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Development of Illinois River Watershed Management Plans Third Stakeholder Meeting – August 10, 2023 Summary of Meeting

The Arkansas Department of Agriculture Natural Resources Division (NRD) and the Oklahoma Conservation Commission (OCC) jointly held a stakeholder meeting as part of updating watershed management plans for the Illinois River watershed. The meeting was held in the afternoon in West Siloam Springs, OK (Cherokee Hotel and Casino). A total of 96 individuals attended the meeting, 81 in person and 15 online. Attendees included landowners and business owners, as well as individuals from interest groups, and employees from state and federal agencies. A list of specific organizations represented at the meetings is included as Attachment 1.

The meeting was facilitated by Tate Wentz, NRD, Water Quality Section Manager. The agenda for the meeting is shown on page 1 of Attachment 2. The meeting was also presented and recorded using Zoom. The recording of the meeting can be viewed on the OCC YouTube site: https://www.youtube.com/@oklahomaconservationcommis9356/videos. A copy of all the presentations from this meeting is provided in Attachment 2.

Tate Wentz opened the meeting thanking everyone for attending and identifying team members present from NRD, their contractor FTN Associates, and OCC. He then went over the agenda and purpose for the meeting. Following this, Mr. Wentz presented basic information on watershed management plans and the process for updating the plans for the Illinois River watershed, along with the benefits of having watershed management plans. Mr. Wentz then summarized information from the first two public meetings, and a proposed time and purpose for the next public meeting. Mr. Wentz then turned the podium over to Greg Kloxin of OCC.

Mr. Kloxin started by asking how many of those present were attending an Illinois River public meeting for the first time. Around one third of those present raised their hand. Mr. Kloxin then stated that this effort is the result of a long collaboration between Arkansas, Oklahoma, the Cherokee Nation, and the US Environmental Protection Agency (EPA). He stated that the water quality models that will be presented today are intended to be tools to assist with decision making about non-regulatory management of nonpoint sources of pollution. The models will inform the update of the watershed management plans, which will be combined to create the Watershed Implementation Plan for the Illinois River. Mr. Kloxin stressed that Arkansas and Oklahoma are collaborating in the preparation of the models and the update of the watershed management plans, freely sharing information and data.

Mr. Kloxin explained that all water quality models attempt to emulate reality, but none do so perfectly. He used Google Maps, which is a computer model, as an example of how models can

do a good job of representing reality, but they aren't always perfect. Most people have had an experience where Google Maps did not easily get them where they wanted to go. Mr. Kloxin explained that a model's representation of reality depends on data. When Google Maps doesn't have the most up to date data, it does not adequately represent reality, whether that is the best road to get you where you want to go, or showing a traffic slowdown that has already cleared.

The Soil and Water Assessment Tool (SWAT) model being used for the Illinois River watershed has been used in Arkansas and Oklahoma for years, and in multiple watersheds (SWAT has been used in the past by both NRD and OCC to model the Illinois River watershed). It has strong capabilities for modeling nonpoint source pollution, particularly from agricultural sources. SWAT is used worldwide, and by many academic institutions. Texas A&M University is the repository of the SWAT model and continually works to improve the model capabilities, usefulness, and accessibility.

NRD has contracted FTN Associates (FTN) to update the SWAT model of the portion of the Illinois River watershed in Arkansas. OCC has contracted with Texas A&M to prepare a new SWAT model of the entire Illinois River watershed. Mr. Kloxin stated that the results that will be presented today are preliminary and represent baseline (current) conditions. He stressed that the models are not considered final, and there will be additional evaluation of model input and results before the models are finalized. When finalized, the SWAT models will be used to prioritize areas in the watershed for management and evaluate the impact of management practices.

Following Mr. Kloxin, Philip Massirer of FTN presented the Arkansas SWAT model (presentation provided in Attachment 2). Mr. Massirer explained that the SWAT model simulates hydrologic and water quality processes, essentially tracking the path of water that enters the watershed as rainfall through the watershed, and associated water quality changes. The models simulate a long timeframe and represent conditions at a sub-watershed scale, i.e., conditions at individual pastures or streambanks or lawns are not represented in the models. The SWAT models are set up to report conditions in 12-digit Hydrologic Unit Code (HUC12) sub-watersheds. The SWAT model refers to these as subbasins. Within each model subbasin, Hydrologic Response Units (HRUs) are defined based on unique combinations of land cover, soil series, and slope range. HRUs are the smallest unit in which activities and processes are modeled in SWAT.

There are 28 HUC12 sub-watersheds with at least 50% of their area in Arkansas. These are the sub-watersheds that are the focus of the Arkansas model. In the Arkansas model, some of these sub-watersheds are further split into subbasins where water quality or flow monitoring stations are located. Mr. Massirer presented maps showing the Illinois River HUC12 sub-watersheds in Arkansas, the location of monitoring stations whose data was used to calibrate the model, the model subbasins, and model HRUs in the Arkansas model. The Arkansas model simulates the period 1990 through 2020, with 1996 through 2020 used for calibration. Mr. Massirer went through the input data used in the model and the sources of the input data. Inputs include daily weather (temperature, precipitation, dewpoint temperature, and wind speed), land use (2019 National Land Cover Database), soils data, and permitted point source discharges (12 in the Arkansas model).

Mr. Massirer stated that the Arkansas SWAT model is set up to model in-stream sediment dynamics. Data available from streambank erosion studies in the watershed was not used as a model input, but rather a guide for selecting coefficient values to represent the extent and effect of streambank erosion. He noted that SWAT is not a sediment transport or hydraulic model that can provide a detailed representation of streambank erosion occurring at specific stream reaches in the watershed.

Another set of input data is management practices. These include things like lawn mowing and fertilizer application in urban and developed areas, cattle grazing and manure deposition on pastures, permitted land application of manure from hog and dairy operations, and application of poultry litter on pastures. Mr. Massirer explained that because the Illinois River watershed in Arkansas is designated as a nutrient surplus area, nutrient applications, including poultry litter application and commercial fertilizer application, is supposed to be guided by an approved nutrient management plan, and reported to NRD. He noted that, based on reported data, poultry litter is applied to only around 10% of pasture in the Arkansas portion of the watershed.

Mr. Massirer then showed maps summarizing how well the SWAT model output matches measured flow and water quality data. He explained that how well the SWAT model matches observed data is categorized based on several statistics using an approach developed around 2015 that has been peer reviewed and is widely accepted and used by SWAT modelers. Mr. Massirer also noted that not all of the stations used to calibrate the model had data for the entire simulation period. The Arkansas SWAT model reproduces flow at the calibration stations very well. The sediment and nutrient outputs used to evaluate the calibration of the Arkansas SWAT model are daily concentrations. The Arkansas SWAT model reproduced suspended sediment concentrations well at most stations, but not so well at one station on Flint Creek downstream of Lake Flint Creek. The model reproduced total nitrogen and total phosphorus concentrations well to very well at the monitoring stations.

Mr. Massirer then presented maps showing the average annual modeled suspended sediment, total nitrogen, and total phosphorus flux from each HUC12 sub-watershed (load leaving the HUC12 minus any load entering the HUC12) divided by the HUC12 sub-watershed area (units of kg/hectare/year for nutrients and metric tons/hectare/year for sediment). The coloring on the maps is not an indication of whether yields are problematic, but rather represents the relative magnitude of yields. The sub-watersheds with the highest simulated yield are shown with the darkest colors, while those with smaller yields are shown with lighter colors. Mr. Massirer noted that sub-watersheds with the highest sediment yields were those with the greatest area of high slopes (> 15%), sub-watersheds with the highest total nitrogen yields were those where there were larger areas where poultry litter is applied, as well as large areas of pasture; and sub-watersheds where total phosphorus yields were highest had relatively high sediment yields (phosphorus is carried by sediment) and larger areas where poultry litter is applied. Mr. Massirer also presented model output showing the portion of sub-watershed sediment yields from streambank erosion, which ranged from zero to 77%. However, for most sub-watersheds modeled yield from streambank erosion was between 10% and 20%. Finally, Mr. Massirer stated

that the modeled sediment and nutrient yields will be used to rank the Arkansas sub-watersheds for nonpoint source pollution management. He

also thanked the other members of the FTN team for their work on this model, Kuan-Hung Lin, the primary modeler, Christina Laurin, and Kelsey Criswell.

After Mr. Massirer's presentation, Brad Rogers of OCC presented the Oklahoma SWAT model. Dr. Rogers explained that Texas A&M developed and maintains the SWAT model. Recently, under a contract with EPA, Texas A&M developed the nationwide HAWQS version of SWAT that is online and makes the SWAT model more accessible and easier to set up. Oklahoma has contracted with Texas A&M to develop an Oklahoma-specific version of HAWQS for watersheds in Oklahoma, with the Illinois River watershed as a pilot project. Therefore, the Oklahoma SWAT model of the Illinois River watershed will be publicly available online for free once the calibration is final, which will be by the end of the year. Anyone who wants to will be able to access the mode and run scenarios with it. Dr. Rogers also explained that the SWAT model has been developed in coordination with FTN and the EPA HSPF model update effort. The results being presented today are preliminary, as they were received from Texas A&M Tuesday and have not been reviewed in detail.

The setup of the Oklahoma SWAT model is similar to the Arkansas model, using much of the same input data, including SSURGO soils; 2019 NLCD land use augmented with the National Agricultural Statistics Service Cropland Data Layer and wetland areas from the National Wetlands Inventory; PRISM weather data with SWAT generated wind data; point sources data from Arkansas and EPA; and management input information from Arkansas and HSPF models. The Oklahoma model does not currently model streambank erosion. In defining the HRUs for the Oklahoma model, all were accepted. In the Oklahoma model the SWAT subbasins are the HUC12 sub-watersheds. The Oklahoma model simulates the period 1998 through 2020. Dr. Rogers also explained the management inputs used in the Oklahoma model.

Dr. Rogers also presented preliminary calibration results. He stated that Oklahoma (GRDA) has contracted with USGS to collect water quality data during high flow events, since the majority of sediment and nutrient loads are transported during high flow events. Calibration results for the Oklahoma model were presented using the same evaluation categories as for the Arkansas model. The flow calibration of the Oklahoma model is satisfactory to good. Dr. Rogers presented the model variables used to calibrate the model and explained that they are based on reported realistic ranges of values. For sediment and nutrient calibration, modeled monthly average loads were compared to monthly average loads calculated using the program LOADEST from observed daily flow and discrete water quality data downloaded from USGS gages in the basin. Dr. Rogers noted that, due to the lack of water quality data for high flow conditions, LOADEST is not working well at some locations, which is causing problems with the sediment calibration. He explained that studies have shown that the top 5% of flows account for around 70% of sediment and phosphorus annual loads and around 50% of nitrogen annual loads. Mr. Rogers stated that the preliminary SWAT model results indicate that the majority of sediment and nutrients in the streams come from pasture. Moving forward, the next steps are to continue

working on calibration of the SWAT model, coordinating with Arkansas, developing management scenarios, and looking more closely at point source contributions.

After Dr. Rogers' presentation, Mr. Wentz opened the floor to questions or comments from the attendees. A summary of the discussion is provided as Attachment 3. After this, Shanon Phillips of OCC made a few comments, stating that this is really the stakeholders' (not OCC's) management plan, intended to benefit the people who live, work, and visit the Illinois River watershed. To do this, many people will be asked to change how they do things, and these meetings

are an opportunity for stakeholders to say what they think those changes should be. Ms. Phillips and Mr. Wentz thanked everyone for attending and thanked the Cherokee Nation for their hospitality. Attendees were encouraged to contact NRD or OCC at any time with questions or comments about the watershed management plan or suggestions of others who would be interested in the plan and/or the meetings. Contact information for NRD and OCC project personnel was provided and is shown below.

For additional information, contact:

- Tate Wentz, Arkansas Department of Agriculture Natural Resources Division, Tate.Wentz@agriculture.arkansas.gov, (501) 682-3914
- Shanon Phillips, Oklahoma Conservation Commission, Shanon.Phillips@conservation.ok.gov, (405) 522-4728
- Greg Kloxin, Oklahoma Conservation Commission, Greg.Kloxin@conservation.ok.gov, (405) 522-4737

ATTACHMENT 1

Illinois River Watershed Management Plan
Second Stakeholder Meeting – August 10, 2023
In-Person Meeting Attendance Summary

Organization / Category	Number of attendees
Arkansas Department of Agriculture Natural Resources Division	3
Arkansas Department of Energy and Environment Division of Environmental Quality (DEQ)	2
Arkansas Farm Bureau	1
Attorneys	1
Beaver Water District	1
BioX Design	1
Breweries	1
Camp/Canoe Operators	1
Carbon Chicken Project	2
Cherokee Nation Environmental Programs	1
City of Bentonville	2
City of Fayetteville	2
City of Springdale	1
City of Tahlequah Public Works	1
City of Tontitown	2
Crafton Tull	1
Emerald Solutions	1
EnviroScapes	1
Envision Group	1
Freese and Nichols	1
FTN Associates	3
Grand River Dam Authority	1
Halff	1
Illinois River Watershed Partnership (IRWP)	6
Interested citizens	13
Jacobs/City of Fayetteville	1
Journalists	1
NCAT (National Center for Appropriate Technology)	1
Northwest Arkansas Regional Planning Commission (NWARPC)	2
OERI	1
Oklahoma Conservation Commission (OCC)	4
Oklahoma Department of Agriculture, Food, and Forestry (ODAFF)	4
Oklahoma Energy & Environment (OEE)	2
Oklahoma Rural Water Association (ORWA)	1
Save the Illinois River (STIR)	1

Organization / Category	Number of attendees
SG Municipal	1
Tyson	1
University of Arkansas Cooperative Extension Service	2
US Environmental Protection Agency Region 6	3
US Fish and Wildlife Service (USFWS)	1
US Geological Survey (USGS)	1
USDA Natural Resources Conservation Service (NRCS)	1
Watershed Conservation Resource Center (WCRC)	2

Attachment 2 Meeting Presentations

ATTACHMENT 3

Illinois River Watershed Management Plan
Second Stakeholder Meeting – August 10, 2023
Discussion Summary

Comment: My understanding from what has been presented is that the Arkansas SWAT model includes streambank erosion, but the Oklahoma SWAT model does not currently model streambank erosion. The Watershed Conservation Resources Center (WCRC) has conducted streambank erosion studies on Osage Creek and developed erosion prediction curves for Osage Creek. WCRC is also conducting streambank erosion monitoring on Clear Creek and several smaller basins, which is funded by the City of Fayetteville and EPA. WCRC is also studying streambank erosion in Owl Creek and more such studies in the Illinois River watershed are in the works. Please contact Sandi Formica at WCRC about providing information from these studies.

Response: Thank you. More information is always welcome. [Note: About a week after the meeting, WCRC provided data and explained the data to FTN and IRWP via Zoom. This data has also been provided to OCC.]

Comment: I went with the US Geological Survey to do bedload sampling during bank-full conditions (i.e., high flows). This required the samplers to collect samples along a transect across the channel, which was difficult and dangerous. Unfortunately, that sampling effort was not successful. I suggest more of an effort be made to collect water quality samples during high flow conditions, at least bank-full conditions. But we need to work out how to collect these samples safely.

Question: What kind of sensitivity analysis was conducted on the models? This question is still being evaluated.

Response: For the Arkansas SWAT model, sensitivity analysis is performed as part of the calibration. We will provide details in the meeting summary. Following is a detailed response to this question for the Arkansas SWAT model. The model parameters selection was a process of first retrieving parameters from previous models, then the parameters went through sensitivity analysis using Sequential Uncertainty Fitting version 2 (SUFI2) and Sorting Genetic Algorithm II (NSGA II) algorithms. For sediment, the parameter that influences the result most is the PRF (Peak rate adjustment factor for sediment routing in the main channel). For nitrogen and phosphorus, the parameters are ERORGN and ERORGP, the nitrogen and phosphorus enrichment ratio for loading with sediment. For the Oklahoma SWAT model, we are not yet completed with model review and calibration, so we don’t have an answer for this at this point.

Question: Can SWAT be used as an adaptive management tool?

Response: Dr. Rogers responded that the Oklahoma SWAT model will be used as an adaptive management tool. Inputs will be updated yearly. Mr. Wentz responded that the Arkansas model will be used to prioritize and evaluate management options.

Question: Does Oklahoma have a riparian law? Requiring wooded or natural riparian areas would solve a lot of problems.

Response: Neither Oklahoma nor Arkansas has state laws requiring that a certain amount of riparian area be wooded or natural. Oklahoma and Arkansas both have programs that encourage protection and restoration of riparian areas. In Oklahoma protection and restoration of riparian areas is done primarily through riparian easements. The focus of the Nonpoint Source Pollution Management Program is voluntary activities. We can help and encourage landowners to protect or restore riparian areas but can't request or require state regulations. We can suggest local ordinances or rules, like Fayetteville's Streamside Protection Ordinance.

Question: In the Arkansas model presentation you said poultry litter application data from one year was used. Why not use/model data from multiple years?

Response from Mr. Massirer: We used the 2019 poultry litter application data for every year simulated. We used data from 2019 because that was the only year for which this information was available at a HUC12 spatial resolution; the data for other years was reported at the county level. Reporting of this data to NRD started only after the area was designated as a Nutrient Surplus Area in 2003. It took NRD a great deal of work to compile the 2019 data by HUC12 sub-watersheds (due to the format in which the data were originally collected). Application rates have probably changed some over time. We will look at the county level data and make sure that the 2019 data are reasonable compared to other years.

Question: How do you account for legacy soil phosphorus in the model?

Response from Mr. Massirer: We set initial soil phosphorus values at the beginning of the simulation based on inputs from previous water quality models of this watershed. Over the course of the model run, SWAT simulates increases and decreases in soil phosphorus in response to fertilizer inputs and plant uptake.

Question: Is effluent from the Tontitown landfill being monitored?

Response from Mr. Wentz: That is a question for DEQ. The landfill is regulated by DEQ, and water quality monitoring is usually required as part of landfill permits. Because it is regulated, the Tontitown landfill will not be addressed in the watershed management plan.

Question: Is the use of commercial fertilizers modeled?

Response from Mr. Massirer: Yes. Application of commercial fertilizers is modeled for pasture lands not receiving poultry litter and for lawns in developed areas.

Question: Do you know the ultimate source for fertilizer numbers/amounts?

Response: We don't, but we can look that up. We are not aware of anywhere this type of information is collected and reported. Fertilizer application amounts in the current models were based on studies used in previous models. After the meeting FTN found that in these studies, the annual commercial fertilizer sales in the basin were estimated at 4,800 ton of nitrogen and 425 tons of phosphorus, and were derived from the Oklahoma Department of Agriculture and Arkansas State Plant Board estimates. However, due to considerable uncertainties in the import and export from neighboring counties, the application rate was compared with Oklahoma State University fertilizer recommendations and adjusted. The application rates used in the previous studies were:
Small Grains – 75 to 80 lb N/acre and 2.8 to 4.5 lb P/acre. In the Arkansas SWAT model, we adopted a constant rate of 79 lb N/acre and 4.4 lb P/acre.

Question: Northwest Arkansas is growing fast. How far out are you looking at scenarios for future development?

Response: The Arkansas model is more a current conditions model. The Oklahoma model may have the capability to model future development scenarios, as long as development or population change projections are available. USGS has population growth models. If there is one for Northwest Arkansas that may provide information that could be used to model future development. It may be more difficult to account for climate change. The SWAT weather generator is not capable of developing future weather inputs. Any model of future conditions would be a rough estimate.

Question: Is industrial nutrient application, e.g., biosolids from wastewater treatment, included in the SWAT models?

Response: During the meeting, Mr. Massirer indicated that application of industrial waste or biosolids from municipal wastewater treatment facilities was not explicitly specified in the model, but any application of nutrient-containing materials in this watershed should be done according to a nutrient management plan and therefore would have been implicitly included in data obtained from NRD. After the meeting, though, FTN personnel went back and reviewed the information that was obtained from NRD when the model was set up in 2022. It appears that the information from NRD included only poultry litter application and not application of other materials such as industrial waste or biosolids. Therefore, the model does not currently include application of industrial waste or biosolids. Application of industrial waste or biosolids is regulated by DEQ and requires a no-discharge permit, which requires annual reporting to DEQ of amounts of waste applied. In nutrient surplus areas, DEQ's no-discharge permits require the permittee to develop and follow a nutrient management plan in compliance with ANRC Title 22 regulations. FTN will investigate this further to see if there is sufficient application of industrial waste and biosolids in the Illinois River watershed to warrant its inclusion in the model.

Question: Does that mean industrial nutrient application is considered a point source in the model?

Response: No. Point source inputs to the model are from NPDES (National Pollutant Discharge Elimination System) permitted facilities. See the response to the question immediately above regarding land application of industrial waste or biosolids.

Comment: It is important to be able to add or include the data that folks have. I hope you can take the time to incorporate other available data.

Response: Arkansas will consider the feasibility of making changes to the SWAT model. Oklahoma will be continuously updating data in HAWQS. Please send any new data to OCC. They would be happy to have it.

Comment from Mr. Wentz: This is not your last opportunity to provide feedback. A summary of this meeting, including this discussion, will be sent out to everyone who provided an email address on the sign-in sheets. Please sign in if you haven't already.

Comment: All conservation practices have pros and cons and work better in some places than in others. In your presentations today stream restoration was identified as being expensive. But stream restoration projects result in significant long-term reductions in sediment and nutrient loads.