Prepared in cooperation with the New Jersey Department of Environmental Protection

Flood-Inundation Maps for the Saddle River in Ho-Ho-Kus Borough, the Village of Ridgewood, and Paramus Borough, New Jersey, 2013

Pamphlet to accompany

Scientific Investigations Map 3299

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

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U.S. Geological Survey
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[Separate documents available online with this report at the U.S. Geological Survey Publications Warehouse (*http://dx.doi.org/10.3133/sim3299*)]

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Tables

Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.59	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.0283	cubic meter per second (m^3/s)

Vertical coordinate information is referenced to either (1) stage, the height above an arbitrary datum established at a streamgage, or (2) elevation, the height above the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Flood-Inundation Maps for the Saddle River in Ho-Ho-Kus Borough, the Village of Ridgewood, and Paramus Borough, New Jersey, 2013

By Kara M. Watson and Michal J. Niemoczynski

Abstract

Digital flood-inundation maps for a 5.4-mile reach of the Saddle River in New Jersey from Hollywood Avenue in Ho-Ho-Kus Borough downstream through the Village of Ridgewood and Paramus Borough to the confluence with Hohokus Brook in the Village of Ridgewood were created by the U.S. Geological Survey (USGS) in cooperation with the New Jersey Department of Environmental Protection (NJDEP). The inundation maps, which can be accessed through the USGS Flood Inundation Mapping Science Web site at *http://water.usgs.gov/osw/flood_inundation/,* depict estimates of the areal extent and depth of flooding corresponding to selected water levels (stages) at the USGS streamgage on the Saddle River at Ridgewood, New Jersey (station 01390500). Current conditions for estimating near real-time areas of inundation using USGS streamgage information may be obtained on the Internet at *http://waterdata.usgs.gov/nwis/uv?site_no=01390500* or at the National Weather Services (NWS) Advanced Hydrologic Prediction Service (AHPS) at *http://water.weather.gov/ahps2/hydrograph.php?wfo=okx&gage=rwdn4*.

In this study, flood profiles were computed for the stream reach by means of a one-dimensional step-backwater model. The model was calibrated by using the most current stage-discharge relation (March 11, 2011) at the USGS streamgage 01390500, Saddle River at Ridgewood, New Jersey. The hydraulic model was then used to compute 10 water-surface profiles for flood stages at 1-foot (ft) intervals referenced to the streamgage datum, North American Vertical Datum of 1988 (NAVD 88), and ranging from 5 ft, the NWS "action and minor flood stage", to 14 ft, which is the maximum extent of the stage-discharge rating and 0.6 ft higher than the highest recorded water level at the streamgage. The simulated water-surface profiles were then combined with a geographic information system 3-meter (9.84-ft) digital elevation model derived from Light Detection and Ranging (lidar) data in order to delineate the area flooded at each water level.

The availability of these maps along with information on the Internet regarding current stage from the USGS streamgage provides emergency management personnel and residents with information that is critical for flood response activities, such as evacuations and road closures as well as for post-flood recovery efforts.

Introduction

The Boroughs of Ho-Ho-Kus and Paramus, and the Village of Ridgewood, are urban communities with estimated populations of 4,080, 24,950, and 26,340, respectively, and population densities of 2,350, 4,340, and 2,510 persons per square mile (U.S. Bureau of Census, 2012). These communities have experienced severe flooding numerous times, most notably in 2011 (Tropical Storm Irene), 1999 (Tropical Storm Floyd), and 1977. National Flood Insurance Program flood insurance claims for these communities were reported to be $2,896,000 in 2011; $3,130,000 in 1999; and $62,800 in 1977 (New Jersey Department of Environmental Protection, State National Flood Insurance Program Coordinators Office, written commun., 2013). Most of the flood damages have occurred along the Saddle River, which flows through the Borough of Ho-Ho-Kus (Ho-Ho-Kus) and forms the boundary between the Borough of Paramus (Paramus), and the Village of Ridgewood (Ridgewood). Floodplains along the Saddle River are highly developed and contain a mix of residential and commercial structures.

Prior to this study, Ho-Ho-Kus, Paramus, and Ridgewood officials relied on several information sources (all of which are available on the Internet) to make decisions on how to best alert the public and mitigate flood damages. One source is the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) for Bergen County dated September 30, 2005 (Federal Emergency Management Agency, 2005). A second source of information is the U.S. Geological Survey streamgage, Saddle River at Ridgewood, New Jersey (station 01390500), from which current and historical water levels (stage) can be obtained. A third source of flood-related information is the National Weather Service (NWS) Advanced Hydrologic Prediction Service (AHPS), which also displays the USGS stage data from the Ridgewood streamgage

[National Weather Service, 2013 (*http://water.weather.gov/ahps2/hydrograph.php?wfo=okx&gage=rwdn4*)]. Although the NWS forecasts flood stage at many USGS streamgages, it does not provide forecasts of flood stages at streamgages with small drainage areas, such as the Saddle River at Ridgewood. This is because the time between a precipitation-runoff event and peak streamflow in these small drainage areas is typically shorter in duration than the 6-hour time step used by the NWS for stage forecasts.

Although the current stage at a USGS streamgage is useful for residents in the immediate vicinity of that streamgage, it is of limited use to residents farther upstream or downstream because the water-surface elevation is not constant along the entire stream reach. A water level at a streamgage is difficult to translate to depth and areal extent of flooding at points distant from the streamgage. One way to address these informational gaps is to produce a library of flood-inundation maps that are referenced to the stages recorded at the USGS streamgage. By referring to the appropriate map, emergency responders can discern the severity of flooding (depth of water and areal extent), identify roads that are or will soon be flooded, and make plans for notification or evacuation of residents in harm's way for some distance upstream and downstream from the streamgage. In 2013, the USGS, in cooperation with the New Jersey Department of Environmental Protection, conducted a project to produce a library of flood-inundation maps for the Saddle River at Ridgewood, New Jersey.

Purpose and Scope

The purpose of this report is to describe the development of a series of estimated flood-inundation maps for the Saddle River at Ridgewood, New Jersey, and to present the maps, which are also available on the USGS Flood Inundation Mapping Science Web site at *http://water.usgs.gov/osw/flood_inundation/.*

The flood-inundation maps cover a 5.4-mile reach of the Saddle River from Hollywood Avenue in Ho-Ho-Kus, downstream along the boundary between Ridgewood and Paramus, to the confluence with Hohokus Brook in Ridgewood, (fig. 1). Maps were produced for water levels referenced to the stage at the USGS streamgage on Saddle River at Ridgewood (01390500) and ranging from 5 ft or approximately bank full, and 0.5 feet (ft) below the NWS "action and minor flood stage", to 14 ft, which is the maximum extent of the stage-discharge relation at the USGS streamgage, and 0.6 ft higher than the maximum recorded water level at the streamgage. Action stage is the stage which when reached by a rising stream, lake, or reservoir represents the level at which the NWS or a partner/user needs to take some type of mitigation action in preparation for possible significant hydrologic activity (National Weather Service, 2013).

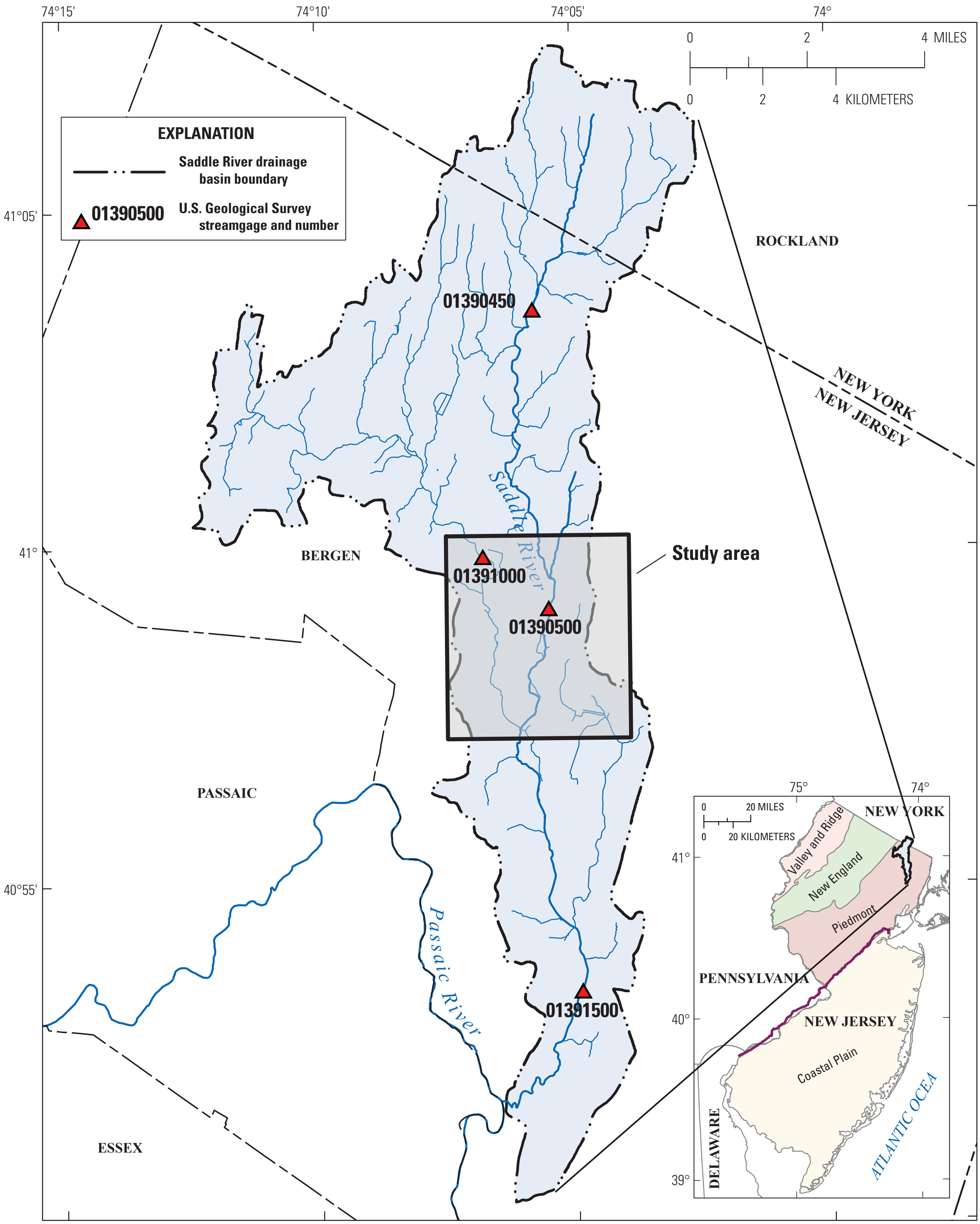
Tasks specific to development of the flood maps were (1) analysis of peak streamflow data from USGS station 01390500 (table 1), (2) collection of topographic data for selected cross sections and geometric data for structures and bridges throughout the study reach, (3) estimation of energy-loss factors (roughness coefficients) in the stream channel and floodplain, and verification of steady-flow data from previous studies, (4) computation of water-surface profiles by use of the U.S. Army Corps of Engineer's HEC–RAS computer program (U.S. Army Corps of Engineers, 2010), (5) production of estimated flood-inundation maps at various stream stages by use of Esri ArcMap 10.0 application of ArcGIS (Environmental Systems Research Institute, Inc., 2010), and (6) preparation of the maps, as shapefile polygons that depict the areal extent of flood inundation and as depth grids that provide the depth of floodwaters, for display on the USGS Flood Inundation Mapping ScienceWeb site.

Study Area Description

The Saddle River is in northeastern New Jersey in the Piedmont Physiographic Province (fig. 1). The drainage area ranges from 21.6 square miles (mi^2) at the Saddle River at Ridgewood streamgage to 23.2 mi^2 at the downstream extent of the study reach. The source of the Saddle River is 13.2 miles upstream from the Saddle River at Ridgewood streamgage in Rockland County in southern New York State. The stream flows generally southward before entering the borough limits of Ho-Ho-Kus in Bergen County, New Jersey. No major tributaries flow into the Saddle River within the study reach. The Saddle River drains into the Passaic River 22.8 miles downstream from the Saddle River at Ridgewood streamgage (fig. 1). The basin terrain is moderately hilly. The study reach is approximately 5.4-miles long, has an average top-of-bank channel width of about 90 ft and has an average channel slope of 10.6 feet per mile. About 78 percent of the land contiguous to the study reach is classified as urban or developed, 14 percent as forest, and 1 percent as wetland (New Jersey Department of Environmental Protection, 2010). The basin is still under development and population has increased 1.17 percent from 54,733 to 55,378 between 2000 and 2010 (U.S. Bureau of Census, 2012). Six major roads and one footbridge span the channel within the study reach (fig. 2).

Previous Studies

The current FIS for Ridgewood (Federal Emergency Management Agency, 2005) was completed by Natural and Technological Hazards Management Consulting, Inc. (NTHMC, 2004) in 2004. The study provided information on the 10-, 2.0-, 1.0-, and 0.2-percent annual exceedance probability water-surface profiles and associated flood plain maps for the Saddle River. Estimates of the peak discharges for these annual exceedance probability floods along the Saddle River, as shown in table 2 for the study reach, were described by FEMA (2005).



Base from U.S. Geological Survey
1:24,000 scale digital data

Figure 1. Location of study reach for Saddle River and location of U.S. Geological Survey streamgages, in New Jersey.

Table 1. U.S. Geological Survey streamgage information for Saddle River at Ridgewood, New Jersey.

[Station location is shown in figure 1; ft³/s, cubic feet per second; NAVD 88, North American Vertical Datum of 1988]

Station name	Saddle River at Ridgewood, New Jersey
Station number	1390500
Drainage area (square miles)	21.6
Latitude	40°59’06”
Longitude	74°05’26”
Period of peak-flow record (water years1)	1945, 1955–2013
Maximum recorded stage, in feet, gage datum (and elevation, in feet above NAVD 88) and date	13.4 (84.16) on September 16, 1999
Maximum discharge, in ft³/s, and date	6,770 on August 28, 2011
Historic peak-of-record, in ft³/s, and date	6,800 on July 23, 1945

[1]Water year is the 12-month period from October 1 of one year through September 30 of the following year and is designated by the calendar year in which it ends.

Table 2. 10-, 2-, 1-, and 0.2-percent annual exceedance probability peak-discharge estimates, drainage areas, and percentage of total discharge for selected locations on the Saddle River in New Jersey (from Federal Emergency Management Agency, 2005)

[mi², square miles; ft³/s, cubic feet per second; NJ, New Jersey]

Location on Saddle River	Drainage area (mi²)	Discharge estimate, 10- percent exceedence probability (ft³/s)	Discharge estimate, 2- percent exceedence probability (ft³/s)	Discharge estimate, 1- percent exceedence probability (ft³/s)	Discharge estimate, 0.2- percent exceedence probability (ft³/s)	Percentage of total discharge
At State Route 17, Saddle River at Ridgewood, NJ streamgage	21.6	2,330	4,720	6,240	11,600	100
Upstream of confluence with Hohokus Brook	23.2	2,460	4,980	6,580	12,200	100

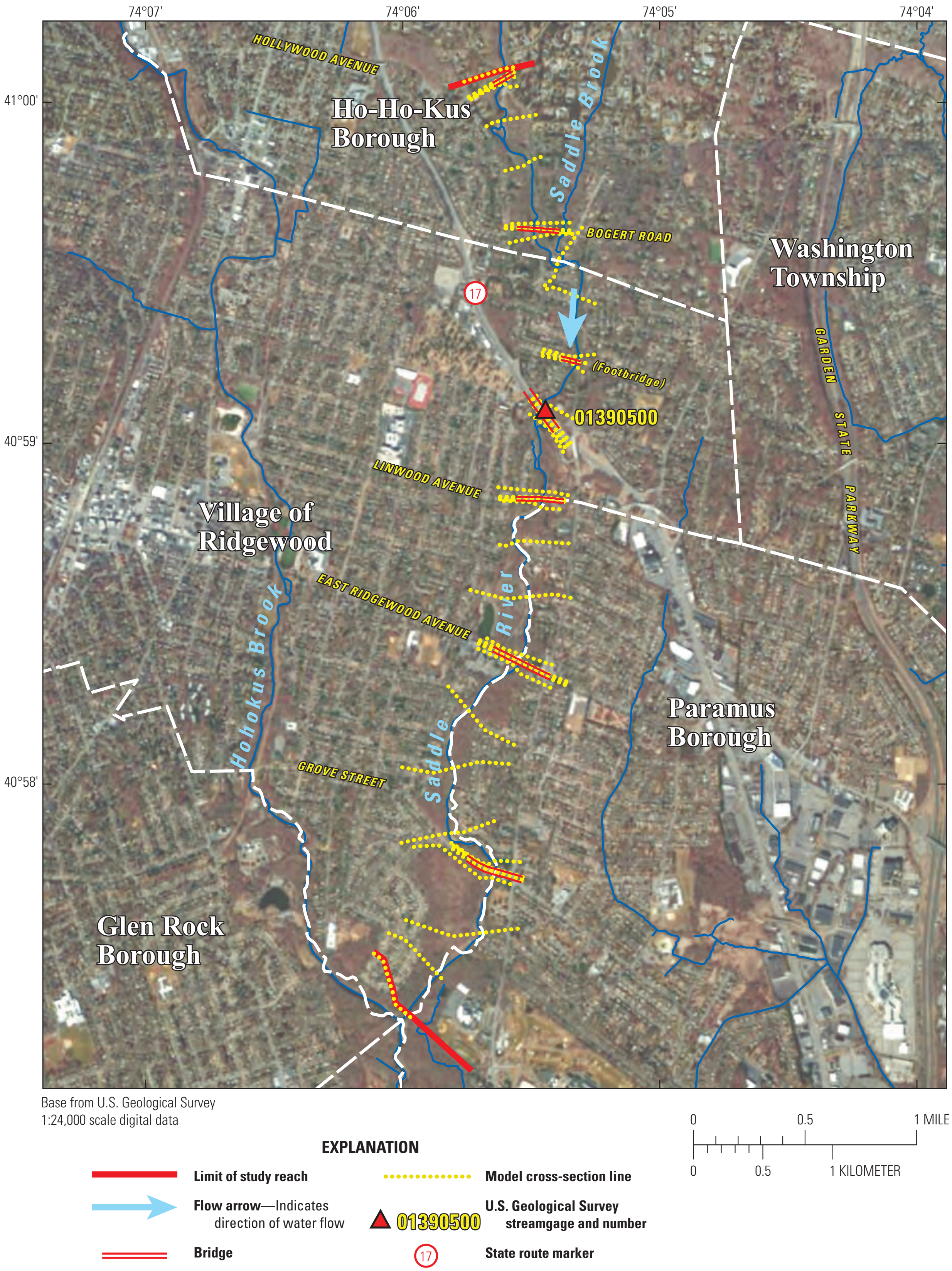


Figure 2. Location of study reach and direction of flow for the Saddle River at Ridgewood, New Jersey.

Constructing Water-Surface Profiles

The water-surface profiles used to produce the 10 flood-inundation maps in this study were computed by using HEC–RAS, version 4.1.0 (U.S. Army Corps of Engineers, 2010) with a hydraulic model, created in 2004, provided by Natural and Technological Hazards Management Consulting, Inc. (NTHMC) for the Saddle River. HEC–RAS is a one-dimensional step-backwater model for simulation of water-surface profiles with steady-state (gradually varied) or unsteady-state flow computation options. The HEC–RAS analysis for this study was done by using the steady-state flow computation option. An unsteady-state model would be more appropriate if the river had dynamic streamflow conditions such as backwater or tidal flow.

Hydrologic and Steady-State Flow Data

The study reach includes one USGS streamgage (01390500) with a period of record from October 1954 to the current water year 2013 (fig. 1; table 1). Water level (stage) is measured continuously in real-time through a satellite radio transmitter, and continuous records of streamflow are computed at this site. Stage data from this streamgage are referenced to a local datum but can be converted to water-surface elevations referenced to the NAVD 88 by adding 70.76 ft.

Steady-state flow data consisted of flow regime, boundary conditions (either known stage associated with a discharge measurement, critical depth, normal depth, or a streamgage stage-discharge relation value), and peak discharge information. Subcritical flow regime was assumed for the simulations. Normal depth was used as the downstream boundary condition for the reach. The slope required for calculation of normal depth, 0.002, was computed from the average streambed slope through the study reach. The peak discharge data for the study reach were obtained from field measurements and the stage-discharge relation (rating number 23.0) that was developed by the USGS for streamgage 01390500.

Topographic and Bathymetric Data

Channel cross sections were developed from NTHMC field surveys that were conducted in 2004 (fig.2); these cross sections provided detailed channel-elevation data below the water surface and were collected by using hydroacoustic instrumentation to measure depth and Differential Global Positioning System instrumentation to determine horizontal position. Light Detection and Ranging (lidar) data were used to create 3-meter (9.84-ft) digital elevation data, from which elevations for the portions of the cross sections that were above the water surface at the time of the surveys were obtained. The lidar data were collcted during 2006–07, and post-processing of these data was completed by the U.S. National Geospatial-Intelligence Agency in 2007 (National Geospatial-Intelligence Agency, 2007).

Various manmade drainage structures (bridges, culverts, and roadway embankments) in and along the stream affect or have the potential to affect water-surface elevations during floods along the stream. To properly account for seven bridges (fig. 2) in the model, the structural dimensions were measured and surveyed in the field concurrently with the stream-channel surveys conducted by NTHMC. A detailed description of the methods used to acquire and process the topographic and bathymetric data can be found in Bales and others (2007).

Energy-Loss Factors

Manning’s roughness coefficients (“n” values) for energy (friction) loss calculations were included in the hydraulic model provided by NTHMC and ranged from 0.025 to 0.035 for the main channel and 0.020 to 0.10 for the overbank areas modeled in this analysis. Channel conditions in the study reach are typified by bed material consisting of coarse gravel and cobbles with occasional scattered boulders and light brush on the banks. Overbank conditions throughout the study reach are variable. About 14 percent of the reach is still classified as forested, and 78 percent is classified as urban or developed (New Jersey Department of Environmental Protection, 2010). Dense vegetation and paved impervious surfaces are often present in the overbank within the same cross section. Roughness coefficients provided with the hydraulic model were considered verified by field conditions and remained unaltered.

Model Calibration and Performance

The hydraulic model was calibrated to 10 points representing the most current stage-discharge relation (rating number 23.0) at the USGS streamgage 01390500. Additionally, the model was calibrated to two recent measured peak discharges at the gage as shown in table 3. Model calibration is typically accomplished by adjusting Manning’s n values and, in some cases, changing the channel cross section or slope until the results of the hydraulic computations closely agree with the known flood discharge and stage values. It was unnecessary to adjust the aforementioned parameters for this particular hydraulic model. The simulated elevations at USGS streamgage 01390500 for the 12 calibration points agreed exactly with the target elevations. The results demonstrate that the model is capable of simulating accurate water levels over a wide range of flows in the basin.

Development of Water-Surface Profiles

Profiles were developed for a total of 10 stages at 1-ft intervals from 5.0 ft to 14.0 ft, gage datum (75.8 to 84.8 ft, NAVD 88) as referenced to USGS streamgage 01390500. Discharges corresponding to the various stages were obtained from the most current stage-discharge relation (rating number 23.0) for the station.

Discharges for all profiles (table 4) upstream from the confluence with Hohokus Brook, 3.3 mi downstream from station 01390500 on the Saddle River, were selected with the assumption that the percentage contribution to the total flow was the same as that assumed for the 0.1-percent annual exceedance probability flood from the 2005 FIS (table 2). The increase in flood flows at the confluence with Hohohus Brook is a result of runoff from the developed areas in the interven-ing drainage area.

Table 3. Measured peak discharges and gage heights for selected peaks at the U.S. Geological Survey streamgage Saddle River at Ridgewood, New Jersey (station 01390500).

[ft^3/s, cubic feet per second; ft, feet]

Date of peak	Peak discharge (ft^3/s)	Peak gage height (ft)
16-Sep-99	5,380	13.4
28-Aug-11	6,770	11.42

Table 4. Estimated discharges, in cubic feet per second, for corresponding stages and water-surface elevations at selected locations along the Saddle River, Ridgewood , New Jersey.

Location	Stage, in feet above gage datum (elevation, in feet above NAVD 88) Associated with the indicated discharge value, in cubic feet per second									
	5 (-75.8)	6 (-76.8)	7 (-77.8)	8 (-78.8)	9 (-79.8)	10 (-80.8)	11 (-81.8)	12 (-82.8)	13 (-83.8)	14 (-84.8)
At State Route 17, Saddle River at Ridgewood, NJ streamgage	990	1,530	2,210	3,010	3,960	5,040	6,270	7,380	8,190	8,870
Upstream of confluence with Hohokus Brook	1,040	1,610	2,330	3,180	4,180	5,320	6,620	7,790	8,640	9,360
Sheet No.	1	2	3	4	5	6	7	8	9	10

Inundation Mapping

Flood-inundation maps were created for the Saddle River at Ridgewood streamgage (station 01390500). The maps were created in a geographic information system by combining the water-surface profiles and digital elevation model data derived from the lidar data. The 3-meter (9.84-ft) digital elevation model data were derived from lidar data obtained from the National Geospatial-Intelligence Agency (National Geospatial-Intelligence Agency, 2007).

Each digitized cross-section line used for the study area was attributed with a HEC-RAS calculated water-surface elevation for each of the 10 profiles. The flood surfaces were generated by using an iterative finite-difference interpolation technique found in the ArcGIS Topo to Raster tool. Topo to Raster is an interpolation method specifically designed for the creation of hydrologically correct digital elevation models (Environmental Systems Research Institute, Inc., 2012). Inputs into the tool include contour data derived from the digital cross sections that had been attributed with the NAVD 88 water-surface elevations, in feet, from the water-surface profiles computed by the HEC-RAS model and boundary data using the study-area polygon. Depth-of-water grids were generated by subtracting the flood water-surface elevation of the study-area digital elevation model from the flood water-surface raster layer. The map products show estimated flood-inundated areas overlaid on high-resolution, geo-referenced, aerial photographs of the study area for each of the water-surface profiles that were generated by the hydraulic model.

There is a discrepancy in the water-surface-elevation value from the HEC-RAS model output and the water-surface-elevation value used to create the water-surface profile layer for the 13-ft stage for six cross-section lines around Route 17 in the Village of Ridgewood. In a review of the output data from the hydraulic model, the water-surface-elevation values for the 13-ft stage layer were found to be higher than those from the 14-ft stage layer. Water-surface-elevation values were adjusted in these six cross sections to maintain hydrologic integrity. The adjusted water-surface-elevation value is the average of the 12-ft and 14-ft stage water-surface elevations. Values in all other cross-sections in the 13-ft stage layer remain unmodified.

Saddle River, New Jersey, Flood-Inundation Maps on the Internet

The flood-inundation maps and current study documentation are available online at the U.S. Geological Survey Publications Warehouse (*http://dx.doi.org/10.3133/sim3299*). Also, a Flood Inundation Mapping Science Web site has been established to provide a portal for USGS flood-inundation study information to the public at *http://water.usgs.gov/osw/flood_inundation/*. The Web portal provides a link to interactive online map libraries that can be downloaded as commonly-used electronic file formats, such as pdf and KMZ (*http://wim.usgs.gov/FIMI/FloodInundationMapper.html*). In the latter link, each stream reach displayed contains further links to the USGS National Water Information System (NWISWeb) graphs of the current stage and streamflow at the USGS Saddle River at Ridgewood streamgage (station 01390500) to which the inundation maps are referenced. A link also is provided to the NWS AHPS site (*http:/water.weather.gov/ahps/*) at which USGS-provided stage data also can be viewed. The estimated flood-inundation maps are displayed in sufficient detail to note the extent of flooding with respect to individual structures so that preparations for flooding and decisions for emergency response can be performed efficiently. Roadways and bridges were closely reviewed and are shown as shaded (inundated and likely impassable) or not shaded (dry and passable) to facilitate emergency planning and use. Bridges that have a simulated water level surface at the low chord of the bridge deck or higher are depicted to be inundated (table 5). However, buildings that are shaded do not reflect inundation but denote that bare earth surfaces in the vicinity of the buildings are inundated. When the water depth (as indicated in the Web Mapping Application by holding the cursor over an inundated area) in the vicinity of the building of interest exceeds that building's height, the structure can be considered fully submerged.

Disclaimer for Flood-Inundation Maps

The flood-inundation maps should not be used for navigation, regulatory, permitting, or other legal purposes. The USGS provides these maps "as-is" for a quick reference, emergency planning tool but assumes no legal liability or responsibility resulting from the use of this information.

Uncertainties and Limitations Regarding Use of Flood-Inundation Maps

Although the flood-inundation maps represent the boundaries of inundated areas with a distinct line, some uncertainty is associated with these maps. The flood boundaries shown were estimated on the basis of water stages and streamflows at the USGS streamgage on the Saddle River at Ridgewood, New Jersey (01390500). Water-surface elevations along the stream reaches were estimated by steady-state hydraulic modeling, assuming unobstructed flow, and by using streamflows and hydrologic conditions anticipated at the USGS streamgage. The hydraulic model reflects the land-cover characteristics and any bridge or other hydraulic structure existing as of 2013. Unique meteorological factors (timing and distribution of precipitation) may cause actual streamflows along the modeled reach to vary from those assumed during a flood, which may lead to deviations in the water-surface elevations and inundation boundaries shown. Additional areas may be flooded due to unanticipated conditions, such as changes in the streambed elevation or roughness, backwater into major tributaries along a main stem river, or backwater from localized debris or ice

Table 5. Occurrence of bridge inundation determined from simulated water-surface profiles corresponding to stages for the Saddle River at Ridgewood, New Jersey streamgage (USGS streamgage 01390500).

Stage (feet)	Bridge inundated
5.0	None
6.0	None
7.0	None
8.0	None
9.0	None
10.0	Linwood Avenue and State Route 17
11.0	Linwood Avenue, State Route 17, and footbridge
12.0	Grove Street, Linwood Avenue, State Route 17, and footbridge
13.0	Grove Street, Linwood Avenue, State Route 17, and footbridge
14.0	Grove Street, Linwood Avenue, State Route 17, and footbridge

jams. The accuracy of the floodwater extent portrayed on these maps will vary with the accuracy of the digital elevation model used to simulate the land surface. If this series of flood-inundation maps will be used in conjunction with National Weather Service (NWS) river forecasts, the user should be aware of additional uncertainties that may be inherent or factored into NWS forecast procedures. The NWS uses forecast models to estimate the quantity and timing of water flowing through selected stream reaches in the United States. These forecast models (1) estimate the amount of runoff generated by precipitation and snowmelt, (2) simulate the movement of floodwater as it proceeds downstream, and (3) predict the flow and stage (and water-surface elevation) for the stream at a given location (AHPS forecast point) throughout the forecast period (every 6 hours and 3 to 5 days out in many locations). For more information on AHPS forecasts, please see: *http://water.weather.gov/ahps/pcpn_and_river_forecasting.pdf.*

Summary

A series of 10 estimated flood-inundation maps were developed in cooperation with the New Jersey Department of Environmental Protection for the Saddle River in New Jersey. The maps cover a 5.4-mile reach from Hollywood Avenue in Ho-Ho-Kus Borough downstream through the Village of Ridgewood and Paramus Borough to the confluence with Hohokus Brook in the Village of Ridgewood. These maps, available at a U.S. Geological Survey (USGS) Web portal, in conjunction with the real-time stage data from the USGS streamgage at Saddle River at Ridgewood, New Jersey (station 01390500), will help to guide the general public in taking individual safety precautions and will provide municipal officials with a tool to efficiently manage emergency flood operations and flood mitigation efforts.

The maps were developed by using the U.S. Army Corps of Engineers' HEC–RAS program to compute water-surface profiles and to delineate estimated flood-inundation areas for selected stream stages. The maps show estimated (shaded) flood-inundation areas overlaid on high-resolution, geo-referenced, aerial photographs of the study area for stream stages between from 5.0 ft to 14.0 ft, gage datum (75.8 to 84.8 ft, NAVD 88) at the Saddle River at Ridgewood streamgage. Interactive use of the maps on the USGS Flood Inundation Mapper Web site can give users a general indication of depth of water at any point by using the mouse cursor to click within the shaded areas. These maps can be accessed through the USGS Flood Inundation Mapping Science Web site at *http://water.usgs.gov/osw/flood_inundation/*.

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