DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
THE NORTHEASTERN ILLINOIS METROPOLITAN
AREA PLANNING COMMISSION

HYDROLOGIC INVESTIGATIONS
ATLAS HA-257

# FLOODS IN BEECHER WEST QUADRANGLE NORTHEASTERN ILLINOIS

This report presents hydrologic data that can be used to evaluate the extent, depth, and frequency of flooding that affect the economic development of flood plains in Beecher West quadrangle, northeastern Illinois. It will aid individuals, government agencies and others responsible for solving existing flood problems and for formulating effective flood-plain regulations that will minimize the creation of new flood problems. The report will also be useful for preparing building and zoning regulations, locating waste disposal facilities, developing recreational areas, and managing surface water in relation to ground-water resources.

The areas inundated by floods along streams in the Beecher West 7½-minute quadrangle are delineated on a topographic map. The quadrangle location is shown in figure 1, Inundated areas for the flood of October 1954 are shown along Plum Creek, and for the flood of July 1957 along Trim Creek, Tower Creek, Canavan Creek, Exline Slough, South Branch Rock Creek, Marshall Slough, Black Walnut Creek, and several unnamed streams.

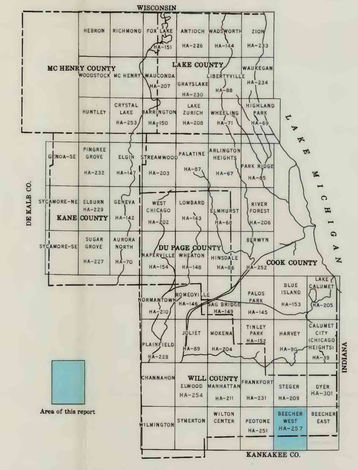


FIGURE 1.—*Index map of northeastern Illinois showing location of quadrangles included in flood-hazard mapping program.*

Local residents reported that the flood of July 1957 was the highest observed in the past 60 years on streams throughout the Beecher West quadrangle. Records at the gaging station on Deer Creek near Chicago Heights, which is 10 miles northeast of the Beecher West quadrangle, are also indicative of the relative magnitude of the July 1957 flood in the area. At the Deer Creek gaging station the 1957 flood was 0.23 foot higher than any other flood recorded since 1947, and it exceeded the estimated 50-year flood stage by 0.2 foot.

Greater floods than those whose boundaries are shown on the map are possible. The flood boundaries shown provide a record of historic fact that reflects channel conditions existing when the floods occurred. Changes in channel conditions, in waterway openings at highways and railroads, or changes in runoff characteristics of the streams caused by increased urbanization that may have taken place subsequent to the floods represented on the map could affect the flood height reached by a future flood of comparable discharge. Protective works built after the floods shown may reduce the frequency of flooding in the area but will not necessarily eliminate all future flooding. The inundation pattern of future floods may be affected by new highways and bridges, relocation and improvement of stream channels, and other cultural changes.

The general procedure used in defining the flood boundaries was to construct flood profiles from elevations of floodmarks identified in the field and from data available from other agencies. The extent of flooding delineated on the topographic map was derived from the profiles by interpolation between contours (lines of equal ground elevations) and by plotting overflow limits identified during field investigations and surveys. The portrayal of flood boundaries is consistent with the scale of the map (1 inch = 2,000 feet; contour interval, 10 feet).

There are several depressions or lowland areas in the Beecher West quadrangle where surface water accumulates because of inadequate drainage into the streams. Frequency and depth of flooding in these areas are unrelated to the water-surface elevation along the streams. Some areas are flooded only briefly after periods of heavy rainfall or snowmelt, whereas others remain inundated continuously, depending largely upon the rates of evaporation and seepage into the ground. Flood boundaries are shown for all such areas that were detected in this investigation.

*Cooperation and acknowledgment.*— The preparation of this report is a part of an extensive flood-mapping program financed through cooperative agreements between the Northeastern Illinois Metropolitan Area Planning Commission and the U.S. Geological Survey. Under previous agreements, flood maps were prepared for forty-three 7½-minute quadrangles. Under the present agreement, the flood-mapping program was expanded to include all the 7½-minute quadrangles shown in figure 1. The program includes parts of Cook and McHenry Counties, nearly all of Kane and Will Counties, and all of De Page and Lake Counties. The six counties cooperate in the program financially through separate agreements with the Planning Commission. Financial support for the preparation of this report was provided by Will County through the Northeastern Illinois Metropolitan Area Planning Commission.

The cooperative program is administered on behalf of the Planning Commission by Matthew L. Rockwell, Executive Director.

The report was prepared by the U.S. Geological Survey under the administrative direction of William D. Mitchell, district chief, and under the immediate supervision of Allen W. Noehre, engineer-in-charge of the project.

*Flood heights.*— The height of a flood at a gaging station usually is stated in terms of gage height, or stage, which is the elevation of the water surface above a selected datum plane. Elevations shown in this report are in feet above mean sea level. Gage heights at crest-stage gages in the Beecher West quadrangle can be converted to elevations above mean sea level by adding the gage height to the appropriate datum of gage listed in the following table.

Size of the drainage basin for each station also is shown in the table. The subbasin divides from which the areas were determined are shown on the flood map. The divides were defined in the usual manner of following the ridge line or highest ground elevation between adjacent streams. Relief in parts of the quadrangle is slight and at times some of the divides may become submerged during floods. When this occurs water may flow in either direction across the divide depending upon the relative elevation of the streams and conveyance of their channels. For example, note the interbasin flow between Canavan Creek and Exline Slough near the southwest corner of the quadrangle.

| Crest-stage gage | Station number | Datum of gage above mean sea level (feet) | Drainage area (square miles) |
|---|---|---|---|
| Trim Creek tributary at Beecher (Indiana Avenue) | 5-5202.4 | 696.73 | 1.73 |
| Trim Creek: Near Sollitt (400 ft upstream from County Road) | 5-5202.5 | 679.92 | 19.9 |
| At Sollitt (County Road N 1100 E) | 5-5202.6 | 672.63 | 23.8 |
| Near Whitaker (County Road N 900 E) | 5-5202.7 | 662.00 | 31.2 |
| Exline Slough: Near Beecher (County Road) | 5-5200.5 | 696.62 | 3.15 |
| Near Whitaker (Will-Kankakee County Line Road) | 5-5200.6 | 681.22 | 11.0 |
| South Branch Rock Creek: Near Beecher (Beecher-Peotone Road) | 5-5262.73 | 710.77 | 4.65 |
| Near Whitaker (County Road) | 5-5262.74 | 696.25 | 6.83 |
| Black Walnut Creek near Beecher (County Road) | 5-5262.85 | 708.50 | 8.13 |

Gage height and year of occurrence of each annual flood (highest peak stage in a calendar year) above 626.4-foot elevation at the gaging station, Deer Creek near Chicago Heights, Ill., during the period 1948–66 are shown in figure 2. The gaging station is at Joe Orr Road and is 10 miles northeast of the Beecher West quadrangle. The graph shows the history of floods at the gage and illustrates the irregular occurrence of floods on Deer Creek.

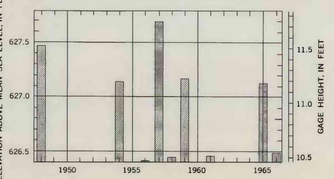


FIGURE 2.—*Annual floods above 626.4-foot elevation, 1948–66, Deer Creek near Chicago Heights (Joe Orr Road).*

*Flood discharge.*— The rate of discharge of a stream is the volume of flow that passes a particular location in a given period of time. Discharge rates usually are expressed in units of cubic feet per second (cfs). Peak discharge, the maximum discharge attained by a flood, generally occurs at the time of the maximum height (stage) of the flood, but if a stream is affected by variable backwater, the time of the peak discharge may not coincide with that of the maximum stage. For example, backwater from an ice or debris jam may cause a high stage during a period of relatively low discharge.

*Flood frequency.*— Frequency of floods at the Geological Survey gaging station on Deer Creek near Chicago Heights was derived from streamflow records of this station combined with records of other nearby stations and with the regional flood-frequency relation for streams in northern Illinois (Mitchell 1954). The relation between discharge and frequency is shown in figure 3 and the relation between stage and frequency is shown in figure 4. The relation between stage and frequency is dependent on the relation of stage to discharge which is affected by changes in the physical conditions of stream channels and constrictions. The frequency curve in figure 4 is based on channel conditions existing in 1967. Longer records and future changes in channel conditions may define somewhat different flood-frequency curves. Extrapolation of the curves beyond the limits shown is not recommended.

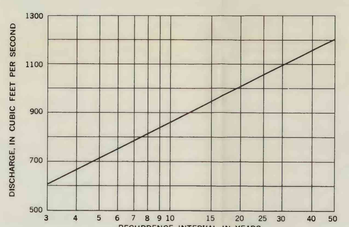


FIGURE 3.—*Frequency of flood discharges on Deer Creek near Chicago Heights (Joe Orr Road).*

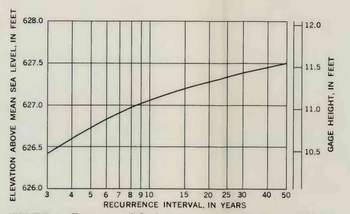


FIGURE 4.—*Frequency of flood stages on Deer Creek near Chicago Heights (Joe Orr Road).*

*Recurrence intervals.*— As applied to flood events, recurrence interval is the average interval of time within which a given flood will be equaled or exceeded once. Frequencies of floods can be stated in terms of their probabilities of occurrence (virtually reciprocals of their recurrence intervals for floods with recurrence intervals greater than 10 years). For example, a flood with a 25-year recurrence interval would have a 4-percent chance of being equaled or exceeded in any given year, or a flood with a 50-year recurrence interval would have a 2-percent chance of being equaled or exceeded in any given year.

The general relation between recurrence interval and flood height at the gaging station on Deer Creek near Chicago Heights (fig. 4) is tabulated below:

| Recurrence interval (years) | Elevation above mean sea level (feet) |
|---|---|
| 50 | 627.3 |
| 30 | 627.4 |
| 20 | 627.5 |
| 10 | 627.1 |
| 5 | 626.7 |
| 3 | 626.4 |

It is emphasized that recurrence intervals are average figures—the average number of years between occurrences of floods that equal or exceed a given magnitude. The fact that a major flood is experienced in one year does not reduce the probability of that flood being exceeded in the next year or even in the next week.

*Flood profiles.*— Profiles of the water surface, based primarily on elevations of marks left by floods of October 1954, July 1957, December 1965, May 1966, and April 1967 are shown in figures 5–10. Where floodmarks could not be identified, the profiles were constructed on the basis of flood crests determined from reports by local residents, and on elevations of streambeds and lower flood stages. River miles used for the profiles correspond to those marked along the streams 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 at the same point, indicated by the profiles in figures 5–10. The approximate ground elevation can be determined from contours on the map, although more accurate elevations can be obtained by leveling from nearby bench marks.

*Additional data.*— Other information pertaining to floods in the Beecher West quadrangle can be obtained at the office of the U.S. Geological Survey, Oak Park, Ill., and from the following published reports:

Daniels, W. S., and Hale, M. D., 1958, Floods of October 1954 in the Chicago area, Illinois and Indiana: U.S. Geol. Survey Water-Supply Paper 1370-B, 107-200.

Mitchell, W. D., 1954, Floods in Illinois, Magnitude and frequency: Illinois Dept. Public Works and Bldgs., Div. of Waterways, 386p.

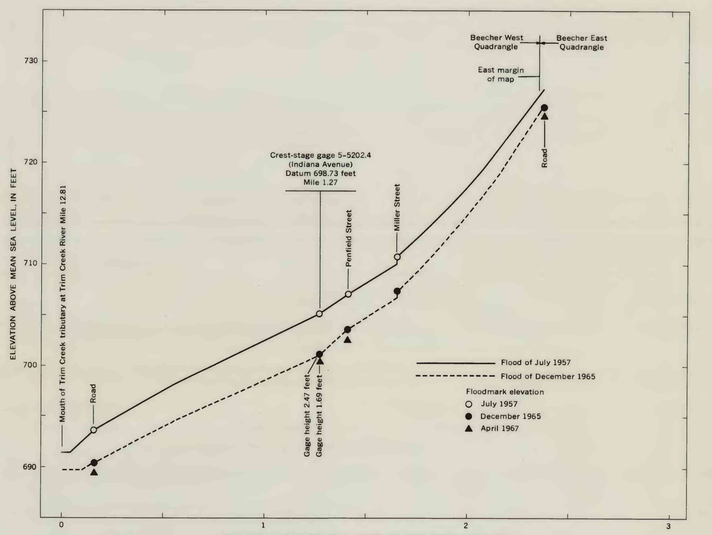


FIGURE 5.—*Profiles of floods on Trim Creek tributary.*

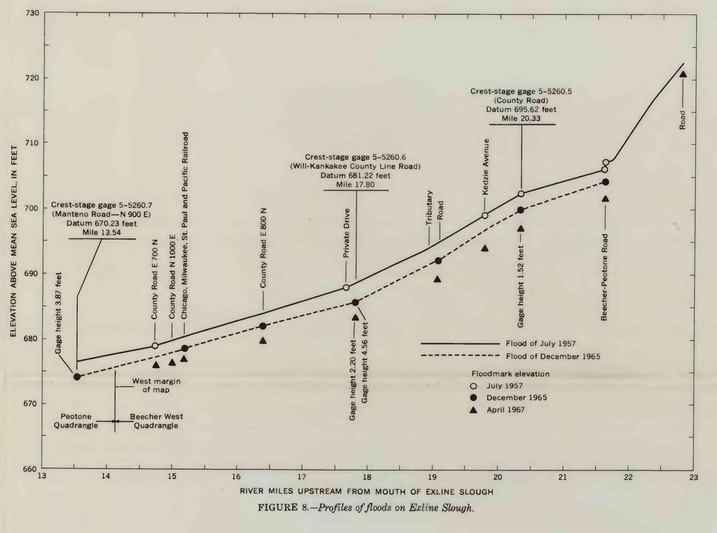


FIGURE 8.—*Profiles of floods on Exline Slough.*

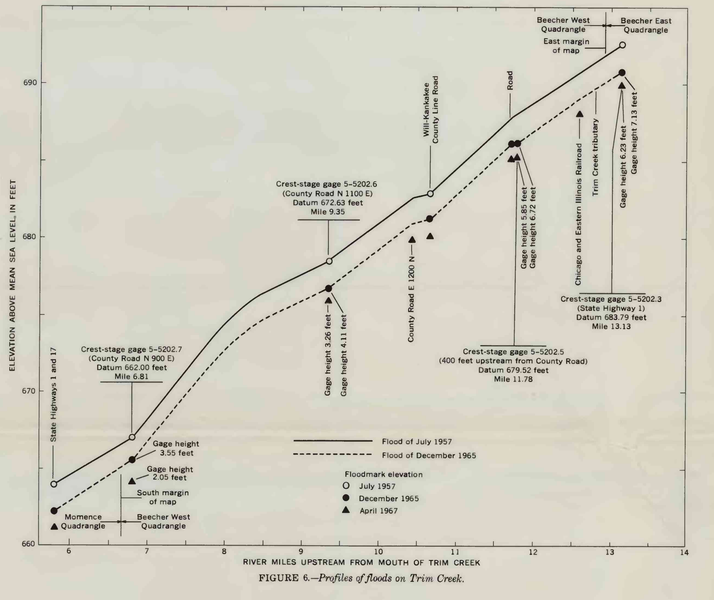


FIGURE 6.—*Profiles of floods on Trim Creek.*

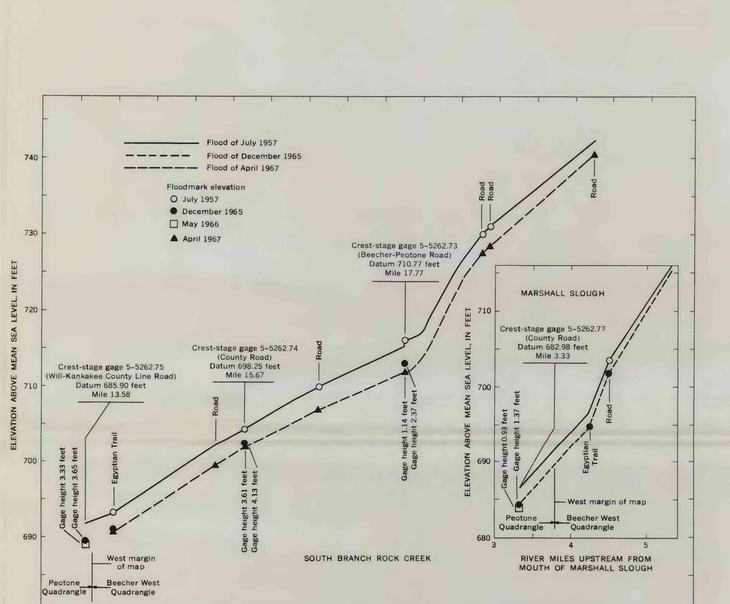


FIGURE 9.—*Profiles of floods on South Branch Rock Creek and Marshall Slough.*

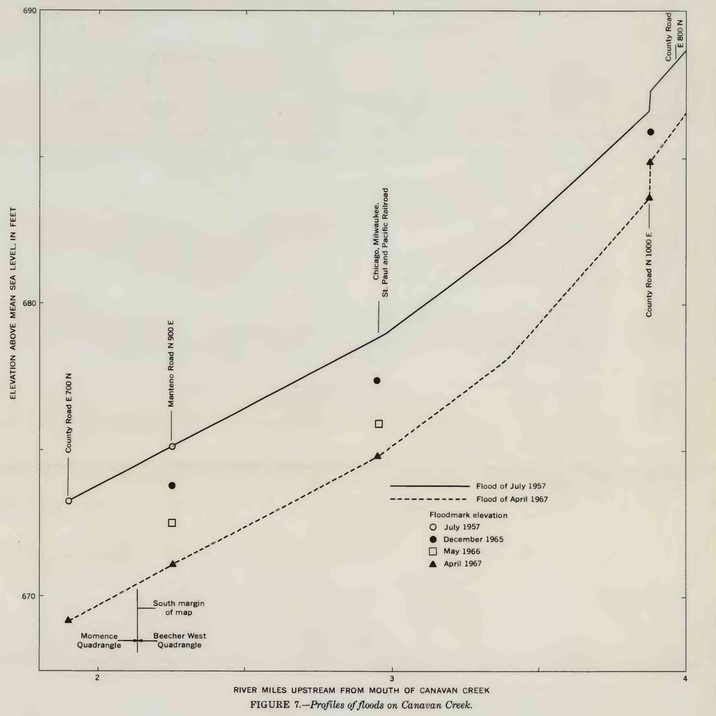


FIGURE 7.—*Profiles of floods on Canavan Creek.*

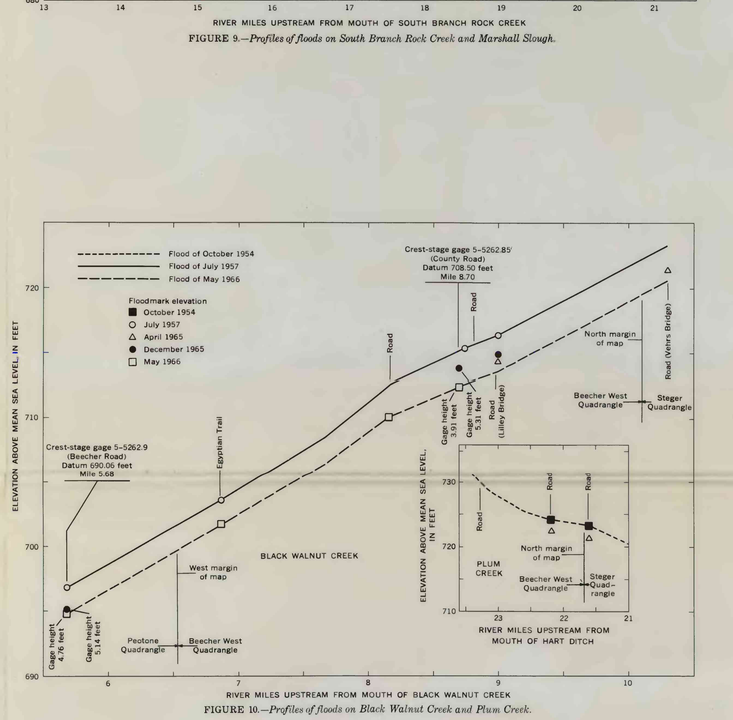


FIGURE 10.—*Profiles of floods on Black Walnut Creek and Plum Creek.*

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By
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