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Creating a Learning Laboratory for Urban Sustainability: Consulting Project for The Blackstone River Corridor Living Systems Laboratory

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CREATING A LEARNING LABORATORY FOR URBAN SUSTAINABILITY:

CONSULTING PROJECT FOR THE BLACKSTONE RIVER CORRIDOR LIVING SYSTEMS LABORATORY

JACQUELYN BURMEISTER

MAY 2016

A CAPSTONE PROJECT

Submitted to the faculty of Clark University, Worcester, Massachusetts, in partial fulfillment of the requirements for the degrees of Master of Science in the Department of International Development, Community, and Environment and Master of Business Administration in the Department of Graduate School of Management

And accepted on the recommendation of

Timothy J. Downs, D.Env.

Donna Gallo. Ph.D.

ABSTRACT

CREATING A LEARNING LABORATORY FOR URBAN SUSTAINABILITY:
CONSULTING PROJECT FOR THE BLACKSTONE RIVER CORRIDOR LIVING SYSTEMS LABORATORY

JACQUELYN BURMEISTER

The Blackstone River Corridor Living Systems Laboratory ("LSL") is a newly formed nonprofit organization with a broad and compelling mission to engage people with local history and water so as to improve public heath though bioremediation. It has evolved from a non-centrally administrated coalition of research institutions and municipalities interested in water quality to a multidisciplinary partnership, requiring consistent coordination. The broad organizational mission with such varied stakeholders requires a stable administrative platform, as well as funds to continue development of novel model process for wastewater treatment. The purpose of this project was to provide long term administrative and project support for the LSL. I worked with the LSL Team to select a funding source, create an organizational framework, organize project partners, design a compelling project, and ultimately write and submit a $453,000 grant proposal.

ACADEMIC HISTORY

Name: Jacquelyn Burmeister Date: March 2016

Baccalaureate Degree: B.S. in Biology

Source: Duke University Date: May 2009

Occupation and Academic Connection

Dual-Degree IDCE/GSOM student, Clark University, 2013 – 2016

ACKNOWLEDGEMENTS

I share credit of this work with Mr. Gene Bernat, who has welcomed me to take part in the development of his vision for the Blackstone River Corridor Living Systems Laboratory. Without his extreme dedication to the Fisherville Mill Site, this project would not exist. His passion for the LSL is truly inspiring, and it was an honor to work beside him.

I also would like to express my deepest appreciation to my readers, Dr. Donna Gallo and Dr. Tim Downs for their guidance, feedback, and support throughout the selection, elaboration and refinement of my capstone project. By focusing on adding value, we developed a sustainable framework for future work at the LSL.

A special thank you to all of the project partners, especially the Town of Grafton, who has believed in and supported the LSL and this project since the very beginning.

Finally, I acknowledge Stefanie Covino, who was integral in the choice and development of the RFP and who continued to work with me through the good times and bad as a colleague and as a friend.

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EXCECUTIVE SUMMARY

The Blackstone River Corridor Living Systems Laboratory ("LSL") is a newly formed nonprofit organization with a broad and compelling mission to engage people with local history and waterways so as to improve public heath though bioremediation. It is located at the Fisherville Mill Site in Grafton, MA. Starting as a laboratory for novel waste water remediation, it had received wide public, private and community support. As the vision for the site evolved to become a learning tool for the socio-ecological history of the Blackstone River for people of all backgrounds, the range of partners for the project has expanded. Lack of consistent funding and a robust organizational structure made the effort to fulfill the organization's mission inconsistent and disjointed. Creating the nonprofit was the first step to building a self-sufficient entity that could apply and administer funds to its projects as needed. The purpose of this project was to provide long term administrative and project support for the Living Systems Laboratory from a medium sized funding source. In doing so, the LSL Team would create an organizational framework that would be capable of executing a large scale, medium term project with multiple, diverse partners. Jacquelyn Burmeister, MS/MBA candidate at Clark University Department of International Development, Community and Environment, worked with the LSL Team to select a funding source, create an organizational framework, organize project partners, design a compelling project, and ultimately write and submit a $453,000 grant proposal. This Capstone Project provides the organizational background to the Living Systems Laboratory and explains the need for the funding, as well as the process for achieving these outcomes. The centerpiece is the grant itself, which was submitted on November 17th, 2015. The final portion of the document is dedicated to the challenges and lessons learned throughout the project development process. Although the application was not funded,

the process of organizing partners and developing an organizational structure will be valuable when the LSL Team pursues other opportunities.

BACKGROUND AND ORGANIZATIONAL HISTORY

The Blackstone River, stretching 46 miles from Worcester, MA to Providence, RI, provided power in the form of rushing water to the factories that spurred the Industrial Revolution. Producing textiles, wire, and furniture, these mill factories provided jobs to many of the local townspeople in the early to mid-1800's. During this time, the town of Worcester was small and relatively isolated in the middle of the state. The Blackstone Canal was constructed between 1825 and 1828, allowing for increased trade of both agricultural and factory produced goods between the town and the Narraganset Bay area. A decade later, the opening of rail lines made the canal obsolete, and led to even more urbanization (Rhode Island Rivers, n.d.). Accelerated growth outstripped the pace of infrastructure development, and much of the region's waste was released into the River and Canal where it mixed with the residues of the factories (Shanahan, 1994; Robinson, 2003).

The Fisherville Mill, located in South Grafton on the banks of the Fisherville Pond (to the North), The Blackstone River (to the West) and the Blackstone Canal (to the South) was in operation from the 1830's through 1986, producing a wide variety of products including cotton textiles, tools and die, and finally lawn furniture and foam rubber. It provided many of the jobs in the Grafton area during this time period, and relied on the Blackstone River as both a source of power at the hydroelectric dam, and a waste discharge point. In the early days, after fabrication, factory

products could be loaded onto barges in the Canal to be sent to Providence to be shipped all over the world (Herbert, 2013).

Although the factory was closed by this time, a suspected act of arson caused a major fire in the old factory building in 1999, burning it to the ground. In the process lead, asbestos, oils and trichloroethylene (TCE) were released into the air and soil. The US Environmental Protection Agency (EPA) initiated an emergency response program to remove lead and asbestos containing materials from the site, additionally capping it with 14 feet of cement. They then removed TCE from the groundwater using an oxidizing agent that was pumped into the ground, destroying the compound. Oil tanks that had been damaged were removed and a cement structure with an oil skimmer was installed to prevent further leakage of oil into the soil (US EPA, 2002).

However, there is still prevalent petroleum contamination in the Blackstone Canal, as well as high loads of nitrogen (N) and phosphorus (P) from incomplete wastewater treatment and nonpoint sources along the Blackstone River. In 2004, the Fisherville Redevelopment Company was formed as a special purpose entity to remediate the property. Co-president Eugene “Gene” Bernat and the Town of Grafton applied for and received $670,000 in funding from EPA to build a novel stormwater treatment system on the site to address this contamination. Eugene worked with NGOs the Blackstone Headwaters Coalition and the Blackstone Heritage Corridor to conduct a pilot study in Woods Hole of Eco Machine Technology, which was being developed by John Todd Ecological Design, Inc. The technology draws upon principles of ecological design, functional biodiversity, and bioremediation to create a series of complex food webs in which contaminated water is

metabolized by bacteria, fungi, plants and animals. Once proof of concept was established, the Eco Machine at the Fisherville Mill Site was constructed in 2012, with the ability degrade petroleum hydrocarbons, as well as remove N and P from up to 10,000 gallons of water per day. It was suspected that the organisms supported by the Eco Machine could also degrade stormwater pathogens, endocrine disrupters and other emerging pollutants of concern (Bernat, 2016).

The technology and its community-based implementation process seen at the LSL represents a novel alternative that promises to change the way we think about water treatment. Presently, most municipal water treatment happens at large scale facilities, which only take advantage of natural services of microbes in either an activated sludge stage of processing in a large tank, or through trickling filters. In these cases, only nutrients and suspended solids are removed from the water, and residence times are extended (Sharron *et al,* 2008). In light of ever increasing threats to global water security, especially in less developed nations, where access to traditional treatment technology and chemicals are less available, Sharron *et al* recommends the continued research and development of novel water treatment technologies, even citing natural ecosystem approaches (Sharron *et al*, 2008). The Eco Machine is a low-cost, natural water treatment technology, built upon principles that can be replicated for point and nonpoint pollution sources in any landscape, making it versatile as well. At present, some large scale engineered ecosystems, like restored wetlands projects, are valued for their role in water filtration, but are passive systems that do not collect water. Dr. John Todd, president of John Todd Ecological Design Inc., and designer of the Eco Machine, has already begun to identify the biological and geological factors that are necessary to create engineered ecosystems that are suitable for waste water treatment and recycling, and has built pilot projects all over the world to test the theories with high successes rates in removing

nutrients, bacteria, and hydrocarbons (Todd and Josephson, 1996; JTED, 2014). However, cross disciplinary research of the processes that allow water treatment to take place, in addition to how to implement these projects in different settings, is necessary to continue to understand how to replicate this model in other contexts.

The success of the Eco Machine excited many people. Over the next years, there was ongoing collaboration between local universities such as Clark, Brown, and Worcester Polytechnic Institute, which formed an educational consortium to research the processes that were taking place at the site. The Mosakowski Institute provided funding for research by fungal biologists at Clark University, and two peer reviewed papers were published. However, the Eco Machine at the Fisherville Mill site remained only a location for research and learning that other groups could utilize and no internal administrative structure had yet been formed. As all grant funding required a formal lead organization, many times Clark University and the Town of Grafton took that role (Bernat, 2016).

As the Eco Machine was gaining popularity, and as tours were becoming more frequent, Gene found himself talking about topics other than bioremediation. The Fisherville Mill Site offered the chance to discuss the social history of the Blackstone River, food webs, ecosystem function, as well as provide a model for how to design sustainable communities. People outside of the field of biology started to want to become involved, seeing potential to use the site as a model for social learning, including sustainable development, green infrastructure technology, and sound environmental policy.

The vision of the LSL was turning into a colaboratory, a term used to describe cross disciplinary, multi stakeholder engagement projects that utilize technology in either information sharing or design. The words "colaboratory" or "CoLab" have been in use since it was coined by William Wulf in 1989. Most CoLabs rely on information sharing technologies like the internet to disseminate information between parties. Collaboration between disciplines has been on the rise, and CoLabs have shown success at attacking problems which require a multidisciplinary effort to solve, ranging from the effective use of technology in classrooms to identifying markers for preclampsia by providing a platform for many people to bring various opinions to the table (Tammaro *et al,* 2012; Staff *et al,* 2013). The Climate CoLab is an example of a successful colaboraory that leverages the internet as a platform for model-based planning, structured online debates, and electronic voting around climate change. With the contribution of thousands of stakeholders, the organization's website became a "collective intelligence system" which was capable to help make decisions about one of the most pressing issues of our time (Introne *et al,* 2011). By bringing together municipalities, scientists, land use planners, educators and other stakeholders, the LSL was to be a center for multidisciplinary applied and empirical environmental and engineering research to improve public health and the systems that surround it.

This multi-disciplinary learning opportunity lead Gene and the Town to apply for a grant from the Blackstone River National Heritage Corridor entitled "Creating a Teaching Landscape", in which the Fisherville Mill Site would be a durable regional asset for tourism, education and research focused on the ecology and industrial history of the greater Blackstone River Valley, and in which local educators and researchers contributed to creating new and compelling systems to engage and interact with the past, present and future of The Blackstone River. The $10,000 grant funded

research from the Conway School of Landscape Design, which developed a master plan for interpretive sites on the Fisherville Mill site and Mill Villages Park that tell the natural, historical, and social history of the site and South Grafton. Implementing this plan would create the infrastructure to bring in more visitors to the site, and provide self-guided tours in which more people could experience the site without a formal tour (Bernat, 2016).

As the vision for the Fisherville Mill Site evolved, it became increasingly clear that Gene could not rely on the Town of Grafton or research institutions to continue to manage the varied work that needed to be done at the site. Among this work was the implantation of Conway's Project Plan, more scientific research, and more education of municipal workers, locals and students. Many felt that the vision of the project was compelling enough to apply for large scale funding. So in the fall of 2015, Gene established a small team of people (henceforth "LSL Team") that had been working with him on the ground over the past few years and registered the site for nonprofit status in the State of Massachusetts, calling the organization "The Blackstone River Corridor Living Systems Laboratory" which would do business as "The Living Systems Lab" or "LSL". Now the LSL could serve as the locational and administrative nexus for the various activities that take place at the site. All that remained was to find the funding to create a stable administrative body and move the projects forward.

Project Partners

The Fisherville Mill Site/LSL has been an example of a participative community development project, and has had a history of diverse partners coming together to reach various project goals. The following is a brief list of organizations that have been involved in the project in some degree, as well as their contribution.

The Town of Grafton has been deeply invested in the development of recreational, educational and cultural activities at the Fisherville Mill Site. The Blackstone Corridor has been designated as an Open Space & Recreation Priority by the Town in the 2007-2012 Open Space and Recreation Plan. The Town has also acted as the fiduciary agent and manager for several grants.

The Fisherville Redevelopment Company (FRC) is the owner of the site and has been the persevering force behind the development of Fisherville Mill Site since it was bought in 2004. Eugene Bernat, co-president of FRC, was the man with the vision to develop and promote the Fisherville Mill Site, and eventually incorporate the LSL. He has done most of the networking within the town and county to promote the project. In 2006 when the soils needed to be tested for contaminants in order to proceed with the project, the FRC provided the funding for the tests.

The Grafton Community has been extremely receptive of the development of the Fisherville Mill Site and town meetings involving the site have been well attended since plans for development began there in 2006. During this year, the community decided in a unanimous vote to fund the cleanup of the site, which at this point had been designated a Brownfield by EPA. The town stepped up again in 2010 when it decided to fund the creation and maintenance of the Mill Villages Park on the site, again, unanimously. Additionally, the community participated in the design of the Mill Villages Park itself through the *Mill Villages Advisory Committee.*

John Todd Ecological Design, Inc (JTED) designed and helped to construct the Living Systems Laboratory's Eco Machine and Canal Restorers, which are responsible for the restoration at the Fisherville Mill site. JTED continues to monitor and upkeep the site, and holds periodic technical workshops at the Fisherville Mill Site on Ecological Design.

The Blackstone River Valley National Heritage Corridor, The Blackstone River Coalition and *Mass Audubon* are regional nonprofit organizations that all have a strong interest in the Fisherville Mill Site. The northern portion is still a designated Brownfield that lies inside the boundaries of the National Heritage Corridor and Watershed and contains several sites of historical value, including the burned down Fisherville Mill. The Blackstone River Valley National Heritage Corridor awarded the Town of Grafton $10,000 in 2014 for the project "Creating a Teaching Landscape" to create compelling ways for visitors to interact with the past, present and future of the Fisherville Mill Site. Donna Williams, of the Blackstone Heritage Corridor Commission, has been integral in garnering public support and helping in the planning of the development of the Fisherville Mill Site, as well as other mill sites in the area, with the co-writing of the South Grafton Villages Master Plan. The

National Heritage Corridor also routinely sends its rangers to the Fisherville Mill site to receive and give regional historical and environmental training. On June 19th of this 2013, these rangers held a summer public "Walkabout" through the site in which the rangers taught participants about the history of the Fisherville Mill Site and how the Eco Machine is helping to protect and preserve the Blackstone Watershed.

The US Environmental Protection Agency (EPA) provided extensive funding for the Fisherville Mill Site. After the 1999 fire at the Fisherville Mill, EPA under "Emergency Response Action", and the *Massachusetts State Department of Environmental Protection (MassDEP)* spent several million dollars treating TCE pollution at the site using various means, including in-situ chemical oxidation and groundwater collection and treatment. EPA later awarded the Town of Grafton a $671,000 grant to design, construct and operate an innovative ground water, storm water and river water treatment and improvement park consisting of several integrated elements. As part of this project, JTED was contracted by the Town to design and implement a restoration plan for the Blackstone River using an engineered ecosystem utilizing the canal trench and the existing infrastructure remaining from the destroyed Fisherville Mill.

The Network for Sustainability Innovation is a multi-disciplinary network of students, professionals and universities that is reexamining efforts to promote urban sustainability, doing case studies in Worcester, Providence and Philadelphia. Currently, major players include Brown University, Clark University and Temple University. The group is focusing on the Living Systems Laboratory as a model for how social, environmental and cultural factors come together to create a more sustainable urban landscape.

Clark University has supported the effort at the Fisherville Mill through the provision of researchers during various stages in its early development. Dr. David Hibbett of the Biology Department and his student, Darcy Young, were indispensable in the refinement of the techniques utilized for the degradation of contaminant oil via fungal enzymes in the Eco Machine. This project was supported in part by *The Mosakowski Institute.* The Fisherville Mill Site has been the subject of a Masters level environmental modeling course in which students examined the importance of each the social, environmental and economic in its future developmental success. One student, Sean Hutton, went on to write a comprehensive narrative for another development project in the site for his thesis. Additionally, several graduate and undergraduate classes have taken field trips to the site while studying ecological diversity and design.

Brown University Superfund Research Program's Dr. James Rice is a Post-Doctoral Researcher and a chemical engineer interested in the fate and transport, chemistry, and thermodynamics of environmental contaminants, and on translation of scientific research to relevant stakeholders, such as regulators, policy makers, and community members. Dr. Rice conducted a 2013 research externship at the Fisherville Mill site under the mentorship of Robert Burgess, Ph.D., a staff scientist at the U.S. Environmental Protection Agency. Dr. Rice will lead a freshwater passive sampler study in the Blackstone River at the Fisherville Mill site to monitor heating oil contamination and other potential pollutants to monitor contaminant concentrations in surface waters and sediment, and provide information on dissolved and biologically available concentrations of persistent organic pollutants. Furthermore, during the summer of 2012 Dr. Rice worked with the Fisherville Redevelopment Company and John Todd Ecological Design to monitor petroleum hydrocarbons in the river sediment and water and from the Eco Machine bioremediation tanks.

The Conway School of Landscape Design has visited the LSL consistently over the past years with new classes, using the site as an example of how to naturally regenerate landscapes. In the spring of 2015, a team of three students with funding from the "Creating a Teaching Landscape" project developed a Landscape Master Plan of the site that would highlight and build upon the current nature, community and industry attractions of the land. The plan was developed collaboratively with the community of Grafton and the Town Planning Department.

The LSL Team

The LSL Team was established by Gene Bernat to navigate the funding and structuring of the organization. It consists of himself and three other people.

Nicholas Bernat holds a certificate in landscape design and has been contracted by JTED over the past years to maintain the Eco Machine. He has worked closely and established good relations with the Town on LSL and other projects. As the LSL Team prepared the proposal, he was the point person between the LSL and the Town and JTED, as he has the most experience with the needs of the Eco Machines physical infrastructure. He will take on the role of Operations Manager at LSL.

Dr. Jacquie Kay is the president at Sun Walking Group, a corporate collaborative focused on financing and providing technical assistance to communities in developing their own innovation

labs, science and technology centers. In this project, she assisted with the creation of the organizational structure and project outreach.

Jacquelyn Burmeister is a dual degree MBA/MS Environmental Science and Policy candidate from Clark University. She has been working with Gene since 2014 in grant writing, outreach and organizational development. She was the grant writer and project organizer. If the project is were funded, she would have been the Project Manager of the LSL.

DEVELOPING AN ORGANIZATION

The Mission of the LSL: A Nexus for Sustainable Innovation

The Blackstone River Corridor Living Systems Laboratory is a nonprofit organization that seeks to engage people in socioecological history of the Blackstone River and create effective solutions to environmental contamination. The purpose of the LSL is to be a nexus of sustainable innovation, connect people with the River, help them to appreciate the benefits of a healthy ecosystem on society in the context of development, and be a part of the restoration of the Blackstone through education, research, and community outreach.

Eugene Bernat envisions an NGO that is a “Learning Landscape” for ecology, local history, green infrastructure development and environmental policy for people of all ages and interests. He aims to make the Eco Machine, as well as the other technology and organizational infrastructure

developed at the site, replicable models that can be implemented throughout the region. Through collaboration with a host of different organizations in small, discrete projects over the years, he has worked incrementally toward this vision, while creating a valuable network of partners.

Grant Submission Process

The LSL Team had three main criteria for a grant in order to pursue it. The first was that it had goals that aligned with the mission and vision of the LSL. This would prove to be the easiest hurdle, as the mission of the LSL is so broad and compelling, that it is not difficult to connect at least one of the projects with a Request for Proposals (RFP), and it seemed that there were many potential grants to choose from. The second criterion was that the grant be large enough to sustain an LSL project or projects over at least a year. While small grants could possibly fund all of the projects that the LSL would like to pursue, and have been the main source of funding in the past, they create a lot more work in terms of administration, and there was no funding to manage them. Third, the LSL needed a grant that would cover administrative costs. There are many grants that will fund materials and other project costs, but expect that labor is volunteered or covered elsewhere in an organizations budget. As a newly formed nonprofit, there were not funds yet available to pay the staff that would manage the projects.

The LSL Team examined several large foundation websites before being referred to a federal funding program that met all of these criteria. The RFP was published by the New England Interstate Water Pollution Control Commission (NEIWPCC) in collaboration with the Narraganset Bay Estuary Program, and called for projects that supported the innovation of nutrient and

pathogen remediation and prevention in regional waterways, provided funding over one year, and would support administrative roles. See Appendix A for the full RFP.

Methodology

After the LSL team selected a grant that seemed to match the priorities of the organization, the grant writing and organizational development began. The process took about four months and hundreds of hours of planning, meetings and writing. In the end, the LSL not only created a high quality preproposal and full proposal that can be recycled into other grants, but strengthened its relationships with its partners and clarified organizational roles and structure. The following are the steps which the LSL team took to complete this process.

1. Establish the goals of the LSL that align with the goals of the RFP and create a rough budget

As the vision and mission of the LSL is much broader than what any individual grant will fund, it was necessary to identify the organizational outcomes that could potentially be funded by the grant, and then make modifications or reframe them in a way that would demonstrate how they align with the goals stated in the selected RFP. Keeping in mind the partners that had previously worked or shown interest in working with the LSL, the team met over several days to establish three rough outcomes that aligned their skills with LSL and the RFP goals. A rough budget was proposed for LSL personnel, as well as some of the costs that the team already knew the project would require, while setting aside a large portion of the funds for partners.

During this time the team was also registering the LSL as a nonprofit organization in the state of Massachusetts so that it may be recognized as a legitimate organization. In doing so, the team articulated the organizational mission, as stated above, as well as the internal structure, identifying leadership roles in the organization, and better understanding the legal limitations for board members. At this point, the team also realized that federal registration as a 501(c)(3) may not be possible within the given time frame, and considered other options for fiduciary agents.

2. Assemble potential partners and discuss their involvement and what they can contribute

The LSL Team then contacted at least ten potential partners, including municipalities, nonprofit organizations, universities and small businesses. They described the opportunity, and how it may align with their interests. Interested parties discussed how they envisioned support for the project and wrote letters of commitments, including any in-kind support they foresaw contributing.

3. Write a preproposal

Having talked to all of the partners, Jacquelyn wrote the preproposal over a week in September. It was reviewed by Jacquie Kay and structural edits were suggested to make it align with the scoring rubric that would be used by the review panel. A budget and letters were attached and submitted September 23, 2015. The final version of the preproposal can be seen in Appendix B. On October 8th, 2015, Jacquelyn was notified via email that the LSL had been invited to submit a full proposal.

4. Detailed discussions with partners (and partners with their organizations) and budget development

As the full proposal was intended to describe the project in more detail over more pages, it was now necessary for the LSL to spend more time with partners to develop the project. More meetings were held and roles were solidified, and the budget was broken down, including the cost that would be incurred by each partner, and the in-kind support that they would lend the project. This was the most time consuming part of the grant writing process, as many of the partner organizations needed to spend time approving the project internally, and calculating costs. Once approved, partners sent budgets and justifications to Jacquelyn, who compiled the costs and justification into a master document in the format requested by the RFP, which was reviewed and approved by Jacquie Kay.

5. Collect letters of commitment, write Abstract, Cover Letter and Timeline

Once the final budget was set and roles established and approved by partner organizations, partners were asked to compose another more specific letter of support, detaining their role in the achievement of outcomes in the project. During this time, Jacquelyn worked on the project Abstract and Cover Letter sections. All partners sent letters to Jacquelyn, who reviewed and formatted them, assuring they matched the partner role descriptions as stated in the Project Narrative. Now that the project was completely formed among all its parts, the Timeline section could also be developed.

6. Complete Project Narrative

After making the final edits in regards to the roles of partner organizations and the LSL, the rest of the narrative was reedited for fluency and handed off to Gene for the final revision. As the visionary of the project, he had some minor changes to suggest in the introduction sections about the goals of the organization and his role. Jacquelyn revised accordingly in this section, then worked on bringing the document to under the page limit with the removal of unnecessary material and skillful formatting.

7. Assemble and submit grant

After all sections were completed and reviewed for the final time, they needed to be combined into a single PDF file in the format stated in the RFP. The grant was submitted on November 17th, 2015. The grant is presented in full in the following section.

SUBMISSION

The following is the final proposal submitted on November 17th, 2015. Included are the Cover Letter, Title Page, Project Narrative, Project Timeline, Overall Budget, Task Based Budget, Budget Justification, and Statement of Qualifications. Not included are the Letters of Support from John Todd Ecological Design, Ocean Arks International, Fisherville Redevelopment Company, Blackstone Headwaters Coalition, Mass Audubon, Sun Walking Group, Fungi Perfecti, Clark University, Town of

Grafton, Tufts University and Brown University. Also not included are the NEIWPCC Subrecipient Risk Assessment Form and the Appendices, which include water quality data and partner organization CV's, and make up 147 pages of the document.

Blackstone Living Systems
River Corridor Laboratory

New England Interstate Water Pollution Control Commission
650 Suffolk Street, Suite 410
Lowell, MA 01854

November 16, 2015

Re: Southeast New England Program Water Quality Management Grant Proposal, Living Systems Lab – ***Bio-remediating the Blackstone River Corridor: A Unique and Natural Storm Water Management Model***

Dear Review Committee,

The Blackstone River Corridor Living Systems Laboratory (LSL) is pleased and honored to have been invited to submit a full proposal for the Southeast New England Program Water Quality Management Grants for the Greater Narragansett Bay Watershed. We believe that out project "Bio-remediating the Blackstone River Corridor using Engineered Ecosystems: A Unique and Natural Stormwater Management Model" aligns the mission of the LSL and its partners with the goals of the present RFP by creating natural, low-cost and replicable model for stormwater nutrient and pathogen management that builds community around our region's rivers.

The LSL is therefore applying for $196,421 in funds under this program, to supplement the non-federal match of $256,408 that the LSL and its partners are contributing to this project. We acknowledge that, if awarded, this funding will be provided on a reimbursement basis and is contingent upon completion of quarterly progress reports.

The LSL, the Town of Grafton, MA, and their numerous and diverse partners are well-positioned to make a positive impact on the Greater Narragansett Bay Watershed, synergistically combining decades of experience in the fields of ecological engineering, planning, wastewater treatment, biology, chemistry, mycology, landscape design, sustainable community development, low impact development, green infrastructure, conservation and management. This grant will fund the development and implementation of technology that will both reduce river nutrient and pathogen contamination, as well as prevent and reduce future point and nonpoint source pollution while building a community of water stewards.

Thank you again for the opportunity to share this project with you. We hope that you find it as compelling as we do. If you have any questions, please feel free to contact me at jacquelyn.burmeister@gmail.com or by phone at 203-417-6319.

Sincerely,

Jacquelyn Burmeister
Program Manager
Blackstone River Corridor Living Systems Laboratory

Project Name: Bio-remediating the Blackstone River Corridor using Engineered Ecosystems: A Unique and Natural Stormwater Management Model

Primary Investigator: Jacquelyn Burmeister, Blackstone River Corridor Living Systems Laboratory Program Manager, 111 Woodland Street, Worcester, MA 01610. E-mail: jacquelyn.burmeister@gmail.com. Phone: 203-417-6319

Project Financial Contact: Peter Coffin, Blackstone River Coalition Coordinator and Project Partner

Contact Information: Street Address: 414 Massasoit Road, Worcester, MA 01604; Mailing Address: P.O.Box 70477, Worcester, MA 01607, Email: peter.coffin@zaptheblackstone.org, Phone: 508-753-6087

Project Partners: Joseph Laydon, Town of Grafton Planner; Heidi Ricci, Mass Audubon Senior Planning Analyst; Dr. Timothy Downs, Clark University Associate Professor of Environmental Science and Policy; John Todd, John Todd Ecological Design LLC President; Paul Stamets, Fungi Perfecti, LLC President; Dr. Jacquie Kay, Sun Walking Group President; Gene Bernat, Fisherville Redevelopment Company President

Funds Requested: $196,421 **Total matching funds**: $256,408

Federal Tax Identification Number: 04 356 3269 **DUNS Number:** 102 302 042

ABSTRACT: The Blackstone River Corridor Living Systems Laboratory (henceforth "LSL") is a newly formed nonprofit organization with the mission to optimize, quantify and communicate the ability of engineered ecologies to remove excess nutrients and contaminants from rivers, thereby providing clean water and creating value-added products for communities. We use the natural ability of plants, animals, bacteria and fungi to remediate freshwater ecosystems degraded by storm water pathogens and nutrients, while performing novel research and delivering transformative environmental education. We build community through engaging the public in the science and practice of remediation and connecting remediation to the beautification of public spaces. Through these actions we strive to become a replicable model for natural stromwater restoration throughout the region. Our current project, "Bio-remediating the Blackstone River Corridor using Engineered Ecosystems: A Unique and Natural Storm Water Management Model", applies a structured scientific research agenda and engineered ecologies to the Blackstone River to create a positive impact to affected natural resources both here and in the Narragansett Bay. *The objectives of this project are: (1) Increased capacity for treatment of non-point source nutrient and pathogen contamination with natural, economical and replicable methods, (2) Investigation of novel water treatment design for removing nutrients and pathogens from water of point and nonpoint source origins, and new site feasibility assessment and (3) the creation of value-added products through water treatment for community benefit to broaden the impact to the Narragansett Bay Watershed.* Over the next year, we will expand our current treatment plant to a capacity of over 50,000 gallons/day. We will develop and conduct two full scale scientific research studies on novel water treatment methodology and a new site feasibility report. Finally, we will construct a nursery that utilizes excess nutrients from the Blackstone River to produce ornamental plants and bioretention soils for public use, while creating a space for students, families, municipal workers and researchers to build community around ecological learning and water resources. All the while, we will work to demonstrate the ability to apply concepts learned at the LSL to other sites in the watershed. Our partners include large research institutions, ecological experts, small businesses, nonprofit organizations and municipalities, all of which have been committed to the LSL's goals for some time now. Partners will all be involved in the development of methodology and evaluation will be carried out by an independent Evaluation Committee of experts in biology, community development and education. This proposal seeks $196,421 in funding from NEIWPCC for our project to support the construction materials, research equipment, analysis and administrative costs associated with obtaining the above mentioned outcomes.

PROPOSAL NARRATIVE

BACKGROUND AND PROJECT DESCRIPTION

Overview

The Blackstone River, birthplace of the American Industrial Revolution and one of the most beautiful rivers in New England, is also assumed to be one of the largest sources of nutrient and pathogen pollution in watershed [1]. It is one of the oldest industrialized and urbanized rivers in world. Water resource use practices established by the mills, and the communities they supported, have been replicated throughout the region and world. The long history of development along the river has left a legacy of antiquated infrastructure and development practices that continue to discharge nutrient laden stormwater and pathogens as well as inadequately treated sewage into the river and ultimately into the Narragansett Bay. The large watershed area (over 500 square miles) subjects the river ecology to large and rapid storm water flooding events that introduce extremely large volumes of nutrients and pathogens while also disrupting the micro and macro biological processes required for a healthy ecology. Point source discharge treatment solutions continue to be inadequate to protect the health of the river and Narragansett Bay. Alternative, non-centralized protection and treatment solutions are required to make meaningful improvements in water quality and pathogen loading.

The portion of the Blackstone Canal located within the Mill Villages Park in Grafton, MA is a highly nutrient and pathogen degraded water way directly connected to the Blackstone River that serves as a de facto storm water basin. This area of the canal and river has been further degraded by oil and other toxins from the location's industrial past. The use of the canal and river as a storm and industrial waste water receptor has been repeated up and down the length of the river. The Eco Machine in Grafton, MA's Mill Villages Park, was created to remediate the oil and nutrient contaminated waters of the canal within the park using engineered ecologies housed within a greenhouse and placed within the open waters of the canal. The Eco Machine, and its placement in the public park has transformed this area and demonstrated the efficacy of engineered ecologies in remediation of impaired waters and local ecologies. It continues to treat the highly degraded waters of the Blackstone Canal and River and has become a model of distributed engineered ecologies and serves as a dynamic educational platform for fundamental and applied research in ecosystem function, bioremediation and green infrastructure. Scalability, replicability and educational capacity are yet to be fully realized and the complex biological processes and interactions that deliver the desired ecosystem services is poorly understood.

Distributed, engineered ecologies, offer both point and nonpoint source treatment solutions that can be used to improve ecosystem health and water quality while delivering multiple social "goods", (ecological literacy, understanding ecosystem services, community engagement, ornamental plants, BMP's, aesthetic amenities, etc.) that can fundamentally transform dysfunctional patterns of resource use and serve as models for sustainable development. Involving the broadest possible audience in remediation and restoration activities will produce communities of connected watershed stewards

Background

The Blackstone River receives nutrient-rich wastewater from seven water treatment plants along the waterway, the largest of which is the Upper Blackstone Wastewater Treatment plant as well as from innumerable point and nonpoint sources of storm water discharges directly upriver of the Living System Laboratory. According to the Blackstone River Coalition (BRC), "polluted runoff is the most significant unaddressed cause of water quality problems today". Over the past 6 years, BRC has consistently given River Report Card water quality scores off "Poor" for nutrient contamination in almost all sites evaluated. Monitoring sites are up gradient, adjacent and down gradient of the LSL. Between 2006 and 2012, sample levels exceeded 1.0 mg/L NO_3 on 67 occasions, and above 0.10 mg/L PO_4 on 94 occasions (see *Appendix A* for the most recent Water Quality Data, sampling points and interpretation methodology). Recent

development around the Blackstone has created almost 16,000 impervious acres since 1999, increasing the flashiness of the river, or the rapid and stressful changes in water levels, that accompany rain events. A study performed by the John H Chafee Blackstone River National Heritage Corridor Commission found that macroinvertebrate communities, an ecosystem health indicator, were moderately impaired due to nutrients and organic enrichment, suggesting that nutrient loading is disrupting food chains in the River [2]. Several studies have shown that the Blackstone River has experienced fecal coliform activity above the 200 most probable number (MPN)/100ml criteria established [3]. The nutrient loading in the Blackstone is an input to the Narraganset Bay, where contamination has led to a high incidence of microalgae blooms, as well as eutrophication and consequently fish kills and the endangerment of mollusk species such as blue mussels, scallops, soft and hard shell clams [4]. Additionally, pathogens from the Blackstone River are contributing to the water quality issues on the beaches of MA and RI, as 42 beaches closures occurred in 2014 for failing to meet EPA standards for bacteria [5].

In order to address the problem of nutrient, pathogen and other industrial contamination, the EPA granted $670,000 in 2007 to the Town of Grafton. The grant funded the design and construction of novel new treatment systems at the Fisherville Mill site to treat storm water and oil contamination in the Blackstone Canal and River on land owned by Fisherville Redevelopment Company (FRC). The Eco Machine, designed by John Todd Ecological Design, LLC (JTED), utilizes the theories of ecological design and induced biodiversity to harness the abilities of native plants, animals, fungi and bacteria and other microrganisms to metabolize water bourne contaminants. By creating engineered microenvironments that induce biodiversity and amplify surface area, organisms metabolize nutrients and contaminants at higher rates than the compromised ecology of the canal and river JTED measured significant reductions in Total Kjeldahl Nitrogen (TKNs) (up to 99%), phosphates (up to 99%), fecal coliforms (up to 99%), and PAHs in other locations (See *Appendix B* for Performance Data for Eco Machines). The Eco Machine is located in a public park next to existing BRC water quality analysis sampling sites. Water from the River is first drawn through a packed column digester, where it is treated by native bacteria. It then passes through a 12-chamber mycelial manifold, where native fungi species growing on woodchip substrate degrade pathogens and petroleum hydrocarbons through enzymatic activity. Lastly, water passes through five, 750-gallon cylindrical translucent solar cells with suspended plant material that metabolize nutrients into plant biomass, and provide habitat for other organisms that treat water contamination. Water is then returned to the canal inoculated with beneficial microbes that will continue to degrade nutrients and pathogens in the river. The system is housed inside 680 square feet greenhouse and can treat up to 10,000 gallons of water daily.

In its first year of operations, the Eco Machine reduced total petroleum hydrocarbons 320.41 ug/l to 5.75 ug/l (a 98% reduction). While there have yet to be any QAPP certified nutrient and pathogen water investigations at the Grafton Eco Machine, the ecosystem nodes found in the Eco Machine have demonstrated a high success rate throughout New England. Aquatic Cells in bioremediation projects in Rhode Island and Massachusetts have demonstrated the ability to remove 98-99% of TKN and 99.99% of fecal coliforms, and informal sampling infers that similar processes are occurring here (See *Appendix B* for Performance Data for Eco Machines). While never tested, it is suspected that the Eco Machine removes P as well. In addition to magnifying the natural ability of native species to remove contaminants, the Eco Machine creates a refuge and incubator for beneficial microorganisms during times of stress in the canal and river, such as storm events, that would normally decimate microbial communities, such that these populations recuperate faster in the canal. Since operation of the Eco Machine began, amphibians, reptiles, birds and fish have returned to the canal, further demonstrating the ability of the Eco Machine to create ecosystem resiliency.

Through extensive public outreach news of the success of the Eco Machine spread sparking interest in researchers, municipal workers, teachers, and community members, who were inspired by the ability of designed ecosystems to restore environmental balance. Since 2007, Gene Bernat, Principal of FRC, and the individual responsible for envisioning the project and specifying the treatment technologies used has hosted dozens of tours, tens of field trips, and trainings for community members wishing to learn more about the technology. He has collaborated with Mass Audubon, using the site as an example of Low Impact Green Infrastructure that can reduce the effects of nutrient loading. The National Heritage Corridor has given walkabout tours through the area, focusing on the region's environmental and industrial history. Additionally, Mr. Bernat has recruited and organized academic partners and has hosted several research projects from the Brown University Superfund Lab, The Conway School of Landscape Design and Worcester Polytechnic Institute, as well as hosted master's theses in mycology, environmental science and business from Clark University. Throughout this time, the site relied on the support of the Town of Grafton, The National Heritage Corridor and the Site Owner to continue operations.

The Eco Machine is an example of green water treatment technology that can easily be expanded and replicated up and down the Blackstone River and throughout the Narragansett Watershed's diverse aquatic environments from river to Bay. Broad public and academic involvement and participation in the process of remediation and restoration has begun to create a community intimately connected to the health and processes of the watershed wide ecosystem. However, there is still a long way to go. One small Eco Machine working alone will not remediate all the water in the Blackstone. The Blackstone River Corridor Living Systems Laboratory (LSL) was formed as a Massachusetts non-profit organization in 2015 to manage the site as a learning resource for ecology, local history, green infrastructure and low impact development to reduce the cost of water treatment through the creation of social goods. The LSL collaborates with researchers and local municipalities to continue to research and develop new technologies that draw upon ecological design principles, while building community and education around ecosystem health. It aims to develop a community of water stewards. As the Town of Grafton strives to reach its new wastewater treatment standards, it looks to the LSL as a beacon of opportunity for novel, low cost methodology, and continues to support its activities as a primary project partner, and has continued to provide and expand permission to use its public parks for these purposes. Together with the Town, local NGOs and small businesses, the LSL is pursuing a new project, "Bio-remediating the Blackstone River Corridor using Engineered Ecosystems: A Unique and Natural Stormwater Management Model", which is designed to implement economical and replicable solutions to point and non-point sources of phosphorous, nitrogen and pathogens while delivering value-added products to the Narragansett Bay Watershed.

PROJECT OBJECTIVES

The LSL has teamed up with diverse stakeholders locally and nationally to deliver a project that will directly address the goals of the Narragansett Bay Comprehensive Conservation Management Plan 2012 Update, the Blackstone River Coalition, the New England Interstate Water Pollution Control Commission RFP and the mission of the LSL. The current project elaborates and implements a realistic methodology to create the greatest impact throughout the Narragansett watershed and beyond via three Objectives. Developed in collaboration with the municipality, local NGOs and universities, these Objectives address local social and environmental needs through the remediation of river water polluted with nutrients and pathogens, investigation of novel treatment and implementation methods, and the creation of value-added social goods, such as educational programs, ornamental plants, rain garden materials and professional trainings in Best Management Practices for green infrastructure and lawn care. Project Outcomes will align with these Objectives and the grant RFP.

Objective 1: Increased capacity for treatment of non-point source nutrient and pathogen contamination with natural, economical and replicable methods. The current Project will increase the capacity of the Eco Machine to degrade nutrients and pathogens from the Blackstone River at a cost effective rate, thus improving the health of a degraded river and reducing the quantity of contamination entering the Narragansett Bay.

Objective 2: Investigation of novel treatment design for removing nutrients and pathogens from water of point and nonpoint source origins, and new site feasibility assessment. The current Project will perform scientific investigations on the natural processes that are taking place in the Eco Machine that allow for the efficient removal of nitrate (NO_3), orthophosphate (PO_4), E. coli and fecal coliforms, as well as the system's ability to create ecosystem resilience. The investigation will produce data to document scale up potential. In doing so, we will better understand how to apply this technology to waterways of varying contamination profiles to increase the reach of its application and efficiency. This project will recommend at least five other sites along the Blackstone River where this technology can be replicated effectively based on River contamination levels and other biogeochemical factors analyzed with Geographic Information Systems technology. These new sites may be suitable for the treatment of both point source and ambient river stormwater discharges.

Objective 3: The creation of value-added products for the community to continue to positively impact the Narragansett Bay Watershed. The Project will build community and awareness around the threats of nutrient and pathogen contamination in the Blackstone River and beyond by offering value-added products to citizens, municipal workers, students and researchers. These products will provide direct positive impact to the health of the River in two ways: by collaboratively improving ecosystems through the dissemination and application of value added plants and other products that will reduce nonpoint source pollution and directly connect the broader community to health of the river, and further knowledge and deepen the understanding of what can be done to prevent nutrients and pathogens from entering waterways to begin with. The Project aims to highlight and celebrate the ways in which the Blackstone River provides services to the population, so as to promote the lasting sense of guardianship among citizens that will ultimately improve ecosystem health downstream.

METHODLOGY

The LSL draws upon the expertise of diverse professionals in the fields of bioremediation, green infrastructure, engineered ecosystems, biological research, landscape design, and sustainable community development to design and implement a comprehensive plan for the present project. These partners have worked with the LSL to develop Outcome metrics and methodology such that the project fulfills the mission of the LSL and the purpose of the NEIWPCC, as well as synergistically advance their own research and community development goals. All methodology is expected to be more efficient and cost effective than current technology, by using low-tech, natural systems technology. The Project also treats the cause of nutrient and pathogen storm water contamination by reducing nonpoint nutrient discharge and mapping future point source discharge before it reaches waterways to begin with. In these ways, the system will be cheaper and easier to implement than traditional strategies. All methodology has or will be evaluated by the LSL Scientific Advisory Board to ensure that it is based in sound theory and can produce actionable conclusions. The following describes the methodology that will be applied in order to reach each of the Project Objectives.

Objective 1 Methodology: Increased capacity for treatment of non-point source nutrient and pathogen contamination with natural, economical and replicable methods. The LSL will increase the capacity of the Eco Machine to degrade or remove contaminants from the River through the expansion of the current greenhouse structure to 1000 square feet. JTED, the system designer, estimates that this will increase the capacity of the combined technologies from 10,000 to 50,000 gallons per day. Given the ability of other

systems to reduce nutrients to 1% of their initial concentration, JTED estimates rates of N removal of 100 lbs/year, of P removal at 30 lbs/year and a 4 log reduction in coliforms annually.

As part of these renovations, the LSL will be expanding the fungal manifold portion of the machine. We have seen that the increased colonization of fungal mycelium in this treatment node will increase the potential of the Eco Machine to metabolize water pathogens, as well as inoculate the Blackstone River with enzymes and fungal associated microbial populations that may reduce harmful bacteria populations even after the water leaves the system. The flow and efficiency of the system to remove contaminants will be assessed bi-monthly over the course of the year, with results being made available through our website. The Town of Grafton has committed their time and expertise in the permitting processes associated with construction. Care will be taken on behalf of the LSL to document the permitting and construction processes which take place during the evolution of this Objective, such that they can be used as a guide in the construction of future Eco Machines along the Blackstone River.

Objective 2 Methodology: Investigation of novel treatment design for removing nutrients and pathogens from water of point and nonpoint origins, and new site feasibility assessment. Objective 2 will be achieved through a series of experiments to understand which elements of the Eco Machine drive removal of nutrients and pathogens, and to determine the optimized operating parameters for these elements. Further, microbial biodiversity studies will help determine how the Eco Machine impacts the health of the surrounding ecosystem by augmenting contamination removal and ecosystem resilience. We will apply these findings as a model for the Narragansett Bay Watershed by identifying other potential sites for other Eco Machines along the Blackstone River and using the project data to extrapolate watershed water quality improvements through replication and amplification of the Fisherville Eco Machine model.

Nutrient and Pathogen Removal Design Research

The first of the "design research" experiments is an inter-nodal water chemistry and pathogen analysis that will be developed with assistance from BHC and Fungi Perfecti. The purpose is to improve understanding of contaminant reduction in each treatment node in the Eco Machine. In this experiment, hydraulic loading of each Eco Machine component will be incrementally increased until the component reaches the failure point as measured by influent and effluent comparisons over time. Once the failure loading is identified, the minimum retention time will be determined and the system as a whole will be tested at the highest possible flow rate while maintaining treatment goals. This analysis will improve understanding of the Eco Machine system and will allow improved sizing, scaling, and pollutant reduction modeling so that the Fisherville Eco Machine Living Systems Laboratory can serve a replicable model for other locations in the watershed. We will also develop an experimental design with assistance from Fungi Perfecti to test the efficiency of fungi in the mycelial manifold to remove E. coli. Previous studies led by Fungi Perfecti have suggested that choice of substrate, hydraulic loading, and retention time are critical factors in the rate at which fungi can filter pathogens such as E. coli. With data from this and the previous experiment, it will be possible to custom design an Eco Machine to match the contamination profile of different kinds of rivers.

Microbial Biodiversity and Ecosystem Resilience Research

The second experiment will evaluate the contributions of different fungi species to soil microbiological diversity and ecosystem resilience. Previous studies between researchers at Fungi Perfecti and Dr. Giovanni Widmer at Tufts University School of Veterinary Medicine have indicated that different species of fungi growing on the same substrate material under the same incubation conditions host significantly different populations of bacteria, suggesting that fungi can significantly alter the soil microbiome in their sphere of influence (See Appendix C for Figure 1). We hypothesize that increasing microbial diversity can increase the resilience of these ecosystems to anthropogenic stressors such as nutrient and

pathogen loading. The LSL will collaborate with Fungi Perfecti and Dr. Widmer to design and implement an experiment to determine if the inoculation by certain fungal species can significantly alter or increase soil microbial diversity, and to assess whether these changes correlate with improved nutrient and pathogen reduction in the system.

Geographic Information Systems for Eco System Replicability Feasibility

The final research component of the Project involves laying the groundwork for future water treatment. While the current Eco Machine is treating water from the Blackstone River itself, it is also possible to implement this technology at discharge points. We envision a Blackstone River that achieves a better state of health through the strategic implementation of Eco Machine technology in places that can best benefit from treatment. The small size and low cost of the Eco Machine make it suitable as a low impact technology in degraded sections of the Blackstone that may not be suitable for large scale treatment projects. Geographic Information Systems (GIS) are capable of mapping contaminant loading sites, physical parameters along with other variables that would determine the suitability of a location for the construction of an Eco Machine. Clark University has committed itself to working with the LSL on this project by supporting two masters' students studying GIS for Development and Environment and Environmental Science and Policy to make the necessary measurements and map layers to determine future Eco Machine site suitability.

Objective 3 Methodology: The creation of value-added products for the community to continue to positively impacting the Narragansett Bay Watershed. Objective 3 focuses on the recycling and repurposing of the resources found in the Eco Machine to further address nutrient and pathogen loading in the Narragansett Bay Watershed and beyond. The LSL will achieve this through a host of collaborations with the local municipalities and NGOs to create physical products as well as educational workshops that will empower people to replicate Eco Machine technology and Best Management Practices in their home and community.

The guiding principles of the Eco Machine include the closing of broken ecological loops through the repurposing of what were once considered waste products. This project will produce ornamental plants, plants to propagate, as well as bioretention soils in the Eco Machine. In doing so, it will help to increase connectivity of communities to the River and raise awareness of the function of the Eco Machine. Plants grown in the Eco Machine are tolerant of the pathogens and TPH in river water, and seem to thrive on its heightened nutrient content. The expanded Eco Machine will have the space necessary to begin to cultivate ornamental plants by diverting some of the nutrient rich water from the river, or growing plants directly inside of the solar cells. The LSL will construct an indoor and outdoor nursery, and the Town of Grafton will donate a small parcel of land in the community garden for outdoor transplanting. These plants will then be propagated in three public locations in the Town of Grafton, with signage to link them to the Blackstone River water and the Eco Machine. Fresh cut flowers from the greenhouse will be donated to local events. Additionally, the LSL will produce bioretention soils to be used in the Mill Villages Park, and, in the future, all along the Blackstone River. The process by which fungi degrade petroleum and pathogens on a woodchip substrate produces a compost inoculated with healthy soil microbes that has the ability to sequester nutrients and pathogens in runoff. These soils serve as a barrier for nonpoint source entry of contaminants to the River when applied in adjacent parks, removing contamination before it enters the waterway. In the future, these valuable soils, as well as greenhouse plants will be a potential source of income for the LSL

In order to continue to improve the health of the Blackstone River and greater Narragansett Bay Watershed, it is necessary to educate municipal workers, landscape professionals and community members about low impact solutions to nutrient and pathogen contamination. The Eco Machine is already an example of green technology that can be replicated at low cost throughout the region, and the LSL will

give tours to explain the principles behind this technology. Additionally, the LSL will serve as an example of how to prevent nutrient loading into the river in the first place. The Town of Grafton has given permission to the LSL to apply Best Management Practices to the Mill Villages Park located adjacent to the Eco Machine, as an example of how to create attractive spaces while minimizing damage to the environment. The LSL will collaborate with the Town of Grafton, Mass Audubon, and the Blackstone Headwaters Coalition to design and present workshops on the implementation of these technologies that will be free to the public, with several being recorded and aired on Grafton Public Access Television. In this way, the public and professionals will gain a greater understanding of what can be done, and how they can reduce nutrient and pathogen contamination. In the future, the LSL will these educational workshops and tours as a source of income to reduce the need for external funding.

The LSL hopes to be a replicable model for preventing and removing contamination from the Blackstone River. In order to make the construction of this technology more attainable in the region, the LSL will collect its experiences in a manual called "Building an Eco Machine Manual" which will be a tool to provide relevant information on the procedures necessary for a municipality to design and construct an Eco Machine. The content will include everything from information on permitting, to internal design, to gaining community support, and will contain the data obtained from the GIS analysis descried above to recommend construction sites. The manual will be available on the LSL website and will greatly enable the replication of the Eco Machine technology.

Project Administration. Several partners have committed large in-kind contributions of time, materials and funds to this project totaling over a 200% match. The LSL will be the primary Project Administrator. LSL Operations Manager Nicholas Bernat, along with JTED, has been instrumental in the creation and establishment of the Eco Machine will head the operations of this project. Nick is uniquely qualified and committed to the long term viability of an ecosystem model for remediation of the Narragansett watershed. The Program Manager, Jacquelyn Burmeister, has been working with the Eco Machine since 2014, and holds an MBA and MS in Environmental Science and Policy. Supporting and advising the team is Dr. Jacquie Kay of The Sun Walking Group, an innovative business lab focused on the nexus of community, finance, energy and the environment. Jacquie's background in management of large-scale projects, internationally and domestically and her knowledge and experience in community participation and economic development, will help to establish frameworks where the scientific aspects and bio-remediation process of the Living Systems Lab works for public participation, modeling for replicability, and including communities and towns in the decision-making process. Her commitment to this LSL goal of developing living, healthy habitat natural and human habitats, and for these local communities in particular, brings added value for the partnership of academia, community, government and the private sector. Lastly, the vision of this site of its owner, Mr. Eugene Bernat, has been instrumental in bringing together the key stakeholders and consultants. Please see Section X for ore qualifications of the management team, as well as *Appendix D* for their CVs.

EXPECTED PROJECT OUTCOMES

Through the intense collaboration of partners and the Municipality, as well as funding from the Southeast New England Program Water Quality Management Grants, and other sources, this project will deliver realistic and measureable outcomes to support its Objectives over the course of 2016. The synergistic nature of the Project creates more value than any of the individual organizations can on their own. As outlined above, these Objectives will culminate to the increased health of the Narragansett Bay Watershed through novel and replicable contaminant removal methods, innovative research, and value added products, aligning with the goals and mission of the LSL, Town of Grafton, local NGOs and the present RFP. The success of each of these Objectives will be realized through the measureable Project Outcomes, or the direct tangible results of the Project. These Outcomes can be grouped under the

categories of River Contaminant Removal, Research on Replicability and Innovation, and Community Empowerment and Education. The following details the measurable indicators of success. All outcomes will be reviewed by the LSL Scientific Advisory Board and Review Committee.

River Contamination Reduction

a. Treatment of 50,000 gallons of water from the Blackstone/day, with increased removal of nutrients and pathogens
b. Creation and application of bioretention soils in parks along the Blackstone River
c. Application of Best Management Practices to the Mill Villages Park

Research on Replicability and Innovation

a. Publicly Accessible Report "Effectiveness of different applied bioremediation techniques to degrade river contaminates and implications for future Eco Machine design"
b. Publicly Accessible Report/Peer Reviewed Paper "Microbial biodiversity in response to fungal treatments on contaminated river water and implications for bioremediation technology"
c. Publicly Accessible Report "Site feasibility for Eco Machine Technology to treat point and non-point nutrient and pathogen contamination along the Blackstone River using GIS Technology"

Community Empowerment, Education and Value-added Products

a. Municipal Tool "Building an Eco Machine Manual"
b. 1000 visitors to the Eco Machine over the course of 2016
c. 8 Professional Workshops, open to the public and professionals on topics including Recreating Eco Machine Technology, Best Practices Management, and Green Infrastructure, training 50 professionals/municipal workers and 100 community members
d. Propagation of flowers in three locations throughout Worcester County
e. Provision fresh cut flowers at local events

PROJECT EVALUATION

In order to ensure that the present Project reaches its potential to make a positive impact on the health of the ecosystems and communities of the Narragansett Bay Watershed, a Review Committee has been formed to benchmark the progress and accomplishment of aforementioned Objectives and their Methodologies. This committee will convene at least quarterly to review project progress and to structure an evaluation system that includes both social impacts and scientific rigor. The Committee is made up of professional scientists, community developers and education specialists. They will set up a monitoring and evaluation system that determines if the metrics and analytics meet goals of social impact – community involvement, community needs and collaborative methods of project involvement. This system will be based on sustainable goals of Resilience and Adaptation guidelines created, and impact analyses. Two members of the Review Committee, Dr. Jacquie Kay and Dr. Timothy Downs, will develop this framework. The scientific outcomes and results based on the nutrient and pathogen studies, the testing of contaminants, and even the expanding of the fungal manifold of the Eco Machine are but examples of how the studies will approach the scientific impact. Thus, the committee will identify both the scientific and social impacts of the analyses conducted to meet the Objectives. The evaluation will consist of qualitative and quantitative analyses and will be a sustainable model.

ROLES AND RESPONSIBILITIES

Blackstone River Corridor Living Systems Laboratory (LSL) - The LSL will act as project manager, outreach coordinator and lead scientific investigator, as well as lead site maintenance and construction. LSL Program and Operations Manager will communicate with the Municipality and other partners to ensure the fulfillment of Project Objectives on time and as described in the standards outlined by the Project Evaluators. The Program Manager will also program tours, produce educational materials and manage social media in relation to Objective 3, as well as implement research agendas produced by Fungi

Perfecti. She will work with in implementing research agendas produced by Fungi Perfecti, and those of the Review Committee in meeting community needs. The LSL Operations Manager will manage construction of the nursery and greenhouse expansion in collaboration with JTED and accordance with Objective 1, as well as lead and develop three educational workshops for community and municipal workers on topics such as Best Management Practices and Eco Machine Design, as described in Objective 3. He will also work with the Town of Grafton to implement Best Management Practices in the Mill Villages Park and manage ornamental plants, plant propagation and creation of bioretention soils. As the Operations Manager, he will be responsible for all decisions regarding the Eco Machine and development of replicable models for the watershed.

Sun Walking Group - Sun Walking Managing Partner will assist and advise staff for all Objectives and aspects of the project. She will work with the LSL Project and Operations Manager and other advisors in establishing networks and connections to increase the outreach of the project to support the achievement of Objective 3. Additionally, she will work with committees, staff and consultants in interpreting and integrating processes and data vis-à-vis their applicability and implications for project replicability throughout the region and application to sustainability standards and social impact. She will also serve on the LSL Review Committee.

Town of Grafton – The Town of Grafton continues to be a major partner the present LSL project and will be offering $11,608 in in-kind donations the form of use of facilities, ongoing maintenance, use of materials and equipment, and technical assistance. The Town will provide the use of the South Grafton Community House and Mill Villages Park Pavilion to host workshops and trainings, as well as space in a local community garden as a storage space for mature plants from the nursery prior to propagation. In the Mill Villages Park, the Town will give the LSL permission to manage the landscape using Best Management Practices, and space to construct rain gardens. Mowing and snow-plow services will be provided. The Town will lend technical assistance in the permitting of the new Eco Machine construction, inspection/oversight during the construction of rain-garden beds, and contracting fees for the development of the rain-gardens. The Town's Conservation Committee will also assist in the development of 3 professional workshops that will be open to community members and municipal workers, as described in Objective 3 of the Project. The Town will record and produce video for five of the workshops to be televised on Grafton's public access television channel and published on LSL's website increasing the reach of the Organization's message.

Mass Audubon - Mass Audubon will act in the role of community outreach education. Project Coordinator for the *Shaping the Future of Your Community Program* will collaborate with LSL Project and Operations manager to organize and deliver two workshops throughout the year, with a focus on the application of Green Infrastructure and Local Stormwater and Water Quality Issues, as well as the ability of the LSL to remediate them. These workshops will target 15 municipal workers and 50 community members. The Project Coordinator will also develop three unique informational pamphlets for dissemination among the community on the topics of sources of nutrient contaminants and pathogens in water, how the LSL functions, and the importance of green infrastructure like the LSL in communities to improve water quality. Outcomes are as described in Objective 3.

Clark University- Clark University will collaborate with the Program Manager at the LSL to organize a GIS study to determine site feasibility for future Eco Machine construction along the Blackstone River as described in Outcome 2. Clark University's Department of International Development, Community and Development will be providing two students to perform work on a semester-long project in the Fall of 2016, culminating with the Report "Site feasibility for Eco Machine Technology to treat point and non-point nutrient and pathogen contamination along the Blackstone River using GIS Technology".

Blackstone Headwaters Coalition (BHC)- BHC will be providing in-kind technical assistance, materials and equipment, as well as outreach support. BHC will provide historical water quality data to the project. BHC Coordinator will work with LSL Program Manager to develop a QAPP for pathogens, and provide trainings in water quality testing to LSL employees. They will provide nutrient and pathogen water testing equipment, as well as a QAPP for nitrate and orthophosphate for use in the execution of water chemistry investigations as described in Objective 2. BHC will also upload links to the LSL Project on their website, increasing outreach. BHC will be the LSL's fiduciary agent, and will therefore manage the disbursement of grant funds and approve reports, providing an in-kind management service

John Todd Ecological Design, LLC– JTED will be providing the technical expertise for the design, as well as carry out the construction of the new water treatment facility, as described in Objective 1. The JTED Lead Engineer and Project Manager will work closely with the LSL Operations Manager and the Town of Grafton in the permitting and coordination of this task and in expanding its development for the future.

Fungi Perfecti – Fungi Perfecti will be providing technical advising by lending their expertise in the design of methodology, execution, and review of a scientific investigation on the effects of different fungi on soil microbiology and their ability to degrade pathogens, in as described in Outcome 2. They will visit the site once from their headquarters in Washington to gain a better understanding of how to design the experiment. The Fungi Perfecti Head and Assistant Researcher will work with the LSL Program Manager and Dr. Widmer of the LSL Advisory Board to implement the project. Fungi Perfecti will also provide the fungi spawn necessary for both the experiment and to keep the Eco Machine running for one year.

FRC and Eugene Bernat- FRC will donate the parking lot and Eco Machine to the project, as well as geotextiles and other materials for the upkeep of the greenhouse and Mill Villages Park. Mr. Bernat's project focus will be advancing the watershed wide replicability of the cost effective remediation, applied science, experiential learning and community water resource stewardship attributes of the LSL model. Mr. Bernat will work with the Operations Manager in the applied science, community outreach, and environmental permitting for the project, working closely with the Town. He serves on the Scientific Advisory Board and will take leadership there. Mr. Bernat will work with JTED and LSL in providing design and operating expertise for the mycological bioreactors that will be developed and for the project.

CITATIONS

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[3] The Louis Berger Group, Inc. The Louis Berger Group, Inc. Water Quality – Blackstone River: Final Report 2: Field Investigations. Rep. N.p.: Rhode Island Department of Environmental Management, 2008. Print. http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/blackwq2.pdf

[4] Narragansett Bay Estuary Program. "Excess Nutrients: Eutrophication." Narragansett Bay Estuary Program - Rhode Island. N.p., 2015. Web. 8 Nov. 2015. http://www.nbep.org/bay-science-nutrients.html

[5] Narragansett Bay Watershed Counts. *Cities By the Bay: Narragansett Bay Watershed Report with a Spotlight on Urban Waters*. Rep. no. 2015. N.p.: n.p., n.d. Print. http://www.watershedcounts.org/documents/Watershed_Counts_Report_2015.pdf

[6] Taylor, Alex, et al. "Removal of Escherichia coli from synthetic stormwater using mycofiltration." Ecological Engineering 78 (2015): 79-86.

[7] Valle, Lauren, and Max Rome. "Informal Interview with JTED Engineers and Project Manager." Personal interview. 13 Nov. 2015.

PROJECT TIMELINE

Month	Objective 1: Eco Machine Expansion	Objective 2: Scientific Research and Development	Objective 3: Value-Added Products
Feb-16	Eco Machine Design and Planning	QAPP development and Submission for Pathogens Development of Water Chemistry and Microbiological Investigation Methodology	Begin Nursery Design Order Seeds
Mar-16		Advertise Internship and Select 2 Clark University Master's students for GIS study Review of Investigation Methodologies by Review Board Begin Water Chemistry Analysis Investigation	Design and Publish 1st Informational Pamphlet Source Nursery Materials Plant First Round of Seeds Begin Best Management Practices in Mill Villages Park
Apr-16	Materials Procurement and Pre-Assembly		School Field Trip 1 Procure Materials for Nursery Construction Buy Larger Plants for Nursery
		Review Committee Meets	
May-16	Construction (4 weeks)	Begin Internship by Clark Students	Design and Publish 2nd Informational Pamphlet 1st Workshop Begin Cultivation of Bioretention Soils Build Interior Portion of Nursery
Jun-16		Begin Microbiological Study	Design and Publish 3rd Informational Pamphlet 2nd and 3rd Workshop Build exterior plant beds and transfer plants from nursery
Jul-16			4th Workshop Continue to Propagate and Expand Plants
		Review Committee Meets	
Aug-16		End Microbiological Study	5th Workshop
Sep-16		Analyze and Report Microbiological Study Data	6th Workshop 7th Workshop
Oct-16		Review of Microbiological Data Study	School Field Trip 2 School Field Trip 3 8th Workshop
		Review Committee Meets	
Nov-16			
Dec-16		Review of Microbiological Data Study End Clark University Internship Final Report: "Site feasibility for Eco Machine Technology to treat point and non-point nutrient and pathogen contamination along the Blackstone River using GIS Technology"	
Jan-17		Final Report: "Microbial biodiversity in response to fungal treatments on contaminated river water and implications for bioremediation technology"	
		Review Committee Meets	
Feb-17			
Mar-17		End Water Chemistry Analysis	
Apr-17		Analyze and Report Water Chemistry Data Final Report: Effectiveness of different applied bioremediation techniques to degrade river contaminates and implications for future Eco Machine design"	
		Review Committee Meets	

OVERALL BUDGET

Budget Category	Match	Grant Request
A. PERSONNEL TOTAL		$80,000
Program Manager		$30,000
Operations Manager		$50,000
B. FRINGE BENEFITS 12% of Personnel Costs TOTAL:		$9,600
C. TRAVEL		$4,000
One Fungi Perfecti Site Assessment		$4,000
D. EQUIPMENT TOTAL:	$4,000	
Water Chemistry Equipment (40 hours)	$4,000	
E. SUPPLIES TOTAL:	$23,750	$8,400
Nursery Materials		$4,000
Informational Pamphlets	$2,750	$3,000
Water Chemistry Tests		$400
Materials for GIS study		$500
Mushroom Spawn		$500
Geomaterials and geotextiles	$20,000	
Fungal cultures, experimental materials and supplies	$1,000	
F. CONTRACTS TOTAL:	$44,935	$85,700
John Todd Ecological Design	$12,000	$60,000
Sun Walking Group	$10,000	$15,200
Fungi Perfecti	$1,000	$4,000
Mass Audubon	$1,250	$2,000
Clark University	$6,800	$4,500
Town of Grafton	$2,885	
Blackstone Headwaters Coalition	$11,000	
G. OTHER TOTAL:	$183,723	$3,000
Greenhouse Heating Costs		$3,000
Use of Eco Machine	$80,000	
Use of Parking Lot	$20,000	
Use of Mill Villages Park, Community House and Town Hall and Services	$8,723	
Eugene Bernat	$75,000	
H. TOTAL DIRECT COSTS (SUM OF A-G)	$256,408	$190,700
I. INDIRECT COSTS 3% of total direct costs TOTAL:		$5,721
J. TOTAL PROJECT COST (SUM OF H+I)	$256,408	$196,421

TASK BASED BUDGET

Cost	Task Number	Task Name	Expected Date of Completion
$60,000	O1-1	Design and Construction of New Eco Machine	May 2016
$4,000	O2-1	Site Visit from Fungi Perfecti	February 2016
$4,000	O2-2	Mycological and Microbiological Experimental Design	March 2016
$5,000	O2-3	GIS Study	December 2016
$400	O2-4	Water Chemistry Testing	March 2017
$4,000	O3-1	Nursery Construction	May 2016
$3,000	O3-2	Educational Pamphlets Printing	June 2016
$2,000	O3-3	Mass Audubon Led Workshops	August 2016

O1= Objective 1, O2= Objective 2, O3= Objective 3

*Remaining budget items are administrative costs for project management and managament consultants.

BUDGET JUSTIFICATION

All budget items are have been donated or are requested in order to fulfil the three Project Objectives outlined in the Project Narrative. The following is a justification of the proposed use of the funds and matches, as well as an explanation of match calculations. In-kind support is 131% of the project total. We are very grateful for the commitment of our partners to give cash, materiel, and so much in-kind time.

REQUESTED FUNDS

Personnel and fringe benefits: Totals support the full time employment of the Project Manager and Operations Manager, as well as fringe benefits to support social security, Medicare, unemployment and worker's compensation. Health insurance, holidays and vacations are not included.

Travel: *Fungi Perfecti Site Assessment* and in-person coordination for implantation of mycological and microbiological experiments (O2).

Supplies: *Nursery Materials* include grow lights, heat mats, materials for grow tables, seeds, seedlings, growth media, plumbing parts and pots necessary for establishing a nursery (O3). *Informational Pamphlets* accounts for the materials and printing costs associated with the creation of the three informational pamphlets by Mass Audubon (O3). *Water Chemistry Tests* accounts for the cost of 400 water sample analysis as stated by BHC, at a cost of $1/reaction (O2). *Materials for GIS Study* accounts for the use of equipment for the field study component of the GIS study performed by two Master's students from Clark University (O2). *Fungi Spawn* is cost of fungal spawn from Fungi Perfecti necessary for Eco Machine for 1 year (site maintenance, O2).

Contracts: *Sun Walking Group (80 hrs)* and *Fungi Perfecti (40 hrs)* consulting services as outlined in Narrative at $200/hr. *Mass Audubon* provides technical assistance to prepare materials, pamphlets, and workshops (O3). *John Todd Ecological Design, LLC (JTED)* design and construction of the new Eco Machine (O1). *Clark University* for $2,225 stipends that will be paid to the graduate students that take on the GIS study described in the Narrative (O2).

Other: *Winter heating costs* are estimates based on previous years' heating bills, allowing the use of the facility for tours and workshops throughout the winter months (site maintenance, O1, O3).

Indirect Costs: There is a 3% cost associated with our fiduciary agent, BHC.

IN-KIND CONTRIBUTIONS

Equipment: *Water chemistry analysis equipment* is based on a value given for equipment rental by Blackstone Headwaters Coalition (O2).

Supplies: *Informational Pamphlets* accounts for the cash donation of materials and printing costs pamphlets by Mass Audubon (O3). *Fungal cultures, experimental materials and supplies* are cash donation from JTED for materials for mycological and microbiological experiments (O2). *Geotextiles and materials,* such as granite for landscaping in Mill Villages Park, PVC piping, and others donated by Fisherville Redevelopment Company (FRC) (site maintenance, O3).

Contracts: *Sun Walking Group (50 hrs), Fungi Perfecti (5 hrs) and Eugene Bernat (375 hrs)* will be offering their in-kind consulting services as outlined in the Narrative at a rate of $200/hr. *JTED (80 hrs)* will offer an in-kind donation of engineering, design, construction and support at 150$/hr (O1). *Clark University (68 hrs) and BHC (111 hrs)* give in-kind consulting services as outlined in the Narrative at a rate of $100/hr. *Mass Audubon* will be offering $1,250 in in-kind services. *Town of Grafton Conservation Commission has offered $2,885 in outreach support.*

Other Costs: *Use of Eco Machine* and *Parking Lot* for one year are being offered as an in-kind donation by FRC. *Use of Mill Villages Park* for Best Management Practices offered by the Town (O3). *Grafton Community House, Town Hall* donated as an in-kind contribution at normal rental rate. *Services* include snow plowing, heavy moving equipment rental and video recording from the Town of Grafton as well. Plows are for basic site maintenance vis-a-vi winter snow removal (site maintenance), heavy moving equipment is for implementation of Best Management Practices in the Mill Villages Park (O3) and video recording equipment is for recording and broadcast of community workshops (O3).

DESCRIPTION OF QUALIFICATIONS

Bio-remediating the Blackstone River Corridor using Engineered Ecosystem: A Unique and Natural Stormwater Management Model" is a collaboration between the LSL, the Town of Grafton, and a host of diverse local and national partners that bring unique expertise in one of the three Project Objectives. The following is a summary of the qualifications of each partner to achieve these Outcomes. All CVs and resumes can be referenced in *Appendix D.*

The Blackstone River Corridor Living Systems Laboratory- LSL Project Manager Jacquelyn Burmeister has been working as an administrator at the Eco Machine since 2014. She graduated with highest distinction in Biology from Duke University and is currently finishing her MBA and MS in Environmental Science and Policy at Clark University. She has five years' experience managing and implementing environmental and community development projects in Central and South America, where she worked as a liaison between communities, NGOs and municipalities to address conservation and waste management issues. She also has extensive experience working in ecology laboratories at Duke and Yale University, and has the quantitative and analytical skills necessary to implement experiments at the LSL. LSL Operations Manager Nicholas D. Bernat is a landscape design professional and the owner of Natura Landscape Design, Inc. After completing a practical farm training program in Massachusetts, Nicholas spent several seasons working in organic agriculture, and opening Natura Landscape Design, Inc. One of his recent assignments for Natura, was in constructing the Eco Machine. He has worked with the owner and John Todd Environmental Design in building this. He has been solely responsible for its operation and maintenance since its opening. Nicholas's background in agriculture and love of natural ecosystems have helped to deal with the eco-machine's impact on developing the greenhouse/nursery aspect of the Living systems Lab.

The Sun Walking Group- The Sun Walking Group, www.sunwalking.net, is a corporate collaborative focused on financing and providing technical assistance to communities in developing their own innovation labs, science and technology centers. Dr. Jacquie L. Kay, who heads up Sun Walking, was previously president of WPI, Inc., an international training and development firm developing projects, providing strategic planning, and creating seminars and workshops on a range of topics related to economic development. Dr. Kay is a thought leader in resilience and adaptation focusing on the nexus of communities, financing, and energy and the environment. She was at MIT as a Research Fellow and Lecturer. Her academic background includes a doctorate in planning from Harvard Graduate School of Education; an M.A. from New York University; and an executive MBA and B.A. from the University of Washington. In addition to her work, she was the founding President of the Asian Community Development Corporation (15 years). Two boards on which she serves currently are the Conservation Law Foundation Ventures board and BDC Capital/New England (See Resume for other boards). She is assisting the LSL in comprehensive management, education, partnering activities with the aim to include access for all (social impact) and long term sustainability efforts. She is able to work with the founder, staff, partners and scientific teams.

The Town of Grafton- The Town of Grafton has been an active supporter of the Living Systems Laboratory and played in integral role in enabling the construction of the facility. The Town, its Staff, and elected/ appointed officials have assisted the project through obtaining grant funding for the cleanup of the Fisherville Mill site and for engaging State and Federal agencies to assist fund the cleanup of the site and the development of the LSL. The Town continues to support the LSL through ongoing maintenance of the site, and providing technical assistance on environmental and land use issues. The Town was recently successful in obtaining funding for the development of a master plan for the Fisherville Mill Site and environs which include the LSL.

Fisherville Redevalopment Company and Eugene Bernat- Mr. Bernat founded the Living System Laboratory at Fisherville Mill as a durable platform for fundamental and applied academic research in ecosystem function, remediation technology and transformative eco cultural literacy concepts to the broadest possible audience. He has over thirty years of professional experience conceiving, developing and operating environmental services, remediation and product businesses. All of his business activities have been conducted in highly regulated environments and has required extensive knowledge of project permitting and performance metrics. Mr. Bernat holds the patent for a mycological bio-product technology directly relating to the project. Mr. Bernat has developed broad community engagement and support for the Living System Laboratory and has worked with the current academic and organizational collaborations, engaged in LSL.

Fungi Perfecti- For the past 30 years, Fungi Perfecti has focused on the cultivation of mushrooms and mycelium and the exploration and development of innovative fungal biotechnologies. Over decades of producing tons of mycelium per week, Fungi Perfecti has developed a keen understanding of fungal culture subtleties that cannot be seen by those doing flask culture in laboratories. Some examples of these unique aspects of mushroom cultivation include: thermogenesis; strain senescence; disease resistance; mycelium integrity and density; recovery from disturbance; polynucleation; outgassing; extracellular metabolite formation from solid substrates; fruitbody formation and development; and pigmentation progression. Accordingly, Fungi Perfecti's unique history and experience with fungal cultivation, evaluation, and characterization, will critically support this project.

Blackstone Headwaters Coalition (BHC)- The Blackstone Headwaters Coalition was incorporated in 2001 and received 501c(3) status the following year. The BHC strives to engage citizens, businesses, environmental organizations and municipal and state officials in the active stewardship of water resources in headwater streams of the Blackstone River. The BHC has successfully managed and completed several grants over the years, from a variety of funding sources such as the Massachusetts Environmental Trust, Greater Worcester Community Foundation and two significant grants from US EPA for previous efforts in and around Fisherville. The BHC won an Environmental Merit Award from USEPA in 2005 for our Blackstone River Volunteer Water Quality Monitoring Program, which is now in its twelfth year of gathering QAPP approved data. Water Quality Monitoring Program Coordinator Susan Thomas and BHC Coordinator Peter Coffin have extensive experience with the challenges that the Blackstone River faces in terms of nutrient and pathogen stormwater contamination.

Clark University's Department of International Development, Community and Environment (IDCE)- The IDCE Department at Clark University focuses on teaching students how to address complex problems and build community while managing resources wisely. The Environmental Science and Policy (ESP) Program has been working with FRC at the Eco Machine site since 2013 when Dr. Timothy Down's used the site as a case study for his class "Environmental Modeling". Dr. Downs has a doctorate in Environmental Science & Engineering from UCLA. He is a specialist in environmental science and engineering with over 25 years field experience designing and managing collaborative projects in the UK, the United States, Latin America and Africa. His research focus is on how humans change the environment, and how those changes impact their health, wellbeing, and the ecosystems they inhabit. IDCE's Geographic Information Systems (GIS) for Development and Environment is a nationally renowned program that specializes in applications of geospatial technologies to problems of sustainable development and the environment, such as Earth system information science, land change modeling, remote sensing, conservation GIS, public health, and environmental justice. These two divisions will contribute their expertise for developing work and studies for the LSL.

John Todd Ecological Design, LLC (JTED)- JTED's designs use biodiversity and natural processes to create mechanically simple but biologically complex systems capable of treating the most difficult contaminants and human-waste streams. JTED president Dr. John Todd is an internationally recognized pioneer in the design and implementation of ecological wastewater treatment systems, and has designed over one hundred ecologically engineered systems for remediating polluted waters caused by human waste, food production, and fuel generation. JTED Engineer Max Rome has a B.S. in Civil and Environmental Engineering from the University of Massachusetts/Amherst and has been designing Eco Machines since 2010. JTED Project Coordinator Lauren Valle has a BA from Columbia University and brings experience in business administration, project coordination, grant writing, and budgeting.

Mass Audubon- Mass Audubon has been involved in the protection and restoration of water resources at the state and local level for decades and is a leader in water resources education and policy. Through the "Shaping the Future of Your Community Program," By cleaning the Blackstone River with applied ecology, this project shows the measurable effects of natural green infrastructure to restore water quality. Mass Audubon is at the forefront in engaging communities around low impact development (LID) and green infrastructure (GI) techniques. Through its current work on cost-effective LID/GI in the Blackstone under an EPA grant, the Shaping program has enhanced relationships with local communities. Town of Grafton recently hosted a Shaping workshops on LID/GI, which included a tour of the Living Systems Lab. Senior Policy Analyst Heidi Ricci has over twenty five years of experience in land use planning and open space protection, environmental policy, and regulation.

The LSL Review Committee- Dr. Jacquie Kay and Dr. Timothy Downs will serve on the Review Committee, to assess and evaluate the project objectives, measuring both scientific and social impact through resilience and adaptation at a formative and summative level. Others who have been approached include Dr. David Hibbett, Department of Biology, Clark University - a fungal evolutionary biologist and ecologist; Dr. David Gute, Tufts University School of Engineering Professor, from the LSL Advisory Board, and others.

The LSL Advisory Board- Dr. John Todd, Mr. Gene Bernat, Dr. David Hibbett, Professor David Gute; Tufts University's Cummings School of Veterinary Medicine Professor Dr. Giovanni Widmer, and Brown University's School of Engineering Professor Dr. Eric Suuberg will serve on this board. Dr. Widmer has performed extensive study on Molecular biology of protozoan parasites and waterborne pathogens. Dr. Suuberg is the Co-Director of the Superfund Basic Research Program, as well as was the founder of Brown University's Chemical Engineering Department. Dr. Suuberg's research includes the characterization and cleanup of lands and sediments contaminated with mixed pollutants. The Brown University Superfund Lab has already provided engineering and hydrocarbon analytical services to the LSL over the past several years. Dr. Paul Mathiesen from Worcester Polytechnical Institute, will also be engaged.

OUTCOME AND FEEDBACK

On December 22nd, 2015, Jacquelyn received an email from the New England Institute of Water Pollution Control Commission indicating that the final project was not selected for funding. Upon request, one of the reviewers talked to Jacquelyn about the selection process and the comments made by reviewers on the proposal.

The reviewer mentioned that the proposal was qualified for the funding, and that there were no doubts about the ability of the organization to manage the project or the partnerships. Additionally, many of the reviewers had heard about the successes of the organization in the past, and were happy to see that it was moving forward. However, he commented that the focus of the RFP was very specific on nutrients and pathogens, and while the proposed project did address these contaminants, there were some secondary educational side projects that were not as targeted. As the criteria for selection was "all or nothing" other organizations with a sharper focus were more competitive.

CHALLENGES AND LESSONS LEARNED

Working with multiple partners in different geographic locations

The LSL team believes that one of the greatest strengths of their project was that it involved multiple diverse partners, spanning the private and public sector, as municipalities, universities,

small businesses and non-profit organizations. Partners bring different complementing strengths and expertise to the table, and the interwoven nature of the project created accountability as entities relied on each other to achieve outcomes. Over the past few years, the number of public-private partnerships (PPPs) and multi-sectoral partnerships has increased dramatically. While the literature seems to be in agreement that there are advantages to this, such as creating novel solutions that individual entities could not come to on their own, there are also accountability risks (Hodge & Greve 2007, Austin & Seitanidi, 2012). Additionally, the incorporation of multiple partners in a network may lead to conflicting ideas about the best way to develop a course of action, and while this conflict can lead to innovative ideas, it can also lead to nothing getting done if organizations do not have completing strategic goals (Munksgaard *et al* 2012).

Managing a team and developing a novel project with such a large group of actors proved to be the biggest challenge, as many of the entities had not previously worked with each other and were located in different geographic locations. After performing several case studies about collaborations to produce innovative products, Mucksgaard *et al* noted that success working with this kind of network was sometimes related to the choices by the central organization on when to lead and when to follow (Munksgaard *et al* 2012). Gathering the entire team was not possible, and many of the meetings that the LSL team had with partners were one-on-one, making conflicts between institutional interests more difficult to solve. Because some the organizations were not familiar with each other's capabilities or goals, many hours were spent on the phone or in meetings trying to coordinate roles and responsibilities for the project. Roles changed last minute with the discovery of a new partner capability or inability to perform a task, and these shifting project

descriptions made it difficult to iron out a final draft narrative and budget of the project until the final hour.

Upon reflection, a large conference call in which all partners introduced each other would have greatly reduced the time necessary for the LSL to spend with individual partners. Instead of acting as a "hub" for coordination, trying to manage all the projects from a central location, the LSL could have acted as a "facilitator", allowing partners that took on complementing project roles to speak among themselves. This communication could have made coming to an understanding about the strategic intentions of each organization for the project more apparent, which is suspected to align people better (Munksgaard *et al* 2012). Finding a time that works for everyone can sometimes be a delay in itself, so starting the project development process earlier would also help to reduce stress.

Entering into a partnership is a risk, for both the nonprofit and each partner, whether it be public or private. Almost all of the partners that were involved in the project had worked with the LSL at some point throughout its lifetime, even if they had never worked with the other partner organizations. In general, they were all enthusiastic and demonstrated their willingness to participate via cooperation during the grant writing process. All of them had good reputations in their field, which is an important factor when PPPs are formed such that they maximize collaborative value creation (Austin & Seitanidi, 2012). One organization, however, which had added a lot of value through its long relationship and prestigious name, did not follow through with

providing the materials that were necessary for their involvement in the project in a timely manner. This organization propped up a large portion of the project's deliverables, therefore it was difficult to edit the grant last minute when the deliverables did not arrive, and a supporting section of data was not present in the narrative. The LSL team believe that this hole greatly decreased the competitiveness of the grant.

While this partner organization clearly did not follow through on its commitments to the project, the LSL team could also have been a little better at creating firm deadlines with enough lead time so as to have the time necessary to make changes to the project narrative if a partner does not follow through. Additionally, this partner had been unreliable in the past, and while a prestigious name is a tempting thing to try to accommodate, it is best to not depend on an organization that is unreliable. Austin & Seitanidi press the importance of formal and informal internal and external risk assessments to identify potential problems in working with partner organizations. In this case, the LSL had information gathered informally necessary to understand the potential risk of working with the organization, but chose to do so anyway. Had the LSL decided to partake in a formal risk assessment, collecting information from previous partners, it is possible that new information would have surfaced that may have indicated that it was not wise to partner with this organization. These formal processes will be completed in the future.

Designing a project and managing a team with limited resources

Much like a for-profit business, starting a non-profit is a risky endeavor. When the LSL registered as a nonprofit in the State of Massachusetts, it had no funding, and therefore was unable to compensate employees monetarily. While some nonprofit organizations are able to leverage volunteer labor successfully, almost all have some paid positions. The time required for the coordination and assemblage of an initial project grant is prohibitive to the average person who needs to earn a salary to support his or her family. Because the LSL was acting as the coordinating role between so many partners, adding more people was not practical, as the task required cohesiveness. As such, the LSL team had to balance other work obligations which sometimes interfered with the tasks needed for the grant, making the scheduling of meetings more complicated, and time less available.

Leveraging other forms of compensation for workers in this case proved invaluable. Students are a wonderful way to cut labor costs. The project became much more manageable to the lead grant writer once she learned that she was able to use it for her Master's Capstone Project. While not monetary compensation, using the project as such meant that she would be assigned knowledgeable advisors that could provide resources and another perspective to the project. Using this project a Capstone as well meant opened up more time for working on the grant verses dividing time between discrete projects.

Networking and loving what you do

For a small organization looking to make big changes, it is necessary to have a broad, strong network of people with overlapping or complementing visions. Unlike government organizations, which have reliable funding and a built in client base, nonprofit organizations must earn their legitimacy through proving their effectiveness (Johasen & LeRou, 2012). Eugene Bernat's passion for the project led him to talk about it often and loudly, and he developed a very compelling case for the value of the organization that left people who listened to him inspired. In doing so, he met a lot of people interested in supporting the cause in diverse fields, even if they had no previous connection to the organization. Many of the funding opportunities that the LSL team came across during the course of this project, including the next opportunity that the Team will pursue, were brought to its attention via other people and organizations that may or may not have been within the LSL network. These people were compelled by the project and the passion of the LSL Team, and took the time to lend a hand when they saw an opportunity. This observation is very much in line with research that examined organizational and advocacy effectiveness by organizations that engaged in informal community and political networking through a survey of 314 nonprofit organizations (Johasen & LeRou 2012). Johasen & LeRou go on to cite and reaffirm that organizations with managers that are able to network with a broader range of types of people are most effective. This research suggests that LSL leaders should continue to cultivate these diverse relationships over the years.

MOVING FORWARD

While the LSL team and its partners were disappointed to not receive funding *for Bio-remediating the Blackstone River Corridor using Engineered Ecosystems: A Unique and Natural Storm Water Management Model* they are optimistic about future funding opportunities, as well as other methodologies to increase the impact of the organization. Jacquelyn and Eugene will continue to work with the organization to coordinate and carry out efforts to seek out and take advantage of these opportunities, as well as other partners with interest that align with the LSL mission.

A new large scale federal grant opportunity was brought to the attention of the LSL in December of 2015. The request for proposals indicates that the source will support projects that support innovative restoration and protection approaches, strategic collaboration, regional impact, integration of habitat and water quality and a focus on connectivity and ecosystem functions. The LSL is optimistic about this opportunity, as it aligns even more with the goals of the organization.

The previous grant, while it was not accepted, will contribute greatly to the latest effort. Many of the previous project partners are still on board with the project, and are willing to participate. Partners are familiar with each other and their capabilities, and less time will be needed in meetings. Jacquelyn and Eugene better understand how to focus the outcomes stated in large proposals. As the organizational structure would not be changing dramatically under this grant compared to the last, less time and effort will be spent creating project and organizational

frameworks. Much of the content of the grant can be reused after being changed slightly. Additionally, the “Lessons Learned” in the previous section can be applied and will lead to less inter organizational stress in the writing of the proposal.

The application process for this grant will take about 6 months. In the meantime, the LSL will seek smaller grants from local organizations to support its staff, as well as apply for 501(c)(3) status.

Appendix A. NEIWPCC RFP

Appendices not included.

Southeast New England Program
Water Quality Management Grants

REQUEST FOR PROPOSALS

Water Quality Management Grants for the Greater Narragansett Bay Watershed

August 2015

The New England Interstate Water Pollution Control Commission (NEIWPCC), in cooperation with the Narragansett Bay Estuary Program and its partners, is inviting proposals for Water Quality Management Grants to solicit nutrient, pathogen, and stormwater management projects within the greater Narragansett Bay watershed under the United States Environmental Protection Agency's (U.S. EPA) Southeast New England Program ("SNEP"). Projects that address fresh or marine water quality degradation from nutrients, pathogens, and stormwater will be considered. Both large and small proposals are encouraged. While a wide range of entities are eligible for funding, the more competitive projects will either include municipal participation, support municipal action to improve water quality, or identify effective solutions that can be applied by municipalities. Through this grant program, the Narragansett Bay Estuary Program and NEIWPCC will provide up to $900,000 in federal funds under this solicitation. Should the amount of available funding change, we reserve the right to increase or decrease the amount of available grant funding. No single grant award may exceed $200,000, and no grantee may be awarded more than $250,000 cumulatively through this RFP.

Key elements in brief: This solicitation is open to county, municipal, and local subdivisions of state government in both Rhode Island and Massachusetts, federal (non-EPA) agencies, interstate agencies, tribes, non-profit organizations, and research and educational institutions of higher learning. For-profit organizations and state agencies are not eligible, but they may be subcontracted by or partnered with the grantee. The **deadline for pre-proposals is 12:00 (noon) EST on September 23, 2015**. The deadline for invited full proposals is **12:00 (noon) EST on November 17, 2015**. Applicants must provide a non-federal match that will equal or exceed 25% of requested funds. Projects are anticipated to end either June 30, 2016 or June 30, 2017 as proposed by the applicant.

This request for proposals (RFP) includes information on:

I. Overview

NEIWPCC
NEIWPCC is a not-for-profit interstate organization, established by Congress in 1947 to serve and assist its member states individually and collectively by providing coordination, research, public education, training, and leadership in the management and protection of water quality in the New England states and New York. NEIWPCC strives to coordinate activities and forums that encourage cooperation among the states, educate the public about key water quality issues, support research projects, train environmental professionals, and provide overall leadership in the management and protection of water quality.

Narragansett Bay Estuary Program
The Narragansett Bay Estuary Program's mission is to protect and preserve Narragansett Bay and its watershed, in both Rhode Island and Massachusetts, through partnerships that conserve and restore natural resources, enhance water quality, and promote community involvement. Founded in 1987, the Narragansett Bay Estuary Program is one of 28 nationally designated programs operating under the National Estuary Program. This national program was established by the federal Clean Water Act and seeks collaborative solutions to protect and restore the water quality and ecological integrity of estuaries of national significance. NEIWPCC serves as the program host for the Narragansett Bay Estuary Program.

Southeast New England Program
SNEP's mission is to protect and restore the southeast New England ecosystem by connecting communities through collaboration and partnerships throughout the region; fostering and promoting innovative approaches; and engaging public stewardship. While this grant round is focused on nutrient and pathogen water quality issues, SNEP's long-term goals are broader, and also include actions to restore physical processes, restore and protect habitat, introduce innovations in policy, technology, and restoration, and promote environmental and economic sustainability of the region.

II. Project Goal

This request for proposals will focus on projects in the greater Narragansett Bay watershed, which is part of the SNEP area of interest.[1] The watersheds of southeast New England face similar opportunities and challenges. SNEP's focus on this geographic area is designed to develop innovative and effective approaches to preserve the region's common critical resources. The Narragansett Bay Estuary Program and NEIWPCC are assisting U.S. EPA in administering and disbursing SNEP funds to projects within the greater Narragansett Bay watershed. Projects within the Buzzards Bay watershed should be directed to the Buzzards Bay National Estuary Program at restore.buzzardsbay.org. Through this grant program, the Buzzards Bay National Estuary Program and the Narragansett Bay Estuary Program will each provide up to $900,000 in federal funds under their individual solicitations. Should the amount of available funding change, we reserve the right to increase or decrease the amount of available grant funding depending on federal funds.

While SNEP expects to address a wide range of environmental issues in the coming years, in this second year of funding through the National Estuary Programs, the SNEP will focus on water quality degradation in southeast New England coastal watersheds, particularly those impairments caused by nutrient and pathogen (bacteria) pollution, including the management of conveyance systems like stormwater networks and discharges. Projects will be sought that implement immediate action to reduce or prevent nutrient or pathogen pollution, develop designs of plans to prevent or reduce nutrient and pathogen pollution from various sources, collect water quality data to help prioritize municipal action, and support municipal capacity in these efforts. Requests for both large and small projects are encouraged.

Through this solicitation, using federal SNEP funds, we will consider funding both local projects, and cross municipal projects, including those that have the potential for transferability throughout Narragansett Bay, Buzzards Bay, and southern Cape Cod. When site-specific solutions are proposed for funding through this grant program, they must be undertaken in the watershed of an impaired water body identified on the Integrated List or 303(d) list in Rhode Island or Massachusetts. Nutrient management projects (addressing either nitrogen or phosphorus) and pathogen management projects degrading both coastal waters and freshwaters will be considered. In recognition that pathogen (bacteria) impairments are often related to stormwater discharges, and because stormwater also conveys nutrients, stormwater projects, including monitoring to establish priorities for action, development of stormwater treatment design for priority sites, the construction of stormwater treatment systems, and proposals that improve municipal capacity to address these problems will be considered. Both large and small proposals are encouraged. A more detailed explanation of these criteria is described below, including activities and projects ineligible for funding.

The strongest proposals are expected to appreciably reduce pollutant contamination (in the short term or long term) and will have municipal involvement, particularly where municipalities have the primary responsibility for management or action. Other positive attributes include adding to the scientific or management knowledge base, transferability and scalability, demonstrating innovation, strong collaboration among partners, or increasing the capacity of municipalities to address water quality problems.

Because municipal government often has the primary responsibility to address these issues, but often does not have the capacity to address these problems, projects that include intermunicipal collaboration (to achieve cost savings, for example), or projects where municipalities collaborate with other eligible applicants under this grant program, will be favored in the scoring criteria.

III. Scope of Work

[1] EPA's SNEP program covers the coastal waters and watershed lands spanning from Westerly, Rhode Island to Pleasant Bay, Massachusetts, and includes the watersheds of Narragansett Bay, Buzzards Bay, the Islands, and southern Cape Cod. More information about SNEP is available at www.epa.gov/region1/snecwrp, with additional information for Narragansett Bay at www.nbep.org and for Buzzards Bay at restore.buzzardsbay.org.

Through this RFP, the Program is encouraging, and is anticipating, the receipt of a broad range of nutrient and pathogen related water quality proposals, from on-the-ground projects with tangible outcomes, to feasibility or planning studies preparing local communities for future projects, to researching new technologies addressing nutrients or pathogens, and projects that enhance municipal capacity and prioritization to manage these issues. Regardless of the project type, successful proposals must target problems associated with existing water quality impairments to surface waters to meet the Clean Water Act's goals, or municipal capacity to address these impairments.

Site-specific projects must lie principally within the greater Narragansett Bay watershed in the states of Rhode Island and Massachusetts (which includes the Narragansett Bay Watershed, the Wood-Pawcatuck Watershed, and the Southwest Coastal Ponds Watershed; see the project area map in Appendix E). Projects that straddle the watershed boundary or applications that include linked complementary areas within and outside the watershed boundary may be considered if the project meets other eligibility requirements.

For projects relating to municipal sewering, municipal wastewater facilities, municipal outfalls, or municipal sewer planning, the only applications that will be considered are those where the municipality or sewer district is the applicant, and where there is an endorsement by the governing body, mayor, sewer commissioners, or authorized contract signatory if they are not the applicant. For projects where a municipality is not an applicant, but where project success requires ongoing or long-term municipal action or commitment (*e.g.*, maintenance), a letter from the governing body or Mayor is required.

Funding for site-specific implementation projects in the greater Narragansett Bay watershed will also be limited to:
(1) projects that benefit water bodies listed as impaired for pathogens/bacteria or nutrients (phosphorus impairments of freshwaters and nitrogen impairments of coastal waters) by the states of Rhode Island or Massachusetts.
(2) projects that benefit water bodies that are not explicitly listed as impaired if adequate evidence is provided to demonstrate to the satisfaction of the Review Committee that the waterbody is adversely affected by excessive nitrogen or phosphorus loading or bacteria or pathogen pollution.
(3) projects that enhance municipal action, capacity, or set priorities that broadly meet categories (1) and (2).

For the purpose of this RFP, waterbody types described in (1) and (2) above shall be defined as impaired. If a draft or final nutrient or pathogen TMDL exists, the site-specific proposals must discuss the specific nutrient or pathogen sources and relative contributions (TMDL loading analysis, catchment areas size, or sources for stormwater systems) and how the proposal would help meet the specified TMDL. If a project is to enhance municipal capacity to address impairments, a preponderance of the activities should focus on actions relating to prioritizing discharges for management remediation.

Projects may cut across watershed boundaries, be municipal-wide, or include regional approaches and technological solutions that have wider applicability, as long as there are some expected benefits to one or more of the specific impaired waterbodies. Proposed efforts could include funding pilot or demonstration projects with strong educational or technological innovation components, small-scale projects at multiple sites as part of a watershed or regional effort, or regional efforts that coordinate specific future actions or funding. Projects may also include smaller scale efforts such as feasibility or planning studies to prepare local communities or organizations for future projects.

Generally, eligible water quality projects include proposals for **implementation** as well as proposals for **feasibility, planning, policy development, monitoring for the purposes of prioritization, and program-building projects that are expected to result in tangible benefits that meet the goals of this effort.** Implementation

projects typically include those that result in specific actions relating to construction, or specific activities including implementation of regulatory or non-regulatory programs, and education elements. Feasibility, planning, policy development, and capacity building and program building projects will prepare for future on-the-ground implementation projects, and can include design or research elements.

By using innovative pollutant reduction technologies, sharing information, and leveraging investments made by multiple partners, especially through partnerships with municipalities, or multiple municipalities to address regional issues, projects with local impacts on water quality can have regionally significant outcomes and create the potential for regional transferability. The grant selection criteria favors projects that show the potential to significantly reduce water quality impacts, that are transferable to other subembayments or watersheds, have a high likelihood of completion or success within a 5 to 17 month period, and result in improved coordination and increased capacity of municipal government.

A project's competitiveness will depend on how well it meets grant selection scoring criteria outlined in Appendix D. Projects that will likely result in clear outcomes and measurable accomplishments will score more highly. Projects with large match contributions will receive additional weight.

Examples of eligible projects with project-specific requirements

- Projects that, through direct action, mitigate for or restore: coastal waters, coastal resources, freshwaters, or freshwater resources adversely affected by excessive bacteria (or pathogens) or nutrient loading (nitrogen and phosphorus respectively).
- Projects that identify and seek to minimize stormwater pathogen or nutrient loadings or identify potential illicit wastewater discharges from stormwater systems.
- Innovative green infrastructure and low impact development techniques specifically designed to reduce pathogens or nutrients (*e.g.*, biofilters, constructed wetlands, etc.), or reduce flows appreciably to allow more effective management of contaminated stormwater flows.
- Techniques that reduce or eliminate nutrient, pathogen, or illicit wastewater inputs into stormwater networks in watersheds of impaired waters, or treat priority stormwater discharges to impaired waters, through enforcement, or implementation of best management practices (*e.g.*, fertilizer reduction).
- Non-structural technologies or approaches (*e.g.*, zoning changes, stormwater management, LID requirements) to manage nutrient or pathogen loads to impaired watersheds or town-wide. For projects relating to specific municipal action (*e.g.*. ordinance or bylaw changes), where the municipality is not the applicant, the proposal must have an endorsement letter from the governing body, mayor, commission, or committee that would oversee the law or regulation.
- Tests of innovative technologies for use at single-family homes for piloting permitting approval.
- In nitrogen-impaired watersheds, construction by a municipality of multi-unit or larger, onsite satellite wastewater systems (up to 10,000-gpd design) with advanced nitrogen or phosphorus removal capabilities.
- Projects to evaluate, modify, or monitor existing municipal wastewater facilities for the purposes of improving system capabilities for denitrification or nitrogen removal, including studies that relate to relocation of outfalls to meet water quality standards. Municipal wastewater facility projects must be undertaken by a municipal entity, and projects that relate to studies of the relocation of outfalls must have an endorsement letter from the governing body or sewer commissioners if they are not the applicant. Where applicable, proposals should identify required permits and compliance with state and Federal regulations.
- Projects that implement innovative and potentially cost-effective source reduction strategies.
- Projects that reduce flows from CSOs.
- Alternative nutrient reduction or interception options (*e.g.*, phytoremediation, etc.) will be considered if they have the permission of the property owner(s) where the system is to be constructed. If a project

will require a permit, the proposal should address how the project will comply with applicable regulations, and a proposed timeline for permitting.

- Physical improvements that increase tidal flushing or provide other beneficial and cost-effective water quality improvements to a water quality impaired water body. Example projects include culvert widening or channel dredging. Such projects must have permission/endorsement of the property owner of the restriction. Projects in this category must have a strong water quality and/or habitat evaluation component, meet state policies for these types of projects, and must include a timeline for obtaining applicable wetland permits.
- Projects that mitigate or ameliorate nutrient or bacteria impacts in the receiving waters. Examples include creation of shellfish reefs or shellfish aquaculture to improve water quality and remove nutrients, or projects that remove stressors such as replacement of regular moorings with conservation moorings to benefit water quality and remove physical disturbance causing eelgrass loss. Projects in this category must have a strong water quality and/or habitat evaluation component, meet state policies for these types of projects, and must include a timeline for obtaining applicable wetland permits.
- Stormwater monitoring that utilizes the most cost effective techniques that integrate water samples or can help pinpoint illicit discharges (for example, the use of cotton absorbent material to detect optical brighteners associated with illicit discharge sewage in stormwater[2]).
- Design, permitting, and construction of stormwater treatment systems that significantly remove bacteria and or nutrient contaminants, and where the discharge contributes to designated water quality impairment. Proposals for site-specific stormwater projects must include water quality data demonstrating that the discharge is contributing to the impairment.
- Projects that implement an effective nutrient or pathogen reduction recommendation in an existing TMDL report, Comprehensive Wastewater Management Plan, or other adopted water quality management plan that will benefit impaired waters.
- Acquisition of land or easements necessary to implement, construct, undertake, or complement specific work that achieves nutrient or bacteria management or reduction goals.
- Projects that expand the capacity of municipalities to implement nutrient, pathogen, and stormwater management actions in the Narragansett Bay Comprehensive Conservation and Management Plan.

Additional requirements for pre-proposals and full proposals: All site-specific projects involving construction **must** have an endorsement from the property owner where construction or alteration is proposed. The exceptions to this rule are those projects that involve an evaluation of multiple sites to select a final site or sites, and where the selection committee feels there is a reasonable expectation that the applicant will receive permission from the participating property owner(s) after undertaking this process. If a municipality or subdivision of government (*e.g.*, a district) is the applicant, a letter of endorsement is required from the board of selectmen, mayor, sewer commissioners, or other authorized contract signatory, if they are not the applicant. Projects where the work is to be undertaken by a municipality or district must have a letter of endorsement from the board of selectmen, mayor, or commissioners if they are not the applicant. Any projects that include environmental data operations must include the development of a Quality Assurance Project Plan. (See **Quality Assurance & Quality Control Requirements** section below for more details.) If data are collected under this grant, the data must be submitted with the final report so that it can be made available publically.

Examples of ineligible projects include;

- Studies to develop TMDLs and studies to collect data or conduct an analysis to define or refine a TMDL.
- General bacteria, nitrogen, or phosphorus loading studies.
- The development of Watershed Management Plans or Comprehensive Wastewater Management Plans.

[2] Chandler, D. M., & Lerner, D. N. (2015). A low cost method to detect polluted surface water outfalls and misconnected drainage. Water and Environment Journal, 29(2), 202–206.

- The preparation of MS4 permit applications.
- Costs associated with designing, building, or expanding public sewer lines or wastewater treatment facilities upgrades that are not resulting in significant nutrient reductions, except for any specific project categories defined as eligible above.
- Standalone habitat restoration projects such as eelgrass transplanting projects.
- Projects that restrict flows in wetlands, or dam, or impound wetland systems for the purpose of nutrient or bacteria retention.
- General public or school education programs that have no direct water quality benefits.

IV. General Guidelines for Applicants

Eligibility

Applicants who are eligible to submit proposals in response to this RFP include: county, municipal, and local subdivisions of state government in both Rhode Island and Massachusetts, federal (non-EPA) agencies, interstate agencies, tribes, non-profit organizations, and research and educational institutions of higher learning. Partnerships are allowed and encouraged. For-profit organizations and state agencies are not eligible, but they may be subcontracted by the grantee. Although multiple partners may be involved with a project, a single grantee will be the recipient of funds, and partners receiving funds through the grantee will be considered subcontractors. The grantee will be responsible for the completion of all tasks including those through subcontracted partners.

Schedule
The schedule* for this RFP is as follows:

Pre-Proposals Due to NEIWPCC	September 23, 2015 **12:00 (noon) EST**
Full Proposals Due to NEIWPCC (By invitation only)	November 17, 2015 **12:00 (noon) EST**
Awards Announced	December 15, 2015 (estimated)
Contracts Commence	January 29, 2016 (estimated)

*Schedule is subject to change.

Funding
It is anticipated that up to $900,000 in federal funds will be available through this solicitation. Should the amount of available funding change, NEIWPCC reserves the right to increase or decrease the amount of available grant funding. Final funding amounts are subject to approval.

A grantee may submit any number of applications and they may receive more than one grant; however, no single grant award may exceed $200,000, and no grantee may be awarded more than $250,000 cumulatively through this solicitation. These limits only apply where an entity is the applicant, not the partner. If the grantee has several proposals in which they are the applicant that rank competitively and are selected for funding, but which cumulatively, exceed $250,000, partial funding may be offered to the lowest ranked proposal where feasible. Applicants will not be penalized if they submit multiple projects, even if the cumulative request exceeds $250,000. We encourage applicants not to self-select proposals or limit budgets of individual projects to meet specific thresholds because it is impossible to predict how applications will fare against projects from other entities.

Proposals with budgets that exceed the identified funding cannot be considered. Final proposal budgets cannot exceed pre-proposal budgets. Awarded funds may be used for expenses specifically related to the proposed project, including wages and consultant fees. Expendable and non-expendable equipment directly related to the proposed project may qualify for funding, but requires pre-approval (prior to proposal submission) by NEIWPCC and must be justified in the proposal. Indirect costs are allowed, but must be in line with the following procedures: Applicants with a valid Negotiated Indirect Cost Rate Agreement with their cognizant federal agency must use that rate, and must provide documentation of the negotiated rate. Applicants that do not have a Negotiated Indirect Cost Rate Agreement may charge a maximum indirect rate of **10 percent** of direct costs.

Match

Applicants must provide a non-federal match that will equal or exceed 25% of requested funds. (Please see further detail in Appendix D as extra points are given for over match). Funds from other federal sources or grants, and funds committed to match other federal grants, are not eligible to be used as matching funds.

Cost share or match can be satisfied with cash or in-kind services, or a combination of both. Cash contributions are those funds used to purchase goods or services associated with the project. In-kind contributions represent the value of non-cash contributions provided by the applicant. Any contributions must be clearly explained in the proposal and must be documented.

Deliverables

The primary deliverables for this project will be the following:

1. **Quarterly reports** delivered to the NEIWPCC project manager no later than the 10th day of January, April, July, and October during the duration of the project.
2. Approved Quality Assurance Project Plan (if required). See below for additional information about this deliverable.
3. **Final report** in Adobe .pdf format.
4. If water quality data are collected under this grant, the data are expected to be entered into U.S. EPA's data systems. Specifically, the successful applicant must ensure all water quality data generated in accordance with an EPA/NEIWPCC- approved Quality Assurance Project Plan, either directly or by subcontract, are transmitted into the Agency's Storage and Retrieval (STORET) Data Warehouse annually or by project completion using either WQX or WQXweb. Water quality data that are appropriate for STORET include physical, chemical, and biological sample results for water, sediment and fish tissue. The data include toxicity data, microbiological data, and the metrics and indices generated from biological and habitat data. The Water Quality Exchange (WQX) is the water data schema associated with the U.S. EPA, State and Tribal Exchange Network. Using the WQX schema partners map their database structure to the WQX/STORET structure. WQXweb is a web-based tool to convert data into the STORET format for smaller data generators that are not direct partners on the Exchange Network. More information about WQX, WQXweb, and the STORET Warehouse, including tutorials, can be found at http://www.epa.gov/storet/wqx/.

All deliverables are to be submitted in draft form in Microsoft Word format for review by project partners and approval by the project manager (See Contact Information in Section IX). All final reports are to be delivered in Adobe .pdf format upon approval by the project manager. All deliverables listed above should be included in the narrative and budgets.

Quality Assurance & Quality Control Requirements

The NEIWPCC Quality Management Plan requires that Quality Assurance Project Plans (QAPPs) are developed and approved for all projects involving environmental data operations (*i.e.*, collection, analysis, and/or

manipulation of environmental data). For projects that involve environmental data operations, the contractor will be responsible for developing the project QAPP and submitting it to EPA and NEIWPCC staff for review after the start of the contract period. NEIWPCC will provide guidelines for QAPP development. The QAPP must be approved by the EPA, the NEIWPCC Project Manager, and the NEIWPCC Quality Assurance Program Manager **prior** to any data collection or analysis. If your proposed project will include environmental data operations, development of the QAPP can be completed as a task under this project and should be included in the proposal narrative, timeline, and budget. While preparing your proposal, please account for the additional time and resources necessary for QAPP development. Allow a minimum of **30 days** for the development of your QAPP and **90 days** for the review and approval of your QAPP by NEIWPCC and EPA QA officers. It is appropriate for an applicant to utilize or build upon an existing, relevant, approved QAPP if one exists.

For more information about QAPPs, see http://www.neiwpcc.org/quality/ and http://www.epa.gov/quality/qapps.html.

Questions regarding the QAPP process or the necessity of a QAPP for a proposed project should be directed to the NEIWPCC Project Manager, Heather Radcliffe (contact information in Section IX) by 4:00 PM EST on August 28, 2015.

Deliverables, Ownership, and Credit Due

All materials, software, maps, studies, reports, and other products or data, regardless of physical form or characteristics, produced as a result of this solicitation and funded, in whole or in part, under an agreement with NEIWPCC shall be made available to NEIWPCC, NBEP, and the U.S. EPA in the formats in which it is stored or maintained. NEIWPCC, NBEP, and the U.S. EPA shall have an unrestricted right to use any materials, software, maps, studies, reports, and other products or data generated using assistance funds or specified to be delivered. The contractor shall not obtain, attempt to obtain, or file for a patent, copyright, trademark or any other interest in any such materials, software, maps, reports, and other products or data without the express, written consent of NEIWPCC and subject to any other approvals required by state or federal law. Reports and other deliverables will credit NEIWPCC, NBEP, and U.S. EPA for any work completed under the grant award.

Geographic Information System (GIS) Data Requirements

GIS data produced under this project must adhere to the requirements of EPA's National Geospatial Data Policy (see http://www.epa.gov/geospatial/docs/National_Geospatial_Data_Policy.pdf). Specifically, the selected contractor must provide documentation for all produced data, including source information for each digital data layer (*i.e.*, scale and accuracy, map projection, coordinate system, etc.), and specific information about the data layer itself (*i.e.*, method used, geographic extent of data layer, file format, date of creation, staff contact, description and definition of data fields and their contents, related files, if any, and description of data quality and quality assurance methods used). The EPA Metadata Editor (EME) was developed to simplify and standardize metadata development and is a recommended tool for streamlining production of required metadata. The EME and related training materials can be downloaded from https://edg.epa.gov/EME/. Specific technical guidance on geospatial deliverables and acceptable formats can be found at http://www.epa.gov/region02/gis/r2gisdeliverables.html. GIS data produced under this project will be submitted to NEIWPCC as a deliverable.

Surveys & Information Collection

This project is funded through a U.S. EPA Assistance Agreement with NEIWPCC. NEIWPCC cannot use these funds to support a survey without completion of an Information Collection Request (ICR) describing the survey. The ICR must be submitted to the U.S. EPA Office of Management and Budget (OMB) for review and approval. This is an extensive process that can take several months to complete. A survey is defined as the collection of identical information from ten or more non-Federal respondents within a 12-month period. OMB approval must be received before any survey activities supported by NEIWPCC funds can begin. If the selected contractor is

providing non-federal match for this project, these matching funds may be used to support the cost of designing and administering a survey without the development of an ICR. NEIWPCC funds may be used for analysis of the survey data and publication of the results regardless of whether or not an ICR is completed.

Insurance Requirements
NEIWPCC requires its contractors to maintain workers compensation and liability insurance. More details will be provided to applicants selected for funding.

Additional Terms and Conditions
Prior to submitting a proposal, applicants are encouraged to review current EPA general terms and conditions available at: http://www.epa.gov/ogd/tc.htm. If selected for funding, as a subrecipient of EPA funding, the applicant will be required to comply with those outlined as well as additional terms and conditions that may be included in the agreement between NEIWPCC and the successful applicant. The successful applicant will be required to certify and assure that all terms and conditions have been met.

V. Proposal Requirements

Application to the Southeast New England Program, Water Quality Management Grants is a two-step process. First, applicants submit a pre-proposal, which will be ranked in a competitive process by a Review Committee. The Review Committee will be composed of state and federal agency representatives, NBEP and NEIWPCC staff, or other subdivisions of government. The Review Committee may include a non-governmental representative to serve in an advisory role to the committee. The Scientific Advisory Committee may be asked to review the scientific validity and technical merit of the proposals. The strongest proposals are expected to add to the scientific or management knowledge base, have transferability and scalability, demonstrate innovation, and show strong collaboration among partners.

Using the Selection Criteria presented in Appendix D, the Review Committee will assign a score to each pre-proposal, and based on these scores, assign a rank order to each. The average rank score among all reviewers shall be the basis of pre-proposal selection. Only the highest ranked pre-proposals will be invited to submit a full proposal. No guidance will be provided to any applicant during this process. The number of applicants to receive invitations will be at the discretion of the Review Committee. Invitations will be offered to the highest ranked proposals in order of rank by the Review Committee. The tentative cutoff is $2 million (twice the maximum possible available), but because the maximum possible request is $200,000, the precise cut-off will depend upon the amounts requested among the highest ranked proposals and the total number of pre-proposals received. The goal of the Review Committee is to ensure that the highest ranked and most promising proposals are invited to submit full proposals. The Review Committee has discretion to select among equally scored proposals based on factors such as project diversity or geographic coverage.

The same competitive review process will be followed for the selection of full proposals. Only the highest mean-ranked full proposals will receive funding. In the case of a tie rank score between selected proposals, funding will go to the proposal that represents the best value for the program. However, as in the pre-proposal review, the Review Committee has discretion to select among equally scored proposals based on factors such as project diversity or geographic coverage. The Review Committee reserves the right to reject any or all pre-proposals or proposals that do not meet the goals and terms of this RFP. The Review Committee intends to fund only the higher-ranking projects, those that demonstrate clear and significant benefits to Narragansett Bay and its environment and those that meet the goals of the U.S. EPA initiative and the threshold eligibility requirements. Lower ranking projects or those with marginal benefits to the bay may not be funded, even if an excess of funding is available. If insufficient funds are available for a project or for projects ranked on the cusp of available funding, partial funded may be awarded. However, if the Review Committee believes partial funding will make such a project unfeasible, the project may be bypassed and a lower cost project may be funded.

Projects earn points for meeting the requirements of each evaluation category; examples are described in the bullet points below each category, as shown on the scoring sheets located in Appendix D. Implementation, planning, research, and design projects will be evaluated using the same criteria. Planning, research, and design projects will be evaluated based on their anticipated future restoration outcomes.

Successful proposals will have many of these attributes:

- The applicant demonstrates sufficient organizational ability to administer and carry out a project;
- The effort addresses water quality or habitat impaired by nutrients or pathogens, particularly those identified on the Integrated List of Impaired Waters or as otherwise described in this RFP, and is consistent with the Program's goal of improving water quality, habitat degradation, or human health risks caused by nutrients or pathogens, whether in a single impaired watershed, or across multiple impaired watersheds;
- The project shows potential for regional transferability;
- The project has watershed-level benefits or an implementation plan that increases the scale of project benefits or cost effectiveness;
- The project invests strategically to leverage resources and harness innovative, cost effective solutions with the potential for high-impact results;
- The proposal includes measurable goals and clear expected outcomes, with plans to evaluate the project's success and share this information with regional stakeholders;
- The project will deliver lasting results;
- A municipality or municipalities will be the lead or a key partner.
- The project will enhance municipal capacity to manage stormwater and nutrients more effectively.
- Successful projects will help improve our understanding of processes that affect efforts to manage stormwater or nutrient impairments, or help evaluate the effectiveness of proposed or planned management action.

NOTE: Incomplete or incorrectly submitted applications may be disqualified. If there are insufficient qualifying eligible proposals to utilize all funds eventually awarded by the U.S. EPA, remaining funds will be directed to subsequent grant rounds.

Application Process

Application to this grant program is a two-step process. First, a pre-proposal must be received by **12:00 (noon) EST** on September 23, 2015. Full proposals will then be invited at the recommendation of the Review Committee. Full proposals must be received by **12:00 (noon) EST** on November 17, 2015.

STEP 1: Pre-proposals

Submit pre-proposals **electronically** through the NEIWPCC website (see VI. Submission Process below). A complete pre-proposal must include a pre-proposal Narrative and any partner commitment letters. The pre-proposal Narrative should not exceed two (2) pages single-spaced, typed 8.5" x 11" pages with 11-point font and 1-inch margins, including figures and narrative. Pre-proposals must be accompanied by brief letters on letterhead from each partner affirming their specific role or contribution to the effort. For site-specific projects, if the applicant is not the property owner, the pre-proposals must be accompanied by a letter from the property owner agreeing to the proposed activities (subject to any necessary conditions). Site-specific proposals that lack support of the property owner where work is to be done may be disqualified. Please do not include any other support documentation at this time, as it will not be reviewed.

The pre-proposal narrative must include the following information:

- Description and location of the proposed project and anticipated benefit(s) as they relate to the funding priorities identified in this RFP;

- Total project budget, making clear the following: total amount requested and nonfederal match; purpose for which funds will be used; other funding sources for this project;
- Timeline for the project (including time for QAPP development, if necessary); and
- Description of project partners and their anticipated role in the project.

STEP 2: Full Proposal (invited by NEIWPCC and the Narragansett Bay Estuary Program only)

Full proposals will only be accepted after invitation, based upon review and approval of a pre-proposal. Applicants must submit proposals **electronically** through the NEIWPCC website (see VI. Submission Process below).

Full proposals must include a **(1) cover letter, (2) title page with abstract, (3) narrative with citations, (4) timeline, (5) budgets (both overall and task-based budget formats), (6) budget justification, (7) description of qualifications, and (8) letters of commitment or support**. Page limits for each of these components are provided in the individual descriptions below. Proposals that do not contain all of the information requested and/or do not meet the format requirements will be eliminated from consideration. Pages that exceed the maximum number specified for each section will not be reviewed.

All full proposals submitted to NEIWPCC must be consistent with the corresponding pre-proposal submission, including funding amount requested.

Cover Letter

Please include a one-page cover letter, printed on official letterhead and signed by an authorized representative of the lead agency, firm, or institution, with each proposal. The cover letter must state that:

- You are applying for funds under this program.
- You commit to the match you are proposing.
- You acknowledge that funding is provided on a reimbursement basis.

Title Page

For your convenience, an electronic version of the title page is available as a Microsoft Word document at http://www.neiwpcc.org/contractors/opportunities.asp. The title page must adhere to the format provided in Appendix A and include all of the following information, using a maximum of one single-spaced, one-sided, typed 8.5" x 11" page with 11-point font and 1-inch margins:

- Project Name: Use the exact project name as it appears throughout the proposal.
- Primary Investigator Name and Contact Information: Provide the name, title, and affiliation of the primary investigator, as well as mailing address, phone number, and email address.
- Financial Contact Name and Contact Information (if applicable): Provide the name, title, and affiliation of the individual responsible for financial/contractual negotiations (if different from primary investigator), as well as mailing address, phone number, and email address.
- Project Partners (if any): Provide the names, titles, affiliations, for each of the additional investigators or support staff who will significantly contribute to the project (if any).
- Funds Requested: Provide the amount of money you are requesting from NEIWPCC for the project.
- Matching Funds: Provide the amount of matching funds you and/or your partners will be contributing to the project (if any).
- Federal Tax Identification Number (FID)

- DUNS Number[3]: A DUNS number is a unique, non-indicative 9-digit identifier that verifies the existence of a business entity globally. Contractors must provide NEIWPCC with a DUNS number to comply with an administrative condition of NEIWPCC's EPA grant (individuals are exempt).
- Certified Disadvantaged Business Enterprise (DBE): Indicate if your organization is a DBE.
- Abstract: The abstract must accurately describe the project being proposed and include: (1) the objectives of the project, (2) the methodology to be used, and (3) the expected outputs and outcomes of the project and how it addresses this RFP, including environmental benefits to Narragansett Bay. **The abstract must fit within the title page.**

Proposal Narrative

The proposal narrative must not exceed 10 consecutively numbered, single-spaced, typed 8.5" x 11" pages with 11-point font and 1-inch margins. The 10 page narrative must include all of the following information:

- **Problem Description:** Briefly describe the project and its relevance to the goals of this RFP. This section can also include brief background or introductory information.
- **Objectives**: Outline how the project will achieve the goals of this RFP.
- **Methodology**: Outline the project's design and describe the methods and techniques that will be used to meet the project's goal and tasks.
- **Expected outputs and outcomes**: Describe the project's expected outputs and outcomes, and list and describe each of the specific deliverables and end-products.
- Briefly discuss the **process to be used to evaluate the effectiveness and success** of the project.
- **Roles and Responsibilities**: Define the roles and responsibilities of all project participants.
- **Citations:** Include references as appropriate within the proposal narrative.

Timeline

Provide a detailed timeline for meeting identified tasks and completing deliverables, with a completion date no later than June 30, 2016, or June 30, 2017 (as proposed by the grantee). All timelines should be stated in terms of Month #1, #2, #4, etc. rather than specific dates, e.g. "March 5, 2012." Although the project start date is anticipated to be on or about January 29, 2016, this date may change based on the time the actual agreement is established. The timeline must be no more than **one** 8.5" x 11" page with 1" margins and 11-point font.

Budget

The project budget must be provided in two formats:

First, provide a complete, detailed budget using the format provided in Appendix B. For your convenience, an electronic version of the budget form is available at http://www.neiwpcc.org/contractors/opportunities.asp. The budget must be no more than **one** 8.5" x 11" page with 1" margins and 11-point font. Along with this budget, provide a brief justification (**one** page maximum) for the proposed costs in terms of meeting project objectives. Include an explanation of how indirect costs are calculated. Justify subcontracts, if any. Identify and describe current and pending financial resources (including the source) for non-federal cost share or matching funds that are intended to support the project. **Entities intending to use a Negotiated Indirect Cost Rate must provide documentation of their rate.** This documentation does not count toward the page limit.

Second, prepare a budget that is broken down by project tasks as shown in Appendix C. For your convenience, an electronic version of the budget form is available at http://www.neiwpcc.org/contractors/opportunities.asp.

[3] Obtaining a DUNS number is free for all entities doing business with the Federal government. Under normal circumstances the DUNS number is issued within 1-2 business days when using the web form process (http://fedgov.dnb.com/webform).

As you develop this budget, keep in mind that contractual payments will be made based on this budget. This budget must be no more than **two** 8.5" x 11" pages with 1" margins and 11-point font. Matching funds should not be included in the task-based budget.

Final proposal budgets cannot exceed pre-proposal budgets.

Qualifications
The applicant chosen for this project should possess the academic and/or professional expertise and certifications in the relevant subject areas, and have a strong track record in delivering projects of this nature Attention to detail in documenting qualifications that meet the scoring requirements is strongly advised. The qualifications section, including resumes, CVs, descriptions of past projects, etc. must not exceed 3 pages.

Letters of Support
General "letters of support" should not be included with the application. Projects undertaken in partnership with other organizations, particularly where the partner will provide a service or action, must include support letters from each partner stating their specific commitments. If your project includes matching funds and the match is to be provided by partners, letters of commitment for the match from those partners must be included. There is no page limit for letters of support.

VI. Submission Process

Pre-proposals must be submitted by no later than **12:00 (noon) EST Tuesday, September 23, 2015**. No late submissions will be considered.

Full proposals must be submitted by no later than **12:00 (noon) EST Friday, November 17, 2015**. No late submissions will be considered.

Applicants **must submit their proposals electronically** through the NEIWPCC website. Unless prior approval is given, proposals received through e-mail, postal delivery, or any other delivery method will not be accepted.

To submit your proposal, go to www.neiwpcc.org/rfp2/ and follow the instructions provided for uploading your file(s). It is highly preferred that the proposal and all supporting information are submitted as a single PDF document. This requires Adobe Acrobat or similar Adobe product (the free Adobe Reader does not allow the conversion of documents into PDF format), or a scanner. If multiple files are to be submitted, you will need to create an archive file (.zip, or .rar) containing all of the files you wish to submit. The file name should be in the following format: "NBEP_NAME OF YOUR ORGANIZATION." Once you have clicked the "submit" button, please allow adequate time for your submission to process and do not hit the back button or close your browser window. The process is not considered complete until you have reached the confirmation page. If submitted successfully, you will receive an email from NEIWPCC (mail@neiwpcc.org) with the subject line "RFP Submission Confirmation" confirming your submission. For questions regarding submission of proposals, contact Heather Radcliffe, NEIWPCC, hradcliffe@neiwpcc.org, (978) 349-2522.

VII. Proposal Evaluation Process

NEIWPCC will screen all proposals to ensure that they meet all requirements of this RFP. If a proposal is found to be incomplete, the proposal will be eliminated from the competition and NEIWPCC will notify the applicant. To be considered complete, proposals must include all of components described in Section V. Proposal Requirements. Pages in excess of the limits specified for each component will not be reviewed. Complete and

eligible proposals will be reviewed by the Review Committee. Proposals may also be submitted for external peer reviews. The Review Committee will evaluate the proposals based upon the criteria In Appendix D.

VIII. Notification of Awards

Award notification to applicants is expected by December 15, 2015 (estimated). Award recipients may be asked to submit a revised work plan, timeline, and budget at this time. Projects cannot start until the contract is signed by both parties. If your project includes environmental data operations, this work may not begin until the QAPP is approved. NEIWPCC will not pay for expenses incurred prior to the contract start date. Payment for costs incurred will be on a reimbursement basis per the contract payment schedule and contingent upon completion of quarterly progress reports and project deliverables.

IX. Contacts

Inquiries about the RFP: NEIWPCC and NBEP will accept questions about this RFP by email or phone through 4:00 p.m. EST on September 4, 2015 for pre-proposals and though 4:00 p.m. EST on October 30, 2015 for full proposals.

For information regarding the application process, contact the NEIWPCC Project Manager:

Heather Radcliffe
New England Interstate Water Pollution Control Commission
650 Suffolk Street, Suite 410
Lowell, MA 01854
(978) 349-2522
hradcliffe@neiwpcc.org

For information regarding the RFP topic, contact the Narragansett Bay Estuary Program:

Tom Borden
NEIWPCC Program Director
Narragansett Bay Estuary Program
(401) 633-0552
tom.borden@nbep.org

Appendix B. Pre-proposal.

Submitted September 23, 2015. Not included: Letters of Support from The Blackstone Headwaters Coalition, Fungi Perfecti, Clark University, Brown University, Fisherville Redevelopment Company, Mass Audubon, Sun Walking Group and Town of Grafton.

Bio-remediating the Blackstone River Corridor Using Engineered Ecosystems: A Unique and Natural Storm Water Management Model

(1) Project Overview. The Blackstone River Corridor Living Systems Laboratory (henceforth "LSL") is a low-cost, low-impact water treatment system that can be implemented in any impaired waterway or discharge point. It draws upon the natural ability of plants, animals, bacteria and fungi to remediate freshwater ecosystems degraded by storm water pathogens and nutrients. Our mission has been to optimize and quantify the ability of engineered ecologies to remove excess nutrients and contaminants from rivers, thereby providing clean water and creating value-added products for communities. These goals are all consistent with the ecological goals of the Narragansett Bay Comprehensive Conservation and Management Plan 2012 Update. While our site-specific project is located in the watershed of a Mass DEP/RIDEM water body, we plan to replicate this model throughout the River corridor. This proposal seeks $196,500 in funding from NEIWPCC for our project, "Bio-remediating the Blackstone River Corridor using Engineered Ecosystems: A Unique and Natural Storm Water Management Model". In it, we use a structured scientific research agenda to apply natural water remediation techniques to the Blackstone River to create a positive impact to affected natural resources. *The objectives of this project are: (1) the expansion of an existing bioremediation treatment center that has demonstrated success in treating storm water nutrients and other contaminants in the Blackstone Canal, (2) the continued investigation and quantification of water chemistry and beneficial ecological relationships and (3) the creation of value-added products from waterborne nutrient wastes for communities.*

PROJECT TIMELINE			
QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4
Submission of EPA-approved QAPP to NEIWPCC	Amplification of Eco Machine	Begin chemical analysis	Continue chemical analysis
Permitting of Ecomachine upgrades	Construction of nursery	Selling of plants	Outreach activities
Creation of promotional materials	Continue mycological research	Continue mycological research	Selling of plants
Develop mycological research questions	Propagation of plants	Outreach activities	Project monetoring and reporting
Project monetoring and reporting	Project monetoring and reporting	Project monetoring and reporting	

(2) Benefits to ecosystems, public. The LSL is located in South Grafton, MA, on the banks of the Blackstone River, a once-brownfield site that has a long history of industrial contamination by industrial pollutants, and more recently by excessive phosphorus (P), nitrogen (N) and pharmaceuticals that have entered the river through storm water runoff or incomplete wastewater treatment. The engineered ecosystem, also known as the Eco Machine, is the centerpiece of LSL, and was constructed in 2007 with funding from the EPA as part of an effort to address this contamination. It draws upon principles of ecological design, biomimicry, and bioremediation to create a series of microcosms in which contaminated water from the Blackstone Canal and river is treated by bacteria, fungi, plants and animals that self-organize into efficient treatment nodes. Improvements to the site have been measured both empirically and observationally. The Eco Machine has demonstrated success in reducing P and N levels in water passing through the system by 99%, and total petroleum hydrocarbons levels by 95%, bringing the water to near drinking standards (Details of monitoring data and analyses will be articulated in the full proposal). Canal water that once had a sheen of oil is visibly clearer, and the entire site, which was once void of animal life, is now vibrant and aesthetically pleasing, with birds, reptiles and amphibians, all of which are strong indicators of environmental health. The diverse ecosystems and biological refuges within the controlled environments serve to create resilience to catastrophic storm water and pollution events and preserve vital populations of cooperative organisms for rapid recovery of ecosystem services. Expansion of the project through the implantation of the latest bioremediation technology proposed in this project will increase the capacity of the Eco Machine from 10,000 to an estimated 50,000 gallons of water treated/day. This project also proposes the continued investigation of the mechanisms for the degradation of these contaminants which are still poorly understood. It implements a water chemistry sampling regiment to test contaminant levels at various points in the system, as well as initiates new studies on fungal remediation, the least understood portion of the bioremediation system. With the increased understanding of the roles of different biological actors in the bioremediation process, we will improve the efficiency of the Eco

Machine and be able to customize future projects to match the contamination profile of the target area.

(3) Innovation and Sustainability. The Living Systems Lab is an innovative model for storm water and pathogen management. Mass Audubon has pointed to the site as a model for low-impact development, and the Eco Machine as a relatively low-cost green infrastructure tool that is prime to be replicated in other municipalities throughout the Narragansett watershed. The Sun Walking Group is working with John Todd Ecological Design, Inc. ("JTED"), Natura Landscape Design and the Fisherville Redevelopment Corp ("FRC") to formulate a management strategy to achieve this and is helping to define the model and develop out a management framework. Mass Audubon is also disseminating technology to municipalities by conducting collaborative workshops on the core principles of the Eco Machine and other green storm water infrastructure.

(4) Municipal Collaboration. This project is continuing a collaborative effort between the Town of Grafton, MA DEP, US EPA, and a variety of water quality focused NGO's such as Mass Audubon and the Blackstone River Valley National Heritage Corridor. Original funding for the construction of the LSL remediation pilot was through a grant to the Town of Grafton. The partnership between the Town and the LSL has deepened over the years. The Town is now faced with compliance with new discharge limits at its waste water treatment plant and the challenges of continued rapid growth of storm water infrastructure needs to which the LSL may provide solutions.

(5) Costs v Benefits. This water quality improvement infrastructure delivers multiple environmental, social and economic benefits to a broad community. Remediation and water quality improvement has become a visual and educational amenity that can be implemented by a variety of groups and institutions. By delivering multiple social products and services, the model offers real cost-saving opportunities for investment in water quality and ecosystem improvement. The LSL non-profit serves as a long term funding mechanism to contribute to the operational expenses of the facility as well as serving as a vehicle for delivery of educational programming. The knowledge base, scientific application of remediation, collaboration of partners, and the management model that is established will yield an innovative technological and community benefit.

(6) BUDGET AND MATCHING

TASK	NON-FEDERAL MATCH	AMOUNT REQUESTED	PROJECT TOTAL
PERSONNEL	$85,000	$70,000	$155,000
EQUIPMENT	$160,000	$84,000	$244,000
RESEARCH AND DEVELOPMENT	$110,000	$35,000	$145,000
COMMUNICATIONS AND OUTREACH	$45,000	$2,500	$47,500
GENERAL AND ADMINISTRATIVE COSTS	$30,000	$5,000	$35,000
TOTAL	$430,000 (219%)	$196,500	$626,500

Matching sources include: Mass Audubon, Blackstone Heritage Coalition, universities, private corporations and personal contributions

(7) Administrative Functions and Roles. The LSL, the non-profit recently formed to manage this project, is in the process of creating a long term development plan which identifies discrete projects, their costs and funding streams. **The Town of Grafton** is a major partner and Executive Committee member that will provide technical advising on permitting in the site. **The Sun Walking Group** (contractor) will manage, coordinate, and develop a knowledge base and sustainability framework. **JTED, Inc.** (contractor), designer of the Eco Machine, will continue planning and coordinating the construction of upgrades and transferability of the bioremediation process. **The Blackstone Headwaters Coalition** will offer a QAPP and support with the collection of water samples. **Clark University, Brown University Superfund Lab** and **Fungi Perfecti, LLC.** will oversee water chemistry analysis, technical issues, and mycological research with a science advisor. **Natura Landscaping Design Inc.** (contractor) and **FRC**, the site owner, will provide support in the design of the nursery and the upgrades Living System Laboratory. Finally, **Mass Audubon** will develop stakeholder engagement materials in order to promote amplification of results. With support from NEIWPCC, the LSL will continue to be a center for community supported innovation of transferable bioremediation technology for the treatment of storm water contaminants.

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