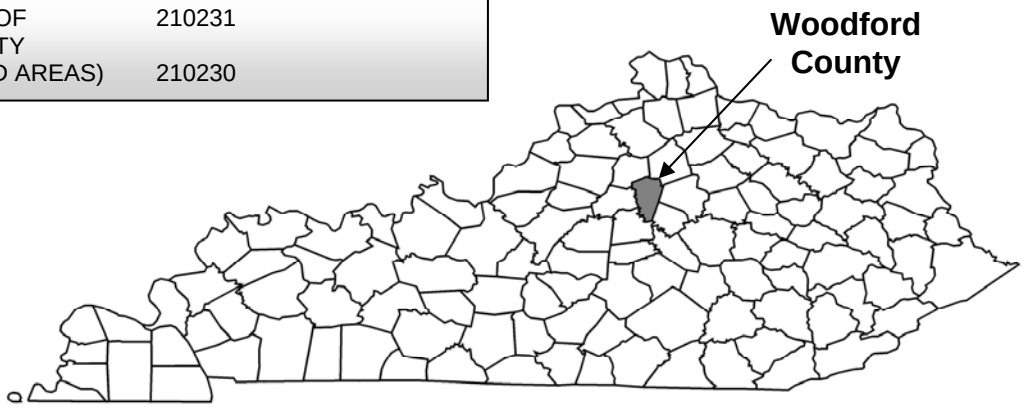
WOODFORD COUNTY, KENTUCKY
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
MIDWAY, CITY OF	210477
VERSAILLES, CITY OF	210231
WOODFORD COUNTY (UNINCORPORATED AREAS)	210230



Effective Date August 2, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

21239CV000A

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) 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 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.

Initial Countywide FIS Effective Date: August 2, 2011

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

FLOOD INSURANCE STUDY
WOODFORD COUNTY KENTUCKY 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 Woodford County, Kentucky; including the Cities of Midway and Versailles, and the unincorporated areas of Woodford County (referred to collectively herein as Woodford County), and 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.

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

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are 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 Woodford 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.

Woodford County (Unincorporated Areas)	The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Louisville District, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-16-75, Project Order No. 12. This work was completed in December 1976 (Reference 1).

The authority and acknowledgements for the Cities of Midway and Versailles are not available since FIS reports have never been published for these communities.

For this countywide FIS, new hydrologic and hydraulic analyses were prepared for FEMA by AMEC Earth & Environmental, Inc. under Contract No. EMA-2007-CA-5772 and this work was completed in July 2009. Topographical data consisted of 2 ft contours covering the cities of Midway and Versailles (Reference 2) and 10 meter Digital Elevation Models (DEM) produced by the U.S. Geological Survey (USGS) (Reference 3).

Planimetric base map information shown on all FIRM panels was derived from multiple sources. Road centerlines, stream centerlines and political boundary files were provided by the Kentucky Geographic Network and additional stream centerlines and areas were downloaded from the National Hydrography Dataset provided by the U.S. Geological Survey. Users of this FIRM should be aware that minor adjustments may have been made to specific base map features.

The coordinate system used for the production of this FIRM is State Plane, Lambert Conformal Conic, Kentucky Single Zone 1600, North American Datum of 1983 (NAD 83), GRS 80 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the UTM projection, NAD 83. 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's (CCO) meeting is held with representatives of the communities, FEMA, and the study contractors to explain the nature and purpose of the FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held with representatives of the communities, FEMA, and the study contractors to review the results of the study.

For this countywide FIS, initial CCO meetings were held on May 24, 2007, and a final CCO meeting was held on November 9, 2009. The initial meetings were attended by representatives of Woodford County Unincorporated Areas and City of Midway, City of Versailles, FMSM Engineers, and Kentucky Division of Water (KYDOW).

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Woodford County, Kentucky, including the incorporated communities listed in Section 1.1. The areas studied were selected with priority given to all known flood hazards and areas of projected development or proposed construction through May 2007.

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Glenns Creek	From its confluence with Kentucky River to approximately 0.1 mile downstream of Steele Road
Kentucky River	For its entire length throughout the county
Lee Branch	From West Leestown Pike to approximately 0.2 miles upstream of Old Frankfort Pike (KY-1681).
South Elkhorn Creek	From Paynes Depot Road to Old Frankfort Pike (KY-1681).

Kentucky River is a new detailed study for this countywide FIS based on a HEC-2 model obtained from the USACE Louisville district. AMEC Earth & Environmental, Inc. converted the HEC-2 model into a steady state HEC-RAS model, adding bridges and calibrating the HEC-RAS model based on USGS gages and historic high water marks on the Kentucky River.

Lee Branch is a new detailed study for this countywide FIS, incorporating recent development, updated ground surface information and updated hydrology and hydraulics.

Glenns Creek and South Elkhorn Creek were redelineated based on information as published in the Flood Insurance Study for Woodford County Unincorporated Areas (Reference 1).

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 representatives of Woodford County Unincorporated Areas and City of Midway and Versailles, FMSM Engineers, AMEC Inc. and Kentucky Division of Water (KYDOW).

2.2 Community Description

Woodford County and its county seat, City of Versailles, are located in the central part of east Kentucky, a part of the Inner Bluegrass Region. The county is bounded on the north by Franklin and Scott County, on the east by Fayette County, on the southeast by Jessamine County, on the southwest by Mercer County, and on the west by Anderson County.

Woodford County was formed in 1788 from a portion of Fayette County. The Inner Bluegrass Region is a region of gently to moderately rolling topography mostly underlain by limestone. There are many areas where shale is dominant, giving rise to finer textured, more steeply sloping topography. There is no extensive development of small streams due to the substratum of soluble limestone. The immediate vicinity of large streams is marked by steep slopes and narrow divides which broaden as the river is left behind. Massive limestones have produced the rugged landscape of the Kentucky River gorge, which is bordered by near-vertical rock cliffs.

In 1970, Woodford County had a population of 14,434, or approximately 75 persons per square mile. This is an increase of 21 percent from the 1960 population. In terms of population, the county is 39 percent urban; but, in terms of land use, it is more than 95 percent rural. The principal agricultural products are barley, tobacco, corn, cattle, and hogs (Reference 1). In 2008 24,751 people resided in Woodford County. The land area of the county covers approximately 171 square miles (Reference 4).

The climate in Woodford County is temperate with moderately cold winters and warm, humid summers, resulting in an average annual temperature of 55.2 degrees as measured by the National Weather Service. Precipitation is fairly well distributed throughout the year. The wettest months on the average are March. Normal rainfall for the year as a whole is 45.91 inches (Reference 4).

2.3 Principal Flood Problems

The most severe flooding problems for Woodford County result from overbank flooding in the immediate Kentucky River floodplain. The operation of Buckhorn and Carr Fork Lakes has reduced major flooding on the Kentucky River in Woodford County by an average of approximately 1.5 feet. The highest flood of record, the January 1937 flood, had a recurrence interval of approximately 45 years at Kentucky River Lock No. 6 and a recurrence interval in excess of 100 years at Lock No. 4. These frequencies are based on natural conditions. Another recent flood of major proportions occurred in April 1972.

Flooding in the Glenns Creek basin is caused by local rainstorms. Backwater flooding from the Kentucky River extends approximately 1 mile upstream on

Glenns Creek. The community of Millville, on the right bank of Glenns Creek, is subject to flooding from local rainstorms only. Flooding on Lee Branch and South Elkhorn Creek is also caused by local rainstorms. No information on historical flooding was found for Glenns Creek, Lee Branch, or South Elkhorn Creek (Reference 1).

2.4 Flood Protection Measures

Buckhorn Lake is located approximately 15 miles northwest of Hazard, Kentucky, which is approximately 96 miles southeast of Woodford County. The damsite is 43.3 miles above the confluence with Middle Fork of the Kentucky River and has a drainage area, above the dam, of 408 square miles. The area receiving the most protection is the valley of the Middle Fork of the Kentucky River below the dam. The project was put in operation in December 1961 (Reference 5).

Carr Fork Lake is located 8.8 miles above the mouth of Carr Fork, a tributary of the North Fork of the Kentucky River. The drainage area above the dam is 58 square miles. The lake is primarily operated to reduce stages from the damsite to Hazard with lesser reductions at points downstream. The dam was placed in operation in January 1976 (Reference 5).

Buckhorn and Carr Fork Lakes presently reduce flooding on the Kentucky River by an average of approximately 1.5 feet for major floods. No known flood protection measures exist on the balance of streams studied in Woodford County.

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 community.

Available gage data along the Kentucky River was used to develop peak discharge-frequency relationships.

The Lee Branch Watershed has an area of approximately 24 square miles and flows primarily northward through the city of Midway before draining into South Elkhorn Creek. The watershed hydrology was modeled using SCS methodology in XP SWMM Version 11. For modeling purposes the watershed was broken into 104 sub-basins, 81 of which contained sinkholes. Land use information was determined from local aerial photography and sub-basins were delineated using GIS methods and manually adjusted based on local elevation data. Soils data was obtained from USDA-NRCS Soil Survey data. Parcel and soils data were assigned appropriate SCS Classification and intersected using GIS methods to generate composite curve numbers for each sub basin.

Times of concentration were computed using the NRCS TR-55 three-segment approach (Reference 9). The SCS Type II rainfall distribution was used to represent rainfall data. Cumulative rainfall information for the 10-, 2-, 1-, and 0.2-percent-annual-chance flood events was obtained from the National Weather Service (NWS) Precipitation Frequency Data Server (Atlas 14). Channel routing was modeled in XP SWMM using survey data to represent natural channel cross sections that account for floodplain storage. Manning's n values for channel reaches were estimated based on field observations and aerial photography. A default initial abstraction was used for all sub basins of 20 percent. Sinkholes were modeled as storage nodes using a stepwise linear depth-surface area approach.

The 10-, 2-, 1-, and 0.2-percent-annual-chance flows for South Elkhorn Creek were taken from a regional discharge-frequency analysis for a local protection study at the City of Nicholasville in Jessamine County, Kentucky (Reference 6). The 10-, 2-, 1-, and 0.2-percent-annual-chance flows for Glenns Creek were based on a study of all U.S. Geological Survey gaging stations in the area which exhibited a high runoff rate for small drainage areas. Its relief is extremely rugged and did not fit into the runoff pattern of South Elkhorn Creek and Lee Branch (Reference 1).

Peak discharge-drainage area relationships for the streams studied by detailed methods are shown in Table 2, "Summary of Discharges."

TABLE 2 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent Annual Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual Chance
GLENNS CREEK					
At confluence with Kentucky River	33.8	7,900	12,800	13,300	19,900
At Steele Road	19.2	6,400	10,600	11,100	17,000
KENTUCKY RIVER					
At River Mile Station 115.19	N/A*	93,200	115,100	124,400	145,000
At River Mile Station 80.86	N/A*	88,200	105,200	111,800	126,000
LEE BRANCH					
At confluence with South Elkhorn Creek	23.6	930	1978	2,546	4,474
At approximately 0.3 miles downstream of U.S. Highway 421	23.2	930	1,978	2,546	4,474
At Interstate 64	23.0	928	1,978	2,553	4,485
At approximately 0.4 miles upstream of Interstate 64	22.5	924	1,984	2,570	4,565
At approximately 0.2 miles downstream of U.S. Highway 62	22.3	930	2,006	2,611	4,624
At approximately 0.5 miles upstream of U.S. Highway 62	21.6	901	1,998	2,637	4,635
At approximately 0.6 miles upstream of Walnut Street	18.9	1,077	2,278	2,898	4,894
At approximately 0.9 miles downstream of Old Frankfort Pike (KY-1681)	18.0	1,566	2,856	3,513	5,447
At approximately 0.4 miles downstream of Old Frankfort Pike (KY-1681)	14.2	1,012	2,022	2,527	4,033
At approximately1.3 miles upstream of Old Frankfort Pike (KY-1681)	9.9	680	1,342	1,670	2,649

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent Annual Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual Chance
SOUTH ELKHORN CREEK					
At Browns Mill Road	57.0	3,800	5,800	6,800	9,800
At gage at Fort Spring, Kentucky (U.S. Highway 60)	24.0	1,850	3,000	3,600	5,400

* Drainage Area not available

Discharges for Zone A studies were developed using Regression Equations contained in the USGS report Estimating the Magnitude of Peak Flows for Streams in Kentucky for Selected Recurrence Intervals (Reference 7). Drainage areas along streams were determined using a flow accumulation grid developed from the USGS 10 meter digital elevation models and corrected National Hydrologic Data (NHD) stream coverage. Flow points along stream centerlines were calculated using the regression equations in conjunction with accumulated area for every 10 percent increase in flow along a particular stream.

Hydrologic analyses for sinkholes studied by approximate methods were carried out to establish peak flow for the 1-percent-annual-chance event for each of the studied sinkholes. Drainage areas for sinkholes within the county were delineated on a USGS 10 Meter DEM. Sinkholes with drainage area greater than one square mile and sinkholes mapped on previous effective FIRMs were selected for hydrologic and hydraulic analysis. SCS Hydrology within XP SWMM along with the SCS Type 2 rainfall distribution was used to simulate runoff for each of the drainage basins delineated.

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 the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Cross sections were field surveyed and were located at close intervals above and below bridges in order to compute the backwater effects of these structures in the urbanized areas. 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.

Peak discharge and channel cross section geometry data from the existing HEC-2 model provided by the USACE for the Kentucky River was used to construct a georeferenced HEC-RAS model. New cross sections were developed and channel geometry for the cross sections were based on an interpolation between the existing HEC-2 cross sections. Overbank geometry was based on the 10 m USGS Digital Elevation Model (DEM). Cross section geometry data was supplemented by survey data for bridges along the Kentucky River. USACE high water mark data for the 1997 storm event was used to calibrate the lower reaches of the Kentucky River (Lock and Dam No. 1 through Lock and Dam No. 4). USGS gage data for the 1978 storm event was used to calibrate the upper reaches of the Kentucky River. The calibration was performed by adjusting the Manning's n values and contraction and expansion coefficients. Encroachment stations for each cross section were set using method 4 within the georeferenced HEC-RAS model.

Hydraulic modeling for Lee Branch was performed using HEC-RAS, version 3.1.2 (Reference 8). Basic modeling data for the detailed hydraulic analysis was performed using GeoRAS, a Geographic Information Systems (GIS) interface developed by HEC for the preparation of hydraulic models. Local contour and point data from Woodford County was used for topographic data in over bank areas and channel data was based on surveyed field points.

Stream crossing information for Lee Branch was taken from field survey points. Field notes consisting of structure dimensions and channel geometry, as well as structure material (i.e. corrugated metal pipe), were used in conjunction with survey data to most accurately represent the structures. Roughness coefficients were assigned based on aerial photography and field reconnaissance. Peak flow values for were obtained from the corresponding HEC-HMS model and starting water surface elevations on Lee Branch were computed using normal depth.

The starting water surface elevations on Glenns Creek were based on the slope-area method near the mouth of the stream. Backwater elevations from the Kentucky River were then used to develop the envelope frequency profiles on Glenns Creek (Reference 1).

Starting water surface elevations for the short stretch of South Elkhorn Creek began downstream of the study reach (Reference 1).

Roughness factors (Manning's "n") used in the hydraulic computations for the streams studied by detailed methods are listed below in Table 3.

TABLE 3 - MANNING'S "n" VALUES

Flooding Source	Channel	Overbank
Glenns Creek	0.045	0.080
Kentucky River	0.038 - 0.045	0.080 - 0.120
Lee Branch	0.040 - 0.060	0.040 - 0.065
South Elkhorn Creek	N/A*	N/A*

* Roughness factors were not published in the Flood Insurance Study for Woodford County Unincorporated Areas (Reference 1).

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

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.

Detail-studied streams that were not re-studied 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 the FIS report. 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 topographical data was used to redelineate floodplain boundaries, the "profile base line" may deviate significantly from the channel centerline or may be outside the SFHA.

Approximate (Zone A) hydraulic modeling was performed using HEC-RAS, version 3.1.2, from the U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC) (Reference 8). AMEC's program, Automated Floodplain Generator (AFG), was used to assist in the development of the geometries and resulting floodplains throughout the county. AFG employs methodologies of HEC-GeoRAS, a Geographic Information Systems (GIS) interface developed by HEC for the preparation of hydraulic models. In a GIS environment, the engineer places stream centerline and cross-section cutlines. The banklines and flow path lines are automatically placed, buffering the stream based on user-specified spacing. The AFG then extracts the vertical elevation from the background topography and creates the input geometry file for the HEC-RAS model. Next, cross-section locations are evaluated in reference to the floodplain boundary and are manually adjusted as necessary. The bank stations, Manning's n values, and ineffective flow areas are prescribed in the HEC-RAS model. Subsequently, the water surface elevation is extracted from the HEC-RAS model output and a water surface Triangulated Irregular Network (TIN) is created. The floodplain boundary is delineated based on the difference between the water surface TIN and ground surface TIN.

Hydraulic analyses for sinkholes studied by approximate methods were carried out to establish peak stage elevation for the 1-percent-annual-chance event for each of the studied sinkholes using Extran Block within XP-SWMM.

Floodplains were delineated using automated GIS methods. Floodplains were mapped to include backwater effects that govern each flooding source near its downstream extent.

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 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.

All flood elevations shown in this FIS report and on the FIRM are now referenced to NAVD 88. In order to perform this conversion, effective NGVD 29 elevation values were adjusted downward by 0.52 feet. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between the communities.

For more information on NAVD 88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3242
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 Technical Support Data Notebook associated with the 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. 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, the boundaries were interpolated using 2 ft contours covering the cities of Midway and Versailles (Reference 2) and 10 meter Digital Elevation Models (DEM) produced by the U.S. Geological Survey (USGS) (Reference 3).

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

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

4.2 Floodways

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

to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain, while allowing a maximum surcharge of 1.0 ft. Floodway widths were computed at cross sections.

Between cross-sections, the floodway boundaries were interpolated. In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

A floodway was not developed for Glenns Creek because the average channel velocity for the entire reach of Glenns Creek is 10 feet per second and a floodway would increase this velocity. In addition, the flood plain above the developed portion is very narrow and the slope of the stream is steep.

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 water-surface elevation (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.

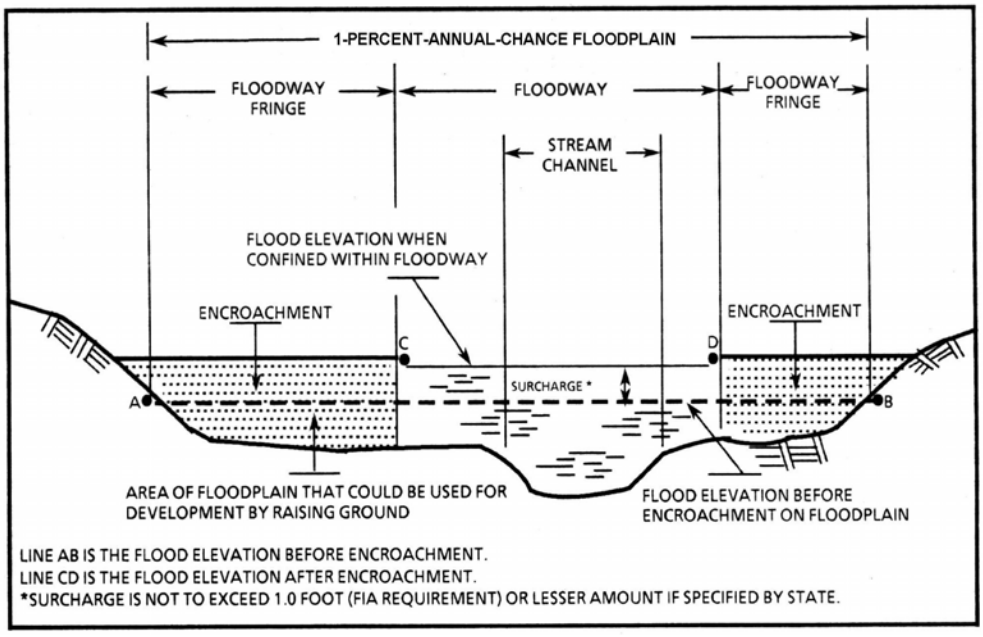


FIGURE 1: FLOODWAY SCHEMATIC

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 4 for certain downstream cross

sections are lower than the regulatory flood elevations in that area, which must take into account the 1 percent annual chance flooding due to backwater from other sources.

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 4, "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 in areas outside the floodway.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Kentucky River								
A	74.08	421/254	20,492	5.5	514.2	514.2	515.1	0.9
B	75.50	504/300	23,260	4.8	515.4	515.4	516.3	0.9
C	77.53	589/64	27,023	4.1	517.1	517.1	518.0	0.9
D	80.08	622/439	29,564	3.8	519.1	519.1	520.0	0.9
E	82.14	415/198	22,846	5.5	520.5	520.5	521.4	0.9
F	82.58	571/367	31,835	3.9	521.4	521.4	522.2	0.8
G	84.07	416/374	19,786	6.3	522.2	522.2	523.1	0.9
H	85.68	600/200	25,087	5.0	523.7	523.7	524.6	0.9
I	86.31	453/397	19,880	6.3	523.9	523.9	524.8	0.9
J	87.67	674/195	26,152	4.8	525.4	525.4	526.3	0.9
K	90.07	547/227	23,816	5.2	526.8	526.8	527.7	0.9
L	90.96	326/85	18,395	6.8	527.2	527.2	528.0	0.8
M	91.36	412/184	20,888	6.0	527.8	527.8	528.6	0.8
N	91.80	321/117	17,762	7.0	528.0	528.0	528.8	0.8
O	93.83	466/186	23,012	5.4	529.6	529.6	530.4	0.8
P	95.34	601/293	27,096	4.6	530.9	530.9	531.7	0.8
Q	95.87	503/275	24,801	5.0	531.3	531.3	532.0	0.7
R	96.63	565/385	30,308	4.1	532.3	532.3	533.0	0.7
S	97.55	421/252	20,210	6.2	532.7	532.7	533.5	0.8
T	99.21	378/140	19,549	6.4	534.6	534.6	535.3	0.7
U	101.51	405/180	21,486	5.8	537.3	537.3	538.1	0.8
V	102.63	382/209	22,341	5.6	538.3	538.3	539.1	0.8

[1]Stream distance in miles above confluence with Ohio River
[2]Width/width within county

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY AND INCORPORATED AREAS

FLOODWAY DATA

KENTUCKY RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Kentucky River								
W	105.04	391/242	22,078	5.6	540.0	540.0	540.8	0.8
X	106.68	389/247	22,691	5.5	541.5	541.5	542.3	0.8
Y	107.97	406/212	21,148	5.9	542.8	542.8	543.5	0.7
Z	109.58	360/162	20,903	6.0	544.5	544.5	545.3	0.8
AA	111.97	404/146	21,101	5.9	546.3	546.3	547.1	0.8
AB	112.89	464/177	24,589	5.1	547.5	547.5	548.3	0.8

[1]Stream distance in miles above confluence with Ohio River
[2]Width/width within county

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY AND INCORPORATED AREAS

FLOODWAY DATA

KENTUCKY RIVER

FLOODING SOURCE		FLOODWAY			BASE 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
Lee Branch								
A	3322	218	1090	2.3	774.2	774.2	774.5	0.3
B	5256	141	1305	2.0	780.7	780.7	780.9	0.2
C	6403	300	2294	1.1	783.7	783.7	783.9	0.2
D	7505	244	1182	2.2	784.0	784.0	784.2	0.2
E	8643	280	1297	2.0	785.4	785.4	785.5	0.1
F	9416	399	1360	1.9	786.8	786.8	787.0	0.2
G	10406	142	567	4.7	790.0	790.0	790.0	0.0
H	11390	207	1016	2.6	792.9	792.9	793.5	0.6
I	12148	380	1690	1.6	793.8	793.8	794.4	0.6
J	13022	471	4299	0.7	801.5	801.5	801.7	0.2
K	13684	155	1543	1.9	801.5	801.5	802.0	0.5
L	15309	292	1924	1.5	801.8	801.8	802.7	0.9
M	18615	450	1798	2.0	805.8	805.8	806.3	0.5
N	21315	219	1213	2.1	808.6	808.6	809.5	0.9
O	22056	350	1231	2.1	810.0	810.0	810.9	0.9
P	22783	220	972	2.6	813.5	813.5	814.1	0.6
Q	23522	191	706	3.6	815.4	815.4	816.2	0.8
R	24500	295	1094	2.3	818.8	818.8	819.7	0.9
S	25122	246	1317	1.3	821.5	821.5	822.2	0.7
T	25940	158	511	3.3	825.4	825.4	826.1	0.7
U	26495	208	1111	1.5	826.9	826.9	827.5	0.6

[1]Stream distance in feet above confluence with South Elkhorn Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY AND INCORPORATED AREAS

FLOODWAY DATA

LEE BRANCH

FLOODING SOURCE		FLOODWAY			BASE 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
South Elkhorn Creek								
A	34.46	332	3,328	1.8	816.6	816.6	817.3	0.7
B	34.50	217	2,263	2.6	816.7	816.7	817.4	0.7
C	34.85	282	2,924	2.0	817.6	817.6	818.3	0.7
D	35.05	238	2,368	2.5	818.0	818.0	818.7	0.7
E	35.16	285	2,883	2.0	818.3	818.3	818.9	0.6

[1]Stream distance in miles above confluence with Kentucky River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH ELKHORN CREEK

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

6.0 FLOOD INSURANCE RATE MAP

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

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

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

The countywide FIRM presents flooding information for the entire geographic area of Woodford 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 5, "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 IV, Koger-Center - Rutgers Building, 3003 Chamblee Tucker Road, Atlanta, GA 30341.

Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To ensure that any user is aware of all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Midway, City of	June 1, 1978	None	June 1, 1978	None
Versailles, City of	July 29, 1977	None	May 1, 1990	None
Woodford County (Unincorporated Areas)	October 18, 1974	None	June 1, 1978	None

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

1. Federal Emergency Management Agency, Flood Insurance Study, Woodford County Unincorporated Areas, Kentucky. Flood Insurance Study Report dated December, 1977, Washington, D.C.

2. 2 ft. contours provided by Versailles-Midway-Woodford County Planning Commission, 103 South Main Street, Courthouse – Suite 204, Versailles, Kentucky 40383, June 2008.

3. U. S. Geological Survey, 7.5 Minute Series (Topographic) Maps, Scale: 1:24,000. The National Elevation Dataset (NED) 1/3 Arc Second is a raster product assembled by the U.S. Geological Survey (USGS). NED 1/3 Arc Second is designed to provide National elevation data in a seamless form with a consistent datum, elevation unit, and projection. Data corrections are made in the NED 1/3 Arc Second assembly process to minimize, but not eliminate, artifacts, perform edge matching, and fill sliver areas of missing data. NED 1/3 Arc Second has a resolution of 1/3 arc-second (approximately 10 meters). Projection is geographic, horizontal datum is NAD83 and vertical datum is NAVD88. 2004

4. Cabinet for Economic Development, Kentucky Quick Facts. http://www.thinkkentucky.com, 2009.

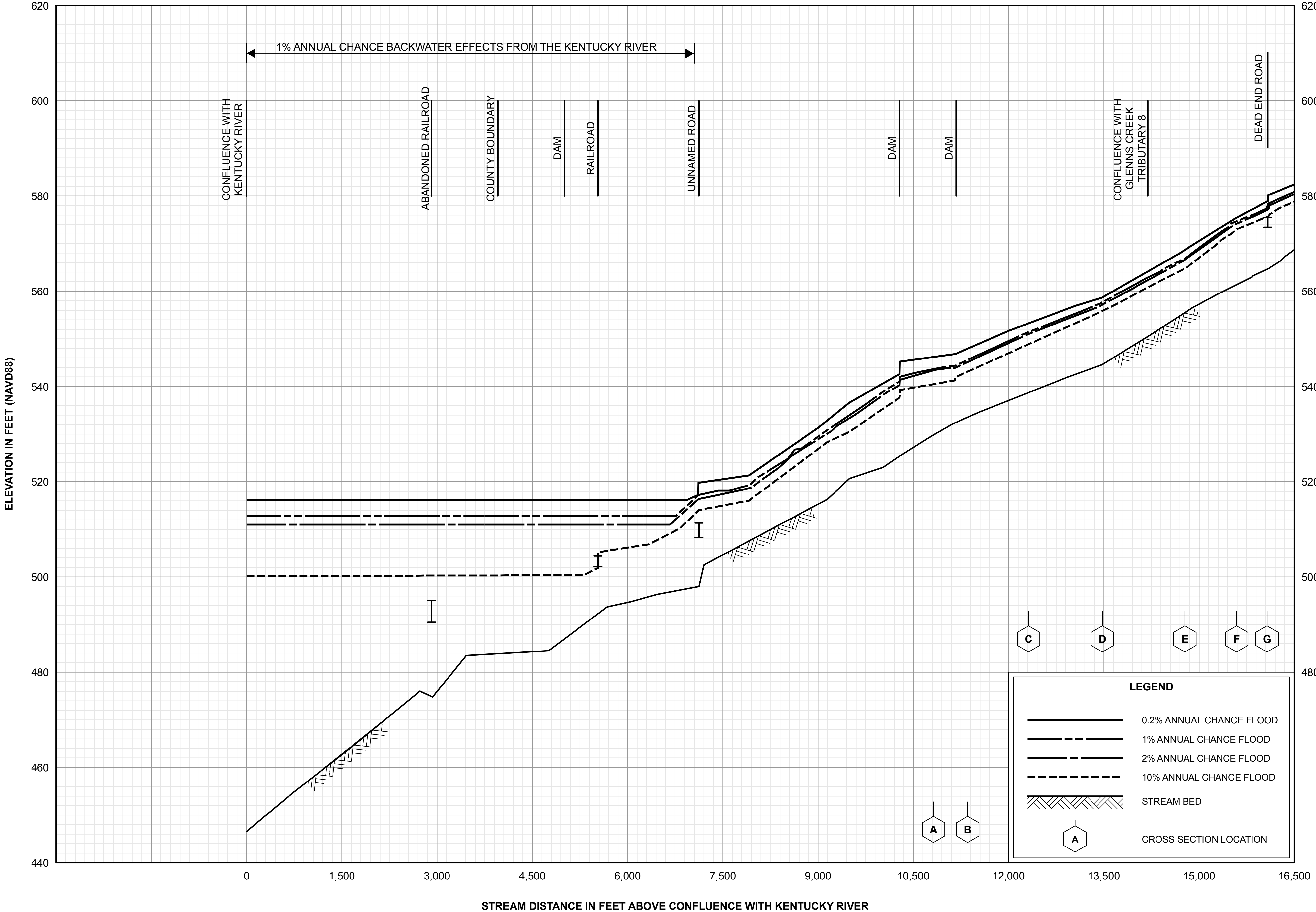
5. U.S. Department of the Army, Corps of Engineers, Louisville District, Project and Index Maps.

6. U.S. Department of the Army, Corps of Engineers, Louisville District, Detailed Project Report, Small Flood Control Project, Town Fork, Nicholasville, Kentucky, November 1975.

7. U.S. Geological Survey, Water Resources Investigations Report 76-62, Techniques for Estimating Magnitude and Frequency of Floods in Kentucky, C.H. Hannum, 1976.

8. U.S. Army Corps of Engineers, Hydrologic Engineering Center, "River Analysis System," HEC-RAS, Version 3.1.2 Computer Program, revised April 2004.

9. Natural Resources Conservation Service, 1986, Urban Hydrology for Small Watersheds, Technical Release 55, Chapter 3.



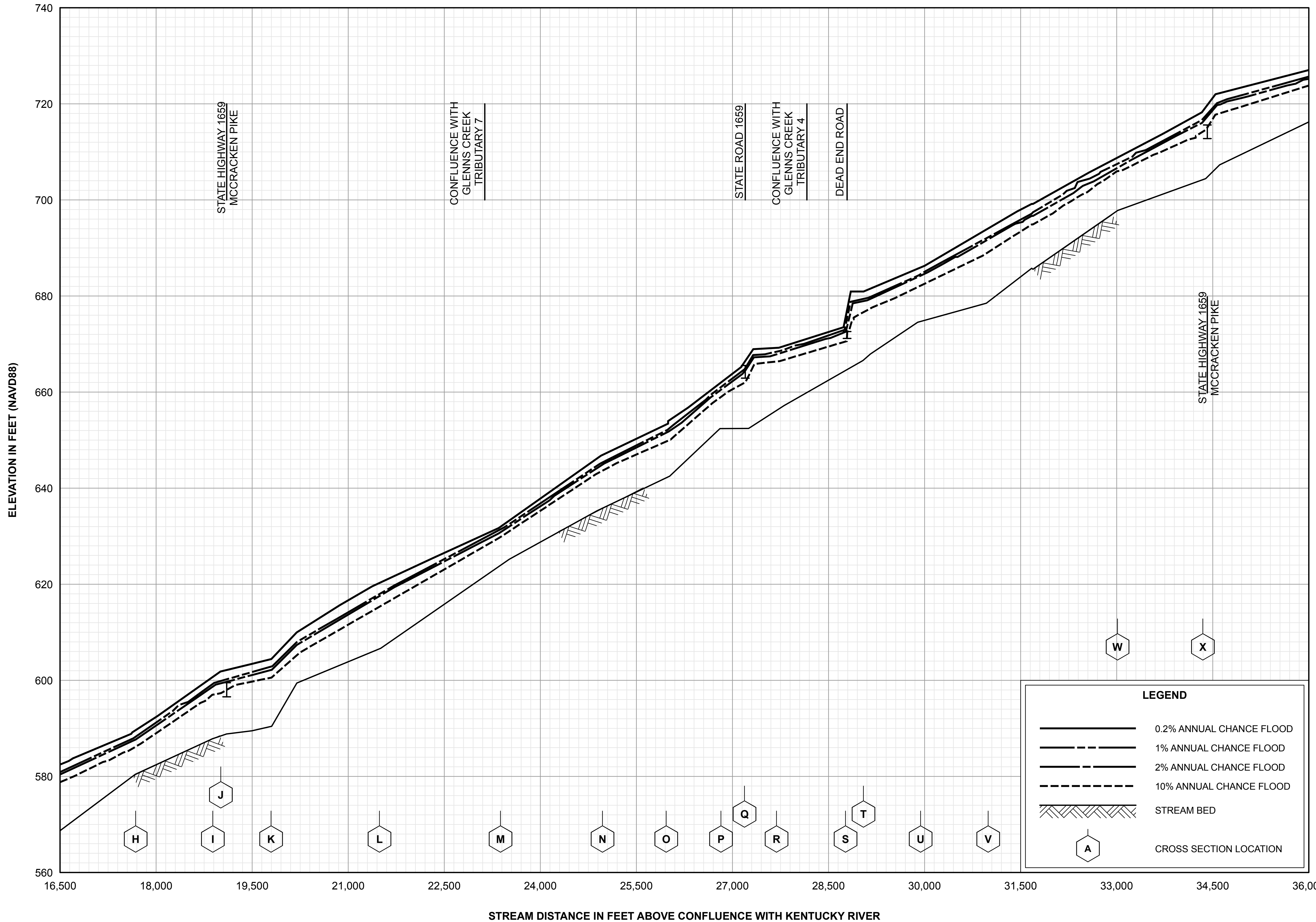
FLOOD PROFILES

GLENNS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY
AND INCORPORATED AREAS

01P



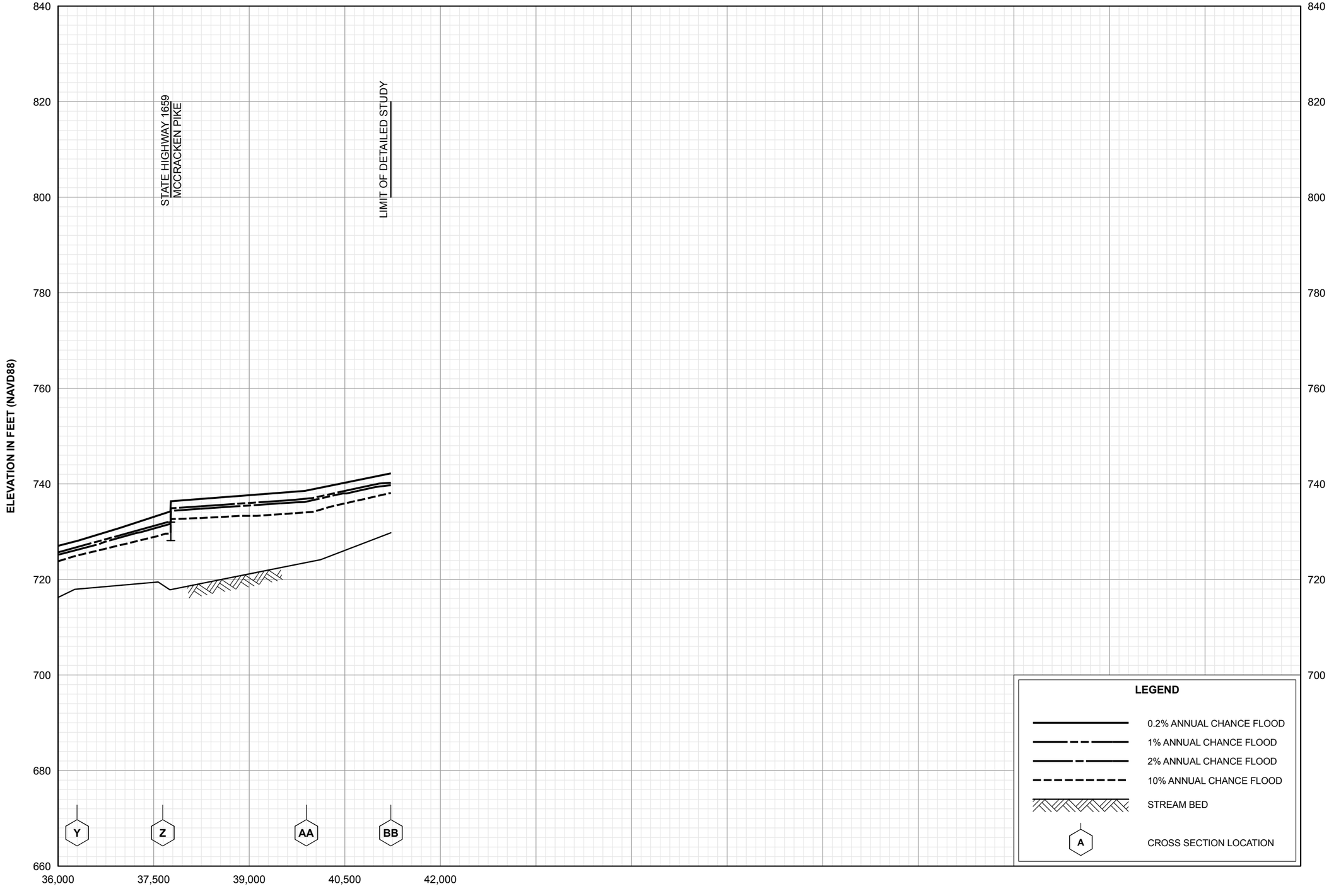
FLOOD PROFILES

GLENNS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY

AND INCORPORATED AREAS

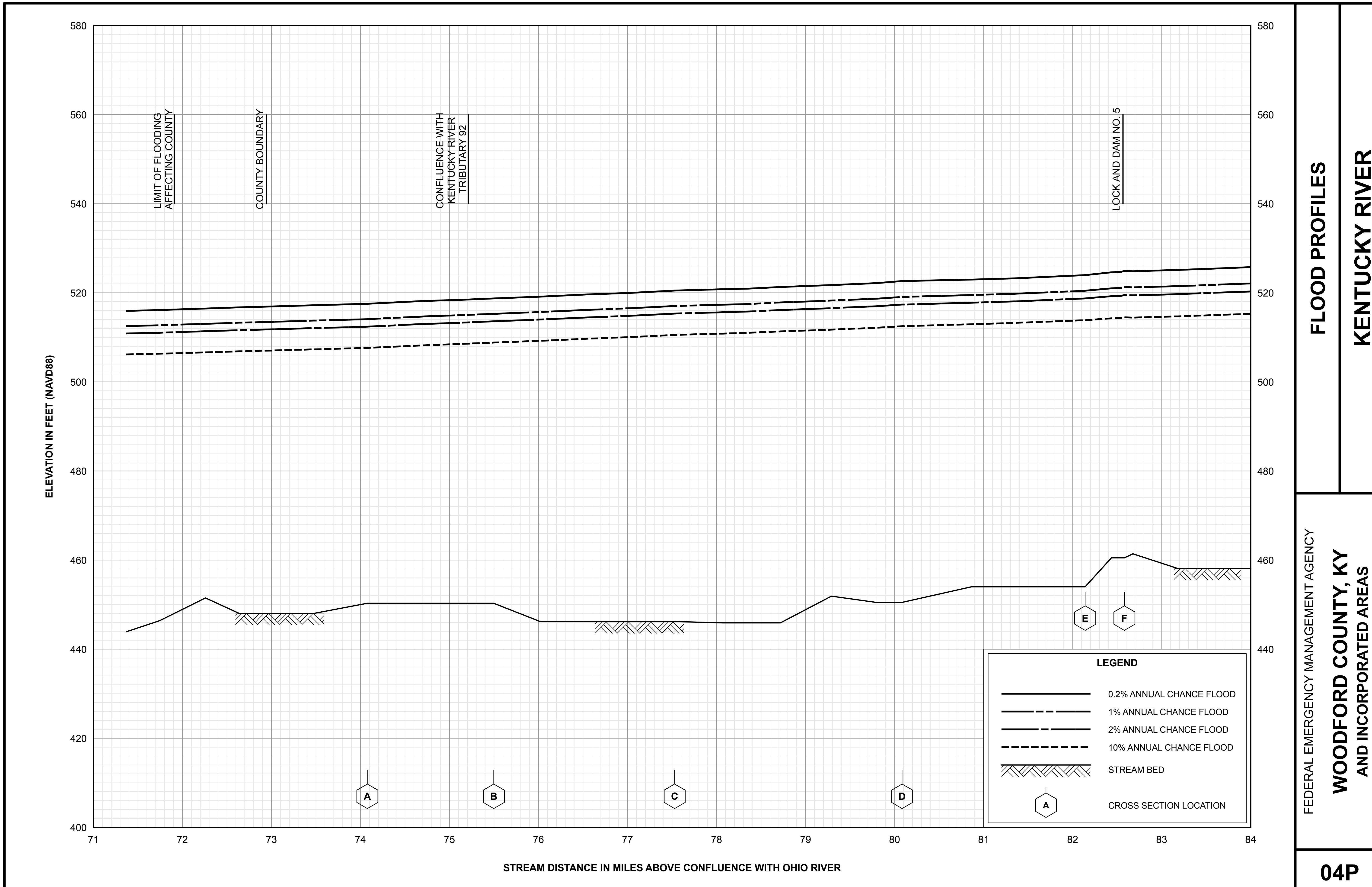


FLOOD PROFILES

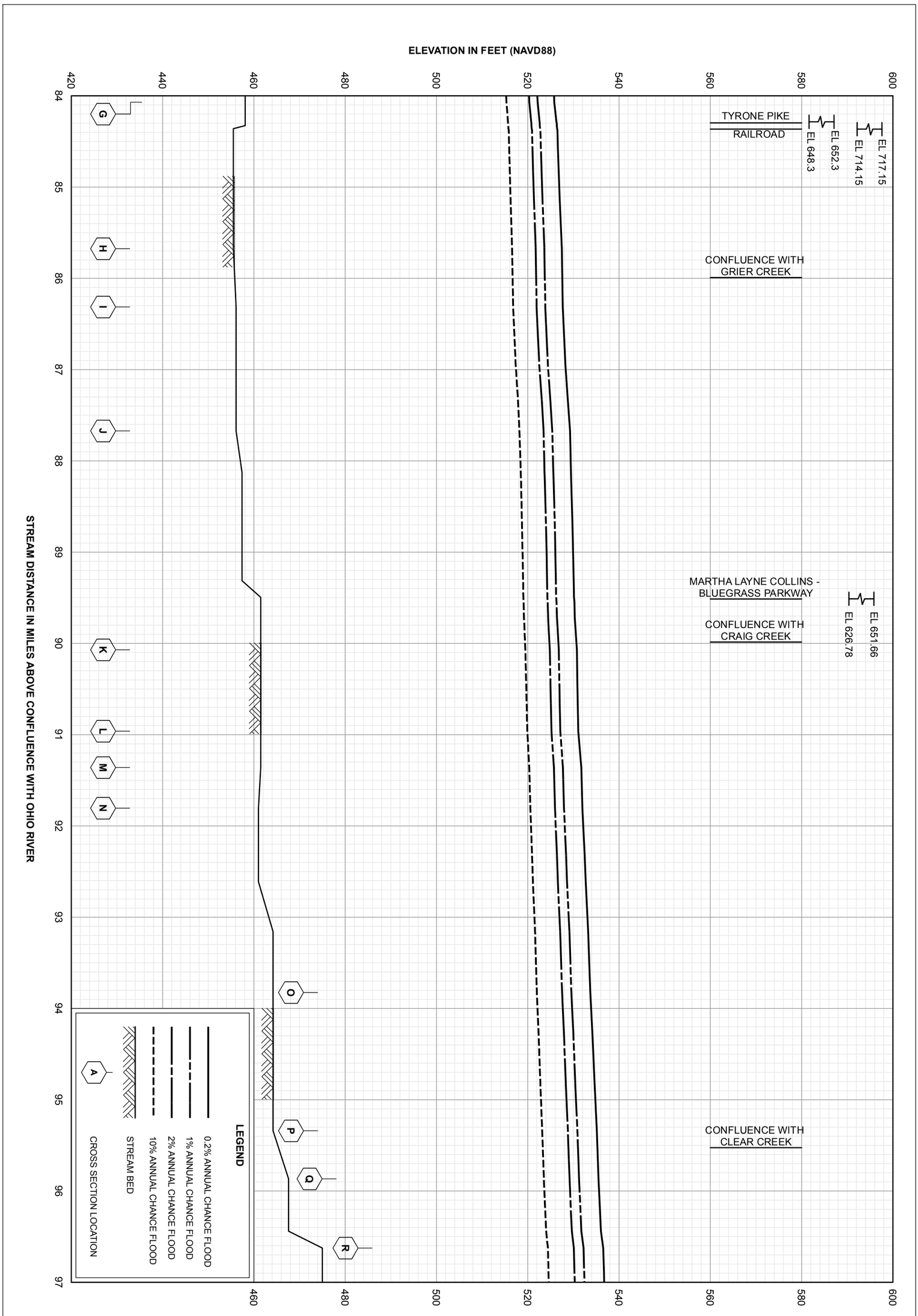
GLENNS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY
AND INCORPORATED AREAS



LIMIT OF FLOODING AFFECTING COUNTY
COUNTY BOUNDARY
CONFLUENCE WITH KENTUCKY RIVER TRIBUTARY 92
LOCK AND DAM NO. 5
ELEVATION IN FEET (NAVD88)
STREAM DISTANCE IN MILES ABOVE CONFLUENCE WITH OHIO RIVER
LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
KENTUCKY RIVER
FEDERAL EMERGENCY MANAGEMENT AGENCY
WOODFORD COUNTY, KY
AND INCORPORATED AREAS
04P



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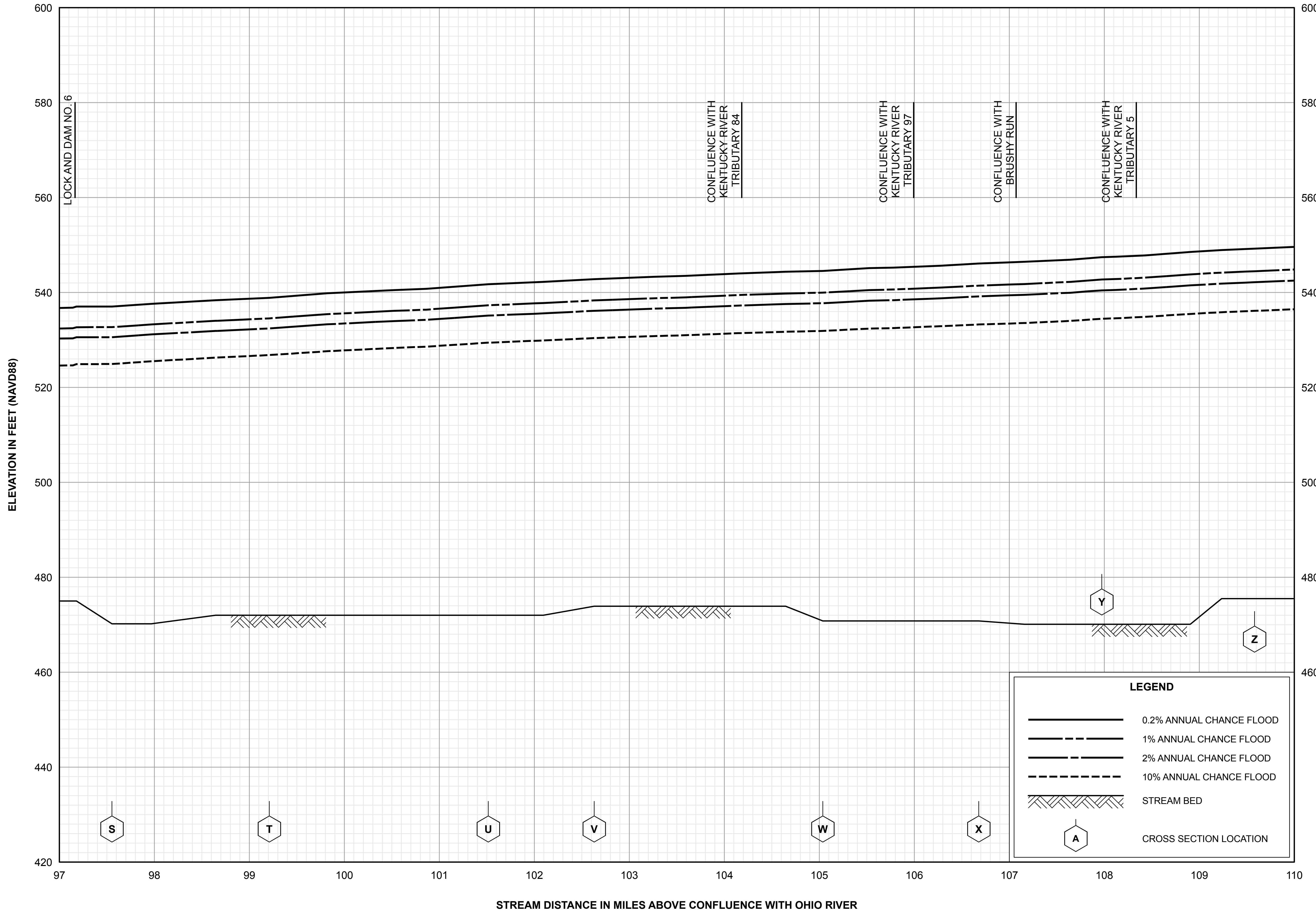
FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY
AND INCORPORATED AREAS

FLOOD PROFILES

KENTUCKY RIVER



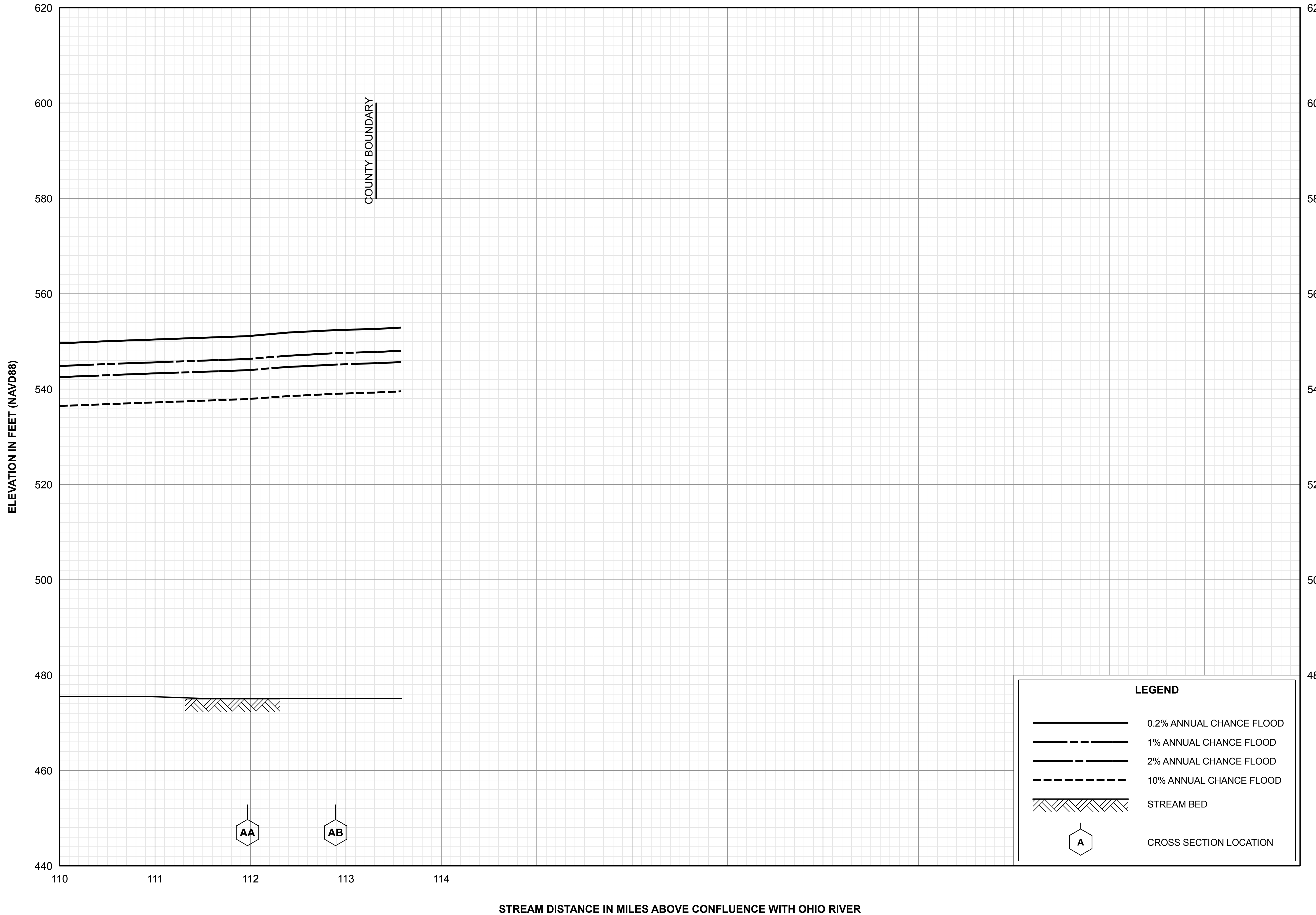
FLOOD PROFILES

KENTUCKY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY
AND INCORPORATED AREAS

06P



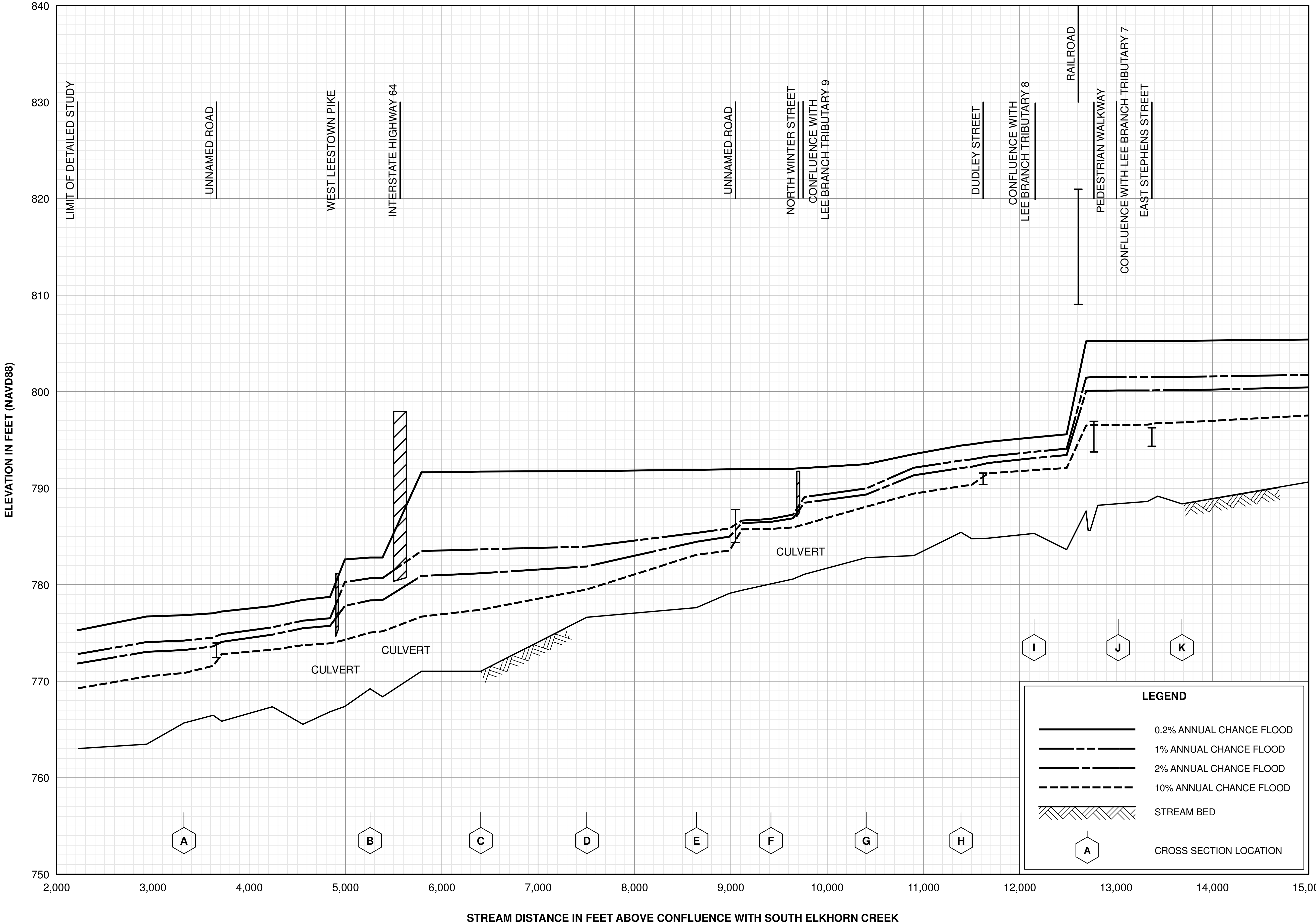
FLOOD PROFILES

KENTUCKY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY
AND INCORPORATED AREAS

07P



FLOOD PROFILES

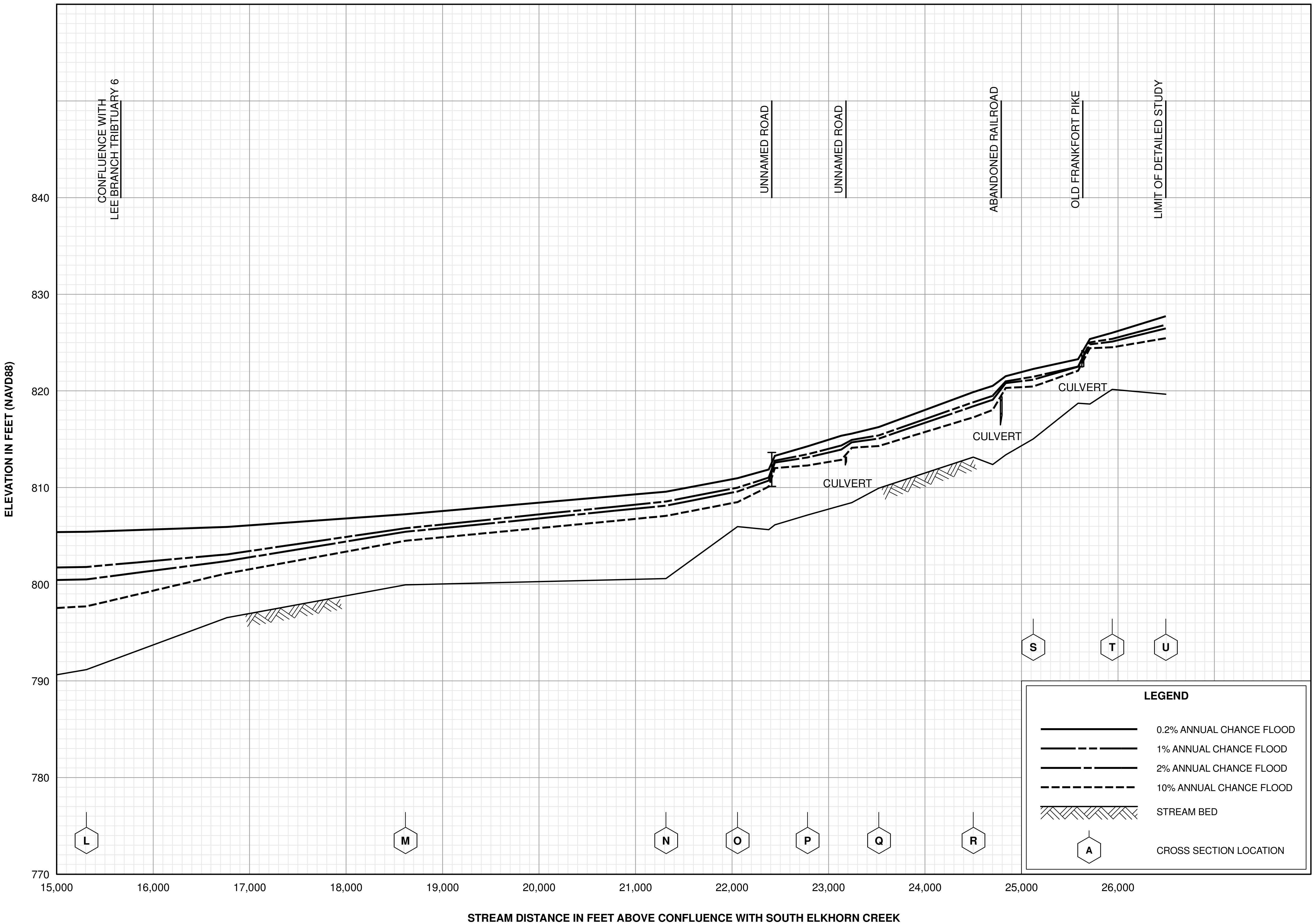
LEE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY

AND INCORPORATED AREAS

08P



FLOOD PROFILES

LEE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY AND INCORPORATED AREAS

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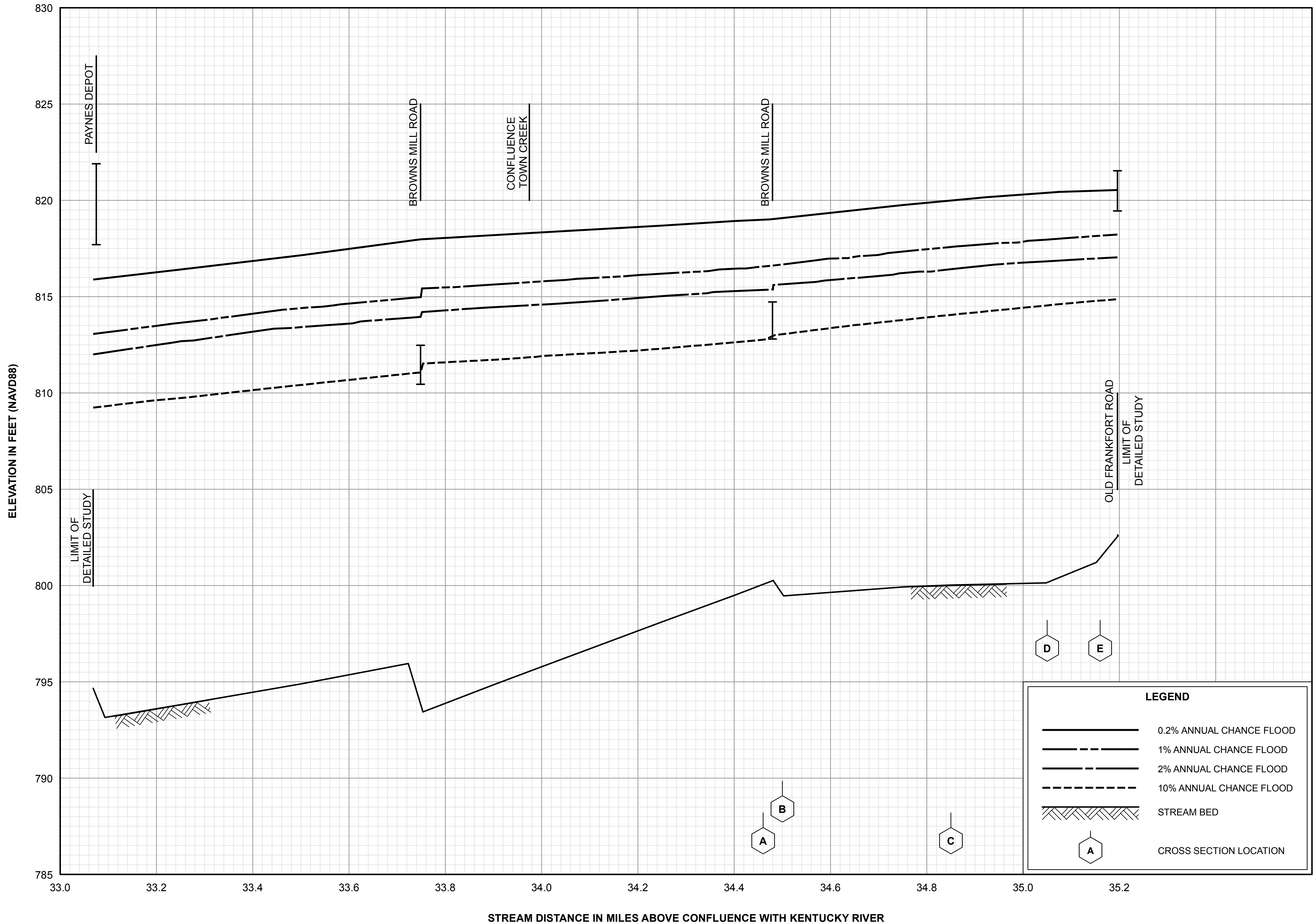

FLOOD PROFILES

SOUTH ELKHORN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WOODFORD COUNTY, KY

AND INCORPORATED AREAS