FLOOD INSURANCE STUDY

FILLMORE COUNTY, MINNESOTA
AND INCORPORATED AREAS

Community Name	***Community Number***
*CANTON, CITY OF	270077
CHATFIELD, CITY OF	270125
FILLMORE COUNTY (UNINCORPORATED AREAS)	270124
*FOUNTAIN, CITY OF	270383
*HARMONY, CITY OF	270358
LANESBORO, CITY OF	270126
MABEL, CITY OF	270127
OSTRANDER, CITY OF	270500
PETERSON, CITY OF	270128
PRESTON, CITY OF	270129
RUSHFORD, CITY OF	270687
RUSHFORD VILLAGE, CITY OF	270131
SPRING VALLEY, CITY OF	270132
WHALAN, CITY OF	270133
*WYKOFF, CITY OF	270431

*No Special Flood Hazard Areas Identified

EFFECTIVE: August 15, 2019

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
27045CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

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

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

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

Initial Countywide FIS Effective Date: August 15, 2019

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FLOOD INSURANCE STUDY
FILLMORE COUNTY, MINNESOTA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This FIS revises and supersedes the FIS reports and/or Flood Insurance Rate Maps (FIRMs) and/or Flood Hazard Boundary Maps (FHBMs) in the geographic area of Fillmore County, Minnesota, including: the Cities of Canton, Chatfield, Fountain, Harmony, Lanesboro, Mabel, Ostrander, Peterson, Preston, Rushford, Rushford Village, Spring Valley, Whalan, and Wykoff; and the Unincorporated Areas of Fillmore County (hereinafter referred to collectively as Fillmore County) and aids the administration of National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by Fillmore County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and 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 C.F.R § 60.3.

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

Please note that the Cities of Canton, Fountain, Harmony, and Wykoff have no mapped special flood hazard areas. This does not preclude future determinations of Special Flood Hazard Areas (SFHAs) that could be necessitated by changed conditions affecting the community (i.e., annexation of new lands) or the availability of new scientific or technical data about flood hazards.

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

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

1.2 Authority and Acknowledgments

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

Precountywide Analyses

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

Chatfield, City of:	The hydrologic and hydraulic analyses for Mill Creek and the North Branch Root River for the February 2, 1982, FIS report (FEMA, 1982) were performed by Toltz, King, Duvall, Anderson, and Associates, Inc., for FEMA, under Contract No. H-4706. The work was completed in March 1981.
Lanesboro, City of:	The hydrologic and hydraulic analyses for the South Branch Root River for the March 2, 1981, FIS report were performed by Edwards and Kelcey, Inc., for the Federal Insurance Administration (FIA), under Contract No. H-4540 (FIA, 1981a). The work was completed in January 1980.
Mabel, City of:	The hydrologic and hydraulic analyses for the Riceford Creek for the September 2, 1980, FIS report (FIA, 1980a) were performed by Edwards and Kelcey, Inc., for the FIA, under Contract No. H-4540, Amendment No. 2. The work was completed in September 1979.
Peterson, City of:	The hydrologic and hydraulic analyses for the Root River for the November 5, 1980, FIS report (FIA, 1980c) were performed by Edwards and Kelcey, Inc., for FIA, under Contract No. H-4540. The work was completed in October 1979.

Preston, City of:	The hydrologic and hydraulic analyses for the South Branch Root River for the February 1, 1979, FIS report (FIA, 1979b) were performed by the U.S. Army Corps of Engineers (USACE), for the FIA, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 15. The work was completed in September 1977. The revised hydrologic and hydraulic analyses for the South Branch Root River for the November 2, 1994, FIS report (FEMA, 1994) were performed by the USACE, St. Paul District, for FEMA, under Inter-Agency Agreement No. EMW-91-E-3529, Project Order No. 4A. The work was completed in January 1993.
Spring Valley, City of:	The hydrologic and hydraulic analyses for Spring Valley Creek and its Eastern and Western Tributaries for the March 2, 1981, FIS report (FIA, 1981b) were performed by Edwards and Kelcey, Inc., for the FIA, under Contract No. H-4540, Amendment No. 2. The work was completed in October 1979.
Whalan, City of:	The hydrologic and hydraulic analyses for the Root River for the September 2, 1980, FIS report (FIA, 1980b) were performed by Edwards and Kelcey, Inc., for FIA, under Contract No. H-4540. The work was completed in October 1979.

The Cities of Canton, Fountain, Harmony, Ostrander, Rushford, Rushford Village, and Wykoff have no previously printed FIS reports.

This Countywide FIS Report

The hydrologic and hydraulic analyses for all streams studied by limited detailed and approximate methods for this study were performed by Atkins, for FEMA, under Contract No. HSFE05-05-D-0023. The work was completed in February 2008.

The interior drainage located within the City of Rushford Levee System was performed by the URS Corporation and incorporated into this countywide study by the Strategic Alliance for Risk Reduction (STARR). This study was performed under contract No. HSFEHQ-09-D-0370, Task Order HSFE05-11-J-0008.

The approximate revision for Root River Segments 1, 2, and 3 and Root River Tributary 3 was the result of an appeal submitted by the Minnesota Department of Natural Resources (MNDNR). The appeal was incorporated and resolved by STARR on April 17, 2018.

Base map information shown on the Flood Insurance Rate Map (FIRM) was derived from aerial photography produced by Image America for Fillmore County at a scale of 1:9,600, photography dated 2006 (Fillmore, 2006). The projection used in the preparation of the base map is the Universal Transverse Mercator Zone 15 North, and the horizontal datum used is the North American Datum of 1983 (NAD83), Geodetic Reference System 1980 (GRS80) spheroid.

1.3 Coordination

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

The initial and final meeting dates for previous FIS reports for Fillmore County and its communities are listed in Table 1:

Table 1: Initial and Final Meeting Dates

Community	FIS Date	Initial Meeting	Final Meeting
Chatfield, City of	February 2, 1982	May 1978	September 2, 1981
Lanesboro, City of	March 2, 1981	September 9, 1976	September 16, 1980
Mabel, City of	September 2, 1980	September 9, 1976	April 4, 1980
Peterson, City of	November 5, 1980	September 9, 1976	April 9, 1980
Preston, City of	February 1, 1979 November 2, 1994	September 9, 1976 May 20, 1991	August 8, 1978 July 8, 1993
Spring Valley, City of	March 2, 1981	September 9, 1976	September 16, 1980
Whalan, City of	September 2, 1980	September 9, 1976	April 7, 1980

For this countywide study, the initial meeting was held on August 28, 2006, and attended by representatives of the FEMA, MNDNR, Atkins and the communities.

An initial letter dated February 28, 2014, was sent to the City of Rushford to notify the city that FEMA was accepting a request for accreditation of the City of Rushford Levee System. The City of Rushford was able to provide FEMA with documentation that the levee system complies with 44. CFR, Section 65.10, therefore, per FEMA guidance, the levee system is shown as protecting from the overflow from Root River and Rush Creek.

The results of the study were reviewed at the final meeting held on April 7, 2015, and attended by representatives of the MNDNR, Atkins, and the communities. All issues and/or concerns raised at that meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Fillmore County, Minnesota, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through the time of the study.

The following streams are studied by detailed methods in this countywide FIS report in are listed in Table 2.

Table 2 - Streams Studied by Detailed Methods

Eastern Tributary	Riceford Creek	Spring Valley Creek
Mill Creek	Root River	Western Tributary
North Branch Root River	South Branch Root River	

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

For this countywide study, the portion of Mill Creek from County Highway 2 to the Fillmore/Olmsted County Boundary was restudied.

The areas studied by limited detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction. The streams studied by limited detailed methods are listed in Table 3.

Table 3 - Streams Studied by Limited Detailed Methods

Stream	Reach Description
Rush Creek	From confluence with Root River to the Fillmore/Olmsted County boundary

Ferndale Creek, South Fork Root River, and Unnamed Tributary to Riceford Creek were incorporated in this study based on the water surface elevations (WSEL) from the Houston County, Minnesota FIRM. The Iowa River was incorporated based on the WSEL from Mower County, Minnesota FIRM. Money Creek, Pine Creek, Unnamed Tributaries and Unnamed Tributary to Pine Creek were incorporated in this study based on the WSELs from the Winona County, Minnesota FIRM.

The City of Rushford Levee System was adjusted from Provisionally Accredited to Accredited which incorporates interior drainage behind the levee.

The approximate SFHA boundary was revised for Root River Segments 1, 2, and Root River Tributary.

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

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

Letters of Map Change (LOMCs) incorporated into this countywide study are listed in Table 4:

Table 4 – Incorporated LOMCs

LOMC	Case Number	Date Issued	Project Identifier
LOMR*	07-05-0877P	07/25/2007	Secluded Land – Whalan

*Letter of Map Revision (LOMR)

2.2 Community Description

Fillmore County is located in southeastern Minnesota, approximately 20 miles southeast of Rochester, Minnesota. The Minnesota counties that border Fillmore are Olmsted and Winona Counties to the north, Mower County to the west, and Houston County to the east. Winneshiek and Howard Counties, Iowa border Fillmore County to the south. The total area contained within the county is approximately 862 square miles. According to the U.S. Census Bureau, the 2010 population estimate for Fillmore County was 20, 866 (U.S. Census Bureau, 2010).

The climate in southeastern Minnesota is classified as continental, characterized by wide variations in temperature, little winter precipitation, and normally ample summer rainfall. The average winter temperature is 26.8 degrees Fahrenheit (°F) and the average summer temperature is 80.8°F (World Climate, 2015). The average rainfall for the county is 28.5 inches per year with higher amounts occurring in the spring and summer then in the remainder of the year (World Climate, 2015).

The Root River, its tributaries and many small intermittent streams in narrow valleys have steep rocky bluffs along their entire course. The Root River drains an area of approximately 1,660 square miles in six southeastern Minnesota counties. The watershed is approximately 77 miles long with a maximum width of 34 miles. There is little natural available floodwater storage in the basin, although numerous Soil Conservation Service (SCS) retention ponds have been built on area farms. Whiles these ponds provide temporary floodwater storage, their relatively small size would not significantly reduce peak discharge on the Root River during a 1-percent-annual-chance flood or larger flood frequency event.

The South Branch Root River, which flows generally in the southern portion of the City of Preston, has a drainage area at Preston of approximately 188 square miles. The river flows in a narrow, well-defined channel having a relatively flat slope. Its soils can be mostly characterized as alluvial land. Most of the soils in this association are medium textured and well to moderately well drained (SCS, 1958).

Drainage throughout most of the Riceford Creek watershed is well defined. Natural floodwater storage is not available to retard peak flows.

The floodplains in Fillmore County vary from being undeveloped farmland to commercial and residential areas. The land within cities of Preston and Whalan is agricultural land, with few restricted developed areas. The cities of Chatfield, Lanesboro, Mabel, Preston, Peterson and Spring Valley are developed and serve as a commercial center for the surrounding agricultural region. There is considerable development within the floodplain in these cities.

2.3 Principal Flood Problems

The history of flooding of the streams of Fillmore County indicates flooding occurs during spring and early summer as a result of heavy rain and snowmelt.

Low lying areas in the City of Preston are subject to periodic overflow from the South Branch Root River. Major floods have occurred in 1881, 1911, 1942, 1950, and 1965. Reliable information is available only for the floods of 1950 and 1965, when discharges were 18,900 and 7,000 cubic feet per second (cfs), respectively, with frequencies of approximate 0.5- and 14.3-percent-annual-chance.

The Root River valley is subjected to at least one flood, and quite frequently two or more floods, each year. Flood flows in the basin are characterized by a very rapid rise, short duration, and an almost as rapid subsidence. Spring floods occur regularly during the latter part of March of the early part of April, generally due to a combination of melting snow and rainfall. Floods due to snowmelt have also occurred during the months of January and February. Ice jams, which occur frequently during these winter and spring floods, can also create additional problems at highway and railway crossings. However, the ice effects generally occur during lower frequency floods and therefore, would have little pronounced effect on the 1-percent-annual-chance flood or larger return frequency events. Summer and early fall floods, because of their relatively greater damaging effects on agriculture, are generally the most serious; however, the do not occur as regularly as spring floods (USACE, 1975).

The largest flood on record for Root River was on June 2, 2000, at the City of Rushford with peak discharges of 32,400 cfs. This flooding also affected the Cities of Lanesboro and Houston.

Historical flood peaks and their estimated recurrence intervals for Root River are presented in Table 5:

Table 5 – Historical Flood Peaks

Date	Root River Near Lanesboro Peak Discharges (cfs)	Root River Near Lanesboro Estimate Recurrence Interval (% Annual Chance)	Root River Near Houston Peak Discharges (cfs)	Root River Near Houston Estimate Recurrence Interval (% Annual Chance)
March 1933	*	*	26,600	10.0
March 1950	20,500	9.1	26,200	10.0
April 1952	20,400	9.1	37,000	3.3
March 1961	19,500	10.0	31,400	5.5
March 1962	22,000	7.1	29,500	7.1
April 1965	19,000	11.1	31,000	5.9
June 1974	17,500	*	19,800	*
April 1993	14,300	*	15,800	*
June 2000	23,000	*	34,600	*

*Data not available

The April 1965 spring flooding event caused over $5.6 million in damages in the Root River basin and created severe social, health, and safety problems. The June 2000 flood summer flooding caused over $3 million dollars in damages in the Root River basin.

The flood of record for Spring Valley Creek in the City of Spring Valley occurred on June 28, 1942. Floodwaters inundated much of the lower portion of the downtown district. Another recorded event was a severe flood on June 15, 1982. No estimate of frequency of return was made for these events due to the lack of stream gage data.

The Riceford Creek watershed has flooded twice during the 1970's due to snowmelt and spring rainfall. During June 1978, the City of Mabel recorded over 11 inches of rain. On July 5, 1978, the City of Mabel and the surrounding area received an additional 5.1 inches of rain causing Riceford Creek to overflow its banks. In June 1973, approximately 7 inches of rain caused Riceford Creek to overflow again. Both of these flooding events reported minimum damage to the surrounding areas. No estimates of the frequency of return for these floods were made.

2.4 Flood Protection Measures

The City of Rushford Levee System provides certified 1-percent-annual-chance flood protection from overflow from Rush Creek and Root River.

A levee system is located along South Branch Root River and Root River. Please refer to the corresponding Flood Insurance Rate Map panels for the protection status of this levee system. A levee system is located in the City of Preston along the South Branch Root River. This levee is not accredited but is providing a reduced risk for land that is above the Base Flood Elevations.

In 1966, the St. Paul Street Bridge was replaced within Preston. At that time the channel was widened in a reach approximately 100 feet upstream to 400 feet downstream to aid the conveyance of the floodwaters.

A dike parallel to Parkway Avenue in the City of Lanesboro was originally built in the 1800's. For many years spring floods would overtop the dike and flood the park. Subsequently, the dike was renovated in the early 1930's. The flood of record for the City of Lanesboro occurred in March 1950 and is known to have overtopped the dike at that time. Shortly thereafter, the dike was raised two feet to its present elevation.

A dike in the City of Whalan, parallels the northwest bank of the Root River in the vicinity of New Street and 1st Avenue. The dike is well vegetated, and prevents the primary flood flows and their accompanying high velocities from reaching this portion of town. However, it does not prevent the backwater flooding that occurs in this area. A berm can also be found to parallel the northeast bank of the Root River upstream of the Main Street bridge.

3.0 ENGINEERING METHODS

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

3.1 Hydrologic Analyses

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

Precountywide Analyses

The hydrologic analysis of the Root River basin including the Root River through the Cities of Peterson, Lanesboro and Whalan and Riceford Creek in the City of Mabel is based upon stream gage records obtained from varying locations in drainage area and geographic location. In addition to stream gage data for the Root River and its main branches, crest gages have been installed on several of the smaller tributaries. This data has been analyzed by the U.S. Geological Survey (USGS) and the USACE using techniques consistent with procedures outlined in the Water Resources Council (WRC) Bulletin No. 17 to obtain discharge-frequency curves for each of the gage locations (WRC, 1976). Administrative agreements were reached for the values of the 1-percent-annual-chance flood discharges at the major gage sites and the community locations.

A drainage area-discharge curve for the 1-percent-annual-chance flood recurrence interval was developed by the USGS for the Root River basin. This curve yields a discharge-drainage area relationship using and exponent of 0.55. Using the frequency analysis information for gages within the Root River basin, a similar relationship was constructed for the 10, 2, and 0.2-percent-annual-chance flood recurrence intervals to provide a family of drainage-area frequency-discharge curves for the Root River basin. Although it is generally not recommended to span their regional relationship over such a wide range of drainage areas, independent analyses by the USGS have found that the results expressed by the transfer relationship are acceptable on the lower drainage are locations.

Discharge frequencies were developed for South Branch Root River downstream of the City of Preston. The adopted frequency curve was based on results of three methods: general relations; rain runoff; and the USGS regression equations. An adopted curve was drawn that reflects the results of these three methods with more weight given to the general relations method.

The general relations method involves a regional analysis of five gaging stations representing hydrologically similar drainage areas. A general relationship of discharge versus drainage area on a log-log plot was used to determine the adopted frequency values for South Branch Root River at Preston. The discharge-frequency values for each of the five gaging stations were determined by applying the log-Pearson Type III statistical analysis as per the WRC Bulletin No. 17B and the USACE Hydrologic Engineering Center's (HEC) computer program "Flood Flow Frequency Analysis" (WRC, 1982, and HEC, 1982). The resulting 10-, 2-, 1-, and 0.2-percent-annual-chance flooding events were plotted versus drainage area on a log-log plot. The five gaging station locations and the gaging station drainage areas used in the analysis are listed in Table 6

Table 6: Gaging Station Locations and Drainage Area

Gaging Station Location	Drainage Area (sq. miles)
Root River near Houston (Gage Number 05385000)	1,270
Root River near Lanesboro (Gage Number 05384000)	615
South Branch Root River near Lanesboro (Gage Number 05384120)	297
South Fork Root River (Gage Number 05385500)	275
Root River below South Fork (Gage Number 05386000)	1,560

Data for the South Branch Root River near the City of Lanesboro gage was supplemented with data from a USACE gaging station No. R043-8 (USACE, no date).

The USGS regression equations were based on the Water Resources Investigation Report 87-4170 (USGS, 1988). The 0.2-percent-annual-chance flood event for the regression model was estimated from the log-probability plot of the 50-, 20-, 10-, 4-, 2-, and 1-percent-annual-chance flood events that the regression equations determined. The rainfall-runoff analysis was based on the USACE May 1975 study, using the HEC-1 computer program (HEC, 1990).

The hydrology of Spring Valley Creek, Eastern Tributary and Western Tributary were analyzed using the SCS TR-20 hydrologic runoff model (SCS, 1965), as no gage data exists. Field inspections of the watershed, aerial photographs (Mark Hurd Aerial Surveys, Inc., 1978), and USGS topographic maps (USGS, 1965b) were used to determine required input data. The 6-hour, 24-hour, and 10-day storms were applied to the watershed to determine the critical runoff event. National Weather Service (NWS) Technical Papers No. 40 and No. 49 were used to determine rainfall amounts for particular storm duration and recurrence intervals (NWS, 1961 and 1964). The 24-hour rainfall event was critical for the 10-, 2-, and 1-percent-annual-chance flood recurrence intervals, while the 6-hour storm was slightly higher for the 0.2-percent-annual-chance flood event.

For Mill Creek and North Branch Root River, the flow-frequency relationship was determined by use of the SCS hydrology computer program TR-20 (SCS, 1965). Watershed areas and slopes were obtained from USGS topographic maps for Chatfield and surrounding areas at a scale of 1:24,000, with a contour interval of 20 feet (USGS, 1972). Rating curves for structures and cross sections were obtained from field data and through manual calculations. Design rainfall depths were obtained from NWS Technical Paper No. 40 (NWS, 1961).

A crest-stage gage is located approximately 3.4 miles upstream from the City of Chatfield on Mill Creek. The flow frequency relationship for this gage was determined by the USGS by fitting a log-Pearson Type III frequency distribution to 14 observed annual peaks from the USGS gaging station No. 07040008 with a period of record from 1962 to 1981. The results of their analysis (USGS, 1977) were used to calibrate the computer model that was developed for the entire watershed.

This Countywide FIS Report

No new hydrologic analyses were performed for the revised portion of Mill Creek, from County Highway 2 to the Fillmore/Olmsted County boundary, and the approximate reaches for Root River Segments 1, 2, and 3 and Root River Tributary 3.

Peak discharge-drainage area relationships for each flooding source studied in detail are shown in Table 7.

Table 7 - Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
EASTERN TRIBUTARY					
Approximately 80 feet upstream of County Highway 1/East Main Street	1.2	200	265	310	440
MILL CREEK					
At confluence with North Branch Root River	30.0	4,660	*	10,260	*
RICEFORD CREEK					
At State Highway 44	12.8	2,080	3,330	4,100	5,400
ROOT RIVER					
At Mill Street	900.0	22,500	36,200	44,800	59,200
Approximately 400 feet downstream of confluence of Gribben Creek	920.0	21,600	34,800	43,600	56,800
SOUTH BRANCH ROOT RIVER					
At County Highway 8	297.0	11,600	18,700	23,200	30,500

* Data not available

Table 7 - Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (square miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
SOUTH BRANCH ROOT RIVER (continued)					
Just downstream of confluence of Camp Creek	217.0	8,700	14,400	17,300	24,000
Just upstream of confluence of Camp Creek	188.0	8,100	13,300	15,800	22,100
SPRING VALLEY CREEK					
Approximately 3,600 feet downstream of U.S. Highway 16	16.4	2,320	3,580	4,430	6,220
WESTERN TRIBUTARY					
At confluence with Spring Valley Creek	1.3	270	440	500	680

The interior drainage analyses for the City of Rushford Levee System was modeled using USACEs, Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS), computer program (Barr, 2013). The precipitation events used in the HEC-HMS model were updated using the precipitation depths in the National Oceanic and Atmospheric Administration’s (NOAA’s) Atlas 14 rainfall charts for the City of Rushford. In 2008, the USACE developed updated hydrologic analysis for Root River and Rush Creek following the August 2007 flood event (USACE, 2008). The study followed general guidelines for discharge-frequency analyses within “Guidelines and Specifications for Study Contractors” for flood studies dated April 2003. The methodology used was also in accordance with Bulletin No 17B, “Guidelines for Determining Flood Flow Frequency,” of the Interagency Advisory Committee on Water Data, dated march 1982 and current Corps Engineers criteria (USACE, 2008).

Stillwater elevations for the interior drainage in Fillmore County are shown in Table 8.

Table 8 - Summary of Stillwater Elevations

Flooding Source	Water Surface Elevations (Feet NAVD[1]) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Interior Drainage Ponding Area No. 1	*	*	731.3	*
Interior Drainage Ponding Area No. 2	*	*	725.0	*
Interior Drainage Ponding Area No. 3	*	*	725.4	*

[1] North American Vertical Datum of 1988
*Data not available

Peak discharges for all limited detailed and approximate studied streams were estimated by the published USGS regional regression equations (USGS, 1988). The following equation was used to estimate the 1-perecnt annual chance flood flows (David L. Lorenz. et al., 1997).

$$Q_{100} = 94.9DA^{0.725}SL^{0.505}$$

Where:

DA = drainage area (square miles)
SL = channel slope (ft/mile)

3.2 Hydraulic Analyses

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

Precountywide Analyses

Stream cross section data for Mill Creek and North Branch Root River were obtained by field survey. Some of the data on the overbank sections were obtained from USGS topographic maps (USGS, 1972). All bridges and dams were surveyed in detail to obtain elevation data and structural geometry.

Channel cross sections for South Branch Root River at Preston were obtained from aerial photography (Mark Hurd Aerial Surveys, Inc., 1974). Bridge data were obtained, in part, from aerial photographs and, in part, from the Minnesota Department of Transportation drawings (MNDOT, 1975). The bridge data were revised to reflect the replaced bridges.

The rest of the stream channel alignments and geometry were obtained by photogrammetric and stadia field methods in April 1978 (Mark Hurd Aerial Surveys, Inc., 1978). Cross sections for the backwater analyses were field surveyed and were located at close intervals above and below bridges in order to compute significant backwater effects in the developing area. Additional survey and cross sections data was obtained by the USACE (USACE, 1968b).

At Preston, WSELs of floods of the selected recurrence intervals were computed for South Branch Root River using the USACE HEC-2 step-backwater computer program (HEC, 1984). Starting WSELs were based on an elevation versus discharge rating curve developed from the existing HEC-2 cross section data.

At Lanesboro, WSELs of floods of the selected recurrence intervals were computed for South Branch Root River using a normal depth analysis for the cross section located downstream of the city limits. A critical depth analysis at the dam was used to determine starting WSELs above the dam. WSELs profiles for the various frequency floods on the South Branch Root River were computed using the USACE HEC-2 step-backwater program (HEC, 1973).

Water surface profiles for the various frequency floods on the Root River, Riceford Creek, Spring Valley Creek, Eastern, and Western Tributaries were computed using the USACE HEC-2 step-backwater computer program (HEC, 1973). A critical depth analysis was used to determine the WSELs on Root River above the dam in the City of Lanesboro.

WSELs for Mill Creek, from the confluence with North Branch Root River to County Highway 2, and North Branch Root River for the 10- and 1- percent-annual-chance flood recurrence intervals were computed through the use of the USACE HEC-2 step-backwater computer program (HEC, 1976). The initial downstream WSELs for the various discharges were obtained using the slope-area method of the HEC-2 program.

Starting WSELs for Eastern and Western Tributaries were obtained from the Spring Valley Creek profile. For the remainder of the streams, the starting WSELs were determined using a normal depth analysis at their downstream cross sections.

This Countywide FIS Report

For Mill Creek, from County Highway 2 to the Fillmore/Olmsted County boundary, stream cross section data for was obtained from a previous flood study completed in 1998 for Mill Creek by the Polaris Group (Polaris, 1998). Starting WSELs were computed using the HEC-RAS version 3.1.3 (HEC, 2005) computer model.

The shaded Zone X (areas protected by levees) for the interior drainage within the City of Rushford was based upon water surface elevations from HEC-RAS models for Root River (URS, 2009) and Rush Creek (USACE, 2008) and delineated using LiDAR based topographic (1-m grid cells) data.

For the approximate reaches for Root River Segments 1, 2, and 3 and Root River Tributary 3, starting WSELs were computed using the HEC-RAS version 4.1.0 (HEC, 2010) computer model.

Hydraulic analyses for the streams studied by approximate analyses were completed using step-backwater calculations. Structures were modeled as weirs, with the weir elevations approximated from the topographic data or bridge elevations from the USGS 7.5-minute topographic quadrangle maps, or the structures were modeled with ineffective flow areas set to the bridge opening.

For stream segments studied by detailed methods, for which a floodway was not computed, selected cross sections are also shown on the FIRM. The selected cross sections are listed in Table 9:

Table 9: Selected Cross Sections without Floodway

CROSS SECTION	DISTANCE	MEAN VELOCITY (FEET PER SECOND)	1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)
Mill Creek			
A	0	2.2	963.6
North Branch Root River			
A	2,557	8.5	963.6

Channel roughness factors (Mannings "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the stream and floodplain areas and review of aerial photography. The Manning's "n" values for all detailed studied streams are listed in Table 10:

Table 10: Manning's "n" Values

Stream	Channel "n"	Overbank "n"
Eastern Tributary	0.040-0.046	0.030-0.100
Mill Creek	0.035-0.038	0.035-0.110
North Branch Root River	0.035-0.038	0.035-0.110
Riceford Creek	0.040-0.046	0.030-0.100
Root River	0.031-0.043	0.040-0.200
Spring Valley Creek	0.040-0.046	0.030-0.100
South Branch Root River	0.030-0.054	0.042-0.150
Western Tributary	0.040-0.046	0.030-0.100

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the FIRM (Exhibit 2). For stream segments studied by detailed methods, for which a floodway was not computed, selected cross sections are also shown on the FIRM. The profile baselines depicted on the FIRM represent the hydraulic modeling baselines that match the flood profiles on this FIS report. As a result of improved topographic data, the profile baseline, in some cases, may deviate significantly from the channel centerline or appear outside the Special Flood Hazard Area.

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

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was NGVD. With the finalization of NAVD, many FIS reports and FIRMs are being prepared using NAVD as the referenced vertical datum. All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD. Structure and ground elevations in the community must, therefore, be referenced to NAVD. It is important to note that adjacent communities may be referenced to NGVD. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between the communities. Some of the data used in this study were taken from the prior effective FIS reports and adjusted to NAVD. The average conversion factor that was used to convert the data in this

FIS report to NAVD was calculated using the National Geodetic Survey's (NGS) VERTCON online utility (NGS, 2006). The data points used to determine the conversion are listed in Table 11.

Table 11 - Vertical Datum Conversion

Quad Name	Corner	Latitude	Longitude	Conversion from NGVD to NAVD
Stewartville	NE	43.875	-92.375	0.052
Spring Valley	NE	43.750	-92.375	0.056
Ostrander	NE	43.625	-92.375	0.082
Ostrander	SE	43.500	-92.375	0.033
Washington	NE	43.875	-92.250	0.023
Wykoff	NE	43.750	-92.250	0.072
Cherry Grove	NE	43.625	-92.250	0.085
Cherry Grove	SE	43.500	-92.250	0.043
Chatfield	NE	43.875	-92.125	0.023
Fountain	NE	43.750	-92.125	0.095
Greenleafton	NE	43.625	-92.125	0.082
Greenleafton	SE	43.500	-92.125	0.039
Pilot Mound	NE	43.875	-92.000	0.046
Preston	NE	43.750	-92.000	0.023
Harmony	NE	43.625	-92.000	0.075
Harmony	SE	43.500	-92.000	0.023
Canton	SE	43.625	-91.875	0.020
Canton	NE	43.500	-91.875	-0.023
Lanesboro	NE	43.750	-91.875	0.030
Arendahl	NE	43.875	-91.875	0.036
Rushford West	NE	43.875	-91.750	0.043
Bratsberg	NE	43.750	-91.750	0.026
Mabel	NE	43.625	-91.750	-0.052
Mabel	SE	43.500	-91.750	-0.052
			Average:	0.037

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

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

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

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

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

For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries for Eastern Tributary, Riceford Creek, Spring Valley Creek, and Western Tributary were interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (USGS, 1965b).

Between cross sections, the boundaries for North Branch Root River were interpolated using topographic maps at a scale of 1:4,800, with a contour interval of 20 feet (USGS, 1972).

Between cross sections, the boundaries for Mill Creek were interpolated using the WSELs computed by the model and the backwater WSELs from North Branch Root River following LiDAR topography provided by MNDNR (Aerometric, 2008).

Between cross section, the boundaries for the Root River at South Branch Root River at Preston were interpolated using topographic maps at a scale of 1:6,000, with a contour interval of 20 feet (Mark Hurd Aerial Surveys, Inc., 1974). For the South Branch Root River at Whalan, USGS quadrangles at a scale of 1:6,000 and contour interval of 20 feet (USGS, 1965a) were used to adjust floodplain boundaries. For the South Branch Root River at Preston, USGS quadrangles at a scale of 1:24,000 and a contour interval of 20 feet (USGS, 1965c) were used to adjust the floodplain boundaries in some areas to reflect revised WSELs in the November 2, 1994, FIS.

Between cross sections, the boundaries for the Root River at Peterson and South Branch Root River at Lanesboro were interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 20 feet (USGS, 1965b). At Peterson, two-foot contour mapping with a scale of 1:1,200 was used within the developed portion of the city (USACE, 1968a).

The City of Rushford Levee system interior drainage boundaries were provided by the URS Corporation (URS, 2009).

The approximate boundaries for Root River Segments 1, 2, 3 and Root River Tributary 3 were delineated using LiDAR based topographic data from the November 18-24, 2008 flight for southeast Minnesota.

For the approximate and limited detailed studies, the floodplain boundaries were interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (USGS, 1965b).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

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

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies. In Minnesota, floodplain encroachment is limited by Minnesota Regulations to that which would cause a 0.5-foot increase in flood heights above prefloodway conditions at any point (MNDNR, 1977). Floodways having no more than a 0.5-foot surcharge were delineated for this study.

The floodways presented in this FIS report and on the FIRM were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections (Table 12). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
EASTERN TRIBUTARY								
A	375	285	1,590	0.2	1,272.0[2]	1,272.0[2]	1,272.4	0.4
B	472	280	1,110	0.3	1,272.0[2]	1,272.0[2]	1,272.5	0.5
C	700	244	1,490	0.2	1,272.0[2]	1,272.0[2]	1,272.5	0.5
D	1,880	93	61	5.1	1,273.6	1,273.6	1,273.6	0.0
E	2,370	160	200	1.6	1,280.3	1,280.3	1,280.3	0.0
F	2,480	250	500	0.6	1,280.3	1,280.3	1,280.3	0.0
G	2,905	210	79	3.9	1,284.5	1,284.5	1,284.5	0.0
H	3,040	200	650	0.5	1,284.9	1,284.9	1,284.9	0.0
I	3,690	207	100	3.1	1,288.0	1,288.0	1,288.0	0.0
J	4,740	178	120	2.6	1,296.8	1,296.8	1,296.8	0.0

[1]Feet above confluence with Spring Valley Creek
[2]1-percent-annual-chance backwater effects from Spring Valley Creek

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

EASTERN TRIBUTARY

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY[2] (FEET NAVD)	WITH FLOODWAY[2] (FEET NAVD)	INCREASE (FEET)
MILL CREEK								
A	3,103	844	3,482	3.0	971.9	965.6	965.6	0.0
B	5,514	464	2,430	4.2	973.0	968.7	968.7	0.0

[1]Feet above confluence with North Branch Root River

[2]Elevation computed without consideration of backwater effects from the North Branch Root River

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MILL CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NORTH BRANCH ROOT RIVER								
A	2,577	*	*	8.5	963.6	*	*	*

[1]Feet above Limit of Detailed Study (Limit of Detailed Study is approximately 2,580 feet upstream of confluence of Mill Creek)

*Data not computed

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH BRANCH ROOT RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
RICEFORD CREEK								
A	1,080	130	610	6.7	1,109.0	1,109.0	1,109.5	0.5
B	1,250	65	390	10.5	1,109.8	1,109.8	1,110.0	0.2
C	1,414	65	440	9.3	1,111.6	1,111.6	1,111.6	0.0
D	1,540	166	950	4.3	1,113.3	1,113.3	1,113.3	0.0
E	1,970	246	1,120	3.7	1,113.9	1,113.9	1,113.9	0.0
F	2,740	296	1,230	3.3	1,114.3	1,114.3	1,114.7	0.4
G	3,690	367	1,610	2.5	1,115.0	1,115.0	1,115.5	0.5
H	4,077	194	740	5.5	1,115.4	1,115.4	1,115.9	0.5
I	4,260	77	660	6.2	1,118.2	1,118.2	1,118.3	0.1
J	4,510	307	1,560	2.6	1,119.1	1,119.1	1,119.1	0.0
K	5,230	481	1,530	2.7	1,119.4	1,119.4	1,119.4	0.0
L	5,900	383	690	5.9	1,121.0	1,121.0	1,121.0	0.0
M	6,240	330	1,450	2.8	1,122.5	1,122.5	1,122.5	0.0

[1]Feet above limit of detailed study (limit of detailed study is approximately 1,130 feet downstream of State Highway 44)

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUTNY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

RICEFORD CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ROOT RIVER								
A	660	2,479	15,450	2.9	747.3	747.3	747.5	0.2
B	1,300	1,632	11,245	4.0	747.4	747.4	747.5	0.1
C	1,860	1,055	8,840	5.1	747.9	747.9	748.1	0.2
D	2,738	690	8,080	5.5	749.8	749.8	750.1	0.3
E	3,170	702	8,690	5.2	750.6	750.6	750.7	0.1
F	3,640	978	11,410	3.9	751.1	751.1	751.3	0.2
G	4,900	1,655	14,420	3.1	751.7	751.7	751.9	0.2
H	58,382	666	6,500	6.7	786.4	786.4	786.8	0.4
I	59,242	933	8,850	4.9	787.5	787.5	788.0	0.5
J	60,132	496	5,160	8.4	788.0	788.0	788.4	0.4
K	60,562	269	3,940	11.1	788.4	788.4	788.8	0.4
L	61,372	315	4,510	9.7	789.8	789.8	789.9	0.1
M	62,289	335	6,530	6.7	792.1	792.1	792.5	0.4
N	62,782	439	6,070	7.2	792.4	792.4	792.7	0.3
O	63,362	586	6,980	6.2	792.9	792.9	793.3	0.4

[1]Feet above limit of detailed study (limit of detailed study is approximately 32,850 feet upstream of county boundary)

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

ROOT RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH BRANCH ROOT RIVER								
A	510	704	6,360	3.6	810.1	810.1	810.6	0.5
B	2,160	529	4,230	5.5	811.0	811.0	811.4	0.4
C	3,660	662	4,790	4.8	813.5	813.5	814.0	0.5
D	5,140	623	3,600	6.4	817.0	817.0	817.4	0.4
E	5,900	510	3,180	7.3	819.3	819.3	819.7	0.4
F	6,540	311	3,250	7.1	822.6	822.6	822.8	0.2
G	6,730	288	2,450	9.5	823.0	823.0	823.1	0.1
H	7,040	102	1,700	13.6	824.8	824.8	824.9	0.1
I	7,600	206	2,190	10.6	828.8	828.8	828.8	0.0
J	8,390	235	2,330	10.0	829.9	829.9	830.1	0.2
K	9,310	292	3,010	7.7	833.1	833.1	833.4	0.3
L	10,350	210	2,320	10.0	836.2	836.2	836.3	0.1
M	10,451	138	1,850	12.6	836.2	836.2	836.3	0.1
N	10,670	133	1,630	14.2	837.0	837.0	837.0	0.0
O	11,051	209	2,780	8.3	840.0	840.0	840.0	0.0
P	11,641	400	5,310	4.4	841.7	841.7	841.7	0.0
Q	12,540	875	11,030	2.1	860.2	860.2	860.5	0.3
R	13,570	1,180	11,070	2.1	860.5	860.5	860.8	0.3
S	15,150	1,791	17,470	1.3	860.8	860.8	861.0	0.2
T	76,578	297	2,263	7.0	931.1	931.1	931.6	0.5
U	77,748	526	2,739	5.8	933.6	933.6	933.6	0.0

[1]Feet above limit of detailed study (limit of detailed study is approximately 3,340 feet upstream of confluence with Root River)

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH BRANCH ROOT RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH BRANCH ROOT RIVER (CONTINUED)								
V	78,568	933	4,931	3.2	934.8	934.8	935.2	0.4
W	79,168	760[2]	4,421	3.6	935.4	935.4	935.7	0.3
X	79,808	840	4,342	3.6	935.8	935.8	936.2	0.4
Y	80,408	436	2,965	5.3	936.6	936.6	937.0	0.4
Z	81,338	370	2,162	7.3	937.9	937.9	938.1	0.2
AA	82,758	299	2,494	6.3	941.3	941.3	941.7	0.4
AB	83,433	380	2,654	6.0	941.8	941.8	942.2	0.4
AC	84,483	237	3,667	4.3	945.7	945.7	945.9	0.2
AD	86,473	1,156	2,755	5.7	947.6	947.6	947.9	0.3
AE	87,848	882	3,245	4.9	951.5	951.5	951.5	0.0
AF	90,513	1,259	7,870	2.0	953.8	953.8	953.8	0.0

[1]Feet above limit of detailed study (limit of detailed study is approximately 3,340 feet upstream of confluence with Root River)

[2]Floodway width widened to levee toe

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH BRANCH ROOT RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SPRING VALLEY CREEK								
A	1,270	417	1,490	3.0	1,261.8	1,261.8	1,262.2	0.4
B	2,650	522	1,730	2.6	1,263.3	1,263.3	1,263.3	0.0
C	3,625	45	395	11.2	1,269.0	1,269.0	1,269.0	0.0
D	4,260	499	3,080	1.3	1,272.1	1,272.1	1,272.1	0.0
E	5,440	790	1,760	2.3	1,272.4	1,272.4	1,272.4	0.0
F	5,953	222	840	4.8	1,274.2	1,274.2	1,274.5	0.3
G	6,043	290	1,200	3.4	1,274.5	1,274.5	1,274.9	0.4
H	6,210	295	990	4.1	1,274.7	1,274.7	1,275.1	0.4
I	6,470	295	1,250	3.2	1,276.1	1,276.1	1,276.1	0.0
J	6,927	230	1,110	3.5	1,276.7	1,276.7	1,277.0	0.3
K	7,004	180	1,110	3.5	1,276.9	1,276.9	1,277.2	0.3
L	7,486	380	2,110	1.9	1,277.3	1,277.3	1,277.5	0.2
M	7,604	405	2,200	1.8	1,277.3	1,277.3	1,277.6	0.3
N	7,852	485	2,100	1.9	1,277.4	1,277.4	1,277.7	0.3
O	8,639	710	720	5.0	1,278.5	1,278.5	1,278.7	0.2
P	8,923	450	810	4.4	1,279.0	1,279.0	1,279.3	0.3
Q	10,143	182	790	4.5	1,279.6	1,279.6	1,280.1	0.5
R	10,372	61	420	8.4	1,283.0	1,283.0	1,283.0	0.0
S	10,634	394	3,570	1.0	1,284.4	1,284.4	1,284.4	0.0
T	11,654	199	1,410	2.5	1,284.5	1,284.5	1,284.5	0.0
U	12,744	228	1,400	2.5	1,284.8	1,284.8	1,284.8	0.0

[1]Feet above limit of detailed study (limit of detailed study is approximately 3,600 feet downstream of U.S. Highway 16)

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

SPRING VALLEY CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
WESTERN TRIBUTARY								
A	220	190	820	0.6	1,277.5	1,277.5	1,278.0	0.5
B	477	170	750	0.7	1,279.1	1,279.1	1,279.4	0.3
C	648	120	150	3.3	1,279.2	1,279.2	1,279.4	0.2
D	1,370	95	200	2.5	1,283.3	1,283.3	1,283.7	0.4
E	2,050	66	80	6.3	1,287.2	1,287.2	1,287.2	0.0
F	3,180	88	110	4.5	1,297.0	1,297.0	1,297.0	0.0
G	4,180	90	110	4.5	1,302.5	1,302.5	1,302.5	0.0

[1]Feet above confluence with Spring Valley Creek

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

WESTERN TRIBUTARY

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

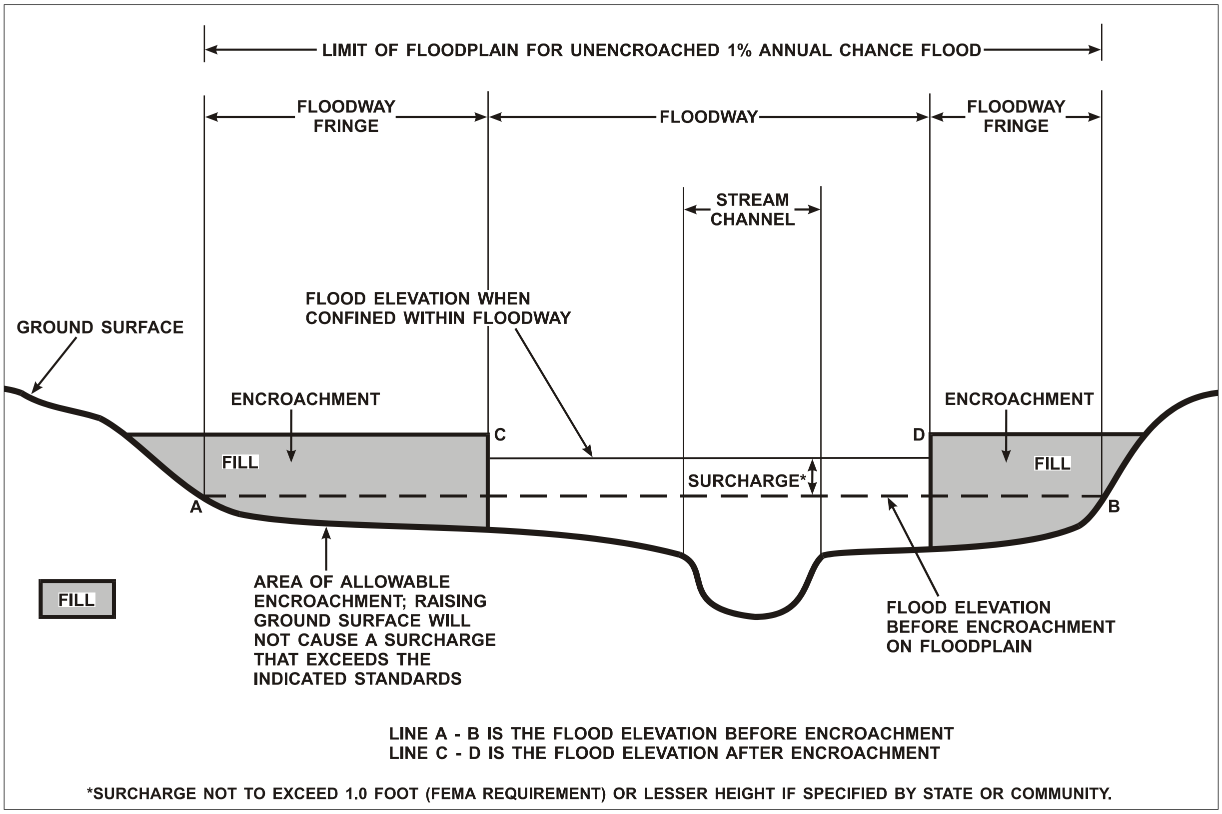

Figure 1 - Floodway Schematic

No floodways were computed for North Branch Root River.

5.0 INSURANCE APPLICATIONS

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

Zone A

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

Zone AE

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

Zone X

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

6.0 FLOOD INSURANCE RATE MAP

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

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

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

The countywide FIRM presents flooding information for the entire geographic area of Fillmore County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community are presented in Table 13.

7.0 OTHER STUDIES

A FIS and FIRM have been prepared for Olmsted County, Minnesota and Incorporated Areas (FEMA, 2017).

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

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Canton, City of[1,2]	N/A	None	N/A	
Chatfield, City of	August 13, 1976	None	August 2, 1982	
Fillmore County (Unincorporated Areas)	December 27, 1974	March 10, 1978	September 18, 1987	
Fountain, City of[1,2]	N/A	None	N/A	
Harmony, City of[1,2]	N/A	None	N/A	
Lanesboro, City of	May 24, 1974	June 4, 1976	September 2, 1981	
Mabel, City of	May 17, 1974	June 4, 1976	March 2, 1981	
Ostrander, City of[1,2]	N/A	None	N/A	
Peterson, City of	August 30, 1974	February 20, 1976	May 5, 1981	
Preston, City of	May 10, 1974	June 11, 1976 January 21, 1977	August 1, 1979	November 2, 1994
Rushford, City of	May 23, 1980	None	May 23, 1980	
Rushford Village, City of	September 5, 1980	None	September 4, 1987	

[1]No special flood hazard areas identified
[2]This community does not have map history prior to the first countywide mapping

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Spring Valley, City of	May 17, 1974	August 13, 1976	September 2, 1981	
Whalan, City of	January 14, 1977	None	March 2, 1981	
Wykoff, City of[1,2]	N/A	None	N/A	

[1]No special flood hazard areas identified
[2]This community does not have map history prior to the first countywide mapping

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

8.0 LOCATION OF DATA

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

9.0 BIBLIOGRAPHY AND REFERENCES

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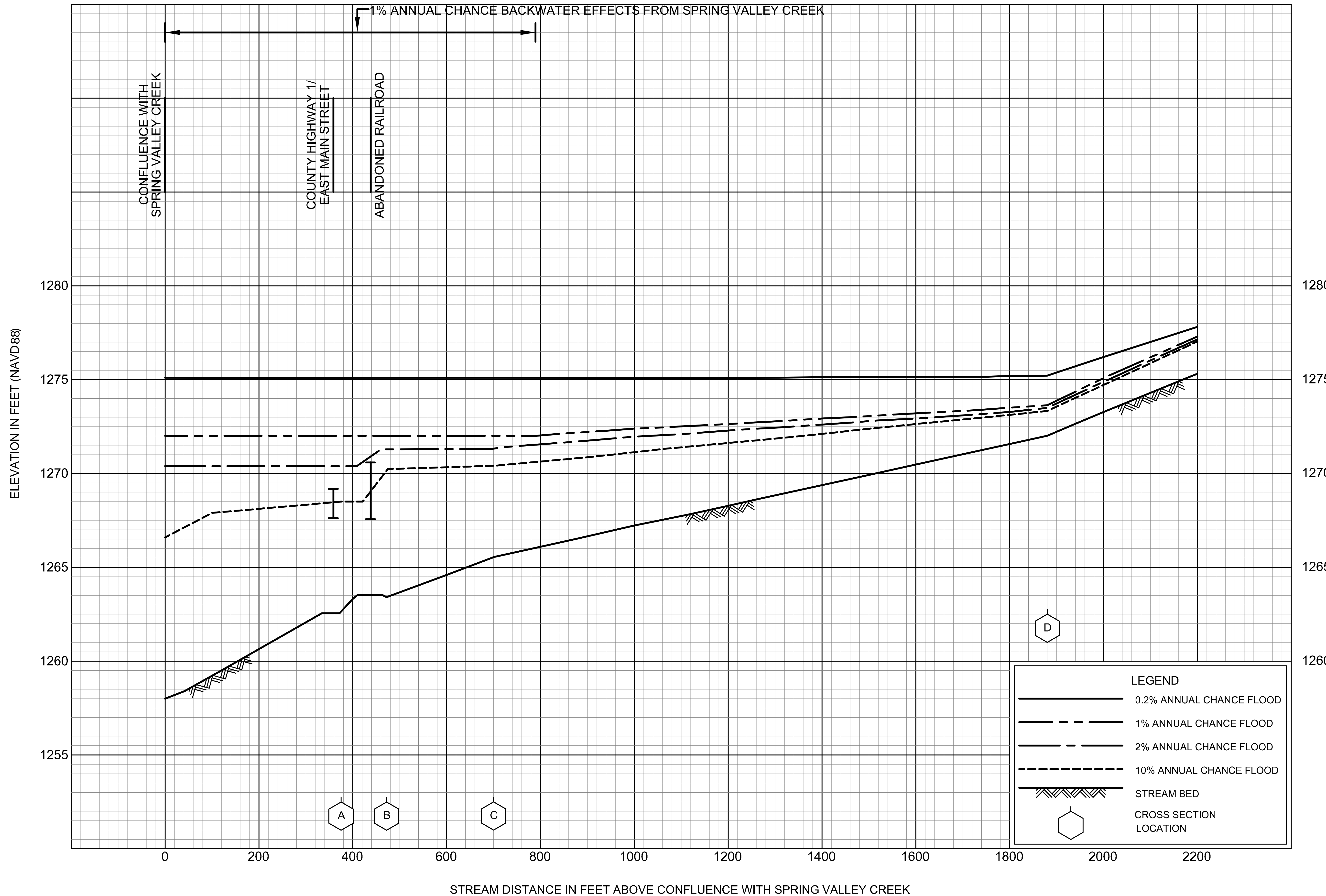


FLOOD PROFILES

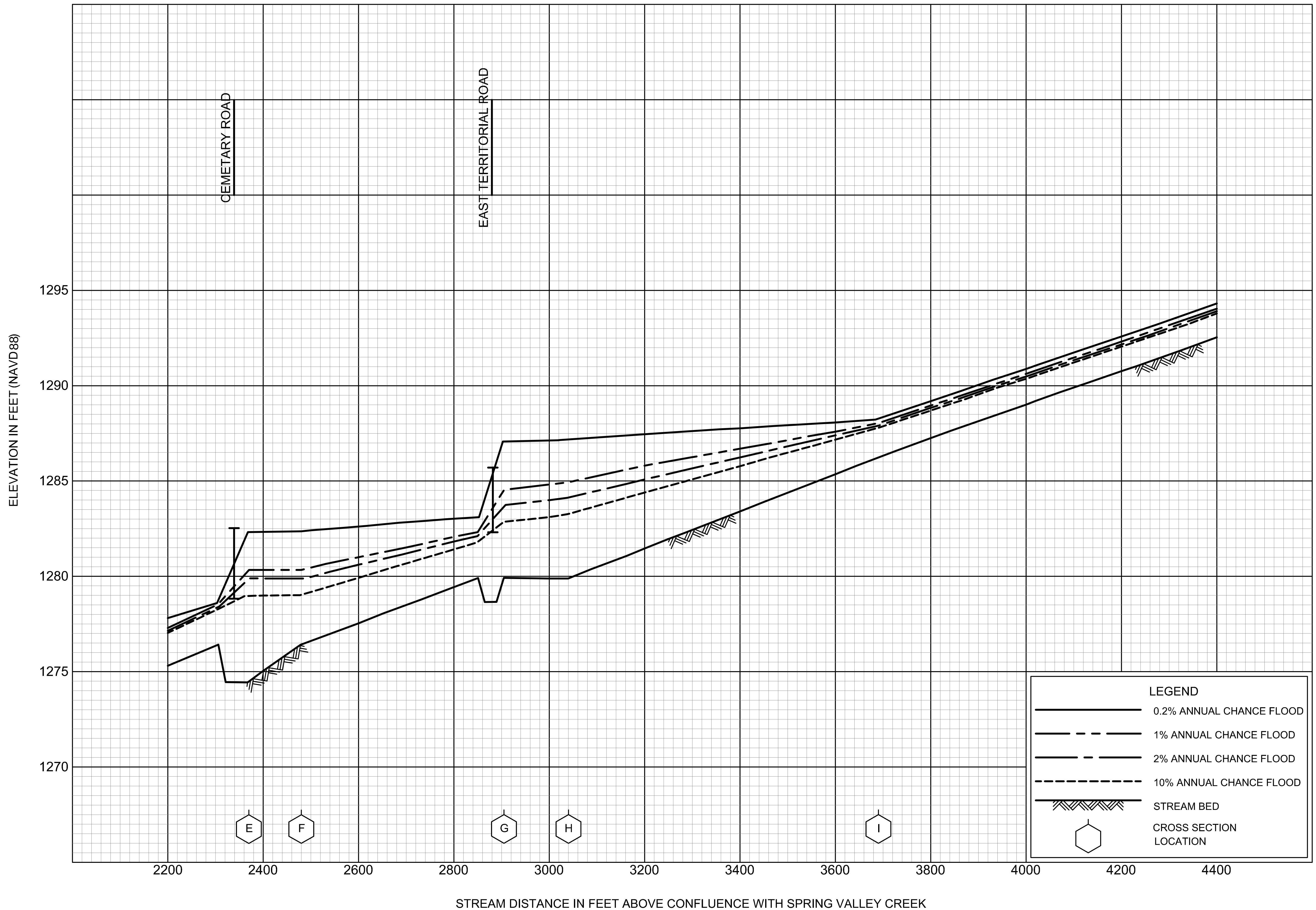
EASTERN TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS

01P



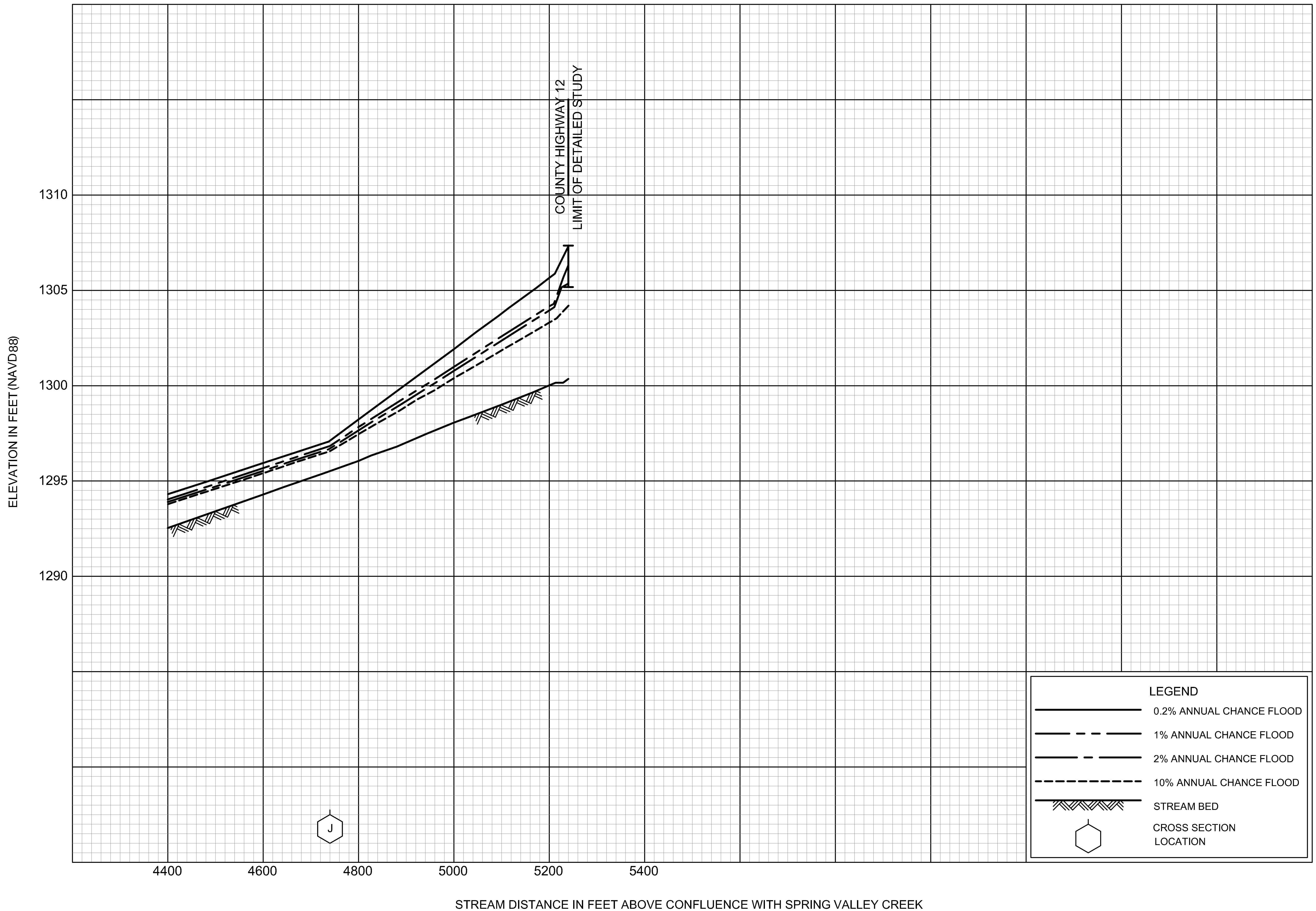
FLOOD PROFILES

EASTERN TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

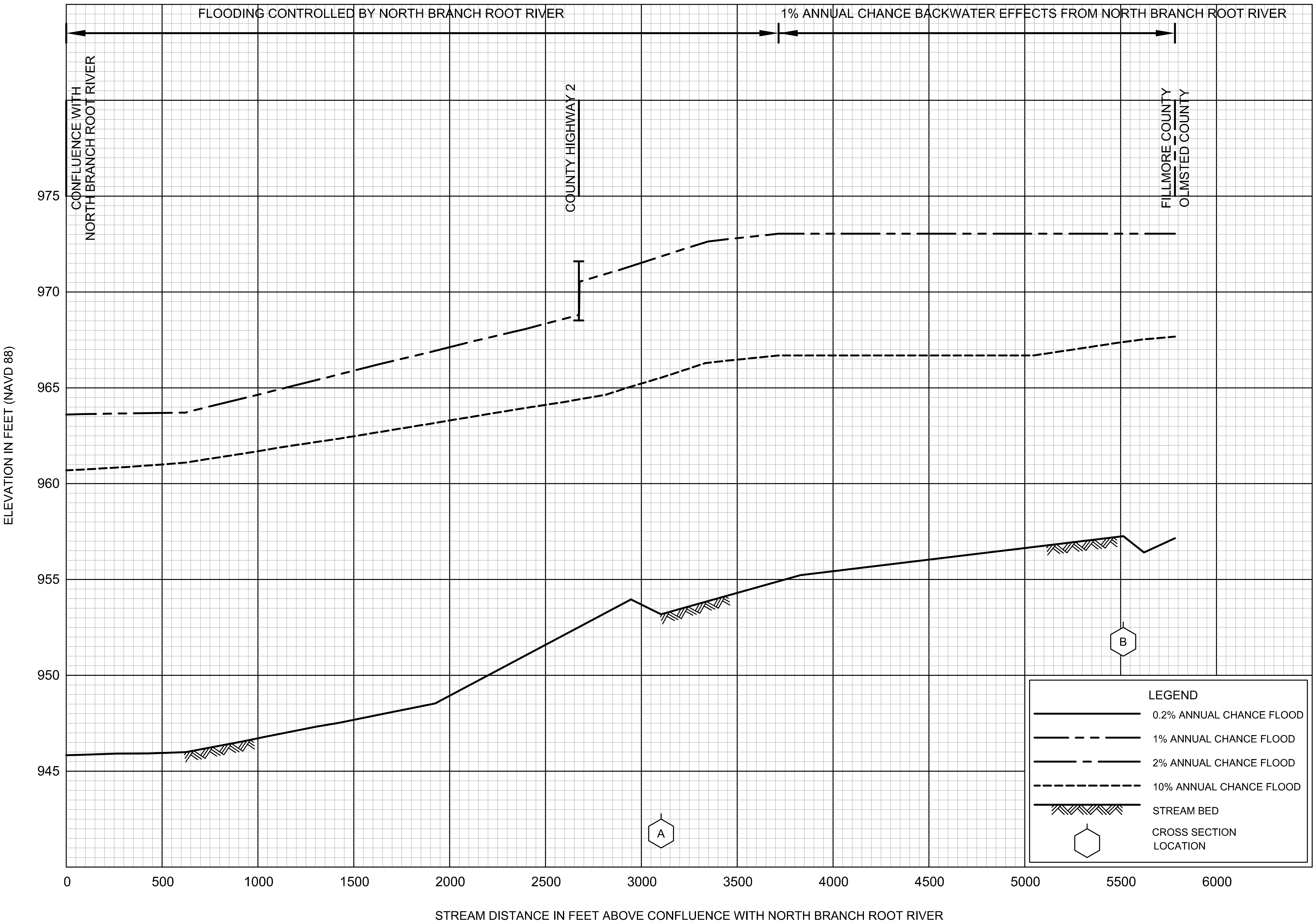
EASTERN TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS

03P



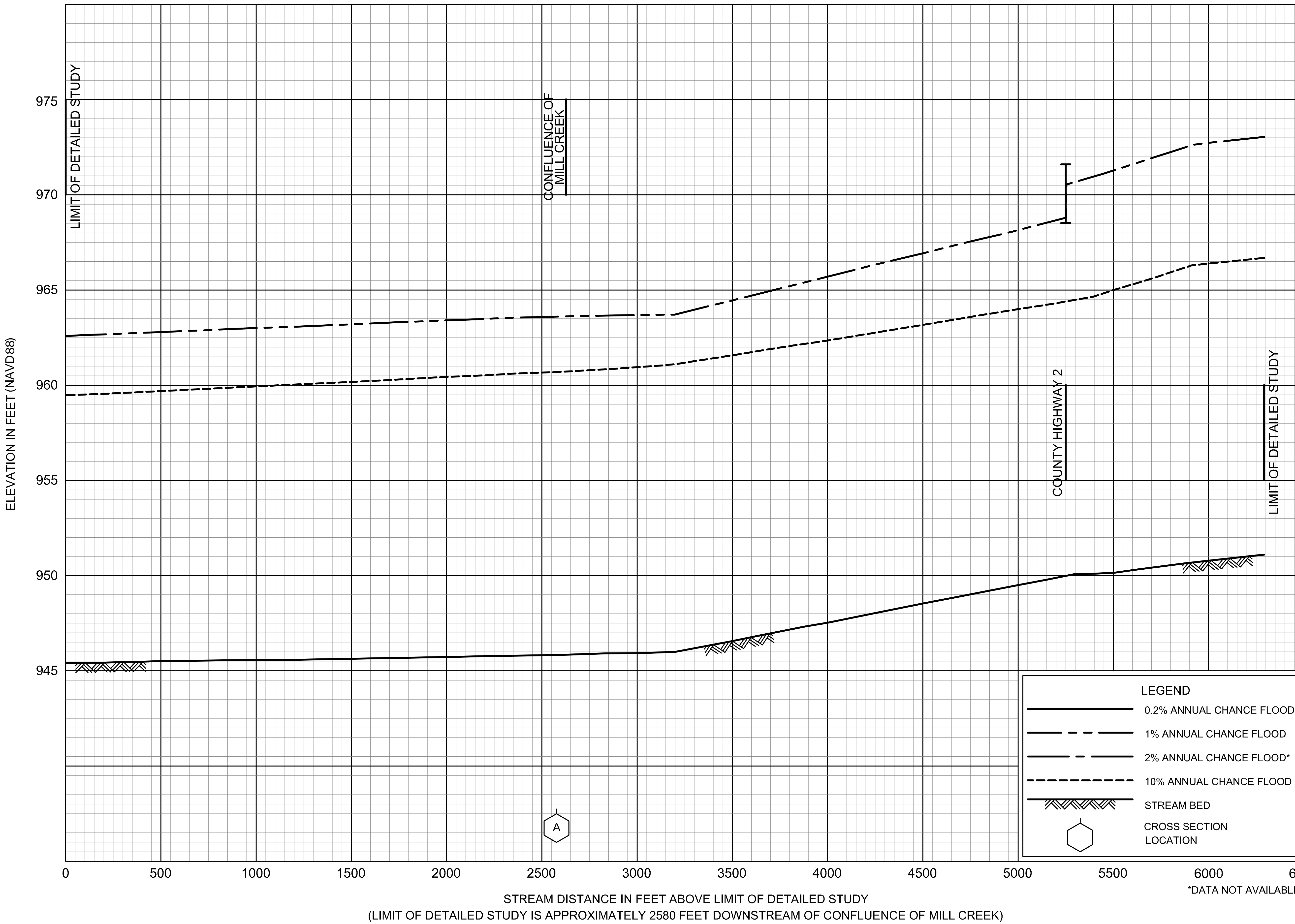
FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

NORTH BRANCH ROOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS

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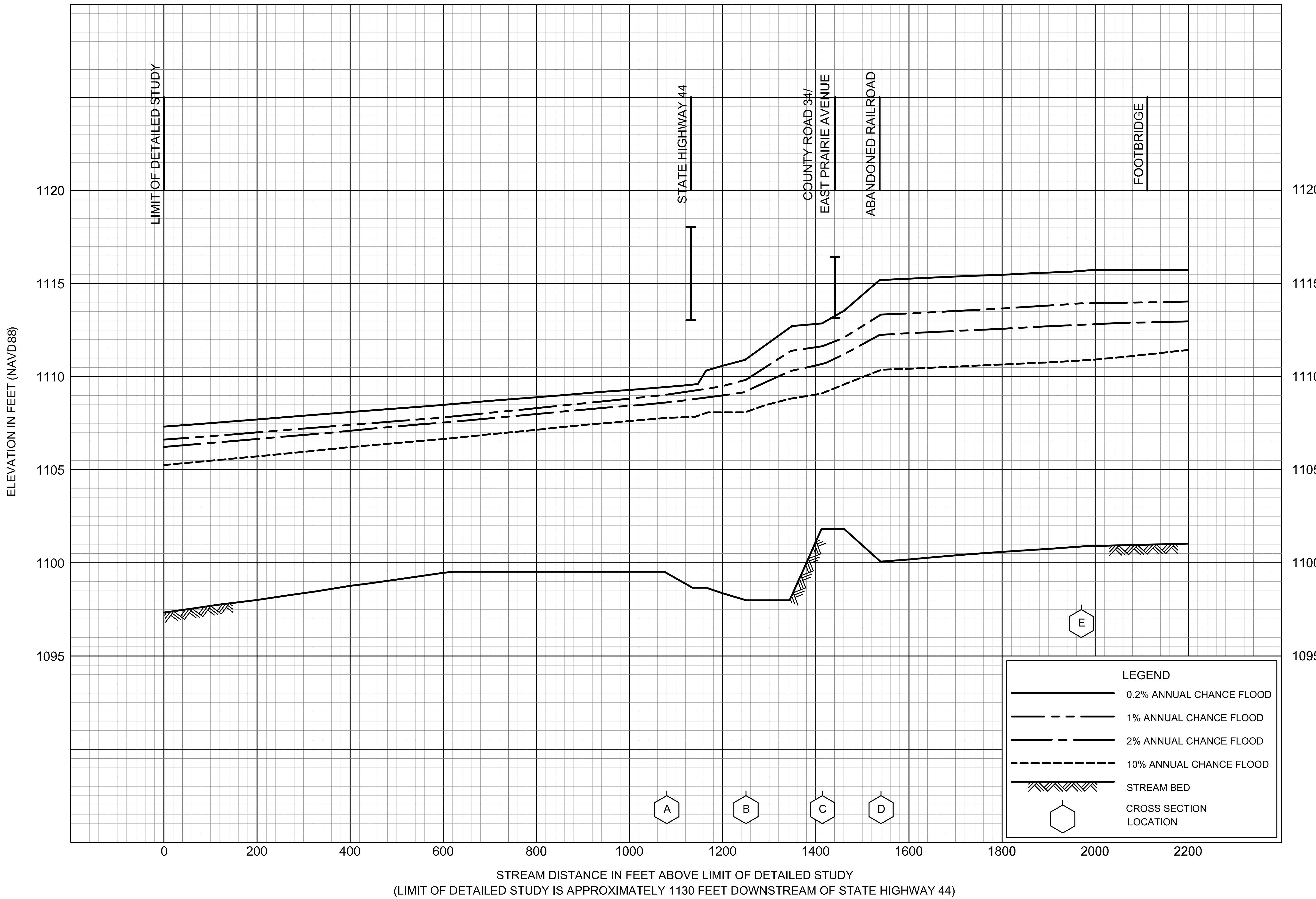


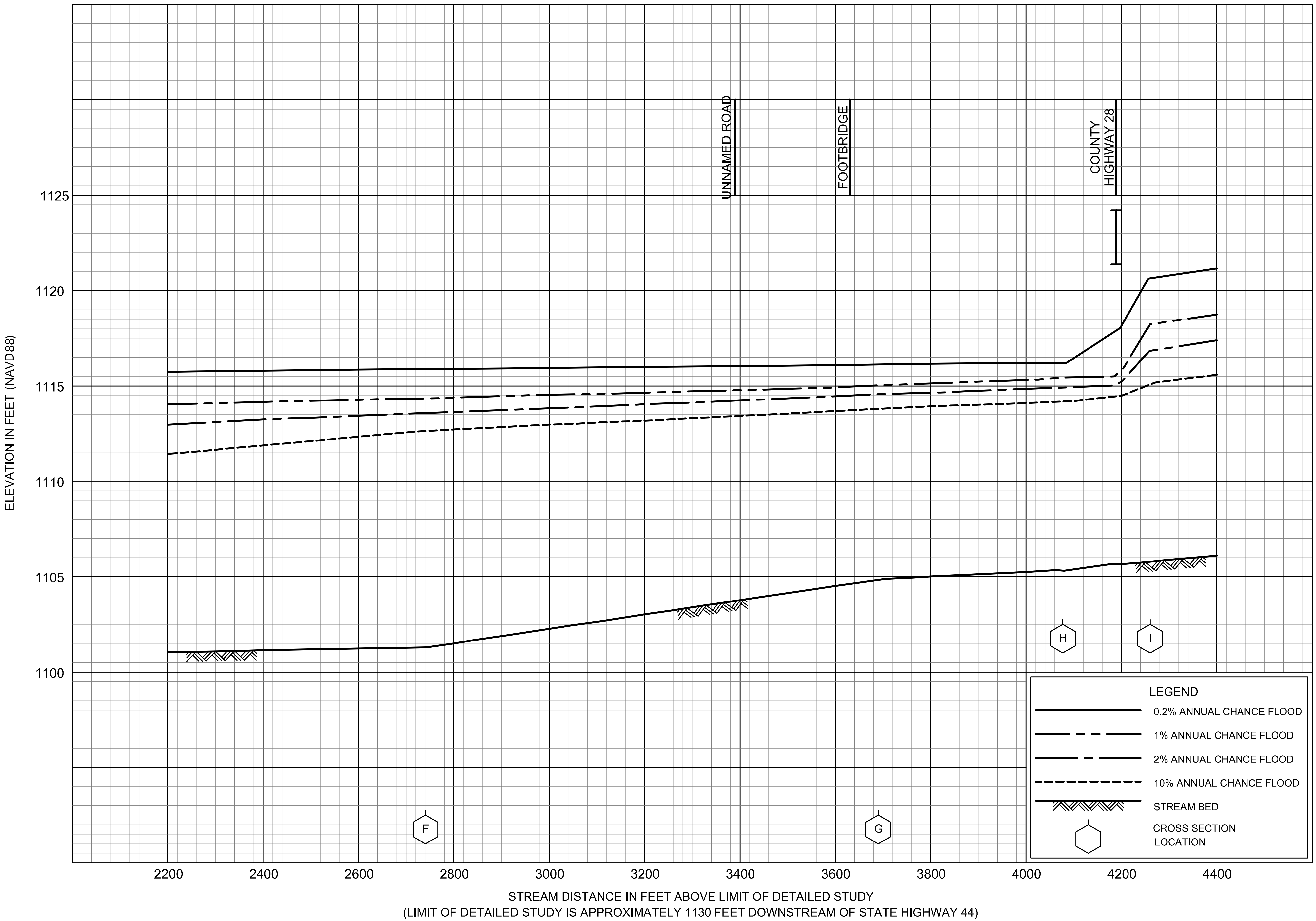
FLOOD PROFILES

RICEFORD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

RICEFORD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

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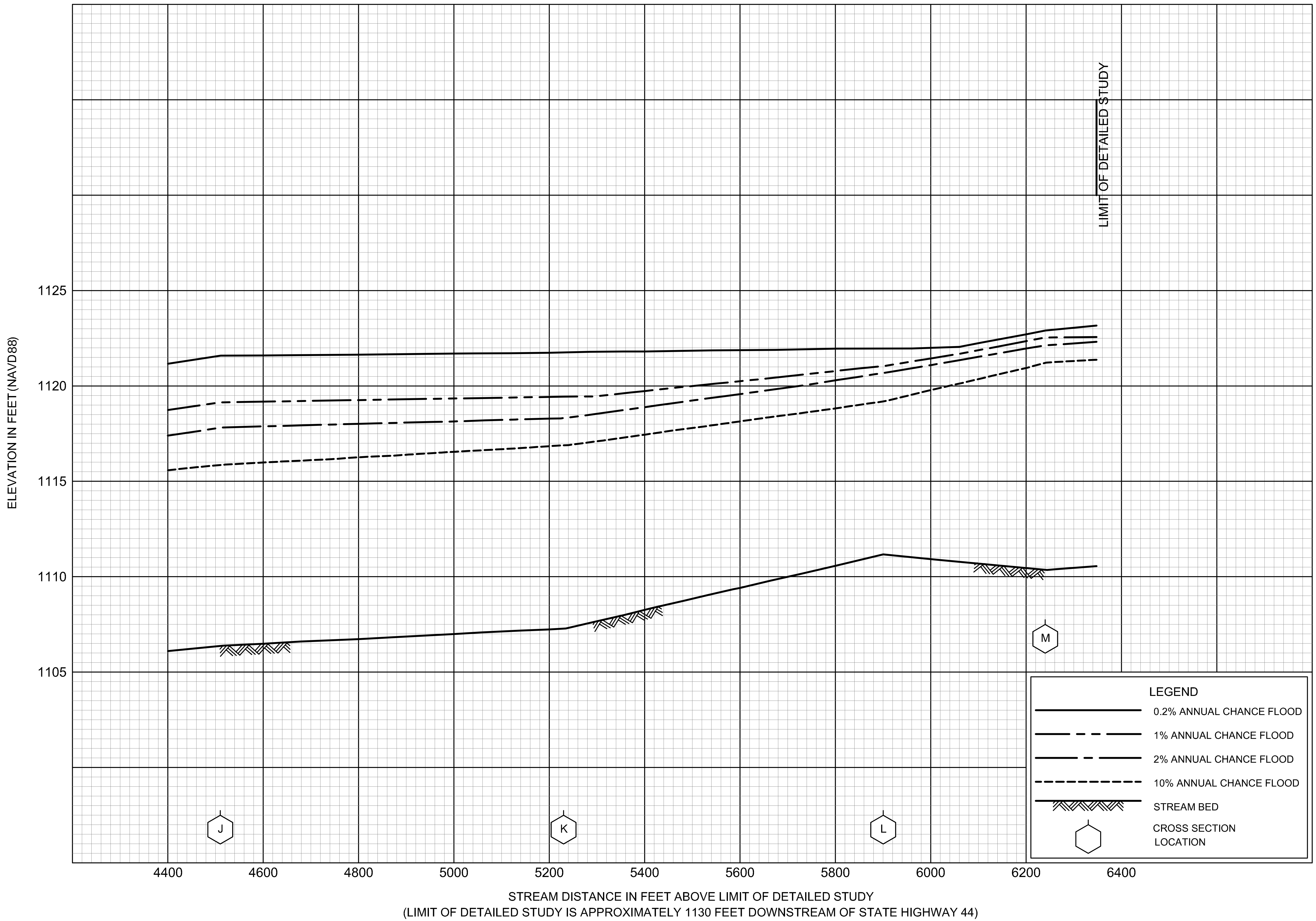


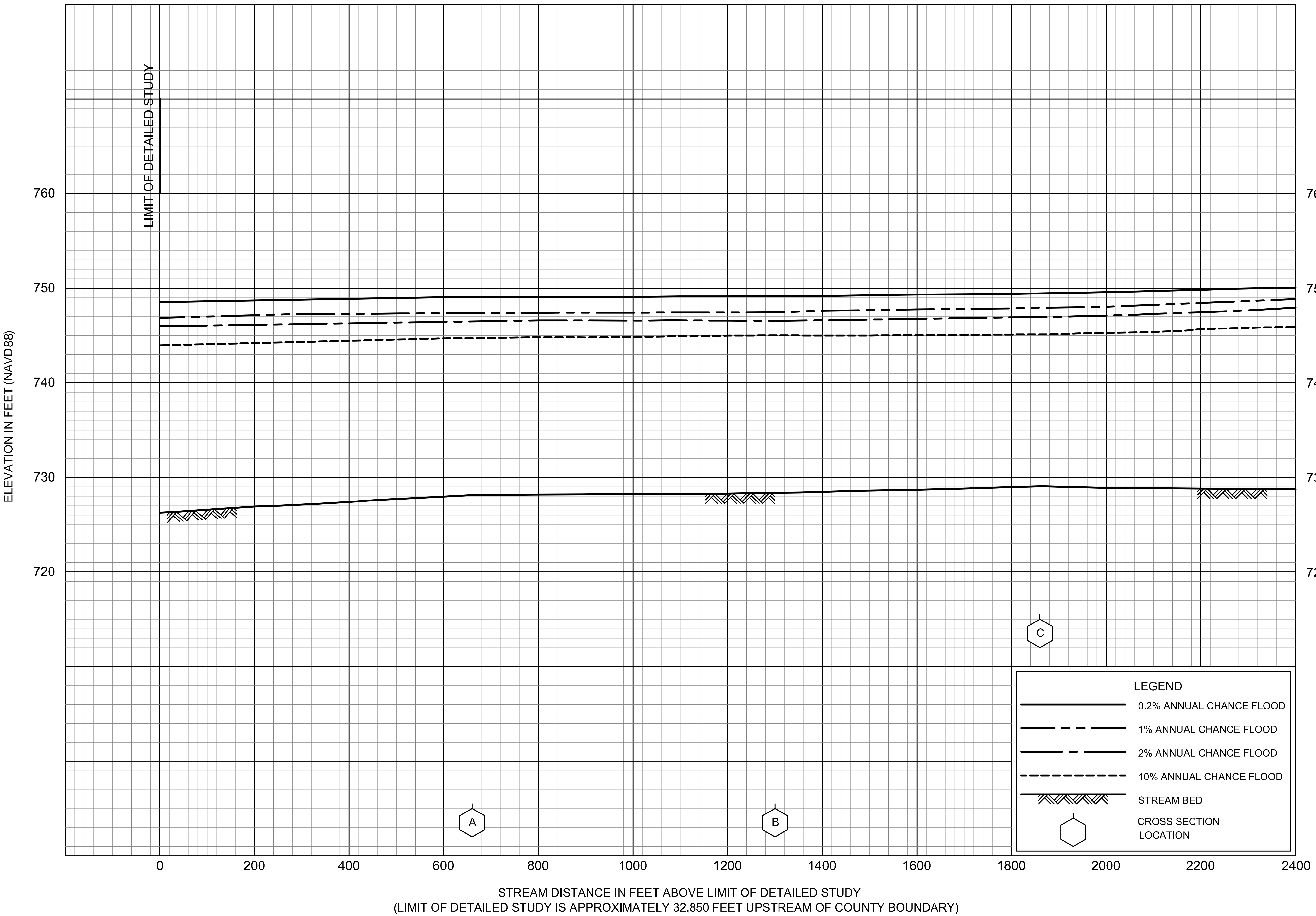
FLOOD PROFILES

RICEFORD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

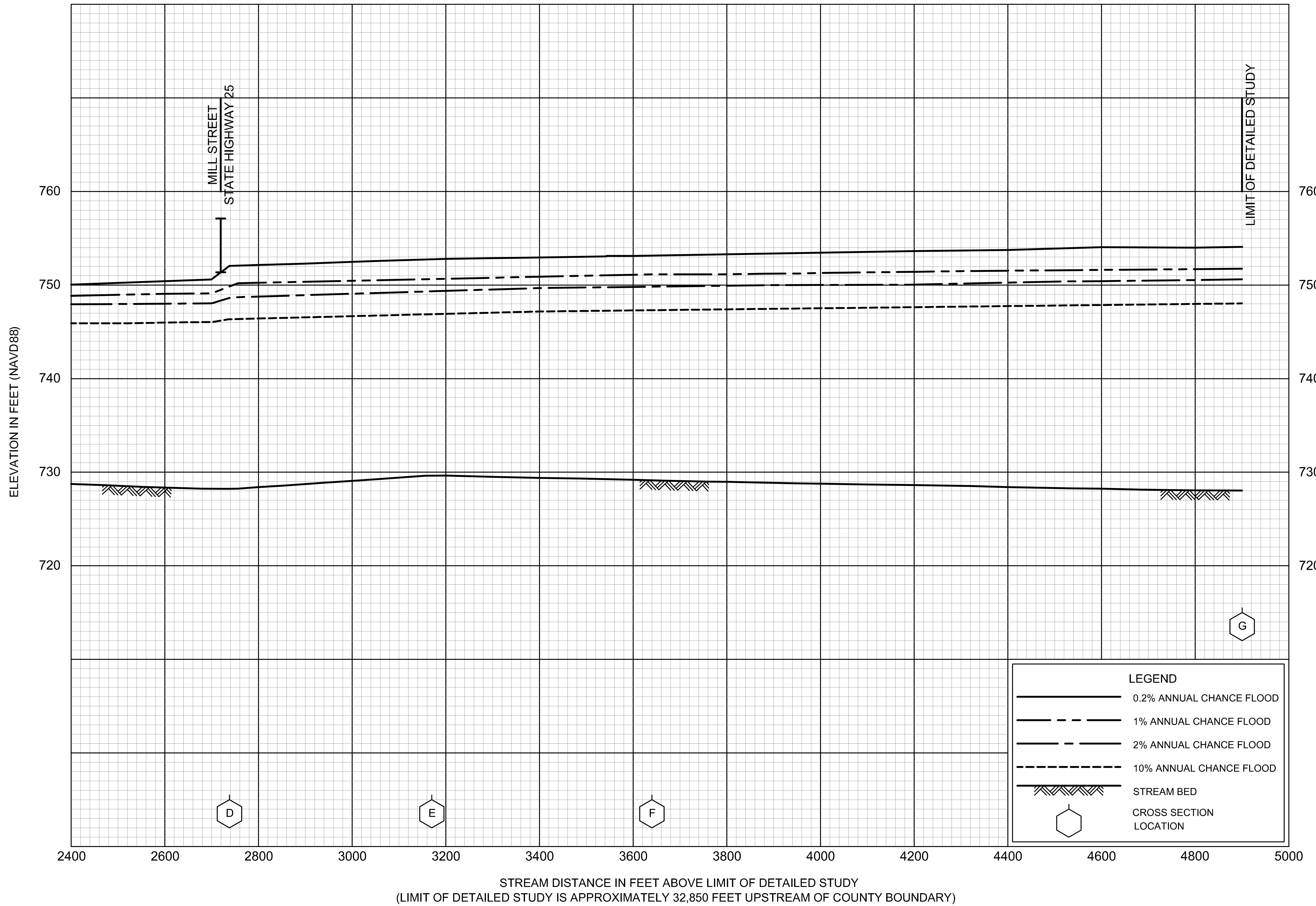
ROOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS

09P



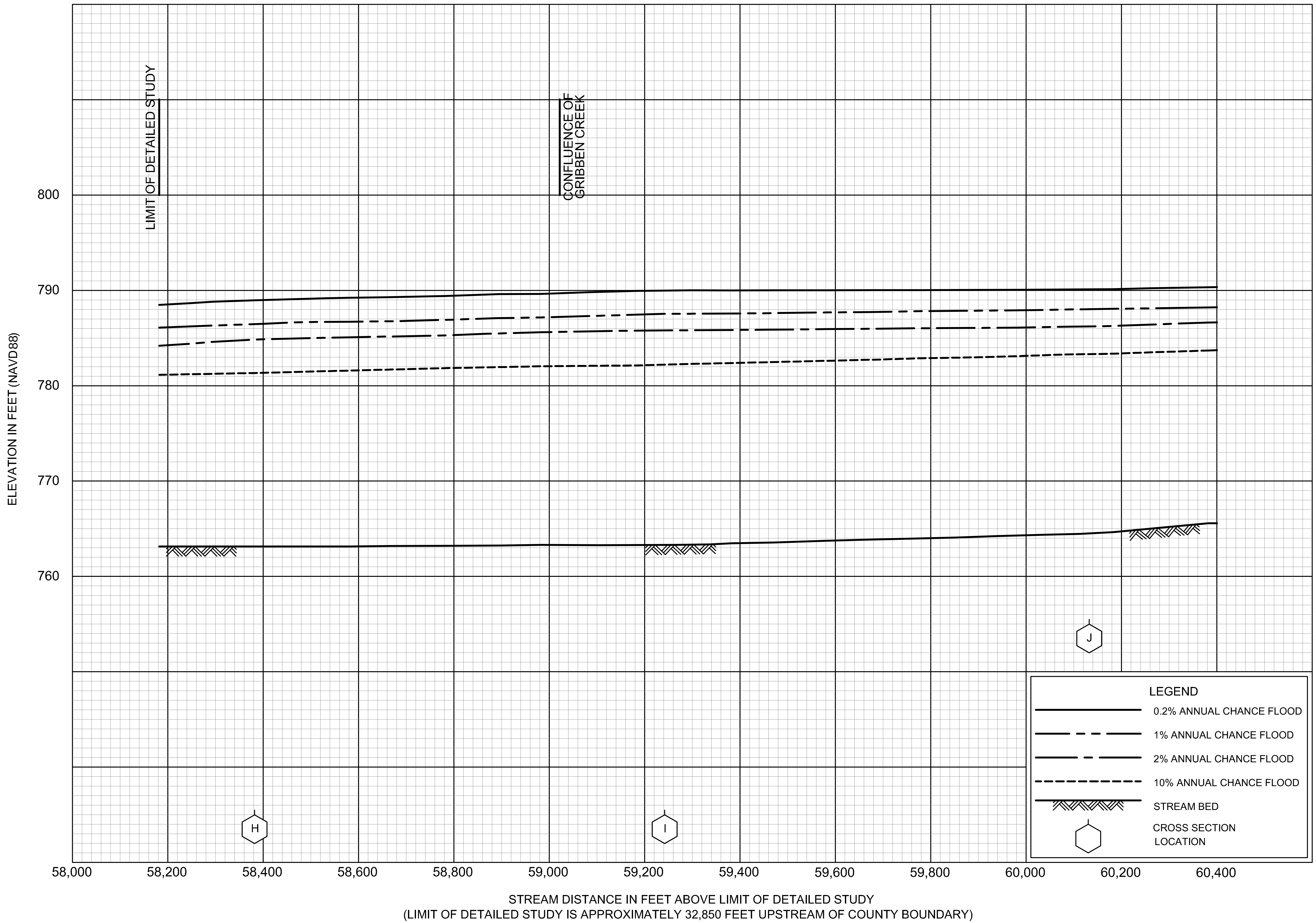
FLOOD PROFILES

ROOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

ROOT RIVER

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FILLMORE COUNTY, MN

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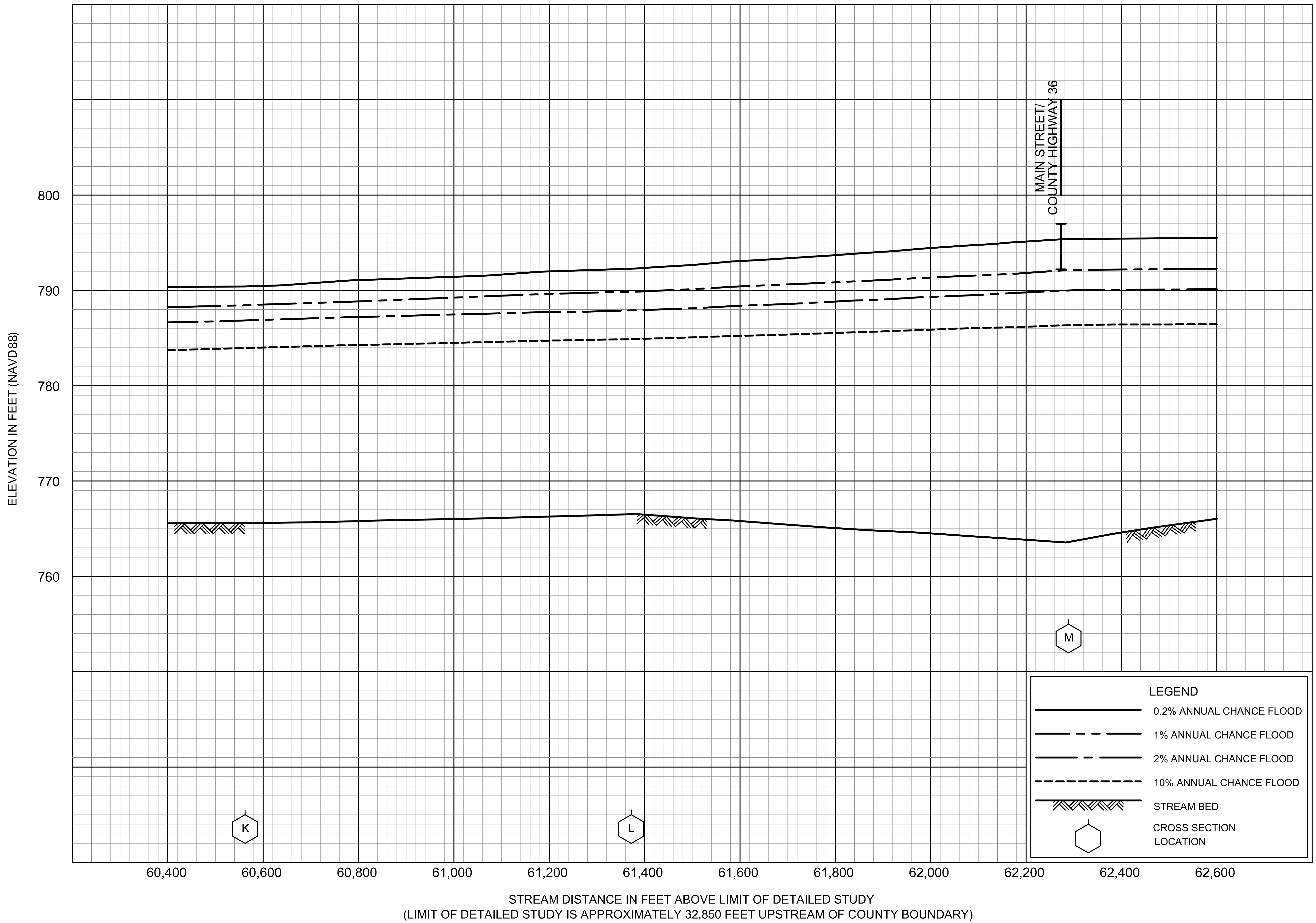

FLOOD PROFILES

ROOT RIVER

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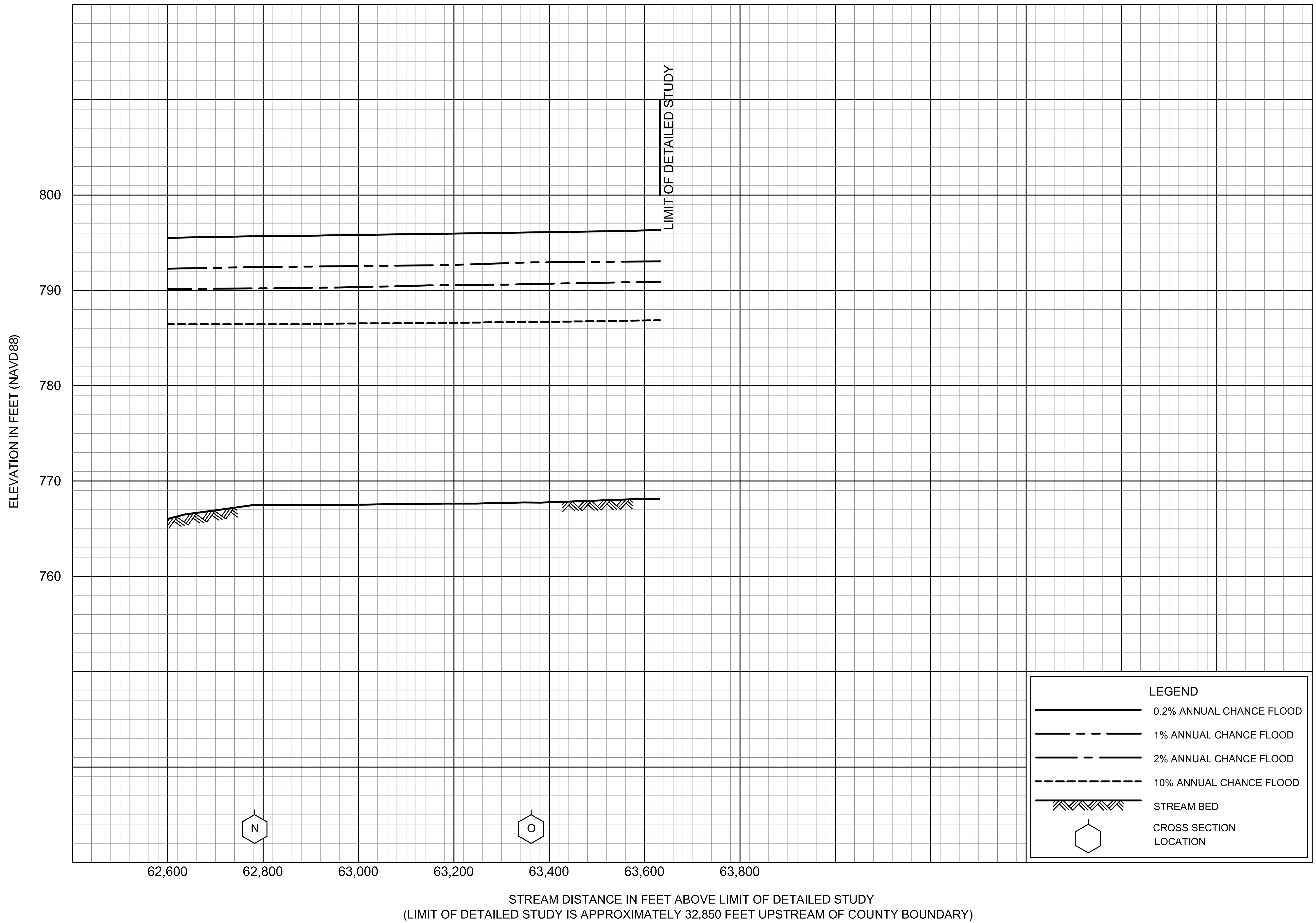
FILLMORE COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

ROOT RIVER

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FILLMORE COUNTY, MN

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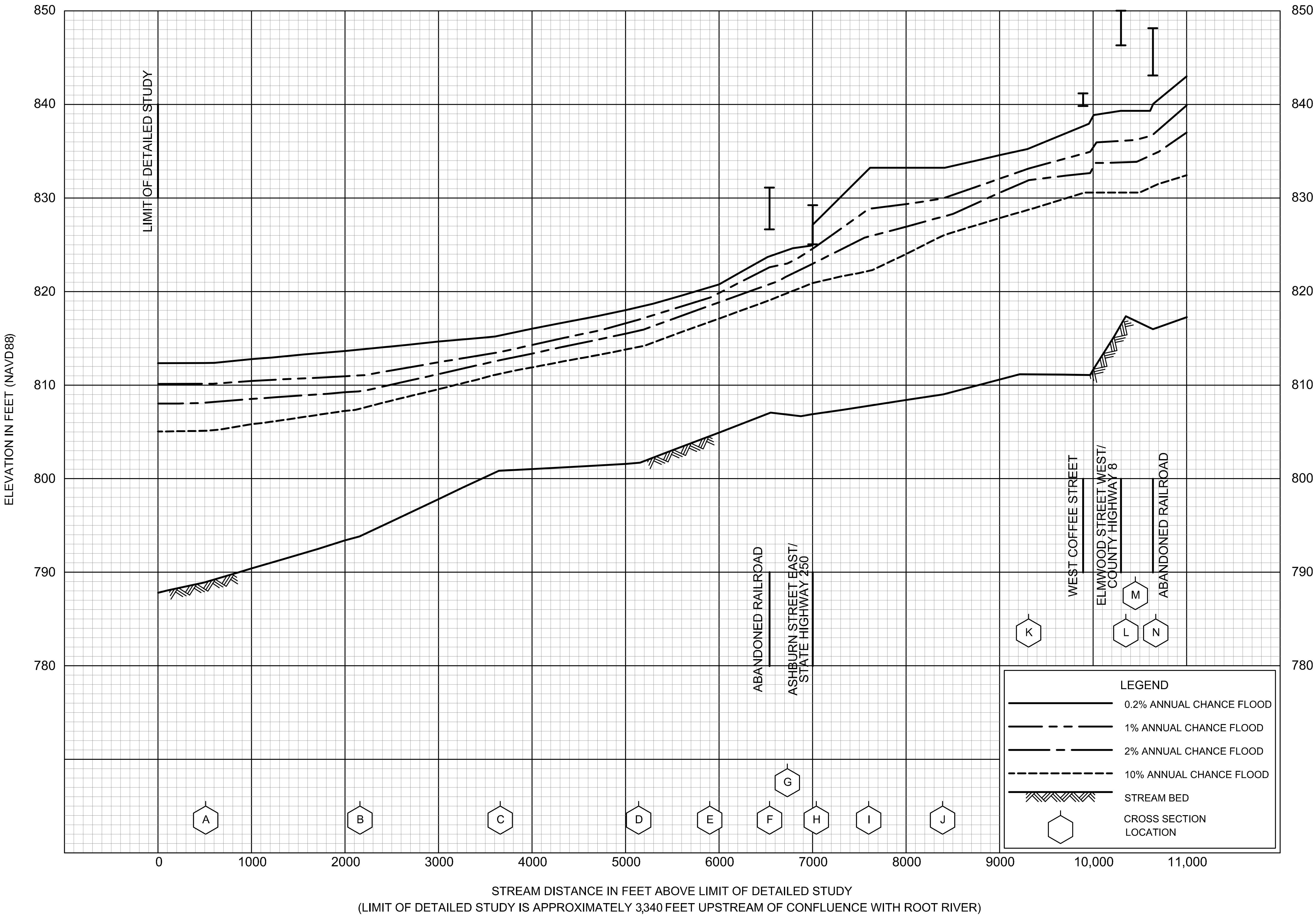


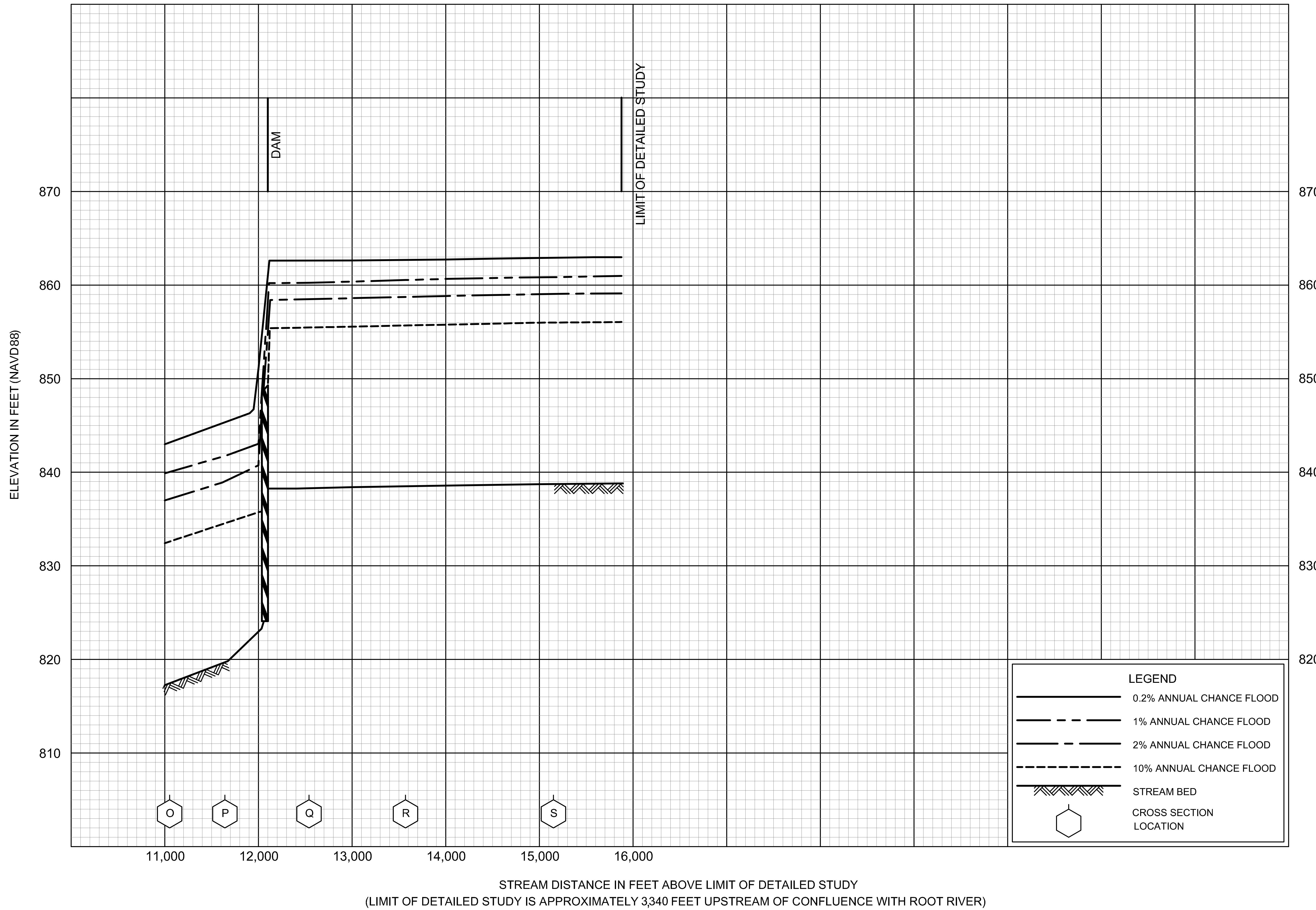
FLOOD PROFILES

SOUTH BRANCH ROOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



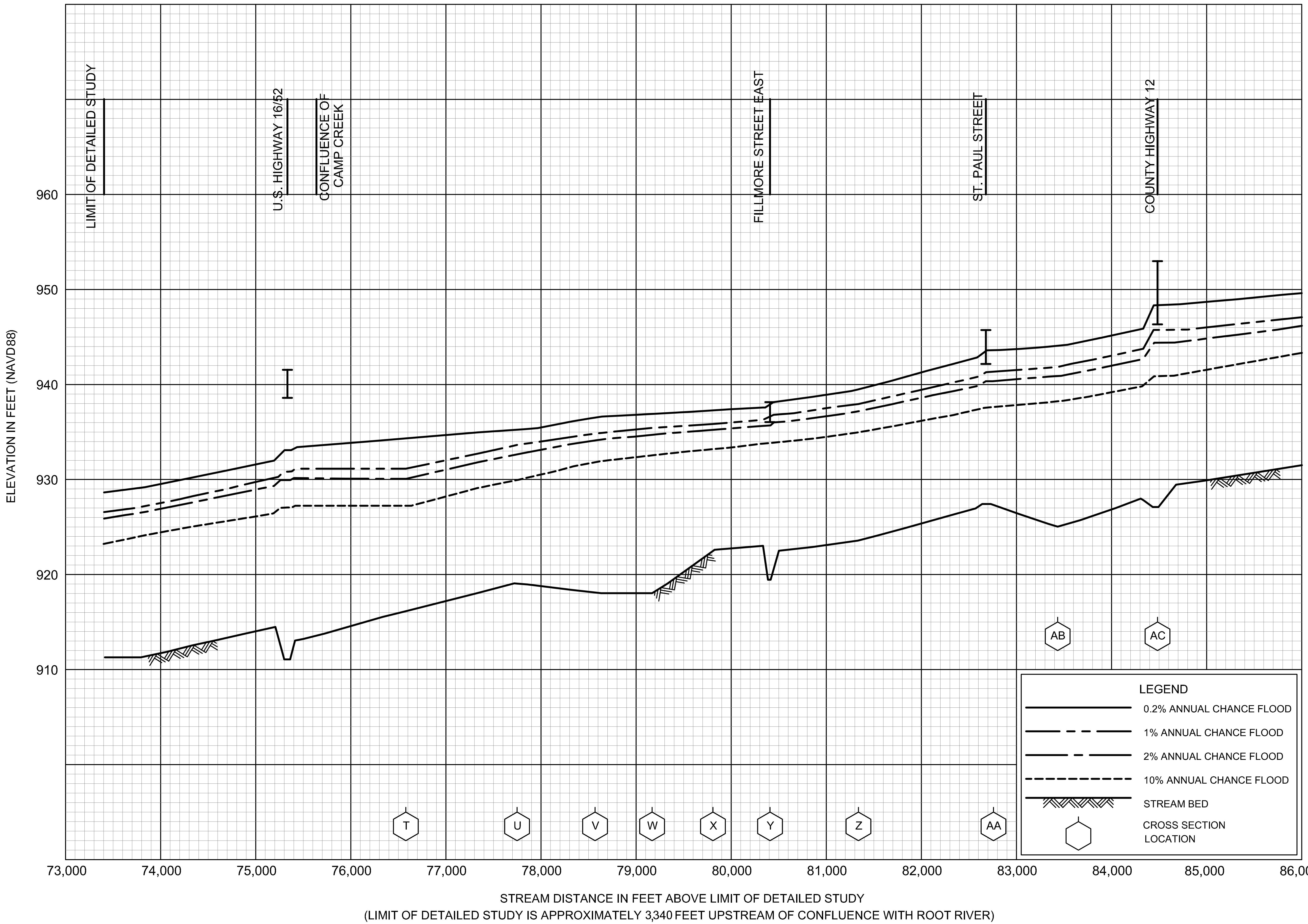
FLOOD PROFILES

SOUTH BRANCH ROOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



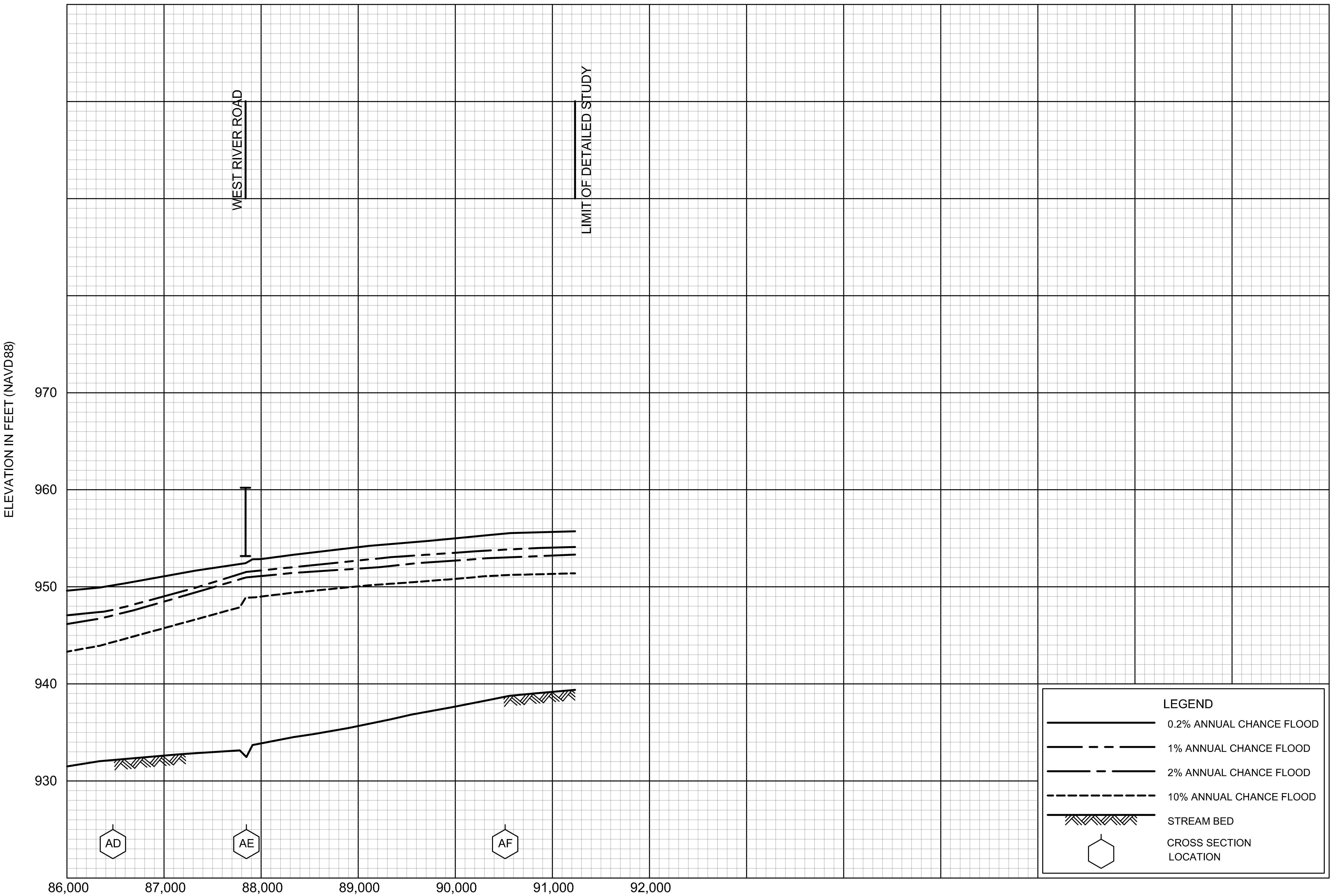
FLOOD PROFILES

SOUTH BRANCH ROOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY
(LIMIT OF DETAILED STUDY IS APPROXIMATELY 3,340 FEET UPSTREAM OF CONFLUENCE WITH ROOT RIVER)

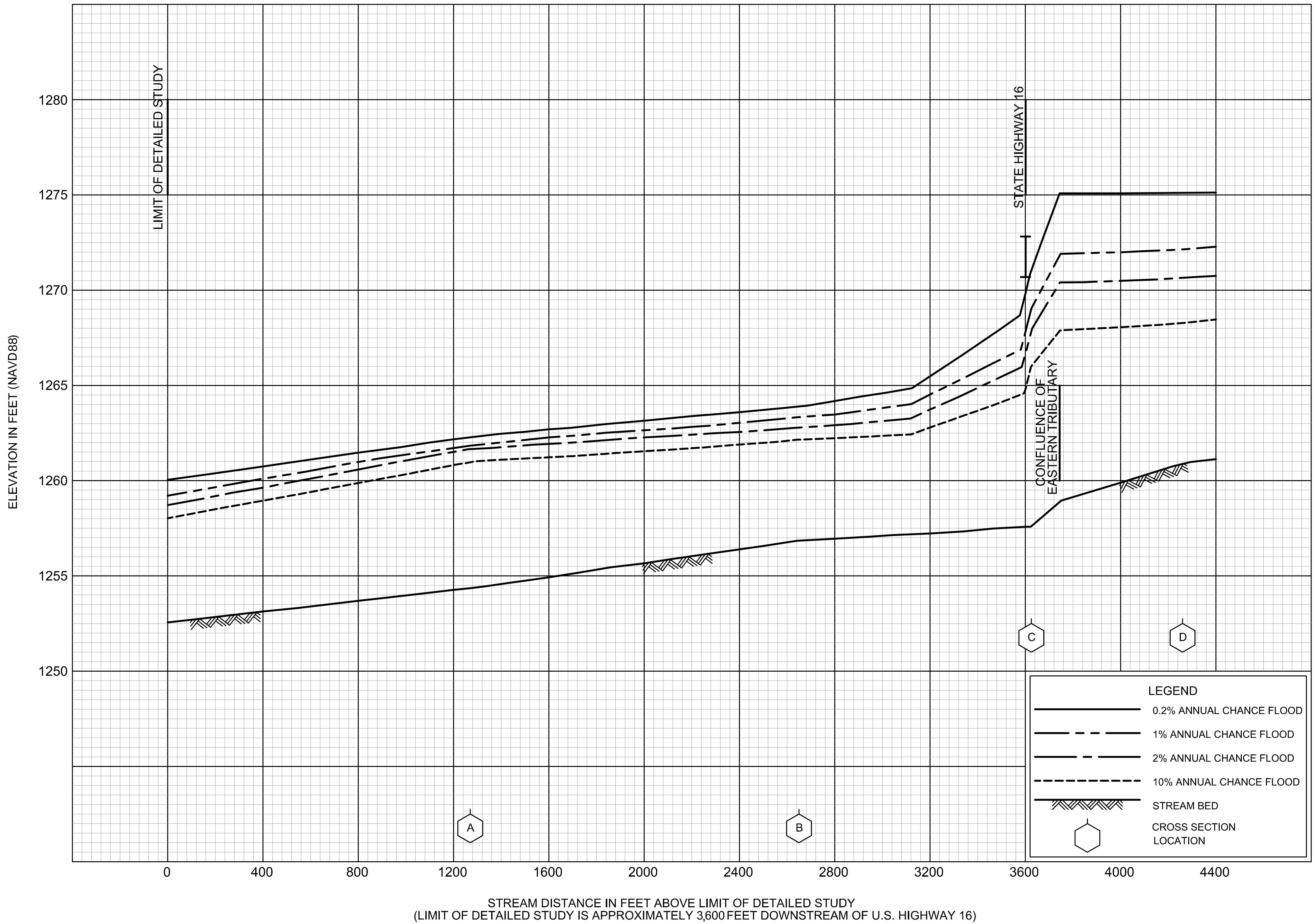
FLOOD PROFILES

SOUTH BRANCH ROOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



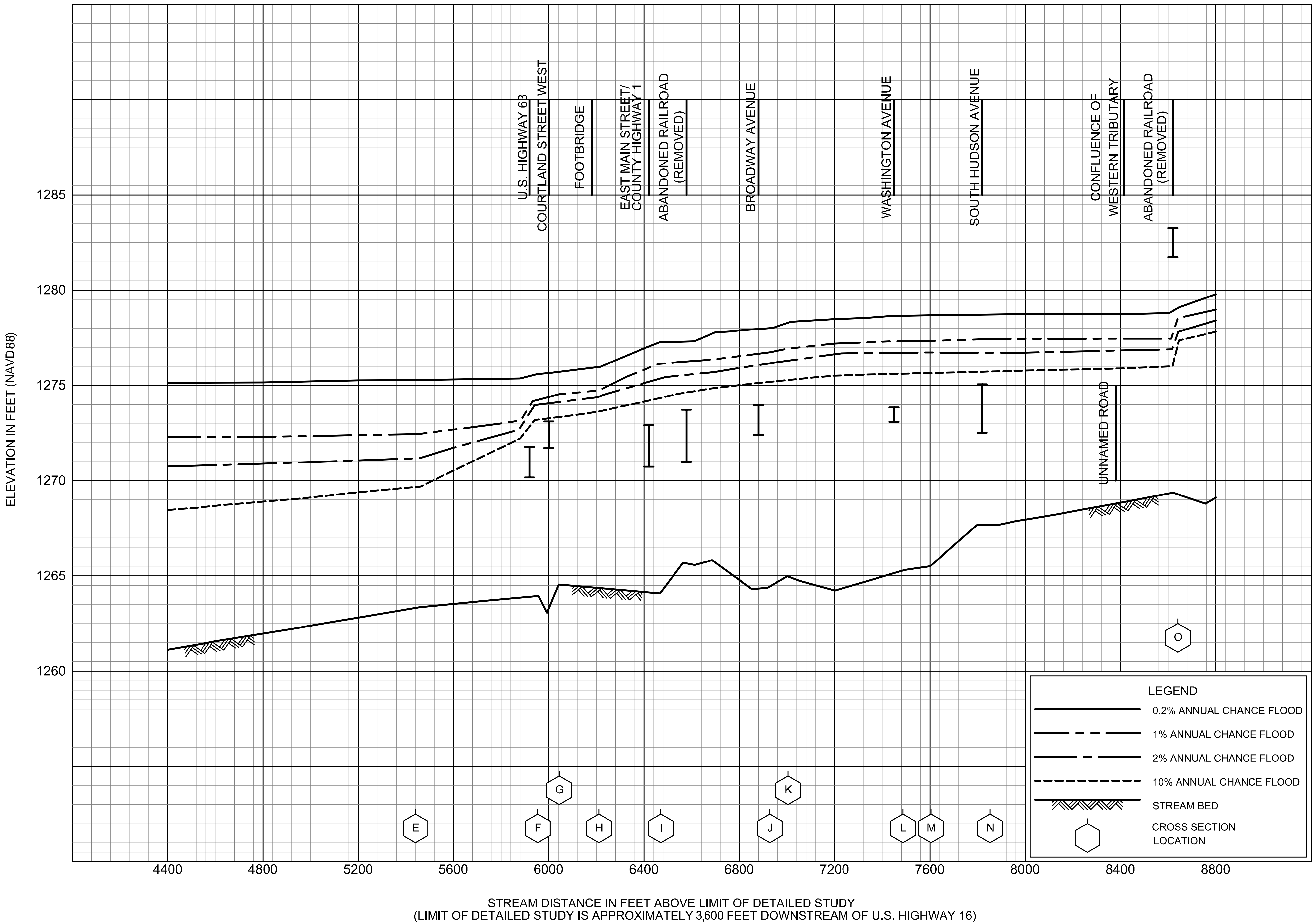
FLOOD PROFILES

SPRING VALLEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS

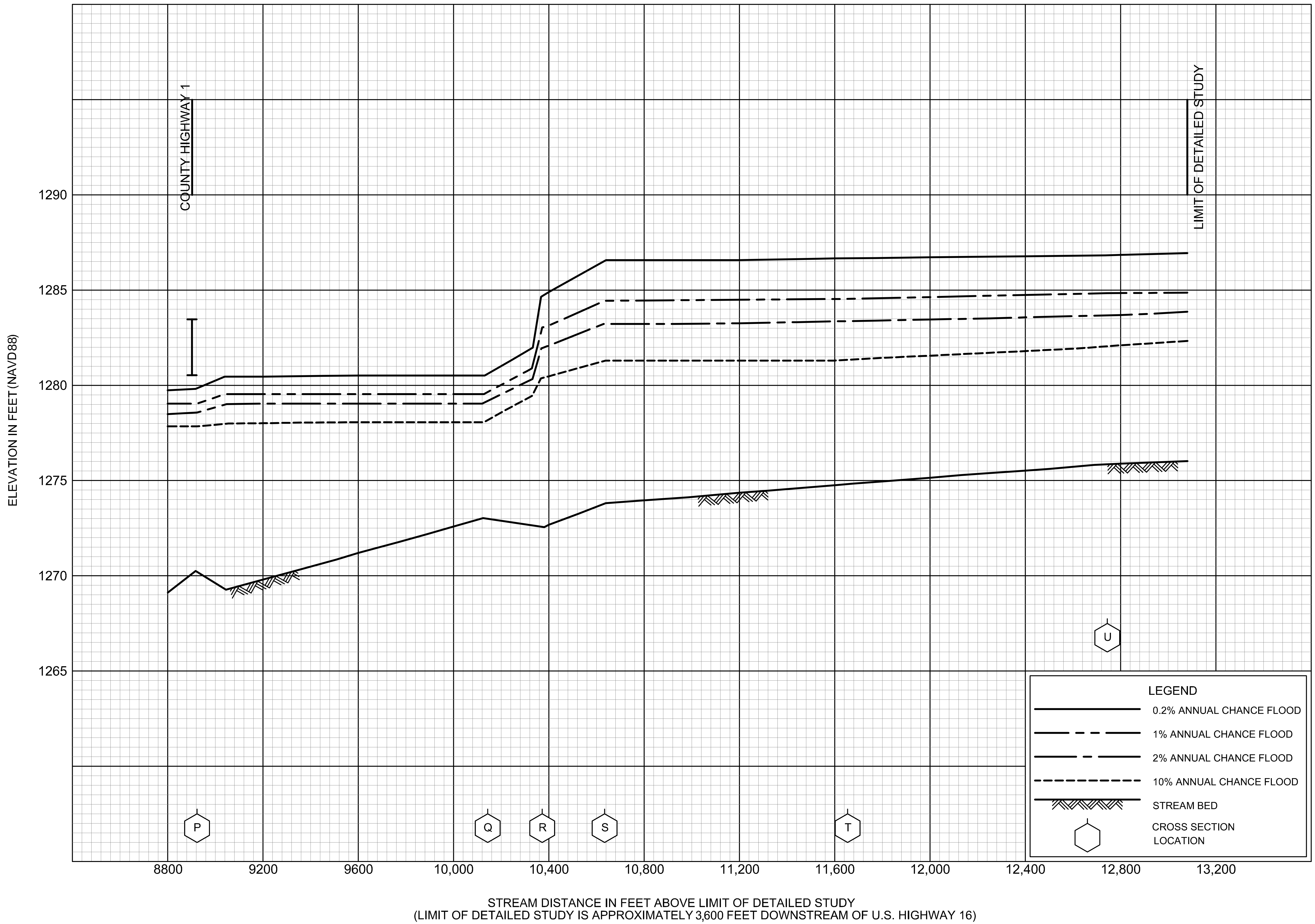


FLOOD PROFILES

SPRING VALLEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN
AND INCORPORATED AREAS



FLOOD PROFILES

SPRING VALLEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS

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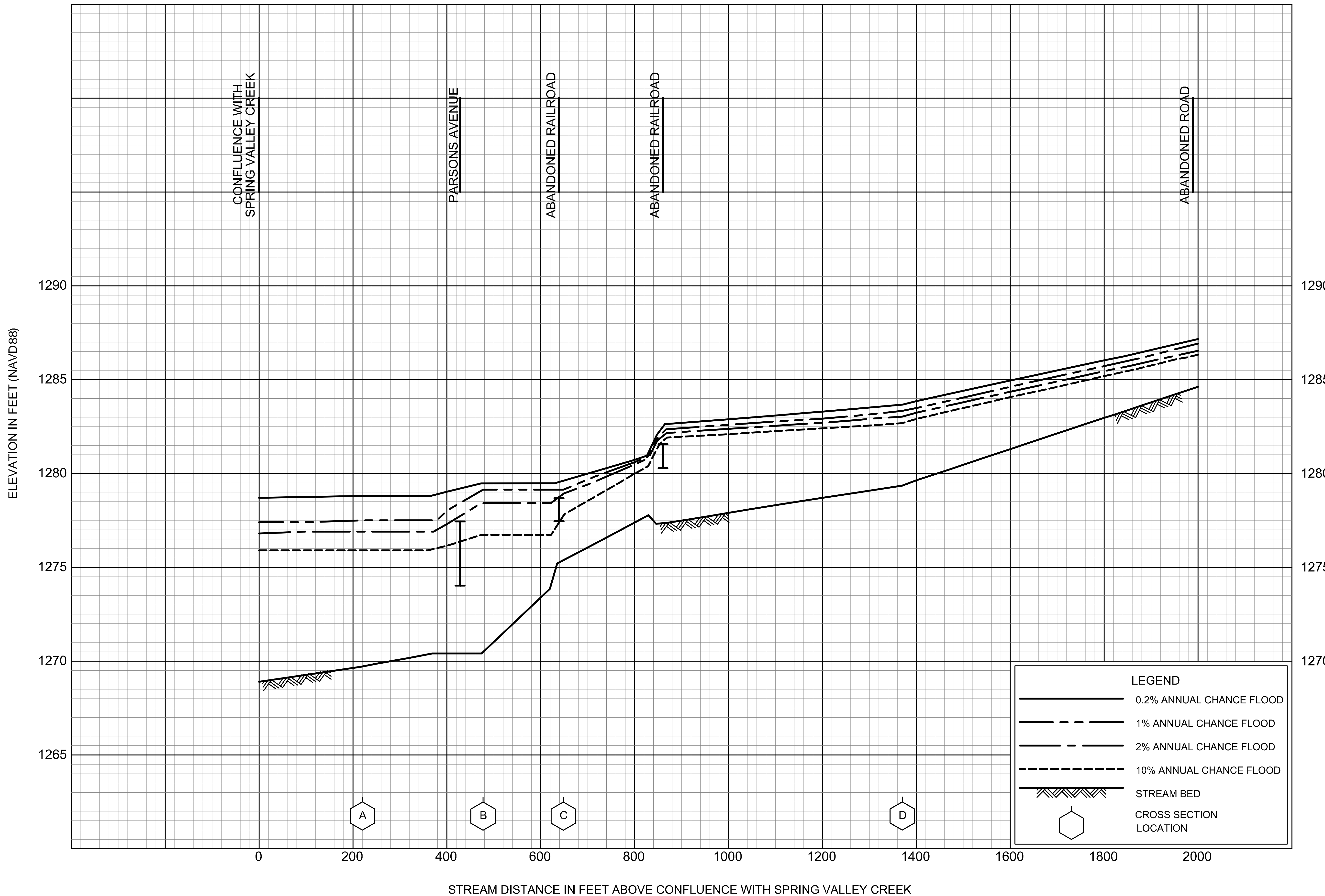


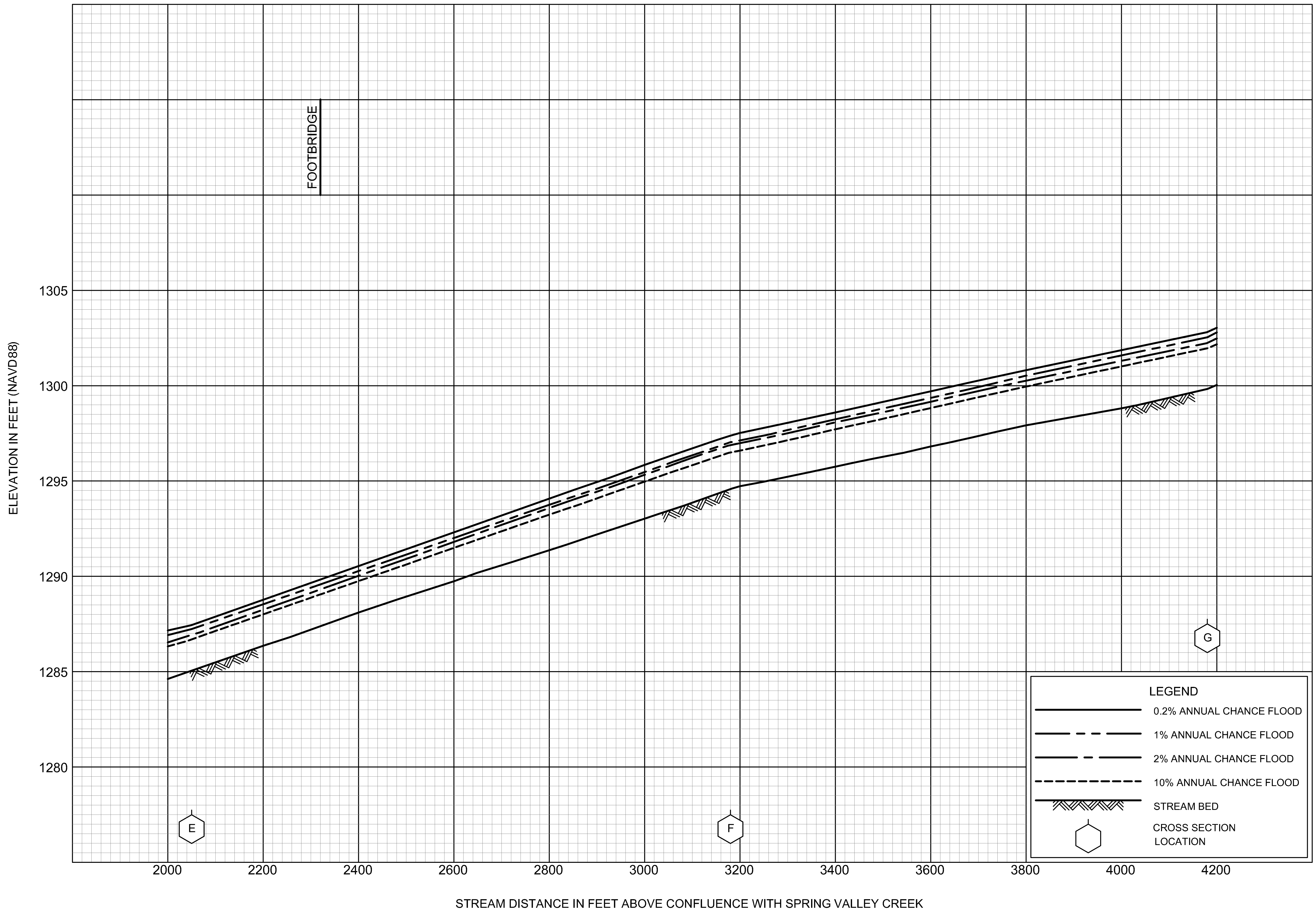
FLOOD PROFILES

WESTERN TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

WESTERN TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

FILLMORE COUNTY, MN

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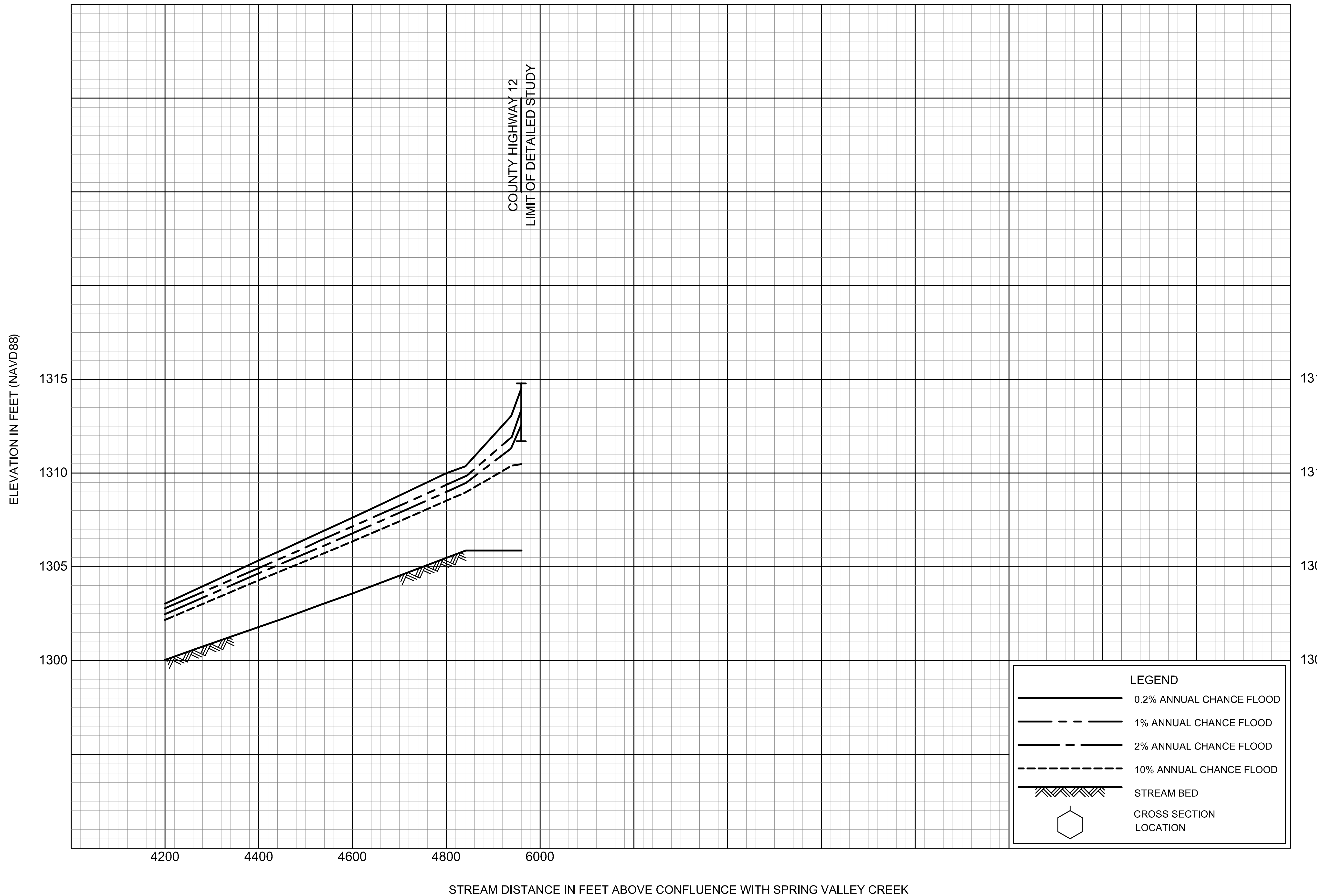

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