UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

# FLOODFLOW CHARACTERISTICS AT PROPOSED BRIDGE SITE ON FISHKILL CREEK, FISHKILL, NEW YORK

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Open-File Report 76-595

Prepared in cooperation with the

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## CONVERSION FACTORS AND ABBREVIATIONS

The following factors may be used to convert English units to the International System of Units (SI):

| Multiply English Units | By | To obtain SI Units |
|---|---|---|
| | Length | |
| feet (ft) | 0.3048 | metres (m) |
| miles (m) | 1.609 | kilometres (km) |
| | Area | |
| square miles ($mi^2$) | 2.590 | square kilometres ($km^2$) |
| | Flow | |
| cubic feet per second ($ft^3/s$) | .02832 | cubic metres per second ($m^3/s$) |
| feet per second (ft/s) | .3048 | metres per second (m/s) |

# FLOODFLOW CHARACTERISTICS AT PROPOSED BRIDGE SITE ON FISHKILL CREEK, FISHKILL, NEW YORK

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## ABSTRACT

An evaluation of floodflow characteristics of Fishkill Creek at the proposed site was made for the 50- and 100-year floods. The flood-frequency analysis revealed that the magnitudes of the 50- and 100-year floods are 8,000 cubic feet per second (227 cubic metres per second) and 10,000 cubic feet per second (283 cubic metres per second), respectively.

The normal water-surface elevation at the approach cross section was determined by the slope-conveyance method to be 209.8 feet (63.95 metres) during a 50-year flood and 210.8 feet (64.25 metres) during a 100-year flood.

During a 50-year flood, the existing bridge and alternative bridge designs 1 and 2 would cause the water level at the approach cross section to increase by 0.2, 0.4, and 0.0 feet (0.06, 0.12, and 0.00 metres), respectively.

During a 100-year flood, the existing bridge and alternative bridge designs 1 and 2 would cause the water level at the approach cross-section to increase by 0.4, 0.8, and 0.2 feet (0.12, 0.24, and 0.06 metres), respectively.

## INTRODUCTION

The New York State Department of Transportation (NYSDOT) proposes to widen and relocate U.S. Highway 9 between the village of Fishkill and Interstate Highway 84 south of the village. The plans call for relocation of Fishkill Creek near the existing bridge and construction of a bridge over the new channel. As part of a cooperative program of water-resources investigations, the U.S. Geological Survey evaluated the floodflow characteristics of the creek for one design plan. The alignment and length of the channel relocation scheme were subsequently revised after several public hearings, and the Survey conducted a second analysis of the effect of two alternative bridge designs on the profiles of the 50- and 100-year floods.

This report provides information on magnitudes and frequency of floods at the proposed bridge site and an analysis of the effect of the existing bridge and of the two alternative bridge designs on the profiles of floods having recurrence intervals of 50 and 100 years.

## Data Available

Hydrologic information in this report is based primarily on data collected by the U.S. Geological Survey at the gaging station on Fishkill Creek at Beacon, N.Y. Additional information, including a bridge plan drawing and channel and valley cross-sectional data, were provided by NYSDOT.

All elevations are referred to mean sea level, datum of 1929.

## Site Description

The general location of the existing bridge, the proposed channel relocation, and the new bridge site is shown in figure 1. The main channel upstream from the site is trapezoidal, with a top width of about 200 ft (61 m). The left (south) and right banks are approximately 15 and 11 ft (4.6 and 3.4 m) above low-water surface, respectively. The left flood plain is covered with fairly dense brush. The top of the right bank is lined with trees and brush and the flood plain, which consists of open fields, rises at a slight grade away from the channel for about 200 ft (61 m), where it forms a ridge that roughly parallels the main channel. The elevation of the top of this ridge ranges from 209 to 210 ft (63.7 to 64.0 m). Floodwaters that exceed the ridge of the right-bank flood plain are routed through a culvert under U.S. Highway 9, 450 ft (140 m) north of the existing bridge, and then back to the main channel. The existing bridge is skewed to the channel at an angle of 22 degrees. The reach is fairly straight through the bridge.

The proposed relocated channel starts just downstream of the existing bridge and continues straight for 750 ft (229 m) to a juncture with the existing channel, shortening the existing channel by about 550 ft (168 m). The proposed bridge is about 120 ft (37 m) downstream from the existing structure and is skewed to the proposed channel at an angle of 25 degrees. Length of the proposed bridge is 140 ft (43 m).

The drainage area of Fishkill Creek at the site is 158 $mi^2$ (409 $km^2$).

## MAGNITUDE AND FREQUENCY OF FLOODS

The Geological Survey has maintained a gaging station on Fishkill Creek at Beacon, N.Y., 4.15 mi (6.68 km) downstream from the study area. Records of flood stages and discharges were collected here in 1902 and from 1945 to 1968. The drainage area of the creek at the gaging station is 190 $mi^2$ (492 $km^2$).

The largest flood of record at the Beacon gaging station occurred on August 20, 1955 and had a discharge of 8,800 $ft^3/s$ (249 $m^3/s$)[1/]. On October 16 of the same year, the second largest flood was recorded and had a discharge of 8,200 $ft^3/s$ (232 $m^3/s$).

### Flood Frequency

A log-Pearson type-III analysis was made of the annual peak discharges obtained from the gaging station at Beacon. An adjustment in the resulting discharge values was made for the smaller drainage area at the proposed site. A curve representing the magnitude and recurrence interval of floods at the Fishkill site is shown in figure 2. The frequency relationship at selected recurrence intervals is presented in table 1.

The design floods used for this study--the 50- and 100-year floods--have discharges of 8,000 $ft^3/s$ (227 $m^3/s$) and 10,000 $ft^3/s$ (283 $m^3/s$), respectively.

Table 1.--Flood-frequency relationship at the proposed bridge site at Fishkill, N.Y.

| Recurrence interval (years) | Discharge $ft^3/s$ |
|---|---|
| 2 | 1,900 |
| 5 | 3,200 |
| 10 | 4,300 |
| 25 | 6,200 |
| 50 | 8,000 |
| 100 | 10,000 |

1/ The flood of March 1, 1902, was recorded as having a discharge of 13,700 $ft^3/s$ (388 $m^3/s$). The U.S. Geological Survey (1960) notes, however, that records collected in 1901-1903 are of doubtful accuracy. The authors have omitted the 1902 peak from the flood-frequency analysis.

## ANALYSIS OF HYDRAULIC CONDITIONS

For the 50- and 100-year floods, hydraulic analyses were made for the existing bridge and the alternative bridge designs. The approach cross section that was furnished for analysis of the existing bridge was also used in the analyses of the two alternative bridge designs. Normal water-surface elevations of 209.8 ft (63.95 m) and 210.8 ft (64.25 m) at the approach cross section were computed for the 50- and 100-year floods, respectively, by the slope-conveyance method. Normal water-surface elevation refers to the water level in a channel unaffected by bridges, dams, encroachments, etc.

Both alternative bridge designs have a 5-ft (1.5-m) pier at mid-channel. Design 2 is modified by the addition of a 40-ft (12-m) bench from the right side of design 1 (figure 3). The two design structures are geometrically identical dual-highway bridges and were treated as such in the computation of backwater levels (Federal Highway Administration, 1970). Results of the analyses are presented in table 2 for the 50-year flood and in table 3 for the 100-year flood.

## SELECTED REFERENCES


Federal Highway Administration, 1970, Hydraulics of bridge waterways: Federal Highway Adm. Hydraulic Design Ser. 1, 111 p.

Tice, R. H., 1968, Magnitude and frequency of floods in the United States, Part 1-B, North Atlantic slope basins, New York to York River: U.S. Geol. Survey Water-Supply Paper 1672, 585 p.

U.S. Geological Survey, 1960, Compilation of records of surface waters of the United States through September 1950--North Atlantic slope basins, New York to York River: U.S. Geol. Survey Water-Supply Paper 1302, 679 p.

_____ 1964, Compilation of records of surface water of the United States, October 1950 to September 1960--Part 1-B, North Atlantic slope basins, New York to York River: U.S. Geol. Survey Water-Supply Paper 1722, 518 p.

_____, Water resources data for New York, Part 1, Surface water records: U.S. Geol. Survey open-file rept., 1961-68 issues (issued annually).

Table 2.--Hydraulic characteristics during 50-year flood at existing and proposed bridges over Fishkill Creek at Fishkill, N.Y.

| | Water-surface elevation (ft) | | Increase in normal water level at approach section (ft) | Wetted bridge area* ($ft^2$) | Average stream velocity through bridge* (ft/s) |
|---|---|---|---|---|---|
| | Approach section | Bridge* | | | |
| Existing bridge | 210.0 | 208.7 | 0.2 | 966 | 8.23 |
| Proposed bridge | | | | | |
| Design 1 | 210.2 | 208.6 | .4 | 962 | 8.26 |
| Design 2 | 209.8 | 208.8 | .0 | 1,150 | 6.91 |

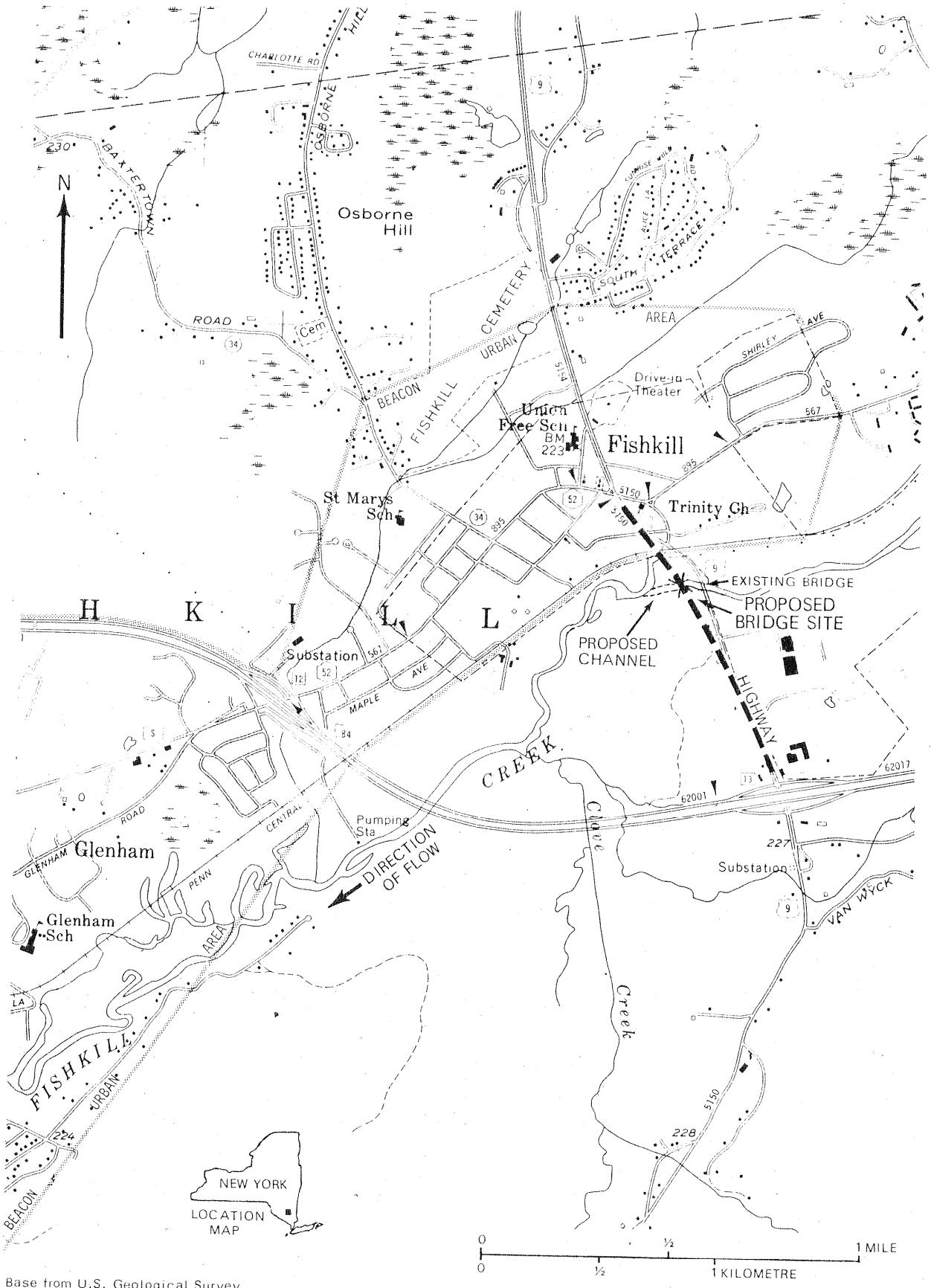
*Downstream side



Table 3.--Hydraulic characteristics during 100-year flood at existing and proposed bridges over Fishkill Creek at Fishkill, N.Y.

| | Water-surface elevation (ft) | | Increase in normal water level at approach section (ft) | Wetted bridge area* ($ft^2$) | Average stream velocity through bridge* (ft/s) |
|---|---|---|---|---|---|
| | Approach section | Bridge* | | | |
| Existing bridge | 211.2 | 209.5 | 0.4 | 1,080 | 9.26 |
| Proposed bridge | | | | | |
| Design 1 | 211.6 | 209.3 | .8 | 1,050 | 9.52 |
| Design 2 | 211.0 | 209.6 | .2 | 1,280 | 7.81 |

*Downstream side




Base from U.S. Geological Survey
Wappingers Falls, 1956
Planimetric base revision by N.Y.S.
Department of Transportation, 1973

Figure 1.--Fishkill Creek, existing bridge, proposed bridge site, and proposed relocated channel, Fishkill, N.Y.

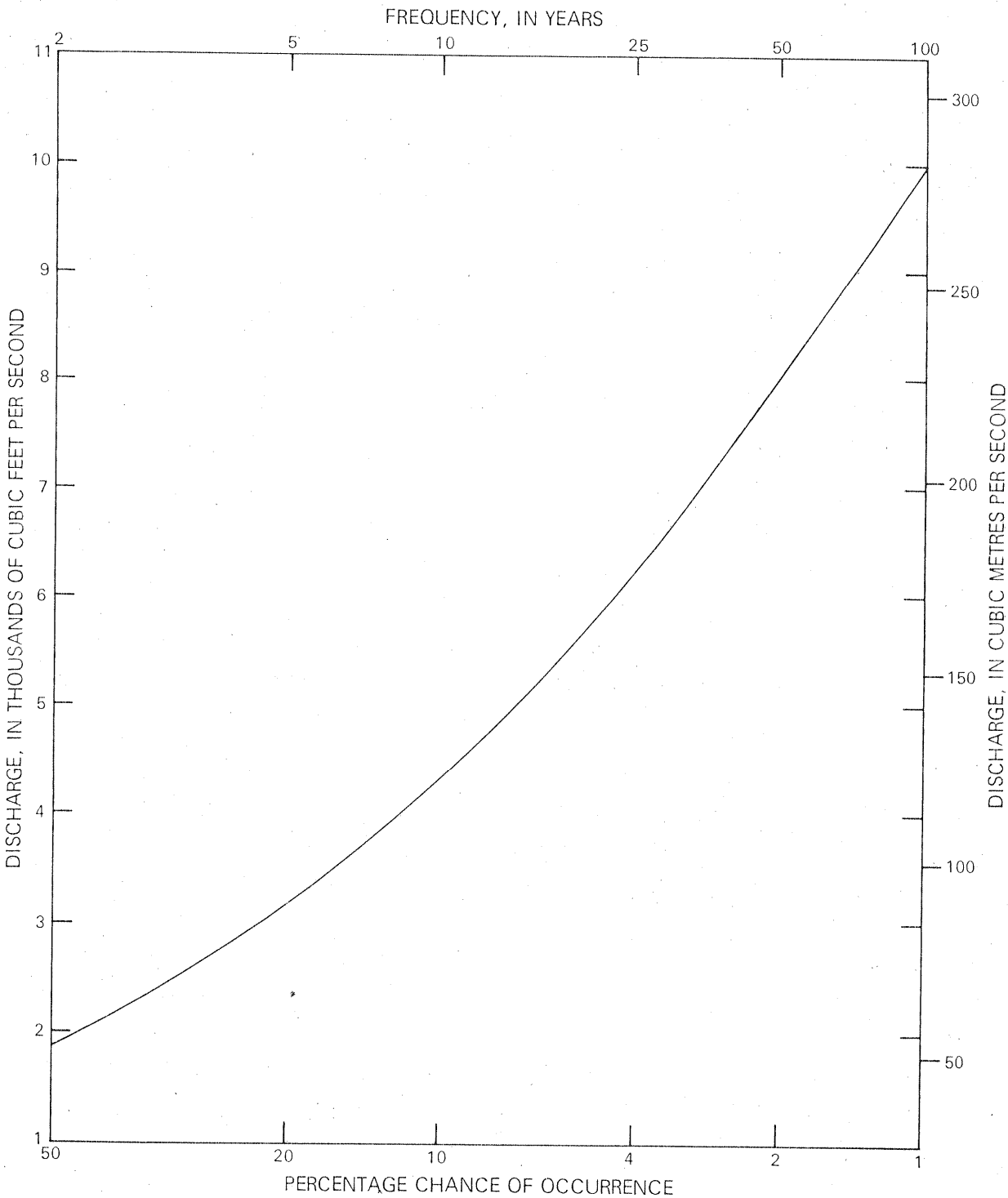



Figure 2.--Flood-frequency curve, Fishkill Creek at Fishkill, N.Y.

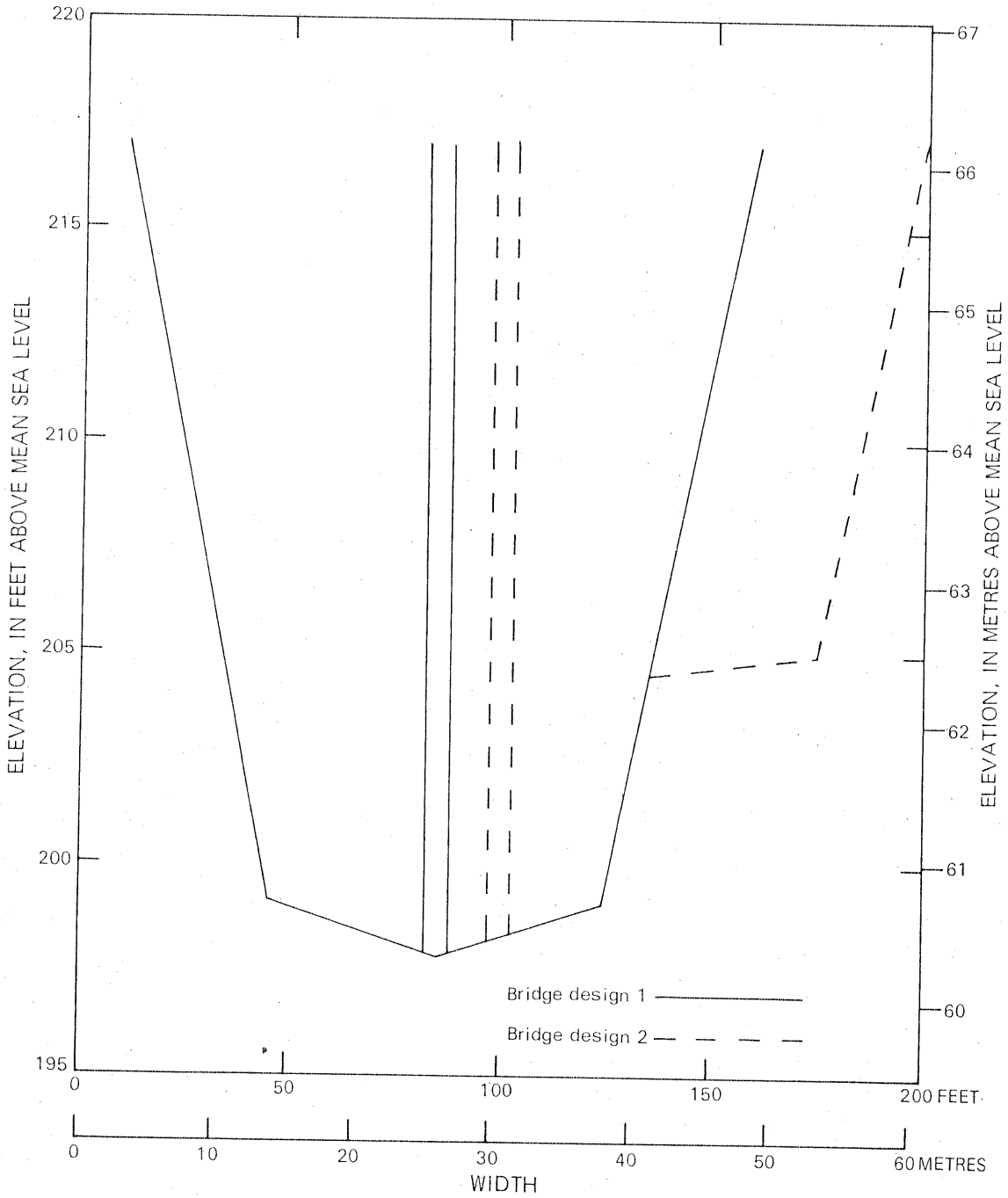



Figure 3.--Cross sections of the two alternative bridge designs.