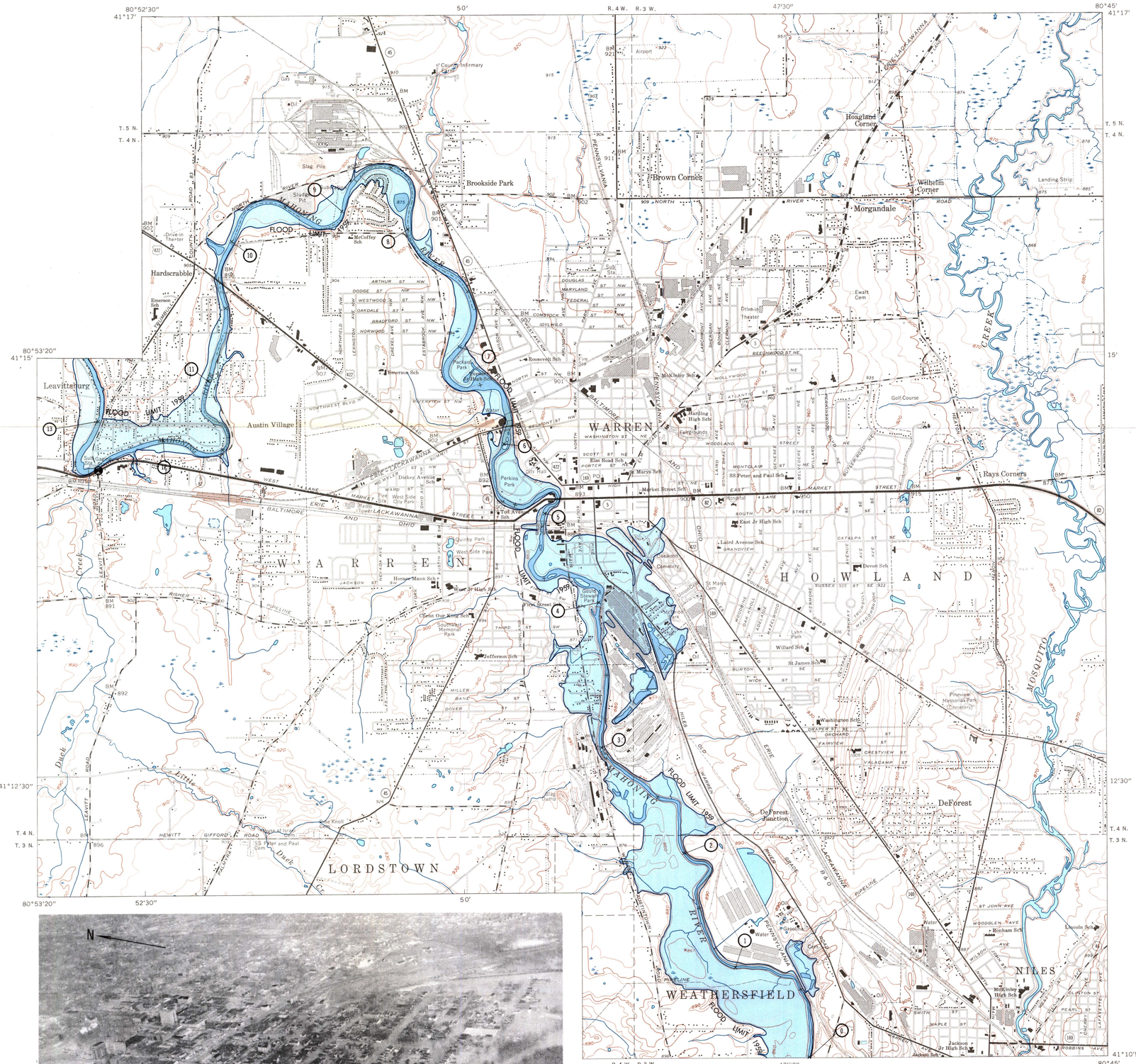
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
THOMAS B. NOLAN, DIRECTOR

PREPARED IN COOPERATION WITH
THE STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
H. B. EAGON, DIRECTOR

HYDROLOGIC INVESTIGATIONS
ATLAS HA-51



Photograph by Warren Tribune

AERIAL VIEW OF FLOODED WARREN, OHIO, JANUARY 23, 1959

EXPLANATION

FLOOD LIMIT 1959

(11) River miles measured upstream from West Park Street in Niles, Ohio

4° MAGNETIC NORTH — TRUE NORTH

APPROXIMATE MEAN DECLINATION, 1963

OHIO

AREA OF THIS REPORT

SCALE 1:24000

1 MILE

1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

MAHONING RIVER FLOOD HEIGHTS

Flood heights recorded at U.S. Geological Survey gaging station on Mahoning River at Leavittsburg, Ohio (Leavitt Road bridge). Overflow limits of 1913 and 1937 floods not shown.

Date of flood	Gage height (feet)	Elevation above mean sea level (feet)
March 26, 1913	*24	*895
January 25 or 26, 1937	17.8	889.0
January 22, 1959	19.4	890.6

* Approximate

FLOODS ON MAHONING RIVER AT WARREN, OHIO, IN 1959

The approximate areas inundated in the vicinity of Warren, Ohio, by the Mahoning River during the flood of January 22, 1959, is shown on a topographic map base to record the flood hazard in graphical form. Greater floods are possible but no attempt has been made to show their probable overflow limits. The flood of January 1959, although reduced somewhat by storage in reservoirs upstream, was the highest on the Mahoning River since the flood of March 26, 1913. The 1913 flood was the greatest after 1800. Protective works built after the flood of January 1959 may reduce the frequency of flooding in the area but will not necessarily eliminate future flooding. New highways and other cultural changes may influence the inundation pattern of future floods.

Flood height.—The height of a flood at a gaging station is usually stated in terms of the gage height or stage, which is the elevation of the water surface above a selected datum plane. Gage heights or stages at the gaging station on Mahoning River at Leavittsburg, Ohio, located at the Leavitt Road bridge near the northwest city limits of Warren, may be converted to elevations above mean sea level by adding 871.2 feet. Elevations shown are in feet above mean sea level.

Gage height and year of occurrence of each annual flood (greatest flood each year) which exceeded elevation 885 feet at the gaging station on Mahoning River at Leavittsburg, Ohio, are shown in figure 1. The irregular occurrence of floods is evident. The annual flood exceeded elevation 885 feet 11 times in 30 years of record (fig. 1). Although floods above elevation 885 feet occurred on the average of about 4 times per decade, 1 was experienced in some decades, whereas 5 occurred during the period 1950–59.

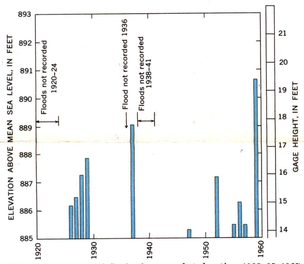


FIGURE 1.—*Annual floods above 885-foot elevation, 1925–35, 1937, 1942–59, on Mahoning River at Leavittsburg, Ohio.*

Flood Frequency.—Frequency of flooding without the effects of storage in reservoirs upstream, at the Geological Survey gaging station on Mahoning River at Leavittsburg, has been derived from a regional flood-frequency relation for all streams in Ohio except those in the Maumee River basin. Large errors may result if the flood frequency curve is extrapolated beyond the limits shown.

Regulation.—Flow of the Mahoning River is subject to regulation by Milton Reservoir (since 1916) and by Berlin reservoir (since 1942). The effect of storage in these reservoirs was substantial during the January 1959 flood.

Recurrence intervals.—As applied to flood events, recurrence interval is the number of years, on the average, within which a given flood height will be equaled or exceeded once. It is inversely related to the chance of a specific flood being equaled or exceeded in any one year. Thus a 20-year flood would have 1 chance in 20 of being equaled or exceeded in any one year, or a 25-year flood would have 1 chance in 25 of being equaled or exceeded in any one year.

The general relationship between recurrence interval and flood height on Mahoning River at Leavittsburg, at the gaging station at Leavitt Road (fig. 2), is tabulated below.

Recurrence interval (years)	Elevation above mean sea level of Mahoning River at Leavittsburg, Ohio, at Leavitt Road (feet)
25	891.1
20	890.9
15	890.6
10	890.2
5	889.5
3	888.8

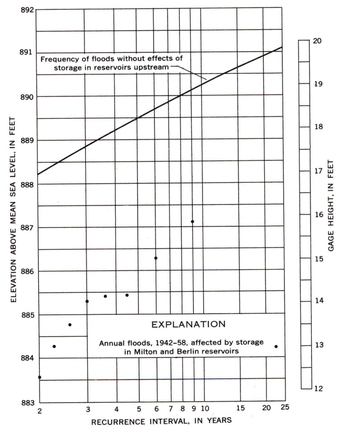


FIGURE 2.—*Frequency of floods above 883-foot elevation at Leavitt Road on Mahoning River at Leavittsburg, Ohio.*

The curve represents natural conditions of flow, uninfluenced by effect of storage in reservoirs upstream. Annual floods above elevation 883-feet, recorded during the period 1943–58, affected by storage in Milton and Berlin reservoirs, are also plotted on figure 2. The January 1959 flood is not shown because its recurrence interval exceeds the limit of figure 2.

It is emphasized that recurrence intervals are average figures—the average number of years that will elapse between occurrences of floods that equal or exceed a certain flood height. Thus a flood on the Mahoning River that is said to have a 20-year recurrence interval, may not be reached in any one 20-year period, or it may be reached more than once, because of the erratic nature of flood occurrence.

Flood profiles.—Profiles of the water surface along the Mahoning River for the floods of March 1913, January 1937, and January 1959, are shown in figure 3. Profiles of floods corresponding to other flood heights can be plotted on this diagram generally parallel to those shown. The abrupt changes in the profile, shown at some street locations and dams, indicate the difference in water-surface elevations at the upstream and downstream sides of the structures. Base lines for the profiles are located along the main channel. River miles measured above West Park Street in Niles, Ohio, used for the profiles in figure 3, are also marked along the Mahoning River on the flood inundation map.

Depth of flooding at any point can be estimated by subtracting the ground elevation (shown by contours on the map) from the water surface elevation indicated by the profile in figure 3.

Additional data.—Other information pertaining to floods at Warren, Ohio, may be obtained at the office of the U.S. Geological Survey, 1509 Hess Street, Columbus, Ohio, and from the following published reports:

Cross, W. P., and Brooks, H. P., Floods of January-February 1959 in Ohio: U.S. Geol. Survey Circ. 418, 54 p.

Cross, W. P., and Webber, E. E., Floods in Ohio, Magnitude and Frequency: Ohio Dept. Nat. Resources, Div. of Water Bull. 32, 325 p.

Cooperation and acknowledgment.—The preparation of this flood inundation map is part of an investigation program financed through a special cooperative agreement between the Ohio Department of Natural Resources, H. B. Eagon, Director, and the U.S. Geological Survey.

Profile data for floods of 1913 and 1937, and supplemental floodmark elevations for flood of 1959, were furnished by the City Engineer of Warren, Ohio.

Additional floodmark elevations for floods of 1913, 1937, and 1959 were provided by the Republic Steel Corporation.

The aerial photograph was furnished by the Warren Tribune. The flood inundation map was prepared by Frederick H. Ruggles, Jr., the flood frequency relation was developed by William P. Cross, and the explanatory text was written by George W. Edelen, Jr., Geological Survey.

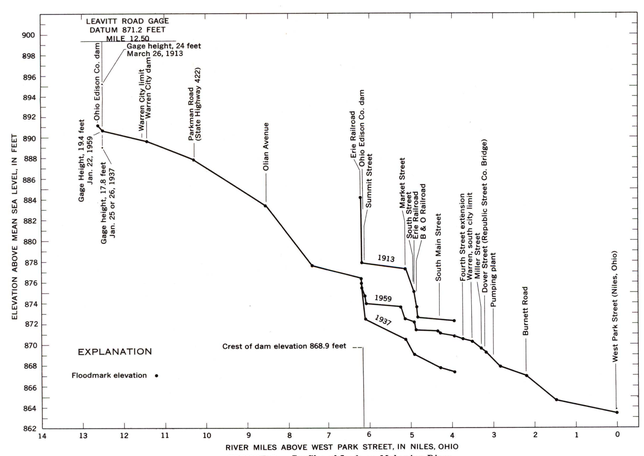


FIGURE 3.—*Profiles of floods on Mahoning River.*

FLOODS AT WARREN, OHIO

By

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1963

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—61446

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