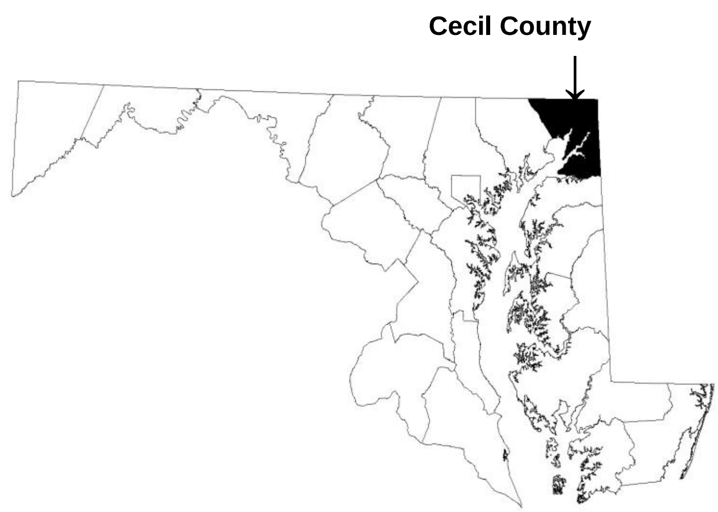
FLOOD INSURANCE STUDY

CECIL COUNTY, MARYLAND

AND INCORPORATED AREAS



Community Name	Community Number
CECIL COUNTY (UNINCORPORATED AREAS)	240019
*CECILTON, TOWN OF	240020
CHARLESTOWN, TOWN OF	240021
CHESAPEAKE CITY, TOWN OF	240099
ELKTON, TOWN OF	240022
NORTH EAST, TOWN OF	240023
PERRYVILLE, TOWN OF	240024
PORT DEPOSIT, TOWN OF	240025
RISING SUN, TOWN OF	240158

*No Special Flood Hazard Areas Identified

Revised: May 4, 2015

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

24015CV000B

NOTICE TO FLOOD INSURANCE STUDY USERS

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

Part or all of this FIS may be revised and republished at any time. In addition, part of the FIS may be revised by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: July 8, 2013

Revised Countywide FIS Effective Date: May 4, 2015

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1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates previous FISs / Flood Insurance Rate Maps (FIRMs) in the geographic area of Cecil County, Maryland including the Towns of Cecilton, Charlestown, Chesapeake City, Elkton, North East, Perryville, Port Deposit, and Rising Sun, and the unincorporated areas of Cecil County (hereinafter referred to collectively as Cecil 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. This information will also be used by Cecil County to update existing floodplain regulations as part of the Regular Phase of the NFIP, and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that on the effective date of this study, the Town of Cecilton has no identified Special Flood Hazard Areas (SFHAs). This does not preclude future determinations of SFHAs that could be necessitated by changed conditions affecting the community (i.e. annexation of new lands) or the availability of new scientific or technical data about flood hazards.

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 Acknowledgements

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

Information on the authority and acknowledgments for each jurisdiction with a pre-countywide printed FIS report.

The FISs for the unincorporated areas of Cecil County, and the Towns of Charlestown, Chesapeake City, North East, and Rising Sun were prepared by the Flood Management Division of the Water Resources Administration (WRA) of the State of Maryland, for the Federal Emergency Management Agency (FEMA) under Contract No. H-4621, and were completed in June 1980. The FIS for the Town of Elkton was prepared by the U.S. Army Corps of Engineers (USACE) for FEMA under Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 20 and was completed in July 1978. The FISs for the Towns of Perryville and Port Deposit were conducted by the Susquehanna River Basin Commission (SRBC) at the request of the Federal Insurance Administration (now FEMA), U. S. Department of Housing and Urban Development (HUD) under Contract No. H-3496 and was completed in August 1976.

There is no pre-countywide FIS for the Town of Cecilton; therefore the previous authority and acknowledgement information for this community is not included in this FIS.

For the July 8, 2013, initial countywide FIS, revised hydrologic and hydraulic analyses were prepared for all streams except the Susquehanna River. The hydraulic analyses for the Susquehanna River were brought forward from the previous FISs. The revised analyses were completed by the USACE for the Maryland Department of the Environment (MDE) as part of the FEMA Map Modernization Program (MMP) under Contract No. ICA-05-CRL-01. This study was completed in March 2009.

For this May 4, 2015, revised countywide FIS, the coastal analysis and mapping for Cecil County was conducted by FEMA under Project Nos. HSFE03-06-X-0023 and HSFE03-09-X-1108. The coastal analysis involved transect layout, field reconnaissance, erosion analysis, and overland wave modeling including wave setup, wave height analysis and wave runup.

The projection used in the preparation of this May 4, 2015, revised countywide FIS was Universal Transverse Mercator (UTM) zone 18. The horizontal datum was North American Datum of 1983 (NAD 83), GRS80 spheroid. Differences in datum, spheroid, projection, or UTM zones used in the production of the FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdictional boundaries. These differences do not affect the accuracy of this FIRM.

The base map information shown on the May 4, 2015, FIRM was provided by Cecil County through the Eastern Shore Communications Alliance. The base orthophotos, published in 2010, have a 6-inch ground pixel resolution. Adjustments were made to base map features to align them to these 1:100 scale orthophotos.

1.3 Coordination

The purpose of the initial Consultation Coordination Officer (CCO) meeting is to discuss the scope of the study. A final CCO meeting is held to review the results of the study.

The initial CCO meetings were held for the pre-countywide studies for the unincorporated areas of Cecil County and the Towns of Charlestown, Chesapeake City, and North East on March 6, 1978, and were attended by representatives of the Maryland WRA and FEMA. Flood discharge information was coordinated with the

U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of Agriculture, Soil Conservation Service (now Natural Resources Conservation Service (NRCS)), and USACE.

The initial CCO meeting for the pre-countywide study for the Town of Elkton was held on December, 16, 1975, and was attended by officials of the Town of Elkton, representatives of the USACE, the State of Maryland and FEMA.

The initial CCO meeting information for the Towns of Perryville, Port Deposit, and Rising Sun is not available. No previous study was conducted for the Town of Cecilton.

The initial CCO meeting for the July 8, 2013, initial countywide FIS was held on April 12, 2005, at the MDE offices and attended by representatives of the MDE, FEMA, and the USACE (study contractor for this study).

Coordination with city officials and federal, state, and regional agencies produced information pertaining to floodplain regulations, community maps, flood history, and other hydrologic data.

For the July 8, 2013, initial countywide FIS, a final CCO meeting was held on June 11, 2010. The meeting was attended by representatives of Cecil County, the Towns of Charleston, Chesapeake City, Elkton, North East, Perryville, and Port Deposit, the State NFIP Coordinator, USACE, and FEMA. No representatives from the Towns of Cecilton and Rising Sun attended the meeting.

For this May 4, 2015, revised countywide FIS, the FEMA Region III office initiated a coastal storm surge study in 2008 for the Atlantic Ocean, the Chesapeake Bay and its tributaries, and the Delaware Bay. Therefore, no initial CCO meeting for the coastal storm surge study was held. A final CCO meeting was held on September 23, 2013, with representatives from FEMA, the MDE, the USACE, the mapping partners, and the local communities.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Cecil County, Maryland, including all unincorporated areas of the county and the Towns of Cecilton, Charlestown, Chesapeake City, Elkton, North East, Perryville, Port Deposit, and Rising Sun.

For the July 8, 2013, initial countywide FIS, all or portions of the flooding sources listed in Table 1, "Flooding Sources Studied by Detailed Methods", were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and the FIRM (Exhibit 2).

Table 1. Flooding Sources Studied by Detailed Methods

Big Elk Creek	Northeast Creek
Christina River	Stone Run Tributary 1
Dogwood Run	Stone Run Tributary 2
Gravelly Run	Susquehanna River
Laurel Run	Unnamed Tributary to Laurel Run
Little Elk Creek	West Branch Christina River
Little Northeast Creek	West Branch Laurel Run
Mill Creek	

For the July 8, 2013, initial countywide FIS, the USACE was contracted to perform approximate studies on the same streams in the pre-countywide FISs. For the pre-countywide FISs, areas to study using approximate analysis were chosen based on low development potential and/or flood risk. The flooding sources listed in Table 2, "Flooding Sources Studied by Approximate Methods", were studied by approximate methods.

Table 2. Flooding Sources Studied by Approximate Methods

Basin Run	Stone Run
Conowingo Creek	Stone Run Tributary 1
East Branch Laurel Run	Stone Run Tributary 2
Gramies Run	Stony Run
Gravelly Run	Susquehanna River
Laurel Run	Tributary 1 to Northeast River
Little Northeast Creek	Tributary 2 to Northeast River
Mill Creek	Tributary to Stony Run
Northeast Creek	Tributary to Susquehanna River
Octoraro Creek	West Branch Laurel Run
Perch Creek	West Branch Little Northeast Creek
Principio Run	

This May 4, 2015, revised countywide FIS incorporates new detailed coastal flood hazard analyses for the Chesapeake Bay, Bohemia River, Elk River, Northeast River, Piney Creek Cove, Sassafras River, and Susquehanna River. Study efforts were initiated in 2008 and concluded in 2012.

No LOMRs were recorded for this May 4, 2015, revised countywide FIS.

2.2 Community Description

Cecil County is located in the northeastern corner of Maryland. It is bordered by the Susquehanna River and the Chesapeake Bay to the west, the Sassafras River to the south, the Commonwealth of Pennsylvania to the north, and the State of Delaware to the east. Much of Cecil County is affected by tidal waters of Chesapeake Bay. The county is drained by the Susquehanna, the Northeast, the

Elk, and the Sassafras Rivers. Land use is predominantly rural with some development on the floodplains of major rivers. Development of waterfront properties is extensive and is susceptible to storm damage from high winds and rising tides (Reference 1).

The population of Cecil County in 2010 was 101,108. The largest city in Cecil County, the Town of Elkton, had a 2010 population of 15,444 (Reference 2).

The topography of Cecil County is characterized by the rolling hills of the Piedmont and the low, flat coastal plain. Piedmont elevations average approximately 300 feet and sometimes exceed 400 feet. Conversely, the coastal plain rarely exceeds 200 feet, averaging approximately 50 feet in elevation (Reference 3).

The climate of Cecil County is characterized by well defined seasons with a large annual temperature range. For example, the average January temperature for the Town of Elkton is 31^{o}F, and the average July temperature is 72^{o}F. Average precipitation for the Town of Elkton is 62 inches (References 1 and 4).

2.3 Principal Flood Problems

Floods in Cecil County are usually caused by severe thunderstorms, rapidly rising tides from runoff, and occasional hurricanes. The Town of Elkton is also subject to fluvial flooding on Big Elk Creek (References 1 and 4).

In late June 1884, a series of thunderstorms ended a period of long drought and caused an estimated $70,000 in bridge damage throughout the county. A water-surface elevation of 14.3 feet was recorded on Elk Creek (Reference 5).

A hurricane brought 7.1 inches of rain on the Town of Elkton in a 48-hour period in August 1933. Little Elk Creek washed away a wall at the Elk Paper Manufacturing Company in Childs. The equipment at the company was inundated by 3 feet of water. Two major highways were covered by 6 feet of water, and basements along Main Street had several inches of water. Piers weakened under the highway bridge over the Northwest River from heavy and rapid flow, causing the State Road Commissioner to close the road (Reference 6).

A severe thunderstorm on July 8, 1935, completely isolated the Town of Elkton. Bridges in Mechanics Valley and Childs were washed out. The state road from Elkton to Glasgow, Delaware was inundated by 3 to 6 feet of water at the Big Elk Creek crossing (Reference 7).

In August 1937, heavy thunderstorms caused automobile traffic to come to a halt as a record 4.24 inches of rain fell in a 24-hour period at Elkton. Approximately 10,000 cars were held up in Elkton because small bridges had washed out, and all roads in a 25-mile radius southwest of Wilmington, Delaware, were inundated (Reference 8).

On September 20, 1945, a storm brought the highest water level to Elkton since the flood of August 1933. The rising Elk River washed out the bridge at the Elk Paper Manufacturing Company and came within a foot of the high-water mark of 1933 (Reference 9).

In October 1954, Tropical Storm Hazel struck the Eastern Shore and brought winds up to 100 miles per hour. As in the 1933 storm and most major storms, the low lying Water and Conestoga Streets in the Town of Charlestown were inundated. Tidal surges reached within 1 foot of the Wellwood Yacht Club front porch along Water Street. The storm overtopped a USGS bench mark at the C.W. Thorn, Jr. Boatyard which has an elevation of 7.41 feet (References 4 and 10).

On August 18, 1955, Hurricane Connie caused an estimated $100,000 in damage to roads in Cecil County, $50,000 of which was done to bridges. Most road damage was to State Routes 272 and 280, north of U.S. Route 40. Newark Road, State Route 7, East Main Street at Farr Creek, and Walnut Lane in the Town of Elkton were flooded and closed for 7 hours. Approximately 1,000 customers of the Conowingo Power Company were without service for approximately 24 hours, and telephones were out in Elkton, North East, and Port Deposit. The Chesapeake and Delaware Canal rose 5 feet above normal high tide at Schaeffer’s Wharf and covered the floor of a restaurant with 8 inches of water. A warehouse along the canal, usually 4 feet above the water surface, was flooded with 6 inches of water. Waterfront properties were extensively damaged, especially Hanford Owen’s Wharf at Perryville. Rising floodwaters from the Susquehanna River swept away piers, docks, gasoline tanks, and small vessels. Nearby, 3 feet of water rose inside many Charlestown beach houses (Reference 11).

In August 1969, severe thunderstorms caused washouts on the Susquehanna River and flooding in Havre de Grace, Port Deposit, and Perryville. Unofficial records show storm totals of 6 inches in Port Deposit and 4 inches in a 2-hour period at Havre de Grace. A reported $100,000 in damage occurred in Port Deposit, as well as $50,000 in Havre de Grace (Reference 12).

In June 1972, Maryland experienced one of the most devastating floods in its history. Hurricane Agnes reportedly caused the deaths of 19 people, injured 57 others, and caused $80 million in damage statewide. In Elkton, business property losses were nearly $300,000. North East reported $14,000 in damage. Conowingo Dam had a record flood stage height of 111.5 feet, 3 feet above its designated capacity. Big Elk Creek, one of the hardest hit areas, overflowed its banks and closed Delaware Avenue, Howard Street, Appleton Road and Rickets Mill Road. Little Elk Creek flooded Newark Avenue. The Maudlin Avenue bridge on Northeast Creek was severely damaged by washout conditions. Basements along Main Street in Elkton were also flooded (Reference 12).

In July 1975, Hurricane Eloise reportedly caused $24 million in damage to the State of Maryland. Cecil County was among the 10 counties in the state listed as disaster areas which were eligible for federal relief. Tidal creeks, such as the Elk River, overflowed their banks and caused business and residential districts to be evacuated in Elkton and Rising Sun (Reference 12).

Tropical Storm David, in September 1979, caused water to inundate the C. W. Thorn, Jr. boatyard to within 1 foot of the 1954 level. Water covered the floor of the boat house and pier damage was experienced due to overtopping (Reference 1).

Cecil County experienced major flooding on September 16, 1999, due to heavy rain associated with Hurricane Floyd. Floyd started as a tropical depression on September 2, 1999, east of the Lesser Antilles but was upgraded to a tropical storm on September 8 and a hurricane by September 10. At its maximum intensity, Floyd was a Category 4 (Major) hurricane on the Saffir-Simpson Hurricane Scale. By the time Floyd made landfall in Cape Fear, North Carolina it had weakened to a Category 2 hurricane with maximum wind speeds of 104 mph. Flash flooding closed 62 roads, damaged 92 homes and 78 businesses, and caused 300 people to be evacuated. Storm totals included 9 inches of rain in the Town of North East and 6.57 inches at the Conowingo Dam. Damage in Cecil County reached $3 million (Reference 13).

On July 2, 2004, flash flooding occurred that was caused by a series of thunderstorms that passed through Cecil County. Five bridges were destroyed or closed and a total of $2 million in property damage was reported. Storm totals included 7.21 inches of rainfall in Elkton and 3.74 inches of rainfall in Conowingo (Reference 13).

Remnants of Hurricane Ivan caused an estimated $1 million in property damage on September 18, 2004. Storm totals included 4.25 inches of rainfall in Elkton (Reference 13).

In September 2011, Hurricane Irene hit the eastern coast and caused substantial damage. On September 16, 2011, President Barack Obama declared the entire eastern portion of the State of Maryland as a disaster area, which allowed residents affected by the hurricane to apply for federal aid.

In October 2012, Hurricane Sandy made landfall north of the State of Maryland, but caused substantial damage in Maryland. President Barack Obama declared the entire State of Maryland as a disaster area, which allowed residents affected by the hurricane to apply for federal aid.

2.4 Flood Protection Measures

At the present time, no major flood control structures exist in Cecil County. However, minor flood protection is afforded by stormwater management ponds and channelization projects (Reference 1). A small channelization project was completed on a tributary that drains the northernmost portion of the Town of Charlestown. Several channelization projects exist within the Town of Elkton which aid in the control of floodwaters during storms. For the Towns of Perryville and Port Deposit, a number of upstream dams contribute to the reduction of flood hazards from the Susquehanna River.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent-annual-chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 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 the peak discharge-frequency relationships for each flooding source studied in detail affecting Cecil County.

Information on the methods used to determine peak discharge-frequency relationships for the streams studied by detailed methods is shown below.

July 8, 2013 Initial Countywide Analyses

The previous FISs for Cecil County, Maryland included hydrologic analyses for the streams studied in detail. For all streams studied by detailed methods, except the Susquehanna River and Unnamed Tributary to Laurel Run, updated hydrologic data was produced as part of this study. The new hydrologic analysis calculated revised 10-, 2-, 1-and 0.2-percent-annual-chance flows, along with 1-percent-annual-chance future flows based on ultimate development conditions. For this FIS flows were also established for streams studied using approximate methods.

The MDE contracted Dr. Glenn Moglen of the Department of Civil and Environmental Engineering at the University of Maryland to perform the updated hydrologic calculations for this FIS (Reference 14).

The current regional regression equations being used by the Maryland State Highway Administration (SHA) were developed by Jonathan Dillow, a hydrologist for the USGS. Dillow defined regression equations for five hydrologic fixed regions: Appalachian Plateaus and Allegheny Ridges, Blue Ridge and Great Valley, Piedmont, Western Coastal Plain and Eastern Coastal Plain (Reference 15).

Dr. Moglen developed a new set of regression equations, called the fixed region regression equations, for the State of Maryland. The fixed region method used in his study is based on the predefined regions of Dillow since these regions are based on physiographic regions. Cecil County is located within the Eastern Coastal Plain, Western Coastal Plain, and Piedmont Regions.

Table 3, "Eastern Coastal Plain Fixed Region Regression Equations", are based on 15 stations in Maryland and 9 stations in Delaware with drainage area (DA) ranging from 2.27 to 112.20 square miles, basin relief (BR) ranging from 5.1 to 43.5 feet, and percent A soils (S_A) ranging from 0.0 to 49.4 percent.

Basin relief is not statistically significant for discharges less than the 20-percent-annual-chance event but is included in the equations for consistency. The standard errors range from 33.7 percent (0.142 log units) for $Q_{1.50}$ to 50.8 percent (0.208 log units) for Q_{500}.

Table 3. Eastern Coastal Plain Fixed Region Regression Equations

Eastern Coastal Plain Fixed Region Regression Equation	Standard error (percent)	Equivalent years of record
$Q_{1.25} = 19.85\ DA^{0.796}\ BR^{0.066}\ (S_A + 1)^{-0.106}$	34.2	4.5
$Q_{1.50} = 20.48\ DA^{0.795}\ BR^{0.156}\ (S_A + 1)^{-0.140}$	33.7	4.1
$Q_{1.75} = 20.81\ DA^{0.799}\ BR^{0.197}\ (S_A + 1)^{-0.146}$	34.2	4.1
$Q_{2} = 20.95\ DA^{0.803}\ BR^{0.222}\ (S_A + 1)^{-0.144}$	34.9	4.1
$Q_{5} = 25.82\ DA^{0.793}\ BR^{0.368}\ (S_A + 1)^{-0.190}$	36.9	6.8
$Q_{10} = 31.17\ DA^{0.777}\ BR^{0.439}\ (S_A + 1)^{-0.215}$	38.2	9.5
$Q_{25} = 40.26\ DA^{0.751}\ BR^{0.511}\ (S_A + 1)^{-0.242}$	40.0	13
$Q_{50} = 50.00\ DA^{0.732}\ BR^{0.549}\ (S_A + 1)^{-0.261}$	41.7	16
$Q_{100} = 63.44\ DA^{0.711}\ BR^{0.576}\ (S_A + 1)^{-0.279}$	44.0	18
$Q_{200} = 79.81\ DA^{0.689}\ BR^{0.601}\ (S_A + 1)^{-0.296}$	46.5	19
$Q_{500} = 108.7\ DA^{0.660}\ BR^{0.628}\ (S_A + 1)^{-0.316}$	50.8	21

Table 4, "Western Coastal Plain Fixed Region Regression Equations", are based on the following parameters. The drainage (DA) ranges from 0.10 to 349.50 square miles, the 1985 impervious area (IA) ranges from 0.0 to 36.8 percent, and percent D should (S_D) range from 2.5 to 26.4 percent. The standard errors range from 35.4 percent (0.149 log units) for Q_2 to 65.7 percent (0.260 log units) for Q_{100}.

Table 4. Western Coastal Plain Fixed Region Regression Equations

Western Coastal Plain Fixed Region Regression Equation	Standard error (percent)	Equivalent years of record
$Q_{1.25} = 18.62\ DA^{0.611}\ (IA+1)^{0.419}\ (S_D+1)^{0.165}$	38.9	3.2
$Q_{1.50} = 21.97\ DA^{0.612}\ (IA+1)^{0.399}\ (S_D+1)^{0.226}$	36.3	3.2
$Q_{1.75} = 24.42\ DA^{0.612}\ (IA+1)^{0.391}\ (S_D+1)^{0.246}$	35.6	3.4
$Q_2 = 26.32\ DA^{0.612}\ (IA+1)^{0.386}\ (S_D+1)^{0.256}$	35.4	3.7
$Q_5 = 42.64\ DA^{0.607}\ (IA+1)^{0.347}\ (S_D+1)^{0.340}$	36.3	6.8
$Q_{10} = 58.04\ DA^{0.603}\ (IA+1)^{0.323}\ (S_D+1)^{0.382}$	40.6	8.4
$Q_{25} = 86.25\ DA^{0.582}\ (IA+1)^{0.295}\ (S_D+1)^{0.421}$	48.9	9.3
$Q_{50} = 111.50\ DA^{0.584}\ (IA+1)^{0.270}\ (S_D+1)^{0.457}$	54.7	9.9
$Q_{100} = 143.56\ DA^{0.586}\ (IA+1)^{0.260}\ (S_D+1)^{0.469}$	65.7	9.0
$Q_{200} = 185.15\ DA^{0.580}\ (IA+1)^{0.243}\ (S_D+1)^{0.488}$	75.5	8.7
$Q_{500} = 256.02\ DA^{0.573}\ (IA+1)^{0.222}\ (S_D+1)^{0.510}$	89.8	8.3

The fixed region equations for the Piedmont Region are based on 34 rural stations and 16 urban stations in. Two sets of regression equations were developed for the rural and urban stations with urban stations having a 10 percent or greater impervious area and rural stations less than 10 percent. Across the two data sets, 9 stations were deleted as outliers: 01582510, 01583000, 01583495, 01583600, 01589000, 01589240, 01592000, 01650050, and 01650085. Therefore, 50 of the 59 stations in the Piedmont Region were used in developing the following two sets of equations. For rural equations, the drainage area (*DA*) ranges from 0.28 to 258.07 square miles and forest cover (*FOR*) ranges from 4.4 to 75.3 percent. For the urban equations, drainage area (*DA*) ranges from 0.39 to 102.05 square miles and impervious area (*IA*) ranges from 10.9 to 42.8 percent. Basin relief and channel slope are highly correlated with drainage area. Therefore, neither basin relief nor channel slope were used as significant parameters in this region.

Rural Equations

Standard errors range from 24.3 percent (0.104 log units for Q_{10} to 39.7 percent (0.166 log units) for Q_{500}.

Table 5. Piedmont Rural Fixed Region Regression Equations

Piedmont Fixed Region Regression Equations	Standard Error (Percent)	Equivalent Years of Record
$Q_{1.25} = 202.9\ DA^{0.682}\ (FOR+1)^{-0.222}$	39.0	3.3
$Q_{1.50} = 262.0\ DA^{0.683}\ (FOR+1)^{-0.217}$	33.8	3.8
$Q_{1.75} = 308.9\ DA_{0}^{.679}\ (FOR+1)^{-0.219}$	32.1	4.3
$Q_{2} = 349.0\ DA^{0.674}\ (FOR+1)^{-0.224}$	31.3	4.8
$Q_{5} = 673.8\ DA^{0.659}\ (FOR+1)^{-0.228}$	25.6	14
$Q_{10} = 992.6\ DA^{0.649}\ (FOR+1)^{-0.230}$	24.3	23
$Q_{25} = 1556\ DA^{0.635}\ (FOR+1)^{-0.231}$	25.3	33
$Q_{50} = 2146\ DA^{0.624}\ (FOR+1)^{-0.235}$	27.5	37
$Q_{100} = 2897\ DA^{0.613}\ (FOR+1)^{-0.238}$	30.6	37
$Q_{200} = 3847\ DA^{0.603}\ (FOR+1)^{-0.239}$	34.2	35
$Q_{500} = 5519\ DA^{0.589}\ (FOR+1)^{-0.242}$	39.7	35

Urban Equations

For the urban equations (10 percent or greater impervious area), the standard errors range from 26.0 percent (0.111 log units) for $Q25$ to 41.7 percent (0.174 log units) for $Q1.25$.

Table 6. Piedmont Urban Fixed Region Regression Equations

Piedmont Fixed Region Regression Equations	Standard Error (Percent)	Equivalent Years of Record
$Q_{1.25} = 17.85\ DA^{0.652}\ (IA+1)^{0.635}$	41.7	3.3
$Q_{1.50} = 24.66\ DA^{0.648}\ (IA+1)^{0.631}$	36.9	3.8
$Q_{1.75} = 30.82\ DA^{0.643}\ (IA+1)^{0.611}$	35.6	4.1
$Q_{2} = 37.01\ DA^{0.635}\ (IA+1)^{0.588}$	35.1	4.5
$Q_{5} = 94.76\ DA^{0.624}\ (IA+1)^{0.499}$	28.5	13
$Q_{10} = 169.2\ DA^{0.622}\ (IA+1)^{0.435}$	26.2	24
$Q_{25} = 341.0\ DA^{0.619}\ (IA+1)^{0.349}$	26.0	38
$Q_{50} = 562.4\ DA^{0.619}\ (IA+1)^{0.284}$	27.7	44
$Q_{100} = 898.3\ DA^{0.619}\ (IA+1)^{0.222}$	30.7	45
$Q_{200} = 1413\ DA^{0.621}\ (IA+1)^{0.160}$	34.8	44
$Q_{500} = 2529\ DA^{0.623}\ (IA+1)^{0.079}$	41.2	40

All calculations using the fixed region regression equations were preformed with GISHydro2000. GISHydro is a computer program used to assemble and evaluate hydrologic models for watershed analysis. Originally developed in the mid-1980s, the program combines a database of terrain, land use, and soils data with specialized geographical information system (GIS) tools for assembling data and extracting model parameters. The primary purpose of the GISHydro program is to assist engineers in performing watershed analyses in the State of Maryland. In the fall of 1997, a new collaborative project between the Department of Civil and

Environmental Engineering at the University of Maryland and the Maryland SHA began to update and enhance GISHydro into GISHydro2000.

It should also be emphasized that these regression equations, although not developed by the USGS, provide better standard error performance than the current USGS regression equations for Maryland and also apply not just to rural but to both rural and urban watershed conditions. These equations were endorsed for use in Maryland by the Maryland Hydrology Panel as documented in their report which can be obtained from the Maryland SHA or from the following URL (Reference 14):

http://www.gishydro.umd.edu/HydroPanel/panel_report_103106.pdf

Peak flows for the Susquehanna River were brought forward from the pre-countywide FIS. These calculations were provided by the SRBC. The flow values were extrapolated from discharge-frequency curves for stream gages in Harrisburg and Sunbury, Pennsylvania.

Peak flow data for the Unnamed Tributary to Laurel Run was taken from LOMR Case 06-03-B926P.

Peak discharge-drainage area relationships for the selected recurrence intervals are shown in Table 7, "Summary of Discharges".

Table 7. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cubic feet per second)				
		10-percent annual chance	2-percent annual chance	1-percent annual chance	1-percent annual chance future	0.2-percent annual chance
BIG ELK CREEK						
At Conrail Railroad Tracks	57.05	6,923	13,478	17,332	19,615	29,589
Approximately 1,900 feet downstream of Brewster Bridge Road	52.72	6,720	13,000	16,700	18,600	28,500
Approximately 400 feet upstream of Maryland/ Pennsylvania border	43.49	6,420	12,500	16,100	16,300	27,600
CHRISTINA RIVER						
Approximately 2,200 feet upstream of Maryland/ Delaware border	3.8	1,100	1,900	2,500	*	3,800
At Maryland/Pennsylvania border	1.6	660	1,050	1,280	*	1,850

Table 7. Summary of Discharges - continued

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cubic feet per second)				
		10-percent annual chance	2-percent annual chance	1-percent annual chance	1-percent annual chance future	0.2-percent annual chance
DOGWOOD RUN						
At mouth	1.63	405	1,022	1,442	1,527	3,010
Approximately 780 feet upstream of Dogwood Road	1.06	298	703	972	1,114	1,978
Approximately 120 feet upstream of Singerly Road	0.53	254	575	782	862	1,530
GRAVELLY RUN						
At confluence with Little Elk Creek	1.15	330	797	1,111	1,316	2,281
LAUREL RUN						
At confluence with Little Elk Creek	4.46	753	1,773	2,412	2,697	4,676
LITTLE ELK CREEK						
At mouth	42.09	5,022	10,446	13,605	16,415	23,854
At Leeds Road	24.96	4,020	7,890	10,200	10,600	17,800
Approximately 800 feet downstream of Blake Road	13.88	3,040	6,080	7,930	7,970	14,000
LITTLE NORTHEAST CREEK						
At Mechanics Valley Road	18.23	2,861	5,892	7,713	9,289	13,709
MILL CREEK						
Approximately 900 feet upstream of Broad Street	5.29	1,314	3,203	4,442	4,798	8,969
Approximately 1,200 feet downstream of Jackson Station Road	2.56	907	2,064	2,825	3,182	5,550
Approximately 300 feet upstream of Diamond Jim Road	1.14	645	1,390	1,850	2,010	3,440
NORTHEAST CREEK						
Approximately 1,000 feet downstream of State Highway 7	44.9	3,971	7,887	10,242	10,528	17,835
At Chessie System Railroad Bridge	25	466	987	1,320	1,910	2,470

Table 7. Summary of Discharges - continued

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cubic feet per second)				
		10-percent annual chance	2-percent annual chance	1-percent annual chance	1-percent annual chance future	0.2-percent annual chance
STONE RUN TRIBUTARY 1						
At East Main Street	1.41	689	1,460	1,950	2,370	3,640
STONE RUN TRIBUTARY 2						
At Main Street	1.52	625	1,440	1,990	2,280	3,970
SUSQUEHANNA RIVER						
At the confluence with Chesapeake Bay	27,500	460,000	680,000	780,000	*	1,200,000
UNNAMED TRIBUTARY TO LAUREL RUN						
At confluence with Laurel Run	*	74	140	176	*	284
WEST BRANCH CHRISTINA RIVER						
At Maryland/Delaware border	2.35	875	1,970	2,690	3,390	5,270
Brewster Bridge Road	1.25	515	1,090	1,450	2,080	2,710
At Jackson Hall School Road	0.42	251	544	735	1,050	1,410
WEST BRANCH LAUREL RUN						
At confluence with Laurel Run	2.05	316	772	1,071	1,072	2,151

* Data not available

May 4, 2015 Revised Countywide Analyses

No new hydrologic analyses were carried out for this May 4, 2015, revised countywide FIS.

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 for the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

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

July 8, 2013 Initial Countywide Analyses

Updated hydraulic analyses were prepared for all streams other than the Susquehanna River. For the updated analyses, a Digital Elevation Model (DEM), which is a 3-D model of the ground surface, was created from Light Detection and Ranging (LiDAR) data provided by the Maryland Department of Natural Resources (DNR). Cross sections for the hydraulic analyses were obtained from this DEM. For detailed study streams, below-water portions of the cross sections were either obtained from the previous FEMA hydraulic models, which in most cases were originally obtained by field survey, or estimated from the thalweg on the Flood Profile sheet in the July 8, 2013, initial countywide FIS. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

The previous FEMA hydraulic models contained surveyed structural geometry and measurements for bridges and culverts. In an effort to identify any bridges/culverts that had been modified or added since the previous studies had been conducted, MDE provided the USACE with a database of bridge/culvert measurements and photographs. Information from the database/field investigation was from compared to the data from the previous hydraulic models. If no difference existed, the surveyed elevations and measurements from the previous model were used. If a difference existed or the bridge/culvert was not included in the previous model, the measurement information from the database/field investigation was used, and structural elevations were based on the DEM.

Additional channel, bridge/culvert, and other hydraulic model input data was obtained from effective LOMRs.

Water-surface elevations for floods of the selected recurrence intervals were computed through use of the USACE's HEC-RAS (Version 4.0) step-backwater computer program (Reference 16).

Starting water-surface elevations were calculated using the slope-area method for detailed study streams. Where the detailed study began at an existing structure with known backwater effects, the headwater elevation for each frequency flood was acquired from the effective FIS and used as the starting water surface elevation in the hydraulic analysis.

Channel and overbank roughness factors (Manning's "n" values) used in the original hydraulic computations were chosen by engineering judgment and were based on field inspection, aerial photography, or stream photographs. The range of values used for Manning's "n" values in this study is shown in Table 8, "Manning's "n" Values."

Table 8. Manning's "n" Values

STREAM	CHANNEL "n"	OVERBANK "n"
Big Elk Creek	0.035-0.100	0.035-0.120
Christina River	0.030-0.045	0.070-0.120
Dogwood Run	0.040-0.100	0.060-0.100
Gravelly Run	0.040-0.045	0.100
Laurel Run	0.040	0.100
Little Elk Creek	0.035-0.110	0.040-0.120
Little Northeast Creek	0.040-0.045	0.100
Mill Creek	0.045-0.050	0.060-0.120
Northeast Creek	0.035-0.045	0.100-0.120
Stone Run Tributary 1	0.035	0.100
Stone Run Tributary 2	0.035	0.100
Susquehanna River	0.030	0.075
Unnamed Tributary to Laurel Run	0.040	0.100
West Branch Christina River	0.035	0.100-0.150
West Branch Laurel Run	0.040-0.045	0.070-0.100

The hydraulic analysis for the Susquehanna River was brought forward from the pre-countywide FISs. Water surface elevations of floods of selected recurrence intervals were computed using the USACE HEC-2 step backwater program. Cross sections for the flooding sources were obtained by field surveys. All hydraulic structures were surveyed to obtain elevation data and structural geometry. For this study, the computed water surface elevations were converted to the North American Vertical Datum of 1988 (NAVD88).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. The Susquehanna River was studied using effective hydraulics from the 1980 State of Maryland study (Reference 14).

May 4, 2015 Countywide Revision

No new hydraulic analyses were carried out for this May 4, 2015, revised countywide FIS.

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

Bench marks cataloged 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 well (e.g., mounted in bedrock)

- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutments)

- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete mounted 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 bench marks, 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 bench marks 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, 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 purposes of establishing local vertical control. Although these monuments are not shown on the digital FIRM, they may be found in the Technical Support Data Notebook (TSDN) associated with this FIS and FIRM. Interested individuals may contact FEMA to access this data.

3.3 Coastal Analyses

Coastal analyses considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods for the selected recurrence intervals along the shoreline. Users of the FIRM should be aware that coastal flood elevations are provided in Table 9, “Summary of Stillwater Elevations”, in this report. If the elevation on the FIRM is higher than the elevation shown in this table, a wave height, wave runup, and/or wave setup component likely exists, in which case, the higher elevation should be used for construction and/or floodplain management purposes.

Residential development encompasses much of the shoreline within Cecil County with the exception of a few commercial areas and large waterfront parks. Shorelines vary from low marshes, in the northern part of the county, to steep cliffs between 40 and 100 feet NAVD88 in height. Behind the shoreline, the ground slopes gently upward into open woodlands or agricultural areas.

An analysis was performed to establish the frequency peak elevation relationships for coastal flooding in Cecil County. The FEMA Region III office, initiated a study in 2008 to update the coastal storm surge elevations within the states of Virginia, Maryland, and Delaware, and the District of Columbia including the Atlantic Ocean, Chesapeake Bay including its tributaries, and the Delaware Bay. The study replaces outdated coastal storm surge stillwater elevations for all FISs in the study area, including Cecil County, and serves as the basis for updated FIRMs. Study efforts were concluded in 2012.

The storm surge study was conducted for FEMA by the USACE and its project partners under Project HSFE03-06-X-0023, “NFIP Coastal Storm Surge Model for Region III” and Project HSFE03-09-X-1108, “Phase II Coastal Storm Surge Model for FEMA Region III.” The USACE and project partners assisted FEMA in the development and application of a state-of-the-art storm surge risk assessment capability for the FEMA Region III domain which includes the Delaware Bay, Chesapeake Bay, District of Columbia, Delaware-Maryland-Virginia Eastern Shore, and Virginia. The work was performed by the Coastal Processes Branch (HF-C) of the Flood and Storm Protection Division (HF), U.S. Army Engineer Research and Development Center – Coastal & Hydraulics Laboratory (ERDC-CHL) (Reference 17).

The end-to-end storm surge modeling system includes the Advanced Circulation Model for Oceanic, Coastal and Estuarine Waters (ADCIRC) (Reference 18) for simulation of 2-dimensional hydrodynamics. ADCIRC was dynamically coupled to the unstructured numerical wave model Simulating WAves Nearshore (unSWAN) to calculate the contribution of waves to total storm surge. The resulting model system is typically referred to as SWAN+ADCIRC. A seamless modeling grid was developed to support the storm surge modeling efforts. The modeling system validation consisted of a comprehensive tidal calibration followed by a validation using carefully reconstructed wind and pressure fields from three major flood events for the Region III domain: Hurricane Isabel, Hurricane Ernesto, and Extratropical Storm Ida. Model skill was accessed by quantitative comparison of model output to wind, wave, water level and high water mark observations.

The tidal surge for those estuarine areas affected by Chesapeake Bay affect the entire shoreline within Cecil County. The entire open coastline, from the Susquehanna River to the Sassafras River, is more prone to damaging wave action during high wind events due to the significant fetch over which winds can operate. Inland, from the mouths of these rivers, as well as the Northeast River, Elk River, and Bohemia River, river widths narrow considerably as they converge with non-tidal tributaries. In these areas, the fetch over which winds can operate for wave generation is significantly less.

The storm-surge elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods were determined for the flooding sources shown in Table 9, "Summary of Stillwater Elevations." The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects.

Table 9. Summary of Stillwater Elevations

	ELEVATION (feet - NAVD88)			
FLOODING SOURCE AND LOCATION	10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
CHESAPEAKE BAY				
At the mouth of the Sassafras River	4.8	6.0	6.5	7.5
At Perry Point	5.3	6.7	7.3	8.7
NORTHEAST RIVER				
At the Town of Charleston	5.3	7.1	8.0	9.7
At the Town of North East	5.4	7.2	8.1	10.0
ELK RIVER				
At Turkey Point	4.9	6.3	6.9	7.9
At Scotland Point	5.3	7.1	7.9	9.5
BOHEMIA RIVER				
At Town Point	5.1	6.6	7.3	8.8
BACK CREEK				
At Randall Point	5.1	6.3	6.9	8.1
PEARCE CREEK				
At 1,000 feet upstream of the confluence with the Elk River	*	*	10.4	*

*Data not available

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (NAS) (Reference 19). This method is based on three major concepts. First, depth-limited waves in shallow water reach maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in the NAS report. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed across transects that were located along coastal areas of Cecil County, as illustrated on the FIRM. Transects are located with consideration given to existing transect locations and to the physical and cultural characteristics of the land so that they would closely represent conditions in the locality.

Each transect was taken perpendicular to the shoreline and extended inland to a point where coastal flooding ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for a 1-percent-annual-chance event were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the Zone VE (area with velocity wave action) was computed at each transect. Along the open coast, the Zone VE designation applies to all areas seaward of the landward toe of the primary frontal dune system. The primary frontal due is defined as the point where the ground profile changes from relatively steep to relatively mild.

Due to the developed nature, dune erosion was not taken into account along the Chesapeake Bay coastline. A review of the geology and shoreline type in Cecil County was made to determine the applicability of standard erosion methods, and FEMA's standard erosion methodology for coastal areas having primary frontal dunes, referred to as the "540 rule," was used (Reference 20). This methodology first evaluates the dune's cross-sectional profile to determine whether the dune has a reservoir of material that is greater or less than 540 square feet. If the reservoir is greater than 540 square feet, the "retreat" erosion method is employed and approximately 540 square feet of the dune is eroded using a standardized eroded profile, as specified in FEMA guidelines. If the reservoir is less than 540 square feet, the "remove" erosion method is employed where the dune is removed for subsequent analysis, again using a standard eroded profile. The storm surge study provided the return period stillwater elevations required for erosion analyses. Each cross-shore transect was analyzed for erosion, when applicable.

Wave height calculations used in this study follow the methodologies described in the FEMA guidance for coastal mapping (Reference 20). Wave setup results in an increased water level at the shoreline due to the breaking of waves and transfer of momentum to the water column during hurricanes and severe storms. For the Cecil County study, wave setup was determined directly from the coupled wave and storm surge model. The total stillwater elevation (SWEL) with wave setup was then used for simulations of inland wave propagation conducted using FEMA's Wave Height Analysis for Flood Insurance Studies (WHAFIS) model Version 4.0 (Reference 21). WHAFIS is a one-dimensional model that was applied to each transect in the study area. The model uses the specified SWEL, the computed wave setup, and the starting wave conditions as input. Simulations of wave transformations were then conducted with WHAFIS taking into account the storm-induced erosion and overland features of each transect. Output from the model includes the combined SWEL and wave height along each cross-shore transect allowing for the establishment of base flood elevations (BFEs) and flood zones from the shoreline to points inland within the study area.

Wave runup is defined as the maximum vertical extent of wave uprush on a beach or structure. FEMA's 2007 Guidelines and Specifications require the 2-percent wave runup level be computed for the coastal feature being evaluated (cliff, coastal bluff, dune, or structure) (Reference 20). The 2-percent runup level is the highest 2 percent of wave runup affecting the shoreline during the 1-percent-annual-chance flood event. Each transect defined within the Region III study area was evaluated for the applicability of wave runup, and if necessary, the appropriate runup methodology was selected and applied to each transect. Runup elevations were then compared to WHAFIS results to determine the dominant process affecting BFEs and associated flood hazard levels. Based on wave runup rates, wave overtopping was computed following the FEMA 2007 Guidelines and Specifications.

Computed controlling wave heights at the shoreline range from 1.5 feet at the western end of the county where the fetch is short to 4.0 feet at the eastern end where the fetch is longer. The corresponding wave elevation at the shoreline varies from 8.0 feet NAVD88 at the northern end to 11.2 feet NAVD88 at the southern end. Vertical reinforced coastlines serve to reduce wave height z.

Between transects, elevations were interpolated using topographic maps, land-use and land cover data, and engineering judgment to determine the aerial extent of flooding. The results of the calculations are accurate until local topography, vegetation, or cultural development within the community experience major changes. Table 10, "Transect Data", provides the 10-, 2-, 1- and 0.2-percent-annual-chance stillwater elevations and the starting wave conditions for each transect. Figure 1, "Transect Location Map", provides an illustration of the transect locations for Cecil County.

TABLE 10 – TRANSECT DATA								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD88)			
Flood Source	Transect	Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Sassafras River	1	N 39.381865, W -75.953822	1.7	2.6	4.9	6.2	6.8	8.2
Sassafras River	2	N 39.379484, W -75.975447	1.7	2.6	4.9	6.2	6.7	8.1
Sassafras River	3	N 39.385125, W -76.001981	2.2	2.9	4.9	6.0	6.1	7.9
Sassafras River	4	N 39.385602, W -76.030537	2.4	3.0	4.9	6.0	6.5	7.5
Sassafras River	5	N 39.386458, W -76.036770	2.4	3.0	4.8	6.0	6.5	7.5
Chesapeake Bay	6	N 39.397974, W -76.038764	2.6	3.2	4.9	6.0	6.6	7.6
Chesapeake Bay	7	N 39.405248, W -76.026288	2.1	2.8	4.9	6.1	6.7	7.8
Chesapeake Bay	8	N 39.416870, W -76.004718	2.3	2.9	4.9	6.2	6.8	8.2
Elk River	9	N 39.432640, W -75.99189	2.3	3.0	5.0	6.3	6.9	8.3
Elk River	10	N 39.438204, W -75.980027	2.1	2.9	5.0	6.3	7.0	8.4
Elk River	11	N 39.447173, W -75.976602	2.1	2.9	5.0	6.4	6.9	8.5
Elk River	12	N 39.456133, W -75.972070	2.2	3.2	5.0	6.4	7.0	8.5
Elk River	13	N 39.468939, W -75.949720	2.4	3.3	5.1	6.5	7.1	8.7
Elk River	14	N 39.472710, W -75.934461	2.0	2.8	5.1	6.5	7.2	8.7

TABLE 10 – TRANSECT DATA (continued)								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD88)			
Flood Source	Transect	Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Bohemia River	16	N 39.470480, W -75.889233	1.4	2.3	5.1	6.7	7.4	8.9
Bohemia River	17	N 39.466245, W -75.880825	2.3	2.3	5.1	6.7	7.4	9.0
Bohemia River	18	N 39.467587, W -75.869088	1.5	2.4	5.1	6.7	7.4	9.0
Bohemia River	19	N 39.483187, W -75.887999	1.7	2.6	5.1	6.7	7.4	9.0
Bohemia River	20	N 39.486442, W -75.904742	2.0	2.8	5.1	6.7	7.4	9.0
Bohemia River	21	N 39.486261, W -75.923875	2.2	2.9	5.1	6.6	7.3	8.8
Elk River	22	N 39.499696, W -75.917979	2.0	3.1	5.1	6.6	7.3	8.8
Elk River	23	N 39.503443, W -75.908231	1.7	2.5	5.2	6.6	7.3	8.8
Elk River	24	N 39.504349, W -75.901880	1.7	2.5	5.2	6.6	7.3	8.8
Elk River	25	N 39.510847, W -75.884242	1.3	2.4	5.2	6.7	7.3	8.9
Elk River	26	N 39.513088, W -75.875431	1.6	2.5	5.2	6.7	7.4	8.9
Elk River	27	N 39.520099, W -75.904742	1.6	2.4	5.2	6.7	7.4	8.9
Elk River	28	N 39.526404, W -75.880579	2.0	2.7	5.2	6.7	7.4	9.0
Elk River	29	N 39.539840, W -75.861975	1.5	2.5	5.3	6.9	7.6	9.2

TABLE 10 – TRANSECT DATA (continued)								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD88)			
Flood Source	Transect	Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Elk River	30	N 39.552841, W -75.857109	1.7	2.7	5.3	6.9	7.7	9.3
Elk River	31	N 39.562977, W -75.848071	1.5	2.6	5.3	7.0	7.8	9.4
Elk River	32	N 39.576489, W -75.848706	1.5	2.6	5.3	7.1	7.9	9.5
Elk River	33	N 39.560330, W -75.859463	1.7	2.8	5.3	7.0	7.8	9.4
Elk River	34	N 39.552841, W -75.870652	1.8	2.7	5.3	6.9	7.7	9.3
Elk River	35	N 39.535717, W -75.885562	1.7	2.7	5.2	6.8	7.5	9.0
Elk River	36	N 39.519174, W -75.895840	1.6	2.5	5.2	6.6	7.3	8.9
Piney Creek Cove	37	N 39.516169, W -75.908411	2.0	2.7	5.2	6.7	7.4	8.9
Piney Creek Cove	38	N 39.515495, W -75.931160	1.7	2.7	5.2	6.7	7.3	8.9
Elk River	39	N 39.498931, W -75.941623	2.5	3.0	5.1	6.6	7.3	8.8
Elk River	40	N 39.481119, W -75.964711	2.4	3.2	5.0	6.5	7.1	8.6
Elk River	41	N 39.470344, W -75.985266	2.1	3.1	5.0	6.4	7.0	8.6
Elk River	42	N 39.457877, W -75.994398	2.6	3.4	5.0	6.4	6.9	8.4
Chesapeake Bay	43	N 39.445441, W -76.012081	3.8	3.8	5.0	6.3	6.9	8.2

TABLE 10 – TRANSECT DATA (continued)								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD88)			
Flood Source	Transect	Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Chesapeake Bay	44	N 39.466144, W -75.997956	2.4	3.5	5.0	6.5	7.1	8.6
Chesapeake Bay	45	N 39.480732, W -75.994926	2.8	3.6	5.1	6.5	7.2	8.7
Chesapeake Bay	46	N 39.495871, W -75.988667	3.0	3.7	5.1	6.7	7.4	8.9
Chesapeake Bay	47	N 39.518753, W -75.980632	2.5	3.4	5.2	6.8	7.6	9.2
Chesapeake Bay	48	N 39.523786, W -75.980360	2.5	3.5	5.2	6.9	7.6	9.2
Northeast River	49	N 39.532424 W -75.964570	1.1	3.4	5.3	7.0	7.8	9.4
Northeast River	50	N 39.541144, W -75.968966	2.3	3.1	5.3	7.0	7.8	9.4
Northeast River	51	N 39.545873, W -75.966688	2.5	3.9	5.3	7.0	7.8	9.5
Northeast River	52	N 39.557674, W -75.969987	2.7	3.8	5.3	7.1	7.9	9.6
Northeast River	53	N 39.569306, W -75.956092	1.9	3.5	5.4	7.1	8.0	9.8
Northeast River	54	N 39.576317, W -75.953554	1.7	3.3	5.4	7.2	8.1	9.9
Northeast River	55	N 39.588628, W -75.948690	1.9	3.0	5.4	7.2	8.1	9.9
Northeast River	56	N 39.593709, W -75.948661	1.8	3.0	5.4	7.2	8.1	10.0
Northeast River	57	N 39.577681, W -75.966267	2.0	3.2	5.4	7.1	8.0	9.8

TABLE 10 – TRANSECT DATA (continued)								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD88)			
Flood Source	Transect	Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Northeast River	58	N 39.571520, W -75.977220	2.4	3.6	5.3	7.1	8.0	9.7
Northeast River	59	N 39.568509, W -75.982813	2.4	3.7	5.3	7.1	7.9	9.7
Northeast River	60	N 39.563297, W -75.993061	2.6	3.5	5.3	7.0	7.8	9.5
Northeast River	61	N 39.556663, W -76.002517	2.5	3.2	5.3	7.0	7.8	9.4
Northeast River	62	N 39.548180, W -76.007078	2.3	3.9	5.3	6.9	7.7	9.3
Chesapeake Bay	63	N 39.539220, W -76.011047	3.4	3.9	5.3	6.8	7.6	9.1
Chesapeake Bay	64	N 39.546546, W -76.047514	3.7	3.9	5.3	6.7	7.4	8.6
Chesapeake Bay	65	N 39.546596, W -76.062877	3.8	3.9	5.3	6.7	7.3	8.6
Susquehanna River	66	N 39.555163, W -76.077387	3.2	3.9	5.3	6.7	7.3	8.7
Susquehanna River	67	N 39.603334, W -76.115835	2.5	3.3	5.4	6.7	7.3	8.8

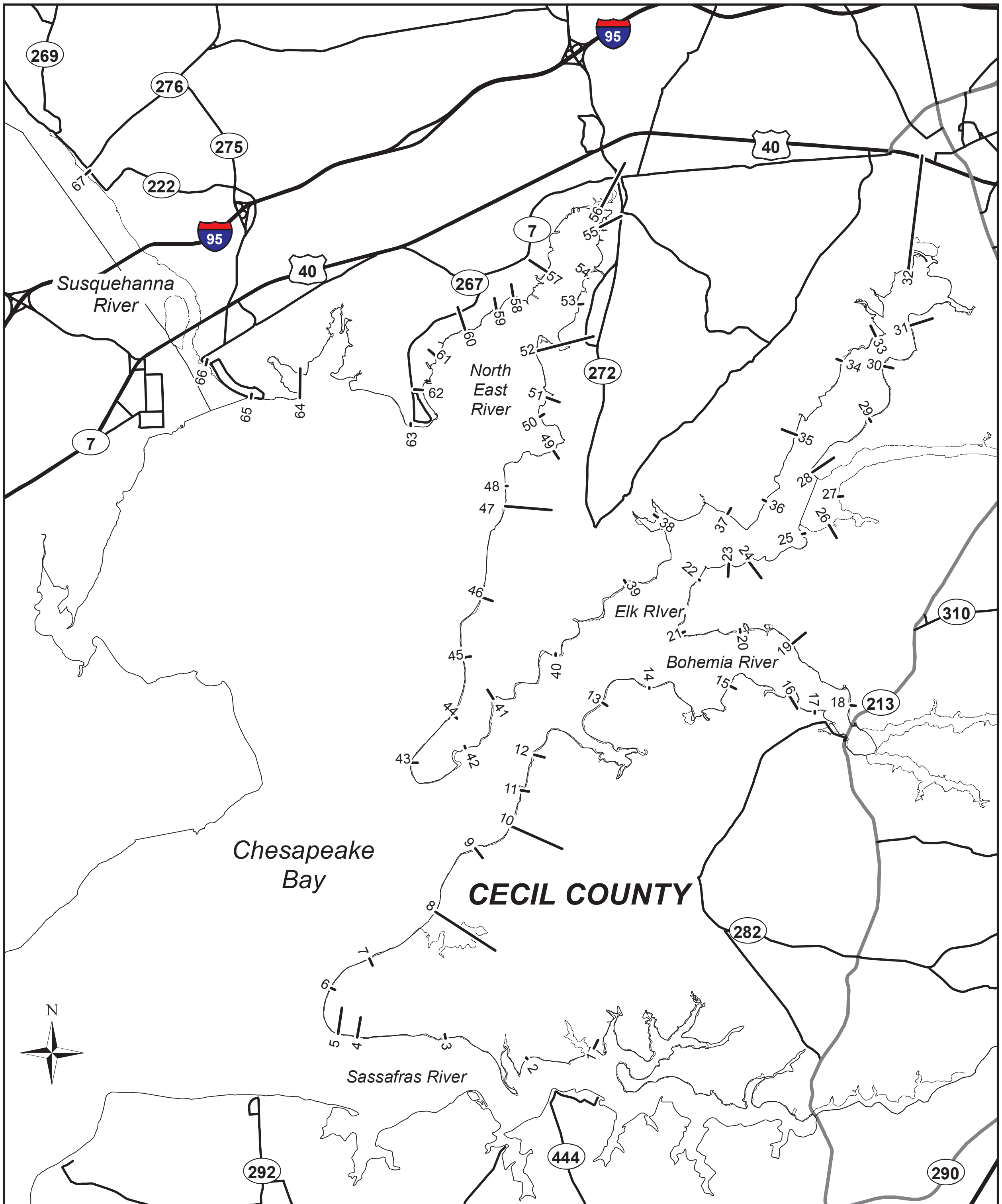

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MARYLAND AND INCORPORATED AREAS

0 0.75 1.5 3 4.5 6 Miles

TRANSECT LOCATION MAP

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The USACE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 22). The 3-foot wave has been determined the minimum size wave capable of causing major damage to conventional wood frame of brick veneer structures. The one exception to the 3-foot wave criteria is where a primary frontal dune exists. The limit of the coastal high hazard area then becomes the landward toe of the primary frontal dune or where a 3-foot or greater breaking wave exists, whichever is most landward. The coastal high hazard zone is depicted on the FIRM as Zone VE, where the delineated flood hazard includes wave heights equal to or greater than 3 feet. Zone AE is depicted on the FIRM where the delineated flood hazard includes wave heights less than 3 feet. A depiction of how the Zones VE and AE are mapped is shown in Figure 2, "Typical Transect Schematic".

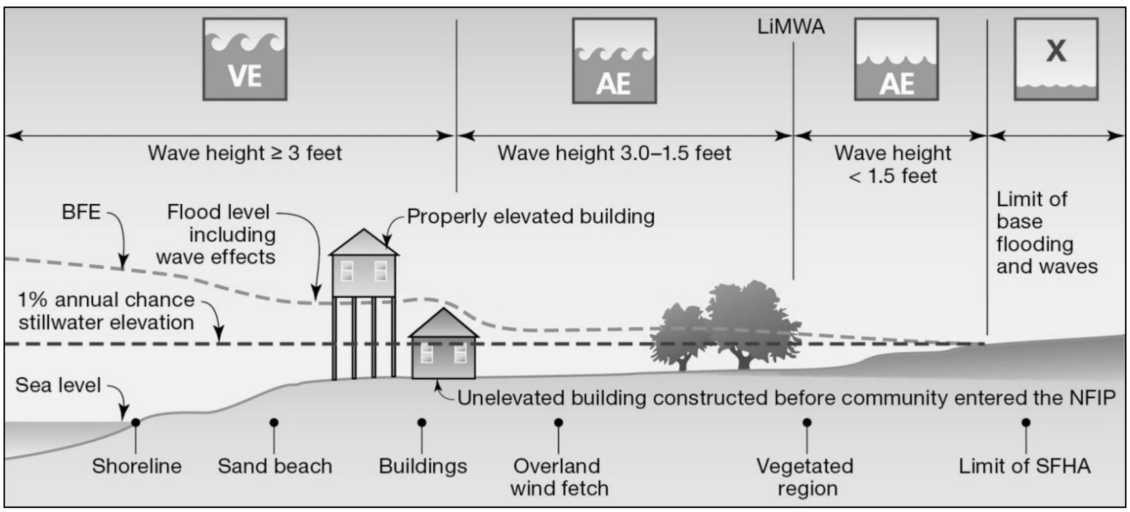

Figure 2 – Typical Transect Schematic

Post-storm field visits and laboratory tests have confirmed that wave heights as small as 1.5 feet can cause significant damage to structures that are constructed without consideration to the coastal hazards. Additional flood hazards associated with coastal waves include floating debris, high velocity flow, erosion, and scour which can cause damage to Zone AE-type construction in these coastal areas. To help community officials and property owners recognize this increased potential for damage due to wave action in the AE zone, FEMA issued guidance in December 2008 on identifying and mapping the 1.5-foot wave height line, referred to as the Limit of Moderate Wave Action (LiMWA). While FEMA does not impose floodplain management requirements based on the LiMWA, the LiMWA is provided to help communicate the higher risk that exists in that area. Consequently, it is important to be aware of the area between this inland limit and the Zone VE boundary as it still poses a high risk, though not as high of a risk as Zone VE (see Figure 2).

3.4 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of NAVD88, many FIS reports and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in BFEs across the corporate limits between the communities. The vertical datum conversion factor from NGVD29 to NAVD88 for Cecil County is –0.83 feet. Therefore, users that wish to convert the elevations in this FIS to NGVD29 should apply the stated conversion factor to elevations shown in this FIS report, which are shown at a minimum to the nearest 0.1 foot.

NGVD29 – 0.83 = NAVD88

For more information on NAVD88, see FEMA publication entitled, Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the NGS online (http://www.ngs.noaa.gov) or at the following address:

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

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 information, 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 table. 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 (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, 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 the DEM discussed in Section 3.2.

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

Floodplain boundaries for the Susquehanna River downstream of the Conowingo Dam were delineated based on the effective hydraulic model produced by the study referenced in Section 1.2. The effective flood elevations from this model were converted to NAVD88 and used to identify floodplain boundaries based on the DEM referenced in Section 3.2. Floodplain boundaries for the Susquehanna River upstream of the Conowingo Dam were digitized and brought forward from the effective study.

For all other streams included in this report, the floodplain boundaries have been delineated based on a comparison of the flood elevations calculated at each cross section to the DEM. Between cross sections the boundaries were interpolated.

4.2 Floodways

Encroachment of floodplains, such as structures and fill, reduces the flood carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this 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 (Table 11, “Floodway Data”). The computed floodways are shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or colinear, only the floodway boundary is shown.

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 11, “Floodway Data”, for certain downstream cross sections of Big Elk Creek, Dogwood Run, Gravelly Run, Little Elk Creek, Little Northeast Creek, Mill Creek, and the Susquehanna River 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 11, “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.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplains will not cause more than a 1.0-foot increase in the BFEs at any point within the community

The area between the floodway and the 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe thus encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent-annual-chance flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 3, “Floodway Schematic”.

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Big Elk Creek								
A	3744 [1]	1,079	7,398	2.4	7.9	9.4 [2]	10.3	0.9
B	4739 [1]	330	3,282	5.4	12.1	12.1	12.9	0.8
C	5455 [1]	651	4,047	4.4	13.2	13.2	13.8	0.6
D	6133 [1]	1,051	7,227	2.5	13.8	13.8	14.8	1.0
E	6818 [1]	1,044	11,028	1.6	14.3	14.3	15.3	1.0
F	9158 [1]	2,042	19,087	0.9	14.6	14.6	15.6	1.0
G	11264 [1]	1,070	9,627	1.8	14.7	14.7	15.7	1.0
H	12131 [1]	814	6,373	2.8	15.1	15.1	16.1	1.0
I	13563 [1]	1,457	9,915	1.8	15.9	15.9	16.8	0.9
J	14638 [1]	635	6,865	2.6	19.5	19.5	20.5	1.0
K	15642 [1]	758	4,863	3.6	20.4	20.4	21.3	0.9
L	17426 [1]	776	5,494	3.2	24.0	24.0	24.9	0.9
M	19008 [1]	266	3,045	5.7	30.4	30.4	30.6	0.2
N	19470 [1]	862	7,872	2.2	31.6	31.6	31.8	0.2
O	20116 [1]	1,230	10,279	1.7	31.7	31.7	32.1	0.4
P	20555 [1]	1,221	10,407	1.7	31.7	31.7	32.2	0.5
Q	20845 [1]	1,065	8,502	2.0	31.8	31.8	32.3	0.5
R	21194 [1]	473	2,875	6.0	32.1	32.1	32.1	0.0
S	21427 [1]	160	1,879	9.2	34.0	34.0	34.1	0.1

[1]Stream distance in feet above confluence with Elk River

[2]Elevation computed without consideration of backwater effects

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

BIG ELK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Big Elk Creek (Continued)								
T	23465 [1]	320	3,082	5.6	37.9	37.9	38.9	1.0
U	25233 [1]	667	4,242	4.0	40.6	40.7	41.6	0.9
V	25303 [1]	490	4,086	4.1	41.3	41.3	42.1	0.8
W	29196 [1]	406	3,236	5.2	48.4	48.4	49.3	0.9
X	30744 [1]	528	2,580	6.5	51.8	51.8	52.7	0.9
Y	32664 [1]	263	3,108	5.4	61.3	61.3	61.3	0.0
Z	34539 [1]	637	2,246	7.5	62.7	62.7	63.7	1.0
AA	34893 [1]	239	2,346	7.2	66.2	66.2	66.3	0.1
Christina River								
A	275 [2]	77	314	8.0	160.6	160.6	161.5	0.9
B	2939 [2]	68	355	6.4	180.0	180.0	180.4	0.4
C	4383 [2]	58	205	10.4	192.9	192.9	193.6	0.7
D	6728 [2]	115	429	4.7	209.7	209.7	210.6	0.9
E	9120 [2]	61	201	8.7	223.0	223.0	223.0	0.0
F	11192 [2]	53	260	6.2	236.7	236.7	237.7	1.0
G	12988 [2]	78	302	5.0	246.8	246.8	247.5	0.7
H	14428 [2]	140	323	4.4	258.1	258.1	258.3	0.2

[1] Stream distance in feet above confluence with Elk River

[2] Stream Distance in feet above Maryland/Delaware border

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

BIG ELK CREEK - CHRISTINA RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Dogwood Run								
A	186 [1]	32	170	8.5	21.7	14.4 [2]	14.8	0.4
B	1384 [1]	26	135	8.0	26.9	26.9	27.9	1.0
Gravelly Run								
A	767 [1]	100	210	4.8	49.4	48.9 [2]	49.9	1.0
B	1960 [1]	50	172	5.9	57.6	57.6	58.3	0.7
Laurel Run								
A	1306 [1]	130	320	7.5	40.7	40.7	41.3	0.6
B	2584 [1]	96	367	5.8	47.0	47.0	47.6	0.6
C	3788 [1]	180	732	2.9	52.3	52.3	52.8	0.5
D	4464 [1]	48	306	6.9	55.2	55.2	56.0	0.8
E	5448 [1]	116	608	3.5	59.2	59.2	60.0	0.8

[1]Stream distance in feet above confluence with Little Elk Creek

[2]Elevation computed without consideration of backwater effects

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

DOGWOOD RUN - GRAVELLY RUN - LAUREL RUN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Little Elk Creek								
A	1274 [1]	1,269	6,570	2.1	9.0	4.7 [2]	5.6	0.9
B	2319 [1]	964	5,859	2.3	9.0	6.8 [2]	7.3	0.5
C	2854 [1]	781	4,659	2.9	9.0	7.1 [2]	7.5	0.4
D	5962 [1]	1,300	8,420	1.6	8.3	8.3 [2]	9.1	0.8
E	7472 [1]	1,382	8,507	1.5	8.6	8.6 [2]	9.6	1.0
F	8245 [1]	1,495	8,531	1.5	8.9	8.9 [2]	9.9	1.0
G	9514 [1]	317	3,150	4.0	14.0	14.0	14.0	0.0
H	10159 [1]	451	4,553	2.7	15.0	15.0	15.0	0.0
I	11657 [1]	418	3,992	3.1	16.2	16.2	16.6	0.4
J	12966 [1]	532	3,849	3.3	19.0	19.0	20.0	1.0
K	14047 [1]	610	4,097	3.0	20.6	20.6	21.4	0.8
L	24875 [1]	505	2,422	4.8	38.7	38.7	39.7	1.0
M	27348 [1]	360	1,872	5.2	46.2	46.2	46.6	0.4
N	28976 [1]	600	3,369	3.3	49.3	49.3	50.1	0.8
O	30000 [1]	610	3,339	3.1	52.7	52.7	53.5	0.8
P	31069 [1]	435	2,029	5.2	58.0	58.0	59.0	1.0

[1]Stream distance in feet above confluence with Elk River

[2]Flooding controlled by Elk River / Chesapeake Bay

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD
AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE ELK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Little Northeast Creek								
A	527 [1]	97	877	8.9	37.4	35.8 [3]	36.6	0.8
B	753 [1]	100	1,042	7.5	37.9	37.9	38.3	0.4
C	2,260 [1]	130	1,092	7.1	41.1	41.1	41.9	0.8
D	3,939 [1]	277	1,193	6.5	49.7	49.7	49.8	0.1
E	4,034 [1]	300	1,889	4.1	53.1	53.1	53.4	0.3
F	5,760 [1]	342	1,074	6.8	57.3	57.3	57.7	0.4
G	7,013 [1]	600	2,046	3.6	65.7	65.7	65.8	0.1
H	8,563 [1]	109	701	10.0	73.7	73.7	74.4	0.7
I	9,253 [1]	121	708	10.0	79.1	79.1	79.1	0.0
Mill Creek								
A	2,349 [2]	220	680	6.9	21.3	21.3	21.7	0.4
B	2,584 [2]	292	1,136	4.1	23.8	23.8	24.8	1.0
C	2,660 [2]	310	1,475	3.2	25.8	25.8	26.7	0.9
D	3,132 [2]	113	411	11.4	29.1	29.1	29.3	0.2
E	3,710 [2]	450	1,593	2.9	35.5	35.5	36.5	1.0
F	4,078 [2]	56	1,949	5.3	44.9	44.9	44.9	0.0
G	4,920 [2]	200	922	4.8	45.9	45.9	46.1	0.2
H	5,144 [2]	245	1,252	3.6	46.7	46.7	47.5	0.8
I	6,301 [2]	270	789	3.2	51.3	51.3	52.0	0.7

[1]Stream distance in feet above confluence with Northeast Creek
[2]Stream distance in feet above confluence with Chesapeake Bay
[3]Elevation computed without consideration of backwater effects

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE NORTHEAST CREEK-MILL CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mill Creek (Continued)								
J	7,468	275	741	4.6	60.6	60.6	61.4	0.9
K	8,349	480	1,670	1.8	69.2	69.2	70.2	1.0
L	9,288	200	540	6.3	75.5	75.5	75.9	0.4
M	10,126	450	1,277	2.7	82.8	82.8	83.4	0.6
N	11,567	56	273	12.5	97.3	97.3	97.3	0.0
O	11,767	68	780	4.8	105.5.	105.5.	105.5	0.0
P	12,126	310	2,295	1.5	107.1	107.1	107.1	0.0
Q	13,540	290	600	5.7	117.0	117.0	117.0	0.0
R	14,704	100	394	8.2	131.5	131.5	131.9	0.4
S	15,687	85	386	8.3	144.3	144.3	144.9	0.6
T	16,746	85	424	6.7	156.8	156.8	157.8	1.0

[1]Stream distance in feet above confluence with Chesapeake Bay

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

MILL CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mill Creek (Continued)								
U	16856 [1]	145	743	3.8	162.9	162.9	163.8	0.9
V	17117 [1]	68	268	10.6	164.0	164.0	164.2	0.2
W	17386 [1]	205	1,937	1.5	175.2	175.2	176.0	0.8
X	17579 [1]	70	365	7.7	175.3	175.3	175.6	0.3
Y	18962 [1]	98	468	6.0	189.3	189.3	190.3	1.0
Z	20578 [1]	94	256	9.3	216.1	216.1	216.6	0.5
AA	20648 [1]	120	489	4.9	220.2	220.2	221.1	0.9
AB	21204 [1]	33	176	13.6	232.5	232.5	232.5	0.0
AC	21255 [1]	49	344	7.0	235.6	235.6	236.2	0.6
AD	21347 [1]	41	190	12.6	237.6	237.6	237.6	0.0
AE	21755 [1]	45	544	5.5	267.2	267.2	267.2	0.0
AF	22325 [1]	95	289	8.3	278.0	278.0	278.6	0.6
AG	22785 [1]	180	387	6.2	284.5	284.5	285.0	0.5
Northeast Creek								
A	1531 [2]	285	1,844	7.7	13.1	13.1	14.1	1.0
B	1684 [2]	290	2,475	5.7	15.4	15.4	16.1	0.7
C	1855 [2]	315	3,578	3.9	17.6	17.6	18.6	1.0
D	3698 [2]	130	1,415	9.9	19.0	19.0	19.8	0.8
E	3753 [2]	125	1,431	9.8	20.8	20.8	21.2	0.4

[1]Stream distance in feet above confluence with Chesapeake Bay

[2]Stream distance in feet above State Route 7

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

MILL CREEK-NORTHEAST CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Northeast Creek (Continued)								
F	4315 [1]	230	2,289	6.1	22.8	22.8	23.1	0.3
G	4569 [1]	157	1,431	9.8	23.3	23.3	23.5	0.2
H	4741 [1]	207	1,987	7.1	35.2	35.2	35.2	0.0
I	6127 [1]	805	5,933	2.4	37.4	37.4	37.4	0.0
J	6919 [1]	162	1,925	8.7	37.2	37.2	37.4	0.2
K	7162 [1]	151	2,839	7.1	40.3	40.3	40.3	0.0
L	8566 [1]	110	901	11.4	48.9	48.9	49.0	0.1
M	9726 [1]	87	674	15.2	63.2	63.2	63.3	0.1
N	10099 [1]	54	558	18.4	72.4	72.4	72.4	0.0
Stone Run Tributary 1								
A	897 [2]	140	488	6.7	276.2	276.2	276.6	0.4
B	1912 [2]	50	319	10.0	282.6	282.6	283.4	0.8
C	3874 [2]	114	417	7.7	293.4	293.4	293.6	0.2
D	3998 [2]	155	1,874	1.7	303.0	303.0	303.0	0.0
E	4419 [2]	175	1,122	2.9	303.0	303.0	303.1	0.1
F	4515 [2]	175	996	3.2	302.9	302.9	303.4	0.5
G	4783 [2]	125	703	4.6	303.0	303.0	303.5	0.5
H	4912 [2]	90	361	8.9	306.7	306.7	307.5	0.8

[1]Stream distance in feet above State Route 7

[2]Stream distance in feet above confluence with Stone Run

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

NORTHEAST CREEK- STONE RUN TRIBUTARY 1

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Stone Run Tributary 1 (Continued)								
I	6310 [1]	190	806	2.8	315.1	315.1	315.8	0.7
J	9641 [1]	125	496	3.9	339.4	339.4	340.4	1.0
K	10805 [1]	22	73	10.3	359.0	359.0	359.1	0.1
Stone Run Tributary 2								
A	632.4494 [1]	100	297	6.7	277.6	277.6	278.1	0.5
B	943.5313 [1]	87	530	3.75	282.8	282.8	283.7	0.9
C	2002.508 [1]	80	258	7.72	295.0	295.0	295.2	0.2
D	3031.687 [1]	75	277	7.19	305.4	305.4	305.5	0.1
Susquehanna River								
A	10286 [2]	5,010	114,491	6.8	9.0	7.6 [3]	8.2	0.6
B	14236 [2]	4,200	109,192	7.1	9.0	8.8 [3]	9.3	0.5
C	17498 [2]	4,555	126,224	6.2	11.0	9.8 [3]	10.2	0.4
D	21411 [2]	4,563	116,906	6.7	10.0	10.5 [3]	10.9	0.4
E	25463 [2]	3,979	73,360	10.2	12.0	11.6 [3]	11.9	0.3
F	27483 [2]	4,255	84,157	9.2	13.4	13.4	13.6	0.2

[1]Stream distance in feet above confluence with Stone Run

[2]Stream distance in feet above confluence with Chesapeake Bay

[3]Flooding controlled by Chesapeake Bay

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

STONE RUN TRIBUTARY 1 - STONE RUN TRIBUTARY 2 SUSQUEHANNA RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Susquehanna River (Continued)								
G	28315 [1]	4,355	106,594	7.3	14.3	14.3	14.5	0.2
H	30550 [1]	4,011	82,982	9.4	14.9	14.9	15.1	0.2
I	32950 [1]	3,291	65,008	12.0	16.4	16.4	16.5	0.1
J	34210 [1]	3,132	51,834	15.0	17.3	17.3	17.4	0.1
K	36180 [1]	3,146	67,286	11.6	21.4	21.4	21.7	0.3
L	37900 [1]	3,011	69,511	11.2	23.1	23.1	23.3	0.2
M	40910 [1]	3,066	75,340	10.3	25.5	25.5	25.7	0.2
N	43170 [1]	2,613	65,522	11.9	26.7	26.7	26.9	0.2
O	47480 [1]	2,528	65,980	11.8	29.4	29.4	29.5	0.1
P	49125 [1]	2,597	61,994	12.6	33.6	33.6	33.7	0.1
Q	49845 [1]	3,226	88,884	8.8	36.8	36.8	37.1	0.3
Unnamed Tributary to Laurel Run								
A	480 [2]	18	40	4.35	41.8	41.8	41.9	0.1
B	1019 [2]	17	30	5.83	47.2	47.2	47.3	0.1
C	1407 [2]	21	34	5.1	52.1	52.1	52.2	0.1

[1]Stream distance in feet above confluence with Chesapeake Bay

[2]Stream Distance in feet above confluence with Laurel Run

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

SUSQUEHANNA RIVER- UNNAMED TRIBUTARY TO LAUREL RUN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
West Branch Christina River								
A	388[1]	135	520	5.0	106.7	106.7	106.9	0.2
B	1667[1]	85	400	6.5	110.7	110.7	111.7	1.0
C	3399[1]	81	323	5.3	117.0	117.0	118.0	1.0
D	4317[1]	195	634	2.7	121.7	121.7	122.6	0.9
E	5791[1]	110	484	3.5	128.3	128.3	128.5	0.2
F	5884[1]	210	510	3.3	127.8	127.8	128.7	0.9
G	6604[1]	120	418	4.1	130.0	130.0	130.9	0.9
H	7609[1]	85	275	6.2	134.0	134.0	134.9	0.9
I	8705[1]	60	206	7.03	138.4	138.4	139.4	1.0
J	9942[1]	63	292	4.97	144.9	144.9	145.9	1.0
K	10341[1]	270	1,071	1.35	149.3	149.3	149.4	0.1
L	10684[1]	320	633	2.29	149.5	149.5	149.6	0.1
M	11185[1]	255	1,019	1.42	152.8	152.8	152.8	0.0
N	12261[1]	35	183	7.92	155.1	155.1	155.5	0.4
O	13077[1]	76	458	2.88	158.1	158.1	159.1	1.0
P	13561[1]	36	180	6.63	158.4	158.4	159.2	0.8
Q	13933[1]	35	160	7.43	160.0	160.0	160.8	0.8
R	14714[1]	43	199	5.99	162.5	162.5	163.5	1.0
S	16094[1]	54	218	5.45	166.7	166.7	167.2	0.5

[1] Stream distance in feet above Maryland/Delaware border

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

WEST BRANCH CHRISTINA RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
West Branch Christina River (Continued)								
T	16521[1]	33	170	7.0	169.1	169.1	170.0	0.9
U	17067[1]	43	178	5.2	171.4	171.4	172.2	0.8
V	18155[1]	65	193	3.8	179.2	179.2	179.9	0.7
W	19531[1]	123	186	3.9	189.2	189.2	189.6	0.4
X	19815[1]	35	114	6.5	192.9	192.9	193.6	0.7
West Branch Laurel Run								
A	513[2]	40	163	5.4	63.9	63.9	64.9	1.0
B	1821[2]	35	154	5.7	69.0	69.0	69.7	0.7
C	2764[2]	40	199	4.4	74.3	74.3	75.2	0.9

[1] Stream distance in feet above Maryland/Delaware border

[2] Stream distance in feet above confluence with Laurel Run

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD AND INCORPORATED AREAS

FLOODWAY DATA

WEST BRANCH CHRISTINA RIVER
WEST BRANCH LAUREL RUN

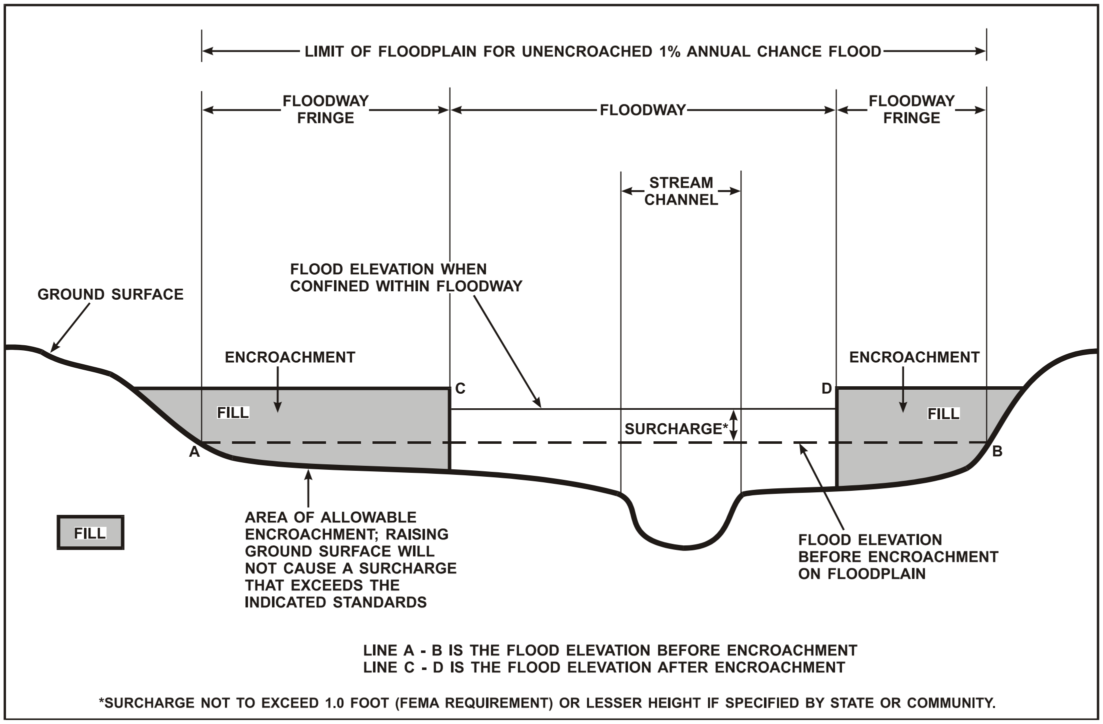

Figure 3 – Floodway Schematic

5.0 INSURANCE APPLICATIONS

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

Zone A:

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

Zone AE:

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

Zone AH:

Zone AH is the flood insurance risk zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO:

Zone AO is the flood insurance risk zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR:

Zone AR is the flood insurance risk zone that corresponds to an area of special flood hazard formerly protected from the 1-percent-annual-chance flood event by a flood-control system that was subsequently decertified. Zone AR indicates that the former flood-control system is being restored to provide protection from the 1-percent-annual-chance or greater flood event.

Zone A99:

Zone A99 is the flood insurance risk zone that corresponds to areas of the 1-percent-annual-chance floodplain that will be protected by a federal flood protection system where construction has reached specified statutory milestones. No BFEs or depths are shown within this zone.

Zone V:

Zone V is the flood insurance risk zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs are shown within this zone.

Zone VE:

Zone VE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X:

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

6.0 FLOOD INSURANCE RATE MAP

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

For flood insurance applications, the map designates flood insurance risk 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 the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

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

The current FIRM presents flooding information for the entire geographic area of Cecil County. Historical data relating to the maps prepared for each community, prior to the July 8, 2013, initial countywide FIS, are presented in Table 12, "Community Map History".

7.0 OTHER STUDIES

This FIS report either supersedes or is compatible with all previous studies on flooding sources and should be considered authoritative for purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Flood Insurance and Mitigation Division, Federal Emergency Management Agency, One Independence Mall, Sixth Floor, 615 Chestnut Street, Philadelphia, PA 19106-4404.

COMMUNITY NAME	INITIAL IDENTIFICATION DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Cecil County (Unincorporated Areas)	July 18, 1975	None	April 4, 1983	September 5, 1984 December 4, 1986 January 3, 1997
Cecilton, Town of [1,2]	N/A	N/A	N/A	
Charlestown, Town of	September 20, 1974	December 19, 1975	November 17, 1982	
Chesapeake City, Town of	September 13, 1974	February 20, 1976	October 15, 1981	
Elkton, Town of	February 15, 1974	December 19, 1975	March 18, 1980	June 16, 1992
North East, Town of	February 7, 1975	None	October 15, 1981	
Perryville, Town of	March 8, 1974	None	March 1, 1977	March 5, 1990 September 30, 1992
Port Deposit, Town of	August 9, 1974	None	August 16, 1976	February 16, 1977
Rising Sun, Town of	January 14, 1977	None	May 15, 1986	

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

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

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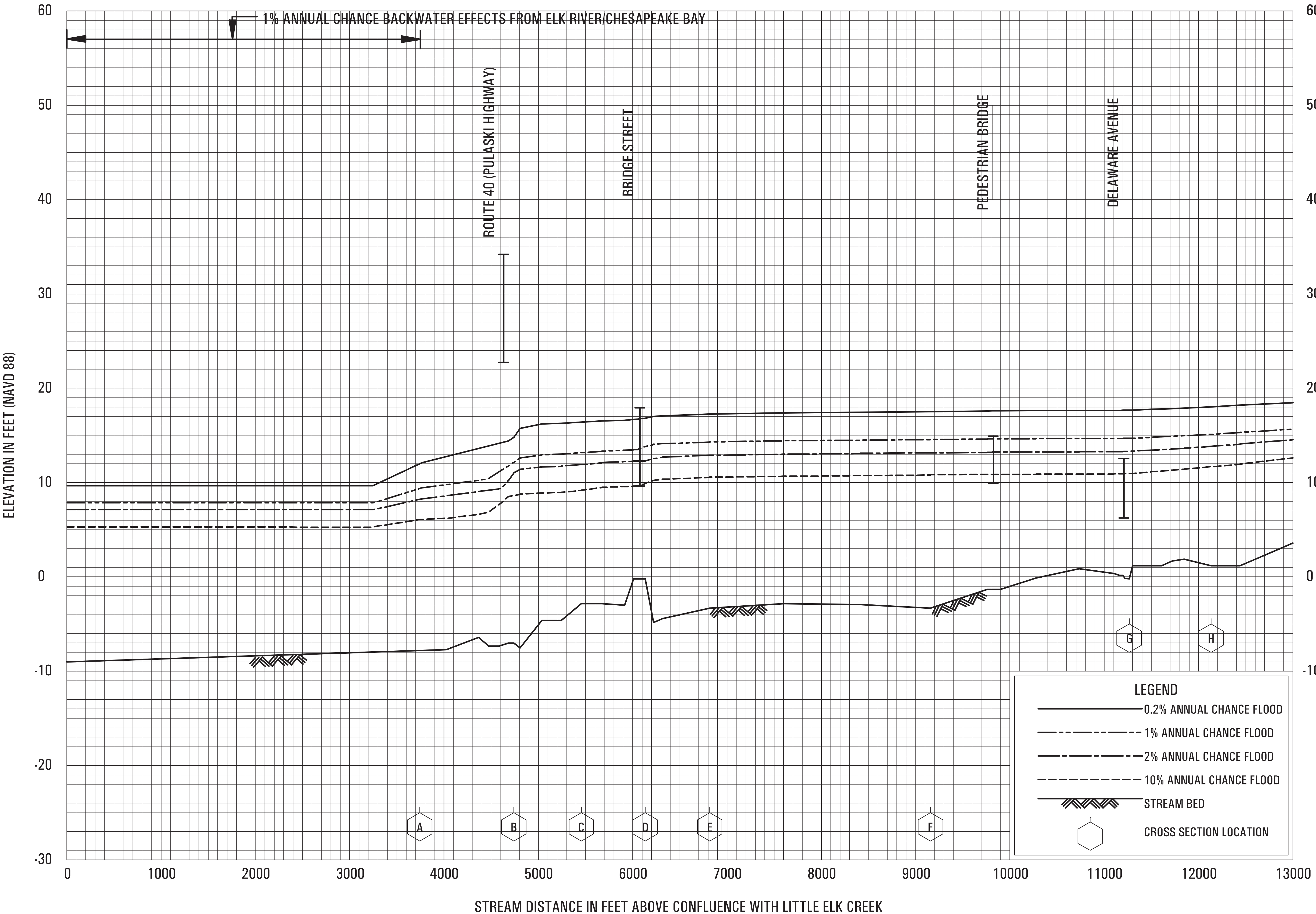


FLOOD PROFILES

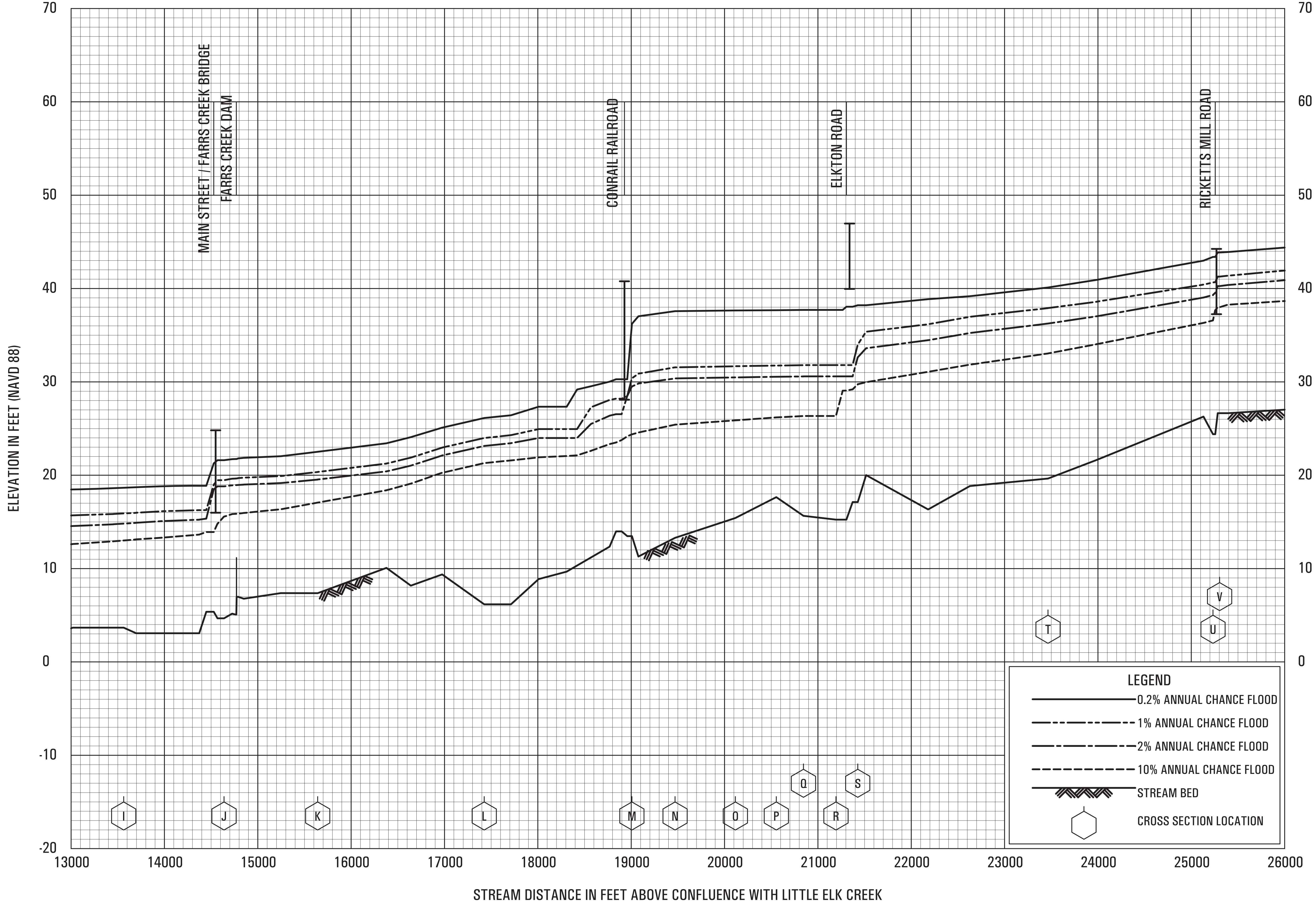
BIG ELK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

01P



FLOOD PROFILES

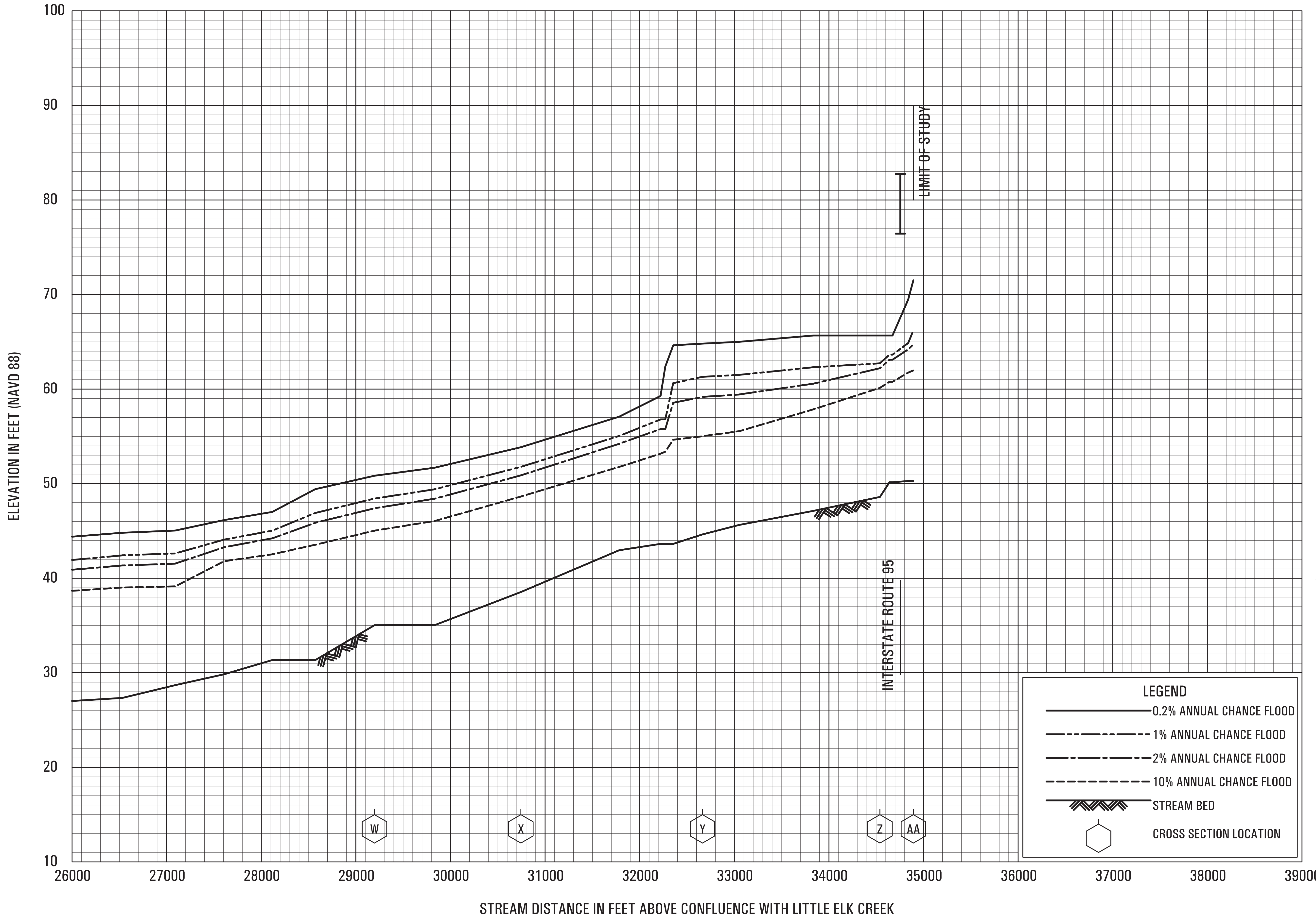
BIG ELK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

02P



FLOOD PROFILES

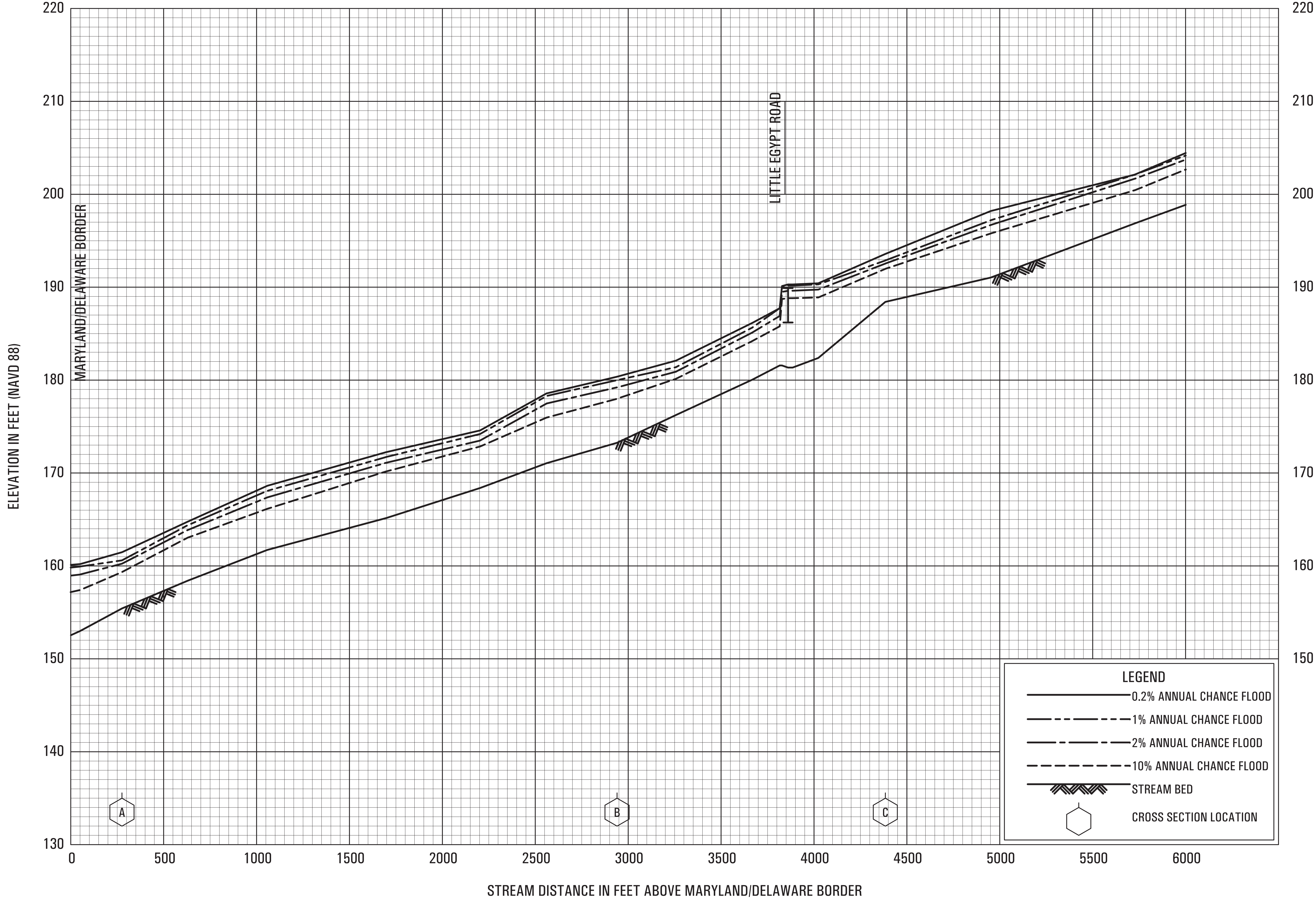
BIG ELK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

03P



FLOOD PROFILES

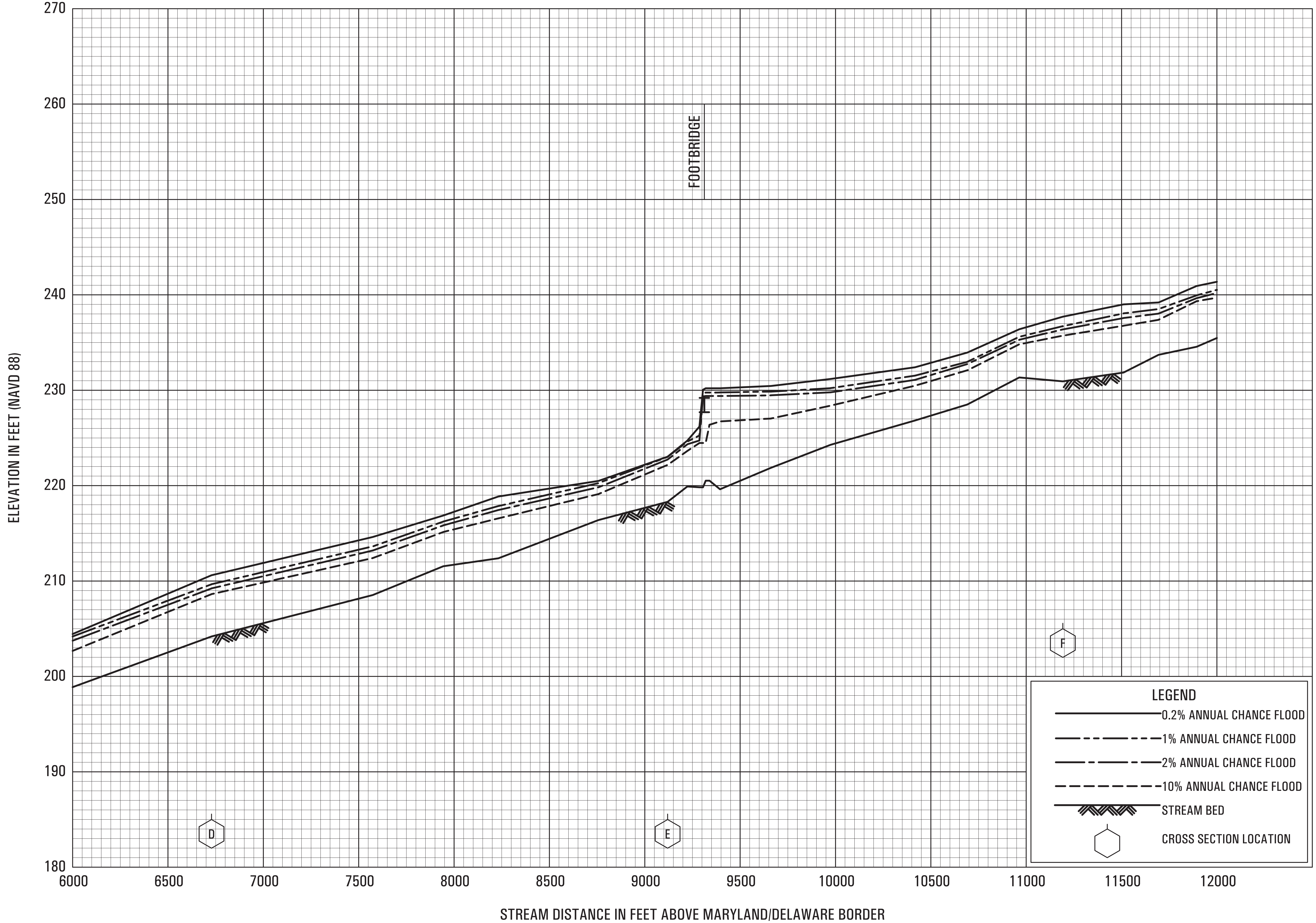
CHRISTINA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

04P



FLOOD PROFILES

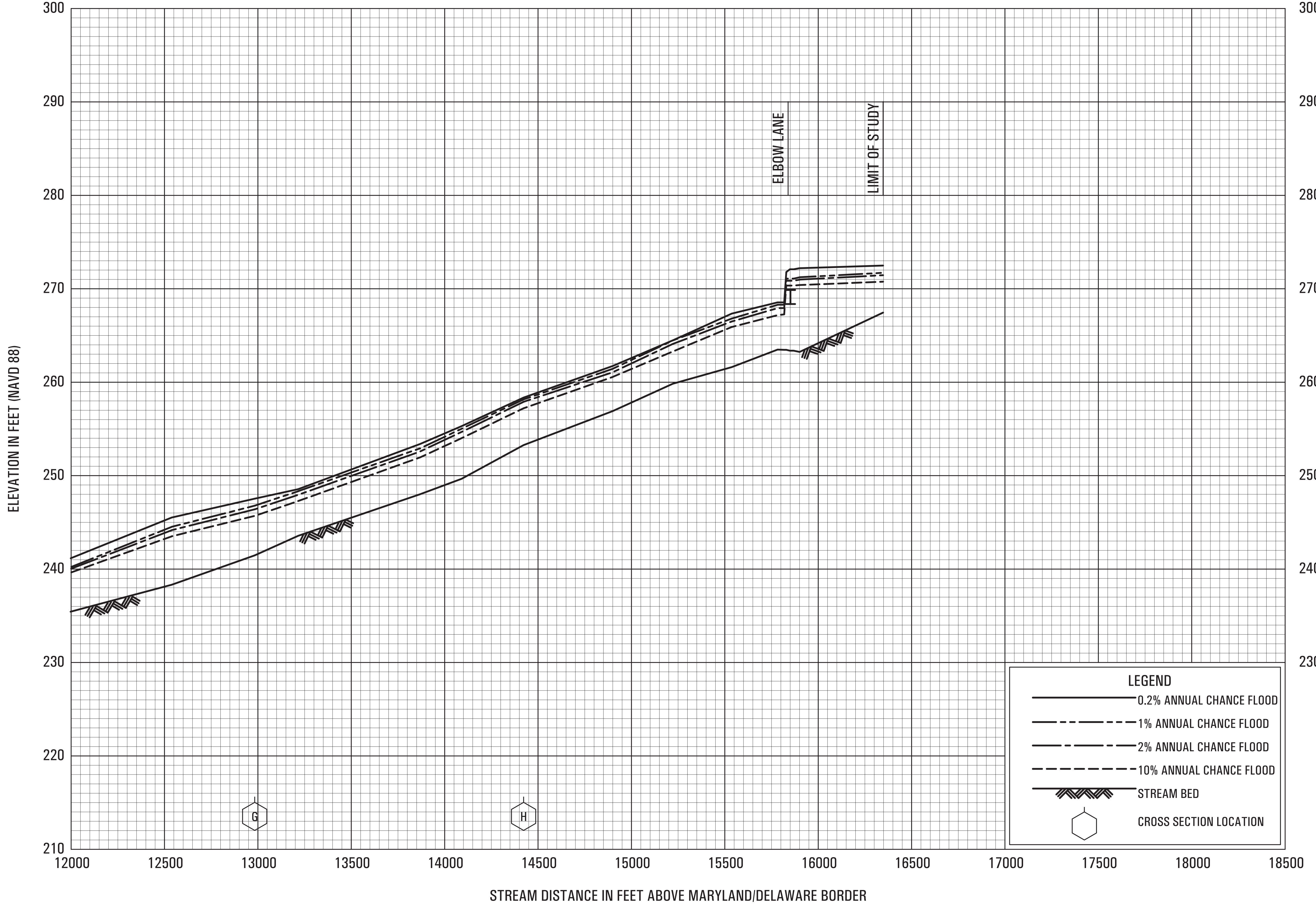
CHRISTINA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

05P



FLOOD PROFILES

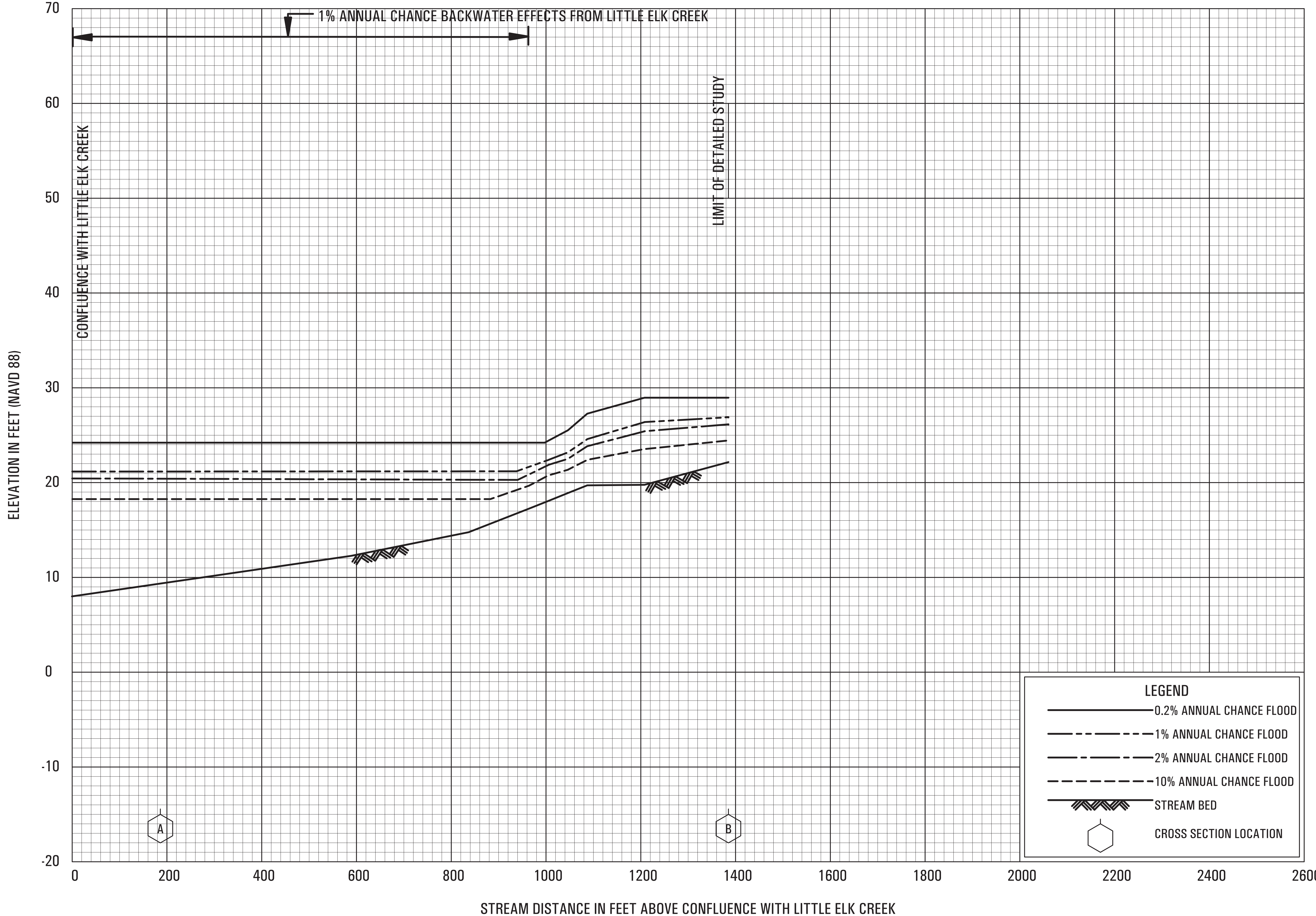
CHRISTINA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

06P



FLOOD PROFILES

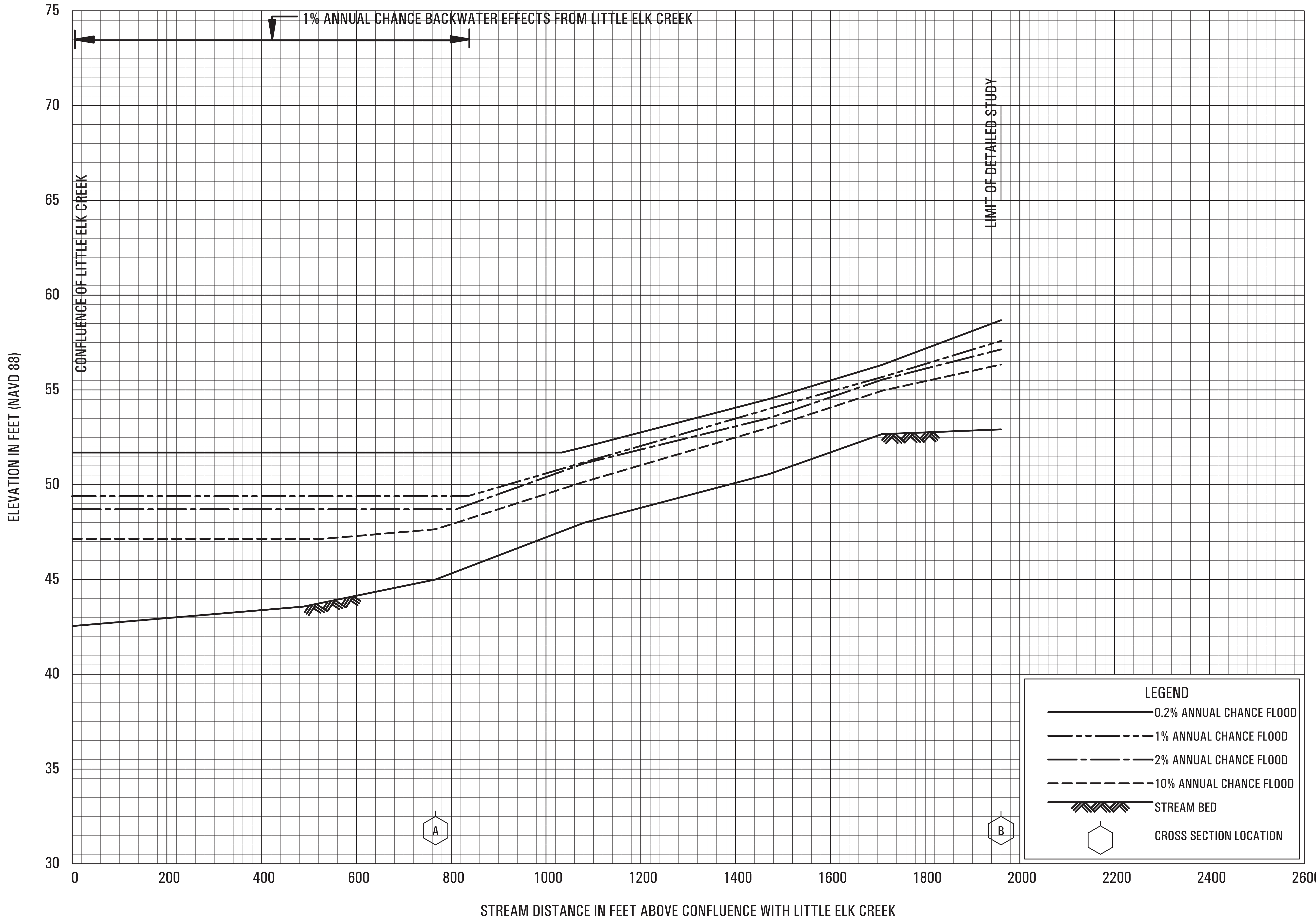
DOGWOOD RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATD AREAS

07P



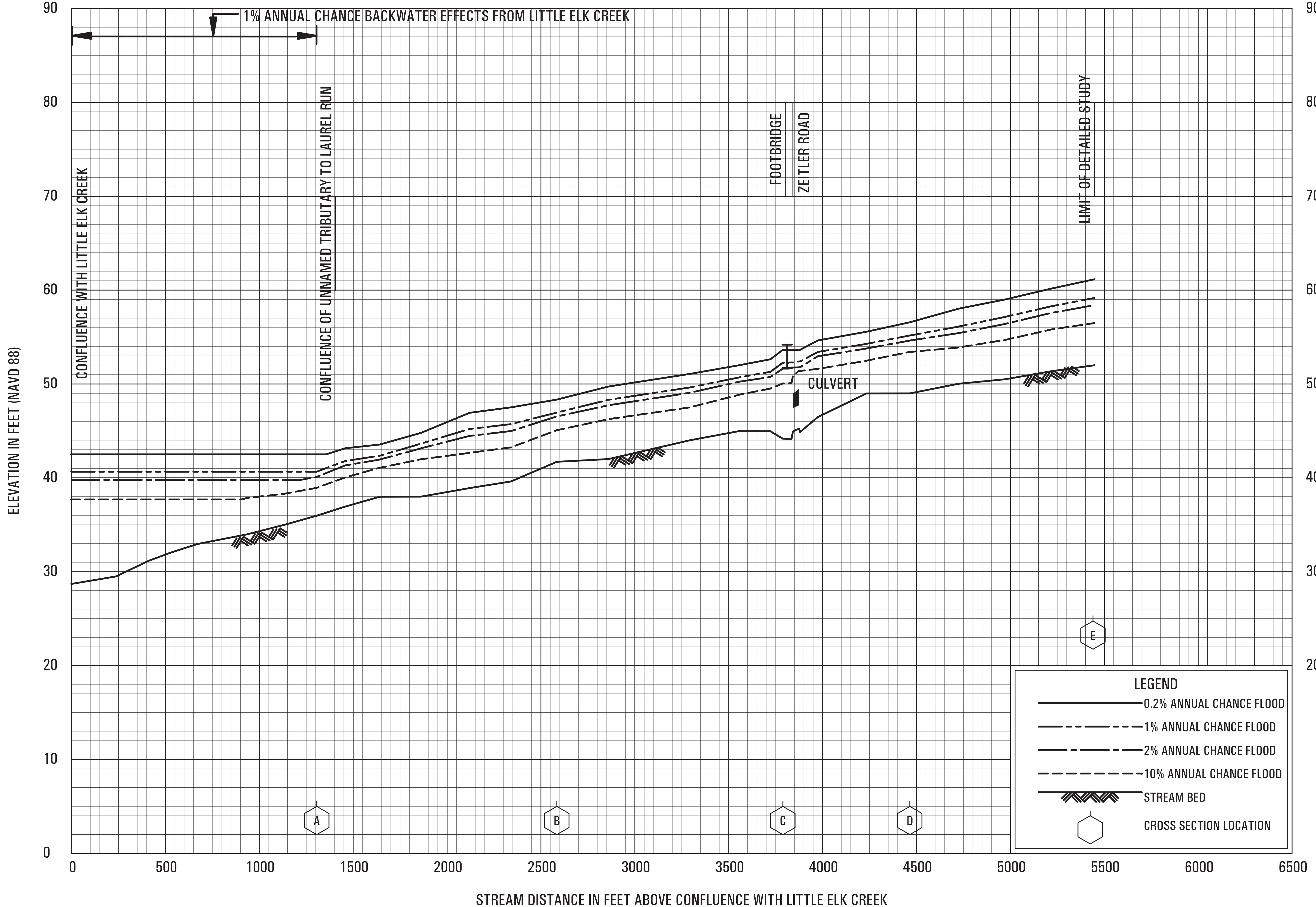
FLOOD PROFILES

GRAVELLY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



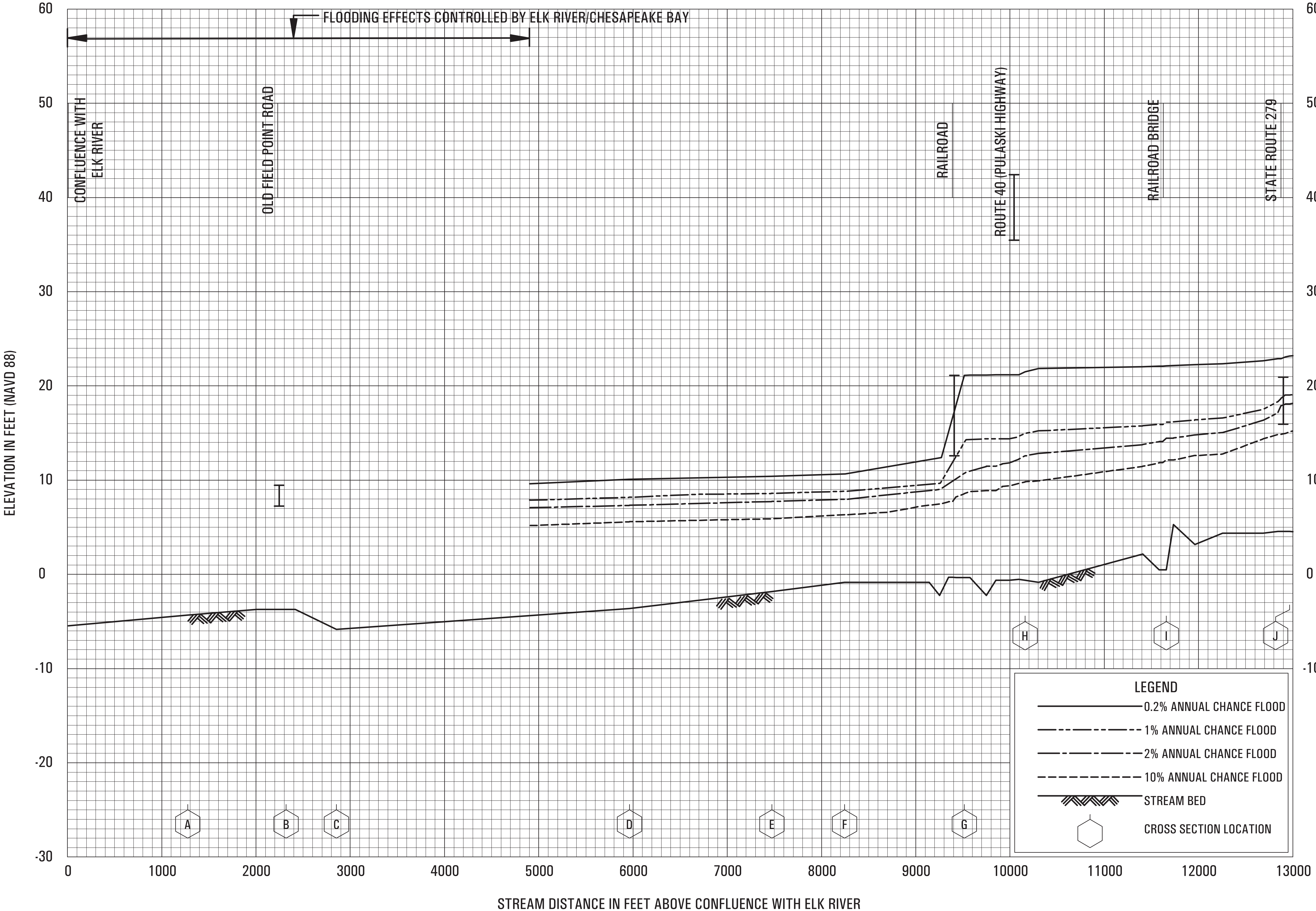
FLOOD PROFILES

LAUREL RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD
AND INCORPORATED AREAS

09P



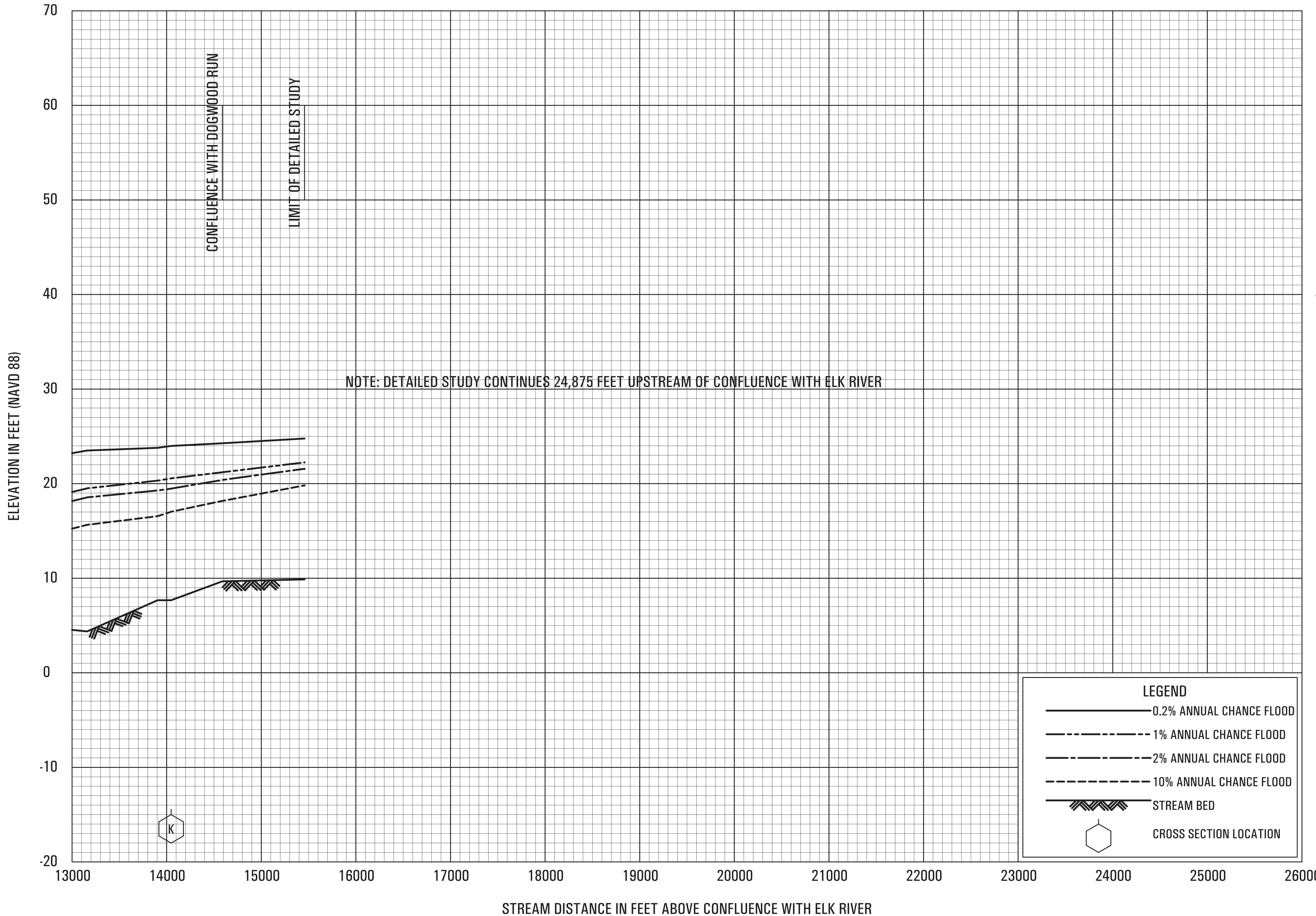
FLOOD PROFILES

LITTLE ELK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



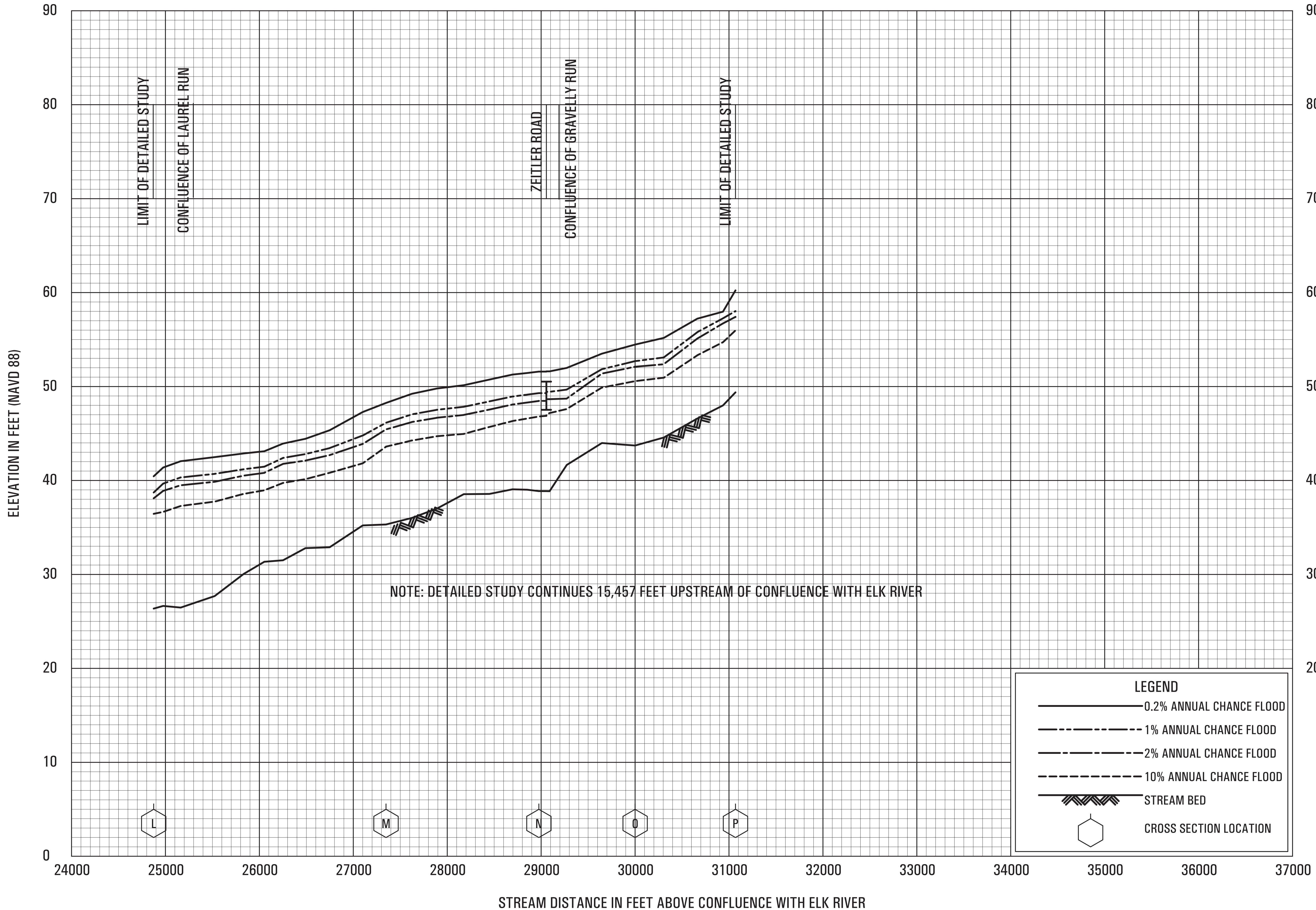
FLOOD PROFILES

LITTLE ELK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



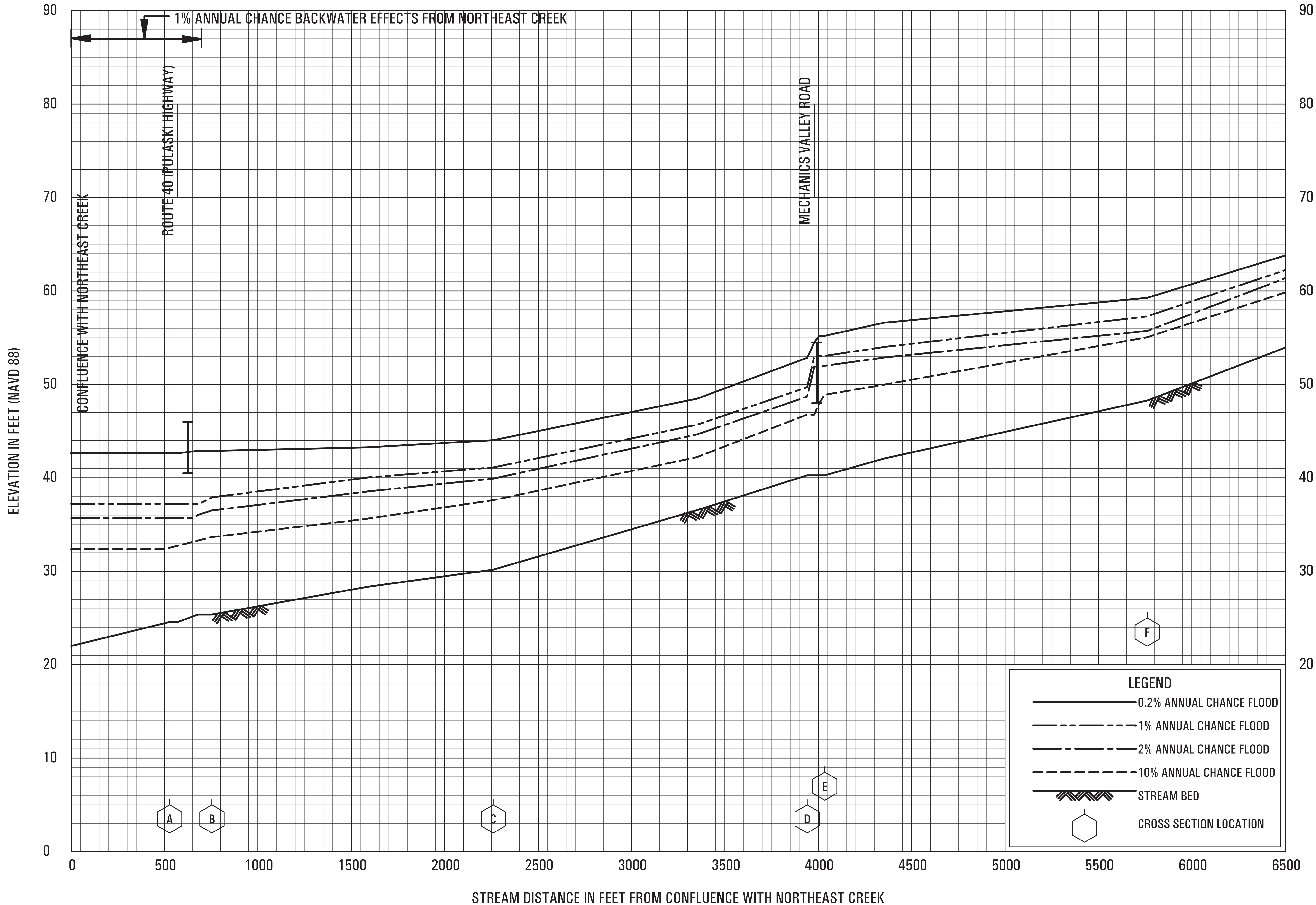
FLOOD PROFILES

LITTLE ELK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



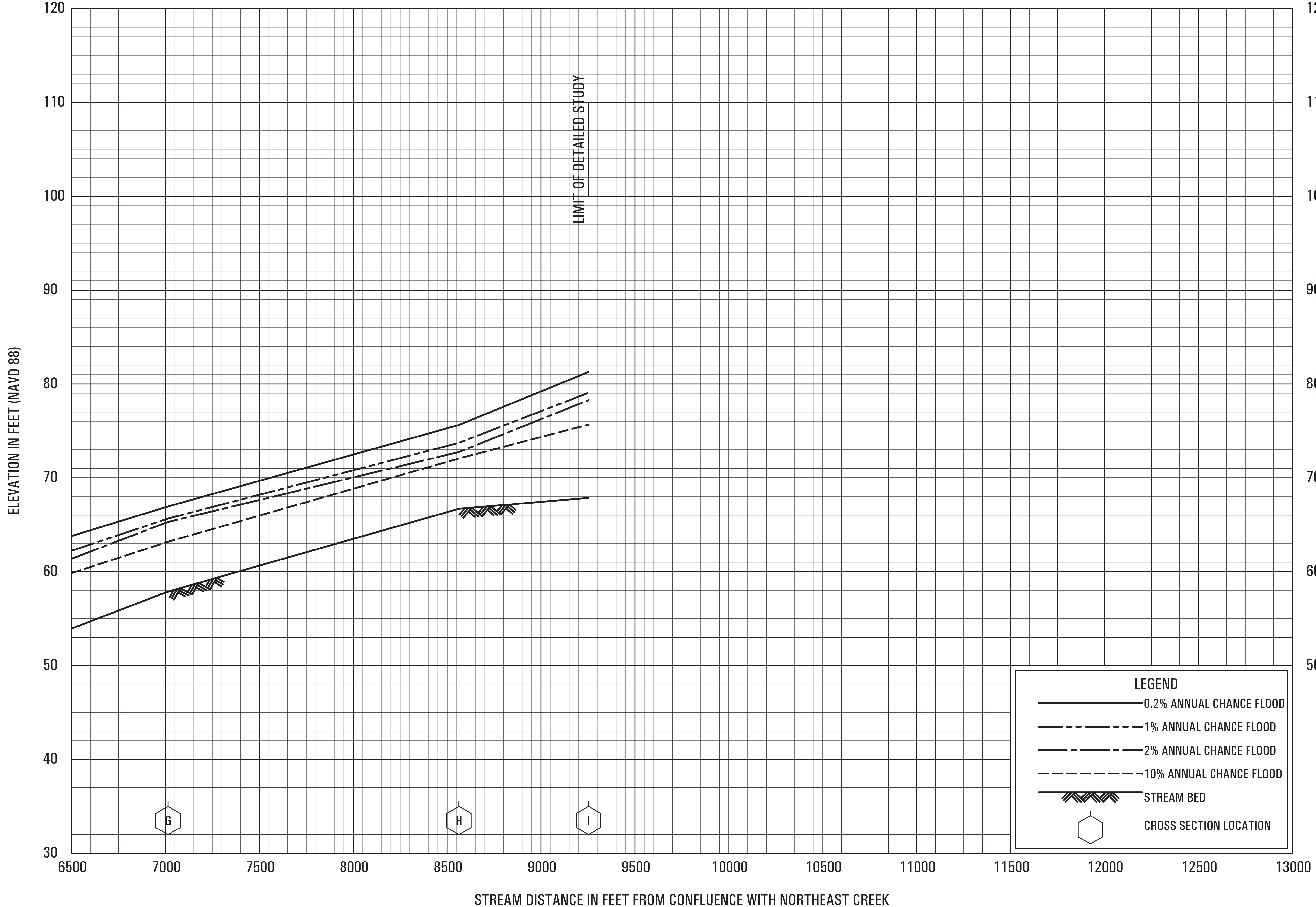
FLOOD PROFILES

LITTLE NORTHEAST CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



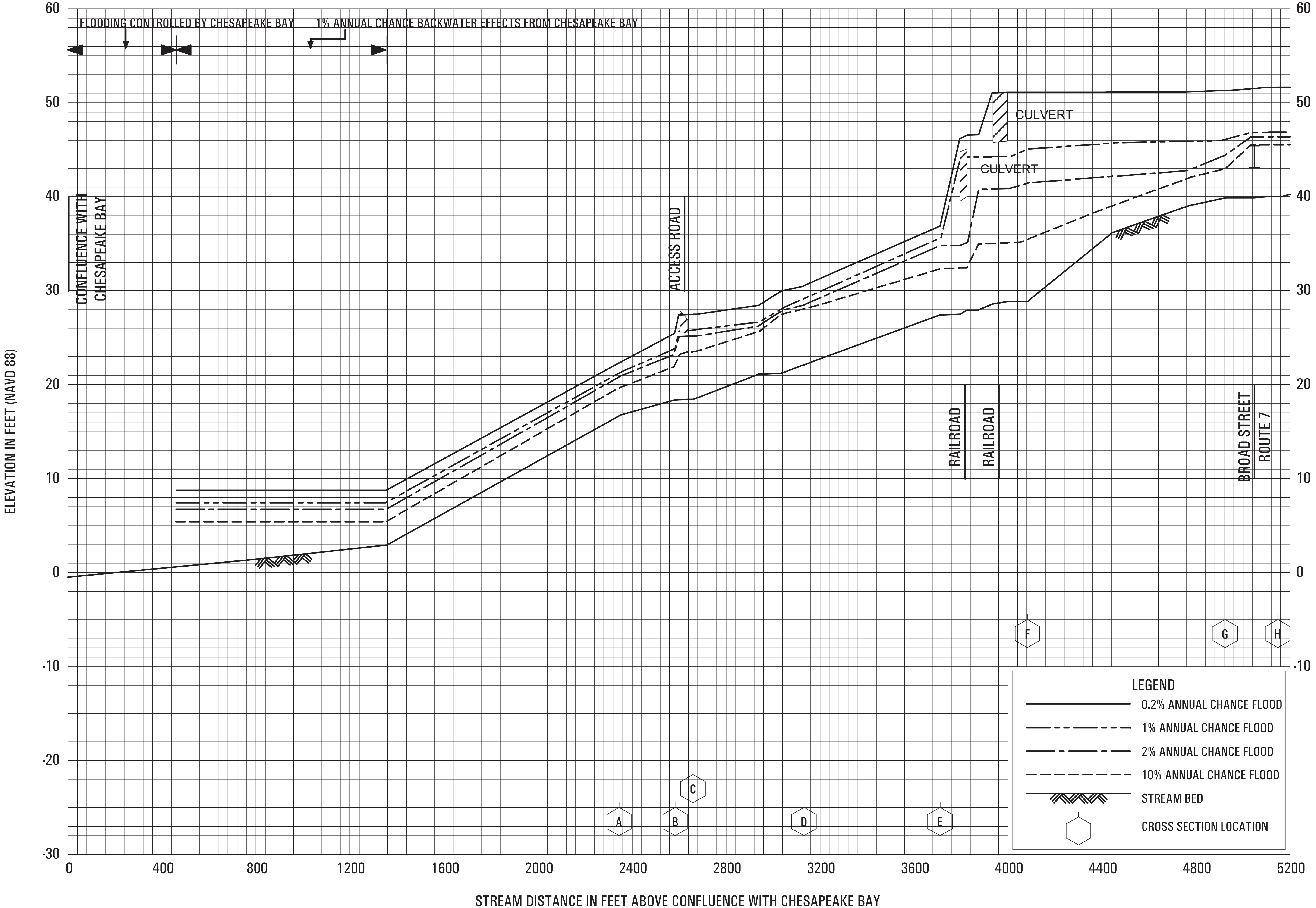
FLOOD PROFILES

LITTLE NORTHEAST CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



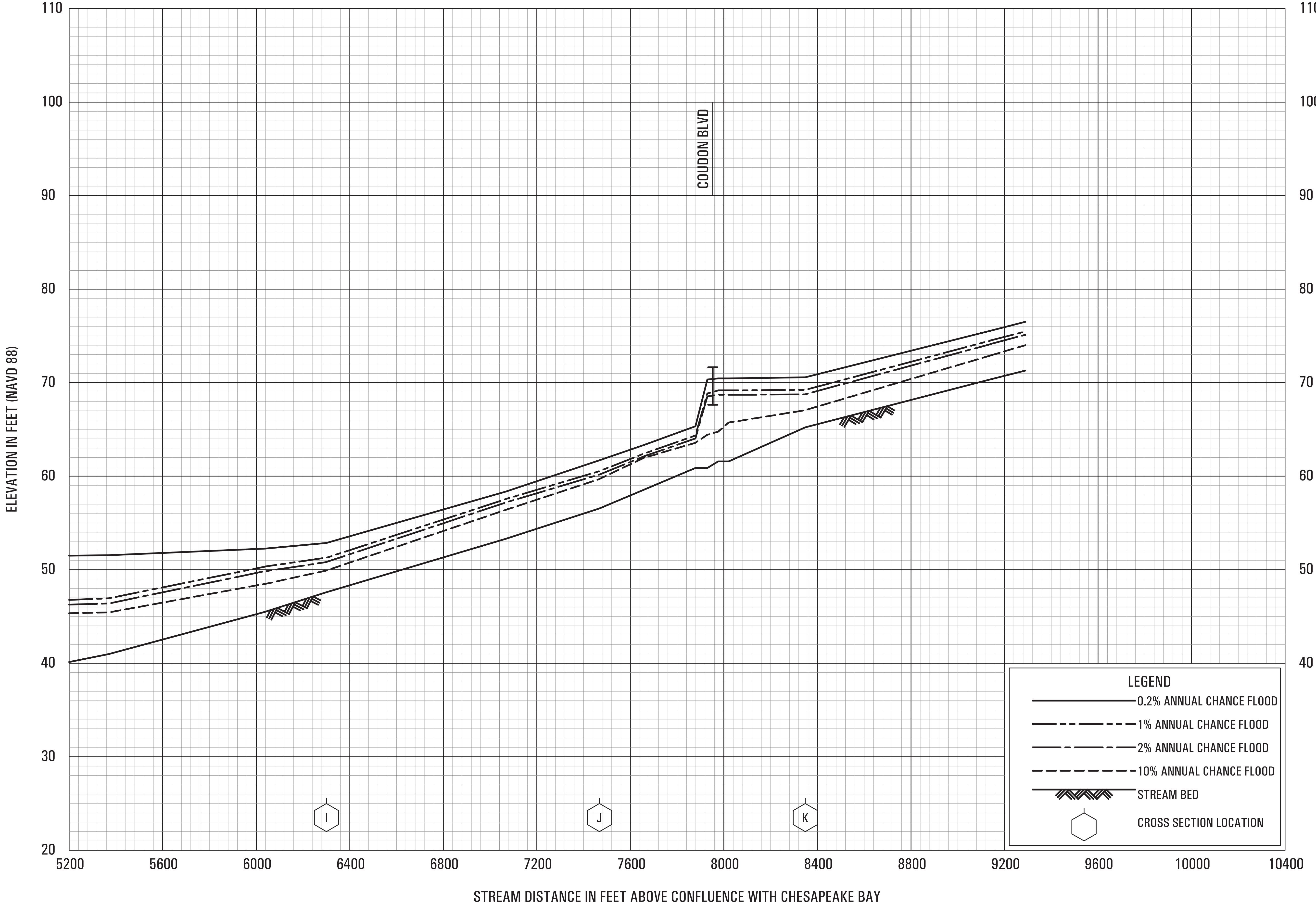
FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



FLOOD PROFILES

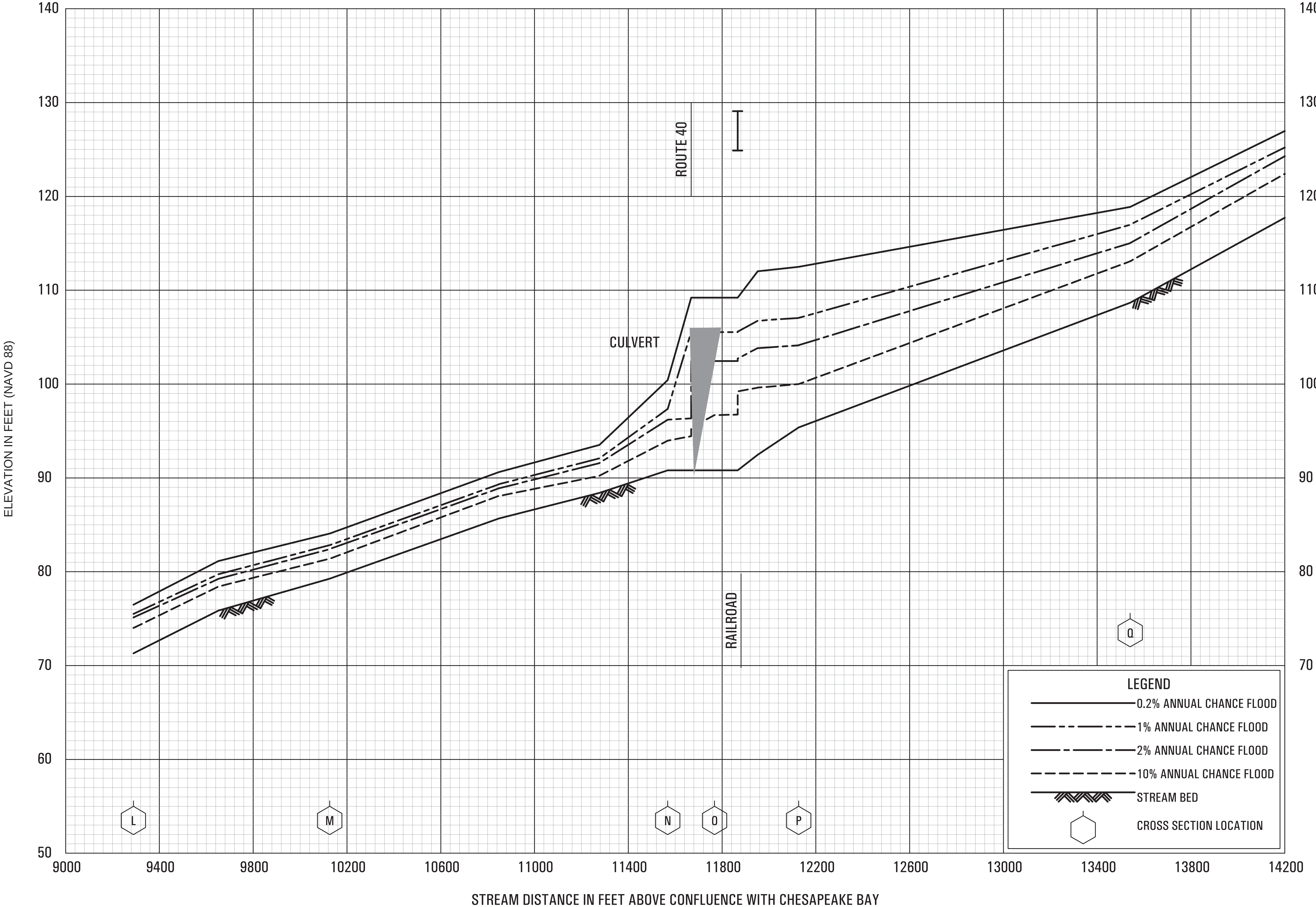
MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

16P



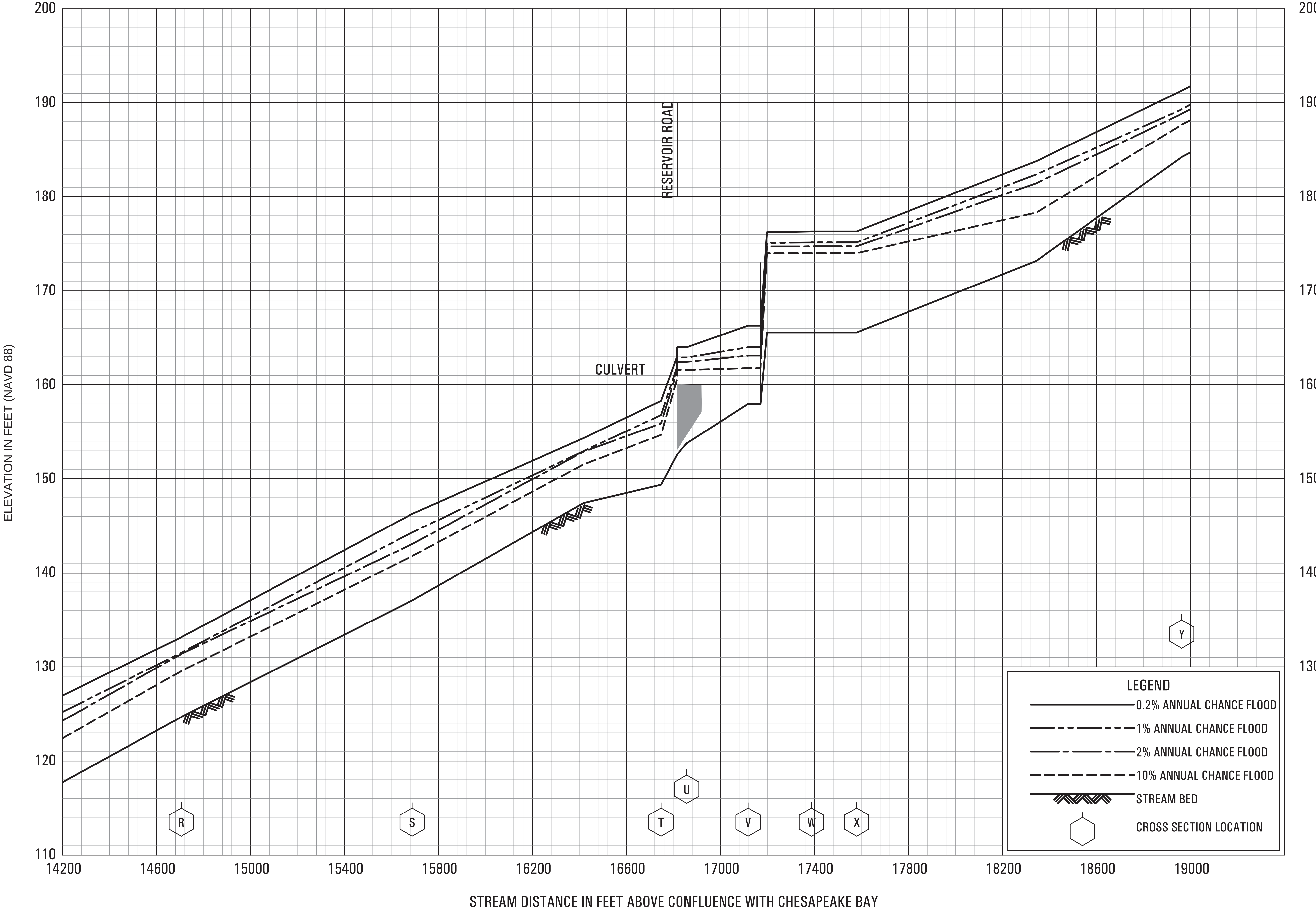
FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



FLOOD PROFILES

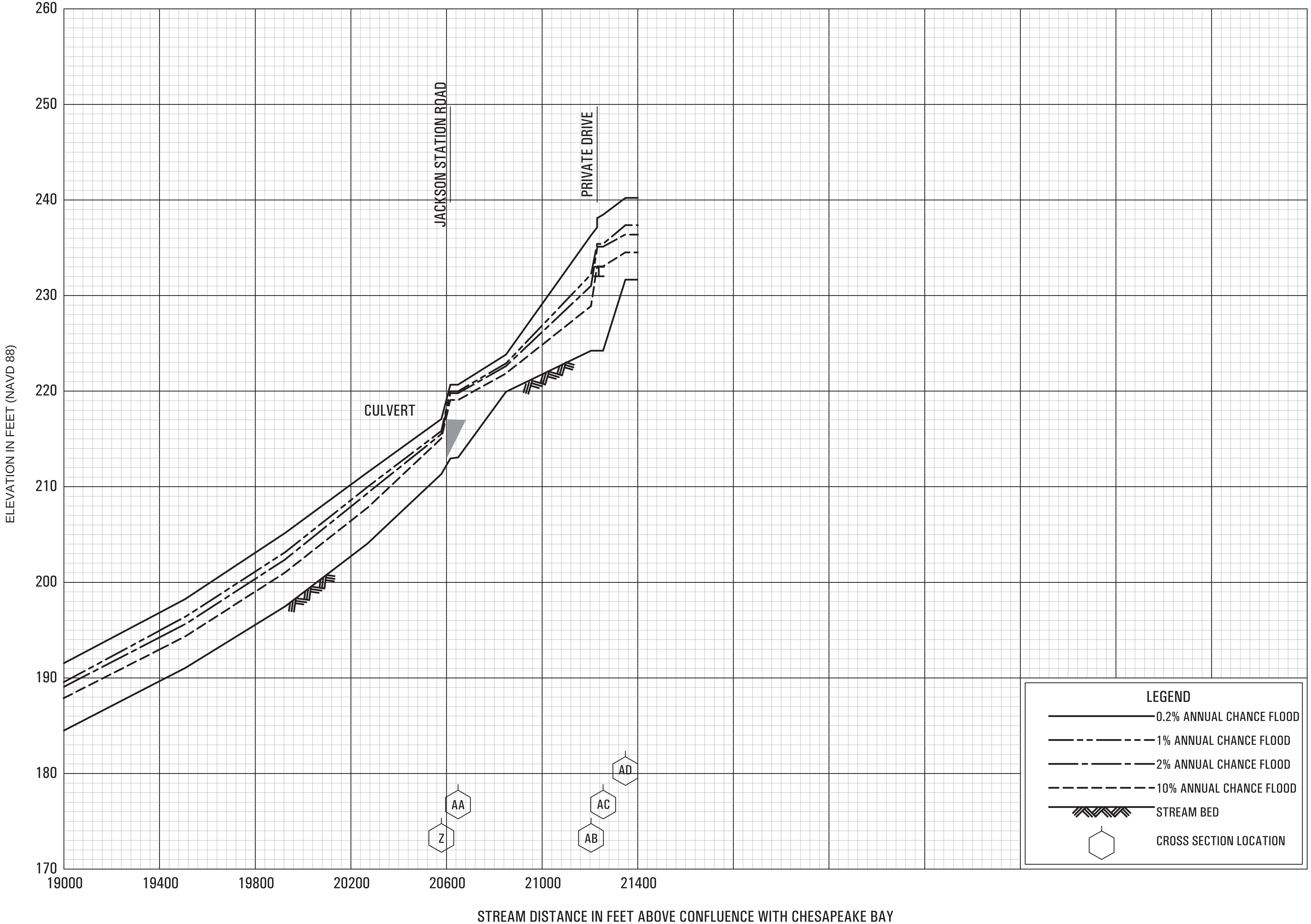
MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

18P



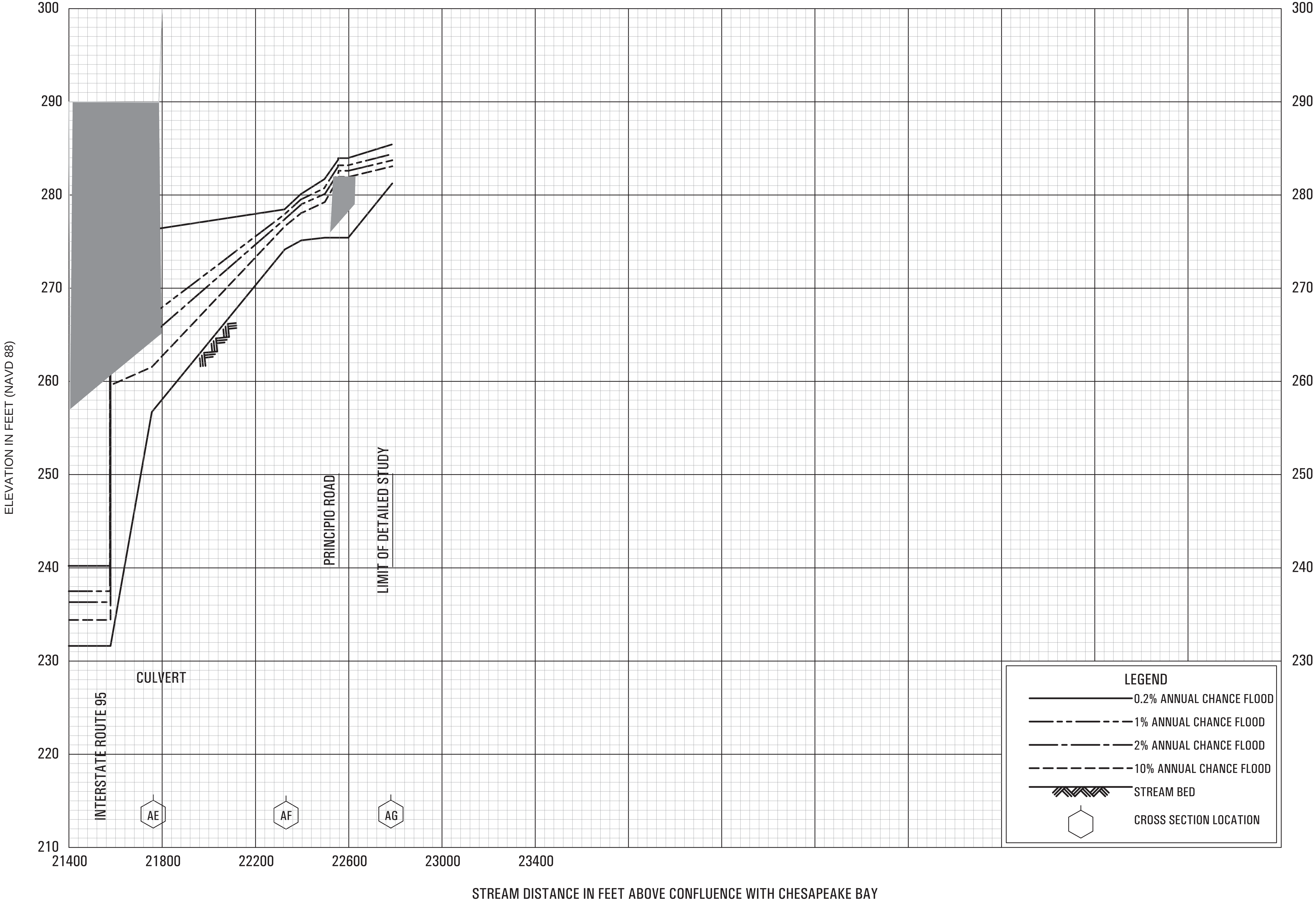
FLOOD PROFILES

MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



FLOOD PROFILES

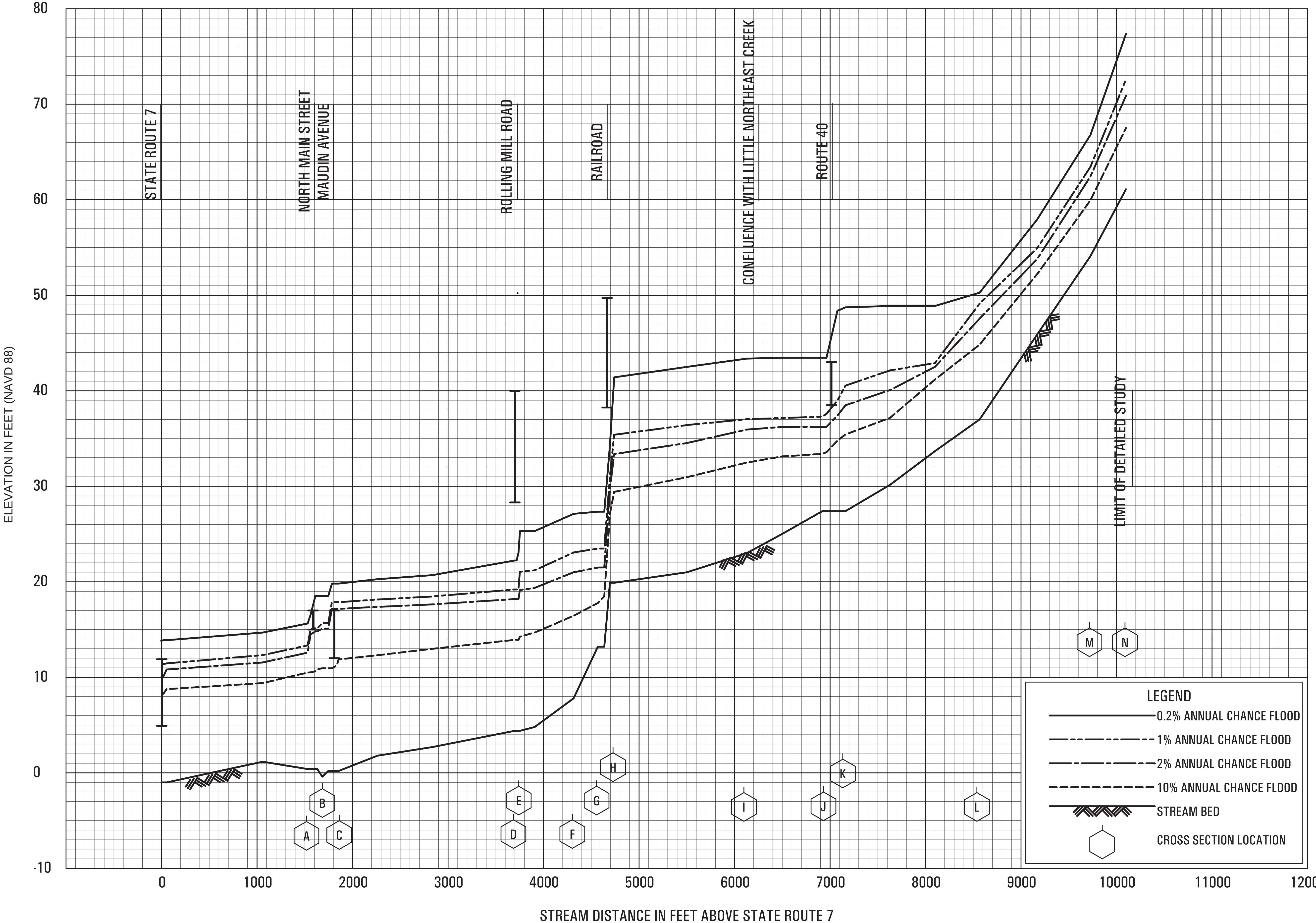
MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS

20P



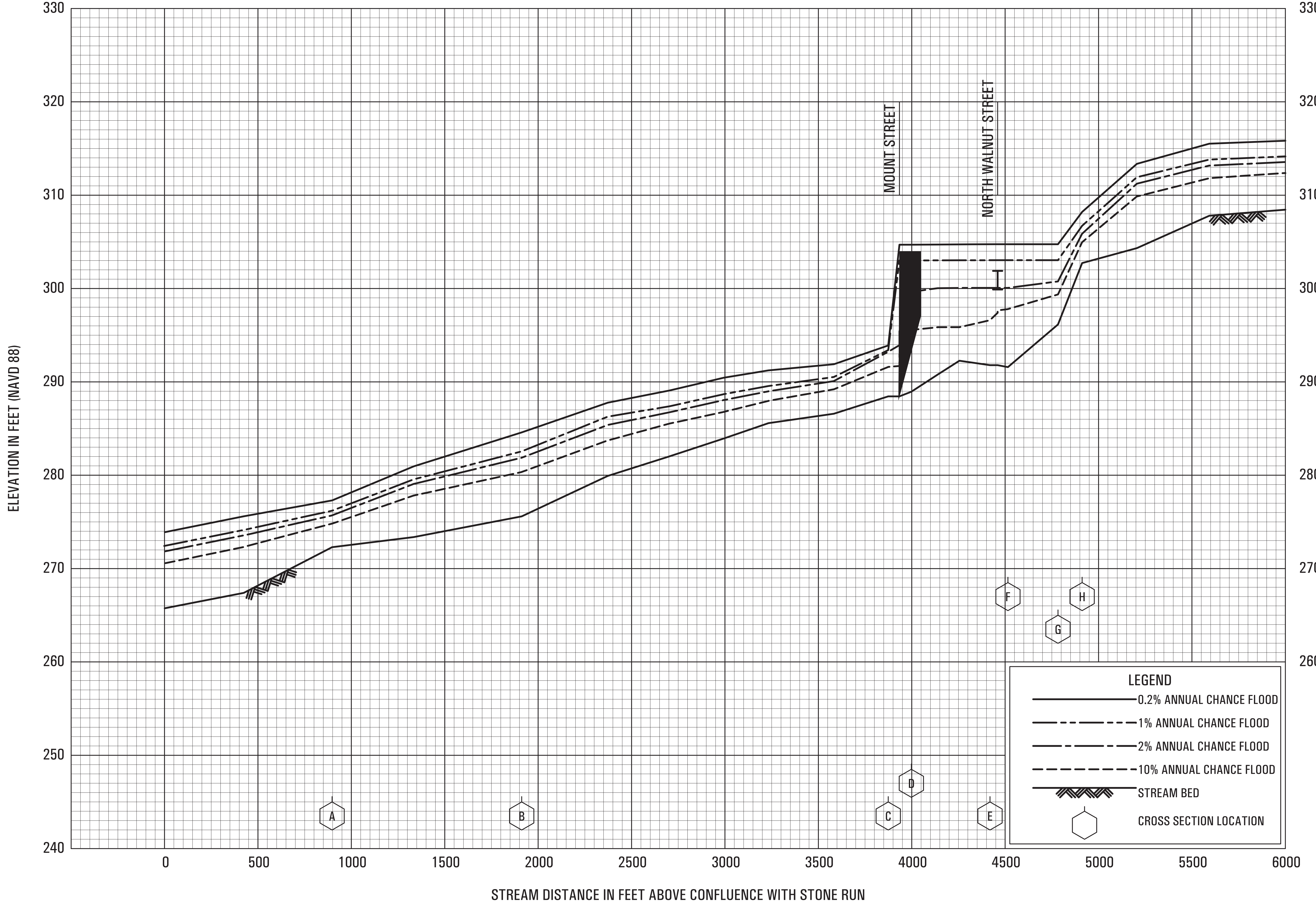
FLOOD PROFILES

NORTHEAST CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



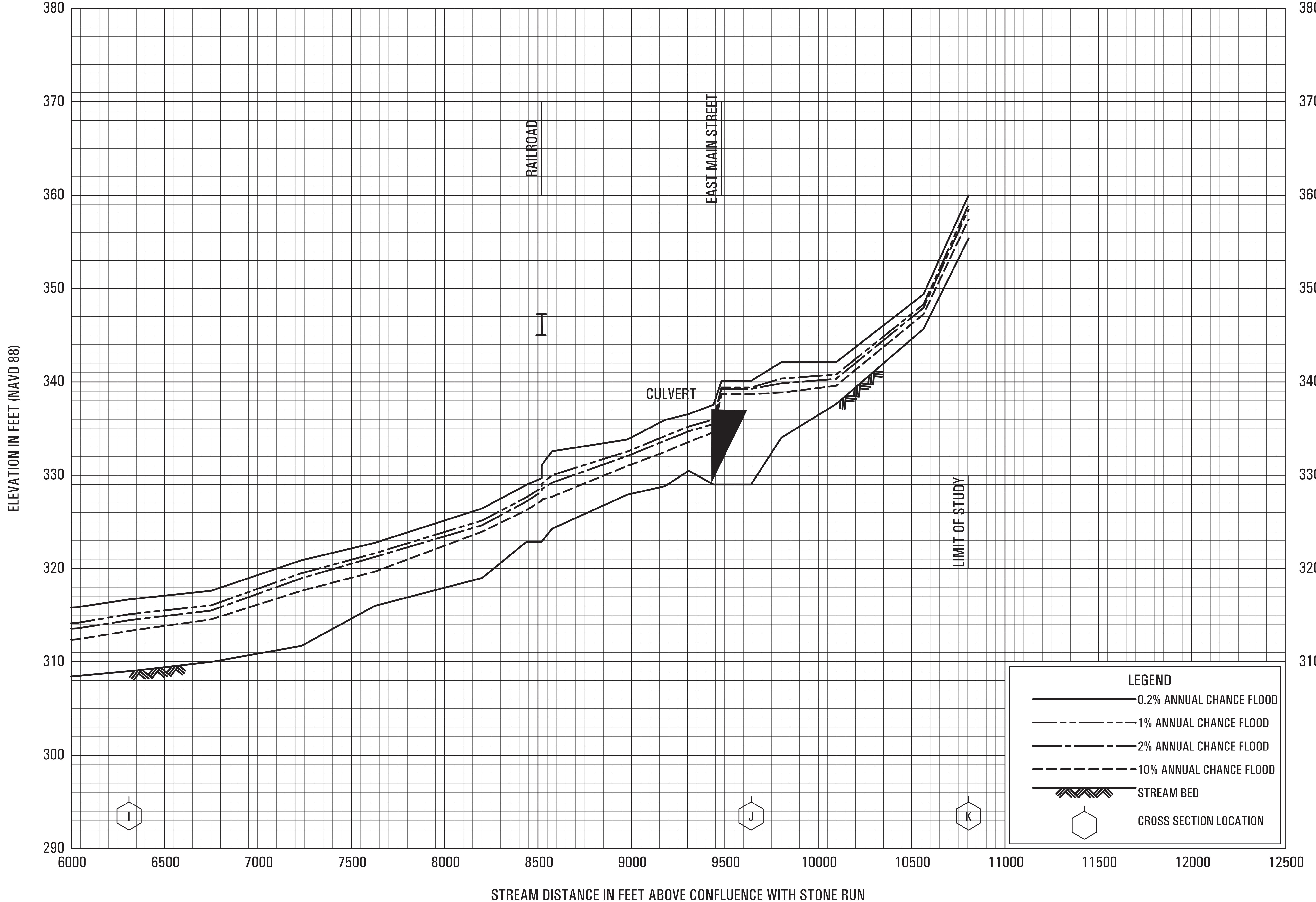
FLOOD PROFILES

STONE RUN TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



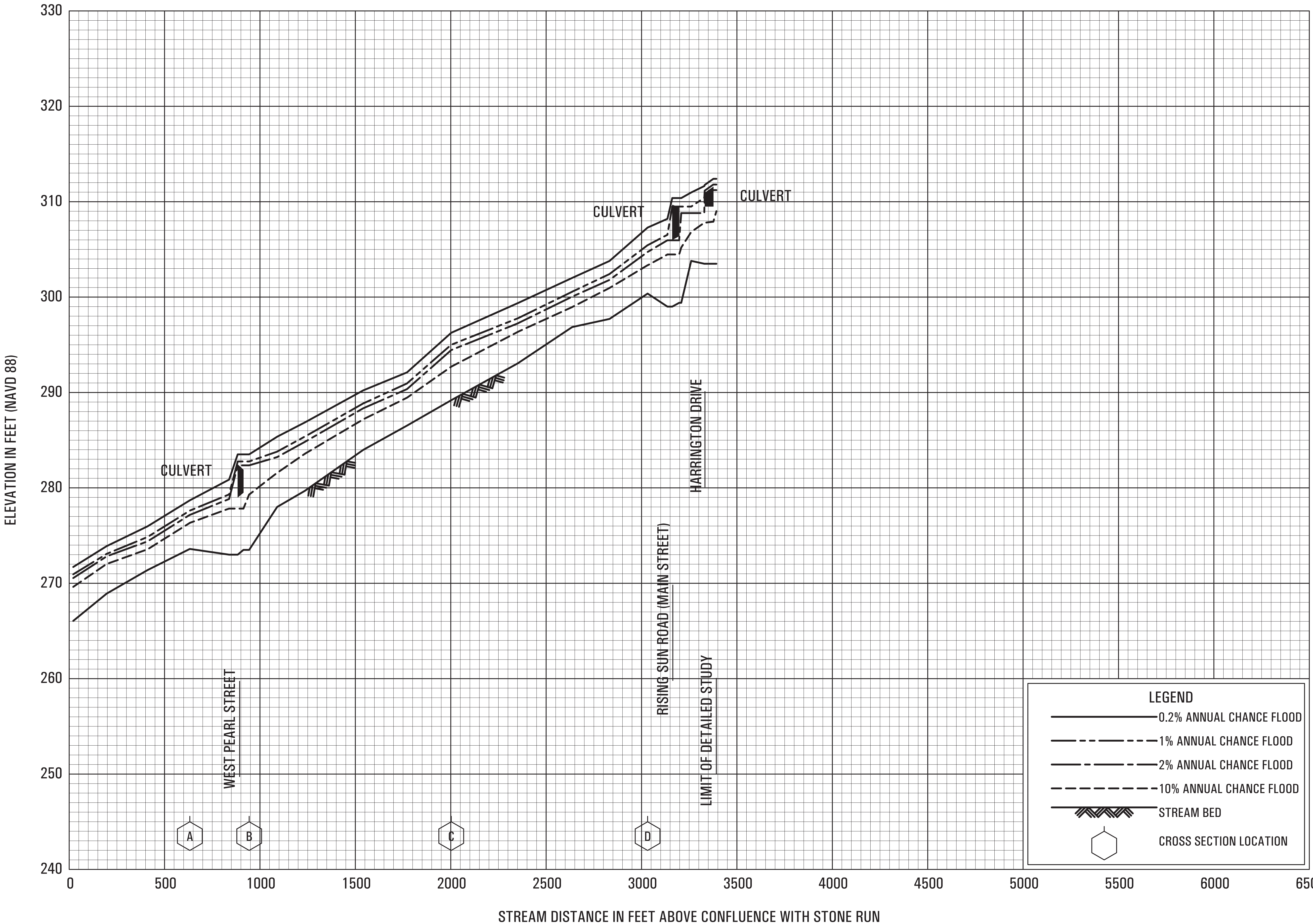
FLOOD PROFILES

STONE RUN TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



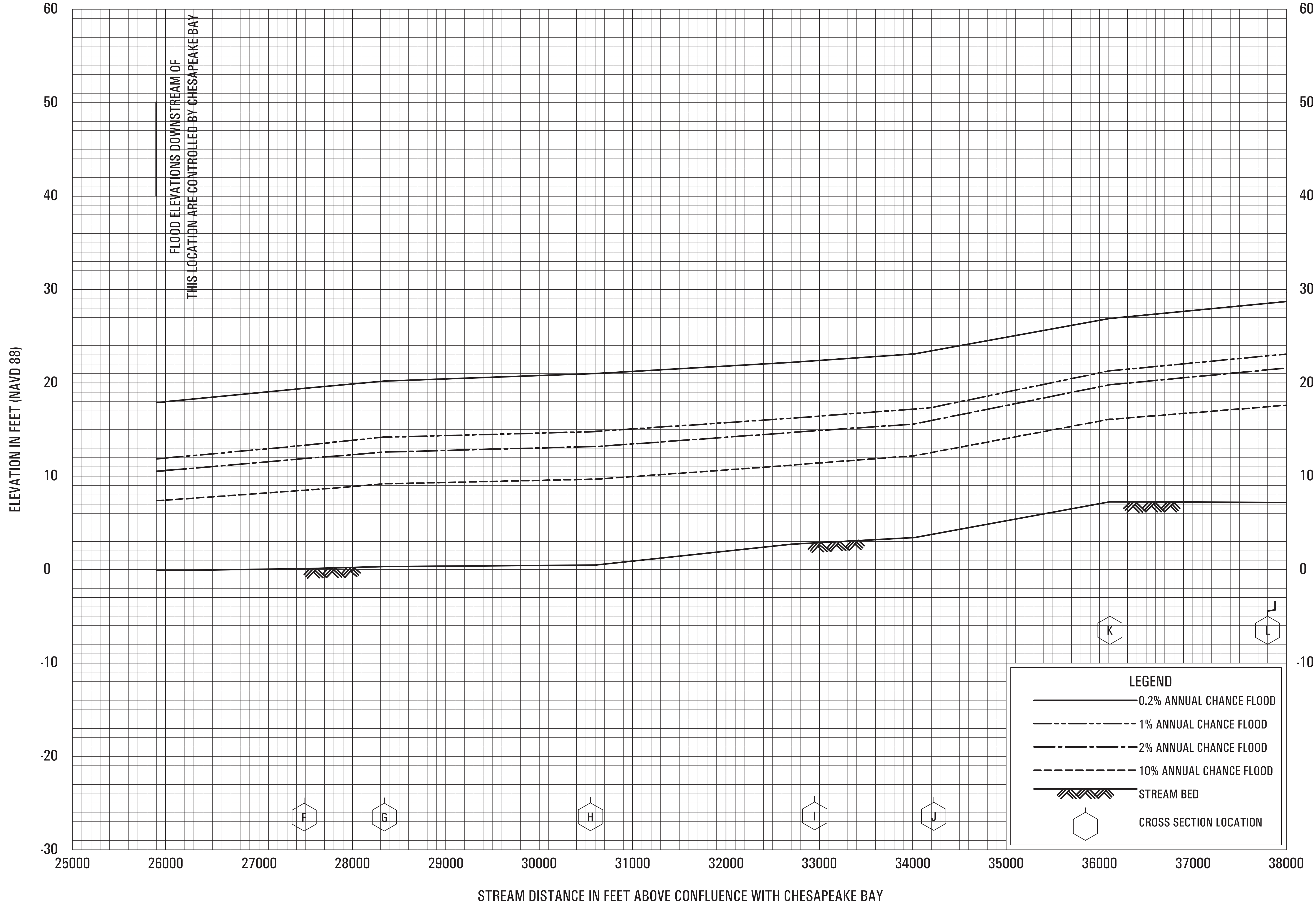
FLOOD PROFILES

STONE RUN TRIBUTARY 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



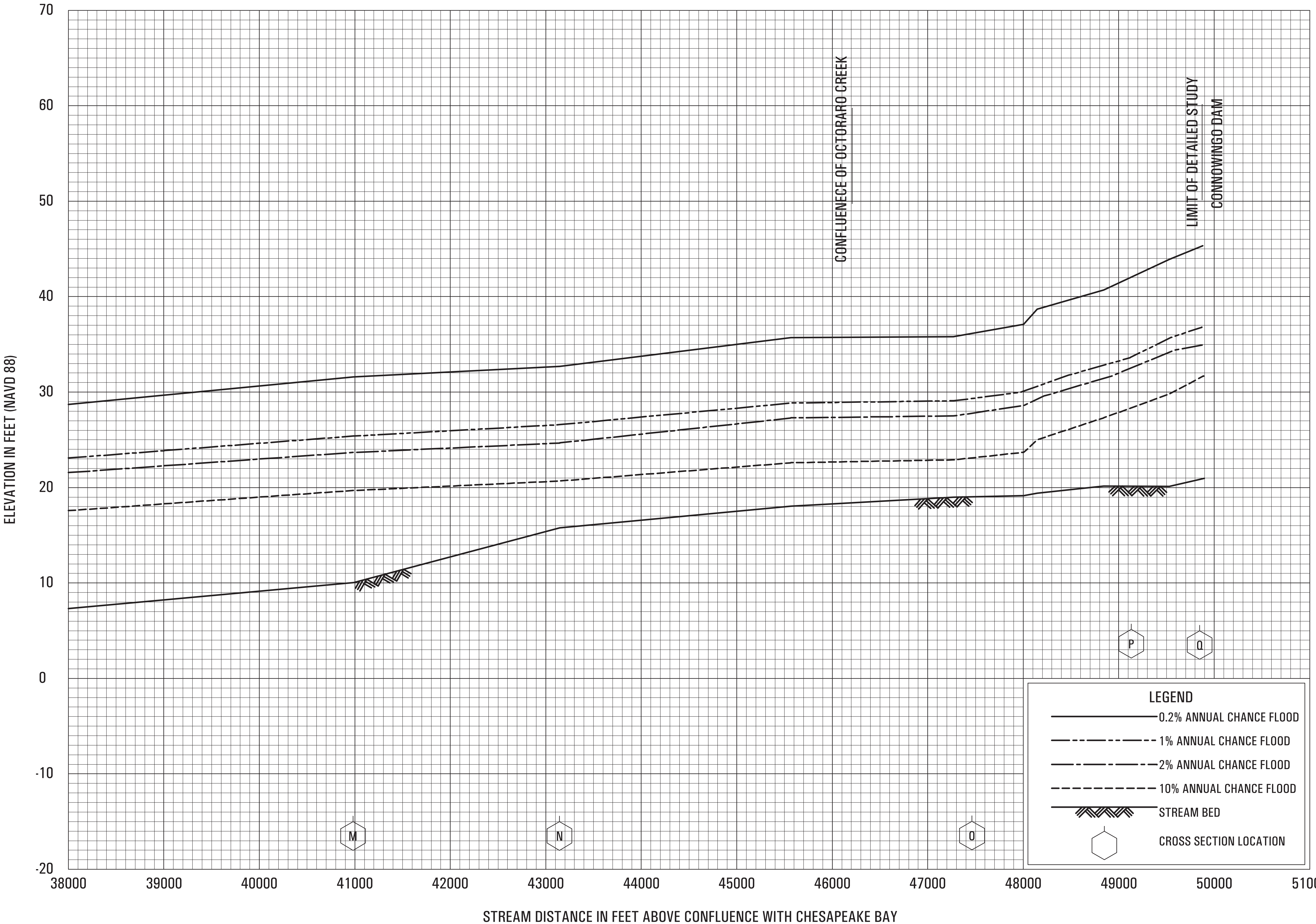
FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



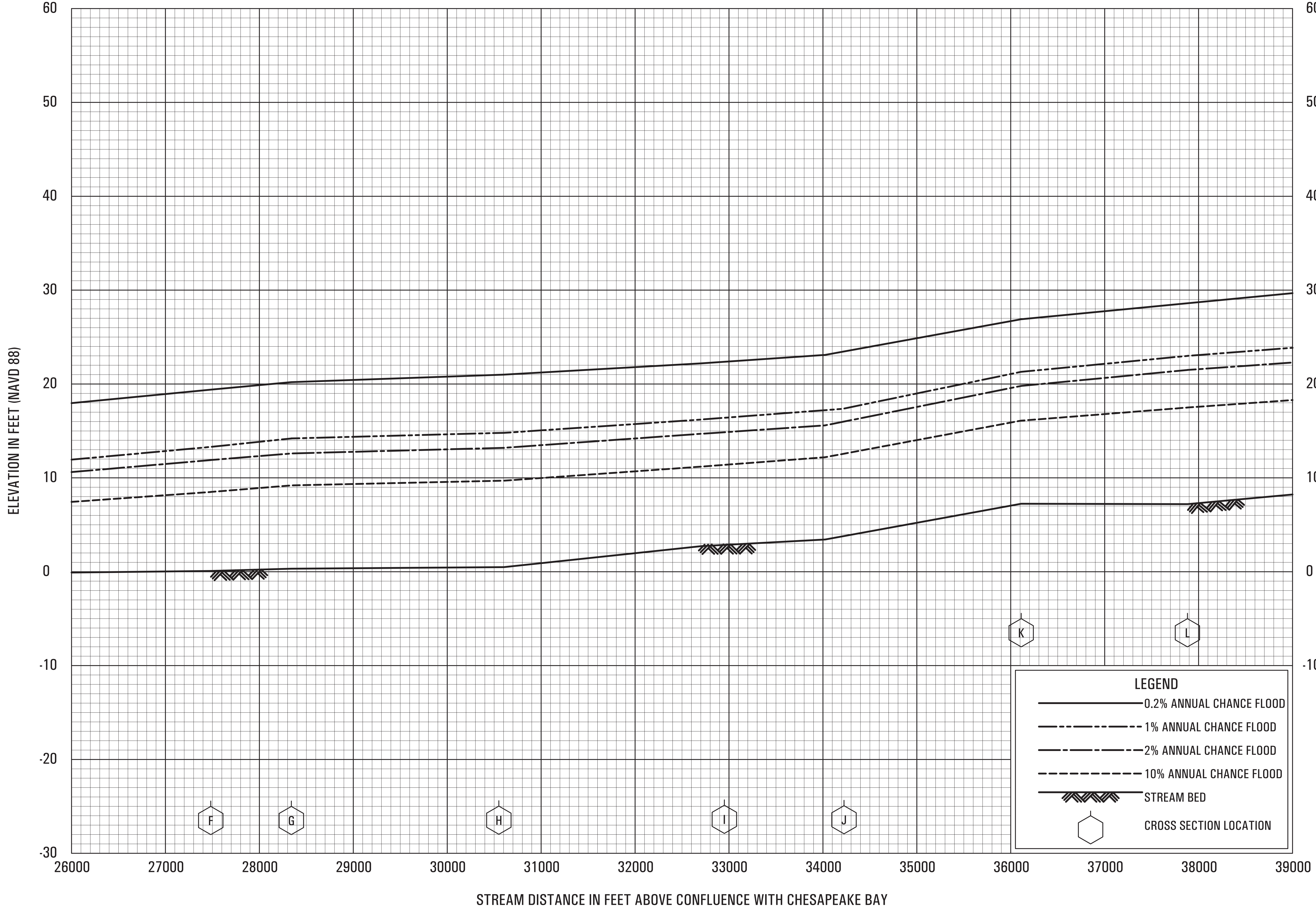
FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



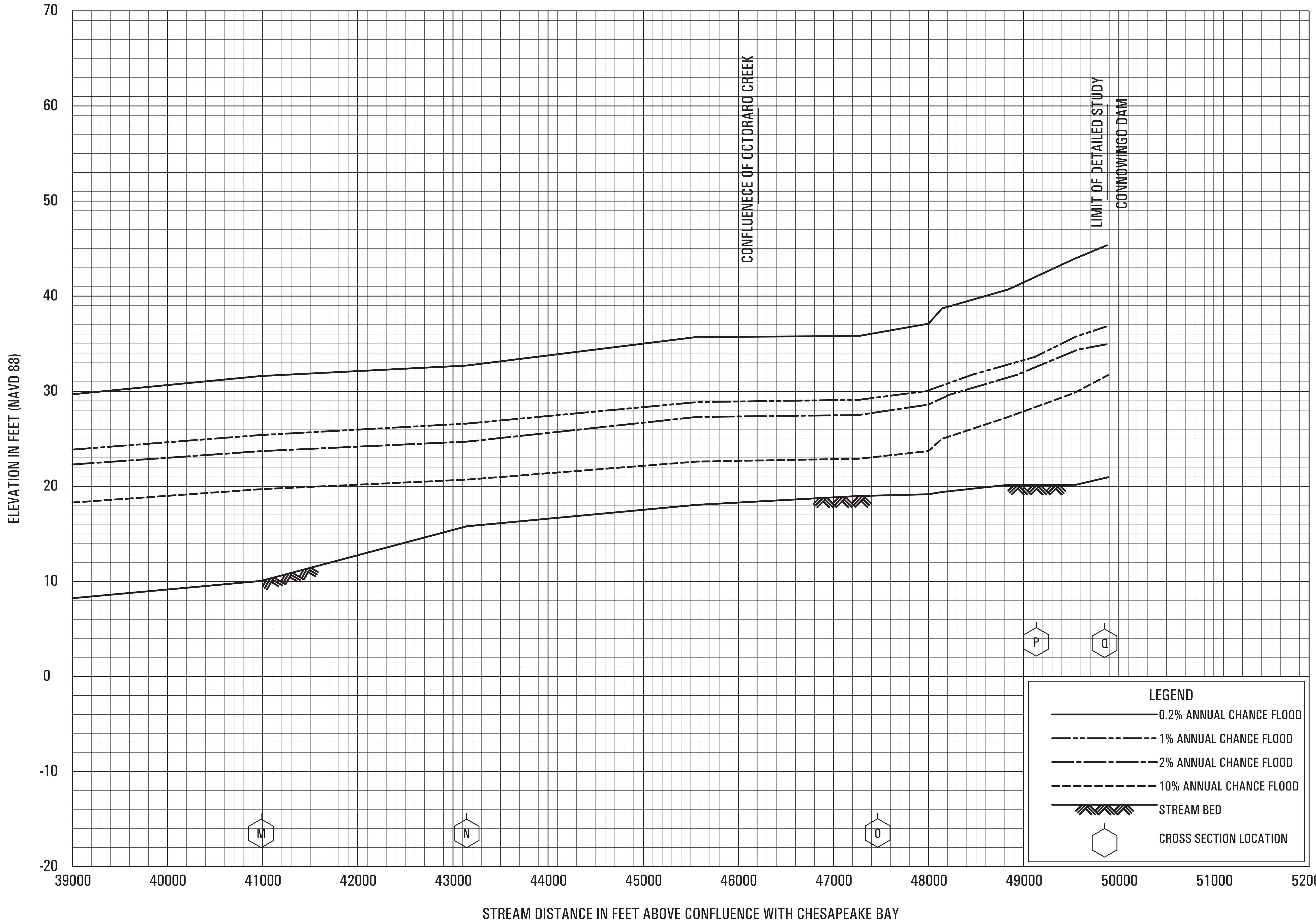
FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



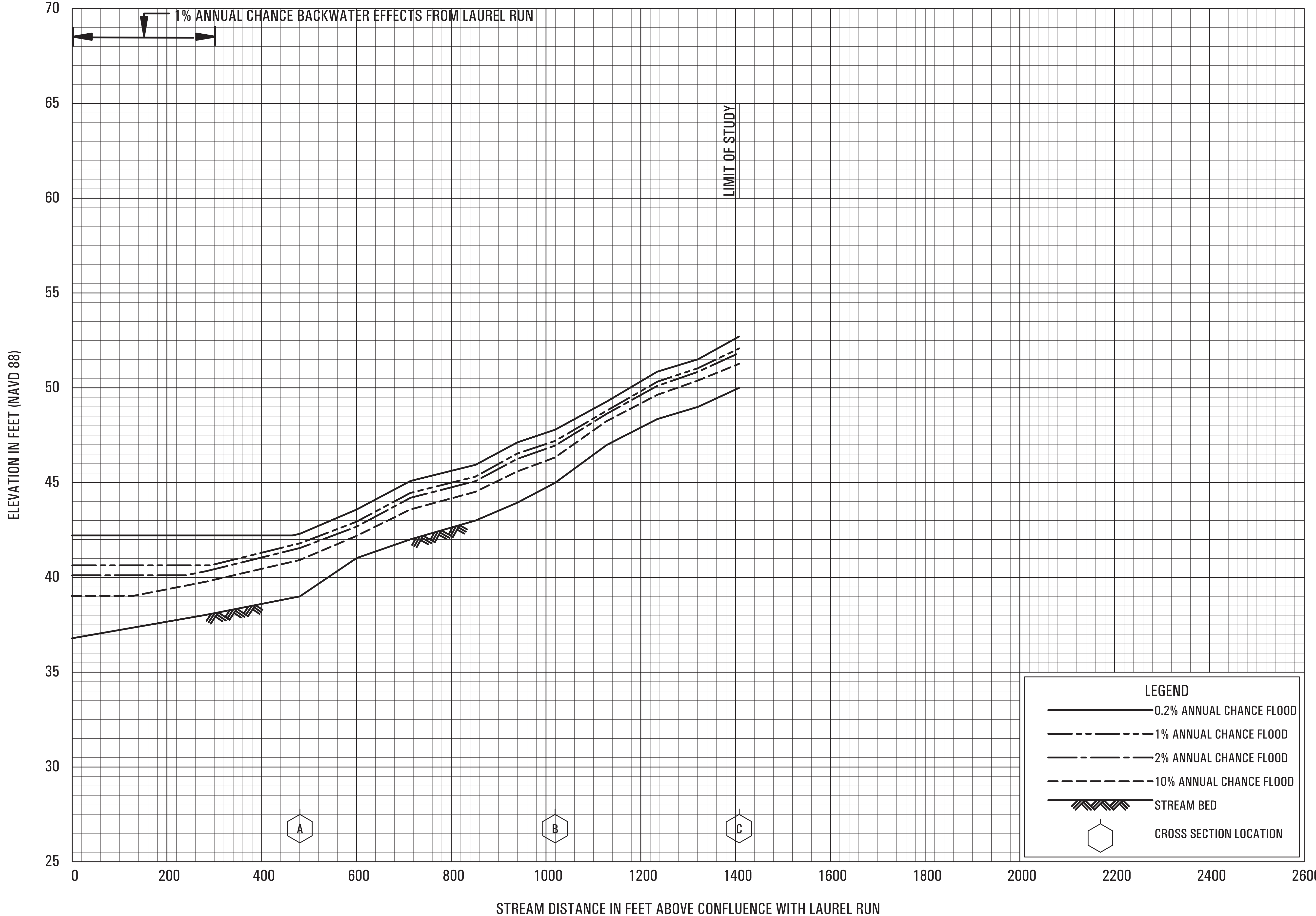
FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



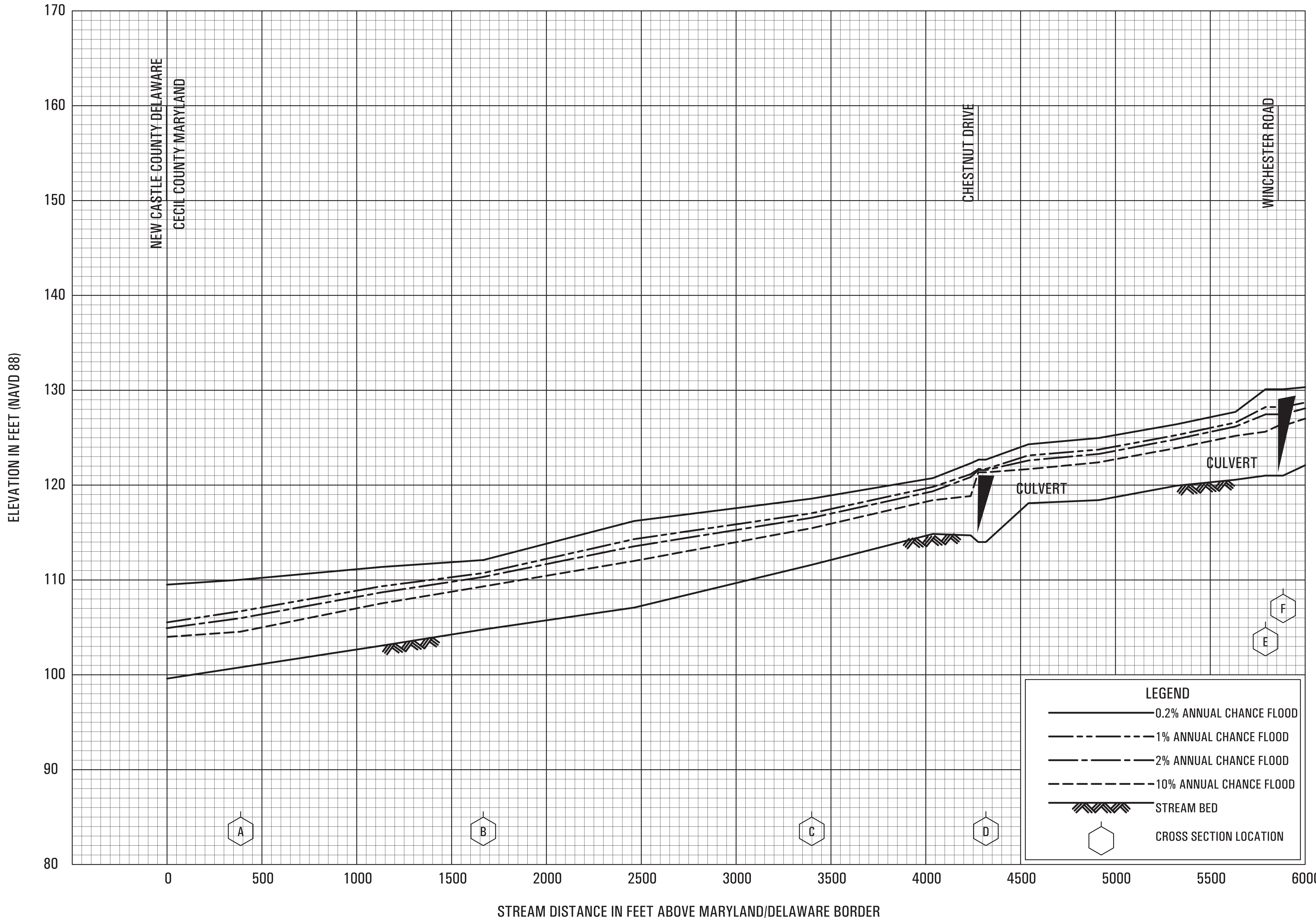
FLOOD PROFILES

UNNAMED TRIBUTARY TO LAUREL RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



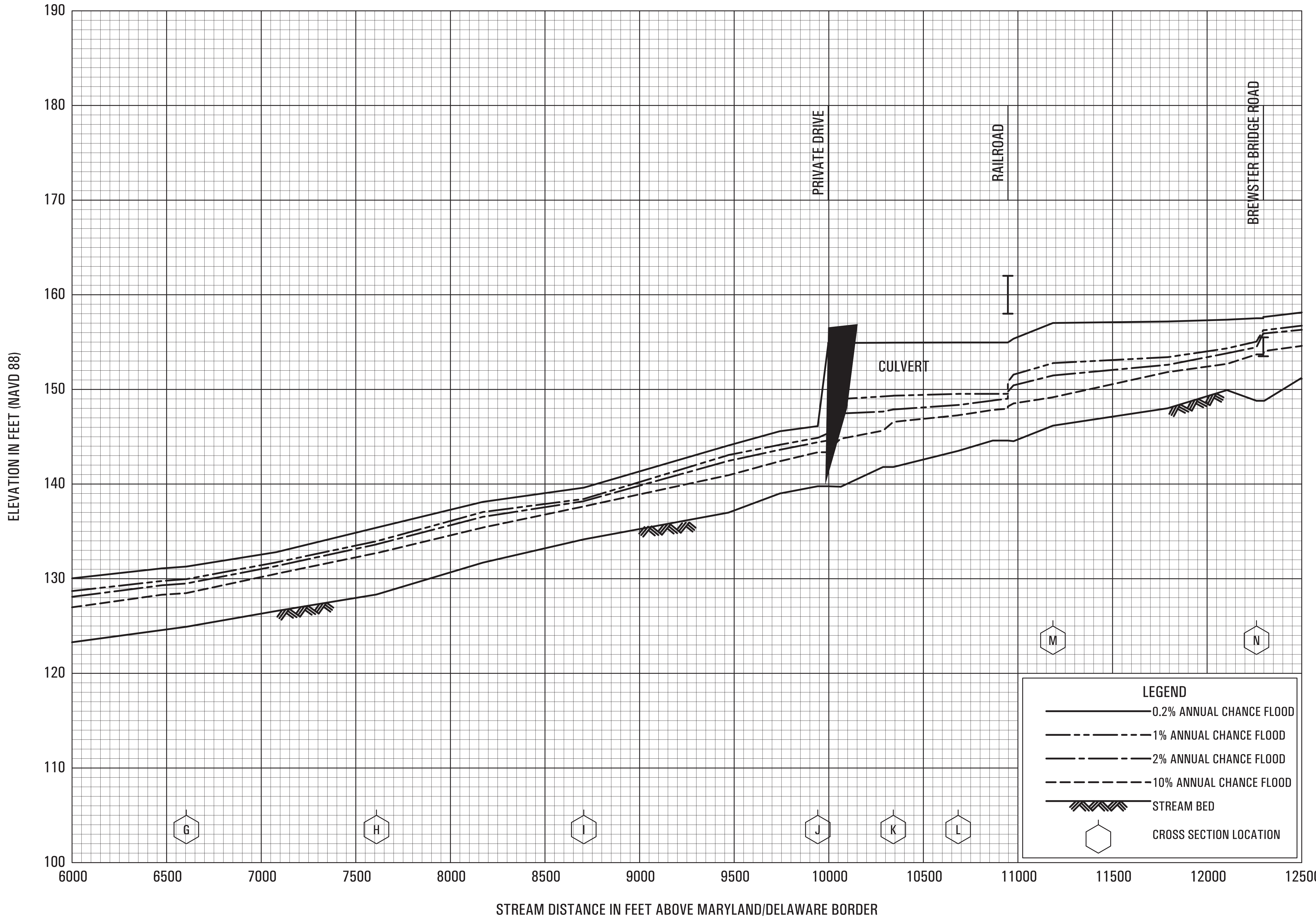
FLOOD PROFILES

WEST BRANCH CHRISTINA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



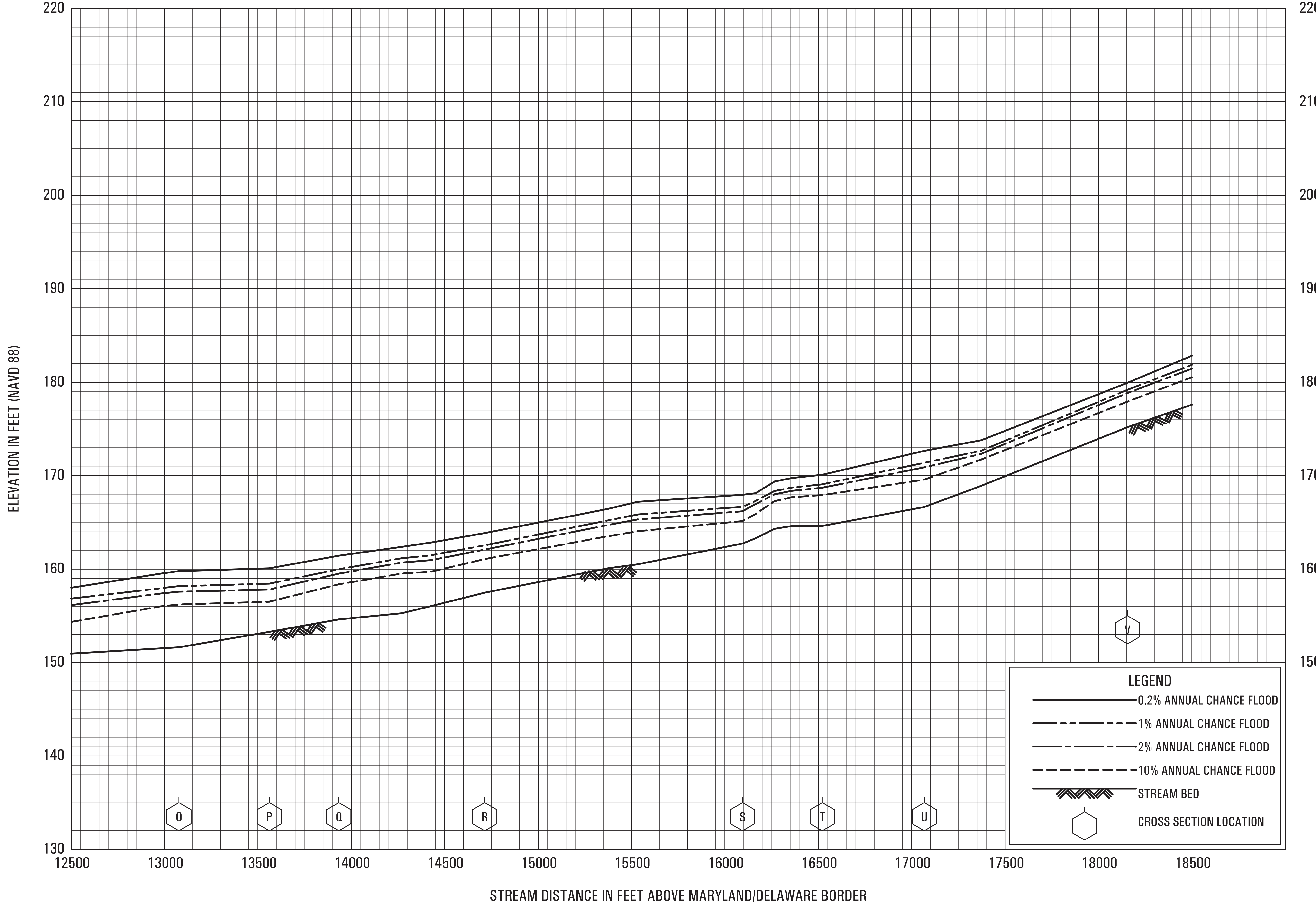
FLOOD PROFILES

WEST BRANCH CHRISTINA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



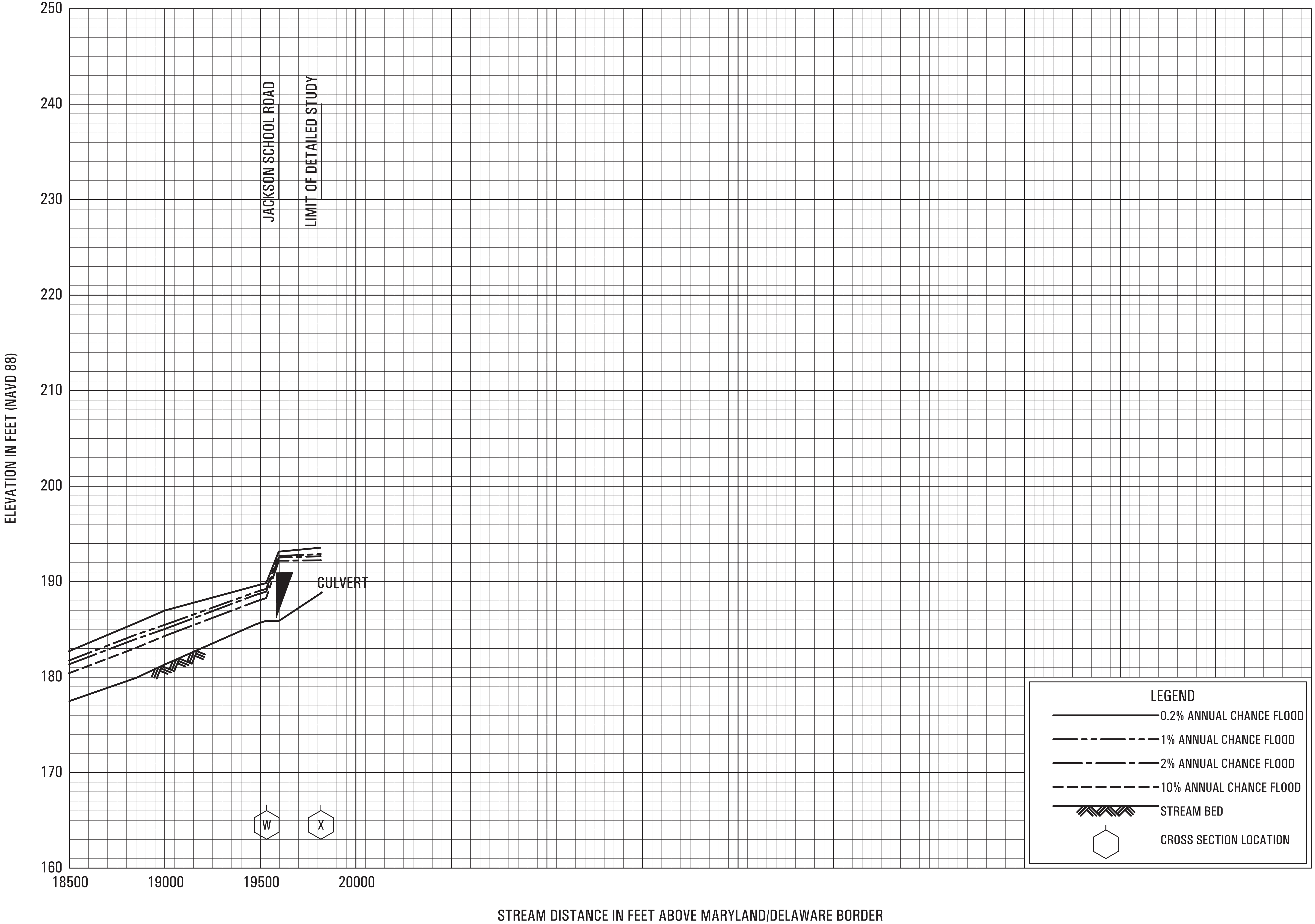
FLOOD PROFILES

WEST BRANCH CHRISTINA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



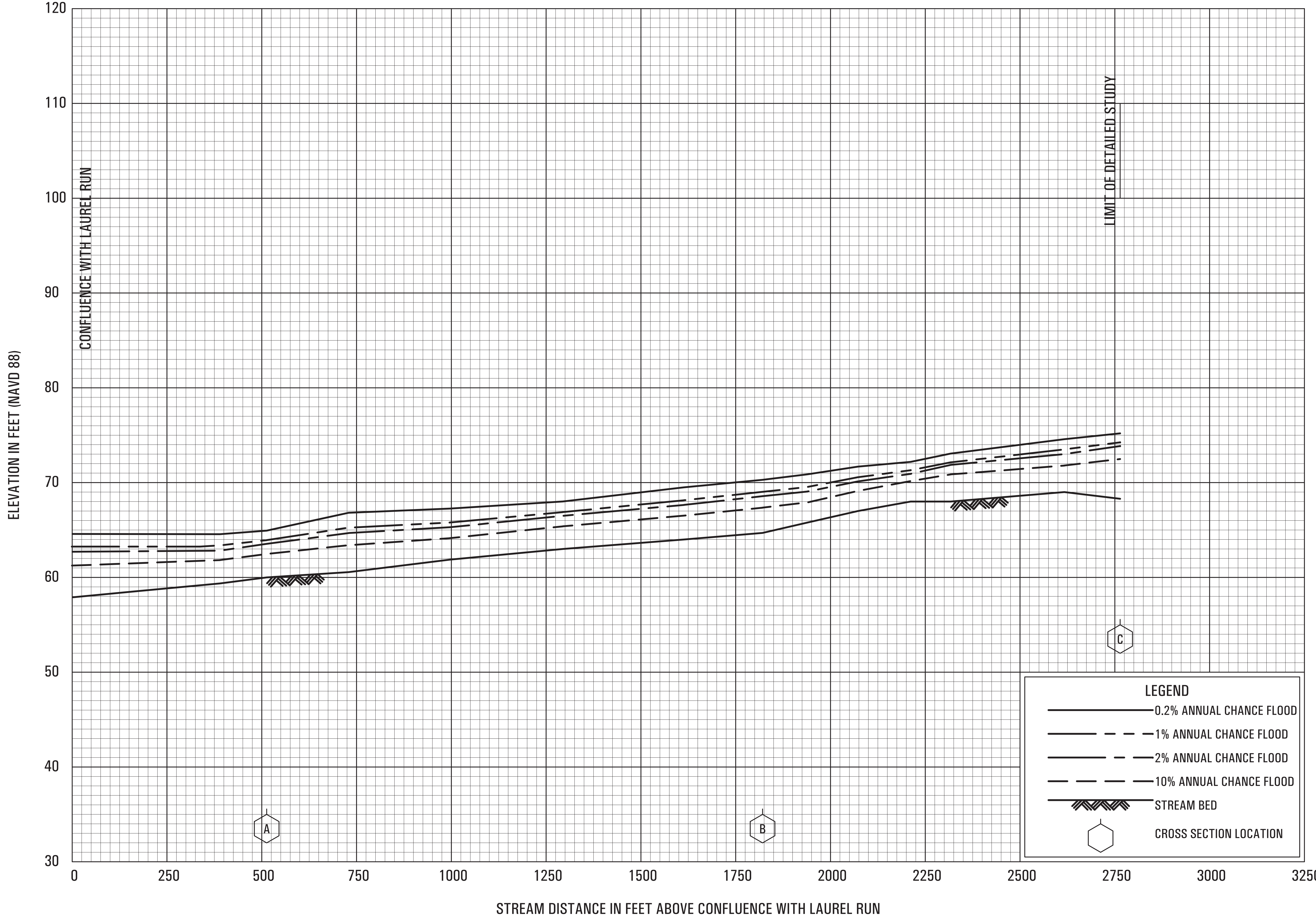
FLOOD PROFILES

WEST BRANCH CHRISTINA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS



FLOOD PROFILES

WEST BRANCH LAUREL RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CECIL COUNTY, MD

AND INCORPORATED AREAS