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REQUEST FOR PROPOSALS (RFP)

Advancing Adaptive Wet Weather Management Approaches to Meet Emerging Challenges for Extreme Snowstorm Events and Cold Climate Impacts (RFP 5128)

Due Date: Proposals must be received by **3:00 pm Mountain Time** on **Thursday, March 10, 2022**

WRF Project Contact: Harry Zhang, PhD, PE, h Zhang@waterrf.org

Project Sponsors

This project is funded by The Water Research Foundation (WRF) as part of WRF's Emerging Opportunities Program.

Project Objectives

- Adapt rainstorm-based management approaches for extreme snowstorms and cold climate events (acute events) as part of long-term holistic wet weather management, resulting in more proactive and coordinated decision-making between municipal departments.
- Develop guidance on the state-of-the-practice for addressing snowstorm and cold climate water quality and quantity issues, infrastructure planning, and community resilience.
- Communicate with stakeholders on research findings and adaptive approaches for future planning, including recommendations on preliminary project concepts for future research.

Budget

Applicants may request up to \$50,000 in WRF funds for this project. WRF funds requested and total project value are evaluation criteria considered in the proposal selection process.

Background and Project Rationale

In the United States (U.S.), about 70% of the population lives in areas that receive 5 inches or more of snow each year. The changing climate is increasing the frequency and intensity of snowfall from winter storms, with twice as many extreme U.S. snowstorms in the latter half of the 20th century than in the first half of the century (NCEI, n.d.), including occurrences in areas unaccustomed to extreme snowstorms and cold weather events (i.e., warmer states).

More than 73% of the U.S. mainland was covered by winter snows during the week of February 14-20, 2021 (NWS, n.d.), from the Southern Plains to the Mid-Atlantic, as well as the Northeast and the Pacific Northwest. At a more regional scale, Winter Storm Uri had a significant impact on Texas, resulting in dozens of fatalities, leaving millions without power and nearly 15 million with water issues, and causing an estimated \$100 billion in damage, which is on a scale matching Hurricanes Harvey and Katrina, and

Superstorm Sandy. The negative impacts of extreme winter storms include power outages, inaccessibility to potable water, and flooding from snowmelt.

Wet weather management measures focused on rainstorms are not optimal for managing extreme snowstorms, snowmelt runoff, or projected cold climate impacts. The focus of this research study is on adaptive approaches to snowstorms and cold weather impacts as they relate to water quantity and quality, infrastructure planning, and community resilience. The geographic focus of this study is North America, with consideration from international frameworks and best practices.

From the water quantity perspective, snowmelt runoff may result in a sudden large volume of runoff in a short period of time, which could lead to flooding, especially in urban areas. From the water quality perspective, while snowmelt contains typical rainfall runoff contaminants, it also contains higher concentrations of salts, toxins, hydrocarbons, and many other accumulated contaminants. An estimated 15 to 20 million tons of deicing salt are applied each year in the United States (Cary Institute 2010). Deicing salt is applied to mitigate snow- and ice-related hazards in the built environment. However, these deicing salts can have detrimental impacts such as degrading pipes, concrete, and other infrastructure; and reaching potable water supplies and watersheds through various pathways.

There is an emerging need to advance adaptive approaches to snowstorms and cold weather events that can facilitate more proactive decision-making by utilities, along with better coordination between traditionally siloed municipal entities.

Research Approach

Task 1. Develop a user-friendly guidance document for utilities and municipalities

The research team will conduct a study to enhance the understanding of changing patterns of snowstorms and cold climate impacts, including snowmelt volume and water quality management, through:

- literature review;
- targeted interviews (e.g., with National Oceanic and Atmospheric Administration [NOAA] for the state of predictive science and Water Resources Dashboard, Federal Emergency Management Agency for a retrospective review of snowstorms that have triggered emergency declarations, Department of Homeland Security Emergency Operations Centers, Electric Power Research Institute for interdependence with the power sector, and interested utilities and municipal partners for the state of the practice;
- online surveys to facilitate information gathering from broader stakeholders.

The research team will look into different types of winter weather according to general classification by NOAA's National Weather Service (e.g., snow, ice, and cold) and related weather variability (e.g., temperature fluctuations, snow showers, and rainfall followed by freezing temperature).

As part of the study, the research team will conduct a retrospective analysis on wet weather management approaches under extreme winter storms over the past 25 to 30 years, including those in traditionally warmer states with rare snowstorms (e.g., Texas Winter Storm Uri in 2021 and Atlanta Snowmageddon due to Winter Storm Leon in 2014).

In addition, the research team will consider equitable approaches to snowstorms and cold weather events (e.g., from socio-economic and related perspectives at the community scale). The research team

will also explore efforts to reach more vulnerable populations, particularly those that have been historically underserved. Sources such as the U.S. Environmental Protection Agency's (EPA's) Environmental Justice Screening and Mapping Tool (EJSCREEN) and studies such as *Water Rising: Equitable Approaches to Urban Flooding* (U.S. Water Alliance 2020) should be used to discuss challenges for these communities during extreme snowstorms and cold weather events.

Furthermore, the research team will prepare a synthesis of existing models and visualization tools that can be used for analyzing snowstorms and cold climate impacts using currently available data (e.g., NOAA's Water Resources Dashboard, U.S. Climate Resilience Toolkit, EPA's Storm Water Management Model, and other decision support systems).

Using the collected and synthesized information, the research team will develop an interactive guidance document for adaptive and proactive management measures in the context of utilities and municipal partners (e.g., public works and transportation agencies). The research team will engage with partner utilities throughout the project, who will help bring real-world experience that can be incorporated into the guidance document.

The research team will build on existing research and methods to identify the available practices, models, tools, and risk/uncertainty reduction strategies to address adaptive and proactive measures for snowstorm and snowmelt management. It is anticipated that a conceptual framework describing different elements of adaptive strategies will need to consider regional variations (colder states versus warmer states).

Furthermore, the research team will consider how to develop an efficient approach for conducting an order-of-magnitude cost and benefit analysis of proactive preparedness measures for extreme winter storms; for example, to make a business case for adaptive and proactive measures for snowstorms and cold climate preparedness (e.g., cost avoidance analysis). This exploratory effort will benefit utilities and municipalities by identifying proven strategies for holistic wet weather and flood management and for infrastructure protection before, during, and after major winter storm events.

This interactive guide will utilize a toolbox-based approach with decision tree logic, including (a) best management practices for deicing salt application by considering multiple objectives, (b) enhanced stormwater control measures under cold climate conditions, and (c) a list of decision support tools with their capabilities for simulating management measures.

Task 1 will connect with Task 2 to identify knowledge gaps that may not be able to be addressed through the current study (e.g., given the level of effort) and provide recommendations on future research needs.

Task 2. Conduct a virtual workshop and community outreach

The research team will conduct an invitation-only virtual workshop with partner utilities and organizations to incorporate real-world experience and gather feedback (e.g., for one full day or two half days). This effort will also help identify knowledge gaps and future research needs to be incorporated into the guidance document before publication. In addition, the research team will develop public outreach materials that can help inform stakeholders at all levels of engagement.

Expected Deliverables

- An interactive guidance document (e.g., a “pocket guide” with decision tree-based navigation and the use of visualization tools) and creative outreach materials (e.g., for city managers).
 - This document will include a chapter that summarizes the knowledge gaps, research needs, and preliminary project concepts for recommended research projects in the future.
- An invitation-only virtual workshop, along with logistics planning and all supporting materials (e.g., agenda, presentations, meeting notes, and workshop summary), and one WRF webcast.

Communication Plan

Please review WRF’s *Project Deliverable Guidelines* for information on preparing a communication plan. The guidelines are available at <https://www.waterrf.org/project-report-guidelines>. Conference presentations, webcasts, peer review publication submissions, and other forms of project information dissemination are typically encouraged.

Project Duration

The anticipated period of performance for this project is 9 to 12 months from the contract start date. The related publications from this project can go beyond the project duration.

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.

AASTHO (American Association of State Highway and Transportation Officials). [Snow and Ice Pooled Fund Cooperative Program \(SICOP\)](#).

Cary Institute. 2010. Road Salt – Moving Toward the Solution. https://www.caryinstitute.org/sites/default/files/public/reprints/report_road_salt_2010.pdf

EPA (U.S. Environmental Protection Agency). [SWMM – Storm Water Management Model](#).

EPA. [Climate Change Indicators in the United States](#).

EPA. [EJSCREEN: Environmental Justice Screening and Mapping Tool](#)

EPRI (Electric Power Research Institute). 2021. *Exploring the Impacts of Extreme Events, Natural Gas Fuel and Other Contingencies on Resource Adequacy*. Palo Alto, CA.

Henderson, J. L. Forthcoming. *Enhancement of Resilience to Extreme Weather and Climate Events: Proactive Flood Management*. Project 4842. Denver, CO: The Water Research Foundation.

Martel, K., J. Habib, J. Sokolow, B. Tobey, L. Apotheker, and R. Woodburn. 2014. *Water Utility Legal Protection and Claims Management from Infrastructure Failure*. Project 4369. Denver, CO: Water Research Foundation.

MPCA (Minnesota Pollution Control Agency). 2021. Minnesota Stormwater Manual. [Cold Climate Impact on Runoff Management](#).

NCEI (NOAA National Centers for Environmental Information). n.d. [Climate Change and Extreme Snow in the U.S.](#)

NOAA (National Oceanic and Atmospheric Association). [Water Resources Dashboard](#).

NOAA (National Oceanic and Atmospheric Association). Snow Data:

- (a) [National Weather Service - 2021 Storm Summaries](#).
- (b) [Daily U.S. Snowfall and Snow Depth](#).
- (c) [Snow and Ice](#).
- (d) [National Snow Analyses](#).

Novotny, V., D. W. Smith, D. A. Kuemmel, J. Mastriano, and A. Bartošová. 1999. *Urban and Highway Snowmelt: Minimizing the Impact on Receiving Water*. Project 94-IRM-2. Alexandria, VA: Water Environment Research Foundation.

NWS (NOAA National Weather Services). n.d. "Winter Weather - Types of Winter Weather." NWS. <https://www.weather.gov/grb/typesofwinterwx>

NWS (NOAA National Weather Services). n.d. "Historic 2021 Cold Outbreak - February 6th - 18th" <https://www.weather.gov/ict/historicCold>.

Sharvelle, S. Forthcoming. *Assessing the Microbial Risks and Potential Impacts from Stormwater Collection and Uses to Establish Appropriate Best Management Practices*. Project 5034.

<https://www.waterrf.org/research/projects/assessing-microbial-risks-and-potential-impacts-stormwater-collection-and-uses>

USGS (United States Geographic Survey). [Snowmelt Runoff and the Water Cycle](#).

U.S. Water Alliance. 2020. [Water Rising: Equitable Approaches to Urban Flooding](#).

WRF (The Water Research Foundation). 2021. [CLASIC \(Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs\)](#).

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

The Emerging Opportunities Program has unique proposal requirements. Please follow the submission instructions below. Proposals not adhering to the restrictions below will not be accepted.

The entire proposal, ***excluding*** the proposal cover worksheet, resumes, budget form, budget narrative, co-funding support form (when applicable), schedule, and references, should **not exceed fifteen pages in length**. Proposals must include the following components to be submitted in 1 PDF file:

- **Proposal Cover Worksheet:** https://www.waterrf.org/sites/default/files/file/2021-07/Proposal_Cover_Worksheet.pdf
- **Background and Statement of Need:** Provide a brief summary of the current state of knowledge for the issue that the proposed research will help address, and the drivers for the proposed research.
- **Objectives:** The proposed research objectives should be clearly identified in a few sentences.
- **Technical Approach:** Describe how the proposed research will be conducted, and the tasks necessary to accomplish the objectives.
- **Benefit to WRF Subscribers:** Identify the practical benefits of the proposed research to water utilities and the water community.
- **Research Team and Other Participants:** Identify the key members of the research team and provide brief statements of their qualifications to conduct the proposed research. Identify any other organizations that have committed to collaborate on the proposed research. Curriculum vitae or resumes for research team members are required.
- **Budget:** A detailed budget is required. The researcher should identify the amount of WRF funds requested and any other cost-share, in-kind, or cash support for the proposed research. *Instructions for Budget Preparation* are available at <https://www.waterrf.org/sites/default/files/file/2019-09/InstructionsforBudgetPreparation.pdf>. The following items will need to be included with the budget:
 - Proposal Budget Form: https://www.waterrf.org/sites/default/files/file/2021-07/15_BudgetForm.xlsx
 - Budget Narrative (see *Instructions for Budget Preparation*)
 - Emerging Opportunities Co-funding Support Form (when applicable): Each co-funding organization providing cash to the project payable directly to WRF must complete a separate Emerging Opportunities Co-funding Support Form and include it with the proposal package. The form is available at https://www.waterrf.org/sites/default/files/file/2021-07/RPP_Co-Funding_Support_Form.pdf
- **Schedule:** A detailed schedule is required.
- **References** (optional): Detailed citations are not required in the proposal, but may be provided at the discretion of the researcher.

Proposals that include the production of web- or software-based tools, such as websites, Excel spreadsheets, Access databases, etc., must follow the criteria outlined for web tools presented in the Web Tool Criteria and Feasibility Study for The Water Research Foundation Project Deliverables at <https://www.waterrf.org/sites/default/files/file/2021-07/WebToolCriteria.pdf>.

Eligibility to Submit Proposals

Proposals will be accepted from domestic or international entities, including educational institutions, research organizations, governmental agencies, and consultants or other for-profit entities.

WRF's Board of Directors has established a Timeliness Policy that addresses researcher adherence to the project schedule. The policy can be reviewed at <https://www.waterrf.org/policies>. 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.

Proposal Review and Funding Decision

WRF may fund one proposal through this solicitation or may choose to fund none of the proposals received, at its sole discretion.

WRF will form a Project Advisory Committee (PAC) composed of volunteer professionals with expertise in the research subject area to oversee the project(s) funded through this solicitation. Proposals will be reviewed by WRF staff and the PAC against established evaluation criteria. WRF may request additional information from the researcher based on this review. Proposals are treated confidentially and will not be shared outside of WRF.

Budget and Funding Information

The maximum funding available from WRF for this project is \$50,000. The applicant must contribute additional resources equivalent to at least 33 percent 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 percent to the project, but the maximum WRF funding available remains fixed at \$50,000.

Proposals that do not meet the minimum 33 percent of the project award will not be accepted.

Consult the *Instructions for Budget Preparation* available at

<https://www.waterrf.org/sites/default/files/file/2019-09/InstructionsforBudgetPreparation.pdf> 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 have a contractual obligation to adhere to the agreed-upon schedule. 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. The policy can be reviewed at <https://www.waterrf.org/policies>.

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, on the last page of this RFP, of utilities and other organizations that have indicated an interest in this research. Proposers are responsible for negotiating utility and organization participation in their particular proposals. The listed utilities and organizations are under no obligation to participate, and the proposer is not obligated to include them in their particular proposal.

Application Procedure and Deadline

Proposals are accepted exclusively online in PDF format, and they must be fully submitted before 3:00 pm Mountain Time on Thursday, March 10, 2022.

The online proposal system allows submission of your documents until the date and time stated in this RFP. Submit your proposal at <https://forms.waterrf.org/212493903316858>.

Please ensure you upload the required documents before the deadline. **Proposals submitted after the deadline will not be accepted.**

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Harry Zhang, PhD, PE, at (571) 384-2098 or hzhang@waterrf.org. Questions related to proposal submittal through the online system may be addressed to Caroline Bruck at (303) 347-6118 or cbruck@waterrf.org.

Utility and Organization Participants

The following utilities have indicated an interest in possible participation in this research. This information is updated within 24 business hours after a utility or an interested organization submits a volunteer form, and this RFP will be re-posted with the new information. **(Depending upon your settings, you may need to click refresh on your browser to load the latest file.)**

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