FLOOD INSURANCE STUDY

REVISED PRELIMINARY

8/5/2016

LENAWEE COUNTY, MICHIGAN

(ALL JURISDICTIONS)

Community Name	Community Number
* Addison, Village of	261098
Adrian, City of	260115
Adrian, Charter Township of	260732
Blissfield, Township of	261078
Blissfield, Village of	260339
* Britton, Village of	261099
Cambridge, Township of	261079
Cement City, Village of (Jackson & Lenawee Counties)	261100
* Clayton, Village of	261101
Clinton, Township of	261080
Clinton, Village of	260437
Deerfield, Township of	260717
Deerfield, Village of	260438
* Dover, Township of	261081
* Fairfield, Township of	261082
Franklin, Township of	261083
Hudson, City of	260116
Hudson, Township of	261084
* Macon, Township of	261085
Madison, Charter Township of	261086
* Medina, Township of	261087
* Morenci, City of	261088
Ogden, Township of	261089
* Onsted, Village of	261102
Palmyra, Township of	260737
Raisin, Charter Township of	261090
* Ridgeway, Township of	261091
Riga, Township of	261092
* Rollin, Township of	261093
Rome, Township of	261094
* Seneca, Township of	261095
Tecumseh, City of	260117
Tecumseh, Township of	261096
Woodstock, Township of	261097

* No Special Flood Hazard Areas identified

EFFECTIVE: TBD

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
26091CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) 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. It is advisable to contact the Community Map Repository for any additional data.

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study 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 Zones	New Zone
A1 through A30	AE
B	X
C	X

Initial Countywide FIS Effective Date: To Be Determined

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PUBLISHED SEPARATELY

Flood Insurance Rate Map Index

Flood Insurance Rate Maps

FLOOD INSURANCE STUDY

LENAWEE COUNTY, MICHIGAN (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) revises and supersedes the FIS reports, Flood Insurance Rate Maps (FIRMs), and/or Flood Boundary and Floodway Maps (FBFMs) in the geographic area of Lenawee County, including the Charter Townships of Adrian, Madison and Raisin, the Cities of Adrian, Hudson, Morenci, and Tecumseh, the Townships of Blissfield, Cambridge, Clinton, Deerfield, Dover, Fairfield, Franklin, Hudson, Macon, Medina, Ogden, Palmyra, Ridgeway, Riga, Rollin, Rome, Seneca, Tecumseh, and Woodstock, and the Villages of Addison, Blissfield, Britton, Cement City, Clayton, Clinton, Deerfield, and Onsted (hereinafter referred to collectively as Lenawee County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Please note that the Village of Cement City is located in both Jackson and Lenawee Counties and is included in this countywide study. The Charter Townships of Adrian and Madison were previously referred to as the Townships of Adrian and Madison. The City of Morenci, the Townships of Dover, Fairfield, Macon, Medina, Ridgeway, Rollin, and Seneca, and the Villages of Addison, Britton, Clayton, and Onsted have no Special Flood Hazard Areas (SFHAs) identified. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Lenawee County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CPR, 60.3.

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

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

1.2 Authority and Acknowledgments

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

Precountywide Analyses

Information on the authority and acknowledgments for each of the previously printed FISs and FIRMs for communities within Lenawee County was compiled and is shown below.

City of Adrian	The hydrologic and hydraulic analyses for the January 1982 study for the City of Adrian were performed by Williams and Works, Inc., for FEMA, under Contract No. H-3970. This study was completed in January 1981 (Reference 1).
Charter Township of Adrian	The hydrologic and hydraulic analyses for the November 1990 study for the Charter Township of Adrian were performed by the U.S. Army Corps of Engineers (USACE), Detroit District, for FEMA, under Inter-Agency Agreement No. EMW-87-E-2509, Project Order No. 10. This study was completed in May 1988 (Reference 2).
Village of Blissfield	The hydrologic and hydraulic analyses for the February 1988 study for the Village of Blissfield were performed the USACE, Detroit District, for FEMA, under Inter-Agency Agreement No. EMW-85-E-1822, Project Order No. 1. This study was completed in June 1986 (Reference 3).
Village of Clinton	The hydrologic and hydraulic analyses for the January 1982 study for the Village of Clinton were performed by Williams and Works, Inc., for FEMA, under Contract No. H-3970. This study was completed in December 1980 (Reference 4).
Village of Deerfield	The hydrologic and hydraulic analyses for the October 1980 study for the Village of Deerfield were performed by McNamee, Porter, and Seeley and Smith, Hinchman, and Grylls Associates, Inc., for the Federal Insurance Administration (FIA), under Contract No. H-4705. This study was completed in November 1979 (Reference 5).
City of Hudson	The hydrologic and hydraulic analyses for the May 1981 study for the City of Hudson were performed by McNamee, Porter, and Seeley and Smith, Hinchman, and Grylls Associates, Inc., for the FIA under Contract No. H-4705. This study was completed in December 1979 (Reference 6).

City of Tecumseh — The hydrologic and hydraulic analyses for the December 1982 study for the City of Tecumseh were performed by Williams and Works, Inc., for FEMA, under Contract No. H-3970. This study was completed in December 1980 (Reference 7).

There are no previously printed FIS reports for the Charter Townships of Madison and Raisin, the City of Morenci, the Townships of Blissfield, Cambridge, Clinton, Deerfield, Dover, Fairfield, Franklin, Hudson, Macon, Medina, Ogden, Palmyra, Ridgeway, Riga, Rollin, Rome, Seneca, Tecumseh, and Woodstock, and the Villages of Addison, Britton, Cement City, Clayton, and Onsted.

Countywide Analyses

The hydrologic and hydraulic analyses for this countywide study were performed by Strategic Alliance For Risk Reduction (STARR) for FEMA, under Contract No. HSFEHQ-09-D-0370, Task Order No. 9. This work was completed in December 2015.

In addition to incorporating the existing seven FISs for communities within Lenawee County, this countywide FIS includes the following:

- a new detailed study for a portion of River Raisin and Mill Race Channel;
- new approximate studies on Beaver Creek, Big Ravine Ditch, Black Creek, Eddy Extension, Evans Creek, Floodwood Creek, Garrison Drain, Goose Creek, several reaches of River Raisin, Savage Drain, South Branch River Raisin and Wolf Creek;
- redelineation of effective studies and profiles on Bean Creek, Camp Brenott Drain, Evans Creek, several reaches of River Raisin, South Branch River Raisin and Wolf Creek;
- detailed study for Lake Loch Erin;
- approximate studies for Dewey Lake, Lake Arrowhead, Osprey Lake, Pickerel Lake, South Lake, South Pond, Stony Lake, Wamplers Lake; and
- incorporation of approved Letters of Map Change (LOMCs).

The vertical datum was shifted to North American Vertical Datum of 1988 (NAVD88). The digital floodplain data was merged into a single, updated DFIRM. The DFIRM includes 2010 Lenawee County Light Detection and Ranging (LiDAR) capable of producing 2-foot contours, 2005 digital orthophotography, political boundaries, road centerlines with street names, railroads with names, airports, rivers, lakes, streams, bridges and other hydraulic structures, and elevation reference marks. The imagery was obtained from the Lenawee County GIS Database, while the remaining basemap data was downloaded from the Michigan Center for Geographic Information.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO's) meeting is to discuss the scope of the FIS. A final CCO meeting is held to review the results of the study. The dates of the initial and final CCO meetings held for the previous FISs for Lenawee County and all the jurisdictions within its boundaries are shown in TABLE 1 (References 1–7).

TABLE 1 – Lenawee County CCO Meetings

Community Name	Initial CCO Date	Final CCO Date
City of Adrian	May 1978	August 18, 1981
Charter Township of Adrian	August 22, 1986	December 6, 1989
Village of Blissfield	not published	March 31, 1987
Village of Clinton	not published	July 21, 1981
Village of Deerfield	March 1, 1978	May 5, 1980
City of Hudson	March 1, 1978	September 24, 1980
City of Tecumseh	not published	July 23, 1982

Results of the technical aspects of this study were coordinated with, reviewed, and approved by the Michigan Department of Environmental Quality (MDEQ), the State coordinating agency.

On May 14, 2007, an initial CCO meeting was held concerning this countywide FIS. This meeting was attended by representatives of FEMA, MDEQ, other local participants, and the study contractor.

On March 29, 2016, a Flood Risk Review meeting was held to view and discuss draft work maps. This meeting was attended by representatives of FEMA, MDEQ, other local participants, and the study contractor.

The results of this study were reviewed at the final CCO meeting held on _____ __, 20__, and attended by representatives of _____. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This countywide FIS covers the geographic area of Lenawee County, Michigan, including all its jurisdictions, which are listed in Section 1.1.

The flooding sources studied previously by detailed methods for the previously-published FISs are shown in TABLE 2. The limits of detailed study are described from downstream to upstream (References 1–7).

TABLE 2 – Limits of Previous Detailed Studies

Flooding Source	Limits of Detailed Study
Bean Creek	From the downstream Township of Hudson / City of Hudson corporate limits to a point approximately 8,350 feet upstream of the Main Street
Camp Brenott Drain	From the confluence with River Raisin to Keegan Street
Evans Creek	From the confluence with River Raisin to a point just upstream of Occidental Road
Mill Race Channel	From the confluence with River Raisin to the divergence from River Raisin
River Raisin	From a point approximately 2,500 feet downstream of Bucholtz Road to a point approximately 11,100 feet upstream of Bucholtz Road; from a point approximately 15,000 feet downstream of Adrian Street to a point approximately 13,150 feet upstream of Adrian Street; from East Russell Road to a point approximately 5,500 feet upstream of Tecumseh (Red Mill) Dam; and from the Township of Clinton / Village of Clinton corporate limits to Atlas Dam
South Branch River Raisin	From Howell Highway to a point approximately 300 feet upstream of the City of Adrian / Charter Township of Madison corporate limits
Wolf Creek	From a point approximately 1,000 feet upstream of Bent Oak Dam to U.S. Highway 223

Lake Loch Erin, which is located in the Townships of Cambridge and Franklin, was previously studied by MDEQ in July 2003 using detailed methods (Reference 8). The results of this analysis have been integrated into this study.

A detailed study along River Raisin and Mill Race Channel near the levee in the Village of Clinton was performed by STARR, under Contract No HSFE05-11-J-0009, Task Order 9. The downstream study limit for River Raisin is approximately 1.5 miles upstream of Staib Road and the upstream study limit is located approximately 0.4 miles upstream of Michigan Street. The downstream study limit for Mill Race Channel is approximately 0.2 miles south of Park Drive and the upstream study limit is located approximately 0.15 miles south of Michigan Street. The study was completed in May 2015.

Approximate analyses are usually used to study areas having a low development potential or minimal flood hazards. In this countywide FIS, streams previously studied by approximate methods were restudied and additional approximate analyses were performed to protect areas where flood hazards were not previously identified. Portions of the streams listed in TABLE 3 were studied by approximate methods as a part of this study.

TABLE 3 – Streams Studied by Approximate Methods

Big Ravine Drain	Evans Creek, Reach 2	South Branch River Raisin, Reaches 1 and 3
Harris Ditch	Goodrich Drain	South Branch River Raisin Tributary 3
Beaver Creek	Goose Creek	Wolf Creek Reaches 1, 3a, and 3b
Big Meadow Drain	Hahn Drain	Garrison Drain
Black Creek	Pease Drain	Garrison Drain Tributary
Brixby Drain	River Raisin, Reaches 2, 4, and 6	
Cook Drain	Savage Drain	
Crandall No. 71 Ditch		
Dillingham Creek		

Lakes previously studied by approximate methods were mapped using flood elevations provided by MDEQ. These lakes are shown in TABLE 4 (Reference 8).

TABLE 4 – Lakes Studied by Approximate Methods

Dewey Lake	Pickerel Lake	Stoney Lake
Lake Arrowhead	South Lake	Wamplers Lake
Osprey Lake	South Pond	

This countywide FIS also incorporates the determination of letters issued by FEMA resulting in map revisions (Letters of Map Revision (LOMRs)) and map amendments (Letters of Map Amendment (LOMAs)). LOMAs incorporated for this study are summarized in the Summary of Map Actions (SOMA) included in the Technical Support Data Notebook (TSDN) associated with this FIS update. Copies of the SOMA may be obtained from the Community Map Repository. Copies of the TSDN may be obtained from FEMA.

2.2 Community Description

Lenawee County is located in southeastern Michigan and encompasses a total area of approximately 761 square miles. It is bounded on the northwest by Jackson County, Michigan, on the northeast by Washtenaw County, Michigan, on the east by Monroe County, Michigan, on the southeast by Lucas County, Ohio, on the southwest by Fulton County, Ohio, and on the west by Hillsdale County, Michigan.

According to U.S. Census Bureau figures, the April 1, 2010, population of Lenawee County was 99,892. The estimated 2015 population was 98,573, a decrease of 1 percent from the April 1, 2010, population figure. The county seat is the City of Adrian, which is home to more than one-fifth of the population of Lenawee County (Reference 9).

The climate of Lenawee County is characteristically continental and is subject to extreme temperature variation. At the National Oceanic and Atmospheric Administration (NOAA) weather station located near the City of Adrian, the mean annual temperature is approximately 50 degrees Fahrenheit (F). During the winter months, the average temperature is approximately 26 degrees F, while the average temperature during the summer months is approximately 71 degrees F. Extremes of 108 degrees F and -26 degrees F have been recorded. The average annual precipitation is approximately 32

inches, including approximately 28 inches of snowfall, and is well distributed throughout the year (Reference 10).

The topography of Lenawee County ranges from nearly flat in the eastern and southeastern portions of the county to heavily rolling in the northwestern portion. This topography was formed by the movement of continental glaciers as they moved south and retreated north (Reference 11).

Approximately 80 percent of Lenawee County is drained by the River Raisin watershed. Agriculture is the top industry in this watershed. An area along the western boundary of the county, which accounts for approximately 16 percent of the county's area, is drained by the Maumee River watershed. The remaining areas are found along the county's southern border and drain to Ohio.

The soils in Lenawee County are considered to be one of the county's most significant natural assets. Rich soil deposits left by Lake Erie as it receded are found in the eastern and southern portions of the county and create high-quality farmland. The deltaic and lacustrine deposits found in this area are generally poorly-drained. Soils in the north and northeastern portions of the county are of glacially-related origin and are generally well-drained silty loams and sandy loams. Morainal deposits are found in the central portion of the county and are fairly well drained. Soils in the western portion of the county vary from limey clay loams and silty clay loams to clays (References 1–7 and 11).

According to data compiled in 1978 for the Michigan Resource Inventory System, approximately 5 percent of Lenawee County's land at the time was urban. While landuse has changed considerably since this data was assembled, Lenawee County is still primarily rural. However, low-density residential developments are now found more frequently in rural areas. Despite the presence of this urban sprawl, the majority of the county's population is found in the urban corridor between the City of Adrian and the Village of Clinton (Reference 11).

The economy of Lenawee County is largely dependent on income from industries located in the Cities of Adrian and Tecumseh, as well as those in the nearby communities of the City of Ann Arbor in Washtenaw County and the City of Jackson in Jackson County. Agriculture also contributes to Lenawee County's economy. Agricultural products produced in the county include corn, wheat, soybeans, vegetables, nursery and greenhouse products, dairy, and cattle.

Development within the floodplain is generally minimal throughout Lenawee County. The majority of the development that is found in the floodplain is agricultural in rural areas, while residential and commercial development can be found in the floodplain in urban areas (References 1–7).

2.3 Principal Flood Problems

Flooding within Lenawee County is generally the result of high-intensity rainfall or rainfall on saturated or frozen ground. Snowmelt can increase the effects of flooding. Such flooding usually occurs in spring or early summer.

High water levels along Bean Creek in the City of Hudson can cause flooding due to the backup of storm sewers. The largest known flooding event along Bean Creek occurred in

March 1978, during which several residential, commercial, and industrial structures were inundated, including the City of Hudson Wastewater Treatment Plant. No high water marks or recorded discharges are available for this event (Reference 6).

According to the January 19, 1982 City of Adrian FIS, the most serious flooding reported along the River Raisin and South Branch River Raisin occurred on March 7, 1908. This flood was reported to be the result of several days of warm rain on top of an unusually heavy winter snowfall. Numerous communities along the River Raisin were affected and experienced extensive damage. Many residents were forced to evacuate to higher ground. While no flood-peak discharge estimate is available for this event, is has been estimated to represent between a 1- and 0.2-percent-annual-chance event (References 1 and 3).

Flooding occurred in April 1947 as a result of several days of intense rainfall combined with frozen soil and snowmelt. The Bucholtz Road bridge across the River Raisin in the Village of Deerfield was washed out by this flood. While no discharge estimates are available for the River Raisin for this event, it was estimated to be equal to the 2-percent-annual-chance flood event (Reference 12).

Major flooding along the River Raisin was also reported to have occurred in the City of Tecumseh and the Village of Clinton on June 26, 1968, as the result of several days of steady rainfall. This flood caused considerable damage to a large portion of the southern approach of the Tecumseh (Red Mill) Dam. The Hayden Fuel Dam on Globe Mill Pond was washed out by this event, and was subsequently rebuilt and renamed Globe Dam.

Other large floods occurred along the River Raisin in April 1956, March 1962, January 1969, February 1971, September 1972, March 1976, March 1978, September 1981, March 1982, May 1983, February 1985, and January 1993. While the March 1978 flood caused backup at the Village of Deerfield Wastewater Treatment Plant and Water Treatment Plant, no other reports of significant damage from these other floods are available. Previous reports have indicated that low-lying areas adjacent to the River Raisin flood regularly in the spring. Additionally, crop damage along the River Raisin has been a problem and several structures have been inundated by smaller flood events (References 3–5, 7, and 13).

Low-lying areas along Wolf Creek in the Charter Township of Adrian flood frequently. No record is available for this flooding. The principal cause of flooding is intense rainfall during wet periods or rainfall on frozen ground. Snowmelt can increase the effects of flooding (Reference 2).

TABLE 5 shows high water marks and streamflow values from past flooding events as reported by the previously-published FISs for communities within Lenawee County and the United States Geological Survey (USGS) National Water Information System (NWISWeb). Elevations are in feet in NAVD88 (References 1–7 and 13).

TABLE 5 - High Water Marks

Flooding Source & Location	Drainage Area (Sq. Miles)	Date	Elevation (ft NAVD88)	Flow (cfs)
River Raisin				
At Academy Road (USGS gage no. 04176000)	463	Apr. 30, 1956	707.6	5,580
		Mar. 23, 1978	706.6	4,180
		Sep. 4, 1981	707.0	4,460
		Mar. 15, 1982	708.5	6,660
		May 3, 1983	707.5	5,160
		Feb. 25, 1985	708.4	5,610
		Jan. 6, 1993	706.8	4,940
Downstream of Raisin Center Highway (USGS gage no. 04175700)	267	Mar. 13, 1962	717.2	1,430
		Jun. 26, 1968	719.2	2,920
		Jan. 30, 1969	717.7	1,870
		Feb. 21, 1971	717.5	1,400
		Mar. 5, 1976	717.0	1,400

2.4 Flood Protection Measures

Both structural and nonstructural flood protection measures are being utilized in the prevention of future flood damage in Lenawee County. Nonstructural measures are in the form of land use regulations adopted from the Code of Federal Regulations (Reference 14), which control building within areas that have a high risk of flooding. Structural measures are seen in the form of dams, dikes, and levees.

Globe Mill Dam is located on Evans Creek in the City of Tecumseh just upstream of the confluence with the River Raisin. This dam regulates the water levels on Globe Pond. Upstream, between Maumee Street and Evans Street, a small levee was constructed along the creek's southern bank. This levee offers some protection during relatively minor floods (Reference 7). This levee is not certified to contain the 1-percent-annual-chance flood event.

Blissfield Dam is located on the River Raisin approximately 3,600 feet downstream of Adrian Street in the Village of Blissfield. This dam is an ogee-shaped weir with no flood gates. Its impoundment storage is limited to the river channel. Hydraulic analyses indicate that the dam would be submerged by approximately nine feet of water during the 1-percent-annual-chance flood event (Reference 3).

Earth dikes are located intermittently along the upper reaches of the River Raisin within the Village of Blissfield. Due to the intermittent nature of these dikes, they provide no protection from the 1-percent-annual-chance flood event (Reference 3).

Standish Dam and Tecumseh (Red Mill) Dam are located along the River Raisin in the City of Tecumseh and regulate the water levels on Standish Pond and Red Mill Pond, respectively. These dams were not constructed specifically for the purpose of flood

Atles Mill Dam is located on the River Raisin in the Village of Clinton. In 1970 and 1971, dikes were built along the river between this dam and Michigan Avenue to protect Water Wheel Estates Trailer Park. At that time, the east earthen embankment of the dam was raised and widened, and the channel downstream of the dam was deepened and widened. These measures protect the reach between Atles Mill Dam and Michigan Avenue for all flood levels analyzed in this study (Reference 4).

Bent Oak Dam is located on Wolf Creek in the City of Adrian. While this dam does regulate peak flood discharges, it is primarily used to control water levels on Lake Adrian, which serves as the City of Adrian's primary water source. As a result, the dam is considered to provide no significant level of flood protection (Reference 1).

Loch Erin Dam is located further upstream on Wolf Creek in the Township of Cambridge. This dam was constructed in 1968 and 1968 as part of a residential development and consists of a 1,000 foot long earth embankment and a concrete spillway. The spillway is 50 feet wide at its upstream inlet decrease to 25 feet wide approximately 25 feet downstream of the inlet. The total length of the spillway is approximately 110 feet and total elevation change from inlet to outlet is 18 feet. A slide gate is located within the earth embankment. This structure was only intended to be operated in order to lower the water level of Lake Loch Erin for maintenance or to provide additional water for the City of Adrian per a Water Rights Agreement signed on July 11, 1967 (Reference 25). No information on flood protection provided by this dam was available for this study.

While no flood protection structures are known to exist on Bean Creek, the City Manager of the City of Hudson has requested that the USACE dredge the stream in order to permit larger discharges to be contained within the within the stream's banks. However, there is no record available to indicate whether such dredging has occurred (Reference 6).

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-, 25-, 50-, 100- or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2-percent 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 one 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. The

information provided in this section was obtained from the previously published FIS reports for Lenawee County unless indicated otherwise.

Precountywide Analyses

The SCS TR-20 computer program (Reference 15) was used to estimate peak flood discharges for several study streams. Input parameters for TR-20 models include total rainfall amounts associated with each flood frequency and individual sub-basin characteristics such as land surface runoff curve numbers, times of concentration, sub-basin areas, reach lengths, and structure/cross section rating curves (References 16–19). The models were calibrated to observed discharge data to ensure that the computed discharges correlated to observed streamflow.

A TR-20 model was used to perform hydrograph routing computations for Evans Creek and the River Raisin in the City of Tecumseh. The model was calibrated to observed discharge data obtained from the stream gage on the River Raisin downstream of Raisin Center Highway (USGS gage no. 04175700) (Reference 7).

A TR-20 model was used to perform hydrograph routing computations for the portion of the River Raisin upstream of the Atles Mill Dam in the Village of Clinton. The model was calibrated to observed discharge data obtained from the stream gage on the River Raisin downstream of Raisin Center Highway (USGS gage no. 04175700) (Reference 4).

A TR-20 model was used to estimate peak flood discharges for the South Branch River Raisin in the City of Adrian. The model was calibrated to discharge data recorded between 1953 and 1978 by the stream gage on the River Raisin at Academy Road (USGS gage no. 04176000) (Reference 1).

Discharges for Wolf Creek in the Charter Township of Adrian have been estimated as a part of several previous studies, including a Dam Safety Report for Bent Oak Dam (Reference 26) and the 1982 City of Adrian FIS (Reference 1). A revised 1-percent-annual-chance discharge estimate following FEMA guidelines was calculated as part of the 1990 Charter Township of Adrian FIS. A statistical model presented in USGS Water-Resources Investigations Report 84-4207 (Reference 27) was applied to Wolf Creek and a 1-percent-annual-chance discharge of 1,390 cfs was obtained. This compared to the 1,840 cfs discharge calculated as part of the 1982 City of Adrian FIS using a TR-20 model. The TR-20 model was determined to be representative of the discharge conditions for Wolf Creek and the 1,840 cfs discharge estimated by the model was selected for use in the 1990 Charter Township of Adrian FIS (Reference 2).

Other methods of analysis were used to establish peak discharge-frequency relationships for the remaining streams studied by detailed methods. These methods include the application of the log-Pearson Type III frequency distribution (Reference 20) and the unit hydrograph method developed by Brater (Reference 24). The analyses performed for these streams are detailed below.

Bean Creek is located within the Maumee River watershed. Two USGS stream gages—one on Bean Creek at Powers, Ohio (USGS gage no. 04184500), and one on the Tiffin River at Stryker, Ohio (USGS gage no. 04185000)—are found downstream of the study area within the Maumee River watershed. Statistical analyses of these gages following the methods outlined in Bulletin No. 17 (Reference 20) are in included in the Ohio

Department of Natural Resources (ODNR) Bulletin No. 45 (Reference 21). These analyses of the Bean Creek and Tiffin River stream gages were performed using 35 and 44 years of data, respectively. In order to estimate the discharges upstream at the study area, equations presented in Bulletin No. 45 were employed. These equations estimate peak discharges using drainage area, main-channel slope, and average precipitation. The results obtained using these equations were found to match discharge estimates obtained by extrapolating the gage results upstream to the study area. Since no equation was given for estimating the 0.2-percent-annual-chance discharge, an extrapolation was made from a plot of discharge versus recurrence interval on probability-log paper (Reference 6).

Peak discharge estimates for Camp Brenott Drain were made using the unit hydrograph method developed by Brater (Reference 24). With this method, runoff hydrographs are developed considering a number of factors, including population density, infiltration capacity, and rainfall intensity-duration patterns (Reference 5).

Peak discharges estimates for the River Raisin in the Village of Blissfield were computed using an USACE computer program (Reference 22) that computes a log-Pearson Type III frequency curve. Skew coefficients were obtained from a report published by the USACE (Reference 23). Observed discharge data was obtained from two stream gages: one on the River Raisin at Academy Road (USGS gage no. 04176000) and one on the River Raisin downstream of Raisin Center Highway (USGS gage no. 04176500). These gages had 39 and 48 years of record available, respectively (Reference 3).

Peak discharge estimates for the River Raisin in the Village of Deerfield were based on observed discharge data obtained from two stream gages. One stream gage is located in Monroe County approximately 27 miles downstream of the Village of Deerfield (USGS gage no. 041765000). The other stream gage is located approximately 35 miles upstream of the Village of Deerfield in Lenawee County at Academy Road (USGS gage no. 04176000). The length of the record obtained from these gages was 41 years and 31 years, respectively. The log-Pearson Type III frequency distribution was fitted to this data following the method outlined in Bulletin No. 17 (Reference 20). The skew coefficient was taken from a skew map provided by the MDEQ. An outlier test developed by MDEQ was used. The peak discharges versus drainage area were plotted on log-log paper and a straight line interpolation was used to determine the flows on the River Raisin at the Monroe / Lenawee County boundary (Reference 5).

Peak discharge-drainage area relationships for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events of the flooding sources studied in detail are shown in TABLE 6 (References 1–7).

TABLE 6 – Peak Discharge Values

Flooding Source and Location	Drainage Area (Sq. Miles)	Peak Discharges (cfs) 10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Bean Creek						
Just upstream of confluence with Garrison Drain	100	2,170	*	3,050	3,420	4,750
Camp Brenott Drain						
Upstream of confluence with River Raisin	7.4	420	*	640	730	960
Evans Creek						
Upstream of confluence with River Raisin	34	1,060	*	1,360	1,480	1,690
Upstream of Globe Mill Dam	34	1,150	*	1,770	2,010	2,450
River Raisin						
At the Monroe / Lenawee County boundary	686	6,300	*	8,200	9,000	10,600
At Adrian Street	643	6,770	*	9,600	10,830	13,730
Just downstream of confluence with Evans Creek	259	2,430	*	3,600	4,090	5,060
Just upstream of confluence with Evans Creek	225	1,360	*	2,240	2,610	3,380
Just upstream of confluence with Raceway Spillway	224	1,340	*	2,060	2,350	3,000
Just upstream of Standish Dam	223	1,280	*	1,830	2,060	2,540
Just upstream of Tecumseh Dan	222	1,280	*	1,820	2,070	2,550
At the downstream Village of Clinton corporate limits	209	1,100	1,200	1,400	1,600	1,900
At West Michigan Avenue (US-12)	202	1,100	1,200	1,400	1,600	1,900
At Atles Mill Dam	201	1,100	1,200	1,400	1,600	1,900
South Branch River Raisin						
At Howell Highway	165	2,960	*	4,620	5,230	6,510
Just upstream of confluence with Wolf Creek	164	1,990	*	3,160	3,650	4,580
Wolf Creek						
At a point approximately 1.0 mile downstream of Birnwick Road	*	*	*	*	1,840	*

* Data not available

For ungaged streams with drainage areas less than 20 square miles, 1-percent-annual-chance discharges were calculated using the methodology described in Computing Flood Discharges for Small Ungaged Watersheds (Reference 30). The method detailed in this report is similar to the dimensionless unit hydrograph method developed by the SCS and described in "Section 4: Hydrology" of the National Engineering Handbook. It utilizes contributing drainage area; curve numbers based on soil type and land use; times of

concentration calculated based on the maximum flow path's length, slope, and flow regime; and the presence of ponds and swamps within the contributing drainage area.

For ungaged streams with drainage areas greater than 20 square miles, 1-percent-annual-chance discharge estimates were calculated using regression equations described in "USGS Water-Resources Investigation Report 94-4002" (Reference 32). These regression equations were developed from peak-discharge records available through 1982 from 185 gaging stations with 10 or more years of record. They are applicable to unregulated, rural streams draining less than 1,000 square miles and have standard errors of estimation ranging from 30 to 39 percent. The explanatory variables used in these equations are contributing drainage area; main-channel slope; percentage of the main-channel length that passes through swamp, lake, or pond; basin slenderness ratio; 1-percent-annual-chance 24-hour rainfall depth; seven characteristics of surficial geologic material; and a regional factor.

Discharge estimates from previous studies were available at locations along several study streams. Sources include the MDEQ Flood Discharge Database and previous FIS reports. At locations where flood discharge estimates were available from multiple sources, engineering judgment was used to determine which discharge would be used.

The stillwater elevations for the 1-percent-annual-chance flood event for the lakes previously studied by approximate methods were obtained from the MDEQ (Reference 8). Information regarding the analysis methods is unavailable.

Initial Countywide Hydrologic Analysis

Peak discharge estimates for the River Raisin in the Village of Clinton were computed by MDEQ. Flood frequency analyses were performed on annual peak discharge data recorded at USGS gage number 04175600, River Raisin near Manchester, and USGS gage number 04175700, River Raisin near Tecumseh. The results of the frequency analyses were weighted according to drainage area to obtain peak discharge estimates within the Village of Clinton.

Peak discharge-drainage area relationships for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events for the River Raisin in the Village of Clinton are shown in TABLE 6.

Lake Loch Erin was studied by detailed methods by MDEQ using the USACE HEC-1 Flood Hydrograph Package (Reference 28), which simulates the precipitation-runoff process using basin characteristics, and can generate, combine, and route flood hydrographs from several subbasins. The calculated 1-percent-annual-chance flood event stillwater elevation for Lake Loch Erin is shown in TABLE 7 (Reference 8).

TABLE 7 – Summary of Stillwater Elevations

	Peak Elevation (feet NAVD88)			
Flooding Source and Location	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Lake Loch Erin				
Townships of Cambridge and Franklin	*	*	927.3	*

* Data not available

Hydrologic calculations were performed using approximate methods for each of the streams listed in TABLE 3. Basins were delineated at various locations throughout each reach. The method of analysis used for each basin was selected based upon the size of the watershed and the availability of a systematic record of peak discharge data or previously published estimates of the 1-percent-annual-chance discharge.

A flood frequency analysis was performed on annual peak discharge data recorded at USGS gage number 04176000, which is located on the River Raisin at Academy Road in the Charter Township of Raisin using the USGS PeakFQWin computer program. PeakFQWin provides an estimate of the 1-percent-annual-chance discharge by fitting the log-Pearson Type III distribution to the annual peak discharges following the guidelines of Bulletin 17B. For stream locations along the River Raisin where the ratio of the drainage areas of the gaged and ungaged sites is between 0.5 and 2.0, the discharge estimate at the gaged site was weighted based on the ratio of the drainage areas. The equation used to weight the discharges, which was provided by MDEQ, is shown below.

$$Q_{100(UG)} = \left(\frac{A_u}{A_g} \right)^{0.89} Q_{100(G)}$$

In the equation above, $Q_{100(UG)}$ is the area-weighted estimate of the 1-percent-annual-chance discharge at the ungaged site; $Q_{100(UG)}$ is the 1-percent-annual-chance discharge estimate at gaged site based on the systematic records; A_u is the drainage area at ungaged site; and A_g is the drainage area at gaged site.

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 Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data Table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Precountywide Analyses

Cross section data used in the riverine hydraulic models are described in TABLE 8. The methods used to obtain cross section data for each hydraulic study are listed (References 1–7).

TABLE 8 – Cross Section Data

Flooding Source	Location	Description
Bean Creek	City of Hudson	Channel cross sections were obtained by field survey. Overbank cross sections were obtained from aerial photographs flown in November 1978 at a scale of 1:9600. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.
Camp Brenott Drain	Village of Deerfield	Cross sections were obtained by field survey. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.
Evans Creek	City of Tecumseh	Cross sections were obtained by field survey in June and July 1979 and supplemented by aerial photography flown in October 1978 at a scale of 1:4800 and with a contour interval of 4 feet.
Mill Race Channel	Village of Clinton	Cross sections were obtained by field survey in August 1979 and supplemented by aerial photography flown in October 1978 at a scale of 1:4800 and with a contour interval of 4 feet.
River Raisin	City of Tecumseh	Cross sections were obtained by field survey in June and July 1979 and supplemented by aerial photography flown in October 1978 at a scale of 1:4800 and with a contour interval of 4 feet.
	Village of Blissfield	Cross sections were obtained by field survey and photogrammetric techniques in June 1979.
	Village of Clinton	Cross sections were obtained by field survey in Nov/Dec 2014 and supplemented by a DEM generated using 2010 Lenawee County LiDAR to obtain cross-section data in floodplain areas outside the extents of the survey.

TABLE 8 – Cross Section Data *(continued)*

Flooding Source	Location	Description
River Raisin *(continued)*	Village of Deerfield	Cross sections were obtained by field survey. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.
South Branch River Raisin	City of Adrian	Cross sections were obtained by field survey in May and June 1979 and supplemented by aerial photography flown in October 1978 at a scale of 1:4800 and with a contour interval of 4 feet.
Wolf Creek	Charter Township of Adrian	Cross sections were obtained by field survey. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

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.

Water-surface elevations for the streams studied by detailed methods were calculated using the USACE HEC-2 step-backwater computer program (Reference 33). The methods for determining starting water-surface elevations used in each hydraulic model are described in TABLE 9 (References 1–7).

TABLE 9 – Starting Water-Surface Elevations

Flooding Source	Location	Method for Determining Starting WSE
Bean Creek	City of Hudson	Slope-area method
Camp Brenott Drain	Village of Deerfield	Slope-area method
Evans Creek	City of Tecumseh	Controlled by downstream submergence from flood stages on the River Raisin at the confluence.
River Raisin	City of Tecumseh	Normal depth at the initial cross section was computed for each flood event. Each starting elevation was shown to be the elevation to which downstream water-surface profiles converged for a 2-foot range of initial starting elevations 3,200 feet downstream.
	Village of Blissfield	Slope-area method
	Village of Clinton	Normal depth at the initial cross section was computed for each flood event. Each starting elevation was shown to be the elevation to which downstream water-surface profiles converged for a 2-foot range of initial starting elevations 5,020 feet downstream.
	Village of Deerfield	Slope-area method

TABLE 9 – Starting Water-Surface Elevations *(continued)*

Flooding Source	Location	Method for Determining Starting WSE
South Branch River Raisin	City of Adrian	Normal depth at the initial cross section was computed for each flood event. The starting stages were calibrated to a rating curve for a staff gage attached to the downstream face of the Howell Highway bridge.
Wolf Creek	Charter Township of Adrian	Water-surface elevation was set equal to 0.5 foot greater than the 1-percent-annual-chance water-surface elevation of Lake Adrian at Bent Oak Dam. The 0.5 foot was added to account for the placement of the initial cross section being at the inlet of the lake, at which point the transition from lake to normal stream channel is near completion.

Roughness coefficients (Manning's "n") were used to compute the hydraulic conveyance of each cross section and to compute friction losses between adjacent sections. Roughness coefficients were chosen by engineering judgment and based on field observations of the river and its adjacent floodplains. TABLE 10 shows the channel and overbank "n" for the flooding sources studied by detailed methods (References 1–7).

TABLE 10 – Manning's "n" Values

Flooding Source and Location	Channel "n" Values	Overbank "n" Values
Bean Creek		
City of Hudson	0.045–0.055	0.078–0.095
Camp Brenott Drain		
Village of Deerfield	0.050–0.065	0.085–0.090
Evans Creek		
City of Tecumseh	0.030–0.045	0.060–0.120
Mill Race Channel		
Village of Clinton	0.045–0.125	0.035–0.125
River Raisin		
City of Tecumseh	0.030–0.045	0.060–0.150
Village of Blissfield	0.023–0.060	0.035–0.120
Village of Clinton	0.045–0.125	0.035–0.125
Village of Deerfield	0.055–0.065	0.085–0.160
South Branch River Raisin		
City of Adrian	0.052–0.078	0.070–0.200
Wolf Creek		
Charter Township of Adrian	0.035–0.045	0.030–0.080

Shallow ponding was found to occur in the area of the intersection of Market Street and Mechanic Street in the City of Hudson. This is due to low elevations in the area and backup from storm sewers in the area which drain to Bean Creek (Reference 6).

Upstream impoundment stages for Globe Mill Dam, Standish Dam, and Tecumseh Dam, each located in the City of Tecumseh, were based on rating curves developed from structural information. This information was primarily obtained from USACE Dam Safety Reports (References 34–36), with data concerning dam operating procedures being obtained from the City of Tecumseh (Reference 7).

In the Village of Clinton, divided flow along the River Raisin was found to occur south of the Michigan Avenue bridge in a portion of the former Mill Race Channel during the 1-percent-annual-chance flood event. The amount of flow in each of the two channels which would result in the same water-surface elevations at the point where the channels converge was determined through a divided flow analysis. This resulted in a flow distribution of approximately 67 percent in the main channel and 33 percent in the former Mill Race Channel for the 1-percent-annual-chance flood event (Reference 4).

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles (Exhibit 1) are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

Flood profiles were drawn showing the computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. In cases where two or more profiles are close together, due to limitations of the profile scale, only the higher profile has been shown.

Water-surface elevations for the 1-percent-annual-chance flood for the streams studied by approximate analyses were computed using the USACE Hydrologic Engineering Center River Analysis System (HEC-RAS) computer program. Roughness factors for these streams were determined based on visual observation of aerial photography and standard, accepted values published in Open-Channel Hydraulics by Chow (Reference 37). Separate overbank and channel roughness values were selected for each stream reach. Starting water-surface elevations were determined using one of two methods: the normal depth routine in the HEC-RAS computer program (Reference 38) or a known water-surface elevation. The downstream gradients used were estimated though the use of USGS topographic maps.

Detail-studied streams that were not restudied as part of this map update may include a "profile base line" on the maps. This "profile base line" provides a link to the flood profiles included in this FIS. The detail-studied stream centerline may have been digitized or redelineated as part of this revision. The "profile base lines" for these streams were based on the best available data at the time of their study and are depicted as they were on the previous FIRMs. In some cases where improved topographic data was used to redelineate floodplain boundaries, the "profile base line" may deviate significantly from the channel centerline or may be outside the SFHA.

Updated Countywide Hydraulic Analysis

For the detailed study reach of River Raisin and Mill Race Channel, cross sections were field surveyed at locations immediately upstream and downstream of hydraulic structures and at select locations along the study reach. Survey data was collected in November and December of 2014. Additional elevation data was extracted from a Digital Elevation Model (DEM) generated using Lenawee County LiDAR data flown in 2010 to obtain cross-section data in floodplain areas located outside the extents of the field survey as well as additional non-surveyed cross sections placed between field surveyed cross sections. Cross-section geometry for the remaining approximate studies consisted of non-surveyed cross-sections developed from the LiDAR data. The analyses performed for this portion of River Raisin and Mill Race Channel is listed in TABLE 11.

TABLE 11 – Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream	Upstream					
Mill Race Channel	Approximately 0.2 miles south of Park Drive	Approximately 0.15 miles south of Michigan Street	Flood Frequency Analyses at USGS Gage 04175700	HEC-RAS 4.1.0	May 2015	AE with Floodway	Natural Valley Analysis was performed for the levee along River Raisin in Village of Clinton
River Raisin (Village of Clinton and Township of Clinton)	Approximately 1.5 miles upstream of Staib Road (Cross Section AM)	Approximately 0.4 miles upstream of Michigan Street (Cross Section BL)	Flood Frequency Analyses at USGS Gage 04175700	HEC-RAS 4.1.0	May 2015	AE with Floodway	Natural Valley Analysis was performed for the levee along River Raisin in Village of Clinton

All bridges and hydraulic structures included in the detailed study reach of River Raisin and Mill Race Channel were modeled using field surveyed data of the structures or "As-Built" construction drawings of the structures. Field survey information and "As-Built" construction drawings obtained for the Lenawee County, MI Countywide FIRM conversion were reported in the "Survey Submittal", prepared by STARR in 2015.

HEC-RAS, a one-dimensional, hydraulic-flow model developed by the USACE (USACE, 2010), was used to model study reaches updated as part of the Lenawee County, MI Countywide FIRM conversion. For detailed study reaches, HEC-RAS models were used to compute water-surface elevations for the 10-, 4-, 2-, 1- and 0.2-percent-annual-chance flood events. HEC-RAS was also used to compute regulatory floodway encroachment stations for all detailed study reaches.

Starting water surface elevations for modeled study reaches were selected based on Section C.3.4.3 of Appendix C of FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners. If the downstream limit of a base study reach terminated in an enhanced study of the same stream, the 1-percent-annual-chance starting water surface elevation for the base reach was determined from the downstream enhanced study. If two study reaches had a drainage area ratio between 0.6 and 1.4 at a confluence point and the two reaches were likely to have coincidental flood peaks, a junction feature was added in the model such that the water surface elevation immediately downstream of the junction would serve as the boundary condition for both streams. Otherwise, normal depth was used as the downstream boundary condition for base study reaches.

Manning's "n" values used in the hydraulic computations were obtained from "Open Channel Hydraulics" (Chow, 1959), and were selected based on a review of 2001 National Landcover Dataset (NLCD) spatial data and aerial imagery. The ranges of Manning's "n" values used in the model for the detailed portion of River Raisin and Mill Race Channel are provided in Table 9.

One split flow location was identified along River Raisin. This is known as Mill Race Channel. For this reach, a separate reach was added to the HEC-RAS model for the secondary channel and hydraulic junctions were included at divergence and convergence locations (if applicable). The "optimize" option in HEC-RAS determined the proportion of flow between the two channels through an iterative process.

The split flow results for the 1-percent-annual chance flood are summarized in Table 12.

TABLE 12 – Split Flow Analysis for Mill Race Channel

Model Station	Main Channel Name	Secondary Channel Name	Study Type	Total Flow (cfs)	Main Channel Flow (cfs)	Secondary Channel Flow (cfs)
321586	River Raisin Reach 7	River Raisin Split 1	Detailed	1600	1000	600

One levee located on the east side of River Raisin, Reach 7 between the Village of Clinton corporate limits and Michigan Avenue was identified on the effective FIRM. The levee discussed was analyzed using the Natural Valley procedure (Reference 41). For the base model, the levee was entered into the HEC-RAS model as left levee stations. The levee crest elevations were set at the highest levee embankment elevation at the cross

section location taken from the LiDAR. For the natural valley analysis, the levee stations were removed from the geometry model.

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 the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

Effective information for this countywide FIS report was converted from NGVD29 to NAVD88 based on data presented in TABLE 13. In order to calculate the vertical datum shift, quadrangle corner points with known elevation shifts were identified. Then, the average conversion was calculated based on the shifts from each quadrangle.

The average conversion of NGVD29-0.464=NAVD88 was applied to convert all effective Base Flood Elevations (BFEs). Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities in other counties not presented in this countywide FIS may be referenced to NGVD29. This may result in differences in BFEs across the corporate limits between communities.

TABLE 13 – Datum Conversion Calculations

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Difference
Palmyra	SE	41.750	-83.875	-0.551 ft
Jasper	SE	41.750	-84.000	-0.541 ft
Clayton	SE	41.750	-84.125	-0.528 ft
Hudson	SE	41.750	-84.250	-0.492 ft
Tecumseh South	SE	41.875	-83.875	-0.502 ft
Adrian	SE	41.875	-84.000	-0.472 ft
Rome Center	SE	41.875	-84.125	-0.463 ft
Addison	SE	41.875	-84.250	-0.427 ft
Tecumseh North	SE	42.000	-83.875	-0.436 ft
Tipton	SE	42.000	-84.000	-0.413 ft
Onsted	SE	42.000	-84.125	-0.397 ft
Cement City	SE	42.000	-84.250	-0.377 ft
Blissfield	SE	41.750	-83.750	-0.564 ft
Pittsford	SE	41.750	-84.375	-0.443 ft
Deerfield	SE	41.875	-83.750	-0.515 ft
Wheatland	SE	41.875	-84.375	-0.397 ft
Macon	SE	42.000	-83.750	-0.466 ft
Somerset Center	SE	42.000	-84.375	-0.377 ft

Average Conversion	-0.464
Range	-0.564 to -0.377
Max Offset	0.099

For more information on NAVD88, see the FEMA publication entitled Converting the National Flood Insurance Program to the North American Vertical Datum of 1988 (Reference 39), or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Silver Spring, Maryland 20910 (http://www.ngs.noaa.gov).

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides l-percent-annual-chance (100-year) flood elevations and delineations of the 1- and 0.2-percent-annual-chance (500-year) floodplain boundaries and l-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of this countywide FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevations table. Users should reference the data presented in this countywide 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 (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps with a contour interval of two feet. For this project, 2010 Lenawee County LiDAR capable of producing 2-foot contours was used to delineate the floodplains (Reference 42).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM. On this map, the l-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 l-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 l-percent-annual-chance floodplain boundary is shown on the FIRM. For lakes designated as Zone A, the floodplains were delineated using the 1-percent-annual-chance pool elevation, which was obtained from MDEQ, if available.

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 l-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 l-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 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 floodway presented in this countywide FIS report and on the FIRM was computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections. In cases where the floodway and l-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and l-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 water-surface elevation of the l-percent-annual-chance flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in FIGURE 1.

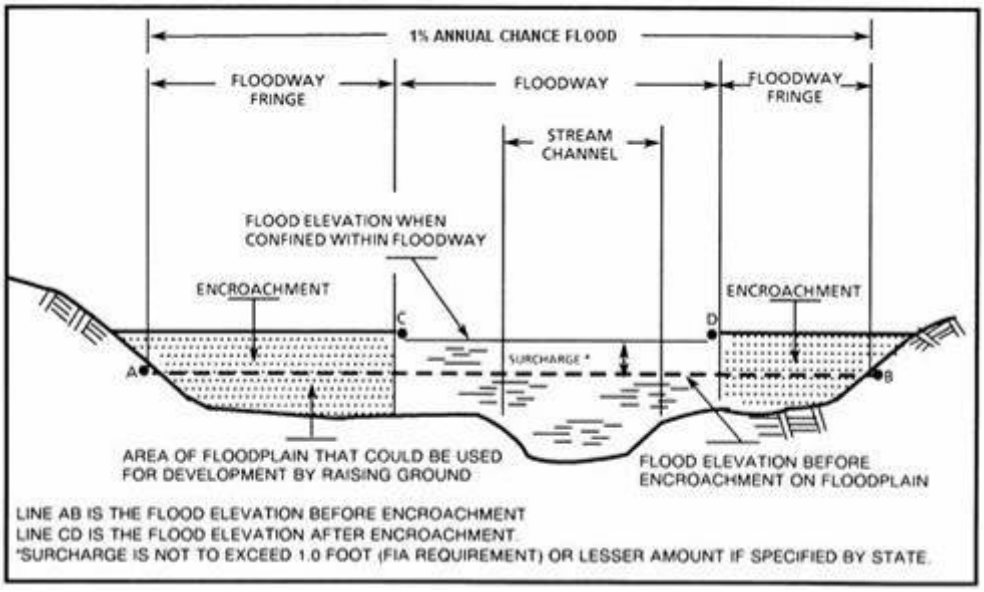

FIGURE 1 – Floodway Schematic

In Michigan, under the State's Floodplain Regulatory Authority, found in of the Natural Resources and Environmental Protection Act, 1994 PA 451, Water Resources Protection, Part 31 (Reference 40), encroachment in the floodplain is limited to that which will cause only insignificant increases in flood heights. At the recommendation of MDEQ, a floodway having no more that a 0.1-foot surcharge has been delineated for this countywide FIS.

The floodways presented in this study were initially computed on the basis of equal conveyance reduction from each side of the floodplain. In those areas where problems arose with the equal conveyance reduction encroachment option of the HEC-2 or HEC-RAS backwater programs, modifications were applied based on experience.

In the redelineation efforts, the floodways were not recalculated. As a result, there were areas where the previous floodway did not fit within the boundaries of the redelineated 1-percent-annual-chance floodplain. In these areas, the floodway was reduced. Water-surface elevations, both with and without a floodway, the mean velocity in the floodway and the location and area at each surveyed cross section as determined by hydraulic methods can be seen in TABLE 14, Floodway Data. The width of the floodway depicted by the FIRM panels and the amount of reduction to fit the floodway inside the 1-percent-annual-chance floodplain, if necessary, is also listed.

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BEAN CREEK								
A	3,980	774	2,053	1.7	896.4	896.4	896.5	0.1
B	5,280	140	763	4.5	898.4	898.4	898.5	0.1
C	5,430	54	510	6.7	899.6	899.6	899.7	0.1
D	5,480	69	563	6.1	899.8	899.8	899.8	0.0
E	6,030	63	558	6.1	900.2	900.2	900.3	0.1
F	6,180	59	586	5.8	900.9	900.9	900.9	0.0
G	6,230	60	524	6.5	901.0	901.0	901.0	0.0
H	6,330	62	446	7.7	902.0	902.0	902.0	0.0
I	6,380	131	976	3.5	902.0	902.0	902.0	0.0
J	6,830	272	1,450	2.4	902.5	902.5	902.5	0.0
K	7,030	234	1,277	2.7	902.6	902.6	902.6	0.0
L	7,155	300	417	8.2	904.0	904.0	904.0	0.0
M	7,305	311	2,028	1.7	904.6	904.6	904.6	0.0
N	8,505	976	4,601	0.7	904.9	904.9	904.9	0.0
O	11,205	785	3,133	1.1	905.6	905.6	905.6	0.0
P	13,755	700	1,717	2.0	907.8	907.8	907.9	0.1

[1]Feet above confluence with Garrison Drain

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

BEAN CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
CAMP BRENOTT DRAIN								
A	150	80	267	2.7	671.1	663.0[2]	663.0	0.0
B	550	150	472	1.6	671.1	663.5[2]	663.5	0.0
C	620	140	201	3.6	671.1	664.1[2]	664.1	0.0
D	660	150	468	1.5	671.1	664.2[2]	664.2	0.0
E	800	175	917	0.8	671.1	664.3[2]	664.3	0.0
F	1,125	150	582	1.3	671.1	664.4[2]	664.4	0.0
G	1,650	274	811	0.9	671.1	664.9[2]	664.9	0.0
H	1,950	90	926	0.8	675.7	675.7	675.7	0.0
I	2,050	75	973	0.8	675.8	675.8	675.8	0.0
J	2,410	75	889	0.8	675.8	675.8	675.8	0.0
K	3,760	80	733	1.0	675.8	675.8	675.8	0.0

[1]Feet above confluence with River Raisin
[2]Elevation computed without consideration of backwater effects from River Raisin

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

CAMP BRENOTT DRAIN

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
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
EVANS CREEK									
A	2,090	461	823	2.4		764.5	764.5	764.5	0.0
B	2,650	443	897	2.2		766.9	766.9	766.9	0.0
C	3,280	100	324	6.2		769.5	769.5	769.5	0.0
D	4,000	442	516	3.9		774.2	774.2	774.2	0.0
E	5,010	59	266	7.6		781.0	781.0	781.0	0.0
F	5,660	114	578	3.5		783.7	783.7	783.7	0.0
G	6,310	178	681	3.0	64	785.1	785.1	785.1	0.0
H	7,980	66	278	7.2		789.0	789.0	789.1	0.1
I	8,690	165	656	3.1		793.1	793.1	793.1	0.0
J	9,800	250	773	2.6		798.4	798.4	798.5	0.1
K	10,290	184	659	3.0		799.6	799.6	799.6	0.0
L	10,997	210	1,158	1.7		804.7	804.7	804.8	0.1
M	12,110	179	979	2.1		807.4	807.4	807.5	0.1
N	12,760	280	1,758	1.1	132	808.1	808.1	808.2	0.1
O	14,950	191	1,270	1.6	82	809.7	809.7	809.7	0.0
P	16,350	422	1,956	1.0	137	810.5	810.5	810.6	0.1
Q	18,000	383	1,469	1.4	417	814.5	814.5	814.5	0.0

[1]Feet above confluence with River Raisin

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

EVANS CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MILL RACE CHANNEL								
A	235	142	390	1.5	798.8	798.8	798.9	0.0
B	893	65	286	2.2	799.2	799.2	799.2	0.0
C	956	83	367	1.6	799.5	799.5	799.5	0.0
D	1,206	95	323	1.8	799.6	799.6	799.7	0.0
E	1,262	87	351	1.6	800.0	800.0	800.1	0.0
F	2,049	62	252	2.3	800.3	800.3	800.4	0.0

[1]Feet above confluence with River Raisin

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

MILL RACE CHANNEL

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
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
RIVER RAISIN									
A	334,000	160	2,370	3.8		670.4	670.4	670.4	0.0
B	334,910	175	3,009	3.0		671.1	671.1	671.1	0.0
C	336,400	1,130	7,646	1.2		671.7	671.7	671.7	0.0
D	338,500	2,500	15,439	0.6		672.0	672.0	672.0	0.0
E	341,990	1,400	9,240	1.0		672.6	672.6	672.6	0.0
F	344,375	1,280	9,525	1.0		673.2	673.2	673.2	0.0
G	403,750	1,350	9,290	1.2	75	683.0	683.0	683.1	0.1
H	410,070	1,438	9,370	1.2		684.1	684.1	684.2	0.1
I	411,350	1,664	10,010	1.1		684.2	684.2	684.3	0.1
J	414,600	1,325	8,302	1.3		684.7	684.7	684.8	0.1
K	415,620	968	7,464	1.5		684.9	684.9	685.0	0.1
L	416,650	406	4,090	2.6		685.1	685.1	685.2	0.1
M	417,490	169	2,466	4.4		685.5	685.5	685.6	0.1
N	417,680	257	2,742	3.9		686.0	686.0	686.1	0.1
O	418,290	990	7,173	1.5		686.7	686.7	686.8	0.1
P	418,990	914	8,736	1.2		686.8	686.8	686.9	0.1
Q	419,940	1,050	9,255	1.2		686.9	686.9	687.0	0.1
R	421,910	1,630	14,461	0.7		687.0	687.0	687.1	0.1
S	423,100	1,379	10,503	1.0		687.1	687.1	687.2	0.1
T	424,360	1,150	9,346	1.2		687.2	687.2	687.3	0.1
U	425,460	1,916	13,932	0.8		687.4	687.4	687.5	0.1
V	598,890	200	1,512	2.7		743.4	743.4	743.4	0.0
W	599,890	603	1,321	3.1		744.3	744.3	744.3	0.0
X	602,010	394	2,043	2.0		746.4	746.4	746.5	0.1
Y	603,040	725	2,966	1.4		747.8	747.8	747.9	0.1

[1]Feet above mouth at Lake Erie

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

RIVER RAISIN

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
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
RIVER RAISIN (CONTINUED)									
Z	604,490	415	1,781	2.3		748.8	748.8	748.9	0.1
AA	605,450	610	3,032	1.3		750.6	750.6	750.6	0.0
AB	606,400	122	882	4.6		751.5	751.5	751.5	0.0
AC	608,220	747	3,570	0.7		752.5	752.5	752.5	0.0
AD	608,940	223	1,433	1.8		752.7	752.7	752.7	0.0
AE	609,700	577	2,061	1.3		753.2	753.2	753.2	0.0
AF	611,010	400	1,225	1.9		754.0	754.0	754.0	0.0
AG	612,920	494	937	2.5		756.0	756.0	756.1	0.1
AH	613,860	198	766	3.1	31	757.5	757.5	757.5	0.0
AI	615,790	231	382	5.4		763.8	763.8	763.8	0.0
AJ	616,670	328	1,083	1.9	259	764.7	764.7	764.7	0.0
AK	618,020	139	457	4.5		765.9	765.9	766.0	0.1
AL	618,510	155	1,183	1.8		766.9	766.9	767.0	0.1
AM	645,490	1,171	1,995	0.8		792.8	792.8	792.9	0.1
AN	646,048	637	910	1.8		793.2	793.2	793.3	0.1
AO	646,150	660	885	1.8		793.7	793.7	793.7	0.0
AP	646,428	736	1,592	1.0		794.2	794.2	794.2	0.0
AQ	646,941	494	1,098	1.5		794.7	794.7	794.8	0.1
AR	647,572	597	1,493	1.1		795.1	795.1	795.2	0.1
AS	648,298	249	773	2.1		795.4	795.4	795.5	0.1
AT	648,848	150	633	2.5		796.2	796.2	796.3	0.1
AU	649,463	343	630	2.5		797.1	797.1	797.2	0.1
AV	649,678	720	1,228	1.3		797.7	797.7	797.8	0.1
AW	650,087	329	692	2.3		798.1	798.1	798.1	0.0

[1]Feet above mouth at Lake Erie

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

RIVER RAISIN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
RIVER RAISIN (CONTINUED)								
AX	650,434	226	714	1.4	798.8	798.8	798.9	0.1
AY	650,793	280	591	1.7	799.0	799.0	799.1	0.1
AZ	651,344	124	456	2.3	799.6	799.6	799.7	0.1
BA	651,517	131	491	2.1	799.8	799.8	799.9	0.1
BB	651,673	205	710	1.4	800.1	800.1	800.2	0.1
BC	652,102	82	338	3.0	800.3	800.3	800.3	0.0
BD	652,301	56	387	4.8	800.7	800.7	800.8	0.1
BE	652,707	266	733	2.2	802.0	802.0	802.1	0.1
BF	652,923	251	690	2.3	802.3	802.3	802.4	0.1
BG	653,217	90	528	3.0	803.1	803.1	803.1	0.0
BH	653,804	62	506	3.2	803.6	803.6	803.7	0.1
BI	654,375	67	485	3.3	804.3	804.3	804.3	0.0
BJ	654,699	79	432	3.7	804.8	804.8	804.8	0.0
BK	654,924	76	392	4.1	805.3	805.3	805.3	0.0
BL	655,064	146	542	3.0	805.8	805.8	805.8	0.0

[1]Feet above mouth at Lake Erie

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
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
SOUTH BRANCH RIVER RAISIN									
A	12,130	130	1,361	3.8		723.1	723.1	723.1	0.0
B	12,650	152	1,494	3.6		724.0	724.0	724.0	0.0
C	13,650	335	1,956	2.7		725.7	725.7	725.7	0.0
D	14,590	113	1,002	5.2		726.9	726.9	727.0	0.1
E	15,950	606	4,233	1.2		728.5	728.5	728.5	0.0
F	17,150	520	3,586	1.5		728.9	728.9	728.9	0.0
G	18,130	1,130	4,838	1.1		729.2	729.2	729.3	0.1
H	19,560	99	708	7.4		730.4	730.4	730.4	0.0
I	20,750	122	974	3.7		734.8	734.8	734.8	0.0
J	21,390	273	1,592	2.3		735.7	735.7	735.7	0.0
K	22,040	180	1,126	3.2		736.2	736.2	736.2	0.0
L	23,180	72	661	5.5		738.3	738.3	738.3	0.0
M	23,340	91	778	4.7		739.0	739.0	739.0	0.0
N	24,670	301	1,072	3.4		742.9	742.9	742.9	0.0
O	25,730	150	1,288	2.8		745.1	745.1	745.1	0.0
P	25,890	186	979	3.7		745.7	745.7	745.7	0.0
Q	26,600	590	1,098	3.3		747.3	747.3	747.3	0.0
R	26,800	732	2,986	1.2		748.2	748.2	748.2	0.0
S	27,710	321	1,741	2.1		749.0	749.0	749.0	0.0
T	28,230	229	1,414	2.6		750.0	750.0	750.0	0.0
U	28,570	324	1,802	2.0		750.3	750.3	750.3	0.0
V	29,270	415	3,271	1.1		750.7	750.7	750.7	0.0
W	30,290	740	5,151	0.7		750.8	750.8	750.8	0.0
X	31,300	87	718	5.1	15	751.0	751.0	751.0	0.0

[1]Feet above mouth

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

SOUTH BRANCH RIVER RAISIN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
SOUTH BRANCH RIVER RAISIN (CONTINUED)								
Y	31,980	270	2,528	1.4	752.1	752.1	752.1	0.0
Z	32,780	495	4,663	0.8	752.3	752.3	752.3	0.0
AA	33,600	345	3,633	1.0	752.4	752.4	752.4	0.0
AB	34,150	720	6,553	0.6	752.4	752.4	752.4	0.0
AC	35,190	620	5,300	0.7	752.5	752.5	752.5	0.0

[1]Feet above mouth

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

SOUTH BRANCH RIVER RAISIN

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
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
WOLF CREEK									
A	6,000	423	2,139	0.9	93	762.5	762.5	762.6	0.1
B	11,200	415	1,355	1.4		768.5	768.5	768.5	0.0
C	12,530	131	472	3.9		769.5	769.5	769.6	0.1
D	14,630	200	653	2.8		773.8	773.8	773.8	0.0
E	17,750	233	517	3.6	22	778.0	778.0	778.1	0.1
F	19,834	77	365	5.0		781.6	781.6	781.6	0.0
G	21,350	233	456	4.0	50	784.1	784.1	784.2	0.1
H	24,738	216	956	1.9	215	789.8	789.8	789.9	0.1
I	32,800	138	492	3.7	15	803.0	803.0	803.1	0.1

[1]Feet above Bent Oak Dam

TABLE 14

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

FLOODWAY DATA

WOLF CREEK

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 AH

Zone AH is the flood insurance risk zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where the average depths are between 1 and 3 feet. 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 that 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 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 current FIRM presents flooding information for the entire geographic area of Lenawee County. Previously, separate FIRMs were prepared for each jurisdiction in the county that had

identified special flood hazard areas. Historical data relating to the maps prepared for each community are presented in TABLE 15.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FIRM EFFECTIVE DATE	FIRM REVISION DATE(S)
[1, 2] Addison, Village of	N/A	N/A	N/A	
Adrian, City of	May 31, 1974	August 22, 1975	July 19, 1982	
Adrian, Charter Township of	October 20, 1982	None	November 16, 1990	
[2] Blissfield, Township of	N/A	N/A	N/A	
Blissvield, Village of	September 12, 1975	December 7, 1979	July 19, 1982	February 17, 1988
[1, 2] Britton, Village of	N/A	N/A	N/A	
[2] Cambridge, Township of	N/A	N/A	N/A	
[2] Cement City, Village of	N/A	N/A	N/A	
[1, 2] Clayton, Village of	N/A	N/A	N/A	
[2] Clinton, Township of	N/A	N/A	N/A	
Clinton, Village of	April 18, 1975	October 1, 1976	July 19, 1982	
[2] Deerfield, Township of	N/A	N/A	N/A	
Deerfield, Village of	September 12, 1975	None	April 1, 1981	

[1] No Special Flood Hazard Areas identified
[2] This community does not have map history prior to the first countywide mapping.

TABLE 15

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FIRM EFFECTIVE DATE	FIRM REVISION DATE(S)
[1, 2] Dover, Township of	N/A	N/A	N/A	
[1, 2] Fairfield, Township of	N/A	N/A	N/A	
[2] Franklin, Township of	N/A	N/A	N/A	
Hudson, City of	May 17, 1974	September 17, 1976	November 4, 1981	
[2] Hudson, Township of	N/A	N/A	N/A	
[1, 2] Macon, Township of	N/A	N/A	N/A	
[2] Madison, Charter Township of	N/A	N/A	N/A	
[1, 2] Medina, Township of	N/A	N/A	N/A	
[1, 2] Morenci, City of	N/A	N/A	N/A	
[2] Ogden, Township of	N/A	N/A	N/A	
[1, 2] Onsted, Village of	N/A	N/A	N/A	
[2] Palmyra, Township of	N/A	N/A	N/A	
[2] Raisin, Charter Township of	N/A	N/A	N/A	

[1] No Special Flood Hazard Areas identified
[2] This community does not have map history prior to the first countywide mapping.

TABLE 15

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FIRM EFFECTIVE DATE	FIRM REVISION DATE(S)
[1, 2] Ridgeway, Township of	N/A	N/A	N/A	
[2] Riga, Township of	N/A	N/A	N/A	
[1, 2] Rollin, Township of	N/A	N/A	N/A	
[2] Rome, Township of	N/A	N/A	N/A	
[1, 2] Seneca, Township of	N/A	N/A	N/A	
Tecumseh, City of	May 24, 1974	June 11, 1976	June 1, 1982	
[2] Tecumseh, Township of	N/A	N/A	N/A	
[2] Woodstock, Township of	N/A	N/A	N/A	

[1] No Special Flood Hazard Areas identified
[2] This community does not have map history prior to the first countywide mapping.

TABLE 15

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

This countywide FIS incorporates all previously published FISs and FIRMs for all jurisdictions within Lenawee County.

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 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 the Flood Insurance and Mitigation Division, Federal Emergency Management Agency, 536 South Clark Street, Sixth Floor, Chicago, Illinois 60605.

9.0 BIBLIOGRAPHY AND REFERENCES

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APPENDIX A

TABLE 16 – Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Addison, Village of	261098	04100006	26091C0150D	
Adrian, City of	260115	04100002	26091C0187D, 26091C0189D, 26091C0191D, 26091C0192D, 26091C0193D, 26091C0194D, 26091C0325D	
Adrian, Charter Township of	260732	04100002	26091C0175D, 26091C0180D, 26091C0186D, 26091C0187D, 26091C0188D, 26091C0189D, 26091C0191D, 26091C0192D, 26091C0194D	
Blissfield, Township of	261078	04100002	26091C0225D, 26091C0334D, 26091C0335D, 26091C0351D, 26091C0352D, 26091C0353D, 26091C0375D	
Blissfield, Village of	260339	04100002	26091C0334D, 26091C0335D, 26091C0351D, 26091C0353D	
Britton, Village of	261099	04100002	N/A	
Cambridge, Township of	261079	04100002	26091C0050D, 26091C0175D	
Cement City, Village of	261100	04100002	26091C0025D	
Clayton, Village of	261101	04100002	N/A	
Clinton, Township of	261080	04100002	26091C0075D, 26091C0078D, 26091C0085D, 26091C0086D, 26091C0087D, 26091C0095D	
Clinton, Village of	260437	04100002	26091C0078D, 26091C0086D, 26091C0087D	
Deerfield, Township of	260717	04100002	26091C0243D, 26091C0244D, 26091C0352D, 26091C0375D	
Deerfield, Village of	260438	04100002	26091C0243D, 26091C0244D	
Dover, Township of	261081	04100002	26091C0175D, 26091C0188D, 26091C0325D	
Fairfield, Township of	261082	04100002	26091C0325D, 26091C0350D	

TABLE 16 – Listing of NFIP Jurisdictions *(continued)*

Franklin, Township of	261083	04100002	26091C0050D, 26091C0075D, 26091C0175D, 26091C0180D	
Hudson, City of	260116	04100006	26091C0251D, 26091C0252D	
Hudson, Township of	261084	04100002, 04100006	26091C0150D, 26091C0175D, 26091C0251D, 26091C0252D, 26091C0255D	
Macon, Township of	261085	04100002	26091C0085D, 26091C0095D	
Madison, Charter Township of	261086	04100002	26091C0188D, 26091C0189D, 26091C0193D, 26091C0194D, 26091C0325D	
Medina, Township of	261087	04100002, 04100006	N/A	
Morenci, City of	261088	04100006	N/A	
Ogden, Township of	261089	04100001, 04100002	26091C0325D, 26091C0334D, 26091C0335D, 26091C0350D	
Onsted, Village of	261102	04100002	26091C0050D, 26091C0175D	
Palmyra, Township of	260737	04100002	26091C0194D, 26091C0225D, 26091C0325D, 26091C0334D, 26091C0335D, 26091C0350D	
Raisin, Charter Township of	261090	04100002	26091C0192D, 26091C0194D, 26091C0202D, 26091C0205D, 26091C0206D, 26091C0210D, 26091C0225D	
Ridgeway, Township of	261091	04100002	26091C0095D, 26091C0210D, 26091C0225D	
Riga, Township of	261092	04100001, 04100002	26091C0334D, 26091C0350D, 26091C0353D, 26091C0375D	
Rollin, Township of	261093	04100002, 04100006	26091C0150D, 26091C0175D	
Rome, Township of	261094	04100002	26091C0175D	
Seneca, Township of	261095	04100002, 04100006	26091C0325D	
Tecumseh, City of	260117	04100002	26091C0088D, 26091C0089D, 26091C0093D, 26091C0202D, 26091C0205D, 26091C0206D, 26091C0210D	
Tecumseh, Township of	261096	04100002	26091C0075D, 26091C0086D, 26091C0087D, 26091C0088D, 26091C0089D, 26091C0093D, 26091C0095D, 26091C0202D, 26091C0205D, 26091C0206D, 26091C0210D	

TABLE 16 – Listing of NFIP Jurisdictions *(continued)*

Woodstock, Township of	261097	04100002, 04100006	26091C0025D, 26091C0050D, 26091C0150D, 26091C0175D	

TABLE 17 – Map Repositories

Community	Address	City	State	Zip Code
Addison, Village of	103 1/2 West Main Street	Addison	MI	49220
Adrian, City of	City Hall, 135 East Maumee Street	Adrian	MI	49221
Adrian, Charter Township of	Township Hall, 2907 Tipton Highway	Adrian	MI	49221
Blissfield, Township of	120 South Lane Street	Blissfield	MI	49228
Blissfield, Village of	Village Hall, 130 South Lane Street	Blissfield	MI	49228
Britton, Village of	Village Office, 120 College Avenue	Britton	MI	49229
Cambridge, Township of	Township Hall, 9990 West M50	Onsted	MI	49265
Cement City, Village of	135 Main Street	Cement City	MI	49233
Clayton, Village of	Town Hall, 3457 State Street	Clayton	MI	49235
Clinton, Township of	Township Hall, 172 West Michigan Avenue	Clinton	MI	49236
Clinton, Village of	Village Office, 119 East Michigan Avenue	Clinton	MI	49236
Deerfield, Township of	Township Hall, 468 Carey Street	Deerfield	MI	49238
Deerfield, Village of	Municipal Building, 101 West River Street	Deerfield	MI	49238
Dover, Township of	Township Hall, 7712 West Carleton Road	Clayton	MI	49235
Fairfield, Township of	Township Offices, 1023 Pine Street	Jasper	MI	49248
Franklin, Township of	Township Hall, 3922 Monroe Road	Tipton	MI	49287
Hudson, City of	City Hall, 121 North Church Street	Hudson	MI	49247
Hudson, Township of	Township Hall, 14510 Carleton Road	Hudson	MI	49247
Macon, Township of	Township Hall, 8329 Macon-Clinton Road	Clinton	MI	49236

TABLE 17 – Map Repositories *(continued)*

Madison, Charter Township of	Township Hall, 4008 South Adrian Highway	Adrian	MI	49221
Medina, Township of	13724 Lime Creek Road	Hudson	MI	49247
Morenci, City of	City Hall, 118 Orchard Street	Morenci	MI	49256
Ogden, Township of	Township Hall, 10128 Pence Highway	Blissfield	MI	49228
Onsted, Village of	Village Office, 108 South Main Street	Onsted	MI	49265
Palmyra, Township of	4276 Main St.	Palmyra	MI	49268
Raisin, Charter Township of	Township Offices, 5525 Occidental Highway	Tecumseh	MI	49286
Ridgeway, Township of	Township Hall, 103 West Chicago Boulevard	Britton	MI	49229
Riga, Township of	Township Hall, 7817 Riga Highway	Riga	MI	49276
Rollin, Township of	730 Manitou Road	Manitou Beach	MI	49253
Rome, Township of	Township Office, 9344 Forrister Road	Adrian	MI	49221
Seneca, Township of	8709 Seneca Highway	Morenci	MI	49256
Tecumseh, City of	City Hall, 309 East Chicago Boulevard	Tecumseh	MI	49286
Tecumseh, Township of	7750 Hendershot Highway	Tecumseh	MI	49286
Woodstock, Township of	Township Hall, 6486 Devils Lake Highway	Addison	MI	49220

FIGURE 2 – 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 Map Service Center website at http://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 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 Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 15 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.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

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 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 2.4 “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 Michigan State Plane South Feet International Zone FIPS 2113. The horizontal datum was NAD83, GRS1980 spheroid. 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.

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 http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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 15 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was provided by Lenawee County, MI Drain Commissioners Office / GIS Department and Michigan Center for Geographic Information (MCGI) at a scale of 1:24,000.

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 Lenawee County, MI, 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 15 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.

FIGURE 2 – FIRM Notes to Users *(continued)*

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.

FIGURE 3 – 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.

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.

FIGURE 3 – Map Legend for FIRM *(continued)*

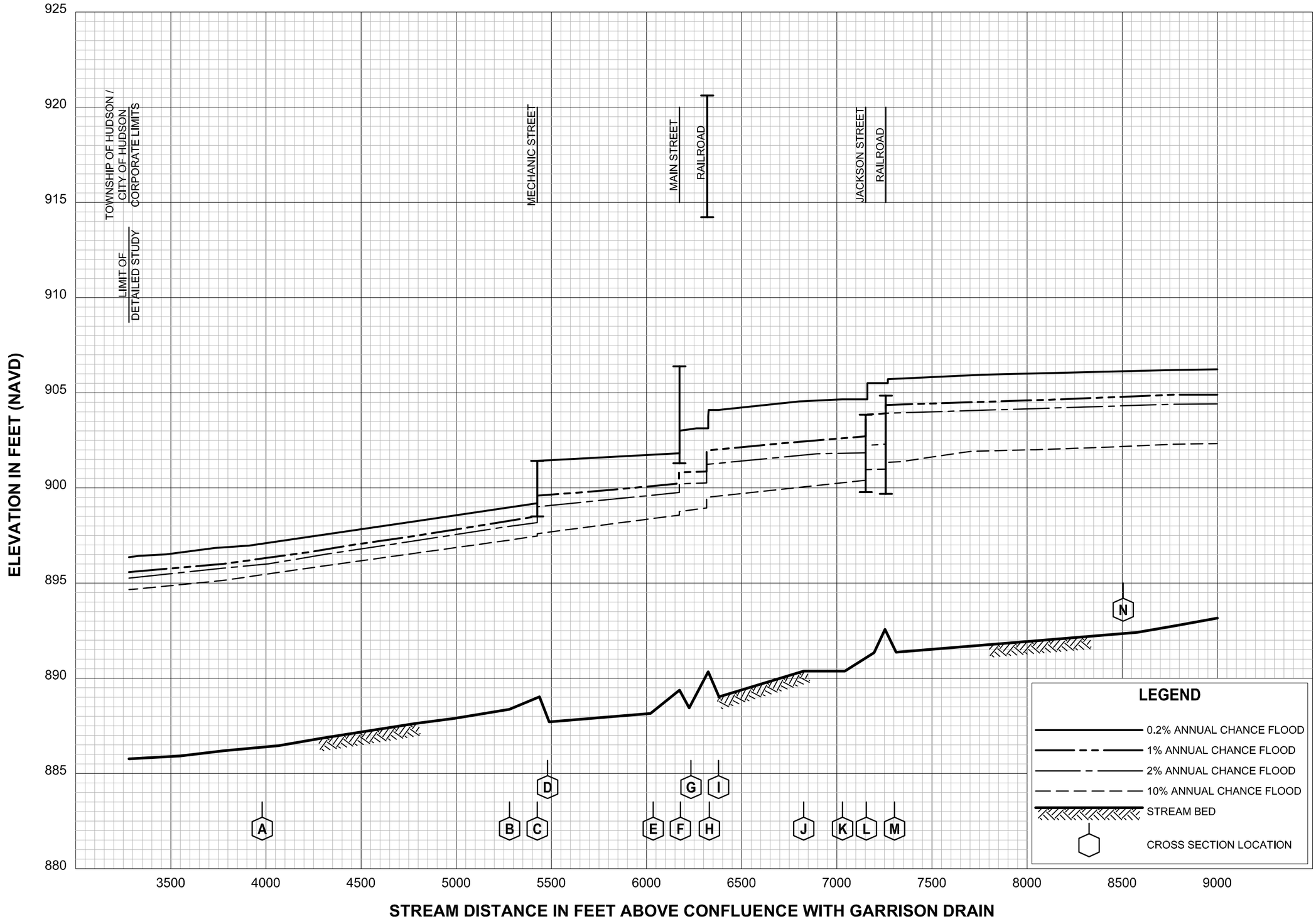
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood.
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.
NO SCREEN	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	
Aqueduct *Channel* *Culvert* *Storm Sewer*	Channel, Culvert, Aqueduct, or Storm Sewer
Dam *Jetty* *Weir*	Dam, Jetty, Weir
	Levee, Dike, or Floodwall
Bridge	Bridge
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.*	
CBRS AREA 09/30/2009	Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.

FIGURE 3 – Map Legend for FIRM *(continued)*

O THERWISE PROTECTED AREA 09/30/2009	Otherwise Protected Area
REFERENCE MARKERS	
22.0	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
B 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
5280 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
8	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.
513	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
BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway

FIGURE 3 – Map Legend for FIRM *(continued)*

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
$^{42}76^{000m}$E	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)



FLOOD PROFILES

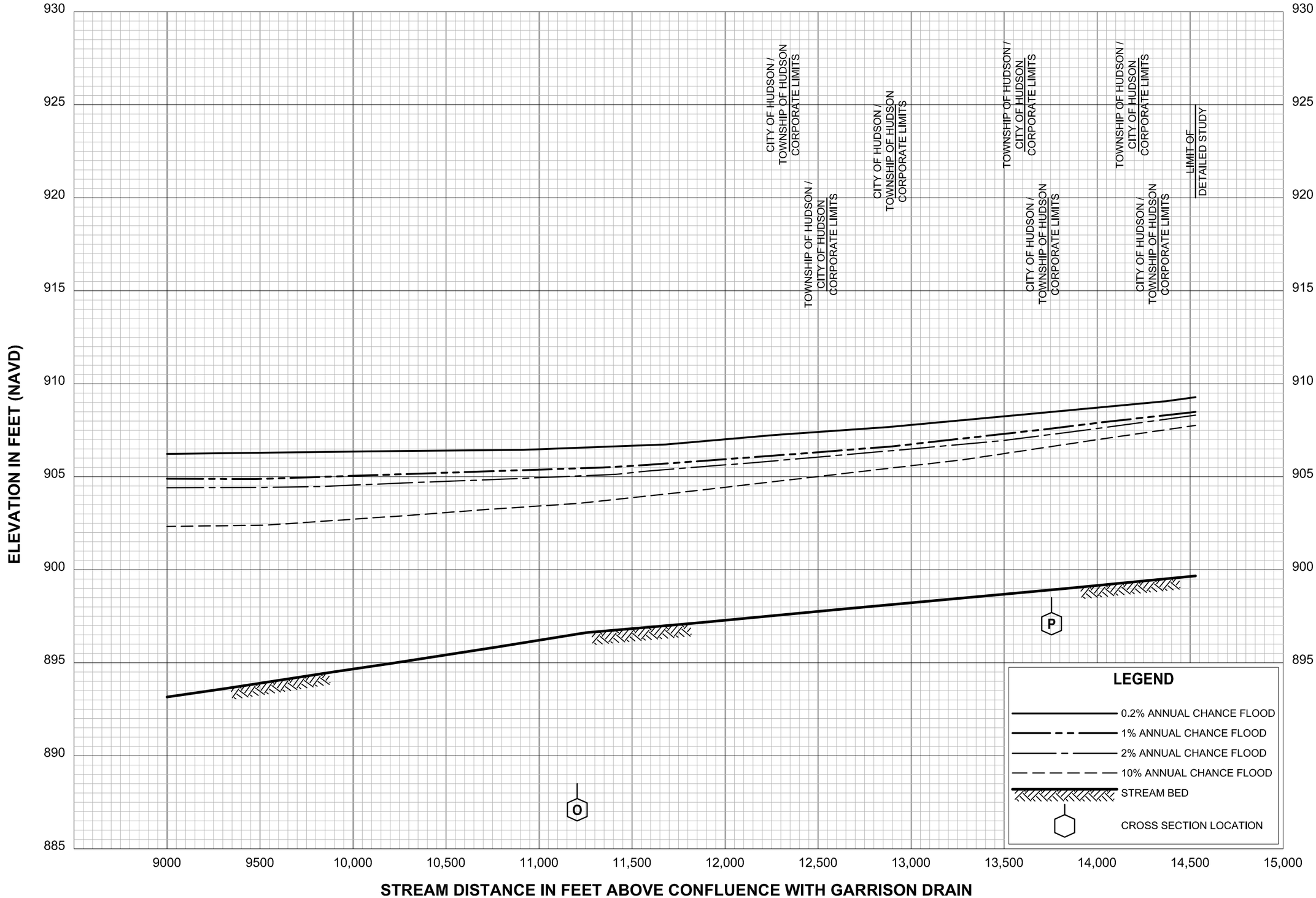
BEAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

01P



FLOOD PROFILES

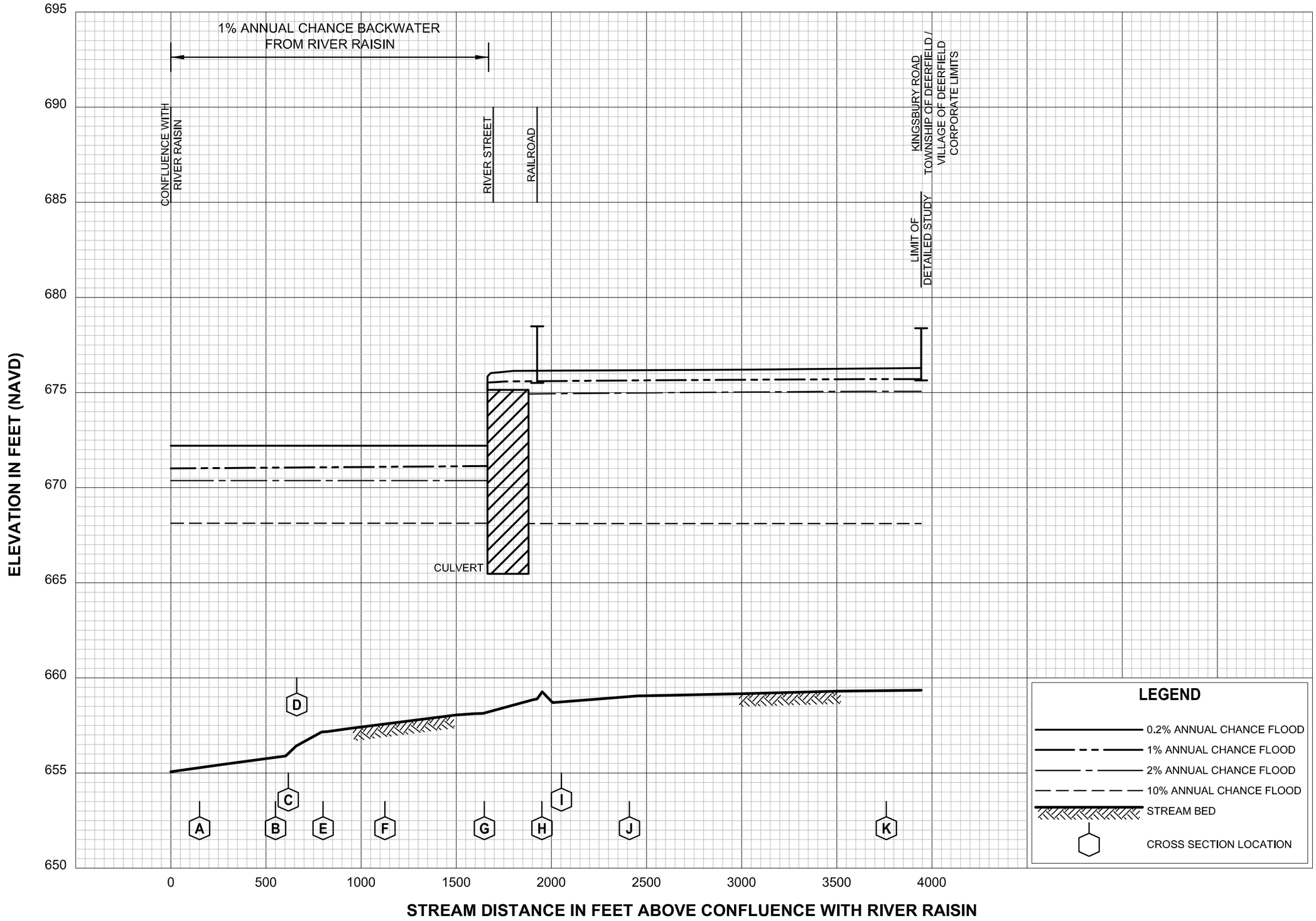
BEAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

02P



FLOOD PROFILES

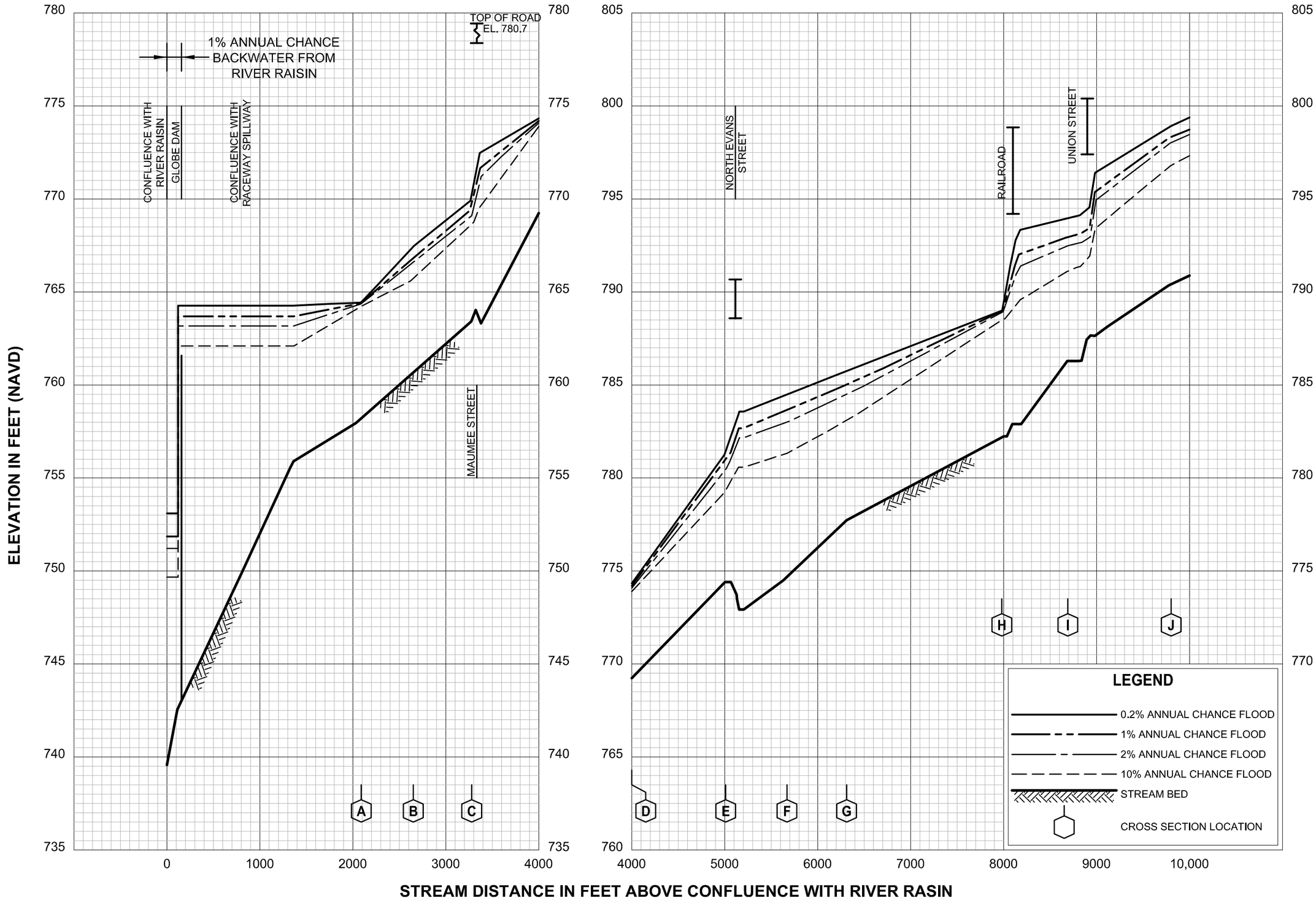
CAMP BRENOTT DRAIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

03P



FLOOD PROFILES

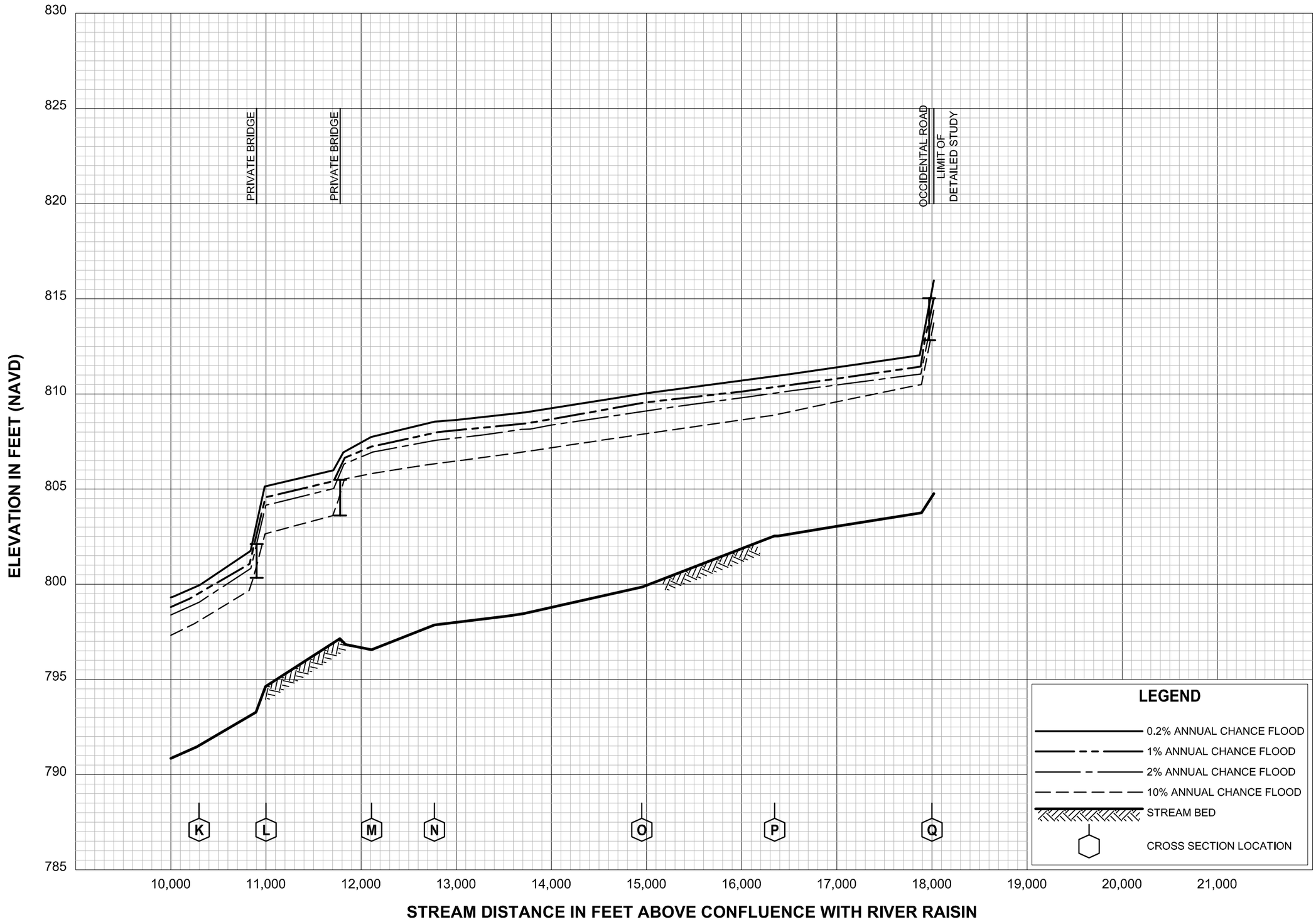
EVANS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

04P



FLOOD PROFILES

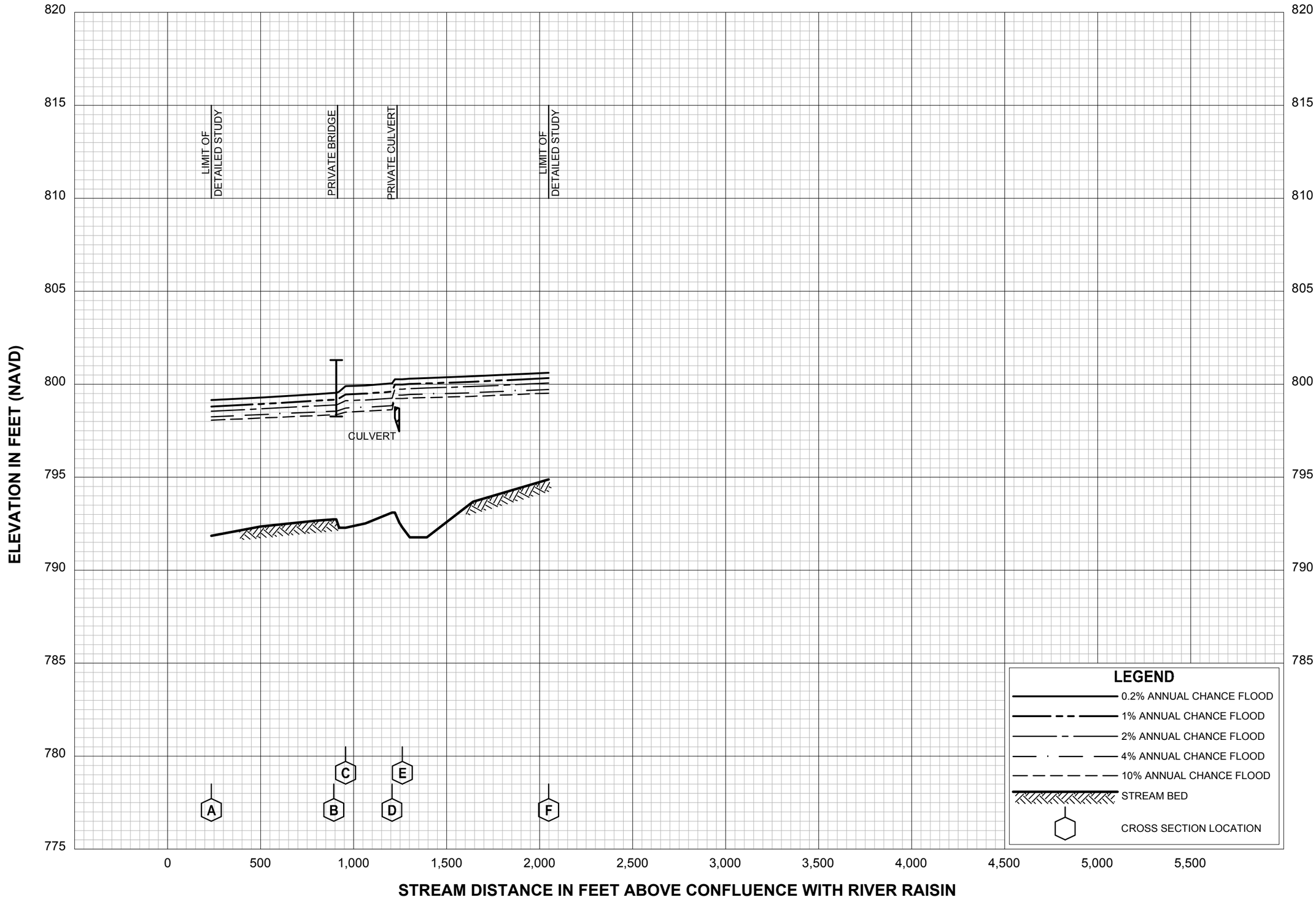
EVANS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

05P



FLOOD PROFILES

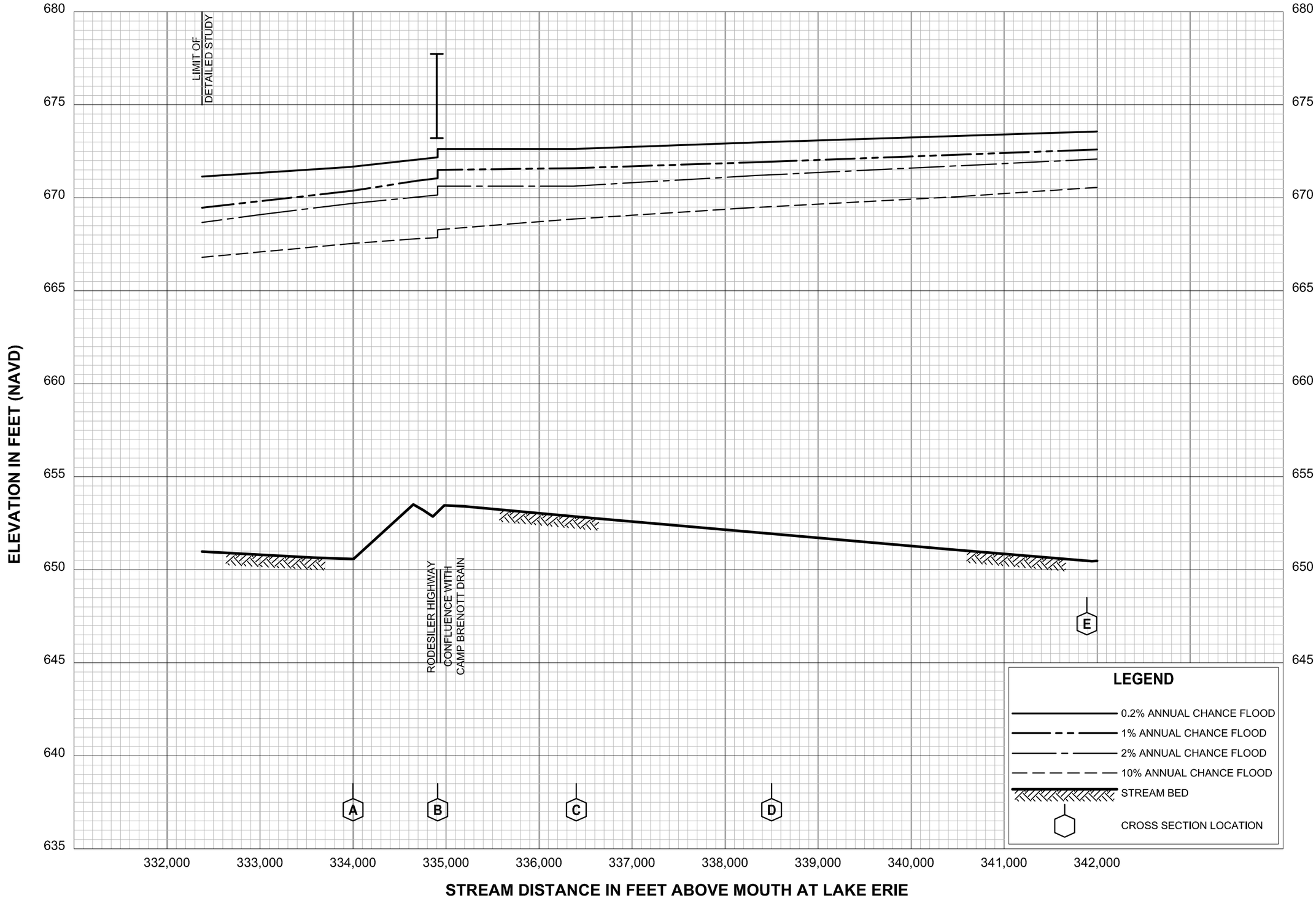
MILL RACE CHANNEL

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

06P



FLOOD PROFILES

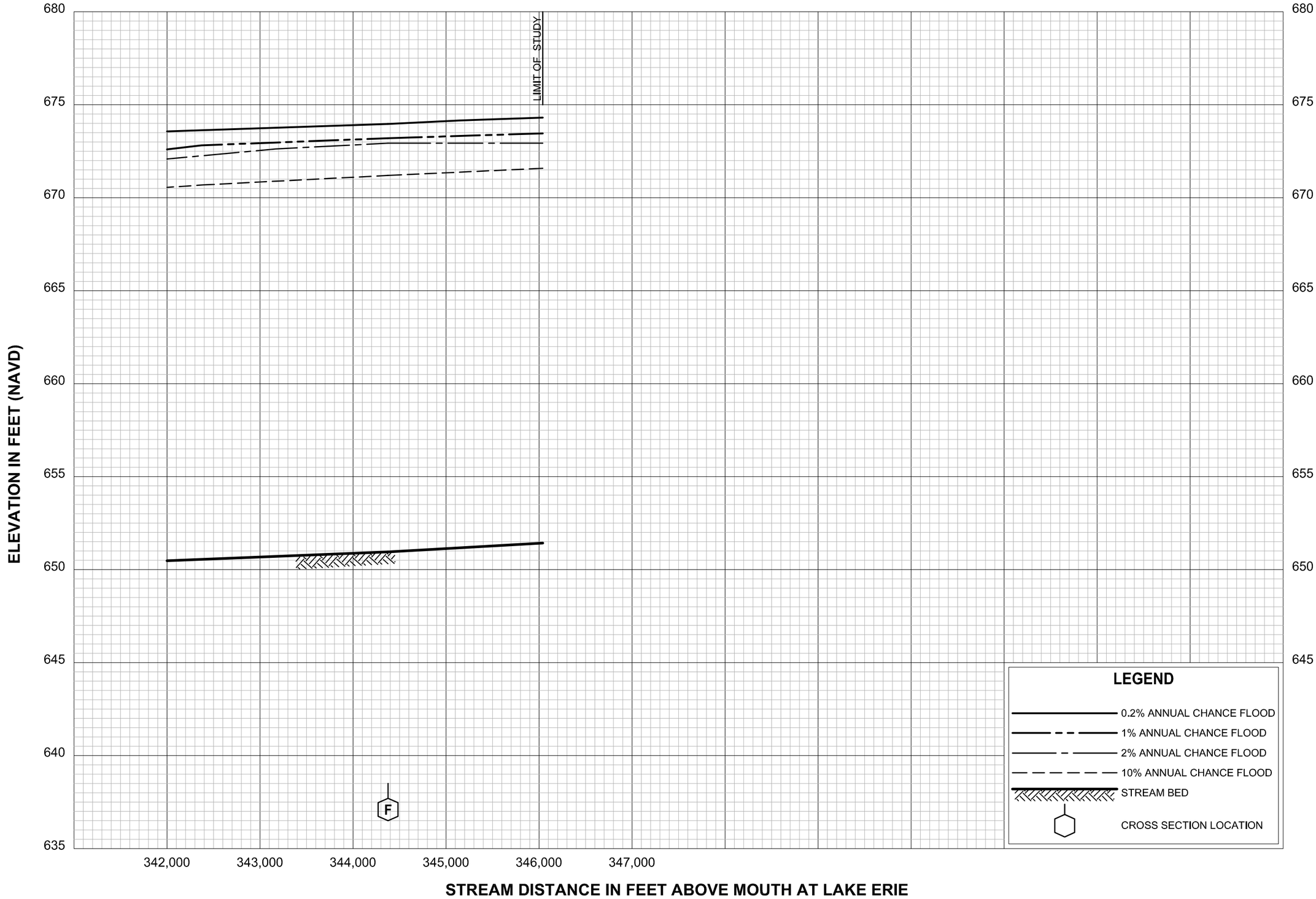
RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

07P



FLOOD PROFILES

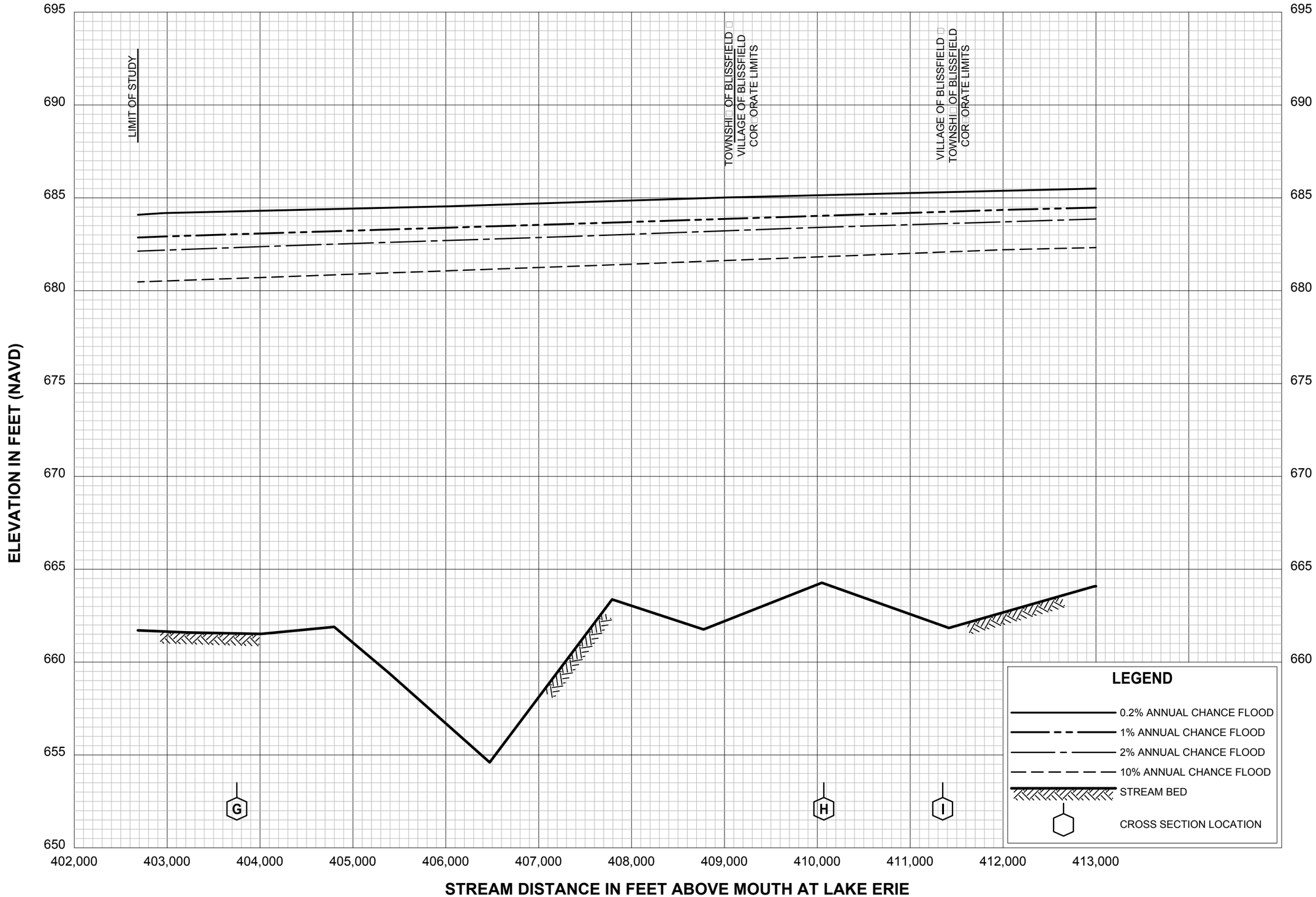
RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

08P



FLOOD PROFILES

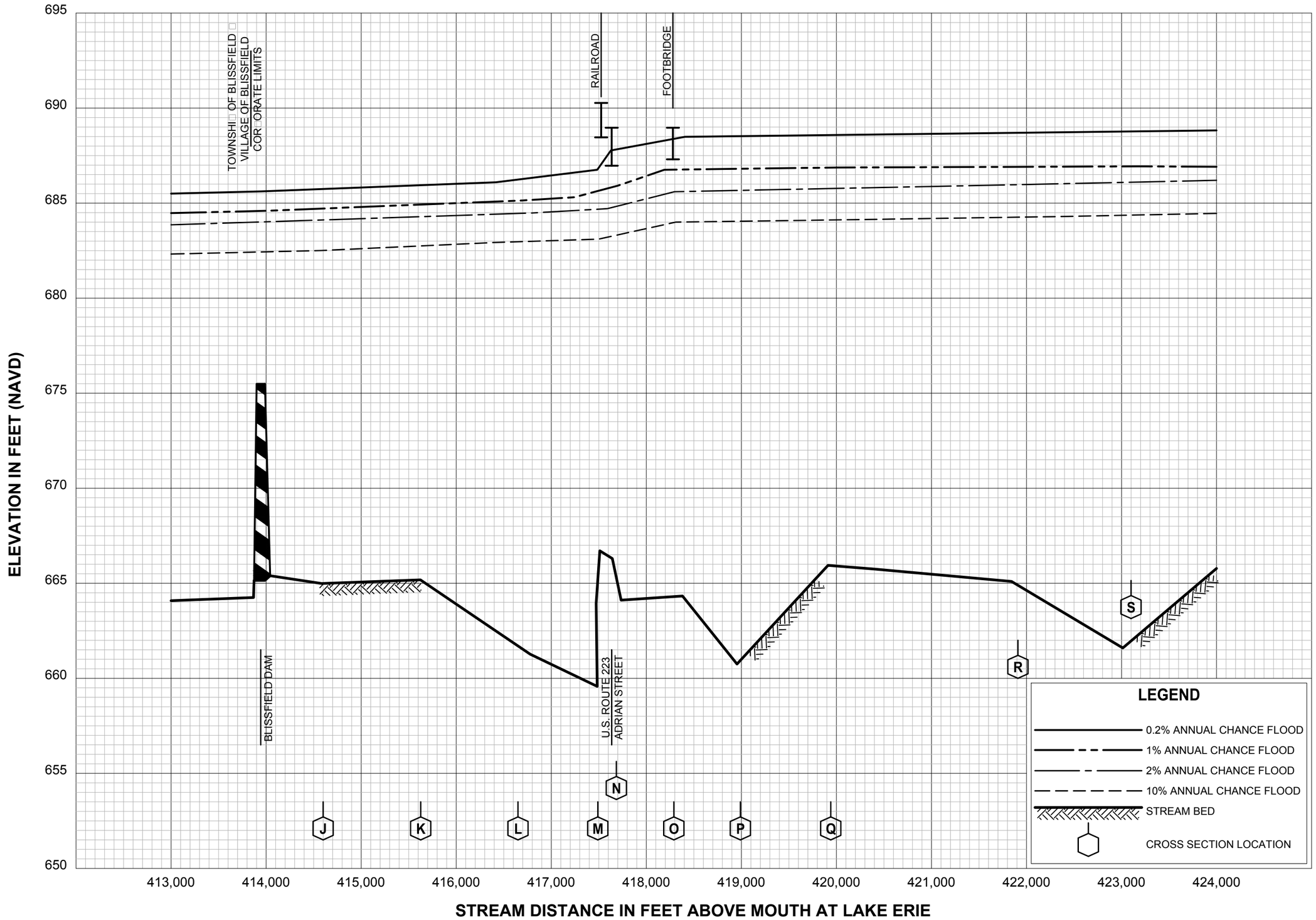
RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

09P



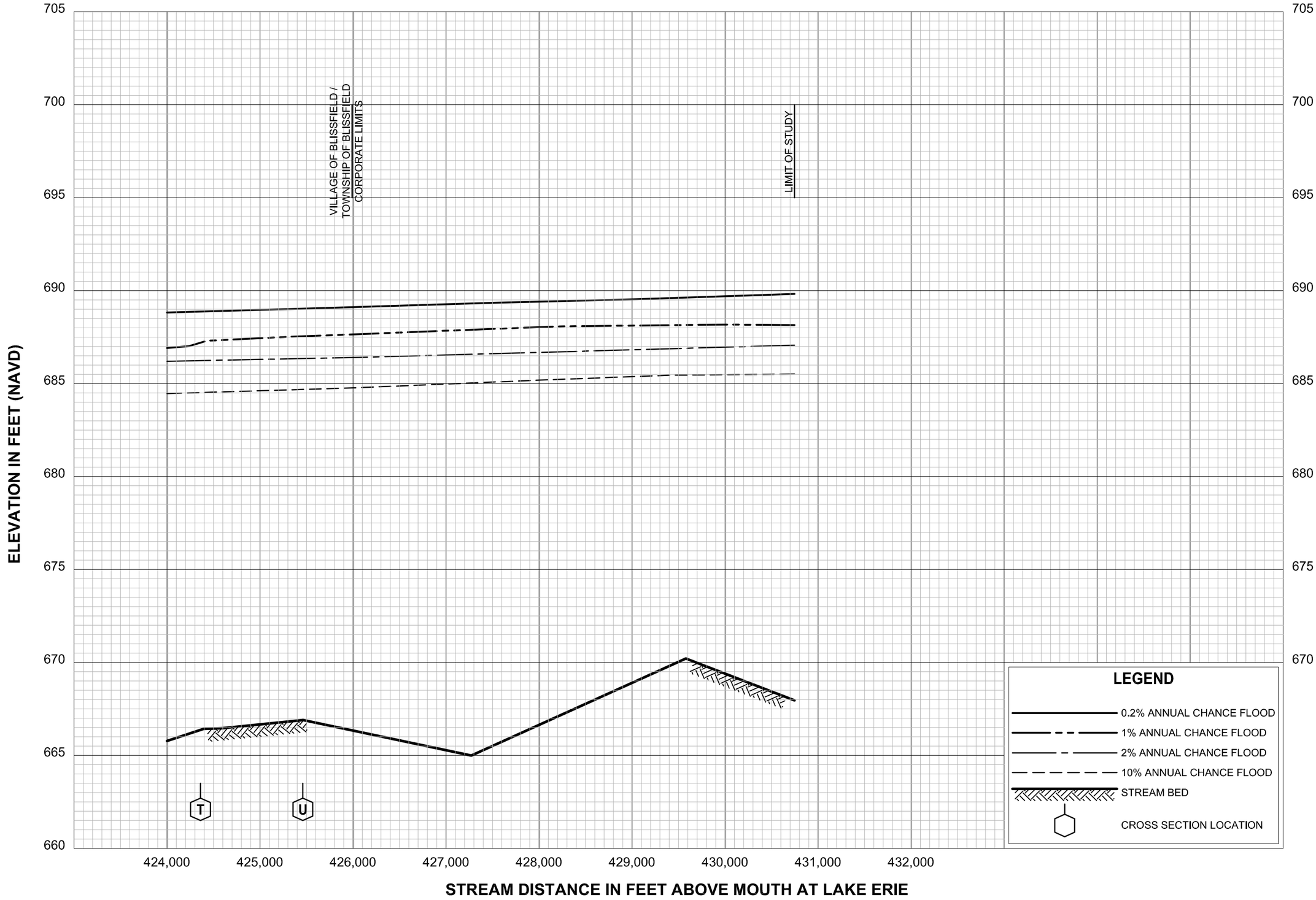
FLOOD PROFILES

RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



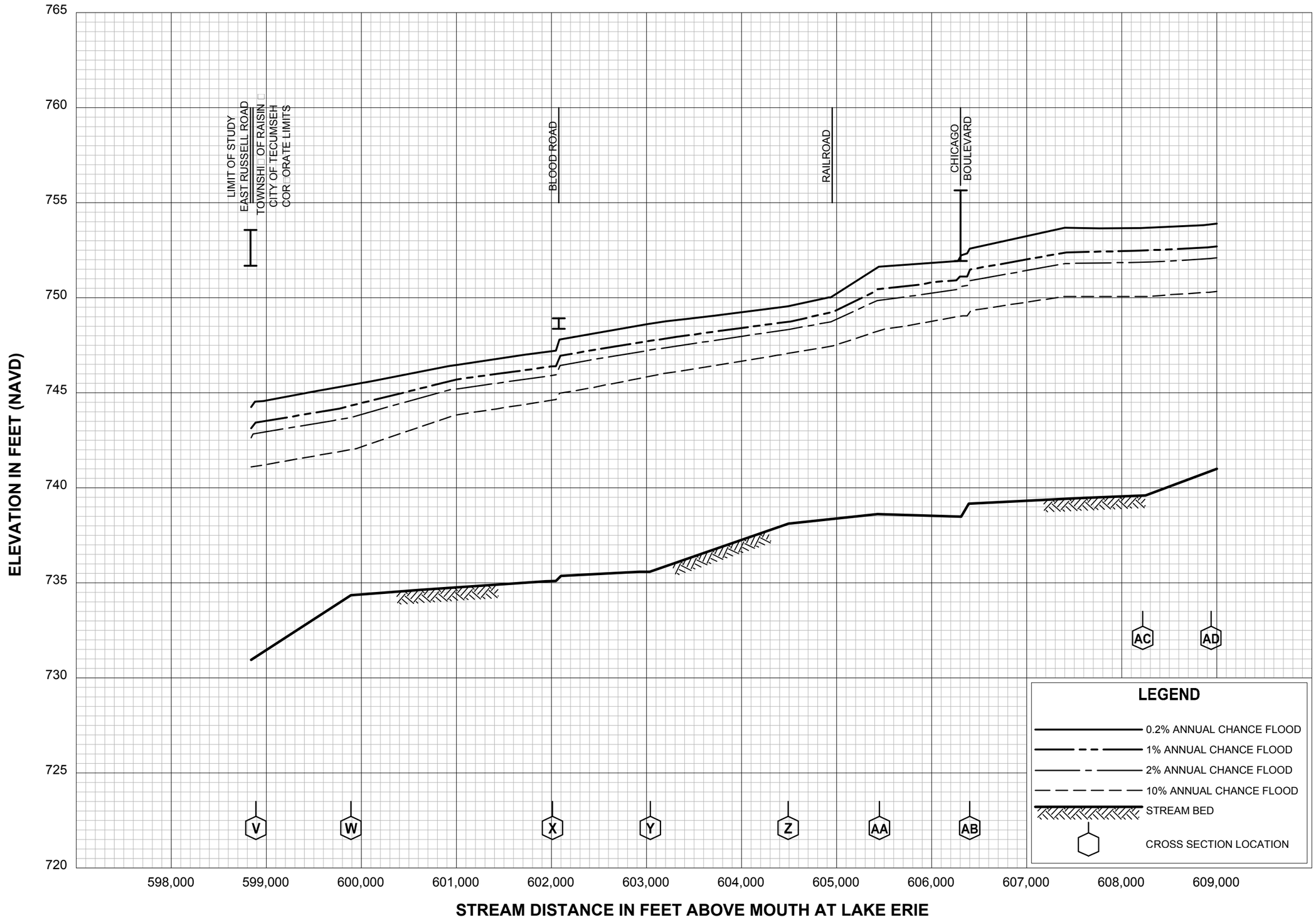
FLOOD PROFILES

RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



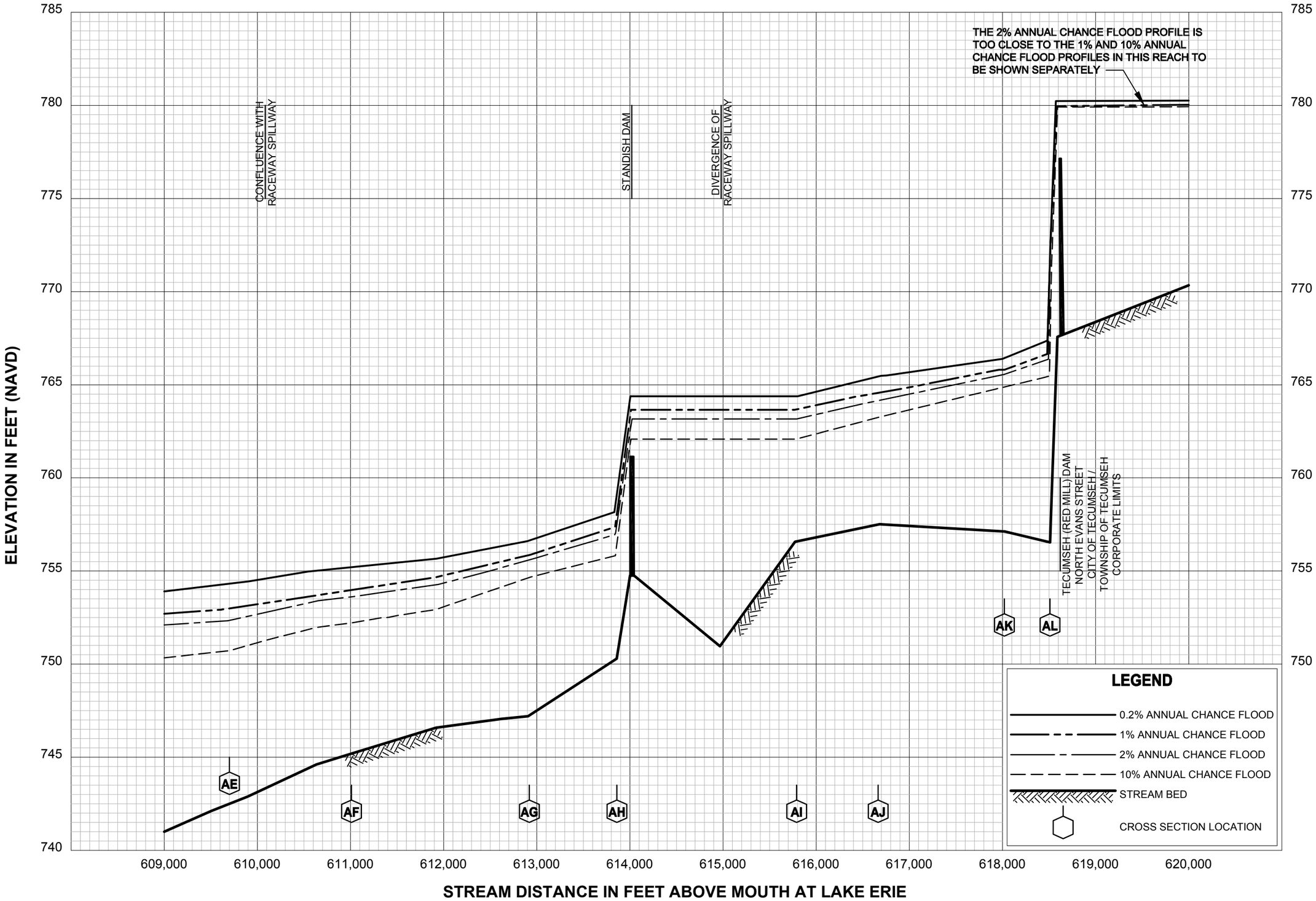
FLOOD PROFILES

RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



FLOOD PROFILES

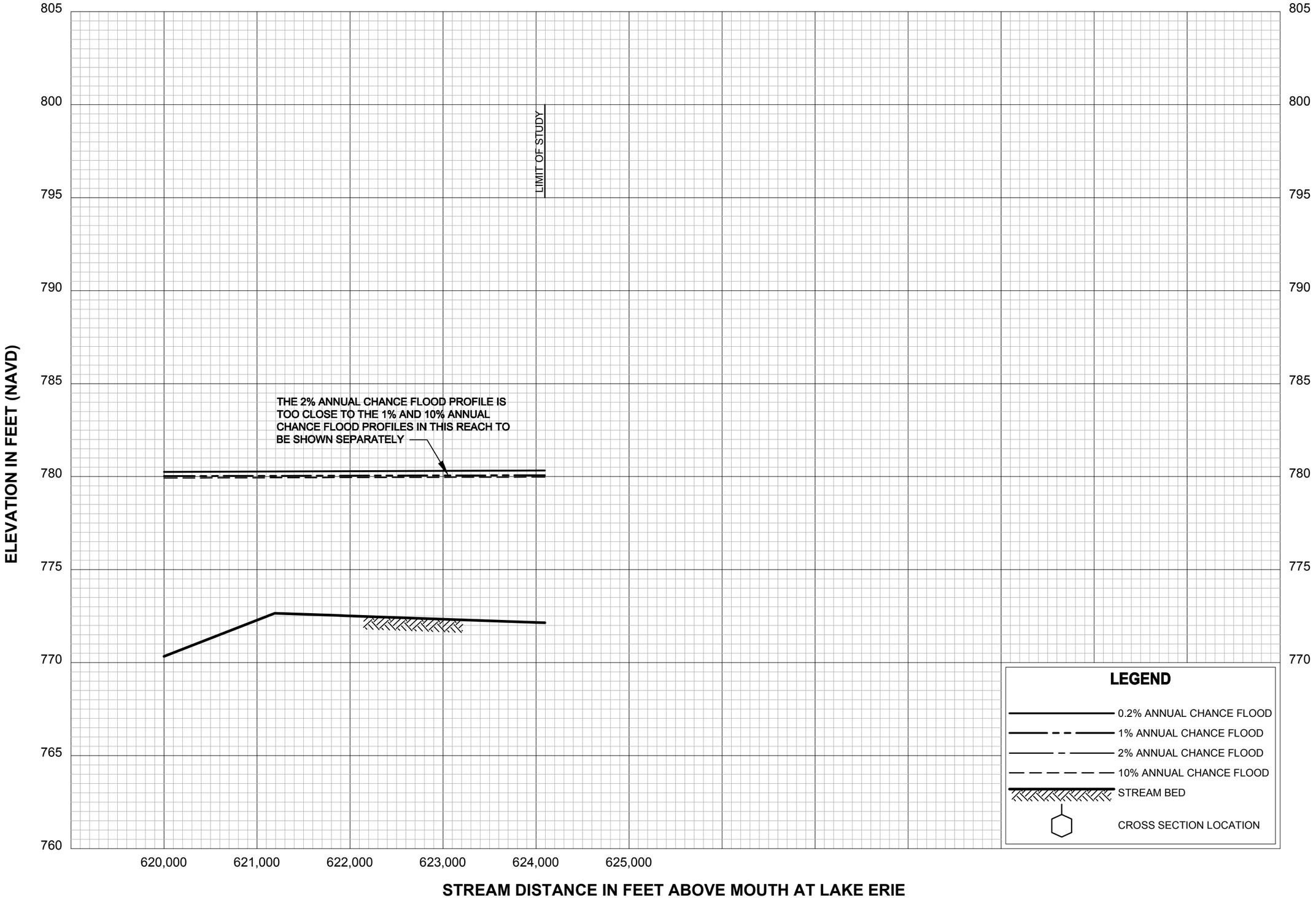
RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)

13P



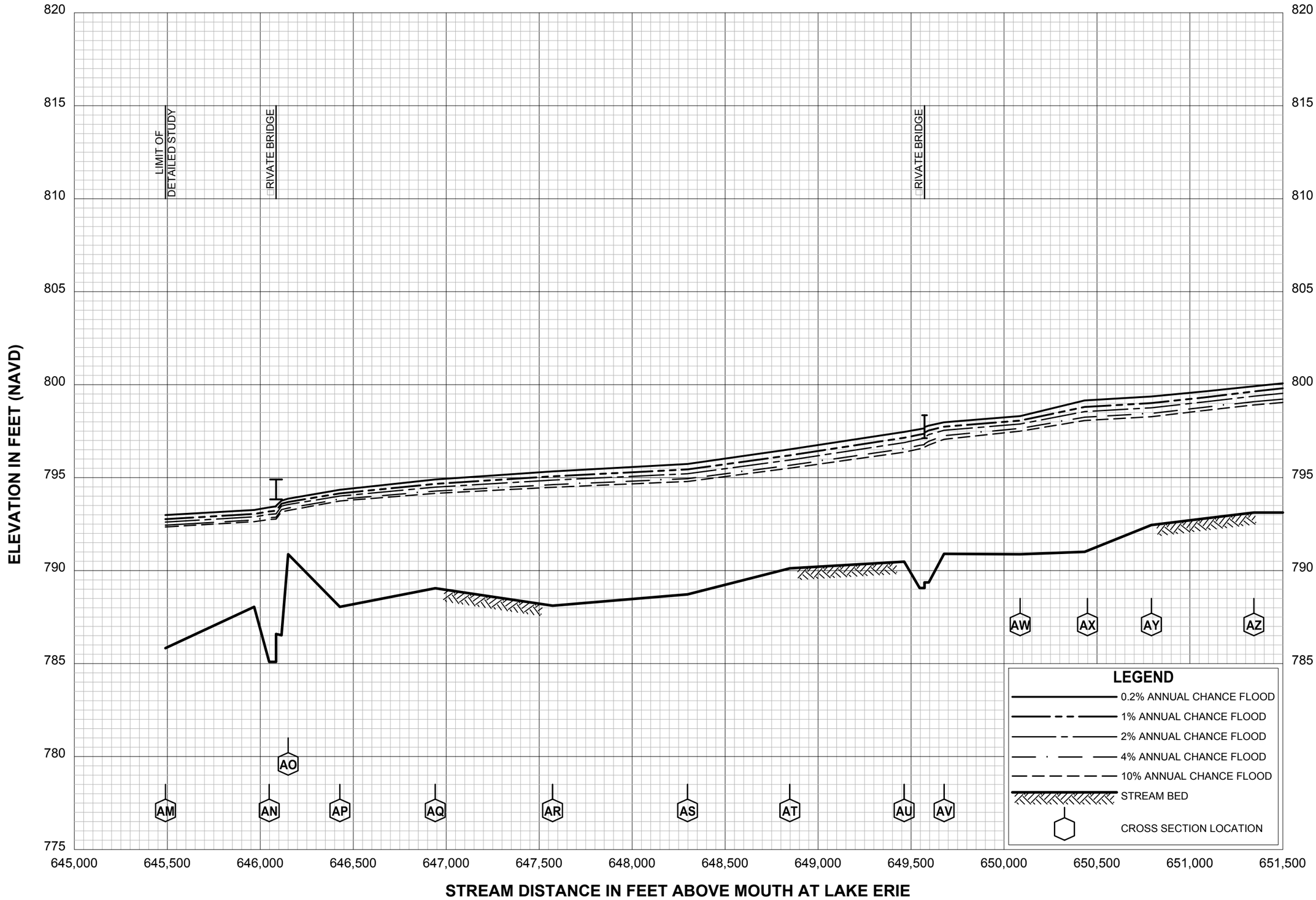
FLOOD PROFILES

RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



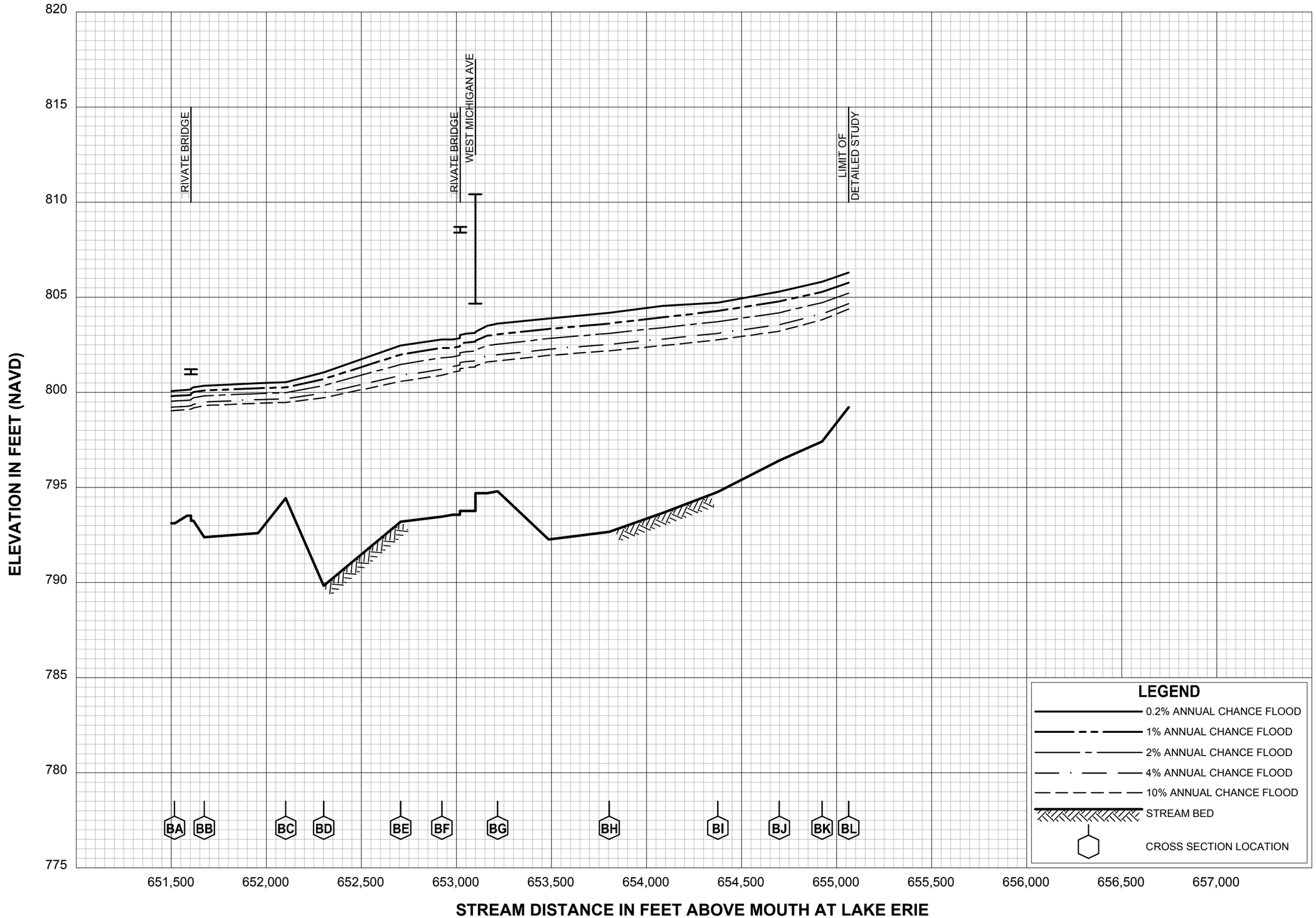
FLOOD PROFILES

RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



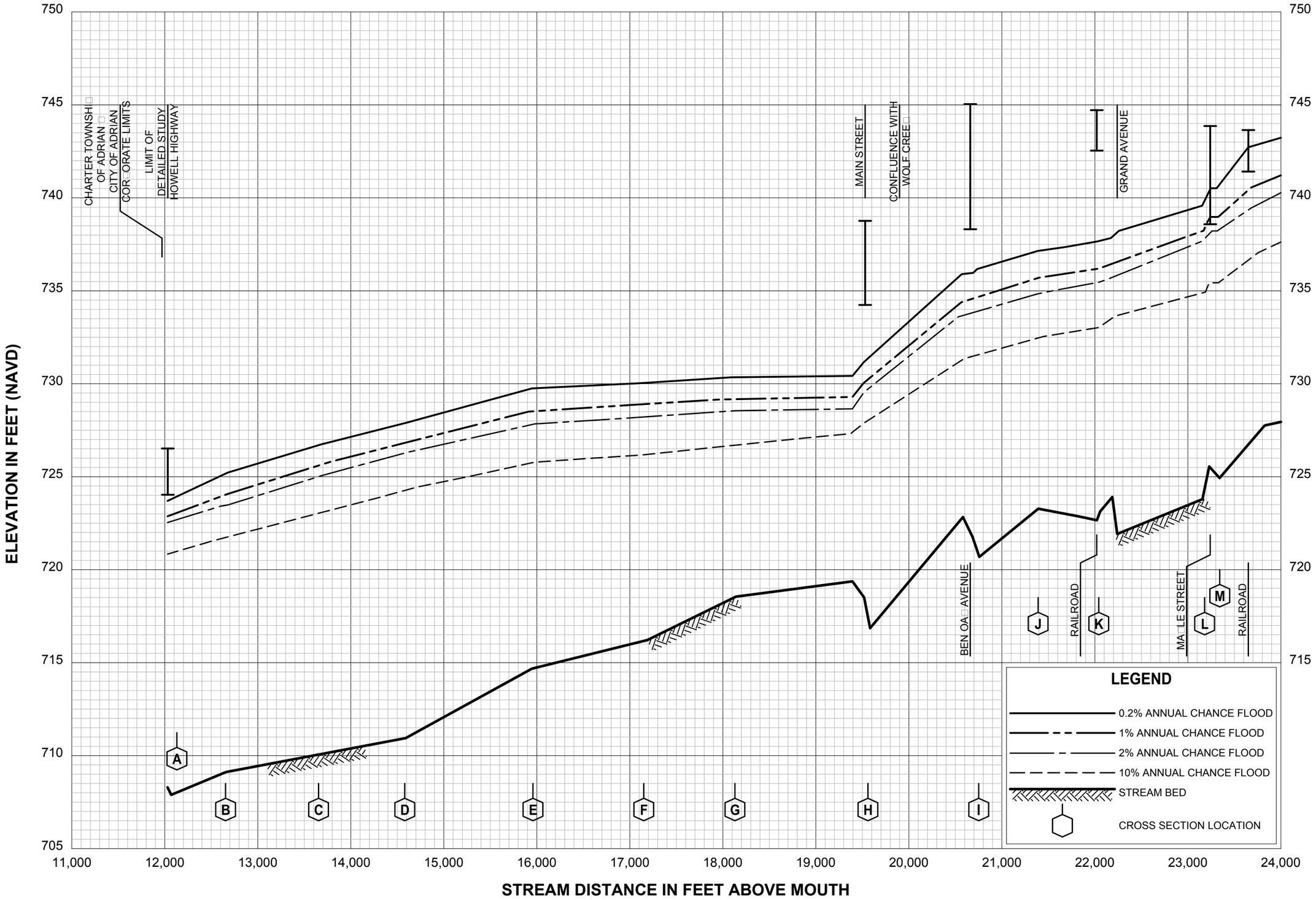
FLOOD PROFILES

RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



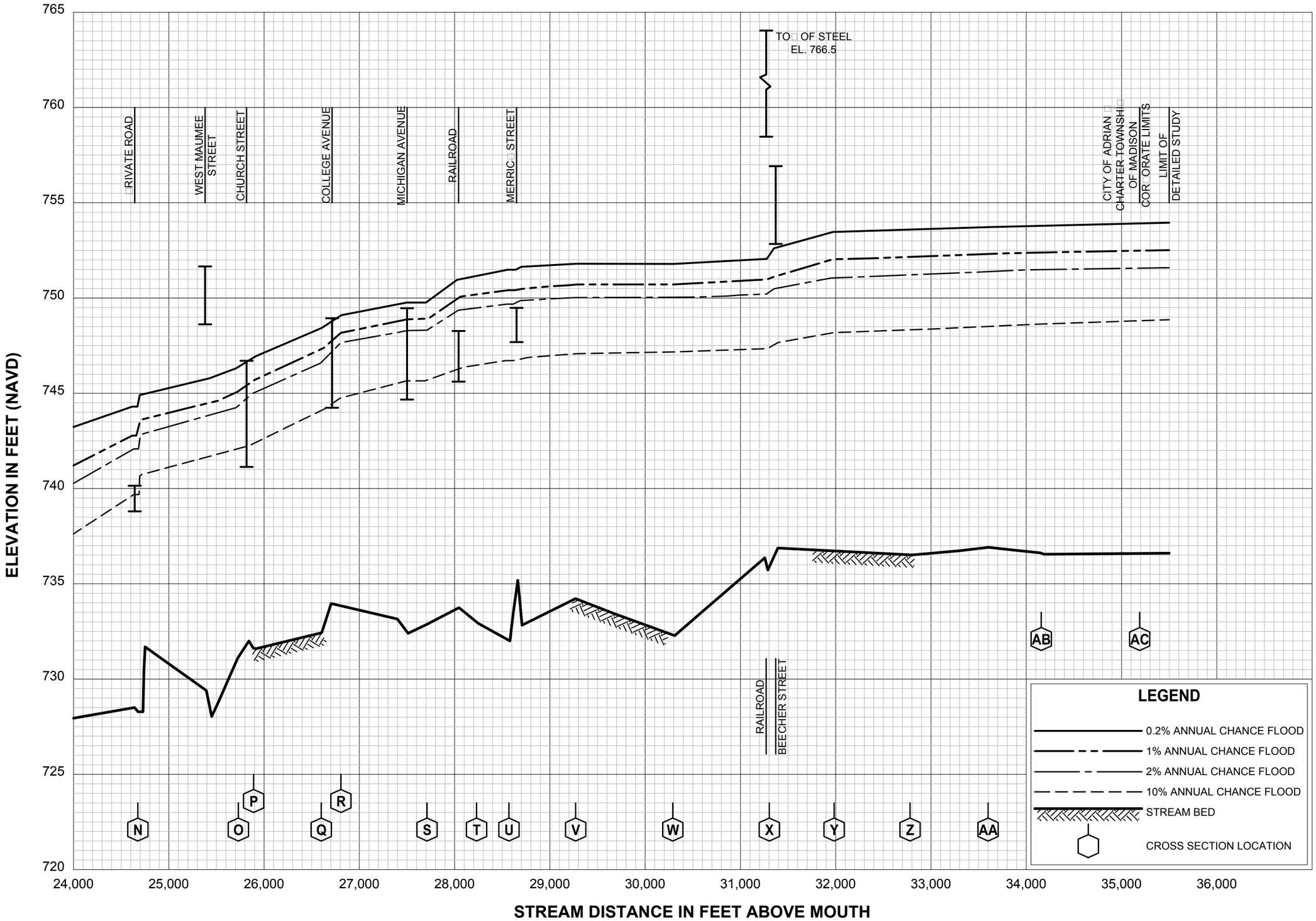
FLOOD PROFILES

SOUTH BRANCH RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



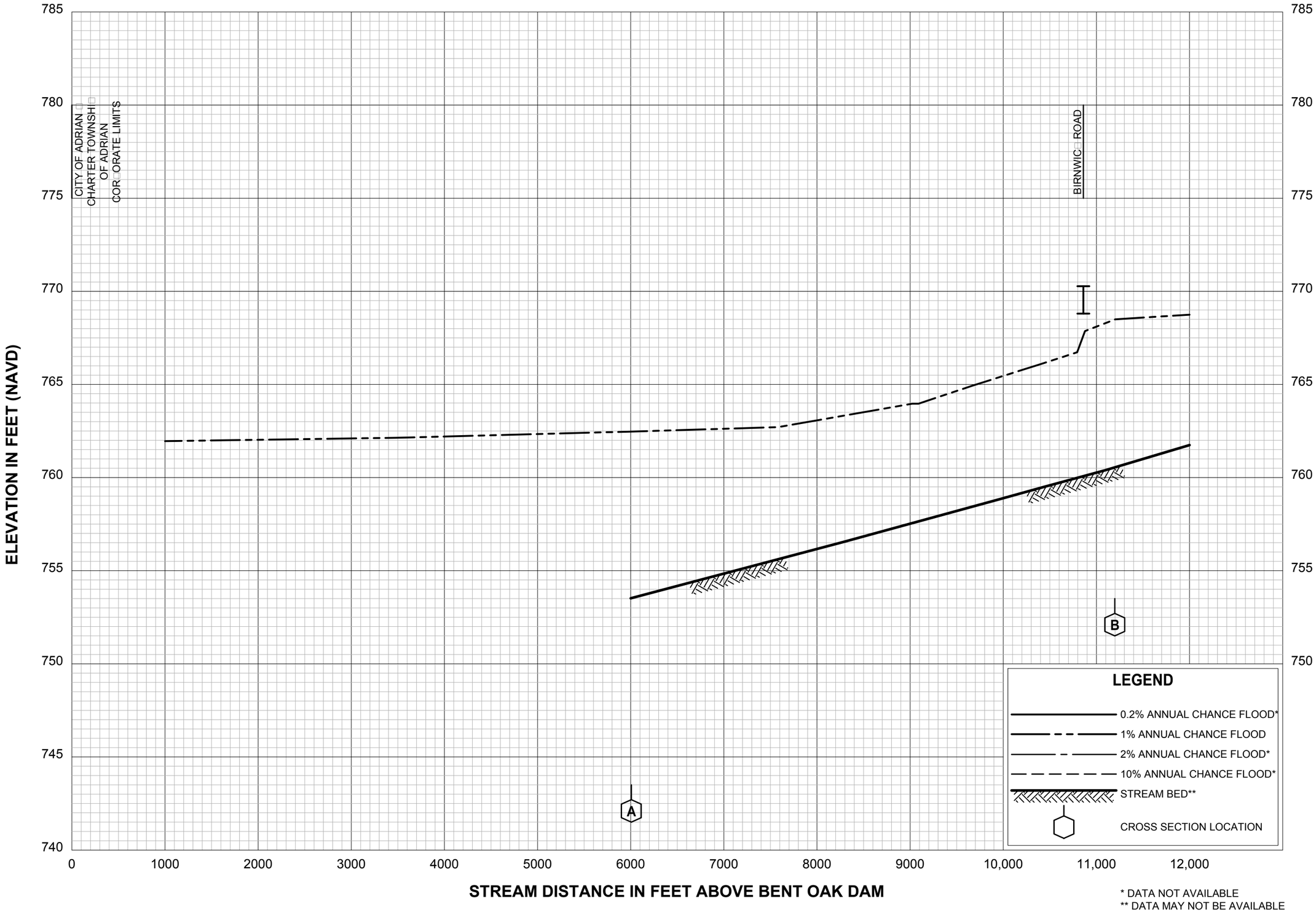
FLOOD PROFILES

SOUTH BRANCH RIVER RAISIN

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



* DATA NOT AVAILABLE
** DATA MAY NOT BE AVAILABLE

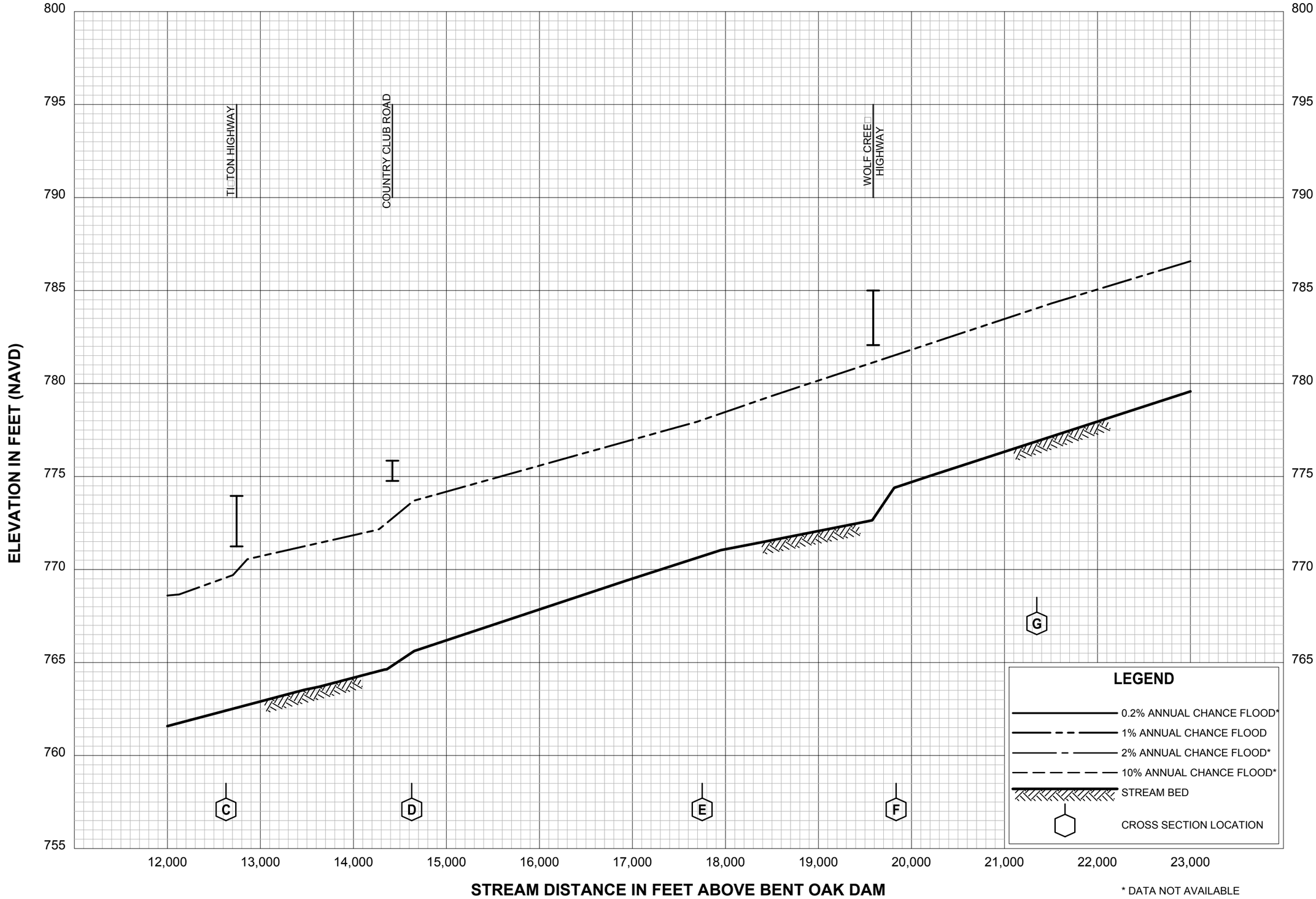
FLOOD PROFILES

WOLF CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



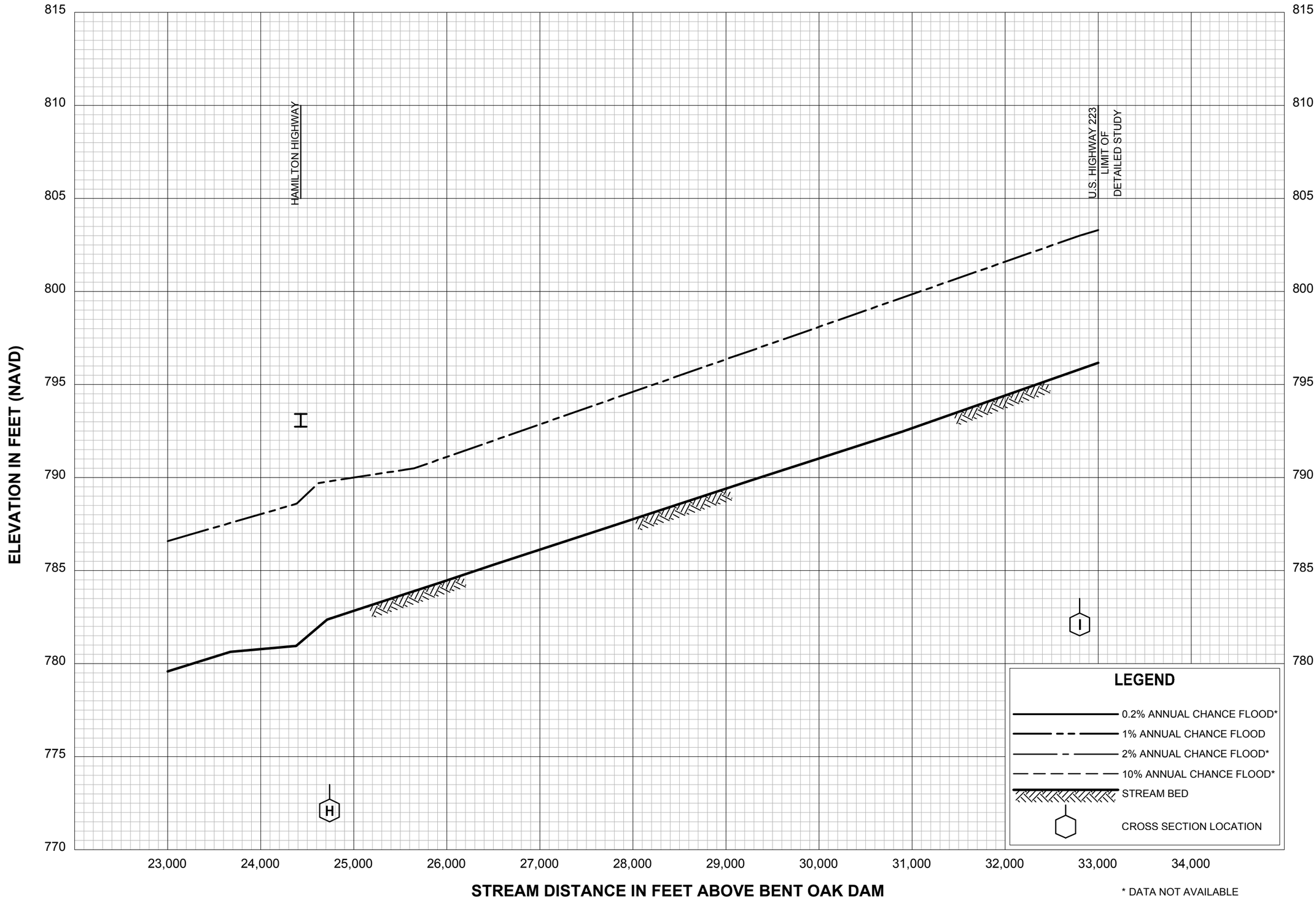
FLOOD PROFILES

WOLF CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)



FLOOD PROFILES

WOLF CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LENAWEE COUNTY, MI

(ALL JURISDICTIONS)