Water Research Foundation℠

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Assessment of the Operational and Economic Impacts of Hurricane Irene on Drinking Water Systems

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at the Second Symposium on Building a Weather-Ready Nation – February 5, 2014

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Water Research Foundation
Project Manager: Kim Linton

Critical infrastructure inundated
Photos courtesy of Nancy Trushell

Acknowledgement:
United Water (N.Y., N.J., Penn.)
New York City Water Supply, N.Y.
Regional Water Authority, Conn.
Aquarion Water Company, Conn.
Deerfield Fire District, Mass.
Norwich Public Utilities, Conn.
Colrain Fire District #1, Mass.
Shelburne Falls Fire District, Mass.
Westfield Water Resources Department, Mass.
Aquaria Water LLC, Mass.
Mattapoisett Water and Sewer, Mass.
Sandwich Water District, Mass.
Middlesex Water Company, N.J.
Town of Bethlehem, N.Y.
City of Plattsburgh, N.Y.
Chester Water Authority, Pa.
Abbey Lane Community Association, R.I.
Shady Harbor Fire District, R.I.
North Kingstown Water, R.I.
Woonsocket Water Division, R.I.
East Smithfield Water District, R.I.
Glendale Water Association, R.I.
Oakland Association Inc., R.I.
Smithfield Water Supply Board, R.I.
Quonochontaug East Beach Water Association, R.I.
Johnston Water Control Facility, R.I.
Newport News Waterworks, Va.
Virginia Beach Department of Public Utilities, Va.

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Goal of Project, Data Acquisition & Methodology

Woodcliff Lake Dam of United Water New Jersey
Photos courtesy of Jim Glozzy

GOAL: Identify magnitude of impact & lessons learned

SURVEY:

- Survey included both open-ended and multiple choice questions
  - * Economic evaluation – key!
- Administered March 15, 2012 to April 12, 2012
- Sent to over 200 water systems that were potential impacted based on:
  - WaterRF Membership
  - State staff in the Northeast states
  - Location and Safe Drinking Water Information System (SDWIS) database
- Follow-up interviews conducted after survey closed




Survey Respondents

Population Range	Did Not Experience Operational or Economic Impacts	Did Experience Operational or Economic Impacts	Total
a. 25-500	4	6	10
b. 501-3,300	2	2	4
c. 3,301-10,000	2	4	6
d. 10,001-100,000	4	9	13
e. >100,000	5	10	15
Not Available	10	7	17
Grand Total	27	38	65

Source: Population estimates retrieved from the Safe Drinking Water Information System (SDWIS) online at http://www.epa.gov/enviro/facts/sdwis/search.html.

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Survey Respondents

State	Did Not Experience Operational or Economic Impacts	Did Experience Operational or Economic Impacts	Total
Rhode Island	9	10	19
Mass.	3	7	10
New Jersey	1	4	5
New York	0	4	4
Connecticut	0	3	3
Pennsylvania	1	1	2
Virginia	0	2	2
Delaware	1	0	1
North Carolina	1	0	1
Did Not Specify	10	7	17
Total	27	38	65

Note: Blue highlighting identifies states in which more than half the respondents experienced operational or economic impacts.




Water Systems Interviewed

- United Water (New York, New Jersey, Pennsylvania)
- New York City Water Supply, N.Y.
- Regional Water Authority, Conn.
- Aquarion Water Company, Conn.
- Deerfield Fire District, Mass.

Spillway flooding

Photo courtesy of Charles Darling

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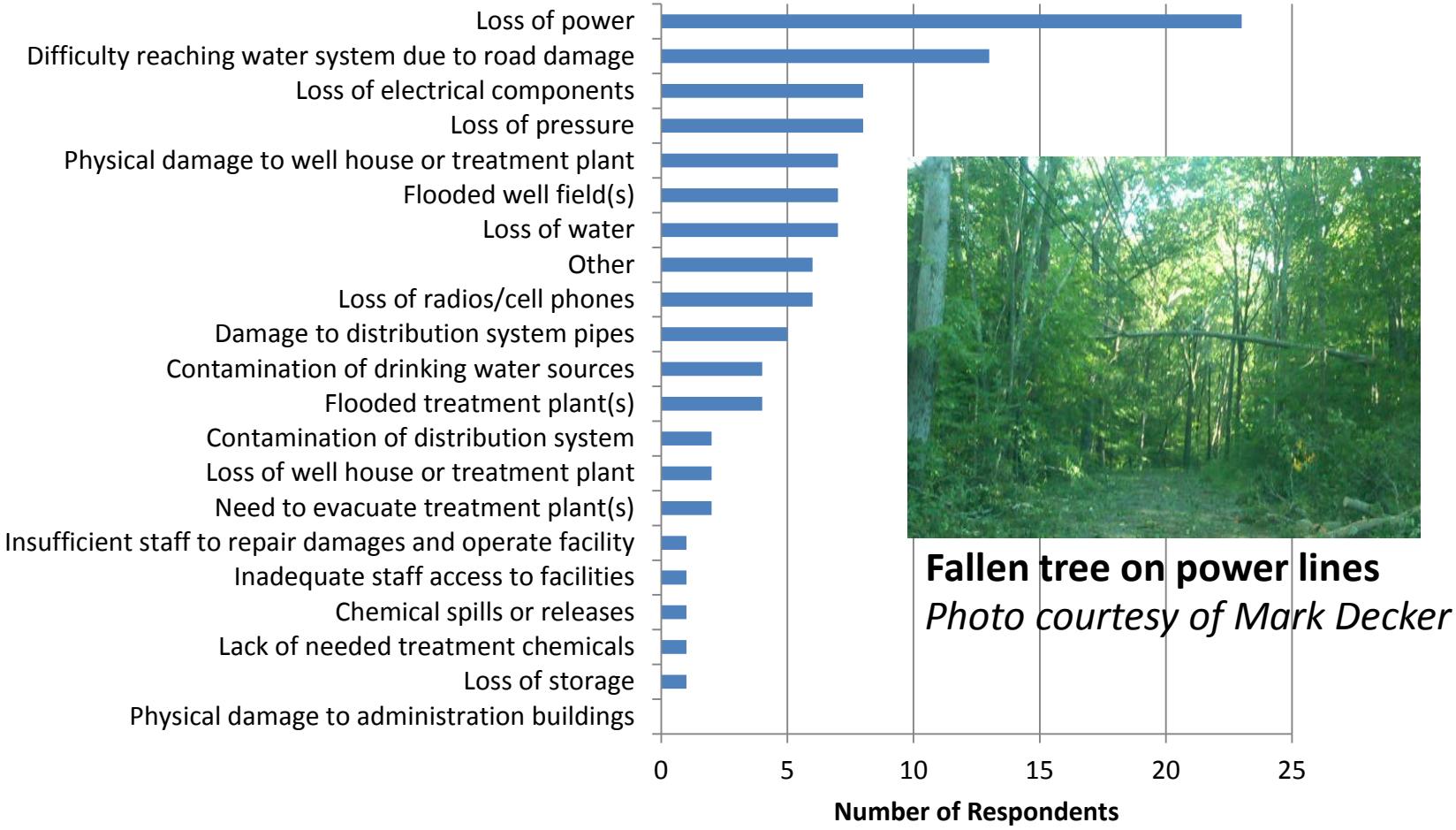
Impacts to Drinking Water Systems During and Following the Storm



Fallen tree on power lines

Photo courtesy of Mark Decker

Note: Several respondents reported more than one impact in the figure above.

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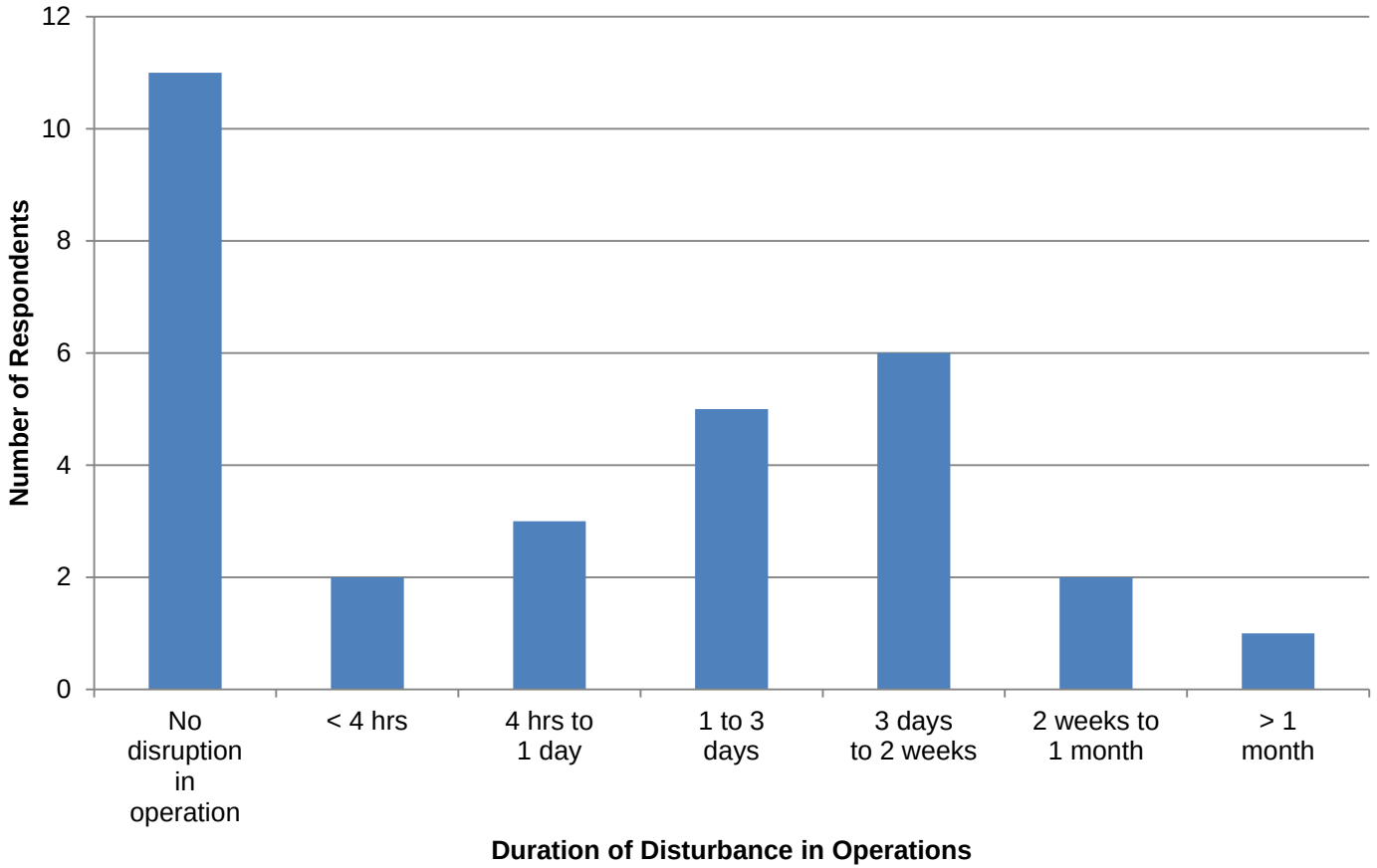
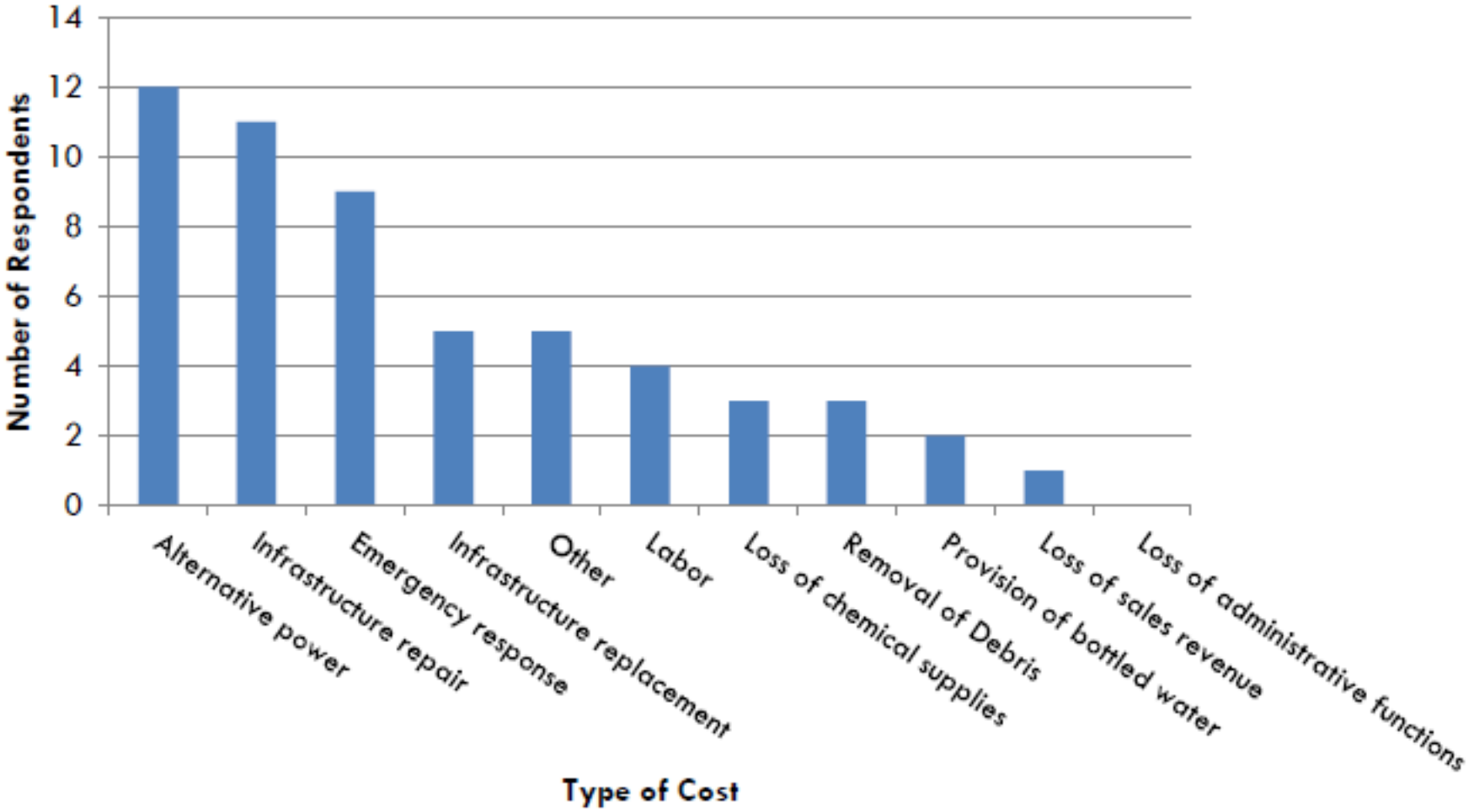
Amount of Time Required for Systems to Become Fully Operational Following Hurricane Irene



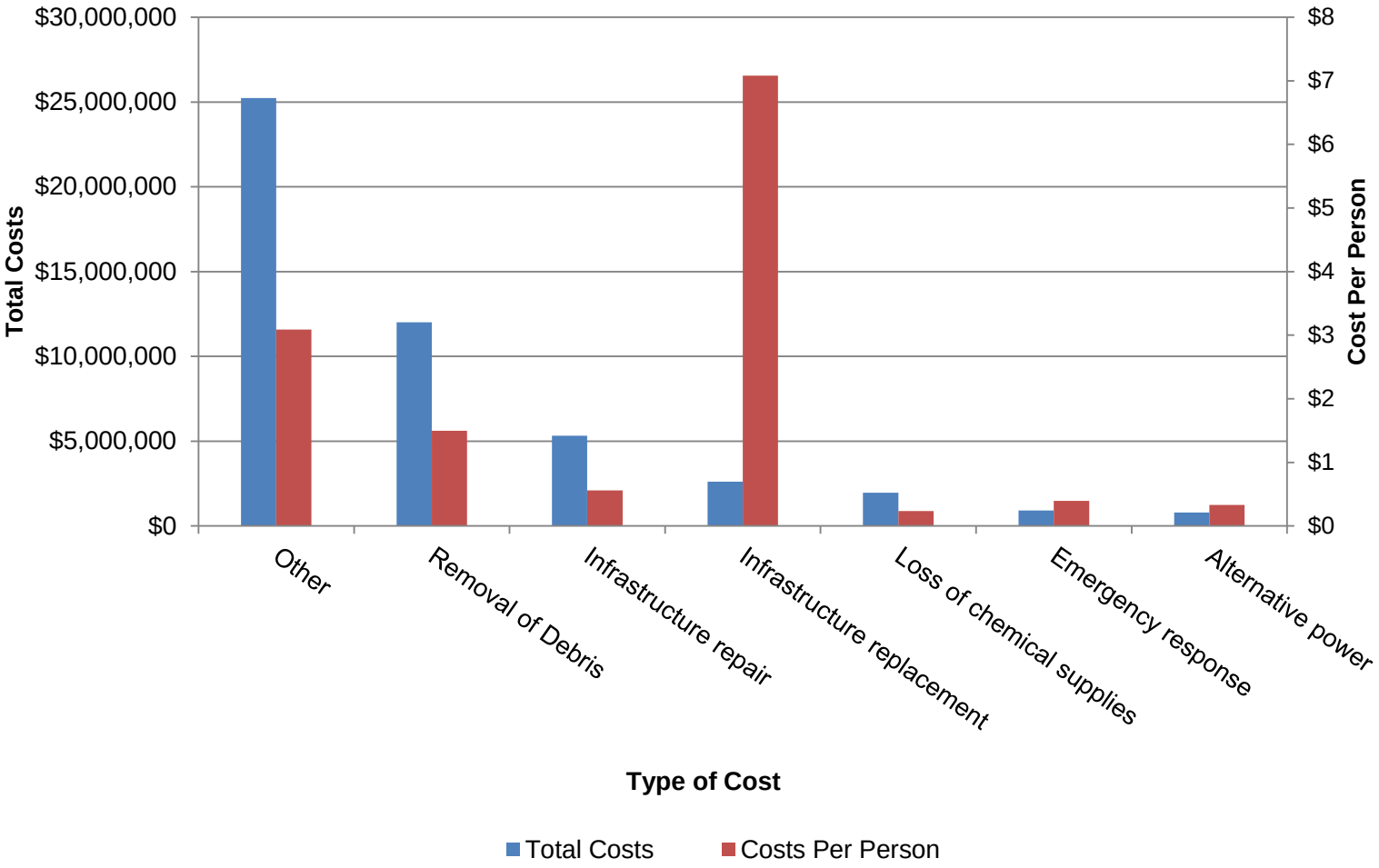



Type of Costs Reported by Drinking Water Systems due to the Hurricane





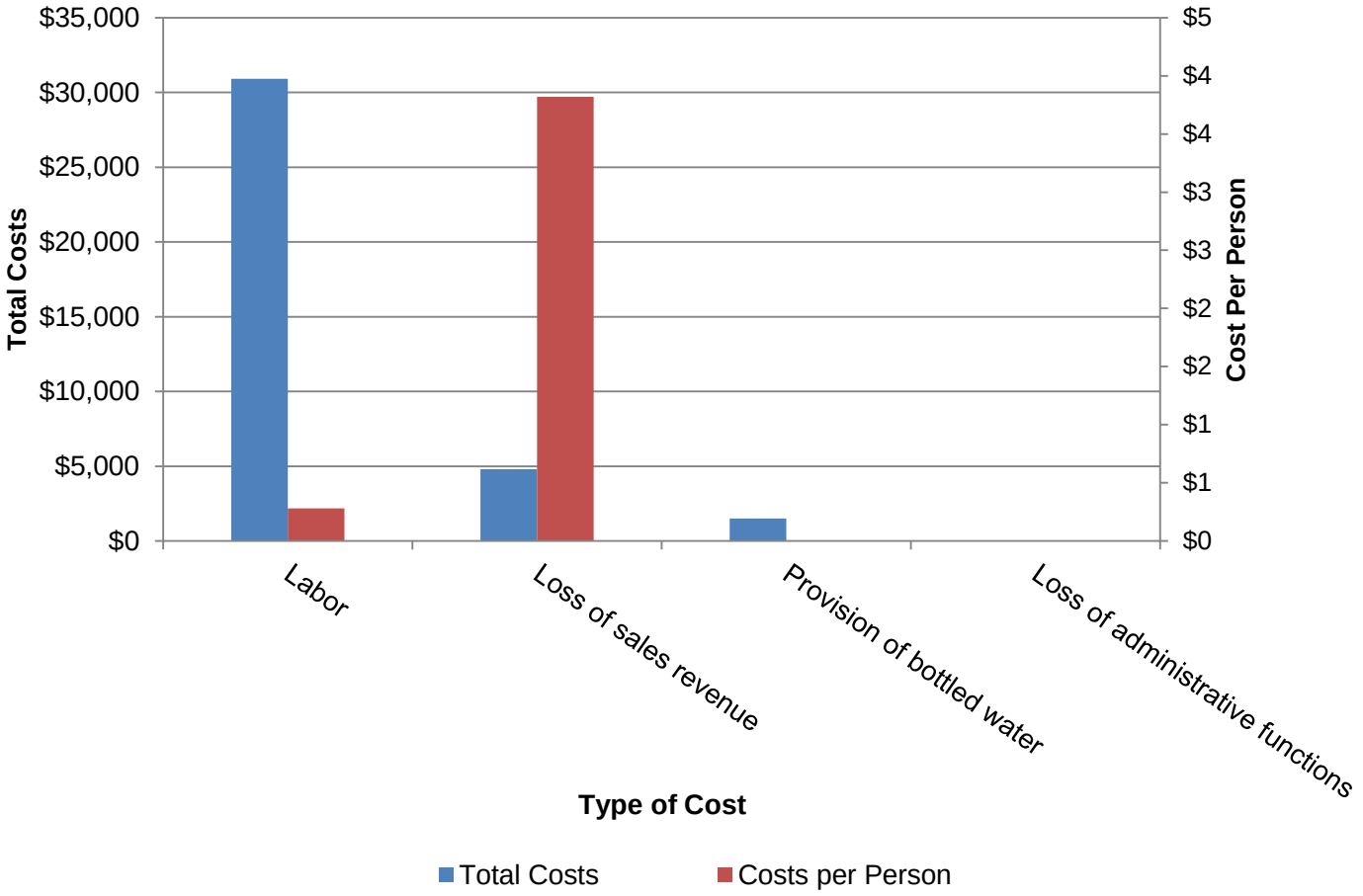

Magnitude of Costs Reported by Drinking Water Systems (1)



Note: Costs per person were calculated by diving the cost in each category by the total population served by drinking water systems that reported a cost in that category.




Magnitude of Costs Reported by Drinking Water Systems (2)



Note: Costs per person were calculated by diving the cost in each category by the total population served by drinking water systems that reported a cost in that category.

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Hurricane Irene Costs by State

State	Number of Drinking Water Systems		Total Costs Reported	Average Costs Reported by Systems with at Least Some Cost (21)	Average Costs Reported for all Respondents (64)	Population of Drinking Water Systems that Reported at Least Some Cost (21)	Average Cost Per Person
	In Survey	Reporting Costs					
CT	3	3	$412,727	$137,576	$137,576	796,388	$0.52
DE	1	None					
MA	10	6	$1,905,307	$317,551	$190,531	75,534	$25.22
NC	1	None					
NJ	5	3	$1,172,000	$390,667	$234,400	922,847	$1.27
NY	4	4	$45,372,500	$11,343,125	$11,343,125	8,325,173	$5.45
PA	2	None					
RI	19	4	$3,550	$888	$187	50,605	$0.07
SC	1	None					
VA	2	1	$6,000	$6,000	$3,000	446,067	$0.01
Total	65	21	$48,872,084	$2,327,242	$751,878	10,616,614	$4.60

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Hurricane Irene Costs by Drinking Water System Size

Population Served	Total Cost Reported	Number of Water Systems Reporting Costs	Average Cost per Water System that Reported Costs	Total Population of Survey Respondents at Water Systems that Reported Costs	Average Cost per Person Served by Drinking Water Systems that Reported Costs
a. 25-500	$2,740	3	$913	475	$5.77
b. 501-3,300	$94,079	2	$47,040	3,492	$26.94
c. 3,301-10,000	$807,408	2	$403,704	11,172	$72.27
d. 10,001-100,000	$2,476,357	7	$353,765	228,740	$10.83
e. >100,000	$45,491,500	7	$6,498,786	10,372,735	$4.39
Not Available	$0	0	$0	N/A	N/A
Total	$48,872,084	21	$2,327,242	10,616,614	$4.60

Source: Population estimates retrieved from the Safe Drinking Water Information System (SDWIS) online at http://www.epa.gov/enviro/facts/sdwis/search.html.



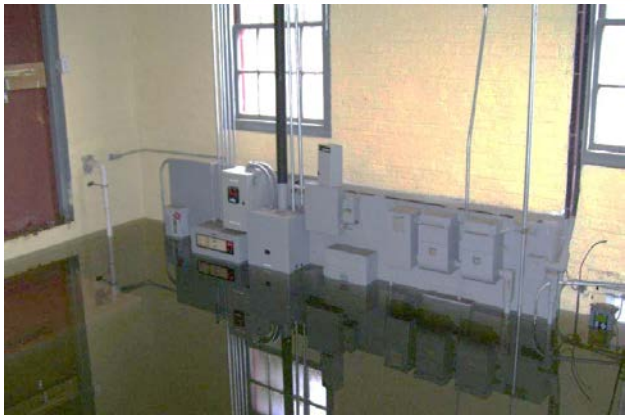

Lessons Learned and Recommendations

Transmission main washout
Photo courtesy of Jim Glozzy

- An increased sampling regimen - most frequently reported precaution.
  - Prepare by having water sampling supplies on hand.
- Additional staff/staff hours required….can be costly.
  - Prepare a staffing plan for emergencies
  - Establish clear expectations with vendors and contractors
- Communication is key.
  - Establish clear channels of communication with regulators, neighboring drinking water systems, other utilities, media outlets, and other local emergency responders.
- Road Blocks (literally) are inevitable
  - Include evacuation and alternate access routes to assist crews during emergency situations in your emergency response plan.




Financing an Emergency



Electrical flooding at well house
Photo courtesy of Susan Licardi

- Medium-sized systems (3,301-10,000) - greatest per person cost as a result of Hurricane Irene.
- Small systems (<3,301) - most vulnerable to increased operating costs as a result of Hurricane Irene.
- FEMA reimbursements can take time;
  - Develop a business continuity plan/contingency plan
  - Work with your FEMA representative ASAP
    - photo log of your damages.
- Insurance coverage (actual and required) will impact your emergency response funding eligibility. Determine if your insurance coverage is appropriate.




Partnerships and Planning

Road block due to storm damage
Photo courtesy of John Triana

- **Strategic partnerships** can provide drinking water systems with support and resources needed to address unexpected failures during an emergency.
  - Utilities, Department of Public Works, and Public Service providers in neighboring towns can help supplement the local availability of emergency assistance.
  - Regulators and local government officials
  - Utilities providers (electricity)
- **After Action Report** Document your lessons learned
- **Plan regularly and practice more often**, including reviewing safety measures with staff frequently.




Summary

- **Regular Planning**: Drinking water systems reported that having an up-to-date emergency response plan was critical. A checklist provided a quick evaluation method to make sure preparations were ready.

- **Power:** Drinking water systems that had developed comprehensive emergency power plans that incorporated communication protocols for internal and external power sources found that they were able to deal with power issues efficiently and avoid prolonged power outages.

- **Communication**: Survey respondents indicated that having established clear channels of communication with regulators, neighboring drinking water systems, other utilities, media outlets, and other local emergency responders prior to the storm was invaluable during and following the hurricane. Phone/telemetry systems were often a large problem.




Summary

- **Incident Command Structure (ICS):** Drinking water systems identified their ICS as an important resource for responding to storm events. Regularly updating their ICS, keeping staff well-informed about their ICS and making sure that all roles are taken seriously were identified as critical actions for being prepared for an emergency. Utilities learned where to place their ICS so that it was not heavily impacted by the storm. Adequate power for communication is fundamentally important.

- **Staffing:** Emergency situations often require additional staff, additional time from existing staff, and in some cases, contract staff or vendors in order to respond to an emergency situation. Utilities prepared special schedules to make sure staff could be rotated. Food and cots for sleeping were available in case roads were closed.

Summary

- **Road Blocks:** A major obstacle that many survey respondents faced was road closures. Respondents recommended including evacuation and alternate access routes to assist crews during emergency situations.

- **Infrastructure Maintenance:** Survey respondents recommended timely infrastructure maintenance and replacement as key to maintaining the resiliency of infrastructure and reducing damages during a major storm event such as a hurricane.




Summary

- **Take Advantage of Resources:** Neighboring water utilities were often able to successfully provide assistance to smaller drinking water systems by loaning them equipment, such as generators, during and after Hurricane Irene. The AWWA Water and Wastewater Agency Response Networks (WARN) was very effective at helping utilities coordinate help across several states. Partnerships with utilities, public works, and public service providers in neighboring towns can help supplement the local availability of emergency assistance.

- **Documenting Lessons Learned**: Documenting successes and failures in an "After Action Report" immediately following an emergency event can act as a record of damages, infrastructure capacity, response protocols, recommendations for future emergencies and improvements.




Summary

- **Financial Assistance and FEMA:** Drinking water systems found that it was important to coordinate with the appropriate entities to determine the primary FEMA contact and to establish clear lines of communication to keep all parties informed of the process. Drinking water systems reported that FEMA reimbursement arrived several months after costs were incurred. Drinking water systems can anticipate this kind of delay in their business continuity plans in order to maintain drinking water services..

- **Insurance.** Insurance coverage may affect emergency fund relief eligibility. Sitting down with an insurance agent may help drinking water systems prepare financially for future emergency costs.

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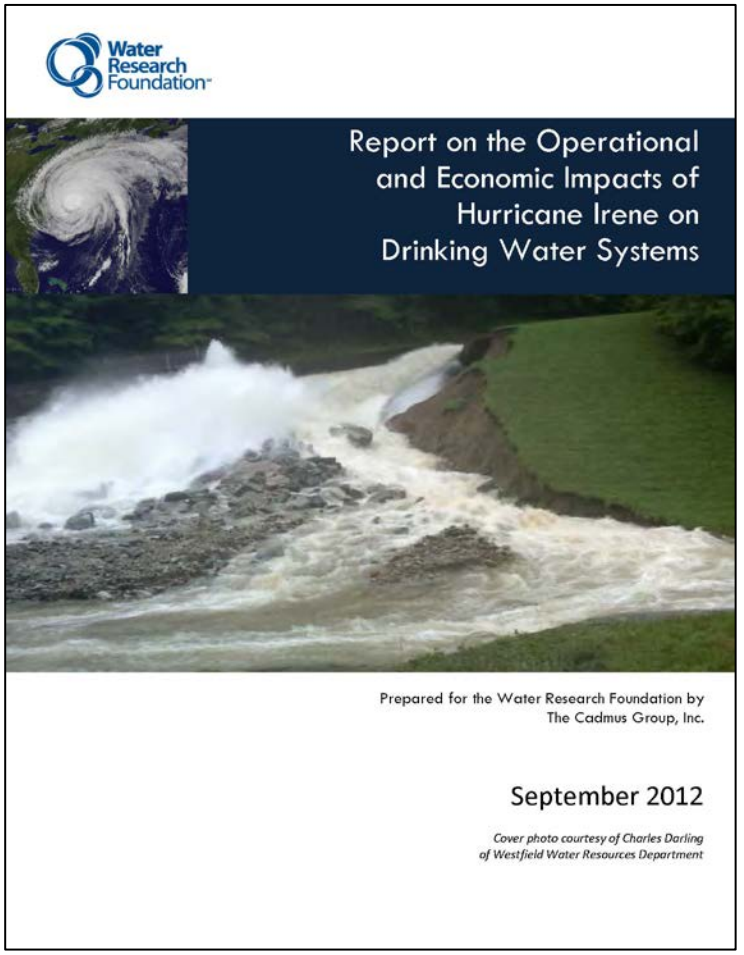
http://www.waterrf.org/resources/Lists/PublicSpecialReports/Attachments/6/Hurricane_Irene_Survey_Report.pdf

Photo courtesy of Alan Weland



Questions?

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