

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 2 OF 2



HENRICO COUNTY, VA

(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
HENRICO COUNTY, UNINCORPORATED AREAS	510077



FEMA

REVISED:

April 25, 2024

FLOOD INSURANCE STUDY NUMBER
51087CV002B
Version Number 2.8.5.6

TABLE OF CONTENTS

Volume 1

	<u>Page</u>
SECTION 1.0 – INTRODUCTION	1
1.1 The National Flood Insurance Program	1
1.2 Purpose of this Flood Insurance Study Report	2
1.3 Jurisdictions Included in the Flood Insurance Study Project	2
1.4 Considerations for using this Flood Insurance Study Report	3
SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS	13
2.1 Floodplain Boundaries	13
2.2 Floodways	19
2.3 Base Flood Elevations	20
2.4 Non-Encroachment Zones	21
2.5 Coastal Flood Hazard Areas	21
2.5.1 Water Elevations and the Effects of Waves	21
2.5.3 Coastal High Hazard Areas	21
2.5.4 Limit of Moderate Wave Action	21
SECTION 3.0 – INSURANCE APPLICATIONS	22
3.1 National Flood Insurance Program Insurance Zones	22
SECTION 4.0 – AREA STUDIED	22
4.1 Basin Description	22
4.2 Principal Flood Problems	22
4.3 Non-Levee Flood Protection Measures	24
4.4 Levees	25
SECTION 5.0 – ENGINEERING METHODS	25
5.1 Hydrologic Analyses	26
5.2 Hydraulic Analyses	36
5.3 Coastal Analyses	45
5.3.1 Total Stillwater Elevations	45
5.3.3 Coastal Erosion	45
5.3.4 Wave Hazard Analyses	45
5.4 Alluvial Fan Analyses	45
SECTION 6.0 – MAPPING METHODS	46
6.1 Vertical and Horizontal Control	46
6.2 Base Map	47
6.3 Floodplain and Floodway Delineation	47
6.4 Coastal Flood Hazard Mapping	82
6.5 FIRM Revisions	82
6.5.1 Letters of Map Amendment	82
6.5.2 Letters of Map Revision Based on Fill	82

6.5.3	Letters of Map Revision	83
6.5.4	Physical Map Revisions	83
6.5.5	Contracted Restudies	84
6.5.6	Community Map History	84
SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION		85
7.1	Contracted Studies	85
7.2	Community Meetings	88

Figures

	<u>Page</u>
Figure 1: FIRM Index	5
Figure 2: FIRM Notes to Users	6
Figure 3: Map Legend for FIRM	9
Figure 4: Floodway Schematic	20
Figure 5: Wave Runup Transect Schematic	21
Figure 6: Coastal Transect Schematic	21
Figure 7: Frequency Discharge-Drainage Area Curves	36
Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas	45
Figure 9: Transect Location Map	45

Tables

	<u>Page</u>
Table 1: Listing of NFIP Jurisdictions	3
Table 2: Flooding Sources Included in this FIS Report	14
Table 3: Flood Zone Designations by Community	22
Table 4: Basin Characteristics	22
Table 5: Principal Flood Problems	23
Table 6: Historic Flooding Elevations	24
Table 7: Non-Levee Flood Protection Measures	24
Table 8: Levees	25
Table 9: Summary of Discharges	27
Table 10: Summary of Non-Coastal Stillwater Elevations	36
Table 11: Stream Gage Information used to Determine Discharges	36
Table 12: Summary of Hydrologic and Hydraulic Analyses	37
Table 13: Roughness Coefficients	44
Table 14: Summary of Coastal Analyses	45
Table 15: Tide Gage Analysis Specifics	45
Table 16: Coastal Transect Parameters	45
Table 17: Summary of Alluvial Fan Analyses	45
Table 18: Results of Alluvial Fan Analyses	45
Table 19: Countywide Vertical Datum Conversion	46
Table 20: Stream-Based Vertical Datum Conversion	46
Table 21: Base Map Sources	47

Table 22: Summary of Topographic Elevation Data used in Mapping	48
Table 23: Floodway Data (place holder for 32 FDTs)	50
Table 24: Flood Hazard and Non-Encroachment Data for Selected Streams	82
Table 25: Summary of Coastal Transect Mapping Considerations	82
Table 26: Incorporated Letters of Map Change	83
Table 27: Community Map History	85
Table 28: Summary of Contracted Studies Included in this FIS Report	85
Table 29: Community Meetings	89

Volume 2

SECTION 8.0 – ADDITIONAL INFORMATION	90
SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES	91

<u>Tables</u>	<u>Page</u>
Table 30: Map Repositories	90
Table 31: Additional Information	91
Table 32: Bibliography and References	92

Exhibits

Flood Profiles	<u>Panel</u>
Allens Branch	01-02 P
Cabin Branch	03 P
Cabin Branch Tributary 1	04 P
Chickahominy River	05-10 P
Copperas Creek	11-13 P
Copperas Creek Tributary 2	14 P
Deep Run	15-17 P
Fourmile Creek	18-20 P
Fourmile Creek Tributary 7	21 P
Gillies Creek	22-24 P
Gillies Creek Tributary 1	25-26 P
Harding Branch	27-29 P
Harding Branch Tributary 1	30 P
Heckler Village Tributary 1	31 P
Heckler Village Tributary 2	32 P
Horsepen Branch	33-34 P
Hungary Creek	35-38 P
James River	39-54 P

Flood Profiles	<u>Panel</u>
Jordans Branch	55-56 P
Little Tuckahoe Creek	57-58 P
Little Tuckahoe Creek Tributary 2	59 P
Meredith Branch	60-61 P
North Run	62-64 P
Rocky Branch	65 P
Rooty Branch	66 P
Stoney Run	67-68 P
Stony Run	69-70 P
Thorpe Branch	71-76 P
Tributary A to Gillies Creek Tributary 1	77 P
Tributary A to Gillies Creek Tributary 1	78 P
Tributary	
Tuckahoe Creek	79-80 P
Upham Brook	81-84 P

Published Separately

Flood Insurance Rate Map (FIRM)

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see www.fema.gov.

The additional data that was used for this project includes the FIS Report and FIRM that were previously prepared for Henrico County (FEMA 2007).

Table 30 is a list of the locations where FIRMs for Henrico County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 30: Map Repositories

Community	Address	City	State	Zip Code
Henrico County, Unincorporated Areas	Henrico County Administration Annex Department of Public Works 4305 East Parham Road	Henrico	VA	23228

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM Databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 31.

Table 31 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the State NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of State and local GIS data in their state.

Table 31: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/engineering-library
NFIP website	www.fema.gov/national-flood-insurance-program
NFHL Dataset	msc.fema.gov
FEMA Region III	Federal Emergency Management Agency One Independence Mall 615 Chestnut Street, 6 th Floor Philadelphia, PA 19106-4404 (215) 931-5500
Other Federal Agencies	
USGS website	www.usgs.gov
Hydraulic Engineering Center website	www.hec.usace.army.mil
State Agencies and Organizations	
State NFIP Coordinator	Wendy C Howard-Cooper, Director, Dam Safety and Floodplain Management, Virginia Department of Conservation & Recreation 600 E. Main St., 24th Floor Richmond, VA 23219 (804)-786-5099 wendy.howard-cooper@dcr.virginia.gov
State GIS Coordinator	Stuart Blankenship, Geospatial Projects Manager Integrated Services Program VITA, Virginia Geographic Information Network (VGIN) 11751 Meadowville Lane Chester, VA 23836 Phone: (804) 416-6208 stuart.blankenship@vita.virginia.gov

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 32 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 32: Bibliography and References

Citation in this FIS	Publisher/Issuer	Publication Title, "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
EPA 2015	US Environmental Protection Agency	<i>Storm Water Management Model (SWMM)</i> User's Manual Version 5.1	Lewis A. Rossman, Environmental Scientist, Emeritus	Cincinnati, OH	September 2015	<u>Storm Water Management Model User's Manual Version 5.1 (epa.gov)</u>
FEMA 2007	Federal Emergency Management Agency	Effective FIRM for Henrico County, Virginia	FEMA	Washington, D.C.	December 18, 2007	<u>https://msc.fema.gov/portal/home</u>
FEMA 2008	Federal Emergency Management Agency	LOMR 08-03-0974P	FEMA	Washington, D.C.	August 5, 2008	<u>https://msc.fema.gov/portal/home</u>
FEMA 2009	Federal Emergency Management Agency	LOMR 09-03-0224P	FEMA	Washington, D.C.	July 17, 2009	<u>https://msc.fema.gov/portal/home</u>
FEMA 2011	Federal Emergency Management Agency	LOMR 10-03-0514P	FEMA	Washington, D.C.	April 20, 2011	<u>https://msc.fema.gov/portal/home</u>
FEMA 2012	Federal Emergency Management Agency	LOMR 12-03-0257P	FEMA	Washington, D.C.	December 7, 2012	<u>https://msc.fema.gov/portal/home</u>
FEMA 2014	Federal Emergency Management Agency	LOMR 13-03-1863P	FEMA	Washington, D.C.	April 7, 2014	<u>https://msc.fema.gov/portal/home</u>

Table 32: Bibliography and References (continued)

Citation in this FIS	Publisher/Issuer	Publication Title, "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FEMA 2017	Federal Emergency Management Agency	LOMR 16-03-1954P	FEMA	Washington, D.C.	April 26, 2017	https://msc.fema.gov/portal/home
FEMA 2020	Federal Emergency Management Agency	LOMR 20-03-0873P	STARR II	Washington, D.C.	February 8, 2021	https://msc.fema.gov/portal/home
STARR II 2018	STARR II	Hydraulic and Hydrologic Submittal for Chickahominy River Zone A (FY 17 BLE STARR II)	STARR II	Washington, D.C.	May 31, 2018	https://msc.fema.gov/portal/home
STARR II 2020a	STARR II	Lower James Watershed Hydraulic and Hydrologic Submittal for James River and all new Zone A's (FY 17 STARR II)	STARR II	Washington, D.C.	March 25, 2020	https://msc.fema.gov/portal/home
STARR II 2020b	STARR II	Middle James Hydraulic and Hydrologic Submittal for Tuckahoe Creek and Little Tuckahoe Creek (FY 19 STARR II)	STARR II	Washington, D.C.	August 3, 2020	https://msc.fema.gov/portal/home
STARR II 2020c	STARR II	Hanover County Hydraulic and Hydrologic Submittal for Chickahominy River Zone AE (FY18 STARR II)	STARR II	Washington, DC	November 20, 2020	https://msc.fema.gov/portal/home
STARR II 2021a	STARR II	Hanover County LOMR Updates (2021 STARR II)	STARR II	Washington, D.C.	January 13, 2021	https://msc.fema.gov/portal/home
STARR II 2021c	STARR II	Hydraulic and Hydrologic Submittal for Shockoe Creek	STARR II	Washington, D.C.	June 15, 2021	https://msc.fema.gov/portal/home

Table 32: Bibliography and References (continued)

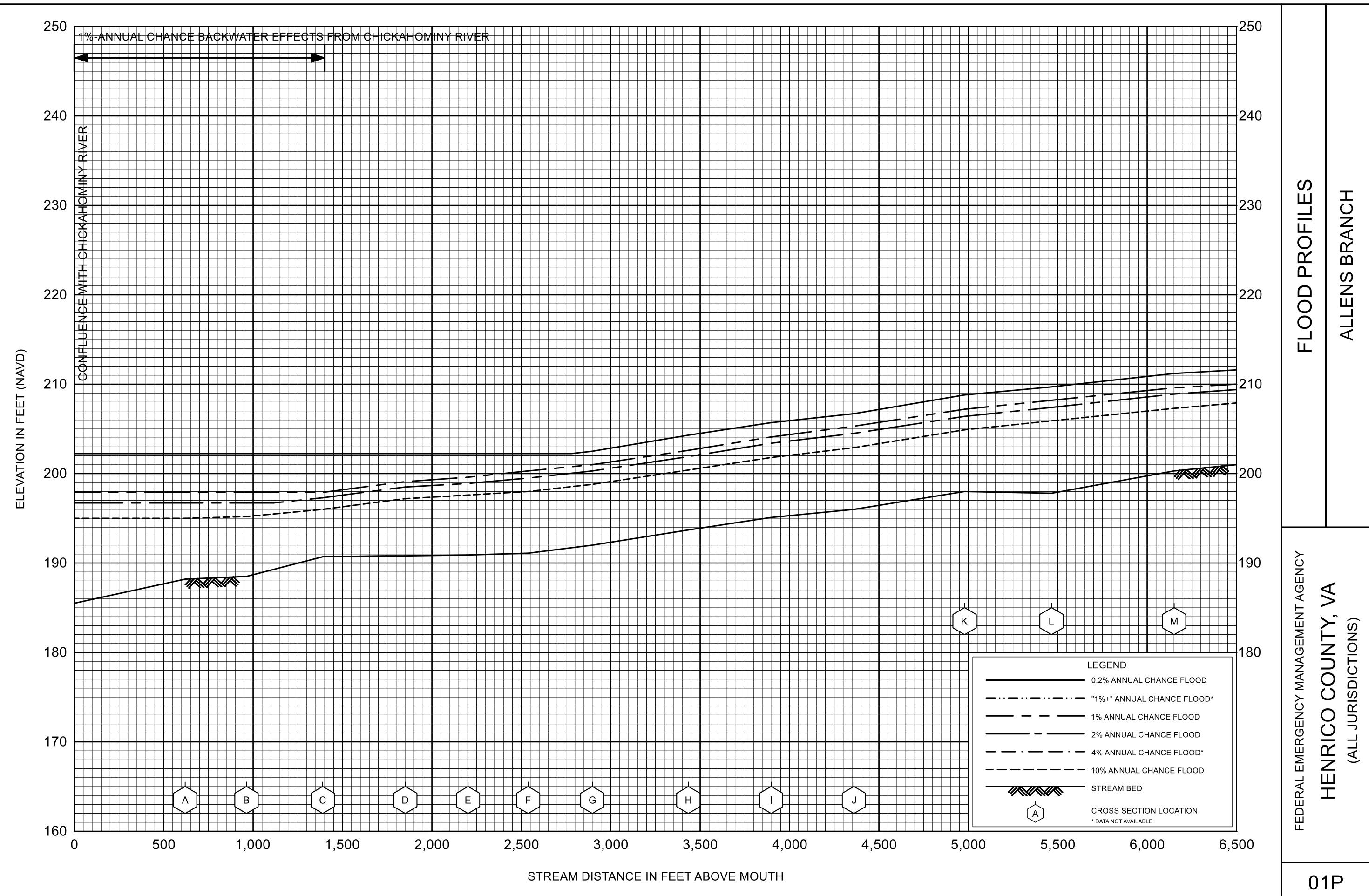
Citation in this FIS	Publisher/Issuer	Publication Title, "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
US Census 2016	U.S. Census Bureau	TIGER Roads and Rail Data	U.S. Census Bureau	Washington, D.C.	August 19, 2016	https://www.census.gov/geo/maps-data/data/tiger-line.html
USACE 2003	US Army Corps of Engineers	HEC-RAS version 3.0.1	The Hydrologic Engineering Center	Davis, CA	January 2003	https://www.hec.usace.army.mil/software/hec-ras/documentation.aspx
USACE 2006	US Army Corps of Engineers	HEC RAS Version 4.0 (Beta)	The Hydrologic Engineering Center	Davis, CA	January 2006	https://www.hec.usace.army.mil/software/hec-ras/documentation.aspx
USACE 2010	US Army Corps of Engineers	HEC-RAS version 4.1	The Hydrologic Engineering Center	Davis, CA	January 2010	https://www.hec.usace.army.mil/software/hec-ras/documentation.aspx
USACE 2018	US Army Corps of Engineers	HEC RAS Version 5.0.5	The Hydrologic Engineering Center	Davis, CA	June 2018	https://www.hec.usace.army.mil/software/hec-ras/documentation.aspx
USACE 2019	US Army Corps of Engineers	HEC-RAS version 5.0.7	The Hydrologic Engineering Center	Davis, CA	March 2019	https://www.hec.usace.army.mil/software/hec-ras/documentation.aspx
USGS National Map	United States Geological Survey National Map	Orthorectified digital aerial photographs and satellite images of 1-meter (m) pixel resolution or finer	United States Geological Survey	Reston, VA	Most recently refreshed data	

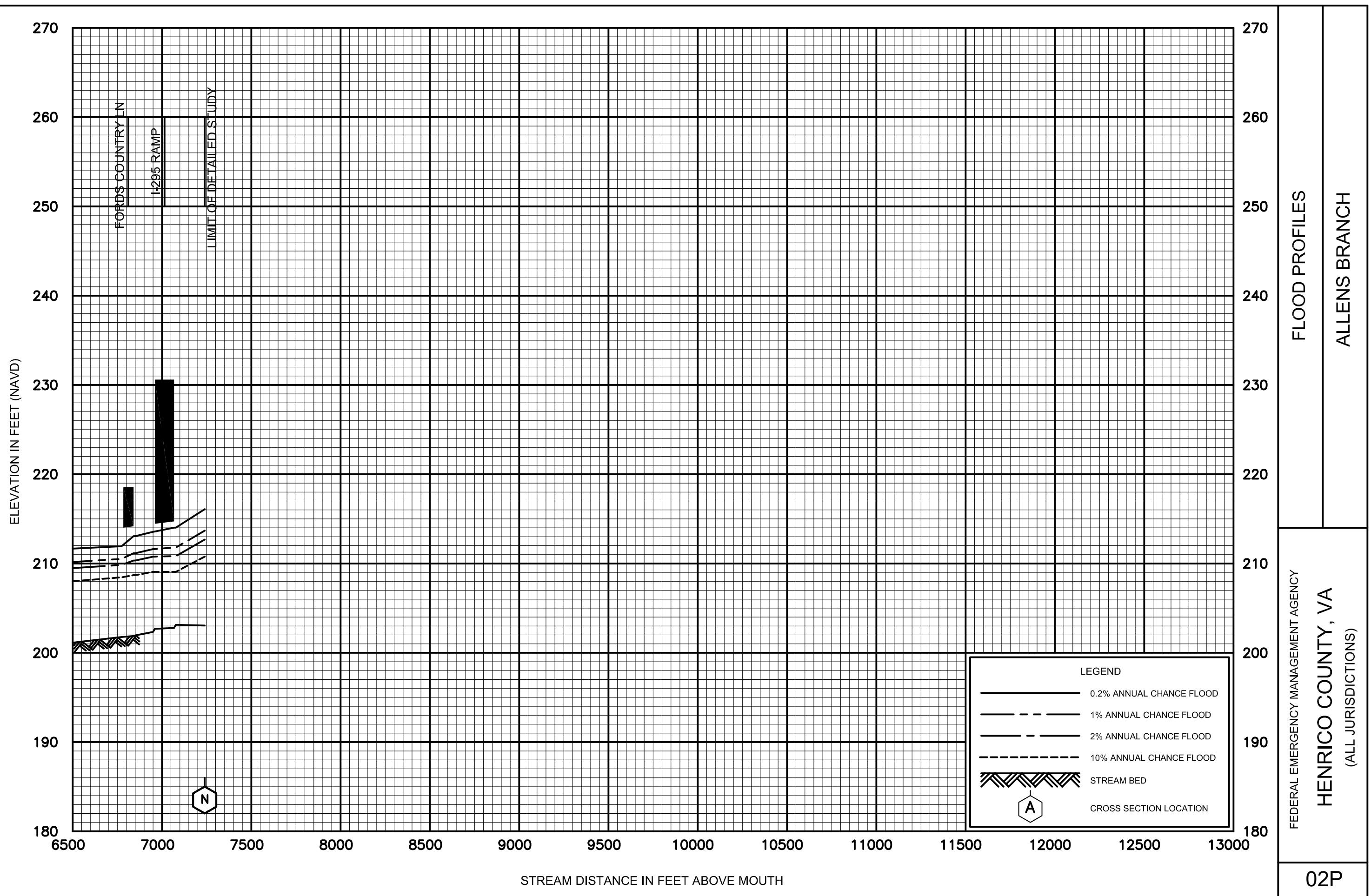
Table 32: Bibliography and References (continued)

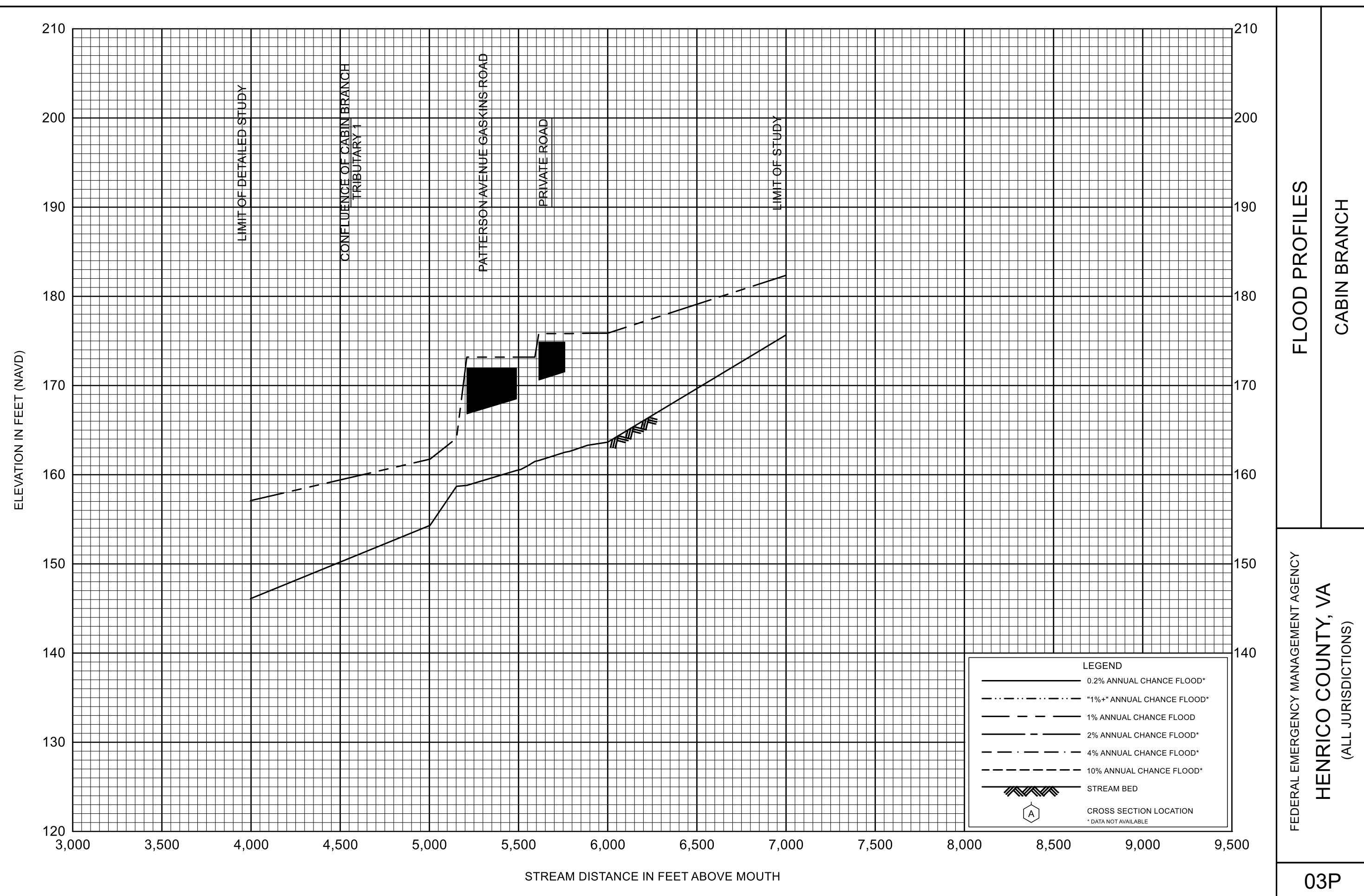
Citation in this FIS	Publisher/Issuer	Publication Title, "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USGS 1983	United States Geological Survey	<i>U.S. Geological Survey, Flood Characteristics of Urban Watersheds in the United States</i> , Water Supply Paper 2207.	United States Geological Survey	Washington, D.C.	January 1983	report.pdf (usgs.gov)
USGS 1994	United States Geological Survey	<i>U.S. Geological Survey, Methods for Estimating the Magnitude and Frequency of Peak Discharges of Rural, Unregulated Streams in Virginia</i> , WRI Report 94-4148.22.	United States Geological Survey	Denver, CO	January 1984	WRIR 94-4148 (usgs.gov)
USGS 2011	United States Geological Survey	<i>Peak Flow Characteristics of Virginia Streams</i> , Scientific Investigations Report 2011-5144	Samuel H. Austin, Jennifer L. Krstolic, and Ute Wiegand	Reston, VA	2011	https://www.usgs.gov/
USGS 2014	United States Geological Survey	2014 USGS VA NRCS SANDY	United States Geological Survey	Reston, VA	January 2014	https://www.usgs.gov/
USGS 2014a	United States Geological Survey	<i>Methods and Equations for Estimating Peak Streamflow Per Square Mile in Virginia's Urban Basins</i> , Scientific Investigations Report 2014-5090	Samuel H. Austin	Reston, VA	2014	https://www.usgs.gov/
USGS 2017	United States Geological Survey	National Hydrography Dataset	United States Geological Survey	Reston, VA	April 26, 2017	https://viewer.nationalmap.gov/basic/?basemap=b1&category=nhd&title=NH%20View

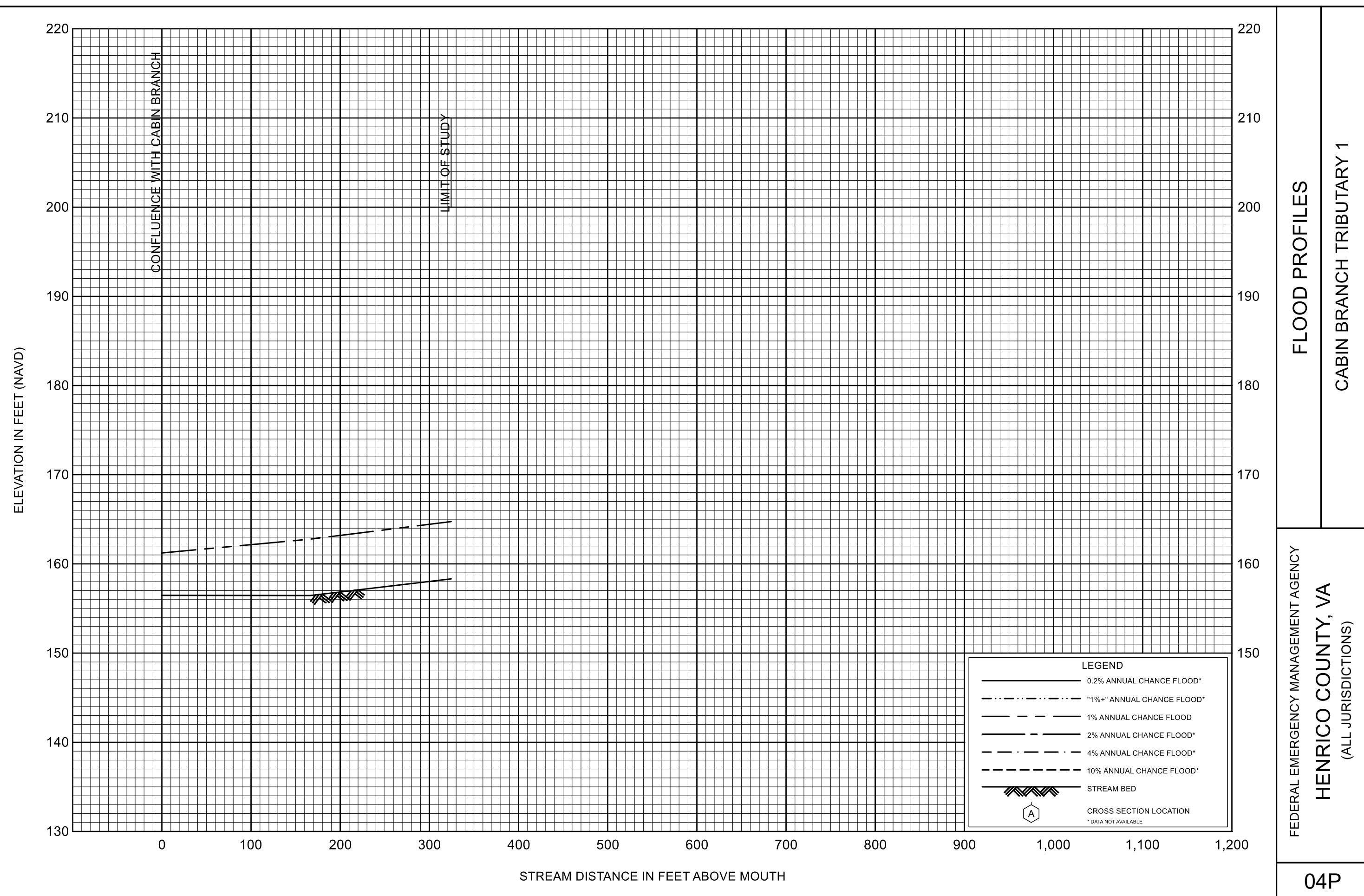
Table 32: Bibliography and References (continued)

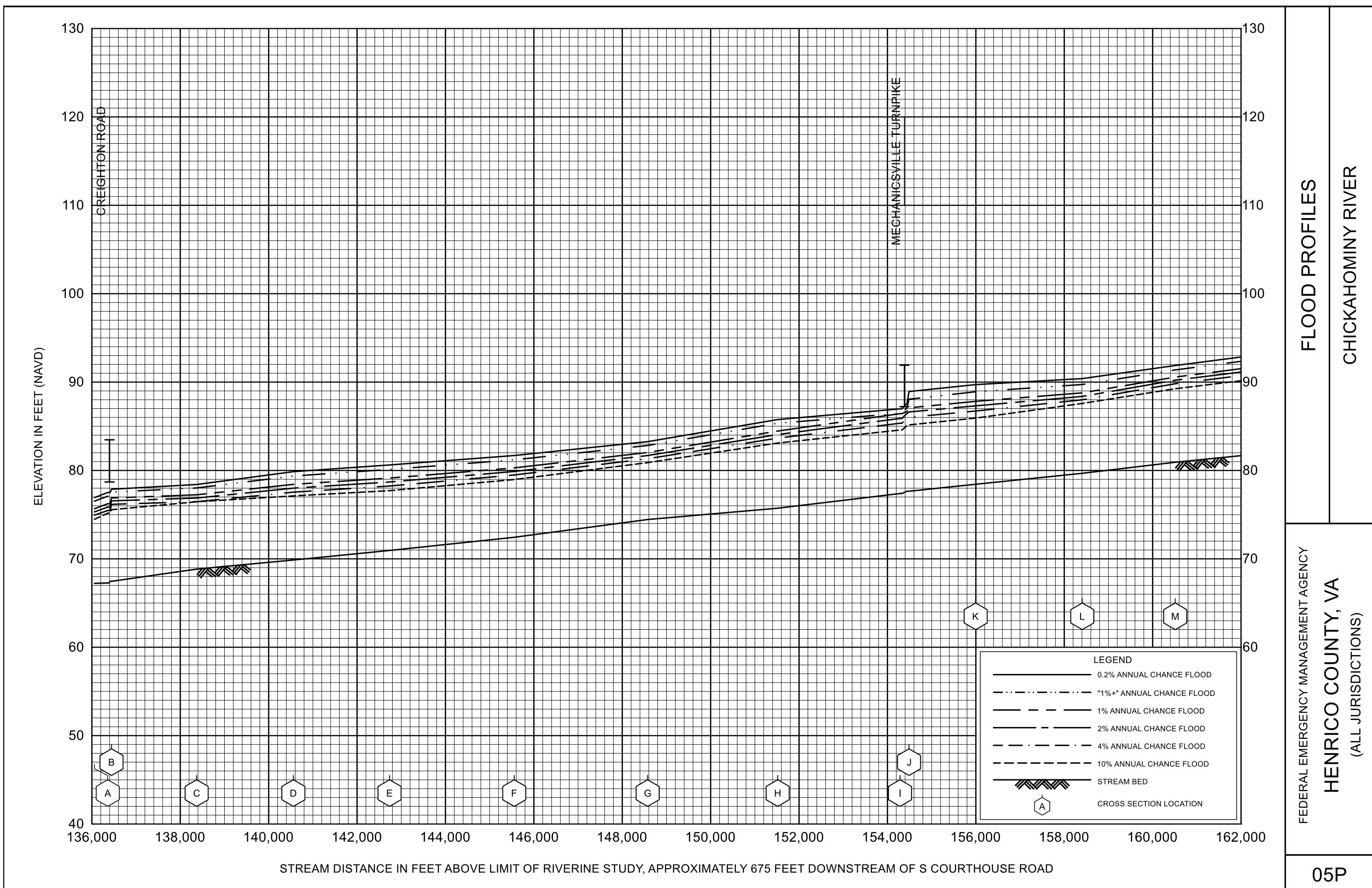
Citation in this FIS	Publisher/Issuer	Publication Title, "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USGS 2018	United States Geological Survey	<i>Peak FQ 7.2. Flood Frequency Analysis based on Bulletin 17 C.</i>	United States Geological Survey	Reston, VA	March 28, 2018	https://water.usgs.gov/software/PeakFQ/
VGIN 2017	USDA FSA Aerial Photography Field Office	Henrico County Ortho Imagery	USDA FSA Aerial Photography Field Office	Salt Lake City, UT	June 16, 2017	https://nrccs.app.box.com/v/naip
VGIN 2018	Virginia Geographic Information Network	Virginia Administrative Boundaries	Virginia Geographic Information Network	State of Virginia	January 2018	http://vgin.maps.arcgis.com/apps/Viewer

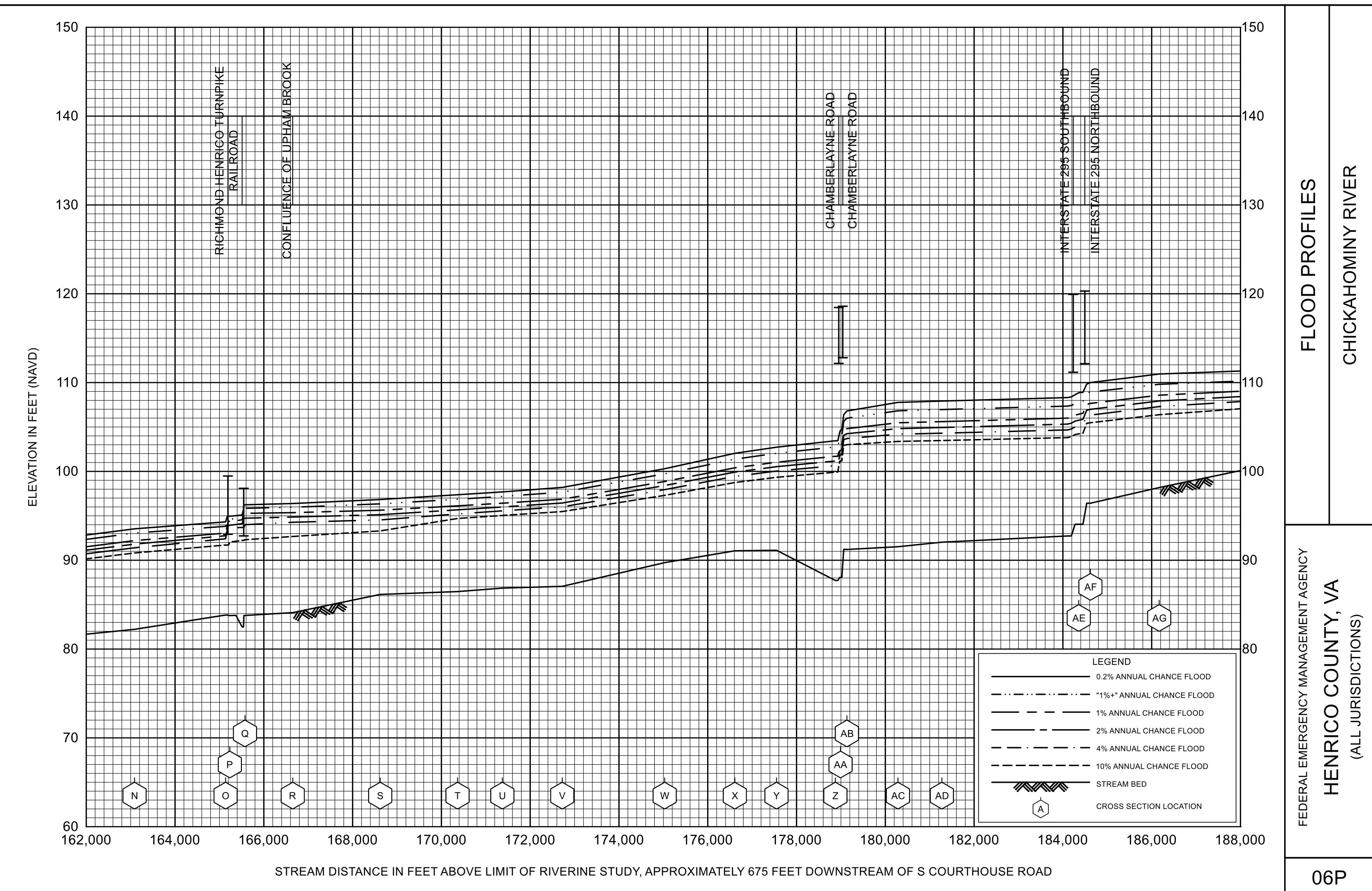


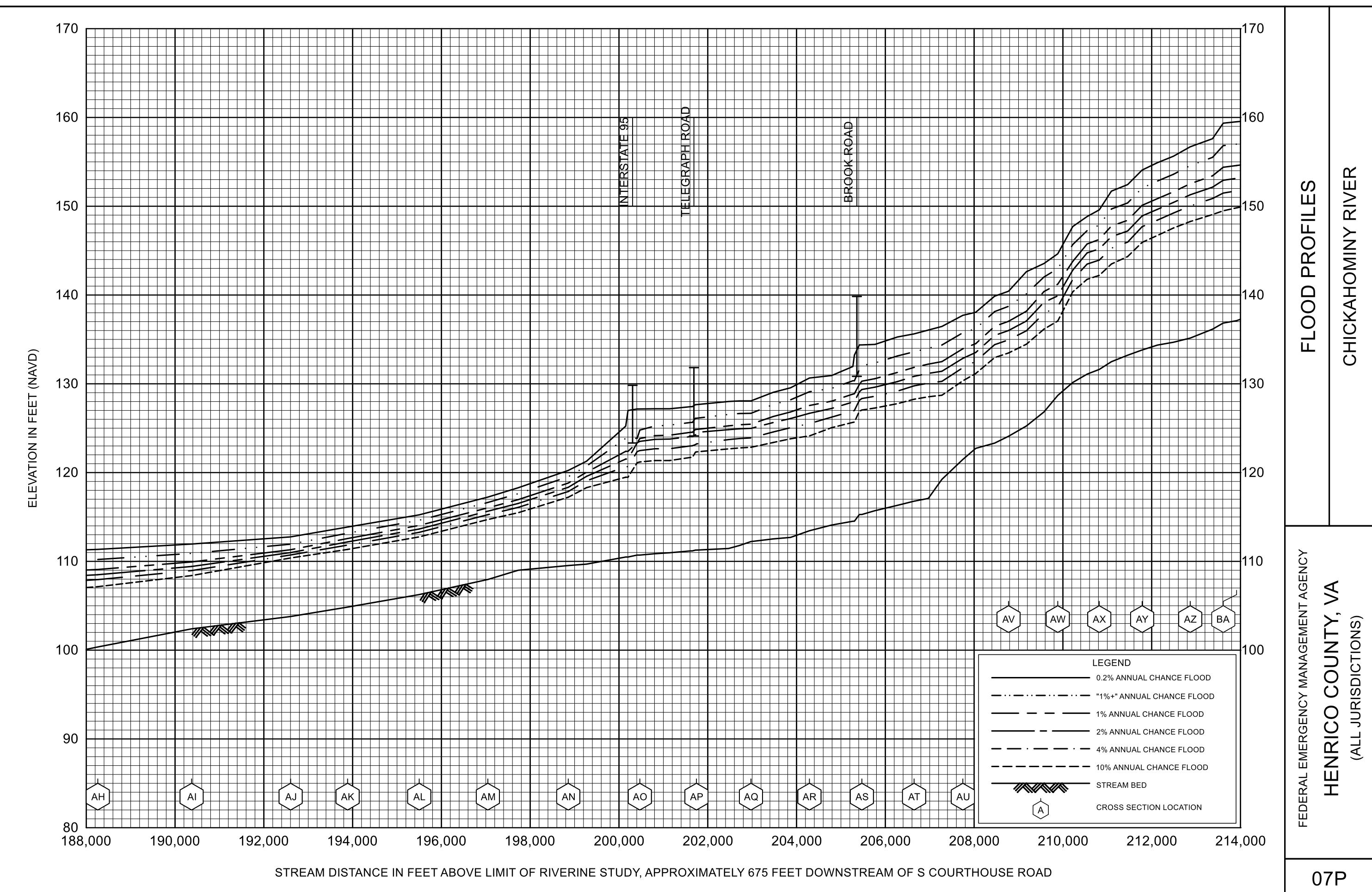


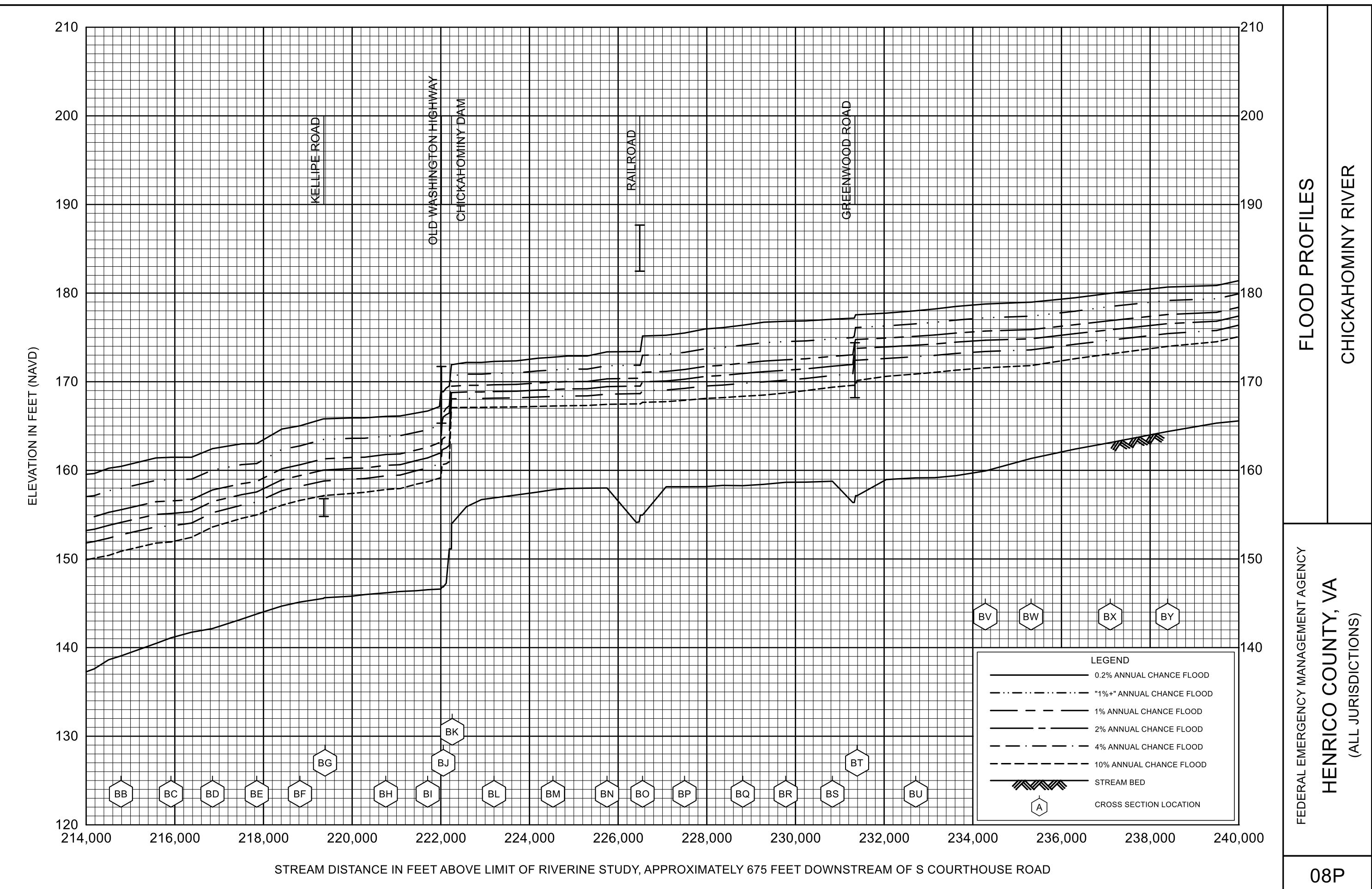


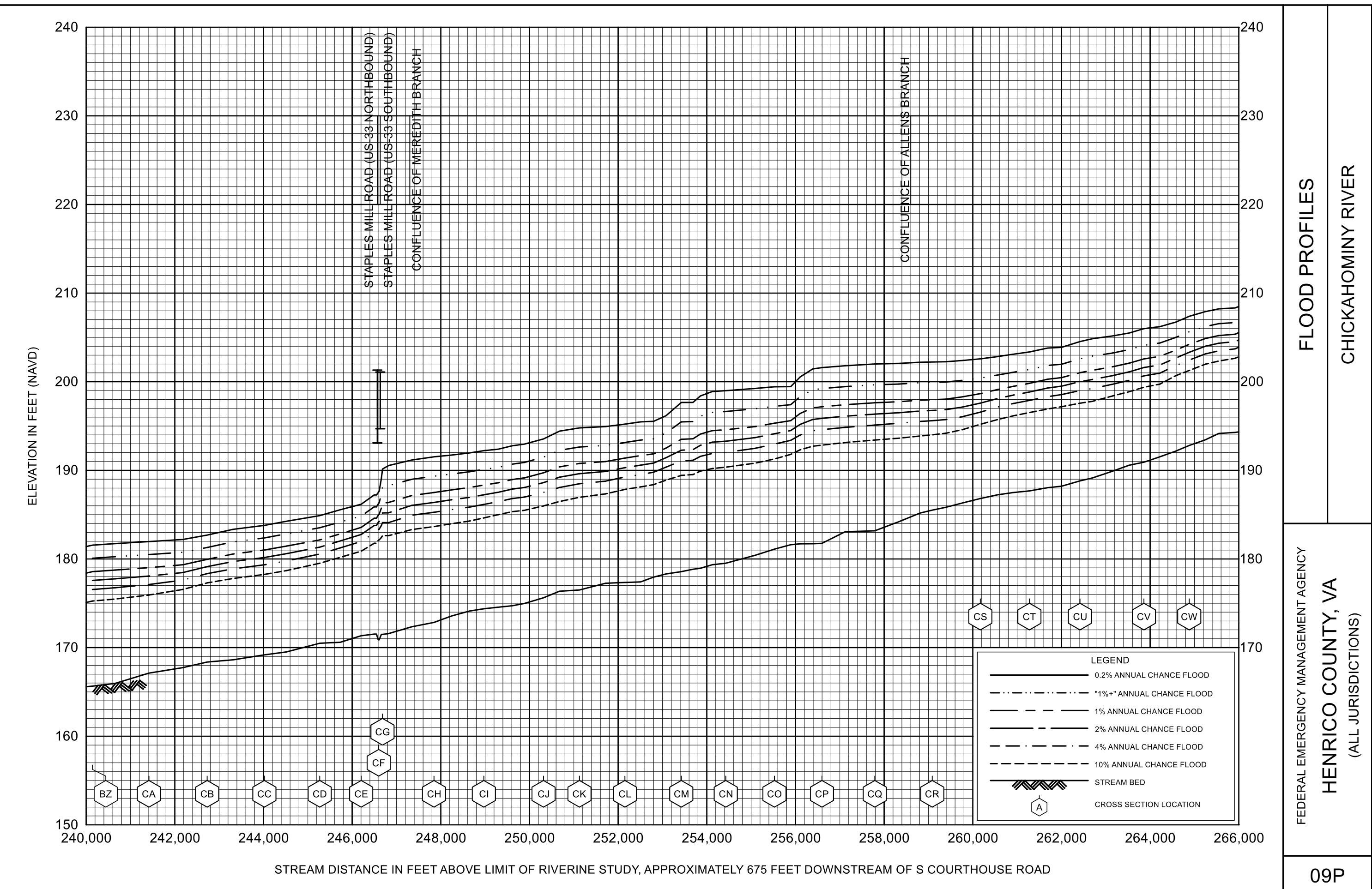


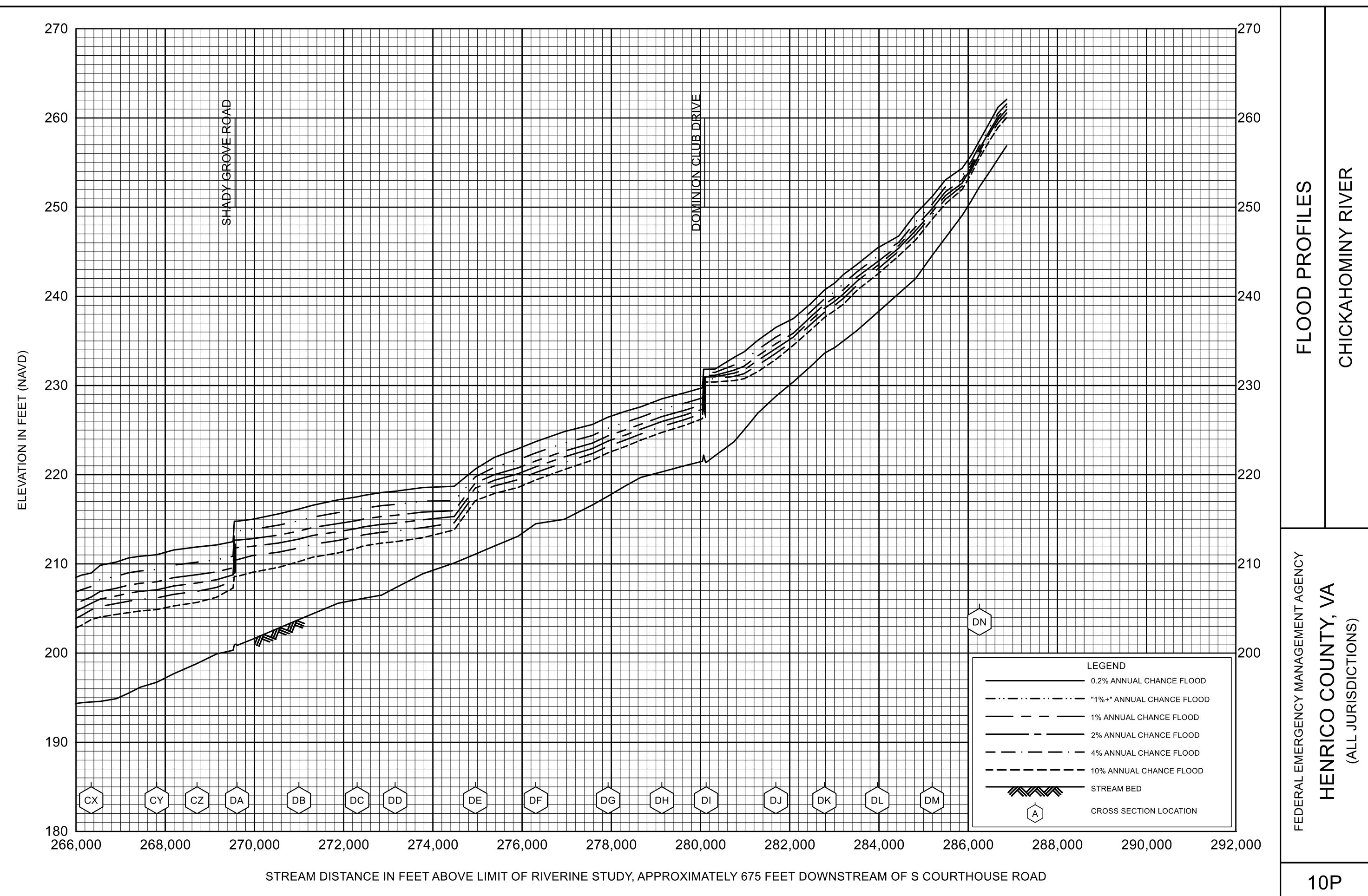


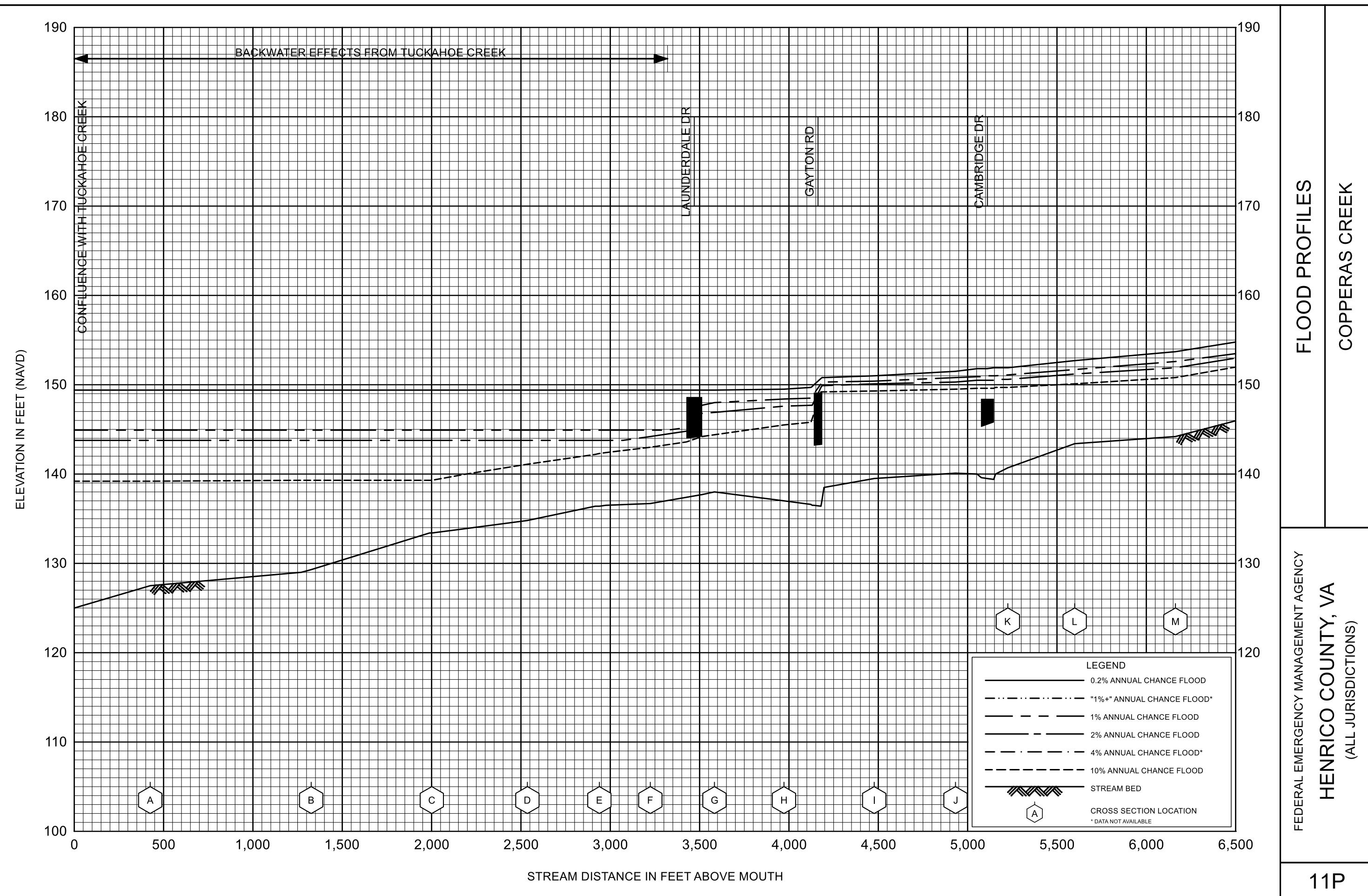


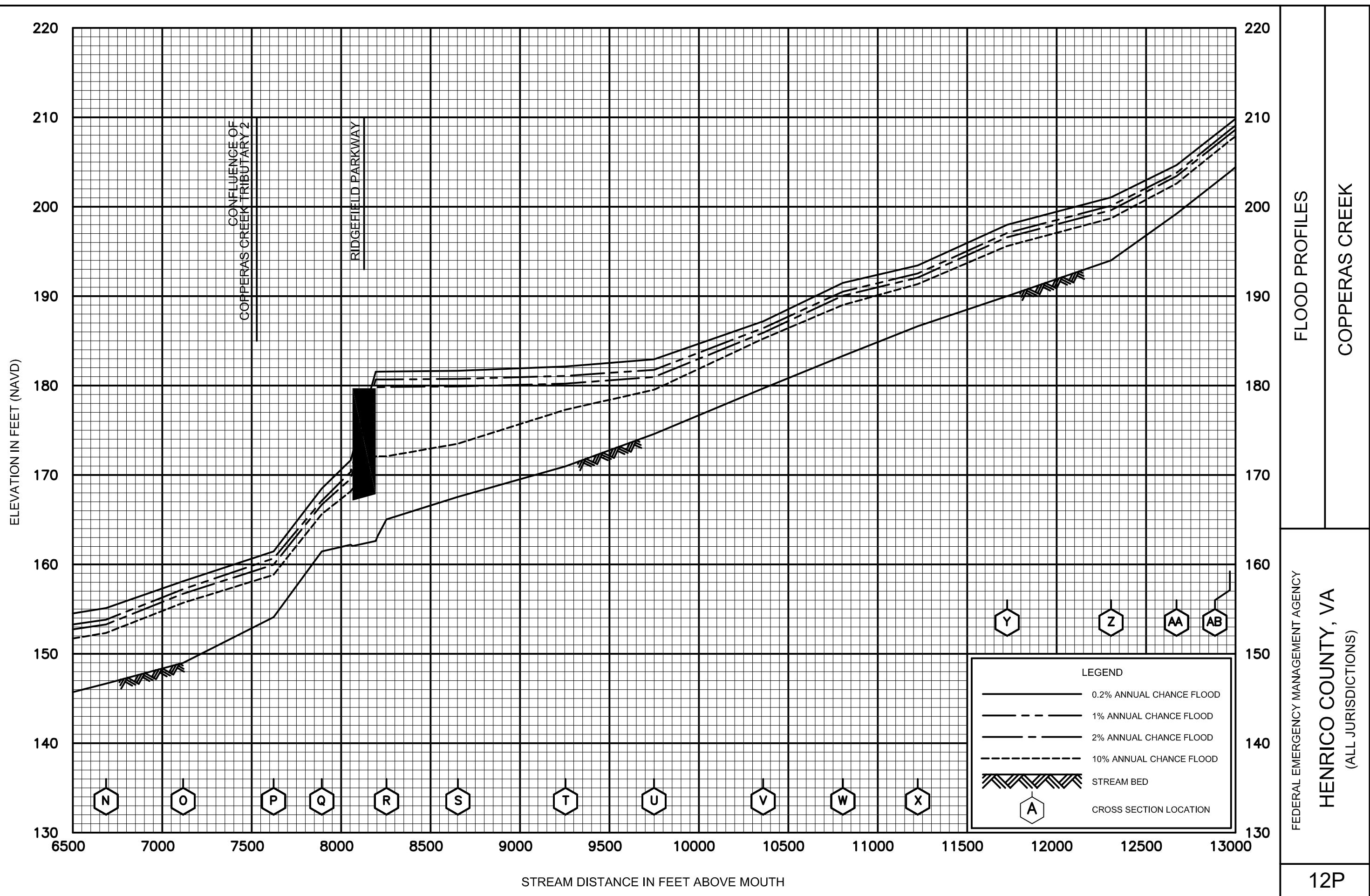


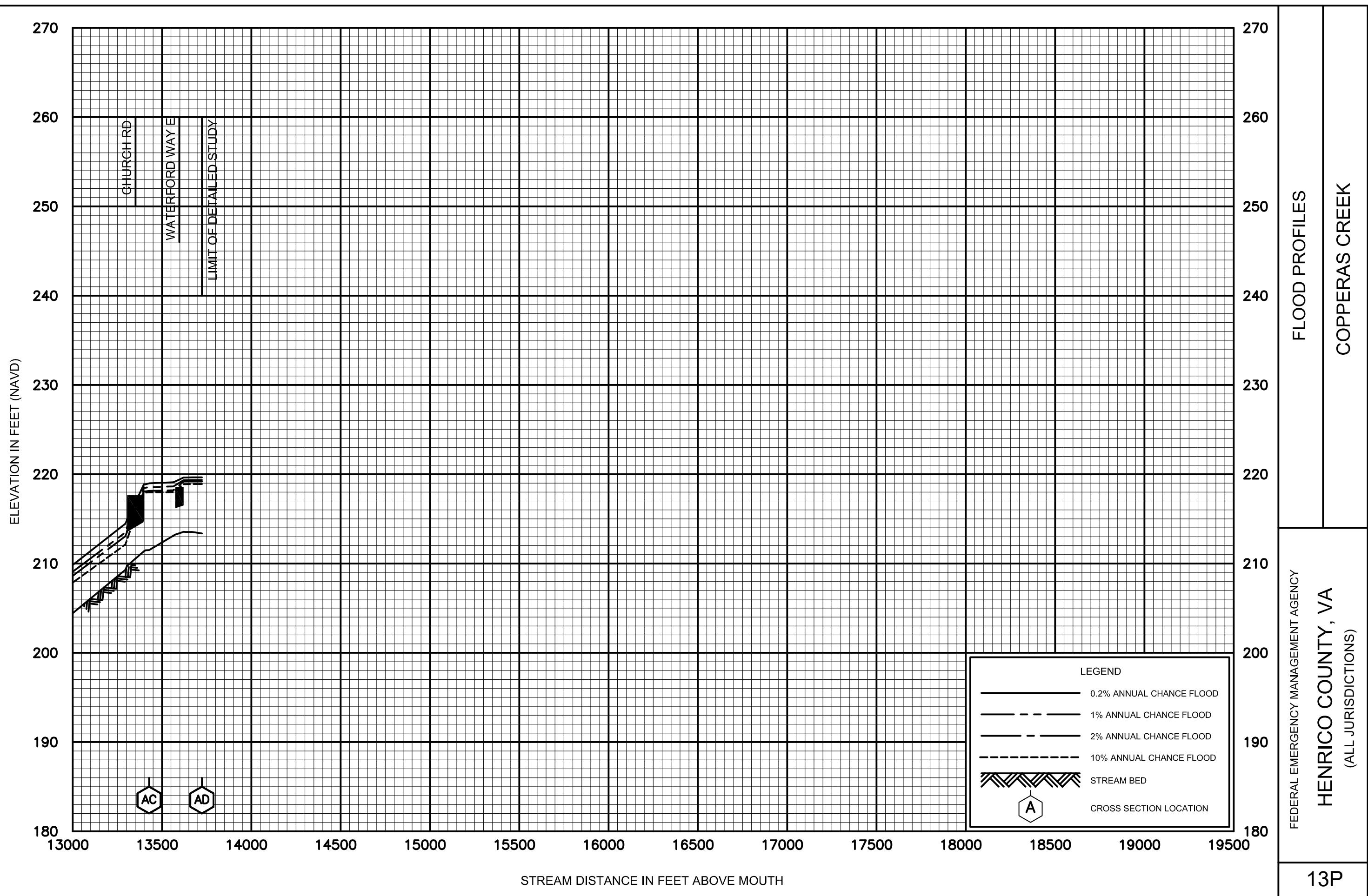


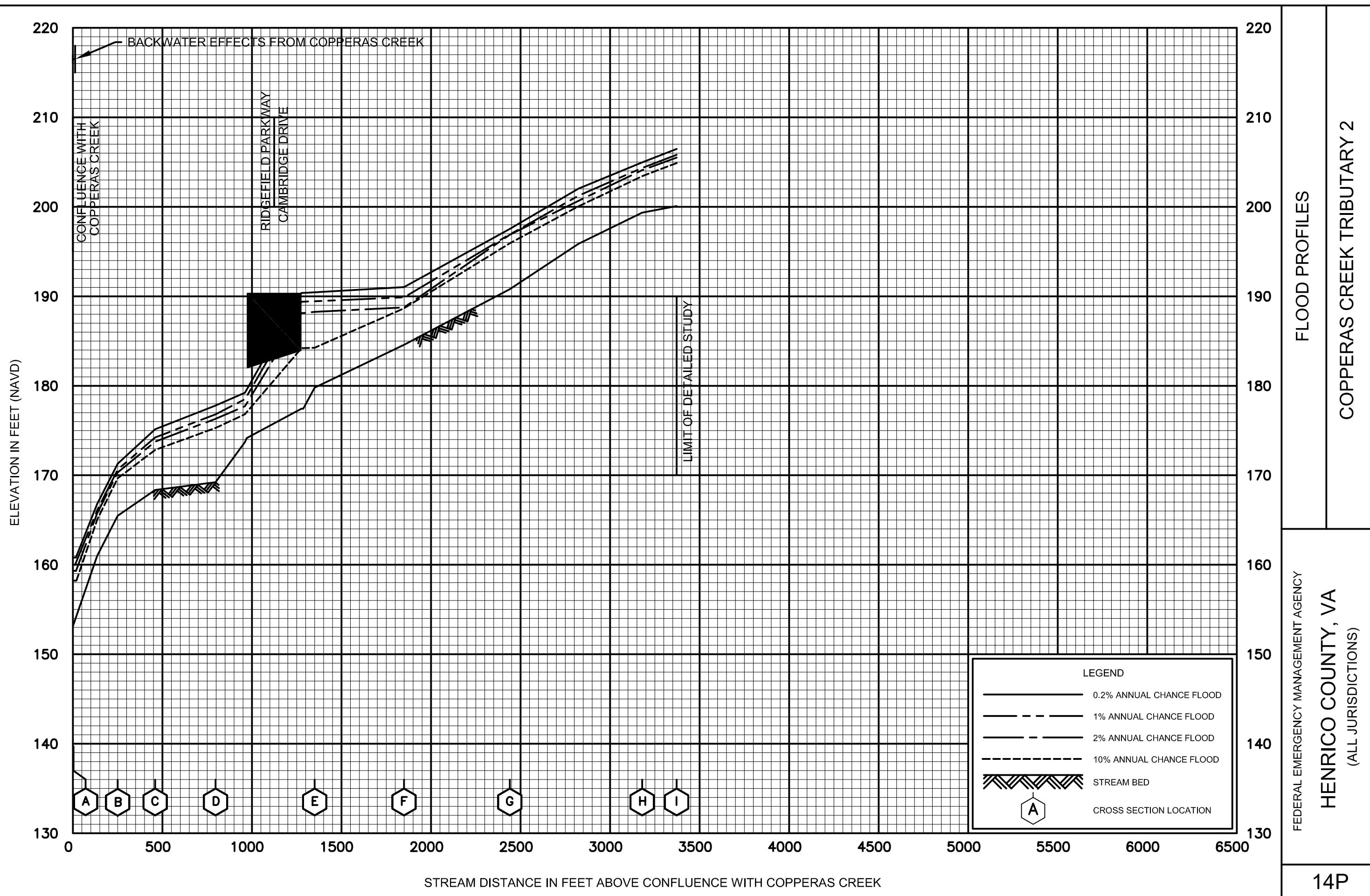


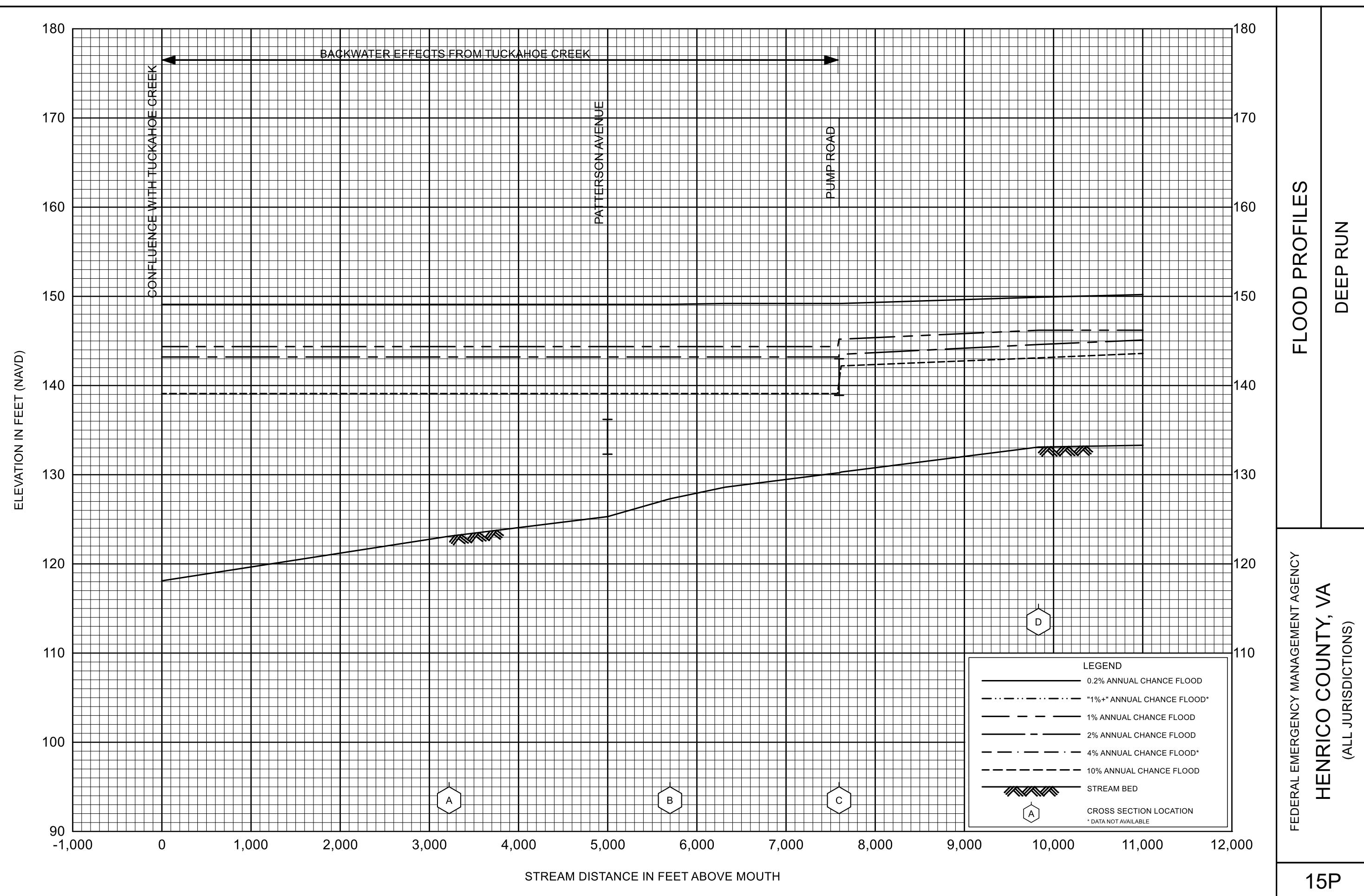


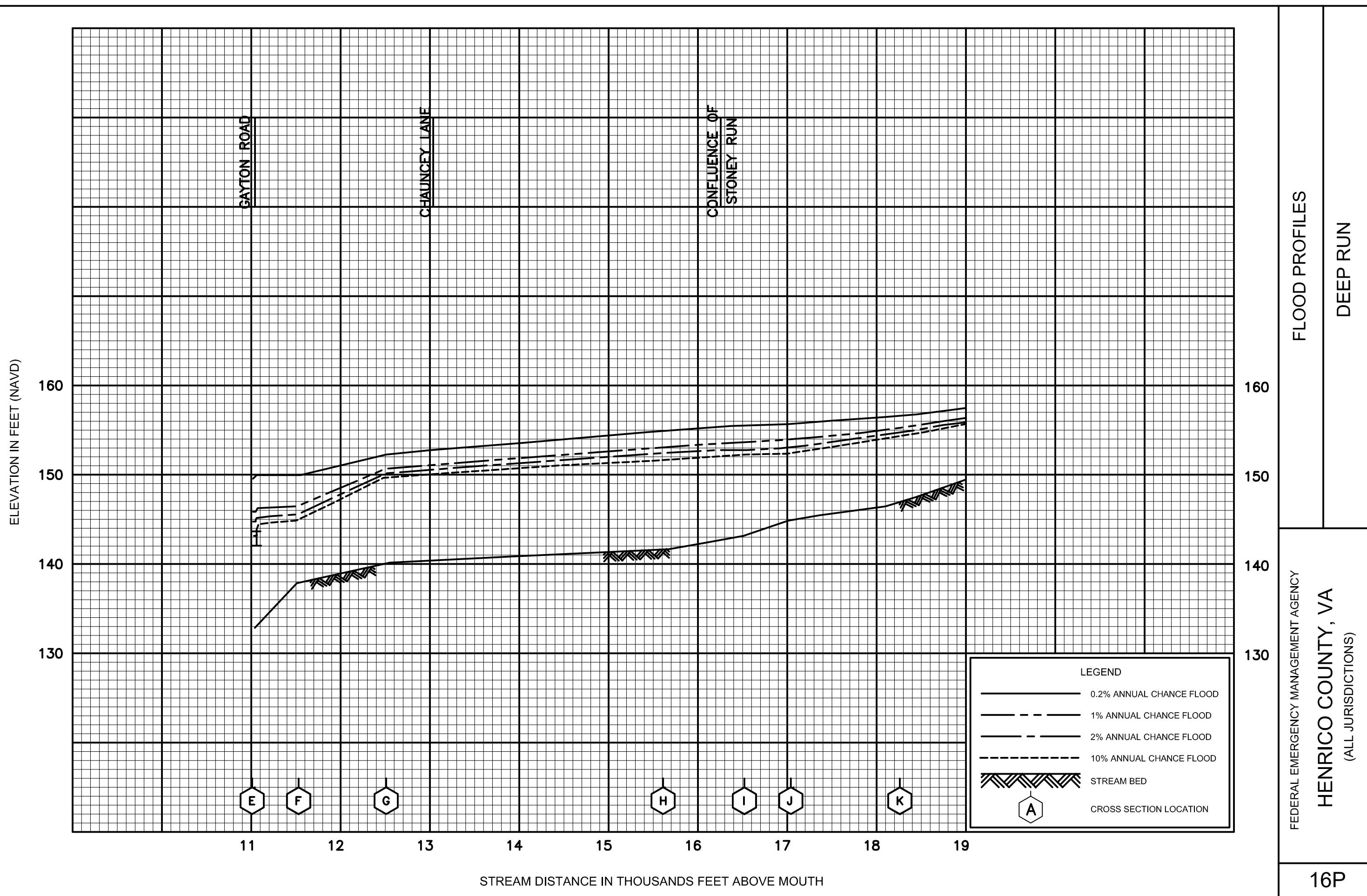


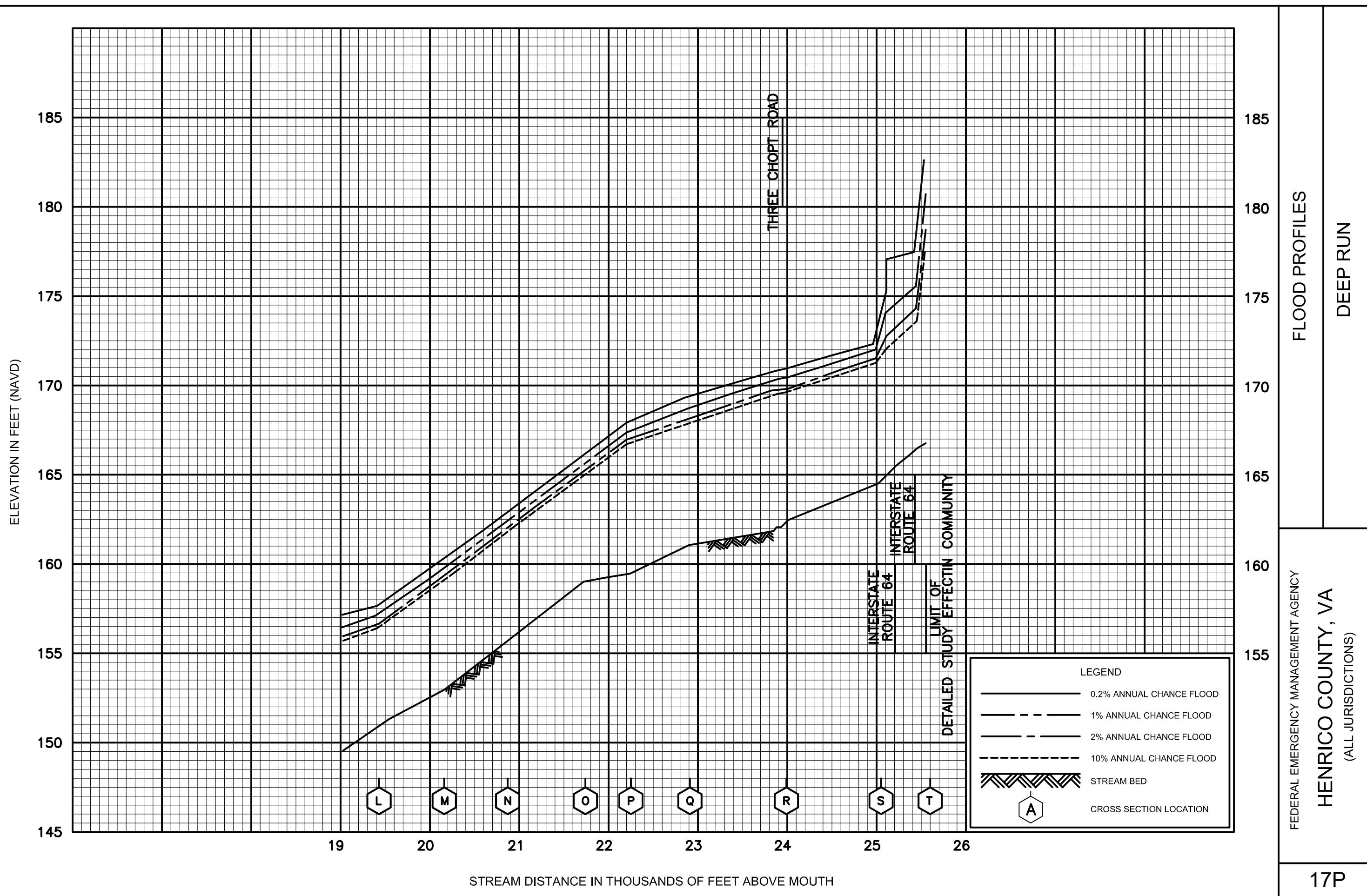


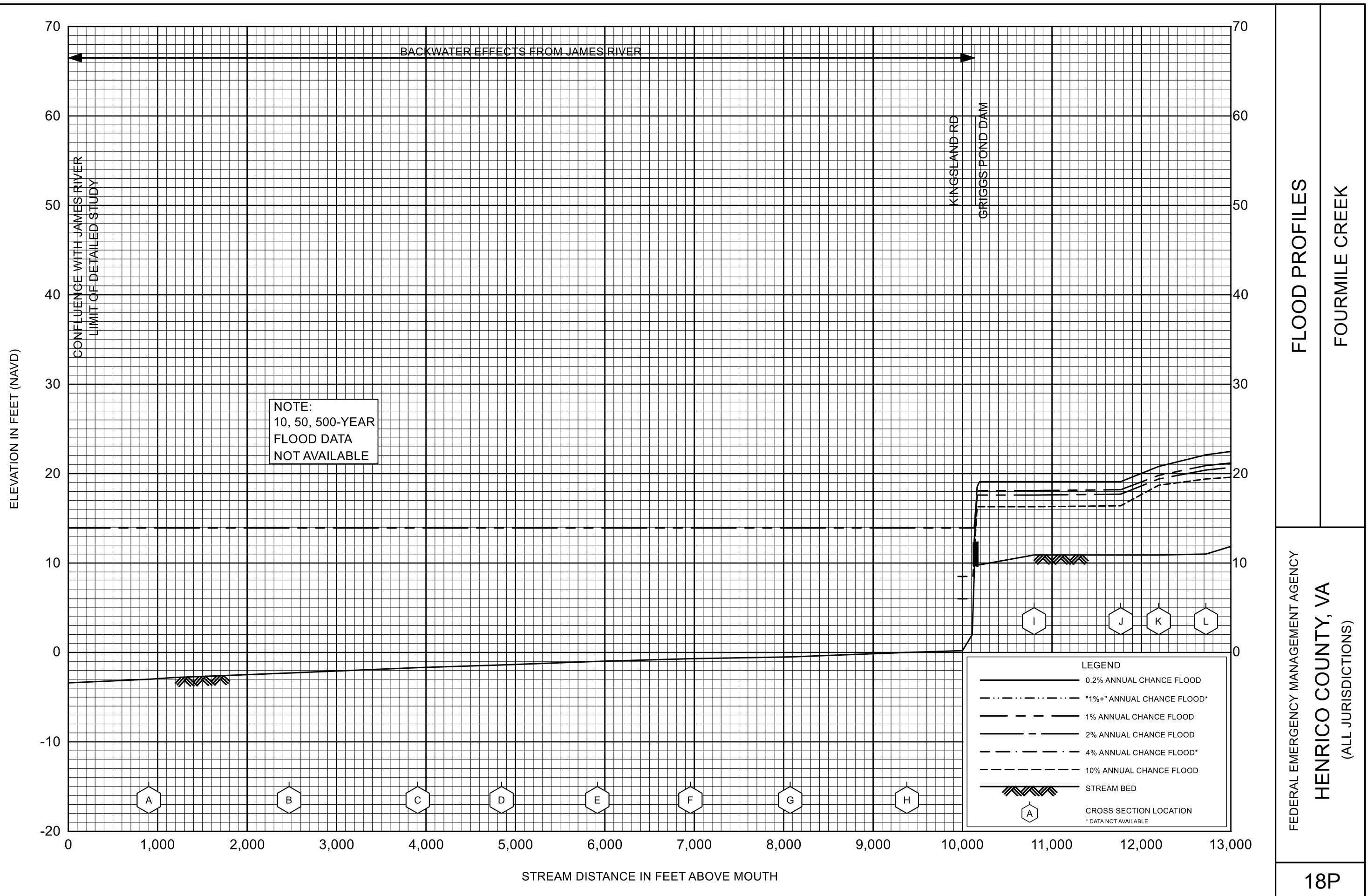


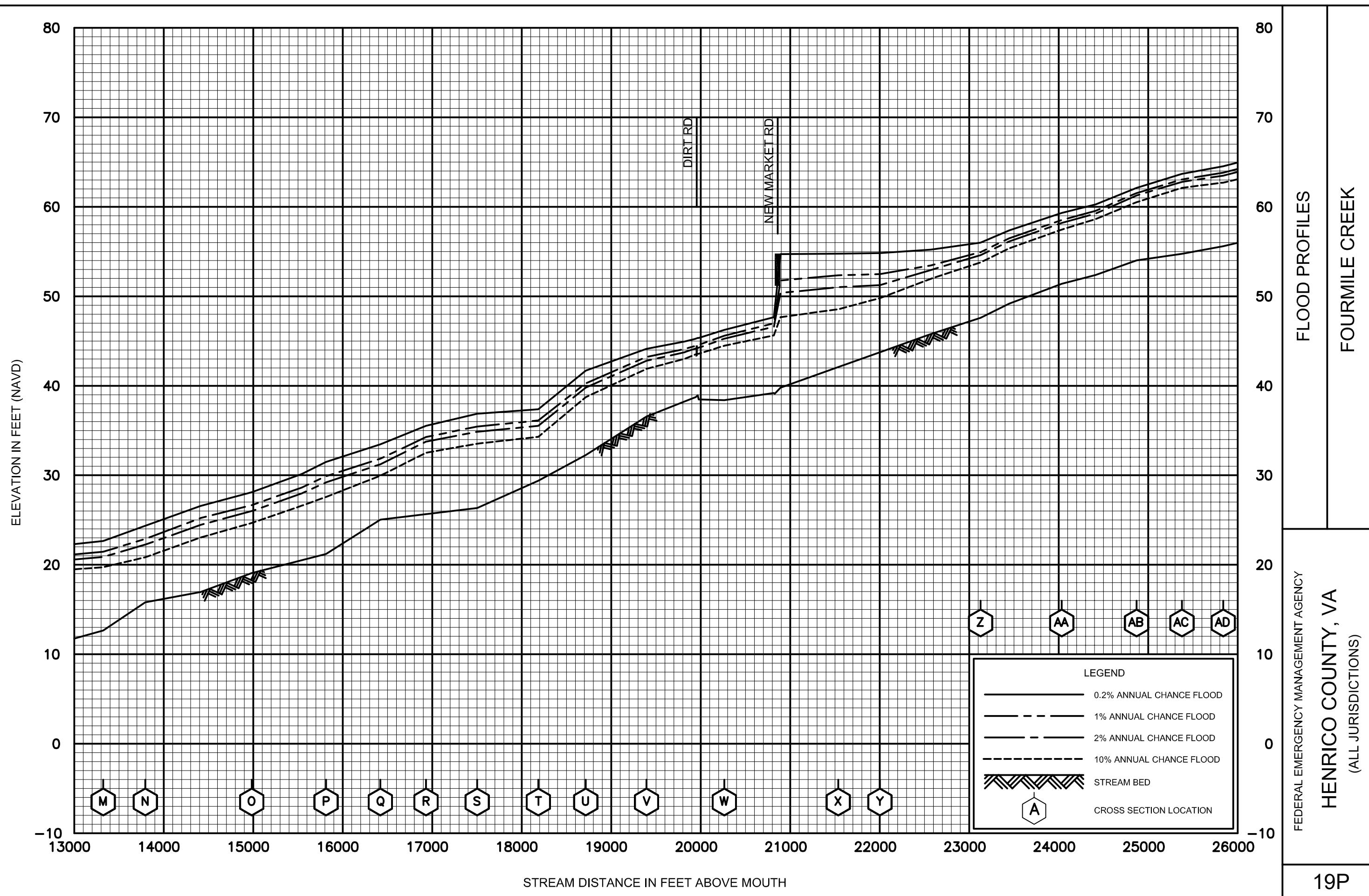


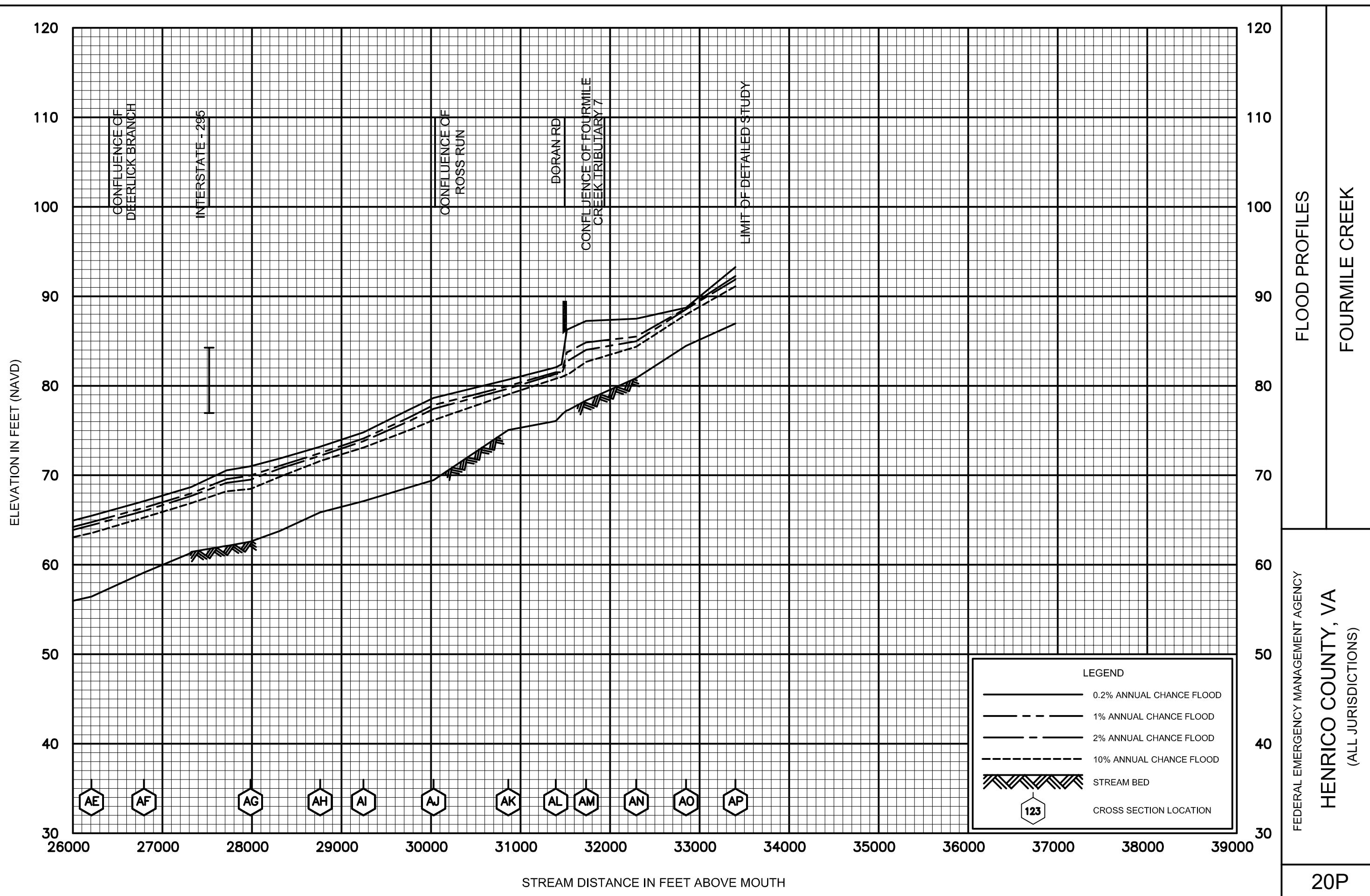


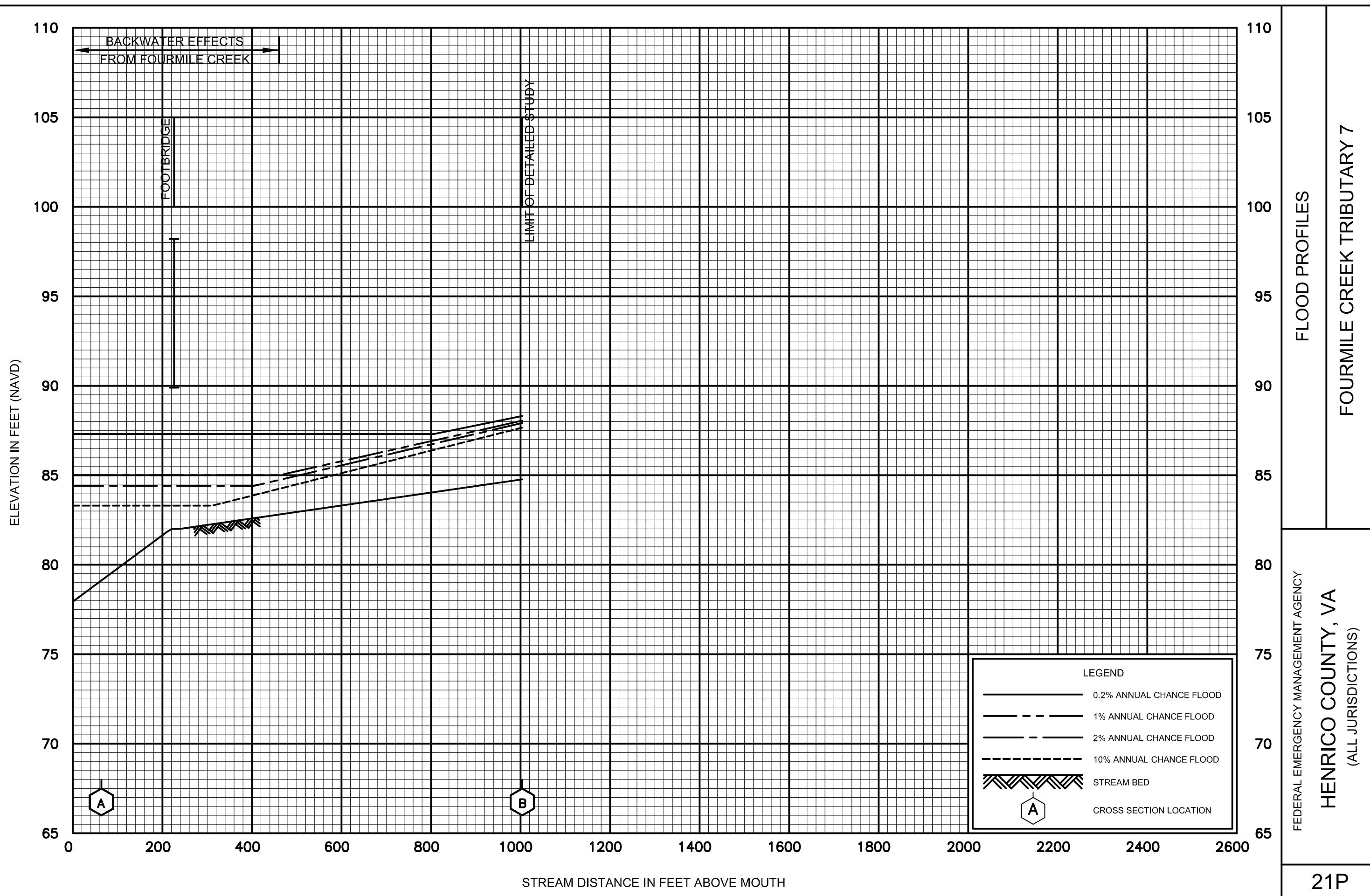


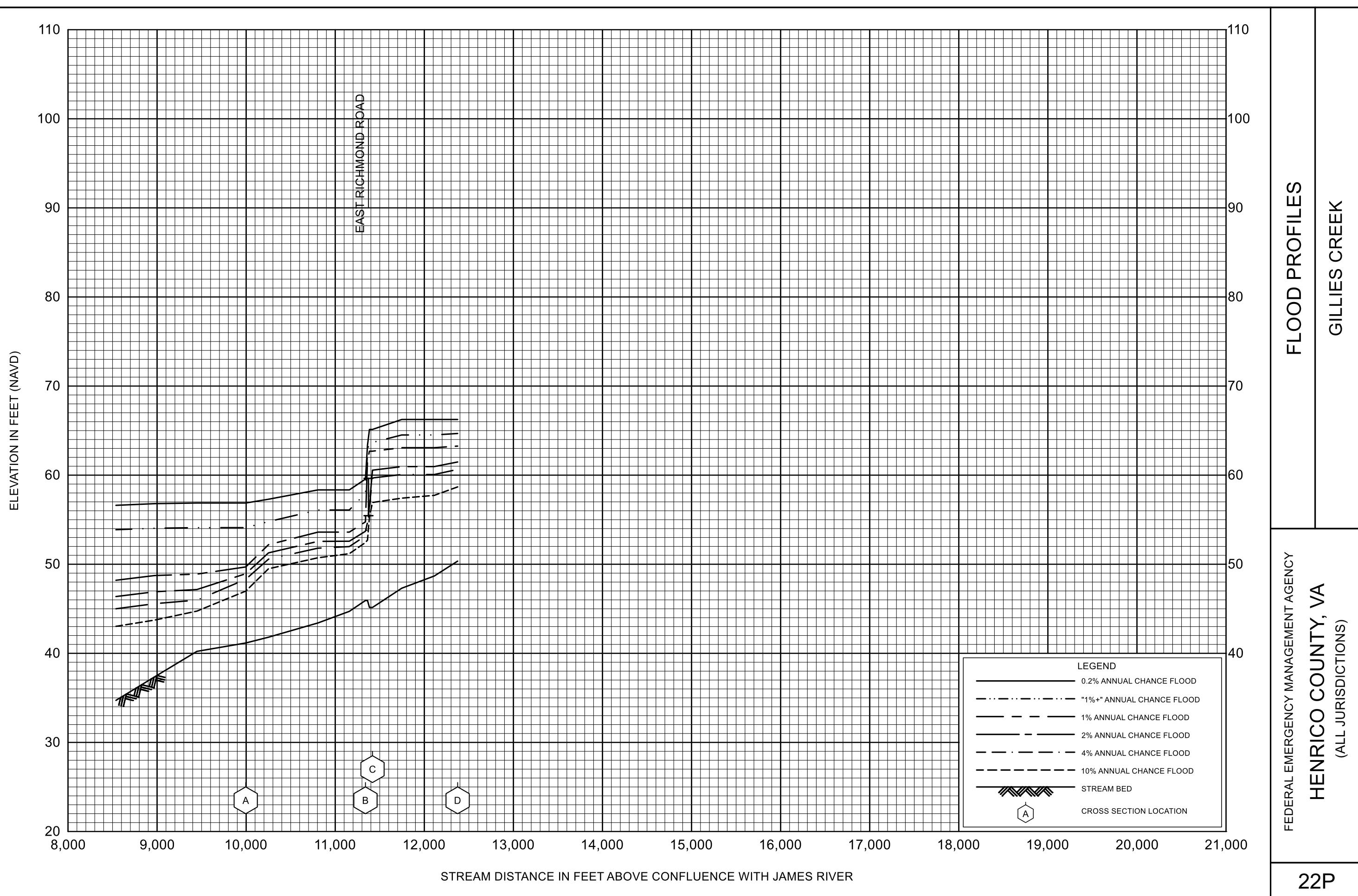


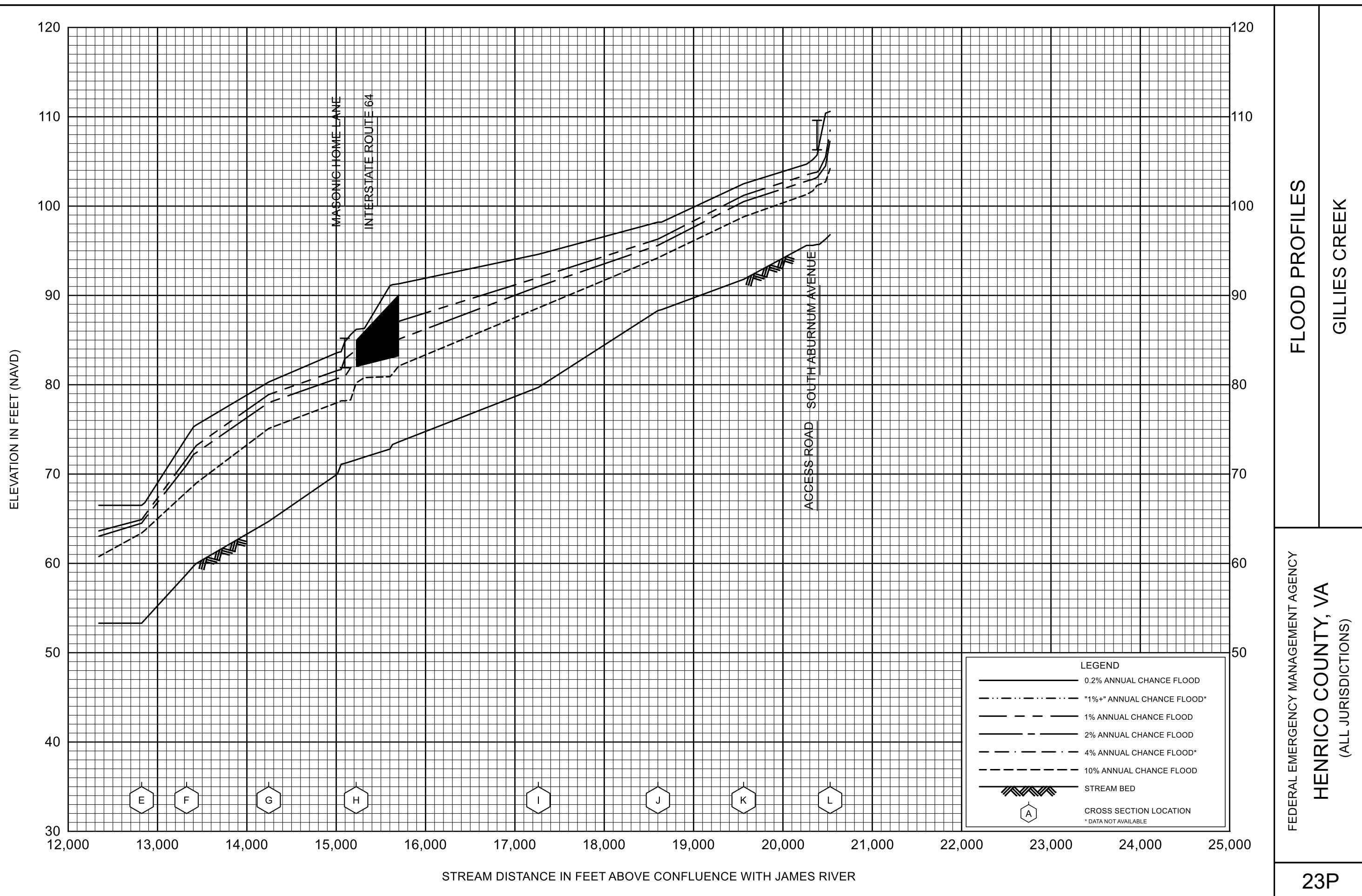


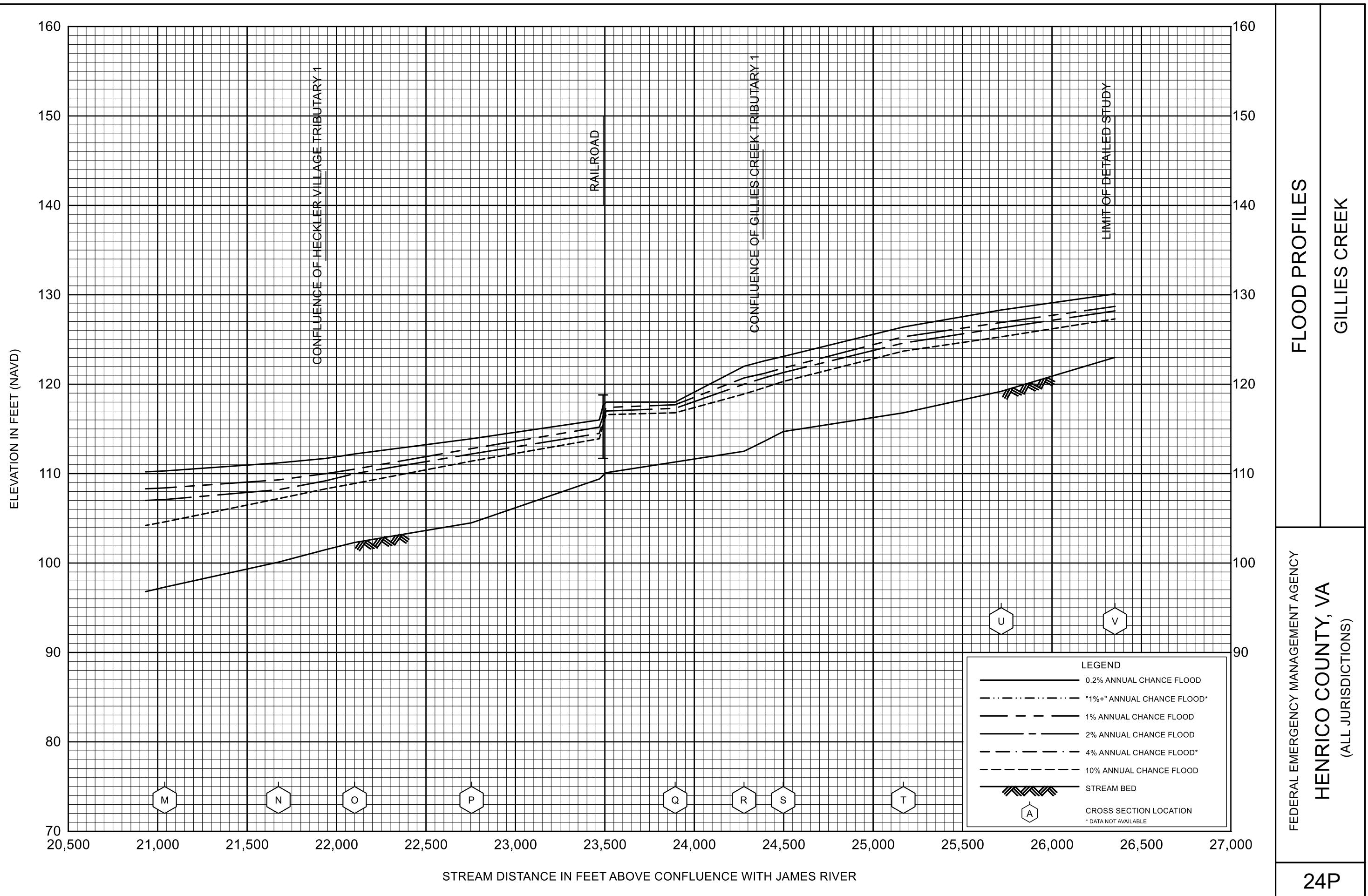


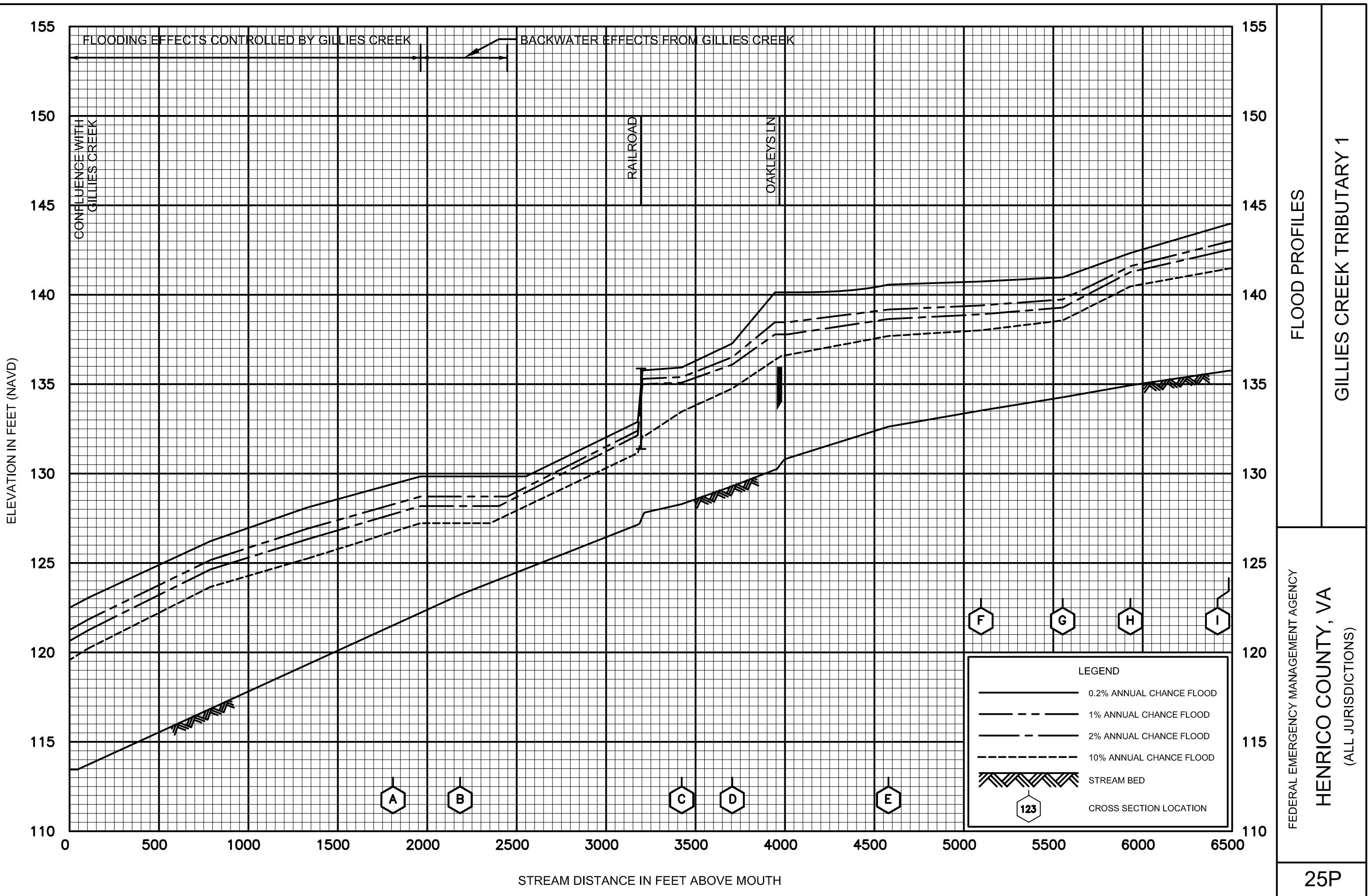


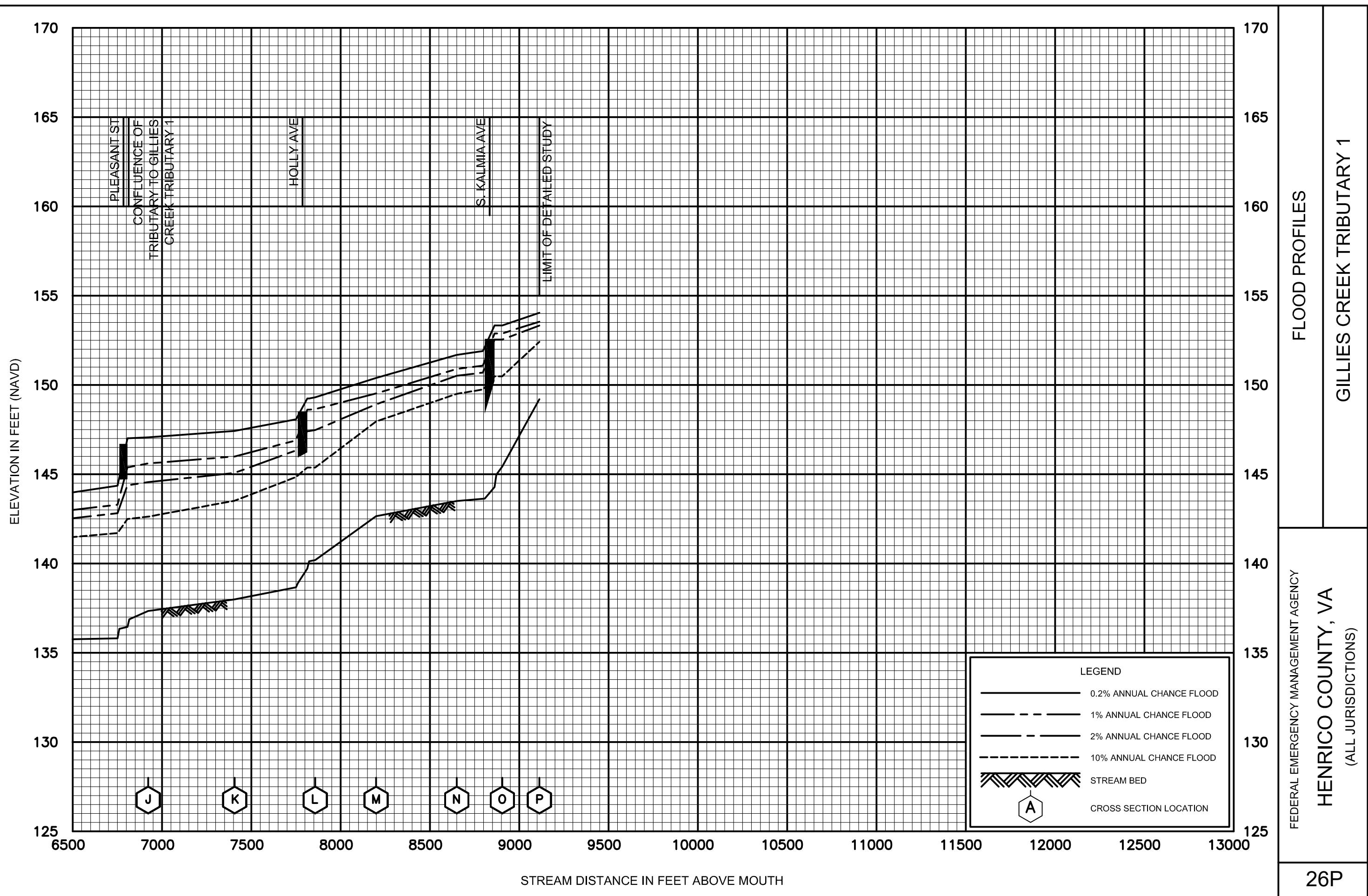


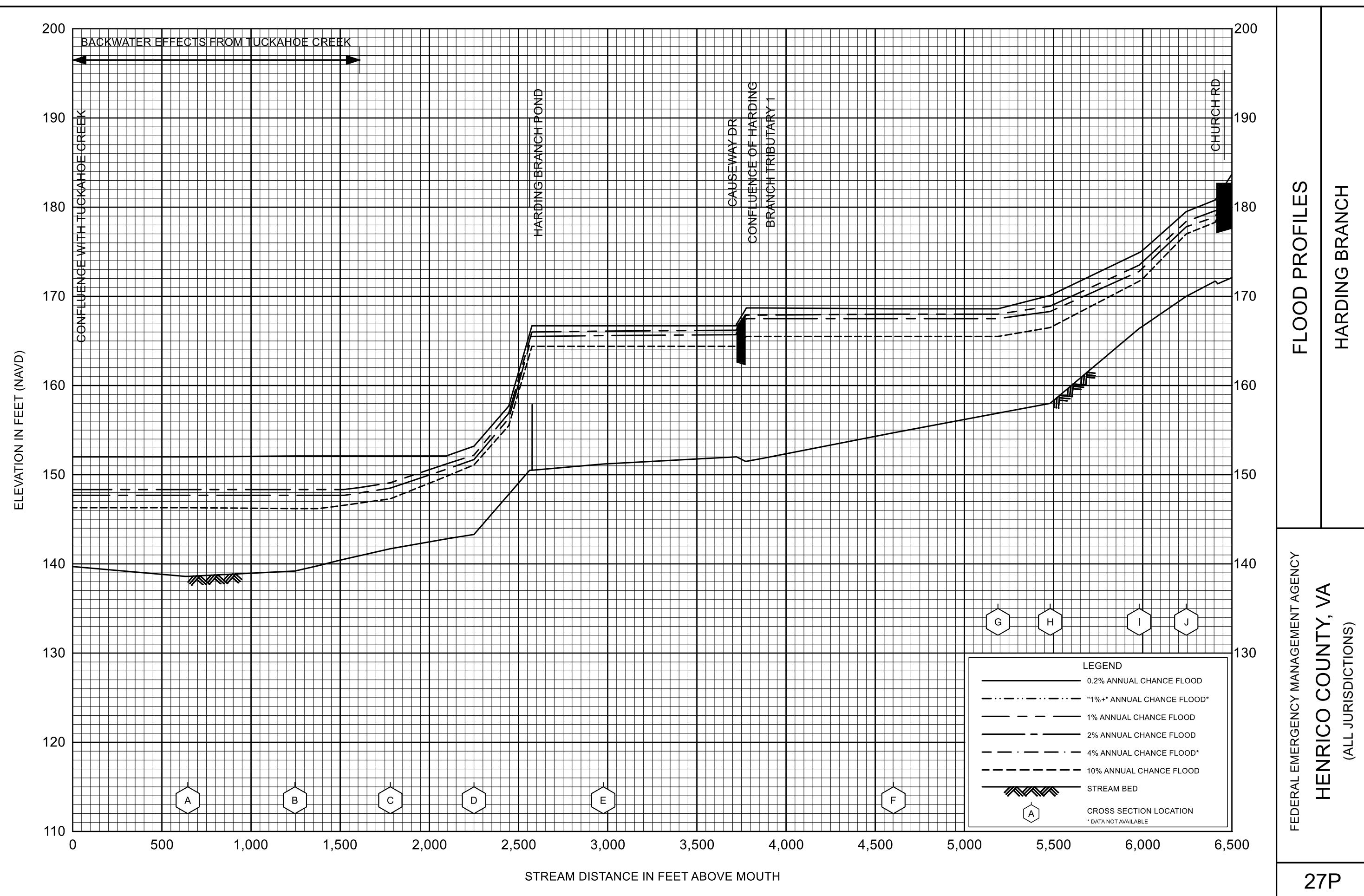


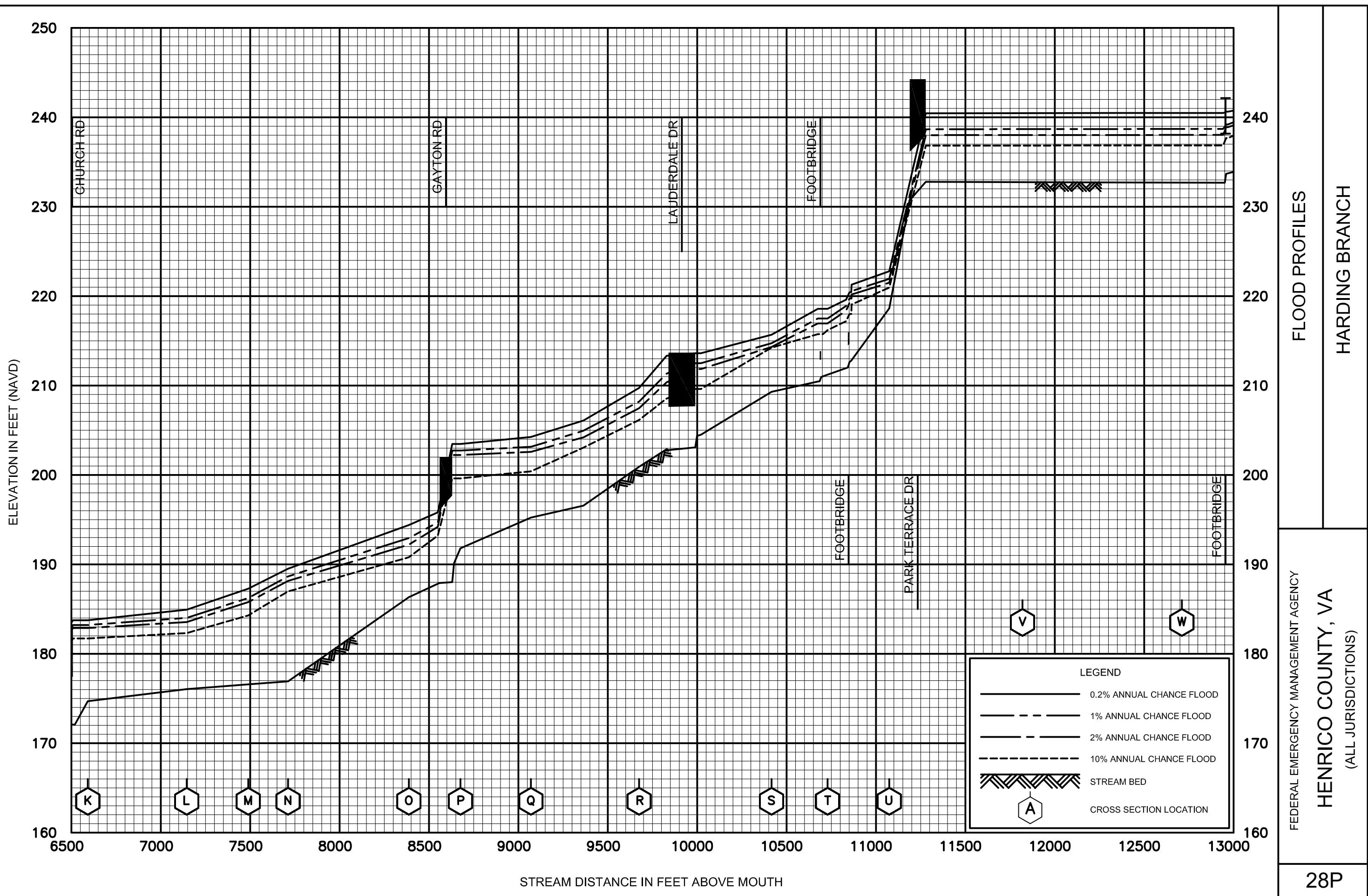


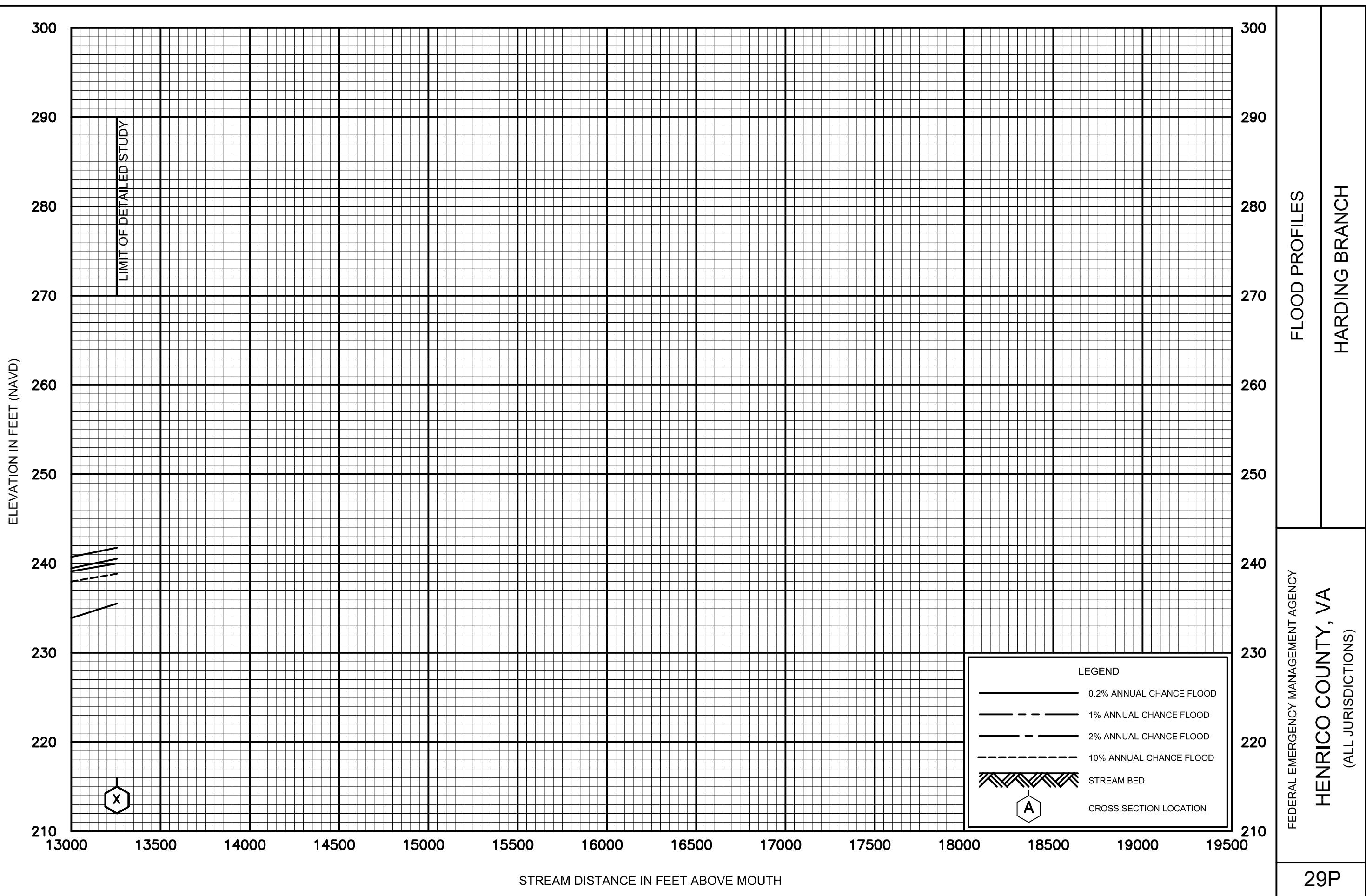


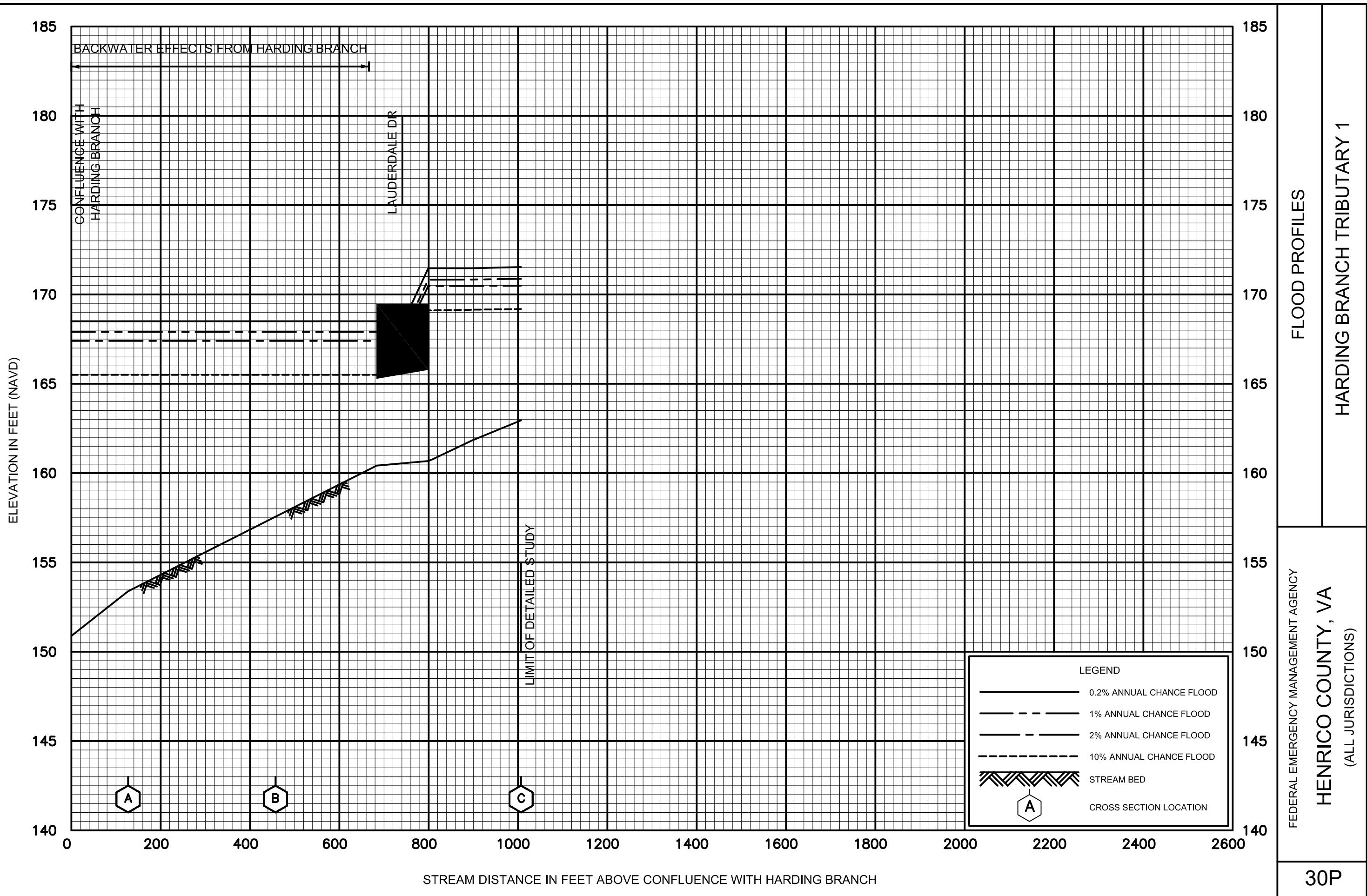


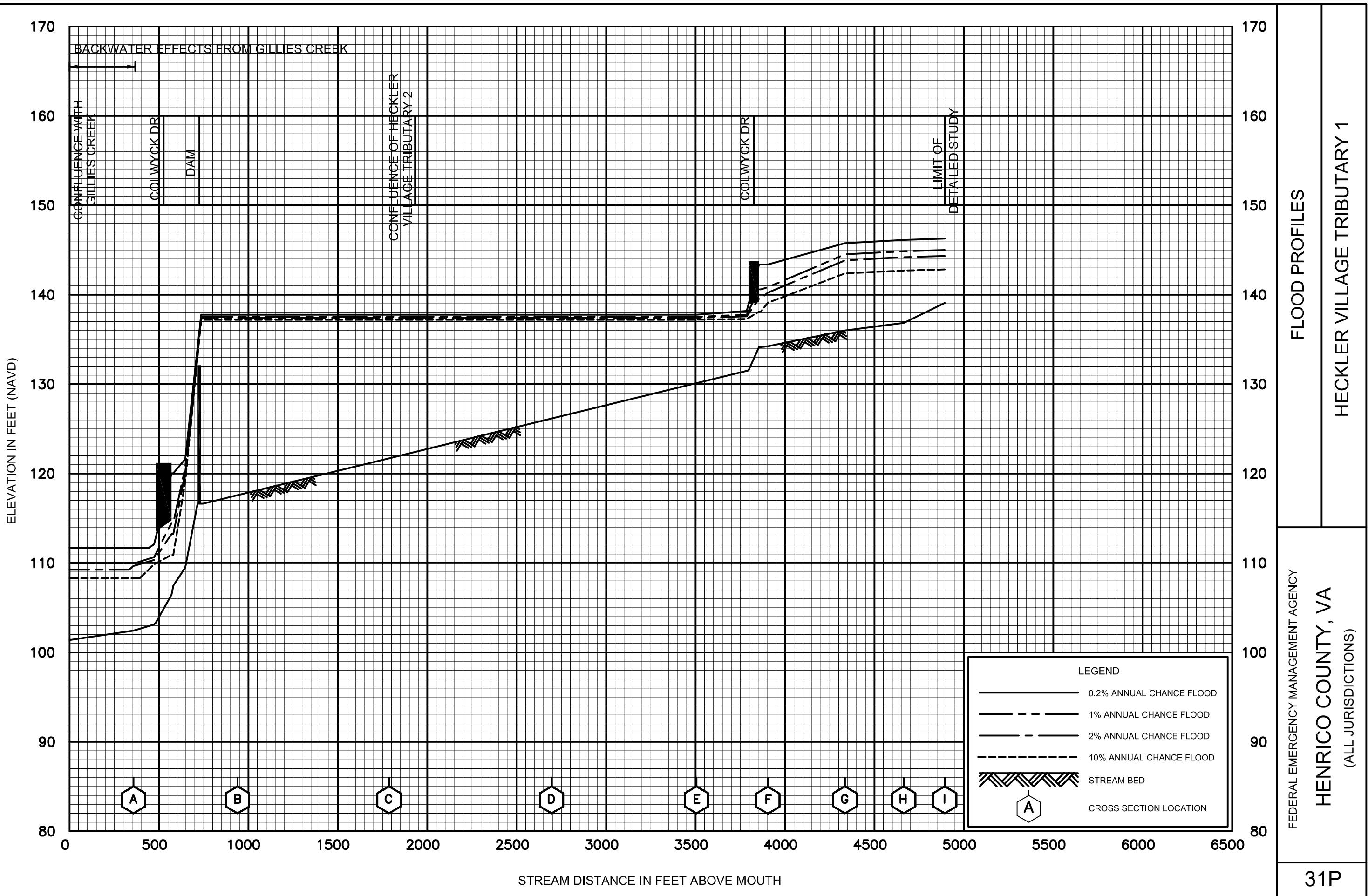


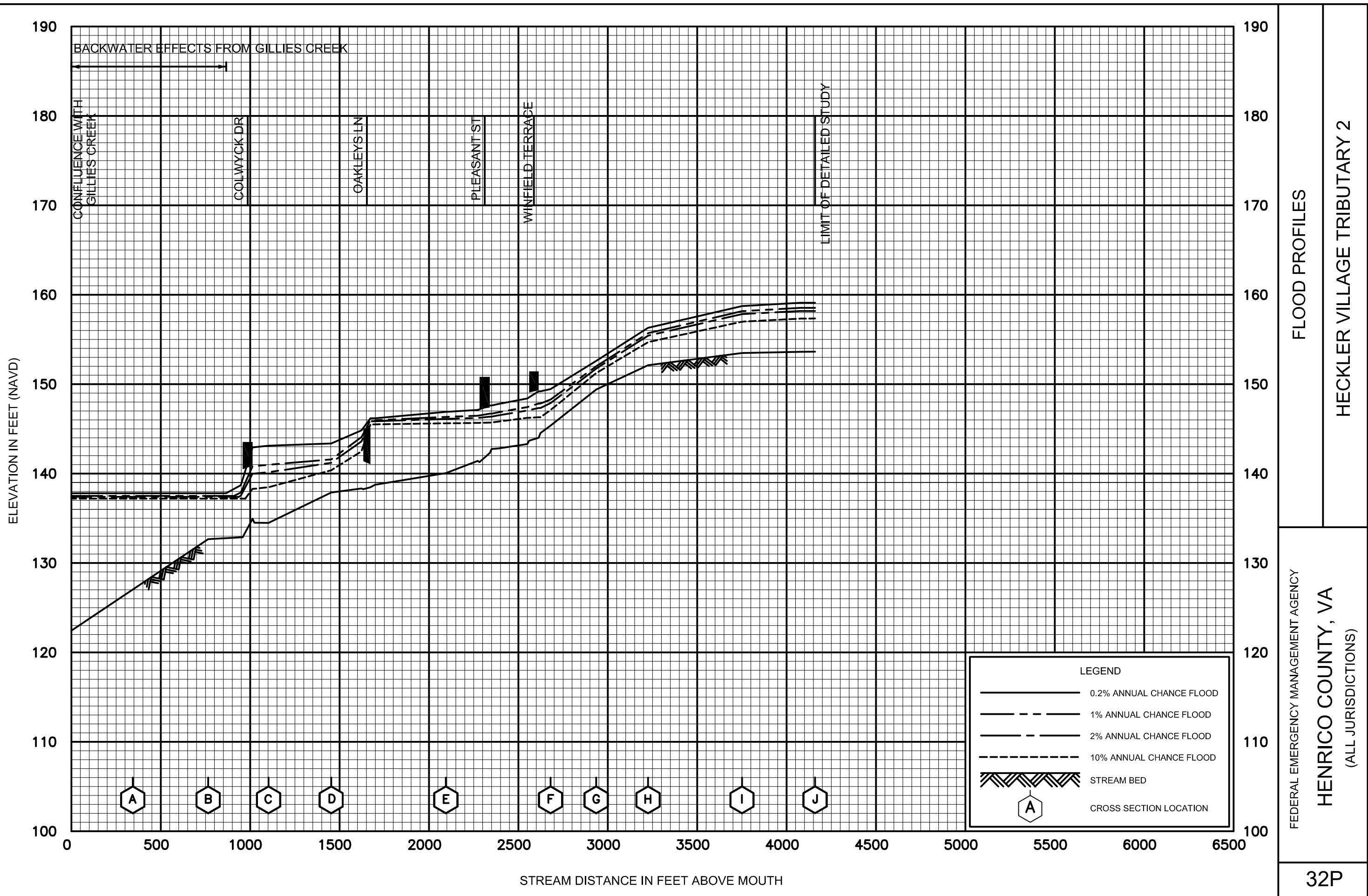


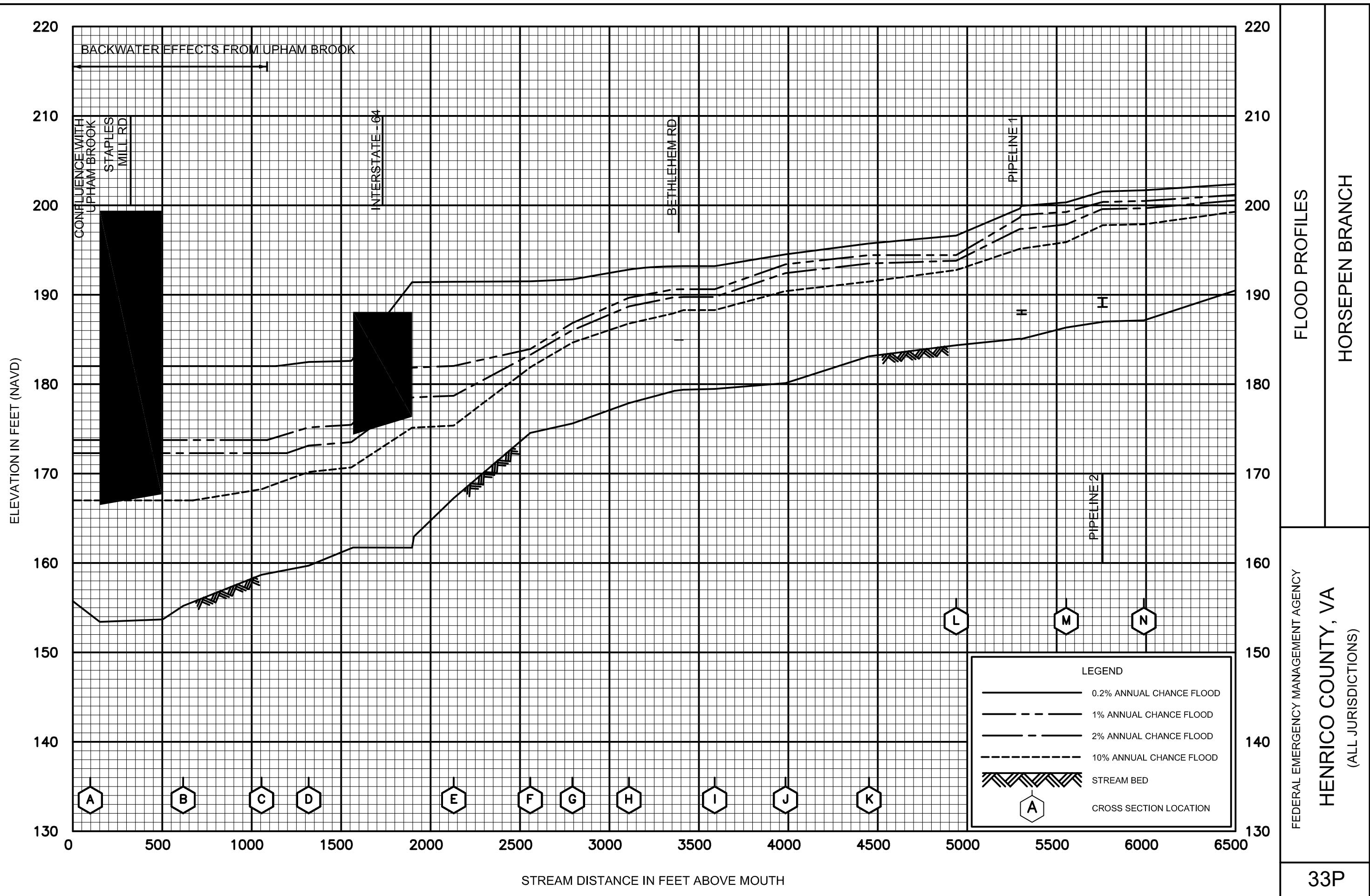


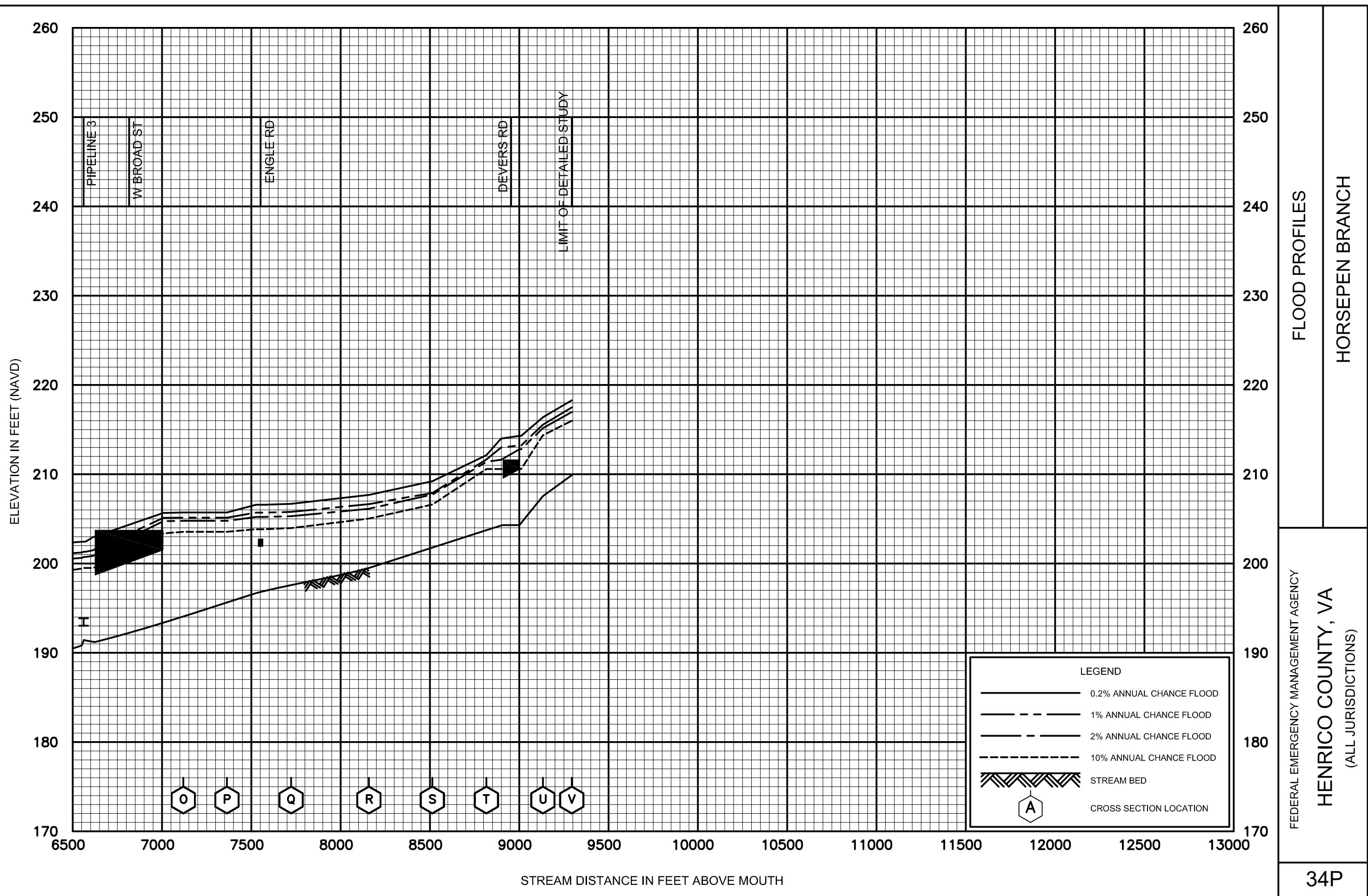


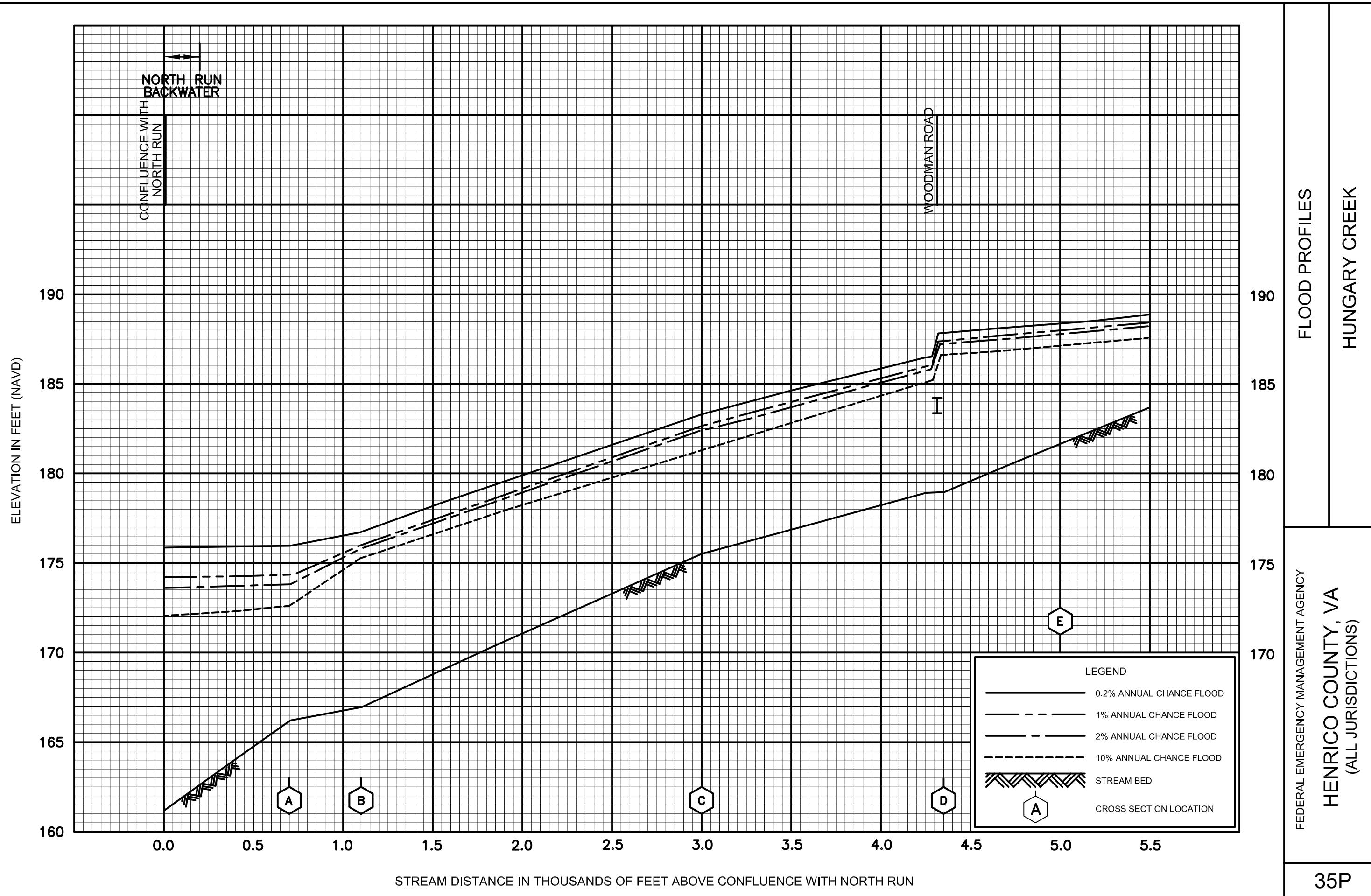


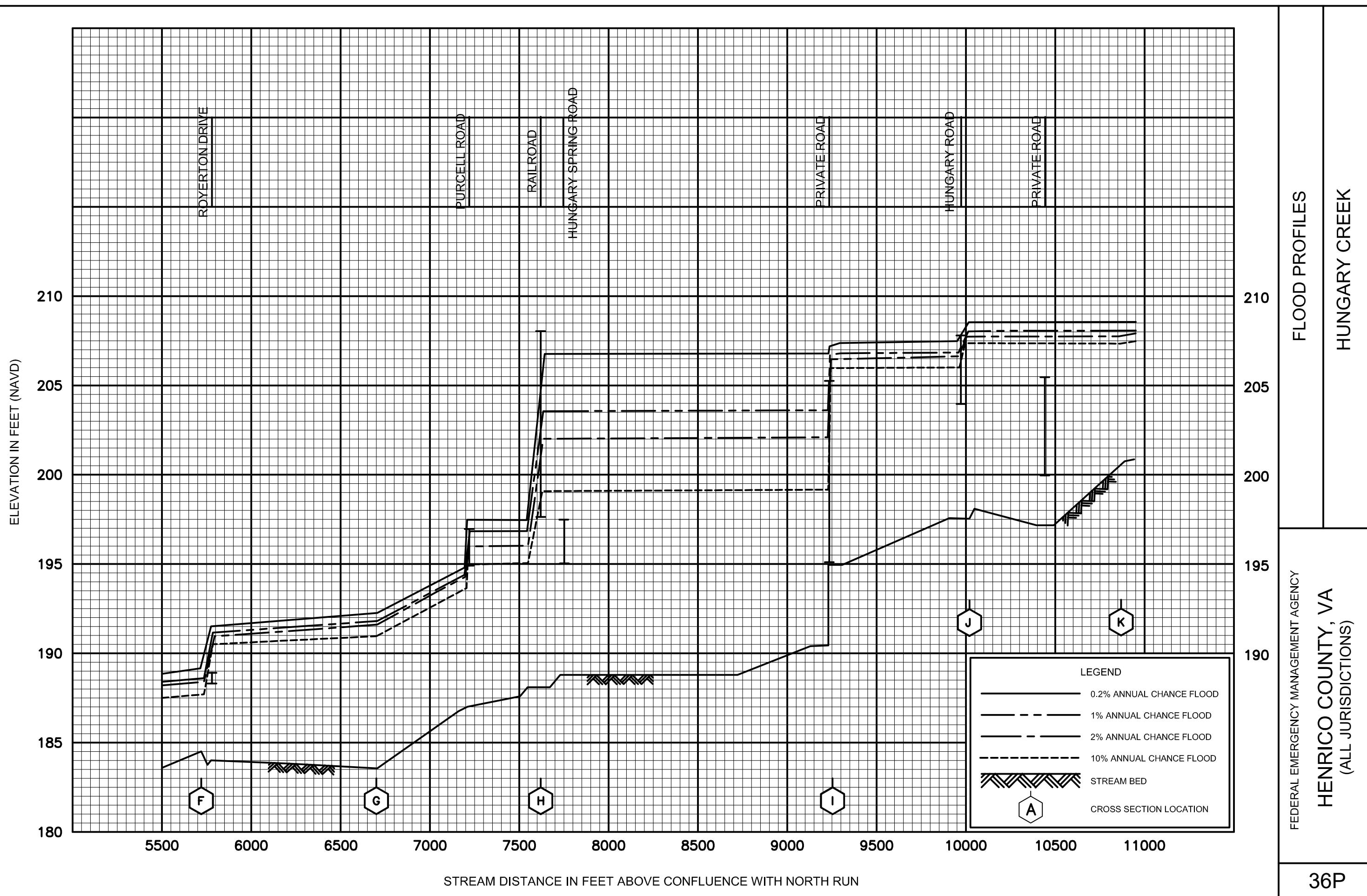


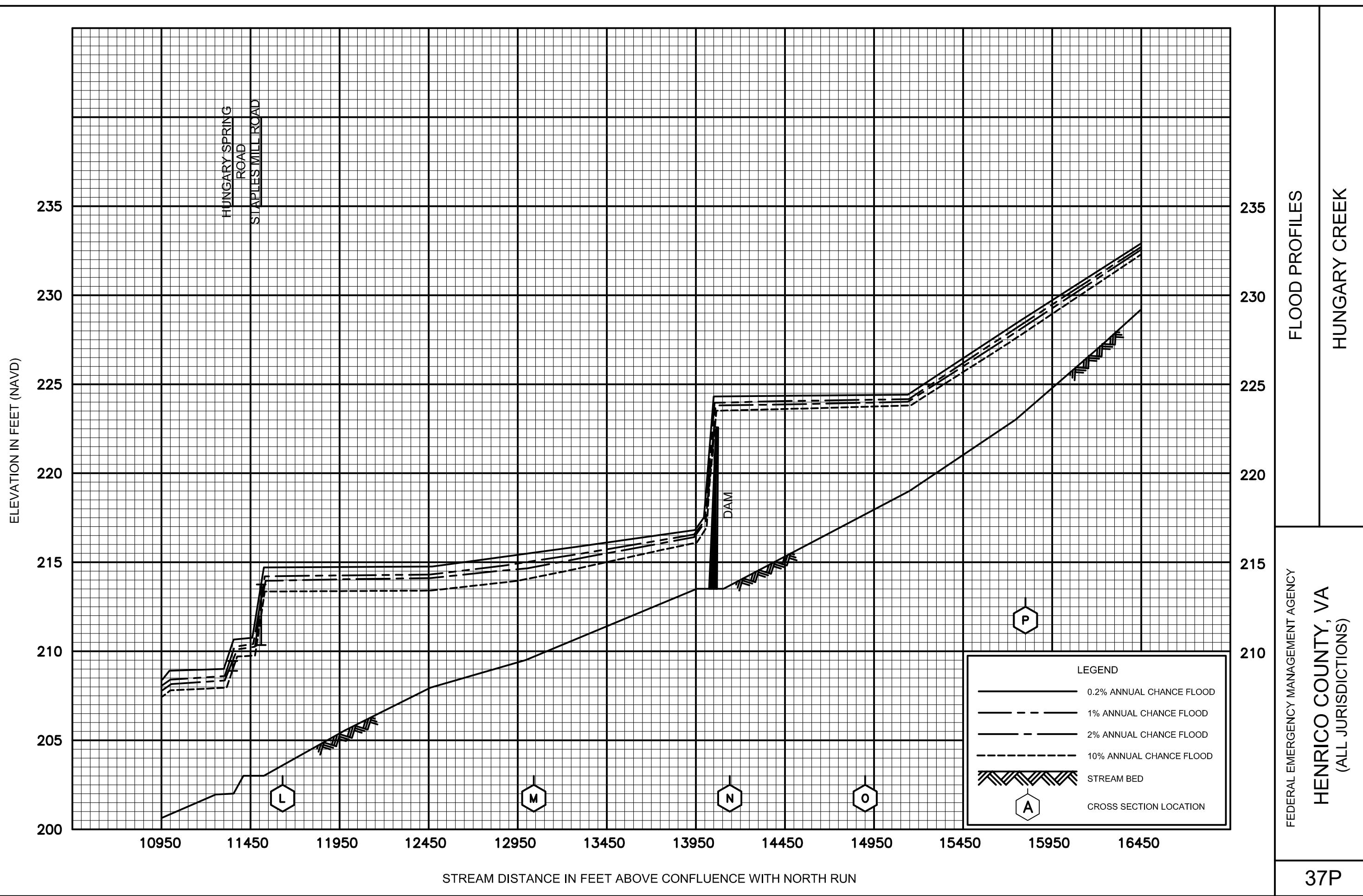


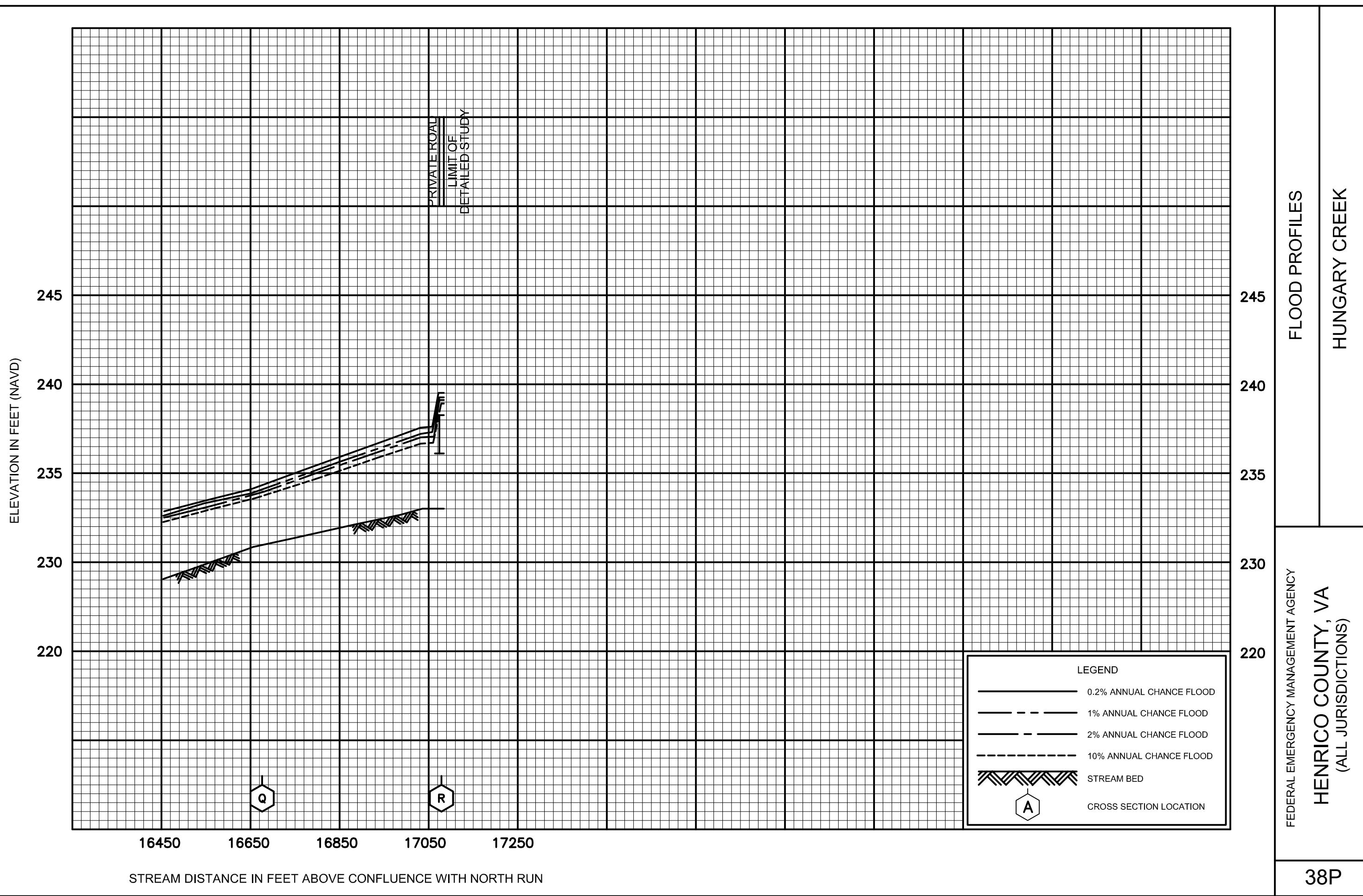


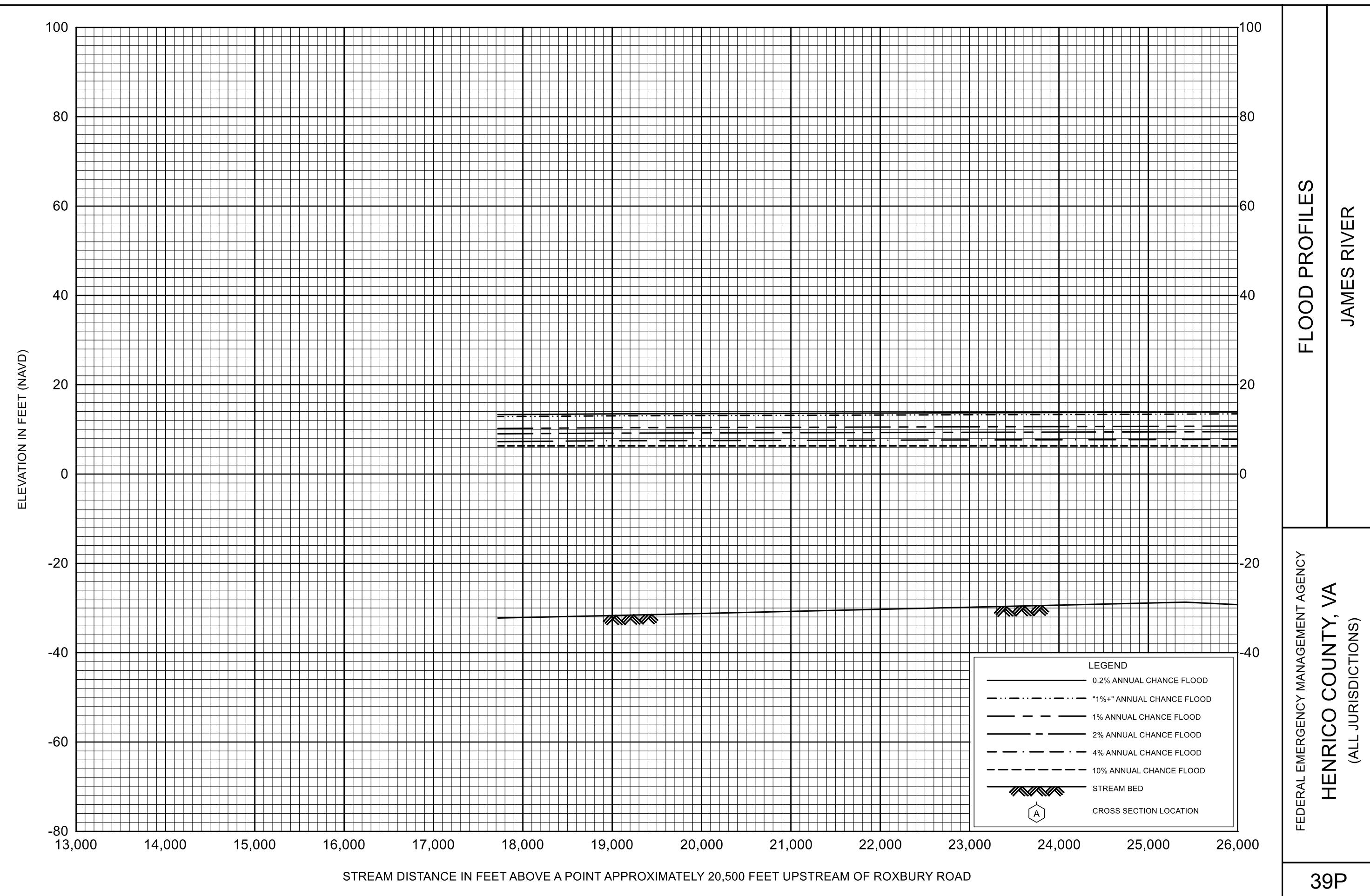


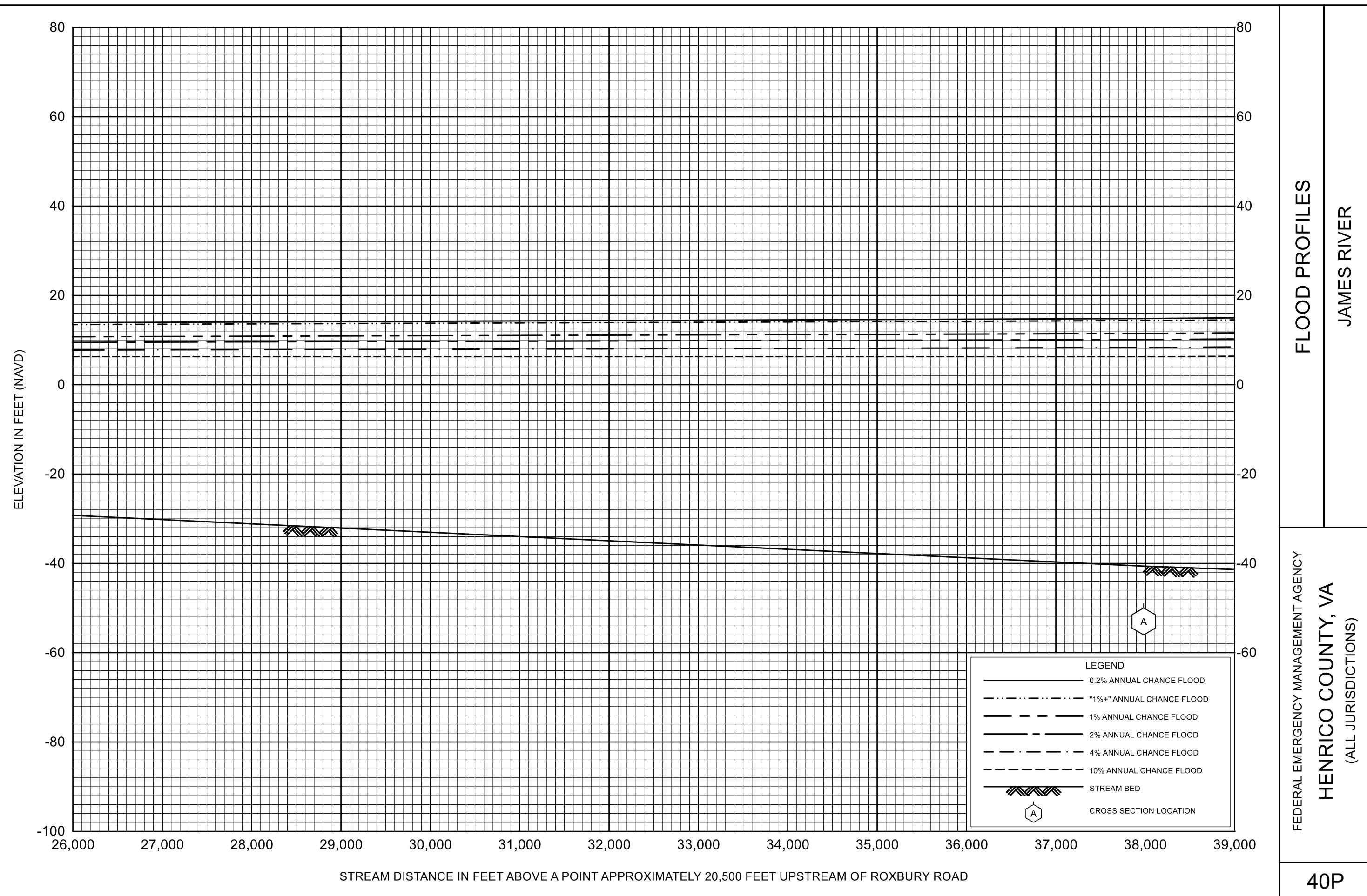


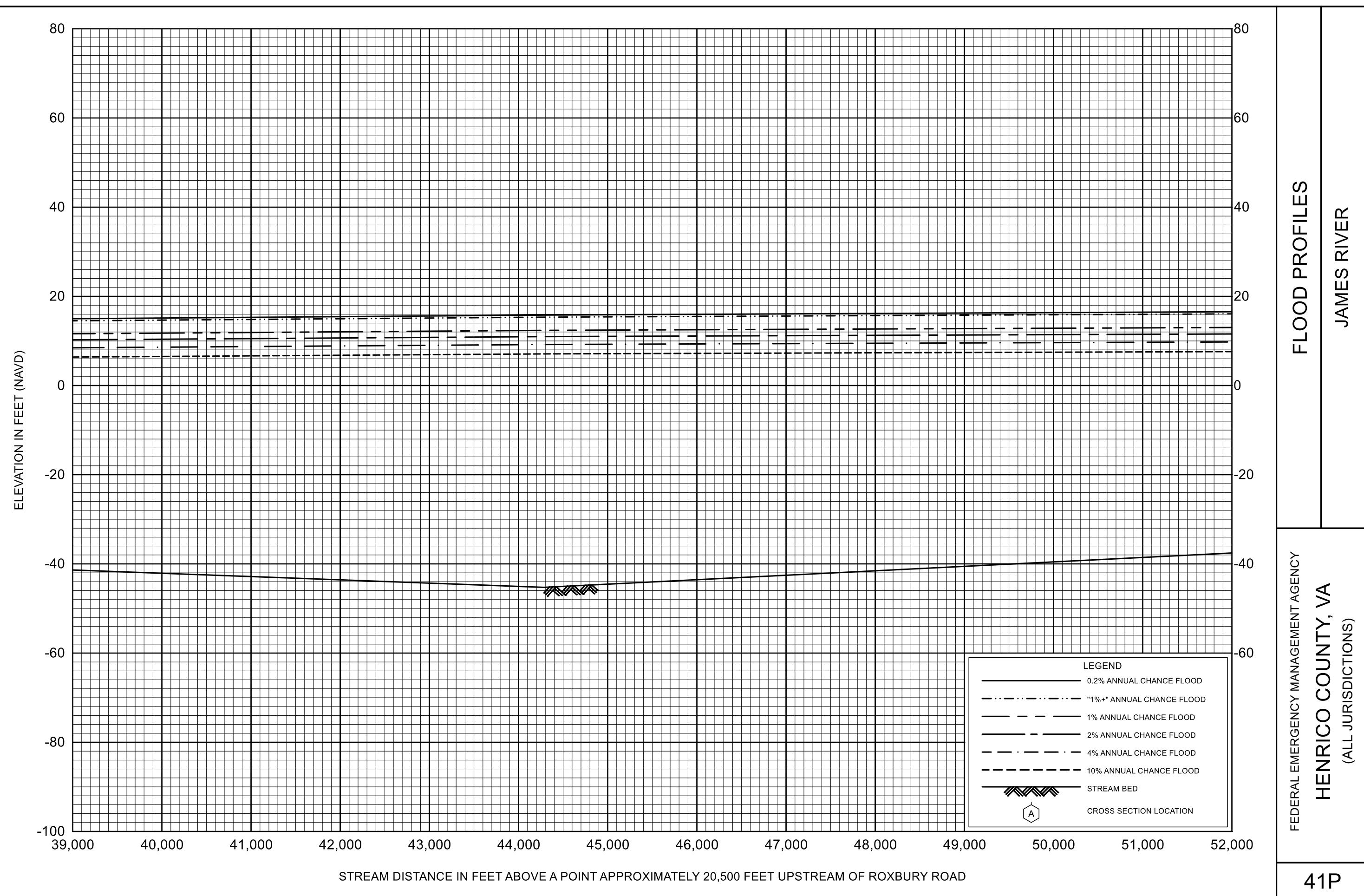


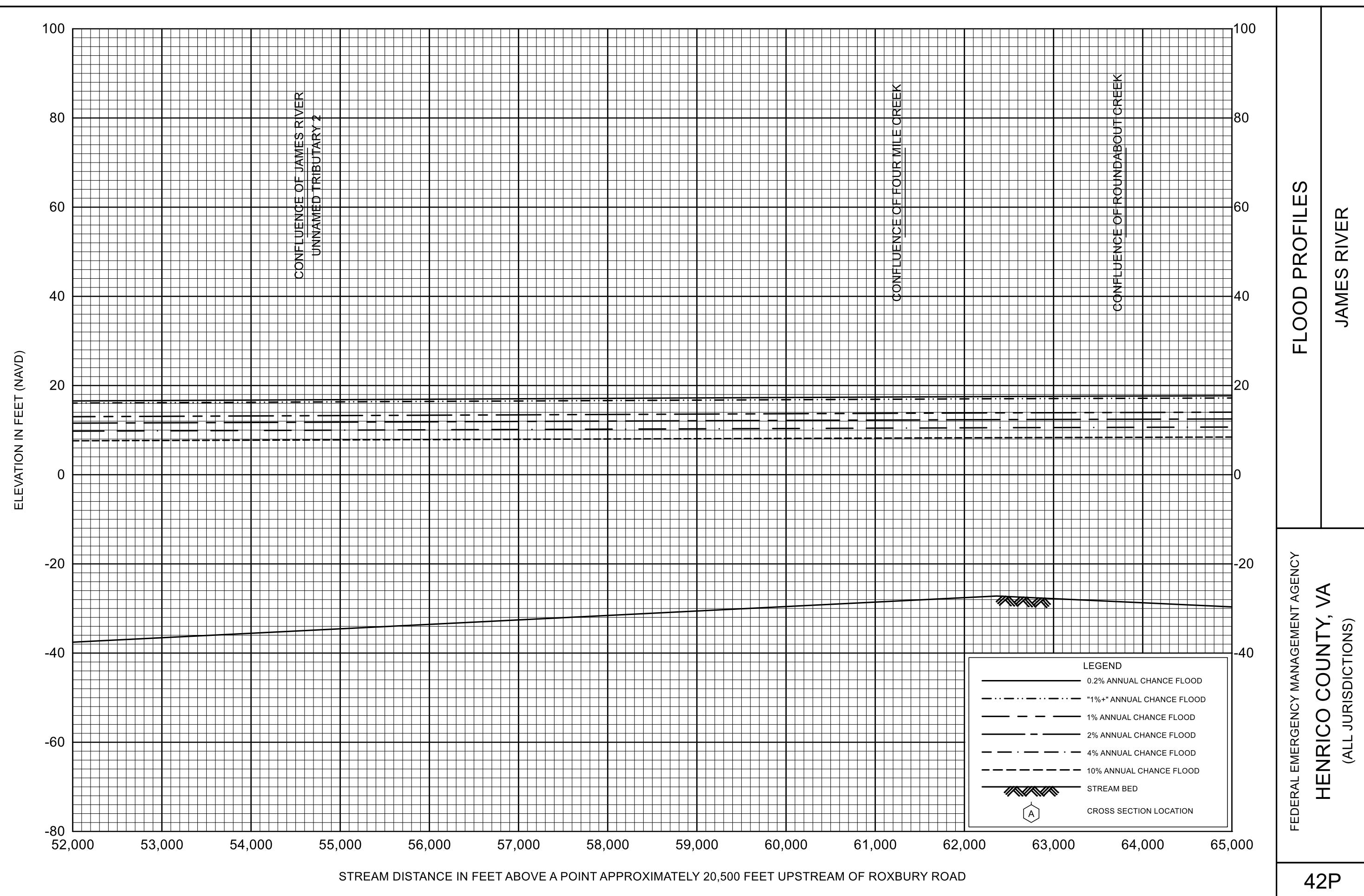


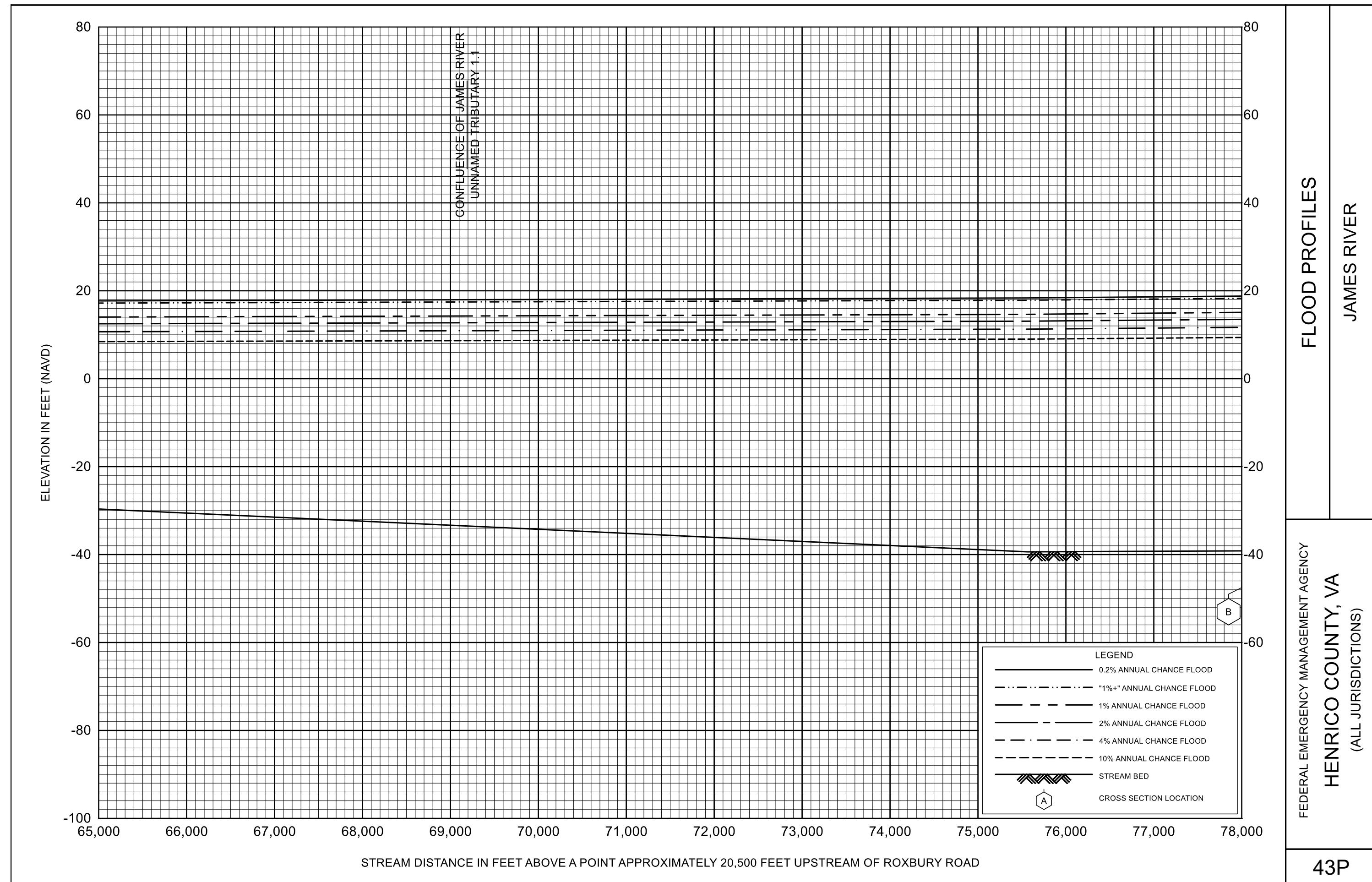


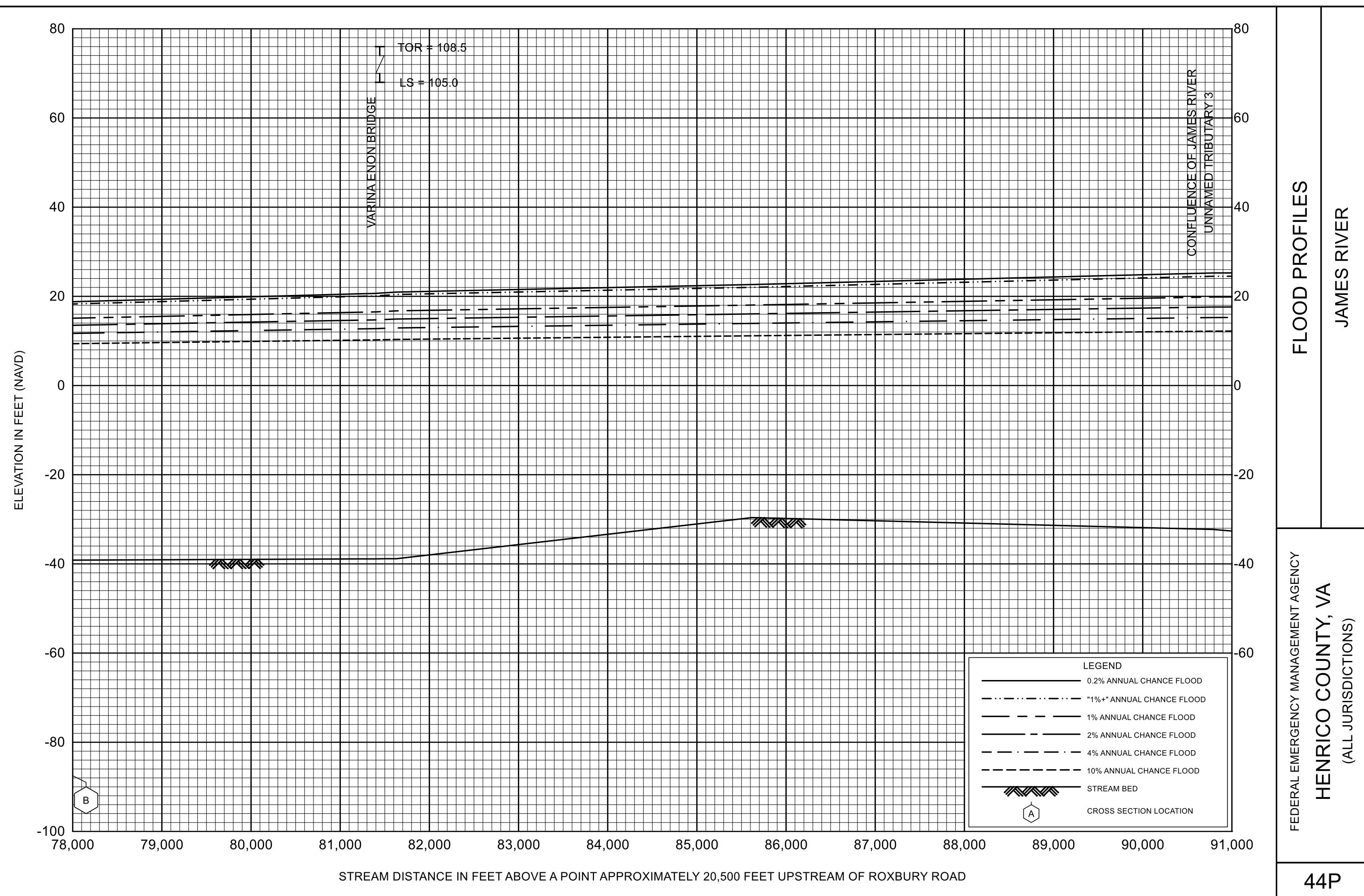


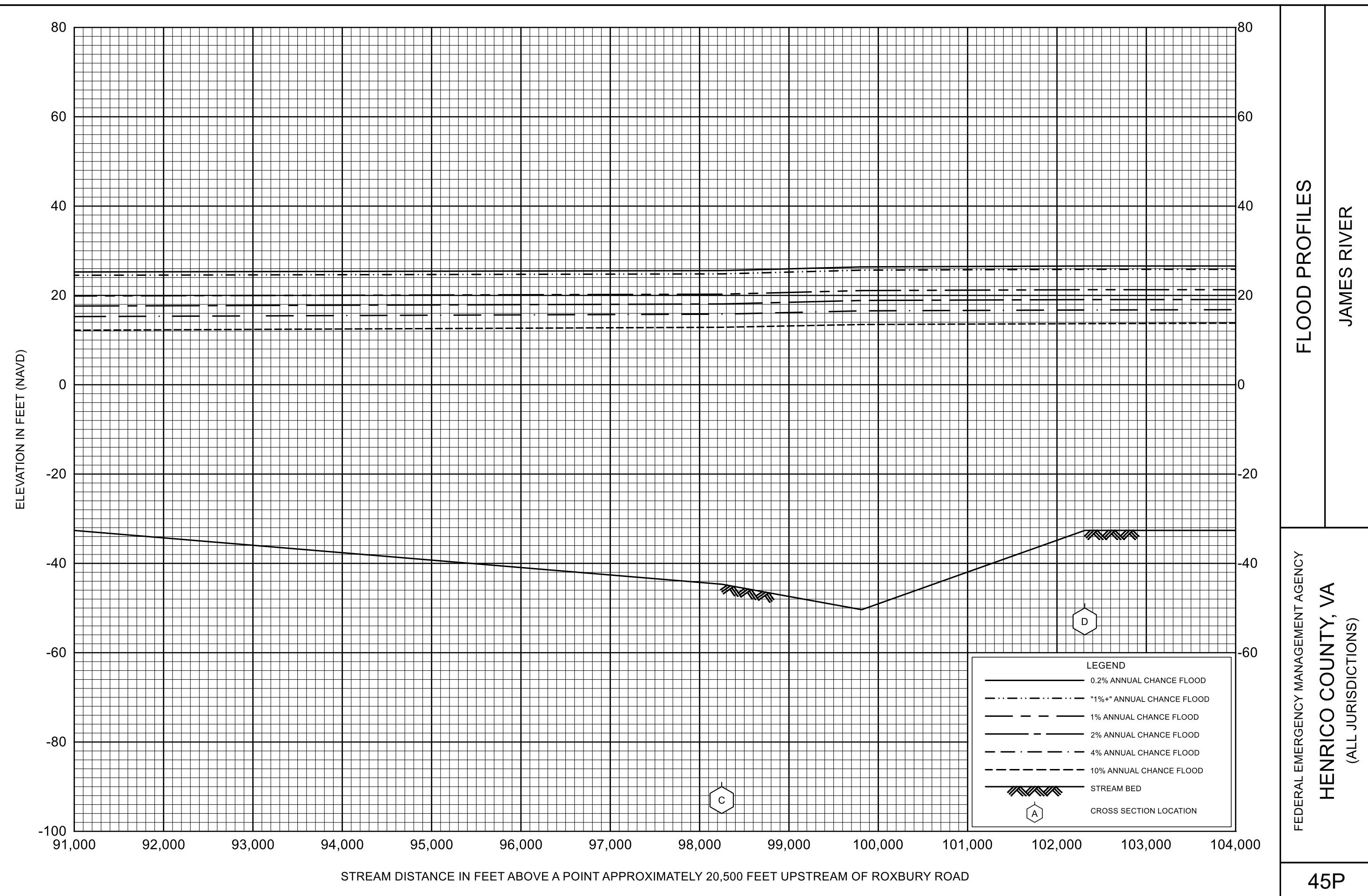


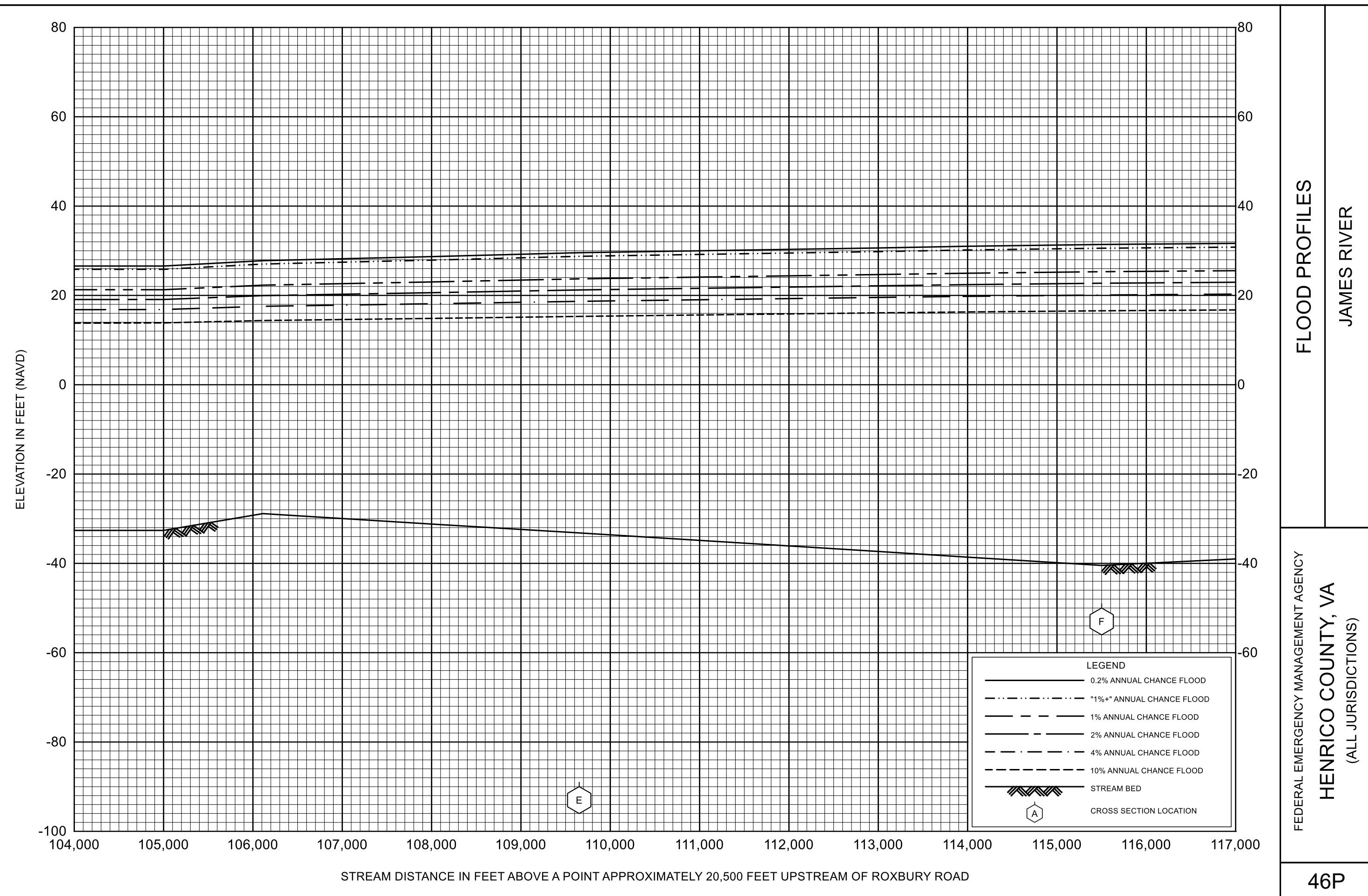


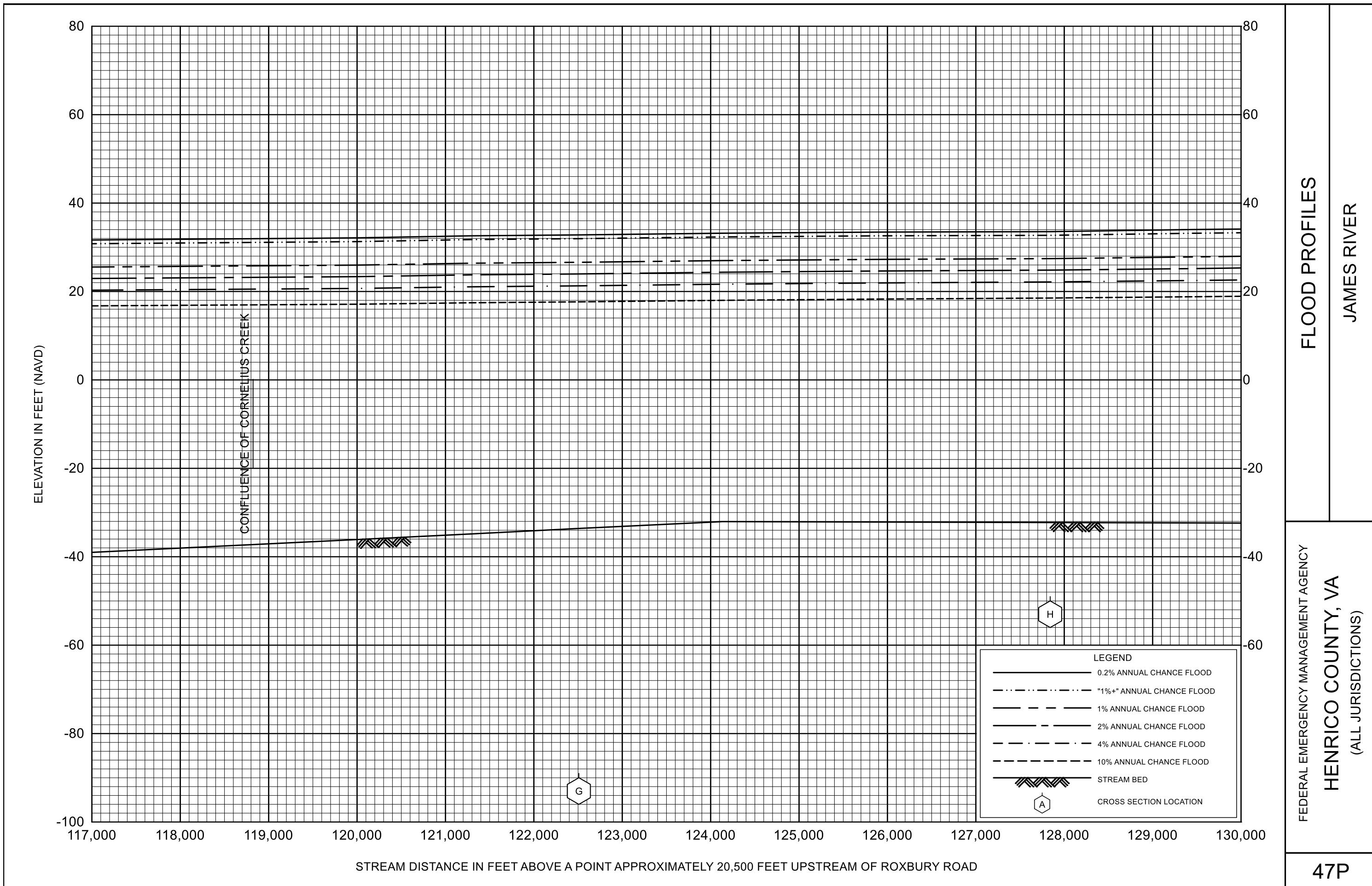


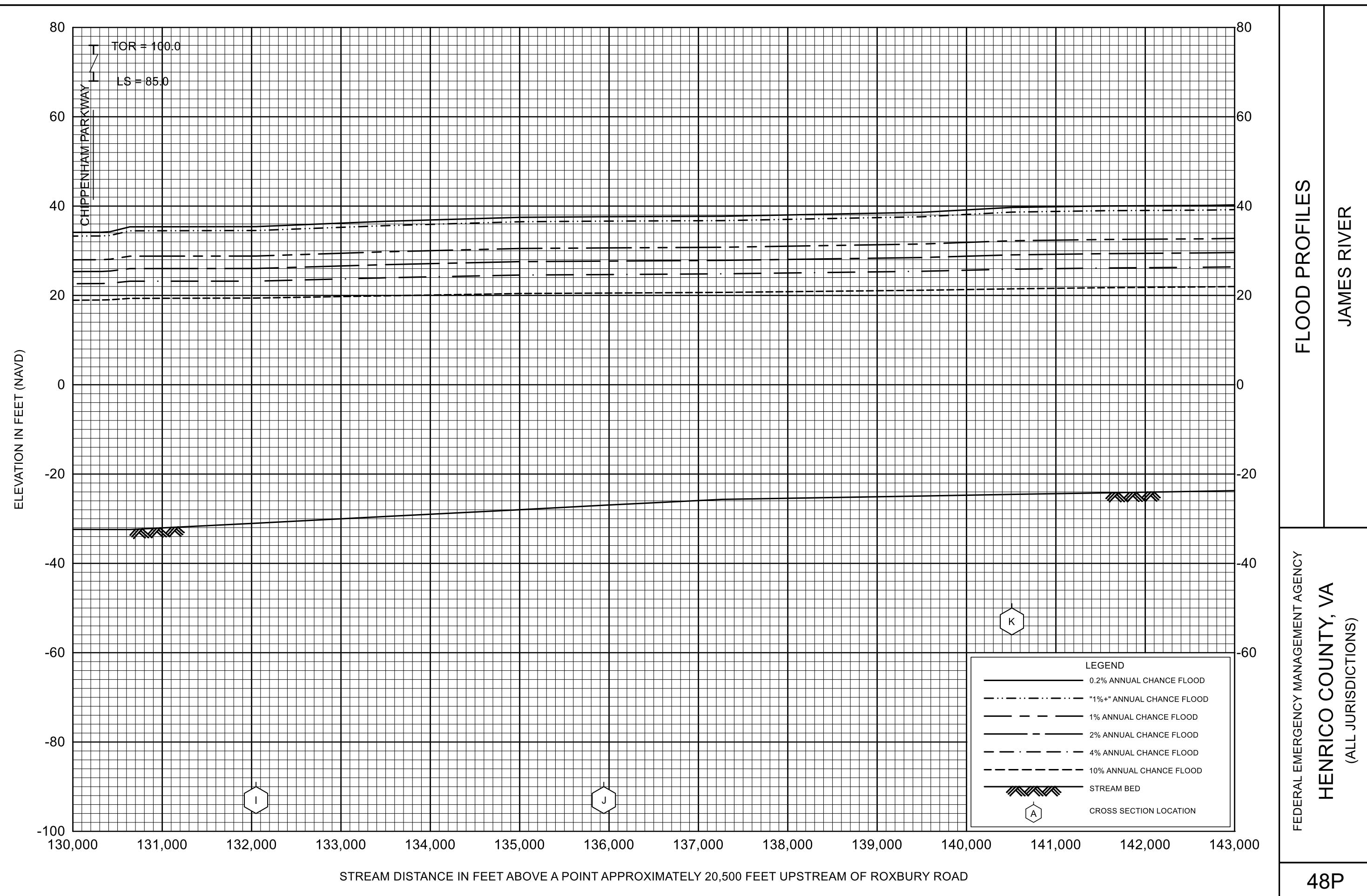


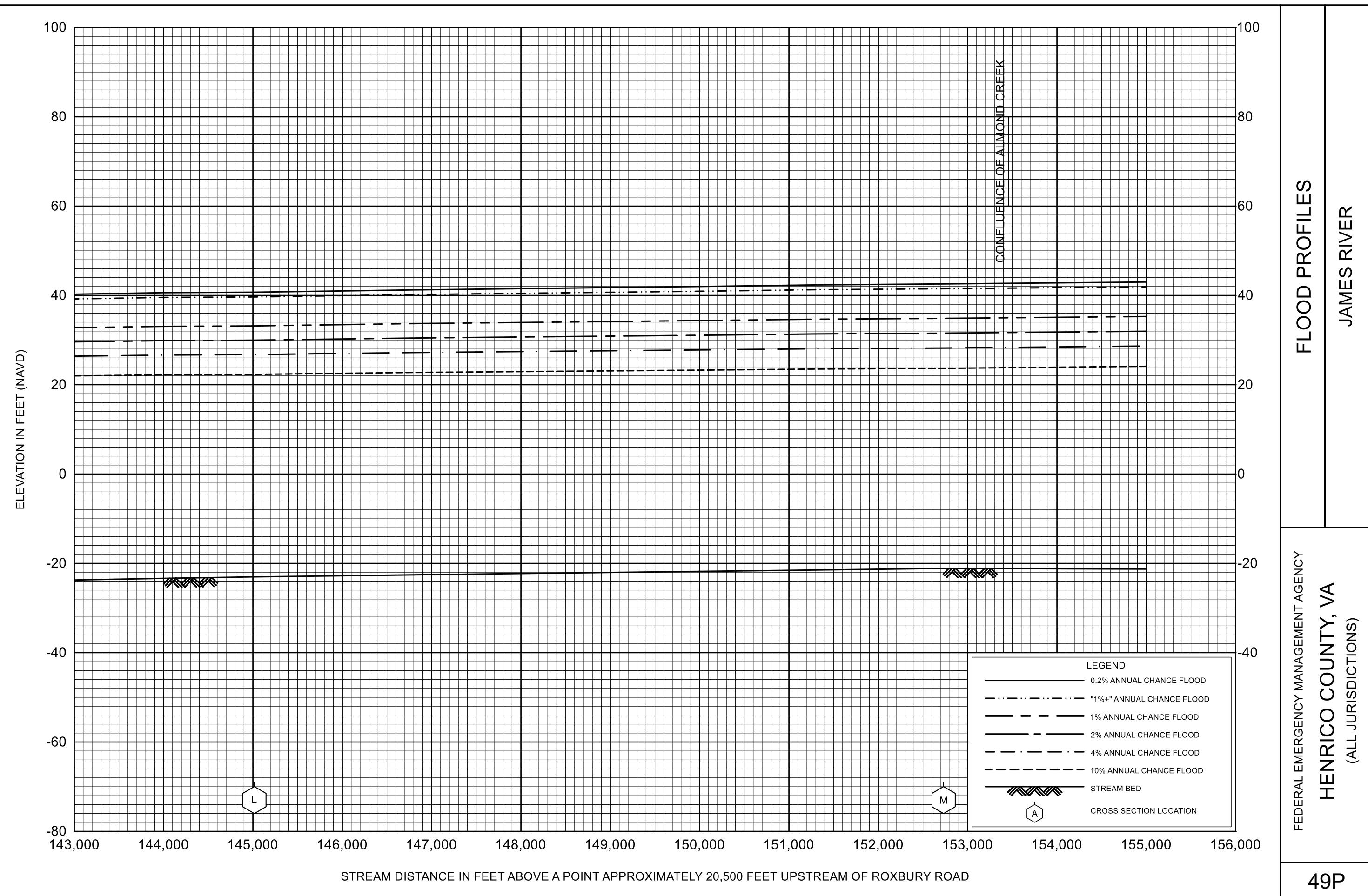


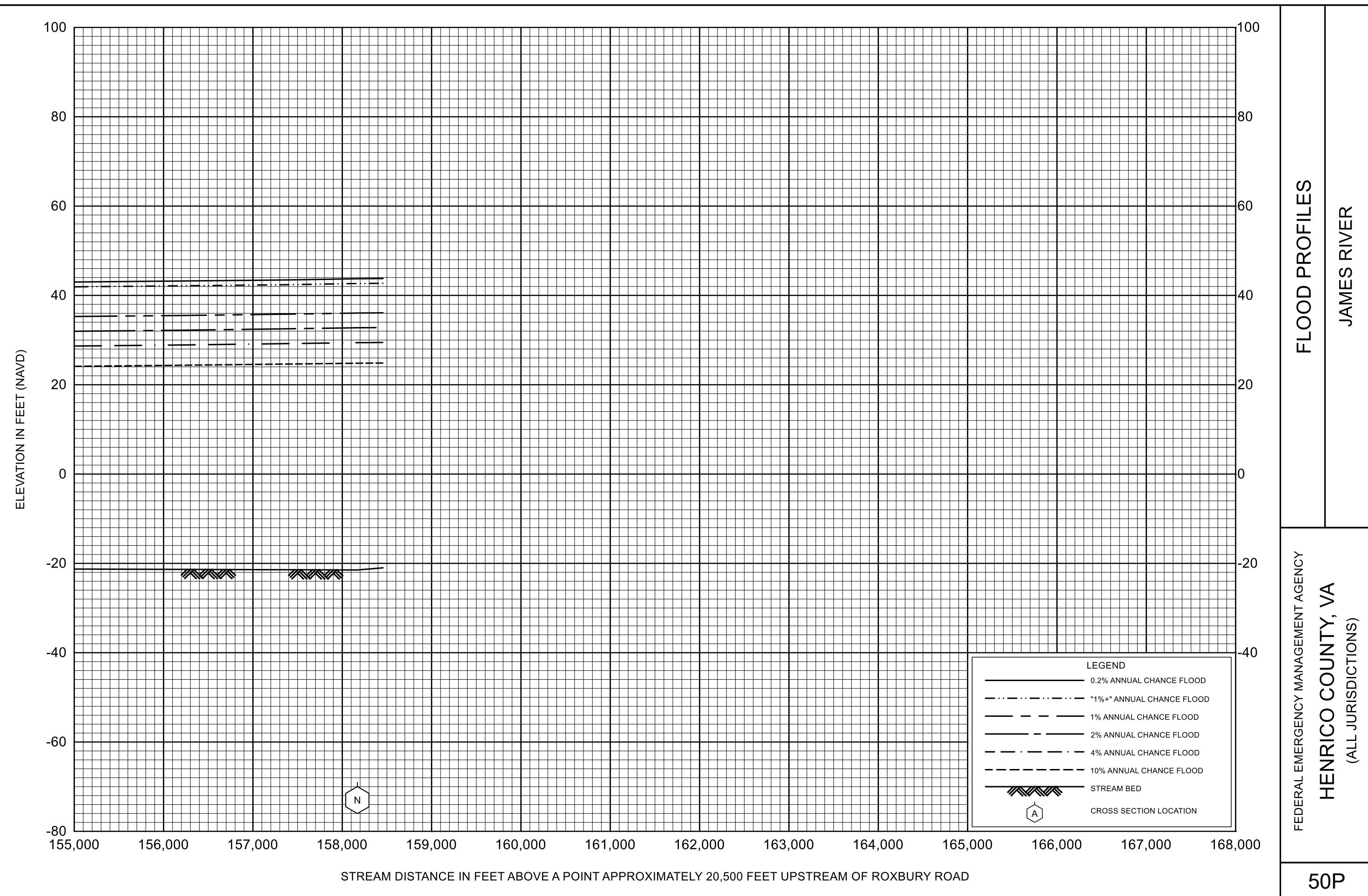


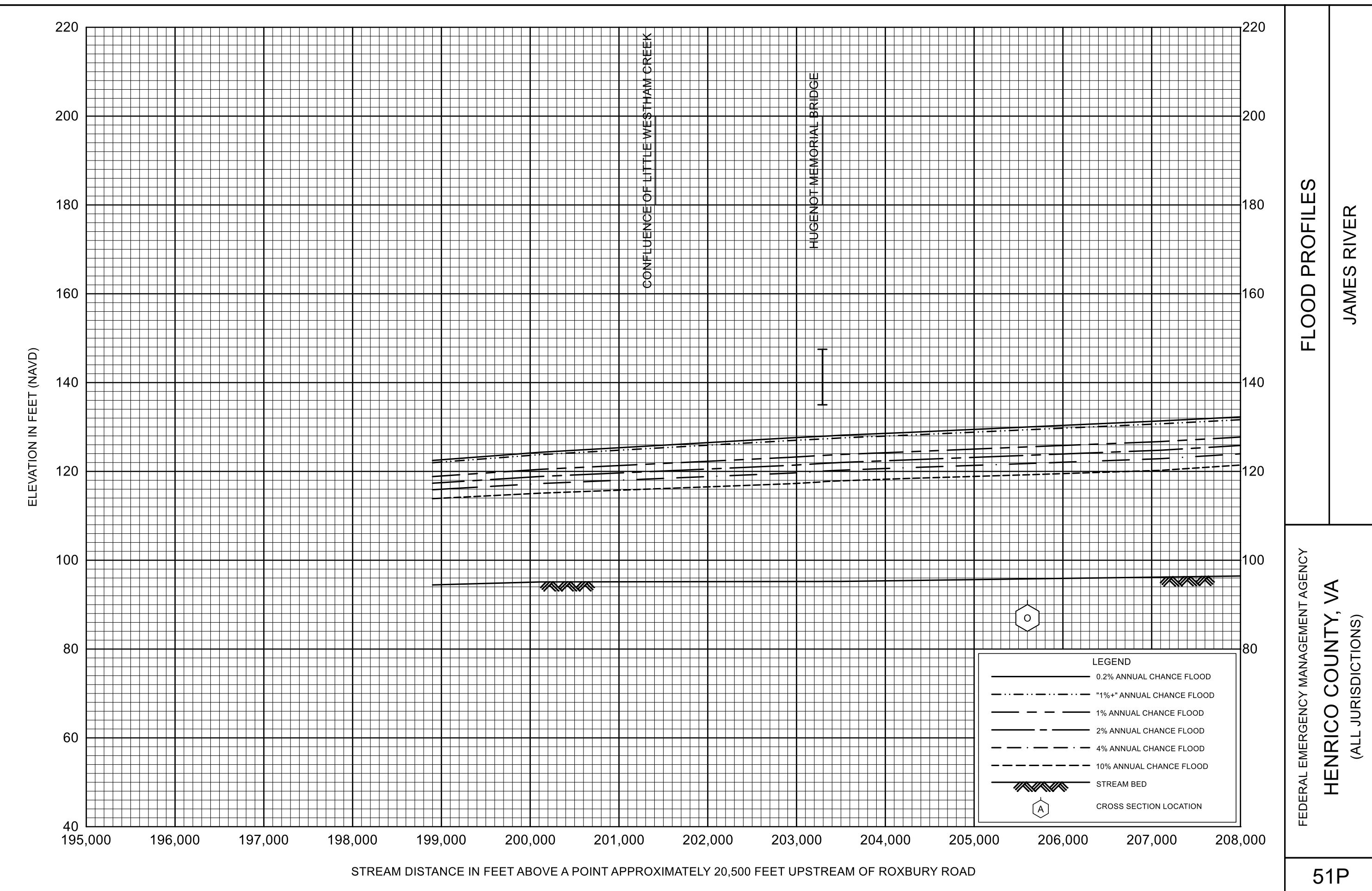


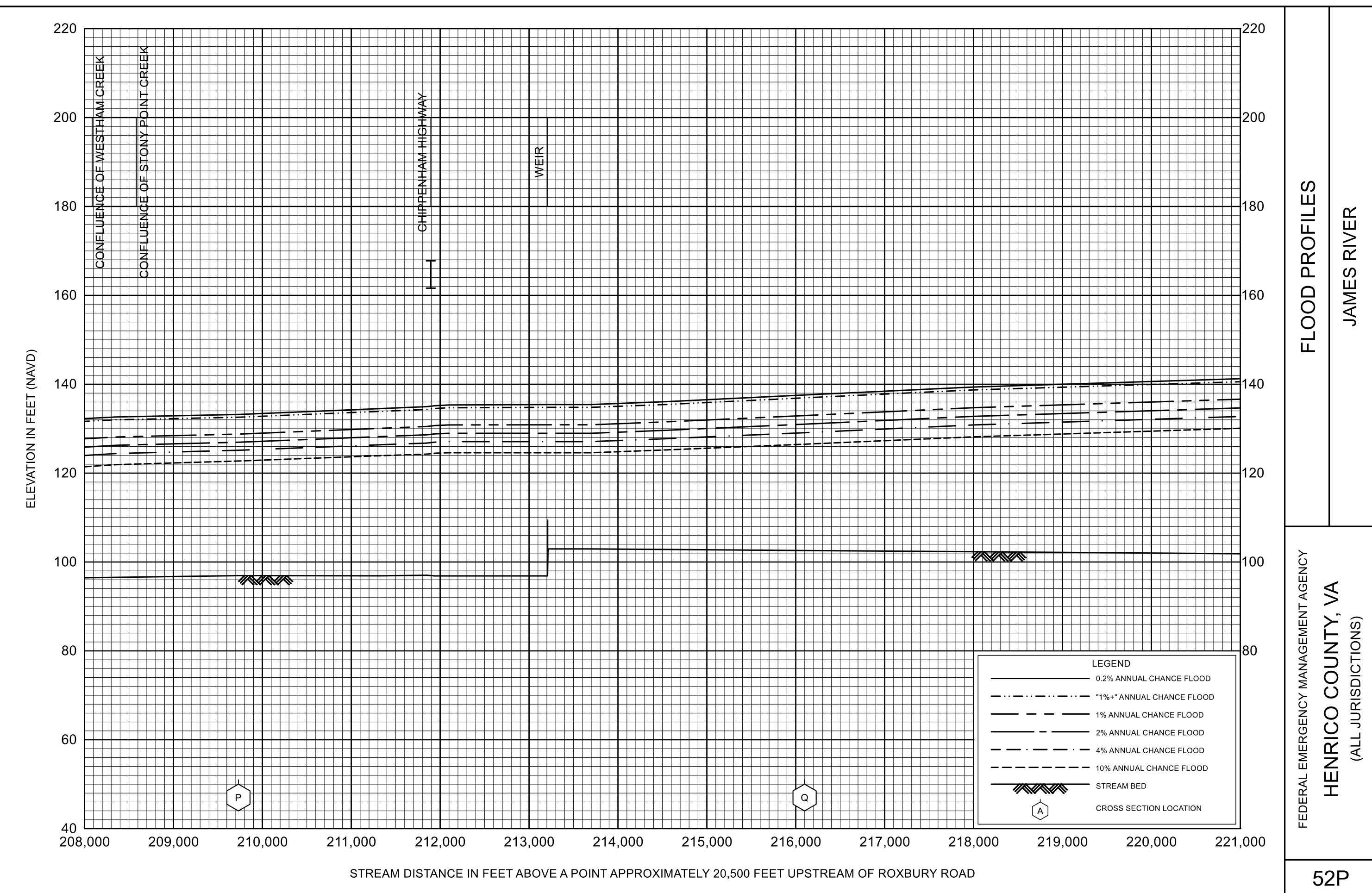


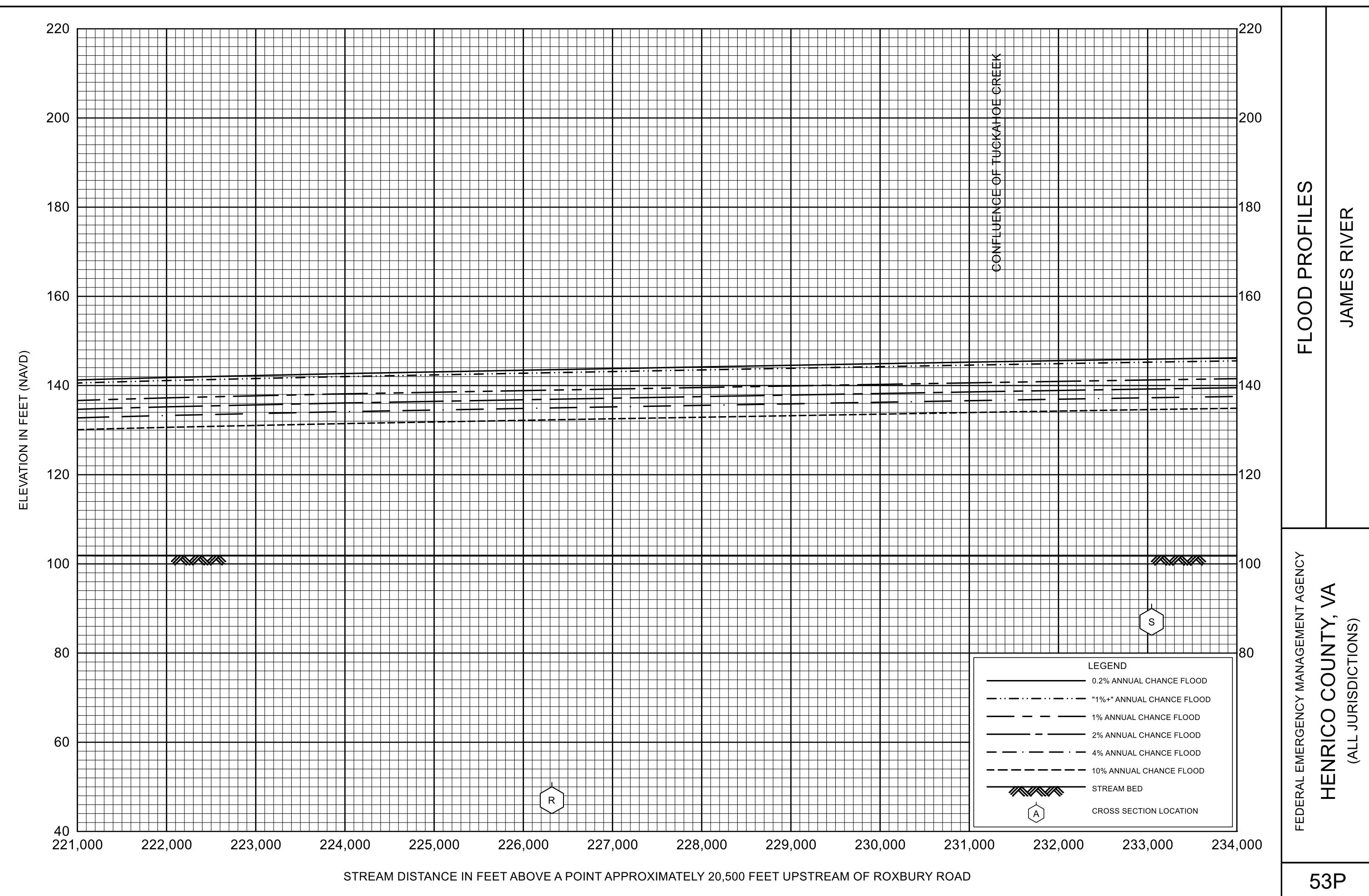


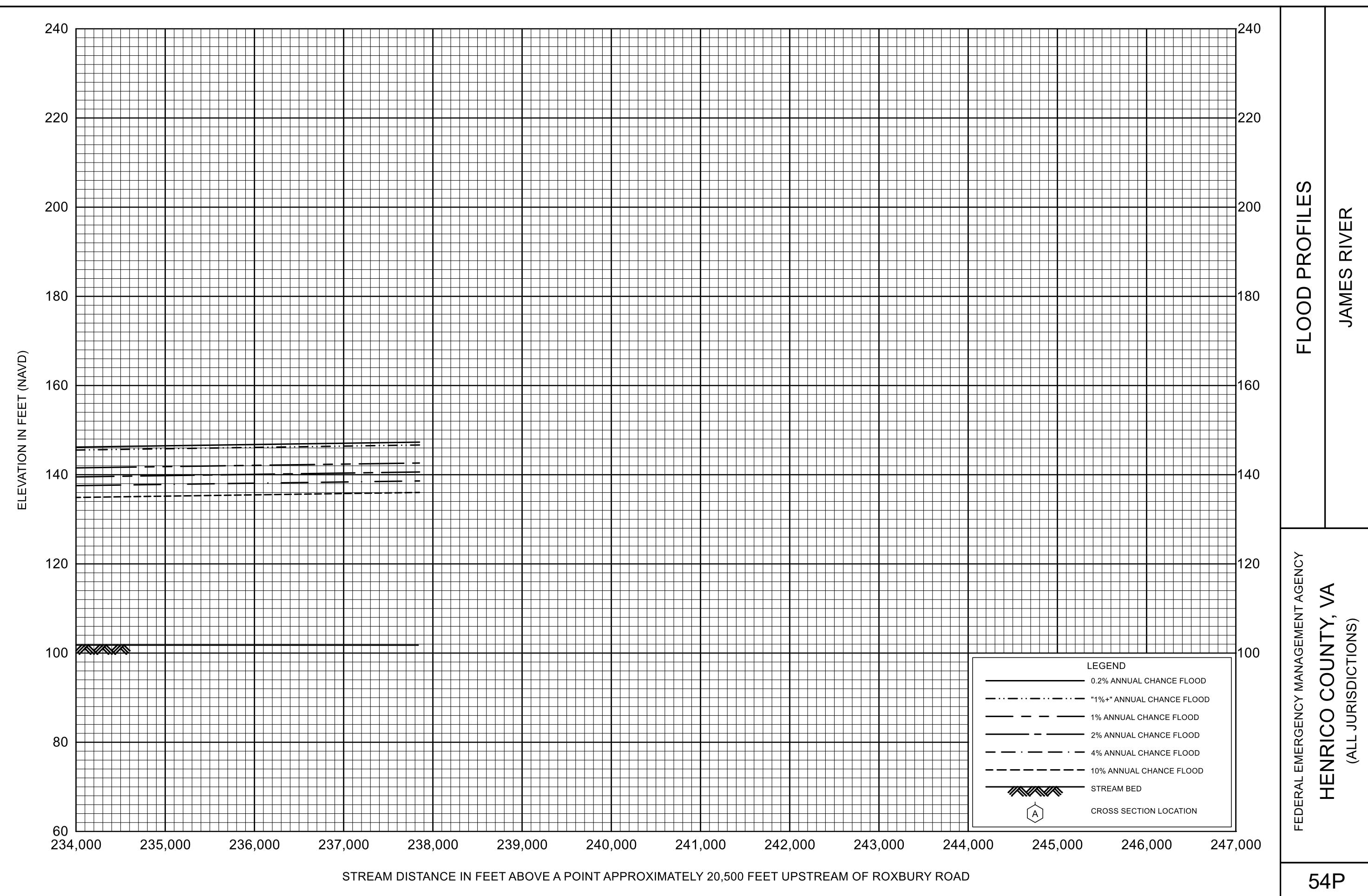


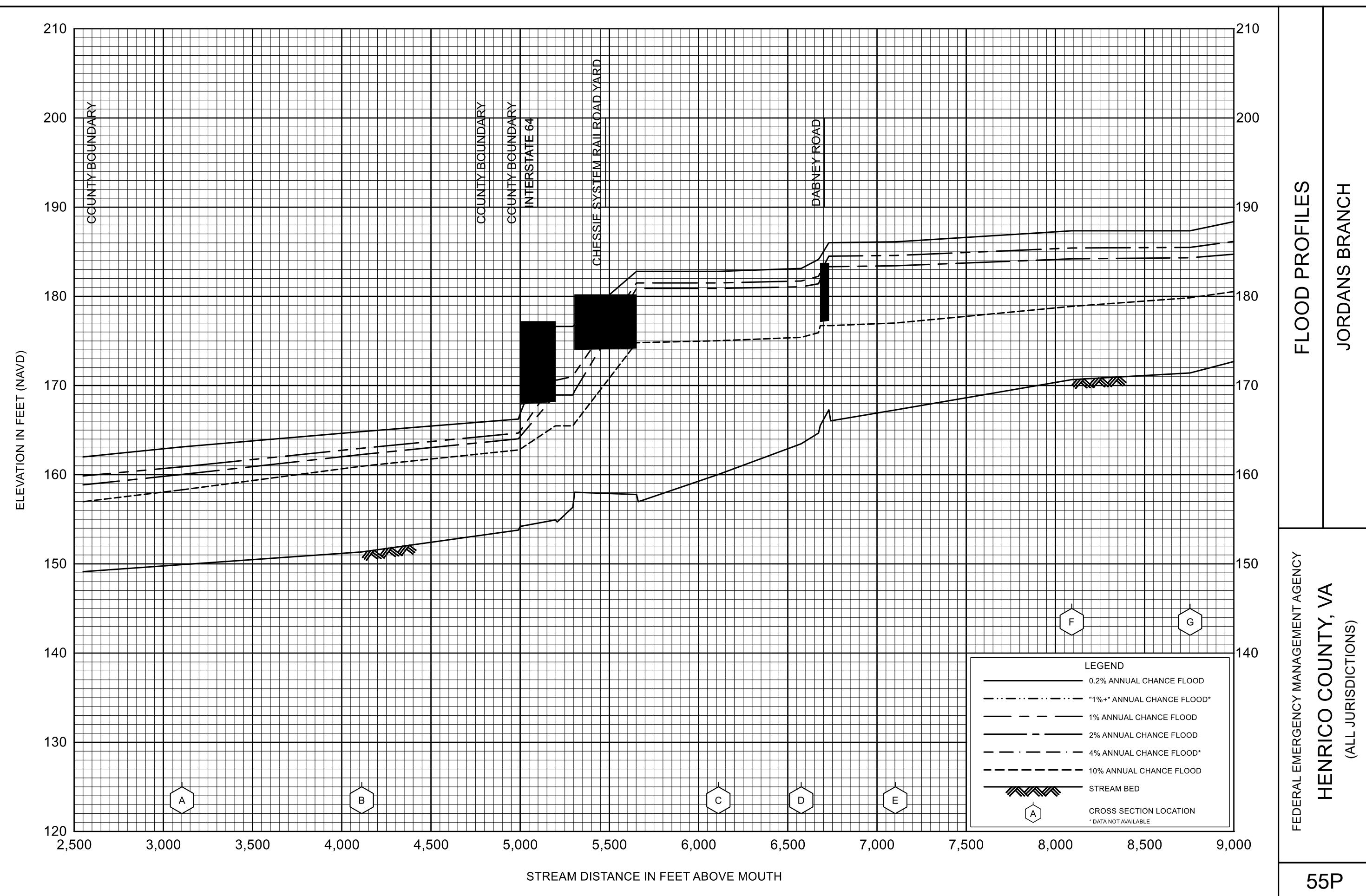


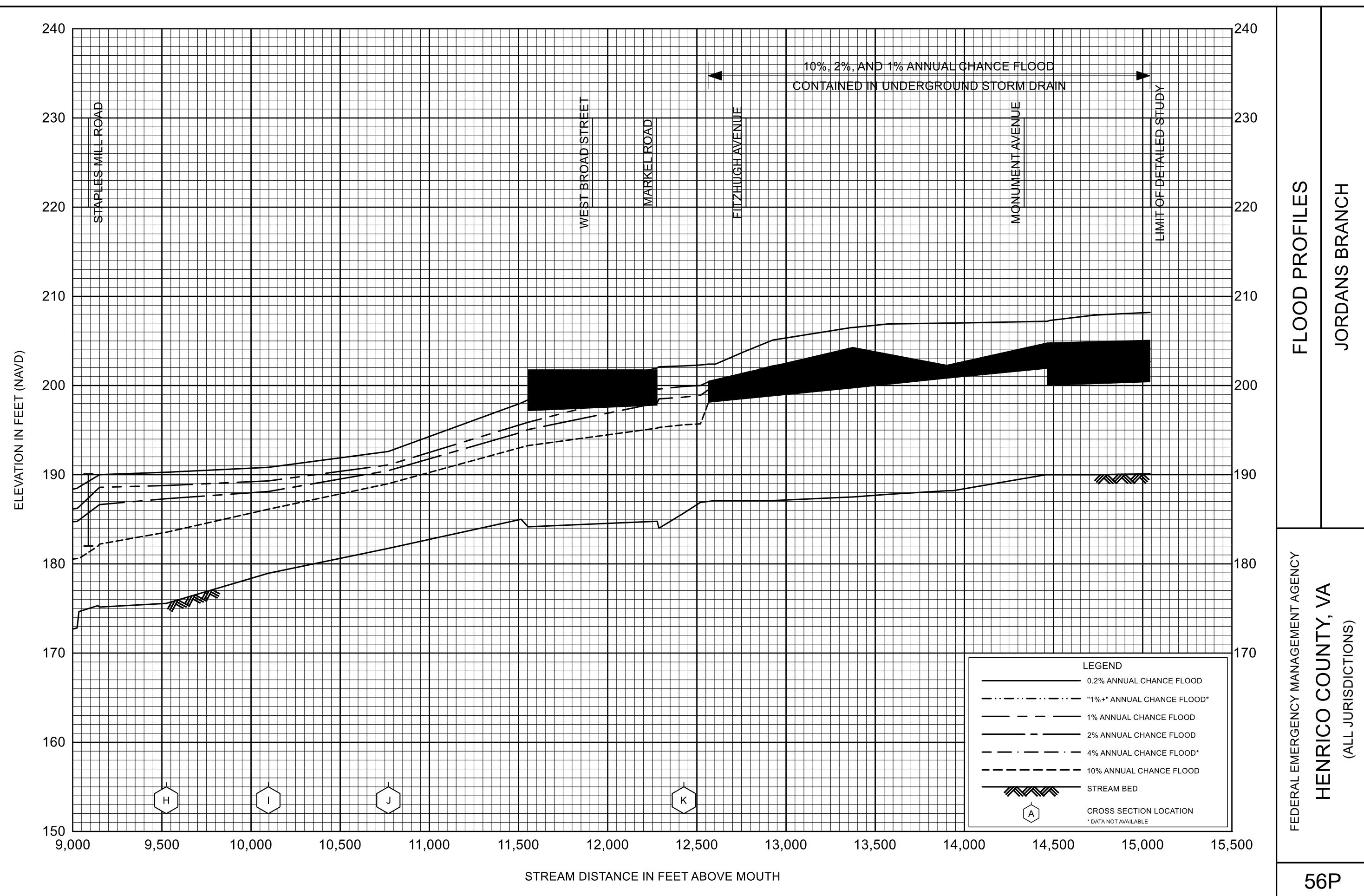


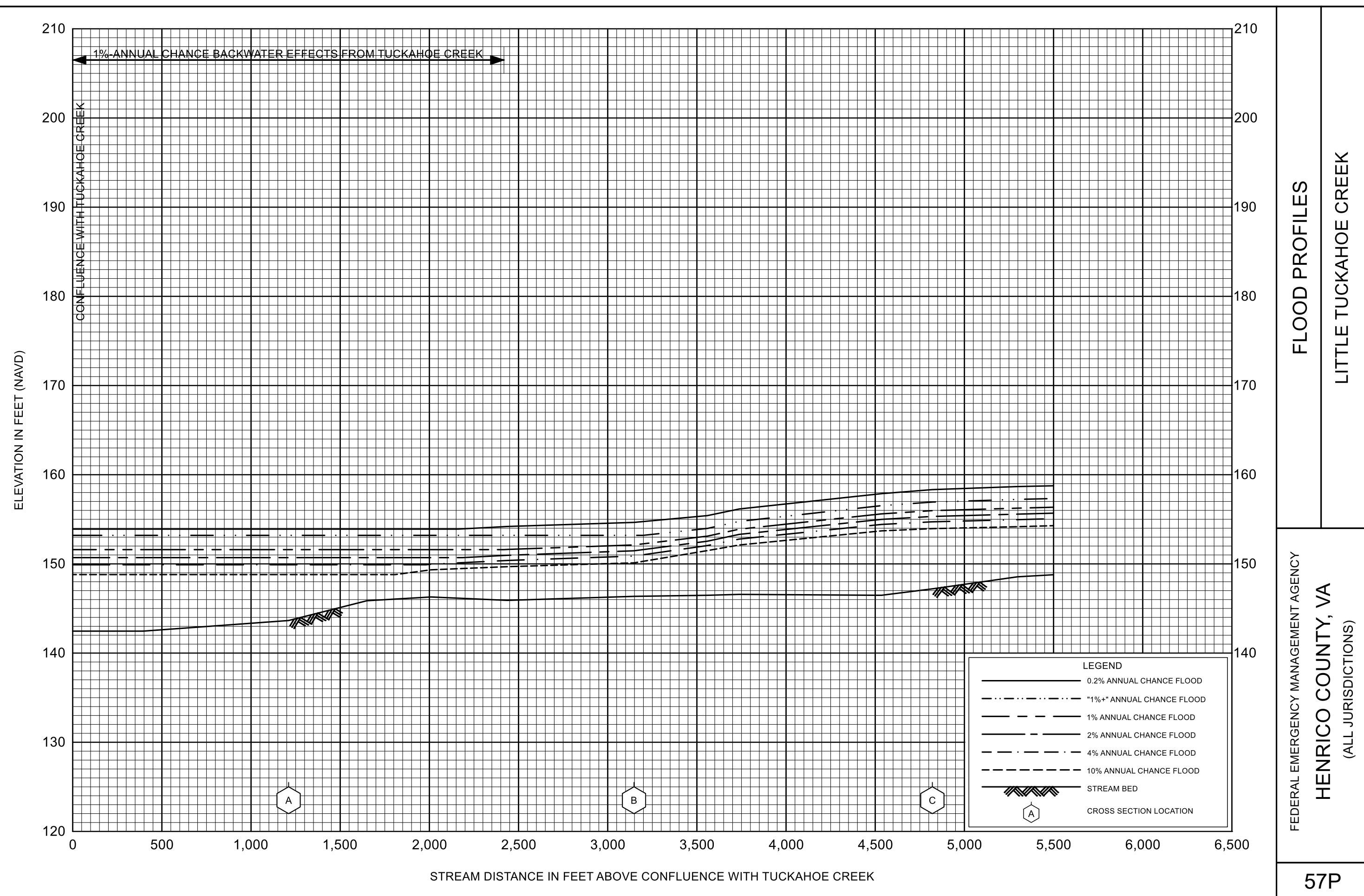


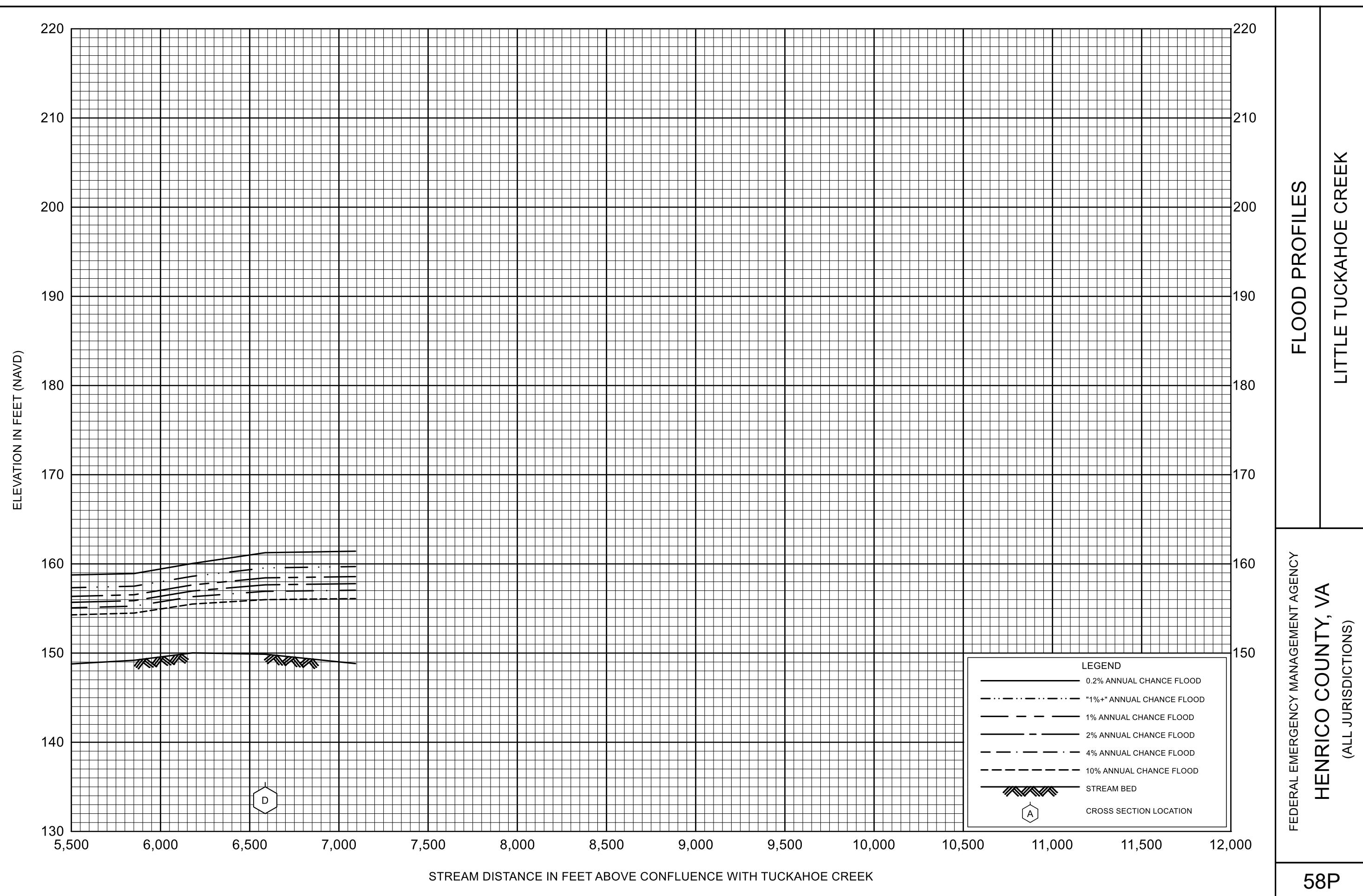


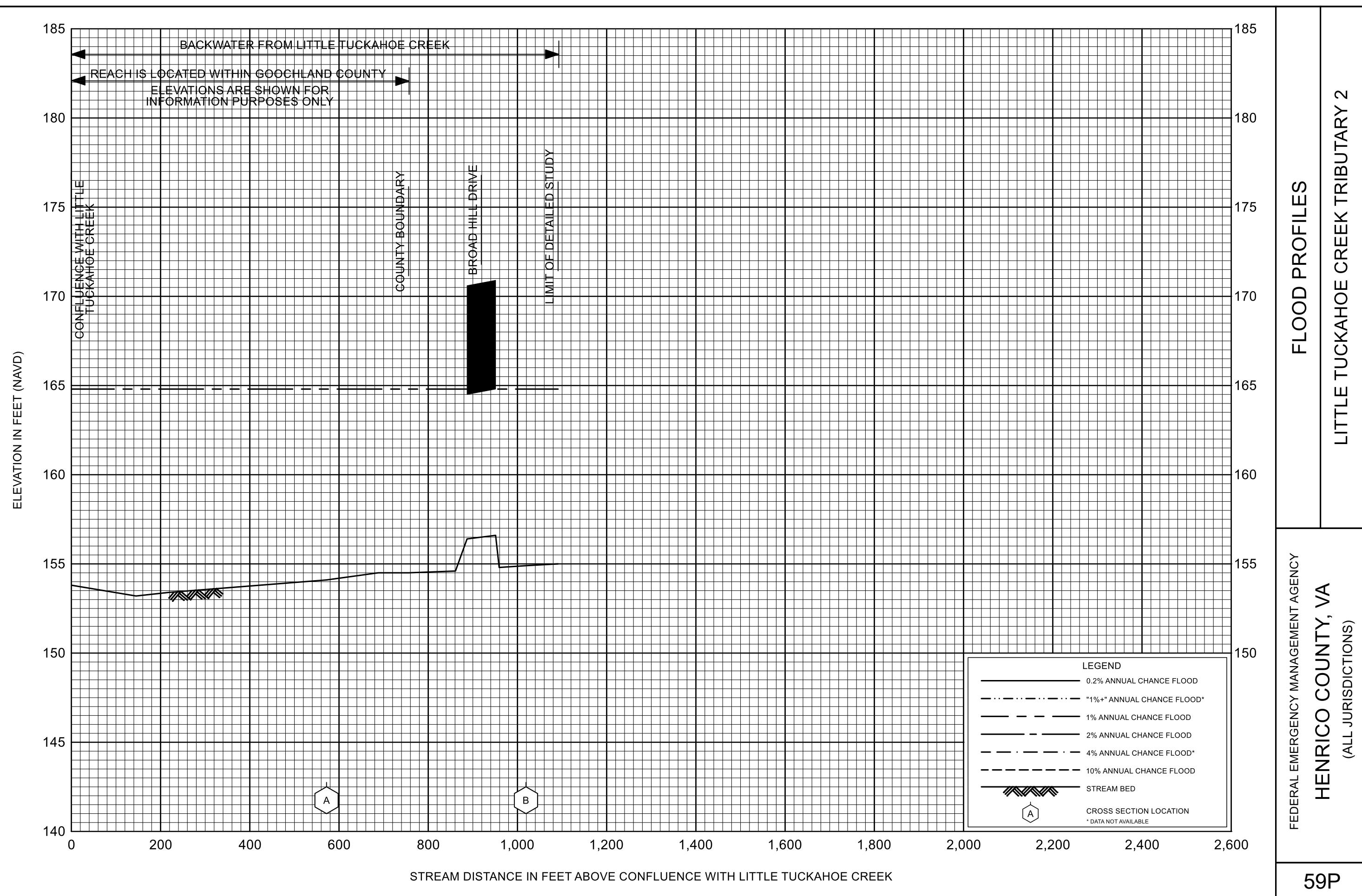


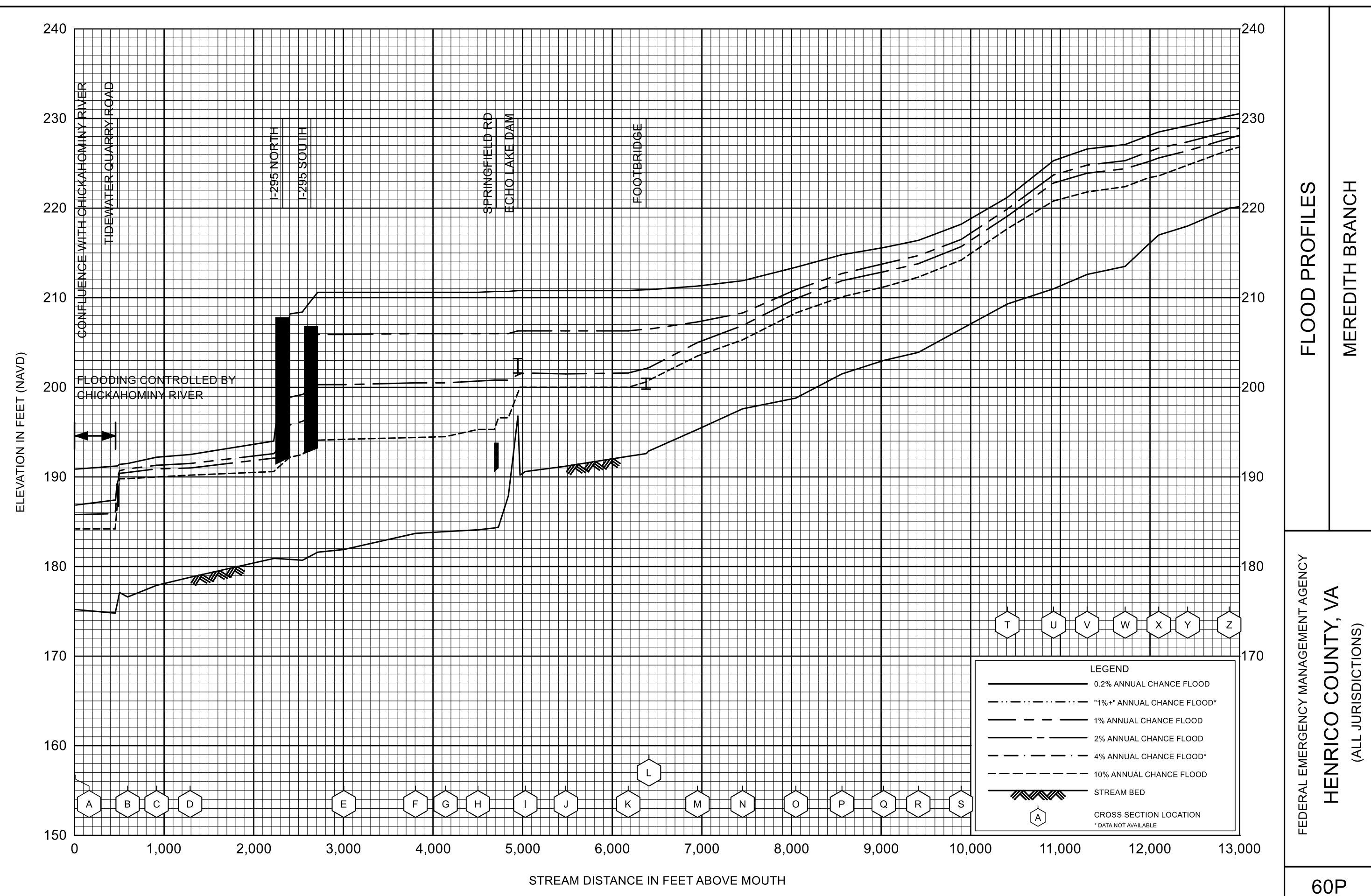


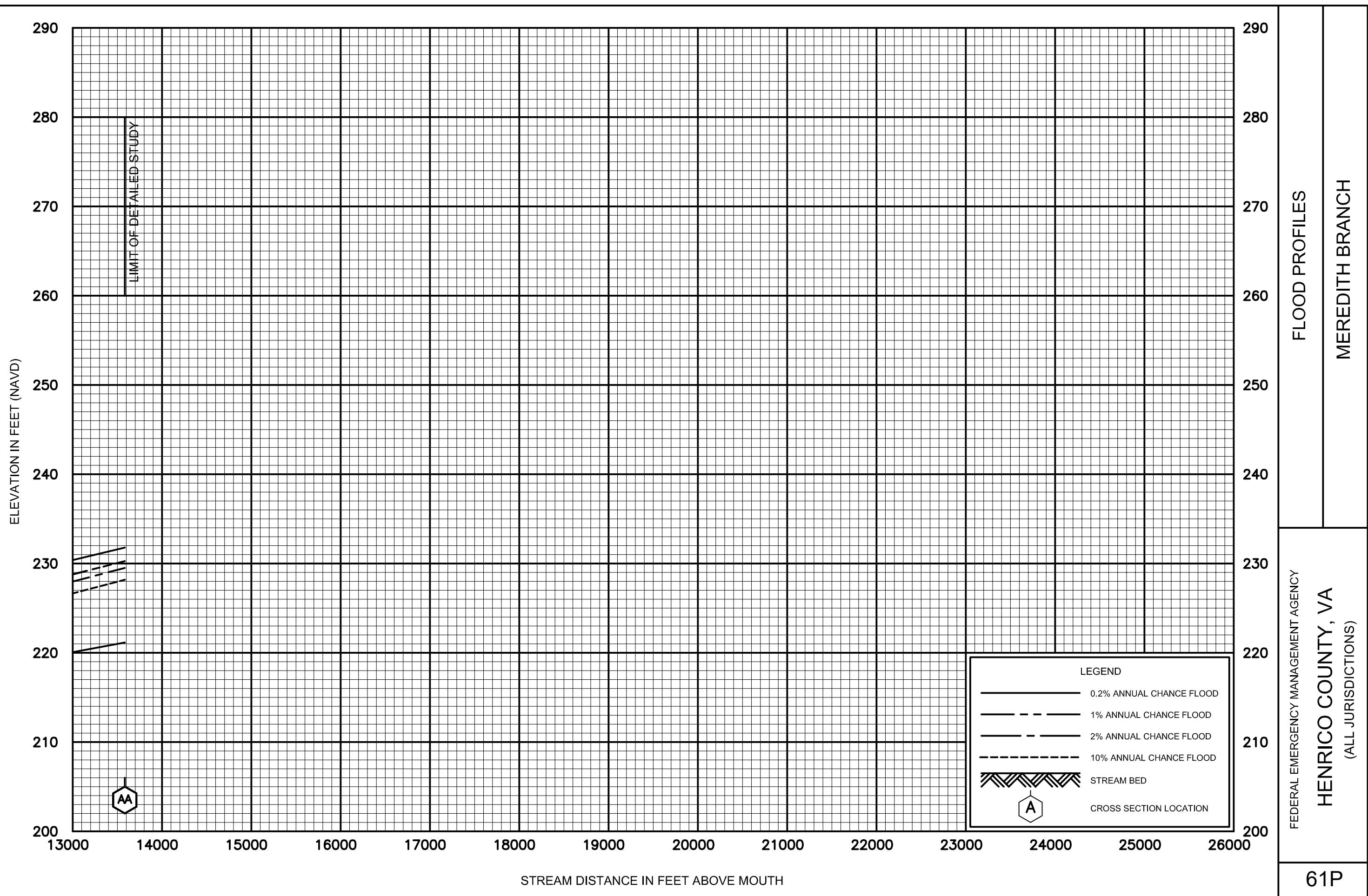


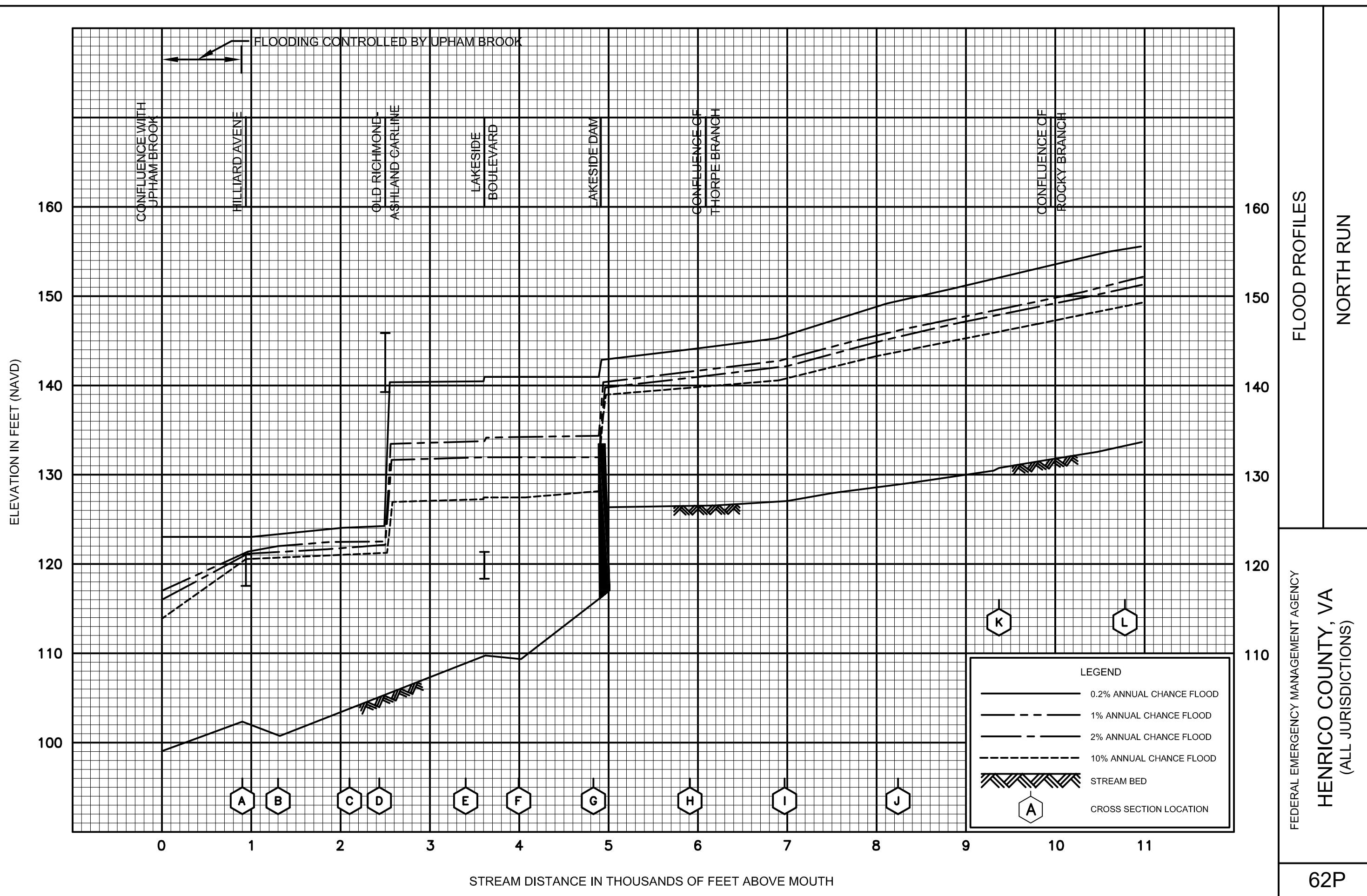


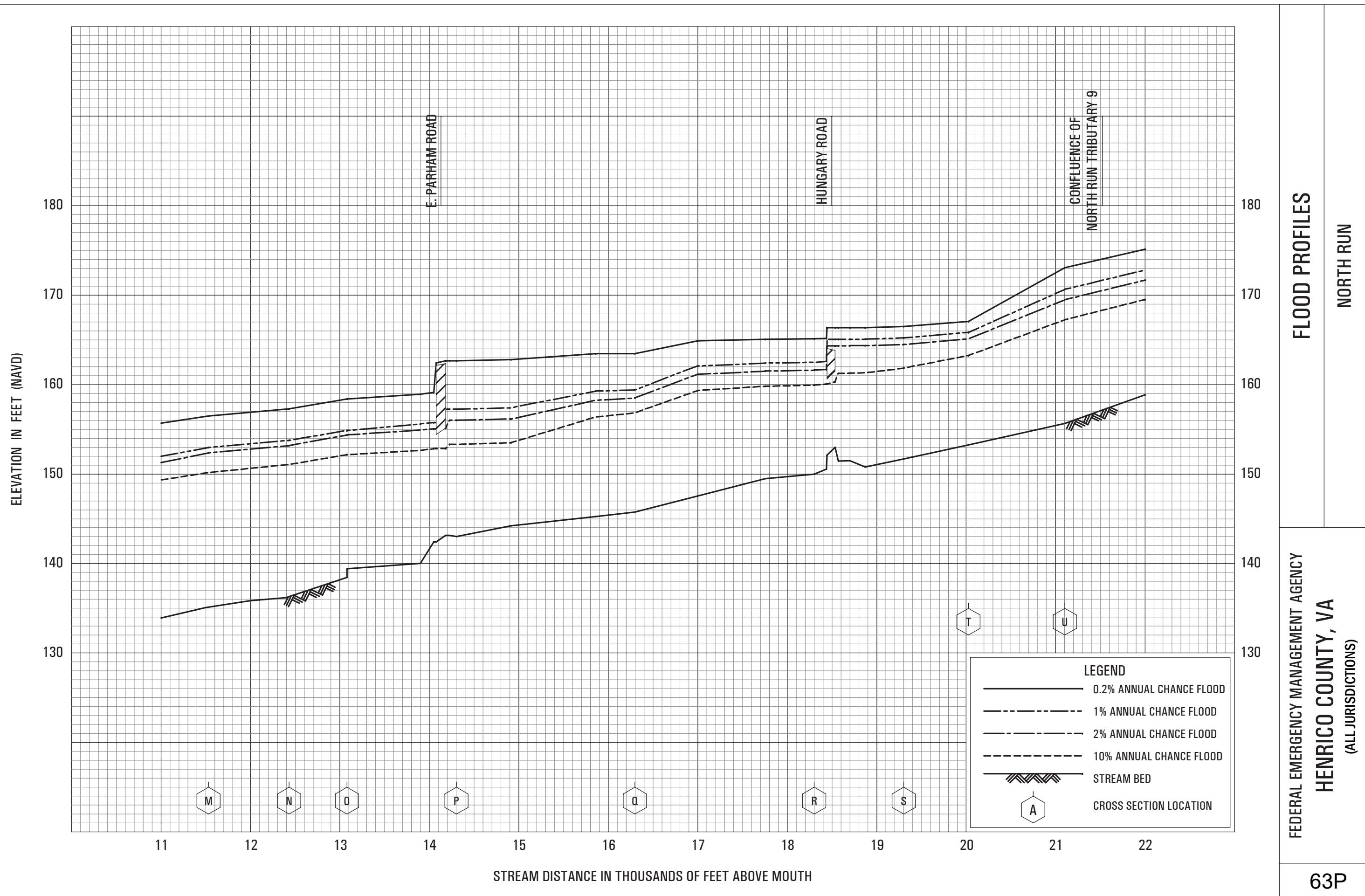




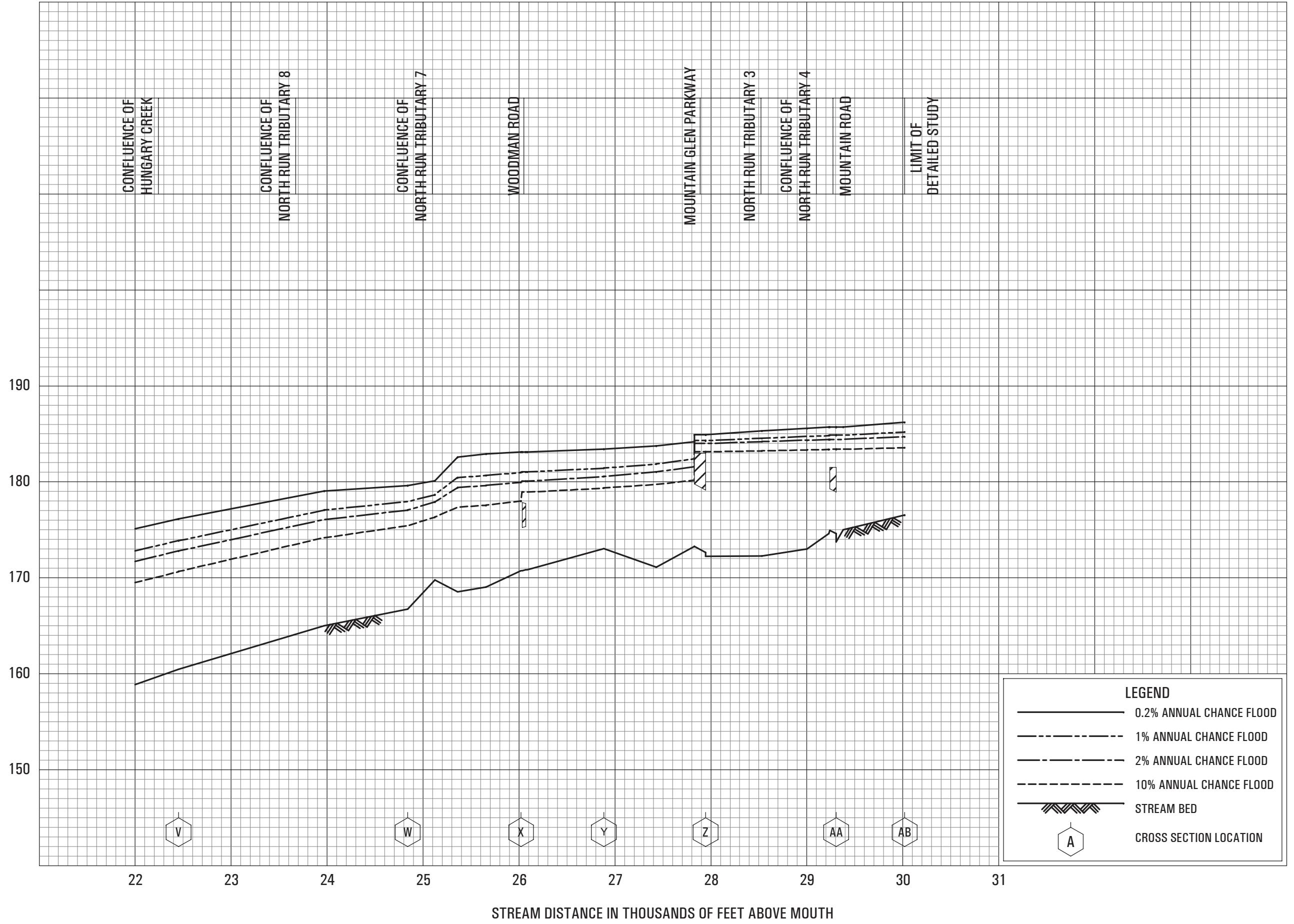








ELEVATION IN FEET (NAVD)



FEDERAL EMERGENCY MANAGEMENT AGENCY
HENRICO COUNTY, VA
(ALL JURISDICTIONS)

FLOOD PROFILES
NORTH RUN

