

Monitoring After Severe Floods/Storms in NJ: Challenges, Solutions & Unanswered Questions

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Adapting to Extreme Climate – Best Practices,
Solutions & Unanswered Questions Panel
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Cincinnati, OH



Atlantic City (near Absecon Inlet)



Harvey Cedars, Long Beach Island

Overview

- **3 Severe Storms Impacted NJ : Irene & Lee, and Sandy**
- **2 types monitoring:**
 - **Coastal shellfish waters**
 - **Inland waters**
- **Key Lesson from Irene & Lee**
- **Superstorm Sandy Monitoring**
- **Challenges, Some Solutions, Unanswered Questions**
- **Resources or Best Practices Used/Needed**

3 Recent Extreme Weather Events in NJ

- **Hurricane Irene (August 27-28, 2011)**

- Major hurricane in NJ (Category 1)
- Both coastal & in-land
- 6-8" of rain statewide; >11" of rain in local areas; 9' storm surge
- Flooding, power outages, sewage bypasses, & sanitary sewer overflows
- Degraded water quality, statewide shellfish closures, and ocean bathing beach closures



Image: NOAA

- **Tropical Storm Lee (September 8, 2011)**

- Both coastal & in-land
- Combined rainfall 2 storms results in record precipitation
- Severe flooding, pump station failures & sewage overflows
- Degraded water quality and shellfish closures (some remaining after Irene)



Image: NASA

- **Superstorm Sandy (October 29, 2012)**

- Tropical storm force winds extended ~1,000 miles (one of largest tropical storms ever recorded)
- Severe coastal flooding, limited inland waters flooding
- Wide range total rainfall in NJ: <1" to >12".
- Barrier islands completely inundated/breached due to storm surge & waves
- Extensive power outages, sewage bypasses & sanitary sewer overflows
- Degraded water quality and statewide shellfish closures



Image: NASA

A Key Lesson from Hurricane Irene/Tropical Storm Lee (August & Sept, 2011)

- Available emergency closure/reopening SOP followed for shellfish monitoring
- Very limited ability to respond to call for inland flood waters sampling - some USGS bacterial sampling for DEP
- Preparation and planning needed for inland waters
- Began development (w/ NJ Water Monitoring Council) of inland waters flood monitoring plan
- **Then along came Sandy....**





Hackensack



Long Beach Island



Hudson County



Jet Star - Seaside Heights



NYC Subway



Union Beach



Mantoloking



Mantoloking



Superstorm Sandy

Storm Surge



- Highest storm surge measured was 8.57 ft. above mean high tide levels at the north end of Sandy Hook
- Since the Sandy Hook station failed during the storm, it is likely that actual storm surge was higher
- Storm surge pushed into New York and Raritan Bays, causing sea water retention within the coastal waterways & wetlands of Newark Bay, the Hudson, Passaic and Hackensack Rivers, Kill Van Kull, & Arthur Kill
- USGS surveyed high-water marks as high as 4 to 5 ft. above ground level in Sea Bright, Tuckerton, Seaside Park, & LBI
- Barrier islands were completely inundated/breached in some areas due to storm surge & waves
- NOS tide gauges in Atlantic City and Cape May measured storm surges of 5.82 ft. and 5.16 ft., respectively

Storm Effects - Sandy

- Surge, rainfall, and inland elevated flows & flooding were issues in some areas more than others.
- Surge damaged municipal storm water and waste water infrastructure.
- ~ 80 sewage treatment plants affected (lost power or damaged)



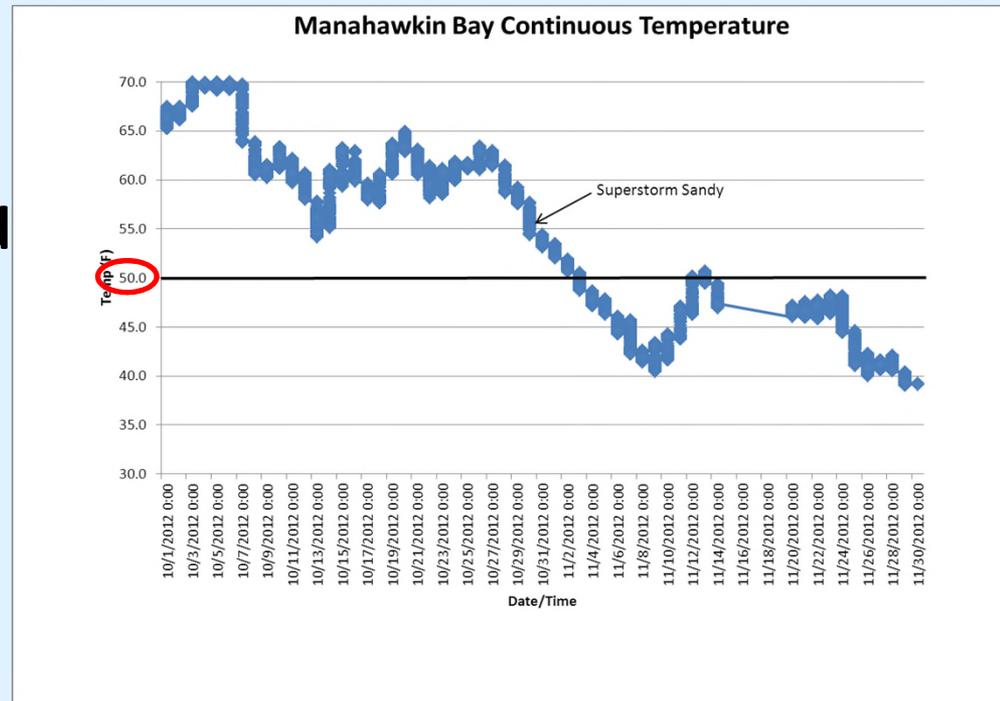
Passaic Valley Waste Water Treatment Plant

Sandy – Shellfish Monitoring

- Followed SOP (Shellfish Emergency Response Plan)
- Statewide shellfish closure in advance of storm (10/28/12)
- 47+ stations sampled for pathogens, starting 11/1/2012
- Due to infrastructure damage, coastal flooding & power outages, much contamination from sewage bypasses & overflows
- Used bacterial (fecal coliform) **water** analyses & shellfish harvest criteria for reopening
- Also used shellfish **tissue** viral (coliphage) analyses for reopening (criteria - <50 PFU/100g)
- Approved use of coliphage analysis from FDA & Interstate Shellfish Sanitation Conference (ISSC)

Sandy Shellfish Bed Openings: Long-term Monitoring Requirement

- Some areas opened for harvest in 2 weeks (Southern waters)
- Some not opened for ~ 5 months until April 2013 (Barnegat Bay)
- Waters remained closed until tissue viral criterion met
- Tissue contamination persisted - cooling water temperature (<50° F) reduced shellfish ability to purge
- Continuous Temp data available



Shellfish Water Quality Sampling: Challenges & Potential Solutions

Challenges

- Power outages - state labs, field offices, employee residences
- Access/ damage to boat ramps & marinas
- Boat navigation - debris in water
- Quick access to GIS maps & info on large # sewage bypasses/ overflows
- Sustained monitoring to reopen waters (>500 water samples, > 1000 shellfish collected)
- 7 day/week sampling and analyses required
- Additional monitoring partners needed

Some Solutions

- Hardening of lab facilities, consider generators for labs
- Steps being taken to provide quicker access to storm-related spill info
- Continuous Temp data helpful in predicting/confirming need for closures (Temp < 50^o F)
- Partner with shellfish industry for shellfish collection

Resources Needed/Used

- Followed State emergency shellfish closure/opening SOP
- Bacterial & coliphage criteria available for reopening waters

NJ: Recreational Fishing and Boating Advisory 11/2/12 (4 days after Sandy)

- Recreational boaters, anglers, and crabbers - avoid selected waterways (including some **inland waters**)
- Advised not to eat fish, crustaceans or shellfish from these waters
- Thoroughly wash, clean and disinfect fishing gear
- Included **Passaic**, Hudson & Raritan Rivers, Newark & Raritan Bays, among others
- Boating, fishing and crabbing advisories lifted for many waterways – December 7, 2012



Inland Flood Water Sampling

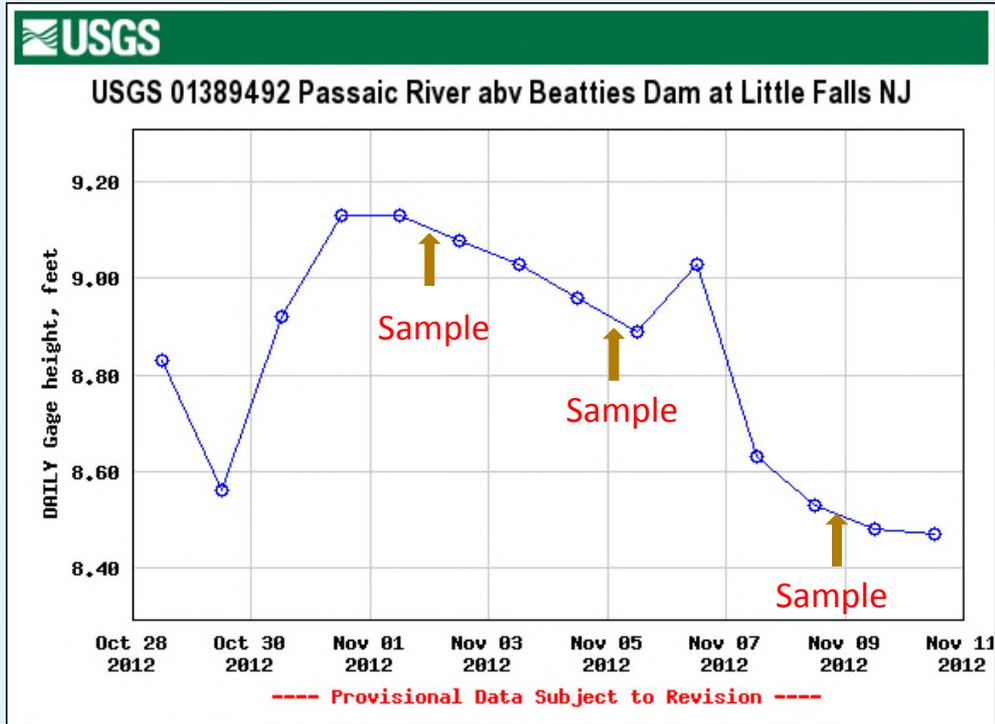


- **Where sample?**
- **When?**
- **How often?**
- **Which parameters?**
- **Response plan (recreational use?) or study of flood impacts?**

Developing Inland Flood Monitoring Response to Sandy

- **Lacked monitoring SOP, but better prepared after Irene/Lee**
- **Management request – sample public access areas with elevated flow/flooding & sewage impacts**
- **Multiple potential objectives - long-term ecological impacts of floods or short –term information (e.g. secondary contact exposure). DEP focused on latter.**
- **Sought assistance for flood monitoring response from other states, EPA, USGS-NJWSC, and NJ Water Monitoring Council**

Example *E. coli* Results Near Public Access Points After Sandy: Passaic River



Flood Stage = 11.3'

Site	Site ID	Location	Historical <i>E. coli</i> Ranges (MPN/100ml)	<i>E. coli</i> Results (MPN/100ml)			NJ SWQS Primary Contact Recreation, Single Sample Maximum = 235/100 ml No Secondary Contact Recreation Criteria
				11/2/2012	11/5/2012	11/9/2012	
Passaic R.	01382000	Two Bridges Rd, Two Bridges	20-5000	34.5	49.6		
Passaic R.	01389500	Union Ave, Little Falls	0-3200	195.6	37.9		
Passaic R.	01389870	Morlot Ave, Fairlawn	not sampled	648.8	410	325.5	
Passaic R.	01389880	Rt. 46, Elmwood Park	5000-14000*		630	81.3	

Blanks= bacterial indicator not collected

* Historical results are only from two samples taken immediately following Hurricane Irene by USGS 8/31&9/1/11.

Water-quality Sampling during Extreme Weather – Field Challenges

Collecting a representative sample

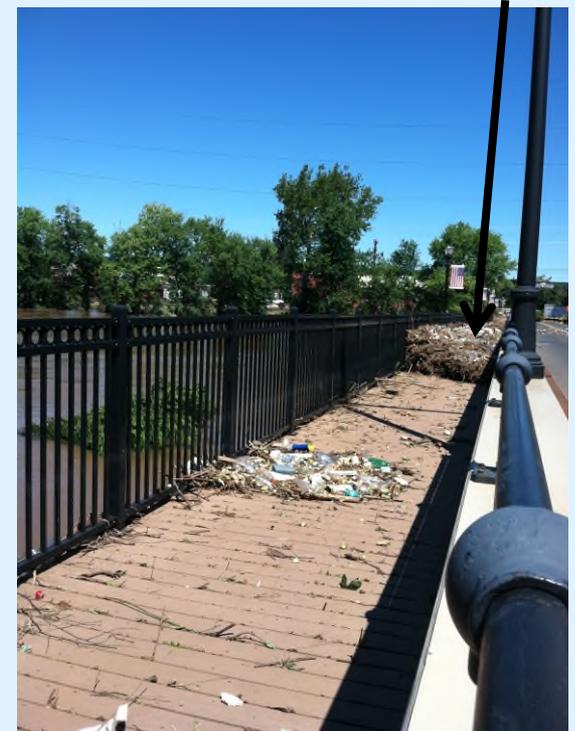
- Streams expand across flood plain
- Increased depth and velocity
- What sampling method is best?



Access to sampling sites

- Roads closed
- Bridge safety – debris (floating and accumulated), structural integrity

Wall of debris



Inland Waters: Challenges/Solutions/Resources Needed

Challenges

- **Sampling prep. w/o field office power**
- **Coordination of lab emergency sample receipt & processing**
- **Lab QA/QC documentation for quick turnaround samples**
- **Assuring field personnel safety**
- **Maintaining communication re: monitoring activities (e.g., USGS phones down)**
- **Secondary contact criteria unavailable for inland waters**

Some Solutions

- **Readily-accessible maps and data - paper or electronic remote access**
- **Established lab emergency protocols**
- **Crews have on-hand all required sample containers and submission forms**
- **Sampling delayed until emergency conditions cease**
- **Two-person crews, readily equipped with necessary safety gear**
- **Partnering with other agencies where possible (e.g., USGS)**
- **Draft Inland Flood Monitoring Plan developed**

Resources Needed/Used

- **Need for flexible Plan to address management requests**
- **Finalize Draft Plan with NJ Water Monitoring Council**
- **Need secondary contact guideline/criterion**
- **Gained knowledge from:**
 - **2008 Iowa flooding (Iowa DNR)**
 - **2005 Hurricane Katrina -New Orleans (EPA R6)**
 - **2011 Hurricane Irene in New Jersey (USGS NJWSC)**
 - **EPA HQ Monitoring Branch**
- **Need ready access to best inland flood monitoring practices– NWQMC website?**



In-land Water-quality Sampling during Extreme Weather – Planning & Preparation

- **Set purpose & scope**
 - How will data be used?
 - Flexible – respond to management needs, env. conditions and potential pollutant sources
- **Develop Sampling plan**
 - Site selection
 - Duration and frequency
 - Parameters
 - Lab capacity
- **Implement plan**
 - Set triggers to start implementation
 - Advanced Planning
- **National Weather Service**
 - Quantitative Precipitation Forecasts (7days prior)
 - Flood forecasts (5-days prior)
 - Flood impacts
- **Event Monitoring**
 - USGS Water Alert
 - Threshold notification
 - USGS Water Watch
 - Near Real-time data
 - Current Flood stages
 - NWS Doppler Radar
- **Safety Preparations**
 - Site specific plans
 - Job hazard analysis
 - Safety gear

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