

Water Pages

Spring 2004
Edition

A Quarterly Newsletter Produced by the Rutgers Cooperative Extension Water Resources Program: Creating Solutions for Water Quality Issues in New Jersey

Featuring Student Staff



From left to right: Michael Mak, a Bioresource Engineering senior, Greg Rusciano a graduate student in Bioresource Engineering, and Eileen Althouse, recent graduate of the Bioresource Engineering Program (January 2004).

The TMDL Advisory Panel

A state-wide Total Maximum Daily Loads (TMDLs) Advisory Panel was formed in August 2001. The Panel functions at the Rutgers University EcoComplex and provides technical assistance to support the New Jersey Department of Environmental Protection (NJDEP) in the development of TMDLs. A TMDL is the sum of the individual wasteload allocations for point sources, load allocations for nonpoint sources and natural background pollutants, and an appropriate margin of safety. The TMDL reports that NJDEP has been producing identify the following:

- *how much pollution a stream or lake can assimilate before water quality standards are exceeded,*
- *how much pollution the waterway is currently receiving from point and nonpoint sources, and*
- *how to reduce the amount of existing pollution loads so that water quality standards will be achieved.*

The development of a TMDL is a very complex process and needs to be based upon good, defensible science. Though the Panel is hosted by Rutgers University, this multidisciplinary group has included scientists and engineers from Rutgers University, Stevens Institute of Technology, New Jersey Institute of Technology, Rowan University and Richard Stockton College of New Jersey. The Panel reviews both technical approaches submitted by NJDEP and proposals solicited by the Department for related research, and offers formal recommendations to the Department.

The University's role in the project includes coordinating the interactions between the Panel and NJDEP and managing the project sub-awards that provide additional technical support to the Department. The Panel also addresses other pertinent issues relating to the success of the project and continues efforts to promote a statewide dialogue on the model of an academic science advisory panel to state TMDL development officials. For more information, please contact Jim Cavazzoni or Christopher Obropta at cavazzoni@aesop.rutgers.edu or obropta@envsci.rutgers.edu, respectively.

RECENT APPEARANCES

Mar. 30, 2004, Monmouth County Planning Board's Stormwater Roundtable: Dr. Obropta presented "Municipal Stormwater Management Planning", a presentation outlining the steps necessary to complete a municipal stormwater management plan.

Apr. 26 and 29, 2004, North Jersey RC&D, Septic Management Workshops: Dr. Obropta presented on the benefits of septic management programs. Three workshops were conducted and held at the Hopatcong Board of Education Administrative Building and the Pequest Trout Hatchery.

May 10, 2004, Union County Stormwater Seminar: Dr. Obropta presented on Municipal Stormwater Management planning and outlined steps to fulfill regulations.

May 11-12, 2004, USDA CSREES Regional Water Quality Program Annual Meeting, Cornell University.

MARK YOUR CALENDARS

May 26, 2004, Whippany River Action Committee's Stormwater Management Conference: Dr. Obropta will be presenting municipal stormwater management planning.

June 1-2, 2004, Office of Continuing Professional Education and NJDEP, Technical Training for Stormwater Management Rule and BMP Manual.

June 11-12, 2004, Cornell University, Raingarden Design and Construction.

A Watershed Assessment Tool for New Jersey

The Water Resources Program has undertaken a project that has future applications to watershed management throughout the state. The project is a study that investigates the characteristics of drainage basins in Watershed Management Area 3 (WMA3) in Hudson, Sussex, Essex, and Passaic Counties and attempts to make correlations between these basin characteristics and stream impairment. The ultimate goal of this project is to develop a model that can use Geographic Information System (GIS) data in ArcView to screen a watershed area and predict what impairments might be encountered in the area based on selected parameters. The hope is that this form of analysis will be a time and cost-saving method of identifying stream reaches of potential areas of concern.

The Stream Visual Assessment Protocol (SVAP) developed by the US Department of Agriculture describes a method to evaluate stream reaches based on physical parameters such as channel modifications, condition of riparian zones and buffers, bank stability within the stream reach, water appearance, benthic macroinvertebrate habitat, hydrologic alterations, and appropriate canopy cover. The parameters are ranked on a scale of 1-10 (1 being most impaired and 10 being optimal conditions). The advantage of using a protocol such as that created by the USDA is the ability to compare stream reaches in a given region of similar conditions, and it is easy to use. A large-scale SVAP assessment was completed by local volunteers in WMA3, and this data was used for analysis in this effort. All of the volunteers participating in the assessment were instructed by the same trainers through consistent training modules. Quality assurance of the data was ensured by regular communication between the trainers and volunteers and data sheet evaluation.

Land use has long been evaluated for its impact on water quality. For each basin in WMA3, the percent of total land use of urban, agriculture, wetlands, forest, water, and barren areas were calculated. The SVAP scores for each of the 255 sites analyzed in the SVAP assessment were overlaid with GIS land use and basin polygons. A trend was noticed that basins with urban areas of greater than 50% of the total basin area had a greater occurrence of stream reaches with a poor or fair SVAP score than those of a lesser percentage of urban area.

Impervious surface cover has been shown to affect streams and habitat as documented by USGS's Jonathan Kennen and others. An investigation of the relationship between impervious surface coverage (ISC) and SVAP scores was performed on WMA3. Impervious surface data from the 1995 GIS land use data was intersected with the basins of WMA3 in ArcView to calculate the total percent ISC of each basin. Calculated ICS ranged from 0-34% of the total drainage basin area, which is consistent with other published reports. The ISC analysis showed

that there may be a correlation between percent urban area and percent ISC. Of basins with urban land use greater than 50%, all sites had total ISC of greater than 15%. There is a transition area between the 40% and 50% urban which coincides with 10-15% ISC. All basins that were 20% ISC or more contained stream reaches of either poor or fair SVAP scores, which confirms the association between impervious surface and impaired streams. According to the Center for Watershed Protection (CWP), impervious coverage can have measurable impacts on stream quality. Beginning at 10% impervious coverage, a stream is likely to be degraded of its most sensitive characteristics. With 25-30% impervious coverage, stream indicators are very likely to move to a poor rating, including diminished aquatic diversity, water quality, and habitat status. The CWP has built an impervious cover model from this information to characterize subwatersheds into specific units that have unique characteristics. Some limitations of this model exist, and more information can be found in the CWP's Vulnerability Report, which is available at www.cwp.org.

The SVAP evaluation method assigns scores based on features such as bank stability, hydrologic alterations, and channel condition. Soil type at the site may be a factor in low scores recorded for these parameters. The soils of WMA3 were evaluated based on their erodibility potential as assigned in SSURGO databases. In the more urban basins, a correlation was found between sites containing soils with a higher erodibility potential and lower SVAP scores. Therefore, a combination of urbanization and erodible soils may result in more impaired streams.

The average slopes for basins delineated by ArcView were compared with the SVAP scores in these basins. Basins of average slopes greater than 10% contained sites with SVAP scores of mostly either excellent or good, while the basins with average slopes of less than 10% had a greater occurrence of fair or poor scores. Issues of erosion and stream stability were the most significant problems in basins of average slope of 5-10%. The relationship between average slope and SVAP score may be a result of the trend of development in lowland areas which supports the idea that land development contributes to stream impairment.

The work of data collection for WMA 3 was completed during 2000-2003. This was a large-scale effort, achievable because of a significant in-kind donation of volunteer time and funding from NJDEP's 319h grant program. With such a large amount of data collected, greater accuracy can be predicted by creating associations between factors within the watershed and visual assessment scores. By comparing visual evaluation rankings with land use, soils, slopes, and impervious surface, a possible level of impairment was characterized. Future efforts will involve other watersheds in need of assessment, and these efforts will test the appropriateness and accuracy of the GIS-based model under construction for WMA 3.

For more information on this work, please contact Eileen Althouse eileena@eden.rutgers.edu.

Managing Nonpoint Source Pollution with Bioretention Systems

The bioretention system is an innovative Best Management Practice (BMP) that is used in suburban settings, especially for the treatment of parking lot runoff. When implemented, bioretention systems have the ability to remove a wide range of pollutants, such as suspended solids, nutrients, metals, hydrocarbons, and bacteria from stormwater runoff. The typical design for a bioretention system includes a grass buffer pretreatment strip, a ponding area that is designed to infiltrate within 72 hours, vegetation, planting layer, organic layer, and sand layer. Pollutant removal is achieved from a variety of processes within the system including settling, filtration, adsorption, plant uptake, and evapotranspiration. However, the need to evaluate these removal capabilities in a more comprehensive manner becomes important since little quantitative data on bioretention systems currently exists in the stormwater management community. Since bioretention is increasingly being implemented as a primary watershed management tool across New Jersey, research on bioretention will help optimize its effectiveness in the field and improve regulatory guidance for the future.

A new study at the Department of Environmental Sciences at Rutgers, The State University of New Jersey, seeks to evaluate the pollutant removal capabilities of bioretention systems in the laboratory. The study, funded in part by the New Jersey Water Resources Research Institute, has been in development since February 2004.

The study seeks to evaluate the ability of bioretention systems to effectively reduce fecal coliform colonies and concentrations of total Kjeldahl nitrogen, ammonia, nitrate, and total phosphorus. Bioretention systems will be modeled in the laboratory as columns with representative depths of sand, soil, mulch. A native plant species such as *Juncus effusus*, typically used in bioretention systems, will also be integrated. Various types of soil blends will be observed with the hope that an ideal blend can be recommended to the stormwater management community for future projects. Typical rainfall conditions for New Jersey will be mimicked in the laboratory with regard to rainfall intensity and frequency and stormwater composition (pollutant concentrations).

With the initial phases of the study nearly complete, experiments are expected to run throughout the summer and fall of 2004. Collaborations have been made with previous researchers of bioretention systems, Rutgers faculty, engineering consultants, and the government agencies currently involved with watershed management oversight. For more information please contact Greg Rusciano at gruscian@eden.rutgers.edu.

On-site Wastewater Management Programs

Wastewater from many homes and small businesses in the United States is treated by on-site wastewater treatment systems (OWTS), but environmental impacts may result from poor siting, sizing, operation, and maintenance. Failing OWTS may not be repaired or replaced due to high costs, may become a financial burden for the landowner, and may cause local and down gradient health and environmental problems. Local governments and contractors are the key to improved installation and management of OWTS.

One focus of the USDA CSREES Regional Water Quality Project in US EPA Region 2 is working with local communities to improve the management of OWTS. The US EPA recognizes the importance of properly managing OWTS and has released management guidelines for these systems. In New Jersey, only eight of the 566 municipalities have adopted on-site wastewater management ordinances/programs. The Township of Montgomery in Somerset County, New Jersey has one of the most successful programs in the state. Montgomery Township's Septic Tank Program is a responsible management entity that requires residents who own septic systems to renew a license every three years by paying a fee and submitting proof that the system was pumped and/or inspected. As part of our participation in the Regional Water Quality Project, the Water Resources Program is working with Montgomery Township to develop Geographic Information System and database tools to update the existing Septic Tank Management Program's database so that it can be linked to the Township's GIS. Standard Operating Procedures (SOPs) will be developed to allow the health officers, inspectors, and support staff to take full advantage of the new database to better manage inspections and to better relate failing systems to physical features within the township. Hopewell Township, New Jersey is also taking a proactive role in investigating the possibilities of a septic management entity that will not only manage systems within the municipality but also identify and repair failing systems throughout the township. Ideally, Hopewell Township would work with each septic owner within the township boundaries to maintain efficiently working systems and minimize their impact to the environment.

Creating an effective management program is an important new focus for municipalities with OWTS within their jurisdiction. These management programs can provide education for the homeowner and perhaps local real estate agencies, as well as ensure improved health of downstream waterbodies and protection of aquifer supplies. For more information about this project, please contact Katie Buckley at kbuckley@envsci.rutgers.edu.

Stormwater Best Management Practices for Small Horse Farms

For their senior design project in BioEnvironmental Engineering Design I and II, the design team addressed the problem of stormwater management at the Equine Science Center, of Rutgers, the State University of New Jersey. The site under consideration within the Equine Science Center will be a small horse farm, surrounded by agricultural fields and horse pastures. Upon preliminary inspection of the site and corresponding topographic maps, the student design team under the direction of Christopher Obropta identified the Equine Science Center as a candidate for improved stormwater management through Best Management Practices (BMPs). Several types of stormwater BMPs were designed to address the potential problem areas at the site. These BMPs included bioswales, infiltration trenches, bioretention basins, and dry wells. Currently, there are no stormwater management strategies in place at the Equine Science Center farm facility, and thus there is little control of non-point source pollution.

The project targeted several observed non-point pollution sources including roadways, paddocks, pastures, rooftops, and agricultural fields. During rainfall events stormwater runoff carries nutrients, fecal matter, sediment, zinc, copper and petroleum hydrocarbons directly to the Lawrence Brook, and consequently into the Raritan River. Agricultural runoff consists of nitrogen and phosphorus that can degrade the health of water bodies by promoting algal growth, which can adversely affect the instream dissolved oxygen concentration. Fecal matter is also a critical issue from both the horses and the geese that frequent the site. Not only

does this fecal matter consume oxygen as it decays in the stream, it also can result in human health hazards, as well as hazards to other animals due to the potential bacteria and viruses associated with this material.

The final design was presented by the senior design team to a group of faculty at the end of the spring semester. The students produced designs for several stormwater management practices that will mitigate the identified problems. The BMPs are cost-effective solutions that can be implemented by the small horse farms across the State to help minimize the impact of their operations on local streams and lakes. Funding is currently being solicited from the NJDEP to construct these BMPs at the Rutgers Equine Science Center site, monitor the effectiveness of the BMPs, and establish an educational program where horse owners can visit the site and tour the various BMPs.

For more information on this effort, please contact Michael Mak at mikemak@eden.rutgers.edu.

LOG ON

New updates and recent presentations can be viewed and downloaded at the CSREES Regional Water Quality Coordination Program page for EPA Region 2.
<http://rwqp.rutgers.edu/>

The New Jersey 2004 Integrated Water Quality Monitoring & Assessment Report is available at the NJDEP's Water Assessment Team's website.
<http://www.state.nj.us/dep/wmm/sgwqt/wat/>

The Center for Watershed Protection can be accessed at <http://www.cwp.org>.



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