LAKE CHICKASHA

CLEAN LAKES PROJECT:

DIAGNOSTIC AND FEASIBILITY

PHASE I

FINAL REPORT

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FINAL REPORT
SEPTEMBER, 1994

Oklahoma Conservation Commission
Water Quality Section
The following report was prepared by the Water Quality Section of the Oklahoma Conservation Commission. Jim Boggs, Clean Lakes Coordinator for O.C.C., was the principle investigator for the project and primary author

of this report. However, much assistance was provided by the following staff:

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Dan Butler, Aquatic Biologist - Sampling assistance and data interpretation.

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This project was dependent upon coordination among the following governmental agencies and their respective representatives:

The U.S. Geological Survey - Joanne Kurklin, Water Quality Specialist/ Hydrologist and Kathy Peter, District Chief, Oklahoma City.

The U.S. Department of Agriculture, Agricultural Research Station, Durant, Oklahoma. - Dr. Frank Scheibe phD, Director, Water Quality and Watershed Research Laboratory.

Oklahoma Department of Pollution Control - Patsy Hudson, Executive Assistant.

Grady County Conservation District, Chickasha, OK. - Dee Surber, Programs Coordinator; Johnny Pelley, Engineering Aide.

City of Chickasha, Police Department - David Smith, Lake Ranger.

Citizen Volunteers who collected data from staff gauges are as follows:

Steve Sanders, Verden, OK. Clyde Williams, Verden, OK.

LAKE CHICKASHA

EXECUTIVE SUMMARY

Although Lake Chickasha was originally constructed to supply drinking water to the City of Chickasha, this reservoir is primarily a recreational facility. Due to high sulfate concentrations originating from gypsum deposits in the geologic formations under the lake, any utility for drinking water was abandoned. Water quality data collected as part of the state's lake assessment program have indicated elevated levels of chlorophyll *a* and high levels of dissolved solids.

Under section 314-A of the Clean Water Act, a study was conducted from March 1991 to October 1992 on the lake and its tributaries. The purpose of this study was to assess the impact of the watershed on the lake, current trophic conditions in the lake, the effect of these conditions on recreational use, and to develop feasible restoration strategies.

The study confirms that Lake Chickasha is hypereutrophic, with peak chlorophyll levels above 75 ug/L. This is due to algal blooms supported by nutrient loading from the watershed and agricultural land use proximal to the shoreline of the lake itself. Sediments revealed low levels of 2-4-D and Atrazine, which did not exceed federal or state MCL. Water samples from the dam and Stinking Cr. arm detected levels of mercury which exceeded chronic limits for aquatic life support. Mercury concentrations did not exceed 1991 Oklahoma Water Quality Standards numerical criteria for the protection of human health. The lake is impacted by shoreline erosion due to a lack of established stabilizing vegetation. These prevailing conditions negatively impact recreational activities especially those associated with fishing.

Presently, there are no restoration plans or Phase II programs in place for Lake Chickasha. However, Phase II restoration options are suggested. These options include improved pasture management and riparian regeneration at sites on inflows, establishment of appropriate shoreline vegetation at severely eroded sites on the lake, and the application of alum to the lake to control phosphorous. These options are labor intensive, expensive and may require many years to demonstrate improvement. Cooperation on the part of landowners/ managers and governmental agencies is necessary to the successful restoration of this public recreational facility.

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DIAGNOSTIC STUDY

I.1 Lake Identification and Description

Lake Chickasha is located in Caddo County at approximately Section 34, Township 8N, Range 9WIM. The approximate center of the lake is Latitude 35° 07' 49" and longitude 97° 55' 27". Lake Chickasha is owned and managed by the City of Chickasha, the county seat of Grady County located twelve miles east of the lake. This lake is 1370 acres in surface area, and contains 15,000 acre-feet of water at the normal pool elevation of 1182 feet mean sea level. Lake Chickasha was originally named Spring Creek Reservoir as part of a SCS workplan. Figure I-1 shows lake location, sample sites, tributaries, and extent of the watershed.

I.2 Geological and Hydrological Description of Drainage Basin

Lake Chickasha has a 19,019 hectare or 46,978 acre watershed (Oklahoma Water Atlas, 1990). The major hydrologic contributors to the lake are Spring and Stinking Creeks, both third order perennial streams. Spring Creek flows into the northwestern arm and Stinking Creek flows into the Northeastern arm of Lake Chickasha. Approximately 90 % of the watershed is equally distributed in these two drainages. Below the Lake Chickasha dam Spring Creek is a tributary of the Washita River.

The topography of the area slopes gradually from the northwest to the southeast as the Washita River takes its southeasterly course. The elevation of the Lake Chickasha watershed ranges 1,610 to 1,170 feet(msl) for the normal pool elevation for the lake. The alluvial plain immediately downstream from the Lake Chickasha dam is at elevation 1,150 feet msl. The watershed consists almost entirely of rolling plains, most of which is in native grass (mixed and tall grass prairie) with some timbered areas (primarily post oak - blackjack oak and eastern red cedar in uplands; sycamore, cottonwood, native pecan and American elm in lowlands). The average annual precipitation of the area is 30-32 inches with average annual runoff of 2-5 inches. Average annual lake evaporation is 62 inches, with a mean temperature of 61° F.

The geology of the area consists of Duncan sandstones and the Chickasha formation and the overlaying Marlow formation and Rush Springs Sandstone. The Chickasha formation is reddish to purplish coarse sandstone with poorly bedded lenses and tongues of clay. Duncan sandstone and the Chickasha formation are found along the east and western shores of Lake Chickasha and along the lower slopes of Stinking Creek watershed. Above the Chickasha formation is the Marlow formation, an even-bedded, orange-brown, fine-grained sandstone, about 100 feet thick, with much gypsum cement, and a few thin pink shales occurring in the upper part.

Figure I-1. Lake Chickasha and Watershed

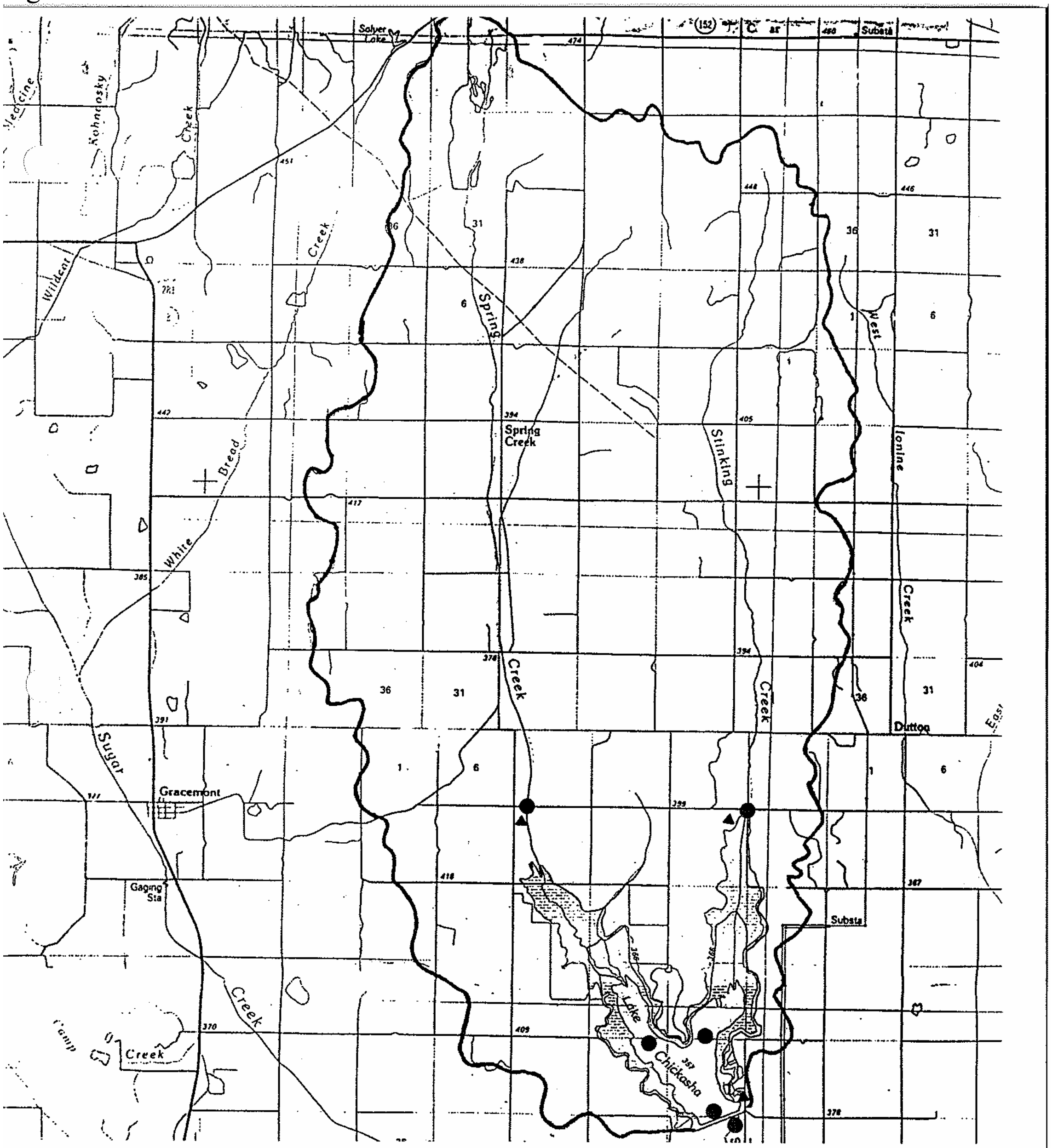

FIGURE I-1

LAKE CHICKASHA AND WATERSHED

Water Quality Sample Sites ● Rain Gauge Locations ▲

The Marlow is exposed along the middle and lower slopes of both Spring and Stinking Creek watersheds. Above the Marlow is the Rush Springs Sandstone, which is 250 to 300 feet of fine-grained, orange-brown, cross-bedded sandstone. The Rush Springs may be 400 feet thick in the subsurface (OWRB, 1969). Rush Springs sandstone is found in the upland areas of the Lake Chickasha watershed. The lower terraces of the watershed along the creeks are of Quartinary alluvium. These deposits of clay and sand fill the valleys that were earlier cut into the bedrock.

Soils of the watershed are characterized as sandy to loamy soils that range from less than 20 inches to greater than 80 inches in depth. A map generated from the Soil Conservation Service 1985 MIAD GIS data of the watershed soils is shown in Figure I-2.

The majority of the uplands within the watershed are typified by soils of the Darnell and Nobel series. These soils are sandy and generally less than 20 inches deep over weakly consolidated sandstones. These soils have rapid permeability and the surface layers are low in organic matter. When disturbed, these soils are susceptible to severe water erosion.

Deep sandy soils are typified by the Dougherty, Eufaula and Konawa series. These soils have permeability ranging from moderate to rapid and have low organic matter levels in the surface layers. These soils are found in gently sloping upland areas.

Deep loamy soils are typified by the Grant, Norge, Minco, Pond Creek, and Cobb series. These soils are very productive and are utilized for cropland agriculture. These soils are generally located along the middle and lower slopes along Spring and Stinking Creeks.

Floodplain soils are typified by the Port, Pulaski, Cyril and Gracemont series. These floodplains are occasionally to frequently flooded and are generally well drained. The Gracemont soils do have an apparent water table and are more poorly drained than the rest of the soils in this floodplain group.

I-3 Lakes Public Access

Lake Chickasha serves the general populace as a multipurpose recreational lake and has fair access from all directions. The lake may be accessed from U.S. highway 281 south from Binger or north from Anadarko. Also, access is easily found from Verden, Oklahoma which is 12 miles west of Chickasha, 8 miles east of Anadarko on State Highway 9 - U.S. Highway 62. U.S. Highway 281 can be accessed from U.S. Interstate 40, west of Oklahoma City and U.S. Highway 62 - State Highway 9 can be accessed from U.S. Interstates 44 and 35, south of Oklahoma City. The dam may be accessed 2 miles west of Caddo-Grady county line road (Figure I-3).

Figure I-2. Soils of Lake Chickasha Watershed.

Figure I-3. Public Access to Lake Chickasha.

I-4 Size and Economic Structure of Population Using Lake

Lake Chickasha is used primarily by people residing in the Cities of Chickasha, Verden, Anadarko, and rural areas of Grady and Caddo counties. Survey information from the City of Chickasha indicates that the majority of people who visit Lake Chickasha are from Caddo and Grady counties (75%), 20% come from all around the state, and 5% come from other states. Demographics for the local area are as follows (U.S. Census, 1990):

	Grady Co.	Caddo Co.
Population	41,747	29,555
Median Age	33.4 yrs	34.3 yrs
Mean Income	$21,885.00	$17,857.00

I-5 Historical Lake Uses and Trends in Use

Lake Chickasha was originally constructed in 1958 for the purpose of supplying water to the population of Chickasha, Oklahoma. Before inundation, the lake bed was farm and pasture land.

Soon after construction, the City of Chickasha abandoned the lake as a primary drinking water source due to high levels of dissolved solids. Deposits of gypsum in the watershed and underlying the lake contribute to these dissolved solids and result in excessive amounts of sulfate. Dissolved solids and sulfates in the concentrations found in Lake Chickasha do not hinder primary productivity or water quality for aquatic organisms, however this water is difficult and expensive to treat for municipal drinking purposes.

Presently, Lake Chickasha provides recreational benefits to the community and generates revenue associated with fishing, skiing, boating, camping, and hunting.

I-6 Lake User Population Impacted by Lake Degradation

All recreation users would be impacted by further degradation of Lake Chickasha. Primarily, anglers would be impacted the most. It is conceivable that the majority of the combined population of Grady and Caddo counties would be impacted by further degradation.

I-7 Comparison of Lake Use to Other Lakes in 80 km Area

Table I-1 provides a list of lakes that are within an 80 km distance from Lake Chickasha.

Table I-1. Comparison of Lake Use to Other Lakes in 80 km Area

Lake	Recreation	Water Supply	Wild-life Mgmt	Flood Cntl.	Storage	Surface Acres
American Horse Lake	X			X	X	100
Lake Arcadia	X	X		X	X	1820
Lake Burtschi	X			X	X	180
Lake Chickasha	X	X	X	X	X	820
Clear Creek Res.	X	X		X	X	722
Crowder Lake	X			X	X	158
Dave Boyer Lake	X	X		X	X	148
Duncan Lake	X	X			X	500
Ellsworth Lake	X	X	X	X	X	5600
Lake Elmer	X				X	60
Elmer Thomas Lake	X				X	334
El Reno Lake	X			X	X	170
Fort Cobb Reservoir	X	X	X	X	X	4100
Fuqua Lake	X	X		X	X	1500
Humphreys Lake	X	X		X	X	882
Hefner Lake	X	X			X	2500
Lake Lawtonka	X	X	X	X	X	2398
Lake Overholser	X	X			X	1500
Purcell Lake	X	X			X	150
Quanah Parker Lake	X				X	89
Stanley Draper	X	X			X	2900

Lake	Recreation	Water Supply	Wild-life Mgmt	Flood Cntl.	Storage	Surface Acres
American Horse Lake	X			X	X	100
Lake						
Taylor Lake	X	X		X	X	227
Lake Thunderbird	X	X	X	X	X	6070
Tom Steed Lake	X	X	X	X	X	6400
Vanderwork Lake	X					135
Waurika Lake	X	X	X	X	X	10,100
Wiley Post Memorial Lake	X	X		X	X	302

Use criteria provided at each lake is denoted with either an X or P symbol. X equals full use, P = partial use.

I-8 Inventory of Point Source Pollutant Discharges

There are no point source discharges into Lake Chickasha or its watershed.

I-9 Watershed Landuse and Watershed Production

Figure I-4 is a computer generated image produced from data input to GRASS software by the Soil Conservation Service. This graphic demonstrates 11 categories of 7 land uses. Table I-2 demonstrates that pasture is the major land use in the Lake Chickasha watershed (46.7%). Other significant land uses in the watershed are total cropland (21%), total rangeland (16.1%), and upland forest (14%). The remaining 1% of the land is associated with roads and housing with a mixture of ranchettes, and suburban dwellings.

Brush control methods are being used throughout the watershed with defoliant being used in the northern end of the watershed for range and pasture management. Wheat occupies at least half of the cropland, with the rest being occupied by corn (non-irrigated), alfalfa, cotton, sorghum, millet, and sudan grass. The cultivated areas are generally located on the lower watershed slopes and alluvial terraces of Spring and Stinking creeks or their major tributaries. Because of their limited availability, the higher quality Port, Pulaski, Cyril and Gracemont soils of the flood plains are, in many places, cultivated to the stream bank. While only a relatively small portion of the watershed is cultivated, the close proximity of that land to the streams allows much greater potential of impact from that land use to the lake.

Of concern in the watershed within the immediate vicinity of the lake are the septic systems on the east shore mobile home park. Although not sampled in this study there appears to be some subsurface flow manifest by the cattail bed on the east shore down hill from the residential area.

Oil and gas exploration and completed wells are of minor concern within the watershed. Although not a major oilfield, there are several producing wells and some exploration. Several unreclaimed locations from recent drilling can be observed and at the time of this writing one active drilling rig was observed in the watershed.
The unpaved section roads and eroding bar ditches are of concern even though they comprise only a small portion of the watershed.

Figure I-4. Land Use Within Lake Chickasha Watershed.

Table I-2. Land Use Within Lake Chickasha Watershed.

Land Use Categories

Cat#	Name	Acres
1	Cropland *(20.7%)	9745.62
2	Cropland - irrigated (.03%)	19.77
4	Rangeland - Open Grasslands (11.4%)	5376.90
13	Rangeland - Blackjack-Postoak Brush LD canopy <35% (3.1%)	1433.18
14	Rangeland - Blackjack-Postoak Brush HD canopy >35% (1.5%)	711.65
15	Rangeland - Cottonwood, Elm, Hackberry, Willow - LD canopy <20% (.1%)	39.54
25	Pastureland (46.7%)	21942.48
33	Postoak-Blackjack Oak Cover Type (14.0%)	6562.98
44	Urban Ranchettes - House & Lot, 2-20 ac. (.05%)	29.65
45	Farmsteads - Greater than 5 acres (.02%)	9.88
98	Water (2.4%)	1107.01
	Totals (100.0%)	46978.66

* Percent useage of total area in watershed

I-10 Lake Limnology

A. Investigative approach

Seasonal sampling by the Oklahoma Conservation Commission in the years 1987 through 1989 indicated that Lake Chickasha was eutrophic to hypereutrophic by the Carlson trophic state Index based on chlorophyll *a* values. Impairment of the recreational uses were recognized as potential results of the high trophic state. The high chlorophyll *a* and corresponding algae blooms in mid to late summer threaten body contact uses and the aesthetics of the lake. While the lake is currently supporting a sports fishery, potential oxygen depletions resulting from massive algae blooms threaten the aquatic community. Based on these data the limnological objectives of this investigation are to:

Assess the lake water quality, physical conditions, and trophic state.

Evaluate the watershed effects, such as sediment and nutrient loading on the lake.

Identify lake problems and their causes.

B. Experimental Procedures

1. Lake Location and Sampling Sites

Lake Chickasha is located approximately 12 miles northwest of the town of Chickasha. Three sampling sites were established on Lake Chickasha for assessment of the lake water quality. These sites were located to represent the main body of the lake at its deepest point and the two arms fed by Spring and Stinking Creeks. Additional sites were established on each of the two main tributaries and on Spring Creek downstream of the reservoir. These sites included staff flow gauges for the purpose of determining lake nutrient and hydrologic budgets. Figure I-1 shows the location of the reservoir, the watershed, lake sampling stations, and sampling stations on the two major tributaries.

2. Lake and Tributary Sampling

The lake and its two tributaries were first sampled in March, 1991 and were sampled at least monthly throughout the project. During the warmer months of the year, May through September, the lake and the two tributaries creeks, were sampled twice per month. Sampling dates are listed in Table I-3.

Table I-3.Sample Dates for Lake Chickasha and Tributaries

Sample Event	Date	Sample Event	Date
1.	3/19/91	14.	12/ 3/91
2.	4/18/91	15.	12/17/91
3.	5/ 6/91	16.	12/31/91
4.	5/22/91	17.	2/ 6/92
5.	6/ 6/91	18.	2/17/91
6.	6/24/91	19.	3/23/92
7.	7/ 9/91	20.	4/ 6/92
8.	7/25/91	21.	4/22/92
9.	8/ 8/91	22.	5/ 8/92
10.	8/26/91	23.	6/12/92
11.	9/13/91	24.	6/26/92
12.	10/14/91	25.	7/13/92
13.	10/31/91	26.	8/10/92

All water quality sampling was carried out according to Standard Operating Procedures on file at the Oklahoma Conservation Commission or as written in the project workplan. A brief summary of these methods follows.

Water temperature, dissolved oxygen, conductivity, and pH profiles were taken in situ at all lake sites with the assistance of a Hydrolab Surveyer III - H2O instrument. Profiles were taken at 1 meter increments from the water surface to the lake bottom. Water transparency was measured with a 20 cm Secchi disk. Water temperature, dissolved oxygen, pH, and conductivity were determined in situ in the two tributaries creeks.

Grab samples were collected from 0.1 m below the surface at the two lake inflows. At lake locations, water was collected at 0.1 m, mid-depth, and 0.5 m above bottom, and then composited into a single sample. When stratification was evident, discrete samples were taken from 0.1 m and from 0.5 m above the lake bottom. Routine water quality samples for analyses of required parameters were taken in appropriate containers handled and preserved as follows:

Nutrients - 0.5 ml HgCl to 125 ml of sample @ 4^oC.

TDS & TSS - no preservative, 500 ml of sample.

Chlorophyll, suspended sediment, SO_4 & Cl - no preservative, 1000 ml sample, @ 4^oC.

Metals (2 times only) - 1ml HNO_3 to 125 ml of sample (2 ea.), 1 ml HNO_3/Dichromate to 250 ml of sample.

Sediment (once only) - no preservative, store @ 4°C.

Zooplankton (quarterly) - collected by vertical tow of Wisconsin plankton net, store in D.I. water, ship immediately to analysis lab (USDA - ARS, Durant, Okla.) @ 4°C.

Phytoplankton (quarterly) - Top, mid-level, and bottom composite sample in a 500 ml container, @ 4°C, ship immediately to analysis lab (USDA - ARS, Durant, OK).

Benthic macroinvertebrates (once during summer, lake only) - sieve bottom material with #30 mesh, preserve organisms with 70% ethanol.

Fish flesh (1 time only) - no preservative @ -18°C.

Twice throughout the project, additional sampling on lake sites was performed for metals analyses. These samples were taken along with routine samples.

Sediment samples were collected from the deep water location at the dam and in both upper lake arms. Samples were obtained utilizing a Ponar Dredge, placed in a 16 oz. solvent rinsed glass jar with a teflon lid, and stored on ice until delivered to the laboratory for analyses of nutrients, metals, total organic carbon, and pesticides.

A 500 ml portion of sample composited at the dam site was collected quarterly for analysis of phytoplankton. A single, bottom to surface vertical tow with a Wisconsin net was taken to collect zooplankton from the dam site. These samples were sent immediately to the USDA Agricultural Water Quality Research Lab in Durant, OK. for taxonomic identification and community analysis.

Samples were taken from inflow streams during four high flow events throughout the course of the study. High flow samples were taken by means of stage activated Manning automatic samplers courtesy of the USGS. Sampling was set to be initiated on a 12 inch rise in creek level. Samples were subsequently drawn at hourly intervals. Gross composites of each event were analyzed for the appropriate field parameters, nutrients, metals, and pesticides.

C. Morphological and Hydrological Characteristics of the Lake

1. Morphology

Lake Chickasha is typical of impoundments constructed at the confluence of 2 perennial streams. The two arms, north of the dam, are relatively equal in size and volume. Stinking Creek arm is short (about 1 mile) and wide whereas Spring Creek arm is long (about 1 1/3 miles) but relatively narrow. A hilly peninsula lies between these 2 arms and drains a grazed pasture directly into the lake. The dam extends southwest to northeast (@ about 30^{o}) for about 1/2 mile. Maximum depth at the dam is 32 feet.

On June 27, 1991, personnel from O.C.C., U.S.G.S. and the U.S.D.A. Agricultural Research Service (Durant, OK) conducted transect measurements at Lake Chickasha. From depth and geographical information collected with the aid of the Global Positioning Satellite service (U.S.G.S.), a bathymetric survey of Lake Chickasha was created (Figure I-5).

2. Hydrological investigations

Flow into and discharge from Lake Chickasha were measured by the fixed staff gauges at the routine sample sites on Stinking and Spring Creeks and a location approximately 0.5 miles downstream of the outfall of the dam. These facilities were constructed and stage discharge curves were calibrated by the U.S.G.S. Staff gauges were read daily by local volunteers. Data management and analyses were performed by the U.S.G.S. office in Oklahoma City, OK.

Precipitation was measured by the use of 3 rain gauges with strip-charts, placed in strategic locations in each of the two sub-watersheds and close to the dam. This information was used to estimate the total quantity of water contributed to the lake and watershed by rainfall.

Evaporation coefficients were determined from data collected from pan evaporators in the watershed. These were managed and monitored by U.S.G.S. personnel.

Figure I-5. Bathymetric Survey of Lake Chickasha.

D. Results

1. Water Quality of the Lake

This comprehensive water quality study on Lake Chickasha and watershed was initiated on March 19, 1991 and proceeded through June 26, 1992. Sampling was conducted monthly from October through April. From May through September, sampling frequency was increased to bi-monthly. There were 3 lake sites, 2 inflow stream sites, and 1 site located at the outfall pipe below the dam. The results of this project are discussed in the following sections.

a. Thermal Structure of the Lake

The thermal structure of Lake Chickasha is as expected for a shallow wind swept lake. The dam site is at the deepest point(8.5m) in the lake and is locally protected from the prevailing south winds of summer by the crest of the dam rising 40 feet above the normal pool elevation. This sample site demonstrated the highest degree of vertical variability. Weak thermal stratification was demonstrated at the dam site from late May through the second week of July, 1991. Similar conditions were observed again in June 1992. Vertical profiles in the two arms were generally uniform throughout the survey. The two arms of the lake have depths of only 4-5 m and no protecting land forms. Complete lake data can be found in Appendix B. Table I-4 presents temperature profiles from March 1991 through August 1992 for the deep water location located near the dam. Sites in the two windswept arms of the lake show more temporal variability with temperature profiles determined by prevailing weather conditions.

b. Dissolved Oxygen

Table I-5 describes dissolved oxygen profiles taken throughout the study at the dam. Dissolved oxygen, as with temperature, was most variable and demonstrated the greatest extremes at the deep water location. Complete data on the entire lake and inflows can be found in Appendix...

Dissolved oxygen profiles generally reflect the highly mixed condition of Lake Chickasha with mid-morning concentrations generally near saturation. During late May, June and early July of 1991 and again in June of 1992 dissolved oxygen concentrations below the depth of five meters were extremely low. The lake at these times showed only weak temperature stratification. By the end of July 1991 and early July 1992 these conditions were eliminated with complete vertical mixing as manifest by nearly homogenous temperature and dissolved oxygen profiles.

Table I-4. Temperature Profiles for the Deep Water Location Near the Lake Chickasha Dam. All values are in degrees Centigrade. There were 26 sample dates.

Depth (meters)	Survey Number/ Month/Year 1	2	3	4	5	6	7	8	9	10	11	12	13
	3/91	4/91	5/91	5/91	6/91	6/91	7/91	7/91	8/91	8/91	9/91	10/91	10/91
0.1	10.1	18.6	18.2	23.5	24.4	26.8	27.1	27.5	27.7	27.0	25.7	18.8	13.2
1.0	10.1	18.6	18.2	23.6	24.4	26.9	27.1	27.6	27.7	27.0	25.7	18.9	13.2
2.0	10.1	18.6	18.2	23.6	24.4	26.9	27.1	27.7	27.7	27.0	25.7	18.9	13.2
3.0	10.1	18.5	18.2	23.3	24.4	26.9	27.1	27.6	27.7	27.1	25.7	18.9	13.2
4.0	10.1	18.5	18.3	22.6	24.4	26.9	27.1	27.7	27.7	27.1	25.7	18.9	13.2
5.0	10.1	18.5	18.3	21.1	24.4	26.0	27.1	27.7	27.7	27.1	25.7	18.9	13.3
6.0	10.1	18.4	18.3	20.5	24.3	25.3	26.5	27.7	27.7	26.9	25.7	18.9	13.3
7.0	10.0	18.4	18.3	19.7	23.7	24.9	26.4	27.7	27.7	26.6	25.7	18.8	13.2
8.0	----	18.1	18.3	19.1	23.6	24.4	26.1	27.7	27.4	26.4	25.6	18.8	13.2
8.5	----	18.0	18.3	19.1	----	----	----	27.7	27.1	26.3	25.5	----	13.2
9.0	----	----	----	----	23.5	23.9	26.1	----	----	----	----	18.6	----
9.5	----	----	----	----	----	----	----	----	----	----	----	----	----

Depth (meters)	Survey Number/ Month/Year 14	15	16	17	18	19	20	21	22	23	24	25	26
	12/91	12/91	12/91	2/92	2/92	3/92	4/92	4/92	5/92	6/92	6/92	7/92	8/92
0.1	6.9	8.8	6.8	7.1	7.1	12.4	13.4	17.3	19.4	23.9	26.1	26.1	27.1
1.0	6.9	8.8	6.7	7.1	7.1	12.3	13.4	17.2	19.4	23.9	26.1	26.1	27.1
2.0	6.9	8.8	6.7	7.1	7.1	12.2	13.4	17.0	19.4	23.8	26.1	26.1	27.1
3.0	6.9	8.8	6.7	7.0	6.9	12.2	13.3	17.0	19.3	23.8	26.1	26.1	27.1
4.0	6.9	8.8	6.7	6.9	6.9	12.2	13.2	17.0	19.3	23.7	26.1	26.1	27.1
5.0	6.9	8.8	6.7	6.9	6.9	12.2	13.1	16.9	19.2	22.0	25.9	26.1	27.1
6.0	6.9	8.8	6.7	6.9	6.9	12.2	13.1	16.9	19.2	20.1	24.5	26.1	27.0
7.0	6.9	8.8	6.7	6.9	6.9	12.2	13.1	16.9	19.1	19.8	24.2	26.1	27.0
8.0	6.9	8.8	6.7	6.9	6.9	12.2	13.1	16.9	19.0	19.5	23.5	26.1	27.0
8.5	---	---	---	---	---	----	----	----	18.9	19.2	22.5	----	----
9.0	---	8.8	6.7	6.9	6.9	12.2	13.0	16.8	----	----	----	----	----
9.5	---	---	---	6.9	6.9	12.2	----	----	----	----	----	----	----

Table I-5. Dissolved Oxygen Profiles for the Deep Water Location Near the Lake Chickasha Dam. All values are in milligrams per liter, oxygen.

Depth (meters)	Survey Number/ Month/Year												
	1	2	3	4	5	6	7	8	9	10	11	12	13
	3/91	4/91	5/91	5/91	6/91	6/91	7/91	7/91	8/91	8/91	9/91	10/91	10/91
0.1	11.5	8.3	8.1	7.1	7.7	5.8	6.3	6.5	6.0	7.3	7.5	7.4	9.0
1.0	11.5	8.3	8.0	7.2	7.7	5.8	6.2	6.4	5.8	7.3	7.9	7.4	9.0
2.0	11.3	8.0	8.0	7.1	7.7	5.7	6.2	6.4	5.8	7.3	7.3	7.4	8.9
3.0	11.3	7.8	8.0	6.1	7.7	5.7	6.1	6.4	5.8	7.3	7.1	7.5	8.8
4.0	11.3	7.8	8.0	3.9	7.6	5.5	6.0	6.4	5.7	7.2	7.3	7.4	8.8
5.0	11.2	7.8	8.0	3.9	7.6	0.7	6.0	6.4	5.7	7.1	7.2	7.5	8.7
6.0	10.1	7.4	8.0	2.7	7.0	0.2	2.6	6.4	5.7	6.3	7.1	7.4	8.7
7.0	10.0	7.3	8.0	1.3	5.0	0.1	1.8	6.3	5.6	5.5	7.1	7.2	8.6
8.0	----	5.8	8.0	0.1	4.2	0.2	0.2	6.3	3.7	4.6	3.7	6.8	8.6
8.5	----	5.0	8.0	0.1	---	---	---	6.3	0.9	4.4	3.5	---	8.6
9.0	----	---	---	---	3.6	0.1	0.2	---	---	---	---	5.5	---
9.5	----	---	---	---	---	---	---	---	---	---	---	---	---

Depth (meters)	Survey Number/ Month/Year												
	14	15	16	17	18	19	20	21	22	23	24	25	26
	12/91	12/91	12/91	2/92	2/92	3/92	4/92	4/92	5/92	6/92	6/92	7/92	8/92
0.1	10.6	11.4	11.5	10.2	10.2	9.9	9.5	9.1	7.3	9.0	7.6	7.3	6.9
1.0	10.5	11.3	11.4	10.1	10.1	9.2	9.4	9.2	7.0	8.9	7.5	7.2	6.6
2.0	10.4	11.1	11.3	10.1	10.1	9.4	9.3	8.8	6.9	8.9	7.5	7.1	6.3
3.0	10.3	11.0	11.3	10.0	10.0	9.3	9.1	8.7	6.7	8.6	7.5	7.1	6.3
4.0	10.3	10.8	11.2	10.0	10.0	9.4	9.0	8.7	6.6	8.4	7.4	7.1	6.2
5.0	10.3	10.8	11.1	10.0	10.0	9.3	8.8	8.6	6.4	5.3	6.9	7.0	6.1
6.0	10.3	10.8	11.0	10.0	10.0	9.3	8.7	8.6	6.3	3.3	2.5	7.0	6.0
7.0	10.3	10.7	11.0	10.0	10.0	9.2	8.7	8.6	6.3	2.2	1.2	7.0	6.0
8.0	10.3	10.6	10.9	10.0	10.0	9.2	8.6	8.3	5.7	1.7	0.6	7.0	5.9
8.5	----	----	----	----	----	---	---	---	5.5	0.7	0.1	---	---
9.0	----	10.6	10.9	10.0	10.0	9.1	7.8	7.6	---	---	---	---	---
9.5	----	----	10.9	10.0	10.0	---	---	---	---	---	---	---	---

c. Chlorophyll *a* and Secchi Depth

Figures I-6 and I-7 present graphs of chlorophyll *a*, turbidity, and Secchi depth data over time for the sample site at the dam during the course of this study. Data are corrected for pheophytin *a*. Data suggest that chlorophyll *a* tends to peak at two distinct times of the year. Peak values have been detected during the coldest part of the year, December, and the onset of the growing season in April. It appears that these peaks follow runoff events which produced high nutrient inputs. Data also suggest that a winter rise in chlorophyll *a* may be related to increased transparency which correlates with a drop in TSS.

Predictably, the spring maximum values of chlorophyll *a* (1991 & 1992) are consistent with other studies (Wetzel, 1983) and are partly a result of nutrient loading from intensified land use practices via spring runoff and warmer water temperatures. Both are common to this time of year. As unbound nutrients are utilized early in the growing season, competition for phosphorous and other inorganic nutrients (ie. silica, magnesium) among algal populations probably increase, ultimately resulting with a decreased rate in algal growth. To some degree, this appears to hold true from May through June, 1991 as chlorophyll *a* values follow a downward trend (26.9 mg/L to 12.7 mg/L at dam). It would be inappropriate to generalize much more than this for Lake Chickasha. Interactions among algal communities (diatoms, blue-green, green), nutrients, zooplankton grazing, fish populations, and weather tend to create complexities which were not addressed and are beyond the scope of this study due to the short period of time allocated.

Chlorophyll *a* shows weak negative correlation to secchi depth at low concentrations. Concentrations greater than 40 ug/l show little additional effect on secchi depth as shown in Figure I-8.

Chlorophyll *a* concentrations taken during this study are similar to seasonal samples taken over the preceding four years with highest levels found in the spring. A very high chlorophyll *a* taken in March 1992 gives evidence to the extreme blooms occurring on Lake Chickasha. Regular herbicide applications controlling the macrophytes and herbicide contributions from the watershed may have skewed the trophic response of Chickasha Lake.

The mean secchi depth of 26 inches and the high chlorophyll *a* manifest as a distinct green color confirm the potential for impairment of body contact recreational uses of Lake Chickasha as mentioned in the application for this project. The consistently low secchi and corresponding algae bloom, however, are desirable and frequently a goal of fisheries enhancement programs.

Figure I-6. Secchi and chlorophyll

Figure I-7. Secchi and chlorophyll

d. Nitrogen and Phosphorous

Data regarding these nutrients are presented in Appendix B. An important reason for nutrient measurement is to determine which component is limiting algal growth in the lake. Total nitrogen values tend to be consistently high in relationship to the typically low values of total phosphorous found in the lake. The ratio of nitrogen to phosphorus ranges from 10:1 to 43:1 with a mean of 24:1. This infers that the lake is, in absence of other limiting factors, generally phosphorus limited. Figure I-8 shows the relative concentrations of N and P and the N:P ratio. This figure shows the two nutrients have a similar pattern over time. The figure also shows that when peak levels occur the ratio drops to where nitrogen becomes limiting for algal growth.
Nutrient loading and the lake trophic response will be discussed in section F.

e. pH, TDS, TSS, Alkalinity, Turbidity, and Specific Conductance

Data regarding the above parameters are presented in Appendix B. Surface alkalinities of lake sites ranged from 78 mg/L (as $CaCO_3$) in August, 1991 to 129 mg/L in April, 1991. Bottom alkalinities ranged from 73 mg/L in August, 1991 to 140 mg/L in June, 1992. There did not appear to be any significant trends in the relationship between top and bottom values over time, among seasons. Alkalinities of the inflow streams ranged from 202 mg/L to 388 mg/L. These are typical of alkalinities of this area of Oklahoma.

Surface pH values from lake sites ranged from 7.2 to 8.4 with the highest values occurring during algal blooms. Bottom pH values demonstrated the same range as those from the surface, however were typically lower. This was especially evident during times of thermal/chemical stratification where deoxygenation and organic decomposition would tend to create a more reduced environment. Surface and bottom pH values did not appear to be adverse to fish or aquatic invertebrate populations in the lake. pH values from inflows ranged from 7.5 to 8.2 and did not demonstrate any significant seasonal differences.

Surface turbidities at Lake Chickasha ranged from 6.3 NTU to 14.0 NTU. Lake Chickasha is a relatively transparent lake for this area of the state. This is, in part, due to the abundance of course (>1.0 micron) clays and the low abundance of fine clays. Course clays, typically ubiquitous throughout central Oklahoma, tend to settle much faster than fine clays, resulting with increased transparency. Also, high concentrations of divalent cations (ie. Mg & Ca) characteristic of Lake Chickasha, tend to increase cohesiveness among clay particles, facilitating even faster settling rates and more difficulty in resuspension.

Figure I-8.Relative Concentrations of N and P and the N:P Ratio.

Turbidities of comparable lakes in the local area are variable and dependent upon local conditions on any given day. However, mean surface turbidities taken quarterly from Crowder and Vanderwork Lakes of 7.3 and 5.8 NTU respectively during 1991 appeared to be comparable.

Total Suspended Solids (TSS) from lake sites ranged from 1 to 48 mg/L while more variable values from stream sites ranged from 1 to 92 mg/L (not including runoff events). There was no seasonal influence on this parameter and it does not appear that TSS interfered with transparency a great deal as some of the most productive algal blooms, indicated by chlorophyll peaks, corresponding with high TSS values (see Appendix B). Bottom samples typically demonstrated higher values. The lowest surface values were found at the dam while increasingly higher values were found in Stinking Cr. arm and Spring Cr. arm, respectively. The highest values at the lake were found in May, 1991 when samples from the dam and Spring Cr. arm exhibited values of 47 mg/L. This coincided with local runoff events. The lowest values at the lake were found in December, 1991 and May, 1992 (1 mg/L at the dam, 1 mg/L at Spring Cr. arm, and 4 mg/L at Stinking Cr. arm). As discussed in the turbidity section the abundance of cat-ions enhance the settling of the larger clay particles, hence reducing TSS.

Total Dissolved Solids (TDS) from lake sites ranged from 172 mg/L to 1960 mg/L. Most values were consistently over 1500 mg/l. These high values are mostly due to Calcium Sulfate (Gypsum) from local geological formations. As mentioned earlier, Lake Chickasha was constructed atop a gypsum formation. It is apparent that this mineral dissociates into the lake creating high TDS and sulfate values. This can be observed in Appendix B.

Electrical Conductivity (EC) at lake sites was typically above 1800 uS/cm. High EC is typical of central and western Oklahoma as values tend to increase in a westerly trend. This is, in part, due to increasing salinity of the soils and high concentrations of divalent cations (Ca and Mg). EC values at Lake Chickasha in 1991 were higher than mean values found that year at Crowder Lake (1170 uS/cm) and similar to values found at Lake Vanderwork (1920 uS/cm). Both lakes are of comparable size, similar geology and in close proximity to Lake Chickasha.

f. Metals

Raw data for pesticide and metals for the lake and streams (runoff events) may be found in Appendix B. Tables I-6 and I-7 present data regarding analysis of metals in Lake Chickasha, Spring Creek and Stinking Creek during the diagnostic study. Coinciding sediment analyses are discussed in a later section.

Metals analyses for Lake Chickasha were performed on 2 separate occasions by 2 different laboratories (Oklahoma State Dept. of Health - 3/19/91 and U.S. Geological Survey, National Q. W. Lab - 6/26/92). Detection limits (ug/L) for the analyses of trace metals by each lab are listed below (NA = Not Analyzed).

Parameter	OSDH	USGS
As	60	5
Ba	10	NA
Cd	5	1
Cr	10	1
Cu	10	100
Hg	0.5	0.01
Pb	45	10
Ni	25	10
Se	70	1
Zn	5	10

Table I-6.Metals Analyses from Epilimnetic and Hypolimnetic waters in Lake Chickasha, 3/19/91 and 6/26/92. All values are in ug/L. ND = Not Detected, NA = No Analyses performed.

ANALYZING LABORATORY	OSDH						USGS					
DATE >	3/19/91		3/19/91		3/19/91		6/26/92		6/26/92		6/26/92	
SITE >	DAM		SPRING CR. ARM		STINKING CR. ARM		DAM		SPRING CR. ARM		STINKING CR. ARM	
PARAMETER												
LIMNOLOGIC LEVEL >	HYP	EPI	HYP	EPI	HYP	EPI	HYP	EPI	HYP	EPI	HYP	EPI
As	ND	ND	ND	ND	ND	ND	3	2	2	2	2	2
Ba	69	68	73	65	73	69	NA	NA	NA	NA	NA	NA
Cd	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cr	ND	ND	ND	ND	ND	ND	3	1	2	ND	ND	ND
Cu	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ni	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	ND	ND
Se	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zn	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hg	ND	ND	ND	ND	.5*	ND	.2	ND	ND	ND	ND	ND
Fe	342	174	439	153	616	318	190	90	310	120	110	140
Mn	152	122	172	117	176	139	--	60	140	50	110	80

* This analysis was followed up on immediately by taking a sediment sample from the same site and analyzing it for Hg. Analysis of the sediment sample revealed no detectable concentration of Hg (<0.01 ug/g).

Table I-7. Metals Analysis from Spring and Stinking Creeks during runoff events and base flow. ND = Not Detectable. NA = Not Analyzed. All values in ug/L.

DATE > LAB. >	3/19/91 Base flow OSDH		12/12/91 Runoff USGS	
SITE > METALS DETECTED	SPRING CR.	STINKING CR.	SPRING CR.	STINKING CR
As	ND	ND	5	5
Ba	65	54	200	200
Cd	ND	ND	5	ND
Cr	ND	ND	28	20
Cu	14	14	NA	NA
Hg	ND	ND	ND	ND
Pb	ND	ND	9	8
Ni	ND	ND	28	17
Se	ND	ND	ND	ND
Zn	ND	ND	110	80
Fe	497	295	16000	12000
Mn	475	877	920	630

North American lakes typically demonstrate iron values around 160 ug/L with neutral to alkaline lakes ranging from 50 - 200 ug/L. Manganese is more variable, with typical North American lakes ranging from 10 - 850 ug/L (Wetzel, 1983). Iron analyses of epilimnetic waters of Lake Chickasha tended to be consistent with these values while hypolimnetic waters were much higher. This should be expected from reservoirs such as Lake Chickasha which demonstrate stratification that results in anoxic conditions in the hypolimnion. The low redox potential of these anoxic waters tends to be proportional to the release of these ions from the sediment into the water column. Epilimnetic samples never demonstrated values above the EPA criteria level of 1000 ug/L for freshwater aquatic life. Manganese values however, did not vary significantly between the epilimnion and hypolimnion waters. In most cases, concentrations of Manganese, which has no maximum standard limit for fresh water, were below 150 ug/L. Oklahoma water quality standards list no criteria for these metals.

Arsenic was only detected at low concentrations from the 1992 sampling. Concentrations detected from Lake Chickasha are well below the chronic life support level of 190 ug/L.

Barium was analyzed for only in samples taken in the 1991 sampling. There are no standards regarding Barium.

Chromium was detected in low concentrations at the dam and Spring Creek arm during the 1992 sampling. These concentrations are well below the chronic life support level of 50 ug/L.

Oklahoma State Environmental Laboratory results show mercury at detection(0.5 ug/l) from a Stinking Creek arm, 3/19/91 sample. A second metal analysis by the USGS, 6/26/92, failed to reproduce this detection. USGS laboratory results did show 0.2 ug/l (0.1ug/l detection) from a hypolimnetic sample at the dam. On both occasions these concentrations exceeded the chronic life support level of 0.012 ug/l and was below the human health criteria for the consumption of fish of 0.5874 ug/l (OWQS 1991). Mercury was at or below detection in the sediments(see section J).

Metals detected from the tributary creeks during both base flow and runoff (As, Ba, Cu, Ni, Cr, Cd, Pb, Zn, Fe, & Mn) did not exceed acute or chronic life support standard levels for fish and wildlife propagation. These values, also, did not exceed the raw water standards for public and private water supplies.

Among the heavy metals analyzed, mercury appears to be the one of most concern, being the only metal detected with concentrations in excess of chronic standards for aquatic life support. On both occasions this metal was detected from hypolimnetic waters. Also it is interesting to note that the levels of mercury in the water column exceeded those concentrations found in the sediment samples taken from the same location by one order of magnitude. Data from the feeder creeks did not indicate that mercury was being transported to the lake from the watershed during the course of this study. Also, there are no known agricultural or industrial discharges in the watershed or proximal to the lake which could be linked to mercury contamination. It is possible that the mercury detected at Lake Chickasha dam is from sediment deposits accumulated over the past 30 years. These deposits are probably released into the hypolimnion during anoxic and low redox conditions.

g. <u>Pesticides</u>

Grab samples taken at low flow and high flow from the two tributaries were analyzed by the USGS for the pesticides and organic pollutants listed in Table I-8. Most of these pollutants were not detected. Results for those pesticides detected are given in Table I-9.

Table I-8.Pesticides Thought to be Used Within the Lake Chickasha Watershed.

BromacilMirex
ButachlorSilvex
ButylateMethoxychlor
CarboxinToxaphene
CycloateHeptachlor
BiphenamidHeptachlor Epoxide
HexazinoneAtrazine
Polychlorinated Biphenyls2,4-D
Propachlor2,4-DP
Terbacil2,4,5-T
VernolateEndrin
Propazine Endosulfan
TrifluralinDieldrin
PerthaneDDD, DDE, DDT
SimazineChlordane
PrometoneLindane
Polychlorinated Napthalenes
Aldrin

Table I-9.Pesticide Analysis Results from Spring and Stinking Creeks during high flow events and base flow in 1991 and 1992. Only those pesticides detected are listed.
ND = Not Detected. NA = Not Analyzed. All values in ug/L.

DATE >	12/12/91		3/4/92		6/3/92	
SITE > PARAMETER	SPRING CR.	STNK. CR.	SPRING CR.	STNK. CR.	SPRING CR.	STNK. CR.
FLOW, CFS	13	1.3	153	338	15	4
2,4-D	ND	ND	0.17	0.1	NA	ND
2,4-DP	0.02	0.03	ND	NA	NA	ND
Atrazine	NA	NA	NA	NA	ND	0.2

The above organics and pesticides which were detected have no specific criteria listed in Oklahoma Water Quality Standards for fish and wildlife propagation. Since Lake Chickasha is considered a secondary drinking water source to the City of Chickasha, the raw water standard for public and private water supplies should be considered. For this use, 2,4-D has a maximum standard of 100 ug/L. Values detected from Spring and Stinking Creeks did not approach this value. The EPA Maximum Contaminant Level (MCL) listed for Atrazine (2-chloro, 4-ethylamino, 6-isopropylamino, s-triazine) in drinking water is 3.0 ug/L. There are no criteria for 2,4-DP.

Since the above data is the result of a limited number of grab samples and only one high flow event, peak pesticide concentrations are unknown. Of particular concern is the low flow detection of atrazine. Higher concentrations and loading may be expected with run off events. Atrazine loads to Lake Chickasha may in turn affect the chlorophyll *a* response to the nutrient influx.

Bio-assay data from a similar watershed in the same county as Lake Chickasha suggest synergistic and additive effects by pesticides in Lake Creek(FY 88 supplemental 106 Task 500). Pesticide use in that watershed should be similar to the Lake Chickasha watershed, therefore, there exists a threat for some pesticide toxicity in Lake Chickasha and its tributaries.

h. Sanitary Quality

Table I-10 presents bacteriological data for Lake Chickasha during the summer of 1991. Generally, fecal coliform and fecal strep contamination was not significant in the lake. Fecal Coliform numbers for the 3 lake sites did not exceed the State criteria (200 cfu /100ml) for primary body contact. However, September data indicated that samples from the dam demonstrated significant values of fecal strep for which no state criteria are issued.

Both fecal coliform and fecal strep values were extremely high in Spring and Stinking Creeks. Fecal coliforms greatly exceeded the primary body contact criteria listed above. However, not enough samples were taken to document a standards violation. Examination of the lake data indicates that fecal coliforms do not pose a risk to human health in the lake. Typically, fecal strep values were higher than fecal coliforms. Throughout the study, observations of cattle utilizing the stream bed for watering, shading and loafing were frequent during the spring and summer. High values of fecal coliform and fecal strep in the streams can be attributed primarily to the degree of livestock activity in the watershed.

Table I-10. Fecal Coliform (FC) and Fecal Strep (FS) Data from Lake Chickasha and Tributaries During 1991. Results are in Coliforms per 100 ml. NA = Not Analyzed.

DATE	5/6/91		5/21/91		6/6/91		6/24/91		7/9/91		7/25/91		8/26/91		9/13/91	
BACT TYPE SITE	FC	FS	FC	FS	FC	FS	FC	FS	FC	FS	FC	FS	FC	FS	FC	FS
1.*	620	530	850	220	480	960	600	70	630	510	620	3100	70	410	380	730
2.	920	700	2800	1700	90	690	80	140	170	370	80	970	800	450	180	630
3.	20	0	0	0	0	0	0	0	0	0	0	0	0	140	0	150
4.	10	0	0	80	20	10	0	0	0	0	0	0	0	20	0	0
5.	10	0	NA	NA	0	10	0	0	0	0	10	0	0	10	0	0

* 1. Spring Creek
2. Stinking Creek
3. Dam
4. Spring Creek Arm
5. Stinking Creek Arm

i. <u>Algal, Macrophyte, and Zooplankton Communities</u>

Lake Chickasha has no complex submerged plant community. A visual survey was conducted 07/18/91. This survey located no submerged aquatic macrophyte beds. The only significant macrophytic communities are found on locations around the lake as shoreline vegetation. These communities are typically dominated by Cattail (*Typha sp*.), Smart Weed (*Polygonum sp.*), Tamarisk (*Tamarix chinensis*), Dock Weed (*Rumex sp*.), and Willow (*Salix sp*.). In the upper reaches of both arms, shallow waters (<1 meter) supported thickets of willow seedlings. The emergent macrophyte, *Juncus sp*., was rarely found. This was typically limited to only the upper 1/10th of the arms. Greater than 40% of the shoreline is dominated by prairie grasses which are continuous throughout the adjoining rangeland and improved pasture. The near total lack of macrophytes can be attributed to herbicide applications by the city of Chickasha and a fluctuating water level. The absence of macrophyte beds affects both the water quality and the lake fisheries. The lack of submerged macrophyte beds can be attributed to herbicide applications and a fluctuating lake level.

The algal community is presented in Table I-11. Detailed sample results regarding the algal community are found in Appendix A. Due to difficulties in collecting complete count data for these samples, only relative abundance was used to measure algal communities. This made biomass determination impossible. Although actual counts are not presented, algal impact can be inferred from the large cholorophyll-a values obtained.

Taxonomy was carried out to genera. Lake Chickasha tends to be dominated by a year-round bloom of green and blue green algal communities. Blue-green algal communities were typically represented by *Oscillatoria sp.* while green algal communities were typically represented by *Ankistrodesmus sp.* Data did not indicate a great deal of seasonal variation, however blue green algal communities tended to be found in significant numbers year round while green algal and pennate diatom communities tended to be dominant from July through December.

Table I-12 describes zooplankton counts from Lake Chickasha.

Table I-11. Algal Genera Present in Lake Chickasha, 1991 - 1992.

Blue green	Green	Diatoms	Euglenoid	Dinoflag-ellate	Other
Anabaena *Anabaenopsis* *Aphanocapsa* *Chroococcus* *Coelospherium* *Merismopedia* *Oscillatoria*	*Ankistrodesmus* *Actinastrum* *Chlorella* *Closteriopsis* *Closterium* *Cosmarium* *Crucigenia* *Elakatothrix* *Scenedesmus* *Selenastrum* *Staurastrum* *Tetraedon* *Tetrastrum*	Centric Pennate	*Euglena* *Trachel-omonas*	*Ceratium* *Peridinium*	*Crypto-monas*

Table I-12. Zooplankton Counts During 1991 and 1992.
Counts are in organisms per liter.

Zooplankton Category	April 18, 1991	June 24, 1991	December 17, 1991
Rotifers Cladocerans Copepods	0 0.4 89.3	128 1 9	7 0 24

j. Lake Sediments

Sediment samples were taken on June 26, 1992 at all lake site locations. Pesticide, metal, and nutrient concentrations were analyzed. Of the 23 following pesticides and organic pollutants, only DDE and DDD were found in detectable concentrations from sampled sediments.

Poly**C**hlorinated**N**apthalenes Aldrin	Parathion
Lindane	Heptachlor
Chlordane	Diazinon
DDD	Heptachlor Epoxide
DDE	Methyl Parathion
DDT	Methoxychlor
Dieldrin	Mirex
Endosulfane	**P**oly**C**hlorinated**B**iphenyls
Endrin	Perthane
Ethion	Malathion
Toxaphene	Ethyl Trithion

Sediment samples taken at the Dam site demonstrated concentrations of DDD at 0.4 ug/Kg and DDE at 1.6 ug/Kg. Samples taken from the Stinking Creek arm had 0.2 ug/Kg of DDE and those from Spring Creek arm had 0.1 ug/Kg of DDD. More data collection regarding the spatial and temporal sources of these DDT residuals would be necessary to thoroughly analyze these accumulations. Runoff data do not indicate any contributions of DDT, DDD, and/ or DDE from the watershed during the period of this study. Therefore, assuming that this limited data is representative of the present land use practices taking place in the watershed of Lake Chickasha, these concentrations of DDD, and DDE are vestigial of the past 30 years of agricultural insect control and do not indicate any usage at the present time.

As indicated by the data in Table I-13, metal accumulation at Lake Chickasha was primarily characterized by iron and manganese. These metals are commonly found in high concentration throughout the state and do not appear to be problematic at Lake Chickasha.

Accumulation of the more toxic metals such as arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc; was not significant. Of these heavy metals, only arsenic, chromium, and copper were found consistently in all sediment samples. Mercury was found at detection level (0.02 ug/g) at the dam and Spring Creek arm sites. Predictably, the greatest accumulation of these metals was found at the dam sample site. Except for mercury and chromium detection at the dam and Spring Cr. arm, these accumulations did not appear to influence the water column during periods of hard thermal and chemical stratification. Only mercury was found to exceed standards for fresh water designated uses (Sec. F).

The appearance of sediment from the sample site at the dam was dark grey to black with an organic odor. The organic odor is characteristically that of H_2S, a respiration end product of anaerobic bacteria which thrive during periods of thermal stratification.

Benthic macroinvertebrates collected from sediment sampled from the same locations as previously mentioned, represented two Phyla: Annelida and Arthropoda (Table I-14).

Table I-13.Metal Concentrations (ug/g) in Lake Sediment Samples Collected from Lake Chickasha, OK., June 26, 1992. ND = Not Detected; (detection limit) in parentheses. Analysis done by USGS.

Metals Detected	Dam	Spring Cr. Arm	Stinking Cr. Arm	Detection
Arsenic	10.0 2.0	11.0	4.0	1.0
Cadmium	30.0	1.0	ND (1)	1.0
Chromium	20.0	20.0	4.0	1.0
Copper	10.0	20.0	3.0	1.0
Lead	0.02	ND (10)	10.0	10.0
Mercury	ND (1)	0.02	ND (.02)	0.02
Selenium	30.0	ND (1)	ND (1)	1.0
Nickel Zinc	70.0	10.0	ND (10)	10.0
Iron Mn	17000.0	30.0	ND (10)	10.0
	1000.0	8800.0	2000.0	1.0
		720.0	160.0	0.1

Table I-14. Benthic Macroinvertebrates Recovered from Sediment Samples Collected from Lake Chickasha, 9/17/92.

CLASS FAMILY	GENUS	DAM individuals/m^2	SPRING CREEK ARM	STINKING CREEK ARM
Oligochaeta				
Naididae	*Dero*	0	11	11
Tubificidae	*Limnodrilus*	0	22	0
Insecta				
Chaobridae	*Chaoborus*	0	22	22
Chironomidae	*Tanypus*	11	301 11	226
Chironomidae	*Procladius*	0	97	0
Chironomidae	*Chironomus*	22	22	22
Chironomidae	*Einfeldia*	0		0

Predictably, the benthic community was dominated by dipteran insects, mostly from chironomid family. The most abundant genus found was *Tanypus*, which was collected in great numbers from both arms. Only one was collected from the deep water site at the dam. The *Chaoborus* identified as part of two samples should be regarded as incidental as they are not considered a benthic organism.

The site located at the dam exhibited a much lower diversity of benthics than sites in the arms. This was probably due, in part, to the typically anoxic conditions of the deep water site during the productive season.

k. Ground Water

Contributions of nutrients from groundwater sources outside the Lake Chickasha watershed are doubtful. The only mode for transportation of nutrients from adjoining watersheds to Lake Chickasha via ground water might be via thin gypsum ($CaSo_4$) formations which are found throughout the lake and watershed. These 1 to 2 inch thick horizontal stratifications could conceivably be dissolved, leaving small passages through which Rush Springs formation water could penetrate. Consultation with geologists from the U.S.G.S. indicated this as improbable.

Ground water contribution to the lake within the watershed is represented by perennial flow from Spring and Stinking Creeks. This perennial flow is result of shallow ground water from the rush springs sandstone. While stream names in Oklahoma are often misleading, Spring Creek at least hints to its source. This contribution of ground water was quantified as part of the tributary stream monitoring. A potentially significant contribution of ground water to the lake not monitored as part of this study is that from the alluvium of the Spring and Stinking creek valleys. The alluvium is made up of unconsolidated deposits of sand, gravel and veins of clay and is highly permeable. Flow through these saturated deposits may be significant.

Historical data from private water wells from the watershed indicate the presence of nitrates from groundwater. However, upon consideration of the aforementioned geological circumstances, it is concluded that these nitrates originate from the watershed and could therefore be characterized by data collected from the lake and streams. Any restorative action implemented to remediate nutrient problems of the surface waters in the Lake Chickasha watershed would certainly address this nutrient source.

l. Overall Water Quality Characteristics of Lake Chickasha

Data collected from this study characterize Lake Chickasha as hypereutrophic. This lake supports sufficient algal biomass to impair the use of its waters for recreation. The excessive nutrient input to this lake comes from landuse activities both in the watersheds of Spring and Stinking Creeks, and from those associated with land proximal to the shoreline of the lake itself. Data indicate that the lake is phosphorous limited. However, nitrogen, phosphorous, and sediment controls should be implemented in any suggested restoration action in order to halt further degradation. Data collected during this study indicate that Lake Chickasha is well mixed throughout most of the year, demonstrated by only limited thermal stratification (2 months per year). However, dissolved oxygen stratification transcended that of temperature (4 months per year). Also, phosphorous values from the hypolimnetic waters did not demonstrate marked increases over those values from the epilimnion during times of hard dissolved oxygen stratification. The combination of these circumstances would indicate that depletion of oxygen in the deep water environments is primarily due to organic decomposition (B.O.D.) resulting from excessive algal growth. Other parameters indicate no apparent impact on lake users.

2. Characteristics of Lake Chickasha Tributaries

Temperatures varied from 4.6^{o} C to 27.0^{o} C at Spring Creek and 5.5^{o} C to 27.0^{o} C at Stinking Creek throughout the study.

Nitrate concentrations ranged from 0.06 (April, 1991) to 1.7 mg/L (March, 1991) at Spring Creek and 0.01 (April, 1991) to 1.30 mg/L (June, 1991 and December, 1991). However, Stinking Creek demonstrated consistently higher values of nitrate throughout the study.

Total ammonia levels were below warm water 4 day chronic criteria as determined by pH and temperature cited by EPA 1986(Gold Book). Total ammonia sampled from the storm flow on March 04, 1991(338cfs) approached that criteria and also contributed a significant part of the nitrogen loading to the lake with that event.

Base flow total phosphorous ranged from 0.07 mg/L to 1.10 mg/L at Spring Creek and <0.10 to 0.85 mg/L at Stinking Creek. Data show moderate to heavy nutrient loading occurs with runoff events. Isolated high base flow values may be result of livestock in or near the creeks. Intensive monitoring would be necessary to accurately correlate nutrient loading with animal movement and/or any relationships regarding intensity of runoff events.

Electrical conductivities of both creeks were similar and ranged from 1228 to 2981 uS/cm^2 throughout this study. As with the lake, it is probable that these high conductivities are a product of soil salinity and gypsum.

Information regarding bacterial abundance, pesticides, organics, and heavy metals are mentioned in previous text.

The sample site at the outfall of Lake Chickasha Dam was on Spring Creek below dam. Because of a malfunction of the main outlet valve in the water intake structure (at the dam), a constant flow from approximately 15 feet below the surface feeds the stream. Throughout the course of this study, water never flowed across the emergency spillway. According to local residents, water has not flowed over the spillway for many years. For all practical purposes regarding this Clean Lakes Project, this site could not be strictly regarded as an outfall due to this phenomenon. Water flowing into this site was not representative of surface water at the dam. Water quality characteristics from this sample site have consistently been indicative of those from 15 feet below the surface at the dam sample site. Data from this site were more specifically used for hydrologic and nutrient budgeting.

E. Hydraulic Budget for the Lake

For the purposes of this study, the Lake Chickasha watershed is divided into the following sub-watersheds:

Spring Creek	34.4 mi^2	8909.6 ha
Stinking Creek	22.1 mi^2	5723.9 ha
Lake	1.3 mi^2	336.7 ha
Ungauged Basin	18.3 mi^2	4739.7 ha
TOTALS	**76.1 mi^2**	**19709.9 ha**

Due to logistical problems, Stinking Creek and the outfall were not gauged for discharge from October, 1991 through December, 1991. The "ungauged basin" is the watershed adjacent to the lake It was not gauged for flow or loss due to evaporation.

The crude hydraulic budget for the USGS water year shown in table I-15 shows the gauged inflow, estimated runoff from the ungauged basin and rainfall less the estimated evaporation. This budget assumes the ground water contribution to the lake equals the loss to the ground water down-gradient and assumes no net change in lake volume. The runoff from the ungauged basin may be under estimated and two and one half months of flow from stinking creek were not gauged and are not included. The resulting hydraulic retention time for lake chickasha as calculated from inflow less evaporation is 1.3 years. Hydraulic retention time as calculated by the gauged outflow (extrapolated from seven months data) is 0.6 years.

Table I-15.Hydraulic budget for Lake Chickasha, October, 1991 to September 1992.

Stinking creek Inflow	5140	ACRE FEET/YEAR
Spring Creek Inflow	8330	ACRE FEET/YEAR
Estimated runoff from ungauged watershed 11700 acres @ 3"/year(OWRB 1969)	2928	ACRE FEET/YEAR
Rainfall	2167	ACRE FEET/YEAR
Evaporation 1358 acres X 62 in/yr (OWRB 1969)	7016	ACRE FEET/YEAR
Calculated Outflow (inflow - evap.)	11549	ACRE FEET/YEAR
Estimated Outflow (based on 7 mos. gauge data)	25100	ACRE FEET/YEAR
Lake Volume @ elev. 1180	15000	ACRE FEET
Hydraulic Residence Time (V/Q)	0.6 - 1.3	YEARS

F. Nutrient Sources for the Lake

1. Estimates of Nutrient Load Based on Flow Data

Data regarding flow and discharge can be found in Appendix B. Nutrient loading was determined by regression analysis of total hydraulic discharge (Stinking Creek, Spring Creek, lake, ungauged basin, and outfall) and observed nutrient concentrations over the course of the project. The total hydraulic discharge model incorporates precipitation and evaporation over the entire watershed throughout the study period (October, 1991 - September, 1992). Correlation coefficients for the nitrogen (total) loading model ranged from 0.50 to 0.75 while those associated with the phosphorous model were much less dependable; -0.03 to 0.47. Phosphorous data from this study were extremely variable and did not correlate well for the loading model. Constituents such as phosphorous which were typically found in such low concentrations (<1.0 mg/L) and highly variable (range: not detectable - 0.85 mg/L), would need to be studied over a longer period of time in order to establish a more dependable analysis.

Because of voids in the discharge data from Stinking Creek, the outfall (October through December, 1991), as well as any nutrient inputs attributable to runoff from the ungauged basin (watershed adjacent to the lake and downstream from staff gauge stations, approximately 4740 ha), nutrient loading values should be considered lower than actual. In order to determine loading on an annual basis, mean monthly values (N = 9 months) were extrapolated to estimate a 12 month model. Extrapolated values are to be considered rough estimates, at best, and are not based on empirical data.

a. Phosphorous Loading

Phosphorus loading from the two tributaries and discharge to Spring Creek were calculated from daily flow as gauged and phosphorus concentrations as derived from a regression of the logs of flow and sample phosphorus concentrations.

Spring Creek......... 1400 kg

Stinking Creek....... 1375 kg

ungauged ....est. 1000 kg

Total .... 3775 kg

Outfall............. 1150 kg

Phosphorus loading to the lake shows a similar pattern to the flow in the two tributaries with the highest concentrations occurring with storm flow. Loading from the Spring Creek based on the above data is 0.16 kg/ha. This value is similar to the loading from moderately grazed good condition grassland reported by Smith et al. 1992 at the nearby USDA-ARS research station. The Stinking creek watershed yielded .24 kg/ha. This is probably result of a greater percentage of cultivated land in the Stinking Creek Watershed. Based on these loadings the ungauged watershed contributes between 760 and 1230 additional kilograms phosphorus per year. Lake Chickasha had a mean standing load of 860 kg. With these figures, less than 1/3 of the phosphorus entering the lake is exported through the outlet. This leaves a significant portion to accumulate in the sediments. Data available are insufficient to determine the extent of phosphorus cycling from the sediments.

b. Nitrogen Loading

Nitrogen loading from the two tributaries was calculated from daily flow as gauged and nitrogen concentrations as derived from a regression of the logs of flow and sample concentrations. Discharge of nitrogen to Spring Creek from the lake is calculated with a mean value rather than derived values from the log regression. Based on a limited number of samples and no high flow samples the regression gave unrealistic high flow values for nitrogen at the outfall. From October 1991 through September 1992 estimated nitrogen loading (based on discharge, 'Q') into the lake from the watershed and export (outfall) from the lake is as follows:

Spring Creek.................14870 kg/yr

Stinking Creek................12920 kg/yr

Rainfall to lake(OSU 1985).....1400 kg/yr

Outfall.......................18771 kg/yr

2. Projected Nutrient Loads

No urban growth or accelerated agricultural development are anticipated in the watershed. Predictable changes in the present rate of nutrient loading would be associated with cattle stocking and cropland management plans developed by local landowners. Presently, there are no known plans to implement any new erosion control practices in the watershed. Markets associated with agriculture and livestock will determine the impact associated with land use practices. Septic systems along the lake are a potential source for nutrient loading. Contributions to the lake from septic tanks will be reduced as the City of Chickasha eliminates the residential area on the east shore.

G. Trophic Response to Nutrient Loading

Carlson (1977) developed the following scale for use with transparency, surface phosphorous, and chlorophyll *a* data. The state of Kansas, which has reservoirs in areas of similar geology, soils, and landuse to Lake Chickasha, modified this numerical scale to include descriptions which assist in defining trophic status for the TSI.

Carlson's TSI Scale
0 - 39 = Oligotrophic
40 - 49 = Mesotrophic
50 - 54 = Slightly Eutrophic
55 - 59 = Eutrophic
60 - 63 = Highly Eutrophic
>64 = Hypereutrophic

TSI values calculated from mean secchi, total phosphorus, and chlorophyll *a* are as follows:

	mean value	Carlson TSI	Carlson TSI
Chlorophyll *a*	26 ug/l	63	Highly eutrophic
Total Phosphorus	47 ug/l	60	Highly eutrophic
Secchi	69 cm	64	Hypereutrophic

Mean TSI values for secchi, total phosphorus and chlorophyll *a* were all in the range of highly eutrophic to hyper eutrophic. These data confirm those values observed during previous lakes assessments. Observed chlorophyll *a* values for Lake Chickasha averaged 25.4 ug/L (range = 17 - 77 ug/L) at the dam, 25.3 ug/L (range = 9.1 - 86.7 ug/L) at Spring Cr. arm, 24.8 ug/L (range = 8.5 - 43.7 ug/L) at Stinking Cr. arm. The overall average chlorophyll *a* value for Lake Chickasha is 26 ug/L. This corresponds with an Carlson's chlorophyll TSI of 63 (Carlson, 1977) which characterizes Lake Chickasha as highly eutrophic. Concentrations of total phosphorous collected from all sites on the lake, throughout the study averaged 47 ug/L. This corresponds with a TSI (Carlson, 1977) of 60 which indicates a trophic state of highly eutrophic. Mean secchi depth in the lake over the study period was 69 cm. This value corresponds to a TSI hypertrophic condition.

Data collected from this study suggest that the trophic continuum of Lake Chickasha is accelerated by nutrient loading from the watershed. While loadings can only be calculated for the later part of the study, peak loading of nitrogen and phosphorous into the system during runoff events are followed by peaks of chlorophyll *a*. Review of the N:P ratios show that during peak phosphorus loads that nitrogen may limit the algal response. Lake Chickasha generally has a high standing crop of algae with occasional extreme peaks such as was seen in April of 1992. Rapid hypolinetic oxygen depletion during the brief periods of thermal stratification can be attributed to the heavy algae blooms.

Because this study took place over only a 15 month period, seasonal trend analysis is deficient and not appropriate to discuss as relevant to other documented studies of a similar nature. Additional monitoring of nutrients (organic and inorganic), suspended solids, phytoplankton community structure, and chlorophyll *a* would greatly enhance any modeling of this reservoir's annual trends. However, the findings of this study clearly indicate that Lake Chickasha is eutrophic and probably deteriorating.

Just as with many reservoirs located in agricultural areas, the primary focus on remediation should be on the watershed and those activities associated therein.

I.11 Lake Biological Resources

A. Fisheries

Sport fishing is the primary recreational use of Lake Chickasha. This section will discuss the past and present activities related to fisheries, and suitability of Lake Chickasha for maintaining a sport fishery.

1. Past and Present Activities and suitability of the Lake

The Oklahoma Department of Wildlife Conservation conducted numerous fish surveys on the fishery at Lake Chickasha prior to this study. The most recently published report (1990) indicated the following:

a) Largemouth bass were abundant but small. Good natural reproduction. A slot range (13 -16 in.) was imposed in 1988 and success with this size class was noted. ODWC stocked 45000 Florida Largemouth fingerlings for 1990 to enhance trophy numbers.

b) Walleye populations and individual size increased from 1987. Natural reproduction was good. ODWC stocked 186,000 fry for 1990.

c) White bass were abundant but small. No re-stocking was performed.

d) Channel catfish catch rate (gill net) was the highest recorded from Lake Chickasha. Good recruitment was indicated. No re-stocking was performed. ODWC recommended that no further catfish stockings unless catch rate falls below 0.1 C/f(catch per hour effort).

e) Blue-gill abundance was down from 1987 and fish from the <4 in. class were almost absent. Crappie numbers were up, however average size was lower than 1987. This decline of blue-gill numbers and crappie average size is probably due to loss of habitat. The loss of cattails and absence of macrophyte beds may have an adverse long-term effect on the crappie population.

f) Gizzard shad numbers were high but fish were in poor condition. Reproduction was poor.

g) ODWC recommended that water levels be stabilized to allow re-establishment of cattails and local community should initiate a "fish attractor" project. This would involve the collection of eastern red cedar trees for sinking in strategic locations.

h) ODWC recommended that a new boat ramp and parking area be built in the southeast corner of the lake. This was completed in 1992.

i) ODWC also recommended that a smaller boat dock be installed at the northeast boat ramp and shoreline access roads be upgraded for bank anglers under the Fishing Access Program.

Overall, the weight of open-water species available for harvest reached a record high at Lake Chickasha in 1990. Game species were abundant and in overall good condition although some were small. Blue-gill and shad are still the primary forage fish, however their numbers are down from previous surveys. There is some need to increase angler access to enhance the value of the fishery. Also, cattail re-establishment is critical to the future of the blue-gill and crappie populations.

Lake Chickasha is a major Walleye fishery in the state of Oklahoma. In 1987, Lake Chickasha was one of the most productive Walleye fisheries in Western Oklahoma. Although fish populations appear numerous, some of their deficiencies (ie small size, poor condition, missing age classes) could be related to impacts from nutrient loading. Also, a deficiency of emergent vegetation, important to the reproductive potential of some game fish, could be attributable to lake level variability and possibly the use of herbicides.

In addition to a productive fishery, Lake Chickasha is also used by the public as a camping and picnic facility and hunting area. Hunting on the areas adjacent to the lake, mostly within the flood pool, includes waterfowl, upland birds, and white-tailed deer. Non-game birds inhabiting the local area include great blue herons, green back herons, cattle egrets, terns, gulls, double crested cormorants, a variety of wading birds (ie. sandpipers, American avocets, black necked stilts, etc.), Osprey, red-tailed hawks, turkey vultures, American kestrels, Mississippi kites, great horned owls, barred owls, song birds etc. Resident non-game mammals would include coyotes, bobcats, and a variety of rodents adaptive to prairie and woodland ecosystems which are native to Oklahoma (ie. hispid cotton rats, eastern wood rat, white-footed deer mice, pocket gophers, rufus-sided harvest mice). Portions of the city owned land around the lake are leased for pasture and small lots are leased from a mobile home park.

2. Wholesomeness of Fish Flesh

On April 10 and 11, 1991, personnel from the Oklahoma State Department of Health and the Oklahoma Conservation Commission collected fish from Lake Chickasha with gill nets set out April 9, 1991. Approximately 600 fish ranging from pan fish to top predators such as Walleye and Channel Catfish were recovered from this operation. A total of 30 specimens were weighed, filleted, then submitted frozen to the U.S.G.S. Laboratory in Arvada, Colorado for analysis. A copy of the letter sent to the lab describing requested lab analysis is located in Appendix C. For unknown reasons, these specimens were allowed to deteriorate prior to any lab preparation, rendering them unsuitable for analysis. Due to the high cost of collection, preparation, and shipment, we were unable to re-submit additional specimens for analysis.

II. FEASIBILITY STUDY

II.1 Lake Restoration and Maintenance Goals

Based on the data presented and discussed in the previous report sections, there appear to be three major goals that should be addressed in order to best protect and maintain good water quality at Lake Chickasha.

1) Reduce erosion of top soil and bank material. Areal photos and drive by assessments show that the flood plains are generally farmed to the stream bank and the stream is often the sole source for livestock water where that land is used as pasture. To decrease sediment and nutrient loads from these areas, the riparian zones of the tributaries should be revegetated. Cattle access should be managed to minimize stream bank erosion and to allow revegetation of the riparian area.

Lake shore erosion was also observed to be a significant problem. While this is partly due to fluctuating lake water levels killing stabilizing vegetation, stabilizing the lake shores should be addressed in the plan revegetating the stream riparian areas. Lake levels should be stabilized by recent repairs to the overflow structure.

2) Reduce phosphorous and nitrogen loading into Stinking and Spring Creeks. The most intensive landuse in the watershed is associated with the higher quality soils along the tributaries. Best management practices(BMP) should be implemented in the watershed as a whole with extra emphasis placed on the cultivated areas along the tributaries. BMPs may include improved tillage and regular soil testing to monitor residual nitrogen and phosphorous prior to fertilization. Reestablishment of riparian area will also help trap nutrients.

3) Reduce biologically available phosphorous in the lake. This is most commonly done by dredging or applying aluminum sulfate (alum). The application of alum would "trap" phosphorous in the sediment so it cannot be released during anoxic conditions. Dredging would increase the capacity of the reservoir and remove the majority of sediment-bound nutrients (as well as other contaminants) which contribute to anoxic hypolimnetic conditions. These strategies should not be implemented without effective implementation of the controls mentioned in 1) and 2) of this section. These strategies may be unnecessary because nutrient cycling from sediments is minimal as compared from the loading from the watershed.

II.2 Lake Restoration and/or Pollution Control Alternatives

A. No Action

On a short term basis this alternative would be the least expensive The trophic state of Lake Chickasha would advance over time, as more nutrients enter the lake. Eventually, phytoplankton levels will severely compromise the aesthetic quality of the lake for fisherman and other recreational interests. Increasing eutrophication would result in the decreased use of the lake as a quality fishery in years to come. Also, increased siltation would result in the loss of aquatic habitat in the upper third of both arms. Restocking of game fish would prolong the collapse of fish communities, however, population fitness (fecundity, longevity) would certainly be diminished. Eventually, restocking costs and fisherman dissatisfaction would be high enough to consider some type of restoration. Potential for massive fish kills currently exists and increased eutrophication increases the potential. Peak algae blooms as seem in April of 1992 will become more frequent. Heavy algae blooms concurrent with heavy cloud cover and little wind during the summer could result in a massive fish kill. By this time, cost share funding will probably not be available and contractual costs would increase with inflation. In the long term, this could be the most expensive alternative.

B. Algae Control

Algae control with copper sulfate is a common practice, especially in the control of odor and taste for drinking water facilities. Lake Chickasha, however, is not primarily used as a drinking water resource due to its high gypsum levels. Copper sulfate is an expensive treatment with only temporary benefits. Effective control could be achieved with bi-weekly applications. Resistant algal strains have been shown to develop with long term use at several water supply reservoirs. The disadvantages of chronic copper sulfate use would not justify its use in a reservoir seldom used as a drinking water source.

Another form of algal control would be biological manipulation by means of fish population control. This could be achieved by regulating the ratio of predator to prey species. By increasing predation pressure on selected zooplankton grazers (gizzard shad, blue-gill, shiners, etc.), it is possible to increase grazing pressure on phytoplankton. Although this would not have a significant impact on nutrient levels, it could certainly decrease turbidity attributable to algal production. Population dynamics studies would need to be performed to quantify algal biomass, identify zooplankton species and their average sizes, and identify components of the zooplankton community (species, feeding strategies, size ranges, predator-prey relationships, etc.). This alternative would not be expensive but would require some long term cooperation on the part of the ODWC.

C. Dredging

Dredging has been demonstrated as an effective method to improve the quality of fisheries and recreational values in eutrophic lakes (Randtke and DeNoyelles, 1985; Peterson, 1982; Cooke et al., 1986). With Lake Chickasha, dredging would facilitate the removal of accumulated nutrients and by-products of anaerobic decomposition. In addition, selected sites could be deepened to enhance fish habitat.

Problems associated with dredging are numerous. The cost of this alternative can range from $1.00 to $10.00 per cubic meter of sediment removed. This would probably cost in excess of $1,000,000.00 for Lake Chickasha in order to effectively remove sediment over a 500 acre area, 2 feet deep. This would focus on the lower fourth proximal to the dam and the upper third of both arms. Prior to dredging, analysis of the sediment for heavy metals should be performed in order to take appropriate precautions to prevent the release of toxic quantities of copper, arsenic, lead, mercury, cadmium, etc. into the lake. During the dredging operation, it would be important to initiate improved land management practices or risk the long term effectiveness of sediment removal.

An important concern would be distress placed on aquatic populations from benthic invertebrates to game fish. It would be very detrimental to the biota of the lake to initiate this alternative during times of hard stratification. Care should be taken to administer the timing and scope of the dredging operation with consultation from ODWC fisheries biologists.

Lastly, a plan for the disposition of dredge material must be developed. Improper disposal or storage can result in the discharge of nutrient rich runoff water to the lake or drainage which would result in algal blooms and in dissolved oxygen depletion of receiving waters.

D. Sediment Covering (aluminum sulfate), Phosphorous Removal

If dredging is considered too expensive, phosphorous inactivation has been found to be an effective method in the reduction of algal and macrophytic biomass. Aluminum sulfate or alum, can effectively bind inorganic phosphorous in the water column, precipitate to the bottom of the lake and prevent internal release of phosphorous from nutrient rich sediment. This will result in the limitation of algal growth by sharply depleting this nutrient. This is especially effective in lakes such as Lake Chickasha which demonstrate some degree of internal phosphorous release from sediments. Costs involved with an application of alum sufficient to effect long term phosphorous inactivation (>10 years) could range from $120,000.00 to $225,000.00 depending on labor intensity.

"The Lake and Reservoir Restoration Guidance Manual", 1st edition, 1988 (USEPA), suggests that impoundments are poor candidates for this type of phosphorous removal because of their inherent inability to limit nutrient income. Therefore, should this method be utilized, it would be of the utmost importance that land practices which limit nutrient loading to Stinking and Spring Creeks be successfully implemented before this treatment is initiated.

Some negative impacts caused by alum application are associated with pH and alkalinity problems. When alum is introduced into the aquatic system, the buffering capacity (alkalinity) of the water is compromised. In soft water lakes this could cause exhaustion of this capacity, sending the pH below 6 which would result in the release of $Al(OH)_2$ and dissolved elemental Al^{+++}. These can be toxic to lake species. Well-buffered, hard water lakes are good candidates. In the case of Lake Chickasha, alkalinities typically ranged from 100 to 120 mg/L $CaCO_3$ and harness was shown to be 760 mg/L $CaCO_3$ at the dam site. Although this is adequate buffering capacity, caution would have to be exercised on the rate of application in order to prevent exhaustion of buffering capacity. Cooke et al., 1986, details dose determination in an effort to prevent these problems and apply enough alum to remove phosphorous.

E. Watershed Management

This is the most important and most feasible of all alternatives because the watershed of Lake Chickasha is the primary source of nutrient and sediment loading into the reservoir.

The Stinking and Spring Creek watersheds are dominated by rangeland and improved pasture. There is some cropland(20%), mainly limited to better quality soils along the tributaries. Areal photos and drive by survey along section roads show that the crop land is generally cultivated up to the stream bank. While the cropland makes up only 1/5 of the watershed it probably source for a significant portions of the nutrient load to the lake. Smith et al 1991 show phosphorus loadings from conventional till wheat up to 10 times that of native grass pasture. Improved tillage practices need to be encouraged in the watershed to reduce sediment and nutrient contributions to the lake.

A revegetation plan should be developed to revitalize riparian growth along the tributaries and lake shore. Riparian growth, dominated by black willow, salt cedar, grasses, sedges, rushes and cattails, in the watershed is narrow and sometimes nonexistent along the stream banks especially where the adjacent land is cultivated. Revegetation of the riparian areas would help trap soil bound nutrients and sediments, reducing the loading to Lake Chickasha. Revegetation of black willow, black locust, cottonwood, and native and/or rhizomatous grasses would certainly provide an effective riparian zone. Reestablishing a riparian corridor would however take valuable land out of production and may require purchase of easements or land owner incentives.

Costs associated with revegetation would include $50.00 per 100 feet for potted trees planted 3 rows deep at 10 foot intervals for upper level and $10.00 per linear foot for dormant posts (willow, cottonwood, etc.) planted 3 rows deep for lower level. Manpower costs would be $10.00 per hour plus that of the wetland coordinator, $20,000.00. Fencing for riparian protection during initial growth would cost $0.56 per linear foot. This fencing would also serve, in part, as a facility for controlled cattle rotation, where applicable.

Where the land along the tributaries is used as pasture the stream is often the sole source for livestock water. Unrestricted livestock of the stream can be a significant nutrient source and as the data show, source for fecal coliforms, possibly impairing the stream's body contact beneficial use. Excessive livestock grazing can denude the stream banks causing severe stream bank erosion and sedimentation downstream. Moderate measures to reduce impact from livestock would include improved pasture management and controlled cattle rotation from pasture to stream side, effectively decreasing detrimental trampling of stream bottoms, banks, and riparian strips. This would also limit the exposure of grazing cattle to new woody growth in the riparian areas. Cattle exclusion from the streams may be considered, however, this as with reestablishing the riparian corridor may require purchase of easements and incentives for landowner cooperation.

At this time, it would be impossible to accurately estimate total costs of riparian establishment and improved pasture management because the extent of land owner cooperation cannot be determined. However, assuming a 70 - 80% rate of landowner cooperation, the following numbers would apply for 15 miles of riparian revegetation and pasture management:

Upper trees	$ 39,600.00
Lower trees	$792,000.00
Fencing	$ 44,352.00
Manpower	$ 40,365.00
Total	$916,317.00

These are maximum costs for completely revegetating 15 stream miles. In reality, the true cost will be less depending upon the length of streamside zones not appropriate for woody revegetation and those zones owned by non-cooperators. Those zones which are not appropriate for woody revegetation, will be planted with appropriate grasses. These figures do not include estimates for land owner incentives or purchase of easements.

Negative impacts by revegetation and improved pasture management may include loss of better quality cultivated land and slower drainage of flood waters as result of increased obstruction of the stream bed.

Sediment retention structures could be constructed on strategic sites of the watershed to trap silt transported from pasture, cropland, and streambank erosion. This has been proven to be successful in highly erodible lands of western and central Oklahoma. The cost of a typical 2000 cubic yard pond with a 90 foot discharge pipe is $2800.00 ($0.72 per cubic yard + $15.00 per foot for discharge pipe). At this cost, 3 structures could be constructed for under $9,000.00.

Frequent maintenance would be performed by the local Soil Conservation Service office in Anadarko, Oklahoma with the cooperation of the landowner.

II.3 Benefits of Various Alternatives

Benefits versus problems of each alternative are listed and summarized.

No Action

Benefits - Low to no cost of implementation.

Problems - Continued advance of eutrophication, eventually resulting with deterioration of recreational values.
- Fish kills.

Algal Control

Benefits -Temporary elimination of algal blooms Decreased odor, improved taste for drinking water.

Problems -Requires repeated treatment with $CuSO_4$.
Treats only the symptoms of eutrophication.
Introduces potentially high concentrations of Cu which can be toxic.
Cost.
Does not address siltation.

Dredging

Benefits -Removes accumulated nutrients and other contaminants bound to sediment.
Increases depth, extending the potential life of the lake and increasing capacity.
Improvement of fishery.

Problems-Expensive.
Does not address nutrient or silt inputs and requires frequent monitoring of dredge material which could be toxic and expensive to dispose of.

Sediment Covering

Benefits - Less expensive nutrient removal than dredging.
Traps sediment bound nutrients preventing internal loading
Problems -Contributes to lost lake volume
Implementation could create adverse water quality conditions detrimental to fish.
Ineffective unless nutrient loading from watershed is limited.

Watershed Management

Benefits -Provides valuable soil and water conservation practices to all land uses.
Would provide significant reductions of nutrient loading and siltation to receiving waters.

Problems -No guarantee of land owner cooperation.
Implementation is expensive.

Biological Manipulation

Benefits - Low cost (Unless stocking is required).
May result in improved fisheries.
No adverse environmental impact.

Problems - Results may not be immediately observable.
Effectiveness not proven.
May provide only short term benefits.

II.4 Description of Phase II Monitoring Program

Lake monitoring throughout the proposed Phase II plan should include monthly sampling from April through October (7 samplings per year). Monitoring should be performed no less than 5 years after the completion of lake restoration activities (both lake and watershed). Ideally, this should be carried out indefinitely, limited only when data indicate maximum improvement has been achieved.

Parameters from lake and inflow sampling should include temperature, dissolved oxygen, conductivity, and pH profiles, alkalinity, fecal coliform bacteria, turbidity, Secchi depth, total dissolved solids, total suspended solids, sulfate, chloride, complete nutrient analysis, metals, chlorophyll *a*, zooplankton dynamics, and phytoplankton dynamics. Water samples submitted for laboratory analysis will be collected from surface water and hypolimnion when stratification exists. Sediments should be sampled once per year and analyzed for pesticides, metals, and nutrients. Fish tissue should be collected once per year for metals and pesticide analysis.

Runoff sampling from the inflows should be performed for 2 significant events per year. Parameters should include TSS, nutrients, turbidity, basic chemistries, metals, and pesticides.

II.5 Lake Restoration and Pollution Control Workplan

At this time, no Phase II workplan exists for a Lake Chickasha restoration project. Before this can be developed, officials from the City of Chickasha and land owners from the watershed will have to agree on a cooperative agreement which would include the commitment of funding for cost shared implementation. It would not be possible to draft any workplan without total commitment of resources from both parties.

II.6 Sources of Non-Federal Funds

Funds for future restoration implementation practices which could be derived from non-federal sources could come from the City of Chickasha and an account established for watershed implementation in behalf of cooperating land owners. This could be managed by the South Caddo Conservation District, Anadarko, Oklahoma.

II.7 Relationship of Project to Other Pollution Control Programs and Watershed Maintenance Plan

Only conservation education programs administered by the South Caddo Conservation District are in progress at this time. No pollution control structures have ever been constructed in the Lake Chickasha watershed. No monitoring programs except for that of this Phase I project, are in place.

II.8 Summary of Public Participation Activities

To date, only the initial public meeting prior to the start of the study was held. This meeting was conducted by the Oklahoma Conservation Commission and the Grady County Conservation District on October 22, 1990 and summarized how these studies are performed and the goals of the Lake Chickasha Clean Lakes Phase I study. Further meetings are anticipated to develop the Phase II plan.

II.9 Necessary Permits

Corps. of Engineer 404 permits will be necessary for any dredging, should that alternative be elected. 401 certification from the Oklahoma Department of Environmental Quality will also be required.

III PROJECT ENVIRONMENTAL EVALUATION

III.1 Displacement of People

There will be no displacement of people as a result of this study.

III.2 Defacement of Residences and Residential Areas, Available and Applied Mitigative Actions

There will be no defacement of residences and residential areas as a result of any action(s) from this project.

III.3 Changes in Land Use Patterns

Since the beginning of the Phase I project, no apparent changes in land use patterns have been noted.

III.4 Impact on Prime Agricultural Land

Assuming measures are taken to reduce nutrient and sediment loading, beneficial impacts should be observed in the form of decreased top soil loss, increased fertility, and preservation of site productivity. Some cultivated land would be taken out of production along the tributaries.

III.5 Impact on Park Land, Public Land,nd, and Scenic Value Lands

Successful riparian revegetation should provide visual aesthetic improvements and the increased utilization by native wildlife. Establishment of riparian corridors will increase the movement of both game and non-game species between woodlands dissected by managed pasture and cropland. The quality of upland game hunting should increase over time on public hunting lands adjacent to the lake on the northern extreme. No adverse impacts are anticipated.

III.6Impact on Lands or Structures of Historic, Architectural, Archeological, or Cultural Value

There are no known lands or structures of historic, architectural, archeological, or cultural value within the Lake Chickasha watershed.

III.7Short and Long Term Energy Impacts

There are no short or long term energy impacts anticipated as a result of any implementation action.

III.8Short and Long Term Ambient Air Quality and Noise Level Impacts

There are no short or long term ambient air quality and/or noise level impacts anticipated as a result of any implementation action.

III.9Short and Long Term Impacts of In-Lake Chemical Treatment

The only in-lake chemical treatment anticipated could be that of alum application. If improperly applied, alum could exhaust the buffering capacity of the water and create mild acidic conditions which in turn would result with fish kills. However, if this alternative is elected, appropriate precautions and the most conservative methodologies will be used to implement this restorative practice.

III.10Flood Plain Impacts

There are no flood plain impacts anticipated as a result of any implementation action.

III.11Impacts of Dredging Activities

If this alternative is elected, implementation would certainly have temporary adverse impacts on the fishery due to sediment disruption and the resulting disturbance to the benthos. However, these short term impacts will be adequately mitigated by long term benefits derived by the removal of nutrient rich and contaminated sediment. Primary concerns should be difficulties and costs associated with the disposal of dredge material and equipment operation.

III.12Wetland, Fish and Wildlife, Endangered Species Impacts

Dredging in the upper lake arms would certainly impact those wetlands which were created by accumulated siltation over the past 35 years since inundation. At the time of inundation, these areas were not primarily wetlands. Reduced nutrient and silt inflow from the watershed, the creation of riparian corridors, and reduced nutrient levels in the lake should benefit fish and wildlife populations residing in the Lake Chickasha watershed. No negative impacts are anticipated and no endangered species have been documented in this area.

III.13 Feasible Alternatives to Project

None

III.14 Other Measures and Impacts Not Previously Discussed

None

IV. Project Public Participation Activities

IV.1 Public Participation Coordinator

Dee Surber, Grady County Conservation District

IV.2 Project Advisory Committee

Noble Brooks, Chickasha City Council
David Smith, Lake Chickasha Ranger
Rick Vickery, Grady County Conservation District Board

IV.3 Project Public Meetings and Hearings

A meeting was conducted on October 22, 1990 by the Oklahoma Conservation Commission and the Grady County Conservation District to inform the public of the purpose of the project.

IV.4 Project Information Depository

The Grady County Conservation District office, Chickasha, Okla., was designated as the Project Information Depository.

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APPENDIX A

TABLE A.1. PHYTOPLANKTON GENERA RECOVERED FROM LAKE CHICKASHA.

Date	Dam	Spring Cr. Arm	Stinking Cr. Arm
4/18/91	*Anabaena Merismopedia Oscillatoria Ankistrodesmus Staurastrum Centric & Pennate Diatoms*	*Merismopedia Ocillatoria Ankistrodesmus Closterium Scenedesmus Tetraedon Centric & Pennate Diatoms Euglena Trachelomonas Peridinium*	*Aphanocapsa Merismopedia Ocillatoria Ankistrodesmus Closterium Crucigenia Scenedesmus Centric & Pennate Diatoms*
5/6/91	*Oscillatoria Merismopedia Ankistrodesmus Scenedesmus Tetraedon Centric & Pennate Diatoms Trachelomonas*	*Oscillatoria Merismopedia Ankistrodesmus Scenedesmus Tetraedon Centric & Pennate Diatoms Euglena*	*Oscillatoria Ankistrodesmus Scenedesmus Tetraedon Centric Diatoms*
5/22/91	*Oscillatoria Anabaena Ankistrodesmus Scenedesmus Tetraedon*	*Oscillatoria Scenedesmus Tetraedon Centric & Pennate Diatoms*	*Oscillatoria Ankistrodesmus Crucigenia Scenedesmus Tetraedon Centric Diatoms Trachelomonas*
6/6/91	*Oscillatoria Merismopedia Closterium Trachelomonas*	*Oscillatoria Ankistrodesmus Scenedesmus Centric & Pennate Diatoms*	*Oscillatoria Closterium Scenedesmus Trachelomonas*
6/24/91	*Oscillatoria Anabaena Ankistrodesmus Scenedesmus*	*Oscillatoria Anabaena Ankistrodesmus Closterium Scenedesmus Centric & Pennate Diatoms Euglena Trachelomonas*	*Oscillatoria Anabaena Closterium Scenedesmus Pennate Diatoms Trachelomonas Ceratium*

Table A.1 Continued.

Date	Dam	Spring Cr. Arm	Stinking Cr. Arm
7/9/91	*Oscillatoria Ankistrodesmus Scenedesmus Tetraedon Centric & Pennate Diatoms Euglena*	*Oscillatoria Ankistrodesmus Anabaena Scenedesmus Pennate Diatoms Euglena Trachelomonas Ceratium*	*Oscillatoria Ankistrodesmus Anabaena Scenedesmus Crucigenia Pennate Diatoms Euglena Trachelomonas*
7/25/91	*Oscillatoria Ankistrodesmus Pennate Diatoms Actinastrum Aphanocapsa Anabaenopsis Closterium Crucigenia Centric Diatoms*	*Oscillatoria Ankistrodesmus Pennate Diatoms Aphanaocapsa Merismopedia Closterium Scenedesmus Centric Diatoms Euglena Trachelomonas*	*Oscillatoria Ankistrodesmus Pennate Diatoms Anabaenopsis Closterium Centric Diatoms Trachelomonas*
8/8/91	*Oscillatoria Ankistrodesmus Anabaena Merismopedia Crucigenia Scenedesmus Tetraedon Tetrastum Pennate Diatoms Trachelomonas*	*Oscillatoria Ankistrodesmus Anabaenopsis Chlorella Crucigenia Tetraedon Pennate Diatoms*	*Oscillatoria Ankistrodesmus Anabaenopsis Merismopedia Closterium Crucigenia Scenedesmus Pennate Diatoms Trachelomonas Ceratium*
8/26/91	*Oscillatoria Ankistrodesmus Crucigenia Anabaenopsis Merismopedia Coelosphaerium Closteriopsis Closterium Scenedesmus Pennate Diatoms Trachelomonas*	*Oscillatoria Ankistrodesmus Crucigenia Anabaenopsis Closterium Scenedesmus Pennate Diatoms Euglena Tetraedon Trachelomonas*	*Oscillatoria Ankistrodesmus Crucigenia Anabaenopsis Anabaena Closterium Scenedesmus Tetraedon Ceratium*

Table A.1 Continued

Date	Dam	Spring Cr. Arm	Stinking Cr. Arm
9/13/91	*Oscillatoria Ankistrodesmus Pennate Diatoms Anabaenopsis Aphanocapsa Chroococcus Merimopedia Closterium Crucigenia Scenedesmus Tetraedon Trachelomonas*	*Oscillatoria Ankistrodesmus Pennate Diatoms Aphanocapsa Chroococcus Merimopedia Closterium Crucigenia Scenedesmus Tetraedon Euglena Trachelomonas*	*Oscillatoria Ankistrodesmus Crucigenia Pennate Diatoms Aphanocapsa Chroococcus Merimopedia Actinastrum Scenedesmus Selenastrum Tetraedon Centric Diatoms Euglena Trachelomonas*
12/3/91	*Oscillatoria Ankistrodesmus Pennate Diatoms Chroococcus Merismopedia Scenedesmus Tetraedon Tetrastrum Centric Diatoms Euglena Trachelomonas Cryptomonas*	*Oscillatoria Ankistrodesmus Pennate Diatoms Anabaenopsis Chroococcus Aphanocapsa Crucigenia Scenedesmus Scenedesmus Selenastrum Tetraedon Tetrastrum Centric Diatoms Euglena Trachelomonas Cryptomonas*	*Oscillatoria Ankistrodesmus Pennate Diatoms Anabaenopsis Chroococcus Aphanocapsa Crucigenia Scenedesmus Scenedesmus Tetraedon Centric Diatoms Trachelomonas Cryptomonas*
12/17/91	*Ankistrodesmus Pennate Diatoms Oscillatoria Centric Diatoms Scenedesmus Anabaenopsis Closterium Crucigenia Selenastrum Tetraedon Tetrastrum Trachelomonas Cryptomonas*	No Data	No Data

Table A.1 Continued

12/31/91	*Oscillatoria Ankistrodesmus Pennate & Centric Diatoms Crucigenia Scenedesmus Selenastrum Tetraedon Tetrastrum Chroococcus Aphanocapsa Euglena Trachelomonas Cryptomonas*	*Oscillatoria Ankistrodesmus Pennate & Centric Diatoms Scenedesmus Selenastrum Tetraedon Tetrastrum Trachelomonas Aphanocapsa*	*Oscillatoria Ankistrodesmus Pennate & Centric Diatoms Euglena Trachelomonas Cryptomonas Chroococcus Scenedesmus*
2/17/91	*Oscillatoria Ankistrodesmus Aphanocapsa Scenedesmus Tetrastrum Pennate & Centric Diatoms*	*Oscillatoria Ankistrodesmus Tetrastrum Pennate & Centric Diatoms*	*Oscillatoria Ankistrodesmus Scenedesmus Selenastrum Tetrastrum Pennate & Centric Diatoms*
3/23/92	*Oscillatoria Ankistrodesmus Closterium Scenedesmus Pennate & Centric Diatoms*	*Oscillatoria Ankistrodesmus Scenedesmus Selenastrum Pennate & Centric Diatoms*	*Oscillatoria Ankistrodesmus Merismopedia Scenedesmus Selenastrum Pennate & Centric Diatoms*
4/22/92	*Oscillatoria Ankistrodesmus Crucigenia Scenedesmus Tetraedron Pennate & Centric Diatoms Trachelomonas*	*Oscillatoria Ankistrodesmus Crucigenia Scenedesmus Pennate & Centric Diatoms Trachelomonas*	*Oscillatoria Ankistrodesmus Crucigenia Scenedesmus Selenastrum Tetraedron Pennate & Centric Diatoms Trachelomonas*
5/8/92	*Oscillatoria Ankistrodesmus Closterium Crucigenia Scenedesmus Centric Diatoms Euglena*	*Oscillatoria Ankistrodesmus Scenedesmus Tetraedron Pennate & Centric Diatoms*	*Oscillatoria Ankistrodesmus Scenedesmus Crucigenia Tetraedron Pennate & Centric Diatoms Euglena*

APPENDIX B

WATER QUALITY DATA

SECCHI DEPTH (in inches) SUMMARY

DATE	DAM	SPRING CR ARM	STINKING CR ARM
3/19/91	25	24	24
4/18/91	32	27	24
5/6/91	21	22	22
5/22/91	26	22	24
6/6/91	39	33	30
6/24/91	30	24	25
7/9/91	31	26	29
7/25/91	25	25	28
8/8/91	29	20	24
8/26/91	24	25	24
9/13/91	28	20	24
10/31/91	NO DATA	NO DATA	NO DATA
12/3/91	33	29	29
12/31/91	32	24	29
2/17/92	36	26	24
3/23/92	19	18	24
4/22/92	23	22	22
5/8/92	23	20	18
6/26/92	41	36	36

350755098075601 — LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER—QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SAM- PLING DEPTH (M) (00098)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
MAR 1991										
19...	0930	84015	84015	0.10	2020	8.2	10.0	800	11.5	127
19...	0938	84015	84015	8.0	2020	8.2	10.0	10	10.8	130
APR										
18...	1000	84015	80020	0.10	1990	8.1	18.5	7.7	8.3	129
18...	1001	84015	84015	1.0	1990	8.1	18.5	—	8.2	—
18...	1002	84015	84015	2.0	1990	8.1	18.5	—	8.0	—
18...	1003	84015	84015	3.0	1990	8.1	18.5	—	7.8	—
18...	1004	84015	84015	4.0	1990	8.1	18.5	—	7.8	—
18...	1005	84015	84015	5.0	1990	8.1	18.5	—	7.8	—
18...	1006	84015	84015	6.0	1990	8.1	18.5	—	7.4	—
18...	1007	84015	84015	7.0	1990	8.1	18.5	—	7.3	—
18...	1008	84015	84015	7.5	1990	8.1	18.5	—	7.1	—
18...	1009	84015	84015	8.0	1990	8.0	18.0	—	5.8	—
18...	1010	84015	80020	8.5	1990	7.9	18.0	17	5.0	107
MAY										
06...	0700	84015	84015	0.10	1990	8.0	18.0	15	8.1	—
06...	0701	84015	84015	1.0	1990	8.0	18.0	—	8.0	—
06...	0702	84015	84015	2.0	1990	8.0	18.0	—	8.0	—
06...	0703	84015	84015	3.0	1990	8.0	18.0	—	8.0	—
06...	0704	84015	84015	4.0	1990	8.0	18.5	—	8.0	—
06...	0705	84015	84015	5.0	1990	8.0	18.5	—	8.0	—
06...	0706	84015	84015	6.0	1990	8.0	18.5	—	8.0	—
06...	0707	84015	84015	7.0	2000	8.0	18.5	—	8.0	—
06...	0708	84015	84015	8.0	2000	8.0	18.5	—	8.0	—
06...	0709	84015	84015	8.5	2000	8.0	18.5	—	8.0	—
22...	0745	84015	80020	0.10	2060	8.1	23.5	14	7.1	120
22...	0746	84015	84015	1.0	2060	8.1	23.5	—	7.1	—
22...	0747	84015	84015	2.0	2060	8.1	23.5	—	7.1	—
22...	0748	84015	84015	3.0	2060	8.1	23.5	—	6.1	—
22...	0749	84015	84015	4.0	2060	8.1	22.5	—	3.9	—
22...	0750	84015	84015	5.0	2070	8.1	21.0	—	3.9	—
22...	0751	84015	84015	6.0	2070	8.1	20.5	—	2.7	—
22...	0752	84015	84015	7.0	2060	8.1	19.5	—	1.3	—
22...	0753	84015	80020	8.0	2070	7.5	19.0	18	0.1	120

350755098075601 – LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER–QUALITY DATA

DATE	TIME	AGENCY COL– LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA– LYZING SAMPLE (CODE NUMBER) (00028)	SAM– PLING DEPTH (M) (00098)	SPE– CIFIC CON– DUCT– ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND– ARD UNITS) (00400)	TEMPER– ATURE WATER (DEG C) (00010)	TUR– BID– ITY (NTU) (00076)	OXYGEN, DIS– SOLVED (MG/L) (00300)	ALKA– LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
JUN 1991										
06...	0900	84015	80020	0.10	1900	8.0	24.5	12	7.7	110
06...	0901	84015	84015	1.0	1900	8.0	24.5	—	7.8	—
06...	0902	84015	84015	2.0	1900	8.0	24.5	—	7.7	—
06...	0903	84015	84015	3.0	1900	8.0	24.5	—	7.7	—
06...	0904	84015	84015	4.0	1900	8.0	24.5	—	7.6	—
06...	0905	84015	84015	5.0	1900	8.0	24.5	—	7.6	—
06...	0906	84015	84015	6.0	1900	8.0	24.5	—	7.0	—
06...	0907	84015	84015	7.0	1910	7.7	23.5	—	5.0	—
06...	0908	84015	84015	8.0	1910	7.7	23.5	—	4.1	—
06...	0909	84015	80020	9.0	1920	7.6	23.5	6.5	3.6	106
24...	0730	84015	80020	0.10	1890	7.9	27.0	7.3	5.8	98
24...	0731	84015	84015	1.0	1880	7.9	27.0	—	5.8	—
24...	0732	84015	84015	2.0	1880	7.9	27.0	—	5.7	—
24...	0733	84015	84015	3.0	1890	7.9	27.0	—	5.7	—
24...	0734	84015	84015	4.0	1890	7.9	27.0	—	5.5	—
24...	0735	84015	84015	5.0	1900	7.4	26.0	—	0.7	—
24...	0736	84015	84015	6.0	1900	7.4	25.5	—	0.2	—
24...	0737	84015	84015	7.0	1900	7.4	25.0	—	0.1	—
24...	0738	84015	80020	8.0	1900	7.3	24.5	59	0.1	129
24...	0739	84015	84015	9.0	1900	7.3	24.0	—	0.1	—
JUL										
09...	0730	84015	80020	0.10	1910	7.9	27.0	6.3	6.3	101
09...	0731	84015	84015	1.0	1910	7.9	27.0	—	6.2	—
09...	0732	84015	84015	2.0	1910	7.9	27.0	—	6.2	—
09...	0733	84015	84015	3.0	1910	7.8	27.0	—	6.1	—
09...	0734	84015	84015	4.0	1910	7.8	27.0	—	6.0	—
09...	0735	84015	84015	5.0	1910	7.8	27.0	—	6.0	—
09...	0736	84015	84015	6.0	1910	7.5	26.5	—	2.6	—
09...	0737	84015	84015	7.0	1910	7.4	26.5	—	1.8	—
09...	0738	84015	84015	8.0	1910	7.3	26.0	—	0.2	—
09...	0739	84015	80020	9.0	1900	7.3	26.0	21	0.2	103

350755098075601 - LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	TIME	AGENCY COL-LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA-LYZING SAMPLE (CODE NUMBER) (00028)	SAM-PLING DEPTH (M) (00098)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
AUG 1991										
08...	0845	84015	80020	0.10	1920	7.9	27.5	—	5.9	—
08...	0846	84015	84015	1.0	1920	7.9	27.5	—	5.8	—
08...	0847	84015	84015	2.0	1930	7.9	27.5	—	5.8	—
08...	0848	84015	84015	3.0	1940	7.8	27.5	—	5.8	—
08...	0849	84015	84015	4.0	1930	7.8	27.5	—	5.7	—
08...	0850	84015	84015	5.0	1930	7.8	27.5	—	5.7	—
08...	0851	84015	84015	6.0	1950	7.8	27.5	—	5.7	—
08...	0852	84015	84015	7.0	1950	7.8	27.5	—	5.6	—
08...	0853	84015	84015	8.0	1930	7.6	27.5	—	3.7	—
08...	0854	84015	80020	8.5	1930	7.3	27.0	—	0.9	—
26...	0730	84015	80020	0.10	1920	8.2	27.0	6.6	7.3	79
26...	0731	84015	84015	1.0	1920	8.2	27.0	—	7.3	—
26...	0732	84015	84015	2.0	1930	8.2	27.0	—	7.3	—
26...	0733	84015	84015	3.0	1930	8.2	27.0	—	7.3	—
26...	0734	84015	84015	4.0	1930	8.2	27.0	—	7.1	—
26...	0735	84015	84015	5.0	1920	8.1	27.0	—	7.1	—
26...	0736	84015	84015	6.0	1930	8.0	27.0	—	6.3	—
26...	0737	84015	84015	7.0	1940	7.9	26.5	—	5.5	—
26...	0738	84015	80020	8.0	1930	7.8	26.5	8.1	4.6	82
26...	0739	84015	84015	8.5	1920	7.8	26.5	—	4.4	—
SEP										
13...	0830	84015	80020	0.10	1860	8.2	25.5	7.0	7.5	86
13...	0831	84015	84015	1.0	1860	8.2	25.5	—	7.4	—
13...	0832	84015	84015	2.0	1870	8.2	25.5	—	7.3	—
13...	0833	84015	84015	3.0	1870	8.2	25.5	—	7.1	—
13...	0834	84015	84015	4.0	1870	8.1	25.5	—	7.3	—
13...	0835	84015	84015	5.0	1870	8.2	25.5	—	7.2	—
13...	0836	84015	84015	6.0	1870	8.1	25.5	—	7.1	—
13...	0837	84015	84015	7.0	1870	8.1	25.5	—	7.1	—
13...	0838	84015	80020	8.0	1870	7.7	25.5	8.0	3.7	87
13...	0839	84015	84015	8.5	1870	7.7	25.5	—	3.5	—

350755098075601 -- LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SAM- PLING DEPTH (M) (00098)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
DEC 1991										
03...	1000	84015	80020	0.10	1840	8.2	7.0	10	10.6	109
03...	1001	84015	84015	1.0	1840	8.2	7.0	—	10.5	—
03...	1002	84015	84015	2.0	1840	8.2	7.0	—	10.4	—
03...	1003	84015	84015	3.0	1840	8.2	7.0	—	10.3	—
03...	1004	84015	84015	4.0	1840	8.2	7.0	—	10.3	—
03...	1005	84015	84015	5.0	1850	8.3	7.0	—	10.3	—
03...	1006	84015	84015	6.0	1850	8.3	7.0	—	10.3	—
03...	1007	84015	84015	7.0	1840	8.3	7.0	—	10.3	—
03...	1008	84015	84015	8.0	1850	8.3	7.0	—	10.3	—
31...	0930	84015	80020	0.10	1760	8.3	7.0	—	11.5	119
31...	0931	84015	84015	1.0	1760	8.3	6.0	—	11.4	—
31...	0932	84015	84015	2.0	1760	8.3	6.5	—	11.3	—
31...	0933	84015	84015	3.0	1780	8.3	6.5	—	11.3	—
31...	0934	84015	84015	4.0	1780	8.3	6.5	—	11.2	—
31...	0935	84015	84015	5.0	1780	8.3	6.5	—	11.1	—
31...	0936	84015	84015	6.0	1780	8.3	6.5	—	11.1	—
31...	0937	84015	84015	7.0	1780	8.3	6.5	—	11.0	—
31...	0938	84015	84015	8.0	1800	8.3	6.5	—	10.9	—
31...	0939	84015	84015	9.0	1750	8.3	6.5	—	10.9	—
31...	0940	84015	84015	9.5	1720	8.3	6.5	—	10.9	—
JAN 1992										
17...	0900	84015	80020	0.10	1750	8.5	5.0	—	12.0	—
17...	0901	84015	84015	1.0	1760	8.5	5.0	—	11.8	—
17...	0902	84015	84015	2.0	1760	8.5	5.0	—	11.8	—
17...	0903	84015	84015	3.0	1760	8.5	5.0	—	11.6	—
17...	0904	84015	84015	4.0	1760	8.5	5.0	—	11.6	—
17...	0905	84015	84015	5.0	1770	8.5	5.0	—	11.5	—
17...	0906	84015	84015	6.0	1740	8.5	5.0	—	11.5	—
17...	0907	84015	84015	7.0	1780	8.5	5.0	—	11.5	—
17...	0908	84015	84015	8.0	1770	8.5	5.0	—	11.5	—
17...	0909	84015	84015	9.0	1730	8.5	5.0	—	11.5	—

350755098075601 - LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	TIME	AGENCY COL-LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA-LYZING SAMPLE (CODE NUMBER) (00028)	SAM-PLING DEPTH (M) (00098)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
FEB 1992										
17...	0900	84015	80020	0.10	1780	8.3	7.0	7.5	10.1	131
17...	0901	84015	84015	1.0	1780	8.2	7.0	—	10.1	—
17...	0902	84015	84015	2.0	1790	8.2	7.0	—	10.1	—
17...	0903	84015	84015	3.0	1780	8.2	7.0	—	10.0	—
17...	0904	84015	84015	4.0	1790	8.2	7.0	—	10.0	—
17...	0905	84015	84015	5.0	1790	8.2	7.0	—	10	—
17...	0906	84015	84015	6.0	1790	8.2	7.0	—	10	—
17...	0907	84015	84015	7.0	1780	8.2	7.0	—	10	—
17...	0908	84015	84015	8.0	1790	8.2	7.0	—	10	—
17...	0909	84015	84015	9.0	1780	8.2	7.0	—	10	—
17...	0910	84015	84015	9.6	1800	8.2	7.0	—	10	—
MAR										
23...	1030	84015	80020	0.10	1900	8.3	12.5	15	9.9	133
23...	1031	84015	84015	1.0	1900	8.3	12.5	—	9.2	—
23...	1032	84015	84015	2.0	1900	8.3	12.0	—	9.4	—
23...	1033	84015	84015	3.0	1900	8.3	12.0	—	9.3	—
23...	1034	84015	84015	4.0	1900	8.3	12.0	—	9.3	—
23...	1035	84015	84015	5.0	1900	8.3	12.0	—	9.3	—
23...	1036	84015	84015	6.0	1900	8.3	12.0	—	9.3	—
23...	1037	84015	84015	7.0	1900	8.3	12.0	—	9.2	—
23...	1038	84015	84015	8.0	1900	8.3	12.0	—	9.2	—
23...	1039	84015	84015	9.0	1900	8.3	12.0	—	9.1	—

350755098075601 — LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SAM- PLING DEPTH (M) (00098)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
APR 1992										
06...	1000	84015	84015	0.10	1910	8.1	13.5	—	9.5	—
06...	1001	84015	84015	1.0	1920	8.1	13.5	—	9.4	—
06...	1002	84015	84015	2.0	1910	8.1	13.5	—	9.3	—
06...	1003	84015	84015	3.0	1910	8.1	13.5	—	9.1	—
06...	1004	84015	84015	4.0	1920	8.0	13.0	—	9.0	—
06...	1005	84015	84015	5.0	1910	8.0	13.0	—	8.8	—
06...	1006	84015	84015	6.0	1920	8.0	13.0	—	8.7	—
06...	1007	84015	84015	7.0	1920	8.0	13.0	—	8.7	—
06...	1008	84015	84015	8.0	1920	8.0	13.0	—	8.6	—
06...	1009	84015	84015	9.0	1920	8.0	13.0	—	7.8	—
22...	0930	84015	80020	0.10	1910	8.3	17.5	15	9.1	128
22...	0931	84015	84015	1.0	1910	8.2	17.0	—	9.1	—
22...	0932	84015	84015	2.0	1910	8.2	17.0	—	8.8	—
22...	0933	84015	84015	3.0	1920	8.2	17.0	—	8.7	—
22...	0934	84015	84015	4.0	1910	8.2	17.0	—	8.7	—
22...	0935	84015	84015	5.0	1930	8.2	17.0	—	8.6	—
22...	0936	84015	84015	6.0	1930	8.2	17.0	—	8.6	—
22...	0937	84015	84015	7.0	1950	8.2	17.0	—	8.6	—
22...	0938	84015	84015	8.0	1950	8.2	17.0	—	8.3	—
22...	0939	84015	84015	9.0	1950	8.2	17.0	—	7.6	—
MAY										
08...	1000	84015	80020	0.10	1950	8.0	19.5	19	7.3	132
08...	1001	84015	84015	1.0	1940	8.0	19.5	—	7.0	—
08...	1002	84015	84015	2.0	1940	8.0	19.5	—	6.9	—
08...	1003	84015	84015	3.0	1950	8.0	19.5	—	6.7	—
08...	1004	84015	84015	4.0	1940	7.9	19.5	—	6.6	—
08...	1005	84015	84015	5.0	1950	7.9	19.0	—	6.4	—
08...	1006	84015	84015	6.0	1950	7.9	19.0	—	6.3	—
08...	1007	84015	84015	7.0	1930	7.9	19.0	—	5.9	—
08...	1008	84015	84015	8.0	1950	7.9	19.0	—	5.7	—
08...	1009	84015	84015	8.5	1930	7.8	19.0	—	5.5	—

350755098075601 – LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER–QUALITY DATA

DATE	TIME	AGENCY COL– LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA– LYZING SAMPLE (CODE NUMBER) (00028)	SAM– PLING DEPTH (M) (00098)	SPE– CIFIC CON– DUCT– ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND– ARD UNITS) (00400)	TEMPER– ATURE WATER (DEG C) (00010)	TUR– BID– ITY (NTU) (00076)	OXYGEN, DIS– SOLVED (MG/L) (00300)	ALKA– LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
JUN 1992										
26...	0900	84015	80020	0.10	1820	8.1	26.0	7.0	7.6	121
26...	0901	84015	84015	1.0	1820	8.1	26.0	—	7.5	—
26...	0902	84015	84015	2.0	1820	8.0	26.0	—	7.5	—
26...	0903	84015	84015	3.0	1820	8.0	26.0	—	7.5	—
26...	0904	84015	84015	4.0	1830	8.0	26.0	—	7.4	—
26...	0905	84015	84015	5.0	1820	8.0	26.0	—	6.9	—
26...	0906	84015	84015	7.0	1830	7.7	24.5	—	2.5	—
26...	0907	84015	84015	7.0	1840	7.6	24.0	—	1.2	—
26...	0908	84015	80020	8.0	1870	7.5	24.0	5.9	0.6	140

350755098075601 — LAKE CHICKASHA, AT DAM NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	TIME	AGENCY COL-LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA-LYZING SAMPLE (CODE NUMBER) (00028)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
APR 1991									
18...	1000	84015	80020	1990	8.1	18.5	7.7	8.3	129
18...	1010	84015	80020	1990	7.9	18.0	17	5.0	107
MAY									
06...	0645	84015	80020	1990	8.0	—	15	—	120
22...	0745	84015	80020	2060	8.1	23.5	14	7.1	120
22...	0753	84015	80020	2070	7.5	19.0	18	0.1	120
JUN									
06...	0900	84015	80020	1900	8.0	24.5	12	7.7	110
06...	0909	84015	80020	1920	7.6	23.5	6.5	3.6	106
24...	0730	84015	80020	1890	7.9	27.0	7.3	5.8	98
24...	0738	84015	80020	1900	7.3	24.5	59	0.1	129
JUL									
09...	0730	84015	80020	1910	7.9	27.0	6.3	6.3	101
09...	0739	84015	80020	1900	7.3	26.0	21	0.2	103
25...	0900	—	80020	1930	7.9	—	12	—	94
AUG									
08...	0845	84015	80020	1920	7.9	27.5	—	5.9	—
08...	0854	84015	80020	1930	7.3	27.0	—	0.9	—
26...	0730	84015	80020	1920	8.2	27.0	6.6	7.3	79
26...	0738	84015	80020	1930	7.8	26.5	8.1	4.6	82
SEP									
13...	0830	84015	80020	1860	8.2	25.5	7.0	7.5	86
13...	0838	84015	80020	1870	7.7	25.5	8.0	3.7	87
OCT									
31...	0845	—	80020	—	—	—	17	—	92
DEC									
03...	1000	84015	80020	1840	8.2	7.0	10	10.6	109
31...	0930	84015	80020	1760	8.3	7.0	—	11.5	119
JAN 1992									
17...	0900	84015	80020	1750	8.5	5.0	—	12.0	—
FEB									
17...	0900	84015	80020	1780	8.3	7.0	7.5	10.1	131
MAR									
23...	1030	84015	80020	1900	8.3	12.5	15	9.9	133
APR									
22...	0930	84015	80020	1910	8.3	17.5	15	9.1	128
MAY									
08...	1000	84015	80020	1950	8.0	19.5	19	7.3	132

WATER-QUALITY DATA

DATE	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	RESIDUE TOTAL AT 105 DEG. C, SUS- PENDED (MG/L) (00530)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITRO- GEN, NITRATE TOTAL (MG/L AS N) (00620)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)
APR 1991									
18...	1000	46	0.40	18	1820	—	0.020	<0.050	0.030
18...	—	—	—	—	—	0.890	0.010	0.900	0.020
MAY									
06...	1000	42	0.40	47	1850	—	<0.010	<0.050	0.020
22...	1200	38	0.30	10	1860	—	<0.010	<0.050	0.030
22...	1200	39	0.30	—	1850	—	0.020	<0.050	0.620
JUN									
06...	1200	42	0.70	11	1700	0.040	0.010	0.050	0.020
06...	1300	44	0.40	10	1710	—	0.010	<0.050	0.340
24...	960	45	0.40	13	1720	—	<0.010	<0.050	<0.010
24...	960	45	0.50	5	1710	—	<0.010	<0.050	0.010
JUL									
09...	—	—	—	6	1750	—	<0.010	<0.050	0.430
09...	—	—	—	3	1720	—	<0.010	<0.050	0.020
25...	—	—	—	13	1780	—	<0.010	<0.050	0.060
AUG									
08...	—	—	—	8	1790	—	0.030	<0.050	<0.010
08...	—	—	—	13	1780	—	<0.010	<0.050	<0.010
26...	—	—	—	—	—	—	0.020	<0.050	<0.010
26...	—	—	—	—	—	—	<0.010	<0.050	<0.010
SEP									
13...	—	—	—	2	1750	—	—	—	—
13...	—	—	—	4	1700	—	—	—	—
OCT									
31...	—	—	—	11	—	—	0.010	<0.050	0.070
DEC									
03...	—	—	—	1	1900	0.071	<0.010	0.071	0.100
31...	—	—	—	10	1660	0.038	0.020	0.058	0.030
JAN 1992									
17...	—	—	—	—	—	—	—	—	—
FEB									
17...	—	—	—	26	1760	—	<0.010	<0.050	0.110
MAR									
23...	—	—	—	18	1650	0.061	0.030	0.091	0.040
APR									
22...	—	—	—	20	1690	—	<0.010	<0.050	0.040
MAY									
08...	—	—	—	<1	1740	—	<0.010	<0.050	0.010

WATER-QUALITY DATA

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS NH4) (71845)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, TOTAL (MG/L AS N) (00600)	NITRO-GEN, TOTAL (MG/L AS NO3) (71887)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHATE, TOTAL (MG/L AS PO4) (00650)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORGANIC TOTAL (MG/L AS P) (00670)
APR 1991									
18...	0.04	0.97	1.0	1.0	—	0.080	0.06	0.020	0.06
18...	0.03	0.28	0.30	1.2	5.3	0.040	0.03	0.010	0.03
MAY									
06...	0.03	0.78	0.80	0.80	—	0.070	—	<0.010	—
22...	0.04	1.2	1.2	1.2	—	0.040	—	<0.010	—
22...	0.80	0.98	1.6	1.6	—	0.090	0.09	0.030	0.06
JUN									
06...	0.03	0.88	0.90	0.95	4.2	0.030	—	<0.010	—
06...	0.44	1.6	1.9	1.9	—	0.050	0.03	0.010	0.04
24...	—	—	<0.20	—	—	0.020	0.06	0.020	0.0
24...	0.01	0.89	0.90	0.90	—	0.050	0.03	0.010	0.04
JUL									
09...	0.55	0.97	1.4	1.4	—	0.080	0.12	0.040	0.04
09...	0.03	0.98	1.0	1.0	—	0.030	—	<0.010	—
25...	0.08	1.2	1.3	1.3	—	0.030	—	<0.010	—
AUG									
08...	—	1.0	1.0	1.0	—	0.040	—	<0.010	—
08...	—	1.1	1.1	1.1	—	0.040	—	<0.010	—
26...	—	1.1	1.1	1.1	—	0.040	0.06	0.020	0.02
26...	—	1.0	1.0	1.0	—	0.040	—	<0.010	—
SEP									
13...	—	—	—	—	—	—	—	—	—
13...	—	—	—	—	—	—	—	—	—
OCT									
31...	0.09	1.2	1.3	1.3	—	0.080	0.09	0.030	0.05
DEC									
03...	0.13	1.0	1.1	1.2	5.2	0.060	0.03	0.010	0.05
31...	0.04	0.87	0.90	0.96	4.2	0.050	0.06	0.020	0.03
JAN 1992									
17...	—	—	—	—	—	—	—	—	—
FEB									
17...	0.14	0.79	0.90	0.90	—	0.030	—	<0.010	—
MAR									
23...	0.05	0.96	1.0	1.1	4.8	0.040	—	<0.010	—
APR									
22...	0.05	0.86	0.90	0.90	—	0.030	—	<0.010	—
MAY									
08...	0.01	0.79	0.80	0.80	—	0.040	0.03	0.010	0.03

350755098075601 - LAKE CHICKASHA, AT DAM NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	HARD- NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM TOTAL RECOV- ERABLE (MG/L AS CA) (00916)
JUN 1992										
26...	0900	84015	80020	1820	8.1	26.0	7.0	7.6	740	230
26...	0908	84015	80020	1870	7.5	24.0	5.9	0.6	760	240

WATER-QUALITY DATA

DATE	MAGNESIUM, TOTAL RECOVERABLE (MG/L AS MG) (00927)	SODIUM, TOTAL RECOVERABLE (MG/L AS NA) (00929)	POTASSIUM, TOTAL RECOVERABLE (MG/L AS K) (00937)	ALKALINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	RESIDUE TOTAL AT 105 DEG. C, SUSPENDED (MG/L) (00530)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITROGEN, NITRITE TOTAL (MG/L AS N) (00615)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITROGEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITROGEN, AMMONIA TOTAL (MG/L AS NH4) (71845)
JUN 1992										
26...	70	65	5.6	121	17	1660	<0.010	<0.050	0.040	0.05
26...	72	64	5.7	140	19	1630	<0.010	<0.050	0.810	1.0

WATER-QUALITY DATA

DATE	NITRO- GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO- GEN, TOTAL (MG/L AS N) (00600)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHATE, TOTAL (MG/L AS PO4) (00650)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORGANIC TOTAL (MG/L AS P) (00670)	ARSENIC TOTAL (UG/L AS AS) (01002)	BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) (01007)	CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) (01027)
JUN 1992										
26...	0.86	0.90	0.90	0.040	—	<0.010	—	2	<100	<1
26...	0.89	1.7	1.7	0.150	0.28	0.090	0.06	3	<100	<1

WATER–QUALITY DATA

DATE	CHRO–MIUM, TOTAL RECOV–ERABLE (UG/L AS CR) (01034)	COPPER, TOTAL RECOV–ERABLE (UG/L AS CU) (01042)	IRON, TOTAL RECOV–ERABLE (UG/L AS FE) (01045)	LEAD, TOTAL RECOV–ERABLE (UG/L AS PB) (01051)	MANGA–NESE, TOTAL RECOV–ERABLE (UG/L AS MN) (01055)	MERCURY TOTAL RECOV–ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV–ERABLE (UG/L AS NI) (01067)	SELE–NIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOV–ERABLE (UG/L AS ZN) (01092)
JUN 1992									
26...	1	<1	90	<1	60	<0.10	<1	<1	<10
26...	3	<1	190	<1	1100	0.20	<1	<1	<10

350755098075601 — LAKE CHICK. ., AT DAM, NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	NITRO- GEN, NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO- GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	CALCIUM RECOV. FM BOT- TOM MA- TERIAL (MG/KG AS CA) (00917)	MAGNE- SIUM, RECOV. FM BOT- TOM MA- TERIAL (MG/KG) (00924)	SODIUM, RECOV. FM BOT- TOM MA- TERIAL (MG/KG AS NA) (00934)	POTAS- SIUM, RECOV. FM BOT- TOM MA- TERIAL (MG/KG) (00938)	ARSENIC TOTAL IN BOT- TOM MA- TERIAL (UG/G AS AS) (01003)	CADMIUM RECOV. FM BOT- TOM MA- TERIAL (UG/G AS CD) (01028)	CHRO- MIUM, RECOV. FM BOT- TOM MA- TERIAL (UG/G) (01029)	COPPER, RECOV. FM BOT- TOM MA- TERIAL (UG/G AS CU) (01043)
JUN 1992										
26...	130	<2.0	55000	16000	510	2500	10	2	30	20

350755098075601 — LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	LEAD, RECOV. FM BOTTOM MATERIAL (UG/G AS PB) (01052)	MANGANESE, RECOV. FM BOTTOM MATERIAL (UG/G) (01053)	NICKEL, RECOV. FM BOTTOM MATERIAL (UG/G AS NI) (01068)	ZINC, RECOV. FM BOTTOM MATERIAL (UG/G AS ZN) (01093)	SELENIUM, TOTAL IN BOTTOM MATERIAL (UG/G) (01148)	IRON, RECOV. FM BOTTOM MATERIAL (UG/G AS FE) (01170)	PCN, TOTAL IN BOTTOM MATERIAL (UG/KG) (39251)	ALDRIN, TOTAL IN BOTTOM MATERIAL (UG/KG) (39333)	LINDANE TOTAL IN BOTTOM MATERIAL (UG/KG) (39343)	CHLORDANE, TOTAL IN BOTTOM MATERIAL (UG/KG) (39351)
JUN 1992										
26...	10	1000	30	70	<1	17000	<1.0	<0.1	<0.1	<1.0

350755098075601 — LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER–QUALITY DATA

DATE	DDD, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39363)	DDE, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39368)	DDT, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39373)	DI- ELDRIN, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39383)	ENDO- SULFAN, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39389)	ENDRIN, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39393)	ETHION, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39399)	TOXA- PHENE, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39403)	HEPTA- CHLOR, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39413)	HEPTA- CHLOR EPOXIDE TOT. IN BOTTOM MATL. (UG/KG) (39423)
JUN 1992										
26...	0.4	1.6	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<0.1	<0.1

350755098075601 — LAKE CHICKASHA, AT DAM, NEAR VERDEN, OK

WATER-QUALITY DATA

DATE	METH-OXY-CHLOR, TOT. IN BOTTOM MATL. (UG/KG) (39481)	PCB, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39519)	MALA-THION, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39531)	PARA-THION, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39541)	DI-AZINON, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39571)	METHYL PARA-THION, TOT. IN BOTTOM MATL. (UG/KG) (39601)	MIREX, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39758)	TRI-THION, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39787)	MERCURY RECOV. FM BOT-TOM MA-TERIAL (UG/G AS HG) (71921)	PER-THANE IN BOT-TOM MA-TERIAL (UG/KG) (81886)
JUN 1992										
26...	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.02	<1.00

350857098080301 — LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER—QUALITY DATA

DATE	TIME	AGENCY COL— LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA— LYZING SAMPLE (CODE NUMBER) (00028)	SAM— PLING DEPTH (M) (00098)	SPE— CIFIC CON— DUCT— ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND— ARD UNITS) (00400)	TEMPER— ATURE WATER (DEG C) (00010)	TUR— BID— ITY (NTU) (00076)	OXYGEN, DIS— SOLVED (MG/L) (00300)	ALKA— LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
MAR 1991										
19...	1100	84015	84015	0.10	2030	8.3	11.5	11	12.6	120
19...	1103	84015	84015	2.7	2050	8.2	11.0	21	10.9	124
APR										
18...	1145	84015	80020	0.10	1980	8.3	20.0	8.6	9.2	113
18...	1150	84015	80020	4.6	1990	8.2	19.0	10	7.7	116
MAY										
22...	0900	84015	80020	0.10	2040	8.2	24.5	17	8.2	110
22...	0905	84015	80020	5.0	2070	8.0	22.0	27	2.5	117
JUN										
06...	1000	84015	80020	0.10	1820	8.0	24.5	14	7.5	104
06...	1001	84015	80020	5.0	1910	7.7	24.0	11	4.9	105
24...	0900	84015	80020	0.10	1880	7.9	27.0	7.0	6.1	96
24...	0906	84015	80020	5.5	1880	7.5	26.0	11	1.5	110
JUL										
09...	0900	84015	80020	0.10	1900	8.0	28.5	8.4	7.7	97
09...	0905	84015	80020	5.0	1910	7.5	28.0	9.5	3.6	92
AUG										
08...	0950	84015	80020	0.10	1930	8.0	28.5	—	7.2	—
08...	0955	84015	80020	5.0	1920	7.3	27.5	—	0.5	—
26...	0930	84015	80020	0.10	1920	7.9	27.5	7.0	8.3	78
26...	0935	84015	80020	4.0	1930	7.2	26.0	—	0.2	—
JUN 1992										
26...	1030	84015	80020	0.10	1830	8.0	26.0	10	7.8	116
26...	1034	84015	80020	4.0	1840	7.8	25.0	14	3.8	132
26...	1035	84015	84015	5.2	—	—	—	—	—	—

350857098080301 - LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	HARD- NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM TOTAL RECOV- ERABLE (MG/L AS CA) (00916)	MAGNE- SIUM, TOTAL RECOV- ERABLE (MG/L AS MG) (00927)
APR 1991											
18...	1145	84015	80020	1980	8.3	20.0	8.6	9.2	—	—	—
18...	1150	84015	80020	1990	8.2	19.0	10	7.7	—	—	—
MAY											
06...	0820	84015	80020	2010	8.0	18.0	21	—	—	—	—
22...	0900	84015	80020	2040	8.2	24.5	17	8.2	—	—	—
22...	0905	84015	80020	2070	8.0	22.0	27	2.5	—	—	—
JUN											
06...	1000	84015	80020	1820	8.0	24.5	14	7.5	—	—	—
06...	1001	84015	80020	1910	7.7	24.0	11	4.9	—	—	—
24...	0900	84015	80020	1880	7.9	27.0	7.0	6.1	—	—	—
24...	0906	84015	80020	1880	7.5	26.0	11	1.5	—	—	—
JUL											
09...	0900	84015	80020	1900	8.0	28.5	8.4	7.7	—	—	—
09...	0905	84015	80020	1910	7.5	28.0	9.5	3.6	—	—	—
25...	1000	84015	80020	1930	7.8	—	12	—	—	—	—
AUG											
08...	0950	84015	80020	1930	8.0	28.5	—	7.2	—	—	—
08...	0955	84015	80020	1920	7.3	27.5	—	0.5	—	—	—
26...	0930	84015	80020	1920	7.9	27.5	7.0	8.3	—	—	—
26...	0935	84015	80020	1930	7.2	26.0	—	0.2	—	—	—
SEP											
13...	0930	84015	80020	1860	8.4	26.5	11	—	—	—	—
OCT											
31...	0930	84015	80020	—	—	—	19	—	—	—	—
DEC											
03...	1100	84015	80020	1860	8.3	6.5	8.0	—	—	—	—
31...	1030	84015	80020	1770	8.3	6.5	12	—	—	—	—
FEB 1992											
17...	1015	84015	80020	1800	8.3	6.5	9.8	—	—	—	—
MAR											
23...	1130	84015	80020	1900	8.4	12.0	17	—	—	—	—
APR											
22...	1130	84015	80020	1930	8.3	16.5	17	—	—	—	—
MAY											
08...	1100	84015	80020	1940	8.2	20.0	17	—	—	—	—
JUN											
26...	1030	84015	80020	1830	8.0	26.0	10	7.8	790	240	74
26...	1034	84015	80020	1840	7.8	25.0	14	3.8	770	240	73

350857098080301 - LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER-QUALITY DATA

DATE	SODIUM, TOTAL RECOV-ERABLE (MG/L AS NA) (00929)	POTAS-SIUM, TOTAL RECOV-ERABLE (MG/L AS K) (00937)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDED (MG/L) (00530)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITRO-GEN, NITRATE TOTAL (MG/L AS N) (00620)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)
APR 1991											
18...	—	—	113	—	—	—	—	—	—	0.020	<0.050
18...	—	—	116	—	—	—	—	—	—	0.020	<0.050
MAY											
06...	—	—	123	1400	44	0.40	20	1820	—	<0.010	<0.050
22...	—	—	110	1200	39	0.30	48	1830	—	<0.010	<0.050
22...	—	—	117	1200	38	0.30	21	1860	—	<0.010	<0.050
JUN											
06...	—	—	104	1000	40	0.30	18	1650	0.040	0.010	0.050
06...	—	—	105	1300	45	0.80	21	1720	20.0	0.020	20.0
24...	—	—	96	1000	45	0.40	7	1700	—	<0.010	<0.050
24...	—	—	110	960	45	0.40	16	1730	—	0.010	<0.050
JUL											
09...	—	—	97	—	—	—	7	1740	—	<0.010	<0.050
09...	—	—	92	—	—	—	16	1730	—	<0.010	<0.050
25...	—	—	95	—	—	—	10	1790	—	<0.010	<0.050
AUG											
08...	—	—	—	—	—	—	5	1790	—	<0.010	<0.050
08...	—	—	—	—	—	—	11	1780	—	0.010	<0.050
26...	—	—	78	—	—	—	—	—	—	<0.010	<0.050
26...	—	—	—	—	—	—	—	—	—	0.030	<0.050
SEP											
13...	—	—	88	—	—	—	7	1190	—	<0.010	<0.050
OCT											
31...	—	—	90	—	—	—	20	1730	—	0.010	<0.050
DEC											
03...	—	—	106	—	—	—	4	1850	0.085	0.010	0.095
31...	—	—	109	—	—	—	8	1650	0.054	0.010	0.064
FEB 1992											
17...	—	—	111	—	—	—	16	1960	—	<0.010	<0.050
MAR											
23...	—	—	133	—	—	—	16	1670	0.066	0.030	0.096
APR											
22...	—	—	136	—	—	—	21	1690	—	<0.010	<0.050
MAY											
08...	—	—	127	—	—	—	4	1740	—	<0.010	<0.050
JUN											
26...	65	5.4	116	—	—	—	13	1620	—	<0.010	<0.050
26...	64	6.0	132	—	—	—	10	1620	—	0.010	<0.050

350857098080301 — LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER-QUALITY DATA

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITROGEN, AMMONIA TOTAL (MG/L AS NH4) (71845)	NITROGEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITROGEN, TOTAL (MG/L AS N) (00600)	NITROGEN, TOTAL (MG/L AS NO3) (71887)	PHOSPHORUS TOTAL (MG/L AS P) (00665)	PHOSPHATE, TOTAL (MG/L AS PO4) (00650)	PHOSPHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOSPHORUS ORGANIC TOTAL (MG/L AS P) (00670)	ARSENIC TOTAL (UG/L AS AS) (01002)
APR 1991											
18...	0.020	0.03	0.98	1.0	1.0	—	0.070	0.03	0.010	0.06	—
18...	0.040	0.05	0.96	1.0	1.0	—	0.090	0.06	0.020	0.07	—
MAY											
06...	0.020	0.03	0.88	0.90	0.90	—	0.060	—	<0.010	—	—
22...	0.020	0.03	0.98	1.0	1.0	—	0.040	—	<0.010	—	—
22...	0.050	0.06	1.2	1.2	1.2	—	0.050	—	<0.010	—	—
JUN											
06...	0.070	0.09	0.63	0.70	0.75	3.3	0.030	—	<0.010	—	—
06...	1.60	2.1	7.0	8.6	29	130	0.970	3.00	0.980	0.0	—
24...	0.020	0.03	0.48	0.50	0.50	—	0.050	—	—	—	—
24...	0.030	0.04	0.87	0.90	0.90	—	0.050	—	—	—	—
JUL											
09...	<0.010	—	0.80	0.80	0.80	—	0.040	—	—	—	—
09...	<0.010	—	1.0	1.0	1.0	—	0.040	—	—	—	—
25...	0.210	0.27	1.5	1.7	1.7	—	0.020	—	<0.010	—	—
AUG											
08...	<0.010	—	1.0	1.0	1.0	—	0.040	—	<0.010	—	—
08...	0.030	0.04	0.97	1.0	1.0	—	0.050	—	<0.010	—	—
26...	0.020	0.03	1.1	1.1	1.1	—	0.040	—	—	—	—
26...	0.140	0.18	0.96	1.1	1.1	—	0.040	—	—	—	—
SEP											
13...	0.050	0.06	1.0	1.1	1.1	—	0.030	—	<0.010	—	—
OCT											
31...	0.080	0.10	1.1	1.2	1.2	—	0.070	0.09	0.030	0.04	—
DEC											
03...	0.140	0.18	1.1	1.2	1.3	5.7	0.070	0.03	0.010	0.06	—
31...	0.020	0.03	1.1	1.1	1.2	5.2	0.060	0.03	0.010	0.05	—
FEB 1992											
17...	0.090	0.12	0.91	1.0	1.0	—	0.090	0.03	0.010	0.08	—
MAR											
23...	0.060	0.08	0.94	1.0	1.1	4.9	0.040	—	<0.010	—	—
APR											
22...	0.030	0.04	0.67	0.70	0.70	—	0.030	0.03	0.010	0.02	—
MAY											
08...	0.010	0.01	0.59	0.60	0.60	—	0.030	0.03	0.010	0.02	—
JUN											
26...	0.040	0.05	0.86	0.90	0.90	—	0.030	—	<0.010	—	2
26...	0.090	0.12	0.81	0.90	0.90	—	0.040	—	<0.010	—	2

350857098080301 - LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER-QUALITY DATA

DATE	BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) (01007)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) (01027)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) (01034)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) (01042)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE) (01045)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) (01051)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) (01055)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) (01067)	SELE-NIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) (01092)
APR 1991											
18...	—	—	—	—	—	—	—	—	—	—	—
18...	—	—	—	—	—	—	—	—	—	—	—
MAY											
06...	—	—	—	—	—	—	—	—	—	—	—
22...	—	—	—	—	—	—	—	—	—	—	—
22...	—	—	—	—	—	—	—	—	—	—	—
JUN											
06...	—	—	—	—	—	—	—	—	—	—	—
06...	—	—	—	—	—	—	—	—	—	—	—
24...	—	—	—	—	—	—	—	—	—	—	—
24...	—	—	—	—	—	—	—	—	—	—	—
JUL											
09...	—	—	—	—	—	—	—	—	—	—	—
09...	—	—	—	—	—	—	—	—	—	—	—
25...	—	—	—	—	—	—	—	—	—	—	—
AUG											
08...	—	—	—	—	—	—	—	—	—	—	—
08...	—	—	—	—	—	—	—	—	—	—	—
26...	—	—	—	—	—	—	—	—	—	—	—
26...	—	—	—	—	—	—	—	—	—	—	—
SEP											
13...	—	—	—	—	—	—	—	—	—	—	—
OCT											
31...	—	—	—	—	—	—	—	—	—	—	—
DEC											
03...	—	—	—	—	—	—	—	—	—	—	—
31...	—	—	—	—	—	—	—	—	—	—	—
FEB 1992											
17...	—	—	—	—	—	—	—	—	—	—	—
MAR											
23...	—	—	—	—	—	—	—	—	—	—	—
APR											
22...	—	—	—	—	—	—	—	—	—	—	—
MAY											
08...	—	—	—	—	—	—	—	—	—	—	—
JUN											
26...	<100	<1	<1	<1	140	<1	80	<0.10	<1	<1	<10
26...	<100	<1	<1	<1	110	<1	110	<0.10	<1	<1	<10

350857098080301 - LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER-QUALITY DATA

DATE	NITRO- GEN,NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO- GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	CALCIUM RECOV. FM BOT- TOM MA- TERIAL (MG/KG AS CA) (00917)	MAGNE- SIUM, RECOV. FM BOT- TOM MA- TERIAL (MG/KG) (00924)	SODIUM, RECOV. FM BOT- TOM MA- TERIAL (MG/KG AS NA) (00934)	POTAS- SIUM, RECOV. FM BOT- TOM MA- TERIAL (MG/KG) (00938)	ARSENIC TOTAL IN BOT- TOM MA- TERIAL (UG/G AS AS) (01003)	CADMIUM RECOV. FM BOT- TOM MA- TERIAL (UG/G AS CD) (01028)	CHRO- MIUM, RECOV. FM BOT- TOM MA- TERIAL (UG/G) (01029)	COPPER, RECOV. FM BOT- TOM MA- TERIAL (UG/G AS CU) (01043)
JUN 1992										
26...	4.0	<2.0	6200	1600	50	270	4	<1	4	3

350857098080301 — LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER—QUALITY DATA

DATE	LEAD, RECOV. FM BOT- TOM MA- TERIAL (UG/G AS PB) (01052)	MANGA- NESE, RECOV. FM BOT- TOM MA- TERIAL (UG/G) (01053)	NICKEL, RECOV. FM BOT- TOM MA- TERIAL (UG/G AS NI) (01068)	ZINC, RECOV. FM BOT- TOM MA- TERIAL (UG/G AS ZN) (01093)	SELE- NIUM, TOTAL IN BOT- TOM MA- TERIAL (UG/G) (01148)	IRON, RECOV. FM BOT- TOM MA- TERIAL (UG/G AS FE) (01170)	PCN, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39251)	ALDRIN, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39333)	LINDANE TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39343)	CHLOR- DANE, TOTAL IN BOT- TOM MA- TERIAL (UG/KG) (39351)
JUN 1992										
26...	<10	160	<10	<10	<1	2000	<1.0	<0.1	<0.1	<1.0

350857098080301 - LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER-QUALITY DATA

DATE	DDD, TOTAL IN BOTTOM MATERIAL (UG/KG) (39363)	DDE, TOTAL IN BOTTOM MATERIAL (UG/KG) (39368)	DDT, TOTAL IN BOTTOM MATERIAL (UG/KG) (39373)	DI-ELDRIN, TOTAL IN BOTTOM MATERIAL (UG/KG) (39383)	ENDO-SULFAN, TOTAL IN BOTTOM MATERIAL (UG/KG) (39389)	ENDRIN, TOTAL IN BOTTOM MATERIAL (UG/KG) (39393)	ETHION, TOTAL IN BOTTOM MATERIAL (UG/KG) (39399)	TOXA-PHENE, TOTAL IN BOTTOM MATERIAL (UG/KG) (39403)	HEPTA-CHLOR, TOTAL IN BOTTOM MATERIAL (UG/KG) (39413)	HEPTA-CHLOR EPOXIDE TOT. IN BOTTOM MATL. (UG/KG) (39423)
JUN 1992										
26...	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<0.1	<0.1

350857098080301 – LAKE CHICKASHA, STINKING CREEK ARM, NR VERDEN,

WATER–QUALITY DATA

DATE	METH-OXY-CHLOR, TOT. IN BOTTOM MATL. (UG/KG) (39481)	PCB, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39519)	MALA-THION, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39531)	PARA-THION, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39541)	DI-AZINON, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39571)	METHYL PARA-THION, TOT. IN BOTTOM MATL. (UG/KG) (39601)	MIREX, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39758)	TRI-THION, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39787)	MERCURY RECOV. FM BOT-TOM MA-TERIAL (UG/G AS HG) (71921)	PER-THANE IN BOT-TOM MA-TERIAL (UG/KG) (81886)
JUN 1992										
26...	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1.00

350859098090201 - LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SAM- PLING DEPTH (M) (00098)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
MAR 1991										
19...	1000	84015	84015	0.10	2020	8.3	11.0	9.4	12.2	127
19...	1004	84015	84015	4.0	2020	8.3	10.5	13	11.1	130
APR										
18...	1100	84015	80020	0.10	1960	8.2	20.0	9.1	8.8	112
18...	1101	84015	84015	1.0	1970	8.2	19.5	—	8.2	—
18...	1102	84015	84015	2.0	1970	8.2	19.0	—	8.0	—
18...	1103	84015	84015	3.0	1990	8.2	19.0	—	7.7	—
18...	1104	84015	80020	4.0	1970	—	19.0	18	7.1	117
MAY										
06...	0750	84015	80020	0.10	2000	8.0	18.0	20	8.2	113
06...	0751	84015	84015	1.0	2000	8.0	18.0	—	8.2	—
06...	0752	84015	84015	2.0	2000	8.0	18.0	—	8.2	—
06...	0753	84015	84015	3.0	2000	8.0	18.0	—	8.2	—
06...	0754	84015	84015	4.0	2010	8.0	18.0	—	8.2	—
22...	0815	84015	80020	0.10	2060	8.0	25.0	20	7.6	113
22...	0816	84015	84015	1.0	2060	8.0	25.0	—	7.6	—
22...	0817	84015	84015	2.0	2060	8.0	25.0	—	7.6	—
22...	0818	84015	84015	3.0	2060	8.0	25.0	—	7.5	—
22...	0819	84015	80020	4.0	2060	8.0	25.0	22	7.2	113
22...	0820	84015	84015	4.5	2060	8.1	23.5	—	2.9	—
JUN										
06...	0930	84015	80020	0.10	1810	8.1	24.5	12	7.8	107
06...	0931	84015	84015	1.0	1810	8.1	24.5	—	7.8	—
06...	0932	84015	84015	2.0	1820	8.1	24.5	—	7.8	—
06...	0933	84015	84015	3.0	1820	8.1	24.5	—	7.7	—
06...	0934	84015	84015	4.0	1840	8.0	24.5	—	7.4	—
06...	0935	84015	80020	5.0	1870	7.7	24.0	32	4.3	108
24...	0840	84015	80020	0.10	1880	7.9	27.5	13	5.8	97
24...	0841	84015	84015	1.0	1880	7.9	27.5	—	5.8	—
24...	0842	84015	84015	2.0	1880	7.9	27.5	—	5.6	—
24...	0843	84015	84015	3.0	1880	7.9	27.5	—	5.5	—
24...	0844	84015	84015	4.0	1880	7.6	27.0	—	3.0	—
24...	0845	84015	80020	4.5	1880	7.4	28.0	14	1.6	104
JUL										
09...	0815	84015	80020	0.10	1900	8.0	28.5	8.1	7.7	92
09...	0816	84015	84015	1.0	1900	8.0	29.0	—	7.6	—
09...	0817	84015	84015	2.0	1900	8.0	29.0	—	7.6	—
09...	0818	84015	84015	3.0	1900	8.0	29.0	—	7.5	—
09...	0819	84015	80020	4.0	1900	7.4	27.0	7.2	1.6	98

350859098090201 - LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SAM- PLING DEPTH (M) (00098)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
AUG 1991										
08...	0930	84015	80020	0.10	1930	8.0	28.5	—	7.0	—
08...	0931	84015	80020	1.0	1940	8.0	28.5	—	6.9	—
08...	0932	84015	80020	2.0	1930	8.0	28.5	—	6.6	—
08...	0933	84015	80020	3.0	1930	8.0	28.5	—	6.3	—
08...	0934	84015	80020	4.0	1950	7.4	27.5	—	1.2	—
26...	0845	84015	80020	0.10	1910	7.8	28.0	11	8.7	78
26...	0846	84015	84015	1.0	1920	7.9	28.0	—	8.6	—
26...	0847	84015	84015	2.0	1920	8.0	28.0	—	8.1	—
26...	0848	84015	80020	3.0	1930	7.3	26.5	6.9	1.6	91
26...	0849	84015	84015	4.0	1920	7.2	26.5	—	0.2	—
SEP										
13...	0816	84015	84015	1.0	1860	8.4	26.5	—	7.7	—
13...	0915	84015	80020	0.10	1860	8.4	26.5	12	7.8	86
13...	0917	84015	84015	2.0	1860	8.4	26.5	—	7.5	—
13...	0918	84015	84015	3.0	1860	8.3	26.5	—	7.4	—
13...	0919	84015	84015	4.0	1850	8.3	26.0	—	7.0	—
DEC										
03...	1030	84015	80020	0.10	1840	8.2	6.5	10	10.9	106
03...	1031	84015	84015	1.0	1840	8.2	6.5	—	10.9	—
03...	1032	84015	84015	2.0	1830	8.2	6.5	—	10.8	—
03...	1033	84015	84015	3.0	1840	8.2	6.5	—	10.8	—
03...	1034	84015	84015	4.0	1840	8.3	6.5	—	10.7	—
03...	1035	84015	84015	5.0	1850	8.3	6.5	—	10.7	—
31...	1001	84015	84015	1.0	1780	8.4	6.5	—	12.2	—
31...	1002	84015	84015	2.0	1780	8.4	6.5	—	12.1	—
31...	1003	84015	84015	3.0	1780	8.4	6.5	—	12.1	—
31...	1004	84015	84015	4.0	1800	8.4	6.5	—	12.1	—
31...	1005	84015	84015	5.0	1770	8.4	6.5	—	12.0	—
FEB 1992										
17...	0940	84015	80020	0.10	1780	8.3	7.0	10	10.8	127
17...	0941	84015	84015	1.0	1790	8.3	6.5	—	10.7	—
17...	0945	84015	84015	5.0	1790	8.2	6.5	—	10.4	—
MAR										
23...	1100	84015	80020	0.10	1890	8.4	12.5	13	9.7	135
23...	1101	84015	84015	1.0	1900	8.4	12.5	—	9.6	—
23...	1102	84015	84015	2.0	1900	8.4	12.0	—	9.3	—
23...	1103	84015	84015	3.0	1900	8.3	12.0	—	9.2	—
23...	1104	84015	84015	4.0	1900	8.3	12.0	—	9.0	—
23...	1105	84015	84015	4.5	1890	8.3	12.0	—	9.0	—

350859098090201 - LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SAM- PLING DEPTH (M) (00098)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
APR 1992										
22...	1030	84015	80020	0.10	1920	8.3	17.0	15	9.2	138
22...	1031	84015	84015	1.0	1920	8.3	17.0	—	9.1	—
22...	1032	84015	84015	2.0	1920	8.3	17.0	—	9.0	—
22...	1033	84015	84015	3.0	1930	8.3	16.5	—	8.9	—
22...	1034	84015	84015	4.0	1930	8.3	16.5	—	8.8	—
22...	1035	84015	84015	4.5	1930	8.3	16.5	—	8.8	—
MAY										
08...	1025	84015	84015	0.10	1950	8.2	20.0	—	8.5	—
08...	1026	84015	84015	1.0	1950	8.2	20.0	—	8.5	—
08...	1027	84015	84015	2.0	1950	8.2	20.0	—	8.4	—
08...	1028	84015	84015	3.0	1950	8.2	20.0	—	8.3	—
08...	1029	84015	84015	4.0	1980	8.2	20.0	—	8.3	—
08...	1030	84015	80020	4.5	1940	8.2	20.0	17	8.2	127
JUN										
26...	1000	84015	80020	0.10	1820	8.0	26.0	8.0	7.2	120
26...	1001	84015	84015	1.0	1820	8.0	26.0	—	7.3	—
26...	1002	84015	84015	2.0	1830	8.0	26.0	—	7.2	—
26...	1003	84015	84015	3.0	1830	7.9	25.5	—	6.1	—
26...	1004	84015	80020	4.0	1840	7.7	25.0	17	2.8	126
26...	1005	84015	84015	4.5	1830	7.6	25.0	—	2.2	—

350859098090201 — LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SAM- PLING DEPTH (FEET) (00003)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)
APR 1991										
18...	1100	84015	80020	—	1960	8.2	20.0	9.1	8.8	112
18...	1104	84015	80020	—	1970	—	19.0	18	7.1	117
MAY										
06...	0750	84015	80020	—	2000	8.0	18.0	20	8.2	113
22...	0815	84015	80020	—	2060	8.0	25.0	20	7.6	113
22...	0819	84015	80020	—	2060	8.0	25.0	22	7.2	113
JUN										
06...	0930	84015	80020	—	1810	8.1	24.5	12	7.8	107
06...	0935	84015	80020	—	1870	7.7	24.0	32	4.3	108
24...	0840	84015	80020	—	1880	7.9	27.5	13	5.8	97
24...	0845	84015	80020	—	1880	7.4	28.0	14	1.6	104
JUL										
09...	0815	84015	80020	—	1900	8.0	28.5	8.1	7.7	92
09...	0819	84015	80020	—	1900	7.4	27.0	7.2	1.6	98
25...	0930	—	80020	—	1930	7.9	—	12	—	94
AUG										
08...	0930	84015	80020	—	1930	8.0	28.5	—	7.0	—
08...	0931	84015	80020	—	1940	8.0	28.5	—	6.9	—
08...	0932	84015	80020	—	1930	8.0	28.5	—	6.6	—
08...	0933	84015	80020	—	1930	8.0	28.5	—	6.3	—
08...	0934	84015	80020	—	1950	7.4	27.5	—	1.2	—
26...	0845	84015	80020	—	1910	7.8	28.0	11	8.7	78
26...	0848	84015	80020	—	1930	7.3	26.5	6.9	1.6	91
SEP										
13...	0915	84015	80020	—	1860	8.4	26.5	12	7.8	86
OCT										
31...	0915	—	80020	—	—	—	—	17	—	87
DEC										
03...	1030	84015	80020	—	1840	8.2	6.5	10	10.9	106
31...	1000	99999	80020	0.10	1780	8.4	6.5	11	12.2	120
FEB 1992										
17...	0940	84015	80020	—	1780	8.3	7.0	10	10.8	127
MAR										
23...	1100	84015	80020	—	1890	8.4	12.5	13	9.7	135
APR										
22...	1030	84015	80020	—	1920	8.3	17.0	15	9.2	138
MAY										
08...	1030	84015	80020	—	1940	8.2	20.0	17	8.2	127

350859098090201 – LAKE CHICKASHA, SPRING CR[illegible] ARM, NEAR VERDEN,

WATER–QUALITY DATA

DATE	SULFATE DIS– SOLVED (MG/L AS SO4) (00945)	CHLO– RIDE, DIS– SOLVED (MG/L AS CL) (00940)	FLUO– RIDE, DIS– SOLVED (MG/L AS F) (00950)	RESIDUE TOTAL AT 105 DEG. C, SUS– PENDED (MG/L) (00530)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITRO– GEN, NITRATE TOTAL (MG/L AS N) (00620)	NITRO– GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO– GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO– GEN, AMMONIA TOTAL (MG/L AS N) (00610)
APR 1991									
18...	—	—	—	—	—	—	0.020	<0.050	<0.010
18...	—	—	—	—	—	—	0.020	<0.050	0.020
MAY									
06...	1400	43	0.40	17	1850	—	<0.010	<0.050	0.020
22...	1200	24	<0.10	14	1870	—	<0.010	<0.050	0.020
22...	1200	38	0.30	26	1850	—	<0.010	<0.050	0.020
JUN									
06...	160	40	0.30	12	1650	—	<0.010	<0.050	<0.010
06...	1100	41	0.30	14	1700	—	0.010	<0.050	0.230
24...	980	45	0.40	11	1720	—	<0.010	<0.050	0.020
24...	970	45	0.40	36	1710	—	<0.010	<0.050	0.020
JUL									
09...	—	—	—	1	1750	—	<0.010	<0.050	<0.010
09...	—	—	—	5	1700	—	<0.010	<0.050	<0.010
25...	—	—	—	8	1790	—	<0.010	<0.050	0.050
AUG									
08...	—	—	—	22	1760	0.00	0.060	0.060	0.030
08...	—	—	—	—	—	—	<0.010	<0.050	<0.010
08...	—	—	—	22	1760	—	—	—	—
08...	—	—	—	9	1800	—	—	—	—
08...	—	—	—	9	1800	0.00	0.060	0.060	0.030
26...	—	—	—	—	—	—	<0.010	<0.050	0.020
26...	—	—	—	—	—	0.025	0.050	0.075	0.050
SEP									
13...	—	—	—	8	1670	—	—	—	—
OCT									
31...	—	—	—	23	1720	—	0.010	<0.050	0.070
DEC									
03...	—	—	—	1	1930	0.069	<0.010	0.069	0.090
31...	—	—	—	13	1650	—	0.010	<0.050	0.020
FEB 1992									
17...	—	—	—	12	1900	—	<0.010	<0.050	0.060
MAR									
23...	—	—	—	23	1660	0.070	0.040	0.110	0.060
APR									
22...	—	—	—	20	1700	—	<0.010	<0.050	0.010
MAY									
08...	—	—	—	8	1750	—	<0.010	<0.050	<0.010

WATER–QUALITY DATA

DATE	NITRO– GEN, AMMONIA TOTAL (MG/L AS NH4) (71845)	NITRO– GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO– GEN, AM– MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO– GEN, TOTAL (MG/L AS N) (00600)	NITRO– GEN, TOTAL (MG/L AS NO3) (71887)	PHOS– PHORUS TOTAL (MG/L AS P) (00665)	PHOS– PHATE, TOTAL (MG/L AS PO4) (00650)	PHOS– PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS– PHORUS ORGANIC TOTAL (MG/L AS P) (00670)
APR 1991									
18...	—	1.1	1.1	1.1	—	0.110	0.06	0.020	0.09
18...	0.03	0.78	0.80	0.80	—	0.070	0.03	0.010	0.06
MAY									
06...	0.03	1.2	1.2	1.2	—	0.070	—	<0.010	—
22...	0.03	1.1	1.1	1.1	—	0.040	—	<0.010	—
22...	0.03	1.1	1.1	1.1	—	0.040	—	<0.010	—
JUN									
06...	—	1.1	1.1	1.1	—	0.050	—	<0.010	—
06...	0.30	0.87	1.1	1.1	—	0.040	—	<0.010	—
24...	0.03	0.78	0.80	0.80	—	0.060	0.06	0.020	0.04
24...	0.03	0.88	0.90	0.90	—	0.050	0.15	0.050	0.0
JUL									
09...	—	1.0	1.0	1.0	—	0.040	0.03	0.010	0.03
09...	—	1.0	1.0	1.0	—	0.040	0.03	0.010	0.03
25...	0.06	1.2	1.3	1.3	—	0.030	—	<0.010	—
AUG									
08...	0.04	0.97	1.0	1.1	4.7	0.050	—	<0.010	—
08...	—	1.0	1.0	1.0	—	0.050	—	<0.010	—
08...	—	—	—	—	—	—	—	—	—
08...	—	—	—	—	—	—	—	—	—
08...	0.04	0.97	1.0	1.1	4.7	0.050	—	<0.010	—
26...	0.03	1.1	1.1	1.1	—	0.050	—	<0.010	—
26...	0.06	0.85	0.90	0.97	4.3	0.030	—	<0.010	—
SEP									
13...	—	—	—	—	—	—	—	—	—
OCT									
31...	0.09	0.83	0.90	0.90	—	0.070	0.09	0.030	0.04
DEC									
03...	0.12	0.91	1.0	1.1	4.7	0.060	—	<0.010	—
31...	0.03	1.1	1.1	1.1	—	0.080	0.06	0.020	0.06
FEB 1992									
17...	0.08	0.74	0.80	0.80	—	0.030	—	<0.010	—
MAR									
23...	0.08	0.84	0.90	1.0	4.5	0.040	—	<0.010	—
APR									
22...	0.01	1.2	1.2	1.2	—	0.040	—	<0.010	—
MAY									
08...	—	0.60	0.60	0.60	—	0.030	0.03	0.010	0.02

350859098090201 — LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	HARD- NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM TOTAL RECOV- ERABLE (MG/L AS CA) (00916)
JUN 1992										
26...	1000	84015	80020	1820	8.0	26.0	8.0	7.2	780	240
26...	1004	84015	80020	1840	7.7	25.0	17	2.8	770	240

350859098090201 - LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	MAGNE- SIUM, TOTAL RECOV- ERABLE (MG/L AS MG) (00927)	SODIUM, TOTAL RECOV- ERABLE (MG/L AS NA) (00929)	POTAS- SIUM, TOTAL RECOV- ERABLE (MG/L AS K) (00937)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	RESIDUE TOTAL AT 105 DEG. C, SUS- PENDED (MG/L) (00530)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA TOTAL (MG/L AS NH4) (71845)
JUN 1992										
26...	73	65	5.5	120	8	1630	<0.010	<0.050	0.040	0.05
26...	73	65	5.7	126	24	1640	0.020	<0.050	0.100	0.13

350859098090201 – LAKE CHICKASHA, SPRING CR[illegible] ARM, NEAR VERDEN,

WATER–QUALITY DATA

DATE	NITRO- GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO- GEN, TOTAL (MG/L AS N) (00600)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHATE, TOTAL (MG/L AS PO4) (00650)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORGANIC TOTAL (MG/L AS P) (00670)	ARSENIC TOTAL (UG/L AS AS) (01002)	BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) (01007)	CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) (01027)
JUN 1992										
26...	0.76	0.80	0.80	0.020	—	<0.010	—	2	<100	<1
26...	0.80	0.90	0.90	0.050	0.03	0.010	0.04	2	<100	<1

350859098090201 – LAKE CHICKASHA, SPRING CR ARM, NEAR VERDEN,

WATER–QUALITY DATA

DATE	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR) (01034)	COPPER, TOTAL RECOVERABLE (UG/L AS CU) (01042)	IRON, TOTAL RECOVERABLE (UG/L AS FE) (01045)	LEAD, TOTAL RECOVERABLE (UG/L AS PB) (01051)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN) (01055)	MERCURY TOTAL RECOVERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI) (01067)	SELENIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN) (01092)
JUN 1992									
26...	<1	<1	120	<1	50	<0.10	<1	<1	<10
26...	2	<1	310	<1	140	<0.10	1	<1	<10

350859098090201 - LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	NITRO-GEN,NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO-GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	CALCIUM RECOV. FM BOT-TOM MA-TERIAL (MG/KG AS CA) (00917)	MAGNE-SIUM, RECOV. FM BOT-TOM MA-TERIAL (MG/KG) (00924)	SODIUM, RECOV. FM BOT-TOM MA-TERIAL (MG/KG AS NA) (00934)	POTAS-SIUM, RECOV. FM BOT-TOM MA-TERIAL (MG/KG) (00938)	ARSENIC TOTAL IN BOT-TOM MA-TERIAL (UG/G AS AS) (01003)	CADMIUM RECOV. FM BOT-TOM MA-TERIAL (UG/G AS CD) (01028)	CHRO-MIUM, RECOV. FM BOT-TOM MA-TERIAL (UG/G) (01029)	COPPER, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS CU) (01043)	LEAD, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS PB) (01052)	MANGA-NESE, RECOV. FM BOT-TOM MA-TERIAL (UG/G) (01053)
JUN 1992												
26...	63	<2.0	44000	6000	300	680	11	1	20	10	<10	720

350859098090201 - LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	NICKEL, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS NI) (01068)	ZINC, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS ZN) (01093)	SELE-NIUM, TOTAL IN BOT-TOM MA-TERIAL (UG/G) (01148)	IRON, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS FE) (01170)	ALDRIN, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39333)	LINDANE TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39343)	CHLOR-DANE, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39351)	DDD, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39363)	DDE, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39368)	DDT, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39373)	DI-ELDRIN, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39383)	ENDO-SULFAN, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39389)
JUN 1992												
26...	10	30	<1	8800	<0.1	<0.1	<1.0	0.1	<0.1	<0.2	<0.1	<0.1

350859098090201 - LAKE CHICKASHA, SPRING CREEK ARM, NEAR VERDEN,

WATER-QUALITY DATA

DATE	ENDRIN, TOTAL IN BOTTOM MATERIAL (UG/KG) (39393)	ETHION, TOTAL IN BOTTOM MATERIAL (UG/KG) (39399)	TOXAPHENE, TOTAL IN BOTTOM MATERIAL (UG/KG) (39403)	HEPTACHLOR EPOXIDE TOT. IN BOTTOM MATL. (UG/KG) (39423)	METHOXYCHLOR, TOT. IN BOTTOM MATL. (UG/KG) (39481)	MALATHION, TOTAL IN BOTTOM MATERIAL (UG/KG) (39531)	PARATHION, TOTAL IN BOTTOM MATERIAL (UG/KG) (39541)	DIAZINON, TOTAL IN BOTTOM MATERIAL (UG/KG) (39571)	METHYL PARATHION, TOT. IN BOTTOM MATL. (UG/KG) (39601)	TRITHION, TOTAL IN BOTTOM MATERIAL (UG/KG) (39787)	MERCURY RECOV. FM BOTTOM MATERIAL (UG/G AS HG) (71921)	PERTHANE IN BOTTOM MATERIAL (UG/KG) (81886)
JUN 1992												
26...	<0.1	<0.1	<10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.02	<1.00

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	DIS- CHARGE, IN CUBIC FEET PER SECOND (00060)	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	HARD- NESS TOTAL (MG/L AS CACO3) (00900)
MAR 1991											
19...	1400	84015	84015	—	—	2200	8.0	13.0	10	10.7	—
APR											
18...	1300	84015	80020	—	—	1800	8.2	22.5	3.3	9.7	—
MAY											
03...	1100	84015	80020	—	—	—	—	—	220	—	—
06...	1000	84015	80020	—	—	2180	7.8	13.5	41	9.5	—
20...	1300	84015	80020	—	—	1790	—	—	370	—	—
22...	1130	84015	80020	—	—	2220	8.1	22.5	50	7.2	—
JUN											
06...	0800	84015	80020	—	—	2260	7.8	21.0	58	7.5	—
24...	0900	84015	80020	1.5	—	2330	7.9	24.0	8.5	9.1	—
JUL											
09...	1045	84015	80020	0.77	0.84	2740	7.9	27.0	7.4	8.4	—
25...	1100	84015	80020	0.28	0.27	2960	7.9	22.5	5.5	10.6	—
AUG											
08...	1130	84015	80020	0.05	—	3650	7.5	28.0	—	6.3	—
26...	1100	84015	80020	0.10	0.07	3000	7.7	22.5	10	2.2	—
30...	1530	84015	80020	15	1.1	1110	—	—	—	—	—
SEP											
13...	1100	84015	80020	E3.7	—	2050	8.1	24.0	9.0	9.1	—
OCT											
31...	1030	84015	80020	17	15	2050	—	—	60	—	—
DEC											
03...	1230	84015	80020	E4.5	—	1980	8.0	4.5	37	11.8	—
12...	1200	84015	80020	E13	72	1490	—	—	—	—	—
31...	1145	84015	80020	E15	—	2120	8.0	8.5	16	10.6	—
FEB 1992											
17...	1115	84015	80020	E5.3	—	2100	8.3	9.0	7.2	13.3	—
MAR											
04...	1255	84015	80020	153	76	1560	—	—	—	—	—
23...	1245	84015	80020	E4.4	—	2200	8.1	11.0	11	13.4	—
APR											
06...	1115	84015	80020	4.2	4.2	2130	8.0	13.5	—	11.6	—
22...	1345	84015	80020	E10	—	2140	8.1	19.5	41	8.7	—

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM TOTAL RECOV-ERABLE (MG/L AS CA) (00916)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, TOTAL RECOV-ERABLE (MG/L AS MG) (00927)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, TOTAL RECOV-ERABLE (MG/L AS NA) (00929)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM AD-SORP-TION RATIO (00931)	POTAS-SIUM, TOTAL RECOV-ERABLE (MG/L AS K) (00937)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
MAR 1991											
19...	—	—	—	—	—	—	—	—	—	284	—
APR											
18...	—	—	—	—	—	—	—	—	—	223	1000
MAY											
03...	—	310	—	79	—	49	—	—	11	—	850
06...	—	—	—	—	—	—	—	—	—	300	1700
20...	—	—	—	—	—	—	—	—	—	—	650
22...	—	—	—	—	—	—	—	—	—	291	1100
JUN											
06...	—	—	—	—	—	—	—	—	—	288	1400
24...	—	—	—	—	—	—	—	—	—	235	1200
JUL											
09...	—	—	—	—	—	—	—	—	—	220	—
25...	—	—	—	—	—	—	—	—	—	215	—
AUG											
08...	—	—	—	—	—	—	—	—	—	—	—
26...	—	—	—	—	—	—	—	—	—	202	—
30...	—	—	—	—	—	—	—	—	—	—	—
SEP											
13...	—	—	—	—	—	—	—	—	—	230	—
OCT											
31...	—	—	—	—	—	—	—	—	—	255	—
DEC											
03...	—	—	—	—	—	—	—	—	—	328	—
12...	—	180	—	53	—	36	—	—	11	—	—
31...	—	—	—	—	—	—	—	—	—	316	—
FEB 1992											
17...	—	—	—	—	—	—	—	—	—	272	—
MAR											
04...	—	—	—	—	—	—	—	—	—	—	—
23...	—	—	—	—	—	—	—	—	—	252	—
APR											
06...	—	—	—	—	—	—	—	—	—	—	—
22...	—	—	—	—	—	—	—	—	—	273	—

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER–QUALITY DATA

DATE	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L) (70300)	SOLIDS, DISSOLVED (TONS PER AC-FT) (70303)	RESIDUE TOTAL AT 105 DEG. C, SUSPENDED (MG/L) (00530)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITROGEN, NITRATE TOTAL (MG/L AS N) (00620)	NITROGEN, NITRATE DISSOLVED (MG/L AS NO3) (71851)	NITROGEN, NITRITE TOTAL (MG/L AS N) (00615)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITROGEN, AMMONIA TOTAL (MG/L AS N) (00610)
MAR 1991											
19...	—	—	—	—	—	—	—	—	—	—	—
APR											
18...	35	0.60	—	—	7	1630	0.040	—	0.020	0.060	0.030
MAY											
03...	26	0.60	—	—	886	2520	0.006	—	0.090	0.096	0.080
06...	44	0.50	—	—	68	2200	0.430	—	0.030	0.460	0.140
20...	28	0.60	—	—	1200	2960	0.050	—	0.080	0.130	0.070
22...	37	0.60	—	—	45	2080	0.310	—	0.040	0.350	0.080
JUN											
06...	49	0.50	—	—	86	2180	0.620	—	0.050	0.670	0.150
24...	66	0.60	—	—	14	2190	0.350	—	0.020	0.370	0.060
JUL											
09...	—	—	—	—	10	2670	0.480	—	0.030	0.510	0.080
25...	—	—	—	—	<1	2960	0.053	—	<0.010	0.053	0.060
AUG											
08...	—	—	—	—	52	3790	—	—	0.030	<0.050	0.050
26...	—	—	—	—	8	3010	—	—	0.030	<0.050	0.170
30...	—	—	—	—	3720	4280	1.32	—	0.080	1.40	0.290
SEP											
13...	—	—	—	—	11	1960	0.620	—	0.030	0.650	0.120
OCT											
31...	—	—	—	—	154	1940	0.700	—	0.050	0.750	0.120
DEC											
03...	—	—	—	—	28	2000	0.470	—	<0.010	0.470	0.080
12...	—	—	—	—	1290	2870	0.380	—	0.030	0.410	0.070
31...	—	—	—	—	17	1870	0.770	—	0.020	0.790	0.150
FEB 1992											
17...	—	—	—	—	13	2150	0.450	—	0.010	0.460	0.030
MAR											
04...	—	—	—	—	535	2400	0.340	—	0.040	0.380	0.090
23...	—	—	—	—	18	1960	0.430	—	0.040	0.470	0.090
APR											
06...	—	—	—	—	—	—	—	—	—	—	—
22...	—	—	—	—	56	2000	0.390	—	0.050	0.440	0.160

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS NH4) (71845)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, TOTAL (MG/L AS N) (00600)	NITRO-GEN, TOTAL (MG/L AS NO3) (71887)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHATE, TOTAL (MG/L AS PO4) (00650)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORGANIC TOTAL (MG/L AS P) (00670)	ARSENIC TOTAL (UG/L AS AS) (01002)
MAR 1991										
19...	—	—	—	—	—	—	—	—	—	—
APR										
18...	0.04	0.47	0.50	0.56	2.5	0.070	0.09	0.030	0.04	—
MAY										
03...	0.10	4.4	4.5	4.6	20	0.790	0.43	0.140	0.65	—
06...	0.18	0.66	0.80	1.3	5.6	0.160	0.25	0.080	0.08	—
20...	0.09	1.5	1.6	1.7	7.7	0.290	0.46	0.150	0.14	—
22...	0.10	1.0	1.1	1.4	6.4	0.140	0.15	0.050	0.09	—
JUN										
06...	0.19	0.65	0.80	1.5	6.5	0.150	0.25	0.080	0.07	—
24...	0.08	0.44	0.50	0.87	3.9	0.090	0.12	0.040	0.05	—
JUL										
09...	0.10	0.72	0.80	1.3	5.8	0.070	0.12	0.040	0.03	—
25...	0.08	0.64	0.70	0.75	3.3	0.050	0.03	0.010	0.04	—
AUG										
08...	0.06	1.9	1.9	1.9	—	0.270	0.25	0.080	0.19	—
26...	0.22	1.1	1.3	1.3	—	0.100	0.06	0.020	0.08	—
30...	0.37	1.2	1.5	2.9	13	1.10	0.61	0.200	0.90	—
SEP										
13...	0.15	0.48	0.60	1.2	5.5	0.080	0.18	0.060	0.02	—
OCT										
31...	0.15	0.88	1.0	1.7	7.7	0.300	0.52	0.170	0.13	—
DEC										
03...	0.10	0.42	0.50	0.97	4.3	0.100	0.21	0.070	0.03	—
12...	0.09	1.8	1.9	2.3	10	0.580	0.61	0.200	0.38	5
31...	0.19	0.35	0.50	1.3	5.7	0.070	0.18	0.060	0.01	—
FEB 1992										
17...	0.04	0.37	0.40	0.86	3.8	0.010	0.03	0.010	0.0	—
MAR										
04...	0.12	1.4	1.5	1.9	8.3	0.560	0.49	0.160	0.40	—
23...	0.12	0.21	0.30	0.77	3.4	0.010	—	<0.010	—	—
APR										
06...	—	—	—	—	—	—	—	—	—	—
22...	0.21	0.84	1.0	1.4	6.4	0.130	0.25	0.080	0.05	—

07327050 – SPRING CREEK NEAR GRACEMONT, OK

WATER–QUALITY DATA

DATE	BARIUM, TOTAL RECOV–ERABLE (UG/L AS BA) (01007)	CADMIUM TOTAL RECOV–ERABLE (UG/L AS CD) (01027)	CHRO–MIUM, TOTAL RECOV–ERABLE (UG/L AS CR) (01034)	IRON, TOTAL RECOV–ERABLE (UG/L AS FE) (01045)	LEAD, TOTAL RECOV–ERABLE (UG/L AS PB) (01051)	MANGA–NESE, TOTAL RECOV–ERABLE (UG/L AS MN) (01055)	MERCURY TOTAL RECOV–ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV–ERABLE (UG/L AS NI) (01067)	SELE–NIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOV–ERABLE (UG/L AS ZN) (01092)
MAR 1991										
19...	—	—	—	—	—	—	—	—	—	—
APR										
18...	—	—	—	—	—	—	—	—	—	—
MAY										
03...	—	—	—	—	—	1200	—	—	—	—
06...	—	—	—	—	—	—	—	—	—	—
20...	—	—	—	—	—	—	—	—	—	—
22...	—	—	—	—	—	—	—	—	—	—
JUN										
06...	—	—	—	—	—	—	—	—	—	—
24...	—	—	—	—	—	—	—	—	—	—
JUL										
09...	—	—	—	—	—	—	—	—	—	—
25...	—	—	—	—	—	—	—	—	—	—
AUG										
08...	—	—	—	—	—	—	—	—	—	—
26...	—	—	—	—	—	—	—	—	—	—
30...	—	—	—	—	—	—	—	—	—	—
SEP										
13...	—	—	—	—	—	—	—	—	—	—
OCT										
31...	—	—	—	—	—	—	—	—	—	—
DEC										
03...	—	—	—	—	—	—	—	—	—	—
12...	200	5	28	16000	9	920	<0.10	28	<1	110
31...	—	—	—	—	—	—	—	—	—	—
FEB 1992										
17...	—	—	—	—	—	—	—	—	—	—
MAR										
04...	—	—	—	—	—	—	—	—	—	—
23...	—	—	—	—	—	—	—	—	—	—
APR										
06...	—	—	—	—	—	—	—	—	—	—
22...	—	—	—	—	—	—	—	—	—	—

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER—QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	DIS- CHARGE, IN CUBIC FEET PER SECOND (00060)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)
MAY 1992									
08...	1230	84015	80020	E1.5	2170	8.1	19.5	8.0	13.0
JUN									
03...	1100	84015	80020	E15	—	—	—	—	—
26...	1245	84015	80020	E4.4	2330	8.0	25.0	20	9.0

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	RESIDUE TOTAL AT 105 DEG. C, SUS- PENDED (MG/L) (00530)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITRO- GEN, NITRATE TOTAL (MG/L AS N) (00620)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA TOTAL (MG/L AS NH4) (71845)
MAY 1992								
08...	202	<1	1970	—	<0.010	<0.050	0.020	0.03
JUN								
03...	—	—	—	—	—	—	—	—
26...	248	37	2270	0.520	0.020	0.540	0.110	0.14

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	NITRO-GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, TOTAL (MG/L AS N) (00600)	NITRO-GEN, TOTAL (MG/L AS NO3) (71887)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHATE, TOTAL (MG/L AS PO4) (00650)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORGANIC TOTAL (MG/L AS P) (00670)
MAY 1992								
08...	0.28	0.30	0.30	—	0.030	0.03	0.010	0.02
JUN								
03...	—	—	—	—	—	—	—	—
26...	0.49	0.60	1.1	5.0	0.070	0.12	0.040	0.03

WATER–QUALITY DATA

DATE	TIME	AGENCY COL– LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA– LYZING SAMPLE (CODE NUMBER) (00028)	BROM– ACIL WATER WHLREC (UG/L) (30234)	BUTA– CHLOR WATER WHLREC (UG/L) (30235)	BUTYL– ATE WATER WHLREC (UG/L) (30236)	CARBOX– IN WATER WHOLE RECOV– ERABLE (UG/L) (30245)
DEC 1991							
12...	1200	99999	80020	—	—	—	—
MAR 1992							
04...	1255	99999	80020	—	—	—	—
JUN							
03...	1100	99999	80020	<0.20	<0.10	<0.10	<0.20

07327050 - SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	CYCLO-ATE WATER WHOLE RECOV-ERABLE (UG/L) (30254)	DIPHEN-AMID WATER WHOLE RECOV-ERABLE (UG/L) (30255)	PCB, TOTAL (UG/L) (39516)	NAPH-THA-LENES, POLY-CHLOR. TOTAL (UG/L) (39250)	HEXAZI-NONE WATER WHOLE RECOV-ERABLE (UG/L) (30264)	METOLA-CHLOR WATER WHOLE TOT.REC (UG/L) (82612)	METRI-BUZIN WATER WHOLE TOT.REC (UG/L) (82611)
DEC 1991							
12...	—	—	<0.1	<0.10	—	—	—
MAR 1992							
04...	—	—	<0.1	<0.10	—	—	—
JUN							
03...	<0.10	<0.10	—	—	<0.20	<0.20	<0.10

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	PROPA-CHLOR WATER WHOLE RECOV. (UG/L) (30295)	TER-BACIL WATER WHOLE RECOV. (UG/L) (30311)	VER-NOLATE WATER WHOLE RECOV. (UG/L) (30324)	ALA-CHLOR TOTAL RECOVER (UG/L) (77825)	ALDRIN, TOTAL (UG/L) (39330)	AME-TRYNE TOTAL (82184)	ATRA-ZINE WATER UNFLTRD REC (UG/L) (39630)	DEETHYL ATRA-ZINE, WATER, WHOLE, TOTAL (UG/L) (75981)	DE-ISO PROPYL ATRAZIN WATER, WHOLE, TOTAL (UG/L) (75980)	CHLOR-DANE, TOTAL (UG/L) (39350)	CYAN-AZINE TOTAL (UG/L) (81757)	2,4-D, TOTAL (UG/L) (39730)
DEC 1991												
12...	—	—	—	—	<0.010	—	—	—	—	<0.1	—	<0.01
MAR 1992												
04...	—	—	—	—	<0.010	—	—	—	—	<0.1	—	0.17
JUN												
03...	<0.10	<0.20	<0.10	<0.10	—	<0.10	<0.1	<0.20	<0.20	—	<0.20	—

07327050 - SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	DDD, TOTAL (UG/L) (39360)	DDE, TOTAL (UG/L) (39365)	DDT, TOTAL (UG/L) (39370)	DI-ELDRIN TOTAL (UG/L) (39380)	2, 4-DP TOTAL (UG/L) (82183)	ENDO-SULFAN, TOTAL (UG/L) (39388)	ENDRIN WATER UNFLTRD REC (UG/L) (39390)	HEPTA-CHLOR, TOTAL (UG/L) (39410)	HEPTA-CHLOR EPOXIDE TOTAL (UG/L) (39420)	LINDANE TOTAL (UG/L) (39340)	METH-OXY-CHLOR, TOTAL (UG/L) (39480)
DEC 1991											
12...	<0.010	<0.010	<0.010	<0.010	0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01
MAR 1992											
04...	<0.010	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01
JUN											
03...	—	—	—	—	—	—	—	—	—	—	—

07327050 — SPRING CREEK NEAR GRACEMONT, OK

WATER-QUALITY DATA

DATE	MIREX, TOTAL (UG/L) (39755)	PER-THANE TOTAL (UG/L) (39034)	PROME-TONE TOTAL (UG/L) (39056)	PROME-TRYNE TOTAL (UG/L) (39057)	PRO-PAZINE TOTAL (UG/L) (39024)	SILVEX, TOTAL (UG/L) (39760)	SIMA-ZINE TOTAL (UG/L) (39055)	SIME-TRYNE TOTAL (UG/L) (39054)	2,4,5-T TOTAL (UG/L) (39740)	TOX-APHENE, TOTAL (UG/L) (39400)	TRI-FLURA-LIN TOTAL RECOVER (UG/L) (39030)
DEC 1991											
12...	<0.01	<0.1	—	—	—	<0.01	—	—	<0.01	<1	—
MAR 1992											
04...	<0.01	<0.1	—	—	—	<0.01	—	—	<0.01	<1	—
JUN											
03...	—	—	<0.20	<0.10	<0.10	—	<0.10	<0.10	—	—	<0.10

WATER-QUALITY DATA

DATE	TIME	AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028)	DIS- CHARGE, IN CUBIC FEET PER SECOND (00060)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	CALCIUM TOTAL RECOV- ERABLE (MG/L AS CA) (00916)	MAGNE- SIUM, TOTAL RECOV- ERABLE (MG/L AS MG) (00927)
APR 1991											
18...	1315	84015	80020	—	2250	8.0	24.0	3.1	11.2	—	—
MAY											
03...	1100	84015	80020	—	—	—	—	800	—	450	98
06...	1040	84015	80020	—	2200	7.7	15.0	63	9.0	—	—
22...	1045	84015	80020	—	2150	7.9	22.0	150	7.2	—	—
24...	1630	84015	80020	—	—	—	—	1300	—	—	—
JUN											
06...	0730	84015	80020	—	2520	7.6	20.5	49	7.4	—	—
24...	1110	84015	80020	—	2710	7.8	25.0	11	8.2	—	—
JUL											
09...	1030	84015	80020	—	2880	9.7	26.0	18	7.4	—	—
25...	1135	84015	80020	—	2810	7.7	22.5	5.2	9.5	—	—
AUG											
08...	1045	84015	80020	—	2980	7.9	27.0	—	9.8	—	—
26...	1045	84015	80020	—	2780	8.3	24.5	2.7	12.7	—	—
SEP											
13...	1130	84015	80020	—	2360	8.0	25.0	23	8.0	—	—
OCT											
31...	1000	84015	80020	—	2310	—	—	78	—	—	—
DEC											
03...	1200	84015	80020	—	2040	8.0	5.5	15	11.4	—	—
12...	0900	84015	80020	1.3	1230	—	—	—	—	130	36
31...	1115	84015	80020	7.5	2280	7.8	9.5	14	10	—	—
FEB 1992											
17...	1100	84015	80020	E5.7	2290	8.1	9.5	9.0	11.9	—	—
MAR											
04...	1330	84015	80020	338	1540	—	—	—	—	—	—
23...	1230	84015	80020	4.3	2350	8.3	14.0	9.0	11.4	—	—
APR											
22...	1330	84015	80020	3.2	2390	8.0	22.5	42	7.9	—	—
MAY											
08...	1215	84015	80020	2.6	2580	7.9	20.0	7.5	9.6	—	—
JUN											
03...	1115	84015	80020	4.0	—	—	—	—	—	—	—
26...	1230	84015	80020	4.9	2350	7.9	25.5	8.0	7.9	—	—

07327055 - STINKING CREEK NR DUTTON, OK

WATER-QUALITY DATA

DATE	SODIUM, TOTAL RECOV-ERABLE (MG/L AS NA) (00929)	POTAS-SIUM, TOTAL RECOV-ERABLE (MG/L AS K) (00937)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDED (MG/L) (00530)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	NITRO-GEN, NITRATE TOTAL (MG/L AS N) (00620)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)
APR 1991											
18...	—	—	243	—	—	—	—	—	—	0.020	<0.050
MAY											
03...	22	17	—	940	9.7	0.50	2720	4180	0.220	0.140	0.360
06...	—	—	309	1500	31	0.50	78	2120	0.740	0.030	0.770
22...	—	—	297	1100	25	0.60	162	2070	0.910	0.030	0.940
24...	—	—	—	430	11	0.20	5470	9630	0.290	0.110	0.400
JUN											
06...	—	—	388	1300	44	<0.10	87	2510	1.26	0.040	1.30
24...	—	—	295	1400	56	0.50	2	2680	1.16	0.040	1.20
JUL											
09...	—	—	300	—	—	—	38	2800	1.06	0.040	1.10
25...	—	—	284	—	—	—	8	2990	0.710	0.010	0.720
AUG											
08...	—	—	—	—	—	—	13	3000	0.420	<0.010	0.420
26...	—	—	219	—	—	—	6	2850	0.400	<0.010	0.400
SEP											
13...	—	—	301	—	—	—	48	2220	0.640	0.050	0.690
OCT											
31...	—	—	320	—	—	—	164	2220	0.690	0.040	0.730
DEC											
03...	—	—	330	—	—	—	3	2050	0.830	<0.010	0.830
12...	22	8.4	—	—	—	—	550	1940	0.350	0.030	0.380
31...	—	—	330	—	—	—	15	2180	1.27	0.030	1.30
FEB 1992											
17...	—	—	300	—	—	—	26	2510	1.08	0.020	1.10
MAR											
04...	—	—	—	—	—	—	10300	20800	0.500	0.030	0.530
23...	—	—	293	—	—	—	5	2120	1.07	0.030	1.10
APR											
22...	—	—	330	—	—	—	92	2260	0.950	0.040	0.990
MAY											
08...	—	—	255	—	—	—	2	2380	0.540	0.010	0.550
JUN											
03...	—	—	—	—	—	—	—	—	—	—	—
26...	—	—	260	—	—	—	39	2220	0.870	0.040	0.910

WATER-QUALITY DATA

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA TOTAL (MG/L AS NH4) (71845)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, TOTAL (MG/L AS N) (00600)	NITRO-GEN, TOTAL (MG/L AS NO3) (71887)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHATE, TOTAL (MG/L AS PO4) (00650)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORGANIC TOTAL (MG/L AS P) (00670)	ARSENIC TOTAL (UG/L AS AS) (01002)
APR 1991											
18...	0.010	0.01	0.89	0.90	0.90	—	0.060	—	<0.010	—	—
MAY											
03...	0.270	0.35	2.3	2.6	3.0	13	0.820	0.40	0.130	0.69	—
06...	0.160	0.21	0.24	0.40	1.2	5.2	0.110	0.18	0.060	0.05	—
22...	0.130	0.17	2.3	2.4	3.3	15	0.180	0.21	0.070	0.11	—
24...	0.150	0.19	1.4	1.6	2.0	8.9	0.460	0.21	0.070	0.39	—
JUN											
06...	0.180	0.23	1.6	1.8	3.1	14	0.120	0.18	0.060	0.06	—
24...	0.170	0.22	0.43	0.60	1.8	8.0	0.080	0.15	0.050	0.03	—
JUL											
09...	0.150	0.19	0.55	0.70	1.8	8.0	0.090	0.18	0.060	0.03	—
25...	0.100	0.13	0.70	0.80	1.5	6.7	0.050	0.06	0.020	0.03	—
AUG											
08...	0.040	0.05	0.56	0.60	1.0	4.5	0.060	0.09	0.030	0.03	—
26...	0.070	0.09	0.43	0.50	0.90	4.0	0.040	0.03	0.010	0.03	—
SEP											
13...	0.140	0.18	0.36	0.50	1.2	5.3	0.060	0.18	0.060	0.0	—
OCT											
31...	0.200	0.26	0.60	0.80	1.5	6.8	0.190	0.34	0.110	0.08	—
DEC											
03...	0.090	0.12	0.31	0.40	1.2	5.4	0.060	0.12	0.040	0.02	—
12...	0.090	0.12	1.3	1.4	1.8	7.9	0.480	0.49	0.160	0.32	5
31...	0.210	0.27	0.39	0.60	1.9	8.4	0.070	0.09	0.030	0.04	—
FEB 1992											
17...	0.060	0.08	0.24	0.30	1.4	6.2	0.020	0.06	0.020	0.0	—
MAR											
04...	0.430	0.55	2.9	3.3	3.8	17	0.850	0.12	0.040	0.81	—
23...	0.070	0.09	0.23	0.30	1.4	6.2	<0.010	—	<0.010	—	—
APR											
22...	0.220	0.28	0.38	0.60	1.6	7.0	0.080	0.21	0.070	0.01	—
MAY											
08...	0.050	0.06	0.25	0.30	0.85	3.8	0.030	0.06	0.020	0.01	—
JUN											
03...	—	—	—	—	—	—	—	—	—	—	—
26...	0.140	0.18	0.46	0.60	1.5	6.7	0.060	0.12	0.040	0.02	—

WATER-QUALITY DATA

DATE	BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) (01007)	CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)	IRON, TOTAL RECOV- ERABLE (UG/L AS FE) (01045)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) (01055)	MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) (01067)	SELE- NIUM, TOTAL (UG/L AS SE) (01147)	ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) (01092)
APR 1991										
18...	—	—	—	—	—	—	—	—	—	—
MAY										
03...	—	—	—	—	—	4000	—	—	—	—
06...	—	—	—	—	—	—	—	—	—	—
22...	—	—	—	—	—	—	—	—	—	—
24...	—	—	—	—	—	—	—	—	—	—
JUN										
06...	—	—	—	—	—	—	—	—	—	—
24...	—	—	—	—	—	—	—	—	—	—
JUL										
09...	—	—	—	—	—	—	—	—	—	—
25...	—	—	—	—	—	—	—	—	—	—
AUG										
08...	—	—	—	—	—	—	—	—	—	—
26...	—	—	—	—	—	—	—	—	—	—
SEP										
13...	—	—	—	—	—	—	—	—	—	—
OCT										
31...	—	—	—	—	—	—	—	—	—	—
DEC										
03...	—	—	—	—	—	—	—	—	—	—
12...	200	<1	20	12000	8	630	<0.10	17	<1	80
31...	—	—	—	—	—	—	—	—	—	—
FEB 1992										
17...	—	—	—	—	—	—	—	—	—	—
MAR										
04...	—	—	—	—	—	—	—	—	—	—
23...	—	—	—	—	—	—	—	—	—	—
APR										
22...	—	—	—	—	—	—	—	—	—	—
MAY										
08...	—	—	—	—	—	—	—	—	—	—
JUN										
03...	—	—	—	—	—	—	—	—	—	—
26...	—	—	—	—	—	—	—	—	—	—

WATER–QUALITY DATA

DATE	TIME	AGENCY COL– LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA– LYZING SAMPLE (CODE NUMBER) (00028)	BROM– ACIL WATER WHLREC (UG/L) (30234)	BUTA– CHLOR WATER WHLREC (UG/L) (30235)	BUTYL– ATE WATER WHLREC (UG/L) (30236)	CARBOX– IN WATER WHOLE RECOV– ERABLE (UG/L) (30245)
DEC 1991							
12...	0900	84015	80020	—	—	—	—
MAR 1992							
04...	1330	84015	80020	—	—	—	—
JUN							
03...	1115	84015	80020	<0.20	<0.10	<0.10	<0.20

07327055 – STINKING CREEK NR DUTTON, OK

WATER-QUALITY DATA

DATE	CYCLO-ATE WATER WHOLE RECOV-ERABLE (UG/L) (30254)	DIPHEN-AMID WATER WHOLE RECOV-ERABLE (UG/L) (30255)	PCB, TOTAL (UG/L) (39516)	NAPH-THA-LENES, POLY-CHLOR. TOTAL (UG/L) (39250)	HEXAZI-NONE WATER WHOLE RECOV-ERABLE (UG/L) (30264)	METOLA-CHLOR WATER WHOLE TOT.REC (UG/L) (82612)	METRI-BUZIN WATER WHOLE TOT.REC (UG/L) (82611)
DEC 1991							
12...	—	—	<0.1	<0.10	—	—	—
MAR 1992							
04...	—	—	<0.1	<0.10	—	—	—
JUN							
03...	<0.10	<0.10	<0.1	<0.10	<0.20	<0.20	<0.10

07327055 — STINKING CREEK NR DUTTON, OK

WATER–QUALITY DATA

DATE	PROPA–CHLOR WATER WHOLE RECOV. (UG/L) (30295)	TER–BACIL WATER WHOLE RECOV. (UG/L) (30311)	VER–NOLATE WATER WHOLE RECOV. (UG/L) (30324)	ALA–CHLOR TOTAL RECOVER (UG/L) (77825)	ALDRIN, TOTAL (UG/L) (39330)	AME–TRYNE TOTAL (82184)	ATRA–ZINE WATER UNFLTRD REC (UG/L) (39630)	DEETHYL ATRA–ZINE, WATER, WHOLE, TOTAL (UG/L) (75981)	DE–ISO PROPYL ATRAZIN WATER, WHOLE, TOTAL (UG/L) (75980)	CHLOR–DANE, TOTAL (UG/L) (39350)	CHLOR–DYRIFOS TOTAL RECOVER (UG/L) (38932)	CYAN–AZINE TOTAL (UG/L) (81757)
DEC 1991												
12...	—	—	—	—	<0.010	—	—	—	—	<0.1	—	—
MAR 1992												
04...	—	—	—	—	<0.010	—	—	—	—	<0.1	—	—
JUN												
03...	<0.10	<0.20	<0.10	<0.10	<0.001	<0.10	0.2	<0.20	<0.20	<0.1	<0.01	<0.20

07327055 - STINKING CREEK NR DUTTON, OK

WATER-QUALITY DATA

DATE	2,4-D, TOTAL (UG/L) (39730)	DDD, TOTAL (UG/L) (39360)	DDE, TOTAL (UG/L) (39365)	DDT, TOTAL (UG/L) (39370)	DEF TOTAL (UG/L) (39040)	DI-AZINON, TOTAL (UG/L) (39570)	DI-ELDRIN TOTAL (UG/L) (39380)	DI-SYSTON TOTAL (UG/L) (39011)	2, 4-DP TOTAL (UG/L) (82183)	ENDO-SULFAN, TOTAL (UG/L) (39388)	ENDRIN WATER UNFLTRD REC (UG/L) (39390)
DEC 1991											
12...	<0.01	<0.010	<0.010	<0.010	—	—	<0.010	—	0.03	<0.010	<0.010
MAR 1992											
04...	0.10	<0.010	<0.010	<0.010	—	—	<0.010	—	<0.01	<0.010	<0.010
JUN											
03...	—	<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.01	—	<0.001	<0.001

WATER-QUALITY DATA

DATE	ETHION, TOTAL (UG/L) (39398)	FONOFOS (DY-FONATE) WATER WHOLE TOT.REC (UG/L (82614)	HEPTA-CHLOR, TOTAL (UG/L) (39410)	HEPTA-CHLOR EPOXIDE TOTAL (UG/L) (39420)	LINDANE TOTAL (UG/L) (39340)	MALA-THION, TOTAL (UG/L) (39530)	METH-OXY-CHLOR, TOTAL (UG/L) (39480)	METHYL PARA-THION, TOTAL (UG/L) (39600)	MIREX, TOTAL (UG/L) (39755)	PARA-THION, TOTAL (UG/L) (39540)	PER-THANE TOTAL (UG/L) (39034)
DEC 1991											
12...	—	—	<0.010	<0.010	<0.010	—	<0.01	—	<0.01	—	<0.1
MAR 1992											
04...	—	—	<0.010	<0.010	<0.010	—	<0.01	—	<0.01	—	<0.1
JUN											
03...	<0.01	<0.01	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1

07327055 - STINKING CREEK NR DUTTON, OK

WATER-QUALITY DATA

DATE	PHORATE TOTAL (UG/L) (39023)	PROME-TONE TOTAL (UG/L) (39056)	PROME-TRYNE TOTAL (UG/L) (39057)	PRO-PAZINE TOTAL (UG/L) (39024)	SILVEX, TOTAL (UG/L) (39760)	SIMA-ZINE TOTAL (UG/L) (39055)	SIME-TRYNE TOTAL (UG/L) (39054)	2,4,5-T TOTAL (UG/L) (39740)	TOX-APHENE, TOTAL (UG/L) (39400)	TRI-FLURA-LIN TOTAL RECOVER (UG/L) (39030)	TOTAL TRI-THION (UG/L) (39786)
DEC 1991											
12...	—	—	—	—	<0.01	—	—	<0.01	<1	—	—
MAR 1992											
04...	—	—	—	—	<0.01	—	—	<0.01	<1	—	—
JUN											
03...	<0.01	<0.20	<0.10	<0.10	—	<0.10	<0.10	—	<1	<0.10	<0.01

APPENDIX C

DOCUMENTATION REGARDING FISH FLESH ANALYSIS

MASON MUNGLE
EXECUTIVE DIRECTOR

BEN POLLARD
ASSISTANT DIRECTOR

DAVID WALTERS
GOVERNOR

STATE OF OKLAHOMA
OKLAHOMA CONSERVATION COMMISSION

5/27/92

USGS National QW Laboratory
5293 Ward Rd.
Arvada, CO 80002

Dear Lab Administrator:

This letter is written to explain the desired analysis for fish flesh collected from Lake Chickasha, Oklahoma, on April 11, 1991. Selected specimens were sorted according to species, filleted, composited, then frozen. Information regarding these composite samples are as follows:

Species	Jar #	specimen wt. (gm)
Walleye Pike	1	572.5
Walleye Pike	2	812.4
Walleye Pike	3	788.3
Walleye Pike	4	466.0
Gizzard Shad	1	600.2
Gizzard Shad	2	179.0
Common Carp	1	719.2
Common Carp	2	221.0
Sand Bass	1	601.8
Sand Bass	2	423.9
Channel Catfish	1	733.5
Channel Catfish	2	519.8
Channel Catfish	3	474.1

We would like the following analyses performed on these specimens:

Arsenic	Aldrin	Gamma - BHC
Cadmium	Alachlor	Heptachlor
Chromium	Chlordane	Heptachlor epoxide
Copper	DDD	Methoxychlor
Lead	DDE	Toxaphene
Selenium	DDT	PCB's total
Zinc	Dieldrin	
Mercury	Endrin	

Please call Joanne Kurklin, USGS in Oklahoma City. if you have any questions.

Sincerely

Jim Boggs

Jim Boggs, Clean Lakes Coordinator

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