Joint Arkansas/Oklahoma Scenic River Monitoring Proposal

Developed by the States of Arkansas and Oklahoma in accordance with the Statement of Joint Principles and Actions to monitor water quality in shared Oklahoma Scenic River watersheds

September 22, 2004

Participating State and Federal Entities:

Arkansas Department of Environmental Quality*
Arkansas Department of Health
Arkansas Forestry Commission
Arkansas Game and Fish Commission
Arkansas Soil and Water Conservation Commission*
Environmental Protection Agency
Oklahoma Conservation Commission*
Oklahoma Department of Agriculture, Food, and Forestry
Oklahoma Department of Environmental Quality*
Oklahoma Department of Wildlife Conservation
Oklahoma Office of the Secretary of the Environment
Oklahoma Scenic Rivers Commission
Oklahoma State University
Oklahoma Water Resources Board*
United States Geological Survey
University of Arkansas
University of Arkansas—Arkansas Water Resources Center

***member of Scenic River Monitoring Technical Workgroup**

Introduction

Oklahoma shares five designated Scenic River watersheds with the state of Arkansas—the Illinois River, Flint Creek, Barren Fork River, Lee Creek, and the Mountain Fork of the Little River (Figure 1). Flint Creek and the Barren Fork River are part of the Illinois River watershed. In addition, Little Lee Creek is a designated Scenic River in Oklahoma but is not shared with Arkansas. Four lakes of concern are present in the watersheds. In Oklahoma, the Illinois River and Mountain Fork River flow into terminal reservoirs, Tenkiller Ferry Lake and Broken Bow Reservoir, respectively. In addition, Lee Creek terminates in Arkansas at Lee Creek Reservoir, and the Illinois River is bisected at the state line by the remnants of Lake Francis.

In the recent past, various monitoring programs in both Arkansas and Oklahoma have shown an increase in various pollutants including phosphorus, suspended sediments, and bacteria. Several actions have been taken by both states to reduce phosphorus in these watersheds. In response to the eutrophication of Tenkiller Lake, the Arkansas-Oklahoma Arkansas River Compact Commission set a phosphorus reduction goal of 40%. Additionally, both states have enacted legislation to help reduce nutrient and sediment loading to the Illinois River and its contributing streams. In 2003, the Arkansas General Assembly enacted legislation that requires registration and nutrient plans for farms in certain watersheds and designated the Illinois River watershed a nutrients surplus area. In 2002, the Oklahoma Water Resources Board (OWRB) promulgated a total phosphorus criterion of 0.037 mg/L in Scenic Rivers with full compliance by 2012. In a Statement of Joint Principles and Actions (JPA) agreed upon in 2003, the states of Oklahoma and Arkansas entered into an agreement to improve these watersheds. In the agreement, both states express several common goals for water quality in the shared watersheds:

1. Improve water quality.
2. Reduce phosphorus through control of both point and non-point sources.
3. Develop coordinated strategies to meet water quality goals in the watersheds.
4. Develop Watershed Plan according to EPA Clean Water Act (CWA) 319 guidance.

A central tenet of the agreement is the development of a coordinated monitoring program in partnership with the Compact Commission. On April 15-16, 2004, in an effort to implement the agreement, various stakeholders in the watersheds, including state and federal environmental agencies and university researchers from both Oklahoma and Arkansas, met in Tahlequah, Oklahoma to discuss the implementation of the agreement. This group characterized the purpose of the agreement in the following questions and statements:

1. Will current and future implementation efforts detect a difference in the water quality of the watersheds, particularly nutrients, sediment and biologically?
2. Provide data for the successful implementation of the Watershed Plan.
3. Provide baseline data to facilitate current and future water quality monitoring and management activities.

A Scenic River Monitoring Technical Workgroup was formed to develop a water quality monitoring program to address these specific questions. The workgroup's membership

represents the pertinent environmental monitoring agencies in both states, including the Arkansas Department of Environmental Quality (ADEQ), Arkansas Soil and Water Conservation Commission (ASWCC), Oklahoma Conservation Commission (OCC), Oklahoma Department of Environmental Quality (ODEQ), and OWRB. On May 12, 2004, the group met in Fort Smith, Arkansas to construct a monitoring proposal. This proposal was formulated to meet the following monitoring objectives:

1. Determine if the Oklahoma Scenic River total phosphorus criterion is being met.
2. Determine if water quality is improving in all the Scenic River watersheds.
3. Determine if Oklahoma and Arkansas are meeting the 40% phosphorus reduction goal using the current agreed upon methodology.
4. Develop a monitoring plan that meets the requirements of a Watershed Plan.

Project Location and Study Design

To meet the goals and objectives outlined above, the Scenic River Monitoring Technical Workgroup proposes that a coordinated and comprehensive monitoring program be initiated in each of the Scenic River watersheds. The monitoring program is designed to provide sufficient data to:

1. Assist in the implementation of the Oklahoma Scenic River total phosphorus criterion;
2. Determine if water quality is improving throughout the Scenic River watersheds;
3. Determine if a 40% reduction in total phosphorus is occurring using the previously agreed upon methodology, and;
4. Support implementation of a Watershed Plan.

To address the data needs characterized in these objectives, a wide variety of parameters will be measured. All parameters will be quantified using EPA approved methods. With the exception of all *in situ* parameters, turbidity, light transmissivity, and discharge, all parameters will be measured in an analytical laboratory. Parametric coverage will include the following series:

Series 1(*in situ*)—dissolved oxygen (DO), specific conductivity (SpC), pH, and water temperature (measured with a multi-parameter instrument or individual meters)
Series 2 (clarity)—total suspended solids (TSS), volatile suspended solids (VSS), light transmissivity (field measurement), and turbidity (field or laboratory measurement)
Series 3 (nutrients)—total phosphorus, ortho-phosphorus, nitrogen as nitrate, nitrogen as nitrite, total Kjeldahl nitrogen, nitrogen as ammonia, and calculated total nitrogen
Series 4 (minerals)—total dissolved solids (TDS), chloride, and sulfate
Series 5 (biological)—sestonic chlorophyll-a, fecal coliform, and enterococci or *E. coli*
Series 6 (discharge)—development of rating curves at all stations through the relationship of instantaneous flow and stage
Series 7 (climate)—continuous rainfall and various measurements during site visits, including air temperature, wind direction and speed, and cloud cover

A two-tiered spatial approach is proposed to allow for monitoring on both the Scenic River mainstems and within Scenic River watersheds (Figures 2 and 3). Stations will be divided into two tiers with monitoring occurring on priority segments (Tier 1) and important segments (Tier 2) in both Oklahoma and Arkansas. These stations are listed in Table 1. The workgroup proposes thirteen (13) Tier 1 stations for monitoring. These stations will provide basic coverage for each of the five Scenic River watersheds shared between Arkansas and Oklahoma. The workgroup also proposes nineteen (19) Tier 2 stations for monitoring. These stations are of importance for a variety of reasons including:

1. Provide other mainstem river stations for more intensive coverage (e.g., Illinois River near Ellerville).
2. Monitor potential contributors of pollutants to Scenic Rivers (e.g., Sager Creek and Osage Creek).
3. Provide spatial coverage to include potential phosphorus contributors to Lake Tenkiller (e.g., Caney Creek).
4. Provide adequate spatial coverage for Watershed Plan implementation.

Table 1. Stations proposed for Monitoring.

No.	Station	Tier	County	Latitude	Longitude
1	Illinois River, US 62, near Tahlequah	1	Cherokee, OK	35.9260	-94.9238
2	Illinois River, US 59, near Watts	1	Adair, OK	36.1299	-94.5715
3	Illinois River, SH 59, near Siloam Springs	1	Benton, AR	36.1086	-94.5333
4	Illinois River, SH 16, near Savoy	1	Washington, AR	36.1017	-94.345
5	Illinois River below Osage Creek	1	Benton, AR	36.1447	-94.4947
6	Flint Creek near W. Siloam Springs	1	Benton, AR	36.2422	-94.4867
7	Flint Creek, off US 412, near Kansas	1	Delaware, OK	36.1867	-94.7068
8	Barren Fork, CR21, near Dutch Mills	1	Washington, AR	35.8764	-94.4611
9	Barren Fork, SH 51, near Eldon	1	Cherokee, OK	35.9217	-94.8372
10	Lee Creek, SH 101, near Short	1	Sequoyah, OK	35.5658	-94.5315
11	Lee Creek, SH 59, near Natural Dam	1	Crawford, AR	35.4838	-94.3927
12	Mountain Fork River, SH 246, near Hatfield	1	Polk, AR	34.5052	-94.4306
13	Mountain Fork River, SH 4, near Smithville	1	McCurtain, OK	34.4616	-94.6323
14	Illinois River, off SH 82, near Ellerville	2	Cherokee, OK	36.0318	-94.9110
15	Illinois River, off SH 16, near Prairie Grove	2	Washington, AR	36.0861	-94.3453
16	Osage Creek, CR70, near Elm Springs	2	Benton, AR	36.2219	-94.2883
17	Spring Creek	2	Benton, AR	36.2157	-94.1722
18	Muddy Fork	2	Washington, AR	36.07	-94.3483
19	Goose Creek near Viney Grove	2	Washington, AR	36.0511	-94.3094
20	Cincinnati Creek	2	Washington, AR	36.0939	-94.5089
21	Ballard Creek, off US 59, near Watts	2	Adair, OK	36.1063	-94.5650
22	Sager Creek, off US 412, near West Siloam Springs (OK)	2	Delaware, OK	36.2016	-94.6053
23	Sager Creek near Siloam Springs (AR)	2	Benton, AR	36.1930	-94.5638
24	Little Flint Creek	2	Benton, AR		
25	Battle Branch, off US 412, near West Siloam Springs (OK)	2	Delaware, OK	36.2104	-94.6843
26	Barren Fork, US 59, near Baron	2	Adair, OK	35.9192	-94.6193
27	Evansville Creek, SH 51, near Piney	2	Adair, OK	35.8262	-94.5725
28	Shell Branch, US 59, near Baron	2	Adair, OK	35.9237	-94.6158
29	Little Lee Creek, SH 101, near Greasy	2	Sequoyah, OK	35.5754	-94.5554

30	Barren Fork, off US 62, near Welling	2	Cherokee, OK	35.8690	-94.8979
31	Caney Creek, off SH 100, near Barber	2	Cherokee, OK	35.7849	-94.8555
32	Tahlequah Creek, off US 62, near Tahlequah	2	Cherokee, OK	35.8905	-94.9494

To quantify both the ambient concentrations and loads of various pollutants, stations will be monitored on two temporal scales. To measure ambient concentrations of pollutants, all stations will be monitored at a fixed interval on a bi-weekly schedule with 26 annual samples collected per station. To obtain a representative sample, a depth-integrated composite will be collected. During these sampling periods, parameter series 1, 6, and 7 as well as light transmissivity and turbidity will be measured in the field. The composite sample will be properly preserved and delivered to the analytical laboratory for the measurement of parameter series 2, 3, 4 and 5. To quantify loads of certain pollutants at Tier 1 stations, approximately 50 stormwater samples per station will be collected throughout the year using autosamplers. Discrete point grab samples will be taken during increased periods of discharge at select points through the hydrograph. Autosamplers will be programmed based on the station's rating curve. The discrete samples will be preserved and delivered to the analytical laboratory for the measurement of parameter series 2, 3 and 4. Autosamplers will not be installed at Tier 2 stations. To measure contributing loads from these watersheds, a minimum of six (6) storm events will be sampled per year. The sampling events will exhibit and be representative of seasonal variability and encompass a minimum of one (1) sampling event per season (January – March, April – June, July – September, and October – December).

So that data from both Tier 1 monitoring schemes may be grouped, calibration samples will be collected during both fixed interval and stormwater sampling. During each fixed interval event, a discrete sample will be taken from the autosampler. These samples will be delivered to the analytical laboratory for the measurement of parameter series 2, 3 and 4. During at least 6 storm events throughout the year, a depth-integrated composite will be collected around the time period that the autosampler is pulling a discrete sample. Throughout the year, representative samples should be taken through the stormwater hydrograph. These samples will be preserved and delivered to the analytical laboratory for the measurement of parameter series 2, 3, 4, and 5.

A discharge rating curve will be established, and stage will be measured continuously at all stations. Currently, all but two Tier 1 stations are rated through USGS cooperative agreements, and it is recommended that the two ungauged stations be added to the relevant cooperative agreements. In addition, it is recommended that each of the Tier 1 stations be telemetered to assist in the collection of autosamples. Of the 19 Tier 2 stations, only four (4) stations are currently gauged. Therefore, gauges will be installed at the remaining fifteen (15) stations, and a rating will be established. To save cost, not all Tier 2 gauges will be outfitted with telemetry equipment.

The workgroup recommends that this monitoring strategy go through periodic review. Future data needs as well as data overlap cannot be projected. The review should be based on empirical data and should be performed on multiple levels. The Technical Workgroup should conduct an annual informal review. Recommendations should be made to the respective states concerning parametric, spatial, and temporal design as well as special studies, and the review should be forwarded to the Compact Commission. In addition, the States, in partnership with the Compact Commission,

should conduct a biennial or triennial formal review of the program. At this time, annual review recommendations should be considered for implementation. This review structure is conceptual and is not meant to be a fully considered recommendation. However, it is the opinion of the workgroup that something analogous should be developed so that the program can provide the best possible information to answer the questions outlined in this proposal.

Special Studies

In addition to the general monitoring program described above, the Technical Workgroup proposes that short-term studies be developed and funded as part of this proposal. An additional $200,000 per year is requested to fund these studies. Although no specific study designs have been fully formulated, the studies could address issues, such as:

1. Reservoir monitoring including Broken Bow Reservoir, Lee Creek Reservoir, Lake Francis, and Tenkiller Ferry Lake.
2. Biological response including measurement of algal biomass or characterization of community health through multiple assemblages (fish, aquatic macroinvertebrates, and algae).
3. Habitat characterization including geomorphology and erosion.
4. Toxics analysis including sediments.
5. Bed Load analysis.
6. Clarity studies to determine organic and inorganic contributors.

Data Management, Interpretation, and Reporting

To effectively coordinate the management of the shared watersheds within the framework of the agreement, a comprehensive data management, interpretation, and reporting scheme will need to be developed. To date, the workgroup has not thoroughly explored the details of such a scheme. However, the framework for how to approach these issues was discussed in the Fort Smith meeting with these resulting recommendations:

1. Data Management—It was agreed that a central database or data-sharing network is essential. The workgroup will explore available options before the September Compact Commission Meeting. If possible, a recommendation will be made at the meeting.
2. Data Interpretation Protocols (JPA)—Per the agreement, data quality objectives include the tracking of improvement of water quality. Because the available dataset will change if this proposal is implemented, analysis methodologies may also change. The workgroup may request the services of a 3rd party consultant to determine the best statistical methods. Additionally, the workgroup recommends continuing to gather the data for the protocol used in determining the 40% phosphorus reduction in the Illinois River watershed at Horseshoe Bend.
3. Data Interpretation Protocols (Oklahoma Scenic River criterion)—Implementation of the Oklahoma Scenic River total phosphorus criterion will follow the rulemaking process outlined in the Oklahoma Administrative Code (OAC). A use support assessment protocol (USAP) will be developed and promulgated into state rule (OAC 785:46-15). Pursuant to state law, the USAP will go through a public participation process, be considered by the Oklahoma State Legislature,

and be signed into law by the Governor. Arkansas has expressed a strong desire to be heard in this process, and agency officials in Oklahoma concur that Arkansas input is desirable and advantageous.

4. Data Reporting—It was agreed by the workgroup that a coordinated, comprehensive data report be generated annually.

Watershed Plan

The JPA specifically states that the states "will work together in partnership with the Arkansas-Oklahoma Arkansas River Compact Commission toward the goal of producing a Watershed Plan". This specific section of the JPA has been referenced in the goals and objectives of this proposal. Specifically, watershed monitoring will attempt to address the water quality data needs of the Plan. To fully develop the Plan, the States will partner with the Compact Commission to develop a timetable for preparing the Watershed Plan.

Budget and Funding

Separate budgets have been developed for the Tier 1 and Tier 2 monitoring designs and are presented in Tables 3 and 4, respectively. For convenience, a combined budget is presented in Table 5. Budgets are projections based on the past experiences of other monitoring programs but should still be considered estimates. Personnel costs are based on a field crew of seven persons. In addition, 2 administrative personnel have been included. Overhead (fringe benefits and indirect including office space and equipment) is calculated at 80% of personnel cost. Laboratory costs are based on a price schedule provided by the ODEQ State Environmental Laboratory and are available upon request. To ensure that data is of the highest quality, quality assurance samples were calculated at 75% of actual sampling cost. Equipment and supplies costs are based on capital outlays during the first year for vehicles, sampling equipment and supplies, autosamplers, and stage recorders. These capital costs also include estimates for installation. In addition, annualized costs for depreciation at 20%, replacement at 10%, and maintenance were calculated over the five years of the program.

Due to shrinking or static state budgets and increasing monitoring needs, neither Arkansas nor Oklahoma is capable of supporting or providing matching funds for the work outlined in this proposal. Therefore, the states suggest that a federal funding source provide monies for all programmatic costs. Furthermore, it is necessary that this source be outside the current federal funding coming to the states from various CWA programs. These monies are needed to continue other monitoring activities not funded through state appropriated monies. If funding is not complete, programmatic cuts will be made in the following order (personnel and equipment will be cut accordingly):

1. Special study monies at $200,000 annually
2. Temporal coverage for Tier 2 stations
3. Spatial coverage for Tier 2 stations
4. Parametric coverage for Tier 2 stations beginning with variables not assessed with numerical criteria
5. Temporal coverage for Tier 1 stations

6. Autosamplers for Tier 1 stations
7. Spatial coverage for Tier 1 stations
8. Parametric coverage for Tier 1 stations beginning with variables not assessed with numerical criteria
9. Quality Assurance reductions

Table 2. Total monitoring budget

Budget Category	Cost
Personnel--Years 1-5	$1,556,656
Overhead--Years 1-5	$1,245,324
Laboratory Analysis--Years 1-5	$4,254,780
Equipment and Supplies--Year 1	$661,750
Equipment and Supplies--Years 2-5	$599,000
Special Studies--Years 1-5	$1,000,000
Total Cost =	**$9,317,510**

Table 3. Tier 1 monitoring budget

Personnel	**Person Yrs.**		**Expenditure**
1.0 Program Manager	5.00		$230,000
3.5 Field Crew	5.00		$548,328
Total Person Years =	***22.50***	***Total Salary =***	***$778,328***
Overhead (includes fringe, all indirect, office space, and office supplies/equipment)			
80% of Salaries			**$622,662**
Laboratory Analysis (Contractual)	**Annual Cost**		
Biweekly Composites w/75% QA	$146,692		**$733,460**
Biweekly Discrete w/75% QA	$120,075		**$600,375**
Storm Sampling--Composites w/75% QA	$56,420		**$282,100**
Storm Sampling--Autosamplers w/75% QA	$230,913		**$1,154,565**
		Total Lab =	***$2,770,500***
Equipment and Supplies	**Annual Cost**		
Year 1 Capital Outlay and Related Costs			**$373,950**
Year 2-5 Equipment Costs	$81,950		**$327,800**
		Total E&S =	**$701,750**
		Total Tier 1 Program Costs	**$4,873,240**

Table 4. Tier 2 monitoring budget

Personnel		Person Yrs.		Expenditure
1.0 Statistician		5.00		$230,000
3.5 Field Crew		5.00		$548,328
	Total Person Years =	**22.50**	**Total Salary =**	**$778,328**
Overhead (includes fringe, all indirect, office space, and office supplies/equipment)				
80% of Salaries				**$622,662**
Laboratory Analysis (Contractual)	**Annual Cost**			
Biweekly Composites w/75% QA	$214,396			**$1,071,980**
Storm Sampling--Composites w/ 75% QA	$82,460			**$412,300**
			Total Lab =	**$1,484,280**
Equipment and Supplies	**Annual Cost**			
Year 1 Capital Outlay and Related Costs				**$287,800**
Year 2-5 Equipment Costs	$67,800			**$271,200**
			Total E&S =	**$559,000**
			Total Tier 2 Program Costs	**$3,444,270**