SON Number: RCSON-15-02 **November 7, 2013**

Strategic Environmental Research and Development Program (SERDP)

FY 2015 STATEMENT OF NEED

Resource Conservation and Climate Change (RC) Program Area

ADAPTING TO CHANGES IN THE HYDROLOGIC CYCLE UNDER NON-STATIONARY CLIMATE CONDITIONS

1. Objective of Proposed Work

The objectives of this Statement of Need (SON) are to improve our fundamental and applied understanding of: (1) the non-uniform spatial and temporal distribution of potential climate-induced changes in the intensity and variability of heavy precipitation and run-off events and (2) the implications for adaptation of these changes for geographic regions and applications of interest to the Department of Defense (DoD). The preceding includes a consideration of the stationary and non-stationary features of the historical data sets and climate change data prediction methods used to create the "next generation" of hydrologic intensity-duration-frequency (IDF) curves.

In particular, the focus of the SON is on: (1) developing the methodologies for constructing IDF curves, especially under non-stationary conditions; (2) developing improved understanding of and responses to changes in the timing and intensity of snowmelt and subsequent run-off events; and (3) developing adaptive frameworks to enable phased application of the preceding information to address DoD infrastructure planning and management decisions. Research needs include developing or improving our understanding of:

1. Potential stationarity versus non-stationarity of future precipitation regimes relative to a changing climate, the uncertainties involved, and the consequences associated with both potential futures, whether correctly assumed or not. Here, regime refers to the timing, intensity, and variability of precipitation whether it falls as rain or snow. Considerations should extend to the subsequent effects on the timing, intensity, and duration of run-off events, including how these may be affected by the timing of snowmelt.
2. Appropriate historic time series as base data for prediction models, with investigation of appropriate downscaling approaches for localized application.
3. Frameworks for responding to the implications of IDF curve and run-off event outcomes that use case studies to assess methodology development and scope of applications. These frameworks should (a) facilitate the phasing in of adaptive responses, including, for example, the ability to incorporate the use of green infrastructure, to account for the pace of change and the time horizon over which decisions must operate and (b) enable evaluation of projected and realized robustness against a range of plausible climate change futures. In addition, DoD desires that any proposed framework assist in (a) guarding against over-committing resources unnecessarily and (b) avoiding maladaptive responses.

4. Processes and procedures for integrating the implications of IDF curve and run-off event outcomes into design, construction, and maintenance standards, building codes, engineering requirements, legal stipulations, and other relevant applications.

Proposals submitted in response to this SON may address one or more of the research needs listed above. Geographic regions of interest include US and territorial locations within which DoD operates permanent installations. Applications of interest include: water treatment, storm water, and sewer systems; roof design; flooding, drainage, and soil erosion implications affecting infrastructure; flood zone delineation and management, and water supply quantity and quality issues.

2. Expected Benefits of Proposed Work

The desired outcome is knowledge that improves our understanding, in the context of a non-stationary world, of: (1) next generation IDF curves and changes in snowmelt-driven run-off events associated with geographic regions and applications that address future DoD management challenges; (2) frameworks for adaptively responding to the implications of IDF curve and run-off event outcomes, including the appropriate use of green infrastructure; and (3) processes and procedures for incorporating the implications of IDF curve and run-off event outcomes into various standards, codes, and requirements.

3. Background

A key focus of the SON is to understand how precipitation (rain and snow) and its variability may change with time and location, and whether localized systems can be considered to operate under stationary or non-stationary conditions. This information is critical for maintaining currency of IDF curves, which have historically been developed using past rainfall patterns. IDF curves are widely used. Therefore, accurately accounting for changing precipitation patterns will be essential for enabling engineering standards and building codes to appropriately adapt and prepare for a changing climate and localized site conditions. In addition, changing patterns in the delivery of precipitation as either rain or snow, the timing of snowmelt, and the subsequent effects on run-off timing, intensity, and duration also will need to be addressed when considering future standards and codes.

Users of the intended research outcomes include but are not limited to: military installations; government agencies; service supply chain, real estate, insurance, and contracting industries; and private developers. This research effort is intended to advance fundamental science considerations. But in addition it is expected that the results of this research will be transitioned to practice soon after its completion because integrated climate change adaptation strategies will rely on appropriately modified engineering and building codes to assure legal compliance and appropriate financial liability. Anticipated research outcomes will allow currently proposed modifications in decision processes, planning, and business workflow to be effective and keep pace with adaptive technologies and innovative management strategies. Implementation also will be facilitated by advancements in the conceptual framing of how to implement phased adaptive responses.

Subsequent application of research conducted under this SON is anticipated to enable precipitation-affected infrastructure systems to remain resilient to meet their desired services.

The speed of such efforts and the ease of implementation strategies will be accelerated when new IDF curves and potential changes to run-off patterns are codified within working standards and frameworks for adaptive response. Failure to account for plausible changes in the spatial and temporal distribution, intensity, and variability of precipitation risks complex and unnecessarily expensive military mission and asset management impacts. The desired outcomes of this research will enable managers to improve the resilience of their assets to climate change-related events that could otherwise incur significant financial burdens and mission/asset impacts due to the need for avoidable repair or rebuilding costs of critical infrastructure and other aspects of the built environment that are maladapted to the stationary or non-stationary conditions that prevail.

4. Cost and Duration of Proposed Work

The cost and time to meet the requirements of this SON are at the discretion of the proposer. Two options are available:

Standard Proposals: These proposals describe a complete research effort. The proposer should incorporate the appropriate time, schedule, and cost requirements to accomplish the scope of work proposed. SERDP projects normally run from two to five years in length and vary considerably in cost consistent with the scope of the effort. It is expected that most proposals will fall into this category.

Limited Scope Proposals: Proposers with innovative approaches to the SON that entail high technical risk or have minimal supporting data may submit a Limited Scope Proposal for funding up to $150,000 and approximately one year in duration. Such proposals may be eligible for follow-on funding if they result in a successful initial project. The objective of these proposals should be to acquire the data necessary to demonstrate proof-of-concept or reduction of risk that will lead to development of a future Standard Proposal. Proposers should submit Limited Scope Proposals in accordance with the SERDP Core Solicitation instructions and deadlines.

5. Point of Contact

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For Core proposal submission due dates, instructions, and additional solicitation information, visit the SERDP website at www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations.