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

Bob Reiser
Chief, Hydrologic Data Assessment Program

USGS science for a changing world

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

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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**

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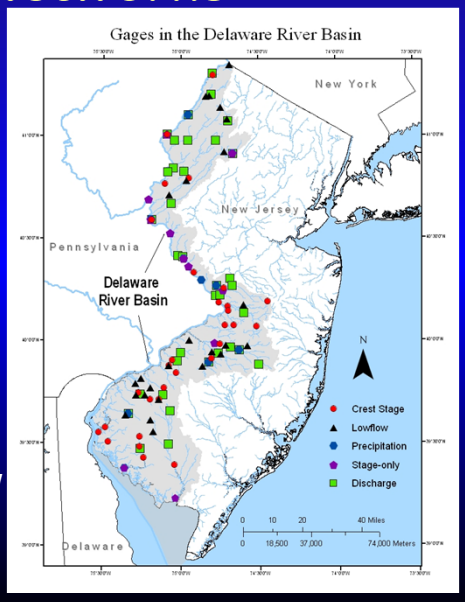
Surface Water Networks

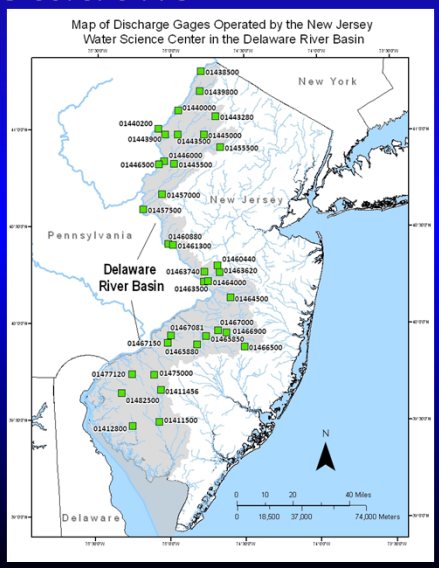
- Gaging stations, continuous-record discharge (35)
- Stage-only gages, continuous-record
  - tidal, non-tidal (11)
- Crest-stage gages
  - Tidal, non-tidal (29)
- Partial-record sites

  Instantaneous low-flow measurements (25)
- Scour Monitoring

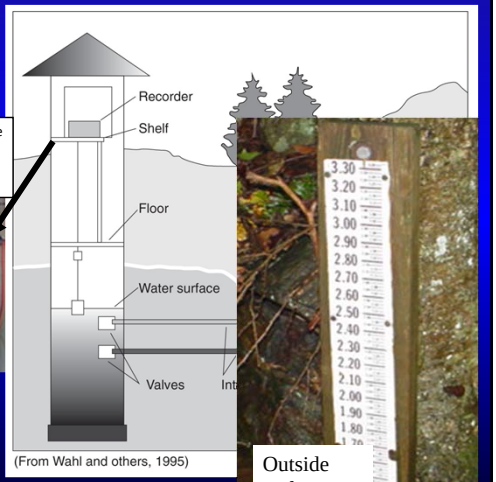


Continuous-record Discharge Gaging Stations

- 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



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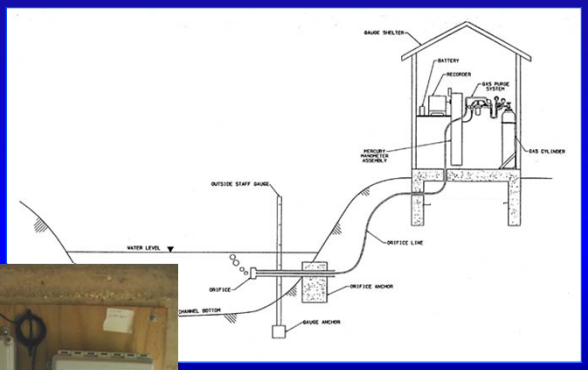
New Gaging Station Design



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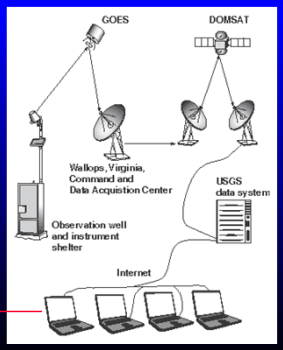
Satellite Telemetry

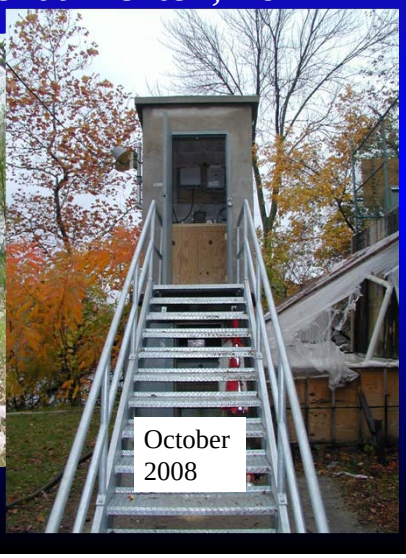
- Geostationary Operational Environmental Satellite (GOES)
  - Operated by NOAA (National Oceanic and Atmospheric Administration)
  - Reliable
  - Automatic switchover during primary failure
- Timed transmissions every hour
- Random transmissions when thresholds are exceeded
  - Stream reaches exceeds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



USGS

Flood Hardened Gages

01463500 Delaware River at Trenton, NJ



USGS

Flood Hardened Gages

01457500 Delaware River at Riegelsville, NJ

USGS

Radar Non-contact stage sensor

- Waterlog H-360 installed Oct. 5, 2005 Del River at Phillipsburg
- A microwave transmittor (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

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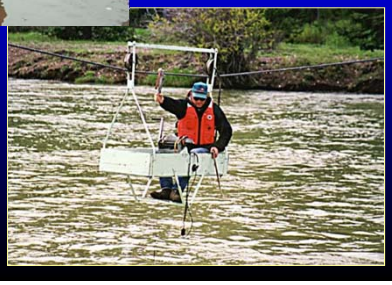
Flood Hardened Gages

01440200 Delaware River at Tocks Island, NJ

Streamflow Data Collection

Traditional Methods

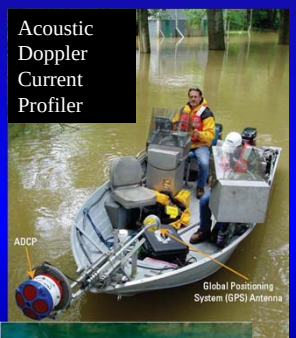


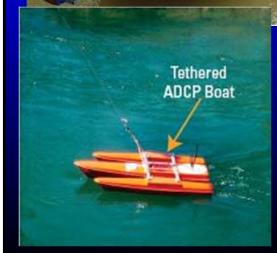
Acoustic Methods

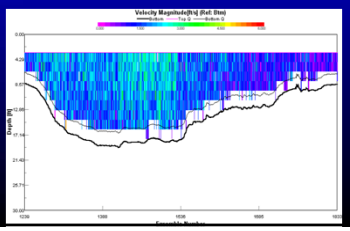
http://pubs.usgs.gov/of/2001/ofr0101/text.pdf

Boat Mounted

Acoustic Doppler Current Profiler



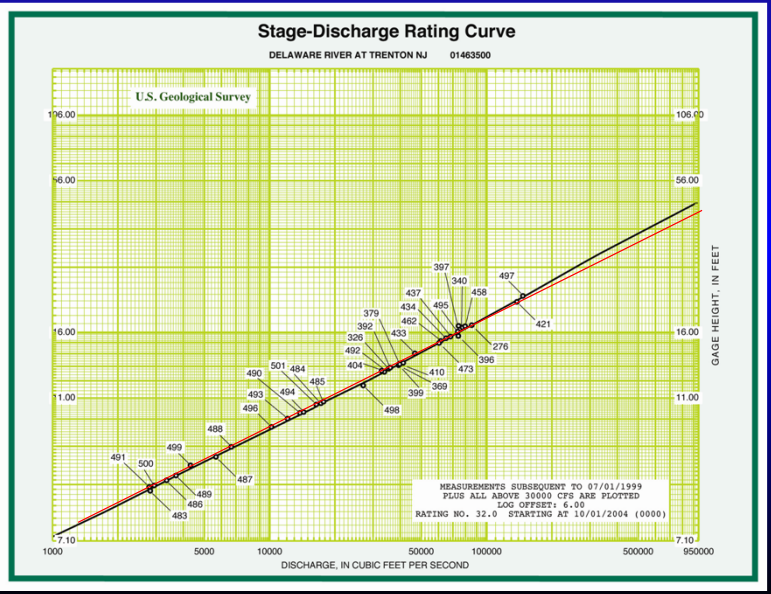




Wading

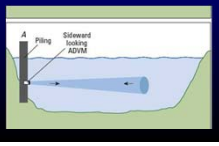
Acoustic Doppler Velocimeter

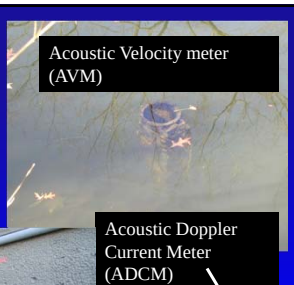
Stage/Discharge Ratings

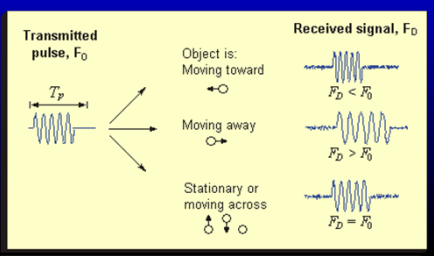


Acoustics at Gages

- **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.

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Precipitation Gages

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

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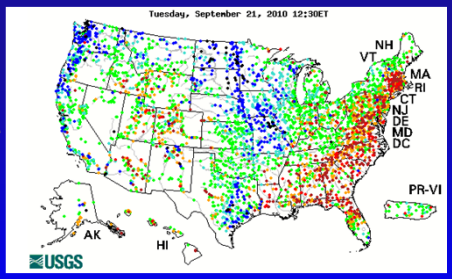
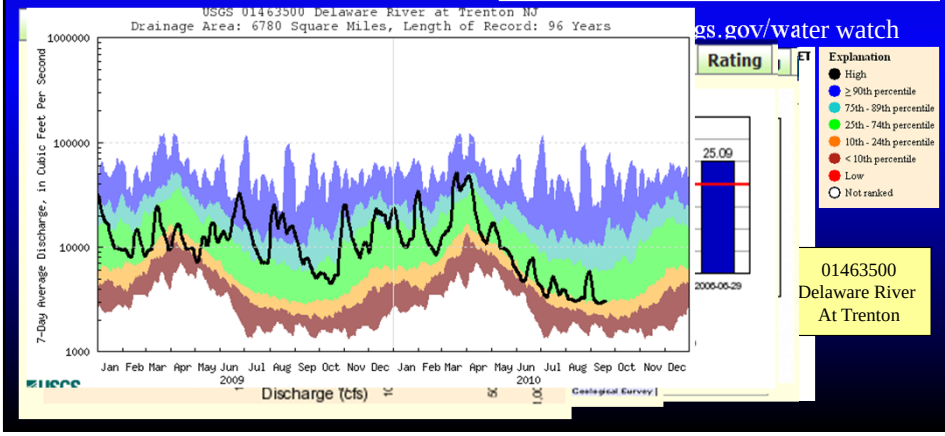
Data Delivery Methods

- 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

USGS

Water Watch Real-time Surface Water Data





gs.gov/water watch

01463500
Delaware River
At Trenton

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

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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

USGS

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

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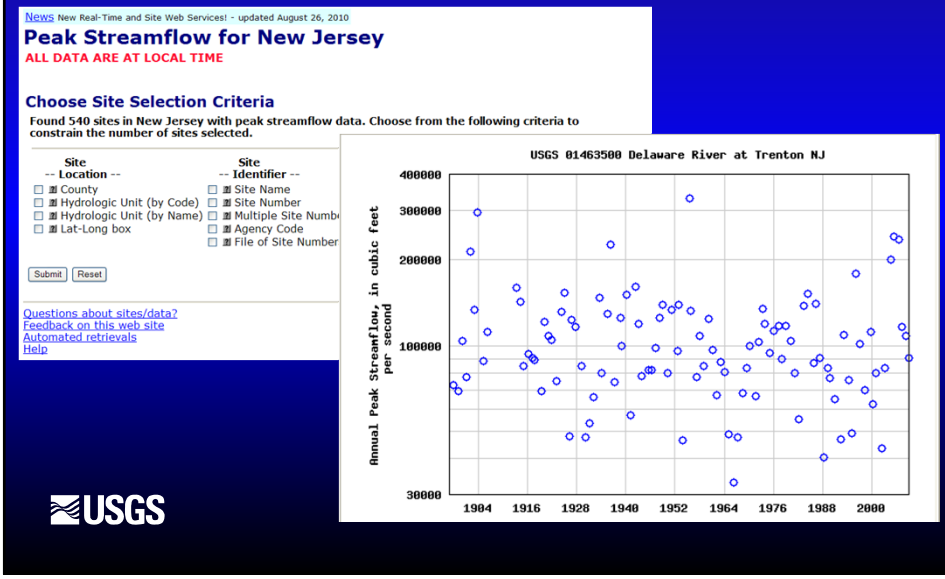
Peak Streamflow Data

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



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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/xxxxxxxx.rdb
- Tab delimited (rdb) format
- Detailed information on current variable stage shifts included

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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

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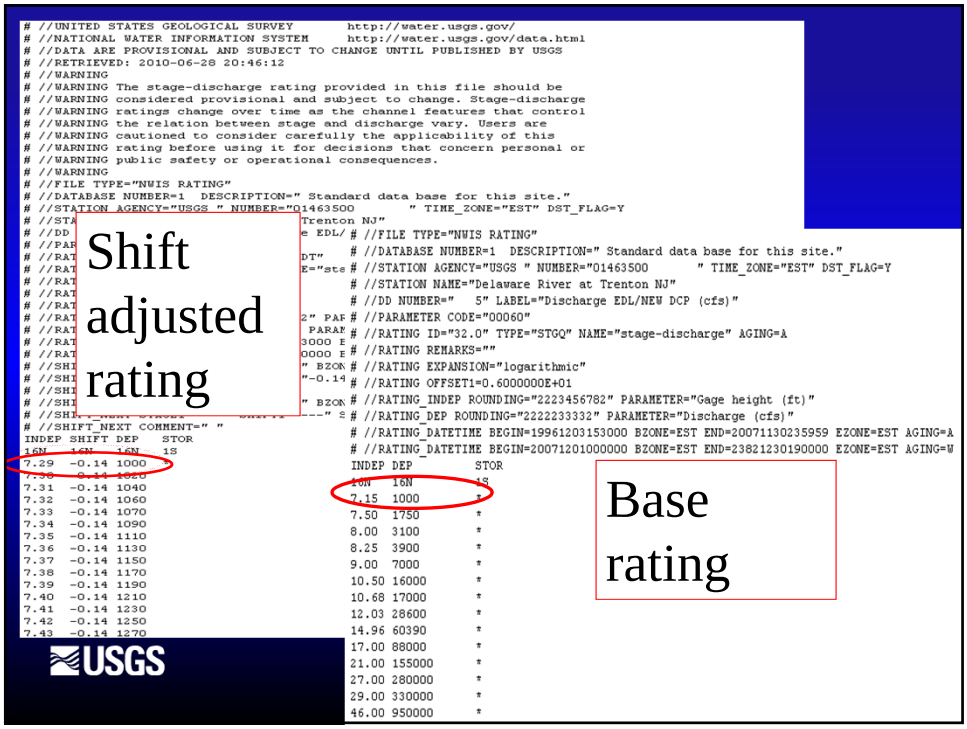


StreaMail

- 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.

USGS

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 "streamail@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)

USGS

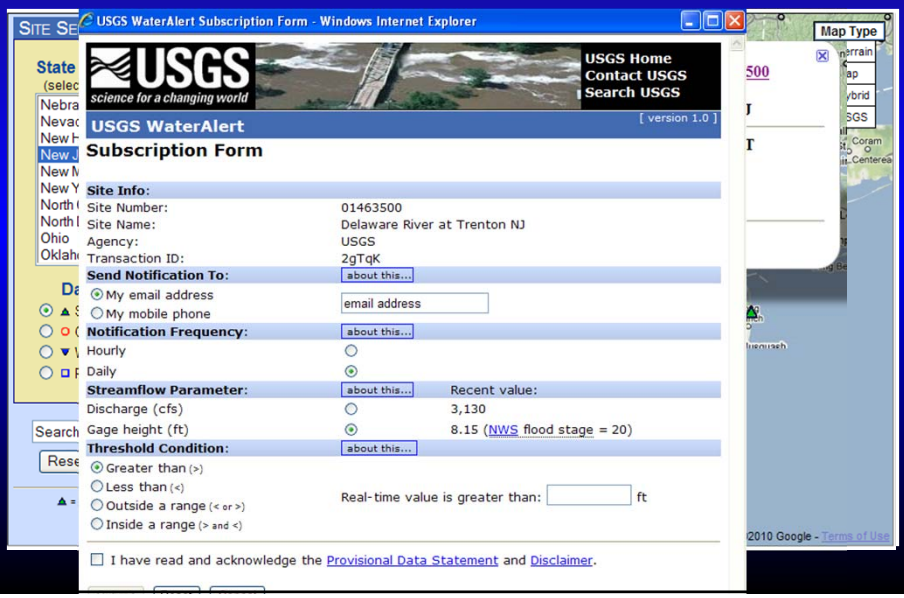
Water Alert

- 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/

USGS

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/uv/?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

USGS

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

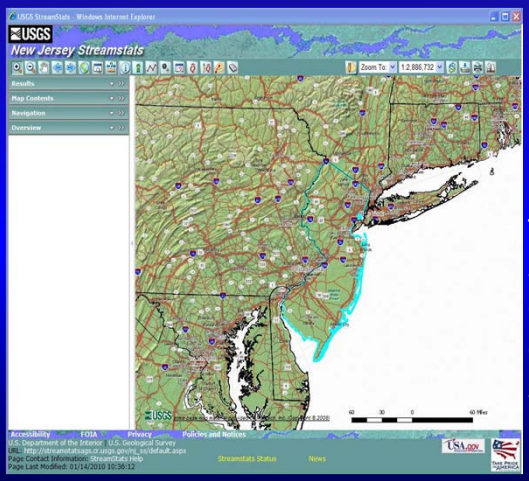
Flood Studies and Reports

- 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/

USGS

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

- Bob Reiser, Chief, Hydrologic Data Assessment Program, USGS New Jersey Water Science Center
  - 609-771-3980 rreiser@usgs.gov
- USGS New Jersey Water Science Center Home Page
  - http://nj.usgs.gov
- Address:
  - USGS NJ Water Science Center
    810 Bear Tavern Road, Suite 206
    West Trenton, NJ 08628
    (609) 771-3900

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