

WATER QUALITY STUDY
OF
LAKE CONWAY
FAULKNER COUNTY, ARKANSAS



NOVEMBER 1998

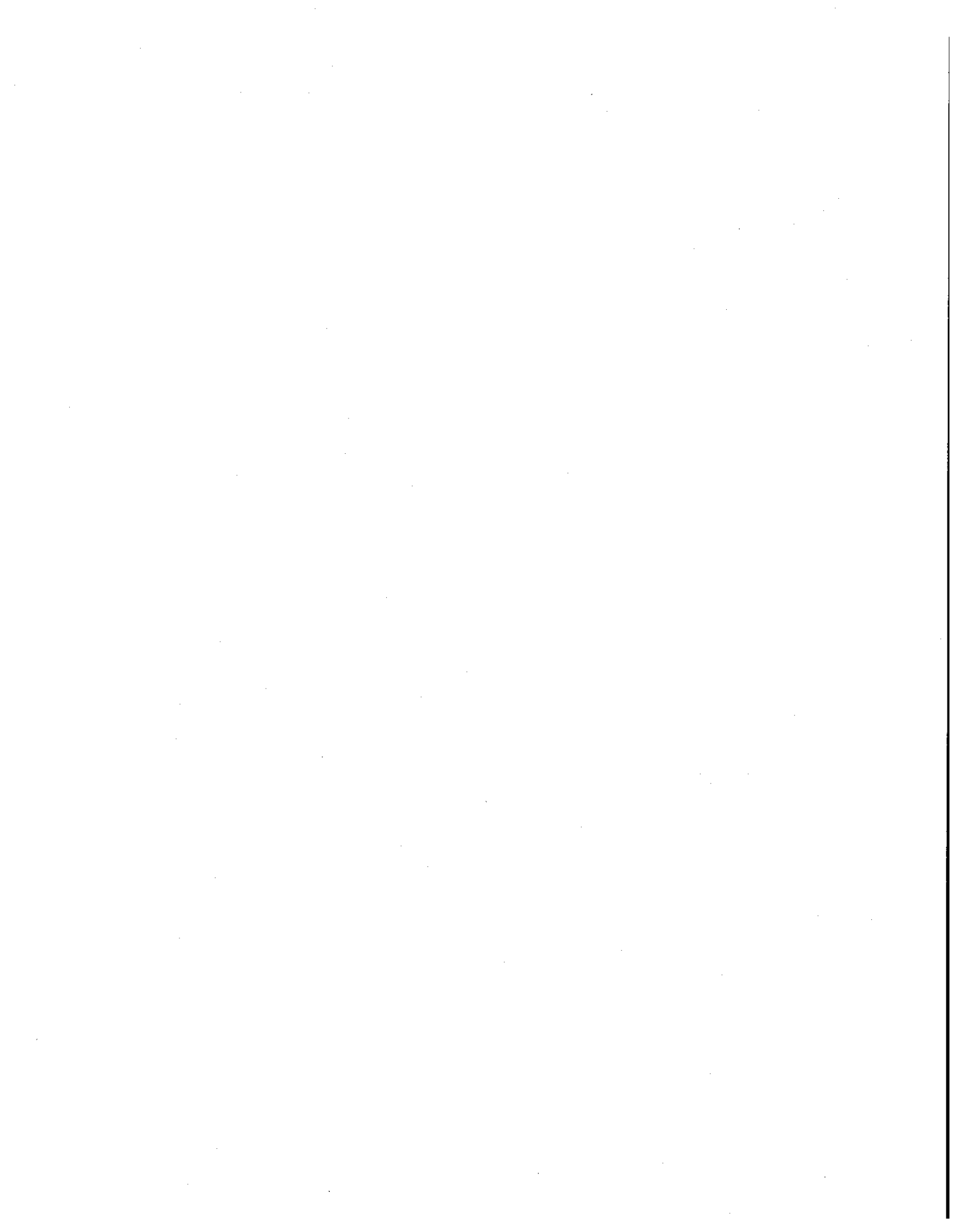
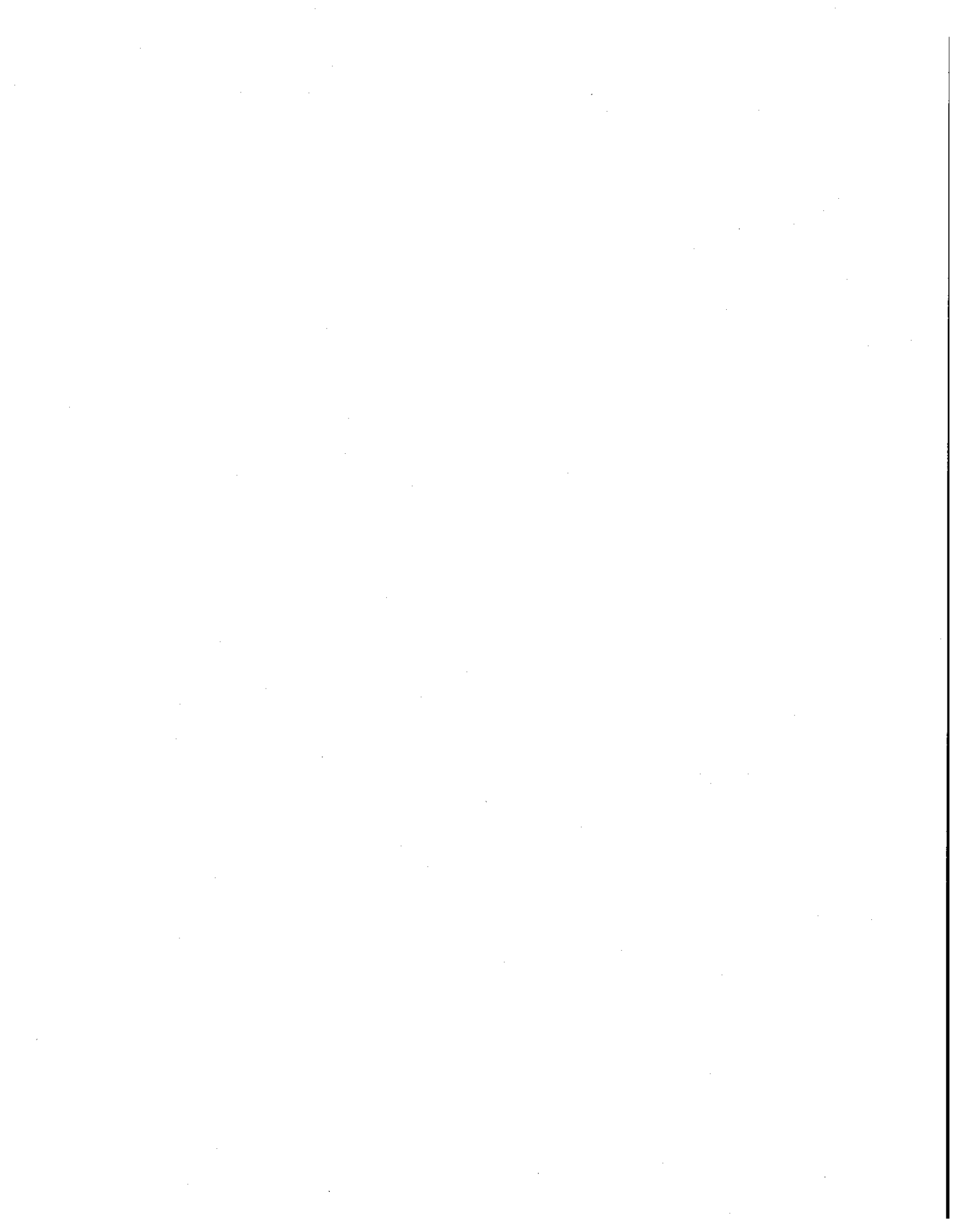


TABLE OF CONTENTS

INTRODUCTION	1
CURRENT STUDY	1
Data Acquisition	1
Parameters	1
Collection, Preservation and Measurements	1
Station Description	2
DATA RESULTS	3
Water Quality	3
Chlorides, Sulfates, and Total Dissolved Solids	3
Nutrients	3
Dissolved Metals	4
Sediment	4
Pesticides	4
Metals	4
CONCLUSIONS	5
APPENDICES	6



WATER QUALITY STUDY OF LAKE CONWAY, FAULKNER COUNTY, ARKANSAS

INTRODUCTION

In July 1998, concerned citizens residing in the area around Lake Conway requested that the Arkansas Department of Pollution Control and Ecology (Department) conduct a study to determine the extent of possible contamination to Lake Conway. The citizens were concerned that the effluent discharge from waste water treatment facilities (WWTF) and poorly designed septic systems may be causing unacceptable levels of nutrients, metals and fecal coliform bacteria in the lake. Lake Conway is located in Faulkner County, Arkansas near the City of Conway.

CURRENT STUDY

Data Acquisition

The Lake Conway Study was initiated on the morning of October 7, 1998 when Department personnel traveled to Lake Conway to select sampling locations and confirm the access points to the lake. On October 12, in-situ measurements, water quality grabs, dissolved metals and fecal coliform bacteria samples were collected at five stations around the shore of Lake Conway. Sediment was also collected at three of the five stations.

Parameters

The water samples collected were analyzed for dissolved oxygen, temperature, pH, 5-day biochemical oxygen demand (BOD₅), total organic carbon (TOC), ammonia-nitrogen (NH₃-N), nitrates (NO₃-N), TKN, ortho-phosphorus (O-PHOS), total phosphorus (T-PHOS), bromide, fluoride, sulfate (SO₄), chlorides, total dissolved solids (TDS), total suspended solids (TSS), turbidity, and fecal coliform bacteria. The water dissolved metals samples were analyzed for aluminum, arsenic, barium, beryllium, boron, cadmium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, vanadium, zinc, and hardness. The sediment samples collected were analyzed for metals and pesticides. Complete parameter lists for the sediment collected can be found in the appendix.

Collection, Preservation and Measurements

Water quality grab samples were collected, preserved, and analyzed according to the 18th edition of Standard Methods for Examination of Water and Wastewater. Analysis was conducted under

ADPC&E's existing Quality Assurance Program. Dissolved oxygen and stream temperature were measured using an Orion Model 840 portable dissolved oxygen meter, which was calibrated according to the manufacturers instruction prior to use. Stream pH was measured using an Orion Model 230A portable pH meter, which was calibrated using buffer solutions of pH 4 and 7.

In-situ, water quality, fecal coliform, and dissolved metals samples were taken at five stations around Lake Conway: ⁽¹⁾ Hwy 89 at the first bridge after exiting I-40, ⁽²⁾at the narrows bridge on Hwy 89, ⁽³⁾at the first bridge on I-40 (Gold Creek) between the cities of Mayflower and Conway, ⁽⁴⁾at the second bridge on I-40 (Stone Dam Creek) between the cities of Mayflower and Conway, and ⁽⁵⁾at the Arkansas Game and Fish Caney Creek access to Lake Conway on Amity Road in Conway. At three of the five sample sites, sediment samples were collected and analyzed for pesticides and metals. Sediment collections were made using a petite ponar dredge (6 in x 6 in x 6 in). Sediment samples were returned to shore where they were passed through a 2 mm sieve. This homogenized sample was then sealed in a glass container and transported with the water grab samples to the ADPC&E laboratory at <4 °C.

Station Description

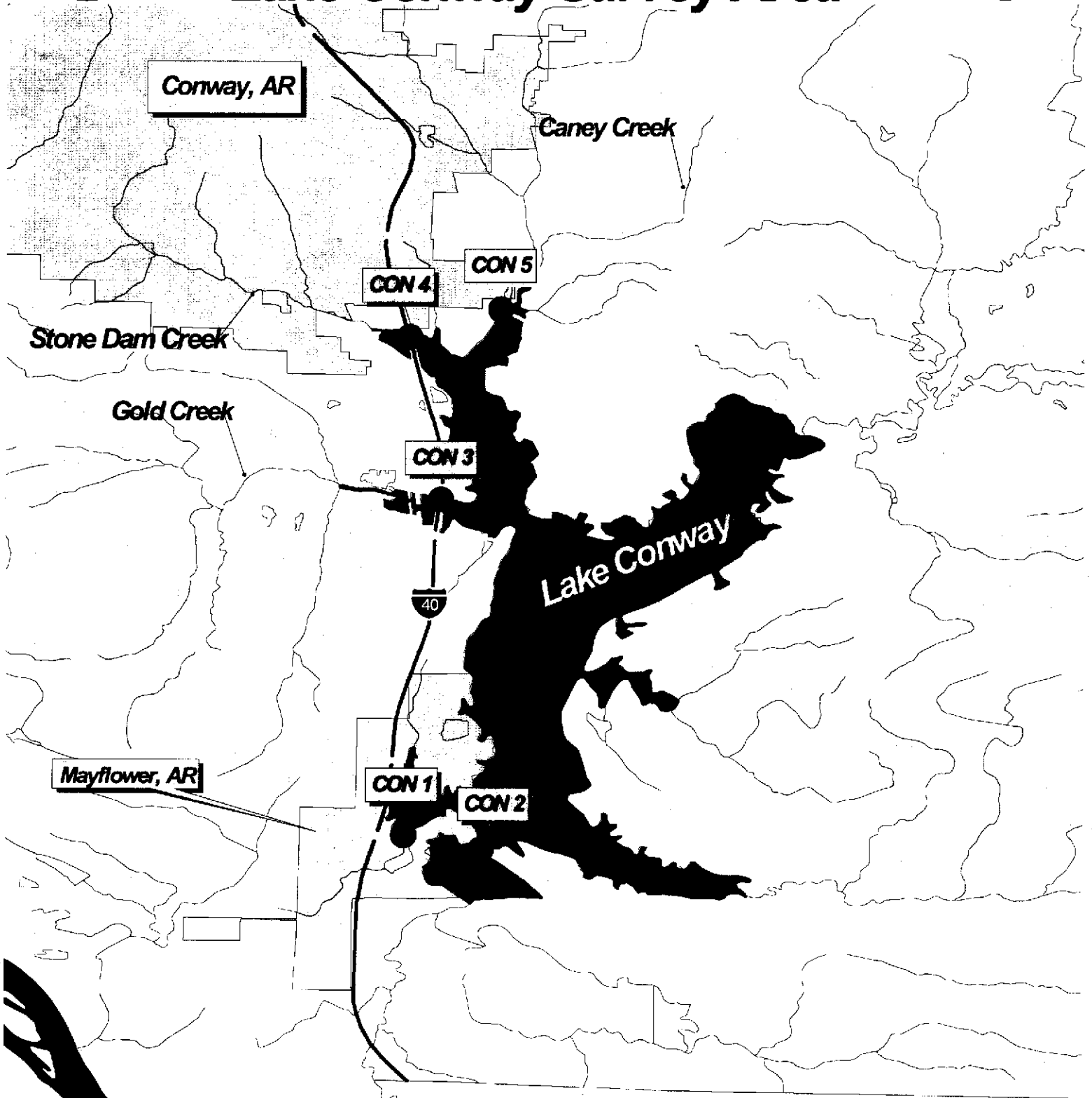
Five stations were established around the shore of Lake Conway (Figure 1). The station descriptions are as follows:

Location of Sample Stations

- | | |
|--------------|---|
| Con 1 | Hwy 89 at the first bridge after exiting I-40. Water quality, fecal coliform, and dissolved metals. |
| Con 2 | Hwy 89 at the narrows bridge. Water quality, fecal coliform, and dissolved metals. |
| Con 3 | At the first bridge on I-40 (Gold Creek) between the cities of Mayflower and Conway. Water quality, fecal coliform, dissolved metals, and sediment. |
| Con 4 | At the second bridge on I-40 (Stone Dam Creek) between the cities of Mayflower and Conway. Water quality, fecal coliform, dissolved metals, and sediment. |
| Con 5 | At the Arkansas Game and Fish Caney Creek access to Lake Conway on Amity Road in Conway. Water quality, fecal coliform, dissolved metals, and sediment. |



Figure 1 Lake Conway Survey Area



Area of Interest



0.7 0 0.7 1.4 Miles

DATA RESULTS

WATER QUALITY

Chlorides, Sulfates, and Total Dissolved Solids

Water quality samples taken at CON 1 had a chloride concentration of 10.90 mg/L. Samples collected at CON 2, CON 3, and CON 5 had comparable chloride concentrations (< 10.90 mg/L). The chloride concentration at CON 4 (45.50 mg/L) was the highest collected during this survey.

Total dissolved solids (TDS) concentrations were also most elevated at CON 4 (450 mg/L). The TDS concentration at CON 1 was 77 mg/L, at CON 2 the concentration was 83 mg/L and at CON 3 and CON 5 the TDS concentrations were 85 mg/L and 82 mg/L, respectively.

Sulfate (SO₄) concentrations collected during this study reflected the same pattern of elevation as the TDS and chloride concentrations. The most elevated concentration was found at CON 4 (195 mg/L). Samples collected at CON 1 and CON 2 had concentrations of 9.62 mg/L and 6.53 mg/L, respectively. The second most elevated sulfate concentration collected was 16.9 mg/L at CON 3. CON 5 had a sulfate concentration of 13.6 mg/L. All water quality data is represented as Appendix A.

Nutrients

The concentrations of nutrients collected around Lake Conway were all relatively low. The ammonia concentration at CON 4 was 0.52 mg/L. Ammonia concentrations at all other stations sampled were below 0.30 mg/L. The sample collected at CON 2 indicated an ammonia concentration below the laboratory detection limit of 0.005 mg/L.

Nitrate concentrations during this survey were also most elevated at CON 4 (4.17 mg/L). The CON 3 nitrate concentration of 0.52 mg/L was the second most elevated. CON 5 had a nitrate value of 0.33 mg/L. CON 1 and CON 2 had nitrate concentrations of 0.04 mg/L and 0.03 mg/L.

Total phosphorus concentrations were relatively low at all stations during this study. The most elevated total phosphorus concentration of 0.86 mg/L was sampled at CON 4. All other stations indicated concentrations of total phosphorus at or below 0.17 mg/L.

Water was collected at all five stations and tested for fecal coliform bacteria. Stations CON 3 and CON 4 had fecal bacteria counts of 590 col/100ml and 560 col/100ml, respectively. The samples collected at the other stations had counts near or below 200 col/100ml. Complete water quality data can be found in Appendix A.

Dissolved Metals

All of the water quality samples taken during this study were analyzed for dissolved metals. Some samples contain elevated metals concentrations. Aluminum was detected at CON 3 and CON 4 at concentrations of 342.5 $\mu\text{g/L}$ and 467.3 $\mu\text{g/L}$, respectively. Aluminum concentrations at the other three stations were collected at concentrations below the laboratory detection level of 127 $\mu\text{g/L}$. Arsenic was detected at only one station, CON 4 (1.64 $\mu\text{g/L}$). Boron concentrations were similar at CON 1 (35.7 $\mu\text{g/L}$), CON 2 (57.6 $\mu\text{g/L}$), CON 3 (33.5 $\mu\text{g/L}$), and CON 5 (23.5 $\mu\text{g/L}$). However, the concentration of boron at the Stone Dam Creek station CON 4 (418.6 $\mu\text{g/L}$) was eleven times higher than the average concentration of the other four stations. The concentration of manganese was also noticeably elevated at CON 4 (653.5 $\mu\text{g/L}$) above the levels indicated at the other stations around Lake Conway. Nickel was collected at a concentration of 17.7 $\mu\text{g/L}$ at CON 4, which is nearly seven times the other detection for nickel (2.62 $\mu\text{g/L}$) at CON 3. Similarly, the zinc concentration at CON 4 of 17.4 was the most elevated detection. This is four times the second most elevated concentration of 5.0 $\mu\text{g/L}$ collected at CON 3. Using ecoregion hardness values for calculating toxic levels as prescribed in the implementation procedure, none of the dissolved metals were found at toxic concentrations during this study. All metals data can be found in Appendix A.

SEDIMENT

Sediment samples were collected from three stations around Lake Conway. In addition to the samples collected for water quality, fecal coliform bacteria, and dissolved metals, sediment was collected at CON 3, CON 4, and CON 5. Sediment samples collected were analyzed for pesticides and metals.

Pesticides

The sediment samples collected during this study were analyzed for 49 specific pesticides or the degradation products of pesticides. These 147 analyses resulted in the detection of only one pesticide. Analysis of the sediment sample collected at CON 3 indicated p-p'-DDE at a concentration of 0.0009 $\mu\text{g/g}$. A complete pesticide parameter list and all pesticide data can be found in Appendix B.

Metals

Sediment samples collected at the three sediment stations during this project were analyzed for 15 metals: aluminum (Al), arsenic (As), barium (Ba), beryllium (Be), copper (Cu), total chromium (Cr), cobalt (Co), cadmium (Cd), iron (Fe), magnesium (Mg), manganese (Mn), nickel (Ni), lead (Pb), vanadium (V), and zinc (Zn). Manganese, zinc and nickel were found in elevated concentrations in the water collected from CON 4. These elevated concentrations discharged in the water are also present in the sediments of Stone Dam Creek (CON 4). Zinc was present at

197 mg/Kg at CON 4. This is 450 % higher than the concentration sampled at CON 5 (44.0 mg/Kg) and over 900 % higher than the zinc concentration in the sediment at CON 3. Analyses for manganese indicated 1440 mg/Kg in the sediment of CON 4. CON 3 and CON 5 had concentrations of 469 mg/Kg and 369 mg/Kg manganese, respectively. Nickel was found at CON 4 (37.8 mg/Kg) at a concentration nearly seven times higher than the concentrations of nickel at CON 3 (5.4 mg/Kg) and CON 5 (5.5 mg/Kg). Copper and chromium were also found in elevated concentrations in the sediments of CON 4, although they were only slightly elevated in the water samples collected. The analyses for copper and chromium at CON 4 yielded concentrations of 21 mg/Kg and 28 mg/Kg, respectively. The concentration of copper in the sediment of CON 4 was more than double that found at CON 3 and CON 5. Chromium concentrations were similar to those for copper, CON 4 had a chromium concentration of 28 mg/Kg. This was nearly five times the concentration of chromium at CON 5. Complete sediment metals data can be found in Appendix C.

CONCLUSIONS

A review of the dissolved and sediment metals analyses conducted indicates elevated concentrations of chromium, copper, nickel, and zinc in the water and/or sediment at CON 4, Stone Dam Creek. However, when calculating the toxic levels of these metals using ecoregion hardness values as prescribed in the implementation procedure, none of the dissolved metals were found at toxic concentrations during this study. Water quality analyses revealed elevated levels over typical ecoregion values for chlorides, total dissolved solids and sulfates at CON 4. Samples collected during this study for the analyses for fecal coliform bacteria did not indicate water quality standards violations for bacteria. However, bacteria counts at CON 3 and CON 4 would constitute a water quality standards violation for those waters if these levels occurred during the primary contact season between April 1 and September 30. Sediment collected during this study indicated the presence of only one compound, p-p'-DDE, that was at a concentration above the laboratory detection limit.

APPENDICES

APPENDIX A - WATER QUALITY & METALS

STATION ID	units	CON 1	CON 2	CON 3	CON 4	CON 5
Water Quality						
October 12, 1998						
Collect_Time	hrs	0900	0920	1000	1020	1140
DO	mg/L	4.11	6.43	4.50	4.11	3.78
pH	s.u.	7.50	7.75	7.40	7.43	7.21
Water Temp	C	17.20	19.70	19.70	19.50	21.30
Bromide(Br)	mg/L	0.06	0.05	<0.03	<0.03	<0.03
Chloride(Cl)	mg/L	10.90	10.20	5.09	45.50	4.78
Fluoride(F)	mg/L	0.16	0.23	0.12	1.54	0.15
Sulfate(SO4)	mg/L	9.62	6.53	16.90	195.00	13.92
NH3-N	mg/L	0.08	<0.005	0.26	0.52	0.29
NO3-N	mg/L	0.04	0.03	0.52	4.17	0.33
O-PHOS	mg/L	1.28	0.01	0.02	0.52	0.02
T-PHOS	mg/L	0.17	0.12	0.17	0.86	0.17
TKN	mg/L	1.73	1.35	1.87	1.52	1.51
TOC	mg/L	6.60	7.90	7.50	7.60	7.10
BOD5	mg/L	4.50	3.70	3.50	2.05	3.29
Turbidity	NTU	*	*	*	*	*
TSS	mg/L	32.00	15.00	55.00	42.00	50.00
TDS	mg/L	77.00	83.00	85.00	450.00	82.00
Fecal Coliform	col/100ml	66	188	590	560	216
Dissolved Metals						
Aluminum (Al)	ug/L	<127	<127	342.50	<127	467.30
Arsenic (As)	ug/L	<1.0	<1.0	<1.0	1.64	<1.0
Barium (Ba)	ug/L	24.00	13.20	24.10	23.90	25.60
Beryllium (Be)	ug/L	<0.11	<0.11	<0.11	<0.11	<0.11
Boron (B)	ug/L	35.70	57.60	33.50	418.60	23.50
Cadmium (Cd)	ug/L	<0.14	<0.14	<0.14	<0.14	<0.14
Calcium (Ca)	mg/L	5.50	5.60	4.10	23.40	4.60
Chromium (Cr)	ug/L	0.41	<0.4	0.44	0.76	0.56
Cobalt (Co)	ug/L	<0.50	<0.50	1.21	1.50	1.34
Copper (Cu)	ug/L	<0.5	<0.5	<0.5	2.15	<0.5
Iron (Fe)	ug/L	198.90	41.70	443.50	164.90	560.70
Lead (Pb)	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3
Magnesium (Mg)	mg/L	2.40	2.40	2.60	3.80	1.90
Manganese (Mn)	ug/L	430.40	113.60	462.80	653.50	485.00
Nickel (Ni)	ug/L	<2.0	<2.0	2.62	17.65	<2.0
Potassium (K)	mg/L	4.90	5.90	4.70	11.10	3.30
Selenium (Se)	ug/L	<3.0	<3.0	<3.0	<3.0	<3.0
Sodium (Na)	mg/L	10.50	14.00	6.30	107.40	4.70
Vanadium (V)	ug/L	<1.0	<1.0	<1.0	2.43	<1.0
Zinc (Z)	ug/L	5.60	3.50	5.00	17.40	4.80
Hardness	mg/L	24.00	24.00	21.00	74.00	20.00
* Turbidity was not run due to laboratory technician error.						

APPENDIX B - SEDIMENT PESTICIDES

STATION ID	units	CON 1 *	CON 2 *	CON 3	CON 4	CON 5
Sediment Pesticides						
October 12, 1998						
Time				1000	1020	1140
Molinate	ug/g			<.00059	<.00618	<.00418
Propachlor	ug/g			<.00072	<.00968	<.00301
Trifluralin	ug/g			<.00017	<.00144	<.00076
Alpha-BHC	ug/g			<.00155	<.01430	<.01121
Atraton	ug/g			<.00076	<.01056	<.00360
Prometon	ug/g			<.00039	<.00589	<.00120
Simazine	ug/g			<.00382	<.02980	<.01020
Atrazine	ug/g			<.00531	<.00583	<.00388
Propazine	ug/g			<.00041	<.00549	<.00219
Beta-BHC	ug/g			<.00203	<.01869	<.01464
Gamma-BHC	ug/g			<.00145	<.01335	<.01045
Terbutylazine	ug/g			<.00824	<.05098	<.01902
Diazinon	ug/g			<.00433	<.01578	<.00313
Fluchloralin	ug/g			<.00028	<.00203	<.00122
Fonofos	ug/g			<.00090	<.01370	<.00380
Delta-BHC	ug/g			<.00211	<.01939	<.01519
Cyprazine	ug/g			<.00055	<.00643	<.00109
Metribuzin	ug/g			<.00049	<.00718	<.00141
Methyl-Parathion	ug/g			<.00045	<.00494	<.00387
Alachlor	ug/g			<.00048	<.01136	<.00201
Ametryn	ug/g			<.00031	<.00605	<.00287
Prometryn	ug/g			<.00049	<.00260	<.00250
Heptachlor	ug/g			<.00071	<.01137	<.00485
Terbutryn	ug/g			<.00031	<.00719	<.00420
Metolachlor	ug/g			<.00024	<.00476	<.00165
Malathion	ug/g			<.00088	<.01731	<.00451
Dipropetryn	ug/g			<.00022	<.00366	<.00192
Chlorpyrifos	ug/g			<.00083	<.00640	<.00294
Cyanazine	ug/g			<.00112	<.01298	<.00412
Aldrin	ug/g			<.00096	<.01050	<.00824
Pendimethalin	ug/g			<.00022	<.00183	<.00179
Heptachlor-Epoxide	ug/g			<.00056	<.00578	<.00418
Endosulfan-I	ug/g			<.06043	<.06413	<.03082
p-p'-DDE	ug/g			0.0009	<.00144	<.00075
Dieldrin	ug/g			<.00354	<.09894	<.01502
Endrin	ug/g			<.00170	<.02433	<.01461
Endosulfan-II	ug/g			<.00480	<.07315	<.03207
p-p'-DDD	ug/g			<.00018	<.00409	<.00073
Endosulfan-Sulfate	ug/g			<.00074	<.00936	<.00302
p-p'-DDT	ug/g			<.00014	<.00315	<.00056
Hexazinone	ug/g			<.00127	<.02516	<.00229
Methoxychlor	ug/g			<.00009	<.00224	<.00081
PCB-as-AR1221	ug/g			<.00136	<.03241	<.00573
PCB-as-AR1232	ug/g			<.00282	<.06708	<.01185
PCB-as-AR1242	ug/g			<.00838	<.33912	<.07186
PCB-as-AR1248	ug/g			<.02311	<.93488	<.19812
PCB-as-AR1254	ug/g			<.03134	<.06213	<.14654
PCB-as-AR1260	ug/g			<.01316	<.02608	<.06153
Technical-Chordane	ug/g			<.00645	<.01428	<.04763
* Sediment samples not collected at these stations.						

APPENDIX C - SEDIMENT METALS

STATION ID	units	CON 1 *	CON 2 *	CON 3	CON 4	CON 5
Sediment Metals						
October 12, 1998						
Collect Time	hrs			1000	1020	1140
Aluminum (Al)	mg/Kg			1620.0	2650.0	2450.0
Arsenic (As)	mg/Kg			<5.0	<5.0	<5.0
Barium (Ba)	mg/Kg			0.7	0.9	0.8
Beryllium (Be)	mg/Kg			83.0	90.0	52.0
Copper (Cu)	mg/Kg			6.3	21.0	8.7
Chromium (Cr)	mg/Kg			3.2	28.0	5.9
Cobalt (Co)	mg/Kg			11.0	10.0	7.1
Cadmium (Cd)	mg/Kg			<0.16	<0.16	<0.16
Calcium (Ca)	mg/Kg			877.0	2390.0	975.0
Iron (Fe)	mg/Kg			7510.0	14400.0	7670.0
Magnesium (Mg)	mg/Kg			466.0	410.0	358.0
Manganese (Mn)	mg/Kg			469.0	1440.0	369.0
Nickel (Ni)	mg/Kg			5.4	37.8	5.5
Lead (Pb)	mg/Kg			12.6	24.3	22.0
Vanadium (V)	mg/Kg			6.9	5.8	8.7
Zinc (Z)	mg/Kg			21.0	197.0	44.0
* Sediment samples not collected at these stations.						