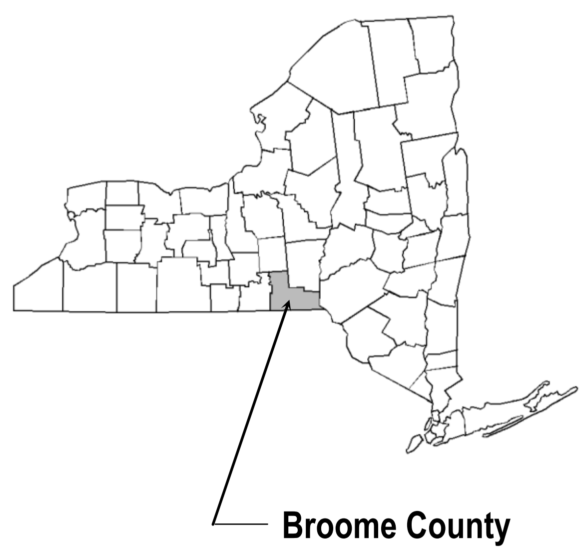
FLOOD INSURANCE STUDY

VOLUME 1 OF 2

BROOME COUNTY, NEW YORK
(ALL JURISDICTIONS)



COMMUNITY NAME	COMMUNITY NUMBER
BARKER, TOWN OF	360037
BINGHAMTON, CITY OF	360038
BINGHAMTON, TOWN OF	360039
CHENANGO, TOWN OF	360040
COLESVILLE, TOWN OF	360041
CONKLIN, TOWN OF	360042
DEPOSIT, VILLAGE OF	360043
DICKINSON, TOWN OF	360044
ENDICOTT, VILLAGE OF	360045
FENTON, TOWN OF	360046
JOHNSON CITY, VILLAGE OF	360047
KIRKWOOD, TOWN OF	360048
LISLE, TOWN OF	360049
LISLE, VILLAGE OF	360050
MAINE, TOWN OF	360051
NANTICOKE, TOWN OF	360052
PORT DICKINSON, VILLAGE OF	360053
SANFORD, TOWN OF	360054
TRIANGLE, TOWN OF	360055
UNION, TOWN OF	360056
VESTAL, TOWN OF	360057
WHITNEY POINT, VILLAGE OF	360058
WINDSOR, TOWN OF	360059
WINDSOR, VILLAGE OF	360060

PRELIMINARY:
February 5, 2010

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
36007CV001A

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) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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

Initial Countywide FIS Effective Date:

Revised Countywide FIS Date:

TABLE OF CONTENTS – Volume 1

TABLE OF CONTENTS – Volume 1 - continued

TABLE OF CONTENTS – Volume 2

EXHIBITS - continued

FLOOD INSURANCE STUDY
BROOME COUNTY, NEW YORK (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) investigates the existence and severity of flood hazards in, or revises and updates previous FISs/Flood Insurance Rate Maps (FIRMs) for the geographic area of Broome County, New York, including: the City of Binghamton; the Towns of Barker, Binghamton, Chenango, Colesville, Conklin, Dickinson, Fenton, Kirkwood, Lisle, Maine, Nanticoke, Sanford, Triangle, Union, Vestal and Windsor; the Villages of Deposit, Endicott, Johnson City, Lisle, Port Dickinson, Whitney Point, and Windsor (hereinafter referred to collectively as Broome County). The Village of Deposit is located in more than one county. Since the Village of Deposit lies predominantly within Broome County, it has been shown in its entirety on the Broome County FIRM (including the portion that lies in Delaware County).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by the communities of Broome County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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

1.2 Authority and Acknowledgments

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

This FIS was prepared to integrate the incorporated communities within Broome County in a countywide format. Information on the authority and acknowledgments for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below.

Barker, Town of:	the hydrologic and hydraulic analyses for the FIS report dated February 5, 1992, for the Tioughnioga River were prepared by Kozma Associates Consulting Engineers, P.C., for the Federal Emergency Management Agency (FEMA), under contract No. EMW-86-C-2244. This work was completed in December 1989. The hydrologic and hydraulic analyses for the Chenango River were taken from the FIS for the Town of Fenton.
Binghamton, City of:	the hydrologic and hydraulic analyses for the FIS report dated December 1976 were compiled by L. Robert Kimball Engineers and Century Engineering for the Federal Insurance Administration (FIA), under Contract No. H-3496.
Chenango, Town of:	the hydrologic and hydraulic analyses for the FIS report dated February 17, 1981, were prepared by the U.S. Geological Survey (USGS) for the FIA, under Inter-Agency Agreement No. IAA-H-14-78, Project Order No. 12. That work was completed in July 1979.
Colesville, Town of:	the hydrologic and hydraulic analyses for the original FIS report dated July 6, 1982, were prepared by McFarland-Johnson Engineers, Inc. (the study contractor), for FEMA, under Contract No. H-4633. That work was completed in April 1980. The hydrologic and hydraulic analyses for the January 20, 1993, FIS revision were prepared by Leonard Jackson Associates for FEMA, under Contract No. EMW-90-C-3127. That work was completed in May 1991.
Conklin, Town of:	the hydrologic and hydraulic analyses for the FIS report dated November 1976 were compiled by L. Robert Kimball Engineers and Century Engineering for the FIA, under Contract No. H-3496.

Deposit, Village of:	the hydrologic and hydraulic analyses for the FIS report dated August 1978 were performed by the Soil Conservation Service for the FIA under Interagency Agreement No. H-8-77, Project Order No. 1. That work, which was completed in August 1977, covered all significant flooding sources affecting the Village of Deposit.
Dickinson, Town of:	the hydrologic and hydraulic analyses for the FIS report dated October 1976 were compiled by L. Robert Kimball Engineers and Century Engineering for the FIA, under Contract No. H-3496.
Endicott, Village of:	the hydrologic and hydraulic analyses for the FIS report dated November 1977 were compiled by L. Robert Kimball Engineers and Century Engineering for the FIA, under Contract No. H-3496. For the September 7, 1998, revision, the hydraulic analyses, which were prepared by Leonard Jackson Associates for FEMA under Contract No. EMW-93-C-4145, were taken from the FIS for the Town of Vestal. That work was completed in April 1994.
Fenton, Town of:	the hydrologic and hydraulic analyses for the FIS report dated February 3, 1981, were prepared by the USGS for the FIA, under Inter-Agency Agreement No. IAA-H-14-78. Project Order No. 12. That work was completed in July 1979.
Johnson City, Village of:	the hydrologic and hydraulic analyses for the FIS report dated September 1977 were compiled by L. Robert Kimball Engineers and Century Engineering for the FIA, under Contract No. H-3496.
Kirkwood, Town of:	the hydrologic and hydraulic analyses for the FIS report dated December 1976 were compiled by L. Robert Kimball Engineers and Century Engineering for the FIA, under Contract No. H-3496.

Lisle, Town of:	the hydrologic and hydraulic analyses for the FIS report dated August 20, 2002, were prepared by Kozma/Medina Venture for FEMA, under Contract No. EMN-98-CO-0013. That work was completed in September 1999.
Maine, Town of:	the hydrologic and hydraulic analyses for the FIS report dated February 5, 1992, were prepared by Kozma Associates Consulting Engineers, P.C., for FEMA, under Contract No. EMW-86-C-2244. That work was completed in May 1985.
Nanticoke, Town of:	the hydrologic and hydraulic analyses for the FIS report dated December 18, 1985, were prepared by Edwards and Kelcey Engineers, Inc., for FEMA, under Contract No. EMW-C-0949. That work was completed in March 1984.
Port Dickinson, Village of:	the hydrologic and hydraulic analyses for the FIS report dated November 1976 were compiled by L. Robert Kimball Engineers and Century Engineering for the FIA, under Contract No. H-3496.
Sanford, Town of:	the hydrologic and hydraulic analyses for the FIS report dated December 1979 were performed by the Soil Conservation Service, for the FIA, under Inter-Agency Agreement No. IAA-H-8-77, Project Order No. 7. That work, which was completed in June 1978, covered all significant flooding sources affecting the Town of Sanford.
Union, Town of:	the hydrologic and hydraulic analyses for the original FIS report were compiled by L. Robert Kimball Engineers and Century Engineering for the FIA, under Contract No. H-3496. In the September 30, 1988, revision, the hydraulic analysis for Nanticoke Creek was prepared by the Soil Conservation Service. That work was completed in August 1987.

Vestal, Town of: the hydrologic and hydraulic analyses for the January 1977 FIS report were compiled by L. Robert Kimball Engineers and Century Engineering for the FIA, under Contract No. H-3496.

For the March 2, 1998, revision, the hydrologic and hydraulic analyses were prepared by Leonard Jackson Associates for FEMA, under Contract No. EMW-93-C-4145. That work was completed in April 1994.

Windsor, Town of: the hydrologic and hydraulic analyses for the FIS report dated November 3, 1981, were prepared by McFarland-Johnson Engineers, Inc., for FEMA under Contract No. H-4633. That work was completed in April 1980.

In the September 30, 1992, FIS revision, the hydrologic and hydraulic analyses for the Susquehanna River were prepared by Leonard Jackson Associates for FEMA, under Contract No. EMW-90-C-3127. That work was completed in May 1991.

Windsor, Village of: the hydrologic and hydraulic analyses for the FIS report dated August 17, 1981, were prepared by McFarland-Johnson Engineers, Inc., for FEMA under Contract No. H-4633. That work was completed in April 1980.

In the May 18, 1992, FIS revision, the hydrologic and hydraulic analyses for the Susquehanna River were prepared by Leonard Jackson Associates for FEMA, under Contract No. EMW-90-C-3127. That work was completed in May 1991.

There are no previous FISs for the Towns of Binghamton and Triangle, and the Villages of Lisle and Whitney Point; therefore, the previous authority and acknowledgment information for these communities is not included in this FIS.

For this countywide FIS, revised hydraulic and hydrologic analyses for the Chenango River, the Susquehanna River Reach 1, the Susquehanna River Reach 2, and the West Branch Delaware River were developed using detailed methods under the Hazard Mitigation and Technical Assistance Contract HSFEHQ-06-D-0162, Task Order HSFHQ-06-J-0065. The work was performed for FEMA by URS Group, Inc., in association with Dewberry & Davis LLC. The work was completed in March 2009.

Floodplains for all of the detailed study streams, including unrevised streams, have been redelineated using new topographic data provided to FEMA as part of this revision. This work was performed by Leonard Jackson Associates and Dewberry and Davis. The new topographic data was generated by the Light Detection and Ranging (LiDAR) project performed under USGS contract No. 07CRCN004. The LiDAR data were collected in the spring of 2007 and processed by Terrapoint USA, a subcontractor to Leonard Jackson Associates and Dewberry & Davis LLC. Leonard Jackson Associates and Dewberry performed the quality assurance/quality control (QA/QC) review to ensure the data met the desired specifications and to verify the usability of the data. New analyses were also performed for the majority of approximate study floodplains throughout the county using LIDAR data.

Aerial base map information shown on the FIRM was derived from information provided by the New York Office of Cyber Security & Critical Infrastructure Coordination. This information was derived for 12-inch and 24-inch resolution natural color orthoimagery from photography dated April 2006.

The projection used for the production of this FIRM is New York State Plane FIPSZONE 3102. The horizontal datum was North American Datum of 1983 (NAD83), GRS80 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to NAD83. Differences in the datum, spheroid, projection, or State Plane zones used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM. The flood elevations in this FIS and FIRM are referenced, in feet, to the North American Vertical Datum of 1988 (NAVD 88). Refer to section 3.3 for more information about the vertical datum and datum conversion.

1.3 Coordination

Consultation Coordination Officer (CCO) meetings may be held for each jurisdiction in this countywide FIS. An initial CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to review the results of the study.

The dates of the initial and final CCO meetings held for Broome County and the incorporated communities within its boundaries are shown in Table 1, "Initial and Final CCO Meetings."

TABLE 1 - INITIAL AND FINAL CCO MEETINGS

Community	Initial CCO Date	Final CCO Date
Town of Barker	*	March 26, 1991
City of Binghamton	*	October 15, 1975

*Data not available

TABLE 1 - INITIAL AND FINAL CCO MEETINGS - continued

Community	Initial CCO Date	Final CCO Date
Town of Chenango	December 1977	July 17, 1980
Town of Colesville	February 13, 1978	November 19, 1981
Town of Conklin	*	October 14, 1975
Village of Deposit	August 26, 1976	March 15, 1978
Town of Dickinson	*	October 14, 1975
Village of Endicott	*	October 15, 1975
Town of Fenton	December 1977	July 22, 1980
Village of Johnson City	*	October 15, 1975
Town of Kirkwood	*	October 14, 1975
Town of Lisle	*	July 9, 2001
Town of Maine	May 1985	March 26, 1991
Town of Nanticoke	June 17, 1982	October 11, 1984
Village of Port Dickinson	*	October 14, 1975
Town of Sanford	August 26, 1976	May 1, 1979
Town of Union	*	October 16, 1975
Town of Vestal	*	October 16, 1975
Town of Windsor	February 1978	February 17, 1981
Village of Windsor	February 1978	February 17, 1981

*Data not available

The initial CCO meetings for this first-time countywide FIS were held on October 3 – 4, 2006. Representatives of the Broome County government; Broome County Department of Planning and Economic Development; Broome County Department of Public Works; Broome County Environmental Management Council; the City of Binghamton; the Towns of Barker, Binghamton, Chenango, Colesville, Fenton, Kirkwood, Maine, Nanticoke, Sanford, Triangle, Union, Vestal, and Windsor; and the Villages of Deposit, Endicott, Johnson City, Port Dickinson, and Whitney Point; and Broome County communities attended as well as representatives of FEMA, New York State Department of Environmental Conservation (NYSDEC), and Michael Baker, Jr., Inc.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Broome County, New York.

The areas studied by detailed methods were selected 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) and on the FIRM (Exhibit 2).

TABLE 2 - FLOODING SOURCES STUDIED BY DETAILED METHODS

Big Hollow	Oquaga Creek	Tributary A to East Branch Nanticoke Creek
Butler Brook	Osborne Creek	Tributary B to East Branch Nanticoke Creek
Castle Creek	Page Brook	West Branch Delaware River
Chenango River	Sanford Tributary	West Branch Nanticoke Creek
Choconut Creek	Snake Creek	
Culver Creek	Susquehanna River Reach 1	
Dry Brook	Susquehanna River Reach 2	
Dudley Creek	Tioughnioga River Reach 1	
East Branch Nanticoke Creek	Tioughnioga River Reach 2	
Little Snake Creek		
Marsh Creek		
Nanticoke Creek		

Table 3, "Stream Name Changes," lists streams that have names in this countywide FIS other than those used in the previously printed FISs for the communities in which they are located.

TABLE 3 - STREAM NAME CHANGES

Community	Old Name	New Name
City of Binghamton	Susquehanna River	Susquehanna River Reach 1
Town of Barker	Tioughnioga River	Tioughnioga River Reach 1
Town of Colesville	Susquehanna River	Susquehanna River Reach 2
Town of Conklin	Susquehanna River	Susquehanna River Reach 1
Town of Kirkwood	Susquehanna River	Susquehanna River Reach 1
Town of Lisle	Tioughnioga River	Tioughnioga River Reach 2
Town of Union	Susquehanna River	Susquehanna River Reach 1
Town of Vestal	Susquehanna River	Susquehanna River Reach 1
Town of Windsor	Susquehanna River	Susquehanna River Reach 2
Village of Endicott	Susquehanna River	Susquehanna River Reach 1
Village of Johnson City	Susquehanna River	Susquehanna River Reach 1
Village of Windsor	Susquehanna River	Susquehanna River Reach 2

As part of this countywide FIS, updated analyses were included for the flooding sources shown in Table 4, "Scope of Revision."

TABLE 4 - SCOPE OF REVISION

Stream	Limits of Revised or New Detailed Study
Chenango River	Entire length within county
Susquehanna River Reach 1	Entire length within county
Susquehanna River Reach 2	Entire length within county
West Branch Delaware River	Entire length within county

Riverine flooding sources throughout the county have been studied by detailed methods at different times and, prior to this countywide FIS, often on a community-by-community basis. Table 5, "Model Dates for Riverine Flooding," provides the hydraulic modeling dates for the flooding sources studied by detailed methods in the county.

TABLE 5 – MODEL DATES FOR RIVERINE FLOODING

STREAM NAME	COMMUNITY	MOST RECENT MODEL DATE
Big Hollow	Village of Deposit	August 1977
Butler Brook	Village of Deposit	August 1977
Castle Creek	Town of Chenango	July 1979
Chenango River	Town of Barker	March 2009
Chenango River	Town of Binghamton	March 2009
Chenango River	Town of Chenango	March 2009
Chenango River	Town of Dickinson	March 2009
Chenango River	Village of Port Dickinson	March 2009
Choconut Creek	Town of Vestal	April 1994
Culver Creek	Town of Lisle	September 1999
Dry Brook	Town of Sanford	June 1978
Dudley Creek	Town of Lisle	September 1999
East Branch Nanticoke Creek	Town of Nanticoke	March 1984
Little Snake Creek	Town of Conklin	*
Marsh Creek	Town of Sanford	June 1978
Nanticoke Creek	Village of Endicott	April 1994
Nanticoke Creek	Town of Maine	May 1985
Nanticoke Creek	Town of Union	August 1987
Oquaga Creek	Village of Deposit	August 1977
Oquaga Creek	Town of Sanford	June 1978
Osborne Creek	Town of Fenton	July 1979
Page Brook	Town of Fenton	July 1979
Sanford Tributary	Town of Sanford	June 1978
Snake Creek	Town of Conklin	*
Susquehanna River Reach 1	City of Binghamton	March 2009
Susquehanna River Reach 1	Town of Barker	March 2009
Susquehanna River Reach 1	Town of Conklin	March 2009
Susquehanna River Reach 1	Town of Kirkwood	March 2009
Susquehanna River Reach 1	Town of Union	March 2009
Susquehanna River Reach 1	Town of Vestal	March 2009
Susquehanna River Reach 1	Village of Endicott	March 2009
Susquehanna River Reach 1	Village of Johnson City	March 2009
Susquehanna River Reach 2	Town of Colesville	March 2009
Susquehanna River Reach 2	Town of Windsor	March 2009
Susquehanna River Reach 2	Village of Windsor	March 2009
Tioughnioga River Reach 1	Town of Barker	December 1989
Tioughnioga River Reach 1	Town of Chenango	July 1979
Tioughnioga River Reach 2	Town of Lisle	September 1999

*Data not available.

All or portions of numerous flooding sources in the county were studied by approximate methods. Approximate methods were used to study those areas having a low development potential or minimal flood hazards.

The scope and methods of study were proposed to, and agreed upon by, FEMA, the NYSDEC, and Broome County. As part of the scoping process at the initial CCO meeting, input from the communities within Broome County was solicited to help determine which areas needed to be restudied.

2.2 Community Description

Broome County is located in the south-central portion of the State of New York. It is bordered on the north by Cortland and Chenango Counties, New York; on the east by Delaware County, New York; on the south by Susquehanna County, Pennsylvania; and on the west by Tioga County, New York. According to the 2000 U.S. Census Bureau, the population of Broome County was 200,536 and the land area was 706.82 square miles. The county is composed of 1 city, 16 towns, and 7 villages.

The climate of south-central New York is the humid continental climate that prevails in the northeastern portion of the country. Temperatures in New York are influenced by cold and dry polar air masses arriving from the north, warm and humid air masses from the Gulf of Mexico and adjacent subtropical waters, and cool, cloudy, and damp air masses that flow inland from the North Atlantic Ocean (New York State Climate Office, 2007). The impact of these air masses is reflected in the region's mean annual temperature of 48.8 degrees Fahrenheit (°F), with extremes from -28°F in the winter to 103°F in the summer. The average annual precipitation for Broome County is approximately 35 inches, most of which occurs during the months of April through October. The average annual snowfalls for Broome County are 50 inches with extremes of 120 inches occurring occasionally (U.S. Department of Housing and Urban Development (HUD), Village of Port Dickinson, 1976).

Broome County is located within the glaciated Allegheny Plateau province, which is a maturely dissected plateau modified notably by Pleistocene glaciations, particularly the late Wisconsinan glaciations. Strata of the plateau are mainly Missisippian and Pennsylvanian in age, rocks are dominantly clastic in nature; conglomerates, sandstones, and shales with some interbedded coals predominate (Thornbury, 1965). The land is composed of deeply eroded, steep-sided, flat-bottomed valleys, and flat to generally rolling plateaus varying in relief from several hundred feet in New York to 2,000 feet in Pennsylvania (HUD, Village of Johnson City, 1977).

The Town of Barker is located in the northern portion of Broome County. According to the U.S. Census Bureau, the 2000 population was 2,738, and the total land area contained within the corporate limits was 41.4 square miles. The Tioughnioga River flows diagonally across the town from the northwest corner to the southeast corner to its confluence with the Chenango River, where it has a drainage area of 761.5 square miles. It has several tributaries within the Town of Barker. The two largest of these are Bull Creek and Halfway Brook. The Chenango River flows in a southwesterly direction. Its length within the Town of Barker is approximately 0.7 mile. The centerline of the Chenango River forms part of the southeast corporate limit for the Town of Barker (FEMA, Town of Barker, 1992).

The City of Binghamton is located in the southern portion of Broome County. In 2000, a total of 47,380 resided within the 11.0 square mile area of the city (U.S. Census Bureau, 2000). This is a large decrease from the 1970 population of 64,123. Within the City of Binghamton, the major sources of flooding are the Susquehanna River and Chenango River and to a lesser extent Park and Pierce Creeks (HUD, City of Binghamton, 1976).

The Town of Binghamton is located in southern Broome County. In 2000, the town's population was 4,969, and the total land area was 25.5 square miles (U.S. Census Bureau, 2000).

The Town of Chenango is located in the north-central part of Broome County. It is situated on the west bank of the Chenango River, adjacent to the Town of Fenton. In 2000, the population was 11,454, and the total land area was approximately 34.3 square miles (U.S Census Bureau, 2000). The Chenango River, which flows south along the east border of the town, is one of the major tributaries to the Susquehanna River (FEMA, Town of Chenango, 1981).

The Town of Colesville is located in the north-central portion of Broome County. It is approximately 79.2 square miles in area, and the 2000 population was 5,441 (U.S. Census Bureau, 2000). The first white settlement in the location that would later become the Town of Colesville occurred in 1785 when an explorer from Connecticut, John Lamphere, discovered the area. The Town of Colesville was formed 36 years later on April 2, 1821. Dairy farming became the principal industry in the Town of Colesville in the early 19th century. Colesville is the only town in Broome County that has no incorporated municipalities. Nineveh, Harpursville, Sanitaria Springs, Ouaquaga, and Tunnel are unincorporated communities within the town (FEMA, Town of Colesville, 1993).

The Susquehanna River, which flows north to south through the Town of Colesville, is the principal stream in the town. The major tributaries in the Town of Colesville include Belden Brook, Wylie Brook Tributary, Osborne Creek, and Ouaquaga Creek. The drainage area of the Susquehanna River, at the southern corporate limits of Colesville, is approximately 1,787 square miles. The drainage areas of Porter Creek, Belden Brook, and Wylie Brook Tributary range from 2.6 to 21.8 square miles (FEMA, Town of Colesville, 1993).

The Town of Conklin is located in the south-central portion of Broome County. In 2000, a total population of 5,940 resided within the 24.9 square mile area of the town (U.S. Census Bureau, 2000). Within the Town of Conklin, the 1-percent-annual-chance (100-year) floodplain of the Susquehanna River includes a strip of riparian land that is roughly bounded by the CONRAIL right of way. The 1-percent-annual-chance floodplain areas of Snake Creek and Little Snake Creek are extensive but largely underdeveloped and contain only a few scattered residential structures (HUD, Town of Conklin, 1976).

The Village of Deposit is located on the Delaware and Broome County line, about 5 miles north of the Pennsylvania state line. The population of the village in 2000 was 1,699, and it had a total area of about 1.3 square miles (U.S. Census Bureau, 2000). When first incorporated in 1811, Deposit was entirely in Delaware County, and its major industry was lumbering. Logs were "deposited" on the banks of the Delaware River, made into large rafts, and floated downstream to Philadelphia and other seaports. In 1835, construction was begun on the Erie Railroad which was to connect New York City and Chicago. By the 1850s, the impact of the railroad caused a shift from lumbering to agriculture as the leading industry, making Deposit one of the leaders of milk and market food volumes in the State. In 1851, the village was reincorporated to gain the additional land necessary to sustain the industrial growth. When reincorporated, the village limits were apportioned in approximately equal areas to Broome and Delaware Counties (HUD, Village of Deposit, 1978).

Oquaga Creek, Butler Brook, Big Hollow, and Bone Creek carry runoff from the steep upland areas through Deposit into the West Branch Delaware River. Bone Creek, which has a concrete-lined channel through the village, retains its steep gradient throughout its course; whereas, the gradients of Oquaga Creek and Butler Brook become gentle in the lower reaches. The West Branch Delaware River is regulated by Cannonsville Reservoir (completed in 1965), a large water supply dam located about one mile upstream of the village (HUD, Village of Deposit, 1978).

The Town of Dickinson is located in the central part of Broome County. In 2000, the town's population totaled 5,335, and the total land area was 4.9 square miles (U.S. Census Bureau, 2000). The Chenango River flows south through the center of Dickinson. The 1-percent-annual-chance floodplain of the Chenango River includes an extensive area of the town along the west side of the river. The majority of this area is undeveloped; however, it includes a number of private residences and Broome County public facilities (HUD, Town of Dickinson, 1976).

The Village of Endicott is located in the Town of Union in western Broome County. The land total area of the village is 3.1 square miles, and it had a 2000 population of 13,038 (U.S. Census Bureau, 2000). The Susquehanna River flows northwesterly from the New York State boundary to Binghamton, where it flows southwesterly forming the village's southern corporate limits. Nanticoke Creek flows southerly through the western portion of Endicott where it empties into the Susquehanna River. Brixius Creek enters Endicott from the Town of Union at the northeast corner of the village and flows southeasterly back into the Town of Union (FEMA, Village of Endicott, 1998).

The Town of Fenton is located in the north-central part of Broome County. It is situated on the east bank of the Chenango River, adjacent to the Town of Chenango. The 2000 population in this town of 33.4 square miles was 6,909 (U.S. Census Bureau, 2000). The Chenango River, which flows south along the west border of the town, is one of the major tributaries to the Susquehanna River. With a total drainage area of 1,612 square miles at the mouth, the fan shaped basin is about 60 miles long and 40 miles wide. Within the study area, the river flows through a broad flat plain (FEMA, Town of Fenton, 1981).

The Village of Johnson City is located within the Town of Union in the southern portion of Broome County. The Village of Johnson City includes a total area of 4.6 square miles with a 2000 population of 15,535 (U.S. Census Bureau, 2000). The Susquehanna River flows generally northwest forming the village's southern boundary. Little Choconut Creek flows in a southwesterly direction through the village. Finch Hollow Creek, a tributary of Little Choconut Creek, flows in a southerly direction through Johnson City (HUD, Village of Johnson City, 1977).

The Town of Kirkwood is located in the south-central portion of Broome County. In 2000, a total population of 5,651 persons resided within the 31.4 square mile area of the town (U.S. Census Bureau, 2000). The 1-percent-annual-chance floodplain of the Susquehanna River includes a varying width area of river edge land along the east bank. The area is primarily undeveloped but includes scattered permanent and seasonal residences, a mobile home park, and several commercial establishments (HUD, Town of Kirkwood, 1976).

The Town of Lisle is located in the northwest corner of Broome County in south-central New York. The population of the town in 2000 was 2,707, and it had a total land area of 47 square miles (U.S. Census Bureau, 2000).

The Tioughnioga River Reach 2 flows in a generally southerly direction through the eastern portion of the town. At the northern corporate limits of the Village of Lisle, the drainage area of the Tioughnioga River Reach 2 is about 425 square miles. Dudley Creek at its confluence with Tioughnioga River Reach 2 has a drainage area of about 29.4 square miles, whereas Culver Creek has a drainage area of 11.1 square miles at its confluence with Dudley Creek (FEMA, Town of Lisle, 2002).

The Town of Lisle is serviced by Interstate 81 and U.S. Route 11, both of which carry traffic in a north-south direction. New York State Route 79 runs east-west through the town westerly from the Village of Lisle. The Erie-Lackawanna Railroad also runs through the town, closely paralleling the Tioughnioga River (FEMA, Town of Lisle, 2002).

The Village of Lisle lies within the Town of Lisle. The population of the village in 2000 was 302, and it had a land area of 0.9 square miles (U.S. Census Bureau, 2000).

The Town of Maine is located in the west-central portion of Broome County. According to the 2000 U.S. Census, the total land area of the town was 45.8 square miles, and its population was 5,459. Nanticoke Creek enters the Town of Maine at its most northerly border, flows south through the west-central portion of the town, and exits through its most southerly border into the adjacent Town of Union. Nanticoke Creek has several tributaries within the Town of Maine. The largest of these are Crocker Creek, Ketchumville Branch, and East Branch of Nanticoke Creek (FEMA, Town of Maine, 1992).

The Town of Nanticoke is located in northwest Broome County. The total land area contained within the corporate limits is approximately 24.5 square miles. According to the US Census Bureau figures, the population of the town increased from 794 in 1960 to 1,790 in 2000.

East Branch Nanticoke Creek, which primarily parallels State Route 26 in a southwest direction through the town, is a tributary of the Susquehanna River. It is approximately 5.3 miles long with a drainage area of 11.9 square miles to the southern boundary of the town (FEMA, Town of Nanticoke, 1985).

Tributary A to East Branch Nanticoke Creek flows in a western direction approximately paralleling Leekville Road. It is approximately 1.9 miles long with a drainage area of 14 square miles. Tributary B to East Branch Nanticoke Creek is approximately 2.6 miles long flowing in a southwestern direction. It has a drainage area of 2.2 square miles. West Branch Nanticoke Creek flows in a southeastern direction and joins the East Branch Nanticoke Creek in the Town of Maine. This stream is approximately 6.1 miles long with a drainage area of 5.2 square miles to the town's southern corporate limits (FEMA, Town of Nanticoke, 1985).

The Village of Port Dickinson, within the Town of Dickinson, is located in the central portion of Broome County. In 2000, 1,697 people resided within the 0.7 square mile total area of the village (U.S. Census Bureau, 2000). The village was incorporated on July 25, 1876. The Chenango River forms the western boundary of the village (HUD, Village of Port Dickinson, 1976).

The Town of Sanford is located in the southeastern corner of Broome County. The population of Sanford in 2000 was 2,477, in an area of 91.0 square miles (U.S. Census Bureau, 2000). Within the Town of Sanford, the West Branch Delaware River is regulated by Cannonsville Reservoir, a large water-supply dam located approximately 1.5 miles upstream of Sanford. Steep hillsides carry runoff into the wide valleys. Oquago Creek separates the highlands of the town into two parts; the summits are 600 to 800 feet above the valleys (FEMA, Town of Sanford, 1979).

The West Branch Delaware River forms the southeastern corporate limits between the Village of Deposit and the State of Pennsylvania. Oquaga Creek, Marsh Creek, Dry Brook, and Sanford Tributary flow south to the Hamlet of McClure and then flow east to the Village of Deposit where Oquaga Creek joins the West

Branch Delaware River. Deer Lake is on the upper end of Fly Creek (which flows south and then east to the confluence with Oquaga Creek at McClure) and lies partly to the west of the Town of Sanford corporate limits. Big Hollow flows southerly to the Village of Deposit corporate limits where it joins the West Branch Delaware River (FEMA, Town of Sanford, 1979).

The Town of Triangle is located in the northern portion of Broome County. In 2000, the population of the town was 3,032, and the total land area was 39.8 square miles (U.S. Census Bureau, 2000).

The Town of Union is located along the western boundary of Broome County. The Susquehanna River forms a portion of Union's southern boundary (FEMA, Town of Union, 1988). The 2000 population, excluding the Villages of Endicott and Johnson City, totaled 56,298 persons who resided within the 35.8 square mile area of the town (U.S. Census Bureau, 2000).

The Town of Vestal is located in southern Broome County. The Town is approximately 52.7 square miles and had a 2000 population of 26,535 (U.S. Census Bureau, 2000). Flooding sources within Vestal include the Susquehanna River, which flows generally southwestward forming the town's northern boundary, and Choconut Creek, which flows north through the center of town and empties into the Susquehanna River. A number of minor tributary streams flow through the town. Most important of these are Sugar and Tracey Creeks (FEMA, Town of Vestal, 1998).

The Village of Whitney Point is located in the northern part of Broome County. In 2000, the village's population was 965, and the total land area was 1.1 square miles (U.S. Census Bureau, 2000).

The Town of Windsor is located near the eastern boundary of Broome County. The town is 92.8 square miles, and, according to the 2000 census, the town's population was 6,421 (U.S. Census Bureau, 2000). The Susquehanna River is the principal stream in the Town of Windsor.

The Village of Windsor is located in southeastern Broome County. The village is completely surrounded by the Town of Windsor. The Village of Windsor had a population of 1,051 in 1990; in 2000, the population decreased to 901, and the land area was 1.2 square miles (FEMA, Town of Windsor, 1992, U.S. Census Bureau, 2000).

In the Town and Village of Windsor, the Susquehanna River, which originates at Otsego Lake in the Town of Cooperstown, flows south through the communities and is the principal stream in the area. The drainage area of the Susquehanna River at the southern corporate limits of the town is approximately 1,849 square miles (FEMA, Town of Windsor, 1992). Occanum Creek, which flows east through the village, has a drainage area of 14.4 square miles at its confluence with the Susquehanna River. It is the only significant tributary to the Susquehanna

River in the village. The average slope of the Susquehanna River in the study area is approximately 2.6 feet per mile (FEMA, Village of Windsor, 1992).

In the Town of Windsor, other flooding sources include Sage Creek, which has a drainage area of 13.0 square miles at its confluence with the Susquehanna River. Tuscarora Creek has a drainage area of 8.9 square miles at its confluence with the Susquehanna River (FEMA, Town of Windsor, 1992).

2.3 Principal Flood Problems

Flooding may occur in the county during any season of the year, but is most likely to occur in the late winter-early spring months when the melting snow may combine with intense rainfall to produce increased runoff. During the winter, flooding has been a threat when ice and debris jam in the channel and at bridges. Summer and fall floods occur due to hurricane and thunderstorm activity (FEMA, Town of Barker, 1992). On July 7 and 8, 1935, thunderstorms caused flooding in south central New York over a two-day period, inundating the region after more than nine inches of rain fell on some parts of the Chenango River basin (U.S. Department of the Interior, 1938). At the USGS gaging station on the Chenango River at Chenango Forks, the flood discharge of 96,000 cubic feet per second (cfs) exceeded that of the 1-percent-annual-chance flood (FEMA, Town of Barker, 1992). It remains the flood of record for the Chenango River (URS Group, Inc., and Dewberry & Davis LLC, 2009).

Since 1913, the Susquehanna River has left its banks over 100 times. Many of these floods have caused extensive damage to commercial and industrial developments, roads, crops, farm buildings, and homes (FEMA City of Binghamton, 1976). The flood of record for the Susquehanna River Reach 1 and the Susquehanna River Reach 2 occurred in June 2006 as a result of heavy rains from extra-tropical storm Ernesto. The flood caused widespread damage throughout the Susquehanna River basin and nearly breached flood protection levees along Susquehanna River Reach 1. Record discharges were recorded by USGS stream gages at Windsor, New York (55,900 cfs), Conklin, New York (76,800), and Vestal, New York (119,000 cfs) (URS Group Inc. and Dewberry & Davis LLC, 2009). Other major floods occurred in 1936, 1942, 1948, and 1964 (U.S. Army Corps of Engineers [USACE], 1969).

The flood of record for the West Branch Delaware River was also observed during the June 2006 storm event. The USGS gage at Hale Eddy, NewYork, recorded a discharge of 43,400 cfs, which exceeds the 1-percent-annual-chance flood (URS Group, Inc., 2008).

For Castle Creek and other smaller streams in the Town of Chenango, stream bank and highway embankment erosion caused by high flow velocities present the most serious flooding problems (FEMA, Town of Chenango, 1981).

In the Village of Deposit, flooding on several streams has caused damage. Butler Brook floods almost every year, causing damage to residential, farm, and commercial properties on the east side of the village. Flooding from Big Hollow has also damaged the school and residential properties. Oquaga Creek can flood residential and commercial properties in the Borden Street area. The West Branch Delaware River floods infrequently and normally floods a relatively small area. Some agricultural flood damage above the Pine Street bridge occurs as well as some residential and commercial flood damage between Pine Street and the CONRAIL embankment (HUD, Village of Deposit, 1978).

Most of the Bone Creek channel is now concrete-lined through the village. In 1929, a flood on Bone Creek led to the subsequent construction of the concrete lined channel. Velocities are high during flood flows and significant amounts of sediment are transported downstream to where the river bends and encounters bridges in the village. Sediment will obstruct the channel causing the floodwater to flow over yards and down streets, finally emptying into Butler Brook above the CONRAIL bridge. One of the largest floods on record occurred in 1903, when the West Branch Delaware River overflowed its banks, sending floodwaters through the center of the village. However, this was before the Cannonsville Reservoir was built, and such a flood today would exceed a 0.2-percent-annual-chance (500-year) event (HUD, Village of Deposit, 1978).

A severe flood occurred in July 1970 and caused damage to over 50 residences and commercial buildings within the village. The majority of the damage was caused by Bone Creek where the frequency was equal to a 1-percent-annual-chance flood. Damage from Butler Brook was less severe, equaling about a 20-percent-annual-chance (5-year) flood, because the storm was centered to the west of Deposit and had decreased greatly in intensity as it passed the Oquaga Creek Watershed. Several less severe floods have occurred since 1970 (HUD, Village of Deposit, 1978).

In the Village of Johnson City, Finch Hollow Creek and Little Choconut Creek are sources of minor flooding. Flooding on these creeks has basically the same causes as flooding on the Susquehanna River, but with the added effect of backwater from the Susquehanna River (HUD, Village of Johnson City, 1977).

In the Town of Nanticoke, the flash flood of July 11, 1976, resulting from intense rainfall over the Nanticoke Creek watershed, particularly on East Branch Nanticoke Creek, caused approximately $900,000 in damage with approximately 30 homes in Glen Audrey the most severely damaged (The Marathon Independent, 1976). Both East Branch Nanticoke Creek and West Branch Nanticoke Creek, along with several tributaries, crested within one hour of the start of the rainfall, with several residents who were visiting nearby communities unaware of the flooding until they returned to Nanticoke. This storm had a peak discharge of 5,350 cfs on East Branch Nanticoke Creek at the southern corporate limits. The return frequency was estimated at once in 2,000 years. Several roads, including State Route 26 at several locations and Pendall Hill Road, were overtopped and impassable. The Leekville Road and Dunham Hill Road bridges over East Branch Nanticoke Creek were washed out. Erosion resulting from the swollen Nanticoke Creek undermined trailers at the Green Valley Trailer Park in

Glen Aubrey. The presence of five flood detention ponds on West Branch Nanticoke Creek significantly minimized flooding and resultant damages along the creek (FEMA, Town of Nanticoke, 1985).

In the Town of Sanford, all streams in the community have caused floodwater damage. The West Branch Delaware River floods infrequently; however, when it overflows, it floods a minimal area throughout the length of the stream, except for a 3-mile segment beginning approximately 4,000 feet downstream of the State Highway 17 Bridge. The most severe flooding along Oquaga Creek occurs in the Hamlet of McClure and at its confluence with Marsh Creek. The July 1970 flood is the most recent flood of record. The areal extent was limited to the eastern part of the Oquaga Creek watershed. The discharge at the mouth of Oquaga Creek was approximately the 1-percent-annual-chance flow. Sediment and debris increased the severity of flooding on Marsh Creek and Deer Lake (FEMA, Town of Sanford, 1979).

2.4 Flood Protection Measures

The Endicott-Johnson City-Vestal project consists of four flood protection units that provide for the protection of communities within the Towns of Union and Vestal and the Villages of Endicott and Johnson City against a design flood of 126,000 cfs on the Susquehanna River Reach 1. For discharges up to 126,000 cfs, the levees within the units are designed to provide a minimum of 3 feet of freeboard. The protective works include approximately 39,400 linear feet of earth levees, 2,800 feet of concrete walls, channel improvements and relocation, channel clearing, drainage structures, pumping stations, highway and railroad closures, and other appurtenant works (NYSDEC – Endicott Flood Control Project, 2008). A detailed description of the flood protection measures for each unit can be found below.

Unit 1, which provides protection to the Village of Johnson City and the Westover area, is divided into two parts. Protection from Part One extends from the Erie Railroad embankment, northeast of the junction of Fifth Street with Endwell Street, and continues in a southerly direction along the right bank of Little Choconut Creek approximately 750 feet to New York Route 17, which is spanned by a stoplog closure structure. The levee continues 1,050 feet downstream from New York Route 17 to a single track railroad siding, which is spanned by a stoplog structure, closure No. 2 (21' 1 3/4" long and 9' 6" high). The improvement in this area consists of a 145 cfs storm water pumping station, clearing and snagging of Little Choconut Creek, and straightening of the channel. From the railroad siding, the levee continues 908 feet downstream to a concrete flood wall and “I” wall 39 feet long and thence to a second railroad siding where a second stoplog structure, 21' 1 3/4" long and 10' 0" high crosses the siding. From the downstream side of the second stoplog structure, the improvement consists of 223 feet of concrete flood wall extending to high ground (NYSDEC – Johnson City Flood Control Project, 2008).

A ring levee was constructed around the Johnson City Street Water Company Plant. This starts on high ground 20 feet east of Camden Street and south of Elbon Street and extends west 182 feet crossing Camden Street, which was raised, and then continues in the following directions: south 213 feet, southeast 119 feet, northeast 136 feet, thence east 85 feet, where it ties into high ground. The improvement on the west side of the Westover community starts from the high ground at the west end of Onondaga Street and consists of 2,545 feet of levee across New York Route 17, which was raised to pass over the levee, to high ground at the Erie Railroad embankment. The improvement also includes two steel sheet pile cutoffs passing through the Erie Railroad at station 0 + 00 and station 73 + 31.5 (NYSDEC – Johnson City Flood Control Project, 2008).

Part 2 of Unit 1 is north of the Erie Railroad and encompasses the Oakdale community. The improvement consists of 3,336 feet of levee closure on the east side extending from the railroad along the right bank of Little Choconut Creek and Finch Hollow Creek to high ground near Harry L Road, and 2,833 feet of levee on the west side extending from the railroad north to high ground. The improvement also relocated the channels of Little Choconut Creek and Finch Hollow Creek on the east side of the improvement and relocated unnamed brooks on the west side of improvements (NYSDEC – Johnson City Flood Control Project, 2008).

Unit 2 provides protection for the Town of Vestal and is divided into two parts. The Part 1 protection works extend from high ground along the right bank of Choconut Creek to New York Route 17, a distance of 3,500 feet, thence to and along the embankment of the D.L. & W. Railroad, a distance of 1,300 feet, thence across the railroad and an open field to and along the left bank of the Susquehanna River to New York State Route 26 (Bridge Street) a distance of 2,300 feet, thence 2,300 feet upstream along the river to high ground including 165 feet of natural high ground. The improvements also include one single track railroad stoplog structure, closure structure 22' 4 ½" long and 4' 9" high; one highway closure at Front Street, closure structure 49' 3" long and 3' 0' high; and clearing and snagging of Big Choconut Creek from the upstream end of the project to the Susquehanna River. A steel truss highway bridge over Big Choconut Creek at Front Street was raised approximately 5 feet and abutments capped to allow the highway to be raised five feet over the levee. Two access roads were provided; one north of the levee at station 45+00 provided access over the levee, and the other from Pump Station Road to ponding area No. 2 (NYSDEC – Vestal Flood Control Project, 2008).

The improvement for the community of Twin Orchards is designated Unit 2, Part 2. The protective works extend from high ground at the D.L. & W. Railroad a distance of approximately 6,300 feet around the east end of the community and thence downstream along the left bank of the Susquehanna River to a closure with high ground. Willow Run was diverted at the D.L. & W. Railroad, and a new diversion channel was constructed extending along the toe of the levee from the existing culvert under the railroad to the Susquehanna River, a distance of 2,182 feet. Vestal Road was raised approximately 10.5 feet to pass over the levee. A 6-

foot x 18-foot concrete box culvert was constructed to permit the diversion channel to pass under Vestal Road. Where the levee ties into the railroad, a cutoff was provided consisting of steel sheet piling with a concrete cap. Drainage structures through the levee provide for gravity discharge (NYSDEC – Twin Orchards Flood Control Project, 2008).

In the Village of Endicott, Unit 3 offers various types of flood protection structures along the right bank of the Susquehanna River Reach 1. The protective works extend from high ground at En-Joie Park a distance of 5,500 feet downstream along the right bank of the Susquehanna River to high ground near Badger Avenue. The improvement consists of 608 feet of levee starting from high ground approximately 190 feet east of South Street in En-Joie Park and continuing to the right bank of the Susquehanna River; 997 feet of concrete flood wall adjacent to the Endicott Water Company property and on the landside of the pumping units with riprapped fill placed approximately to the height of the existing river bank over the toe of the flood wall and keyed into the existing channel bottom; 2,648 feet of levee starting at the end of the flood wall 170 feet west of Hunt Avenue and extending downstream along the top of river bank beyond Vestal Avenue Bridge to the foot of Liberty Street; and 1,180 feet I-type wall on steel sheet piling continuing downstream adjacent to River Terrace to high ground 180 feet west of Badger Avenue. The improvements also included reconstruction of water facilities for the Endicott Water Company, consisting of three new submersible pumps and well boxes, and well boxes over three existing wells; two combined sanitary and storm water pumping stations constructed by local interests adjacent to the water company and in Mercereau Park; and other appurtenant drainage structures. The River Terrace pumping station is also located in Endicott. This station is located immediately adjacent to the Endicott Water Works Company in a residential area. The River Terrace pumping station utilizes no ponding area. The station is designed to handle a peak storm water discharge of 171 cubic feet per second from a 5-year storm (NYSDEC – Endicott Flood Control Project, 2008).

The protection works of Unit 4 in West Endicott consist of 7,848 feet of levee starting at high ground west of Nanticoke Avenue along the left bank of Nanticoke Creek across Wendell Street to the overpass of New York Route 17 over the Erie Railroad; a double track stoplog closure structure, which is 62' 0" along and 6' 2 3/8" high, and 750 feet of dike across the low spot in natural closure, starting 500 feet east of the railroad and parallel to New York Route 17. The improvement also includes two gravel access roads to extend over the levee, one crossing the levee at station 75 + 81 and the other at station 84 + 60. At the upstream end of the unit, 2,500 feet of new channel was constructed for Nanticoke Creek, and the original channel was filled to meet existing ground elevations. Drainage structures were provided for gravity discharge through the levee. A pumping station was constructed by local interests with a 20-inch steel pipe discharge line passing through the levee at station 74 + 91 (NYSDEC – West Endicott Flood Control Project, 2008).

The project consists of 3 berms around the Fairmont Park Development, a pump station, a stop log structure, an overflow channel, and a combination of several drainage pipes. The three berms, located west, southeast, and east of the Fairmont Park Development, are described below:

1. The longest berm is due west of the development and runs parallel to Homestead Road, and ends with its southern edge just past Watson Boulevard. There is a stoplog structure at this crossing point of Watson Boulevard, with concrete retaining wall on either side of the street, and a nearby stoplog storage building storing the actual stoplog, which would be placed in the road in the event of a flood. Near the midpoint of this berm is a pump station that may be used to pump high waters into a drainage conduit, which goes through and under the berm, and releases water into the golf course on the unprotected side of the berm.

2. The shortest of these berms is due east of the Fairmont Development Park and fills in a gap between a naturally high area near the Country Club parking lot and the actual development, protecting a portion of the development from possible overflow from Greys Creek.

3. Further to the southeast, a third berm separates an open area near the Country Club Tennis Courts from a protected storage tank area.

There is an overflow channel to assist in minimizing the flooding of businesses along Watson Boulevard, including the IBM Country Club and a tank storage area, from flooding of Greys Creek during high water events. A 36" RCP drains into the south end of the channel from a ponding area. At the southern end, the channel drains into a 7' by 10' box culvert, and then a 10' by 10' box culvert conveys the water to its outlet at the Susquehanna River. A network of corrugated metal pipe conduits lead from the Fairmont Development Park to the golf course via the pump station and berm, and south to the channel (NYSDEC – Fairmont Park Flood Control Project, 2008).

Two upstream dams at Whitney Point Lake on the Otselic River and East Sidney Lake on Ouleout Creek, completed in 1950, reduce flood hazards from the Susquehanna River, on both Reach 1 and Reach 2 (FEMA, Town of Union, 1988).

In the Town of Barker, there are no structural flood control measures for either the Tioughnioga or the Chenango Rivers (FEMA, Town of Barker, 1992). The town adopted Local Law No. 3 entitled "Flood Drainage Prevention Local Law," in 1987, which restricts construction in flood hazards areas. This law is in response to NFIP regulations and their revisions effective October 1, 1988 (Town of Barker).

In the City of Binghamton, protective works consist chiefly of 22,200 feet of earth levee, 13,100 feet of concrete flood walls, 3,100 feet of channel excavation, 1,060 feet of pressure conduit, check dam and channel construction on Park Creek, 645 feet of channel paving, and appurtenant drainage and closure structures along the Susquehanna and Chenango Rivers. The improvements provide protection for

Binghamton for design discharges of up to 80,000 cfs on the Susquehanna River Reach 1 and 75,000 cfs on the Chenango River. When supplemented by seven flood control dams located upstream from the area, the structures provide protection against flood discharges approximately 20 percent greater than the maximum flood of record (prior to construction), which occurred in July 1935 on the Chenango River and in March 1936 on the Susquehanna River. Two of these dams, the Whitney Point reservoir, which controls 16 percent of the drainage area of the Chenango River upstream from Binghamton, and the East Sidney Reservoir, which controls 5 percent of the drainage area of the Susquehanna River upstream from Binghamton, are now operating. Levees have been designed to provide a minimum of 2 feet of freeboard at design discharge, while floodwalls are designed to provide up to 0.5 feet of freeboard (NYSDEC – Binghamton Flood Control Project, 2008).

In the Village of Deposit, Cannonsville Reservoir has a significant effect on flood reduction on the West Branch Delaware River. Peak discharges on the West Bank Delaware River in the village have been reduced by approximately 50 percent of the pre-dam flows. The concrete lining of the Bone Creek channel has prevented much flooding by increasing the channel carrying capacity. A culvert was installed under State Route 10 above the village limits to carry out-of-bank flood flows from Butler Brook into the West Branch Delaware River. This reduces the flood flows, which otherwise would reach the village (HUD, Village of Deposit, 1978). In addition, the Soil Conservation Service (SCS) completed a Public Law 566 project in the Village in 1982. It resulted in the construction of Palmers Pond Dam upstream of Butler Brook, a diversion channel from Butler Brook to the West Branch Delaware River and a dike along Butler Brook and Big Hollow. This project reduces flooding from the 1-percent-annual-chance flood on Butler Brook .

Following the flood of 1935, dikes were constructed to protect the Village of Lisle along the Tioughnioga River and along Dudley Creek to the north and west of the village. Protective works at Lisle consist chiefly of 4,150 feet of earth levee, 970 feet of concrete flood wall, 5,700 feet of channel relocation and realignment along the Tioughnioga River, and relocation of about 3,000 feet of the Dudley Creek channel; raising of about 1,860 feet of the Erie Lackawanna single-track railroad over the levee; relocation of about 1,600 feet of Cortland Street; a new bridge relocated over Dudley Creek; and construction of appurtenant drainage structures. The improvements provide protection for Lisle against flood discharges of up to 52,000 cfs on the Tioughnioga River and 18,000 cfs on Dudley Creek. Minimum designed freeboard for the project is 2 feet (NYSDEC – Lisle Flood Control Project, 2008). More recently, in an effort to minimize risk of flood hazard and private losses due to flooding, the Town of Lisle in 1987 adopted Local Law No. 1, known as “Flood Damage Prevention” (Town of Lisle, Local Law No. 1, 1987).

In the Village of Whitney Point, protective works consist chiefly of 7,000 feet of earth levee, 1,800 feet of channel realignment, a twin-barrel reinforced concrete culvert, and other appurtenant drainage structures along the Tioughnioga River. The improvements, supplemented by the Whitney Point Dam upstream from the area, provide protection for Whitney Point Village for design discharges of up to

57,000 cfs on the Tioughnioga River and 5,000 cfs on the Otselic River. A minimum of 2 feet of freeboard is provided for flooding from the Tioughnioga River and 1 foot of freeboard for flooding from the Otselic River (NYSDEC – Whitney Point Flood Control Project, 2008).

The Town of Maine has no structural flood control measures for Nanticoke Creek (FEMA, Town of Maine, 1992). To minimize the damage to residences in the community, the Town of Maine has adopted a land use zoning ordinance and amended it on May 13, 1975, to include construction and land use restrictions in flood hazard areas (Town of Maine, 1975).

In the Town of Nanticoke, in addition to the five detention basins constructed in the watershed of West Branch Nanticoke Creek prior to the 1976 flood, one basin was constructed on a tributary to East Branch Nanticoke Creek subsequent to this flood (FEMA, Town of Nanticoke, 1985).

Although not constructed for flood protection, incidental flood damage reduction is provided by Cannonsville Reservoir on the West Branch Delaware River and by the dam at North Sanford on Oquaga Creek (FEMA, Town of Sanford, 1979).

In the Town of Union, the SCS has provided flood detention structures for Nanticoke Creek Watershed, which provide a small amount of protection. Other SCS structures on Little Choconut Creek, Finch Hollow Creek, Patterson Creek, and Brixius Creek reduce flood hazards from these streams (FEMA, Town of Union, 1988).

FEMA specifies that all levees must have a minimum of 3 foot freeboard against 1-percent-annual-chance flooding to be considered a safe flood protection structure.

Levees exist in the study area that provide the community with some degree of protection against flooding. However, it has been ascertained that some of these levees may not protect the community from rare events such as the 1-percent-annual-chance flood. The criteria used to evaluate protection against the 1-percent-annual-chance flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect against the 1-percent-annual-chance flood are not considered in the hydraulic analysis of the 1-percent-annual-chance floodplain.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this FIS. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long term average period between floods of a specific magnitude, floods could occur at short intervals or even within the same year. The risk of experiencing a flood increases when periods greater than one year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) 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 county at the time of completion of this FIS. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each riverine flooding source studied by detailed methods affecting the community.

For each community within Broome County that had a previously printed FIS report, the hydrologic analyses described in those reports have been compiled and are summarized below.

Pre-countywide Analyses

For the Tioughnioga River Reach 1 and Nanticoke Creek, the peak discharge of the selected recurrence interval was determined using the procedures and regression equations outlined in "USGS Water Resources Investigations 79-83," for ungaged sites on gaged streams (U.S. Department of the Interior, 1979; Water Resources Council, 1977). For the western region of New York, the following equation was used:

$$Q = K(DA)^{x}(St+10)^{-y}$$

where Q is the stream discharge; DA is the drainage area; St is the percentage of total drainage area shown as lakes, ponds, and swamps; K, x, and y are functions of the frequency. A value of 49,900 was used for K, 0.733 for x, and 2.03 for y, for the 1-percent-annual-chance flood discharge.

The calculated peak discharge as calculated by the regression equation for the USGS gaging station (No. 01511500) at Itaska was used to adjust the peak discharge calculated by the regression equation at an ungaged site in accordance with the following equation:

$$Qw = Qs\left[(Kg-1) * \frac{(2Ag-As)}{Ag} + 1\right]$$

where Qw is the weighted discharge at the ungaged site, Qs is the discharge calculated by the regression equation for the ungaged site, As and Ag are the drainage areas at the site and the gage respectively, and Kg is the ratio of the weighted peak discharge to the peak discharge calculated by the regression equation at the gage.

For Tioughnioga River Reach 1, Dudley Creek, and Culver Creek, the peak discharges of the selected recurrence intervals were determined using the procedures and regression equations outlined in "USGS Water Resources Investigations Report 90-4197," for ungaged streams (U.S. Department of the Interior, 1991; Water Resources Council, 1977). For Hydrologic Region 5 of New York State, the following equation was used:

$$Q=K(DA)^{w}(SL)^{x}(ST+1)^{y}(SH)^{z}$$

where Q is the stream discharge; DA is the drainage area in square miles; SL is the main channel slope in feet per mile; ST is the basin storage in percent of total basin drainage area; and SH is the basin shape index in mile per mile; whereas K, w, x, y, and z are functions of frequency. The values used for K, w, x, y, and z are functions of the frequency. The values are as follows:

FREQUENCY	K	w	x	y	Z
10-percent-annual-chance	30.2	0.981	0.295	-0.196	-0.141
2-percent-annual-chance	39.2	0.978	0.329	-0.211	-0.150
1-percent-annual-chance	43.4	0.976	0.339	-0.217	-0.152
0.2-percent-annual-chance	53.5	0.972	0.357	-0.231	-0.158

The peak discharges for the Tioughnioga River as calculated by the above regression equation and those estimated as weighted peak discharges for USGS Gaging Station No. 01511500 at Itaska, New York, were used to adjust the peak discharges calculated by the regression equations at ungaged sites in accordance with the following equation:

$$Q_{T(w\,u)} = \left[\frac{Q_{T(w)}}{Q_{T(r)}} - \frac{2(\left|A_g - A_u\right|)}{A_g}\ x\ \left(\frac{Q_{T(w)}}{Q_{T(r)}} - 1\right)\right] Q_{T(ru)}$$

where $QT_{(wu)}$ is the weighted peak-discharge estimate for the ungaged site; $QT_{(w)}$ is the weighted peak discharge estimate for the gaged site; $QT_{(ru)}$ is the regression peak-discharge estimate for the ungaged site; A_u is the drainage area of the ungaged site, and A_g is the drainage area of the gaged site.

To define discharge-frequency data for Castle Creek, Osborne Creek, and Page Brook, regional regression equations relating basin characteristics to streamflow characteristics were used. The regional relationship was developed by the USGS for floods on rural, unregulated streams in New York State, excluding Long Island (U.S. Department of the Interior, 1979). Discharges for the 0.2-percent-annual-chance floods were determined by extrapolation of the 10-, 2-, and 1-percent-annual-chance discharge-frequency curves developed using the regression equations.

The discharges for Snake Creek, Little Snake Creek, Choconut Creek, Sugar Creek, Tracy Creek, Nanticoke Creek, and Brixius Creek were obtained from the regional flood frequency method developed by the USACE (Leo R. Beard, 1962). For Nanticoke Creek, the coefficients for the USACE method were modified slightly to match the flood frequency curve computed by the SCS, and the discharges were modified for the effect of the existing structures. For Brixius Creek, the discharges were modified for the effects of urbanization, and further modified for the effect of the existing structure.

Flows for Butler Brook and Big Hollow had been developed by TR-20 flood routing for the SCS PL-566 study (U.S. Department of Agriculture, 1977) in the Village of Deposit for all but the 0.2-percent-annual-chance frequency flow, which was extrapolated from data plotted on log-probability paper (U.S. Department of Agriculture, 1965). Discharge on Butler Brook decreases in a non-uniform manner moving downstream near and in the village limits. This is because flows from high frequency storms are channeled out of the Butler Brook Watershed into the West Branch Delaware River.

Frequency-discharge data for Oquaga Creek were determined by a log-Pearson Type III analysis of the stream gage data at the USGS Gaging Station No. 01426000 (33 years of record) in accordance to Water Resources Council Bulletin 17 (U.S. Water Resources Council, 1976). This same type of stream gage analysis was used to investigate the West Branch Delaware River at the Hale Eddy USGS Gaging Station No. 01426500 (49 years of record). The results were compared to the frequency-discharge data developed by the USACE. The USACE data were developed by flood routing gage-developed frequency-hydrographs through Cannonsville Reservoir. The USACE data correlated very well and were used for this study, except that expected probability was converted to exceedence probability according to Bulletin 17. Discharges at the gage were adjusted to reflect the upstream decrease in drainage area as per the SCS National Engineering Handbook (U.S. Department of Agriculture, 1954) and applied to Marsh Creek, Dry Brook, and Sanford Tributary to obtain the desired discharge-frequency relationships.

Since the Bone Creek channel is so easily blocked by sediment and debris, and because the floodplain has supercritical and unconfined flood flows, the frequency analysis was based on shallow overflow rather than standard methods.

For the detailed study of East Branch Nanticoke Creek and West Branch Nanticoke Creek, the hydrologic analysis followed a procedure presented in the USGS publication Techniques for Estimating Magnitude and Frequency of Floods on

Rural Unregulated Streams in New York State Excluding Long Island (U.S. Department of the Interior, 1979). This procedure relates basin characteristics such as drainage area and storage area to a series of regression equations for a given region. Discharges were computed for a given recurrence interval by substituting the appropriate values into the corresponding regression equations. For Tributaries A and B to East Branch Nanticoke Creek, the hydrologic analysis used the procedure contained in the SCS publication, A Method for Estimating Volume and Rate Runoff in Small Watersheds, which is particularly appropriate for use on small drainage basins (U.S. Department of Agriculture, 1973).

The presence of five storm water detention basins on tributaries to West Branch Nanticoke Creek and one on a tributary to East Branch Nanticoke Creek necessitated a reduction in the derived discharges to reflect the impact of the basins.

Countywide Analyses

In the wake of the severe 2006 floods, FEMA commissioned revised hydrologic and hydraulic analyses for several flooding sources within the Upper Susquehanna River basin in New York State. The analyses resulted in new technical information that will support mitigation and recovery efforts through the production of revised hydrologic and hydraulic models and work maps that can be used to update FISs and FIRMs. The hydrologic analyses for this study were prepared as part of the Hazard Mitigation and Technical Assistance Contract HSFEHQ-06-D-012, Task Order HSFHQ-06-J-0065. The work was performed by URS Group, Inc., in association with Dewberry & Davis LLC.

The hydrologic analyses here reflect peak flow discharges summarized in the *Final Hydrology Report – Susquehanna River Basin Study – Broome, Chenango, Delaware, Otsego, and Tioga Counties* (URS Group, Inc., and Dewberry & Davis LLC, 2009). A summary of these analyses can be found below.

Peak flow discharges for gages located on restudied detailed streams were based on Bulletin 17B procedures (Interagency Advisory Committee on Water Data [IACWD], 1982) and were computed at other points of interest using gage transfer/ regression equations developed by the USGS for New York (Special Investigation Report (SIR) 2006-5112; USGS, 2006). The generalized skew values for the log-Pearson type III (LP-III) analysis were derived from Water Resources Investigations Report 00-4022 (USGS, 2000). The LP-III analysis was completed using the USGS PeakFQ program (v5.0, Beta 8; Flynn et al, 2006).

Weighted peak flows at the gaged sites (unregulated) were estimated by weighting the peak flow at the gage, determined with the log-Pearson Type III analysis with the regional regression peak flow at the gage site using Equation 3 of SIR 2006-5112:

$$Q_{T(w)} = \frac{Q_{T(g)}\,(N) + \,Q_{T(r)}\,(E)}{N + E}$$

Where,

$Q_{T(w)}$ is weighted peak discharge at the gaged site, in cubic feet per second, for the T-year recurrence interval

$Q_{T(g)}$ is peak discharge at gage, in cubic feet per second, calculated through log-Pearson Type III frequency analysis of the station's peak discharge record, for the T-year recurrence interval

N is the number of years of annual peak-discharge record used to calculate $Q_{T(g)}$ at the gauging station

$Q_{T(r)}$ is the regional regression estimate of the peak discharge at the gaged site, in cubic feet per second, for the T-year recurrence interval

E is the region-specific average equivalent years of record associated with the regression equation (Table 2 of SIR 2006-5512) used to calculate $Q_{T(r)}$

The weighted estimate of peak discharge for all those ungaged sites (discharge change locations) that were on a gaged stream and that had a drainage area within 50 percent and 150 percent of the drainage area of the stream at the gage, was computed by using Equation 4 of SIR 2006-5112:

$$Q_{T(U)w} = \frac{2\Delta A}{A_g} Q_{T(U)r} + \left(1 - \frac{2\Delta A}{A_g}\right) Q_{T(U)g}$$

Where

$Q_{T(U)w}$ is the weighted estimate of discharge Q_T for recurrence interval T at the ungaged site of a gaged stream

ΔA is the absolute value of the difference between the drainage areas of the streamflow gauging station (A_g) and the ungaged site (A_u), $|A_g - A\underline{u}|$

$Q_{T(U)r}$ is the peak-flow estimate for recurrence interval T at the ungaged site, derived from applicable regional regression equations

$Q_{T(U)g}$ is the peak-flow estimate for the recurrence interval T at the ungaged site, derived from the weighted estimate of peak discharge at the streamflow-gauging station by adjusting for the effect of the difference in drainage area between the streamflow-gauging station and the ungaged site.

$Q_{T(U)g}$ was computed by using Equation 5 of SIR 2006-5112:

$$Q_{T(U)g} = \left(\frac{A_u}{A_g}\right)^b \; Q_{T(w)}$$

Where,

A_u is the drainage area of the ungaged site

A_g is the drainage area of the gaged site

b is the region-specific transfer exponent (Table 3 of SIR 2006-5512)

$Q_{T(w)}$ is the weighted peak flow for the gaged site

If the ungaged site on a gaged stream was located between two gaging stations, the following equation was used (page 36, Equation 6 in SIR 2006-5112):

$$Q_{T(uf)w} = [Q_{T(ul)w}(A_{g2} - A_u) + Q_{T(u2)w}\,(A_u - A_{g1})]/(A_{g2} - A_{g1})$$

Where,

$Q_{T(uf)w}$ is the final weighted flow estimate for the ungaged site located between two gaging stations

$Q_{T(u1)w}$ is the weighted flow estimate computed for the ungaged site from the upstream gage records as described in the method above

A_{g2} is the drainage area of the downstream gage

A_u is the drainage area of the ungaged site

$Q_{T(u1)w}$ is the weighted flow estimate computed for the ungaged site from the downstream gage records as described in the method above

A_{g1} is the drainage area of the upstream gage

For ease of use, more detailed information on the methodology used to study different streams is organized based on an 11-digit Hydrologic Unit Code (HUC). The USGS developed the 8-digit HUC system as a hierarchical classification system of hydrologic drainage basins in the United States. The NYSDEC, in conjunction with the USGS and the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture, developed 11-digit HUCs for classification at the subwatershed level.

The HUC hierarchy corresponds to codes with 2, 4, 6, 8, and 11 digits. In decreasing area (increasing number of digits in the HUC) order, each is made up of several of the contiguous watersheds of lower hierarchy. The first two digits of the HUC are the code for the Regional Boundary (e.g., 02, for the Mid-Atlantic Region). The next two digits of the HUC are the code for the Subregional Boundary (e.g., 0202, Upper Hudson). The next two digits are the code for the Accounting Unit (e.g., 020200, the Upper Hudson basin). The next two digits of the HUC are the Cataloging Unit (e.g., 02020004, Mohawk). The last three digits of the HUC are the code for the NRCS Watershed Boundary (e.g., 02020004390, Stony Clove).

In Broome County, revised detailed analyses were performed in portions of the following HUC 11 units:

02050102150
02050102130
02050102120 -
Chenango River
Peak flow discharges for the Chenango River were calculated at USGS stream gage locations using Bulletin 17B procedures (IACWD, 1982) and were computed at other points of interest using gage transfer/ regression equations developed by the USGS for New York (SIR 2006-5112; USGS, 2006). A log-Pearson Type III analysis using the USGS PeakFQ program (v5.0, Beta 8; Flynn et al, 2006) was conducted at USGS stream gages for the Chenango River at the Greene (gage 01507000) and Chenango Forks (gage 015125000). The generalized skew values for the log-Pearson Type III analysis were derived from Water Resources Investigations Report 00-4022 (USGS, 2000). Based on the criteria set out in Bulletin 17B, the two-station method was used to extend the gage record at the Greene gage (USGS 01507000) to include a large storm event occurring in 1936 (URS Group Inc. and Dewberry & Davis LLC, 2009).

02050103100
02050103090
02050103050
02050103030
02050103020
02050103010
02050101370
02050101300 -
Susquehanna River Reach 1
The USGS SIR 2006-5112 (USGS, 2006) recommends weighing the statistical analysis result with the regression equation estimates. However, although the regression equation estimate at the Conklin stream gage 01510300 location is the same as the gage analysis result, the regression equation estimate at the Vestal stream gage location is negligibly lower than the gage analysis result. For instance, the 1-percent-annual-chance peak discharge derived from the regression equation at the Conklin gage is estimated as 65,900 cfs, which is the same as the

gage analysis result of 65,900 cfs for the same annual chance peak discharge. At Vestal gage 01513500, the regression equation is estimated as 117,000 cfs, which is 0.8 percent lower than the gage analysis result of 118,000 cfs for the same annual chance. At the Windsor gage, the regression equation is estimated as 55,300 cfs, which is 3.0 percent higher than the gage analysis result of 53,600 cfs for the same annual chance.

Although the Vestal gage is located within Hydrologic Region 5, the drainage area within Region 5 is negligible, with the majority of the drainage area located in Region 4. Also, Table 8 in SIR 2006-5112 shows Hydrologic Region 4 associated with the Vestal gage. Therefore, the region-specific constant of E for Hydrologic Region 4 was used for this gage.

The methods described earlier from SIR 2006-5112 were used to estimate the peak discharges of selected recurrence intervals for ungaged sites, except in cases where the drainage area of an ungaged site extends into an adjacent hydrologic region or State, the percentage that lies within each hydrologic region and (or) State is estimated. Peak discharge estimates are computed by using the National Flood Frequency Program, Version 3 (Ries and Crouse, 2002) for the entire drainage basin through each of the appropriate regional or State equations, and the drainage-area percentages are used as weighting factors by multiplying the percentages by the corresponding peak-discharge estimate; the resulting values are then summed to compute the peak discharge for the entire basin.

To estimate the peak flows for Pennsylvania, the regression equations from Pennsylvania WRI 00-4189 were used. The following equations were applied to obtain the peak discharges for *T*-year recurrence interval:

$$Q_{10} = 334.4DA^{.7770}(1+.01F)^{-.9712}(1+.01U)^{1.0217}(1+.01C)^{-1.7184}(1+0.1CA)^{-.5179}$$
$$Q_{50} = 698.4DA^{.7414}(1+.01F)^{-1.0821}(1+.01U)^{.5785}(1+.01C)^{-1.3955}(1+0.1CA)^{-.4980}$$
$$Q_{100} = 925.8DA^{.7278}(1+.01F)^{-1.1342}(1+.01U)^{.4040}(1+.01C)^{-1.2691}(1+0.1CA)^{-.4637}$$
$$Q_{500} = 1{,}696DA^{-.6994}(1+.01F)^{-1.2666}(1+.01U)^{.0208}(1+.01C)^{-.9877}(1+0.1CA)^{-.3834}$$

Where,

Q_T is return interval peak flow, in cfs

DA is the drainage area, in square miles

F is the percentage of forest cover, in percent

U is the percentage of urban development, in percent

C is the percentage of basin underlain by carbonate rock, in percent

CA is the percentage of basin controlled by lakes, swamps, or reservoirs, in percent

It can be seen that Lower Susquehanna Basin's "*C*" values are negligible based on *Figure 2: Carbonate regions in Pennsylvania*, which can be found in PA WRI 00-4189. "*F*", "*U*", "*C*" values are computed per basin using ArcGIS from Pennsylvania landcover data.

The Lower Susquehanna Basin lies within Hydrologic Regions 4 and 5, and the adjacent State of Pennsylvania. If an ungaged site's basin lies within Regions 4 and 5, the New York Flood Frequency Tool was run for both of the regions. Since the contributing drainage area from Pennsylvania is more than 5 percent of the whole drainage area for all of the ungaged sites, Pennsylvania regression equations are applied as well.

After the peak discharges were computed based on regression analysis, the gage influence was checked for 28 ungaged site locations. According to SIR 2006-5112 criterion, all the ungaged sites are influenced by two gages and required the application of Equation 6.

02050101220-
Susquehanna River Reach 2

A log-Pearson Type III analysis using the USGS PEAKFQ program (v5.0, Beta 8) was conducted for the Susquehanna River at Bainbridge, New York, gage (01500500); the Susquehanna River at Windsor, New York, gage (01502731); and the Susquehanna River at Conklin, New York, gage (01503000). All gages used for the log-Pearson Type III analyses had at least 15 years of systematic record.

After log-Pearson Type III analyses and regression equation estimates were used to calculate weighted flows, the flows were evaluated from upstream to downstream. When an upstream flow was computed to be higher than the downstream flow, the upstream flow was transferred downstream in an effort to keep flows conservative. This method was used for all 190 discharge points. Then the discharge points were evaluated with the conservative flows, and specific discharges were selected to be used in the hydraulic analysis based on significant flow change increases.

Flows for 2006 were calculated for the discharge points selected for hydraulic analysis. The following equation was used to calculate the exponent (n) to be used in the standard gage transfer equations discussed above.

$$Q1/Q2 = (A1/A2)^n$$

Where,

$$n = [\log(Q1) - \log(Q2)]/[\log(A1) - \log(A2)]$$

Where,

Q1	Upstream gage flow in 2006, cfs
Q2	Downstream gage flow in 2006, cfs
A1	Upstream gage drainage area, sq mi
A2	Downstream gage drainage area, sq mi
n	Transfer equation exponent

After the exponent (n) is calculated, the equation below, which was discussed above, can be used to calculate 2006 flows at ungaged site locations. Substitute (n) for (b).

$$Q_{T(u)g} \; = \; Q_{T(w)} \, (A_u/A_g)^b$$

02040101100
02040101090 -
West Branch Delaware River

A flood frequency gage analysis was performed to estimate the peak discharges at gage locations within the study area watershed for 10-, 2-, 1-, and 0.2-percent-annual-chance events along the West Branch Delaware River. The gage analysis was performed using PEAKFQ software that performs flood frequency analysis based on the guidelines delineated in Bulletin 17B, published in 1982 by the U.S. Interagency Advisory Committee on Water Data (IACWD). PEAKFQ uses the method of moments to fit the log-Pearson Type III distribution to the logarithms of annual flood peaks. Log-Pearson Type III analysis was conducted for the USGS stream gages at Hale Eddy, New York (01426500); Stilesville, New York (01425000); Walton, New York (01423000); and Delhi, New York (01422000).

Two gauging stations, the gage at Stilesville (01425000) and the gage at Halle Eddy (01426500), are under regulation. A trend analysis, Kendall's tau trend test, was applied to annual flood peak data from Water Year 1904 through Water Year 2006 at USGS gage 01426500, West Branch Delaware River at Hale Eddy, New York. The results did indicate the presence of a statistically significant negative trend at USGS gage at Hale Eddy (01426500). Since the presence of a trend induces statistical errors in flood frequency analysis, use of the entire record was not considered justifiable at the USGS gage at Hale Eddy along the West Branch Delaware River. Therefore, only the regulated portion of the record was used to perform the gage analysis at the regulated gage at Hale Eddy. The Kendall's tau trend test was also applied to the full period of record at Stilesville (01425000). The results indicated no statistically significant trend present at the USGS gage at Stilesville, and, therefore, a full period of record was used to perform the gage analysis at the regulated gage at Stilesville.

The discharges determined by gage analysis were weighted with the regression analysis discharges at all unregulated gage locations within the study area watershed by using weighting techniques that are described in SIR 2006-5112.

SIR 2006-5512 recommends weighting the gage statistical analysis results with the regression equation estimates for unregulated gages, as the weighting process tends to decrease time sampling errors. The weights of the two independent estimates are based on the length of the gage record (in years) and the equivalent years of record of the applicable regression equation.

The June 28, 2006, flood event was recorded at various USGS gage locations on the West Branch Delaware River. Observed high water marks were collected along various streams in this basin. In order to calibrate the hydraulic model to the observed high water marks, 2006 flows were estimated at all possible discharge change locations by transposition of the flows at the gaged sites to the ungaged sites within the influence of a gaged site.

For all those ungaged sites that were located between two gages and determined to be within the influence of both gages by having a drainage area between 50 percent and 150 percent of both gaged sites, 2006 flows were estimated by using Equation 6 from SIR 2006-5112.

For those ungaged locations that were within the influence of one gage, a method identified in the Chapter 14 of the National Engineering Handbook (NEH) was used to estimate 2006 flows. The NEH method defines the rate of discharge at any point in the watershed based on the following formula:

$$Q_1 = \frac{Q_2 \ x \ A_1 \left(\frac{0.894}{A_1^{0.048}} - 1\right)}{A_2 \left(\frac{0.894}{A_2^{0.048}} - 1\right)}$$

where Q_1 and A_1 represent the discharge rate in cubic feet per second per square mile and drainage area in square miles of one point in the watershed respectively, and Q_2 and A_2 represent the discharge rate and drainage area at another point in the watershed respectively. For this study, Q_2 and A_2 represent the 2006 flow and drainage area at the gage location whereas Q_1 and A_1 represent the flow and drainage area at the ungaged discharge change location.

A summary of the drainage area-peak discharge relationships for all the streams studied by detailed methods is shown in Table 6, “Summary of Discharges.”

TABLE 6 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BIG HOLLOW					
At Second Street	5.5	1,350	2,100	2,425	3,350
BUTLER BROOK					
At CONRAIL bridge	8.5	1,550	2,100	2,275	2,800
At Elm Street	8.3	1,625	2,150	2,395	2,850
CASTLE CREEK					
At confluence with Chenango River	30.3	2,570	4,040	4,800	6,600
CHENANGO RIVER					
At confluence with Susquehanna River Reach 1	1,593.9	38,923	54,032	60,970	78,237
At Town of Dickinson – City of Binghamton corporate limits	1,590.3	38,891	54,010	60,948	78,241
At Town of Fenton – Town of Chenango – Town of Dickinson corporate limits	1,585.3	38,769	53,866	60,803	78,094
USGS Gage 01512500, Chenango River at Chenango Forks, NY	1,474.7	36,452	51,264	58,142	75,584
BIG HOLLOW					
At Town of Barker – Town of Fenton corporate limits, upstream of confluence with Tioughnioga River Reach 1	716.9	18,361	25,044	27,934	34,795
CULVER CREEK					
At confluence with Dudley Creek	11.1	620	880	1,000	2,700
DRY BROOK					
At Clark Road bridge	3.7	605	875	1,005	1,350
DUDLEY CREEK					
At confluence with Tioughnioga River	29.4	1,680	2,370	2,680	3,410
Upstream of confluence of Culver Creek	11.9	940	1,370	1,570	2,040

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
EAST BRANCH NANTICOKE CREEK					
At Town of Maine – Town of Nanticoke corporate limits	11.9	1,236	1,980	2,365	3,486
Upstream of Tributary A to East Branch Nanticoke Creek	8.5	983	1,593	1,911	2,916
Upstream of Tributary B to East Branch Nanticoke Creek	3.9	610	1,023	1,242	1,956
Upstream of Tributary C to East Branch Nanticoke Creek	2.7	443	747	907	1,310
MARSH CREEK					
At State Highway 41 bridge	9.6	1,240	1,795	2,060	2,765
NANTICOKE CREEK					
At Town of Union – Town of Maine corporate limits	85.1	*	*	9,970	*
OQUAGA CREEK					
At Mill Street	66.9	4,395	6,360	7,305	9,805
At Village of Deposit – Town of Sanford corporate limits	65.4	4,335	6,280	7,210	9,675
At Old State Highway 17 at McClure	57.2	3,947	5,750	6,600	8,860
At State Highway 17 at Interchange 82	44.5	3,415	4,940	5,675	7,615
At North Sanford Road	29.8	2,660	3,850	4,420	5,935
At Clark Road	20.0	2,050	2,970	3,410	4,580
OSBORNE CREEK					
At confluence with Chenango River	25.0	2,390	3,810	4,550	6,000
Upstream of Ballyhack Creek	20.4	2,100	3,380	4,040	5,600
At Town of Fenton – Town of Colesville corporate limits	16.5	1,760	2,850	3,420	4,600
PAGE BROOK					
At confluence with Chenango River	34.9	2,860	4,490	5,320	7,000-

*Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
SANFORD TRIBUTARY					
At stream cross section A	6.0	880	1,275	1,465	1,970
SUSQUEHANNA RIVER REACH 1					
At downstream Town of Vestal – Town of Union – Village of Endicott corporate limits	4,124	84,290	110,203	121,465	147,182
Downstream of Nanticoke Creek	4,111	83,979	109,823	121,041	146,668
Upstream of Nanticoke Creek	3,998	81,079	106,161	116,923	141,705
At USGS Gage 01513500, Susquehanna River at Vestal, NY	3,939	79,548	104,203	114,776	139,174
At control structure 110 feet downstream of State Highway 26	3,937	79,543	104,196	114,769	139,164
At upstream Town of Vestal – Town of Union – Village of Endicott corporate limits	3,937	79,542	104,196	114,769	139,163
At control structure 128 feet downstream of State Highway 17	3,934	79,535	104,188	114,761	139,151
At control structure 161 feet downstream of spillway	3,898	79,448	104,095	114,669	139,006
At control structure – 157 feet upstream of State Highway 201	3,896	79,448	104,090	114,664	138,998
At corporate limit downstream of City of Binghamton	3,890	79,430	104,077	114,651	138,976
Downstream of Chenango River	3,888	79,451	104,071	114,645	139,032
Upstream of Chenango River	2,283	49,335	64,240	70,534	85,056
At point 62 feet upstream of railroad bridge	2,274	49,277	64,207	70,515	85,103
At downstream Town of Kirkwood – Town of Conklin corporate limits	2,271	49,235	64,145	70,446	85,011
At control structure 100 feet downstream of Conklin Kirkwood bridge	2,265	49,084	63,939	70,213	84,718
At control structure 94 feet downstream of Cedarhurst Road bridge	2,233	48,419	63,024	69,179	83,406

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
SUSQUEHANNA RIVER REACH 1 (continued)					
At USGS Gage 01510300, Susquehanna River at Conklin, NY	2,232	48,424	63,031	69,186	83,414
At NY/PA State line	2,118	46,384	60,630	66,644	80,480
SUSQUEHANNA RIVER REACH 2					
At NY/PA State line	1,885	41,400	53,929	59,104	70,759
At USGS Gage 01502731, Susquehanna River at Windsor, NY	1,854	41,161	53,837	59,089	70,985
At USGS Gage 01502632, Susquehanna River at Bainbridge, NY	1,621	40,216	52,474	57,503	68,986
TIOUGHNIOGA RIVER REACH 1					
At confluence with Chenango River	761.5	*	*	43,800	*
TIOUGHNIOGA RIVER REACH 2					
At Town of Lisle – Village of Lisle corporate limits	425.0	12,660	16,850	18,680	22,990
TRIBUTARY A TO EAST BRANCH NANTICOKE CREEK					
At confluence with East Branch Nanticoke Creek	1.4	560	840	990	1,325
TRIBUTARY B TO EAST BRANCH NANTICOKE CREEK					
At confluence with East Branch Nanticoke Creek	2.2	690	1,050	1,225	1,650
WEST BRANCH DELAWARE RIVER					
At USGS Gage 01426500, West Branch Delaware River at Hale Eddy, NY	593.3	16,840	29,940	37,180	58,900

*Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
WEST BRANCH NANTICOKE CREEK					
At Town of Maine – Town of Nanticoke corporate limits	6.4	915	1,550	1,892	2,821
Upstream of Tributary E to West Branch Nanticoke Creek	3.3	557	969	1,193	1,821
Upstream of Tributary F to West Branch Nanticoke Creek	2.0	380	670	833	1,296

* Data not available

The Frequency-Discharge, Drainage Area Curves are shown in Figure 1.

The elevation-frequency data for Deer Lake were developed by using the U.S. SCS computer program Technical Release No. 20 (U.S. Department of Agriculture, 1965). Lake elevations for each of the evaluated frequencies were part of the output from the computer run. The flood elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods have been determined for Deer Lake. The analysis reflects the level pool elevations due to reservoir routing, but does not include the contributions from wave action such as the wave crest height and wave runup. Nonetheless, this additional hazard due to wave action effect should be considered in planning of future development.

The level pool elevations have been determined for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods for the flooding sources studied by detailed methods and are summarized in Table 7, "Summary of Stillwater Elevations."

TABLE 7 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD*) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
DEER LAKE				
Entire shoreline	1,519.7	1,520.9	1,521.3	1,522.7

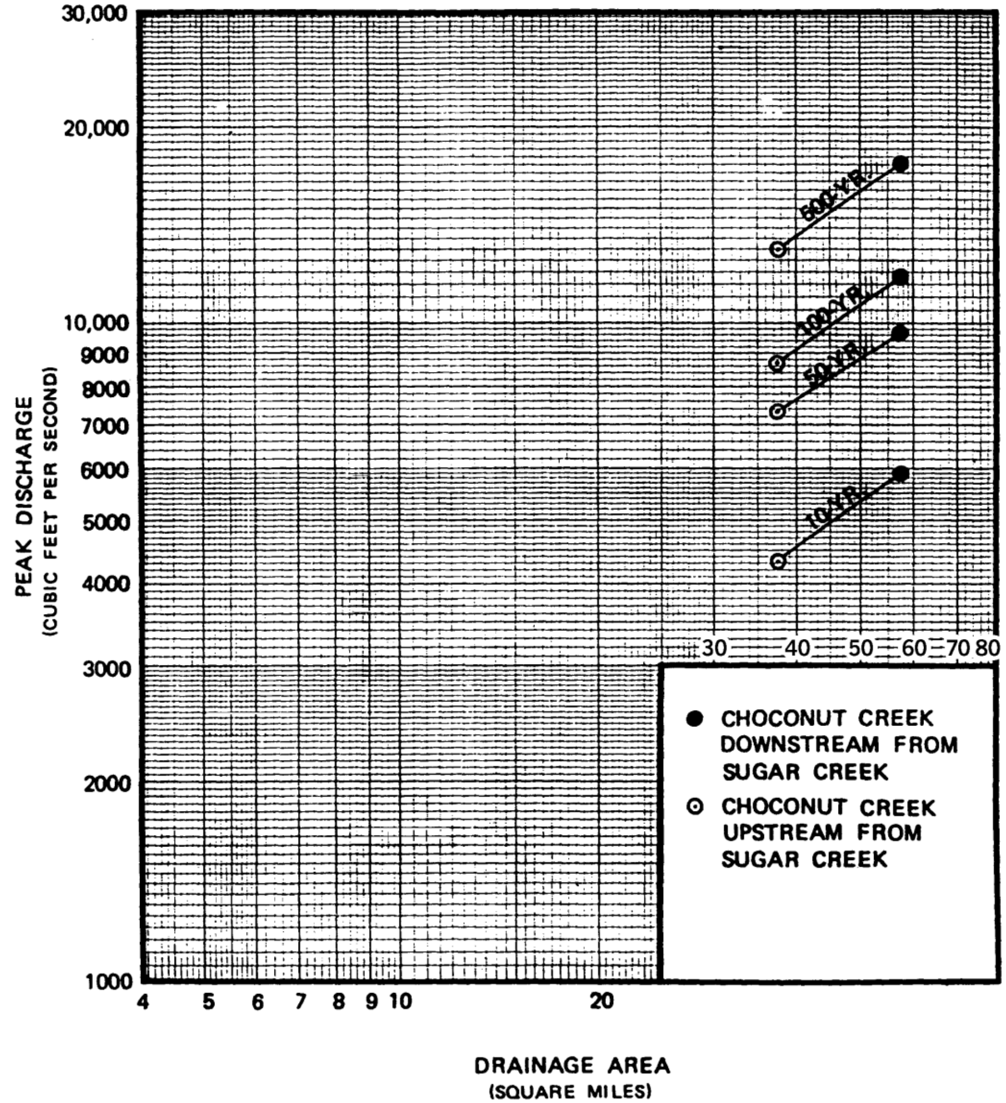


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FREQUENCY-DISCHARGE, DRAINAGE AREA CURVES

CHOCONUT CREEK

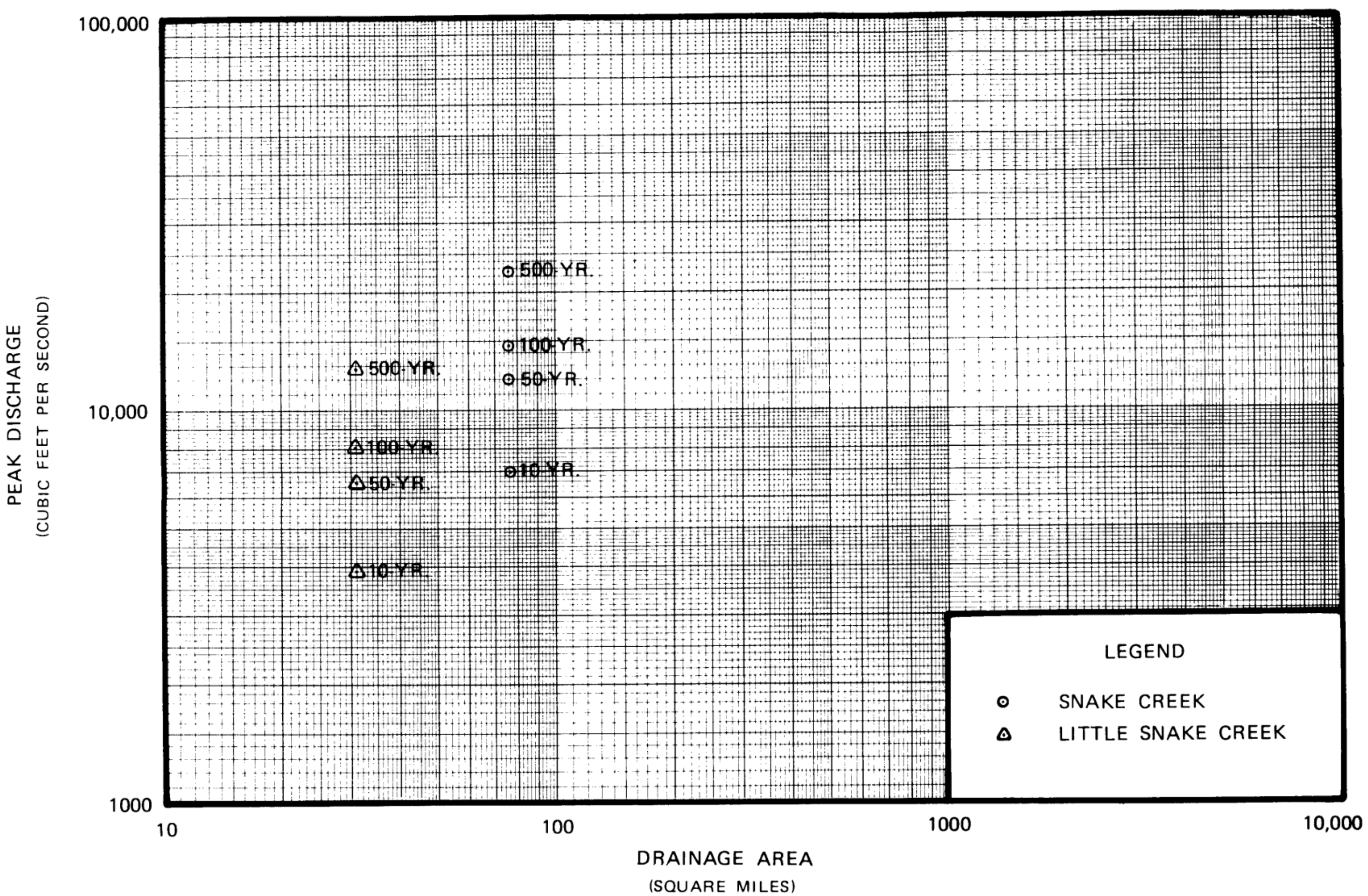


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FREQUENCY-DISCHARGE, DRAINAGE AREA CURVES

LITTLE SNAKE CREEK, SNAKE CREEK

Most streams with no stream gages were studied by approximate methods. Discharges were developed for hydraulic analysis using area-only regression equations as provided in the USGS SIR 2006-5112 for New York State Hydrologic Region 4:

$$Q = 221A^{0.743}$$

where A is the area in square miles and Q is the discharge at the location in cubic feet per second.

For remaining approximate streams that were gauged, the methodology is described in the Countywide Hydrologic Analyses section.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source 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 tables in the FIS report. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

For each incorporated community within Broome County that had a previously printed FIS report, the hydraulic analyses described in those reports have been compiled and are summarized below.

Pre-countywide Analyses

Cross sections for the flooding sources studied by detailed methods were obtained from field surveys, topographic maps, or aerial photographs. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Water-surface elevations of floods of the selected recurrence intervals for Choconut Creek, Culver Creek, Dudley Creek, East Branch Nanticoke Creek, Little Snake Creek, Nanticoke Creek, Snake Creek, Tioughnioga River Reach 1, Tioughnioga River Reach 2, Tributary A to East Branch Nanticoke Creek, Tributary B to East Branch Nanticoke Creek, and West Branch Nanticoke Creek were computed using the USACE HEC-2 step-backwater computer program (USACE, 1976).

Water-surface elevations of floods of the selected recurrence intervals for Castle Creek, Osborne Creek, and Page Brook were developed using the USGS E431 and J635 step-backwater computer programs (U.S. Department of the Interior, 1976;

U.S. Department of the Interior, unpublished). Water-surface elevations of floods of the selected recurrence intervals for Dry Brook, March Creek, Oquaga Creek, Sanford Tributary, and West Branch Delaware River were developed using the SCS WSP2 program (U.S. Department of Agriculture, 1976). Water-surface elevations of floods of the selected recurrence intervals for Big Hollow and Butler Brook were developed by the modified Leach method (U.S. Department of Agriculture, 1976).

Starting water-surface elevations for Choconut Creek, Culver Creek, Dudley Creek, East Branch Nanticoke Creek, Nanticoke Creek, Tioughnioga River Reach 1, Tioughnioga River Reach 2, Tributary A to East Branch Nanticoke Creek, Tributary B to East Branch Nanticoke Creek, and West Branch Nanticoke Creek were calculated using the slope/area method. Starting water-surface elevations for Castle Creek, Dry Brook, Marsh Creek, Osborne Creek, Page Brook, and Sanford Tributary were obtained from normal depth calculations. The starting water-surface elevations for Butler Brook and Oquaga Creek were based on backwater from West Branch Delaware River. Starting water-surface elevations for Big Hollow were taken from the corresponding flood elevations at the confluence with Butler Brook.

Countywide Analyses

For ease of use, information on the methodology used to study different streams is organized based on 11-digit HUC. See Section 3.1 for an explanation of the HUC system.

In Broome County, revised detailed analyses were performed for the Chenango River, the Susquehanna River Reach 1, the Susquehanna River Reach 2, and the West Branch Delaware River.

For all detailed, revised streams, field survey was obtained for both the channel portion of natural stream cross sections as well as hydraulic obstructions such as bridges, culverts, dams, and weirs. Field survey information was combined with LiDAR topographic data in the overbank areas to complete the cross-sectional geometry used in the hydraulic modeling. Topographic data was preprocessed using the HEC-GeoRAS interface for ArcGIS 9.1 prior to its use in HEC-RAS.
HEC-RAS Version 3.1.3 was used for the hydraulic analyses. HEC-GeoRAS Version 4.2.92 for ArcGIS 9.2 was used to generate the required geometry file from the developed terrain. Check RAS Version 1.4 was used to verify the models.

02050102150
02050102130
02050102120 -
Chenango River

The new hydraulic analysis for the Chenango River reveals increases and decreases in water-surface elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance frequencies compared to the effective FIS models for the respective reaches.

The starting water-surface elevation was determined using the slope/area method. A slope of 0.0018 was computed for the Chenango River just upstream of the Susquehanna River confluence. The drainage area of the Chenango River at its mouth is 1,594 square miles. The Susquehanna River drains approximately 2,250 square miles at the confluence with the Chenango River. It is assumed that the large difference in the size of the drainage areas will result in the Chenango River's peak flow occurring prior to the Susquehanna River's peak flow.

The floodwall and levees located in the City of Binghamton and Port Dickinson Village are reflected in the HEC-RAS model by incorporating ineffective flow areas and levee options into the model. The with-levee HEC-RAS model was developed by applying the levee option on the left and right overbank of modeled cross sections in the location of the floodwall and levee. Ineffective flow areas were used along cross sections 2 and 3. The levees and floodwall were not overtopped during the 2006 flood. Floodwaters were as high as the crest elevation of the flood wall at a few locations; however, overtopping did not occur for a prolonged period. Therefore, the calibrated HEC-RAS model reflected with-levee conditions.

The calibrated HEC-RAS model was used in the modeling of the 10-, 2-, 1-, and 0.2-percent-annual-chance flood discharges. The elevation profile computed for the 1-percent-annual-chance flood was compared with the surveyed crest elevations of the earth levees and the floodwall. Based on this comparison, the floodwall and the earth levees did not have the 3 feet of freeboard required by FEMA for flood protection measures. Accordingly, a without-levee HEC-RAS model was developed by removing the HEC-RAS levee feature assigned along the earth levees and floodwall. This allowed the area behind the levees and floodwall to convey the floodwaters of the Chenango River.

Left overbank and right overbank levee breach models were developed to compute the overbank water-surface elevations for the left and right levee breaches. No significant changes in the water-surface elevations were observed when the levee breach models were compared to the with-levee HEC-RAS model. These results are consistent with the HEC-RAS modeling of the highly developed overbank areas protected by the levees and floodwall as ineffective flow areas with most of the flow contained within the channel.

02050103100
02050103090
02050103050
02050103030
02050103020
02050103010
02050101370
02050101300 -
Susquehanna River Reach 1

The new hydraulic analyses for Reach 1 of the Susquehanna River reveal increases in water-surface elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance frequencies compared to the effective FIS models for the respective reaches.

The starting water-surface elevation was determined using the known water-surface elevation method. The starting water-surface elevation was taken from the effective FIS study for the Town of Athens, Pennsylvania, for 10-, 2-, 1-, and 0.2-percent-annual-chance floods. The starting water-surface elevation for the 2006 HEC-RAS profile was interpolated by using the discharge ratios of the flow change location farthest downstream.

A total of eight levees/floodwalls are located along the Lower Susquehanna River within the study area and were included in the HEC-RAS model. Five of the levees were surveyed; crest elevation data for the other three levees were obtained from USACE. The levees/floodwalls were not overtopped during the 2006 flood. Floodwaters were as high as the crest elevation of the levees at a few locations; however, overtopping did not occur for a prolonged period. Therefore, the calibration model reflects the with-levee condition. In order to reflect the condition that all levees were not overtopped, the levee crest elevations were artificially raised in the HEC-RAS model to confine the flow within the channel.

The calibrated, with-levee HEC-RAS model (with existing crest elevations) was run for the 1-percent-annual-chance flood event. For each of the river stations crossing the levees, the 1-percent-annual-chance water-surface elevation was recorded. To check compliance with NFIP requirements, 3 feet of freeboard were added to the 1-percent-annual-chance water-surface elevations. This “1-percent water-surface elevation + 3 feet of freeboard” elevation was then compared to the Levee Survey Elevation to determine if the levees met NFIP requirements. The majority of the levee sections did not have 3 feet of freeboard based on the results of this study. Since the freeboard conditions were not met, the floodplain and floodway analysis are based on the without-levee scenario.

A without-levee HEC-RAS model was developed by removing the HEC-RAS levee features assigned along the earth levees and floodwalls. This allowed the area behind the levee to convey the floodwaters of the Lower Susquehanna River. In some locations, levees or floodwalls border both sides of the river. To analyze the effects of the levees individually, two HEC-RAS plans were created: one excluding the left overbank levees with the right overbank levees in place, and the other excluding the right overbank levees with left overbank levees in place.

02050101220-
Susquehanna River Reach 2

The new hydraulic analyses for Reach 2 of the Susquehanna River reveals increases in water-surface elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance frequencies compared to the effective FIS models for the respective reaches.

The starting water-surface elevation was determined using the known water-surface elevation method. The starting water-surface elevation was taken from a study conducted on the part Susquehanna River between the upstream of Reach 1 and Reach 2, going through the State of Pennsylvania (URS Group, Inc. and Dewberry & Davis, LLC. 2008). The starting conditions were obtained for 10-, 2-, 1-, 0.2-percent-annual-chance floods and also the 2006 flood.

02040101100
02040101090 -
West Branch Delaware River
The starting water-surface elevation was determined using the slope area method. A slope of 0.0025 was computed for the West Branch Delaware River at its confluence with the Delaware River.

The following table, "Table 8, High-Water Marks," lists the locations and elevations of the high water marks used in the calibration of the models for the Chenango River, Susquehanna River Reach 1, Susquehanna River Reach 2, and the West Branch Delaware River.

TABLE 8– HIGH-WATER MARKS

Identifier	Flooding Source	Observed Water-Surface Elevation (NAVD 88)	Latitude	Longitude
CHEN-1	Chenango River	845.8	42° 5' 32.4" N	75° 55' 6.9" W
CHEN-2	Chenango River	847.2	42° 5' 49.5" N	75° 55' 1.1" W
CHEN-3	Chenango River	848.75	42° 7' 34.2" N	75° 54' 7.9" W
CHEN-4	Chenango River	884.9	42° 13' 5.3" N	75° 50' 53.7" W
CHEN-5	Chenango River	894.2	42° 14' 20.6" N	75° 50' 44.9" W
SUSQ1-1	Susquehanna River Reach 1	832.39	42° 5' 27.3" N	76° 3' 21.7" W
SUSQ1-2	Susquehanna River Reach 1	845.8	42° 5' 32.4" N	75° 55' 6.9" W
SUSQ1-3	Susquehanna River Reach 1	865.6	42° 2' 7.3" N	75° 48' 10.7" W
SUSQ2-1	Susquehanna River Reach 2	923.24	42° 4' 29.3" N	75° 38' 15.7" W
SUSQ2-2	Susquehanna River Reach 2	964.6	42° 11' 39.5" N	75° 36' 7.6" W
WBDEL-1	West Branch Delaware River	965.1	42° 0' 11.3" N	75° 23' 0.6" W
WBDEL-2	West Branch Delaware River	994.5	42° 3' 38.6" N	75° 25' 32.1" W
WBDEL-3	West Branch Delaware River	994.4	42° 3' 40" N	75° 25' 5" W
WBDEL-4	West Branch Delaware River	995.3	42° 3' 41.4" N	75° 25' 1.3" W

For most streams studied by approximate methods, floodplains were developed using the USACE HEC-GeoRAS and HEC-RAS computer programs assuming normal depth. The backwater effects associated with bridges and other structures located within the floodplain were not incorporated into the Zone A areas developed for streams.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 9, "Manning's "n" Values."

TABLE 9 – MANNING'S "n" VALUES

Stream	Channel "n"	Overbank "n"
Big Hollow	0.050-0.080	0.060-0.095
Butler Brook	0.050-0.080	0.060-0.095
Castle Creek	0.035-0.045	0.045-0.100
Chenango River	0.030-0.048	0.055-0.120
Choconut Creek	0.031-0.040	0.032-0.114
Culver Creek	0.030-0.040	0.060-0.080
Dry Brook	0.055-0.065	0.065-0.080
Dudley Creek	0.030-0.040	0.060-0.095
East Branch Nanticoke Creek	0.021-0.035	0.030-3.000
Little Snake Creek	0.031-0.037	0.042-0.110
Marsh Creek	0.060	0.065-0.080
Nanticoke Creek	0.060-0.064	0.060-0.097
Oquaga Creek	0.040-0.080	0.055-0.095
Osborne Creek	0.035-0.045	0.050-0.110
Page Brook	0.033-0.036	0.055-0.080
Sanford Tributary	0.060	0.065-0.075
Snake Creek	0.031-0.037	0.042-0.110
Susquehanna River Reach 1	0.031-0.038	0.060-0.200
Susquehanna River Reach 2	0.030-0.060	0.016-0.100
Tioughnioga River Reach 1	0.035-0.045	0.070-0.090
Tioughnioga River Reach 2	0.030-0.045	0.060-0.085
Tributary A to East Branch Nanticoke Creek	0.021-0.035	0.070
Tributary B to East Branch Nanticoke Creek	0.024-0.035	0.065
West Branch Delaware River	0.030-0.060	0.060-0.16
West Branch Nanticoke Creek	0.028-0.030	0.070-1.000

Qualifying bench marks within a given jurisdiction that are cataloged 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.

Bench marks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

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

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

- Stability C: Monuments that 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 bench marks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for bench marks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3191, or visit their Web site at www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with this FIS and FIRM. Interested individuals may contact FEMA to access this data.

3.3 Vertical Datum

All FISs 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 FISs and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD 29). With the finalization of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are being prepared using NAVD 88 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. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base (1-percent-annual-chance) flood elevations (BFEs) across the corporate limits between the communities.

Prior versions of the FIS report and FIRM were referenced to NGVD 29. When a datum conversion is effected for an FIS report and FIRM, the Flood Profiles, BFEs and elevation reference marks reflect the new datum values. To compare structure and ground elevations to 1-percent-annual-chance (100-year) flood elevations shown in the FIS and on the FIRM, the subject structure and ground elevations must be referenced to the new datum values.

As noted above, the elevations shown in the FIS report and on the FIRM for Broome County are referenced to NAVD 88. Ground, structure, and flood elevations may be compared and/or referenced to NGVD 29 by applying a standard conversion factor. The conversion factor to NGVD 29 is +0.457 foot. The BFEs shown on the FIRM represent whole-foot rounded values. For example, a BFE of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD 29 should apply the stated conversion factor(s) to elevations shown on the Flood Profiles and supporting data tables in the FIS report, which are shown at a minimum to the nearest 0.1 foot.

NGVD 29 = NAVD 88 + 0.457 foot

For more information on NAVD 88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the Spatial Reference System Division, National Geodetic Survey, NOAA, Silver Spring Metro Center, 1315 East-West Highway, Silver Spring, Maryland 20910 (Internet address http://www.ngs.noaa.gov).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the county. For the streams studied in detail, the 1-percent-annual-chance 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 bare earth digital elevation data provided by Broome County. The point elevation data is comprised mostly of LiDAR with some spot elevations generated from aerial photography flown within the same year in support of digital orthophotography acquisition. Water-surface elevation triangulated irregular networks (TINs) were created from the model cross sections and intersected with the bare earth ground TIN to produce the floodplain corridor. The resulting floodplains were smoothed and incorporated in the DFIRM.

Similarly, using datum-converted effective flood profiles for non-revised, detailed streams, all flood boundaries were made current with the topography supplied by the county to FEMA.

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

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this FIS are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 10). The computed floodways are shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Portions of the floodway for the Chenango River and the West Branch Delaware River extend beyond the county boundary.

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.

In addition, the floodway widths for Butler Brook were modified administratively from the widths calculated from the effective hydraulic model. This is because of the construction of the upstream Elm Street Flood Control Project, which diverts flood flows from just downstream of the confluence of Big Hollow and Butler Brook into the West Branch Delaware River. A 200 cfs bypass flow is conveyed in Butler Brook under 1-percent-annual-chance conditions. Therefore, the floodways were designated at the top of the channel bank in this bypass area (unless the West Branch Delaware River floodway encompassed Butler Brook).

Floodway adjustments were necessary along levees and floodwalls for administrative purposes. In such cases, floodways were mapped at the riverward toe of the structure.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 10 for certain downstream cross sections of Castle Creek, the Chenango River, Choconut Creek, Little Snake Creek, Nanticoke Creek, Osborne Creek, Oquaga Creek, Page Brook, Snake Creek, and the Tioughnioga River Reach 1 are lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

FLOODING SOURCE		FLOODWAY				BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Big Hollow								
A	4,000	148	413	5.9	1,000.0	1,000.0	1,001.0	1.0
B	4,100	44	224	10.8	1,002.1	1,002.1	1,003.1	1.0
C	4,500	52	275	8.8	1,011.2	1,011.2	1,012.2	1.0
D	5,300	42	246	9.9	1,025.0	1,025.0	1,026.0	1.0
E	6,000	51	239	10.1	1,041.2	1,041.2	1,042.2	1.0
Butler Brook								
A	400	17[2]	731	3.1	994.0	987.4	988.4	1.0
B	1,085	17[2]	698	3.3	995.0	989.9	990.9	1.0
C	1,295	15[2]	1,151	2.0	995.3	990.2	991.2	1.0
D	1,520	12[2]	838	2.8	995.5	991.2	992.2	1.0
E	1,910	13[2]	1,031	2.3	995.8	992.8	993.8	1.0
F	2,645	23[2]	1,007	2.3	996.9	994.3	995.3	1.0
G	3,400	11[2]	650	3.7	997.5	995.7	996.7	1.0
H	3,750	586	1,170	1.5	997.6	997.5	998.5	1.0
I	4,210	134	560	3.1	999.3	999.3	1,000.3	1.0
J	4,725	218	629	2.8	1,001.5	1,001.5	1,002.5	1.0

[1]Feet above confluence with the West Branch Delaware River
[2]This floodway width has been modified from the effective width for administrative purposes

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

BIG HOLLOW – BUTLER BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Castle Creek								
A	500[1]	100	480	9.9	853.8	848.8[3]	848.8	0.0
B	820[1]	110	520	9.1	853.8	851.1[3]	851.1	0.0
C	1,080[1]	80	420	11.3	853.8	853.1[3]	854.0	0.0
D	1,270[1]	75	530	9.0	855.2	855.2	855.2	0.0
E	1,730[1]	70	620	7.7	857.6	857.6	857.6	0.0
F	2,050[1]	70	570	8.5	858.9	858.9	858.9	0.0
G	2,260[1]	95	720	6.7	860.3	860.3	860.3	0.0
H	2,470[1]	100	570	8.4	861.1	861.1	861.1	0.0
I	3,020[1]	85	530	9.0	864.0	864.0	864.0	0.0
J	3,510[1]	75	410	11.8	871.0	871.0	871.0	0.0
K	3,930[1]	100	580	8.3	876.1	876.1	876.1	0.0
L	4,240[1]	75	390	12.2	878.2	878.2	878.2	0.0
M	4,420[1]	60	500	9.5	881.0	881.0	881.0	0.0
N	4,550[1]	70	480	10.1	881.4	881.4	881.4	0.0
Chenango River								
A	1,423[2]	301	5,237	11.6	845.6	838.0[4]	838.1	0.1
B	8,702[2]	523	12,997	4.7	845.8	845.8	846.0	0.2
C	9,728[2]	600	13,562	4.5	846.5	846.5	846.5	0.0
D	11,167[2]	659	13,687	4.5	846.9	846.9	846.9	0.0
E	15,035[2]	768	11,736	5.2	847.5	847.5	847.9	0.4
F	17,981[2]	1,110	15,935	3.8	849.2	849.2	849.7	0.5
G	21,041[2]	1,021	15,378	4.0	851.7	851.7	852.3	0.6
H	24,284[2]	1,223	23,867	2.6	853.6	853.6	854.3	0.7
I	29,390[2]	1,121	12,296	4.9	854.4	854.4	855.1	0.7
J	31,523[2]	397	6,852	8.9	856.9	856.9	857.6	0.7
K	32,000[2]	331	5,636	10.8	857.6	857.6	858.3	0.7

[1]Feet above confluence with the Chenango River
[2]Feet above confluence with the Susquehanna River Reach 1
[3]Elevation computed without consideration of backwater effects from the Chenango River
[4]Elevation computed without consideration of backwater effects from the Susquehanna River Reach 1

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

CASTLE CREEK – CHENANGO RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Chenango River (continued)								
L	33,146	631	10,018	6.1	860.5	860.5	861.1	0.6
M	35,814	880	14,435	4.2	862.7	862.7	863.4	0.7
N	39,459	532	8,582	7.1	866.6	866.6	867.2	0.6
O	43,065	504	9,344	6.5	869.6	869.6	870.6	1.0
P	43,820	429	6,943	8.8	869.7	869.7	870.6	0.9
Q	47,958	373	5,792	10.5	874.2	874.2	874.9	0.7
R	49,321	871	13,128	4.6	877.2	877.2	877.6	0.4
S	54,467	426	6,955	8.7	878.5	878.5	879.2	0.7
T	57,800	691	12,811	4.8	883.5	883.5	884.5	1.0
U	61,266	923	10,374	5.9	884.9	884.9	885.7	0.8
V	63,374	443	6,018	10.1	886.1	886.1	886.7	0.6
W	64,370	772	8,577	7.1	888.2	888.2	888.6	0.4
X	65,103	504	6,679	8.7	888.8	888.8	889.1	0.3
Y	67,508	642	10,307	5.6	892.9	892.9	893.4	0.5
Z	70,616	681	8,540	6.8	895.4	895.4	896.1	0.7
AA	71,283	622	12,184	2.3	897.7	897.7	898.5	0.8
AB	74,553	378	5,685	4.9	898.8	898.8	899.6	0.8
AC	75,198	319[2]	5,509	5.1	899.2	899.2	900.0	0.8
AD	77,847	275[2]	6,247	4.5	900.3	900.3	901.0	0.7

[1]Feet above confluence with the Susquehanna River Reach 1

[2]This width extends beyond the county boundary

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

CHENANGO RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Choconut Creek								
A	1,450	140	1,306	8.9	831.7	820.0[2]	820.9	0.9
B	1,905	110	1,213	9.6	831.7	821.2[2]	822.2	1.0
C	2,070	185	1,049	11.2	831.7	821.2[2]	822.2	1.0
D	2,530	190	1,394	8.4	831.7	824.1[2]	824.3	0.2
E	2,830	271	1,786	6.5	831.7	826.0[2]	826.2	0.2
F	3,680	224	1,623	7.2	831.7	827.2[2]	827.7	0.5
G	5,320	175	830	14.1	838.0	838.0	838.0	0.0
H	6,070	100	1,022	11.4	844.7	844.7	844.8	0.1
I	6,600	90	722	16.2	847.5	847.5	847.5	0.0
J	7,050	130	1,142	10.2	851.8	851.8	852.1	0.3
K	7,860	150	857	13.7	856.2	856.2	856.2	0.0
L	9,740	120	769	15.2	870.6	870.6	871.7	0.1
M	9,785	120	1,017	11.5	873.2	873.2	874.2	1.0
N	10,440	428	2,152	5.4	878.1	878.1	878.3	0.2
O	11,860	115	781	15.0	886.4	886.4	886.4	0.0
P	12,905	284	2,002	5.8	892.2	892.2	892.8	0.6
Q	14,335	155	866	13.5	896.4	896.4	896.4	0.0
R	14,410	144	1,237	9.5	898.7	898.7	899.7	1.0
S	14,790	441	3,265	3.6	901.1	901.1	901.7	0.6
T	15,450	192	1,030	11.4	903.5	903.5	904.4	0.9
U	16,760	340	1,835	6.4	912.7	912.7	913.7	1.0
V	17,710	100	748	15.6	919.9	919.9	920.9	1.0
W	18,800	135	1,048	11.2	928.2	928.2	929.2	1.0
X	20,050	140	836	14.0	935.8	935.8	936.1	0.3
Y	21,000	296	2,070	5.7	941.7	941.7	942.5	0.8
Z	22,380	160	928	12.6	949.5	949.5	949.9	0.4

[1]Feet above mouth
[2]Elevation computed without consideration of backwater effects from the Susquehanna River Reach 1

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

CHOCONUT CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Choconut Creek (continued)								
AA	23,450	440	2,301	5.1	958.4	958.4	959.4	1.0
AB	24,235	360	1,463	8.0	962.4	962.4	962.5	0.1
AC	25,000	230	1,164	10.1	968.0	968.0	969.0	1.0
AD	26,010	240	1,591	7.4	975.1	975.1	976.1	1.0
AE	27,660	252	1,173	10.0	982.4	982.4	983.1	0.7
AF	28,430	213	1,832	6.4	989.5	989.5	990.3	0.8
AG	29,000	402	3,080	2.8	990.9	990.9	991.8	0.9
AH	29,790	717	4,080	2.2	991.2	991.2	992.1	0.9
AI	30,980	230	994	8.7	992.1	992.1	992.8	0.7
AJ	32,380	370	1,220	7.1	1,001.8	1,001.8	1,002.1	0.3
AK	33,830	780	2,728	3.2	1,006.9	1,006.9	1,007.9	1.0
AL	34,950	249	937	9.2	1,015.2	1,015.2	1,015.6	0.4
AM	35,840	210	1,251	6.9	1,021.8	1,021.8	1,022.7	0.9
AN	37,020	264	1,725	5.0	1,026.8	1,026.8	1,027.6	0.8
AO	38,450	107	625	13.8	1,031.3	1,031.3	1,031.3	0.0
AP	39,380	292	2,132	4.1	1,035.5	1,035.5	1,036.0	0.5
AQ	39,905	779	4,908	1.8	1,036.1	1,036.1	1,036.7	0.6
AR	40,985	70	542	16.0	1,038.1	1,038.1	1,038.1	0.0

[1]Feet above mouth

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

CHOCONUT CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Culver Creek								
A	160[1]	24	107	9.4	1,074.3	1,074.3	1,075.3	1.0
B	1,345[1]	55	214	4.7	1,082.9	1,082.9	1,083.7	0.8
C	2,095[1]	70	202	5.0	1,088.0	1,088.0	1,088.6	0.6
D	3,140[1]	35	126	7.9	1,095.4	1,095.4	1,095.5	0.1
E	4,530[1]	62	235	4.3	1,105.5	1,105.5	1,106.3	0.8
Dry Brook								
A	300[2]	42	213	4.8	1,267.0	1,267.0	1,268.0	1.0
B	1,300[2]	30	135	7.5	1,291.3	1,291.3	1,292.3	1.0
C	1,725[2]	26	172	5.8	1,300.8	1,300.8	1,301.8	1.0
D	1,925[2]	45	252	4.0	1,305.4	1,305.4	1,306.4	1.0
E	2,200[2]	36	131	7.7	1,312.4	1,312.4	1,313.4	1.0
F	2,500[2]	50	182	5.5	1,320.0	1,320.0	1,321.0	1.0

[1]Feet above confluence with Dudley Creek
[2]Feet above confluence with Oquaga Creek

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

CULVER CREEK – DRY BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Dudley Creek								
A	505[1]	50	380	7.1	1,045.3	1,045.3	1,046.0	0.7
B	2,115[1]	40	271	9.9	1,054.3	1,054.3	1,055.1	0.8
C	3,880[1]	90	445	6.0	1,064.7	1,064.7	1,065.5	0.8
D	4,900[1]	120	423	6.3	1,069.5	1,069.5	1,070.4	0.9
E	6,330[1]	40	263	6.0	1,076.6	1,076.6	1,077.6	1.0
F	7,820[1]	145	876	1.8	1,078.8	1,078.8	1,079.6	0.8
G	8,825[1]	100	521	3.0	1,079.6	1,079.6	1,080.2	0.6
H	10,465[1]	100	375	4.2	1,083.2	1,083.2	1,083.7	0.5
I	12,520[1]	55	260	6.0	1,090.0	1,090.0	1,090.5	0.5
J	13,995[1]	35	177	8.9	1,094.7	1,094.7	1,095.7	1.0
East Branch Nanticoke Creek								
A	50[2]	123	642	3.7	975.0	975.0	975.2	0.2
B	6,618[2]	72	489	3.9	998.4	998.4	998.8	0.4
C	11,778[2]	68	274	7.0	1,016.6	1,016.6	1,017.1	0.5
D	15,223[2]	29	112	11.1	1,040.8	1,040.8	1,040.9	0.1
E	19,813[2]	18	80	11.3	1,102.7	1,102.7	1,103.6	0.9
F	28,223[2]	30	110	8.2	1,226.6	1,226.6	1,227.3	0.7

[1]Feet above Limit of Detailed Study (Limit of Detailed Study is located approximately 660 feet downstream of Owen Hill Road)
[2]Feet above Limit of Detailed Study (Limit of Detailed Study is located approximately 3,026 feet downstream of Leekville Road)

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

DUDLEY CREEK – EAST BRANCH NANTICOKE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Little Snake Creek								
A	340	379	1,230	6.6	865.7	861.4[2]	861.8	0.4
B	395	78	755	10.7	865.7	864.9[2]	865.9	1.0
C	1,010	638	4,120	2.0	868.4	868.4	869.4	1.0
D	1,130	746	5,265	1.5	870.6	870.6	871.2	0.6
E	2,290	100	583	13.9	875.7	875.7	875.1	-0.6
F	3,160	80	553	14.6	883.8	883.8	884.1	0.3
G	3,250	80	539	15.0	884.8	884.8	884.9	0.1
H	3,830	177	1,047	7.7	891.2	891.2	891.1	-0.1
I	4,410	150	672	12.1	895.8	895.8	895.6	-0.2
J	4,875	106	729	11.1	901.2	901.2	901.0	-0.2
K	6,505	170	791	10.2	911.5	911.5	911.0	-0.5
L	7,225	80	543	14.9	918.2	918.2	918.0	-0.2
M	8,735	75	565	14.3	935.6	935.6	935.6	0.0
N	10,285	90	616	13.1	952.7	952.7	952.8	0.1
O	11,585	146	916	8.8	964.8	964.8	965.8	1.0
P	12,385	181	1,067	7.6	972.7	972.7	973.3	0.6
Q	13,415	244	1,549	5.2	981.3	981.3	982.0	0.7
R	14,755	288	1,036	7.8	994.0	994.0	994.1	0.1
S	16,095	222	1,211	6.7	1,007.7	1,007.7	1,008.6	0.9
T	17,125	183	863	9.4	1,018.3	1,018.3	1,019.2	0.9
U	17,725	189	912	8.9	1,025.0	1,025.0	1,025.0	0.0
V	18,315	102	650	12.5	1,035.1	1,035.1	1,034.0	-1.1
W	18,695	180	1,257	6.4	1,037.3	1,037.3	1,038.1	0.8
X	19,485	65	508	15.9	1,046.2	1,046.2	1,045.2	-1.0
Y	19,525	65	559	14.5	1,046.5	1,046.5	1,046.3	-0.2

[1]Feet above mouth
[2]Elevation computed without consideration of backwater effects from Susquehanna River Reach 1

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

LITTLE SNAKE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Marsh Creek								
A	650[1]	70	241	8.6	1,115.7	1,115.7	1,116.7	1.0
B	800[1]	64	359	5.7	1,118.7	1,118.7	1,119.7	1.0
C	1,100[1]	296	773	2.7	1,120.1	1,120.1	1,121.1	1.0
D	1,350[1]	41	241	8.5	1,123.7	1,123.7	1,124.7	1.0
Nanticoke Creek								
A	1,970[2]	282	2,713	5.3	831.0	816.6[3]	817.1	0.5
B	2,165[2]	158	3,100	4.7	831.0	819.2[3]	819.7	0.5
C	3,160[2]	164	1,985	7.3	831.0	820.6[3]	821.4	0.8
D	4,465[2]	575	4,364	3.3	831.0	824.0[3]	824.7	0.7
E	5,355[2]	834	4,843	3.0	831.0	824.6[3]	825.4	0.8
F	5,965[2]	769	6,275	2.3	831.0	825.3[3]	825.9	0.6
G	6,575[2]	417	4,293	3.4	831.0	825.4[3]	826.1	0.7
H	7,165[2]	388	3,652	4.0	831.0	825.8[3]	826.5	0.7
I	7,625[2]	527	5,123	2.8	831.0	826.3[3]	827.1	0.8
J	9,145[2]	526	7,539	1.9	831.0	826.9[3]	827.7	0.8
K	11,645[2]	674	6,692	2.1	831.0	827.7[3]	828.4	0.7
L	12,745[2]	640	6,960	2.0	831.0	827.9[3]	828.8	0.9
M	13,845[2]	115	1,617	8.5	831.0	829.6[3]	830.3	0.7
N	14,810[2]	172	2,609	5.3	831.9	831.9	832.4	0.5
O	16,125[2]	630	5,756	2.4	833.1	833.1	833.6	0.5
P	17,805[2]	1,283	10,993	1.3	833.4	833.4	834.0	0.6
Q	19,265[2]	382	2,313	6.0	833.5	833.5	833.8	0.3
R	20,405[2]	1,087	7,476	1.9	835.3	835.3	836.0	0.7
S	22,455[2]	1,140	5,722	2.5	836.9	836.9	837.6	0.7

[1]Feet above confluence with Oquaga Creek
[2]Feet above confluence with the Susquehanna River Reach 1
[3]Elevation computed without consideration of backwater effects from the Susquehanna River Reach 1

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

MARSH CREEK – NANTICOKE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Nanticoke Creek (continued)								
T	26,855[1]	1,011	6,153	2.4	844.5	844.5	845.5	1.0
U	27,435[1]	425	1,964	7.4	846.1	846.1	847.0	0.9
V	28,065[1]	444	3,199	4.5	849.7	849.7	850.7	1.0
W	30,281[1]	407	2,396	6.1	858.5	858.5	859.1	0.6
X	31,546[1]	232	1,976	7.3	865.4	865.4	866.2	0.8
Y	32,386[1]	480	4,174	3.5	869.3	869.3	869.8	0.5
Z	35,530[1]	244	1,335	7.5	878.1	878.1	878.7	0.6
AA	39,970[1]	276	2,705	3.7	885.4	885.4	886.3	0.9
AB	42,420[1]	186	1,108	9.0	887.2	887.2	887.8	0.6
AC	46,010[1]	242	2,198	4.5	896.2	896.2	897.1	0.9
AD	50,190[1]	290	2,276	4.4	907.1	907.1	907.8	0.7
AE	54,380[1]	300	1,390	3.9	914.2	914.2	914.7	0.5
Oquaga Creek								
A	485[2]	159	1,014	7.2	992.2	985.3[3]	986.3	1.0
B	1,340[2]	124	1,068	6.8	992.2	991.8[3]	992.8	1.0
C	1,440[2]	124	1,185	6.2	993.5	993.5	994.5	1.0
D	1,800[2]	178	1,420	5.1	995.0	995.0	996.0	1.0
E	2,855[2]	643	2,654	2.7	997.5	997.5	998.5	1.0
F	3,755[2]	278	1,173	6.1	1,002.1	1,002.1	1,003.1	1.0
G	4,335[2]	374	1,650	4.3	1,004.3	1,004.3	1,005.3	1.0
H	5,000[2]	138	1,073	6.6	1,007.8	1,007.8	1,008.8	1.0
I	6,490[2]	135	946	7.5	1,013.8	1,013.8	1,014.8	1.0
J	6,710[2]	89	784	9.1	1,015.8	1,015.8	1,016.8	1.0
K	9,100[2]	202	1,252	5.6	1,025.3	1,025.3	1,026.3	1.0

[1]Feet above confluence with the Susquehanna River Reach 1
[2]Feet above confluence with the West Branch Delaware River
[3]Elevation computed without consideration of backwater effects from the West Branch Delaware River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

NANTICOKE CREEK – OQUAGA CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Oquaga Creek (continued)								
L	11,200	206	1,436	4.9	1,029.7	1,029.7	1,030.7	1.0
M	12,900	625	2,249	3.1	1,034.3	1,034.3	1,035.3	1.0
N	14,900	216	1,064	6.6	1,047.7	1,047.7	1,048.7	1.0
O	17,000	193	1,103	6.3	1,060.1	1,060.1	1,061.1	1.0
P	19,200	284	1,524	4.4	1,068.2	1,068.2	1,069.2	1.0
Q	20,925	250	1,322	5.0	1,076.1	1,076.1	1,077.1	1.0
R	21,275	156	1,272	5.2	1,080.7	1,080.7	1,081.7	1.0
S	23,000	286	1,425	4.6	1,086.7	1,086.7	1,087.7	1.0
T	24,500	422	1,194	4.8	1,095.0	1,095.0	1,096.0	1.0
U	26,300	134	753	7.5	1,109.0	1,109.0	1,110.0	1.0
V	27,000	100	677	7.2	1,113.0	1,113.0	1,114.0	1.0
W	27,400	88	905	5.4	1,115.5	1,115.5	1,116.5	1.0
X	27,600	88	1,097	4.4	1,115.9	1,115.9	1,116.9	1.0
Y	28,300	87	1,111	4.4	1,116.6	1,116.6	1,117.6	1.0
Z	29,200	200	1,586	3.1	1,117.6	1,117.6	1,118.6	1.0
AA	30,300	317	2,061	2.3	1,118.2	1,118.2	1,119.2	1.0
AB	30,600	215	1,771	2.7	1,119.8	1,119.8	1,120.8	1.0
AC	32,300	366	2,246	2.1	1,120.6	1,120.6	1,121.6	1.0
AD	35,150	163	1,099	4.3	1,125.7	1,125.7	1,126.7	1.0
AE	35,350	85	709	6.6	1,127.2	1,127.2	1,128.2	1.0
AF	36,000	69	598	7.9	1,130.5	1,130.5	1,131.5	1.0
AG	36,600	249	1,473	3.2	1,132.1	1,132.1	1,133.1	1.0
AH	37,500	92	712	6.6	1,136.7	1,136.7	1,137.7	1.0
AI	38,000	92	880	5.2	1,138.3	1,138.3	1,139.3	1.0

[1]Feet above confluence with the West Branch Delaware River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

OQUAGA CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Oquaga Creek (continued)								
AJ	38,600	211	1,698	2.7	1,138.9	1,138.9	1,139.9	1.0
AK	39,500	802	6,816	0.7	1,139.0	1,139.0	1,140.0	1.0
AL	41,600	603	1,917	2.4	1,142.7	1,142.7	1,143.7	1.0
AM	44,400	850	1,671	2.7	1,152.3	1,152.3	1,153.3	1.0
AN	46,000	435	1,039	4.3	1,161.9	1,161.9	1,162.9	1.0
AO	46,200	393	1,911	2.3	1,165.4	1,165.4	1,166.4	1.0
AP	46,800	202	963	4.0	1,167.0	1,167.0	1,168.0	1.0
AQ	47,000	211	830	4.6	1,167.9	1,167.9	1,168.9	1.0
AR	49,700	175	691	5.4	1,184.4	1,184.4	1,185.4	1.0
AS	52,400	148	599	6.2	1,205.0	1,205.0	1,206.0	1.0
AT	53,250	244	672	5.3	1,210.0	1,210.0	1,211.0	1.0
AU	53,700	345	961	3.6	1,215.0	1,215.0	1,216.0	1.0
AV	55,000	167	579	6.0	1,226.2	1,226.2	1,227.2	1.0
AW	56,300	177	580	5.9	1,238.2	1,238.2	1,239.2	1.0
AX	58,150	63	420	8.1	1,257.7	1,257.7	1,258.7	1.0
AY	58,350	59	636	5.4	1,261.8	1,261.8	1,262.8	1.0
AZ	60,300	270	788	3.7	1,272.5	1,272.5	1,273.5	1.0
BA	61,800	109	462	5.9	1,282.0	1,282.0	1,283.0	1.0
BB	62,400	161	574	4.7	1,285.6	1,285.6	1,286.6	1.0
BC	63,200	104	514	5.3	1,291.3	1,291.3	1,292.3	1.0

[1]Feet above confluence with the West Branch Delaware River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

OQUAGA CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Osborne Creek								
A	1,240	115	700	6.5	871.8	869.3[2]	870.1	0.8
B	1,350	120	600	7.5	871.8	870.8[2]	870.8	0.0
C	2,020	80	380	12.0	874.8	874.8	875.0	0.2
D	3,010	120	660	7.0	881.9	881.9	882.4	0.5
E	3,580	65	290	14.0	886.3	886.3	886.3	0.0
F	3,690	65	420	9.6	888.7	888.7	889.4	0.7
G	4,130	65	440	9.2	891.9	891.9	892.2	0.3
H	4,790	90	370	10.8	896.3	896.3	896.3	0.0
I	5,230	70	310	13.1	901.2	901.2	901.5	0.3
J	5,870	110	480	8.4	910.7	910.7	910.7	0.0
K	6,410	110	400	10.1	918.2	918.2	918.2	0.0
L	7,090	160	600	6.7	925.1	925.1	925.4	0.3
M	7,940	80	560	7.2	928.9	928.9	929.4	0.5
N	8,960	120	530	7.6	938.2	938.2	938.5	0.3
O	10,000	150	670	5.1	945.7	945.7	946.4	0.7
P	10,690	100	340	9.9	952.6	952.6	952.6	0.0
Q	11,420	80	380	8.9	958.8	958.8	959.2	0.4
R	12,360	90	410	8.3	967.1	967.1	967.2	0.1
S	13,470	80	310	11.0	979.8	979.8	980.0	0.2
T	14,300	50	300	11.5	987.6	987.6	988.0	0.4
U	15,090	60	320	10.6	993.8	993.8	994.4	0.6
V	15,780	60	280	12.2	1,001.0	1,001.0	1,001.0	0.0

[1]Feet above confluence with the Chenango River
[2]Elevation computed without consideration of backwater effects from the Chenango River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

OSBORNE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Page Brook								
A	270[1]	570	2,080	2.6	878.3	873.2[3]	874.2	1.0
B	685[1]	470	2,670	2.0	878.3	873.6[3]	874.6	1.0
C	1,425[1]	420	1,700	3.1	878.3	874.1[3]	875.1	1.0
D	1,775[1]	240	630	8.4	878.3	875.1[3]	876.0	0.9
E	2,200[1]	150	580	9.2	879.4	879.4	879.4	0.0
F	2,575[1]	100	590	9.0	881.5	881.5	882.2	0.7
G	2,700[1]	150	800	6.6	883.4	883.4	883.4	0.0
H	3,170[1]	90	620	8.6	884.5	884.5	884.6	0.1
I	3,700[1]	90	570	9.3	886.4	886.4	886.7	0.3
Sanford Tributary								
A	1,200[2]	157	353	4.2	1,177.4	1,177.4	1,178.4	1.0
B	1,400[2]	77	213	3.5	1,181.1	1,181.1	1,182.1	1.0
C	1,500[2]	37	193	7.6	1,184.9	1,184.9	1,185.9	1.0

[1]Feet above confluence with the Chenango River
[2]Feet above confluence with Oquaga Creek
[3]Elevation computed without consideration of backwater effects from the Chenango River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

PAGE BROOK – SANFORD TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Snake Creek								
A	480	313	2,174	6.8	868.4	859.9[2]	860.9	1.0
B	1,010	160	1,464	10.1	868.4	862.1[2]	863.0	0.9
C	1,095	160	1,449	10.2	868.4	862.2[2]	863.2	1.0
D	1,990	380	2,405	6.2	868.4	865.6[2]	865.9	0.3
E	2,950	604	3,306	4.5	868.4	867.2[2]	867.8	0.6
F	3,915	290	1,241	11.9	870.6	870.6	870.2	-0.4
G	4,565	339	2,003	7.4	874.9	874.9	875.6	0.7
H	5,645	692	3,435	4.3	878.3	878.3	879.3	1.0
I	6,495	457	2,163	6.8	884.0	884.0	884.5	0.5
J	7,505	240	1,529	9.7	890.7	890.7	891.3	0.6

[1]Feet above mouth
[2]Elevation computed without consideration of backwater effects from the Susquehanna River Reach 1

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

SNAKE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Susquehanna River Reach 1								
A	1,297	2,154	36,039	3.4	829.2	829.2	830.0	0.8
B	10,882	1,579	38,846	3.1	831.1	831.1	832.0	0.9
C	15,848	1,712	40,332	3.0	831.5	831.5	832.4	0.9
D	18,273	871	27,370	4.4	832.5	832.5	833.2	0.7
E	20,155	940	27,540	4.2	832.8	832.8	833.7	0.9
F	27,377	532	18,520	6.2	833.9	833.9	834.7	0.8
G	29,406	940	27,357	4.2	834.7	834.7	835.4	0.7
H	36,362	819	20,679	5.6	835.8	835.8	836.3	0.5
I	40,327	1,245	32,743	3.5	836.4	836.4	837.4	1.0
J	43,844	1,361	31,224	3.7	837.1	837.1	838.0	0.9
K	46,472	837	19,757	5.8	837.9	837.9	838.7	0.8
L	48,917	804	18,627	6.2	838.8	838.8	839.5	0.7
M	50,684	917	21,724	5.3	839.6	839.6	840.4	0.8
N	54,778	1,002	22,308	5.1	841.0	841.0	841.6	0.6
O	57,471	580	13,756	8.3	841.9	841.9	842.4	0.5
P	59,435	740	17,498	6.6	843.2	843.2	844.0	0.8
Q	63,971	574	14,102	8.1	845.2	845.2	845.9	0.7
R	66,506	417	9,505	7.4	847.4	847.4	848.0	0.6
S	70,069	539	11,073	6.4	849.8	849.8	850.2	0.4
T	71,610	636	13,021	5.4	850.7	850.7	851.1	0.4

[1]Feet above county boundary

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

SUSQUEHANNA RIVER REACH 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Susquehanna River Reach 1 (continued)								
U	75,659	754	15,414	4.6	851.9	851.9	852.4	0.5
V	78,180	636	14,137	5.0	852.8	852.8	853.3	0.5
W	83,644	395	10,315	6.8	853.9	853.9	854.4	0.5
X	87,967	780	16,624	4.2	855.4	855.4	856.1	0.7
Y	91,531	1,680	29,503	2.4	856.6	856.6	857.4	0.8
Z	97,250	582	11,551	6.1	857.5	857.5	858.4	0.9
AA	100,577	490	11,577	6.1	858.7	858.7	859.5	0.8
AB	104,559	945	17,492	4.0	860.1	860.1	860.9	0.8
AC	107,734	1,235	22,926	3.1	861.5	861.5	862.4	0.9
AD	112,000	1,470	21,842	3.2	862.8	862.8	863.7	0.9
AE	118,619	1,100	16,982	4.1	865.2	865.2	865.9	0.7
AF	120,887	1,077	17,284	4.0	866.9	866.9	867.7	0.8
AG	124,677	560	11,363	6.1	868.3	868.3	869.2	0.9
AH	127,054	672	15,981	4.3	870.1	870.1	870.8	0.7
AI	132,019	604	15,805	4.4	871.1	871.1	871.9	0.8
Susquehanna River Reach 2								
A	544	440	12,273	4.8	917.8	917.8	918.7	0.9
B	5,106	612	14,758	4.0	918.4	918.4	919.3	0.9
C	12,377	1,180	22,218	2.7	919.1	919.1	920.0	0.9
D	16,361	843	17,856	3.3	919.3	919.3	920.2	0.9
E	24,868	810	12,139	4.9	920.0	920.0	920.9	0.9
F	29,175	1,901	31,856	1.9	921.3	921.3	922.2	0.9
G	34,463	406	9,012	6.6	923.4	923.4	924.1	0.7
H	38,220	1,769	22,968	2.6	925.3	925.3	926.1	0.8
I	44,477	2,070	21,880	2.7	926.2	926.2	927.0	0.8

[1]Feet above county boundary

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

SUSQUEHANNA RIVER REACH 1 -
SUSQUEHANNA RIVER REACH 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Susquehanna River Reach 2 (continued)								
J	50,714	1,078	10,121	5.8	928.1	928.1	928.6	0.5
K	52,237	733	10,340	5.7	929.1	929.1	929.7	0.6
L	54,720	1,520	17,075	3.5	930.4	930.4	930.9	0.5
M	57,652	1,078	10,374	5.7	931.2	931.2	931.8	0.6
N	60,550	445	5,663	10.4	933.7	933.7	933.8	0.1
O	63,968	613	11,621	5.0	937.5	937.5	938.2	0.7
P	69,010	540	9,415	6.2	939.3	939.3	939.9	0.6
Q	71,953	1,326	19,748	3.0	940.5	940.5	941.2	0.7
R	76,891	1,329	16,307	3.6	941.1	941.1	942.1	1.0
S	78,288	1,061	11,831	4.9	941.5	941.5	942.4	0.9
T	82,410	418	7,477	7.8	943.7	943.7	944.7	1.0
U	85,574	331	6,252	9.3	946.4	946.4	947.1	0.7
V	86,883	431	7,506	7.8	947.9	947.9	948.4	0.5
W	89,842	521	9,844	5.9	949.6	949.6	950.4	0.8
X	93,051	519	8,905	6.5	950.9	950.9	951.8	0.9
Y	98,343	589	7,907	7.4	954.6	954.6	955.2	0.6
Z	102,247	550	8,571	6.8	958.7	958.7	959.6	0.9
AA	104,356	703	11,510	5.1	962.1	962.1	962.8	0.7
AB	105,755	1,077	16,224	3.6	963.9	963.9	964.6	0.7
AC	109,905	579	11,537	5.1	964.8	964.8	965.5	0.7

[1]Feet above county boundary

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

SUSQUEHANNA RIVER REACH 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tioughnioga River Reach 1								
A	1,330[1]	583	6,104	7.2	897.7	895.4[4]	895.4	0.0
B	3,830[1]	461	6,856	6.4	900.8	900.8	901.3	0.5
C	6,410[1]	550	7,180	6.1	904.4	904.4	905.0	0.6
D	8,780[1]	785	10,157	4.3	908.4	908.4	909.1	0.7
E	11,030[1]	661	7,776	5.6	910.1	910.1	910.8	0.7
Tioughnioga River Reach 2								
A	1,010[2]	595	5,722	3.3	978.1	978.1	979.1	1.0
B	3,420[2]	495	4,432	4.2	979.6	979.6	980.5	0.9
C	4,660[2]	560	4,141	4.5	980.8	980.8	981.7	0.9
D	7,355[2]	510	4,202	4.4	983.2	983.2	984.2	1.0
E	9,715[2]	515	4,600	4.1	986.5	986.5	987.4	0.9
F	12,330[2]	340	2,783	6.7	989.7	989.7	990.5	0.8
G	14,945[2]	445	3,357	5.6	994.2	994.2	995.0	0.8
H	16,325[2]	230	2,901	6.4	995.9	995.9	996.8	0.9
I	17,855[2]	310	2,656	7.0	997.6	997.6	998.4	0.8
J	20,460[2]	615	4,136	4.5	1,000.8	1,000.8	1,001.7	0.9
K	22,095[2]	472[3]	4,662	4.0	1,002.2	1,002.2	1,003.0	0.8

[1]Feet above confluence with the Chenango River
[2]Feet above Limit of Detailed Study (Limit of Detailed Study is located approximately 16,450 feet downstream of Main Street)
[3]Width extends beyond county boundary
[4]Elevation computed without consideration of backwater effects from the Chenango River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

TIOUGHNIOGA RIVER REACH 1 –
TIOUGHNIOGA RIVER REACH 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tributary A to East Branch Nanticoke Creek								
A	42[1]	24	119	8.3	994.1	994.1	994.1	0.0
B	1,572[1]	19	83	11.9	1,040.3	1,040.3	1,041.2	0.9
Tributary B to East Branch Nanticoke Creek								
A	565[1]	25	105	11.6	1,044.4	1,044.4	1,044.7	0.3
B	1,295[1]	35	117	10.5	1,062.0	1,062.0	1,062.0	0.0
West Branch Delaware River								
A	402[2]	356[3]	4,359	9.0	953.4	953.4	954.3	0.9
B	3,857[2]	625[3]	8,721	4.5	959.5	959.5	960.5	1.0
C	6,860[2]	290[3]	5,269	7.4	961.5	961.5	962.4	0.9
D	9,013[2]	221[3]	3,702	10.6	962.9	962.9	963.8	0.9
E	11,041[2]	735[3]	8,462	4.4	968.6	968.6	969.3	0.7
F	13,983[2]	530[3]	8,388	4.4	974.0	974.0	974.9	0.9
G	21,575[2]	747[3]	11,090	3.4	980.2	980.2	981.1	0.9
H	26,799[2]	1,240[3]	14,142	2.6	984.3	984.3	985.2	0.9
I	30,707[2]	1,584[3]	13,140	2.8	986.3	986.3	987.1	0.8
J	32,787[2]	1,044[3]	8,638	4.3	990.7	990.7	991.3	0.6
K	33,618[2]	1,148[3]	15,434	2.4	991.6	991.6	992.3	0.7
L	37,525[2]	870	8,337	4.5	996.4	996.4	997.0	0.6
M	40,822[2]	780	6,514	5.7	998.3	998.3	999.0	0.7

[1]Feet above confluence with East Branch Nanticoke Creek
[2]Feet above county boundary
[3]This width extends beyond the county boundary

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

TRIBUTARY A TO EAST BRANCH NANTICOKE CREEK – TRIBUTARY B TO EAST BRANCH NANTICOKE CREEK – WEST BRANCH DELAWARE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
West Branch Nanticoke Creek								
A	2,040	52	309	6.1	1,056.3	1,056.3	1,057.3	1.0
B	6,460	48	156	7.6	1,073.3	1,073.3	1,073.7	0.4
C	10,263	58	194	6.1	1,095.6	1,095.6	1,096.4	0.8
D	13,353	34	159	7.5	1,115.9	1,115.9	1,116.4	0.5
E	17,979	38	119	7.0	1,145.5	1,145.5	1,146.0	0.5

[1]Feet above Limit of Detailed Study (Limit of Detailed Study is located approximately 7,587 feet downstream of Cherry Valley Hill Road)

TABLE 10

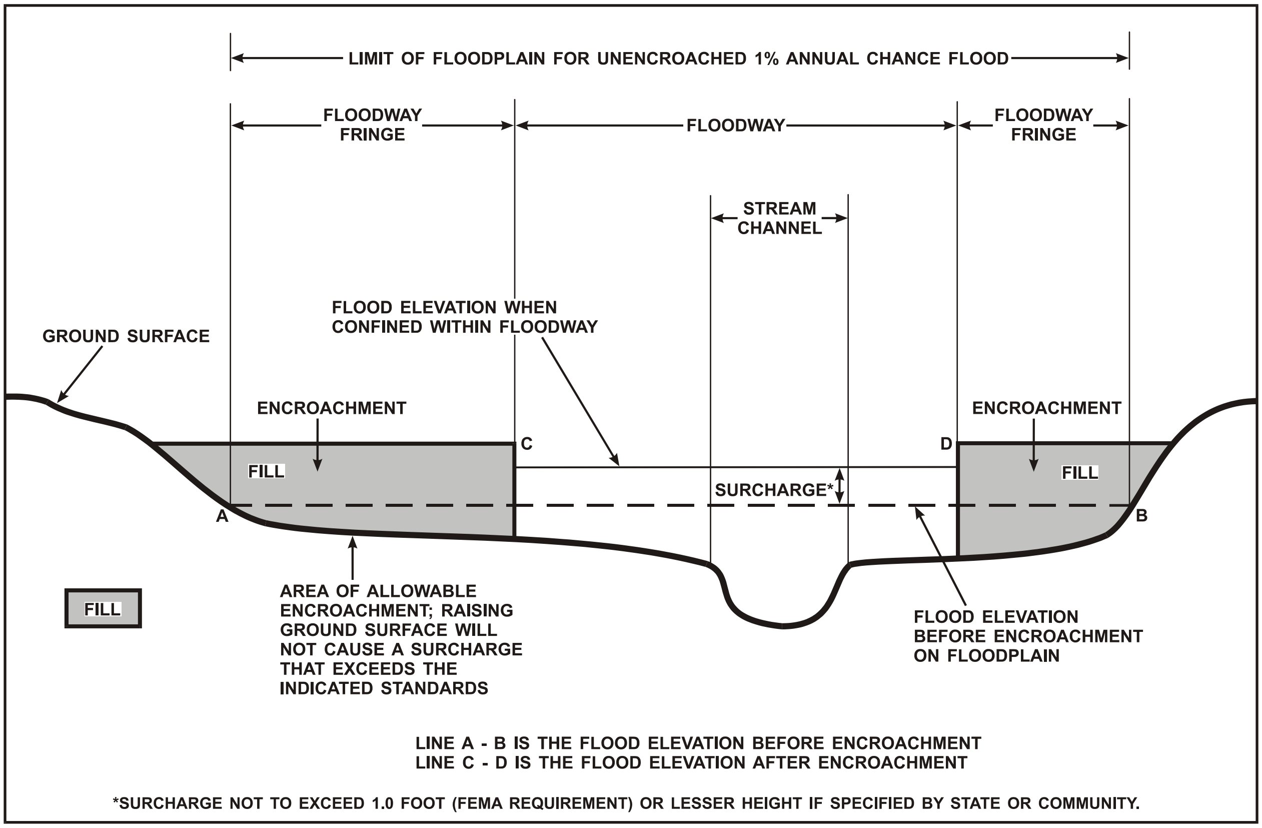
FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

WEST BRANCH NANTICOKE CREEK

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 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.



FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. 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 base flood elevations 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 base flood elevations 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 base flood elevations 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-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

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

Zone A99

Zone A99 is the flood insurance 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 base flood elevations 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 base flood elevations 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 base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent–annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No base flood elevations 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 base flood elevations or average depths. Insurance agents use the zones and base flood elevations 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 Broome County. Previously, separate Flood Hazard Boundary Maps (FHBMs) and/or FIRMs were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. This countywide FIRM also includes flood hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community, up to and including this countywide FIS, are presented in Table 11, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Barker, Town of	February 15, 1974	November 14, 1975	January 6, 1984	February 5, 1992
Binghamton, City of	April 12, 1974	October 17, 1975 April 23, 1976	June 1, 1977	
Binghamton, Town of	June 7, 1974	November 10, 1975 April 23, 1976	January 6, 1984	
Chenango, Town of	March 8, 1974	February 7, 1975 December 26, 1975	August 17, 1981	
Colesville, Town of	June 28, 1974	April 18, 1975 August 6, 1976 January 13, 1978	January 6, 1983	January 20, 1993
Conklin, Town of	April 5, 1974	November 14, 1975	May 16, 1977	September 26, 1980 July 17, 1981
Deposit, Village of	June 14, 1974	October 24, 1975	February 1, 1979	
Dickinson, Town of	March 8, 1974	February 7, 1975	April 15, 1977	
Endicott, Village of	October 1, 1976	None	May 15, 1978	September 7, 1998
Fenton, Town of	May 3, 1974	February 7, 1975	August 3, 1981	
Johnson City, Village of	April 12, 1974	September 19, 1975	September 30, 1977	
Kirkwood, Town of	October 5, 1973	None	June 1, 1977	

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Lisle, Town of	February 15, 1974	February 20, 1976	January 6, 1984	August 20, 2002
Lisle, Village of	August 9, 1974	April 9, 1976	January 6, 1984	
Maine, Town of	May 17, 1974	October 10, 1975	March 18, 1983	February 5, 1992
Nanticoke, Town of	April 12, 1974	November 7, 1975 February 24, 1978	December 18, 1985	
Port Dickinson, Village of	February 1, 1974	April 25, 1975 November 28, 1975	May 2, 1977	
Sanford, Town of	July 26, 1974	January 2, 1976	June 4, 1980	
Triangle, Town of	April 5, 1974	November 21, 1975	July 20, 1984	
Union, Town of	February 6, 1976	None	March 1, 1978	December 21, 1980 May 8, 1981 September 30, 1988
Vestal, Town of	April 5, 1974	January 3, 1975	July 5, 1977	March 18, 1983 September 5, 1984 March 2, 1998
Whitney Point, Village of	February 22, 1974	October 24, 1975	June 6, 1984	
Windsor, Town of	June 28, 1984	August 27, 1976	May 3, 1982	September 30, 1992
Windsor, Village of	June 19, 1975	October 24, 1975	February 17, 1982	May 18, 1992

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY (ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

FISs are also being prepared for Cortland County (All Jurisdictions), Chenango County (All Jurisdictions), Delaware County (All Jurisdictions), Tioga County (All Jurisdictions), and Susquehanna County, Pennsylvania (All Jurisdictions).

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Broome County has been compiled into this FIS. Therefore, this FIS supersedes all previously printed FIS Reports, FHBMs, FBFMs, and FIRMs for all of the incorporated jurisdictions within Broome County.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this FIS can be obtained by contacting FEMA, Federal Insurance and Mitigation Division, 26 Federal Plaza, 13th Floor, New York, New York .

9.0 BIBLIOGRAPHY AND REFERENCES

Beard, Leo R. (January 1962). Statistical Methods in Hydrology. U.S. Army Corps of Engineers, Sacramento District.

Federal Emergency Management Agency. (Flood Insurance Study report, August 20, 2002; Flood Insurance Rate Map, August 20, 2002). Flood Insurance Study, Town of Lisle, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, September 7, 1998; Flood Insurance Rate Map, September 7, 1998). Flood Insurance Study, Village of Endicott, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, March 2, 1998; Flood Insurance Rate Map, March 2, 1998). Flood Insurance Study, Town of Vestal, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, January 20, 1993; Flood Insurance Rate Map, January 20, 1993). Flood Insurance Study, Town of Colesville, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, September 30, 1992; Flood Insurance Rate Map, September 30, 1992). Flood Insurance Study, Town of Windsor, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, May 18, 1992; Flood Insurance Rate Map, May 18, 1992). Flood Insurance Study, Village of Windsor, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, February 5, 1992; Flood Insurance Rate Map, February 5, 1992). Flood Insurance Study, Town of Maine, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, February 5, 1992; Flood Insurance Rate Map, February 2, 1992). Flood Insurance Study, Town of Barker, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, September 30, 1988; Flood Insurance Rate Map, September 30, 1988). Flood Insurance Study, Town of Union, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Study report, December 18, 1985; Flood Insurance Rate Map, December 18, 1985). Flood Insurance Study, Town of Nanticoke, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Rate Map, July 20, 1984). Flood Insurance Study, Town of Triangle, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Rate Map, January 6, 1984). Flood Insurance Study, Village of Whitney Point, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Rate Map, January 6, 1984). Flood Insurance Study, Town of Binghamton, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency. (Flood Insurance Rate Map, January 6, 1984). Flood Insurance Study, Village of Lisle, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency, Federal Insurance Administration. (Flood Insurance Study report, February 17, 1981; Flood Insurance Rate Map, August 17, 1981). Flood Insurance Study, Town of Chenango, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency, Federal Insurance Administration. (Flood Insurance Study report, February 3, 1981; Flood Insurance Rate Map, August 3, 1981). Flood Insurance Study, Town of Fenton, Broome County, New York. Washington, D.C.

Federal Emergency Management Agency, Federal Insurance Administration. (Flood Insurance Study report, December 1979; Flood Insurance Rate Map, June 4, 1980). Flood Insurance Study, Town of Sanford, Broome County, New York. Washington, D.C.

Flynn, K. M., Kirby, W. H., and Hummel, P.R. (2006). User's Manual for Program PeakFQ, Annual Flood Frequency Analysis Using Bulletin 17B Guidelines: U.S. Geological Survey Techniques and Methods Book 4, Chapter B4, 42 pgs. U.S. Geological Survey. http://water.usgs.gov/software/PeakFQ/. Reston, Virginia.

Interagency Advisory Committee on Water Data, 1982, Guidelines for determining flood flow frequency: Bulletin 17B of the Hydrology Subcommittee, Office of Water Data Coordination, U.S. Geological Survey, Reston, VA., 183 p.

Kimball, L. Robert, Consulting Engineers. (February 1973). Topographic Maps, Scale 1"=200'. Ebensburg, Pennsylvania.

New York State Climate Office. (2007).

New York State Department of Environmental Conservation. (2008). Binghamton Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). Endicott Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). Fairmont Park Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). Johnson City Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). Lisle Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). Port Dickinson Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). Twin Orchards Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). Vestal Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). West Endicott Flood Control Project, Region 7 Headquarters.

New York State Department of Environmental Conservation. (2008). Whitney Point Flood Control Project, Region 7 Headquarters.

Ries, K.G., III, and Crouse, M.Y. (2002). The National Flood Frequency Program, Version 3: A Computer Program for Estimating Magnitude and Frequency of Floods for Ungaged Sites. U.S. Geological Survey Water-Resources Investigations Report 02-4168.

Stuckey, Marla H. and Reed, Lloyd A. Techniques for Estimating Magnitude and Frequency of Peak Flows for Pennsylvania Streams, Water Resources Investigations Report 00-4189.

The Marathon Independent. (July 15, 1976). Volume 102, No. 48. Marathon, New York.

Thornbury, William D. (1965). Regional Geography of the United States. John Wiley and Sons, Inc., New York.

Town of Barker. Local Law No. 1, Flood Damage Prevention, by the Town Board of the Town of Barker, Broome County, New York.

Town of Lisle. (1987). Local Law No. 1, A Local Law, Flood Damage Prevention, by the Town Board of the Town of Lisle, Broome County, New York.

Town of Maine, New York. (Adopted by the Town Board, April 11, 1972, last amended May 13, 1975). Zoning Ordinance.

URS Group Inc. Final Hydrology Report: Delaware River Basin - Study, submitted to FEMA Region II, New York, NY, July 2008.

URS Group Inc. and Dewberry & Davis LLC.. Draft Hydraulics Report: Susquehanna River Basin – Susquehanna County, Pennsylvania, submitted to FEMA Region III, New York, NY, July 2008.

URS Group Inc. and Dewberry & Davis LLC.. Final Hydrologic Report Susquehanna River Basin – Broome, Chenango, Delaware, Otsego, and Tioga Counties, submitted to FEMA Region II, New York, NY, February 2009.

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

U.S. Army Corps of Engineers, Broome County. (December 1969). New York Flood Plain Information, Susquehanna and Chenango Rivers (Triple Cities Area).

U.S. Census Bureau. American FactFinder. (2000). http://factfinder.census.gov/home/saff/main.html?_lang=en

U.S. Department of Agriculture, Soil Conservation Service. (April 1977). Draft Watershed Plan and Environmental Impact Statement for Deposit Watershed.

U.S. Department of Agriculture, Soil Conservation Service. (May 1976). Technical Release No. 61, WSP2 Computer Program.

U.S. Department of Agriculture, Soil Conservation Service. (1974). Technical Release No. 61, WSP-2, Computer Program for Determining Flood Elevations and Flood Areas for Certain Flow Rates. Hyattsville, Maryland.

U.S. Department of Agriculture, Soil Conservation Service. (May 1965). Technical Release No. 20, Computer Program for Project Formulation Hydrology.

U.S. Department of Agriculture, Soil Conservation Service. (January 1968, Revised April 1973). SCSTP149, A Method for Estimating Volume and Rate of Runoff in Small Watersheds. Washington, D.C.

U.S. Department of Agriculture, Soil Conservation Service. (Section 4, August 1972; Section 5, 1954). National Engineering Handbook.

U.S. Department of Commerce, Weather Bureau. (May 1961). Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 minutes to 24 hours and Return Periods 1 to 100 Years.

U.S. Department of Housing and Urban Development, Federal Insurance Administration. (Flood Insurance Study report, August 1978; Flood Insurance Rate Map, February 1, 1979). Flood Insurance Study, Village of Deposit, Broome County, New York. Washington, D.C.

U.S. Department of Housing and Urban Development, Federal Insurance Administration. (Flood Insurance Study report, September 1977; Flood Insurance Rate Map, September 30, 1977). Flood Insurance Study, Village of Johnson City, Broome County, New York. Washington, D.C.

U.S. Department of Housing and Urban Development, Federal Insurance Administration. (Flood Insurance Study report, December 1976; Flood Insurance Rate Map, June 1, 1977). Flood Insurance Study, Town of Kirkwood, Broome County, New York. Washington, D.C.

U.S. Department of Housing and Urban Development, Federal Insurance Administration. (Flood Insurance Study report, December 1976; Flood Insurance Rate Map, June 1, 1977). Flood Insurance Study, City of Binghamton, Broome County, New York. Washington, D.C.

U.S. Department of Housing and Urban Development, Federal Insurance Administration. (Flood Insurance Study report, November 1976; Flood Insurance Rate Map, May 2, 1977). Flood Insurance Study, Village of Port Dickinson, Broome County, New York. Washington, D.C.

U.S. Department of Housing and Urban Development, Federal Insurance Administration. (Flood Insurance Study report, November 1976; Flood Insurance Rate Map, July 17, 1981). Flood Insurance Study, Town of Conklin, Broome County, New York. Washington, D.C.

U.S. Department of Housing and Urban Development, Federal Insurance Administration. (Flood Insurance Study report, October 1976; Flood Insurance Rate Map, April 15, 1977). Flood Insurance Study, Town of Dickinson, Broome County, New York. Washington, D.C.

U.S. Department of the Interior, Geological Survey (USGS). (2006). Magnitude and Frequency of Floods in New York. Scientific Investigations Report 2006-5112. U.S. Geological Survey, Reston. VA.

U.S. Department of the Interior, Geological Survey (USGS). (2000). Development of a Contour Map Showing Generalized Skew Coefficients of Annual Peak Discharges of Rural Unregulated Streams in New York, Excluding Long Island, U.S. Geological Survey, Water-Resources Investigations Report 00-4022.

U.S. Department of the Interior, Geological Survey. (1991). Water Resources Investigations Report 90-4197, Regionalization of Flood Discharges for Rural Unregulated Streams in New York State Excluding Long Island. Albany, New York.

U.S. Department of the Interior, Geological Survey. (1979). Water Resources Investigation 79-83, Techniques for Estimating the Magnitude and Frequency of Floods on Rural Unregulated Streams in New York State Excluding Long Island. T. Zembrzuski and B. Dunn (authors). Washington, D.C.

U.S. Department of the Interior, Geological Survey. (1976). Open-File Report, Computer Program E431, User's Manual, Computer Applications for Step-Backwater and Floodway Analyses. James O. Shearman (author). Washington, D.C.

U.S. Department of the Interior, Geological Survey. (Town of Maine, New York, 1969, Photorevised 1974; Town of Lisle, New York, 1949, Photorevised 1974). 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet.

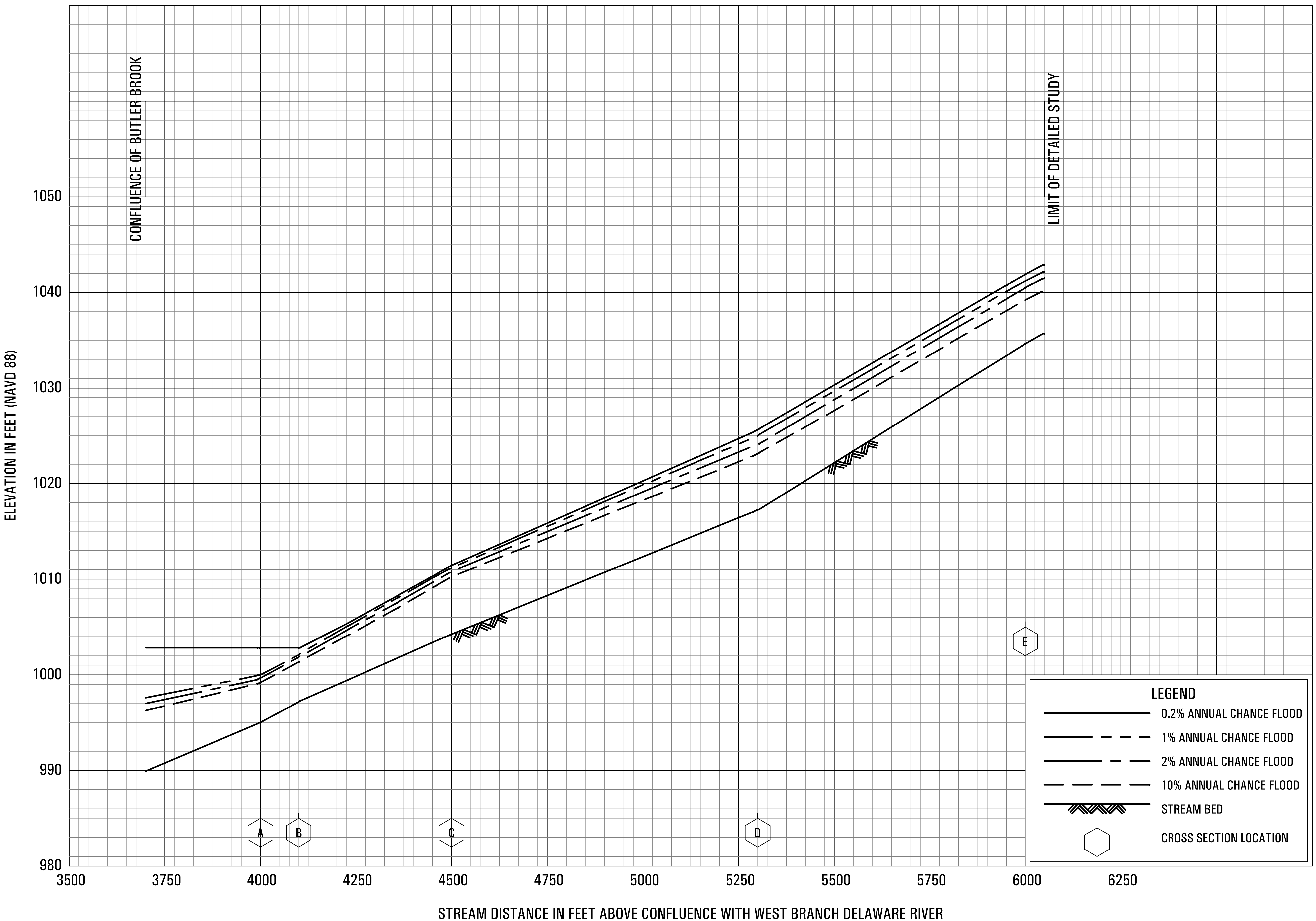
U.S. Department of the Interior, Geological Survey. (Deposit, New York, 1965; North Sanford, New York, 1965; Gulf Summit, New York, 1952). 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet.

U.S. Department of the Interior, Geological Survey. (1938). Water-Supply Paper 773E, The New York State Flood of 1935. H. Johnson (author). Washington, D.C.

U.S. Department of the Interior, Geological Survey. (Unpublished). Computer Program J635, Users Guide, Step-Backwater and Floodway Analyses. James O. Shearman (author).

U.S. Department of the Interior, Geological Survey. 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 feet. Chenango Forks, New York; Whitney Point, New York.

Water Resources Council. (June 1977). Guidelines for Determining Flood Flow Frequency, Bulletin 17A. Washington, D.C.



FLOOD PROFILES

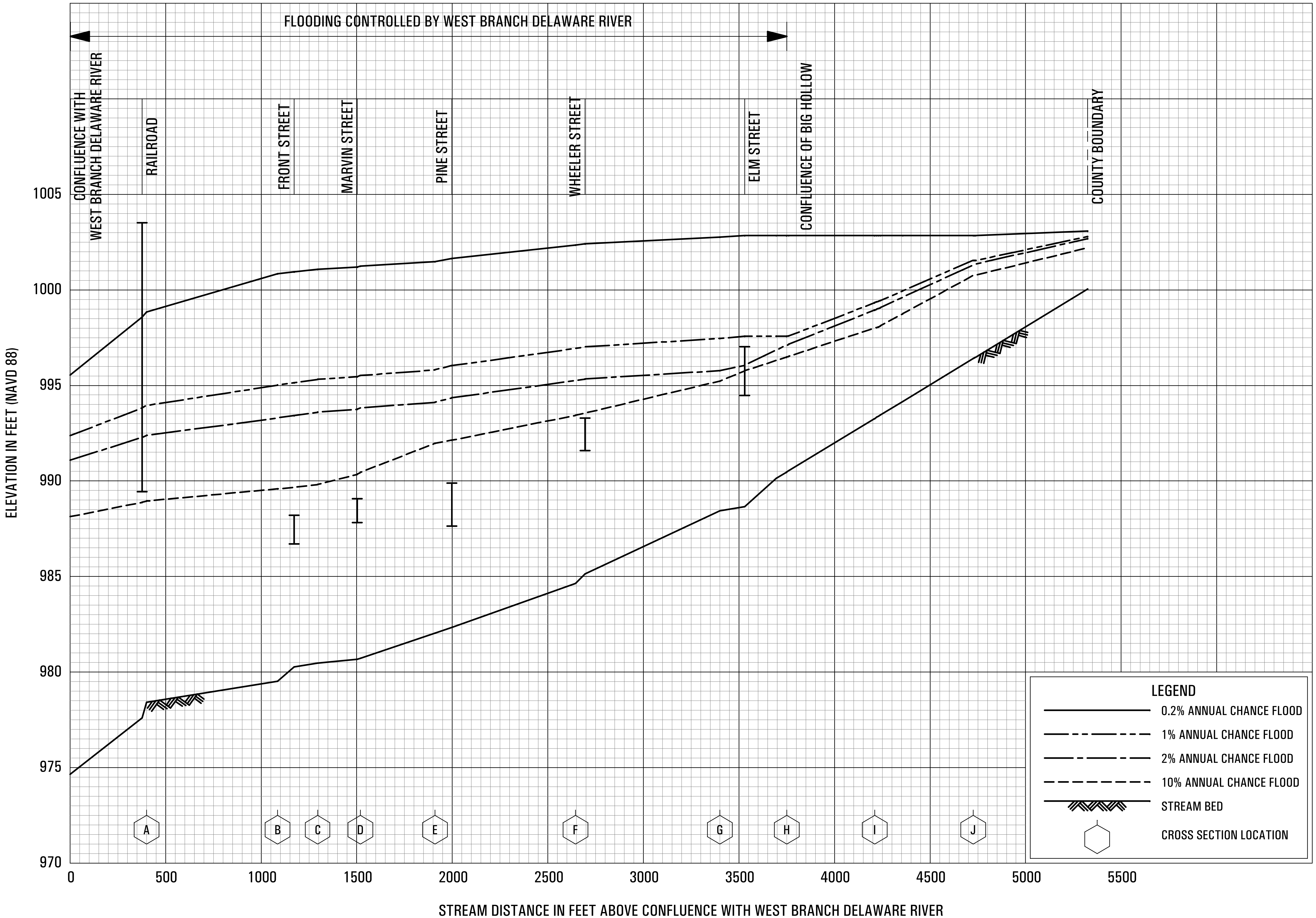
BIG HOLLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

01P



FLOOD PROFILES

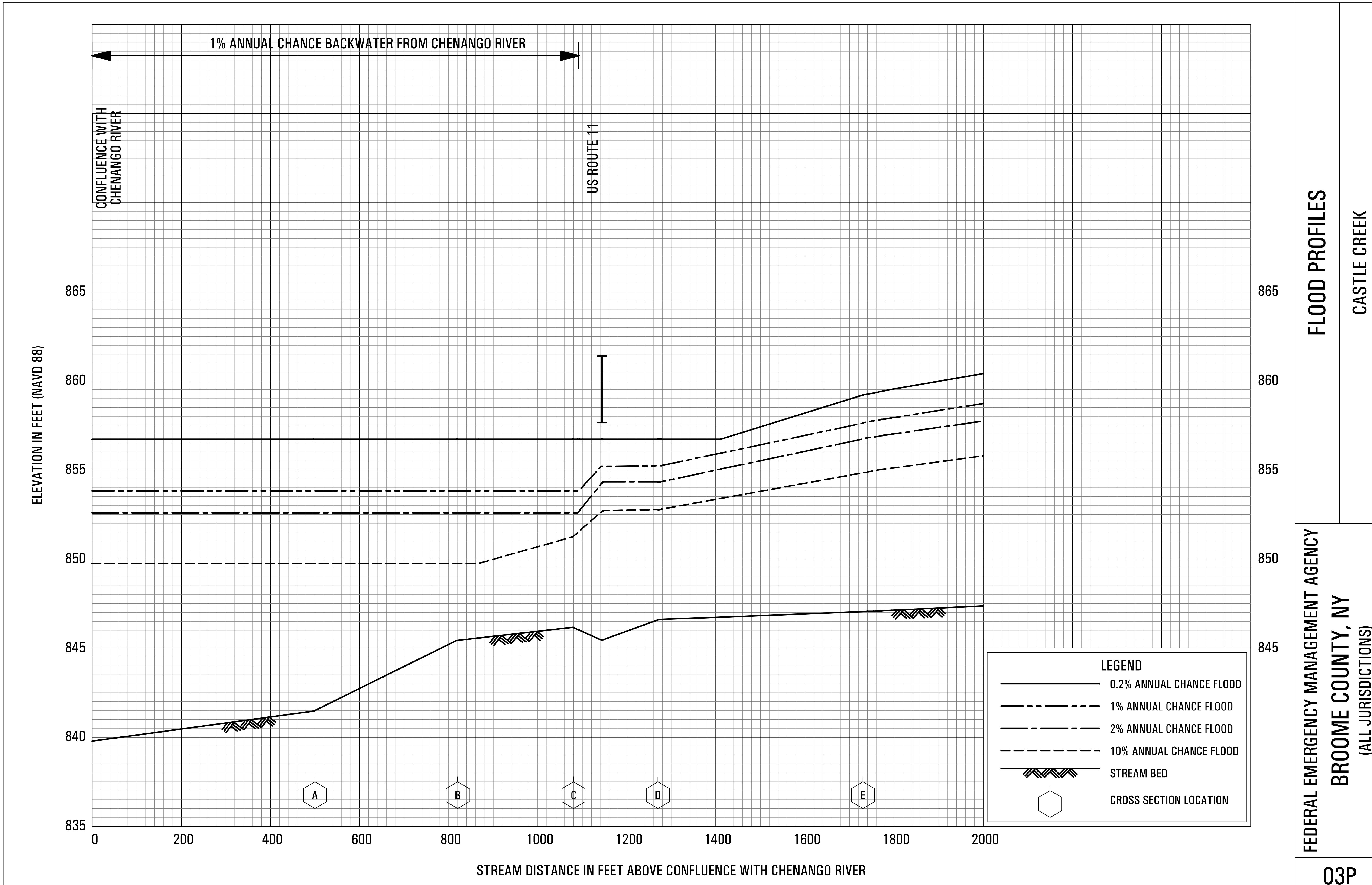
BUTLER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

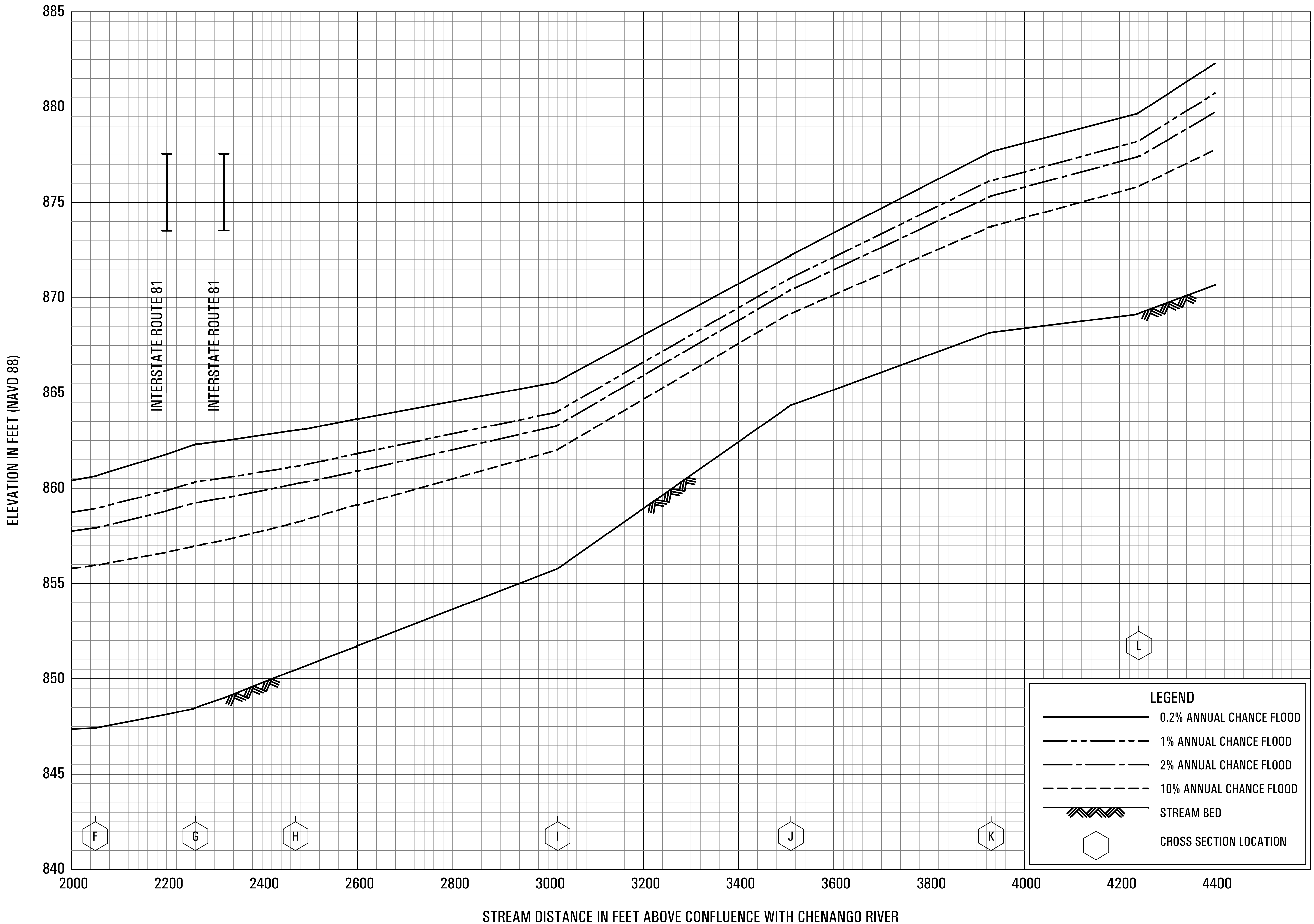
BROOME COUNTY, NY

(ALL JURISDICTIONS)

02P



1% ANNUAL CHANCE BACKWATER FROM CHENANGO RIVER
CONFLUENCE WITH CHENANGO RIVER
US ROUTE 11
ELEVATION IN FEET (NAVD 88)
865
860
855
850
845
840
835
0
200
400
600
800
1000
1200
1400
1600
1800
2000
A
B
C
D
E
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH CHENANGO RIVER
LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
CASTLE CREEK
FEDERAL EMERGENCY MANAGEMENT AGENCY
BROOME COUNTY, NY
(ALL JURISDICTIONS)
03P



FLOOD PROFILES

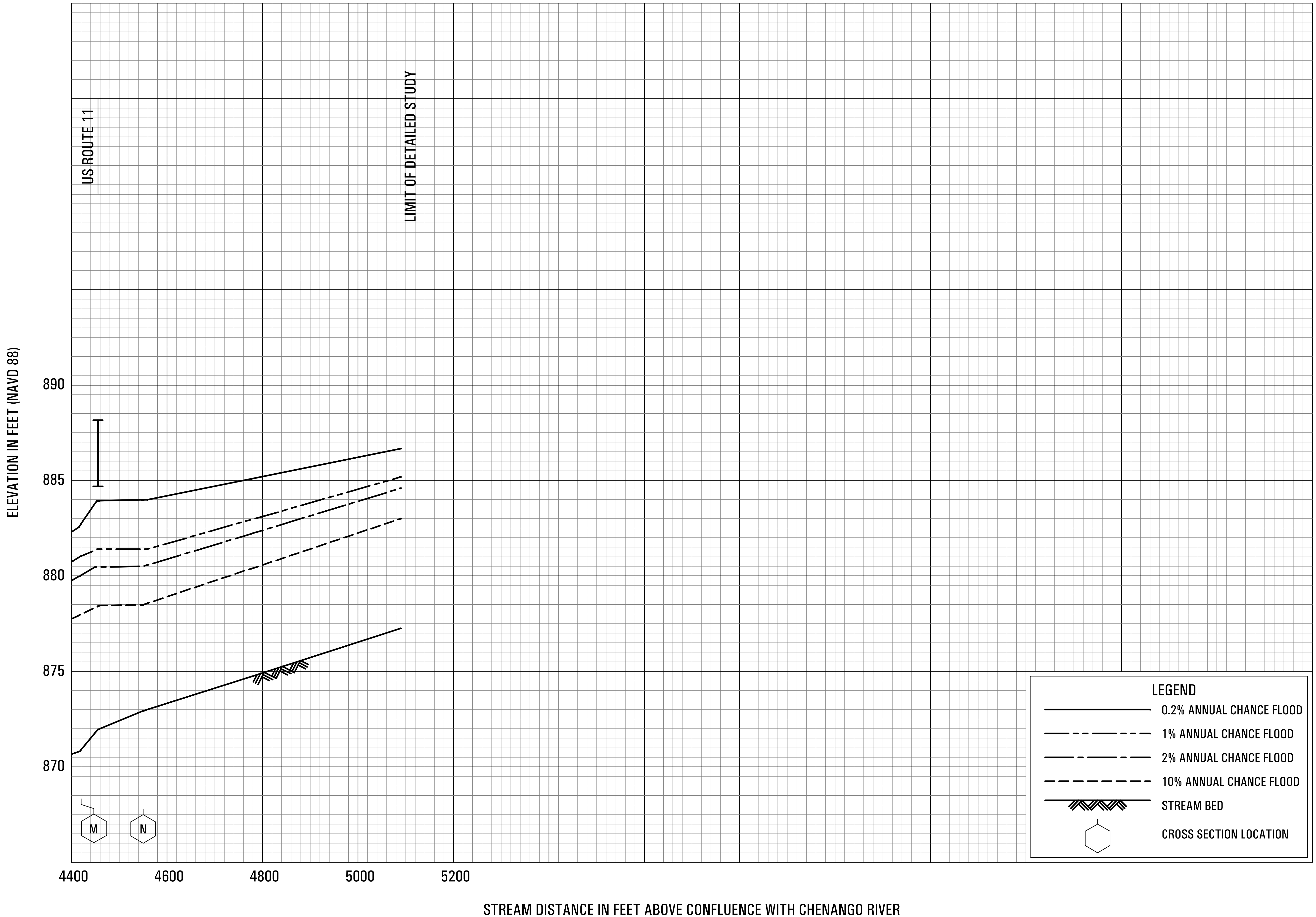
CASTLE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

04P



FLOOD PROFILES

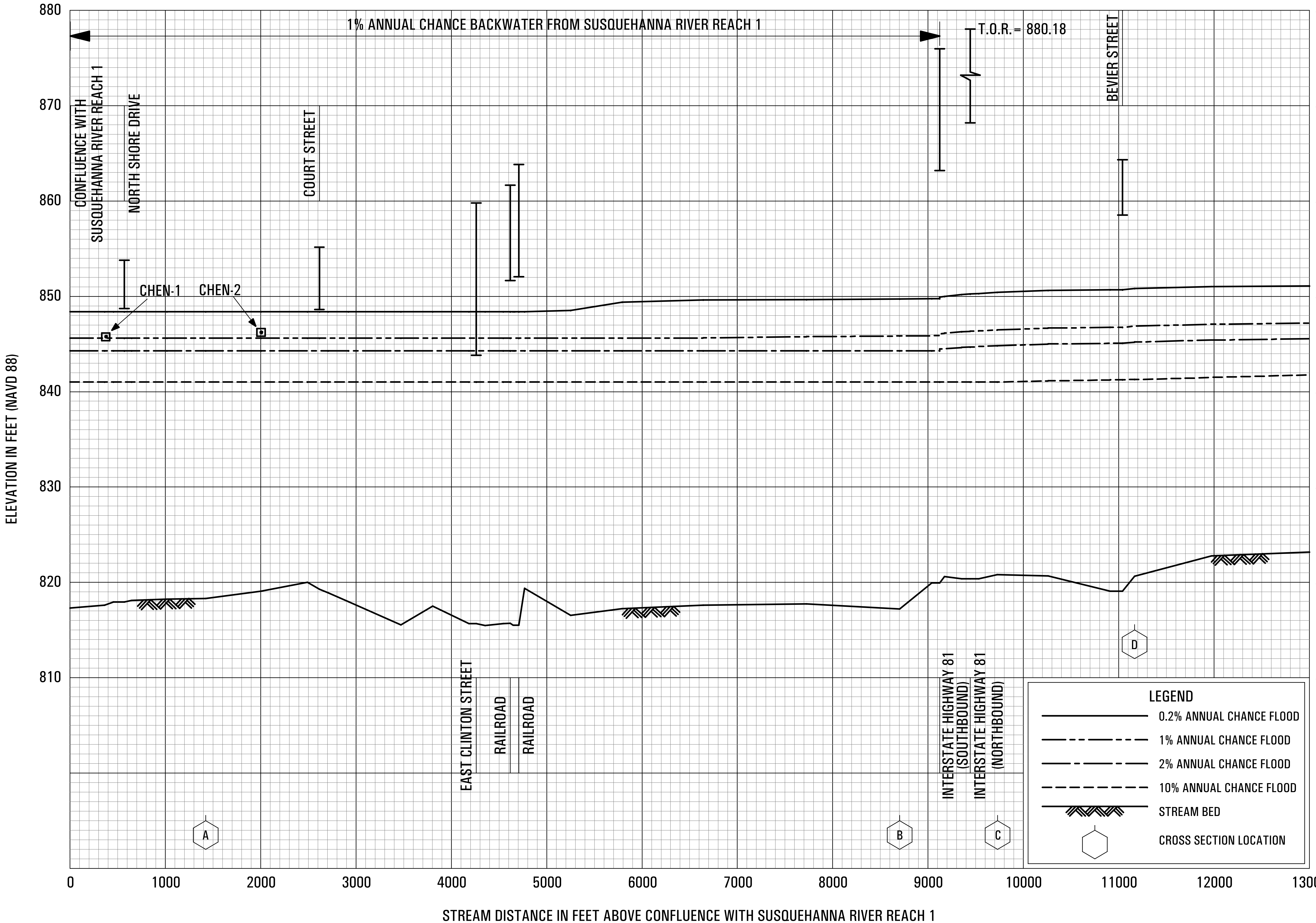
CASTLE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

05P



FLOOD PROFILES

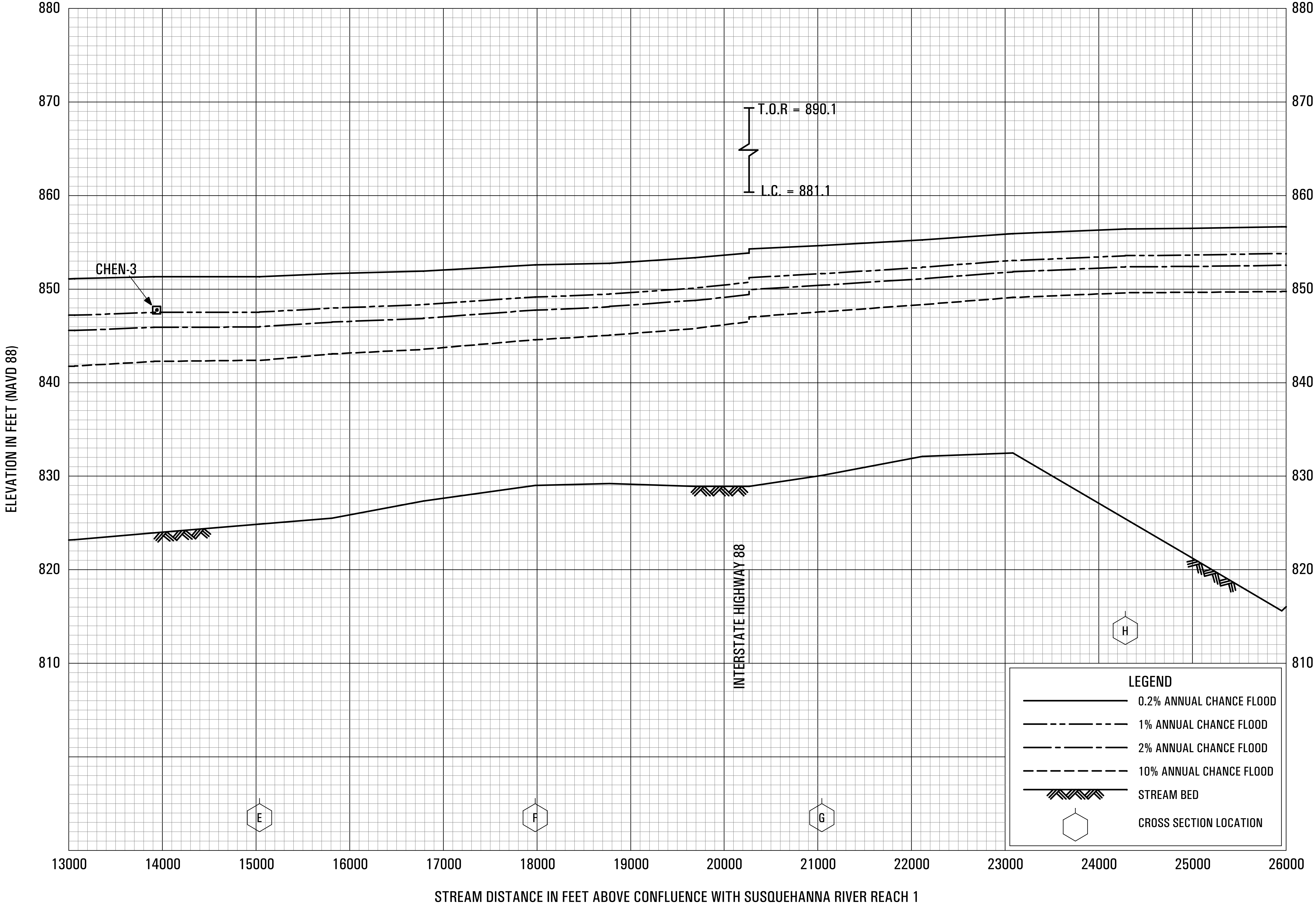
CHENANGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

06P



FLOOD PROFILES

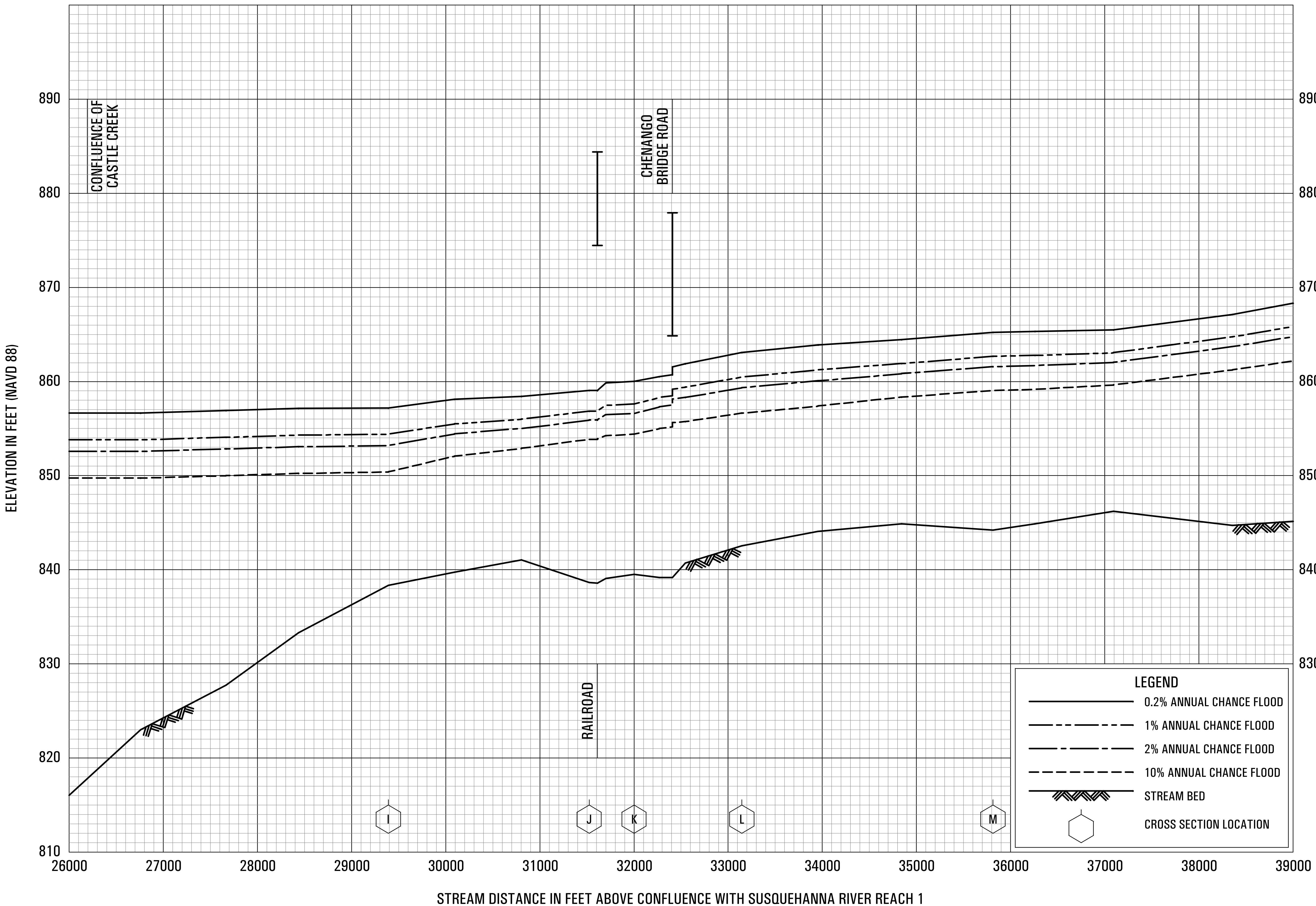
CHENANGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

07P



FLOOD PROFILES

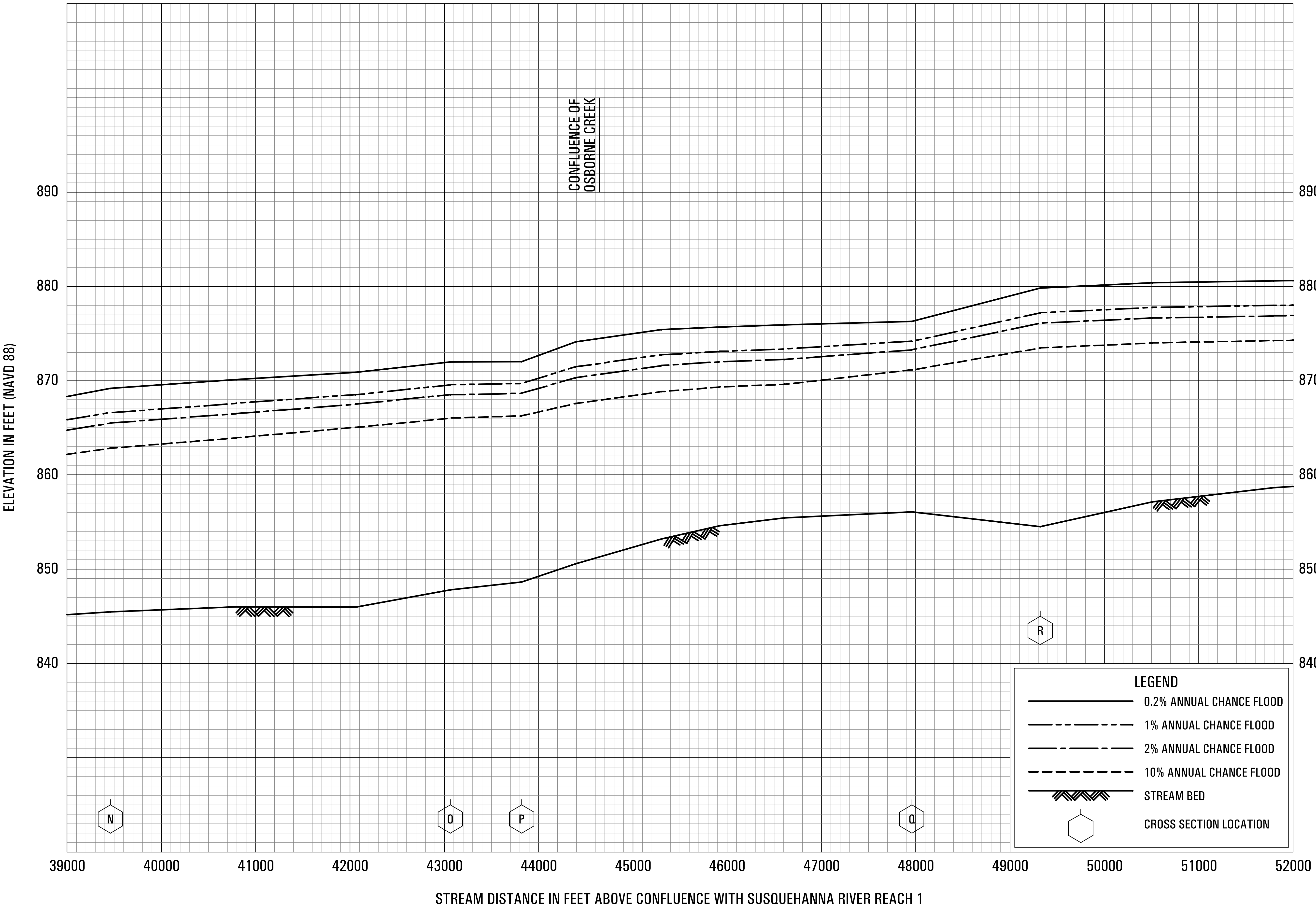
CHENANGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

08P



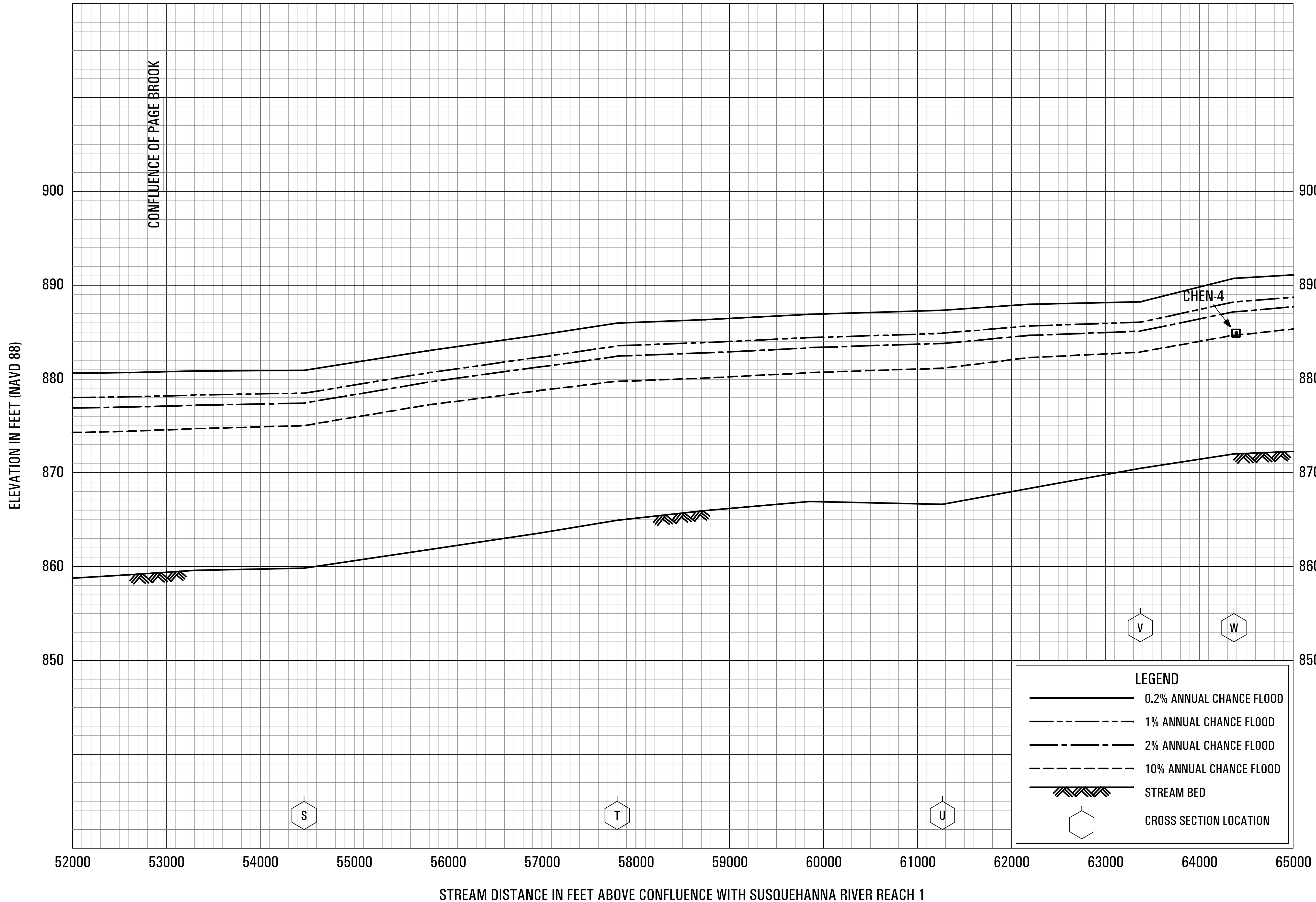
FLOOD PROFILES

CHENANGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



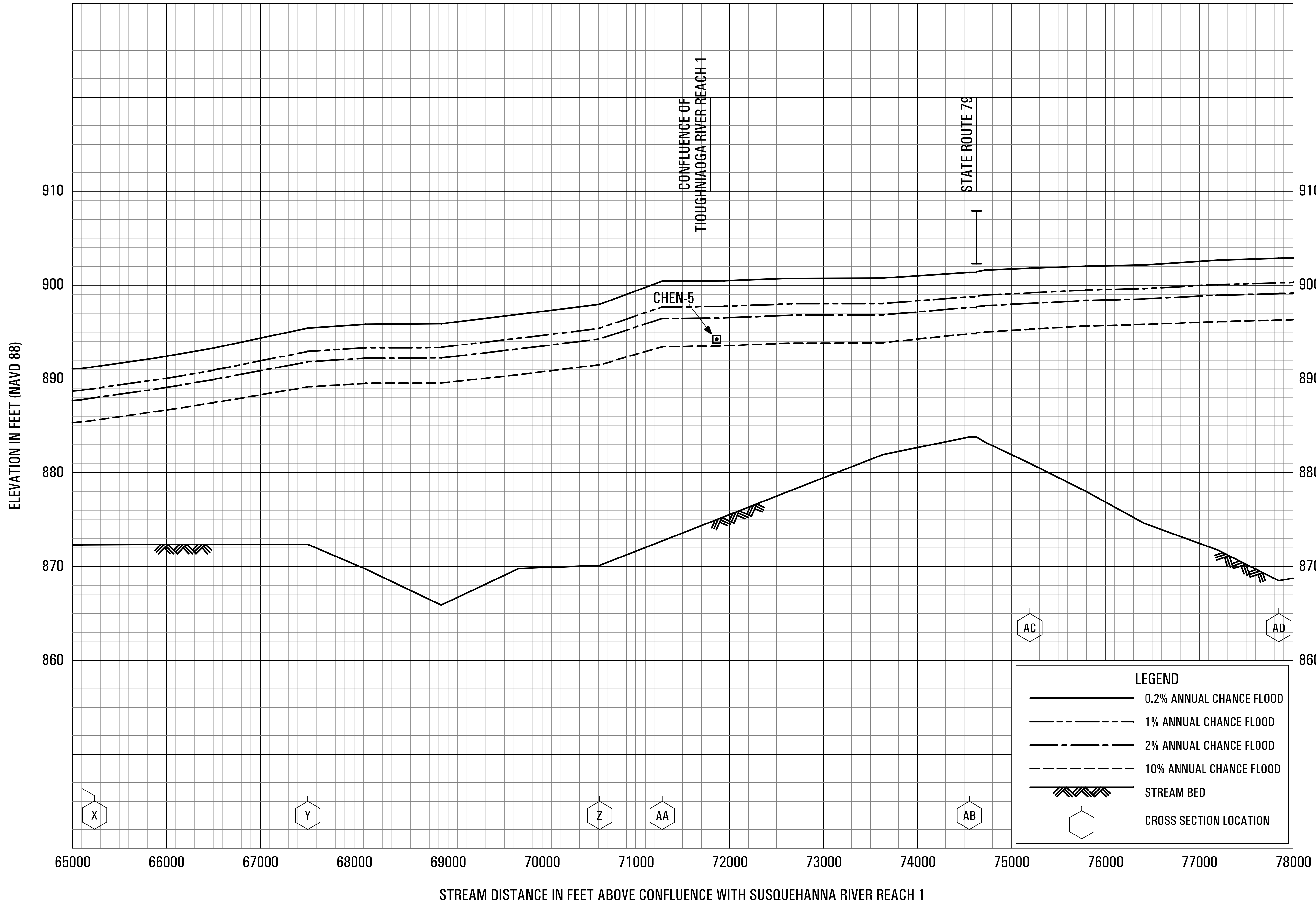
FLOOD PROFILES

CHENANGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

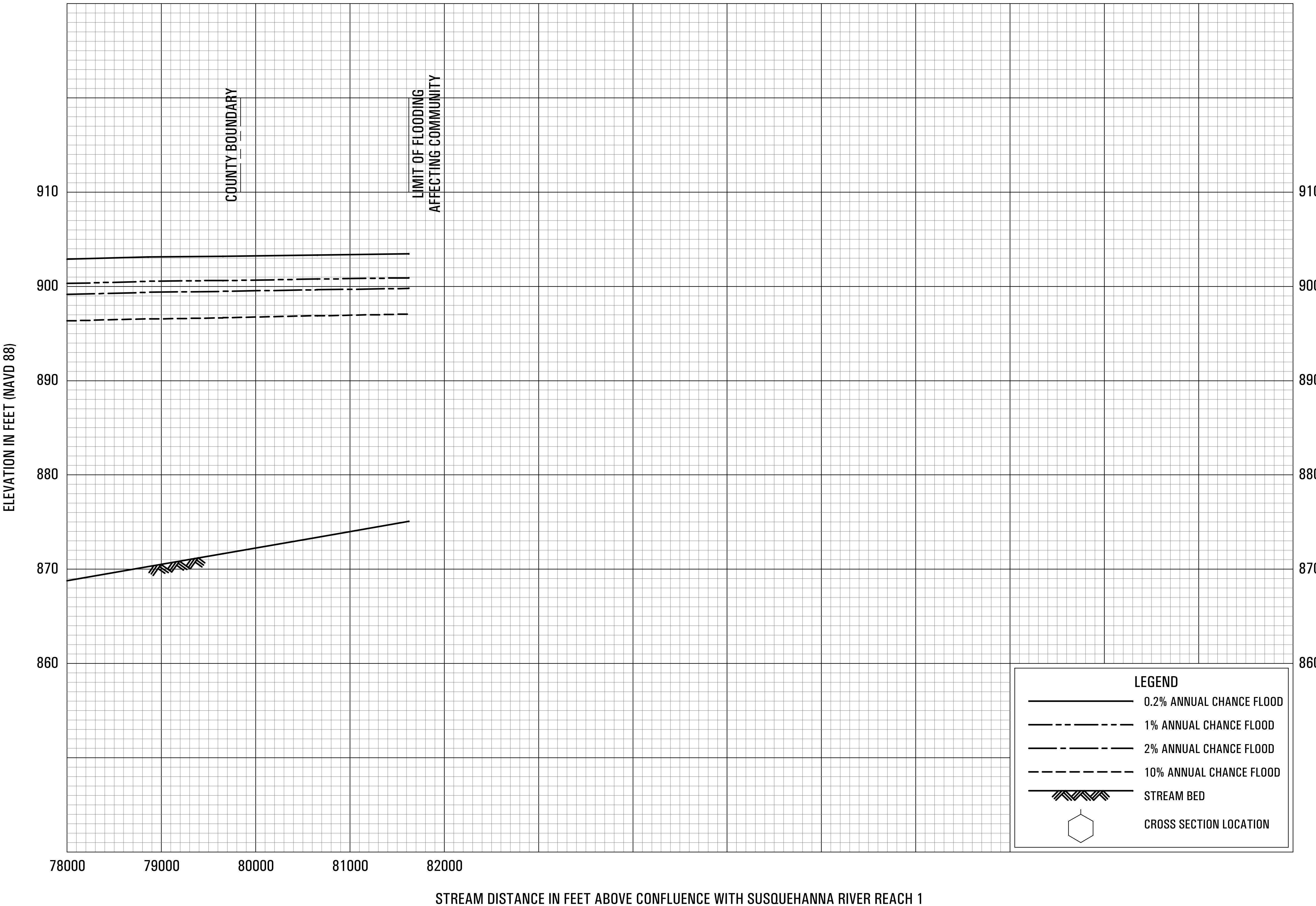
CHENANGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

11P



FLOOD PROFILES

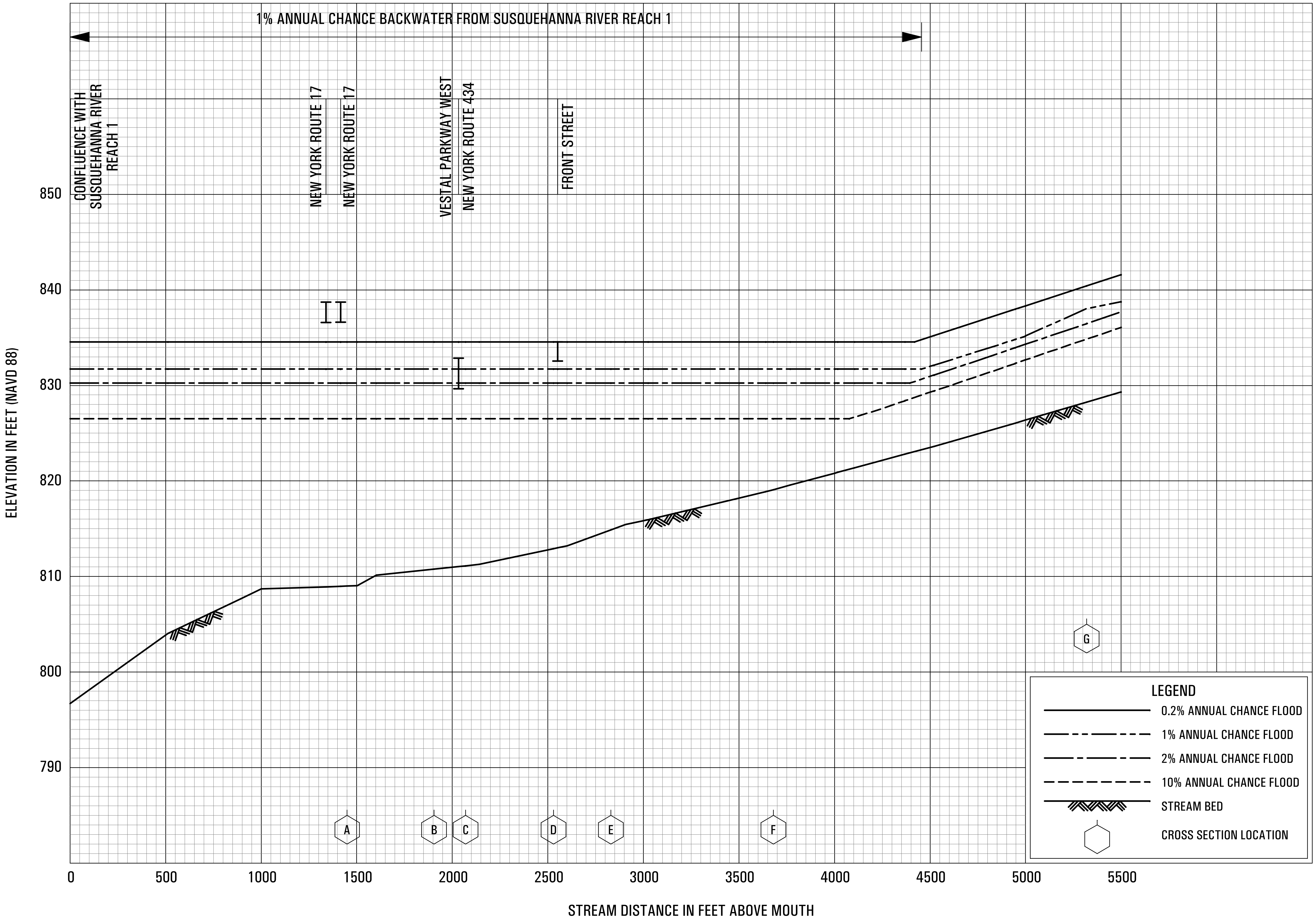
CHENANGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

12P



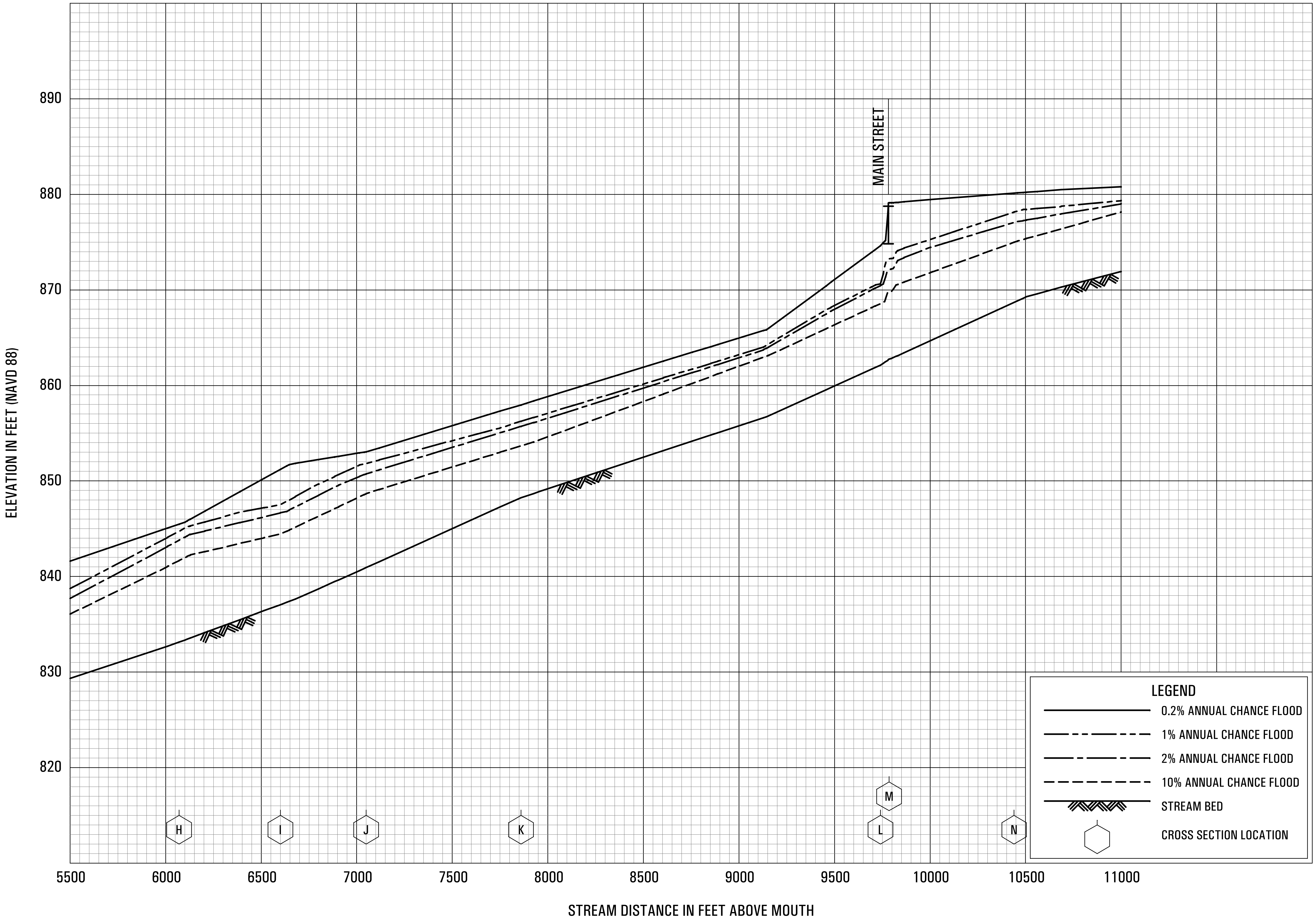
FLOOD PROFILES

CHOCONUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



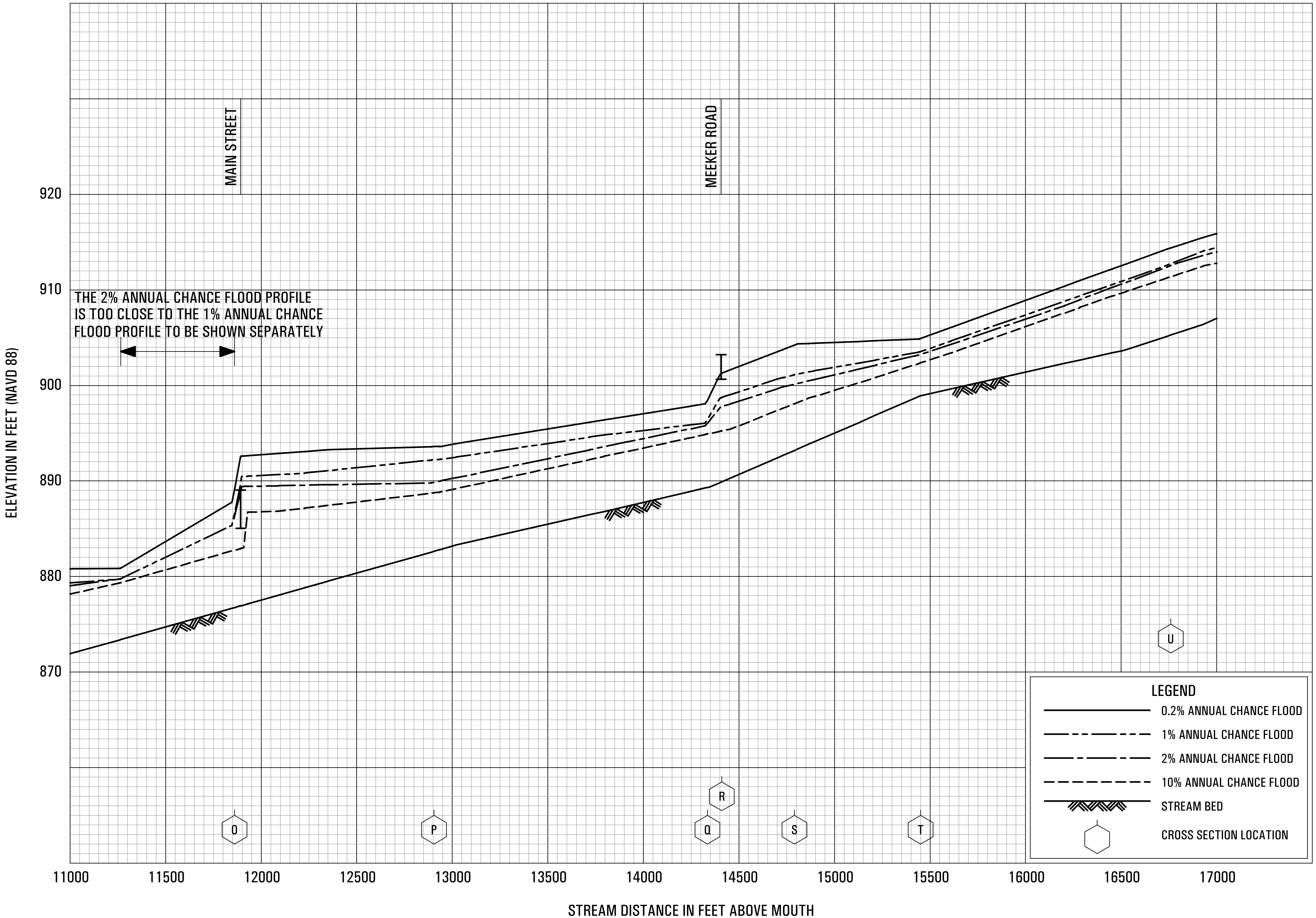
FLOOD PROFILES

CHOCONUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



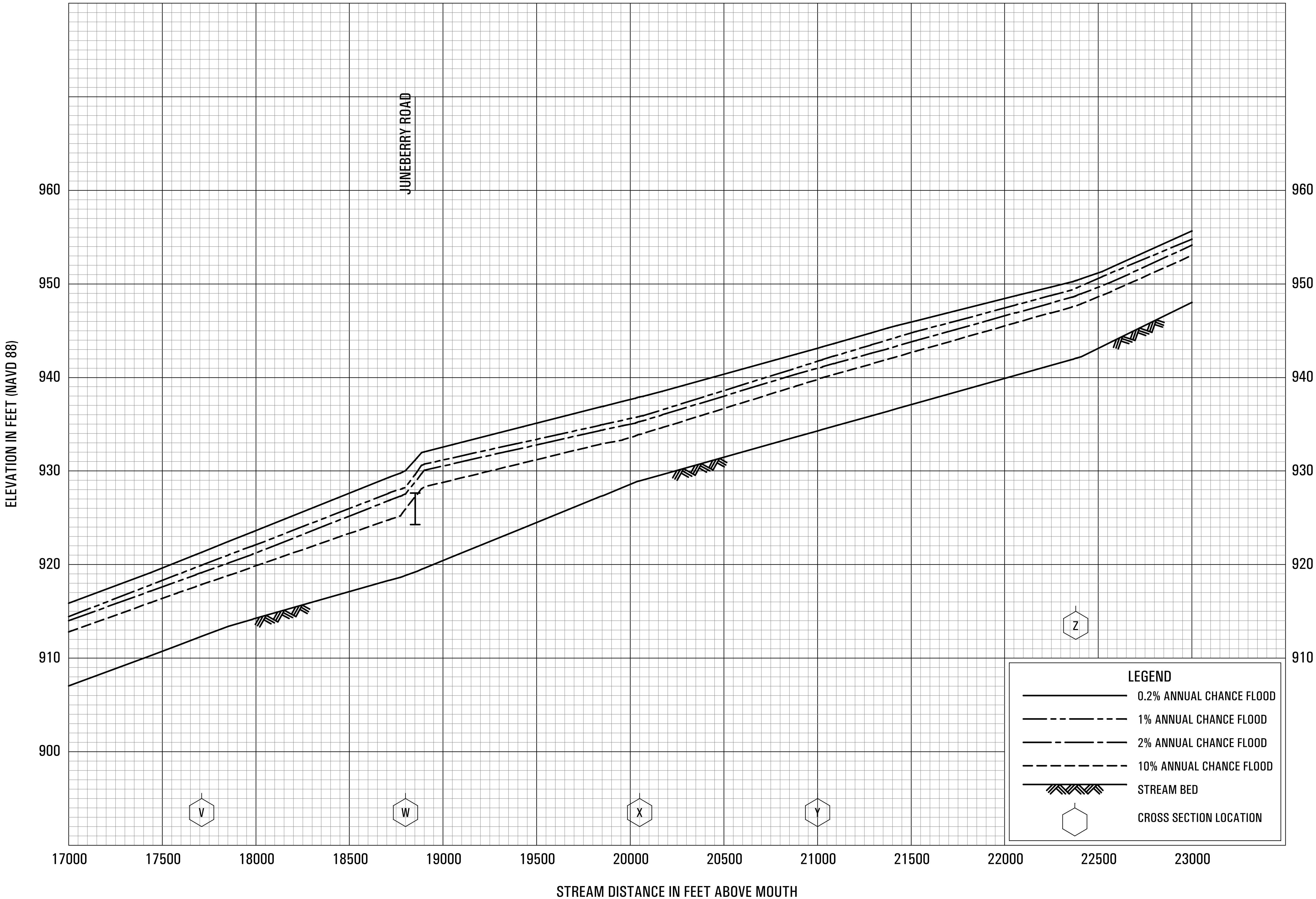
FLOOD PROFILES

CHOCONUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

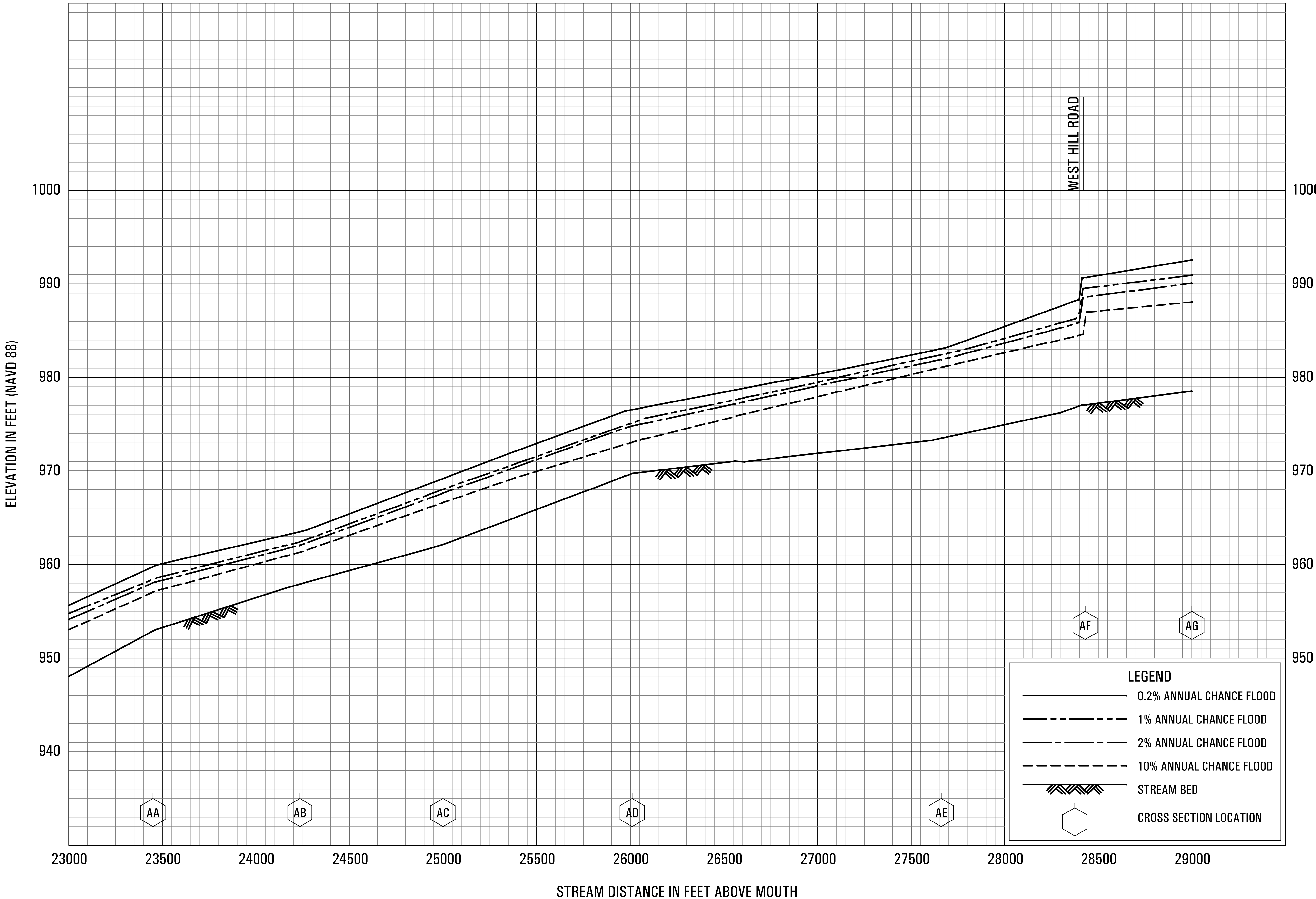
CHOCONUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

16P



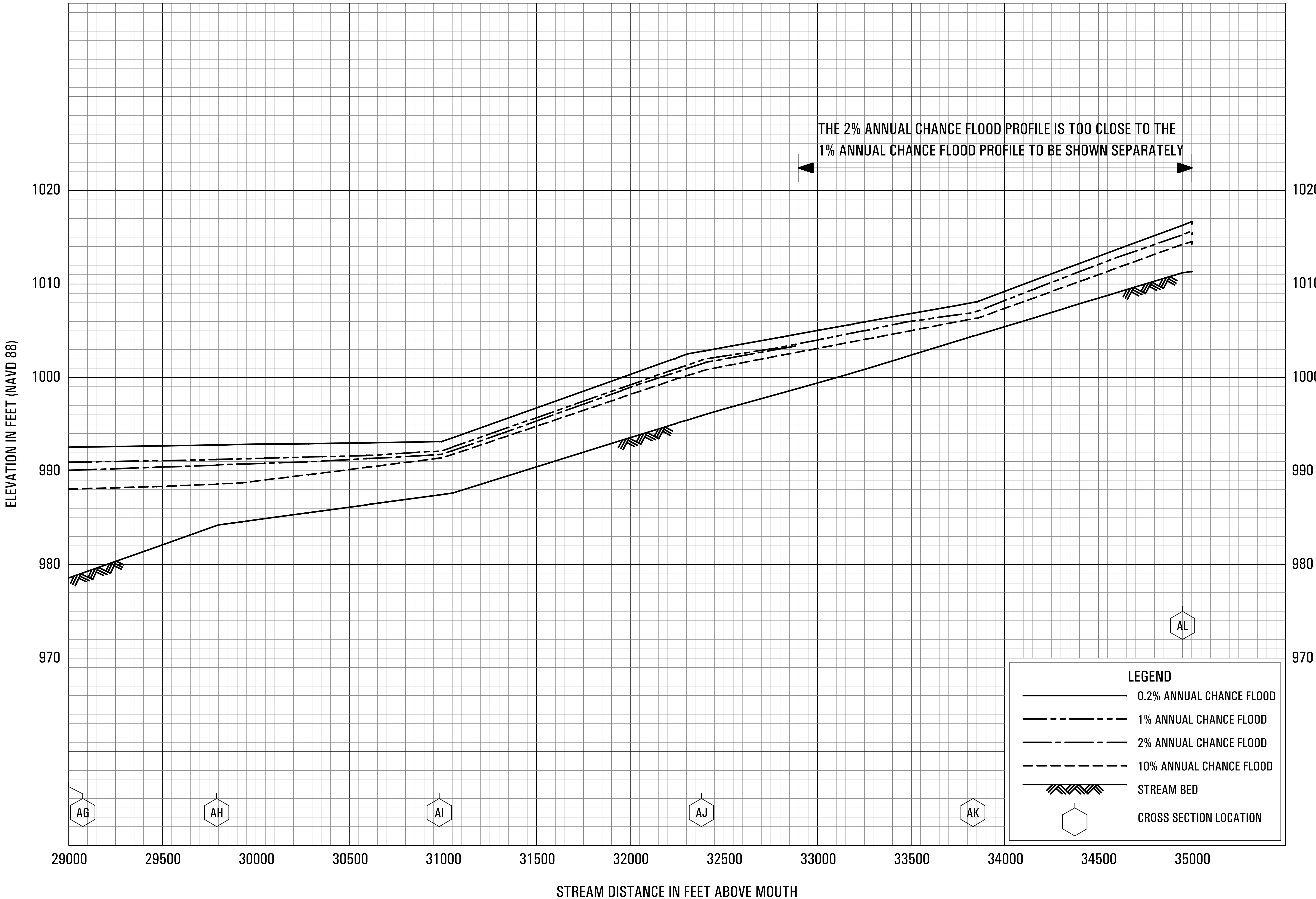
FLOOD PROFILES

CHOCONUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

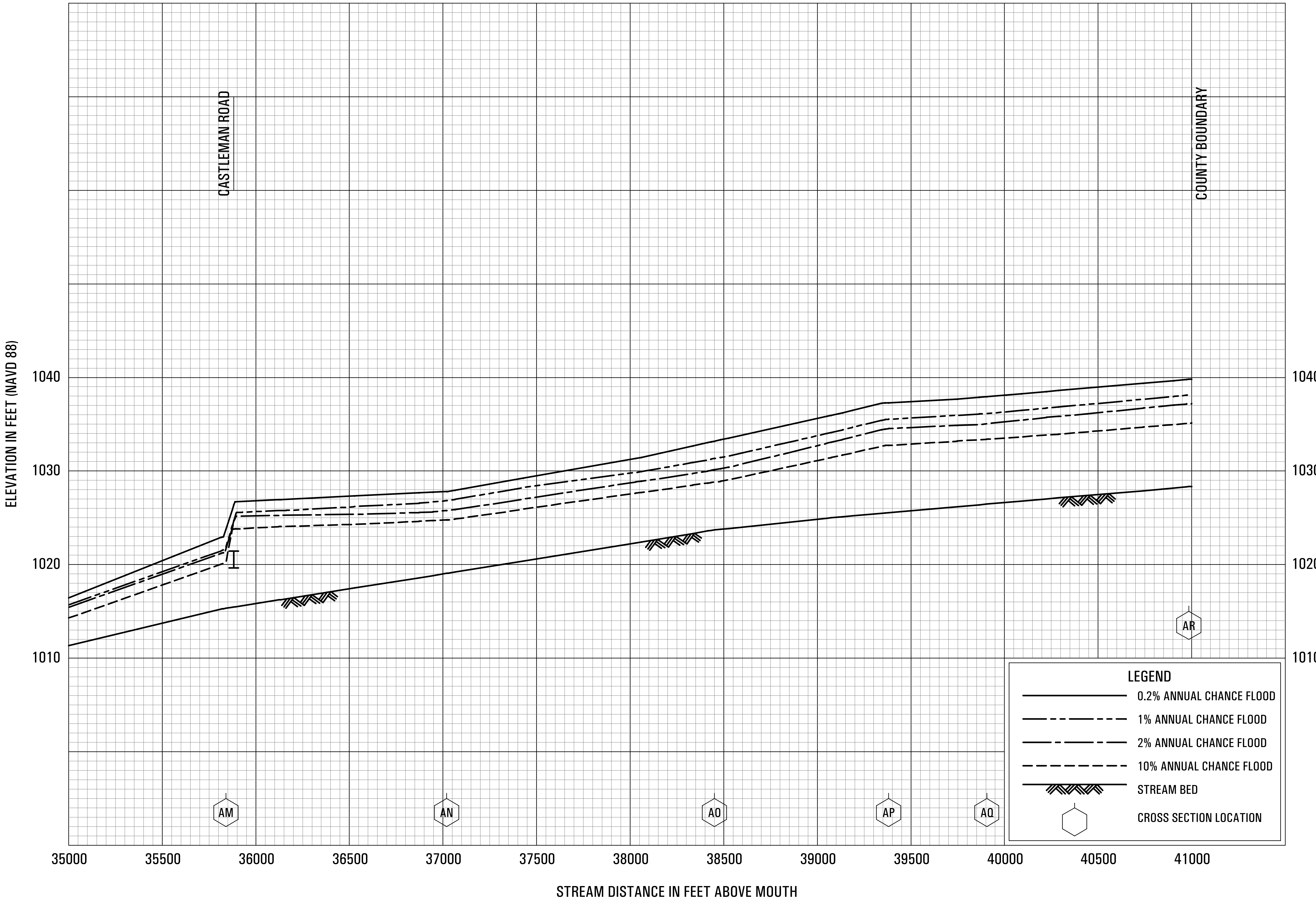
CHOCONUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

18P



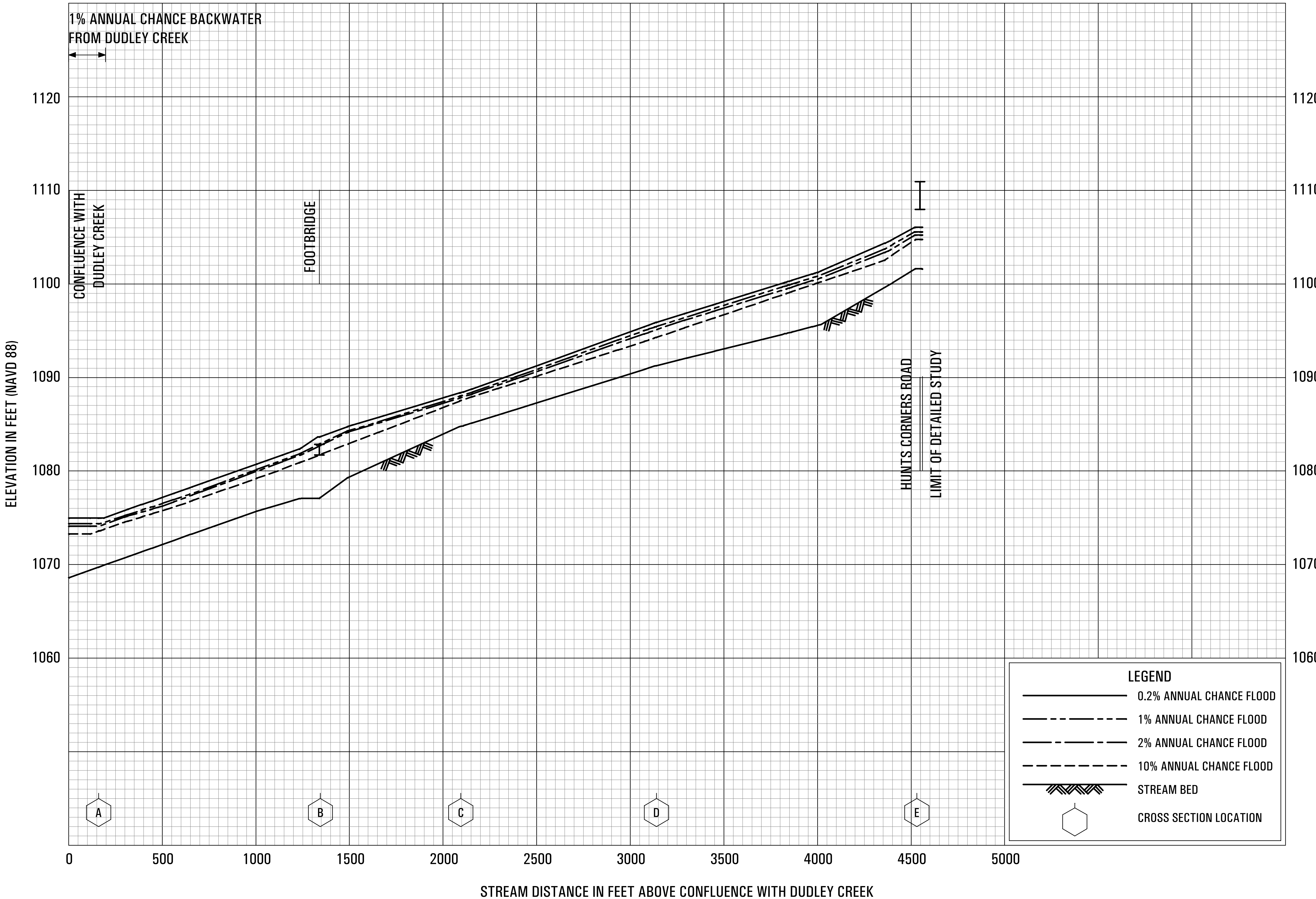
FLOOD PROFILES

CHOCONUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



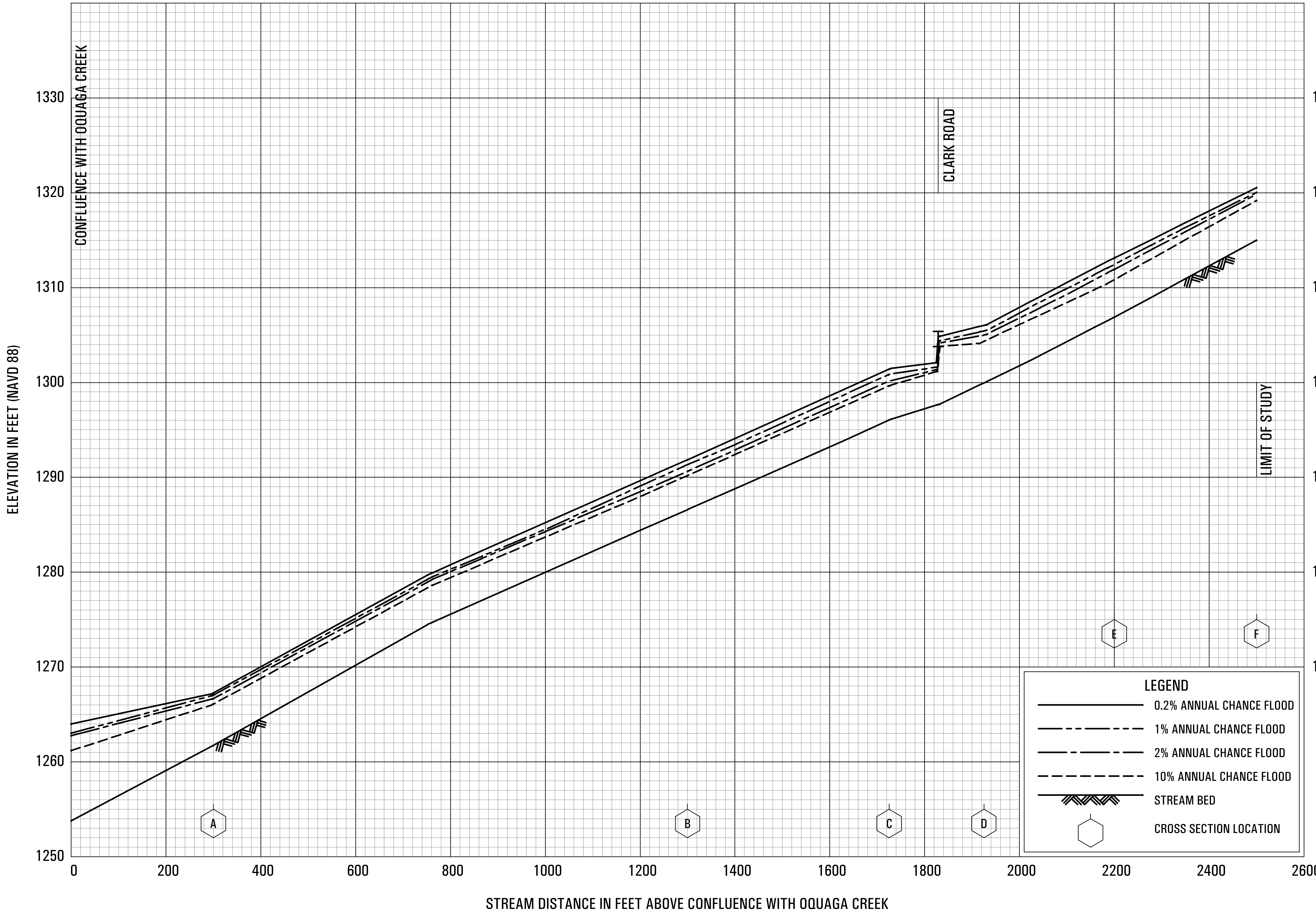
FLOOD PROFILES

CULVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



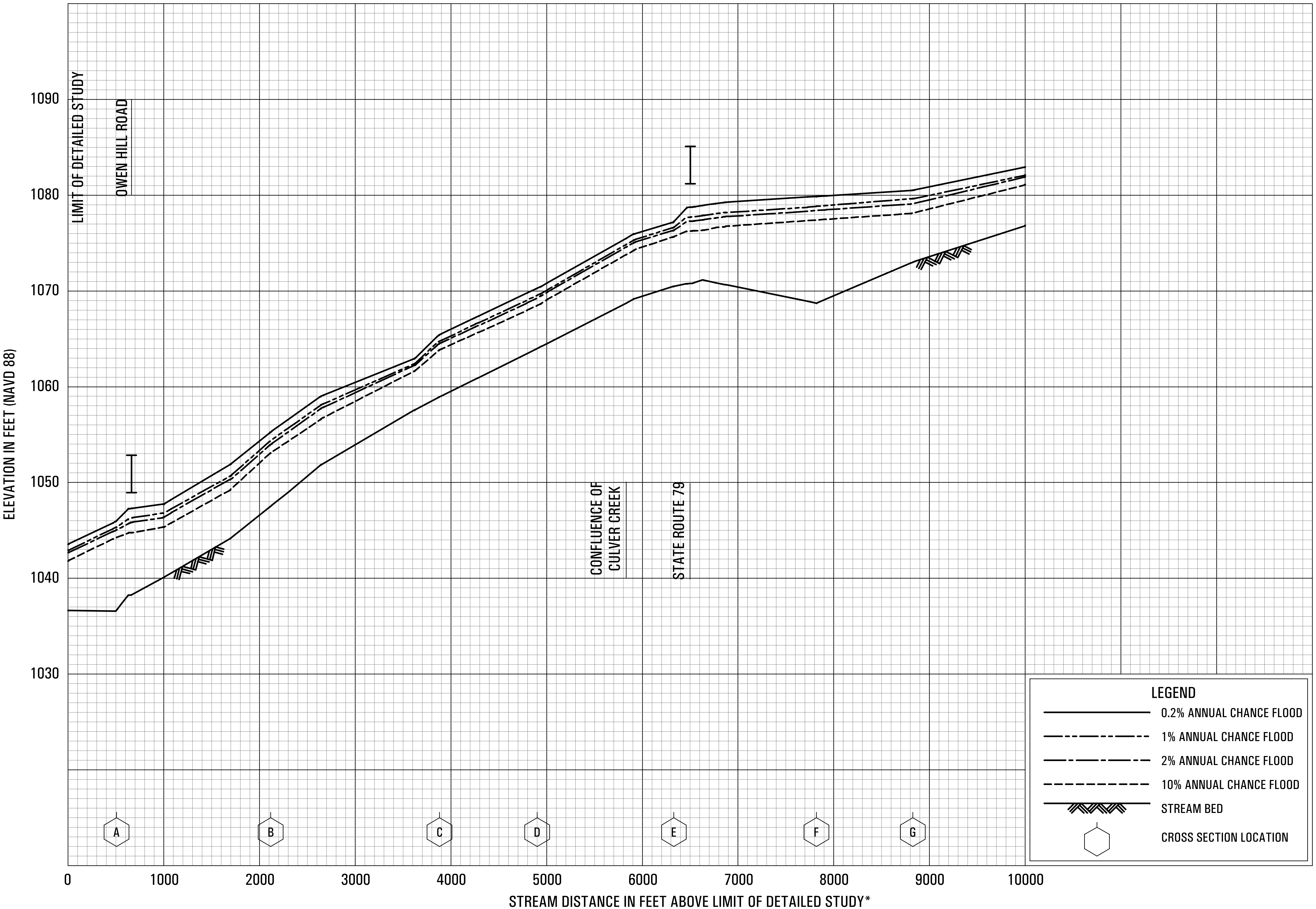
FLOOD PROFILES

DRY BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



* LIMIT OF DETAILED STUDY IS APPROXIMATELY 660 FEET DOWNSTREAM OF OWEN HILL ROAD

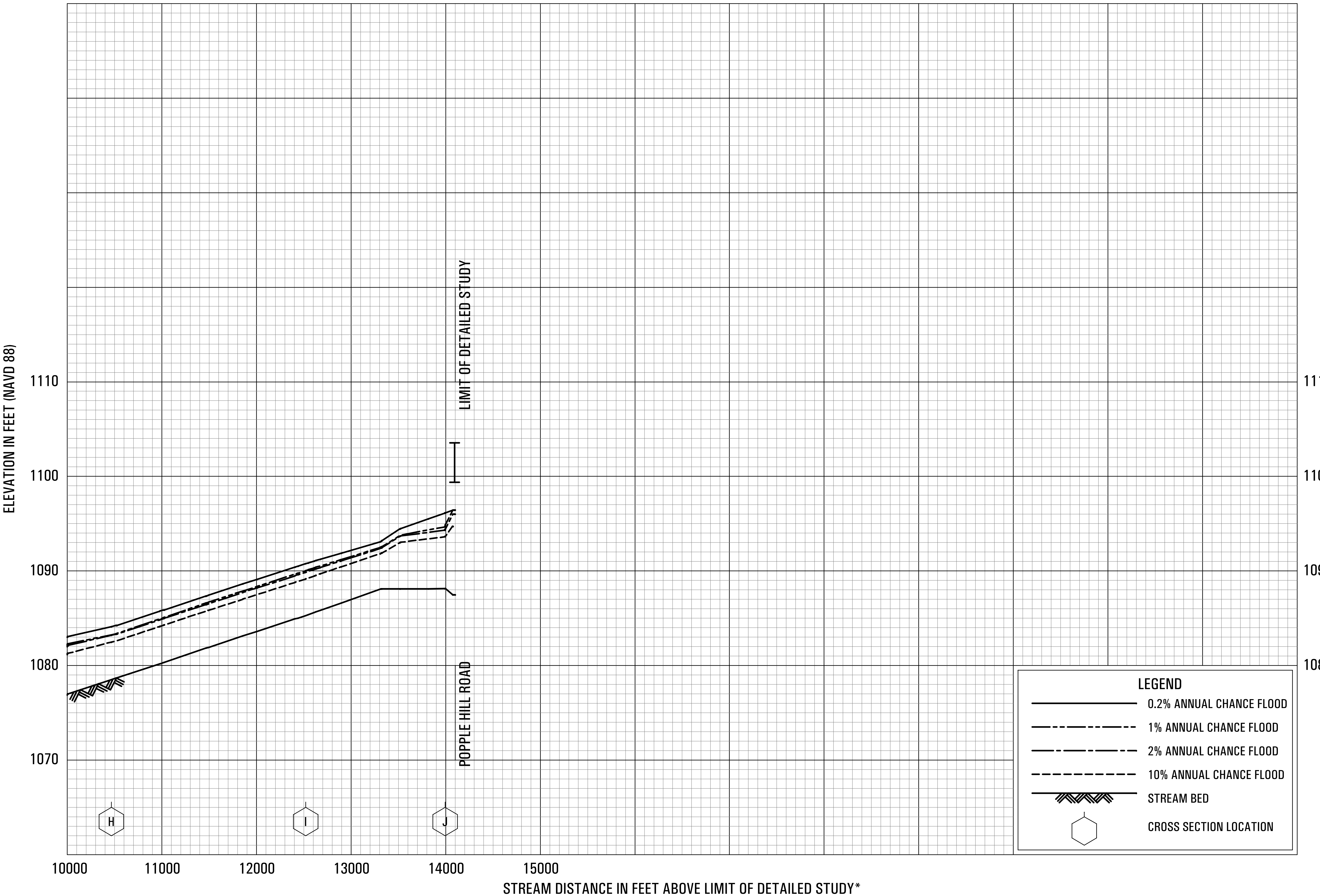
FLOOD PROFILES

DUDLEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



* LIMIT OF DETAILED STUDY IS APPROXIMATELY 660 FEET DOWNSTREAM OF OWEN HILL ROAD

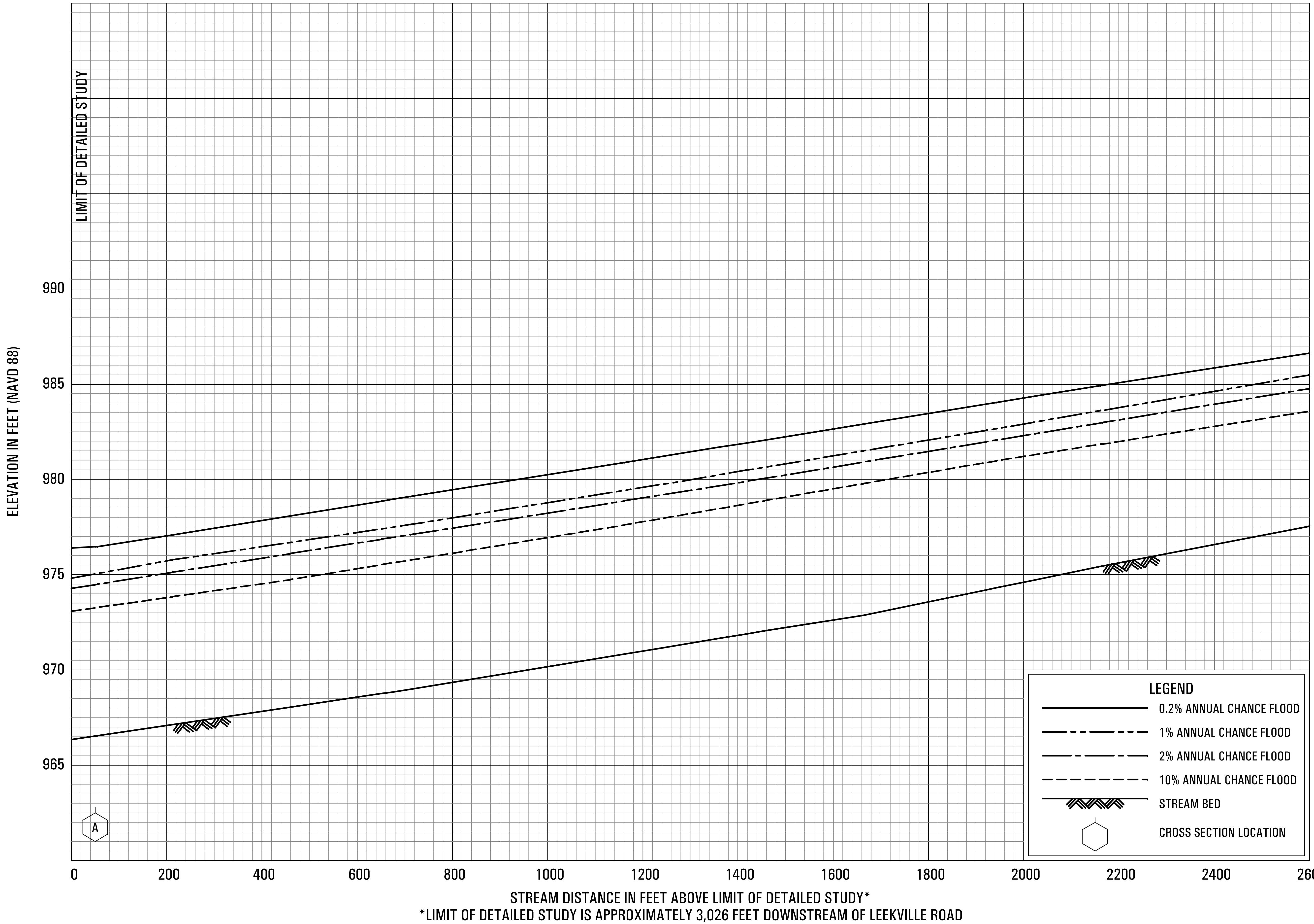
FLOOD PROFILES

DUDLEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



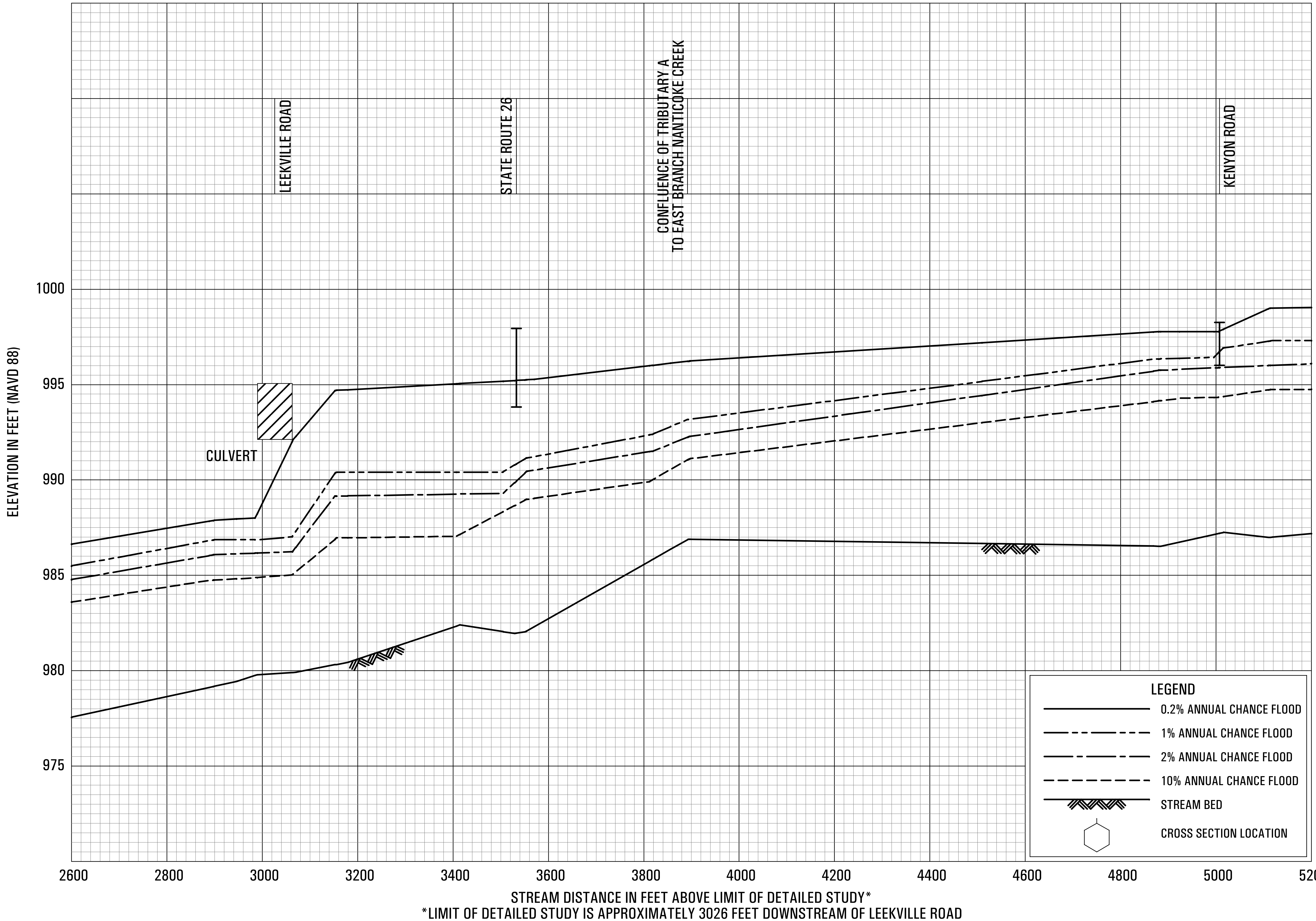
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



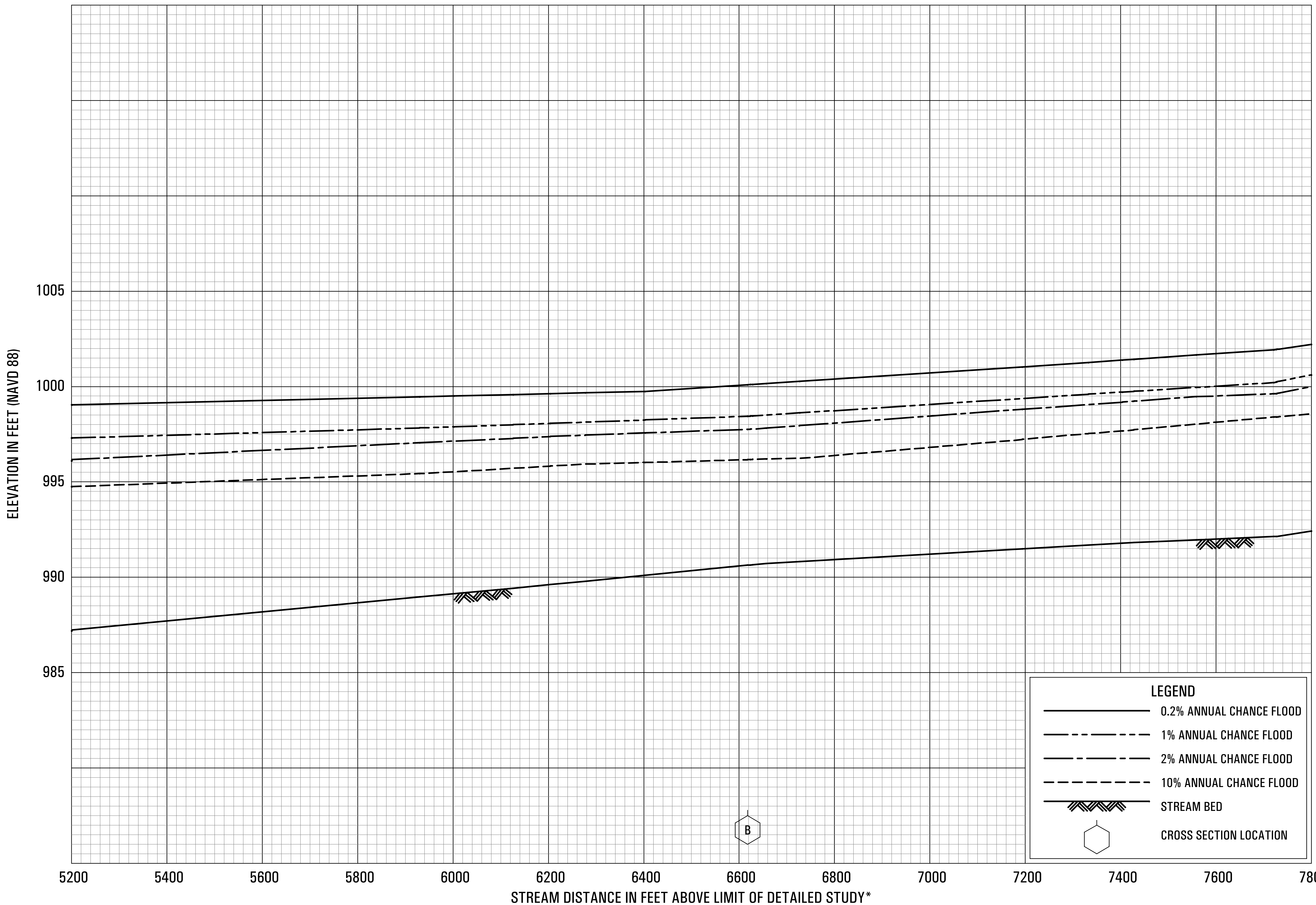
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



*LIMIT OF DETAILED STUDY IS APPROXIMATELY 3,026 FEET DOWNSTREAM OF LEEKVILLE ROAD

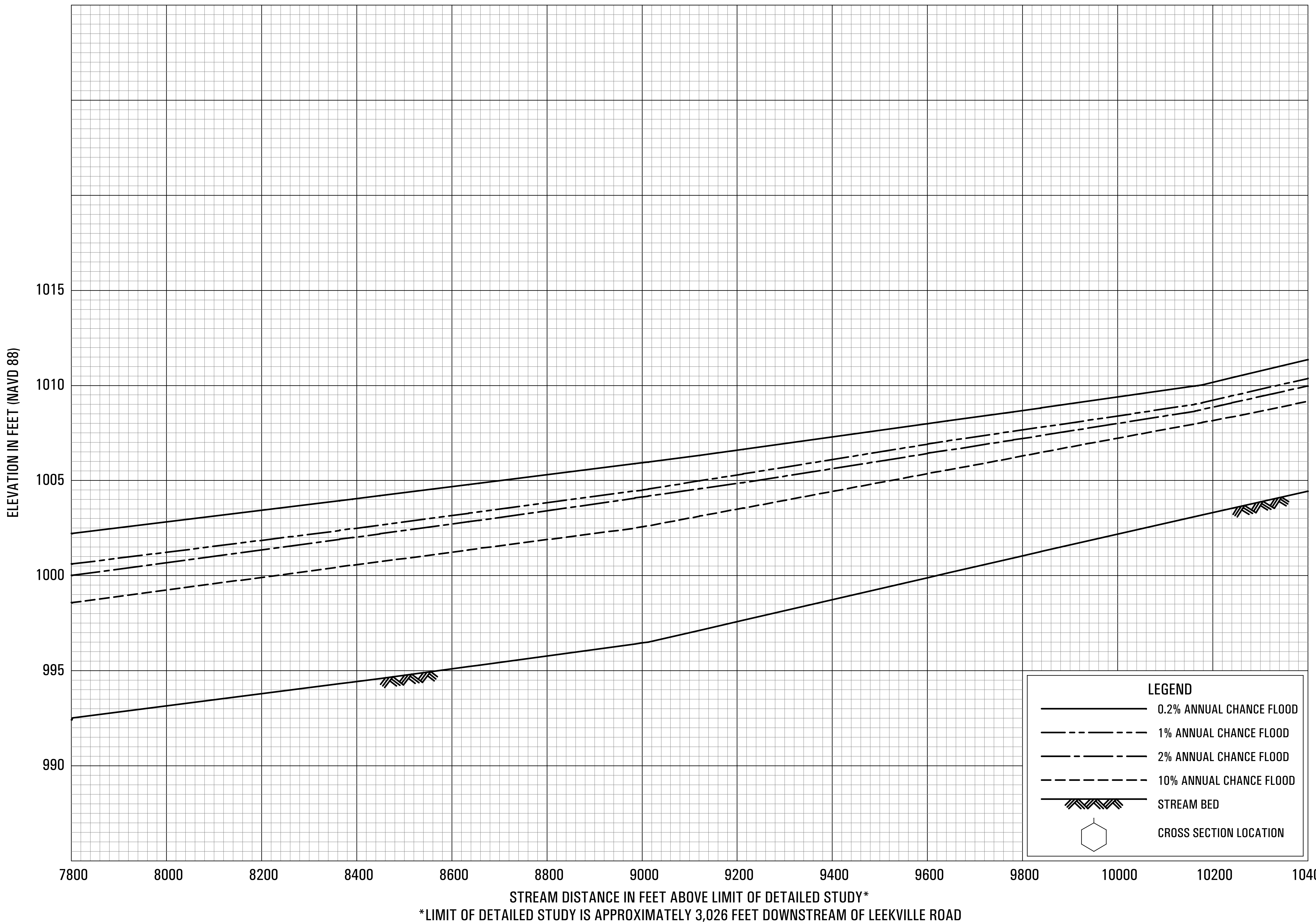
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



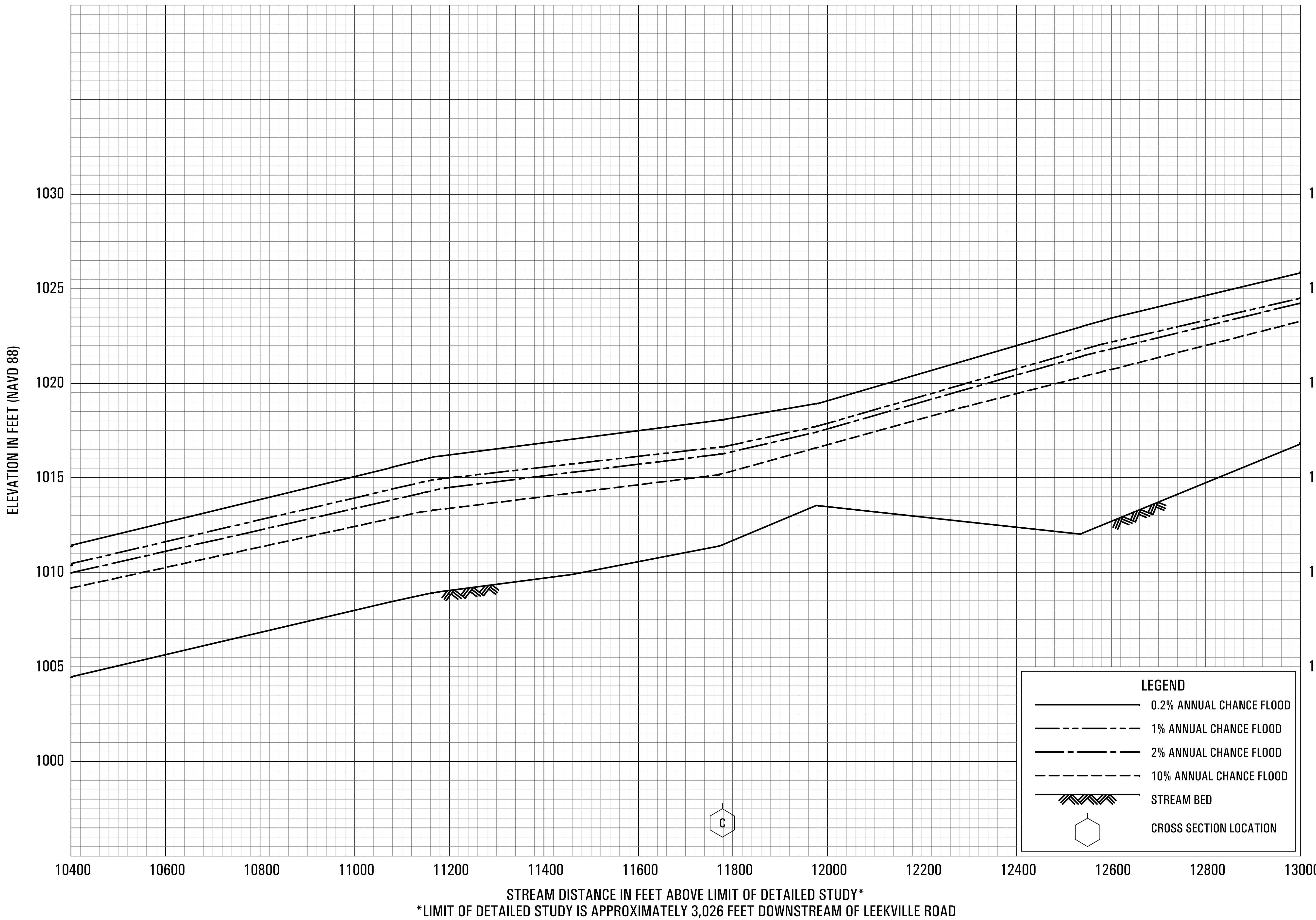
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



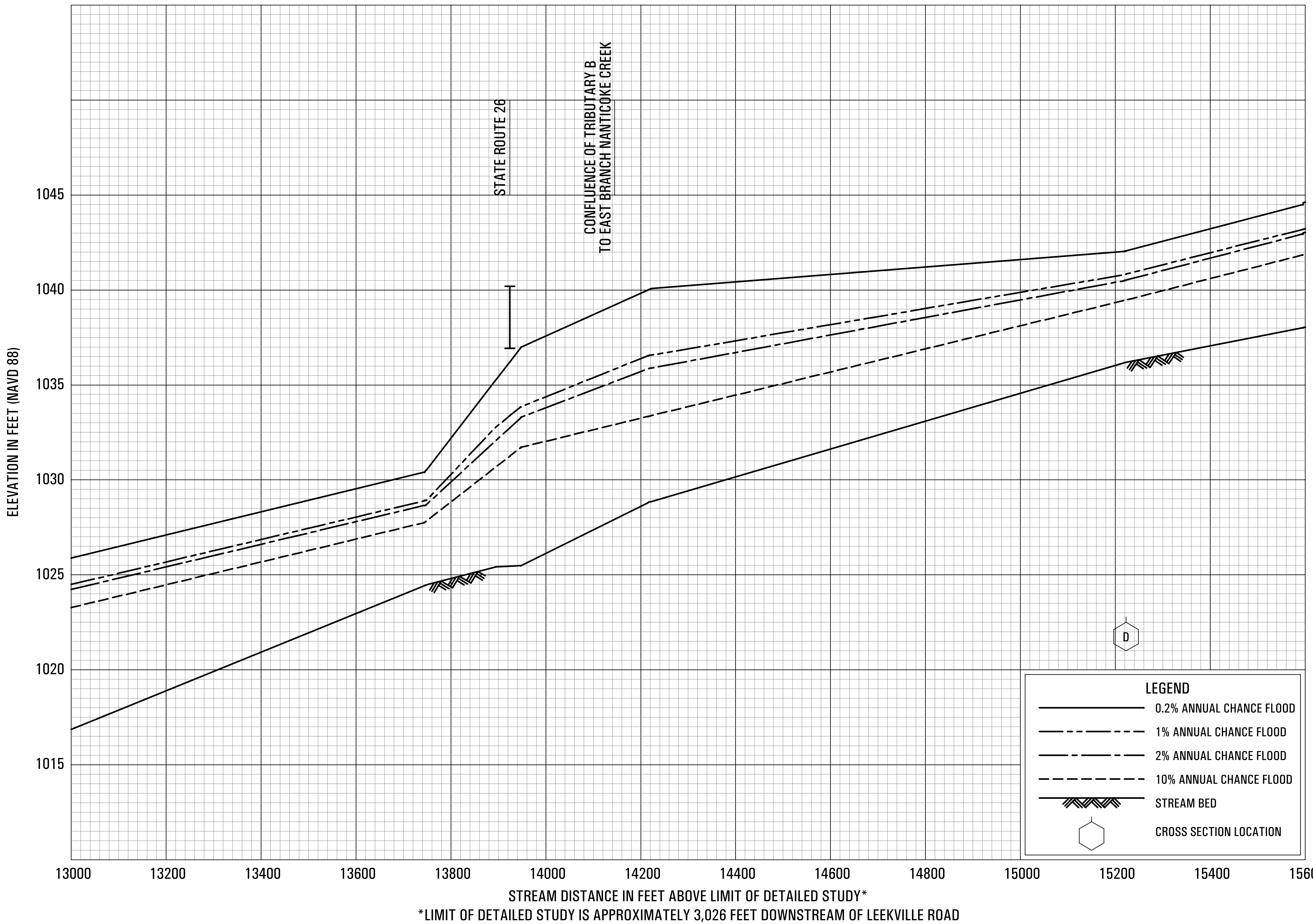
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



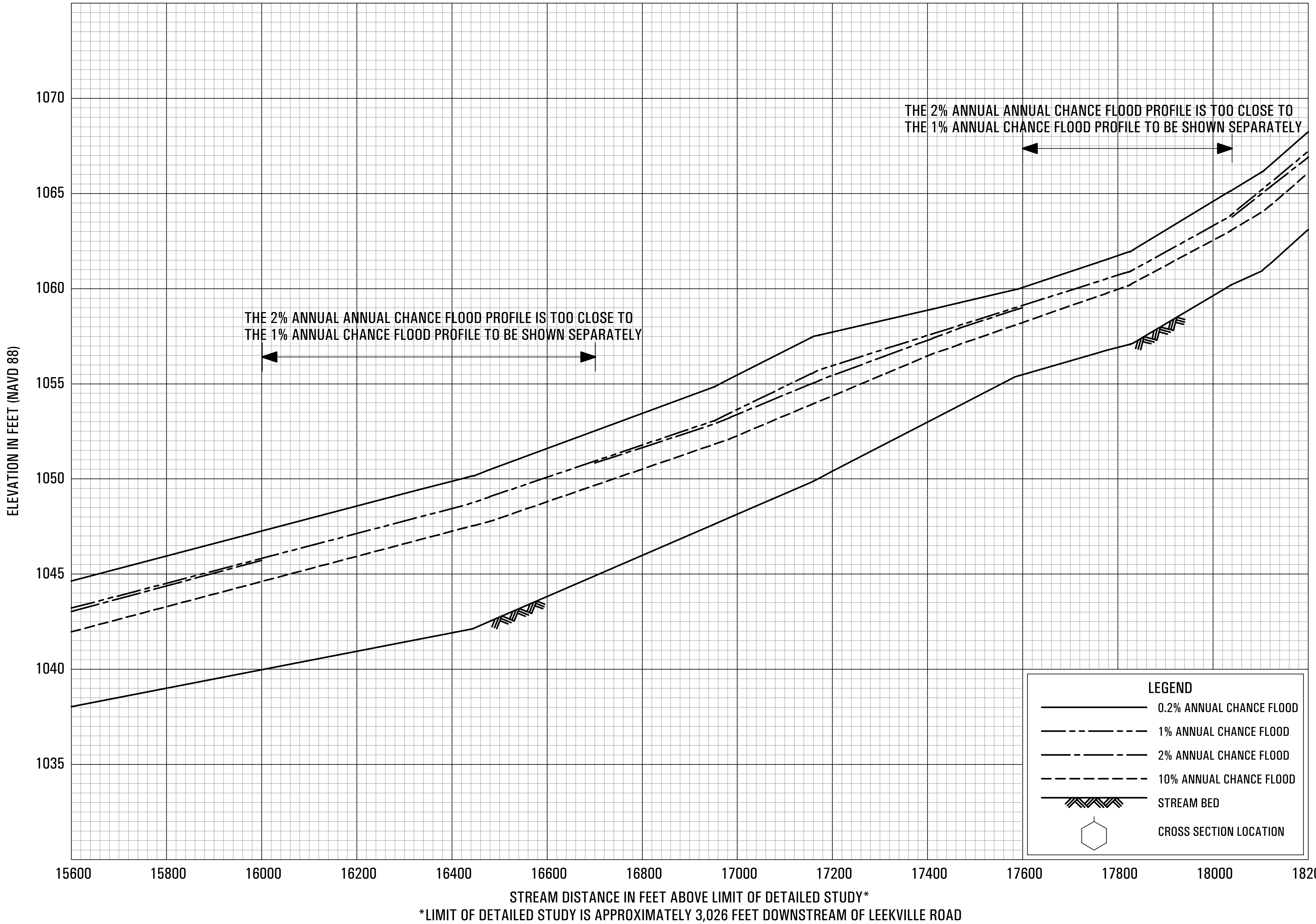
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



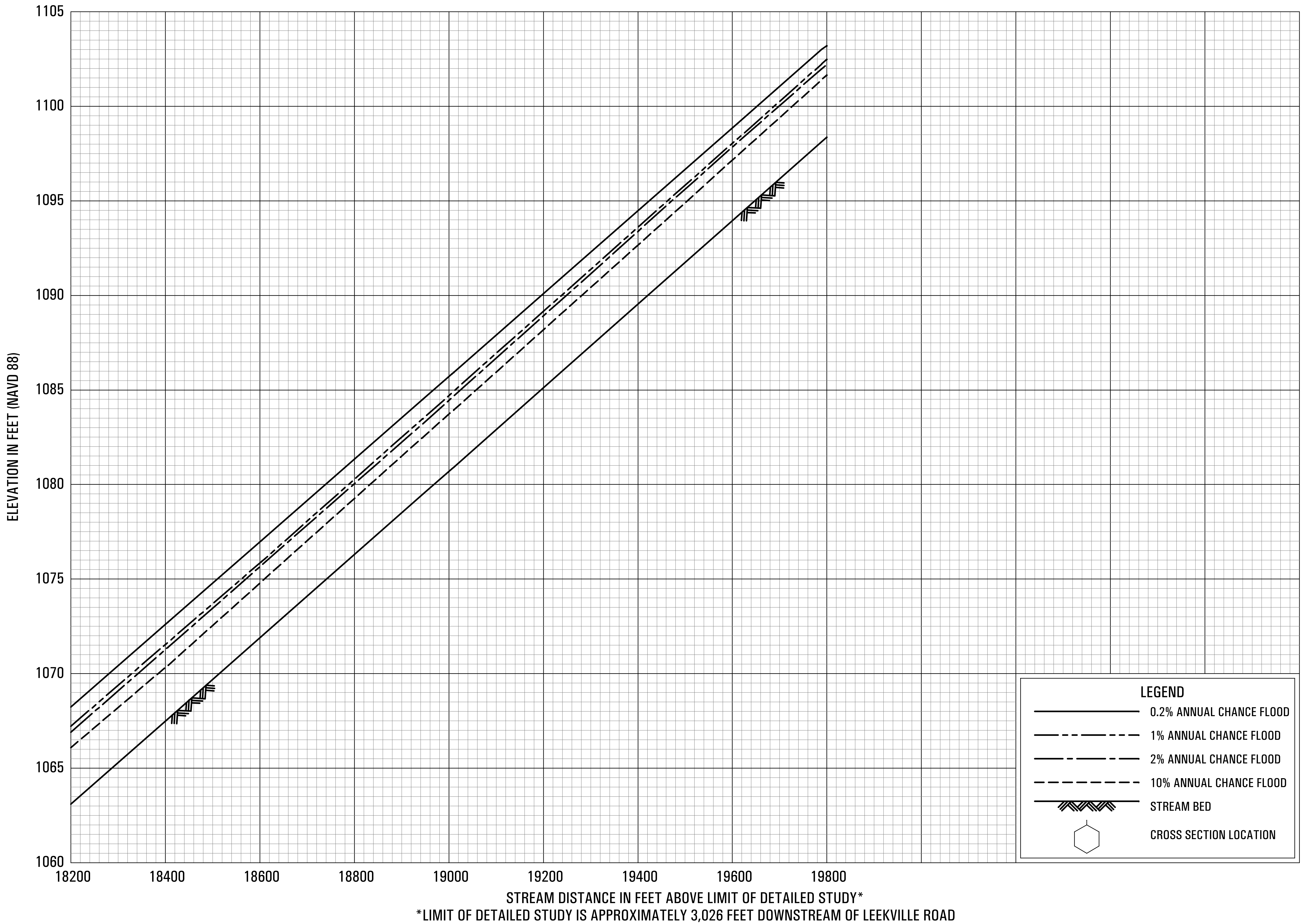
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



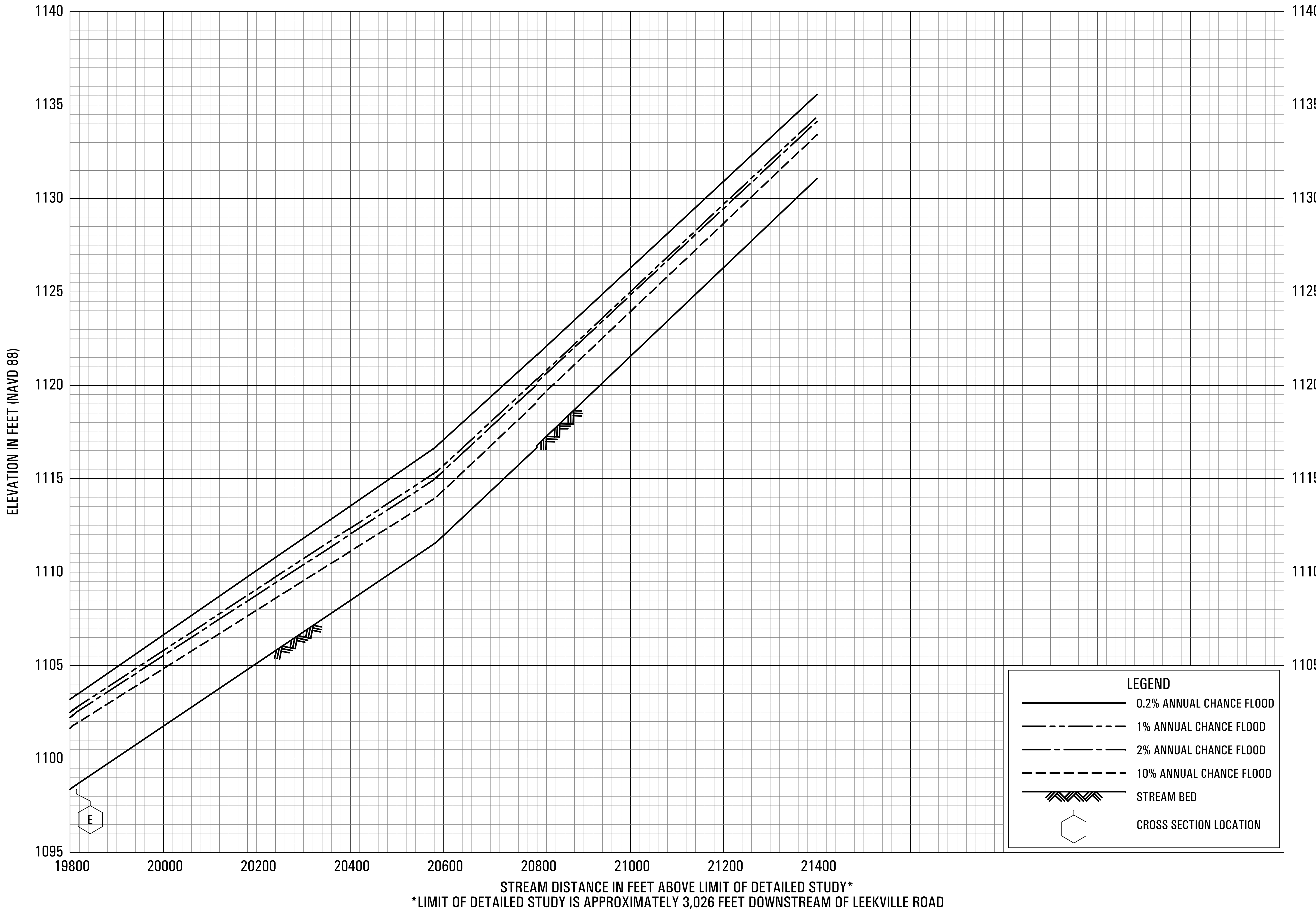
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



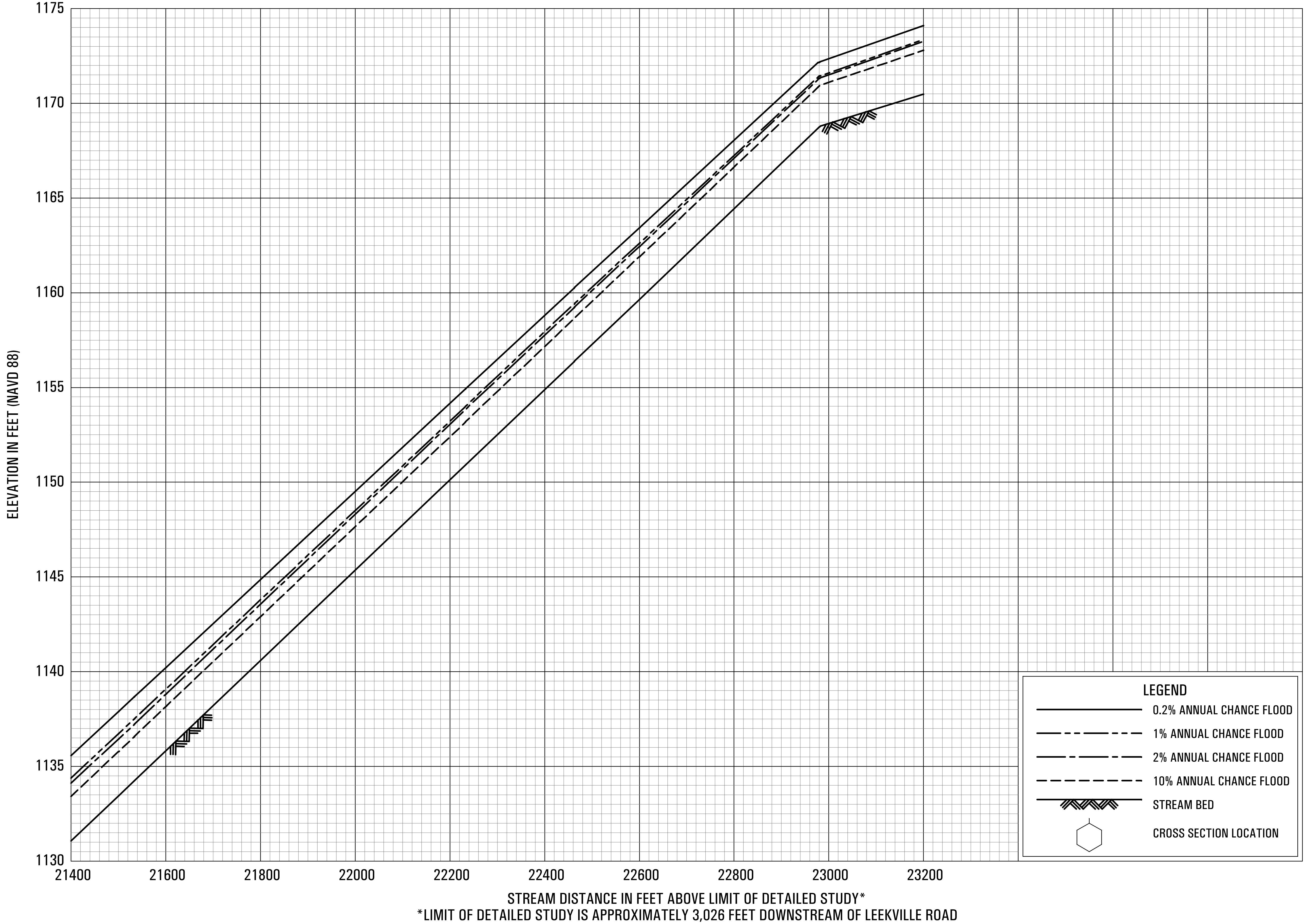
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

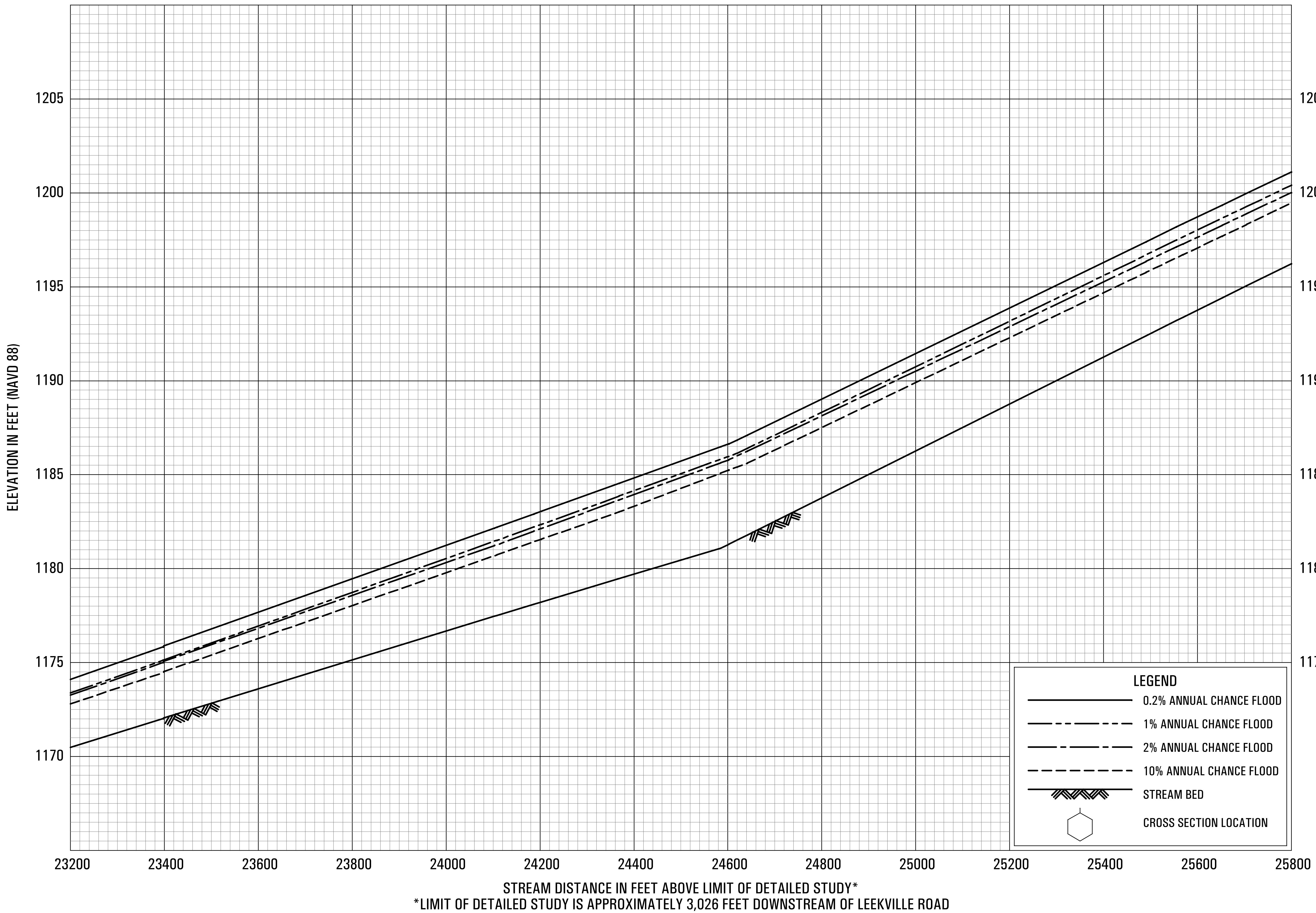
EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

33P



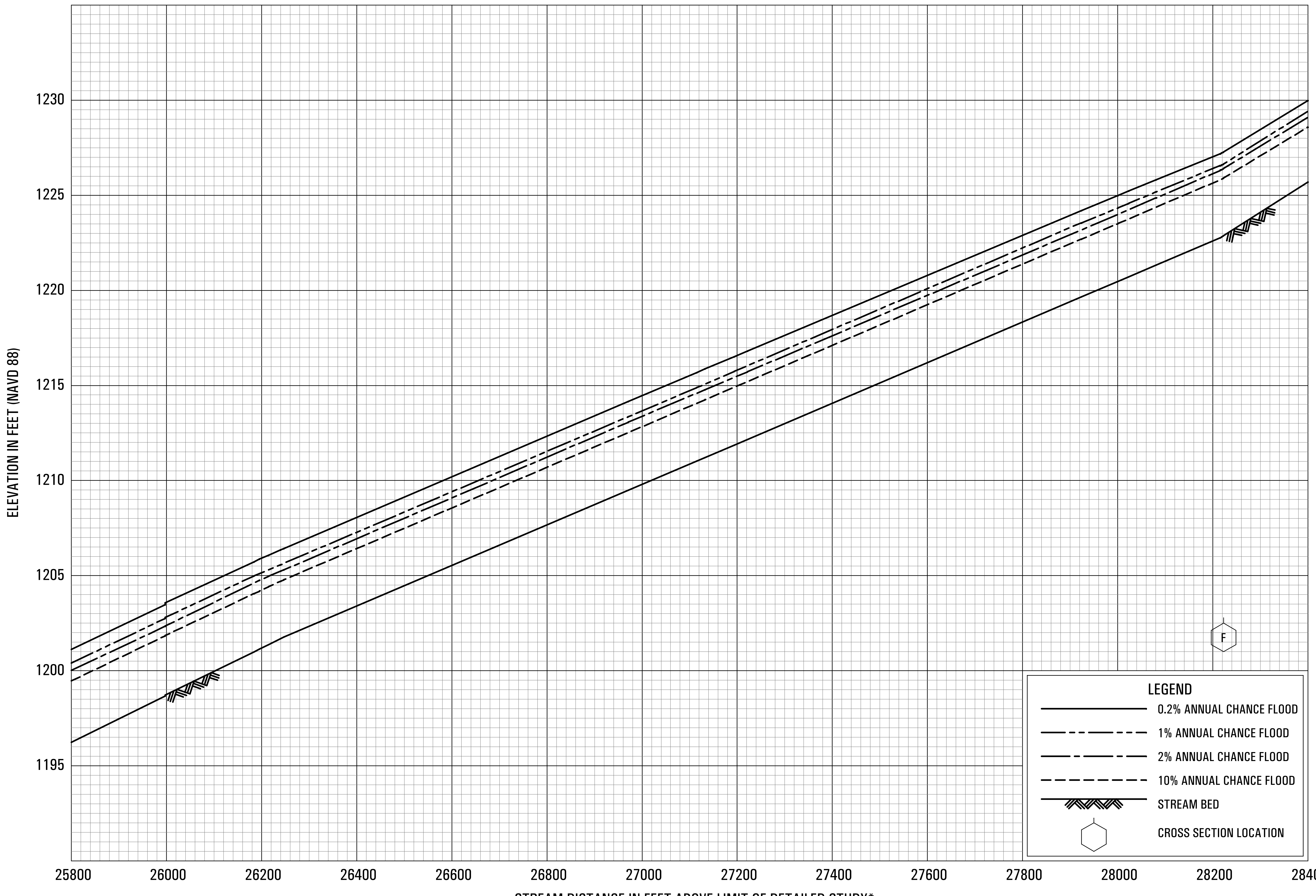
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



*LIMIT OF DETAILED STUDY IS APPROXIMATELY 3,026 FEET DOWNSTREAM OF LEEKVILLE ROAD

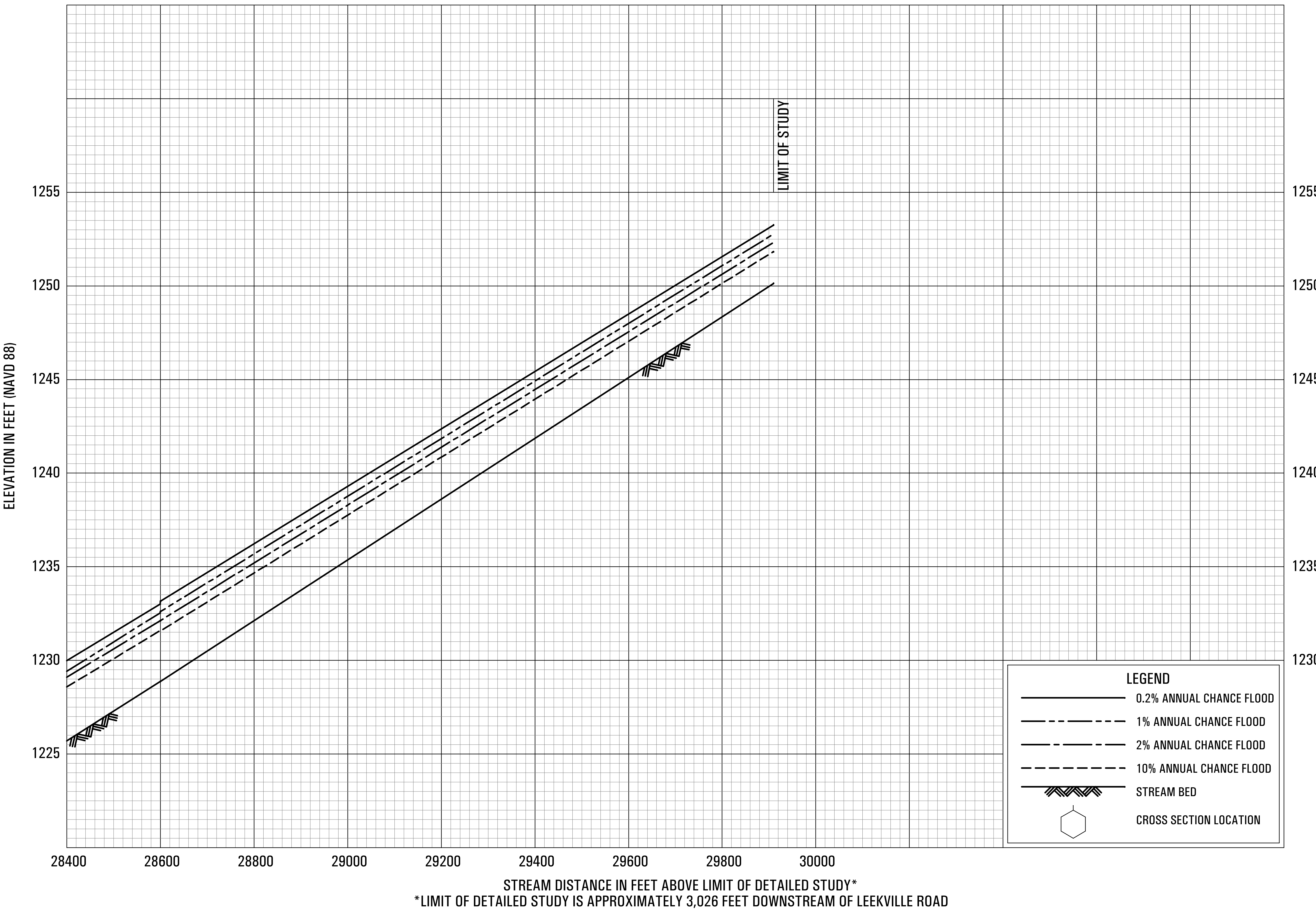
FLOOD PROFILES

EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

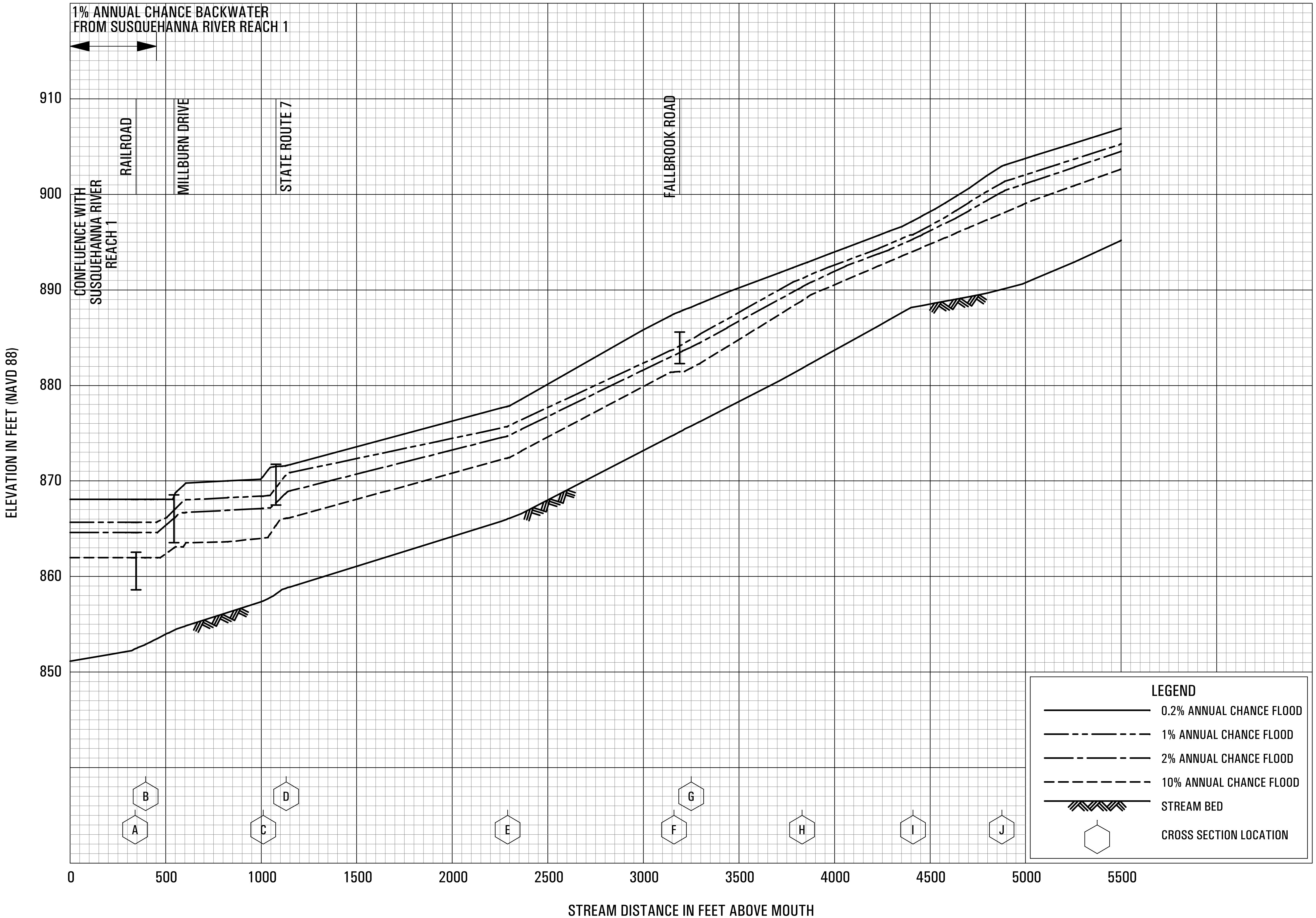
EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

36P



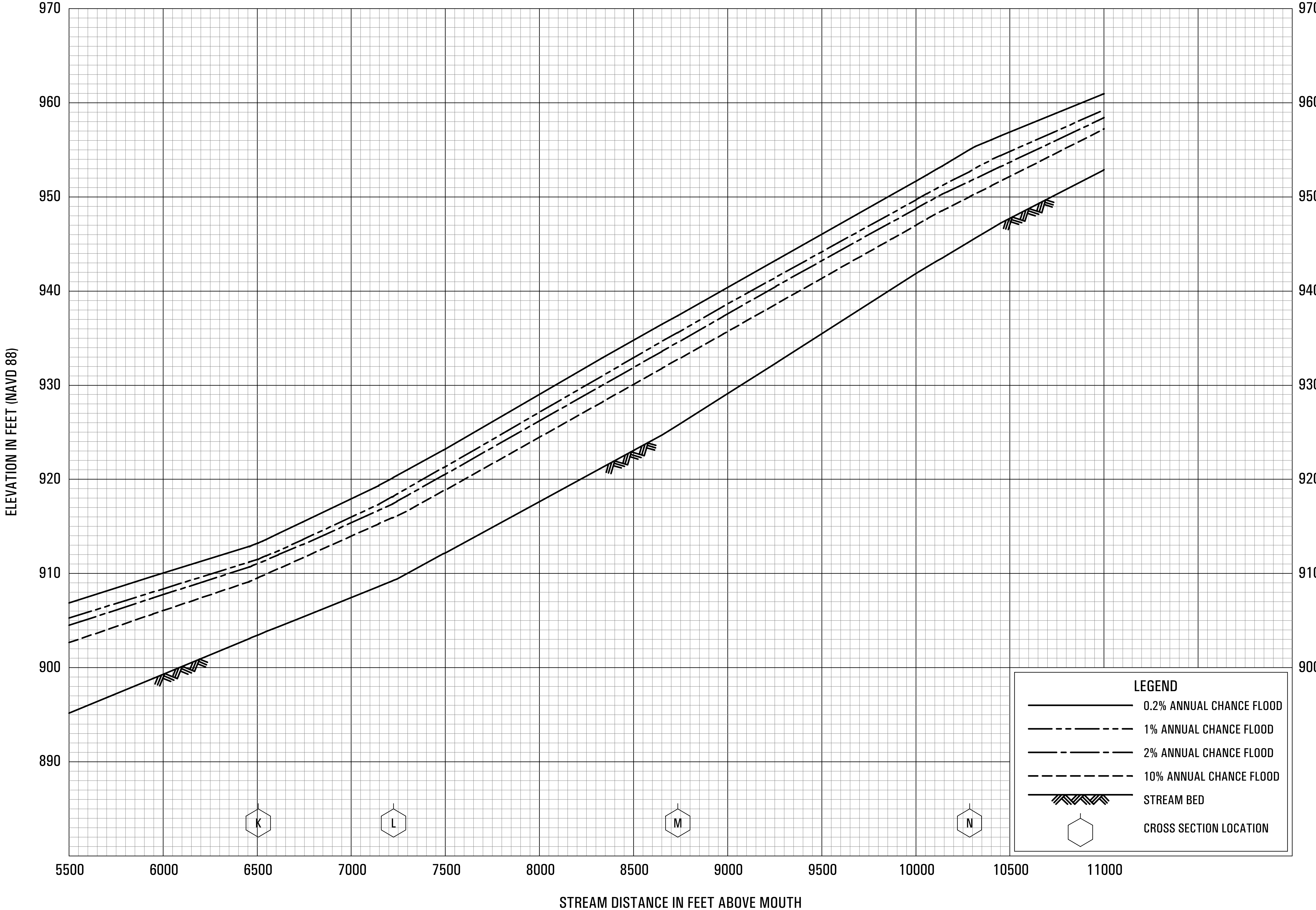
FLOOD PROFILES

LITTLE SNAKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

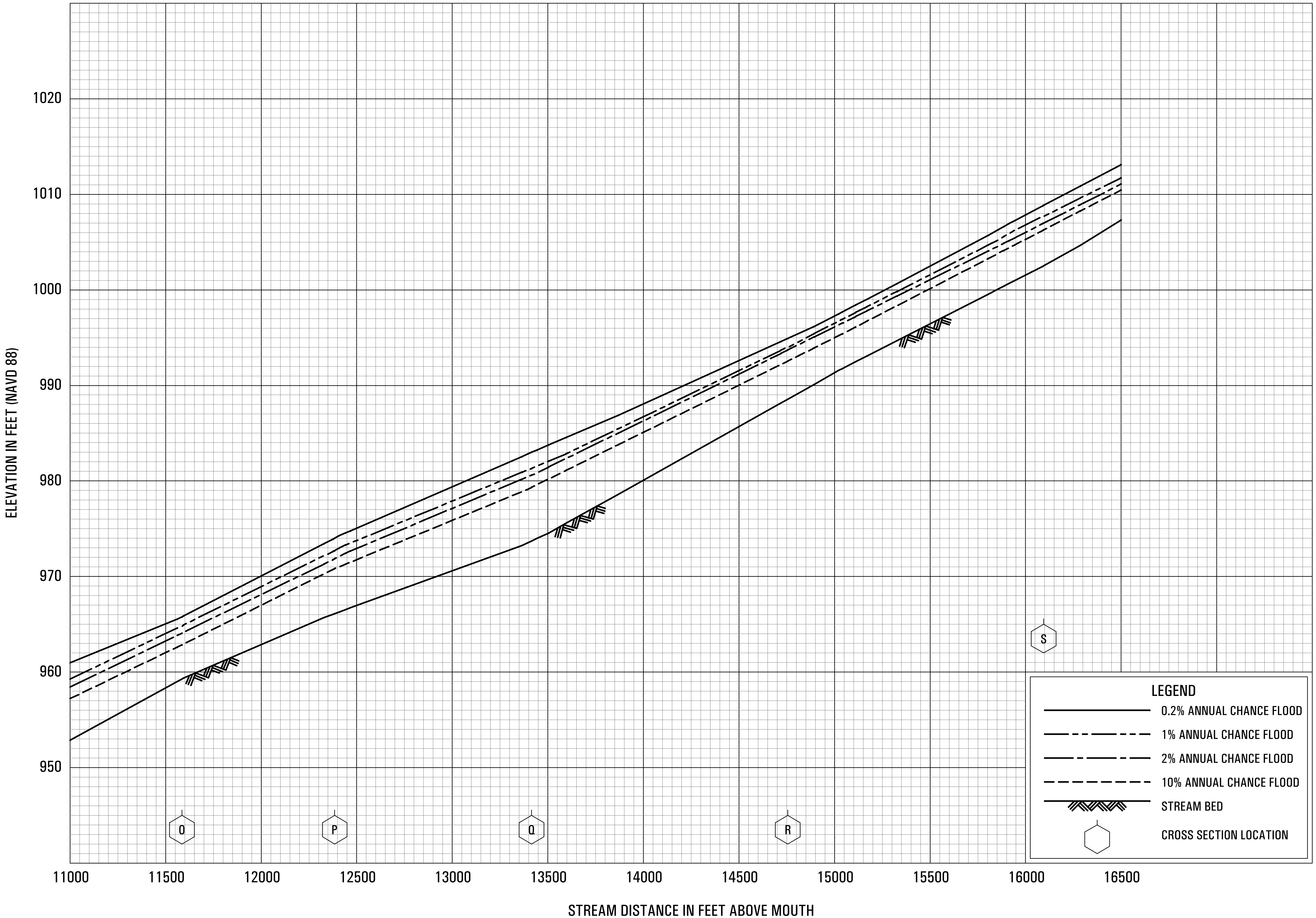
LITTLE SNAKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

38P



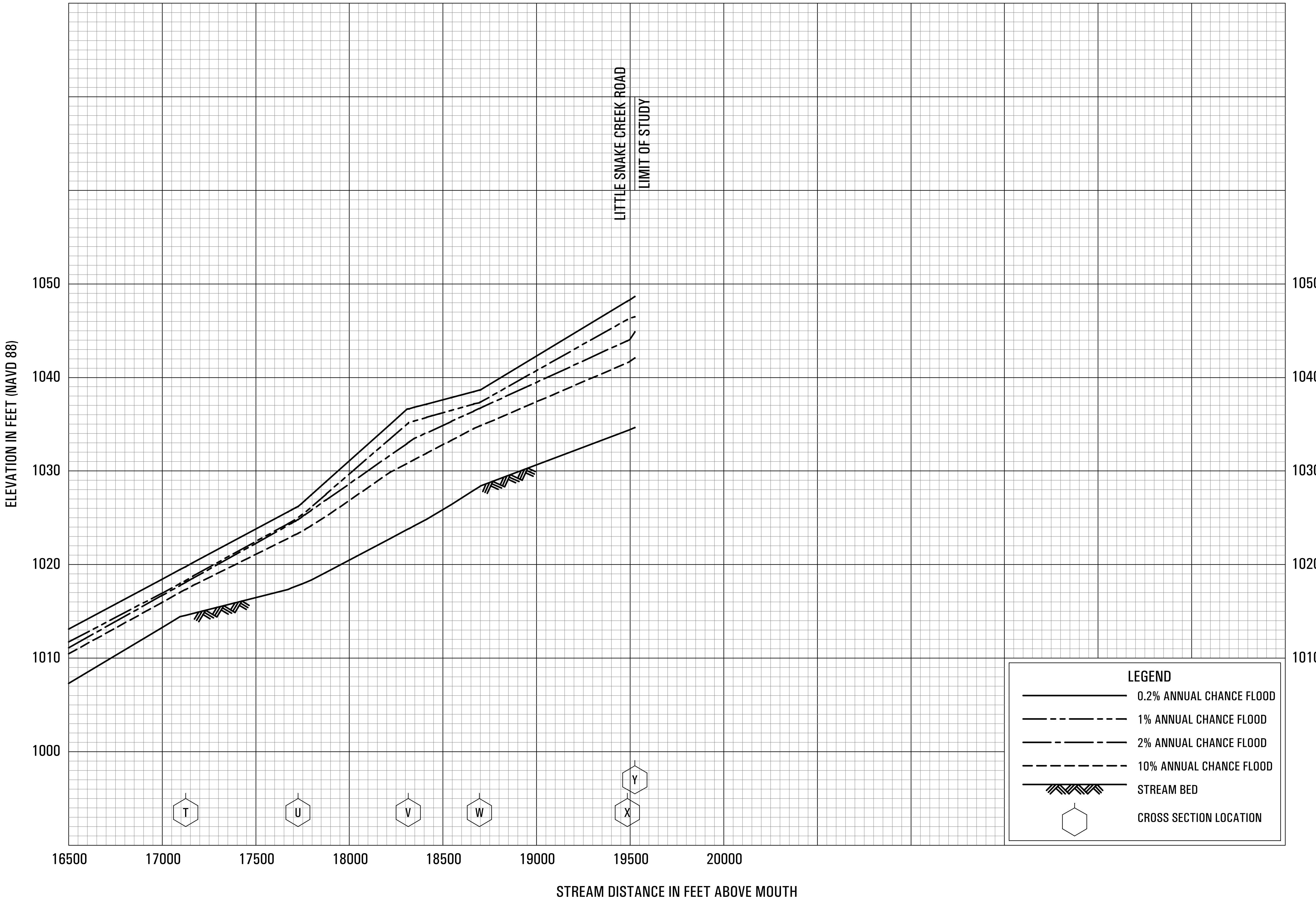
FLOOD PROFILES

LITTLE SNAKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

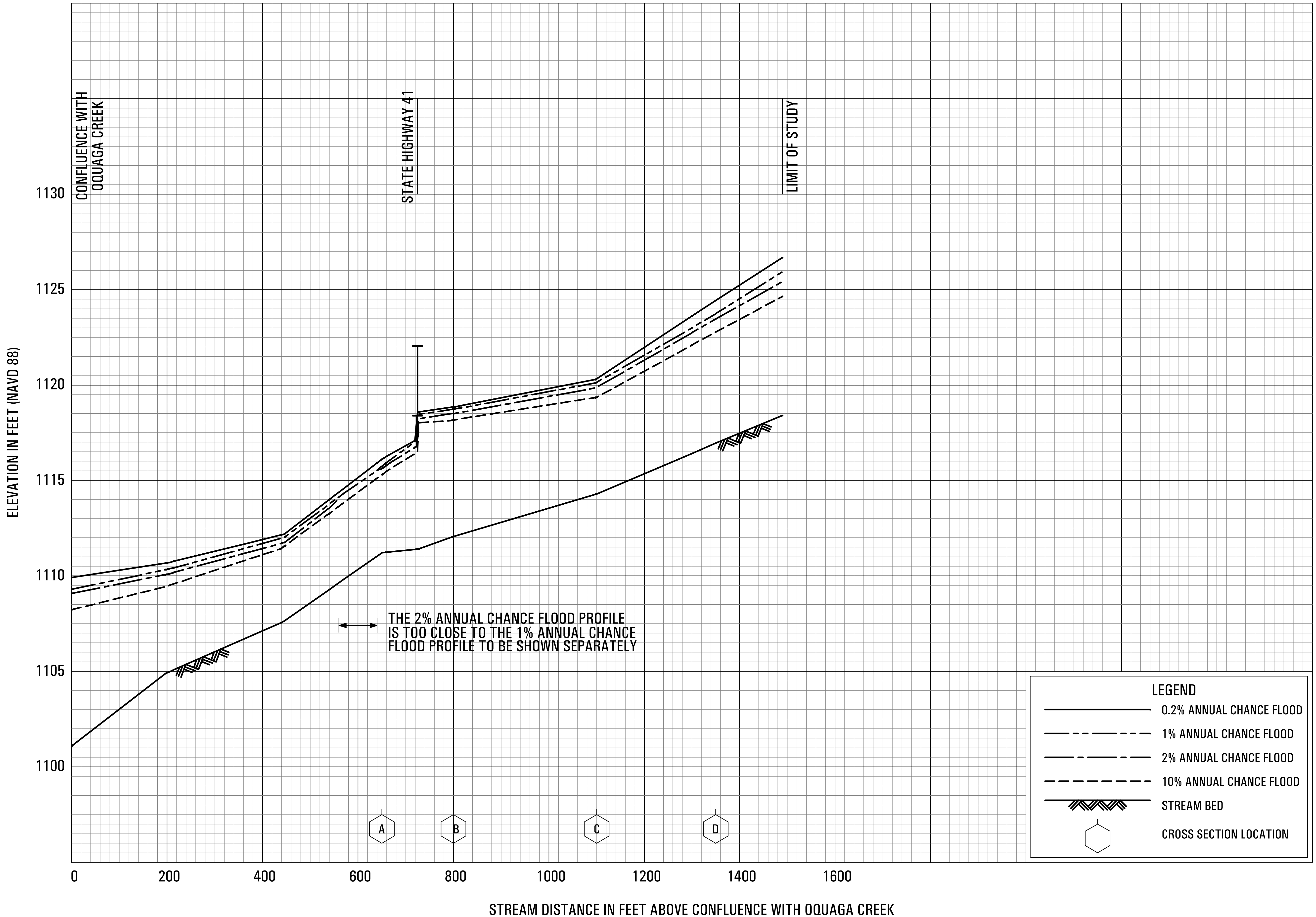
LITTLE SNAKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

40P



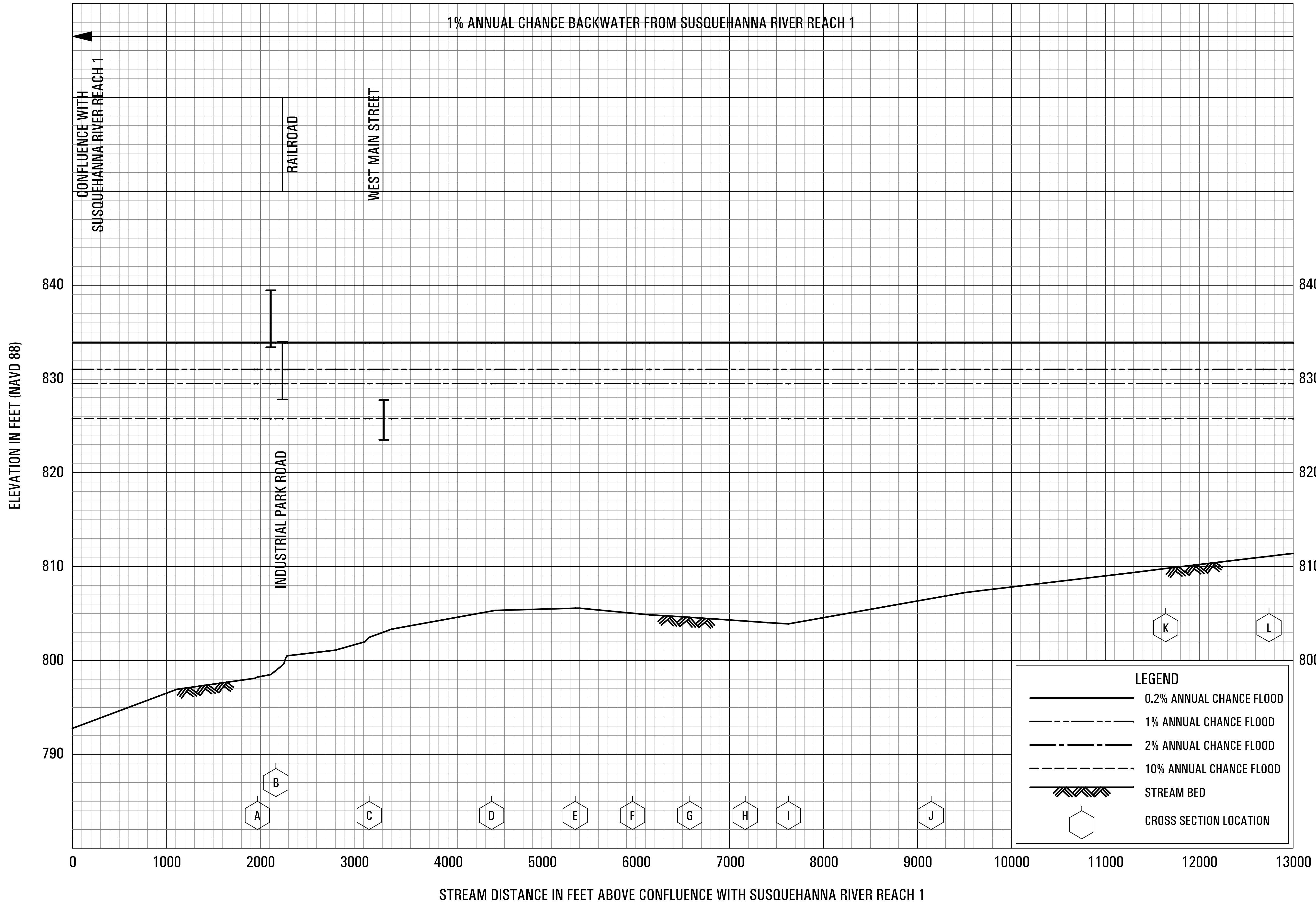
FLOOD PROFILES

MARSH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



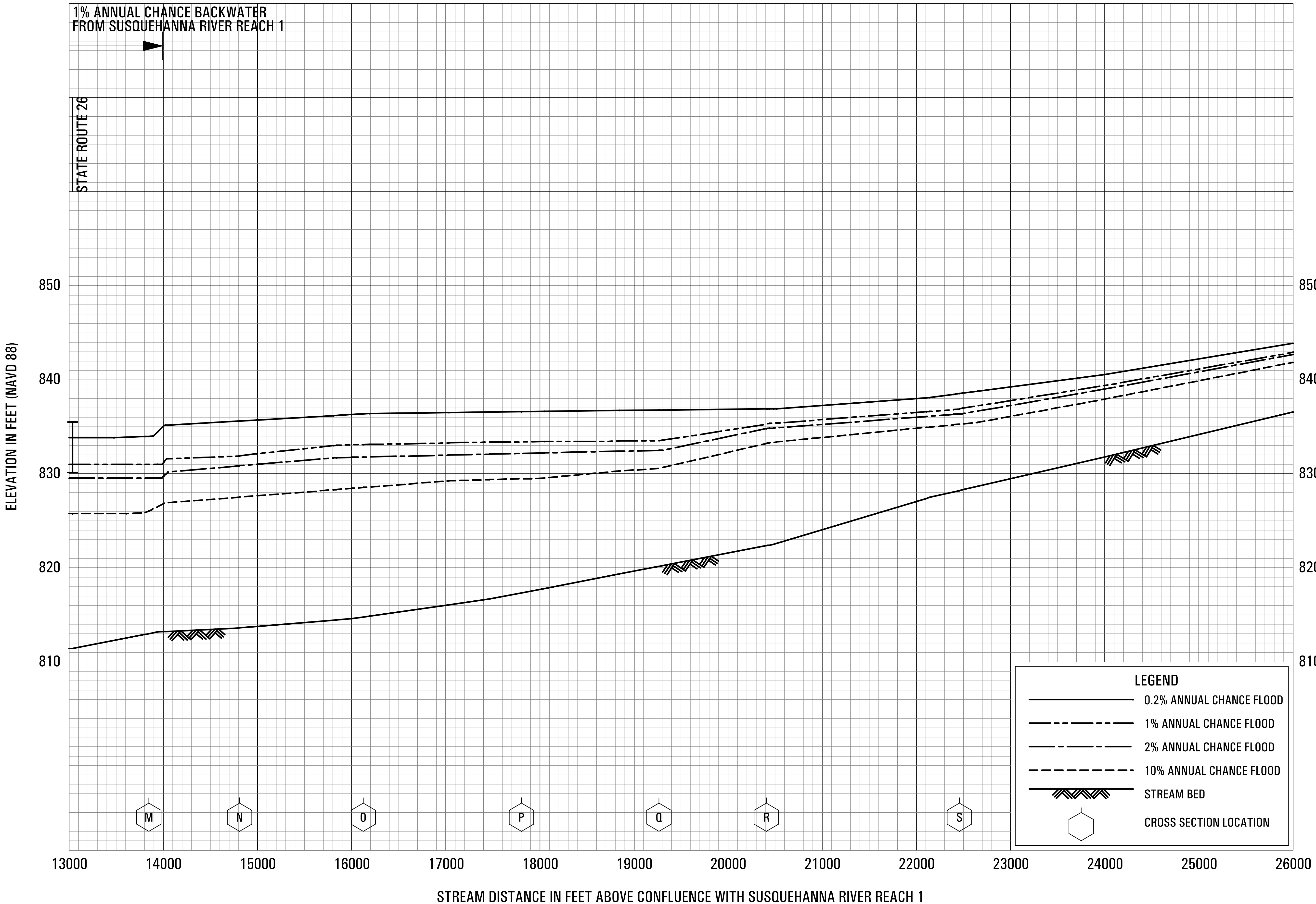
FLOOD PROFILES

NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



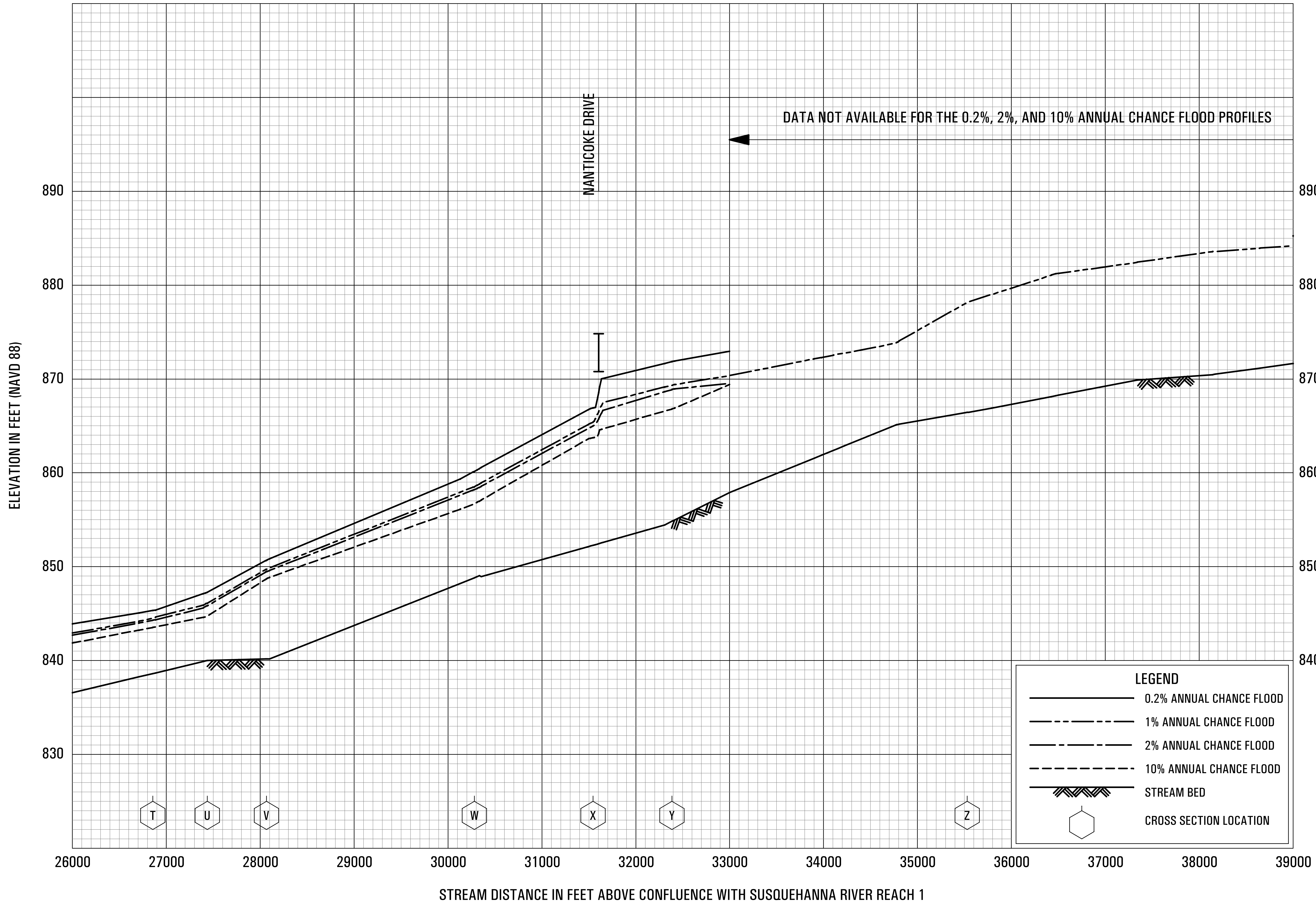
FLOOD PROFILES

NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



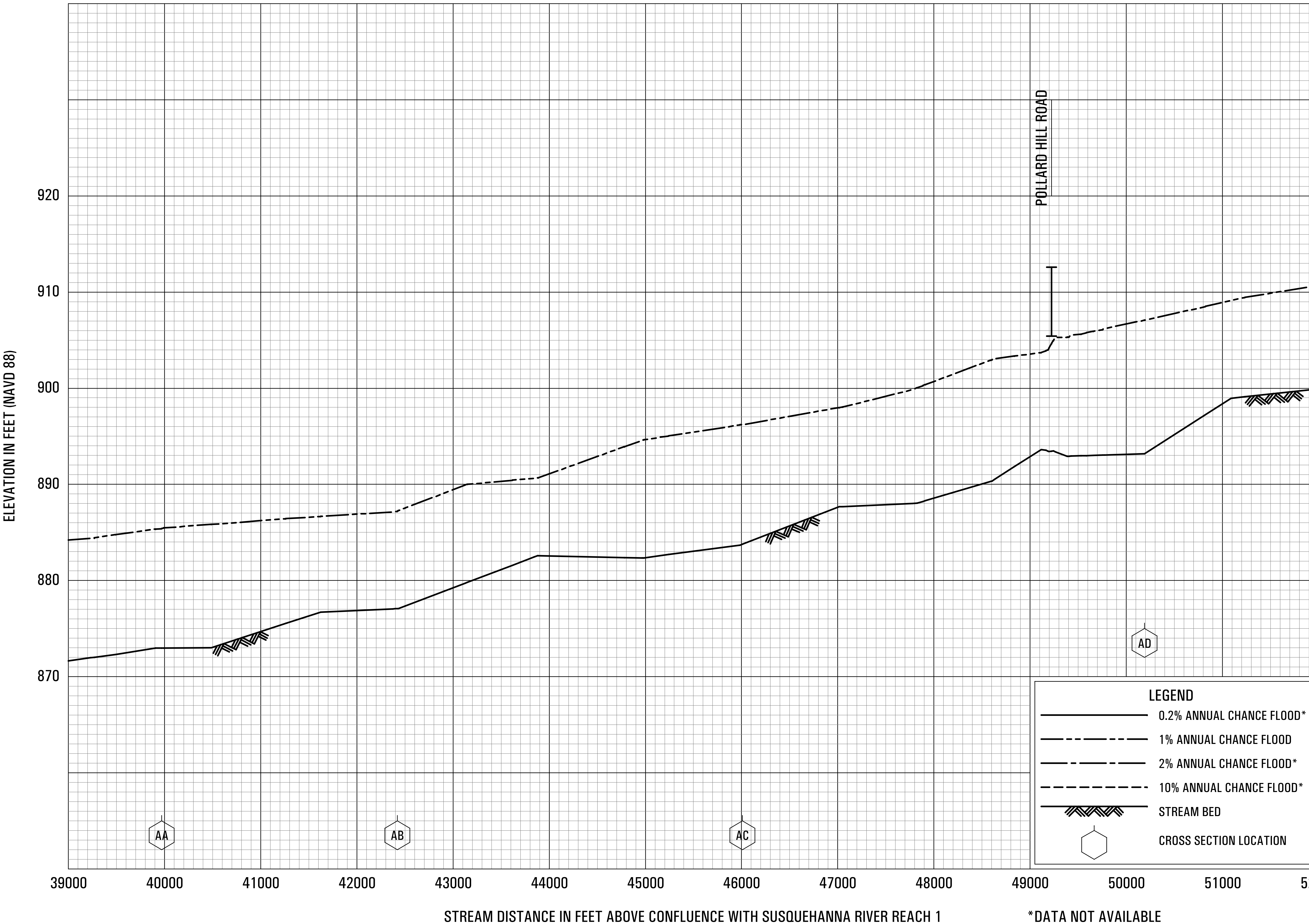
FLOOD PROFILES

NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



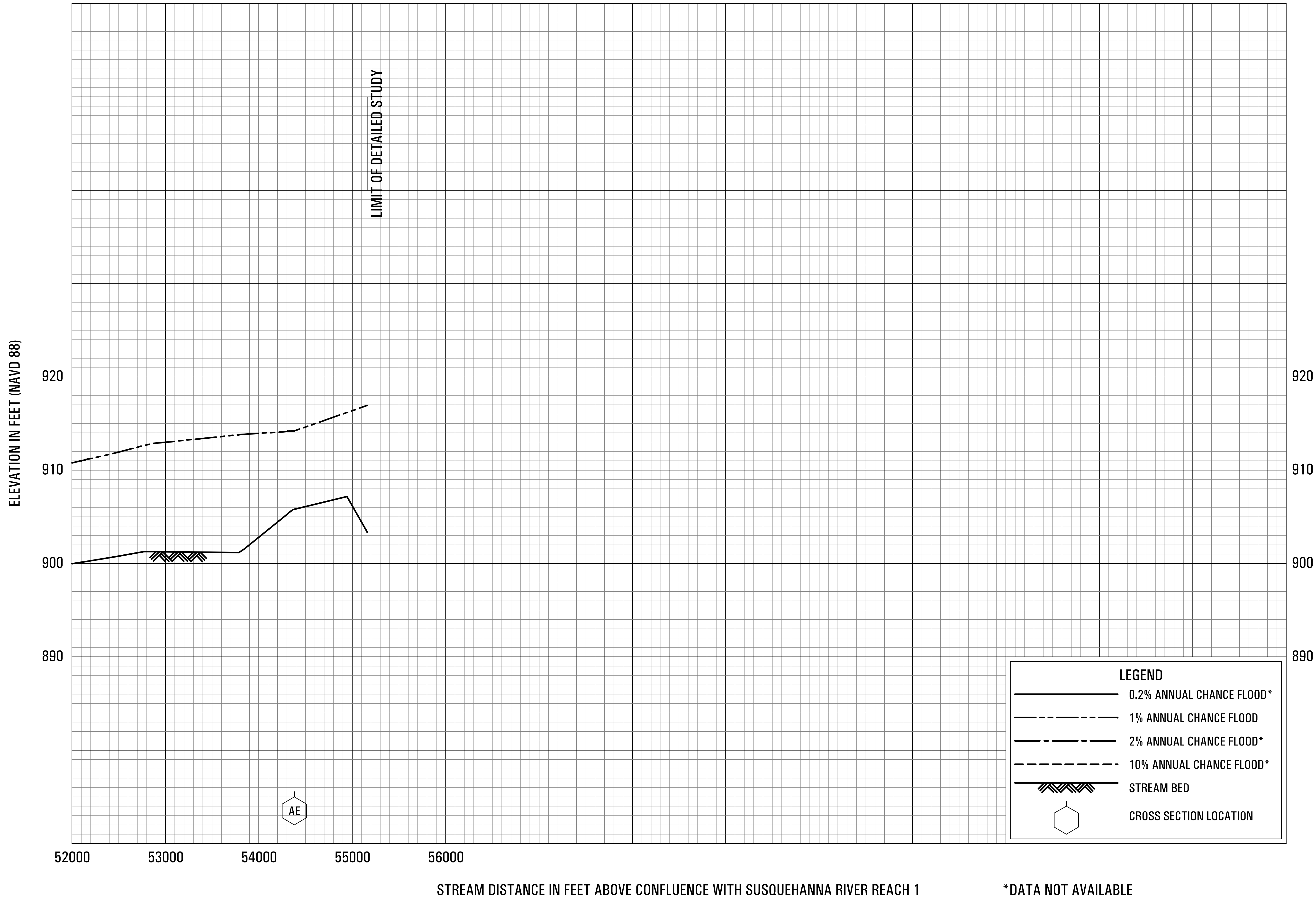
FLOOD PROFILES

NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



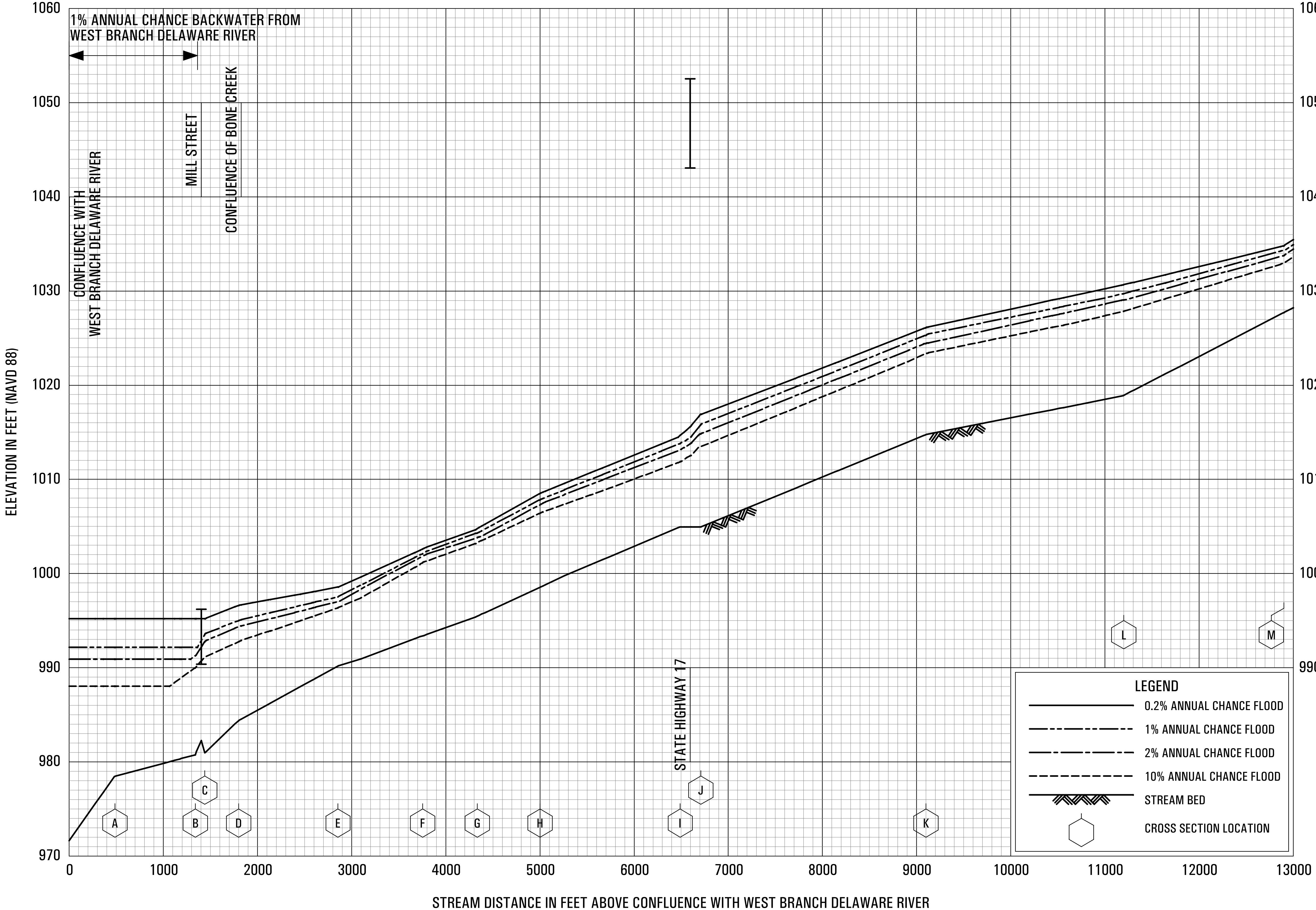
FLOOD PROFILES

NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



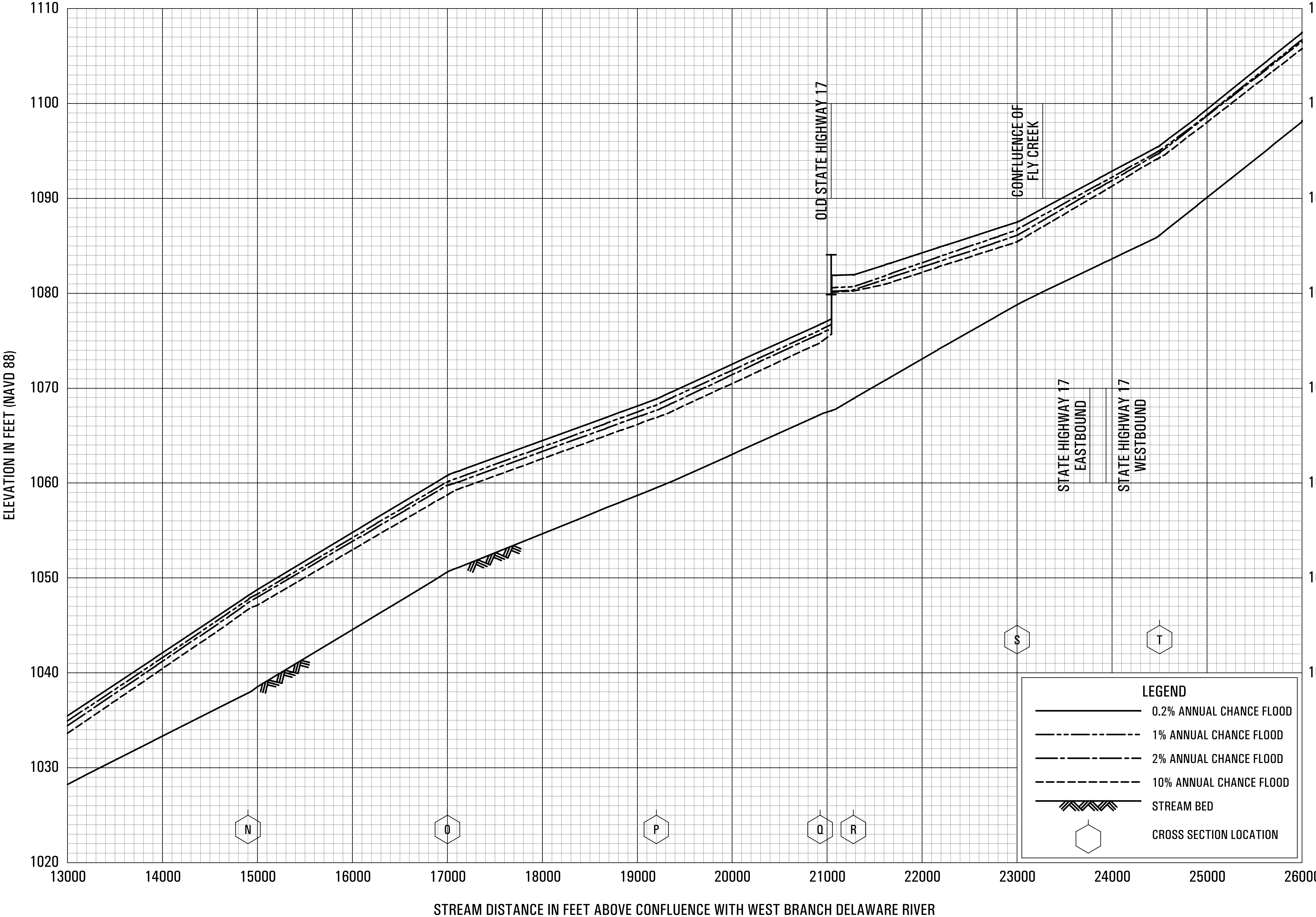
FLOOD PROFILES

OQUAGA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



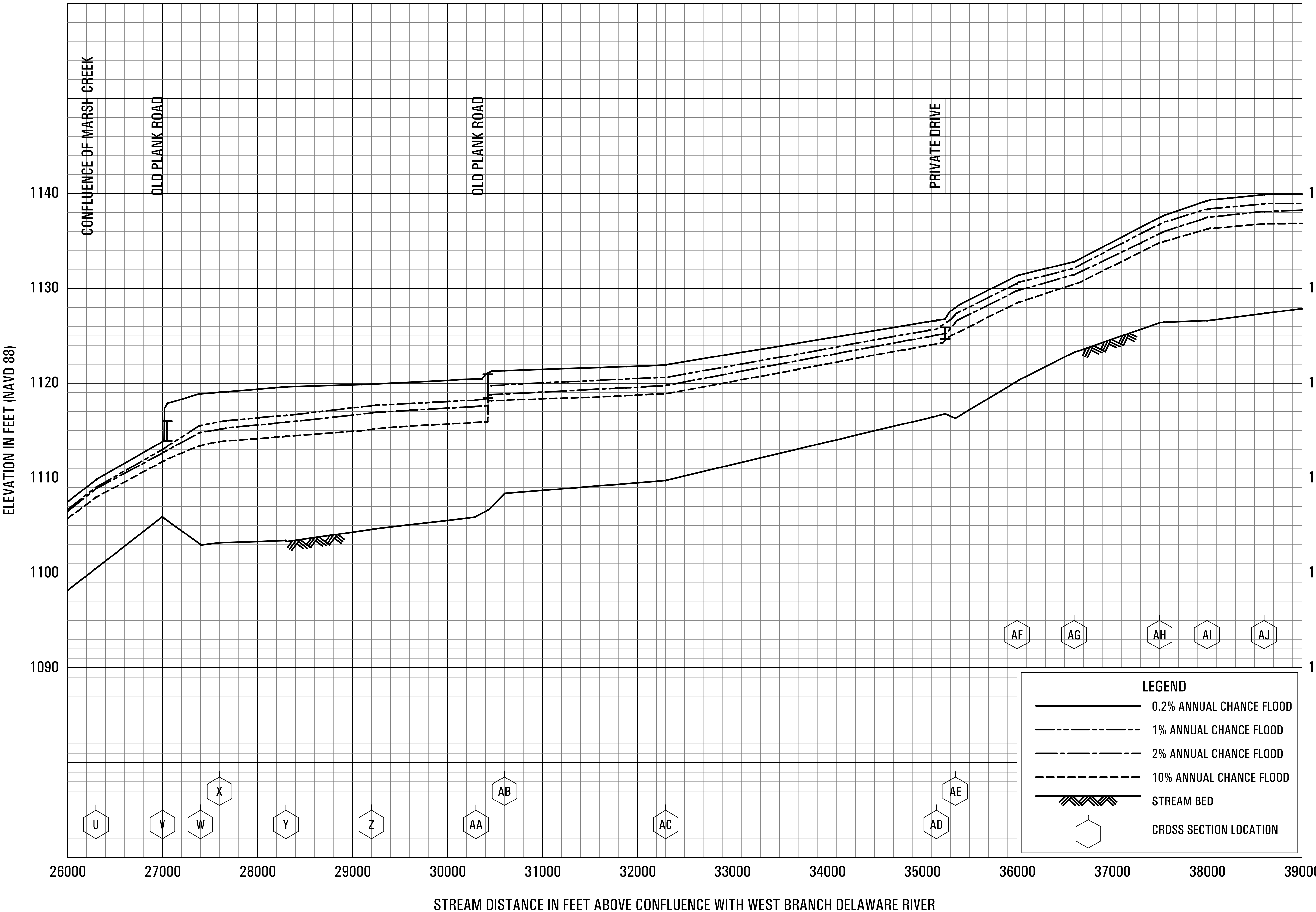
FLOOD PROFILES

OQUAGA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



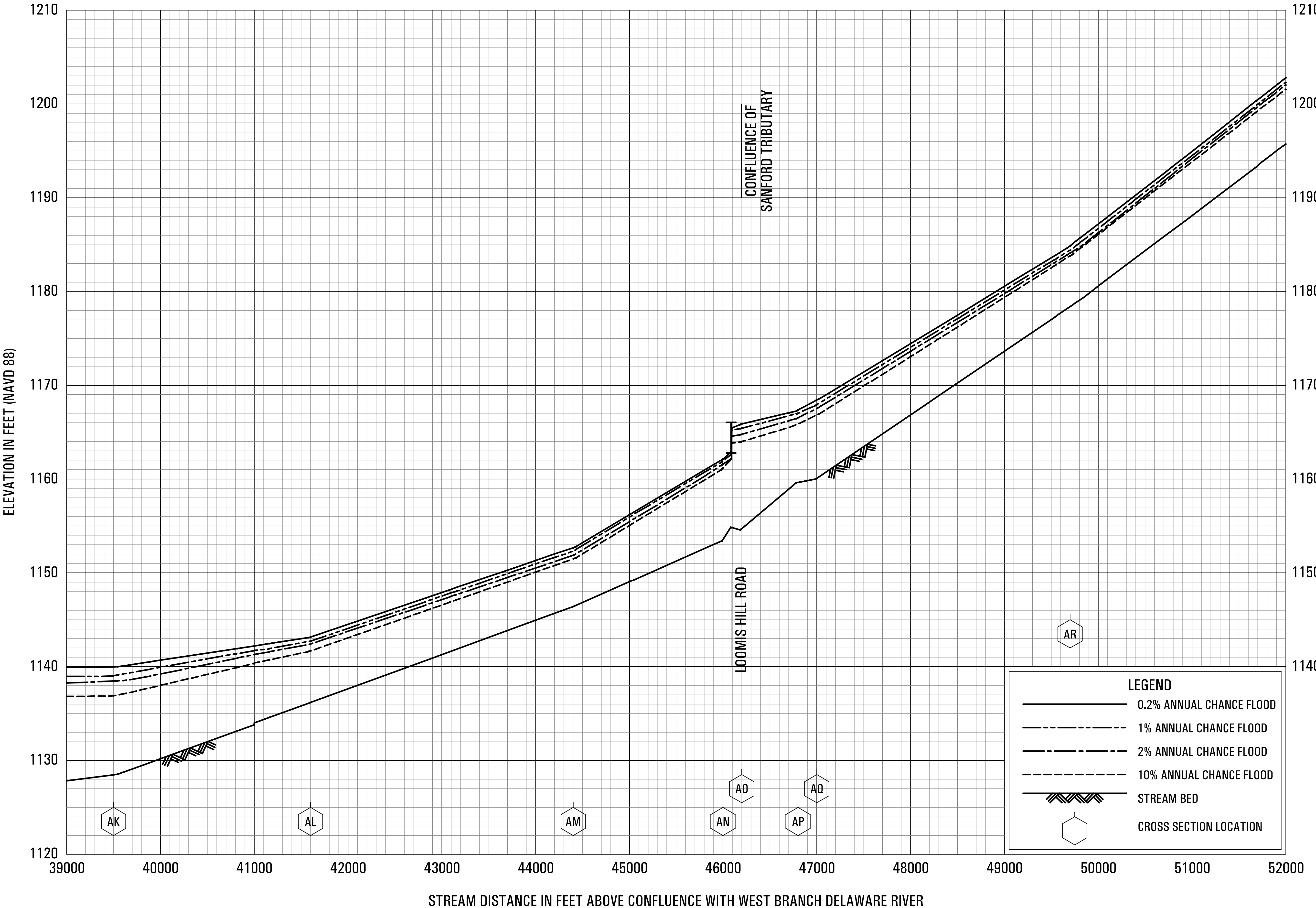
FLOOD PROFILES

OQUAGA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

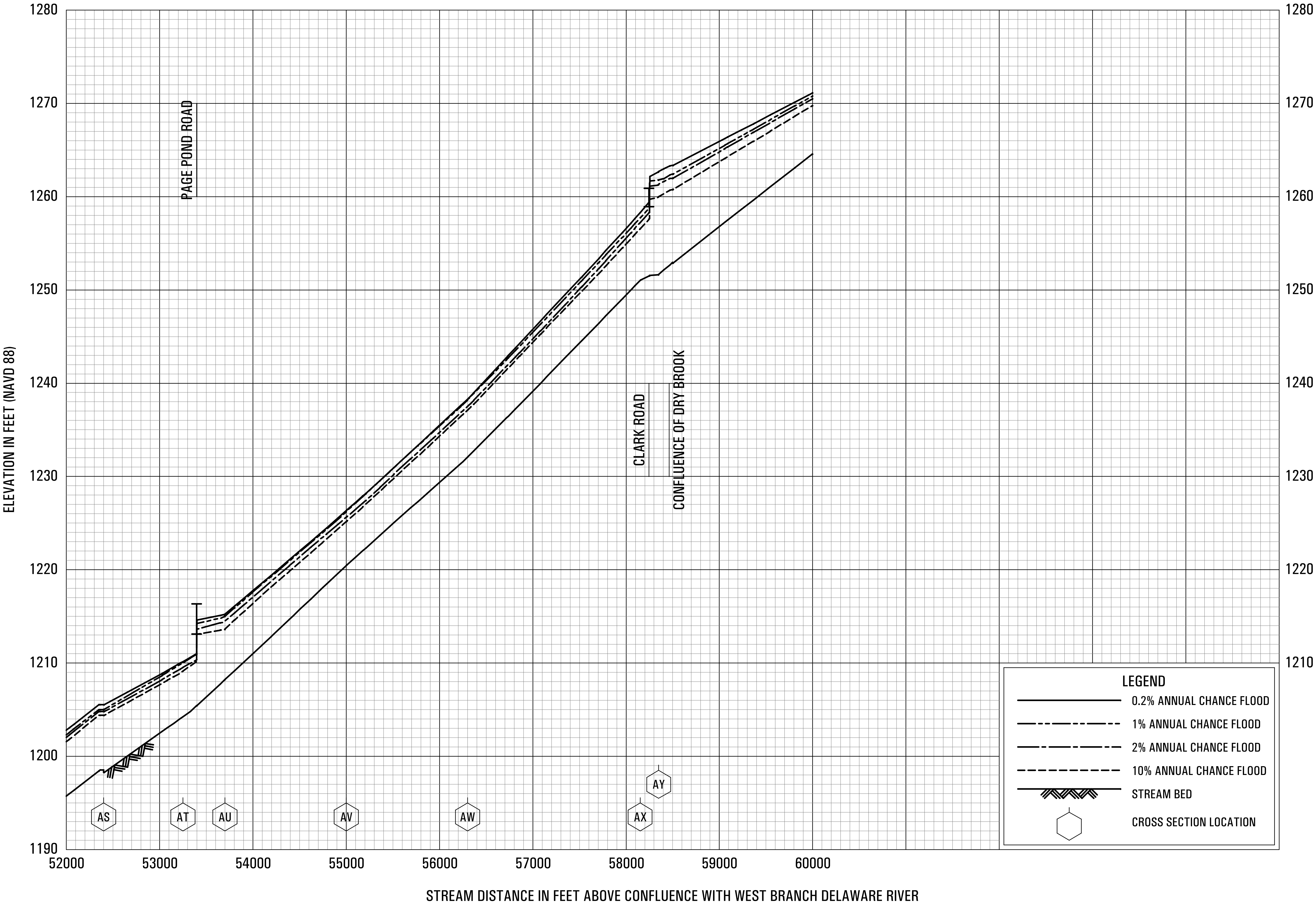
OQUAGA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

50P



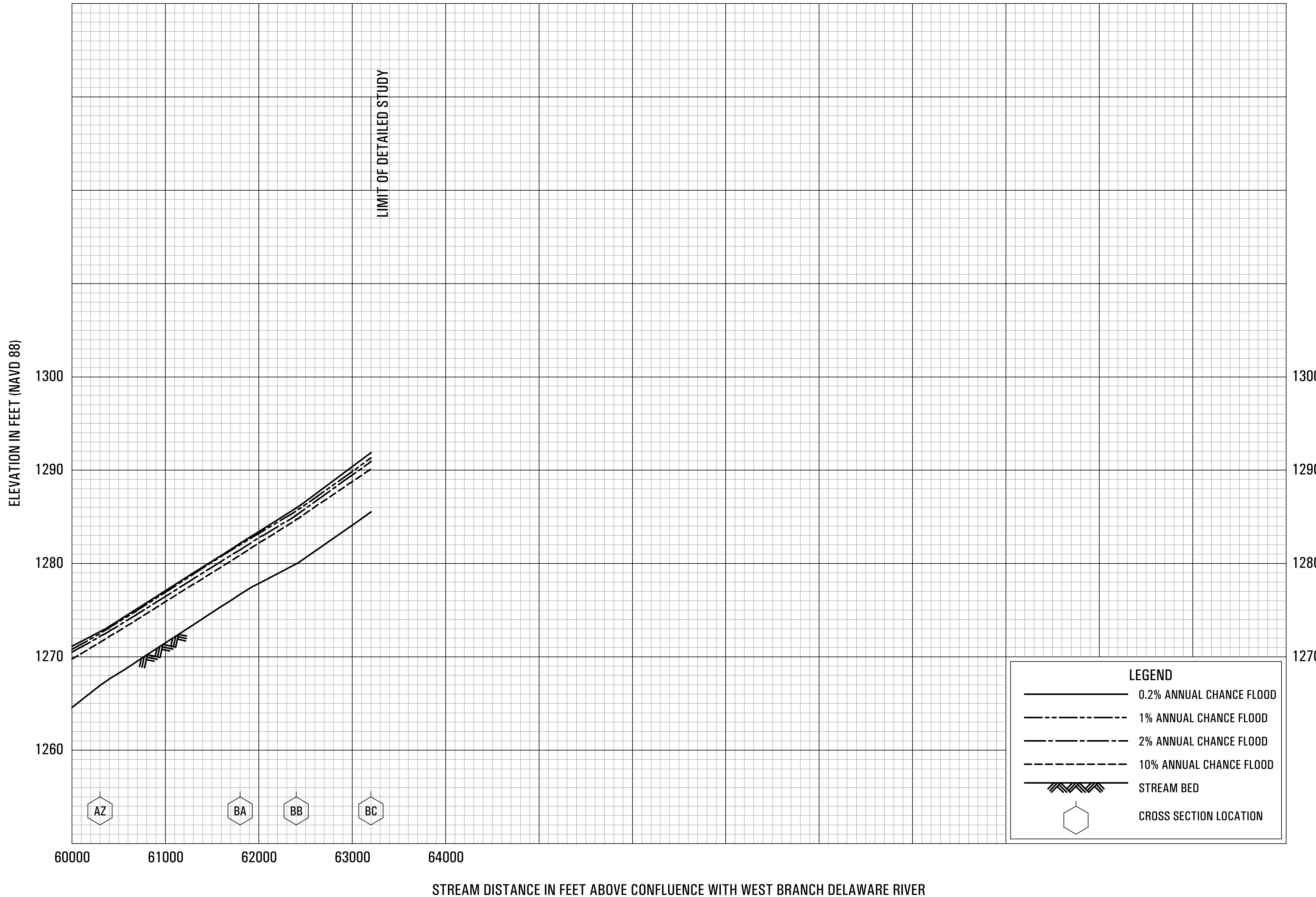
FLOOD PROFILES

OQUAGA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



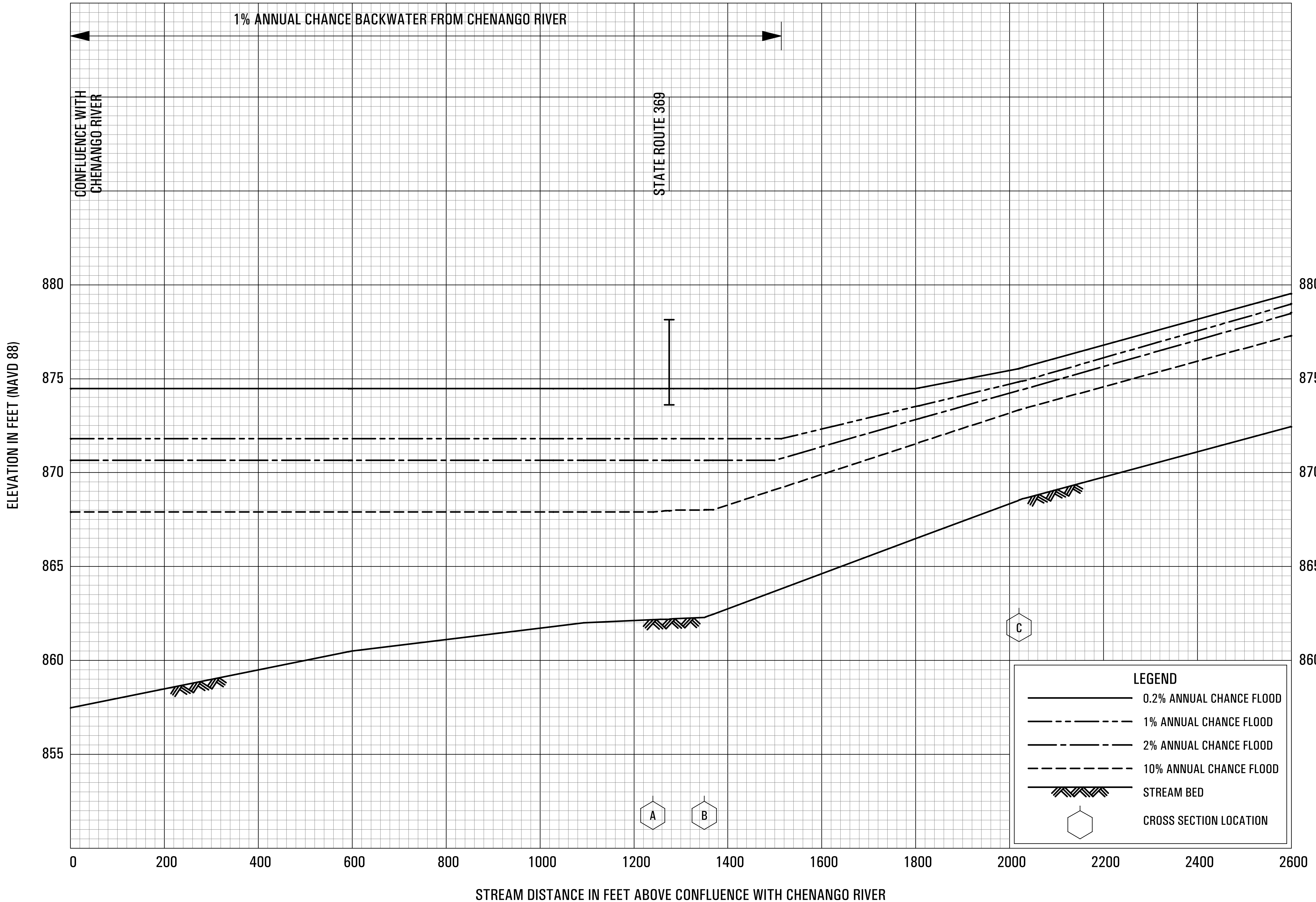
FLOOD PROFILES

OQUAGA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



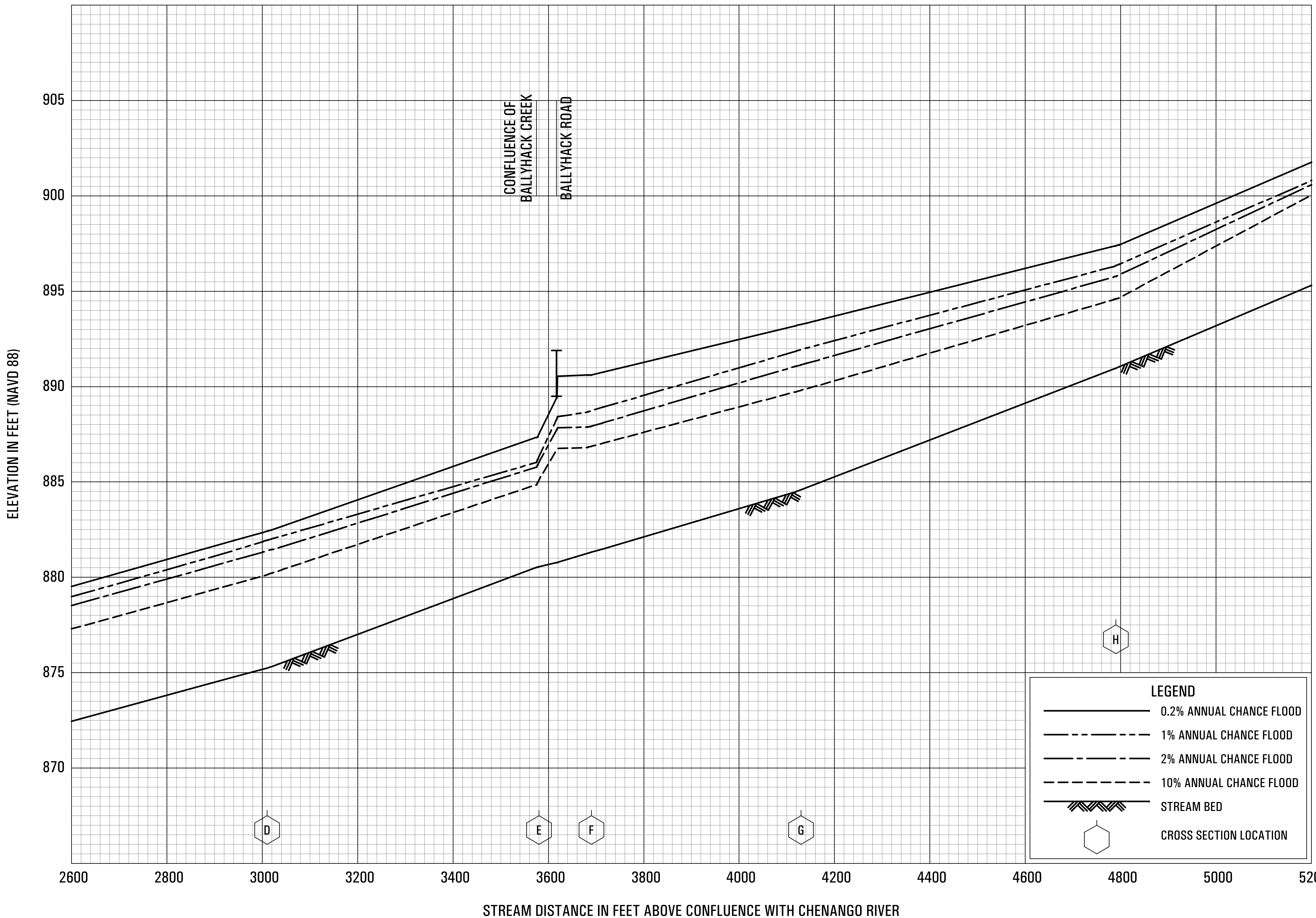
FLOOD PROFILES

OSBORNE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



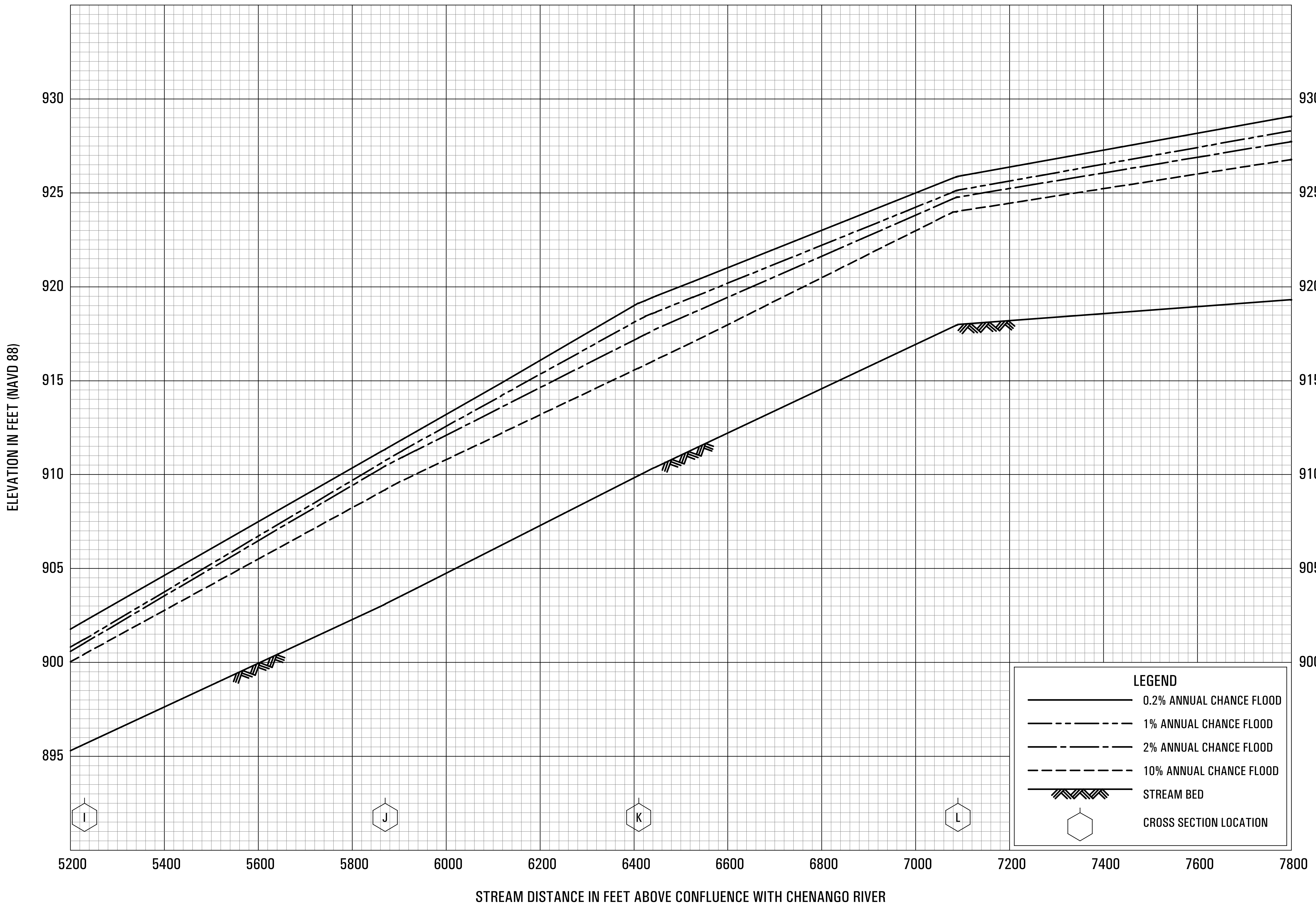
FLOOD PROFILES

OSBORNE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



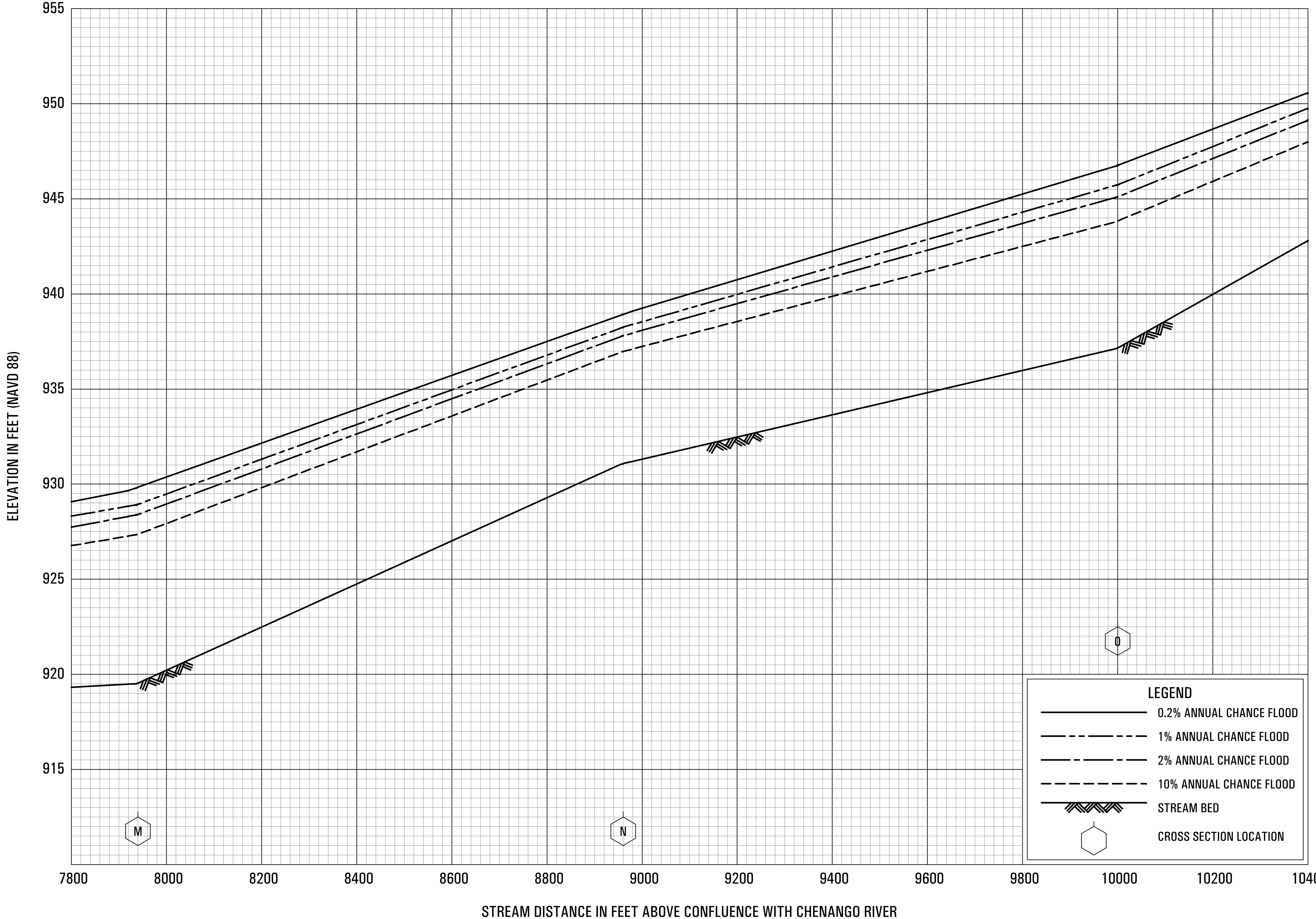
FLOOD PROFILES

OSBORNE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



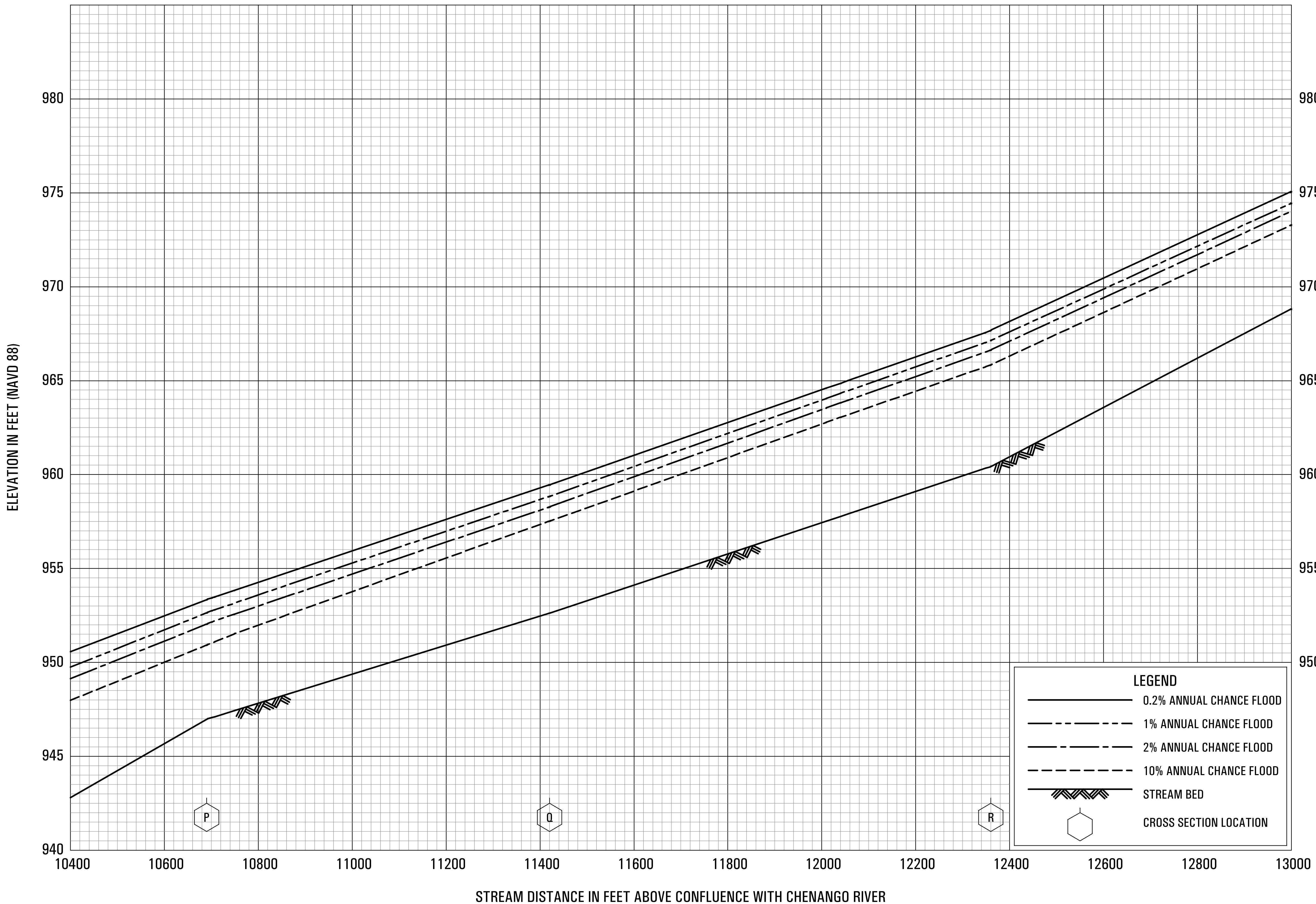
FLOOD PROFILES

OSBORNE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



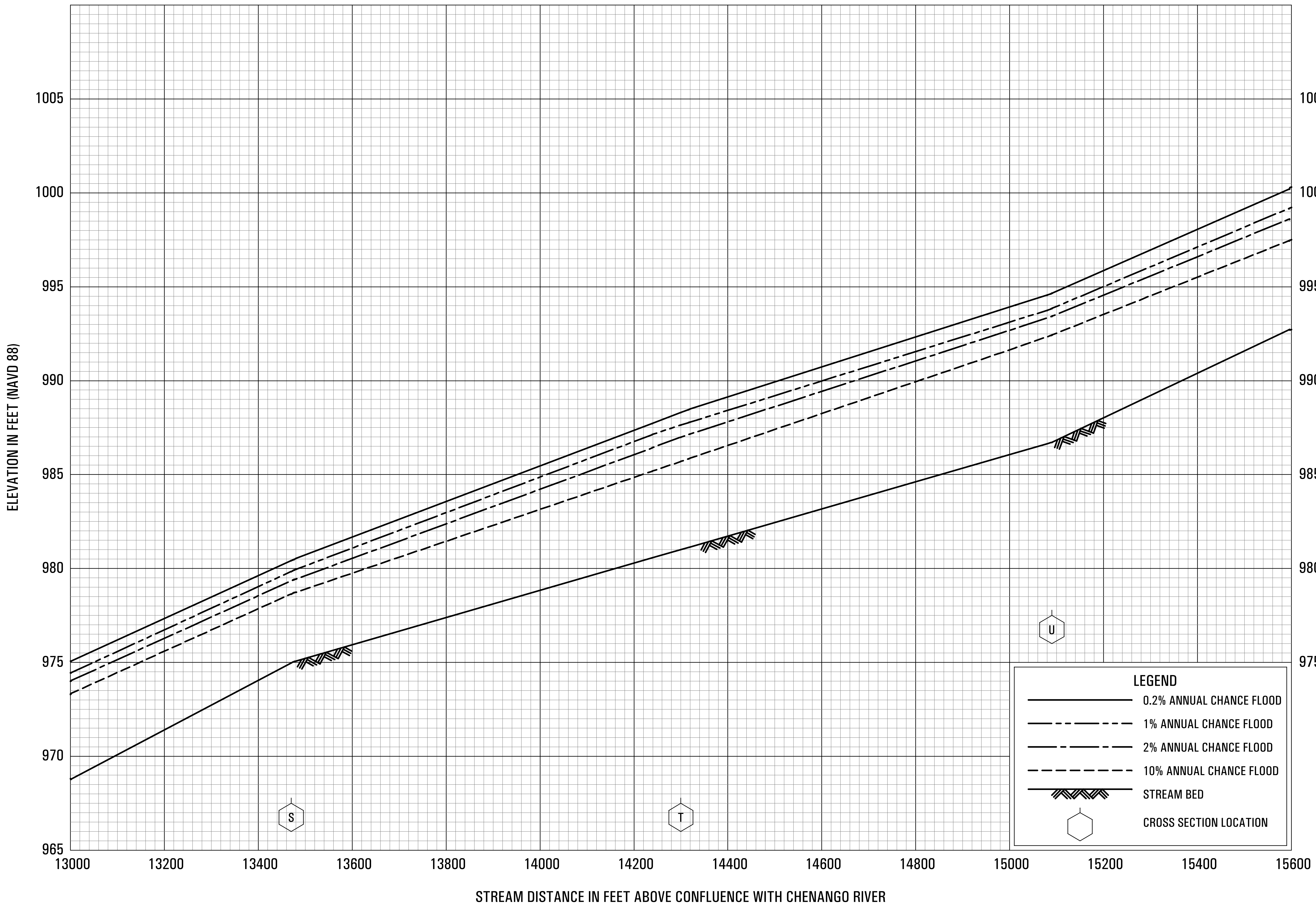
FLOOD PROFILES

OSBORNE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

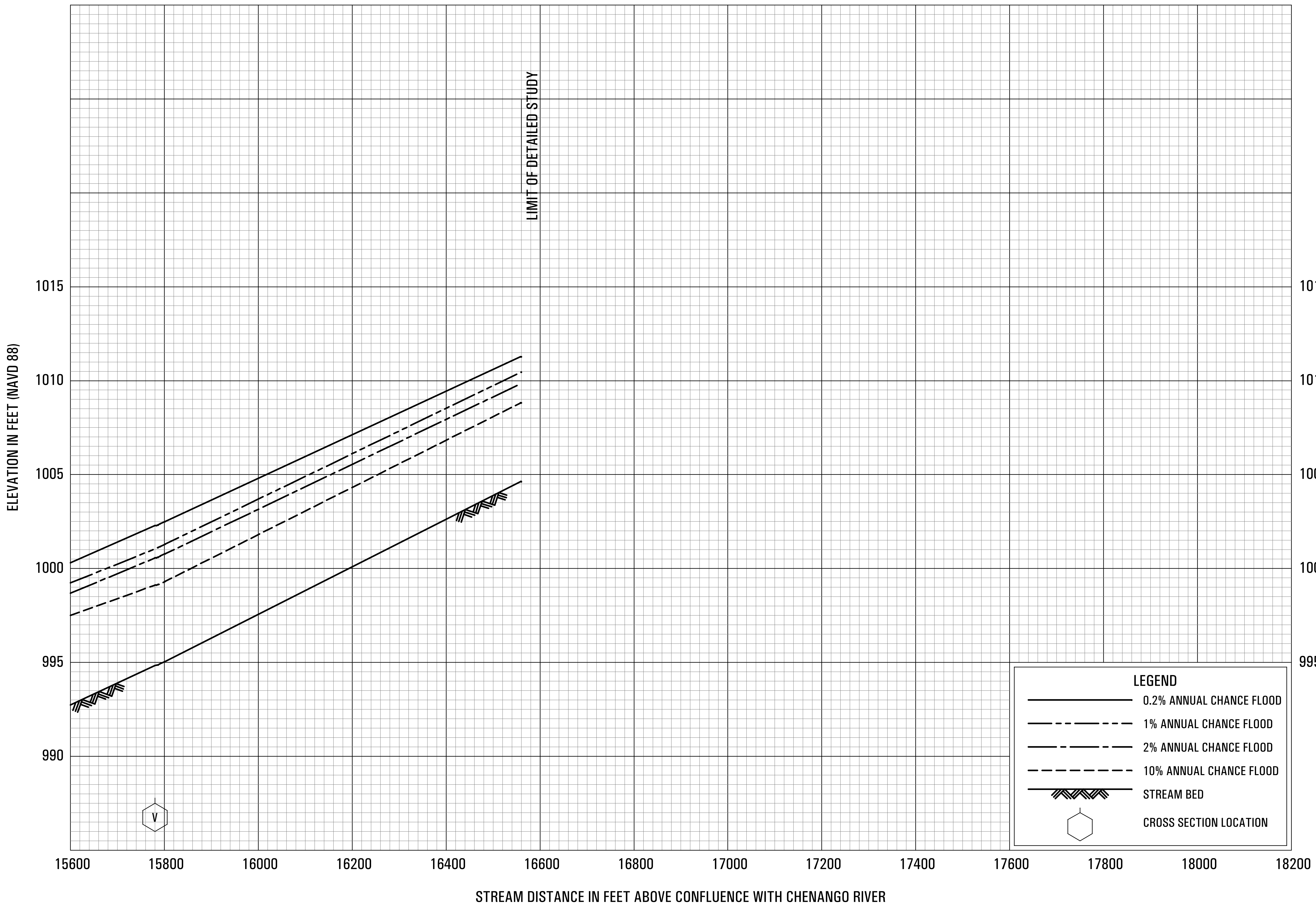
OSBORNE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

58P



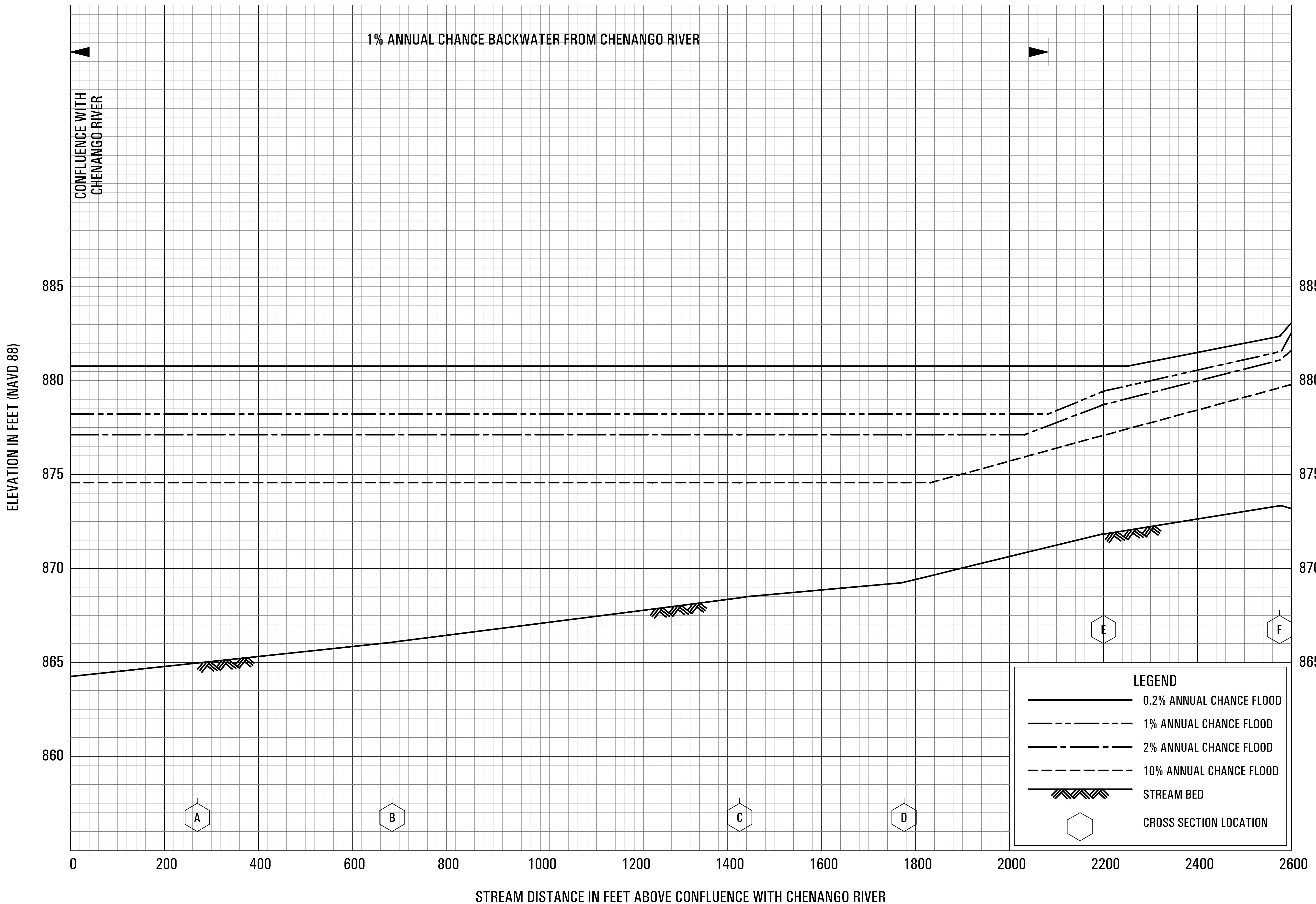
FLOOD PROFILES

OSBORNE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



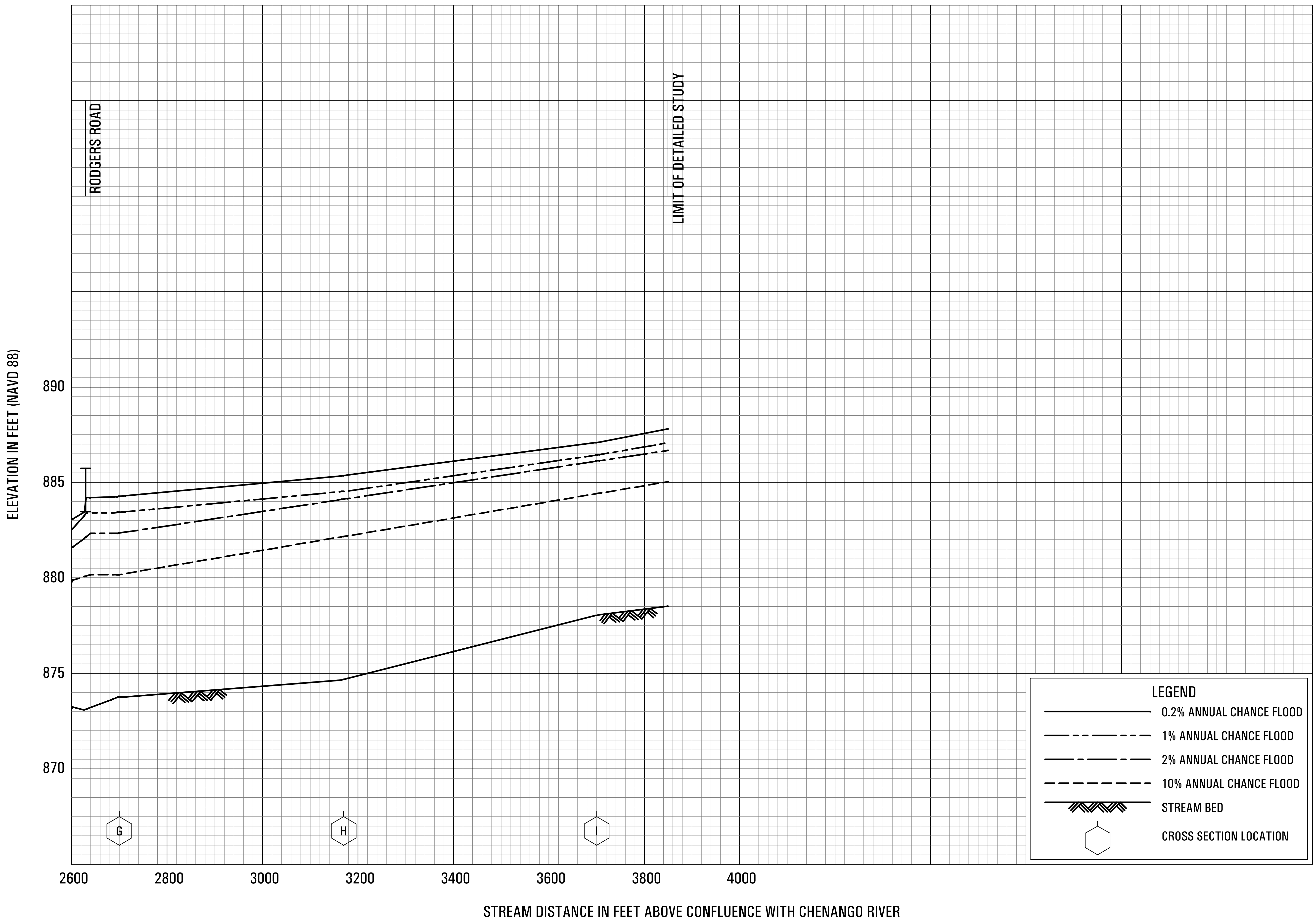
FLOOD PROFILES

PAGE BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



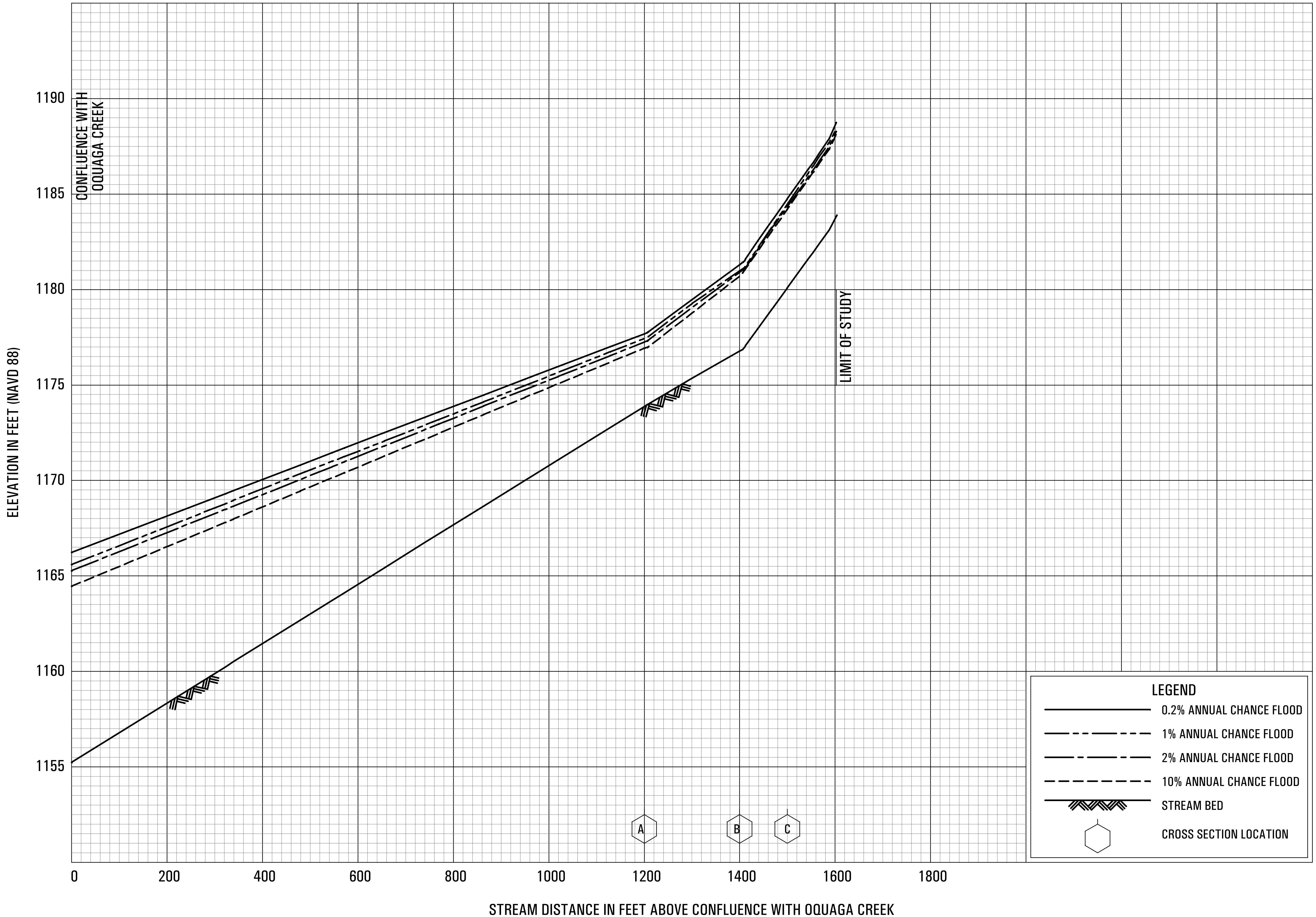
FLOOD PROFILES

PAGE BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



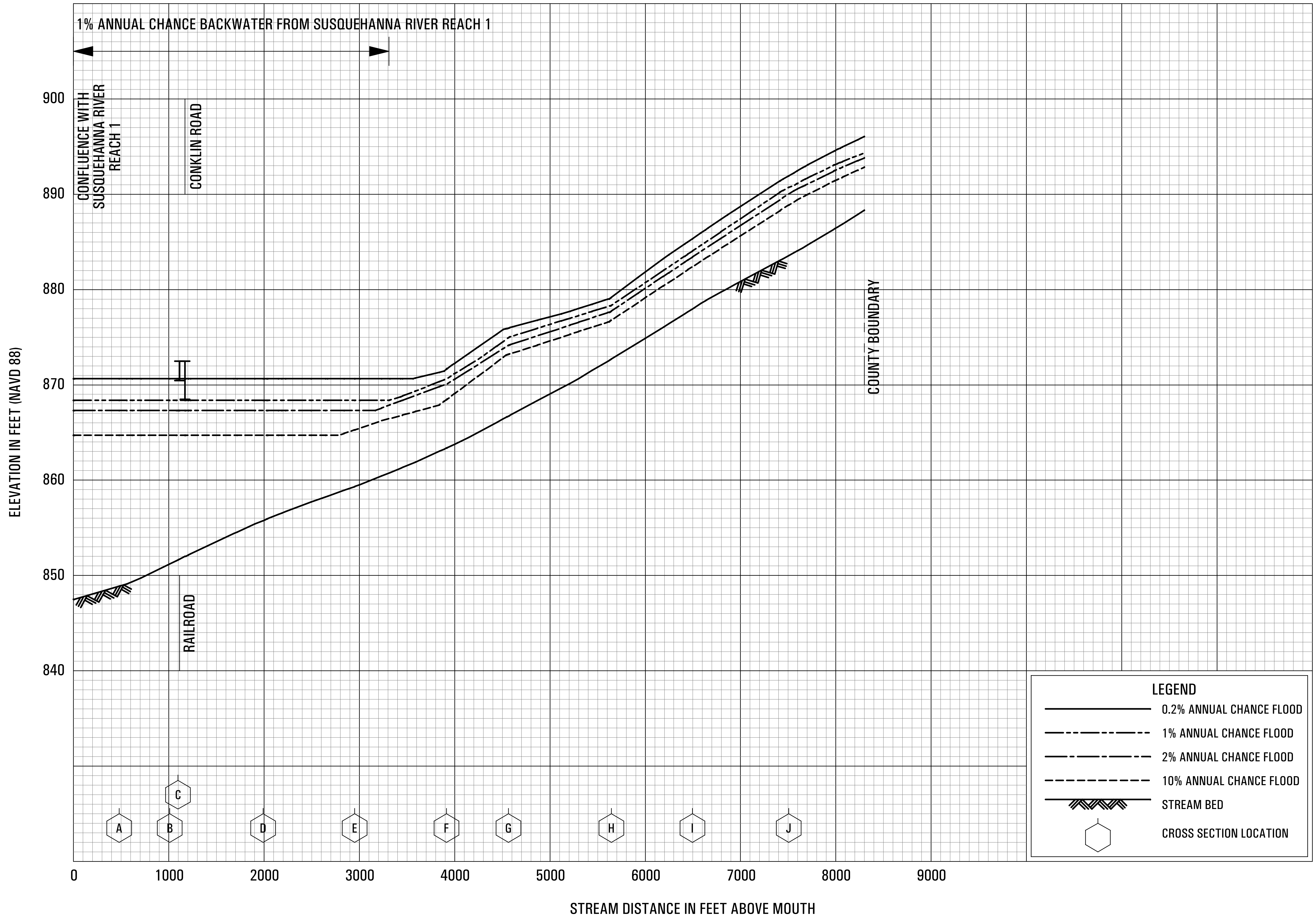
FLOOD PROFILES

SANFORD TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



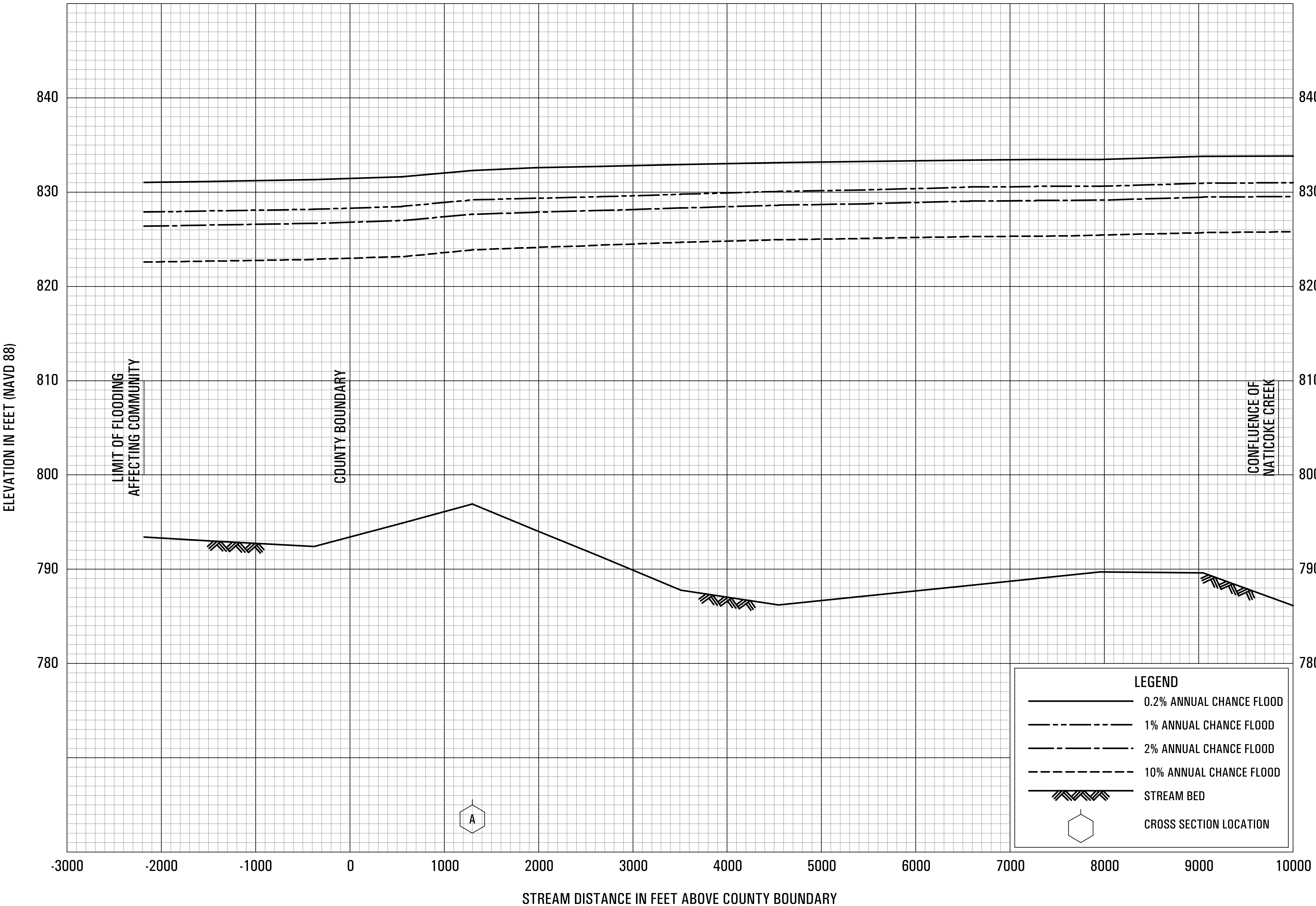
FLOOD PROFILES

SNAKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



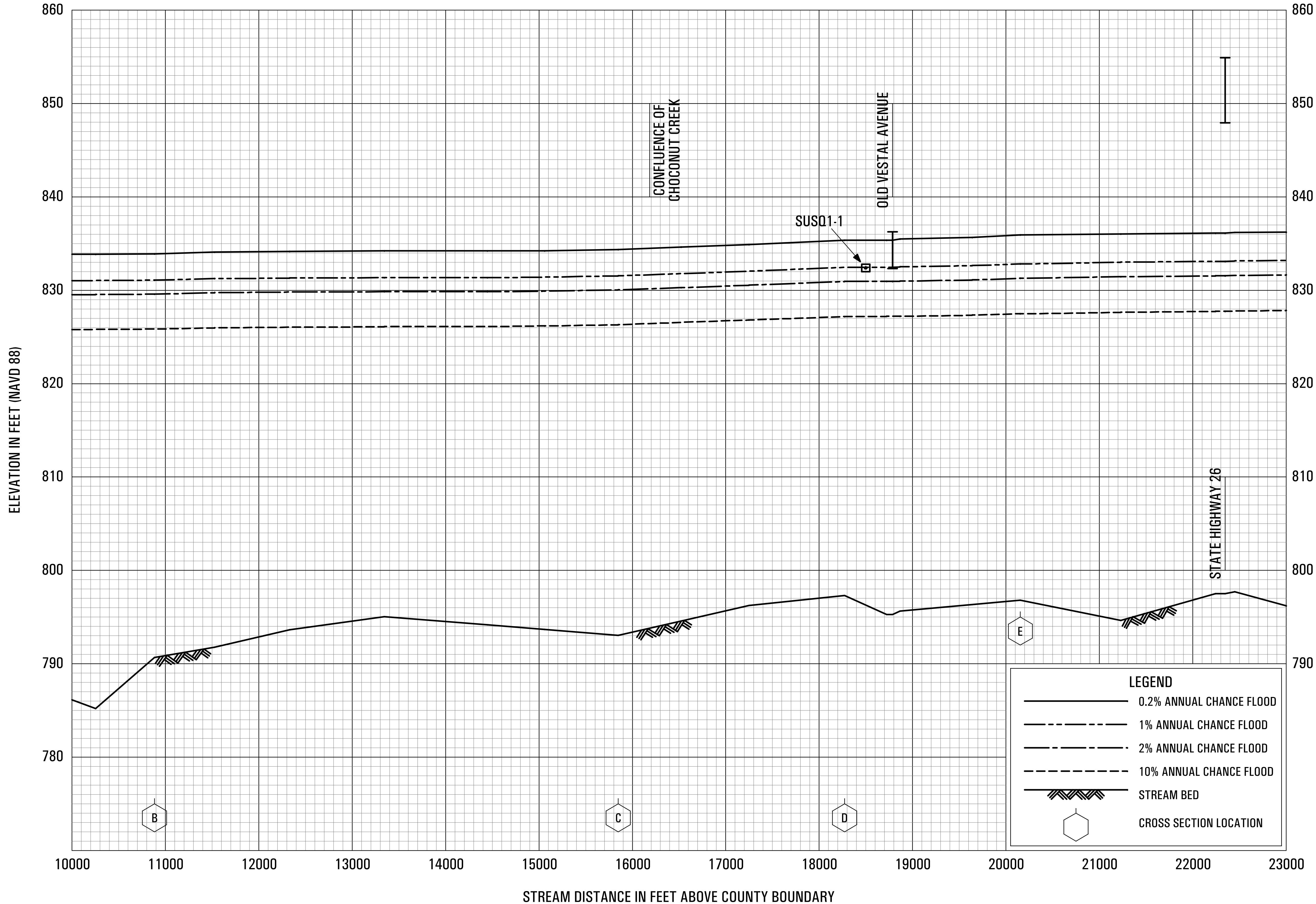
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



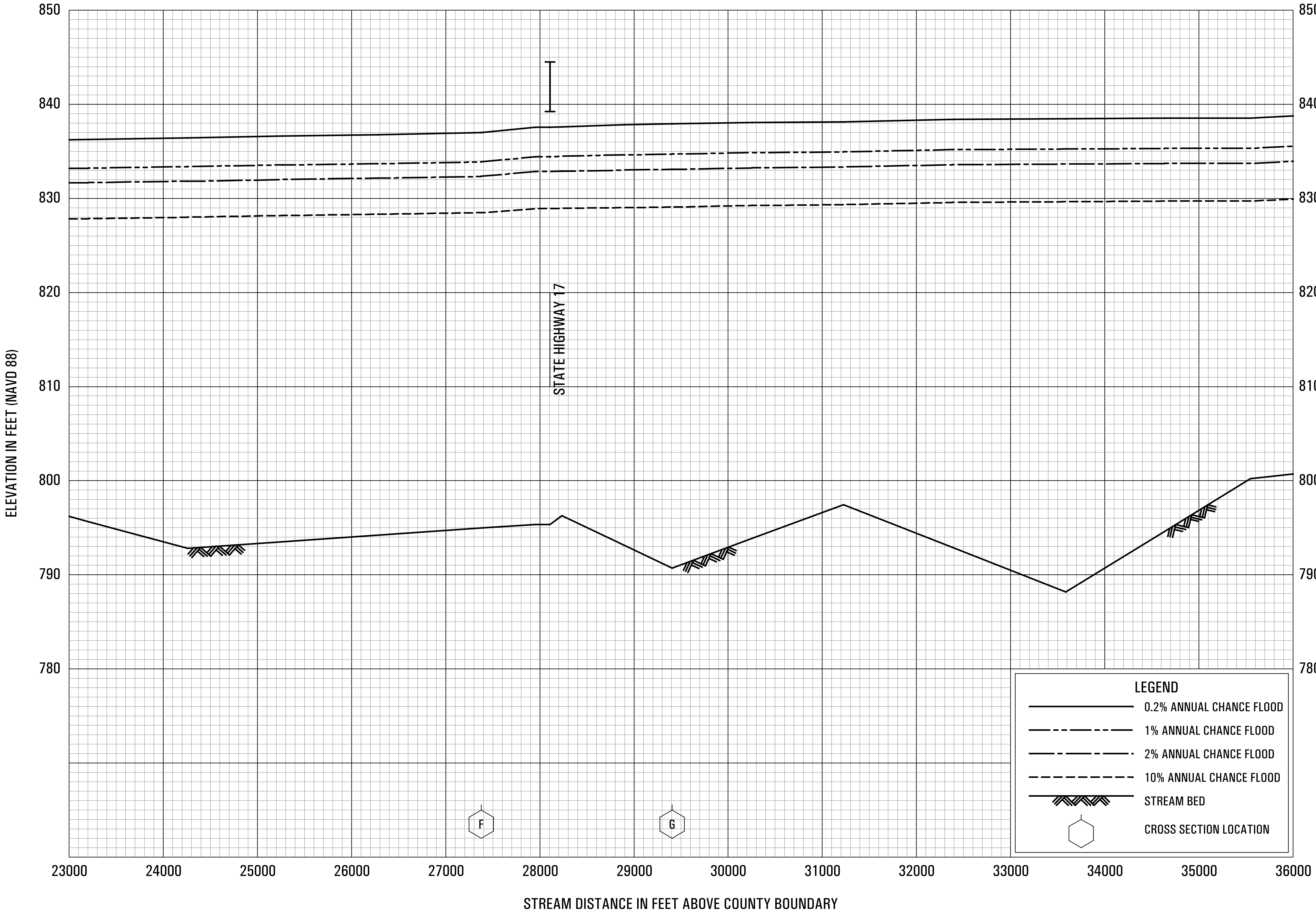
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

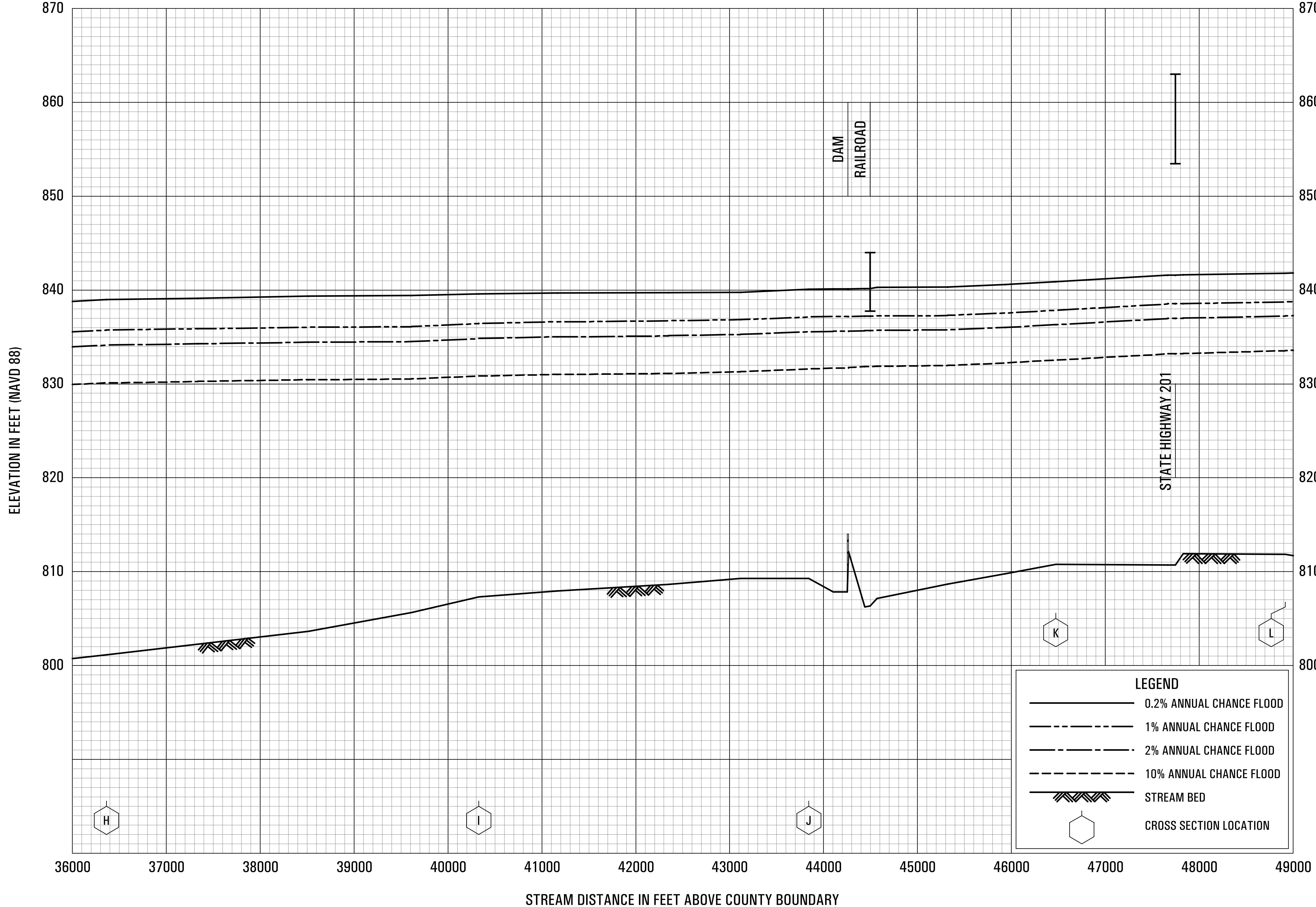
SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

66P



FLOOD PROFILES

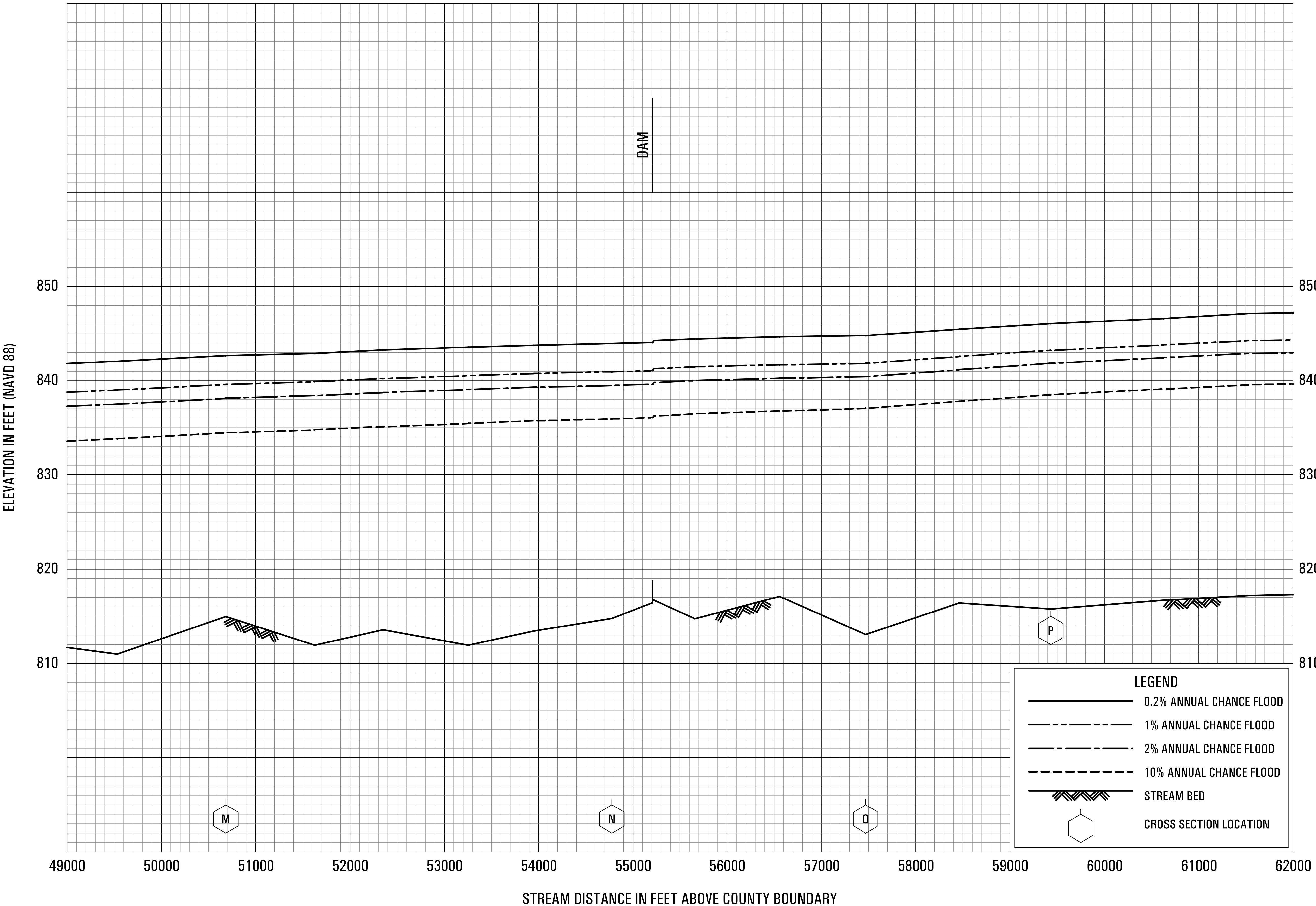
SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

67P



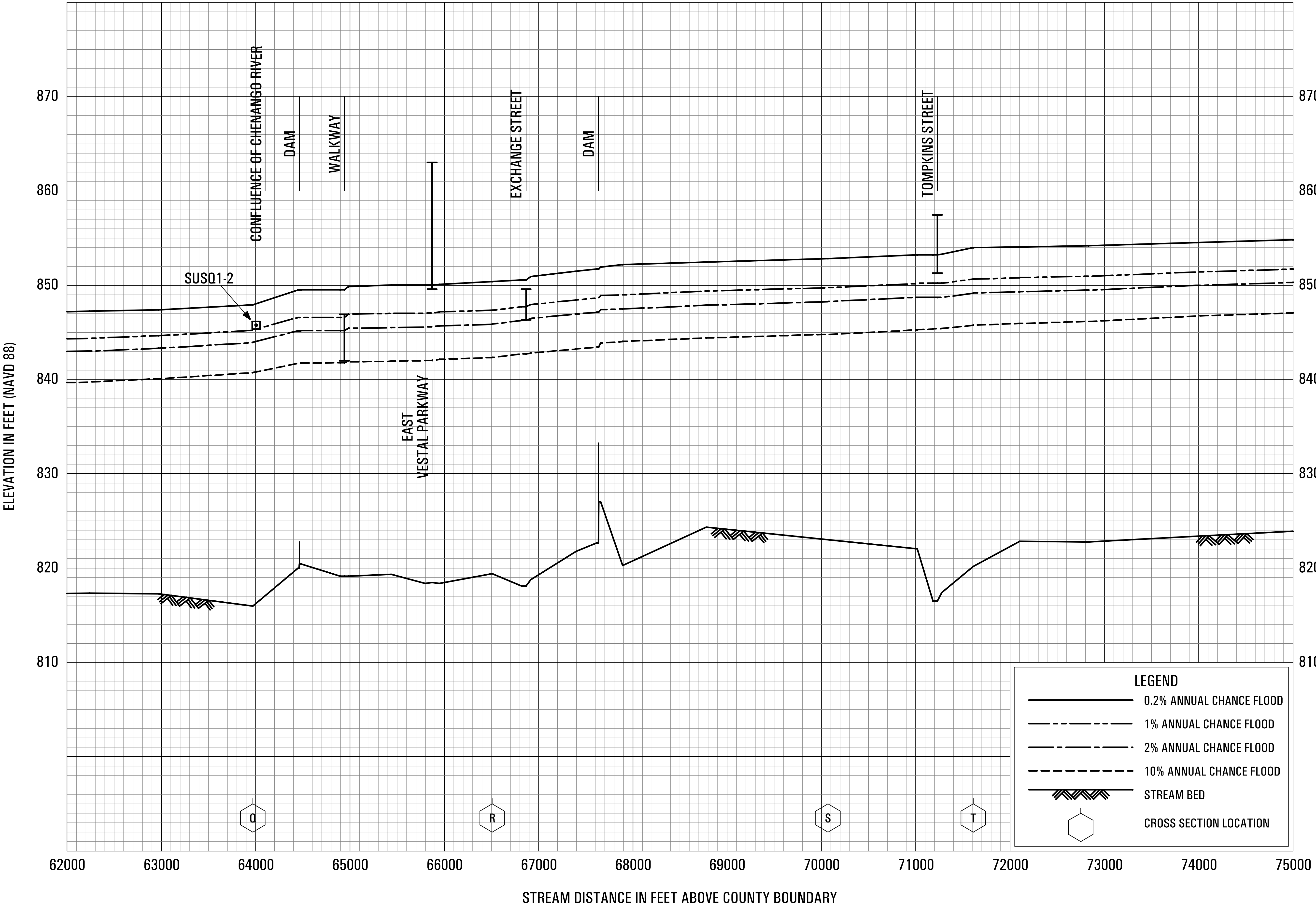
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



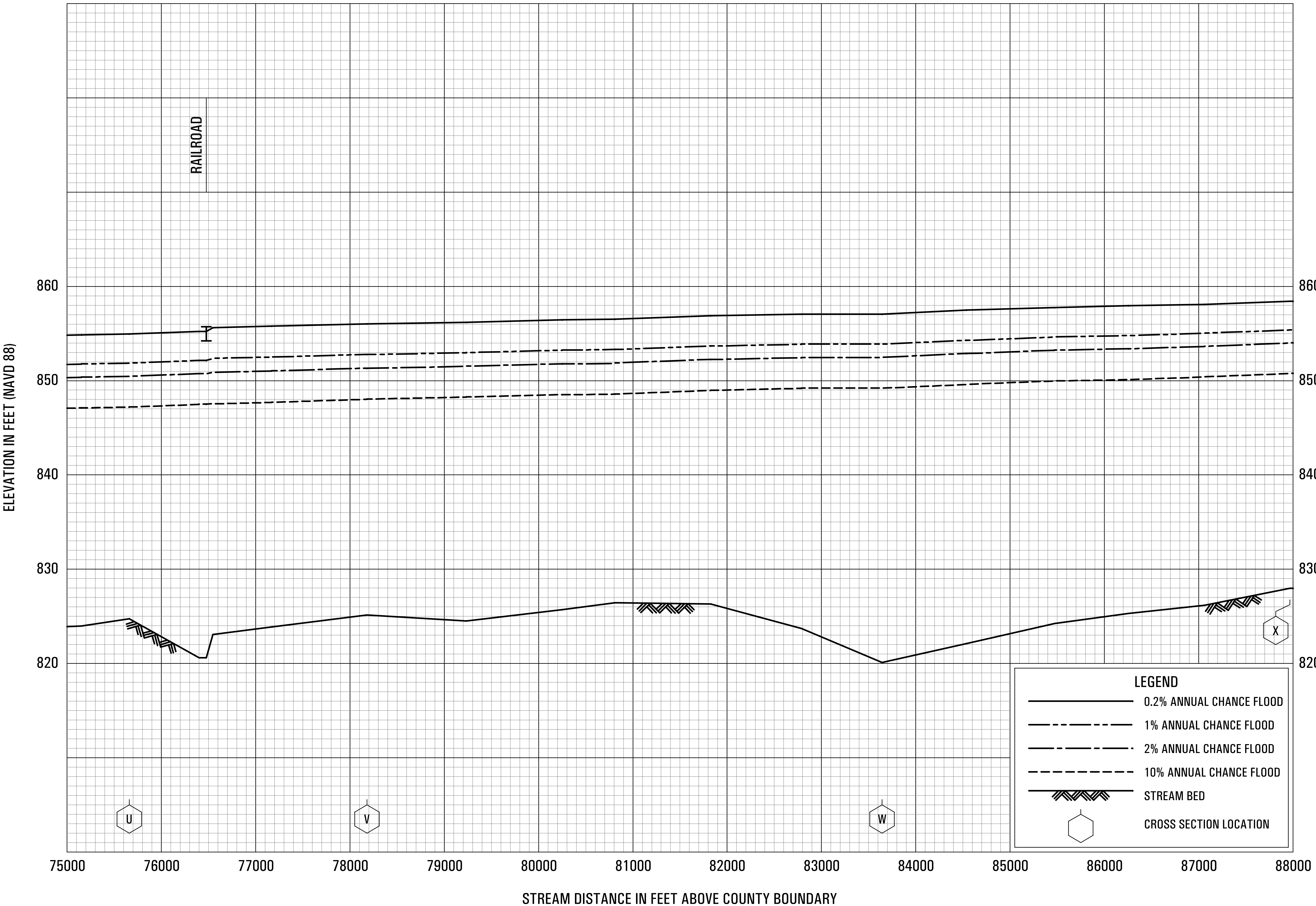
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



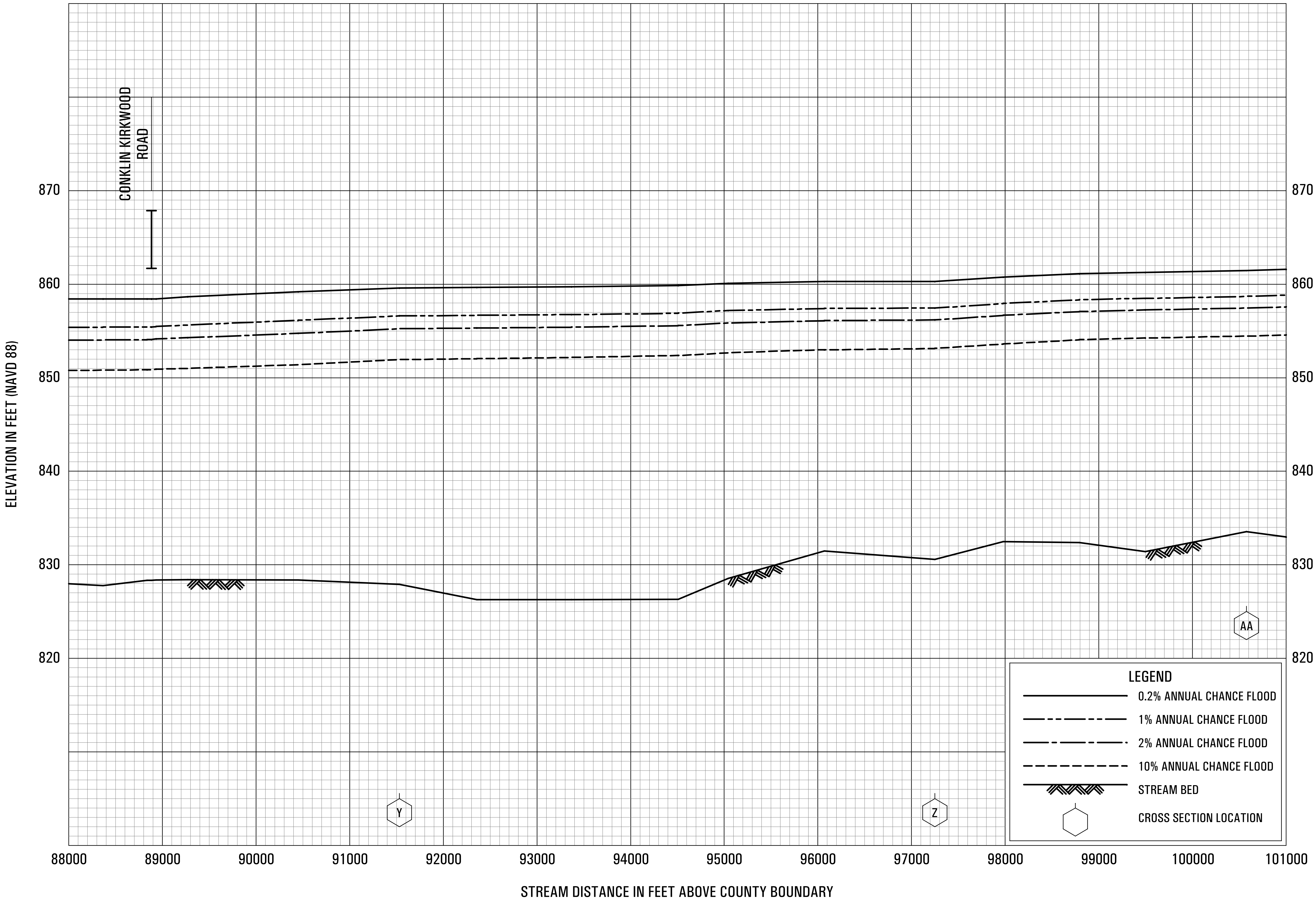
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



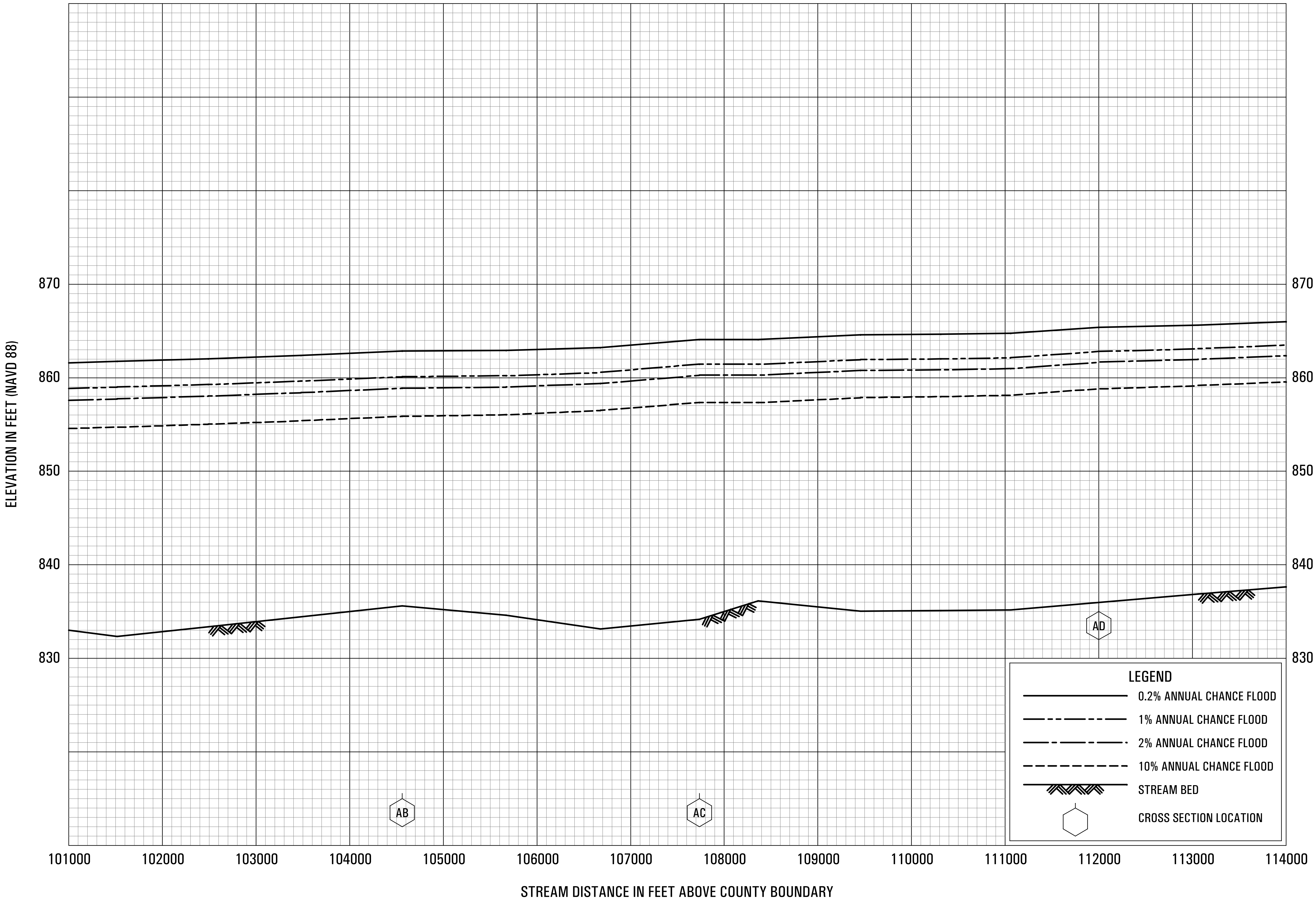
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



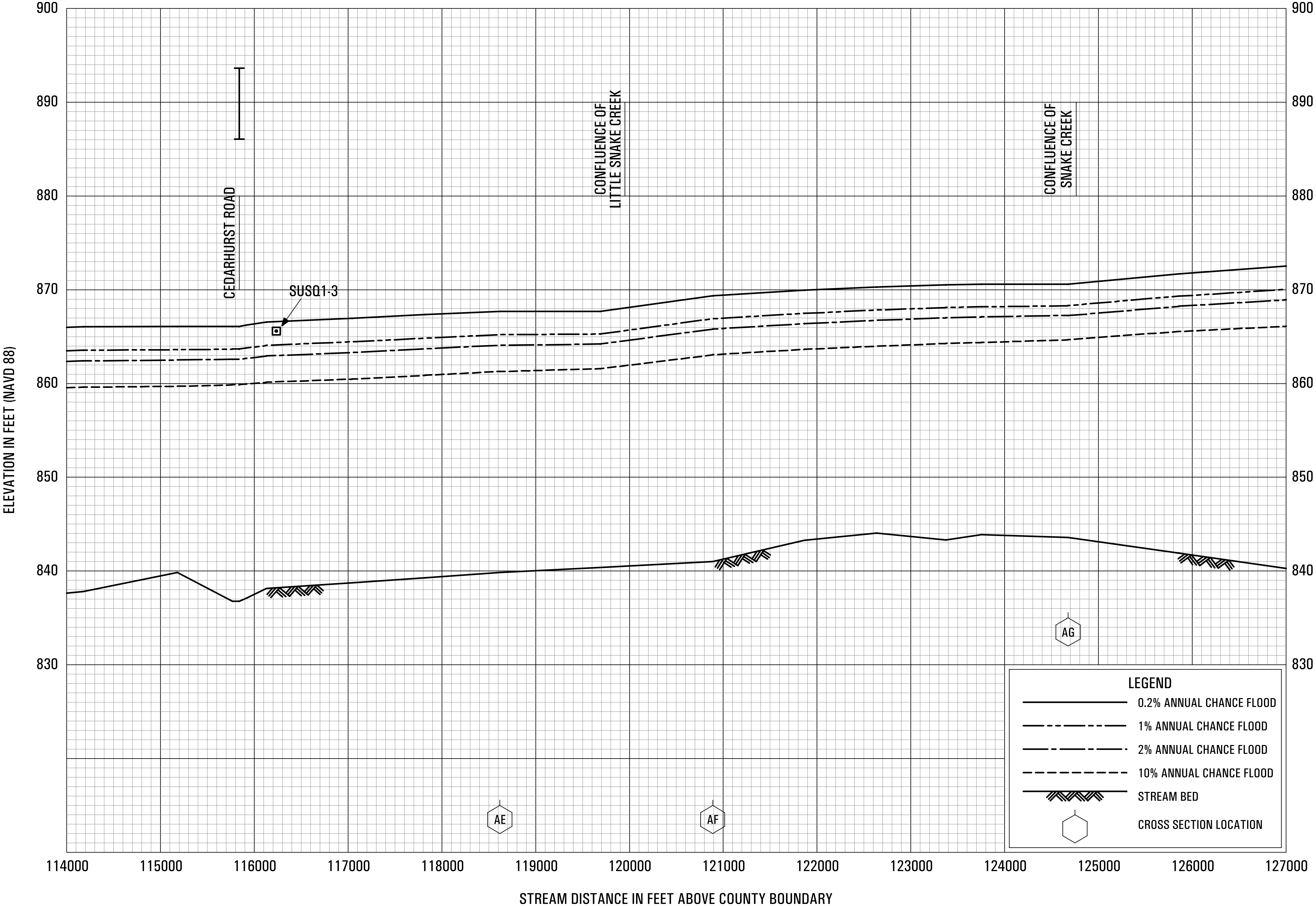
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



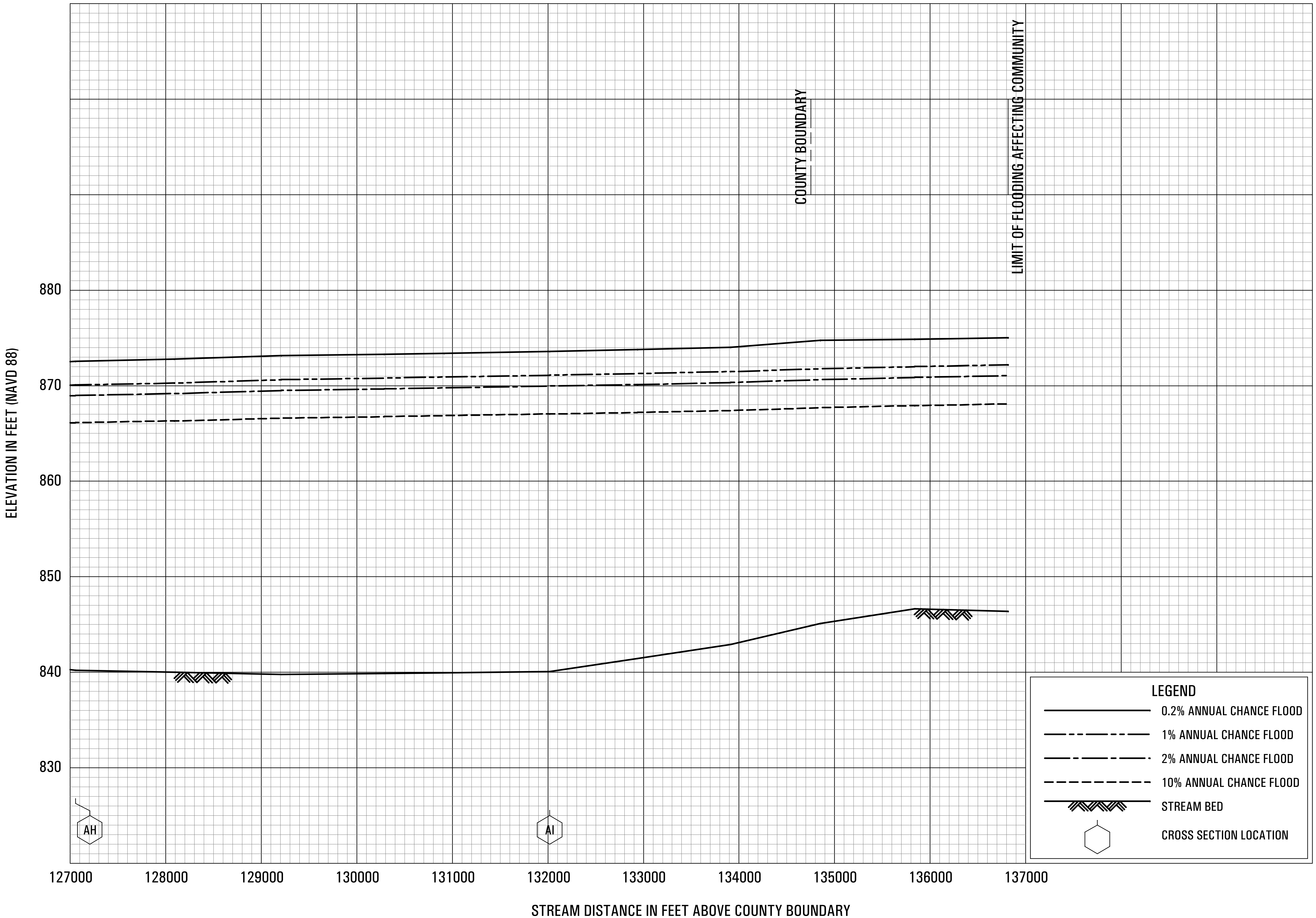
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



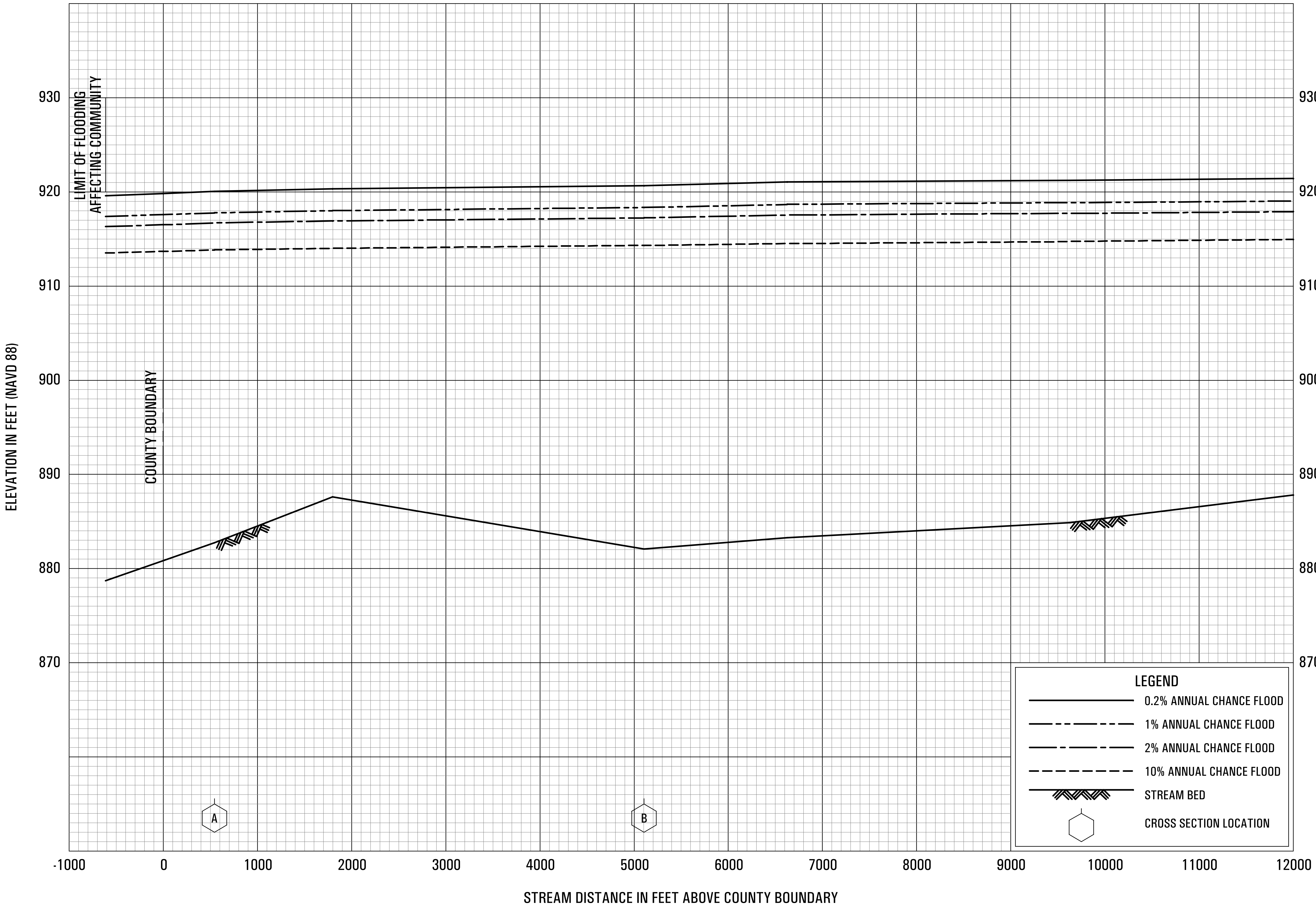
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



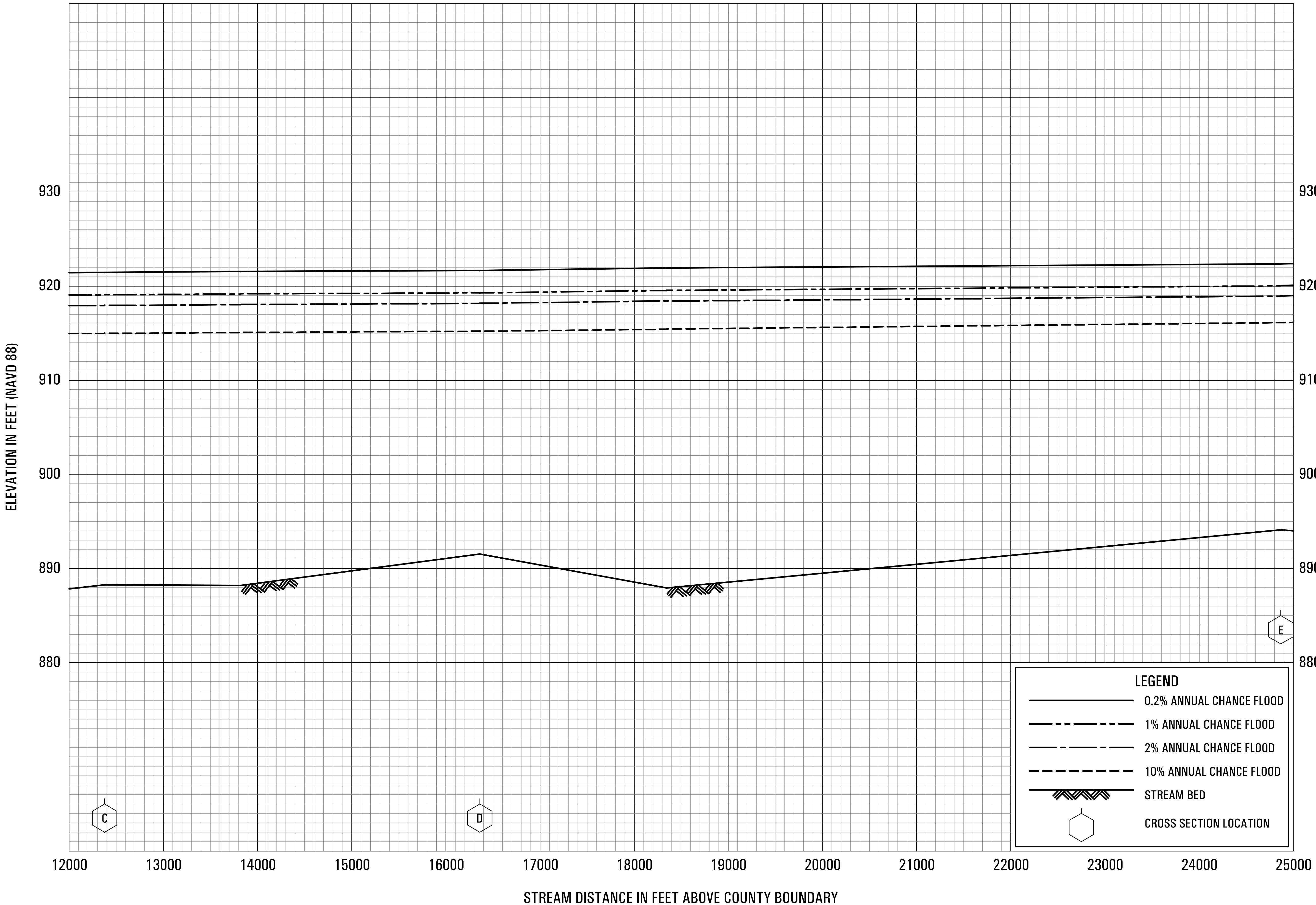
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



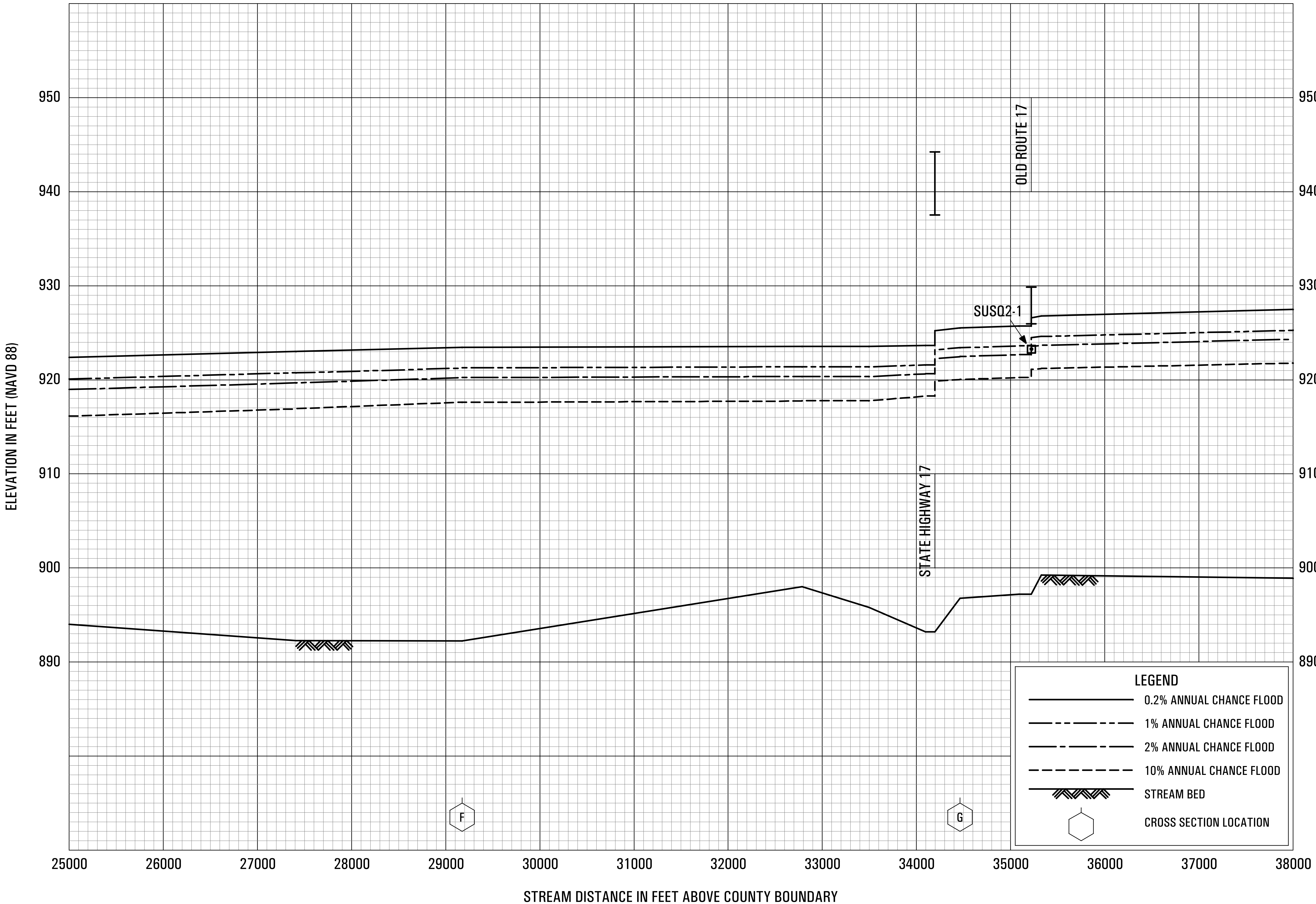
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



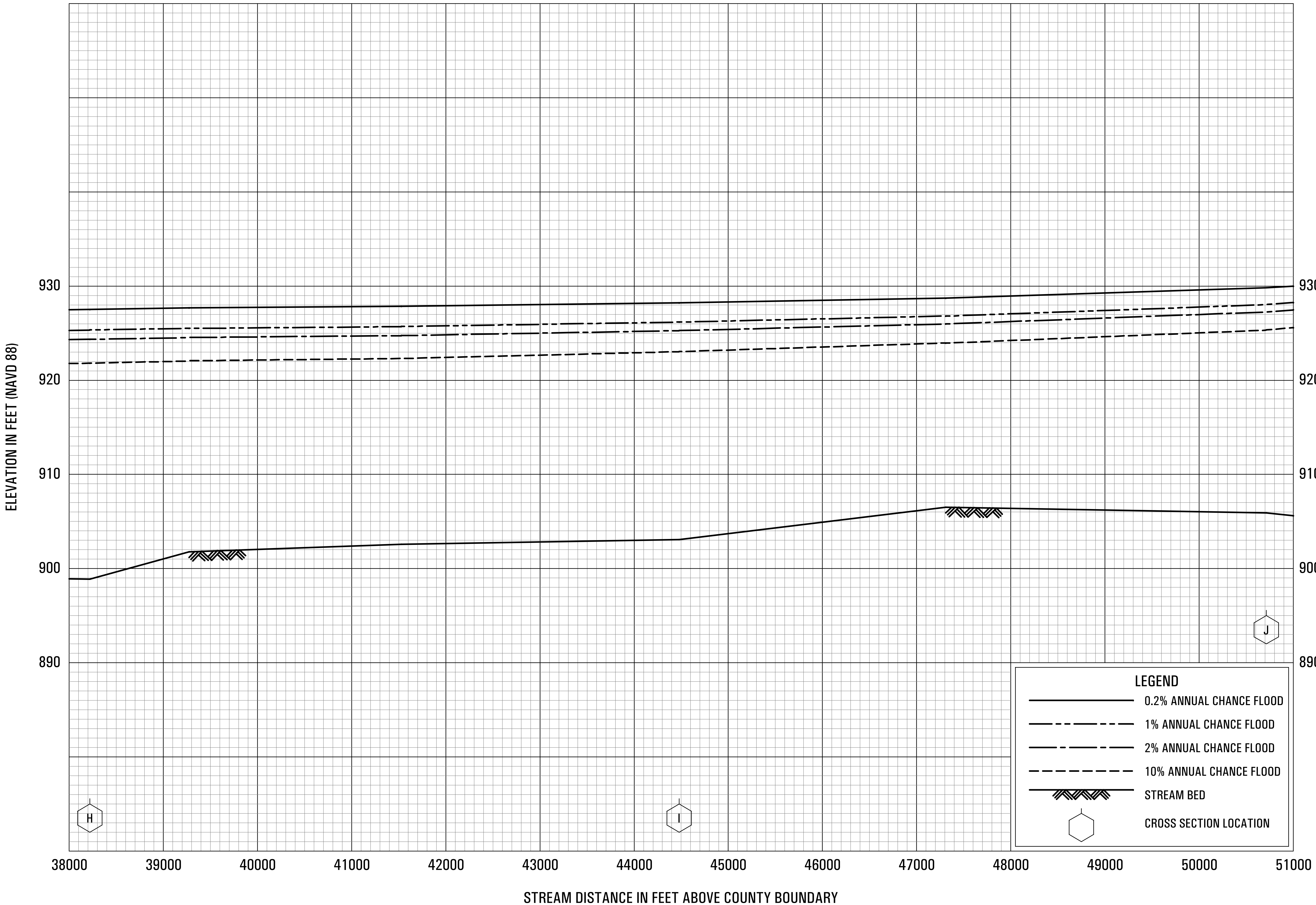
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



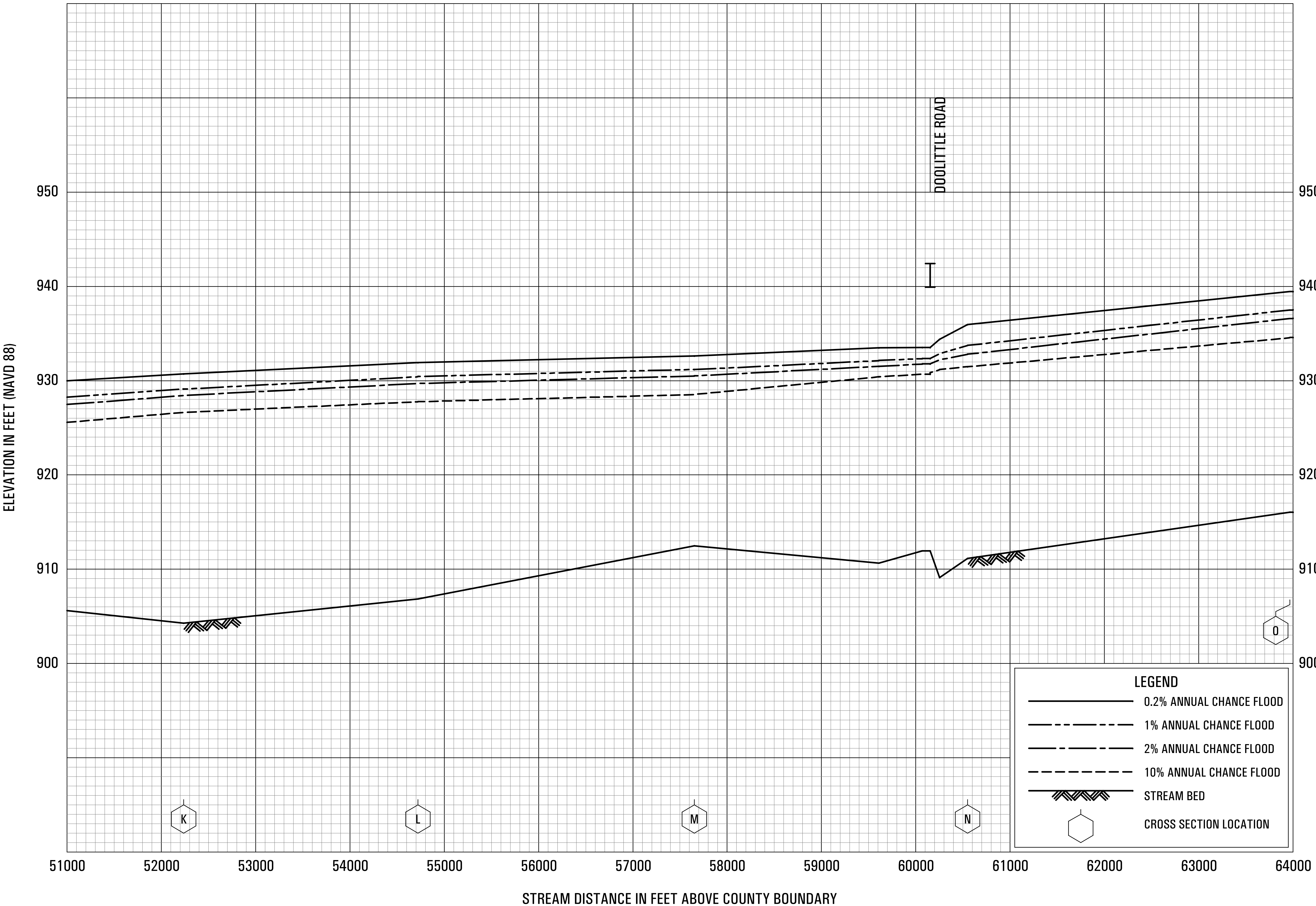
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



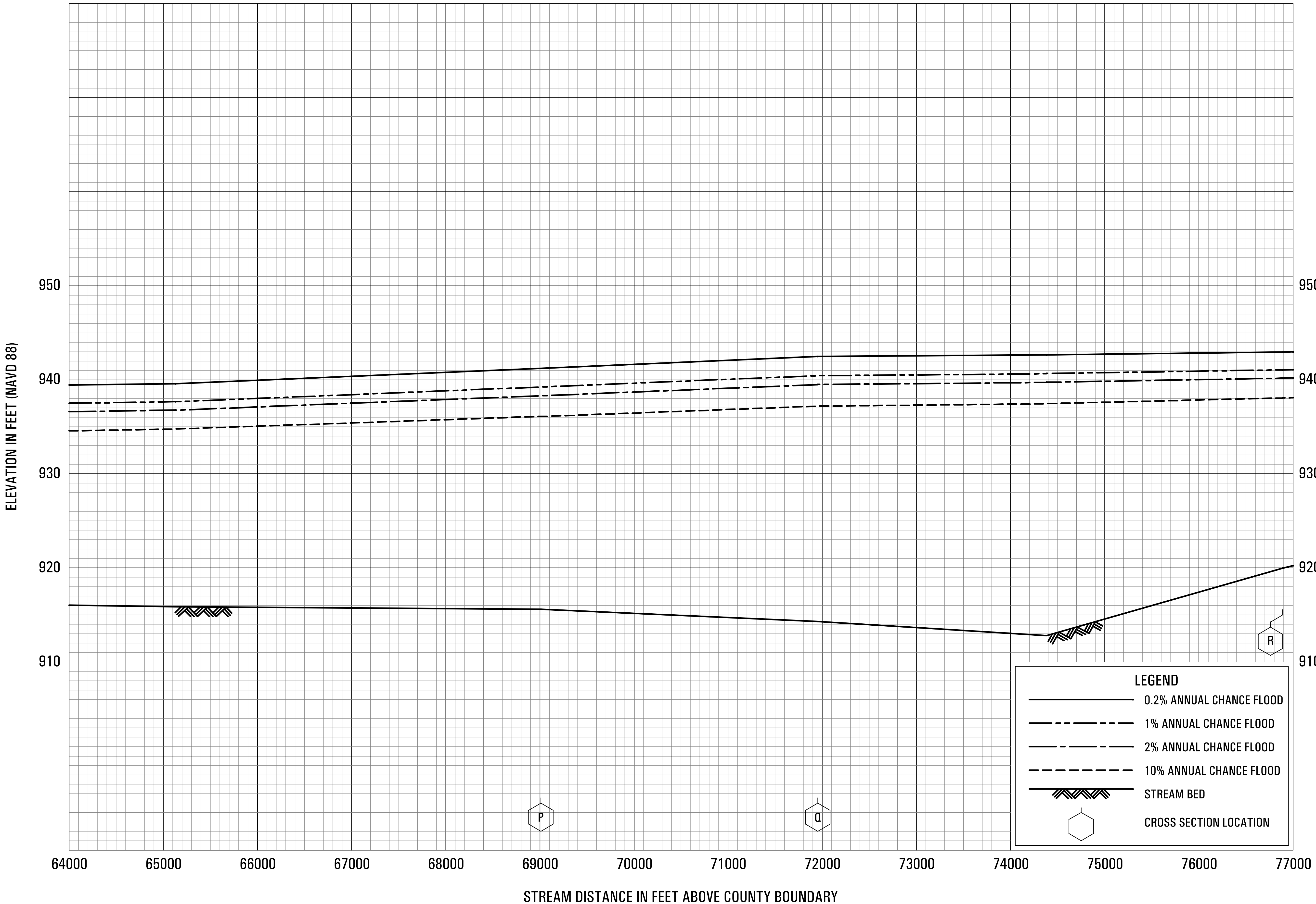
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



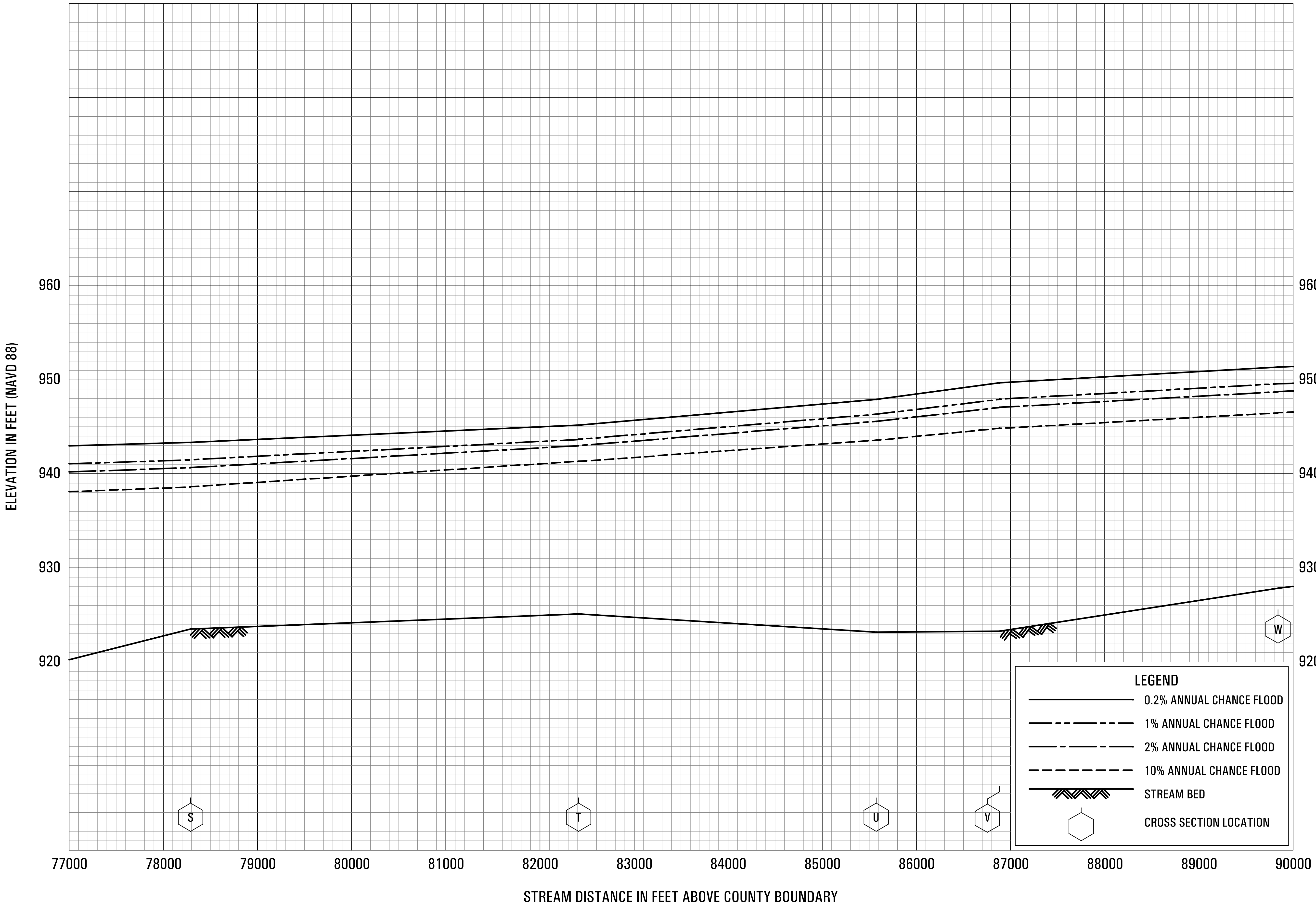
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

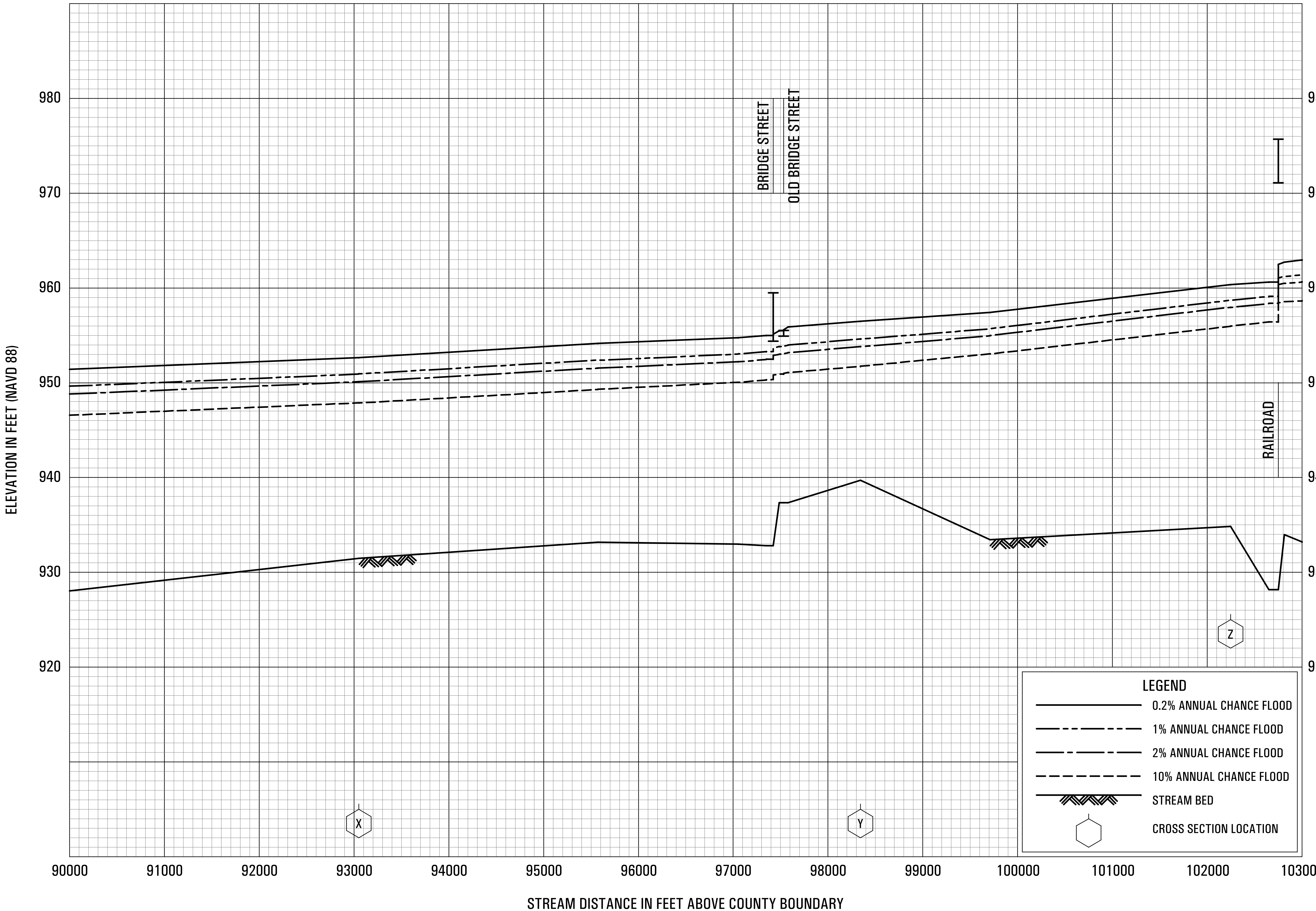
SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

81P



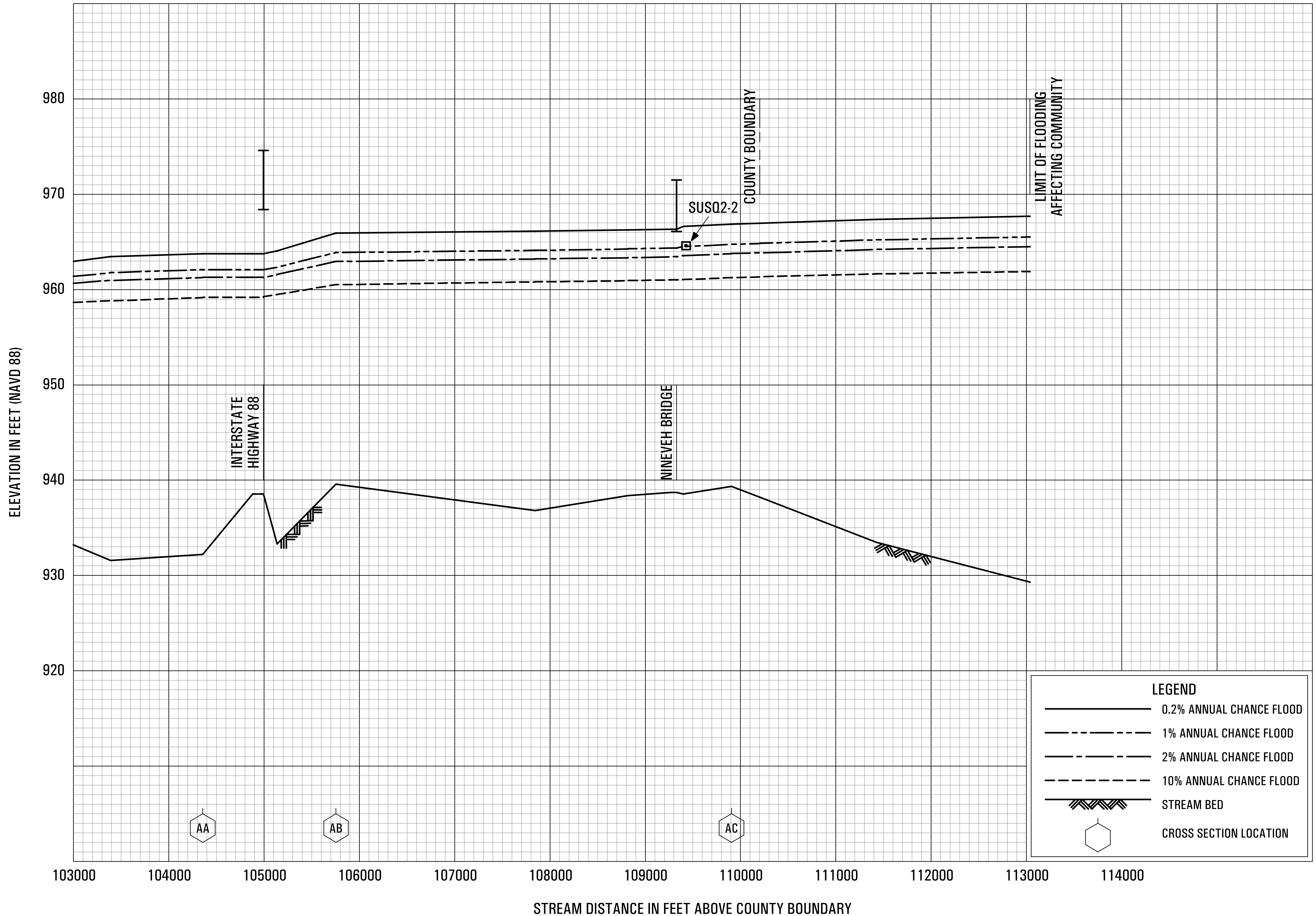
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



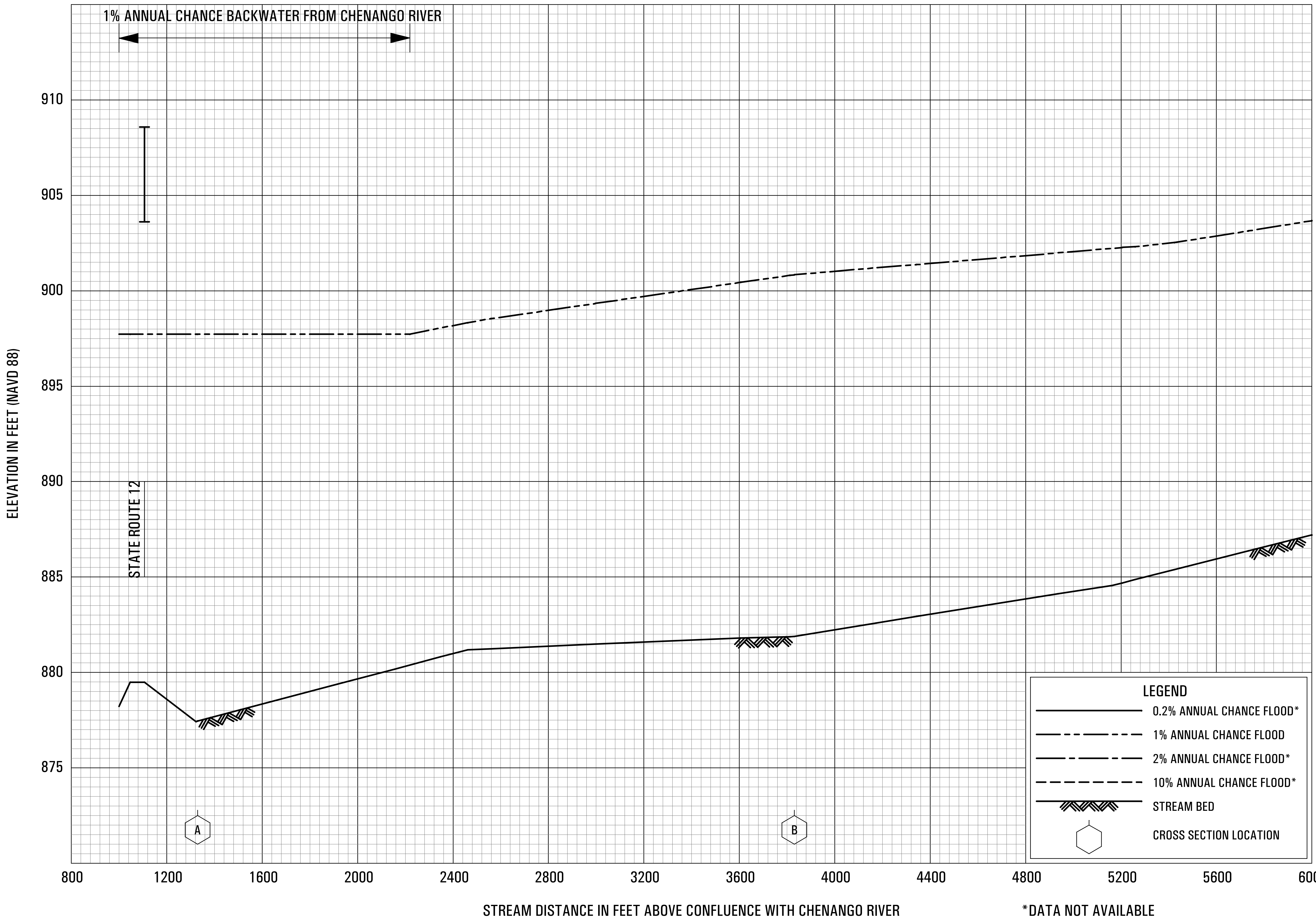
FLOOD PROFILES

SUSQUEHANNA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



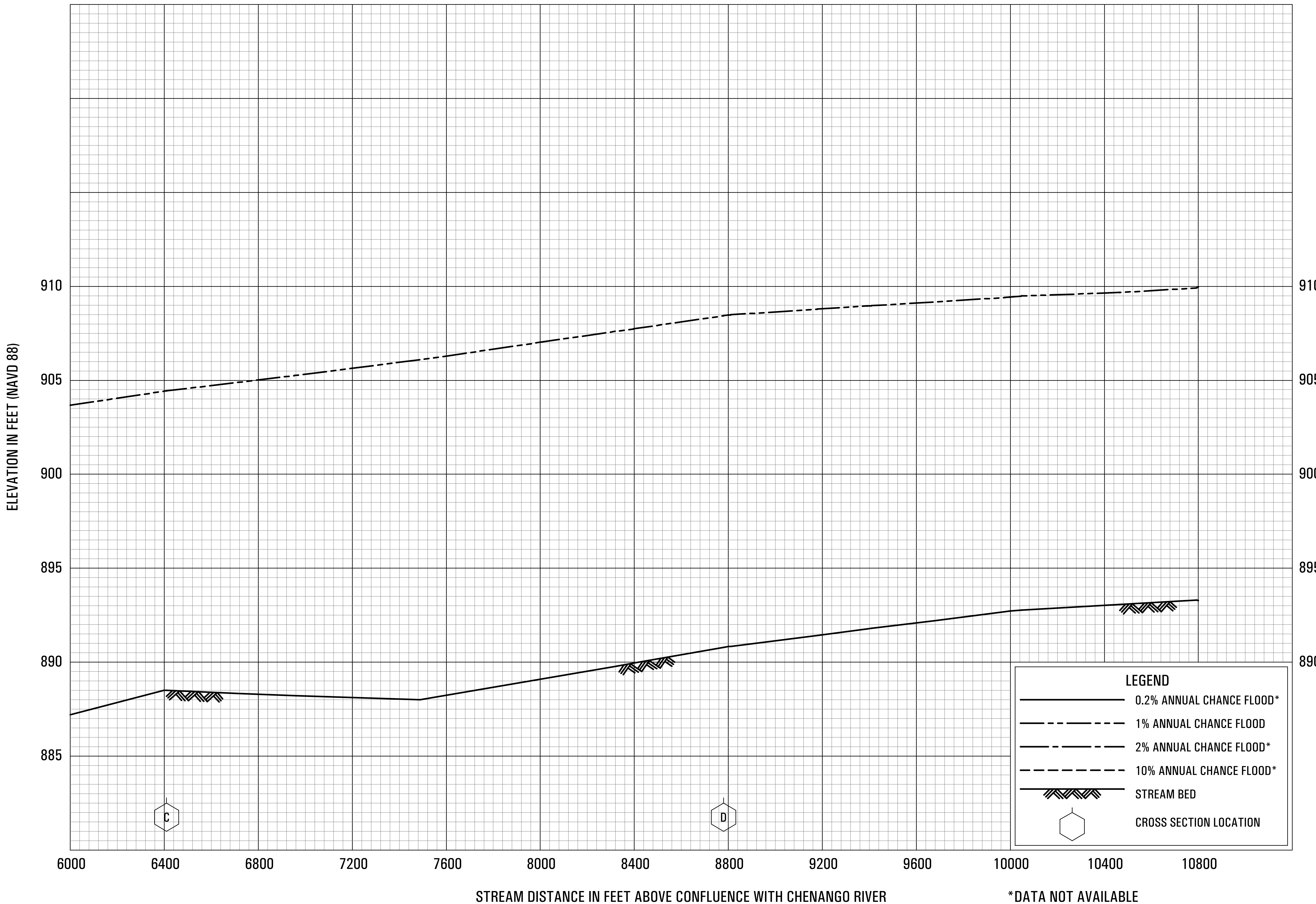
FLOOD PROFILES

TIOUGHNIOGA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



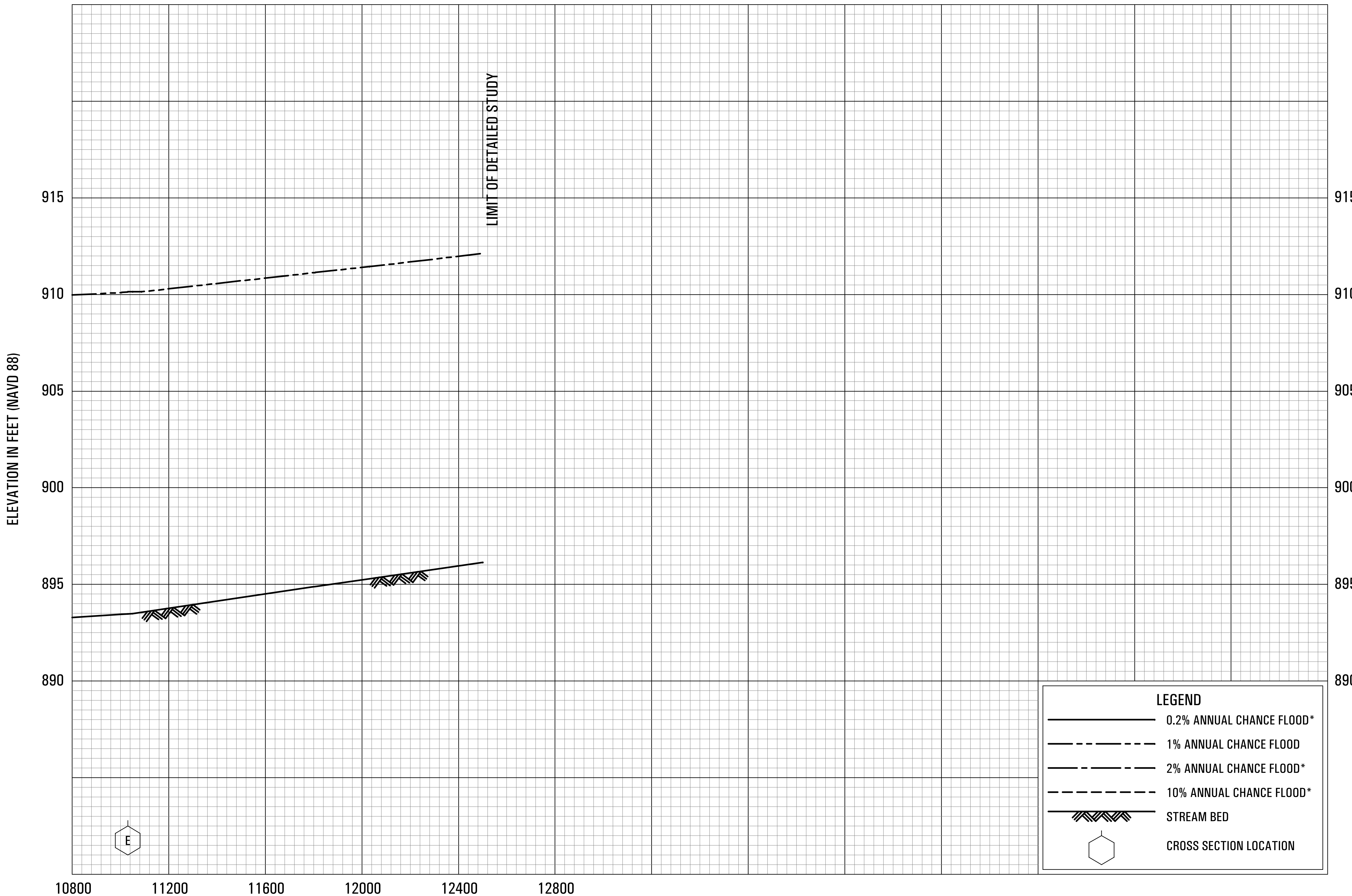
FLOOD PROFILES

TIOUGHNIOGA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



*DATA NOT AVAILABLE

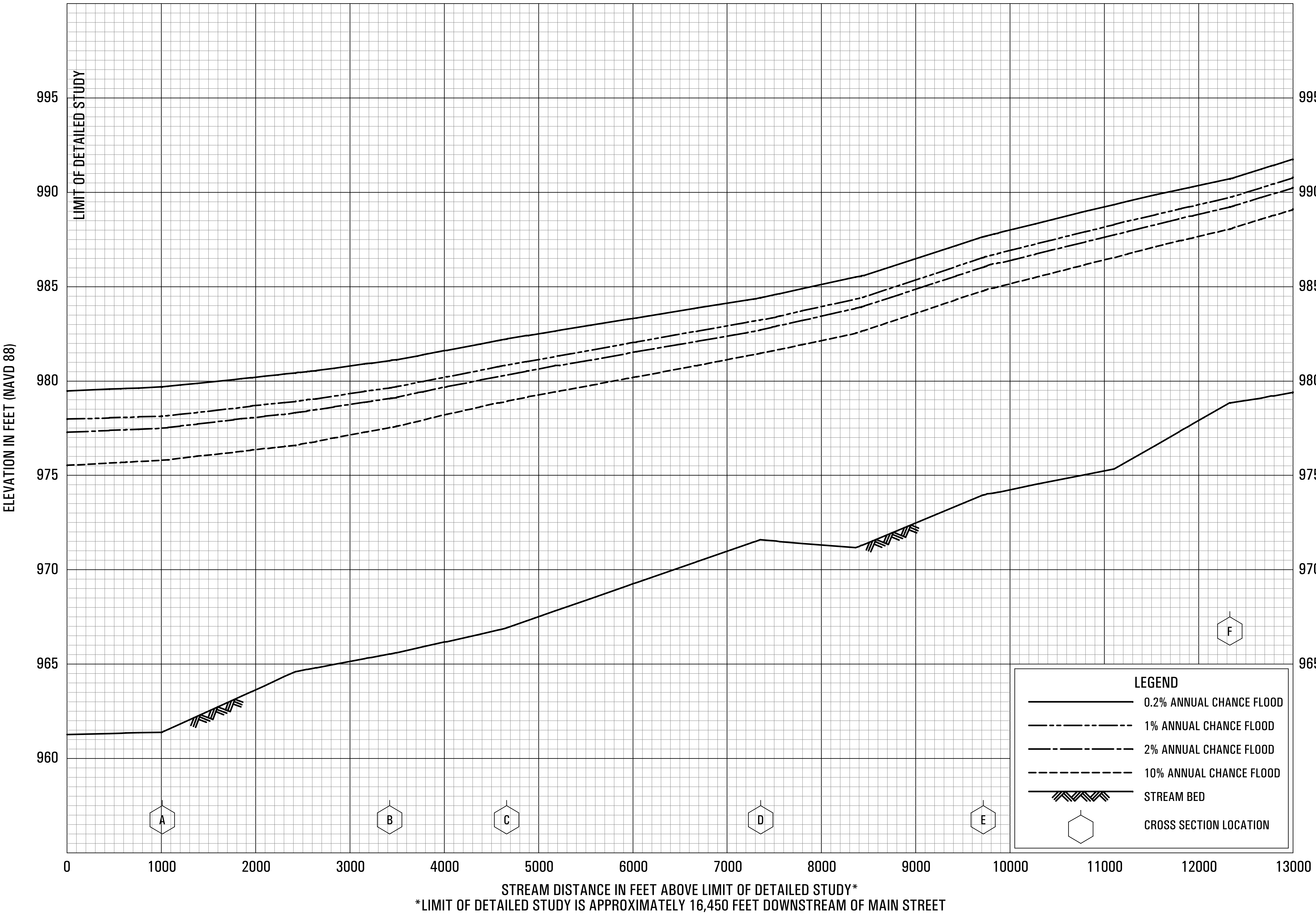
FLOOD PROFILES

TIOUGHNIOGA RIVER REACH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



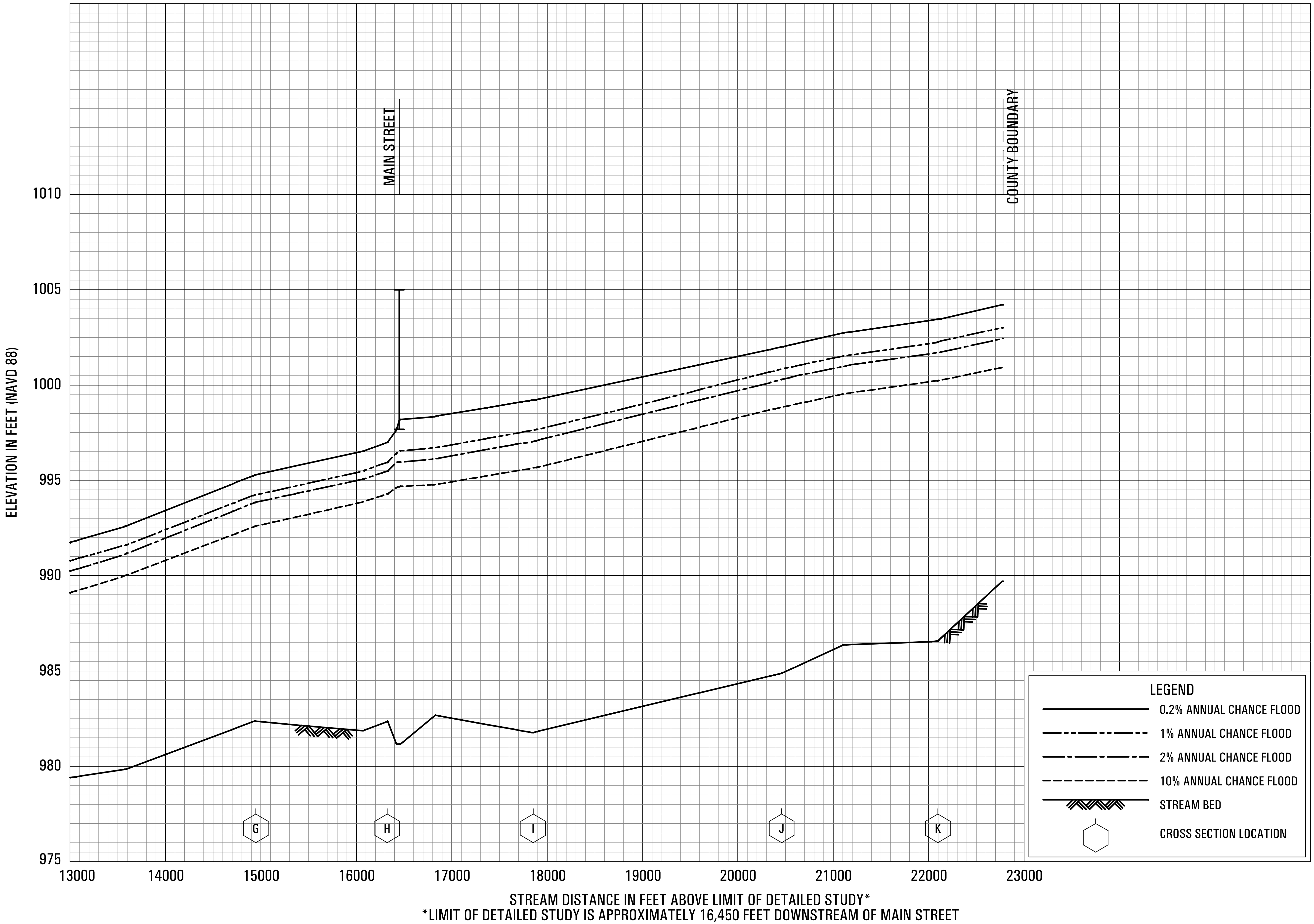
FLOOD PROFILES

TIOUGHNIOGA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



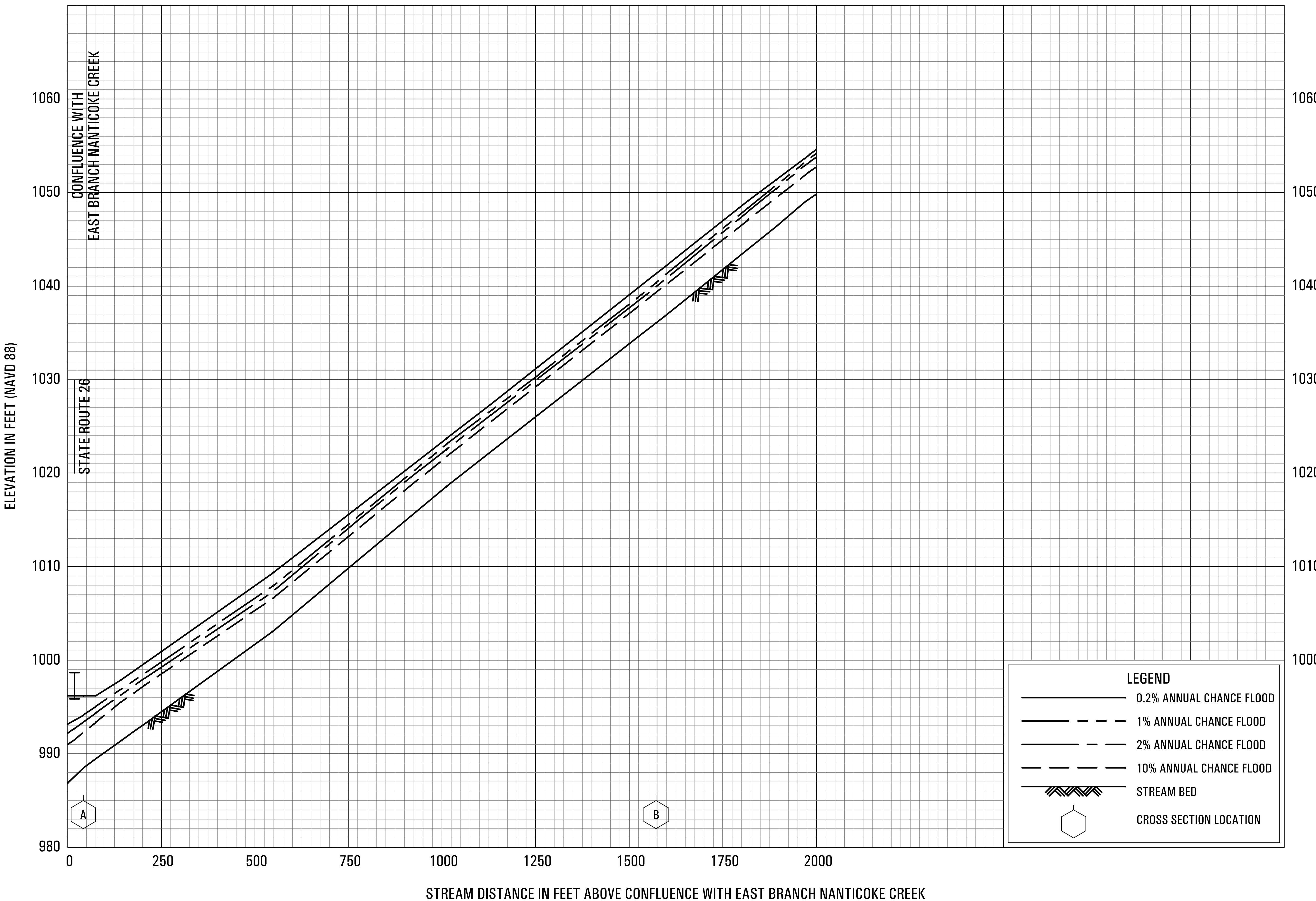
FLOOD PROFILES

TIOUGHNIOGA RIVER REACH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



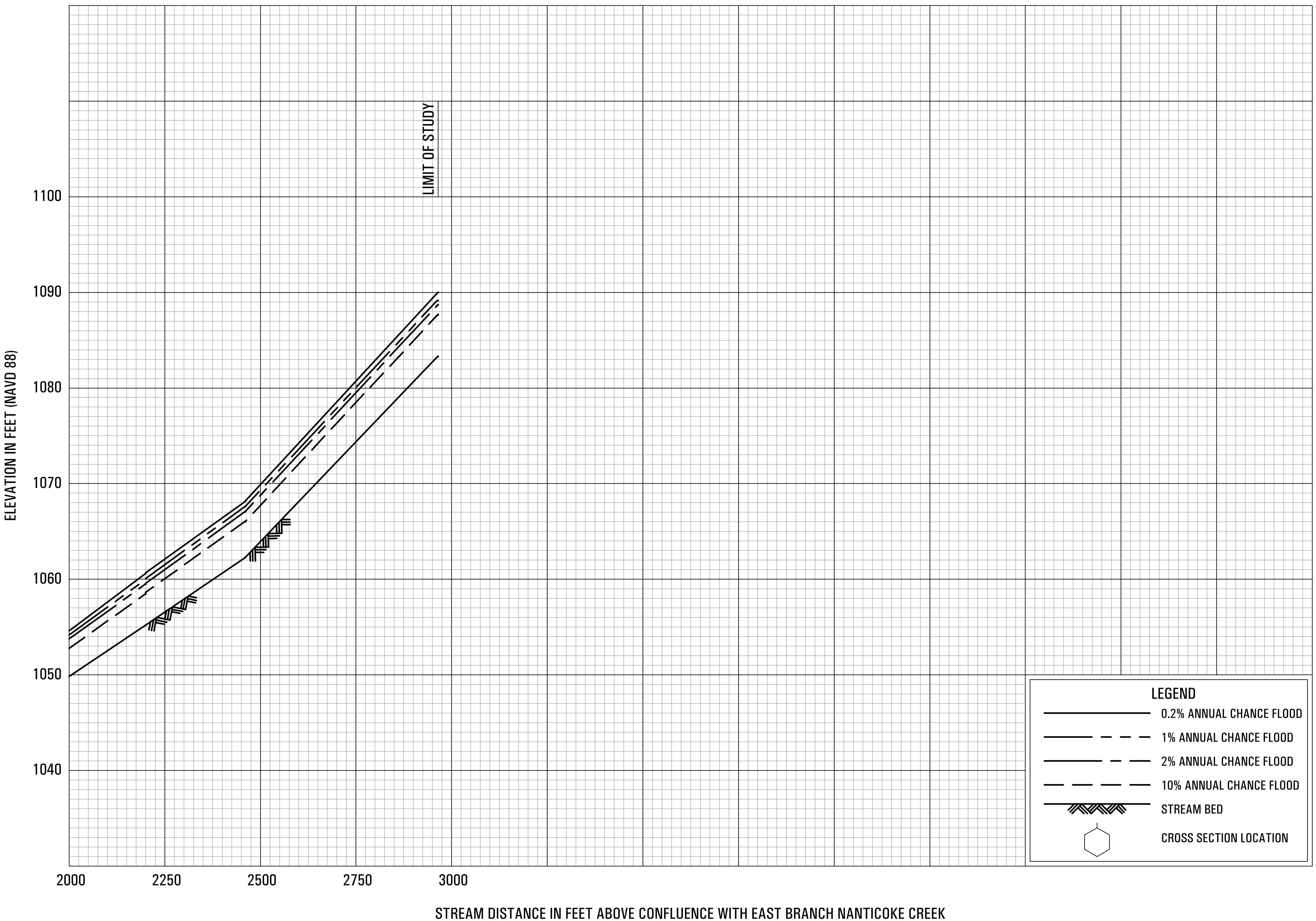
FLOOD PROFILES

TRIBUTARY A TO EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



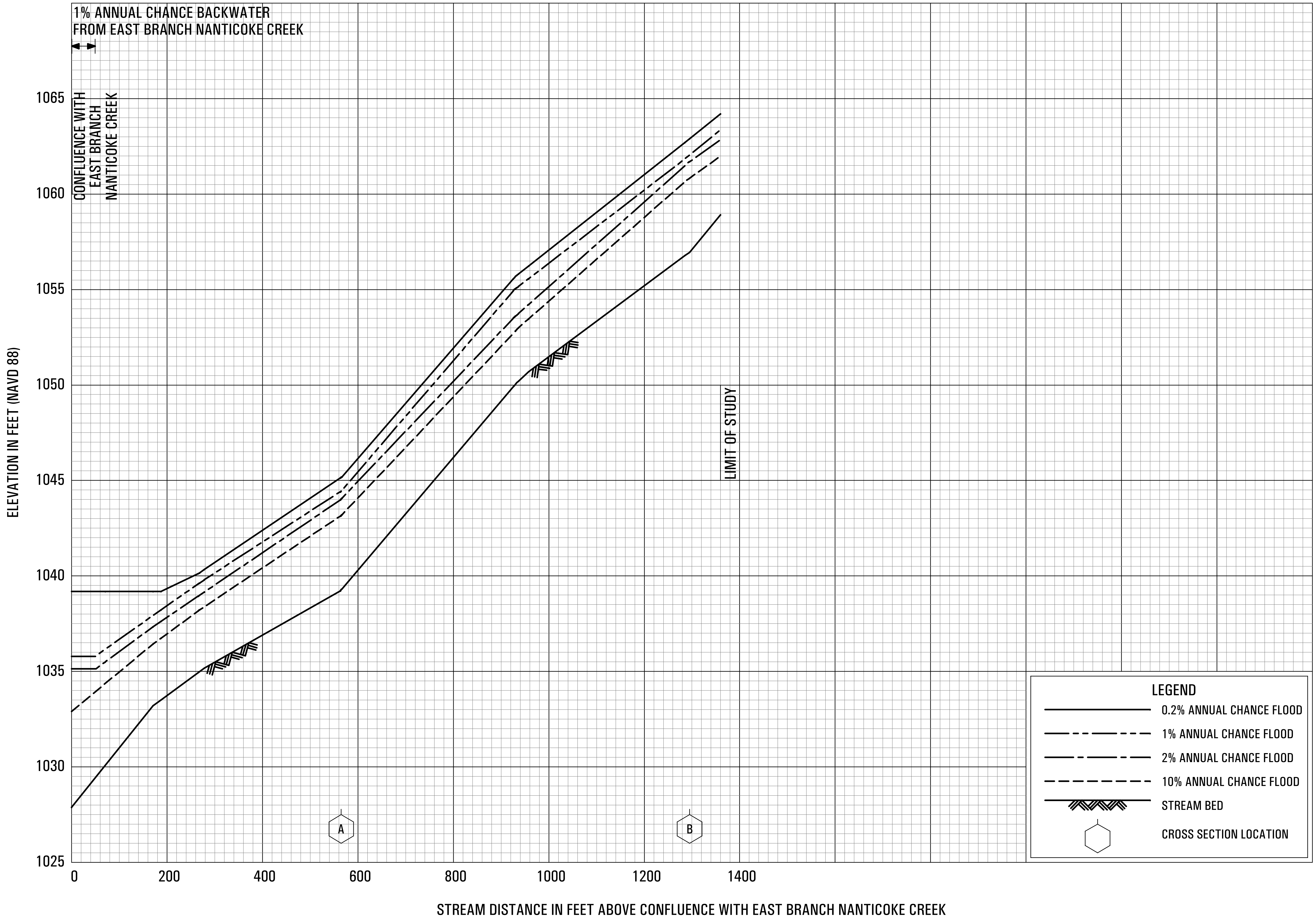
FLOOD PROFILES

TRIBUTARY A TO EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



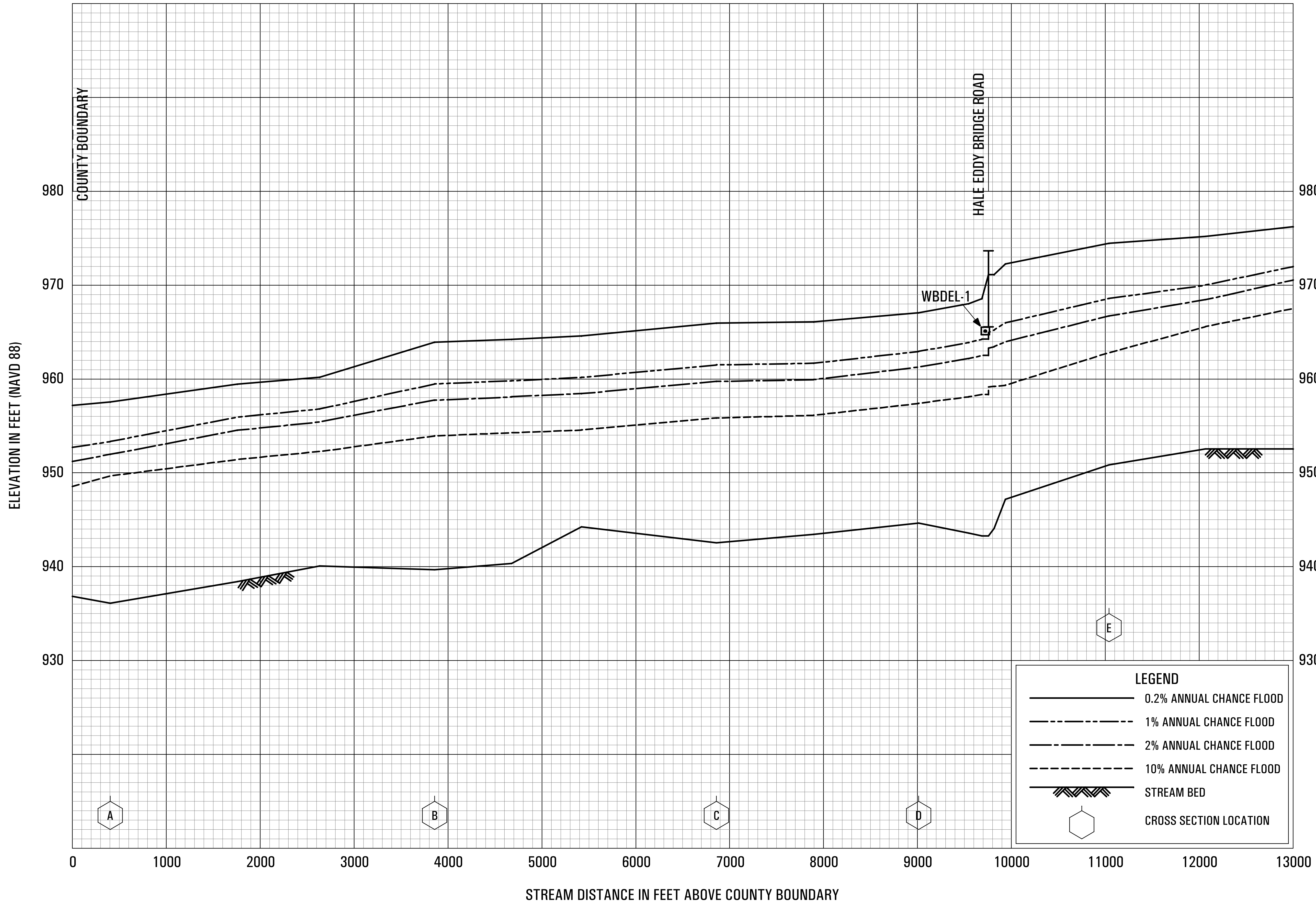
FLOOD PROFILES

TRIBUTARY B TO EAST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

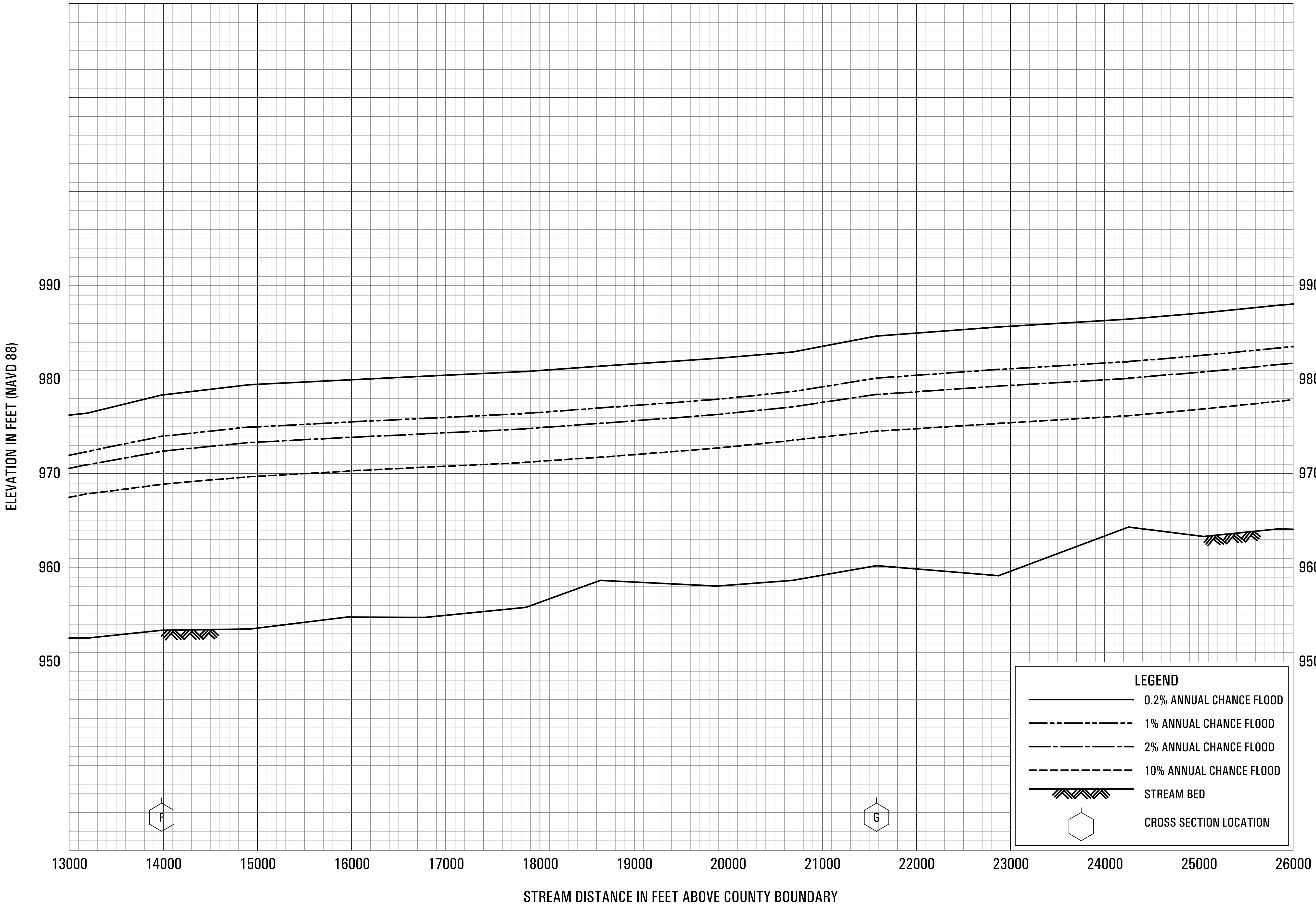
WEST BRANCH DELAWARE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

92P



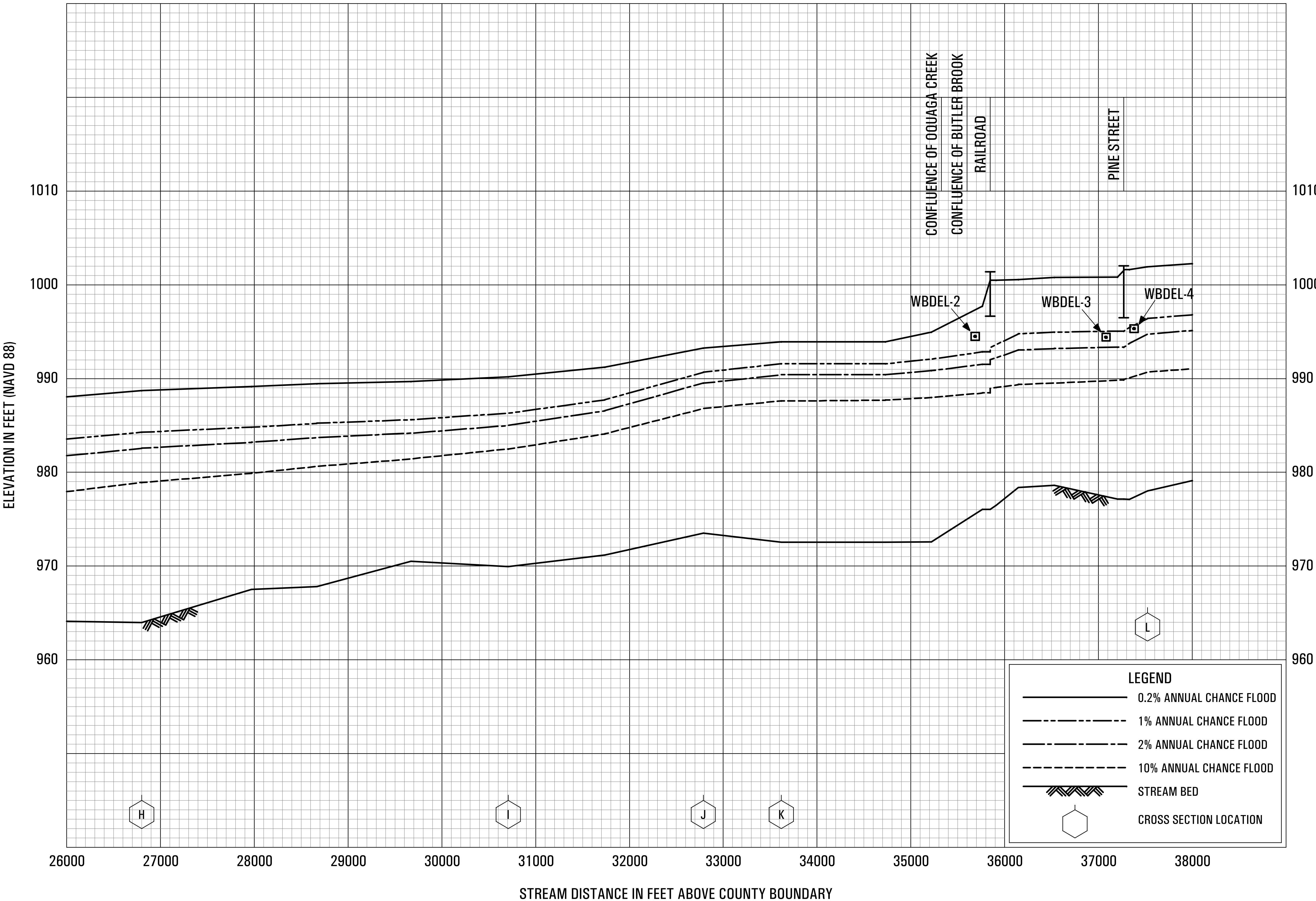
FLOOD PROFILES

WEST BRANCH DELAWARE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



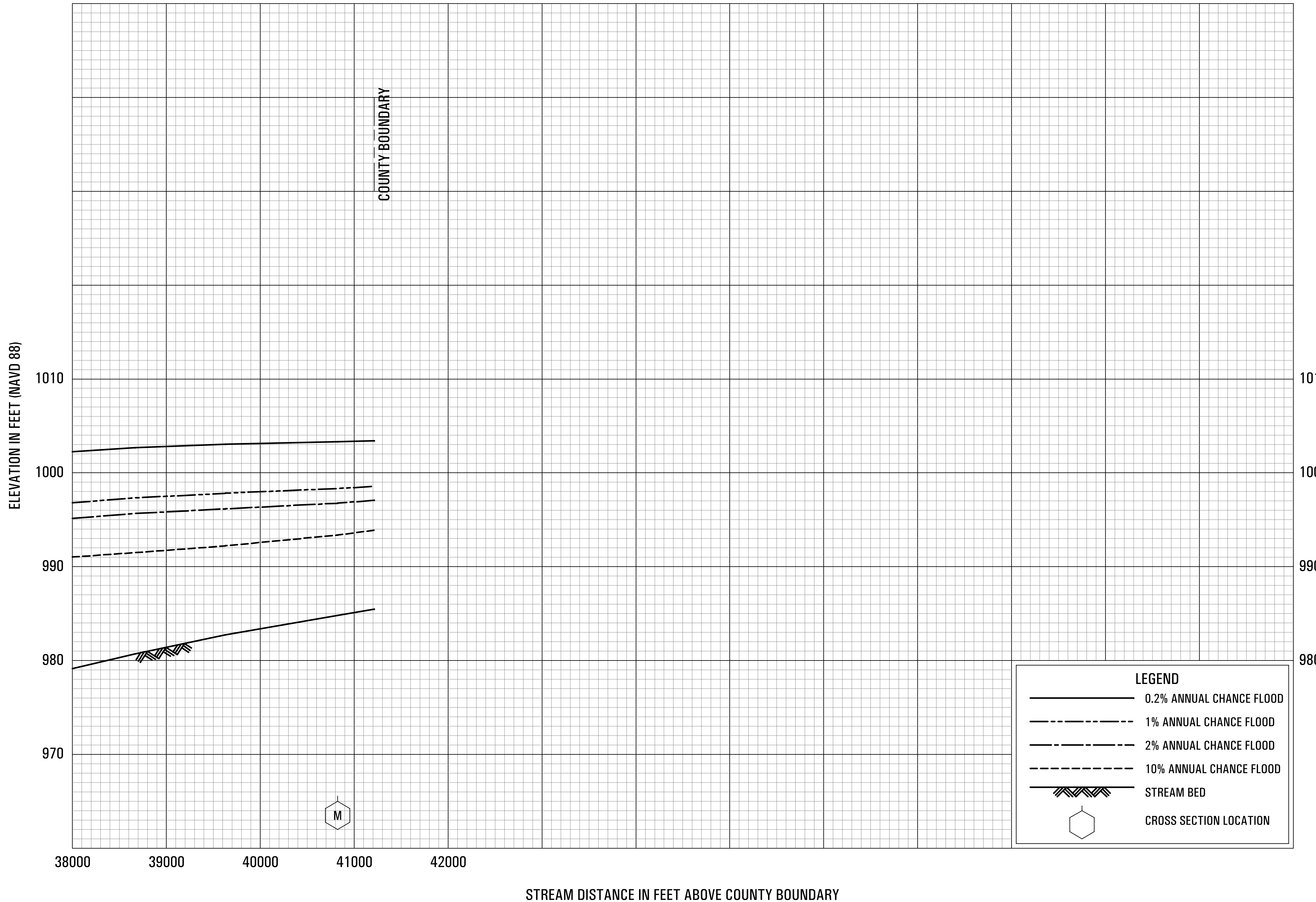
FLOOD PROFILES

WEST BRANCH DELAWARE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

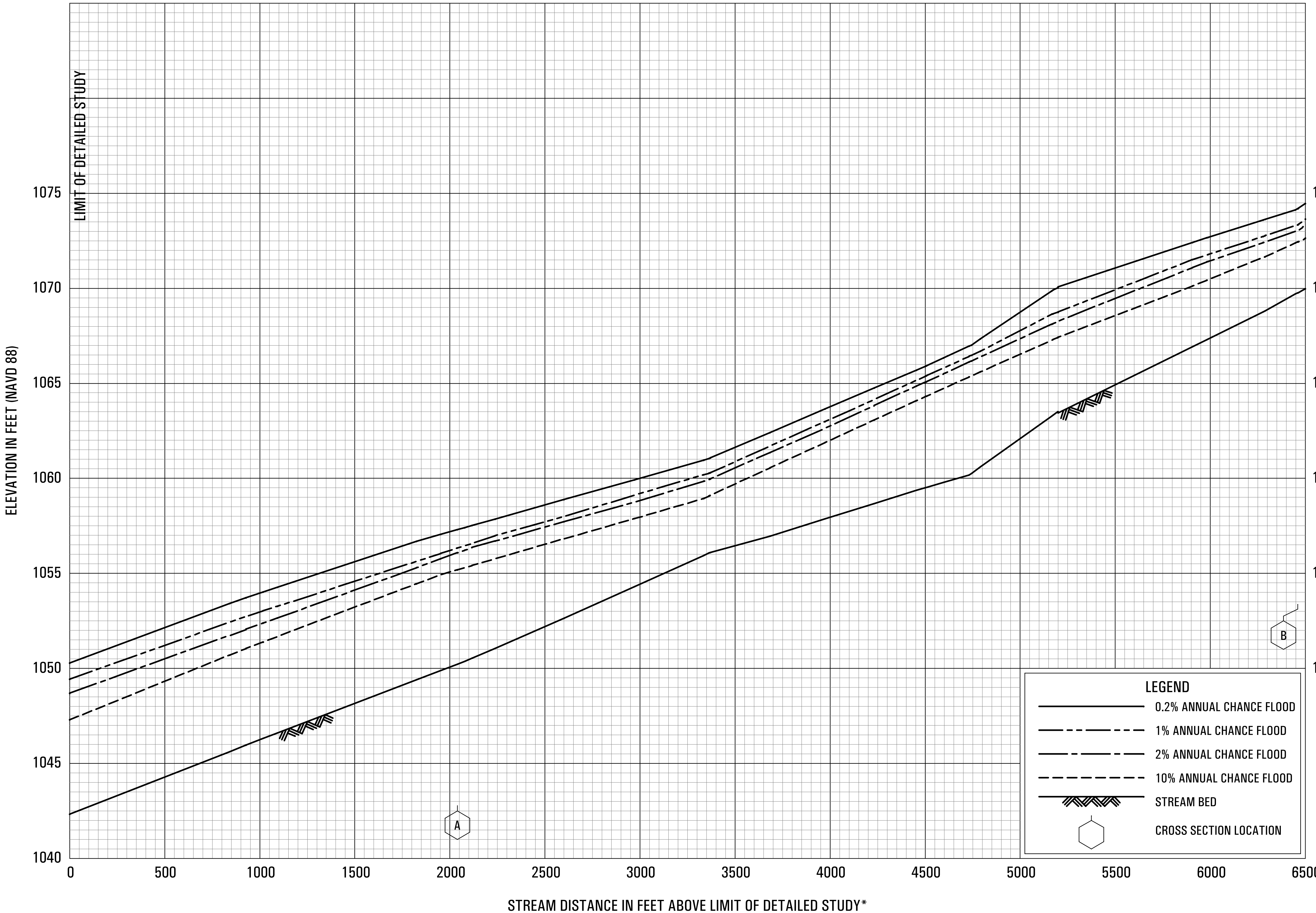
WEST BRANCH DELAWARE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)

95P



*LIMIT OF DETAILED STUDY IS APPROXIMATELY 7,587 FEET DOWNSTREAM OF CHERRY VALLEY HILL ROAD

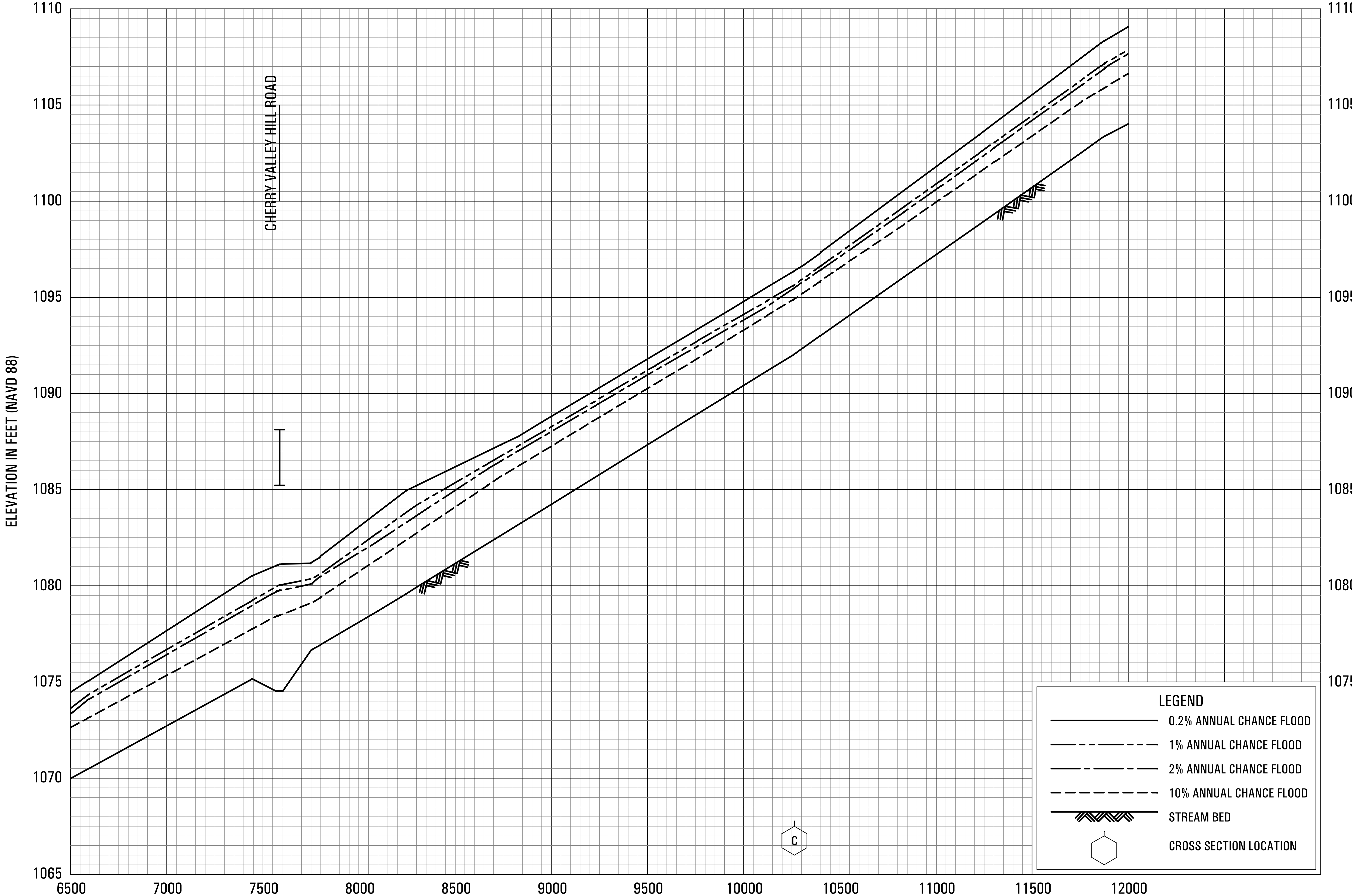
FLOOD PROFILES

WEST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY*
*LIMIT OF DETAILED STUDY IS APPROXIMATELY 7,587 FEET DOWNSTREAM OF CHERRY VALLEY HILL ROAD

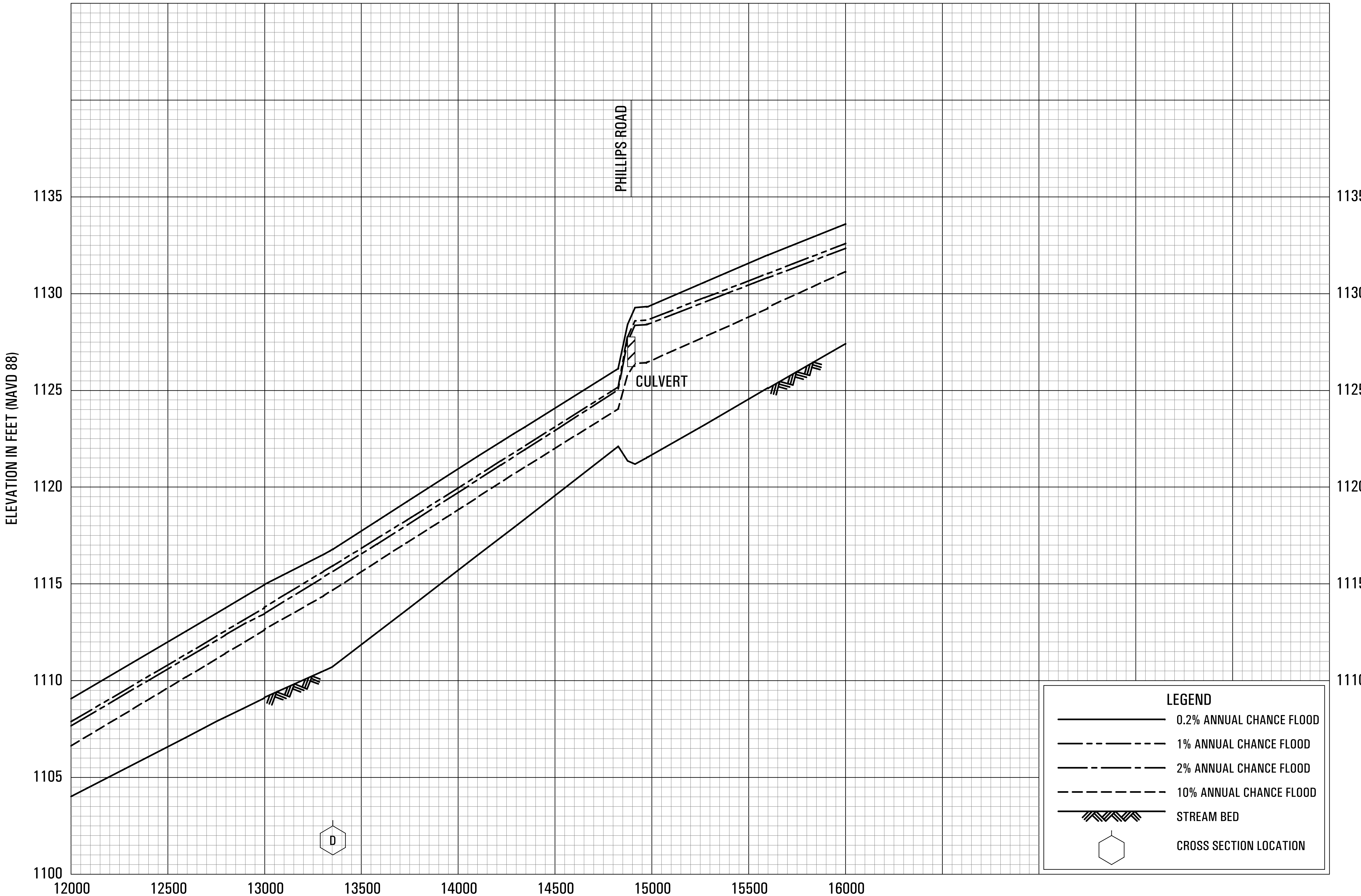
FLOOD PROFILES

WEST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY*
*LIMIT OF DETAILED STUDY IS APPROXIMATELY 7,587 FEET DOWNSTREAM OF CHERRY VALLEY HILL ROAD

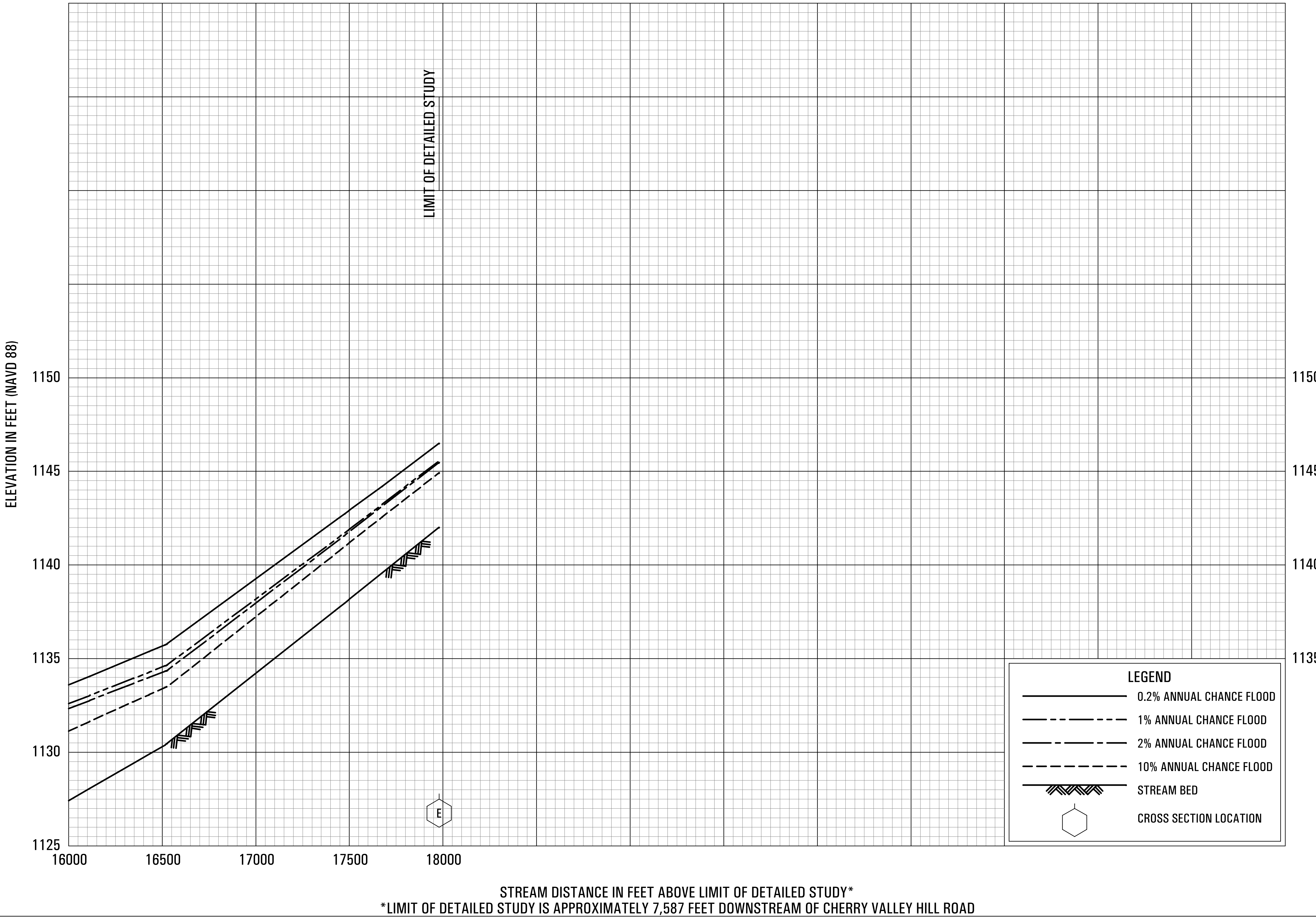
FLOOD PROFILES

WEST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY

(ALL JURISDICTIONS)



FLOOD PROFILES

WEST BRANCH NANTICOKE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BROOME COUNTY, NY
(ALL JURISDICTIONS)