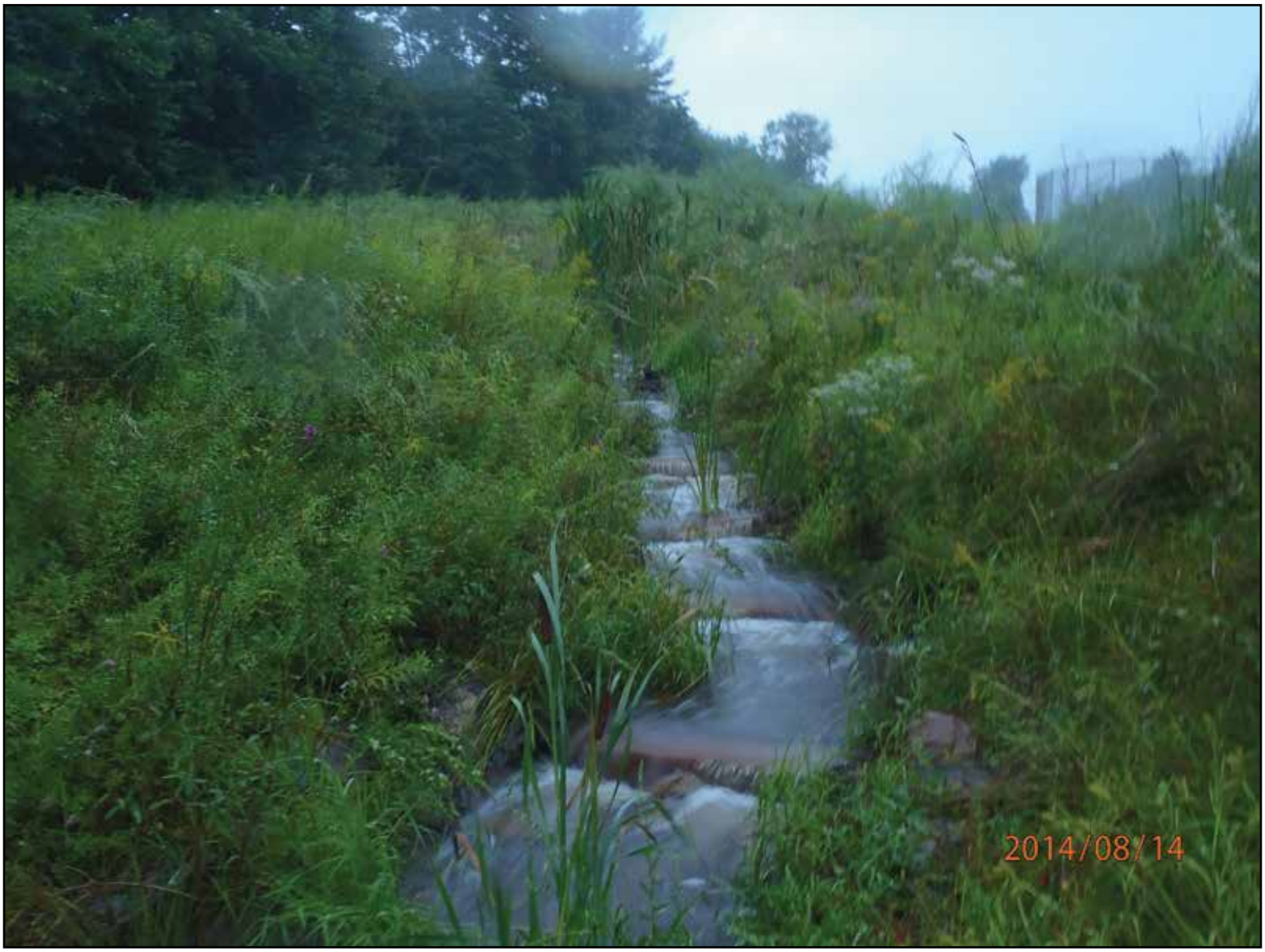
Going the Distance Along Dover's Berry Brook



A step pool sequence along an 1,100 ft long section of a day-lighted and restored stream.

In 2006, Berry Brook became famous for the wrong reason: it was deemed "impaired" by the United States Environmental Protection Agency (USEPA). A good chunk of the watershed surrounding this short, hardworking urban stream was covered by impervious surfaces that have been channeling polluted stormwater runoff into the brook for decades and it was no longer fit for human contact.

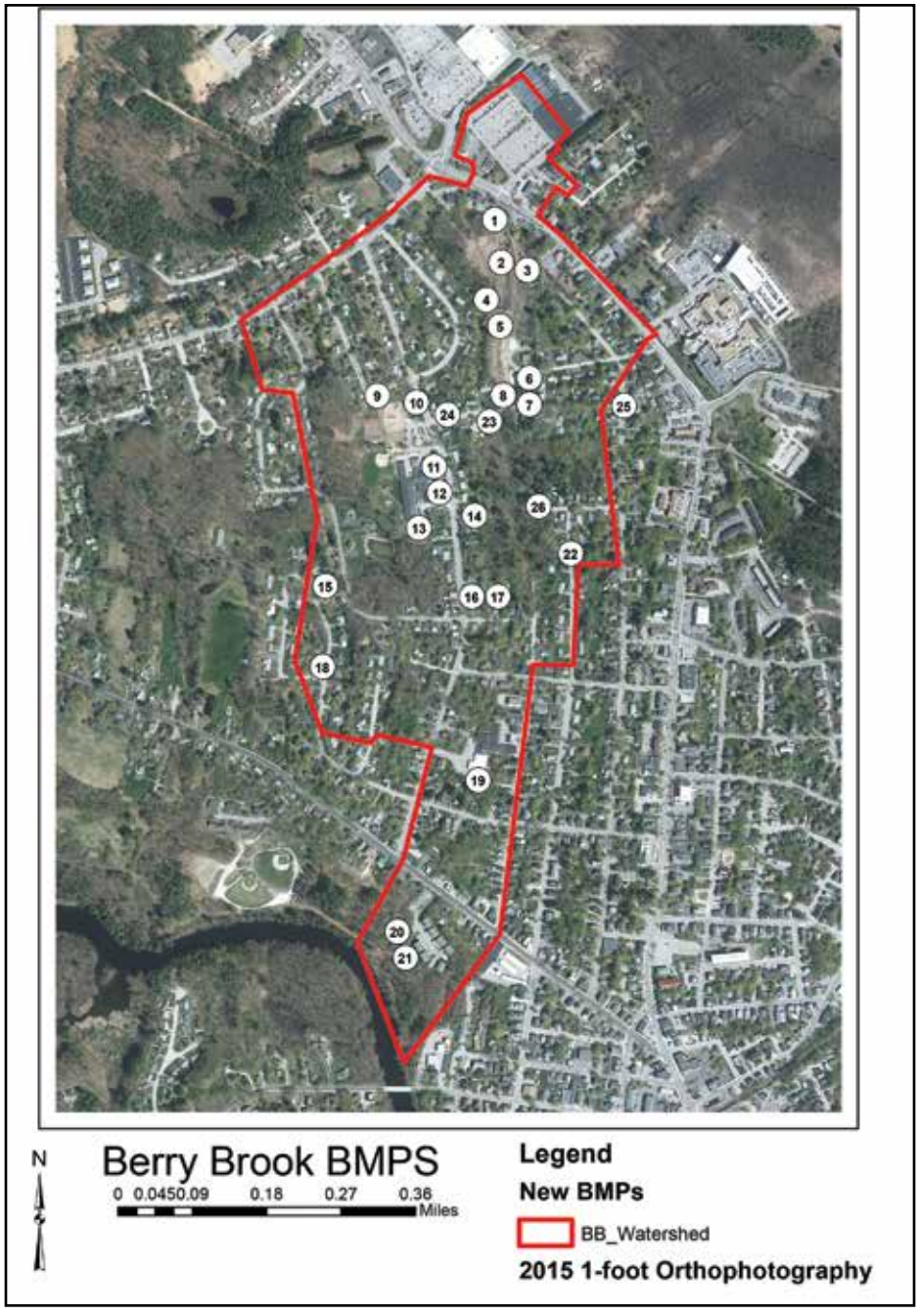
Today, Berry Brook has become famous again, but now it's held up as a model for how scientists and public works departments can collaborate to improve water quality in an urban watershed, using Low Impact Development (LID) and Green Infrastructure (GI) retrofits, stream restoration, community outreach, persistence, and some good old fashioned ingenuity.

Berry Brook flows through the urban heart of Dover, New Hampshire, extending from the city's Miracle Mile through one of its older neighborhoods before joining the Cochecho River, a major tributary of Great Bay. More than 30 percent of this short brook's 185-acre watershed is paved roads, parking lots, and buildings.

Stormwater runoff travels over this hardened landscape, picking up pollutants such as lawn fertilizer, pet waste, smog-related pollution, sediments, heavy metals, oil, and road salt and washes them into the brook. So much so that in 2006, Berry Brook joined thousands of other streams on USEPA's federally impaired waterways list, due to its high levels of E. coli bacteria during heavy rains and lack of the aquatic macroinvertebrates that are so important for healthy streams.

In 2007 the University of New Hampshire Stormwater Center (UNHSC) began partnering with the city of Dover's Department of Public Works and Utilities and other staff to filter and reduce the untreated runoff that reaches the brook. To date that partnership has resulted in the installation of 25 LID retrofits, these include: 12 bioretention systems, a tree filter, a subsurface gravel wetland, a standard wetland, daylighted and restored 1,100 linear feet of stream at the headwaters and restored 500 linear feet of stream at the at the confluence, three grass-lined swales, two subsurface gravel filters, and developed an innovative filtering catch basin design that has been installed in 3 different locations. Some of the BMPs were based on designs tested at the UNHSC field site and proven for their ability to treat water quality and reduce runoff, and others re-invented by city staff to decrease costs and reduce operation and maintenance burdens. The ability for city staff to reinvent and adapt stormwater BMPs was critical to the success of the project and involved the direct participation of respected staff like Bill Boulanger, Superintendent of Public Works and Utilities for the city. They were able to tackle three fundamental problems that are often associated with municipal adoption of innovative stormwater management approaches; compatibility, complexity and trialibility, or in other words, does it fit the management culture, can people understand it, and can local staff adapt the designs for greater utility? Due to the inherent flexibility of innovative LID management strategies, it seems logical that trusted municipal officials experiment with designs to more easily adapt seemingly complex configurations into a form more readily understood and accepted by peers.

The stormwater controls that have been implemented have reduced the impervious cover in the watershed from 30% to just under 10%. The sampling and modeling efforts have shown that these controls effectively remove more than 19



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tons of sediment, 710 lbs. of nitrogen, and 127 lbs. of phosphorus annually from the stream and drainage area.

Over the past decade of work, the city has placed itself ahead of the game in preparing for the new municipal separate storm sewer systems (MS4) permits in New Hampshire.

This project underscored the need to adapt "text book," research-based designs with what is practical for a public works department working in an urban setting. Sharing lessons learned about how to do this is an important step toward helping other communities adopt LID strategies to manage stormwater, according to Sally Soule, the New Hampshire Department of Environmental Services (NHDES) program manager for the project. "Many communities in our region look to Dover as the leader in LID innovation and implementation. Their story and experience is powerful and it's important to share this knowledge with other municipalities as they set out on the LID journey."

Sometimes, when it's "pouring buckets," Bill Boulanger will drive over to the Horne Street School to see how its stormwater systems are handling the deluge. "I'm satisfied with their construction and performance," he says, "they've made a believer out of me."

High praise from a self-defined "construction guy" whose pragmatic, resourceful attitude as Superintendent has set the tone for the City's Department of Public Works and Utilities for over 25 years. When he first began to work with the LID stormwater systems in the Berry Brook watershed, Boulanger acknowledged it was challenging to figure out how to make these approaches work for Dover. The designs, and the concepts that make them so effective in treating water quality, were new for him, his staff, and the contractors they worked with.

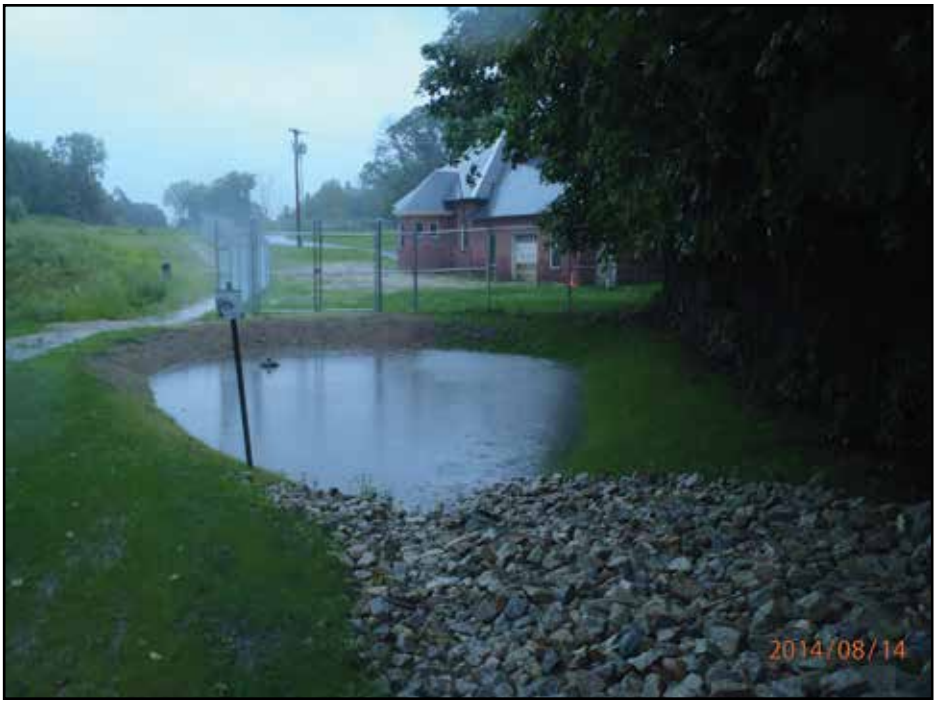
"Maintenance was my major concern," says Boulanger, who was recently awarded an EPA Environmental Merit Award for his efforts at Berry Brook. "I could see where the rain gardens and porous pavements could collect a lot of silt and debris. We had a lot of conversations with the UNH Stormwater Center and came up with a game plan, and it's really worked."

Diffusion of innovation theory documents that in public organizations, decisions to adopt new technologies like GI ultimately relies on the implementation phase where innovations are re-invented or adapted to better suit the community. This is an important aspect of municipal decision making that is often not breached in smaller single location demonstration projects. Boulanger collaborated with UNHSC engineers to reinvent several GI technologies for example, rain gardens were outfitted with deep sump catch basins to hold water and collect silt, making maintenance easier. Planted rain gardens were replaced with grasses that could be easily mowed and maintained. Some stormwater management options like pervious pavements

are simply off the table for communities due to both real and perceived internal barriers. Lacking equipment to maintain the recommended porous asphalt system, they developed the "Boulanginator," a system that mimics the features of a porous asphalt system through a subsurface storage and filtration component connected to easily maintainable catch basins. This system looks like a typical cross-section of a porous pavement but is paved with normal dense mix asphalt. The hydraulic inlet and outlet are instead controlled through perforated inlets and underdrains. Not only was this system effective at treating water quality through unit operations like filtration, sedimentation and infiltration, but the system exceeded the performance expectation having never reached capacity despite four events that were larger than the design storage (1 inch of rainfall). Boulanger and his crews were also able to use leftover materials from other projects to build it. They even timed installations to coordinate with other infrastructure upgrades to save money and time and minimize public disturbance. This underscores another key to successful wide scale implementation, and that is that maintenance considerations should dictate design. The UNHSC's 14 years of experience have informed them that maintenance and maintainability of stormwater controls is the ultimate predictor of performance, not necessarily the system itself. That is, if a system is not maintained, regardless of what it is, it is not going to function long-term.

Installation of a bioretention system next to the City's historic 1888 water works pumping station.

For Dover's Berry Brook, ten years and 25 LID systems later, its well on its way to a clean bill of health. Perhaps even more



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importantly, Boulanger and his colleagues have changed how they approach stormwater across the city.

"The nice thing about Berry Brook is that it's like a demonstration site for a mixture of techniques that we can build and maintain. We know how they work and what situation they're good for," says Boulanger. "Now, my highway crew wants to think about what we can do in projects that don't have stormwater in the plan. It's changed our thinking all together and that's true in the community as well. People want to know what they can do on their own property." **L&W**

by James Houle, Ph.D., CP-SWQ, CPESC, & Dolores Jalbert-Leonard

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