Prepared in cooperation with the
Federal Emergency Management Agency

Flood of April 2007 and Flood-Frequency Estimates at Streamflow-Gaging Stations in Western Connecticut

Scientific Investigations Report 2009–5108

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

Cover: The upstream side of the bridge crossing the Rippowam River at Bridge Street in Stamford, Connecticut.

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KEN SALAZAR, Secretary

U.S. Geological Survey
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Conversion Factors and Datums

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
cubic foot (ft^3)	0.02832	cubic meter (m^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per second per square mile [(ft^3/s)/mi^2]	0.01093	cubic meter per second per square kilometer [(m^3/s)/km^2]

Vertical coordinate information is referenced to “North American Vertical Datum of 1988 (NAVD 88).”

Flood of April 2007 and Flood-Frequency Estimates at Streamflow-Gaging Stations in Western Connecticut

By Elizabeth A. Ahearn

Abstract

A spring nor'easter affected the East Coast of the United States from April 15 to 18, 2007. In Connecticut, rainfall varied from 3 inches to more than 7 inches. The combined effects of heavy rainfall over a short duration, high winds, and high tides led to widespread flooding, storm damage, power outages, evacuations, and disruptions to traffic and commerce. The storm caused at least 18 fatalities (none in Connecticut). A Presidential Disaster Declaration was issued on May 11, 2007, for two counties in western Connecticut—Fairfield and Litchfield. This report documents hydrologic and meteorologic aspects of the April 2007 flood and includes estimates of the magnitude of the peak discharges and peak stages during the flood at 28 streamflow-gaging stations in western Connecticut. These data were used to perform flood-frequency analyses. Flood-frequency estimates provided in this report are expressed in terms of exceedance probabilities (the probability of a flood reaching or exceeding a particular magnitude in any year). Flood-frequency estimates for the 0.50, 0.20, 0.10, 0.04, 0.02, 0.01, and 0.002 exceedance probabilities (also expressed as 50-, 20-, 10-, 4-, 2-, 1-, and 0.2- percent exceedance probability, respectively) were computed for 24 of the 28 streamflow-gaging stations. Exceedance probabilities can further be expressed in terms of recurrence intervals (2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval, respectively). Flood-frequency estimates computed in this study were compared to the flood-frequency estimates used to derive the water-surface profiles in previously published Federal Emergency Management Agency (FEMA) Flood Insurance Studies. The estimates in this report update and supersede previously published flood-frequency estimates for streamflow-gaging stations in Connecticut by incorporating additional years of annual peak discharges, including the peaks for the April 2007 flood.

In the southwest coastal region of Connecticut, the April 2007 peak discharges for streamflow-gaging stations with records extending back to 1955 were the second highest peak discharges on record; the 1955 annual peak discharges are the highest peak discharges in the station records. In the Housatonic and South Central Coast Basins, the April 2007 peak discharges for streamflow-gaging stations with records extending back to 1930 or earlier ranked between the fourth and eighth highest discharges on record, with the 1936, 1938, and 1955 floods as the largest floods in the station records.

The peak discharges for the April 2007 flood have exceedance probabilities ranging between 0.10 to 0.02 (a 10- to 2-percent chance of being exceeded in a given year, respectively) with the majority (80 percent) of the stations having exceedance probabilities between 0.10 to 0.04. At three stations—Norwalk River at South Wilton, Pootatuck River at Sandy Hook, and Still River at Robertsville—the April 2007 peak discharges have an exceedance probability of 0.02.

Flood-frequency estimates made after the April 2007 flood were compared to flood-frequency estimates used to derive the water-surface profiles (also called flood profiles) in FEMA Flood Insurance Studies developed for communities. In general, the comparison indicated that at the 0.10 exceedance probability (a 10-percent change of being exceeded in a given year), the discharges from the current (2007) flood-frequency analysis are larger than the discharges in the FEMA Flood Insurance Studies, with a median change of about +10 percent. In contrast, at the 0.01 exceedance probability (a 1-percent change of being exceeded in a year), the discharges from the current flood-frequency analysis are smaller than the discharges in the FEMA Flood Insurance Studies, with a median change of about -13 percent.

Several stations had more than + 25 percent change in discharges at the 0.10 exceedance probability and are in the following communities: Winchester (Still River at Robertsville, +50 percent change); Hamden (Mill River near Hamden, +46 percent change); Woodbury (Weekeepeemee River at Hotchkissville, +29 percent change); and Newtown (Pootatuck River at Sandy Hook , +28 percent change). Although the majority of the streamflow-gaging stations had discharges at the 0.01 exceedance probability smaller than in the Flood Insurance Studies, the (2007) flood-frequency estimates were larger than in the Flood Insurance Studies for stations in the following communities: Hamden (Mill River near Hamden, +53 percent change); Thomaston (Naugatuck River at Thomaston, +27 percent change); Newtown (Pootatuck River at Sandy Hook, +18 percent change); and Wallingford

(Quinnipiac River at Wallingford, +13 percent change). The 1-percent exceedance probability (100-year flood) elevations at streamflow-gaging stations exceeded the FEMA projected 100-year flood elevations by more than +0.5 feet in two Flood Insurance Studies in the communities of Wallingford (Quinnipiac River at Wallingford, +0.6 feet change) and Hamden (Mill River near Hamden, + 2.3 feet change).

Introduction

Major flooding occurred in Fairfield and Litchfield Counties, Connecticut, from April 15 to 18, 2007, resulting in substantial damage to public and personal property. The Federal Emergency Management Agency (FEMA) reported that flood damages in Connecticut exceeded an estimated $6.4 million (FEMA, 2007). The two counties have a combined land area of 1,545 mi^2. Fairfield County is 625 mi^2, the population density is about 1,430 people per square mile, and it is characterized by residential, industrial, commercial, and institutional development. Litchfield County is 920 mi^2, the population density is 205 people per square mile, and, in contrast to Fairfield County, it is considerably less developed, with development characterized primarily as low-density residential. Since 1990, both counties have experienced an 8.1 percent growth in population (USA Counties IN Profile, 2009).

In response to the flooding, President George W. Bush issued a Disaster Declaration on May 11, 2007, for the counties of Fairfield and Litchfield (see appendix 1, Federal Emergency Management Agency Disaster Declaration map). FEMA requested that the U.S. Geological Survey (USGS) perform a flood-frequency analysis of recorded long-term streamflow-gaging station data to determine the magnitude and frequency of flooding within the disaster-declaration areas and compare the current (2007) flood-frequency estimates to the estimates used to derive the water-surface profiles in Flood Insurance Studies developed for the local communities. This study provides FEMA and local communties with updated estimates of magnitude and frequency of floods for the streams studied and presents base data that can be used to identify deficiencies in floodplain delineations and to prepare any subsequent revisions to the Flood Insurance Studies.

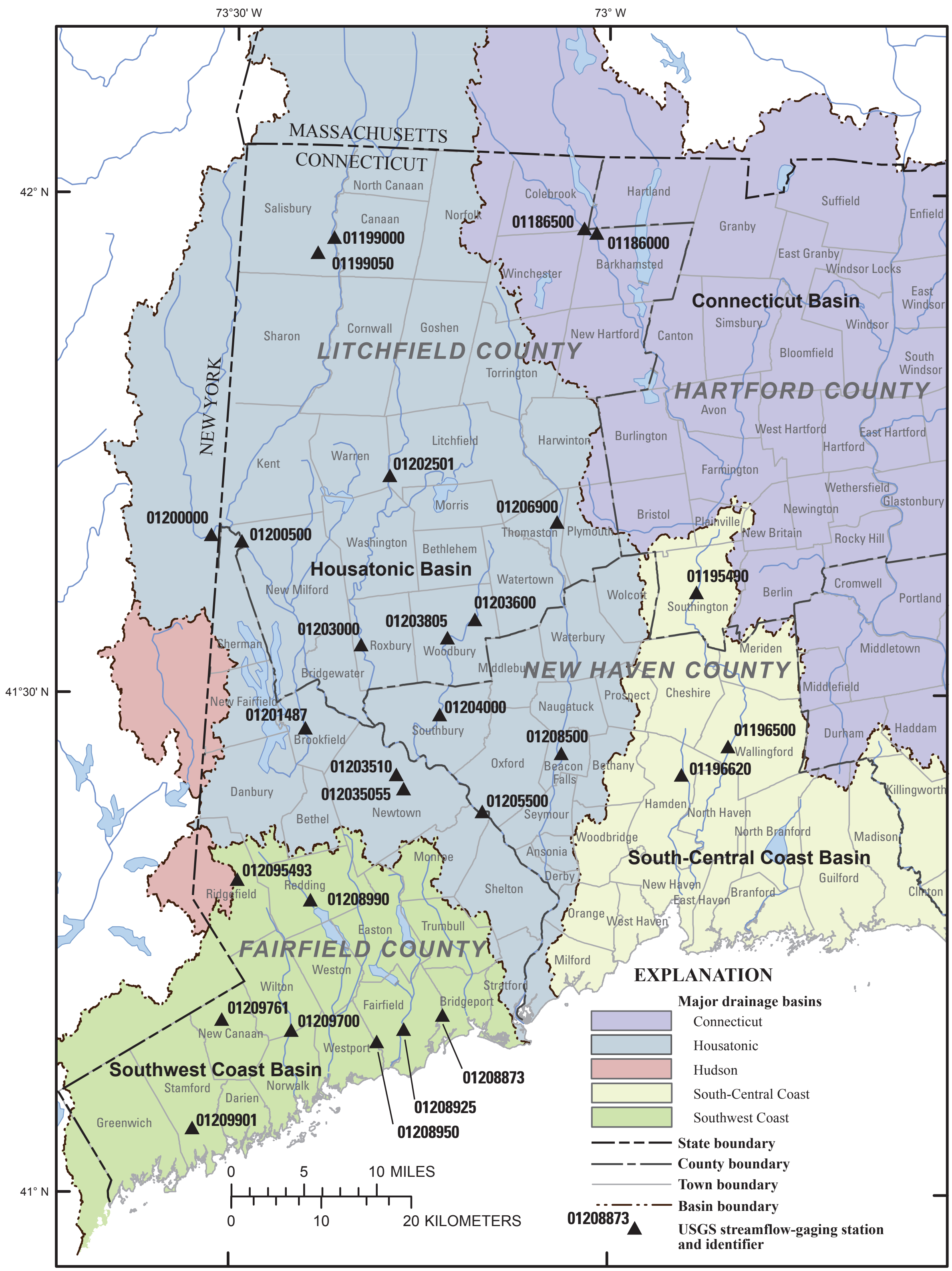
The relation of discharge to frequency of occurrence at a streamflow-gaging station is generally expressed in terms of exceedance probability or recurrence interval. Exceedance probability is the percent chance or likelihood that a given discharge will be exceeded in any 1-year period. Recurrence interval is the average time interval (in years) during which a given flow is expected to be exceeded one time. Recurrence interval does not imply regular, predictable occurrences. A large flood in one year does not preclude the occurrence of an even larger flood the next year. It is possible that a flood with a recurrence interval of 100 years could occur during consecutive years because, statistically, there is a 1 percent chance or likelihood of occurrence in any year. For this study, the 0.50, 0.20, 0.10, 0.04, 0.02, 0.01, and 0.002 exceedance probabilities (also expressed as 50-, 20-, 10-, 4-, 2-, 1-, and 0.2- percent exceedance probability, respectively) were determined for stations in western Connecticut. Exceedance probabilities can further be expressed in terms of recurrence intervals (recurrence interval of 2, 5, 10, 25, 50, 100, and 500 years, respectively).

The study area in western Connecticut—primarily Fairfield and Litchfield Counties—includes 28 active streamflow-gaging stations for reporting peak stages and peak discharges (fig. 1 and table 1). The data collected and analyzed from this storm enhance the scientific understanding of flood characteristics and are critical for reducing deaths, injuries, and property damages from floods. Current estimates of the magnitude and frequency of floods provide key information for updating Flood Insurance Studies, mitigating losses associated with future floods, and designing bridges and culverts.

This report includes information on rainfall that led to the flooding, peak stages and peak discharges for the April 2007 flood for rivers with active streamflow-gaging stations, and updated flood-frequency estimates for streamflow-gaging stations in western Connecticut. Also included in this report is a comparison of flood-frequency estimates using (1) reported data through water year 2007 (ending September 30, 2007) to (2) flood-frequency estimates in community Flood Insurance Studies prepared for communities by FEMA. The changes in flood stages at the stations attributed to changes in the recurrence interval values are described.

Previous Flood Investigation Studies

Several studies published by the USGS provide estimates of the magnitude and frequency of floods in Connecticut. These studies provide FEMA with a means to identify flood-prone areas, enabling communities to guide development away from areas subject to flood damage, and to assess risk and set flood-insurance rates for properties subject to flooding. In 2003, the USGS published flood-frequency estimates for 138 streamflow-gaging stations in Connecticut (Ahearn, 2003). In 2004, the USGS published a statewide flood-frequency study (Ahearn, 2004) that included (1) flood-frequency estimates for 70 rivers with streamflow-gaging stations (the estimates are weighted averages derived from the log-Pearson Type III distribution of the annual peak discharges at the gaging station and a regression equation for estimating the magnitude and frequency of the peak discharges); (2) regional regression equations for estimating the 0.50, 0.10, 0.04, 0.02, 0.01, and 0.002 exceedance probabilities (2-, 10-, 25-, 50-, 100-, and 500-year recurrence intervals, respectively) at ungaged locations; and (3) a method for combining the flood-frequency estimates derived from the log-Pearson Type III distribution of the annual peak discharges at the station and from a regression equation. In 2005, the USGS published flood-frequency estimates for stations on the main stem of the



Base from U.S. Geological Survey, 1:24,000, 1969–1984
Connecticut State Plane Projection

Figure 1. Locations of U.S. Geological Survey streamflow-gaging stations used to investigate the April 2007 flood in western Connecticut.

Table 1. Descriptions of U.S. Geological Survey streamflow-gaging stations whose records were used to determine the magnitude and frequency of the April 2007 flood in western Connecticut.

[Station locations shown on figure 1. lat, latitude; long, longitude; mi, miles; ft, feet; right and left bank are referenced facing downstream]

Station number	Station name	Description of station location
01186000	West Branch Farmington River at Riverton	Lat 41°57'47", long 73°01'05", Litchfield County, Hydrologic Unit 01080207, on right bank at downstream side of bridge on State Route 20 at Riverton, 0.3 mi upstream from Still River, 2.0 mi downstream from Goodwin Dam of West Branch Reservoir, and at mile 55.
01186500	Still River at Robertsville	Lat 41°58'01", long 73°02'02", Litchfield County, Hydrologic Unit 01080207, on left bank 1,500 ft downstream from Sandy Brook, 1 mi southeast of Robertsville, 1 mi northwest of Riverton, and 1 mi upstream from mouth.
01195490	Quinnipiac River at Southington	Lat 41°36'13", long 72°52'59", Hartford County, Hydrologic Unit 01100004, on west bank, 400 ft downstream from bridge on Mill Street, and 500 ft upstream from bridge on Center Street in Southington.
01196500	Quinnipiac River at Wallingford	Lat 41°26'60", long 72°50'28", New Haven County, Hydrologic Unit 01100004, on right bank on Wilbur Cross Highway, 0.8 mi downstream from bridge on Quinnipiac Street in Wallingford, and 2 mi upstream from Wharton Brook.
01196620	Mill River near Hamden	Lat 41°25'14", long 72°54'10", New Haven County, Hydrologic Unit 01100004, 150 ft downstream from bridge on Mount Carmel Avenue, 0.4 mi downstream from Eaton's Brook, and 2.5 mi north of Hamden.
01199000	Housatonic River at Falls Village	Lat 41°57'26", long 73°22'09", Litchfield County, Hydrologic Unit 01100005, on left bank at hydroelectric plant of Connecticut Light and Power Company at Falls Village, 1.4 mi downstream from Hollenbeck River, and at mile 75.9.
01199050	Salmon Creek at Lime Rock	Lat 41°56'32", long 73°23'28", Litchfield County, Hydrologic Unit 01100005, on left bank 300 ft upstream from bridge on Uptown Salisbury Road, 0.6 mi north of Lime Rock, and 3.0 mi upstream from mouth.
01200000	Tenmile River near Gaylordsville	Lat 41°39'32", long 73°31'44", Dutchess County, Hydrologic Unit 01100005, on right bank 0.1 mi downstream from Deuel Hollow Brook, 1.2 mi upstream from New York-Connecticut State line.
01200500	Housatonic River at Gaylordsville	Lat 41°39'12", long 73°29'24", Litchfield County, Hydrologic Unit 01100005, on left bank 0.4 mi downstream from hydroelectric plant of Connecticut Light and Power Co., 0.5 mi upstream from bridge on U.S. Route 7 at Gaylordsville, 1.5 mi downstream from Tenmile River, and at mile 50.6.
01201487	Still River ar Route 7 at Brookfield Center	Lat 41°27'58", long 73°24'13", Litchfield County, Hydrologic Unit 01100005, on bridge on upstream side of State Route 7 South, 800 ft upstream from Silvermile Rd.
01202501	Shepaug River at Peter's Dam at Woodville	Lat 41°71'92", long 73°29'33", Litchfield County, Hydrologic Unit 01100005, 0.2 mi downstream from Shepaug Reservoir Dam, at end of Reservoir Rd., 1 mi north of Woodville.
01203000	Shepaug River near Roxbury	Lat 41°32'59", long 73°19'47", Litchfield County, Hydrologic Unit 01100005, at Wellers Bridge, 1.2 mi southwest of Roxbury.
012035055	Pootatuck River at Berkshire	Lat 41°24'22", long 73°16'22", Fairfield County, Hydrologic Unit 01100005, on property of Pootatuck Fish and Game club, near upstream side of bridge on Mile High Rd.
01203510	Pootatuck River at Sandy Hook	Lat 41°25'12", long 73°16'56", Fairfield County, Hydrologic Unit 01100005, at bridge on Church Hill Road, at Sandy Hook.
01203600	Nonewaug River at Minortown	Lat 41°34'33", long 73°10'43", Litchfield County, Hydrologic Unit 01100005, on right bank 1,000 ft downstream from bridge by State Routes 6 and 202 at Minortown, and 2.5 mi northeast of Woodbury.
01203805	Weekeepeemee River at Hotchkissville	Lat 41°33'26", long 73°12'57", Litchfield County, Hydrologic Unit 01100005, on downstream left bank at Jack's Bridge Rd., 500 ft upstream from confluence with Pomperaug River and 1 mi north of Woodbury.

Table 1. Descriptions of U.S. Geological Survey streamflow-gaging stations whose records were used to determine the magnitude and frequency of the April 2007 flood in western Connecticut.—Continued

[Station locations shown on figure 1. lat, latitude; long, longitude; mi, miles; ft, feet; right and left bank are referenced facing downstream]

Station number	Station name	Description of station location
01204000	Pomperaug River at Southbury	Lat 41°28'54", long 73°13'29", New Haven County, Hydrologic Unit 01100005, on right bank 200 ft upstream from bridge on Poverty Rd., 800 ft downstream from Bullet Hill Brook, 0.6 mi west of Southbury, and 5.8 mi upstream from mouth.
01205500	Housatonic River at Stevenson	Lat 41°23'02", long 73°10'02", New Haven County, Hydrologic Unit 01100005, on left bank, 0.2 mi downstream from dam of Connecticut Light and Power Company at Stevenson, Fairfield County, 0.2 mi upstream from Eightmile Brook, and at mile 19.2.
01206900	Naugatuck River at Thomaston	Lat 41°40'26", long 73°04'12", Litchfield County, Hydrologic Unit 01100005, on left bank at downstream side of bridge on U.S. Routes 6 and 202 at Thomaston, 1.5 mi downstream from Thomaston Reservoir, 2.5 mi upstream from Branch Brook, and at mile 29.5.
01208500	Naugatuck River at Beacon Falls	Lat 41°26'31", long 73°03'47", New Haven County, Hydrologic Unit 01100005, on left bank at downstream side of bridge on Bridge Street at Beacon Falls, 0.4 mi upstream from Bronson Brook, and at mile 10.1.
01208873	Rooster River at Fairfield	Lat 41°10'48", long 73°13'09", Fairfield County, Hydrologic Unit 01100006, on left bank, on floodwall, at corner of Renwick Drive and Renwick Place, Bridgeport.
01208925	Mill River near Fairfield	Lat 41°09'55", long 73°16'13", Fairfield County, Hydrologic Unit 01100006, on right bank just downstream from bridge on Duck Farm Rd., 1.5 mi north of Fairfield, 14.0 mi downstream from headwater of Mill River.
01208950	Sasco Brook near Southport	Lat 41°09'10", long 73°18'21", Fairfield County, Hydrologic Unit 01100006, on left down stream abutment of bridge on Hulls Farm Rd., 1.5 mi northwest of Southport.
01208990	Saugatuck River near Redding	Lat 41°17'40", long 73°23'42", Fairfield County, Hydrologic Unit 01100006, on right downstream side of bridge on State Route 53, 100 ft south of intersection of State Routes 53 and 107, 0.8 mi upstream from Saugatuck Reservoir, and 1.0 mi southwest of Redding.
012095493	Ridgefield Brook at Shields Lane near Ridgefield	Lat 41°09'50", long 73°25'11", Fairfield County, Hydrologic Unit 01100006, on right bank at end of Sheilds Lane in Town of Ridgefield, on western side of street, 1.4 mi west of Redding.
01209700	Norwalk River at South Wilton	Lat 41°09'50", long 73°25'11", Fairfield County, Hydrologic Unit 01100006, on right bank at upstream side of bridge on Kent Rd. at South Wilton, 2.5 mi north of Norwalk.
01209761	Fivemile River near New Canaan	Lat 41°10'28", long 73°30'43", Fairfield County, Hydrologic Unit 01100006, on right bank, 40 ft downstream from paved driveway leading to private residence, at end of cul-de-sac of Indian Rock Rd.
01209901	Rippowam River at Stamford	Lat 41°03'56", long 73°32'59", Fairfield County, Hydrologic Unit 01100005, on left bank 100 ft upstream from bridge on Bridge St., 2.7 mi downstream from Holts Ice Pond Brook, and 1.7 mi upstream from Long Island Sound.

Connecticut River in Connecticut (Ahearn, 2005). The flood-frequency estimates in this report update and supersede previously published flood-frequency estimates for streamflow-gaging stations in Connecticut.

In addition to the various flood-frequency studies described above, the USGS summarized substantial floods in Connecticut in a series of Water-Supply Papers entitled “Summary of Floods in the United States” and in a series of “State Summaries of Floods” as part of the USGS National Water Summary that documents extreme hydrologic events on the basis of stream-discharge data (Perry, 2001 and 2005; Perry and others, 1998; Paulson and others, 1991). These reports detail the areal extent of the most notable floods and provide estimates of how frequently floods of such severity can be expected to recur.

Storm Characteristics

Major storms in Connecticut include nor’easters, which form along the East Coast, usually between October and April, although they can form any time of the year. A nor’easter is a macro-scale storm associated with two major systems colliding—a Gulf Stream low-pressure system and an arctic high-pressure system. Usually nor’easters bring massive amounts of precipitation, hurricane-force winds, and storm surges to coastal areas that create coastal flooding. Nor’easters can be devastating, especially in the winter months when most damage and deaths are cold-related.

A late season nor’easter impacted Fairfield and Litchfield Counties primarily April 15–16, 2007, and persisted with trace amounts of rainfall through April 18. Initially, the precipitation fell as a mixture of wet snow, sleet, and rain across the higher elevations and changed to all rain by late Sunday afternoon (April 15) into Monday (April 16). The precipitation fell as rain across the lower elevations. Rainfall totals from the National Weather Service (NWS) rain gages and from the Connecticut Department of Environmental Protection (DEP) Flood Alert Network ranged from 3.31 to 7.81 inches (fig. 2) (National Climate Data Center, 2007b; M.K. Baribault, Connecticut Department of Environmental Protection, written commun., 2008). The heaviest rain fell across southwest and south-central Connecticut, where many small rivers and streams exceeded their banks within 12 hours of the heavy rainfall during Sunday, April 15 (National Climate Data Center, 2007b). Rainfall in Fairfield County ranged from 3.57 inches in Bridgeport to 7.81 inches in Ridgefield. Rainfall in Litchfield County ranged from 3.31 inches in Falls Village to 6.73 inches in New Hartford. Figures 3a and 3b show Next-Generation Radar (NEXRAD) 1-day rainfall totals ending April 15 and April 16, 2007 (National Weather Service, 2007a, b). The NEXRAD data are multi-sensor (radar and rain) rainfall estimates obtained from NWS River Forecast Centers (National Weather Service, 2008a, b).

Conditions prior to a storm affect the amount of runoff that occurs during the storm. Streamflow prior to the April 15–18 flooding generally was in the normal range (between the 25th and 75th percentiles) of the seasonal high flow at the streamflow-gaging stations in the two counties examined. Antecedent moisture conditions are substantially affected by preceding rainfall amounts. Prior to the April storm, recent rainfall had saturated the soils in most of the State. Other variables such as air temperature, minimal tree canopy, and melting snow and ice also impacted antecedent moisture conditions. Air temperatures were below freezing in higher elevations. Tree canopy cover was minimal. Precipitation fell as a mixture of wet snow, which changed to all rain. The liquid equivalent precipitation total from this storm ranged from 3 to slightly more than 7 inches.

In Ridgefield, rainfall intensity averaged 1 inch every 2 or 3 hours over a 13-hour period and totaled 7 inches in 23 hours (DEP Flood Alert System, Ridgefield station). The 50-year, 24-hour highest rainfall total for southwestern Connecticut is between 7 and 8 inches (DeGaetano, 1997). In Thomaston, rainfall intensity averaged 1 inch every 2 or 3 hours over a 5- to 6-hour period and totaled about 5 inches in about 15 hours (DEP Flood Alert System, Thomaston station). The 25-year, 12-hour highest rainfall total is between 4.8 and 5.4 inches for northwestern Connecticut (DeGaetano, 1997). The recurrence intervals determined from the rainfall-frequency maps for Connecticut (DeGaetano, 1997) indicate the rainfall in southwestern Fairfield County was approximately equal to or greater than 50 years, and for other areas of Fairfield County, the recurrence interval was approximately equal to or greater than 25 years.

Event record details from the National Climatic Data Center are provided in appendix 2 (National Climatic Data Center, 2008b). Additional storm data—information on areas affected by river, coastal, and urban flooding; and high winds for April 2007 for Fairfield, Litchfield, New Haven, New London, and Hartford counties—and statistics on personal injuries and damage estimates is provided in “Storm Data April 2007, Volume 49, Number 4,” by the National Weather Service (http://www1.ncdc.noaa.gov/pub/orders/04045B03-435C-ADE8-23F3-70793651897F.PDF)

Drainage-Basin Characteristics

Drainage-basin characteristics that could potentially affect the magnitude and frequency of floods and that are used in Connecticut’s peak-flow regression equations (Ahearn, 2004) are summarized in table 2. Locations of streamflow-gaging stations and the extent of their upstream drainage basins are shown in figure 4. Basin characteristics were compiled for all stations except three on the main stem of the Housatonic River where Connecticut’s peak-flow regression equations are not applicable. The drainage areas for the

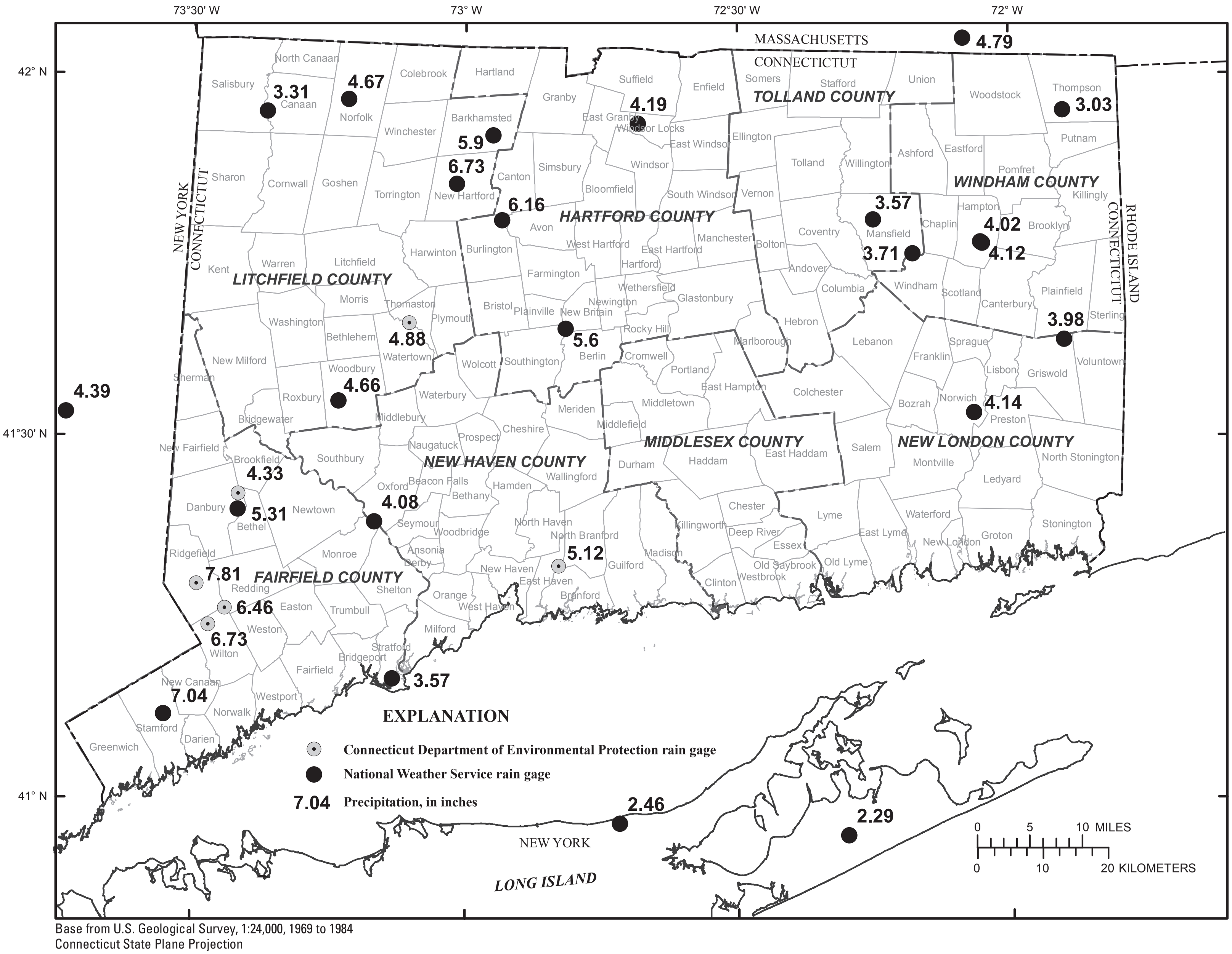


Figure 2. Rainfall totals for April 15–17, 2007, at selected National Weather Service and Connecticut Department of Environmental Protection Flood Alert Network rain gages, Long Island, New York and Connecticut (National Climatic Data Center, 2007a; 2007b).

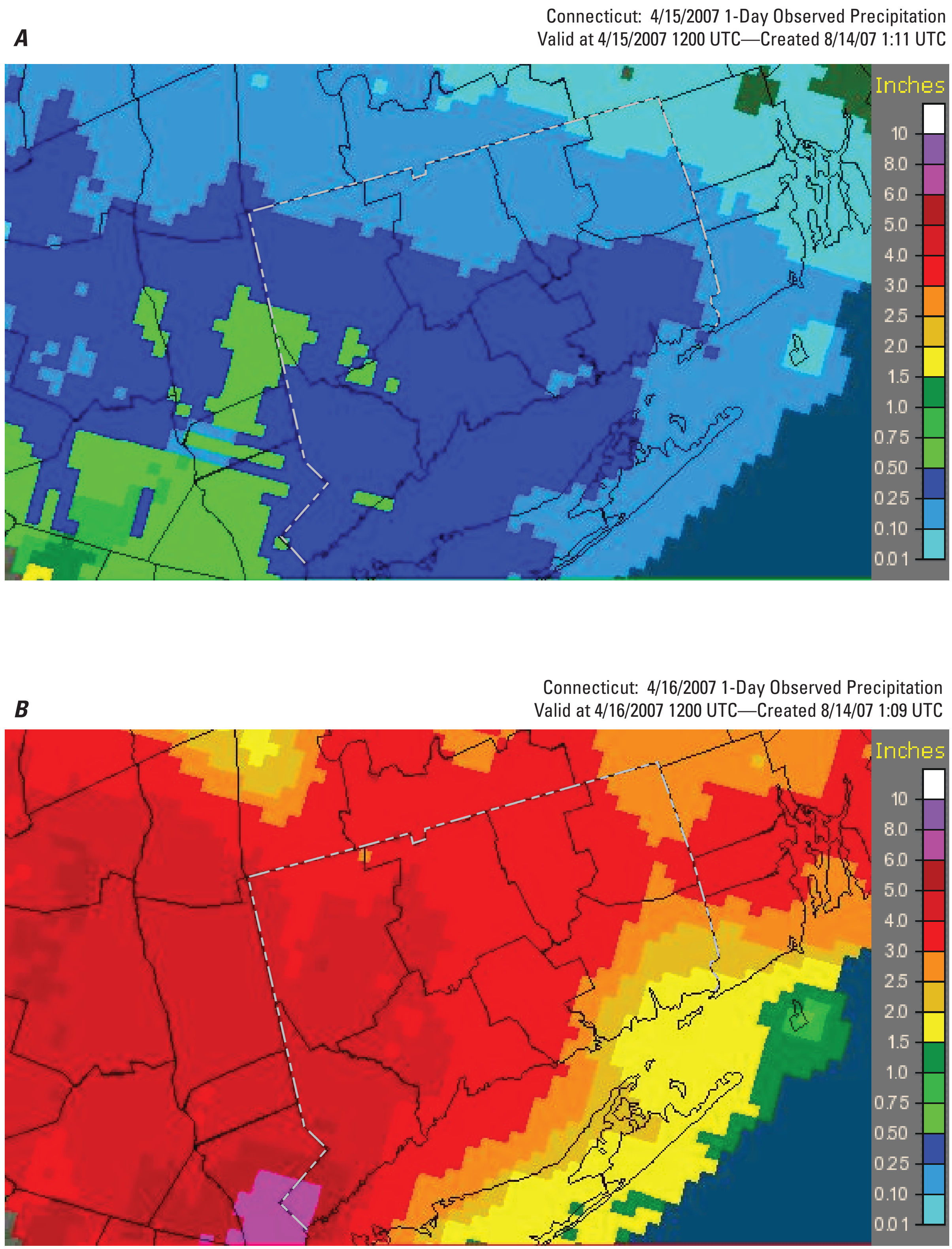


Figure 3. Next-Generation Radar (NEXRAD) 1-day rainfall totals in Connecticut ending *(A)* April 15, 2007, and *(B)* April 16, 2007 (NOAA, National Weather Service).

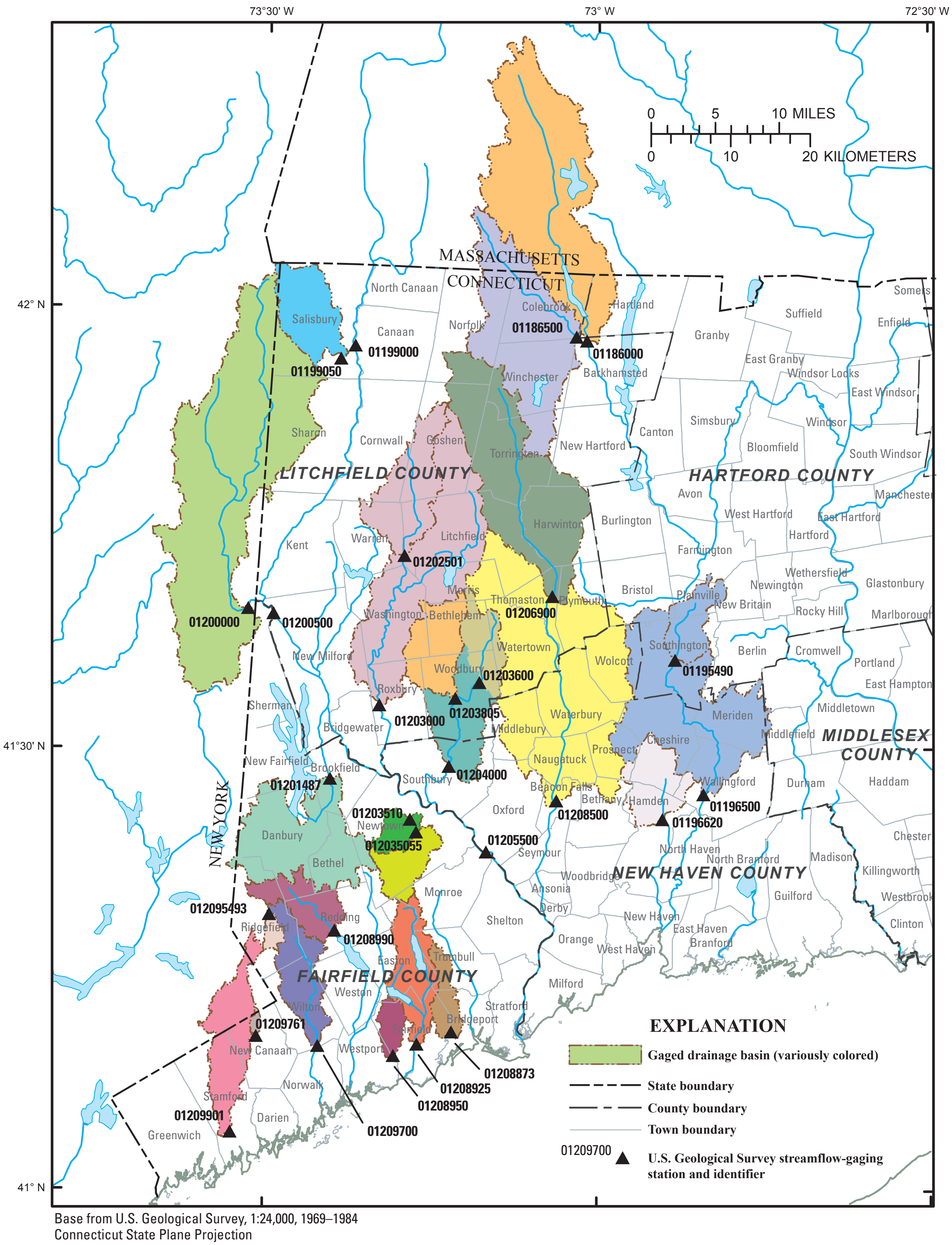


Figure 4. Drainage basins for U.S. Geological Survey streamflow-gaging stations in western Connecticut.

Table 2. Drainage-basin characteristics for the streamflow-gaging stations used to investigate the April 2007 flood in western Connecticut.

[Station locations are shown in figure 1. Impervious cover and land cover derived from National Land Cover Data at a 30-meter resolution grid (U.S. Geological Survey, Data at a 30-meter resolution grid (U.S. Geological Survey, 2001); Drainage area, mean basin elevation, and 24-hour rainfall derived from Connecticut StreamStats (Ahearn,

USGS station number	Station name	Drainage area (mi^2)	Impervious cover (percentage of drainage area)	Water (percentage of drainage area)	Developed, open space (percentage of drainage area)	Developed, low intensity (percentage of drainage area)	Developed, medium intensity (percentage of drainage area)
			Farmington River Basin				
01186000	West Branch Farmington River at Riverton	131	0.4	4.4	4.7	0.5	0.1
01186500	Still River at Robertsville	85	1.7	2.5	5.7	2.3	0.8
			South-Central Coast Basin				
01195490	Quinnipiac River at Southington	17.4	22.7	0.8	21.3	22.3	17.2
01196500	Quinnipiac River at Wallingford	115	16.4	1.4	18.7	19.5	10.9
01196620	Mill River near Hamden	24.5	8.1	0.2	16.0	14.2	2.8
			Housatonic River Basin				
01199000	Housatonic River at Falls Village	634	--	--	--	--	--
01199050	Salmon Creek at Lime Rock	29.4	0.8	3.9	4.7	1.0	0.4
01200000	Tenmile River near Gaylordsville	203	1.2	1.2	4.7	1.5	0.6
01200500	Housatonic River at Gaylordsville	996	--	--	--	--	--
01201487*	Still River at Route 7 at Brookfield Center	62.3	14.4	2.3	13.8	14.0	10.0
01202501	Shepaug River at Peters Dam at Woodville	38.1	0.5	4.8	4.6	0.5	0.0
01203000	Shepaug River near Roxbury	132	1.1	2.9	5.9	1.4	0.3
012035055	Pootatuck River at Berkshire	16	3.1	0.5	9.2	5.0	1.0
01203510	Pootatuck River at Sandy Hook	24.8	5.4	0.3	11.0	8.1	2.5
01203600	Nonewaug River at Minortown	17.7	1.9	1.1	6.4	3.8	0.4
01203805	Weekeepeemee River at Hotchkissville	26.8	0.9	0.7	6.5	1.0	0.1
01204000	Pomperaug River at Southbury	75.1	2.1	0.7	7.1	3.1	0.8
01205500	Housatonic River at Stevenson	1,544	--	--	--	--	--
01206900	Naugatuck River at Thomaston	99.8	4.2	2.0	6.8	4.4	2.9
01208500	Naugatuck River at Beacon Falls	260	8.6	1.9	9.1	8.4	6.8
			Southwest Coast Basin				
01208873	Rooster River at Fairfield	10.6	36.3	0.8	28.1	29.0	29.9
01208925	Mill River near Fairfield	28.6	5.7	5.4	17.3	9.1	1.7
01208950	Sasco Brook near Southport	7.38	5.4	0.0	30.0	7.2	0.5
01208990	Saugatuck River near Redding	21.0	1.2	1.3	11.9	0.8	0.3
012095493	Ridgefield Brook at Shields Lane near Ridgefield	3.39	11.8	0.0	18.1	10.6	6.4
01209700	Norwalk River at South Wilton	30.0	5.2	0.8	14.8	4.5	2.9
01209761	Fivemile River near New Canaan	1.00	1.7	2.3	7.2	3.1	0.0
01209901	Rippowam River at Stamford	34.0	6.1	2.8	18.2	7.5	2.8

* Basin characteristics for 01201487 Still River exclude the Candlewood Lake drainage area of 41.1 square miles.

Land cover derived from National Land Cover Data at a 30-meter resolution grid (U.S. Geological Survey, 2001); Mean basin slope derived from the National Elevation 2004); USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information systems; --, not determined]

Developed, high intensity (percentage of drainage area)	Forest (percentage of drainage area)	Main basin slope (feet)	GIS drainage area at selected point (mi²)	Mean basin elevation (feet)	2-year, 24-hour rainfall (inches)	10-year, 24-hour rainfall (inches)	25-year, 24-hour rainfall (inches)	50-year, 24-hour rainfall (inches)	100-year, 24-hour rainfall (inches)
Farmington River Basin									
0.0	81.6	10.8	129	1,380	3.2	5.0	6.4	7.8	9.4
0.1	78.9	11.5	85.5	1,210	3.4	5.2	6.6	7.9	9.4
South-Central Coast Basin									
3.1	27.8	6.2	17.8	258	3.6	5.2	6.6	7.8	9.2
1.9	38.7	7.2	111	302	3.6	5.2	6.4	7.6	8.9
0.4	58.0	8.2	24.5	303	3.6	5.2	6.4	7.6	8.9
Housatonic River Basin									
--	--	--	--	--	--	--	--	--	--
0.0	73.1	13.0	29.4	1,170	2.9	4.2	5.3	6.2	7.3
0.1	55.0	12.9	200	819	3	4.3	5.3	6.3	7.4
--	--	--	--	--	--	--	--	--	--
2.8	47.8	9.4	62.3	597	3.6	5.0	6.1	7.0	8.1
0.0	74.2	9.7	38.4	1,210	3.3	4.7	5.9	6.9	8.1
0.0	67.1	9.9	132	1,020	3.3	4.7	5.8	6.8	7.9
0.2	63.8	7.5	16.3	530	3.8	5.3	6.4	7.3	8.5
0.5	58.0	7.8	24.9	511	3.8	5.2	6.3	7.3	8.4
0.0	49.0	7.7	17.7	764	3.3	4.5	5.5	6.3	7.3
0.0	69.6	10.8	27	763	3.3	4.5	5.5	6.3	7.3
0.1	67.7	9.9	75.3	653	3.3	4.6	5.5	6.4	7.4
--	--	--	--	--	--	--	--		
0.5	71.0	10.3	101	978	3.5	5.1	6.4	7.6	9.0
1.1	59.4	9.9	259	784	3.4	4.9	6.0	7.1	8.3
Southwest Coast Basin									
5.7	6.2	5.1	11	244	3.6	5.3	6.7	7.9	9.5
0.3	56.1	7.0	28.6	349	3.6	5.3	6.5	7.7	9.1
0.0	50.7	5.3	7.38	230	3.6	5.2	6.5	7.7	9.1
0.1	75.3	12.0	22.3	571	3.7	5.2	6.3	7.3	8.4
3.1	39.0	6.8	3.39	642	3.7	5.2	6.4	7.4	8.7
0.9	67.1	8.56	29.9	477	3.7	5.2	6.3	7.4	8.6
0.3	66.4	4.4	1.2	504	3.6	5.2	6.5	7.6	8.9
0.6	61.9	7.1	34.2	402	3.6	5.3	6.5	7.7	9.0

Housatonic River streamflow-gaging stations are not shown in figure 4 because of the limited extent of the map.

Drainage-basin characteristics were determined from digital map data and included (1) drainage subbasins at 1:24,000 scale from the DEP; (2) elevation from USGS Digital Elevation Models (DEMs) at 1:24,000 scale from the USGS National Elevation Dataset (U.S. Geological Survey, 2006); (3) land cover at 1:24,000 scale from the USGS National Land Cover Dataset (U.S. Geological Survey, 2000); (4) hydrography (stream network) for Connecticut at 1:24,000 scale (Danenberg and Bogar, 1994; U.S. Geological Survey, 2005); and (5) maximum 24-hour rainfall characteristics (Miller and others, 2003; B.N. Belcher, Northeast Regional Climate Center, written commun., 2003).

The drainage basins analyzed had a wide range of characteristics and represent various stream types—from steep, mountainous streams to low-gradient, meandering streams and from small streams to large rivers—and basin types—from mostly forested environments to urban environments. Land elevations range from zero feet above the North American Vertical Datum of 1988 (NAVD 88) at the coast in Fairfield County to greater than 2,300 ft in the northwestern part of Litchfield County. Litchfield County has the steepest topography in the State; land-surface elevations range from 500 to 2,300 ft. For the streamflow-gaging stations studied, drainage areas range from 1.0 mi^2 (Fivemile River near New Canaan) to 1,544 mi^2 (Housatonic River at Stevenson). Mean basin slopes range from 4.4 percent (Fivemile River near New Canaan) to 13 percent (Housatonic River at Falls Village). Mean basin elevations range from 230 ft (Sasco River near Southport) to 1,380 ft (Farmington River at Riverton). Basin characteristics were not compiled for the three stations on the main stem of the Housatonic River because the Housatonic River Basin extends into Massachusetts, and Connecticut's peak-flow regression equations do not apply.

Streams in urbanized basins tend to rise more quickly during storms and have higher peak discharges than those in less urbanized basins. To determine the degree to which a basin has been urbanized, impervious area was evaluated (U.S. Geological Survey, 2000). The amount of impervious area for the basins with streamflow-gaging stations ranged from 0.4 percent (Farmington River at Riverton) to 36.3 percent (Rooster River at Fairfield). Basins that have more than 20 percent of their drainage area designated as impervious include Rooster River in Fairfield (36.3 percent) and Quinnipiac River at Southington (22.7 percent). The flood-frequency estimates for these basins were adjusted for urbanization using the nationwide seven-parameter urban regression equation (Sauer and others, 1983).

Annual Peak-Discharge Data

Annual peak-discharge data are used to characterize the magnitude and frequency of floods, such as the flood from the April 2007 storm. The annual peak discharge is defined as the maximum flow occurring in a water year (October 1–September 30). Annual peak-discharge data, along with the corresponding gage heights, date of occurrence, information on the cause of the annual peak (for example, hurricane, ice jam, dam failure), and known effects of flood control, urbanization, or basin changes are stored in the USGS National Water Information System (NWIS) database (http://waterdata.usgs.gov/nwis/peak).

The maximum peak stages and peak discharges recorded at the 28 streamflow-gaging stations for the April 2007 flood and for the entire period of record are summarized in table 3. The streamflow-gaging station locations are shown on figure 1 and described in table 1. The peak discharges at streamflow-gaging stations for the April 2007 flood are the maximum flows occurring in water year 2007, except for one station—Rooster River at Fairfield—where the maximum flow occurred on March 2 (maximum peak discharge, 2,040 ft^3/s; gage height, 10.78 ft).

During the April flood, all the rivers studied for which flood stages have been established by the NWS rose to or exceeded flood stage (table 3). The NWS defines flood stage as the river level that begins to impact life and (or) property. The main stem of the Quinnipiac River at Southington (USGS streamflow-gaging station 01195490) and at Wallingford (01196500) rose 6.97 ft and 1.51 ft above flood stage on April 16, respectively. The lower Housatonic River crested 8.96 ft above flood stage at Stevenson (01205500) and 4.97 ft above flood stage at Gaylordsville (01200500) on April 16; the upper Housatonic River crested 3.93 ft above flood stage at Falls Village (01199000) on April 18. The main stem of the Naugatuck River at Beacon Falls (01208500) rose to 12.1 ft on April 16; 0.1 ft above flood stage. Two other rivers with established flood stages (Tenmile River near Gaylordsville (01200000) and Pomperaug River at Southbury (01204000)) also rose above flood stage by 2.23 ft and 4.85 ft, respectively, on April 16.

During the 20th century, the most severe floods in terms of magnitude in western Connecticut occurred in March 1936, September 1938, August and October 1955, January 1979, and June 1982. The April 2007 peak discharges were compared in magnitude to all the historical annual peak discharges for streamflow-gaging stations with records extending back to 1955 or earlier. Nine of the 28 streamflow-gaging stations had records extending back to 1955 or earlier and are not affected by flood-control regulation (only three stations in the western region have records extending back to 1936). The ranking of the April 2007 peak discharges in relation to other annual peak discharges in the station records is listed in table 3. The April 2007 peak discharges in the Southwest Coast Basin (fig. 1) ranked between the highest and fourth highest in the streamflow-gaging records (table 3); the 1955 annual peak discharges are the highest peak discharges in the station records. Only 2 of the 8 streamflow-gaging stations in the Southwest Coast Basin have records back to 1955. The April 2007 peak discharges in the Housatonic and South Central Coast Basins (fig. 1) ranked between the fourth and tenth highest peak discharges with years of records greater than 50 and 30 years for the Housatonic and South Central Coast Basins, respectively (table 3). Generally, the 1938 and 1955 floods are the largest floods on record in the Housatonic and South Central Coast Basins. Other major floods—January 1979 and June 1982—impacted several of the stations in the Housatonic and South Central Coast Basins. For the majority of these stations, the April 2007 peak discharges were less than the January 1979 and June 1982 peak discharges. Streamflow-gaging stations in the Connecticut River Basin are located downstream from flood-control dams. The April 2007 peak discharges for these stations ranked between the highest and 3rd highest since the flood-control dams were completed between 1962 and 1969.

Peak discharges on the Rippowam River at Stamford (01209901) and the Quinnipiac River at Southington (01195490) were the highest recorded discharges for these stations; both stations have less than 20 years of record. Peak discharges on the Norwalk River (01209700) and the Saugatuck River (01208990) were the second highest in the records for these stations. Although the April peak discharges at Mill River (01208925) and Rooster River (01208873) were not the highest for the 2007 water year, peak discharges on the Mill River and Rooster River in Fairfield were the third highest in 35 and 30 years of record, respectively. Peak discharge on the Housatonic River at Gaylordsville (1200500) was the seventh largest peak in 95 years of record.

Peak discharges were determined by applying the peak stage to the most current stage-discharge relation developed by taking flow measurements at different water elevations. At seven streamflow-gaging stations (Tenmile River, Still River, Pootatuck River at Sandy Hook, Pootatuck at Berkshire, Saugatuck River, Ridgefield Brook, and Fivemile River), the current stage-discharge relations are not yet developed (highest discharge measurement is less than 2 times the maximum peak discharge recorded) for the April 2007 flood peak. In such cases, the stage-discharge relation was graphically extended to the peak stage by using the trend of the upper end of the peak discharge relation and the stage-discharge relation from water-surface profiles. The error introduced to the peak-discharge relation is unknown when the stage-discharge relation is extended without manually measured discharges; this introduces additional error in the flood-frequency estimates.

Peak Discharges Affected by Flood-Control Dams

The U.S. Army Corp of Engineers (USACE) constructed 10 flood-control dams in and near Litchfield County after the 1955 floods in New England: seven dams in the Naugatuck River Basin, which control 152 mi^2 or about 50 percent of the basin; and three dams in the Farmington River Basin, which control 139 mi^2 or about 25 and 50 percent of the Still River and West Branch of the Farmington River Basins, respectively (fig. 5). The flood-control dams in the Naugatuck River Basin are located on tributaries to the Naugatuck River, except for Thomaston Dam, which is located on the main stem. Thomaston Dam is the largest flood-control dam in the Naugatuck River Basin and helps to minimize flooding in the cities of Naugatuck, Seymour, and Ansonia. The Colebrook River Lake Dam is the largest flood-control dam in the Farmington River Basin and helps to minimize flooding on the main stem of the Farmington River. The Mad River Dam and Sucker Brook Dam have comparatively small drainage areas and can minimize flooding on the Mad River in Winsted. Since the flood-control dams were constructed, peak discharges for the April 2007 flood on the Still River (tributary of the Farmington River, 01186500) and West Branch Farmington River (01186000) were the highest and third highest, respectively. To maximize flood protection, a minimum amount of water is maintained in the flood-control pool prior to flooding. Specific reductions of peak discharges resulting from these dams are tabulated by USACE after noteworthy storms and are available on the USACE Web site (https://rsgis.crrel.usace.army.mil/nae/pls/nae/nae_web.nae_webmenu.displaymenu?menu=main, accessed September 29, 2008).

During the April 2007 flood, the USACE dams stored substantial runoff. Flood-control storage at the 10 USACE dams ranged from 9 to 55 percent of the dam capacities. All discharge releases (at dams with controlled gates) were considered controlled releases; no water spilled over the spillway crests. The highest pool stage recorded occurred during the April 2007 flood at three dams—Mad River Dam, Sucker Brook Dam, and East Branch Dam. The Colebrook River Lake Dam reached 55 percent capacity and peaked 34 ft below the spillway crest. In contrast, Sucker Brook Dam reached 9 percent capacity and peaked 39 ft below the spillway crest. A summary of maximum pool levels reached and the percent of storage for individual dams during the April 2007 flood is included in appendix 3—Summary of Maximum Pool Levels for U.S. Army Corps of Engineers Flood-Control Dams. Peak discharges also are affected by storm runoff stored in water-supply reservoirs. However, water-supply reservoirs in the Mill River Basin (Hemlock Reservoir and Easton Reservoir) and the Rippowam River Basin (Laurel Reservoir) were near or at capacity at the start of the April 2007 flood, and consequently, the flood-storage capacity was negligible. Information on the activities of the USACE New England District's Reservoir Regulation Section, which was responsible for the Corps flood-control reservoirs and hurricane barriers during the April 2007 flood, is provided in "Water Control Management, Annual Report FY 2007, April 16 (Patriots Day), 2007 Flood," U.S. Army Corp of Engineers, New England District http://reservoircontrol.com/

Table 3. Summary of peak stages and peak discharges during the April 2007 flood and maximum peak discharges and gage heights for

[USGS, U.S. Geological Survey; NWS, National Weather Service; mi², square miles; ft, feet; ft³/s, cubic feet per second; ft³/s/mi², cubic feet per second per roads and or damage man-made features and generally applies to a localized point.]

USGS station number (figure 1)	Station name	Drainage area (mi²)	NWS flood stage (ft)	Flood of April 15–16, 2007				
				Peak stage, local datum (ft)	Peak discharge (ft³/s)	Peak discharge (ft³/s/mi²)	Date	Time (hr)
	Farmington River Basin							
01186000	West Branch Farmington River at Riverton	131		8.13	3,040	23	04/24/07	10:15 AM
01186500	Still River at Robertsville	85		9.7	8,130	96	04/16/07	9:00 AM
	South-Central Coast							
01195490	Quinnipiac River at Southington	17.4	3.5	10.47	949	55	04/16/07	9:15 AM
01196500	Quinnipiac River at Wallingford	115	10.0	11.51	4,220	37	04/16/07	05:30 PM
01196620	Mill River near Hamden	24.5		5.2	1,940	79	04/15/07	011:00 PM
	Housatonic River Basin							
01199000	Housatonic River at Falls Village	634	7.0	10.93	10,900	17	04/18/07	1:15 AM
01199050	Salmon Creek at Lime Rock	29.4		5.18	1,400	48	04/16/07	12:45 PM
01200000	Tenmile River near Gaylordsville	203	9.0	11.23	9,650	48	04/16/07	05:45 PM
01200500	Housatonic River at Gaylordsville	996	8.0	12.97	23,400	23	04/16/07	011:00 PM
01201487	Still River at Route 7 at Brookfield Center[4]	62.3		18.69	3,580	57	04/16/07	12:45 PM
01202501	Shepaug River at Peters Dam at Woodville	38.1		6.51	4,160	109	04/16/07	8:45 AM
01203000	Shepaug River near Roxbury	132		10.37	8,000	61	04/16/07	10:45 AM
012035055	Pootatuck River at Berkshire	16		7.6	[e]3,000	194	04/16/07	7:45 AM
01203510	Pootatuck River at Sandy Hook	24.8		10.05	4,090	165	04/16/07	7:30 AM
01203600	Nonewaug River at Minortown	17.7		6.83	4,320	244	04/16/07	1:00 AM
01203805	Weekeepeemee River at Hotchkissville	26.8		9.19	3,670	137	04/16/07	2:30 AM
01204000	Pomperaug River at Southbury	75.1	9.0	13.85	7,350	98	04/16/07	7:00 AM
01205500	Housatonic River at Stevenson	1,544	11.0	19.96	50,300	33	04/16/07	02:00 PM
01206900	Naugatuck River at Thomaston	99.8		5.91	3,210	32	04/20/07	9:00 AM
01208500	Naugatuck River at Beacon Falls	260	12.0	12.1	13,300	51	04/16/07	--
	Southwest Coast Basin							
01208873	Rooster River at Fairfield	10.6		10.08	1,730	163	04/15/07	05:00 PM
01208925	Mill River near Fairfield	28.6		6.99	3,010	105	04/16/07	4:15 AM
01208950	Sasco Brook near Southport[5]	7.38		6.28	1,300	176	04/15/07	07:00 PM
01208990	Saugatuck River near Redding[6]	21.0		6.01	2,280	109	04/16/07	6:45 AM
012095493	Ridgefield Brook at Shields Lane near Ridgefield	3.39		5.21	373	110	04/16/07	10:15 AM
01209700	Norwalk River at South Wilton [7]	30.0		8.37	3,490	116	04/16/07	5:00 AM
01209761	Fivemile River near New Canaan	1.00		--	[e]200	--	04/16/07	--
01209901	Rippowam River at Stamford	34.0		7.85	2,490	73	04/16/07	2:15 AM

[1] Regulated during April 2007 flood: Y, yes; N, no.

[2] Period of record in bold italics indicates annual peak discharges affected by flood-control regulation.

[3] For stations with flood-control regulation, rankings based on regulated years.

[4] Annual peak discharges from 1932–1966 from station 01201500, Still River near Lanesville, and annual-peak discharges from 1967–1984 from station 01201510, Still

[5] Historic record used to estimate October 16, 1955, flood peak for Sasco River by averaging Norwalk River and Saugatuck River peak discharges per square mile. An

[6] October 16, 1955, peak discharge estimated from downstream peak discharge on Saugatuck River at drainage area 33.5 mi².

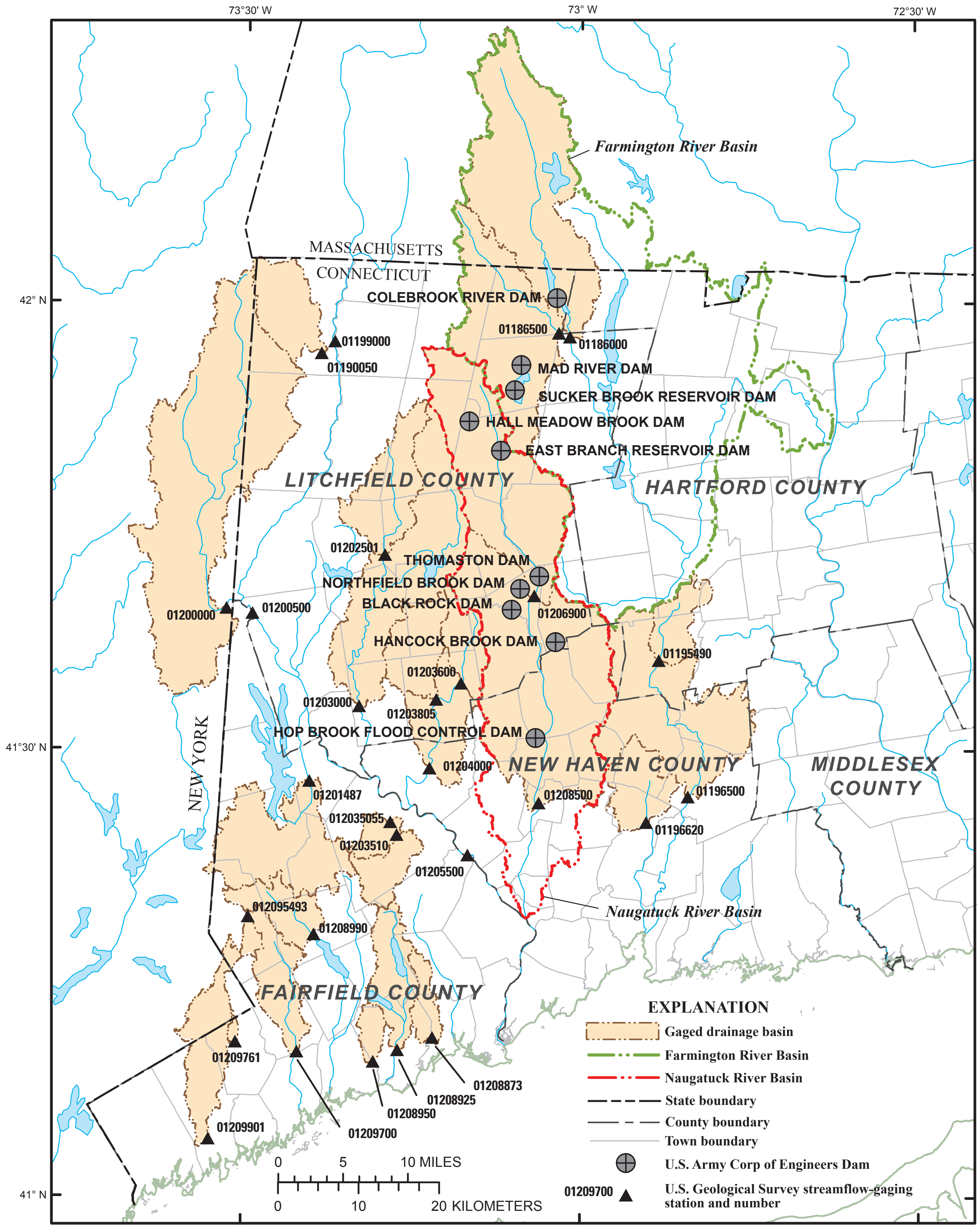
[7] October 16, 1955, peak discharge estimated from upstream peak discharge on Norwalk River at drainage area 7.54 mi².

the period of record for 28 streamflow-gaging stations in western Connecticut.

square mile; hr, hours; WY, water year; e, estimated; -- unknown; National Weather Service flood stage refers to flood water levels that actually flood

Maximum stage and discharge for period of record through water year 2006			Regulated during April 2007 flood [1]	Period of record (WY) [2]	Number of peaks in record	Rank of April peak [3]
Peak stage (ft)	Peak discharge (ft^3/s)	Date				
Farmington River Basin						
--	57,200	08/19/1955	Y	1955–1968, ***1969–2007***	53	3
16.48	44,000	08/19/1955	Y	1936, 1938, 1949–1961, ***1962–2007***	61	1
South-Central Coast						
10.04	876	05/13/2006	N	1988–2007	20	1
14.02	8,200	06/06/1982	N	1931–2007	77	6
9.53	5,580	06/06/1982	N	1969–1970, 1979–2007	31	6
Housatonic River Basin						
19.4	23,900	01/01/1949	Y	1913–2007	95	10
13.5	6,300	08/19/1955	N	1949, 1955, 1962–2007	48	8
14.9	17,400	08/19/1955	N	1930–1987, 1992–2007	74	5
18.58	51,800	08/19/1955	Y	1901–1914, 1924, 1928–2007	95	7
14.11	7,980	10/16/1955	N	1932–1984, 2002–2007	59	4
6.22	3,740	10/15/2005	N	2001–2007	7	1
17.2	50,300	8/19/1955	N	1931–1984, 2007	55	5
--	--	--	N	2007	1	1
8.47	2,720	1/25/1979	N	1966–1984, 2007	20	1
13.2	10,000	8/19/1955	N	1955, 1963–1976, 1979, 2002–2007	23	4
9.33	3,790	4/23/2006	N	2001–2007	7	2
21.8	29,400	8/19/1955	N	1933–2007	75	8
24.5	75,800	10/16/1955	Y	1924–1925, 1928–2007	82	7
27.0	53,400	8/19/1955	Y	1955, ***1960–2007***	49	10
25.7	106,000	8/19/1955	Y	1920–1959, ***1960–2007***	88	4
Southwest Coast Basin						
11.65	2,170	4/9/1980	N	1978–2007	30	3
7.15	1,800	4/10/1980	N	1973–2007	35	3
7.00	1,640	6/19/1972	N	1960–2007	49	4
--	5,000	10/16/1955	N	1956, 1962–2007	47	2
4.17	149	10/4/2005	N	2003–2007	4	1
13.5	9,000	10/16/1955	N	1956, 1963–2007	46	2
3.28	56	6/19/1999	N	1998–2007	10	1
6.56	1,890	4/10/1980	N	1978–1982, 2002–2007	11	1

River at Lanesville adjusted to site (data transferred using transfer equation 6.12, Drainage Manual, Connecticut Department of Transportation, January 2000).
estimate of 2,000 ft^3/s used in frequency analysis.



Base from U.S. Geological Survey, 1:24,000, 1969 to 1984
Connecticut State Plane Projection

Figure 5. Locations of U.S. Army Corps of Engineers flood-control dams in the Farmington and Naugatuck River Basins, U.S. Geological Survey streamflow-gaging stations, and their upstream drainage basins in western Connecticut.

Flood-Frequency Analyses of the April 2007 Flooding

Flood-frequency estimates for 24 of 28 streamflow-gaging stations were calculated using the guidelines in Bulletin 17B of the Interagency Advisory Committee on Water Data (1982). These guidelines present a uniform technique for estimating flood frequencies for streamflow-gaging stations. Guidelines in Bulletin 17B recommend determining the flood-frequency distribution by fitting a log-Pearson, Type III frequency distribution to the log transformations of the annual peak discharges. Fitting the distribution requires calculating the mean, standard deviation, and skew coefficient of the logarithms of annual peak-dischcarge series. The mean, standard deviation, and skew coefficient describe the mid-point, slope, and curvature of the peak-discharge frequency curve, respectively. Flood-frequency estimates are computed by inserting the three statistics of the frequency distribution into the equation.

$$LogQ = \bar{X} + KS, \quad (1)$$

where

Log$Q$	=	the logarithm of the flood-frequency estimate for a given exceedance probability, in cubic feet per second;
$\bar{X}$	=	the mean of the logarithms of annual peak discharges at the streamflow-gaging station;
K	=	a factor dependent on the skew coefficient and exceedance probability; and
S	=	the standard deviation of the means of the logarithms of annual peak discharges.

The USGS computer program PeakFQ, version 5.2 (Flynn, Kirby, and Hummel, 2006), which is based on Bulletin 17B guidelines, was used to compute the flood-frequency statistics for the streamflow-gaging stations in this report. PEAKFQ automates many of the analysis procedures recommended in Bulletin 17B, such as outlier detection, historical periods, and weighting of station skews with a generalized skew based on the skews of other stations within the region. The frequency curves generated from PeakFQ for this study were reviewed to determine how well the annual peak discharges fit the theoretical (log-Pearson Type III) distribution and were adjusted for outliers using historic flood information when appropriate. The assignment of a longer historic period is based upon examination of longer flood records from nearby, similar streamflow-gaging stations. The computer program and user manual for PeakFQ are available at http://water.usgs.gov/software/peakfq.html, accessed April 15, 2008.

Flood-Frequency Estimates for Streamflow-Gaging Stations

Flood-frequency estimates for the 0.50, 0.20, 0.10, 0.04, 0.02, 0.01, and 0.002 exceedance probabilities (2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval, respectively) were computed for 24 of 28 active gaging stations in Connecticut (table 4). Four of the 28 gaging stations—Shepaug River at Peters Dam at Woodville (01202501), Pootatuck River at Berkshire (102035055), Ridgefield Brook at Shields Lane near Ridgefield (012095493), and Fivemile River near New Canaan (01209761)—had insufficient data on which to perform a flood-frequency analysis. The flood-frequency estimates are weighted averages determined by combining the frequency estimates from a log-Pearson Type III analysis with the frequency estimates from the peak-discharge regression equations. The weight applied to the frequency estimates is based on the years of record at the station and the equivalent years of record for the regression equation. Generally, a flood-frequency estimate derived by combining and weighting estimates is more reliable than one derived from the log-Pearson Type III analysis, particularly for stations with a short length of record relative to the recurrence interval evaluated. A longer record than the period of the flood frequency to be determined is necessary for the frequency estimate to be highly dependable (within 10 percent of the true, long-term value), as described in Dalrymple (1960).

A regional regression equation for estimating the peak discharge for the 0.2 exceedance probability (5-year recurrence interval) does not exist for Connecticut; therefore, a weighted average for the 0.2 exceedance probability was not derived. Flood-frequency estimates for the West Branch of the Farmington River (01186000), Still River at Robertsville (01186500), Naugatuck River at Thomaston (01206900), and Naugatuck River at Beacon Falls (01208500) (streams with flood-control dams) and for the main stem of the Housatonic River (01199000, 01200500, and 01205500) (streams with regulation) are based on a log-Pearson Type III analysis of the post-flood control or regulated record using the individual station skew.

The results of the flood-frequency analysis indicate that the April 2007 peak discharges equaled a 0.02 exceedance probability (50-year recurrence interval) at three stations—Norwalk River at South Wilton (01209700), Pootatuck River at Sandy Hook (01203510), and Still River at Robertsville (01186500). These stations had the smallest probabilities of exceedance in Connecticut. The majority of the stations had peak discharges between 0.1 to 0.04 exceedance probabilities (10 to 25-year recurrence interval): seven stations with 0.04 exceedance probability (25-year recurrence interval); six stations between a 0.10 and 0.04 exceedance probability (10- and 25-year recurrence interval); and seven stations with a 0.10 exceedance probability (10-year recurrence interval) (table 4). One station—Naugatuck River at Thomaston (01206900)—had a 0.2 exceedance probability (5-year recurrence interval).

Table 4. Flood-frequency estimates for selected exceedance probabilities for 24 streamflow-gaging stations in western Connecticut.

[Station locations are shown on figure 1. USGS, U.S. Geological Survey; ft³/s, cubic feet per second; yr, years; e, estimated; LP3, log-Pearson Type III; WGT, weighted average; REG EQ, Reqression equation; MOVE-1, Maintenance of Variance Extension; --, not determined]

USGS station number	Station name	April 2007 peak discharge (ft³/s)	Exceedance probability of April peak discharge (percent)	Discharges for selected exceedance probabilities (ft³/s)							Frequency determination method
				0.5	0.2	0.1	0.04	0.02	0.01	0.002	
				Farmington River Basin							
01186000	West Branch Farmington River at Riverton	3,040	0.04	1,490	2,240	2,680	3,180	3,500	3,790	4,370	LP3
01186500	Still River at Robertsville	8,130	0.02	2,870	4,550	5,650	7,010	7,990	8,930	11,000	LP3
				South Central Coast Basin							
01195490	Quinnipiac River at Southington	949	0.10	510	--	1,040	1,360	1,640	1,940	2,510	WGT (LP3 and urban REG EQ)
				467	508	841	1,040	1,180	1,340	1,700	LP3
				851	--	1,760	2,230	2,740	3,270	4,250	REG EQ
01196500	Quinnipiac River at Wallingford	4,220	0.10	2,150	--	4,200	5,420	6,420	7,480	9,960	WGT (LP3 and REG EQ)
				2,140	3,280	4,110	5,220	6,100	7,020	9,300	LP3
				2,390	--	5,230	7,020	8,780	10,500	14,200	REG EQ
01196620	Mill River near Hamden	1,940	0.10	906	--	1,990	2,690	3,320	3,980	5,860	WGT (LP3 and REG EQ)
				926	1,570	2,100	2,910	3,630	4,440	6,800	LP3
				750	--	1,620	2,150	2,660	3,150	4,290	REG EQ
				Housatonic River Basin							
01199000	Housatonic River at Falls Village	10,900	0.10	6,250	9,050	11,400	15,200	18,500	22,400	34,400	LP3
01199050	Salmon Creek at Lime Rock	1,400	0.10–0.04	626	--	1,620	2,420	3,140	4,010	7,010	WGT (LP3 and REG EQ)
				624	1,150	1,630	2,440	3,200	4,140	7,160	LP3
				650	--	1,560	2,330	2,920	3,610	6,540	REG EQ
01200000	Tenmile River near Gaylordsville	9,650	0.04	3,090	--	6,900	9,550	11,900	14,600	22,700	WGT (LP3 and REG EQ)
				3,100	5,200	6,920	9,540	11,800	14,400	21,800	LP3
				2,860	--	6,680	9,620	12,600	15,700	27,600	REG EQ

Table 4. Flood-frequency estimates for selected exceedance probabilities for 24 streamflow-gaging stations in western Connecticut.—Continued

[Station locations are shown on figure 1. USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; yr, years; e, estimated; LP3, log-Pearson Type III; WGT, weighted average; REG EQ, Reqression equation; MOVE-1, Maintenance of Variance Extension; --, not determined]

USGS station number	Station name	April 2007 peak discharge (ft^3/s)	Exceedance probability of April peak discharge (percent)	Discharges for selected exceedance probabilities (ft^3/s)							Frequency determination method
				0.5	0.2	0.1	0.04	0.02	0.01	0.002	
				Housatonic River Basin—Continued							
01200500	Housatonic River at Gaylordsville	23,400	0.10–0.04	10,900	16,600	21,000	27,300	32,500	38,200	53,600	LP3
01201487	Still River at Route 7 at Brookfield Center	3,580	0.10–0.04	1,230	--	2,950	4,180	5,250	6,480	10,200	WGT (LP3 and REG EQ)
				1,200	2,100	2,870	4,080	5,170	6,440	10,200	LP3
				1,836	--	3,620	4,770	5,620	6,660	10,300	REG EQ
01202501	Shepaug River at Peters Dam at Woodville	4,160		Flood-frequency estimates not determined							
01203000	Shepaug River near Roxbury	8,000	0.10	3,010	--	7,300	10,700	13,800	17,500	30,100	WGT (LP3 and REG EQ)
				3,012	5,300	7,440	11,100	14,600	18,900	33,200	LP3
				2,920	--	6,400	8,830	11,000	13,200	20,800	REG EQ
012035055	Pootatuck River at Berkshire	[e]3,000		Flood-frequency estimates not determined							
01203510	Pootatuck River at Sandy Hook	4,090	0.02	1,180	--	2,490	3,390	4,200	5,120	7,840	Record extension using MOVE-1
01203600	Nonewaug River at Minortown	4,320	0.10–0.04	1,620	--	3,870	5,550	7,100	8,940	14,600	Record extension using MOVE-1
01203805	Weekeepeemee River at Hotchkissville	3,670	0.10	1,570	--	3,540	4,910	6,110	7,510	12,400	Record extension using MOVE-1
01204000	Pomperaug River at Southbury	7,350	0.10–0.04	2,760	--	6,290	8,760	11,000	13,700	22,600	WGT (LP3 and REG EQ)
				2,820	4,880	6,700	9,630	12,300	15,600	25,600	LP3
				1,680	--	3,490	4,570	5,660	6,830	12,200	REG EQ
01205500	Housatonic River at Stevenson	50,300	0.10	21,100	35,500	46,700	62,700	75,900	90,100	128,000	LP3
01206900	Naugatuck River at Thomaston	3,210	0.20	2,470	3,280	3,750	4,270	4,610	4,920	5,560	LP3
01208500	Naugatuck River at Beacon Falls	13,300	0.04	6,060	9,150	11,500	14,900	17,600	20,700	28,800	LP3

Table 4. Flood-frequency estimates for selected exceedance probabilities for 24 streamflow-gaging stations in western Connecticut. —Continued

[Station locations are shown on figure 1. USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; yr, years; e, estimated; LP3, log-Pearson Type III; WGT, weighted average; REG EQ, Reqression equation; MOVE-1, Maintenance of Variance Extension; --, not determined]

USGS station number	Station name	April 2007 peak discharge (ft^3/s)	Exceedance probability of April peak discharge (percent)	Discharges for selected exceedance probabilities (ft^3/s)							Frequency determination method
				0.5	0.2	0.1	0.04	0.02	0.01	0.002	
				South West Coast Basin							
01208873	Rooster River at Fairfield	1,730	0.10–0.04	1,070	--	2,160	2,890	3,520	4,250	6,350	Record extension using MOVE-1
				1,190	1,610	1,850	2,110	2,280	2,430	2,720	LP3
01208925	Mill River near Fairfield	3,010	0.04	729	--	1,990	2,850	3,620	4,480	6,750	WGT (LP3 and REG EQ)
				716	1,390	1,990	2,940	3,790	4,780	7,680	LP3
				876	--	1,990	2,590	3,190	3,820	4,990	REG EQ
01208950	Sasco Brook near Southport	1,300	0.04	282	- -	782	1,190	1,580	2,060	3,640	WGT (LP3 and REG EQ)
				282	550	818	1,300	1,790	2,430	4,700	LP3
				277	--	595	810	991	1,170	1,570	REG EQ
01208990	Saugatuck River near Redding	2,280	0.04	607	--	1,490	2,090	2,610	3,180	4,880	WGT (LP3 and REG EQ)
				590	1,050	1,450	2,060	2,593	3,210	5,000	LP3
				894	--	1,780	2,260	2,670	3,080	4,540	REG EQ
012095493	Ridgefield Brook at Shields Lane near Ridgefield	373		Flood-frequency estimates not determined							
01209700	Norwalk River at South Wilton	3,490	0.02	998	--	2,170	2,900	3,530	4,180	6,030	WGT (LP3 and REG EQ)
				993	1,650	2,180	2,940	3,580	4,280	6,210	LP3
				1,070	--	2,130	2,720	3,310	3,880	5,520	REG EQ
01209761	Fivemile River near New Canaan	[e]200		Flood-frequency estimates not determined							
01209901	Rippowam River at Stamford	2,490	0.04	793	--	1,750	2,370	2,900	3,500	5,130	Record extension using MOVE-1

Record Extension Using Two Methods: MOVE-1 and Two-Station Comparison

Often, streamflow-gaging stations have too short a length of record to contain a sufficient range of annual peak discharges to estimate the long-term flood probability for the basin. Consequently, estimates of the larger exceedance probabilities, such as the 0.01 exceedance probability (100-year recurrence interval), can be very uncertain. Hydrologic records of the annual peak discharges are often extended by mathematical procedures that relate the annual peak discharges at the short-term stations to those from nearby long-term stations. Record extensions provide better estimates of statistical parameters that describe the random variation of a set of observations (annual peak discharges) and can be used to estimate flow values that have not been measured at a short-term station.

For this study, records were extended at five streamflow-gaging stations—Pootatuck River at Sandy Hook (01203510), Nonewaug River at Minortown (01203600), Weekeepeemee River at Hotchkissville (01203805), Rooster River at Fairfield (01208873), and Rippowam River at Stamford (01209901)—using a mathematical procedure developed by Hirsch (1982) and referred to as Maintenance of Variance Extension (MOVE-1). The MOVE-1 method allows users to estimate annual peak discharges to fill in the missing peaks at a short-term station. The MOVE-1 technique produces peak discharge estimates at the short-term station with a statistical distribution similar to that expected if the streamflow had actually been measured (Helsel and Hirsch, 1992, p. 277). The frequency curve used to obtain the exceedance probabilities is fitted to the population of estimated and observed annual peak discharges at the record-extension station. The 95-percent confidence intervals were computed using PeakFQ for the four stations (table 5). Although the confidence intervals for the record-extension stations do not account for all of the uncertainty in the estimated peaks, the uncertainty is assumed to be evenly distributed, and therefore, reflected in the PeakFQ uncertainty analysis. A MOVE-1 relation was developed for stations where the correlation coefficients were greater than 0.8. The correlation coefficients for the stations with record extensions range from 0.87 for 20 years of concurrent record (Pootatuck River at Sandy Hook) to 0.98 for 7 years of concurrent record (Weekeepeemee River at Minortown). The long-term station used to extend the record of the short-term station was selected on the basis of the correlation coefficient of the concurrent record, record length (concurrent and period-of-record), and proximity to the short-term station.

The two-station comparison method of record extension (Interagency Advisory Committee on Water Data, 1982) also was used to extended records for the same short-term stations. The two-station comparison method involves adjusting the logarithmic mean and standard deviation of a short-term station with statistics from a long-term station. The two-station comparison method is used to model the relation between the two stations and not to generate missing peaks. Minimum allowable correlation coefficients varied depending on the length of the concurrent record. The minimum requirement set for the correlation coefficient by the Interagency Advisory Committee on Water Data (1982) for improving the standard deviation of peaks from a short-record station ranged from 0.65 for 10 years of concurrent record to 0.47 for 20 years of concurrent record. The minimum requirement set for the correlation coefficient for improving the mean of peaks from a short-record station ranged from 0.35 for 10 years of concurrent record to 0.24 for 20 years of concurrent record.

The flood-frequency estimates for the 0.20, 0.10, 0.04, 0.02, 0.01, 0.002, and 0.005 exceedance probability (5-, 10-, 25-, 50-, 100-, 200-, and 500-year recurrence intervals, respectively) for the five short-term stations with record extensions are shown in table 5. The flood-frequency estimates determined from the record-extension techniques were lower than estimates from the frequency analysis of the observed annual peak discharges, except for the Pootatuck River at Sandy Hook (01203510) and the Rooster River at Fairfield (01208873). Generally, the short-term records contain several large peak discharges or are missing several large peak discharges that can be affecting the shape of the peak-discharge-frequency curve resulting in flood-frequency estimates for selected recurrence intervals that may not be representative of the long-term frequency. The peak discharges determined from the record-extension methods for the Pootatuck River at Sandy Hook (01203510) are comparable to the peak discharges from the frequency analysis of the observed annual peak discharges, which indicates that the observed record is similar to the extended record and may cover a wider range of hydrologic conditions.

The record extension for the Pootatuck River at Sandy Hook provides a much narrower range of discharges within the 95-percent confidence limits than the estimates from the frequency analysis of the observed annual peak discharges (1966–1984, 2007). The flood-frequency estimates for the 0.01 exceedance probability (100-year recurrence interval) range from 4,580 to 12,600 ft^3/s based on observed data (no extension) and 6,170 to 10,700 ft^3/s based on the record extension. The MOVE-1 record-extension method may provide improved estimates of the exceedance probabilities; however, as of 2009, the method has not been incorporated into the Bulletin 17B national guidelines for estimation of flood frequency.

Comparison of the April 2007 Flood Data to Flood Insurance Studies

FEMA Flood Insurance Studies contain information on flood elevations and corresponding discharges for selected exceedance probabilities for each stream studied in detail in a given community. For rivers with streamflow-gaging stations, the discharges for the 0.1, 0.02, 0.01, and 0.002 exceedance probabilities (10-, 50-, 100-, and 500-year recurrence intevals,

Table 5. Flood frequency estimates derived using the Maintenance of Variance Extension (MOVE-1) method and the two-station comparison extended-record analysis for five streamflow-gaging stations in western Connecticut.

[USGS, U.S. Geological Survey; ft³/s, cubic feet per second; R, correlation coefficient]

Pootatuck River (USGS station 01203510), Newtown

Exceedance probability	Recurrence interval (years)	Period-of-record analysis (1966–1984, 2007)			Extended-record analysis (1933–2007)[a] Two-station comparison[b]			Extended-record analysis (1933–2007)[a] MOVE-1[c]		
		Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper	Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper	Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper
0.2	5	2,140	1,740	2,840	2,010	1,720	2,430	1,890	1,700	2,140
0.1	10	2,730	2,160	3,850	2,620	2,190	3,300	2,490	2,190	2,900
0.04	25	3,550	2,700	5,400	3,510	2,840	4,690	3,390	2,910	4,100
0.02	50	4,210	3,120	6,750	4,280	3,380	5,960	4,200	3,530	5,220
0.01	100	4,910	3,550	8,270	5,150	3,960	7,440	5,120	4,220	6,550
0.005	200	5,650	3,980	9,990	6,110	4,590	9,180	6,180	4,990	8,130
0.002	500	6,715	4,580	12,600	7,570	5,520	11,900	8,590	6,170	10,700

[a] Records extended using Pomperaug River (USGS station 01204000); R=0.87.

Nonnewaug River (USGS station 01203600), Woodbury

Exceedance probability	Recurrence interval (years)	Period-of-record analysis (1955, 1963–1979, 2001–2007)			Extended-record analysis (1933–2007)[a] Two-station comparison[b]			Extended-record analysis (1933–2007)[a] MOVE-1[c]		
		Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper	Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper	Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper
0.2	5	2,850	2,120	4,180	2,560	2,210	3,030	2,450	2,140	2,860
0.1	10	4,070	2,930	6,510	3,540	2,990	4,340	3,300	2,830	3,980
0.04	25	5,980	4,090	10,600	5,070	4,150	6,540	4,600	3,830	5,760
0.02	50	7,690	5,060	14,700	6,470	5,160	8,630	5,720	4,670	7,380
0.01	100	9,650	6,110	19,700	8,090	6,310	11,200	6,980	5,590	9,260
0.005	200	11,900	7,270	26,000	9,990	7,610	14,200	8,400	6,600	11,400
0.002	500	15,350	8,970	36,300	13,000	9,600	19,300	10,600	8,090	14,900

[a] Records extended using Pomperaug River (USGS station 01204000); R=0.97.

Weekeepeemee River (USGS station 01203805), Woodbury

Exceedance probability	Recurrence interval (years)	Period-of-record analysis (2001–2007)			Extended-record analysis (1933–2007)[a] Two-station comparison[b]			Extended-record analysis (1933–2007)[a] MOVE-1[c]		
		Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper	Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper	Peak flow (ft³/s)	95-percent confidence limit Lower	95-percent confidence limit Upper
0.2	5	3,240	2,060	7,240	2,910	2,470	3,530	2,810	2,470	3,270
0.1	10	4,480	2,730	12,600	3,990	3,310	5,060	3,870	3,320	4,640
0.04	25	6,340	3,620	23,400	5,690	4,550	7,620	5,550	4,630	6,970
0.02	50	7,960	4,300	35,300	7,210	5,620	10,100	7,100	5,780	9,220
0.01	100	9,770	5,010	51,400	8,990	6,820	13,100	8,940	7,100	12,000
0.005	200	11,800	5,760	72,900	11,100	8,170	16,700	11,100	8,630	15,400
0.002	500	14,800	6,800	112,000	14,300	10,200	22,600	14,600	11,000	21,000

[a] Records extended using Pomperaug River (USGS station 01204000); R=0.98.

[b] Extended-record using two-station comparison technique following Interagency Advisory Committee on Water Data (1982).

[c] Extended-record using the Maintenance of Variance Extension (MOVE-1) method.

Table 5. Flood frequency estimates derived using the Maintenance of Variance Extension (MOVE-1) method and the two-station comparison extended-record analysis for five streamflow-gaging stations in western Connecticut.—Continued

[USGS, U.S. Geological Survey; ft³/s, cubic feet per second; R, correlation coefficient]

Rooster River (USGS station 01208873), Fairfield

Exceedance probability	Recurrence interval (years)	Period-of-record analysis (1978–2007)			Extended-record analysis (1955, 1962–2007)[a]					
					Two-station comparison[b]			MOVE-1[c]		
		Peak flow (ft³/s)	95-percent confidence limit		Peak flow (ft³/s)	95-percent confidence limit		Peak flow (ft³/s)	95-percent confidence limit	
			Lower	Upper		Lower	Upper		Lower	Upper
0.2	5	1,610	1,410	1,900	1,920	1,430	2,890	1,670	1,470	1,940
0.1	10	1,850	1,600	2,230	2,700	1,940	4,500	2,160	1,860	2,600
0.04	25	2,110	1,800	2,620	3,940	2,670	7,510	2,890	2,410	3,660
0.02	50	2,280	1,930	2,880	5,080	3,290	10,700	3,520	2,880	4,630
0.01	100	2,430	2,040	3,110	6,430	3,980	14,800	4,250	3,390	5,790
0.005	200	2,560	2,140	3,330	8,030	4,750	20,200	5,080	3,960	7,150
0.002	500	2,720	2,250	3,590	10,600	5,910	29,700	6,350	4,800	9,340

[a] Records extended using Fivemile River near Norwalk (USGS station 01209770); R=0.91.

Rippowam River (USGS station 01209901), Stamford

Exceedance probability	Recurrence interval (years)	Period-of-record analysis (1978–1982, 2002–2007)			Extended-record analysis (1963–2007)[a]					
					Two-station comparison[b]			MOVE-1[c]		
		Peak flow (ft³/s)	95-percent confidence limit		Peak flow (ft³/s)	95-percent confidence limit		Peak flow (ft³/s)	95-percent confidence limit	
			Lower	Upper		Lower	Upper		Lower	Upper
0.2	5	1,780	1,290	2,910	1,430	1,170	1,830	1,320	1,130	1,600
0.1	10	2,370	1,660	4,370	2,000	1,560	2,650	1,750	1,460	2,190
0.04	25	3,220	2,130	6,900	2,780	2,130	4,060	2,370	1,920	3,130
0.02	50	3,930	2,500	9,330	3,530	2,610	5,430	2,900	2,300	3,980
0.01	100	4,700	2,890	12,300	4,390	3,150	7,120	3,500	2,700	4,960
0.005	200	5,550	3,280	15,900	5,390	3,750	9,190	4,150	3,140	6,090
0.002	500	6,800	3,830	21,700	6,960	4,660	12,600	5,130	3,780	7,840

[a] Records extended using Norwalk River at South Wilton (USGS station 01209700); R=0.93.

[b] Extended-record using two-station comparison technique following Interagency Advisory Committee on Water Data (1982).

[c] Extended-record using the Maintenance of Variance Extension (MOVE-1) method.

Table 6. Magnitude and frequency of floods from flood insurance studies and current (2007) flood-frequency estimates for streamflow-gaging

[USGS, U.S. Geological Survey; FIS, Federal Emergency Management Agency Flood Insurance Study; NGVD29; National Geodetic Vertical Datum of 1929;

USGS station number	Station name	FIS community	FIS report date	Drainage area (mi^2)	Peak discharge of April 2007 (ft^3/s)	Recurrence interval of April 2007 (yrs)		Magnitude of discharge for X-yr recurrence interval at streamflow-gaging station location from effective FIS[1] (ft^3/s)			
						Based on frequency analyses using data water year 2007	Based on FIS	10-yr	50-yr	100-yr	500-yr
				Farmington River Basin							
01186000	West Branch Farmington River at Riverton	Barkhamsted	17-Aug-81	131	3,040	25	50	2,440	3,350	4,370	22,800
01186500	Still River at Robertsville	Winchester	Jan-78	85	8,130	50	~100	2,800	4,600	9,500	--
				South Central Coast							
01195490	Quinnipiac River at Southington	Hartford	26-Sep-08	17.4	949	10	10	902	1,620	1,880	2,480
01196500	Quinnipiac River at Wallingford	Wallingford	18-Mar-99	115	4,220	10	10	3,900	5,700	6,500	7,380
01196620	Mill River near Hamden	Hamden	Dec-78	24.5	1,940	10	> 100	1,080	1,670	1,870	2,460
				Housatonic River Basin							
01199000	Housatonic River at Falls Village	Canaan	2-Sep-88	634	10,900	10	10	11,900	18,400	21,900	31,400
01199050	Salmon Creek at Lime Rock	Salisbury	5-Jan-89	29.4	1,400	10–25	10	1,400	2,920	3,870	7,100
01200000	Tenmile River near Gaylordsville	Dover, NY	4-Jul-98	203	9,650	25	~10 and 50	7,240	13,100	16,100	25,000
01200500	Housatonic River at Gaylordsville	Sherman	18-Jun-87	996	23,400	10–25	10	23,500	40,400	50,400	81,400
01201487	Still River at Route 7 at Brookfield Center	Brookfield	Dec-78	62.3	3,580	10–25	~10 and 50	2,600	6,200	8,580	17,400
01202501	Shepaug River at Peters Dam at Woodville	Litchfield	2-Jan-92	38.1	4,160	--		--	--	7,000	--
01203000	Shepaug River near Roxbury	Roxbury	3-Dec-87	132	8,000	10		--	--	24,100	--
012035055	Pootatuck River at Berkshire	Newtown	16-Apr-03	15.5	e3000	--	>100	1,200	2,220	2,810	4,620
01203510	Pootatuck River at Sandy Hook	Newtown	16-Apr-03	24.8	4090	50	100	1,800	3,320	4,200	6,930
01203600	Nonewaug River at Minortown	Woodbury	Mar-77	17.7	4,320	10~25	~10 and 50	3,020	6,460	8,620	16,200
01203805	Weekeepeemee River at Hotchkissville	Woodbury	Mar-77	26.8	3,670	10	~10 and 50	2,500	5,500	8,000	17,000
01204000	Pomperaug River at Southbury	Southbury	Sep-79	75.1	7,350	10–25	~10 and 50	5,680	12,300	17,000	34,100
01205500	Housatonic River at Stevenson	Oxford	18-Mar-91	1,544	50,300	10	~10 and 50	42,000	87,000	126,000	196,000
01206900	Naugatuck River at Thomaston	Thomaston	5-Jan-82	99.8	3,210	5	10	3,500	3,500	3,600	6,760
01208500	Naugatuck River at Beacon Falls	Beacon Falls	Sep-78	260	13,300	25	~10 and 50	9,070	20,700	28,800	66,900
				South West Coast							
01208873	Rooster River at Fairfield	Fairfield	6-Oct-98	10.6	2,040	10–25	~10 and 50	1,600	2,600	3,500	5,900
01208925	Mill River near Fairfield	Fairfield	6-Oct-98	28.6	3,010	25	10	2,720	5,340	7,520	14,000
01208950	Sasco Brook near Southport	Fairfield	6-Oct-98	7.38	1,300	25	10	1,350	2,100	2,600	4,300
01208990	Saugatuck River near Redding	Redding	15-Dec-81	21.0	2,280	25	~10 and 50	1,560	2,930	3,740	5,920
012095493	Ridgefield Brook at Shields Lane near Ridgefield	Ridgefield	23-Aug-99	3.39	373	--		125	185	235	410
01209700	Norwalk River at South Wilton	Wilton	18-Feb-98	30.0	3,490	50	~10 and 50	2,980	5,840	7,460	12,500
01209761	Fivemile River near New Canaan	New Canaan	4-Jun-90	1.00	e 200	--		150	260	310	550
01209901	Rippowam River at Stamford	Stamford	17-Nov-93	34.0	2,490	25	10	2,730	5,470	6,980	8,770

[1] The date the Flood Insurance Study (FIS) is effective in the National Flood Insurance Program.

stations in western Connecticut.

mi², square miles; ft³/s, cubic feet per second; yr, years; e, estimated; --, not determined; ~, approximately; >, greater than]

Magnitude of discharge for X-yr recurrence interval at streamflow-gaging location from hydrologic analyses 2008 (ft³/s)				Differences between 2008 flood-frequency estimates and effective FIS discharge values (in percent) (positive percents indicate higher discharges (in bold) and negative percents indicate lower discharges)				100-year flood elevation at USGS streamflow-gaging location (note-elevation differences are for sites where updated flood-frequnecy estimates are greater than the discharges in the FIS report)		
10-yr	50-yr	100-yr	500-yr	10-yr	50-yr	100-yr	500-yr	100-year FIS report flood elevation (NGVD29)	100-year flood elevation from current stage-discharge relation at gage (NGVD29)	Flood elevation difference
Farmington River Basin										
2,680	3,500	3,790	--	**9.0**	**4.3**	-15.3	--			
5,650	7,990	8,930	--	**50.4**	**42.4**	-6.4	--			
South Central Coast										
1,040	1,640	1,940	2,510	**13.3**	**1.2**	**3.1**	**1.2**	--	Undefined	--
4,200	6,420	7,480	9,960	**7.1**	**11.2**	**13.1**	**25.9**	32.2	32.9	0.7
1,990	3,320	3,980	5,860	**45.7**	**49.7**	**53.0**	**58.0**	88.0	90.4	2.4
Housatonic River Basin										
11,400	18,500	22,400	34,400	-4.4	**0.5**	**2.2**	**8.7**	547.0	547.4	0.4
1,620	3,140	4,010	7,010	**13.6**	**7.0**	**3.5**	-1.3	629.5	629.8	0.3
6,900	11,900	14,600	22,700	-4.9	-10.1	-10.3	-10.1			
21,000	32,500	38,200	53,600	-11.9	-24.3	-31.9	-51.9			
2,950	5,250	6,480	10,200	**11.9**	-18.1	-32.4	-70.6			
--	--	--	--	--	--	--	--			
7,300	13,800	17,500	30,100	--	--	-37.7	--			
--	--	--	--	--	--	--	--			
2,490	4,200	5,120	7,840	**27.7**	**21.0**	**18.0**	**11.6**	230.0	Undefined	--
3,870	7,100	8,940	14,600	**22.0**	**9.0**	**3.6**	-11.0	366.0	Undefined	--
3,540	6,110	7,510	12,400	**29.4**	**10.0**	-6.5	-37.1			
6,290	11,000	13,700	22,600	**9.7**	-11.8	-24.1	-50.9			
46,700	75,900	90,100	128,000	**10.1**	-14.6	-39.8	-53.1			
3,750	4,610	4,920	--	**6.7**	**24.1**	**26.8**	--	363.2	361.3	-1.9
11,500	17,600	20,700	--	**21.1**	-17.6	-39.1	--			
South West Coast										
2,160	3,520	4,250	6,350	**25.9**	**26.1**	**17.6**	7.1	19.5	Undefined	--
1,990	3,620	4,480	6,750	-36.7	-47.5	-67.9	-107.4			
782	1,580	2,060	3,640	-72.6	-32.9	-26.2	-18.1			
1,490	2,610	3,180	4,880	-4.7	-12.3	-17.6	-21.3			
--	--	--	--	--	--	--	--			
2,170	3,530	4,180	6,030	-37.3	-65.4	-78.5	-107.3			
--	--	--	--	--	--	--	--			
1,750	2,900	3,500	5,130	-56.0	-88.6	-99.4	-71.0			

respectively) were compiled from these studies and are listed in table 6. The flood-frequency data obtained from the FEMA studies often differ from updated estimates of the magnitude and frequency of floods because in the updated estimates more data are available for statistical analysis and (or) the methods used for determining the magnitude and frequency of floods may be different. The additional data allow for more accurate estimates of magnitude and frequency of floods for streamflow-gaging stations.

The magnitude and frequency of discharges determined in this study using data through water year 2007 were compared to the magnitude and frequency of discharges in the community Flood Insurance Studies for streamflow-gaging stations in western Connecticut. The comparison indicated that, in general, the discharges at the 0.10 exceedance probability (10-year recurrence interval) from the flood-frequency analysis are larger than in the Flood Insurance Studies, but the discharges at the 0.01 exceedance probability (100-year recurrence interval) from the flood-frequency analysis are smaller than in the Flood Insurance Studies. For example, the discharges at the 0.10 exceedance probability in the Flood Insurance Study and frequency analysis are 5,680 ft^3/s and 6,290 ft^3/s, respectively (data from station 01204000). For the same station, the discharges at the 0.01 exceedance probabities in the Flood Insurance Study and flood-frequency analysis are 17,000 ft^3/s and 13,700 ft^3/s, respectively. Differences in the flood-frequency estimates at the 0.10 exceedance probability (10-year recurrence interval) ranged from -72.6 to -4.4 percent (8 stations) and +6.7 to +50.5 percent (15 stations) with an overall median change of about +10 percent. At the 0.01 exceedance probability (100-year recurrence interval), differences in the flood-frequency estimates ranged from -99.5 to -6.4 (15 stations) to +2.2 to +53.0 (9 stations) with an overall median change of about -13 percent (table 5).

At the 0.10 exceedance probability (10-year recurrence interval), the largest (+) changes—where the flood-frequency estimates are greater than the estimates in the FEMA Flood Insurance Studies—were for Winchester (Still River at Robertsville, +50 percent change); Hamden (Mill River near Hamden, +46 percent change); Newtown (Pootatuck River at Sandy Hook, +28 percent change); and Woodbury (Weekeepeemee River at Hotchkissvile, +29 percent change). At the 0.01 exceedance probability (100-year recurrence interval), the largest (+) changes—where the flood-frequency estimates are larger than the published estimates in the FEMA Flood Insurance Studies—were for Wallingford (Quinnipiac River at Wallingford, +13 percent change); Hamden (Mill River near Hamden, +53 percent change); Newtown (Pootatuck River at Sandy Hook, +18 percent change); and Thomaston (Naugatuck River at Thomaston, +27 percent change).

The 0.01 exceedance probability (100-year) flood elevations—determined at streamflow-gaging station locations from the current (water year 2007) USGS stage-discharge relation using the flood-frequency estimates—were compared to the 0.01 exceedance probability (100-year) flood elevations in the Flood Insurance Studies. The comparison shows that the flood elevations reported by the USGS are higher at the streamflow-gaging stations than the flood elevations in the FEMA studies by more than 0.5 ft for Wallingford (Quinnipiac River at Wallingford, 0.6 ft difference) and Hamden (Mill River near Hamden, 2.3 ft difference).

The 0.01 exceedance probability (100-year) flood elevations were obtained from the water-surface profiles of the Flood Insurance Studies. It is not known if the differences in the exceedance probability discharges or flood elevations translate to a large change in the delineation of the regulatory floodplain. In relatively flat topography, a change of 0.5 ft can represent a significant change to the regulatory floodplain boundary. Several stations that showed increases in discharges at the 0.01 exceedance probability could not be evaluated for changes in the flood elevations because the relation between the stage and discharge at the streamflow-gaging stations is not defined for higher flows. These stations included Quinnpiac River at Southington (01195490), Pootatuck River at Sandy Hook (01203510), Nonewaug River at Minortown (01203600), and Rooster River at Fairfield (01208873).

Summary

From April 15 to 18, 2007, Fairfield and Litchfield Counties in Connecticut experienced moderate to severe flooding caused by a late season nor'easter that dropped more than 7 inches of rainfall in the region. A Presidential Disaster Declaration was issued on May 11, 2007, for the two counties. Because communities need up-to-date estimates of the magnitude and frequency of flooding in order to make sound decisions about community planning, zoning, and development, the Federal Emergency Management Agency requested that the U.S. Geological Survey conduct a study to determine the magnitude and frequency of discharges at streamflow-gaging stations in and near the declared disaster areas. Records of annual maximum flows and information on the magnitude and frequency of floods are used extensively in Flood Insurance Studies to determine flood zones and promote sound land use and flood-plain development. In addition, information on the magnitude and frequency of floods is important in the design of hydraulic structures such as bridges and culverts.

Peak discharges for exceedance probabilities of 0.50, 0.20, 0.10, 0.04, 0.02, 0.01, and 0.002 (recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years, respectively) were determined for 24 streamflow-gaging stations in western Connecticut. Flood-frequency curves were derived from data through water year 2007 by fitting the annual series of peak-discharge data to a log-Pearson Type III frequency distribution. The frequencies were computed following the guidelines recommended by the Interagency Advisory Committee on Water Data (1982) in Bulletin 17B. Annual peak-discharge data at several stations (Pootatuck River, Nonewaug River, Weekeepeemee River, Rooster River, and Rippowam River) were determined to have too short a record to contain a sufficient range of hydrologic conditions; consequently, record extension methods were applied to improve the flood-frequency estimates for these stations. The estimates in this report update and supersede previously published flood-frequency estimates for streamflow-gaging stations in Connecticut by incorporating additional years of annual peak discharges, including the peaks for the April 2007 flood.

During the April 2007 flood, all streamflow-gaging stations at which flood stages have been established by the NWS rose to or exceeded flood stage. Peak discharges on the Norwalk River and the Saugatuck River were the highest since the historical New England flood of 1955. Discharges on the Rippowam River at Stamford and the Quinnipiac River at Southington were the maximum discharges for the period of record for those stations. For the majority (80 percent) of the streamflow-gaging stations, the April 2007 peak discharges range between a 0.10 and 0.04 exceedance probability of being equaled or exceeded in any one year (recurrence intervals of 10- and 25-years, respectively). At three streamflow-gaging stations—Norwalk River at South Wilton, Pootatuck River at Sandy Hook, and Still River at Robertsville—the April 2007 peak discharges have a 0.02 exceedance probability of being equaled or exceeded in any one year (recurrence interval of 50 years).

Flood-frequency estimates determined using peak-discharge data through water year 2007 were compared to those used to calculate water-surface profiles in Federal Emergency Management Agency Flood Insurance Studies prepared for communities. The comparison indicated that for the majority of the streamflow-gaging stations—at the 0.10 exceedance probability (10-year recurrence interval)—the peak discharges determined in the flood-frequency analysis are larger than the peak discharges in the FEMA Flood Insurance Studies. The differences in the peak discharges determined using data through water year 2007 compared to the flood-frequency estimates in the Flood Insurance Studies ranged from -72.6 to -4.4 percent (8 stations) and +6.7 to +50.5 percent (15 stations), with an overall median change of about +10 percent. At the 0.10 exceedance probability (10-year recurrence interval), several stations for which discharges from the frequency analysis using data through water year 2007 exceeded discharges in the Flood Insurance Studies had more than +25 percent change: Winchester (Still River at Robertsville, +50 percent change); Hamden (Mill River near Hamden, +46 percent change); Woodbury (Weekeepeemee River at Hotchkissville, +29 percent change); and Newtown (Pootatuck River at Sandy Hook, +28 percent change).

The comparison also indicated that for the majority of the streamflow-gaging stations—at the 0.01 exceedance probability (recurrence interval of 100 years)—the discharges determined in the flood-frequency analysis using data through water year 2007 are smaller than the discharges reported in the FEMA Flood Insurance Studies. The differences in the magnitude of discharges ranged from -99.5 to -6.4 (15 stations) to +2.2 to +53.0 (9 stations) with an overall median change of about -13 percent. Although the majority of the streamflow-gaging stations studied had discharges at the 0.01 exceedance probability smaller than in the Flood Insurance Studies, the (2007) flood-frequency estimates were larger than in the Flood Insurance Studies for four stations in the following communities: Hamden (Mill River near Hamden, +53 percent change); Thomaston (Naugatuck River at Thomaston, +27 percent change); Newtown (Pootatuck River at Sandy Hook, +18 percent change); and Wallingford (Quinnipiac River at Wallingford, +13 percent change).

A comparison of the 0.01 exceedance probability (recurrence interval of 100 years) flood elevations determined at streamflow-gaging stations from the current U.S. Geological Survey stage-discharge relation to the 0.01 exceedance probability flood elevations in the Flood Insurance Studies indicated that the flood elevations determined from the frequency analysis exceeded the flood elevations in the Flood Insurance Study water-surface elevation by more than 0.5 ft for Wallingford (Quinnipiac River at Wallingford, 0.6 ft difference) and Hamden (Mill River near Hamden, 2.3 ft difference). It is unknown whether the differences in the 100-year peak discharges or flood elevations translate to a large change in the delineation of the regulatory 100-year floodplain.

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Appendix 1. Federal Emergency Management Agency Disaster Declaration Map.

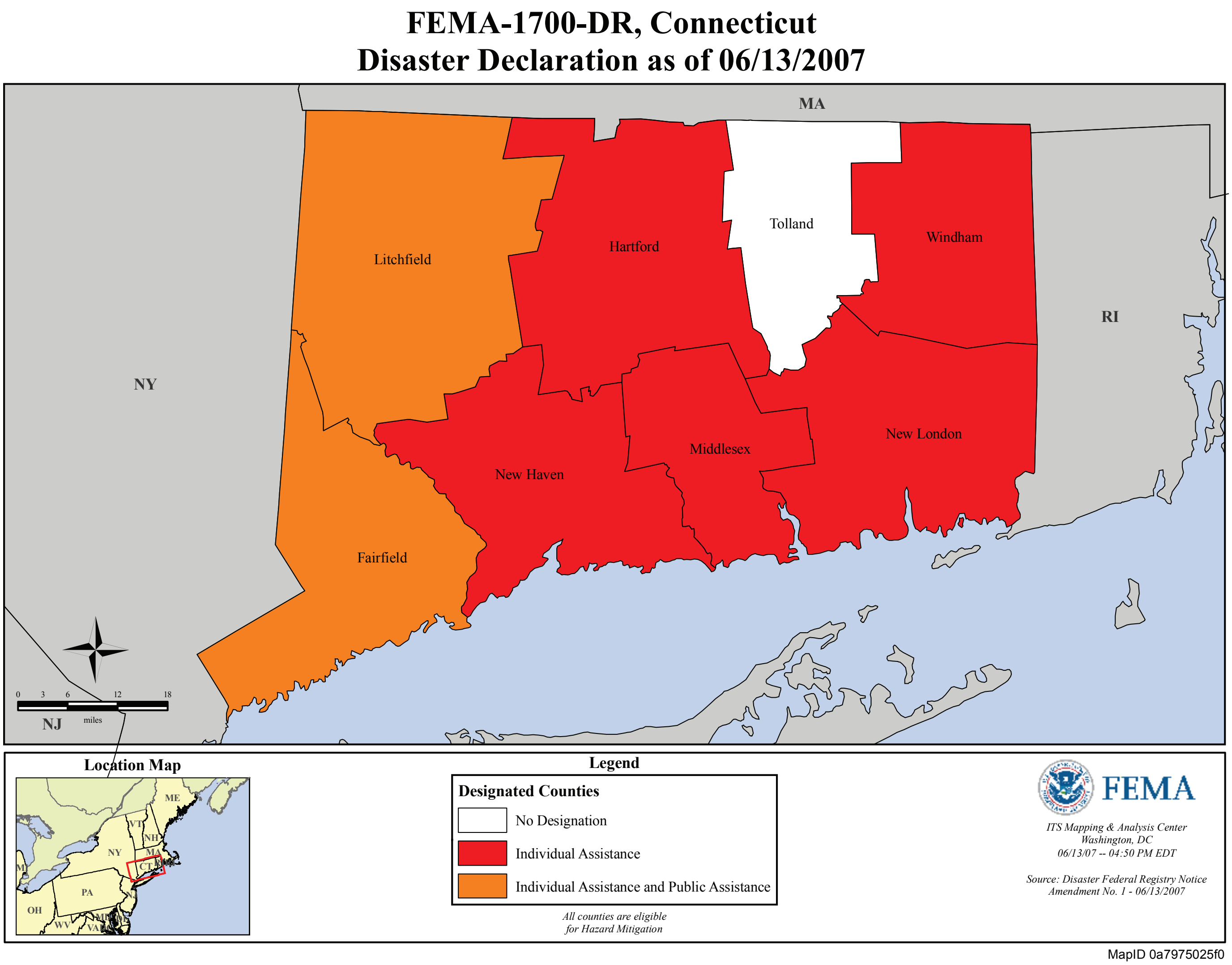

Figure 1. Federal Emergency Management Agency Disaster Declaration map.

Appendix 2. National Climatic Data Center April 2007 Storm Events: Details for Fairfield and Litchfield Counties, Connecticut

These event record details are from the National Climatic Center Web site at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms, accessed August 25, 2008.

Event Record Details

Event:	**Flood**	State:	**Connecticut** *Map of Counties*
Begin Date:	**15 Apr 2007, 14:00:00 PM EST**	County:	**Fairfield**
Begin Location:	**Stamford**		
Begin LAT/LON:	**41°03'N / 73°31'W**		
End Date:	**16 Apr 2007, 07:00:00 AM EST**		
End Location:	**Shelton**		
End LAT/LON:	**41°19'N / 73°00'W**		
Magnitude:	**0**		
Fatalities:	**0**		
Injuries:	**0**		
Property Damage:	**$ 0.0K**		
Crop Damage:	**$ 0.0K**		
Map of Counties			

Description:

A Northeaster occurred during Sunday and Monday, April 15th and 16th. It brought heavy rain and high winds that caused widespread and significant river, stream, and urban flooding of low lying and poor drainage areas. High winds downed many trees and power lines across Southeast Connecticut. The combination of high winds, heavy rain, and high water tables produced widespread moderate tidal flooding across portions of the Long Island Sound Shorelines through Thursday, April 19th. Significant river flooding lasted through Monday, April 23rd. Storm Total Rainfall amounts ranged from 1.76 inches at New London Airport in Groton to 7.83 inches in New Canaan. Fairfield County rainfall ranged from 3.49 inches at Bridgeport to 7.83 inches at New Canaan. New Haven County rainfall ranged from 3.32 at Oxford Airport in Waterbury to 4.50 inches at Hamden. Middlesex County rainfall at Middletown was 5.25 inches. New London County rainfall at New London Airport was 1.76 inches. Flooding from Rainfall: The heaviest rain fell across southwest and southcentral Connecticut, where many small rivers, streams, and brooks rose over their banks within 12 hours of the heavy rainfall during Sunday, April 15th. River Flood Observations include: Long stem larger rivers, such as the Housatonic and the Connecticut Rivers rose over their banks the following day, on Monday, April 16th. The Yantic River rose above its flood stage of 9.0 feet at 3:45 am on April 16th. It crested at 10.42 feet at 10:42 am, then fell below flood stage at 9:45 pm on April 16th. Urban Flood Observations include: Trained spotters reported sewage drains overflowing in Greenwich, street flooding in Trumbull, Old Greenwich, and Hamden; and flooding along I-95 in Fairfield and New Haven Counties. High Wind Observations include: The highest winds occurred across southeast Connecticut during Saturday night from April 15th to the 16th. East winds increased during the day, Sunday as the low approached. Wind speeds gusted from 35 to 55 mph. As the low moved toward Long Island, another period of high winds occurred during Sunday night with peak wind speeds from 45 to 55 mph. The National Weather Service (NWS)

Automated Surfacing Observing System (ASOS) measured a peak wind gust of 53 mph from the Southeast at Meriden Markham Airport in Meriden on April 16th. The NWS ASOS measured a peak wind gust of 52 mph from the Southeast at New London Airport on April 15th. Based on the receipt of many downed trees and power lines in New London County Sunday night, instantaneous peak wind gusts of 60 to 70 mph were estimated. Tidal Flooding: Coastal flooding occurred along the Long Island Sound shores of Connecticut around the times of high tide starting Sunday evening, and lasting through Thursday, April 19th. The highest surges of 3 to 4 feet occurred across the Southeast shores of Connecticut Sunday evening. Because of the new moon on April 17th, the highest water levels (and highest tidal departures) occurred during Tuesday, April 17th. Water slowly receded during the remainder of the week, when mainly minor tidal flooding occurred during Wednesday and Thursday.

Event Record Details

Event:	**Coastal Flood**	State:	**Connecticut** *Map of Counties*
Begin Date:	**15 Apr 2007, 22:00:00 PM EST**	Forecast Zones affected:	**Southern Fairfield, Southern New Haven**
Begin Location:	**Not Known**		
End Date:	**16 Apr 2007, 00:00:00 AM EST**		
End Location:	**Not Known**		
Magnitude:	**0**		
Fatalities:	**0**		
Injuries:	**0**		
Property Damage:	**$ 0.0K**		
Crop Damage:	**$ 0.0K**		

Description:

A strong late season Nor'easter impacted the region with a period of moderate coastal flooding. The low orignated over the southern plains on Friday, April 13, and then reached the mid Atlantic coast Sunday morning, April 15. From there, it underwent rapid deepening and tracked northeast, reaching the waters off southern New England Sunday night. The combination of a strong high off the New England coast and a period of higher than normal spring tides resulted in tidal piling across Long Island Sound. Tidal departures were highest on western Long Island Sound from Sunday evening through Monday morning, ranging from 2.5 to 3.5 feet. At Stamford, Connecticut, there was moderate coastal flooding with the highest tide level 11.34 feet (MLLW) at 10:30 p.m. on Sunday, April 15. This was comparable to tide levels reached during the March 1993 Nor'easter and Hurricane Donna. Several days prior to this event, model storm surge forecasts were as high as 4.5 feet. For Long Island Sound, such a surge would have produced flooding approaching the level of the December 1992 Nor'easter. While these levels were not realized due to changes in the forecast track, this storm resulted in considerable damage to property.

Event Record Details

Event:	**Flood**	State:	**Connecticut** *Map of Counties*
Begin Date:	**15 Apr 2007, 21:00:00 PM EST**	County:	**Litchfield**
Begin Location:	**New Hartford**		
Begin LAT/LON:	**41°52’N / 72°58’W**		
End Date:	**18 Apr 2007, 10:00:00 AM EST**		
End Location:	**Not Known**		
Magnitude:	**0**		
Fatalities:	**0**		
Injuries:	**0**		
Property Damage:	**$ 750.0K**		
Crop Damage:	**$ 0.0K**		

Description:

Heavy rain led to widespread flooding across Litchfield County from Sunday evening on the 15th, and persisted through Wednesday morning on the 18th. Several streams and creeks exceeded bankful as a result of this heavy rain, including the Still River in Winsted, and the Nepaug Brook and River in New Hartford. This led to numerous road closures across the county, as well as some evacuations. Some of the roads that were closed included Carpenter Road in new Hartford, where a foot of water was reported covering the bridge just north of Route 202, South Main Street and Highland Lake Road in Torrington, where some debris also covered portions of Highland Lake Road, Route 47 and Weekeepeemee Road in Woodbury, Torrington Road between Torrington and Winsted, Cross Road and Youngsfield Road in New Milford, as well as several roads in Washington and Winsted that were washed out. In addition, several evacuations also occurred, including residents on Standard Avenue in Winsted, as well as at a 40 unit apartment complex in Winsted. A mudslide also was reported at Grove Street in New Milford by an Emergency Manager. This resulted in the evacuation of 5 homes. The runoff from this heavy rainfall also led to moderate flooding on the Housatonic River. At Falls Village, the Housatonic River crested at 11.14 feet at 0115 EST on the 18th, while at Gaylordsville, the river crested at 12.97 feet at 2300 EST on the 16th. Further south, the Housatonic River at Stevenson Dam crested at 19.96 feet at 1400 EST on the 16th. Low pressure developed over the lower Mississippi Valley on Saturday April 14th, and then moved northeast while intensifying, reaching the southern Appalachians by Sunday morning, April 15th, and then just south of western Long Island by Monday morning, April 16th. This low became very intense, with a central barometric pressure falling below 970 millibars upon reaching just south of Long Island Monday morning. The low then headed off the New England coast by Tuesday morning. This intense coastal storm spread heavy precipitation across northwest Connecticut, starting on Sunday, and persisting into late Monday. Initially, the precipitation fell as a mixture of wet snow, sleet and rain, with snow and sleet more prevalent across the higher elevations. The precipitation then changed to plain rain by late Sunday afternoon into Monday. Liquid equivalent precipitation total from this storm ranged from 3 to 7 inches. This led to widespread flooding across northwest Connecticut from late Sunday into Monday evening.

Appendix 3. Summary of Maximum Pool Levels for U.S. Army Corps of Engineers Flood-Control Dams

Flood-Control Dams

Summary of maximum pool levels, in feet

[From U.S. Army Corps of Engineers, Water Control Management, Annual Report FY 2007, Exhibit 3, December 2007]

Reservoir	Fiscal year 2007			Highest pool of record		
	Pool level	Percent full	Date	Pool level	Percent full	Date
Colebrook River Lake	739.9	55	Apr 07	757.5	90	Jun 84
Mad River Dam	79.2	29	Apr 07	79.2	29	Apr 07
Sucker Brook Dam	15.2	9	Apr 07	25.2	24	Dec 73
East Branch Dam	44.7	39	Apr 07	44.7	39	Apr 07
Hall Meadow Brook Dam	25.6	30	Apr 07	25.6	30	Apr 07
Thomaston Dam	78.9	38	Apr 07	87.2	50	Jun 84
Northfield Brook Lake	64.8	36	Apr 07	67.4	40	Jun 84
Black Rock Lake	80.5	45	Apr 07	93.4	65	Jun 84
Hancock Brook Lake	12.7	13	Apr 07	23.4	58	Jun 82
Hop Brook Dam	47.8	31	Apr 07	57.7	53	Jun 82

Prepared by the Pembroke Publishing Service Center.

For more information concerning this report, contact:
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or visit our Web site at:
http://ct.water.usgs.gov

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