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Flood of July 27–31, 2006, on the Grand River near Painesville, Ohio

Open-File Report 2007–1164

U.S. Department of the Interior
U.S. Geological Survey

Photograph by Timothy Snell, Lake County General Health District (reproduced with permission)

Photograph by Barbara Petersen, Eckart America Corporation (reproduced with permission)

Above: Photographs of the July 27–31, 2006, flood on the Grand River near Painesville, Ohio. *Top*, Photograph showing flooding from the Grand River at Jack Britt Memorial Field, Painesville, Ohio. *Bottom*, Photograph showing the Grand River on July 28, 2006, viewed from the U.S. Route 20 bridge in Painesville, Ohio. Building shown behind trees in right of picture is the same office pictured on cover.

Cover: (Left) Floodwaters from the Grand River on July 28, 2006, rushing through the parking area below the Eckart Building in Painesville, approximately 6 miles upstream from the river mouth (photo by Barbara Petersen, Eckart America Corporation, reproduced with permission). (Right) A photo taken from about the same vantage point after the flood, on October 11, 2006 (photo by Andrew Ebner, U.S. Geological Survey).

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Suggested citation:
Ebner, A.D.; Sherwood, J.M.; Astifan, Brian; and Lombardy, Kirk, 2007, Flood of July 27–31, 2006, on the Grand River near Painesville, Ohio: U.S. Geological Survey Open-File Report 2007–1164, 17 p.

Contents

Figures

Tables

Conversion Factors

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
knot	1.688	feet per second (ft/s)
feet per second	0.3048	meters per second

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).
Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).
Elevation, as used in this report, refers to distance above the vertical datum.

All times reported herein are Eastern Daylight Time.

Flood of July 27–31, 2006, on the Grand River near Painesville, Ohio

By Andrew D. Ebner[1], James M. Sherwood[1], Brian Astifan[2], and Kirk Lombardy[2]

Abstract

Two separate weather systems produced storms resulting in more than 11 inches of rain in parts of Lake County, Ohio, on July 27–28, 2006. As a result of the storms and ensuing flooding caused by the weather systems, the counties of Lake, Geauga, and Ashtabula were declared Federal and State disaster areas, with damages estimated at $30 million and one fatality in Lake County. About 600 people were evacuated in Lake County. The U.S. Geological Survey streamflow-gaging station at Grand River near Painesville, Ohio (station 04212100), had a record peak stage of 19.35 feet (elevation, 614.94 feet), with a record peak streamflow of 35,000 cubic feet per second and an estimated recurrence interval of approximately 500 years.

This report describes the meteorological factors that resulted in severe flooding on the Grand River near Painesville from July 27 to July 31, 2006, and addresses the damages caused by the storms and flooding. Peak-stage, peak-streamflow, and recurrence-interval data are reported for the Grand River near Painesville. A plot of high-water marks is also presented for the Grand River in a reach that includes the City of Painesville, Painesville Township, the Village of Fairport Harbor, and the Village of Grand River.

Introduction

After an unusually wet June and July in northeastern Ohio, intense rains and thunderstorms on July 27–28, 2006, caused extensive flooding along the Grand River in the areas of the City of Painesville, Painesville Township, the Village of Fairport Harbor, and the Village of Grand River (figs. 1 and 2). The river did not recede below flood stage until July 31. The storms caused severe flooding across three counties (Lake, Geauga, and Ashtabula) in northeastern Ohio, all of which were declared Federal and State disaster areas (FEMA–1656–DR, Ohio declared on August 1, 2006). One death was attributed to flooding in Lake County, but no fatalities were associated with the flooding of the Grand River. About 600 people were evacuated from their homes, and roads were closed throughout Lake County.

Because of the magnitude of this flood, the U.S. Geological Survey (USGS), in cooperation with the Federal Emergency Management Agency (FEMA), did a study to gather and describe pertinent flood information to document this historic event. Documentation of flood events can assist Federal, State, and local agencies in making informed decisions on flood-plain management and flood emergency practices.

[1] U.S. Geological Survey.
[2] National Weather Service, Cleveland, Ohio.

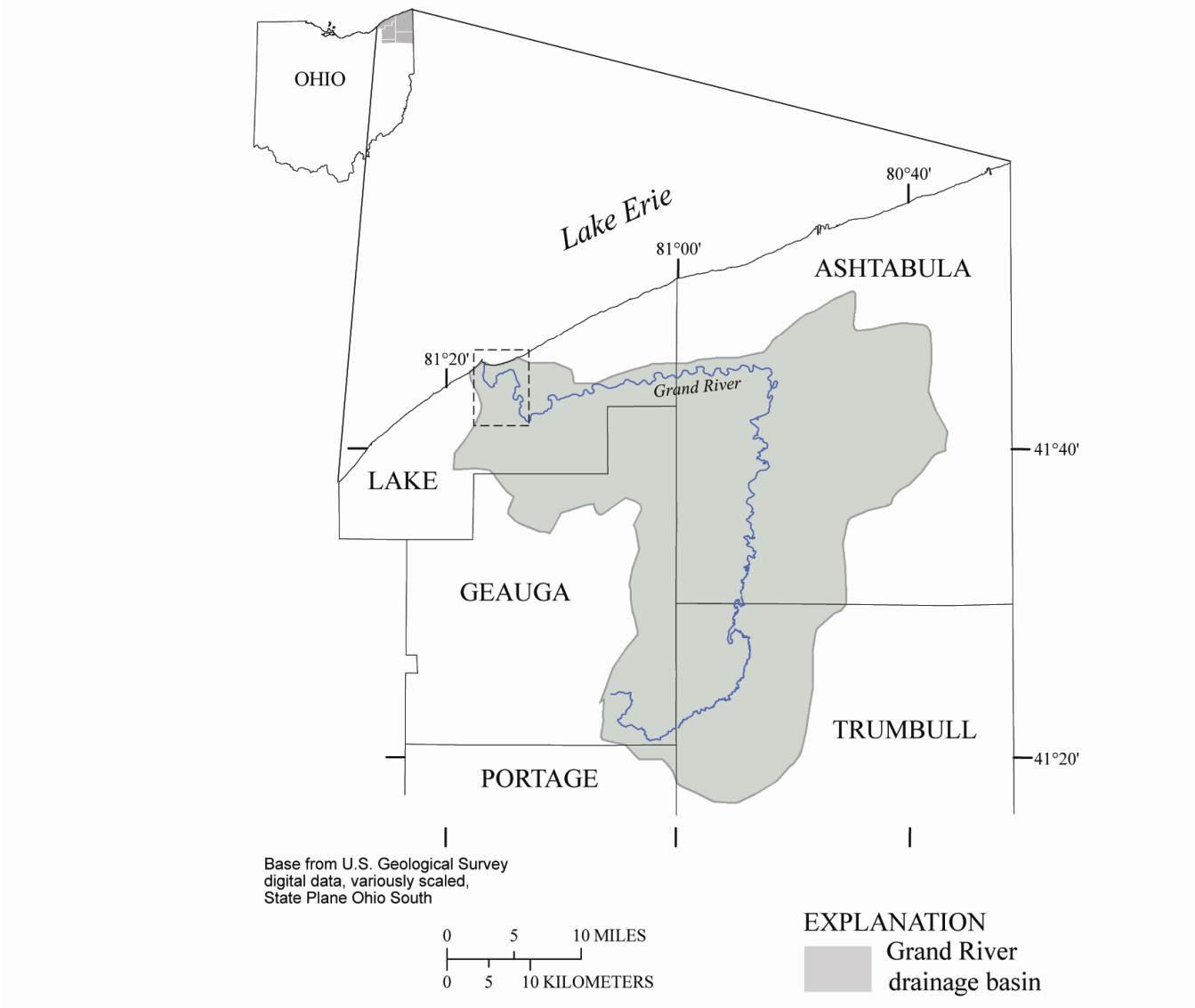

Figure 1. The Grand River and its drainage basin. (Dashed box indicates area highlighted in figure 2.)

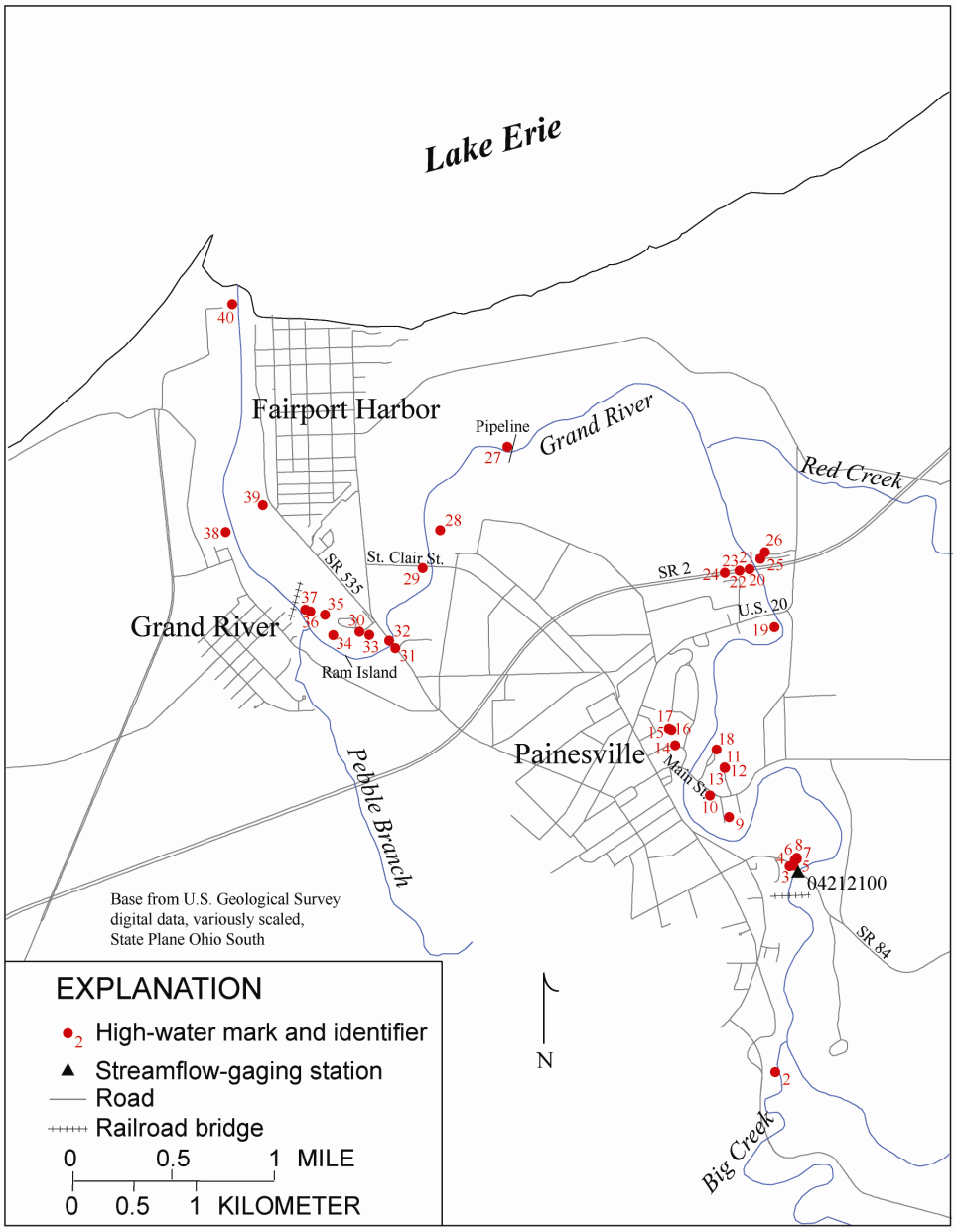

Figure 2. Locations of high-water marks (HWM) near Painesville, and the Villages of Fairport Harbor and Grand River. HWM 1 is another 5 miles upstream and is not shown on this map. Map shows area within the dashed box in figure 1. (Disconnected parts of Painesville Township flank the municipalities shown.)

This report describes the results of that study. The climate preceding and the meteorological conditions leading to the flood are discussed. A general description of the flood is presented, based on data from the USGS streamflow-gaging station on the Grand River near Painesville (station 04212100) and associated high-water marks. Damage estimates to Lake County due to this event also are listed.

Meteorological Conditions Associated With the Flood

The storms of July 27–28, 2006, occurred at the end of a 2-month wet period in northeastern Ohio. Several storms tracked through north and northeastern Ohio during June and early July, bringing heavy rains and flooding to much of the region. These wet conditions likely contributed to the severity of the flooding that resulted from the July 27–28 storms.

Antecedent Conditions

June 2006. Precipitation for much of Ohio was above normal[3] during this month. The National Oceanic and Atmospheric Administration (NOAA) divides Ohio into 10 regions based on similar climatological characteristics. As shown in figure 3, only the Northwest, South Central, and Southeast Regions had below-normal precipitation, whereas precipitation in the other seven regions was above normal. The Northeast Region, which contains Lake County, had the third-highest average rainfall (5.42 inches) in Ohio for the month. Severe storms on June 21–22, 2006, brought heavy rains to the northern third of the State and flooding to the Northeast and North Central Regions. June 2006 was the 12th-wettest June for the Northeast Region in the 112 years preceding this event (Kirk, 2006a).

July 2006. Precipitation in all 10 climatologic regions was above normal during this month (fig. 3). The Northeast Region had the highest average rainfall, receiving 8.47 inches. Within the Northeast Region, Painesville (Lake County) received 14.61 inches, and Chardon (Geauga County) received 14.01 inches. Widespread showers during the first week of the month brought 1–2 inches to most of the State. Storms on July 10–14 brought another 1–2 inches to most of Ohio, with 3–6 inches falling in northern parts of the State. Storms on July 21–22 stretched from southwestern to northeastern Ohio and brought another 1–2 inches of precipitation. July 2006 ranks as the 10th-wettest July for the entire State, and the 3d-wettest July for the Northeast Region in the 124 years preceding this event (Kirk, 2006b).

Storms of July 27–28, 2006

Early on the morning of July 27, 2006, northern Ohio was bounded by a weak stationary front that extended from Iowa across central Michigan and southern Ontario, Canada, and a subtropical high-pressure center over Georgia. This produced a weak, low-shear westerly wind pattern aloft over northern Ohio and Lake Erie, causing storms to move nearly due east throughout the day. Close to the surface, south to southwesterly winds brought a steady stream of very moist, unstable tropical air northward into the region. As thunderstorms developed and were moved eastward by the winds aloft, the low-level flow replenished the moisture quickly, allowing additional storms to form in their wake. For much of the flood event, the winds at these two levels remained nearly constant, maintaining convection (the vertical movement of air, such as warm air rising) once it developed.

[3] "Normal" refers to the average value for the period 1951–2000 (Kirk, 2006 a,b).

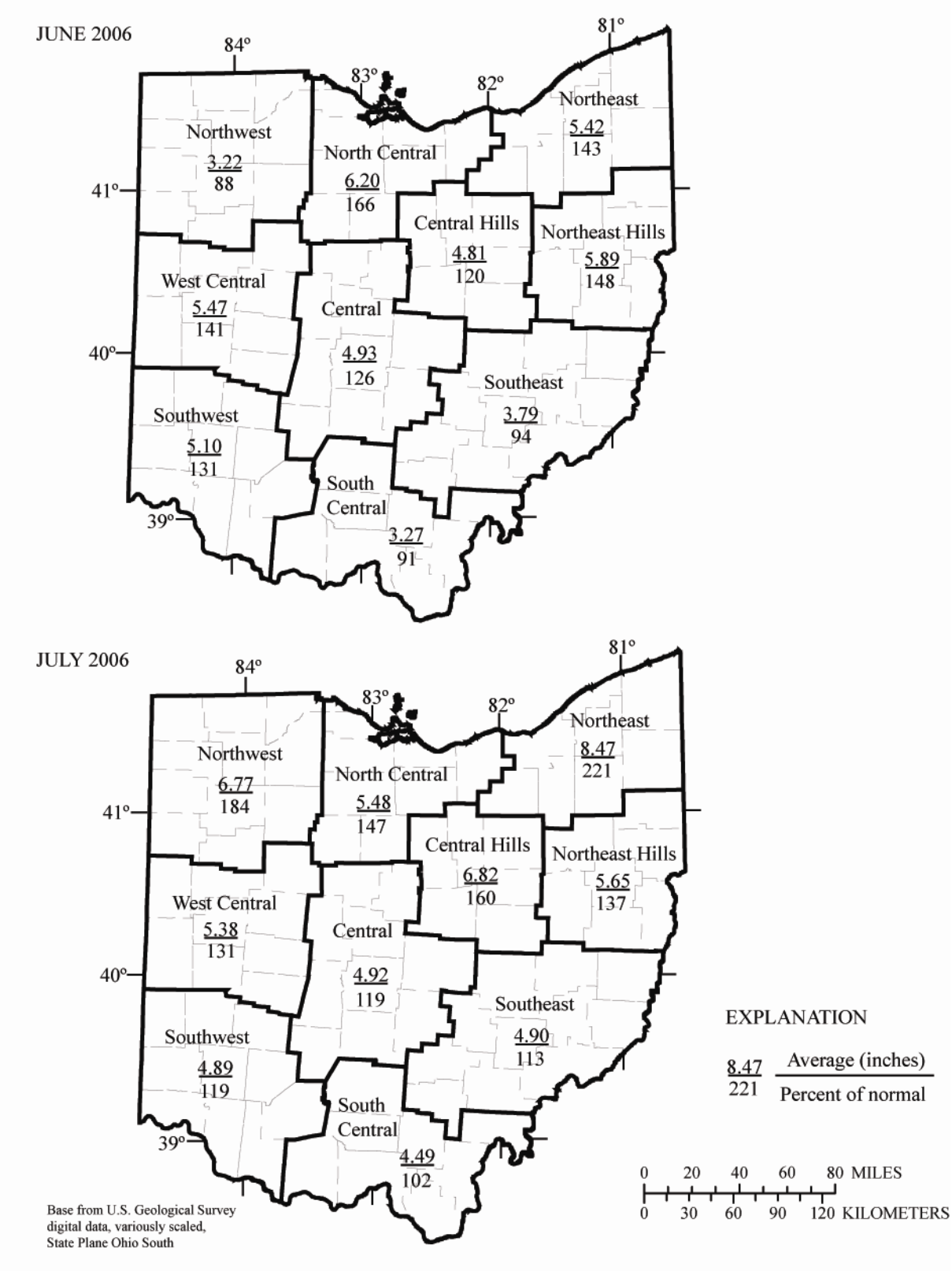

Figure 3. Regionally averaged monthly total precipitation and percentage of normal precipitation for the 10 climatic regions of Ohio, June and July 2006 (from Kirk, 2006 a,b).

The tropical air mass in place over northern Ohio during this flood event played a key role in allowing the thunderstorms to produce heavy rainfall. Precipitable water values—a measure of how much total water is in the atmosphere at a given location—were greater than 2 inches on the day of the flood. The precipitable water values were greater than 2 standard deviations above normal for the month of July. The atmosphere was also very warm, with the freezing level nearly 3 miles above the surface. These two factors limited intrusion of dry air into the storms and maximized the production of raindrops within the storms, resulting in intense rainfall rates.

Two distinct rounds of thunderstorm activity occurred during this flood: the first during the afternoon and evening of July 27 and the second overnight. In both cases, thunderstorms formed or intensified over Lake Erie before moving into Lake County, but the root cause of the convection in each storm was different. During the first half of the flood event on July 27, daytime heating and the development of a lake-breeze boundary along the southern edge of Lake Erie provided the lift and focus required for convection to begin. Thunderstorms began near the western Lake Erie islands during the late morning of July 27 and were pushed across the lake by the weak, westerly upper-level flow. These thunderstorms, which intensified as they moved over the lake, reached Lake County during the early afternoon.

In the wake of these storms, thunderstorm development continued along a developing lake-breeze boundary west of Lake County. This boundary remained nearly stationary for much of the afternoon and evening and provided the focus for repeated thunderstorm development. Flooding began during the late afternoon of July 27 throughout Lake County as the intense rainfall from these storms overwhelmed small creeks and storm sewers.

In the evening, some brief weakening in the convection across northern Ohio was noted. However, shortly after solar heating was lost, an upper-level disturbance (shortwave) moved eastward from the upper Mississippi River Valley into the lower Great Lakes, enhancing thunderstorm activity across the region. By 9:00 p.m., a nearly unbroken line of eastward-moving convection stretched from central Illinois and northern Indiana across Lake Erie to northeast Ohio. As the evening progressed, this area of thunderstorm activity matured into a mesoscale convective complex[4], driven by a 35-knot nocturnal low-level jet (that is, a fast wind at a low level in the atmosphere that transports moisture). This jet provided a persistent source of tropical air into the rear of the complex, allowing thunderstorms to maintain their intensity and produce torrential rainfall rates. The persistent westerly flow aloft and southwesterly flow at the surface allowed thunderstorms developing on the leading edge of this complex to maintain their eastward path across Lake Erie into the Grand River Basin. With streams and creeks now running high (Grand River near Painesville gage height was 10.24 feet at 9:00 p.m.) and soils already saturated from the afternoon convection, flooding ensued as the complex moved over northern Ohio.

[4] Mesoscale convective complexes typically form during the afternoon and evening in the form of several isolated thunderstorms, which expand in scale because of extremely divergent flow aloft, such as near the split in an upper level jet stream. Early in the life cycle of the complex, the potential for severe weather is greatest. As the system matures, a stratified cloud layer with embedded heavy rain forms behind the leading thunderstorms. During peak intensity, the primary threat shifts from severe weather toward heavy rain and flooding.

Early on July 28, the upper-level disturbance moved east of the area, stabilizing the atmosphere and bringing an end to the thunderstorms. Radar and raingage reports indicated that 5 to 10 inches of rain had fallen across Lake County during a roughly 17-hour period, with more than half of the rain falling at the end of the event between midnight and 5:00 a.m. on July 28. Over the 48-hour period of July 27–28, 11.35 inches of rain fell at the Painesville Waste Water Treatment Plant (Randy Bruback and Joe Elliot, City of Painesville Division of Water Pollution Control, oral commun., 2006). This rainfall rate exceeds the 1,000-year recurrence interval for 48-hour rainfall intensity for Painesville (National Weather Service, 2007a). An isohyetal map of the 48-hour rainfall totals for July 27–28, 2006, is shown in figure 4.

General Description of the Flood

The following sections present information about the flood and associated damages that resulted from the July 27–28 storms. Although these storms caused flooding throughout Lake, Geauga, and Ashtabula Counties, this report focuses on flooding along the Grand River in the City of Painesville, Painesville Township, the Village of Fairport Harbor, and the Village of Grand River (fig. 2). The omission of communities outside of this study area is not a reflection on the severity of the flooding or the impact on those communities

Areal Distribution

The storms of July 27–28 led to severe flooding in northeastern Ohio, and caused enough damage for the counties of Lake, Geauga, and Ashtabula to be declared Federal and State disaster areas. The most severe flooding in the Painesville area occurred in the areas of Hidden Harbor Drive in Fairport Harbor; at the Springlake Mobile Home Park on Huntington Road in Painesville; and on East Main Street, Grand River Avenue, Millstone Drive, and Gristmill Drive in Painesville. In the lower 1.5- to 2-mile reach of the Grand River, the water remained within the banks.

At the USGS streamflow-gaging station on the Grand River near Painesville (fig. 2), the water level rose more than 10 feet in a 12-hour period, ultimately exceeding the National Weather Service flood stage of 8 feet (2007b) by 11.35 feet (fig. 5a). Streamflow at this site increased more than 26,000 cubic feet per second in a 12-hour period (fig. 5b).

High-Water Marks, Flood Stages, Streamflows, and Recurrence Intervals

USGS crews identified and surveyed 34 high-water marks along the Grand River on July 28, August 2–3, and September 8, 2006. High-water-mark elevations were surveyed by means of standard surveying techniques. To supplement this high-water-mark dataset, information on six high-water marks identified by the Lake County Engineer's office is also listed (tables 1 and 2, fig. 2).

Elevations of high-water marks were obtained to document peak water elevations throughout the study area and to calculate the peak stage during the flood. High-water marks are an indication of the highest water level at a point during the flood, but they are not always accurate because debris or sediment may not be available at the time of high water. A scatterplot is shown in figure 6 of high-water-mark elevations measured by USGS and by the Lake County Engineer's office.

The Grand River near Painesville exceeded the flood stage on July 27, 2006, and did not fall below the flood stage until July 31. Peak-stage and peak-streamflow data from the July 2006 flood are listed in table 3 for the USGS streamflow-gaging station at Grand River near Painesville, Ohio (station 04212100). The known peak stage and peak streamflow prior to 2006 and the recurrence interval for the 2006 flood are also listed in table 3.

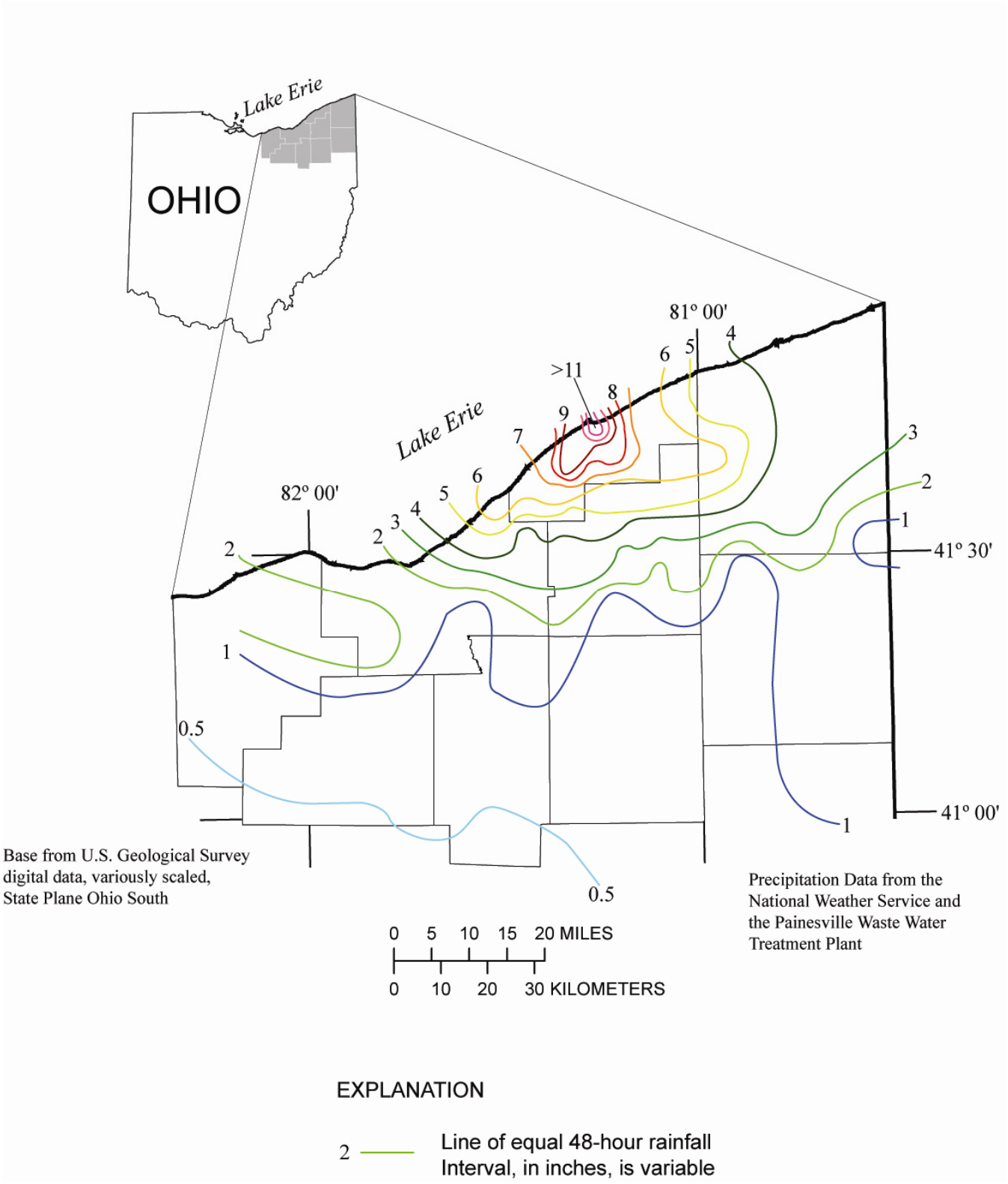

Figure 4. Isohyetal map of 48-hour rainfall totals for July 27–28, 2006.

Table 1. Elevation of high-water marks on the left bank of the Grand River at selected locations in Lake County, Ohio, for July 2006 flooding. Locations of high-water marks are shown on figure 2.

[Data collected and compiled by the U.S. Geological Survey Ohio Water Science Center unless otherwise noted. Abbreviations: HWM ID, high-water mark identifier; SR, State Route; U.S., U.S. Route]

HWM ID	Community	Latitude	Longitude	Distance from mouth of river (thousands of feet)	Elevation (feet)	Description and location of high-water mark
1	Leroy Township	41° 43' 28"	-81° 10' 56"	76.0	640.52	Observation by the Lake County Storm Water Management Department of peak stage in center of Vrooman Road near bridge over Grand River.
2	Painesville Township	41° 42' 17"	-81° 13' 49"	51.9	622.12	Mud line on pavilion at Helen Hazen Wyman Park.
3	City of Painesville	41° 43' 10"	-81° 13' 43"	46.3	616.38	Debris line upstream of old bridge for E. Walnut Ave. (SR 84).
4	City of Painesville	41° 43' 11"	-81° 13' 42"	46.0	614.49	Mud line on drain pipe near new bridge for E. Walnut Ave. (SR 84).
5	City of Painesville	41° 43' 11"	-81° 13' 41"	46.0	614.40	Drift line downstream from new bridge for E. Walnut Ave. (SR 84) (1).
6	City of Painesville	41° 43' 11"	-81° 13' 42"	46.0	614.17	Drift line downstream from new bridge for E. Walnut Ave. (SR 84) (2).
7	City of Painesville	41° 43' 11"	-81° 13' 41"	46.0	614.61	Debris on lawn at 535 E. Walnut Ave. between house and garage.
8	City of Painesville	41° 43' 12"	-81° 13' 41"	45.9	613.54	Drift line behind garage at 535 E. Walnut Ave. (SR 84).
14[1]	City of Painesville	41° 43' 40"	-81° 14' 21"	36.5	605.92	Latimore Road.
16	City of Painesville	41° 43' 45"	-81° 14' 23"	35.5	602.84	Mud line on rear post of visitors' bleachers at Jack Britt Field (1).
17	City of Painesville	41° 43' 45"	-81° 14' 24"	35.5	602.84	Mud line under visitors' bleachers at Jack Britt Field.
18	City of Painesville	41° 43' 45"	-81° 14' 24"	35.5	602.84	Mud line on rear post of visitors' bleachers at Jack Britt Field (2).
19	City of Painesville	41° 44' 11"	-81° 13' 47"	31.4	601.54	Mud line on Eckart office building at 830 E. Erie Street (U.S. 20).

Table 1. Elevation of high-water marks on the left bank of the Grand River at selected locations in Lake County, Ohio, for July 2006 flooding.—Continued

[Data collected and compiled by the U.S. Geological Survey Ohio Water Science Center unless otherwise noted. Abbreviations: HWM ID, high-water mark identifier; SR, State Route; U.S., U.S. Route]

HWM ID	Community	Latitude	Longitude	Distance from mouth of river (thousands of feet)	Elevation (feet)	Description and location of high-water mark
20[1]	City of Painesville	41° 43' 40"	-81° 14' 21"	29.8	596.60	Eastbound SR 2 on the bridge over the Grand River.
21[1]	Painesville Township	41° 44' 26"	-81° 13' 54"	29.8	596.38	Westbound SR 2 on the bridge over the Grand River.
22[1]	Painesville Township	41° 44' 25"	-81° 13' 60"	29.8	596.12	Eastbound SR 2 west of the Grand River.
23[1]	Painesville Township	41° 44' 26"	-81° 13' 59"	29.8	596.14	Westbound SR 2 west of the Grand River.
24[1]	Painesville Township	41° 44' 25"	-81° 14' 05"	29.7	595.66	Median of SR 2 west of the Grand River.
28	City of Painesville	41° 44' 37"	-81° 15' 41"	16.1	585.98	Observation by employee of Painesville Waste Water Treatment Plant on N. State Street of peak stage at top of stairs at Building H.
31	City of Painesville	41° 44' 07"	-81° 15' 57"	12.4	582.82	Mud line on bridge for SR 535 on left bank.
38	Village of Grand River	41° 44' 38"	-81° 16' 55"	6.6	572.55	Observation by employee of Grand River Marine Inc. on side wall of boat launch at marina at end of Charles Street.
40	Painesville Township	41° 45' 36"	-81° 16' 52"	0.6	572.86	Observation by U.S. Coast Guard (USCG) employee of peak stage on side wall of USCG boat launch at 2 Coast Guard Road.

[1]Data collected and compiled by the Lake County Engineer's office.

Table 2. Elevation of high-water marks on the right bank of the Grand River at selected locations in Lake County, Ohio, for July 2006 flooding. Locations of high-water marks are shown on figure 2.

[Data collected and compiled by the U.S. Geological Survey Ohio Water Science Center. Abbreviations: HWM ID, high-water mark identifier; SR, State Route]

HWM ID	Community	Latitude	Longitude	Distance from mouth of river (thousands of feet)	Elevation (feet)	Description and location of high-water mark
9	City of Painesville	41° 43' 22"	-81° 14' 04"	39.2	609.09	Mud line on door of garage at 227 Grand River Ave.
10	City of Painesville	41° 43' 28"	-81° 14' 10"	37.9	606.70	Mud line on electric meter box at 330 E. Main Street.
11	City of Painesville	41° 43' 35"	-81° 14' 05"	36.4	605.79	Mud line in support pole in front of 65–69 Gristmill Drive (1).
12	City of Painesville	41° 43' 35"	-81° 14' 05"	36.4	605.79	Mud line in support pole in front of 65–69 Gristmill Drive (2).
13	City of Painesville	41° 43' 35"	-81° 14' 05"	36.4	605.78	Mud line in support pole in front of 65–69 Gristmill Drive (3).
15	City of Painesville	41° 44' 40"	-81° 14' 08"	36.1	605.60	Seed line inside garage at 24 Millstone Drive.
25	Painesville Township	41° 44' 29"	-81° 13' 52"	29.6	595.25	Mud line on community information board for Springlake Mobile Home Park on Huntington Road.
26	Painesville Township	41° 44' 30"	-81° 13' 50"	29.4	595.16	Water line on shed door in Springlake Mobile Home Park on Huntington Road.
27	Painesville Township	41° 44' 59"	-81° 15' 18"	19.6	589.25	Debris in trees near pipeline bridge.
29	Village of Fairport Harbor	41° 44' 28"	-81° 15' 48"	15.1	585.64	Mud line on bridge for St. Clair Street at Grand River Landing Park.
30	Village of Fairport Harbor	41° 44' 12"	-81° 16' 10"	13.1	581.64	Mud line in garage at 606 Hidden Harbor Drive.
32	Village of Fairport Harbor	41° 44' 09"	-81° 16' 00"	12.5	580.93	Mud line on bridge for SR 535 on right bank.

Table 2. Elevation of high-water marks on the right bank of the Grand River at selected locations in Lake County, Ohio, for July 2006 flooding.—Continued

[Data collected and compiled by the U.S. Geological Survey Ohio Water Science Center. Abbreviations: HWM ID, high-water mark identifier; SR, State Route]

HWM ID	Community	Latitude	Longitude	Distance from mouth of river (thousands of feet)	Elevation (feet)	Description and location of high-water mark
33	Village of Fairport Harbor	41° 44' 11"	-81° 16' 06"	12.1	579.30	Drift line behind 616 Hidden Harbor Drive.
34	Village of Fairport Harbor	41° 44' 11"	-81° 16' 19"	10.6	578.75	Mud line on electric box on clubhouse for River Edge Yacht Club.
35	Village of Fairport Harbor	41° 44' 16"	-81° 16' 21"	9.8	578.16	Mud line on electric box near restrooms in Riverbend Marina.
36	Village of Fairport Harbor	41° 44' 17"	-81° 16' 26"	9.8	576.61	Mud line on boat cradle in Riverbend Marina.
37	Village of Fairport Harbor	41° 44' 17"	-81° 16' 28"	9.5	576.52	Mud line on electric box for boat slips 6A–7B in Riverbend Marina.
39	Village of Fairport Harbor	41° 44' 44"	-81° 16' 42"	5.3	573.18	Mud line on side wall of boat basin at Grand River Marine Inc.

Table 3. Peak stage and peak streamflow at the USGS streamflow-gaging station at Grand River near Painesville, Ohio, July 2006.

[Abbreviations: mi^2, square miles; ft, feet above gage datum; ft^3/s, cubic feet per second]

Station number	Stream and place of determination	Drainage area (mi^2)	Gage datum (NAVD 88)	Period of systematic record (water years)[1]	Maximum Prior to 2006			Maximum in 2006			Estimated recurrence interval range for July 2006 flood (years)
					Year	Stage (ft)	Streamflow (ft^3/s)	Date	Stage (ft)	Streamflow (ft^3/s)	
04212100	Grand River near Painesville	685	595.59	1975 – present	1986	13.07[2]	18,700	7/28/2006	19.35	35,000	≈ 500

[1]A water year is a 12-month period from October 1 through September 30 and is designated by the calendar year in which it ends.

[2]A peak stage of 13.16 ft occurred in 1980 but was associated with a peak streamflow of only 16,900 ft^3/s.

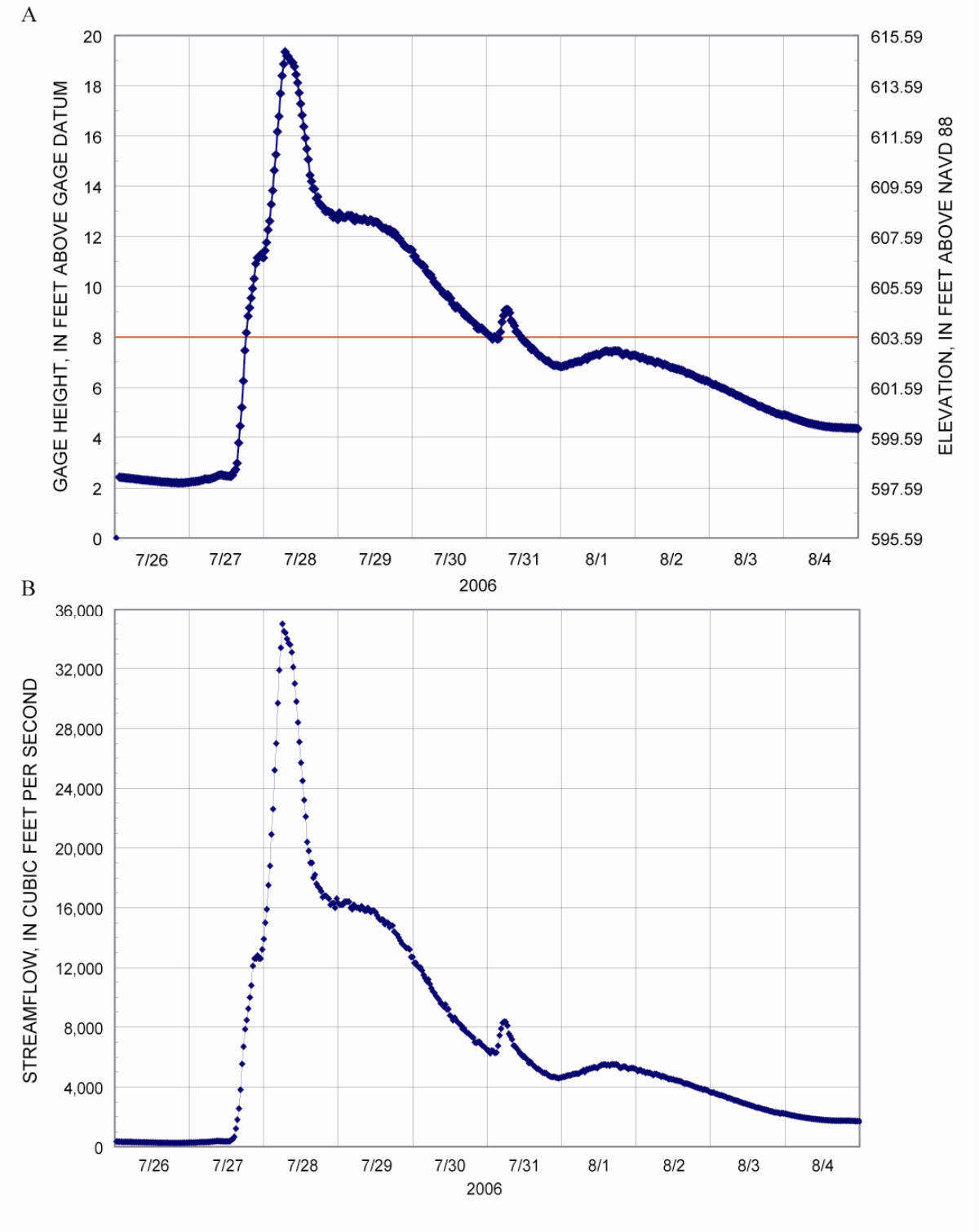

Figure 5. Hydrographs from the USGS streamflow-gaging station on the Grand River near Painesville for July 26–August 4, 2006. *A*, Stage hydrograph showing gage height above datum and elevation of water surface. Red line shown in *A* denotes the flood stage for the Grand River near Painesville as defined by National Weather Service (2007b). *B*, Streamflow hydrograph.

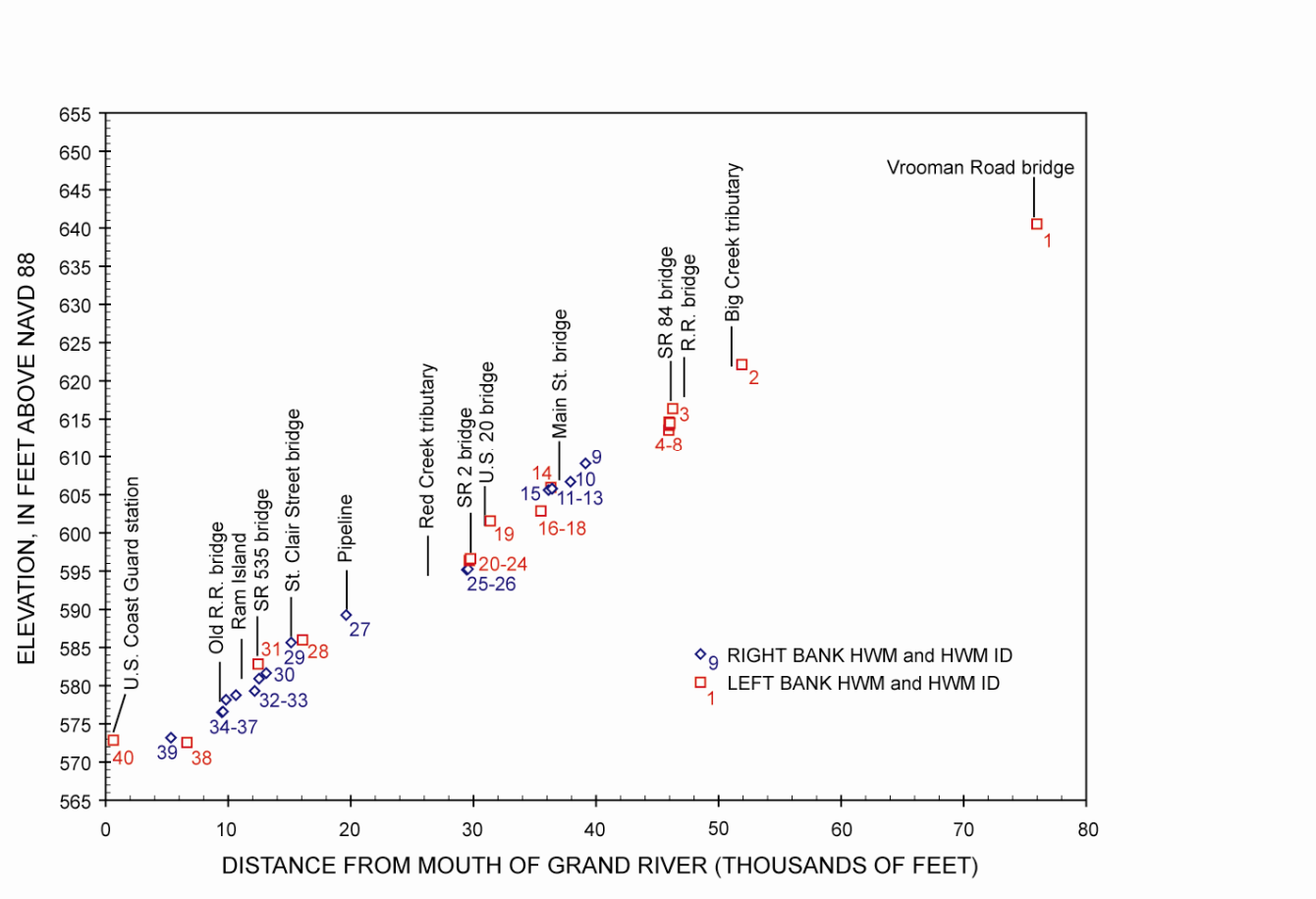

Figure 6. High-water-mark elevations for the Grand River in Lake County, Ohio, on July 28, 2006. High-water marks listed in tables 1 and 2. Labels correspond to landmarks shown in figure 6. Grand River near Painesville streamflow-gaging station is on the State Route 84 bridge.

An estimated peak stage of 19.35 feet (elevation 614.94 feet) occurred at 5:30 a.m. on July 28, 2006. The peak stage was estimated on the basis of high-water elevations upstream and downstream from the station as well as the peak stage recorded at the station. Standard USGS techniques were used to compute the streamflow corresponding to the peak stage (Rantz, 1982). An extension of the most recent stage-discharge relation indicates a peak streamflow of 35,000 cubic feet per second associated with the stage of 19.35 feet.

The peak streamflow of 35,000 cubic feet per second on the Grand River near Painesville, Ohio, has an estimated recurrence interval of approximately 500 years, based on a log-Pearson Type III analysis of annual peak streamflows including this flood and the entire period of record (Interagency Advisory Committee on Water Data, 1982).

Flood Damages

According to the Lake County Emergency Management Agency (Larry Greene, written commun., 2007), flooding on July 27–31, 2006, caused an estimated $30 million in damage to Lake County. No fatalities were associated with the flooding of the Grand River, but one person was killed as a result of flooding elsewhere in Lake County. Because flooding began overnight, evacuation of flooded areas was difficult. In total, 600 people had to be evacuated from their homes. Over all of Lake County, 100 homes and businesses were destroyed, including 81 in the Painesville area, and an additional 731 homes and businesses were damaged. Flooding destroyed 5 bridges in the county, and 13 roads were closed as a result of flood damage.

Summary

Solar heating produced thunderstorms over Lake Erie during the afternoon of July 27, 2006, bringing the first round of storms to Lake County, Ohio. Overnight, another group of thunderstorms (a mesoscale convective complex) moved over the region, bringing a second round of storms. The most intense rainfall from these storms was centered over Lake County, with 5–10 inches falling over most of the county during July 27–28. More than 11 inches of rain was recorded in Painesville during this 48-hour period; this rainfall event has an estimated recurrence interval in excess of 1,000 years.

Severe flooding occurred in Lake County between July 27 and July 31, 2006. Three counties in northeast Ohio (Lake, Geauga, and Asthabula) were declared Federal and State disaster areas. The storms and flooding in Lake County caused approximately $30 million in damages, and one fatality resulted from flooding in the county.

In cooperation with FEMA, the USGS has documented this historic flood. The flagging and surveying of high-water marks permitted estimation of the peak stage and peak streamflow of the Grand River during the flood. Record peak stage (19.35 ft) and peak streamflow (35,000 cubic feet per second) occurred at the USGS streamflow-gaging station on the Grand River near Painesville at 5:30 a.m. on July 28, 2006. This record peak streamflow has an estimated recurrence interval of approximately 500 years.

Acknowledgments

Special thanks are extended to Richard Kotapish and Jim Branch of the Lake County GIS Department for providing Lake County GIS data, and to Mitch Ferguson of the Lake County Engineers Office for contributing data for several high-water marks. Pictures of the flood were supplied by Barbara Petersen of Eckart America Corporation in Painesville, and Timothy Snell of the Lake County General Health District.

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