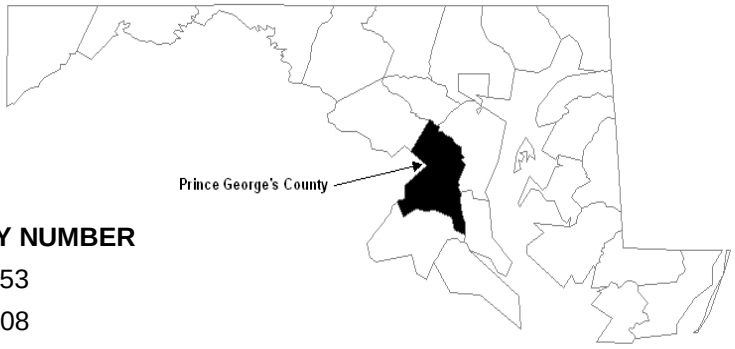
FLOOD INSURANCE STUDY

VOLUME 1 OF 3

PRINCE GEORGE'S COUNTY, MARYLAND

AND INCORPORATED AREAS

This Revised Preliminary FIS report only includes revised Flood Profiles. The unrevised Flood Profiles will appear in the final FIS report.



COMMUNITY NAME	COMMUNITY NUMBER
Laurel, City of	240053
Prince George's County (Unincorporated Areas)	245208

REVISED PRELIMINARY
JANUARY 16, 2015

EFFECTIVE:

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

24033CV001A

NOTICE TO FLOOD INSURANCE STUDY USERS

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

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

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

Old Zone(s)	New Zone
A1 – A30	AE
V1 – V30	VE
B	X
C	X

Initial Countywide FIS Effective Date: TBD

ATTENTION: On FIRM panel 24033C0129E, the Allison Street levee system has not been demonstrated by the community or levee owner(s) to meet the requirements of Section 65.10 of the NFIP regulations in 44 CFR as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. The subject areas are identified on FIRM panels (with notes and bounding lines) and in the FIS report as potential areas of flood hazard data changes based on further review.

FEMA has updated the levee analysis and mapping procedures for non-accredited levees. Until such time as FEMA is able to initiate a new flood risk project to apply the new procedures, the flood hazard information on the aforementioned FIRM panel that is affected by the Allison Street levee system is being added as a snapshot of the prior previously effective information presented on the FIRMs and FIS reports dated June 16, 1987. As indicated above, it is expected that affected flood hazard data within the subject area could be significantly revised. This may result in floodplain boundary changes, 1-percent-annual-chance flood elevation changes, and/or changes to flood hazard zone designations.

The effective FIRM panels (and the FIS report) will again be revised at a later date to update the flood hazard information associated with the Allison Street levee system when FEMA is able to initiate and complete a new flood risk project to apply the new levee analysis and mapping procedures.

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FLOOD INSURANCE STUDY
PRINCE GEORGE'S COUNTY, MARYLAND AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Prince George's County, including the City of Laurel, and the unincorporated areas of Prince George's County (referred to collectively herein as Prince George's 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 Prince George's County and incorporated areas that will be used to establish actuarial flood insurance rates and to assist the communities in efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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

Please also note that FEMA has identified one or more levees in this jurisdiction that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part Section 65.10 of the NFIP regulations (44CFR65.10) as it relates to the levee's capacity to provide 1-percent annual -chance flood protection. As such, there are temporary actions are being taken until such time as FEMA is able to initiate a new flood risk project to apply the new levee analysis and mapping procedures. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

1.2 Authority and Acknowledgments

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

This FIS was prepared to include all jurisdictions within Prince George's County into a countywide format FIS. Information on the authority and acknowledgments for each jurisdiction with a previously printed FIS report included in this countywide FIS is shown below.

In the original FIS for Prince George's County (Unincorporated Areas), dated July 19, 1982, the hydrologic and hydraulic analyses were performed by the U.S. Army Corps of Engineers (USACE), Baltimore District, for the Federal

Emergency Management Agency (FEMA). That work was completed in June 1980.

In the FIS revision for Prince George's County (Unincorporated Areas), dated September 6, 1996, the hydrologic and hydraulic analyses for Bald Hill Branch were prepared by the Prince George's County Department of Environmental Resources, Watershed Protection Branch. This work was completed in August 1993.

For the City of Laurel, the hydrologic and hydraulic analyses in the August 19, 1985 study represented a revision of the original analyses prepared by USACE for FEMA, under Inter-Agency Agreement Nos. IAA-H-2-73, IAA-H-19-74, and IAA-H-16-75; Project Order Nos. 4, 19, and 22, respectively. This work was completed in August 1977. The hydrologic and hydraulic analyses for the original study were conducted by Greenhorne & O'Mara under subcontract to USACE. In the updated study, Dewberry & Davis revised flood boundaries based on updated topographic mapping and updated corporate limits. Also, approximate flood boundaries for Walker Brook and North Fork Walker Brook were added based upon analysis performed by Greiner Engineering Sciences, Inc. This work was completed in December 1984.

This [date] countywide FIS is a revision and compilation of the City of Laurel FIS and the Prince George's County (Unincorporated Areas) FIS.

With the exception of Bald Hill Branch, revised hydrologic and hydraulic analyses for all flooding sources in this study were performed by the following organizations:

- Prince George's County Department of Environmental Resources for the FEMA under Mapping Activity Statement 2008-01;
- USACE for Maryland Department of the Environment (MDE) as part of the FEMA's Map Modernization Program (MMP) under Contract No. ICA-05-CRL-01. The MMP study was completed in September 2009;
- USACE for FEMA under Contract No. HSFE03-04-X-0016 to reconcile 1% annual chance tidal elevations for the Potomac River into a unified storm surge profile. This work was completed in August 2008;
- USACE for Prince George's County as part of the *Anacostia River Levee Raising, Northeast and Northwest Branches, Project No. 541685, Contract No. 853-H*;
- Greenman-Pederesen, Inc. for City of Laurel, Water Resources Administration of the Maryland Department of Natural Resources and former Watershed Protection Branch of the Prince George's County Department of Environmental Resources under *Contract No. 90117.01*

The coastal analyses for this revision were performed by Risk Assessment Mapping and Planning Partners (RAMPP) under contract No. HSFEHQ-09-D-0369, Task Order HSFE03-10-0023. This study was completed in December 2012.

No previously issued Letters of Map Revision (LOMRs) have been incorporated as part of this countywide revision.

Base map files were obtained in digital spatial data format from Prince George's County. Road centerlines were provided by Prince George's County Office of Information Technology and Communications. Road centerlines were produced at a scale of 1"=200' using geodetic control and aerial photography. Political Boundaries and stream lines were provided by Prince George's County Department of Environmental resources. Streamline were rectified to match 2007 digital aerial photography for Prince George's County.

FEMA may use and distribute map products which can be derived from the prepared digital base map free of charge. The Prince George's County GIS data may only be distributed in raster format.

The coordinate system used for the production of this FIRM is Universal Transverse Mercator (UTM), Zone 18 North, North American Datum of 1983 (NAD 83), GRS 80 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the UTM projection, NAD 83. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the Prince George's County boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

An initial Consultation Coordination Officer's (CCO) meeting is typically held with representatives of FEMA, the community, and the study contractor to discuss the scope of the FIS. A final CCO meeting is held to review the results of the study.

The dates of previous initial and final CCO meetings held for the communities within the boundaries of Prince George's County are shown in Table 1, "CCO Meeting Dates for Pre-countywide FISs."

TABLE 1 – CCO MEETING DATES FOR PRE-COUNTYWIDE FISs

Community Name	Initial CCO Date	Final CCO Date
Prince George's County (Unincorporated Areas)	June 1982	January 16, 1986
Laurel, City of	1972	October 5, 1977

For this [date] revision, the initial CCO meeting was held on December 19, 2006 at the Prince George's County Department of Environmental Resources and attended by representatives of FEMA and the Prince George's County Department of Environmental Resources.

Coordination with Prince George's County officials and Federal, State and regional agencies produced information pertaining to floodplain regulations, community maps, flood history and other hydrologic data.

The results of the study were reviewed at CCO meetings held on November 30, 2010, and again on [TBD] attended by representatives of FEMA, the community, the State, and FEMA contractors. All comments and concerns were incorporated.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Prince George's County, Maryland including the City of Laurel.

Prince George's County, a Cooperating Technical Partner, was contracted to perform detailed studies on the same flood sources which were studied with detailed methods in previously published FIS reports. The selection of streams for detailed study in the previously published FIS reports was made with priority given to all known flood hazard areas and areas of projected development and proposed construction. All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1), on the FIRM (Exhibit 2), and in the study area description of Table 3, "Scope of Study."

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS

Ammendale Branch	Horsepen Branch	Patuxent River
Anacostia River	Hunters Mill Branch	Pea Hill Branch
Bald Hill Branch	Indian Creek	Piscataway Creek
Barnaby Run	Little Paint Branch	Potomac River
Bear Branch	Lottsford Branch	Ritchie Branch
Brier Ditch	Lower Beaverdam Creek	Sligo Creek
Broad Creek	Mattawoman Creek	Southwest Branch
Burch Hill Branch	Meetinghouse Branch	Timothy Branch
Cabin Branch	Muirkirk Branch	Tinkers Creek
Charles Branch	Northeast Branch – Western Branch	Unnamed Tributary to Broad Creek

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS-continued

Collington Branch	Northeast Branch – Anacostia River	Western Branch
Crow Branch	Northwest Branch – Anacostia River	
Federal Spring Branch	Oxon Run	
Folly Branch	Oxon Run – Split Flow	
Henson Creek	Paint Branch	

TABLE 3 – SCOPE OF STUDY

Stream	Study Area Description
Ammendale Branch	From just upstream of the confluence with Indian Creek to approximately 300-feet upstream of Virginia Manor Road
Anacostia River	From the downstream county boundary to the confluence of the Northeast and Northwest Branches of Anacostia River.
Bald Hill Branch	From its confluence with Western Branch to approximately 1,000 feet upstream of Good Luck Road.
Barnaby Run	From just upstream of its confluence with Oxon Run to approximately 250-feet upstream of Audrey Lane
Bear Branch	From its confluence with Crow Branch to approximately 200 feet upstream of Contee Road.
Brier Ditch	From its confluence with the Northeast Branch Anacostia River to approximately 2,100-feet upstream of the Baltimore-Washington Parkway.
Broad Creek	From its confluence with the Potomac River to the confluence of Henson Creek and Hunters Mill Branch.
Burch Hill Branch	From its confluence with Piscataway Creek to approximately 200-feet upstream of Springfield Road.
Cabin Branch	From just upstream of its confluence with Lower Beaverdam Creek to approximately 200-feet upstream of Central Avenue (SR 214)
Charles Branch	From its confluence with Western Branch to approximately 150-feet upstream of State Route 223.

TABLE 3 – SCOPE OF STUDY - continued

Stream	Study Area Description
Collington Branch	From its confluence with Western Branch to approximately 3,300-feet north of U. S. Route 50.
Crow Branch	From its confluence with Patuxent River to just downstream of Montrose Avenue
Federal Spring Branch	From its confluence with Western Branch to just upstream of Ritchie Marlboro Road.
Folly Branch	From its confluence with Lottsford Branch to approximately 300-feet upstream of State Route 564.
Henson Creek	From is confluence with Broad Creek to just upstream of Interstate 95.
Horsepen Branch	From its confluence with the Patuxent River to approximately 600-feet upstream of Hillmeade Road.
Hunters Mill Branch	From its confluence with Broad Creek to approximately 7,300-feet upstream of Indian Head Highway.
Indian Creek	From its confluence with the Northeast Branch (of Anacostia River) to approximately 4,000-feet upstream of Ammendale Road
Little Paint Branch	From its confluence with Paint Branch to approximately 400-feet upstream of Greencastle Road.
Lottsford Branch	From its confluence with Western Branch to approximately 260-feet upstream of State Route 450.
Lower Beaverdam Creek	From the downstream county boundary to approximately 300-feet upstream of U. S. Route 50.
Mattawoman Creek	From the downstream county boundary to approximately 5,000-feet upstream of the U.S. Route 301.
Meetinghouse Branch	From its confluence with Tinkers Creek to approximately 80-feet upstream of State Route 5.
Muirkirk Branch	From just upstream to approximately 4,000-feet upstream of the confluence with Indian Creek

TABLE 3 – SCOPE OF STUDY - continued

Stream	Study Area Description
Northeast Branch Western Branch	From its confluence with Western Branch to approximately 300-feet upstream of Woodmore Road.
Northeast Branch Anacostia River	From its confluence with the Anacostia River to the confluence of Indian Creek and Paint Branch.
Northwest Branch Anacostia River	From its confluence with the Anacostia River to approximately 150-feet upstream of Piney Branch Road.
Oxon Run	For the lower reach, from its confluence with the Potomac River to the confluence of Barnaby Run at the county boundary and for the upper reach, from approximately 1,200 feet downstream of 23rd Parkway to approximately 1,500-feet upstream of State Route 4.
Oxon Run Split Flow	From approximately 300 feet downstream to approximately 900 feet upstream of Suitland Parkway
Paint Branch	From its confluence with the Northeast Branch Anacostia River to approximately 3,000 feet upstream of Powder Mill Road.
Patuxent River	From the downstream county boundary to just downstream of Rocky Gorge Dam.
Pea Hill Branch	From its confluence with Tinkers Creek to approximately 120-feet upstream of Old Branch Avenue.
Piscataway Creek	From its confluence with the Potomac River to approximately 100-feet upstream of State Route 223 (Woodyard Road).
Potomac River	For its entire length within the county
Ritchie Branch	From its confluence with Southwest Branch to approximately 2,200-feet upstream of Ritchie Road.
Sligo Creek	From its confluence with the Northwest Branch Anacostia River to approximately 1,900-feet upstream of East West Highway.
Southwest Branch	From its confluence with Western Branch to approximately 10,500-feet upstream of Walker Mill Road.

TABLE 3 – SCOPE OF STUDY - continued

Stream	Study Area Description
Timothy Branch	From its confluence with Mattawoman Creek to approximately 0.25 mile upstream of State Route 381.
Tinkers Creek	From its confluence with Piscataway Creek to the confluence of Meetinghouse Branch and Paynes Branch
Unnamed Tributary to Broad Creek	From its confluence with Broad Creek to approximately 6,400 feet upstream of Ft. Washington Road.
Western Branch	From its confluence with the Patuxent River to the confluence of Bald Hill Branch and Lottsford Branch.

Tidal flooding effects from the Chesapeake Bay and the Potomac River were also studied by detailed methods. Tidal analyses were performed by the USACE for FEMA (References 1, 2 and 3).

Approximate methods were used to study those areas having a low development potential or minimal flood hazards. This methodology included computation of the 1-percent annual chance discharge, hydraulic modeling and GIS-based mapping. For certain streams, as described in Section 3.2, the floodplain boundaries were adjusted on the basis of a comprehensive watershed management plan or the preceding FIS. The scope and methods of study were agreed upon by FEMA, Prince George's County and the City of Laurel. Table 4, "Flooding Sources Studied By Approximate Methods" lists the rivers or streams studied in whole or in part by approximate methods in this study.

TABLE 4 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS

Back Branch	Oxon Run
Bald Hill Branch	Paint Branch
Barnaby Run and an unnamed tributary	Patuxent River
Beaverdam Creek and an unnamed tributary	Paynes Branch
Beck Branch and an unnamed tributary	Pea Hill Branch
Black Branch	Piscataway Creek
Black Swamp Creek	Ritchie Branch
Burch Branch	Rock Branch
Butler Branch	Southwest Branch of Charles Branch
Cabin Branch	Spice Creek
Carey Branch	Stanley Run
Cattail Branch	Taynard Branch
Charles Branch	Tom Walls Branch
Collington Branch	Turkey Branch
Dower House Branch	Tributary to Northeast Branch – Western Branch

TABLE 4 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS-continued

East Branch of Collington Branch
Federal Spring Branch
Folly Branch and an unnamed tributary
Full Mill Branch
Green Branch
Greenbelt Park Branch
Henson Creek
Honey Branch
Hotchkins Branch
Horsepen Branch
House Branch
Hunters Mill Branch
Indian Creek
Little Paint Branch
Lottsford Branch
Mattaponi Creek and an unnamed tributary
Mattawoman Creek and an unnamed tributary
Meetinghouse Branch
Mill Branch
Mt. Nebo Branch
Muirkirk Branch
Northeast Branch of Western Branch
North Fork Walker Branch
Unnamed Tributary No. 1 and its tributaries
Unnamed Tributary No. 2
Unnamed Tributary No. 3
Unnamed Tributary No. 4
Unnamed Tributary No. 5
Unnamed Tributary No. 6 and its tributaries
Unnamed Tributary No. 7 to Northeast Branch of Western Branch
Unnamed Tributary to Unnamed Tributary No. 7 to Northeast Branch of Western Branch
Unnamed Tributary No. 8 to Southwest Branch
Unnamed Tributary No. 9
Unnamed Tributary No. 10 to Collington Branch
Unnamed Tributary No. 11 to Mattaponi Creek
Unnamed Tributary No. 12 to Mattaponi Creek
Unnamed Tributary to Brier Ditch
Unnamed Tributary to Broad Creek and its tributaries
Unnamed Tributary to Federal Spring Branch
Unnamed Tributaries to Henson Creek
Unnamed Tributaries to Piscataway Creek
Unnamed Tributary to Potomac River
Walker Branch
Wolf Den Branch
Zekiah Swamp Run and an unnamed tributary

2.2 Community Description

Prince George's County

Prince George's County is located in the south-central portion of Maryland. It is bordered to the west by the unincorporated areas of Montgomery County, Maryland, Washington, DC, the City of Alexandria, Virginia, and the unincorporated areas of Fairfax County, Virginia. To the north, it is bordered by the unincorporated areas of Howard County, Maryland. To the east, it is bordered by the unincorporated areas of Anne Arundel and Calvert Counties, Maryland. To the south, it is bordered by the unincorporated areas of Charles County, Maryland.

The areas of Prince George's County in close proximity to Washington, DC, have experienced, and continue to experience, significant population increases and development pressures. The extreme southern and eastern portions are still largely rural, except for localized areas such as Bowie and Upper Marlboro. Upper Marlboro is the county seat of Prince George's County. The population of the

county increased from 360,000 in 1960, to: 661,719 in 1970; 665,071 in 1980, 801,515 in 2000, and 863,420 in 2010 (Reference 4).

Prince George's County consists of 485 square miles situated almost entirely within the Atlantic Coastal Plain. A small area along the Montgomery County boundary is in the Piedmont province. The Patuxent River forms the northern and eastern boundaries. The Piedmont is gently rolling to hilly and moderately dissected by broad, shallow valleys. The northern part of the Coastal Plain is gently rolling and has broad valleys; the rest is a partly dissected low plateau that extends south into Charles County. Approximately half the Prince George's County drains east to the Patuxent River, while the remainder drains southwest through the Anacostia River and other streams to the Potomac River.

The area has a humid temperate climate with generally mild winters and warm, wet summers. Prince George's County experiences a wide range of temperatures, from a historic low of -26 degrees Fahrenheit (˚ F) to a high of 107˚ F. (Reference 5). The annual mean daily maximum and minimum temperatures range from 65˚ F to 70˚ F and from 45˚ F to 50˚ F, respectively. The annual mean total precipitation ranges from approximately 40-inches to 50-inches (Reference 6).

Approximately 45-percent of Prince George's County is covered by woodland (Reference 7). Most floodplain areas of the Patuxent River are thickly wooded with red and white oaks, sweetgum, yellow poplar, and pines. Thickets consisting of short coarse grass, low shrubs, bushes, and small trees are characteristic of the tidal areas of the river.

The Patuxent River enters Prince George's County at Rocky Gorge Reservoir, north of the City of Laurel. Rocky Gorge Reservoir was constructed in 1954 by the Washington Suburban Sanitary Commission for water supply. As the river passes through Laurel, it is joined by Walker Branch. At Bowie, the Middle Patuxent River joins the Patuxent River. South of Bowie at Chalk Point, the Patuxent River has retained its natural state as a tidal estuary. This tidal area is important ecologically and consists of wide floodplains and swampy areas of brackish water.

The Patuxent River is of great historic significance to the settlement and development of southern Maryland, particularly Prince George's County. The river was one of the two major watercourses used to transport settlers and supplies by barge to the county. Harbor towns along the river developed rapidly in order to handle the trading and storage of tobacco, southern Maryland's principal crop. During the War of 1812, the Patuxent River was the scene of many fierce naval battles. In this war, a British invasionary force landed at Nottingham, a small settlement on the river in southern Prince George's County, and proceeded to Washington, DC, where they burned the city. With the advent of the railroad, the importance and use of the river diminished. Many historic plantations and

mansions remain as monuments to the significant contributions of the Patuxent River.

City of Laurel

The City of Laurel is located in central Maryland and in the northern portion of Prince George's County. In 1940, Laurel had a population under 3,000. Population estimates for 2000 indicated a population of 19,960 and 25,115 in 2010 (Reference 4).

In 1668, Richard Snowden received a memorial grant of 10,500 acres spread over four counties in Maryland, which included the area now known as Laurel. By 1812, Laurel had become a regular stop along the stagecoach route between Baltimore and Washington. The excellent location of Laurel along the banks of the Patuxent River was first utilized by Nicholas Snowden in 1811, when he erected a grist mill on the river. With transportation available by stagecoach and occupations provided by the milling enterprise, a small town developed and prospered. Additional mills were put in operation, and with the advent of the Baltimore and Ohio Railroad in 1835, the town developed into a bustling industrial center. Laurel was incorporated in 1870, and by 1888 had become the largest town in Prince George's County and the main station on the Baltimore and Ohio Railroad line between Baltimore and Washington. As the cities of Baltimore, Maryland, and Washington, DC developed, the industrial development of Laurel waned considerably; however, due to its location between the two cities, Laurel flourished as a residential community.

A ridge marking the fall line between the Atlantic Coastal Plain and the Hills of the Piedmont Plateau defines the western edge of the developed area of Laurel. The western half of the city is characterized by gently rolling topography, while the eastern half is flat. The City of Laurel is divided into the three drainage basins for the Patuxent River, Crow Branch and Bear Branch. Although these watercourses provide natural drainage, the eastern half of the city, with its flat topography, has experienced extensive flooding due to surface ponding during heavy rainstorms. The city's Capital Improvement Program has been designed to alleviate this problem by construction of extensive storm drainage and storm water management systems. These systems provide for rapid drainage of surface runoff (Reference 8).

The Patuxent River forms the northern corporate limits of Laurel, flowing in a southeast direction. The headwaters of the Patuxent are in northern Howard County. Crow Branch is a small stream which runs through the southern portion of the city. The floodplains of the Patuxent River and Crow Branch have been highly urbanized. Development of the floodplains includes single- and multi-family dwellings, commercial establishments, and the amenities which accompany such urban development (i.e., streets, bridges, public utilities, etc.). Until 1973, when Crow Branch was encased in a concrete channel, it was the

source of intermittent flooding problems. Continued use of the floodplain areas will be tempered by ordinances adopted by Prince George's County. Essentially, these ordinances restrict construction, grading or filling operations within the area that would be inundated by the flood having a 1-percent annual chance of being equaled or exceeded in any given year (Reference 9).

The Patuxent River crosses two major physiographic regions, the Piedmont Province and the Atlantic Coastal Plain. The Piedmont is underlain by crystalline rocks of Precambrian age, with soils consisting of the products of in-place weathering of the parent rock formations. These soils are moderately well-compacted, consisting of a high percentage of sand with lesser quantities of silt. The Atlantic Coastal Plain is underlain by unconsolidated deposits of gravel, sand, silt and clay.

The soils in the Crow Branch watershed where urbanization has not taken place are characteristic of the Atlantic Coastal Plain. The soils are moderately deep, dense, and have almost impermeable subsoil. The soils are moderately to poorly drained and generally silty.

The vegetation of the study area where urbanization has not taken place consists of thickly wooded areas to shrubs and small trees that tolerate salty or at least brackish water.

2.3 Principal Flood Problems

Due to the intense development pressures and resulting encroachment into floodplains, flooding has occurred throughout Prince George's County. Historically, flooding in this county occurs during the mid and late summer and is associated with tropical storms and hurricanes. During a major storm in August 1933, flood elevations reached 1 foot below the 1-percent annual chance storm on the Anacostia River system, and residents near Piscataway Creek reported flooding over the Livingston Road bridge (Reference 10). In August 1955, Hurricane Connie reached an elevation 4 feet below the 1-percent annual chance storm on Western Branch and inundated a large commercial section of Upper Marlboro (Reference 11). This storm also flooded some buildings on Piscataway Creek (Reference 12). Other major storms causing severe flooding occurred in August 1971, September 1975 (Hurricane Eloise), and September 1979 (Hurricane David) (References 13 and 14).

The flood of record in the area occurred in June 1972 as a result of Tropical Storm Agnes, causing much flooding and varying degrees of flood related damage. Elevations and high-water marks in the Laurel area were recorded by the Washington Suburban Sanitary Commission in September 1971 and June 1972 (References 15 and 16). The recurrence interval of the September 1971 flood is between a 10-and 2-percent annual chance floods.

City of Laurel

The floodplains of the Patuxent River and Crow Branch are highly developed within the City of Laurel, and both are periodically subjected to severe flooding. Ponding problems occur when culverts and small bridge openings become clogged with debris washed into the streams during major storms. The largest flood of record, slightly greater than the estimated discharge for the 1-percent annual chance storm, occurred in June 1972 when Tropical Storm Agnes passed through the Prince George's County area. The Patuxent River reached an estimated peak discharge of 26,000 cubic feet per second (cfs), which caused severe flooding in Laurel. The Crow Branch Channel Improvement Project was in the construction stage when Tropical Storm Agnes passed through the area. There was extensive localized flooding upstream of the Chessie System embankment which acted as a dam due to the unfinished construction.

The Washington Suburban Sanitary Commission recorded high-water elevations during the aftermath of Tropical Storm Agnes. Within the limits of the study for the city, these known elevations correspond closely to calculated elevations for the 1-percent annual chance flood.

Elevations were also taken within the Laurel area by the Washington Suburban Sanitary Commission in September 1971, after a 3-day storm. The discharge recorded for this flood indicated that it ranked between the10- and 2-percent annual chance flood events.

2.4 Flood Protection Measures

Within this jurisdiction, there are one or more levees that have not been demonstrated by the communities or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as they relates to the levee's capacity to provide 1-percent- annual -chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

There are a number of flood protection measures in-place in Prince George's County. These projects have been incorporated into the hydrologic and hydraulic computer models for the studied streams. The following is a list of some of the major projects:

a. Extensive channel improvements on Western Branch in the Upper Marlboro area;
b. Channel and culvert improvements along Indian Creek between Powder Mill Road and Baltimore Avenue;
c. Detention ponds on the upper portions of Indian Creek and Ammendale Branch;

d. Levees on the Anacostia River, the Northeast Branch Anacostia River, and the Northwest Branch Anacostia River;
e. Channel improvements along Paint Branch;
f. Flood mitigation construction along Oxon Run at Forest Heights; and
g. Acquisition of floodprone homes in the Piscataway Creek, Henson Creek and Western Branch Watersheds

Flood control levees were constructed along the Anacostia River and two of its tributaries, Northeast and Northwest Branches, to mitigate flooding. The Allison Street levee system was constructed by the Washington Suburban Sanitary Commission. This levee was originally designed and constructed to control riverine flood flows for the 1-percent annual chance flood and lesser events. At the time of issuance of this FIS, and due to changes in criteria and requirements for such systems, this system has not been shown to comply with Section 65.10 of the NFIP regulations. Work is underway at Prince George's County with the USACE to rehabilitate this system to control riverine flood flows for the 1-percent annual chance flood. The Bladensburg, Edmonston, Riverdale-Hyattsville and Brentwood levee systems were constructed by the USACE. These systems are accredited to control riverine flood flows for the 1-percent annual chance flood. The Colmar Manor levee system is accredited and meets the minimum certification requirements outlined in Title 44 of the Code of Federal Regulations, Section 65.10. As such, it has been shown as providing protection from the base flood and is mapped as a shaded Zone X.

A flood protection measure of great impact is the Patuxent River Acquisition Program established under the provisions of the master plan for the Patuxent River Watershed Park, which is maintained by the Maryland-National Capital Park and Planning Commission (Reference 17). This plan provided for flood prevention by floodplain land acquisition, with land-use being limited to non-development activities. As of 1977, approximately 5,000 acres of floodplain had been purchased under this program. In 1961, four floodplain management provisions were included in the Patuxent River Watershed Act. These included the prevention of floodplain encroachment due to urban development, the protection of areas subject to erosion and sediment damage, the promotion of conservation, and the beginning of flood prevention programs. Floodplain development has also been limited by Prince George's County floodplain ordinances.

Rocky Gorge and Triadelphia Reservoirs are primarily water-supply reservoirs. They provide regulation of the discharges of lower frequency floods on the Patuxent River. The regulation effect on large floods was found to be minimal.

A channel improvement project on Crow Branch was begun in 1972 and has now been completed. This project included the concrete channelization of Crow Branch, removal of waterway obstruction and minor channel realignment. The

concrete channel was designed to contain the discharge for the 10-percent annual chance storm; therefore, floods of higher magnitudes will not be contained within the channel.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on average during any 10-, 2-, 1-, or 0.2-percent annual chance 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 chances, 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 which equals or exceeds 1-percent annual chance flood in any 50-year period is approximately 40 percent (4 in 10), and, 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.

Note: Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner to meet the requirements of 44CFR 65.10 as it relates to the levee's capacity to provide 1-percent- annual - chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

3.1 Hydrologic Analyses

Prior to the [date], FIS the following hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods in the county.

The Technical Release No. 20 (TR-20) computer program was used to compute discharges for Mattawoman Creek and the 0.2-percent annual chance discharge for Northwest Branch-Anacostia River, from approximately 1,050-feet downstream of Ager Road to the upstream limit of study. The TR-20 program computes surface runoff resulting from a synthetic or natural rainstorm, routes the flow through stream channels and reservoirs, and combines the routed hydrograph with those from other tributaries to determine peak discharges. This program

takes into account conditions that have a bearing on runoff and can use either an input hydrograph or a synthetic hydrograph on any tributary (Reference 18).

Discharges for the following streams were determined from drainage area-discharge curves developed by Greiner Engineering Sciences, Inc., which was the study contractor for the pre-countywide FIS for Prince George's County: Ammendale Branch, Indian Creek and Muirkirk Branch. In addition, these curves were used to determine discharges for: Little Paint Branch, from approximately 600-feet downstream of Cherry Hill Road to approximately 250-feet downstream of Interstate 95 for the 1-percent annual chance event; Little Paint Branch, for the 0.2-percent annual chance event; Paint Branch, from approximately 550-feet upstream of the confluence for Little Paint Branch to the upstream limit of study for the 10-, 2-, and 1-percent annual chance events; and Paint Branch, for the 0.2-percent annual chance event. The drainage area-discharge curves were developed for the various recurrence intervals by analyzing gage records of streams in and around Prince George's County by the U. S. Geological Survey (USGS) J407 computer program (Reference 19). This program followed the log-Pearson Type III flood-frequency analysis as outlined by the Water Resources Council (Reference 20). The adjusted values for each station for the 10-, 2, 1-, and 0.2 -percent annual chance discharges were plotted, and representative curves were then selected for each frequency.

For the Patuxent River, flood-flow frequency data were based on a statistical analysis of stage-discharge records covering a 26-year period at gaging stations operated by the USGS (Reference 21). This analysis followed the standard log-Pearson Type III method as outlined by the Water Resources Council (Reference 22). Consideration was given to the regulatory effect of Rocky Gorge Reservoir and Triadelphia Reservoir in the discharge determinations.

<u>For the [date] countywide FIS</u>

Discharges for the following streams were determined using the TR-20 computer program: Bald Hill Branch, Barnaby Run, Bear Branch, Broad Creek, Burch Branch, Cabin Branch, Charles Branch, Collington Branch, Crow Branch, Federal Spring Branch, Folly Branch, Henson Creek, Horsepen Branch, Hunters Mill Branch, Lottsford Branch, Lower Beaverdam Creek, Meetinghouse Branch, Northeast Branch-Western Branch, Northeast Branch-Anacostia River, Oxon Run, Pea Hill Branch, Piscataway Creek, Ritchie Branch, Southwest Branch, Timothy Branch, Tinkers Creek, Unnamed Tributary to Broad Creek and Western Branch. The flows for Bear and Crow Branches were obtained from the study entitled, "Patuxent Watershed Study (GPI #90117.01 IA#101011)," prepared by Greenman- Pedersen, Inc. and dated 1991 (Reference 23).

Discharges for the following streams were determined from the HEC-HMS computer modeling system developed by the USACE: Anacostia River; Brier Ditch; Little Paint Branch, for the 10- and 2-percent annual chance events; Little

Paint Branch, from approximately 250-downstream of Interstate 95 to the upstream limit of detailed study for the 1-percent annual chance event; Northeast Branch–Anacostia River; Northwest Branch–Anacostia River, from just upstream of the confluence with Anacostia River to the upstream limit of study for the 10, 2- and 1-percent annual chance discharges; Northwest Branch-Anacostia River, from just upstream of confluence with Anacostia River to approximately 1,050-feet downstream of Ager Road for the 0.2-percent annual chance discharge; Paint Branch, from just upstream of the confluence with Indian Creek to approximately 550-feet upstream of the confluence for Little Paint Branch for the 10-, 2- and 1-percent annual chance events; and Sligo Creek. The HEC-HMS program simulates precipitation-runoff and routing processes (Reference 24).

A summary of drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 5, "Summary of Discharges."

TABLE 5 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE			
		10%	2%	1%	0.2%
AMMENDALE BRANCH					
Approximately 550 feet downstream of US Route 1	2.2	1,100	1,650	1,950	3,200
ANACOSTIA RIVER					
Prince George's County Boundary	131.8	21,550	33,320	39,510	52,940
BALD HILL BRANCH					
Approximately 50 feet upstream of the confluence with Western Branch	6.09	2,048	2,612	3,113	3,865
Just downstream of Conrail	1.62	985	1,163	1,238	1,408
BARNABY RUN					
At the confluence with Oxon Run	4.17	2,639	3,424	3,932	5,122
BEAR BRANCH					
At its confluence with Crow Branch	2.43	1,218	1,704	2,053	2,669
Upstream of Contee Road	1.07	1,508	2,078	2,404	3,055

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE 10%	2%	1%	0.2%
BRIER DITCH					
Approximately 300 feet downstream of the Kenilworth Avenue	8.09	3,310	5,070	6,020	7,690
Approximately 60 feet downstream of Kenilworth Avenue	4.23	1,970	2,930	3,430	4,310
BROAD CREEK					
Approximately 3,100 feet downstream of Oxon Hill Road	25.57	5,144	6,808	8,000	10,743
BURCH BRANCH					
Just upstream of confluence with Piscataway Creek	3.78	1,936	2,621	3,293	5,097
CABIN BRANCH					
Approximately 2,400 feet downstream of Sheriff Road	3.55	2,546	3,407	3,892	4,712
Just downstream of Seat Pleasant Drive (F Street Bridge)	2.47	1,955	2,809	3,333	4,281
CHARLES BRANCH					
Approximately 3,200 feet upstream of its confluence with Western Branch	17.38	3,110	4,622	5,285	8,153
Approximately 2,040 feet upstream of Croom Road bridge	7.90	2,213	3,586	4,580	6,270
Approximately 4,930 feet upstream of US Route 301 bridge	2.92	1,732	2,588	3,130	4,436
COLLINGTON BRANCH					
Approximately 40 feet downstream of State Route 202	23.46	1,951	3,005	4,206	7,005

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE 10%	2%	1%	0.2%
COLLINGTON BRANCH -continued					
Approximately 100 feet upstream of Oak Grove Road	12.06	1,408	2,184	3,210	5,165
Approximately 3,000 feet upstream of Mount Oak Road	5.68	1,670	2,475	3,051	4,191
CROW BRANCH					
Upstream of confluence with Patuxent River	4.0	2,825	3,465	3,873	4,678
Just upstream of Eighth Street	1.0	1,217	1,569	1,781	2,147
FEDERAL SPRING BRANCH					
Approximately 4,100 feet downstream of State Route 408	4.10	1,735	2,320	2,669	3,470
FOLLY BRANCH					
Approximately 20 feet upstream of the confluence with Lottsford Branch	6.33	1,157	1,670	1,997	2,672
Approximately 3,625 feet downstream of Conrail	3.31	1,170	1,525	1,816	2,431
HENSON CREEK					
Approximately 3,000 feet upstream of the confluence of Hunters Mill Branch	21.17	4,859	6,346	7,389	9,864
Approximately 3,100 feet upstream of Bock Road	15.98	4,961	7,032	8,351	10,852
Approximately 1,400 feet upstream of Brinkley Road	12.11	4,280	5,220	5,714	6,787
Approximately 5,000 feet upstream of Maryland State Route 5	6.30	2,935	4,017	4,736	6,271

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE			
		10%	2%	1%	0.2%
HENSON CREEK - continued					
Approximately 650 feet upstream of Suitland Road	3.72	1,169	1,570	1,967	3,079
HORSEPEN BRANCH					
Approximately 2,600 feet downstream of Bowie Race Track Road	6.71	2,359	3,245	3,825	4,965
Just downstream of the Conrail Bridge	2.97	1,362	1,914	2,211	2,740
HUNTERS MILL BRANCH					
Approximately 550 feet upstream of Livingston Road	2.38	2,424	3,434	4,015	4,947
INDIAN CREEK					
Approximately 3,100 feet downstream of Berwyn Road	29.2	4,400	7,900	10,800	21,000
Approximately 300 feet downstream of US Interstate Highway 95	25.0	4,000	7,100	8,800	19,000
Upstream of the confluence of Ammendale Branch	2.6	1,200	1,800	2,154	3,600
Approximately 1,800 feet downstream of Ammendale Road	1.90	980	1,450	1,723	2,750
LITTLE PAINT BRANCH					
Approximately 600 feet downstream of Cherry Hill Road	10.36	2,560	4,430	5,220	6,600
Approximately 250 feet downstream of US Interstate Highway 95	7.90	3,070	4,590	5,410	6,820
Approximately 3,300 feet downstream of Green Castle Road	4.23	2,120	3,170	3,730	4,700

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE 10%	2%	1%	0.2%
LOTTSFORD BRANCH					
Just downstream of Lottsford Vista Road	9.63	2,190	3,233	4,121	5,902
Approximately 20 feet upstream of the confluence with Folly Branch	2.82	1,163	1,654	1,965	2,638
LOWER BEAVERDAM CREEK					
Just downstream of Kenilworth Avenue	15.0	5,826	7,293	8,329	10,786
Just downstream of Columbia Park Road	7.96	3,638	4,679	5,338	6,764
Just upstream of the confluence for Cattail Branch	3.26	1,527	1,941	2,184	2,346
Approximately 1,400 feet downstream of Veteran's Parkway (SR 410)	1.96	1,095	1,369	1,526	1,831
MATTAWOMAN CREEK					
Approximately 10,025 feet downstream of the Berry Road	35.01	3,761	6,698	8,140	12,169
Approximately 100 feet downstream of Sharperville Road	27.05	3,152	5,843	7,236	11,046
Approximately 4,835 feet downstream of Gardner Road	17.98	2,846	5,269	6,508	9,832
Approximately 1,800 feet downstream of U.S. Route 301	8.78	1,615	3,491	5,080	7,880
MEETINGHOUSE BRANCH					
Just upstream of the confluence with Tinkers Creek	2.92	2,387	3,239	3,768	4,897
MUIRKIRK BRANCH					
Just upstream of the confluence with Indian Creek	1.76	2,000	3,300	4,470	7,600

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE 10%	2%	1%	0.2%
NORTHEAST BRANCH – WESTERN BRANCH					
Approximately 2,100 feet downstream of State Route 214	8.74	1,901	2,910	3,624	5,473
Approximately 2,250 feet downstream of Kings Manor Drive	3.88	911	1,324	1,591	2,176
NORTHEAST BRANCH – ANACOSTIA RIVER					
Just upstream of confluence with Anacostia River	75.4	9,840	14,430	17,160	21,390
NORTHWEST BRANCH – ANACOSTIA RIVER					
Just upstream of confluence with Anacostia River	53.1	10,290	16,930	21,090	29,670
Approximately 1,050 feet downstream of Ager Road	35.48	6,400	12,260	15,490	22,290
Approximately 350 feet upstream of University Boulevard	33.25	7,060	13,190	16,470	22,400
OXON RUN					
At the downstream County boundary	13.95	7,970	10,430	11,961	15,524
Approximately 400 feet downstream of 23rd Street	6.28	3,683	4,913	5,736	7,595
Just downstream of Suitland Road	2.79	2,340	3,098	3,623	4,914
PAINT BRANCH					
Approximately 350 feet upstream of confluence with Indian Creek	31.10	4,400	8,100	11,200	22,500
Approximately 550 feet upstream of confluence with Little Paint Branch	17.31	3,300	5,800	7,700	14,500

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE 10%	2%	1%	0.2%
PEA HILL CREEK					
Approximately 1,800 feet upstream of its confluence with Tinkers Creek	3.87	2,106	2,913	3,432	4,440
PATUXENT RIVER					
Just upstream of the confluence for Western Branch	400.0	24,500	43,000	52,500	77,000
PISCATAWAY CREEK					
Approximately 7,800 feet downstream of Indian Head Highway (State Route 210)	63.4	8,801	13,263	16,121	23,524
Approximately 200 feet upstream confluence for Tinker's Creek	35.9	4,369	6,466	8,031	12,080
Approximately1,850 feet upstream confluence for Butler Branch	22.9	3,037	4,682	6,002	9,749
Just downstream of Commo Road	9.2	4,161	6,237	7,548	10,528
RITCHIE BRANCH					
Approximately 2,250 feet downstream of Ritchie Road	2.44	1,514	2,106	2,486	3,335
SLIGO CREEK					
Approximately 800 feet upstream confluence with Northwest Branch	11.19	4,380	7,130	8,540	10,800
SOUTHWEST BRANCH					
Approximately 1,250 feet downstream of White House Road	15.59	4,063	5,996	7,189	9,868
Approximately 200 feet downstream of Interstate 95 (I-95)	8.55	3,472	5,180	6,146	8,022

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE 10%	2%	1%	0.2%
SOUTHWEST BRANCH - continued					
Approximately 250 feet upstream of Walker Mill Road	2.85	2,021	2,814	3,320	4,290
TIMOTHY BRANCH					
Approximately 1,700 feet downstream of US Route 301	4.68	1,906	2,768	3,343	4,428
Approximately 1,300 feet downstream of Brandywine Road	1.54	995	1,377	1615	2,127
TINKERS CREEK					
Approximately 3,350 feet downstream of Gallahan Road	16.82	5,322	7288	8,594	11,609
Approximately 4,800 feet upstream of the confluence with Pea Hill Branch	5.95	3,289	4,326	5,051	7,071
UNNAMED TRIBUTARY TO BROAD CREEK					
Approximately 4,000 feet downstream of Fort Washington Road	2.69	1,500	2,150	2,606	4,493
WESTERN BRANCH					
Approximately 50 feet downstream of US Route 301	91.87	7,786	12,114	15,321	22,427
Approximately 150 feet upstream of Main Street	66.76	6,434	10,027	12,471	17,683
Just downstream of State Route 202	30.50	3,696	5,501	6,812	9,840
Just downstream of the confluence for Bald Hill Branch and Lottsford Branch	17.42	3,131	4,341	5,293	7,178

For streams studied by approximate methods, the discharges were determined using the TR-20 computer model and GIS-based hydrologic analysis tool GISHydro2000 developed by University of Maryland (Reference 25). ArcGIS based GISHydro2000 contained landuse and soils data for entire state of Maryland and performs automated hydrologic analysis using the regression equations developed by Moglen et al. (2006). In some cases, the discharges were obtained from hydrology models which were prepared for detailed study reaches.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the flood profiles or in the floodway data 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.

Triangulated irregular networks (TIN), which is a 3–D model of a ground surface, were created from Light Detection And Ranging (LiDAR) data obtained from the Maryland-National Capital Park and Planning Commission and from digital terrain data provided by the Baltimore District of the USACE (NAB (Reference 29). Cross sections that were used in the hydraulic computer models for the following watersheds were obtained from a TIN created from the M-NCPPC LIDAR data: Charles Branch, Henson Creek, Horsepen Branch, Lower Beaverdam Creek, Mattawoman Creek, Oxon Run, Patuxent River, Piscataway Creek and Western Branch watersheds. Cross sections that were used in the hydraulic computer models for the following flooding sources, or specified river reaches, were obtained from a TIN created from the NAB digital terrain data: Anacostia River; Northeast Branch – Anacostia River, from just upstream of the confluence with Anacostia River to just downstream of Riverdale Road; and Northwest Branch – Anacostia River, from just upstream of the confluence with Anacostia River to approximately 600-feet upstream of Queen’s Chapel Road.

Data for the below-water portions of TIN-generated cross sections was obtained from effective hydraulic models or estimated from thalwegs on the profile sheets in the effective FIS. The below-water portions of cross sections in the effective hydraulic models were originally obtained by field survey or sounding maps. Estimates of thalwegs were used if data was not available from effective hydraulic models.

Some hydraulic computer models used cross section data that was obtained from flood studies prepared by engineering consultants for Prince George’s County (References 23 and 30). Cross sections used in the hydraulic models for the

following flood sources were obtained from these studies: Bear Branch; Brier Ditch; Crow Branch; Indian Creek; Little Paint Branch; Ammendale Branch; Muirkirk Branch; Northeast Branch – Anacostia River, from just downstream of Riverdale Road to the confluence with Paint Branch; Northwest Branch – Anacostia River, from approximately 600 feet upstream of Queens Chapel Road to the upstream limit of detailed study; Paint Branch and Sligo Creek. The ground data and below-water portions of the cross sections in these studies were obtained from either 2-foot topographic maps or field survey data.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2). Along certain portions of Piscataway Creek, Broad Creek, Lower Beaverdam Creek, Oxon Run, Collington Branch and Folly Branch, profile base lines are shown on the maps to represent channel distances as indicated on the flood profiles.

Waterway opening dimensions and roadway elevations of structures and culverts were either taken from the Prince George's County stormwater management studies or determined from field surveys by Prince George's County and the MDE. Prince George's County teamed with the MDE to conduct field surveys of waterway openings along the Patuxent River, Mattawoman Creek, Timothy Branch and Horsepen Branch. Information acquired from these surveys was compared with the effective hydraulic models and where differences occurred, effective bridge and culvert data was replaced with the field data.

Water-surface elevations for floods of the selected recurrence intervals were computed using the USACE's Hydrologic Engineering Centers HEC-2 Water Surface Profiles (Version 4.6) and River Analysis System (HEC-RAS Version 3.1.3) step-backwater computer programs. Flood profiles were drawn showing computed water-surface elevations and where backwater conditions prevail, backwater elevations for floods of the selected recurrence intervals (References 31and 32).

Starting water-surface elevations were calculated assuming a coincident peak situation for most detailed study streams. Starting water-surface elevations were obtained from the Potomac River tidal profile for Broad Creek, Piscataway Creek and Oxon Run (Reference 28). For the Patuxent River, tidal influences were not factored into the HEC-RAS hydraulic computer model and the starting water surface elevation was calculated using the slope-area method to compute normal depth. Where a coincident peak was not assumed and tidal influences are not present, the starting water surface elevations for detailed study streams were calculated using normal depth, acquired from the pre-countywide FIS for Prince George's County, or acquired from the FIS for the District of Columbia.

Cross sections were located along the detailed study streams at intervals ranging from approximately 1-foot to approximately 2,200-feet depending on stream alignment, roadway structures and overbank topography. Topographic maps

derived from digital elevation data were prepared by Prince George's County for the entire county (Reference 29).

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations or aerial photography. The channel "n" and overbank "n" values for the streams studied by detailed methods are shown in Table 6. Overbank values listed in the table were determined by field inspection. Modeling of some cross sections involved "n" values not within the listed ranges. Values as high as 10.0 were used for portions of the cross sections where buildings obstructed some or the entire overbank. Such an extreme value was omitted from the table in order to give a better description of the natural floodplain. Channel "n" values in the table include all the values used in the modeling.

TABLE 6 – ROUGHNESS COEFFICIENTS

Stream	Channel "n"	Overbank "n"
Ammendale Branch	0.020 – 0.090	0.040 – 0.100
Anacostia River	0.028 – 0.040	0.030 – 0.150
Bald Hill Branch	0.015 – 0.080	0.060 – 0.120
Barnaby Run	0.020 - 0.048	0.035 – 0.095
Bear Branch	0.010 – 0.060	0.025 – 0.120
Brier Ditch	0.020 – 0.045	0.040 – 1.000
Broad Creek	0.050 – 0.050	0.150
Burch Branch	0.030 – 0.050	0.060 – 0.115
Cabin Branch	0.015 – 0.050	0.020 – 0.100
Cattail Branch	0.025 – 0.040	0.050 – 0.080
Charles Branch	0.030 – 0.065	0.060 – 0.113
Collington Branch	0.035 – 0.050	0.010 – 0.120
Crow Branch	0.022 – 0.035	0.025 – 1.00
Federal Spring Branch	0.040 – 0.050	0.080 – 0.110
Folly Branch	0.040 – 0.055	0.075 – 0.120
Henson Creek	0.020 – 0.085	0.070 – 0.150
Horsepen Branch	0.025 – 0.060	0.020 – 0.110
Hunters Mill Branch	0.050 – 0.055	0.080 – 0.150
Indian Creek	0.015 – 0.055	0.030 – 0.120
Little Paint Branch	0.015 – 0.065	0.025 – 0.120
Lottsford Branch	0.045 – 0.065	0.075 – 0.100
Lower Beaverdam Creek	0.015 – 0.400	0.020 – 0.100
Mattawoman Creek	0.040 – 0.090	0.013 – 0.115
Meetinghouse Branch	0.040 – 0.050	0.090 – 0.120

TABLE 6 – ROUGHNESS COEFFICIENTS - continued

Stream	Channel "n"	Overbank "n"
Muirkirk Branch	0.030 – 0.060	0.030 – 0.120
Northeast Branch Western Branch	0.035 – 0.069	0.010 – 0.104
Northeast Branch Anacostia River	0.015 - 0.085	0.020 – 0.150
Northwest Branch Anacostia River	0.015 – 0.070	0.015 – 1.000
Oxon Run	0.039 – 0.105	0.020 – 0.070
Oxon Run Split Flow	0.030 – 0.049	0.060 – 0.105
Paint Branch	0.025 – 0.110	0.025 – 0.110
Patuxent River	0.020 - 0.050	0.040 – 0.120
Pea Hill Branch	0.035 – 0.050	0.085 – 0.120
Piscataway Creek	0.035 – 0.050	0.050 – 0.140
Ritchie Branch	0.045 – 0.054	0.063 – 0.110
Sligo Creek	0.020 – 0.120	0.013 – 1.000
Southwest Branch	0.035 – 0.073	0.060 – 0.130
Timothy Branch	0.035 – 0.055	0.050 – 0.130
Tinkers Creek	0.030 – 0.063	0.050 – 0.120
Unnamed Tributary to Broad Creek	0.040 – 0.050	0.080 – 0.150
Western Branch	0.030 – 0.050	0.055 – 0.200

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

For the streams studied by approximate methods, the extent of the 1-percent annual chance flood was determined using detailed study discharges. These discharges were used in hydraulic analyses to approximate the elevation of the 1-percent annual chance flood. Approximate boundaries for the following tributaries to Western Branch are based on the water surface elevations from HEC-2 computer models: Lottsford Branch, Northeast Branch, Turkey Branch, Cabin Branch, Back Branch, Federal Spring Branch, Ritchie Branch, Black Branch, East Branch, Unnamed Tributary No.7, Unnamed Tributary No. 10 located upstream of Leeland Road and Unnamed Tributary No.8. Approximate boundaries for Upper Beaverdam Creek and Beck Branch were based on a watershed study for the Anacostia River Watershed (Reference 30). Approximate boundaries for Cattail and Cabin Branches of the Lower Beaverdam Creek were

based on a watershed study for Lower Beaverdam Creek watershed (Reference 33). For Oxon Run, approximated boundaries were based on the Comprehensive Watershed Management Plan for Oxon Run (Reference 34). Approximate boundaries for Southwest Branch of Charles Branch were based on the Comprehensive Watershed Management Plan for Charles Branch (Reference 35). Approximate boundaries for Burch Branch, Butler Branch, House Branch, Unnamed Tributary No.4, Unnamed Tributary No.5, Unnamed Tributary No. 6 and certain reaches of Piscataway Creek were based on the Comprehensive Watershed Management Plan prepared for Piscataway Creek (Reference 36). Approximate boundaries for Carey Branch, an unnamed tributary to Broad Creek, certain reaches of Henson Creek, and unnamed tributaries to Henson Creek were based on the Comprehensive Watershed Management Plan prepared for Henson Creek (Reference 37).

For all other streams studied by approximate methods, GIS-based automated hydraulic methodologies were employed. These streams are supported by geo-referenced HEC-RAS models. While hydraulic structures were not incorporated into the models, cross sections were automatically generated and manually adjusted, where applicable, to capture areas of hydraulic contraction.

All elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88). Elevation reference marks used in this study are shown on the maps.

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

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

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

- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)

- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be

placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

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

3.3 Coastal Analyses

Coastal analysis, 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 of the selected recurrence intervals along the shoreline.

Potomac River and Patuxent River are primary flooding sources in Prince George's County which discharge flows into Chesapeake Bay. Majority of the coastal flooding in the county is caused due to Potomac River and Patuxent River. Coastal flooding along the Potomac River located in the western parts of the county. Eastern portions of the county are impacted Patuxent River and impact portion of Upper Marlboro, Eagle Harbor, and rural areas along the coastal line. Generally, there are no dunes along the coastline. Coastline along Patuxent River has heavy vegetation and also includes some marshy areas.

The USACE performed a cursory frequency-of-occurrence analysis of storm surge to determine the extreme water levels along the tidal Potomac River from the confluence with the Chesapeake Bay to Washington, DC. In this analysis, the USACE utilized 1-percent annual chance flood elevations at Lewisetta, VA, to define the downstream boundary condition; wind and atmospheric pressure forcings for an extreme historical hurricane (emulating Hurricane Isabel) were modified and imposed so that the storm surge computer model would replicate the elevation of the flood having 1-percent annual chance of being equaled or exceeded in any given year at Washington, DC. The 1-percent annual chance flood elevation for the Potomac River was determined in the re-evaluation of the FIS for Washington, DC, which is in press at the time of this document production. A Log-Pearson Type III analysis of 73-years of gage-measured water-surface elevations was used to determine this 1-percent annual chance elevation (Reference 3).

A summary of peak elevation-frequency relationships for the effect of the Chesapeake Bay on the Potomac River is shown in Table 7, "Summary of Storm Surge Elevations (Potomac)" (Reference 28).

TABLE 7 – SUMMARY OF STORM SURGE ELEVATIONS (POTOMAC)

FLOODING SOURCE AND LOCATION	ELEVATION (FEET) NAVD 88 1-PERCENT ANNUAL CHANCE
POTOMAC RIVER	
At the Corporate Limit for District of Columbia	9.98
At confluence with Broad Creek	9.64
At confluence with Piscataway Creek	9.39
At the boundary with Charles County	9.33

New tidal analysis for Patuxent River was performed to establish the frequency peak elevation relationships for coastal flooding in Prince George's 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 FIS Reports in the study area, including Prince George's County, MD, and serves as the basis for updated FIRMs. Study efforts were initiated in 2008 and concluded in 2012.

Users of the FIRM should be aware that coastal flood elevations along the Patuxent River are provided in Table 9, "Summary of Coastal Stillwater Elevations" table in this report. If the elevation on the FIRM is higher than the elevation shown in this table, a wave height and/or wave runup component likely exists, in which case, the higher elevation should be used for construction and/or floodplain management purposes.

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 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).

The end-to-end storm surge modeling system includes the Advanced Circulation Model for Oceanic, Coastal and Estuarine Waters (ADCIRC) for simulation of 2-dimensional hydrodynamics (Reference 42). ADCIRC was dynamically coupled to the unstructured numerical wave model Simulating Waves Nearshore

(unSWAN) to calculate the contribution of waves to total storm surge (Reference 45). The resulting model system is typically referred to as SWAN+ADCIRC (Reference 40). 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, and water level and high water mark observations.

Overland waves were modeled for 5 miles of shoreline within the county. The coastal floodplain extends 18 miles northward from Charles County boundary on the Patuxent River. The fetch over which winds can operate for wave generation is narrow so wave modeling was focused on fetches greater than half mile. Because the fetch is narrow, wave action is limited, however it was still significant enough to contribute to BFE's along the Patuxent River.

The storm-surge elevations for the 10-, 2-, 1-, and .2- percent annual chance floods were determined for Delaware Bay and are shown in Table 8, "Summary of Coastal Stillwater Elevations (Patuxent)." The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects.

TABLE 8 - SUMMARY OF COASTAL STILLWATER ELEVATIONS (PATUXENT)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD)			
	10-percent chance	2-percent chance	1-percent chance	0.2-percent chance
PATUXENT RIVER				
Entire shoreline within county limits	3.9-4	4.8 - 5	5.3 - 5.5	7.8 - 8.3

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 (Reference 27). 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 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.

The Region III coastal analysis involved transect layout, field reconnaissance, erosion analysis, and overland wave modeling including wave height analysis and wave runup.

Wave heights were computed across transects that were located along coastal areas of Prince George's County, as illustrated on the FIRMs. The transects were 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% 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.

Wave height calculations used in this study follow the methodologies described in the FEMA guidance for coastal mapping (Reference 42). 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 Prince George's 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 overland wave propagation conducted using FEMA's Wave Height Analysis for Flood Insurance Studies (WHAFIS) model Version 4.0 (Reference 43). WHAFIS is a one-dimensional model that was applied to each transect in the study area. The model uses the specified SWEL 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 42). 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, wave overtopping was computed following the FEMA 2007 Guidelines and Specifications.

Computed controlling wave heights at the shoreline range from 3.1 feet at the northern end of the study area where the fetch is short to 3.5 feet at the southern end where the fetch is longer. The corresponding wave elevation at the shoreline is 7.7 feet NAVD 88 along the majority of the shoreline. Wave heights are quickly reduced by topographic features and the vegetation typical to the Patuxent River shoreline.

Figure 1, "Transect Location Map," illustrates the location of each transect. Along each transect, wave envelopes were computed considering the combined effects of changes in ground elevation, vegetation and physical features. 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 undergoes major changes. In Table 9, "Transect Data," the flood hazard zone and base flood elevations for each transect flooding source is provided, along with the 10-, 2-, 1-, and 0.2-percent annual chance stillwater elevations for the respective flooding source.

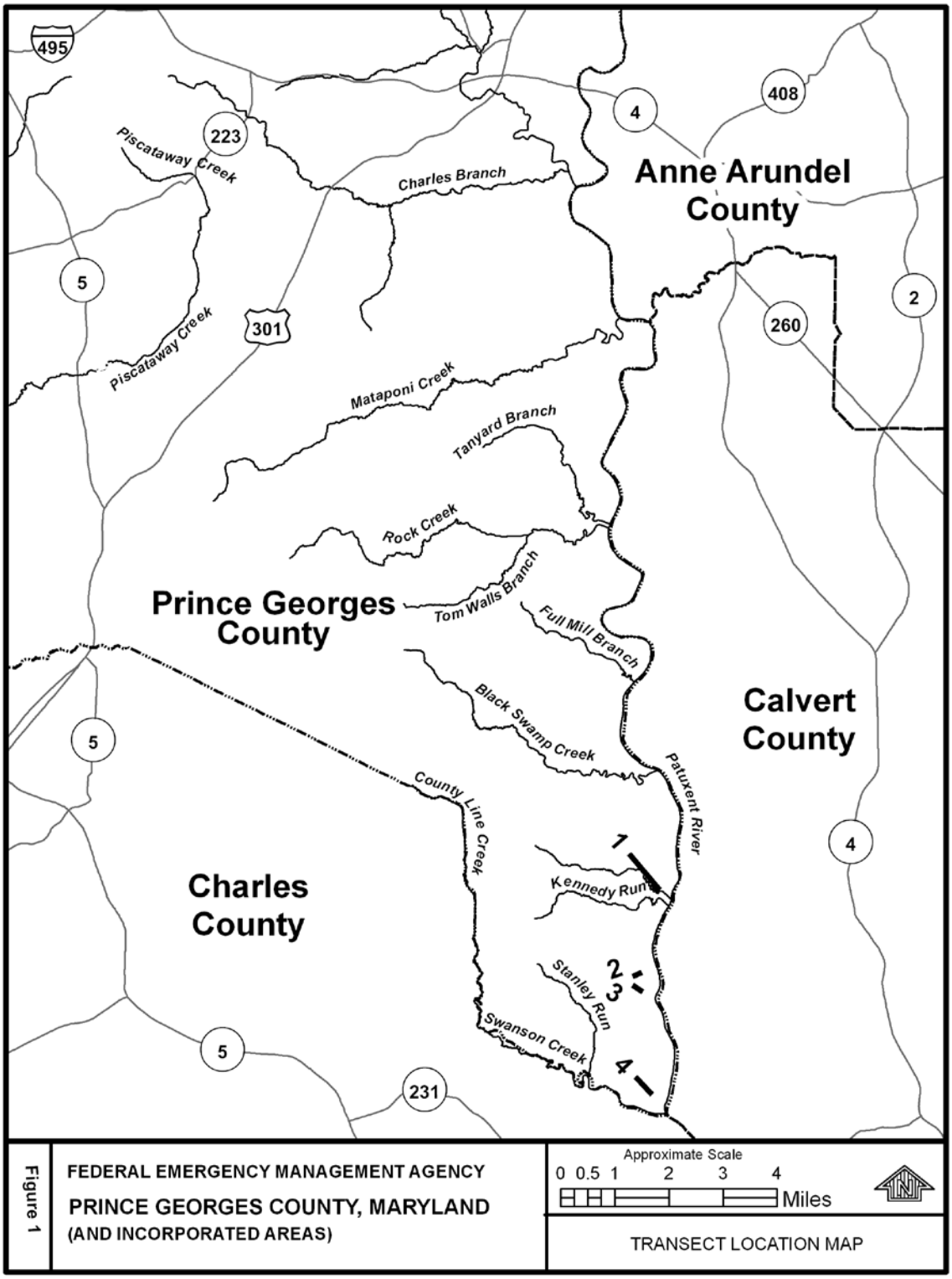


Figure 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGES COUNTY, MARYLAND
(AND INCORPORATED AREAS)

TRANSECT LOCATION MAP

*

TABLE 9 - TRANSECT DATA								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (ft NAVD88)* Range of Stillwater Elevations (ft 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
Patuxent River	1	N 38.596193 W 76.679408	1.91	2.46	3.9 3.9 - 4	5	5.5	8.3
Patuxent River	2	N 38.573917 W 76.684983	1.97	2.71	3.9	4.9	5.4	8.1
Patuxent River	3	N 38.568662 W 76.684609	2.13	2.86	3.9	4.9	5.4	8.1
Patuxent River	4	N 38.541225 W 76.680716	2.53	2.94	3.9	4.8	5.3	7.8

*For Transects with a constant Stillwater Elevation, only one number is provided to represent both the starting value and the range.

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 44). The 3-foot wave has been determined to be 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 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 FIRMs as Zone VE, where the delineated flood hazard includes wave heights equal to or greater than three feet. Zone AE is depicted on the FIRMs where the delineated flood hazard includes wave heights less than three feet. A depiction of how the Zones VE and AE are mapped is shown in Figure 2.

Post-storm field visits and laboratory tests have confirmed that wave heights as small as 1.5 feet can cause significant damage to structures when 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).

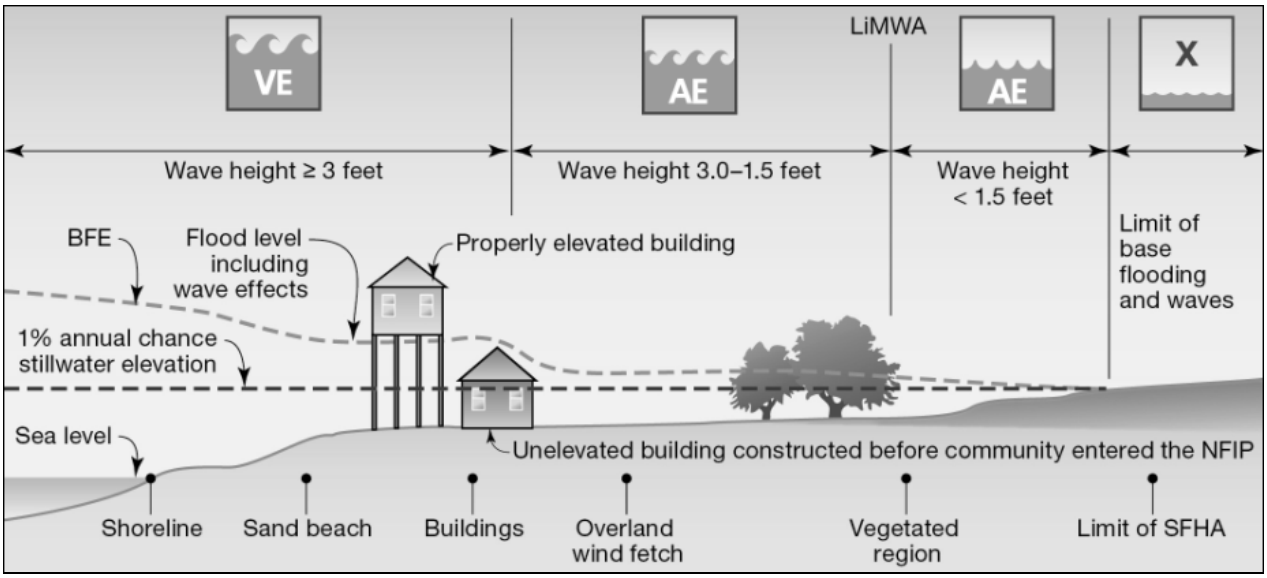


Figure 2: Transect Schematic

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 the NAVD 88, 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 NAVD 88. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. The datum shift between NGVD 29 and NAVD 88 is specific to a particular county. In the case of Prince George's County, the datum shift was -0.78 feet. The equation for Prince George's County for the conversion of elevations from NGVD 29 to NAVD 88 is given by:

$$\text{NAVD 88} = \text{NGVD 29} - 0.78$$

It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between communities.

For more information on NAVD 88, see FEMA publication titled, Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the National Geodetic Survey 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 National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing floodplain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 –percent annual chance (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 TIN discussed in Section 3.2.

The 1- and 0.2-percent annual chance floodplain boundaries are shown on the Digital FIRMs (Exhibit 2). 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. This boundary was delineated using the topographic maps developed from LiDAR, the previous FIS for Prince George's County, Anacostia Watershed Study, Beaverdam Creek Watershed Study and the Comprehensive Watershed Management Plans prepared by the Prince George's County Stormwater Management Technical Group (References 29, 36, 37, 30 and 35).

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44CFR Part 65.10 of the NFIP regulations as it relates to the levee’s capacity to provide 1% annual chance flood protection. As such, the floodplain boundaries in this area were taken directly from the previously effective FIRM and are subject to change. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information on how this may affect the floodplain boundaries shown on the FIRM.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, 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 floodway in this study is presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

Crow Branch and Mattawoman Creek had floodway analyses conducted as part of the previous FIS. The revised FIS includes a floodway analysis for Crow Branch but a floodway has not been redesignated under this study for Mattawoman Creek.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the floodplain. The results of this analysis are tabulated at selected cross sections along Crow Branch (Table 10).

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 10, "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.

As shown on the updated FIRM (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and 1-percent annual chance flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 1-percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent annual chance flood by more than 1 point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 3. The floodway in this FIS is presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

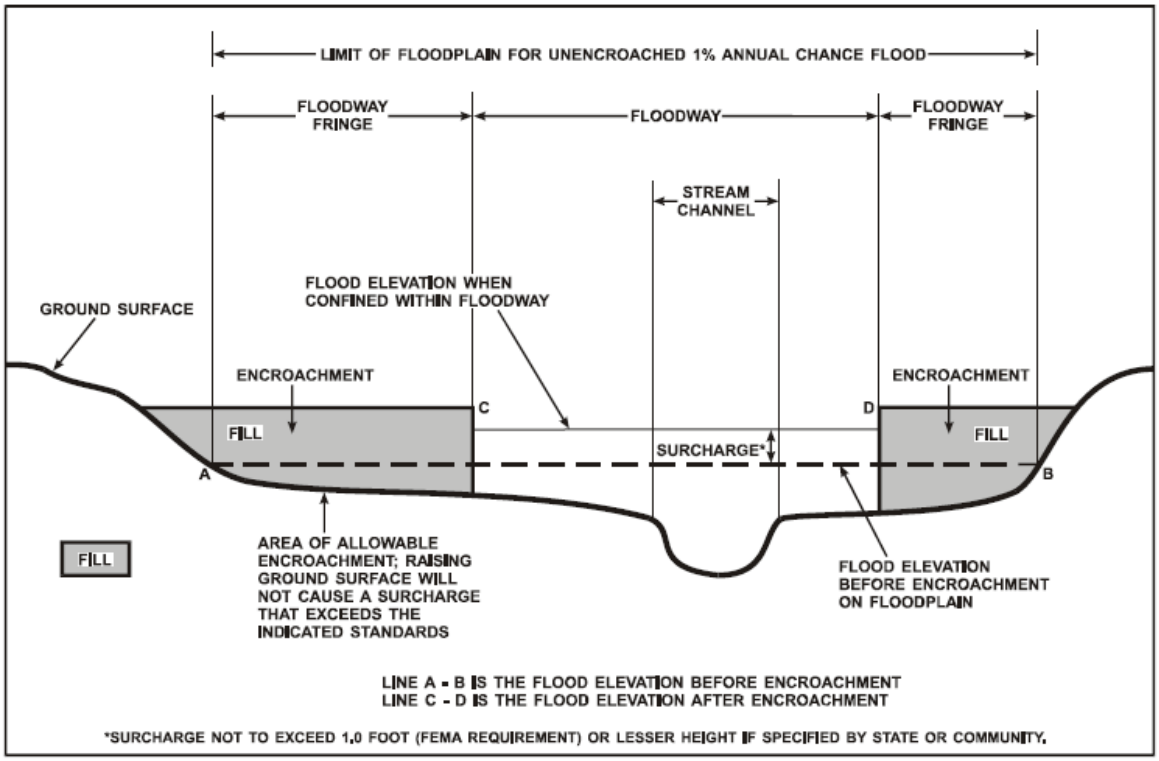


Figure 3: Floodway Schematic

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
CROW BRANCH								
A	3,932	60	342	11.3	130.4	130.0[2]	130.5	0.5
B	4,822	120	547	7.1	137.6	137.6	138.1	0.5
C	5,814	125	1036	4.6	145.9	145.9	145.9	0.0
D	6,297	71	420	11.3	146.0	146.0	146.0	0.0
E	7,422	27	226	12	155.2	155.2	156.1	0.9
F	7,922	43	226	12	159.3	159.3	159.3	0.0
G	8,521	26	220	9.4	164.3	164.3	164.9	0.6
H	8,945	26	153	13.5	166.5	166.5	166.8	0.3
I	9,325	21	178	11.6	172.0	172.0	172.7	0.7
J	9,585	19	161	11.1	174.1	174.1	174.6	0.5

[1]Feet above confluence with Patuxent River

[2] Elevation computed without consideration of backwater effects from Patuxent River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS

FLOODWAY DATA

CROW BRANCH

5.0 INSURANCE APPLICATION

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

Zone A:

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

Zone AE:

Zone AE is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the FIS 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 rate 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 rate 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-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99:

Zone A99 is the flood insurance rate 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 rate 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 rate 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 rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, and to areas of 1-percent annual chance flooding where average depths are less than 1 foot, areas of 1-percent annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent –annual-chance flood by levees. No BFEs or depths are shown within this zone.

Zone D:

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

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

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and in the 1-percent annual chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use 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 are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Prince George's County. Previously, separate Flood Hazard Boundary Maps and/or FIRMS were prepared for each incorporated community with identified flood hazard areas and the unincorporated areas of the county. Historical map dates relating to pre-countywide maps prepared for each community are presented in Table 11, "Community Map History."

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1% annual chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information on how this may affect the FIRM.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	INITIAL FIRM DATE	FIRM REVISION DATE
Laurel, City of	August 9, 1974	None	November 1, 1978	August 19, 1985
Prince George's County (Unincorporated Areas)	August 4, 1972	None	August 4, 1972	July 1, 1974 August 28, 1976 July 19, 1982 June 18, 1987 December 15, 1989 September 6, 1996

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

Flood Insurance Study updates are being conducted for Calvert County, Maryland and Charles County, Maryland which border Prince George's County on the South; Anne Arundel County, Maryland which borders Prince George's County on the East; Howard County, Maryland which borders Prince George's County on the North; and Fairfax County, Virginia and the District of Columbia which border Prince George's County on the West.

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

The FIS for Montgomery County, Maryland and incorporated areas has been completed (Reference 38). The Montgomery County FIS includes detailed studies for a tributary to Paint Branch and another tributary to Little Paint Branch, namely Tributaries 190 and 192, which are not included in the FIS for Prince George's County. In addition, Long Branch is no longer part of the FIS for Prince George's County because it is wholly contained within the City of Tacoma Park, which has been annexed by Montgomery County.

This is a multi-volume FIS. Each volume may be revised separately, in which case it supersedes the previously printed volume. Users should refer to the Table of Contents in Volume 1 for the current date of each volume; volumes bearing these dates contain the most up-to-date flood hazard data.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Flood Insurance and Mitigation Division, Federal Emergency Management Agency, One Independence Mall, 6th Floor, 615 Chestnut Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. USACE, Baltimore District, Hurricane Survey, *Tidewater Portions of Patuxent, Potomac and Rappahannock Rivers, Including Adjacent Chesapeake Bay Shoreline* (Unpublished).

2. USACE, Hydrologic Engineering Center, "Anacostia River Model Study, Hydraulic Analysis of the Anacostia River System using HEC-RAS, Model Study Report," Davis, CA, May 2004.

3. US Army Engineer Research and Development Center (ERDC) Coastal and Hydraulics Laboratory (CHL), *Cursory-Level Analysis of the 100-Year Storm Surge Elevation for the Lower Potomac River*, April 2008.

4. U. S. Department of Commerce, Bureau of the Census, DP-1. *Profile of General Demographic Characteristics: 2010*, Census 2010 Summary File 1 (SF 1) 100-Percent Data, http://www.factfinder.census.gov.

5. Federal Emergency Management Agency, *Flood Insurance Study, Unincorporated Areas of Prince George's County, Maryland*, Washington, D. C., December 15, 1989.

6. US Department of Commerce, National Climatic Data Center, NOAA Satellite and Information Service, National Environmental Satellite, Data and Information Service. http://cdo.ncdc.noaa.gov/cgi-bin/climaps/climaps.pl?directive=quick_results&subrnum=&pop=YES http://cdo.ncdc.noaa.gov/climaps/prec0113.pdf

7. Prince George's County, Geographic Information System, Tree Canopy, 2005.

8. Federal Emergency Management Agency, *Flood Insurance Study, City of Laurel, Prince George's County, Maryland*, Washington, D. C., August 19, 1985.

9. Prince George's County, Maryland, *The County Code, Part II, Title 17. The Public Local Laws of Prince George's County, Subtitle 4. Building, Division 2. Floodplain Ordinance*, 2003.

10. USACE, Baltimore District, *Flood Plain Information, Northeast Branch, Northwest Branch (Anacostia River), Paint Branch, Indian Creek, Sligo Creek, Prince George's County, Maryland*, Baltimore, Maryland, June 1968.

11. USACE, Baltimore District, *Flood Plain Information, West Branch (Folly, Lottsford, and Bald Hill Branches, Patuxent River:-Prince George's County, Maryland*, Baltimore, Maryland, December 1972.

12. USACE, Baltimore District, *Flood Plain Information, Piscataway Creek, Prince George's County, Maryland*, November 1967.

13. Prince George's County, Council Task Force on Flooding, *Report of the County Council's Task Force on Flooding*, Upper Marlboro, Maryland, September 1974.

14. Clark, Finefrock and Sackett, *Indian Creek Storm Water Management Study, Prince George's County, Maryland*, December 1979.

15. Washington Suburban Sanitary Commission, *High-Water Marks from the September 1971 Flood*, Washington, D. C., October 1971.

16. Washington Suburban Sanitary Commission, *High-Water Marks from the June 1972 Flood*, Washington, D. C., July 1972.

17. Maryland-National Capital Park and Planning Commission, *Patuxent River Master Plan*, Washington, D. C., 1975.

18. U. S. Department of Agriculture, Soil Conservation Service, *Technical Release No. 20, Computer Program, Project Formulation, Hydrology*, Washington, D. C., 1965. Numerous modifications and additions to model culminated in Version 2.04 (1992).

19. U. S. Department of the Interior, Geological Survey, *Annual Flood Frequency Analysis Using Water Resources Council Guidelines* by William Kirby, located in the "Watstores User's Guide", Washington, D. C., August 1979.

20. U. S. Department of the Interior, Geological Survey, *Log-Pearson Type III Flood Frequency Analysis Following Water Resources Council Guidelines*, Washington, D.C.

21. U. S. Department of the Interior, Geological Survey, *Water Resources Data for Maryland and Delaware, Part I, Surface Water Records*, Washington, D. C., 1977.

22. Water Resources Council, "A Uniform Technique for Determining Flood Flow Frequency", Bulletin 15, Washington, D. C., December 1967.

23. Greenman-Pedersen, Inc., *Laurel, Maryland Flood Study - Interagency Agreement No. 101011 (GPI# 90117.01)*, July 30, 2002.

24. USACE, Hydrologic Engineering Center, HEC-HMS hydrologic modeling system, Davis, CA.

25. University of Maryland and Maryland State Highway Administration, *GIS Hydro: A GIS-Based Hydrologic Modeling Tool*, 2000, www.gishydro.umd.edu.

26. Virginia Institute of Marine Science, *A Storm Surge Model Study, Volumes I and II*, Gloucester Point, Virginia, June 1978.

27. National Academy of Sciences, *Methodology for Calculating Wave Action Effects Associated with Storm Surges*, Washington, DC, 1977.

28. FEMA, Regional Management Center III, "Unified Storm Surge Profile Methodology, For Tidal Portions of the Potomac River, Version 1.1," August 6, 2008.

29. Prince George's County, Topographic Maps compiled from Light Detection and Ranging (LIDAR), Scale 1" = 300', Contour Interval 2-feet, Maryland National Capital Park and Planning Commission, March 2001.

30. Prince George's County, Greenhorne & O'Mara, Inc., *Anacostia River Watershed Study*, September 1993.

31. USACE, Hydrologic Engineering Center, *HEC-2 Water Surface Profiles*, Version 4.6, Davis, CA.

32. USACE, Hydrologic Engineering Center, *HEC-RAS River Analysis System*, Version 3.1.3, Davis, CA.

33. Prince George's County, Greenhorne & O'Mara, Inc., *Beaverdam Creek Watershed Study*, May 1991.

34. Prince George's County Storm Water Management Technical Group (SWMTG), *Comprehensive Watershed Management Plan for Oxon Run, Prince George's County, Maryland*, 1991.

35. Prince George's County Storm Water Management Technical Group (SWMTG), *Comprehensive Watershed Management Plan for Charles Branch, Prince George's County, Maryland*, 1991.

36. Federal Emergency Management Agency, *Flood Insurance Study, Unincorporated Areas of Prince George's County, Maryland*, Washington, D. C., December 15, 1989.

37. Prince George's County Stormwater Management Technical Group, *Comprehensive Watershed Management Plan, Piscataway Creek, Prince George's County, Maryland*, edited by M-NCPPC, April 1986.

38. Prince George's County Stormwater Management Technical Group, *Comprehensive Watershed Management Plan, Henson Creek, Prince George's County, Maryland*, April 1986.

39. Federal Emergency Management Agency, *Flood Insurance Study, Montgomery County, Maryland and Incorporated Areas*, Washington, D. C., September 29, 2006.

40. S. Bunya, J. C. Dietrich, J. J. Westerink, B. A. Ebersole, J. M. Smith, J. H. Atkinson, R. Jensen, D. T. Resio, R. A. Luettich, C. Dawson, V. J. Cardone, A. T. Cox, M. D. Powell, H. J. Westerink, and H. J. Roberts, *High-Resolution Coupled Riverine Flow, Tide, Wind, Wind Wave, and Storm Surge Model for Southern Louisiana and Mississippi. Part I: Model Development and Validation*, 2010

41. ESRI (Environmental Systems Resource Institute), *ArcMap 10.0*, Redlands, California, 2010.

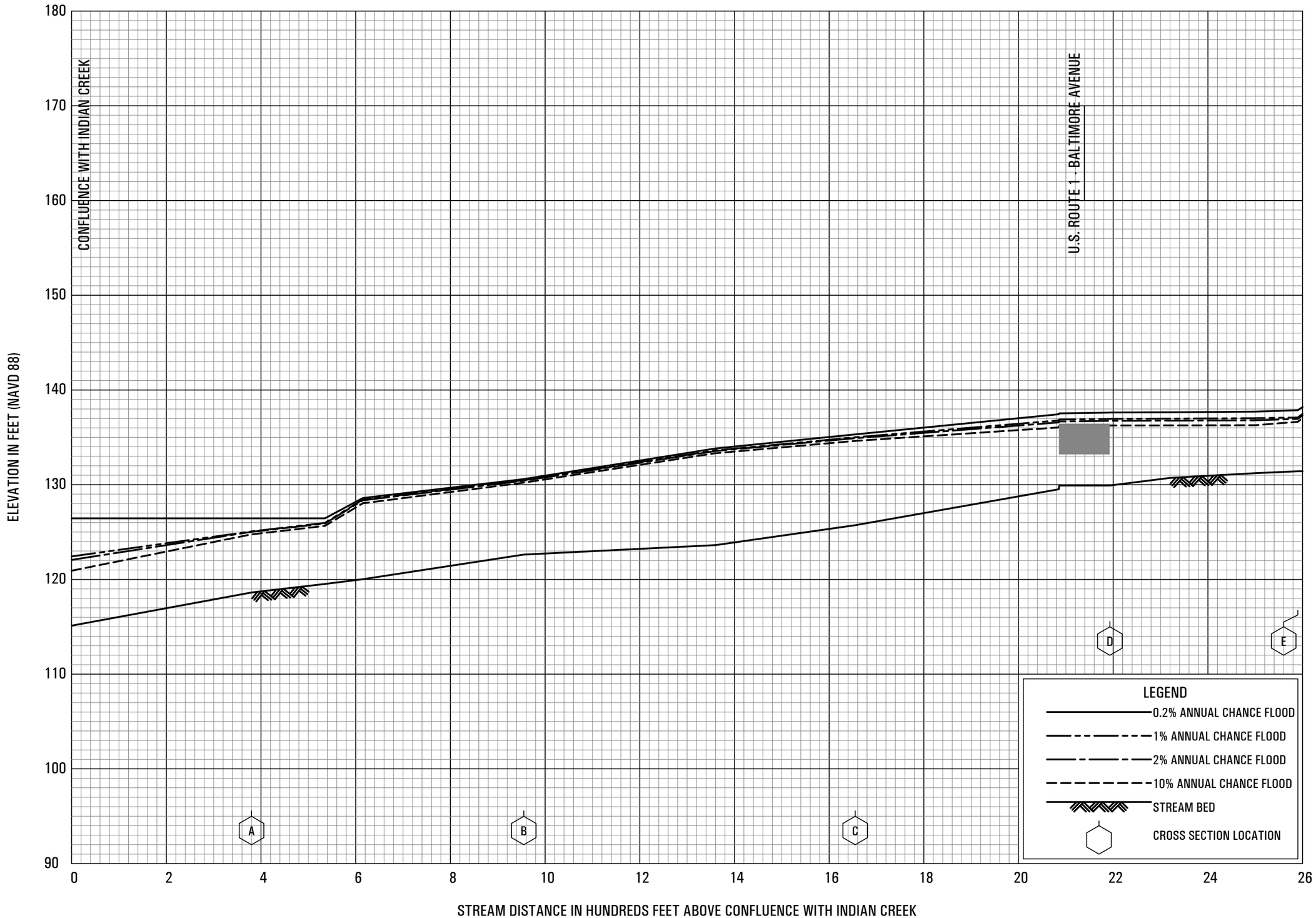
42. Luettich, R. A. and J.J Westerink. A (Parallel), *Advanced Circulation Model for Oceanic, Coastal and Estuarine Waters (ADCIRC). Version 45.12*. University of North Carolina at Chapel Hill, Institute of Marine Sciences. Morehead City, NC, February 6, 2008.

42. Federal Emergency Management Agency, *Atlantic Ocean and Gulf of Mexico Update Coastal Guidelines Update*. Washington, DC, 2007.

43. Federal Emergency Management Agency, *Wave Height Analysis for Flood Insurance Studies (WHAFIS)*, Version 4.0. Washington, DC, August 2007.

44. U.S. Army Corps of Engineers, Galveston District, *Guidelines for Identifying Coastal High Hazard Zones*. Galveston, Texas, June 1975.

45. U.S. Army Core of Engineers, ERDC/CHL TR11-X, *FEMA Region 3 Storm Surge Study Coastal Storm Surge Analysis: Modeling System Validation Submission No.2*. US Army Corps of Engineers, 2012.



FLOOD PROFILES

AMMENDALE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS

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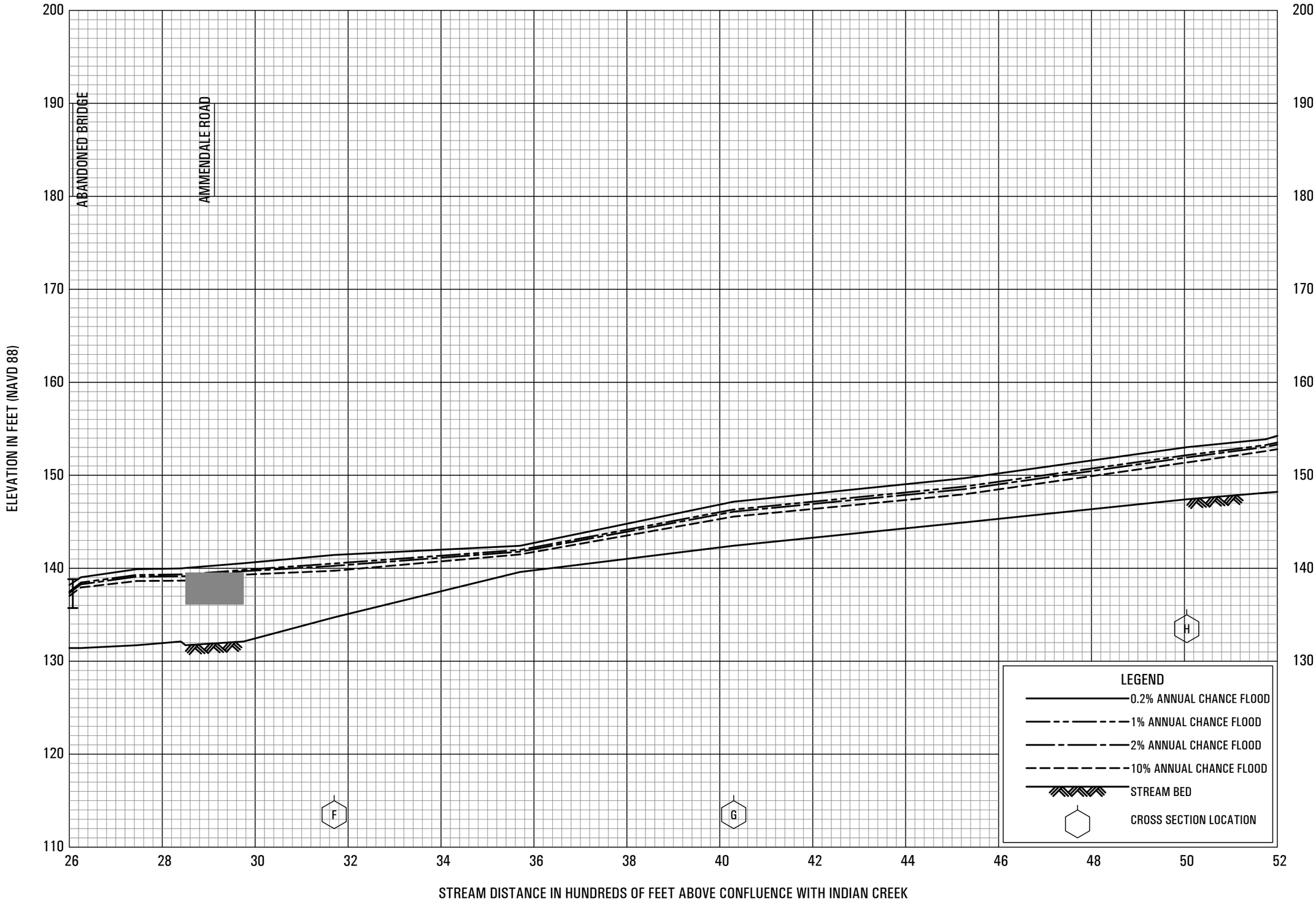

FLOOD PROFILES

AMMENDALE BRANCH

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PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS

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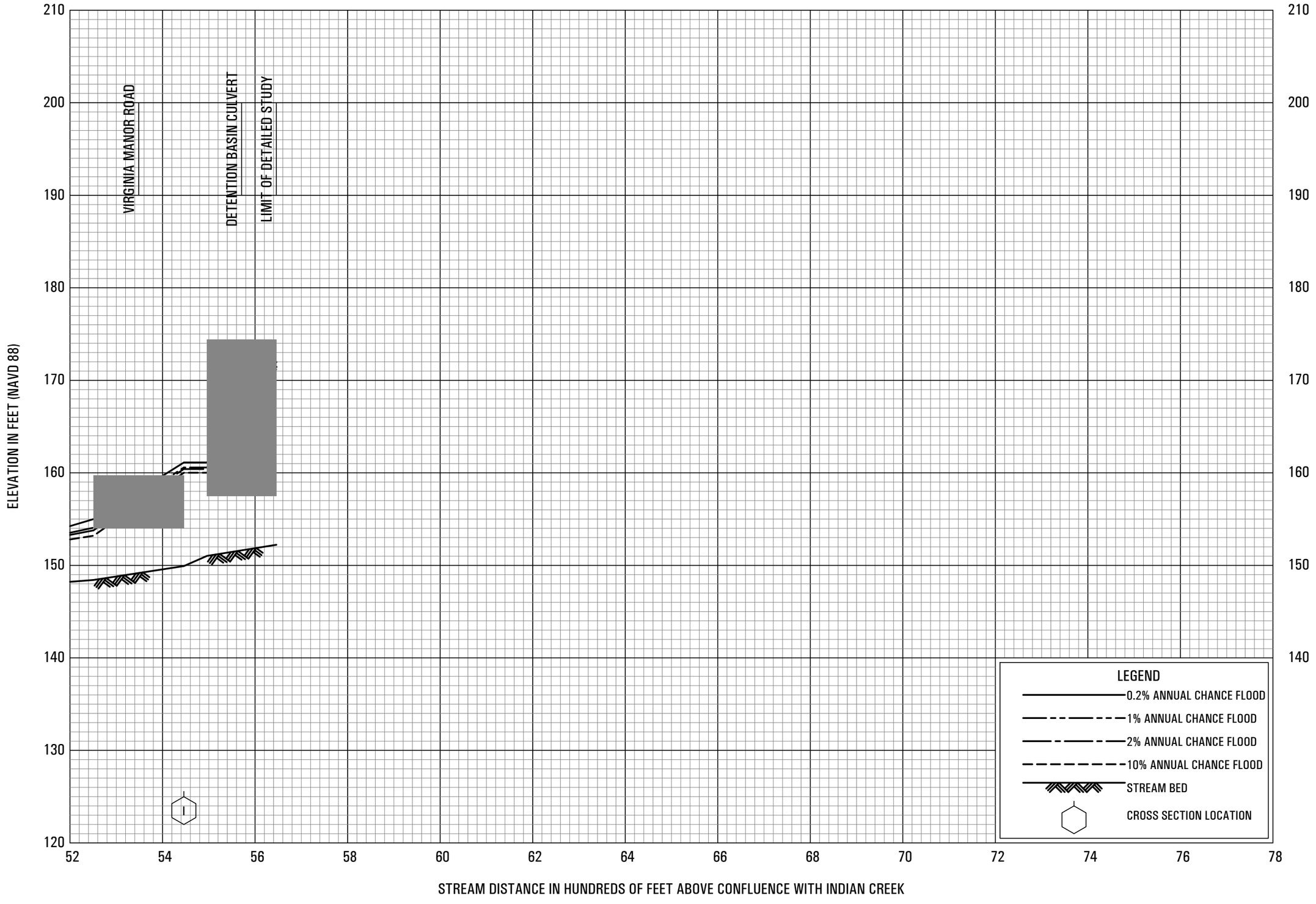

FLOOD PROFILES

AMMENDALE BRANCH

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PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS

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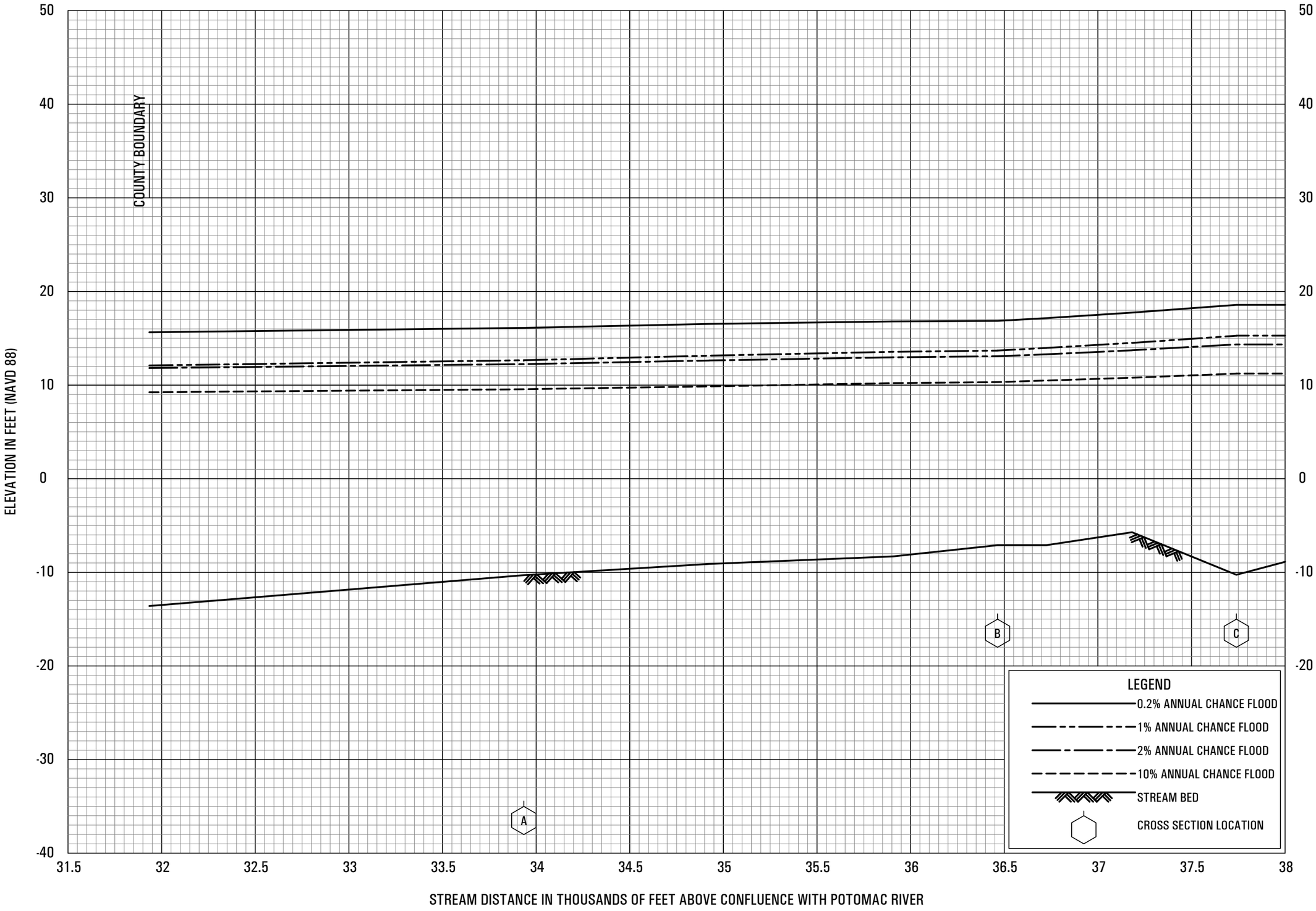

FLOOD PROFILES

ANACOSTIA RIVER

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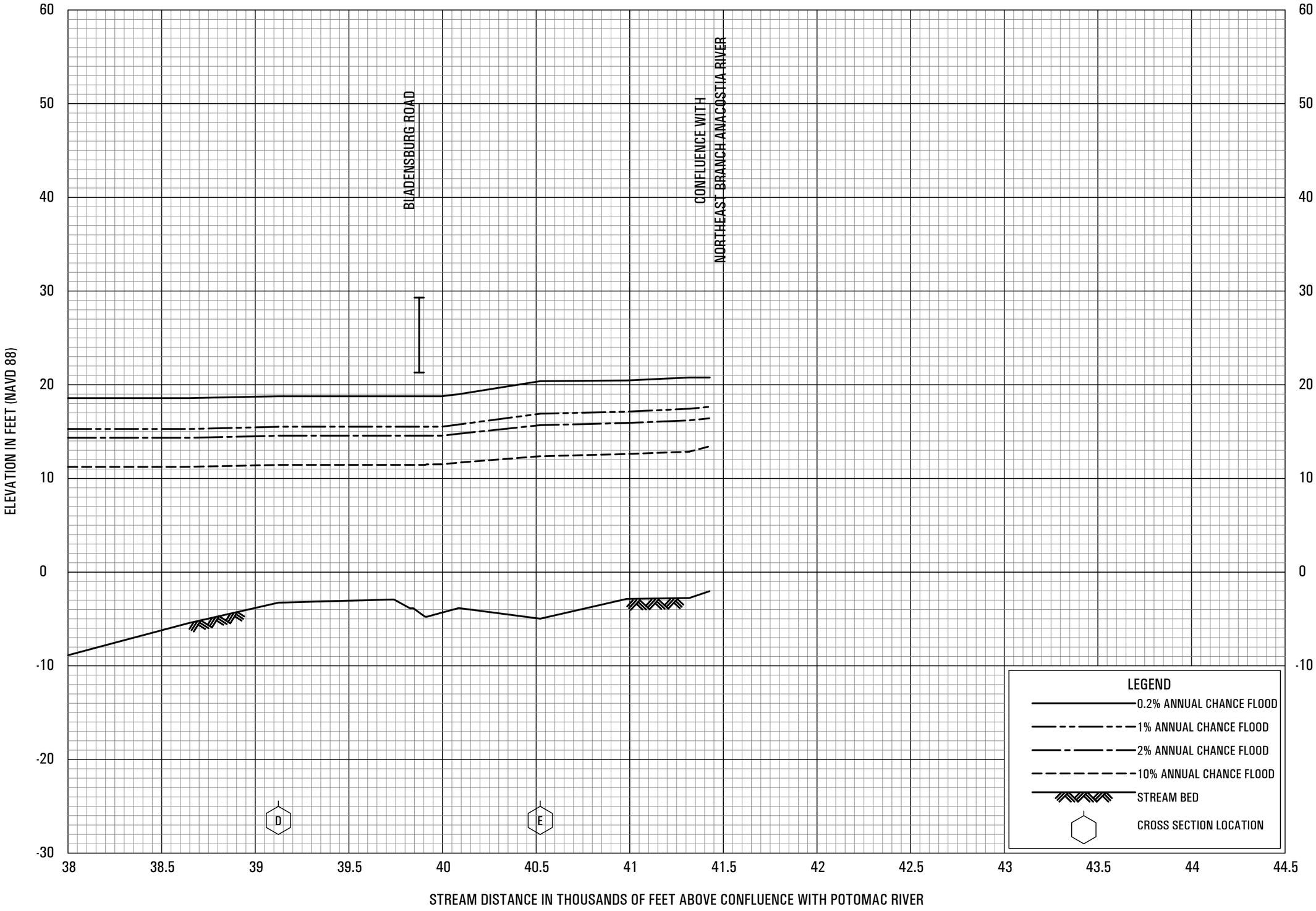
AND INCORPORATED AREAS



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ANACOSTIA RIVER

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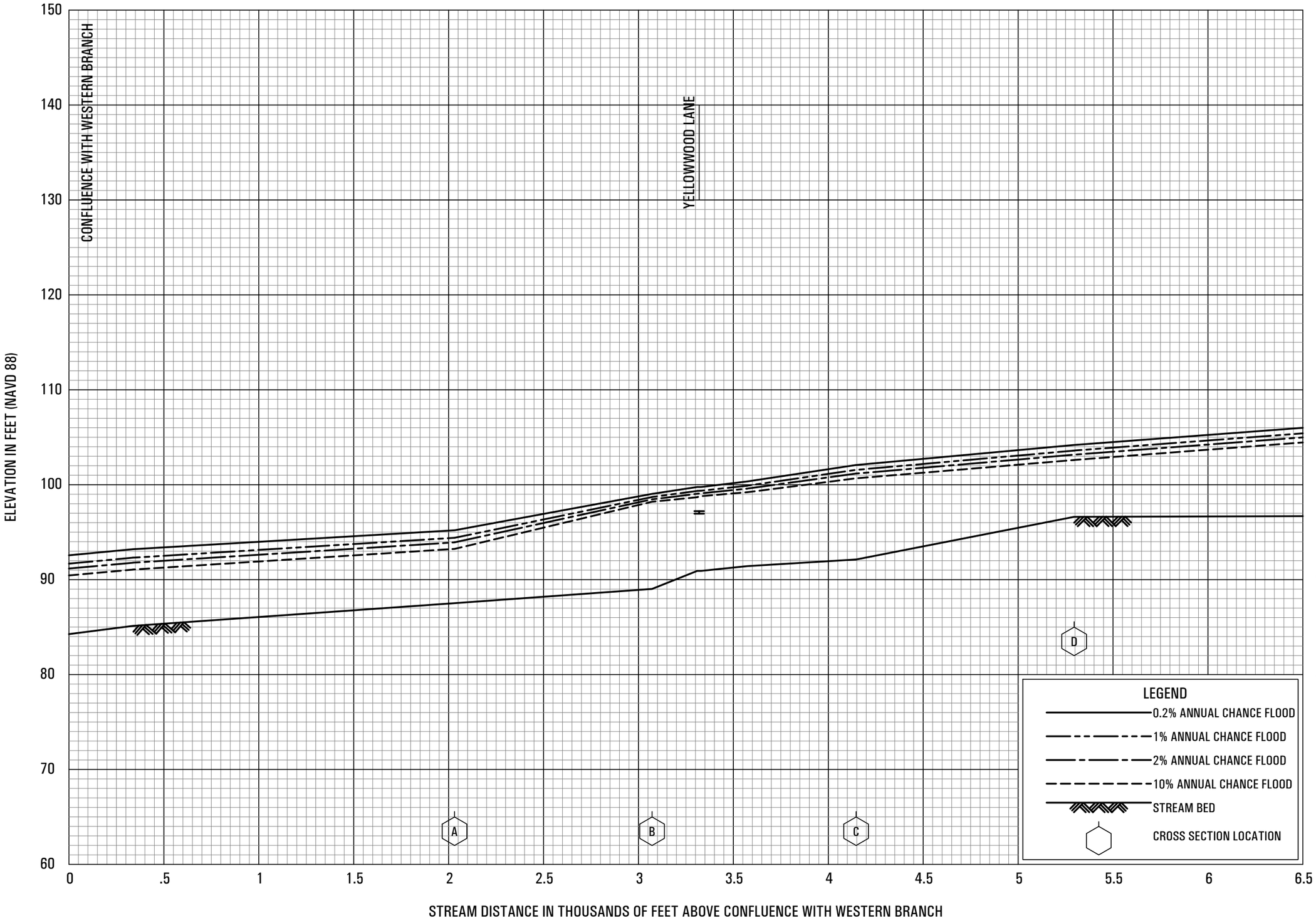

FLOOD PROFILES

BALD HILL BRANCH

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AND INCORPORATED AREAS

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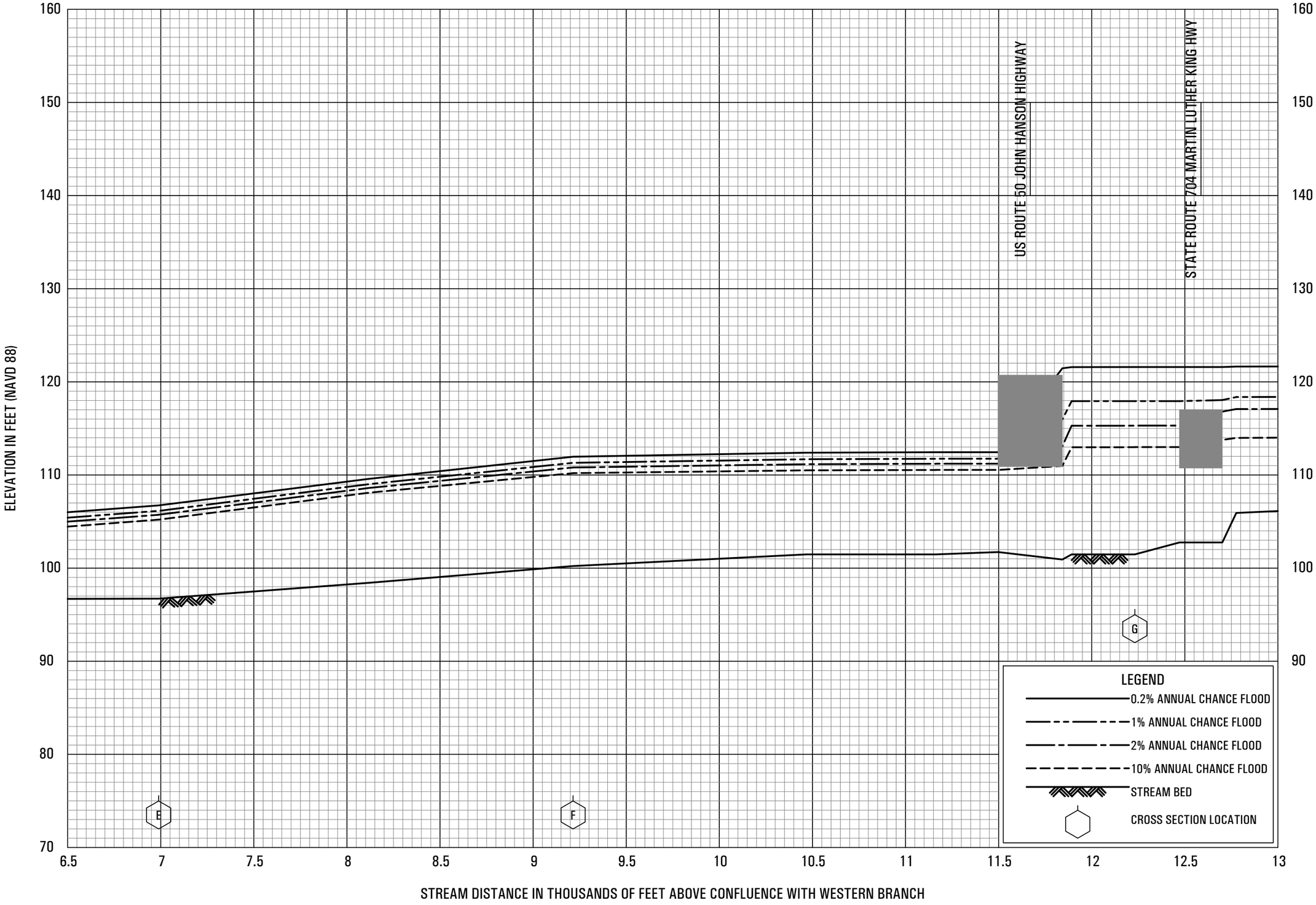

FLOOD PROFILES

BALD HILL BRANCH

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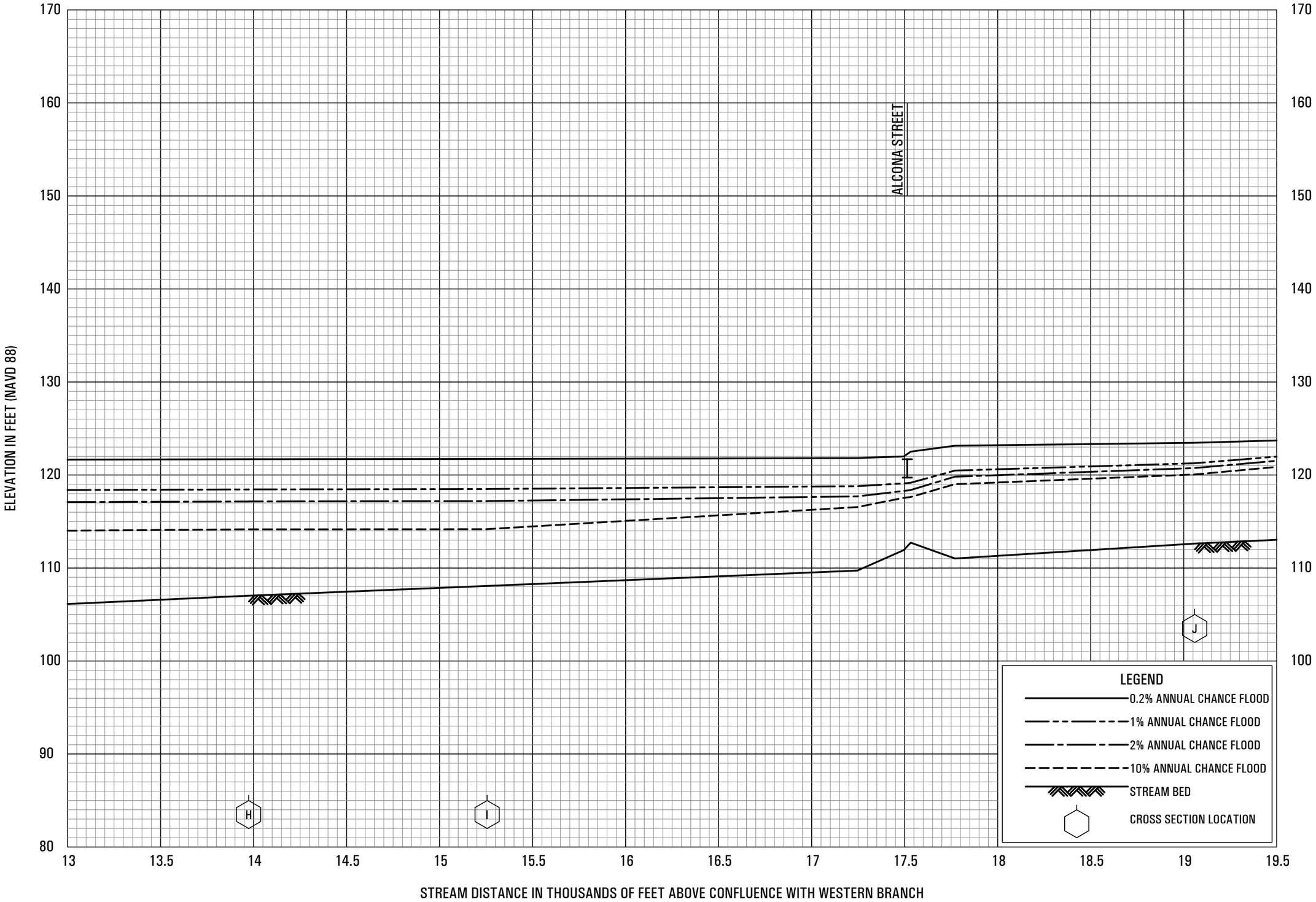

FLOOD PROFILES

BALD HILL BRANCH

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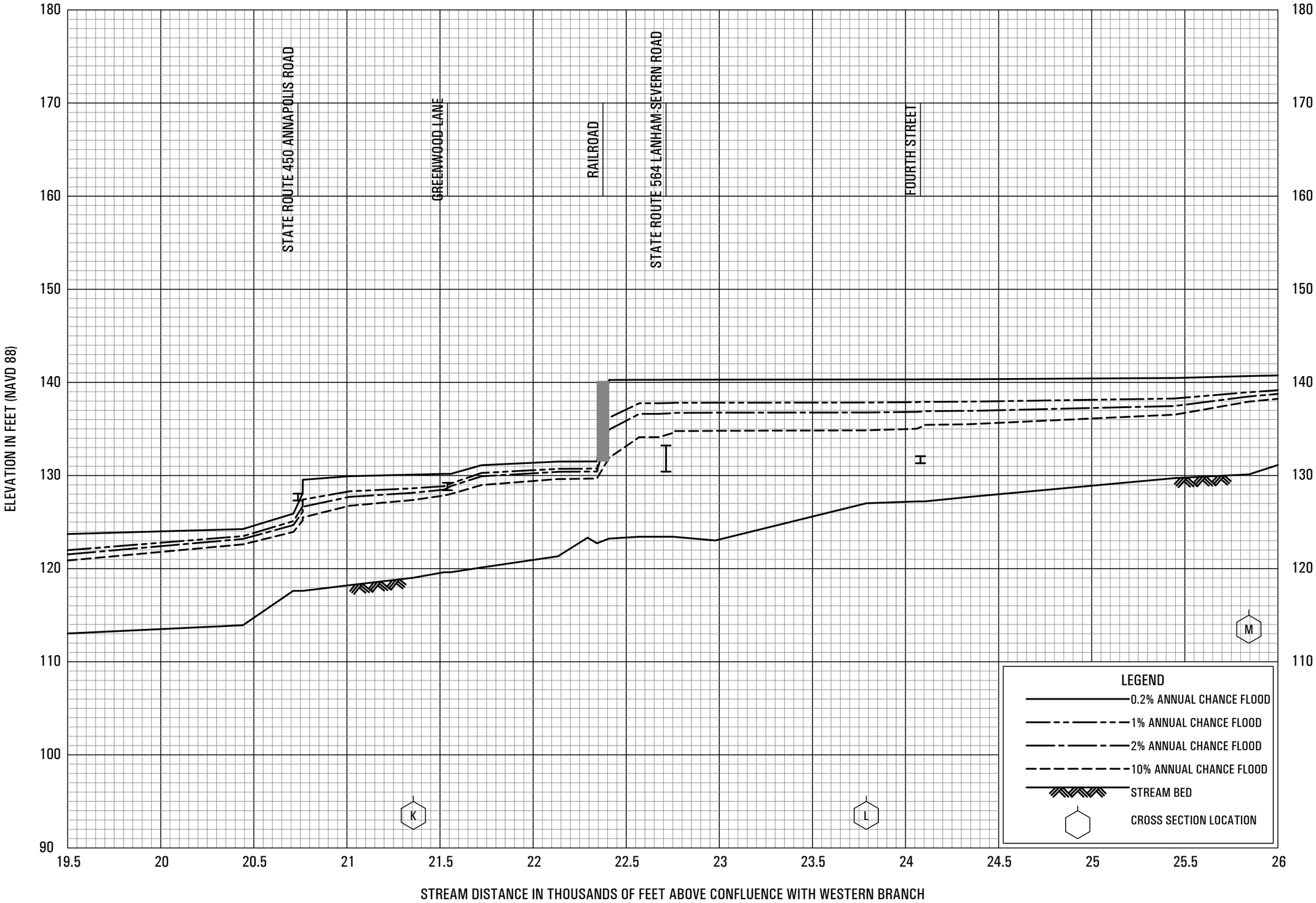

FLOOD PROFILES

BALD HILL BRANCH

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PRINCE GEORGE'S COUNTY, MD

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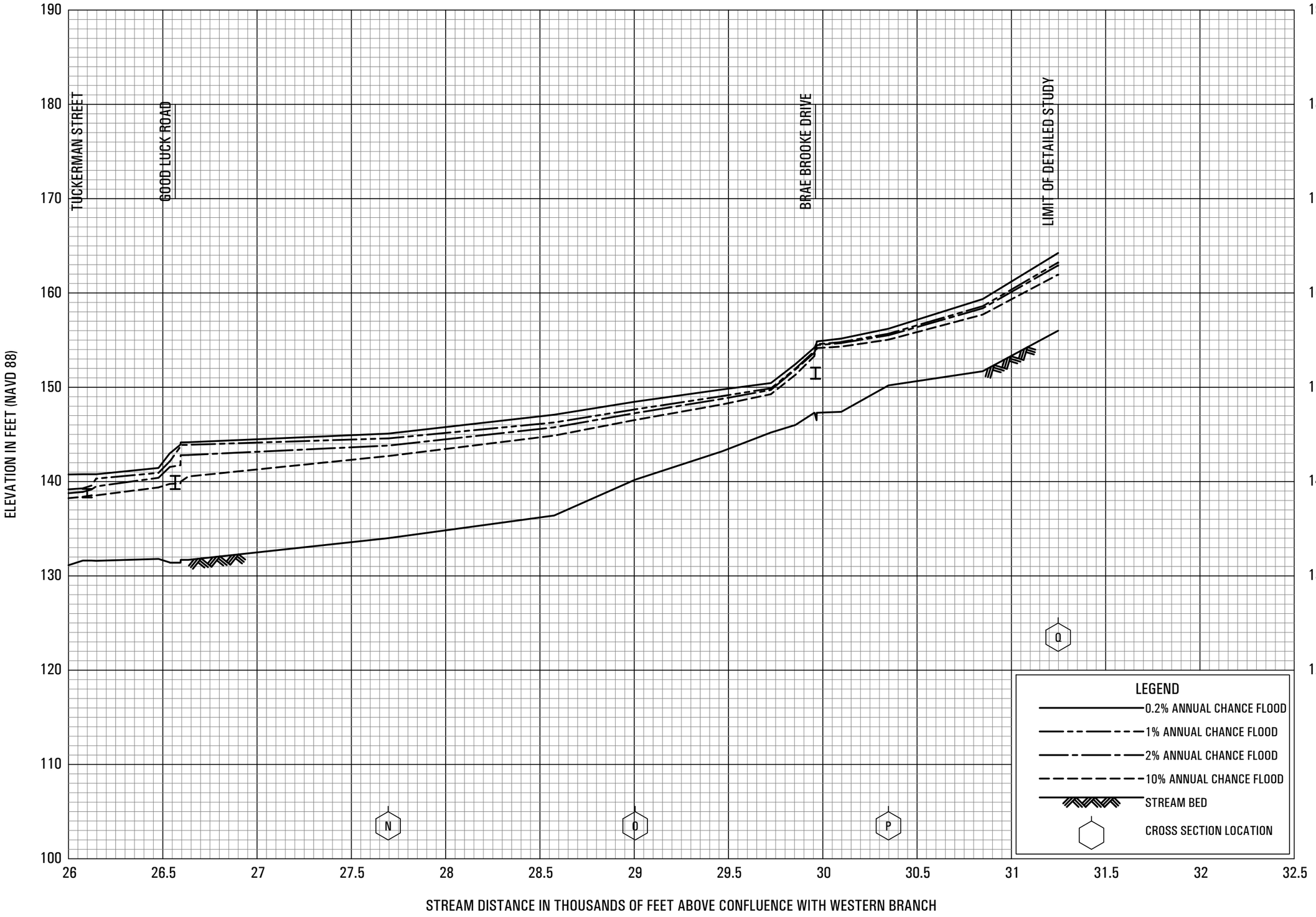

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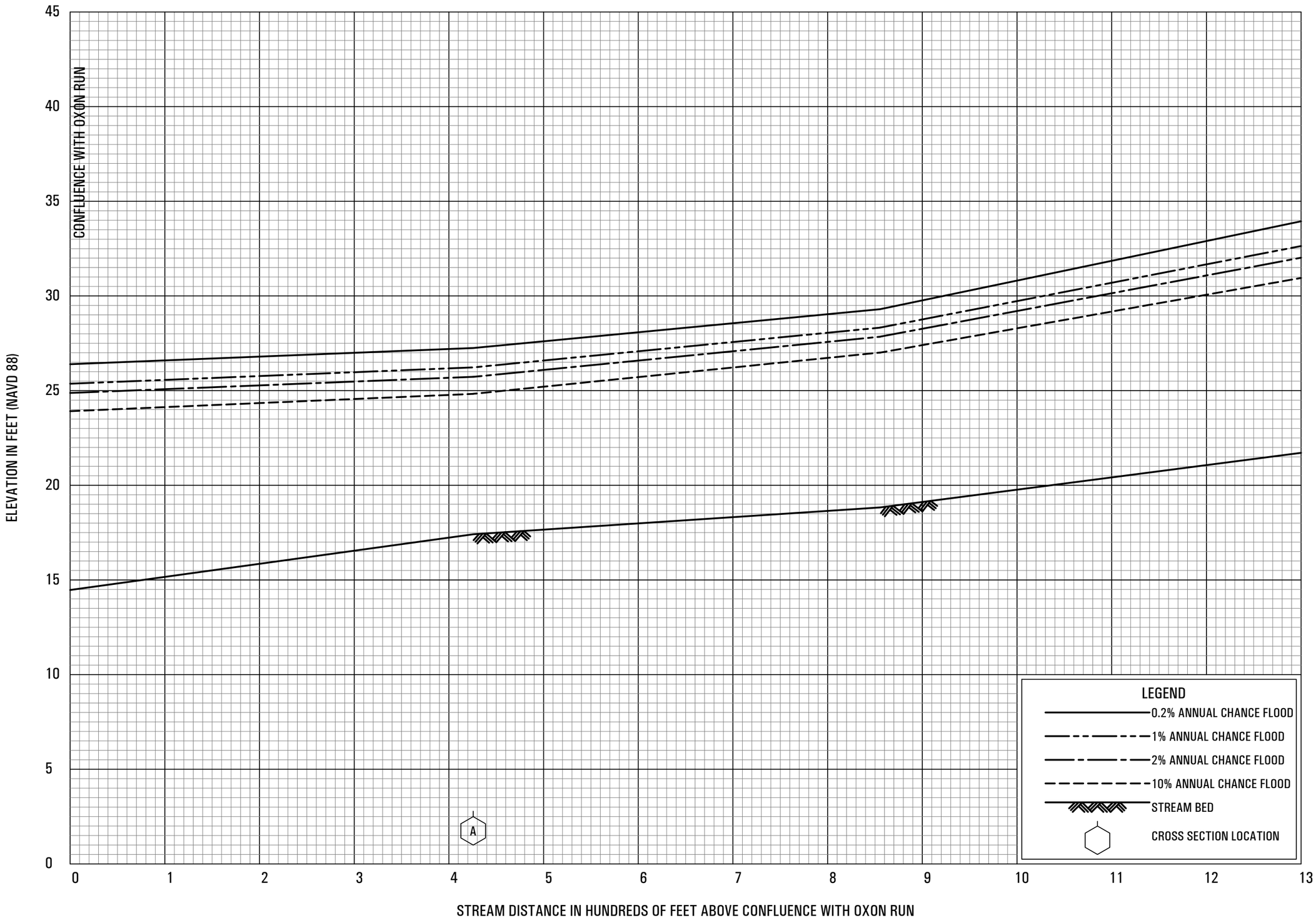

FLOOD PROFILES

BARNABY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

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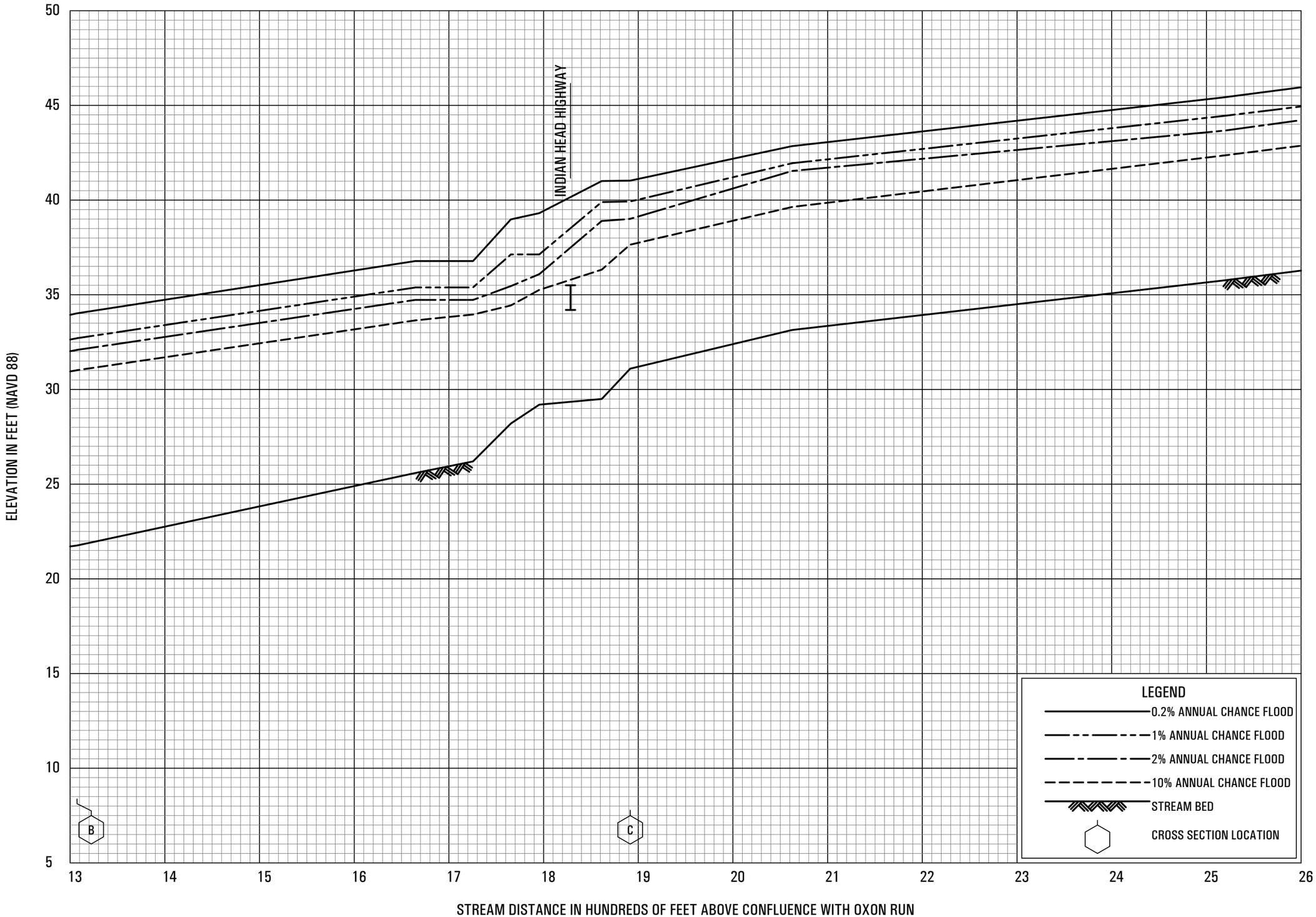

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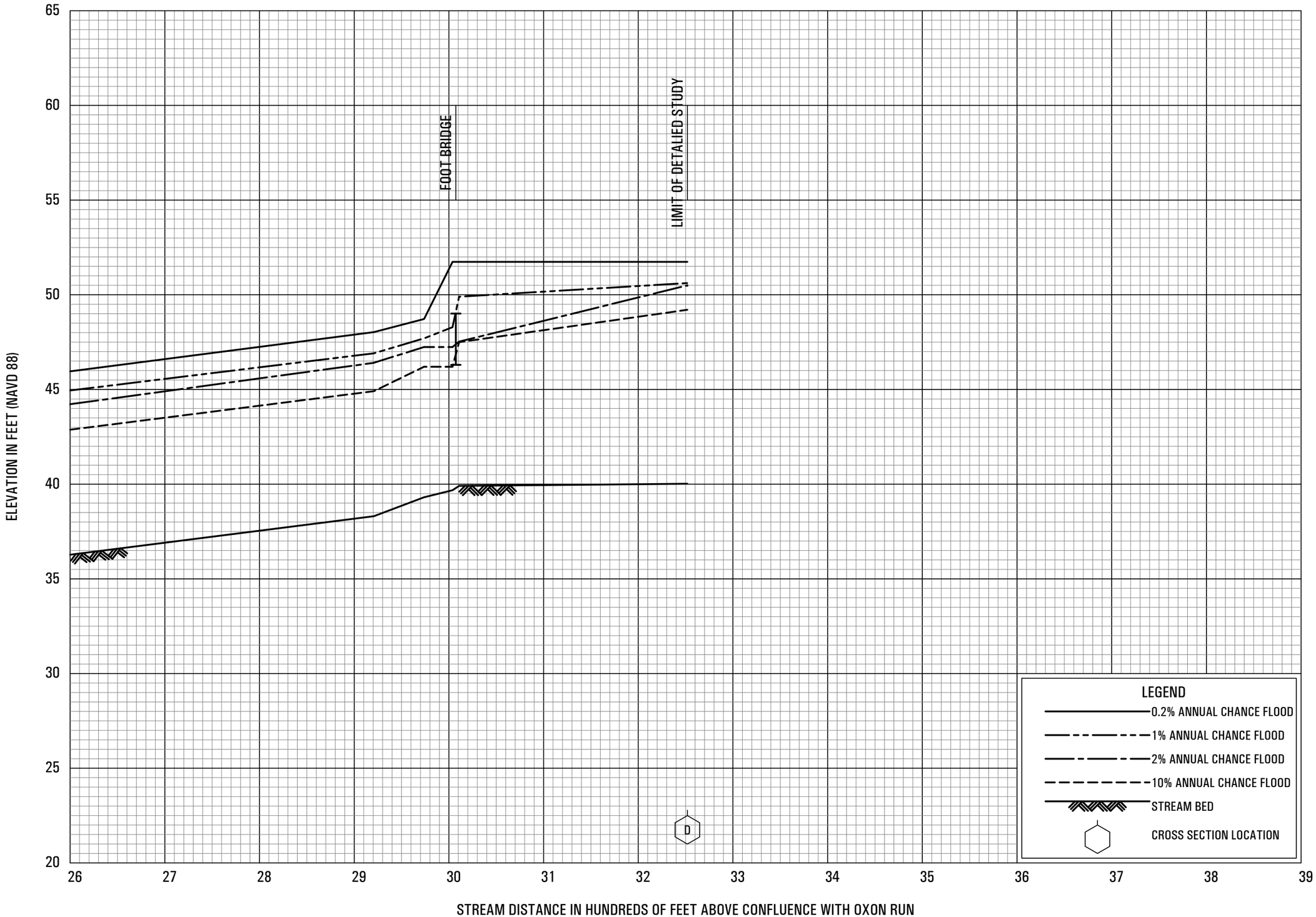

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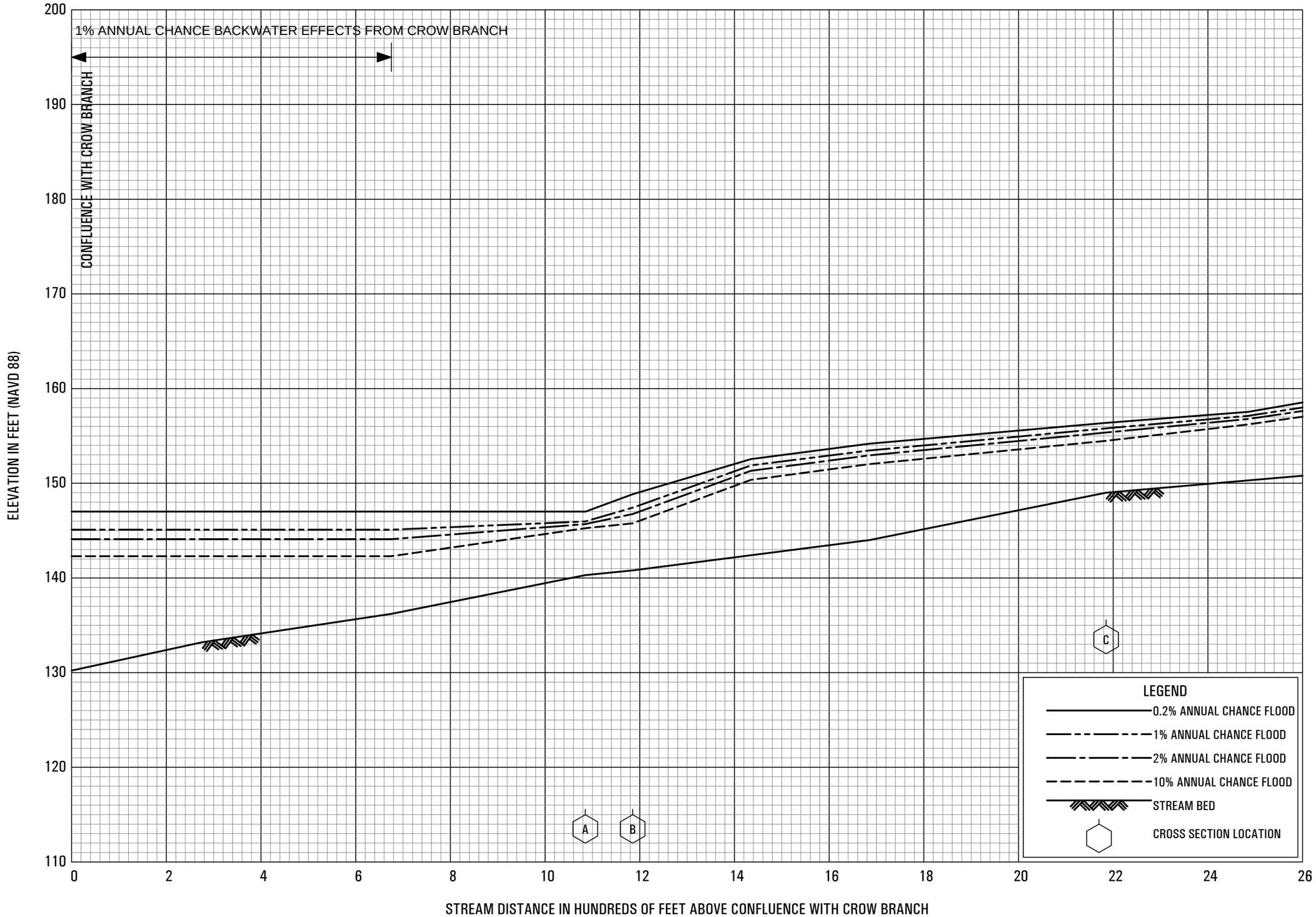

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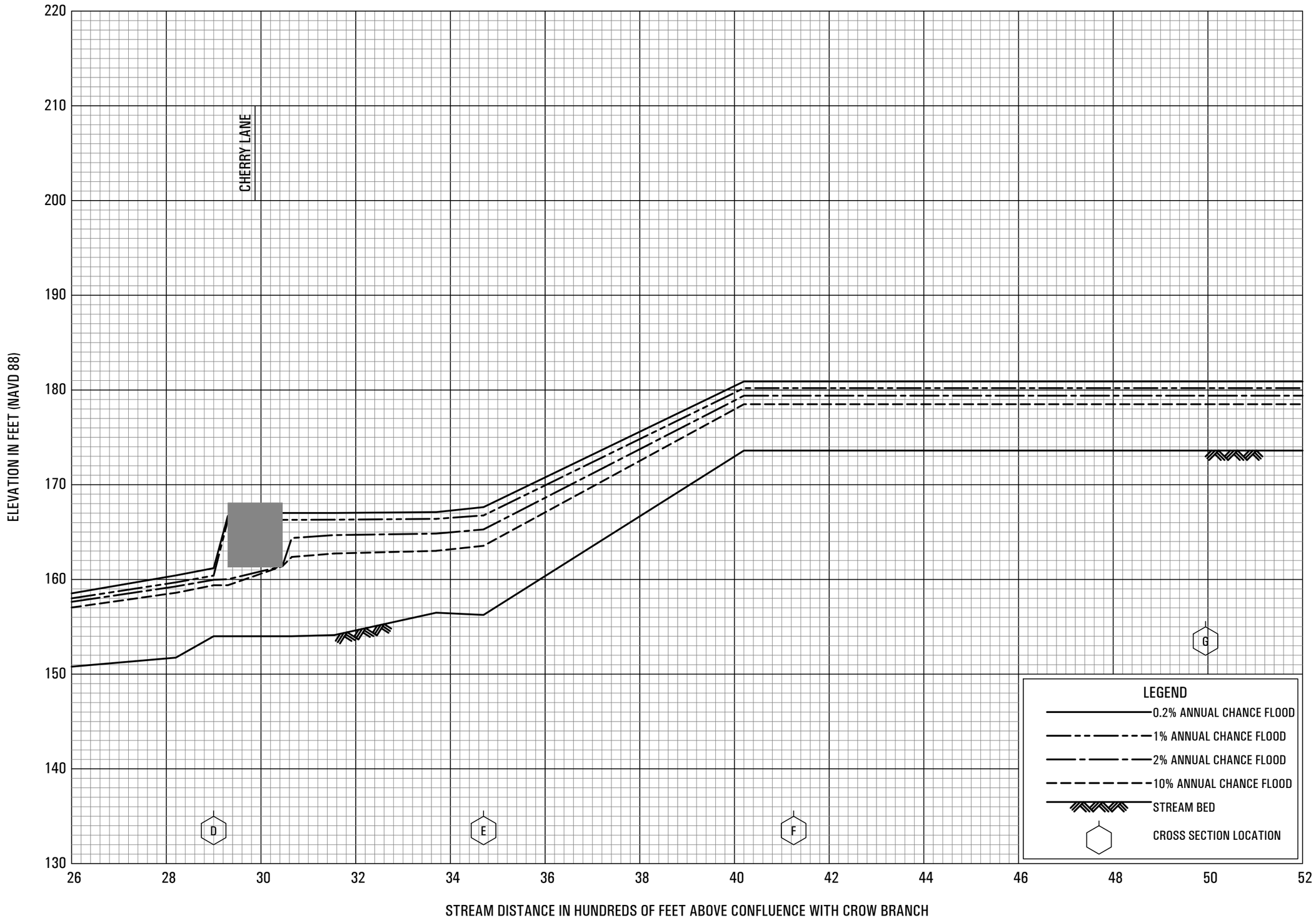

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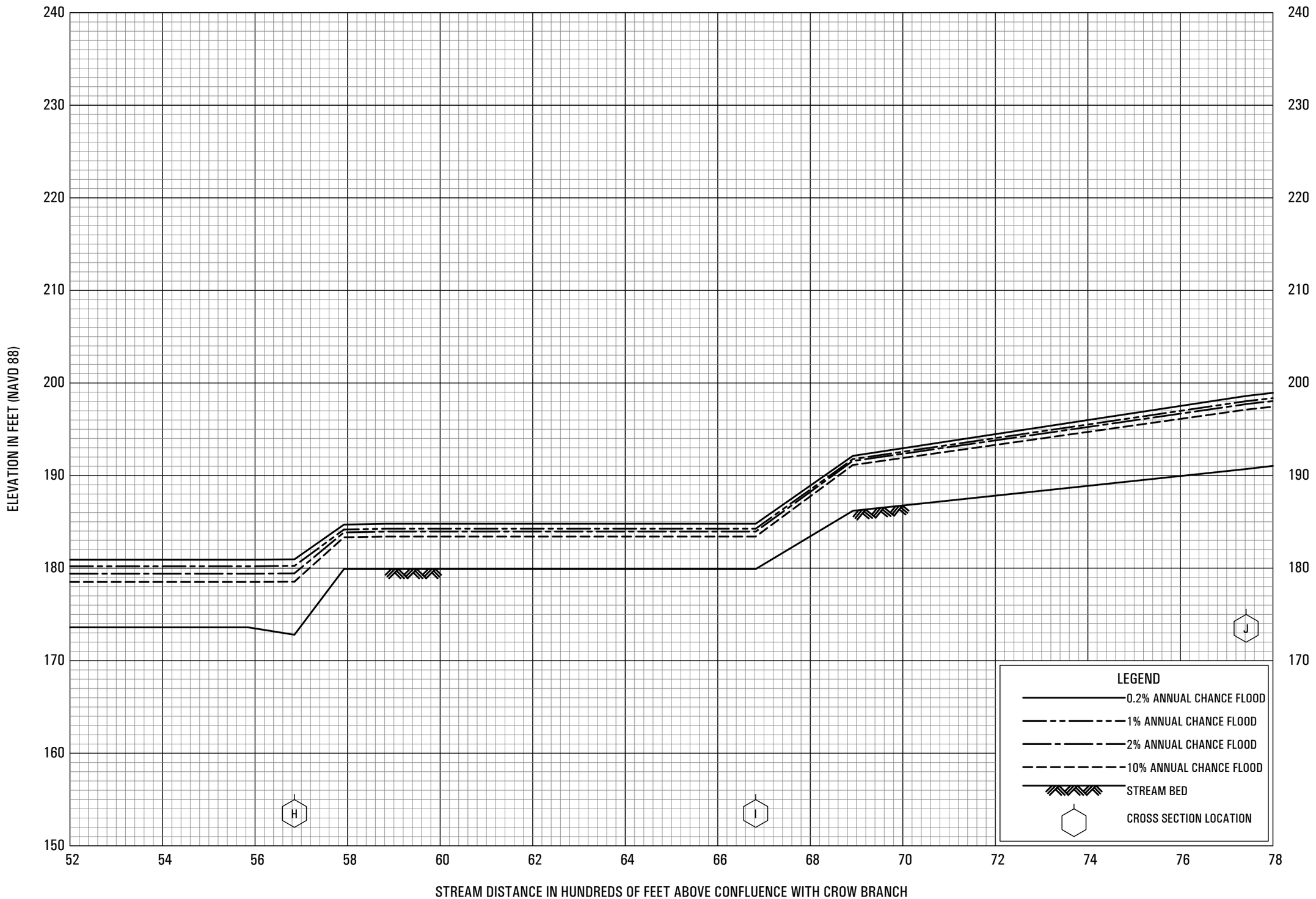

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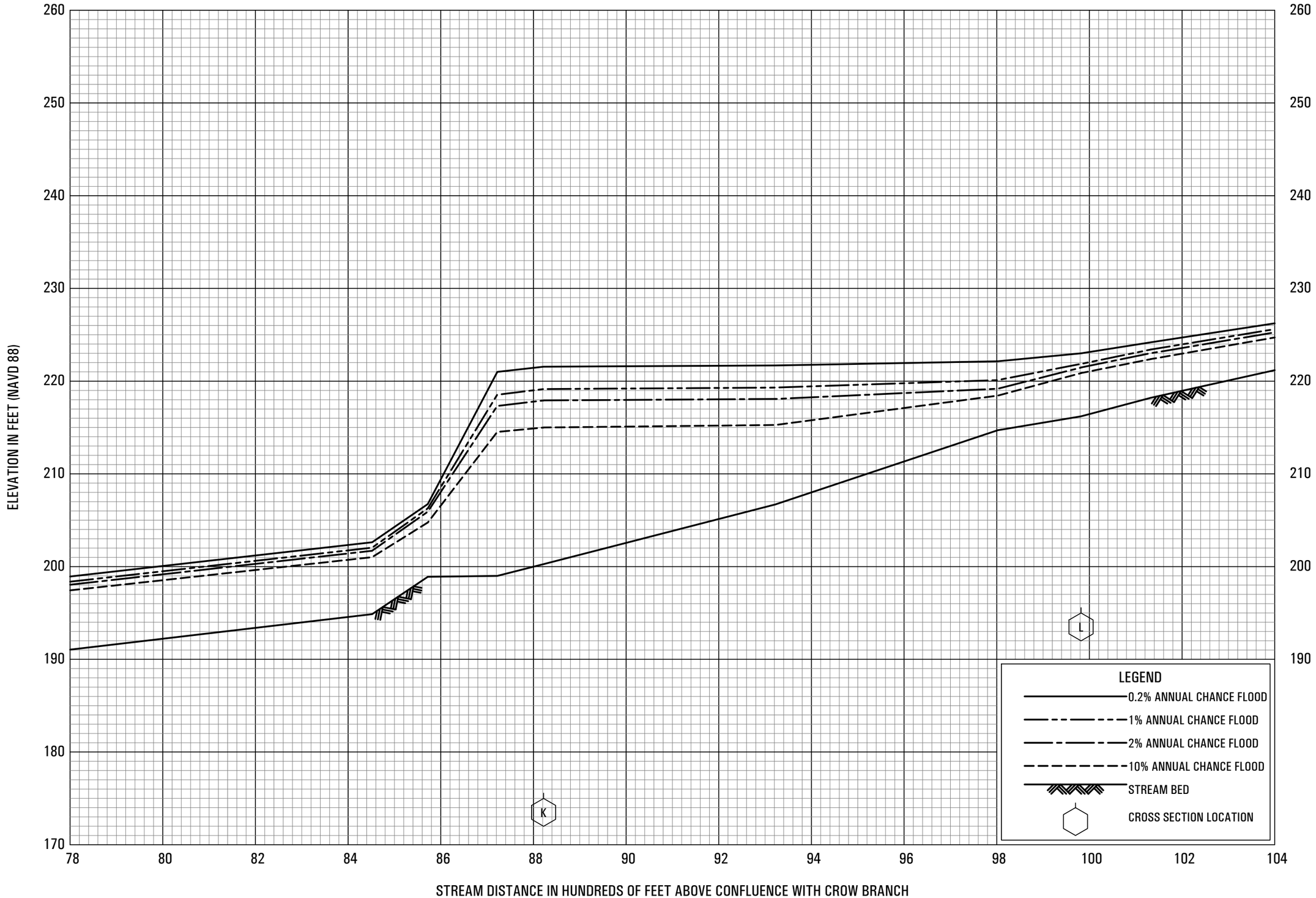

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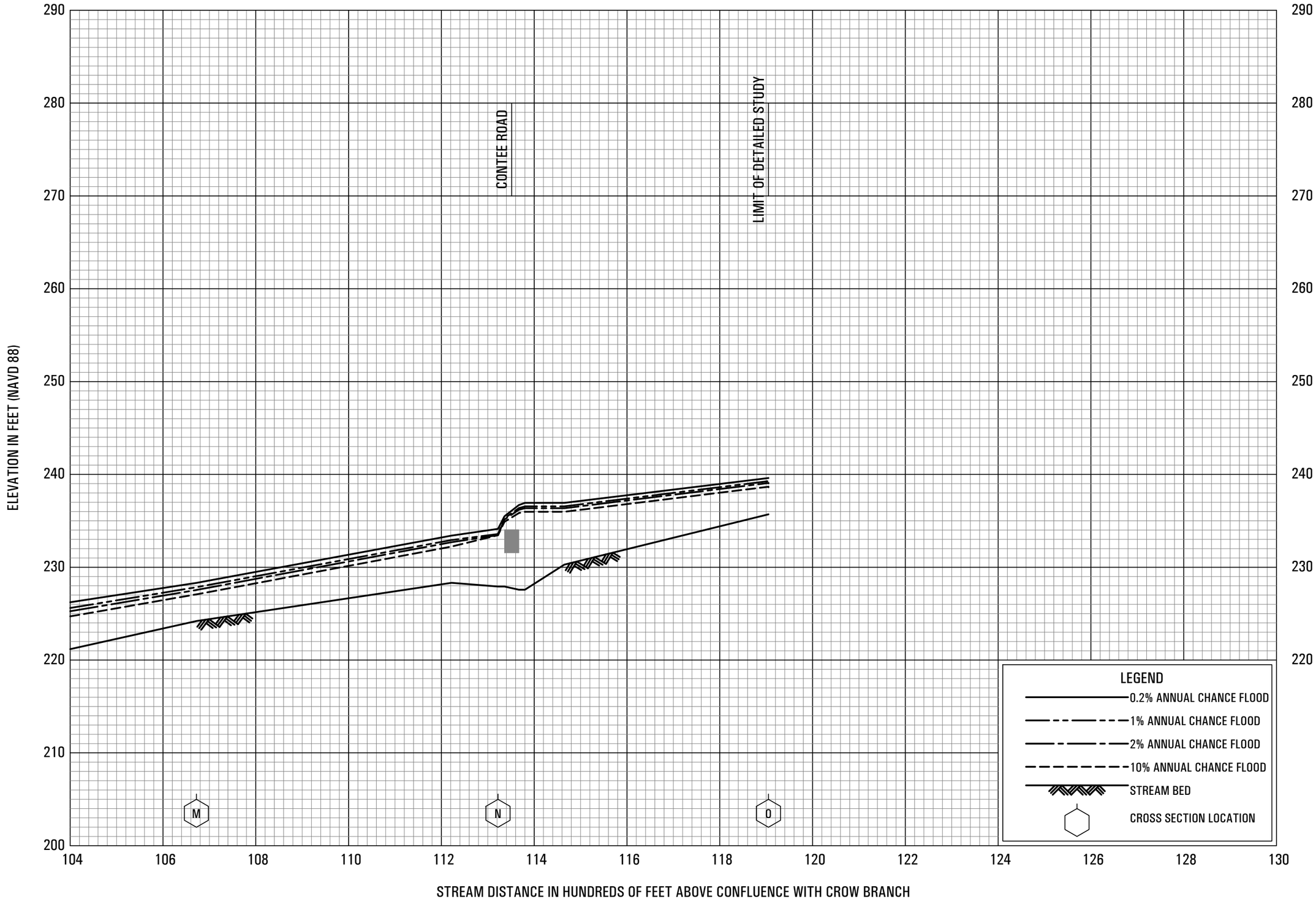

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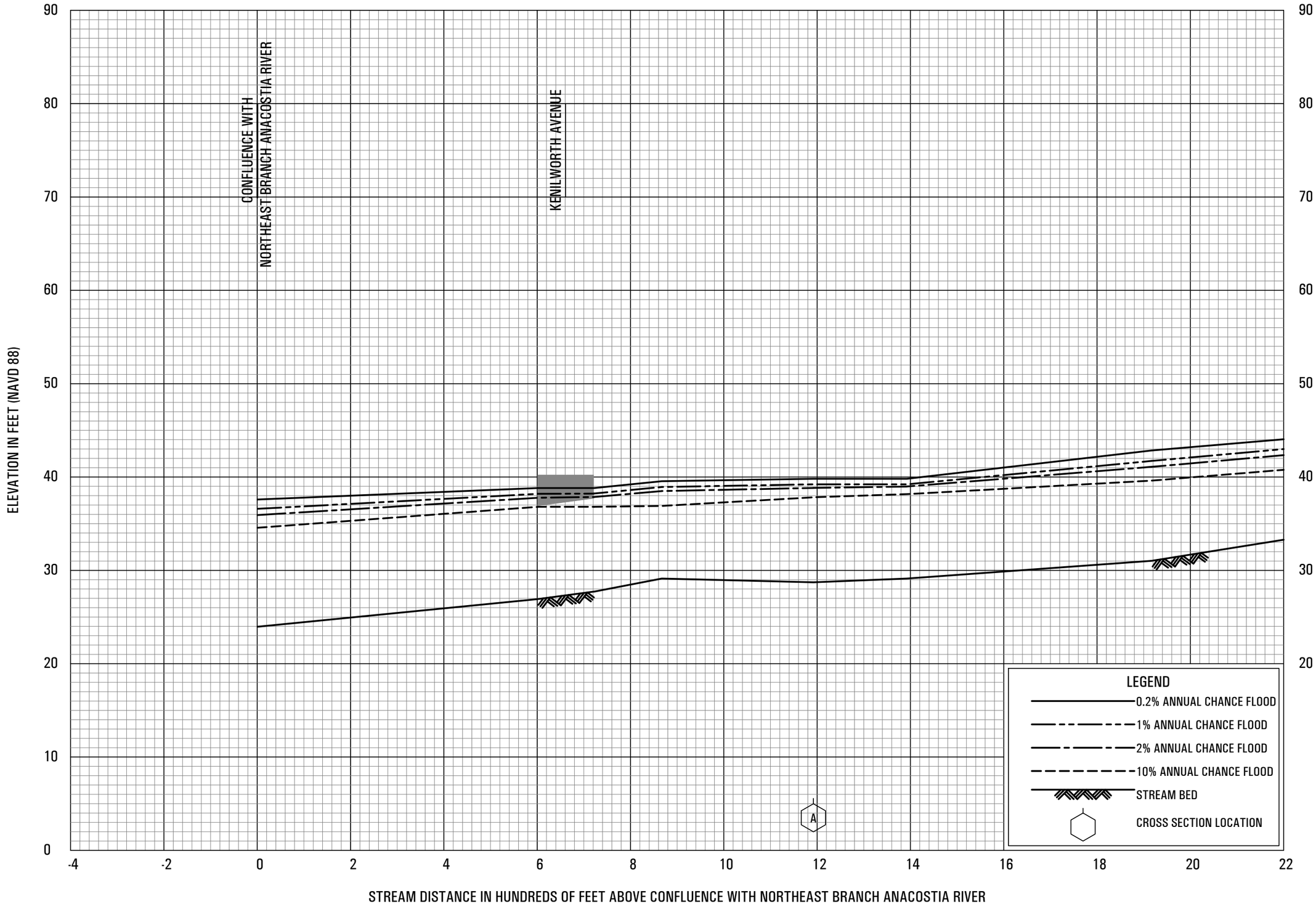


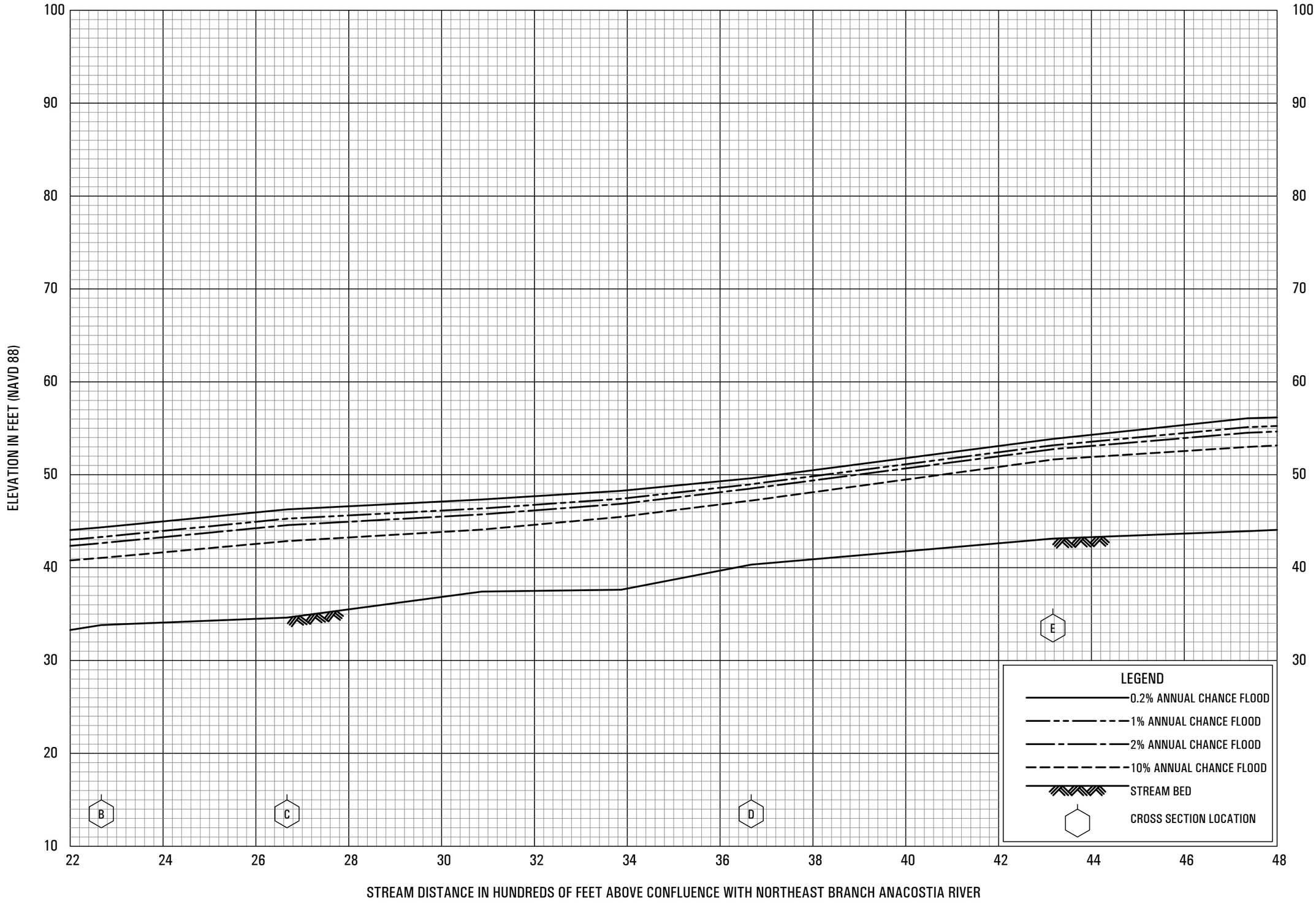
FLOOD PROFILES

BRIER DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS



FLOOD PROFILES

BRIER DITCH

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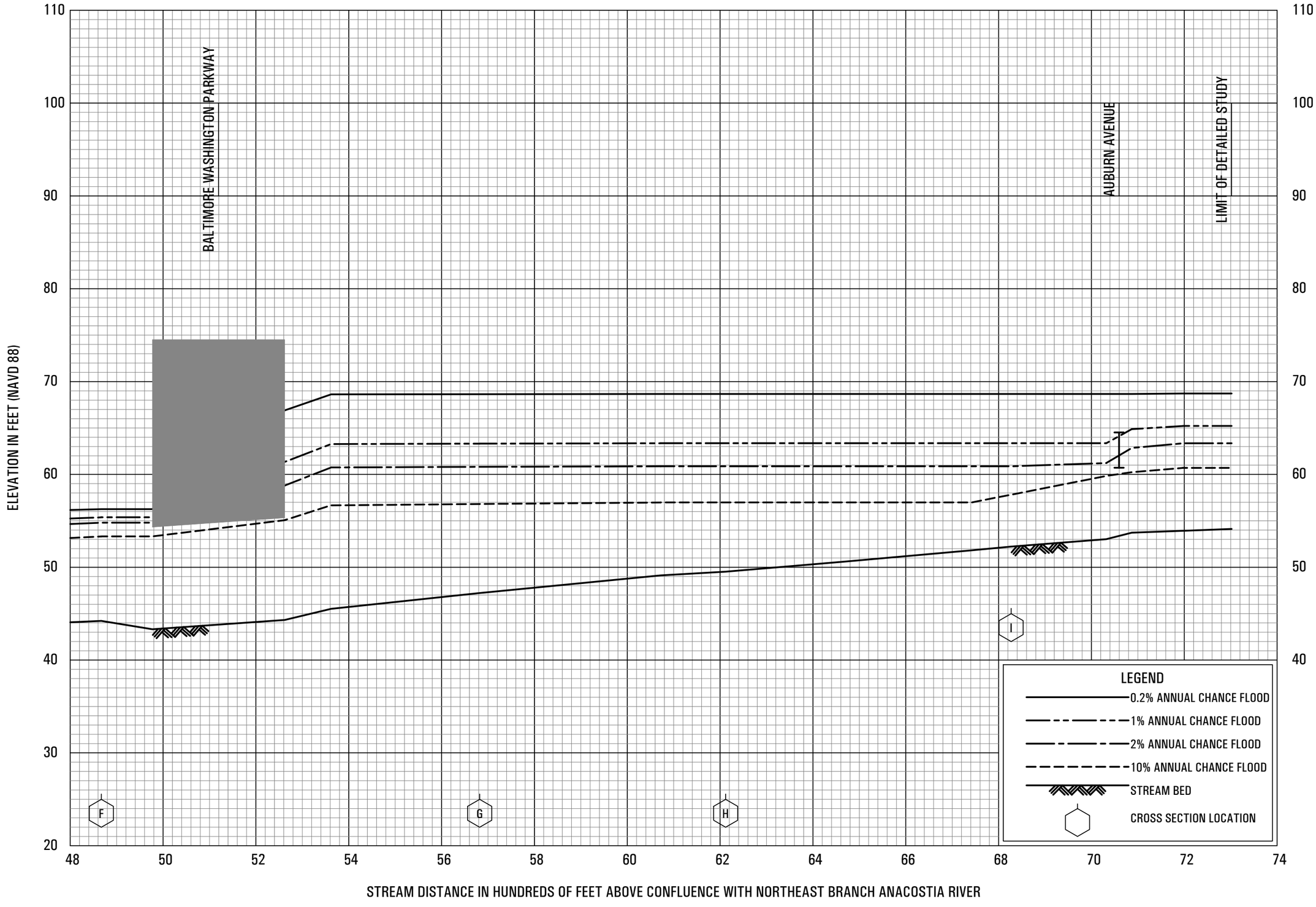

FLOOD PROFILES

BRIER DITCH

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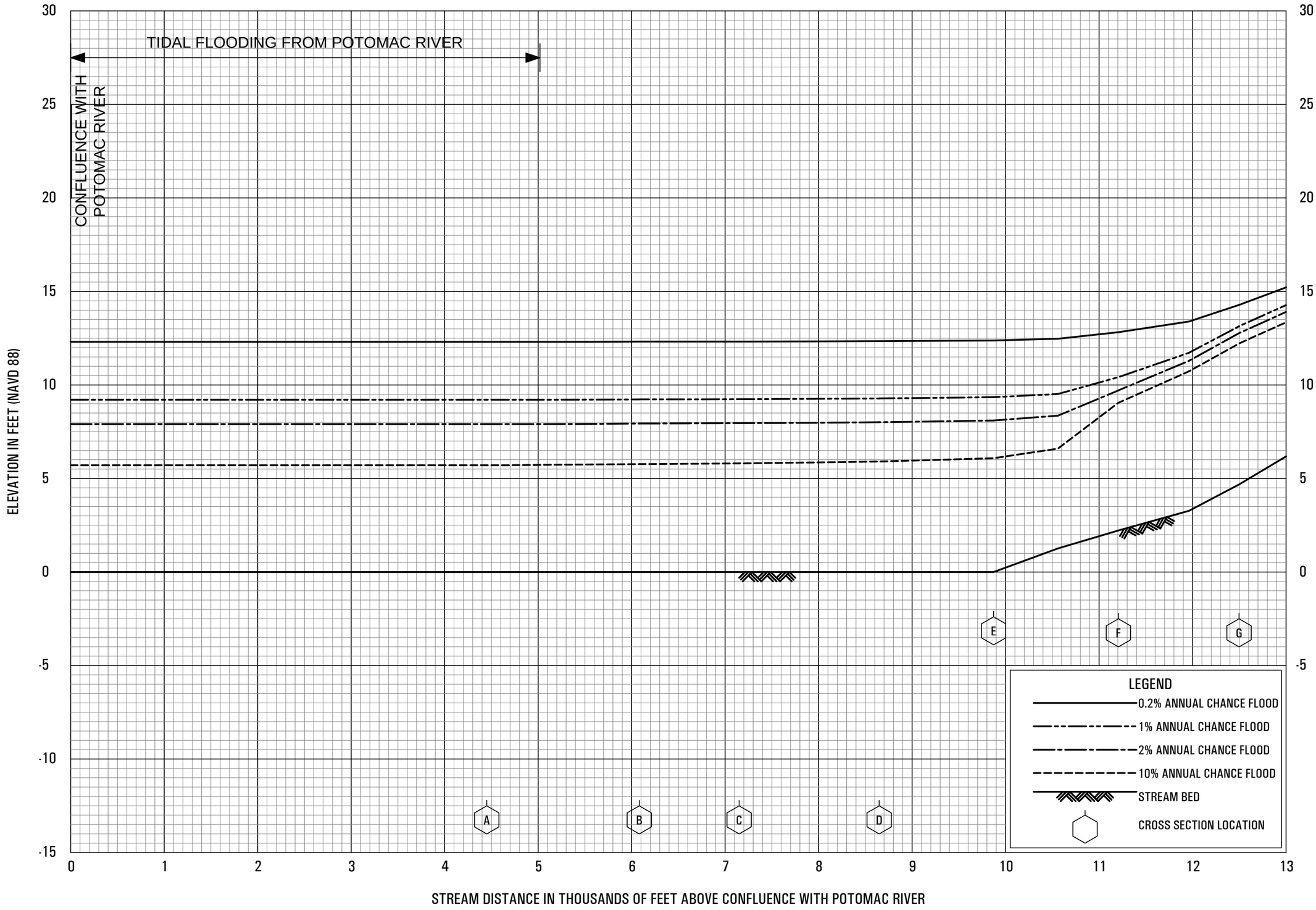


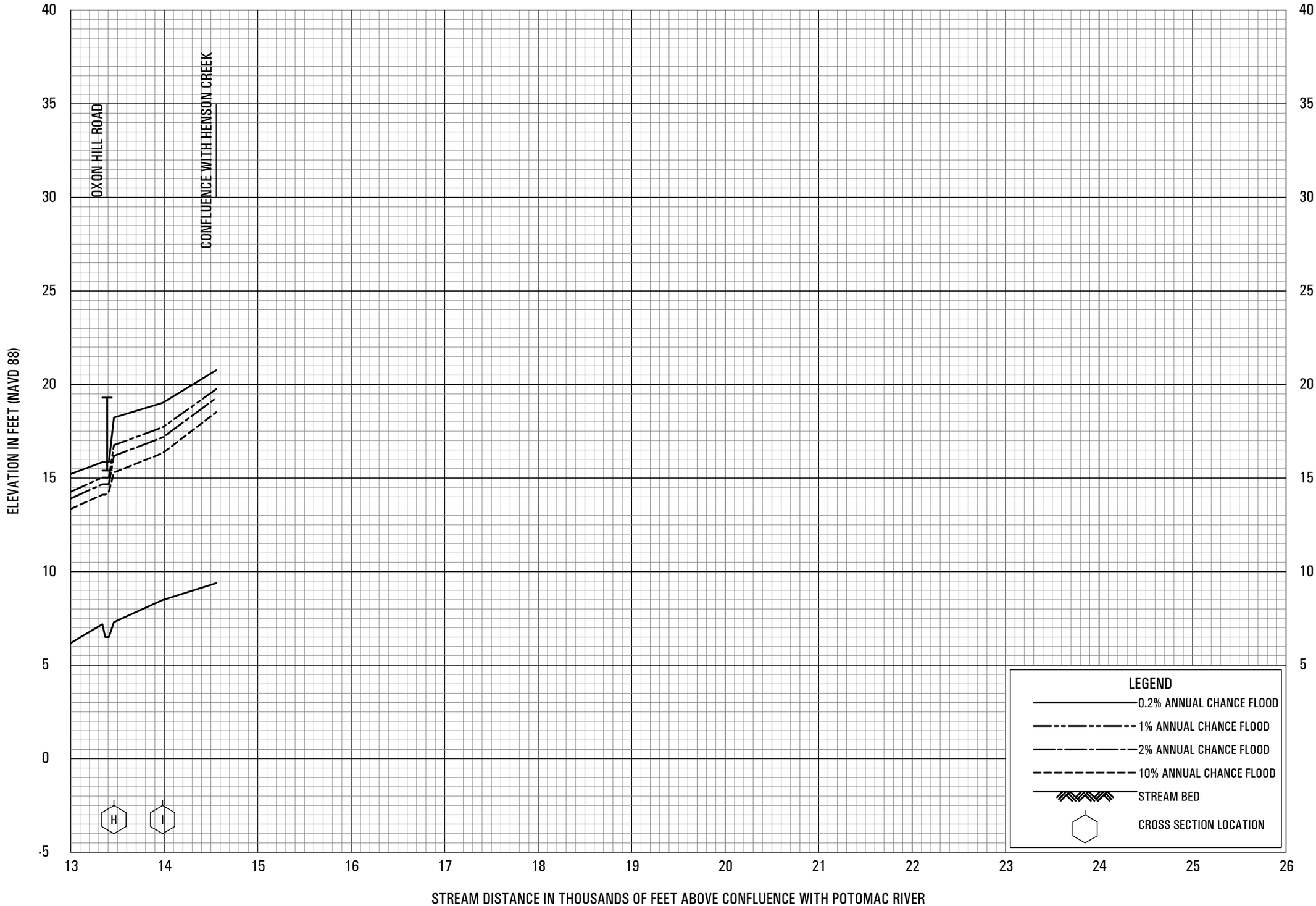
FLOOD PROFILES

BROAD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS



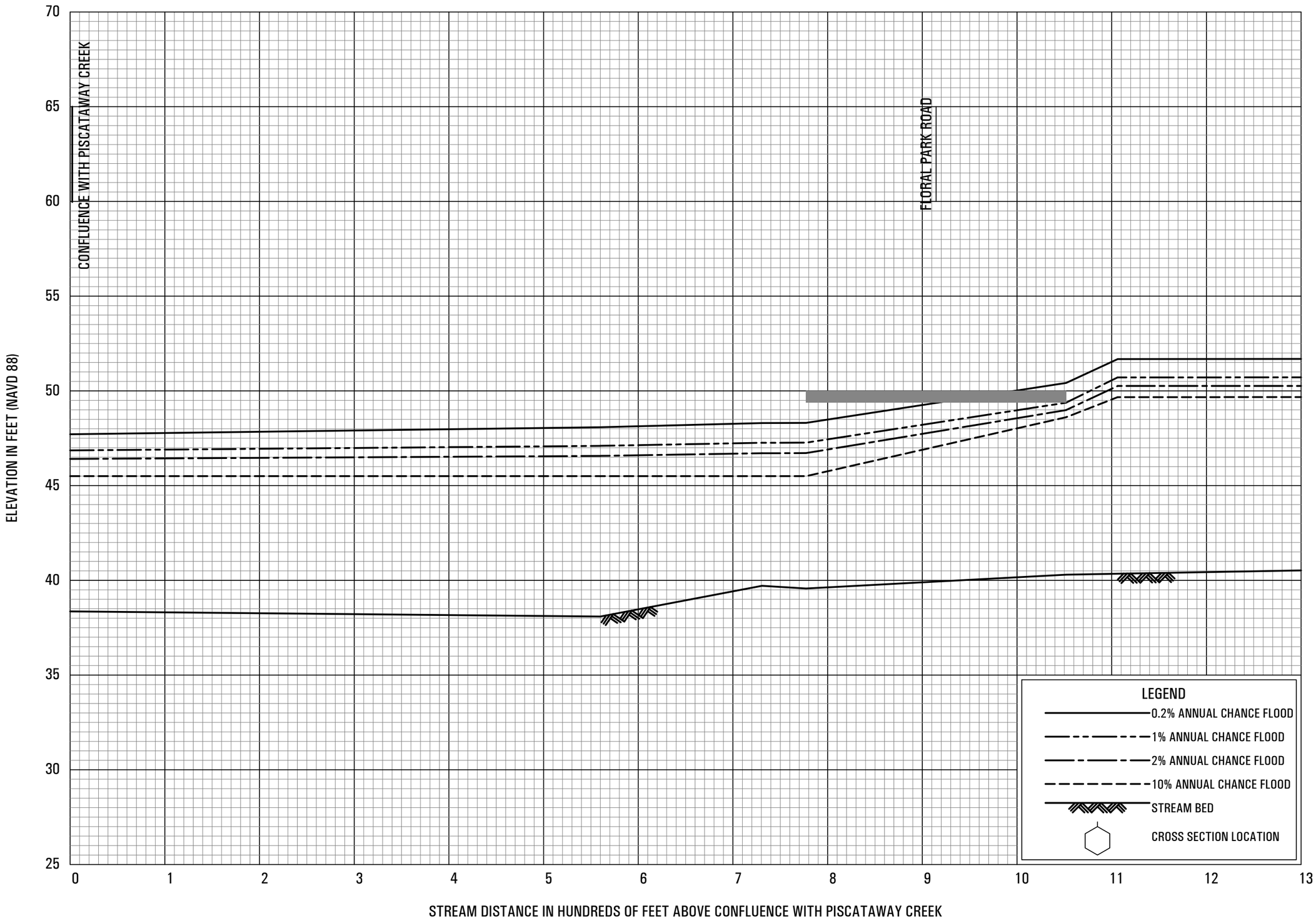
FLOOD PROFILES

BROAD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS



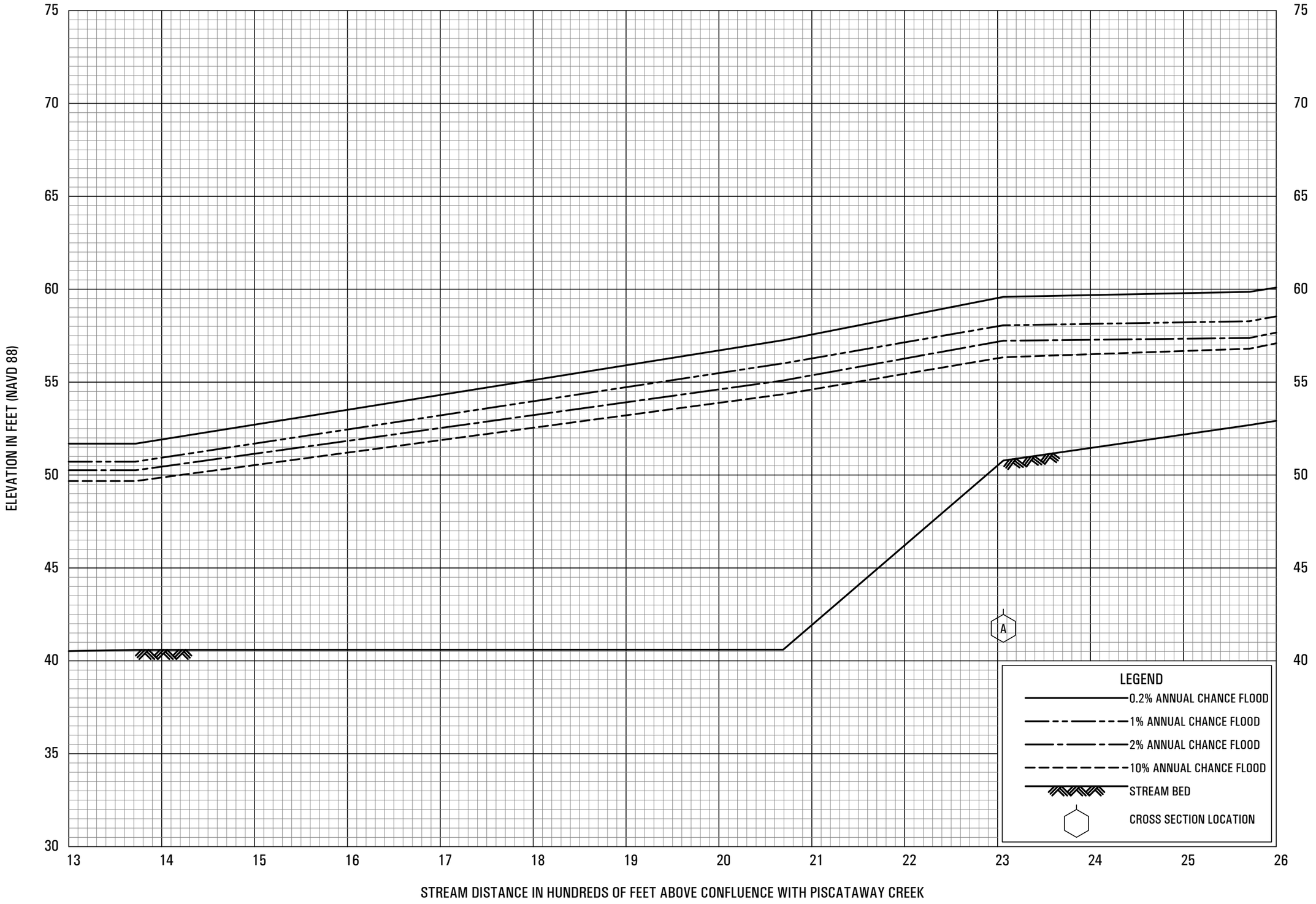
FLOOD PROFILES

BURCH BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS



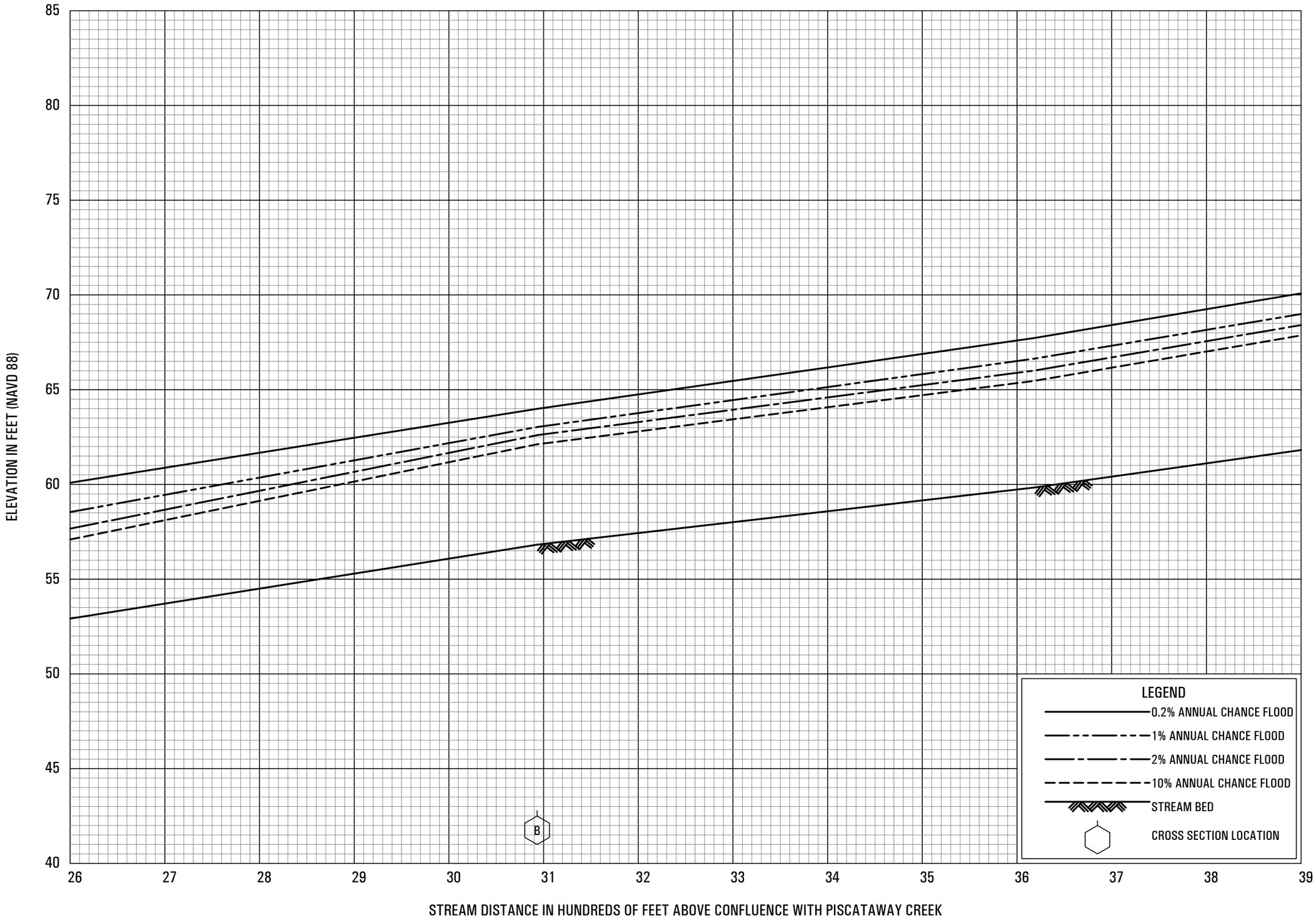
FLOOD PROFILES

BURCH BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS



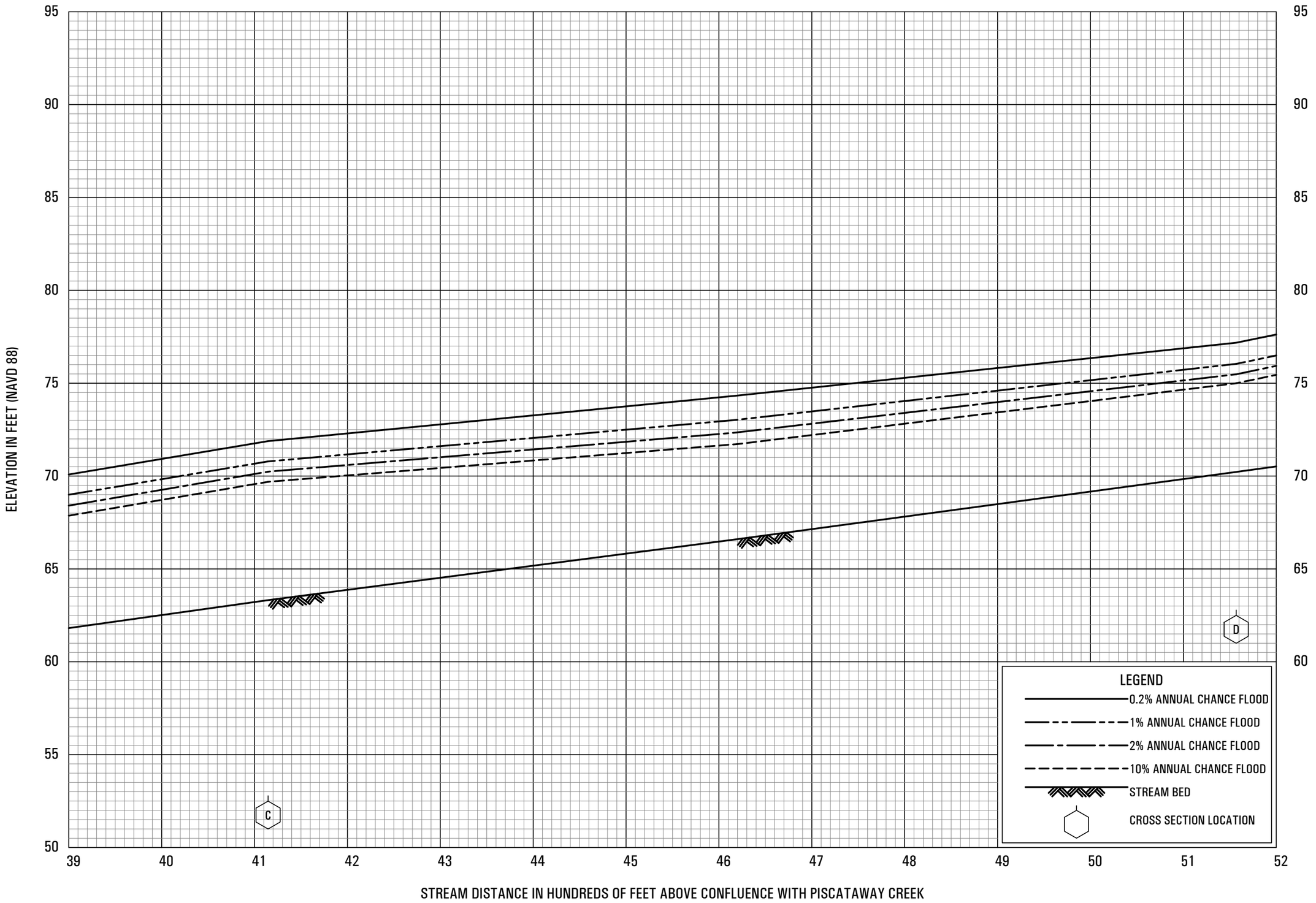
FLOOD PROFILES

BURCH BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS



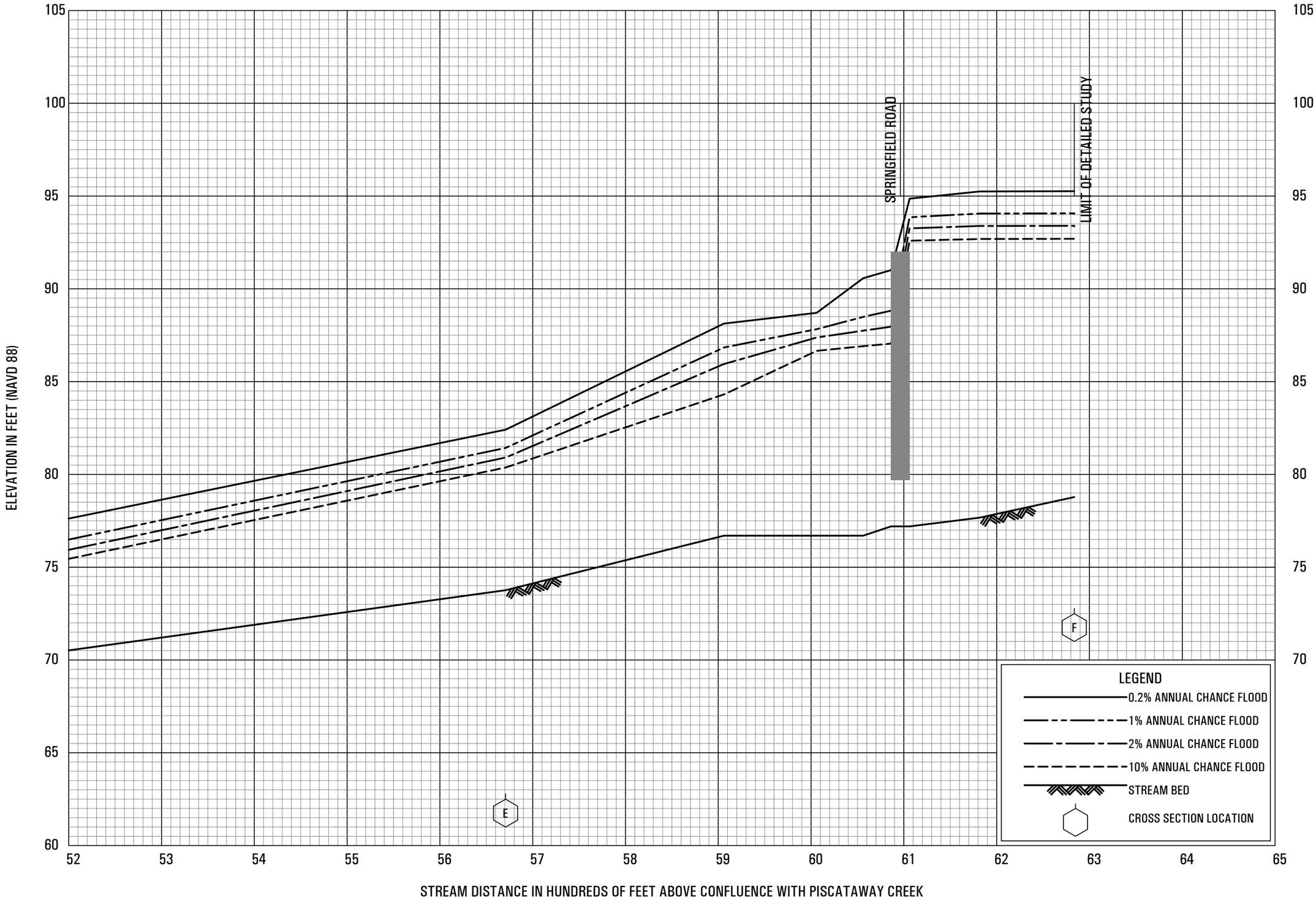
FLOOD PROFILES

BURCH BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS



FLOOD PROFILES

BURCH BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

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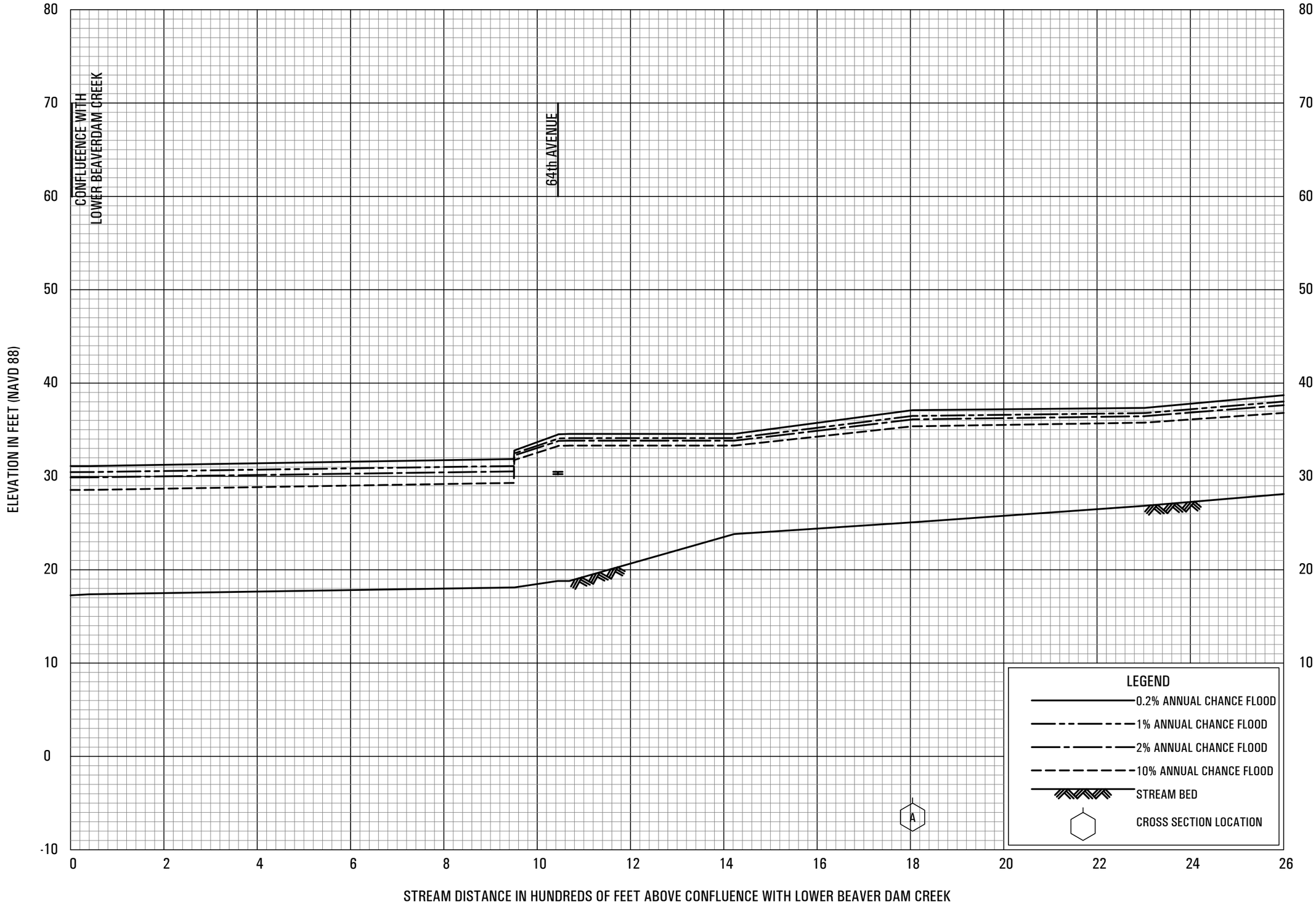


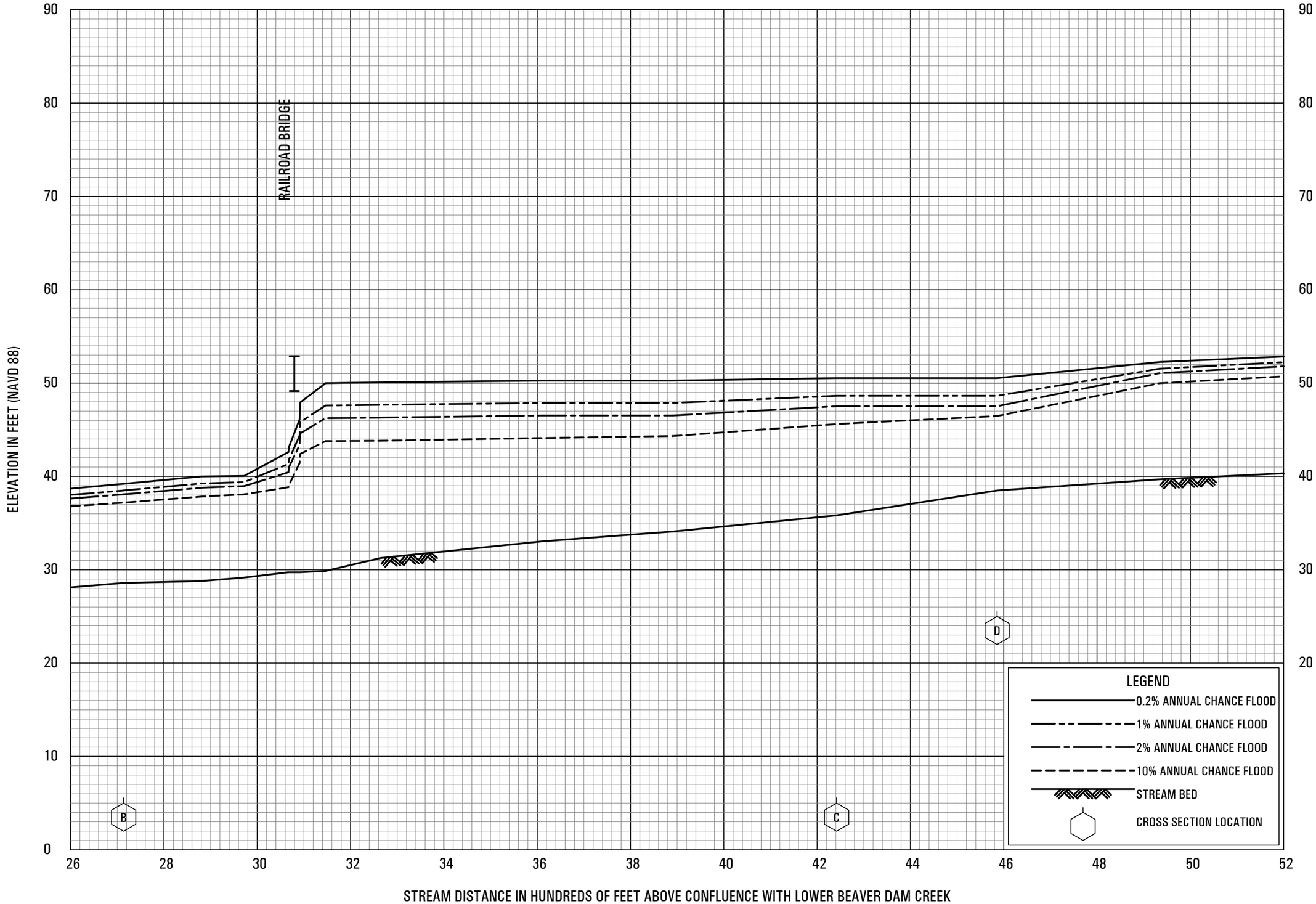
FLOOD PROFILES

CABIN BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PRINCE GEORGE'S COUNTY, MD

AND INCORPORATED AREAS



FLOOD PROFILES

CABIN BRANCH

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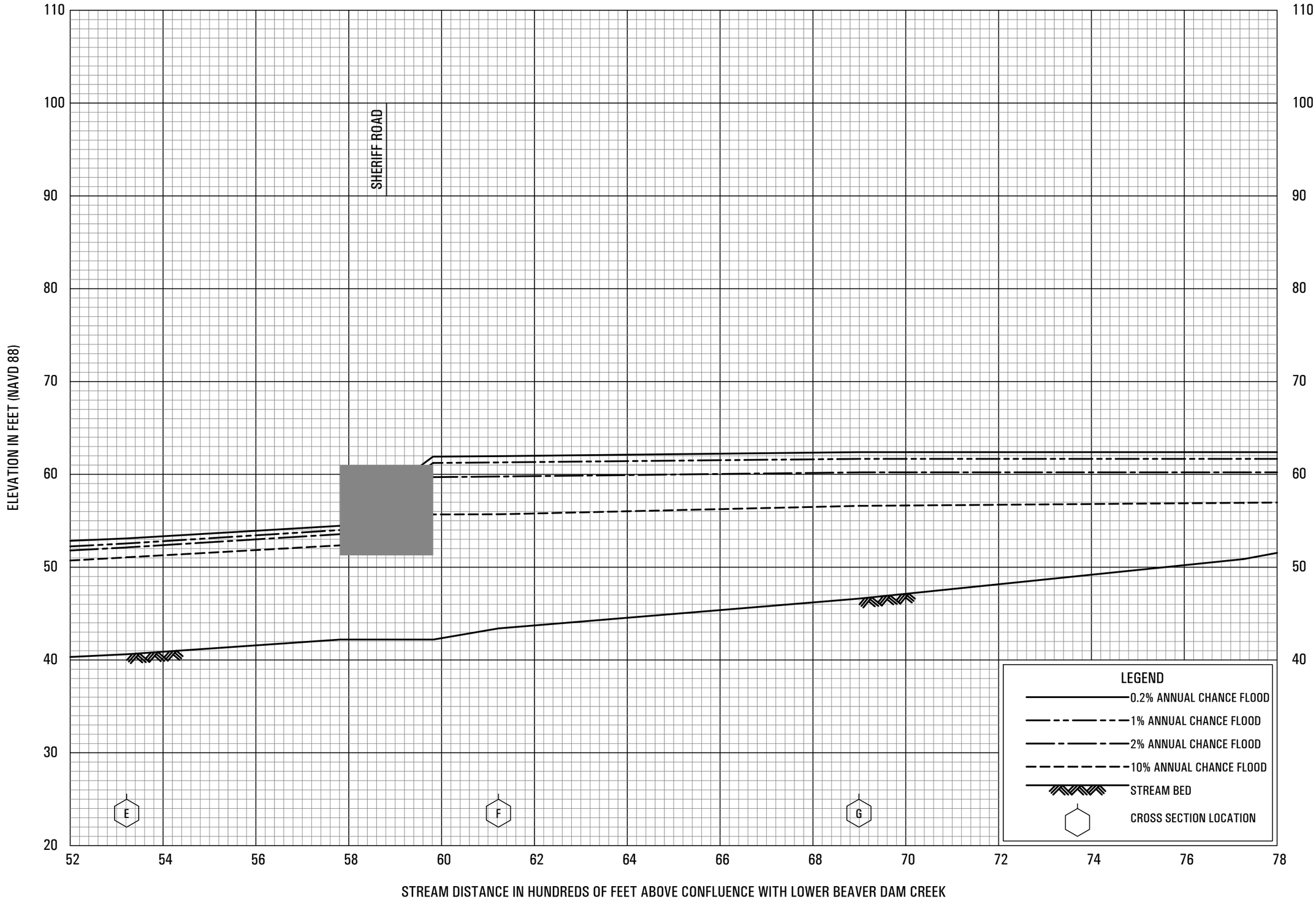

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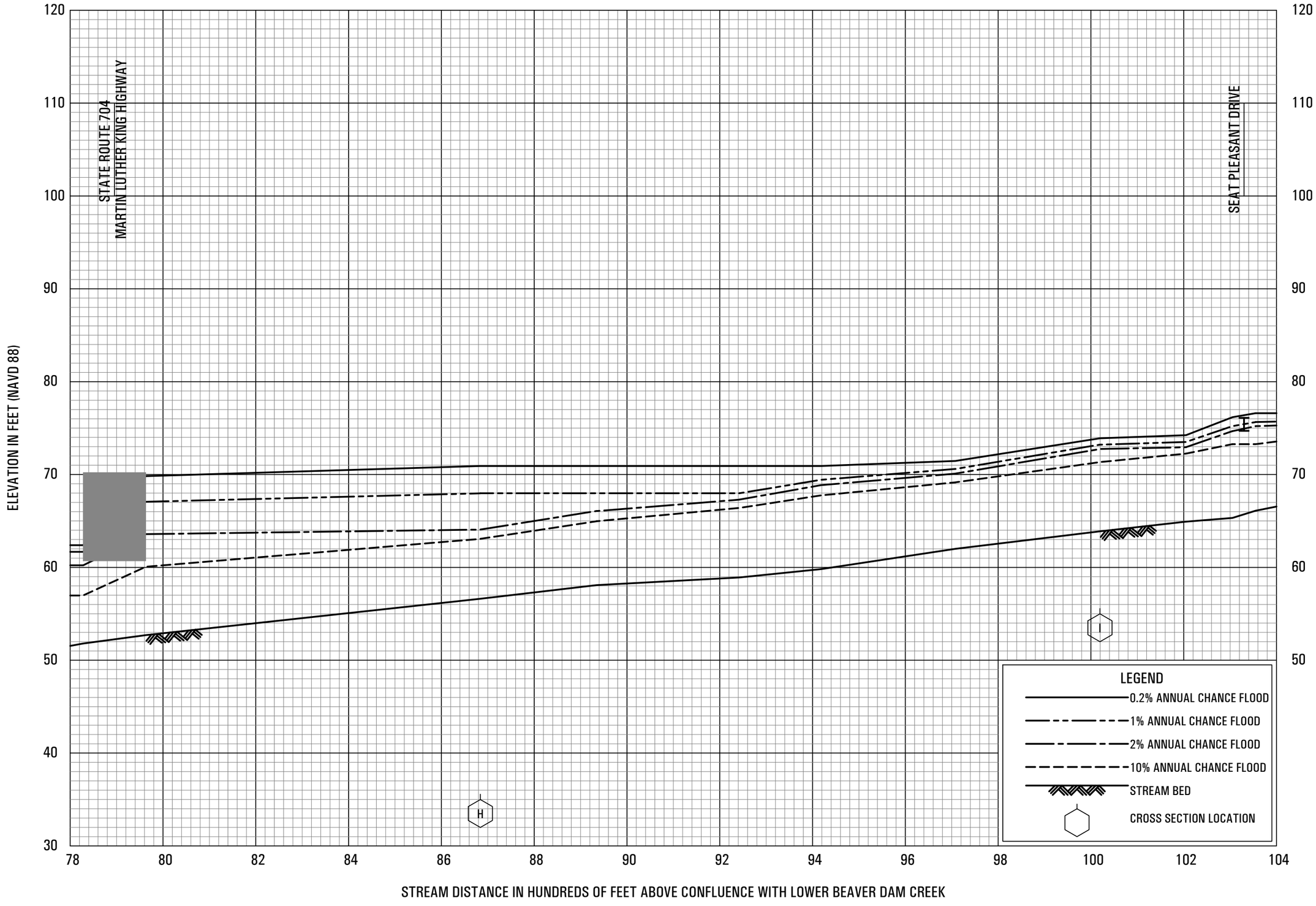

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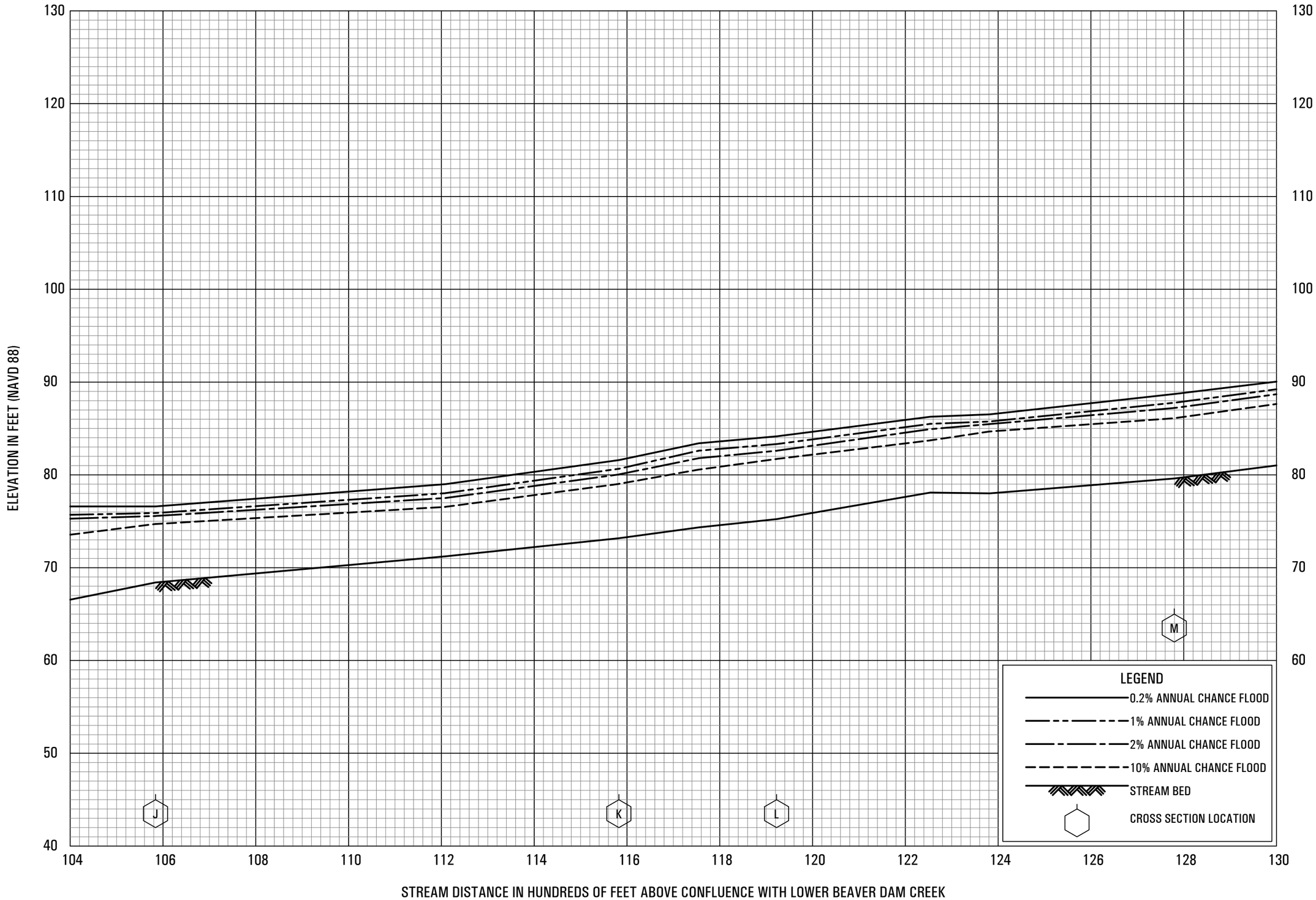

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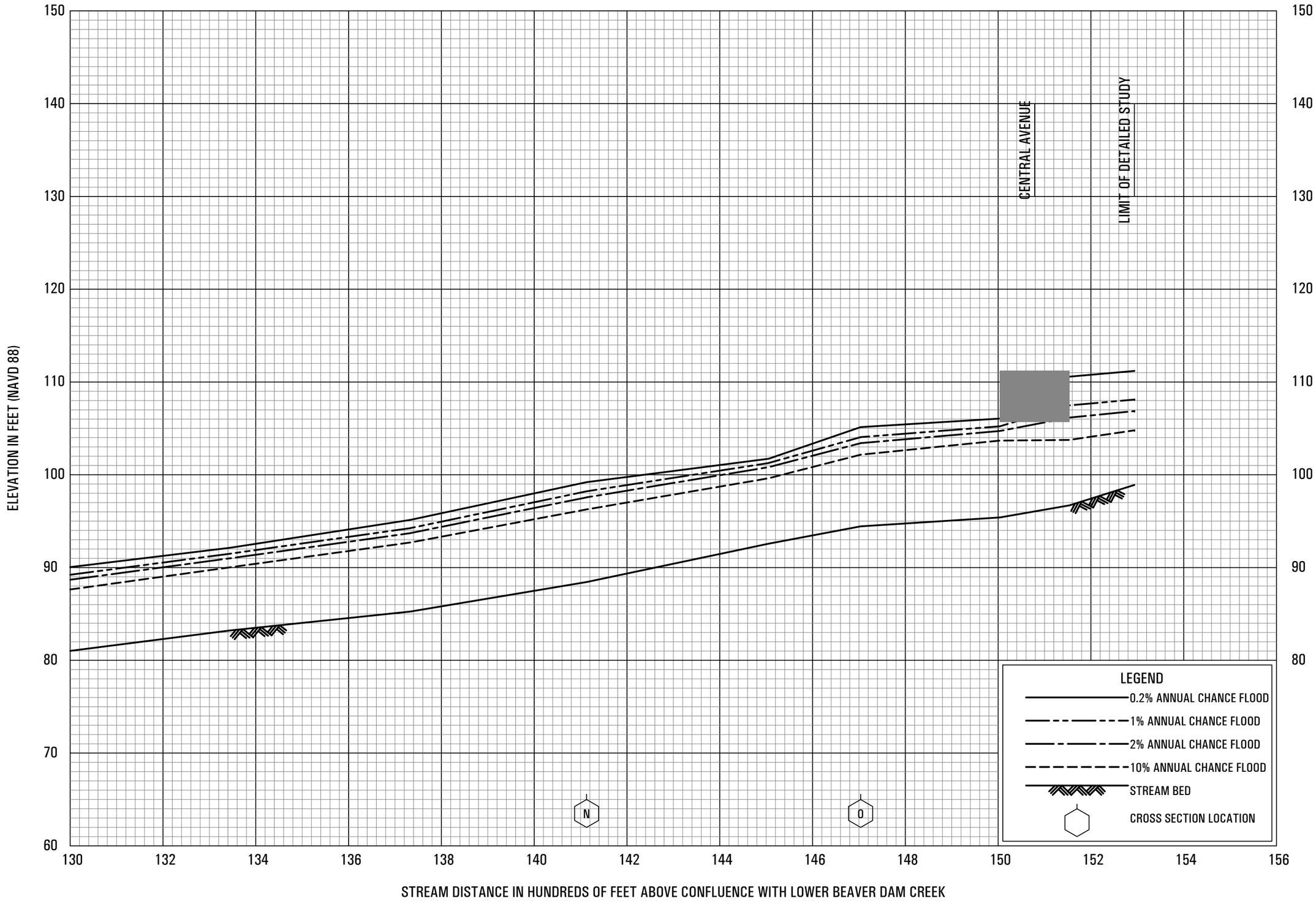

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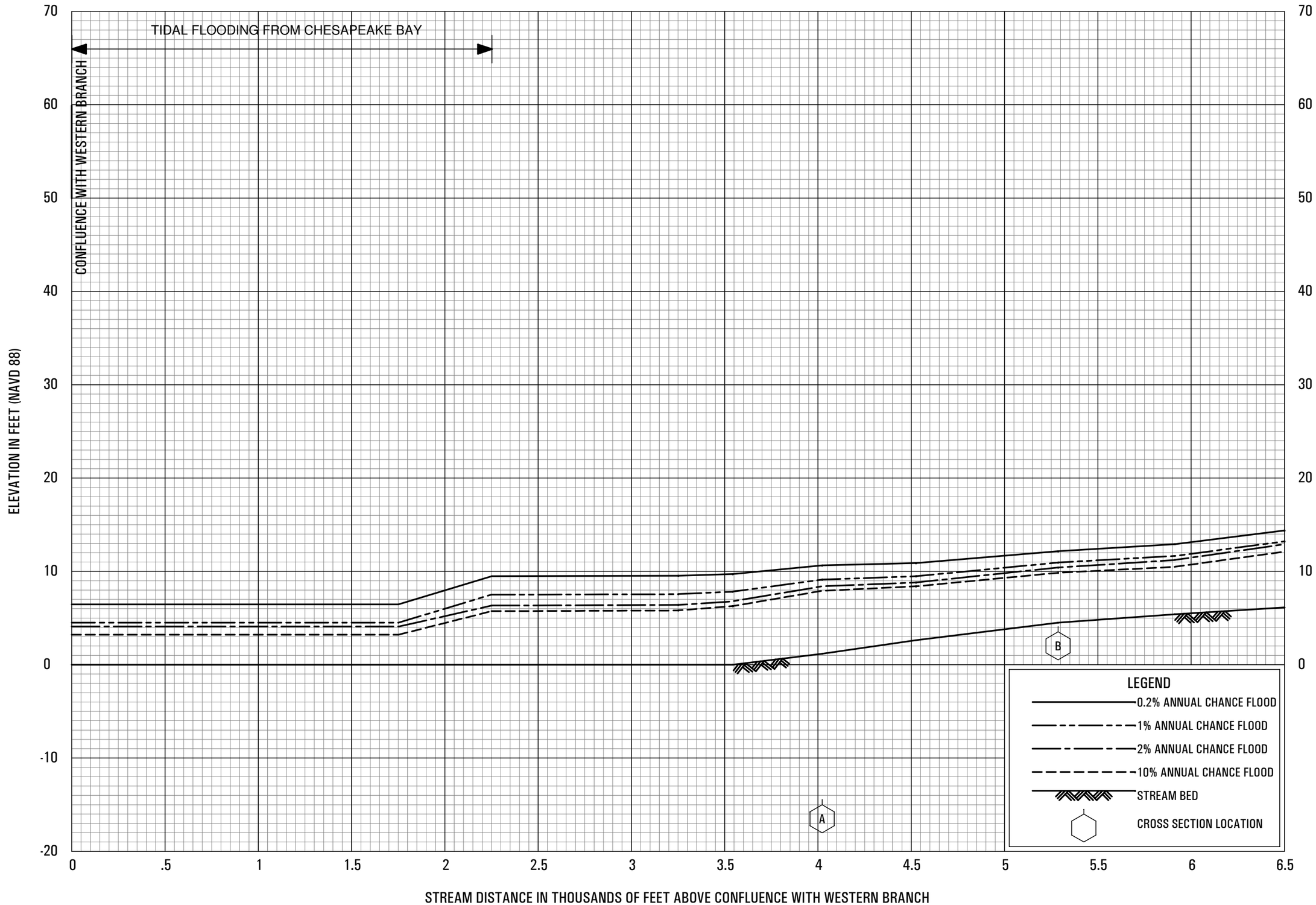

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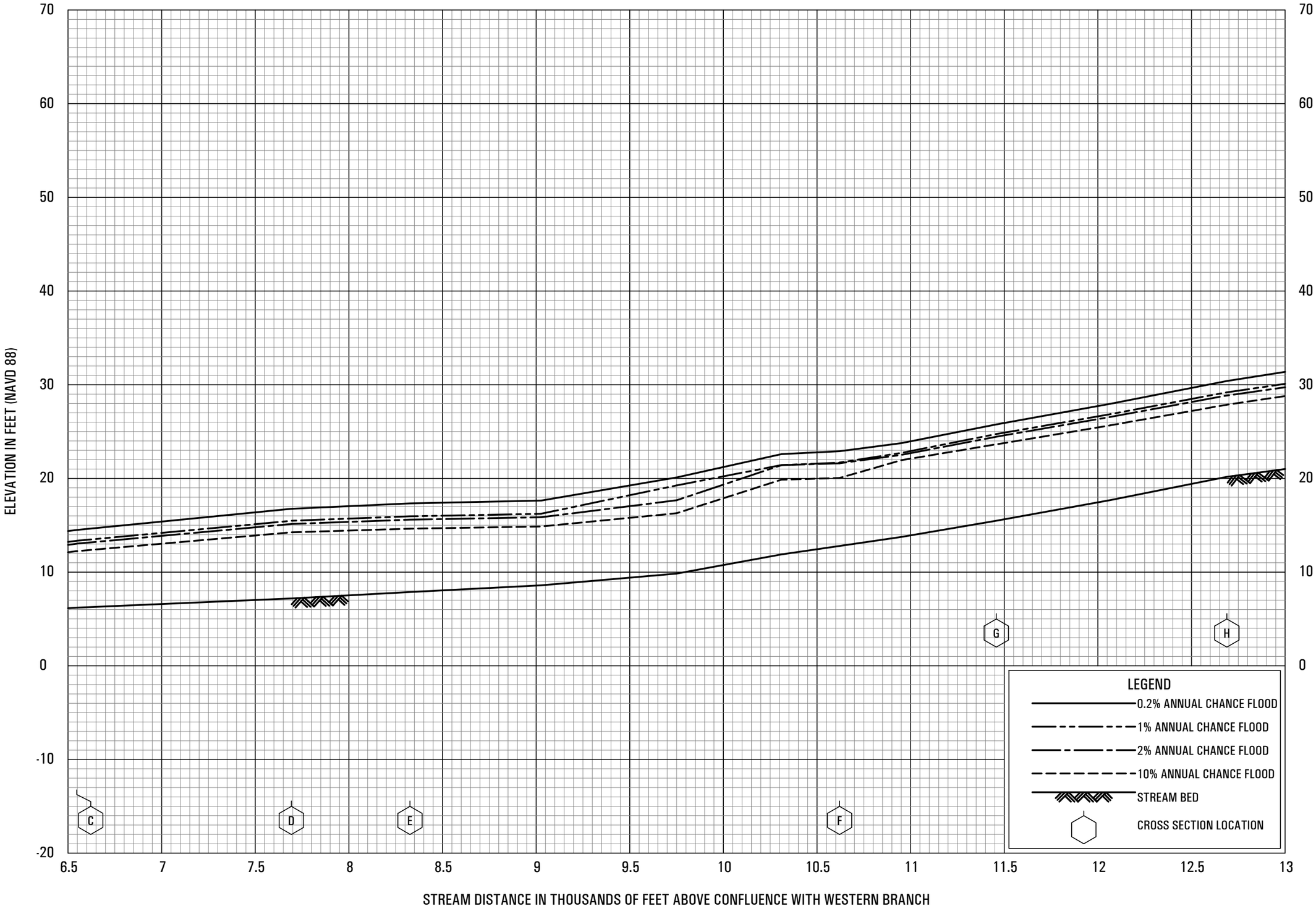

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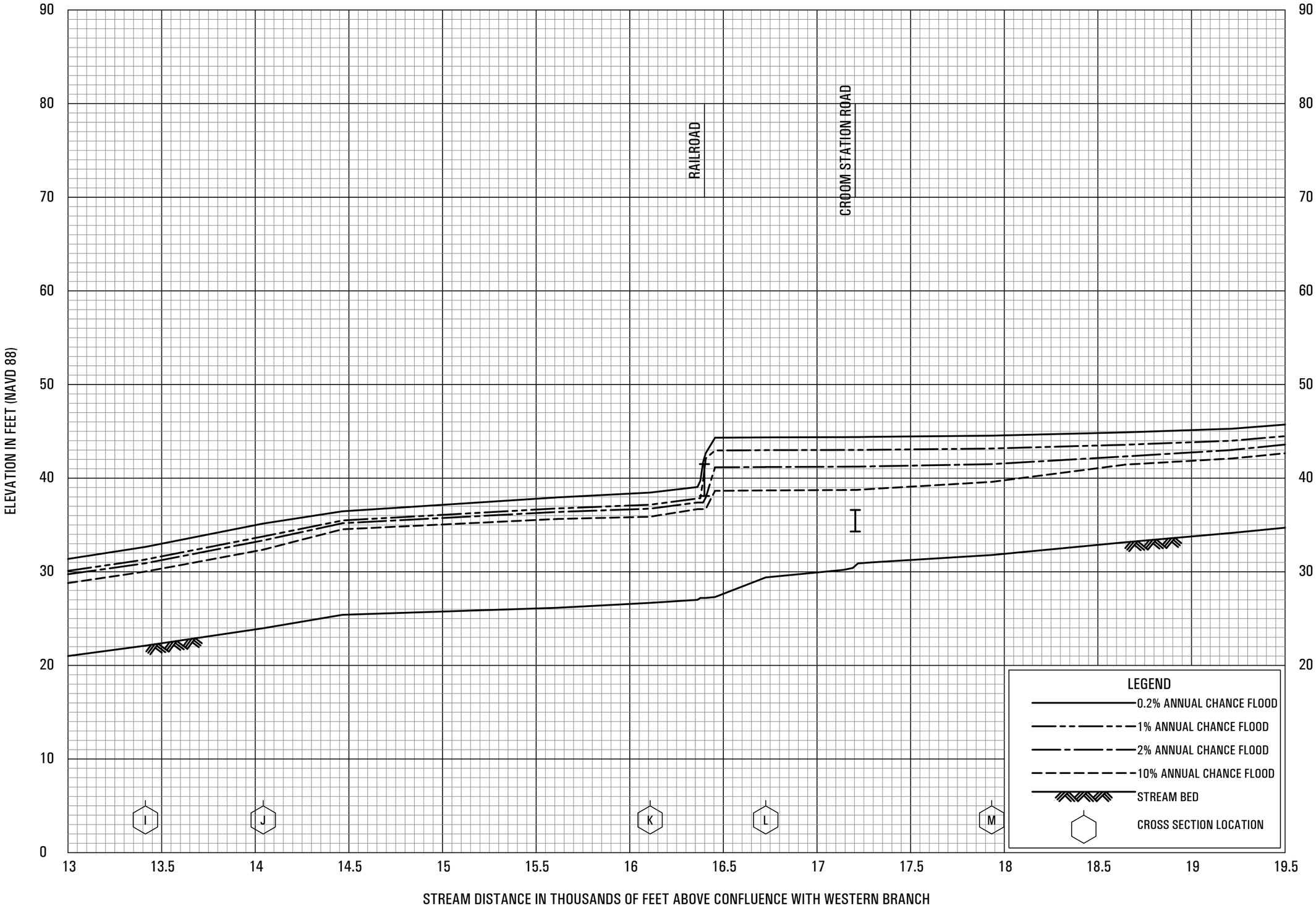

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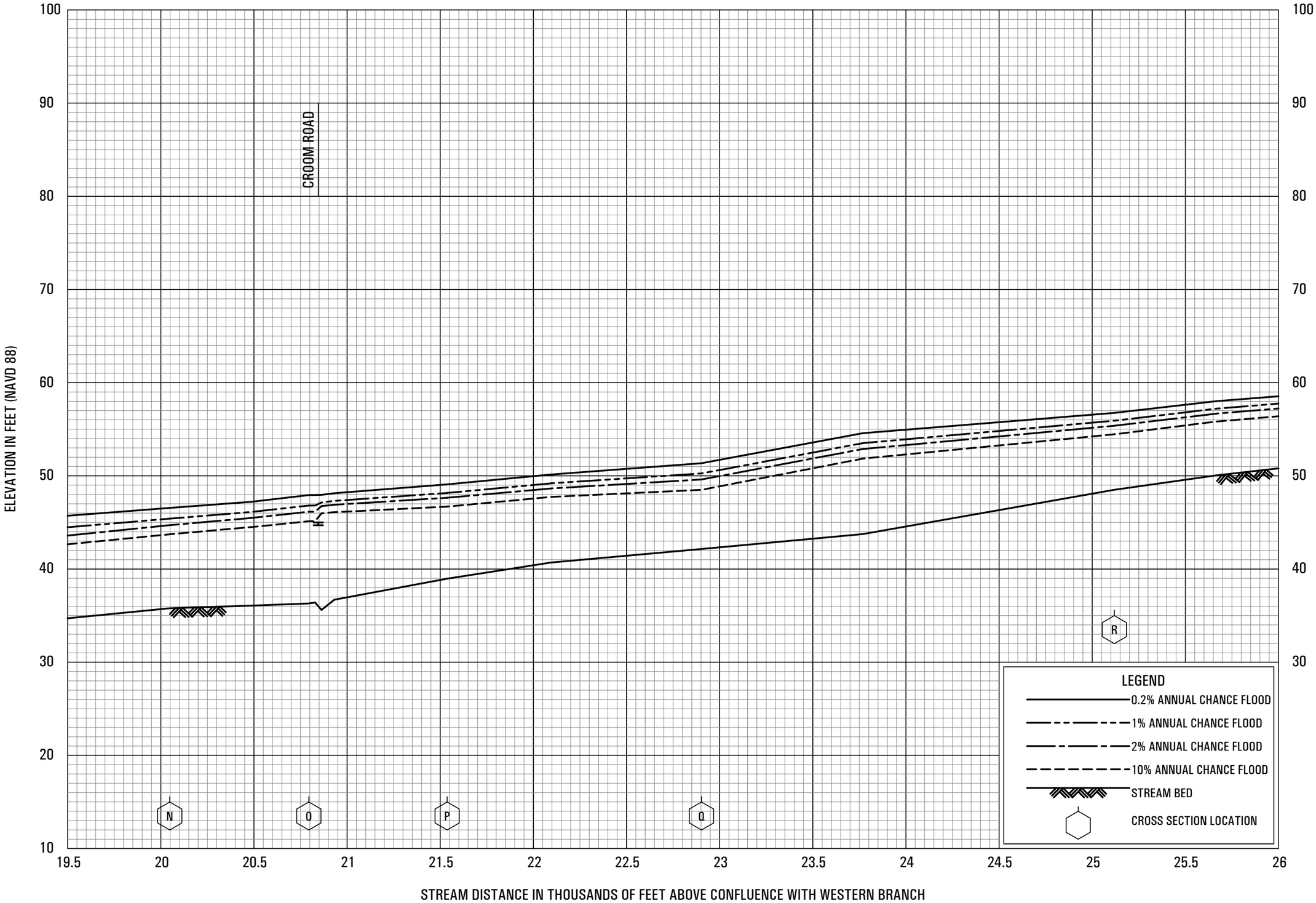

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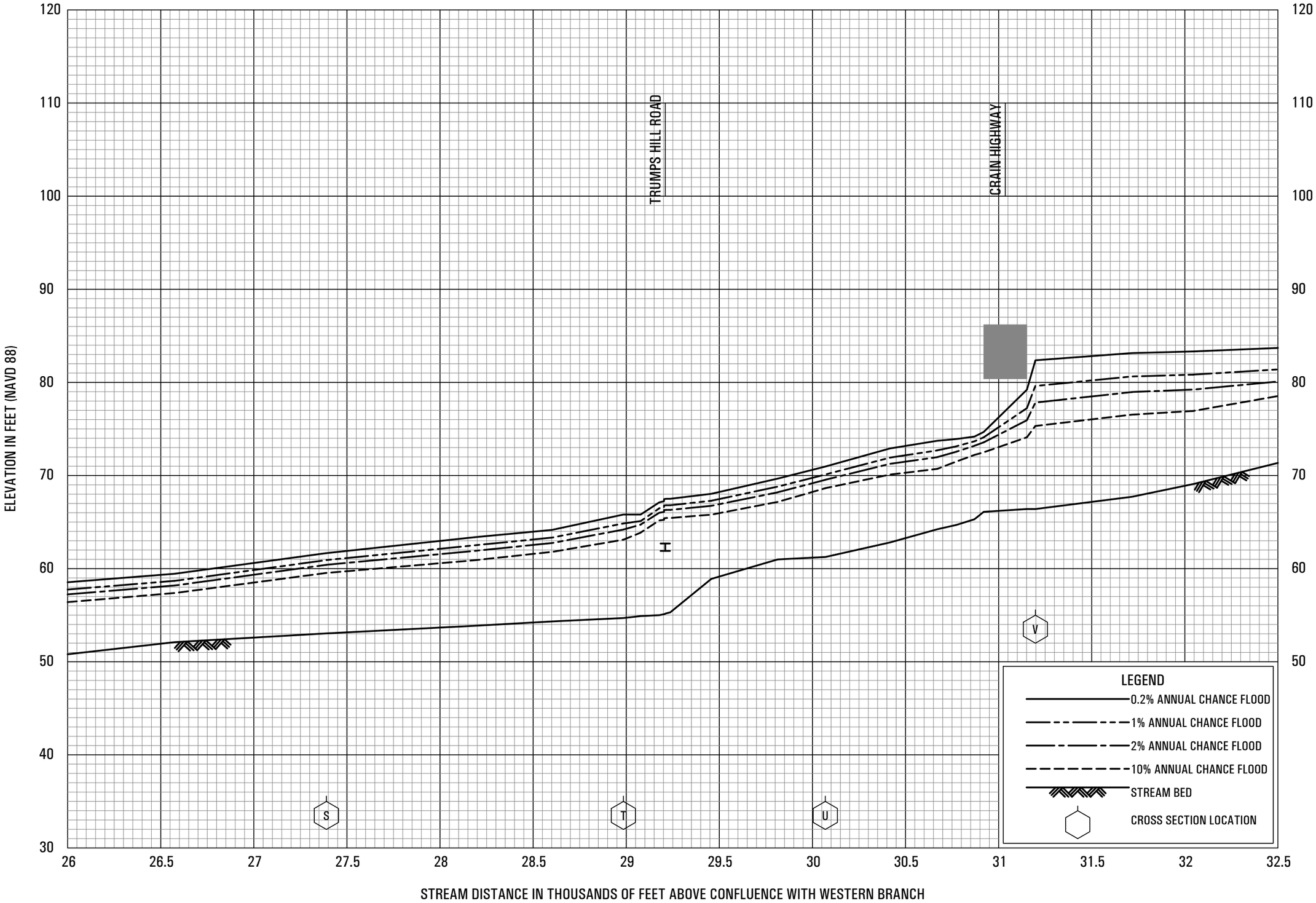

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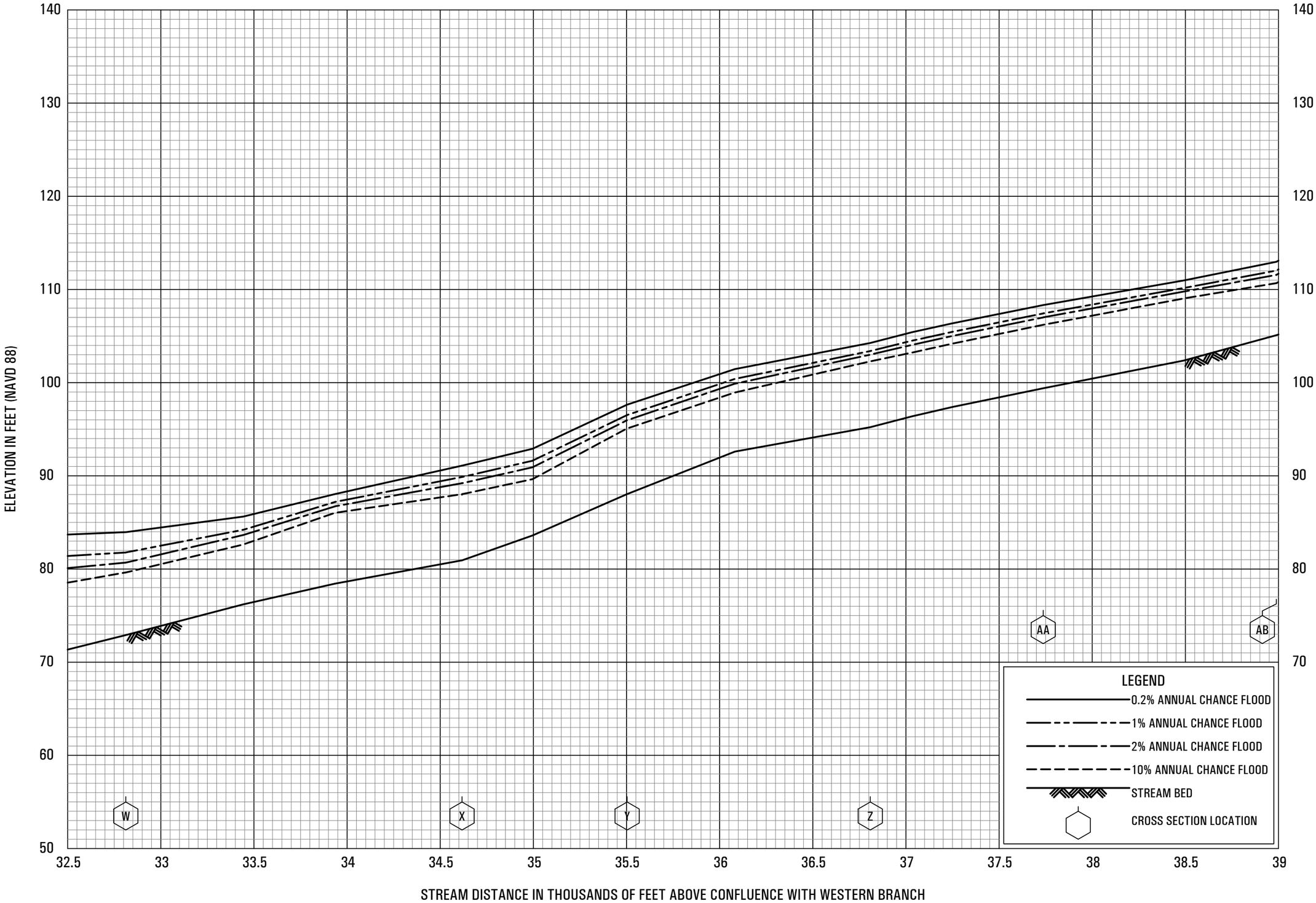

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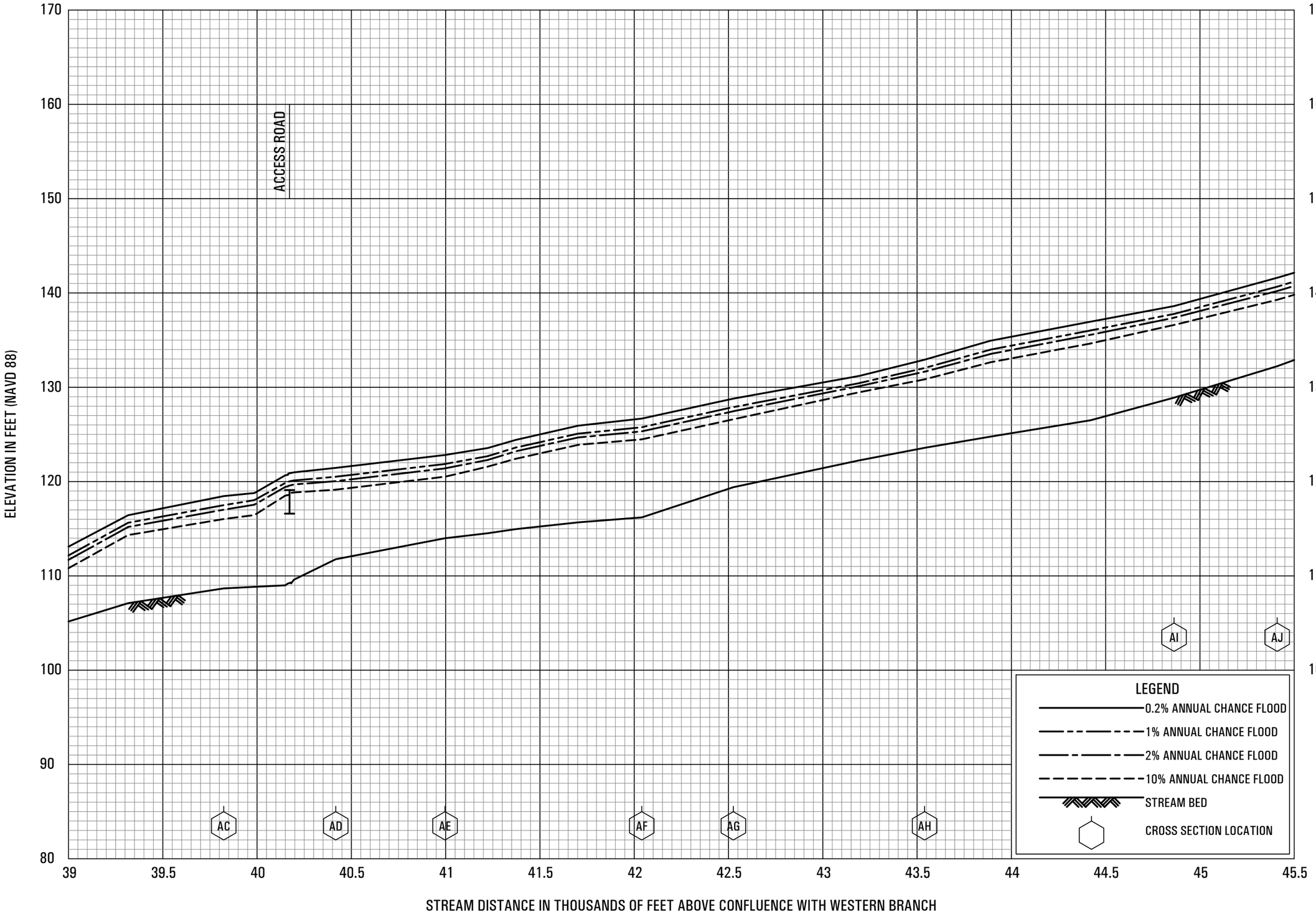

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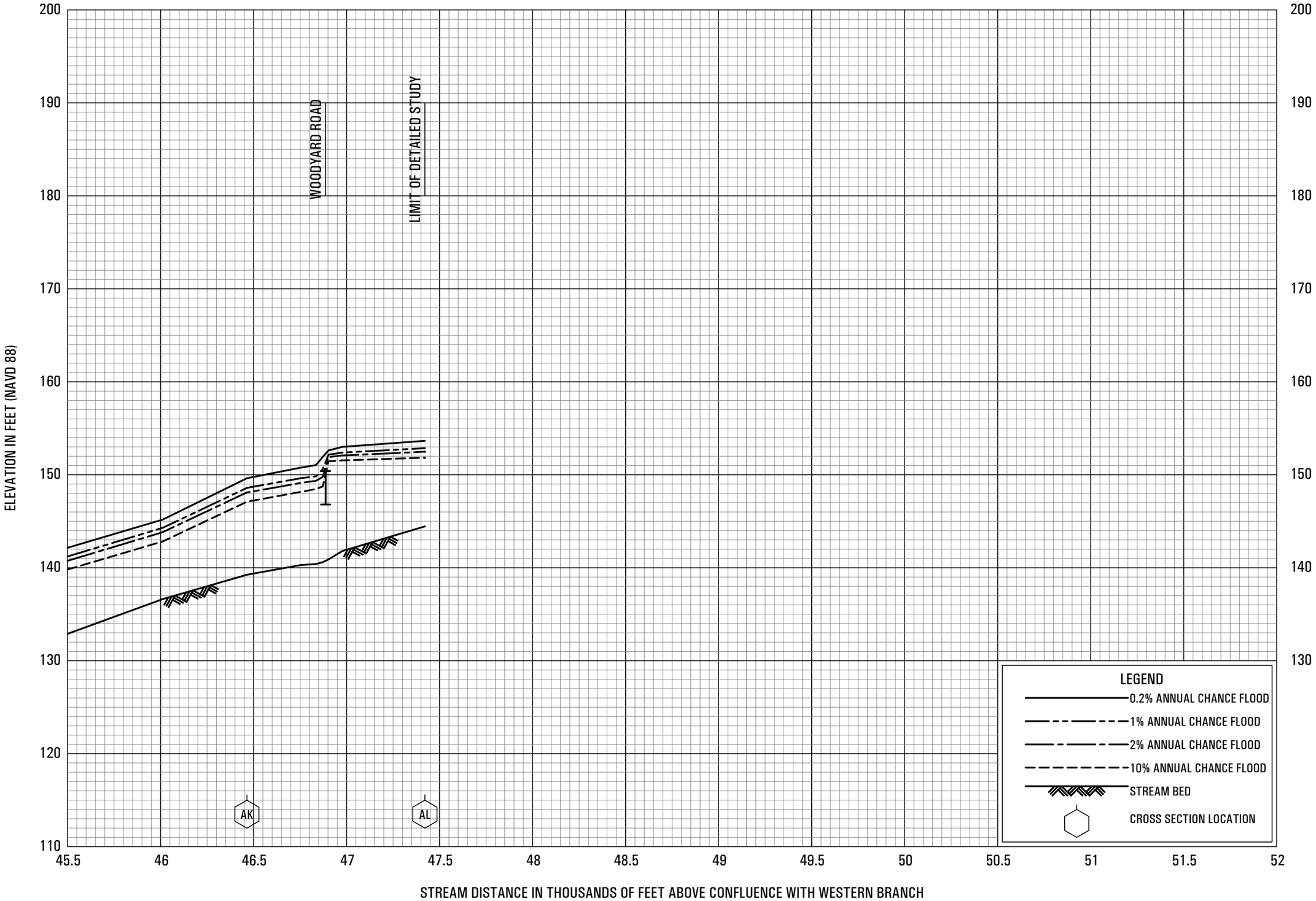

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