

FLOOD INSURANCE STUDY



WASHINGTON COUNTY, INDIANA AND INCORPORATED AREAS

COMMUNITY NAME

COMMUNITY NUMBER

*CAMPBELLSBURG, TOWN OF	180634
*HARDINSBURG, TOWN OF	180635
LITTLE YORK, TOWN OF	180398
*LIVONIA, TOWN OF	180278
NEW PEKIN, TOWN OF	180463
SALEM, CITY OF	180279
*SALTILLO, TOWN OF	180636
WASHINGTON COUNTY (UNINCORPORATED AREAS)	180446

* No Special Flood Hazard Areas Identified



Washington County

REVISED: 4/27/2015

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
18175CV000A



**NOTICE TO
FLOOD INSURANCE STUDY USERS**

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

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

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

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

Initial Countywide FIS Effective Date: To Be Determined

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**FLOOD INSURANCE STUDY
WASHINGTON COUNTY, INDIANA
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 Washington County, Indiana; including the City of Salem; the Towns of Campbellsburg, Hardinsburg, Little York, Livonia, New Pekin, and Saltillo and the Unincorporated Areas (referred to collectively herein as Washington County).

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 county that will establish actuarial flood insurance rates and to assist the county in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that on the effective date of this study, the Towns of Campbellsburg, Hardinsburg, Livonia, and Saltillo have no mapped Special Flood Hazard Areas (SFHA). This does not preclude future determinations of SFHA that could be necessitated by changed conditions affecting the community (i.e. annexation of new lands) or the availability of new scientific or technical data about flood hazards.

Please note that the Town of Fredericksburg was dissolved into Washington County (Unincorporated Areas) in June 2012. The Town of Fredericksburg did not have a previously printed FIS report.

In some states and 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 takes 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 source of authority for this FIS is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

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

Salem, City of	The hydrologic and hydraulic analyses were prepared by the U.S. Geological Survey (USGS) for the Federal Insurance Administration (FIA), under Inter-Agency Agreement No. IAA-H-19-72. This work, which was completed in March 1974, covered all significant flooding sources affecting the City of Salem (Reference 1).
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FIS reports were not published for Towns of Campbellsburg, Hardinsburg, New Pekin, Saltillo; as well as Washington County (Unincorporated Areas); therefore, the authorities and acknowledgements for these communities are not included in this FIS and may not appear in the Community Map History Table (Section 6.0).

The hydrologic and hydraulic analyses for four approximate streams (Bear Creek, Blue River, Muscatatuck River, and South Fork Blue River) were performed by Morley and Associates, Inc., on behalf of the Indiana Department of Natural Resources (DNR), under Indiana Public Works Project Number E060008. The Indiana DNR managed the production of this study as part of their Cooperating Technical Partner agreement with the Federal Emergency Management Agency (FEMA) dated April 29, 2004, which was defined by the Indiana DNR mapping Activity Statement 07-22 dated July 3, 2007 and funded under agreement number EMC-2005-GR-7022.

Redelineation of the East Fork White River, correction to the North American Vertical Datum of 1988 (NAVD88), and conversion of the unincorporated and incorporated areas of Washington County into the Countywide format was performed by Morley and Associates, Inc., on behalf of the Indiana DNR, under Indiana Public Works Project Number E060008. The Indiana DNR managed the production of this study as part of their Cooperating Technical Partner agreement with the FEMA dated April 29, 2004, which was defined by the Indiana DNR Mapping Activity Statement 07-22 dated July 3, 2007 and funded under agreement number EMC-2005-GR-7022.

The digital countywide FIRM was produced in the Transverse Mercator projection, Indiana State Plane coordinate system, East Zone, referenced to the North American Datum of 1983, GRS80 spheroid. Differences in datum and spheroid used in the production of the 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 this FIRM.

1.3 Coordination

An initial Consultation Coordination Officer's (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 streams to be studied by detailed methods. A final CCO meeting is held typically with the same representatives to review the results of the

study. The initial and final meeting dates for the previous FIS reports for Washington County and its communities are listed in Table 1, “Initial and Final CCO Meetings”.

Table 1 – Initial and Final CCO Meetings

<u>Community Name</u>	<u>Initial Meeting</u>	<u>Final Meeting</u>
Salem, City of	*	*
* Data Not Available		

For this countywide FIS, the initial CCO meeting date was held on November 21, 2006 and was attended by the Indiana DNR, the Washington County Emergency Management Agency (EMA), the Washington County Surveyor, the Washington County Senior Emergency Medical Service Instructor, the City of Salem and the Town of New Pekin.

The final CCO meeting was held on July 11, 2012, and attended by representatives of FEMA, Indiana DNR, and local officials. All problems raised at that meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Washington County, Indiana, including communities listed in Section 1.1.

All or portions of the flooding sources listed in Table 2, “Flooding Sources Studied by Detailed Methods” were studied by detailed methods. Limits of Detailed Study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

Table 2 – Flooding Sources Studied by Detailed Methods

<u>Stream</u>	<u>Limits of Detailed Study</u>
Blue River	Approximately 0.55 miles downstream of State Route 150 to approximately 0.55 miles upstream of County Route 1075 South
Brock Creek	At confluence with West Fork Blue River to approximately 50 feet upstream of State Route 135
Highland Creek	From West Market Street to State Routes 56 & 60
West Fork Blue River	Approximately 350 feet downstream of Becks Mill Road to approximately 50 feet upstream of State Route 56

All or portions of the flooding sources listed in Table 3, “Flooding Sources Studied by Approximate Methods” were studied by approximate methods.

Table 3 – Flooding Sources Studied by Approximate Methods

Bear Creek	Muscatatuck River
Blue River	South Fork Blue River
Middle Fork Blue River	

The East Fork White River was redelineated from the County boundary to Muscatatuck River.

The areas studied by detailed methods were selected with priority given to all known flood hazards areas, areas of projected development, and areas of proposed construction through August 1992.

Numerous flooding sources in the county were studied by approximate methods. 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.

No Letters of Map Revision (LOMRs) were incorporated as part of this study.

2.2 Community Description

Washington County is located in southern Indiana and is bordered by Jackson County to the north, Lawrence County to the northwest, Orange County to the west, Crawford County to the southwest, Harrison County to the South, Floyd County to the southeast, and Clark and Scott Counties to the east. Washington County is located approximately 100 miles south of Indianapolis. Washington County is served by U.S. route 150, and State Routes 56, 60, 39, 135, 160, and 335.

The climate in Washington County ranges from hot and humid in the summertime to cold during the winter season. Average daytime temperatures during the summer fall around 73.9 degrees Fahrenheit (°F), while winter temperatures average at approximately 33.5°F. Precipitation for Washington County totals an annual amount of 46.07 inches.

According to U.S. Census Data the population of Washington County in 2010 was reported to be 28,262 (Reference 2).

2.3 Principal Flood Problems

Major floods principally occur during the winter and spring months, but can occur during any season. Generally, two types of storm events cause flooding. During the winter and spring, storms of moderate intensity and long duration, coupled with frozen ground, cause flooding to occur. During the summer, thunderstorms which have high intensities and relatively short durations can cause floods.

In the Town of Little York, the principle flood areas are the low-lying areas along Henry Creek, a tributary of Muscatatuck River.

In the Town of Pekin, the principle flood areas are along the South Fork Blue River.

In the City of Salem, principle flood areas are low lying areas along the Brock Creek, Highland Creek, and West Fork Blue River. A significant flood occurred in 1959.

There are currently no flooding problems in the Towns of Campbellsburg, Hardinsburg, Livonia, and Saltillo.

2.4 Flood Protection Measures

The City of Salem has limited protection from floods in the form of small retaining walls along West Fork Blue River in the vicinity of the fairgrounds.

The state of Indiana has also set regulations concerning development in a floodplain. The Indiana Flood Control Act of 1945, as amending, requires that the channels and that portion of the flood plain known as the floodway be kept free and clear of interference or obstructions which could restrict the flow rate in a significant manner. The Act stipulates that the Indiana Flood Plain Management Act of 1973 further requires that floodplain management regulations adopted after July 1, 1974, meet a minimum set of standards for the delineation and regulation of flood hazard areas.

At present, there are no existing or proposed flood protection structures within the Towns of Campbellsburg, Hardinsburg, Little York, Livonia, New Pekin, and Saltillo and the Unincorporated Areas. Residents of these municipalities rely on the usual warnings through radio, television, and local newspapers for information concerning possible flood conditions.

3.0 **ENGINEERING METHODS**

For the flooding sources studied in detail 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 which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent-annual-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 which 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 the peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the communities within Washington County.

A summary of drainage area-peak discharge relationships for all streams studied by detailed methods is shown in Table 4, "Summary of Discharges."

Table 4 – Summary of Discharges

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (SQ. MILES)</u>	PEAK DISCHARGES (CFS)			
		<u>10%- ANNUAL- CHANCE</u>	<u>2%- ANNUAL- CHANCE</u>	<u>1%- ANNUAL- CHANCE</u>	<u>0.2%- ANNUAL- CHANCE</u>
BLUE CREEK					
At U.S. 150	283.0	15,600	25,100	30,400	42,000
Above South Fork Blue River	157.0	11,200	19,000	24,600	35,500
BROCK CREEK					
At West Fork Blue River	8.0	2,500	3,600	4,250	4,800
HIGHLAND CREEK					
At the Washington- Susquehanna County boundary	9.3	2,800	4,000	4,700	5,400
WEST FORK BLUE RIVER					
At Becks Mill Road	41.3	5,900	8,400	10,000	11,300
Above Highland Creek	28.2	5,000	7,000	8,400	9,400
At Main Street	19.4	4,100	5,800	6,800	7,700

Flood-flow frequency data were based on statistical analysis of stage-discharge records at gaging stations on West Fork Blue River at Salem (established in 1970), Blue River at White Cloud (established in 1930), Middle Fork Anderson River near Bristow (established in 1961), and Blue River near East U.S. Highway 150. These gaging stations are operated by the USGS.

Using the station frequency data, regional flood-frequency curves were developed, and an average skew coefficient of 0.30 was obtained. The 10-, 2-, 1-, and 0.2-annual-chance peak discharges for each station were plotted against drainage area and adjusted for consistency with adjacent stations.

Discharges for the 0.2-annual-chance floods of all streams were determined by straightline extrapolation of a single-log graph of flood discharges computed for frequencies up to 1-percent-annual-chance.

The equations used to determine the discharges in the majority of the cases are taken from Estimation of Peak Discharges of Indiana Streams by using log Pearson III (Reference 3) distribution. The equations presented in the report are also included in the latest version of the National Flood Frequency (NFF) program by the USGS, and are included in the USGS StreamStats application. In some cases, the discharges for a stream have been coordinated with the Indiana DNR, the Natural Resources Conservation Service (formally the Soil Conservation Service), the USGS and the USACE, through a Memorandum of Understanding dated May 6, 1976.

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 the 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. The flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Flood profiles were drawn showing computed water surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. 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 is computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

The hydraulic analyses for these studies were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations shown on the Flood Profiles and FIRM (Exhibits 1 and 2) are referenced to the North American Vertical Datum of 1988 (NAVD88).

Cross sections for the backwater analyses were obtained from a variety of sources including: physical survey data, Indiana DNR contour mapping, USGS topographic mapping, and local contour mapping. 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 floods of the selected recurrence intervals were computed through use of the USACE Hydrologic Engineering Centers River Analysis System (HEC-RAS) step-backwater computer program. HEC-RAS is an updated version of the HEC-2 program (Reference 4) used to perform step-backwater analyses.

Flood profiles were prepared for all streams studied by detailed methods and show computed water-surface elevations to an accuracy of 0.5 feet for floods of the selected recurrence intervals. For this countywide FIS, flood profiles and approved LOMRs have been consolidated into continuous stream reaches and adjusted to reflect the current vertical datum as described in Section 3.3. New profiles have been prepared for the new detailed studies and for the purposes of incorporating the LOMRs described in Section 2.1 above.

Channel and overbank roughness factors (Manning’s “n” values) used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the stream and floodplain areas. For other streams, factors were estimated by field inspection with the aid of “n” value tables and equations. The tabulation showing the channel and overbank Manning’s “n” values for the streams studied by detailed methods can be found in Table 5, “Manning’s “n” Values”.

Table 5 – Manning’s “n” Values

<u>Stream</u>	<u>Channel “n”</u>	<u>Overbank “n”</u>
Blue River	0.030 – 0.035	0.035 – 0.100
Brock Creek	0.040	0.060
Highland Creek	0.040 – 0.050	0.030 – 0.100
West Fork Blue River	0.035 – 0.045	0.030 – 0.100

For new approximate study areas, analyses were based on field inspection and modeling of the stream reaches using USACE HEC-RAS program, version 3.1.3. The approximate study structural data are based on field measurements. The cross section geometry was derived from the 2005 IDHS 2005 Digital Elevation data. The starting water surface elevations were assumed to be normal depth.

All qualifying benchmarks within a given jurisdiction that are catalogued by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Benchmarks catalogued by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation (e.g. mounted in bedrock)

- Stability B: Monuments which generally hold their position/elevation (e.g. concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g. concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g. concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

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

It is important to note that 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.

3.3 Vertical Datum

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

For this countywide FIS, all flood elevations shown in the FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in BFEs across corporate limits between the communities.

As noted above, the elevations shown in the FIS report and on the FIRM for Washington County are referenced to NAVD88. Ground, structure, and flood elevations may be compared and/or referenced to NGVD29 by applying a standard conversion factor. The conversion factor from NGVD29 to NAVD88 for Washington County is **-0.39** foot. The locations used to establish the conversion factor were USGS 7.5-minute topographic quadrangle corners that fell within the County, as well as those that were within 2.5 miles outside the County (VERTCON, 2005). The bench marks are referenced to NAVD88.

The BFEs are shown on the FIRM represent whole-foot rounded values. For example, a BFE of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD29 should apply the

conversion factor to elevations shown on the Flood Profiles and supporting data tables in this FIS report, which are shown at a minimum to the nearest 0.1 foot.

NAVD88 = NGVD29 + conversion factor

For additional information regarding conversion between the NGVD29 and NAVD88, visit the National Geodetic Survey website at <http://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 <http://www.ngs.noaa.gov>.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic mapping from the City of Salem and from the 2005 statewide orthophotography flight.

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

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

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights, and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this FIS are presented to local agencies as a minimum standard 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 6, "Floodway Data"). The Computed floodways are shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross sections is provided in Table 6, "Floodway Data". In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development to areas outside the floodways.

The State of Indiana, however, per Indiana Code IC 14-28-1 (Reference 5) and Indiana Administrative Code 312 IAC 10 (Reference 6), has designated that encroachment in the floodplain is limited to that which will cause no significant increase in flood height. As a result, floodways for this study are delineated based on a flood surcharge of less than 0.15 feet. The floodways in this study were approved by the Indiana DNR, and 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 area between the floodway and the 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 water surface elevation of the 1-percent-annual-chance flood by 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, "Floodway Schematic".

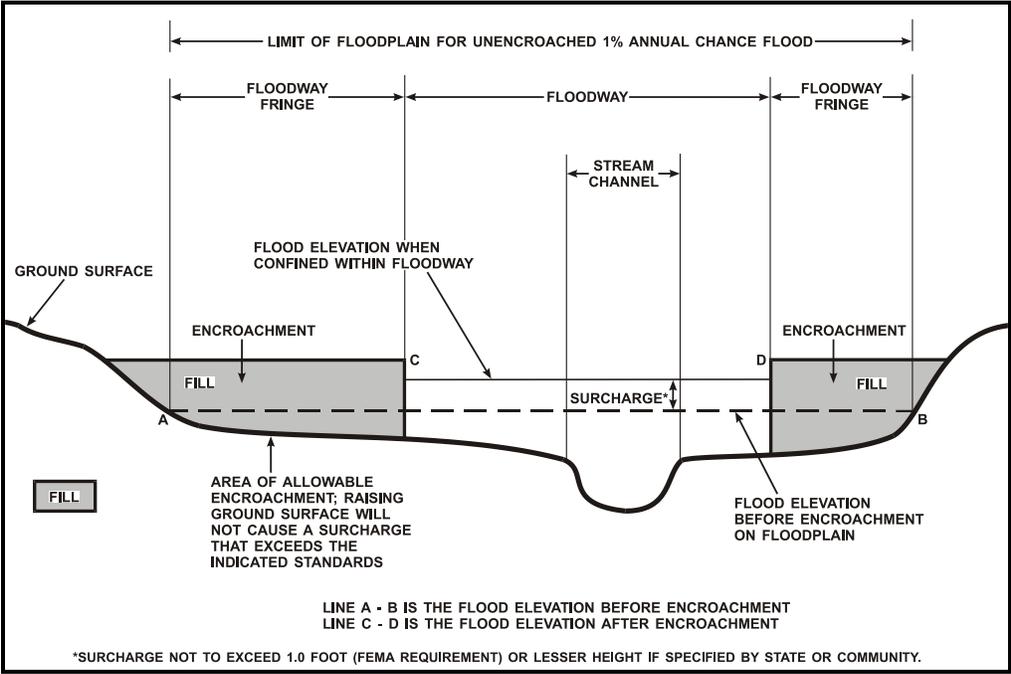


Figure 1 – Floodway Schematic

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
BLUE RIVER								
A	56.76 ¹	1,250	9,132	3.3	614.8	614.8	641.8	0.0
B	57.10 ¹	1,175	8,072	3.8	615.3	615.3	615.3	0.0
C	57.34 ¹	1,615	8,938	3.4	616.3	616.3	616.4	0.1
D	57.68 ¹	2,500	22,648	1.3	617.1	617.1	617.2	0.1
E	58.42 ¹	1,050	6,852	3.6	617.3	617.3	617.3	0.0
BROCK CREEK								
A	0.26 ²	250	867	5.9	722.1	722.1	722.1	0.0
B	0.36 ²	210	535	9.1	722.8	722.8	722.9	0.1
C	0.40 ²	235	646	7.6	724.4	724.4	724.5	0.1
D	0.49 ²	240	975	6.5	726.1	726.1	726.2	0.0
E	0.54 ²	175	633	6.7	726.6	726.6	726.7	0.1
F	0.62 ²	220	1,430	4.8	728.6	728.6	728.7	0.1
G	0.70 ²	195	972	6.9	729.1	729.1	729.1	0.0
H	0.78 ²	185	977	5.6	729.9	729.9	730.0	0.1
I	0.96 ²	150	849	7.1	735.9	735.9	736.0	0.1
J	1.46 ²	105	558	8.9	744.5	744.5	744.6	0.1

¹ Miles above mouth

² Miles above West Fork Blue River

**T
A
B
L
E
6**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**WASHINGTON COUNTY, IN
AND INCORPORATED AREAS**

FLOODWAY DATA

BLUE RIVER – BROCK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
HIGHLAND CREEK								
A	0.40	*	*	*	713.8	713.8	*	*
B	0.47	*	*	*	715.3	715.3	*	*
C	0.57	*	*	*	717.8	717.8	*	*
WEST FORK BLUE RIVER								
A	2.54	325	2,001	5.0	693.4	693.4	693.4	0.0
B	2.74	425	1,505	6.7	697.2	697.2	697.3	0.1
C	2.90	365	2,335	4.3	699.1	699.1	699.1	0.0
D	3.01	370	2,332	4.3	699.8	699.8	699.8	0.0
E	3.20	300	1,958	5.1	701.1	701.1	701.1	0.0
F	3.29	321	2,831	3.6	701.7	701.7	701.7	0.0
G	3.50	540	3,671	4.5	702.4	702.4	702.4	0.0
H	3.64	528	3,190	5.4	702.9	702.9	703.0	0.1
I	3.77	611	3,922	4.0	703.5	703.5	703.6	0.1
J	3.86	491	2,732	4.4	703.8	703.8	703.8	0.0
K	3.98	406	2,384	5.9	704.4	704.4	704.5	0.1
L	4.17	309	2,233	6.3	706.0	706.0	706.1	0.1
M	4.34	363	2,363	7.1	707.2	707.2	707.2	0.0
N	4.49	311	2,414	4.9	708.2	708.2	708.2	0.0

¹ Miles above Mouth

* Floodway Data Not Computed

TABLE 6

**FEDERAL EMERGENCY MANAGEMENT AGENCY
WASHINGTON COUNTY, IN
AND INCORPORATED AREAS**

FLOODWAY DATA

HIGHLAND CREEK – WEST FORK BLUE RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
WEST FORK BLUE RIVER (CONTINUED)								
O	4.61	464	3,052	5.0	708.8	708.8	708.9	0.1
P	48.0	616	1,952	7.2	711.2	711.2	711.3	0.1
Q	5.09	415	2,435	3.8	713.3	713.3	713.4	0.1
R	5.18	253	1,620	5.5	713.7	713.7	713.8	0.1
S	5.42	433	2,231	5.1	715.7	715.7	715.8	0.1
T	5.52	428	2,499	4.3	716.1	716.1	716.2	0.1
U	5.89	203	1,527	5.7	718.1	718.1	718.1	0.0
V	5.97	329	2,182	5.5	718.7	718.7	718.8	0.1
W	6.06	251	1,842	5.5	719.1	719.1	719.2	0.1
X	6.15	560	3,359	4.3	719.8	719.8	719.9	0.1
Y	6.26	692	3,702	3.8	720.4	720.4	720.5	0.1
Z	6.32	276	1,585	7.0	720.5	720.5	720.6	0.1
AA	6.56	569	3,338	3.4	724.0	724.0	724.0	0.0
AB	6.62	591	3,428	2.9	724.1	724.1	724.1	0.0
AC	6.66	544	1,433	4.7	724.1	724.1	724.1	0.0
AD	6.78	606	899	8.5	726.1	726.1	726.1	0.0
AE	7.02	819	4,182	2.6	728.7	728.7	728.8	0.1
AF	7.20	545	2,669	4.7	729.0	729.0	729.0	0.0
AG	7.61	314	1,826	4.1	732.6	732.6	732.7	0.1

¹ Miles above Mouth

TABLE 6	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	WASHINGTON COUNTY, IN AND INCORPORATED AREAS	
		WEST FORK BLUE RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
WEST FORK BLUE RIVER (CONTINUED)								
AH	7.76	365	1,907	5.6	733.6	733.6	733.7	0.1
AI	7.95	548	2,556	3.9	735.0	735.0	735.1	0.1
AJ	8.04	496	1,938	5.7	735.6	735.6	735.6	0.1
AK	8.32	590	3,007	2.5	739.4	739.4	739.5	0.0
AL	8.48	405	1,043	11.1	739.6	739.6	739.6	0.1
AM	8.65	573	2,663	4.4	742.9	742.9	743.0	0.0
AN	8.78	512	1,771	4.4	743.9	743.9	744.0	0.1
AO	8.91	660	2,250	5.7	745.2	745.2	745.3	0.1
AP	9.04	607	1,841	7.7	746.6	746.6	746.7	0.1
AQ	9.21	703	2,288	6.0	748.7	748.7	748.8	0.1
AR	9.38	399	1,492	8.0	751.0	751.0	751.1	0.1
AS	9.76	345	1,451	7.5	755.5	755.5	755.6	0.1

¹ Miles above Mouth

TABLE 6	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	WASHINGTON COUNTY, PA AND INCORPORATED AREAS	
		WEST FORK BLUE RIVER

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zoning designations are assigned to a community based on the results of the engineering analyses. The 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 (1-percent-annual-chance) BFEs or base flood depths are shown within this zone.

Zone AE

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

Zone X

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

6.0 FLOOD INSURANCE RATE MAP

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

For flood insurance applications, the map designates flood insurance 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 base flood elevations or average depths. Insurance agents use the zones and base flood elevations 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-percent-annual-chance floodplains and the location of the selected cross sections used in the hydraulic analyses.

The countywide FIRM presents flooding information for the geographic area of Washington County. Previously, separate Flood Hazard Boundary Maps (FHBM)s and/or FIRMs were prepared for each incorporated community with identified flood hazard areas. Historical map dates relating to pre-countywide maps prepared for each community are presented in Table 7, “Community Map History.”

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
* Campbellsburg, Town of	N/A	None	N/A	None
* Hardinsburg, Town of	N/A	None	N/A	None
Little York, Town of	March 21, 1975	None	N/A	None
* Livonia, Town of	October 18, 1974	June 11, 1976	N/A	None
New Pekin, Town of	March 9, 1979	None	N/A	None
Salem, City of	November 23, 1973	None	August 15, 1978	None
* Saltillo, Town of	N/A	None	N/A	None
Washington County (Unincorporated Areas)	April 21, 1978	None	N/A	None

* No Special Hazard Areas Identified

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

**WASHINGTON COUNTY, IN
AND INCORPORATED AREAS**

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

Information pertaining to revised and unrevised flood hazards for each community within Washington County has been compiled into this countywide FIS. Therefore, this FIS 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 FIS can be obtained by contacting FEMA, Flood Insurance and Mitigation Division, Federal Emergency Management Agency, Region V, 536 S. Clark Street, 6th Floor, Chicago, IL 60605.

9.0 BIBLIOGRAPHY AND REFERENCES

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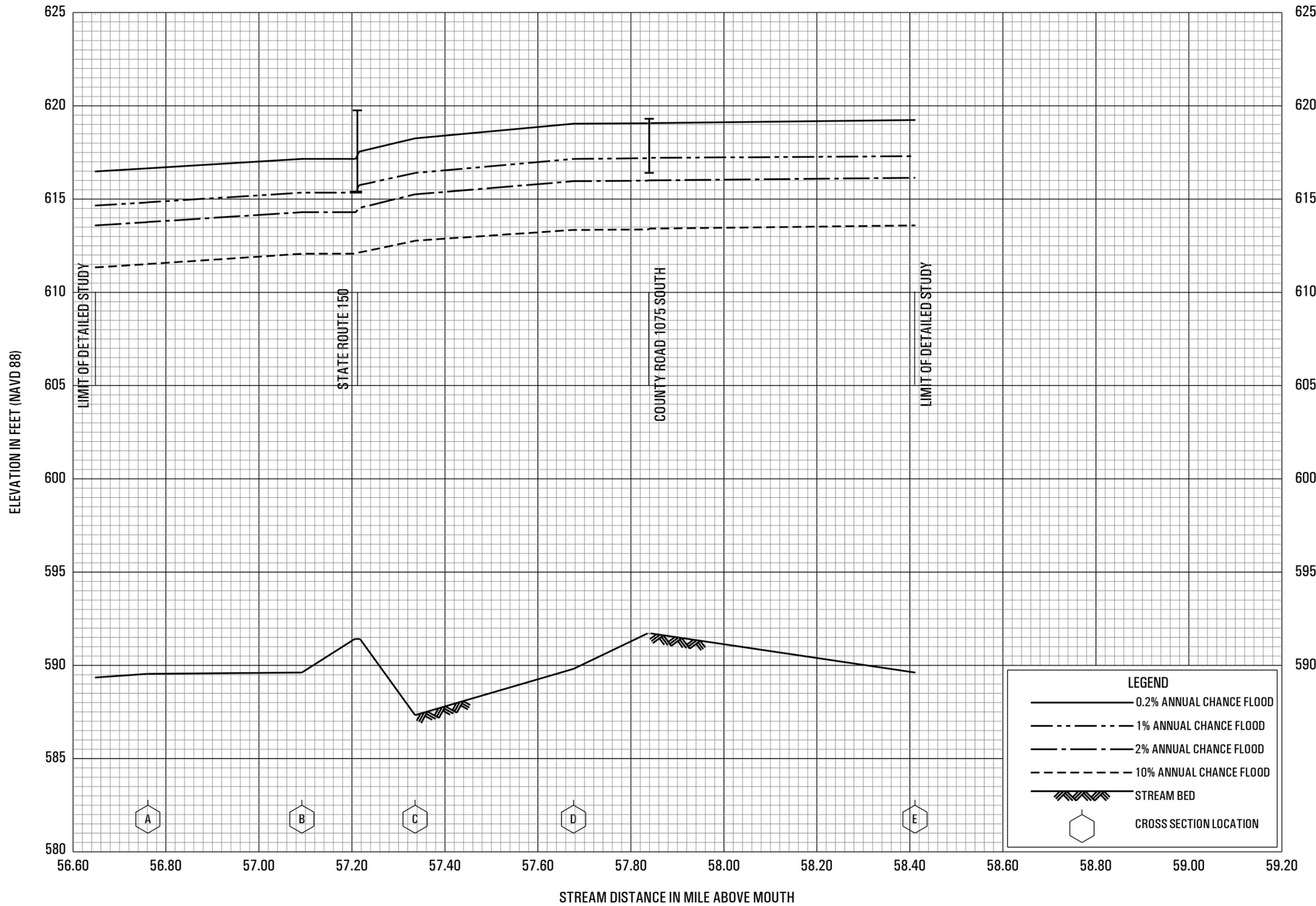
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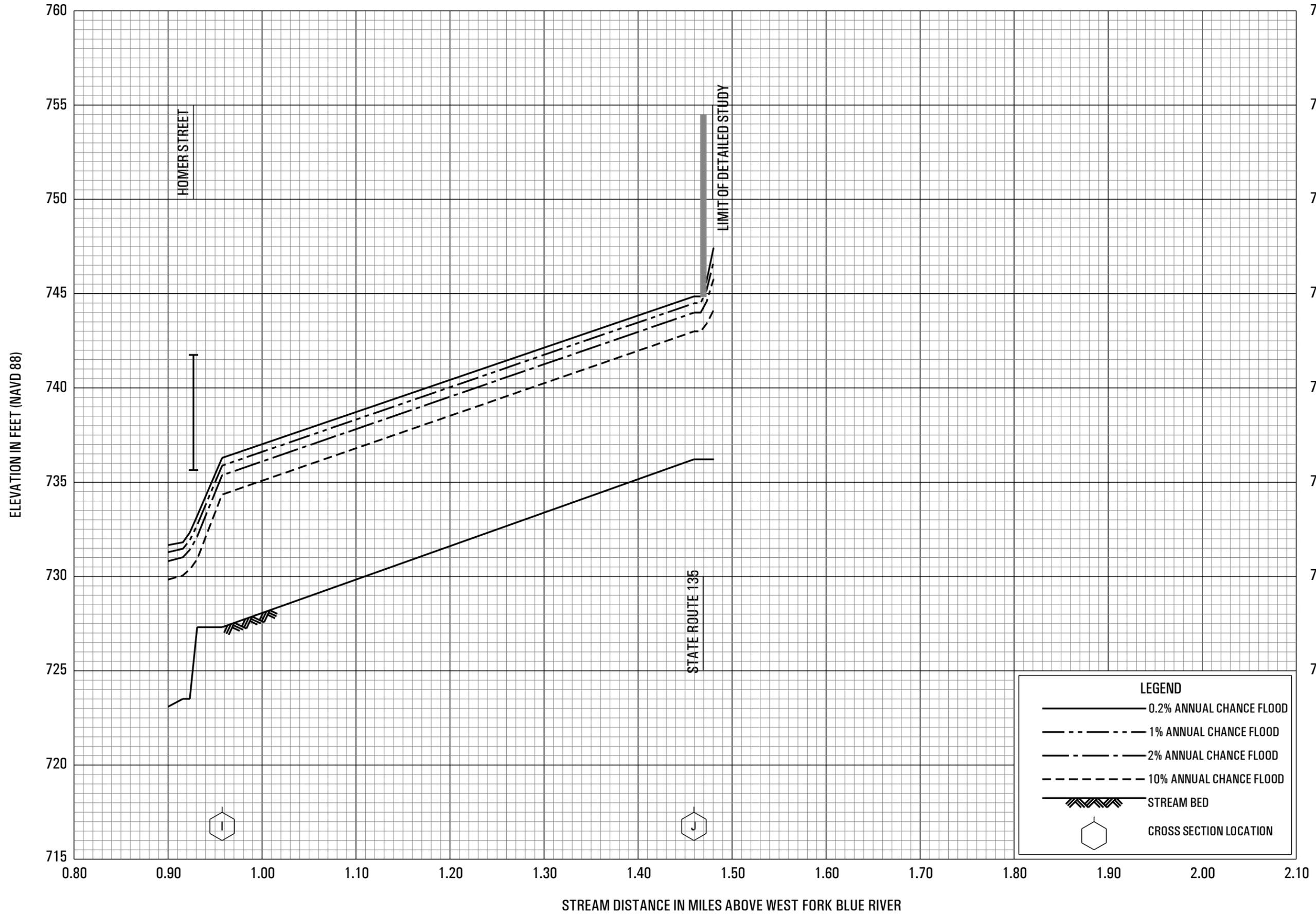
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FLOOD PROFILES

BLUE RIVER

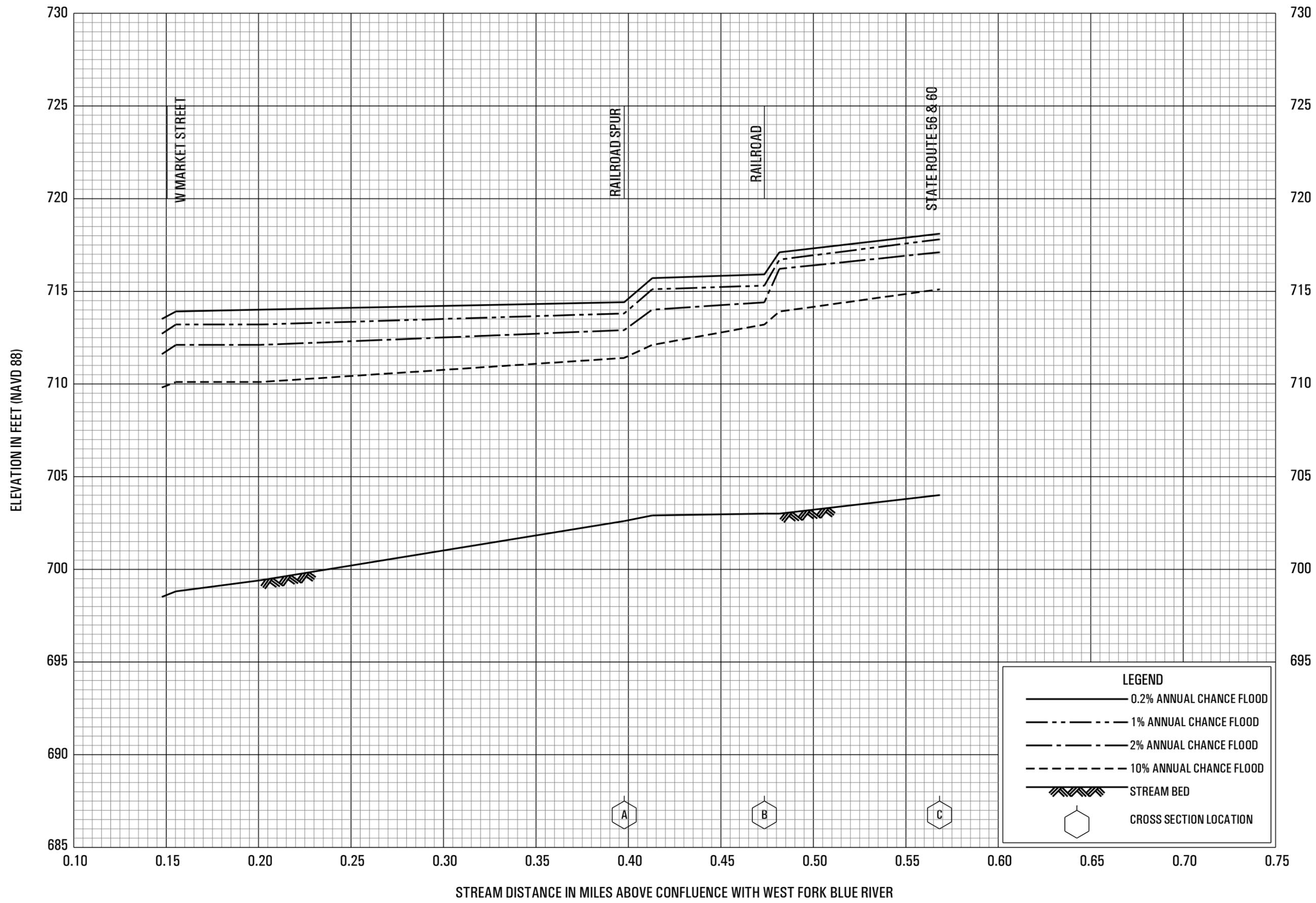
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WASHINGTON COUNTY, IN
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FLOOD PROFILES

BROCK CREEK

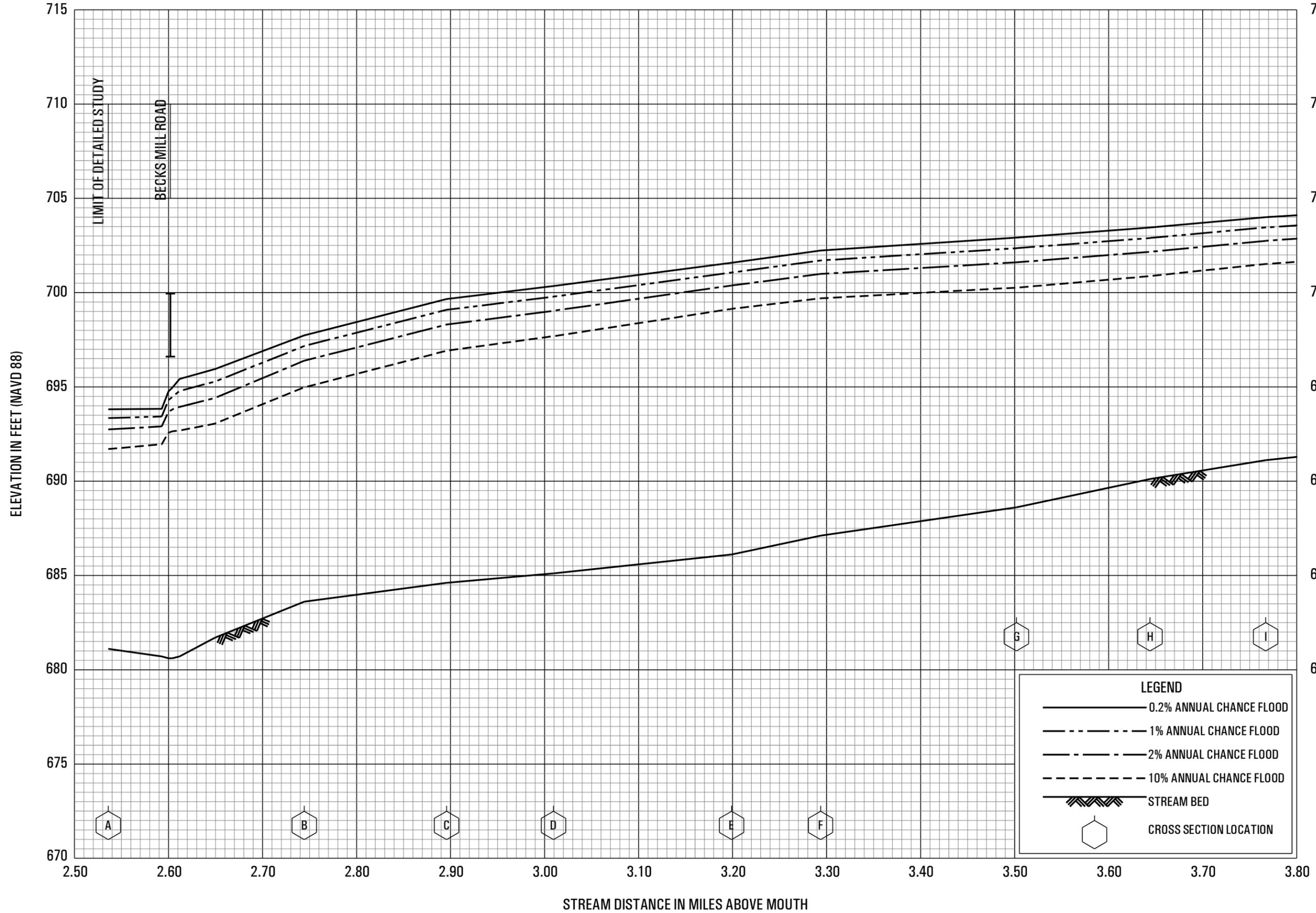
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FLOOD PROFILES
HIGHLAND CREEK

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AND INCORPORATED AREAS

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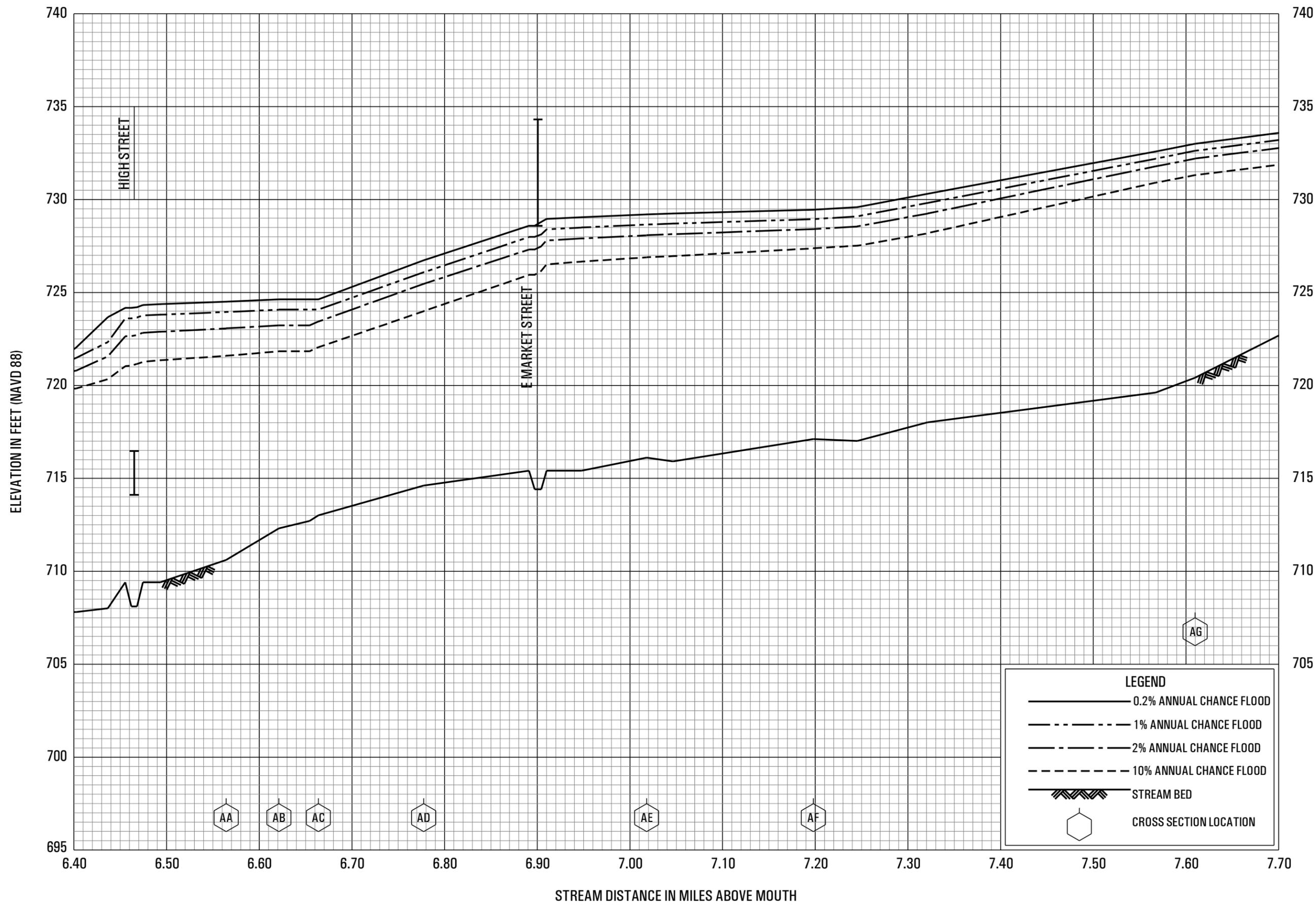
FLOOD PROFILES

WEST FORK BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

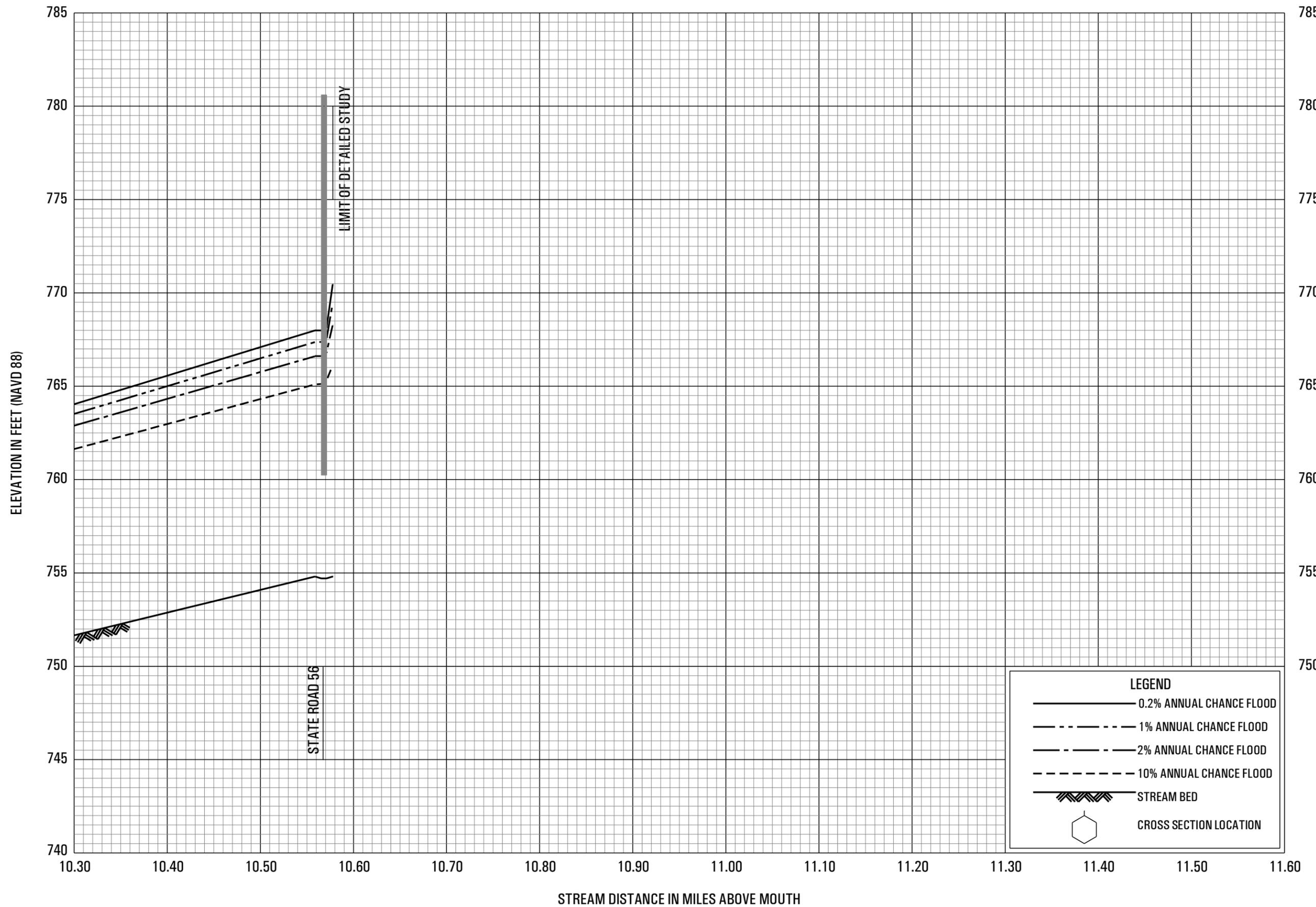
WASHINGTON COUNTY, IN

AND INCORPORATED AREAS



FLOOD PROFILES
WEST FORK BLUE RIVER

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WEST FORK BLUE RIVER

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