University of New Hampshire
Stormwater Center

2012 Biennial Report
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About the Center

The University of New Hampshire Stormwater Center (UNHSC) is dedicated to the protection of water resources through effective stormwater management. The Center has four main focus areas: 1) BMP Performance Testing, 2) Targeted Research, 3) Outreach and Education, and 4) Design and Implementation. Center researchers examine and refine the performance of stormwater treatment systems to treat the pollution in stormwater runoff and reduce the flooding that it can cause. Targeted research examines cold climate performance, cost, design, maintenance, and other information needed to advance the practice and understanding of stormwater science. This research provides information which is then integrated into an outreach program for stormwater managers and professionals who seek to build programs that protect water quality, preserve environmental values, and reduce the impact of stormwater runoff. The Center receives funding and program support from the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), a partnership of UNH and the National Oceanic and Atmospheric Administration (NOAA), and other federal, state, and private sources. It is housed within the University’s Environmental Research Group, a division of the College of Engineering and Physical Sciences.

Resources for Stormwater Managers

The Center’s research has served as the foundation for a range of outreach products—from best management practice (BMP) workshops geared to support municipal decision makers and stormwater engineers to peer-reviewed publications that explore the frontiers of stormwater science. Learn more about these resources at www.unh.edu/unhsc/.

- Data Reports
- Design Specifications
- Fact Sheets
- Case Studies
- Journal Articles
- Web Resources
Directors’ Message

This is a bittersweet report to issue. The roots of the UNHSC were in our stormwater studies in the early 1990’s that were trying to follow-up on the conclusions of the original studies included in the National Urban Runoff Program (NURP). In fact, one of the field sites we studied in the 1990’s was one of the original NURP sites in Durham, NH. Those studies made it clear that a more holistic approach to evaluating the performance of stormwater management strategies was warranted. In 2002, we formally founded the Stormwater Center, located a large field site on the University of New Hampshire campus, designed and then constructed a full field facility. Afterwards, I brought onboard a full time Director, Rob Roseen. Rob masterfully oversaw our original site construction and as Director, fostered UNHSC initiatives in outreach and research. Rob has taken on a new opportunity in the private sector, we will miss him and we wish him all the best.

Some of the fundamental reasons for creating a field research facility that could do parallel testing of stormwater management technologies were to: develop field protocols; obtain performance metrics for LID systems; and to assist manufacturers in bringing technologies to market. These objectives are still timely and salient. Many regulatory agencies still struggle with protocols for field-based acceptance and verification of stormwater treatment device performance. One only needs to look at the very few systems that have been certified under national protocols to see there is still much work to do. In addition, because of the need to remove more than just sediment, proprietary systems are rapidly being proposed to meet the permit needs of communities (for example nutrient reduction), yet very little performance information exists for the new technologies. Even when considering some basic changes to bioretention systems (soil amendments, internal water storage volumes, etc.), little has found its way into design guidance. Nationwide, thousands of these systems will be constructed each year with very few monitored to verify that they are meeting performance expectations. As such, we rely on the long term performance results of actual field installations to guide the design and selection of stormwater management.

In this our tenth year of operation, the UNHSC renews its commitment to advancing the field and science of stormwater management. We will also continue to offer and improve on our outreach and training. For example, because of the documented performance of the UNHSC subsurface gravel wetland system, states like New Jersey are recommending this practice in watersheds with nutrient impairments. In the past year we offered three subsurface gravel wetland and permeable pavement workshops throughout the state of New Jersey to strengthen the design capacity as well as to provide regulators, designers, and contractors with the most recent and updated information on these systems. Over the next two years we expect to continue to expand our outreach offerings.

This present, 2012 biennial report has some fantastic findings to present to you on stormwater system performance, cost, maintenance, and education. We hope the information is useful to you, and as always, we enjoy hearing back from you.

Sincerely,

Thomas Ballestero
Director
The UNHSC’s primary field research facility sits adjacent to a nine-acre commuter parking lot in Durham, N.H. The contributing drainage area—curbed and almost completely impervious—generates runoff typical of a commercial development. For nine months of the year, this lot is used near capacity by a combination of passenger vehicle and bus traffic. The pavement is frequently plowed, salted, and sanded during the winter.

The facility is designed to provide an “apples-to-apples” comparison of water quality treatment and water quantity management performance. A range of stormwater systems is installed in a parallel yet separate configuration that normalizes the variability inherent in stormwater contaminant loading and rainfall. Each system is uniformly sized to address a Water Quality Volume (WQV) of runoff generated by one inch of rainfall off one acre of impervious surface.

The facility contains three classes of stormwater treatment systems: conventional, structural systems such as swales and ponds; LID designs such as bioretention cells and subsurface gravel wetlands; and manufactured systems such as hydrodynamic separators and subsurface infiltration and filtration systems.

The lot’s contaminant concentrations are above, or equal to, national norms for commercial parking lot runoff. The local climate is coastal, cool temperate forest, with an average annual precipitation of 44 inches and monthly averages of 3.7 inches. The mean annual temperature is 48°F, with averages of 15.8°F in January and 82°F in July. The design depth for frost penetration is 48 inches.
In addition to its main field facility, UNHSC also conducts monitoring on numerous satellite systems including porous asphalt, pervious concrete, permeable interlocking concrete pavement, bioretention, tree filters, and gravel wetlands.

1. Stormwater runoff from the parking lot is channeled into a 36-inch pipe where it is monitored in real time for flow, pH, conductivity, dissolved oxygen, temperature, and turbidity. Concurrently, automated devices collect flow-weighted samples of runoff throughout the runoff hydrograph. These samples are processed and evaluated for a range of contaminants, or frozen for future evaluation.

2. Runoff then flows into a distribution box with a floor that rests slightly higher than the invert of the outlets that direct runoff to the various stormwater treatment systems. This configuration insures that runoff will scour the floor of the box, thereby preventing sediment accumulation. Baffles and flow splitters help to distribute the runoff evenly among systems.

3. From the distribution box, runoff flows through a network of pipes and into each system.

4. Runoff moves through the stormwater treatment systems.

5. Runoff leaves the systems through perforated subdrains and is conveyed into a sampling gallery.

6. In the gallery, runoff is monitored in real time for the same characteristics monitored in step one. Concurrently, automated devices collect flow-weighted samples of runoff throughout the runoff hydrograph. These samples are evaluated for the same range of contaminants as step one, thereby serving as the basis for system performance evaluation.

A detailed quality assurance project protocol governs all UNHSC’s methods, procedures, maintenance tasks, and analyses related to the evaluation of stormwater treatment systems. All systems are installed with an impermeable liner so that researchers can provide a strict accounting of the runoff flowing through the systems, as well as the contaminants it contains.
UNHSC Dedicated to the protection of water resources through effective stormwater management.