



Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-267

Proposal Title: Impact of Changing Climate on Municipal Water Demand

Project Manager Information

Name: Harsh Anurag

Organization: Geosyntec Consultants, Inc.

Office Telephone: (612) 253-8212

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Project Basic Information

Project Summary: Developing tool that utilizes advanced statistics on water demand and climate data to forecast the effect of climate change on municipal water demand, aiding in enhancing water supply system resilience

ENRTF Funds Requested: \$351,000

Proposed Project Completion: June 30, 2027

LCCMR Funding Category: Air Quality, Climate Change, and Renewable Energy (E)

Project Location

What is the best scale for describing where your work will take place?

Region(s): Metro, Central,

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Considerable attention is given to understanding the effects of climate change on water supply, including alterations of rainfall patterns, river discharge, and groundwater recharge. There remains a notable gap in assessing its impacts on water demand, which introduces uncertainty into water resource management strategies in the context of a changing climate. Climate variability can prompt shifts in both potable and non-potable water usage, encompassing operational processes, sanitation, landscaping, and other purposes. Both total water demand and peak demand are susceptible to alteration.

Research suggests that climatic factors, alongside socioeconomic variables, influence water demand. For instance, water requirements for industrial cooling processes increases as intake water temperatures rise. Likewise, urban water usage studies show correlations between increasing temperatures and per capita water consumption.

Currently, municipal water demand planning uses historical per capita water usage to forecast future demand, potentially overlooking climate-related impacts. There is a rising need for a systematic evaluation that considers both climatic and non-climatic influences on municipal water usage patterns. Developing a water demand forecasting tool that incorporates climate variability is essential in planning for future water demand scenarios. Such a tool would enhance traditional water demand forecasting methodologies by addressing the interplay between climate and demand dynamics.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

Our proposal will take a two-step approach to better understand the evolving water demand and develop an effective forecasting tool. First, statistical methods, including machine learning, will be employed to analyze historical water demand and climate data and identify underlying signals that indicate the impact of climate change on water demand patterns. This analysis will provide insights into historical trends of water demand and their correlation with climate variations. Second, building upon this understanding and leveraging the ensemble of Global Climate Model (GCM)'s climate projection data, statistical models will be developed to forecast future water demand based on anticipated climate changes.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

This work will result in a better basis to account for the effects of climate change on future water demand. This will enhance the ability of municipalities to be good stewards of our state's finite water resources in the face of a changing climate. The work will also enhance the ability of municipalities to deliver on their critical mission of providing a safe, reliable supply of drinking water to the public now and in the future.

Activities and Milestones

Activity 1: Data Collection

Activity Budget: \$18,900

Activity Description:

The goal of this activity is to collect details and water demand data from up the municipal partners. The data gathering effort will extend beyond basic water demand usage, incorporating additional details that will help inform the planned forecasting tool. This can include peak water usage patterns and demand data across diverse water usage types, including but not limited to potable water usage, industrial requirements and cooling-related usage. Three partners have committed to share their pertinent water usage data for this analysis. Depending on the available time span of water demand data, climate data will be compiled. The collated climate data will encompass primary climatic variables such as temperature, precipitation, and humidity, as well as derived variables like the count of days exceeding a defined temperature threshold (e.g., 25°C), occurrences of anomalously hot or cold days, and the frequency of days with above-average humidity.

Activity Milestones:

Description	Approximate Completion Date
Review data sources and types with partners	July 31, 2025
Review, clean and organize received Data	August 31, 2025

Activity 2: Statistical Analysis of Historical Water Demand

Activity Budget: \$175,000

Activity Description:

The collected water demand data will be pre-processed to optimize it for subsequent statistical analysis. The pre-processing will include essential steps such as data cleaning, normalization and executing statistical tests aimed at identifying variables that significantly influence water demands. Following pre-processing, an ensemble of statistical models will be used to analyze the historical water demand data, utilizing the previously shortlisted variables. The model development process comprises two essential steps: training and validation. Initially, we calibrate the model parameters using a training dataset, chosen from the available water demand data. This step allows us to fine-tune the model's performance to historical water demand trends and patterns. Subsequently, the validation dataset, comprising the remaining water demand data, is employed to assess the performance of the trained model. By comparing the model's outputs with the actual observed values in this separate dataset, we can gauge the model's predictive ability. Established validation metrics will be used to measure the model performance in the validation stage. Overall, this activity will provide valuable insights into historical water demand trends and highlight the most important factors influencing water consumption patterns.

Activity Milestones:

Description	Approximate Completion Date
Data pre-processing	October 31, 2025
Initial statistical testing; factor selection	January 31, 2026
Statistical testing, model tuning and calibration	June 30, 2026
Model validation	August 31, 2026

Activity 3: Development of Assessment Tool

Activity Budget: \$113,900

Activity Description:

In this activity we will use the understanding of the relationship between climatic factors and water demand pattern to develop the forecasting tool. We will use climate projection data from multiple Global Climate Models (GCM) to drive the developed forecasting models and obtain future water demand projections. We will employ an ensemble modeling approach to enhance the reliability of the predictions. By leveraging multiple statistical models driven by multiple GCM’s projection data, we will generate a range of outputs rather than a single deterministic prediction. This approach not only allows for a more comprehensive exploration of potential future scenarios but also provides insights into the inherent uncertainty of the forecasting process. Emphasis will be given to understanding the variability of future water demand including analyzing the peak demand changes in future. We will build the forecasting tool and incorporate features after consultation with the targeted users (municipal partners).

Activity Milestones:

Description	Approximate Completion Date
GCM selection and future demand forecasting	October 31, 2026
Development of forecasting tool with input/output interfaces	January 31, 2027
Testing and finalization of tool	March 31, 2027

Activity 4: Final Report and Tool

Activity Budget: \$43,200

Activity Description:

This activity involves preparation of a report that will document the entire workflow involved in the development of forecasting tool, as well as present the findings derived from the analysis of water demand forecasting. This report will encapsulate insights gleaned from the forecasting tools, shedding light on anticipated future water demand patterns. The final deliverable will consist of a final report consolidating all data and insights garnered from the analysis of the available data, alongside the methodologies employed for statistical analysis and tool development. Additionally, the forecasting tool will be made accessible to the public for utilization.

Activity Milestones:

Description	Approximate Completion Date
Draft project report	May 31, 2027
Final report and tool deployment	June 30, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Tracy E. Hodel	City of St. Cloud	Sharing water demand data, reports, and other pertinent usage information as required. Contributing inputs for the development of demand forecasting tool as necessary. Assist in evaluation of the utility of the tool.	No
Judy Sventek	Metropolitan Council	Sharing water demand data, reports, and other pertinent usage information as required. Contributing inputs for the development of demand forecasting tool as necessary. Assist in evaluation of the utility of the tool.	No
Scott M. Anderson	City of Bloomington	Sharing water demand data, reports, and other pertinent usage information as required. Contributing inputs for the development of demand forecasting tool as necessary. Assist in evaluation of the utility of the tool.	No

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

The proposed project will result in a tool (e.g. macro-enabled spreadsheet or simple computer application) that can utilize user-input historical data to project future water demand under a selected climate change scenario. This tool could be adapted to a variety of scales (e.g., city, metro area, etc.). Geosyntec will deliver technical presentations describing the analysis and the tool at local conferences, such as the Conference on the Environment, the Water Resources Conference, and the Minnesota AWWA conference.

Project Manager and Organization Qualifications

Project Manager Name: Harsh Anurag

Job Title: Senior Staff Professional

Provide description of the project manager’s qualifications to manage the proposed project.

Dr. Anurag holds a Ph.D. in hydrology from the University of Minnesota, where he studied aquifer recharge trends in Minnesota using future climate projection data and land-surface hydrologic models. Dr. Anurag designed and implemented a statistical method (Ensemble Kalman Filter) to use observations for improving model predictions. As a consulting professional, Dr. Anurag has performed hydrological calculations and modeling to assist mines in Minnesota and Canada evaluate the potential impacts of climate change on water management infrastructure and practices.

Organization: Geosyntec Consultants, Inc.

Organization Description:

Geosyntec Consultants is an internationally renowned environmental consulting firm with over 2,500 employees worldwide that works with private and public sector clients to address new ventures and complex problems involving our environment, natural resources, and civil infrastructure. Staff from Geosyntec’s Minneapolis office will lead the project. The Geosyntec staff leading this project have recently developed a similar scope, using similar tools, for the US Navy to assist in assessing future climate change-related water risks at several of their facilities. This project will benefit from the Geosyntec team’s knowledge of Minnesota climate and issues, as well as Geosyntec’s access to international experts to support the project.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Lead Principal Investigator		Subject Matter Expert; Oversee all aspects of research, technical analysis and tool development			70%	0.16		\$45,000
Project Technical Advisor		Oversee the technical analysis and tool development			70%	0.16		\$40,000
Senior Staff Professional		Executing technical analysis and tool development; Project Management			70%	0.86		\$146,700
Staff Professional		Provide support for technical analysis and tool development			70%	0.82		\$119,300
							Sub Total	\$351,000
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
							Sub Total	-

Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$351,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Total Project Cost: \$351,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [58056e58-0a0.pdf](#)

Alternate Text for Visual Component

The flowchart provides an overview of the analysis framework that will be used for the development of the water demand forecasting tool....

Financial Capacity

Title	File
Financial Capacity Note	747682a6-7d7.pdf

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Letter of Commitment from Metropolitan Council	42223710-78f.pdf
Letter of Commitment from City of St. Cloud	f485e811-c11.pdf
Letter of Commitment from City of Bloomington	d2a54207-6fb.pdf
Letter authorizing proposal submission	04980c32-2e1.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care,

treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

Todd DeJournett, Geosyntec Consultants, Inc.

