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3:30 PM – 5:00 PM
SESSION 34: TMDL Issues

Union River Fecal Coliform TMDL Effectiveness Monitoring in Washington State - Scott Collyard, WA State Department of Ecology, Olympia, WA (co-authors: George Onwumere, Markus Von Prause)

Union River, a largely rural stream, was listed under Section 303(d) of the federal Clean Water Act for not meeting Washington State fecal coliform bacteria water quality standards. The state is required, under Section 303(d) and U.S. Environmental Protection Agency's implementing regulations, to develop and implement total maximum daily loads (TMDLs) for impaired waters, and to evaluate the effectiveness of the clean-up action recommended in the TMDL to achieve the needed improvement in water quality. Currently, the State of Washington has approximately 660 EPA-approved TMDLs with impairments caused by pathogens, metals, conventional pollutants, priority pollutants, and exotic biological species. Union River has one of these TMDLs. In the 1990s, monitoring by several agencies indicated that the Union River violated the Washington State water quality standards for fecal coliform bacteria. The river, which supports a variety of salmonid species and recreation, may not be meeting the designated uses. Subsequently a TMDL study was conducted that attributed the pollution to nonpoint sources such as septic systems, stormwater, bio-solids land applications, small farms, and wildlife. Cleanup activities have begun, and the expectation is that the Union River will meet both target limits set in the TMDL and the state water quality criteria. The objective of the study was to evaluate the effectiveness of implementation efforts in meeting fecal coliform target concentrations in the Union River. Preliminary results indicate a drastic reduction in fecal coliform concentrations. However, most of the sites are still not meeting both TMDL target limits and water quality standards.

Examining the Effects of TMDL Implementation on the Flow-Concentration Relationship in the Neuse River Basin - Ibrahim Alameddine, Duke University, Durham, NC (co-authors: Song Qian, Kenneth H. Reckhow)

In-stream nutrient concentrations are well known to exhibit a strong relationship with river flow. The use of flow measurements to predict nutrient concentrations and subsequently nutrient loads is common in water quality modeling and is often used to draw upon the large databases of daily flow measurements to augment infrequent water quality sampling. Nevertheless, most adopted models assume that the relationship between flow and concentration is fixed across time as well as across different flow regimes. Yet, the implementation of environmental management measures at a river basin scale can result in changes to the underlying relationship linking flow to concentration measurements and ultimately to load estimates. We have developed a Bayesian temporal-hierarchal model that allows for the identification and quantification of change in the underlying relationship linking daily mean flow measurements to instantaneous nitrite-nitrate concentrations across time. The results from our model identify the occurrence of a changepoint in time that coincided with the period of implementing nutrient control measures as part of the TMDL program developed for the Neuse Estuary in North Carolina. Our findings challenge the underlying assumption of temporal invariance in the relationship between flow measurements and nutrient concentrations. The model also indicates a transition in the river system from a point source dominated loading system towards a non-point source nutrient delivery system following the implementation of the TMDL. Moreover, the results also identify the presence of a flow threshold, beyond which the observed flow-concentration regime transitions to a dilution dominated system.

Assessment of the Chesapeake Bay TMDL: Nutrient and Sediment Load Reductions are Needed to Restore Living Resources - Lewis Linker, U.S. Environmental Protection Agency, Annapolis, MD (co-authors: Gary Shenk, Ping Wang Jing Wu, Richard Batiuk, Carl Cerco)

The Chesapeake Bay Program is developing a TMDL for the entire watershed to meet tidal water quality standards established in 2003 to restore the Bay's living resources. These water quality standards are for dissolved oxygen, chlorophyll, and water clarity. The standards are achieved by restricting nutrient and sediment loads to the Bay. We examine estimated nutrient and sediment loads in the major river basins of the Chesapeake Bay under different management approaches using the airshed, watershed, estuarine, and living resource models of the Chesapeake. To simulate the Chesapeake watershed, the river flows, and associated transport and fate of nutrients and sediment, the Chesapeake Bay Community Phase 5 Watershed Model was applied which has expanded the calibration stations, model segments, land uses, and management practices by an order of magnitude over the previous version. This allows the option of developing TMDL allocations down to the local government scale. A next generation airshed model provides nitrogen atmospheric deposition input to the continuous 21 year simulation of the watershed and estuary. The Bay Water Quality and Sediment Transport Model has been refined to provide sediment transport simulation capacity as well as providing an examination of the effects of filter feeders such as oysters and menhaden on estuarine water quality.

Water Quality Benefits of Riparian Buffers in Agricultural Watersheds: Unanswered Questions -
Karl Williard, Southern Illinois University Carbondale, Carbondale, IL (co-author: Jon Schoonover)

Riparian buffers have been promoted for the past three decades as one of the primary means to combat non-point source pollution in agricultural watersheds. Since the early 1980's, research groups across the United States have documented riparian buffers can reduce sediment and nutrient levels in surface runoff by 30 to 100% and retain between 20 and 100% of nutrients in groundwater. Sediment and nutrient attenuation rates of buffers vary by vegetation type, age, and physiographic and hydrogeologic setting. Recent research in southern Illinois has demonstrated that the majority of surface runoff entering riparian buffers was in a concentrated form, which likely limits their effectiveness. The vast majority of riparian buffer studies have been performed at the field-scale, with very few conducted at the watershed-scale. Most riparian buffers are established through government cost-share programs where private landowners sign-up for programs on a first come, first serve basis, and provide either tax incentives or annual payments based on the agricultural rental value of the land. Targeted placement of riparian buffers within a watershed where they will have the greatest impact on water quality, remains in the conceptual phase and is not practiced widely. Several questions focused on the function and management of riparian buffers remain unanswered including: 1. How effective are riparian buffers in terms of removing sediment and nutrients from concentrated flow paths and how can we effectively manage concentrated flow from agricultural fields? 2. What is the relative importance of the two dominant groundwater nitrogen loss mechanisms: denitrification and plant uptake? 3. Has riparian buffer implementation improved water quality at the watershed scale and to what degree? 4. What is the most effective placement of riparian buffers within a watershed for maximum water quality benefit? 5. How should established riparian buffers be managed for the long-term (decades) to maintain maximum nutrient and sediment attenuation rates? 6. How can landowner participation be improved on private lands to provide more contiguous buffer networks within watersheds? Answering these key questions will be critical to increase the water quality benefits of and landowner participation in future riparian buffer restoration and management strategies.