

ILLINOIS RIVER
WATER QUALITY, MACROINVERTEBRATE
and
FISH COMMUNITY SURVEY
STATUS REPORT



ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY

WATER DIVISION

DECEMBER 15, 1995

WQ95-12-3

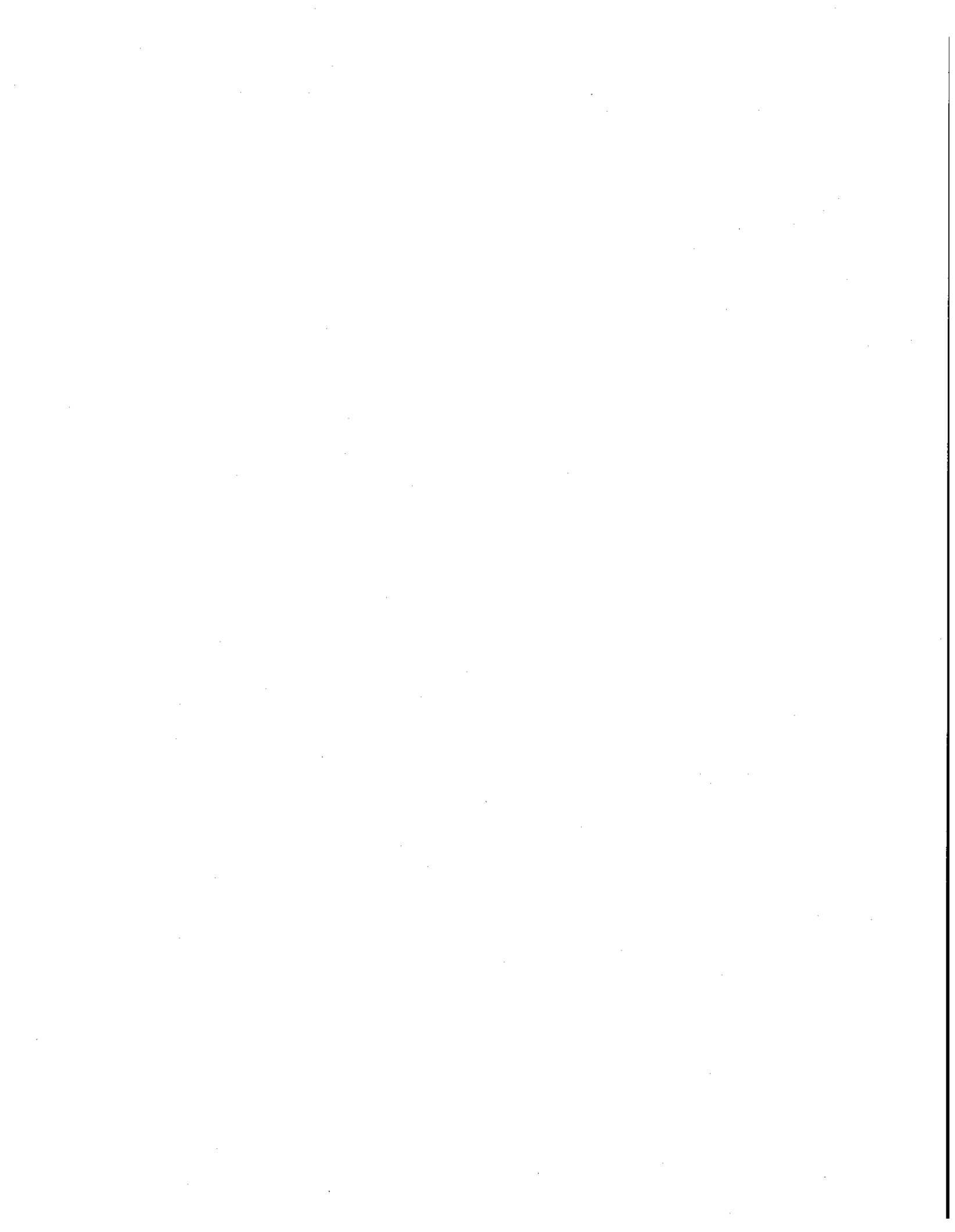


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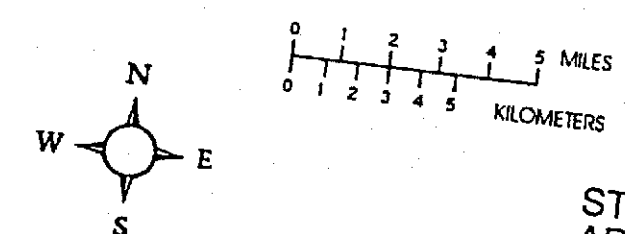
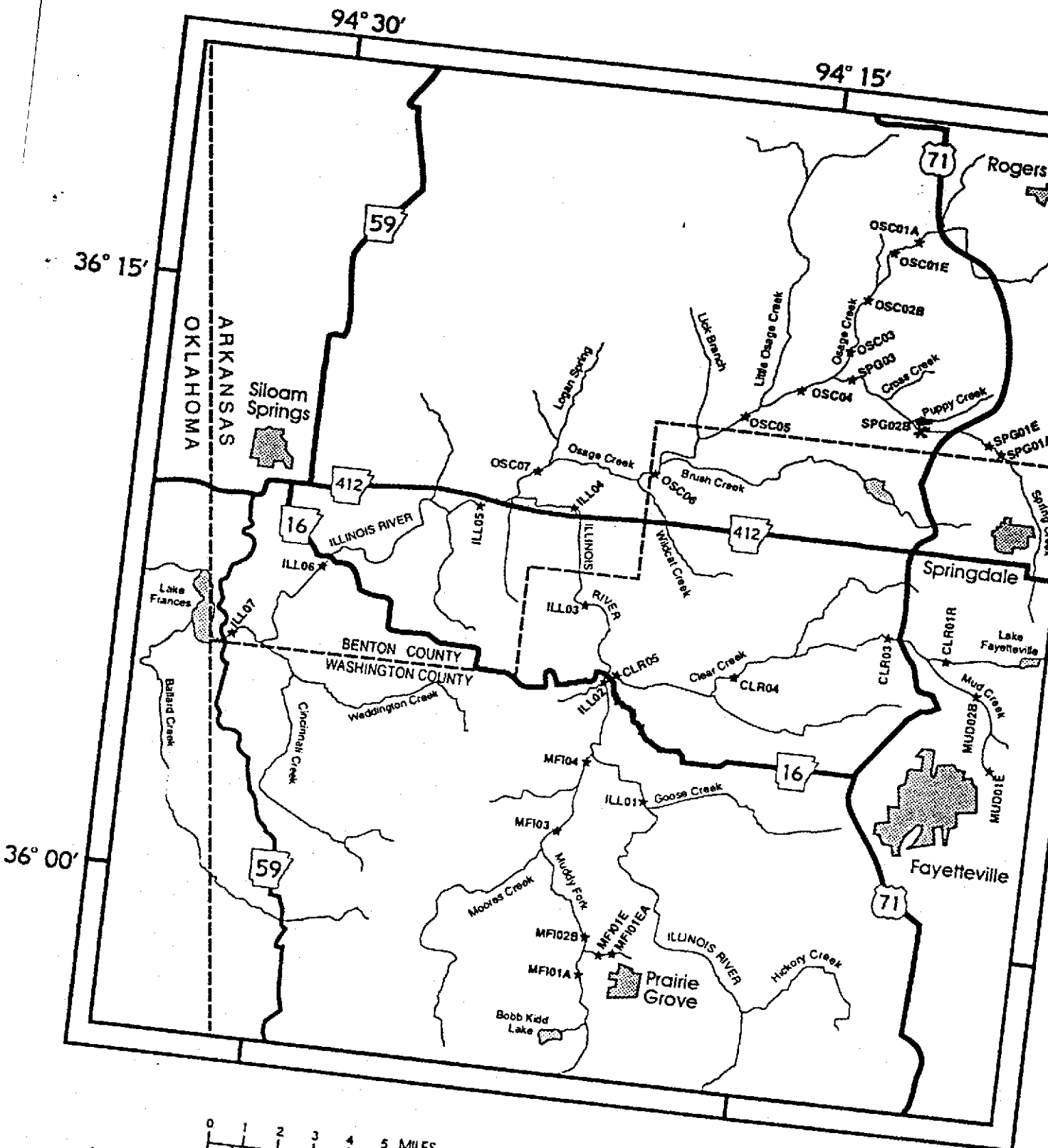
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Introduction

The Illinois River in Northwest Arkansas arises on the Springfield Plateau and flows westward into Oklahoma just south of Siloam Springs, Arkansas where it enters the lake bed of Lake Francis. Major tributaries entering the Illinois River include Osage Creek, draining the northern portion of the watershed near Rogers, Arkansas, Clear Creek draining the Fayetteville area, and the Muddy Fork of the Illinois River Draining the southern portion of the watershed near Prairie Grove. Spring Creek drains the Springdale area and enters Osage Creek south of Cave Springs, Arkansas (Figure 1).

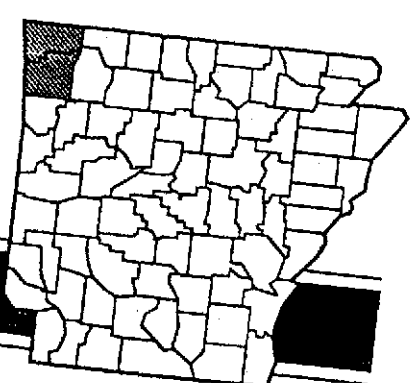
This survey was initiated to determine the impacts of the Prairie Grove, Rogers, Springdale and Fayetteville wastewater treatment facilities on the Illinois River and to determine the nonpoint source pollution contribution to the system. Consent Administrative Orders were handed down by the State of Oklahoma and the Oklahoma Scenic Rivers Commission to the Arkansas Department of Pollution Control and Ecology (Department) requesting that the Department to modify the NPDES permits of the cities of Prairie Grove, Fayetteville, and Rogers and conduct an in-stream water quality survey. These data will be used to determine the effects of these inputs on the water quality of the receiving streams of the Illinois River.

This status report outlines the work to be completed in the original work plan (Appendix A) and the work that has been completed as of November 30, 1995. This report also contains a brief summary characterizing the different sampling activities and events and any quality assurance/quality control problems that may have occurred during the sampling events. Also, a short discussion of the remaining work to be completed and an outline of targeted completion dates is included.



STUDY AREAS:
 ARKANSAS COUNTIES:
 Washington & Benton

ILLINOIS RIVER BASIN



List of Activities

Water Quality Sampling

As outlined in Appendix A, Section A, water quality grab samples were to be collected 6-8 times during different climatological and biological events from the thirty water quality stations listed in the work plan. In-situ measurements of dissolved oxygen, pH, water temperature and stream flow were to be measured and laboratory analyses for an additional 11 parameters were to be completed. Metals samples were to be collected during at least four different sampling events. Continuous dissolved oxygen and temperature data was to be collected at the furthest most downstream station in the major tributaries receiving WWTP effluent and at the furthest most downstream station on the Illinois River for a period of not less than 48 hours during the critical low-flow season.

Four water quality sampling events have been completed as is outlined in Table 1. Metals samples were collected during the three latter sampling events. An additional water quality sampling station (MF101EA) was added in the receiving stream upstream of the City of Prairie Grove's WWTP effluent discharge during the initial sampling event. Also, an additional sampling station, OSC08, was added near the mouth of the Little Osage Creek west of Cave Springs on Arkansas Highway 264 after the third sampling event. Review of the water quality data collected during the first three sampling events indicated that there was a significant amount of flow input from this tributary to Osage Creek. Water quality samples will continue to be collected from these two additional stations throughout the remainder of the survey.

Flows were not measured at the ILL06 sample station during the initial sampling event and at the ILL07 sample site during any of the sampling events because of excessive water depths and velocities. However, USGS wire gage readings have supplied a flow for the ILL06 site for the missed flow measurement and a newly activated continuous read USGS flow station with an additional wire gage have supplied flow data for the ILL07 site for the three latter sampling events. All other flow and in-situ measurements have been collected during all of the sampling events.

The water quality data from the previous sampling events has been assimilated into a spreadsheet for evaluation purposes, QA/QC analysis and for inclusion into the final report.

There has not been any QA/QC problems in the field collection of the in-situ measurements or in the laboratory analyses of the water quality samples.

Diurnal Dissolved Oxygen and Temperature Measurements

Continuous read dissolved oxygen and temperature recorders were deployed on two occasions in August. Samplers were deployed below the Hwy 68 bridge, downstream of OSC07, and at CLR05, MFI04, and ILL07 on August 15th and retrieved August 17th, 1995. The meters were again deployed on August 21st and retrieved August 23rd, 1995 at MFI02B, SPG02B, MUD02B, and approximately 250 yards below the Rogers WWTP effluent. Measurements were recorded every 15 minutes for at least a 48 hour period at each site. These data were downloaded into a spreadsheet for future analysis and inclusion in the final report. In-situ DO and temperature measurements were taken with a calibrated Orion Model 840A Dissolved Oxygen meter for data quality assurance comparisons with the continuous read meters. There were not any QA/QC problems associated with this sampling activity.

Periphyton Sampling

Periphytometers were deployed at 18 of the water quality sampling sites as is outlined in Appendix A on August 14-16, 1995 in accordance with the Oklahoma Conservation Commission's guidelines. Two separate samplers were deployed at each site. The samplers were retrieved approximately seven days later in the same order as they were deployed to ensure that each sampler was exposed to the same growth duration. In-situ measurements of pH, dissolved oxygen, water temperature, stream velocity, time of day and percent canopy cover were recorded at each site during both the deployment and recovery of the periphytometers. Comments were recorded noting any unusual circumstances with the periphytometers during recovery. The periphytometers at four of the sample sites had either been tampered with or were missing altogether. Chlorophyll ^a analyses were completed by August 25th, 1995 on all samples. Ash free dry weight analyses were completed by September 15th, 1995. All analyses were accomplished in accordance to the 18th Edition of "Standard Methods For The Examination Of Water And Wastewater" 1992, Section 10300. These data have been tabulated for future productivity computations and inclusion into the final report. There were not any QA/QC problems associated with this sampling activity.

Macroinvertebrate Sampling

Macroinvertebrate community samples were collected at 18 sample sites as outlined in Appendix A by August 16th, 1995 in accordance with the U.S. EPA rapid bioassessment protocols. The samples were returned to the Departments' laboratory and have not yet been separated, identified, or quantified. There were not any QA/QC problems associated with this sampling activity.

Fish Community Sampling

Fish community samples were collected at eight locations in June, 1995 as outlined in Appendix A. Samples were collected at all the sites listed in Appendix A except at the ILL07 site. These eight samples were separated and the fish species were identified and quantified by August, 1995. The percent abundance of each species per community has been calculated and a preliminary determination of the fish community structure at each site has been completed. Additional fish community samples were collected at SPG01A, SPG02B in September, 1995, and the ILL07 site was sampled in September, 1995.

Wastewater Treatment Plant Data Reports

The Fayetteville, Rogers, Springdale and Prairie Grove WWTPs have been supplying the Department with daily discharge and water quality information on a monthly basis. Data has been received from each of these cities for the months of May, June, July, August, September and October.

United States Geological Survey Flow Stations

The United States Geological Survey operated gaging stations at three locations within the survey area at the onset of the survey. Recently, they have upgraded the OSC05 station and added an additional station on the Illinois River, ILL07, as is indicated in the table below:

USGS Illinois River Gaging Stations		
Station	Previous Activity	Current Activity
OSC05	Staff gage	Staff gage, continuous read (as of September, 1995)
ILL02	Wire gage, continuous read	Wire gage, continuous read
ILL06	Wire gage, continuous read	Wire gage
ILL07	None	Wire gage, continuous read (as of September, 1995)

Data from these gages will be incorporated into the final report and used for QA/QC purposes.

TABLE 1

COMPLETED TASK OUTLINE			
Work plan Task	Completion Date* (*)Expected	Analyses Completed (Y=Yes N=No)	
		In-Situ	Lab Analysis Metals
Detailed Work plan	May, 1995		
Identification of Sample Sites	May, 1995		
Install Sample Sites in STORET	May, 1995		
Water Quality Sampling Event	May, 1995	Y	N
Fish Community Surveys (except ILL07)	June, 1995		
Water Quality Sampling Event	July, 1995	Y	Y
Periphyton Samplers Deployed	Aug. 14-16, 1995	Y	
Continuous DO and Temp Data	Aug. 15, 1995	Y	
Continuous DO and Temp Data	Aug. 21, 1995	Y	
Periphyton Samplers Retrieved	Aug. 21-23, 1995	Y	
Chlorophyll a Analysis	Aug. 25, 1995		Y
Fish collections separated	Aug. 30, 1995		
Fish Community Survey (ILL07, SPG01A, SPG02B)	Sept., 1995		
Water Quality Sampling Event	Sept., 1995	Y	Y
Macroinvertebrate Community Sampling	Sept., 1995		
Water Quality Sampling Event	Nov., 1995	Y	Y

Future Activities

Water Quality Sample Events

Approximately four additional water quality sampling events will occur through the remainder of the survey. Sampling events are tentatively scheduled for January and March, 1996 and during specific hydrological events during the remainder of the study. Metal samples will be collected during at least two more sampling events. The remainder of the sampling events should be completed by October, 1996.

Periphyton Data Evaluated

The chlorophyll *a* and ash free dry weight data will be evaluated and the primary productivity at each sample site will be determined. This activity should be completed by June, 1996.

Macroinvertebrates

The macroinvertebrate samples will be separated, the community structure determined, and common rapid bioassessment metrics will be used to analyze the data. This activity should be completed by June, 1996.

Fish Community

The remaining fish community samples will be separated and the fish species identified and quantified. Fish community analysis as percent community structure will be determined. This activity should be completed by June, 1996.

Wastewater Treatment Plant Data

The wastewater treatment plants will continue to supply the Department with daily flow and water quality data through June, 1996. The last of the data sheets should be received by the Department by August, 1996.

Final Report

Initialization of a final report outlining the task of the survey, the results of the survey and summarizing all the collected data will begin by October, 1996. A final report will be completed in March, 1997.

APPENDIX A

Illinois River Work Plan

ILLINOIS RIVER
WATER QUALITY, MACROINVERTEBRATE
and
FISH COMMUNITY SURVEY
WORK PLAN

Arkansas Department of Pollution Control and Ecology
Water Quality Management Planning Section
Water Division



March 1995

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Illinois River
Water Quality, Macroinvertebrate
and
Fish Community Survey
Work Plan

- Study Objectives:
- 1) To quantify and determine the impacts from point source discharges of nutrient loading to Osage Creek, Spring Creek, Mud Creek/Clear Creek, Muddy Fork of the Illinois River and the Illinois River at the State line, Figure 1;
 - 2) To generally characterize the seasonal water quality in this drainage area

Activities: Conduct water quality, periphyton density and production, macroinvertebrate and fish community investigations as follows:

A. Water Quality Studies

Objective I: Determine annual nutrient loadings from the Fayetteville (Illinois River), Rogers, Springdale and Prairie Grove Waste Water Treatment Plants (WWTP)

Objective II: To quantify the nutrient loading seasonally and by major source in the Illinois River in Arkansas, and in the Osage-Spring Creek, Mud/Clear Creek and Muddy Fork of the Illinois River subbasins

Activities:

1. Determine the monthly average discharge flows and concentrations of primary nutrients and CBOD₅ from the Fayetteville, Rogers, Springdale and Prairie Grove WWTP effluent for a one year period beginning in May 1995

2. Collect water quality grab samples and flow seasonally from strategically located sites within the basin
 - a. Location - 30 stations: listed in Appendix 1 and depicted in Figures 3 & 4
 - b. Frequency - During different hydrological and biological seasons; e.g. 6-8 times per year for a one year period beginning in May 1995
 - c. Parameters - Flow, temperature, D.O., pH, TDS, Cl, SO₄, hardness, TSS, turbidity, CBOD₅, NH₃-N, NO₂+NO₃-N, total phosphorus, ortho-phosphorus and trace metals (Cd, Cr, Cu, Pb, Zn) four events - high and low flows
 - d. Methodology - Water quality sampling and analysis will be in accordance with the Departments existing "Quality Assurance Plan for Ambient Water Quality and Compliance Sampling, September, 1993"; flow will be determined from cross-sectional, incremental depth and velocity flow measurements.

3. Collect continuous dissolved oxygen and temperature data at the furthest most downstream station in the major tributaries receiving WWTP effluent and at the furthest most downstream station on the Illinois River in Arkansas
 - a. Location - 4 stations: OSC07, CLR05
MFI04, ILL07
 - b. Frequency - for a minimum of 48 hours during low-flow, high temperature critical season in August 1995
 - c. Parameters - continuous D.O. and temp., and calculated D.O. saturation for a minimum of 48 hours
 - d. Methodology - installation of continuous recording D.O. meters at each station; calibration each 24 hours or more often; data adjustment for calibration as necessary

B. Periphyton Productivity Sampling

Objective: Determine periphyton production using artificial substrate samplers at strategic locations throughout the survey area

Activities:

1. Collect periphyton samples from artificial substrate (periphytometers)
 - a. Location - 18 stations: OSC01A, OSC02B, OSC03, OSC04, OSC07 SPG01A, SPG02B, MUD02B, CLR01R, CLR05, MFI01A, MFI02B, ILL01, ILL02, ILL03, ILL04, ILL05, ILL07
 - b. Frequency - low-flow, high temperature critical season in August 1995.
 - c. Parameters - chlorophyll ^a mass, pheophytin and ash free weight/surface area
 - d. Methodology - as per protocol in Standard Operating Procedures to be provided by the State of Oklahoma.

C. Aquatic Life Community

Objective: Determine the effects of nutrient input on the fish and macroinvertebrate communities in Spring Creek, Osage Creek, Clear/Mud Creek, Muddy Fork and the Illinois River at the State Line

Activities:

1. Collect macroinvertebrate communities from typical riffle areas from each site listed below:
 - a. Location - 18 stations: OSC01A, OSC02B, OSC03, OSC04, OSC07, SPG01A, SPG02B, MUD02B, CLR01R, CLR05, MFI01A, MFI02B, ILL01, ILL02, ILL03, ILL04, ILL05, ILL07
 - b. Frequency - Once during critical season conditions of low-flow and high temperature
 - c. Parameters - Community structure with typical RBA metrics
 - d. Methodology - Department Standard Operating Procedures, RBA technique

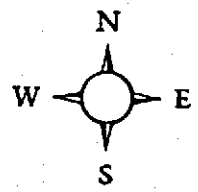
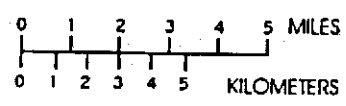
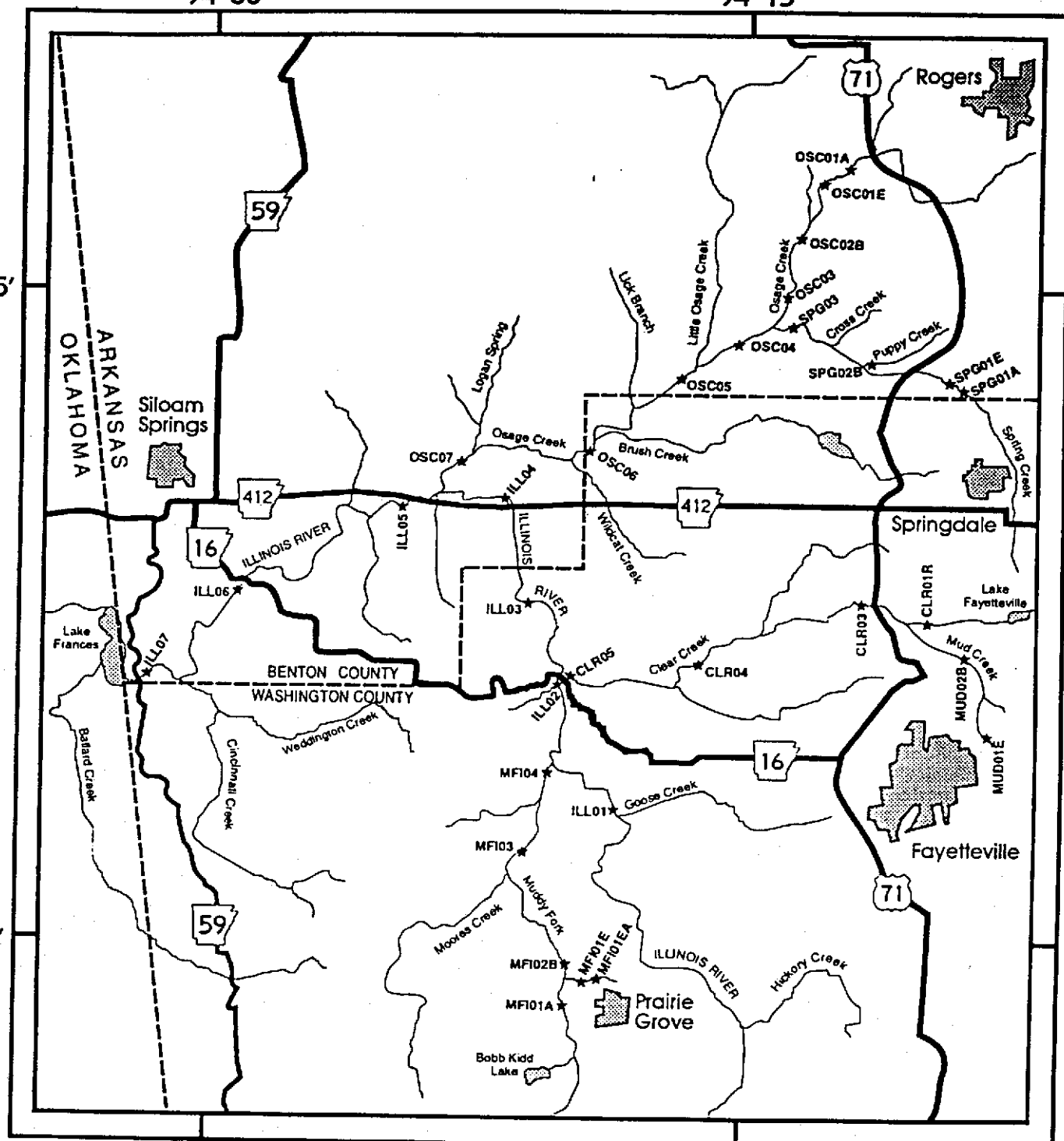
2. Compare the fish communities above and below WWTP stations and/or in reference stream(s) and determine fish community structure from the Illinois River near State line
 - a. Location - 9 stations: OSC01A, OSC02B, SPG01A, SPG02B, MUD02B, CLR01R, MFIO1A, MFIO2B, ILL07
 - b. Frequency - All stations will be sampled during the critical season of low-flow, high temperature in September 1995, and all stations except ILL07 will be sampled in June 1995.
 - c. Parameters - relative abundance of fish species (% of total numbers collected) in order to determine similarity of communities and of key species; trophic feeding guilds; similarity of major feeding groups; etc.
 - d. Methodology - electrofishing collections of all species in the fish community; sampling to include all habitats of stream segment and of sufficient length to adequately characterize the community; adequacy of sample will be based on judgement of field collectors that all basic habitats of the stream and all major components of the fish community have been sampled

94° 30'

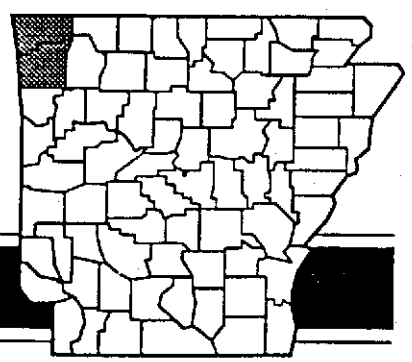
94° 15'

36° 15'

36° 00'



STUDY AREAS:
 ARKANSAS COUNTIES:
 Washington & Benton



ILLINOIS RIVER BASIN

REVISED MAP 6/20/4

Figure 2

ILLINOIS RIVER DRAINAGE BASIN

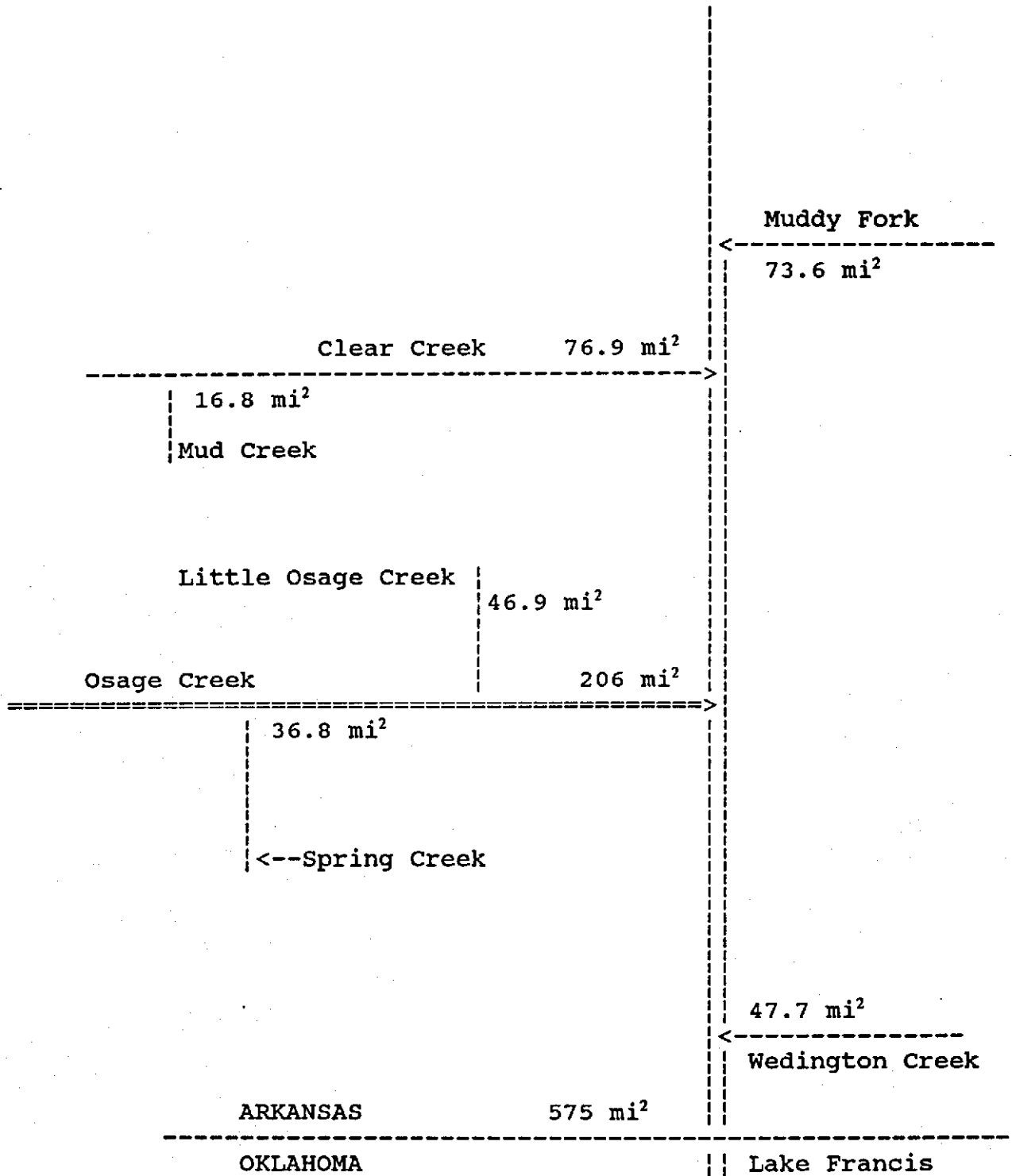


Figure 3 - OSAGE CREEK & SPRING CREEK
DRAINAGE BASIN and STATION LOCATIONS

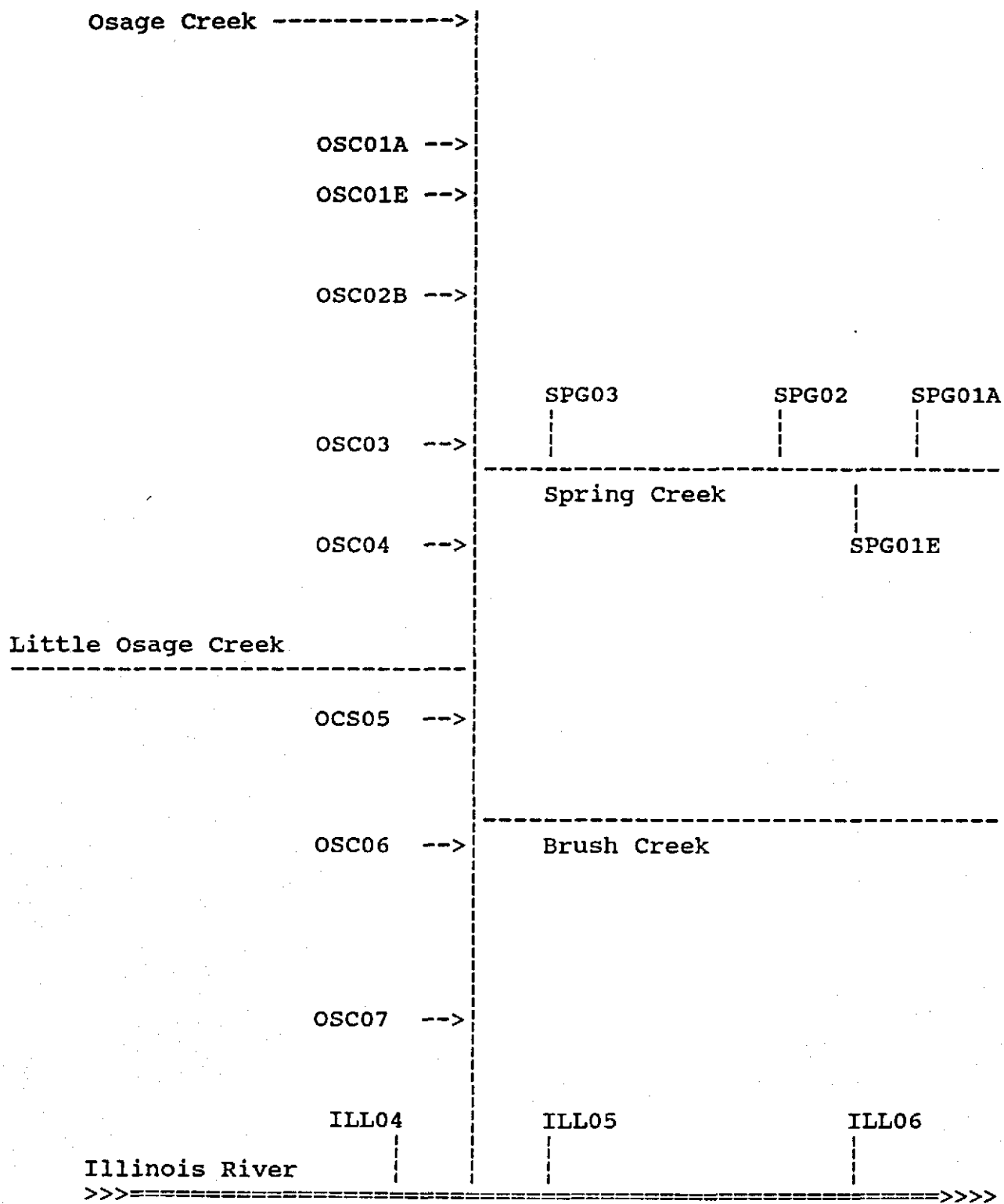
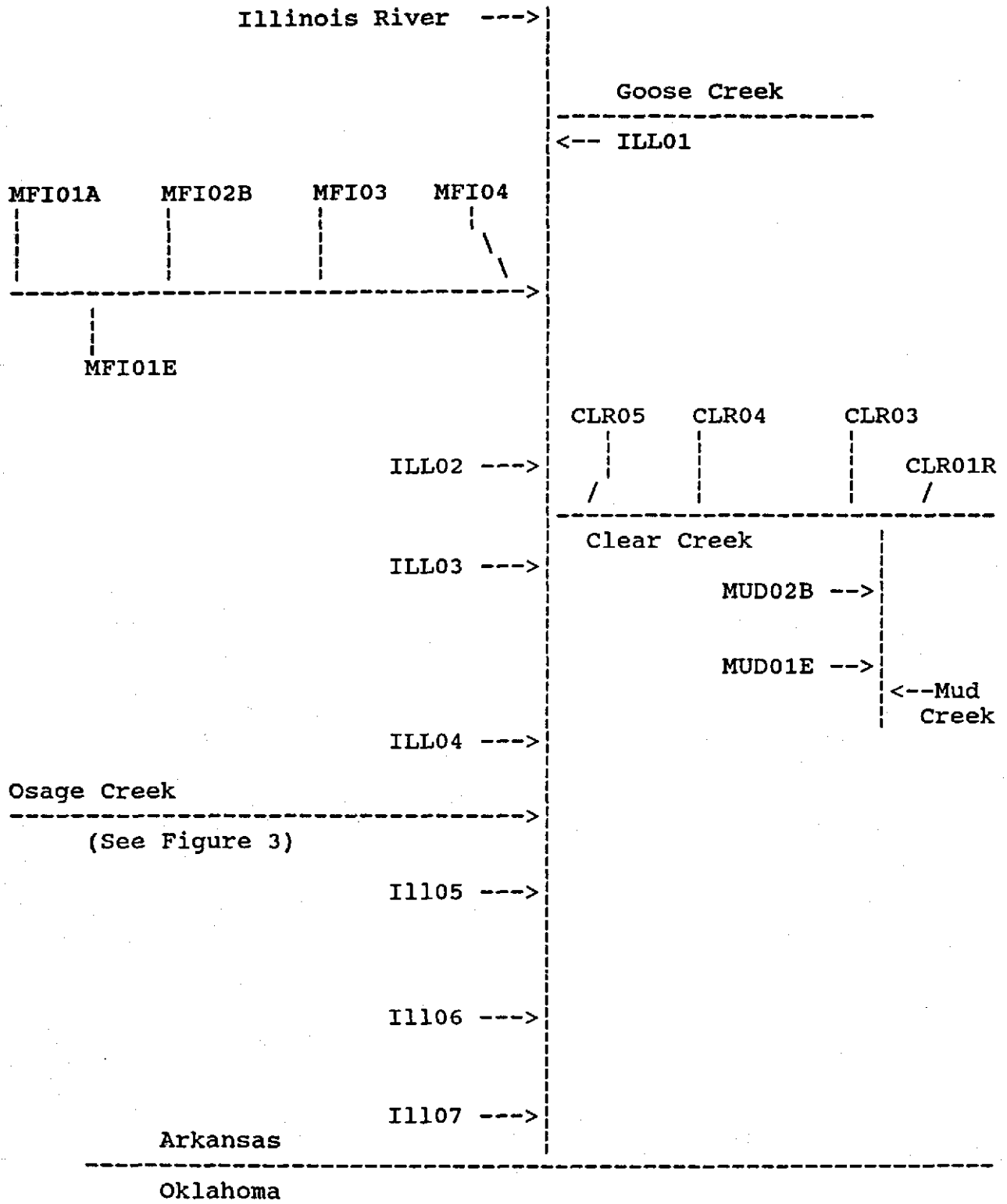


Figure 4 - ILLINOIS RIVER & MUDDY FORK
DRAINAGE BASIN and STATION LOCATION



Appendix 1 - Location of Sampling Stations

OSAGE CREEK

- OSC01A (ARK25B) Osage Creek above Rogers WWTP outfall (Sec 19, T19N, R30W); drainage basin 33.0 mi²; 4.4 stream miles from headwaters; samples - WPMF.
- OSC01E City of Rogers WWTP outfall (Sec 19, T19N, R30W); 31.7 stream miles to State line; 5.5 stream miles from headwaters; samples - W.
- OSC02B (ARK25C) Osage Creek @ Ar Hwy 112 (Sec 36, T19N, R31W); drainage basin 40 mi²; 1.6 stream miles below WWTP; samples - WPMF.
- OSC03 Osage Creek off Ar Hwy 112 above Spring Creek confluence (Sec 12, T18N, R31W); drainage basin 42.5 mi²; 3.5 stream miles below WWTP; samples - WPM.
- OSC04 (ARK68B) Osage Creek at county rd bridge below Spring Creek confluence (Sec 14, T18N, R31W); drainage basin 80.0 mi²; 4.7 stream miles below WWTP; samples - WPM.
- OSC05 (ARK41) Osage Creek @ Co Rd 0.5 mi below Little Osage Creek (Sec 21, T18N, R31W); drainage basin 129 mi²; 8.3 stream miles below WWTP; samples - W.
- OSC06 Osage Creek below confluence of Brush Creek near Washington County line (NE $\frac{1}{4}$ Sec 36, T18N, R32W); drainage basin 170.5 mi²; 12.9 stream miles below WWTP; samples - W.
- OSC07 (ARK82) Osage Creek @ Co Rd (Logan Cave Rd.) 1.5 mi above Illinois River S of Logan (Sec 34, T18N, R32W); drainage basin 205.0 mi²; 16.6 stream miles below WWTP; 1.6 stream miles to confluence with Illinois River; samples - WPM.
- OSC08 Little Osage Creek @ Hwy 264 bridge, approx. 2.5 mi. W. of Cave Springs (Sec 10, T18N, R31W); drainage basin 42.5 mi²; samples - W as of November, 1995.

SPRING CREEK

- SPG01A (ARK26A) Spring Creek above the City of Springdale WWTP discharge (Sec 22, T18N, R30W); drainage basin 8.0 mi²; 2.8 stream miles from headwaters; samples - WPMF.
- SPG01E City of Springdale WWTP discharge (Sec 22, T18N, R30W); 3.0 stream miles from headwaters; 33.5 stream miles to State line; samples - W.

SPG02B (ARK26B) Spring Creek on Co Rd above Puppy Creek Confluence (NW $\frac{1}{4}$ Sec 21, T18N, R30W); drainage basin 12.2 mi²; 1.8 stream miles below WWTP; samples - WPMF.

SPG03 (ARK68C) Spring Creek @ Ar Hwy 112 (Sec 12, T18N, R31W); drainage basin 36.8 mi²; 5.6 stream miles below WWTP; 0.5 stream miles to Osage Creek confluence; samples - W.

MUD/CLEAR CREEK

MUD01E Fayetteville WWTP discharge (Sec 1, T16N, R30W); 1.0 mile from headwaters; 44.2 stream miles to State line; samples - W.

MUD02B Mud Creek E. of US Hwy 71B (Sec 26, T17N, R30W); drainage basin 8.0 mi²; 3.5 stream miles below WWTP; 1.8 stream miles to Clear Creek confluence; samples - WPMF.

CLR01R Clear Creek just above confluence of Mud Creek (reference site) (Sec 22, T17N, R30W); drainage basin 10.8 mi²; 5.3 stream miles below WWTP; samples - WPMF.

CLR03 Clear Creek below confluence of Mud Creek @ US Hwy 71 (Sec 21, T17N, R30W); drainage basin 31 mi²; 6.3 stream miles below WWTP; samples - W.

CLR04 Clear Creek on Co. Rd N. of Wheeler (Sec 26, T17N, R31W); drainage basin 50.8 mi²; 13.3 stream miles below WWTP; samples - W.

CLR05 Clear Creek on Co. Rd. just above confluence with Illinois River SW of Savoy (Sec 31, T17N, R31W); drainage basin 76.9 mi²; 18.9 stream miles below WWTP; 0.2 stream miles to confluence with Illinois River; samples - WPM.

MUDDY FORK ILLINOIS RIVER

MFI01A Muddy Fork below confluence of Budd Kidd Creek, above Prairie Grove WWTP discharge (Sec 12, T15N, R32W); drainage basin 27.5 mi²; 9.1 stream miles from headwaters; samples - WPMF.

MFI01E Prairie Grove WWTP discharge (Sec 12, T15N, R32W); 37 stream mile to State line; samples - W.

MFI02B Muddy Fork below Prairie Grove WWTP discharge W of Viney Grove (Sec 2, T15N, R32W); drainage basin 32 mi²; 1.8 stream miles below WWTP; samples - WPMF.

MFI03 Muddy Fork N of Viney Grove (Sec 26, T16N, R32W); drainage basin 64.5 mi²; 5.8 stream miles below WWTP; samples - W.

MFI04 Muddy Fork above confluence with Illinois River
(Sec 14, T16N, R32W); drainage basin 73.2 mi²; 7.9 stream
miles below WWTP; 0.4 stream miles to confluence with
Illinois River; samples - W.

Illinois River

ILL01 Illinois River above confluence of Muddy Fork of the
Illinois River (Sec 19, T16N, R31W); drainage basin 80.17
mi²; 22.5 stream miles from headwaters; 30.5 stream miles
from State line; samples - WPM.

ILL02 (ARK40) Illinois River at AR Hwy 16 above confluence of
Clear Creek SW of Savoy, below confluence of Muddy Fork
of the Illinois River (Sec 36, T17N, R32W); drainage
basin 167 mi²; 25.5 stream miles from State line;
samples - WPM.

ILL03 Illinois River below confluence of Clear Creek
(Sec 23, T17N, R32W); drainage basin 249 mi²; 22 stream
miles from State line; samples - WPM.

ILL04 Illinois River N of Hwy 412, above Osage Creek confluence
(Sec 4, T17N, R32W); drainage basin 263 mi²; 14.4 stream
miles from State line; samples - WPM.

ILL05 Illinois River S of Hwy 412 below confluence of Osage
Creek (Sec 7, T17N, R32W); drainage basin 477 mi²; 11.2
stream miles from State line; 2.2 stream miles below
confluence of Osage Creek; samples - WPM.

ILL06 ARK06A - Illinois River at Hwy 16 bridge S of Siloam
Springs (Sec 22, T17N, R33W); drainage basin 520 mi²;
5.0 stream miles from State line; samples - W.

ILL07 Illinois River @ Ar Hwy 59 bridge (Sec 31, T17N, R33W);
drainage basin 568 mi²; 1.4 stream miles from state line;
samples - WPMF.

- A Station located above a discharge
- B Station located immediately below a discharge
- E Station is WWTP effluent
- R Reference stream site
- W Water Sample
- P Periphyton Sample
- M Macroinvertebrate Sample
- F Fish Community Sample

Osage Creek Drainage

<u>STREAM</u>	<u>mi² drained</u>
Osage Creek at Hwy 264, Cave Springs	40.4
Osage Creek above mouth of Little Osage Creek	82.1
Little Osage Creek at mouth	46.9
Spring Creek at mouth	36.8
Cross Creek	5.0
Puppy Creek	9.0
Osage Creek near Elm Springs, 1 mi. below Little Osage Creek confluence	130.0
Brush Creek at mouth	23.3
Osage Creek below Brush Creek near Washington County line	170.0
Osage Creek at mouth, Hwy 112	206.0
Illinois River above Osage Creek	263.0