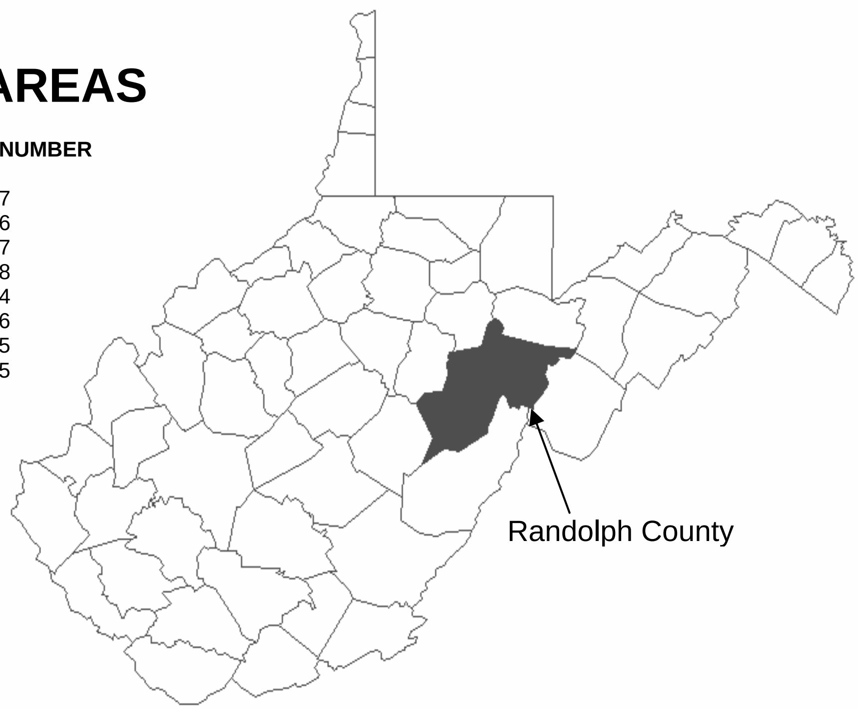
# FLOOD INSURANCE STUDY

# RANDOLPH COUNTY, WEST VIRGINIA

## AND INCORPORATED AREAS

| COMMUNITY NAME | COMMUNITY NUMBER |
| --- | --- |
| BEVERLY, TOWN OF | 540267 |
| COALTON, TOWN OF | 540176 |
| ELKINS, CITY OF | 540177 |
| HARMAN, TOWN OF | 540178 |
| HUTTONSVILLE, TOWN OF | 540264 |
| MILL CREEK, TOWN OF | 540266 |
| MONTROSE, TOWN OF | 540265 |
| RANDOLPH COUNTY (UNINCORPORATED AREAS) | 540175 |




SEPTEMBER 29, 2010

Federal Emergency Management Agency

**FLOOD INSURANCE STUDY NUMBER**
**54083CV000A**

**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.

Initial Countywide FIS Effective Date: September 29, 2010

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**FLOOD INSURANCE STUDY**
**RANDOLPH COUNTY, WEST VIRGINIA 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 Randolph County, including the City of Elkins; the Towns of Beverly, Harman, Huttonsville, Mill Creek, Montrose and Coalton (Womelsdorf); and the unincorporated areas of Randolph County (referred to collectively herein as Randolph 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.

## 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.

| | |
|---|---|
| Town of Beverly: | The hydrologic and hydraulic analyses for this study were performed by the Pittsburgh District of the U.S. Army Corps of Engineers (USACE), for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-87-E-2509, Project Order No. 3. This study was completed in April 1989. |
| City of Elkins: | The hydrologic and hydraulic analyses for this study were prepared by the USACE, Pittsburgh District, for FEMA, under Inter-Agency Agreement EMW-E-1153, Project No. 1, Amendment No. 20. This work was completed in September 1985. |
| Randolph County: | The hydrologic and hydraulic analyses for this study were prepared by the USACE, Pittsburgh District, for FEMA, under Inter-Agency Agreement EMW-87-E-2509, Project No. 3. This work was completed in April 1989. |

The Digital Flood Insurance Rate Map (DFIRM) conversion for this study was performed by West Virginia University GIS Technical Center and AMEC Earth and Environmental, Inc. for the Federal Emergency Management Agency (FEMA), under Contract No. HSFE03-07-D-0030, Task Order HSFE03-08-J-0008.

## 1.3 Coordination

The purpose of an Initial Consultation Coordination Officer's (CCO) meeting is to discuss the scope of the FIS. A final CCO meeting is held to review the results of the study. The dates of the initial and final CCO meetings held for all the communities within Randolph County are listed below.

Town of Beverly

The initial Consultation Coordination Officer (CCO) meeting was held on May 21, 1986, and attended by representatives of FEMA, Randolph County, West Virginia Emergency Services, and the U.S. Geological Survey (USGS) to determine the streams to be studied by detailed methods.

The results of the study were reviewed at the final CCO meeting held on November 13, 1990, and attended by representatives of FEMA, the town, and the USACE (the study contractor. All problems raised at that meeting have been addressed in this study.

City of Elkins

The initial Consultation Coordination Officer (CCO) meeting was held on August 1, 1983, in the City of Philippi, and attended by representatives of FEMA, the Cities of Philippi and Buckhannon, the State of West Virginia, and the USACE (the study contractor) to discuss the scope of the study for the Cities of Elkins, Philippi, and Buckhannon. Coordination involved Notice of Initiation letters, public meetings, and incidental meetings with city officials. Notice of Initiation letters dated December 1, 1983, announced the start of the study and were sent to all Federal, State, and local government agencies and private firms that could possibly make input to the study. Representatives from the City of Elkins were unable to attend; therefore, the scope of study was determined by input from the State of West Virginia coordinator.

The results of the study were reviewed at the final CCO meeting held on May 21, 1986, and attended by representatives of FEMA, the City of Elkins and the study contractor. All problems raised at that meeting have been addressed in this study.

Randolph County (Unincorporated Areas)

The initial Consultation Coordination Officer (CCO) meeting was held on May 21, 1986, and attended by representatives of FEMA, Randolph County, West Virginia Emergency Services, and the USACE (the study contractor) to determine the stream to be studied by detailed methods.

The results of the study were reviewed at the final CCO meeting held on November 13, 1990, and attended by representatives of FEMA, the county, and the study contractor. All problems raised at that meeting have been addressed in this study.

For this 2010 revision, Randolph County and the Towns of Beverly, Coalton, Harman, Huttonsville, Mill Creek, and Montrose, and the City of Elkins, were notified by letter on September 16, 2008 that the FIS would be updated and converted to countywide format. A final meeting was held on June 5, 2009 and was attended by representatives of Randolph County, the City of Elkins, the Town of Coalton, the Town of Harman, the study contractor, and FEMA.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

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

All, or portions of, the flooding sources listed in Table 1, "Detailed Studied Streams", were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the Flood Insurance Rate Map (FIRM).

Table 1. Detailed Studied Streams

| Stream Name | Limits of Study |
|---|---|
| Craven Run | From approximately 630 feet downstream of Virginia Avenue to just upstream of Harpertown Road |
| Cut-Off-Canal | From the confluence with the Tygart Valley River to the divergence from the Tygart Valley River |
| Leading Creek | From the confluence with the Tygart Valley River to approximately 1.4 miles upstream of U.S. Route 219 |
| Tygart Valley River | From approximately 0.5 mile downstream of the CSX Transportation Railroad to approximately 1.6 miles upstream of C.R. 39 |

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 each individual municipality.

No Letters of Map Revision (LOMRs) were recorded for this countywide study.

## 2.2 Community Descriptions

Town of Beverly

The Town of Beverly is located in the central portion of Randolph County, in east-central West Virginia. It is bordered on all sides by the unincorporated areas of Randolph County. The town has a land area of approximately 0.4 square miles; the population in 2000 was 651 (Reference 1).

City of Elkins

The City of Elkins is located in northeastern Randolph County in north-central West Virginia. The total land area contained within the city is 2.82 square miles. The city is surrounded by the unincorporated areas of Randolph County and is located approximately 50 miles southeast of the City of Clarksburg. According to the U.S. Census Bureau, the population of Elkins was 7,032 in 2000 (Reference 1).

The Tygart Valley River, with a total drainage area of 1, 374 square miles, has its headwaters in the western slope of the Appalachian Mountains near the southern boundary of Randolph County. It flows approximately 135 miles in a northern direction to its mouth in Fairmont, West Virginia, where it joins the West Fork River to form the Monongahela River. In the City of Elkins, the river makes a narrow elongated loop approximately 4.2 miles in length. Elkins is at the downstream end of the long broad reach of the upper Tygart Valley, at an elevation of more than 1,900 feet. Local relief above the stream varies from a low of 500 feet to a high of 800 feet. Development within the floodplain is chiefly residential and small business.

Craven Run, with a drainage area of 4.23 square miles, is a tributary of Leading Creek, with joins the Tygart Valley River at mile 77.5 approximately 2 miles downstream of Elkins. Craven Run flows in a western direction through Elkins to Leading Creek. It is bounded on the east by the Shavers Fork Basin, to the north by Leading Creek Basin, and to the south by the Tygart Valley River Basin. The average slope through the study areas is 20 feet per mile.

Randolph County (Unincorporated Areas)

Randolph County is located in east-central West Virginia. It is bordered by the unincorporated areas of the following counties: Barbour and Tucker Counties to the north, Pendleton County to the east, Pocahontas County to the east and south, and Webster and Upshur Counties to the west. The total land area contained within the unincorporated areas of the county is 1,040 square miles. The population of Randolph County was 28,262 in 2000 (Reference 1).

The Tygart Valley River, with a total drainage area of 1,374 square miles at its mouth, has its headwaters in the western slope of the Appalachian Mountains near the southern boundary of Randolph County. It flows from the south towards the northeast through Randolph County from the headwaters to Elkins. At Elkins it turns and flows towards the west through the remaining portions of Randolph County. The Tygart Valley River flows a total of 135 miles toward the north to its mouth in Fairmont, West Virginia, where it joins the West Fork River to form the Monongahela River. The average stream gradient in the study area is approximately 3 feet per mile. Elevations in the main valley vary from a low of 1, 890 feet to 2,780 feet. The local relief above the stream varies from a low of 5 00 feet to a high of 800 feet. The valley floor varies from 300 feet to over 1,000 feet in width.

Leading Creek, with a total drainage area of 60.1 square miles at its mouth, joins the Tygart Valley River at mile 77.6 on the right bank. The average stream gradient is approximately 4.5 feet per mile. Elevations in the main valley vary from 1,890 feet to 2,015 feet. Local Relief above the stream varies from a low of 400 feet to a high of 800 feet. The valley floor varies from 100 feet to 300 feet in width.

The climate for Randolph County and Incorporated Areas is temperate, with the usual seasonal variations in temperature. The area is located in a region of variable air-mass activity, being subjected to both polar and tropical, continental and maritime air-mass invasions. The weather is usually moderate, but it is subject to frequent and rapid changes as a result of air-mass movement. Temperatures range from an average of 29 degrees Fahrenheit (°F) in January to an average of 70°F in July. Measurable precipitation occurs an average of 130 days per year and amounts to an average annual precipitation of about 46 inches (Reference 2).

### 2.3 Principal Flood Problems

Major floods may occur on the Tygart Valley River at various times of the year. Flood occurring in the winter months are usually the result of heavy rainfall and snowmelt. Floods occurring during other times of the year are the result of high-intensity, short-duration storms or from major tropical storms.

The maximum known flood on the Tygart Valley River occurred on November 5, 1985, with a peak flood flow of 28,000 cubic feet per second (cfs) at the USGS gage located in Elkins. This flood has a computed recurrence interval greater than the 1-percent-annual-chance flood. The following tabulation shows major floods on the Tygart Valley River at river mile 79, as recorded at the USGS gage in Elkins.

| Date of Crest | Stage(feet) | Elevation (feet) | Discharge (cfs) |
|---|---|---|---|
| November 5, 1985 | 22.81 | 1,916.76 | 28,000 |
| December 31, 1969 | 15.65 | 1,909.60 | 13,100 |
| March 7, 1967 | 15.61 | 1,909.56 | 13,000 |
| February 27, 1972 | 14.69 | 1,908.64 | 11,200 |
| June 3, 1974 | 14.62 | 1,908.57 | 11,100 |
| June 24, 1972 | 14.42 | 1,908.37 | 10,800 |
| December 9, 1972 | 14.39 | 1,908.34 | 10,700 |

| | | | |
|---|---|---|---|
| October 16, 1954 | 14.45 | 1,908.40 | 10,700 |
| January 27, 1978 | 15.84[1] | 1,909.79 | 10,700 |

[1] Stage affected by ice
Note: Gage zero equals 1,893.95 feet

Although high floods may occur on Craven Run at various times of the year, the main food season is usually during the summer months of June to October. Craven Run, due to its basin size, shape, and slope, is more susceptible to flash flooding from short duration thunderstorms than the winter type of storm.

Major floods may occur on Leading Creek at various times of the year. The lower reach of Leading Creek is subjected to backwater flooding from the Tygart Valley River. Leading Creek is also subject to flooding in the spring and summer months. Floods in the summer are usually the result of high-intensity, short-duration storms.

2.4 Flood Protection Measures

The Elkins Local Flood Protection Project on the Tygart Valley River was completed by the USACE in January 1949. The improvement consists of the following principal features:

a. An upstream diversion dike to divert flood discharges from the upstream arm of the loop of a natural river channel into an artificial cut-off channel, thereby bypassing the City of Elkins.

b. A diversion or cut-off channel across the narrow neck of the loop of the river. The fall through the channel is concentrated largely at a fixed weir in the rock cut. This weir will serve to control water-surface elevations and velocities in the channel upstream of Elkins.

c. A downstream protection dike to prevent the diverted flood discharge from backing into the city by way of the natural river channel. And opening, which requires that a closure be installed during major flood events, is provided through the dike for a single-track railroad.

d. Controlled inlet conduits through the diversion dike and controlled outlet conduits through the protection dike to permit varying degrees of discharge to pass through the loop of the river except during major flooding and to permit accumulated drainage from the protected areas to be released into the river after a major flood has receded.

e. A ponding basin within the protected area is provided to collect and pond storm run-off from the local drainage area within the loop. The natural river channel in the loop, cut off by the diversion and protection dikes, will constitute the ponding basin

The dike is designed to provide complete protection against the maximum flood of reasonable expectancy estimated to be 58,500 cfs at the upper end of the cut-off channel under natural conditions, corresponding to a water-surface elevation of 1,939.2 feet. In comparison, the maximum known flood, which occurred on February 4, 1932, reached an elevation of about 1,923.5 feet at the site of the upper end of the cut-off. With proper operation of the project gates, the loop ponding area has the capacity to contain the local runoff up to approximately a 4-percent-annual-chance flood event from the basin enclosed by the dike without exceeding elevation 1,911.0. The local runoff from events greater than this will exceed available ponding capacities and will inundate areas near the downstream protection dike. This dike meets FEMA freeboard requirements.

There are no other existing, authorized, or proposed flood control or related measures within Randolph County that would reduce flood levels.

## 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.

Town of Beverly

Natural discharge-frequency curves from the Tygart Valley River were analyzed following the log-Pearson Type III analysis outlined in USGS Bulletin 17B (Reference 3). The stage-discharge records used in the analysis of the Tygart Valley River were obtained from the former USGS gaging station (No. 03050000) at Dailey, located approximately three miles upstream of Beverly. The USGS gaging station (No. 03050500) located in Elkins, approximately 15 miles downstream of Beverly, was also used in the analysis. Stage-discharge records are available from 1944 to the present. The 1-percent-annual chance flood flow was developed from a drainage area-flow relationship that was developed from the entire Tygart Valley River Basin.

City of Elkins

Natural discharge-frequency curves on the Tygart Vally River were developed following the standard log-Pearson Type III analysis as outlined by the USGS Bulletin 17B (Reference 3). The stage-discharge record used in the analysis of the Tygart Valley River was obtained from the USGS gage No. 03050400 at Elkins, West Virginia, approximately 0.2 miles downstream of the City of Elkins. This gage has been in operation since 1944. The USACE has installed several gages at the inlet and outlet of the local protection project to ensure proper operation during flood events. The 10-, 2-, 1-, and 0.2-percent annual chance flood hydrograph was developed from past flood hydrographs for the Tygart Valley River at Elkins. These selected flood hydrographs were routed through the project in accordance with the Elkins Flood Protection Project Operation and Maintenance Manual (Reference 4). For each of these storm events, the local flows within the loop was computed and combined with the flow routed through the diversion dike to develop the total flow within the protected area. This combined flow within the protected area were computed through the use of the USACE HEC-1 flood hydrograph computer program (Reference 5).

There are no gage or stream flow records available for Craven Run. Flows for the 10-, 2-, 1-, and 0.2-percent annual chance floods were developed using the multiple regression formulas based on factors determined from a USACE study of small streams in the Pittsburgh District (Reference 6). The factors used were drainage area, stream length, stream slope, and basin shape.

Randolph County (Unincorporated Areas)

Natural discharge-frequency curves for the Tygart Valley River were analyzed following the log-Pearson Type III analysis outlined in USGS Bulletin 17B (Reference 3). The stage-discharge records used in the analysis of the Tygart Valley River covered a 45-year period and were obtained from the USGS gaging station (No. 03050500) at Elkins, West Virginia. The 1-percent annual chance flood flows for selected locations on the Tygart Valley River in Randolph County were developed from the drainage area-flow relationship that was developed for the entire Tygart Valley River Basin.

There are no gage or stream flow records available for Leading Creek. Flows for the 1-percent annual chance floods were obtained from the Tygart Valley River Basin drainage area-flow relationship.

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

For this countywide revision, no new hydrologic analysis was developed.

## 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 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.

Table 2 – Summary of Discharges

| Flooding Source and Location | Drainage Area (Square Miles) | Peak Discharges (cfs) 10 percent-Annual-Chance | 2-percent-Annual-Chance | 1-percent - Annual-Chance | 0.2-percent - Annual-Chance |
|---|---|---|---|---|---|
| CRAVEN RUN | | | | | |
| At downstream corporate limits of Elkins | 4.23 | 670 | 1,140 | 1,370 | 2,060 |
| LEADING CREEK | | | | | |
| At confluence with Tygart Valley River | 60.1 | -- | -- | 7,270 | -- |
| Upstream of confluence of Claylick Run | 47.4 | -- | -- | 6,160 | -- |
| Upstream of confluence of Pearcy Run | 38.6 | -- | -- | 5,330 | -- |
| TYGART VALLEY RIVER | | | | | |
| At the downstream county boundary | 334.7 | -- | -- | 25,100 | -- |
| At downstream corporate limits of Elkins | 268.0 | 11,000 | 14,500 | 15,700 | 19,200 |
| Upstream of confluence of Leading Creek | 272.9 | -- | -- | 22,100 | -- |
| Upstream of confluence of Chenoweth Creek | 240.4 | -- | -- | 20,900 | -- |
| At downstream corporate limits of Beverly | 216.0 | -- | -- | 20,900 | -- |
| Upstream of confluence of Files Creek | 196.6 | -- | -- | 16,200 | -- |
| Upstream of confluence of Mill Creek | 127.5 | -- | -- | 13,100 | -- |

-- Data not available

Town of Beverly

Cross section data for the Tygart Valley River were obtained by field measurements taken in 1988 and supplemented by USACE field sections taken in

1986. All bridges were field surveyed to obtain elevation data and structural geometry.

Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 7). The starting water-surface elevation was obtained from the USACE flood protection project from the City of Elkins, approximately 15 miles downstream of Beverly. Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The result of the water-surface computations are tabulated for the selected cross sections.

Channel roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of photographs taken in the field. The channel "n" values for the Tygart Valley River ranged from 0.032 to 0.042, and the overbank "n" value was 0.060. The well-defined floods of March 1967 and November 1985 were successfully reproduced using the "n" values stated above.

<u>City of Elkins</u>

No hydraulic analyses were required within the Tygart Valley River due to the type of local flood protection project.

Cross section data for the backwater analyses were obtained from topographic maps compiled from aerial photographs at a scale of 1:4,800 with a contour interval of 4 feet (Reference 8). All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Craven Run were derived using the slope/area method.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen by observing the characteristics of its channel. The channel "n" value for Craven Run was 0.045, and the overbank value was 0.080.

<u>Randolph County (Unincorporated Areas)</u>

Cross sectional data for the Tygart Valley River and Leading Creek were obtained by field measurements taken in 1988. The Tygart Valley River was supplemented by USACE field sections taken in 1986. All bridges were field surveyed to obtain elevation data and structural geometry.

For the Tygart Valley River and Leading Creek, water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 7). For Cut-Off Canal, water-surface elevations were obtained by combining the elevations computed for the Tygart Valley River upstream and downstream of the canal. Flood Profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The results of the water-surface computations are computed for the selected cross sections for each stream segments.

Water-surface computations for the Tygart Valley River were calculated in two reaches: downstream and upstream of the City of Elkins. The starting water-surface elevation for the downstream reach was obtained from a rating curve computed at the access road bridge at the downstream study limit. For the reach of the river upstream of the City of Elkins, the starting water-surface elevation was obtained from a rating curve computed at the upstream limit of the USACE flood protection project for the city. Starting water-surface elevations for Leading Creek were based on critical depth.

Channel roughness factors (Manning's "n") used in the hydraulic computations for the Tygart Valley River and Leading creek were chose on the basis of photographs taken in the field. The channel "n" values for the Tygart Valley River ranged from 0.032 to 0.042, and the overbank "n" value was 0.060. For the river, the well-defined floods of March 1967 and November 1985 were successfully reproduced using the "n" values stated. The channel "n" value for Leading Creek was 0.040, and the overbank "n" was 0.080.

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 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.

For this countywide revision, no new hydraulic analyses were performed. However, this entire study was updated to the North American Vertical Datum of 1988 (NAVD 88).

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.

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. The average conversion factor of -0.42 feet was applied to convert all effective Base Flood Elevations (BFEs) For 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, the boundaries were interpolated using topographic maps at scales of 1:4,800 and 1: 24,000, with a contour intervals of 4 and 20 feet, respectively (References 8 and 9).

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

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

Approximate 1-percent-annual-chance floodplain boundaries in some portions of the study area were taken directly from the FIRMs for Town of Beverly, City of Elkin and the Unincorporated Areas of Randolph County (References 10, 11, and 12).

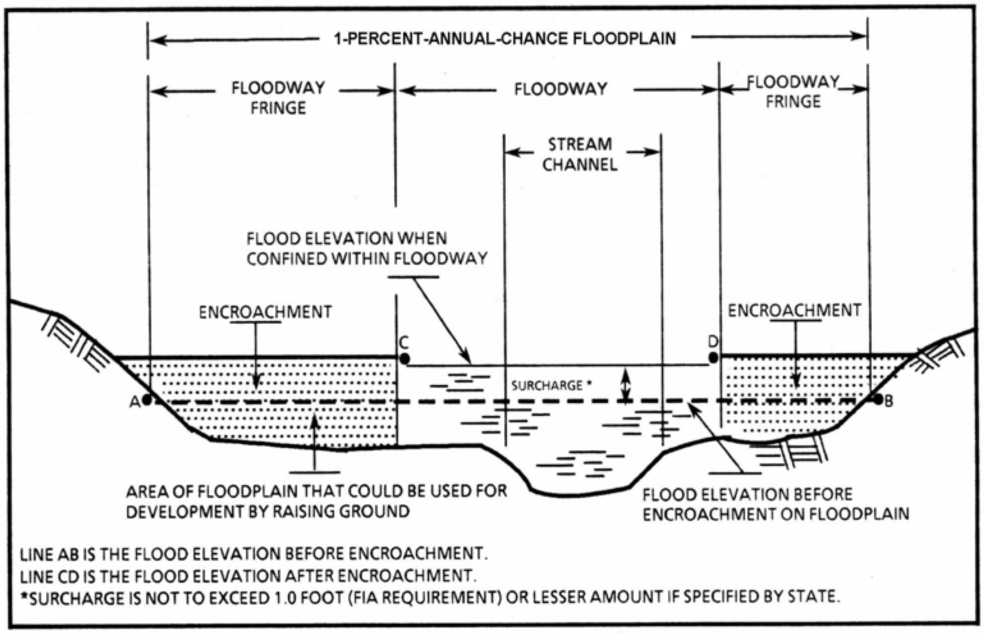
### 4.2 Floodways

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. 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 2, 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 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




No floodways were computed for Tygart Valley River or Leading Creek.

| FLOODING SOURCE | | FLOODWAY | | | 1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD) | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| CRAVEN RUN | | | | | | | | |
| A | 300 | 900 | 993 | 1.4 | 1,909.4 | 1,909.4 | 1,910.4 | 1.0 |
| B | 1,100 | 75 | 331 | 4.1 | 1,912.6 | 1,912.6 | 1,912.9 | 0.3 |
| C | 1,770 | 55 | 237 | 5.8 | 1,914.3 | 1,914.3 | 1,914.7 | 0.4 |
| D | 2,490 | 75 | 637 | 2.2 | 1,920.9 | 1,920.9 | 1,920.9 | 0.0 |
| E | 3,150 | 50 | 347 | 3.9 | 1,921.0 | 1,921.0 | 1,921.0 | 0.0 |
| F | 5,350 | 77 | 369 | 3.7 | 1,927.9 | 1,927.9 | 1,928.7 | 0.8 |
| G | 6,370 | 75 | 244 | 5.6 | 1,932.5 | 1,932.5 | 1,932.5 | 0.0 |
| H | 7,810 | 315 | 527 | 2.6 | 1,939.5 | 1,939.5 | 1,939.9 | 0.4 |

[1] Feet above Corporate Limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

**RANDOLPH COUNTY, WV**
AND INCORPORATED AREAS

**FLOODWAY DATA**

**CRAVEN RUN**

## 5.0 INSURANCE APPLICATIONS

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

Zone A

Zone A is the flood insurance 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, 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 Randolph 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 3, Community Map History.

## 7.0 OTHER STUDIES

Flood Insurance Studies have previous studies have been prepared for the Town of Beverly, the City of Elkins, and the Unincorporated Areas of Randolph County, West Virginia. The results of those studies are in exact agreement with the results of this study. FIRMs for the Towns of Coalton, Harman, Huttonsville, Mill Creek, Montrose, and Womelsdorph have also been incorporated into this study (References 10, 11, 12,13, 14, 15, 16, 17, and 18).

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 III, One Independence Mall, Sixth Floor, 615 Chestnut Street, Philadelphia, PA 19106-4404.

| COMMUNITY NAME | INITIAL IDENTIFICATION | FLOOD HAZARD BOUNDAY MAP REVISION DATE | FIRM EFFECTIVE DATE | FIRM REVISION DATE |
|---|---|---|---|---|
| Beverly, Town of | November 22, 1974 | None | December 3, 1991 | September 29, 2010 |
| Coalton, Town of | August 9, 1974 | June 25, 1976 | September 10, 1984 | September 29, 2010 |
| Elkins, City of | February 15, 1974 | April 9, 1976 | April 3, 1987 | September 29, 2010 |
| Harman, Town of | April 1, 1977 | None | August 24, 1984 | September 29, 2010 |
| Huttonsville, Town of | November 15, 1974 | None | August 24, 1984 | September 29, 2010 |
| Mill Creek, Town of | January 10, 1975 | None | August 24, 1984 | September 29, 2010 |
| Montrose, Town of | November 15, 1974 | July 2, 1976 | September 24, 1984 | September 29, 2010 |
| Randolph County (Unincorporated Areas) | April 18, 1975 | None | September 27, 1991 | September 29, 2010 |

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**RANDOLPH COUNTY, WV**
AND INCORPORATED AREAS

**COMMUNITY MAP HISTORY**

## 9.0 BIBLIOGRAPHY AND REFERENCES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2. The Weather Channel website, Retrieved on September 29, 2005, from http://www.weather.com.

3. U.S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

4. U.S. Army Corps of Engineers, Operation and Maintainance Manual, Elkins Flood Protection Works, Elkins, West Virginia, Tygart River, Pittsburgh, Pennsylvania, November 1949.

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7. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, November 1976, with updates.

8. L. Robert Kimball & Associates of Ebensburg, Pennsylvania, Topographic Maps complied from aerial photographs, Scale 1: 4,800, Contour Interval 4 Feet: Elkins, West Virginia, April 1984.

9. U.S. Department of the Interior, Geologic Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Beverly West, West Virginia, 1968, Photorevised 1976; Beverly East, West Virginia, 1969, Photorevised 1976; Elkins, West Virginia, 1969, Photorevised 1976; Junior, West Virginia, 1969, Photorevised 1976; Mill Creek, West Virginia, 1977.

10. Federal Emergency Management Agency, Flood Insurance Study, Town of Beverly, Randolph County, West Virginia, Washington, D.C., December 3, 1991.

11. Federal Emergency Management Agency, Flood Insurance Study, City of Elkins, Randolph County, West Virginia, Washington, D.C., April 3, 1987.

12. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Randolph County, West Virginia, Washington, D.C., September 27, 1991.

13. Federal Emergency Management Agency, Flood Insurance Study, Town of Coalton, Randolph County, West Virginia, Washington, D.C., September 10, 1984.

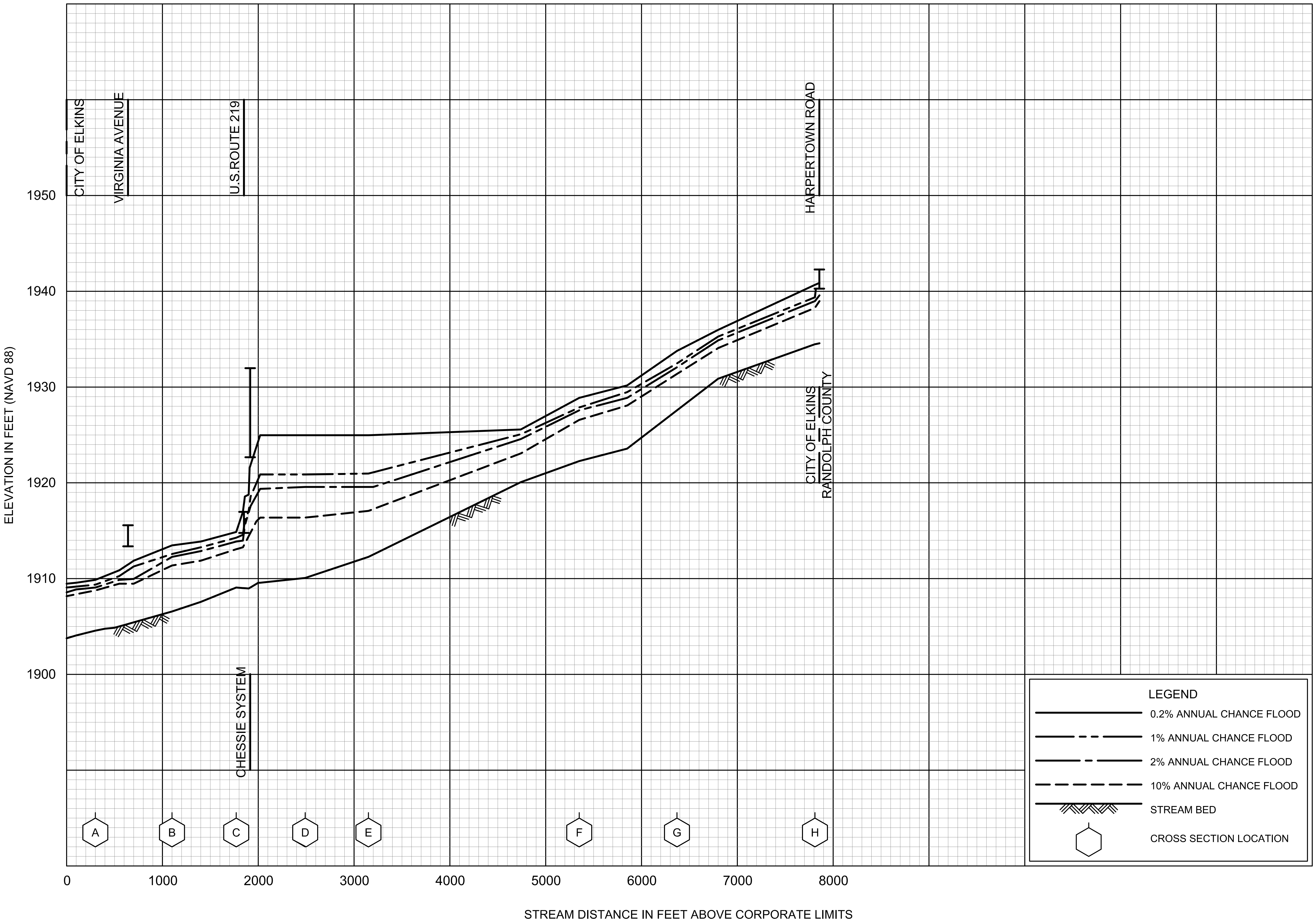
14. Federal Emergency Management Agency, Flood Insurance Study, Town of Harman, Randolph County, West Virginia, Washington, D.C., August 24, 1984.

15. Federal Emergency Management Agency, Flood Insurance Study, Town of Huttonsville, Randolph County, West Virginia, Washington, D.C., August 24, 1984.

16. Federal Emergency Management Agency, Flood Insurance Study, Town of Mill Creek, Randolph County, West Virginia, Washington, D.C., August 24, 1984.

17. Federal Emergency Management Agency, Flood Insurance Study, Town of Montrose, Randolph County, West Virginia, Washington, D.C., September 24, 1984.

18. Federal Emergency Management Agency, Flood Insurance Study, Town of Womelsdorph, of Randolph County, West Virginia, Washington, D.C., September 10, 1984.




FLOOD PROFILES

CRAVEN RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS

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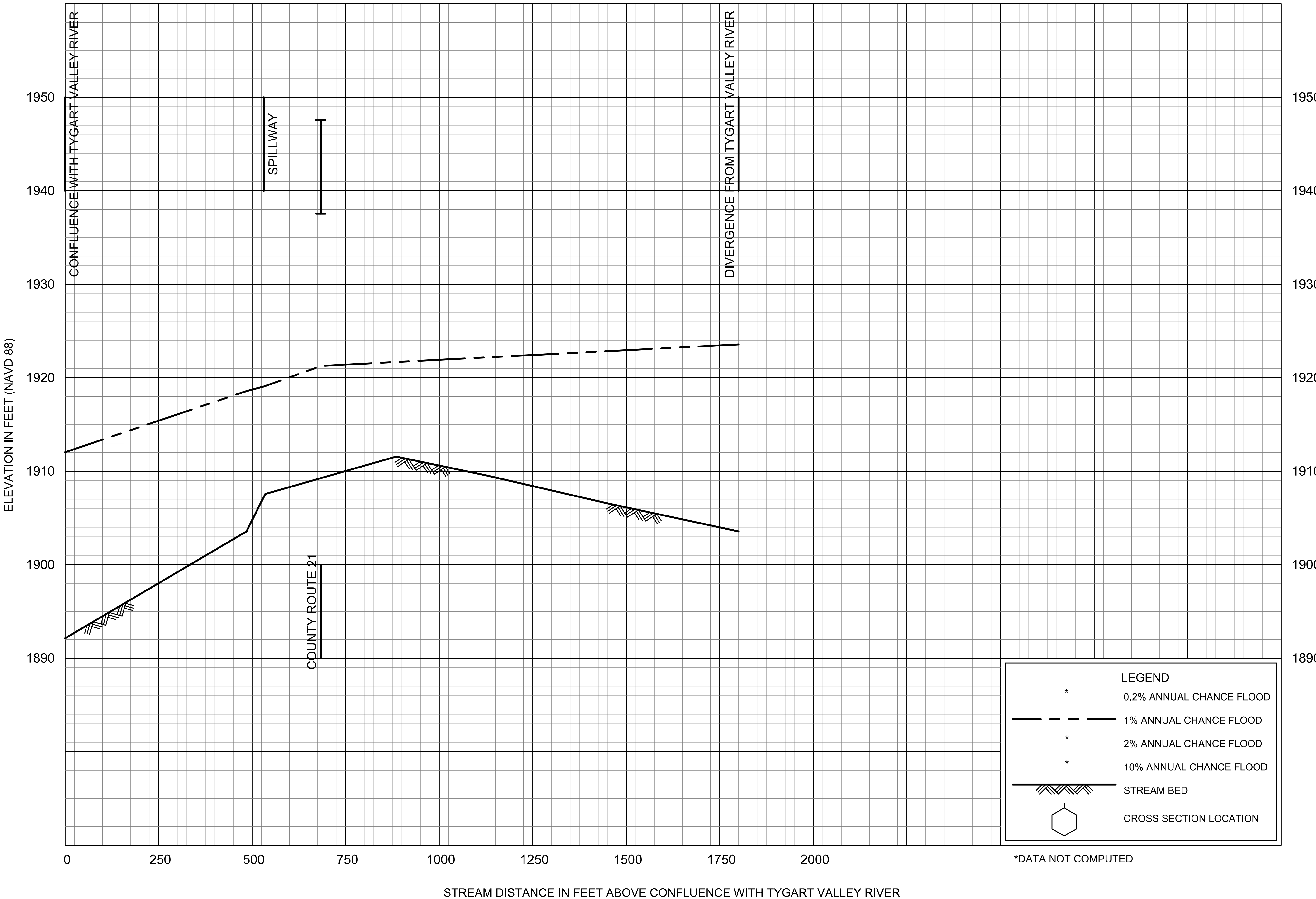


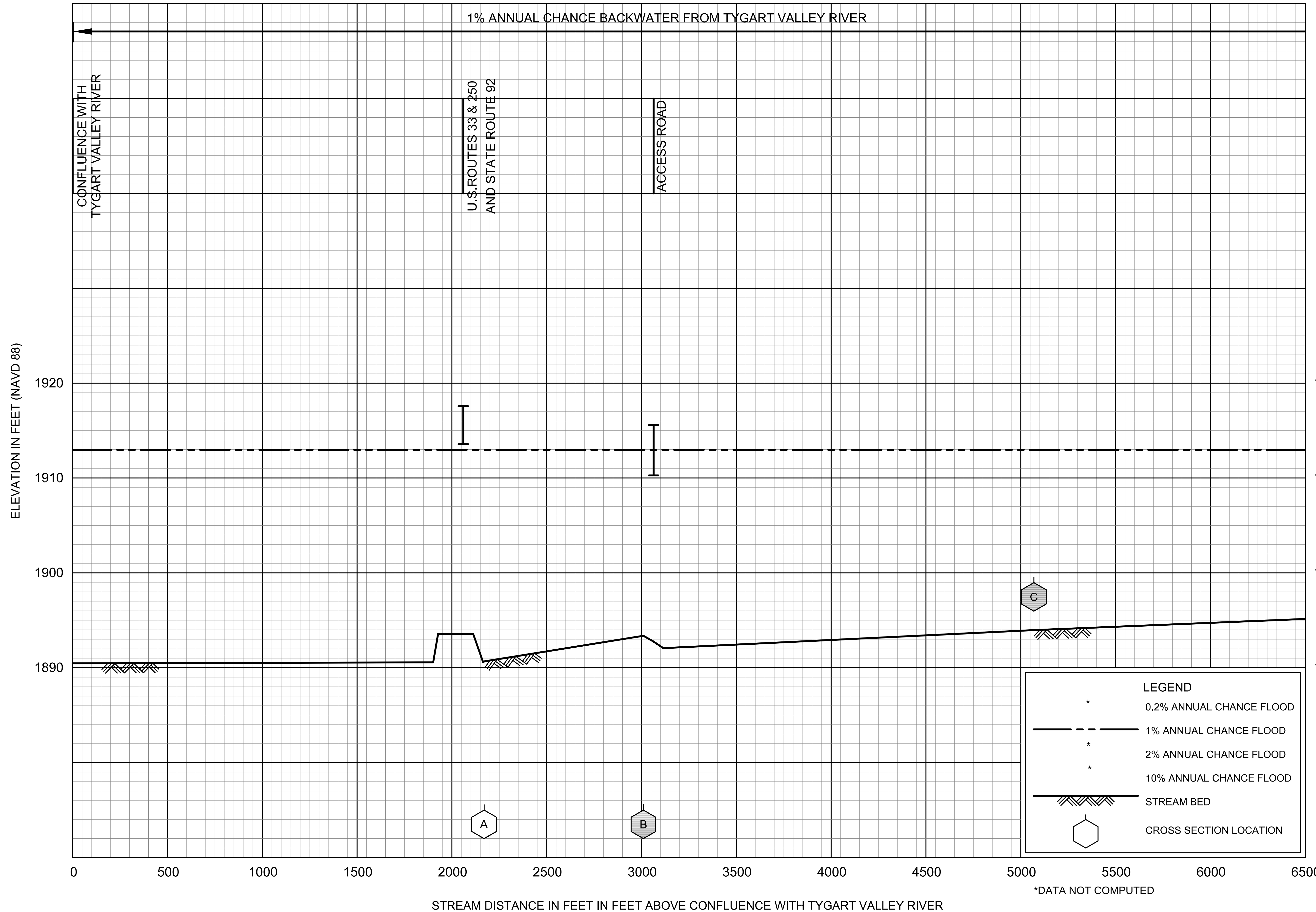

# FLOOD PROFILES

## CUT-OFF CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



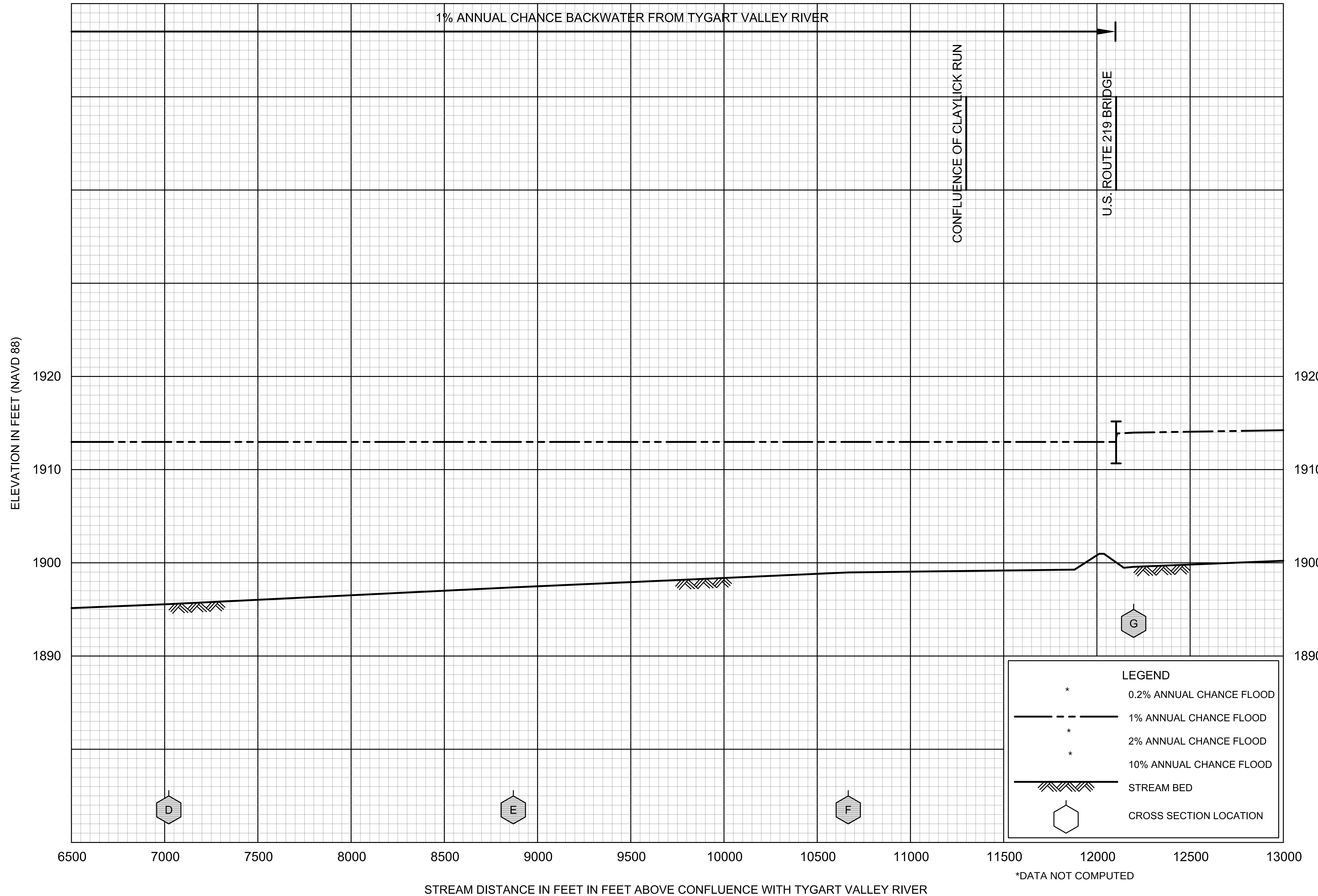

FLOOD PROFILES

LEADING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



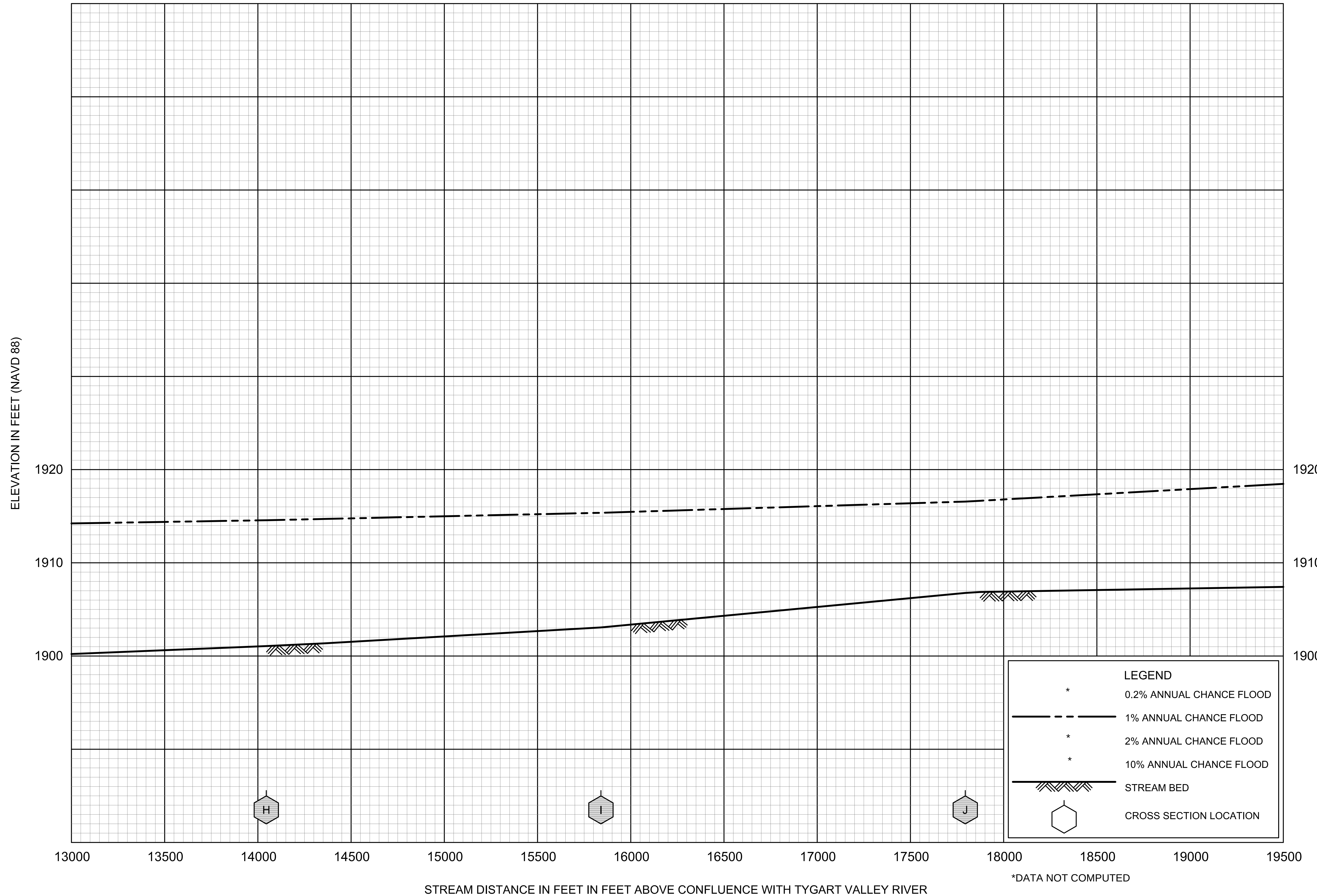

FLOOD PROFILES

LEADING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



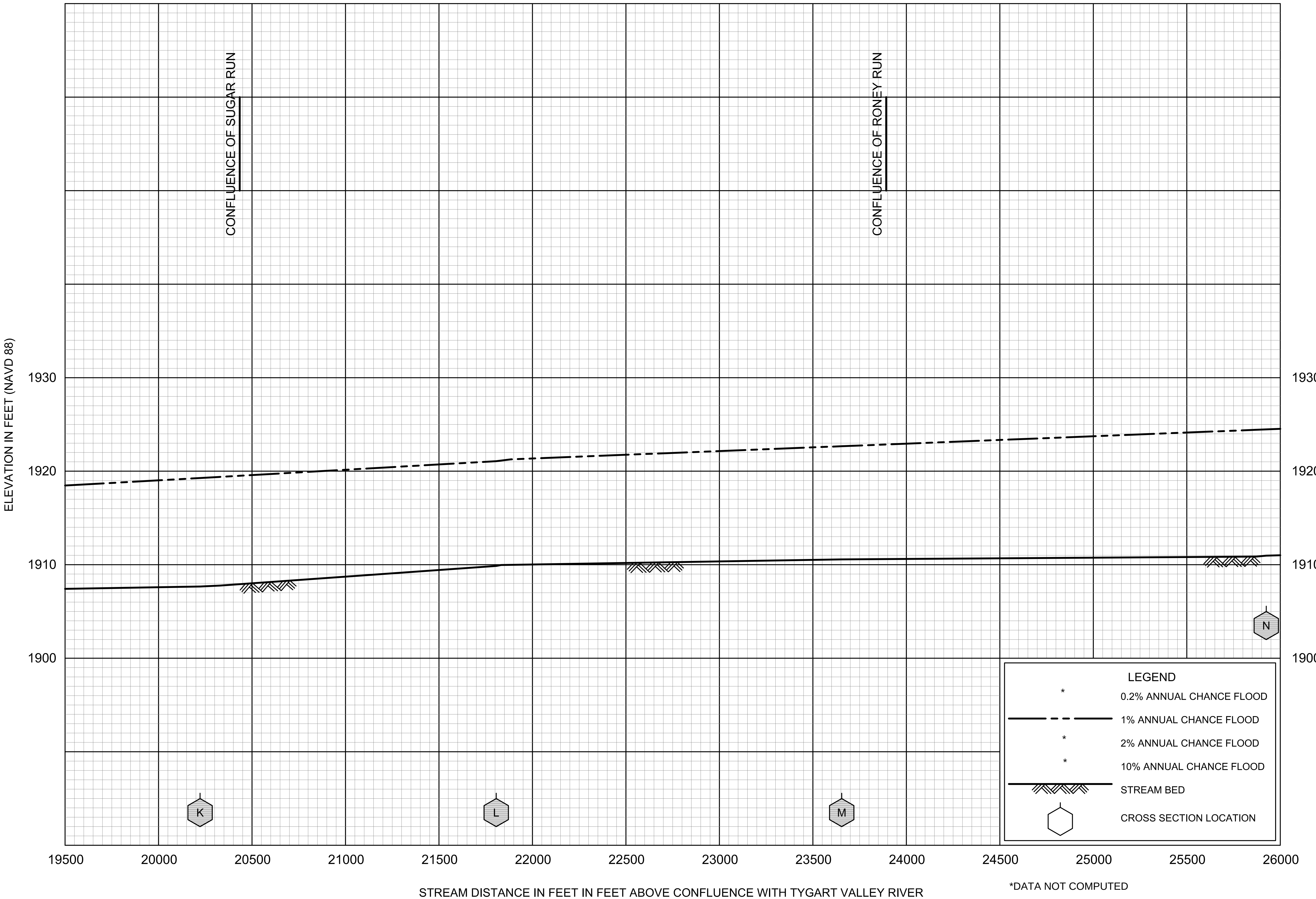

FLOOD PROFILES

LEADING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



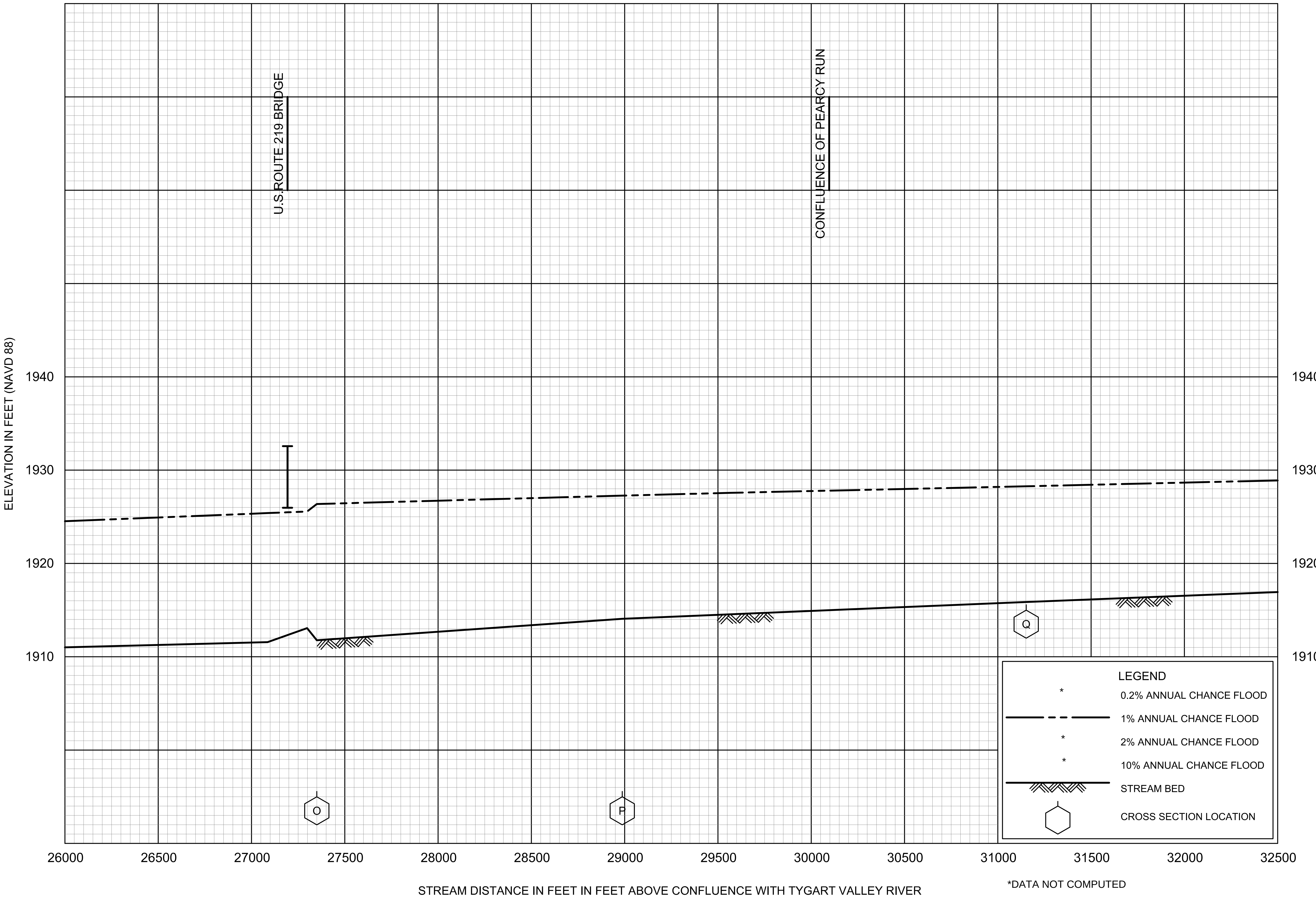

FLOOD PROFILES

LEADING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



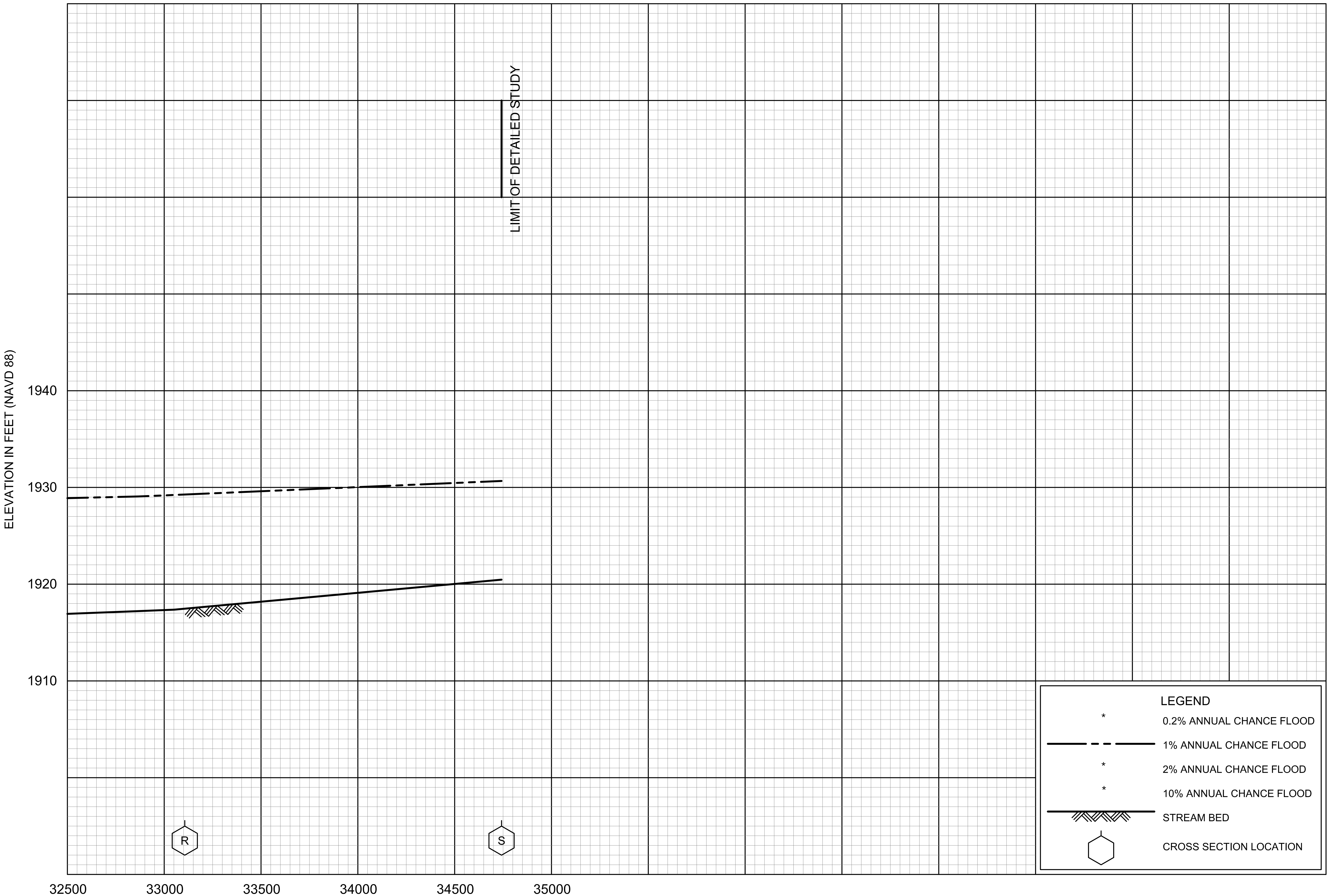

# FLOOD PROFILES

## LEADING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS




*DATA NOT COMPUTED

STREAM DISTANCE IN FEET IN FEET ABOVE CONFLUENCE WITH TYGART VALLEY RIVER

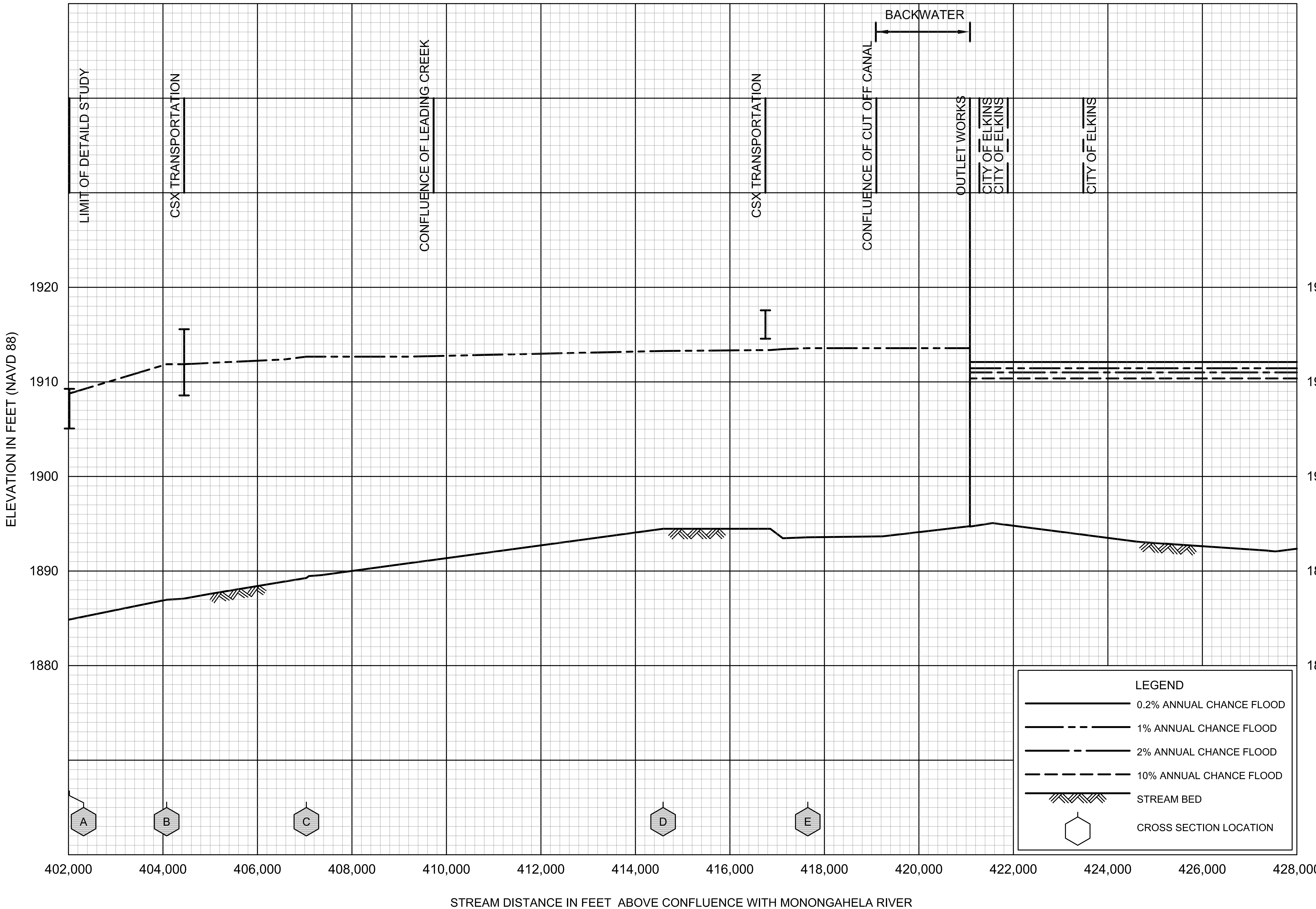
FLOOD PROFILES

LEADING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



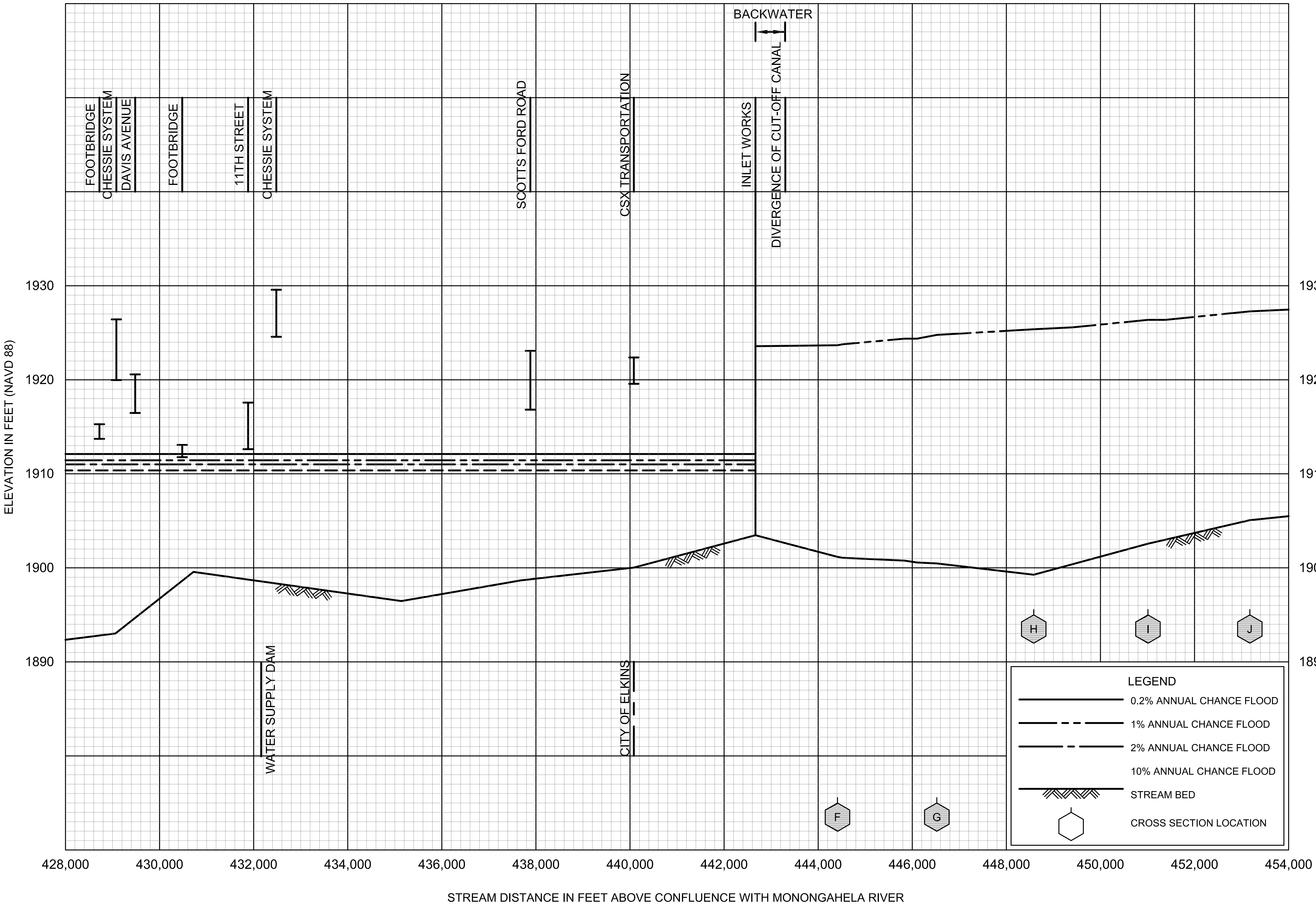

FLOOD PROFILES

TYGART VALLEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS




FLOOD PROFILES

TYGART VALLEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS

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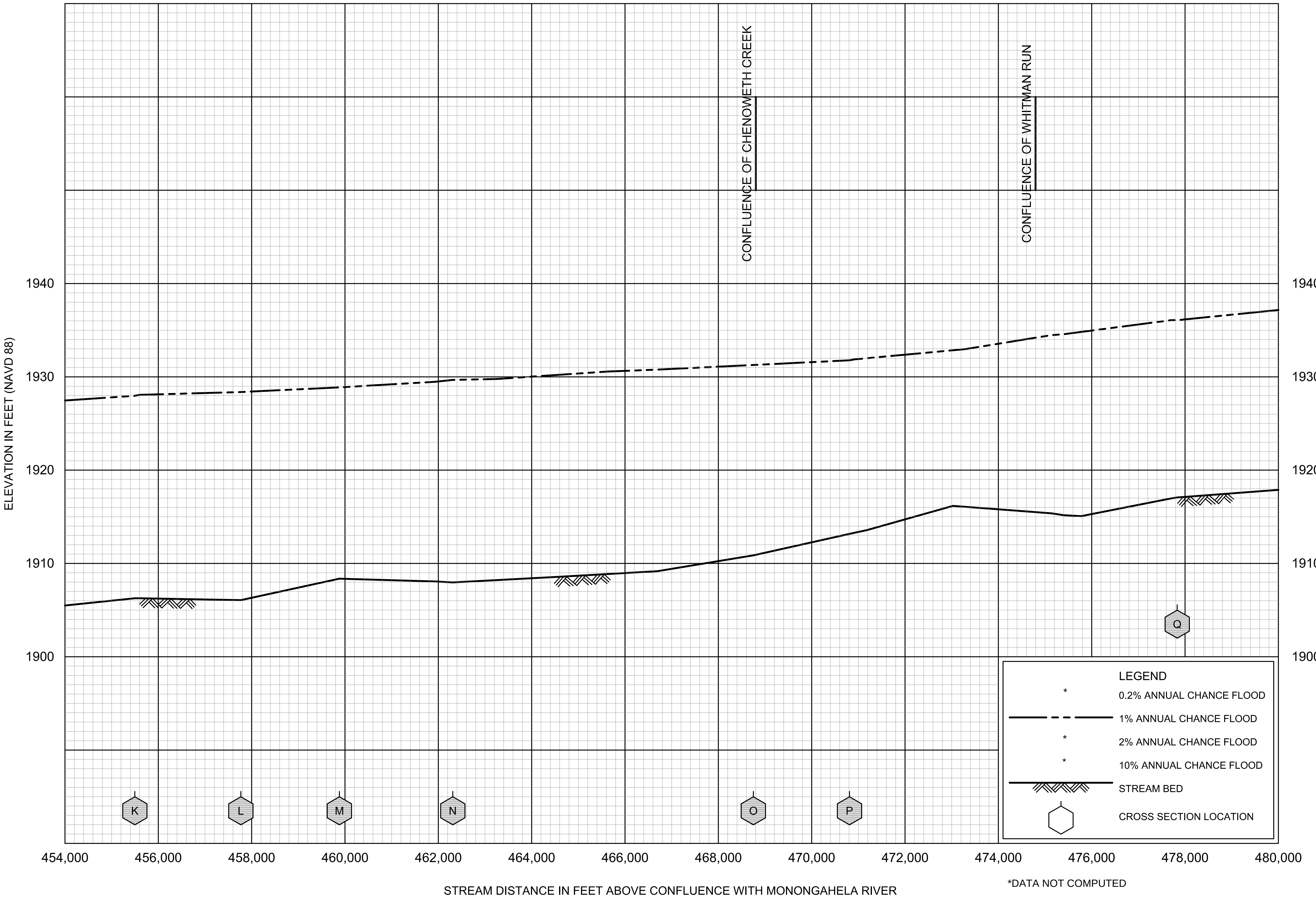


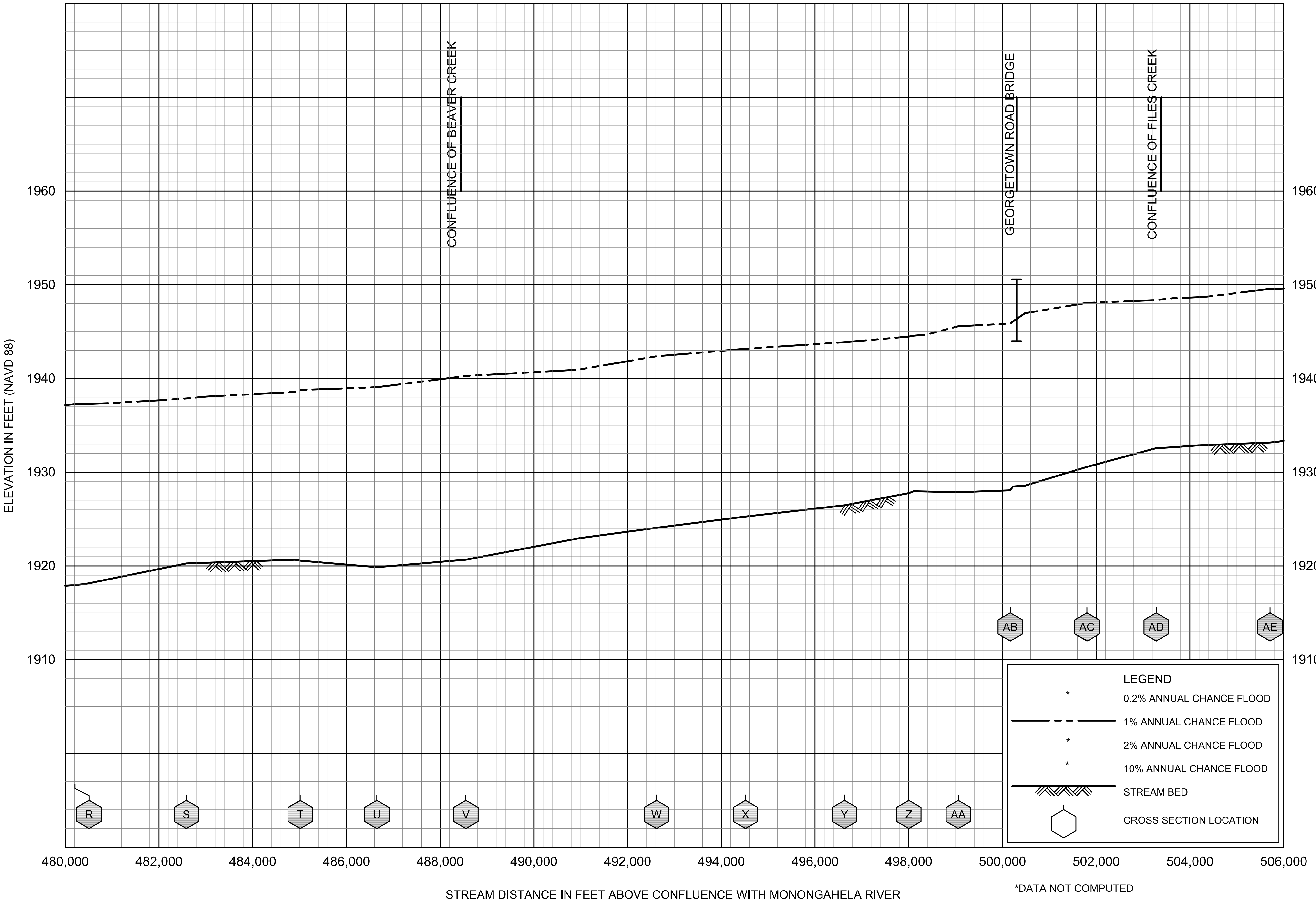

FLOOD PROFILES

TYGART VALLEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



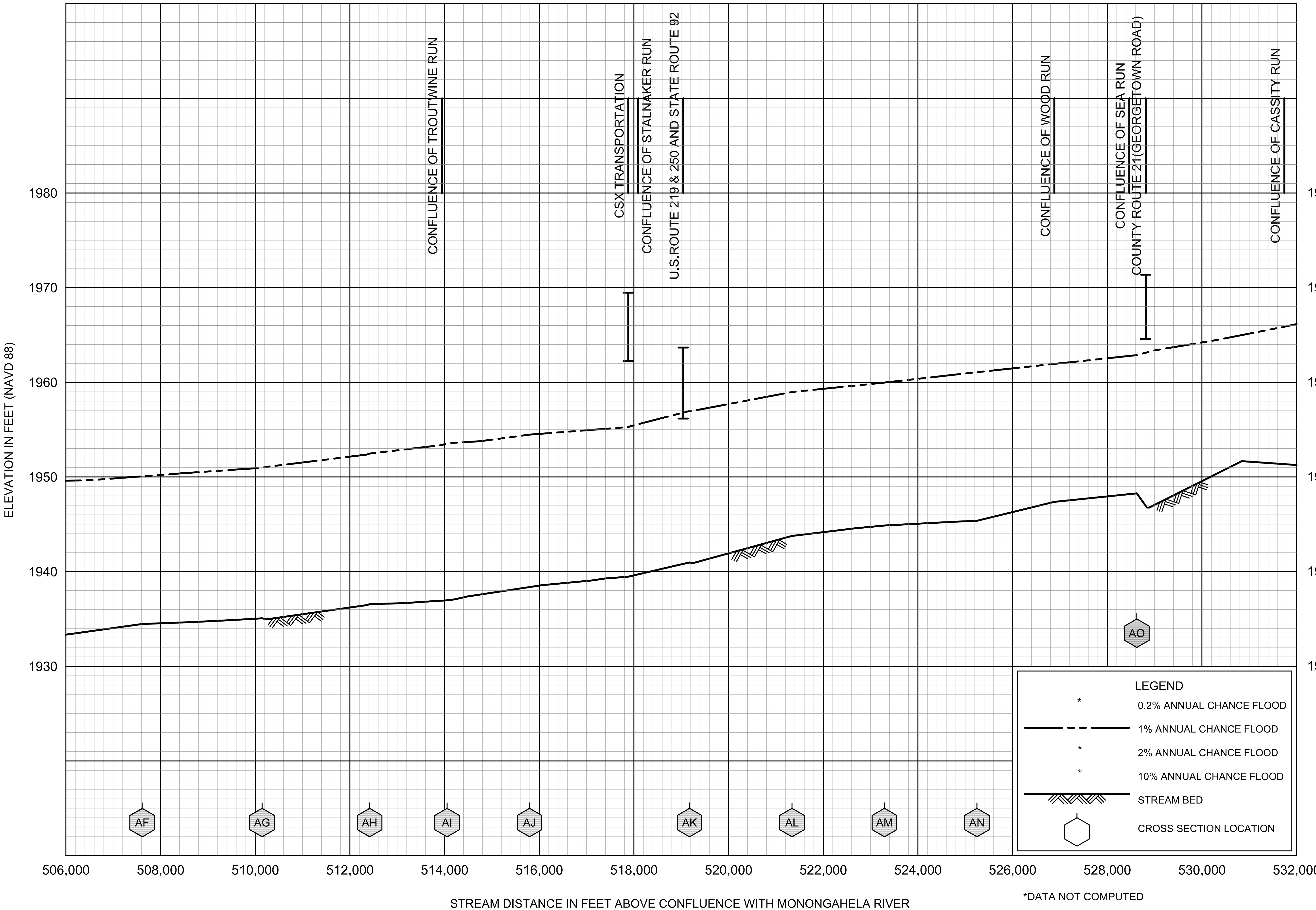

FLOOD PROFILES

TYGART VALLEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



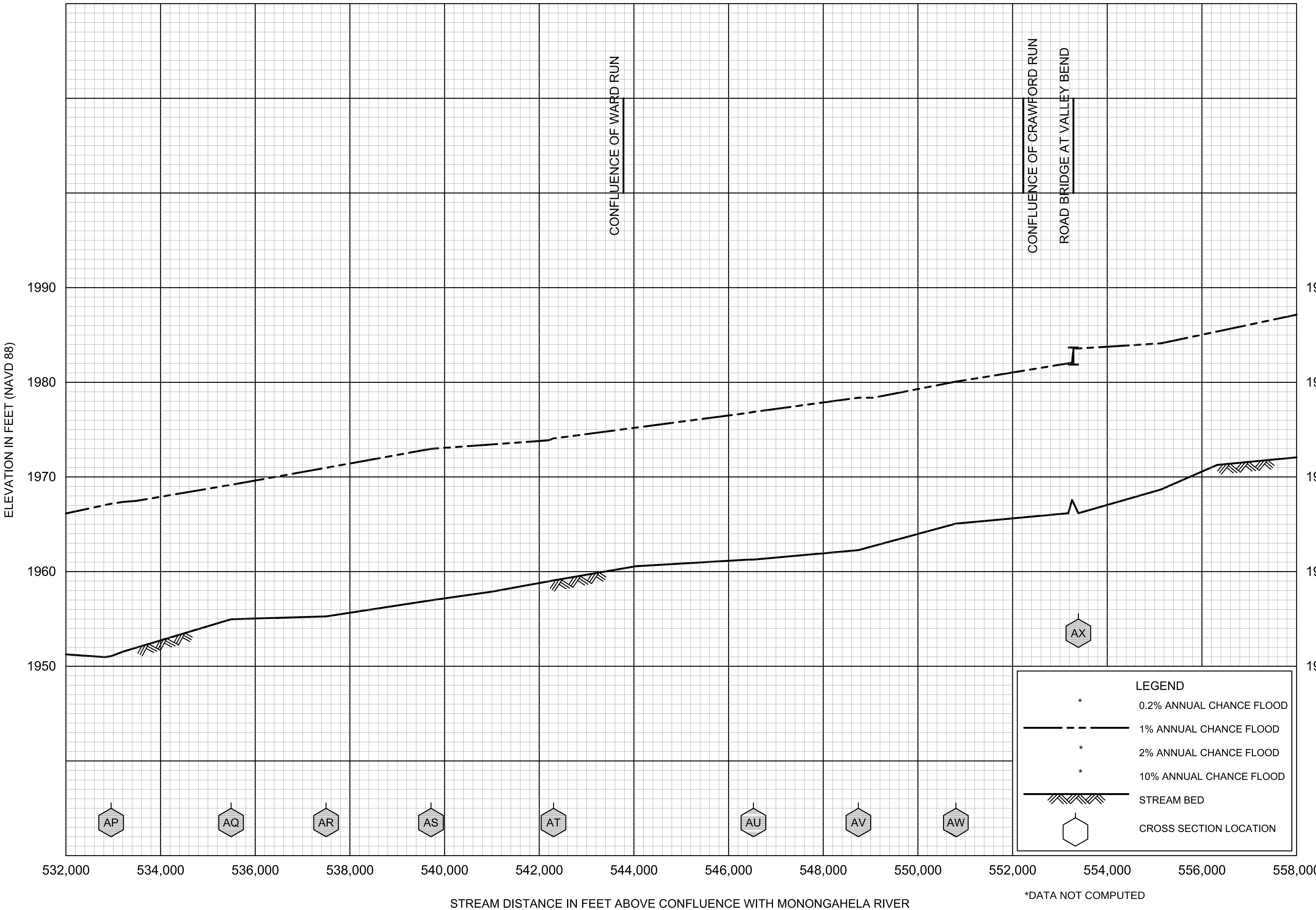

FLOOD PROFILES

TYGART VALLEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



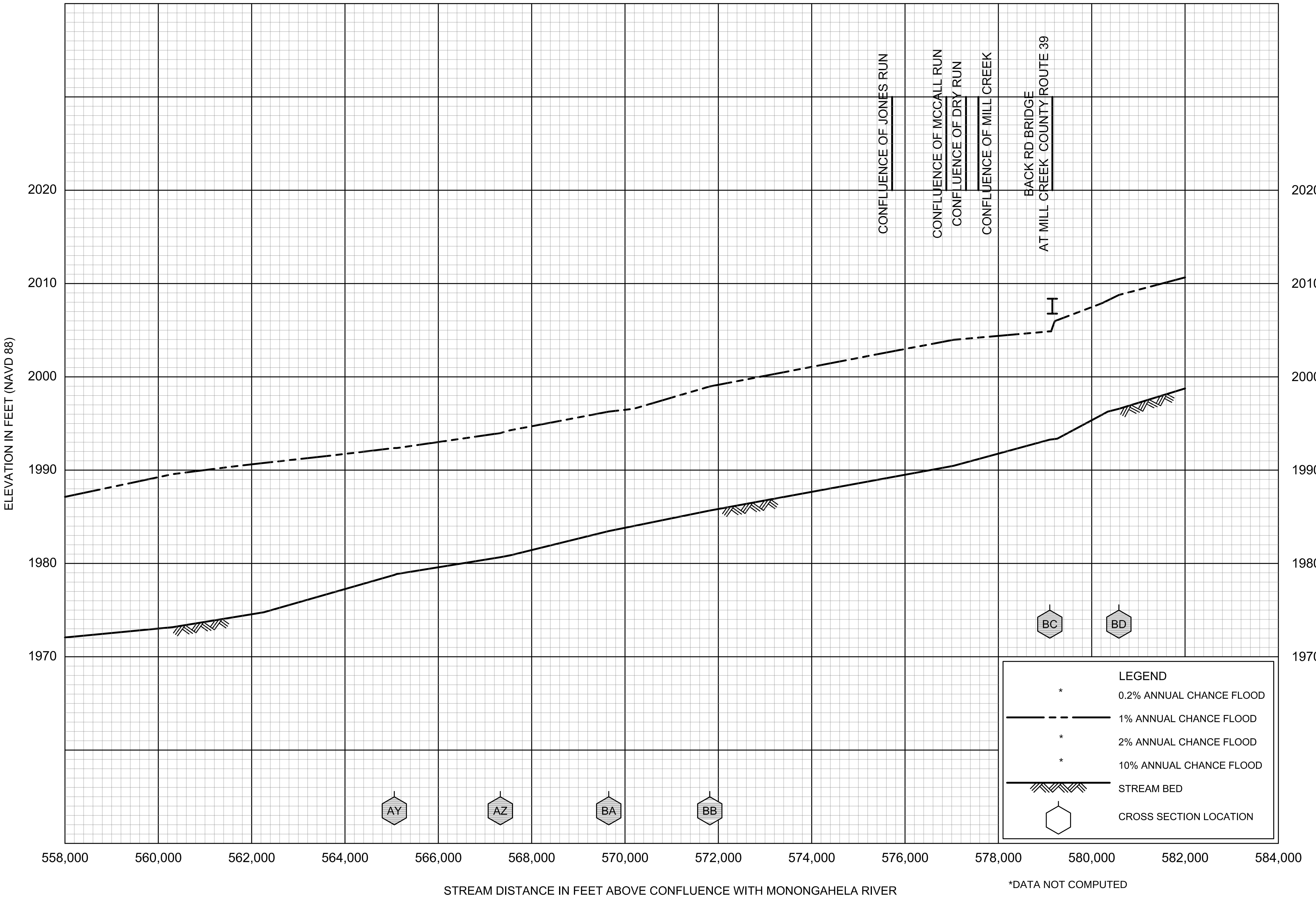

FLOOD PROFILES

TYGART VALLEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS



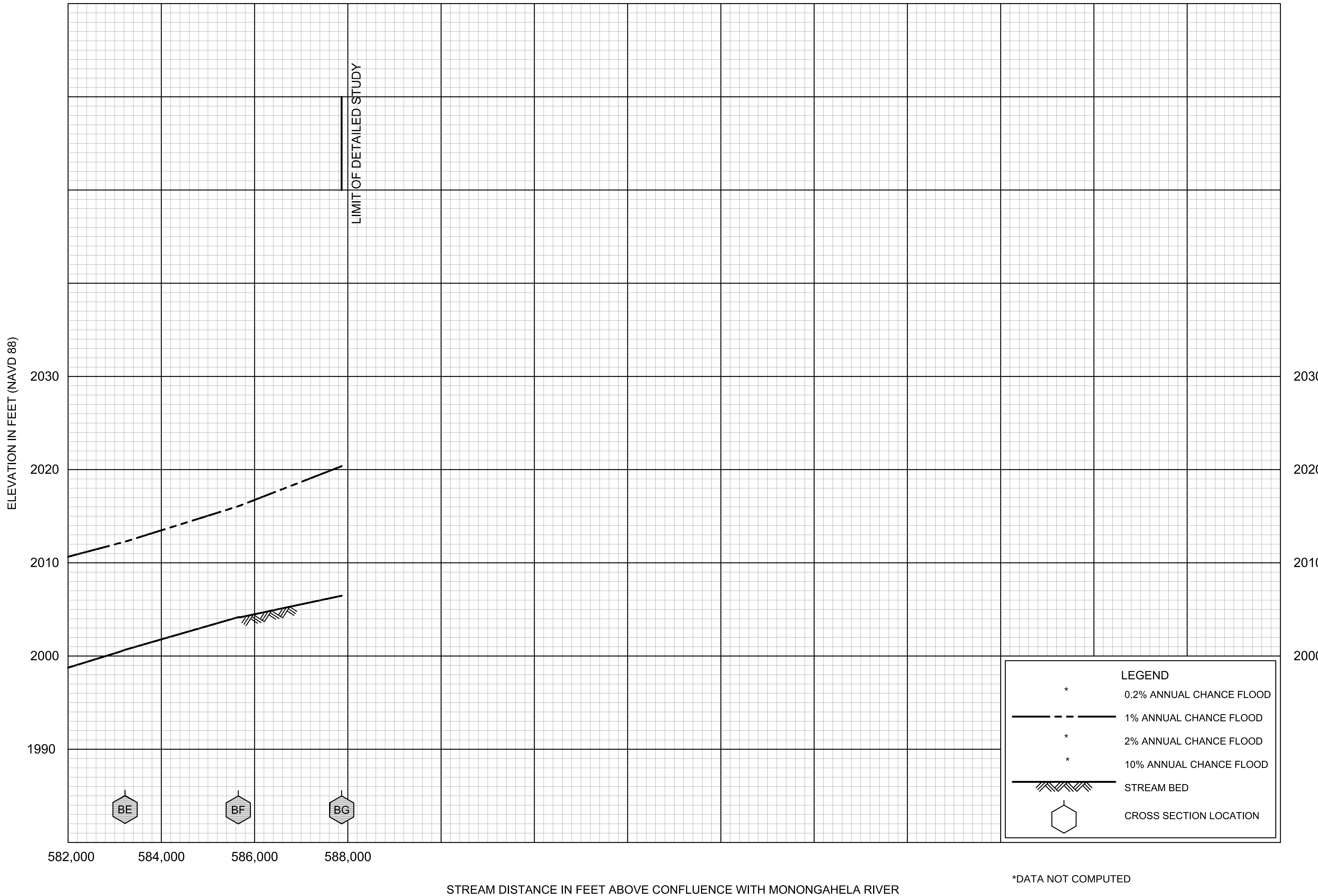

FLOOD PROFILES

TYGART VALLEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS




FLOOD PROFILES

TYGART VALLEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RANDOLPH COUNTY, WV

AND INCORPORATED AREAS