Nutrient Sensor Action Challenge

Registration

Upload the completed form to challenge.gov by clicking on the "**Submit Solution**" tab on the Nutrient Sensor Action Challenge page.

General Information

Project Lead:

First name: Wilfred Last name: Wollheim

Organization: University of New Hampshire

Title: Associate Professor

Phone: 603-862-5022 Email: Wil.wollheim@unh.edu

Contact for matters of communication and media:

First name: Wilfred Last name: Wollheim

Organization: _____

Title: _____

Phone: _____ Email: _____

Do you agree to allow EPA to share project information with journalists for potential coverage of the project?

- ☒ Yes
- ☐ No

Are there others who should be notified via email about webinars and other updates? (provide as many as needed)

First name: _____ Last name: _____

Organization: _____

Title: _____

Phone: _____ Email: _____

Is there is any information about the project that should be treated as confidential?

☐ Yes

☒ No

If yes, please explain:

Project Description and Potential for Impact [limit 250 words]

Describe the specific nutrient issue that the project will address.

Nitrogen exports from watersheds to coastal zones are increasing and leading to eutrophication, deadzones, and loss of estuarine organisms. A substantial proportion of non-point nitrogen sources that enter streams and rivers are retained or removed by freshwater ecosystems during downstream transport, thereby lowering fluxes to coastal areas. Reservoirs are thought to contribute to this retention, particularly reservoirs in relatively small watersheds. At the same time, dams and their reservoirs are increasingly being removed from the landscape, often because they are aging and would need costly repairs, have no significant utility and/or to improve anadromous fish passage and connectivity with spawning areas. A greater understanding of the strength and timing of N removal by smaller reservoirs is needed. A new generation of high frequency nitrate sensors deployed in freshwater ecosystems will greatly increase understanding of where and when reservoirs remove nitrogen. The overarching question of this research is: **How effective are smaller reservoirs in coastal New England at retaining or removing nitrogen, and how does this effectiveness vary across season and flow condition?** We propose to deploy sensors upstream and downstream of several reservoirs in coastal New England to quantify nitrate removal across seasons and storm events. The wave of dam removals that is ongoing in New England, and throughout the country, also offers a unique opportunity, through before and after studies that apply high frequency sensors, to quantify accurately the impact of reservoirs on N exports.

How will the addition of data and information from nutrient sensors inform and improve specific decisions and actions pertaining to nutrient management?

Findings will improve decision making by providing information regarding reservoir nitrate retention across flow conditions. This information can be used to prioritize dam removals in New England, while also developing an approach that could serve as a model for application elsewhere in the nation.

What are the potential impacts and benefits of the project?

Benefits include improved landscape management of nitrogen fluxes to coastal zones to prevent future eutrophication and mitigate current eutrophication in estuaries. Management will factor in strength and timing of reservoir retention, the role of climate variability and land use change, as well as where and when dams are being removed.

Sensors

Provide the following information for each type of sensor that will be used in the project.

Manufacturer/Model	Real Tech Real Nitrate Analyzer; Satlantic SUNA; Onset Hobo Conductivity
Parameter being measured	NO3; Conductivity
Sensor Price	Real Tech = 12,0000; SUNA = 22,000; Hobo = 750
Maintenance Requirements	Fouling; Calibration
Accuracy	
Precision	
Range	

Monitoring [limit 250 words]

What is the general schedule for the project? Include: sensor deployment, maintenance and calibration, data analysis, and approximate date that data will be available to the Challenge Administrator.

We will begin deployment in reservoir 1 (Mill Pond) by mid April, leave the sensors out for ~1 month to capture baseflow and storm conditions during spring. Then the deployment will be shifted to reservoir 2 (Sawyer Mill Reservoir) for another 1 month period (going to mid June). Then we will rotate every 1.5 months two more times, to capture storms during each season. Measurements will be completed by late November. Additional grab sampling will be conducted weekly. Regular calibration and instrument maintenance will take place weekly. Data analysis will begin immediately following deployment at each location/time. We expect preliminary data will be available for review within a month of each deployment.

Describe location (provide map or link to a map) and monitoring frequency for each sensor.

We will be monitoring inputs and outputs at two reservoirs for 1-2 month periods each several times over the course of the year. For one reservoir (Mill Pond on Oyster River), there are three inputs and one output. For the other (Sawyer Mill Reservoir on the Bellamy River) there is just one input and output. The major river input and output at each site will be monitored using two low cost sensors. The other two inputs at the Mill Pond will be monitored with Satlantic SUNA's. Sensors will measure at half hour intervals. A mixing model approach using reactive nitrate and conservative chloride (derived from conductivity) will be used to estimate nitrate retention over various time periods.

If applicable, describe any existing monitoring data being collected in the area and whether these data will be integrated:

We will also be measuring with high frequency sensors stage height, discharge, water temperature, conductivity, dissolved oxygen and potentially turbidity and chromophoric dissolved organic matter (to derive other nitrogen forms). Grab samples will be collected regularly. We will also sample within the reservoirs periodically.

Data Architecture **[limit 250 words]** [Web service endpoint and authentication information are due to Challenge Administrator by November 1, 2018.]

Describe the plan for sensor data collection and management. Please provide any information about plans to meet data and web interface standards. Also identify any software products you intend to use that support the use of the standards.

Under construction