FLOOD INSURANCE STUDY

PEPIN COUNTY, WISCONSIN

AND INCORPORATED AREAS

Community Name	Community Number
Durand, City of	550320
Pepin, Village of	555569
Stockholm, Village of	555570
Pepin County (Unincorporated Areas)	555581

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
55091CV000A

Pepin County, Wisconsin
And Incorporated Areas

NOTICE TO
FLOOD INSURANCE STUDY USERS

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

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this Preliminary FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult community officials and check the Community Map Repository to obtain the most current FIS components. Selected Flood Insurance Rate Map panels for this community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways and cross sections). In addition, former flood hazard zone designations have been changed as follows.

Old Zone(s)	New Zone
A1 through A30	AE
B	X
C	X

Initial Countywide FIS Effective Date:

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FLOOD INSURANCE STUDY
PEPIN COUNTY, WISCONSIN AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Pepin County, Wisconsin; including the City of Durand, the Villages of Pepin and Stockholm, and the unincorporated areas of Pepin County (referred to collectively herein as Pepin County). Note that the Village of Stockholm did not have previous FIS report; and Pepin County, Unincorporated Areas and Village of Pepin reports were never released to public.

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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

1.2 Authority and Acknowledgments

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

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

Durand, City of:	For the December 1976 FIS report and the June 1, 1977 Flood Insurance Rate Map (FIRM), the hydrologic and hydraulic analyses were performed by Owen Ayres and Associates, Inc., for the Federal Insurance Administration (FIA) under Contract No. H3805. That work was completed in May 1976 and covered all flooding sources affecting the City of Durand (Reference 1).

Pepin County, Unincorporated Areas:	The hydrologic and hydraulic analyses for this study were performed by Stanley Consultants Inc., for FIA, under Contract No. H-1792 and completed in October 1972 (Reference 2).
Village of Pepin:	The hydrologic and hydraulic analyses for this study were performed by the U.S. Department of Agriculture, Soil Conservation Service (SCS) under Contract IAA-H-16-72 and completed in March 1971 (Reference 3).

For this countywide FIS, redelineation of special hazard areas as well as hydrologic and hydraulic analyses for Arkansaw Creek approximate study were performed by CDM Federal Programs Corporation (CDM), for the Wisconsin Department of Natural Resources (WDNR), under Contract No. HSFE05-05-D-0027/TO010. This study was completed in June 2008.

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

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

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

1.3 Coordination

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

For the December 1976 City of Durand FIS, flood elevations, flood boundaries, and floodway delineations were reviewed with community officials and with officials of the WDNR during the course of the work. The results of the work were reviewed at a final coordination meeting on May 27, 1976.

For this countywide FIS, an initial CCO meeting was held on June 27, 2007, and attended by representatives of CDM, FEMA, U.S. Army Corps of Engineers (USACE) and the communities.

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

2.0 **AREA STUDIED**

2.1 Scope of Study

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

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

TABLE 1 – FLOODING SOURCES STUDIED BY DETAILED METHODS

Flooding Source	Limits of Detailed Study
Chippewa River	From northern City of Durand Corporate Limits to southern City of Durand Corporate Limits
Mississippi River	From county boundary with Pierce County to county boundary with Buffalo County

As part of this countywide FIS, updated analyses were included for the flooding sources shown in Table 2, "Scope of Revision."

TABLE 2 – SCOPE OF REVISION

Flooding Source	
Arkansaw Creek*	From approximately 3300 ft upstream of County Highway Z to confluence with Eau Galle River
Eau Galle River*	From county boundary with Dunn County to County Highway P
Mississippi River	From county boundary with Pierce County to county boundary with Buffalo County
Plum Creek*	From county boundary with Pierce County to confluence with Chippewa River
Unnamed Tributary to Plum Creek*	From county boundary with Pierce county to confluence with Plum Creek

* Approximate Analysis

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

All or portions of Arkansaw Creek, Bear Creek, Bear Creek Swamp, Chippewa River, Cranberry Creek, Duscham Creek, Eau Galle River, Fall Creek, Little Rock Creek, Missouri Creek, Plum Creek, Rock Creek, Unnamed Tributary to Bear Creek, Unnamed Tributary to Chippewa River, Unnamed Tributary to Rock Creek, Unnamed Tributary to Fall Creek, and Unnamed Tributary to Fall Creek were studied by approximate methods.

2.2 Community Description

Pepin County is located in the western part of Wisconsin, and surrounded by Pierce County on northwest, Dunn County on north, Eau Claire County on east, Buffalo County on South, Wabasha County, Minnesota on southwest, and Goodhue County, Minnesota on west. City of Durand, the county seat of Pepin County, is located on the east side of the Chippewa River, approximately 17 miles above its confluence with the Mississippi River. The population of Pepin County was 7,213 in 2000, 7,462 in 1990 and 7897 in 1980 (Reference 4).

Chippewa River begins at the great divide in Northern Wisconsin. The drainage basin, which is elliptical in shape, 84 miles wide and over 160 miles long, was once covered by glaciers. Upstream of City of Durand, there are many tributaries feeding the Chippewa River. These tributaries include the Brunet, Thornapple, Flambeau, Jump, Fisher, Yellow, Eau Claire, Red Cedar, and Eau Galle Rivers. All of these basins, together with other smaller basins, form a total area of approximately 9010 square miles. Also, within this area, there are five major flowages-the Chippewa, Flambeau, Big Falls, Holcombe, and Miller Dams- plus many smaller flowages, and natural and manmade lakes.

A portion of the main business district of City of Durand lies on relatively flat to gently rolling land within the floodplain. Moving away from the Chippewa River, the topography becomes very steep. Soils in the area generally consist of Sparta loamy fine sand and loamy alluvial land. Steep topography, unsuitable soil conditions, and extensive flood prone areas limit the amount of land suitable for development within the city. The floodplain use includes residential, commercial, industrial, and recreational usages. The Chippewa River floodplain is quite broad in this area since it follows the natural valley limits.

Long, cold winters and warm summers with several hot, humid periods are characteristic of the climate for the area. Of the average annual 30 inches of rainfall, about 65 percent normally occurs between May and September. Snowfall ranges from more than 100 to less than 20 inches in a season. Thunderstorms occur on an average of 41 days a year and hail occurs on an average of twice a year (Reference 5). Prevailing winds are from the northwest during December through April, and from the south the rest of the year.

2.3 Principal Flood Problems

The most significant water body in Pepin County is the Mississippi River which flows from northwest to southeast along the county boundary with Goodhue and Wabasha counties. Flooding on the Mississippi River is generally caused by heavy rain in the watershed which encompasses much of northern Wisconsin and Minnesota upstream of Pepin County. The flood on the Mississippi River most readily recalled by local residents was the April 1965 event. An analysis of streamflow measurements made at the U.S. Geological Survey (USGS) gaging station at Prescott, Wisconsin indicates that a flood equal in magnitude to the 1965 event would have a recurrence interval of about 200 years. Other major floods were experienced in 1951, 1952 and 1969.

Two recent floods observed in the Pepin County were in 1997 and 2001. In April 1997, the peak crest measured at City of Red Wing on the Mississippi in Goodhue County was 17.2 feet. The Mississippi fell back to below flood stage by the last week of April. Two dozen homes were evacuated in the seasonal Village of Deer Island, between Villages of Pepin and Stockholm. The river crested at 18.3 feet at Village Pepin. In April 2001, heavy snow fall during winter remained on the ground through the end of March and then rapidly melted, resulting in river stages close to record levels along Wisconsin's western border. Mississippi River remained well above flood stage into May. The crest at City of Red Wing was the third highest level, lower only than during the floods of 1965 and 1969. A few homes and businesses in the City of Durand had water in basements, numerous county roads and bridges were flooded (Reference 6).

Chippewa River, which flows through the northeast to southwest through the edge of the City of Durand, is another significant flooding source. Chippewa River's main flood season is in the spring and summer. Most of the larger floods have resulted from heavy rains in combination with snowmelt and frozen ground. A stage of 18.4 feet based on historical records, with an estimated discharge of 160,000 cubic feet per second (cfs), the maximum on record, occurred on September 12, 1884. The second largest discharge, based on flow records, was 123,000 cfs with a stage of 16.93 feet at the City of Durand gage and occurred on April 2, 1967. In April 1997, Chippewa River reached flood crested at 13.0 feet in April 97. A portion of Main Street in Durand was flooded for a time (Reference 6).

Although the majority of flooding occurs from the Chippewa River in the City of Durand, flooding and erosion damage can and have occurred due to heavy precipitation on the steep watersheds. The erosion and sediment transport associated with these high velocities are the major problems in these steep watersheds.

2.4 Flood Protection Measures

There are several dams in Pepin County, but they do not provide protection against significant flood events such as 1-percent-annual-chance flood.

3.0 **ENGINEERING METHODS**

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this

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

3.1 Hydrologic Analyses

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

City of Durand has a previously printed FIS report; and Pepin County, Unincorporated Areas and Village of Pepin have previous reports which were not released to public. The hydrologic analyses described those reports have been compiled and summarized below.

Pre-Countywide Analysis:

For the original City of Durand study, records of the river stages and discharges on the Chippewa River near City of Durand are maintained by the USGS. A water-stage recording gage was established on December 9, 1930, at a point 75 feet downstream from the old U.S. Highway 10 bridge on the left bank of the river. Prior to December 9, 1930, it was a non-recording gage located 400 feet downstream of the above-mentioned bridge.

To supplement the gauging station records obtained for Chippewa River, newspaper files and historical documents and records were searched. Through these investigations and records, knowledge of floods on the Chippewa River was developed.

Using the gage records, statistical analyses were made, including a log-Pearson Type III analysis (Reference 7). The statistical analyses included the correlation of the Durand gage data with the long term records of the gage on the Chippewa River at the City of Chippewa Falls, Wisconsin.

For the original Pepin County, Unincorporated Areas study, discharge-frequency curves compiled by the USACE at locks and dams in and near the study area were used to develop discharge-drainage area relationships for the 10-, 4-, 1-, 0.2-percent-annual-chance flood frequencies. From these relationships the peak discharges were obtained for the various frequency floods in Pepin County.

For the original Village of Pepin study, flood-frequency relationship was established for the Mississippi River; using the log-Pearson Type III (Reference 7) method of analyzing the USGS gaging station records at City of Prescott, Wisconsin. This gage has operated continuously since June 1928. On the Mississippi River the 1965 flood (200 year), the 1952 flood (35 year), and the intermediate regional flood (100 year) elevations were used to plot on elevation-discharge curve at Pepin. The curve was plotted on semi-log paper and extrapolated to obtain the elevation of the 10-, 4-, 0.2-percent-annual-chance floods. Highwater marks of the 1952, 1965 and 1969 events were supplied by the USACE and local residents. The elevation of the intermediate regional flood was obtained from the WDNR.

This Countywide Analysis:

The hydrologic information for the Mississippi River used in this countywide study was obtained from the Upper Mississippi River System Flow Frequency study (Reference 8). Upper Mississippi River Basin Flow Frequency study began in 1998 as the Upper Mississippi, Lower Missouri, and Illinois Rivers Flow Frequency Study and was completed in 2003. The study addresses the Illinois River from Lockport to the mouth, the Missouri River from Gavins Point to the mouth, and the Mississippi River from St. Paul to the confluence with the Ohio River.

In Upper Mississippi River System Flow Frequency study, annual peak flows and peak stages from the period of record run of the calibrated UNET model (Reference 9) were used to develop rating curves for each cross section location. Using these station rating curves and the station frequency flows developed during the hydrology phase, frequency elevation points were obtained for each cross section location. Connecting the corresponding points resulted in flood frequency profiles. These profiles were coordinated among the computational teams and appropriate adjustments were made to assure consistency. The discharges for each cross-section determined by this approach were later imported into a HEC-RAS model in 2004 by USACE (Reference 10).

Discharges for Arkansaw Creek were calculated from the regression equations outlined in the USGS document "Flood-Frequency Characteristics of Wisconsin Streams" (Reference 11). The attributes of watershed area and forest cover needed for use in the regression equations were determined in geographic information systems using ArcGIS Spatial Analyst Extension and ArcHydro Tools in conjunction with the USGS canopy cover raster (Reference 12).

For hydrologic analysis of the Eau Galle River, the 1-percent-annual-chance flood inflow hydrograph was developed. Based on this information, National Weather Service Dam-Break Flood Forecasting Computer Model (DAMBRK) program (Reference 13) was used to compute the outflow hydrograph (Reference 14).

The hydrologic analyses for Plum Creek and the Unnamed Tributary of Plum Creek consisted of a flood frequency analysis and development of an inflow hydrograph for the 1-percent-annual-chance flood. The inflow hydrograph is required for the dam failure analysis. USGS regression equations (Reference11) were used and drainage basin comparisons with similar USGS-gauged watersheds in the Driftless Region to perform the flood frequency analysis for the Plum Creek. SCS TR-20 rainfall-runoff model was used to calculate additional flood frequency values and to develop an

inflow hydrograph for the 1-percent-annual-chance flood. The peak discharge at the dam was calculated in accordance with Wisconsin Administrative Code NR 333 and NR 116 requirements. The flood-frequency results varied with the method of analysis, and the final decision was to use the rainfall-runoff model results for both the flood frequencies and the 1-percent-annual chance flood hydrograph (Reference 15 & 16).

Peak discharge-drainage area relationships for streams studied by detailed methods are shown in Table 3, Summary of Discharges.

TABLE 3 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES(cfs) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
CHIPPEWA RIVER					
At City of Durand	9,010.0	85,000	125,000	145,000	195,000
EAU GALLE RIVER					
At Eau Galle Dam	181.0	*	9920	*	*
MISSISSIPPI RIVER					
At the County Boundary with Pierce County	*	*	*	198,832	*
At Village of Pepin	*	*	*	199,232	*
At Village of Stockholm	*	*	*	199,232	*
At the County Boundary with Buffalo County	*	*	*	199,232	*
PLUM CREEK					
At Plum Creek Structure 2	17.1	4,785	7400	9,159	*
UNNAMED TRIBUTARY TO PLUM CREEK					
At Plum Creek Structure 19	1.4	370	725	915	*

* Data not available or not calculated

3.2 Hydraulic Analyses

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

City of Durand has a previously printed FIS report; and Pepin County, Unincorporated Areas and Village of Pepin have previous reports which were not released to public. The hydraulic analysis described those reports have been compiled and summarized below.

Pre-Countywide Analysis:

For the original City of Durand study, water-surface elevations (WSELs) were computed using the USACE HEC-2 step-backwater computer program (Reference 17). Seven cross sections were field surveyed in the study area and four of the cross sections were taken outside the study limits; three on the downstream side and one on the upstream side to facilitate proper modeling of the stream.

For the original Pepin County, Unincorporated Areas study, stage-discharge rating curves for the study area were prepared from information on past flood profiles supplied by the USACE. Resulting flood profiles were compared with the regional flood profiles published by the WDNR and the flood profiles developed by the SCS. Where elevation differences occurred, the regional flood was used to maintain consistency with previously published data.

For the original Village of Pepin study, water surface profiles of the 10-, 4-, 1-, and 0.2-percent chance floods were determined using information obtained from the elevation discharge curve.

This Countywide Analysis:

Development of the hydraulic analysis of the Upper Mississippi River began with converting the Upper Mississippi River System Flow Frequency Study UNET model (Reference 9) to HEC-RAS Version 3.1.1 (Reference 10). The study limits were from Hastings, Minnesota to Cairo, Illinois. The project's quality control plan stated that the steady flow HEC-RAS model (Reference 10) would be calibrated to the 1-percent-annual-chance Upper Mississippi River System Flood Frequency Study profile. The UNET model produced unique values of discharge at each cross-section. The discharge value for each cross-section was imported into the HEC-RAS model. The calibrated 1-percent-annual-chance HEC-RAS profile is generally within 0.1 foot of the Upper Mississippi River System Flow Frequency Study 1-percent-annual-chance profile. Near some bridges differences of more than 0.1 foot occur, but this was expected and is considered acceptable. Manning's n values are typically lower near the locks and dams where the channel is deeper and a greater percentage of the floodplain is continuously inundated by the pool.

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

The floodway analysis began with running HEC-RAS's method of equal reduction in conveyance using each state's maximum allowable floodway stage increase criteria (1.0 foot for Iowa, 0.5 foot for Minnesota, and 0 for Wisconsin). The floodway limits generated from this model run were exported to ArcGIS (Reference 12).

Eau Galle River, Plum Creek and Unnamed Tributary to Plum Creek hydraulic analyses were performed with the DAMBRK model (Reference 13).

Roughness factors (Manning's "n" values) used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 4, "Manning's "n" Values."

TABLE 4 – MANNINGS "N" VALUES

Stream	Channel "n"	Overbank "n"
Chippewa River	0.028 – 0.032	0.04 – 0.10
Mississippi River	0.032	0.045 – 0.11

For Arkansaw Creek, HEC-GeoRAS was used to convert centerline and cross section data created in ArcGIS (Reference 12) for use in HEC-RAS 3.1.3 (Reference 10). HEC-GeoRAS utilized an area Triangulated Irregular Network (TIN) model developed from 10 and 30 meter resolution National Elevation Dataset (NED) Digital Elevation Model (DEM) files to develop the model cross sections. The same TIN which was used for floodplain mapping. Road crossing locations were selected by looking at the aerial photos and modeled as inline structures. Normal depth was used as the downstream boundary condition for reaches in this study. The slope was calculated using the channel invert profile between the five downstream most cross sections (approximately most downstream mile of channel).

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

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

3.3 Vertical Datum

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

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD. These flood elevations must be compared to structure and ground elevations

referenced to the same vertical datum. Some of the data used in this revision were taken from the prior effective FIS reports and FIRMs and adjusted to NAVD88. The datum conversion factor from NGVD29 to NAVD88 in Pepin County is 0.1 foot (NGVD29+0.1=NAVD88).

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

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

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

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section.

Between cross sections on Mississippi River, the boundaries were interpolated using digital topographic data that meets National Map Accuracy Standards at a scale with a vertical tolerance of 1.7 feet at a contour interval of 4 feet (Reference 20). For all other areas, the boundaries were interpolated using topographic maps at a scale of 1:24000, with a contour interval of 20 feet (Reference 21).

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

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

4.2 Floodways

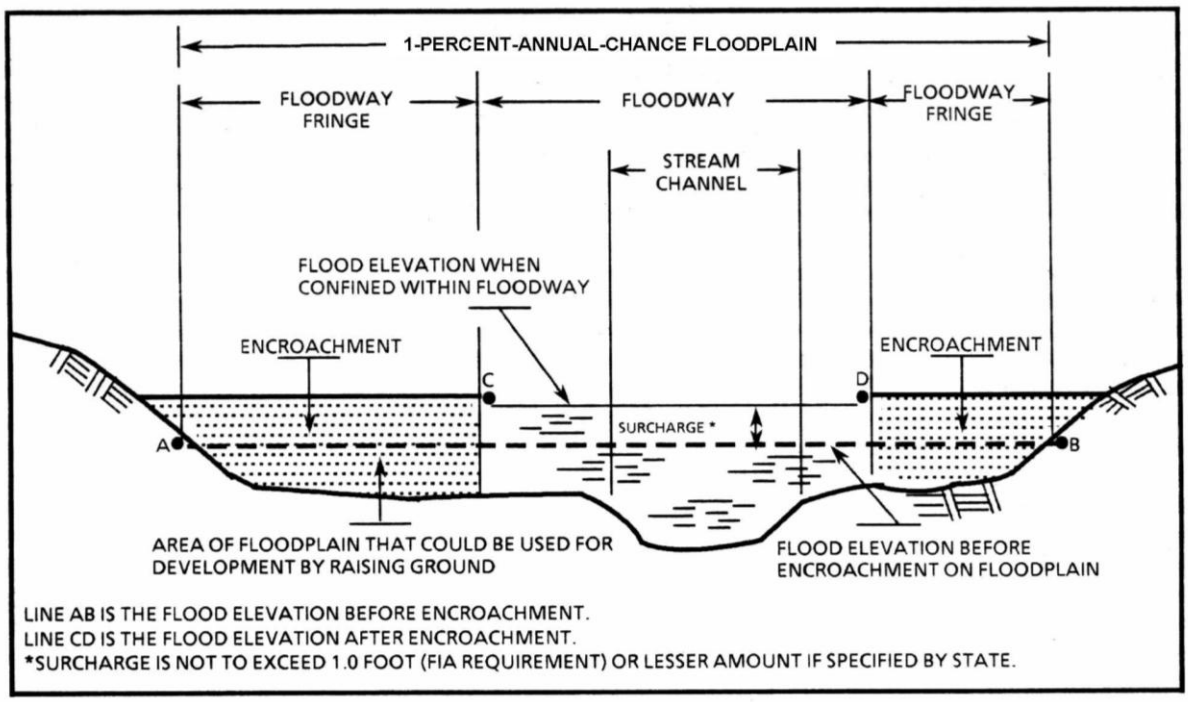
Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. However, Wisconsin has established a more strict policy and does not allow any increase in the regional flood height for flood fringe developments (Reference 22). The increase shown in Table 5, "Floodway Data" for certain stream segments were calculated before this policy went into effect, and are shown as the regulatory elevation to remain in compliance with the current regulation. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (see Table 5, Floodway Data). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the

floodplain that could be completely obstructed without increasing the WSEL of the base flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

FIGURE 1 – FLOODWAY SCHEMATIC



FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
CHIPPEWA RIVER								
A	17.31	2,450	37,100	3.9	712.6	712.6	712.6	0
B	17.63	1,500	25,480	5.7	712.9	712.9	712.9	0
C	17.64	1,440	27,060	5.4	713.1	713.1	713.1	0
D	17.65	1,440	27,220	5.3	713.2	713.2	713.2	0
E	17.71	2,270	32,930	4.4	713.3	713.3	713.3	0
F	17.89	4,370	56,770	2.6	713.8	713.8	713.8	0
G	18.90	6,930	59,000	2.5	714.9	714.9	714.9	0

[1]MILES ABOVE CONFLUENCE WITH MISSISSIPPI RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

PEPIN COUNTY

AND INCORPORATED AREAS

FLOODWAY DATA

CHIPPEWA RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MISSISSIPPI RIVER								
A	763.66	7,738[2] / 8,347[3]	104,115	1.91	680.7	680.7	680.7	0
B	765.53	5,003[2] / 8,758[3]	273,872	0.73	681.3	681.3	681.3	0
C	770.53	7,657[2] / 13,800[3]	472,307	0.42	681.4	681.4	681.4	0
D	772.34	5,173[2] / 10,940[3]	412,826	0.48	681.4	681.4	681.4	0
E	775.19	4,024[2] / 8,273[3]	285,472	0.70	681.4	681.4	681.4	0
F	777.88	2,663[2] / 8,117[3]	228,779	0.87	681.4	681.4	681.4	0
G	779.00	4,195[2] / 8,647[3]	287,607	0.69	681.5	681.5	681.5	0

[1]MILES ABOVE CONFLUENCE OF OHIO RIVER

[2]WIDTH WITHIN PEPIN COUNTY

[3]TOTAL WIDTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

PEPIN COUNTY

AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER

5.0 INSURANCE APPLICATION

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

Zone A

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

Zone AE

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

Zone X

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

6.0 FLOOD INSURANCE RATE MAP

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

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

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

The countywide FIRM presents flooding information for the entire geographic area of Pepin County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the county identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 6, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Durand, City of	October 12, 1973	April 2, 1976	June 1, 1977	None
Pepin, Village of	May 26, 1972	None	May 26, 1972	July 1, 1974 May 2, 1975
Pepin County (Unincorporated Areas)	December 16, 1972	None	December 16, 1972	July 1, 1974 January 2, 1976
Stockholm, Village of	December 12, 1972	None	December 12, 1972	March 28, 1975

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

PEPIN COUNTY, WI AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

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

8.0 LOCATION OF DATA

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

9.0 BIBLIOGRAPHY AND REFERENCES

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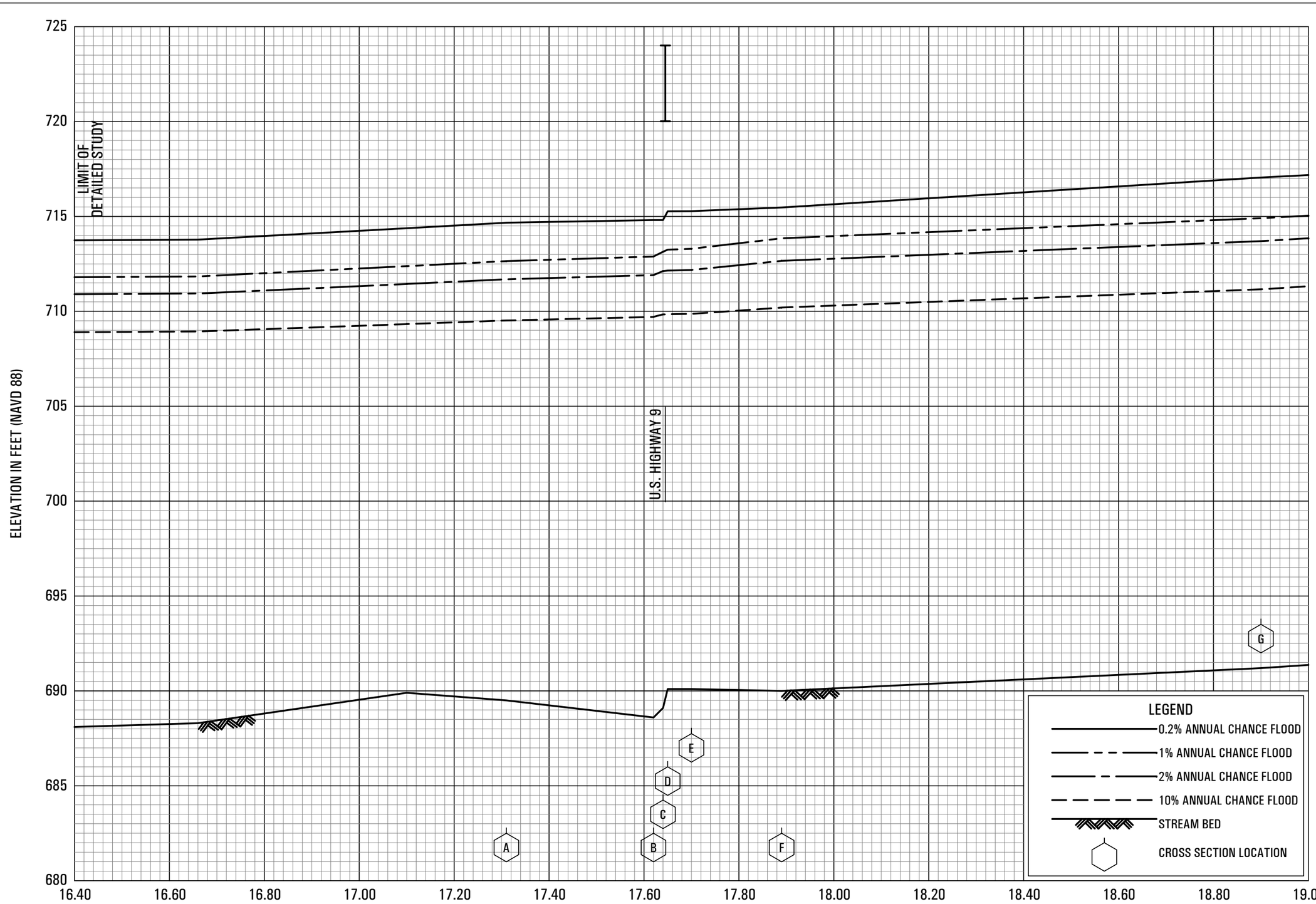


ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN MILE ABOVE CONFLUENCE WITH MISSISSIPPI RIVER

FLOOD PROFILES

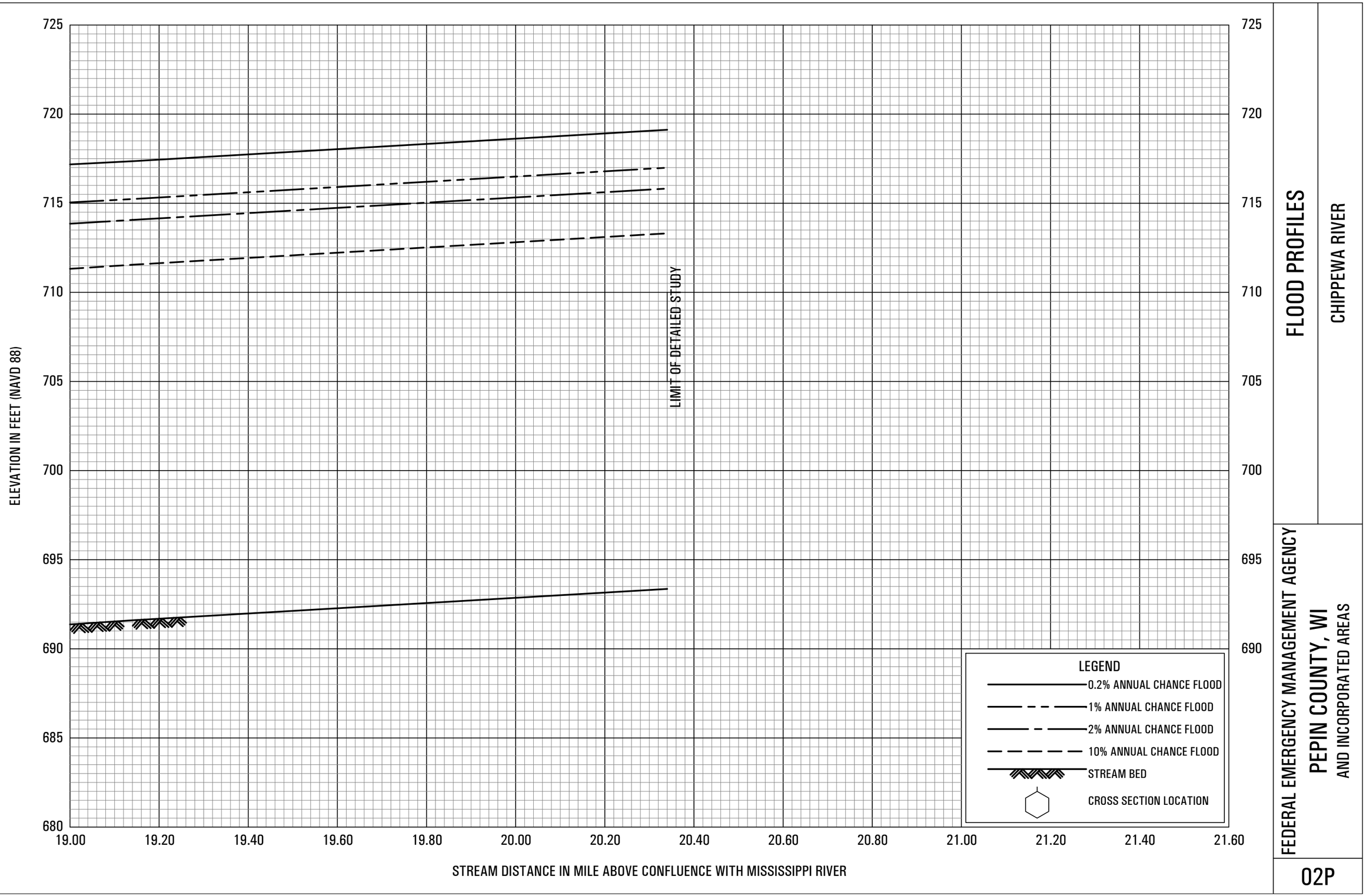
CHIPPEWA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

PEPIN COUNTY, WI

AND INCORPORATED AREAS

01P



FLOOD PROFILES

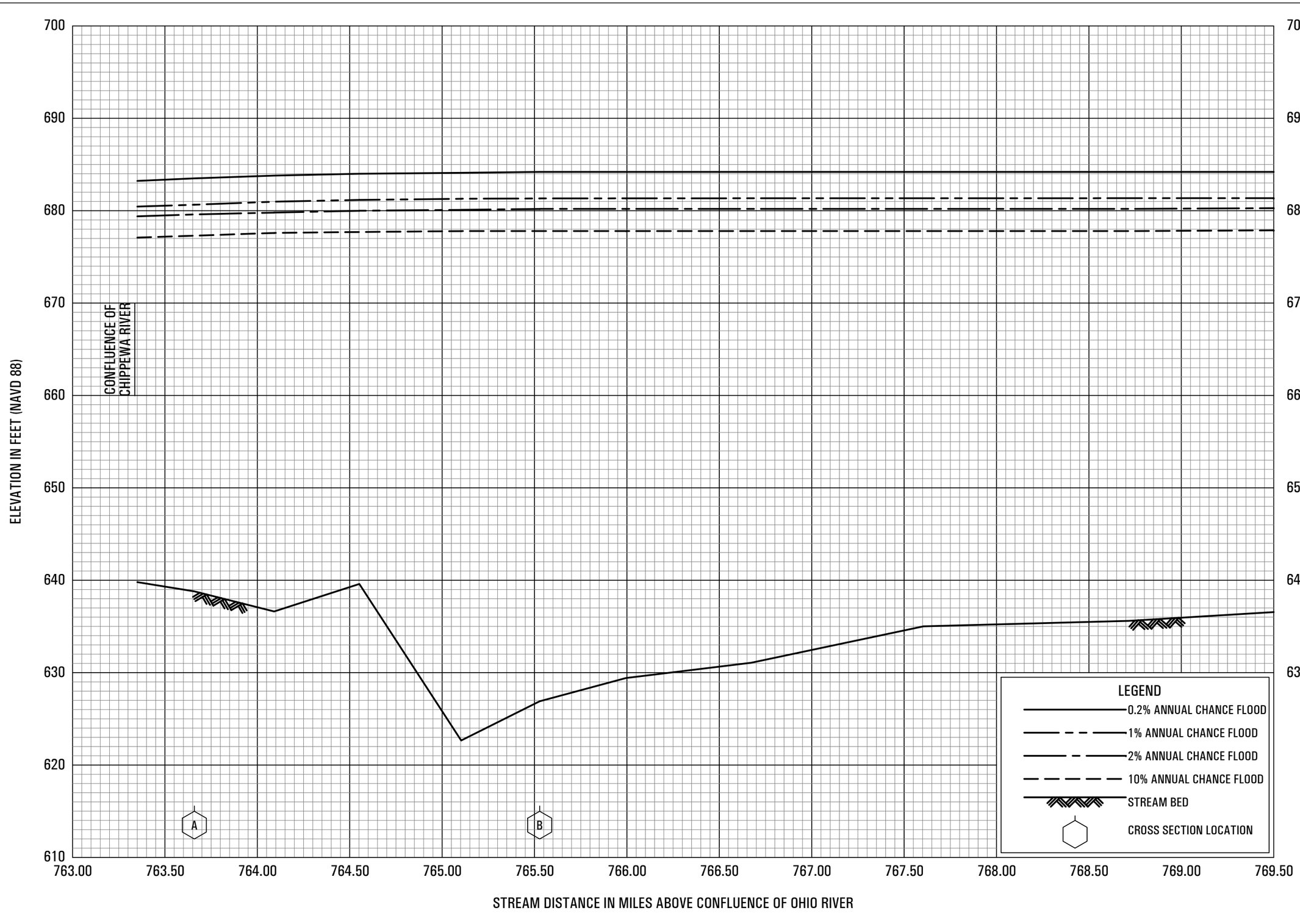
CHIPPEWA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

PEPIN COUNTY, WI

AND INCORPORATED AREAS

02P



FLOOD PROFILES

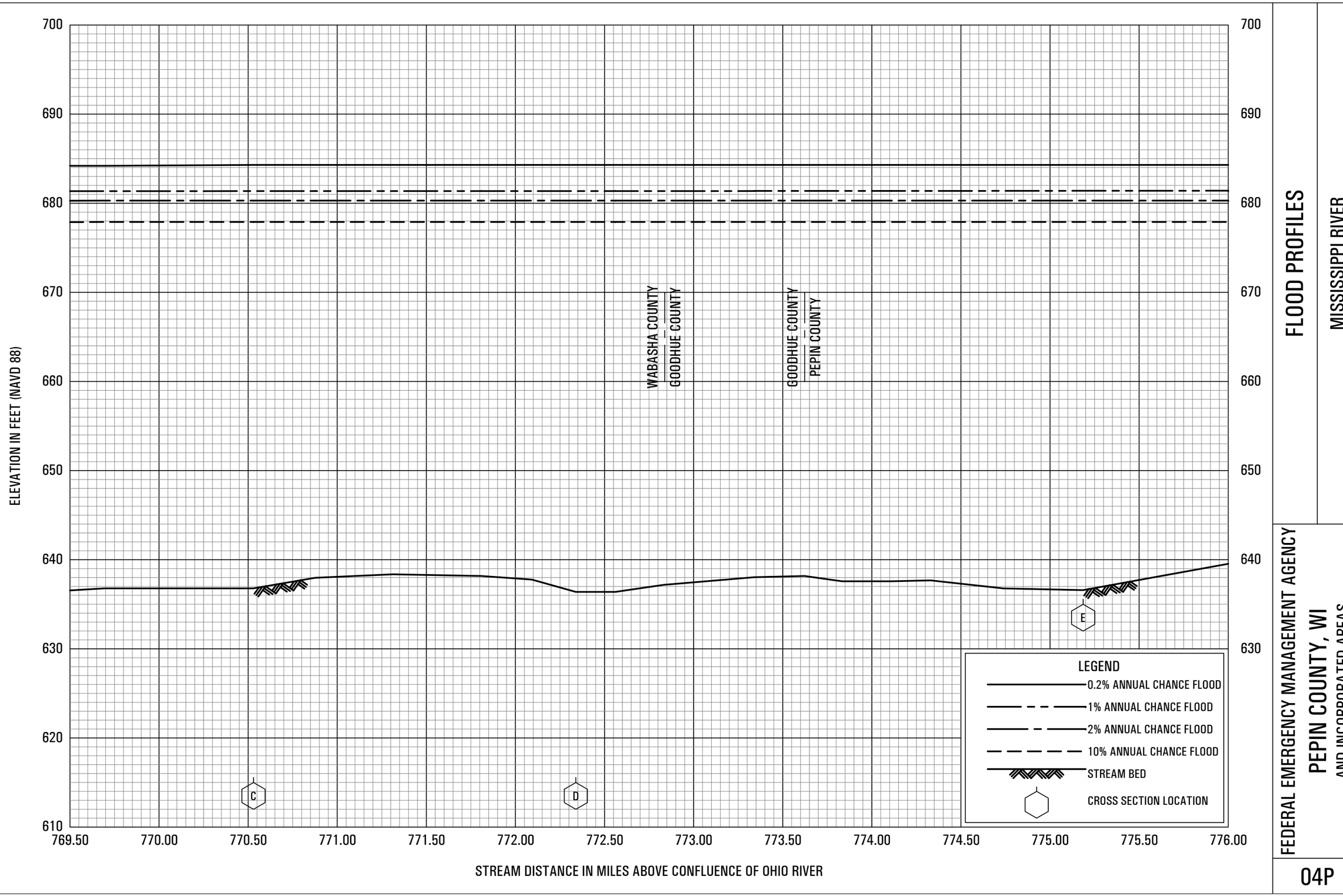
MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

PEPIN COUNTY, WI

AND INCORPORATED AREAS

03P



FLOOD PROFILES

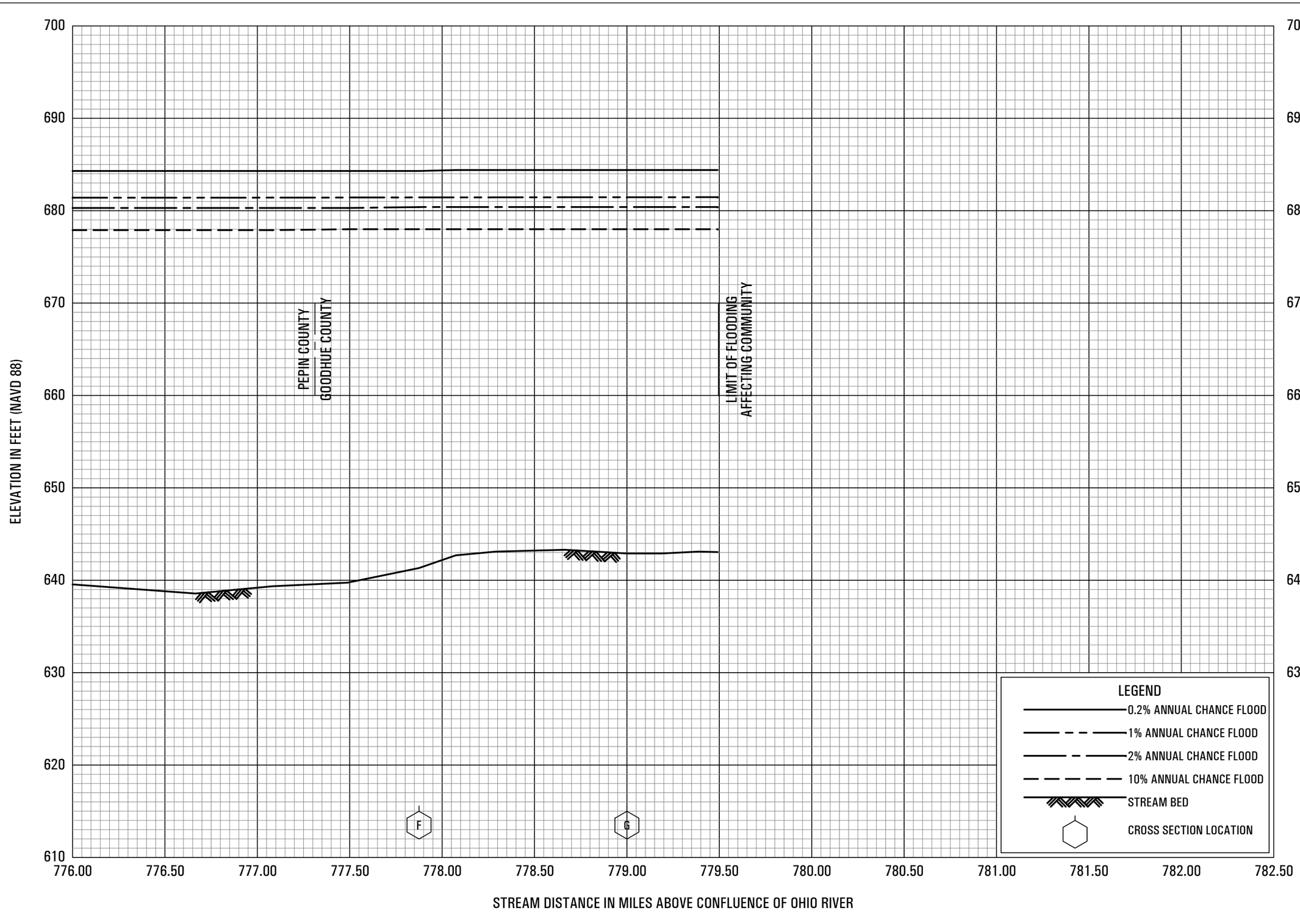
MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

PEPIN COUNTY, WI

AND INCORPORATED AREAS

04P



FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

PEPIN COUNTY, WI

AND INCORPORATED AREAS

05P