American Water Resources Association
2009 ANNUAL WATER RESOURCES CONFERENCE
November 9-12, 2009
Seattle, WA

Tuesday, Nov. 10
10:30 AM – 12:00 Noon
SESSION 24: Monitoring

Linked Watershed-Lake Models for the Lake Whatcom Phosphorus TMDL - Paul Pickett, WA Dept. of Ecology, Olympia, WA (co-author: Steve Hood)

Lake Whatcom, located in northwest Washington State near the city of Bellingham, has been listed by Washington State as impaired for declining dissolved oxygen caused by increasing watershed phosphorus loading from development. Monitoring surveys were conducted in 2002 and 2003. An HSPF model was developed for the watershed to predict tributary flows and total phosphorus concentrations based on land use conditions. Watershed model outputs were translated into inputs for a CE-QUAL-W2 lake model, which was calibrated to predict lake algae and dissolved oxygen levels for 2002-03 conditions ("base" scenario). State oxygen standards require no more than a 0.2 mg/L decline from natural conditions. Therefore a "full rollback" scenario of the watershed model was developed to predict natural phosphorus loading by returning all developed land uses to natural levels. Another scenario, "full buildout", set all land uses at maximum development under current zoning. Then "partial rollback" scenarios were developed that converted developed acreage in the base and full buildout scenarios into natural land uses, thus reducing phosphorus loading until standards were met. To reduce the effect of initial conditions and allow equilibrium of the lake to altered loading, a "looping" tool was developed to rerun the model multiple times, with the final conditions of each loop being used as initial conditions for the next loop. To determine compliance with the standards, a curve plotting lake dissolved oxygen levels by cumulative volume over the growing season was calculated for each scenario. Standards were met when the cumulative volume curve for a scenario was no more than 0.2 mg/L less than the cumulative volume curve for the full rollback scenario. Potential allocations were determined both in terms of total phosphorus and in terms of developed acres that generate phosphorus at 2003 levels. Results of the partial rollback modeling scenarios will be used in consultation with local stakeholders for completion of a final total maximum daily load for phosphorus and a TMDL implementation plan.

Effect of an Effluent Discharge on Phosphorus Retention at Goose Creek and the Illinois River, Northwest Arkansas – Brian E. Haggard, Arkansas Water Resources Center, Fayetteville, AR (co-authors: J.T. Scott, L.B. Massey)

Effluent discharges have a profound effect on water chemistry and phosphorus dynamics in streams, where dissolved phosphorus usually travels kilometer scale distance before net retention. This study evaluated the effect of a new effluent discharge on stream phosphorus concentrations, whole-reach retention, and stoichiometry of benthic biofilms in the receiving stream, Goose Creek; we also monitored phosphorus concentrations further downstream at the Illinois River in northwest Arkansas. Water samples were collected before the municipal wastewater treatment plant started discharges and thereafter on an approximately every other week to monthly basis. The new effluent discharge had an immediate impact on dissolved and total phosphorus concentrations in Goose Creek; this increase in phosphorus concentrations was almost immediately observed 10 kilometers further downstream in the Illinois River. Goose Creek showed little intrinsic ability to retain dissolved phosphorus, suggesting that biological processes and sediments within the fluvial channel have little phosphorus buffering capacity or the system saturates relatively quickly. Microbial stoichiometry showed that carbon to phosphorus ratios decreased after the effluent discharge started, suggesting that microbial community was a short-term net sink of dissolved phosphorus. The observation that phosphorus concentration increased in the Illinois River less than a week after the effluent discharge began, suggest that this source will be important in watershed management planning and it may limit the ability of the Illinois River to retain dissolved phosphorus from other sources.

Bacteriological Indicators and Onshore Inputs in Tropical Waters - Graciela Ramírez toro, CECIA, UIPR, Lajas, PR (co-authors: Carol Ferrer, H. A. Minnigh)

Standards for marine bacteriological water quality in Puerto Rico are those proposed by US EPA. The standard for primary contact recreational use is based on densities and occurrence of Enterococcus spp. There is a new method approved and encouraged by the US EPA for recreational and marine waters (1106.1 - Enterococci in Water by Membrane Filtration Using membrane-Enterococcus-Esculin Iron Agar (mE-EIA)). The authors conducted a comparative study of the new and traditional Standard Methods methods and compared results with other bacteriological indicators of water quality including total coliforms, fecal coliforms, Escherichia coli and heterotrophic plate count. In addition, possible inputs from onshore sources are presented and measures of effects discussed. Finally, the utility of these indicators in signaling the presence of Salmonella, also analyzed, is presented. Several of the traditional indicators may be relied on in tropical waters as well as enterococci.

Surface-Water Monitoring for Pesticides in Salmonid-Bearing Streams of the Lower Yakima Valley. - Dan Dugger, Washington State Department of Ecology, Yakima, WA (co-authors: Debby Sargeant, Paul Anderson, Dale Norton, Jim Cowles)

The Washington State Departments of Ecology and Agriculture have conducted weekly monitoring during the typical application season in the Yakima Basin since 2003. The focus has been on current use pesticides. The Yakima Basin is one of the most diverse and important agricultural areas in Washington. This is also an important habitat area for salmon and trout. Occurrence and magnitude of pesticide detections in surface waters will be discussed along with the timing of salmon and trout utilization. Monitoring was conducted at Marion Drain, Sulphur Creek Wasteway, and Spring Creek. Sample basins were selected based on salmonid presence, including endangered summer steelhead, and farming practices representative of Eastern Washington agriculture. Temporal trends and potential impacts to aquatic species are investigated through comparison to (1) EPA registration toxicological criteria for fish, aquatic invertebrates, and plants, (2) Washington State Water Quality Standards, and (3) EPA National Recommended Water Quality Criteria.