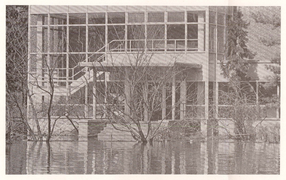

Photograph by Brian Burd, The State Journal

FIGURE 5.--Overflow of the Red Cedar River at the Womens Intramural Building, Michigan State University.

Photograph by Brian Burd, The State Journal

FIGURE 6.--Overflow of the Red Cedar River at Bessey Hall, Michigan State University.

Photograph by Brian Burd, The State Journal

FIGURE 8.--Overflow of the Red Cedar River at Jenison Field House, Michigan State University (note rapids in foreground).

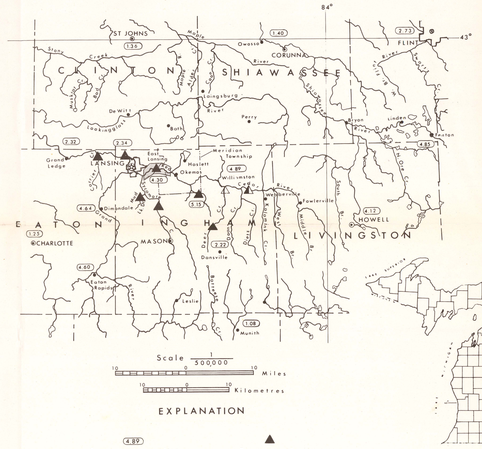

FIGURE 1.--Index map.

Photograph by Norris Ingalls, The State Journal

FIGURE 7.--Overflow of the Red Cedar River at Jenison Field House, Michigan State University (Kalamazoo Street Bridge is at the lower right edge of the photograph).

EXPLANATION

Area flooded April 1975

Boundary of April 1975 flood (Boundary dashed where estimated)

Direction of flow

200 0 200 400 600 800 1000 FEET

100 0 100 200 300 METRES

APPROXIMATE SCALE

FLOOD OF APRIL 1975 AT EAST LANSING, MICHIGAN

by

R.L.Knutilla and L.A.Swallow

1975

FLOOD OF APRIL 1975 AT EAST LANSING, MICHIGAN

On April 18 between 5 p.m. and 12 p.m. the city of East Lansing experienced an intense rainstorm that caused the Red Cedar River to overflow its banks, resulting in the most devastating flood since 1904. During the period of flooding the U.S. Geological Survey obtained aerial photography of the East Lansing area to document the disaster. The photography has been used to show the extent of flooding on a photomosaic base map. Data on streamflow, collected at the station on the Michigan State University campus, are given. Suspended sediment data collected at the gaging station have been used to estimate sediment transport during the period of the flood. Information on the magnitude of the flood is useful in making decisions regarding the use of flood plains in the area. The report is one of a series of reports on the April 1975 flood in the Lansing metropolitan area.

BASIN CHARACTERISTICS

The Red Cedar River begins in southwest Livingston County. Along its course the river has been dredged and alined in places to accommodate flood runoff. The drainage area of the Red Cedar River at East Lansing is 355 square miles (920 km^2). Glacial materials, primarily of morainal origin, are the principal surface deposits in the basin; outwash occurs along stream channels at some locations. Most of the basin is relatively flat and drainage is not well developed. The highest point in the basin is about 1,050 feet (320 m) above msl (mean sea level). However, most of the basin is at an elevation of about 900 ft (270 m) above msl. The water surface elevation at East Lansing is normally about 830 feet (253 m) above msl. Most of the basin is rural, except in the lower reaches where extensive development has occurred. The Red Cedar River is unregulated although there is a small dam at Williamston about 15 miles (24 km) upstream from the study area. The impoundment formed by the dam has little storage and consequently has little effect on floodflows.

PRECIPITATION

Records of the National Weather Service show that most of the Red Cedar River basin received 4 to 5 inches (102 to 127 mm) of rain during the 7-hour duration of the April 18 storm (fig. 1). Precipitation of that intensity has a frequency of occurrence of about once in 100 years. In nearby areas precipitation of as much as 5.15 inches (131 mm) was reported.

About two weeks prior to the flood a heavy snow fell over most of the Red Cedar River basin. As much as 13 inches (330 mm) were recorded at some places. Subsequent melting caused streamflow to be relatively high. In addition, soils became relatively saturated as the snow melted and their capacity to absorb water was reduced. This condition probably caused streams to reach higher flood levels than they would have otherwise.

FLOOD HISTORY

Streamflow data have been collected at East Lansing since August 1902, except for the period 1905 to 1910. The National Weather Service has determined the flood stage for the gage at East Lansing to be 7 feet (2.13 m). At this stage the river is bankfull and flooding begins in low lying areas. Flood stages of 7 feet (2.13 m) or more occur almost annually at the East Lansing gage, and may occur several times in one year. Most of these floods cause little damage because the areas inundated are comparatively undeveloped. Table 1 lists floods that have exceeded the 7-foot (2.13 m) flood stage by about 2 feet (0.6 m). The April 1975 flood was the highest since 1904, and was approximately equal to that of April 1947.

Table 1.--Highest known floods on the Red Cedar River at East Lansing.

Date	Stage (ft)	Discharge (ft^3/s)
March 24, 1904	13.4	8,000
April 3, 1912	9.5	4,100
March 27, 1916	10.2	4,700
March 15, 1918	10.7	5,130
March 13, 1920	9.0	3,680
February 14, 1938	9.2	4,020
April 7, 1947	11.6	5,920
March 20, 1948	10.5	4,960
May 11, 1948	10.0	4,330
March 31, 1960	9.2	3,580
April 20, 1975	12.0	5,940

FLOODED AREAS

The extent of flooding along the Red Cedar River is shown on the photomosaic base map. The area covered by the map is shown on figure 1.

The photomosaic base map has not been corrected for distortion caused by camera tilt or minor changes of altitude during flight. Although distortion might cause a slight error in the linear scale or in the alinement of the photographs, it has no effect on the boundaries of the flooding. The mosaics were compiled from photographs taken about 9:40 a.m. on April 20, 1975. River stage records obtained at East Lansing indicate that the flood crested about 12 hours after the photographs were taken. The stage of the river had increased only about 3 to 4 inches (76 to 102 mm) during the 12-hour period. Thus, the photographs were taken very near the flood peak, and areas shown as being inundated on the mosaics depict the maximum extent of the flood. Although inundated areas were clearly visible in most photographs, flooding may have extended slightly beyond the outlined areas in a few places.

ADDITIONAL INFORMATION

Other information pertaining to floods on the Red Cedar River at East Lansing may be obtained from the U.S. Geological Survey, Okemos, Michigan, and from the following reports:

U.S. Army, Corps of Engineers, 1968, Flood plain information, Red Cedar River, Ingham County, Michigan: U.S. Army Corps of Engineers, Detroit District, Detroit, Michigan, 38 p.

U.S. Army, Corps of Engineers, 1970, Flood plain information, Grand River, Red Cedar River, and Sycamore Creek, Lansing, Michigan and vicinity: U.S. Army Corps of Engineers, Detroit District, Detroit, Michigan, 86 p.

Wiitala, S. W., 1965, Magnitude and frequency of floods in the United States, Part 4, St. Lawrence River basin: U.S. Geol. Survey Water-Supply Paper 1677, 357 p.

Table 3.--Factors for converting English to International System (SI) units.

Multiply English units	By	To obtain SI units
inches (in)	25.4	millimetres (mm)
feet (ft)	.3048	metres (m)
miles (mi)	1.609	kilometres (km)
square miles (mi^2)	2.590	square kilometres (km^2)
cubic feet per second (ft^3/s)	.02832	cubic metres per second (m^3/s)
tons (short)	.9072	metric tons or tonnes (t)

STREAM DISCHARGE

The discharge hydrograph for the Red Cedar River at East Lansing is shown in figure 2. The peak discharge of 5,940 ft^3/s (168 m^3/s) occurred near midnight on April 20.

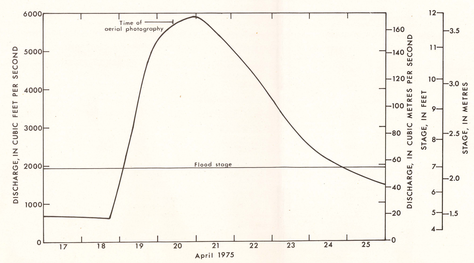

FIGURE 2.--Discharge hydrograph for the Red Cedar River at East Lansing.

This discharge is equivalent to a runoff of about 16.7 ft^3/s (0.47 m^3/s) per square mile of drainage area. Although high, the runoff is low if compared to that of some nearby streams (table 2). Streams having small drainage areas had appreciably higher runoff than did the Red Cedar River.

Table 2.--Peak discharges at selected gaging stations near East Lansing.

Stream	Drainage Area (mi^2)	Peak Discharge (ft^3/s)	Runoff [$(ft^3/s)/mi^2$]
Red Cedar River at M-52	163	2,650	16.3
Deer Creek near Dansville	16.3	962	59.0
Sloan Creek near Williamston	9.34	1,290	138
Red Cedar River at East Lansing	355	5,940	16.7
Sycamore Creek near Holt	80.6	2,110	26.2
Mud Lake Drain near Holt	4.28	485	113
Grand River at Lansing	1,230	11,200	9.11
Carrier Creek near Lansing	12.1	532	44.0

FLOOD FREQUENCY

The frequency of a flood may be expressed in terms of recurrence interval or of probability of occurrence. Recurrence interval is the average interval of time within which a flood of a given magnitude will be equaled or exceeded once. Probability of occurrence is the inverse of recurrence interval.

The frequency with which a flood of a given magnitude can be expected on the Red Cedar River at East Lansing can be determined from figure 3. The flood of April 1975 has a recurrence interval of about 40 years, or about a 2.5 percent chance of occurrence in any year. Floods, however, do not occur at regular intervals nor can the time of their occurrence be predicted. A flood equal to or greater than that of April 1975 can occur at any time. It is thus important to recognize potential flood problems and to adopt land use practices designed to protect communities against flood losses.

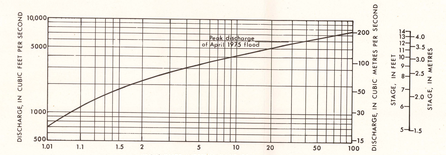

FIGURE 3.--Frequency of floods on the Red Cedar River at East Lansing.

SEDIMENT TRANSPORT

Suspended sediment samples were obtained at the gaging station on the Red Cedar River at East Lansing during the April 1975 flood. Laboratory analysis of these samples for sediment concentration have been used to prepare the suspended sediment graph and to determine the average daily sediment loads shown in figure 4. A maximum sediment concentration of about 350 mg/l (milligrams per litre) occurred on April 20; peak concentrations occurred several hours prior to the time of peak discharge (see figure 2).

During the April 19-24 period, an estimated 11,500 tons (10,400 t) of suspended sediment passed the gaging station. Almost half of this amount--an estimated 5,200 tons (4,700 t) --was transported by the river on April 20. Sediment loads of 10 to 15 tons (9 to 14 t) per day are probably typical under normal flow conditions.

Samples were also obtained for particle size analysis of the suspended material. These data indicate that the composition of the suspended load ranged from 4 to 11 percent sand, from 4 to 11 percent silt, and from 78 to 91 percent clay.

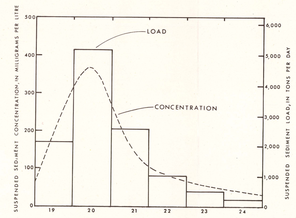

FIGURE 4.--Suspended sediment transport of the Red Cedar River at East Lansing during the April 1975 flood.