REPORT OF INVESTIGATION NO. 14 1952

STATE OF ILLINOIS

ADLAI E. STEVENSON, *Governor*

THE STORM OF JULY 8, 1951 IN NORTH CENTRAL ILLINOIS

A Cooperative Study by
Illinois State Water Survey Division,
Geological Survey United States Department
of the Interior, Soil Conservation Service
United States Department of Agriculture

DEPARTMENT OF REGISTRATION AND EDUCATION

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URBANA, ILLINOIS

(Printed By Authority of State of Illinois)

MR. LESTER PFISTER EXAMINING THE RECORDING RAIN GAGE ON HIS FARM NEAR **EL PASO AFTER THE** STORM OF 8 JULY 1951, (8.25 inches).

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SUMMARY

1. An intense rainstorm, exceeding 13 inches in 6 hours in some localities, occurred on the night of July 8, 1951 in north central Illinois—in northern McLean, southeastern Woodford, and southwestern Livingston Counties, resulting in major floods on the Vermilion and Mackinaw River Basins with discharges exceeding previously known maxima at nine of eleven Stream-gaging stations in the basins.

2. A survey of antecedent rainfall and groundwater level conditions, utilizing cumulative and daily rainfall amounts as well as a hydrograph of Well D in the Panther Creek Basin, indicated a relatively moist sub-soil at the time of the storm of July 8, suggesting an even larger surface runoff, after a short interval of excess rainfall, than the amounts recorded.

3. The meteorological surface and upper air charts for the storm interval show that the intense rainfall resulted from thunderstorm activity associated with a slow moving squall line. Commercial airline pilots, who attempted to fly through the storm area, reported that severe turbulence and lightning discharges were encountered upon penetration into the storm.

4. At intervals during the storm, photographs were taken of the Plan-Position-Indicator radar scope (APS-15 set) operated by the State Water Survey at the University of Illinois Airport south of Champaign, Illinois. These photographs clearly define the radar-rainfall patterns of this intense storm, and provide additional data for a more detailed study of rainfall intensity and areal distribution as determined from the radar scope.

5. A total of 350 rainfall observations are included in a detailed tabular presentation of the basic rainfall data. These data include 280 field observations collected by State Water Survey personnel, as well as reports of 29 recording and 20 non-recording gages operated by the Water Survey, and 21 U.S. Weather Bureau gages.

6. Maps and graphs have been prepared to give a detailed picture of the rainfall pattern, including: isohyetal maps of the total storm area as well as for the smaller Panther Creek Basin, mass curves of rainfall at selected stations, and area-depth curves for the total storm and Panther Creek areas.

7. The United States Geological Survey compiled the basic stage-discharge data for the eleven stream-gaging stations in the Vermilion and Mackinaw Basins, supplemented by a record of stage at Lake Bloomington supplied by the State Water Survey. These basic data, including the station description, daily mean discharges during July, 1951, stage-discharge records for selected intervals, and a summary of flood discharges, have been presented in detailed tabular form.

8. Personnel of the Soil Conservation Service conducted land damage surveys in the Vermilion and Mackinaw River Watersheds in order to determine the efficiency of conservation practices in this region of rich prairie soil under extreme test conditions. This report presents the data for the Mackinaw basin, on a farm-to-farm basis of damage incurred, from twenty-four farms, (averaging 157 acres), with complete farm conservation plans, and from twenty additional farms, (averaging 168 acres) without conservation plans. The erosion survey results showed that conservation practices reduced soil losses by 85.5 per cent in cultivated fields where these practices were used in contrast to nearby fields where no practices were used; a sizable reduction of sheet erosion, gully formation and extension, and deposition, was evident on the conservation farms.

THE STORM OF JULY 8, 1951 IN NORTH CENTRAL ILLINOIS

by

Illinois State Water Survey Division

Geological Survey, United States
Department of the Interior

Soil Conservation Service, United States
Department of Agriculture

INTRODUCTION

Except for the State Water Survey operators of a radar set, who noted some strong echoes on the APS-15 radar scope at the University of Illinois Airport near Champaign, and several cooperative rainfall observers, few people in north central Illinois realized on Sunday evening, July 8, 1951, that a very intense rainfall, exceeding 13 inches in 6 hours in some localities, was occurring on the Vermilion and Mackinaw River Basins. Quite by chance, the resulting major floods in these basins occurred at the same time as the more publicized floods in eastern Kansas.

First reports from the Water Survey field representative, some 10 hours after th,e rain storm ended, indicated that at least 8 inches of rainfall had fallen' in 6 hours on the Panther Creek Hydrologic Project near El Paso*. It was soon realized that" this 6-hour intense storm had-extended over a larger area than the Panther Creek Basin. Therefore, two meteorologists and three engineers were-dispatched to the area to determine the magnitude and extent of the precipitation. A total of 350 point-rainfall observations were collected, including 280 observations obtained by the field survey group, 29 from Water Survey recording gages, 20 Water Survey 8-inch stick gages, and 21 U. S. Weather Bureau reports.

There is no record in Illinois in recent years of any rain storm of 6 hours duration over an area of 2,200 square miles exceeding this "cloud burst". However, a rain of slightly larger magnitude fell on June 9-10, 1905 near La Harpe, Illinois (on the Mississippi River), and in southeastern Iowa. The report on "Storm Rainfall in the United States", as published by the Corps of Engineers, lists 17 storms of similar magnitude and extent in the midwest, and a total of 90 storms over the entire area east of the continental divide. Therefore, although this was a rare storm for Illinois, it has occurred elsewhere.

Figure 1 is a base map showing the locations of the various streams, stream gages, and municipalities referred to in the text of the report.

Objectives of Report

The primary purpose of this report on the storm of July 8, 1951 , on the Vermilion and Mackinaw Basins in north central Illinois, is to present a detailed summary of the basic rainfall and stage-discharge data, supplemented by discussions of antecedent conditions, the synoptic situation, radar-rainfall patterns, isohyetal maps, area-depth curves, and a land damage survey on the Mackinaw Watershed; to record these data, and to enable future investigators to carry on more detailed hydrometeorological studies of this very intense and interesting storm.

Scope of Investigation

The present report has been divided into the following five principal sections in accord with the various meteorological and hydrological investigations conducted: (1) antecedent conditions, (2) the synoptic situation, (3) radar-rainfall analysis, (4) stage-discharge data, and (5) erosion effects.

***The Panther Creek Hydrologic Project was initiated four years ago when Lester Paster, President of the Pfister Hybrid Corn Company, developed an interest in artificially induced and natural rainfall. Dense rain gage networks, stream gage stations, groundwater level recorders, and radar equipment are employed in a jointly-sponsored project with the State Water Survey, and extensive data has been collected and analyzed. Mr. Pfister is shown on the frontispiece, inspecting the Stevens weighing-bucket rain gage that recorded 8. 25 inches of rainfall at his farm home, 3. 5 miles northeast of El Paso.**

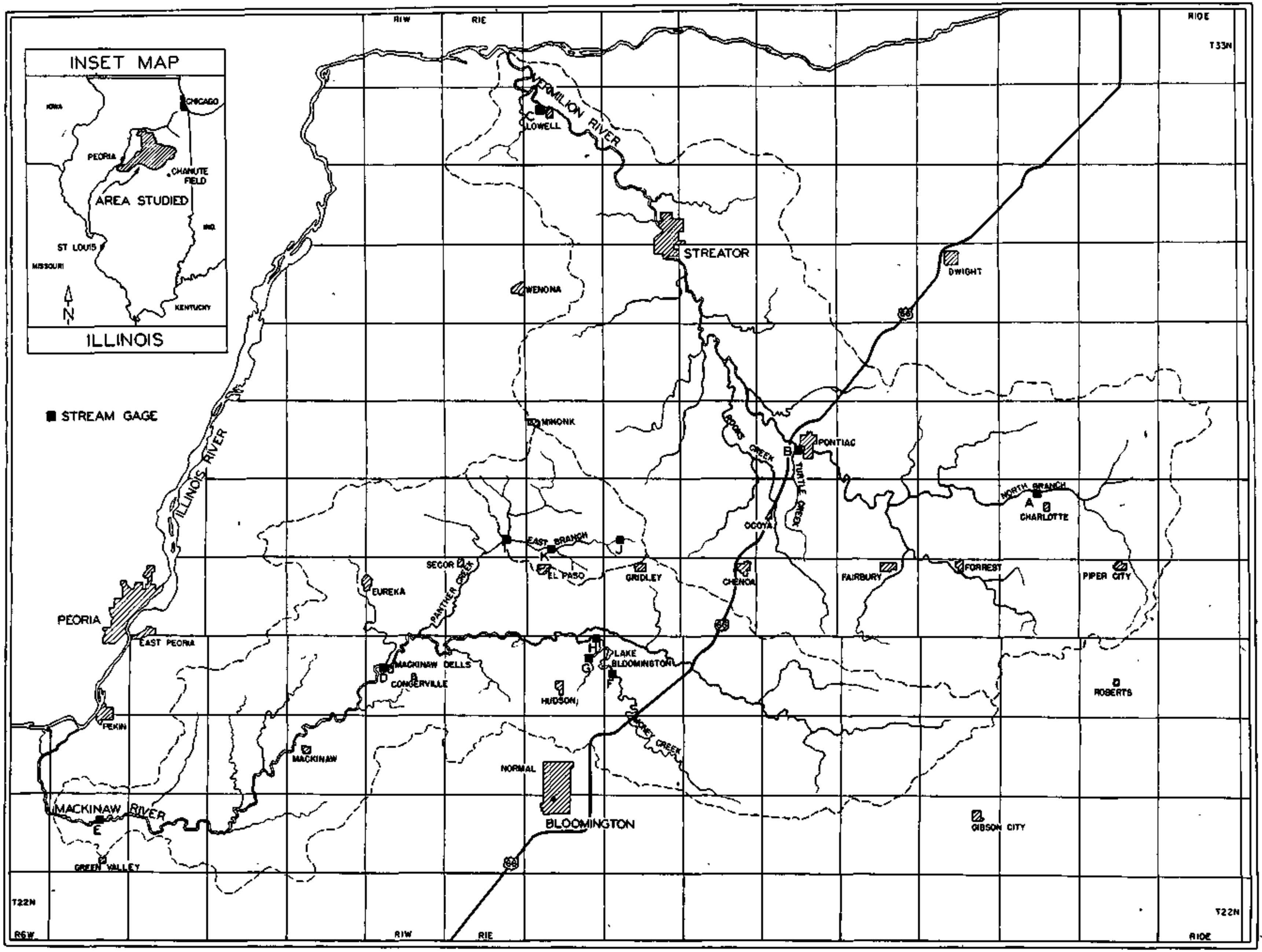


FIG. 1. BASE MAP OF VERMILION AND MACKINAW RIVER BASINS.

FIG. 2. AN 80 FOOT WASHOUT ON THE ILLINOIS TERMINAL RAILROAD NEAR ITS MACKINAW RIVER BRIDGE WEST OF MACKINAW.

Antecedent Conditions

Curves of cumulative (ten-day totals) and daily rainfall amounts, as well as a hydrograph of Well Din the Panther Creek Basin, have been presented to facilitate a better evaluation of the antecedent conditions for the storm of July 8, 1951.

Synoptic Situation

The intriguing synoptic situation associated with this storm necessitates a brief description of the meteorological events characterizing this storm. Therefore, representative surface and upper air charts have been presented, supplemented by pilot reports of attempted flights through the storm.

Radar-Rainfall Analysis

The APS-15 (3 cm.) radar equipment operated by the State Water Survey was used to good advantage during the storm of July 8, 1951. Photographs of the Plan-Position-Indicator scope, taken at intervals during the storm, provide supplementary information about the storm, as well as additional data for the radar-rainfall studies of the Water Survey.

The basic rainfall data, consisting of 350 observations, were determinedby the aid of field observations and recording and non-recording rain gages. These data have been presented in detailed tabular form in the appendix, and provide one of the principal contributions of the present report.

Furthermore, an isohyetal map and area-depth curves have been drawn for the total storm area, with additional, more detailed maps, curves, and intensity data provided for the Panther Creek Hydrologic Project near El Paso, as a part of the Water Survey's comprehensive hydrometeorological study in that area.

Stage-Discharge Data

The Water Resources Division of the United States Geological Survey prepared a summary of the stage-discharge data for the present storm, supplemented by a discussion of the measurements.

These basic data include a detailed description of 11 stream-gaging stations in the two basins. Furthermore, the daily mean discharges throughout July, 1951, and gage heights and corresponding discharges during the flood period from July 8-19, 1951, (or to July 25 for the larger drainage areas), have been presented in detailed tabular form and, when combined with the detailed rainfall data and the land damage survey, provide a complete summary of the basic data available.

Erosion Effects

The Soil Conservation Service conducted a detailed land damage survey in the Mackinaw River Watershed to determine the efficiency of conservation programs under extreme test conditions.

Twenty-four farms with complete conservation farm plans were selected as the basic sample, and twenty additiona1 non-conservation farms were also surveyed to permit a comparative evaluation of the data. This survey provided pertinent facts to supplement the detailed hydrometeorological data discussed above.

Acknowledgement

State Water Survey Division

The investigation of the storm of July 8, 1951 was initiated by the meteorological section of the Engineering Sub-Division, and the basic

FIG. 3. THE SWINGING BRIDGE TO THE CITY PARK AT PONTIAC BECOMES A "SWIMMING" BRIDGE AS THE VERMILION RIVER CONTINUES TO RISE, 10 JULY 1951.

FIG. 4. AN UNDERCUT SLAB ON ROUTE 150 WEST OF MACKINAW DELLS BRIDGE.

FIG. 5. TRANSPORT TRUCKS STALLED ON ROUTE 66 BETWEEN CHENOA AND PONTIAC.

rainfall data was collected by the following men: Kenneth A. Faulk, Raingage Operator; Homer W. Hiser; Herbert E. Hudson, Jr. , Head, Engineering Sub-Division; Douglas M. A. Jones, Assistant Professional Scientist: Bernt O. Larson and W. J. Roberts, both Associate Engineers. Much of the analysis of the data was performed by George F. Beatty and Harry W. Maynard, supervised by Glenn E. Stout, Professional Scientist. The isohyetalmap was prepared by Homer W. Hiser, (assisted by Stanley Changnon, who was also responsible for the drafting required in the present report).

The entire report was assembled and edited by Walter H. Roschke, Jr. , Engineering Assistant, under the supervision of Mr. Herbert E. Hudson, Jr. , Head of the Engineering Sub-Division.

Geological Survey

The Water Resources Division of the Geological Survey, United States Department of the Interior, cooperated with the State Water Survey in collecting and preparing the basic stream flow data. Engineers of the Champaign, Illinois district office, under the direction of J. H. Morgan, District Engineer, and W. S. Daniels, Hydraulic Engineer, prepared the discussion, station description, mean daily discharge , stage-discharge data, and summary of flood discharges for the present storm.

Soil Conservation Service

The Regional Water Conservation Division of the Soil Conservation Service, United States Department of Agriculture, conducted the detailed land damage survey in the Mackinaw River Watershed; the written report was prepared by George Robert Hall of the Milwaukee, Wisconsin office.

Meteorological Data

The basic rainfall data were supplemented by reports of rainfall at the United States Weather Bureau raingages located in the storm area, prepared by Paul Sutton, Section Director, U. S. Weather Bureau, Springfield, Illinois.

The synoptic maps, employed in the study of the meteorological aspects of the storm, were provided by Gordon Dunn, Chief Meteorologist, U. S. Weather Bureau, Chicago, Illinois, while the basic weather teletype data was loaned by the Weather School, Chanute Air Force Base, Rantoul, Illinois.

Others

Mr. Lester Pfister, President of the Pfister Hybrid Corn Company, El Paso, Illinois, cooperated with the State Water Survey in every way, even loaning an automobile to be used in collecting the basic rainfall data.

John McCann of The Pantagraph Newspaper, Bloomington; Harold M. Legg, Pontiac; and the City Council of Pontiac provided pertinent photographs of the storm area.

The American Airlines, Chicago and Southern Airlines, and Ozark Airlines, provided pilot reports of attempted flights through the storm, as well as some of the initial meteorological data.

ANTECEDENT CONDITIONS

Walter H. Roschke, Jr.

State Water Survey

Discussion

An examination of antecedent rainfall conditions at four selected stations located in the region of heavy rainfall for the storm of July 8, 1951, Figure 6, indicates that in the interval from April 1 to June 20 the rainfall was nearly normal at these stations (except Gridley) as-compared with the 45-year standard rainfall for Chenoa, Gridley and Pontiac, as computed by the U. S. Weather Bureau.

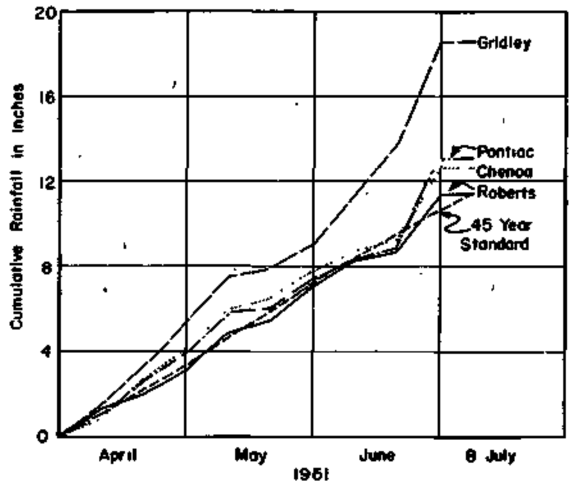


FIG. 6. CUMULATIVE RAINFALL AT SELECTED STATIONS ANTECEDENT TO STORM OF JULY 8, 1951.

A more detailed analysis of rainfall for the above-normal interval of June 21 to July 8, 1951, Figure 7, reveals that heavy rainfall occurred during the June 21 -29 interval, but almost no rain was recorded for the 10-day interval immediately prior to the intense storm of July 8. The small amounts of rainfall in this pre-storm interval indicate that the top-soil had a relatively high infiltration capacity when the July 8 rainfall occurred.

In order to obtain some concept of the moisture condition of the sub-soil, a hydrograph of Panther Creek observation Well D (Well location shown in Figures 23, 24, and 25) is included for the interval of August 1, 1950 to July 31, 1951. An analysis of this well hydrograph, Figure 8, indicates that the groundwater level was relatively high at the time of the July 8 storm.

The existence of unsaturated top-soil and moist sub-soil in the interval immediately prior to this intense storm, indicates that after a relatively short interval of excess rainfall, a large portion of the rainfall would become surface runoff. While maximum discharges were obtained at nine of the eleven stream-gaging stations in the basin, the resulting runoff was not as large as would be expected from the antecedent soil condition, suggesting that a large amount of the rainfall was retained as surface storage due to the relative flatness of the land in the region.

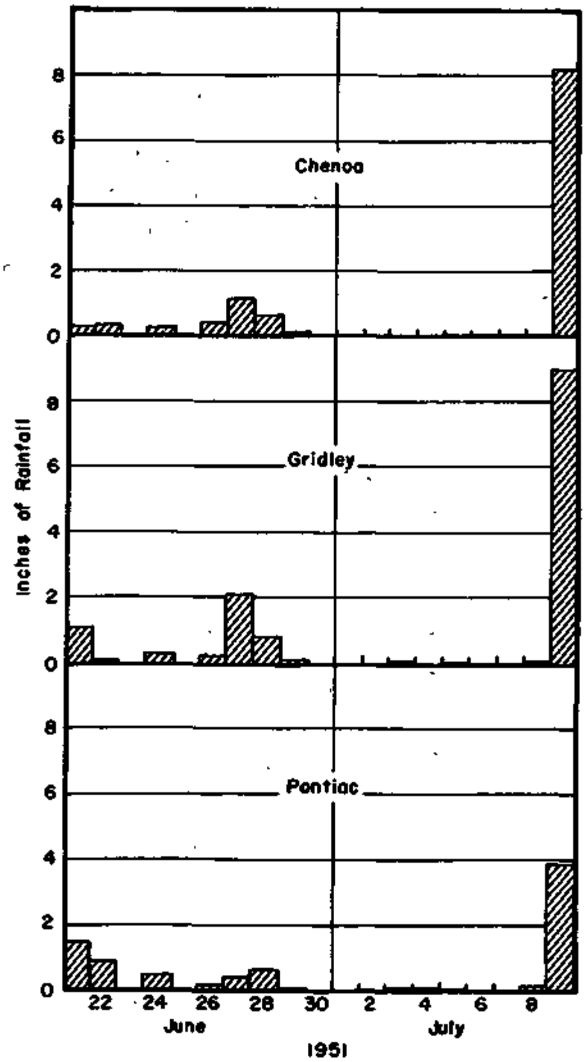


FIG. 7. DAILY RAINFALL AMOUNTS. JUNE 21-JULY 9, 1951.

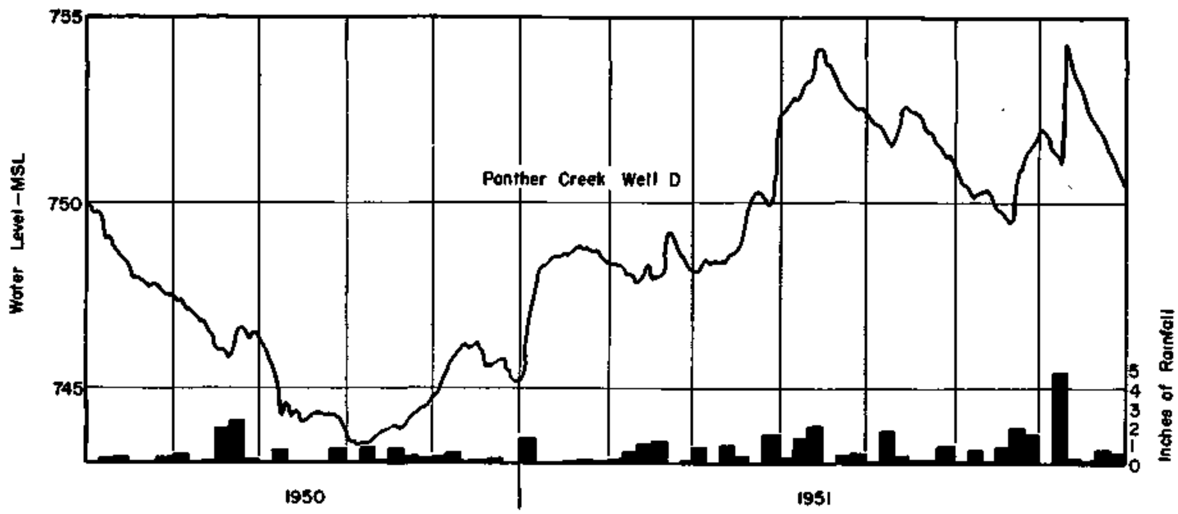


FIG. 8 HYDROGRAPH OF PANTHER CREEK OBSERVATION WELL AUGUST 1, 1950 TO JULY 31, 1951.

SYNOPTIC SITUATION

Harry W. Maynard

State Water Survey

Discussion

On July 7, 1951, the eastern half of the U. S. was dominated by a large high pressure cell, which was centered off the Virginia Capes. A weak trough of low pressure was located over the Great Plains area, accompanied by a weak cold front that formed the boundary between the polar air, to the northwest of the cold front, and the strong southwesterly flow of moist, maritime tropical air, to the southeast of the frontal zone in Illinois, Wisconsin, and Iowa.

During the evening of the 7th, a line of thunderstorms formed near the surface position of the cold front, and subsequently moved rapidly to the southeast, ahead of the front. A line of thunderstorms which behaves in this manner is known as a "squall line", and if there is more than one line of showers, it may be eferred to as a "squall zone".

At 0030* on the 8th, this cold front, extending south-southeastward from the low pressure center in southern Canada and then across northwestern Minnesota, the Dakotas, and Nebraska, was advancing slowly to the southeastward.

By 0630, this initial squall line had reached northern Indiana and Illinois, as shown in Figure 9, with brief heavy rainshowers accompanying its rapid progress across Minnesota and Wisconsin. However, when it reached northern Illinois, the rapid southward motion of this squall line was retarded somewhat and the thunderstorm activity diminished, with the squall line being completely dissipated by 1715. The surface weather data indicates that the direction of motion of this squall line was almost perpendicular to the direction of the surface winds existing at this time.

The upper air winds, at approximately 19, 000 feet, were from the northwest early on the 8 th, shifting to a westerly direction by 0900. This wind shift coincided with the retardation of the squall line along with a reduction of the strength of the strong southwesterly flow of maritime tropical air at low levels. Figure 10 illustrates the flow pattern at the 500 millibar level (19, 000 feet) for 2100.

Almost coincident with the dissipation of the initial squall line, scattered thunderstorms began to develop some 60-100 miles northwest of Champaign, Illinois; and a second, more intense, squall line developed, extending across the Vermilion and Mackinaw Basins by 1830 , as shown on the Surface Weather Map presented in Figure 11. The very intense rainfall discussed in this report was associated with the thunderstorm activity in this second, more intense, squall line.

Both the squall lines discussed above were also recognizable on the Plan -Position -Indicator radar scope, operated by the State Water Survey at the University of Illinois Airport south of Champaign, Illinois, permitting a much more detailed analysis of the squall line than would ever have been possible from the weather reports alone.

***All times listed are Central Standard Time.**

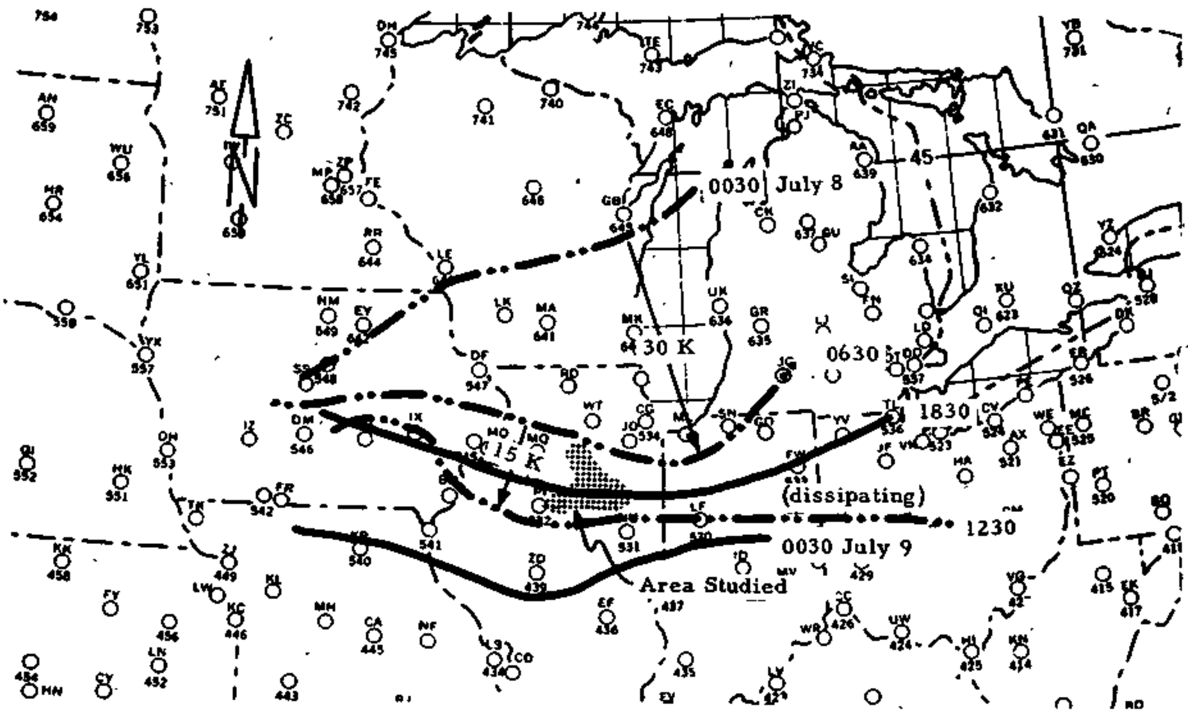


FIG. 9. SUCCESSIVE POSITIONS OF SQUALL LINES, (K - nautical miles per hour).

The synoptic weather reports, while being somewhat far apart both in time and space for a detailed investigation of a storm of this magnitude, are valuable, however, as a supplement to the radar analysis, which will be discussed in a subsequent section.

<u>Pilot Reports of Attempted Flights Through Storm</u>

The extreme violence of this storm is indicated in the following report by the pilot of a DC-6, Flight Captain F.W. Jeberjahn, who attempted to fly across the flood area. Captain Jeberjahn, who was in charge of American Airlines Trip 152, Dallas to Chicago, has many years of experience in both military and commercial flying, and is considered very conservative in his manner of performance. In both cases of penetration into the thunderstorm area, precautionary measures had been taken to reduce the effects of turbulence, as much as possible, by reducing the air speed to the minimum for that type of flight, (approximately 160 miles per hour).

Following is Captain Jeberjahn's account*, "Out of Dallas planned 17, 000 and it was CAVU (Ceiling and Visibility Unlimited), to lower Missouri. Saw the build-ups ahead from about Vichy, Missouri, quite some distance north. It looked about average, nothing different in appearance from the usual thunderstorm zone we often see. Changed flight plan north of St. louis, descended to make balance of trip, Springfield, Illinois to Chicago, at low levels (3000), because of the thunderstorms ahead. Entered ctouds north of Springfield and it became moderately rough. Changed to a more easterly heading to get out of the clouds and thunderstorms, but roughness increased, and at about 25 to 30 miles east of Pontiac, Illinois, decided to return southward.

Returned to Springfield and landed at 2105 CST with plan to hold a couple of hours. Nothing unusual about that part-of the trip and returned mostly because of the thunderstorms reported all the way to Chicago with holding probable in Chicago area control pattern.

"Took off again at 2350 CST planning 7000 to see if it would be above the scud clouds and turbulence previously encountered at 3000. At 7000 we were mostly between layers, well above the lower stuff. Necessary to do a bit of detouring to avoid penetrating some build-ups and only slight, to occasionally moderate turbulence. Upon reaching 7000 after take off, there was the most vivid lightning display I have ever seen. It was practically a continuous arching, with the entire area lit up to the extent that, even wearing sun glasses, there was partial blindness in the cockpit. A few minutes after take off and reaching 7000, I was making a slight turn, to avoid what appeared to be an ordinary cumulus cloud building up, when we were sudde'nly enveloped by clouds.; violent turbulence ensued, the worst I ever encountered. ** I immediately made a 180 degree turn to get out of there, but it seemed an <u>awful</u> long time to me, ten minutes or so, but probably somewhat less; but fighting it the way we were, it really seemed a long time. We encountered only light precipitation in gen-

*Courtesy R. L. Curre. Assistant Supervisor, American Airlines, Inc., Chicago, Illinois.

**One tornado struck the Panther Creek area about 9:00 p. m. ; although high winds prevailed throughout the storm area, wind damage was rather slight.

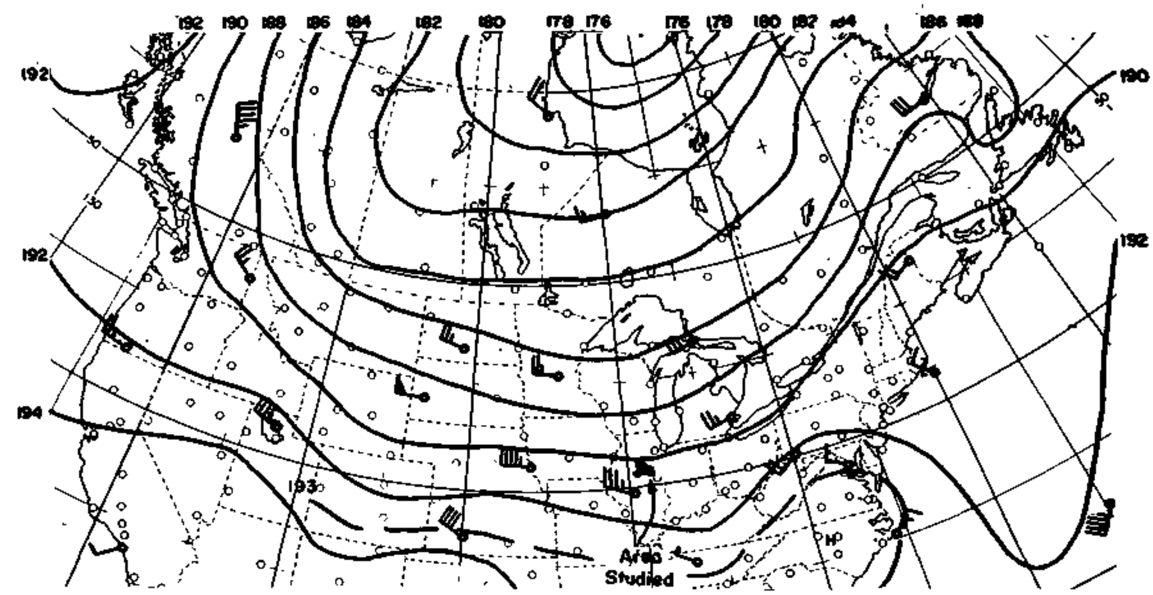


FIG. 10. UPPER AIR MAP FOR 2100 CST. 8 JULY 1951, (500 millibars - 19.000 feet).

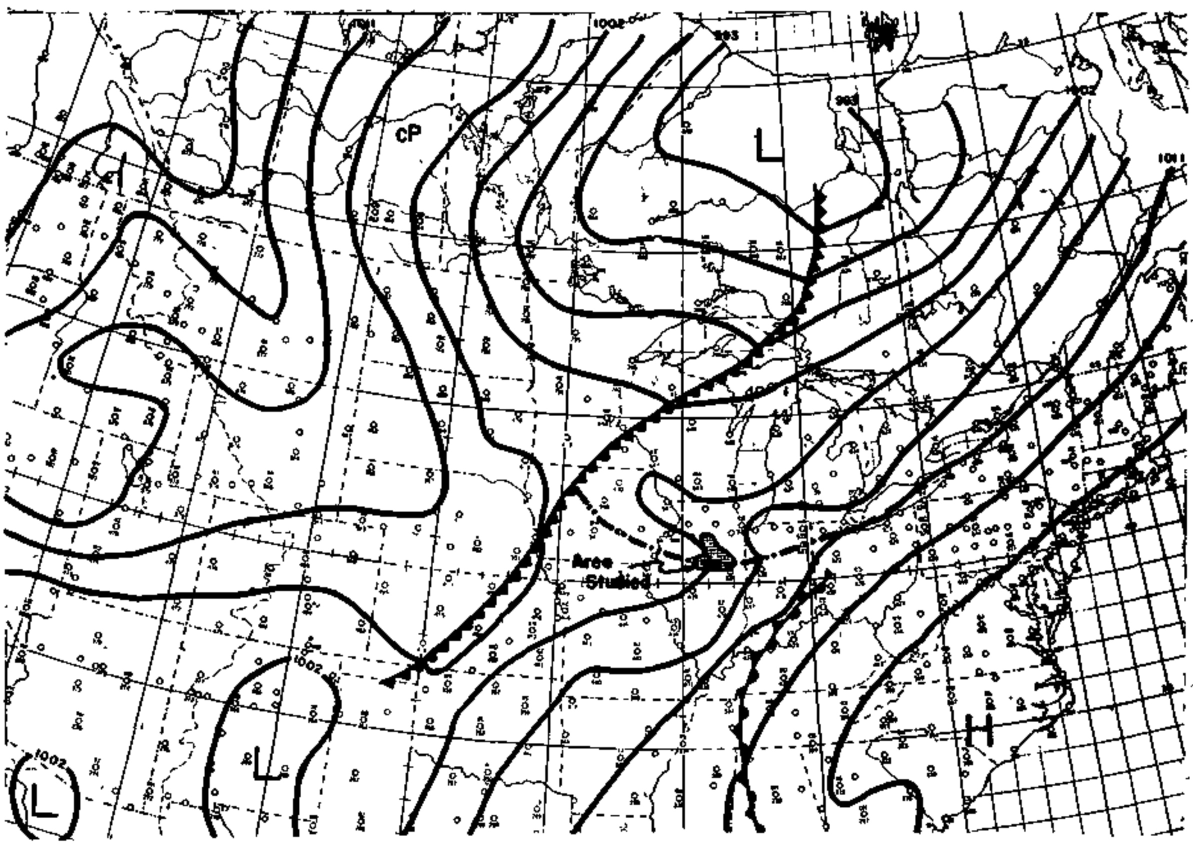


FIG. 11. SURFACE WEATHER MAP FOR 1830 CST, 8 JULY 1951.

eral, probably because of the shower character and my endeavours to avoid the buildups. Precipitation was only moderate, except for a very brief heavy hail shower in the latter few minutes that I was in the severe turbulent area. After seeing and reading about the widespread floods caused by that storm, I was surprised about the generally light precipitation I encountered. We came out some distance east of Springfield and I returned to Springfield. Was glad to get on the ground after that. Trip was deferred until next morning!"

A somewhat similar experience was reported by the pilot of Chicago and Southern Air Lines, Flight 70, St. Louis to Chicago. Following are the pilot's remarks***, "After take off at St. Louis, (1657 CST), planned 7000 feet; could see the build-ups, north through southwest, with cloud tops at 4000 feet, and a very square eastern edge. Let down to 3000 feet and encountered heavy turbulence in the clear for about two minutes before entering storm. Very frequent, brilliant cloud to ground lightning was noticed. Turned around in the storm just north of Pontiac in severe turbulence at 3000 feet (1814 CST) and experienced severe turbulence even five minutes south of the storm. Intense static blocked St. Louis range signals until 30 miles out. Landed at Springfield, 1838 CST. "

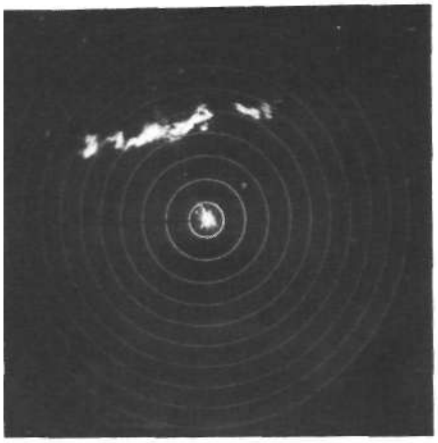
RADAR-RAINFALL ANALYSIS

H. W. Maynard and G. E. Stout

State Water Survey

Radar

Analysis of the radar data for the storm of July 8, 1951 utilized photographs of the APS-15 radar scope operated by the State Water Survey at the University of Illinois Airport on Route 45 south of Champaign. Figure 12 shows the Plan-Position-Indicator (PPI) scope, which presents a map or picture of the region around the radar station located at the center of the scope; distance between range lines is 10 nautical miles. Raindrops reflect radar signals so that rain showers appear as bright "echoes" (white spots) on the radar scope. (The bright area in the center of the scope is ground return from objects in the immediate vicinity of the radar station.)



1906 CST

FIG. 12. PLAN-POSITION-INDICATOR RADAR SCOPE (APS-15) OPERATED AT THE UNIVERSITY OF ILLINOIS AIRPORT NEAR CHAMPAIGN SHOWING THE SECOND SQUALL LINE ON 8 JULY 1951, (100 mile radius).

Detailed data were obtained on both the initial squall line (that dissipated southeast of Champaignby 1715*) and the second more intense squall line that produced the heavy rain and resulting floods in the Mackinaw and Vermilion basins. While a large amount of data is available, only a few pertinent scope pictures of the second squall line have been included.

An examination of the radar scope photographs indicated that the initial squall line passed the Champaign radar station at about 1400 traveling at an average speed of 20 knots, and was completely dissipated to the southeast of Champaign by 1715. In general, the radar echoes associated with this squall line were rather weak and scattered.

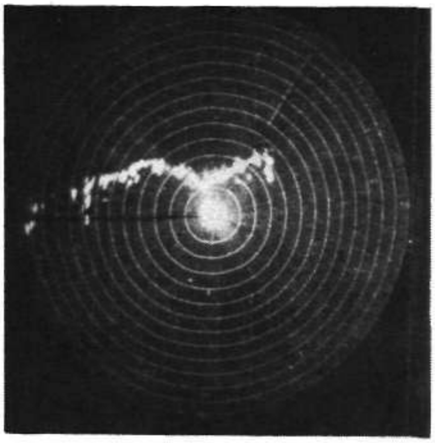
Coincident with the dissipation of this first squall line, scattered thunderstorms began to develop 60 - 100 miles northwest of the radar station, and strong southwesterly winds reappeared in the low levels of the atmosphere. By 1730 a definite line of storms had formed about 70 nautical miles northwest of Champaign, orientated NE-SW; unlike the earlier storms, this second, more intense squall line produced well defined, bright echoes on the radar scope.

By 1906 rain was falling over the Vermilion-Mackinaw basin, and an almost solid line of echoes extended E-W across the southern portion of the watershed region and a considerable distance southwest and northeast of the area, as shown in Figure 12. The individual echoes were moving from west to east at about 30 knots.

The depth of this second, more intense squall zone cannot be accurately determined from the radar pictures, because the heavy rains attenuated the radar signal (APS-15 set)

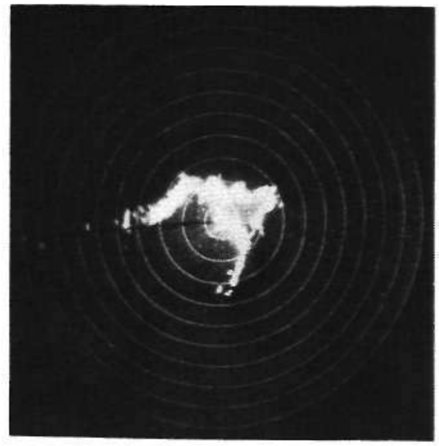
*AU times listed are Central Standard Time.

***Courtesy E. B. Buxton, Superintendent of Meteorology, Chicago and Southern Air Lines.



2215 CST

FIG. 13. PLAN-POSITION-INDICATOR SCOPE FOR 8 JULY 1951; SECOND SQUALL LINE APPROACHING CHAMPAIGN, (140 mile radius).



0002 CST

FIG. 14. PLAN-POSITION-INDICATOR SCOPE FOR 9 JULY 1951, (100 mile radius).

to such an extent that it could only penetrate 10 miles into the storm. However, a study of the recording rain gage records shows that it was raining over most of the northern portions of the watershed at this time, indicating that the squall zone was at least 30 miles in depth. At the height of the storm, Figure 13, (2215 CST) the line of echoes was 150 miles in length and approximately 50 miles in depth, as evidenced by thunderstorm activity and rainfall reports in the flooded area.

The second squall line moved rather slowly southward, resulting in the storm remaining over a particular region longer than normal. The leading edge of the storm reached the Champaign radar station shortly after midnight, as shown in Figure 14. The squall zone became nearly stationary 50-100 miles south of Champaign on the 9th. However, the rainfall was not exceptionally heavy in the area, and in 24 hours this storm had also dissipated.

The upper air sounding, (RAOB), taken at 2100 at Chanute Field (RAN), Figure 15, shows that there was about 2. 11 inches of precipitable water in the atmosphere of the storm region at that time, indicating that excessive convergence and vertical motion were present in the atmosphere.

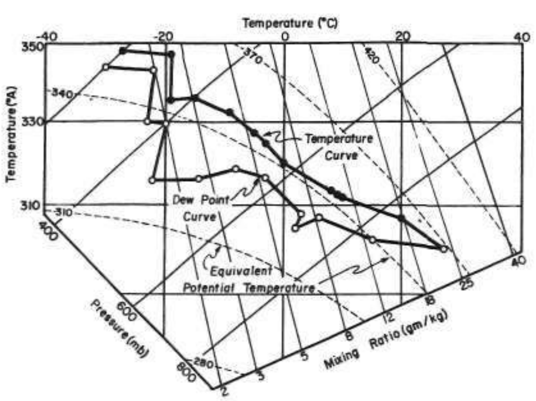


FIG. 15. TEPHIGRAM , (Chanute Field); SOUNDING AT 2100 CST, 8 JULY 1951.

Rainfall

Rainfall measurements were made at 350 points for the storm of July 8, 1951 over the Vermilion and Mackinaw basins. These data include 280 field observations obtained by two meteorologists and three engineers of the Water Survey's staff, as well as reports of 29 recording and 20 stick-gages operated by the Water Survey and 21 U.S. Weather Bureau gages.

The Water Survey's Panther Creek Hydrologic Project includes 44 of these gages, consisting of 25 recording gages within the basin, and surrounded by 1 recording and 16 non-recording gages, (plus 2 of the 21 gages operated by the U. S. Weather Bureau in the storm area). The remaining gages operated by the Water Survey include 2 recording and 3 non-recording gages in the Money Creek basin near Lake Bloomington, while an additional recording and 8-inch stick gage are located in the vicinity of Peoria.

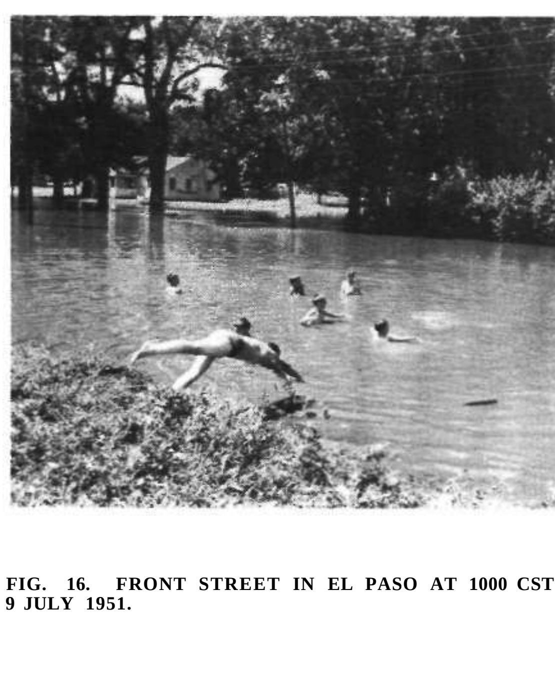


FIG. 16. FRONT STREET IN EL PASO AT 1000 CST ON 9 JULY 1951.

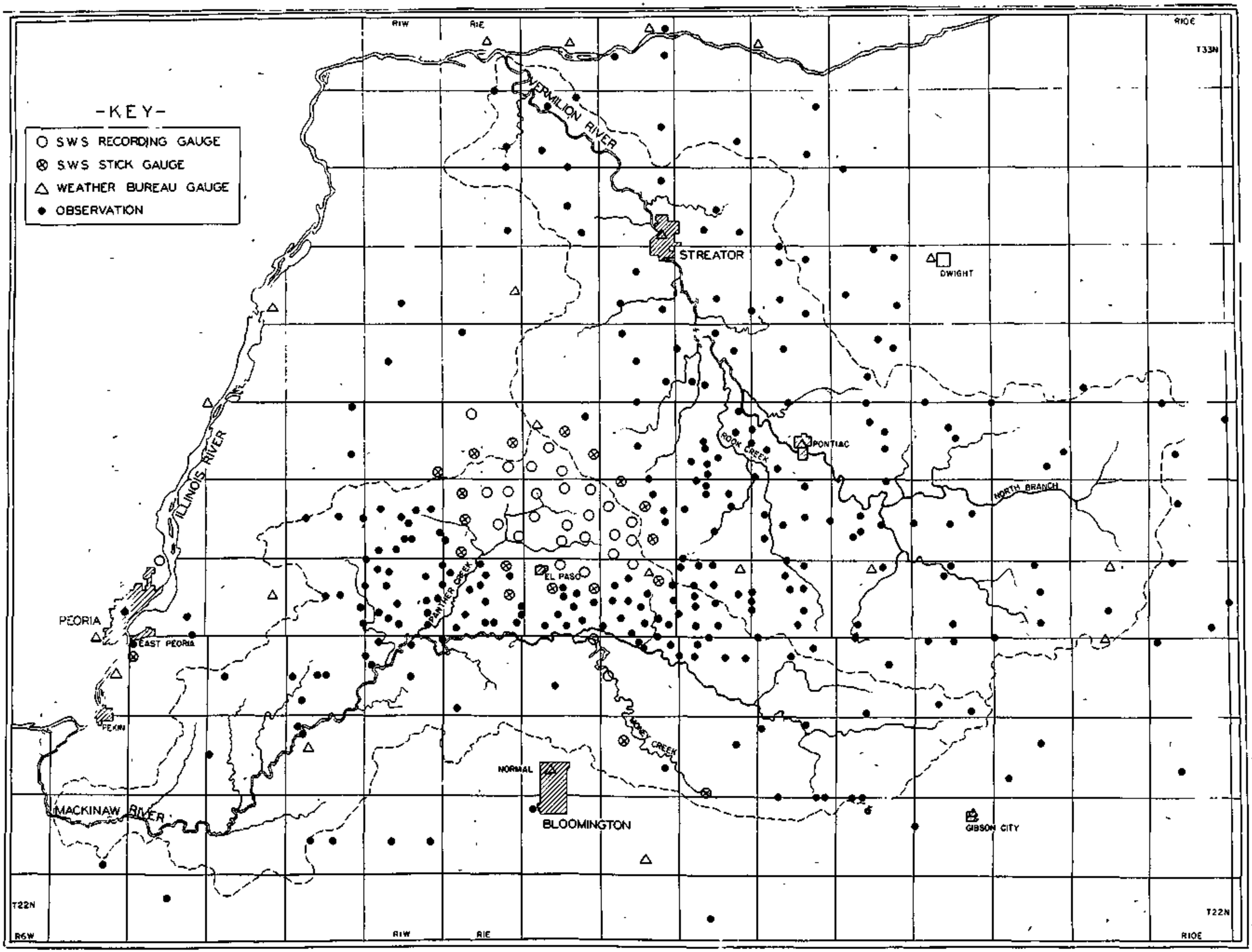


FIG. 17. LOCATION OF 350 POINT RAINFALL OBSERVATIONS LISTED IN APPENDIX.

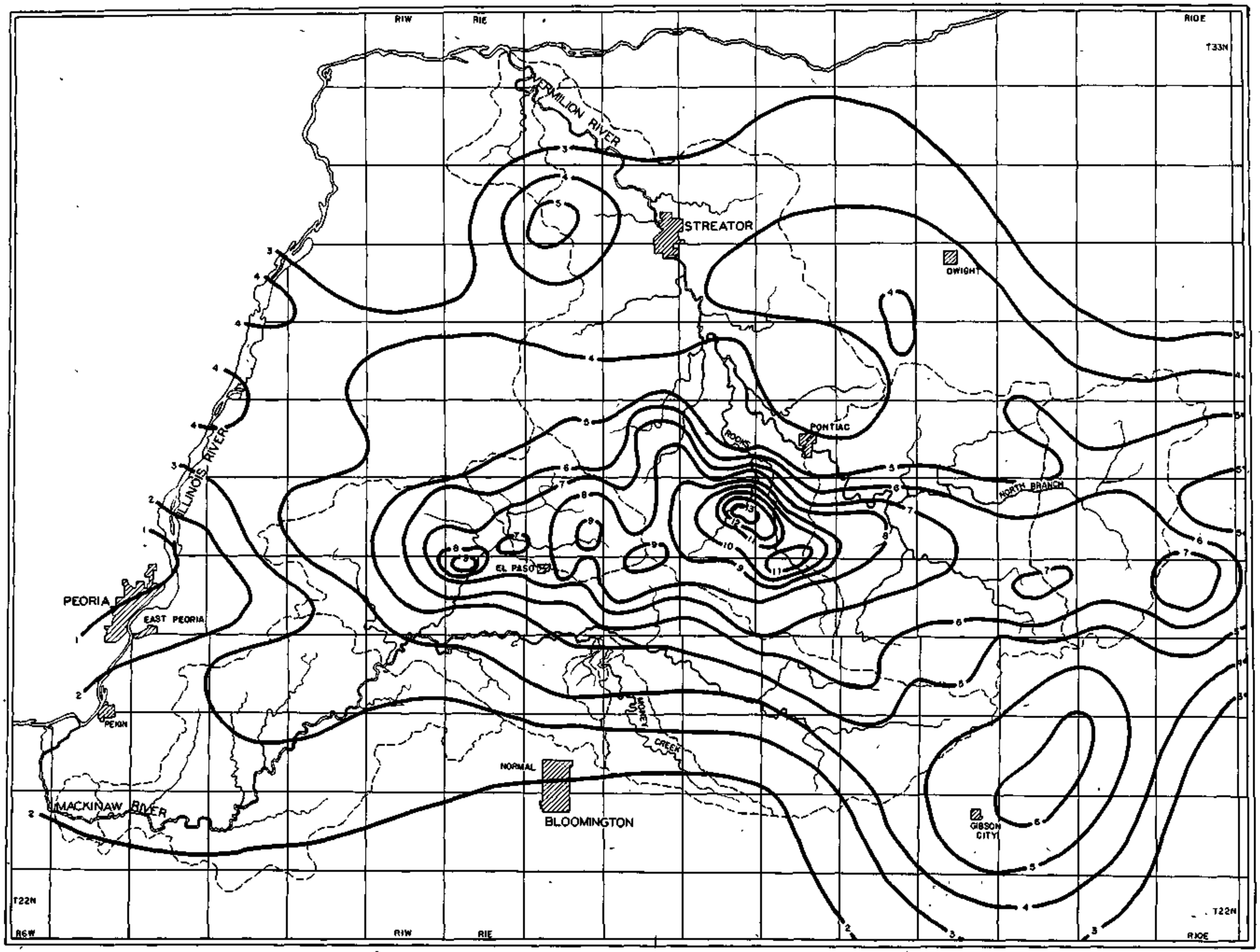


FIG. 18. ISOHYETAL PATTERN FOR THE TOTAL STORM RAINFALL.

Figure 17 shows all the points of rainfall observation; the boundaries of the two watersheds that were flooded are indicated by a dashed line, and the small black dots indicate the observations collected by a member of the Survey staff.

Reliability of Data

In view of the extremely heavy rainfall associated With this storm, every precaution was employed to obtain reliable data.

Since almost all of the rain gage collector tubes overflowed, Water Survey personnel visited the Survey's stations as soon as the water subsided, and in several cases the cooperating farmer waited for someone to help him in measuring the total catch. Most of the U. S. Weather Bureau observers have made weather observations for years, and their data may also be considered as most reliable.

In addition, the meteorologists and engineers conducting the field survey carefully inspected each observation site and noted the type of measuring device employed. An examination of the basic rainfall data contained in Tables 3, 3A, and 3B of the Appendix shows that the following types of gages and containers were utilized in determining the rainfall amounts: Friez-and Stevens weighing - bucket recording gage, tipping-bucket gage, 8-inch stick gage, glass-tube fence-post gage, feed, milk, and 5-gallon paint buckets, various sized crocks, and even a dog's pan. The glass-tube fence-post gages, which are found on almost every farm, have prpved valuable in defining the isohyetal pattern. These are 3/4 inch diameter glass or plastic cylinders, usually 5.5 inches long, mounted in metal holders that are graduated in inches. They are designed tobe nailed tofence posts and usually located with good exposures. During the July 8-9 storm many of them overflowed, but a number were emptied-during lulls in the storm on the evening of July 8 and thus gave good data on the total storm rainfall.

The careful collection of rainfall data by personnel of the Water Survey and the U. S. Weather Bureau provides an abundance of reliable data for this storm, and the detailed tabular presentation should prove useful for additional, more detailed analyses. .

Total Storm Rainfall

The isohyetal pattern for the total storm rainfall is shown in Figure 18. Note the tight isohyetal gradient between the 13 inch line and the city of Pontiac; in a distance of 5 miles, the rainfall varied from 5 to 13 inches. While such steep rainfall gradients are quite common, this magnitude of rainfall variation is detectable only when dense raingage networks are employed.

Duration

The duration of rainfall was greatest in the area of heaviest rainfall. Although there were actually no recording gages near the 13-inch isohyetal, the recording gages in the immediate vicinity verify observer reports that it rained 5 to 6 hours. Figure 19 was obtained from a few selected rainfall charts; only one of 25 gages in the Panther Creek network is shown. In areas where the amount of rainfall was less, the duration of rainfall was generally 2 to 4 hours. The Lake Bloomington record illustrates the rainfall as it fell over that area after the main storm area started to move southward. (The Wenona, Piper City and Fairbury mass rainfall curves are taken from U.S. Weather Bureau records) .

Intensity

The rainfall intensities, as compiled from all of the recording raingage stations, are presented in Table 1. Also, included, (at the bottom of the table), is a point-rainfall record of July 28, 1948 which was measured by a Survey recording gage west of Minonk. This storm was limited to a very small area. Radar records indicate that three individual-storms converged from different directions over this rain gage.

The rate of rainfall over the Panther Creek Networkis well illustrated by the curve for station 24, Figure 19, indicating that there were several individual "bursts" or cells of rainfall. While this follows the typical thunderstorm pattern, as outlined in "The Thunderstorm"[1] the durations of the "bursts" are much longer than the average life of a thunderstorm cell. Note that the rate is virtually constant for station # 24 in Figure 19 for approximately 90 minutes . The Piper City curve shows little change of rate for a similar period.

Area-Depth Data

Area-depth curves of the total storm rainfall, Figure 20, were drawn for both the Vermilion and the Mackinaw Basins, and for their combined watersheds. The portions of the curves for small areas are considered ques-

"The Thunderstorm", a joint project of the U. S. Air **Force, Navy. Weather Bureau, and National Advisory Committee for Aeronautics,** 287 pp. illus., Washington, D. C , **U.S. Government Printing Office, June, 1949.**

Table 1. RAINFALL INTENSITIES[1] - Recording Gages

Station	No.	(5)	(10)	(15)	(30)	(60)	(120)	(180)	(240)	(300)	(360)
					Time Periods in Minutes						
L. Bloomington		0.45	0.88	1.22	1.90	2.91	4.14	4.67	4.75	4.95	5.20
Piper City				0.73	1.80	3.12	4.77	4.97	5.67	6.31	6.72
Wenona				0.70	1.10	1.95	2.20	2.83	3.62	3.72	3.92
Peoria L. & D.				0.63	1.26	1.75	2.21	2.21	2.21	2.21	2.31
Fairbury				0.90	1.70	2.40	4.11	4.90	6.48	6.88	7.25
Panther Creek	25				0.95	2.05	4.20	4.39	----	----	9.15[2]
	24				1.55	2.50	3.72	4.86	6.60	8.05	8.49
	2				1.15	1.80	2.65	3.29	4.13	4.80	5.28
	9				1.45	2.40	3.23	4.22	5.73	6.33	6.54
	3				0.80	1.50	2.48	3.18	4.31	4.76	5.19
	4				0.90	1.68	2.16	3.01	4.23	4.67	4.90
	5				1.21	1.84	3.01	3.67	4.81	5.30	5.39
	6				0.98	1.68	2.84	3.58	4.13	5.07	5.63
	7				0.91	1.63	2.51	2.71	3.64	4.86	6.33
	8				1.10	2.04	3.47	4.06	5.34	6.58	6.64
	10				1.08	2.25	3.72	3.94	----	----	8.15[2]
	11				0.98	2.00	3.68	3.72	4.55		7.27[2]
	12				1.90	3.00	4.58	5.55	7.00	7.98	8.13'
	13				2.13	3.21	4.25	6.30	----	----	8.49[3]
	14				1.32	2.19	3.80	4.37	5.97	7.52	8.15
	15				0.85	1.52	2.54	3.42	3.99	5.23	7.54[2]
	16				1.47	2.40	3.62	4.50	5.76	6.58	6.78
	17				1.04	1.89	3.64	3.74	5.16	6.77	7.76
	18				1.96	2.98	3.87	5.91	----	----	9.0+[3]
	19				1.23	2.08	—	—	—	—	7.80
	20				1.28	2.40	3.72	5.04	—	—	8.14[2]
	21										7.82[4]
	22				2.04	2.80	3.48	4.43	5.91	6.74	6.79
	23				1.51	1.88	2.86	3.46	5.40	7.10	7.25
	44				1.55	1.57	1.94	2.74	3.47	3.94	4.08
	1				1.25	1.82	2.54	3.93	4.68	5.22	5.38
Minonk, Storm of June 28, 1948											
Panther Creek	44			1.90	3.10	3.70	4.38	4.38	4.38	4.38	4.38

[1] Amounts as read from chart, not corrected.
[2] Non-reversible gage; total catch measured.
[3] Gage flooded
[4] Tipping-bucket gage, chart never changed on Sunday, (total catch measured).

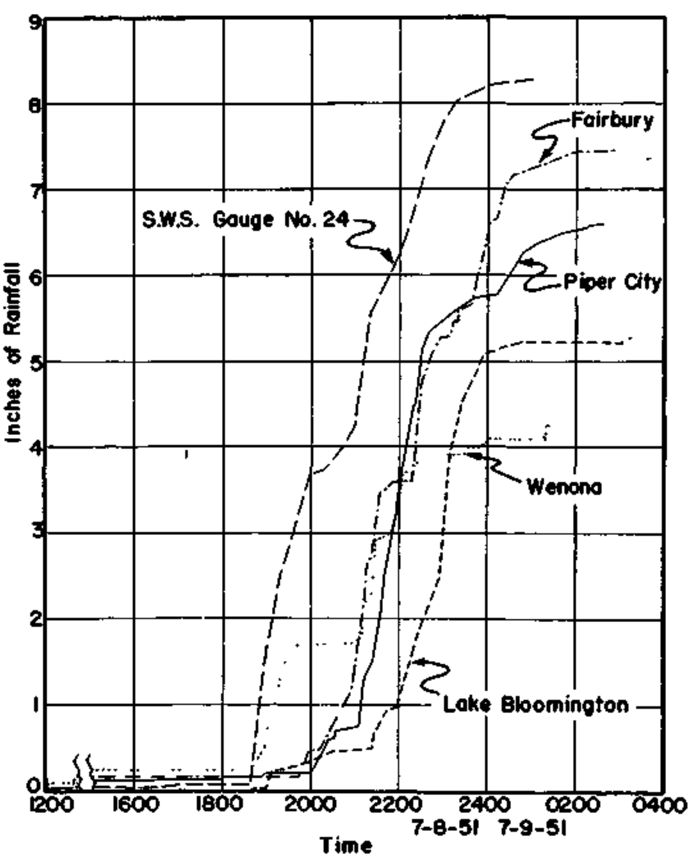


FIG. 19. MASS CURVES OF RAINFALL FROM SELECTED STATIONS.

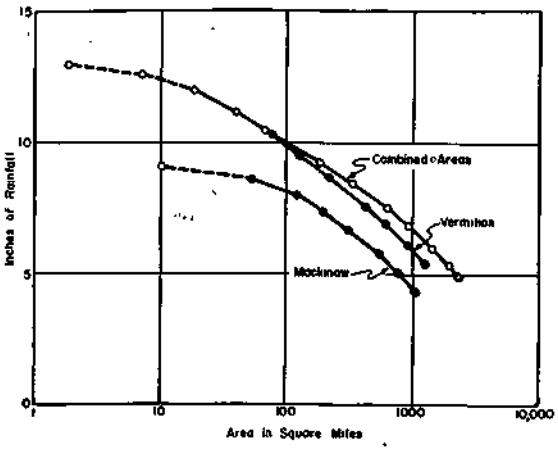


FIG. 10 AREA-DEPTH CURVES, IOTAL STORM RAINFALL.

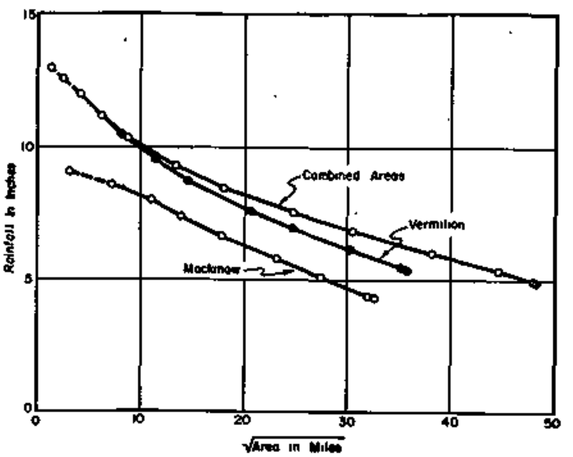


FIG. 21. √AREA-DEPTH CURVES, TOTAL STORM RAINFALL.

tionable since the position of these isohyets is determined by a small number of observations. In addition, the portions 01 the curves corresponding to large areas are somewhat unrepresentative, since the isohyets do not close within the area studied. The 6-hour average depths of rainfall for the individual as well as the combined basins is presented in Table 2 for areas of 10, 20, 50, 200, 500, 1,000 and 2,000 square miles.

Table 2. 6-Hour Average Depths of Rainfall, in Inches.

Area in Square Miles	Mackinaw Basin	Vermilion Basin	Combined
10	9.1	12.4	12.4
20	8.9	11.9	11.9
50	8.6	10.9	10.9
- 100	8.2	- 9.9	10.0
200	7.3	8.9	9.15
500	5.9	7.3	7.9
1000	4.5	5. 95	6.7
2000	---		5.3

The same data was used to plot curves of. total rainfall vs. the square root of the area enclosed by the isohyet, after a method discussed in a pending publication by Huff and Stout. The concept of total rainfall vs. the square root of the area is relatively new in the literature, and is the result of hydrometeorological investigations in the Panther Creek Basin by the Illinois State Water Survey.

These particular curves, Figure 21, of depth vs. square root of the area, show a characteristic straight line plot except at their extremities. The extreme upper and lower portions of the curve may not be representative for the reasons stated above. The results of the present storm indicate that Huff's concept may be extended to even larger watersheds than those considered in the original paper, which were for areas of 5.2, 95, and 280 square miles. ,

An area-depth curve for the Panther Creek watershed, Figure 22 was also prepared. The curve is not considered to be fully representative, since only a few isohyets close within this relatively small basin area.

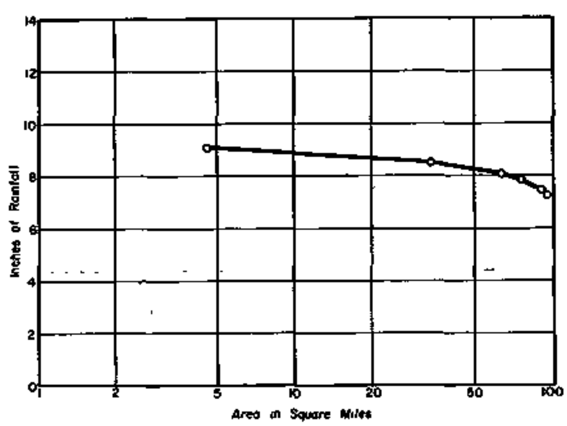


FIG. 22. PANTHER CREEK AREA-DEPTH CURVE.

Panther Creek Data

Since precise rainfall data were available for the Panther Creek Hydrologic Project, detailed isohyetalmaps were prepared. To facilitate a better understanding of the nature of the storm, the cellular structure, and the movement and dissipation of cells, considerable time was spent in preparing 15 and 30 minute rainfall maps. However, a successful relationship was not established due to the weekly charts employed which made it impossible to correct precisely for chart and clock errors that were inherent in the network.

The first 2 hours of the storm, Figure 23, indicates that the center of the network received more than 4 inches of precipitation. The storm was thought to be almost stationary during this

[2] **F. A. Huff and G. E. Stout, (Illinois State Water Survey), "Area-Depth Relations for Small Basins in Thunderstorm Rainfall," pending publication in Transactions of the American Geophysical Union.**

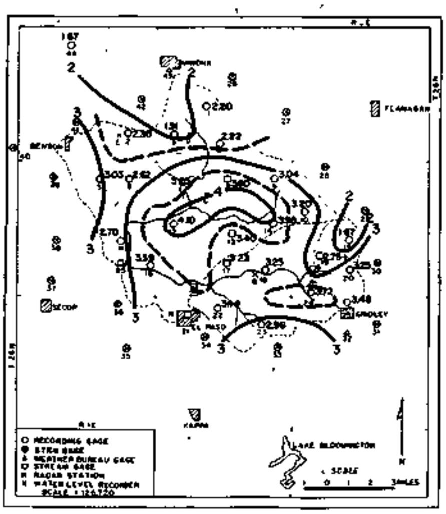


FIG. 23. PANTHER CREEK 1SOHYETAL PATTERN FOR FIRST 2 HOURS OF STORM. (1900-2100 CST).

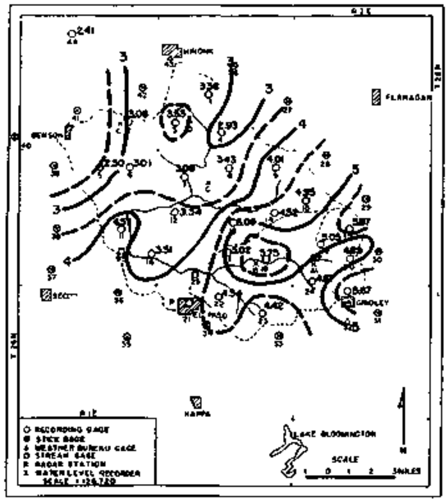


FIG. 24. PANTHER CREEK ISOHYETAL PATTERN, LAST 4 HOURS OF STORM, (2100-0100 CST).

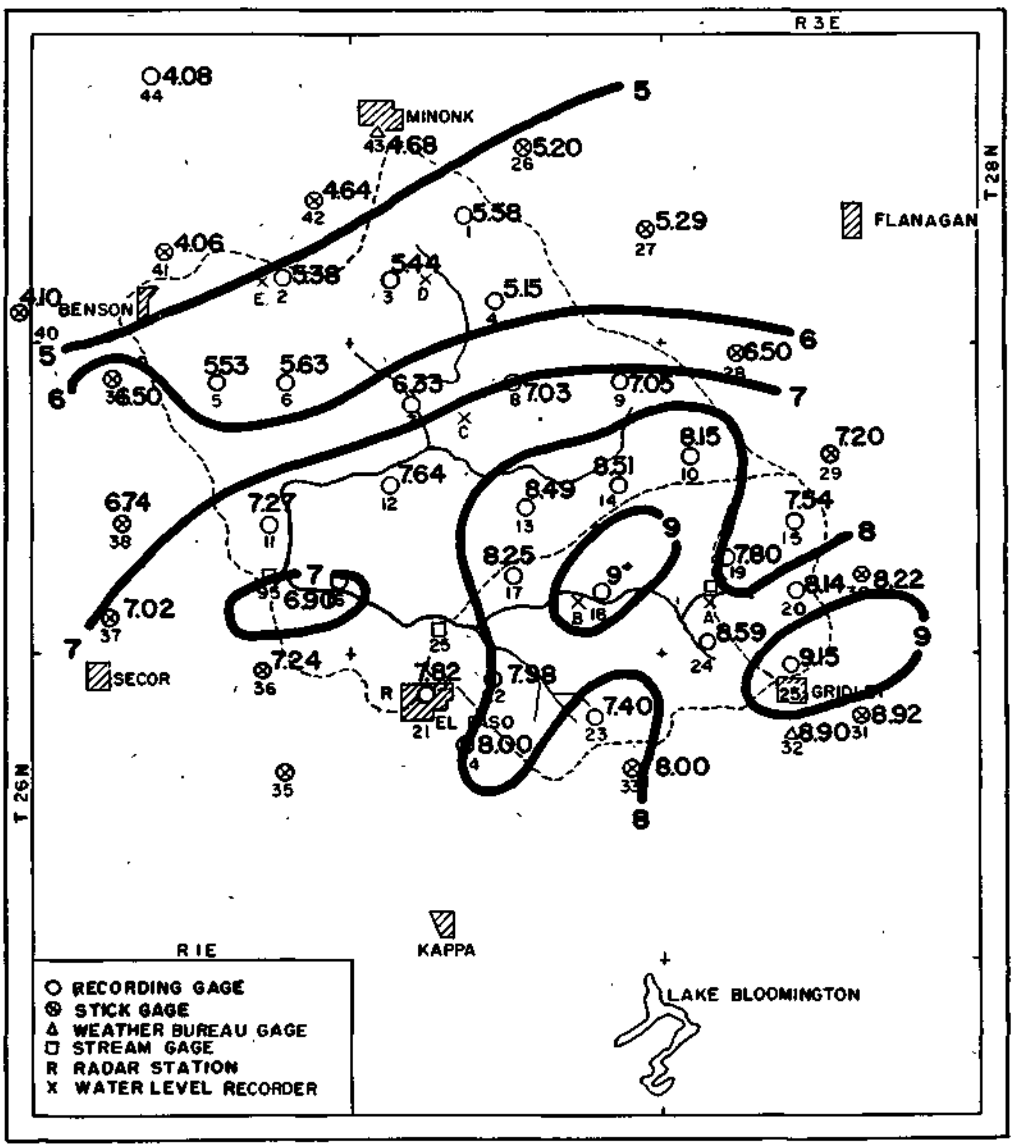


FIG. 25. PANTHER CREEK ISOHYETAL PATTERN FOR THE TOTAL STORM RAINFALL.

period. Figure 24, which presents the storm during the last four hours, shows the southeastward drifting of the main storm cell into this area. The total storm rainfall for Panther Creek is shown in Figure 25. It should be rioted that the heaviest rainfall struck the southeastern portion of Panther Creek, also known as the East Branch of Panther Creek. During the four years of the Panther Creek study, this area has consistently received the heaviest rainfall, with one exception: the storm of June 28, 1948 west of Minonk, as indicated in Table 1.

STAGE AND DISCHARGE RECORDS FOR STORM PERIOD

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Discussion

The Water Resources Division of the United States Geological Survey operates eleven stream-gaging stations in the Vermilion and Mackinaw River Basins under cooperative agreement with the Illinois State Water Survey. The Chicago District of the Corps of Engineers, U. S. Army, is cooperating also on three of the stations. Of the eleven stations, three are on the Vermilion River, two on the Mackinaw River, and two groups of three stations each are in the Panther Creek and Money Creek Basins, tributary to the Mackinaw River. In addition, the State Water Survey has furnished a record of stage at Lake Bloomington.

A complete and satisfactory gage-height record for the flood was obtained at all eleven stations. At Panther Creek near El Paso the peak stage reached the instrument shelf on which the recorder rests, so it was necessary to construct the graph for the three-and-a-half-hour period during which the peak occurred, using the elevation of the floodmark in the gage house. Another floodmark inside the wire-weight gage box on the bridge gave the same peak elevation.

At each gaging station the Geological Survey has an observer, who reads the gage at least twice daily at non-recording stations, or inspects the recorder weekly at recording stations. Each observer is instructed to telephone the district office at Champaign whenever a storm has caused the stream to reach, or exceed, a predetermined stage above which additional discharge measurements are needed to define the stage-discharge relation curve. In the Panther CreekBasin arrangements had been made to get warning in advance of, or during, a heavy storm from the radar station at El Paso. This system of flood warnings is necessary, particularly on small drainage areas or flashy streams, to enable engineers toget to the station for measurements before the flood has passed.

During this flood the warning system was only partially effective. Heavy showers in Champaign the night of July 8 led to the belief that high water might be expected somewhere. The first reports received on Monday morning

***Published with the approval of the Director, U. S. Geological Survey.**

FIG. 26. VERMILION STREET BRIDGE, (looking south), AT PONTIAC, ON 11 JULY 1951; ABOUT 0. 5 FOOT BELOW CREST.

FIG. 27. VERMILION STREET BRIDGE, (looking south), AT PONTIAC, NEAR THE END OF AUGUST, 1951. (Published by permission of the City Council of Pontiac).

FIG. 28. MACKINAW RIVER AT THE OLD BIG FOUR BRIDGE; MAIN CHANNEL IS NORMALLY BEYOND THE TREES IN THE BACKGROUND.

FIG. 29. PANTHER CREEK NEAR SECOR (southwest from Route 24), ON 10 JULY 1951.

(between 8 and 9:30 a.m.) were from the Iroquois River Basin, to the east of the Vermilion River Basin and along the Indiana line. Two parties were sent to the area immediately.

Unfortunately, because of communications failures, no word of the magnitude of the storm in the El Paso area was relayed from the radar station until Monday noon, ten hours after the storm ended. The observer for East Branch Panther Creek at El Paso telephoned a report at 1:40p.m. He had been unable to get to the gage earlier and had also been delayed by interruptions in telephone service. A party was sent to El Paso and obtained a high measurement on the East Branch that afternoon. Realizing that the peak had passed the upstream station near Gridley even earlier, the party concentrated its later efforts on the main Panther Creek station near El Paso. This station was all but inaccessible because of flooded or muddy roads, but was reached at about 9 p.m. As water was five feet deep over the road on the left side of the bridge and no boat equipment was available, a measurement at the station was impossible. However, a second measurement was made on the East Branch at El Paso, still well above any previous measurement.

On the Vermilion and Mackinaw Rivers the greater lag in time that occurs on larger drainage areas between a storm and the peak of the resultant rise made it possible to get excellent discharge measurements at or near the crest at each station.

After compilation of the rainfall data had been completed and isohyetal maps of the storm were prepared, it was considered desirable to make a computation of the discharge in the Rooks CreekBasin, a tributary of the Vermilion River lying to the west and south of Pontiac. Here the storm was heaviest, with a maximum rainfall in excess of 13 inches. A detailed field examination of the entire basin was made but no site satisfactory for computation of peak discharge by special methods (slope-area reach or contracted-opening site) was found. Flood marks showed that the creek and its tributaries were practically long narrow lakes during the flood, out of the high-water banks and spread across the flat fields for hundreds of feet and in some cases for half a mile or more. Every road bridge in the basin was under water by 1 to 4 feet, and low approaches to some of the bridges had even deeper water over them. All the flow of Rooks Creek passed under the Illinois Central Railroad bridge about 6 miles west of Pontiac, but channel conditions above and below were such that no computation of any accuracy could be made. East of Ocoya School, in the headwaters of Rooks Creek, the flood was so high that water flowed over a low saddle into the adjoining basin of Turtle Creek, (Figure 30).

The discharge records in the Panther Creek Basin have one notable peculiarity for which no adequate explanation can yet be given. The East Branch at El Paso recorder graph shows two

FIG. 30. AN ISOLATED FARM NEAR OCOYA SHOWING THE OVERLAND FLOW FROM ROOKS CREEK BASIN (left center) TO TURTLE CREEK BASIN, (lower right).

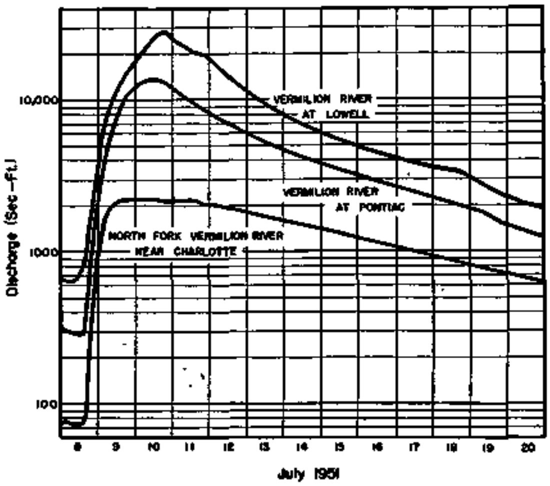

FIG. 31 HYDROGRAPHS - VERMILION RIVER BASIN.

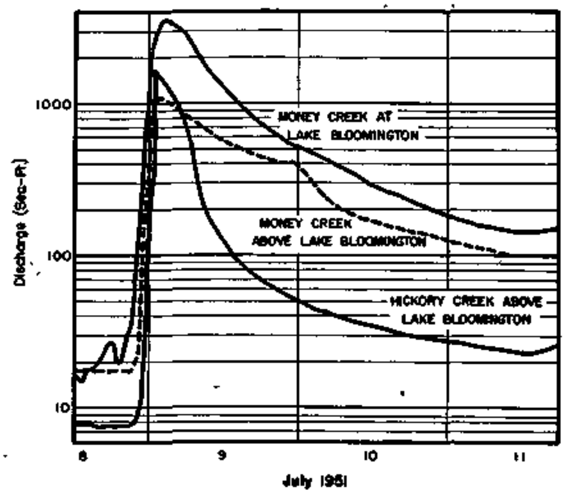

FIG. 33. HYDROGRAPHS - MACKINAW RIVER BASIN.

distinct peaks, the first at 1 a.m. on July 9 and the second at 7:30 a.m. , (Figure 34). The first peak agrees well in timing with the peak at the other two stations in the basin, but the reason for the second peak, which was 0. 04 feet higher and which followed a drop of 0. 9 foot from the initial peak, is unknown. There was no burst of rain above the gage to which the rise can be attributed. Various conjectures have been made as to the cause, as follows:

1. A jam of logs or debris downstream caused the first peak and then washed out. This would eliminate the first peak so far as the discharge record is concerned and would leave the timing of the peak discharge out of harmony with the other stations and out of line with past experience on smaller floods within the basin. There is no evidence or knowledge of any jamming at the Illinois Central Railroad bridge downstream, the most likely spot for such to happen.

2. A jam downstream caused the second peak. If so, the discharge for the first peak would be much greater than computed. In view of the lack of evidence of jamming this is considered unlikely.

3. A jam upstream gave way and produced the second peak by release of water ponded behind the jam. There is no evidence at hand to

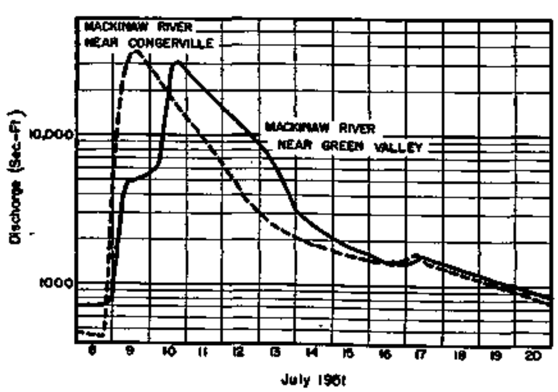

FIG. 32. HYDROGRAPHS - MACKINAW RIVER BASIN.

support or disprove this idea. The second peak does not show up at the Panther Creek station downstream as a secondary peak or as a noticeable flattening off of the recession curve . Whether the second peak could be so flattened by effects of valley storage that it would not be discernible at the Panther Creek station is not known, but such a condition is not impossible .

4. The second peak resulted from delayed runoff from drain tiles. It is known that large areas of farm land above El Paso are heavily drained by tiles, and it has been suggested that the tiling has such an effect as to produce the second peak. The idea is interesting, but data are inadequate to warrant any conclusions.

The data presented in the following pages comprise a table for each of the eleven stream-gaging stations showing a description of the sta-

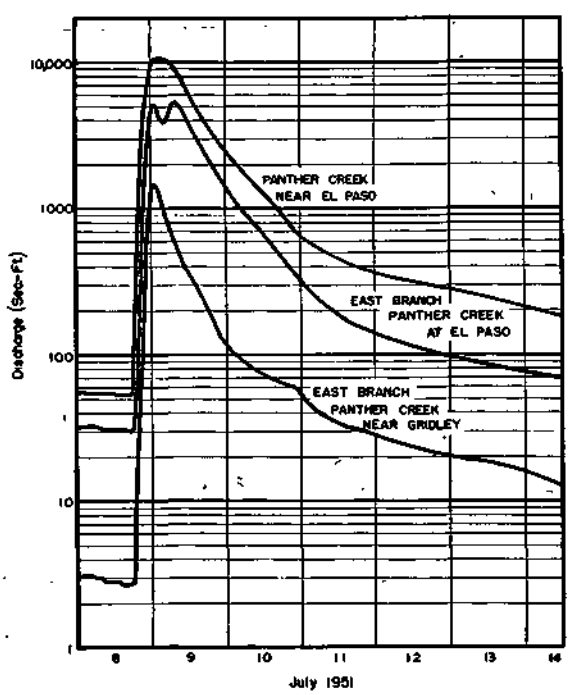

FIG. 34 HYDROGRAPHS - MACKINAW RIVER BASIN.

tion, the daily mean discharges throughout the month of July 1951, and gage heights and corresponding discharges at indicated times during the flood period from July 8 to July 19, or to July 25 if necessary to define the recession at the stations of larger drainage area.

The description of the station gives information concerning the location of the gage, the area of the drainage basin, the record of gage heights and discharge, and maxima of the flood of 1951 and the previous highest flood of record.

The summary that follows the individual station records gives in tabular form the data on maxima for the 1951 flood and the previous maxima of record for the eleven stations included in this report.

(Text resumes on page 34)

North Fork Vermilion River near Charlotte-

Location. - Lat. 40°50'08", long. 88°17'58", in SE 1/4 SE l/4 sec. 4, T. 27 N., R. 8 E., at Foreman highway bridge, half a mile downstream from Illinois Central Railroad, 1-1/4 miles northwest of Charlotte, 5-1/2 miles north of Chatsworth, and 15 miles upstream from confluence with South Fork. Datum of gage is 640.00 feet above mean sea level, datum of 1929 (Corps of Engineers).

Drainage area. -184 square miles.

Gage-height record. -Water-stage recorder graph.

Discharge record. -Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 3.5 and 5.2 feet; hundredths below and tenths above these limits.

Maxima. -July 1951: Discharge, 2,180 second-feet 4 p.m. July 9 to 4 p.m. July 10; gage height, 15. 01 feet 12 p.m. July 9 to 4 a.m. July 10.

1942 to June 1951: Discharge 2,400 second-feet May 18, 1943; gage height, 13.78 feet Aug. 4, 1943.

Daily Mean Discharge, in second-feet, July, 1951

Day	Discharge	Day	Discharge	Day	Dischargie	Day	Discharge
1	614	9	1,900	17	1,010	25	200
2	-521	10	2, 160	18	886	26	147
3	411	11	2, 100	19	772	27	172
4	285	12	1,960	20	674	28	624
5	180	13	1,770	21	584	29	592
6	117	14	1,540	22	502	30	495
7	85	15	1,340	23	410	31	370
8	162	16	1, 170	24	299	Total	24,052

Monthly Mean Discharge, in second-feet - 776
Second feet per square mile --------------------------------------- 4.22
Runoff, in inches --- 4.86

Gage Height in Feet, and Discharge in Second-Feet, at Indicated Time, 1951

Hour	July 8 Gage ht.	July 8 Discharge	July 9 Gage ht.	July 9 Discharge	July 10 Gage ht.	July 10 Discharge	July 11 Gage ht.	July 11 Discharge	July 12 Gage ht.	July 12 Discharge	July 13 Gage ht.	July 13 Discharge
1	4.07	75	12.92	1,120								
2	4.06	75	13.29	1,300	15.01	2, 180	14. 91	2, 120				
3	4.04	75	13.58	1,430								
4	4.03	75	13.82	1,530	15.01	2, 180	14.91	2, 120				
5	4.01	73	14.01	1,630								
6	3.99	73	14. 17	1,740	15.00	2, 180	14. 91	2, 120	14.71	2,020	14.35	1,850
7	3.97	71	14.30	1,800								
8	3.97	71	14.41	1,850	14.99	2, 180	14.91	2, 120				
9	3.96	71	14.53	1,900								
10	3.96	71	14.64	1,960	14.99	2, 180	14.90	2,120				
11	3.95	71	14.73	2,020								
Noon	3. 94	71	14.80	2,070	14.98	2, 180	14.88	2, 120	14.63	1,960	14.25	1,740
1	3.96	71	14.85	2,070								
2	3.99	73	14.90	2,120	14.96	2, 180	14.87	2, 120				
3	4.01	73	14.92	2, 120								
4	4.02	73	14.95	2,180	14.95	2, 180	14.86	2, 120				
5	4.44	91	14.96	2, 180								
6	5. 19	127	14.97	2,180	14.93	2, 120	14.84	2,070	14.54	1,900	14. 15	1,740
7	5.90	162	, 14. 98	2, 180								
8	6.94	227	14.99	2, 180	14.93	2, 120	14.83	2,070				
9	8.64	375	15.00	2, 180								
10	10.25	533	15.00	2,180	14.92	2, 120	14.81	2,070				
11	11.38	713	15.00	2, 180								
12	12.28	914	15.01	2, 180	14.91	2, 120	14.78	2,070	14.44	1,850	14.05	1,630
Mean	5.20	162	14.47	1,900	14 97	2, 160	14.87	2, 100	14.62	1,960	14.25	1,770

Hour	July 14 Gage ht.	July 14 Discharge	July 15 Gage ht.	July 15 Discharge	July 16 Gage ht.	July 16 Discharge	July 17 Gage ht.	July 17 Discharge	July 18 Gage ht.	July 18 Discharge	July 19 Gage ht.	July 19 Discharge
6	13.95	1,630	13.52	1,380	13. 13	1,200	12.74	1,050	12.28	914	11.85	789
Noon	13.85	1,530	13.43	1,340	13.03	1, 160 ,	12 64	1,010	12. 16	885	11.74	769
6	13.74	1,480	13.33	1,300	12.95	1, 160	12.52	978	12.07	858	11.61	750
12	13.64	1,430	13.22	1,250	12.85	1,090	12.40	945	11.96	833	11.47	731
Mean	13.85	1,540	13.43	1,340	13. 04	1, 170	12.63	1,010	12. 17	886	11.73	772

Hour	July 20 Gage ht.	July 20 Discharge	July 21 Gage ht.	July 21 Discharge	July 22 Gage ht.	July 22 Discharge	July 23 Gage ht.	July 23 Discharge	July 24 Gage ht.	July 24 Discharge	July 25 Gage ht.	July 25 Discharge
6	11.33	695	10.76	614	10. 13	521	9.27	439	8.08	330	6.75	220
Noon	11.20	678	10.60	585	9.97	510	9. 01	411	7.75	303	6.49	199
6	11.04	1 645	10.43	558	9.74	479	8.69	384	7.38	267	6.22	180
12	10.90	629	10.24	533	9.53	459	8.36	357	7.03	235	5.97	168
Mean	11. 19	674	10.59	584	9.93	502	8.98	410	7.73	299	6.49	200

Vermilion River at Pontiac.

Location. -Lat. 45"52'40", long. SS^S'lO", in SW 1/4 sec. 22, T. 26 N., R. 5 E., at Vermilion Street Bridge in Pontiac, 0. 1 mile upstream from Chicago & Alton Railroad and U. S. Highway 66f three-quarters of a mile upstream from Turtle Creek, and 1-1/2 miles downstream from Wabash Railroad. Datum of gage is 619.45 feet above mean sea level, datum of 1929.

Drainage area. -568 square miles.

Gage'height record.-Graph based on twice-daily readings of wire-weight gage supplemented by additional readings near peak stage.

Discharge record - Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 4.5 and 5.1 feet; hundredths below and tenths above these limits.

Maxima.-July 1951: Discharge, 13, 600 secona-teet 8 a.m. to 12 m. .July 10; gage height, 17.90 feet 10 a.m. July 10.

1942 to June 1951: Discharge, 8,170second-feet Aug. 5, 1943 (gage height, 15.90 feet, from graph based on gage readings).

A stage of 17. 0 feet occurred in May 1933, and is said to have been the pre'vious highest within the last 35 years.

Remarks. -An average of 1.4 second-feet diverted half a mile above station for water supplyfor cityof Pontiac, is not included in records .

Daily Mean Discharge, in second--feet, July, 1951

Pay	Discharge	Day	Discharge	Day	Discharge	Day	Disicharge
1	1,730	9	7,530	17	2,450	25	554
2	1,490	10	13,100	18	2,070	26	430
3	1,060	11	10,200	19	1,710	27	380
4	850	12	7,120	20	1,370	28	550
5	610	13	5,380	21	1, 150	29	850
6	460	14	4,260	22	968	30	820
7	330	15	3,490	23	829	31	760
8	494	16	2,870	24	640	Total	76,505

Monthly Mean Discharge, in second-feet -- — -- — - - - - - . - _ - - - - _ - - - - - - - 2,468
Second feet per square mile _ - _ _ _ - 4. 35
Runoff, in inches _ _ _ _ - 5. 01

Gage Height in Feel:, and Dischargie in Second-Feet, at Indicated Time, 1951

Hour	July 8 Gage ht.	July 8 Dis-charge	July 9 Gage ht.	July 9 Dis-charge	July 10 Gage ht.	July 10 Dis-charge	July 11 Gage ht.	July 11 Dis-charge	July 12 Gage ht.-	July 12 Dis-charge	July 13 Gage ht.	July 13 Dis-1:harge
2	4.04	300	8.30	2,790	17.56	12,800	17. 11	11,800				
4	4. 03	295	9. 62	3,650	17 71	13,000	16.93	11,400				
6	4. 03	295	10.91	4,590	17.83	13,300	16.73	11,000	14.52	7,600	12.35	5,720
8	4. 02	290	12.28	5,640	17 88	13,600	16.57	10,800				
10	4.02	290	13.50	6,600	17.90	13,600	16.43	10,400				
Noon	4. 01	285	14 51	7,600	17.88	13,600	16.28	10,200	13.95	7,070	11 93	5,340
2	4. 00	280	15.40	8,770	17.85	13,300	16. 13	9,870				
4	4.01	285	16.06	9,870	17.81	13,300	15.97	9,700				
6	4.09	325	16.50	10,600	17.72	13,000	15.78	9,380	13.43	6,520	11.53	5. 040
B	4 80	730	16.80	11,200	17.60	12,800	15.58	9,070				
10	5.82	1,370	17. 11	11,800	17 46	12,600	15.38	8,770				
12	7. 00	2,050	17 38	12,400	17.29	12,200	15. 18	8,490	12.88	6, 120	11 12	4,740
Mean	4.37	494	13.60	7,530	17.71	13, 100	16.26	10,200	13.98	7, 120	11.95	5,380

Hour	July 14 Gage ht.	July 14 Dis-charge	July 15 Gage ht.	July 15 Dis-charge	July 16 Gage ht.	July 16 Dis-charge	July 17 Gage ht.	July 17 Dis-charge	July 18 Gage ht.	July 18 Dis-charge	July 19 Gage ht.	July 19 Dis-charge
6	10.75	4,520	9.64	3,650	8.57	2,990	7 90	2,550	7.22	2, 150	6.50	1,790
Noon	10.43	4,220	9.35	3,510	8.42	2,860	7.74	2,430	7. 04	2,050	6.35	1,730
6	10. 12	4,000	9.06	3,310	8.25	2,730	7.57	2,370	6.88	2,000	6.25	1,610
12	9.87	3,860	8.81	3, 120	8.07	2,670	7.40	2,250	6.68	1,900	6.05	1,490
- Mean	10.45	4,260	9.35	3,490	8.42	2,870	7.74	2,450	7. 04	2,070	6.37,	1,710

Hour	July 20 Gage ht.	July 20 Dis-charge	July 21 Gage ht.	July 21 Dis-charge	July 22 Gage ht.	July 22 Dis-charge	July 23 Gage ht.	July 23 Dis-charge	July 24 Gage ht.	July 24 Dis-charge	July 25 Gage ht.	July 25 Dis-charge
6	5.90	1,430	5 48	1, 190	5.21	990	5. 04	885	4.62	610	4.57	580
Noon	5.80	1,370	5.43	1, 130	5. 15	990	4.98	850	4.62	610	4.52	550
6	5.73	1,310	5.40	1, 130	5. 10	920	4 90	790	4.68	670	4 46	520
12	5.61	1,250	5.30	1,060	5.06	885	4.73	700	4.66	640	4.40	490
Mean	5.82	1,370	5.44	1, 150	5. 16	968	4. 95	829	4.65	640	4.52	554

Vermilion River at Lowell.

Location. -Lat. 41°15'18", long. 89°00'49", in SE 1/4 sec. 8, T. 32 N., R. 2 E., at highway bridge a quarter of a mile northwest of Lowell and 10 miles upstream from mouth. Datum of gage is 500.61 feet above mean sea level, datum of 1929.

Drainage area. -1,230 square miles.

Gage-height record.-Graph based on twice-daily readings of wire-weight gage supplemented by additional readings near peak stage.

Discharge record. -Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 2.5 and 3.6 feet, hundredths below and tenths above these limits.

Maxima.-July 1951: Discharge, 27,700 second-feet 6 to 6:30 p.m. July 10 (gage height, 12.70 feet).

U9T1 to June 1951: Discharge, 23,300 second-feet Apr. 25, 1950 (gage height, 11.10 feet, from graph based on gage readings).

Maximum stage known, about 16 feet during ice jam, date unknown.

Daily Mean Discharge, in second-feet, July, 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	3,170	9	11,500	17	3,710	25	956
2	2,550	10	25,100	18	3,240	26	820
3	1,890	11	21,500	19	2,650	27	705
4	1,550	12	14,900	20	1,910	28	740
5	1,250	13	9,300	21	1,880	29	940
6	980	14	6,980	22	1,690	30	If 120
7	740	15	5,320	23	1,400	31	1,120
8	972	16	4,400	24	1,240	Total	136,223

Monthly Mean Discharge, in second-feet - 4,394
Second feet per square mile - 3.57
Runoff, in inches - 4.12

Gage Height in Feet, and Discharge in Sescond-Feet, at Indicated1 Time, 1951

Hour	July 8 Gage ht.	July 8 Discharge	July 9 Gage ht.	July 9 Discharge	July 10 Gage ht.	July 10 Discharge	July 11 Gage ht.	July 11 Discharge	July 12 Gage ht.	July 12 Discharge	July 13 Gage ht.	July 13 Discharge
2	2.89	670	6.31	5,510	10.83	20,400	11.80	24,200				
4	2.87	635	6.94	6,960	11.22	22,000	11.62	23,500				
6	2.85	635	7.42	8,320	11.65	23,500	11.45	22,700	9.92	17,000	7.98	10,100
8	2.85	635	7.77	9,500	11.94	24,600	11.30	22,300				
10	2.86	635	8.08	10,400	12.24	25,800	11.16	22,000				
Noon	2.88	670	8.37	11,400	12.42	26,500	11.02	21,200	9.30	14,700	7.68	9,200
2	2.93	705	8.65	12,100	12.55	27,300	10.90	20,800				
4	3.01	740	8.95	13,600	12.64	27,300	10.79	20,400				
6	3.18	900	9.30	14,700	12.70	27,700	10.70	20,100	8.78	12,800	7.45	8,320
8	3.46	1,120	9.67	16,300	12.56	27,300	10.59	19,700				
10	4.35	2,140	10.05	17,400	12.28	26,100	10.49	19,300				
12	5.37	3,690	10.49	19,300	12.03	25,000	10.36	18,900	8.34	11,100	7.28	8,040
Mean	3.19	972	8.29	11,500	12.Ci.	25,100	11.08	21,500	9.34	14,900	7.73	9,300

Hour	July 14 Gage ht.	July 14 Discharge	July 15 Gage ht.	July 15 Discharge	July 16 Gage ht.	July 16 Discharge	July 17 Gage ht.	July 17 Discharge	July 18 Gage ht.	July 18 Discharge	July 19 Gage ht.	July 19 Discharge
6	7.15	7,760	6.32	5,510	5.90	4,650	5.44	3,690	5.18	3,340	4.92	2,850
Noon	6.92	6,960	6.18	5,290	5.74	4,250	5.37	3,690	5.12	3,170	4.77	2,700
6	6.62	6,210	6.08	5,070	5.66	4,250	5.35	3,690	5.12	3,170	4.65	2,410
12	6.47	5,970	6.02	4,860	5.57	4,060	5.29	3,510	5.05	3,010	4.47	2,270
Mean	6.89	6,980	6.21	5,320	5.77	4,400	5.40	3,710	5.15	3,240.	4.78	2,650

Hour	July 20 Gage ht.	July 20 Discharge	Jul 7-1 Gage ht.	Jul 7-1 Discharge	July 22 Gage ht.	July 22 Discharge	July 23 Gage ht.	July 23 Discharge	July 24 Gage ht.	July 24 Discharge	July 25 Gage ht.	July 25 Discharge
6	4.20	1,890	4.20	1,890	4.08	1,770	3.81	1,450	3.66	1,350	3.31	980
Noon	4.14	1,770	4.17	1,890	4.01	1,660	3.74	1,350	3.58	1,250	3.28	980
6	4.15	1,890	4.16	1,890	3.95	1,660	3.70	1,350	3.52	1,160	3.20	900
12	4.18	1,890	4.14	1,770	3.89	1,550	3.68	1,350	3.41	1,070	3.14	860
Mean	4.20	1,910	4.17	1,880	4.01	1,690	3.76	1,400	3.48	1,240	3.26	956

Supplemental record. -July 10, 6:30 p.m., 12.70 ft., 27,700 sec.-ft.

Mackinaw River near Congerville.

Location. -Lat. 40°37'25", long. 89°14'30", in NE 1/4 SW 1/4 sec. 17, T. 25 N. , R. 1 W. , at bridge on U. S. Highway 150, 900 feet downstream from New York, Chicago, & St. Louis Railroad bridge, a quarter of a mile downstream from Walnut Creek, and 2 miles northwest of Congerville.

Drainage area. -764 square rriles.

Gage-height record. -Water-stage recorder graph.

Discharge record -Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 2.7 and 4.1 feet; hundredths below and tenths above these limits. Shifting-control method used July 18-31.

Maxima.-July 1951. Discharge, 36,000 second-feet 12 m. to 3p.m. July 9; gage height, 19.41 feet 1:30 p.m. July 9.

1944 to June 1951: Discharge, 15,500 second-feet Apr. 30, 1947 (gage height, 16.02 feet).

Daily Mean Discharge, in second--feet, July, 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	1,710	9	26,300	17	1,450	25	587
2	1,270	10 •	18,100	18	1,210	26	524
3	980	11	9,270	19	1,010	27	506
4	843	12	4,290	20	864	28	450
5	691	13	2,450	21	748	29	389
6	580	14	1,900	22	807	30	353
7	506	15	1,600	23	850	31.	318
8	606	16	1,440	24	691	Total	83,293

Monthly Mean Discharge, in second-feet — 2,687
Second feet per square mile — 3. 52,
Runoff, in inches - 4. 06

Gage Height in Feet, and Discharge in Second-Feelt, at Indicated Time, 1951

Hour	July 8 Gage ht.	July 8 Dis-charge	July 9 Gage ht.	July 9 Dis-charge	July 10 Gage ht.	July 10 Dis-charge	July 11 Gage ht.	July 11 Dis-charge	July 12 Gage ht	July 12 Dis-charge	July 13 Gage ht.	July 13 Dis-charge
1	2.77	468	12.27	6,550	18. 02	24,700						
2	2.76	468	13.05	7,900	17.87	24,000	14.83	12,100	11.85	5,800		
3	2.76	468	14.20	10,600	17.75	23,400						
4	2.75	468	15.60	14,300	17.60	22,200	14 58	11,600	11.58	5,500		
5	2.75	468	16.85	18,200	17.50	21,600						
6	2.74	468	17 50	21,600	17.38	21,100	14.32	10,800	11.30	5,130	7.66	2,650
7	2.73	468	17.97	24,700	17.28	20,600						
8	2.73	468	18.35	27,600	17. 10	19,600	14. 06	10,400	10.97	4,800		
9	2.72	450	18.70	29,900	17.00	19,100						
10	2.71	450	19. 00	32,400	16.90	18,600	13.82	9,600	10.60	4,480		
	2.70	450	19.30	35, 100	16.77	18,200						
Noon	2.69	446	19.37	36,000	16.65	17,400	13.58	9, 100	10.22	4,160	7.25	2,400
1	2.69	446	19.39	36,000	16.52	17,000						
2	2.68	443	19.40	36,000	16.40	16,700	13.35	8,700	9.77	3,880		
3	2.68	443	19.35	36,000	16.27	16,400						
4	2.67	439	19.25	34,200	16. 12	15,800	13. 12	8, 100	9.32	3,580		
5	2.67	439	19 10	33,300	16. 00	15,500						
6	2.66	436	19. 00	32,400	15.88	15,200	12.85	7,500	8.87	3,340	6.88	2,250
7	2.66	436	18.85	30,700	15.76	14,900						
8	2.67	439	18.70	29,900	15.63	14,300	12 62	7, 100	8.58	3, 160		
9	2.68	443	18.58	29, 100	15.48	14,000						
10	3. 10	598	18.45	27,600	15.36	13,700	12. 38	6,700	8.35	3,040		
11	6.00	1,800	18.30	26,800	15.23	13, 100						
12	11.00	4,800	18 15	26, 100	15. 12	12,800	12. 12	6,250	8. 16	2,920	6.60	2,100
Mean	3.08	606	17.71	26,300	16.63	18,100	13.59	9,270	10. 13	4,290	7.29	2,450

Hour	July 14 Gage ht.	July 14 Dis-charge	July 15 Gage ht.	July 15 Dis-charge	July 16 Gage ht.	July 16 Dis-charge	July 17 Gage ht.	July 17 Dis-charge	July 18 Gage ht.	July 18 Dis-charge	July 19 Gage ht.	July 19 Dis-charge
6	6.36	2,000	5.68	1,660	5.22	1,440	5.55	1,620	4.78	1,270	4.42	1,060
Noon	6. 16	1,900	5.55	1,620	5. 13	1,400	5 19	1,440	4.73	1,220	4. 34	1,020
6	5 98	1,800	5.43	1,530	5. 18	1,440	4 97	1,350	4.64	1, 140	4.24	960
12	5.82	1,710	5.32	1,480	5.29	1,480	4.86	1,310	4.54	1, 100	4. 15	920
Mean	6. 18	1,900	5.56	1,600	5.21	1,440	5.20	1,450	4.71	1,210	4.34	1,010

Hour	July 20 Gage ht.	July 20 Dis-charge	July 21 Gage ht.	July 21 Dis-charge	July 22 Gage ht.	July 22 Dis-charge	July 23 Gage ht.	July 23 Dis-charge	July 24 Gage ht.	July 24 Dis-charge	July 25 Gage ht.	July 25 Dis-charge
4					3.73	729	4.16	920				
6	4.08	900	3.84	767					3.70	710	3.49	598
8					3.79	748	4. 19	940				
Noon	4 01	862	3.80	748	3.94	843	4. 03	681	3.65	691	3.45	580
4					-3.98	862	3.89	786				
6	3.95	843	3.77	729					3.60	672	3.41	561
8					3.97	843	3.81	748		•		
12	3.89	786	3.72	710	4. 15	920	3.76	729	3.55	654	3.38	561
Mean	4.02	. 864	3.80	748	3.89 .	807	4. 01	850	3.65	691	3.46	587

Supplemental record. -July 9, 1:30 p.m. , 19.41 feet, 36, 000 sec. -ft

Mackinay River near Green Valley,

Location. -Lat. 40°26'40", long. 89°38'00", in sec.15, T. 23 N., R 5 W., at bridge on State Highway 29, 3 miles north of hamlet of Green Valley. Datum of gage is 479. 10 feet above mean sea level, datum of 1929-

Drainage area. -1,100 square miles.

Gage-height record. -Graph drawn on basis of two or more wire-weight gage readings daily for period July 8-25. Average of twice-daily readings used July 1-7, 26-31.

Discharge record.-Stage-discharge relation defined by current-meter measurements below 26, 000 second-feet and extended to peak stage. Gage heights used to half tenths below 1. 4 feet and to tenths above.

Maxima. -July 1951: Discharge, 31,000 second-feet 4 to 7 p.m. July 10; gage height, 13. 12 feet 6:30 p.m. July 10.

1921 to June 1951: Discharge, 26,400 second-feet Apr. 24, 1944 (gage height, 12.50 feet, from graph based on gage readings).

Daily Mean Discharge, in second--feet, July' 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	4,180	9	4,060	17	1,410	25	773
2	1,850	10	17,800	18	1,220	26	691
3	1.570	11	21,100	19	1,050	27	645
4	1,390	12	11,800	20	918	28	600
5	1,150	13	5,650	21	842	29	556
6	870	14	2,530	22	2,690	30	512
7	765	15	1,820	23	1,090	31	491
8	726	16	1,460	24	931	Total	93, 140

Monthly Mean Discharge, in second-feet ------------------------------------ 3, 005
Second feet per square mile --- 2. 73
Runoff, in inches-- 3.15

Gag;e Height in Feet, and Discharge in Second-Feet, at Indicated Time, 1951

Hour	July 8		July 9		July 10		July 11		July 12		July 13	
	Gage. ht.	Dis-charge	Gage ht.	Dis-charge	Gage ht.	Dis-charge	Gage ht	Dis-charge	Gage ht.	Dis-charge	Gage ht	Dis-,charge
1			2. 17	870	7. 72	5,720	12 54	26,200				
2			2 66	1,150	7.81	5,840	12.47	26,200	11. 00	15, 000	9.22	8,260
3			3 20	1,450	7.90	5,960	12.38	25,400				
4			3 77	1,850	8.00	6,080	12.30	24,600	10.88	14,400	9.00	7,800
5			4 37	2,330	8. 11	6,220	12.23	23,800				
6	1.94	713	4.99	2,880	8.23	6,360	12. 17	23,800	10.74	13,200	8.75	7, 370
7			5.60	3,480	8.38	6,640	12.09	23,000				
8			6.21	4, 080	8.54	6,800	12. 03	22,200	10.59	12, 700	8.45	6,640
9			6.63	4,500	8.80	7, 370	11.98	22,200				
10			6.86	4,830	9. 11	8,030	11.92	21,400	10.45	11,800	8. 00	6,080
			6. 95	4,940	9.85	9,820	11.87	21,400				
Noon	1.93	713	6.99	4,940	11.05	15,000	11.82	20,600	10.30	11,400	7.53	5,490
1			7.03	4,940	12. 10	23,000	11.77	20,600				
2			7.05	4,940	12.68	27,800	11.71	19,900	10. 17	-11, 000	7. 02	4,940. .
3			7. 07	5,050	12.97.	30,200	11.67	19,900				
4			7. 09	5, 050	13.07	31, 000	11.61	19,200	10.07	10,700	6 49	4,390
5			7 12	5,050	13. 11	31,000	11.57	19,2'00				
6	' 1.92	713	7 18	5, 160	13 11	31,000	11.51	18,500	9.93	10, 100	6 04	3,880
7			7.23	5, 160	13.09	31., 000	11.46	18,500				
8			7. 33	5,270	13.00	30,200	11.39	17,800	9.78	9,820	5.72	3,580
9			7.42	5,380	12 90	"29,400	11.33	17,100				
10			7 50	5,490	12.81	28,600	11.28	17,100	9. 61	9,280	5 51	3,380
11			7. 58	5,600	12.71	27,800	11 21	16,400				
12	2. 02	765	7.65	5,600	12.62	27,000	11. 14	15,700	9 42	8,750	5.34	.3, 180
Mean	1.92	726	6. 03	4, 060	10.63	17,800	11 80	21, 100	10 31	11,800	7.43	5,650

Hour	July 14		July 15		July 16		July 17		July 18		July 19	
4	5. 04	2,880	4. 02	2,010								
6					3.33	1,510	3. 18	1,450	2.89	1,280	2 49	1,080
8	4 79	2,680	3.92	1,930								
Noon	4. 58	2,490	3 77	1,850	3. 18	1,450	3. 18	1,450	2.77	1,230	2.42	1,030
4	4. 39	2,330	3 63	1,700								
6					3.09	1,390	3. 12	1,390	2.64	1, 130	2.36	1, 030
8	4 24	2, 170	3. 52	1,630								
12	4. 12	2,090	3.44	1,570	3. 10	1,390	3. 01	1,330	2.56	1, 130	2.30	980
Mean	4.62	2,530	3.77	1,820	3.22	1,460	3 13	1,410	2.77	1,220	2 42	1,050

Hour	• July 20		July 21		July 22		July 23		July 24		July 25	
4			2 02	833	4.90	2,780	2 74	1, 180				
6	2.23	930							2.28	980	1.91	785
8			1.99	833	6.24	4,080	2.52	1, 080				
Noon	2. 17	930	1. 96	833	6. 02	3,880	2.45	1,030	2. 17	930	1.86	785
4			1.93	785	4.60	2,490	2.41	1,030				
6	2: 11	881							2. 07	881	1.81	738
8			1 91	785	3.59	1,700	2.39	1,030				
12	2.06	881	2 51	1,080	3. 11	1,390	2.35	1,030	1.99	833	1.77	738
Mean	2. 17	918	2 02	842	4.69	2,690	2.54	1,090	2. 18	931	-1.86	773

Supplemental record. -July 10, 6:30 p.m., 13. 12 ft., 31, 000 sec. -ft

Money Creek above Lake Bloomington.

Location. -Lat. 40°37'13", long. 88°54'59", in SE 1/4 SW l/4-sec. ,18. T. 25 N., R. 3E., 200 feet north of line between sees. 18 and 19 and 1 mile upstream from Lake Bloomington.

Damage area. -45 square miles.

Gage-height record. -Water-stage recorder graph.

Discharge record. -Stage- discharge relation defined by current-meter measurements . Gage .heights used to half tenths above 3. 1 feet and hundredths below.

Maxima. -July 1951: Discharge, 1,120 second-feet 1:30 a. m. July 9 (gage height, 6.73 feet).

1933 to Jane 1951: Discharge, 3,900 second-feet Apr. 30, 1947 (gage height, 9.16 feet), from rating curve extended above 1,800 second-feet on basis of flood-routing study.

Daily Mean Discharge, in second--feet, July, 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	57	9	641	17	30	25	14.4
2	41	10	192	18	26	26	13.2
3	33	11	110	19	23	27	12.0
4	28	12	128	20	21	28	11.2
5	24	13	84	21	19.0	29	10.8
6	21	14	59	22	19.6	30	9.1
7	19.0	15	44	23	17.4	31	8.5
8	39	16	36	24	15.9	Total	1,807.1

Monthly Mean Discharge, in second-feet ---------------------------- 58. 3
Second feet per square mile ------------------------------------ 1.30
Runoff, in inches -- 1.49

Gage Height in Feet, and Discharge in Second-Feet, at Indicated Time, 1951

Hour	July 8 Gage ht.	July 8 Discharge	July 9 Gage ht.	July 9 Discharge	July 10 Gage ht.	July 10 Discharge	July 11 Gage ht.	July 11 Discharge	July 12 Gage ht.	July 12 Discharge	July 13 Gage ht.	July 13 Discharge
1	1.92	18.4	6.68	1,090	4.38	365						
2	1.92	18.4	6.70	1,090	4.10	317	2.71	120	2.85	142		
3	1.92	18.4	6.56	1,000	3.83	281						
4	1.91	17.9	6.44	945	3.58	247	2.69	116	2.92	153		
5	1.91	17.9	6.32	870	3.40	222						
6	1.91	17.9	6.17	810	3.29	209	2.66	112	2.95	158	2.53	91
7	1.91	17.9	6.00	750	3.21	196						
8	1.91	17.9	5.83	705	3.15	189	2.64	108	2.88	147		
9	1.91	17.9	5.70	660	3.10	182						
10	1.91	17.9	5.60	630	3.07	177	2 62	105	2.81	136		
11	1.91	17.9	5.50	600	3.04	172						
Noon	1.90	17.4	5.40	574	3.00	166	2.59	100	2.75	126	2.49	84
1	1.90	17.4	5.31	550	3.01	168						
2	1.90	17.4	5.17	515	3.07	177	2.57	97	2.71	120		
3	1.90	17.4	5.05	493	2.98	163						
4	1.90	17.4	4.94	471	2.93	155	2 57	97	2.68	115		
5	1.90	17.4	4.83	450	2.89	148						
6	1.90	17.4	4.77	430	2.86	144	2.58	99	2.66	112	2.43	75
7	1.90	17.4	4.75	430	2.84	140						
8	1.90	17.4	4.74	430	2.82	137	2.68	115	2.64	108		
9	1.89	16.9	4.74	430	2.79	132						
10	1.98	22	4.73	430	2.78	131	2.76	128	2.62	105		
11	2.70	118	4.68	421	2.77	129						
12	6.17	810	4.56	392	2.75	126	2.80	134	2.59	100	2.40	70
Mean	2.03	39	5.50	641	3.19	192	2.65	110	2.76	128	2.49	84

Hour	July 14 Gage ht.	July 14 Discharge	July 15 Gage ht.	July 15 Discharge	July 16 Gage ht.	July 16 Discharge	July 17 Gage ht.	July 17 Discharge	July 18 Gage ht.	July 18 Discharge	July 19 Gage ht.	July 19 Discharge
6	2.36	64	2.25	48								
Noon	2.33	59	2.22	44	2.14	35	2.09	30	2.05	26	2.00	23
6	2.30	54	2.19	40								
12	2.27	50	2.18	39	2.12	33	2.07	28	2.03	25	1.98	22
Mean	2.33	59	2.22	44	2.14	36	2.10	30	2.06	26	2.00	23

Supplemental record. -July 9, 1:30 a.m., 6.73 ft., 1,120 sec.-ft.

Hickory Creek above Lake Bloomington.

Location. -Lat. 40°38'15", long. 88°57'00", in SE 1/4 sec. 11, T. 25 N. , R. 2 E. , 100 yards downstream from unnamed tributary, a quarter of a mile upstream from Lake Bloomington, and 3 miles northeast of Hudson. Datum of gage is 716. 0 feet above mean sea level.

Drainage area. -10. 1 square miles.

Gage-height record. -Water-stage recorder graph.

Discharge record. - Stage discharge relation defined by current-meter measurements below 300 second-feet and extended to peak stage on basis of slope-area determinations at gage heights 6. 12 and 7. 12 feet. Gage heights used to half tenths between 3. 4 and 6. 0 feet; hundredths below and tenths above these limits. Shifting-control method used July 1-31.

Maximal-July 1951: Discharge, 1,690 second-feet 12:30 a.m. July 9 (gage height 7.57 feet).

1938 to June 1951: Discharge, 1,460 second-feet Aug. 3. , 1943 (gage height, 7. 12 feet).

Daily Mean Discharge, in second-feet, July, 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	24	9	396	17	9.3	25	2.7
2	20	10	36	18	7.9	26	2.3
3	17	11	26	19	6.6	27	1.8
4	14	12	23	20	5.3	28	1.6
5	12	13	18	21	4.5	29	1 3
6	11	14	15	22	5.6	30	1.0
7	9.3	15	13	23	4. 1	31	.8
8	42	16	12	24	3.3	Total	746.4

Monthly Mean Discharge, in second-feet _ _ _ _ _ 24. 1
Second feet per square mile - 2. 39
Runoff, in inches - 2. 75

Gage Height in Feet, and Discharge in Second-Feet, at Indicated Time, 1951

	July 8		July 9		July 10		July 11		July 12		July 13	
Hour	Gage ht.	Dis-charge	Gage ht.	Dis-charge	Gage ht.	Dis-charge	Gage ht	Dis-charge	Gage ht.	Dis-charge	Gage ht.	Dis-charge
1	0.83	8.5	7.24	1,490								
2	.83	8.5	6.68	1,290	1.76	45	1 39	26				
3	.83	8.5	6.41	1, 170								
4	.83	8.5	5.98	1,010	1.71	42	1.37	26				
5	.83	8.5	5.58	855								
6	.83	8.5	5.05	662	1.67	40	1.36	25	1.35	24	1.22	20
7	.83	8.5	4.38	455								
8	.82	8.2	3.77	296	1.63	38	1.34	24				
9	.82	8.2	3.25	202								
10	.82	8.2	- 2.96	154	1.60	36	1 32	24				
11	.82	8.2	2.77	130								
Noon	.81	8.0	2.63	114	1.57	35	1.31	23	1.30	23	1.18	18
1	81	8.0	2.52	103								
2	.80	7.8	2.42	93	1.54	34	1.37	26				
3	.80	7.8	2.33	85								
4	.79	7.6	2.24	78	1.50	32	1.40	27				
5	.79	7.6	2. 17	72								
6	.79	7.6	2. 11	68	1.47	30	1.38	26	1.26	21	1.14	17
7	.79	7.6	2.04	63								
8	.79	7.6	1.98	59	1.45	29	1.41	28				
9	.79	7.6	1.93	56								
10	.85	8.9	1.88	52	1.42	28	1.41	28				
11	1.68	41	1.85	51								
12	7.44	1,590	1.82	49	1.40	27	1.40	27	1.24	21	1.12	16
Mean	.99	42	3.54	396	1.58	36	1.37	26	1.31	23	1.18	18

	July 14		July 15		July 16		July 17		July 18		July 19	
Noon	1.08	15	1 00	13	.95	12	.87	9.3	.81	8.0	.74	6.6
12	1.03	14	. 96	12	.91	10	.83	8.5	.77	7.2	.71	6.0
Mean	1.08	15	1.00	13	.94	12	.87	9.3	.80	7.9	.74	6.6

Supplemental record. -July 9, 12:30 a.m. , 7.57 ft. , 1, 690 sec. -ft.

Lake Bloomington at Lake Bloomington.

Location. -Lai. 40°39'40", long. 88°56'10", in NE 1/4 sec. 1, T. 25 N., R. 2 E., on Money Creek, 2.8 miles above mouth and 4 miles northeast of Hudson.

Drainage area. -61 square miles.

Gage-height record. -Water-stage recorder graph.

Remarks.-Record furnished by State Water Survey. Spillway elevation 715. 00 feet (lake area, 531 acres). Water diverted from lake for municipal supply of Bloomington.

Capacity table (elevation, in feet, and contents in millions of gallons) above 690 feet elevation.

Elevation	Contents	Elevation	Contents	Elevation	Contents
715.0	2,261.3	715.5	2,349.8	716.0	2,438. 3
715. 1	2,279. 0	715.6	2,367.5	716. 1	2,456.8
715.2	2,296.7	715.7	2,385.2	716.2	2,475.3
715.3	2,314.4	715.8	2,402.9	716.3	2,493.8
715.4	2,332. 1	715.9	2,420.6	716.4	2,512. 3

Gage Height in feet, at Indicated Time, 1951

Hour	July 8	July 9	July 10	July 11	July 12	July 13
1	15.08	16.22	15. 54	15.29		
2	15. 08	16.36	15. 53	15.29	15.27	
3	15. 09	16.36	15. 52	15.28		
4	15. 08	16.33	15. 50	15.28	15.27	15.24
5	15. 08	16.28	15.49	15.28		
6	15. 08	16.22	15.47	15.28	15.28	
7	15. 08	16. 15	15.45	15.27		
8	15. 08	16.07	15.43	15.27	15.2'9	15.24
9	15. 07	16. 00	15.42	15.27		
10	15. 08	15.93	15.40	15.26	15.29	
11	15. 08	15.87	15. 39	15.26		
Noon	15. 09 0	15.81	15. 38	15.26	15.29	15.23
1	15. 08	15.77	15. 37	15.25		
2	15. 08	15.74	15. 36	15.25	15.28	
3	15. 08	15.70	15. 36	15.27		
4	15. 08	15.68	15. 35	15.27	15.28	15.22
5	15. 09	15.65	15. 34	15.27		
6	15. 09	15.63	15. 33	15.26	15.27	
7	15. 08	15.61	15. 32	15.26		
8	15. 10	15. 59	15. 32	15.26	15.26	15.22
9	15. 10	15.58	15. 31	15.26		
10	15. 10	15.57	15. 31	15.26	15.26	
11	15.22	15. 56	15. 30	15.26		
12	15.68	15. 55	15. 30	15.26	15.25	15.21

Note. -Add 700. 00 feet to obtain elevations above mean sea level.

Money Creek at Lake Bloomington.

Location.-Lat.,40°39'47'', long. 88°56'23", in NW 1/4 sec. 1, T. 25N., R. 2E., 1,300 feet downstream from dam at Lake Bloomington, 2.1 miles upstream from mouth and 4miles northeast of Hudson. Datum of gage is 678. 05 feet above mean sea level.

Drainage area. -61 square miles.

Gage-height record. -Water-stage recorder graph.

Discharge record. -Stage-discharge relation defined by current-meter measurements below 1,600 second-feet and extended to peak stage on basis of computed flow over dam at Lake Bloomington. Gage heights used to half tenths between 3. 5 and 4. 8 feet and above 6. 4 feet, hundredths below 3. 5 feet, and tenths between 4. 8 and 6. 4 feet.

Maxima. -July 1951: Discharge, 3,500 second-feet 2 to 3 a. m. July 9; gage height 8. 51 feet 2:30 a.m. July 9.

1930 to June 1951: Discharge, 3,350 second-feet Apr. 30, 1947 (gage height, 8.35 feet).

Remarks. -Flow regulated by Lake Bloomington(areaof lake at level of crest of spillway, 531 acres). Water is diverted from lake by pumping for municipal supply of Bloomington. Discharge past gage is made up of discharge through spillway, seepage through dam, runoff from area below dam (0.4 square miles), and return flow from water diverted from lake for use at pumping plant. Records not adjusted.

Dai.ly Mean Discharge, in second--feet, July, 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	90	9	1,650	17	42	25	11
2	68	10	309	18	35	26	"9.4
3	54	11	150	19	27	27	7.7
4	39	12	154	20	26	28	4. 1
5	34	13	112	21	23	29	4.4
6	30	14	82	22	30	30	3. 1
7	28	15	63	23	22	31	2. 0
8	74	16	51	24	15	Total	3,249.7

Monthly ean Discharge, in second

Second fee

Runoff, in

Gag.e Height in Feet, and Discharge in Second-Feet, at Indicated Time, 1951

Hour	July 8 Gage ht.	July 8 Dis-charge	July 9 Gage ht.	July 9 Dis-charge	July 10 Gage ht.	July 10 Dis-charge	July 11 Gage ht.	July 11 Dis-charge	July 12 Gage ht.	July 12 Dis-charge	July 13 Gage ht.	July 13 Dis-charge
1	1.26	26	8.33	3,280	4.00	495						
2	1.28	27	8 50	3,500	3.95	480	2.78	172	2.64	148		
3	1.40	33	8 48	3,500	3.88	465						
4	1.31	28	8.35	3,280	3.80	435	2.73	T63	2.67	153""		
5	1.22	25	8 16	2,980	3.72	405						
6	1. 13	21	7.93	2,720	3.64	390	2.69	156	2.71	160	2.45	122
7	1..11	20	7.67	2,360	3.58	375						
8	1.08	19	7.38	2,090	3.51	345	2.65	150	2.74	,165		
9	.85	11	7.08	1,840	3.44	327						
10	1.08	19	6.78	1,620	3.39	312	2.62	145	2.76	168		
11	1. 08	19	6.50	1,430	3.34	298						
Noon	1.00	16	6.22	1,270	3.27	279	2.57	138	2.74	165	2.35	109
1	.93	13	5.93	1, 140	3.22	265						
2	1. 05	18	5.65	1,020	3. 18	255	2 55	135	2.71	160		
3	1.04	18	5.38	950	3 15	248						
4	1.07	19	5. 15	890	3. 13	242	2.65	150	2.67	153		
5	1. 14	22	4.91	800	3. 11	238						
6	1.28	27	4.72	740	3.06	226	2.62	145	2.65	150	2.28	101
7	1.07	19	4 55	688	3.00	213						
8	1. 16	22	4.41	635	2.97	207	2.59	141	2.62	145		
9	1.40	33	4.28	600	2.91	195						
10	1.66	49	4. 18	565	2.89	191	2.59	141	2.58	139		
11	3.35	301	4. 11	530	2.85	184						
12	7. 18	1,920	4.05	512	-2.84	182	2.61	144	2.55	135	2.22	94
Mean	1.38	74	6.26	1,650	3.35	309	2.64	150	2.67	154	2.37	112

Hour	July 14 Gage ht.	July 14 Dis-charge	July 15 Gage ht.	July 15 Dis-charge	July 16 Gage ht.	July 16 Dis-charge	July 17 Gage ht.	July 17 Dis-charge	July 18 Gage ht.	July 18 Dis-charge	July 19 Gage ht.	July 19 Dis-charge
6	2. 15	87	1.91	67	1.69	50	1.59'	. 44	1.50	39	1.29	28
Noon	2. 09	81	1.88	64	1.74	54	1.54	41	1.45	36	1.27	27
6	2.01	75	1.81	59	1.68	50	1.50	39	1.34	30	1.24	26
12	1.97	72	1.72	52	1 67	49	1 46	37	1.33	30	1.23	25
Mean	2. 09	82	1.86	63	1 70	51	1.55	42	1.42	35	1.27	27

Supplemental record. -July 9, 2:30 a m., 8.51 ft., 3, 500 sec. -ft.

Panther Creek near El Paso.

Location. -Lat. 40°46'05", long. 89°04'30", in center of sec. 26, T. 27 N., R. 1E., just downstream from East Branch Panther Creek, 2 miles upstream from West Fork, and 3-3/4 miles northwest of El Paso. Datum of gage is 658.8 feet above mean sea level, datum of 1929.

Drainage area. -95. 0 square miles.

Gage-height record.-Water-stage recorder graph except 1-4:30 a.m. July 9, for which graph was drawn on basis of flood mark in gage house.

Discharge record. - Stage -discharge relation defined by current-meter measurements below 1,600 second-feet and extended to peak stage. Gage heights used to half tenths between 3. 2 and 5. 3 feet and between 7. 0 and 9. 3 feet, to hundredths below 3.2 feet and to tenths between 5. 3 and 7.0 feet and above 9. 3 feet. Shifting-control method used July 21-31.

Maxima.-July 1951: Discharge, 10,900 second-feet 2:30 a.m. July 9 (gage height, 15.15 feet).

1949 to June 1951: discharge, 2,910 second-feet July 17, 1950(gage height, 9.57 feet).

Daily Mean Discharge, in second--feet, July, 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	214	9	6,460	17.	119	25	53
2	152	10	1,330	18	102	26	48
3	125	11	467	19	88	27	50
4	102	12	321	20	76	28	44
5	84	13	242	21	70	29	39
6	70	14	189	22	68	30	35
7	61	15	156	23	65	31	32
8	1,110	16	130	24	58	Total	12, 160

Monthly Mean Discharge, in second-feet ------------------------------------ 392
Second feet per square mile - 4. 13
Runoff, in inches --- 4. 76

Gage Height in Feet, and Discha:rge in Second-Feet, at Indicated Time, 1951

Hour	July 8 Gage ht.	July 8 Dis-charge	July 9 Gage ht.	July 9 Dis-charge	July 10 Gage ht.	July 10 Dis-charge	July 11 Gage ht.	July 11 Dis-charge:	July 12 Gage ht.	July 12 Dis-charge	July 13 Gage ht.	July 13 Dis-charge
1	2.40	56	15.02	10,-500	9. 00	2,200						
2	2.39	55	15. 12	10,700	8.88	2, 100	6.55	620	5.09	359		
3	2.38	55	15. 12	10,700	8.78	2,000						
4	2.38	55	15.02	10,500	8.68	1,900	6.36	580	5.05	352		
5	2.38	55	14.83	10,100	8.60	1,800						
6	2.38	55	14.52	9,620	8.51	1,700	6. 15	540	4.99	344	4.36	256
7	2.38	55	14. 16	9. HO	8.42	1,610						
8	2.38	55	13.85	8,440	8.33	1,560	5.93	486	4.96	337		
9	2.38	55	13.48	7,960	8.25	1,480						
10	2.38	55	13. 10	7,320	8. 15	1,380	5.75	468	4.90	330		
11	2.38	55	12.71	6,710	8.07	1,300						
Noon	2.37	54	12.30	6, 120	7.99	1,260	5.62	436	4.84	323	4.23	244
1	2.37	54	11.89	5,560	7.93	1,220						
2	2.37	54	11.51	5,030	7.86	1, 140	5.51	420	4.78	316		
3	2.36	53	11. 18	4,640	7.77	1,080						
4	2.35	53	10.86	4,280	7.69	1,040	5.43	404	4. 72	302		
5	2.35	53	10.56	3,920	7.60	980						
6	2.35	53	10.28	3,570	7.50	920	5.34	389	4.66	296	4.09	226
7	3.85	196	10.00	3,240	7.37	845						
8	8. 13	1,380	9.79	3,020	7.21	780	5.28	389	4.60	289		
9	10.30-	3,570	9.59	2,800	7. 06	730						
10	12.37	6„260	9.42	2,600	6.94	690	5.20	374	4.56	282		
11	14. 18	9, 110	9.27	2,450	6.83	665						
12	14.82	10,, 100	9.13	2,350	6.73	640	5. 14	366	4.51	276	3.97	208
Mean	4. 17	1, 110	12.31	6,460	7.97	1,330	5.75	467	4.83	321	4.23	242

Hour	July 14 Gage ht.	July 14 Dis-charge	July 15 Gage ht.	July 15 Dis-charge	July 16 Gage ht.	July 16 Dis-charge	July 17 Gage ht.	July 17 Dis-charge	July 18 Gage ht.	July 18 Dis-charge	July 19 Gage ht.	July 19 Dis-charge
6	3.87	196	3 54	164	3.27	132	3. 11	118				
Noon	3 79	191	3.49	158	3.26	132	3. 18	125	2.95	102	2.79	88
6	3.69	180	3.40	147	3.20	127	3. 1C	117				
12	3.62	169	3.32	137	3. 13	120	3.02	109	2.86	94	2.70	80
Mean	3.79	189	3.48	156	3.24	130	3. 12	119	2.94	102	2.78	88

Supplemental record. -July 9, 2:30 a.m., 15. 15 ft. , 10,900 sec. -ft.

East Branch Panther Creek near Gridley.

Location. -Lat. 40°46'00", long. 88°54'35", at line between secs. 29 and 30, T. 27 N. , R. 3 E , 2 miles northwest of Gridley, 6 miles upstream from Illinois Central Railroad bridge , and 9 miles upstream from mouth. Datum of gage is 707.89 feet above mean sea level, datum of 1929.

Drainage area. -6. 9 square miles.

Gage-height record. -Water-stage recorder graph.

Discharge record. -Stage -discharge relation defined by current-meter measurements below 210 second-feet and extended to peak stage. Gage heights used to half tenths 2. 1 to 5. 6 feet and 7.2 to 9.8 feet, hundredths below 2. 1 feet and above 9.8 feet, and tenths between 5.6 and 7.2 feet. Shifting-contro1 method used July 22-31.

Maxima.-July 1951: Discharge, 1,470 second-feet 1:15 a.m. July 9 (gage height, 10.68 feet).

1949 to June 1951: Discharge, 285 second-feet July 17, 1950 (gage height, 8. 32 feet).

Daily Mean Discharge, in second--feet, July, 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	18	9	500	17	9.2	25	2.6
2	13	10	80	18	7.2	26	2.4
3	9.4	11	36	19	6.0	27	2.3
4	7. 1	12 ,	24	20	4.9	28	1.8
5	5.3	13	18	21	4.0	29	1.4
6	4.2	14	13	22	3.5	30	1. 1
7	3.5	15	10	23	3. 1	31	1. 0
8	71	16	8.8	24	2.8	Total	874.6

Monthly Mean Discharge, in second-feet -------------------------------- 28. 2
Second feet per square mile -- 4. 09
Runoff, in inches --- 4. 71

Gage Height in Feet, and Discharge in Second- Feet, at Indicated Time, 1951

Hour	July 8 Gage ht.	July 8 Discharge	July 9 Gage ht.	July 9 Discharge	July 10 Gage ht.	July 10 Discharge	July 11 Gage ht.	July 11 Discharge	July 12 Gage ht.	July 12 Discharge	July 13 Gage ht.	July 13 Discharge
1	1.69	3.0"	10.67	1,460	5.82	108						
2	1.69	3.0	10.63	1,400	5.69	104	4. 00	49	2.99	28		
3	1.70	3. 1	10.47	1, 180	5.58	100						
4	1.70	3. 1	10.26	950	5.46	94	3.74	43	2.96	27		
5	1.70	3. 1	10.06	782	5.35	90						
6	1.69	3.0	9.84	650	5.26	86	3.55	39	2.92	26	2.56	19
7	1.69	3.0	9.64	572	5. 17	82						
8	1.69	3.0-	9.45	505	5. 08	81	3.40	36	2.88	26		
9	1.68	2.8	9.27	448	4.99	78						
10	1.68	2.8	9.12	415	4.89	75	3.30	34	2.85	25		
11	1.68	2.8	8.94	386	4.81	72						
Noon	1.68	2.8	8.80	359	4.74	70	3.23	33	2.82	24	2.50	18
1	1.68	2.8	8.63	335	4.66	68						
2	1.68	2.8	8.45	306	4.63	68	3. 17	31	2.78	24		
3	1.67	2.7	8.27	279	4.80	72						
4	1.-67	2.7	8.06	255	4.89	75	3. 14	31	2.74	23		
5	1.67	2.7	7.79	229	4.88	75						
6	1.67	2.7	7.49	203	4.87	74	3. 11	30	2.71	22	2.43	17
7	1.95	7.6	7.07	173	4 88	75						
8	3.77	43	6.76	155	4.85	74	3. 08	30	2.67	21		
9	6.79	155	6.51	139	4.76	70						
10	8.78	359	6.31	129	4.64	68	3.06	29	2.64	21		
11	9.63	572	6. 12	120	4.49	63						
12	10.35	1,040	5.96	116	4.32	57	3.03	29	2.62	20	2.38	16
Mean	2.80	71	8.62	500	5. 01	80	3.37	36	2.82	24	2.50	18

Hour	July 14 Gage ht.	July 14 Discharge	July 15 Gage ht.	July 15 Discharge	July 16 Gage ht.	July 16 Discharge	July 17 Gage ht.	July 17 Discharge	July 18 Gage ht.	July 18 Discharge	July 19 Gage ht.	July 19 Discharge
4							2. 17	11				
6	2.32	14										
8							2. 10	10				
Noon	2.27	13	2. 12	10	2. 01	8.6	2.06	9.4	1.93	7.2	1.86	6.0
4							2. 01	8.6				
6	2.22	12										
8							1. 98	8.1				
12	2.18	12	2.06	9.4	2. 00	8.5	1.97	8.0	1.89	6.5	1.83	5.4
Mean	2.27	13	2. 12	10	2.02	8.8	2. 05	9.2	1.93	7.2	1.86	6.0

Supplemental record. -July 9, l:15,a.m. 10.68 ft. , 1,470 sec. -ft.

East Branch Panther Creek at El Paso.

Location. -Lat. 40°45'15'', long. 89°00'20", on line between sees. 32 and 33, T. 27 N., R. 2 E., 0. 5 mile upstream from Illinois Central-Railroad bridge, 0. 9 mile north of El Paso, and 4 miles upstream from mouth. Datum of gage is 688. 08 feet above mean sea level, datum of 1929.

Drainage area -27. 9 square miles.

Gage-height record.-Water-stage recorder graph.

Discharge record.- Stage- discharge relationdefined by current-meter measurements below 2,500 second-feet and extended to peak stage. Gage heights used to half tenths between 2. 9 and 5.7 feet and above 13.8 feet, hundredths below 2. 9 feet, and tenths between 5. 7 and 13. 8 feet. Shifting-control method used July 1-8, 12-31.

Maxima.-July 1951: Discharge, 5,300 second-feet 7 to 8 a.m. July 9; gage height, 14. 21 feet 7:30 a.m. July 9.

1949 to June 1951: Discharge, 916 second-feet July 17, 1950 (gage height, 9. 27 feet).

Daily Mean Discharge, in second--feet, July, 1951

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	87	9	3,500	17	49	25	28
2	67	10	684	18	44	26	26
3	56	11	194	19	40	27	24
4	48	12	116	20	36	28	22
5	41	13	85	21	34	29	20
6	37	14	68	22	33	30	17
7	34	15	58	23	34	31	15
8	405	16	53	24	31	Total	5, 986

Monthly Mean Discharge, in second-feet ---------------------------------- 193
Second feet per square mile -- 6.92
Runoff, in inches -- 7. 98

Gage Height in Feet, and Discharge in Second -Feet, at Indicated Time, 1951

Hour	July 8 Gage ht.	July 8 Dis-charge	July 9 Gage ht.	July 9 Dis-charge	July 10 Gage ht.	July 10 Dis-charge	July 11 Gage ht.	July 11 Dis-charge	July 12 Gage ht.	July 12 Dis-charge	July 13 Gage ht.	July 13 Dis-charge
1	2.08	32	14. 16	5, 180	10. 15	1,210						
2	2.08	32	13.82	4,450	9.97	1, 130	5.25	290				
3	2.08	32	13.40	3,860	9.71	1,020						
4	2.08	32	13.30	3,730	9.54	960	4.98	257	3.69	131		
5	2.08	32	13.64	4, 140	9.32	916						
6	2.08	32	14.01	4,830	9. 13	876	4.71	222			3.24	90
7	2.07	31	14. 19	5,300	8.92	838						
8	2.07	31	14.20	5,300	8.74	802	4.50	201	3.60	123		
9	2.07	31	14. 14	5, 180	8.53	770						
10	2.07	31	13.95	4,730	8.31	738	4.36	186				
11	2.06	31	13.67	4,290	8.06	706						
Noon	2.06	31	13.42	3,860	7.81	658	4.24	178	3.53	115	3.16	84
1	2. 06	31	13. 17	3,610	7.53	610						
2	2.06	31	12.87	3,270	7.22	562	4. 13	168				
3	2.06	31	12.58	2,970	6.95	534						
4	2.05	30	12.34,	2,680	6.70	492	4.03	160	3.44	108		
5	2.04	30	12. 13	2,500	6.45	450						
6	2.04	30	11.90	2,320	6.26	436	3.95	151			3.10	81
7	2.22	40	11.68	2, 160	6. 10	408						
8	7.83	658	11.45	1,930	5.99	394	3.89	147	3.38	101		
9	9.89	1,090	11.20	1,790	5.87	380						
10	11.09	1,720	10.84	1,530	5.75	366	3.82	139				
11	12.86	3,270	10.64	1,410	5.63	345						
12.	13.95	4,730	10.43	1,310	5.52	324	3.78	139	3. 32	98	3.04	75
Mean	3.71	405	12.87	3,500	7.78	684	4.38	194	3.53	116	3. 17	85

Hour	July 14 Gage ht.	July 14 Dis-charge	July 15 Gage ht.	July 15 Dis-charge	July 16 Gage ht.	July 16 Dis-charge	July 17 Gage ht.	July 17 Dis-charge	July 18 Gage ht.	July 18 Dis-charge	July 19 Gage ht.	July 19 Dis-charge
6	2.99	72	2.83	61								
8					2.71	54	2.67	51				
Noon	2.94	68	2.79	58					2.56	44	2.50	40
4					2.68	52	2.62	48				
6	2.90	65	2.76	56								
12	2.86	63	2.74	55	2.64	49	2.58	45	2.52	41	2.46	38
Mean	2. 94	68	2.80	58	2.69	53	2.63	49	2.56	44	2.50	40

Supplemental record. -July 9, 7::30 a.m., 14.21 ft., 5,300 sec. -ft.

Summary of Flood Discharges

	Stream and Place of Determination	Drainage area (square miles)	Period of Record	Maximum Flood Previously Known: Date		Discharge: Second-feet	Discharge: Second feet per square mile	Maximum During Present Flood: Time	Gage height (feet)	Discharge: Second-feet	Discharge: Second feet per square mile	Remarks
A.[1]	North Fork Vermilion River near Charlotte	184	1942-	May 18, 1943	13.54	2,400	i3.0	4 p.m. July 9 to 4 p m. July 10	15.01	2,180	11.8	Max G.H. previously known, 13 78 ft. Aug 4, 1943
B.	Vermilion River at Pontiac	568	1942-	Aug. 3, 1943	15. 90	8,170	14.4	8 a. m. to 12m. July 10	17. 90'	13,600	23.9	Max. G.H previously known in 35 years, 17. 0 ft, May 1933.
C.	Vermilion River at Lowell	1,230	1931-	Apr. 25, 1950	11. 10	23,300	18.9	6 to 6:30 p. m. July 10	12.76	27,766	22. 5	Max. stage known, about 16 ft. (ice jarn); date unknown.
D.	Mackinaw River near Congerville	764	1944-	Apr, 30, 1947	16 02	15,500	20.3	12 m. to 3 p,m. July 9	19 41	36,006	47. 1	
E.	Mackinaw River near Green Valley	1, 100	1921-	Apr. 24, 1944	12.50	26,400	24.0	4 to *1 p.* m. July 10	13. 12	31,660	28.2	
F.	Money Creek above Lake Bloomington	45	1933-	Apr. 30, 1947	9. 16	3,900	86.7	l 30 a, m. July 9	6.73	1, 120	24.9	
G.	Hickory Creek above Lake Bloomington	10. 1	1938-	Aug. 3, 1943	7. 12	1,460	145	12:30 a.m. July 9	7.57	1,690	167	
H.	Money Creek at Lake Bloomington	61	1930-	Apr. 30, 1947	8. 35	3,350	54.9	2 to 3 a. m. July 9	8.51	3,506	57.4	
I.	Panther Creek near El Paso	95.0	1949-	July 17, 1950	9.57	2,916	30.6	2:36 a.m. July 9	15. 15	10,900	115	
J.	East Branch Panther Creek near Gridley	6.9	1949-	July 17, 1950	8.32	285	41.3	1:15 a.m. July 9	10.68	1,470	213	
K.	East Branch Panther Creek at El Paso	27.9	1949-	July 17, 1950	9.27	916	32.8	7 to 8 a. m. July 9	14.21	5,300	190	

[1] Letter refers to location of gage on FIGURE 1.

LAND DAMAGE SURVEY, MACKINAW RIVER WATERSHED

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Introduction

The upper portion of the Mackinaw River Watershed in northern Mc Lean, southeastern Woodford, and southwestern Livingston Counties in Illinois, was subjected to an extremely intense rainfall the night of July 8, 1951.

In certain localities, the rainfall exceeded 13 inches in 6 hours; the storm area which was studied for this report was subjected to rains of from 4 inches in 6 hours to the maximum of 13 inches.

Object of Study

The object of the survey was to obtain data, on a farm to farm basis of damages incurred in the area, on land with conservation practices, as well as on land without practices. Damages considered were crop losses by washing, smothering, and drowning; soil losses by erosion; and damage to runoff retarding structures, waterway stabilization structures, drainage ditches, fences, and other rural property.

Method of Survey

The survey was conducted by Soil Conservation Service personnel. Twenty-four farms with complete farm plans were selected as the basic sample. An additional 20 farms were surveyed to obtain comparative data as to the efficiency of the conservation program. These check farms were selected in the field as adjoining farms to the conservation farms. Criteria for their selection was that they should represent, insofar as possible, the same soil and topographic conditions as the conservation farms.

A study of the survey results indicates that these standards were met, with the very minor criticism that the non-conservation farms averaged 168 acres in size as contrasted to 157 acres for the conservation farms. The 20 non-conservation farms totaled 3, 360 acres whereas the 24 conservation farms totaled 3,763 acres.

Results of Survey

Erosion Survey Results

Due to the fact that this storm occurred during the summer, land damage by erosion was restricted to fields in row crops, such as corn and soybeans. The most striking fact revealed by the survey was the efficiency of conservation practices in controlling erosion under extreme test conditions.

From a detailed analysis of the isohyetal map of the total storm, (Figure 18), it should be possible to substantiate observations by the farmers and the field men that contour practices approached nearly absolute soil stabilization under intensities of up to five inches of rain in six hours; where survey samples fell in areas having greater intensities, the efficiency of the practices decreased. In no instance were the conservation practices less than 50 percent effective. The average reduction in soil loss amounted to 85. 5 percent.

On lands where conservation practices were used, 22. 9 acres were measurably affected by erosion per 100 acres of farm land. These 22.9 acres lost 320 tons of soil, or an average of 14 tons per acre, which would be less than one-tenth inch of soil over an entire acre.

Where conservation practices were not used, 31. 4 acres were measurably affected by erosion per 100 acres of farm land. These 31.4 acres lost 2,210 tons of soil, or an average of 70 tons per acre. Seventy tons of soil lost per acre is equivalent to one-half inch of soil over an entire acre.

From the standpoint of controlling soil losses the conservation practices affected an 85. 5 percent reduction in soil loss from sheet erosion.

New gullies and new growth of existing gullies were found to total 1, 030 feet in length on the 20 farms without practices, producing a total of 100 cubic yards of soil. The 24 farms with practices had 88 feet of gully growth producing 35 cubic yards of soil

Deposition measured

A total of 8.25 acres of deposition was measured on upland areas on conservation farms . These areas ranged in size from less than 1/4 acre to 2 acres and were found at the toe of slopes and in small swales. The total measured deposition on the conservation farms amounted to 8 acre-inches of deposition.

The farms without practices had 104 acres of deposition amounting to 67. 2 acre-inches of deposited material.

It was impossible to measure bottomland deposition or erosion because of high water at the time of survey.

FIG. 35. A CORN FIELD IN McLEAN COUNTY AFTER A 7-INCH RAIN. THE LONG GENTLE SLOPES ARE ESPECIALLY VULNERABLE TO EROSION DAMAGE.

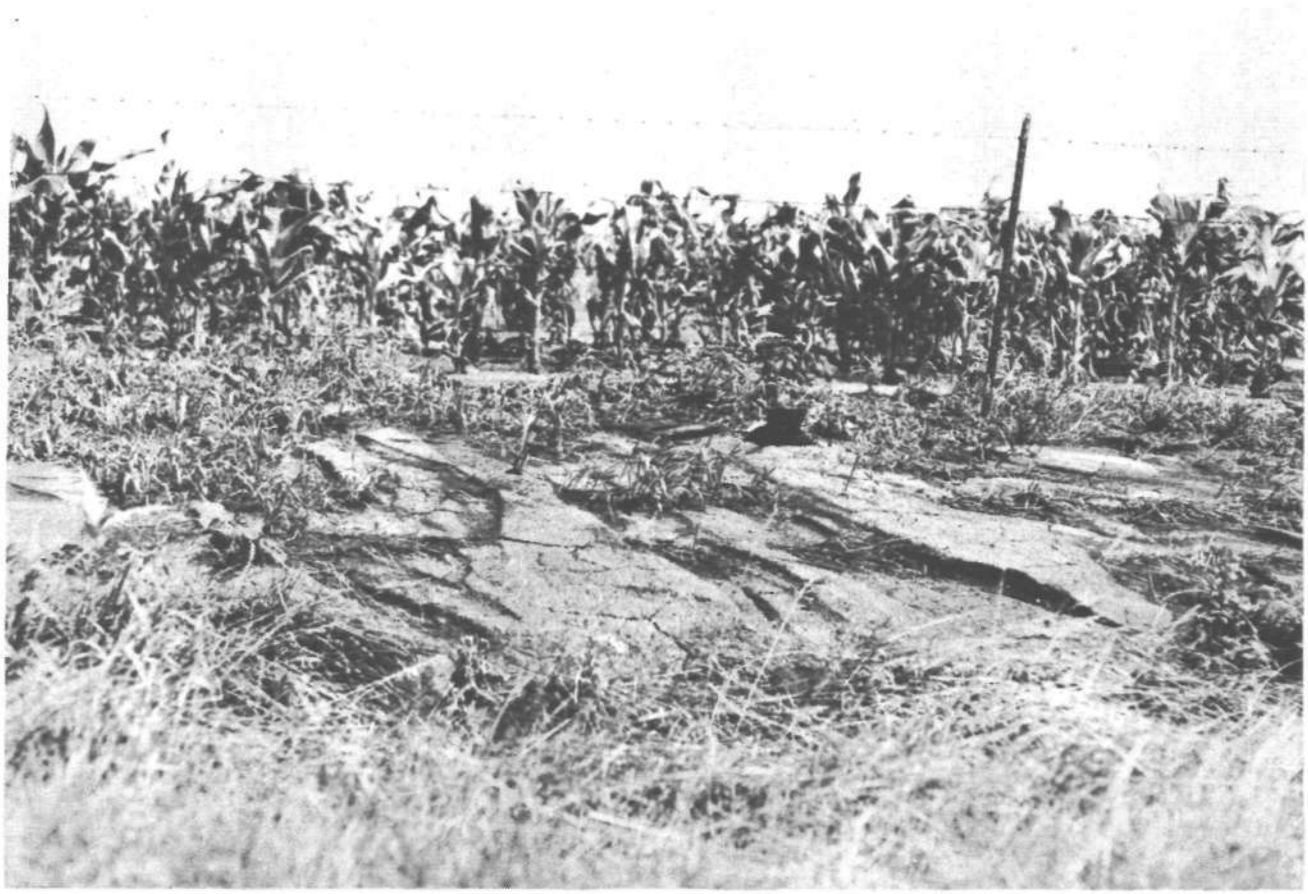

FIG. 36. TONS OF SOIL WERE DEPOSITED IN THE GRASS AS RUNOFF FROM THE CORN FIELD SHOWN IN FIG. 35 FILTERED THROUGH THIS SOD.

Damage to Crops

Numerous observations were made where deposition had smothered clover seedings in small grain fields. At the time of the survey it was impossible to determine whether the silt or the water caused this damage. The survey disclosed that 44 acres of crops were totally destroyed by deposition on non-conservation farms compared to 14 acres on conservation farms.

On farms which did not follow a conservation plan, 46.3 acres of crops were lost by flooding. Farms with conservation practices lost a total of 24 acres of crops by flooding.

Crop Yields in the Area

Estimates of crop yields by the farmer varied considerably, as no doubt the yields vary. Estimates of corn yield ran from 55 to 90 bushel per acre. The average corn yield in McLean County in 1950 was 51 bushel per acre. Soybeans averaged 26 bushel per acre in 1950, oats 42 bushel per acre, and wheat 27 bushel per acre.

Evaluation of Conservation Practices

Operators' Estimates: Does conservation farming reduce erosion and runoff?

One of the universal observations of the field men conducting this survey was that the farm operators were highly pleased with their conservation practices. An estimate was obtained from each operator as to the efficiency of his practices in reducing erosion and runoff. It is interesting to note that only one operator estimated that erosion was reduced less than 50 percent, two estimated a 50 percent reduction in erosion, and the other twenty-one operators estimates ranged from 75 to 98 percent. The average of all the estimates amounts to 81 percent. The farm operators' estimates of conservation practices effect on runoff ranged from 10 to 90 percent. The average of all estimates was 53 percent.

How Conservation Practices Withstood the Storm

The conservation practices, which the Soil Conservation Service has endorsed in this area, were very successful in reducing erosion damage and runoff. The agronomic practices such as contour cultivation, terracing, soil building, rotations, etc. were successful beyond the expectation of the technicians. The survey revealed however, that many conservation programs fell a little bit short of complete control. On several fields where corn was contoured, the need for terracing or diversion ditches was obvious when such land is subjected to rainfall intensities which exceed that expected once in 50 years.

Engineering practices such as runoff control structures, terrace outlet stabilization structures, and drainage works were examined with the object of determining, if possible, the adequacy of design of the structures and the need for an intensification of their use.

Out of over fifty structures in the area only two were damaged to any appreciable extent. This damage was the partial loss of the earth fills. In these two cases the concrete work was not damaged and the fills can be replaced.

In a number of cases the runoff overtopped the fills but did no damage either to the fill or the concrete work. Some of the earth fills had been overtopped by a foot or more of water with no appreciable damage where good grass sod was established on the fill.

The need to design and construct emergency spillways in conjunction with some of the structures was obvious in the area of highest intensity rainfall. These emergency spillways are a form of insurance to protect the structure in the event of a flood-producing runoff which is larger than the design capacity of the structure.

Summary

Although conservation practices are designed to give maximum protection to the land, it is entirely probable that the land will be subjected to storm conditions that exceed the design criteria. The intense storm which struck northern McLean, southeastern Woodford, and southwestern Livingston counties in Illinois on July 8, 1951 presented an opportunity to study conservation practices under extreme test conditions. The area involved is one of rich prairie soils in the corn belt.

Conservation practices reduced soil losses by 85.5 percent in cultivated fields where these practices were used in contrast to cultivated fields where no practices were used.

On farms where a conservation program is being followed, 22.9 acres were measurably affected by sheet erosion per 100 acres of land. These 22.9 acres lost an average of 14 tons of soil per acre. The average soil loss per 100 acres of farm land under a conservation program amounted to 320 tons. Farms which did not have a conservation program had 31.4 acres measurably affected by sheet erosion per 100 acres of land, with an average soil loss of 70 tons of soil per acre. The average soil loss per 100 acres of farm land without a conservation program was 2,210 tons.

New gullies and new growth of existing gullies were found to total 1,030 feet in length, producing a total of 100 cubic yards of soil from the 3,360 acres surveyed where no conservation program was being followed. The 3,763 acres with a conservation program had 88 feet of gully growth, producing 35 cubic yards of soil. This amounts to a soil loss of 0.93 cubic

FIG. 37 CONSERVATION PRACTICES, (1 mile north of Eureka), WHICH SUCCESSFULLY WITHSTOOD 4 INCHES OF RAIN IN 6 HOURS

yards per 100 acres of land under a conservation program as contrasted to 2.98 cubic yards per 100 acres of land without a program. A 69 percent reduction in soil loss by gullies being attained by the conservation program.

Deposited material amounting to 0.22 acre-inches per 100 acres of land under a conservation program and 2.00 acre-inches per 100acres of land without a conservation program was measured. This material was found in upland swales and low areas. Bottomland erosion and deposition was not surveyed, because of high water at the time of the survey.

APPENDIX

Basic Rainfall Data

The basic rainfall data for the storm of July 8, 1951 in north central Illinois have been presented in detailed tabular form in the accompanying tables to facilitate their use in a more detailed hydrometeorological study.,

A total of 350 rainfall observations are included in the tabular presentation; almost all of these observations were obtained through an extensive field survey conducted by members of the staff of the Illinois State Water Survey.

Tables 3, 3A, and 3B include the following information: the operator of the rain gage (if known) and the municipality nearby; the location of the gage by township, range, and section; the total storm rainfall; and the reliability of the observation.

Table 3 includes certain comments, such as the type of measuring device employed, while Tables 3A and 3B include the station-designation-numbers for the recording and non-recording gages in the Panther Creek Hydrologic Project. (These numbers correspond to those shown in Figures 23, 24 and 25).

The accompanying diagram (Figure 38)will facilitate an understanding of the symbols employed in designating the observation location in a particular section.

The rainfall amount has been recorded to the nearest tenth for field observations in various containers, and to the nearest hundredth for observations in rain gages.

A question mark appearing in the column designated "reliability of observation" , indicates either that the original observation was questioned by the observer during the field survey, or that the magnitude of the observed rainfall differs considerably from adjacent observations when plotted on a base map.

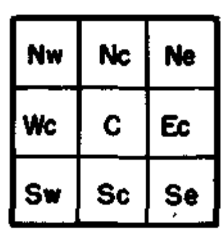

FIG. 38 SECTION DIVISIONS FOR LOCATING RAINFALL OBSERVATIONS IN TABLES 3, 3A, AND 3B.

ft
Table 3. Rainfall Observations

#	Gage Operated	Section	Township	Range	Rainfall	Reliability of Observation	Comments *
1	John D. Mackinson, Pontiac, I11.	NE 4	28N	5 E	3.8		-
2	Edward E. Lyons, Odell	NC 16	29 N	5 E	3.8		
3	H. G. Emms, Streator '	SW 7	29 N	4 E	3. 1		
4	M. Walters, Ancona	SW 25	30 N	3 E	3.7		
5	Dale Carpenter, Dwight	SE 2	30 N	6 E	4.5		
6	J. D. Webb, Blackstone	SE 3	30 N	5 E	6. 0	?	Claims to have emptied gage.
7	J. W. Webb, Blackstone	NW 28	30 N	5 E	4.5		
8	Charles Oak, Blackstone	NW 9	30 N	5 E	4. 3		
9	John Webber, Blackstone	NW 4	30 N	5 E	4.5		
10	W. C. Walling, Streator	NW 36	31 N	4 E	3.8		Keeps precipitation record.
11	F. H. Werner, Streator	SC 29	31 N	4 E	3. 5		
12	H. C. Coe, Streator	SE 9	30 N	3 E	3.5		
13	Earl Gourley, Ancona	EC 29	30 N	3 E	3.4		
14	J. D. Fry, Long Point	SC 5	29 N	3 E	3.3		
15	Lavon Ellis, Long Point	NW 22	29 N	3 E	4. 0+	?	By word of mouth.
16	Russell Tesch, Flanagan	C 25	29 N	3 E	4.8		
17	Various Observers, Graymont	EC 20	28 N	4 E	5.0+	?	By word of mouth, gages overflowed.
18	Floyd Rich, Pontiac	NC23	28 N	4 E	4.5		
19	J. R. Deamer, Pontiac	NW 12	28 N	4 E	5. 0+		Slightly over 5".
20	Willard Williams, Pontiac	WC 28	29 N	4 E	4.6±		
21	Paris Lundy, Manville	SE 4	29 N	4 E	2.3		
22	James Connor, Manville	NW 27	30 N	4 E	4.5		
23	Orval Long, Blackstone	SW 30	30 N	5 E	4.5 -		
24	Earl Duay, Odell	NW 35	30 N	5 E	4. 1		
25	Phillip Biros, Odell	SW 20	30 N	6 E	4.5		
26	T. E. Martin, Odell	NC 10	29 N	6 E	4. 5		By word of mouth •
27	Francis Legner, Odell	EC 26	30 N	6 E	3.8		-
28	Wm. Hoke, Odell	NC 14	29 N	6 E	3.8		
29	Clarence Mund, Odell	NE 28	29 N	6 E	3. 3		
30	John Schnoor, Pontiac	NE 15	28 N	6 E	4.5		
31	Lester Ulrich, Pontiac	EC 22	28 N	6 E	4.5		
32	John Allinson, Pontiac	NW 2	27 N	6 E	5.5+		
33	Harry Waters, Fairbury	EC 22	27 N	6 E	6.9		Measured in bucket.
34	M. J. Gould, Champlin	EC 29	27 N	6 E	8. 3		Gage emptied twice. - -
35	Fairbury Water Works, Fairbury	C 3	26 N	6 E	7.25		U.S. W. B. Co-op., weighing bucket gage.
36	Dale Orendorff, Flanagan	SW 2	27 N	3 E	7.8	?	By word of mouth.
37	Roger Williams, Pontiac	WC 22	28 N	5 E	3.97		U. S. W.B. Co-op., 8" stick gage.
38	Murphy's Drug Store, Cornell	SC 11	29 N	4 E	4.0		
39	J. Prefcke, Streator	NE 35	31 N	3 E	3.38		U.S. W.B. Co-op., 8" stick gage.
40	J. F. Ziegler, Dwight	SE 4	30 N	7 E	4. 10		8" stick gage.
41	Leonard Foleys, Wenona	EC 24	30 N	1 E	3.90		U. S. W. B. Co-op., weighing bucket gage.
42	, Lostant	SE 26	31 N	1 E	4.0		Intersection Rts. 51 and 18.
43	Ray Keyt, Tonica	NE 2	31 N	1 E	2.0	?	
44	Lola Riley, Lowell	SE 4	32 N	2 E	2.2		Includes rainfall earlier in day.
45	R. E. Ebmer, Tonica	WC 25	32 N	1 E	2.4		
46	Herbert Guenther, Oglesby	NW 2	32 N	1 E	2. 5		Includes rainfall earlier in day.
47	, Streator	SC 26	31 N	2 E	4.0		Includes rainfall earlier in day.

***Unless indicated otherwise, all values are based on observations from glass tube gages of approximately 3/4 inch diameter and a capacity of 5.5 inches; these gages are often mounted on a fence post. Any value of 5. 0 or 5. 0+ inches should be viewed with caution in view of possible loss due to splashing; values of 5. 5 and 5. 5+ inches may indicate gage overflowed.**

#	Gage Operated By	Section	Township	Range	Rainfall	Reliability of Observation	Comments
48	Wm. Freise, Milla	NC 22	31 N	2E	5.0		
49	Leonore	SC 34	32 N	2 E	3.5		Includes rainfall earlier in day.
50	Tonica	SC 29	32 N	2E	3.0		Includes rainfall earlier in day.
51	, Lowell	WC 3	31 N	2 E	2.8	?	Includes rainfall earlier in day.
52	Hillard Logsclon, Ottawa	NW 20	33 N	3 E	1.5		Includes rainfall earlier in day.
53	Daily Republic Times, Ottawa	NW 12	33 N	3 E	2.8		Includes rainfall earlier in day.
54	Adrian Pike, Ottawa	WC 24	33 N	3 E	2.5		Includes rainfall earlier in day.
55	, Grand Ridge	NW 24	32 N	3 E	2.5		Includes rainfall earlier in day.
56	The Pmes, Streator	NW 12	31 N	3 E	3.5+		
57	Elevator, Kernan	C 22	31 N	4 E	3.2		Includes rainfall earlier in day.
58	, Grand Ridge	NC 19	32 N	5 E	3.6		
59	, Seneca	WC 31	33 N	6 E	3. 0+	?	
60	Clarence Fry, Seneca	C 25	32 N	5 E	3.8		
61	, Kinsman	NW 5	31 N	6 E	3.0		
62	Alex Savage, Nevada	NW 3	30 N	6 E	4.3		Includes rainfall earlier in day.
63	John Miller, Metamora	SC 17	27 N	2 W	4.7		
64	, Lowpomt	WC 24	28 N	2 W	3.2		
65.	, Lowpoint	NC 31	28 N	2 W	4.8		
66	Harry Snyder, Washburn	NW 1	28 N	2 W	4. 50		U. S. W. B. Co-op., 8" stick gage.
67	Sinclair Gas Station, LaRose	SW 16	29 N	1 W	4.4		
68	, Varna	NE 28	30 N	1 W	2. 5	?	5" reported near Varna.
69	, Toluca	C 5	29 N	1 E	3. 9		
70	, Lacon	SE 26	30 N	3 W	4.19		U. S. W.B. Co-op., 8" stick gage.
71	, Chillicothe	NC *b*	28 N	3 W	4.49		U. S. W. B. Co-op., 8" stick gage.
72	, Green Valley	NW 35	23 N	5 W	1.8		
73	, Delavan	WC 10	22 N	4 W	1.0		1.2" reported nearby.
74	, Tremont	WC 18	24 N	3 W	2.5		
75	, Minier	C 22	23 N	2 W	2. 0		
- 76	, Minier	C 20	23 N	2 W	2. 5		
77	, Stanford	C 21	23 N	1 W	2. 0		
78	, Stanford	WC 24	23 N	1 W	1. 9		
79	Frank Schulz, Meadows	NW 24	27 N	3 E	8.8		
80	, Waldo	NW 9	27 N	4 E	5. 5		
81	, Waldo	NC 18	27 N	4 E	7.0+	?	Measured in bucket.
82	, Flanagan	NC 5	27 N	4 E	7. 0		Measured in bucket.
83	, Flanagan	NE 30	28 N	4 E	8.0		Measured in bucket.
84	, Flanagan	WC 4	27 N	4 E	8. 0+		
85	, Graymont	EC 21	28 N	4 E	5.0		
86	, Pontiac	NC 19	28 N	5 E	4. 5		
87	T. H. Brock, Eureka	NC 13	26 N	2 W	4.23		8" stick gage; County Farm Adviser.
88	, Eureka	NE 24	26 N	2 W	4. 0		
89	Libby, McNeill & Libby Co., Eureka	C 7	26 N	1 W	4. 90		8" stick gage; data supplied by T. H. Brock.
90	, Eureka	NW 9	26 N	1 W	4. 5+		
91	, Eureka	NE 17	26 N	1 W	5. 0		
92	, Eureka	SC21	26 N	1 W	4.8		
93	, Eureka	NE 3	26 N	1 W	5. 0+		
94	, Secor	EC 1	26 N	1 W	8.3		Gagung device unknown.
95 -	, Secor	SW 11	26 N	1 W	5. 0+		

#	Gage Operated By	Section	Township	Range	Rainfall	Reliability of Observation	Comments
96	, Secor	NC 24	26 N	1 W	5.0+		
97	, Secor	NE 13	26 N	1 W	5.0+		
98	, Secor	EC 23	26 N	1 W	5. 0+		
99	, Secor	NC 26	26 N	1 W	5. 0		
100	, Eureka	SE 29	26 N	1 W	4. 0		
101	, Eureka	NE 30	26 N	1 W	5. 0	?	
102	, Eureka	SE 28	26 N	1 W	5. 0+		
103	, Eureka	SC 27	26 N	1 W	4.4		
104	, Eureka	SW 26	26 N	1 W	4.8		
105	, Eureka	SE 26	26 N	1 W	5. 0		
106	, Congerville	NE 1	25 N	1 W	3. 5+	?	Gage near a tree.
107	, Goodfield	WC 5	25 N	1 W	3.9+		
108	, Congerville	C 3	25 N	1 W	4. 0		Measured in bucket.
109	, Congerville	SC 15	25 N	1 W	3. 0		
110	, Secor	SC 9	26 N	1 E	5. 5		
111	, Secor	NE 17	26 N	1 E	5.0+		
112	, Secor	SW 15	26 N	1 E	6. 8		Gage emptied during night. .
113	, Secor	NE 29	26 N	1 E	4.8		
114	, Secor	SW 27	'26 N	1 E	4.0		
115	, Secor	SC 27 ,	26 N	1 E	4.5		
116	, El Paso	NE 25	26 N	1 E	5.0		
117	, El Paso	NC 25	26 N	1 E	5.0		
118	, El Paso	SE 25	26 N	1 E	4.6	?	Poor gage location.
119	, Secor	EC 31	26 N	1 E	4. 3		
120	• , Kappa	NE 32	26 N	2 E	5.0+	?	By word of mouth.
121	, Hudson	SC 21	25 N	2 E	5.3	?	By word of mouth.
122	, El Paso	WC 15	26 N	2 E	5.5+	?	
123	, El Paso	SE 9	26 N	2 E	8. 0		
124	, El Paso	WC 14	26 N	2 E	5. 5	?	
125	, Meadows	EC 5	26 N	4 E	8.1 +		
126	, Meadows	SC 6	26 N	4 E	8. 0+		
127	, Chenoa	EC 4	26 N	4 E	6. 0+	?	
128	, Chenoa	NE 16	26 N	4 E	8.3		
129	, Chenoa	EC 21	26 N	4 E	7.5+		
130	, Lexington	NC 33	26 N	4 E	5.5+		
131	, Lexington	WC 5	25 N	4 E	4.8	?	Measured in bucket; poor location.
132	, Lexington	NE 7	25 N	4 E	4. 5		5" reported nearby.
133	, Lexington	C 1	25 N'	3 E	6.8		
134	, Lexington	WC 32	26 N	4 E	4. 5		
135	,• Lexington	SW 20	26 N	4 E	5. 5		
136	, Meadows	NW 17	26 N	4 E	5. 0+		
137	, Meadows	SE 12	26 N	3 E	10.0+	?	5 gal. bucket, straight sides.
138	, Lexington	NW 17	26 N	4 E	6.5+		5gal. bucket, straight sides.
139	, El Paso	SE 22	26 N	2 E	5.5+		
140	, El Paso	NE 28	26 N	2 E	5.3		5 gal. bucket, straight sides.
141	, El Paso	NC 34	26 N	2 E	5.2		
142	, El Paso	SC 26	26 N	2 E	5. 5+		
143	, El Paso	C 24	26 N	2 E	8. 0		5 gal. bucket, straight sides.
144	, Gridley	SE 7	26 N	3 E	9. 0		Gage overflowed into bucket
145	, Gridley	NE 19	26 N	3 E	7.0	?	Measured in bucket near a tree.
146	, Gridley	NW 31	26 N	3 E,	6.0		
147	, Gridley	NE 20	26 N	3 E	8.5		In large crock.
148	, Gridley	NE 20	26 N	3 E	8.0		In small crock.
149	, Gridley	C 29	26 N	3 E	5.5+		
150	, Gridley	EC 8	26 N	3 E	9.'o		
151	, Gridley	EC 15	26 N	3 E	9.0+		
152	, Gridley	SC 21	26 N	3 E	8.0+		
153	, Gridley	SC 27	26 N	3 E	9.0+	?	
154	, Lexington	SC 3	25 N	3 E	5. 0		
155	, Lexington	NE 4	25 N	3 E	4. 5		
156	, Lexington	SC 33	26 N	3 E	5. 0		

#	Gage Operated By	Section	Township	Range	Rainfall	Reliability of Observation	Comments
157	, Lexington	SC 35	26 N'	3 E	5. 5+		
158	, Lexington	SW 25	26 N	3 E	5. 5		
159	, Lexington	C 26	26 N	3 E	5. 5+		
160	, Gridley	EC 24	26 N	3 E	8.0		5 gal. bucket, straight sides.
161	Fred Pretzloff, Sibley	WC 35	25 N	7 E	4.3		Mr. Norton, Land Office, Sibley, reporting.
162	Weston	EC 3	26 N	5 E	8. 5		Several observations in re-gion.
163	Clifford Gentes, Chenoa	SC 4	26 N	5 E	11.0	?	Measured in bucket under tree.
164	, Chenoa	SW 1	26 N	4 E	8. 20		U. S. W. B. Co-op., 8" stick gage.
165	Farm Bureau, Ocoya	WC 17	27 N	5 E	8. 0+		By word of mouth.
166	, Swygert	WC 10	28 N	6 E	3.7		
167	■ . , Saunemin	C 15	28 N	7 E	6. 0	?	By word of mouth.
168	, Graymont	SW 28	28 N	4 E	5.5		
169	Hermann Eckhoff, Graymont	NW 33	28 N	4 E	7.0		Gage emptied during storm.
170	Frank Masterson, Dana	SW 24	29 N	2 E	4. 5		
171	Fred Dune, Dana	NE 11	28 N	2 E	4. 3		
172	Herbert Uftring, Flanagan	NW 3	28 N	3 E	5. 0		
173	, Strawn	NW 3	25 N	7 E	7. 0	?	Measured in bucket.
174	Wm. Perdelwitz, Strawn	SW 27	26 N	7 E	5. 9		6" in buckets nearby.
175	, Weston	NE 22	27 N	5 E	8.0		By word of mouth.
,176	, Weston	NE 24	27 N	5 E	8.0		Several observations in region.
177	A. W. Swartz & Sons, Lexington	WC 8	25 N	4 E	5. 0		
178	Joe Farner, Lexington	EC 10	25 N	4 E	5.0		
179	Roland Peden, Lexington	NW 7	25 N	5 E	5. 0+		
180	Russell Thompson, Lexington	NC 9	25 N	5 E	5. 0		
181	Ed Weinzirel, Colfax	NW 11	25 N	5 E	5.5+	?	6" estimated.
182	, Colfax	SC 2	25 N	5 E	7. 0	?	By word of mouth.
183	J. H. Winter, Weston	SW 26	26 N	5 E	5.5		
184	George Brady, Weston	SE 10	26 N	5 E	8. 0		Gage emptied during night.
185	, Weston "	SW 23	26 N	5 E	7. 0+	?	
186	, Fairbury	NE 32	26 N	6 E	6.5		By word of mouth; hail re-ported.
187	Phil Thompson, Fairbury ,	SE 32	26 N	6 E	7. 0		Gage emptied during night; hail reported,
188	Carl Goembel, Cropsey	NE15	25 N	6 E	5.4		
189	Raymond Mishier, Risk	SC 29	26 N	7 E	5.3		
190	W. P. Brady, Risk	SW 30	26 N	8 E	5.0+	?	
191	Vernon Hammel, Chatsworth	NC 27	26 N	8 E	6.5		Measured in bucket.
192	, Guthrie	EC 30	24 N	8 E	6.0+		
193	G. Harshbarger, Melvin	SC10	24 N	8E	6.0		Measured in 5 gal. paint bucket.
194	Mr. Bradbury, Roberts	NE 4	25 N	9 E	3. 90		U. S. W. B. Co-op., 8" stick gage.
195	LaVern Soegmiller, Piper City	NW 22	26 N	9 E	4. 6	?	6" in bucket nearby.
196	, Loda	SC21	24 N	10 E	3.0		Includes rainfall earlier in day.
197	, Chatsworth	WC 3	26 N	8 E	6.8		
198	Frank Trank, Chatsworth	SW 10	26 N	8 E	7.0		
199	, Onarga	WC 19	26 N	11 E	5.8		By word of mouth.
200	State Reformatory for Women, Dwight	EC 5	30 N	7 E	4.20		U. S. W. B. Co-op., weighing bucket gage.
201	Clarence Humphrey, Washington	SE 14	26 N	3 W	2.10		U. S. W. B. Co-op., weighing bucket gage.
202	Melvin Schuler, Lexington	NE 1	25 N	4 E	7. 0		Measured in feed bucket.
203	Charles Cunningham, Chenoa	WC 19	26 N	5 E	8.0+		Measured in milk bucket.
204	Melvin Rhode, Chenoa	SW13	26 N	4 E	7. 0	?	Estimated.
205	Charles Volland, Chenoa	NE 24	26 N	4 E	7.7		Some lost due to splashing.
206	Gilbert Brown, Chenoa	WC 18	26 N	5 E	9. 0		Measured in grease bucket.
207	Merle Zook, Lexington	NW 4 ■	25 N	4 E	5. 0+		

#	Gage Operated By	Section	Township	Range	Rainfall	Reliability of Observation	Comments
208	Mr. Streid, Chenoa	EC 4	26 N	4 E	9. 0+		5 gal. bucket overflowed.
209	Mr. Nicol, Waldo	SE 21	27 N	4 E	9.5		10" in bucket nearby.
210	Elmer Dunahee, Graymont	SE 3	27 N	4 E	6. 5		
211	George Scholtz; Pontiac	SW 36	28 N	5 E	9.0		Measured in grease bucket.
212	Carl Bressner, Pontiac	SE 19	28 N	5 E	4.8		
213	Alfred Weber, Pontiac	SE 29	28 N	5 E	5. 0		;
214	.Pontiac	SE 22	28 N	5 E	4.70		U. S. W. B. Co-op., 8" stick gage.
215	John Jensen, Saunemin	SE 31	29 N	7 E	4.5+	?	Apparently less than 5".
216	James Malone, Kempton	NE 31	29 N	9 E	4.0		
217	McCutcheon Bros. , Kempton	NE 6	28 N	10 E	5.0		
218	Clarence Peters, Kempton	EC 12	28 N	10 E	5. 0		
219	John Aden, Ashkum	NE 28	27 N	10 E	5.5		
220	Robert Sparenberg, Danforth	C 16	27 N	10 E	5. 0	?	
221	Bert McMillen, LaHogue	NW. 4	26 N	10 E	7.5		
222	Ed Warneke, Onarga .	EC 35	26 N	10 E	5.2		
223	L. Hildenbrand, Thawville	NC 6	25 N	10 E	5.80-		Good observation.
224	Frank Honegger, Forrest	SE 4	26 N	7 E	6. 5		
225	, Forrest	EC 4	26 N	7 E	7. 2	?	By word of mouth.
226	Martin Mauer, Forrest	NE 21	27 N	7 E	5.5+		
227	E. H. Brown, Forrest	C 19	27 N	7 E	7. 0		Measured in bucket.
228	Earnest G. Mies, Fairbury	NW 21	27 N	6 E	8. 1		Measured in bucket.
229	James Gould, Fairbury	NE 29	27 N	6 E	8. 3+	?	Gaging device unknown.
230	.Weston	NW 15	26 N	5 E	7. 3	?	
231	Walter Lee, Weston	NC 4	26 N	5 E	8. 5	?	Gaging device unknown.
232	Harold Kridner, Ocoya	SE 21	27 N	5 E	7.0		
233	Mr. Wade, Ocoya	WC 29	27 N	5 E	13:0+		Measured in wash boiler; 5 gal. bucket, (12.5" high,) overflowed.
234	Albert Grusy, Meadows	NC 6	26 N	4 E	9. 1		
235	Kenneth Gerig, Waldo	EC 24	27 N	3 E	8. 0+		Measured in bucket.
236	C. F. Smith, Flanagan	WC 22	28 N	3 E	7.5	?	Measured in bucket.
237	Mr. Jones, Cornell	C 29	29 N	4E	4.1		
238	Maurice Duffey, Graymont	NW 28	28 N	4 E	5. 5		
239	Wm. Duffey, Graymont	SE 12	28 N	4 E	4. 3		
240	Omar Yordy, Ocoya	SW 11	27 N	4 E	12.5+		Measured in bucket.
241	W. B. Righter, Saunemin	NW 15	28 N	7 E	4.0		
- 242	Gus-Kohler,- Cullom	SC 24.	28 N	8 E	5.2		
243	Peoria Lock & Dam, Pekin	NW 12	25 N	5 W	2.29		U. S. W. B. Co-op. , weighing bucket gage.
244	, East Peoria	SE 26	26 N	4 W	1.80		8" stick gage.
245	Farm Creek Dam, Peoria	NE 26	26 N	4 W	1.70		Gaging device unknown.
246	U. S. Eng. Office, Peoria	C 16	26 N	4 W	1. 03		Corps of Engineers; Gaging device unknown.
247	Caterpillar Co. , East Peoria	WC 6	25 N	4 W	1.60		Gaging device unknown.
248	Peoria Airport, Peoria	NC 3	25 N	5 W	1.45		U.S. W. B. 1st order station; tipping bucket gage.
249	Sankoty, Peoria	NC 4	26 N	4 W	0.80		SWS** weighing bucket gage.
250	E. Peoria Sewerage Plant, East Peoria	WC 7	25 N	4 W	1.59		SWS 8" stick gage.
251	Howard Hitchcraft, Gibson City	SW 7	23 N	7 E	4.8		
252	, Saybrook	WC 9	23 N	6 E	4. 0		
253	, Saybrook	SC 32	24 N	6 E	3.9		
254	, Saybrook	SW 32	24 N	6 E	3.2		
255	, Arrowsmith	SW 36	24 N	5 E	2.7		
256	, Arrowsmith	SE 35	24 N	5 E	2.2		
257	Oscar Morefield, Arrowsmith	SW 32	24 N	5 E	2. 0		
258	Merna Elevator, Merna	NW 25	24 N	3 E	2. 5		
259	Henry Dover, Cooksville	NW 14	24 N	4 E	3. 1		
260	Kennedy Bros., Cooksville	NC 8	24 N	5 E	4. 0		
261	, Colfax	C 3	24 N	5 E	4. 5		
262	, Anchor	SC 33	25 N	6 E	6. 1	?	

****SWS - Illinois State Water Survey**

#	Gage Operated By	Section	Township	Range	Rainfall	Reliability of Observation	Comments
264	, Colfax	WC 10	25 N	5 E	5.5+		
263	. , Sibley	NC 32	25 N	7 E	4.6		
265	, Lexington	WC 12	25 N	4 E	5.0	?	Very poor exposure.
266	, Lexington	WC 10	25 N	4 E	5. 1		Good exposure.
267	, Lexington	WC 9	25 N	4 E	4.9		Good exposure.
268	, Lexington	WC 21	26 N	4 E	4. 0		
269	, Meadows	SC 17	26 N	4 E	7. 0	?	Measured in bucket.
270	Edward J. Adams, Towanda	NW 18	25 N	3 E	4.40		SWS weighing bucket gage.
271	Leo Kraft, Towanda	NE 17	24 N	3 E	2. 13		SWS 8" stick gage.
272	Mrs. Doren Spaid, Ellsworth	SW 33	24 N	4 E	2. 16		SWS 8" stick gage.
273	D. Riser, Hudson	NE 1	25 N	2 E	5.20		SWS tipping bucket gage.
274'	D. Riser, Hudson	NE 1	25 N	2 E	5.66		SWS 8" stick gage.
275	,Normal	NW 28	24 N	2 E	1.91		U.S. W.B. Co-op., 8" stick gage.
276	James Nelson, Congerville	WC 14	25 N	1 W	3.5		
277	, Deer Creek	SE 9	25 N	2 W	3.5		Measured in can.
278	Mr. Haensel, Mackinaw *	SC 17	24 N	2 W	2.35		U.S. W.B. Co-op., 8" stick gage.
279	Bloomington-Normal Sanitary District	SE 6	23 N	2 E	2.04		8" stick gage.
280	Mrs. A. A. DeVine, Downs	NW 11	23 N	3 E	2.50		U. S. W. B. Co-op., weighing bucket gage. •
281	Mr. Leres, LeRoy	WC 21	22 N	4 E	1.31		8" stick gage.
282	W. H. Fuller, Mackinaw	NW 8	24 N	2 W	3.0		
283	Mr. Jones, Mackinaw	SE 6	24 N	2 W	5.0		Reported by W. H. Fuller.
284	Frank Hoffman, Allentown	SW 29	25 N	2 W	3.5		
285	, Deer Creek	NC 19	25 N	2 W	3.5		
286	Mr. Dietrich, Deer Creek	NC 21	25 N	2 W	3.5		
287	Mr. Mickens, Deer Creek	SW 15	25 N	2 W	3.5		
288	Mr. Knapp, Goodfield	NC 18	25 N	1 W	3.0+		Dog's pan full.
289	George Knapp, Goodfield	SW 7	25 N	1 W	3.5		Good location.
290	Jonas Yordy, Goodfield	EC 25	26 N	2 W	3.5		Good location.
291	Louis Voorhees, Eureka	NW 22	26 N	2 W	3.3	?	Possibly as high as 4".
292	.Mr. Schertz, Eureka	SE 16	26 N	2 W	3.0		
293	Mr. Harnish, Eureka	SW 31	27 N	1 W	4.9		
294	, Eureka	SC 5	26 N	1 W	5.0		
295	, Metamora	SW 14	27 N	2 W	4.0		
296	Airport, Metamora	SW 18	27 N	1 W	4.1		
297	, Roanoke	NC 20	27 N	1 W	5.0		
298	, Roanoke	SE 13	27 N	1 W	5.0		
299	, Roanoke	NW 22	27 N	1 W	4.6		
300	, Roanoke	NE 34	27 N	1 W	5. 0+	?	Poor location, near barn and tree.
301	, Secor	NW 10	26 N	1 E	8.4		4" at 9:30 p.m., 7-8-51; emptied.
302	, Secor	C 4	26 N	1 E	8. 5+		4.2" at 9:30 p.m. , 7-8-51.
303	, El Paso	NC 11	26 N	1 E	5.0+		2. 7" at 9:30 p. m. , 7-8-51.
304	, Piper City	WC 3	26 N	9 E	6.52		U. S. W. B. Co-op., weighing bucket gage.
305	, Gibson City	EC 11	23 N	7 E	5.70		U. S. W. B. Co-op., 8" stick gage.
306	Commonwealth Edison Co. , , Powerton	EC 9	24 N	5 W	2.65		Gaging device unknown.

Table 3A. Panther Creek Project, Recording Rain Gage Observations.

Gage Operated By	Section	Township	Range	Rainfall	Reliability of Observations	Panther Creek Station Designation*
Fred Broers, Minonk, I11.	WC 21	28 N	2 E	5. 58		#1
Mrs. Christina Kapraun, Benson	SE 26	28 N	1 E	5. 38		# 2
John Janssen, Minonk	SE 30	28 N	2 E	5.44		#3
Fred Falk, Minonk	NE 33	28 N	2 E	5. 15		#4
Paul Cunningham, Benson	SE 4	27 N	1 E	5. 53		#5
, Benson	SE 2	27 N	1 E	5.63		#6
Elmer Krug, El Paso	NW 8	27 N	2 E	6. 33		#7
Ray Baker, El Paso	SW 3	27 N	2 E	7. 03		#8
Morris Gaede, El Paso	SW 1	27 N	2 E	7. 05		#9
Sam Martin, Gridley	NE 18	27 N	3 E	8.15		#10
Carl Quiram, El Paso	C 23	27 N	1 E	7. 27		#11
Fred Herd, El Paso	SE 18	27 N	2 E	7.64		#12
Arthur Hartuig, El Paso	NW 22	27 N	2 E	8.49		#13 (gage flooded)
Dale Baker, El Paso	SW 13	27 N	2 E	8.51		#14
A. D. Yordy, Gridley '	C 21	27 N	3 E	7. 54		#15
Leroy Stoller, El Paso	SE 25	27 N	1 E	6.90		#16
Lester Pfister, El Paso	WC 27	27 N	2 E	8.25		#17
(Along creek), El Paso	SE 26	27 N	2 E	9. 0+		# 18 (gage flooded)
Ike Lane, El Paso	NW 29	27 N	3 E	7.80		#19
Emil, Grusy, Gridley	SC 28	27 N	3 E	8. 14		#20
Pfister Office, El Paso	SC 5	26 N	2 E	7.82		#21
Lester Kingdon, El Paso	EC 4	26 N	2 E	7. 98		#22
Pat Cleary, El Paso	NW 12	26 N	2 E	7.40		#23
Joe Murray, Gridley	SE 31	27 N	3E	8.59		#24
Benedict Diggle, Gridley	NC 4	26 N	3 E	9.15		#25
Lester Davidson, Minonk	SC 4	28 N	1 E	4. 08		#44

Table 3B. Panther Creek Project, Non-Recording Rain Gage Observations

Gagg Operated By	Section	Township	Range	Rainfall	Reliability of Observations	Panther Creek Station Designation*
Russell Sullivan, Minonk	NC 15	28 N	2 E	5.20		#26
William Bonk, Minonk	SE 24	28 N	2 E	5. 29		#27
A. Ringenberg, Flanagan	NW 5	27 N	3 E	6.50		#28
Walter Parzelius, Flanagan	NW 15	27 N	3 E	7.20		#29
Edward R. Werner, Gridley	EC 27	27 N	3 E	8.22		#30
Henry Miller, Gridley	NE 10	26 N	3 E	8.92		#31
M. J. Cleary, El Paso	NC 13	26 N	2 E	8.00		#33
Clyde Stotler, El Paso	SW 9	26 N	2 E	8. 00		#34
Llye Armstrong, El Paso	NE 14	26 N	1 E	6. 00		#35
Cnarles Stephens, El Paso	NC 2	26 N	1 E	7.24		#36
Erby McGhee, Roanoke	C 32	27 N	1 E	7. 02		#37
John Martin, Roanoke	EC 20	27 N	1 E	6.74		#38
Willis Janssen, Benson	SC 5	27 N	1 E	6. 50		#39
W. Riclenius, Benson	NE 36	28 N	1 W	4.10		#40
Lester Tjaden, Benson	NE 28	28 N •	1 E	4. 06		#41
William Von Behren, Minonk	NW 24	28 N	1 E	4.64		#42
Ezra D. Stoller, Gridley (U.S.W.B.)	C 9	26 N,	3 E	8.90		#32
City of Minonk (U. S. W. B.)	SC 7	28 N	2 E	4.68		#43

***See FIGURES 23, 24, and 25.**

REPORTS OF INVESTIGATIONS
ISSUED BY THE STATE WATER SURVEY

No. 1. Temperature and Turbidity of Some River Waters in Illinois. 1948.

No. 2. Groundwater Resources in Winnebago County, with Specific Reference to Conditions at Rockford. 1948.

No. 3. Radar and Rainfall. 1949

No. 4. The Silt Problem at Spring Lake, Macomb, Illinois. 1949.

No. 5. Infiltration of Soils in the Peoria Area. 1949.

No. 6. Groundwater Resources in Champaign County. 1950.

No. 7. The Silting of Ridge Lake, Fox Ridge State Park, Charleston, Illinois. 1951.

No. 8. The Silting of Lake Chautauqua, Havana, Illinois. 1951.

No. 9. The Silting of Carbondale Reservoir, Carbondale, Illinois. 1951.

No. 10. The Silting of Lake Bracken, Galesburg, Illinois. 1951.

No. 11. Irrigation in Illinois.

No. 12. The Silting of West Frankfort Reservoir, West Frankfort, Illinois. 1951.

No. 13. Studies of Thunderstorm Rainfall with Dense Raingage Networks and Radar. 1951.

No. 14. The Storm of July 8, 1951 in North Central Illinois. 1952.°