

USGS Streamgages: Data Collection and Delivery

U.S. Geological Survey
New Jersey Water Science Center
West Trenton, New Jersey

Flood Warning User Forum
Delaware River Basin
Lambertville, New Jersey
September 22, 2010

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Chief, Hydrologic Data Assessment Program



*Providing reliable, impartial, and timely data to
assess the quantity and quality of our nation's water
resources*

History of Streamgaging

- Director John Wesley Powell establishes first gaging station in 1887
- First USGS streamgage data in New Jersey, Passaic River at Paterson & Delaware River at Lambertville in 1897
- Nationally the first USGS flood studies in Passaic River basin in 1902 & 1903
- Cooperative streamgaging program with State & local agencies established in 1921 at the NJ USGS office



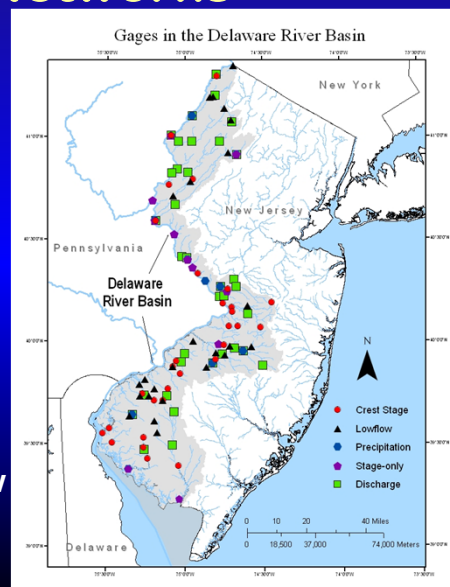
Common uses of USGS streamflow data

- Flood forecasting and flood warning by National Weather Service and other emergency managers
- Estimate flood annual exceedance probabilities for designing bridges, dams, flood control structures & flood plain designation
- Determine stream discharge and water withdrawal limits for regulatory purposes
- Water supply planning & drought management
- Compute loads to develop water-quality standards and TMDL's
- Study trends in water quantity and quality
- Plan recreational activities



Surface Water Networks

- Gaging stations, continuous-record discharge (35)
- Stage-only gages, continuous-record
 - tidal, non-tidal (11)
- Crest-stage gages
 - Tidal, non-tidal (29)
- Partial-record sites
Instantaneous low-flow measurements (25)
- Scour Monitoring



Continuous-record Discharge Gaging Stations

35 active gages in New Jersey portion of Delaware Basin

Stage and Discharge Data collected

Cooperation

9 agencies

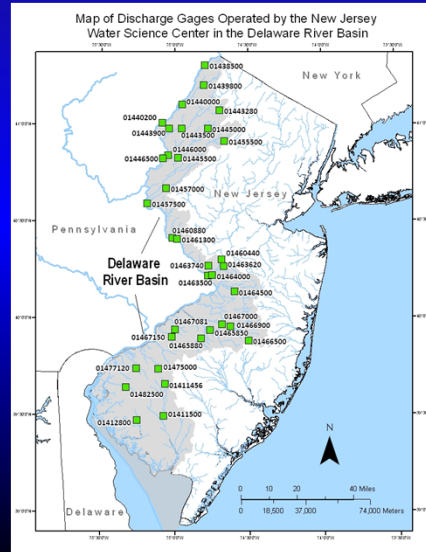
13 funding sources (projects)

Continuous Records

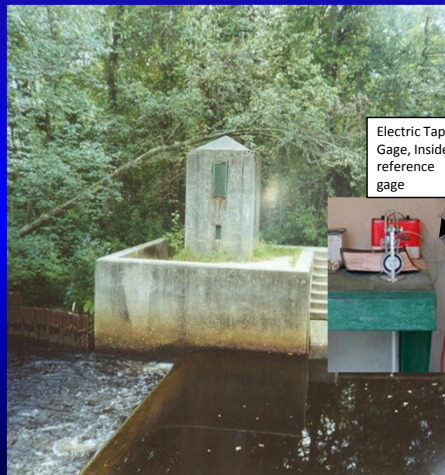
Musconetcong River since 1910

Del River at Riegelsville, 1906

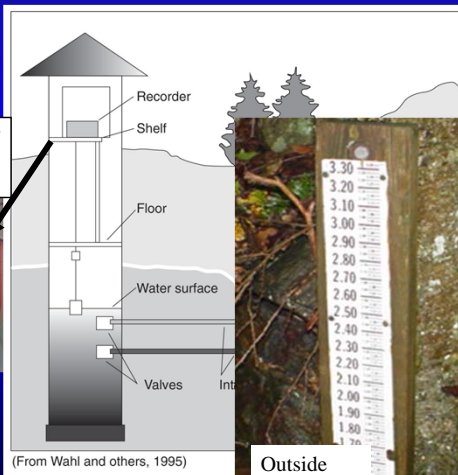
Del River at Trenton, 1913



Gaging Station Design



Electric Tape Gage, Inside reference gage

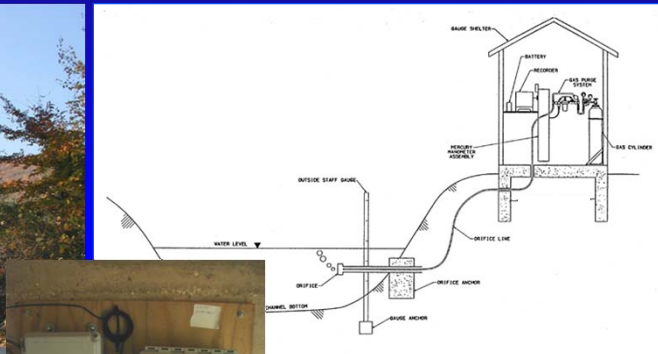


Outside Reference Gage

New Gaging Station Design



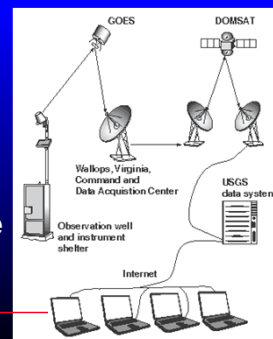
USGS



Satellite Telemetry

- Geostationary Operational Environmental Satellite (GOES)
 - Operated by NOAA (National Oceanic and Atmospheric Administration)
 - Reliable
 - Automatic switchover during primary failure
- Timed transmissions every hour
- Random transmissions when thresholds are exceeded
 - Stream reaches exceeds flood stage
- Data transmitted to computer base stations and USGS archival database

USGS



Your computer

Flood Hardened Gages

01463500 Delaware River at Trenton, NJ



April 2008



October
2008

Flood Hardened Gages

01457500 Delaware River at Riegelsville, NJ



Radar Non-contact stage sensor

- Waterlog H-360 installed Oct. 5, 2005 Del River at Phillipsburg
- A microwave transmitter (9.5 – 10.5 GHz) and receiver aimed at water surface from bridge (2" to 115')
- Echo is received and evaluated to determine distance to water surface
- SDI-12 digital communication
- Sensor output is compatible with our DCPs
- Distance, elevation, and signal strength stored
- Accuracy ± 0.01 ft



Flood Hardened Gages

01440200 Delaware River at Tocks Island, NJ



Streamflow Data Collection

Traditional Methods

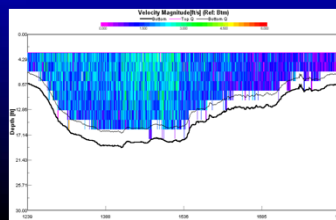
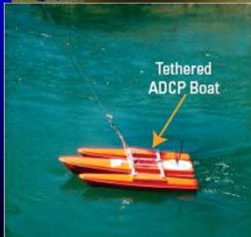
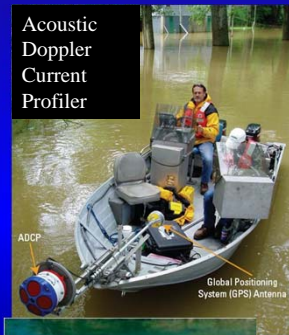


Acoustic Methods

<http://pubs.usgs.gov/of/2001/ofr0101/text.pdf>

Boat Mounted

Acoustic
Doppler
Current
Profiler

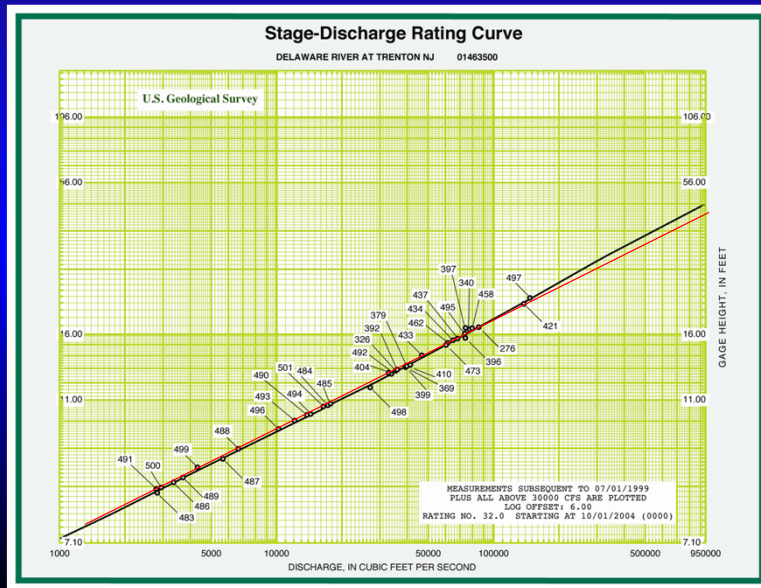


Wading

Acoustic
Doppler
Velocimeter

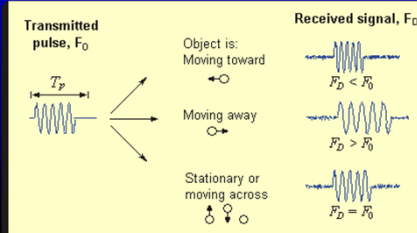
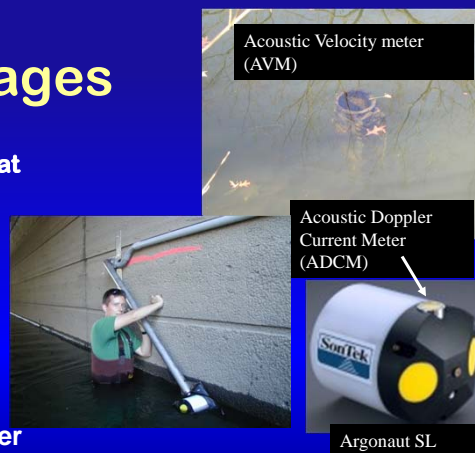
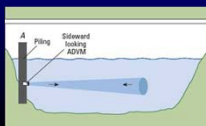


Stage/Discharge Ratings



Acoustics at Gages

- **Acoustic Velocity Meter**
 - Delaware & Raritan Canal at Port Mercer 1988-2010
- **ADCM**
 - installed summer 2010
- **Velocity**
 - Range: ± 20 ft/s
 - Resolution: 0.003 ft/s
 - Accuracy: ± 0.015 ft/s
- **2 horizontal Beam transducer**
 - Beam range: 1.6 – 66 ft
- **1.5 MHz signal**
- **Multi-cell current profiling**



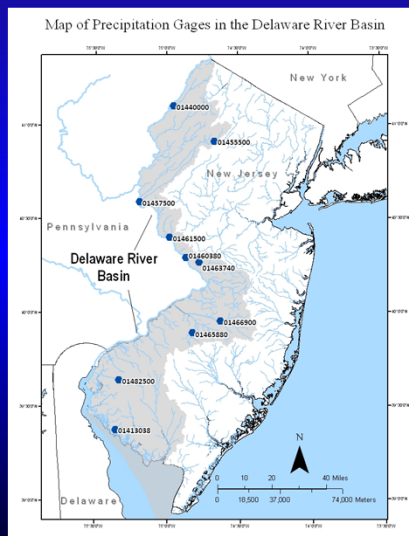
Crest-stage Gages

- 23 non-tidal, 6 tidal in basin
- Records peak stage between visits
- Simple, reliable, economical, easy installation
- Used for regional studies of flood frequency to augment gaging station network
- Provide flood peak information at many sites at a reasonable cost.



Precipitation Gages

- 10 gages – all have real-time data located on homepage <http://nj.usgs.gov/index.html>

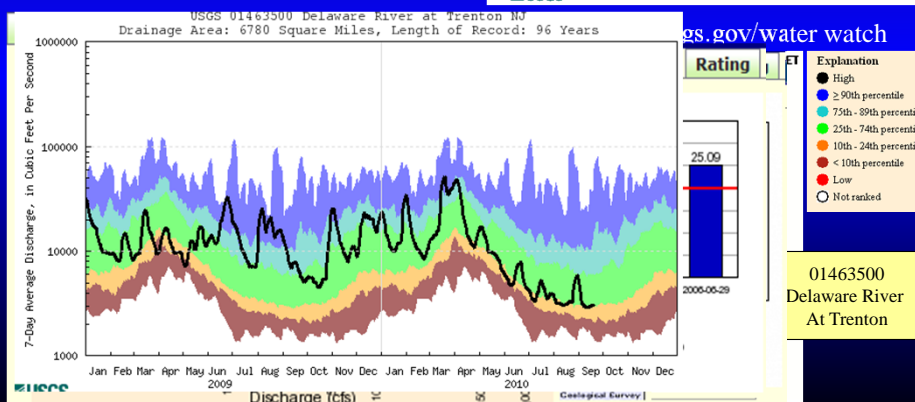
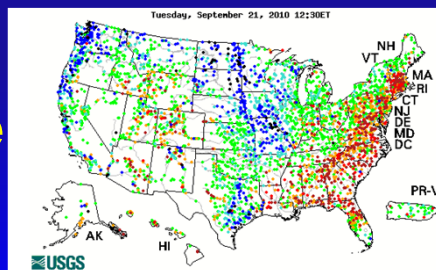


Data Delivery Methods

- Real-time : Satellite & telephone telemetry
- Annual Water Data Report
- National Water Information System (NWIS WEB)
- Instantaneous Streamflow & Peak Data
- Ratings Depot
- Alert Systems: StreaMail & Water Alert
- Streamflow Statistics
- Flood Reports



Water Watch Real-time Surface Water Data



Annual Water Data Report

- National Reports since water year 2006
<http://wdr.water.usgs.gov/>
- Mapper Interface
<http://wdr.water.usgs.gov/adrgmap>
- New Jersey publishes it's own version online and on CD
http://nj.usgs.gov/publications/adr/adr2008/Main_Index.html



National Water Information System (NWIS WEB)

- Much of the hydrologic data collected by the USGS is available through the NWIS Web interface
- Surface water - Water flow and levels in streams, lakes, and springs ,
- Ground water - Water levels in wells
- Water quality data - Chemical and physical data for streams, lakes, springs, and wells
- <http://waterdata.usgs.gov/nwis>
- <http://wdr.water.usgs.gov/nwisgmap>



Instantaneous Data Archive

- Time-series discharge data now available online at the Instantaneous Data Archive (IDA)
 - <http://ida.water.usgs.gov/>
- Enter station # or get a list of gages by state
- Available for New Jersey gages back to October 1981



Peak Streamflow Data

<http://nwis.waterdata.usgs.gov/nj/nwis/peak>

News: New Real-Time and Site Web Services! - updated August 26, 2010

Peak Streamflow for New Jersey

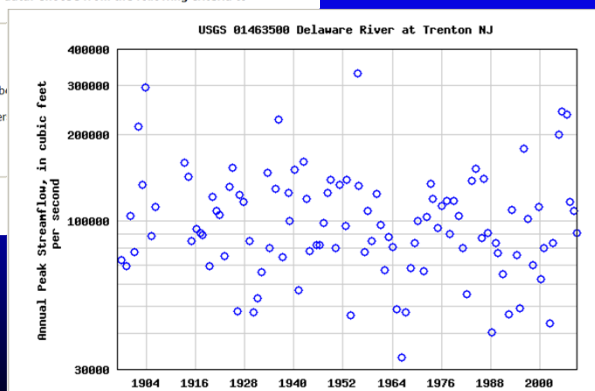
ALL DATA ARE AT LOCAL TIME

Choose Site Selection Criteria

Found 540 sites in New Jersey with peak streamflow data. Choose from the following criteria to constrain the number of sites selected.

Site -- Location --	Site -- Identifier --
<input type="checkbox"/> County	<input type="checkbox"/> Site Name
<input type="checkbox"/> Hydrologic Unit (by Code)	<input type="checkbox"/> Site Number
<input type="checkbox"/> Hydrologic Unit (by Name)	<input type="checkbox"/> Multiple Site Number
<input type="checkbox"/> Lat-Long box	<input type="checkbox"/> Agency Code
	<input type="checkbox"/> File of Site Number

[Questions about sites/data?](#)
[Feedback on this web site](#)
[Automated retrievals](#)
[Help](#)



Stage/Discharge Rating Data

- Expanded Base ratings, and latest shift-adjusted rating retrieved from all stage-discharge sites at 8 PM local time
- Available on web by site:
http://nwis.waterdata.usgs.gov/nwisweb/data/exsa_rat/xxxxxxx.rdb
- Tab delimited (rdb) format
- Detailed information on current variable stage shifts included



Ratings Depot

- The development of a new interface (common gateway interface (cgi)) to allow targeted retrievals of depot files (by update period, station, type, etc.)

http://waterdata.usgs.gov/nwisweb/cgi-src/get_ratings?help

To view base rating

<http://waterdata.usgs.gov/nwisweb/data/ratings/base/USGS.01463500.base.rdb>

To view gage height corrections to current rating

<http://waterdata.usgs.gov/nwisweb/data/ratings/corr/USGS.01463500.corr.rdb>

To view current shift adjusted rating

<http://waterdata.usgs.gov/nwisweb/data/ratings/exsa/USGS.01463500.exsa.rdb>

- Ratings now available through WaterWatch website



<pre> //UNITED STATES GEOLOGICAL SURVEY http://water.usgs.gov/ //NATIONAL WATER INFORMATION SYSTEM http://water.usgs.gov/data.html //DATA ARE PROVISIONAL AND SUBJECT TO CHANGE UNTIL PUBLISHED BY USGS //RETRIEVED: 2010-06-28 20:46:12 //WARNING //WARNING The stage-discharge rating provided in this file should be //WARNING considered provisional and subject to change. Stage-discharge //WARNING ratings change over time as the channel features that control //WARNING the relation between stage and discharge vary. Users are //WARNING cautioned to consider carefully the applicability of this //WARNING rating before using it for decisions that concern personal or //WARNING public safety or operational consequences. //WARNING //FILE TYPE="NWIS RATING" //DATABASE NUMBER=1 DESCRIPTION=" Standard data base for this site." //STATION AGENCY="USGS " NUMBER="01463500 " TIME_ZONE="EST" DST_FLAG=Y //STA Trenton NJ" //DD e EDL/ //FILE TYPE="NWIS RATING" //PAR DT" //DATABASE NUMBER=1 DESCRIPTION=" Standard data base for this site." //RAT E="sta //STATION AGENCY="USGS " NUMBER="01463500 " TIME_ZONE="EST" DST_FLAG=Y //RAT //STATION NAME="Delaware River at Trenton NJ" //RAT //DD NUMBER=" 5" LABEL="Discharge EDL/NEW DCP (cfs)" //RAT 2" PAF //PARAMETER CODE="00060" //RAT PARAT //RATING ID="32.0" TYPE="STGQ" NAME="stage-discharge" AGING=A //RAT 3000 //RATING REMARKS="" //RAT 0000 //RATING EXPANSION="logarithmic" //SHI "-0.14 //RATING OFFSET1=0.6000000E+01 //SHI " BZOK //RATING_INDEP ROUNDING="2223456782" PARAMETER="Gage height (ft)" //SHI " BZOK //RATING_INDEP ROUNDING="222333332" PARAMETER="Discharge (cfs)" //SHIFT NEXT COMMENT=" " //SHIFT NEXT COMMENT=" " INDEP SHIFT DEP STOR 10M 10M 10M 15 7.29 -0.14 1000 7.30 -0.14 1020 7.31 -0.14 1040 7.32 -0.14 1060 7.33 -0.14 1070 7.34 -0.14 1090 7.35 -0.14 1110 7.36 -0.14 1130 7.37 -0.14 1150 7.38 -0.14 1170 7.39 -0.14 1190 7.40 -0.14 1210 7.41 -0.14 1230 7.42 -0.14 1250 7.43 -0.14 1270 </pre>			<pre> //RATING ID="32.0" TYPE="STGQ" NAME="stage-discharge" AGING=A //RATING REMARKS="" //RATING EXPANSION="logarithmic" //RATING OFFSET1=0.6000000E+01 //RATING_INDEP ROUNDING="2223456782" PARAMETER="Gage height (ft)" //RATING_INDEP ROUNDING="222333332" PARAMETER="Discharge (cfs)" //RATING_DATETIME BEGIN=19961203153000 BZONE=EST END=20071130235959 EZONE=EST AGING=A //RATING_DATETIME BEGIN=20071201000000 BZONE=EST END=23821230190000 EZONE=EST AGING=W INDEP DEP STOR 10M 15M 15 7.15 1000 7.50 1750 8.00 3100 8.25 3900 9.00 7000 10.50 16000 10.68 17000 12.03 28600 14.96 60390 17.00 88000 21.00 155000 27.00 280000 29.00 330000 46.00 950000 </pre>		
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Shift
adjusted
rating

Base
rating

StreamMail

- Request, by email or cellphone text message, the most recent USGS river stage and streamflow data for streams in the United States.
- To use the system, send an email to "streamail@usgs.gov" and in the "Subject" line, put in a USGS station (site) number. Station numbers available at <http://waterdata.usgs.gov/usa/nwis/rt>
- An email will be sent back to you with the most recent stream stage and flow.



Example of StreaMail Response

- U.S. Geological Survey (USGS) StreaMail:
The latest river stage and streamflow values you requested from StreaMail. Site: 01463500
Station name: Delaware River at Trenton NJ
Date: 08/05/2010
Time: 10:15:00
Stage: 8.17 feet
Streamflow: 3190 cubic feet per second (cfs)
- Link to charts for 01463500:
Stage:
http://waterwatch.usgs.gov/wwapps/zchart.php?i=nwis2&vt=uv&cd=00065&site_no=01463500
Streamflow:
http://waterwatch.usgs.gov/wwapps/zchart.php?i=nwis2&vt=uv&cd=00060&site_no=01463500
- The U.S. Geological Survey's (USGS) StreaMail system allows you to request, by email, the most recent USGS river stage and streamflow data for streams in the United States. To use the system, send an email to "streammail@usgs.gov" and in the "Subject" line, put in a USGS station (site) number. An email will be sent back to you with the most recent stream stage and flow.
- If you need help, contact Howard Perlman (hperlman@usgs.gov)



Water Alert

- Threshold notification system
- User selects station & desired notification settings; i.e. data type, threshold condition, and frequency
- Interactive map with search options
- Subscription form and Confirmation
- Text message or email sent to subscriber
- <http://water.usgs.gov/wateralert/>



Water Alert

<http://water.usgs.gov/wateralert>

Water Alert's Email Response when threshold reached

- Streamflow of 3280 cfs is below subscriber threshold of 4200 at 2010-08-05 00:15:00 EDT
01463500 00060 Delaware River at Trenton NJ
Notification interval, no more often than: Daily
- For Realtime Data at this station:
http://waterdata.usgs.gov/nwis/rtv/?site_no=01463500
- To Delete this Specific Alert
reply with Subject: SIGNOFF hni-CrY2s
- To Pause this Specific Alert for 5 days
reply with Subject: PAUSE hni-CrY2s 5
- To List Settings
reply with Subject: LIST hni-CrY2s
- To List Settings for all Notifications of the Same Address
reply with Subject: LIST ALL hni-CrY2s
- For Help
reply with Subject: HELP hni-CrY2s
- To Sign up for New Notifications
<http://water.usgs.gov/wateralert>
- To Modify a threshold, set a "new" notification with the same email address, site number and parameter



Send Questions to: GS-W_RT-HNS_Feedback@usgs.gov

Flood Studies and Reports

- New Jersey Flood Watch web site
<http://nj.usgs.gov/hazards/flood/index.html>
- Flood summary reports for major floods
<http://nj.usgs.gov/hazards/flood/flood0310/>
- Flood Magnitude and Frequency of the Delaware River in NJ, NY and PA <http://pubs.usgs.gov/of/2008/1203/>
- Flood of April 2-4, 2005, Delaware River main Stem from Port Jervis, New York, to Cinnaminson, New Jersey
<http://pubs.usgs.gov/sir/2007/5067/>
- Flood of July 12-13, 2004, Burlington and Camden Counties, South Central New Jersey <http://pubs.usgs.gov/sir/2006/5096/>
- Methodology for Estimation of Flood Magnitude & Frequency for NJ streams <http://pubs.usgs.gov/sir/2009/5167/>



StreamStats New Jersey

http://water.usgs.gov/osw/streamstats/new_jersey.html



- Interactive map-based web application available for public use
- Users can obtain flood-frequency statistics and basin characteristics for gaged and ungaged sites

Lowflow statistics through 2003 published: <http://pubs.usgs.gov/sir/2005/5105>

Contact Information

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