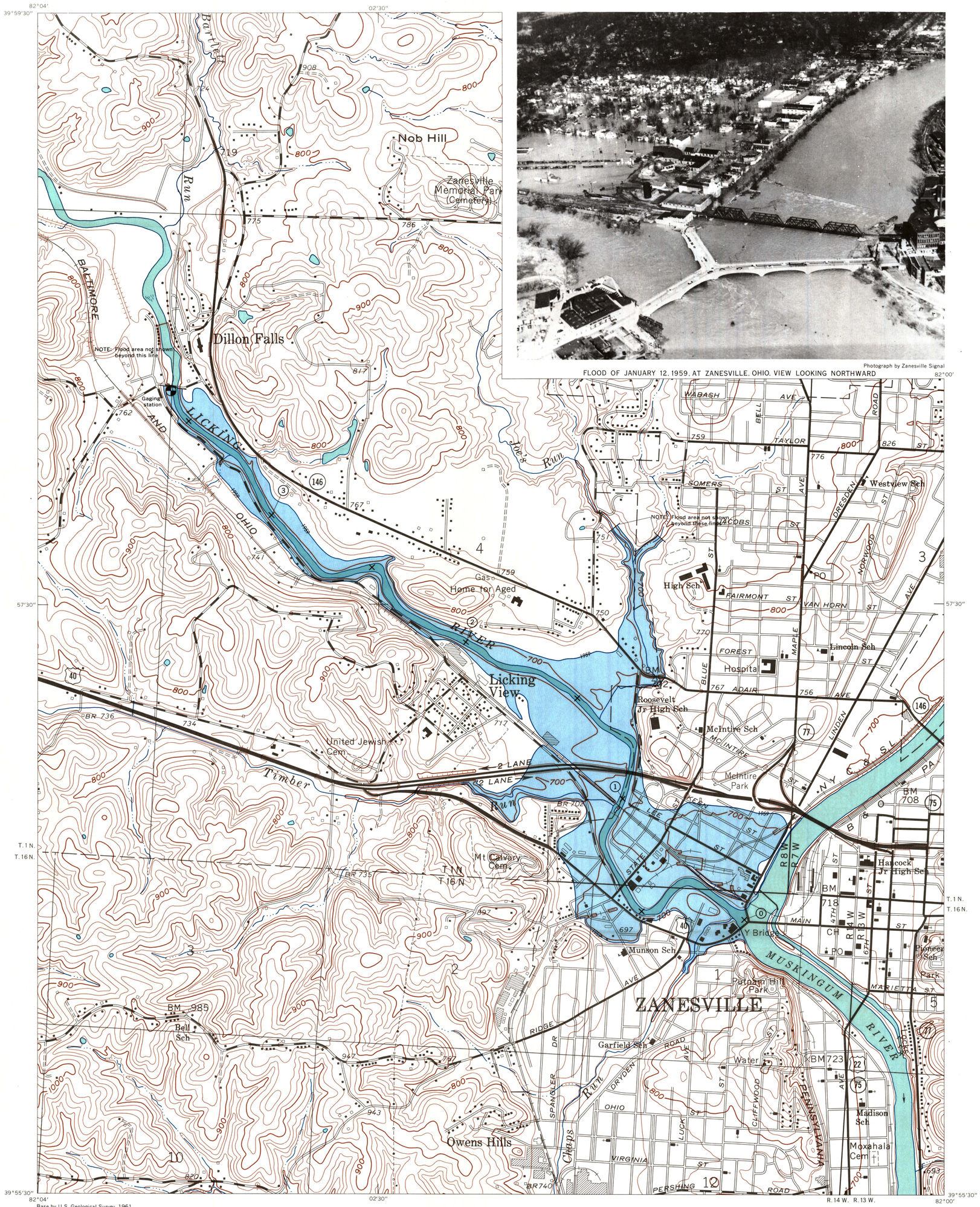
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
THOMAS B. NOLAN, DIRECTOR

PREPARED IN COOPERATION WITH
THE STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
FRED E. MORR, DIRECTOR

HYDROLOGIC INVESTIGATIONS
ATLAS HA-46






Photograph by Zanesville Signal

FLOOD OF JANUARY 12, 1959, AT ZANESVILLE, OHIO, VIEW LOOKING NORTHWARD

SCALE 1:12 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

EXPLANATION

Area flooded January 22, 1959

1959
Boundary of 1959 flood

③ River mile measured upstream from mouth of Licking River

3° TRUE NORTH MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1964

OHIO
AREA OF THIS REPORT

## LICKING RIVER FLOOD DATA

Tabulated below are flood data recorded at the U.S. Geological Survey gaging station on Licking River at Dillon, located 3.65 miles upstream from the mouth. Overflow limits for only the flood of January 22, 1959, are shown on the map.

| Date of flood | Stage (feet) | Elevation above mean sea level (feet) | Discharge (cubic feet per second) |
|---|---|---|---|
| March ——, 1913 | *37.0 | *720.7 | — — |
| January 27, 1952 | 27.63 | 711.33 | 29,800 |
| January 22, 1959 | 32.46 | 716.16 | 47,000 |

*Affected by backwater from the Muskingum River

## FLOODS ON LICKING RIVER AT ZANESVILLE, OHIO, IN 1959

Hydrologic data relating to the depth and frequency of flooding along the Licking River in the vicinity of Zanesville, Ohio, are presented in this atlas. The Licking River flows into the Muskingum River at Zanesville. In January 1959, prior to the completion of the Dillon Reservoir, the western part of Zanesville was inundated extensively by the Licking River. Very little flooding was caused by the Muskingum River, which is regulated by storage in several reservoirs. The map and flood data provide a technical basis for making land-use decisions designed to minimize flood damages. No recommendations or suggestions for land-use regulations are made, and no solutions of existing flood problems are proposed.

The approximate area flooded on January 22, 1959, is shown on a topographic map to record the flood hazard in graphic form. Greater floods are possible but no attempt has been made to define their probable overflow limits. The flood of January 22, 1959, was the second highest on the Licking River at Zanesville since 1884, having been exceeded only by the flood of March 1913. However, 10 miles upstream from Zanesville, beyond the effects of backwater from the Muskingum River, the 1959 flood was greater than that of 1913. In 1913 great floods occurred simultaneously on the Licking and Muskingum Rivers at Zanesville, but during the January 1959 flood the Muskingum River was several feet lower than in 1913.

Protective works, such as the Dillon Reservoir, may reduce the frequency of flooding on the Licking River at Zanesville but will not necessarily eliminate flooding. New highways and other cultural changes made after the flood of 1959 may influence the inundation pattern of future floods.

*Cooperation and acknowledgment.*— The preparation of this flood map is a part of an investigative program financed through a cooperative agreement between the Ohio Department of Natural Resources, Fred E. Morr, Director, and the U.S. Geological Survey, Thomas B. Nolan, Director.

Data for part of the 1959 flood profile were furnished by the Corps of Engineers.

The aerial photograph was furnished by the Zanesville Signal.

The explanatory text was written by George W. Edelen, Jr., the flood boundaries were defined by Frederick H. Ruggles, Jr., and the flood-frequency relation was derived by William P. Cross, Geological Survey.

*Flood height.*— The height of a flood at a gaging station usually is stated in terms of the gage height or stage, which is the elevation of the water surface above a selected datum plane. Elevations shown on the map are in feet above mean sea level. Gage heights or stages at the U.S. Geological Survey gaging station on Licking River at Dillon, located at highway bridge 3.65 miles upstream from the mouth of Licking River in Zanesville, can be converted to elevations above mean sea level by adding 683.7 feet.

Gage height and year of each annual flood (highest momentary peak discharge each year) which exceeded the 16-foot stage at the gaging station on Licking River at Toboso, Ohio, are shown in figure 1. The record for the Toboso gaging station, located about 19 miles upstream from Zanesville, is used because it covers a much longer period than the record for the gaging station at Dillon. The irregular occurrence of floods is evident. Annual floods at Toboso exceeded the 16-foot stage 13 times in the 44 years of record (fig. 1), an average of about one flood each 3 1/2 years. Although no flood of this magnitude occurred in 31 of the years, there were 5 floods that exceeded this stage during the 11-year period 1935-45.

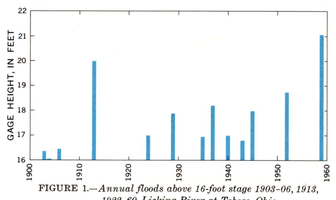



FIGURE 1.—*Annual floods above 16-foot stage 1903–06, 1913, 1922–60, Licking River at Toboso, Ohio.*

*Flood discharge.*— The rate of discharge of a stream is the volume of flow that passes a specific location in a given period of time. Peak discharge is the maximum value of the discharge reached during a flood. Discharge rates usually are expressed in units of cubic feet per second (cfs).

*Regulation.*— The Dillon flood-control reservoir, placed in operation after the flood of January 22, 1959, regulates flood discharges from 96 percent of the Licking River drainage area. The reservoir, located about 6 miles upstream from the mouth, will probably have a substantial effect on Licking River discharges at Zanesville in the future. About 32 square miles of the Licking River drainage area lies downstream from the Dillon Reservoir.

Upstream from Zanesville, the flow of the Muskingum River is regulated by 14 flood-control reservoirs. During the January 1959 flood the reservoirs reduced the stage of the Muskingum River at Zanesville and therefore reduced the Muskingum River backwater effect on Licking River.

*Flood frequency.*— Frequency of flooding on the Licking River at Dillon has been derived for conditions of natural flow without the effect of storage in Dillon Reservoir. The frequency derivation, which is based on records from the U.S. Geological Survey gaging station located at Dillon, is combined with a regional flood-frequency relation for all streams in Ohio except those in the Maumee River basin. The relation between stage and frequency is dependent on the relation of stage to discharge. The stage-discharge relation is affected by changes in physical conditions of channels and constrictions and is not necessarily permanent. The frequency curve shown in figure 2 is based on channel conditions existing in 1959. Large errors may result if the flood-frequency curve is extrapolated beyond the limits shown.

*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 probability of a specific flood being equaled or exceeded in any one year. Thus a 20-year flood would have 1 chance in 20, or a 5-percent chance, of being equaled or exceeded in any year.

The general relation between recurrence interval and both flood height and flood discharge at the U.S. Geological Survey gaging station on the Licking River at Dillon is shown in figure 2 and is tabulated below. The curve represents conditions of natural flow without the effects of storage in Dillon Reservoir and backwater from Muskingum River.

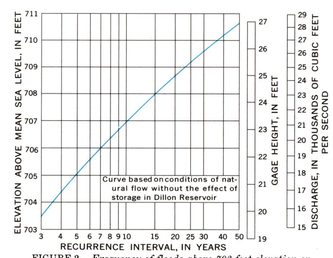



FIGURE 2.—*Frequency of floods above 703-foot elevation on Licking River at Dillion Ohio.*

| Recurrence interval (years) | Elevation above mean sea level at gaging station at Dillon (feet) | Discharge (cubic feet per second) |
|---|---|---|
| 50 | 710.7 | 28,400 |
| 40 | 710.2 | 27,400 |
| 30 | 709.6 | 26,100 |
| 20 | 708.7 | 24,300 |
| 10 | 707.0 | 21,100 |
| 5 | 705.1 | 18,000 |

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. For example, about 5 floods of at least the magnitude of a 20-year flood may be expected to occur in a 100-year period. A flood that reaches a 708.7-foot elevation at the gaging station at the highway bridge at Dillon is said to have a 20-year recurrence interval (fig. 2). However, because of the irregularity of flood occurrences, the fact that a 20-year flood is experienced in one year does not reduce the probability of that flood being equaled or exceeded in the next year or in the next week.

*Flood profiles.*— A profile of the water surface along Licking River, constructed from marks left by the flood of January 22, 1959, is shown in figure 3. Profiles of floods corresponding to other flood heights can be plotted on this diagram generally parallel to that shown, although backwater effects from high stages on the Muskingum River may affect the profile at times. Downstream from river mile 0.43 near the mouth of Licking River, profiles for both the left (north) bank and right (south) bank are shown. The differences in elevation between water levels in the vicinity of McIntire Park and those along the main channel of Licking River are evident. The base line for the profile is located generally along the main channel. River miles measured upstream from the mouth of Licking River, used for the profile of figure 3, are also marked along the channel on the flood map.

*Flood depths.*— Depth of flooding at any point can be estimated by subtracting the ground elevation from the water-surface elevation indicated by the profile in figure 3. The approximate ground elevation can be determined from information indicated by contours on the map, although more accurate elevations can be obtained by leveling to nearby bench marks.

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

Cross, W. P., and Brooks, H. P., 1959, Floods of January-February 1959 in Ohio: U.S. Geol. Survey Circ. 418, 54 p.
Cross, W. P., and Webber, E. E., 1959, Floods in Ohio, magnitude and frequency: Ohio Dept. Nat. Resources, Div. of Water, Bull. 32, 325 p.

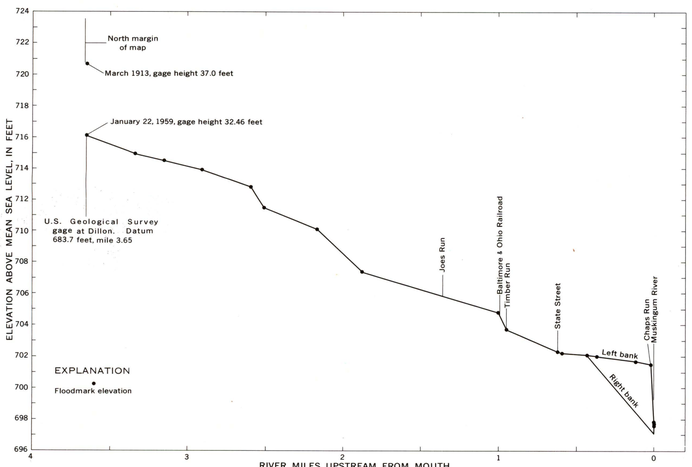



FIGURE 3.—*Profile of January 22, 1959, flood on Licking River.*

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# FLOODS AT ZANESVILLE, OHIO

By
George W. Edelen, Jr., Frederick H. Ruggles, Jr.
and William P. Cross

1964

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For sale by U. S. Geological Survey, price 75 cents