Illinois River Watershed Project

Summary Report – January 29, 2018

Background

Oklahoma has six Scenic Rivers, which include the Illinois River and two of its tributaries. Oklahoma's water quality standards apply a phosphorous criterion of 0.037 mg/L to the Scenic Rivers, but levels are often found to be in the range of 0.01 - 0.15 mg/L at the Illinois River near the Arkansas-Oklahoma border. Oklahoma's Lake Tenkiller and portions of the Illinois River Watershed in Northwest Arkansas and Northeast Oklahoma were included on both states' Clean Water Act Section 303(d) lists of impaired waters. Phosphorus levels in the Illinois River are impacted by municipal discharges and nonpoint sources (i.e., runoff from poultry litter application sites). Downstream impacts to Lake Tenkiller are reflected by high chlorophyll-*a* and low dissolved oxygen concentrations in the lake, which result from nutrients including phosphorus and other environmental parameters.

Therefore, since late 2009, EPA Region 6 has been engaged in efforts to develop a robust scientifically defensible water quality model of the Illinois River Watershed (IRW) in northeast Oklahoma and northwest Arkansas. The modeling effort relies on two highly specialized computer models – a watershed and lake model – and is designed to reproduce conditions within the IRW. States, tribes, and local stakeholders have been engaged throughout the project. Principals made up of state and tribal water directors have been convened and calls have been held relaying progress and soliciting input on the direction of the project. The most recent principals' call was held on January 11, 2016.

In the Fall of 2015, EPA completed an initial calibration of the watershed and lake models as well as a sensitivity and uncertainty evaluation for those models. Since that time, EPA has been working closely with Arkansas and Oklahoma Agencies as well as with the Cherokee Nation to further refine the models. To build consensus around the effort as well as the technical underpinnings of the model. EPA has convened a total of six Technical Workgroup Meetings between April, 2016 and November 2016 with the expressed purpose of refining the models and to garner the support of the state and tribal agencies. Members of the Technical Workgroup consists of representatives from Arkansas and Oklahoma agencies and the Cherokee nation. This was done initially to provide an opportunity for buy-in by the states and tribe for a press release announcing the opportunity for a 90-day informal review of the watershed model where the agency would have collected and evaluated comments from the public on the watershed model and subsequently on the Lake Tenkiller model. At the end of the informal comment period, EPA along with the state and tribal agencies intended to hold a public meeting to review the models, discuss next steps, and receive comments from all stakeholders.

EPA's delay on moving forward to public notice the models early in 2017 was due to refinements being necessary on the Lake Tenkiller model.

Concurrently, over two years (2015 – 2016), an Arkansas-Oklahoma Joint Committee commissioned a study to evaluate the Oklahoma Scenic River Total Phosphorus Standard. In December, 2016, the study recommended a rolling six-month average phosphorus concentration not to exceed 0.035 mg/L. For the recommendation to take effect, it would need to be approved as an Oklahoma Water Quality Standard (WQS). The recommendation is similar in magnitude to the current rolling 30-day average "shall not exceed" 0.037 mg/L WQS.

Since the beginning of the project, the EPA has expended about $1.5M. The EPA has committed approximately 0.5 FTE to overseeing the project.

Regulatory Framework and Technical Issues

The Clean Water Act (CWA) and its implementing regulations require that an upstream state's water quality standards be protective of downstream state water quality standards. NPDES regulations prohibit pollutant discharges which may cause or contribute to an in-stream excursion above water quality criteria and also require that permit effluent limits must be consistent with the assumptions and requirements of any approved waste load allocation (WLA).

Technical Issues and Resolutions

As part of the consensus building efforts engaged in by the Agency, the Technical Workgroup highlighted areas where the models needed to be refined to provide a more robust demonstration the models were working correctly. Most of the following issues were raised by Arkansas Natural Resource Council consultant, Dr. Brian Haggard of the University of Arkansas. The areas identified and the resolution agreed upon follow. Additionally, calibration was mainly evaluated at the Arkansas/Oklahoma State line and at Tahlequah, OK. Each step was evaluated based on temporal and spatial improvement as well as root mean square error calculations.

Meteorological Data Review

NEXRAD Meteorological data in the HSPF model was reviewed and compared to National Climatic Data Center data for Fayetteville, AR. NEXRAD data matched the NCDC data and was determined to be useable in the model by the Technical Workgroup. Therefore, no changes were made.

Litter and Fertilizer Applications

A question arose on the timing of litter and fertilizer applications in the Illinois River Watershed. Oklahoma Department of Agriculture, Food and Forestry provided data and the Technical Workgroup recommended modifications which were made regarding litter application in the HSPF model.

Flow Balancing

Given the low flow conditions for the 2005-2006 model years in the HSPF Model, a thorough review of the water balance was conducted and with the input of the Technical Workgroup, additional flow was added to headwater type streams to provide for a more robust calibration to actual flow data.

Surface and Upper Layer Fractioning

Surface and upper layer contributions to nutrients from both poultry litter and seasonal fertilizer were evaluated. After extensive review and analysis including multiple model reruns, a 10% surface and 90% upper layer allocation for litter and fertilizer was selected as yielding the most representative response.

Atmospheric Deposition of Nitrogen

EPA addressed a calculation error in the input file regarding both wet and dry deposition of nitrogen in the model.

Denitrification

Denitrification rates (KNXy) were initially set based on literature rates. Those initial KNXy rates were set to the lowest possible values in HSPF. Dissolved oxygen (DO) thresholds as well as the NH_3, NO_2, NO_3,

and DO based denitrification rates were all adjusted with input and evaluation by the Technical Workgroup.

Baseline Model Run Conditions

In an effort to take into account the various changes in the watershed over the temporal model domain, the Technical Workgroup developed a baseline model run which can be used to assess impacts and reductions moving forward. The baseline run utilizes the following data:

2009 Litter Application Rates

2011 National Land Cover Data

2015 DMR flows and Permit Limits

2015 Point Sources

Meteorological data from 1992 – 2009

Conceptual Approaches and Scenarios

Conceptual approaches have been discussed at Technical Workgroup meetings. An adaptive management approach as well as possible scenarios have been discussed with the Technical Workgroup.

Lake Tenkiller Model

Lake Tenkiller has received less attention from the Technical Workgroup than the Watershed model due to a number of factors. However, in the Fall of 2017, the Technical workgroup evaluated output form the Lake Tenkiller Environment Fluid Dynamic Code (EFDC) model and supported further use in developing a model

Current Conditions

At present, the Technical Workgroup has agreed that the watershed model is useful for making decisions regarding water quality. The Technical Workgroup also reviewed output from the Lake Tenkiller model and found its output to adequately represent dissolved oxygen and Chlorophyll-*a* in Lake Tenkiller. EPA is finalizing the models, a general reduction scenario and drafting documentation that can be used to develop Total Maximum Daily Loads (TMDLs), Watershed-based Plans (WBPs) or other efforts to improve water quality in the Illinois River.

Future Steps and Anticipated Actions

EPA Region 6 anticipates providing finalized models, a general reduction scenario and documentation which can be used to develop Total Maximum Daily Loads or Watershed-based Plans to Arkansas and Oklahoma Agencies and the Cherokee nation in early April, 2018. EPA anticipates Arkansas Department of Environmental Quality and Oklahoma Department of Environmental Quality to review and coordinate the establishment of TMDLs or WBPs based on the information to be provided.

Stakeholders

Historically, Arkansas has expressed concern that Oklahoma's current phosphorus criterion for Scenic Rivers is overly stringent; while Oklahoma has maintained that it is appropriately protective of designated uses and the Scenic status applicable these waters. Point source dischargers in the IRW

watershed are concerned that establishment of a total maximum daily load (TMDL) will require expensive controls to meet waste load allocations for nutrients. Non-point sources in the IRW watershed are concerned that the establishment of a TMDL may provide pressure to accomplish non-regulatory load reductions.

Correspondence and Inquiry

The modeling project has received significant interest from members of Congress as well as the Northwest Arkansas Regional Planning Commission, Tyson's Chicken and other concerned parties. For example, senator Boozman's office inquired on the status of the modeling effort in early 2016. The inquiry concluded with EPA HQ and Regional representatives meeting with the senator to discuss the details of the modeling as well as Region 6 and HQs staff supplying the senator's office with technical responses to his inquiries.

Name	*Title*	*Affiliation*	*Email*
Dr. Bob Blanz	Water Division Manager	Arkansas Department of Environmental Quality	blanz@adeq.state.ar.us
Mr. Bill Cauthron	Water Quality Programs Division Chief	Oklahoma Water Resources Board	Bill.Cauthron@owrb.ok.gov
Dr. Brian Haggard	Director	Arkansas Water Resources Center	Haggard@uark.edu
Dr. Chris Adams	Environmental Scientist	Oklahoma Water Resources Board	Chris.Adams@owrb.ok.gov
Mr. David Akakpo P.E.	Professional Engineer	Oklahoma Department of Environmental Quality	david.akakpo@deq.ok.gov
Mr. Greg Kloxin	Assistant Director	Oklahoma Conservation Commission	Greg.kloxin@conservation.ok.gov
Mr. Joe Long	Watershed Planning Section Manager	Oklahoma Department of Environmental Quality	Joe.Long@deq.ok.gov
Ms. Julie Chambers	Environmental Programs Manager	Oklahoma Water Resources Board	Julie.Chambers@owrb.ok.gov
Dr. Soojung Lim P.E.	Professional Engineer	Oklahoma Department of Environmental Quality	soojung.lim@deq.ok.gov
Mr. Patrick Gwin	Administrative Liaison	Cherokee Nation	pgwin@cherokee.org
Ms. Shanon Phillips	Director	Oklahoma Conservation Commission	shanon.phillips@conservation.ok.gov
Mr. Tom Elkins	Administrator	Cherokee Nation	tom-elkins@cherokee.org
Ms. Rebecca Veiga Nascimento	Environmental Scientist	Oklahoma Water Resources Board	Rebecca.Veiga@owrb.ok.gov
Mr. Tate Wentz	Ecologist Coordinator	Arkansas Department of Environmental Quality	Wentz@adeq.state.ar.us
Mr. Jeremy Seiger	Director	Oklahoma Department of Agriculture, Food and Forestry	Jeremy.Seiger@ag.ok.gov
Mr. Ryan Benefield P.E.	Deputy Director	Arkansas Natural Resources Commission	Ryan.Benefield@arkansas.gov