EFFECTS OF RELOCATING STATE ROUTE 151 ON THE FLOOD PROFILES OF CONOTTON CREEK AND ITS TRIBUTARIES BETWEEN BOWERSTON AND SCIO, OHIO

By William P. Bartlett, Jr., Bruce E. Krejmas,
Ronald I. Mayo, and S. William Wandle, Jr.

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WILLIAM P. CLARK, Secretary

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CONVERSION FACTORS

For readers who prefer to use the International System of units (SI), conversion factors for terms used in this report are listed below:

Multiply	By	To obtain
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile(mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

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ABSTRACT

The Ohio Department of Transportation proposes to relocate an 8-mile segment of State Route 151 between Bowerston and Scio, Harrison County, Ohio. About 3.1 miles of this relocated highway will be within the flood plain of Conotton Creek or its tributaries.

Water-surface profiles of the 100-year flood along Conotton Creek before and after the highway relocation are virtually the same between Bowerston and the western corporation limit of Scio. Upstream from that point to the upper end of the study reach, the modified profile would be about 1 foot lower than for existing conditions. Design-flood profiles on the three studied tributaries showed that Dining Fork profiles will be unaffected, Irish Creek profiles will be 0.7 to 0.9 foot lower, and Scott Run profiles will be 0.1 to 0.5 foot lower.

INTRODUCTION

The Ohio Department of Transportation (ODOT) is planning to relocate State Route 151 between Bowerston and Scio in Harrison County, Ohio (fig. 1). This realignment will be within the flood plain of Conotton Creek or its tributaries for approximately 3.1 mi of the 7.5-mi proposed highway route. As part of the highway construction project, 1.1 mi of Conotton Creek and short reaches of Dining Fork and Scott Run will be relocated. As part of a continuing cooperative program with ODOT, the U.S. Geological Survey (USGS) determined the effect of this highway construction project on elevations of the 10-, 25-, 50-, and 100-year-frequency flood discharges along Conotton Creek and its tributaries.

The purpose of this report is to present the results of a detailed hydraulic study of flood-surface profiles along Conotton Creek and its tributaries in the reach between Bowerston and Scio before and after the proposed relocation of State Route 151 (fig. 2). The ground-elevation and bridge-geometry data provided by ODOT were used to compute water-surface profiles for existing and modified conditions for the 10-, 25-, 50-, and 100-year floods in the study reach. Profiles were also computed in the downstream reaches of Scott Run, Dining Fork, and Irish Creek, all of which are tributaries of Conotton Creek.

Elevations of the design floods before and after the highway construction project are presented in tabular and graphic form. Maps are also included showing the area inundated by the 100-year flood under existing and modified conditions. Elevations given in this report refer to the National Geodetic Vertical Datum of 1929 (NGVD of 1929), formerly called mean sea level.

ACKNOWLEDGMENTS

The Ohio Department of Transportation (ODOT) provided cross sections of the stream valley in the study reach and the geometry of existing bridges. Cross-sectional data at locations specified by the USGS were obtained by a combination of photogrammetric methods and ground survey of the river channels and adjacent flood plains.

Topographic maps showing limited 3-ft contours were furnished by ODOT at scales of 1 in. = 200 ft and 1 in. = 80 ft. These maps, compiled in 1978, show the location of cross sections and the centerline of the proposed highway. They cover the study reaches of Conotton Creek, Scott Run, Dining Fork, and Irish Creek. Topographic maps (scale 1 in. = 50 ft, 2-ft contour interval) showing plans for the proposed highway route between Bowerston and Scio were also provided by ODOT. The ground data for both series of topographic maps were compiled by ODOT from aerial photographs taken in April 1969.

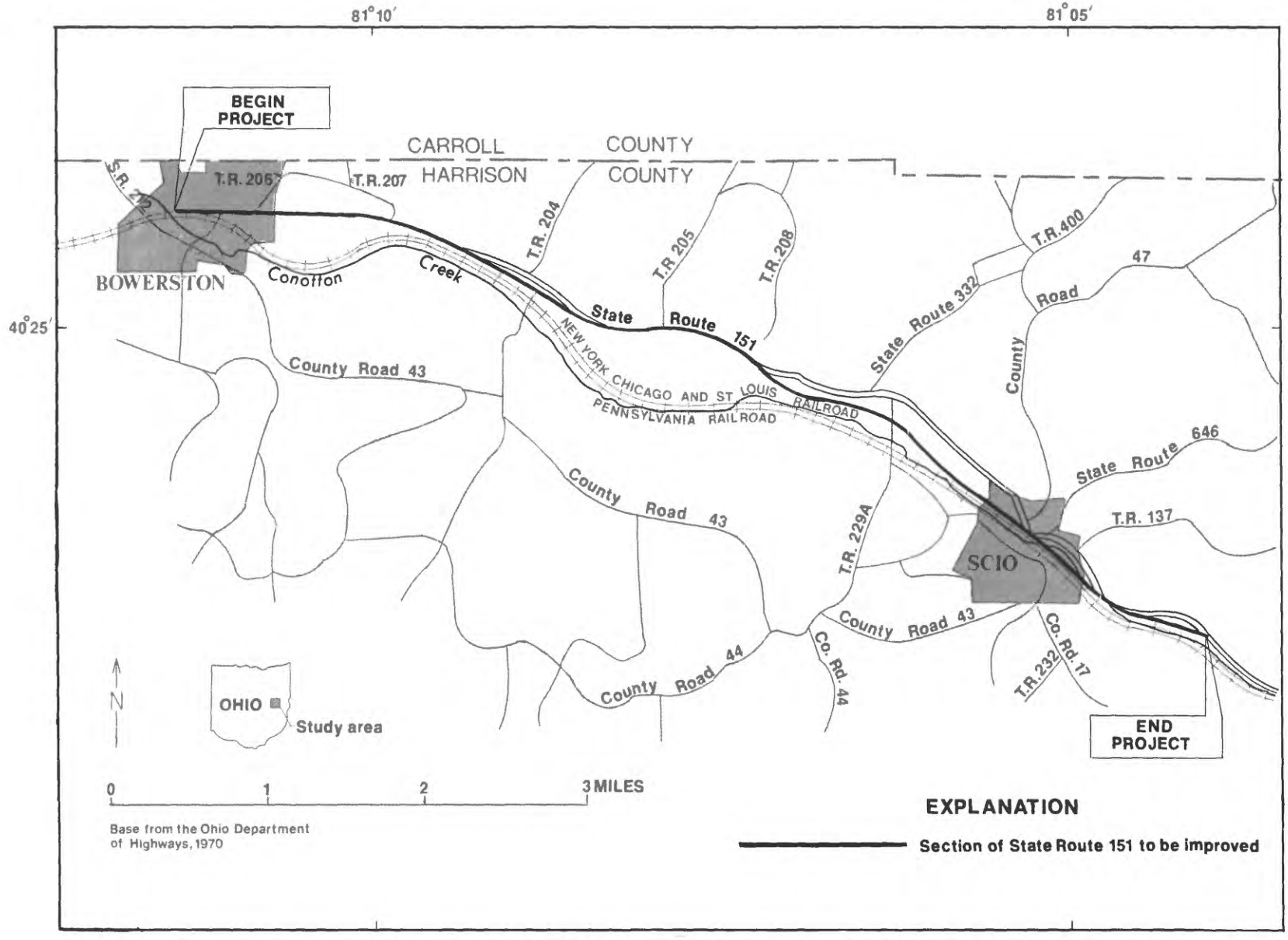


Figure 1.--Location of study area--Highway Project HAS-151-4.97.

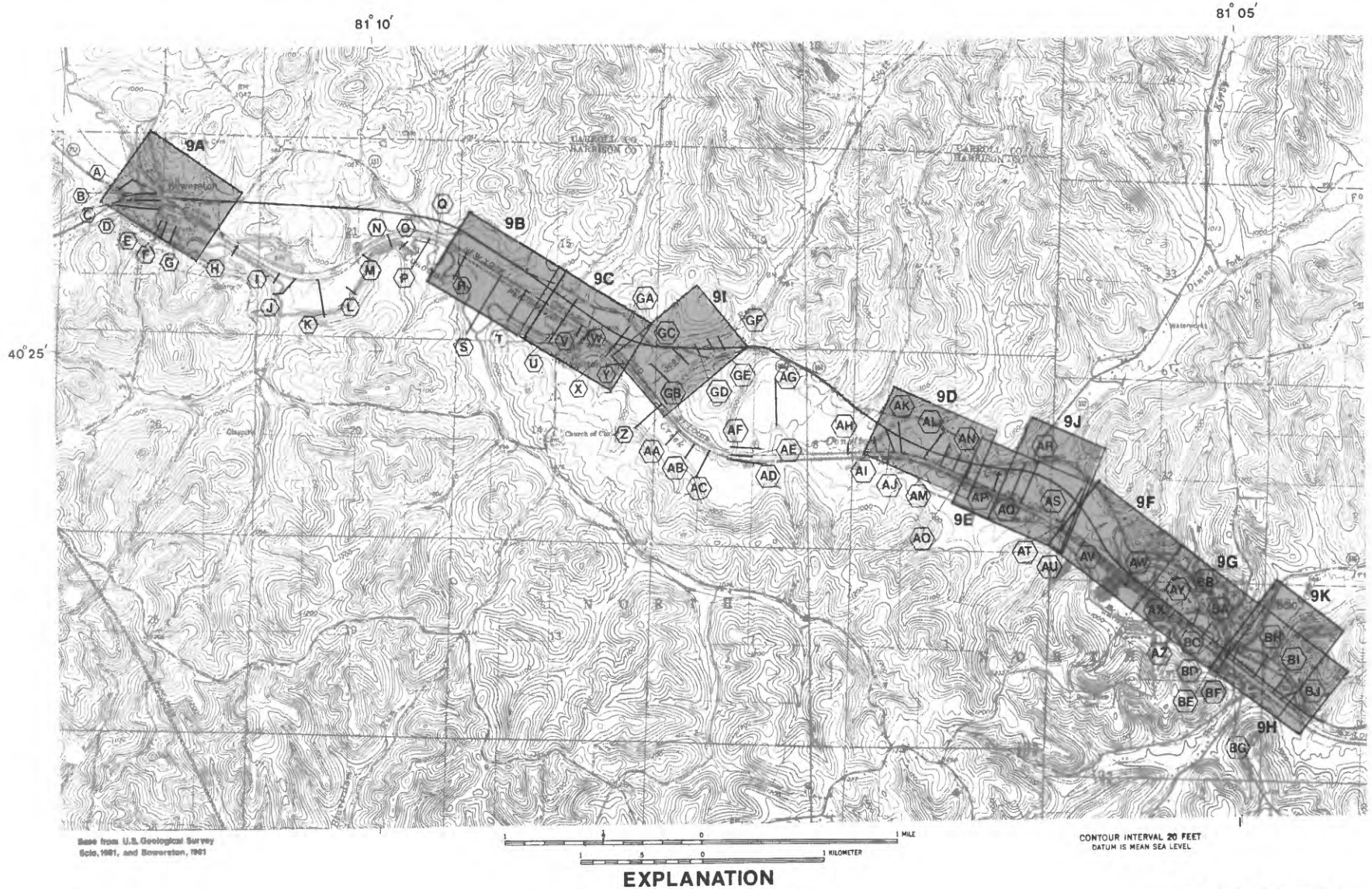


Figure 2.--Study area showing location of cross sections, Conotton Creek between Bowerston and Scio, Ohio.

BASIN CHARACTERISTICS

Conotton Creek, a tributary of the Tuscarawas River, is located in Harrison County in eastern Ohio (fig. 1). The Conotton Creek basin drains an area of 81.9 mi^2 above Bowerston (fig. 3) in the unglaciated area of the State. The creek flows northwestward through the villages of Jewett, Scio, Conotton, and Bowerston, and joins the Tuscarawas River in Dover Lake.

Study Area Description

In the 8.8-mi study reach between Bowerston and Scio, Conotton Creek follows a meandering course through fine material in a broad valley. This valley meanders in a general northwesterly direction. The flood plain ranges from 160 to 1,700 ft wide except in four reaches totaling 1.2 mi where it is confined to less than 120 ft by railway embankments. Embankments of two parallel railways confine Conotton Creek in a 0.9-mi reach downstream from Scio; one railway embankment borders one side of the flood plain in the remaining 7.9-mi reach.

Land use within the Conotton Creek flood plain is primarily agricultural, although there is some urban use in the villages of Scio, Conotton and Bowerston. Within these villages, land is mainly residential; there are some scattered industrial, municipal, and recreational areas. The remaining flood plain is forested or wooded swampland.

A part of the flood plain of Scott Run is cropland, the remaining area being either grass, brush, or wooded swampland. The entire Dining Fork flood plain is used for pasture. Except for a small baseball field, the Irish Creek flood plain is occupied by weeds, brush, and a few trees.

There are five roadway and six railway bridges along the Conotton Creek channel. Existing State Route 151 crosses over Scott Run by a culvert and crosses Dining Fork and Irish Creek by small bridges.

The Conotton Creek channel has a fairly uniform trapezoidal shape throughout the study reach. In areas where the channel meanders excessively, there is a greater variation in the channel shape because of unstable banks. The channel banks are from 6 to 9 ft high where the flood plain is unconfined. Brush and trees line most of the flood plain adjacent to the main channel and the channel banks. The vegetation ranges from scattered trees and grass in the open areas to heavy brush and trees in the forested areas. Outside the urban areas several fallen trees were noted in the Conotton Creek channel.

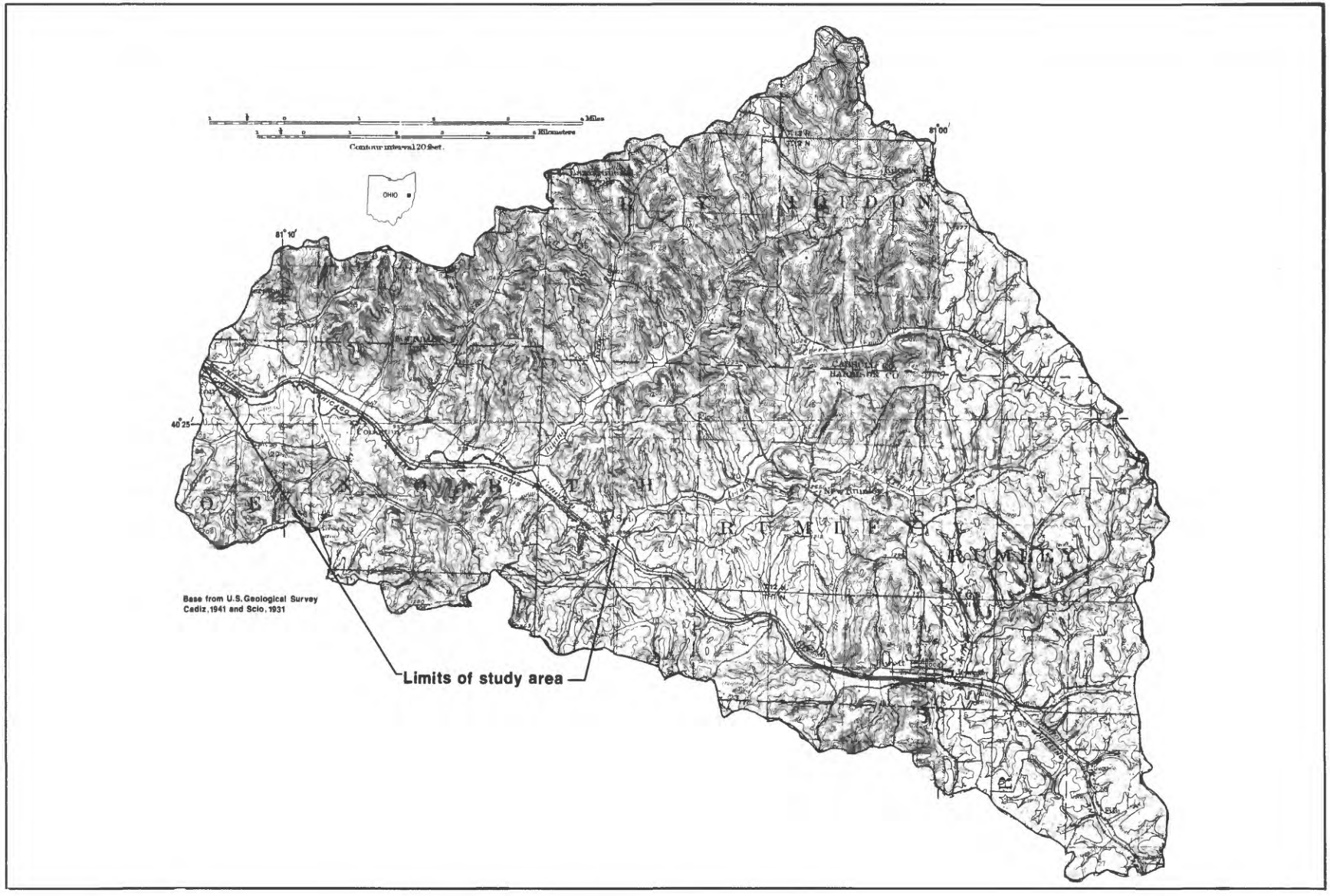


Figure 3.--Drainage basin of Conotton Creek above Bowerston, Ohio and limits of study area.

Valley cross-sectional shape varies considerably along the reach. The main channel meanders within the flood plain, and this flood plain is confined at least on one side by railway embankments along most of the study reach. The channel is confined between two railway embankments in a 0.9-mi reach downstream from Scio.

Stream channels of Scott Run, Dining Fork and Irish Creek are trapezoidal in shape; their banks are 1 to 3 ft high, 4 to 8 ft high, and 4 to 9 ft high, respectively. Valley cross sections of Scott Run and Irish Creek are typically broad flood plains on either side of narrow channels. The cross-sectional geometry of Dining Fork changes as the stream channel diagonally crosses the flood plain of pasture land. The banks and the adjacent flood plains of Irish Creek and Scott Run are lined with brush.

Hydrology

Peak discharges for the design floods were calculated according to the latest flood-frequency report for Ohio by Webber and Bartlett (1977). Flood magnitudes having recurrence intervals of 10, 25, 50, and 100 years were computed using the regional regression equations for geographic area 5. The peak discharges for Conotton Creek, Scott Run, Dining Fork, and Irish Creek are given in table 1, and shown graphically in figure 4.

Flood-frequency information based on data collected since 1947 at the gaging station on Conotton Creek at Jewett (03119700) compared favorably with the regional data. The drainage area at the gage site (14.3 mi^2) is too small for direct transfer of peak data to the study site (upstream drainage area, 27.8 mi^2).

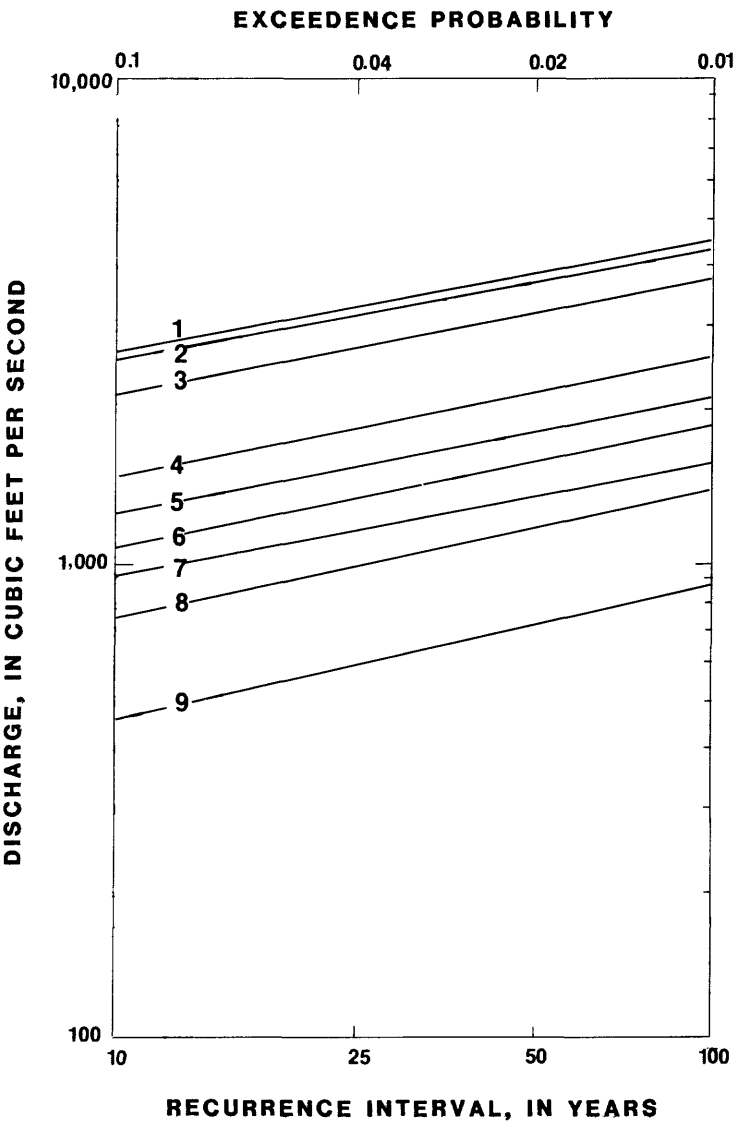
FLOOD PROFILE COMPUTATION--EXISTING CONDITIONS

Water-surface profiles for the 10-, 25-, 50-, and 100-year design floods were determined using the standard step-backwater method (Chow, 1959), by which profiles in a reach are computed upstream from a previously determined water-surface elevation. The U.S. Geological Survey's computer program E431 (Shearman, 1976) was used in the step-backwater analysis. This analysis assumes that flow in the reach is unobstructed and that structures do not fail.

Table 1.--Summary of basin characteristics and hydrologic data for Conotton Creek, Scott Run, Dining Fork and Irish Creek

Stream and location	Drainage area (mi^2)	Main-channel slope (ft/mi)	Peak discharge, in ft^3/s for indicated recurrence interval, in years			
			10	25	50	100
Conotton Creek at Jewett (03119700)	14.3	20.9	[a]920	1,100	1,390	1,610
			[b]1,080	1,400	1,670	1,940
Conotton Creek above Irish Creek	27.8	14.1	1,520	1,960	2,310	2,680
Conotton Creek below Irish Creek	46.6	14.1	2,220	2,830	3,320	3,810
Conotton Creek below Dining Fork	62.8	11.8	2,600	3,290	3,840	4,400
Conotton Creek at SR 151 at Bowerston	81.9	7.54	2,690	3,390	3,960	4,540
Scott Run at mouth	3.31	41.6	470	630	760	900
Dining Fork at mouth	14.7	29.3	1,240	1,610	1,910	2,220
Irish Creek at mouth	18.8	4.62	770	1,000	1,200	1,410

[a] Station records (1947-75)
[b] Computed by regression equation



EXPLANATION

1 Conotton Creek at State Route 151 at Bowerston
2 Conotton Creek below Dining Fork
3 Conotton Creek below Irish Creek
4 Conotton Creek above Irish Creek
5 Dining Fork at mouth
6 Conotton Creek at Jewett (Bulletin 45)
7 Conotton Creek at Jewett (Station records)
8 Irish Creek at mouth
9 Scott Run at mouth

Figure 4. --Flood-frequency curves, Conotton Creek and tributaries near Scio, Ohio.

Basic Hydraulic Data

Cross Sections and Bridge Geometry

Cross-section data along Conotton Creek, Scott Run, Dining Fork, and Irish Creek within the study area (fig. 2) were provided by ODOT. The cross-section locations had been selected by Geological Survey personnel following a field inspection. Overbank data were compiled by ODOT by photogrammetric methods from aerial photographs taken in April 1969. Geometry of the main channel, adjacent flood plain, and bridges were obtained from ground survey by ODOT field survey parties during the summer and fall of 1978.

For each cross section, the flood-plain and channel-section data were merged into a composite valley cross section. Only the cross sections in the Scott Run reach were compiled entirely by photogrammetry; this narrow, shallow channel could be defined from the aerial photographs. The cross-section locations are indicated on the study area map (fig. 2), on the profiles (figs. 5-8 and 10, at the end of report) and on the flood inundation maps (fig. 9, in pocket at the back of report).

Roughness Coefficients

Manning's roughness coefficient "n" was used to compute the hydraulic property (conveyance) of each cross section and to compute friction loss in the reach between adjacent sections. Roughness coefficients for existing conditions were evaluated on the basis of the field reconnaissance during August 1978. Information on roughness characteristics in Barnes (1967) and Chow (1959) aided in selecting the "n" values. Summer foliage conditions were assumed.

Roughness values for the Conotton Creek channel range from 0.035 to 0.064. For the flood plain, the range is from 0.016 to 0.100. Roughness values in the channel of Irish Creek range from 0.026 to 0.040 and, in the flood plain, from 0.030 to 0.065. In the Dining Fork reach, the roughness ranges from 0.028 to 0.034 in the main channel and is 0.038 at all stages in the flood plain. Roughness values for Scott Run range from 0.028 to 0.38 in the main channel and from 0.035 to 0.085 on the flood plain.

Hydraulic Analysis

A stage-discharge relationship was developed for Conotton Creek below State Route 151 in Bowerston using the convergence reach method discused by Davidian (1976). The initial section was located several thousand feet downstream from the study reach in order that normal depths would be defined at the beginning of the study reach.

Flooding in the tributary reaches is caused by a combination of backwater from Conotton Creek and peak flows in the tributary basins. Initial water-surface elevations for Scott Run, Dining Fork, and Irish Creek were computed by the slope-conveyance method (Wiitala and others, 1961). Profiles computed by routing flood discharges upstream from these starting elevations were compared with backwater profiles from flooding by Conotton Creek; the profile with the highest elevations was used for the design flood.

The cross sections located by ODOT on the work maps (1 in. = 80 ft and 1 in. = 200 ft, 3-ft limited contours) were adjusted to maintain each cross section perpendicular to the flow line. Cross sections were extended, shortened, or added to define changes in the reach geometry or roughness. A few cross sections were relocated horizontally to improve the agreement between the photogrammetric and ground-survey sections.

In the profile computations, flow distances between cross sections upstream from the starting point were required. Where the main channel meanders across the flood plain or where the flood plain is curvilinear, an effective reach length between cross sections was used. In these situations the flow distance was weighted according to the relative flow distance and conveyance of the main channel versus the relative flow distance and conveyance of the overbank of the flood plain. An initial flow distance of 0 ft was assumed at the Carroll-Harrison County line, which is about 2,100 ft downstream from the SR 151 bridge in Bowerston.

The geometry of two irregular bridge openings was adjusted to avoid computational problems. The double-arch railway bridge in Bowerston (between sections C and D) was treated as an equivalent type I bridge opening as defined by Matthai (1967). The Bridge Street bridge in Bowerston between sections E and F was analyzed as a series of valley cross sections because most of the flood flow goes over the low road embankment rather than through the bridge.

Under low and medium flow conditions the entire discharge of Conotton Creek is confined between two railway embankments in an 0.9-mi reach downstream from the railway bridge just east of Eastport Road in Scio (sections AT to AZ). During high flood flows when the water surface upstream from Eastport Road is higher than 965.7 ft, the stream overtops Eastport Road and flows through a flood-plain channel north of the railway embankments. This flow rejoins Conotton Creek 0.9 mi downstream, below the railway bridge at section AS.

An elevation-discharge relationship was computed by the flow-around-island method (Davidian, 1976) for both the main channel and the overflow channel at Eastport Road to apportion the flood flows between the two routes. These ratings were combined for a total flow rating to continue computation of the flood profiles upstream from this point.

The computed water-surface elevations for existing conditions for the 10-, 25-, 50-, and 100-year floods are summarized for Conotton Creek in table 2 (at the end of report). The flood elevations for Scott Run, Dining Fork, and Irish Creek are given in table 3 (at the end of report). Profiles of the design floods along Conotton Creek are shown in figure 5 (A-H). Profiles of the design floods in the tributary reaches are shown in figures 6, 7, and 8 for Scott Run, Dining Fork, and Irish Creek, respectively.

Boundaries of the 100-year flood under existing conditions are delineated in figure 9 (A-K). The area inundated by the 100-year flood along Conotton Creek is shown in figure 9 (A-H). Limits of the 100-year flood on the tributary streams are shown in figure 9I for Scott Run, figure 9J for Dining Fork, and figure 9K for Irish Creek. Small areas within the flood boundaries that may lie above the flood elevations are not delineated owing to a lack of detailed topographical information. Inundation at specific sites should be determined on the basis of the elevations given in the profiles rather than from the flood maps.

FLOOD-PROFILE COMPUTATIONS -- MODIFIED CONDITIONS

The relocation of State Highway 151 between Bowerston and Scio involves realignment of the stream channels as follows: 6,000 ft of Conotton Creek (sections AI to AN, AQ, and BA to BE), 440 ft of Scott Run, and 410 ft of Dining Fork. The proposed highway route is within the flood plain of Conotton Creek and its tributaries for 3.1 mi. In the encroachment areas the flood plain will be further altered by clearing and seeding the land within the defined work limits. There are additional crossings of Conotton Creek proposed in the Scio area. An additional bridge is planned over Dining Fork. The existing structures over Conotton Creek in Bowerston and over Scott Run will be replaced by structures with wider spans. No construction is planned within the flood plain of Irish Creek.

The location of the proposed highway route through Scio would cut off the right-bank overflow channel at a point about 1,800 ft downstream from Eastport Road, forming a storage area. Under existing conditions, 55 percent of the 100-year flood was carried by this overflow channel. The modified plans include a 22-ft-wide concrete flume that will convey 70 percent of the 100-year flood. The flume will divert the flood flow from a point

upstream from the railway bridge, about 400 ft upstream from Eastport Road, to a point about 2,200 ft downstream. At this point a dredged channel is to carry the flow from the flume to a point opposite the railway bridge at section AS, where it rejoins Conotton Creek. The concrete flume will be placed between the existing northernmost railway embankment and the proposed highway embankment.

Basic Hydraulic Data

Highway plans for the proposed project were used to define the roadway encroachment pattern and to determine the extent of channel relocation. Revised channel sections were combined with existing overbank data to form complete valley sections. Existing overbank data were revised to include the relocated roadway embankment, the location of which was determined from the 3-foot contour interval map provided by ODOT. Sections that were relocated are indicated in the tables and figures with an "m" in the identifier. The geometry for each of the proposed bridges and culverts was available from the roadway plans.

Roughness coefficients were revised for areas where the field conditions would be altered by the proposed highway. Roughness values for the Conotton Creek channel under modified conditions range from 0.030 to 0.064, and range in the flood plain from 0.016 to 0.100. Roughness in the main channel of Dining Fork ranges from 0.028 to 0.034; the flood plain roughness is equal to 0.038 under modified conditions. In the Scott Run reach, the revised roughness coefficient of the channel ranges from 0.018 to 0.038, and in the flood plain, from 0.030 to 0.085. Roughness coefficients for Irish Creek range from 0.026 to 0.040 in the main channel and from 0.030 to 0.065 in the flood plain.

Hydraulic Analysis

Water-surface profiles for modified conditions of Conotton Creek were computed by routing the design floods upstream from the previously determined elevations at Bowerston. The modified cross sections and bridge sections were used in the step-backwater computations. The reach beween sections A and AI was not reanalyzed because it was not modified by the design plans. Profile computations were continued from section AI to the upstream end of the study reach of Conotton Creek using the modified cross sections and revised flow distances. The design-flood elevations are lowered as much as 1.1 ft by improving and lowering the stream bed in the reach between sections AI and AO.

The reach from AS to AZ where the flume and dredged channel will carry the previous Eastport Road overflow was treated by the flow-around-island method (Davidian, 1976). In the reach between the railway bridge at section AS and Eastport Road at section AZ, water-surface elevations in the main channel are lowered as much as 2.1 ft. This is due to a diversion of a large part of the flow into a flume north of the railway. (Note: For this reach, the flood profiles shown in table 2 and figure 5 are for the main channel.) Flood flows were divided between the flume and the main Conotton Creek reach between sections AS and BA on the basis of relative conveyance of the two channels. Flows in the two channels were combined above the point of diversion, a combined elevation-discharge rating was computed, and the total flood flows were routed upstream to the upper end of the study reach.

The computed water-surface profile elevations for the 10-, 25-, 50-, and 100-year floods along Conotton Creek under modified conditions are summarized in table 2 and shown graphically in figure 5. The area inundated by the 100-year flood under modified conditions is shown in figure 9 (A-K). The profiles of the new SR 151 and the modified 100-year flood elevations are shown in figure 10.

Water-surface elevations on the tributary streams were determined by the same procedures used in the analysis of existing conditions. In the Scott Run reach, the backwater and peak-flow profiles were merged to form the maximum profile for each frequency discharge. Scott Run will be conveyed through the proposed highway fill by two culverts. The existing roadway fill will not be leveled, but its culverts are to be removed. Upstream from the proposed roadway the water-surface elevations will be increased by 0.1 to 0.5 ft above existing conditions. Downstream from the proposed roadway the modified water-surface elevations are about the same as those for existing conditions.

Backwater from Conotton Creek controls the water-surface elevations in the entire Dining Fork and Irish Run reaches in the study area. The proposed route for State Highway 151 is downstream from the existing highway at the crossing of Dining Fork. The highway project involves relocating the channel of Dining Fork between the mouth and existing highway. The entire Dining Fork study reach will be in backwater from flooding on Conotton Creek. There is no essential difference between the existing and modified flood profiles on Conotton Creek at its confluence with Dining Fork.

Water-surface elevations on Irish Creek are also under backwater from Conotton Creek. The elevations for the design floods on Conotton Creek in this area are 0.7 to 0.9 ft lower under modified conditions than under existing conditions.

The water-surface elevations for the 10-, 25-, 50-, and 100-year floods along the tributary streams are summarized in table 3. The profiles of the design floods for modified conditions are shown in figures 6, 7, and 8 for Scott Run, Dining Fork, and Irish Creek, respectively. The area inundated by the 100-year flood on the tributary streams is shown in figure 9I for Scott Run, figure 9J for Dining Fork, and figure 9K for Irish Creek.

SUMMARY

Relocation of State Highway 151 will either reduce or have little effect on the design-flood profiles in the 8.8-mi reach of Conotton Creek between Bowerston and Scio. The 100-year flood profiles from Bowerston to the western corporate boundary of Scio will be virtually unchanged, and upstream from that point to the end of the study reach, the modified profile will average 1 foot lower. The design-flood profiles for the three tributaries that were studied indicated that Dining Fork profiles will be unaffected, Irish Creek profiles will be 0.7 to 0.8 ft lower, and Scott Run profiles will be 0.1 to 0.5 ft higher.

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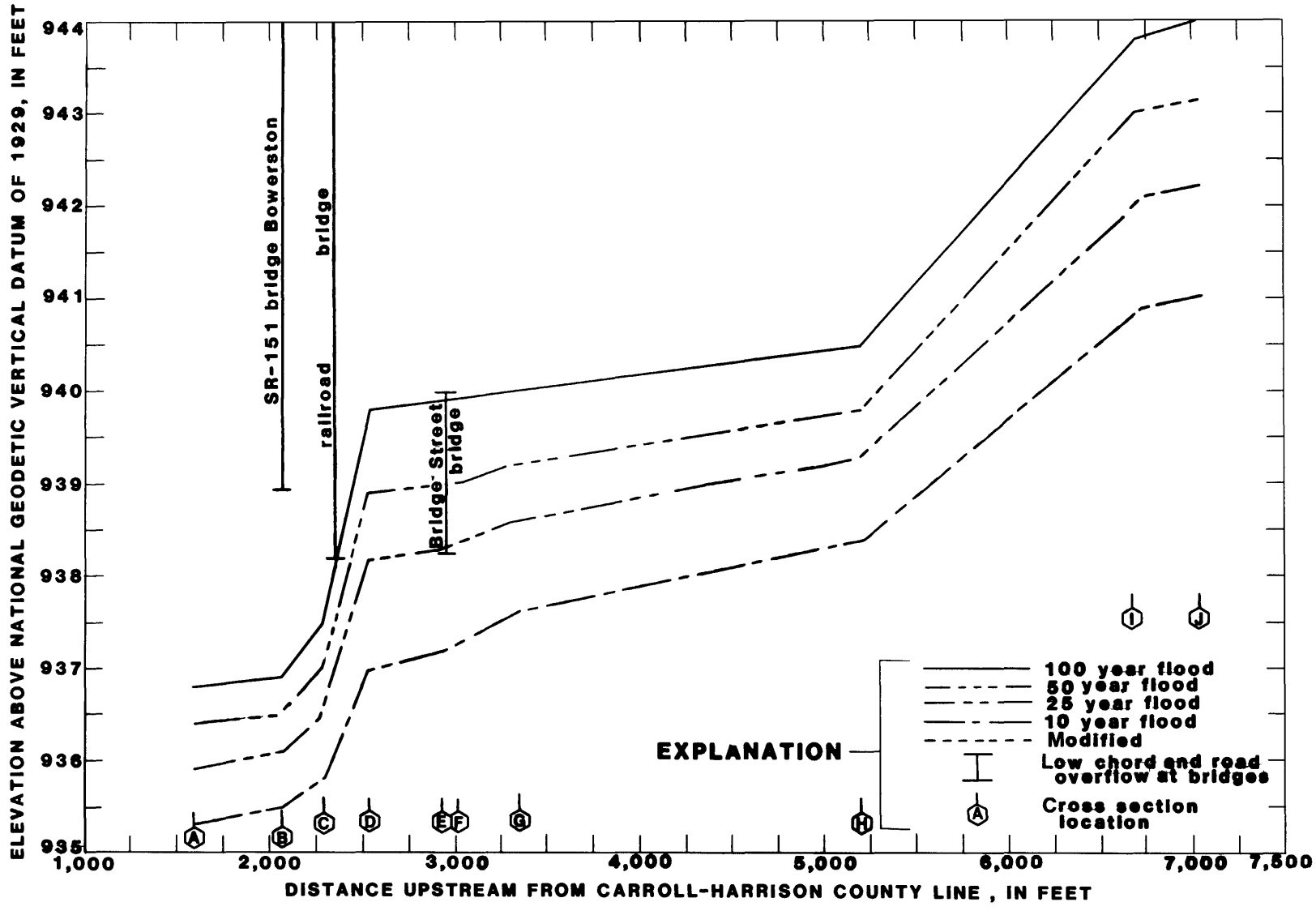


Figure 5a.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

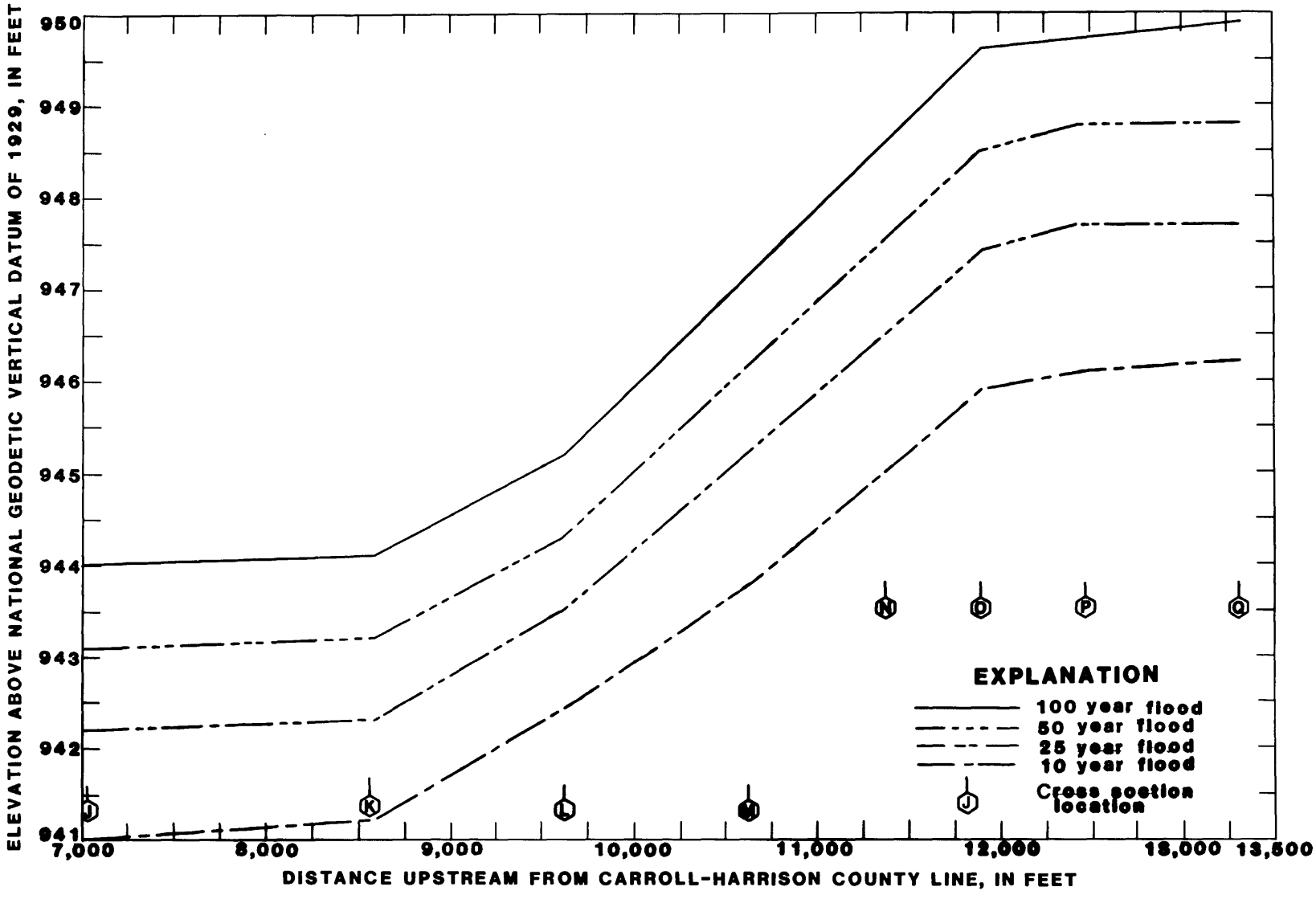


Figure 5b.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

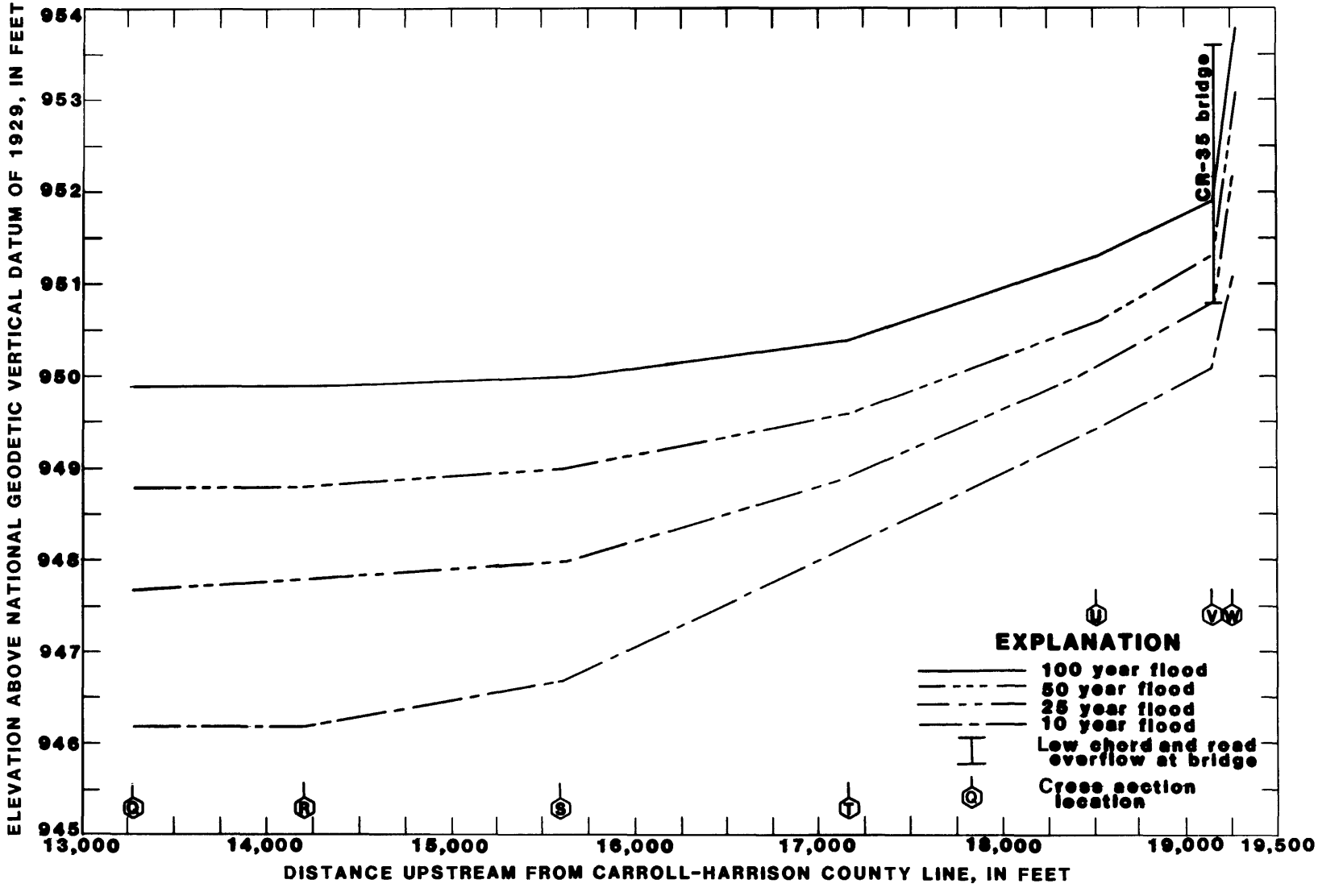


Figure 5c.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

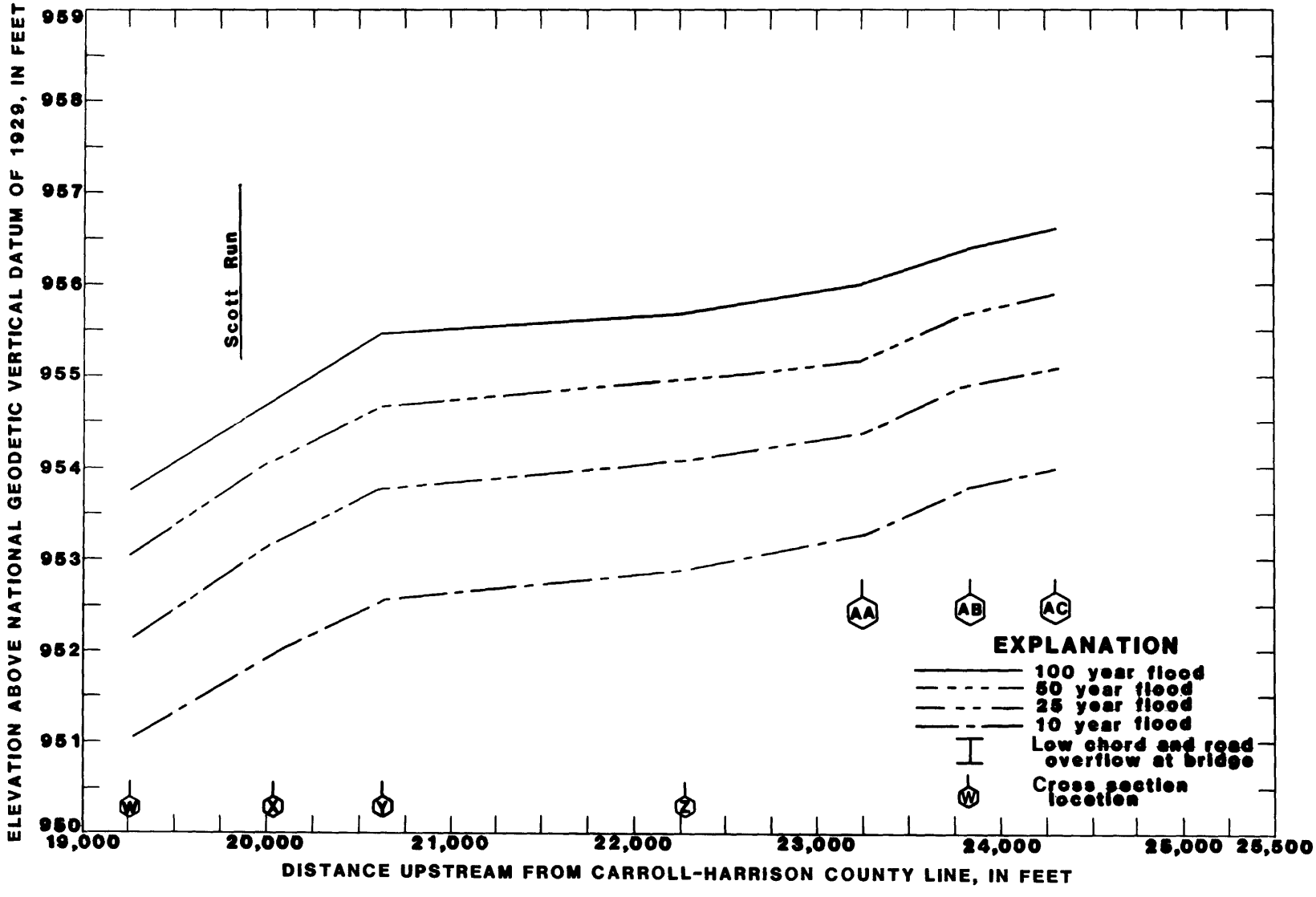


Figure 5d.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

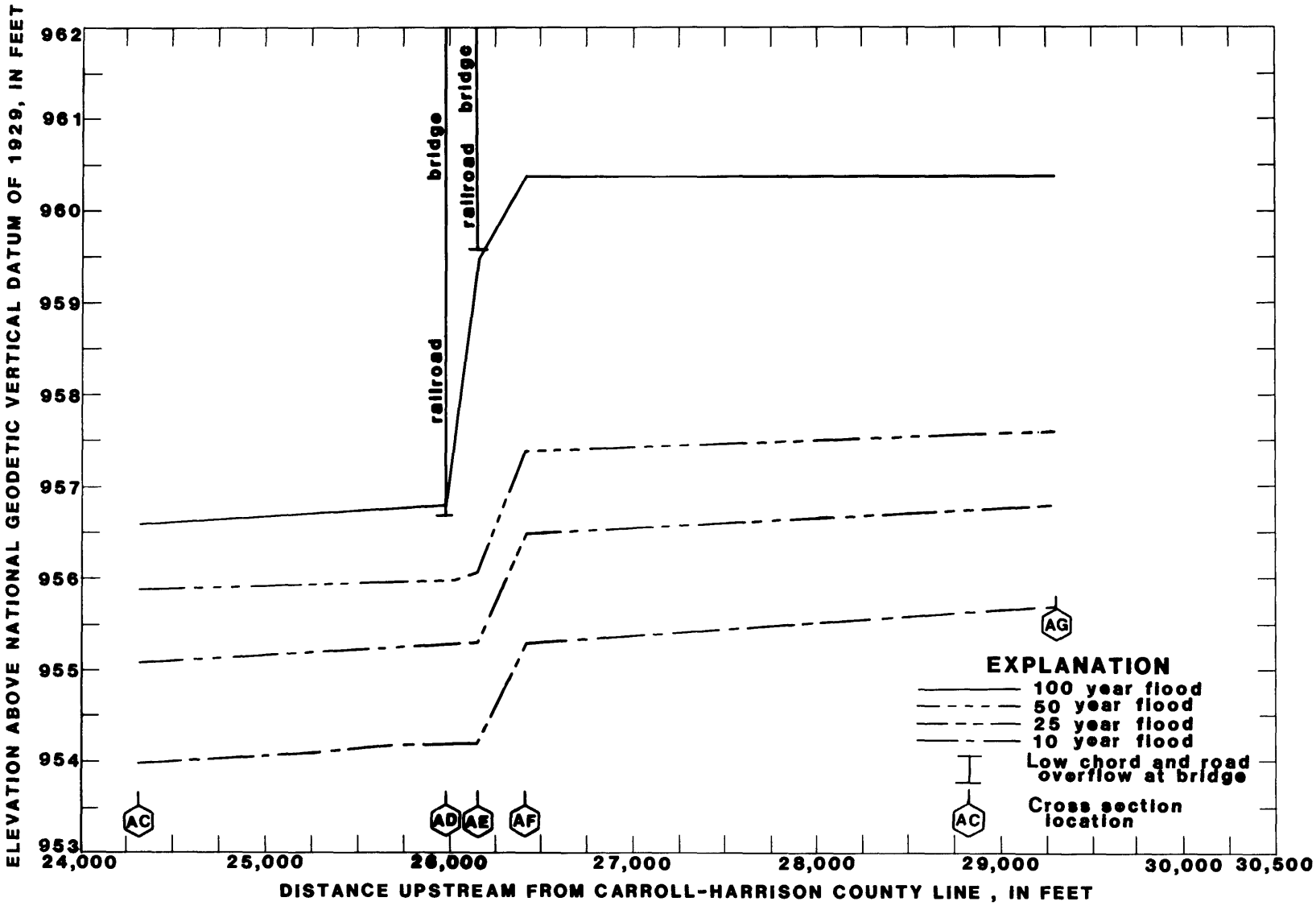


Figure 5e.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

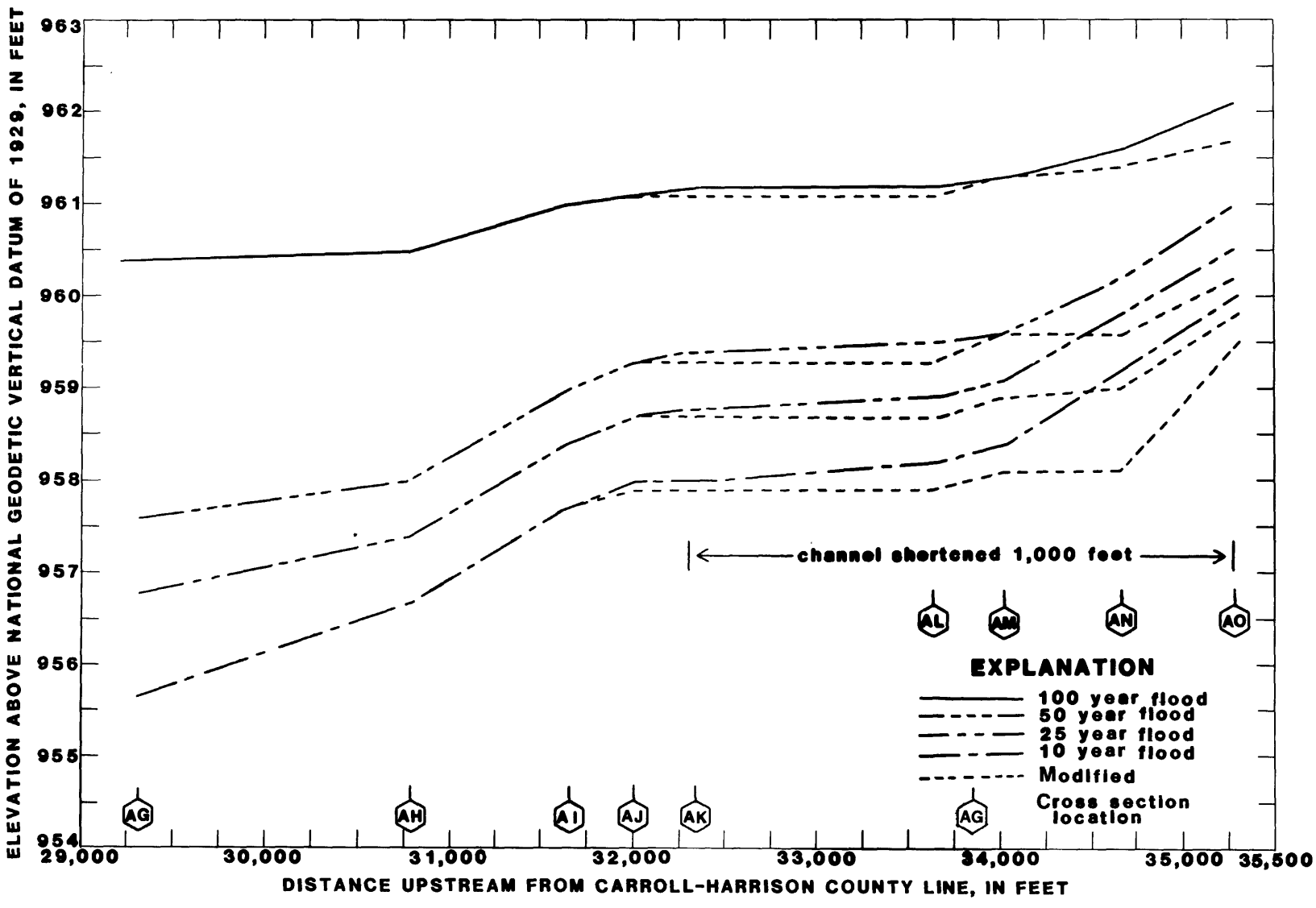


Figure 5f.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

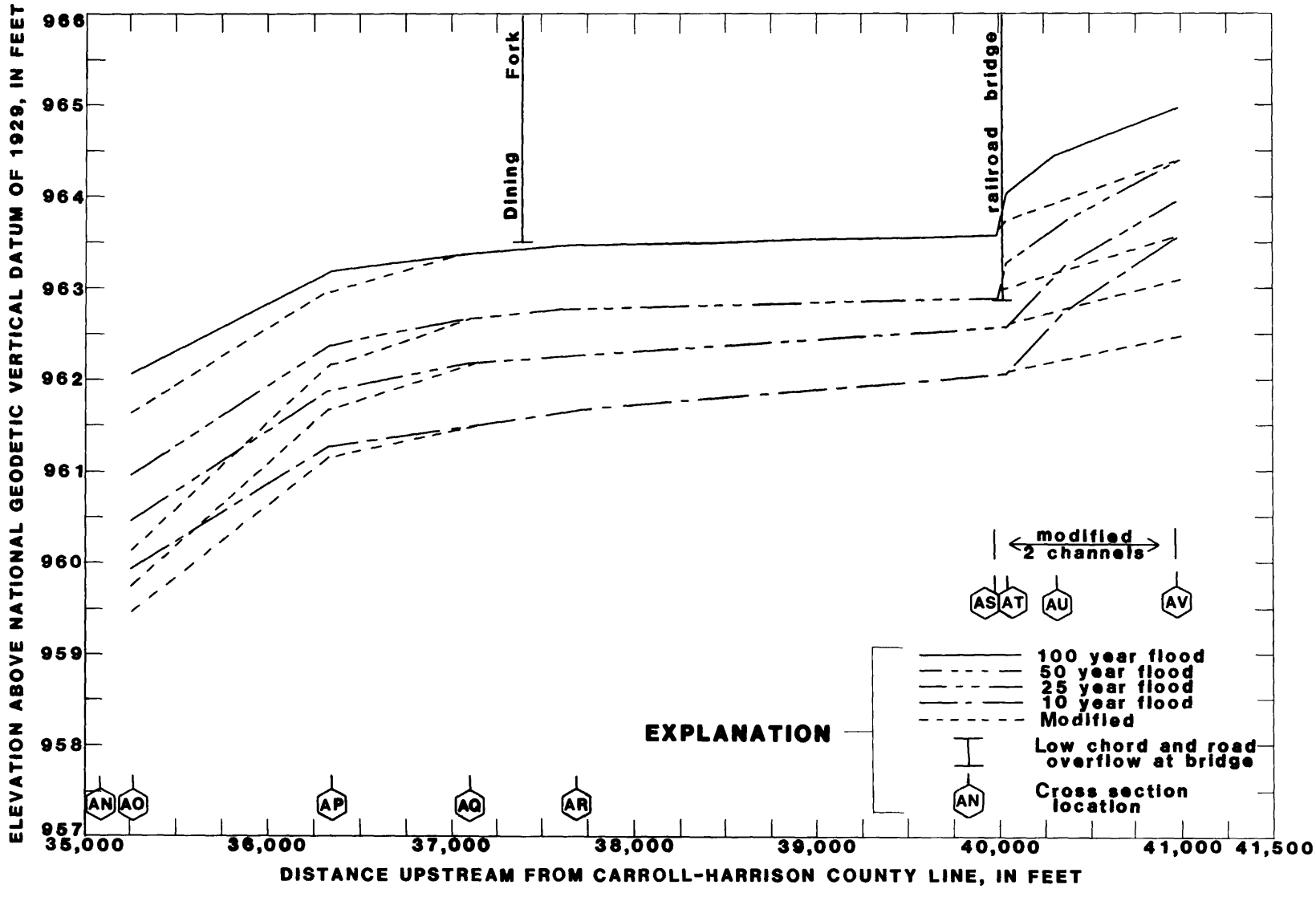


Figure 5g.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

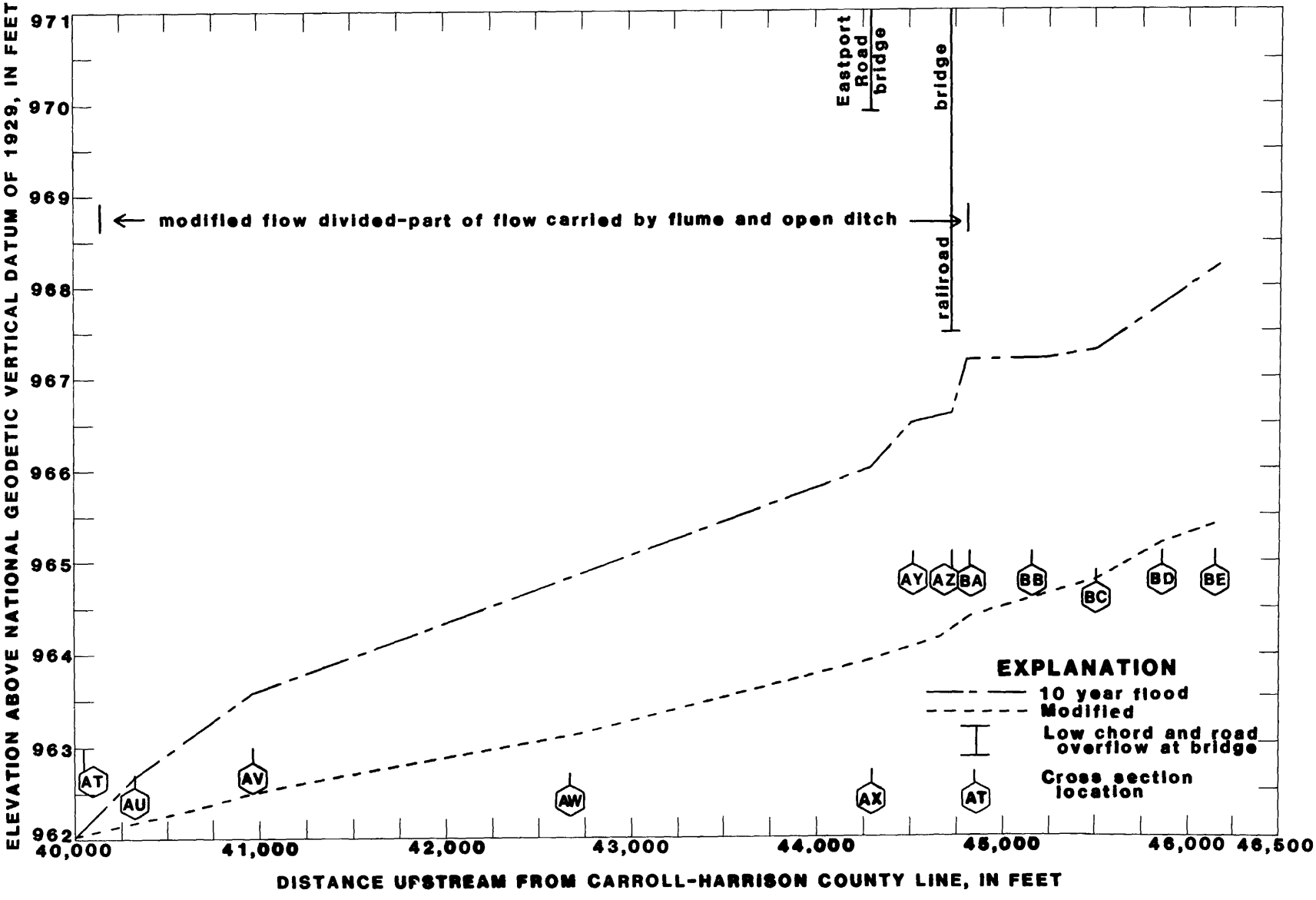


Figure 5h.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

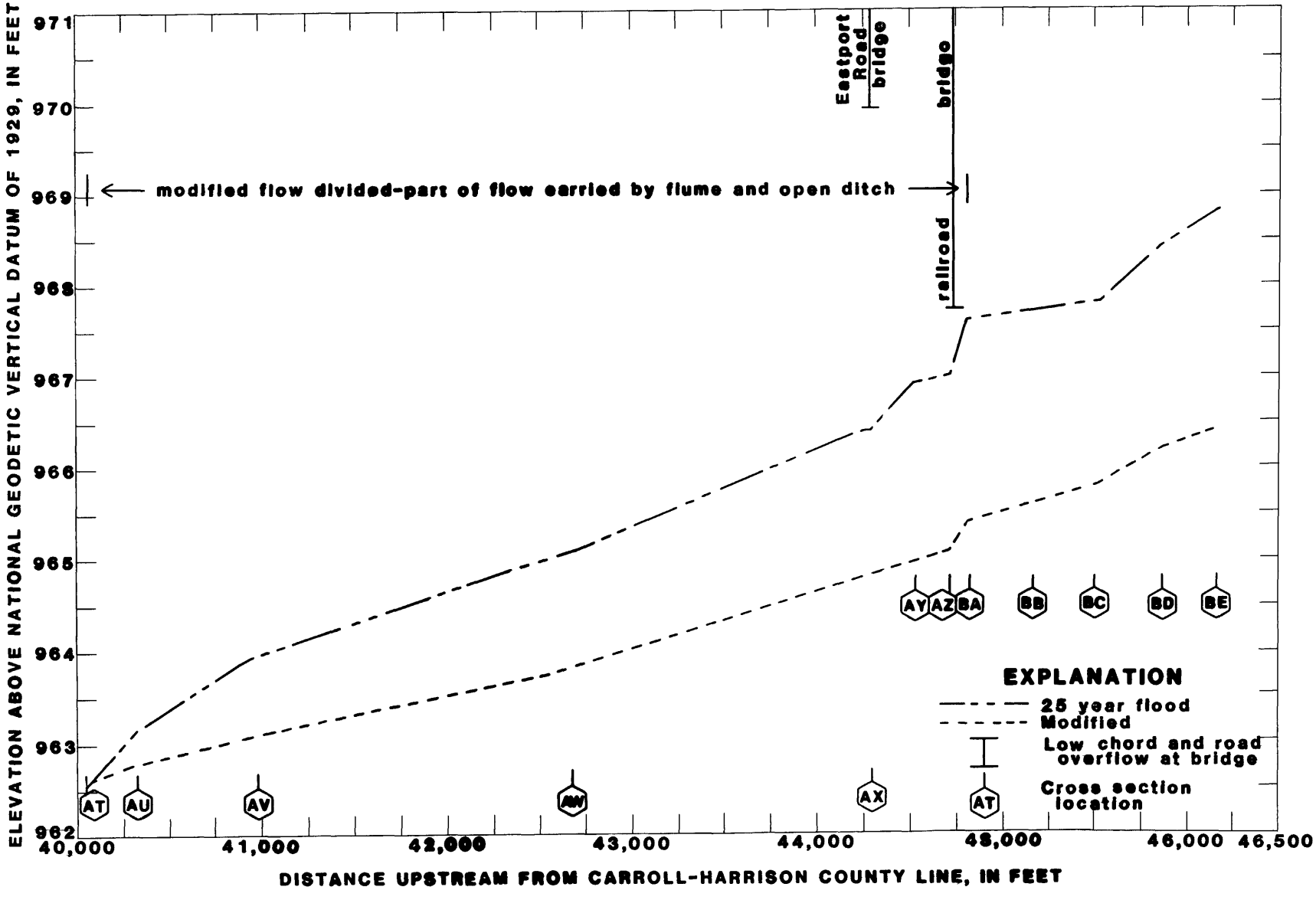


Figure 5i.--Profiles for existing and modified conditions, Conotton Creek between Beverston and Scio, Ohio.

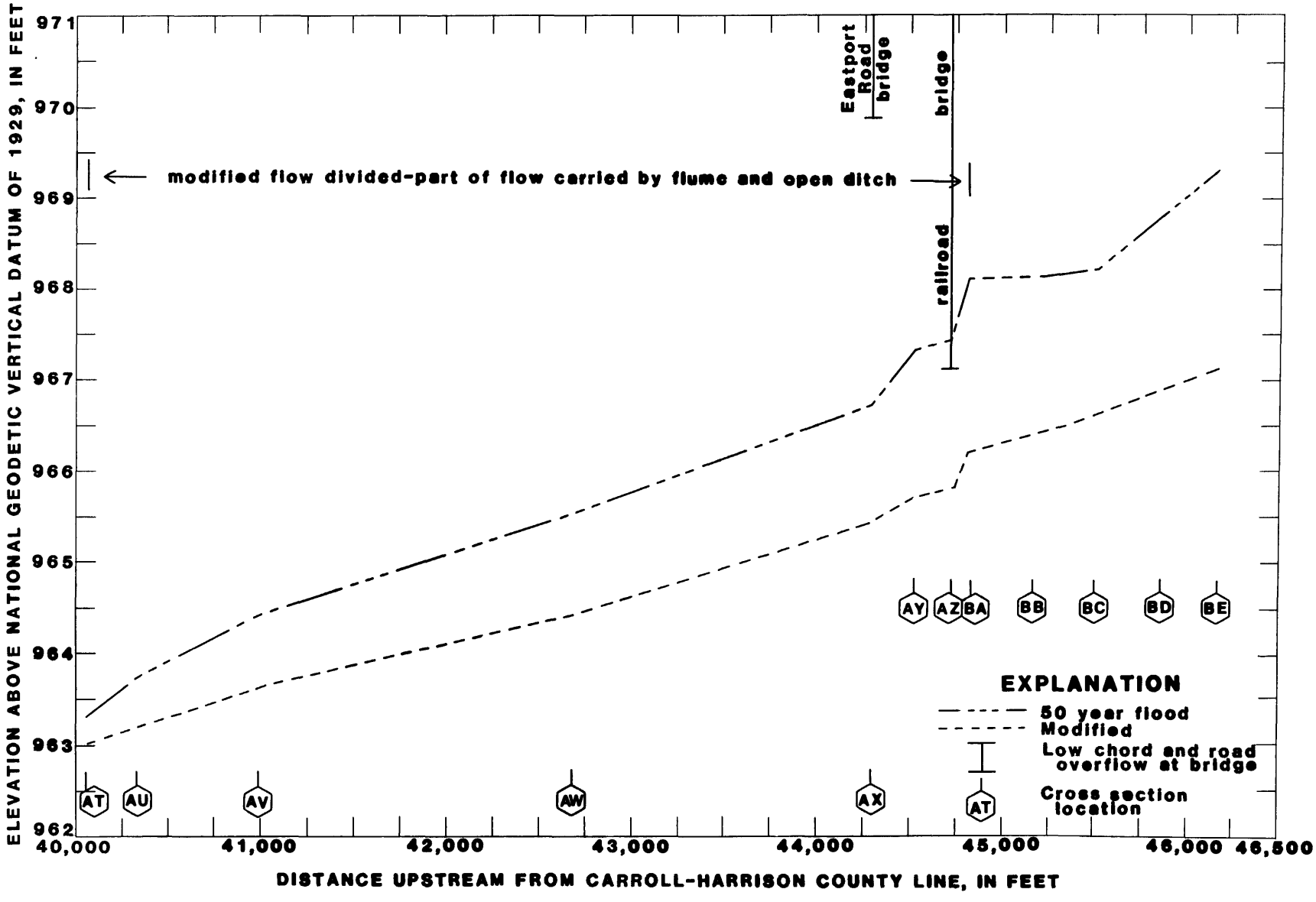


Figure 5j.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

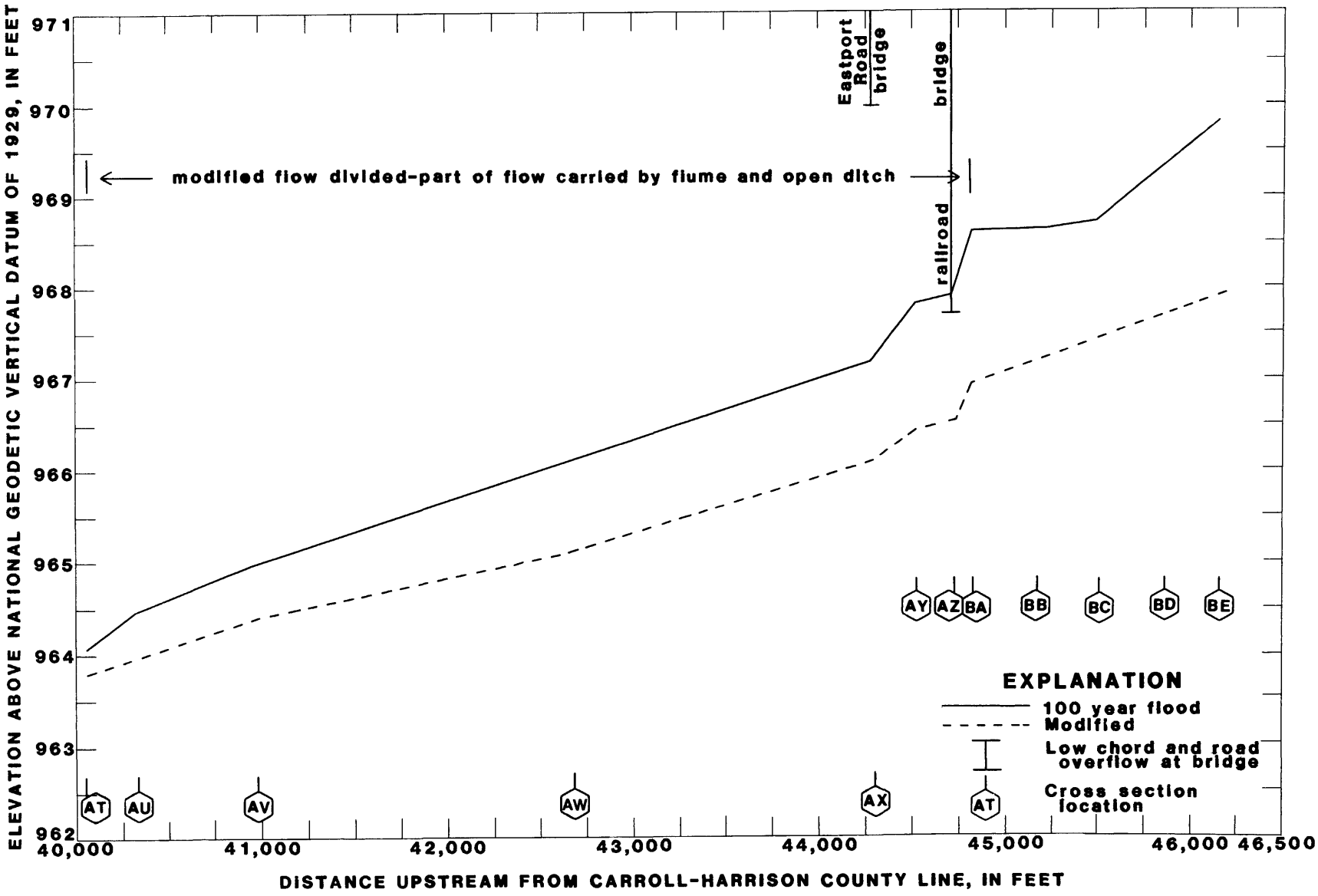


Figure 5k.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

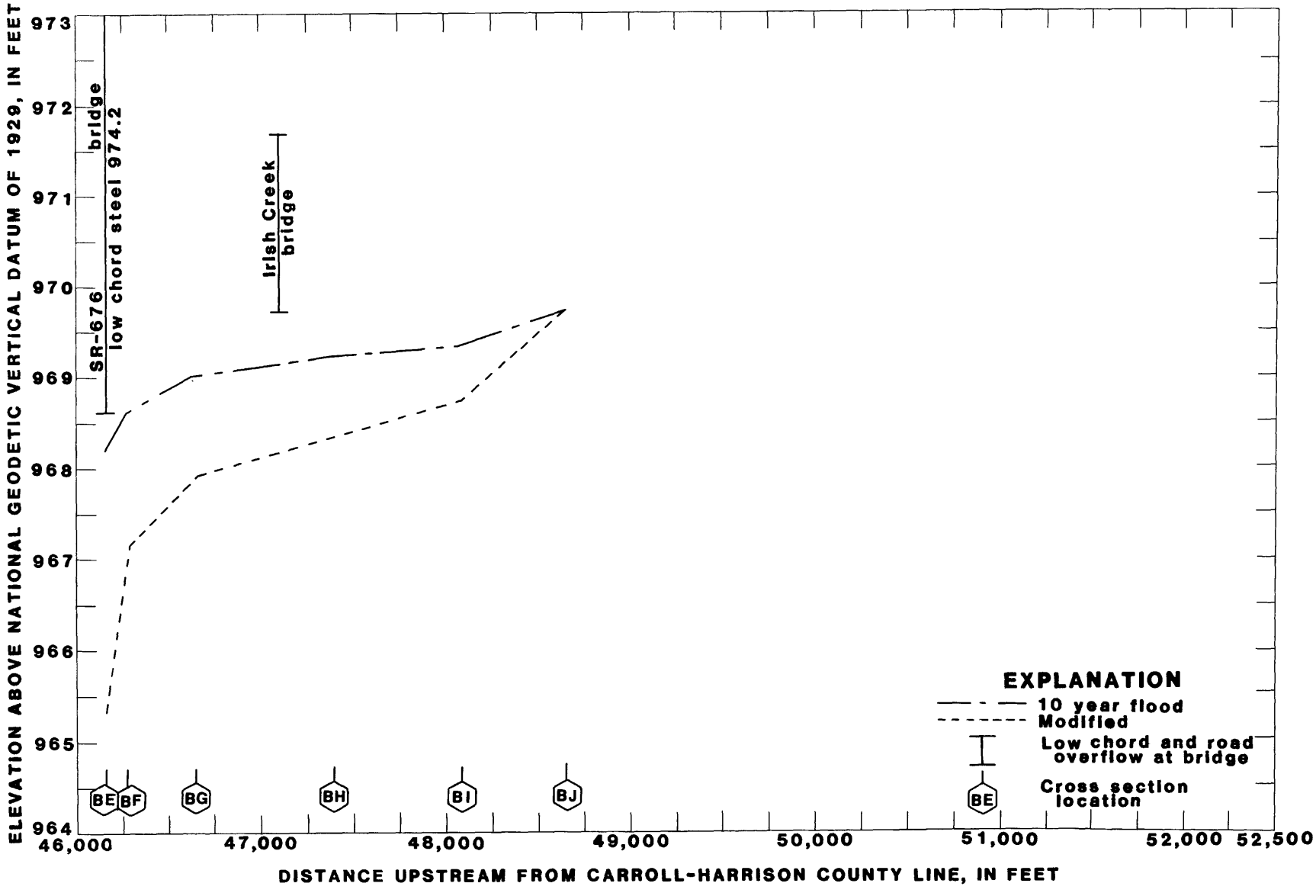


Figure 51.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

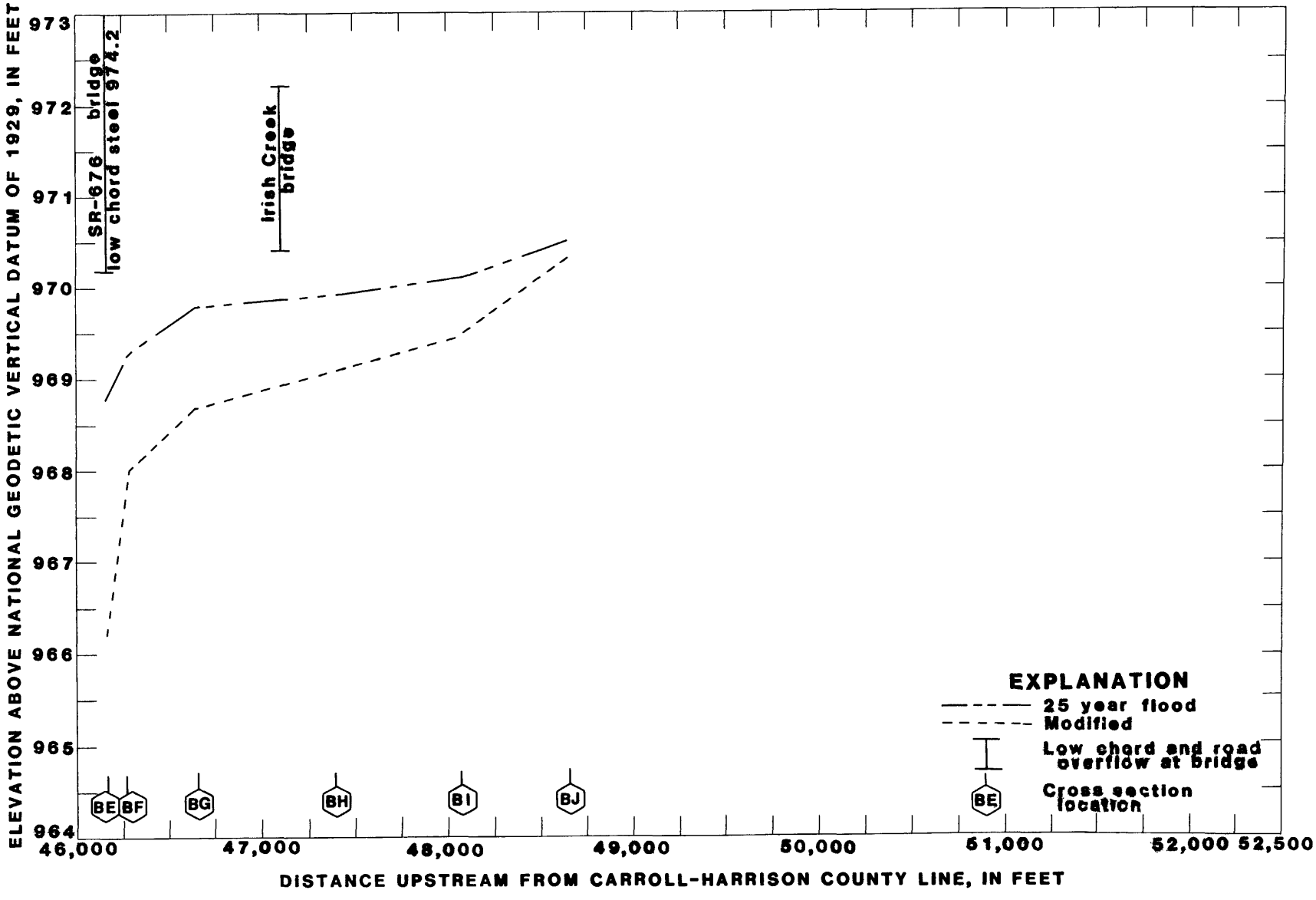


Figure 5m.--Profiles for existing and modified conditions, Conotton Creek between Bowerstom Bowerston and Scio, Ohio.

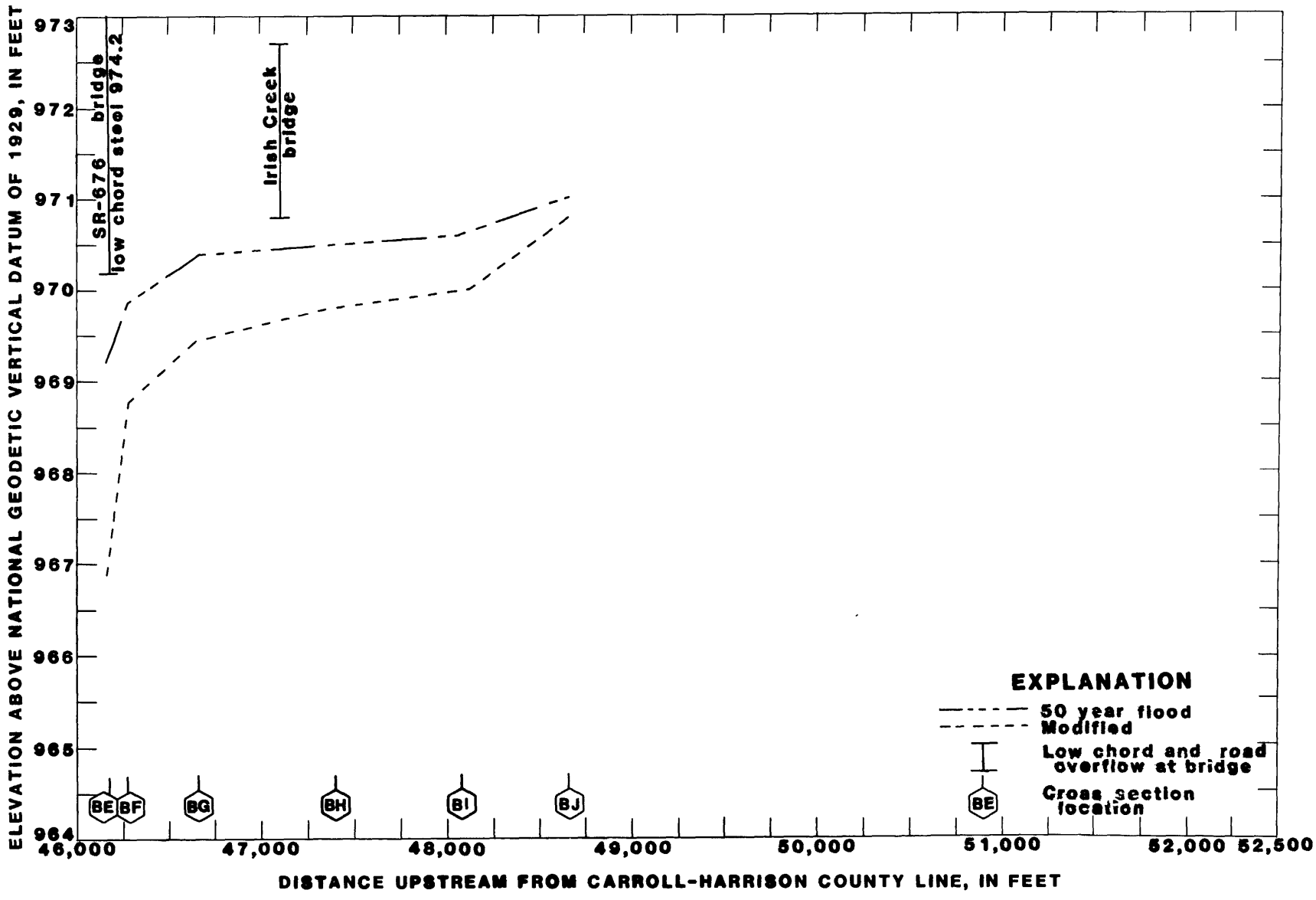


Figure 5n.--Profiles for existing modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

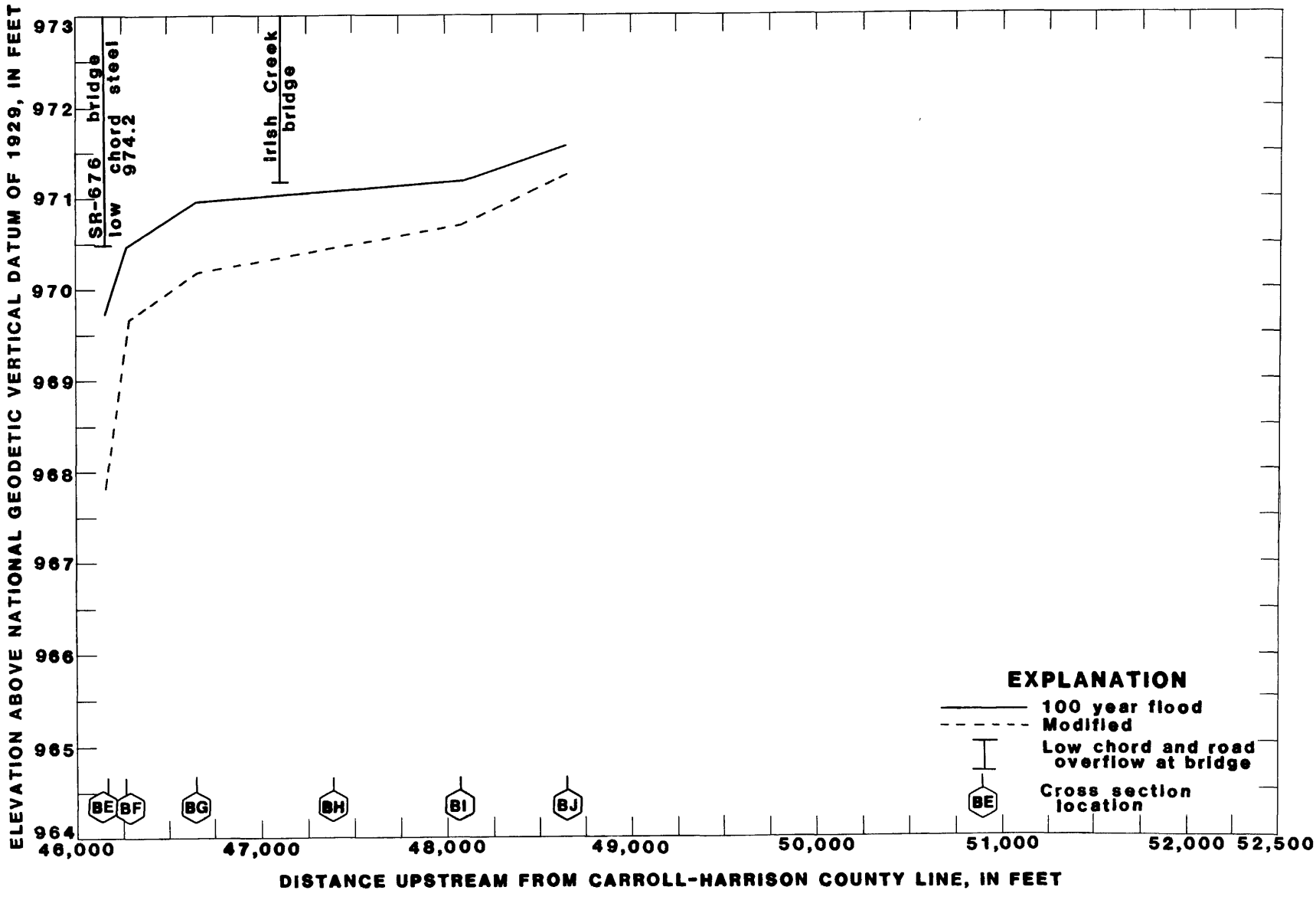


Figure 5o.--Profiles for existing and modified conditions, Conotton Creek between Bowerston and Scio, Ohio.

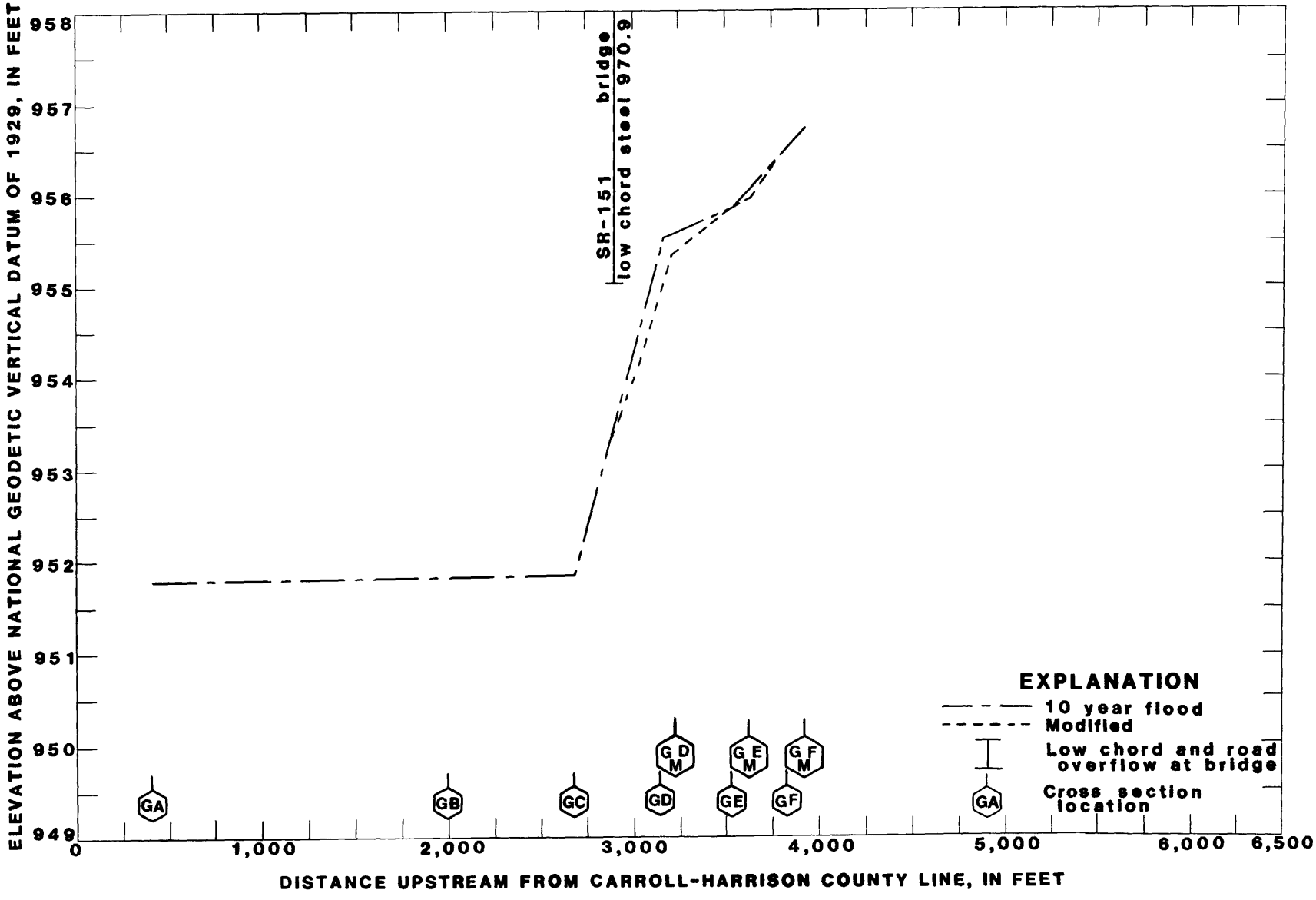


Figure 6a.--Profiles for existing and modified conditions, Scott Run.

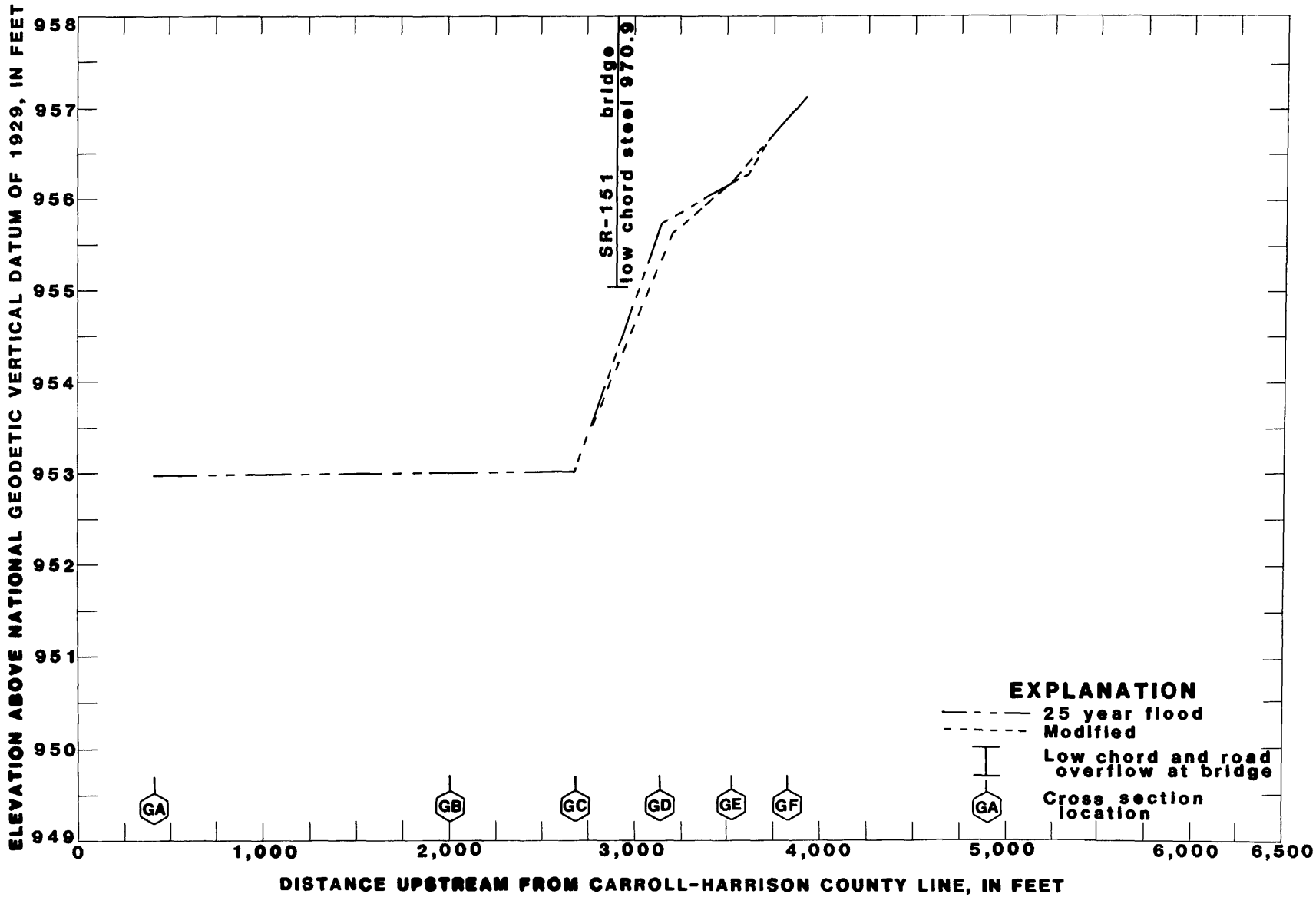


Figure 6b.--Profiles for existing and modified conditions, Scott Run.

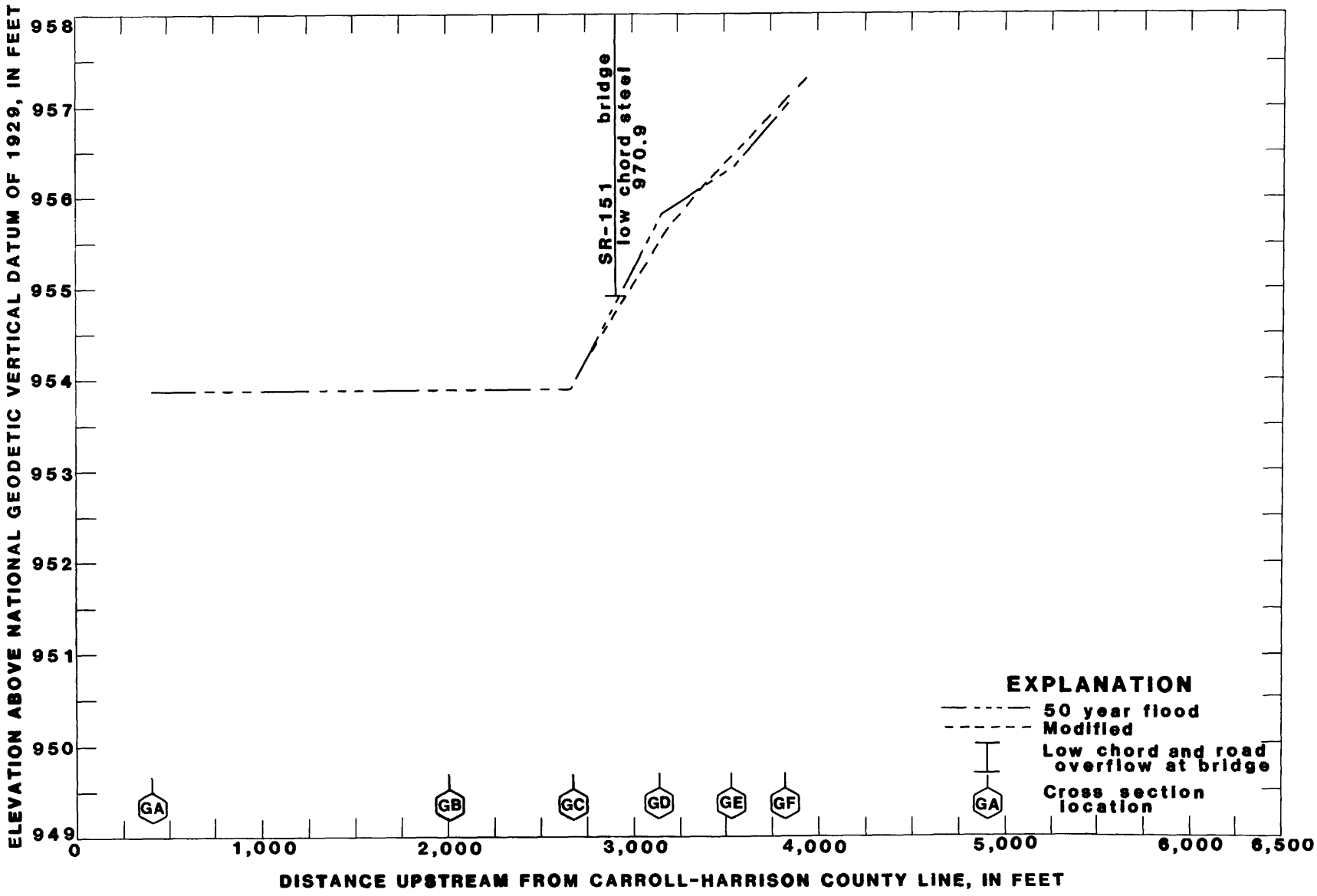


Figure 6c.--Profiles for existing and modified conditions, Scott Run.

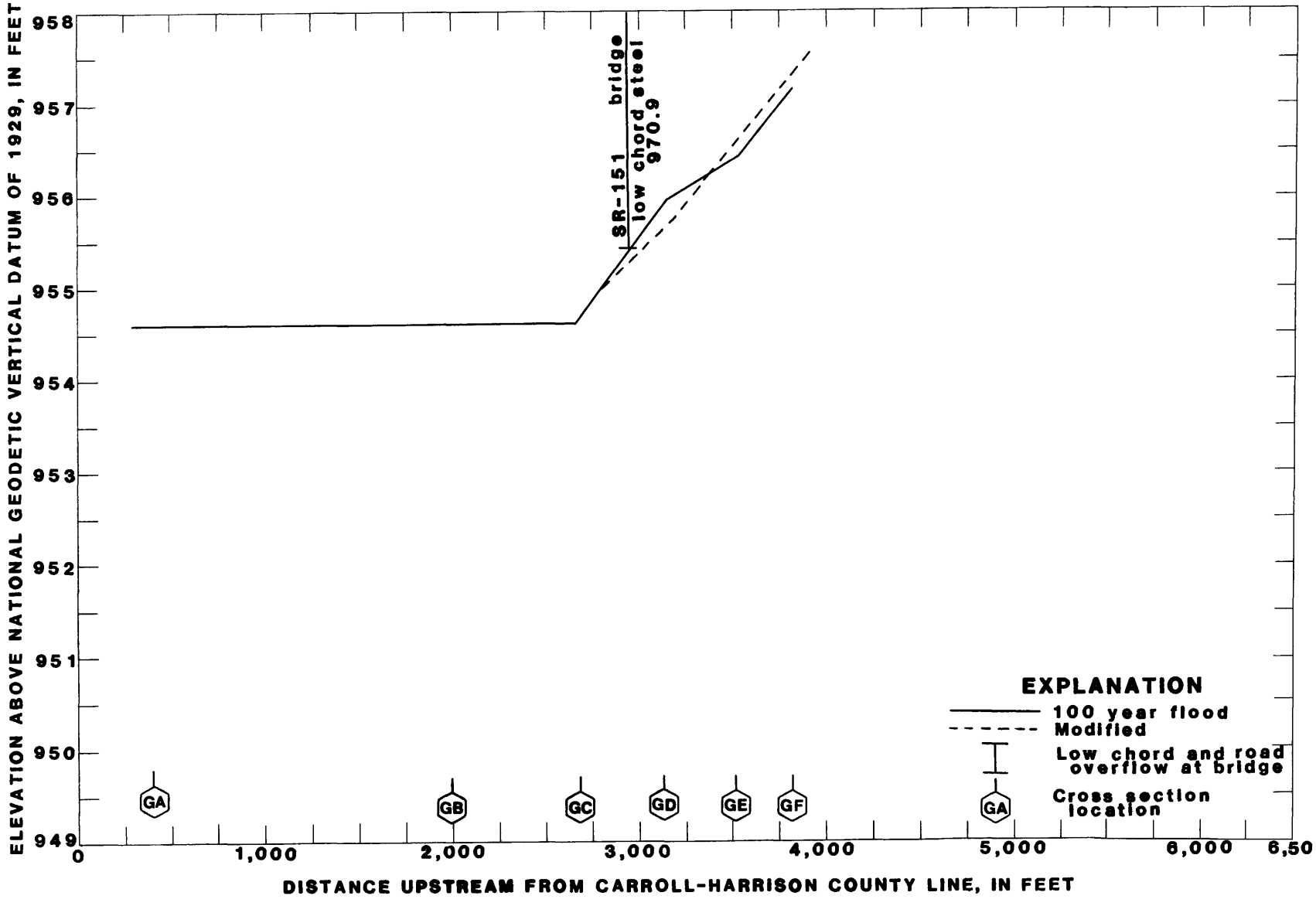


Figure 6d.--Profiles for existing and modified conditions, Scott Run.

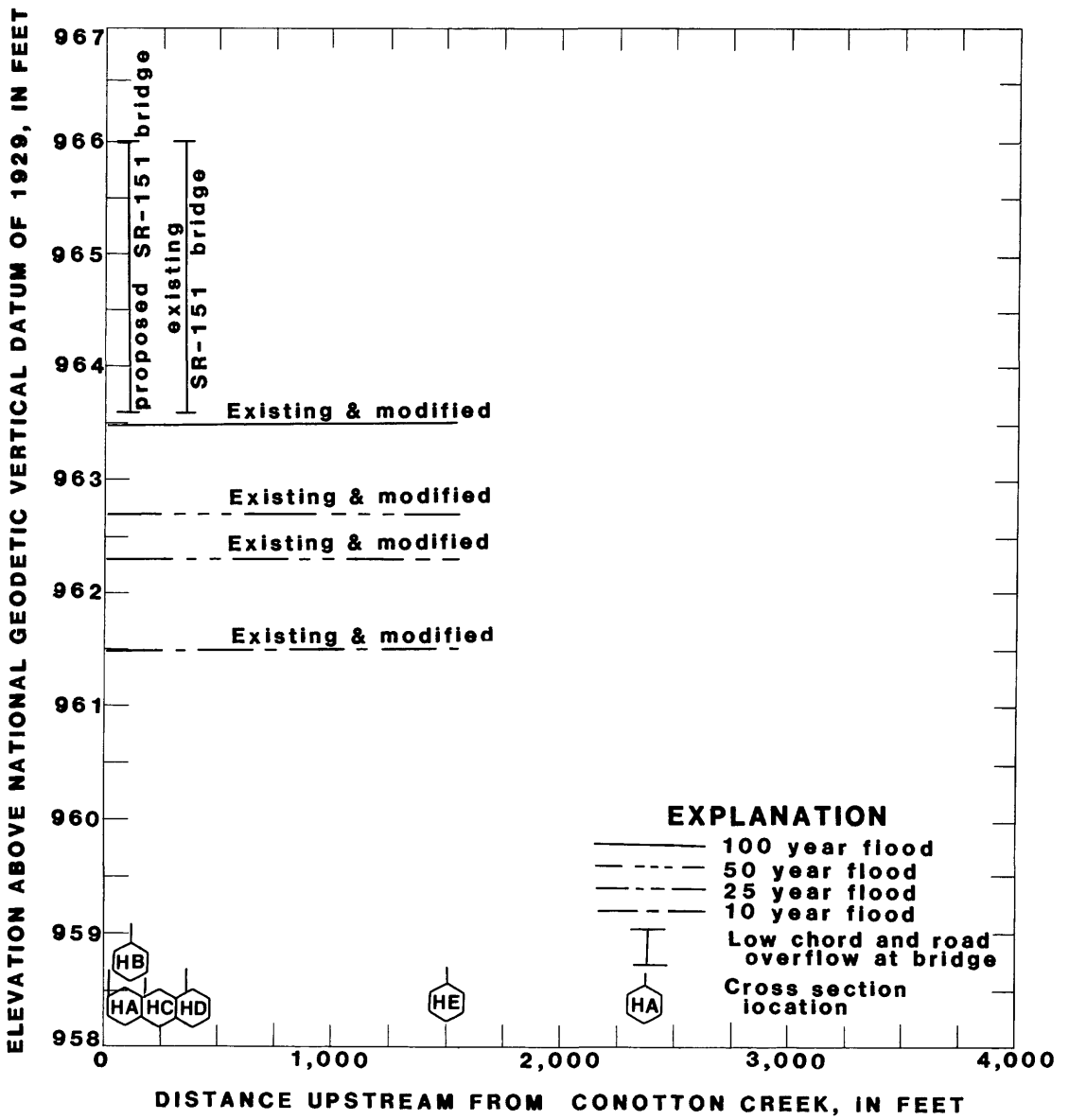


Figure 7.--Profiles for existing and modified conditions, Dining Fork.

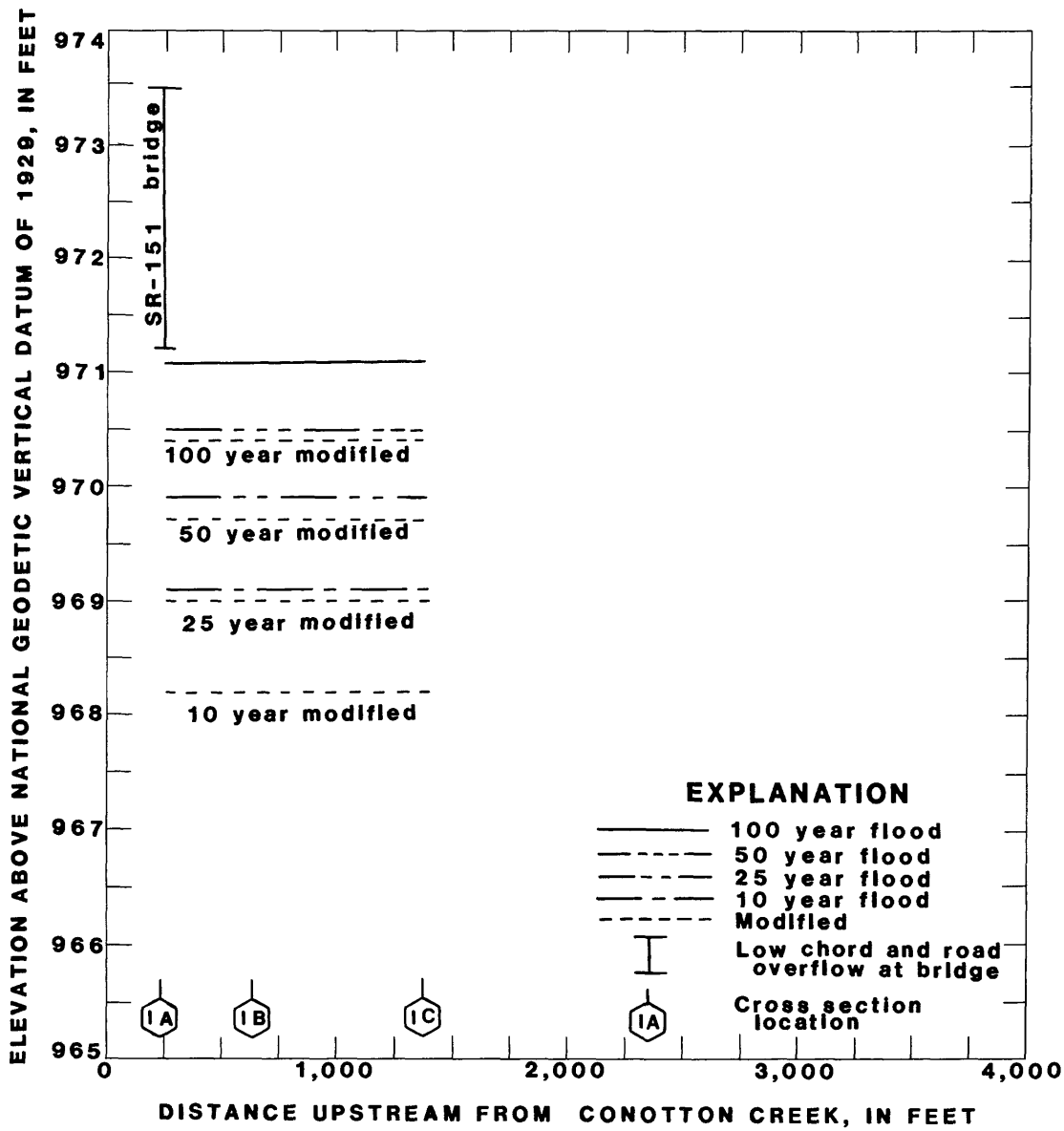


Figure 8.--Profiles for existing and modified conditions, Irish Creek.

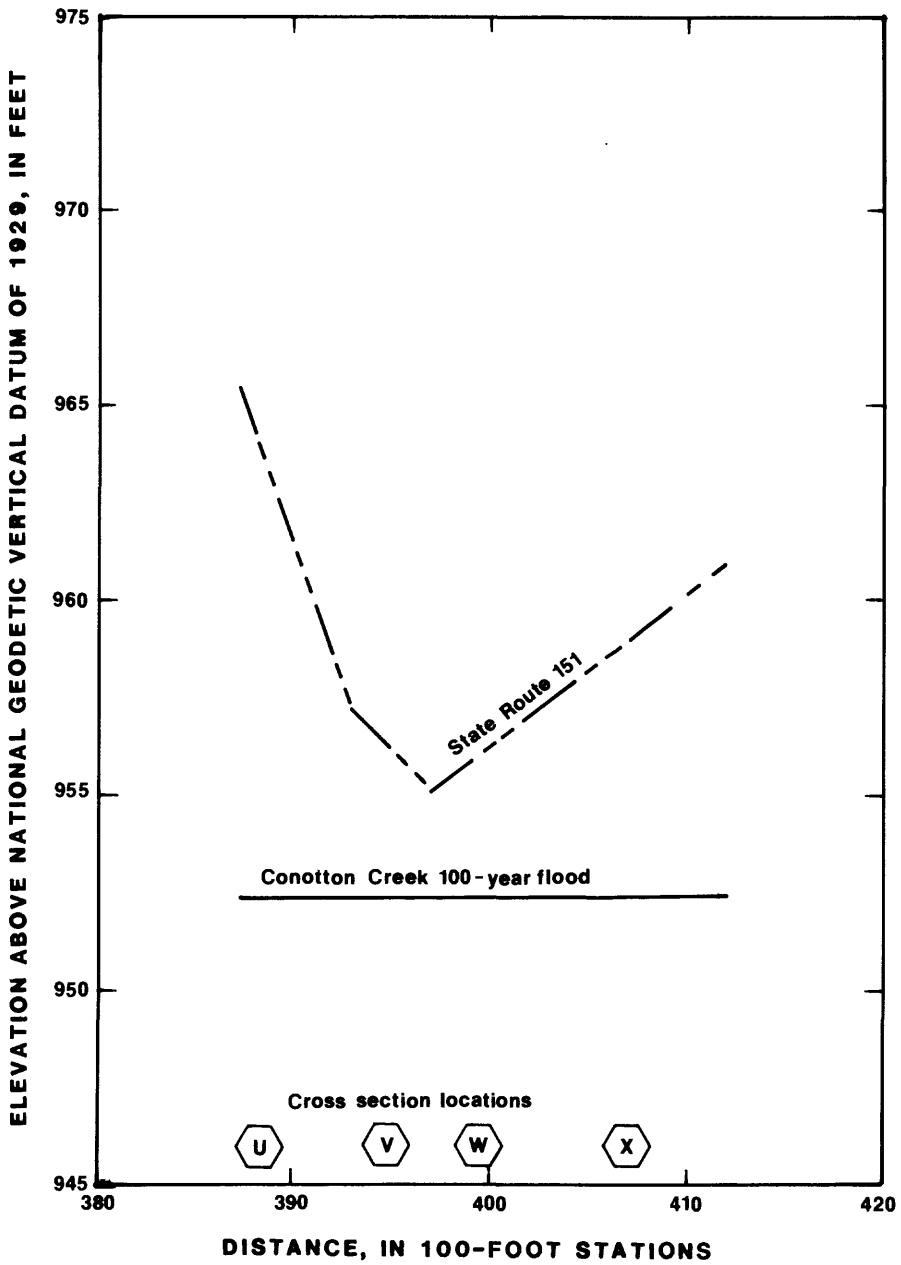


Figure 10A.--Profile of State Route 151 and 100-year flood under modified conditions.

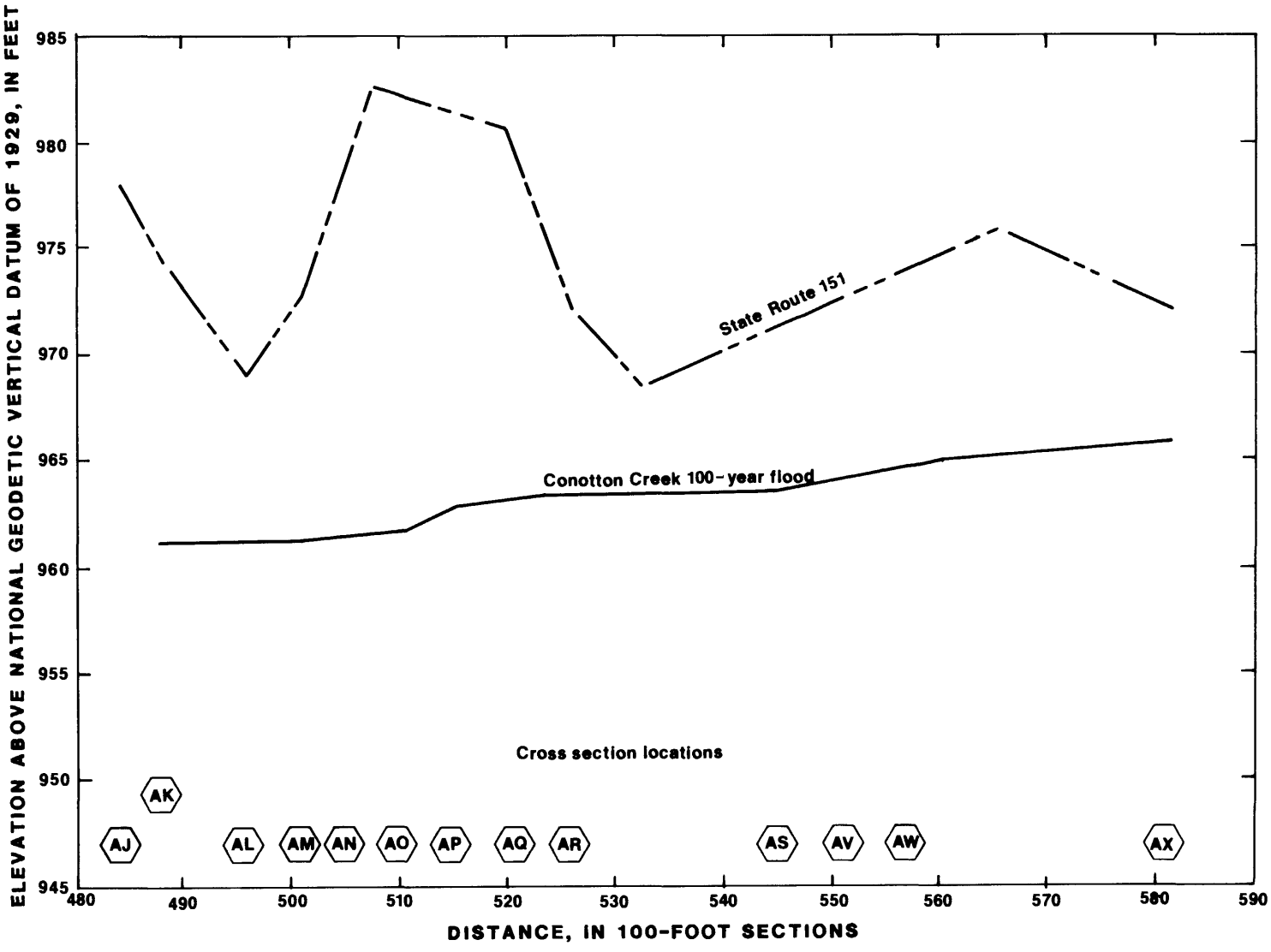


Figure 10B.--Profile of State Route 151 and 100-year flood under modified conditions.

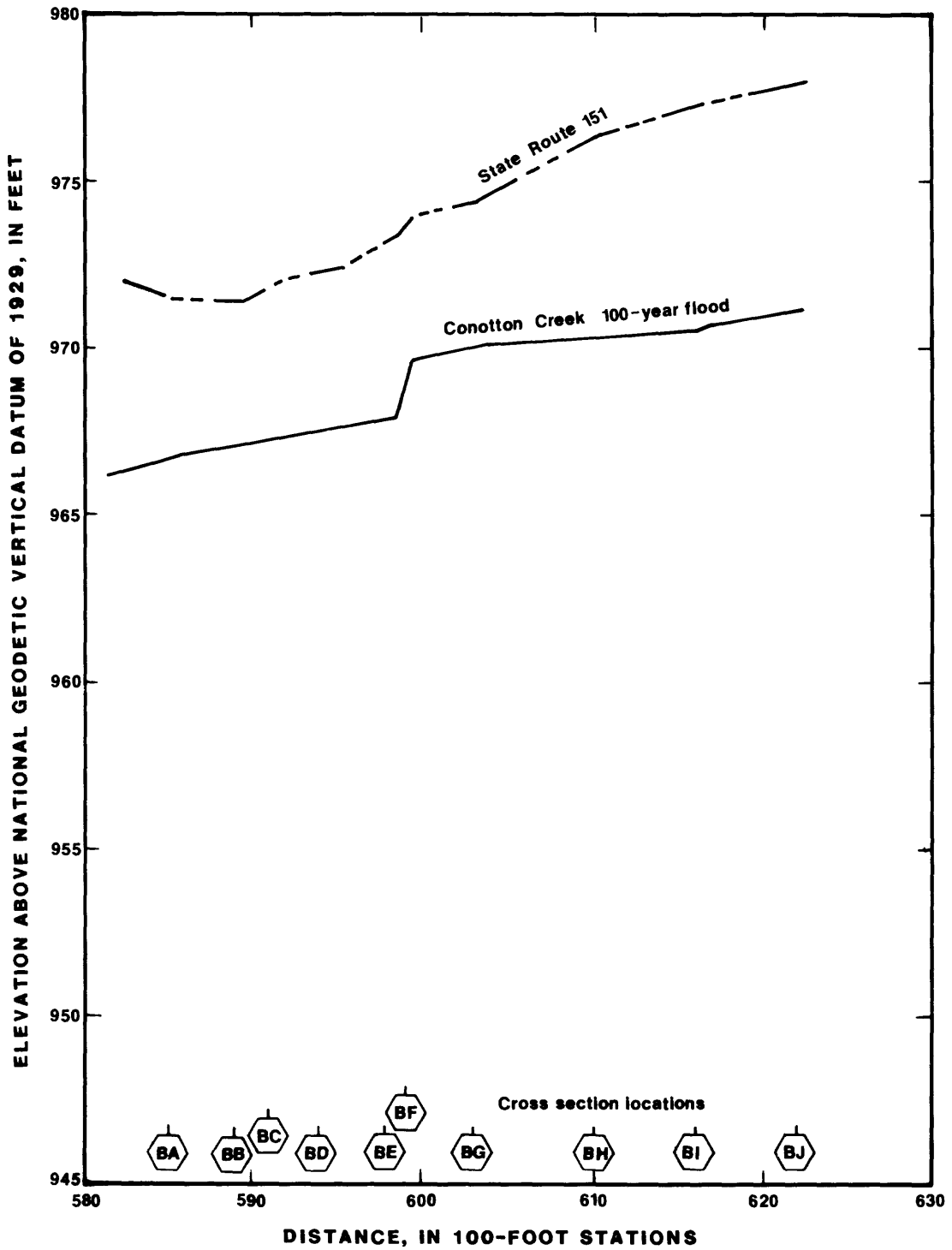


Figure 10C.--Profile of State Route 151 and 100-year flood under modified conditions.

Table 2.--Water-surface elevations for design floods along Conotton Creek

Section	River distance (feet)		Water-surface profiles, present and modified conditions (Elevation in feet, National Geodetic Vertical Datum of 1929)							
			10-year		25-year		50-Year		100-Year	
	Present	Modified	Present	Modified	Present	Modified	Present	Modified	Present	Modified
A Initial section	1,580	1,580	935.3	935.3	935.9	935.9	936.4	936.4	936.8	936.8
B	2,070	2,070	935.5	935.5	936.1	936.1	936.5	936.5	936.9	936.9
SR 151 bridge										
C	2,280	2,280	935.8	935.8	936.5	936.5	937.0	937.0	937.5	937.5
RR. bridge	2,360	2,360								
D	2,530	2,530	937.0	937.0	938.2	938.2	938.9	938.9	939.8	939.8
E	2,930	2,930	937.2	937.2	938.3	938.3	939.0	939.0	939.9	939.9
Bridge Street bridge										
F	3,010	3,010	937.3	937.3	938.4	938.4	939.0	939.0	939.9	939.9
G	3,340	3,340	937.6	937.6	938.6	938.6	939.2	939.2	940.0	940.0
H	5,200	5,200	938.4	938.4	939.3	939.3	939.8	939.8	940.5	940.5
I	6,690	6,690	940.9	940.9	942.1	942.1	943.0	943.0	943.8	943.8
J	7,030	7,030	941.0	941.0	942.2	942.2	943.1	943.1	944.0	944.0
K	8,560	8,560	941.2	941.2	942.3	942.3	943.2	943.2	944.1	944.1
L	9,610	9,610	942.4	942.4	943.5	943.5	944.3	944.3	945.2	945.2
M	10,610	10,610	943.8	943.8	945.2	945.2	946.2	946.2	947.2	947.2
N	11,350	11,350	945.0	945.0	946.5	946.5	947.6	947.6	948.6	948.6
O	11,870	11,870	945.9	945.9	947.4	947.4	948.5	948.5	949.0	949.0
P	12,440	12,440	946.1	946.1	947.7	947.7	948.8	948.8	949.9	949.9
Q	13,280	13,280	946.2	946.2	947.7	947.7	948.8	948.8	949.9	949.9

Table 2.--Water-surface elevations for design floods along Conotton Creek--Continued

Section	River distance (feet)		Water-surface profiles, present and modified conditions (Elevation in feet, National Geodetic Vertical Datum of 1929)							
			10-year		25-year		50-year		100-year	
	Present	Modified	Present	Modified	Present	Modified	Present	Modified	Present	Modified
R	14,200	14,200	946.2	946.2	947.8	947.8	948.8	948.8	949.9	949.9
S	15,600	15,600	946.7	946.7	948.0	948.0	949.0	949.0	950.0	950.0
T	17,170	17,170	948.2	948.2	948.9	948.9	949.6	949.6	950.4	950.4
U	18,510	18,510	949.4	949.4	950.1	950.1	950.6	950.6	951.3	951.3
V	19,140	19,140	950.1	950.1	950.8	950.8	951.4	951.4	951.9	951.9
Co. Rd. 25 bridge										
W	19,260	19,260	951.1	951.1	952.2	952.2	953.1	953.1	953.8	953.8
X	20,030	20,030	952.0	952.0	953.2	953.2	954.1	954.1	954.8	954.8
Y	20,620	20,620	952.6	952.6	953.8	953.8	954.7	954.7	955.5	955.5
Scott Run	21,580									
Z	22,280	22,280	952.9	952.9	954.1	954.1	955.0	955.0	955.7	955.7
AA	23,240	23,240	953.3	953.3	954.4	954.4	955.2	955.2	956.0	956.0
AB	23,830	23,830	953.8	953.8	954.9	954.9	955.7	955.7	956.4	956.4
AC	24,300	24,300	954.0	954.0	955.1	955.1	955.9	955.9	956.6	956.6
AD	25,980	25,980	954.2	954.2	955.3	955.3	956.0	956.0	956.8	956.8
RR. bridge										
AE	26,140	26,140	954.2	954.2	955.3	955.3	956.1	956.1	959.5	959.5
RR. bridge										
AF	26,400	26,400	955.3	955.3	956.5	956.5	957.4	957.4	960.4	960.4
AG	29,300	29,300	955.7	955.7	956.8	956.8	957.6	957.6	960.4	960.4
AH	30,780	30,780	956.7	956.7	957.4	957.4	958.0	958.0	960.5	960.5

Table 2.--Water-surface elevations for design floods along Conotton Creek--Continued

Section	River distance (feet)		Water-surface profiles, present and modified conditions (Elevation in feet, National Geodetic Vertical Datum of 1929)							
			10-year		25-year		50-year		100-year	
	Present	Modified	Present	Modified	Present	Modified	Present	Modified	Present	Modified
AI	31,640	31,640	957.7	957.7	958.4	958.4	959.0	959.0	961.0	961.0
AJ	32,010	32,010	958.0	958.0	958.7	958.7	959.3	959.3	961.1	961.1
AK	32,330	32,330	958.0	958.0	958.8	958.7	959.4	959.3	961.2	961.1
AL	33,630	33,030	958.2	957.9	958.9	958.7	959.5	959.3	961.2	961.1
AM	34,010	33,530	958.4	958.1	959.1	958.9	959.6	959.6	961.3	961.3
AN	34,650	33,930	959.2	958.1	959.8	959.0	960.2	959.6	961.6	961.4
AO	35,270	34,260	960.0	959.5	960.5	959.8	961.0	960.2	962.1	961.7
AP	36,340	35,330	961.3	961.2	961.9	961.7	962.4	962.2	963.2	963.0
AQ	37,110	36,060	961.5	961.5	962.2	962.2	962.7	962.7	963.4	963.4
Dining Fork	37,400									
AR	37,700	36,510	961.7	961.7	962.3	962.3	962.8	962.8	963.5	963.5
AS[a]	39,990	38,800	962.1	962.1	962.6	962.6	962.9	962.9	963.6	963.6
RR. bridge										
AT	40,040	38,850	962.1	962.1	962.6	962.6	963.3	963.0	964.1	963.8
AU	40,320	39,130	962.7	962.2	963.2	962.8	963.7	963.2	964.5	964.0
AV	40,980	39,790	963.6	962.5	964.0	963.1	964.4	963.6	965.0	964.4
AW	42,670	41,480	964.8	963.1	965.1	963.8	965.5	964.4	966.1	965.1
AX	44,290	43,100	966.0	963.9	966.4	964.8	966.7	965.4	967.2	966.1
Eastport Road bridge										
AY	44,520	43,330	966.5	964.1	966.9	965.0	967.3	965.7	967.8	966.4

Table 2.--Water-surface elevations for design floods along Conotton Creek--Continued

Section	River distance (feet)		Water-surface profiles, present and modified conditions (Elevation in feet, National Geodetic Vertical Datum of 1929)							
			10-year		25-year		50-year		100-year	
	Present	Modified	Present	Modified	Present	Modified	Present	Modified	Present	Modified
AZ[a]	44,730	43,540	966.6	964.2	967.0	965.1	967.4	965.8	967.9	966.5
RR. bridge										
BA	44,820	43,630	967.2	964.4	967.6	965.4	968.1	966.2	968.6	966.9
BB	45,170	43,990	967.2	964.6	967.7	965.6	968.1	966.4	968.6	967.2
BC	45,510	44,330	967.3	964.8	967.8	965.8	968.2	966.6	968.7	967.4
BD	45,860	44,690	967.8	965.2	968.4	966.2	968.8	966.9	969.3	967.7
BE	46,160	44,980	968.2	965.4	968.8	966.4	969.3	967.1	969.8	967.9
SR 646 bridge										
BF	46,260	45,080	968.6	967.1	969.3	968.0	969.9	968.8	970.5	969.7
BG	46,640	45,460	969.0	967.9	969.8	968.7	970.4	969.5	971.0	970.2
Irish Creek	47,100	45,920								
BH	47,390	46,210	969.2	968.3	969.9	969.1	970.5	969.8	971.1	970.5
BI	48,070	46,900	969.3	968.7	970.1	969.4	970.6	970.0	971.6	970.7
BJ	48,650	47,510	969.7	969.7	970.5	970.3	971.0	970.8	971.6	971.3

[a] Stream channel divided into two channels between AS and AZ

Table 3.--Water-surface elevations for design floods along Scott Run, Dining Fork and Irish Creek

Stream and section	Distance upstream from Conotton Creek (feet)		Water-surface profiles, present and modified conditions (Elevation in feet, National Geodetic Vertical Datum of 1929)							
			10-year		25-year		50-year		100-year	
	Present	Modified	Present	Modified	Present	Modified	Present	Modified	Present	Modified
SCOTT RUN										
GA	400	400	951.8	951.8	953.0	953.0	953.9	953.9	954.6	954.6
GB	2,000	2,000	951.8	951.8	953.0	953.0	953.9	953.9	954.6	954.6
GC	2,680	2,680	951.8	951.8	953.0	953.0	953.9	953.9	954.6	954.6
SR 151	2,900	2,900								
GD	3,140	--	955.6	--	955.7	--	955.8	--	955.9	--
GE	3,530	--	955.9	--	956.1	--	956.2	--	956.4	--
GF	3,820	--	956.6	--	956.8	--	957.0	--	957.1	--
GDM	--	3,180	--	955.4	--	955.6	--	955.7	--	955.7
GEM	--	3,630	--	956.0	--	956.3	--	956.6	--	956.9
GFM	--	3,920	--	956.9	--	957.1	--	957.3	--	957.5
DINING FORK										
HA	0	0	961.5	961.5	962.3	962.3	962.7	962.7	963.5	963.5
HB (Proposed SR 151)	105	105	961.5	961.5	962.3	962.3	962.7	962.7	963.5	963.5
HC	180	180	961.5	961.5	962.3	962.3	962.7	962.7	963.5	963.5
HD (Existing SR 151)	350	350	961.5	961.5	962.3	962.3	962.7	962.7	963.5	963.5
HE	1,530	1,530	961.5	961.5	962.3	962.3	962.7	962.7	963.5	963.5
IRISH CREEK										
IA (SR 151)	240	240	969.1	968.2	969.9	969.0	970.5	969.7	971.1	970.4
IB	640	640	969.1	968.2	969.9	969.0	970.5	969.7	971.1	970.4
IC	1,380	1,380	969.1	968.2	969.9	969.0	970.5	969.7	971.1	970.4

Figure 9

In its original form, figure 9 consisted of 11 oversized plates (9a-9k). For purposes of microfilming and reproduction, each plate has been subdivided into three page-size sections. Figures 9A1, 9A2, and 9A3, for example, represent the left, middle, and right sections of the original figure 9A.

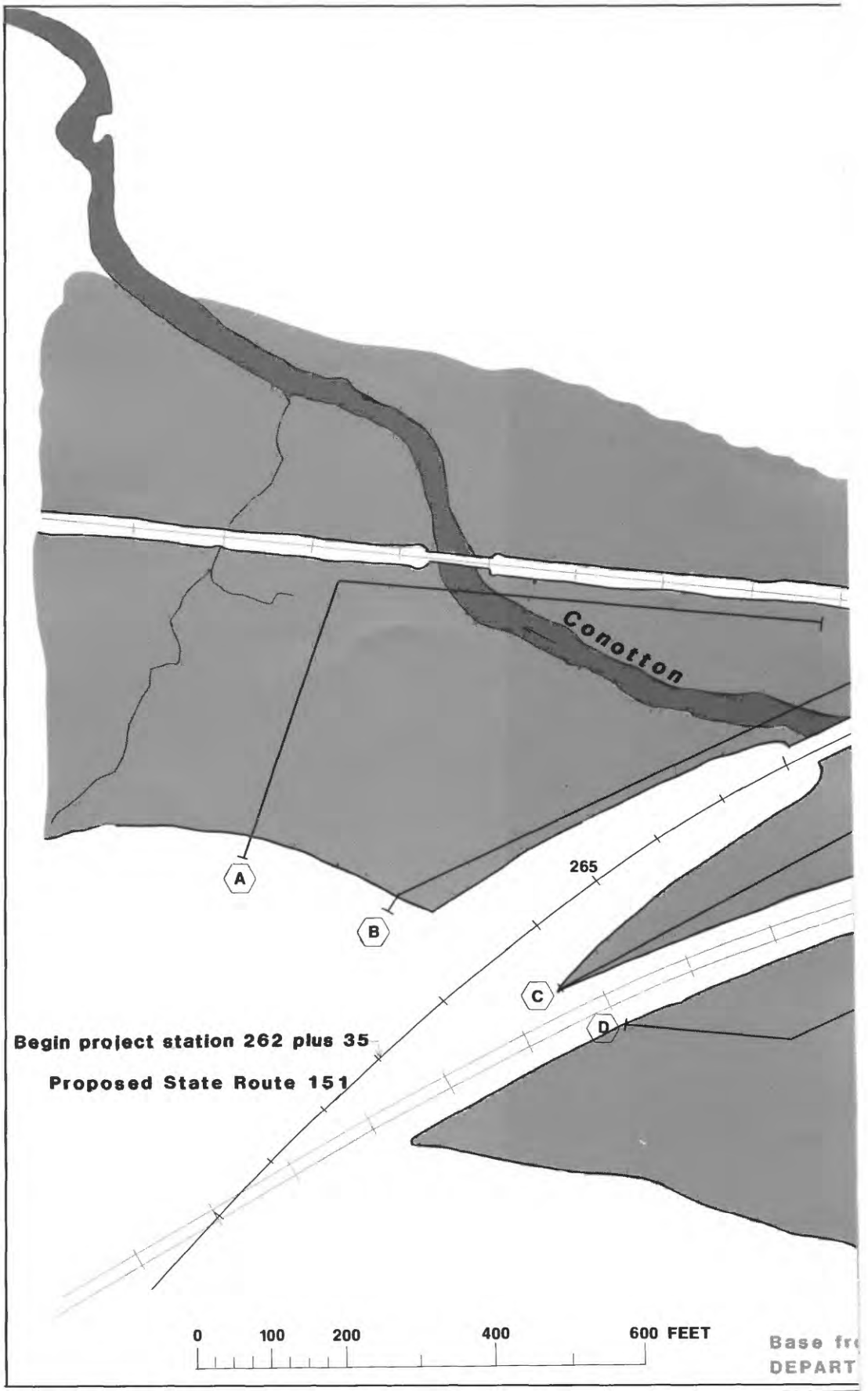


Figure 9A1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

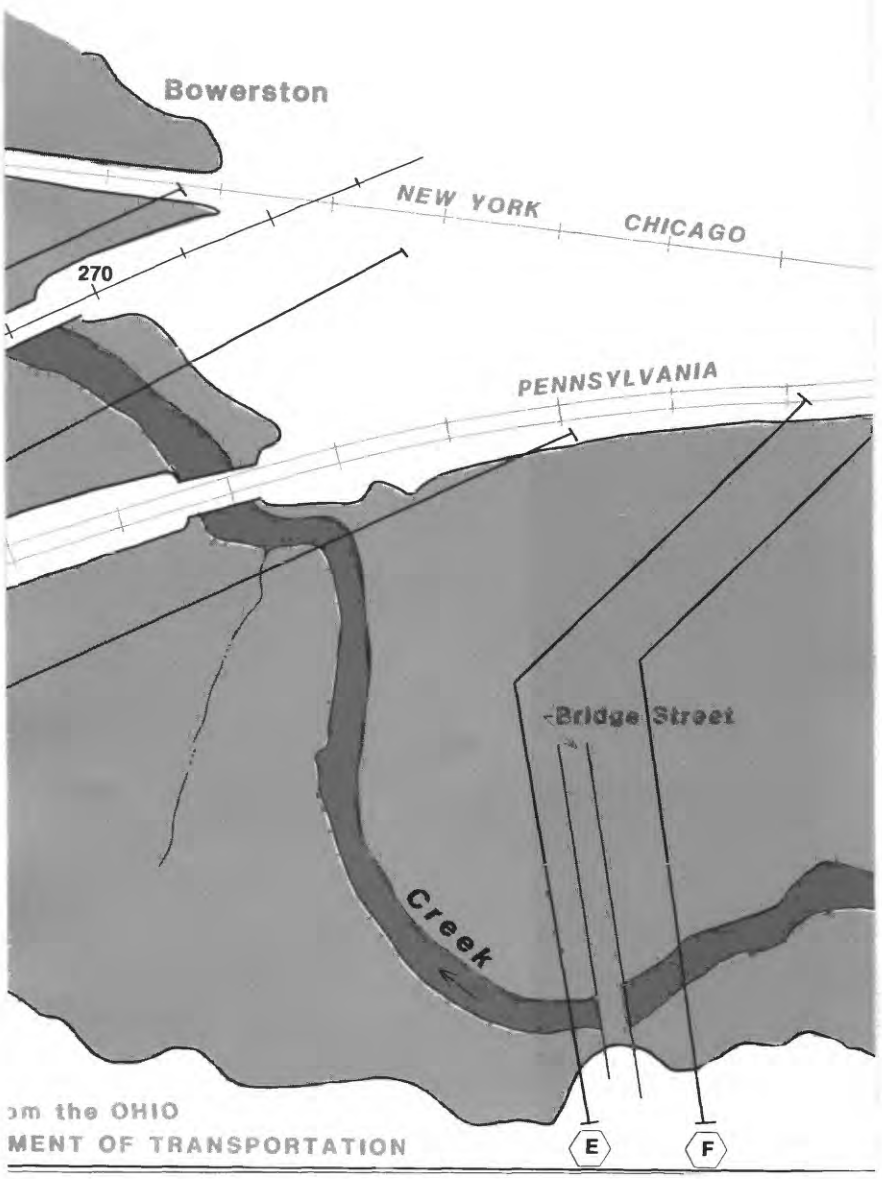


Figure 9A2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

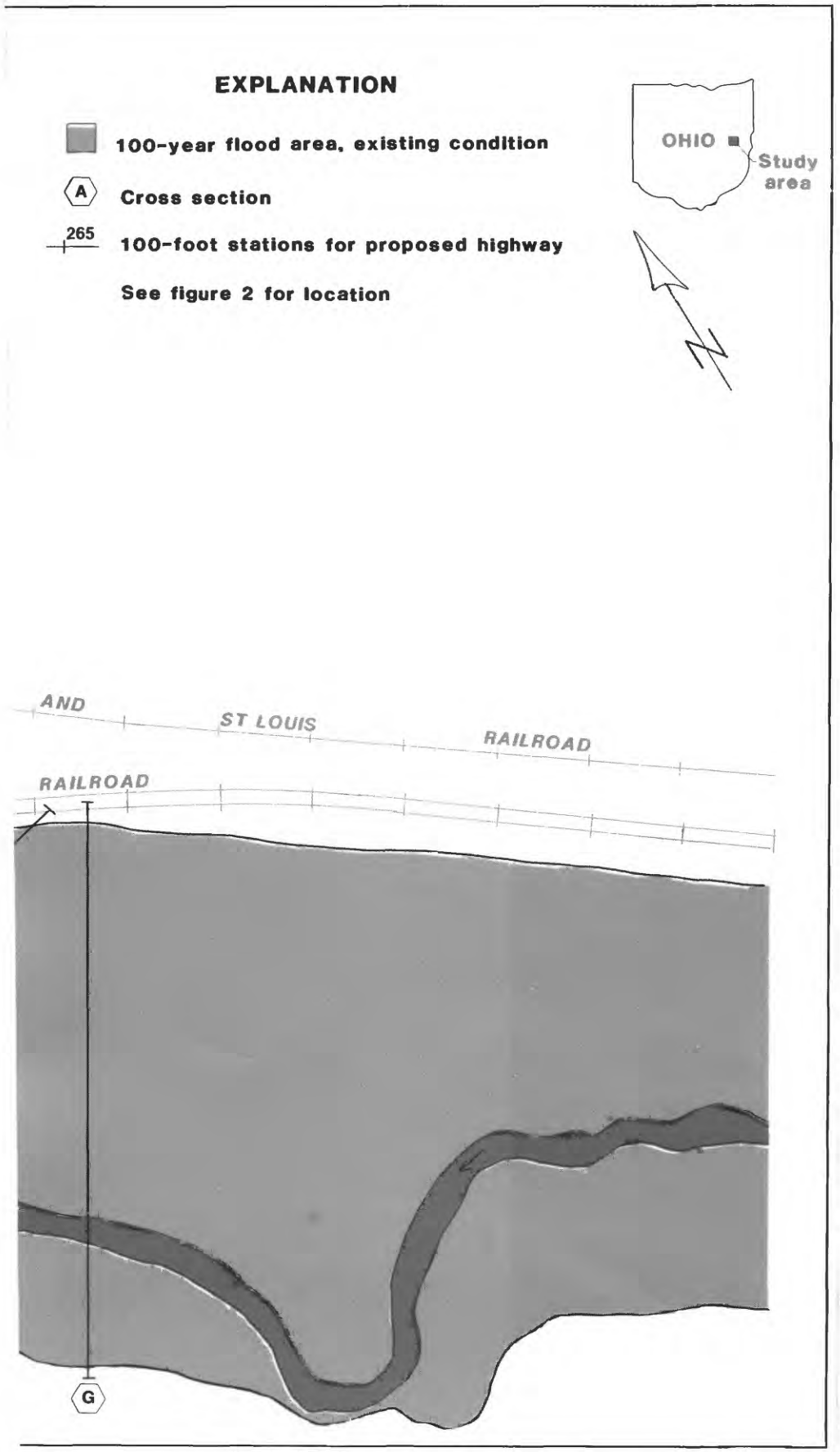


Figure 9A3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

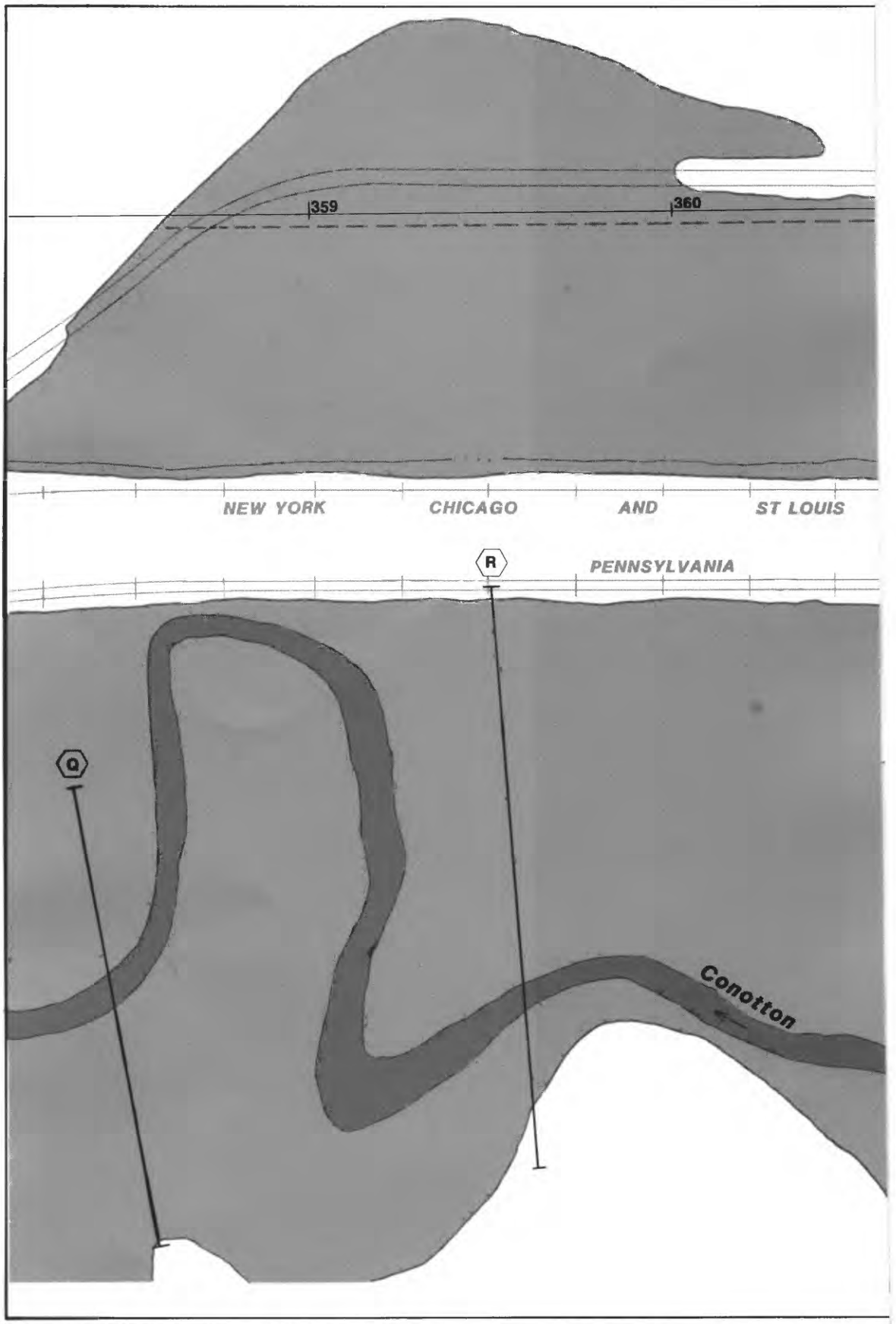


Figure 9B1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

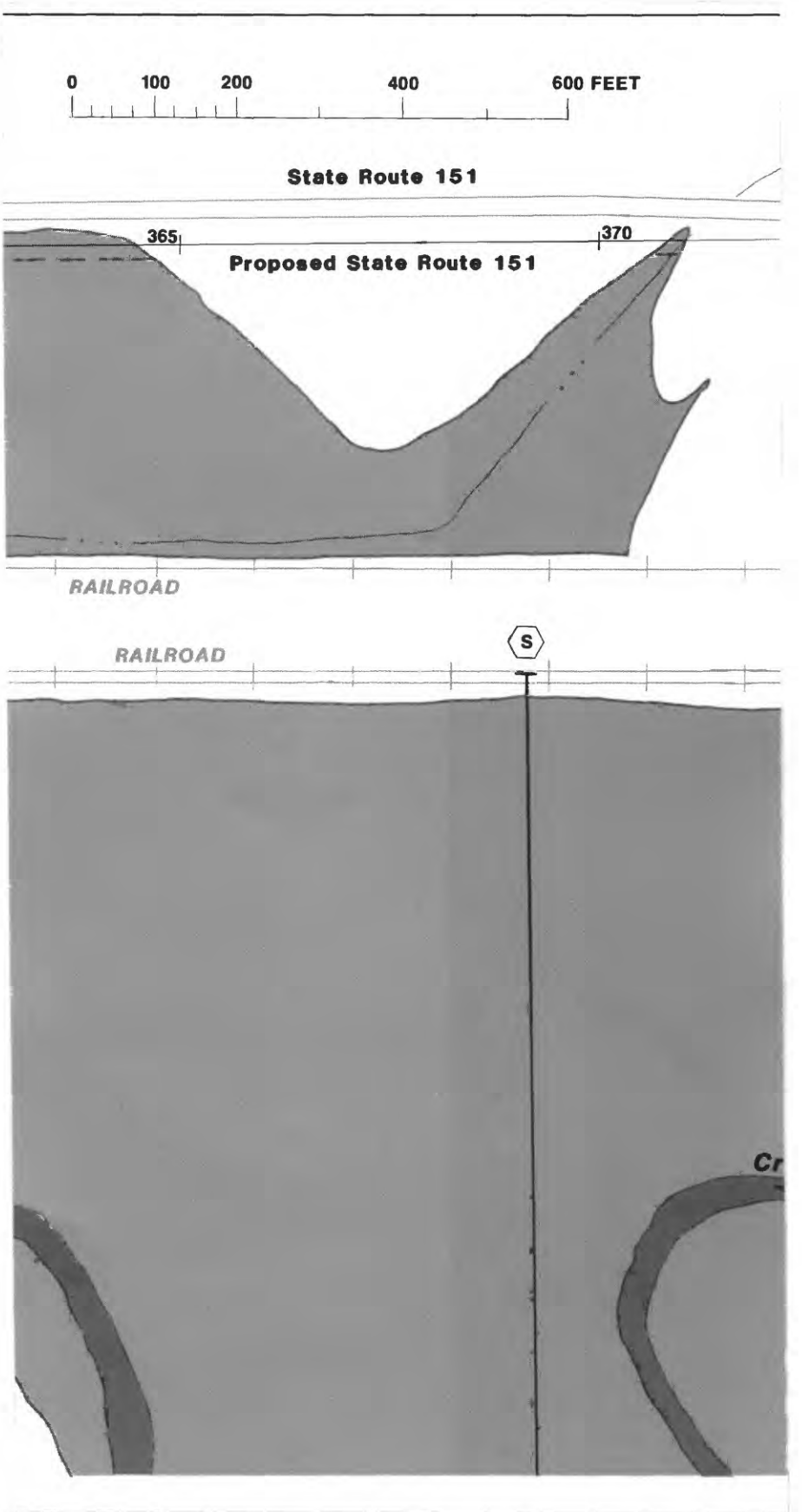


Figure 9B2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

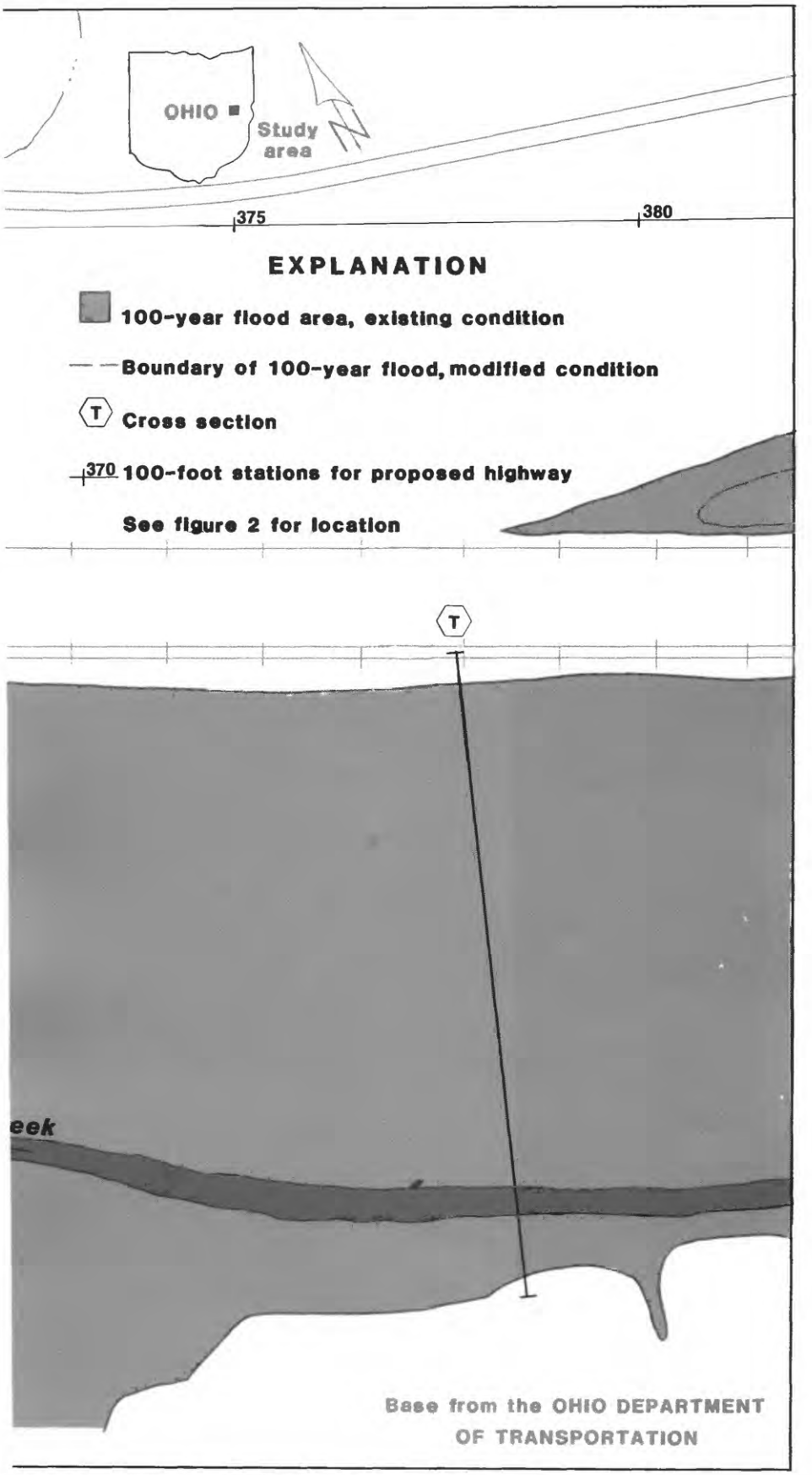


Figure 9B3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

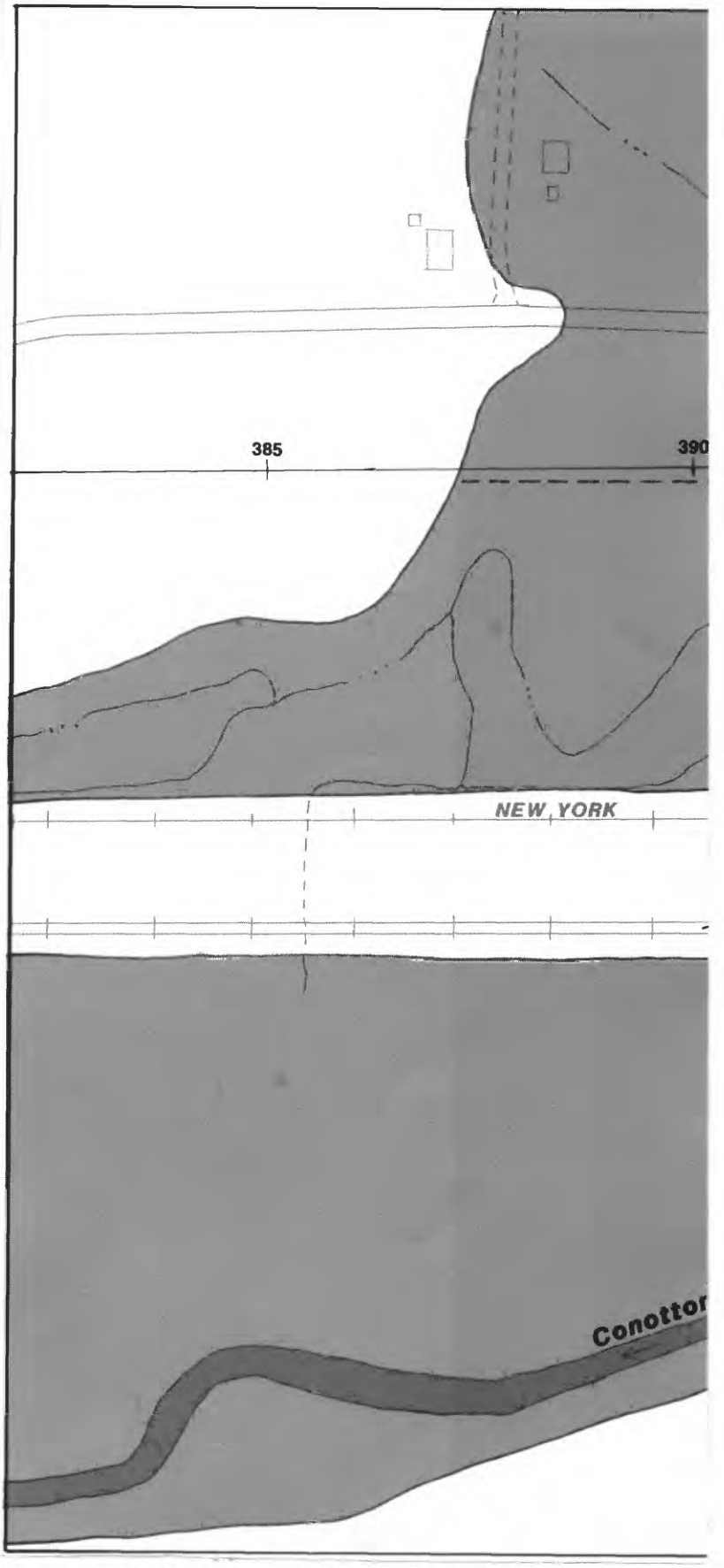


Figure 9C1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

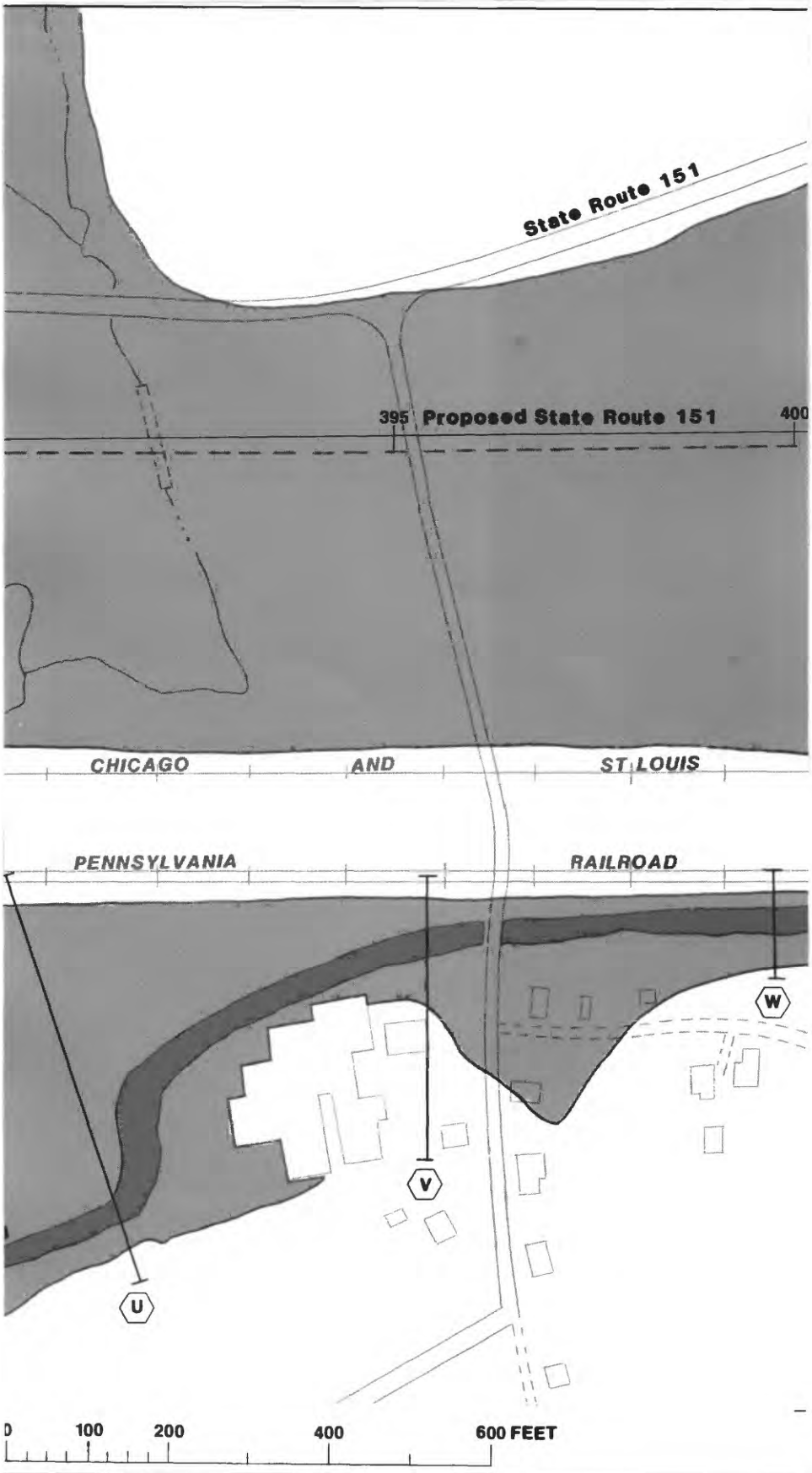


Figure 9C2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

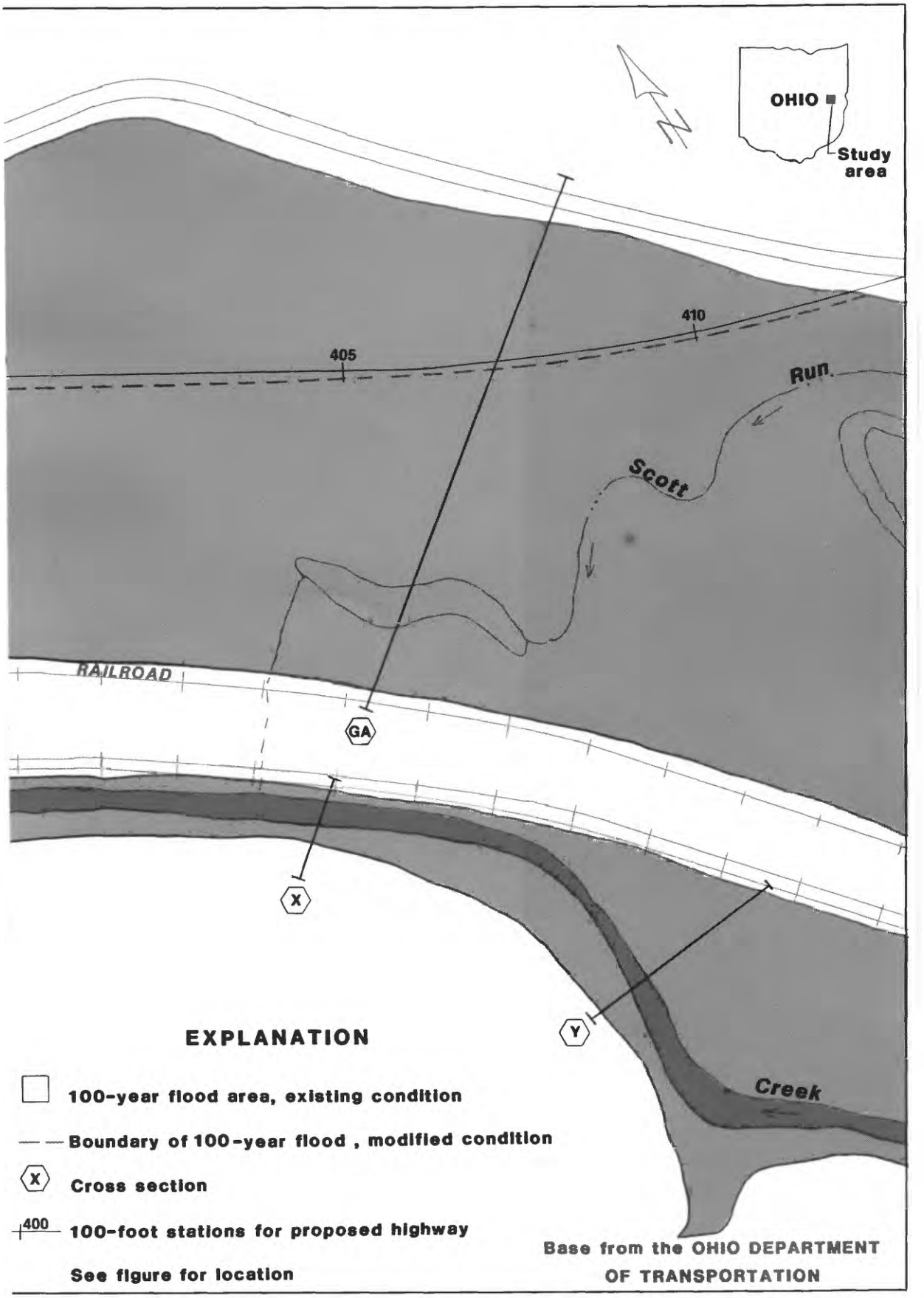


Figure 9C3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

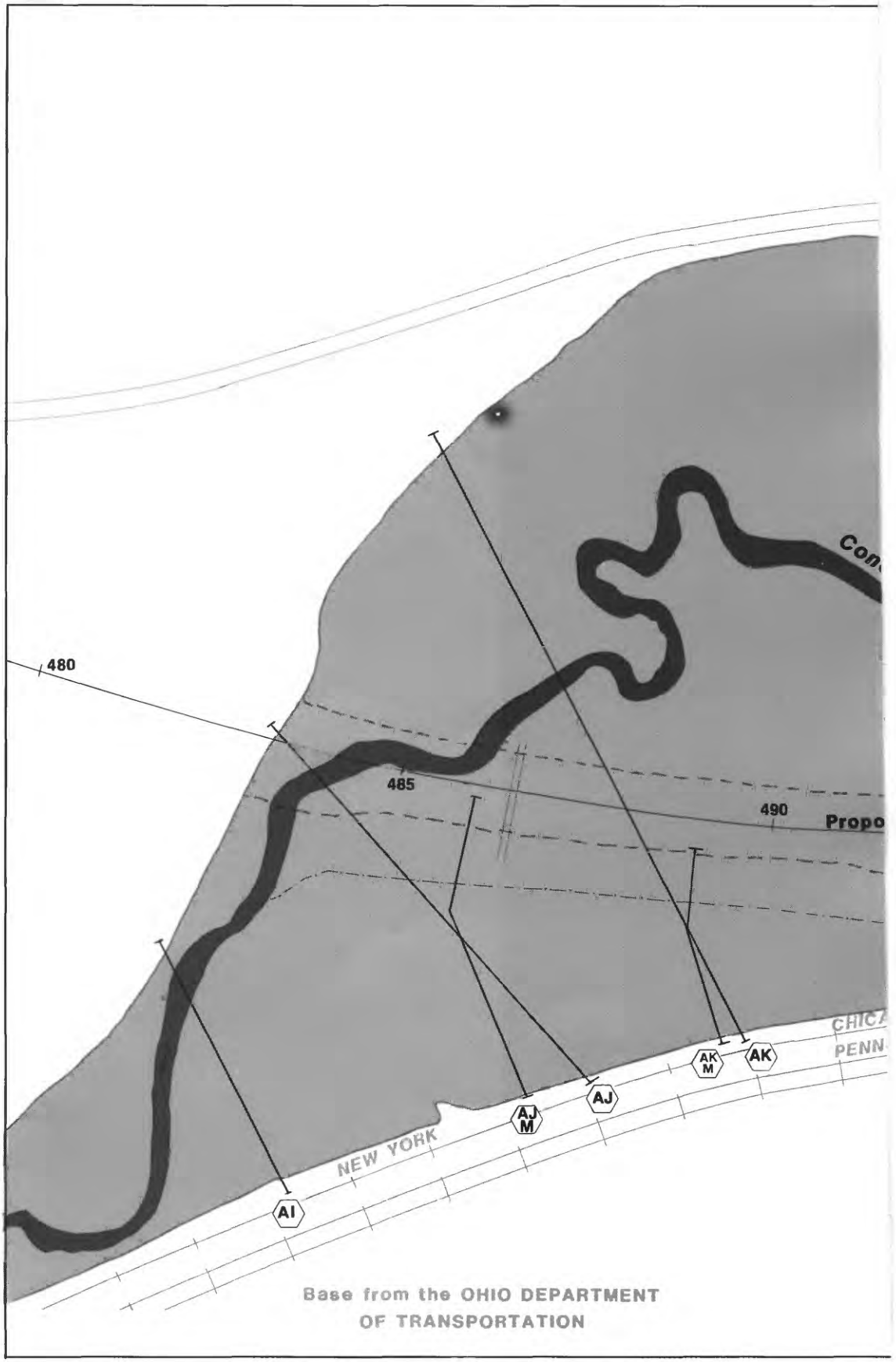
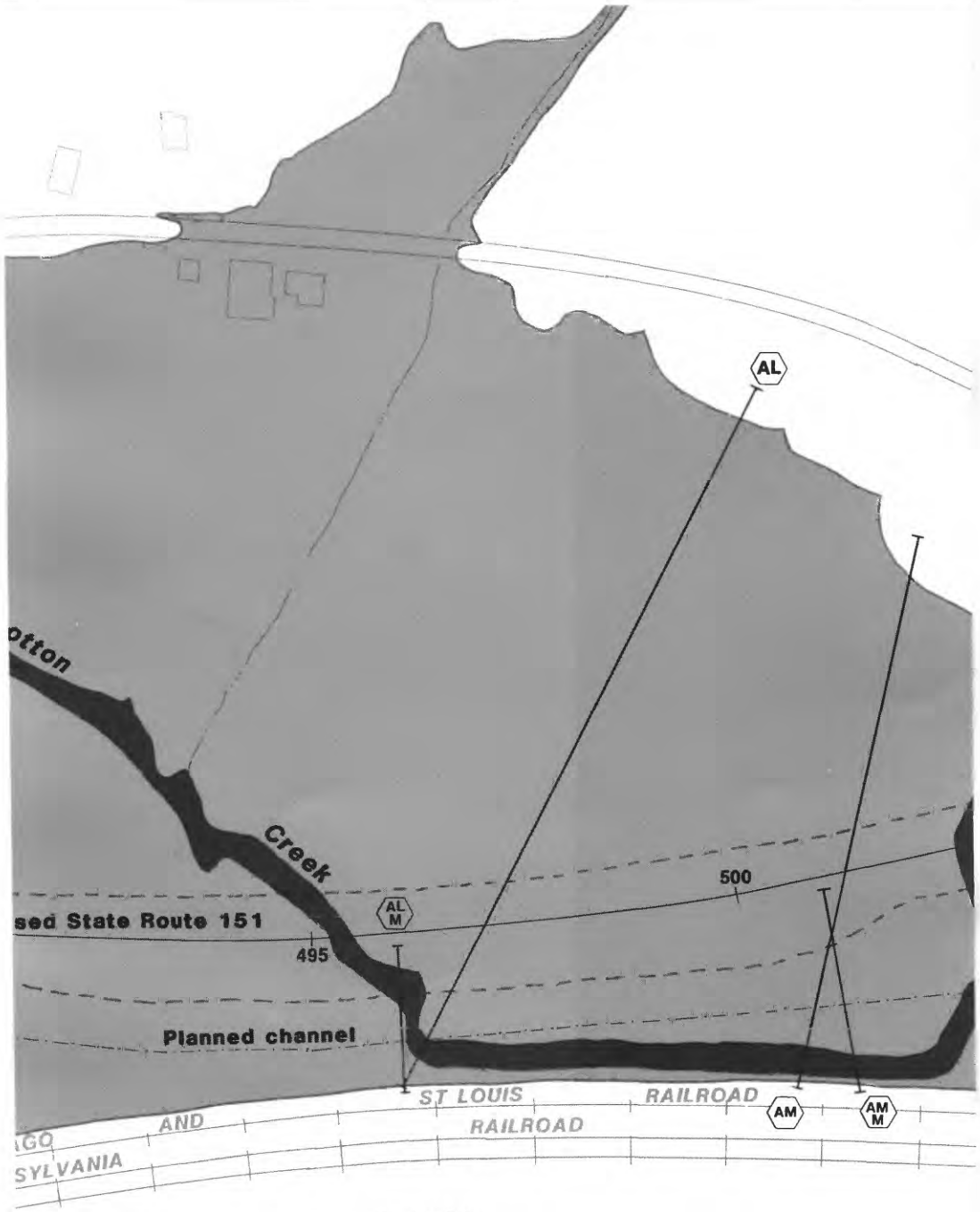


Figure 9D1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.



EXPLANATION

AL — Cross section

100-year flood area, existing condition

490 — 100-foot stations for proposed highway

Boundary of 100-year flood, modified condition

See figure 2 for location

Figure 9D2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

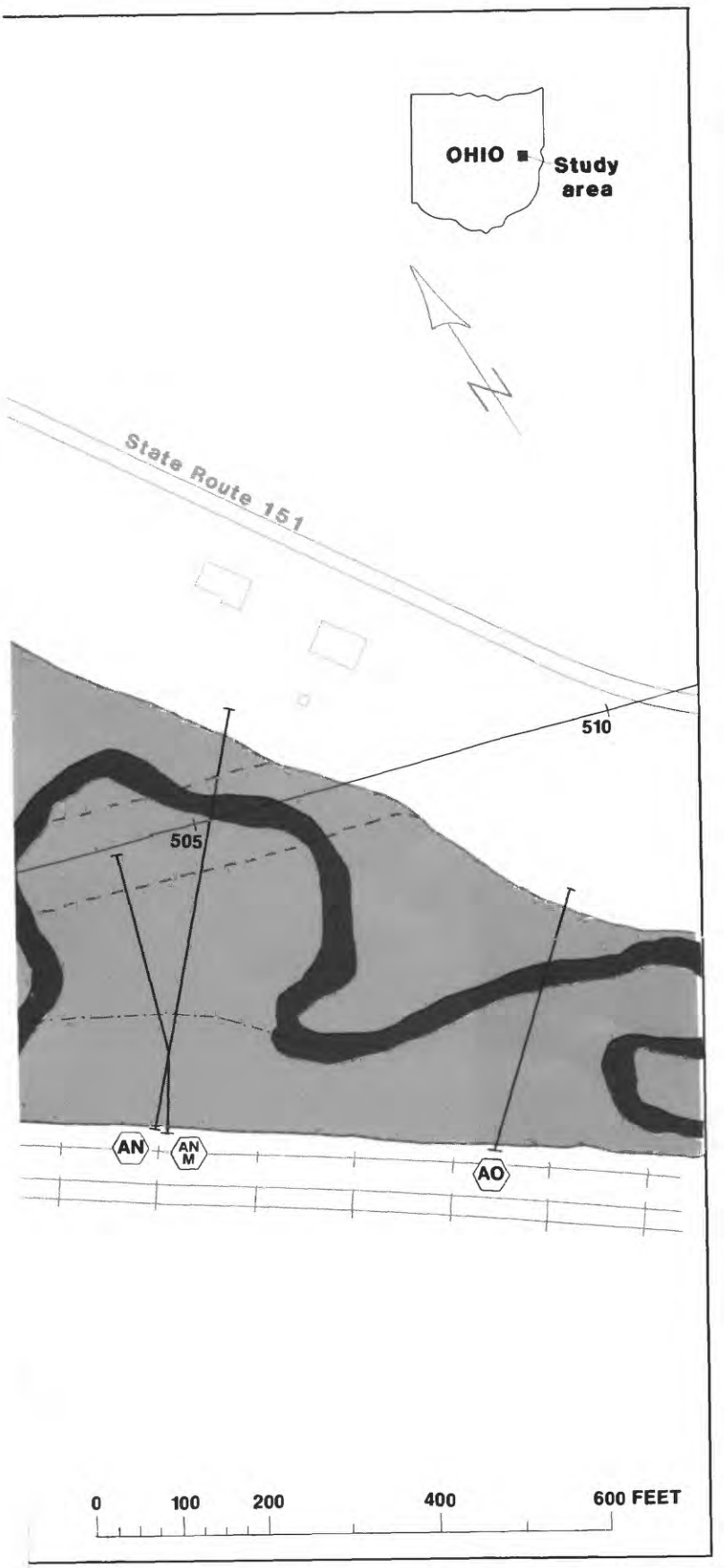


Figure 9D3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

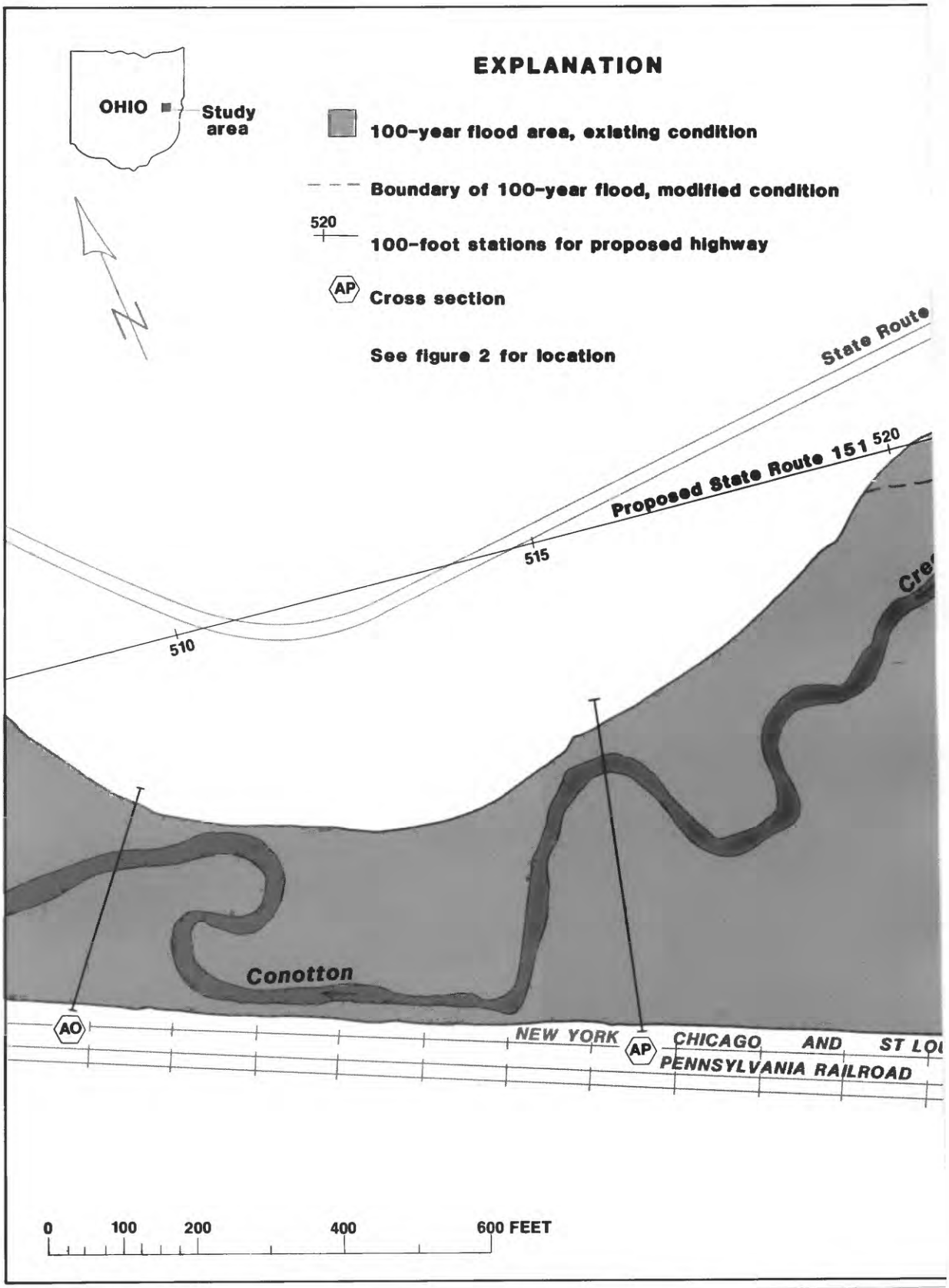


Figure 9E1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

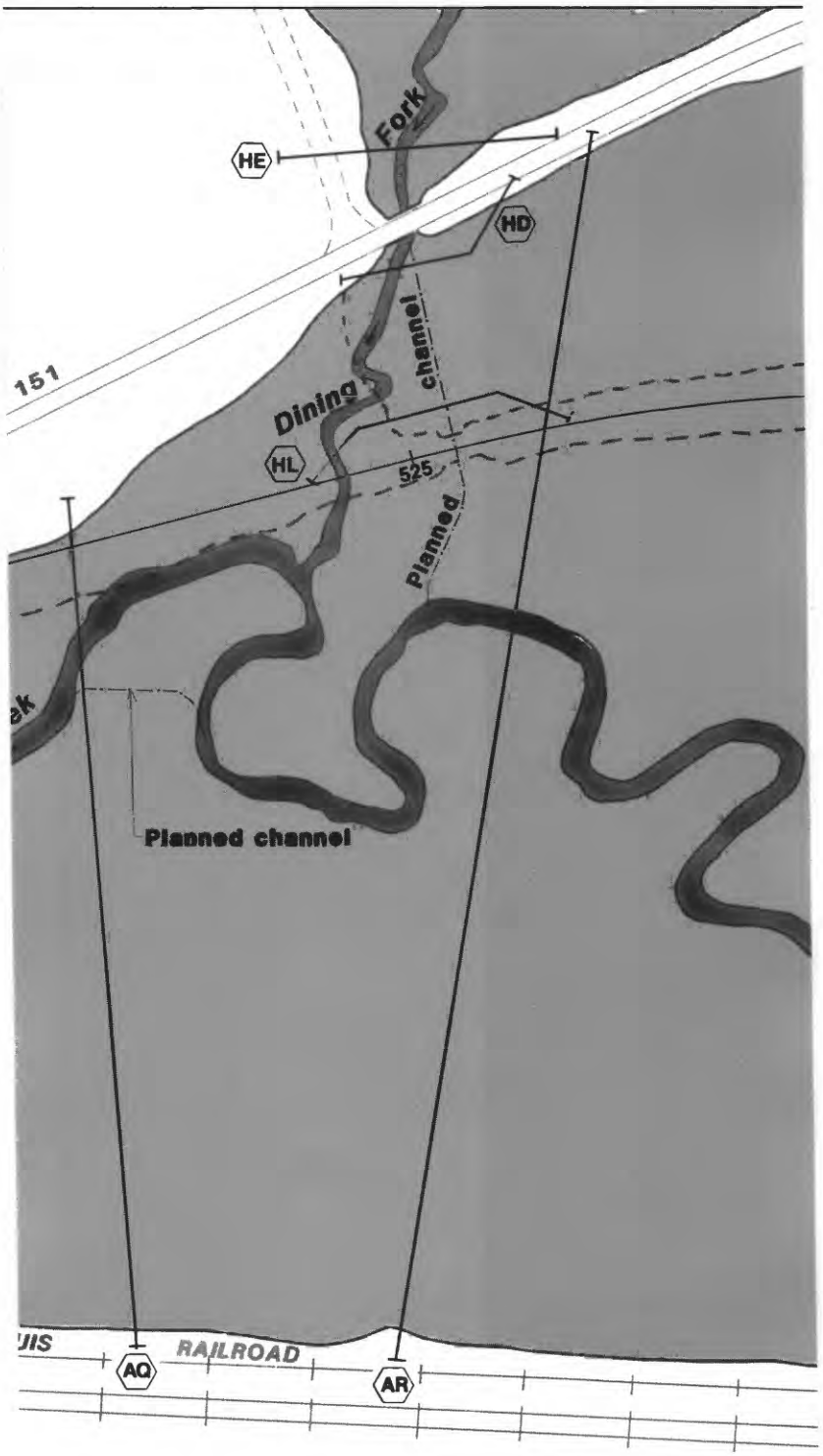


Figure 9E2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

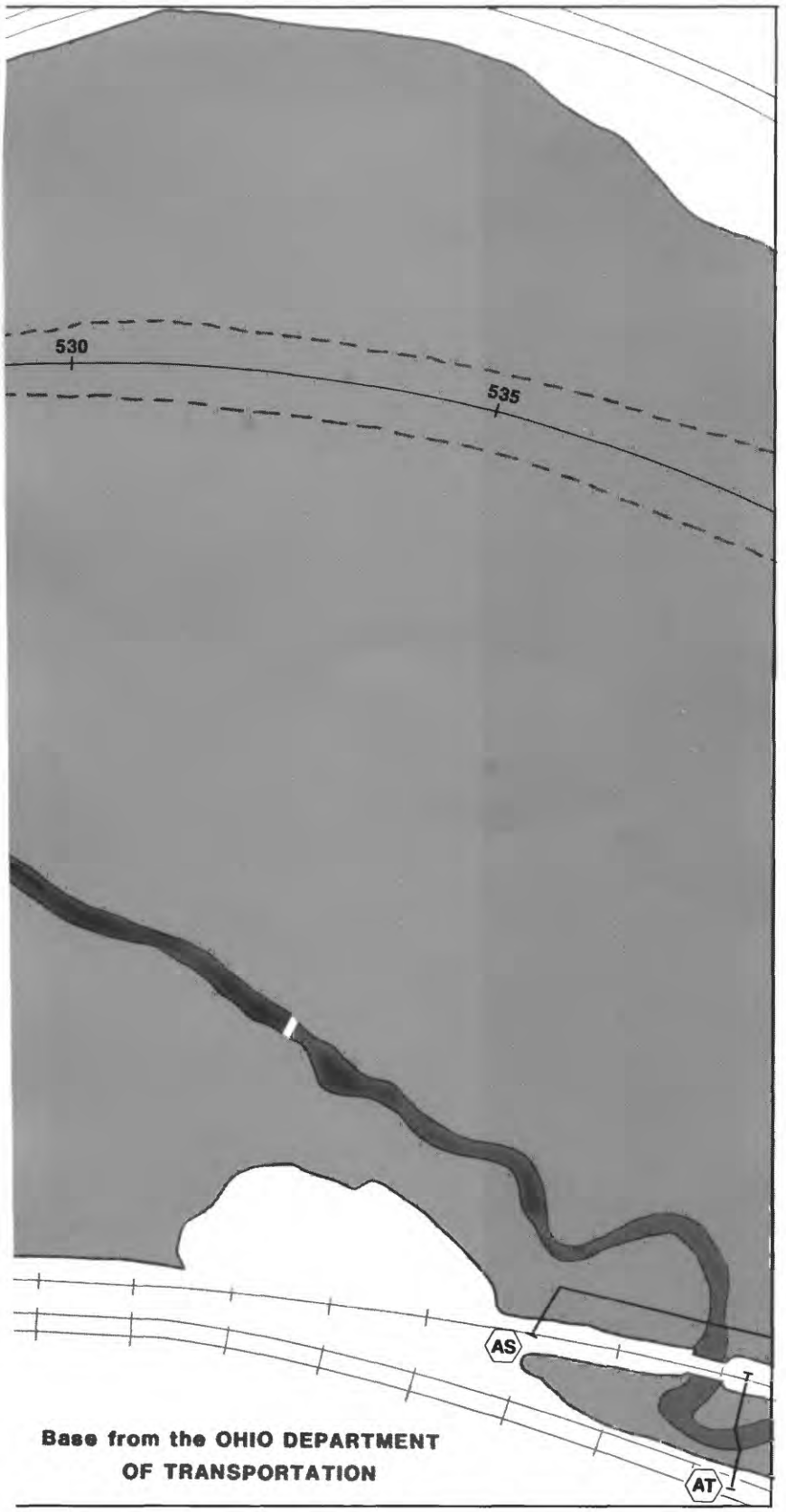


Figure 9E3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

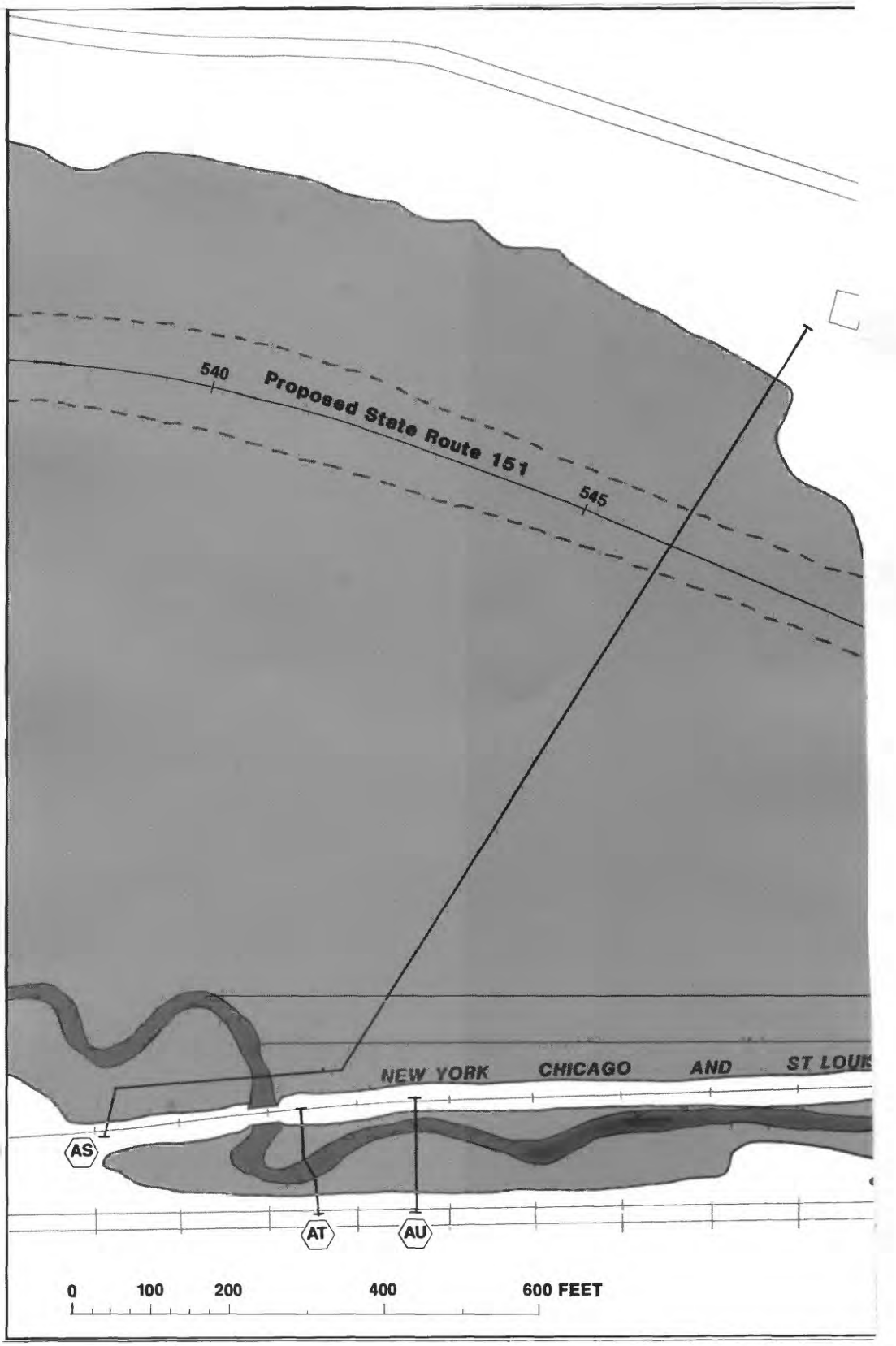


Figure 9F1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

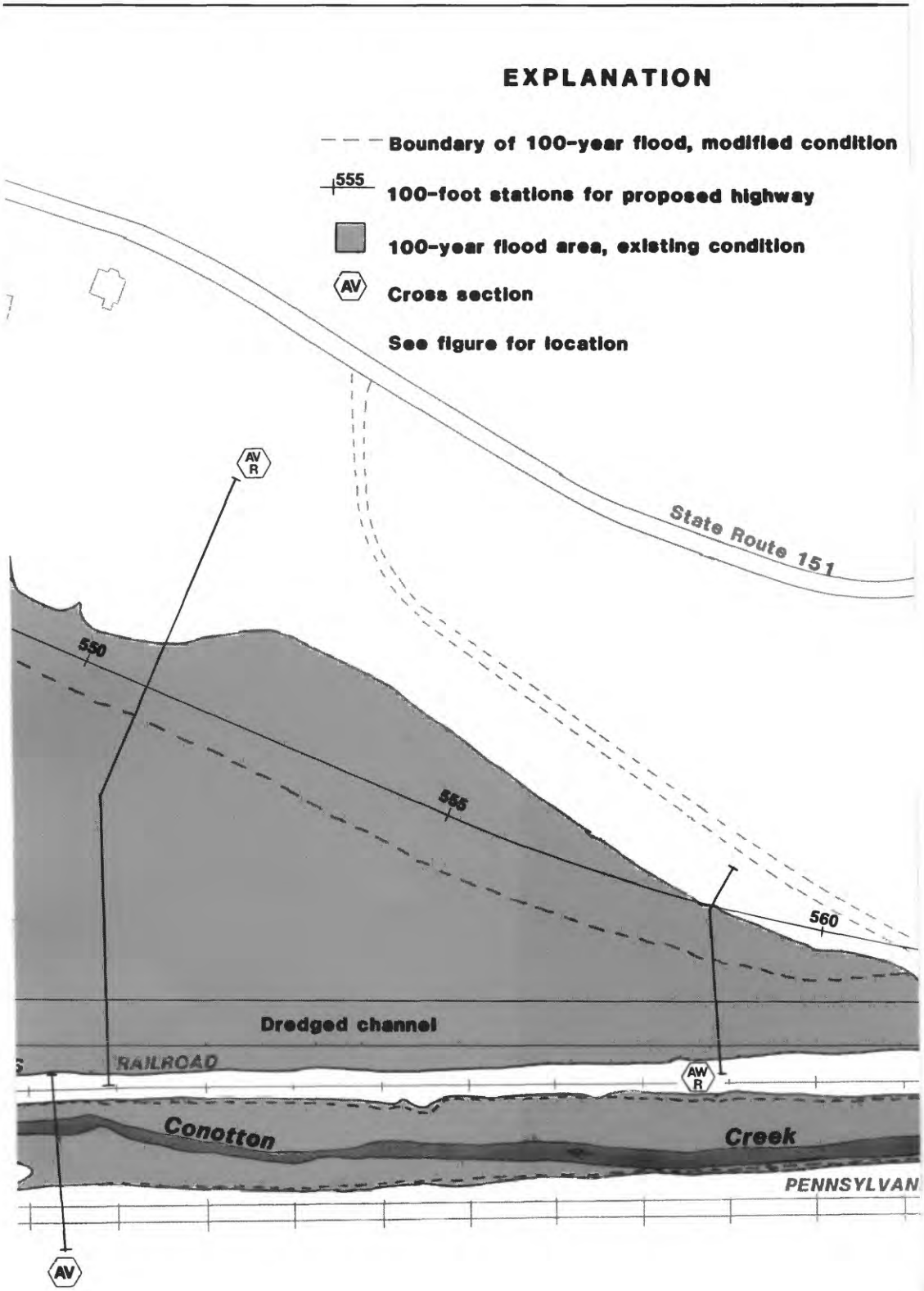


Figure 9F2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

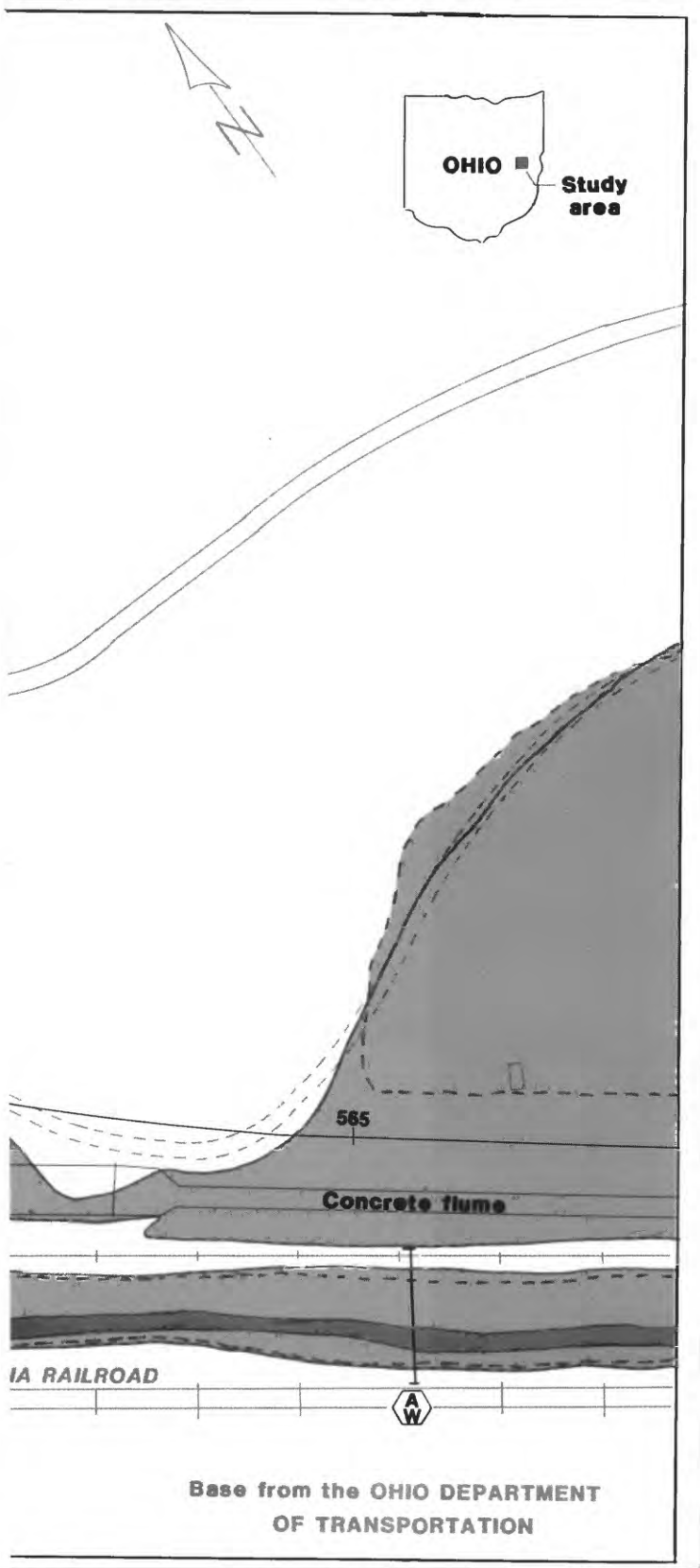


Figure 9F3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

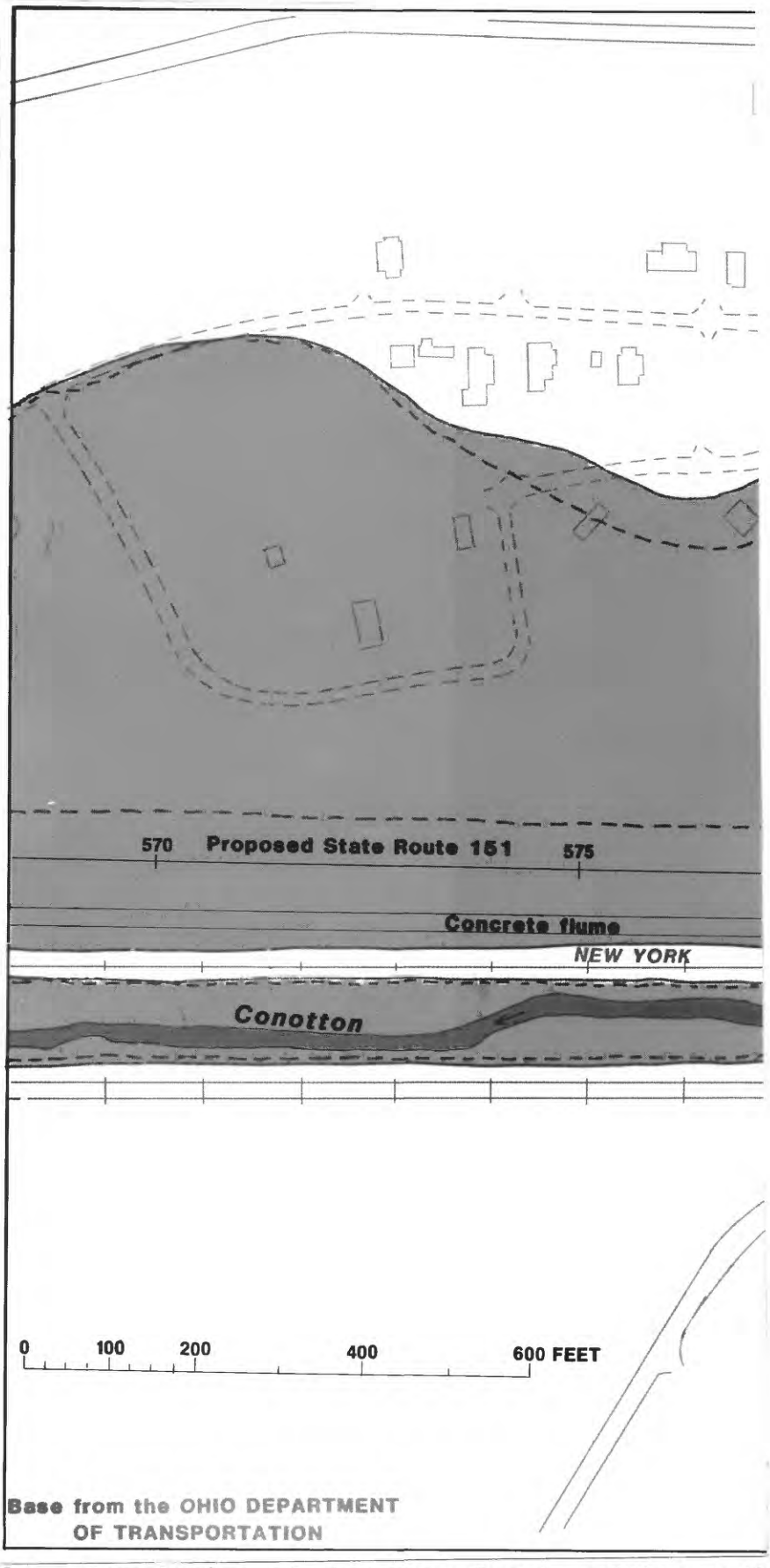


Figure 9G1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

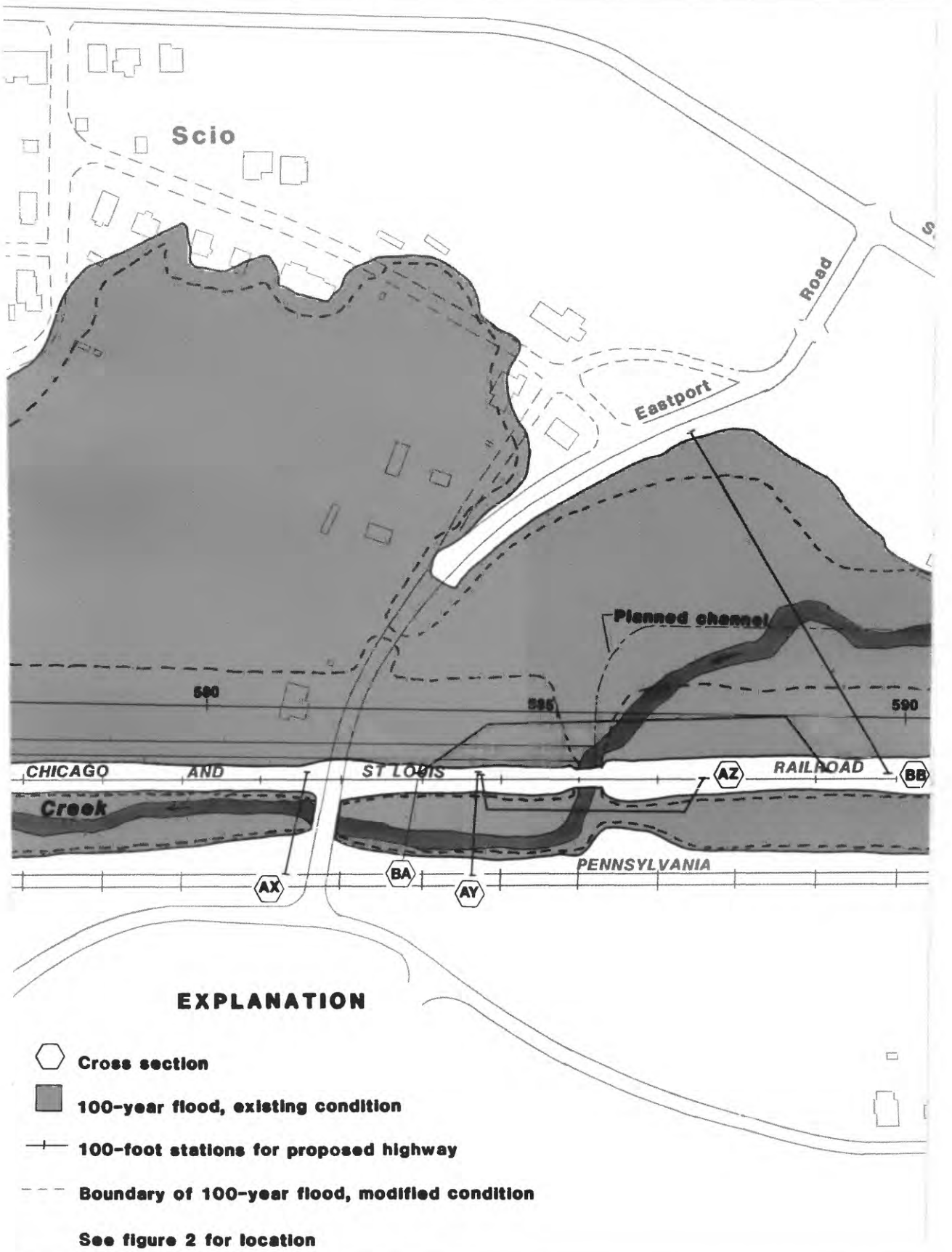


Figure 9G2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

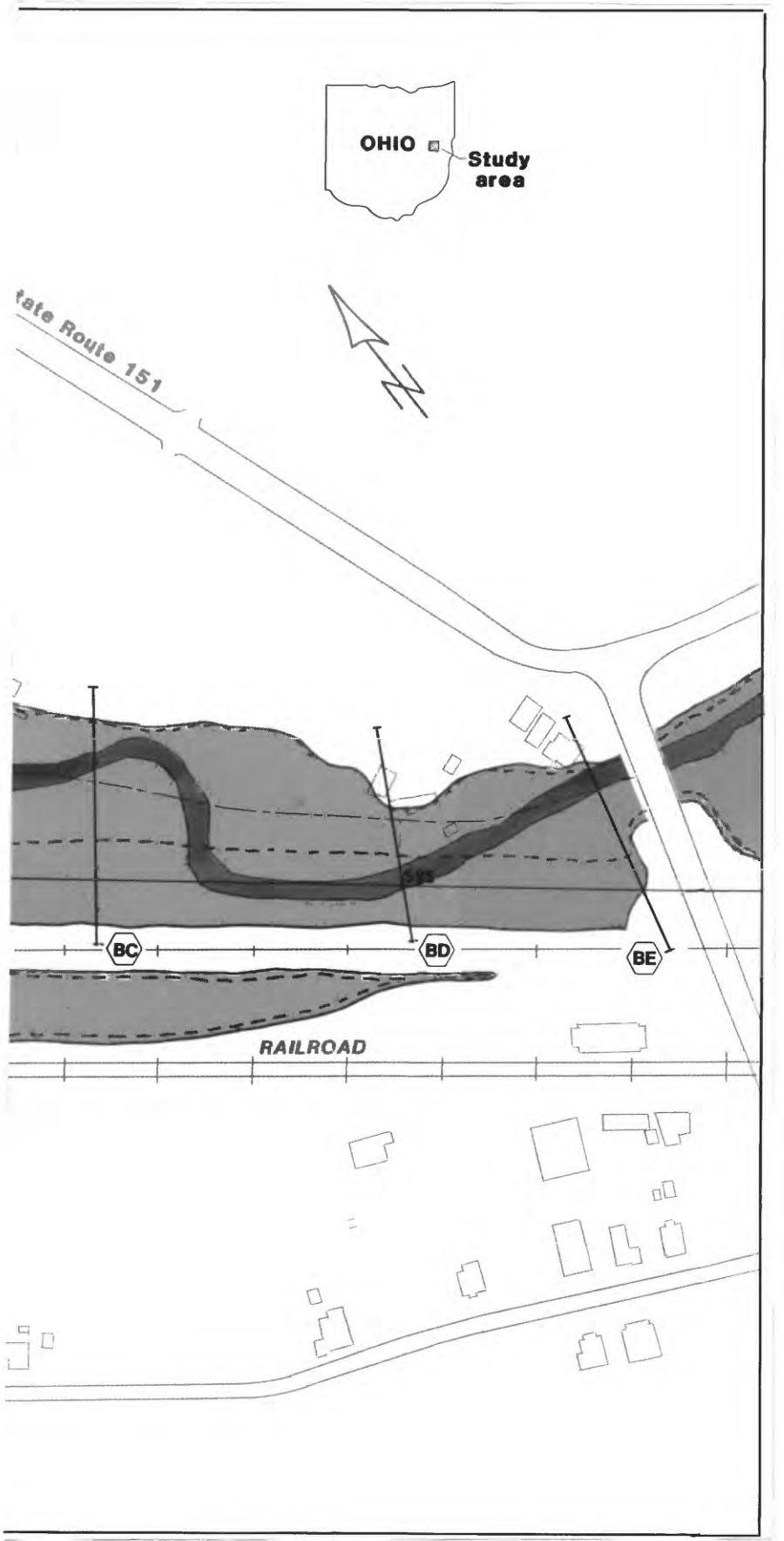


Figure 9G3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

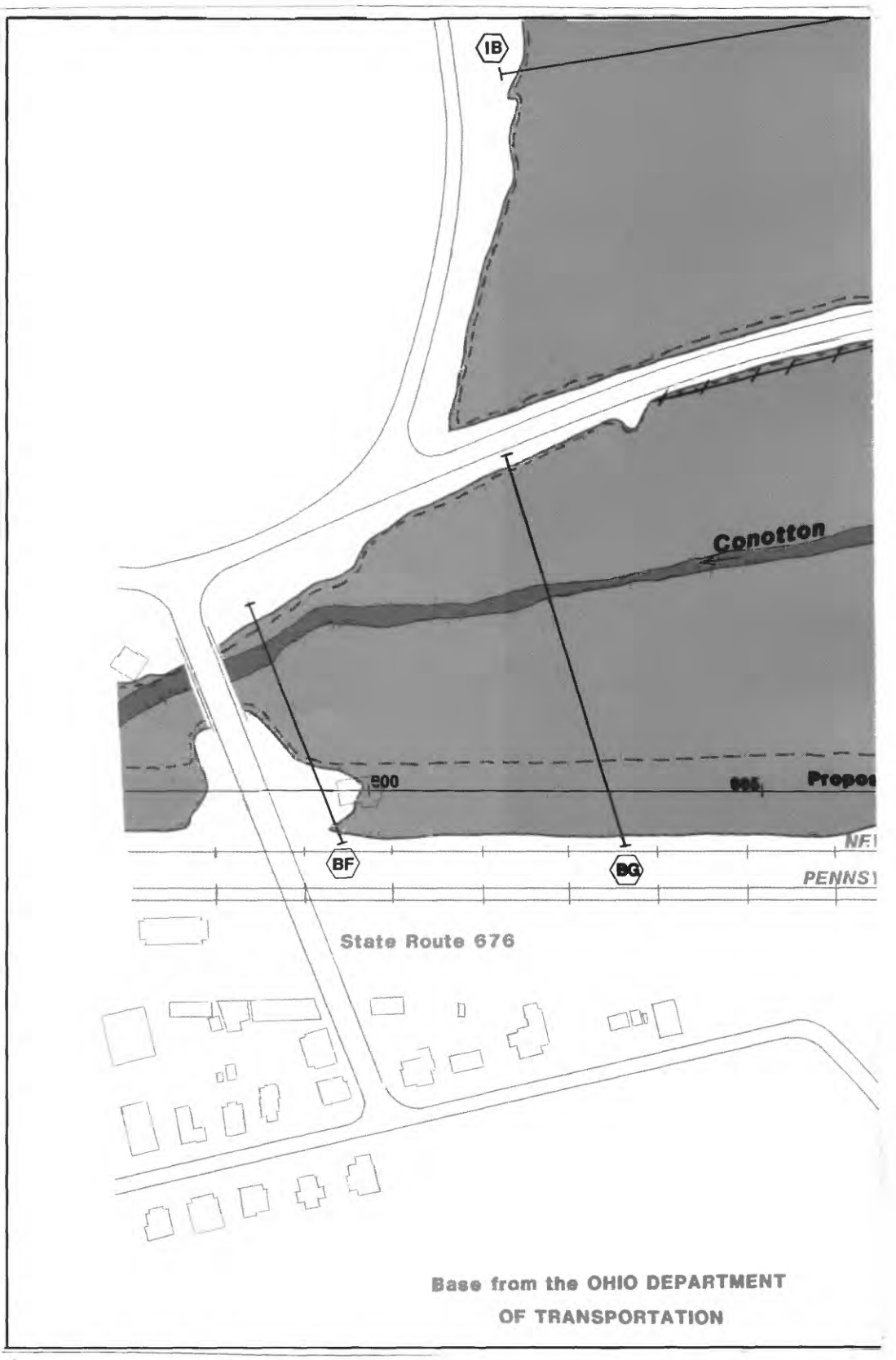


Figure 9H1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

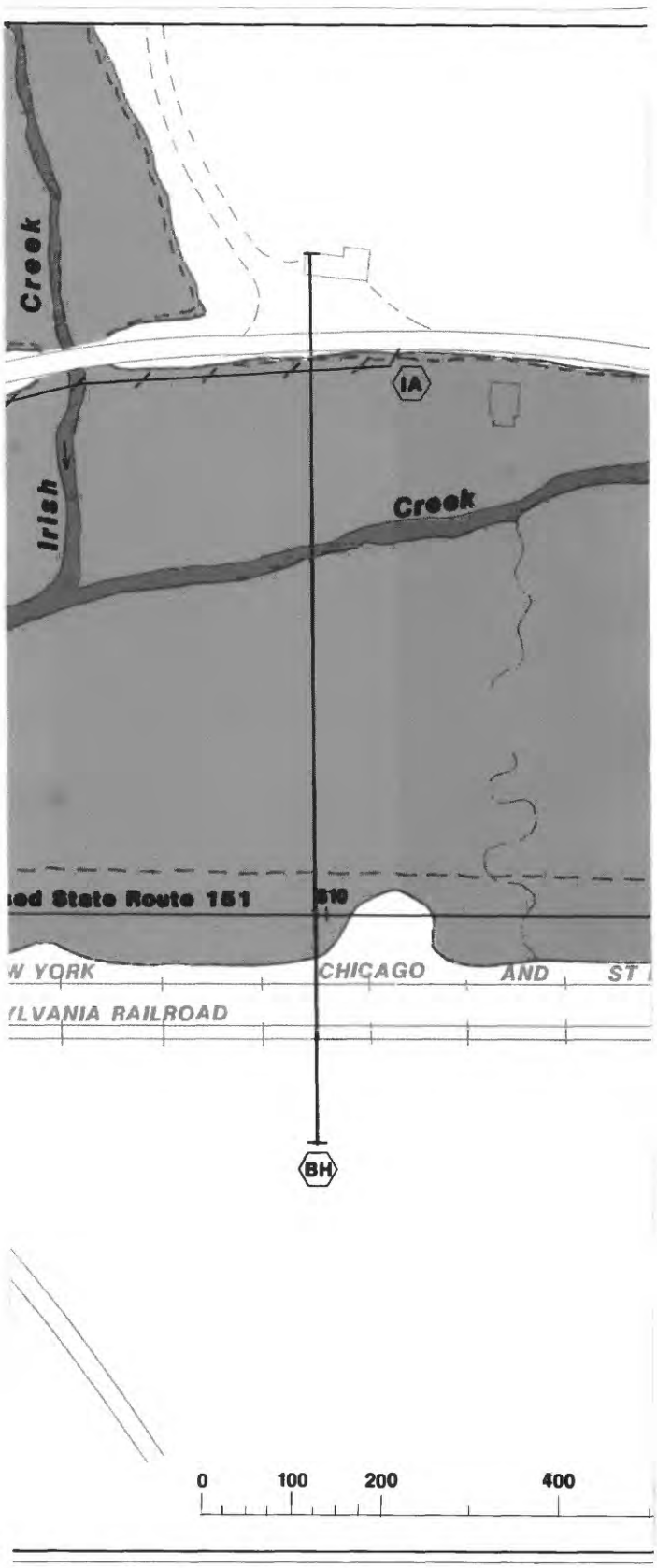


Figure 9H2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

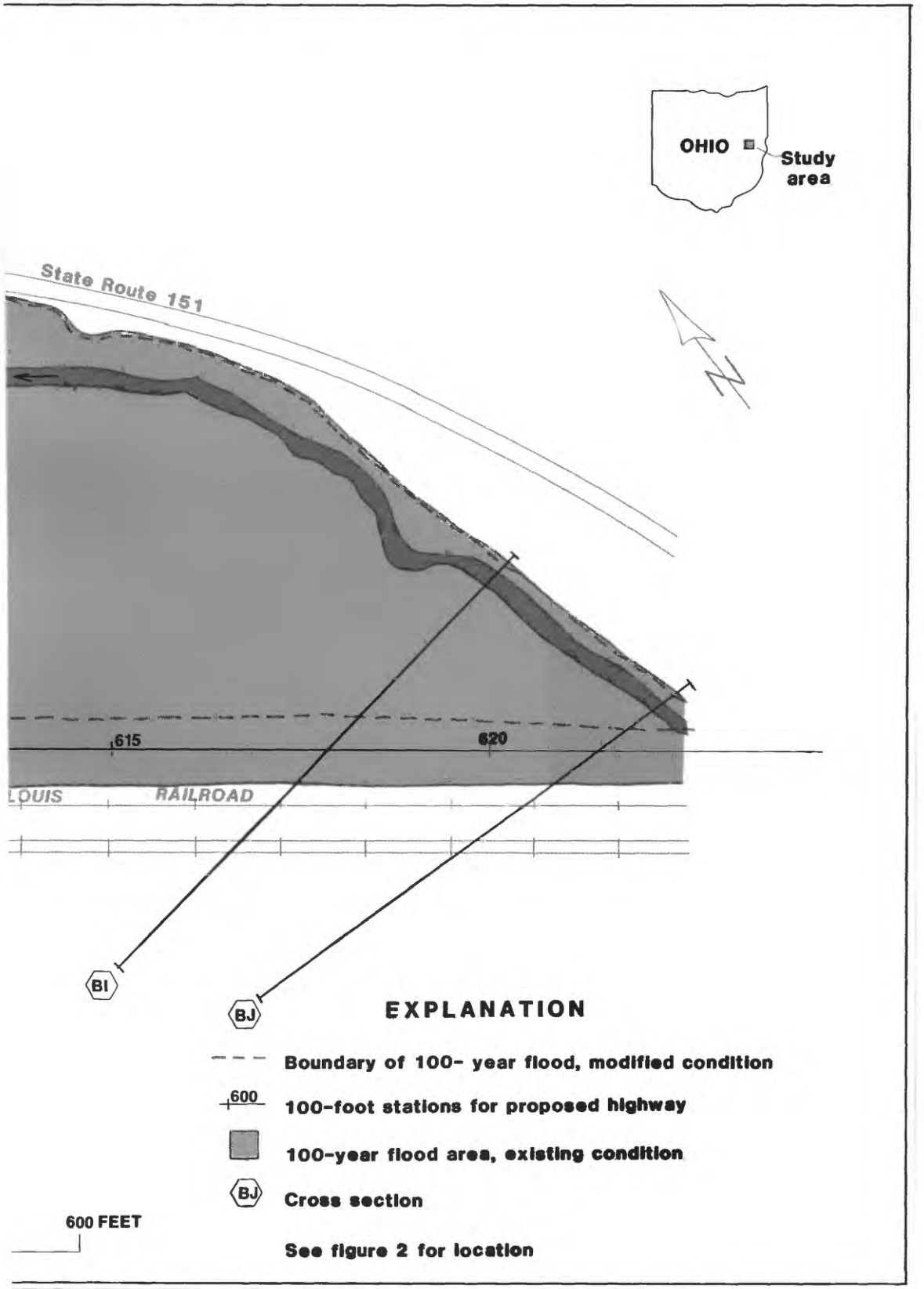


Figure 9H3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

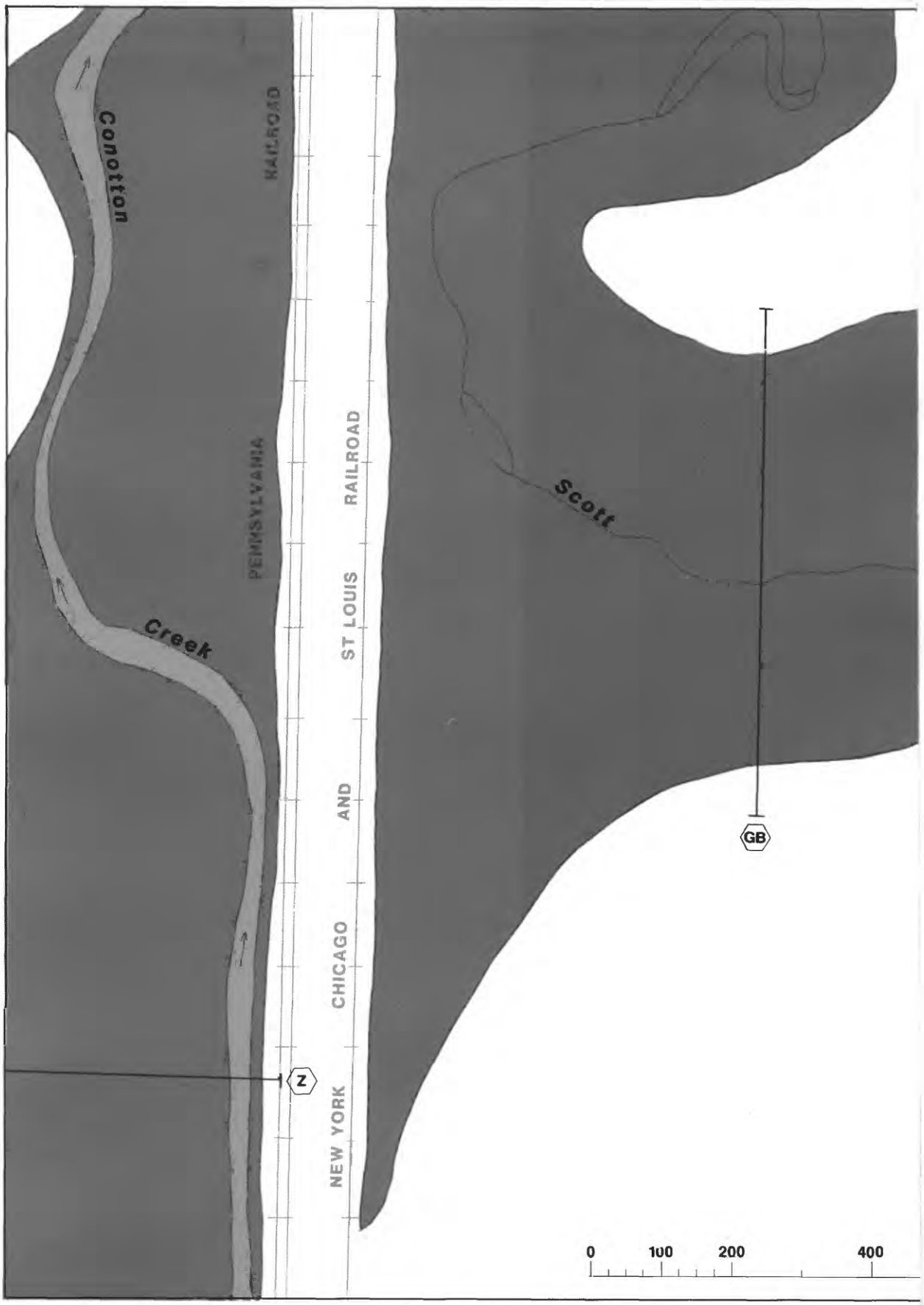


Figure 9I1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

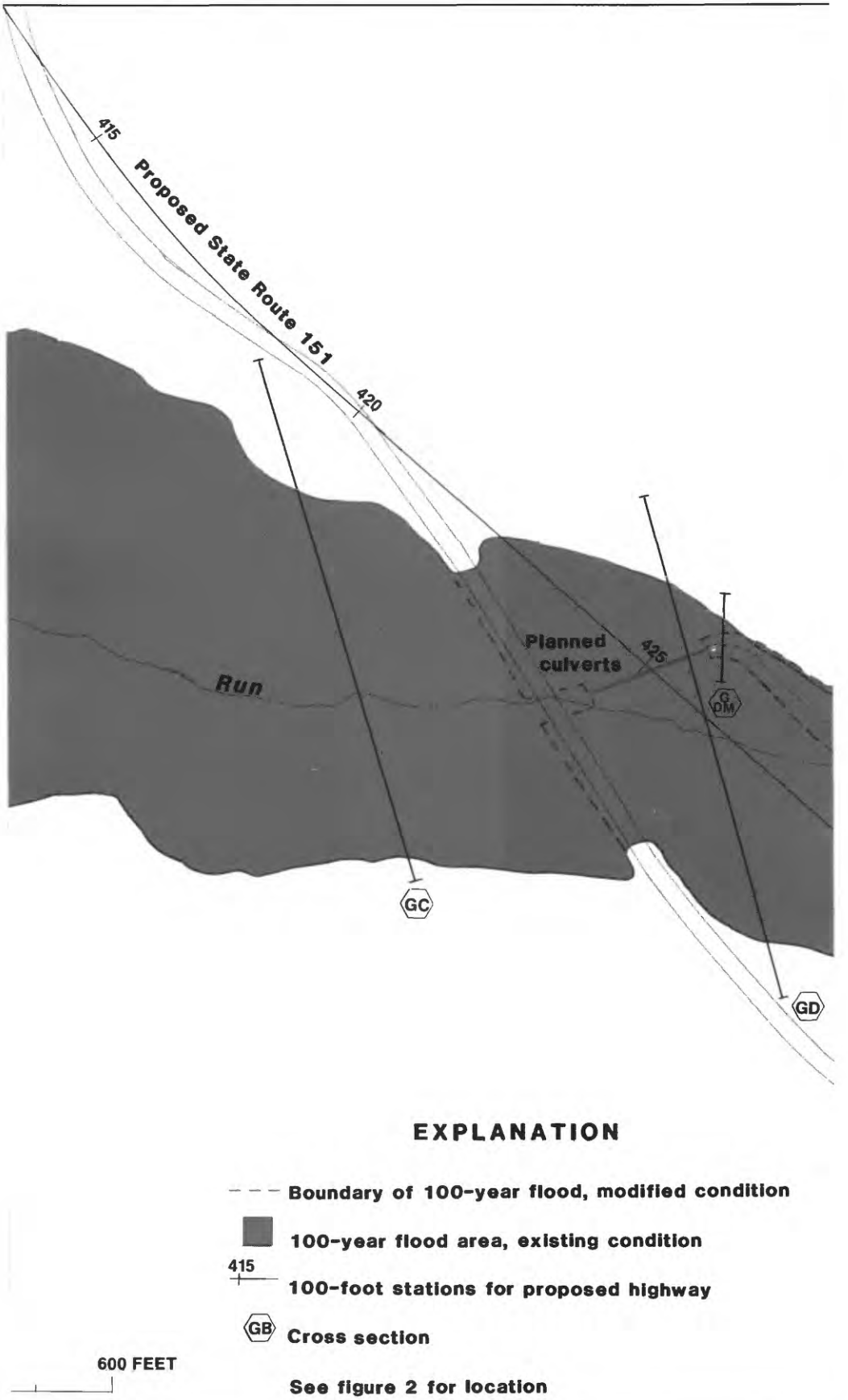


Figure 9I2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

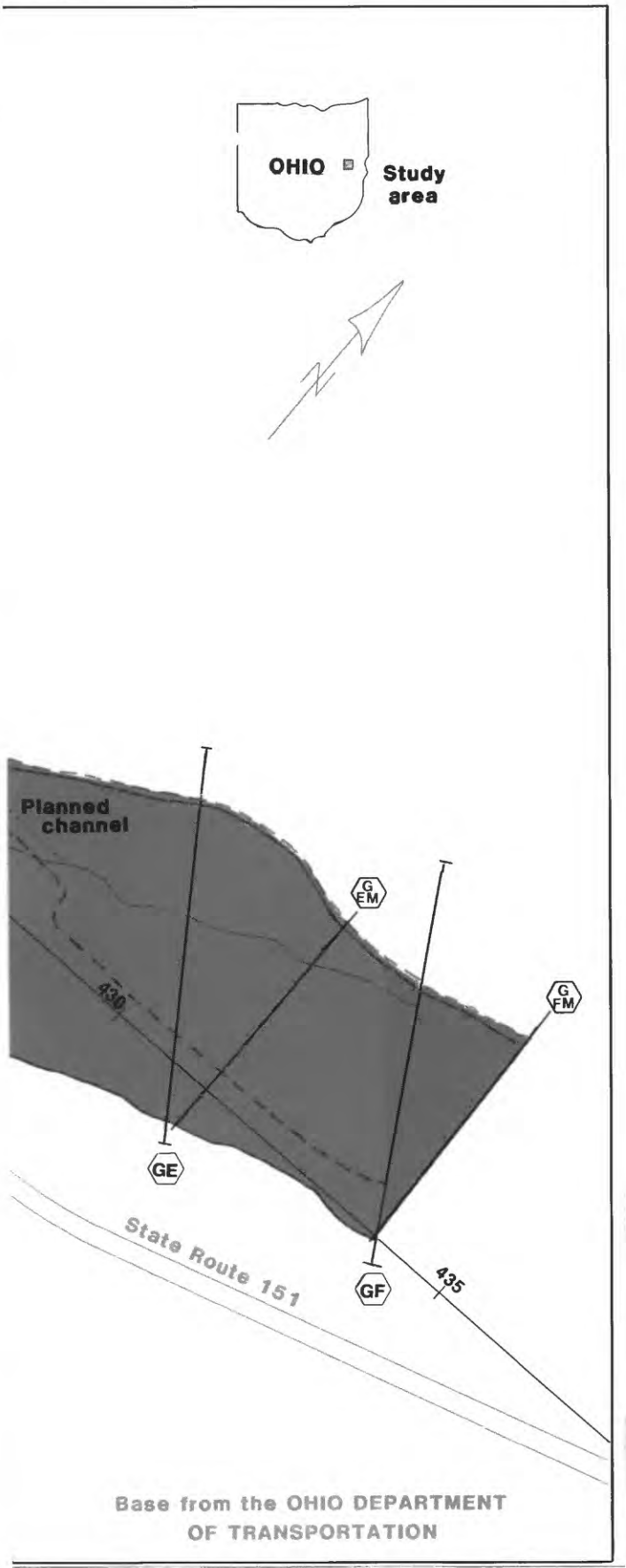


Figure 9I3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

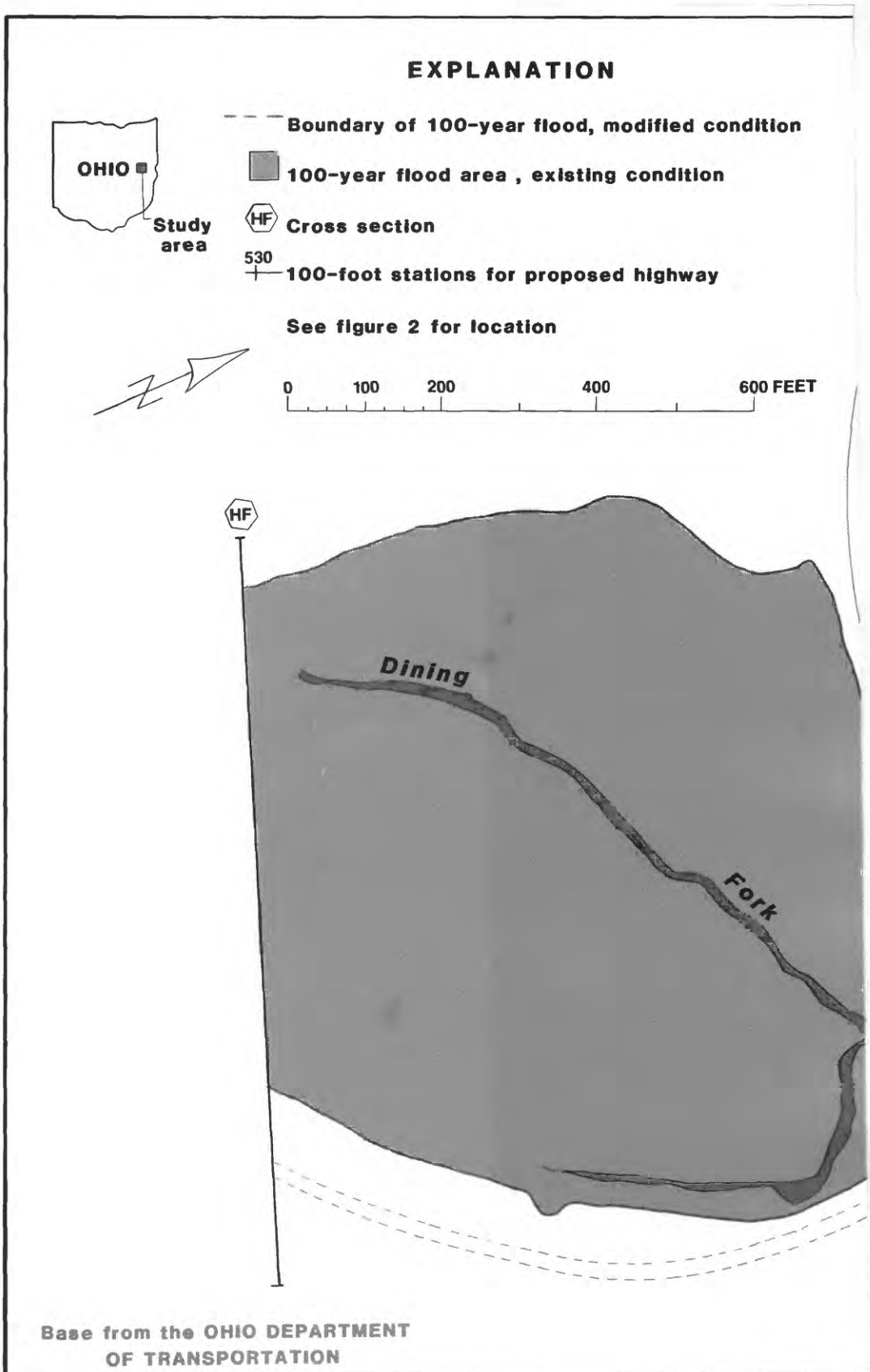


Figure 9J1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

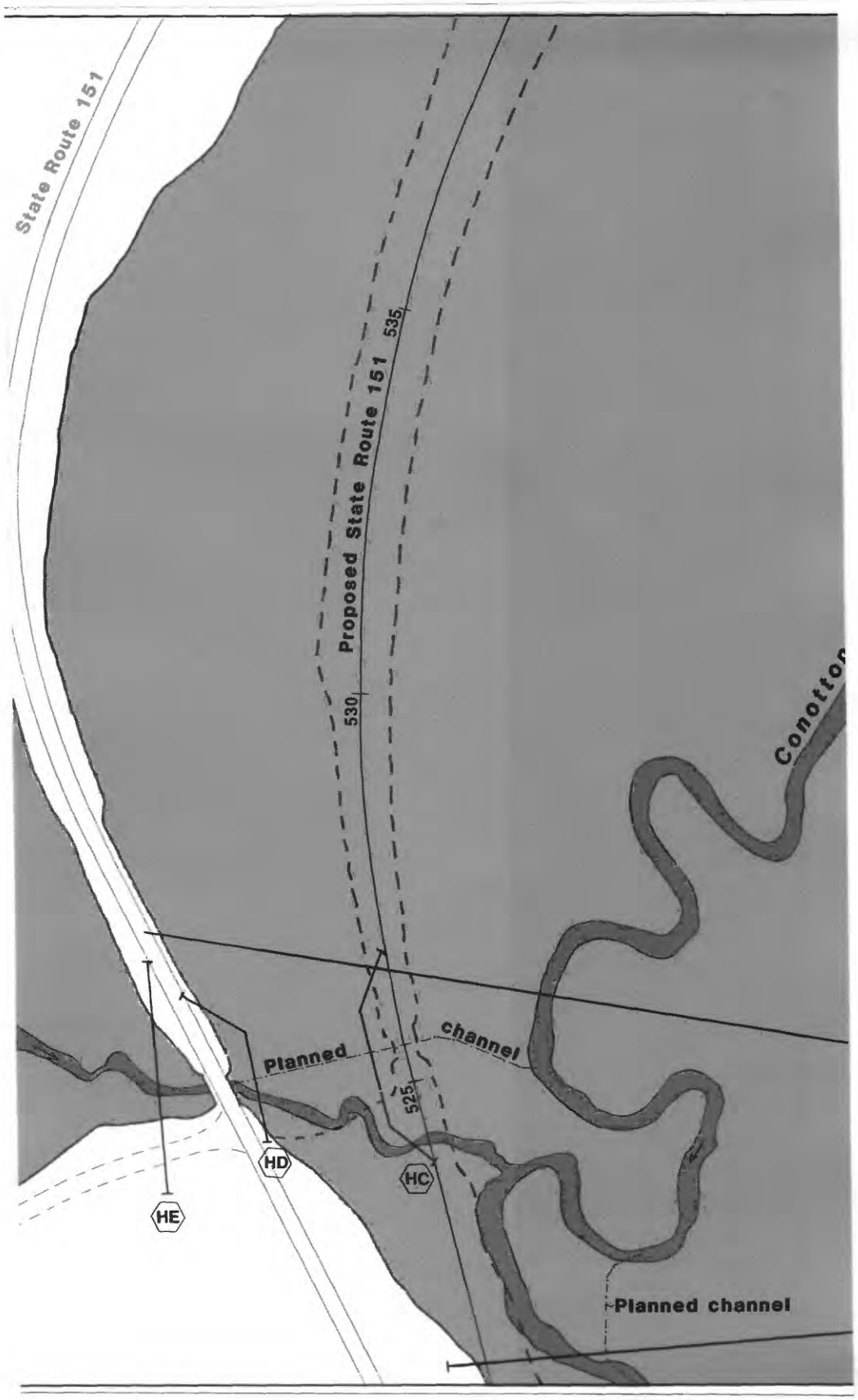


Figure 9J2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

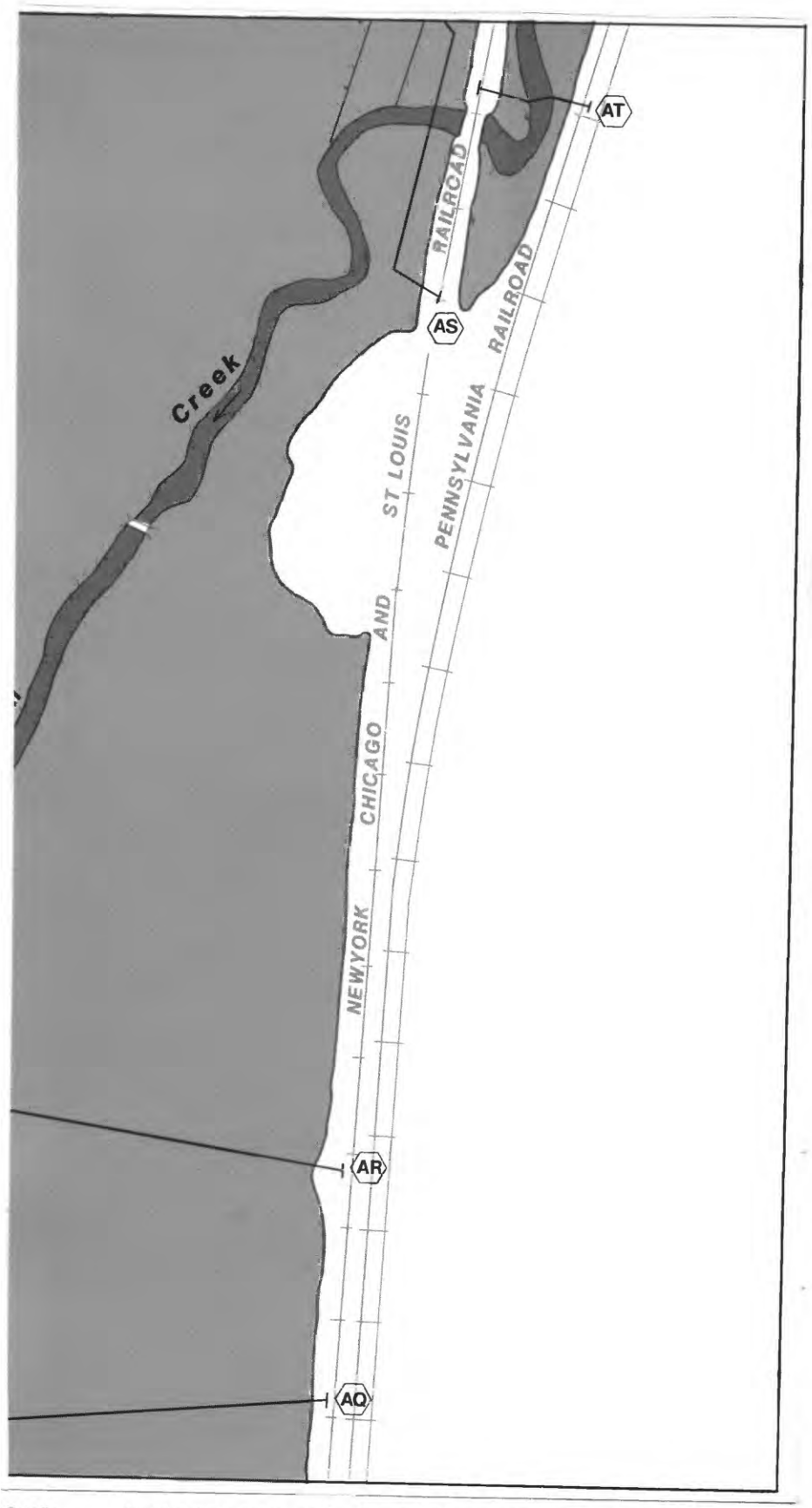


Figure 9J3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

BLANK

(No mapped features of any significance)

Figure 9K1 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

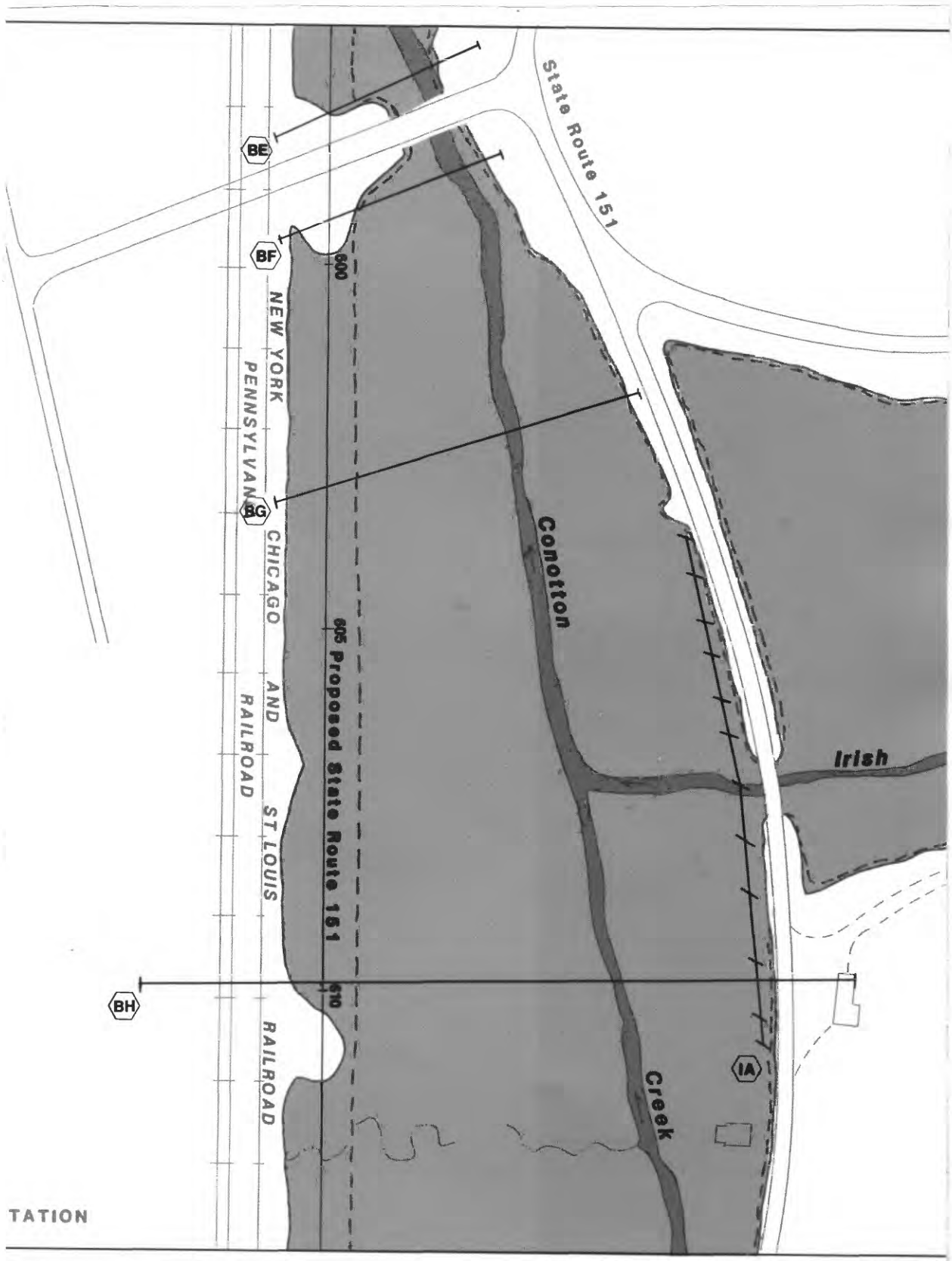


Figure 9K2 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.

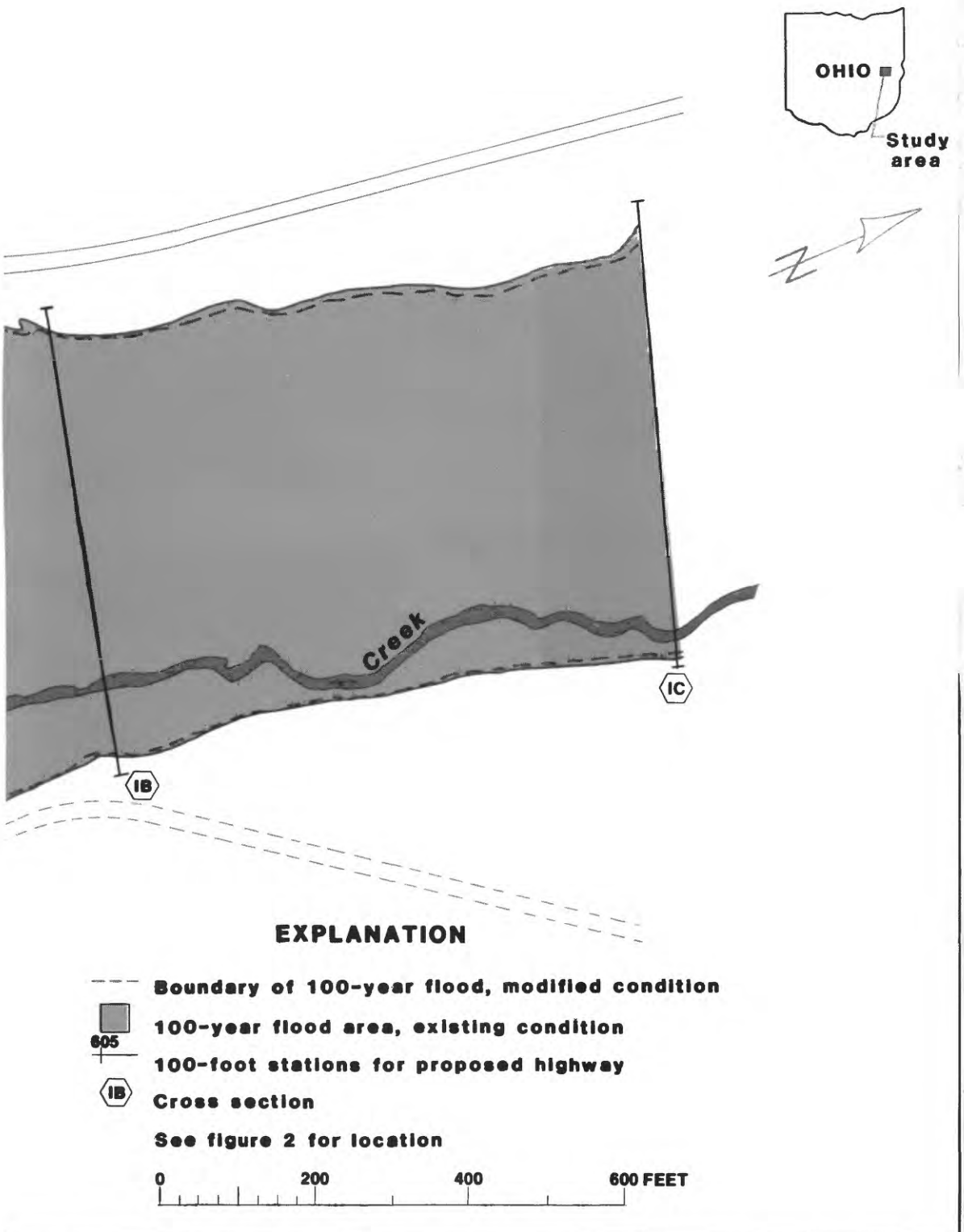


Figure 9K3 -- Inundation of Conotton Creek and its tributaries by 100-year flood under existing and modified conditions.