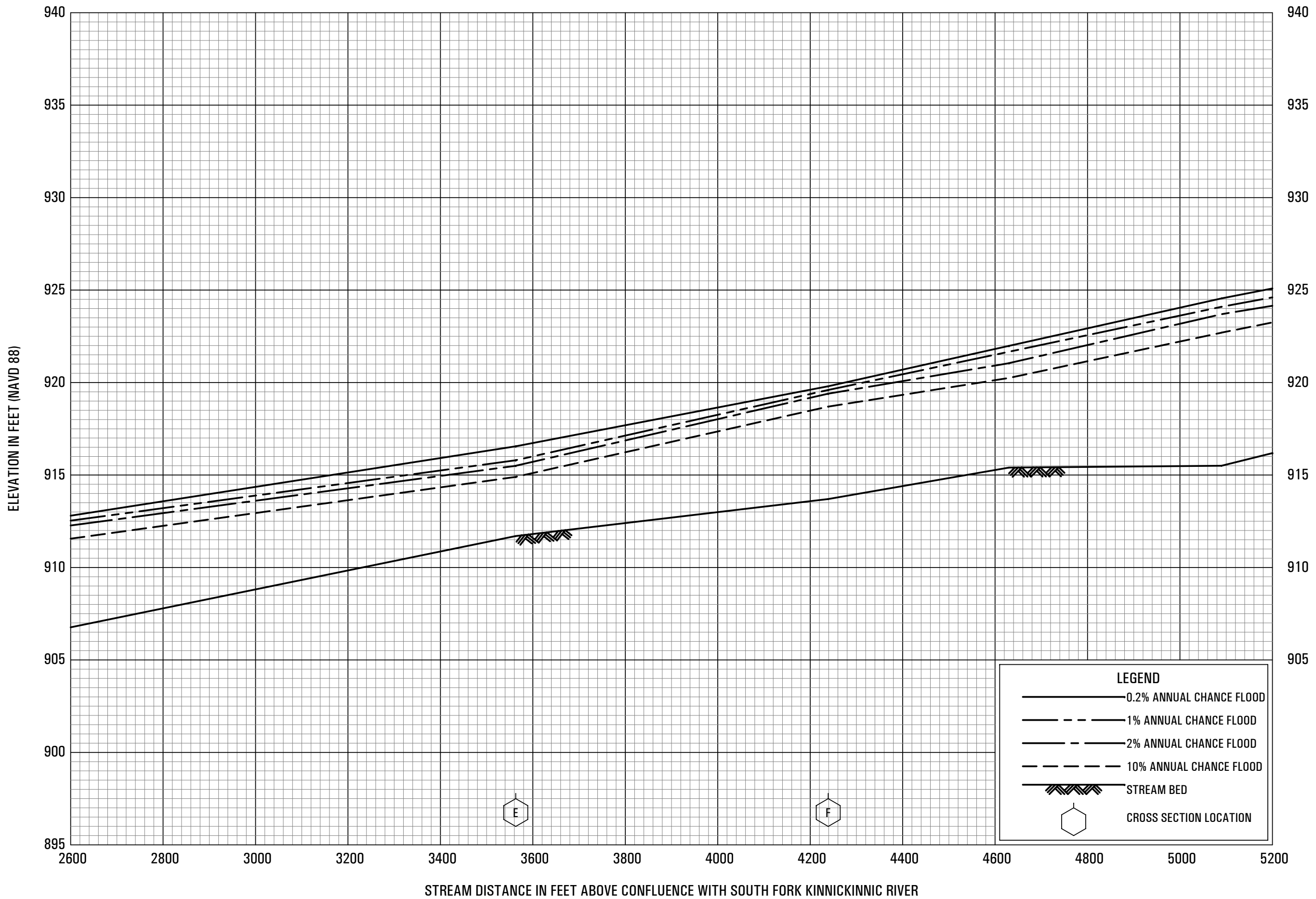
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AND INCORPORATED AREAS**



FLOOD PROFILES

SOUTH FORK KINNICKINNIC RIVER TRIBUTARY NO. 2

**FEDERAL EMERGENCY MANAGEMENT AGENCY
PIERCE COUNTY, WI
AND INCORPORATED AREAS**

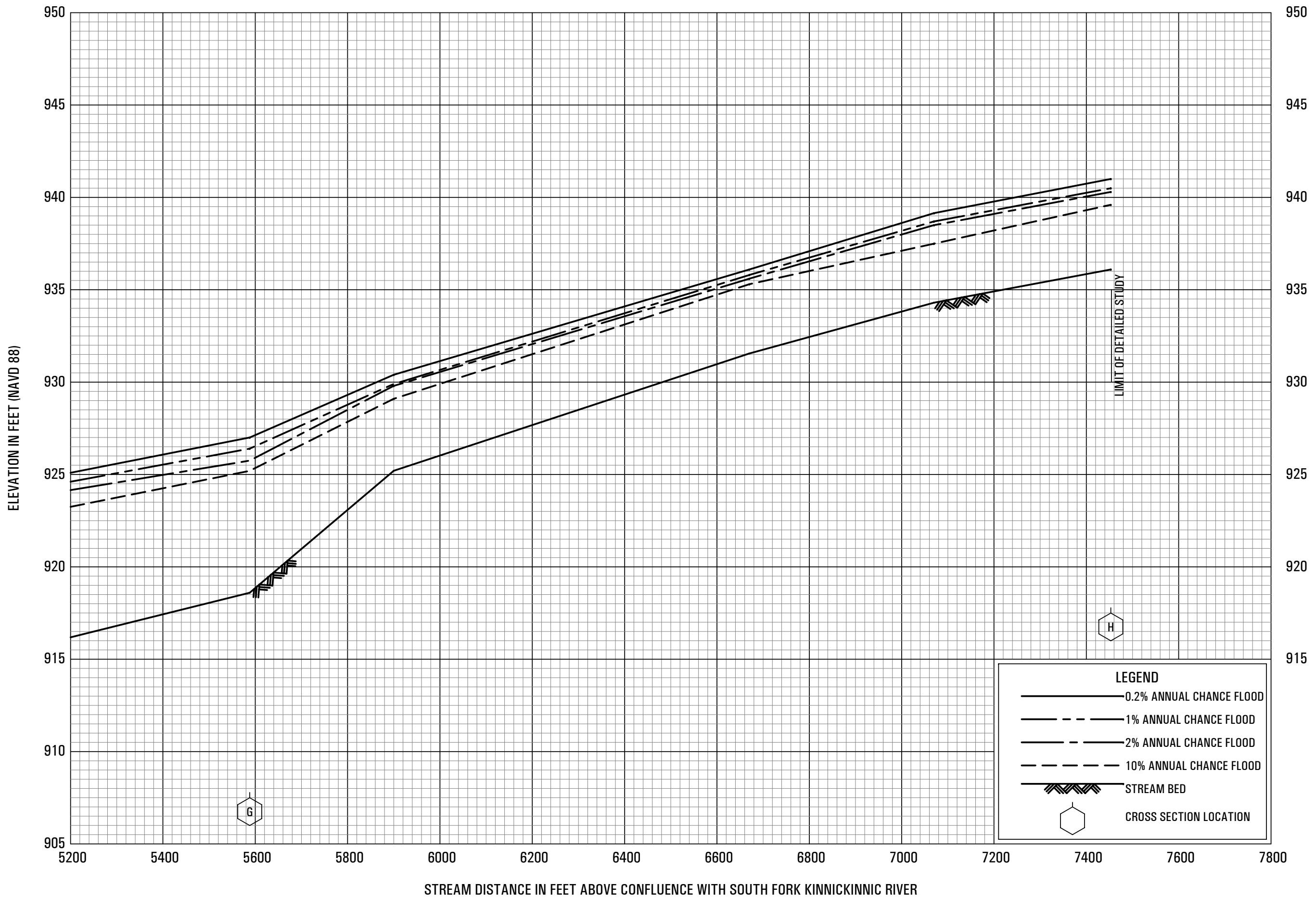


FLOOD PROFILES

SOUTH FORK KINNICKINNIC RIVER TRIBUTARY NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

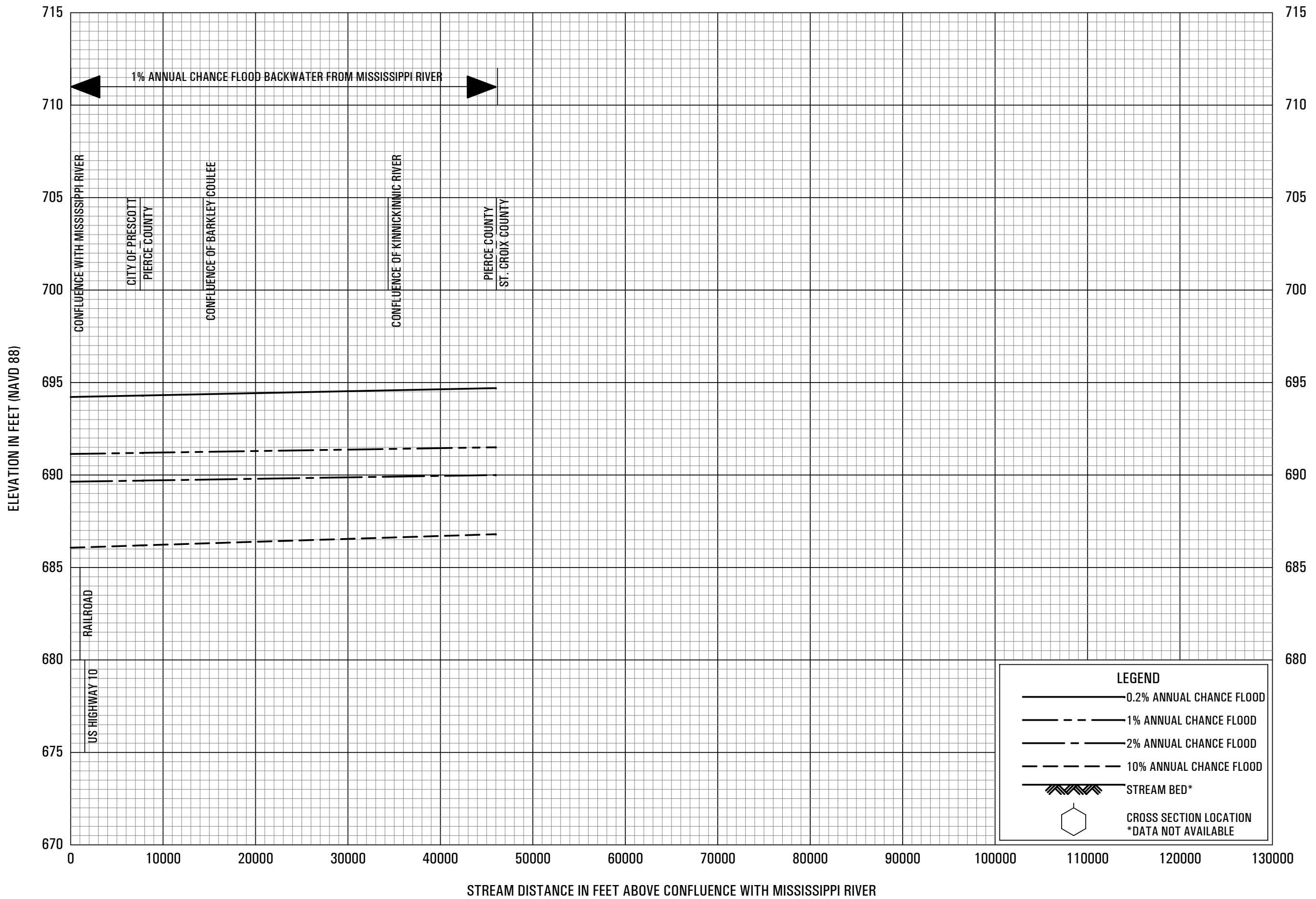
**PIERCE COUNTY, WI
AND INCORPORATED AREAS**



FLOOD PROFILES

SOUTH FORK KINNICKINNIC RIVER TRIBUTARY NO. 2

**FEDERAL EMERGENCY MANAGEMENT AGENCY
PIERCE COUNTY, WI
AND INCORPORATED AREAS**

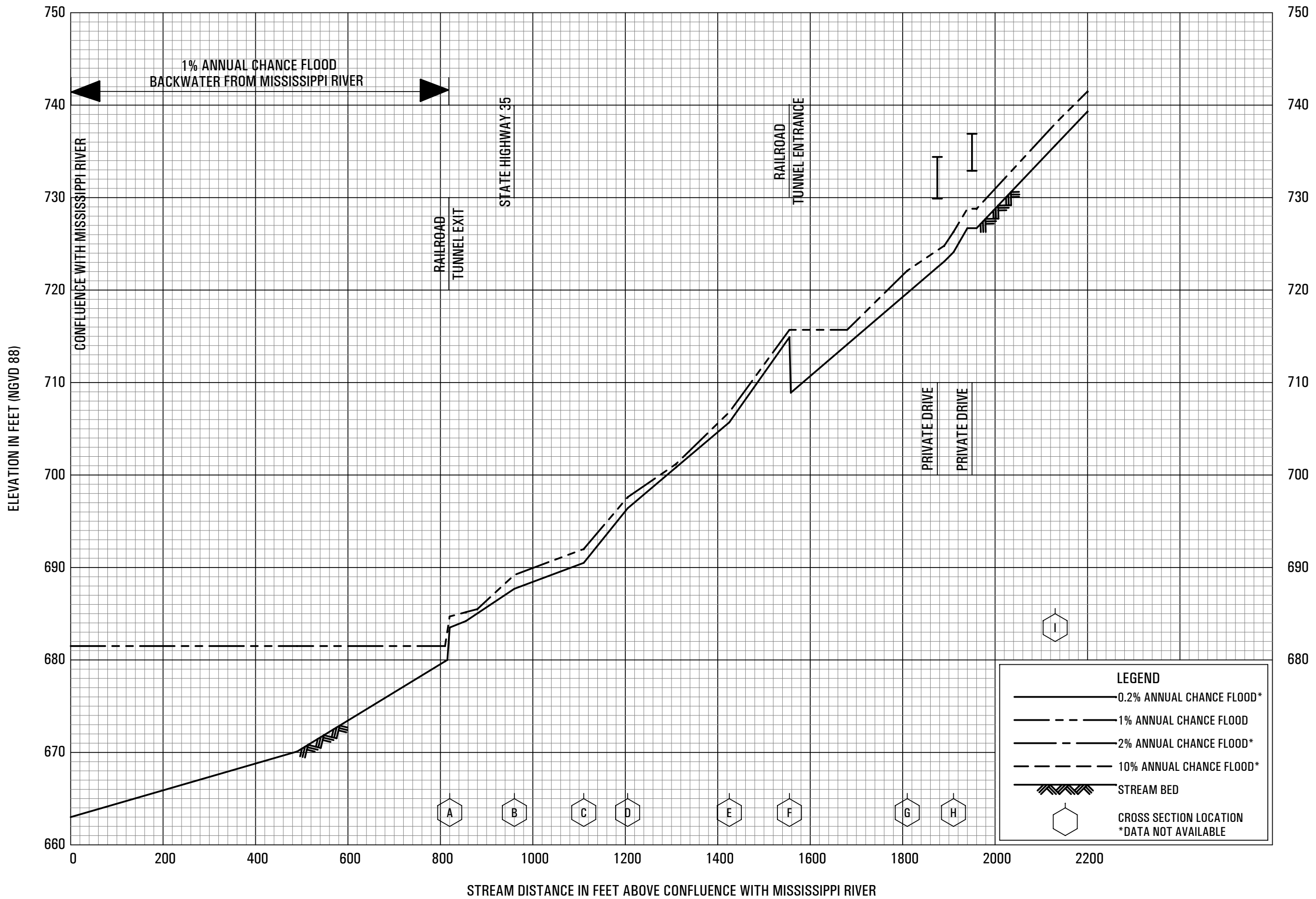


FLOOD PROFILES

ST. CROIX RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

**PIERCE COUNTY, WI
AND INCORPORATED AREAS**



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