FLOOD INSURANCE STUDY

VOLUME 1 OF 2

CHITTENDEN COUNTY, VERMONT
(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
BOLTON, TOWN OF	500308
BUELS GORE*	500112
BURLINGTON, CITY OF	500032
CHARLOTTE, TOWN OF	500309
COLCHESTER, TOWN OF	500033
ESSEX, TOWN OF	500034
ESSEX JUNCTION, VILLAGE OF	500035
HINESBURG, TOWN OF	500322
HUNTINGTON, TOWN OF	500036
JERICHO, TOWN OF	500037
MILTON, TOWN OF	500038
RICHMOND, TOWN OF	500040
SHELBURNE, TOWN OF	500193
SOUTH BURLINGTON, CITY OF	500195
ST. GEORGE, TOWN OF	500320
UNDERHILL, TOWN OF	500042
WESTFORD, TOWN OF	500203
WILLISTON, TOWN OF	500043
WINOOSKI, CITY OF	500044

*No Special Flood Hazard Areas Identified

REVISED
AUGUST 4, 2014

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
50007CV001B

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.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult community officials and check the Community Map Repository to obtain the most current FIS components. Selected Flood Insurance Rate Map panels for this community contain the most current information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways and cross sections). In addition, former flood hazard zone designations have been changed as follows.

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

Initial Countywide FIS Effective Date: July 18, 2011

Revised Countywide FIS Effective Date: August 4, 2014

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FLOOD INSURANCE STUDY
CHITTENDEN COUNTY, VERMONT (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Chittenden County, including the Cities of Burlington, South Burlington, and Winooski; the Village of Essex Junction; the Towns of Bolton, Charlotte, Colchester, Essex, Hinesburg, Huntington, Jericho, Milton, Richmond, Shelburne, St. George, Underhill, Westford, and Williston; and Buels Gore (referred to collectively herein as Chittenden County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

At the time this Countywide FIS was published, the Town of St. George and the Village of Essex Junction were listed as not participating in the NFIP, with identified flood hazard areas. No Special Flood Hazard Areas were identified for Buels Gore.

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

1.2 Authority and Acknowledgments

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

This FIS was prepared to incorporate all the communities within Chittenden County in a countywide format. Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below:

Bolton, Town of:	The hydrologic and hydraulic analysis done on October 1, 1980 was prepared by ECJ/KCE Consulting Engineers for the Federal Insurance Administration (FIA), under Contract No. H-4750. This study was completed in September 1979.

Burlington, City of:	The original analysis was completed January 16, 1979 by Anderson-Nichols & Company, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. H-3862. The hydrologic and hydraulic analyses in the January 16, 1987 study represent a revision of the original analyses. The hydrologic and hydraulic analyses were updated by Dufresne-Henry, Inc., for FEMA under Contract No. EMW-C-5097. This study was completed in September 1985. The hydrologic and hydraulic analysis was computed by Dufresne-Henry, Inc.
Charlotte, Town of:	The hydrologic and hydraulic analyses in the March 1980 study were prepared by the U.S. Department of Agriculture, Soil Conservation Service (NRCS/SCS) for the FIA, under Inter-Agency Agreement No. IAA-H-17-78, Project Order No.6. This work, which was completed in January 1979, covered all significant flooding sources in the Town of Charlotte.
Colchester, Town of:	The hydrologic and hydraulic analyses for the September 1, 1981 study were prepared by DuBois and King, Inc., for FEMA, under Contract No. H-4749. This work was completed in March 1980.
Essex. Town of:	The hydrologic and hydraulic analyses for the July 16, 1980 study were prepared by Edward C. Jordan/Knight Consulting Engineers for the FIA, under Contract No. H-4750. This work was completed in July 1979.
Essex Junction, Village of:	The hydrologic and hydraulic analysis for the July 2, 1980 study was prepared by Edward C. Jordan/Knight Consulting Engineers for the FIA, under Contract No. H-4750. This work was completed in July 1979.

Hinesburg, Town of:	For the original September 29, 1985 FIS, no flood hazards were studied by detailed methods. The hydrologic and hydraulic analyses were updated for the LaPlatte River, Patrick Brook, The Canal, and Unnamed Diversion Channel and were prepared by the U.S. Geological Survey (USGS) for FEMA, under Inter-Agency Agreement No. EMW-2002-IA-0115. This work was completed in June 2003. Digital base map information shown on this FIRM was derived from Vermont digital orthophotography provided by the Vermont Department of Taxes Mapping Program. These data were produced at a scale of 1:5,000 from photography dated 1999. The base map information used by the USGS for their analyses was derived from USGS Digital Raster Graphs at a scale of 1:24,000 (Reference 1).
Huntington, Town of:	The hydrologic and hydraulic analysis for the January 1978 study was performed by DuBois and King, Inc. for the FIA, under Contract No. H-4007. This work, which was completed in May 1977, covered all significant flooding sources affecting the Town of Huntington.
Jericho, Town of:	The hydrologic and hydraulic analysis for the December 1, 1980 study was prepared by ECJ/KCE Consulting Engineers for FIA, under Contract No. H-4750. This work was completed in August 1979.
Milton, Town of:	The hydrologic and hydraulic analysis for the July 6, 1981 study was performed by DuBois & King, Inc., for FEMA under Contract No. H-4749. This work was completed in March 1980.
Richmond, Town of:	The hydrologic and hydraulic analysis for the February 2, 1982 study was prepared by ECJ/KCE Consulting Engineers, for FEMA, under Contract No. H-4750. This work was completed in August 1979.
Shelburne, Town of:	The hydrologic and hydraulic analysis for the June 1980 study was performed by the U.S. Department of Agriculture, SCS, for the FIA, under Inter-Agency Agreement No. IAA-H-17-78, Project Order No. 6. This study was completed in January 1979.

South Burlington, City of:	The hydrologic and hydraulic analysis for the September 16, 1980 study was prepared by Edward C. Jordan/Knight Consulting Engineers for the FIA, under Contract No. H-4750. This work was completed in July 1979.
Underhill, Town of:	The hydrologic and hydraulic analysis for the June 15, 1988 study was prepared by the SCS during the preparation of a Floodplain Management Study for the Town of Underhill. The work for the Floodplain Management Study was completed in June 1986.
Williston, Town of:	The hydrologic and hydraulic analysis for the September 2, 1980 study was prepared by Edward C. Jordan/Knight Consulting Engineers for the FIA, under Contract No. H-4750. This work was completed in July 1979.
Winooski, City of:	The hydrologic and hydraulic analysis for the February 4, 1987 study represents a revision of the original analyses by Anderson-Nichols & Company, Inc., for the FEMA, under Contract No. H-3862. The hydrologic and hydraulic analysis was update by Dufresne-Henry, Inc., for FEMA, under Contract No. EMW-C-5097. This work was completed in September 1985.

Base map information shown on this Flood Insurance Rate Map (FIRM) was derived from Vermont Center for Geographic Information (http://www.vcgi.org/dataware/). Base map files were provided in digital form by Vermont Center for Geographic Information. Ortho imagery was produced by Vermont Mapping Program using half-meter resolution. Aerial photography is dated 1999. The projection used in the preparation of this map was Vermont State Plane Meters. The horizontal datum was NAD83, GRS1980 spheroid.

1.3 Coordination

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

The dates of the initial, intermediate and final CCO meetings held for the incorporated communities within Chittenden County are shown in Table 1, "CCO Meeting Dates for Previous FIS."

TABLE 1 – CCO MEETING DATES FOR PREVIOUS FIS

Community Name	Initial CCO Date	Intermediate CCO Date	Final CCO Date
Bolton, Town of	March 1978	*	May 6, 1980
Burlington, City of	April 1984	*	February 21, 1986
Charlotte, Town of	December 27, 1977	October 26, 1978	September 24, 1979
Colchester, Town of	April 6, 1978	*	March 24, 1981
Essex, Town of	March 1978	*	January 23, 1980
Essex Junction, Village of	March 1978	*	January 24, 1980
Hinesburg, Town of	May 9, 2002	*	September 14, 2004
Huntington, Town of	April 13, 1976	*	August 1, 1977
Jericho, Town of	March 1978	*	May 19, 1980
Milton, Town of	April 6, 1978	*	December 15, 1980
Richmond, Town	March 1978	*	April 6, 1981
Shelburne, Town of	December 27, 1977	October 25, 1978	July 30, 1979
South Burlington, City of	March 1978	*	February 25, 1980
Underhill, Town of	November 19, 1986	*	June 10, 1987
Williston, Town of	March 30, 1978	*	March 18, 1980
Winooski, City of	April 1984	*	February 21, 1986

*Data not available

For the countywide FIS, the initial CCO meeting was held on October 26, 2006, and was attended by representatives of FEMA, Vermont Agency of Natural Resources (VANR), the Chittenden County Regional Planning Commission (CCRPC), CDM, and Chittenden County communities. The results of the study were reviewed at the final CCO meeting held on July 28, 2009 and was attended by representatives of FEMA, VANR, CCRPC, CDM and Chittenden County communities. All problems raised at that meeting have been addressed.

The countywide study published in July 2011 did not include the Town of Richmond. This revised study was completed on August 4, 2014 by CDM Smith to incorporate the results of the 2013 Winooski River study by KAS Inc. within the Town of Richmond. The community will now become part of the countywide study for Chittenden County.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Chittenden County, Vermont, including all jurisdictions listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and to projected development or proposed construction. All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods in the previous countywide FISs. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM.

TABLE 2 –FLOODING SOURCES STUDIED BY DETAILED METHODS

FLOODING SOURCE	LIMITS OF STUDY
Alder Brook	From its confluence with the Winooski River to approximately 1,600 feet upstream of State Route 128 in the Village of Essex Junction.
Browns River	From approximately 9,900 feet above its confluence with Lamoille River to approximately 1,000 feet upstream of Maple Leaf Road.
Crossett Brook	From its confluence with the Winooski River to approximately 1,200 feet upstream of the southwestern crossing of State Route 100 over Crossett Brook.
Huntington River	From its confluence with the Winooski River to approximately 100 feet upstream from its confluence with the Cobb Brook.
Lake Champlain	For the entire shoreline.
Lamoille River	From its confluence with Lake Champlain to approximately 2.5 miles upstream of Clark Falls Dam.
LaPlatte River	From approximately 8,925 above Dorset Street to approximately 100 feet upstream of Silver Street in the Town of Hinesburg.
Lee River	From its confluence with Browns River to approximately 75 feet upstream from Browns Trace Road in the Town of Jericho.
McCabes Brook	From its confluence with LaPlatte River to approximately 1.59 miles upstream from Harbor Road in the Town of Charlotte.
Munroe Brook	From its confluence with Webster Brook to approximately 0.59 mile upstream from Longmeadow Drive in the Town of Shelburne.
Patrick Brook	From its confluence with LaPlatte River to approximately 100 feet upstream from the divergence of The Canal in the Town of Hinesburg.
Shelburne Bay	The shoreline within the Town limits of Shelburne.
The Canal	From its confluence with LaPlatte River to its confluence with The Canal.

TABLE 3 – FLOODING SOURCES STUDIED BY DETAILED METHODS
(continued)

FLOODING SOURCE	LIMITS OF STUDY
The Creek	From its confluence with the Browns River upstream to approximately 1.06 miles upstream of Palmer Lane.
Unnamed Diversion Channel	From its confluence with Patrick Brook to its confluence with The Canal.
Winooski River	From approximately 600 feet upstream of Main Street/Colchester Avenue to approximately 550 feet downstream of Park Street/State Route 2A.

As part of this countywide FIS, updated detailed analyses were included for the following sources shown in Table 3, "Scope of Revision."

TABLE 3 – SCOPE OF REVISION

FLOODING SOURCE	LIMITS OF STUDY
Browns River	From the confluence with the Lamoille River in Franklin County to approximately 1,100 feet upstream of Maple Leaf Road in the Town of Underhill.
Winooski River (Downstream)	From the mouth at Lake Champlain to approximately 1,200 feet downstream of Main Street / Colchester Avenue
Winooski River (Upstream)	From the Green Mountain Power Dam, approximately 450 feet upstream of Essex Road / Park Street, to approximately 1,550 feet upstream of the railroad crossing near the Chittenden / Washington County Boundary in the Town of Bolton.

For this revision, an 18-mile portion of the Winooski River, extending from Lake Champlain to the Green Mountain Power Dam, was redelineated using existing topographic data.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and the individual communities within Chittenden County. For this countywide revision, no new approximate studies were executed. Entire reaches or portions of the flooding sources listed in Table 4, "Flooding Sources Studies by Approximate Methods," were studied by approximate methods in the previous FISs.

TABLE 4 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS

FLOODING SOURCE	COMMUNITY
Alder Brook	Essex
Abbey Brook	Essex
Allen Brook	Colchester, Milton, Williston
Area bordering Shelburne Pond	Shelburne
Around Lake Iroquois	Williston
Bakers Brook	Huntington
Beaver Brook	Underhill
Browns River	Underhill
Brush Brook	Huntington
Carpenter Brook	Huntington
Cobb Brook	Huntington
Colchester Pond	Colchester
Crane Brook	Underhill
Fargo Brook	Huntington
Hollow Brook	Hinesburg, Huntington
Huntington River	Huntington
Indian Brook	Colchester, Essex Junction
Johnnie Brook	Richmond
Johns Brook	Huntington
Jones Brook	Huntington
Large swampy area located west of Arrowhead Mountain	Milton
Lee River	Jericho
Lewis Creek	Hinesburg, Charlotte
Long Pond	Milton
Mallets Creek	Colchester, Essex, Milton
Muddy Brook	South Burlington, Williston
Munson Flats	Colchester
Pond Brook	Colchester, Essex
Potash Brook	South Burlington
Settlement Brook	Underhill
Seymour River, remaining portions	Underhill
Snipe Island Brook	Richmond
Sucker Brook	Williston
Sunder land Brook	Colchester, Essex Junction
Texas Brook	Huntington
The Creek, remaining portions	Underhill
Unnamed Brooks	Huntington
Unnamed Reservoir	Winooski
Unnamed Streams	Milton
Unnamed Tributaries	Colchester, Underhill
Unnamed Tributaries of Browns River	Jericho
Unnamed Tributary of the Mill Brook	Jericho
Upstream Portions of Cobb Brook and the Huntington River	Huntington

Detailed-studied streams that were not re-studied as part of this revision may include a profile baseline on the FIRM. The profile baselines for these streams were based on the best available data at the time their study and are depicted as they were on the previous FIRMs. In some cases the transferred profile baseline may deviate significantly from the channel or may be outside of the floodplain.

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letter of Map Revision [LOMR], Letter of Map Revision – based on fill [LOMR-F], and letter of Map Amendment [LOMA]). No Letters of Map Change (LOMC) have been identified in Chittenden County.

2.2 Community Description

Chittenden County is located in Northern Vermont. In Chittenden County, there are fourteen (14) towns, and three (3) cities, one (1) village, and one (1) gore. The Towns of Milton, Colchester, Shelburne and Charlotte, and the Cities of Burlington and South Burlington are located along the Lake Champlain shoreline on the western county boundary. The City of Winooski and the Towns of Essex, Jericho, Richmond, Williston, and St. George, and the Village of Essex Junction lie in the central part of the county. The Towns of Westford and Underhill fall in the northeastern part of the county, and the Towns of Bolton, Hinesburg, and Huntington, as well as Buels Gore, lie in the southeastern part of the county.

Chittenden County itself is bordered on the north by Grand Isle County and on the east by Lamoille County, Vermont. Chittenden County is also bordered on the south and southeast by Washington County and Addison County in Vermont, and to the west by Essex County in New York.

According to census records, the population of Chittenden County was 151,072 in 2000, 131,761 in 1990 and 115,534 in 1980 (Reference 2). The total area in Chittenden County consists of 620 mi^2, including 81 mi^2 of water area. All communities in Chittenden County, along with their population and total area, are listed in Table 5, "Population and Total Area by Community."

TABLE 5 – POPULATION AND TOTAL AREA BY COMMUNITY

Community	Total Area (sq. mi) [1]	Population[1]
Bolton, Town of	42.8	971
Buels Gore	5.1	12
Burlington, City of	15.5	38,889
Charlotte, Town of	50.4	3,569
Colchester, Town of	58.6	16,986
Essex, Town of	39.3	18,626
Essex Junction, Village of	4.9	8,591
Hinesburg, Town of	40.1	4,340
Huntington, Town of	36.4	1,861

TABLE 5 – POPULATION AND TOTAL AREA BY COMMUNITY
(continued)

Community	Total Area (sq. mi) [1]	Population[1]
Jericho, Town of	35.5	5,015
Milton, Town of	60.9	9,479
Richmond, Town of	32.3	4,090
Shelburne, Town of	44.9	6,944
South Burlington, City of	9.6	15,814
St. George, Town of	3.6	698
Underhill, Town of	51.4	2,980
Westford, Town of	39.3	2,086
Williston, Town of	30.7	7,650
Winooski, City of	1.51	6,561

[1]Data obtained from U.S Census Bureau (Reference 2)

2.3 Principle Flood Problems

Past flooding on the rivers, lakes and streams within Chittenden County indicates that flooding can occur during any season of the year. Most major floods have occurred during every season and are usually the result of rainfall, snowmelts and ice jams. Floods occur also as a result of heavy rain on saturated ground. Spring floods are common and are caused by rainfall in combination with snowmelt. Floods in late summer and fall are usually the results of above normal precipitation. Winter floods result from the occasional thaws, particularly in years of heavy snow cover.

Trees, brush, and other vegetation growing along river banks impede flood flows during high waters, thus creating backwater and increasing flood heights. Furthermore, trees, ice, and other debris may be washed away and carried downstream to collect on bridges and other obstructions. As the flood flow increases, significant amounts of this debris often break loose, and a wall of water and debris surges downstream until another obstruction is encountered. Debris may collect against a bridge or culvert until the load exceeds the structural capacity, causing its destruction. It is difficult to predict the degree to which, or the location where, debris may accumulate. Therefore, in the development of the flood profiles it has been necessary to assume no accumulation of debris or obstruction of flow.

The flood problems for the communities within Chittenden County have been compiled and are described below:

In the Town of Bolton, the Winooski River flows through the middle of the community and its floodplain encompasses residential and agricultural property. Major floods occurred in the Winooski River Valley in November 1927, March 1936, and September 1938. The 1927 flood is the largest known flood since 1830. The 1927 flood in particular caused major damage to Bolton along the

Winooski River. The 1927 flood was caused by heavy rain on saturated ground. More recent floods have caused relatively minor damage (Reference 3). Flooding in June 1990 completely washed out large sections of Bolton Valley Access Road. January 1996 flooding damaged Bolton Valley Access Road again but less extensive than in 1990. Shoulder repair and new gravel on Stage Road, Mill Brook and Notch Road and minor repairs on Bolton Valley Access Road were required following flooding in July 1998 (Reference 4).

Floodplains in Burlington are frequently flooded; however, damages are not severe. Notable floods in the Winooski River Basin occurred in 1830, 1869, 1927, 1936, and 1977. The 1927 flood was the largest on record with an estimated statistical recurrence interval of greater than 0.2 percent-annual-chance. Although the 1927 flood caused widespread death and devastation along the Winooski River above Burlington, losses to the city were confined to the two railroad bridges and one Road Bridge that crossed the river (Reference 5). Lake Champlain has caused flood damage near the mouth of the Winooski River along North Avenue Extension and also around Appletree Point. Most of the damage has been associated with wave and ice run-up accompanying high lake levels. More recent flooding on August 11, 1995 caused by thunderstorms resulted in numerous power outages, fallen trees, and structural damage to houses and cars (Reference 6). Urban flooding in the City of Burlington resulted in storm drains backing up.

Flooding in Charlotte from Lake Champlain generally occurs only along Converse Bay, McNeil Cove, and Town Farm Bay, since much of the shoreline is above the elevation of the 1-percent-annual-chance. During periods of spring runoff, off-bank flow occurs along Lewis Chittenden-Addison County line. However, no buildings are affected by this flooding condition (Reference 7).

Low-lying areas in the Town of Colchester are subject to periodic flooding caused by overflows of the Winooski and Lamoille Rivers and their tributaries. Fluctuations in the water level of Lake Champlain also produce flooding along the shoreline. Notable floods occurred on the Winooski River in 1933, 1936, 1938, 1973, and 1977 (Reference 8). The corresponding recurrence intervals for these floods were approximately 0.8-, 3-, 8-, 17, and 11-percent-annual-chance, respectively. The recurrence intervals are based on the frequency curve developed from records of the USGS gage located on the Winooski River at Essex, Vermont. Major floods on the Lamoille River occurred in 1936, 1938, 1940, 1942, 1973, 1976, and 1977. The corresponding recurrence intervals for these floods were 5-, 8-, 7-, 10-, 13-, 14, and 17-percent-annual-chance, respectively. The recurrence intervals are based on the frequency curve developed from the records of the USGS gage located on the Lamoille River at East Georgia, Vermont. The flood of 1927 was the flood of record for the Winooski and Lamoille Rivers and had an estimated recurrence interval statistically larger than the 0.2-percent-annual-chance. Lake Champlain high-water levels occurred in 1939, 1947, 1971, 1972, and 1976. The corresponding recurrence intervals for these floods were 4-, 7-, 9-, and 10-percent-annual-chance, respectively. The recurrence intervals are based on the frequency curve developed from the records of the USGS gage located on Lake Champlain at Rouses Point, New York.

In the Town of Essex, the banks along the Winooski River are subject to annual flooding. The Winooski Gorge, which is located at the downstream corporate limits of Essex, is a major flow constriction in the Winooski River. Just upstream of the Gorge, the river slope is gradual and the valley widens out considerably. It is subject to substantial inundation almost every spring which causes varying degrees of damage to agricultural land. There is a group of residences along State Route 117 which is in the 1-percent-annual-chance floodplain. Major floods occurred in the Winooski River valley in November 1927, March 1936, and September 1938. The flood of November 1927 had a peak discharge of 113,000 cfs and an estimated return frequency of over 0.2 percent-annual-chance. The March 1936 flood had a peak discharge of 45,300 cfs and estimated return frequency of 40 years. The flood of September 1938 had a peak discharge of 34,300 cfs and an estimated return frequency of 12 years (Reference 9). The 1927 flood, caused by heavy rain on already saturated ground, is the largest flood of record since 1830. In the Browns River valley, the major problem is annual flooding of agricultural land. Among the major floods on record are those that occurred in 1927, 1938, 1955 and 1973. The August 17, 1955, flood is reportedly the largest storm on record for the valley (Reference 9). The Town of Essex has had considerable growth since its last flood map update and this may have affected the floodplains.

Essex Junction has banks along the Winooski River that are subject to annual flooding. Major floods occurred in the Winooski River Valley in November 1927, March 1936 and September 1938. The 1927 flood is the largest known flood since 1830 (Reference 10).

Floods in the Town of Hinesburg have occurred in every season of the year. Flooding of significant magnitude in the past century has occurred in Hinesburg in November 1927, March 1936, September 1938, and July 1973. Other flood problems are related to the condition of the diversion structure directing large discharges from The Canal back to Patrick Brook. In this analysis it is assumed that the structure is in good working condition. Furthermore, the location where water from Patrick Brook is diverted to the Canal is not maintained. Debris could change the flow distribution at this unmaintained diversion which could cause additional flood waters to flow down The Canal and exceed its capacity (Reference 11). More recent flooding on July 17, 1998 caused washed out roads in the Towns of Hinesburg and Bolton due to torrential downpours (Reference 6).

Huntington’s low lying areas are subject to periodic flooding caused by overflow of the Huntington River and its tributaries. Severe floods occurred in 1830, 1858, 1927, 1936, 1938, 1971, 1973, and 1976. Flooding caused by Hurricane Belle in August of 1976 resulted in much road, bridge, and personal property damage. The approximate recurrence interval of this flood is 4-percent-annual-flood chance (Reference 12).

In the Browns River and Lee River Valleys, the greatest problem is the annual flooding of agricultural land. Among the major floods on record were those in 1927, 1938, 1955, and 1973. The August 17, 1955 flood is reportedly the largest storm on record for the Browns River Valley in the Town of Jericho (Reference 13).

Low-lying areas in the Town of Milton are subject to periodic flooding caused by the overflow of the Lamoille River and its tributaries. Also, fluctuations in the water level of Lake Champlain produce flooding along the shoreline. The flood of 1927 is the flood of record on the Lamoille River and has an estimated recurrence interval of more than 0.2-annual-percent-chance. Other major floods on the Lamoille River occurred in 1936, 1938, 1940, 1942, 1973, 1976, and 1977. The discharges for these floods were 23,200 cfs, 20,200 cfs, 22,300 cfs, 19,400 cfs, 18,000 cfs, 17,400 cfs, and 16,300 cfs; the estimated recurrence intervals were 5-, 8-, 7-, 10-, 13-, 14-, and 17- percent annual chance, respectively. The recurrence intervals are based on the frequency curve developed from the gage records of the USGS gage located on the Lamoille River at East Georgia, Vermont. High water levels have occurred on Lake Champlain in 1939, 1947, 1971, 1972, and 1976 which have recurrence intervals of 9-, 10-, 7-, 4-, and 4-percent-annual-chance, respectively (Reference 14).

Portions of the Village of Richmond and Jonesville, a small settlement in the eastern portion of the Town of Richmond, lie within the floodplain of the Winooski River. These areas, containing a school as well a commercial establishments and residences, are susceptible to damage during major floods. The agricultural property along the Winooski River is also subject to varying amounts of flooding damage annually. Richmond Bridge in the Town of Richmond was under reconstruction at the time this countywide report was published. The bridge suffered damages due to the 1927 flood and has since been designated as historic, thus no changes to structure, abutments, grade or floodway will occur (Reference 15). Flooding on January 26, 2010 resulted from an ice jam moving down the Winooski River from the Town of Richmond to the Town of Essex backing water up into Rogers Lane and Johnny Brook Road near the Town of Richmond and Jericho line (Reference 6).

The Town of Shelburne experiences few flooding problems from the streams and the stretch of lake shore within its corporate limits. Bay Road in the vicinity of Shelburne Bay and the bridge over the LaPlatte River have been frequently flooded in the past. However, the bridge and the roadway were raised in 1947 and 1976, respectively. Both the road and the bridge as they now stand are above the elevation of the 1-percent-annual-chance flood. A building located along Munroe Brook near Long Meadow Drive, experienced up to 3 feet of flooding in June 1974 and June 1975 from minor storms. This apparently was the result of an inadequate culvert under Long Meadow Drive. The Town of Shelburne replaced this culvert in 1975, and no flooding has occurred there since. However, the building would still be subject to flooding during a 10 percent-annual-chance storm event (Reference 16).

The City of South Burlington has low lying portions along the southern bank of the Winooski River that are subject to periodic flooding from the river. The Winooski Gorge, located at the downstream corporate boundary of South Burlington, is a major flow constriction of the Winooski River. Just upstream of the Gorge the river slope is gradual and the valley widens out considerably. This reach of the river is the major flood prone area in South Burlington. It is subject to substantial inundation almost every spring, causing varying degrees of damage to agricultural land. Major floods have occurred in the Winooski River Valley in November 1927, March 1936, and September 1938. Of these, the November 1927 flood was the most severe, with a discharge of 113,000 cfs and a recurrence interval of more than 0.2-percent-annual-chance. The March 1936 flood had a discharge figure of 45,300 cfs and a recurrence interval of 2.5 percent-annual-chance. The September 1938 flood had a discharge figure of 34,300 cfs and a recurrence interval of 8-percent-annual-chance. Because the floodplain in South Burlington is primarily agricultural, even in the 1927 flood the damage was limited mostly to agricultural losses. The major problem facing the lakeshore portion of the City of South Burlington is lake-bank stabilization. This problem results from wave action and ice run-up produced by high winds (Reference 17). Flooding on August 12, 1998 resulted from heavy rain and thunderstorms setting a new August daily rainfall record at the Burlington Airport of 3.62 inches. In the City of South Burlington Williston Road was closed and Muddy Creek flooded resulting in backed up culverts (Reference 6).

Severe flooding in the Town of Underhill occurred during March 1913, November 1927, March 1936, June 1973, and June and July 1984. Underhill Center and Underhill Flats experienced serious property damages during these floods. A particular problem along the Browns River from Underhill Center to Underhill Flats is stream bank instability, which causes erosion of the stream bank. Several property owners have installed private stream bank protection measures to arrest erosion where high value property has been threatened (Reference 18).

The Winooski River forms Williston's northern boundary. A large amount of agricultural land along this portion of the river is flooded each spring because of snowmelt and ice jams. The agricultural land is subjected to varying degrees of damage. Major floods occurred in the Winooski River Valley in November 1927, March 1936, and September 1938. The 1927 flood was the largest recorded flood since 1930, and caused major damage to the land in Williston along the Winooski River (Reference 19). More recent flooding occurred on June 29, 2005 resulting in the closure of Route 2 due to washouts in Williston. Thunderstorms with very heavy rainfall impacted the Towns of Williston, Essex and the Village of Essex Junction (Reference 6).

The Winooski River within the Winooski community is frequently flooded but damages have not typically been severe. Notable floods occurred in 1830, 1869, 1927, 1936, and 1977. The 1927 flood was the largest on record with an estimated statistical recurrence interval of greater than 500 years. Although the 1927 flood caused widespread death and devastation along the river above Winooski, losses in the city were heavy but not catastrophic. The highway and railroad bridges between Burlington and Winooski were lost and the mills along the river were undermined and heavily damaged. Shops and houses on East and West Canal Streets were evacuated and one was destroyed (Reference 20).

2.4 Flood Protection Measures

Flood protection measures for Chittenden County have been compiled and are summarized below:

The state of Vermont has limited regulatory control in flood hazard areas under Vermont State Act 250, which enables municipalities to develop local floodplain zoning regulations.

Also, some articles of state legislation, including health department regulations and stream alteration legislation, affect development of the floodplain.

Three flood control structures are operated on tributaries to the Winooski River. Reservoirs on Jail Branch at East Barre, the North Branch of the Winooski River in Wrightsville at Washington County, and the Little River in Waterbury control the runoff from 214 square miles of the 1,044 square mile drainage area above the study area. This provides protection in the communities of Bolton, Burlington, Colchester, Essex, Essex Junction, and Jericho. In the Towns of Bolton, Essex, East Barre, and Jericho, and the Villages of Essex Junction and Wrightsville, a small amount of storage is available in Peacham Lake and Mollys Falls Reservoir (Reference 20, 3, and 10).

Development in the Town of Essex is controlled in the flood district by local zoning ordinances (References 10 and 21).

The Town of Bolton, in addition to being protected by the three flood control structures, has inter-zoning regulations for flood hazard areas in the town (Reference 22). These regulations control development in the floodplain.

The City of Burlington is also protected by the three above mentioned control structures. Other power dams within the basin provide little flood storage. Two local flood protection projects protect specific areas of the city. The first is a breakwater in Lake Champlain that reduces wave action in the Burlington harbor area. The second is a dike built around the McNeil Station wood-fired power plant operated by Burlington Electric in the Intervale area of the Winooski River floodplain. 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. The dike was built to elevation 115.6 feet and does meet the freeboard specifications (Reference 5).

There are no flood protection structures in the Town of Colchester. The three detention reservoirs on the Winooski River are however, just upstream of Colchester. In addition, there are other reservoirs in the Winooski River basin that do provide a small amount of flood protection storage, but these reservoirs are operated for power purposes, not for flood control. There are no flood control reservoirs in the Lamoille River basin, but there are several hydroelectric power generation dams along its length. There are three dams, the Peterson, Great Falls, and Clark Falls Dams, on the Lamoille River immediately upstream of Colchester in Milton. All are used for power generation, and although they have a small regulatory capability, they cannot be relied upon for significant control of floodwaters (Reference 8).

The Town of Colchester does provide non-structural flood protection measures that discourage construction in the floodplain (Reference 23).

There are no structural or regulatory flood control measures in the Town of Charlotte or the Town of Hinesburg (Reference 7 and 11). In the Town of Charlotte, residents around Thompson Point have placed rip-rap to protect the shoreline from wave action (Reference 7).

Huntington constructed non-certified levees along the Huntington River after Hurricane Belle, but these structures do not offer significant protection against flooding events (Reference 12).

The Town of Jericho has zoning regulations that establish special regulations for the management of flood hazard areas. The regulations apply to areas of special flood hazard as indicated by the NFIP (Reference 13).

There are no flood protection structures in the Town of Milton and the Town of Underhill (Reference 14 and 18).

The Town of Milton does have non-structural flood protection measures which discourage building in the floodplain, and is enforced through its zoning by-laws (Reference 24).

There is no major form of flood protection used within the Shelburne area. However, some of the homeowners along Lake Champlain have taken such steps as laying down riprap to protect the shoreline from wave action (Reference 16).

Bay Road in Shelburne and its bridge over the LaPlatte River has been raised above the elevation of the 1-percent-annual-chance-flood. However, this is primarily a measure to keep the road open during high-water periods. Generally, no houses are afforded protection by this measure. A larger culvert was installed in Munroe Brook at Long Meadow Drive. However, this only protects against storms of less than a 10-percent-annual-chance-flood frequency of occurrence (Reference 16).

The City of South Burlington has a designated a floodplain district in their permanent zoning. This district is based on the 1-percent-annual-chance floodplain. The zoning regulations permit the Board of Adjustment to allow certain types of buildings to be constructed in the floodplain as long as they are constructed at an elevation above the elevation of the floodplain district boundary. In addition to the floodplain district, there is a conservation and open space district which controls new development in the following areas: a 150 foot deep (as measured from the high-water elevation of 102.5 feet above mean sea level) strip along Lake Champlain; 100 feet from the centerline of major streams or 8 feet above their low-water mark, whichever is further from the stream; 50 feet from the centerline of minor streams and 100 feet from the Winooski River (Reference 17).

The Town of Williston zoning ordinance includes a designated stream bank and floodplain district, by means of which land use is controlled along the Winooski River and streams, lakes, ponds, and swamps in the town (Reference 19).

Three detention reservoirs exist in the Winooski River Basin upstream of Winooski River in the Town of Winooski. The East Barre Detention Reservoir (1935), Wrightsville Detention Reservoir (1935), and the Waterbury Reservoir (1937), control 38.8, 66.5, and 109 square miles of drainage area, respectively. Thus, a total of approximately 20 percent or 214 square miles of the 1,065 square mile drainage area is subject to control. There is also another reservoir in the community: however, it provides no flood protection measures. Other power dams within the basin provide little flood storage. There are no local flood protection projects (Reference 20).

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent-annual-chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

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

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

Previous Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency and elevation-frequency relationships for floods of the selected recurrence intervals for the flooding sources studied in detail.

In the Towns of Colchester, Essex, and Williston, the City of South Burlington, and the Village of Essex Junction, values of the 10-, 2-, 1-, and 0.2- percent-annual-chance year peak discharges for the portion of the Winooski River not studied as part of this countywide study and the Lamoille River in the Towns of Colchester and Milton were obtained from a USACE log-Pearson Type III distribution of annual peak flow data in accordance with the Water Resources Council Bulletin 17A (Reference 29 and 25). The USGS gages at Essex Junction and Montpelier were used for the Winooski River. At the time of analyses the Essex Junction gage (No. 04290500) had a 49-year period of record, and the Montpelier gage (No. 04286000) had a 61-year period of record (Reference 30). The USGS gages at Johnson and East Georgia were used for the Lamoille River. The Johnson gage (No. 04292000) has a 51-year period of record, and the East Georgia gage (No. 04292500) has a 48-year period of record (References 31, 25, and 29). The discharges on the Winooski River differed from those utilized in the USACE Floodplain Information Report (Reference 32). Concurrence was obtained from the USACE on the discharges in this report. The discrepancy was due to the treatment of the 1927 flood and the historical period of record associated with this flood. A separate hydrologic analysis was performed for the Winooski River backwater on the northeast side of the Central Vermont Railroad and approximately 4,000 feet northwest of the intersection of U. S. Route 2 and Bolton Valley Road in the Town of Bolton. The analysis included the development of hydrographs for the Winooski River, rating curves for the two culverts beneath the railroad tracks, and a stage-storage curve for the area.

In the City of Burlington and the City of Winooski, flood discharges for the Winooski River were determined by analyses of data collected at USGS gaging station (No. 04290500) on the Winooski River in Essex Junction, Vermont, a short distance upstream of Burlington. The annual flood peaks for the period 1929 to 1977 were analyzed. These results were then adjusted to include the 1927 flood as a historical outlier. The 1927 flood is recognized as the largest since at least 1830. All methods were in accordance with Water Resources Council Bulletin 17A (References 25, 20, and 5). The resulting discharges were previously used in the Flood Insurance Studies for South Burlington and Colchester (References 17 and 8). Although several more years of record are now available and statistical methods have changed slightly, the change in estimated flood discharges would be insignificant.

In Hinesburg, discharge values for the LaPlatte River were determined from the log-Pearson Type III statistical analysis (Reference 34) on peak-flow data from USGS gage No. 04282795, LaPlatte River at Shelburne Falls, Vermont. The discharges were then adjusted for drainage area using the formula:

$$Q/Qg = (A/Ag)^{0.8}$$

where Q and A are the peak-flow discharge and drainage area, respectively, at the point of interest, and Qg and Ag are the peak-flow discharge and drainage area, respectively, at the gage.

Discharge values for Patrick Brook in Hinesburg were determined using regression equations for estimating peak flows on unregulated and ungaged rural streams in Vermont (Reference 34). Discharges for The Canal were determined using flow-diversion optimization routines run during the hydraulic analysis of Patrick Brook and The Canal. The hydraulic analysis of the diversion, including the diversion channel that carries water from The Canal back to Patrick Brook is discussed further in the next section.

Peak discharges for Alder Brook in the Town of Essex and Huntington River in the Towns of Huntington and Richmond were calculated using regression equations which relate peak discharge to drainage area, channel slope and rainfall (Reference 25 and 31).

For the Huntington River, a regional analysis of discharge-frequency drainage area was performed using the following selected stream gages in northern and central Vermont to obtain the relationship for flow versus drainage area: (a) Gage # 042870 on Dog River at Northfield Falls, Vermont (42 years of record); (b) Gage # 042880 on Mad River at Moretown, Vermont (48 years of record); (c) Gage # 011420 on White River at Bethel, Vermont (24 years of record); (d) Gage # 011440 on White River at West Hartford (59 years of record); and (e) Gage # 011515 on Ottauquechee River at North Hartford (30 years of record).

On Cobb Brook in Huntington, the following methods were used to define discharge frequency data: (a) Peak Rates of Runoff for New England Hill and Lowland Areas (Reference 38); (b) National Cooperative Highway Research Program Report 136, Experiment E-2 (Reference 39); (c) "Discharge Index Slope" method of determining low frequency flows (Reference 40).

In Jericho, the peak discharges on the Lee River and The Creek were developed by the SCS on the basis of stream hydraulics, soil cover, land use, and rainfall data (References 41).

In Milton, the flood flow discharges for the Lamoille River were determined by a log-Pearson Type III analysis as outlined by the Water Resources Council (Reference 25). The two USGS gages used in this study on the Lamoille River are at the Towns of Johnson and East Georgia. The gage (No. 04292000) at Johnson has a period of record of 51 years, from 19l2 to 1913 and from 1929 to 1977. The gage (No. 04292500) in East Georgia has a period of record of 48 years, from 1930 to 1977 (Reference 42).

Using stream hydraulics, soil cover, land use and rainfall-frequency data as the basic input for the Town of Shelburne, the peak discharges were calculated for the 10-, 2-, 1-, and 0.2- percent-annual-chance flood frequencies by the tabular method of flood routing for Munroe and McCabe’s Brook (References 43). The

0.2-percent-annual-chance rainfall was extrapolated from a plot of the 10-, 2-, and 1-percent-annual-chance rainfall on probability paper.

The hydrologic analysis for the Town of Underhill was taken from a SCS Floodplain Management Study (Reference 45). Flood-flow frequencies for The Creek in that study were determined from flood runoff volumes and flow rates using SCS Technical Release No. 20 (Reference 46). These flow frequencies were adjusted as necessary in analyzing them with frequency values based on similar gaged watersheds in the region (References 47). Frequency results agree with known high-water marks in the floodplains.

Previous countywide peak discharge-drainage area relationships for Chittenden County are shown in Table 6, "Previous Summary of Discharges". Revised discharges for Browns River and portions of Winooski River can be found in the Countywide Analysis section below.

TABLE 6 – PREVIOUS SUMMARY OF DISCHARGES

		PEAK DISCHARGES (CUBIC FEET PER SECOND)			
FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
ALDER BROOK					
At confluence with Winooski River	10	670	1,140	1,330	1,780
COBB BROOK					
At Huntington River	5.5	540	910	1,200	2,200
HUNTINGTON RIVER					
At the Town of Richmond downstream corporate limits	66	6,000	10,000	12,100	18,500
At the Town of Huntington downstream corporate limits	55.5	5,200	8,700	10,500	16,000
At Cross Section J	47.5	4,700	7,700	9,300	14,200
At Cross Section Y	41.0	4,200	6,900	8,300	12,700
At Cross Section AH	30.5	3,300	5,500	6,600	10,100
At Cross Section AQ	25.5	2,900	4,800	5,800	8,800
LAMOILLE RIVER					
At confluence with Lake Champlain	722	19,100	28,300	33,310	48,330
LaPLATTE RIVER					
At downstream corporate limit in the Town of Hinesburg	27.0	1,420	2,210	2,600	3,610
Upstream of confluence with The Canal in the Town of Hinesburg	9.3	604	942	1,110	1,540

TABLE 6 – PREVIOUS SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
LEE RIVER					
At confluence with Browns River in the Town of Jericho	16.7	690	1,450	1,950	3,400
McCABE'S BROOK					
At Harbor Road	4.65	794	1,181	1,323	1,631
At Vermont Railway Crossing	3.50	681	1,009	1,127	1,387
MUNROE BROOK					
At State Route 7	5.21	884	1,325	1,491	1,837
At Longmeadow Road	2.97	478	723	817	1,015
At Webster Road	2.60	440	666	753	935
PATRICK BROOK					
At its confluence with LaPlatte River in the Town of Hinesburg	*	178	243	271	342
Upstream of diversion to The Canal in the Town of Hinesburg	6.31	230	313	348	432
THE CANAL					
At State Route 116 in the Town of Hinesburg	*	52	70	77	90
Upstream of Lateral Diversion Structure in the Town of Hinesburg	*	120	166	186	227
THE CREEK					
At confluence with Browns River	11.3	1,030	1,840	2,370	3,700
At downstream corporate Limits in the Town of Underhill	9.6	1,030	1,930	2,370	3,400
UNNAMED DIVERSION CHANNEL					
Below lateral structure in the Town of Hinesburg	*	68	96	109	137
WINOOSKI RIVER					
At USGS gage in Essex Junction	1,044	32,900	48,100	55,700	76,900

*Data Not Available

In the City of Burlington, and the Towns of Colchester, Charlotte, Milton, and Shelburne, the data and analyses presented for Lake Champlain were adopted from the previous countywide FIS reports for the Town of Plattsburgh, New York

(Reference 26). The USGS measured lake stages at two gaging stations on the northern end of Lake Champlain: gage number 04294500 at Burlington, Vermont, about 19.5 miles south-southeast of Plattsburgh, and gage number 04295000 at Rouses Point, New York, about 20 miles north-northeast of Plattsburgh. The data from the Rouses Point gage were used for these analyses because the period of record (1871 to present) is longer than that of the Burlington gage and because examination of the records of these gages shows that the lake stages at both locations are very similar. The Rouses Point gage has been in operation since 1869. Graphical frequency analysis was chosen as the method most likely to determine lake stages of the selected recurrence intervals with a reasonable degree of accuracy. The results of this analysis were plotted on an arithmetic-probability graph (rather than a logarithmic probability graph) which allowed data points to vary over a wider range. This flexibility helped to describe a stage-frequency curve more accurately and reduced the human error introduced in fitting a curve through the plotted points. It was decided not to employ the log-Pearson Type III frequency analysis because the range of logarithms of the lake stage data is too narrow to yield reliable results. Three graphical frequency analyses were applied to the data measured at the Rouses Point gage from 1871 to 1976 (References 27 and 28). The stages for Lake Champlain presented in previous countywide reports were obtained from the stage-frequency curve produced by the third, the Beard Method, because this curve appeared to be an average of the curves produced by the other two formulas.

Flood elevations for Lake Champlain in the City of South Burlington were taken from a report of the Physical Aspects Committee of the International Champlain-Richelieu Board (Reference 44). Lake Champlain floods Shelburne Bay.

A Summary of frequency-elevation relationships for Lake Champlain is shown in Table 7, "Previous Summary of Elevations".

TABLE 7 – PREVIOUS SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD)			
	10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
LAKE CHAMPLAIN*				
At Plattsburgh, NY	100.6	101.4	101.6	101.9
City of South Burlington	100.8	101.5	101.6	101.9

*Superseded with the Countywide Analyses, See Table 9

Countywide Analyses

For the rivers that have a long-term stream gage, existing flood frequency analyses performed by USGS, in cooperation with the Vermont Agency of Transportation, was used (Reference 39).

USGS also developed new regression equations for ungaged streams, which are appropriate for use in Vermont. Equations for Vermont are valid for drainage areas ranging in size from 0.21 to 850 square miles, and are valid for a wide range of watershed elevations (an important consideration in this mountainous region).

Where possible, peak discharges were developed from a statistical analysis of USGS stream gage data (Log Pearson Type III). Supplemental hydrologic analyses were performed using regional regression equations and/or the USACE Hydrological Modeling System (HEC-HMS) computer program (for flood routing computations) where stream gage data was either unavailable or not applicable. Peak discharges for the 10-percent, 2-percent, 1-percent and 0.2-percent annual chance flood events were then developed. These flood discharges were the basis for subsequent hydraulic analyses, described in the next section.

For all river reaches, discharges were developed at several intermediate points along the river, at locations printed in previous countywide FISs, as well as at confluences of major tributaries and other flow change locations. For these locations, watersheds were delineated using topographic data in order to estimate drainage areas. For ungaged sites upstream or downstream of a gage, the-drainage area ratio method was used where appropriate to determine flood flows. This method is generally applicable for ungaged sites where the drainage area ratio of the ungaged site to the gaged site lies between about 0.6 and 1.4. Thus, it was not appropriate for all study reaches.

Peak discharge values are an average of peak discharges reported from two flood frequency scenarios; (1) using all USGS records disregarding regulation and (2) using USGS records with modified flows from 1928-1934 to simulate the three flood control reservoirs containing all flow from peak flow events. Modified flows were calculated from the standard discharge-drainage area transposition relation assuming the reservoirs control 214 square miles of the 1,044 square mile drainage area where Q_1 is the modified flow, Q is the unregulated flow, A is the drainage area not controlled by reservoirs, and A_1 is the total drainage area.

$$Q_1 = \left(\frac{A}{A_1} \right)^{0.75} Q$$

New hydrologic analyses were performed for the reaches of the Browns and Winooski Rivers described in Section 2.1, Scope of Study.

For the upstream 33-mile portion of the Winooski River extending from the Green Mountain Power Dam in Chittenden County to the Middlesex Dam No. 2 in Washington County, a hydrologic analysis was completed using an existing flood-frequency analysis and drainage-area ratio method.

For the downstream 10-mile portion of the Winooski River extending from the mouth of Lake Champlain to approximately 1,200 feet downstream of Main Street/Colchester Avenue, a flood frequency analysis was performed using PeakFQWin software provided by USGS (Reference 36). PeakFQWin provides an estimate of the 1-percent-annual-chance flow using the Log-Pearson Type III distribution to fit the logarithms of the peak flows following *Guidelines for Determining Flood Flow Frequency: Bulletin 17B* (Reference 34). Generalized skew value was determined from USGS's *Flow-Frequency Characteristics of Vermont Streams* (Reference 37).

Flood discharges for the Winooski River were determined by analysis of data collected at USGS gaging station (No. 04290500) on the Winooski River in Essex Junction, Vermont, a short distance upstream of Burlington. The annual flood peaks for the period of 1927 to 2008 were analyzed. The 1927 flood event is noted as a historic peak and was recognized as the largest since at least 1830. For the flood frequency analysis, the historic period was extended to 1830 to account for this observation. After 1935, the Winooski River was considered regulated by the USGS. There are currently three flood control reservoirs located upstream of the City of Burlington. As a result of these flood control structures, a modified analysis was performed to determine peak discharge values.

For the 27-mile portion of the Browns River extending from its confluence with the Lamoille River to the end of the detail study area in the Town of Underhill, a hydrologic analysis was completed using regional regression equations (Reference 35).

Revised peak-discharges were calculated for the 10-, 2-, 1-, and 0.2-percent-annual-chance storm events and are shown in Table 8, "Countywide Summary of Discharges".

TABLE 8 – COUNTYWIDE SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BROWNS RIVER					
At its confluence with Lamoille River	92.99	4,076	5,794	6,521	8,299
Downstream of its confluence with Morgan Brook	87.37	3,866	5,510	6,208	7,920
Upstream of its confluence with Morgan Brook	75.84	3,465	4,972	5,617	7,207
At downstream corporate limits of Essex/Westford	66.55	3,172	4,588	5,199	6,717
Downstream of its confluence with Lee River	54.76	2,699	3,939	4,479	5,831
Upstream of its confluence with Lee River	38.55	1,976	2,910	3,321	4,356
Downstream of its confluence with The Creek	32.42	1,752	2,606	2,985	3,947
Upstream of its confluence with The Creek	21.24	1,236	1,868	2,153	2,886

TABLE 8 – COUNTYWIDE SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
WINOOSKI RIVER					
At Confluence with Lake Champlain	1,044	30,830	41,950	47,170	60,660
At USGS gage in Essex Junction	1,016.42	32,900	48,100	55,700	76,900
At downstream corporate limits of Richmond	970.44	32,300	47,300	54,800	75,600
At downstream corporate limits of Bolton	875.79	28,000	40,000	46,000	62,000
Downstream of its confluence with Little River	824.26	27,700	39,500	45,400	61,200
Upstream of its confluence with Little River	703.88	25,800	36,800	42,400	57,100

A summary of peak elevation-frequency relationships for Lake Champlain is shown in Table 9, "Summary of Stillwater Elevations".

TABLE 9 – SUMMARY OF STILLWATER ELEVATION

FLOODING SOURCE AND LOCATION	ELEVATION (NAVD) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
LAKE CHAMPLAIN				
Entire Shoreline Within Community	100.7	101.36	101.57	101.92

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in this FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Cross section data for the below-water sections were obtained from field surveys conducted March 2007. Cross sections were located at close intervals above and below bridges, culverts, and dams in order to compute the significant backwater effects of these structures. In addition, cross sections were taken between hydraulic controls whenever warranted by topographic changes.

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 3.2), selected cross-section locations are also shown on the FIRM.

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

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

Previous Analyses

In the City of Burlington, cross sections for the backwater analysis of the Winooski River were obtained from a variety of sources. The USACE Floodplain Information report for the Town of Colchester, the City of Burlington, and the City of Winooski made use of field surveyed cross sections (Reference 33). The location and channel data of most of these sections have been retained in subsequent studies. Additional sections in the vicinity of the U.S. Route 2 bridge were obtained by photogrammetric methods and field surveyed for the initial previous countywide City of Burlington FIS (Reference 5). New photogrammetric mapping was also obtained for that study. For the previous countywide Burlington study, cross sections in the FIS for the Town of Colchester were modified or replaced to account for subsequent developments in the floodplain that include the New Heineberg Bridge, Northern Connector, and the McNeil Station Dike (Reference 8).

Water-surface elevations of floods of the selected recurrence intervals in Burlington were computed using the USACE HEC-2 step-backwater computer program (Reference 48). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the Winooski River were assumed to be the mean annual high water elevation on Lake Champlain.

In Hinesburg, cross sections for the flooding sources studied by detailed methods were obtained from field surveys (Reference 11).

Water-surface elevations for floods of the selected recurrence intervals in Hinesburg were computed using the USACE HEC-RAS program (Reference 49). Normal depth was used as the starting water-surface elevation for the LaPlatte River at the downstream corporate limit of the Town of Hinesburg (Reference 52). The starting water-surface elevation for Patrick Brook was taken from the hydraulic analysis of the LaPlatte River where Patrick Brook enters the LaPlatte River. The starting water-surface elevation for The Canal was determined from a weir-flow equation applied at the dam at the downstream end of the detailed study reach of The Canal.

Two diversions occur within the detailed study area in the Town of Hinesburg. The first diversion is just downstream of Mechanicsville Road, where Patrick Brook and The Canal split. The second diversion occurs approximately 500 feet upstream of the Commerce Street culvert over The Canal. At this diversion, there is a lateral structure allowing flows to leave The Canal and enter an unnamed diversion channel, which empties back into Patrick Brook. Both Patrick Brook and The Canal drain into the LaPlatte River. The split-flow optimization routines in HEC-RAS were utilized to evaluate the amount of flow that would go down each reach.

Water-surface elevations determined at each cross section in Hinesburg were then used along with the USGS 1:24,000 Topographical Maps with 20-foot contour intervals and USGS 1:24,000 Digital Raster Graphs to determine the extent of flooding (Reference 50). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. In those areas where the analysis indicated supercritical flow conditions, critical depth was assumed for the flood elevation due to the inherent instability of supercritical flow.

Cross section data for streams in the Huntington area were obtained by photogrammetry (Reference 51). The channel cross section data were obtained by field measurements.

Starting water-surface elevations for the Huntington River in the Town of Huntington utilized normal depth analysis. Water-surface profiles for the Huntington River and Cobb Brook were developed using the HEC-2 computer step-backwater model (Reference 48). Profiles were determined for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods, showing computed water-surface elevations to an accuracy of 0.5 foot for these selected floods (Exhibit 1). The resulting profiles were computed to actual flood heights on these streams in the recent past to check the reasonableness of the flooded area. For Cobb Brook where the analysis indicated supercritical flow conditions, critical depth was assumed for the flood elevation due to the inherent instability of supercritical flow.

Water-surface elevations of floods of the selected recurrence intervals in the Town of Milton were computed through the use of the USACE HEC-2 step-backwater computer program (Reference 48). Starting water-surface elevation for the Lamoille River was the mean annual flood stage elevation of 99.75 (Reference 26). Cross-section data were obtained by photogrammetric methods (Reference 57); the below-water data were obtained by field survey. All bridges and culverts were field surveyed to obtain elevation data and structural geometry. The hydraulic analysis for the Lamoille River included individual computations on the old and new U. S. Route 2 Bridge. The elevation data and structural geometry were obtained from a field survey for the old bridge and from preliminary construction information prepared by the State of Vermont, Department of Highways, supplemented by field surveys for the new bridge (Reference 39). The effects of each bridge were studied separately. The hydraulic analysis of the new U. S. Route 2 Bridge was used in this study.

In the Town of Essex, Alder Brook was studied in detail from its confluence with the Winooski River to the Chapin Road Bridge in the Town of Essex and was obtained from the field study (Reference 56). Normal depth was used as the starting water-surface elevation for the LaPlatte River at the downstream corporate limit of the Town of Hinesburg (Reference 52). The starting water-surface elevation for Patrick Brook was taken from the hydraulic analysis of the LaPlatte River where Patrick Brook enters the LaPlatte River. The starting water-surface elevation for The Canal was determined from a weir-flow equation applied at the dam at the downstream end of the detailed study reach of The Canal.

Cross-section data for the detailed study areas in the Town of Richmond were obtained from field survey (Reference 56). All bridges, dams and culverts were surveyed to obtain elevation data and structural geometry. Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 step-backwater computer program (Reference 48). Starting water-surface elevations were calculated using the slope/area method.

Cross sections for the backwater analyses of the detailed-study streams in the Town of Shelburne were field-surveyed and were located at close intervals above and below bridges and culverts in order to compute the significant backwater effects of these structures in the urbanized areas. Water-surface profiles of floods of the selected recurrence intervals were computed through use of the SCS step-backwater computer program WSP 2 (Reference 54). The starting water-surface elevation used in the analyses was the l-percent-annual-chance flood level on Lake Champlain of 101.6 feet.

For the approximate-study area around Shelburne Pond, the 1 percent-annual-chance storm discharge was used to compute the water-surface elevation of the pond, which increases the natural surface elevation by 10 inches. Flood boundaries were then delineated, and field-surveyed for accuracy using topographic maps (Reference 55). Flood profiles were drawn showing computed water-surface elevation to an accuracy of 0.5 foot for floods of the selected recurrence intervals.

For the City of South Burlington the starting water-surface elevation was calculated using the slope/ area method. Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step backwater computer program (Reference 48). Cross-section data for the area studied by detailed methods were obtained from field survey conducted by the Vermont Department of Water Resources (Reference 56). All bridges, dams and culverts were surveyed in order to obtain elevation data and structural geometry.

In Underhill, cross-section data for the backwater analysis for The Creek and structural geometry of bridges and culverts were obtained by transit surveys. Water-surface elevations of floods of the selected recurrence intervals were computed using the SCS WSP-2 computer program and Technical Release No. 64

(References 54 and 61). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

During the Colchester study, the extremely detailed representation of the broad overbank floodplain areas downstream of Winooski River was simplified by eliminating ineffective flow areas such as local depressions.

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 which generally hold their position/elevation well (e.g., concrete bridge abutment)
>
> Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
>
> Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

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

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

Previous Countywide Roughness factors (Manning’s “n” values) used in the hydraulic computations were determined from field observations, guided by U.S. Geological Water Supply Publications, as well as by using the method outlined by

Ven Te Chow and by engineering methods. Table 10, "Previous Manning's "n" Values" shows the channel and overbank "n" values for the streams studied by detailed methods in the previous countywide FISs:

TABLE 10 – PREVIOUS MANNING'S "n" VALUES

Flooding Source	Channel "n"	Overbanks
Huntington River (Huntington)	0.028-0.033	0.02-0.10
Huntington River (Richmond)	0.035-0.05	0.05-0.09
Lamoille River (Colchester)	0.031-0.048	0.041-0.098
Lamoille River (Milton)	0.028-0.065	0.020-0.100
Lee River (Jericho)	0.045-0.05	0.065-0.13
McCabe's Brook (Shelburne)	0.04-0.05	0.04-0.12
Munroe Brook (Shelburne)	0.035-0.07	0.05-0.2
The Creek (Jericho)	0.024-0.045	0.065-0.08
Winooski River (Burlington)*	0.034-0.055	0.045-0.200
Winooski River (South Burlington)*	0.035-0.04	0.07-0.09
Winooski River (Winooski)*	0.035-0.04	0.06-0.09

*Superseded by analyses, see Table 11

Countywide Analyses

For this countywide revision, new Hydraulic Analyses were conducted along Browns and Winooski Rivers, for the reaches described in Section 2.1, Scope of Study. Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data Tables in this FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Hydraulic model development for both streams studied by detailed methods was accomplished using HEC-GeoRAS (Version 4.1, beta) for ArcGIS 9.2 (Reference 62).

Water surface elevations for floods of the selected recurrence intervals for both streams studied were determined by the USACE HEC-RAS computer program (Version 3.1.3) (Reference 49).

The terrain and field data used for the computer model development process described in this report includes the collection of hydraulic data for both streams studied.

Field surveys of both streams were performed to provide a detailed representation of the channel features.

The survey effort included surveying of the river cross-sections every 50 feet on both side of bridges and culverts, and the physical description of bridges and culverts. The cross-section data included taking 3-dimensional ground elevation shots, beginning at the declivity point on the left descending bank, and extending across the stream channel to the top declivity of the right descending bank. Surveys were positioned at appropriate locations necessary to define the hydraulic features of the stream channel to describe its size and shape. The description of bridges included the roadway centerline elevation, the length of each open span, the elevation of the bridge guardrail and low chord, the ground profile of bridge approaches, and the number and physical description of each pier. Each bridge was photographed and made a permanent record of the study data. The description of culverts included the type, size, length, number and road centerline profile elevation. A physical sketch of each culvert crossing was also provided.

Cross section overbank data utilized LIDAR topographic maps. The surveyed channel sections were merged with the LIDAR to create a complete topography surface of the entire cross section.

HEC-GeoRAS was used to cut the cross-sections from the topographic data for areas were cross-sections were not surveyed.

Cross-sections for the 2013 restudy of the Winooski River in the Town of Richmond consist of five surveyed channel sections, twenty-one channel sections obtained from the 1985 FIS study and unsurveyed overbank sections. Unsurveyed overbank sections were extracted from a triangulated irregular network (TIN) developed from Light Detection and Ranging (LiDAR) data for Chittenden County. The density of points collected supports the creation of two-foot contours. LiDAR data was collected by Green Mountain GeoGraphics (Reference 73). 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. Channel and overbank roughness coefficients (Manning's "n") for the hydraulic computations were assigned based on field observations of channel and floodplains, review of aerial photographs, engineering judgment, and from previous studies. The coefficients were manually inputted into the HEC-RAS model and are summarized in Table 11, "Countywide Manning's "n" Values," included below. For Winooski River, Manning's "n" values were based on visual observation of 2004 aerial photography (1 meter resolution) from the Vermont Center for Geographic Information, and standard, accepted values published in Open-Channel Hydraulics (Reference 52). The finalized hydraulic model for this reach was submitted by KAS, Inc. The results of this revised hydraulic model were not mapped to the north of Interstate 89 at the confluence with Snipe Island Brook. After consultation with the Town of Richmond, the Vermont Department of Environmental Conservation, and FEMA, it was determined that the effective model results reflect the flood hazard risk appropriately in this area.

For the Winooski River, the downstream boundary condition was set at the elevation of backwater from Lake Champlain. Also note that the western portion of cross section BH is mapped showing backwater effects from the Town of Williston. For the floodway models, starting water-surface elevations were inputted as the 1-percent-annual-chance elevation plus one (1) foot.

TABLE 11 – COUNTYWIDE MANNING'S "n" VALUES

Stream	Channel "n"	Overbank "n"
Browns River	0.04	0.06-0.1
Winooski River	0.035-0.10	0.045-0.2

The detail-studied stream centerline may have been digitized or redelineated as part of this revision. The "profile base lines" for these streams were based on the best available data at the time of their study and are depicted as they were on the previous FIRMs. In some cases where improved topographic data was used to redelineate floodplain boundaries, the "profile base line" may deviate significantly from the channel centerline or may be outside the Special Flood Hazard Areas (SFHA).

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles (Exhibit 1) are, therefore, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail, and if channel and overbank conditions remain essentially the same as ascertained during this study.

Flood profiles were drawn showing the computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals.

All elevations are referenced to NAVD88; elevation reference marks used in the study are shown on the maps.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD 88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. This can be done by applying a standard conversion factor. The Flood Profiles, and Base (1-percent annual chance) Flood Elevations (BFEs) in the previous countywide FIS reports, are in NGVD. These were converted to NAVD by applying the conversion factor of -0.4 feet to each detailed study stream in the effective FIS reports (**NGVD – 0.4 ft. = NAVD**). It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between the communities. For information regarding conversion between the NGVD 29 and NAVD 88, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

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

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

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 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.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

In order to provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community.

For each unrevised stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries were originally delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:62,500 with a contour interval of 20 feet (Reference 58), at a scale of 1:24,000, with a contour interval of 20 feet (Reference 59), at a scale of 1:2,400 with a contour interval of 10 feet (Reference 60), at a scale of 1:4,800, with a contour interval of 4 feet (References 56), or at a scale of 1:2,400, with a contour interval of 5 feet (Reference 55).

With new topographic data available in many communities for this countywide study, floodplain boundaries between cross sections were updated using topographic data with contour intervals of 2-ft in the communities of Burlington, Colchester, Essex, Hinesburg, Jericho, Milton, St. George, Shelburne, South Burlington, Williston, Winooski and the Village of Essex Junction; and at 2-ft (where available) and 20-ft contours for the remaining communities of Bolton, Buels Gore, Charlotte, Huntington, Richmond, and Underhill, Westford.

For unrevised streams in Chittenden County, data was taken from previously printed FISs for each individual community and are compiled below.

An approximate study was done on Lewis Creek which consisted of examining the soils in the floodplain and establishing the 1-percent-annual-chance flood boundary by the location of alluvial soils.

It should be noted that the boundaries drawn for Lake Champlain delineate the 102-foot elevation mark and are not a delineation of areas of possible wave action or ice damage. Erosion caused by wave action varies depending on wind direction, velocity, and shoreline exposure. This study does not deal with these factors.

For the areas studied by approximate methods in the communities of Colchester, Essex, Essex Junction, Jericho, Hinesburg, Milton, South Burlington, Underhill, and the Richmond, the 1-annual-percent-chance flood boundaries were delineated using the previous countywide Flood Hazard Boundary Map for the respective Communities (References 63, 64, 65, 66, 67, 68, 69, 70, 71, 72).

In Hinesburg, an area of approximate flooding was delineated around Lake Iroquois in order to match approximate flooding in the contiguous community of the Town of Williston (Reference 11).

For the Lamoille River, the boundaries of the 1-percent-annual-chance and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using photogrammetric maps at a scale of 1: 4,800 with a contour interval of 4 feet (Reference 59). For Lake Champlain the 1- and 0.2-percent-annual-chance boundaries were delineated using photogrammetric maps of the study area at a scale of 1: 4,800, with a contour interval of 4 feet (Reference 60). In cases where the 1- and 0.2- annual-percent-chance flood boundaries are close together, only the 1- percent-annual-chance boundary has been shown.

In Milton, the 1-percent-annual-chance flood boundaries field checked after their delineation (Reference 68).

The shorelines of Lake Champlain and Shelburne Bay along Shelburne were included in the detailed-study area. A topographic survey was conducted along the shorelines to determine the location of the 102-foot contour. This contour line was accepted as the 1 percent-annual-chance flood boundary line.

Flooding from Lake Champlain was based on a report of the Physical Aspects Committee of the International Champlain Richelieu Board (Reference 44). These elevations were plotted onto a 7.5-minute USGS topographic map (Reference 59).

For this countywide study, new flood boundaries were delineated along 18 miles of the 1- and 0.2-percent-annual-chance floodplain boundaries and the regulatory floodway boundaries for the Winooski River. The reach of this redelineation is noted in Section 2.1, Scope of Study. Two foot contours generated from 2006 LIDAR coverage were used in this redelineation.

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

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

4.2 Floodways

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

Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (see Table 12, “Floodway Data”). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Floodways were not calculated for portions of Patrick Brook, The Canal, and Unnamed Diversion Channel.

Due to the supercritical nature of Cobb Brook and its resulting hazardous velocities, a floodway was not determined.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "With Floodway" elevations presented in Table 12 for certain downstream cross sections of Lee River are lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

Certain downstream cross sections of the Huntington River are lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross sections is provided in Table 12, “Floodway Data.” 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.

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 12, for certain downstream cross sections are lower than the regulatory flood elevations in those areas, 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 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	614	50	232	5.7	292.5	284.8 [2]	284.9	0.1
B	1,504	30	217	6.1	292.5	287.6 [2]	288.2	0.6
C	3,494	56	199	6.7	297.0	297.0	297.9	0.9
D	5,304	38	127	10.5	323.9	323.9	323.9	0.0
E	6,604	35	183	7.3	335.6	335.6	336.4	0.8
F	7,894	67	259	5.1	341.6	341.6	342.2	0.6
G	9,954	31	140	9.5	353.9	353.9	353.9	0.0
H	12,414	38	149	8.9	381.3	381.3	382.0	0.7
I	14,754	52	230	5.8	397.2	397.2	397.6	0.4
J	15,654	60	254	5.2	400.7	400.7	400.9	0.2
K	16,644	48	138	9.6	408.5	408.5	408.5	0.0
L	17,264	41	128	10.4	437.6	437.6	437.6	0.0
M	17,932	43	132	10.1	463.1	463.1	463.1	0.0
N	18,095	47	344	3.9	472.8	472.8	472.8	0.0
O	19,620	61	384	3.5	473.8	473.8	474.2	0.4

[1] FEET ABOVE CONFLUENCE WITH WINOOSKI RIVER

[2] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM WINOOSKI RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

ALDER BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	9,866	105	867	7.5	354.2	354.2	354.9	0.7
B	10,489	112	859	7.6	356.1	356.1	356.7	0.6
C	11,045	113	928	7.0	357.8	357.8	358.2	0.4
D	11,479	102	761	8.6	359.0	359.0	359.2	0.2
E	11,790	128	933	7.0	360.5	360.5	360.9	0.4
F	12,447	90	536	12.2	363.1	363.1	363.7	0.6
G	12,875	143	773	8.4	367.8	367.8	368.2	0.4
H	13,872	136	779	8.4	374.3	374.3	374.3	0.0
I	14,644	241	1,267	5.1	377.2	377.2	378.1	0.9
J	15,191	135	959	6.8	378.8	378.8	379.6	0.8
K	15,769	119	626	10.4	381.3	381.3	381.3	0.0
L	16,381	130	822	7.9	386.3	386.3	386.3	0.0
M	17,356	69	455	14.3	391.8	391.8	391.8	0.0
N	17,777	110	1,058	6.2	395.1	395.1	396.1	1.0
O	18,315	410	2,682	2.4	396.1	396.1	397.1	1.0
P	19,489	113	1,103	5.9	396.8	396.8	397.6	0.8
Q	19,984	194	1,592	4.1	397.5	397.5	398.3	0.8
R	20,504	203	1,797	3.6	397.9	397.9	398.8	0.9
S	20,989	120	556	11.7	400.9	400.9	400.9	0.0
T	21,480	97	522	12.5	408.9	408.9	409.0	0.0
U	22,039	97	624	10.5	415.1	415.1	415.2	0.1
V	22,683	122	1,000	6.5	418.6	418.6	418.7	0.1
W	23,154	106	819	8.0	419.4	419.4	419.6	0.2
X	23,743	81	662	9.8	421.4	421.4	421.5	0.1
Y	24,255	91	570	11.4	424.1	424.1	424.5	0.4
Z	24,715	130	878	7.4	427.3	427.3	427.9	0.6
AA	25,337	170	1,559	4.2	428.8	428.8	429.6	0.8

[1] FEET ABOVE CONFLUENCE WITH LAMOILLE RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

BROWNS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	25,549	87	501	12.4	432.2	432.2	432.7	0.5
AC	25,857	141	1,212	2.1	438.7	438.7	438.7	0.0
AD	26,353	172	1,078	7.5	439.3	439.3	439.3	0.0
AE	27,337	213	1,449	4.3	440.6	440.6	440.7	0.1
AF	27,972	86	854	6.6	440.9	440.9	441.2	0.3
AG	28,304	84	806	7.0	442.2	442.2	442.3	0.1
AH	29,287	91	955	5.9	443.7	443.7	444.1	0.4
AI	30,930	74	793	7.1	445.4	445.4	446.2	0.8
AJ	31,588	72	885	6.4	446.6	446.6	447.4	0.8
AK	32,675	68	842	6.7	447.8	447.8	448.7	0.9
AL	33,780	154	1,714	3.3	449.6	449.6	450.6	1.0
AM	35,006	547	3,618	1.6	450.3	450.3	451.2	0.9
AN	36,500	331	2,291	2.5	450.5	450.5	451.5	1.0
AO	38,318	292	1,975	2.8	451.2	451.2	452.1	0.9
AP	39,807	665	3,813	1.5	452.6	452.6	453.5	0.9
AQ	40,482	585	3,311	1.8	452.8	452.8	453.7	0.9
AR	41,506	183	1,744	3.2	453.5	453.5	454.4	0.9
AS	42,174	912	8,373	0.7	453.8	453.8	454.7	0.9
AT	44,516	548	3,460	1.6	454.1	454.1	455.0	0.9
AU	45,973	434	2,561	2.2	454.5	454.5	455.4	0.9
AV	46,128	442	2,842	2.0	454.7	454.7	455.6	0.9
AW	46,648	234	1,778	3.2	454.9	454.9	455.7	0.8
AX	49,994	970	6,136	1.0	456.3	456.3	457.2	0.9
AY	51,620	915	5,222	1.0	456.6	456.6	457.4	0.8
AZ	54,595	980	4,427	1.2	456.9	456.9	457.9	1.0
BA	54,793	841	4,733	1.1	458.6	458.6	459.5	0.9
BB	59,296	2,203	6,547	1.0	459.3	459.3	460.2	0.9

[1] FEET ABOVE CONFLUENCE WITH LAMOILLE RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

BROWNS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BC	60,794	1,993	5,061	1.0	459.8	459.8	460.6	0.8
BD	61,018	1,869	7,121	1.0	460.5	460.5	461.4	0.9
BE	65,814	2,060	3,479	1.5	461.5	461.5	462.3	0.8
BF	66,809	1,890	3,961	1.3	462.1	462.1	462.8	0.7
BG	69,979	1,869	3,345	1.6	463.9	463.9	464.8	0.9
BH	70,959	2,040	3,357	1.6	465.8	465.8	465.9	0.1
BI	72,667	1,940	4,024	1.3	466.8	466.8	467.4	0.6
BJ	76,622	850	2,770	1.9	470.5	470.5	471.3	0.8
BK	76,893	660	3,743	1.4	473.6	473.6	473.9	0.3
BL	79,384	1,223	3,918	1.3	473.8	473.8	474.5	0.7
BM	80,987	1,220	2,254	2.3	474.4	474.4	475.4	1.0
BN	83,236	652	1,548	3.4	477.4	477.4	478.1	0.7
BO	84,154	774	1,917	2.7	478.3	478.3	479.0	0.7
BP	85,766	541	2,440	2.1	481.0	481.0	481.6	0.6
BQ	86,475	274	1,026	5.1	481.6	481.6	482.2	0.6
BR	87,320	350	1,675	3.1	483.1	483.1	483.8	0.7
BS	87,794	483	1,790	2.9	483.2	483.2	484.0	0.8
BT	88,417	83	749	6.4	483.8	483.8	484.7	0.9
BU	89,315	180	1,041	4.4	485.2	485.2	486.1	0.9
BV	89,799	344	1,725	2.6	485.9	485.9	486.8	0.9
BW	91,908	618	1,565	2.9	486.9	486.9	487.8	0.9
BX	92,857	763	2,164	2.6	488.2	488.2	489.0	0.8
BY	94,711	1,173	2,178	2.1	490.5	490.5	491.1	0.6
BZ	95,897	778	1,648	2.7	491.5	491.5	492.2	0.7
CA	96,824	607	1,160	3.9	492.9	492.9	493.6	0.7
CB	97,804	135	846	4.0	495.7	495.7	496.2	0.5
CC	98,465	43	242	13.7	524.5	524.5	524.5	0.0

[1] FEET ABOVE CONFLUENCE WITH LAMOILLE RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

BROWNS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
CD	98,845	59	358	9.3	529.7	529.7	529.8	0.1
CE	99,307	60	274	12.1	534.5	534.5	534.5	0.0
CF	100,118	61	271	12.3	553.1	553.1	553.1	0.0
CG	101,444	59	271	12.2	584.5	584.5	584.5	0.0
CH	101,688	103	410	8.1	588.5	588.5	588.5	0.0
CI	102,305	69	298	11.1	602.6	602.6	602.6	0.0
CJ	103,125	205	926	3.6	612.0	612.0	612.1	0.1
CK	104,181	94	605	5.5	612.8	612.8	613.8	1.0
CL	105,142	104	879	3.8	614.3	614.3	614.9	0.6
CM	105,443	106	1,064	3.1	625.0	625.0	625.4	0.4
CN	108,329	1,200	1,632	2.0	626.6	626.6	627.6	1.0
CO	109,624	740	1,067	3.1	629.8	629.8	630.5	0.7
CP	111,053	752	1,395	2.4	634.6	634.6	635.5	0.9
CQ	111,662	78	355	9.4	635.8	635.8	636.8	1.0
CR	112,117	99	658	5.1	638.5	638.5	638.7	0.2
CS	112,705	87	407	8.2	639.6	639.6	639.7	0.1
CT	113,058	70	511	5.8	642.9	642.9	642.9	0.0
CU	113,930	286	851	3.5	644.1	644.1	644.1	0.0
CV	114,671	74	364	6.0	645.9	645.9	646.5	0.6
CW	115,811	113	449	4.8	652.6	652.6	652.8	0.2
CX	116,305	88	385	5.6	653.8	653.8	654.5	0.7
CY	117,531	75	328	7.0	660.1	660.1	660.2	0.1
CZ	117,767	65	300	7.2	662.4	662.4	662.4	0.0
DA	118,570	63	429	5.0	665.1	665.1	665.2	0.1
DB	118,870	84	423	5.1	666.9	666.9	666.9	0.0
DC	119,675	143	402	5.4	669.1	669.1	669.1	0.0
DD	121,274	71	268	8.0	678.7	678.7	679.0	0.3

[1] FEET ABOVE CONFLUENCE WITH LAMOILLE RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

BROWNS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
DE	122,050	76	293	7.4	685.1	685.1	685.2	0.1
DF	123,324	190	425	5.1	692.5	692.5	692.8	0.3
DG	124,663	74	287	7.5	703.4	703.4	703.5	0.1
DH	125,389	90	404	5.3	709.4	709.4	709.6	0.2
DI	126,400	54	198	10.9	716.5	716.5	716.8	0.3
DJ	127,194	239	613	3.5	724.7	724.7	725.5	0.8
DK	128,998	73	333	6.5	739.1	739.1	740.0	0.9
DL	131,211	51	238	9.0	758.3	758.3	759.1	0.8
DM	132,427	63	244	8.8	771.0	771.0	771.2	0.2
DN	133,622	44	185	11.7	782.5	782.5	782.7	0.2
DO	135,097	91	332	6.5	798.6	798.6	799.2	0.6
DP	135,818	53	197	11.0	803.8	803.8	803.8	0.0
DQ	136,551	69	237	9.0	814.6	814.6	814.6	0.0
DR	137,505	45	187	11.5	828.8	828.8	829.4	0.6
DS	141,194	128	313	6.9	910.3	910.3	911.0	0.7
DT	143,088	83	223	9.6	979.7	979.7	979.7	0.0

[1] FEET ABOVE CONFLUENCE WITH LAMOILLE RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

BROWNS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,040	107	784	15.4	323.6	318.2 [2]	318.2 [2]	0.0
B	2,280	159	1,094	11.1	326.3	326.3	326.3	0.0
C	3,420	103	1,098	11.0	331.6	331.6	332.5	0.9
D	4,180	142	1,495	8.1	335.3	335.3	336.1	0.8
E	5,360	64	659	18.4	342.6	342.6	342.6	0.0
F	9,340	65	1,406	8.6	405.2	405.2	405.4	0.2
G	10,780	86	677	15.5	417.1	417.1	417.3	0.2
H	11,490	56	721	15.0	426.7	426.7	427.3	0.6
I	11,920	83	654	16.1	461.0	461.0	461.0	0.0
J	12,690	102	1,288	8.2	469.8	469.8	470.4	0.6
K	14,310	100	1,044	10.1	475.0	475.0	475.8	0.8
L	16,100	335	1,762	6.0	487.4	487.4	488.4	1.0
M	18,070	128	896	11.7	501.1	501.1	501.1	0.0
N	20,440	477	2,748	3.8	510.1	510.1	511.0	0.9
O	22,000	630	2,812	3.7	512.9	512.9	513.6	0.7
P	22,310	480	1,430	7.3	517.6	517.6	517.9	0.3
Q	22,530	186	1,319	8.0	519.5	519.5	519.5	0.0
R	23,100	112	815	12.9	520.8	520.8	521.3	0.5
S	25,050	117	768	13.7	530.5	530.5	530.8	0.3
T	26,370	191	955	11.0	538.4	538.4	538.5	0.1
U	26,528	200	883	11.9	539.9	539.9	540.4	0.5
V	27,743	165	972	10.8	548.2	548.2	548.2	0.0
W	28,957	192	1,105	9.5	553.7	553.7	553.8	0.1
X	29,221	512	1,585	6.6	557.1	557.1	558.0	0.9
Y	30,330	126	728	14.4	566.2	566.2	566.2	0.0
Z	31,650	115	987	10.6	573.1	573.1	573.3	0.2
AA	32,759	320	1,485	7.1	576.3	576.3	577.2	0.9

[1] FEET ABOVE CONFLUENCE WITH WINOOSKI RIVER

[2] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM WINOOSKI RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

HUNTINGTON RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	34,448	595	1,492	6.2	582.6	582.6	582.6	0.0
AC	35,557	770	2,620	3.5	584.5	584.5	585.5	1.0
AD	37,141	103	646	14.4	593.2	593.2	593.2	0.0
AE	38,989	251	1,179	7.9	602.8	602.8	603.4	0.6
AF	39,728	120	757	12.3	605.6	605.6	605.8	0.2
AG	39,887	110	878	10.6	607.8	607.8	607.8	0.0
AH	40,045	115	660	14.1	607.8	607.8	607.8	0.0
AI	40,151	121	613	15.2	609.5	609.5	609.5	0.0
AJ	40,679	89	779	11.9	613.7	613.7	613.7	0.0
AK	41,682	129	984	9.5	617.2	617.2	617.5	0.3
AL	41,840	128	889	10.5	618.1	618.1	619.1	1.0
AM	43,055	81	599	15.5	625.9	625.9	625.9	0.0
AN	44,216	264	1,501	6.2	632.2	632.2	633.1	0.9
AO	44,903	551	2,210	4.2	634.3	634.3	635.3	1.0
AP	46,117	688	1,473	6.3	637.9	637.9	638.7	0.8
AQ	46,856	145	728	11.4	643.1	643.1	643.1	0.0
AR	47,015	265	1,323	6.3	645.3	645.3	646.0	0.7
AS	48,124	152	703	11.8	648.7	648.7	648.8	0.1
AT	49,549	102	776	10.7	654.5	654.5	655.4	0.9
AU	50,764	103	689	12.0	659.1	659.1	659.5	0.4
AV	51,872	145	904	9.1	664.4	664.4	664.6	0.2
AW	52,876	189	912	9.1	667.6	667.6	668.2	0.6
AX	53,140	338	1,560	5.3	673.3	673.3	673.3	0.0
AY	54,196	263	884	9.4	677.5	677.5	677.6	0.1
AZ	55,199	132	732	9.0	682.6	682.6	683.6	1.0
BA	55,991	108	476	13.9	687.7	687.7	687.7	0.0
BB	56,994	169	1,011	6.5	692.4	692.4	693.4	1.0

[1] FEET ABOVE CONFLUENCE WITH WINOOSKI RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

HUNTINGTON RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BC	58,314	97	571	11.6	698.0	698.0	698.3	0.3
BD	59,740	83	551	12.0	705.9	705.9	706.6	0.7
BE	59,898	73	691	9.6	710.1	710.1	710.1	0.0
BF	60,479	68	565	11.7	711.2	711.2	711.2	0.0
BG	61,376	73	584	11.3	714.7	714.7	715.2	0.5
BH	61,535	214	868	7.6	716.2	716.2	716.8	0.6
BI	62,063	98	533	10.9	719.3	719.3	719.3	0.0
BJ	62,802	246	1,051	5.5	722.8	722.8	723.8	1.0
BK	63,647	324	950	6.1	726.8	726.8	727.3	0.5
BL	64,861	520	1,400	4.1	732.6	732.6	733.4	0.8
BM	66,604	79	435	13.3	744.0	744.0	744.0	0.0
BN	66,973	83	466	12.4	748.2	748.2	748.2	0.0
BO	67,448	151	743	7.8	751.2	751.2	751.9	0.7
BP	68,188	95	430	13.5	754.9	754.9	754.9	0.0

[1] FEET ABOVE CONFLUENCE WITH WINOOSKI RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

HUNTINGTON RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	2,000	12,098	2.8	101.6	99.4 [2]	100.4	1.0
B	1,985	850	7,325	4.5	101.6	100.3 [2]	101.1	0.8
C	3,830	500	5,665	5.9	101.6	101.1 [2]	101.9	0.8
D	5,120	370	5,111	6.5	101.8	101.8	102.6	0.8
E	6,630	395	5,649	5.9	103.2	103.2	103.9	0.7
F	8,552	305	5,000	6.7	104.3	104.3	104.9	0.6
G	9,080	505	7,367	4.5	105.5	105.5	105.7	0.2
H	11,515	480	7,136	4.7	106.1	106.1	106.4	0.3
I	13,575	1,238	9,956	3.3	106.9	106.9	107.1	0.2
J	14,385	1,350	10,620	3.1	107.1	107.1	107.4	0.3
K	15,405	1,480	12,591	2.6	107.4	107.4	107.8	0.4
L	18,215	2,700	17,812	1.9	108.1	108.1	108.6	0.5
M	19,425	2,650	19,909	1.7	108.4	108.4	108.9	0.5
N	21,795	1,400	13,034	2.6	108.8	108.8	109.5	0.7
O	23,365	650	8,489	3.9	109.3	109.3	110.1	0.8
P	24,615	330	6,697	5.0	109.8	109.8	110.5	0.7
Q	24,725	335	6,567	5.1	110.2	110.2	110.9	0.7
R	25,525	410	7,570	4.4	110.7	110.7	111.4	0.7
S	27,315	350	6,342	5.3	111.8	111.8	112.4	0.6
T	27,575	325	4,895	6.8	111.8	111.8	112.4	0.6
U	27,985	367	4,348	7.7	153.6	153.6	153.6	0.0
V	28,185	347	12,066	2.8	154.5	154.5	154.5	0.0
W	29,410	205	8,159	4.1	154.5	154.5	154.5	0.0
X	30,475	325	9,298	3.6	154.7	154.7	154.7	0.0
Y	34,605	520	11,384	2.9	155.2	155.2	155.2	0.0
Z	35,885	550	18,111	1.8	155.4	155.4	155.4	0.0
AA	37,125	340	5,789	5.8	155.4	155.4	155.4	0.0

[1] FEET ABOVE CONFLUENCE WITH LAKE CHAMPLAIN

[2] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM LAKE CHAMPLAIN

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

LAMOILLE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	37,315	303	5,054	6.6	155.4	155.4	155.4	0.0
AC	38,630	340	5,370	6.2	156.2	156.2	156.2	0.0
AD	40,270	327	4,893	6.8	157.0	157.0	157.1	0.1
AE	42,085	466	3,047	10.9	157.9	157.9	158.3	0.4
AF	42,460	380	4,514	7.4	160.2	160.2	160.3	0.1
AG	43,495	950	6,932	4.8	162.4	162.4	162.7	0.3
AH	44,205	326	3,119	10.7	255.3	255.3	255.3	0.0
AI	44,345	240	5,176	6.4	256.5	256.5	256.5	0.0
AJ	45,035	350	5,546	6.0	256.9	256.9	256.9	0.0
AK	45,745	177	2,409	13.8	256.9	256.9	256.9	0.0
AL	46,275	160	1,776	18.8	259.4	259.4	259.7	0.3
AM	46,380	220	2,971	11.2	269.1	269.1	269.1	0.0
AN	46,640	387	9,569	3.5	289.6	289.6	289.6	0.0

[1] FEET ABOVE CONFLUENCE WITH LAKE CHAMPLAIN

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

LAMOILLE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	8,925	81	681	3.8	320.8	320.8	321.6	0.8
B	10,647	270	1,646	1.6	321.4	321.4	322.4	1.0
C	10,852	500	2,424	1.1	321.5	321.5	322.5	1.0
D	12,720	1,650	7,944	0.3	321.5	321.5	322.5	1.0
E	16,440	435	1,616	1.6	321.6	321.6	322.6	1.0
F	17,460	325	1,271	2.0	321.9	321.9	322.9	1.0
G	20,385	780	2,492	1.0	323.3	323.3	324.3	1.0
H	22,704	175	634	4.1	325.4	325.4	326.4	1.0
I	24,622	310	1,286	0.9	326.8	326.8	327.8	1.0
J	24,870	310	1,383	0.8	327.7	327.7	328.4	0.7
K	25,581	150	777	1.4	327.7	327.7	328.5	0.8
L	26,449	46	303	3.7	327.7	327.7	328.7	1.0
M	26,570	49	243	4.6	328.3	328.3	328.8	0.5

[1] FEET ABOVE DORSET STREET

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

LAPLATTE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	650	67	242	8.1	496.0	496.0	496.0	0.0
B	880	100	522	3.7	499.1	499.1	499.1	0.0
C	4,285	120	278	7.0	509.8	509.8	510.2	0.4
D	7,355	90	385	5.1	527.9	527.9	528.3	0.4
E	11,645	220	290	6.7	564.4	564.4	564.4	0.0
F	12,885	50	251	7.8	573.1	573.1	573.9	0.8
G	14,280	53	183	10.6	589.7	589.7	589.7	0.0
H	15,175	60	256	7.6	600.4	600.4	600.5	0.1
I	15,550	50	266	7.3	603.8	603.8	603.8	0.0

[1] FEET ABOVE CONFLUENCE WITH BROWNS RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

LEE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	8,350	151	592	2.2	109.6	109.6	110.6	1.0
B	8,600	188	1058	1.3	111.0	111.0	112.0	1.0
C	12,905	95	319	3.6	129.5	129.5	130.5	1.0
D	13,105	143	694	1.7	132.8	132.8	133.8	1.0
E	14,190	75	208	5.4	144.5	144.5	145.5	1.0

[1] FEET ABOVE CONFLUENCE WITH LAPLATTE RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

McCABES BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	455	70	254	5.9	107.9	107.9	108.9	1.0
B	645	104	1276	1.2	124.3	124.3	125.3	1.0
C	2,240	54	289	5.2	141.3	141.3	142.3	1.0
D	2,640	60	500	3.0	147.2	147.2	148.2	1.0
E	2,880	274	2938	0.5	152.7	152.7	153.7	1.0
F	5,140	142	746	1.1	153.1	153.1	154.1	1.0
G	5,390	214	1197	0.7	154.2	154.2	155.2	1.0
H	6,290	63	247	3.3	156.1	156.1	157.1	1.0
I	6,535	111	667	1.2	161.5	161.5	162.5	1.0
J	8,420	138	423	1.8	167.9	167.9	168.9	1.0
K	9,520	96	247	3.0	171.5	171.5	172.5	1.0

[1] FEET ABOVE CONFLUENCE WITH SHELBURNE BAY

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

MUNROE BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	130	*	*	*	324.6	*	*	*
B	1,458	*	*	*	326.4	*	*	*
C	2,457	*	*	*	331.3	*	*	*
D	2,556	*	*	*	334.0	*	*	*
E	3,275	*	*	*	334.7	*	*	*
F	3,680	*	*	*	337.4	*	*	*
G	5,635	*	*	*	360.1	*	*	*
H	5,708	*	*	*	361.5	*	*	*

[1] FEET ABOVE CONFLUENCE WITH LAPLATTE RIVER

* NO DATA AVAILABLE

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

PATRICK BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,360	*	*	*	346.2	*	*	*
B	1,438	*	*	*	346.2	*	*	*
C	1,885	*	*	*	346.3	*	*	*
D	1,941	*	*	*	346.4	*	*	*
E	2,375	*	*	*	346.5	*	*	*
F	2,636	*	*	*	346.5	*	*	*
G	2,728	*	*	*	346.6	*	*	*
H	3,243	*	*	*	346.8	*	*	*
I	4,974	*	*	*	360.1	*	*	*

[1] FEET ABOVE CONFLUENCE WITH LAPLATTE RIVER

* DATA NOT AVAILABLE

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

THE CANAL

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	230	230	723	3.3	648.1	648.1	649.1	1.0
B	1,515	85	246	9.6	659.4	659.4	659.4	0.0
C	3,630	72	255	9.3	676.4	676.4	676.4	0.0
D	4,610	177	795	3.0	679.4	679.4	680.1	0.7
E	6,600	60	377	6.3	684.1	684.1	684.6	0.5
F	7,840	450	1923	1.2	687.0	687.0	688.0	1.0
G	12,200	53	297	5.1	700.5	700.5	701.5	1.0

[1] FEET ABOVE CONFLUENCE WITH BROWNS RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

THE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	230	*	*	*	336.5	*	*	*
B	1,015	*	*	*	340.7	*	*	*

[1] FEET ABOVE CONFLUENCE WITH PATRICK BROOK

* NO DATA AVAILABLE

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

UNNAMED DIVERSION CHANNEL

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	139	275	5,401	8.7	101.6	99.5 [2]	100.5	1.0
B	6,130	3,320	25,895	1.8	104.1	104.1	104.7	0.6
C	12,719	1,365	14,516	3.3	106.2	106.2	107.0	0.8
D	14,950	875	11,057	4.3	107.0	107.0	107.9	0.9
E	15,359	670	10,210	4.6	107.2	107.2	108.0	0.8
F	19,261	2,417	22,352	2.1	108.6	108.6	109.4	0.8
G	22,865	2,125	24,428	1.9	109.4	109.4	110.2	0.8
H	26,639	3,115	30,610	1.5	109.9	109.9	110.7	0.8
I	31,031	3,495	31,977	1.5	110.4	110.4	111.3	0.9
J	40,930	4,885	45,646	1.0	111.7	111.7	112.6	0.9
K	45,676	1,010	10,190	4.6	112.1	112.1	113.1	1.0
L	46,847	580	7,946	5.9	112.8	112.8	113.6	0.8
M	48,792	690	11,386	4.1	113.9	113.9	114.8	0.9
N	49,793	367	7,696	6.1	113.9	113.9	114.8	0.9
O	51,798	330	7,799	6.1	115.5	115.5	116.4	0.9
P	53,385	880	18,189	2.6	116.3	116.3	117.2	0.9
Q	54,263	230	3,103	17.9	128.3	128.3	129.0	0.7
R	54,576	191	3,040	18.3	133.3	133.3	133.3	0.0
S	54,789	309	3,203	17.4	144.1	144.1	144.1	0.0
T	54,947	367	5,226	10.7	149.8	149.8	149.8	0.0
U	55,394	349	5,569	10.0	151.0	151.0	151.0	0.0
V	55,819	534	3,687	15.1	158.3	158.3	158.3	0.0
W	57,674	1,446	11,986	4.6	165.1	165.1	165.7	0.6
X	58,709	860	9,997	5.6	165.6	165.6	166.4	0.8
Y	58,824	760	9,561	5.8	165.7	165.7	166.5	0.8
Z	59,124	645	9,550	5.8	165.8	165.8	166.6	0.8
AA	59,424	256	4,050	13.8	165.8	165.8	166.5	0.7

[1] FEET ABOVE CONFLUENCE WITH LAKE CHAMPLAIN

[2] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECT FROM LAKE CHAMPLAIN

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

WINOOSKI RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	60,600	158	2,860	19.5	167.9	167.9	168.9	1.0
AC	61,020	420	21,395	2.6	203.9	203.9	203.9	0.0
AD	61,320	175	7,681	7.3	203.9	203.9	204.9	1.0
AE	64,430	107	3,722	15.0	211.9	211.9	212.0	0.1
AF	66,767	1,200	27,801	2.0	217.7	217.7	217.9	0.2
AG	67,847	1,500	31,603	1.8	217.7	217.7	218.0	0.3
AH	83,097	856	17,448	3.2	218.4	218.4	219.3	0.9
AI	85,227	*	7,420	7.5	218.4	218.4	219.3	0.9
AJ	86,337	*	7,594	7.3	219.0	219.0	219.9	0.9
AK	88,671	1,663	26,636	2.1	220.2	220.2	221.2	1.0
AL	89,936	1,084	18,275	3.0	220.4	220.4	221.4	1.0
AM	91,571	310	5,846	9.5	220.4	220.4	221.4	1.0
AN	92,641	360	6,748	8.3	221.9	221.9	222.8	0.9
AO	93,641	310	5,471	10.2	223.9	223.9	224.6	0.7
AP	95,268	596	27,657	2.0	286.0	286.0	286.8	0.8
AQ	98,535	526	16,087	3.5	286.2	286.2	286.9	0.7
AR	101,988	500	11,834	4.7	286.5	286.5	287.2	0.7
AS	102,434	508	10,771	5.2	287.1	287.1	287.9	0.8
AT	105,763	631	13,770	4.0	288.4	288.4	289.1	0.7
AU	108,163	405	8,051	6.9	289.1	289.1	289.9	0.8
AV	108,425	386	7,453	7.5	289.4	289.4	290.1	0.7
AW	110,166	268	5,641	9.9	290.3	290.3	291.0	0.7
AX	110,692	378	8,509	6.6	291.5	291.5	292.2	0.7
AY	112,154	309	7,110	7.8	292.1	292.1	292.8	0.7
AZ	112,987	653	9,731	5.7	293.9	293.9	294.1	0.2
BA	114,494	1,009	16,757	3.3	294.8	294.8	295.1	0.3
BB	118,605	1,014	14,294	3.9	295.3	295.3	295.9	0.6

[1] FEET ABOVE CONFLUENCE WITH LAKE CHAMPLAIN

* NO DATA AVAILABLE

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

WINOOSKI RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BC	121,956	1,910	23,597	2.4	296.0	296.0	296.7	0.7
BD	123,156	1,670	21,406	2.6	296.7	296.7	297.2	0.5
BE	129,161	1,815	21,160	2.6	297.5	297.5	298.1	0.6
BF	139,236	1,500	19,350	2.9	299.5	299.5	300.4	0.9
BG	140,778	2,699	27,014	2.1	302.2	302.2	302.2	0.0
BH	147,063	782	7,687	7.1	302.2	302.2	302.8	0.6
BI	149,108	1,009	15,438	3.6	304.5	304.5	305.0	0.5
BJ	150,111	610	10,275	5.3	304.6	304.6	305.1	0.5
BK	151,189	256	5,764	9.5	305.5	305.5	306.0	0.5
BL	151,952	226	5,063	10.8	305.9	305.9	306.3	0.4
BM	152,737	628	12,370	4.4	308.0	308.0	308.4	0.4
BN	163,611	493	7,691	7.1	310.3	310.3	310.9	0.6
BO	163,907	606	11,711	4.7	311.3	311.3	311.9	0.6
BP	168,036	653	7,968	6.9	312.6	312.6	313.2	0.6
BQ	168,853	765	11,492	4.8	314.2	314.2	314.8	0.6
BR	170,678	744	8,604	6.4	314.6	314.6	315.2	0.6
BS	173,515	1,309	17,510	3.1	317.3	317.3	317.7	0.4
BT	176,959	1,005	9,775	5.6	318.9	318.9	319.4	0.5
BU	179,487	773	10,016	5.5	320.8	320.8	321.3	0.5
BV	181,881	383	6,015	7.7	324.3	324.3	324.5	0.2
BW	183,027	500	8,186	5.6	325.7	325.7	326.4	0.7
BX	186,891	359	5,857	7.9	328.8	328.8	329.3	0.5
BY	187,633	473	8,048	5.7	330.1	330.1	330.6	0.5
BZ	190,013	935	12,450	3.7	331.8	331.8	332.6	0.8
CA	191,377	567	6,250	7.4	331.9	331.9	332.6	0.7
CB	193,184	899	11,332	4.1	334.8	334.8	335.4	0.6
CC	194,889	961	12,781	3.6	336.0	336.0	336.7	0.7

[1] FEET ABOVE CONFLUENCE WITH LAKE CHAMPLAIN

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

FLOODWAY DATA

WINOOSKI RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
CD	199,744	312	5,931	7.8	338.4	338.4	339.2	0.8
CE	203,809	409	7,106	6.5	342.2	342.2	342.6	0.4
CF	206,754	367 / 297 [2]	5,343	8.6	343.9	343.9	344.2	0.3
CG	208,386	516 / 279 [2]	7,593	6.1	347.0	347.0	347.4	0.4
CH	209,770	447 / 202 [2]	7,570	6.1	350.0	350.0	350.2	0.2
CI	211,236	450 / 218 [2]	7,048	6.5	351.6	351.6	351.9	0.3
CJ	212,665	410 / 245 [2]	8,403	5.5	353.9	353.9	354.1	0.2
CK	213,336	307 / 206 [2]	5,814	7.9	354.8	354.8	355.1	0.3

[1] FEET ABOVE CONFLUENCE WITH LAKE CHAMPLAIN
[2] TOTAL WIDTH / WIDTH WITHIN CHITTENDEN COUNTY

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

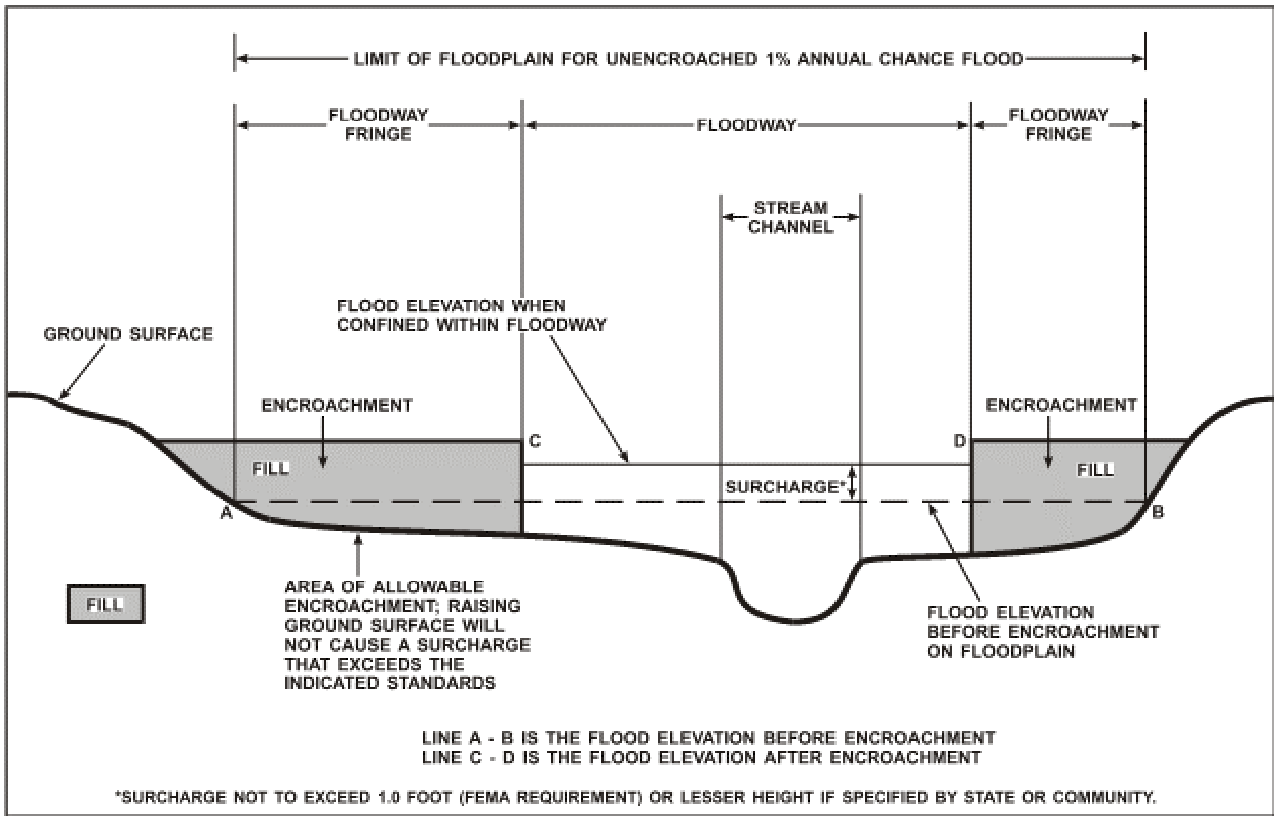
CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

FLOODWAY DATA

WINOOSKI RIVER

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

FIGURE 1 – FLOODWAY SCHEMATIC



For this countywide FIS, floodway modeling for the Browns and Winooski Rivers was performed utilizing the FEMA recommended Method 4 which is based on equal conveyance reduction with floodway encroachment surcharge of 1.0 foot. After calibrating the model Method 4 was converted to Method 1 and was manually adjusted wherever needed to match it to the effective floodway.

5.0 INSURANCE APPLICATION

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

Zone A

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

Zone AE

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

Zone AH

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

Zone X

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

Zone D

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

6.0 FLOOD INSURANCE RATE MAP

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

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

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

The countywide FIRM presents flooding information for the entire geographic area of Chittenden County. Previously, separate FIRMs were prepared for each incorporated community of the County identified as flood prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 13, “Community Map History”.

7.0 OTHER STUDIES

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Chittenden County has been compiled in this FIS. Therefore, this FIS supersedes all previously printed FIS reports, FIRMs, and/or FHBMs for all of the incorporated jurisdictions within Chittenden County and should be considered authoritative for the purposes of the NFIP.

FISs have been prepared for adjacent communities and/or counties and are in agreement with this FIS (msc.fema.gov).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA Region I, 99 High Street, 6th Floor, Boston, MA 02110.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Bolton, Town of	February 21, 1975	None	April 1, 1981	None
*Buels Gore	N/A	None	N/A	None
Burlington, City of	July 19, 1974	March 4, 1977	November 15, 1978	January 16, 1987
Charlotte, Town of	January 3, 1975	None	September 3, 1980	None
Colchester, Town of	August 23, 1974	October 8, 1976	March 1, 1982	None
Essex, Town of	September 20, 1974	December 10, 1976	January 16, 1981	March 25, 1983
Essex Junction, Village of	June 28, 1974	July 30, 1976	January 2, 1981	None
Hinesburg, Town of	January 31, 1975	February 7, 1978	September 27, 1985	August 4, 2005
Huntington, Town of	July 26, 1974	May 14, 1976	July 17, 1978	None
Jericho, Town of	June 14, 1974	None	June 1, 1981	None
Milton, Town of	July 26, 1974	April 15, 1977	January 6, 1982	None
Richmond, Town of	March 22, 1974	June 4, 1976	July 5, 1982	None

*No Special Flood Hazard Areas Identified

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Shelburne, Town of	December 13, 1974	April 9, 1976	December 16, 1980	None
South Burlington, City of	November 1, 1974	October 8, 1976	March 16, 1981	None
St. George, Town of	April 11, 1975	None	September 27, 1985	None
Underhill, Town of	May 31, 1974	March 4, 1977	June 15, 1988	None
Westford, Town of	January 3, 1975	None	July 18, 2011	None
Williston, Town of	March 15, 1974	March 4, 1977	March 2, 1981	None
Winooski, City of	February 1, 1974	None	August 1, 1978	February 4, 1987

*No Special Flood Hazard Areas Identified

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

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FLOOD INSURANCE STUDY

VOLUME 2 OF 2

CHITTENDEN COUNTY, VERMONT
(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
BOLTON, TOWN OF	500308
BUELS GORE*	500112
BURLINGTON, CITY OF	500032
CHARLOTTE, TOWN OF	500309
COLCHESTER, TOWN OF	500033
ESSEX, TOWN OF	500034
ESSEX JUNCTION, VILLAGE OF	500035
HINESBURG, TOWN OF	500322
HUNTINGTON, TOWN OF	500036
JERICHO, TOWN OF	500037
MILTON, TOWN OF	500038
RICHMOND, TOWN OF	500040
SHELBURNE, TOWN OF	500193
SOUTH BURLINGTON, CITY OF	500195
ST. GEORGE, TOWN OF	500320
UNDERHILL, TOWN OF	500042
WESTFORD, TOWN OF	500203
WILLISTON, TOWN OF	500043
WINOOSKI, CITY OF	500044

*No Special Flood Hazard Areas Identified

REVISED
AUGUST 4, 2014

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
50007CV002B

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.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult community officials and check the Community Map Repository to obtain the most current FIS components. Selected Flood Insurance Rate Map panels for this community contain the most current information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways and cross sections). In addition, former flood hazard zone designations have been changed as follows.

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

Initial Countywide FIS Effective Date: July 18, 2011

Revised Countywide FIS Effective Date: August 4, 2014

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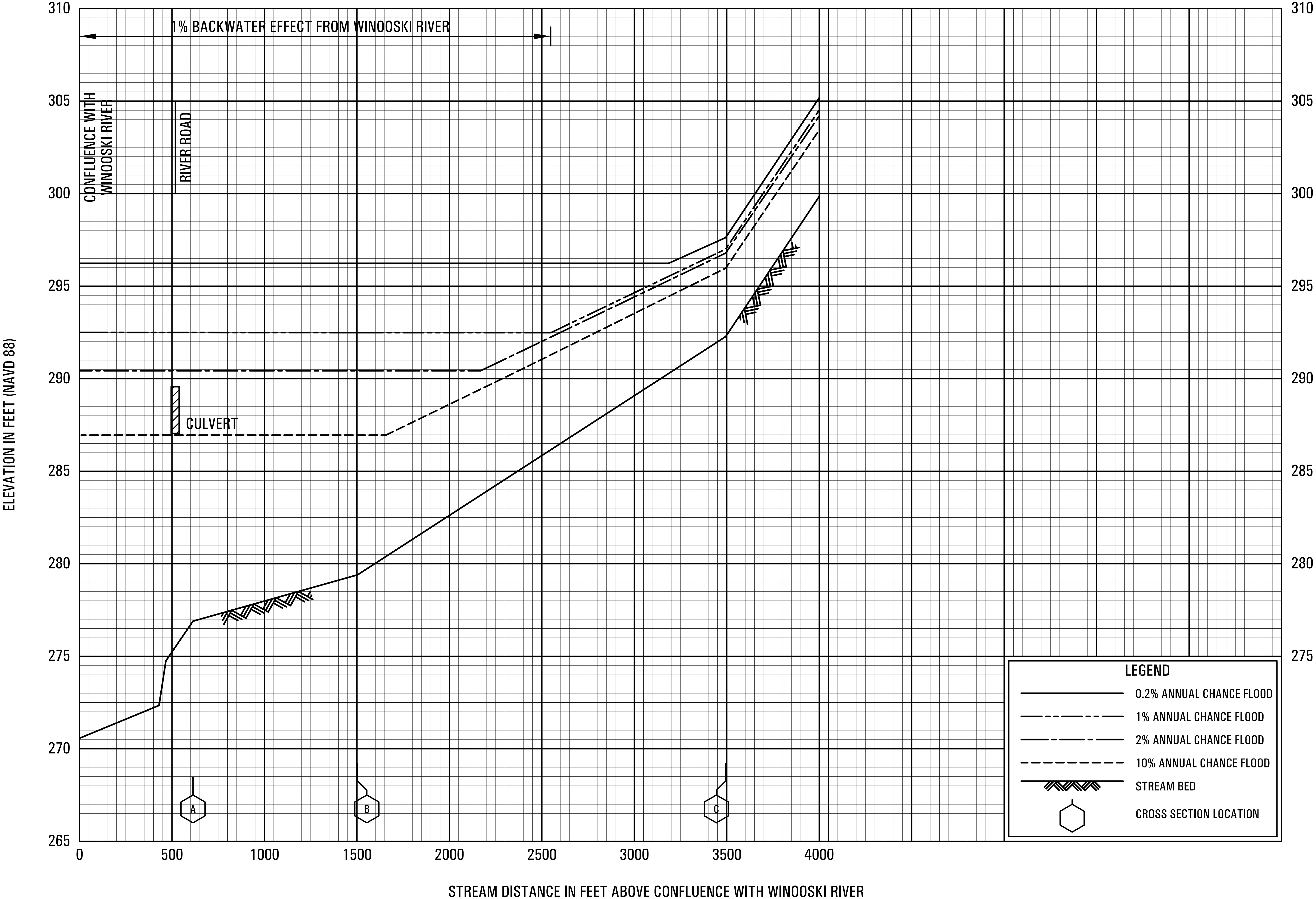

FLOOD PROFILES

ALDER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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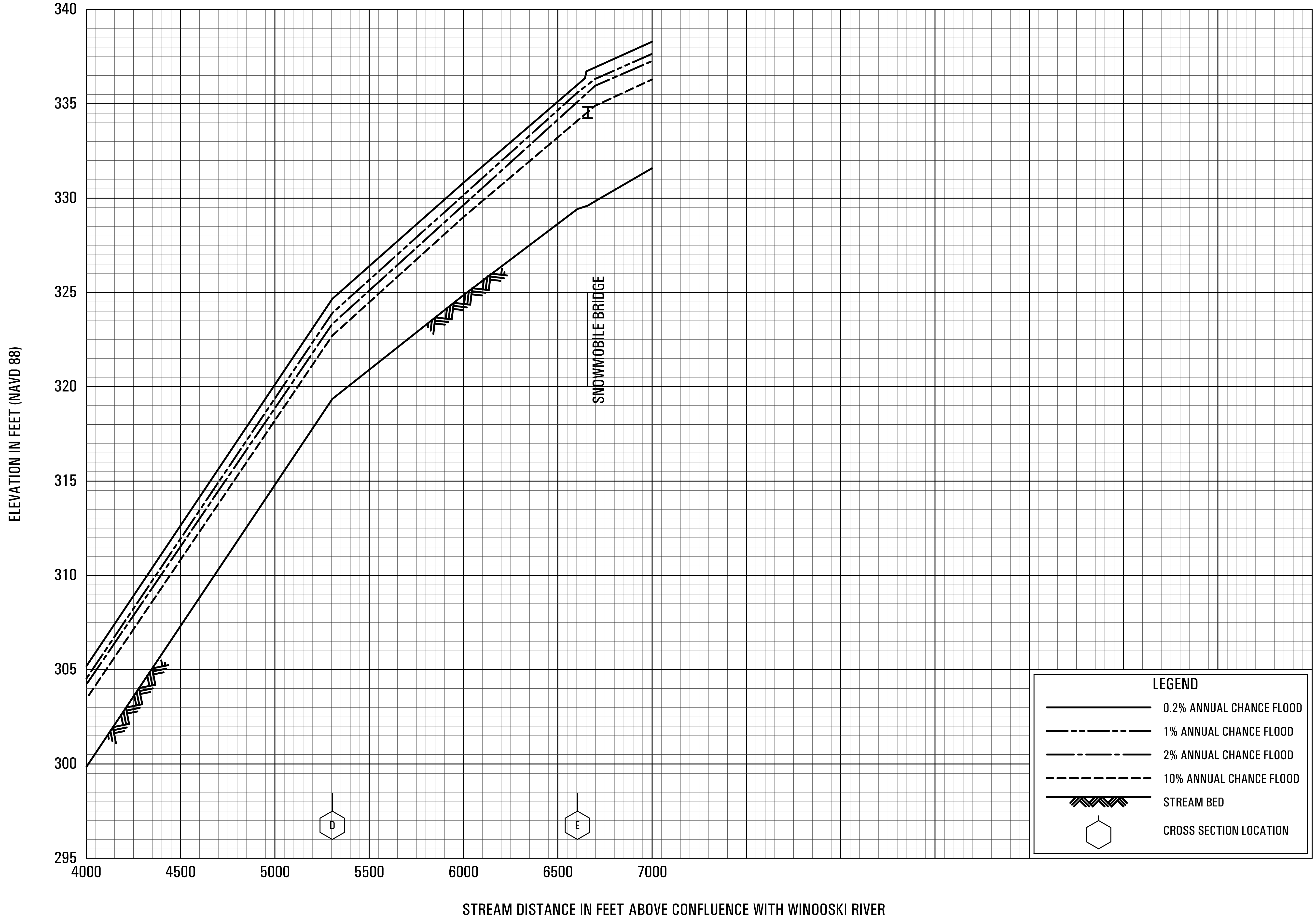

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ALDER BROOK

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CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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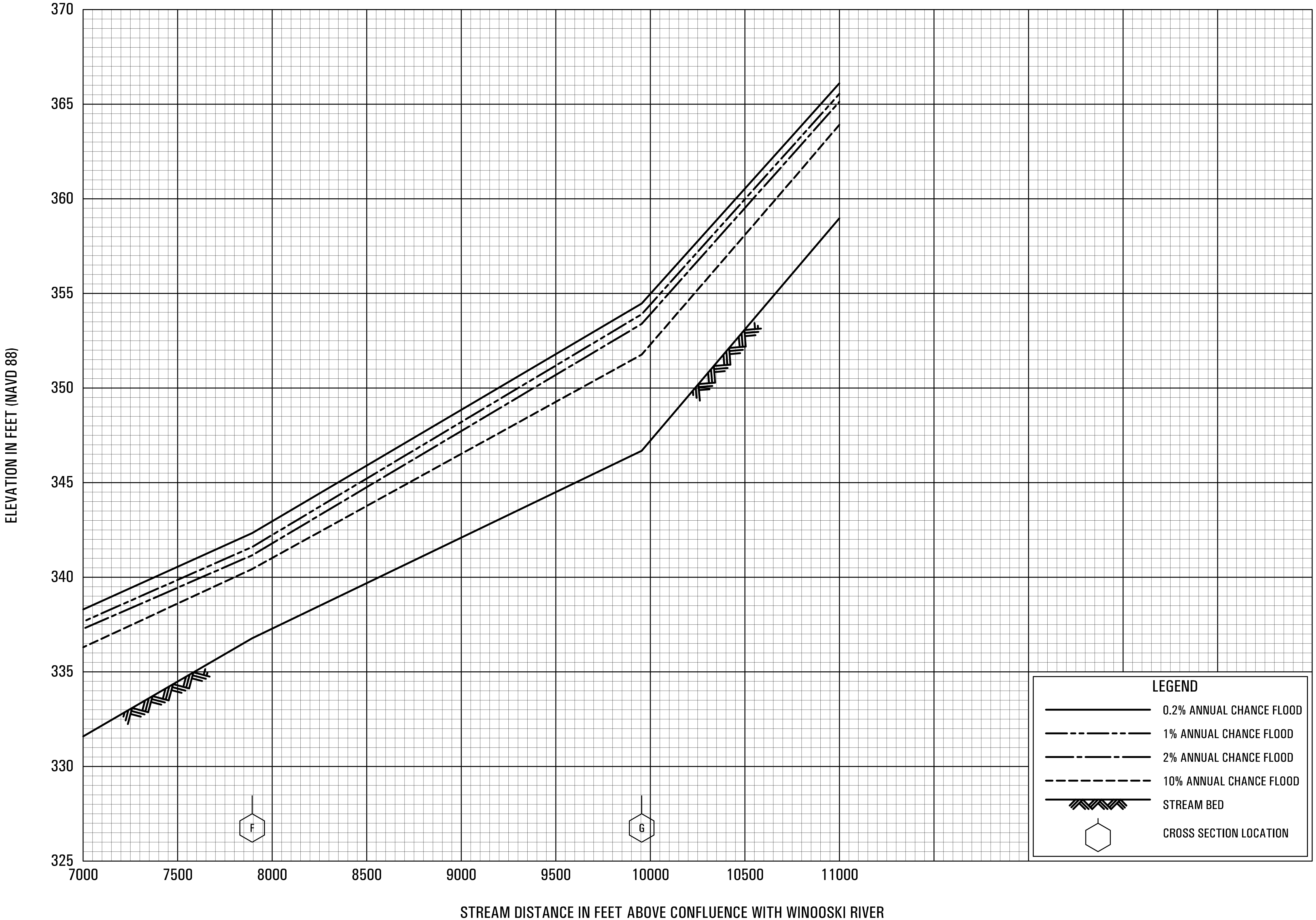

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ALDER BROOK

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CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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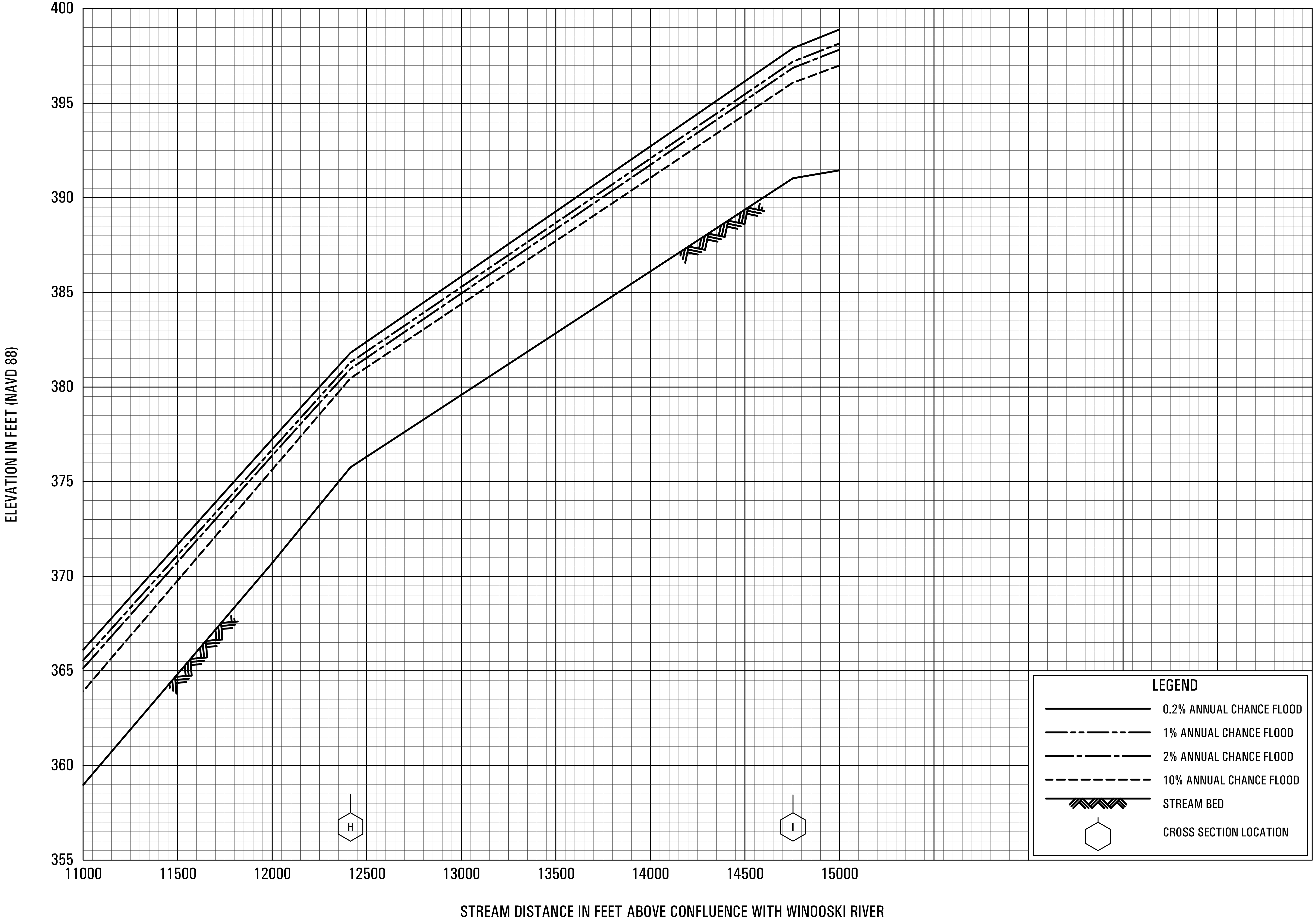

FLOOD PROFILES

ALDER BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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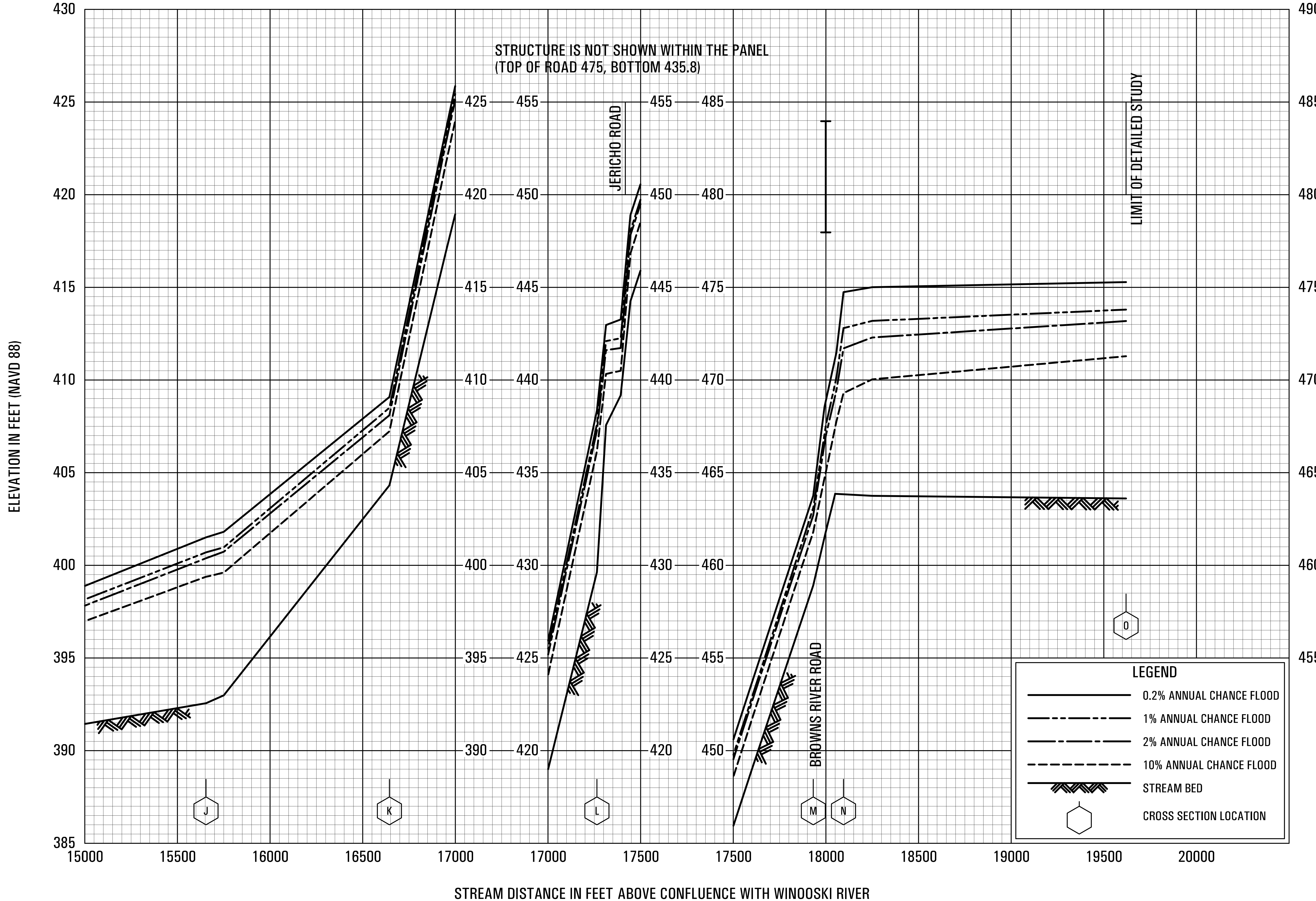

FLOOD PROFILES

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FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

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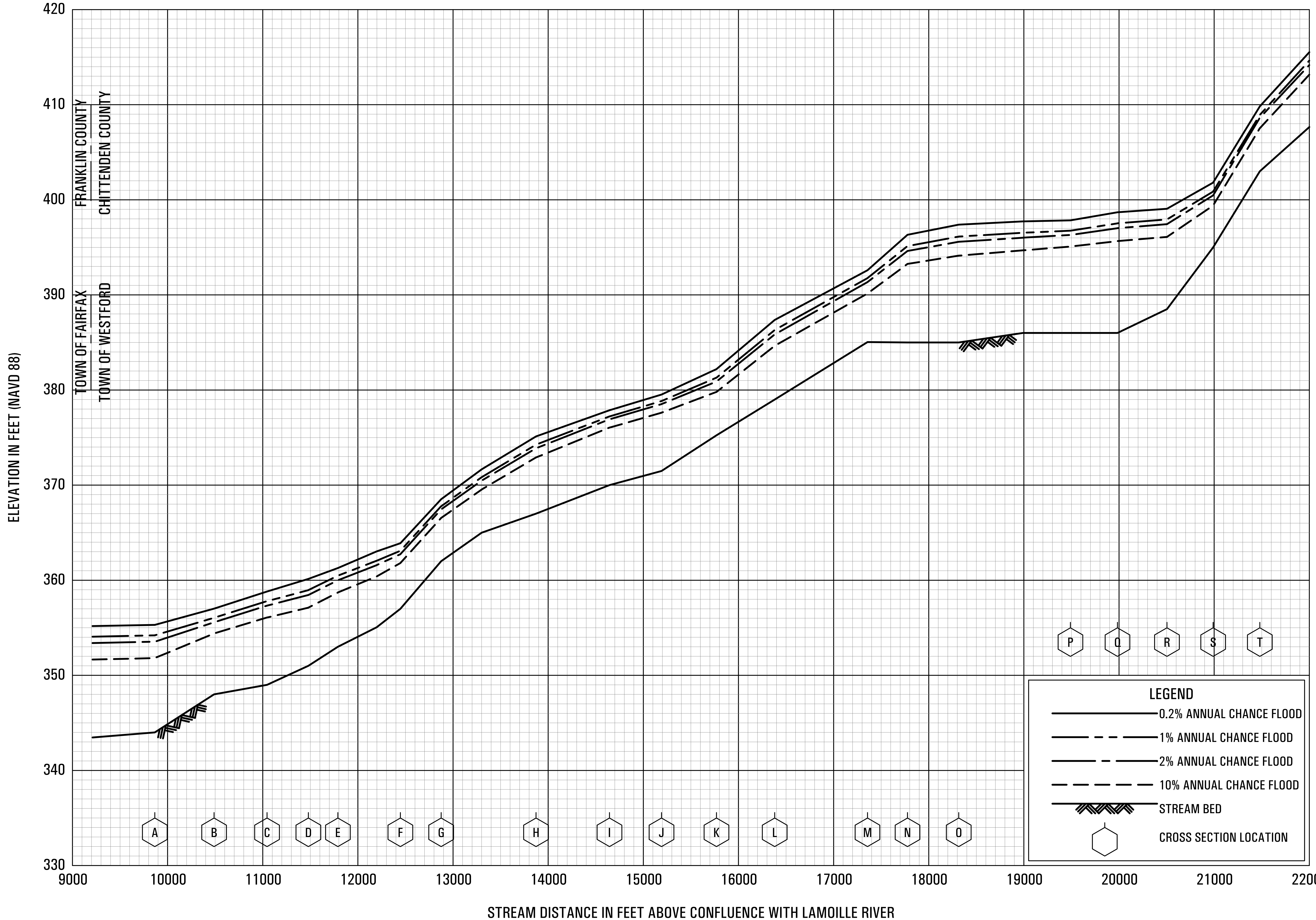

FLOOD PROFILES

BROWNS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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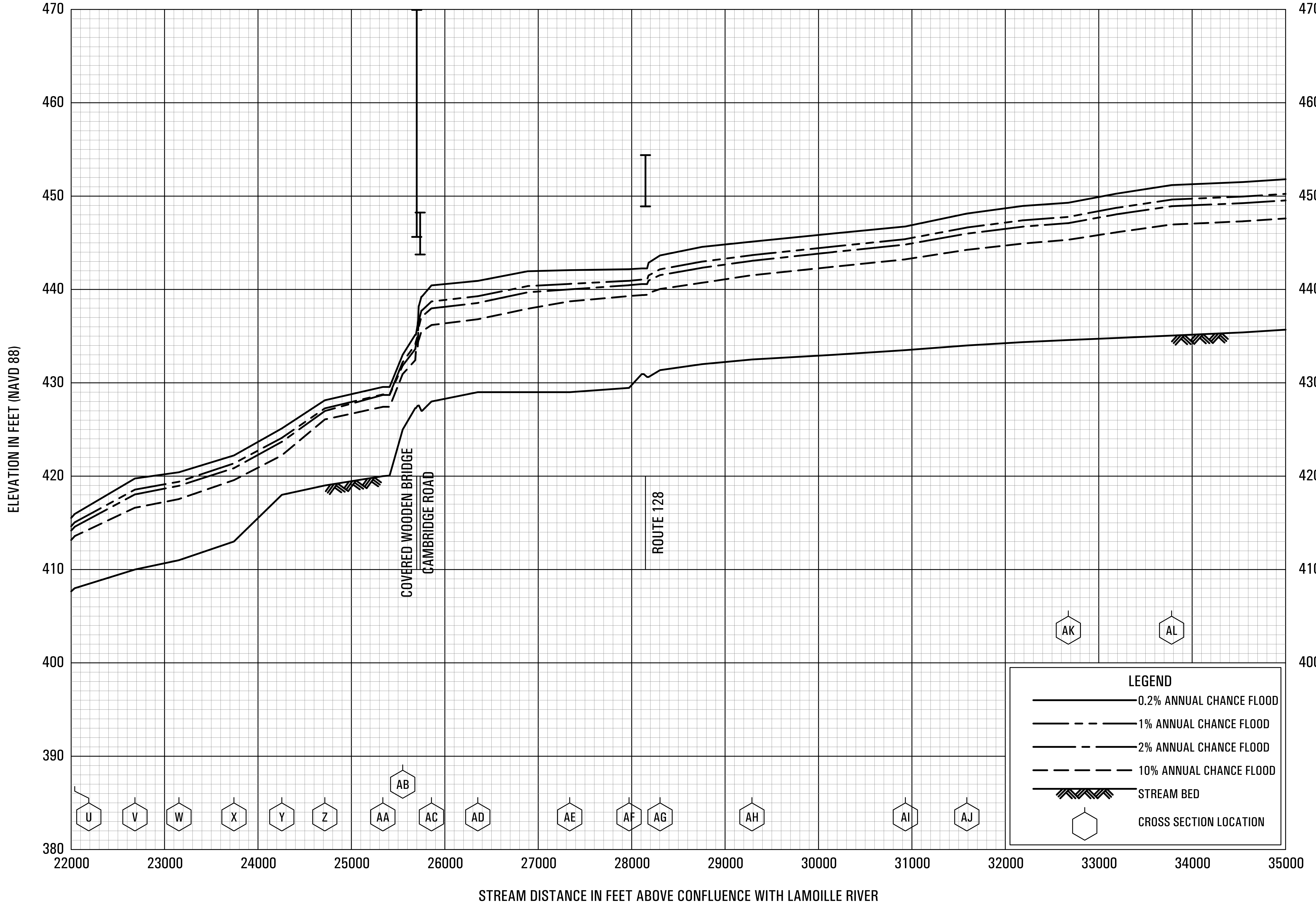

FLOOD PROFILES

BROWNS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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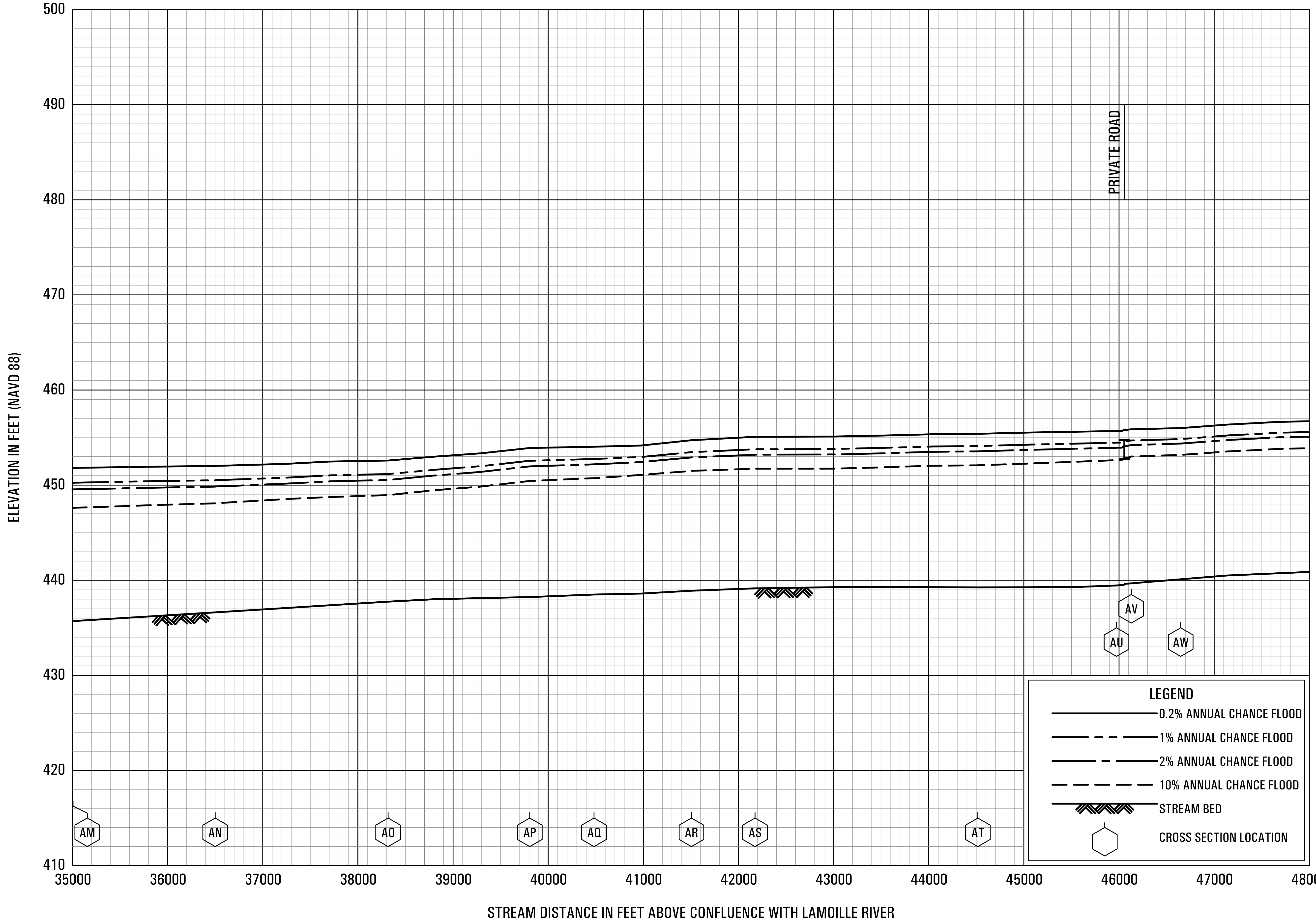

FLOOD PROFILES

BROWNS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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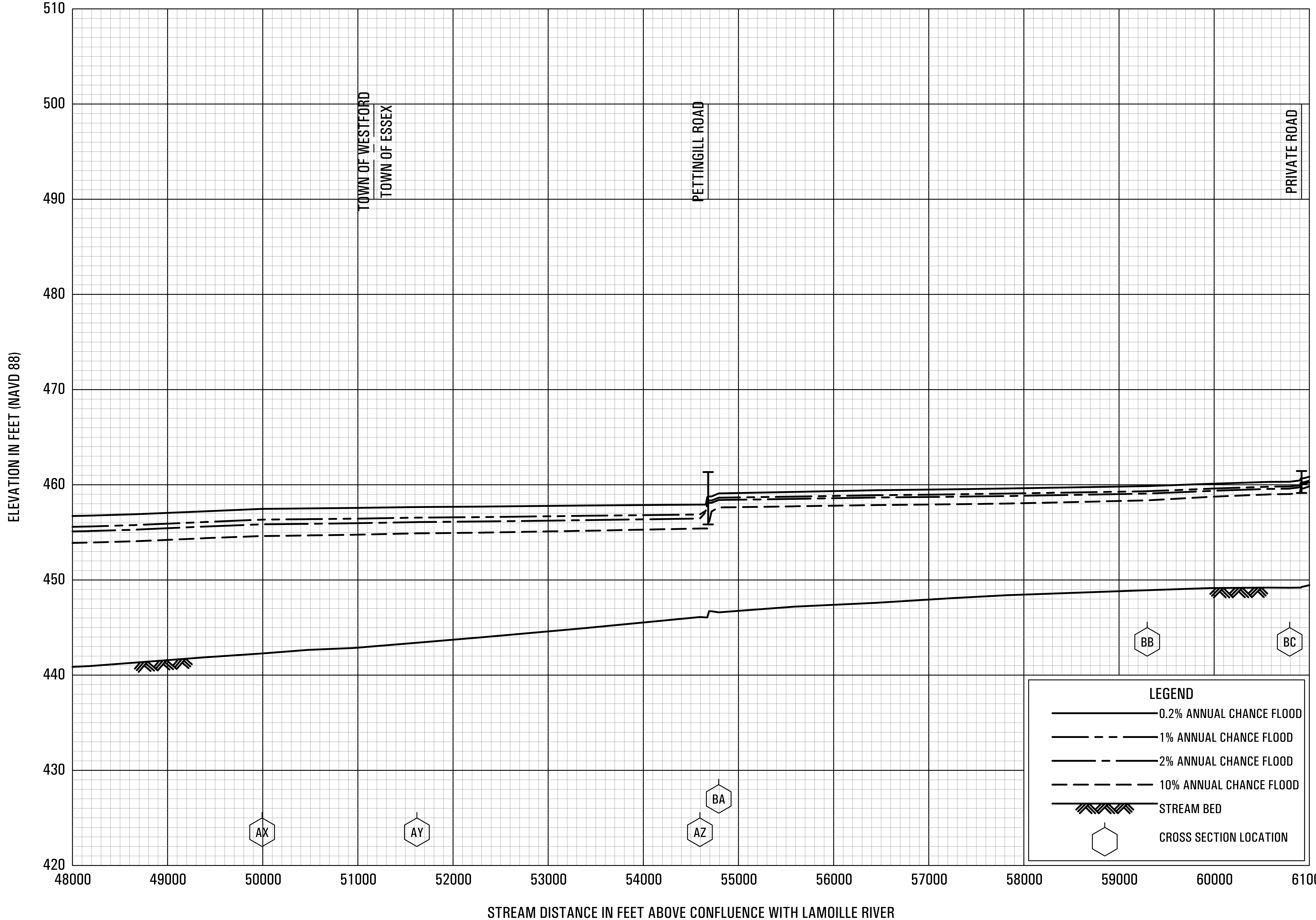

FLOOD PROFILES

BROWNS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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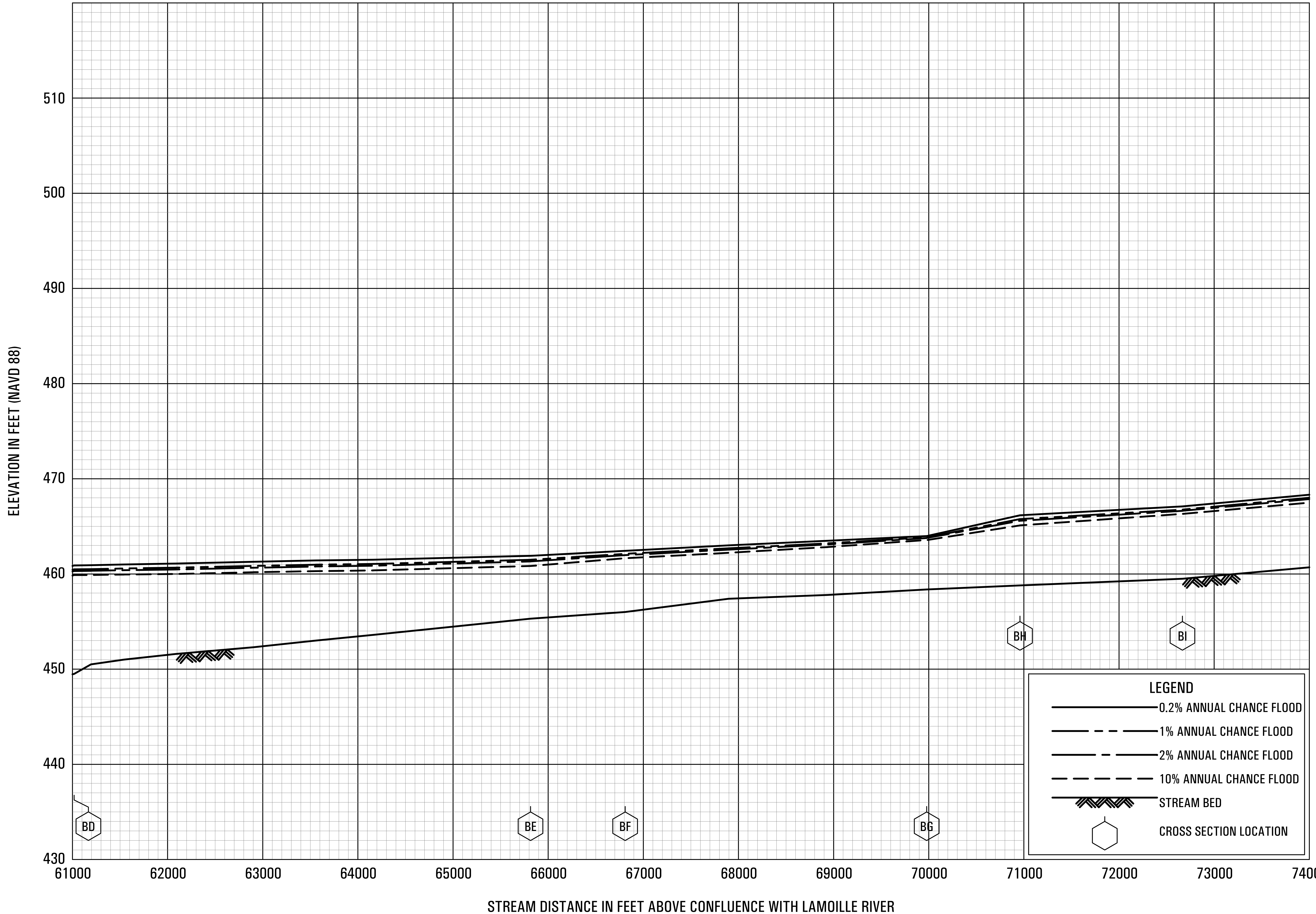

FLOOD PROFILES

BROWNS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

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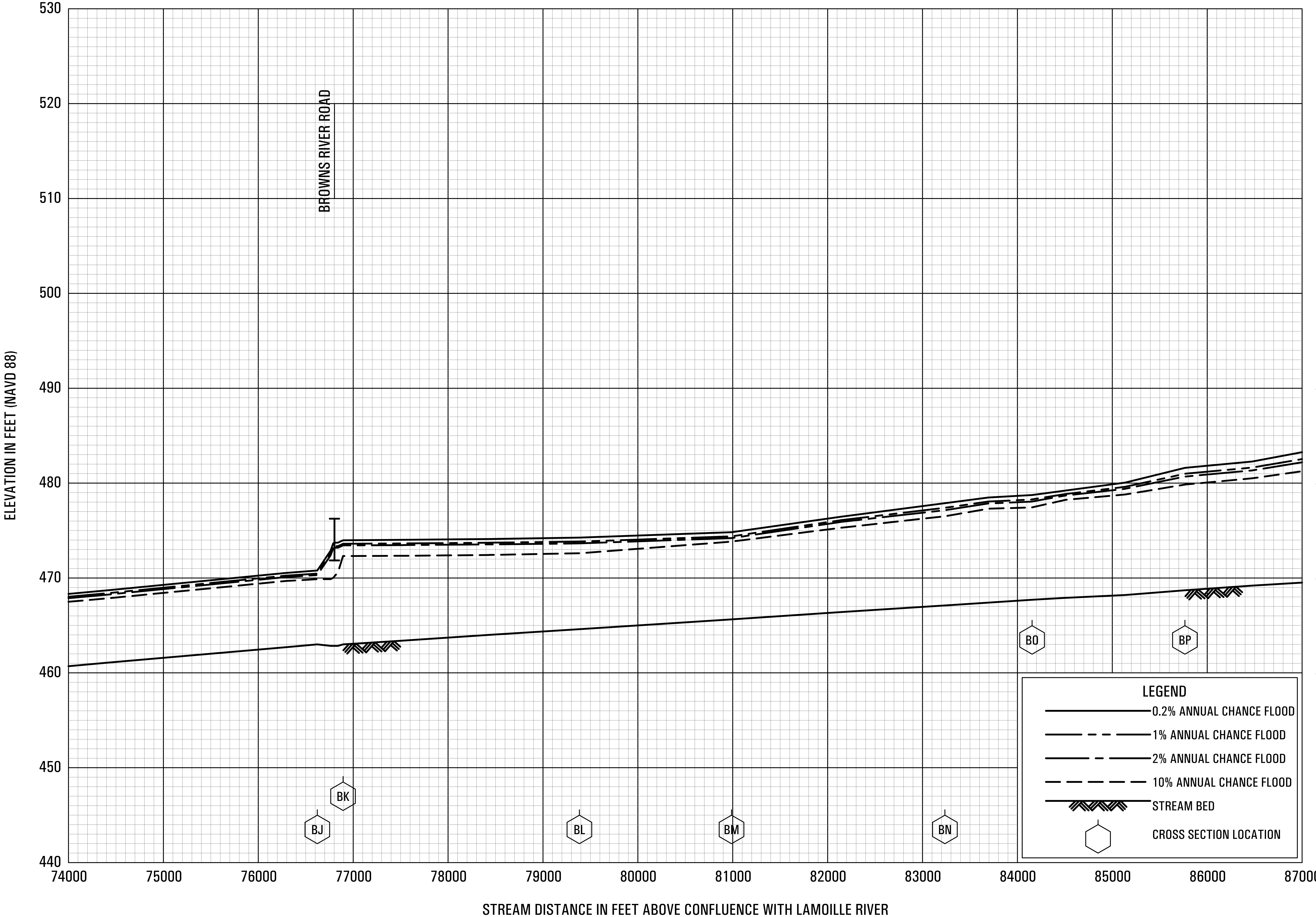

FLOOD PROFILES

BROWNS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

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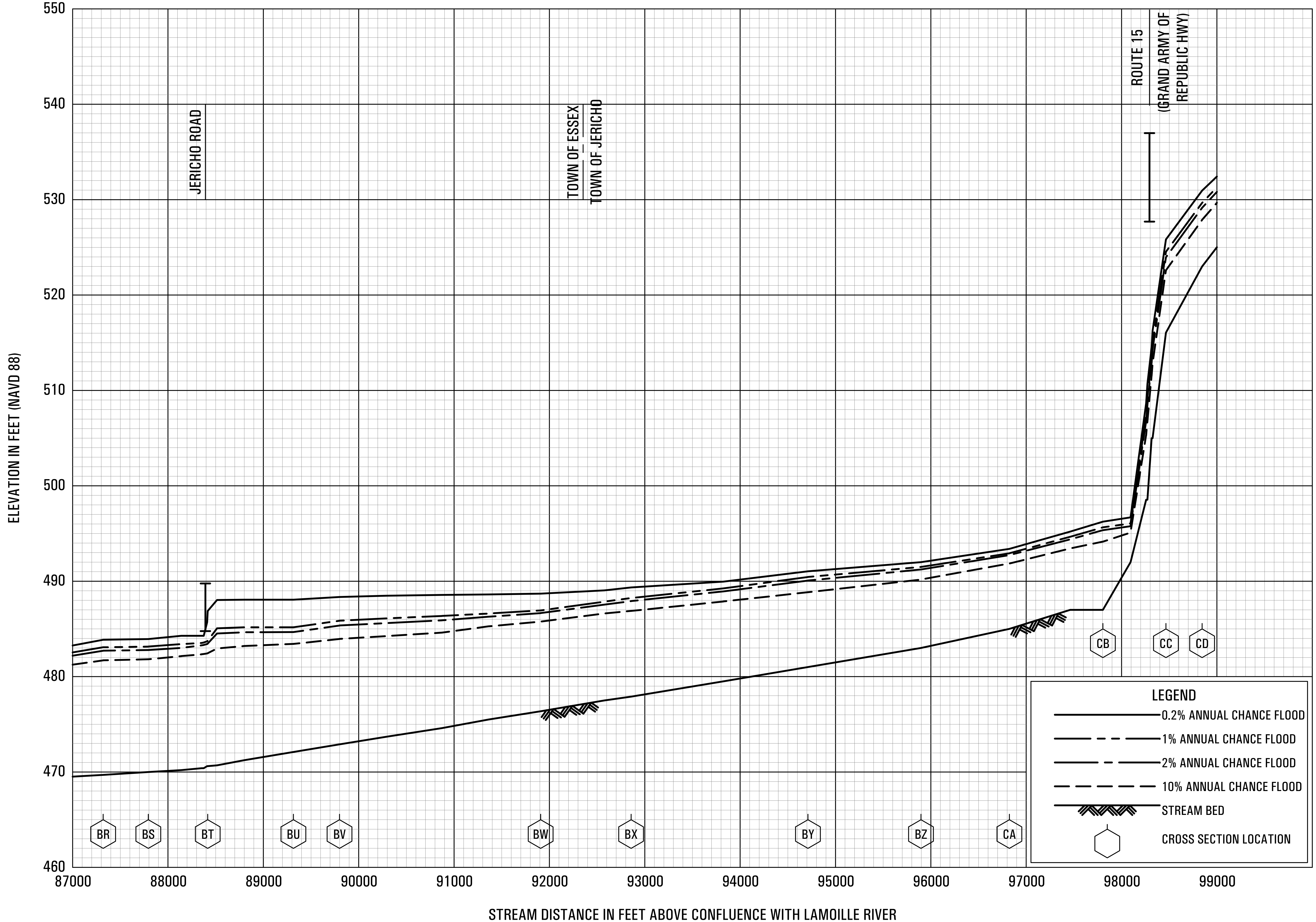

FLOOD PROFILES

BROWNS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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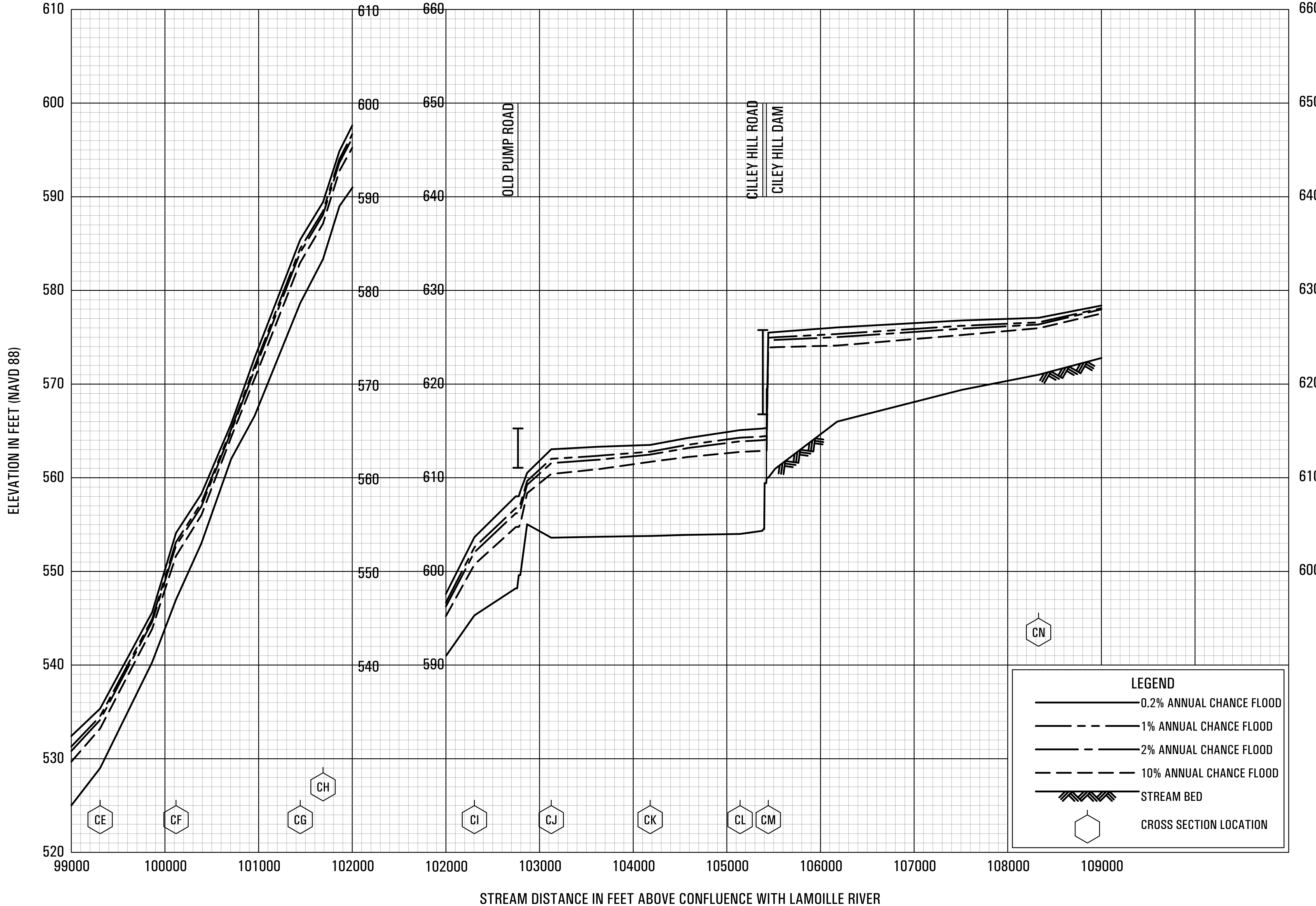

FLOOD PROFILES

BROWNS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

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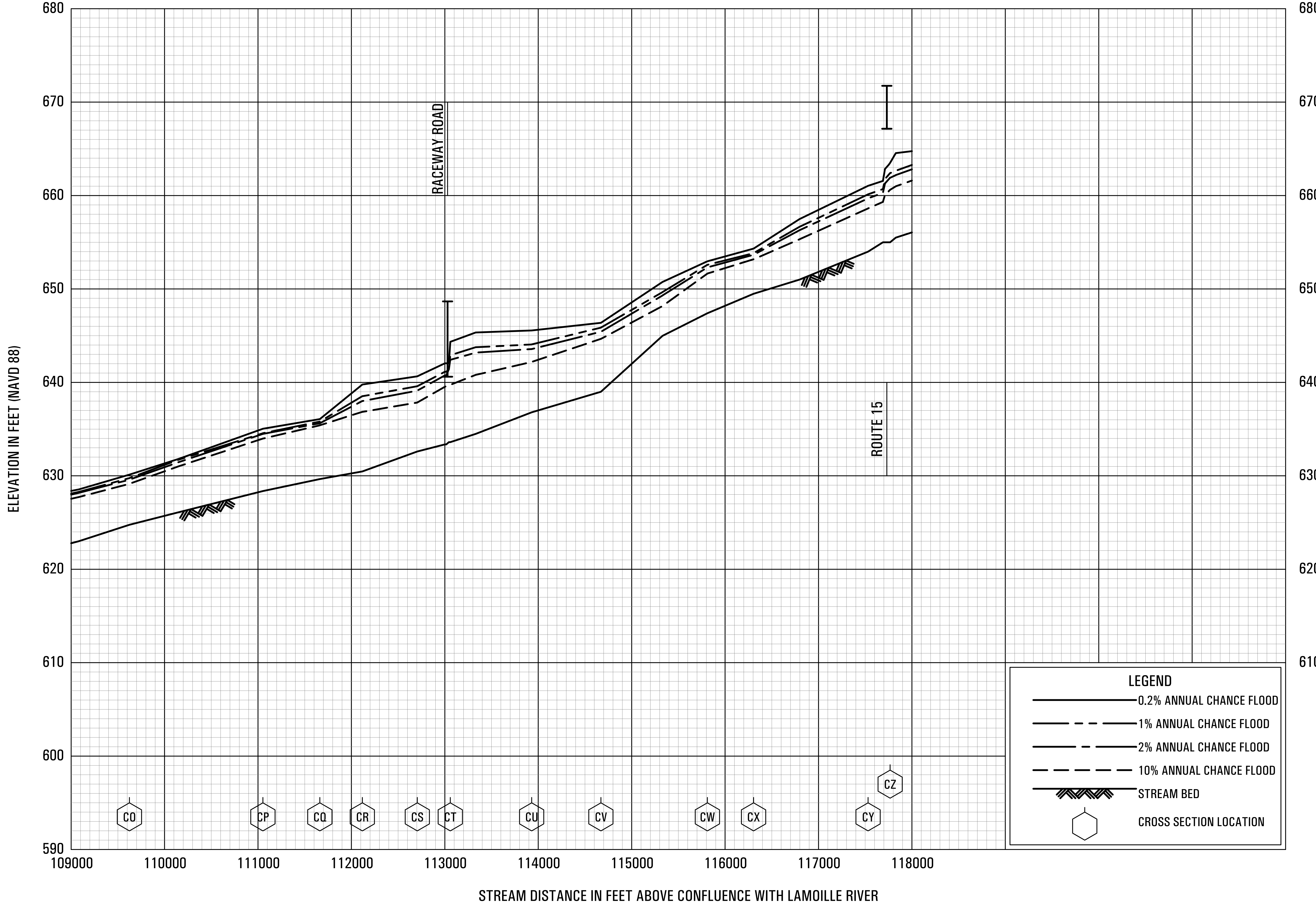

FLOOD PROFILES

BROWNS RIVER

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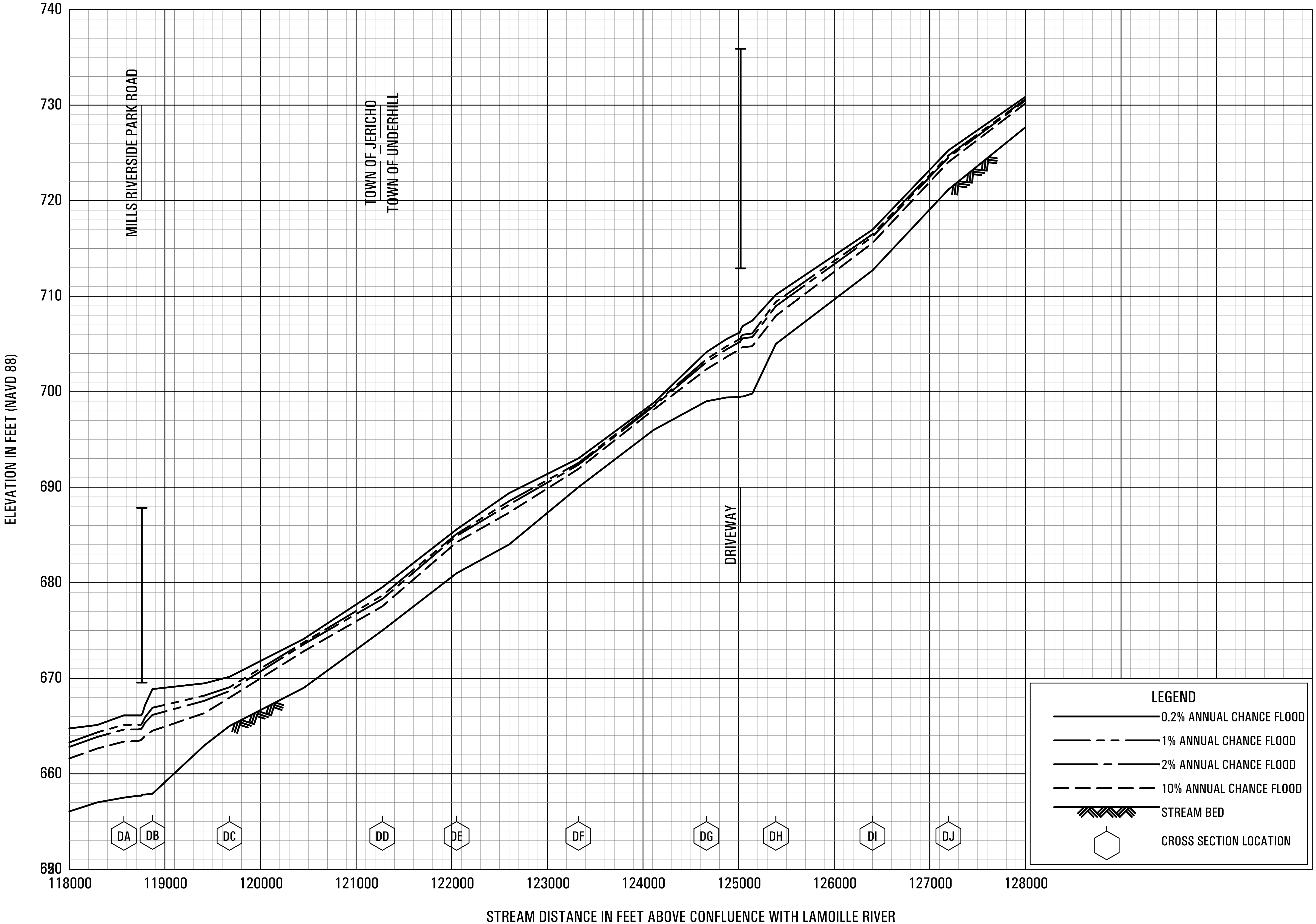
CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



FLOOD PROFILES

BROWNS RIVER

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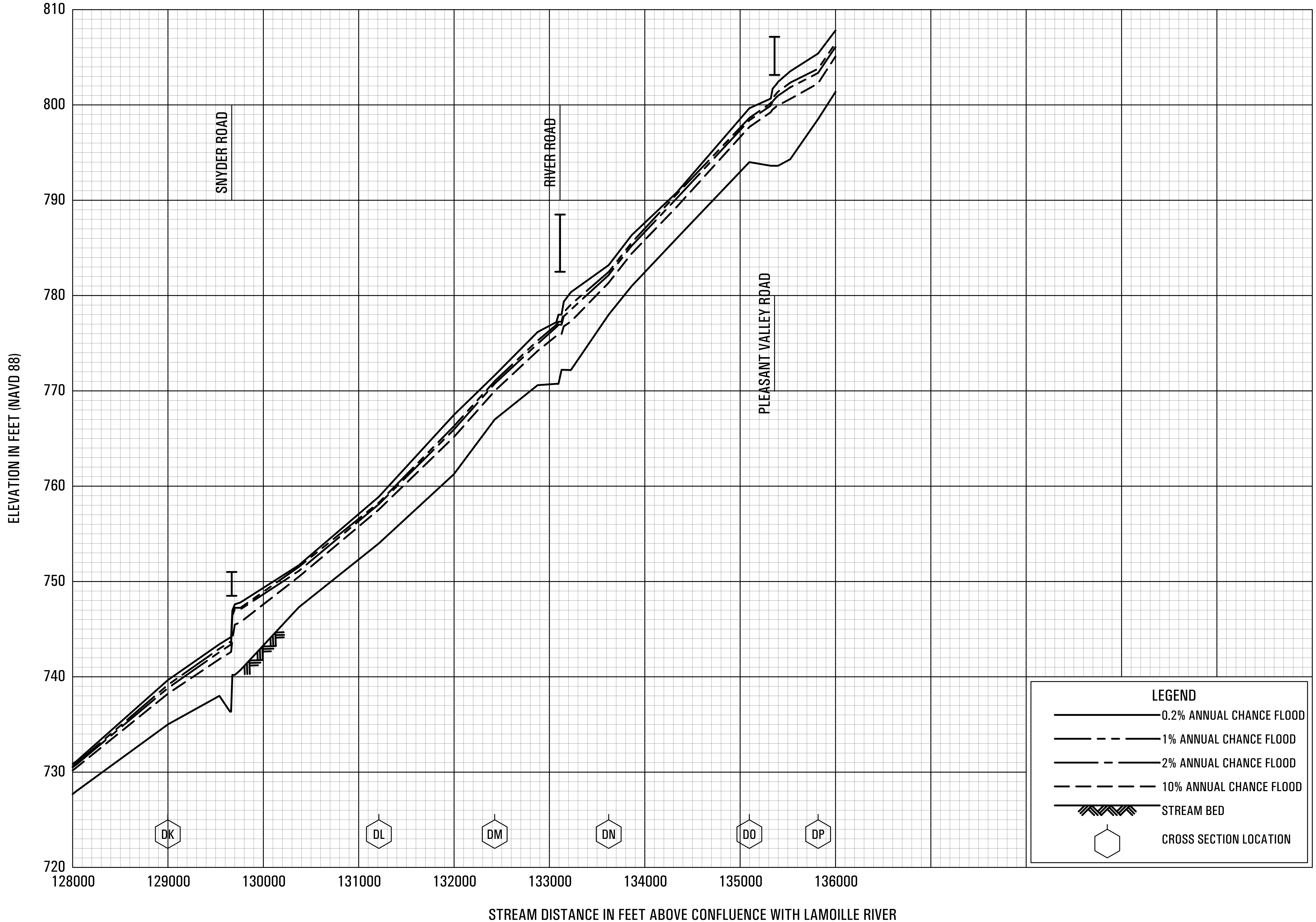

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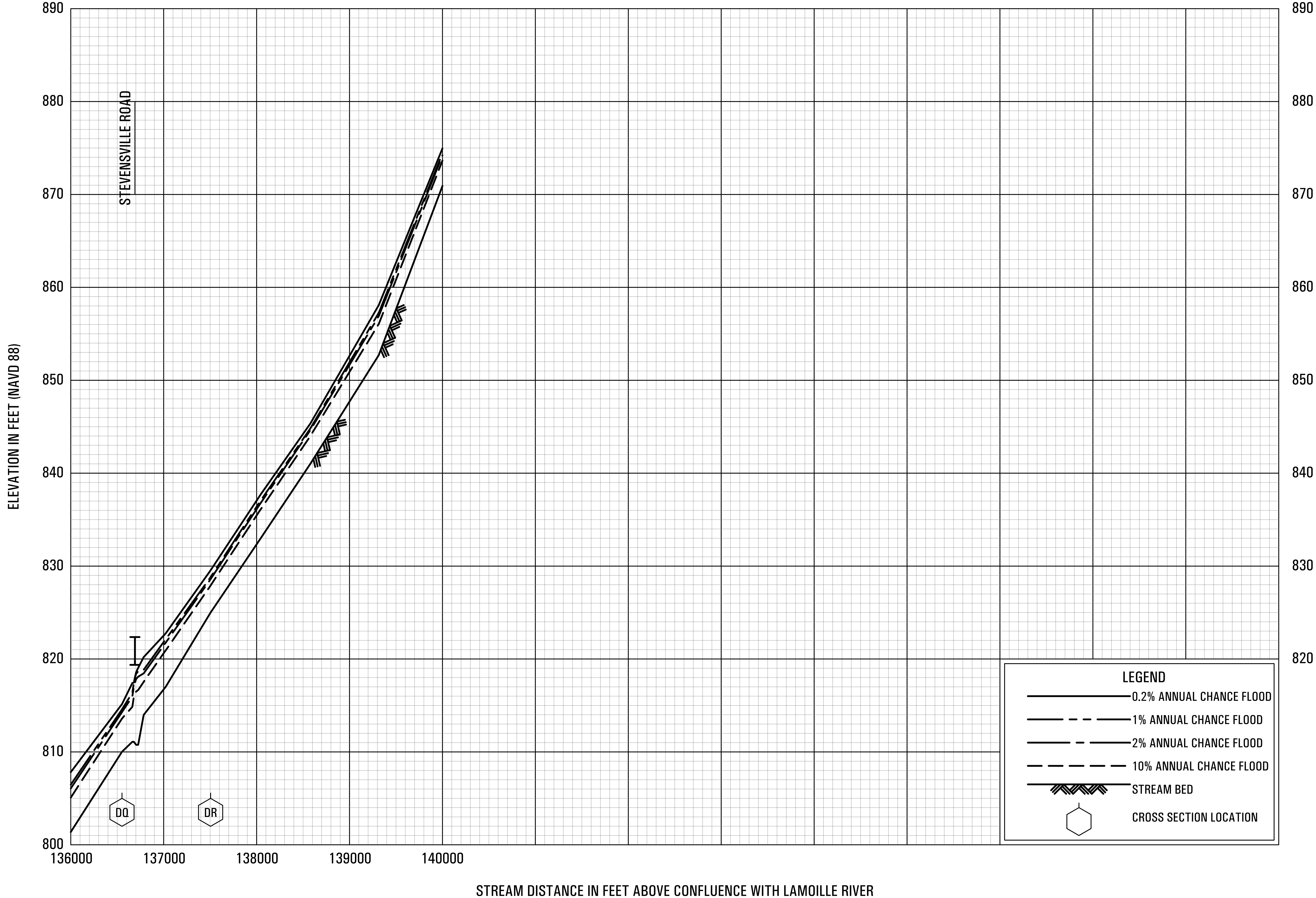

FLOOD PROFILES

BROWNS RIVER

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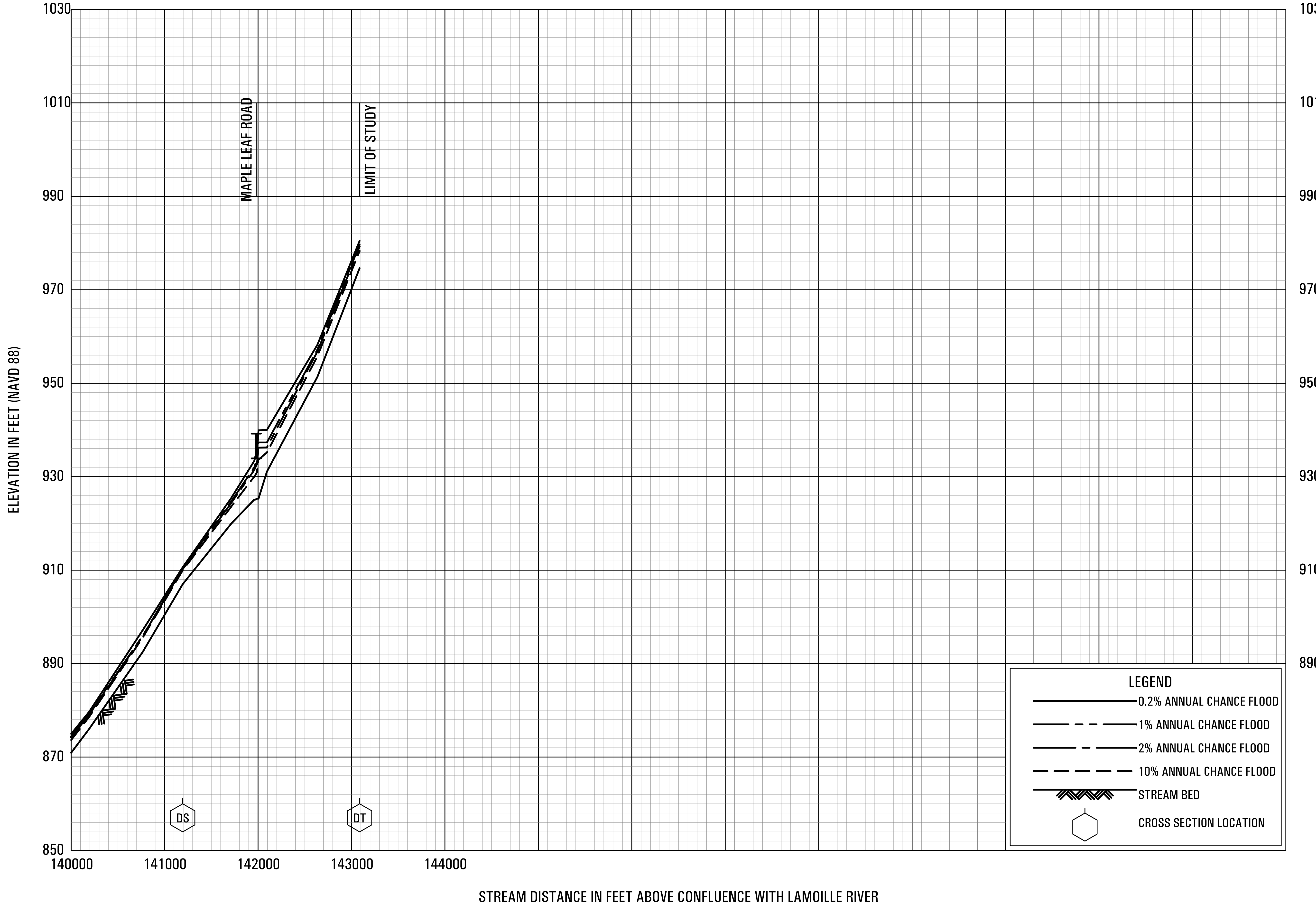

FLOOD PROFILES

BROWNS RIVER

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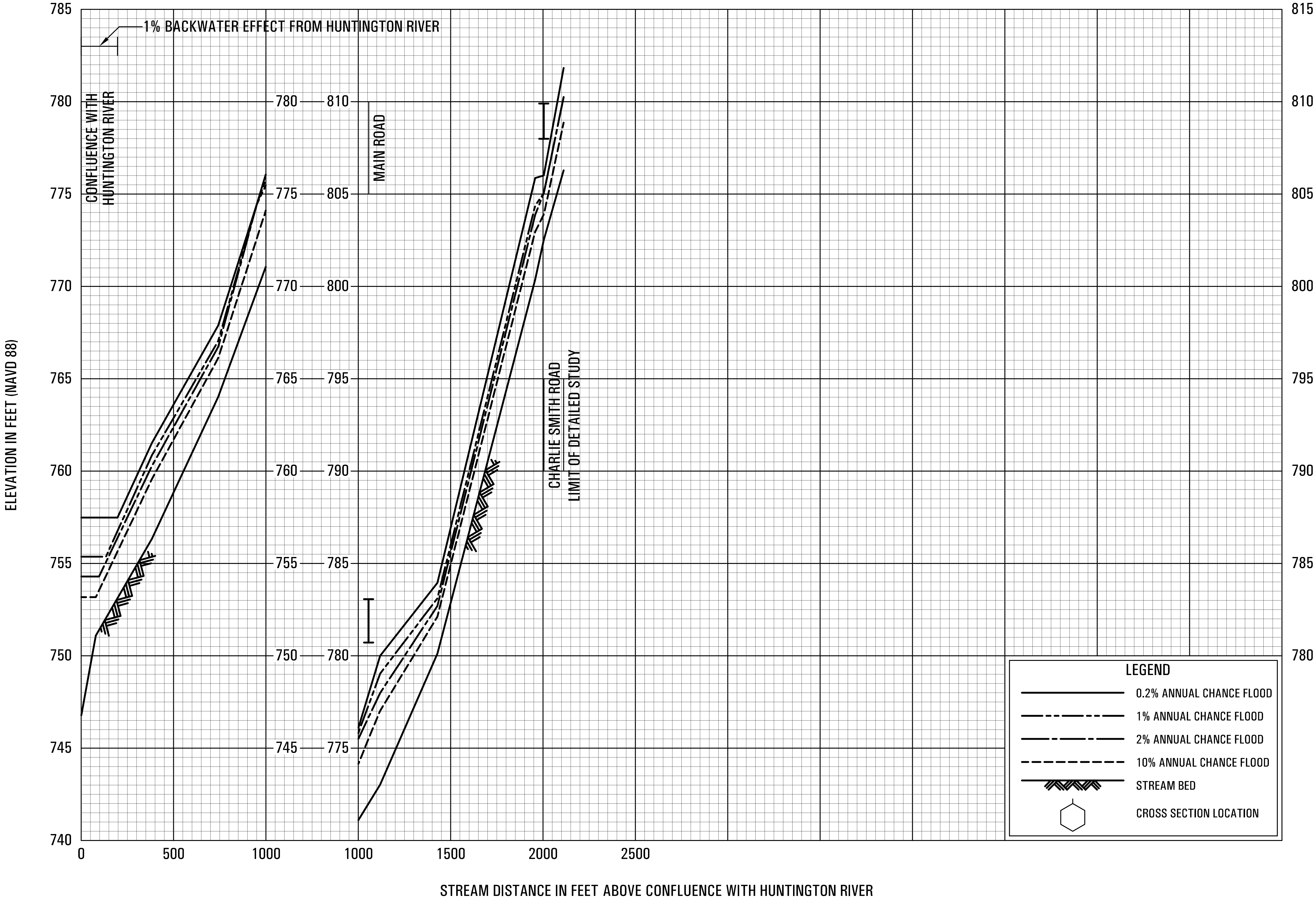


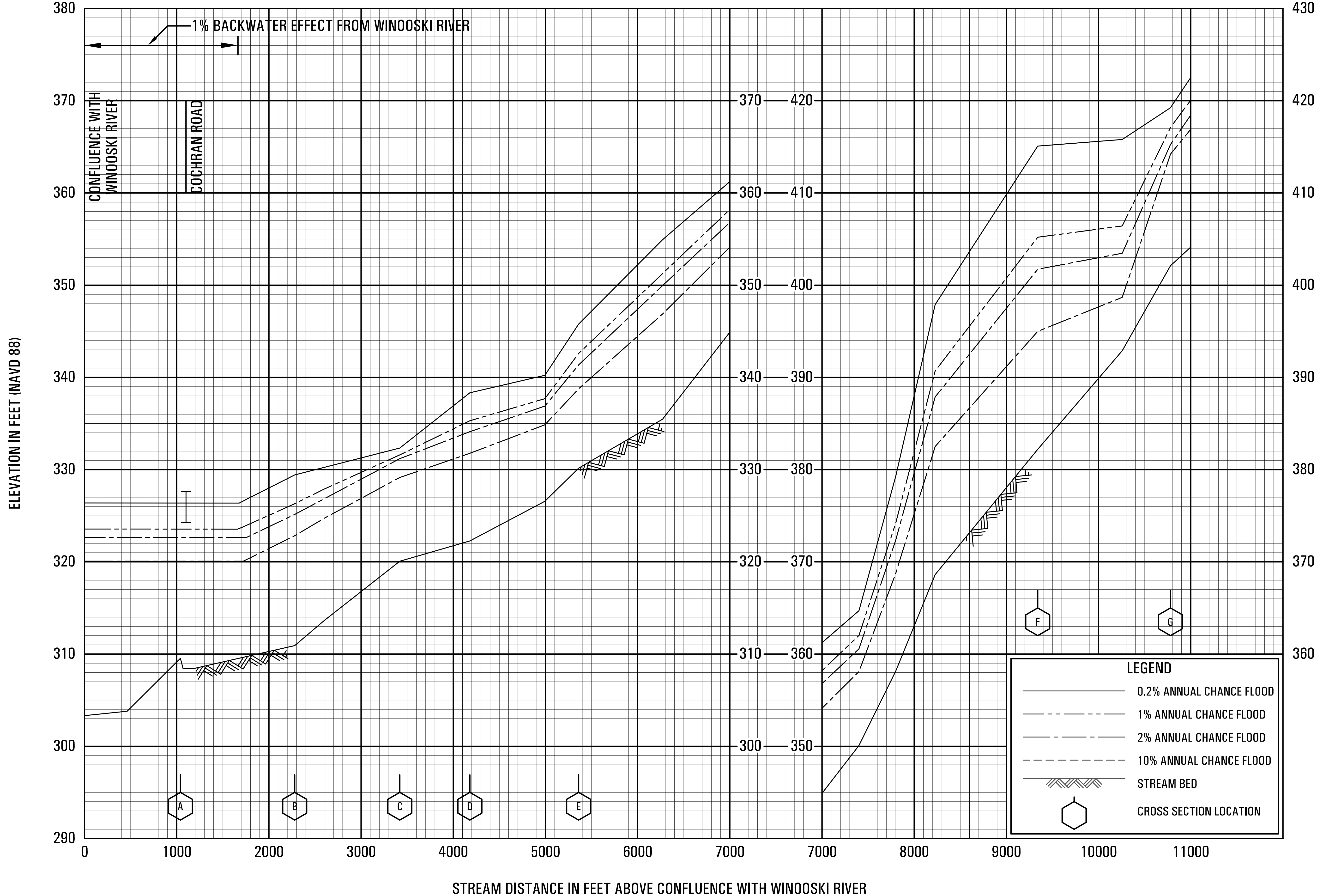
FLOOD PROFILES

COBB BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



FLOOD PROFILES

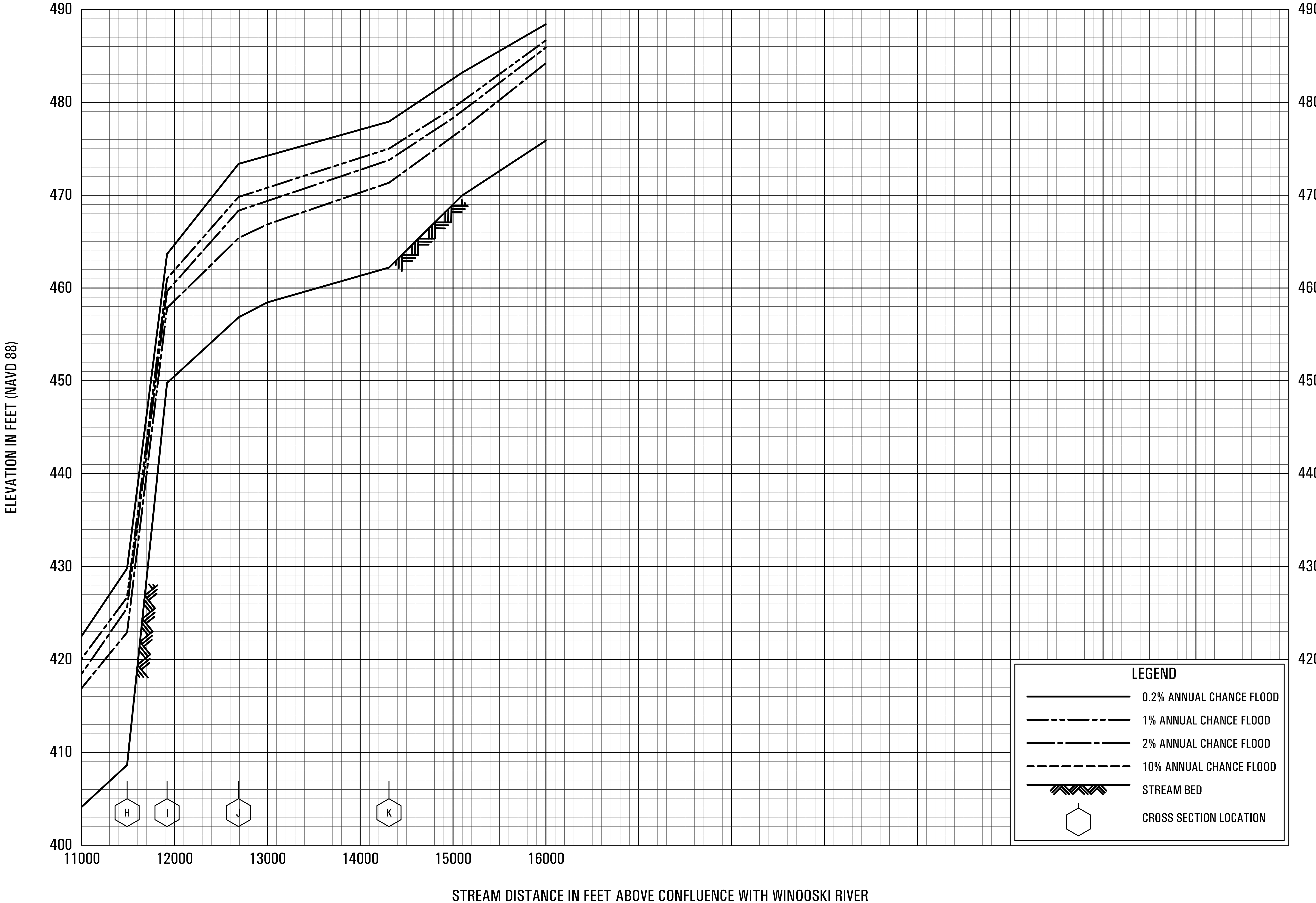
HUNTINGTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

20P



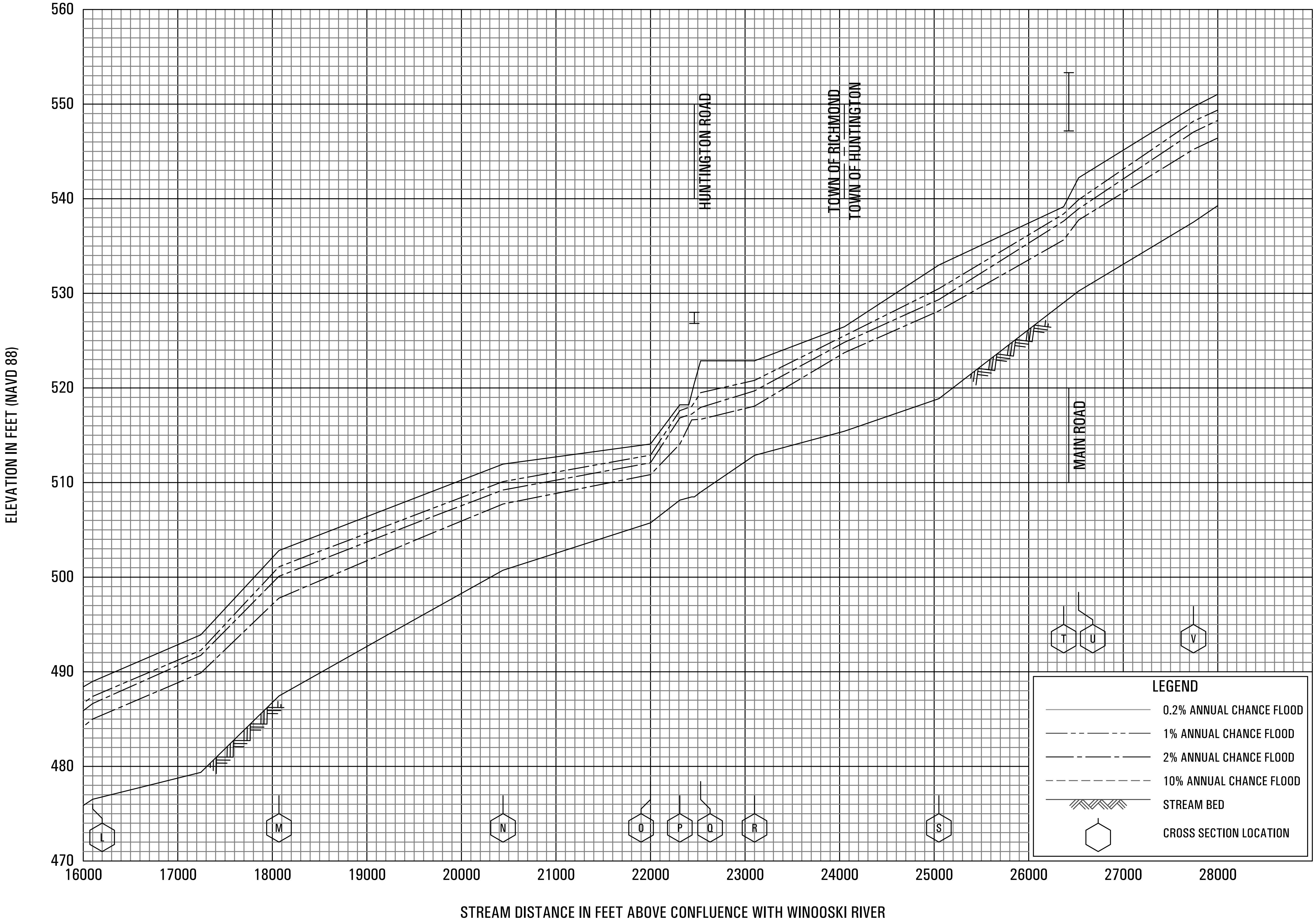
FLOOD PROFILES

HUNTINGTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



FLOOD PROFILES

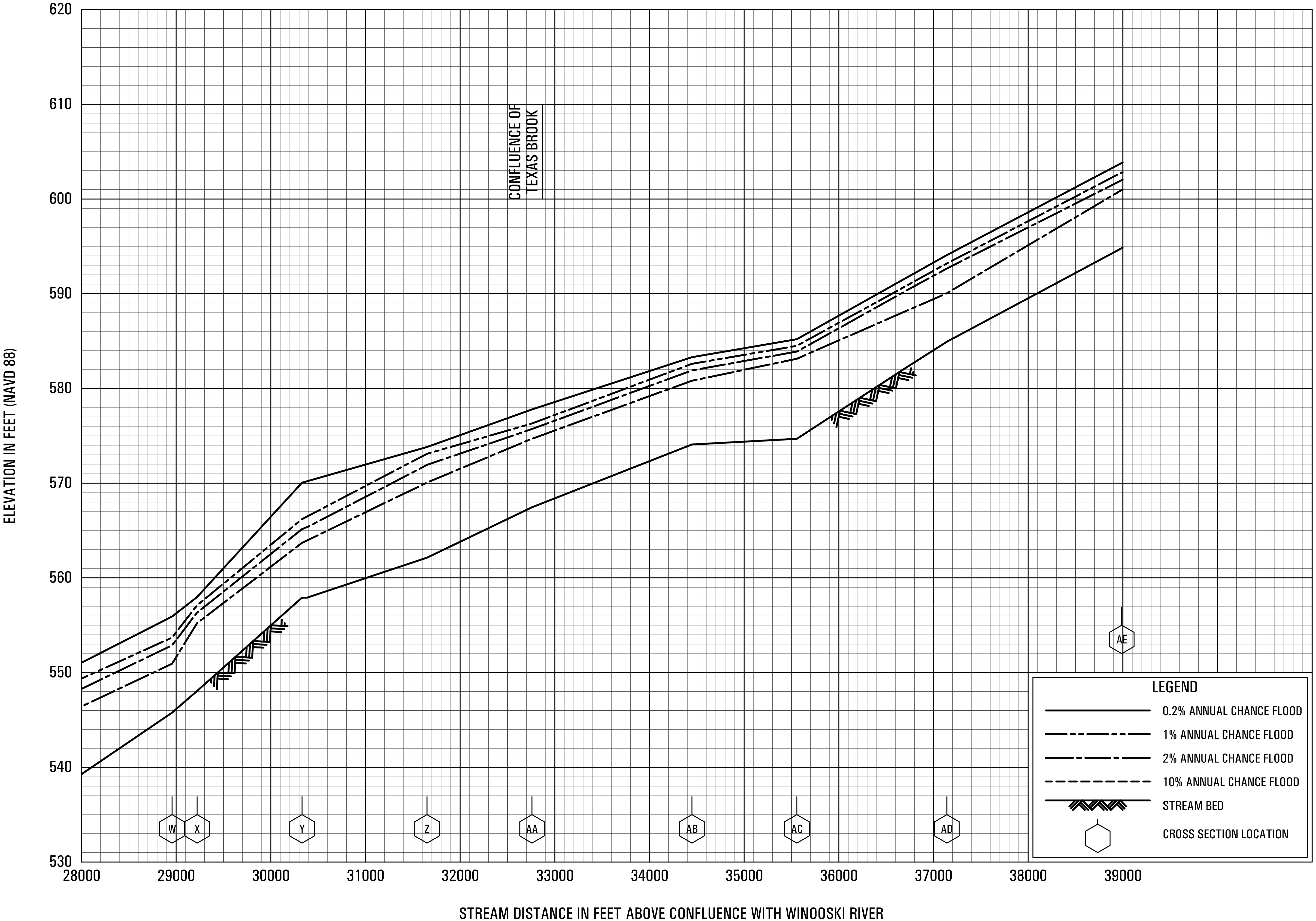
HUNTINGTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

22P



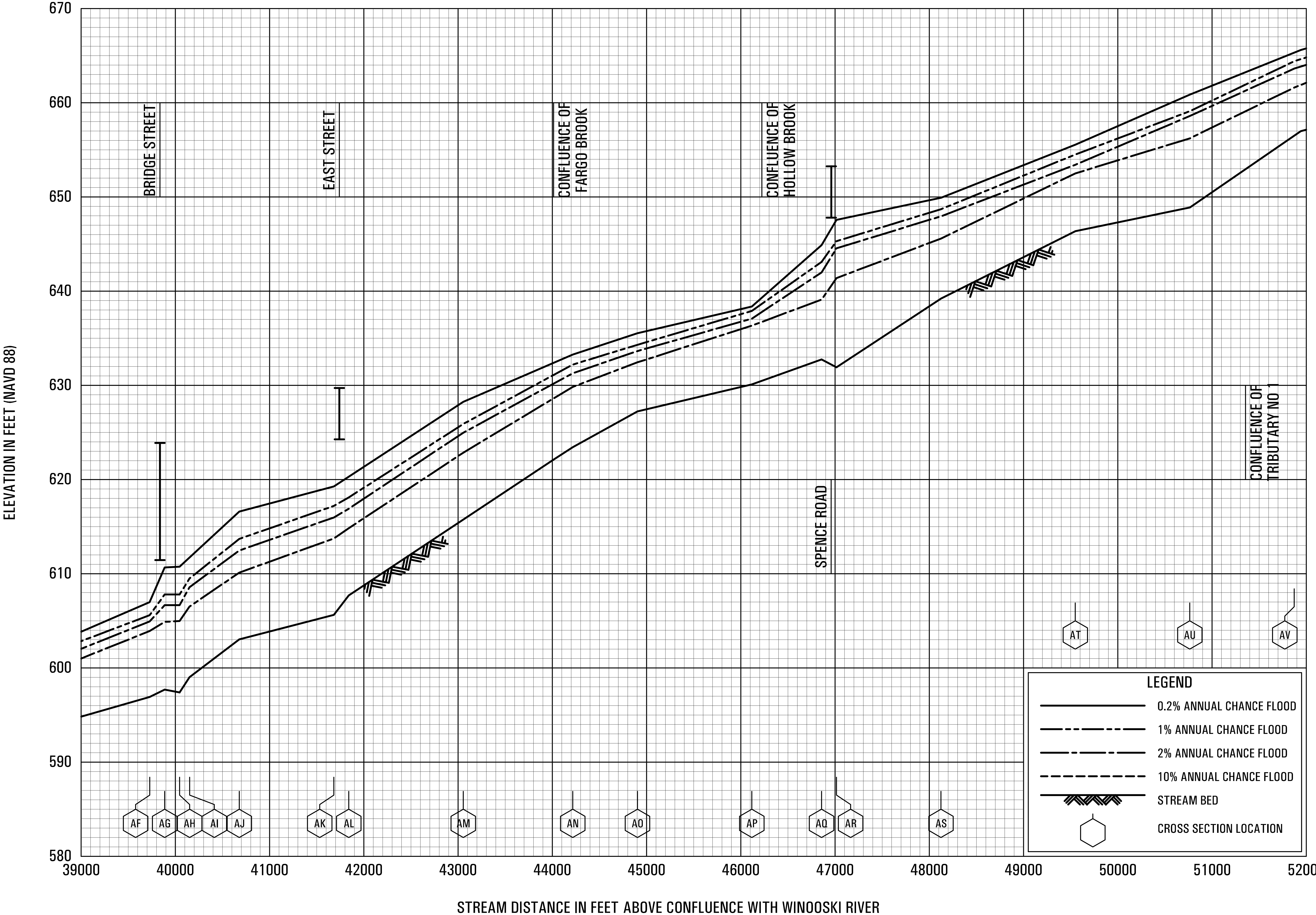
FLOOD PROFILES

HUNTINGTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



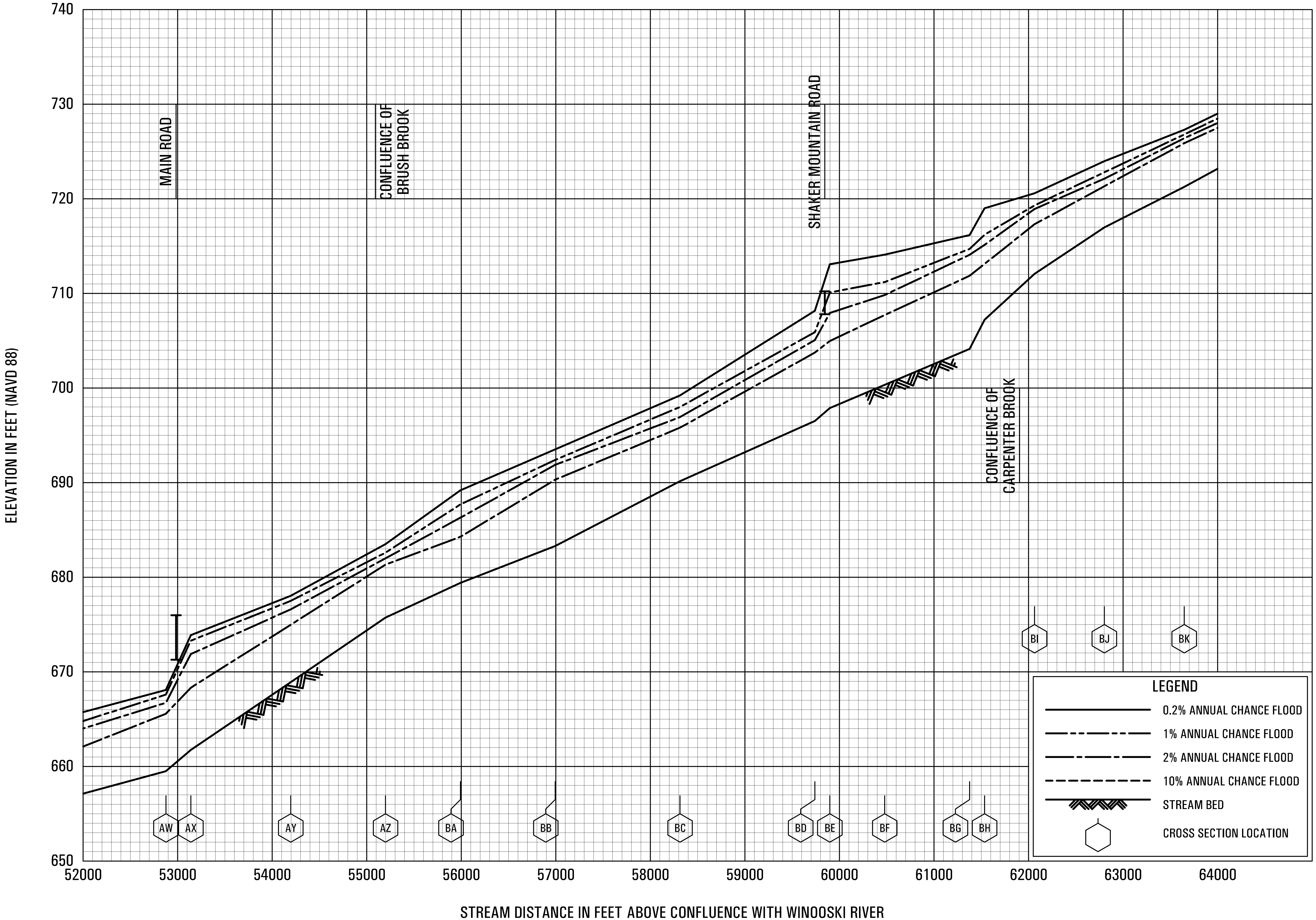
FLOOD PROFILES

HUNTINGTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



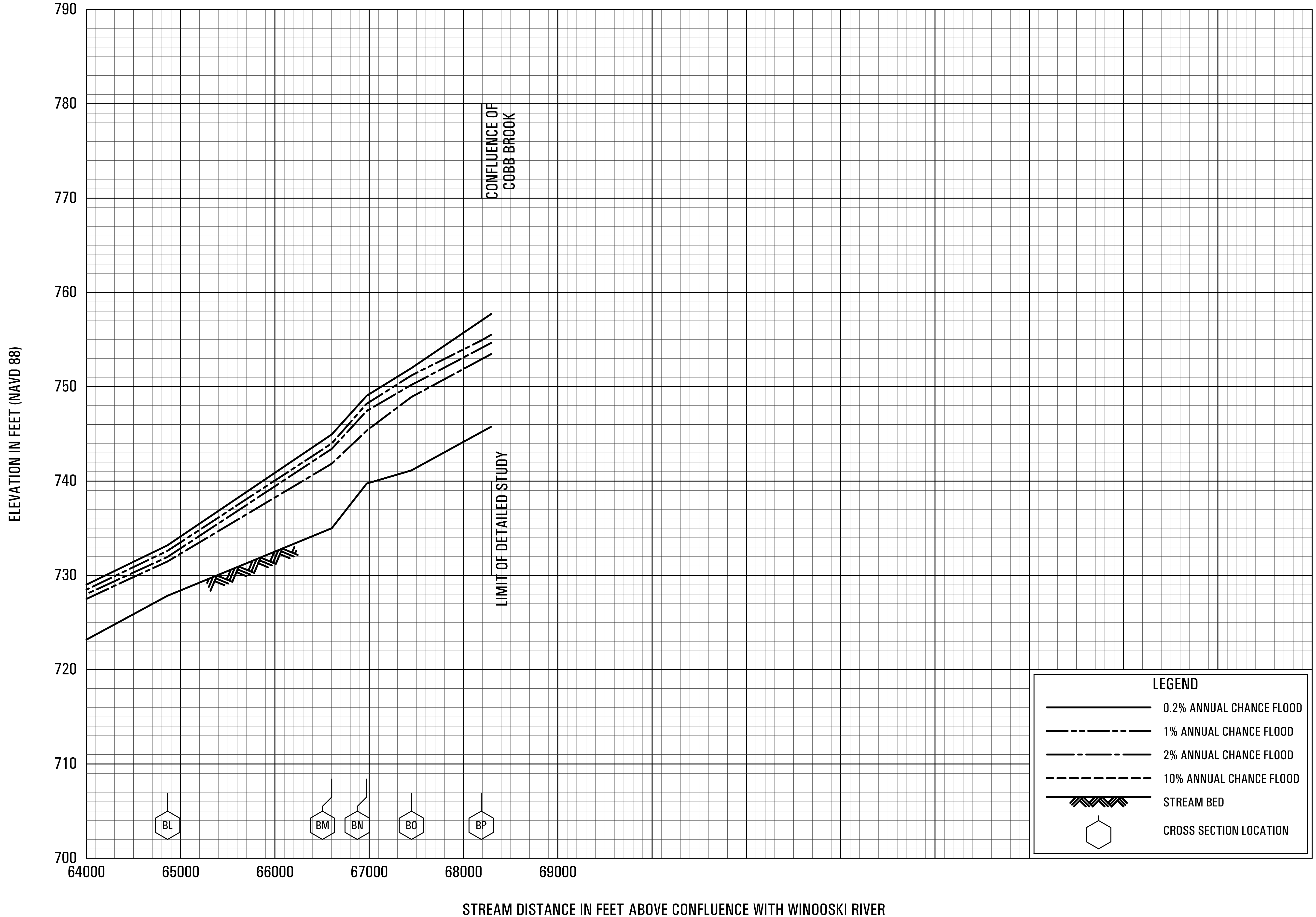
FLOOD PROFILES

HUNTINGTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



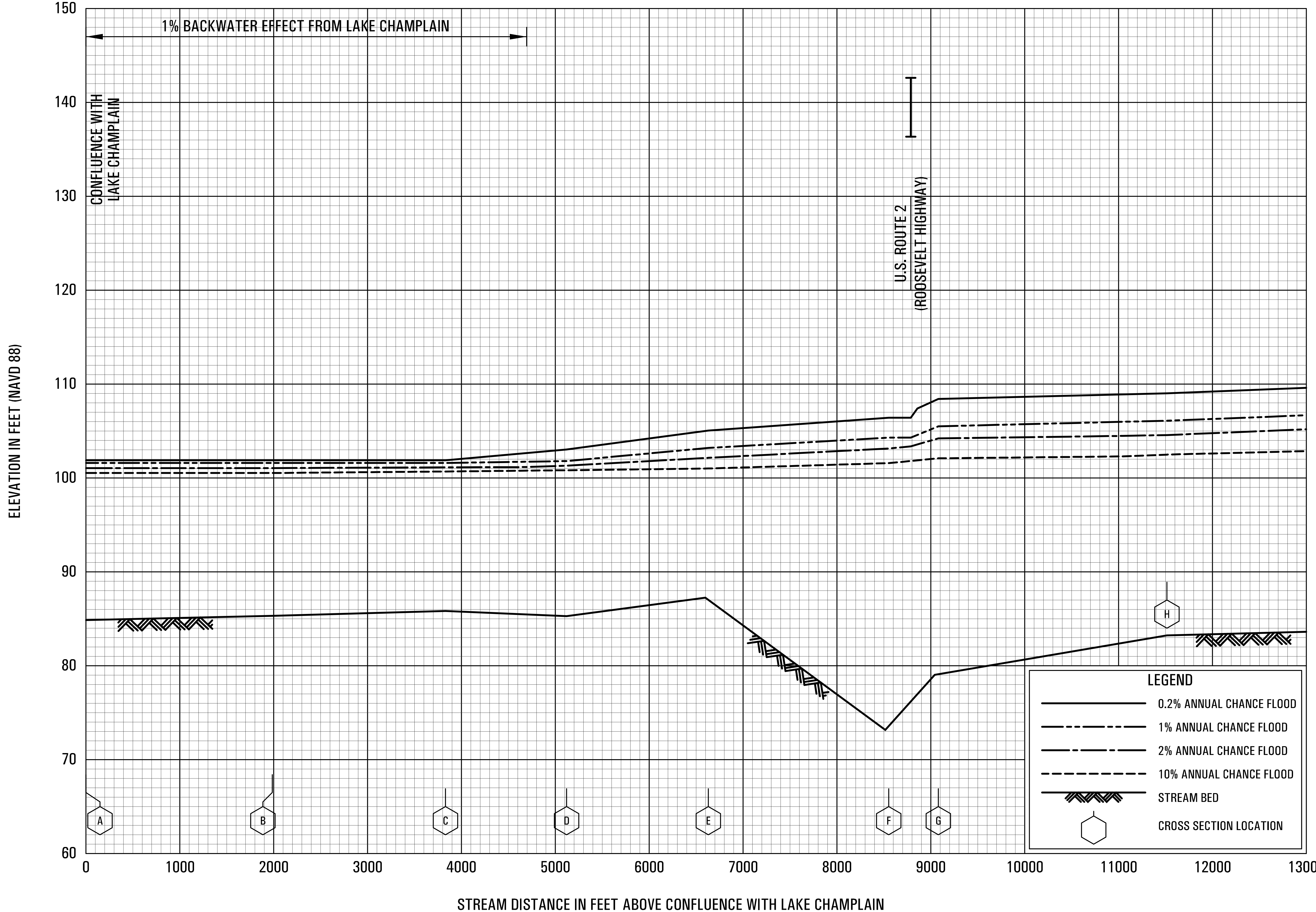
FLOOD PROFILES

HUNTINGTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



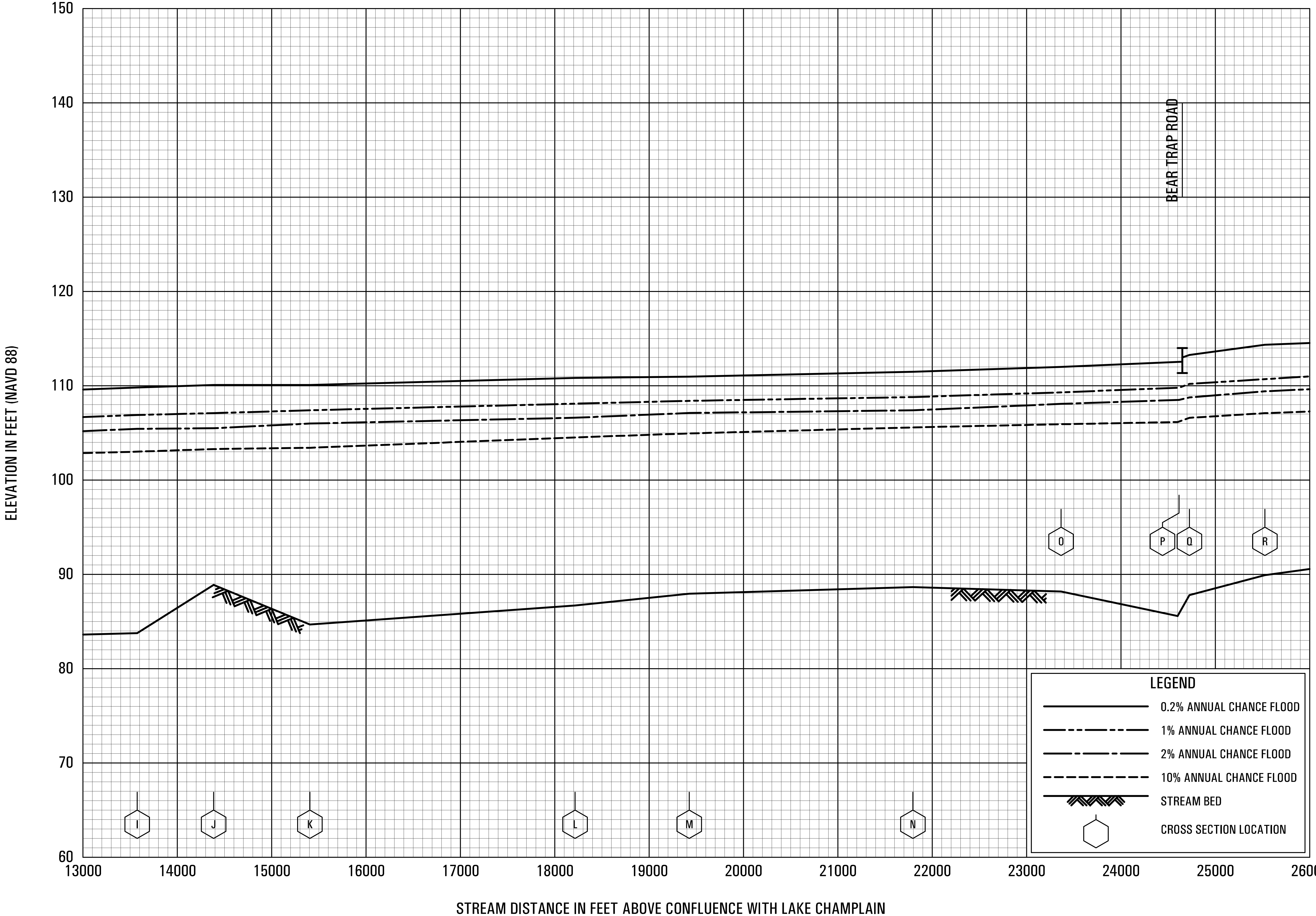
FLOOD PROFILES

LAMOILLE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



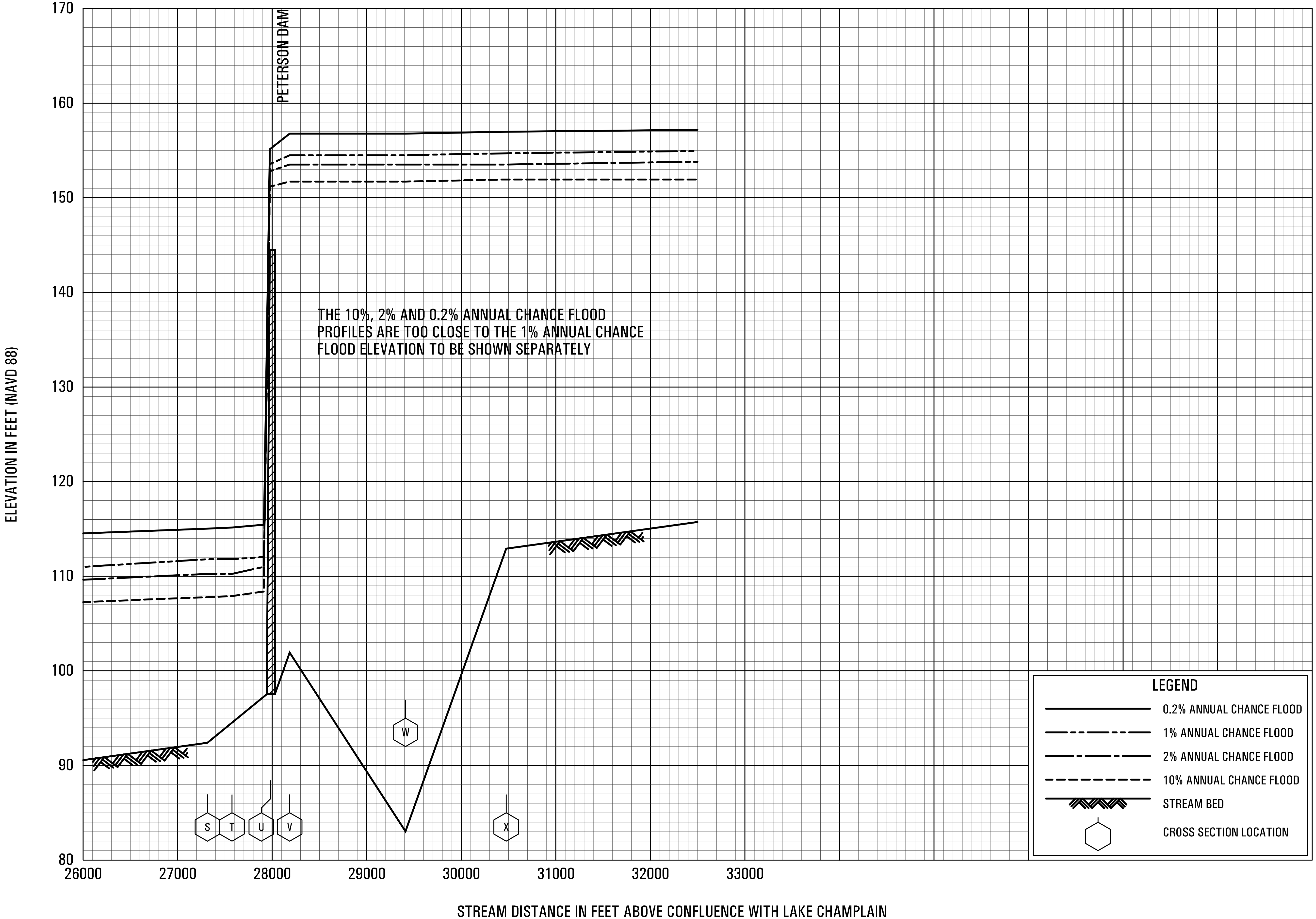
FLOOD PROFILES

LAMOILLE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



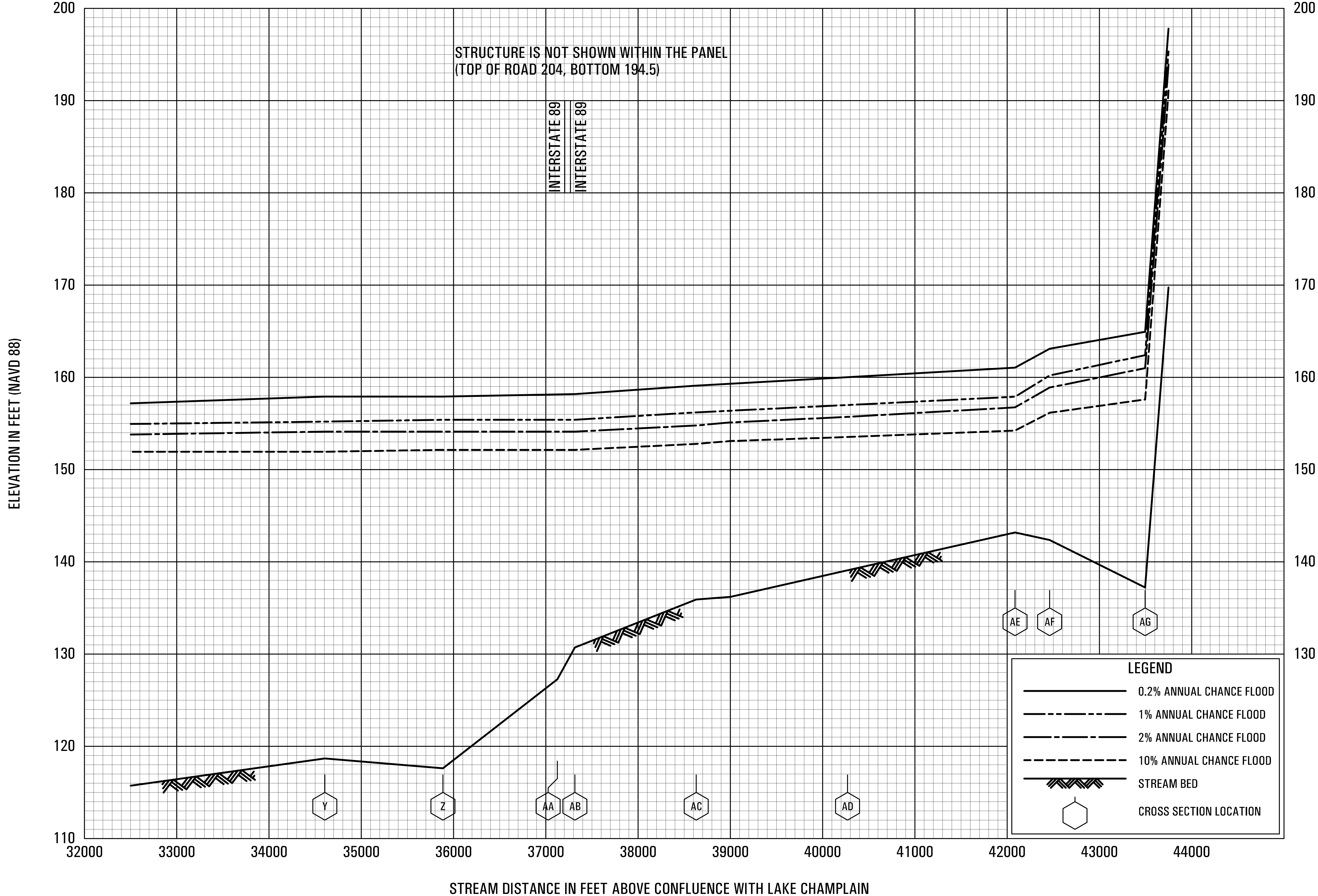
FLOOD PROFILES

LAMOILLE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



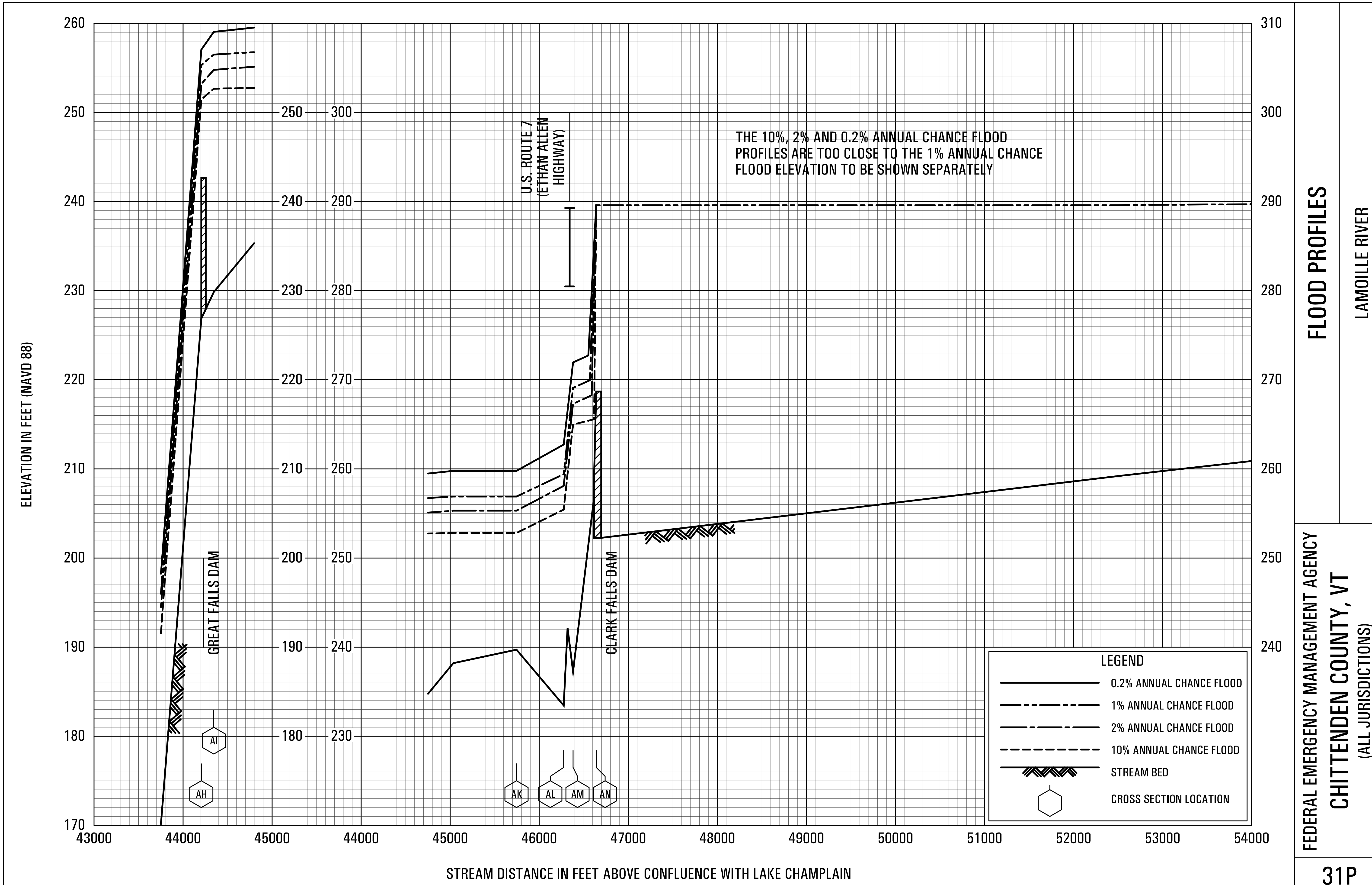
FLOOD PROFILES

LAMOILLE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)


FLOOD PROFILES
LAMOILLE RIVER
FEDERAL EMERGENCY MANAGEMENT AGENCY
CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)
31P
ELEVATION IN FEET (NAVD 88)
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH LAKE CHAMPLAIN
THE 10%, 2% AND 0.2% ANNUAL CHANCE FLOOD
PROFILES ARE TOO CLOSE TO THE 1% ANNUAL CHANCE
FLOOD ELEVATION TO BE SHOWN SEPARATELY
U.S. ROUTE 7
(ETHAN ALLEN
HIGHWAY)
GREAT FALLS DAM
CLARK FALLS DAM
AH
AI
AK
AL
AM
AN
LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION
170
180
190
200
210
220
230
240
250
260
230
240
250
260
270
280
290
300
310
43000
44000
45000
44000
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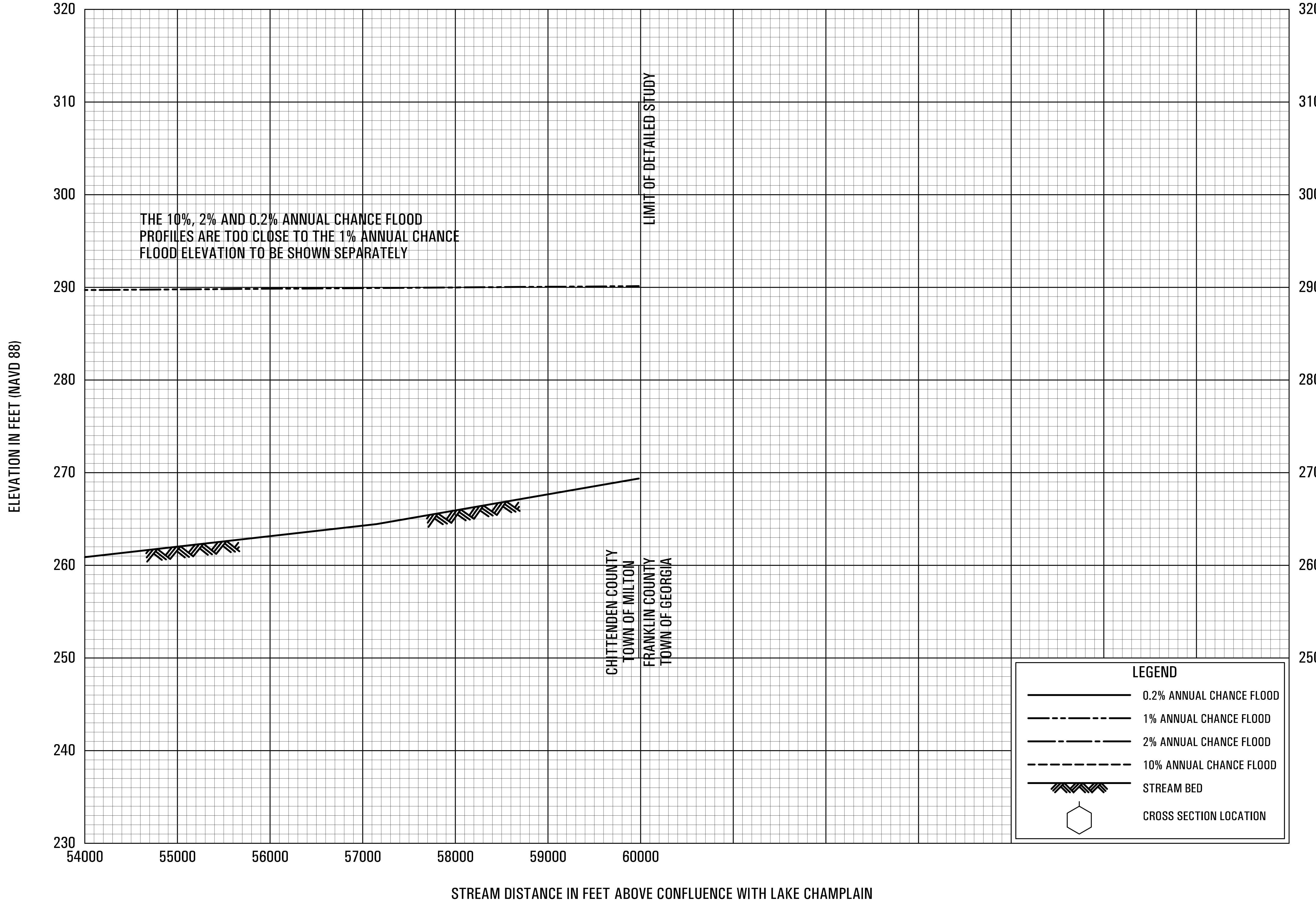
49000
50000
51000
52000
53000
54000



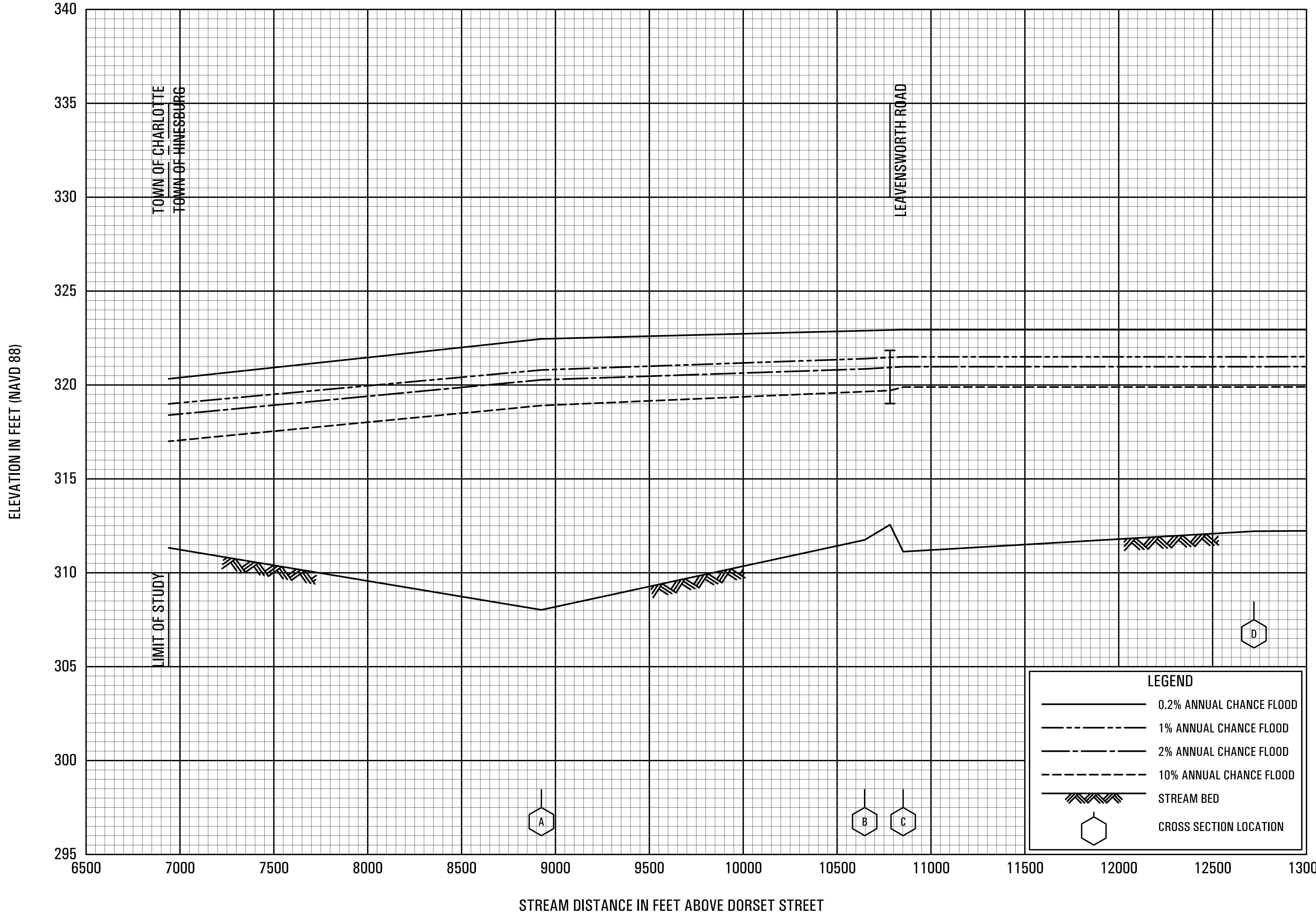
FLOOD PROFILES

LAMOILLE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



FLOOD PROFILES

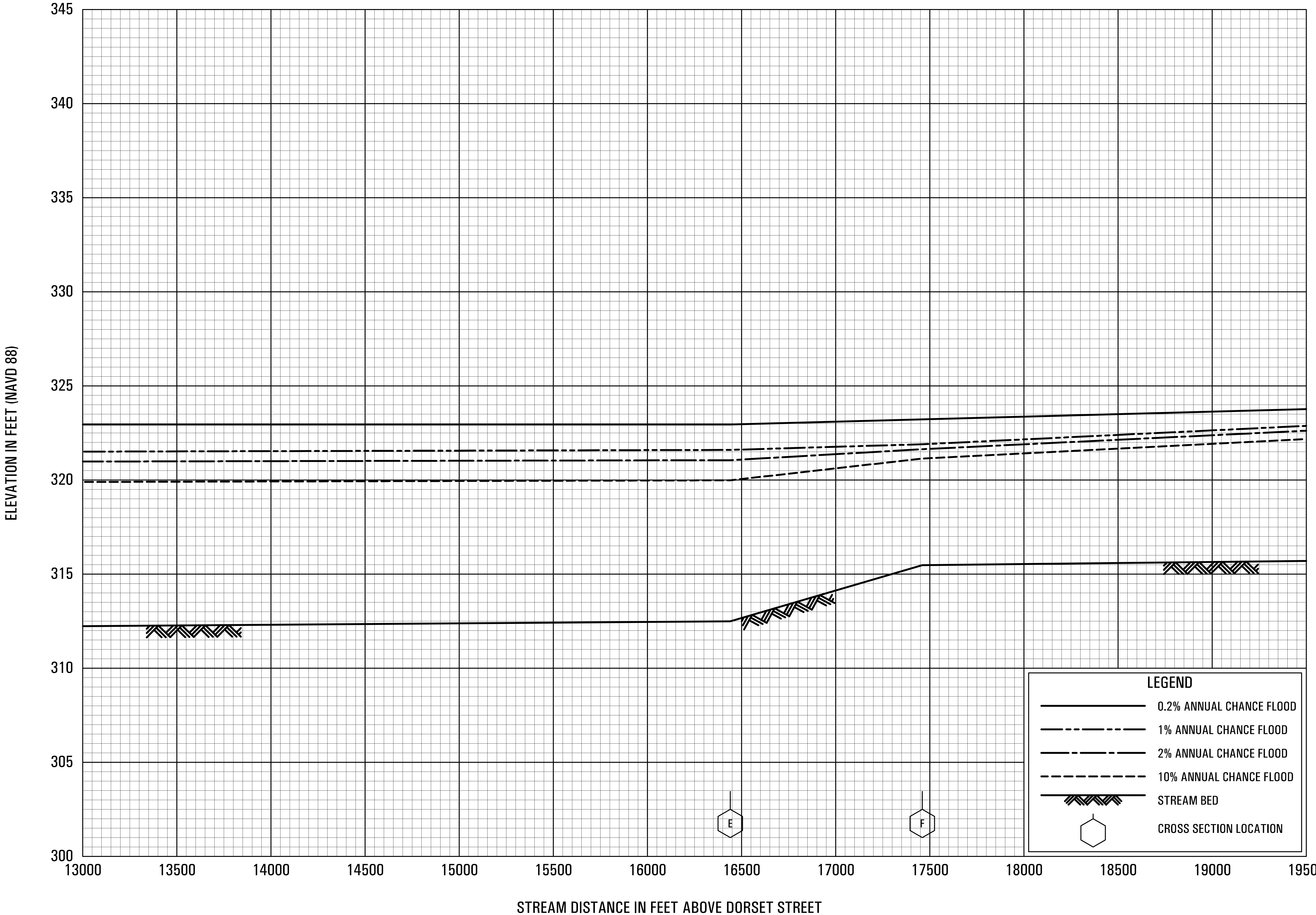
LAPLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

33P



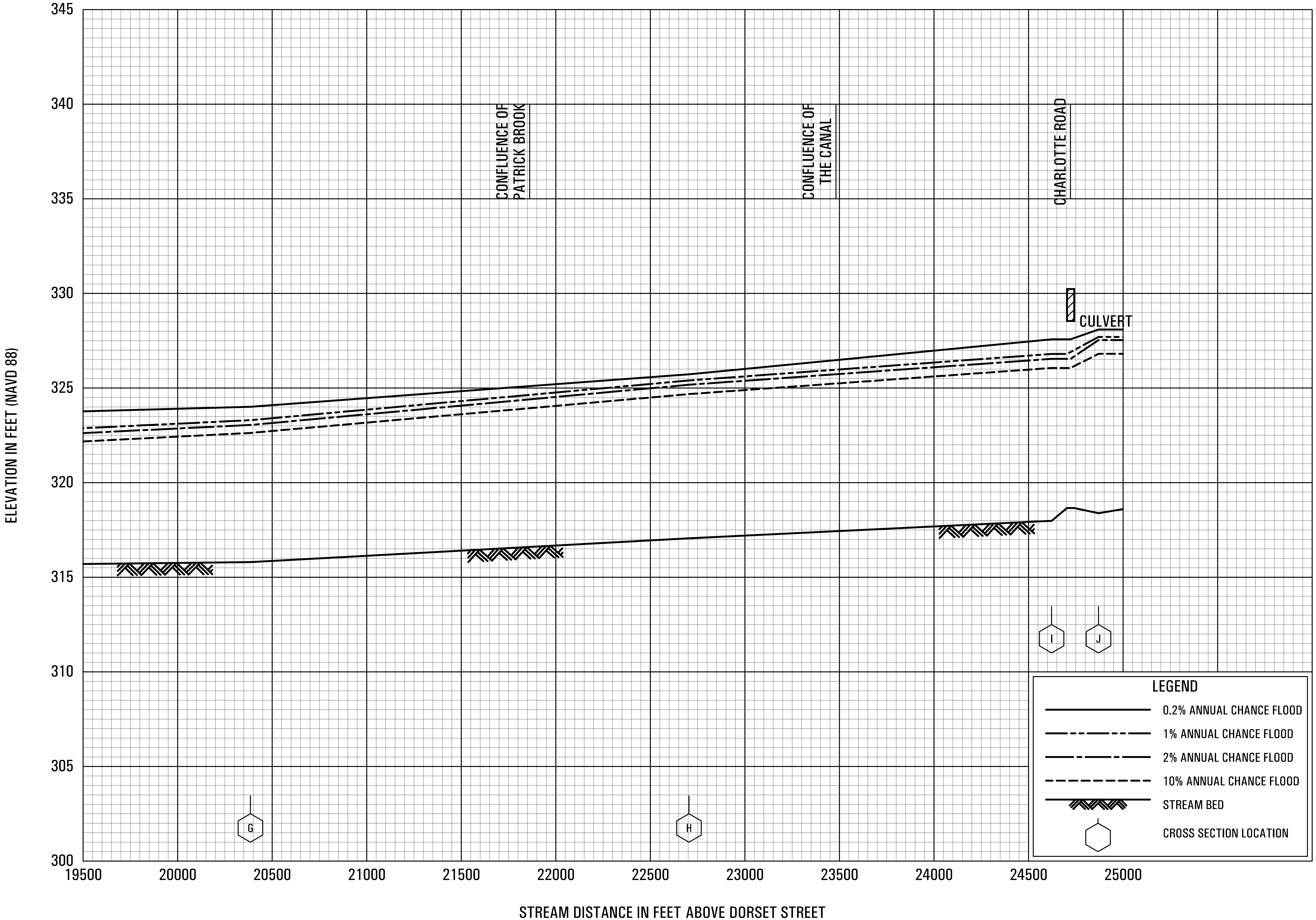
FLOOD PROFILES

LAPLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



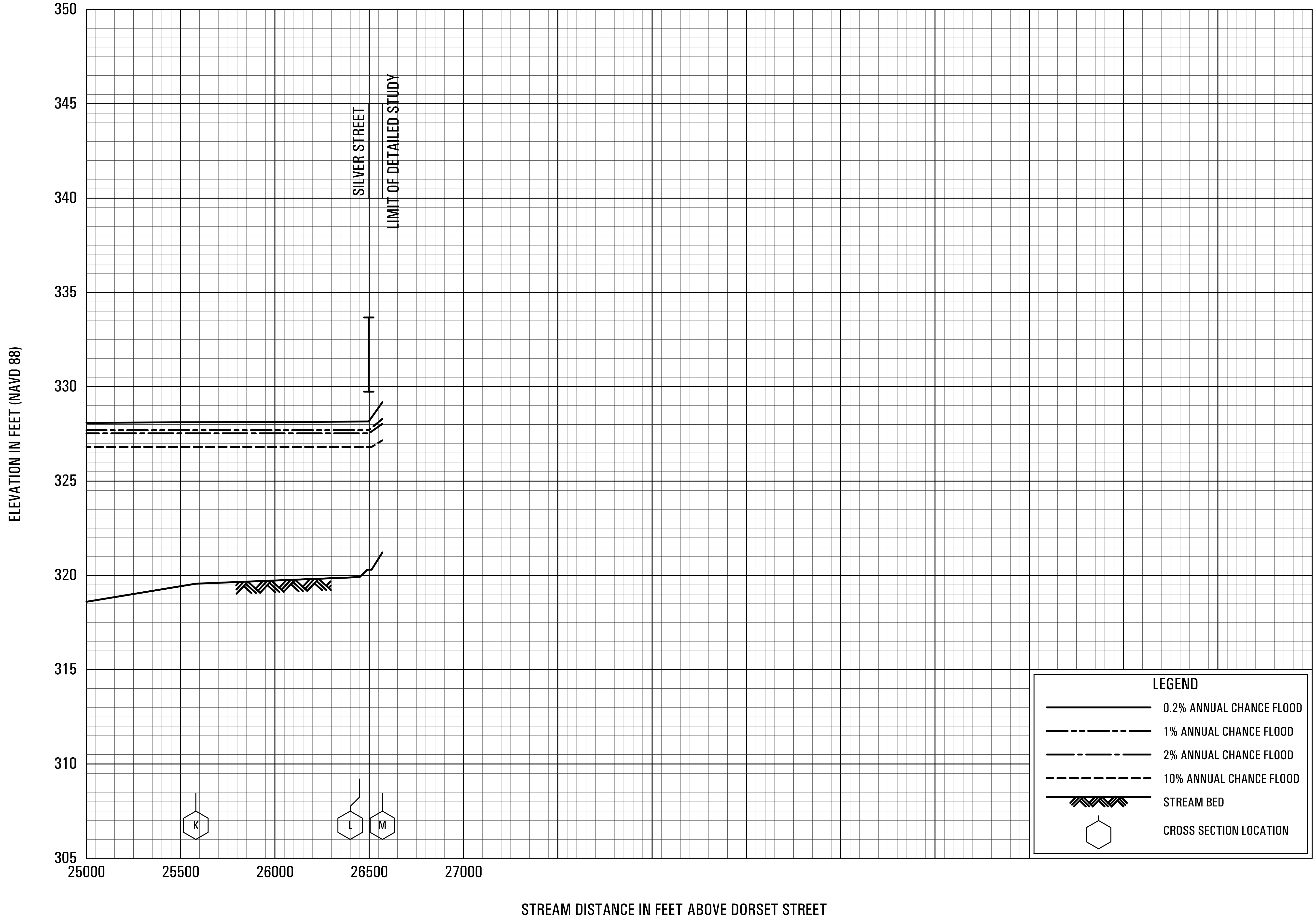
FLOOD PROFILES

LAPLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



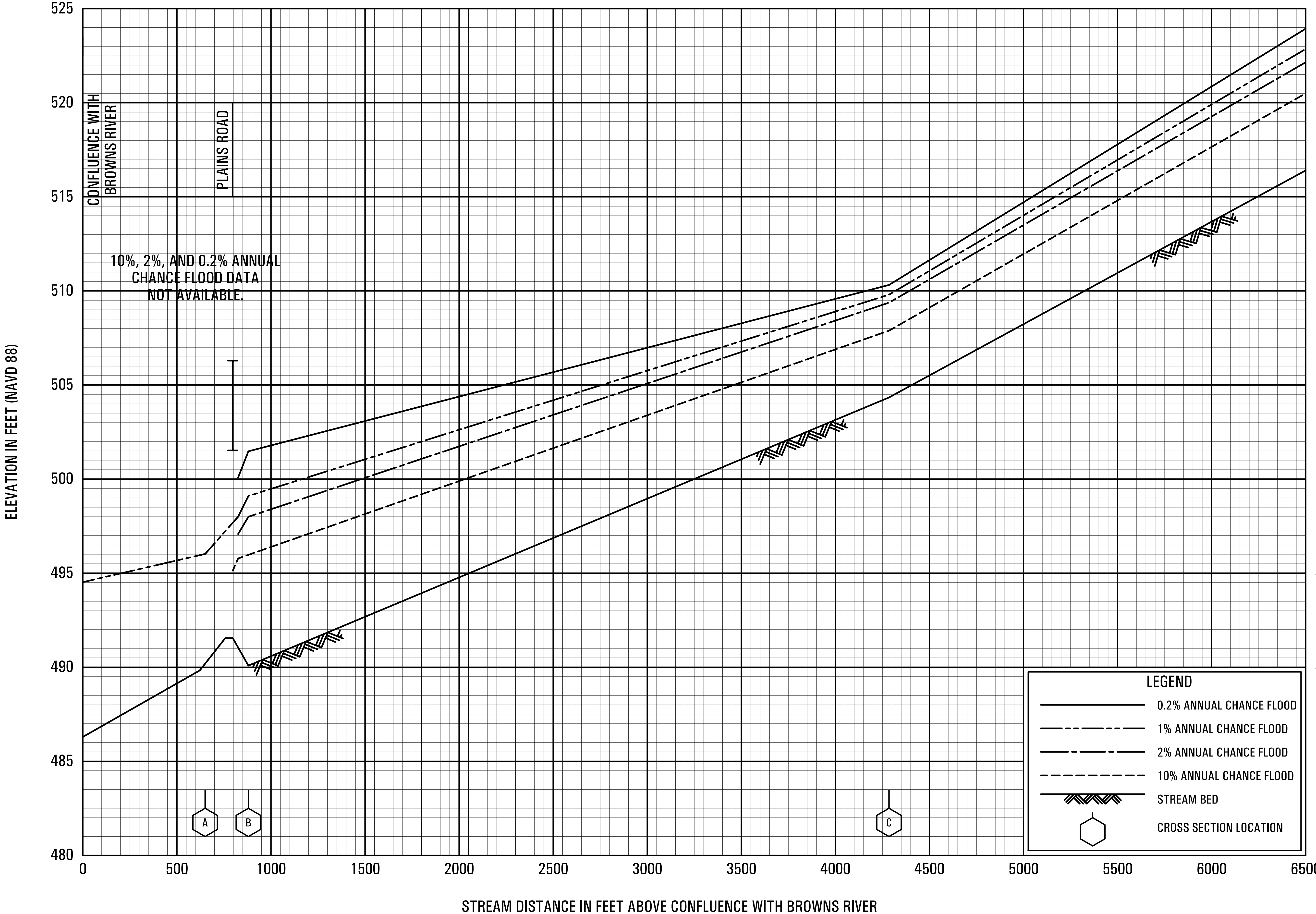
FLOOD PROFILES

LAPLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



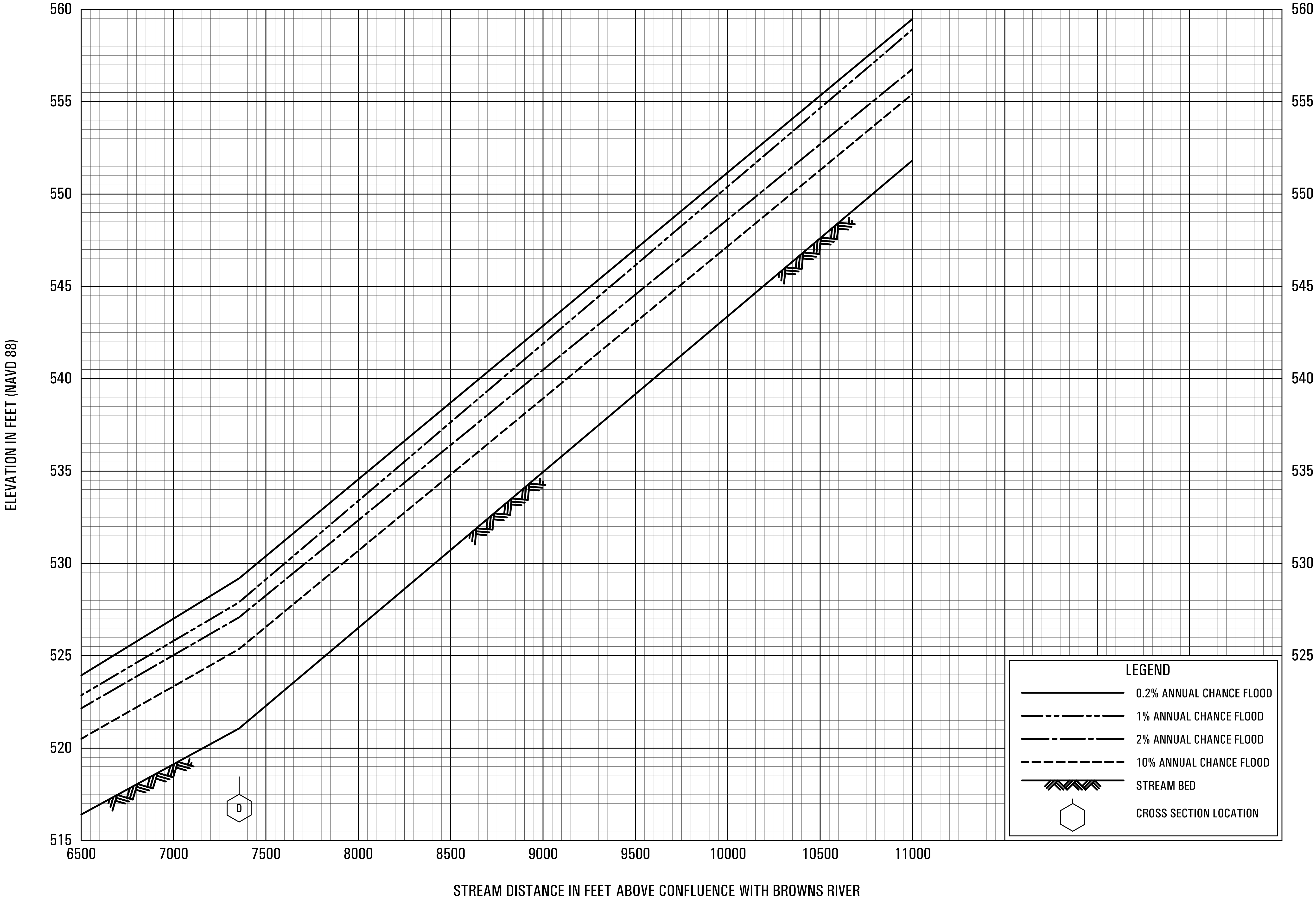
FLOOD PROFILES

LEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



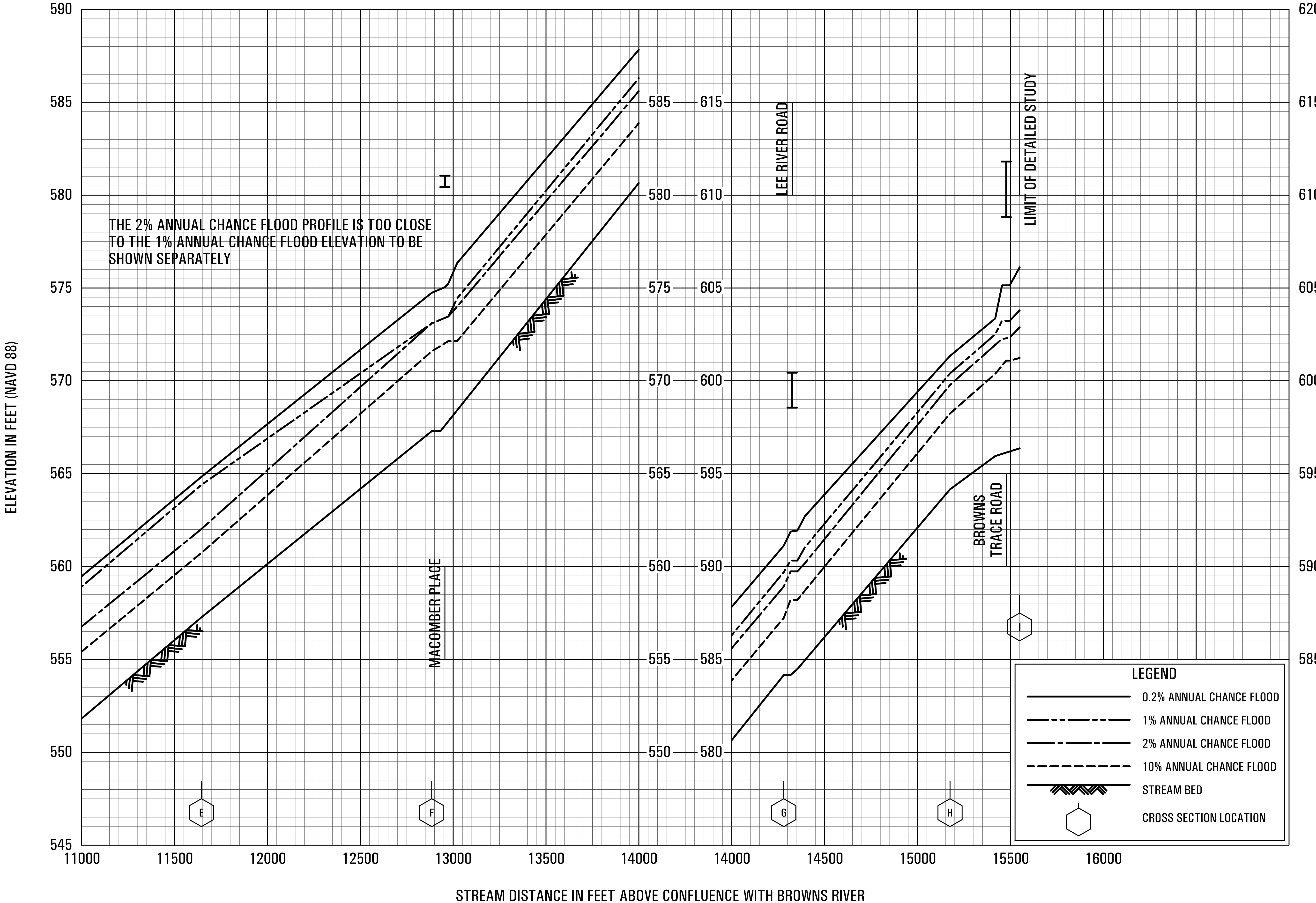
FLOOD PROFILES

LEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



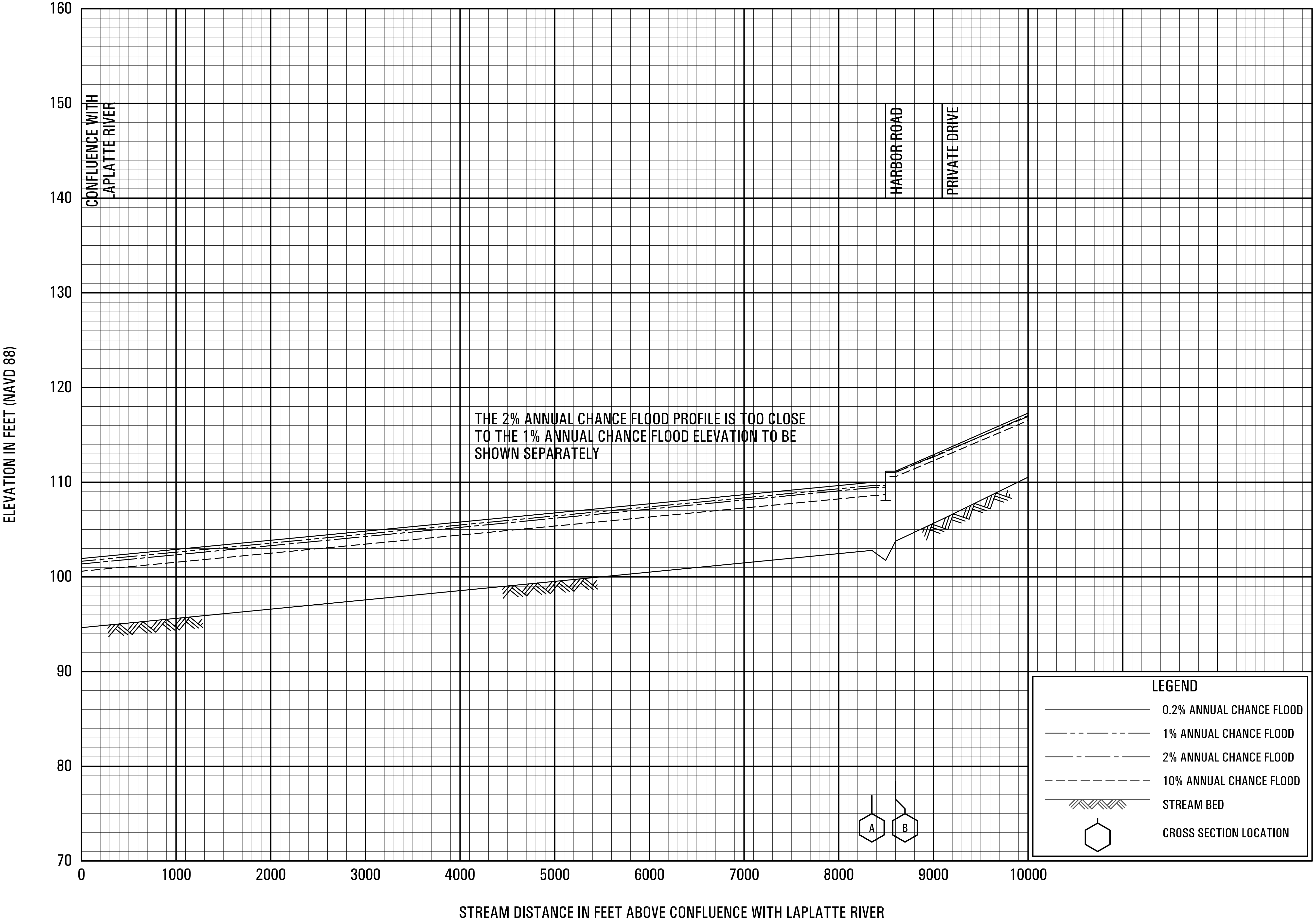
FLOOD PROFILES

LEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



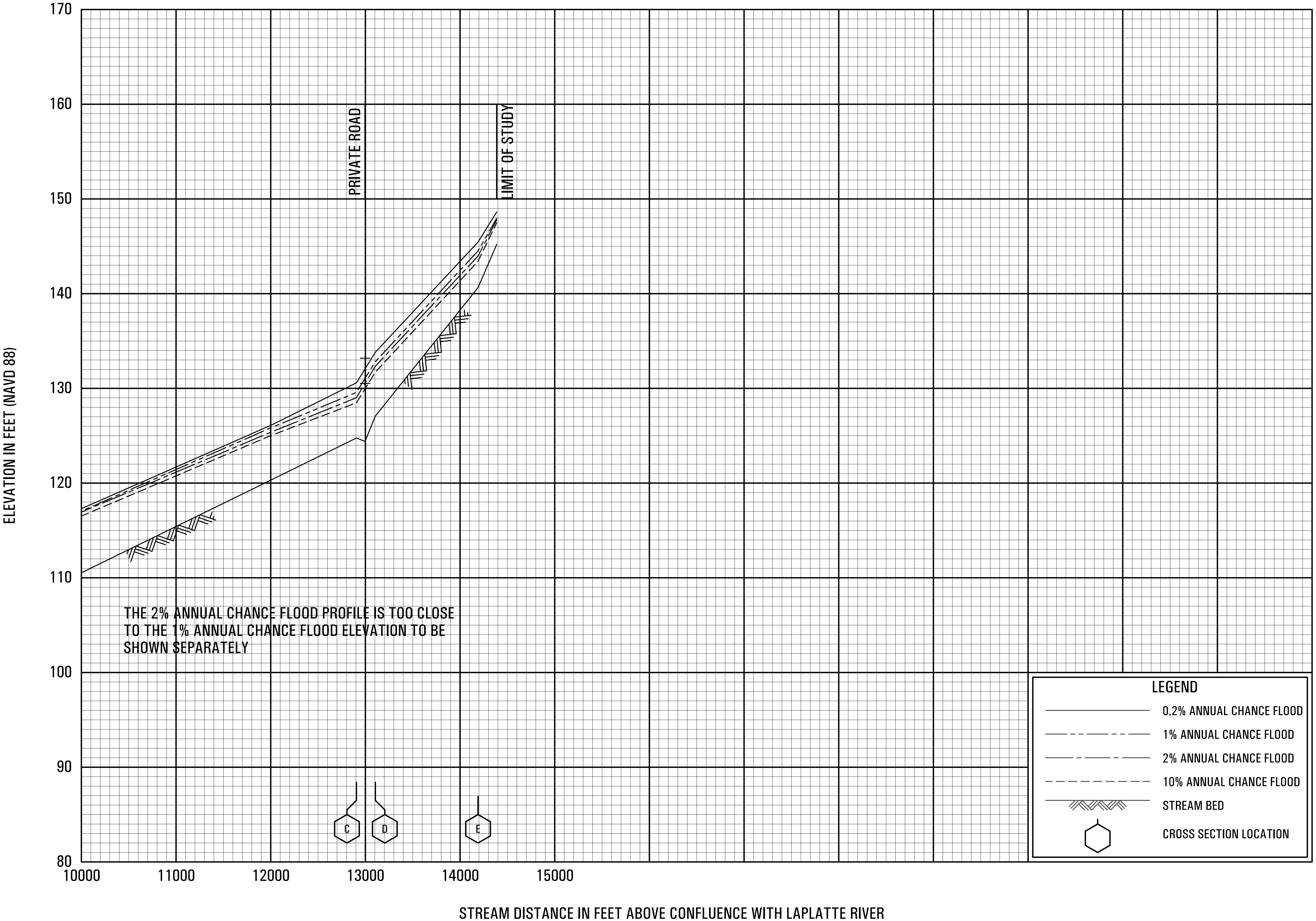
FLOOD PROFILES

McCABES BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

ALL JURISDICTIONS



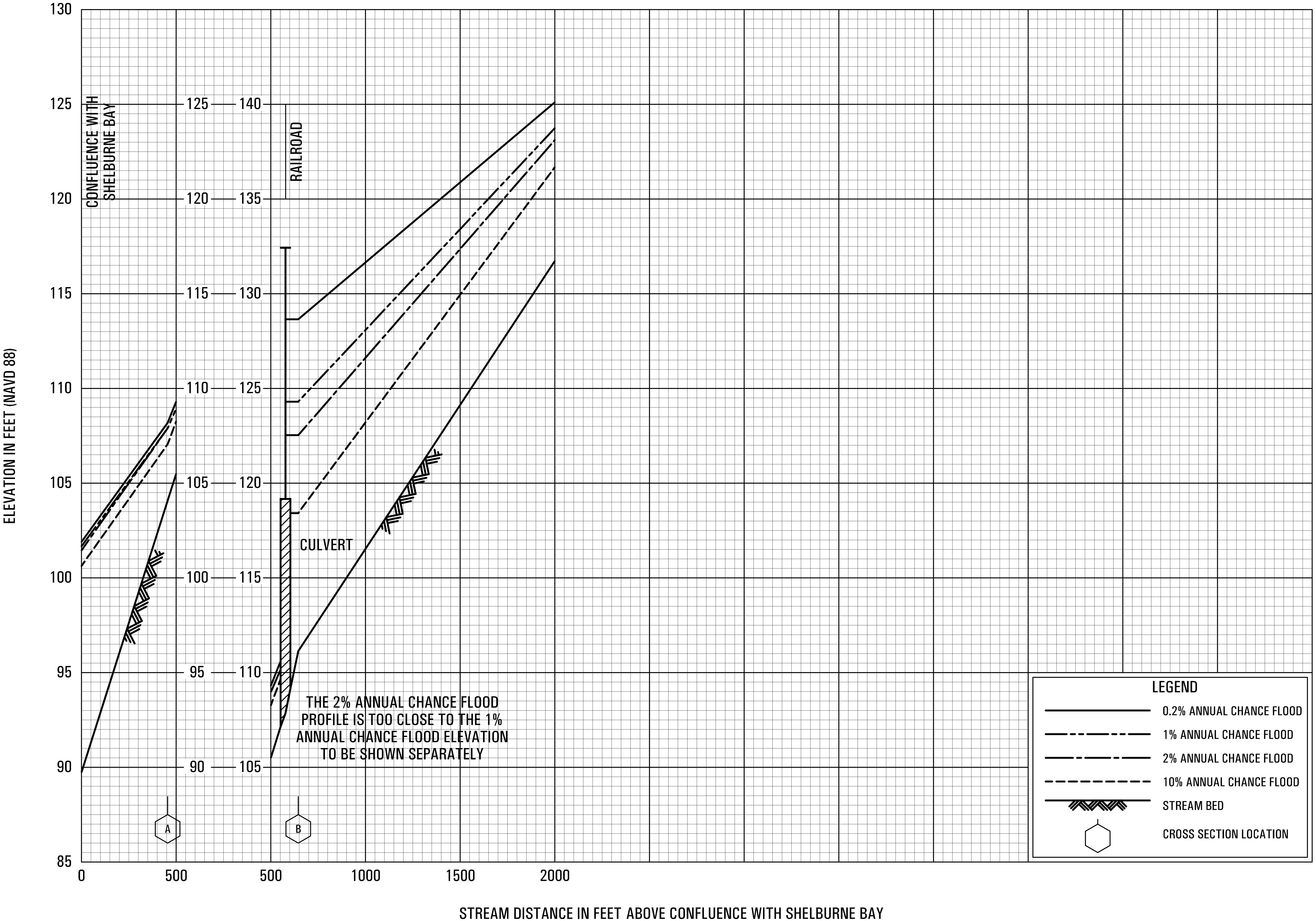
FLOOD PROFILES

McCABES BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

ALL JURISDICTIONS



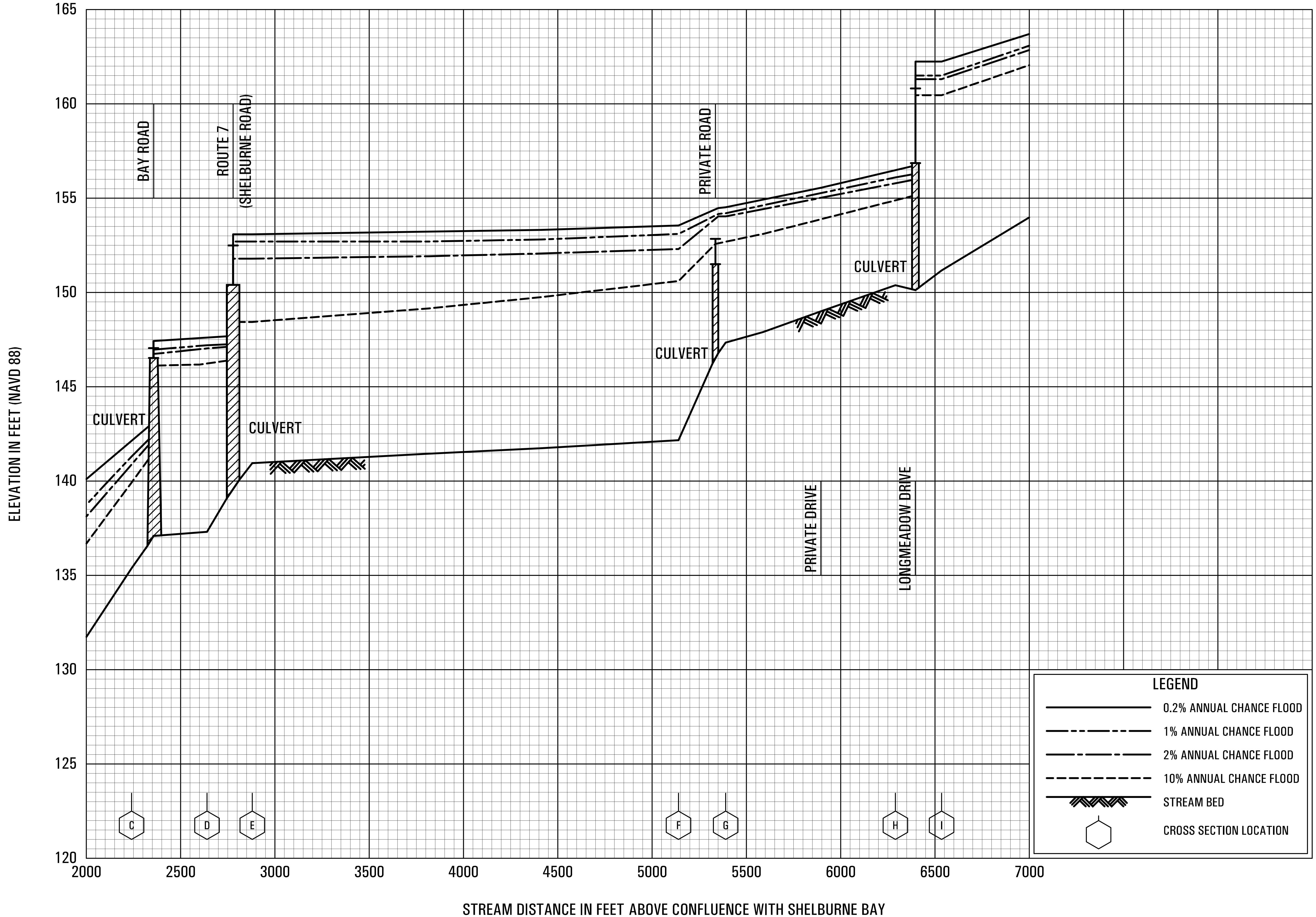
FLOOD PROFILES

MUNROE BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



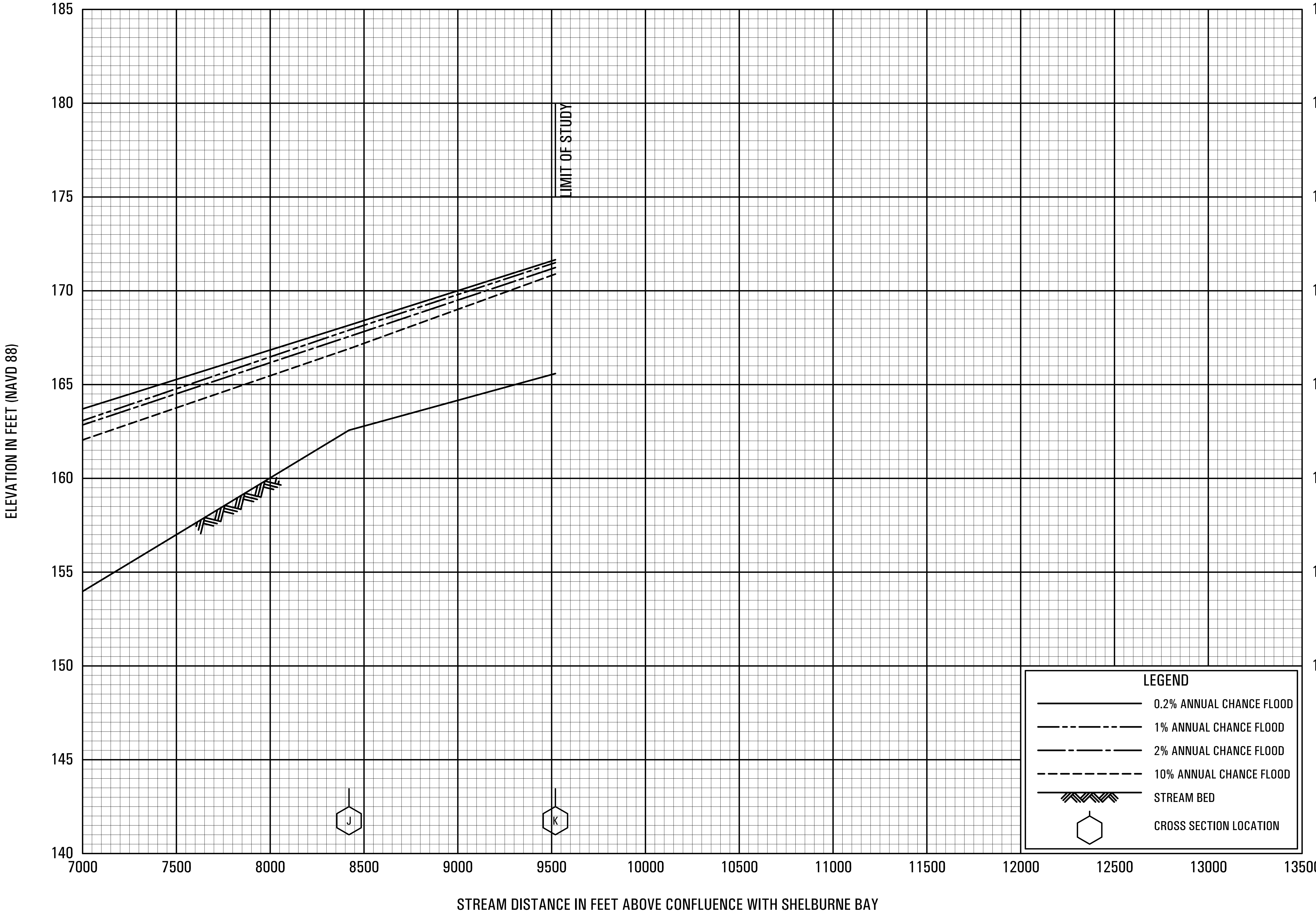
FLOOD PROFILES

MUNROE BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



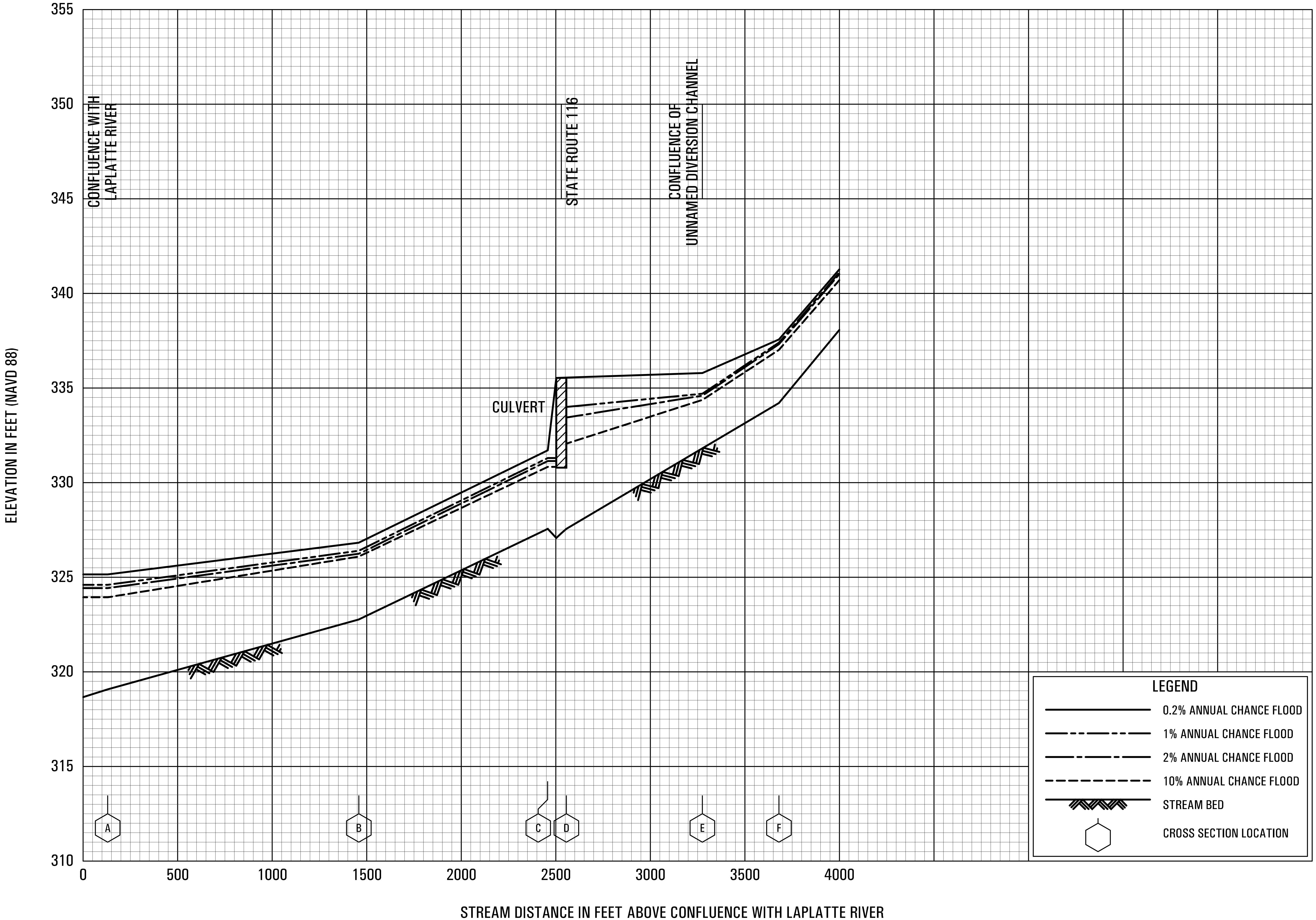
FLOOD PROFILES

MUNROE BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

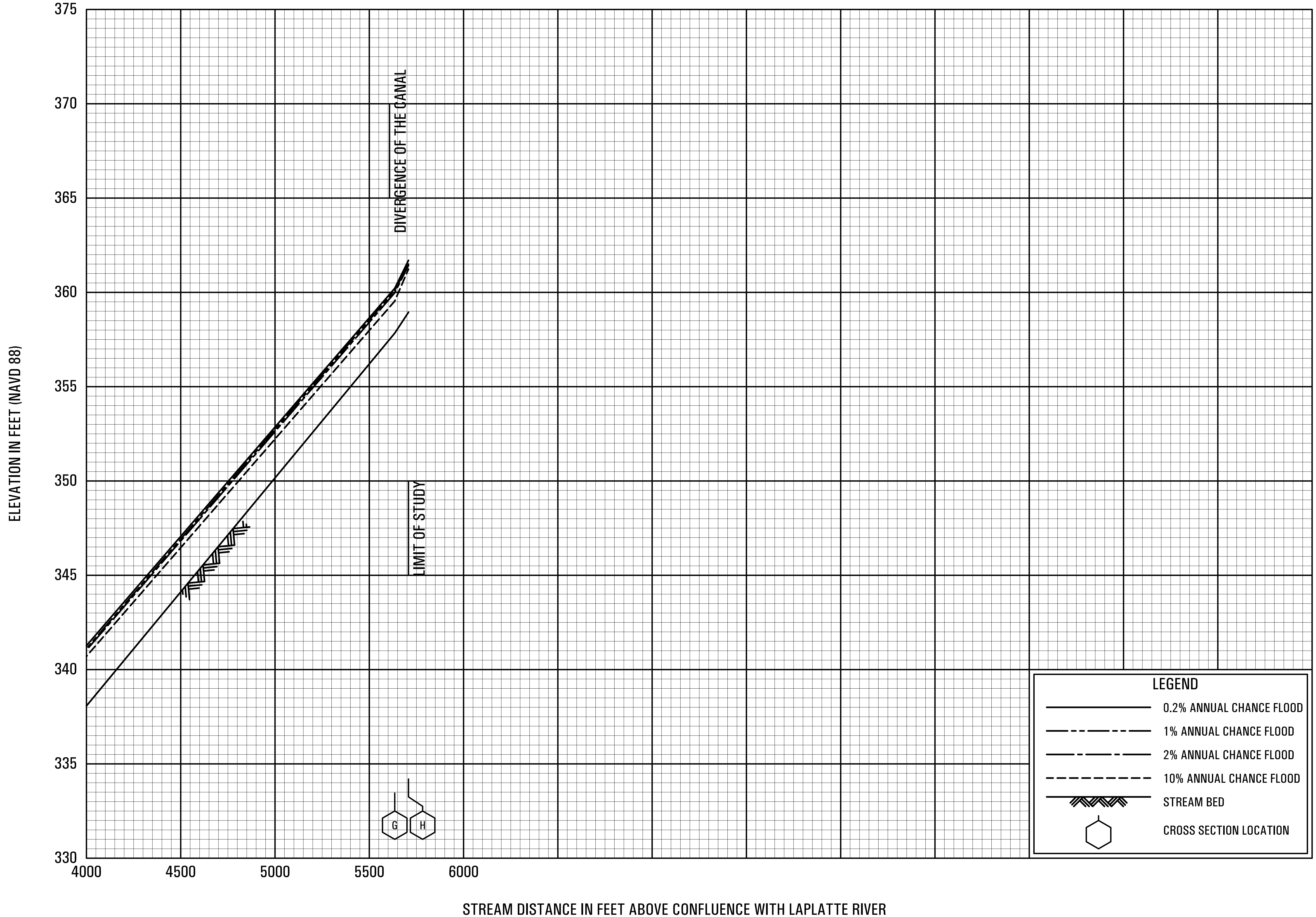


FLOOD PROFILES

PATRICK BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)



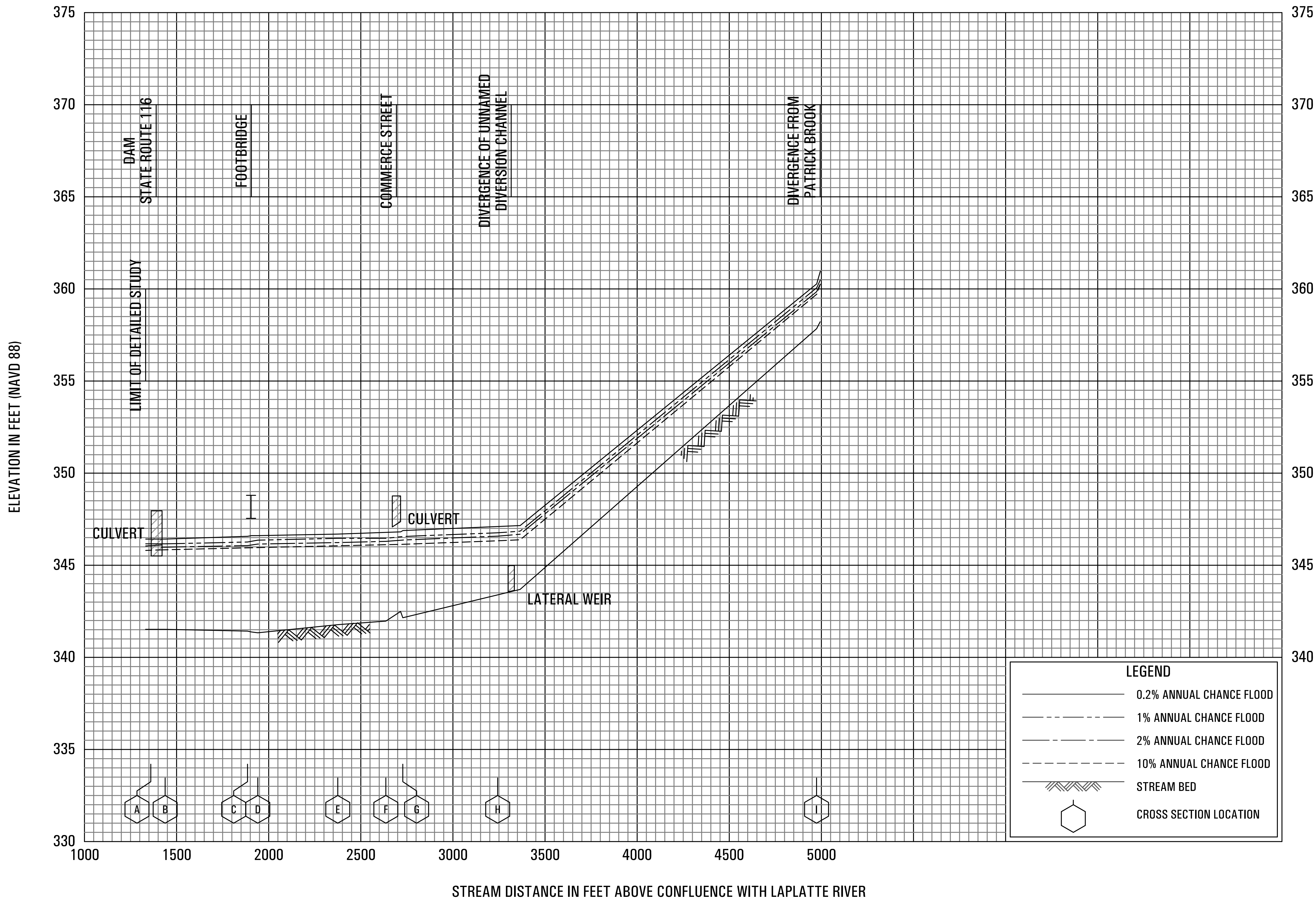
FLOOD PROFILES

PATRICK BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



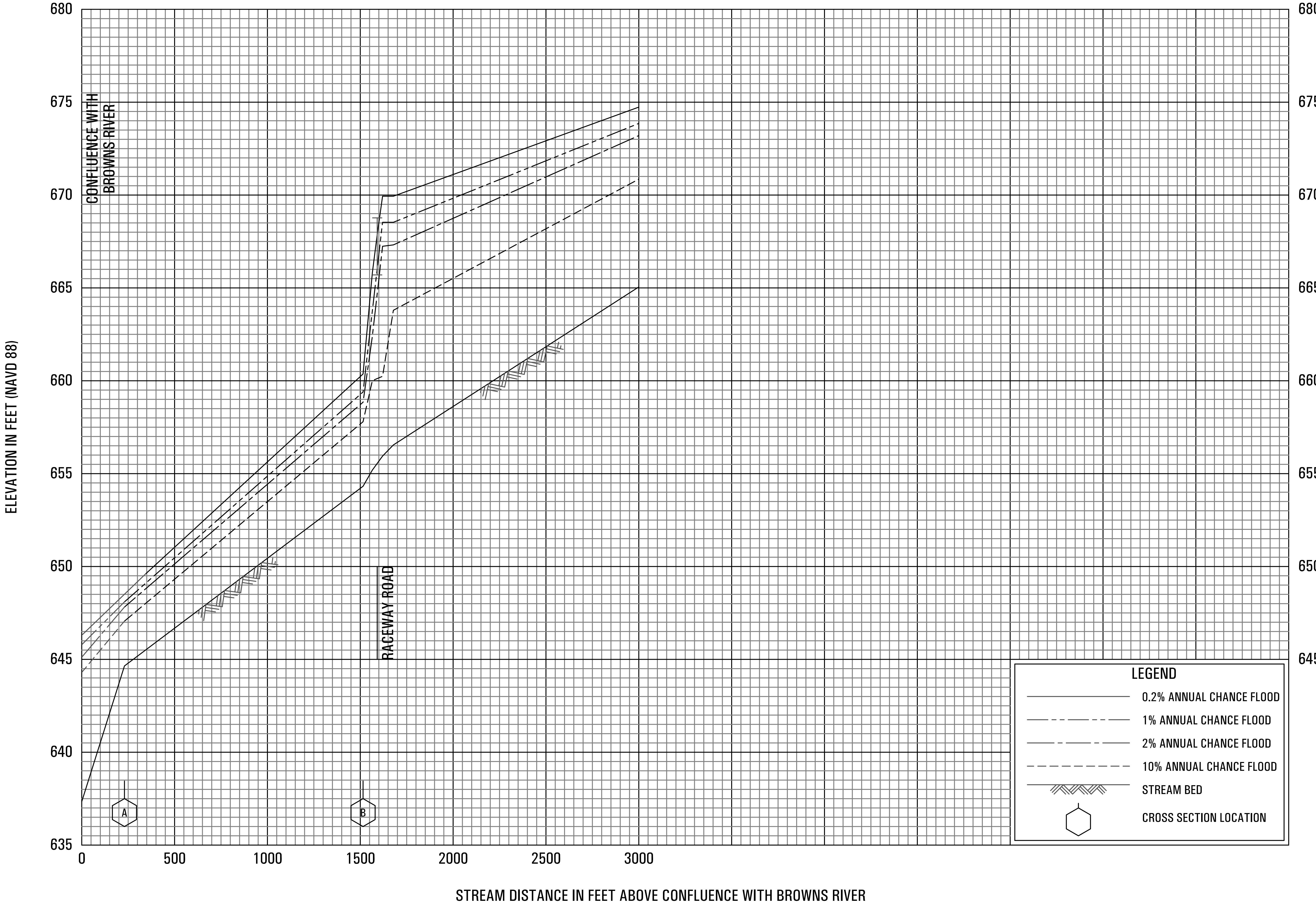
FLOOD PROFILES

THE CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

ALL JURISDICTIONS



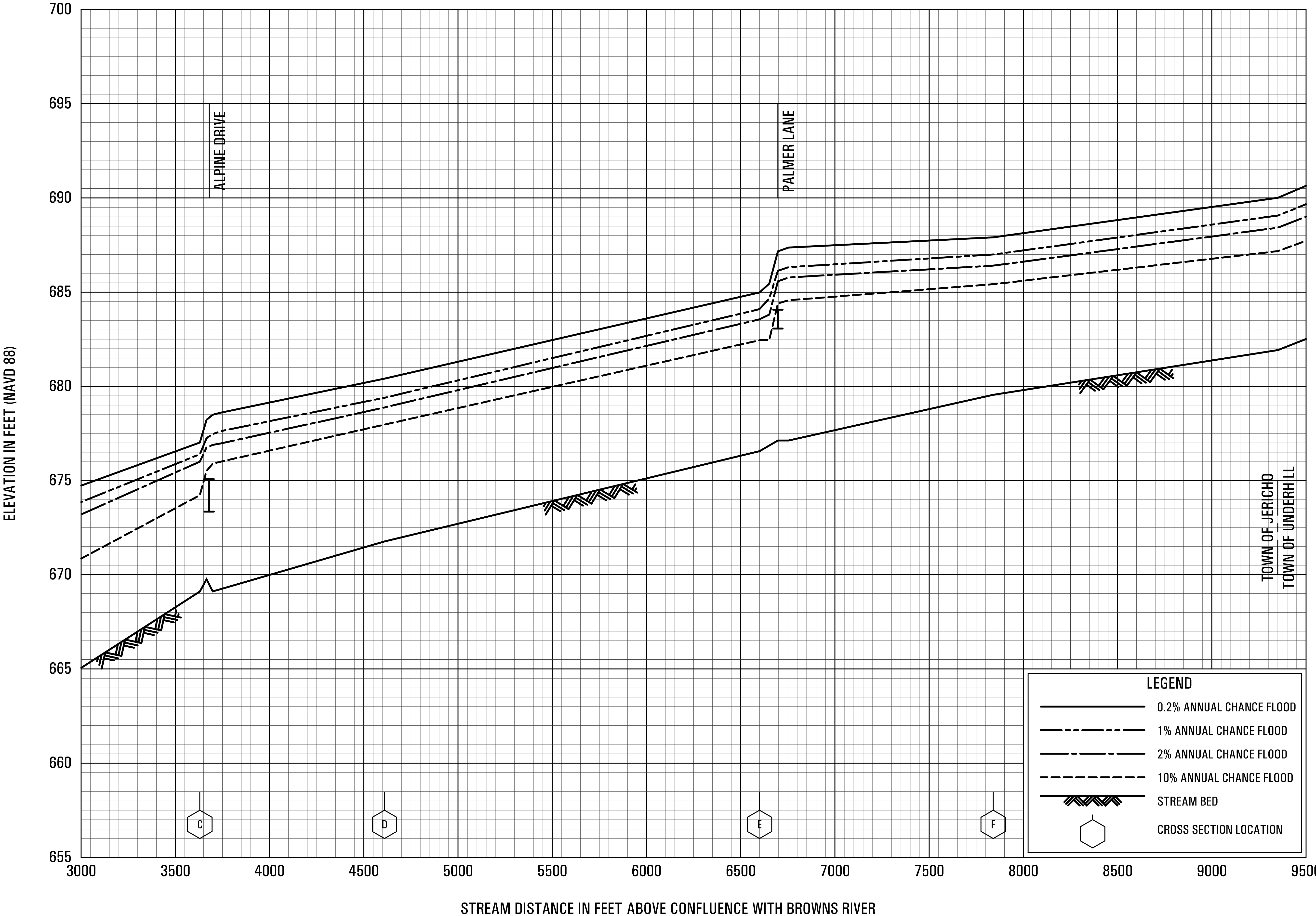
FLOOD PROFILES

THE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



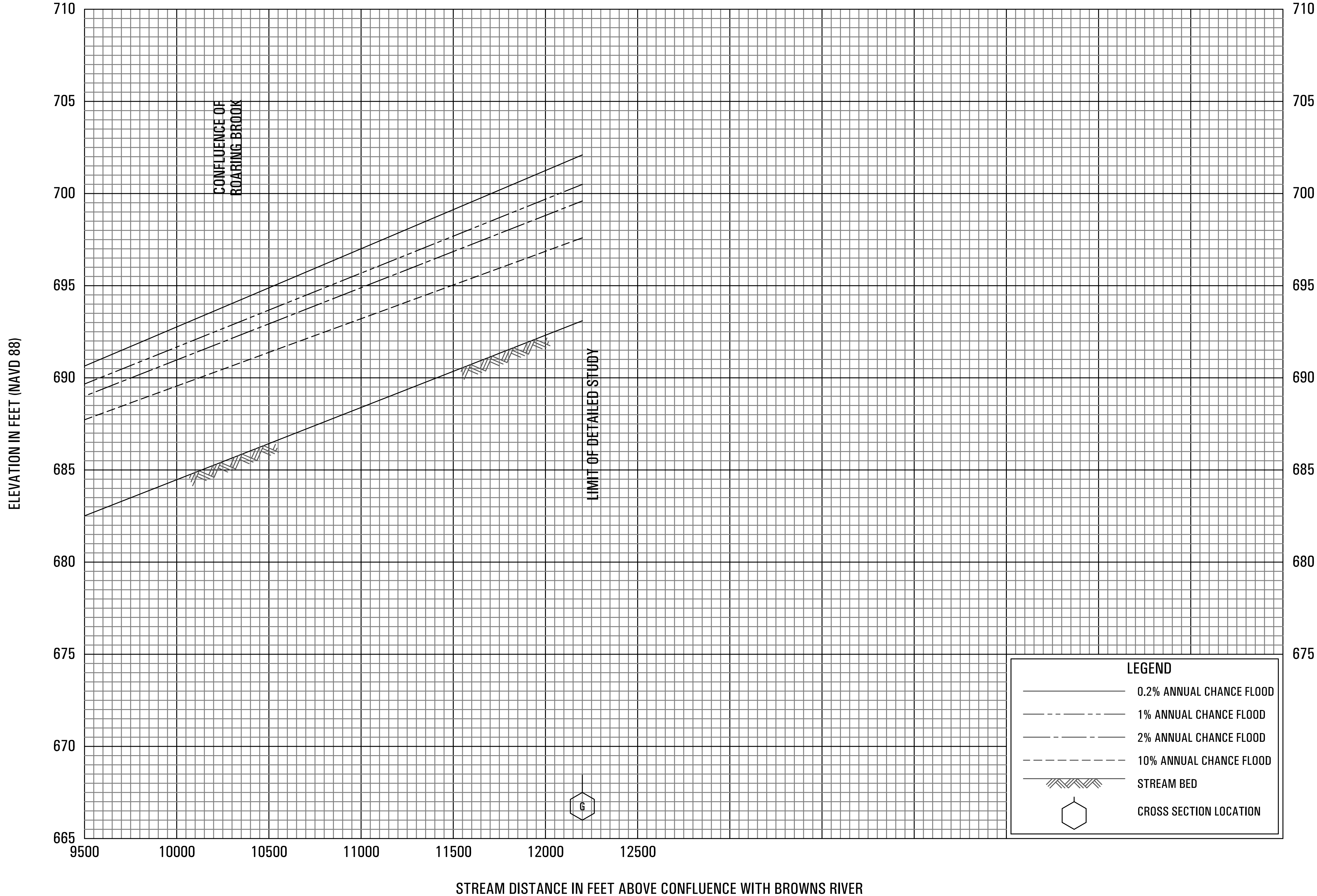
FLOOD PROFILES

THE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



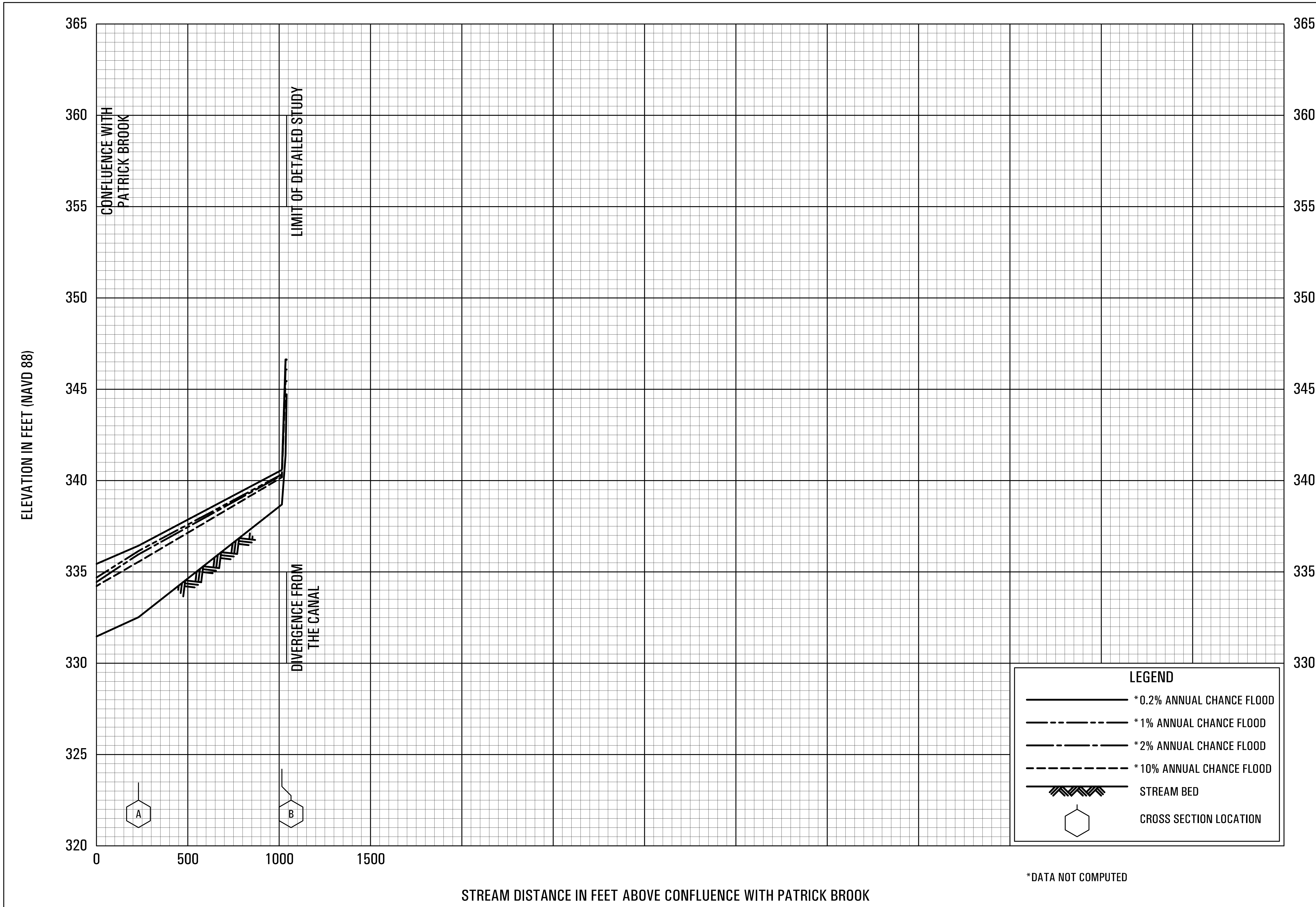
FLOOD PROFILES

THE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



FLOOD PROFILES

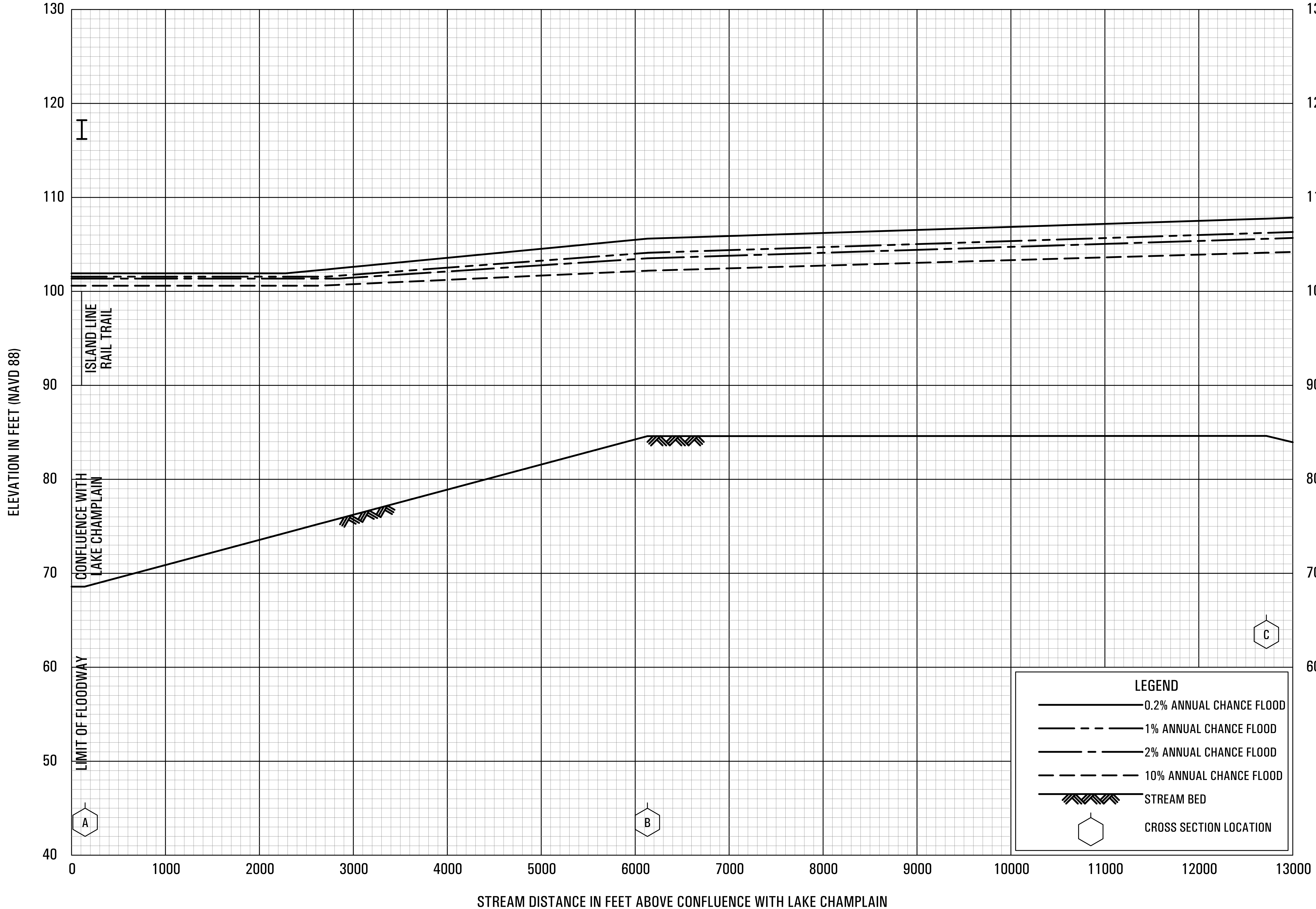
UNNAMED DIVERSION CHANNEL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)

51P



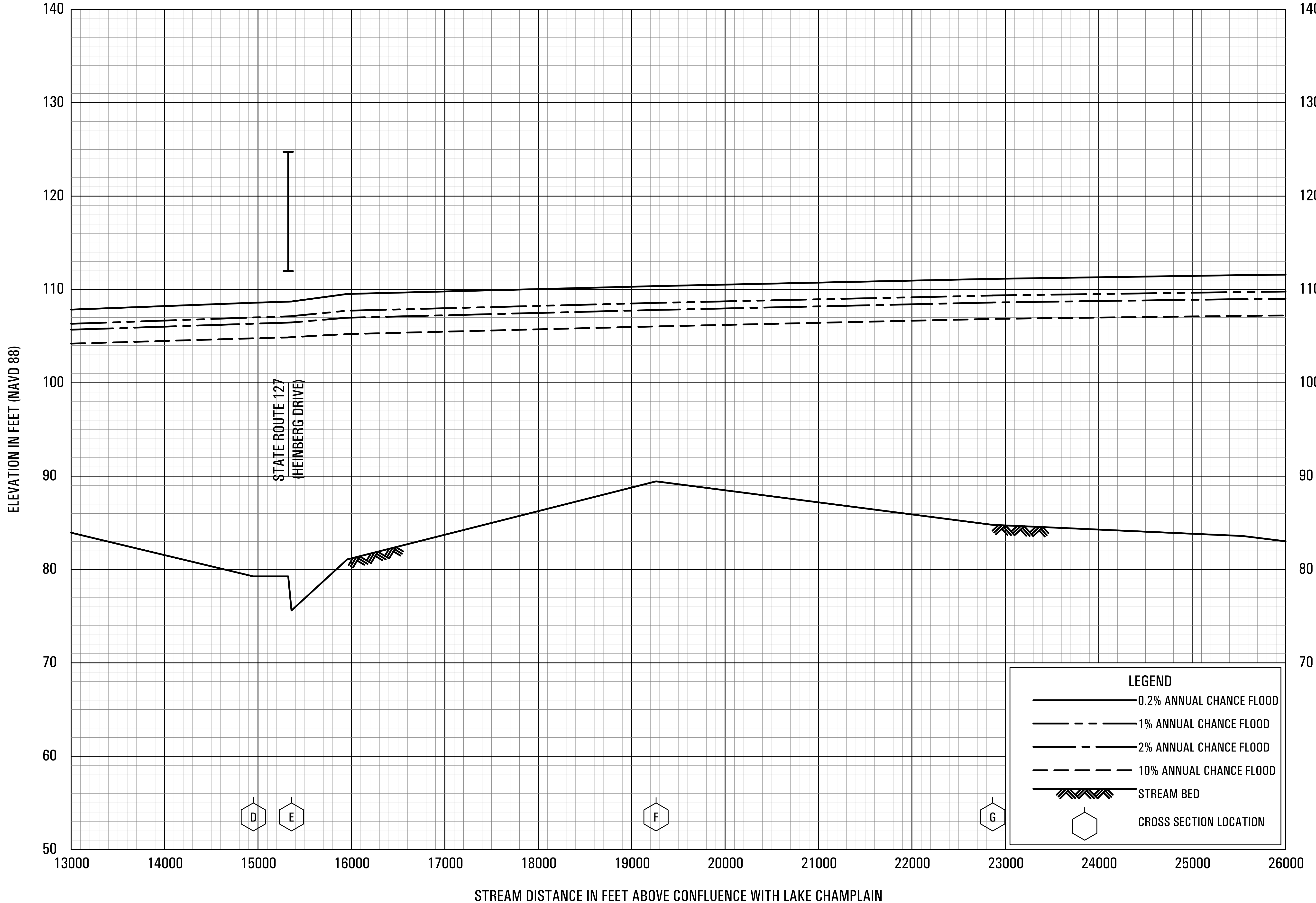
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



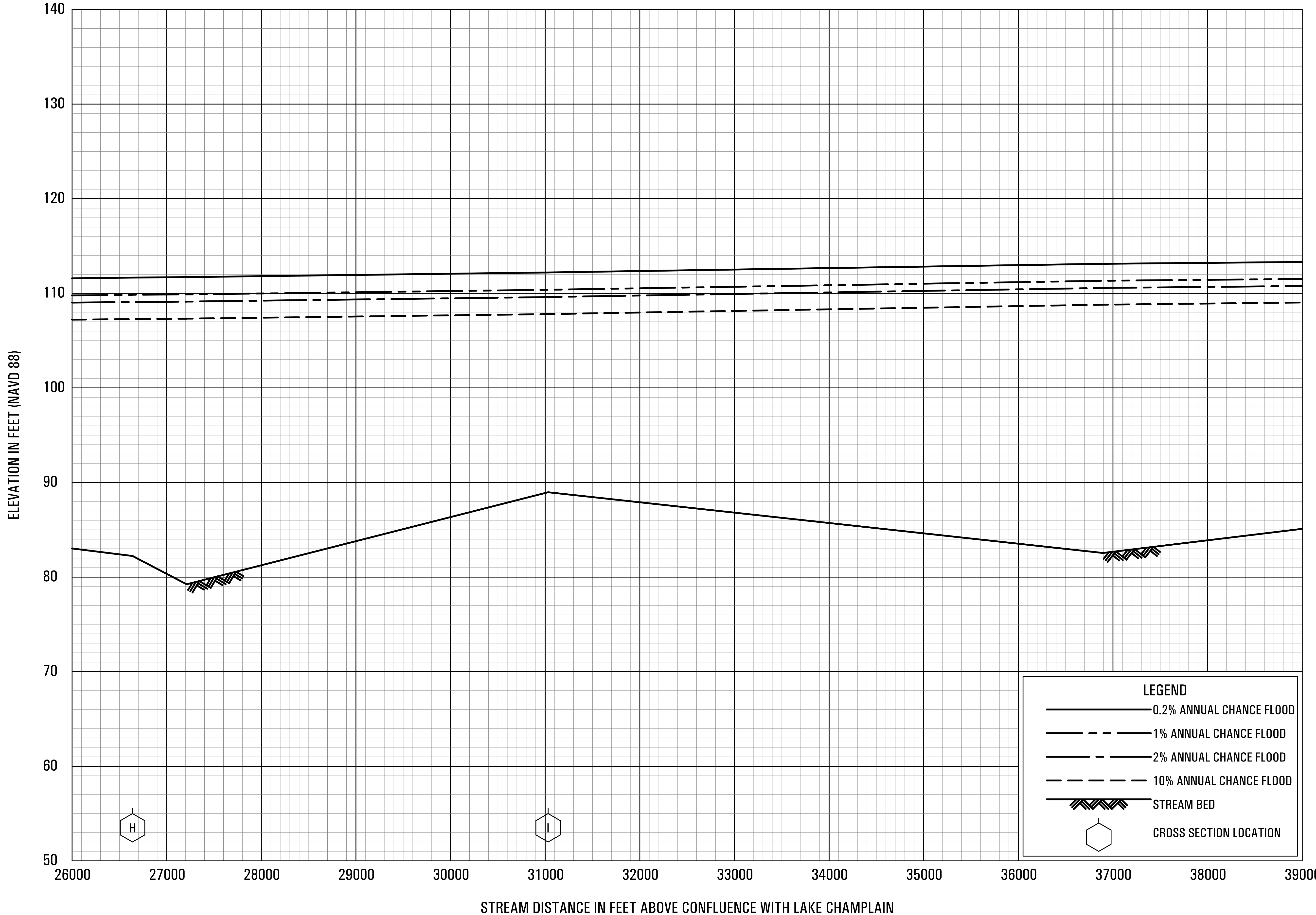
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



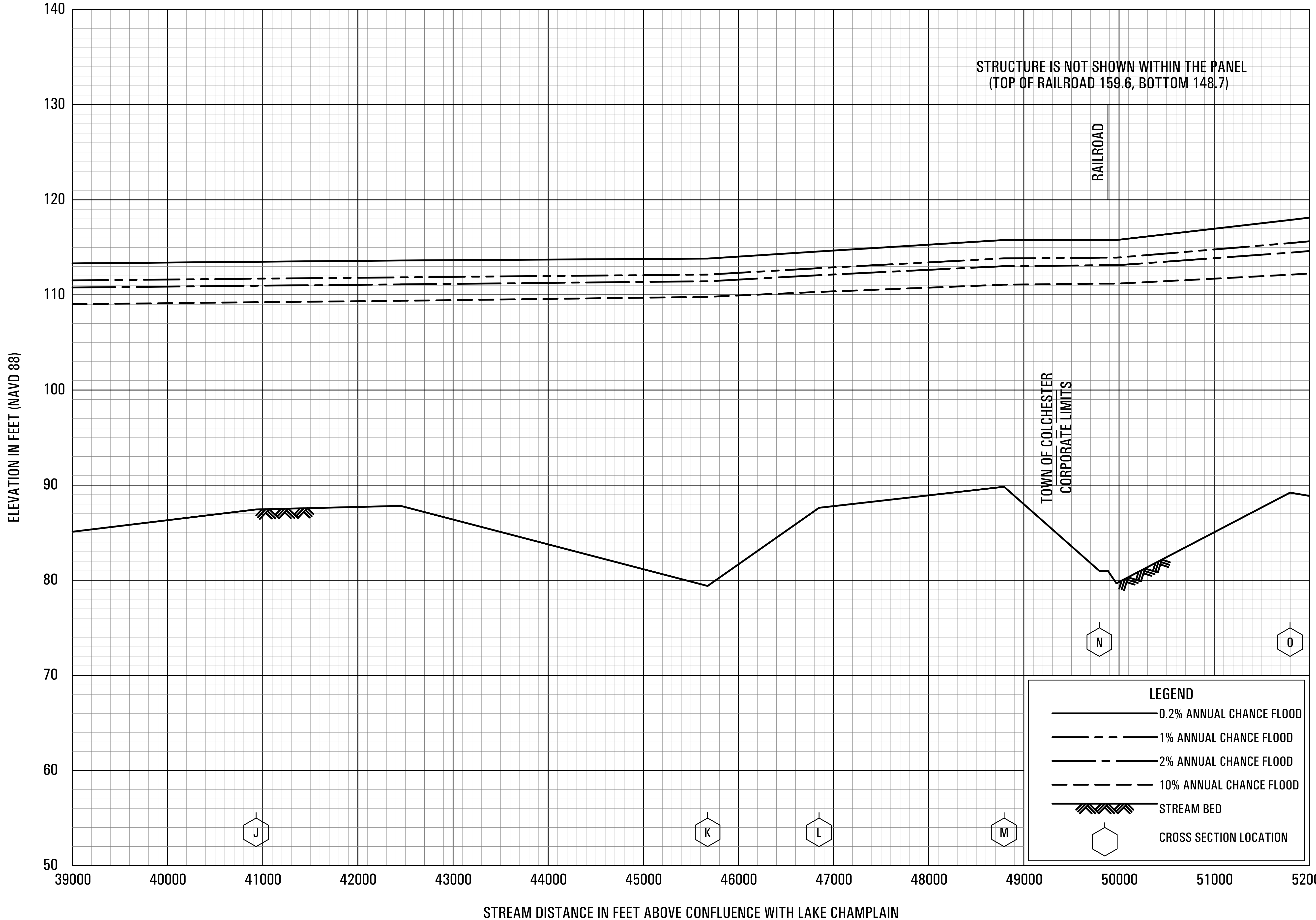
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



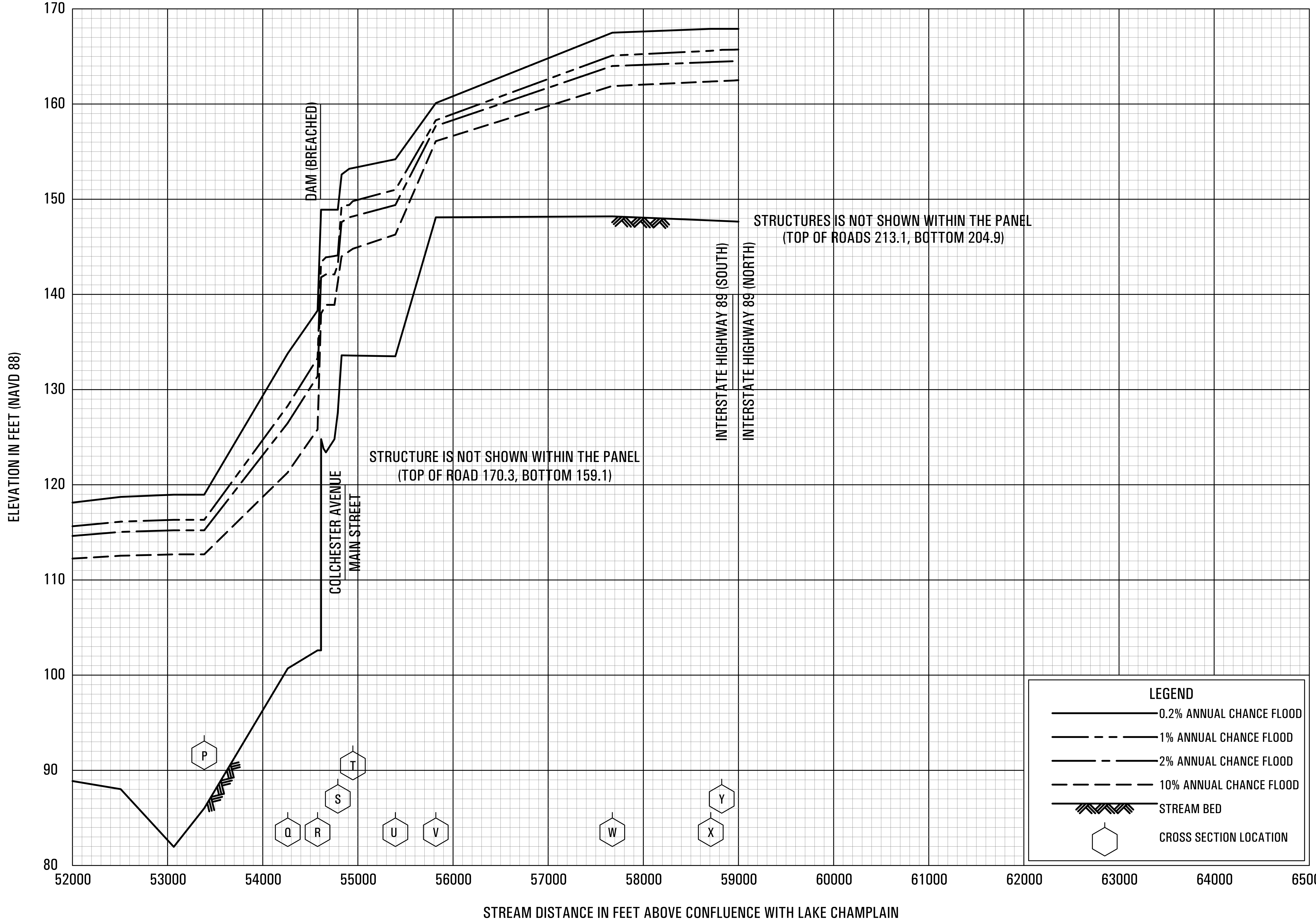
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



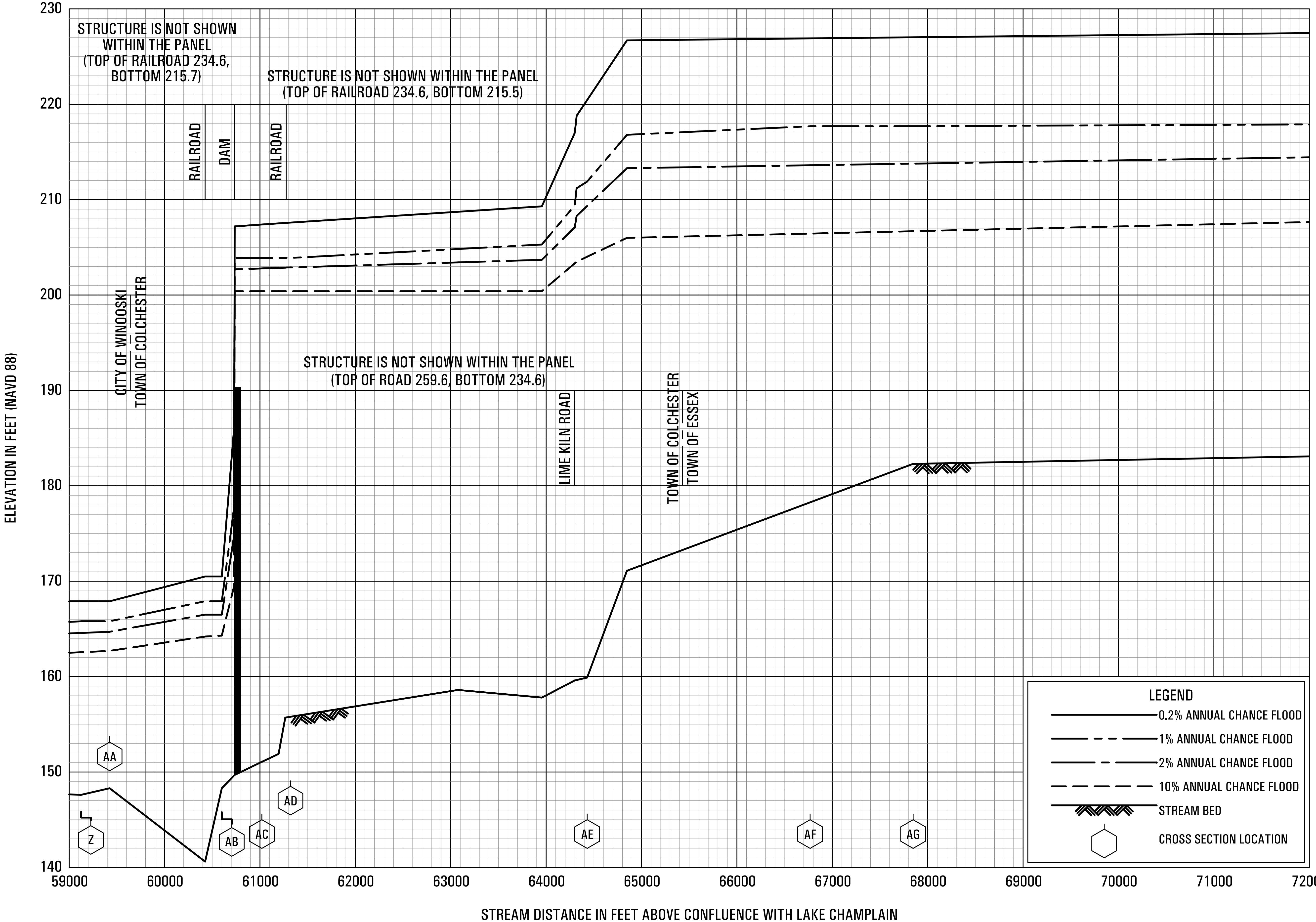
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



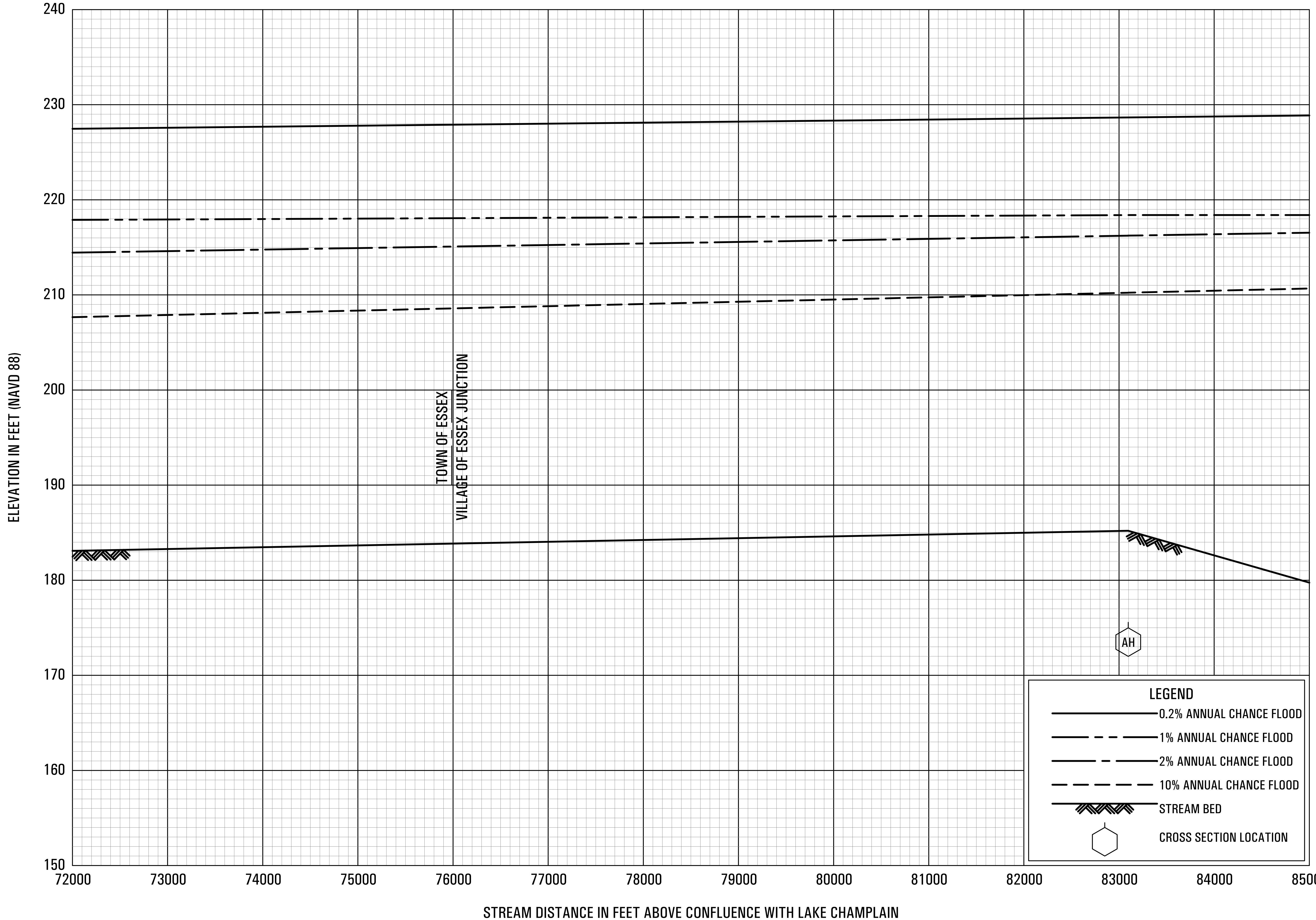
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



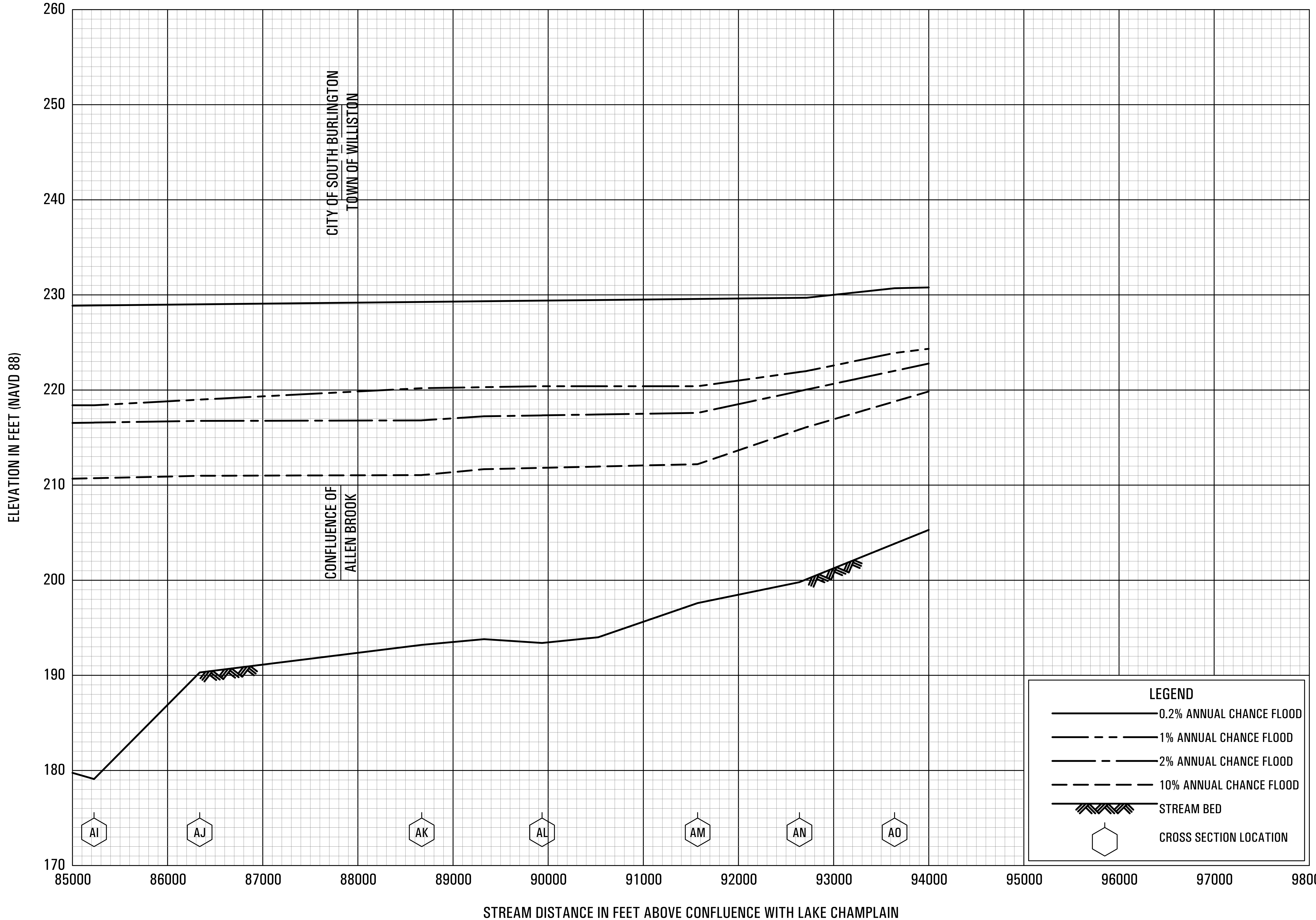
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



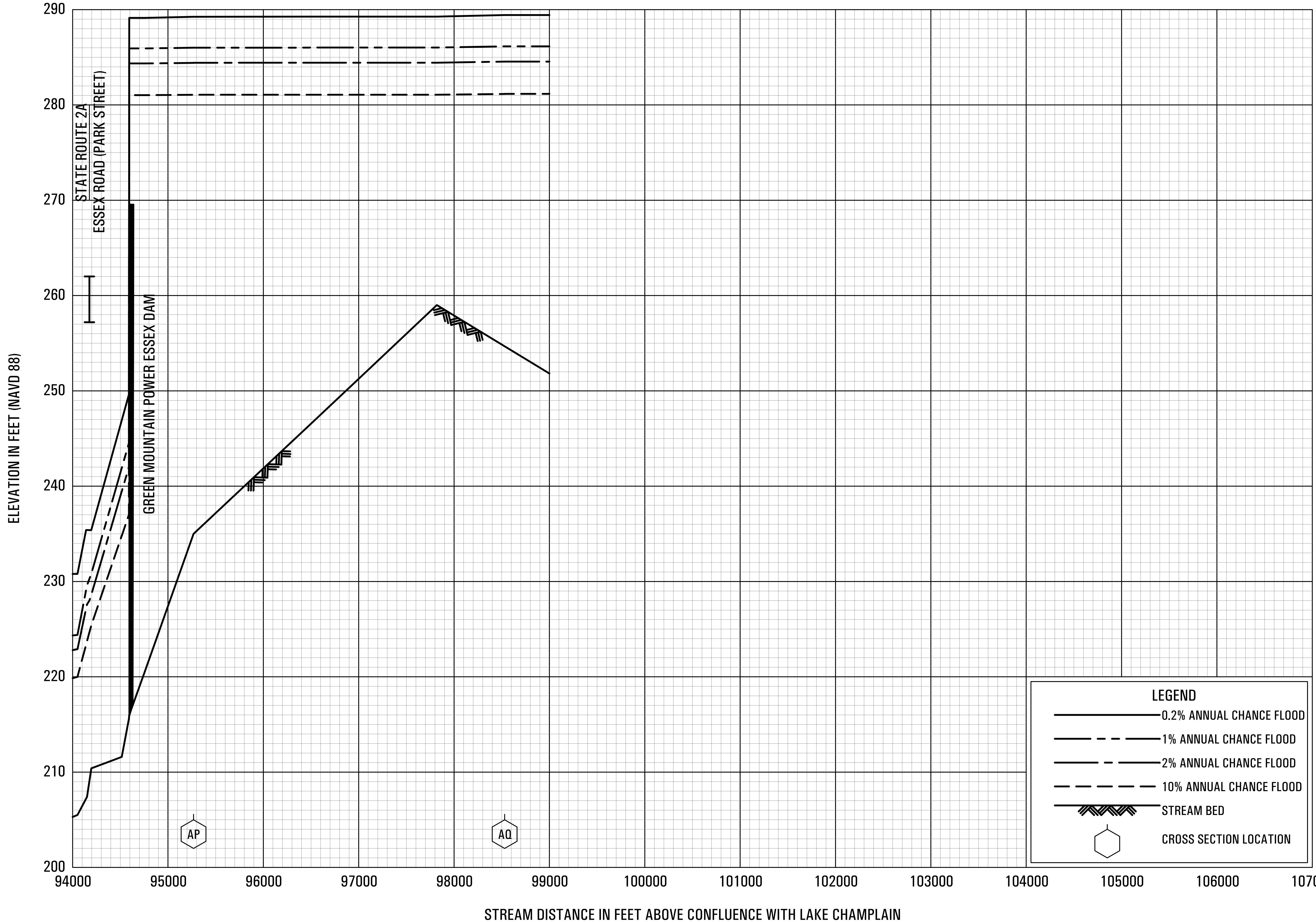
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



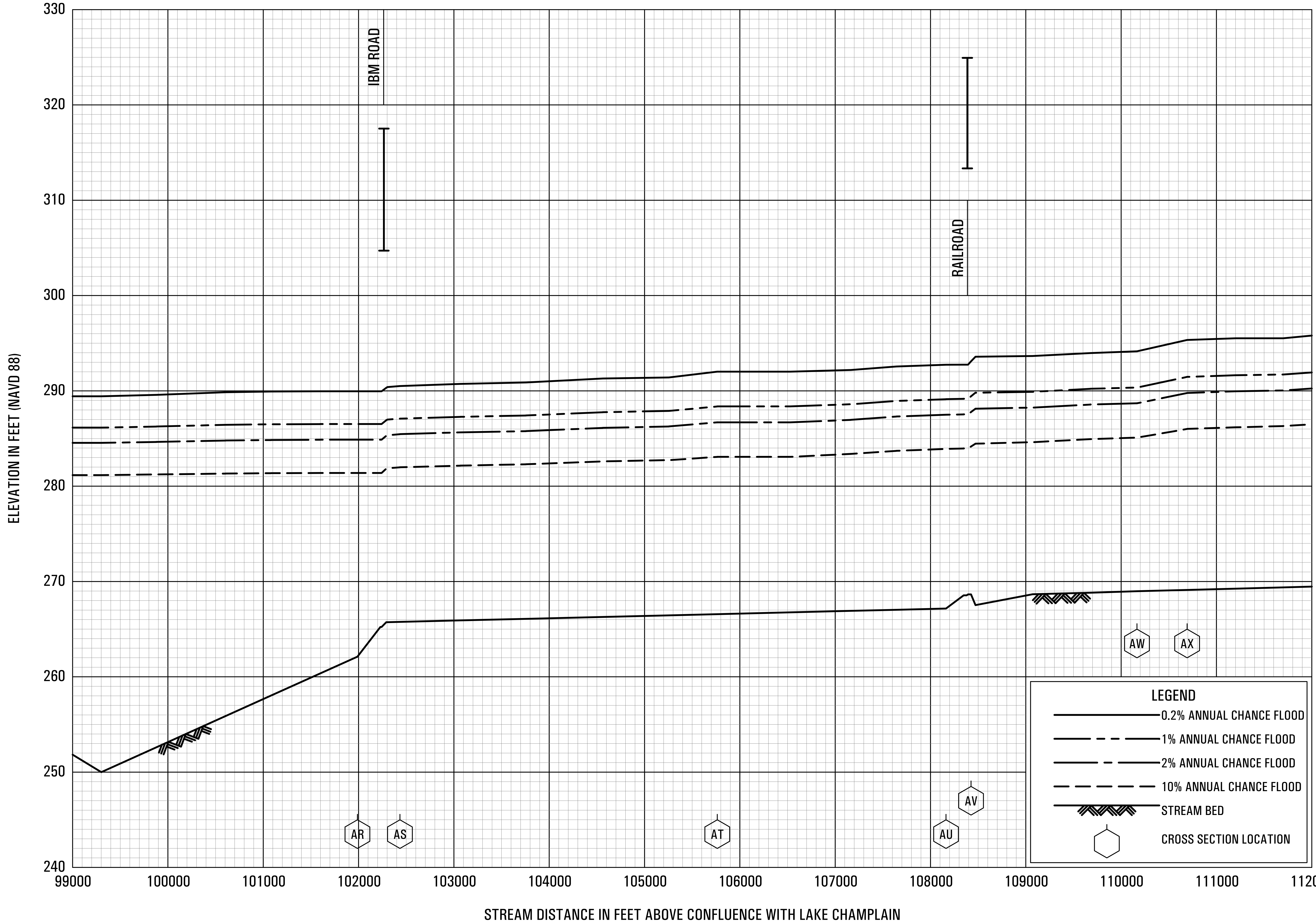
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



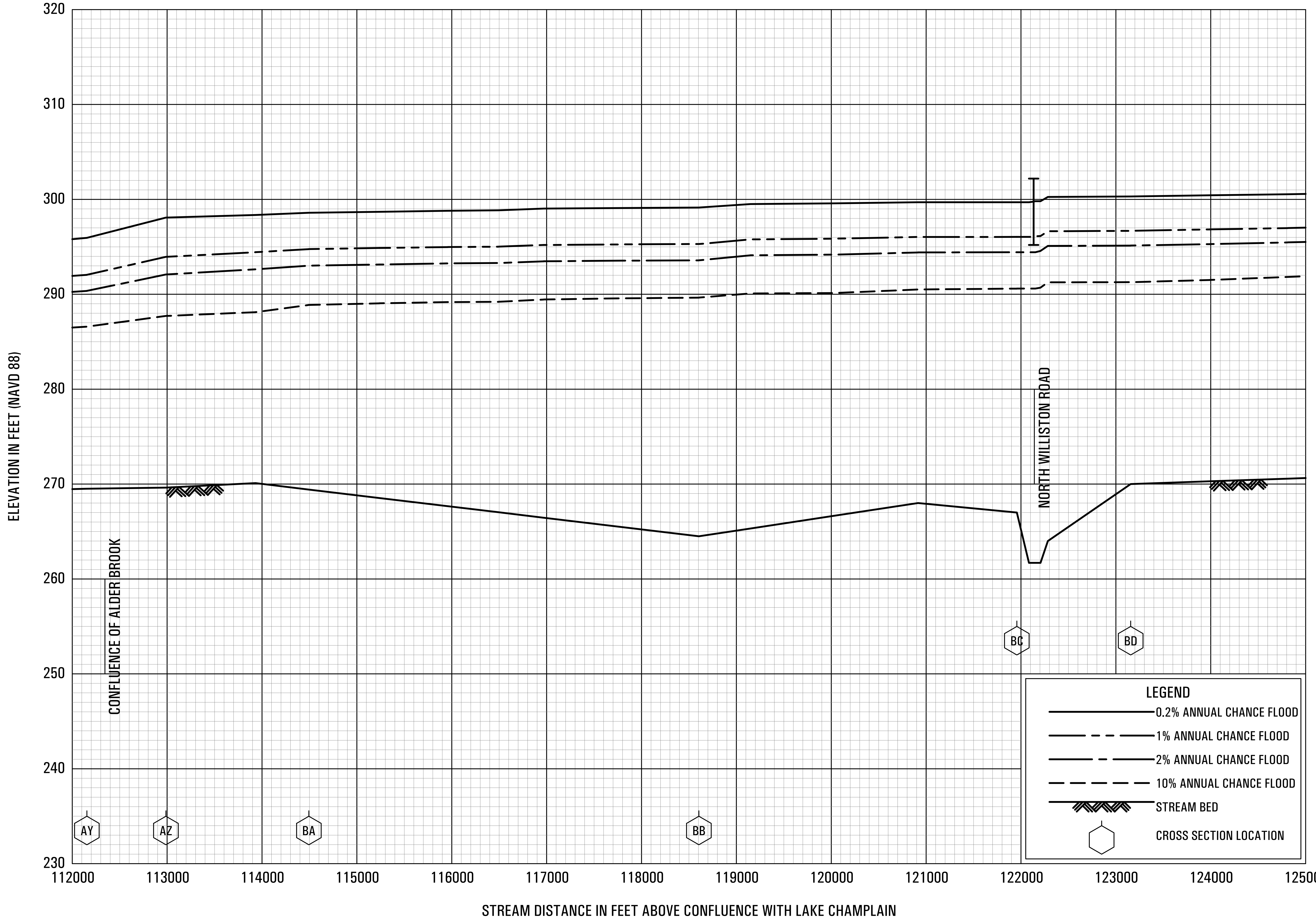
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



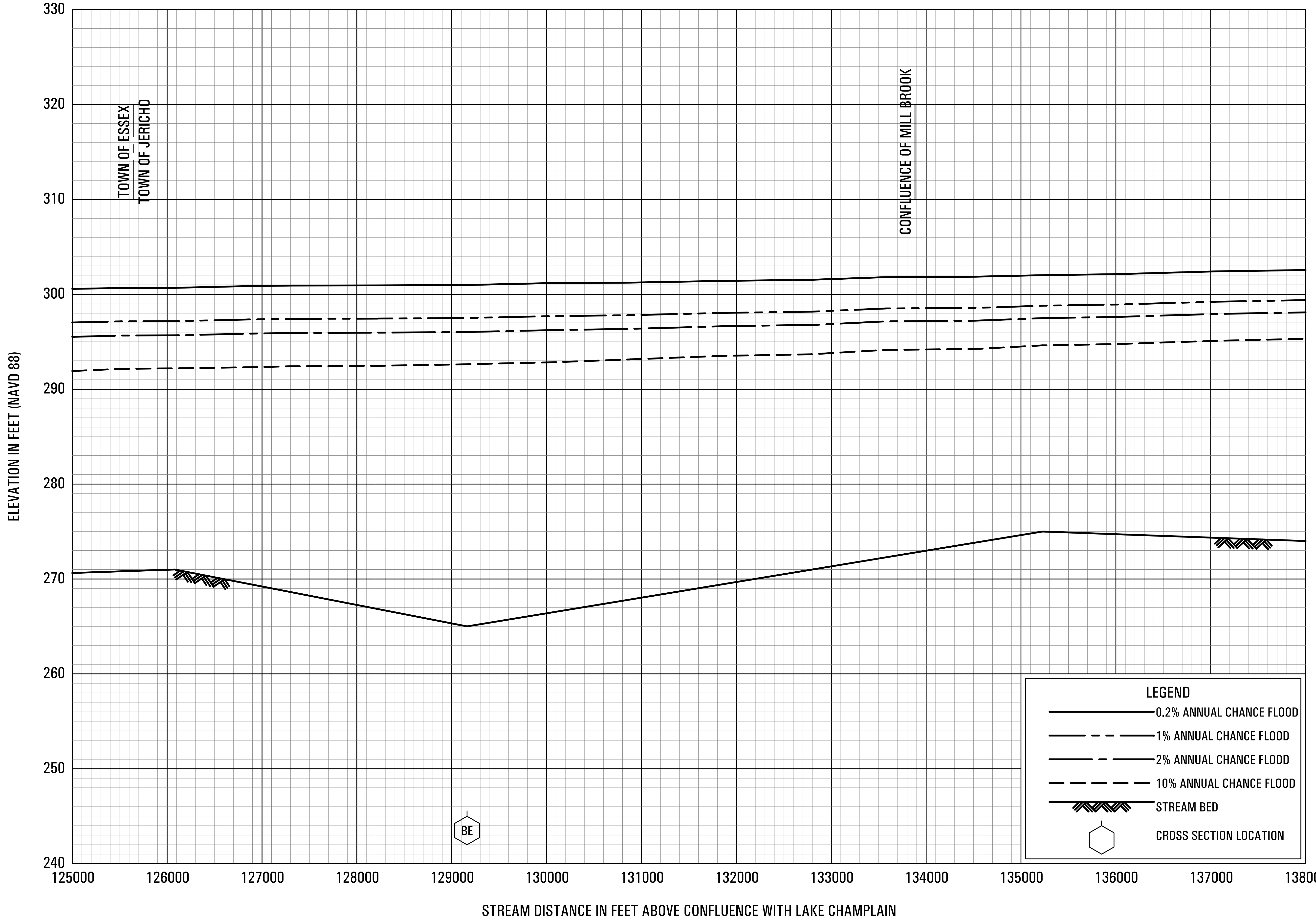
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



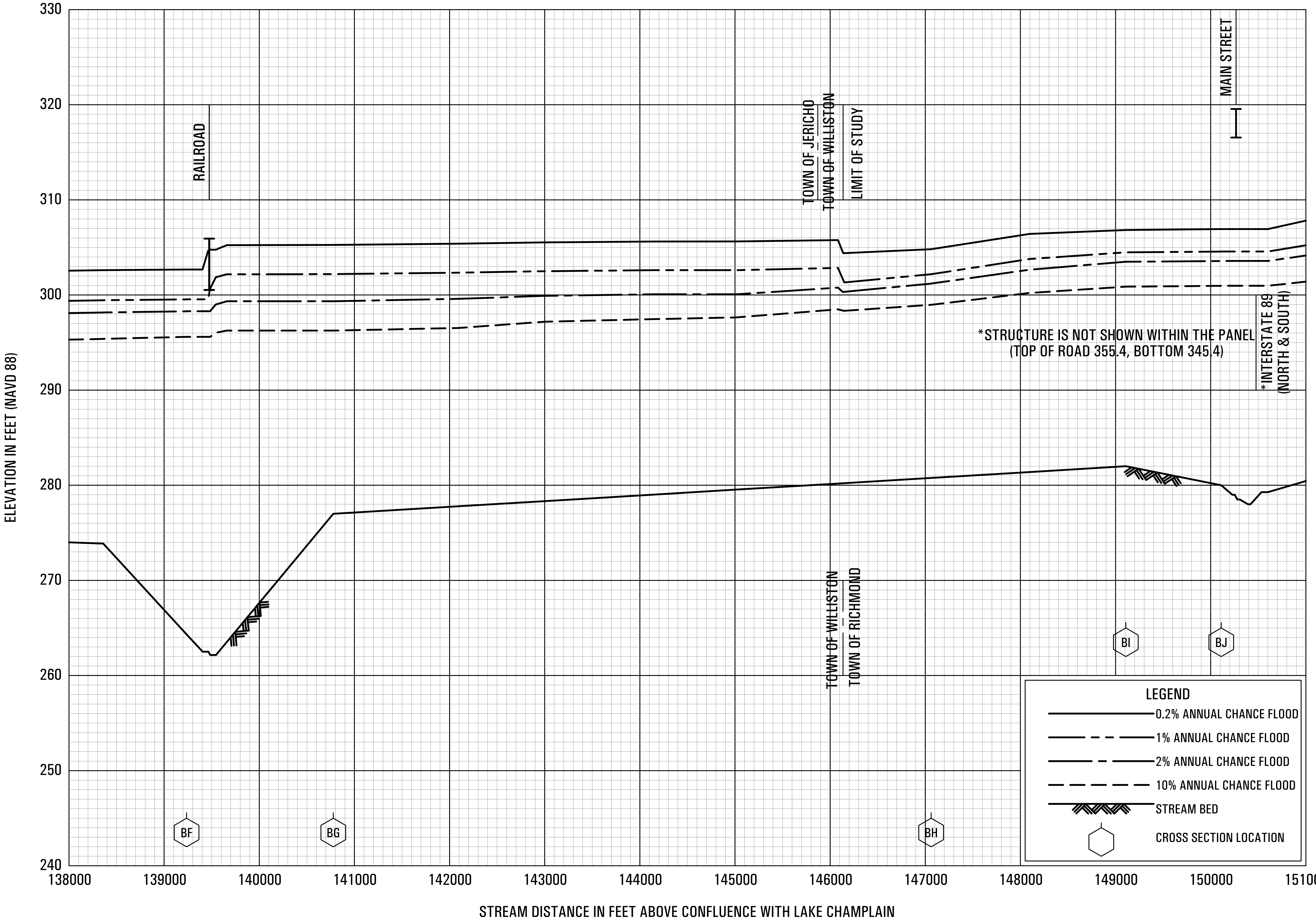
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



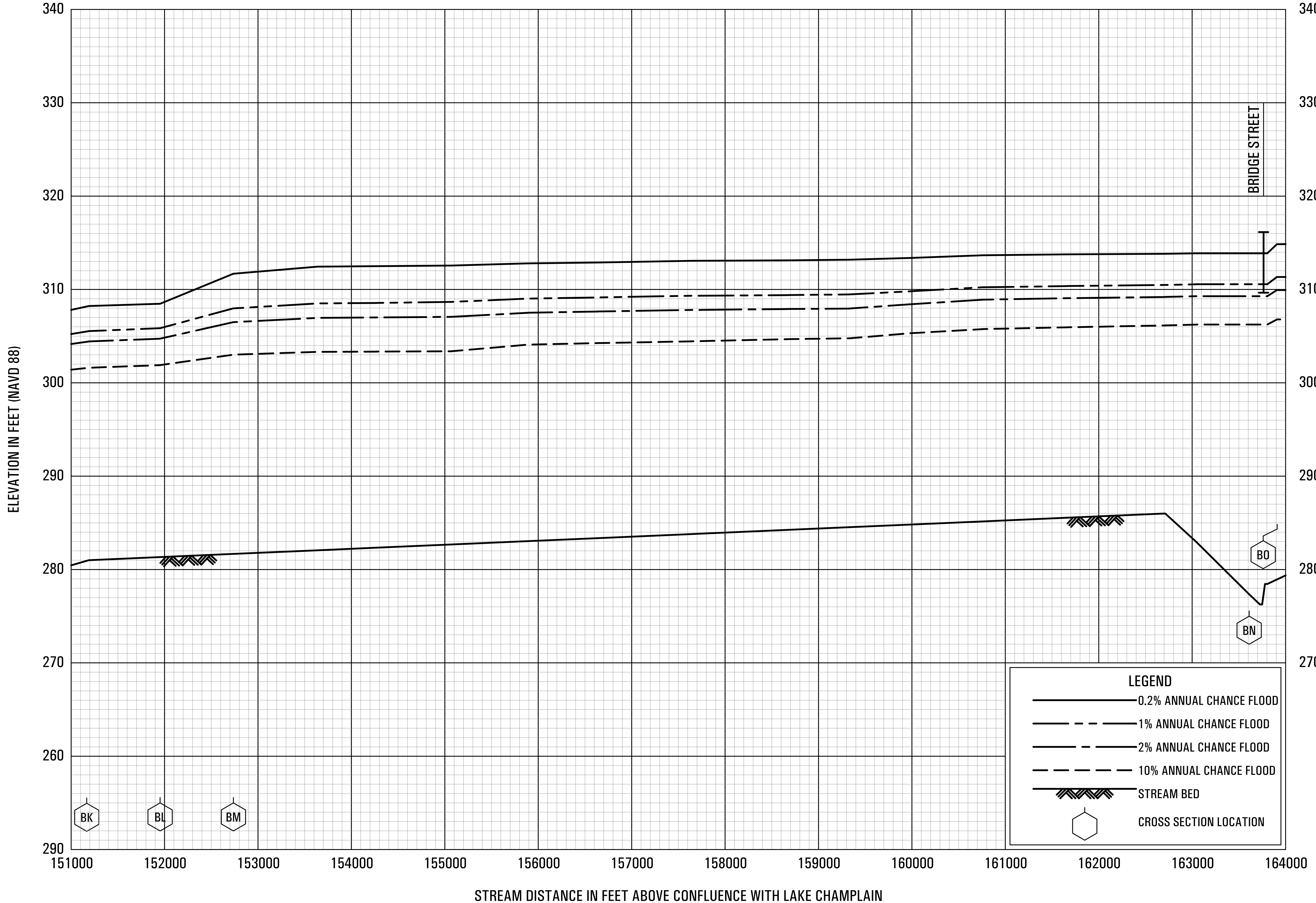
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



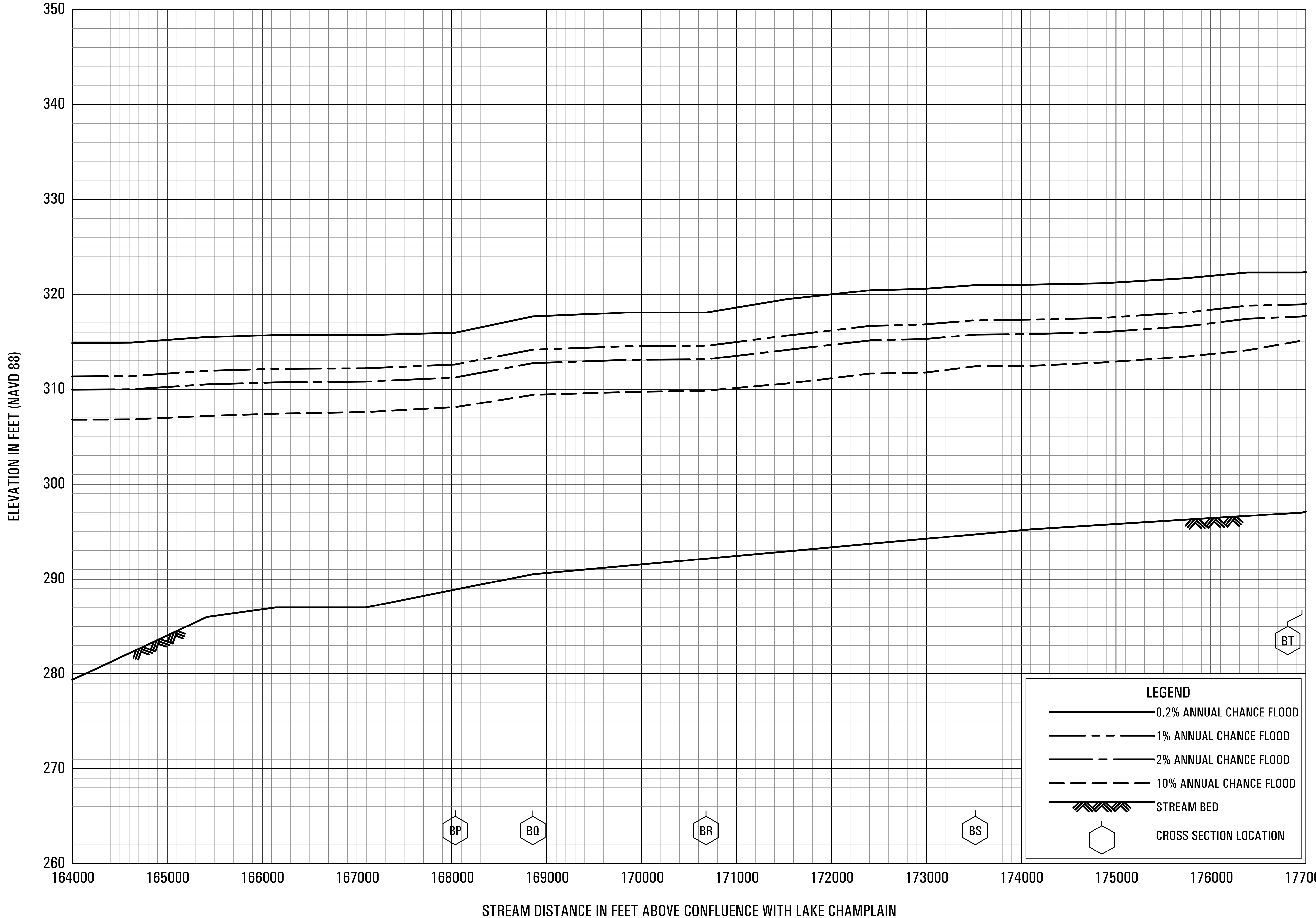
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



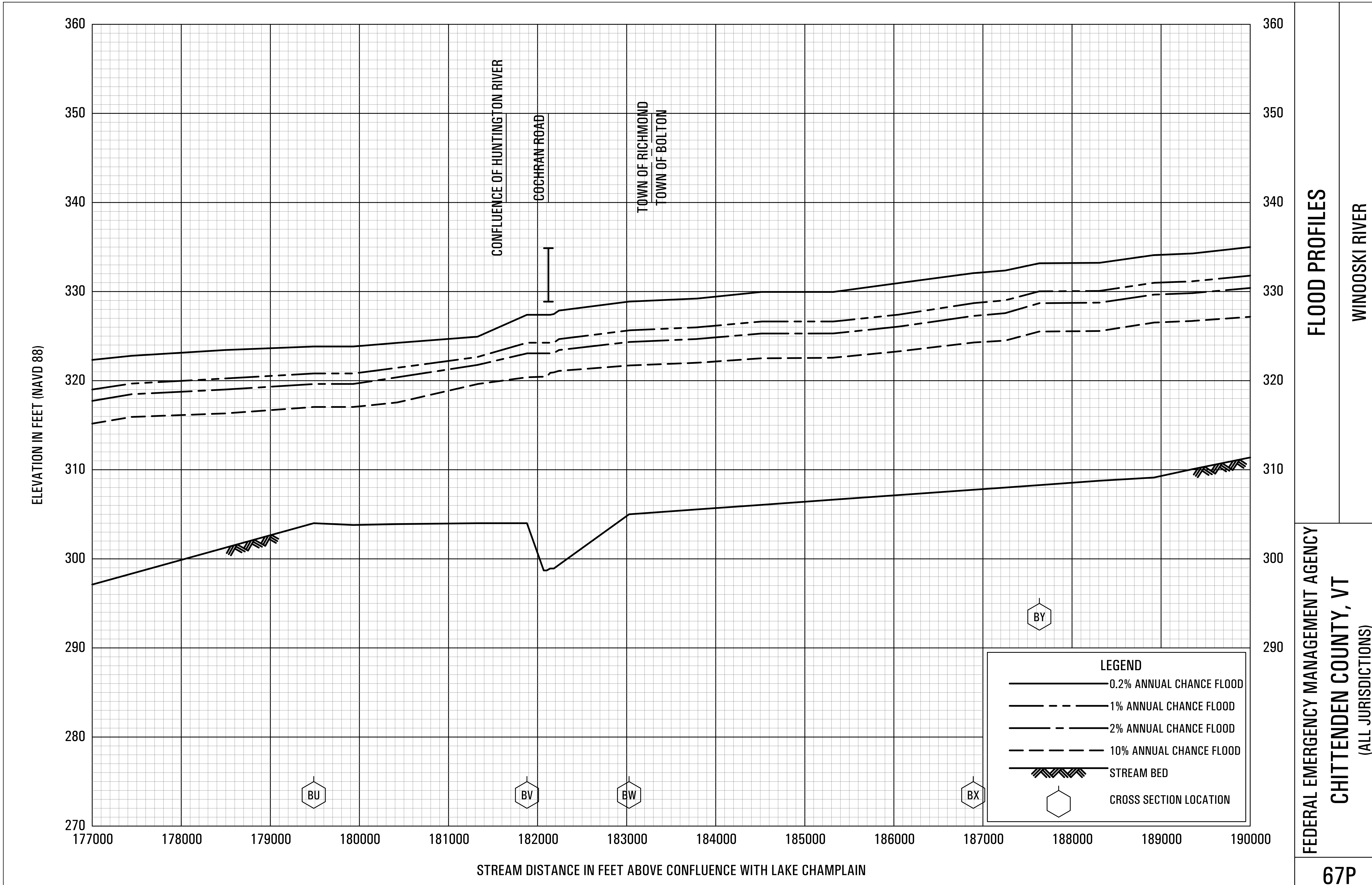
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



FLOOD PROFILES
WINOOSKI RIVER
FEDERAL EMERGENCY MANAGEMENT AGENCY
CHITTENDEN COUNTY, VT
(ALL JURISDICTIONS)
67P
ELEVATION IN FEET (NAVD 88)
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH LAKE CHAMPLAIN
CONFLUENCE OF HUNTINGTON RIVER
COCHRAN ROAD
TOWN OF RICHMOND
TOWN OF BOLTON
BU
BV
BW
BX
BY
LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION
360
350
340
330
320
310
300
290
280
270
177000
178000
179000
180000
181000
182000
183000
184000
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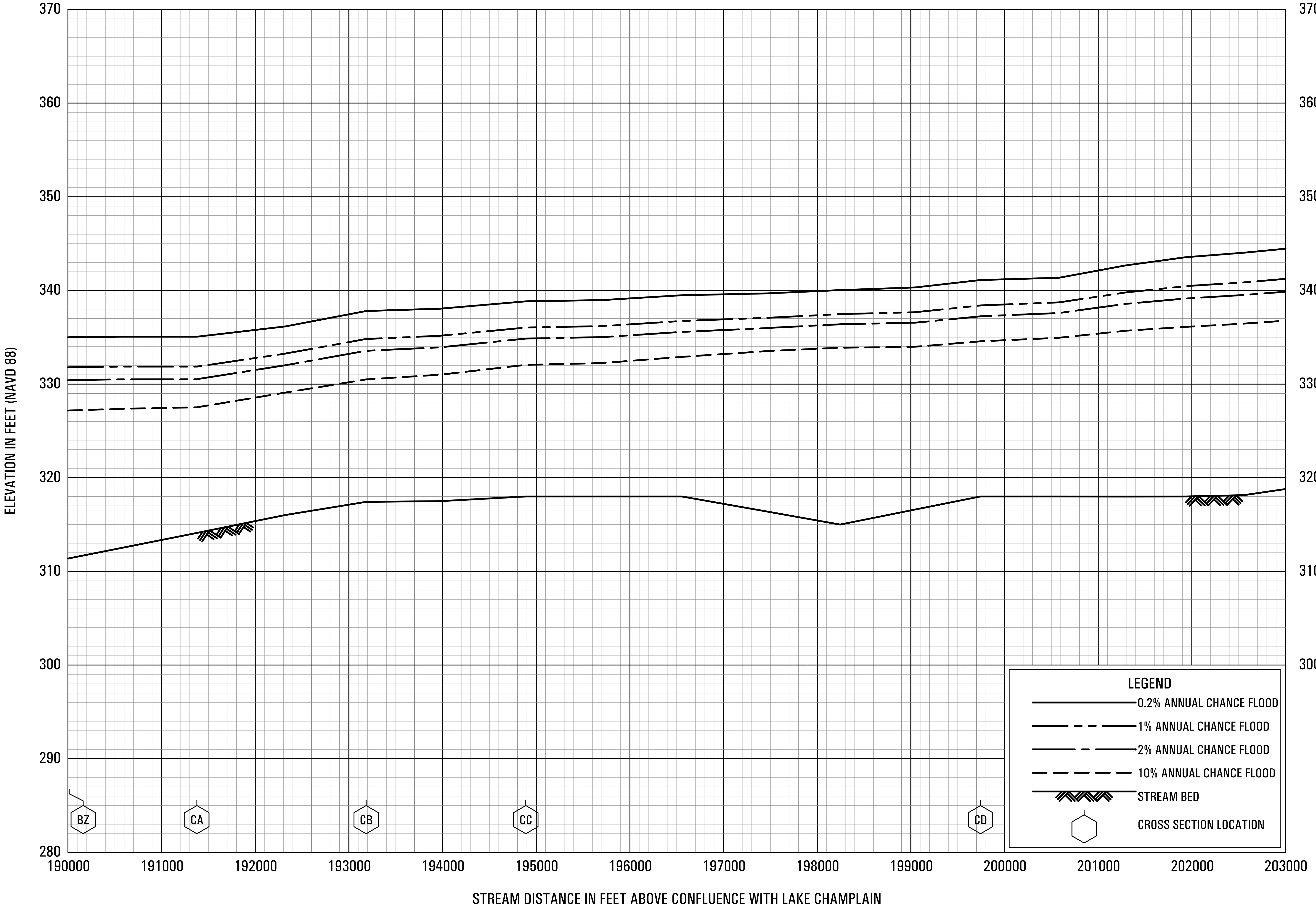


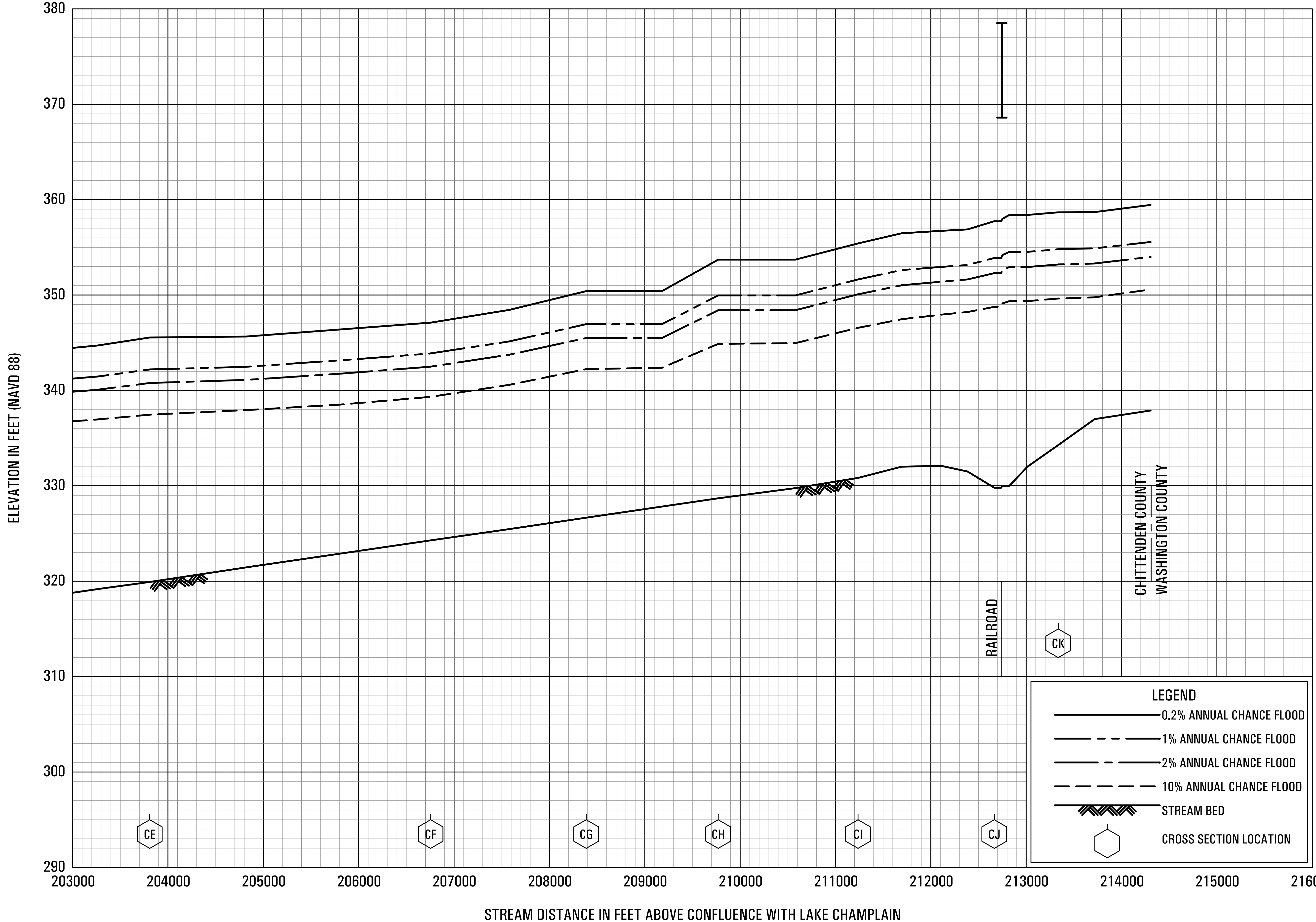
FLOOD PROFILES

WINOOSKI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CHITTENDEN COUNTY, VT

(ALL JURISDICTIONS)



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