REQUEST FOR PROPOSALS (RFP)

Framework for Returning Distribution Systems to Service After Extreme Events (RFP 5422)

Date Posted
Monday, July 27, 2026

Due Date
Proposals must be received by 3:00 pm Mountain Time on Monday, September 14, 2026.

WRF Project Contact
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Project Sponsors
This project is funded by The Water Research Foundation (WRF) as part of WRF's Research Priority Program.

Project Objectives
The purpose of this project is to provide guidance to help utilities safely restore drinking water distribution systems following extreme events. Restoration is defined as returning system functionality and water quality to conditions that allow the safe resumption of normal service and the lifting of public health advisories.

Specific objectives are to:

1. Identify and categorize extreme events (e.g., flooding, wildfires, freezing events, storms, and other relevant events) that impact distribution systems and assess their implications for system performance and water quality.
2. Evaluate system characteristics that increase vulnerability, including depressurization, pipe leakage and aging infrastructure, equipment or power failures, electrical grid dependencies, and limited source water availability or treatment constraints.
3. Characterize chemical, microbiological, and other contaminants that may affect a distribution system following an extreme event.
4. Examine how extreme events influence treatment processes and operational conditions during system recovery, including the need to adjust treatment dosing under non-ideal startup conditions.
5. Evaluate approaches for restoring system integrity and water quality during system recovery.

6. Assess the criteria used by utilities and regulators to determine when normal operations can safely resume. Review and compare public notification practices, including boil water advisories, do-not-drink notices, and do-not-use notices with respect to the conditions required to lift these advisories.
7. Identify and evaluate monitoring, sampling, and analytical strategies; relevant data sources; and available state and federal support programs that support quicker response time and decision making during system recovery.
8. Synthesize best practices and develop practical guidance, including decision-making frameworks, to support utilities in safely restoring distribution system operations and improving resilience to future extreme events.

Budget
Applicants may request up to $250,000 in WRF funds for this project.

Background and Project Rationale
Extreme events place severe stress on distribution infrastructure, resulting in multi-point failures, compromised structural integrity, and unpredictable system dynamics. These events can also create cascading impacts, such as disruptions to supply chains that limit access to treatment chemicals for public health and regulatory compliance.

In such situations, the transition from emergency response to normalized service represents a critical phase of vulnerability. When an extreme event (e.g., flood, wildfire, earthquake, hurricane) subsides and the distribution system has been fully or partially compromised, often through depressurization, ensuring the safety of the drinking water supply before returning the system to service is essential.

The increasing frequency and severity of extreme weather events further elevate the risk of service disruptions and contamination. These disruptions can affect water quality, service reliability, regulatory compliance, consumer confidence, and operational costs. In addition, changes in source water quality (e.g., pH, alkalinity, hardness, turbidity, and total organic carbon [TOC]) may affect the treatability following such events.

Distribution systems may also become contaminated with a range of chemical and microbiological contaminants, including nutrients, volatile organic compounds (VOCs), heavy metals, disinfection byproducts (DBPs), pathogens, and fecal and total coliforms. Additional concerns include nitrification, taste and odor compounds, cyanotoxins, and corrosion-related byproducts such as lead and copper mobilization following stagnation or changes in water chemistry.

Compounding these challenges, many utilities lack the resources necessary to identify contamination sources and validate water safety across their distribution systems, including reliable hydraulic models, adequate laboratory capacity, and specialized personnel. This disparity in technical readiness is often more pronounced in smaller systems compared to larger utilities.

Several WRF projects have highlighted the complexity of extreme events and their ability to expose previously unknown system vulnerabilities. For example, Stanford et al. 2014 compiled utility case studies demonstrating how extreme weather can disrupt both treatment and distribution systems and compromise water quality. Such events may involve simultaneous power outages, infrastructure damage, treatment interruptions, and depressurization, revealing both operational and infrastructure weaknesses.

Some studies have also reported increases in gastrointestinal illnesses and waterborne diseases following extreme events, although these impacts are often associated with a range of exposure pathways, including disruptions to water infrastructure and environmental contamination (Cann et al. 2013, Lowe et al. 2013, Lynch and Shaman 2023, Bekkelund et al. 2025).

Despite these insights, utilities continue to face challenges in safely restoring distribution system operations after extreme events. Recovery actions typically include repairing damaged infrastructure, restoring system pressure, flushing affected pipelines, adjusting disinfectant residuals, and conducting microbial monitoring before reactivation. However, there remains limited consolidated guidance on systematically assessing microbial and chemical contamination risks, identifying appropriate monitoring parameters, and determining when it is safe to lift public health notifications such as boil water or do-not-drink advisories.

Research Approach

This project will primarily use a desktop study approach to synthesize existing knowledge from published literature, utility experiences, regulatory practices, and available resources related to extreme events affecting drinking water distribution systems. The research will identify best practices and develop practical guidance to support utilities in restoring normal operations following such events.

The research approach will include the following tasks:

- **Literature Review:** A comprehensive review of published literature, technical reports, and previous research studies will be conducted to document the impacts of extreme events on drinking water distribution systems. The review will cover events such as flooding, severe storms, wildfires, blizzards or freezing conditions, earthquakes, and other incidents that may result in depressurization, infrastructure damage, and water quality degradation.

  The review will also synthesize information on chemical and microbiological contaminants, treatment challenges, monitoring parameters, and relevant data sources used during system disruption and recovery. In addition, the review will examine approaches for restoring system integrity and water quality, including pipe flushing and line cleaning, turbidity management, and disinfection strategies. Mitigation and preparedness strategies, as well as lessons learned from past events, will also be documented. Relevant state and federal guidance and existing best practices for system recovery and public health protection will be synthesized.

- **Case Studies of Utility Experiences**: Case studies will be compiled from utilities that have experienced extreme events affecting their distribution systems, supplemented by interviews and surveys. Each case study will include a summary profile of key utility characteristics (e.g., size, location, source water, treatment complexity, and hazard profile).

  Case studies will examine the types of events encountered, operational challenges during recovery, actions taken to restore system integrity and water quality, including treatment adjustments and restoration practices (e.g., flushing, cleaning, and disinfection strategies). Monitoring and sampling strategies, as well as public notifications issued, will be reviewed, including communication approaches and conditions used for lifting advisories. Lessons learned, successful strategies, and areas requiring additional guidance will be documented.

- **Review of Regulatory Practices:** Federal and state regulatory guidance and requirements related to emergency response and system recovery will be reviewed. Particular attention will be given to the criteria used for issuing and lifting public notifications, including boil water advisories, do-not-drink notices, and do-not-use notices, as well as criteria used to determine when normal and/or modified operations can safely resume. Differences across jurisdictions will be summarized to identify common practices and opportunities for improving guidance.

- **Review the Available Resources and their Applications**: This task will evaluate the technologies, tools, and operational capabilities available to support system recovery. Consideration will be given to differences in resources across small and large utilities. Technologies to be reviewed may include monitoring systems (e.g., chlorine analyzers, turbidity sensors, pressure monitoring), hydraulic system models, sampling technologies, and analytical methods. Relevant resources (e.g., Risk and Resilience Assessments and Emergency Response Plans under America's Water Infrastructure Act [AWIA]) will also be evaluated.

  This task will also identify state and federal agencies and support programs available to utilities during system recovery. Findings will inform recommendations tailored to utilities with varying levels of technical capacity.

- **Development of Best Practice Guidance:** Findings from the literature review, case studies, and regulatory review will be synthesized into practical guidance for utilities. The guidance will provide recommended approaches for assessing system impacts, evaluating water quality, implementing monitoring and sampling strategies, and communicating with the public. The guidance will also address mitigation and preparedness strategies to improve future system resilience and response.

  The guidance will include decision-support frameworks to assist utilities in determining when it is safe to return systems to normal operation following extreme events and lifting public health advisories. Knowledge gaps and areas requiring further research will be identified.

Expected Deliverables
The expected deliverables are outlined while allowing flexibility to encourage creativity and originality from proposers.

- Research report (must use WRF's *Research Report Template*)
- Literature review
- Workshop
- Utility and state or federal regulator interviews and survey responses
- Guidance documents
- Practical implementation checklist for utilities
- Webcast
- Peer-reviewed publications

Communication Plan
Please review WRF's *Project Deliverable Guidelines* for information on preparing a communication plan. Conference presentations, webcasts, peer-reviewed publication submissions, and other forms of project information dissemination are typically encouraged.

Project Duration
The anticipated period of performance for this project is 24-30 months from the contract start date.

References and Resources
The following list includes examples of research reports, tools, and other resources that may be helpful to proposers. It is not intended to be comprehensive, nor is it a required list for consideration.

Bekkelund, A., P. Langlete, C. F. Nordheim, T. A. Ziesler, E. H. Madslien, and S. Hyllestad. 2025. *Extreme weather and drinking water safety: impacts of the 2023 flood Hans in Norway*. International Journal of Hygiene and Environmental Health, Volume 270. https://doi.org/10.1016/j.ijheh.2025.114677.

Cann, K. F., D. Rh. Thomas, R. L. Salmon, A. P. Wyn-Jones, and D Kay. 2013. *Extreme water-related weather events and waterborne disease*. Epidemiology & Infection. Volume 141. Issue 4. pp. 671 – 686. https://doi.org/10.1017/S0950268812001653.

Draper, W. M., N. Li, G. M. Solomon, Y. C. Heaney, R. B. Crenshaw, R. L. Hinrichs, and R. E. P. Chandrasena. 2022. *Organic chemical contaminants in water system infrastructure following wildfire*. ES&T. Vol. 2. Issue 2. https://doi.org/10.1021/acsestwater.1c00401

Lowe, D, K. L. Ebi, and B. Forsberg. 2013. *Factors Increasing Vulnerability to Health Effects before, during and after Floods*. Int. J. Environ. Res. Public Health. Volume 10. Issue 12. pp. 7015 –7067. https://doi.org/10.3390/ijerph10127015.

Lynch, V. D., and J. Shaman. 2023. *Waterborne Infectious Diseases Associated with Exposure to Tropical Cyclonic Storms, United States, 1996–2018.*, Volume 29, Number 8. https://doi.org/10.3201/eid2908.221906.

Solomon, G. M., S. Hurley, C. Carpenter, T. M. Young, P. English, and P. Reynolds. 2021. *Fire and Water: Assessing Drinking Water Contamination after a Major Wildfire*. ES&T. Volume 1. Issue 8. https://doi.org/10.1021/acsestwater.1c00129.

Stanford, B. et al. 2014. *Water Quality Impacts of Extreme Weather-Related Events*, Project 4324. Denver, CO: The Water Research Foundation. (A copy will be provided upon request)

Proposal Evaluation Criteria

The following criteria will be used to evaluate proposals:

- Understanding the Problem and Responsiveness to RFP (maximum 20 points)
- Technical and Scientific Merit (maximum 30 points)
- Qualifications, Capabilities, and Management (maximum 20 points)
- Communication Plan, Deliverables, and Applicability (maximum 15 points)
- Budget and Schedule (maximum 15 points)

PROPOSAL PREPARATION INSTRUCTIONS

Proposals submitted in response to this RFP must be prepared in accordance with WRF's *Guidelines for Research Priority Program Proposals*. The guidelines include instructions on technical aspects, financial statements, indirect costs, and administrative requirements that the applicant must follow when preparing a proposal.

Proposals that include the production of web- or software-based tools, such as websites, spreadsheets, databases, etc., must follow the criteria outlined for web tools presented in the *Technology Deliverables Guidance*.

Eligibility to Submit Proposals
Proposals will be accepted from both U.S.-based and non-U.S.-based entities, including educational institutions, research organizations, governmental agencies, consultants, or other for-profit entities.

WRF's Board of Directors has established a *Timeliness Policy* that addresses researchers' adherence to the project schedule. Researchers who are late on any ongoing WRF-sponsored studies without approved no-cost extensions are not eligible to be named participants in any proposals. Direct any questions about eligibility to the WRF Project Contact listed at the top of this RFP.

Administrative, Cost, and Audit Standards
WRF's research program standards for administrative, cost, and audit compliance are based upon, and comply with, Office of Management and Budget (OMB) Uniform Grants Guidance (UGG), 2 CFR Part 200 Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, and 48 CFR 31.2 Contracts with Commercial Organizations. These standards are referenced in WRF's *Guidelines for Research Priority Program Proposals* and include specific guidelines outlining the requirements for indirect cost negotiation agreements, financial statements and the Statement of Direct Labor, Fringe Benefits, and General Overhead. Well in advance of preparing the proposal, your research and financial staff should review the detailed instructions included in WRF's *Guidelines for Research Priority Program Proposals*.

Budget and Funding Information
The maximum funding available from WRF for this project is $250,000. The applicant must contribute additional resources equivalent to at least 33% of the project award. For example, if an applicant requests $100,000 from WRF, an additional $33,000 or more must be contributed by the applicant. Acceptable forms of applicant contribution include cost share, applicant in-kind, or third-party in-kind that comply with 2 CFR Part 200.306 cost sharing or matching. The applicant may elect to contribute more than 33% to the project, but the maximum WRF funding available remains fixed at $250,000. Proposals that do not meet the minimum 33% of the project award will not be accepted. Consult the *Instructions for Budget Preparation* on the Outbound Grants page for more information and definitions of terms.

Period of Performance
It is WRF's policy to negotiate a reasonable schedule for each research project. Once this schedule is established, WRF and its sub-recipients are contractually obligated to adhere to it. Under WRF's *No-Cost Extension Policy*, a project schedule cannot be extended more than nine months beyond the original contracted schedule, regardless of the number of extensions granted.

Utility and Organization Participation
WRF encourages participation from water utilities and other organizations in WRF research. Participation can occur in a variety of ways, including direct participation, in-kind contributions, or in-kind services. To facilitate their participation, WRF has provided contact information for utilities and other organizations that have indicated an interest in this research. Proposers are responsible for negotiating utility and organization participation in their proposals. The listed utilities and organizations are under no obligation to participate, and the proposer is not obligated to include them in their proposal.

Application Procedure and Deadline
Proposals are accepted exclusively through WRF's Portal and they must be fully submitted before 3:00 pm Mountain Time on Monday, September 14, 2026.

To learn how to submit a proposal for this RFP, please visit www.waterrf.org/proposals and follow the instructions on the page.

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Grace Jang, PhD, at 303.347.6112 or hjang@waterrf.org. Questions about how to submit proposals through WRF's Portal should be directed to WRF's Customer Care Form.