

**NH WATER AND WATERSHED CONFERENCE ABSTRACTS**  
**FRIDAY, MARCH 25, 2011**

**ABOUT THE PLENARY**

*New Hampshire's Water Resource and Infrastructure Issues – from the Headwaters to the Sea*  
This talk will present an update on the New Hampshire Water Resources Primer and Water Planning Efforts, taking a “Headwaters to Sea” view of water resource issues. The presentation will also provide examples of how some of these issues have recently been dealt with through legislatively established commissions. Specific findings of the SB60, Water Infrastructure Funding Sustainability Commission, will illustrate Water Infrastructure needs related to dams, stormwater drinking water and wastewater and the great challenge New Hampshire communities and state government face in funding critical infrastructure needs. Finally, a case study will provide an example of how one community is dealing with their infrastructure issues; including drinking water, wastewater and stormwater.  
- Sarah Pillsbury, NH Department of Environmental Services and John Boisvert, Pennichuck Water Works

**PLENARY SPEAKER PROFILE**

**Sarah Pillsbury**, Administrator, Drinking Water and Groundwater Bureau  
*NH Department of Environmental Services*

Sarah is the Administrator of the Drinking Water and Groundwater Bureau at the NH Department of Environmental Services. She has a BS in Resource Economics and is a Professional Geologist and a trained mediator. She has worked in various water related programs at the NH Department of Environmental Services for 25 years and currently is a staff lead on the Department's efforts to comprehensively plan for New Hampshire's water future.

**John Boisvert**, Chief Engineer  
*Pennichuck Water Works*

John has held the position of Chief Engineer for Pennichuck Water Works of Merrimack NH since 2006. John has over 25 years of experience in water resources engineering. He holds both a B.S. and M.S. in Civil Engineering from the University of New Hampshire and a Masters in Environmental Law and Policy from Vermont Law School. John is a member of the NEWWA, the NHWWA, and is a member of the NH Legislature's Water Infrastructure Sustainability Funding Commission. He is a lifelong resident of NH and serves as Chair of the Town of Stratham Public Works Commission where he currently resides.

**FRIDAY INFORMATIONAL PRESENTATIONS**

Each session will consist of a presentation and detailed discussion of a specific aspect of lake, river, groundwater, drinking water or watershed management, and will be followed by time allotted for questions.

## **MORNING BREAKOUT - 1** **(10:30 AM - 11:00 AM)**

**A. A hydrologic response to calcium amendment at Hubbard Brook Experimental Forest –** Acid deposition during the 20<sup>th</sup> century depleted base cations in the northeast United States and around the globe, substantially altering terrestrial ecosystem function. To understand ecological response to depleted calcium (Ca) soil concentrations, watershed 1 (W1) at the Hubbard Brook Experimental Forest was amended with enough Ca to bring soil Ca concentrations to pre-industrial levels. Following the amendment, the hydrology of W1 changed; annual evapotranspiration (ET; calculated as the difference between precipitation and runoff) increased by 25%, 18%, and 19% respectively for the three years following treatment, followed by a return to normal ET rates ever since. Concurrently, stream water chemistry changed, showing high Ca retention following the wollastonite addition. We hypothesize that trees in W1 responded to the Ca amendment through a few possible mechanisms that stimulated transpiration for the three years following treatment. Hydrologic change resulting from the Ca amendment suggests that historical and future changes to soil Ca concentrations may have concurrently altered or will alter water cycle dynamics.

*- Mark B. Green, Plymouth State University and the U.S. Forest Service*

**B. Assessing wild brook trout populations in New Hampshire –** This session will focus on the radio telemetry research project on the Swift Diamond River and will provide a summary of the work performed thus far for the Eastern Brook Trout Joint Venture-A Fish Habitat Partnership.

*- Dianne Timmins, NH Fish and Game Department*

**C. Cyanobacteria at freshwater beaches –** Since 2003, NHDES has issued cyanobacteria advisories at Designated Public Beaches as provided through the NH Water Quality Standards. Since 2008, Lake Warnings have been issued to alert the public of potential health issues. Advisories and Warnings are issued when potentially toxic-producing cyanobacteria make up more than 50% of the total cell count of the collected sample. Cyanobacteria identification takes only a few hours as opposed to the several days necessary to perform microcystin analyses. Additional rapid assessment methods of toxic cell concentrations are being explored.

*- Sonya Carlson, NH Department of Environmental Services*

**D. Pharmaceuticals and personal care products in the environment -** Pharmaceuticals and Personal Care Products (PPCPs) are among a class of emerging environmental contaminants that have received increasing attention in the media and scientific community. PPCPs (over-the-counter and prescription drugs, lotions, dermal patches, perfumes etc.) have been found in increasing frequencies and concentrations throughout the aquatic environment as a result of human use. Rebecca Harvey, recent graduate of Plymouth State University's Masters in

Environmental Science and Policy and Ecological Manager at the Squam Lakes Association summarizes her research on the presence of PPCPs in New Hampshire lakes and rivers.

– *Rebecca Harvey, Squam Lakes Association and PSU Center for the Environment*

- E. Assessment of water levels in bedrock wells in New Hampshire** - The US Geological Survey and the NHDES completed a study of 60,000 reported values of water levels in bedrock wells in New Hampshire. The study assesses the variation in water levels over time using available data. The results of this study and factors relating to changes in water levels in bedrock wells over time will be presented. Additionally, water level trends at sites with large groundwater withdrawals from bedrock aquifers and improvements to New Hampshire's water level monitoring well network will also be presented.

- *Brandon Kernen, NH Department of Environmental Services*

## **MORNING BREAKOUT - 2** **(11:00 AM – 11:30 AM)**

- F. Modification of suburban carbon and nitrogen fluxes by stream channels and floodplains** - Biogeochemical fluxes in human dominated streams and rivers are highly impacted, but effects can be attenuated downstream through natural ecosystem processes. In situ sensors deployed in a channel/floodplain system just downstream of a suburban catchment indicate significant modification of dissolved organic matter and nitrate over relatively short distances. A river network model applied to a coastal New England watershed indicates that while river channels can be significant nitrogen sinks, floodplains likely also play an important role, especially over annual time scales. Use of in situ sensors coupled with models is likely to improve understanding and management of nutrient perturbations in watersheds.

- *Wilfred Wollheim, University of New Hampshire, Department of Natural Resources*

- G. Detailed observations of fish swimming in a turbulent stream environment** -

Simultaneous high-frequency measurements of fish location, simple kinematic parameters such as tail beat frequency and amplitude, and flow characteristics were obtained in an outdoor experimental laboratory facility resembling a natural stream. Experimental tests at each of two flow rates used two native fish species with contrasting habitat preferences (*Nocomis biguttatus* and *Ameiurus nebulosus*). Simultaneous single-camera measurements were obtained of surface flow patterns using particle image velocimetry and of fish position by tracking beads attached to the dorsal musculature of each fish. Presented with multiple microhabitats within the vicinity of a rock structure, the fishes chose locations with similar hydraulic characteristics, even though those hydraulic conditions were in different locations at different flow rates. In addition, fishes were observed to adjust their position and tail beat amplitude and frequency in response to local time varying flow features, confirming that fish are sensitive to turbulent time varying flow features.

– *Anne Lightbody, Ph. D., University of New Hampshire, Department of Earth Sciences*

**H. Newfound Lake watershed – Innovative approaches for sustainable stewardship** – The Newfound Lake watershed is roughly 60,000 acres of rural landscapes whose waters drain to pristine Newfound Lake. Watershed residents identify clean water, healthy forests and rural character as the region’s most desirable characteristics. However, local zoning and enforcement do not support this vision, making the watershed vulnerable to unplanned development. Key project objectives are to engage residents of all watershed towns to work together to protect their shared resources. Innovative tools include stormwater demonstration projects, shared professional planners, and community-based social marketing-informed, web-based and traditional communications.

- *Boyd Smith, Newfound Lake Region Association and Steve Whitman, Jeffrey H. Taylor & Associates*

**I. Water use and the potential stress to the groundwater and surface water systems** – In 2008, New Hampshire Geological Survey (NHGS) began a state-wide assessment of water use and the potential stress to the ground water and surface water systems from that usage. NHGS used a variety of GIS tools and techniques to build the datasets and perform this analysis. Over the past two conferences we have presented the initial concept of how we were going to perform the assessment and some of the results and final processes. This year we would like to present the final results, how we arrived at these results and what they illustrate about New Hampshire water use. There will also be additional illustration of how these data can be used to support other hydrologic analyses.

- *Greg Barker, NH Department of Environmental Services*

**J. The rainy day fund – estimating groundwater storage at the catchment scale** - The temporal and spatial dimensions of the saturated zone are important factors to consider in assessing water availability, providing insight into the hydrologic behavior of watersheds. A GIS was used to estimate spatially-distributed storage volume throughout the Piscataqua/ Coastal Watershed of New Hampshire under normal recharge conditions. Catchments (i.e. reach-scale drainage areas) provided a useful way to organize the analysis to allow inferences about the potential of different segments of the landscape to support baseflow in streams and groundwater withdrawals.

- *Fredrick Chormann, NH Department of Environmental Services*

### **MORNING BREAKOUT - 3 (11:30 AM – 12:00 PM)**

**K. Restoring brook trout habitat and minimizing erosion in western Maine streams** – In 2007, the Androscoggin River Watershed Council led an experiment to add coarse woody material (CWM) to streams in the Mahoosuc Range. Trees were felled into streams in the area. CWM traps eroding sediment and creates pools by scouring. Annual monitoring though 2009, including biological, morphological and water levels, has indicated improvement. The 2010 data, the final field session for the project, will be analyzed to help determine the project’s success. This technique offers a relatively inexpensive way to improve habitat and erosion control in headwater streams.

- L. Stream temperature impacts due to stormwater runoff** – Small streams in New England are highly sensitive to changes in temperature and their water temperature dictates many aspects of the health and ecology of the stream corridor. This talk will discuss the impact of stormwater runoff on stream temperature, and how engineering controls can be implemented to best protect the thermal regime in streams.

- Jennifer Jacobs, Ph.D., University of New Hampshire, Department of Civil Engineering

- M. Ten years of invasive plant management in the Squam Lakes** – In mid-July of 2000, the invasive plant, variable milfoil, was confirmed to exist in the Squam Lakes Watershed. Since then, the Squam Lakes Association has actively managed milfoil infestations found throughout the lakes using multiple techniques to maximize effectiveness. Ten years later, the Squam Lakes still have variable milfoil but the area of the infestations has been limited to less than 5 acres, less than 0.1% of the entire 6,700 acre lake.

- Rebecca Harvey, Squam Lakes Association

- N. Water usage demographics in NH's community water systems** – New Hampshire has over 700 community water systems. Water usage varies widely among these systems depending on the demographics of the customers and population served. This presentation will summarize water use demographics of New Hampshire's large, medium and small community water systems using two years of data from 2009 and 2010. Seasonal water use characteristics will also be explored along with the effects of the water conservation efforts implemented by some of these systems.

- Brian Goetz, Weston & Sampson, and Brandon Kernan and Derek Bennett, NH Department of Environmental Services

- O. Evaluating recharge sources for bedrock and sand & gravel production wells -**

Developing *sustainable* groundwater resources for public water systems requires an assessment of potential recharge sources for proposed production wells. Case studies from recent groundwater investigations in New Hampshire will be used to highlight site-specific variability of groundwater recharge sources to production wells developed in bedrock and sand & gravel aquifers. The potential utilization of artificial recharge as a groundwater resource management tool is also discussed in this presentation.

- John Brooks Ph.D., P.G., Senior Geologist, Emery & Garrett Groundwater, Inc.

## **AFTER LUNCH PLENARY (1:00 PM – 1:45 PM)**

### **The Weeks Act and Beyond: Protecting NH's Water Resources**

Description not yet available.

- Paul Doscher, Society for the Protection of New Hampshire Forests

**AFTERNOON BREAKOUT - 1**  
**(2:00 PM - 2:45 PM)**

- P. Management of headwaters streams in the White Mountain National Forest** – Wild Eastern brook trout dominate cold headwater streams in the White Mountain National Forest. Brook trout biomass was influenced by watershed size, percent pool habitat, and woody debris that formed pools. Woody debris additions benefitted brook trout more in smaller streams where pool habitat is limited. Seventy percent of perennial stream crossings are potential fish barriers and most are located in drainage areas less than 0.5 square miles. These findings are discussed relative to threats such as climate change.  
- *Mark Prout, US Forest Service*
- Q. Climate and land use consequences to 100-year flooding in the Lamprey River watershed**  
- This project evaluated change in the 100-year floodplain based on current and projected alterations in land use and climate for the 213 square mile Lamprey River watershed. The evaluation includes the use of Low Impact Development as an adaptation planning tool, and, in particular, as a means for building community resiliency in managing water resources. The analysis was consistent with guidance for Federal Emergency Management Agency floodplain analysis.  
- *Ann Scholz, University of New Hampshire Stormwater Center*
- R. Optimizing wastewater disposal areas to minimize impact to groundwater supplies** - This presentation provides a case study look at the disposal of treated effluent in a nutrient-impaired watershed for a mixed-use development planned in southeastern Massachusetts. A no-net nitrogen increase solution to wastewater disposal was proposed and permitted. A site screening analysis coupled with groundwater modeling and nitrogen load modeling was used to assess a variety of solutions and mitigation options. The approach was geared toward maximizing attenuation, optimizing return flow, and minimizing impact to surface water bodies and groundwater withdrawals.  
- *Kevin MacKinnon, Weston & Sampson*
- S. Restoring water quality in the Willow Brook watershed through LID retrofits** - Willow Brook is a tributary to the Cochecho River in the urban center of Rochester, NH and is impaired for E. coli. This project presents 2 LID retrofit locations, an ultra urban setting and a residential neighborhood. The first location was a neighborhood school with no stormwater management. The second location was a recently built residential subdivision with conventional curb, catch basin and gutter stormwater conveyances. Retrofits included rain gardens, tree filters, drywell, pervious pavements, and rain barrels and nearly 80% reduction in impervious cover.  
- *Robert Roseen, University of New Hampshire Stormwater Center*
- T. Surface water impacts from groundwater withdrawals** - The potential for groundwater withdrawals to impact surface water is a critical consideration in the determination of sustainable yield on a watershed basis. A general overview of scenarios where groundwater/surface water interactions may occur will be presented along with current regulatory requirements associated with groundwater withdrawals. Methods of measuring

and assessing potential impacts on surface waters from groundwater withdrawals during pumping tests and for long-term monitoring programs will be presented.

- Al Pratt, PE, and Steve Howe, AECOM

## **AFTERNOON BREAKOUT - 2** **(2:45 PM – 3:30 PM)**

- U. Watershed controls on spatial and temporal variation in headwater stream variation** – The US Forest Service Northern Research Station sampled the headwaters of Paradise Brook, Woodstock, NH under varying flow conditions at 50 meter intervals along the stream network. Watershed characteristics controlling stream chemistry were evaluated by topographic indices derived from a LiDAR based 5 meter digital elevation model. Height and duration of water table were measured in 40 monitoring wells, distributed by soil type and landform; samples were taken to characterize groundwater chemistry. Control of surface water chemistry by diagnostic soil horizons, drainage from distinct soil types, the riparian zone, and isolated groundwater seeps was evaluated.

- Scott W. Bailey, US Forest Service Northern Research Station

- V. Nitrogen inputs, outputs, retention and concentrations in the Great Bay Estuary** - Impairment of the Great Bay Estuary (GBE) by elevated nitrogen has spurred considerable focus on reducing point and non-point sources of nitrogen from contributing watersheds. We quantified nitrogen inputs, outputs and retention among sub-basins of the contributing Lamprey and Oyster River watersheds and have documented increased export and decreased retention with increased nitrogen inputs. Preliminary nitrogen concentrations at over 200 sites throughout the GBE watershed and new research activities to identify nitrogen sources and transport pathways will also be presented.

- Michelle Daley, NH Water Resources Research Center, University of New Hampshire

- W. The new NH method for wetland evaluation – revised and updated** - The *Method for the Comparative Evaluation of Non-tidal Wetlands in New Hampshire* was first published in 1991. As it nears its 20 year anniversary, we are pleased to present the first update/revision in 20 years! We have incorporated new studies, developed a new mapping section, updated the method with currently available technology, streamlined the functions, and developed a web site. Be among the first to learn from three of the revised method's authors what is new, how the new mapping section works, and why this is still the most frequently used wetland evaluation method in New Hampshire.

- Amanda Stone and Frank Mitchell, UNH Cooperative Extension, and Rick Van de Poll, Ph.D. Ecosystem Management Consultants

- X. Long Creek – baseline monitoring of water quality and streamflow in an urban watershed** - Long Creek is a 630-acre urban watershed in southern Maine that discharges to Clarks Pond in Casco Bay. The newly formed Long Creek Watershed Management District is conducting a collaborative, permit-driven, watershed-wide restoration effort. The

impervious cover is extremely high, from 61.2% to 100% across subcatchments. The District initiated comprehensive water quality and hydrologic monitoring in mid 2010. It includes continuous water quality data from sondes at 7 locations, and additional sampling during storms and base flow. Six stream gauging stations were established across the watershed to evaluate stream flow and stormwater input. The presentation will review the recently collected hydrologic and water quality data, and reflect on specific challenges and solutions in measuring the effectiveness of aggressive urban stream restoration efforts.

- Cayce Dalton, F.B. Environmental, Inc. and Danna Truslow, Truslow Resource Consulting

- Y. Tomorrow's drinking water: dwindling opportunities for new sources** - In 1999, NHDES developed a GIS-based model to identify favorable areas to site new gravel wells for municipal water supply in stratified-drift aquifers. Working with the Forest Society, this model has been updated in 2010, using new spatial data (e.g. roads and highways, water features, contamination sites, and various urban features that may constrain the development of new large water supply wells. The results indicate less than one third of the state's total aquifer area of 805,500 acres remains "favorable" after accounting for constrained areas associated with these features, and of that, only 85,000 acres appears to be suitable for high-yield wells pumping at 75 gallons per minute or greater. The study also makes several recommendations for improving the model and the accuracy of the data for use in regional and municipal planning.

- Dan Sundquist, Society for the Protection of New Hampshire Forests and Pierce Rigrod, NH Department of Environmental Service