What's new at the New Jersey Water Science Center: Data Collection and Delivery

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

> New Jersey Water Monitoring Summit Ewing, New Jersey December 2, 2011

Bob Reiser Chief, Hydrologic Data Assessment Program



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

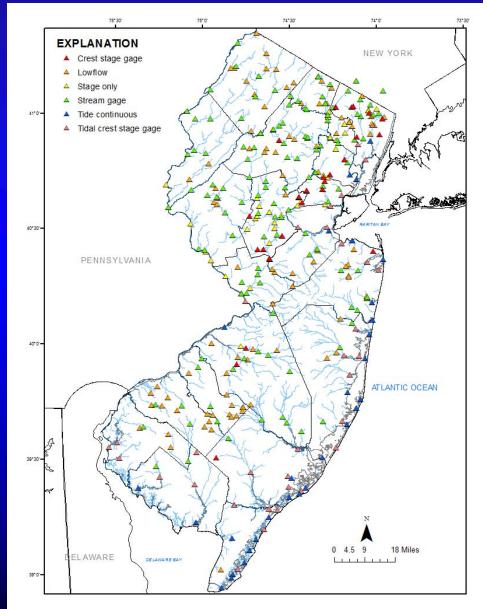
History of Hydrologic Monitoring by USGS in New Jersey

- First USGS streamgage data at Passaic River at Paterson & Delaware River at Lambertville in 1897
- Ground-water levels data since 1923
- Water Quality data since 1923, NJDEP/USGS coop network since 1976
- Cooperative Water Program with State & local agencies established in 1921 at the NJ USGS office



Surface Water Stage & Flow Networks

- Streamgages (130)
- Stage-only, non-tide(48) 8 lake/reservoir, 40 stream
- Stage-only, tide (24)
- Precipitation (41)
- Crest-stage gages (17)
- Tidal Crest-stage gage (32)
- Low-flow sites (96)
- Miscellaneous Flow sites (127)
- Scour Monitoring (22) http://nj.usgs.gov/infodata/surf acewater.html

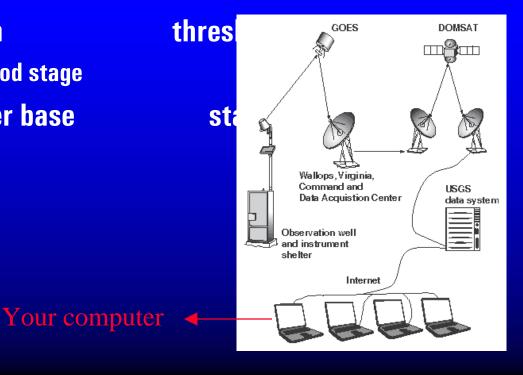


New Gaging Station Design



Satellite Telemetry

- <u>Geostationary Operational Environmental Satellite (GOES)</u>
 - **Operated by NOAA** (National Oceanic and Atmospheric Administration)
 - Reliable
 - Automatic switchover during primary failure
- Timed transmissions every hour
- Random transmissions when
 - Stream reaches & exceeds flood stage
- Data transmitted to computer base archival database





Radar Non-contact stage sensor

- 6 Delaware River stage gages, First 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 satellite telemetry (DCPs)
- Distance, elevation, and signal strength stored
- Accuracy <u>+</u> 0.01 ft





Streamflow Data Collection

Traditional Methods



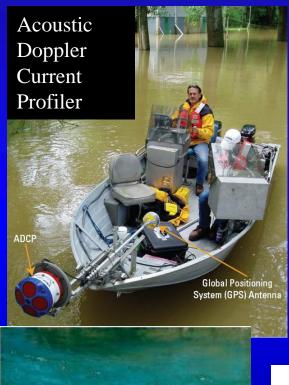




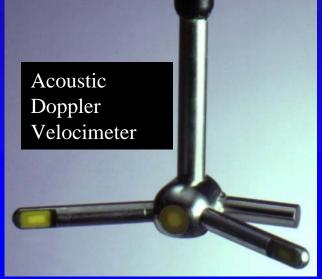


Acoustic Methods Boat Mounted

http://pubs.usgs.gov/of/2001/ofr 0101/text.pdf Wading

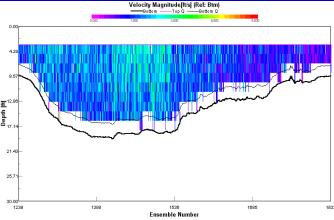






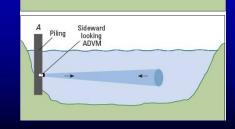






Acoustics at Gages

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





Transmitted

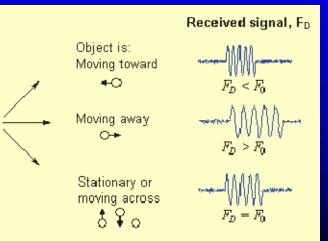
pulse, F_o

Acoustic Velocity meter (AVM)









Common uses of USGS streamflow data

- Flood forecasting and flood warning by National Weather Service and other emergency managers
- Compute 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

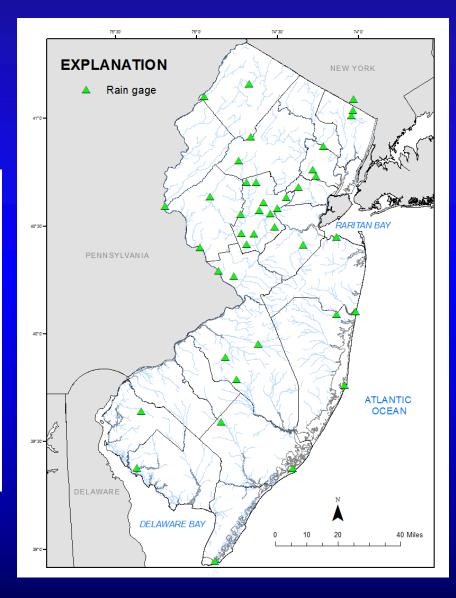


Precipitation Gages

 41 gages – 40 have real-time data located on homepage http://nj.usgs.gov/index.html



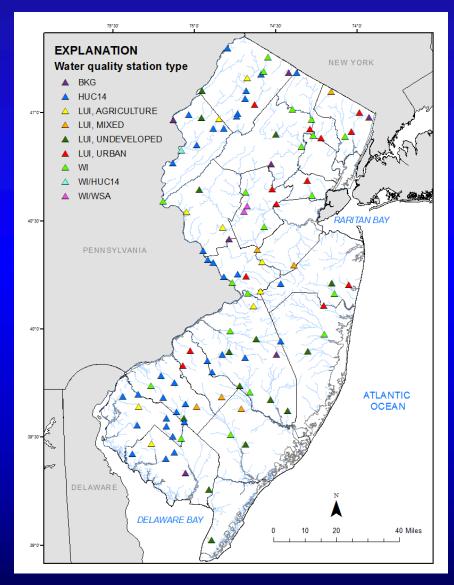




Surface Water Sampling Sites

Cooperative Networks

- 113 Site network with NJDEP
- 2 sites with NJWSA
- I site with DRBC
 - Station Types in NJDEP network:
 - 7 Background, 23
 Watershed Integrator, 43
 Land-use Indicator, 40
 HUC14 and Watershed
 reconnaissance sites
- Coop network since 1976
 USGS



Sampling Schedule & Constituent List

Routine parameters at all sites quarterly: field parameters, major ions, nutrients, suspended sediment, DOC & particulate carbon

- Nov./Dec.: routines only
- Feb./March: trace elements at 7 Background & 40 HUC14 sites
- May/June: pesticides at 20 HUC14, 3 BKG
- Aug/Sept: trace elements at all 40 HUC14 and 7 background stations and bed sediments (analyzed for nutrients, carbons, trace elements and polyaromatic hydrocarbons) collected at 20 selected HUC14 sites each year

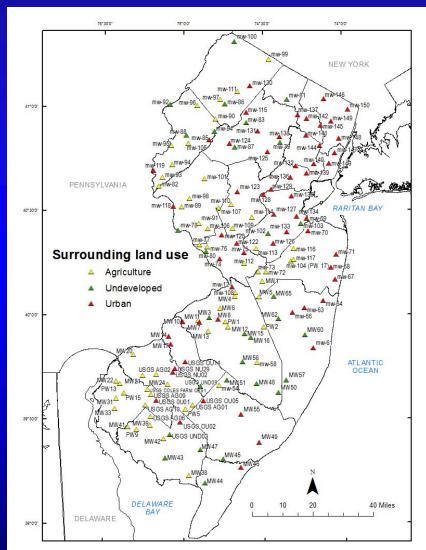
Streamflow provided at 73 fixed sites



Groundwater Sampling network

150 shallow wells sampled cooperatively with NJDEP

- 60 urban, 60 Ag, 30 undeveloped
- 30 wells sampled per year, resulting in a fiveyear rotation
- Focuses on nonpoint source pollution of GW
- Randomly stratified as a function of land-use

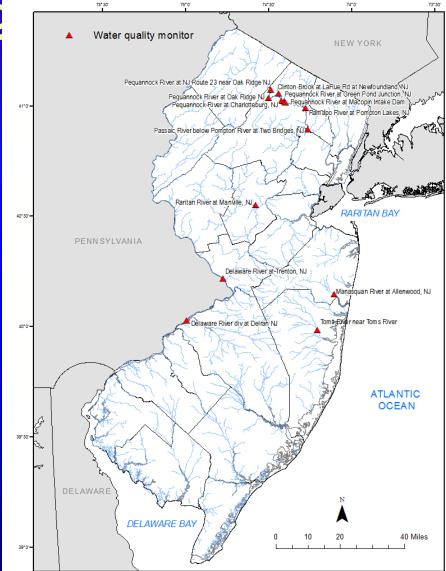




Long-term Continuous Water Quality Monitoring

- 13 monitors active
 - 7 year-round, 6 seasonal (5 temp only)
- Temp., SC, pH, DO, turbidity, Nitrate, chlorophyll
- Provisional temp at 32 streamgages

≈USGS



Nitrate and Chlorophyll-a Sensors





Passaic River at Two Bridges http://waterdata.usgs.gov/nj/nwis/uv/?site_no=01389005&PARAmeter_cd= 00010,00095,00300,00301,00400,63680



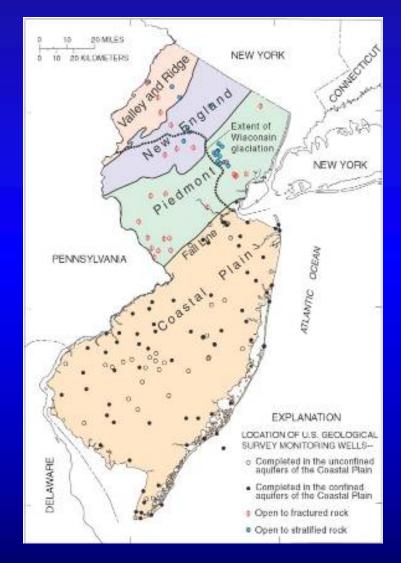
Short-term continuous QW monitoring

- Purpose: assess 3-6 day diurnal physical measurements and constituent concentrations at a subset of network sites
- Selection Criteria: previous occurrences of Dissolved Oxygen (DO) supersaturation (>120%), DO undersaturation (<60%) or DO less than the instream standard
- Data Management:
 - Data stored in our national NWIS database
 - Published in annual data report
 - Available from NJWSC web page
 http://nj.usgs.gov/qw/diurnal_do/



Ground-water Level Observation Well Network

- 193 wells in Long-term networks
 - 133 continuous-record
- NJDEP/USGS: 162 wells
 - 105 continuous-record
 - 56 manual
 - 1 subsidence
- NJDEP/USGS: Drought network
 - 19 continuous-record
 - 3 manual
 - Real-time data on 20 shallow wells
- Local Municipalities: 9 continuous-record wells





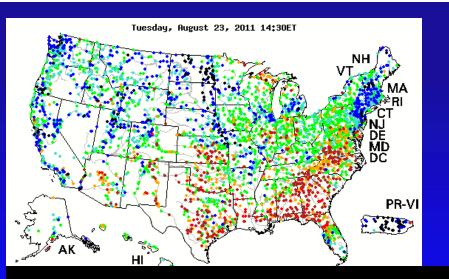
Data Delivery Methods

- Water Watch: Near Real-time and Historical Data
- Monthly Hydrologic Conditions Report
- Annual Water Data Report
- National Water Information System (NWIS WEB)
- Instantaneous Streamflow & Peak Databases
- Stage/Discharge Ratings Depot
- Alert Systems: StreaMail & Water Alert
- Flood Reports
- Streamflow Statistics (StreamStats)

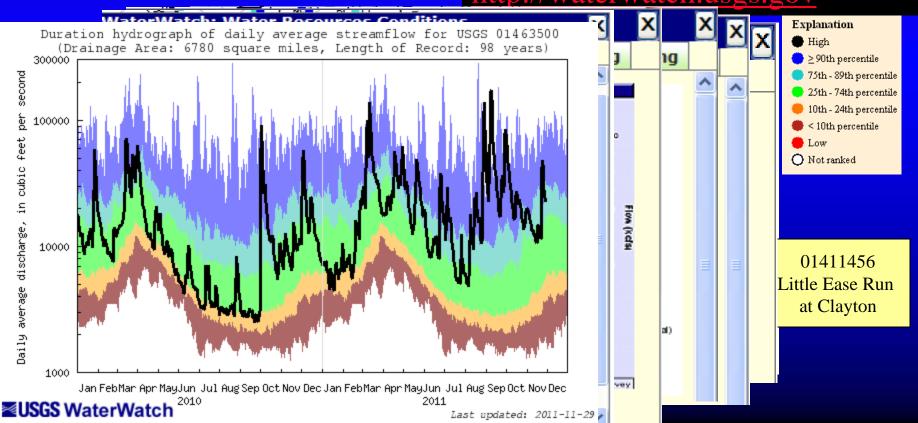


Water Watch Near Real-time Surface Water Data

http://nj.usgs.gov

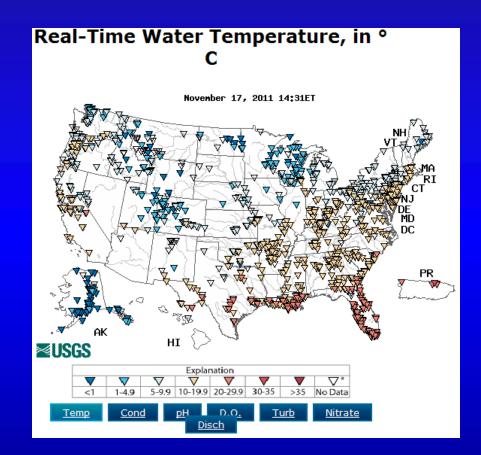


http://waterwatch.usgs.gov



Water Quality Watch

- Near Real-time water quality parameters
 - Temp, SC, pH, DO, turbidity, nitrate
- Google map interface
- Links to NWIS & technical resources
- Links to sites displaying surrogate data (suspended sediment, TP, TN)





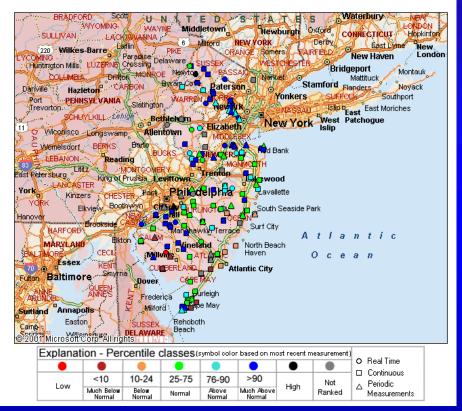
http://water.usgs.gov/waterwatch/wqwatch

Groundwater Watch

- Field measurements
- Daily Data
- Daily, monthly and annual statistics
- Well information
- Data in plots and tables
- Display wells on Google map

New Jersey Groundwater Network

Hover mouse over site for information. Click site to open page with county information and site selection.



http://groundwaterwatch.usgs.gov/NJN/StateMaps/NJ.html
http://groundwaterwatch.usgs.gov/
≥USGS

Annual Water Data Report & Monthly Hydrologic Conditions Report

- National Reports since water year 2006 <u>http://wdr.water.usgs.gov/</u>
- Mapper Interface <u>http://wdr.water.usgs.gov/adrgmap</u>
- New Jersey Water Science Center publishes NJ data online and on CD

http://nj.usgs.gov/publications/adr/adr2009/Main Index.html

 Monthly Hydrologic Conditions Report http://nj.usgs.gov/special/monthly_summary/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

NJ NWISWeb_http://nj.usgs.gov/infodata/nwisweb.html

Site mapper http://wdr.water.usgs.gov/nwisgmap

National NWISWeb <u>http://waterdata.usgs.gov/nwis</u>

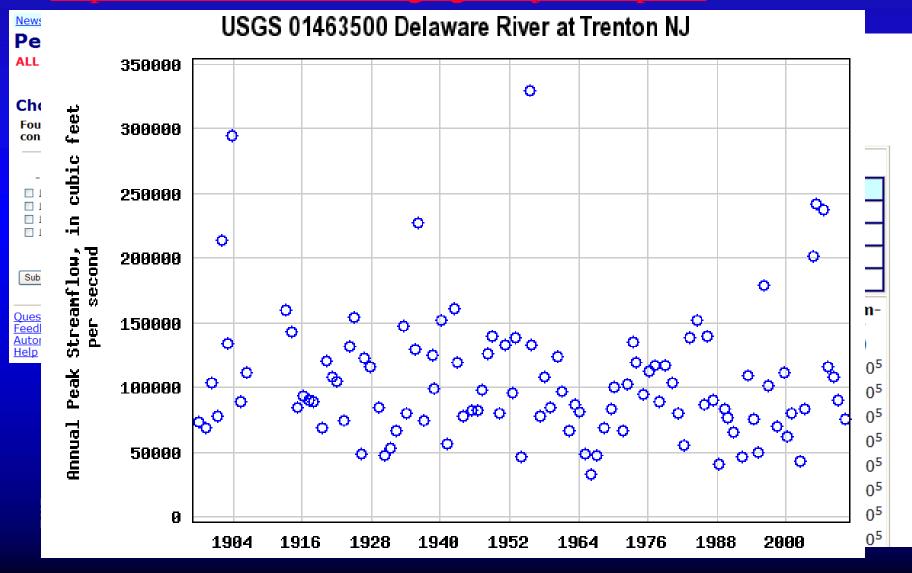
Instantaneous Data Archive

- 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

Site Inventory http://waterdata.usgs.gov/nj/nwis/inventory

Peak Streamflow Data

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



Stage/Discharge Ratings Depot

- Expanded Base ratings, and latest shift-adjusted rating retrieved from all stage-discharge sites at 8 PM local time
- Available on web by site: <u>http://nwis.waterdata.usgs.gov/nwisweb/data/exsa_rat/xxxxxx.rd</u>
 b
- Tab delimited (rdb) format
- Detailed information on current variable stage shifts included
- Rating plots now available through WaterWatch website

//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" Shift # //PAF # //DATABASE NUMBER=1 DESCRIPTION=" Standard data base for this site." # //RAI DT" E="sts # //STATION AGENCY="USGS " NUMBER="01463500 " TIME ZONE="EST" DST FLAG=Y # //RAI # //RAI # //STATION NAME="Delaware River at Trenton NJ" # //RAT adjusted # //DD NUMBER=" 5" LABEL="Discharge EDL/NEW DCP (cfs)" # //RAI 2" PAF # //PARAMETER CODE="00060" # //RAI # //RAT PARAM # //RATING ID="32.0" TYPE="STGQ" NAME="stage-discharge" AGING=A # //RAI 3000 E 0000 E # //RATING REMARKS="" # //RAI # //SHI " BZON # //RATING EXPANSION="logarithmic" # //SHI "-0.14 # //RATING OFFSET1=0.6000000E+01 # //SHI BZON # //RATING INDEP ROUNDING="2223456782" PARAMETER="Gage height (ft)" # //SHI # //SHI --" ≈ # //RATING DEP ROUNDING="2222233332" PARAMETER="Discharge (cfs)" # //SHIFT NEXT COMMENT=" " # //RATING DATETIME BEGIN=19961203153000 BZONE=EST END=20071130235959 EZONE=EST AGING=A INDEP SHIFT DEP STOR # //RATING DATETIME BEGIN=20071201000000 BZONE=EST END=23821230190000 EZONE=EST AGING=W 1 6N 1 6N 16N 13 7.29 -0.14 1000 INDEP DEP STOR Base rating 16N LON -0.14 1040 7.31 7.15 1000 7.32 -0.14 1060 7.33 -0.14 1070 7.50 - 17507.34 -0.14 1090 8.00 3100 7.35 -0.14 1110 7.36 -0.14 1130 8.25 3900 7.37 -0.14 1150 9.00 7000 7.38 -0.14 1170 10.50 16000 7.39 -0.14 1190 7.40 -0.14 1210 10.68 17000 7.41 -0.14 1230 12.03 28600 7.42 -0.14 1250 14.96 60390 7.43 -0.14 1270 17.00 88000 21.00 155000 * 27.00 280000 * * 29.00 330000 * 46.00 950000

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.
- http://water.usgs.gov/wateralert/streamail.html



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: 11/28/2011 Time: 10:15:00 Stage: 11.34 feet Streamflow: 22,300 cubic feet per second (cfs)

Link to charts for 01463500:

Stage: http://waterwatch.usgs.gov/wwapps/zchart.php?i=nwis2&vt=uv&cd=00060&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 (<u>hperlman@usgs.gov</u>)



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
- <u>http://water.usgs.gov/wateralert/</u>
- Instructions http://water.usgs.gov/wateralert/help/instructions.html



Water Alert

http://water.usgs.gov/wateralert

SITE SE 🖉 USGS WaterAlert Subscription Form - Windows Internet Explorer	ap Type
Thank you. Your form has been submitted (ID=hBbmx).	nerrain
	ap
A confirmation message has been sent to rreiser@usgs.gov.	ybrid SGS
	d Coram
You must reply to the confirmation message before Thursday, December 01, 2011 2:26:45 PM in order to activate	in_Centerea
this subscription.	
	2
USGS Real-Time Hydrologic Notification System subscription for:	18
	3e
Site number: 01463500	
Site name: Delaware River at Trenton NJ	
Notification Method (e): email message to rreiser@usgs.gov	
Parameter Code: 00065 Parameter Name: Gage height (ft)	
Notification interval: Daily	
Threshold condition: value > 18	
Check your "Spam" mail folder if you don't receive a confirmation email from the USGS within a few minutes	
	ms of Use
Close	

Water Alert Confirmation Emails



Re[2]: USGS WaterAlert confirmation: SUBSCRIBE hBbmx WaterAlert to: Robert G Reiser

ng

1e

Your USGS WaterAlert request has been processed.

The notification threshold for your existing entry is changed from: exceeds subscriber threshold of 15.0 to: exceeds subscriber threshold of 18

Site Number: 01463500 Station Name: Delaware River at Trenton NJ Parameter Code: 00065 Parameter Name: Gage height Agency Code: USGS Notify when value exceeds subscriber threshold of 18 ft Notification interval, no more often than: Daily Address: rreiser@usgs.gov Message type (e=email, t=text msg): e Notification id: hni-m3cPv

For Help: http://water.usgs.gov/hns?hni-m3cPv:01463500

Water Alert's Email message when threshold reached

Gage height of 18.5 ft exceeds subscriber threshold of 18.0 at 2011-08-28 06:15:00 EDT 01463500 00065 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

For Subscription Help: http://water.usgs.gov/hns?m3cPv:01463500

To Sign up for New Notifications: http://water.usgs.gov/wateralert

Send Questions to: wateralert@usgs.gov USGS

Water Alert's Help page

- Send email replies to wateralert@usgs.gov
- To Pause this Specific Alert for 5 days: reply with Subject: PAUSE hni-HPUhW 5
- To Pause all Alerts for 5 days: reply with subject: PAUSE ALL hni-HPUhW 5 (can change 5 to any number of days)
- To Continue (unpause) this or ALL alerts: reply with Subject: CONTINUE hni-HPUhW CONTINUE ALL hni-HPUhW
- To Delete (signoff) this alert: reply with Subject: SIGNOFF hni-HPUhW
- To List Settings send email with Subject: LIST hni-HPUhW
- To List Settings for all Notifications at same site reply with Subject: LIST ALL hni-HPUhW
- For Help
 reply with Subject: HELP hni-CHPUhW
- To Change existing notification or sign up for New Notifications go to http://water.usgs.gov/wateralert
 To Modify a threshold, set a "new" notification with
 - the same email address, site number and parameter



Get list of all subscriptions

You may also obtain custom management instructions on

ALL your WaterAlerts by submitting this request:

WaterAlert Management Help

Send WaterAlert		
Help for		
💿 my email		
address	email address	Get My Alerts
⊖my mobile		
phone		



Reply from Request for settings Email Subject: LIST hni-HPUhW

Your USGS WaterAlert request has been processed.

Site Number: 01463500 Station Name: Delaware River at Trenton NJ Parameter Code: 00065 Parameter Name: Gage height Agency Code: USGS Notify when value exceeds subscriber threshold of 18.00 ft Notification interval, no more often than: Daily Address: rreiser@usgs.gov Message type (e=email, t=text msg): e Notification id: hni-HPUhW:01463500 For Help: http://water.usgs.gov/hns?hni-HPUhW:01463500



Flood Studies and Reports

- New Jersey Flood Watch web site http://nj.usgs.gov/hazards/flood/index.html
- Flood summary reports for major floods (Hurricane Irene) http://nj.usgs.gov/hazards/flood/flood1108/
- Methodology for Estimation of Flood Magnitude & Frequency for NJ streams http://pubs.usgs.gov/sir/2009/5167/
- 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/



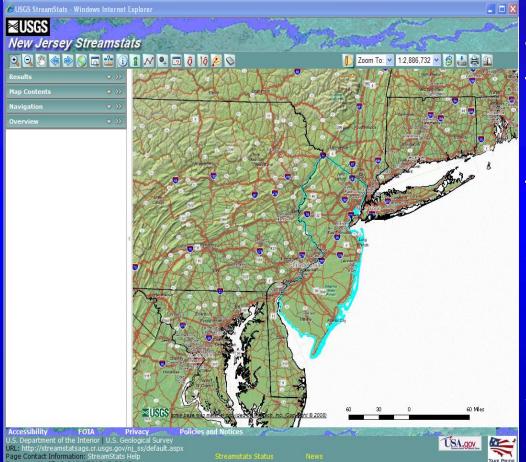
Contact Information

- 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
 - <u>http://nj.usgs.gov</u>
- Address:
 - USGS NJ Water Science Center 810 Bear Tavern Road, Suite 206 West Trenton, NJ 08628 (609) 771-3900



StreamStats New Jersey

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



 Interactive map-based web application available for public use

 Users can obtain floodfrequency statistics and basin characteristics for gaged and ungaged sites

 Developing equations for estimating lowflow statistics

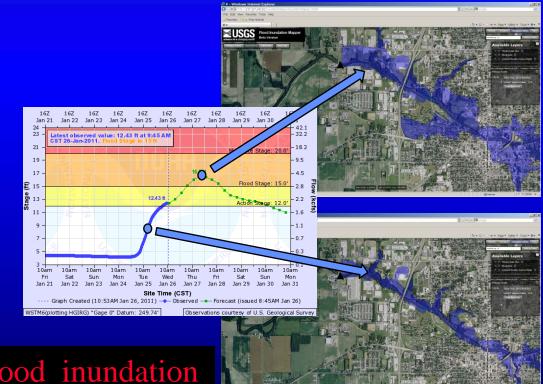
Lowflow statistics through 2003 published: http://pubs.usgs.gov/sir/2005/5105

Flood Inundation Mapping

- Passaic River Basin- selected stream reaches
- Flood inundation maps, <u>used in conjunction with USGS</u> real-time streamgage data & NWS flood forecasts, allow users to visualize current and forecasted

flood-inundated areas

 EM officials and residents can see where the potential threat
 of flood water is
 highest



http://water.usgs.gov/osw/flood_inundation

01396091 – S.B. Raritan River at Route 46 at Budd Lake, NJ



USGS Fathometer at upstream right wingwall scour hole