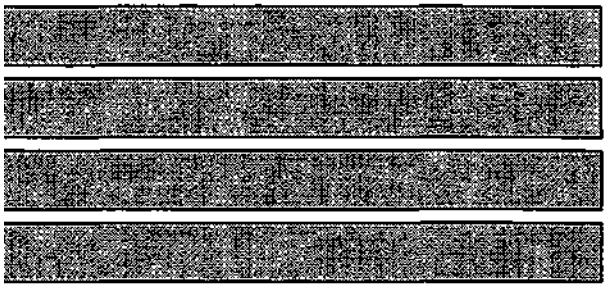
Contract Report 574

Illinois Lake Quality Assessment Program -1993

by Shun Dar Lin and Raman K. Raman
Office of Water Quality Management

Prepared for the
Lake and Watershed Unit
Illinois Environmental Protection Agency

September 1994



Illinois State Water Survey
Chemistry Division
Champaign, Illinois

A Division of the Illinois Department of Energy and Natural Resources

Illinois Lake Quality Assessment Program -1993

by

Shun Dar Lin and Raman K. Raman

Prepared for
the Lake and Watershed Unit
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62794-9276

Illinois Department of Energy and Natural Resources
Illinois State Water Survey Division
Office of Water Quality Management
P.O. Box 697
Peoria, Illinois 61652

September 1994

This report was printed on recycled and recyclable papers.

CONTENTS

ILLINOIS LAKE QUALITY ASSESSMENT -1993

by Shun Dar Lin and Raman K. Raman

INTRODUCTION

Background

The state of Illinois has more than 3,000 lakes or reservoirs with surface areas of six acres or more. The origins of these water impoundments vary. Some were formed by glaciers, but most were developed by damming of streams. Over 100 of them serve as raw water-supply sources, and a few are used for industrial cooling. They are all used for recreational activities such as swimming, fishing, boating, and water-skiing, however.

Most Illinois impoundments are relatively shallow and have low capacity-inflow ratios. The impoundments in Illinois inundate fertile bottomlands and topsoils; thus they normally begin their lives with the potential for high biological productivity. Plant nutrients (nitrogen and phosphorus) and organic matter are leached from these fertile soils into the overlying waters. In addition, runoff from predominantly agricultural watersheds results in considerable input of nutrients into the lakes. Consequently, most Illinois lakes show symptoms of eutrophy characterized by hypolimnetic dissolved oxygen depletion, high levels of nitrogen and phosphorus, and varying degrees of algae and macrophyte growth. These problems become more severe over time.

Lakes are extremely complex systems. Lake conditions are a function of physical, chemical, and biological (the presence and predominance of the various plants and organisms that are found in the lake) factors.

Lake Management Methods

The most common lake problems are eutrophication, siltation, shoreline erosion, algal blooms, bad taste and/or odor, excessive growth of aquatic vegetation, toxic chemicals, and bacterial contamination. Eutrophication, or "aging," the process by which a lake becomes enriched with nutrients, is caused primarily by point and nonpoint pollution sources from natural and human induced activities. Because all of these problems impact aesthetic and practical uses of the lake, lake management is needed.

Lake management should cover both watershed and in-lake management. A guidance manual for lakes and reservoirs has been published by the U.S. Environmental Protection Agency (USEPA, 1990). It recommends an integrated and comprehensive approach to assessment and management of the lake watershed and water quality. Investigations of the lake watershed should include assessment of soil types, slopes, land uses and land-use practices, soil losses, point and nonpoint pollution loads, and other relevant characteristics. Because of the limited resources for abating sediment and nutrient loads emanating from the watershed, it is imperative to identify and prioritize critical areas of the watershed for proper management so that the available resources can be allocated judiciously.

Watershed Management

Benefits accrue over a long period from measures such as erosion control, changes in land-use practices, and adoption of best management practices (BMPs). These measures require the willingness and cooperation of all the landowners in the watershed. But even in a small watershed, it takes several years to implement a watershed management plan and to achieve perceptible lake water quality enhancement.

BMPs may include, but are not limited to: 1) erosion and sediment control, 2) agricultural soil conservation practices, such as crop rotation, grass waterway, no till or minimum till, etc., 3) irrigation management measures, 4) stormwater management

measures, 5) timber harvesting plans, 6) construction period management, and 7) porous pavement designs. The incentives for BMP applications include tax incentives, subsidies and compensation, awards and public recognition, and grants.

In-Lake Management

In-lake management techniques such as aeration/destratification, chemical control, dredging, dilution, drawdown, nutrient inactivation, shading, lake-bottom sealing, harvesting of nuisance organisms, fisheries management, and shoreline management can improve lake water quality in a time span of two to three years. Detailed limnological studies can indicate whether these measures would be beneficial for a particular lake.

Detailed limnological assessments for each lake system will include the examination of physical, chemical, and biological characteristics of the tributary to the lake; the lake water and sediments; and the development of hydraulic budgets, nutrient budgets, and bathymetric maps.

The data collected for each lake system will aid in identifying and quantifying the lake and watershed problems, and will lead to a well-planned, comprehensive, and integrated lake and watershed management plan. The benefits that can be derived from such an endeavor fall into three categories: those that can be realized soon after the implementation of management strategies, those that can be realized in one to three years, and those benefits that accrue only over a long period of time.

Lake Water Quality Assessment Program

For nearly two decades, Federal Clean Lakes Programs (CLP) have established guidelines for watershed protection and lake management. The programs have been a resounding success through the cooperative participation of federal and state environmental agencies, local organizations, and lake owners.

In Illinois, more than 500 lakes and reservoirs have been assessed by the Illinois Environmental Protection Agency (IEPA) pursuant to funding provided through the

Federal Clean Water Act. To increase the number of lakes studied in Illinois, the IEPA has applied for and received funds from the U.S. Environmental Protection Agency (USEPA) Region V under Section 314 of the Federal Clean Lakes Program - Lake Water Quality Assessment (LWQA) grants. The awarded funds under the LWQA grants were used by IEPA to assess additional lakes, which had little or no lake data readily available, such as this 1993 project.

To fulfill IEPA's goal, the Office of Water Quality Management of the Illinois State Water Survey (ISWS) was contracted to collect data on 20 selected lakes throughout the state of Illinois. The Water Survey staff visited these and three additional lakes, and collected water and sediment samples, as well as lake assessment information from various sources.

This report presents all the data obtained for the 23 lakes assessed.

Acknowledgments

Partial funding for this survey was provided by the Planning Section of the IEPA's Water Pollution Control Division. Gregg Good, Jeff Mitzelfelt, and Steve Kolsto, IEPA, assisted immeasurably in carrying out this task to its successful completion. Their help is gratefully acknowledged.

Wiley Scott, Conservation Agronomist, U.S.D.A. - Soil Conservation Service (USDA-SCS), Champaign, Illinois, was instrumental in coordinating and obtaining information pertaining to watershed land-use management practices from several regional offices. The authors immensely appreciate USDA-SCS's help.

Special thanks go to the individuals associated with the 23 lakes surveyed. They were very courteous, shared their information and knowledge about the lakes and their watersheds which made data collection easier. Without their fullest cooperation, this task could not have been accomplished in a timely and orderly fashion. The authors owe a debt of gratitude to each of them.

Luke Lin, Motorola Corporation, Schaumburg, Illinois, designed the format and compiled all analytical data and lake assessment information into a two-page report for each lake. Bill Kocher, ISWS, participated in the field work. Linda Dexter typed the manuscript and the final report, and Sarah Hibbeler edited the manuscript.

SCOPE OF WORK

The ISWS assisted the IEPA in collecting basic lake assessment data, as well as water and sediment samples for 25 sites at 23 Illinois lakes. The names and locations of these lakes are given in figure 1. Their surface areas varied from 10 acres (Lake Loami) to 935 acres (East Fork Lake). Lake types included excavated lowland, strip-mine, side channel, and dammed stream.

Basic lake assessment data gathered included: lake location; morphology; hydrology; ownership/access; lake, watershed, and shoreline usages and impairments; water quality problems; source, cause, and magnitude of pollution; lake and watershed management previously undertaken; and a lake map.

MATERIALS AND METHODS

Lake water and sediment samples were collected at one or two sites on each lake (typically the deepest estimated location) by the ISWS and delivered to IEPA laboratories for analysis. Grab water samples were taken at 0.3 meters (m) (1 foot) below the surface and 0.6 m (2 feet) above the lake bottom, transported in ice, and refrigerated until analysis. Sediment samples were taken with an epoxy-coated 15-cm x 15-cm (6-inch x 6-inch) ponar dredge.

All sampling and site visits were made during a period from July 12, 1993, through August 19, 1993. Samples were collected according to the IEPA field methods guide quality assurance/quality control procedures (IEPA, 1987).

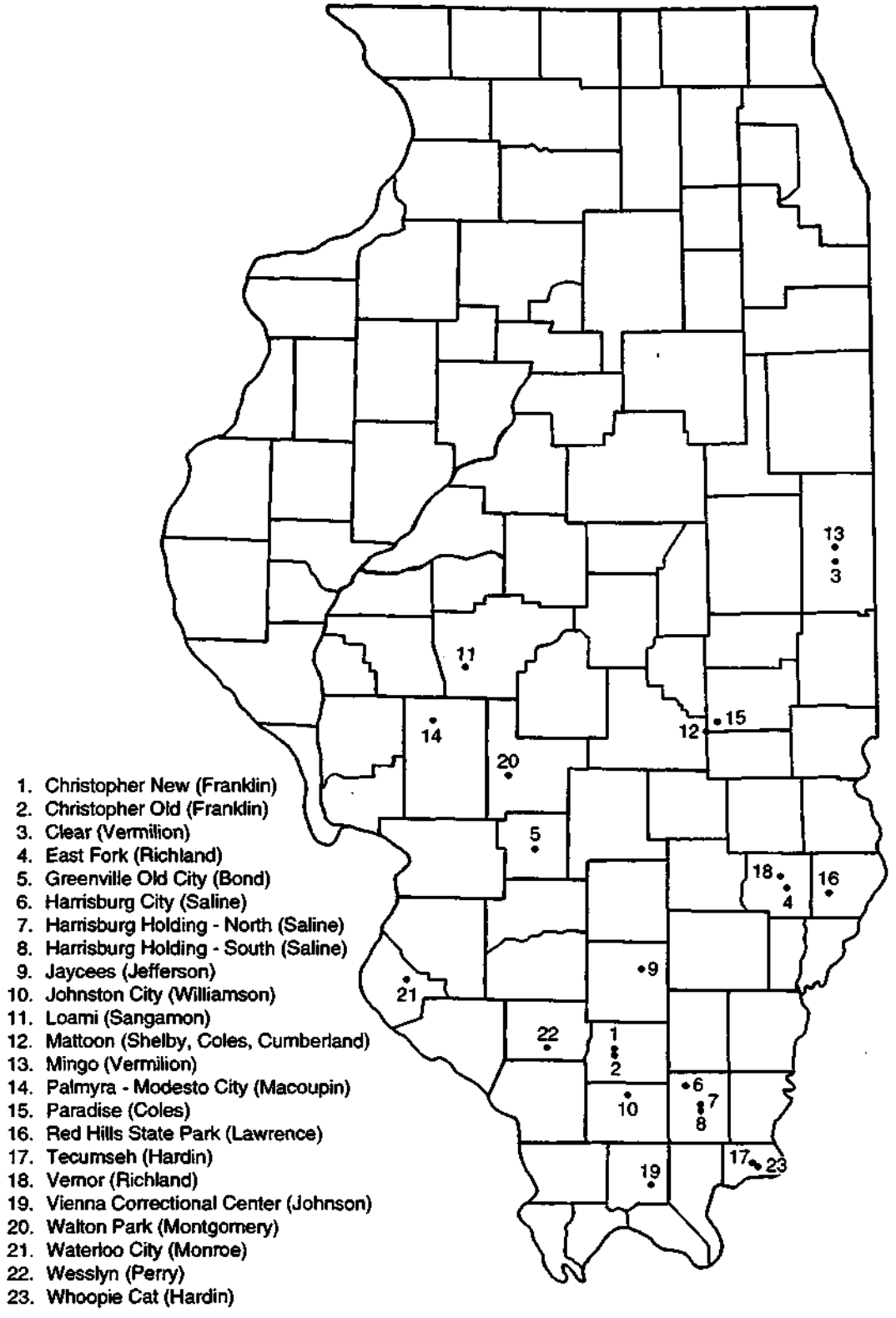


Figure 1. Locations of 23 lakes monitored

These samples were delivered to IEPA laboratories for analysis of total suspended solids (TSS), volatile suspended solids (VSS), turbidity, total phosphorus (TP), nitrite/nitrate-nitrogen (NO2/NO3-N), ammonia nitrogen (NH3-N), total kjeldahl nitrogen (TKN), chemical oxygen demand (COD), chlorophyll *a, b, c,* and pheophytine *a.* All analyses were performed using approved methods.

In-situ measurements of water temperature and dissolved oxygen (DO) were made using a 50-foot DO/temperature probe (Yellow Springs Instrument Company model 59), which was calibrated with a saturated water chamber. DO/temperature profiles were measured in the water column at each site at 1- or 2-foot intervals commencing from the surface of the lake.

Transparency was determined with an 8-inch-diameter Secchi disc with black and white quadrant markings attached to a calibrated line. The Secchi disc was lowered until it disappeared from view, and the depth of immersion of the disc was noted. The disc was lowered further and then raised slowly until it reappeared. Again the depth of immersion was recorded. The average of these two measurements was used as the secchi disc reading.

Phenolphthalein alkalinity, total alkalinity, and pH were measured in the field after sample collection.

A weighted bottle sampler and clean half-gallon bottle were used to collect a depth-integrated (surface to twice the Secchi depth) quart sample for chlorophyll at the site. This sample was placed in a foil-wrapped, quart, polyethylene bottle for chlorophyll analysis. An adequate volume of the sample was immediately filtered (with a Fisher glass fiber filter G4) with a hand vacuum pump, while in the shade. The algae-laden filter was promptly folded into quadrants, blotted with a paper towel, wrapped in aluminum foil, and placed in a small plastic bag, which was then labelled and stored in a freezer prior to shipment for lab analysis. The volume of filtrate required to saturate each filter with suspended material was recorded to facilitate calculation of chlorophyll concentrations in micrograms per liter **(µg/L).**

Replicate sediment samples were collected at the deepest point of the lake using a Petite Ponar dredge. A portion of each sample was placed in a specially prepared glass bottle for organic analyses and in a plastic bottle for metal and nutrient analyses according to IEPA field methods (IEPA, 1987). All sediment samples were collected on the same dates as the lake water samples and were transported to IEPA laboratories for analysis using approved methods. Sediment samples were analyzed for phosphorus, kjeldahl-nitrogen, total and volatile solids, total organic carbon (TOC), 13 metals, and organic chemicals.

Basic lake assessment information mentioned above was gathered by the ISWS and transferred onto lake assessment forms developed by the IEPA. The completed forms were submitted to the IEPA, and data were incorporated into the Waterbody System and a Comprehensive Lake Data Management System.

RESULTS AND DISCUSSION

General Discussion

The analytical results of water and sediment quality samples collected as well as completed lake assessment summaries are individually shown in illustration A. For each of the 21 lakes with one sampling site, two pages of data are presented. For the lakes with two sampling sites (Mattoon and Paradise), three pages of data are presented. For each lake, a lake map, DO/temperature profile, and tables indicating the lake's general features, uses and impairments, water quality problems, causes of quality problems, lake protection and management, and water/sediment qualities are provided. This section describes the information included in each lake summary.

In each summary, general information includes data on the lake's morphology (form), such as surface area, maximum and average depth, lake type, watershed (drainage basin) size, and other features. These features are important in determining how a lake will respond to nutrient or other pollutant loadings. For instance, deep lakes with

comparatively small watersheds respond much more slowly to nutrient loadings than do shallow lakes with large watersheds.

Usages and impairments information includes whether public access is available, the number of visitors to the lake annually, types of recreational facilities and usages available and used, and shoreline and watershed land usage. Designated uses and impairments are also described, and warrant further discussion here.

The degree of use support identified for each designated use indicates the ability of the lake to: 1) support a variety of high quality recreational activities, such as boating, sport fishing, swimming, and aesthetic enjoyment; 2) support healthy aquatic life and sport fish populations; and 3) provide adequate, long-term quality and quantity of water for public or industrial water supply (if applicable). Determination of a lake's use support is based upon the state's water quality standards as described in Subtitle C of Title 35 of the State of Illinois Administrative Code. Each of four established use designation categories (including General Use, Public and Food Processing Water Supply, Lake Michigan, and Secondary Contact and Indigenous Aquatic Life) has a specific set of water quality standards.

The lake uses that are assessed in this report fall under General Use standards - primarily the 0.05 mg/L TP standard. The TP standard has been established for the protection of aquatic life, primary contact (e.g., swimming) and secondary contact (e.g., boating) recreation, agriculture, and industrial uses. In addition, lake-use support is based in part on the amount of sediment, macrophytes, and algae in the lake and how these might impair designated lake uses. The following is a summary of the various classifications of use impairment:

Full = full support of designated uses, minimal impairment

Full/threatened = full support of designated uses, indications of declining water quality or evidence of existing use impairment problems

Partial/minor = partial support of designated uses, slight impairment

Partial/moderate = partial support of designated uses, moderate impairment

Nonsupport = no support of designated uses, severe impairment

Full support lakes may still exhibit some impairment, or have slight to moderate amounts of sediment, macrophytes, or algae in a portion of the lake (e.g., headwaters or shoreline); however, most of the lake acreage shows minimal impairment of the aquatic community and uses. *It is important to emphasize that if a lake is rated as not fully supporting designated uses, it does not necessarily mean that the lake cannot be used for those purposes or that a health hazard exists.* Rather, it indicates that the ability of significant portions of the lake waters to support either a variety of quality recreational experiences or a balanced sport fishery is impaired. Since most Illinois lakes are multiple-use waterbodies, a lake can fully support one designated use (e.g., aquatic life) but exhibit impairment of another (e.g., swimming).

Partial support lakes have a designated use that is slightly to moderately impaired in a portion of the lake (e.g., swimming impaired by excessive aquatic macrophytes or algae, or boating impaired by sediment accumulation). Nonsupport lakes have a designated use that is severely impaired in a substantial portion of the lake (e.g., a large portion of the lake has so much sediment that boat ramps are virtually inaccessible, boating is nearly impossible, and fisheries are degraded). However, in other parts of the same nonsupport lake (e.g., near a dam), the identical use may be supported. *Nonsupport does not necessarily mean that a lake cannot support any uses, that it is a public health hazard, or that its use is prohibited.*

Use support and level of attainment were determined for aquatic life, recreation, swimming, and overall lake use using methodologies described in the IEPA's *Illinois Water Quality Report 1992-1993* (IEPA, 1994). Assessment of fish consumption use-attainment could not be done, since fish tissue samples were not collected. Additionally, although many of the 23 lakes monitored are used for drinking water supply, an assessment of

drinking water quality was not made, because information required by the DEPA methodologies could not be collected in a single field visit.

The primary criterion in the aquatic life use assessment is an Aquatic Life Use Impairment Index (ALI), while in the recreation use assessment the primary criterion is a Recreation Use Impairment Index (RUI). Both indices combine ratings for Trophic State Index (TSI) (Carlson, 1977) and degree of use impairment from sediment and aquatic macrophytes; however, each index is specifically designed for the assessed use. ALI and RUI relate directly to the TP standard of 0.05 mg/L. If a lake water sample is found to have a TP concentration at or below the standard, the lake is given a "full support" designation. The aquatic life use rating reflects the degree of attainment of the "fishable goal" of the Clean Water Act, whereas the recreation use rating reflects the degree to which pleasure boating, canoeing, and aesthetic enjoyment might be obtained at an individual lake.

The assessment of swimming use for primary contact recreation was based on available data using two criteria: 1) Secchi disc transparency depth data, and 2) Carlson's TSI. The swimming use rating reflects the degree of attainment of the "swimmable goal" of the Clean Water Act. If a lake is rated as nonsupport for swimming, it does not mean that the lake cannot be used or that health hazards exist. It indicates that, in comparison to other Illinois lakes, swimming may be less desirable than at those lakes assessed as fully or partially supporting swimming.

Finally, in addition to assessing individual aquatic life, recreation, and swimming uses, the overall use support of lakes was assessed. The overall use support methodology aggregates the use support attained for each of the individual lake uses assessed. Values assigned to each use support attainment category are summed and averaged, and then used to assign an overall lake-use attainment value for each lake.

Water quality problems and their causes are presented in each lake summary. The type and extent of problems (e.g., sediment deposition, algal blooms, excessive weeds, etc.)

are described, and the apparent causes and sources of pollution contributing to the problems are identified (e.g., agriculture, construction, nutrients, suspended solids, etc.). These causes and sources of pollution are identified based on knowledge of watershed land uses and activities, discussions with each lake's management personnel, and field observations made during the monitoring visit. By no means are these potential causes and sources meant to be conclusive or quantified; rather, they are meant to bring about an awareness of the particular activities in the lake and its watershed that could impair that lake.

Information concerning lake protection and management is provided for each lake, including the type and extent of best management practice (BMP) implementation in the watershed to protect the lake, and the specific reasoning for the treatment. Much of this information was gathered from local county Soil and Water Conservation Districts and USDA-SCS personnel.

Finally, each lake summary presents the water and sediment quality data generated from the samples collected during the field visit. Water quality data provided include results of nutrient, suspended solids, alkalinity, pH, COD, turbidity, and chlorophyll parameters. Site depths and sampling dates are also recorded. Although sediment metals and organics were analyzed, only sediment metals data are provided, as sediment organics analyses results were not available at the time of this writing. The TSI value and lake trophic status are also provided. However, it should be realized that TSI alone is not adequate to assess the condition of a lake, because the TSI does not account for lakes with high nonalgal turbidity (i.e., suspended inorganic sediment) nor extensive aquatic macrophyte growth. Many of the lakes assessed, as well as other Illinois lakes, are impacted by inorganic sediment runoff from their watershed or by resuspension of sediment from the lake's bottom. Some highly productive lakes may be dominated by aquatic macrophyte growth but exhibit low surface water concentrations of phosphorus and high Secchi disc transparencies. Hence, TSIs calculated for lakes exhibiting conditions

of high suspended sediment or extensive macrophyte growth may indicate that the lake is less eutrophic than is actually the case.

Although it is preferable to collect limnological data periodically for one year or at least one season, lack of adequate resources limited in-situ observations and sampling to one visit per lake and restricted them to the deepest lake location. With only one dataset for each lake, it is impractical to dwell on the limnological characteristics of each. Some very general comments are included, however, with discussions of each water quality parameter determined. On the basis of these comments and lake management experiences, some conclusions can be drawn.

Thermal and Dissolved Oxygen Profiles

Deep lakes in the temperate zone (in Illinois, generally those with depths greater than 12 to 15 feet) experience thermal stratification from April to September. During thermal stratification, the upper layer (the epilimnion) is isolated from the lower layer (the hypolimnion) of the water by a temperature gradient (the thermocline or metalimnion). The most important phase of the thermal regime from the standpoint of eutrophication is the summer stratification period (June - September). The hypolimnion traps sediment materials such as decaying plants produced in the epilimnion or transported from the watershed. In a eutrophic lake, the hypolimnion becomes anoxic (devoid of oxygen) because of the increased amount of oxidizable material and its isolation from the atmosphere. Also, the oxygen demand from organic, rich bottom sediments hastens the oxygen depletion in thermally stratified lakes. With the absence of oxygen, the conditions for chemical reduction become favorable, and more nutrients are released to the overlying waters from the bottom sediment.

The amount of oxygen dissolved in water has an important impact on aquatic animals and plants. Most aquatic animals, such as fish, require oxygen in lake water to survive. The two major sources of oxygen in lake waters are diffusion from the atmosphere

across the water surface and photosynthetic oxgygen production from aquatic plants such as algae and macrophytes. Important factors that affect DO in lake water include temperature, aquatic plant photosynthetic activity, wind and wave mixing, and organic contents of the water.

Excessive growth of algae (blooms) or other aquatic plants may provide very high concentrations of DO, so-called supersaturation. On the other hand, oxygen deficiencies can occur when plant respiration depletes oxygen beyond the atmospheric diffusion rate, especially during the winter ice cover period, and when intense decomposition of organic matter in the bottom sediment occurs during the summer. These oxygen deficiencies will result in fish kills.

Illustration A depicts profiles of DO and temperature for all 25 lake sites (23 lakes) studied. The observed data are presented in appendix A. Since DO and temperature were not monitored continually during this project, it is not possible to identify the onset of thermal stratification, its progression, or times of peak stratification and subsequent fall turnover.

The results obtained (illustration A and appendix A) suggest that all the lakes studied (except Lake Paradise) showed a temperature gradient. The lakes with depths >15 feet generally had temperature profiles that display classic thermal stratification (epilimnion, metalimnion, and hypolimnion). Few deep lakes (Loami, Mattoon, and Palmyra-Modesto City) showed a lesser degree of temperature deviation with depth. Two of the lakes, Palmyra-Modesto City Lake and Lake Loami, had destratifiers to circulate water, although the Lake Loami destratifier was out of commission at the time of this field investigation. Three shallow lakes (Walton Park and Harrisburg Holding Reservoir - North and South, all 11 feet deep) along with the lakes mentioned above had surface to bottom temperature gradients of about 3-5° C. Johnson City Lake had an 8.5° C difference between surface and bottom temperatures, while the other 16 lakes had surface and bottom temperature differences of 14-24° C.

The DO levels in lake water have a dramatic effect on the lake's ability to support life. The surface DO values for 23 lakes ranged from a low of 2.1 milligrams per liter (mg/L) in Lake Loami to a high of 15.3 mg/L in Greenville Old City Lake. An unusual situation occurred in Lake Loami, where the destratifier was out of order. Heavy organic loads and algal biomass were washed into the lake from the upper sedimentation basin due to a storm event (Raman and Lin, 1993). Of the 25 sites studied, only six (Christopher - Old, Greenville Old City, Lake Harrisburg, Johnson City, Mattoon - Site 2, and Vernor) had surface DO > 10 mg/L.

DO profiles (illustration A and appendix A) in nearly all lakes had anoxic or low DO concentrations in the bottom waters. There is a destratifier installed in Lake Paradise and in Palmyra-Modesto City Lake. Site 1 (deepest point) of Lake Paradise had low DO at 2 feet above the bottom (17-19 feet in depth). However, near the intake at site 2, DO of about 6.9 mg/L was observed from the middle to the bottom of the water column. In Palmyra-Modesto City lake, a mechanical destratifier was installed and operated continuously from the fall of 1992. DO contents in Palmyra-Modesto City Lake also were low, from 5.7 mg/L at the surface to 0.2 mg/L at the bottom, decreasing progressively with water depth.

All 23 lakes studied had depths of at least 11 feet. Excluding Lake Paradise and Palmyra-Modesto City Lake, most lakes (except Clear Lake) became anoxic between 6 and 17 feet. Clear Lake, which is 48 feet deep, exhibited anoxic conditions at depths below 36 feet.

Secchi Disc Transparency

Water transparency is measured with a Secchi disc on a calibrated rope, which suggests the depth of light penetration into a body of water. From the water surface to approximately two - three times the Secchi disc depth is the region of a lake where enough

sunlight penetrates to allow photosynthetic production of oxygen by algae and other aquatic plants.

Secchi disc transparency for the 23 lakes studied ranged from 12 inches near the intake in Lake Mattoon - Site 2 to 155 inches in Clear Lake (table 1). In a previous survey of 25 Illinois lakes, Lin and Raman (1993) observed the highest Secchi disc readings as 186 inches in Strode Lake. For a survey of southern Illinois lakes, Burns (1991) reported the highest Secchi transparency (240 inches) in Crystal Lake in Perry County. Seven of the 23 lakes in this study (Greenville Old City, Johnston City, Loami, Mattoon - Sites 1 and 2, Paradise - Sites 1 and 2, Red Hills State Park, and Walton Park) had a Secchi disc transparency $\leq$ 24 inches, which represents the level generally associated with lake impairment (IEPA, 1978). Eleven lakes had Secchi transparencies between 24 and 48 inches. Five lakes (Clear, Tecumseh, Vienna Correctional Center, Wesslyn, and Whoopie Cat) had Secchi transparencies $\geq$ 48 inches. Excluding Wesslyn Lake, four of those lakes had transparencies $\geq$ 95 inches. The minimum recommended Secchi transparency set by the Illinois Department of Public Health for bathing beaches is 48 inches. Nevertheless, a lake that does not meet the transparency criteria does not necessarily constitute a public health hazard.

Total Suspended Solids

TSS represent material residue left on a filter $\leq$ 2.0 micrometers (µm) normal pore size, i.e., the concentration of all inorganic and organic matter suspended in a water column. Inorganic portions of TSS originate from the erosion and weathering of soil and rocks in a lake watershed and resuspension of lake sediments. Organic portions of TSS are derived from a variety of biosolids in the lake which, for the most part, comprise algae and resuspended animal and plant materials from the lake bottom. Generally, the higher the TSS concentration, the lower the Secchi disc reading. A high TSS concentration results in decreased water transparency, which can reduce photosynthetic activities, and

Table 1. Trophic State Index (TSI) and Trophic State for Lakes Assessed in 1993

Lake	Secchi disc		Chlorophyll		Total phosphorus		Mean TSI	Trophic* state
	inch	TSI	µg/L	TSI	µg/L	TSI		
Christopher-New	34	62.2	43.39	67.3	24	50.0	59.8	E
Christopher-Old	26	66.0	78.57	73.3	207	81.0	73.4	H
Clear	155	40.7	2.81	40.7	1	4.2	28.6	O
East Fork	36	61.5	47.17	68.3	12	40.0	56.6	E
Greenville	20	69.8	152.57	80.1	111	72.1	74.0	H
Harrisburg	26	66.0	44.71	67.9	14	42.4	58.8	E
Harrisburg HR-N	25	66.5	9.08	52.4	9	35.8	51.6	E
Harrisburg HR-S	31	63.6	2.14	38.2	26	51.1	51.0	E
Jaycees	34	62.2	30.04	41.5	7	32.2	45.3	M
Johnston City	24	62.0	88.11	74.5	16	44.1	60.2	E
Loami	19	70.5+	37.15	66.2	27	51.6	62.8	E
Mattoon - Site 1	22	68.5	99.32	75.6	30	53.2	65.8	E
Mattoon - Site 2	12	76.2	192.24	82.2	125	73.8	77.4	H
Mingo	33	62.8	35.24	65.6	5	27.4	51.9	E
Palmyra-Modesto	47	57.7	21.81	60.7	28	52.2	56.9	E
Paradise - Site 1	18	71.4	82.24	73.7	22	48.7	64.6	E
Paradise - Site 2	16	73.1	86.26	74.3	13	41.1	62.8	E
Red Hills	29	70.6	42.55	67.3	9	35.8	57.9	E
Tecumseh	95	47.7	3.89	43.8	8	34.1	41.9	M
Vernor	32	63.1	54.84	69.8	28	52.2	61.7	E
Vienna Corr.	110	45.6	28.48	63.4	6	30.0	46.3	M
Walton Park	20	69.8	29.13	63.6	98	70.3	67.9	E
Waterloo	31	63.6	32.93	64.7	199	80.5	69.6	E
Wesslyn	52	56.2	8.34	51.3	1	4.2	37.2	O
Whoopie Cat	133	42.8	8.54	51.8	1	4.2	32.9	O

* Note: E = eutrophic; H = hypertrophic; M = mesotrophic; O = oligotrophic

+ Data gathered after an extraordinary storm event

subsequently decrease the amount of oxygen produced by algae, possibly creating anoxic conditions. Anaerobic water may limit fish habitats and potentially cause taste and odor problems by releasing noxious substances such as hydrogen sulfide, ammonia, iron, and manganese from the lake bottom sediments.

TSS in the surface water samples of the lakes studied ranged from 2 mg/L (Clear Lake, Wesslyn Lake, and Whoopie Cat Lake) to 40 mg/L (Johnson City Lake). High TSS concentrations in Johnston City Lake and Lake Mattoon - Site 2 were linked to high levels of chlorophyll *a.* TSS concentrations in the bottom water samples were between 3 mg/L (Clear Lake) and 61 mg/L (Jaycees Lake). With few exceptions (Harrisburg Holding Reservoir - South, Loami, Mattoon - Site 2, Mingo, and Red Hills Lakes), TSS concentrations in lake bottom water were higher than those in surface water. Lake Loami samples were collected after an abnormal storm event, and the combination of unusually heavy rainfall and the failure of the mechanical destratifier resulted in an algal bloom (flushed out from the upper silt basin) and DO depletion in the lake. Application of copper sulfate to the lake to control the algal bloom resulted in a fish kill (Raman and Lin, 1993).

On the basis of Illinois Lake Assessment Criteria (IEPA, 1978), TSS $\geq$ 25 mg/L are classified as high lake-use impairment, while TSS for moderate use impairment are between 5 and 25 mg/L. TSS $\leq$ 5 mg/L are considered minimal impairment. In this study, based on the surface TSS concentrations, 4 lakes/sites (Johnston City, Loami, Paradise - Site 2, and Mattoon - Site 2), 16 lakes/sites, and 7 lakes are in the categories of high, moderate, and minimal use impairments, respectively.

Volatile Suspended Solids

VSS are the portion of TSS lost to ignition at 500 ± 50° C. VSS represent the organic portion of TSS, such as phytoplankton, zooplankton, and other suspended organic matter. VSS concentrations in surface waters for the 25 sites ranged from $\leq$ 1 mg/L

(Clear, Wesslyn, and Whoopie Cat Lakes) to 33 mg/L (Lake Loami). Excluding Lake Loami, the highest VSS level occurred at Lake Mattoon - Site 2 (14 mg/L). VSS levels for bottom water samples were between 1 mg/L (Clear Lake) and 15 mg/L (Jaycees Lake). High VSS levels are generally indicative of turbidity caused by algae and other organic debris.

The VSS/TSS ratio in surface waters for the 25 sites was in the range of 0.22 (Harrisburg Holding Reservoir - South) and 0.85 (Lake Loami) with an average of 0.52. High ratios also were observed in Jaycees Lake (0.80) and Lake Tecumseh (0.75), although both lakes have low TSS (5 and 4 mg/L, respectively) concentrations. For nonvolatile suspended solids (SS), five lakes (Johnston City, Waterloo City, Walton Park, Palmyra-Modesto City, and Greenville Old City) equaled or exceeded 12 mg/L, which is the impairment margin for overall use (USEPA, 1992). Johnston City Lake had the highest nonvolatile SS concentration, 28 mg/L, which is considered high/substantial impairment (>20 mg/L).

For bottom water samples, the VSS/TSS ratios ranged from 0.19 for Palmyra-Modesto City Lake to 1.00 for Wesslyn Lake, with an overall average of 0.49. In general, the lower the VSS/TSS ratio, the higher the nonvolatile SS fraction. Based on nonvolatile SS concentrations, three lakes (Jaycees Lake, Lake Paradise - Site 2, and Walton Park Lake) could be classified as highly/substantially impaired. Four other lakes (Palmyra-Modesto City, Greenville Old, Loami, and Vienna Correctional Center) are also classified as impaired (< 12 mg/L of nonvolatile SS).

Turbidity

Turbidity is an expression of the property of water that causes light to be scattered and absorbed by a turbidimeter, and is reported as nephelometric turbidity units (NTU). Turbidity in water is caused by dissolved substances and suspended matter, such as clay, silt, finely divided inorganic and organic matter, soluble colored organic compounds, and

plankton and other microorganisms. Generally, turbidity in lakes is influenced by sediment runoff carried into a lake from its watershed, algae in the water column, or resuspension of lake bottom sediments.

Turbidity of 25 site samples from the 23 lakes assessed ranged from 0.1 NTU for surface water (Vienna Correctional Center Lake) and 0.4 NTU for bottom water (Clear Lake) to 25 NTU for surface water (Greenville Old City Lake) and 25 NTU for bottom water (Waterloo City Reservoir). Illinois Lake Assessment Criteria (IEPA, 1978) for a moderate amount of sediment set a turbidity value between 7 and 14 NTU. Turbidity > 15 NTU is indicative of substantial suspended sediment. On the basis of surface turbidity levels, only two lakes (Greenville Old City and Loami) are considered to have substantial turbidity. Three lakes (Christopher - Old, Walton Park, and Waterloo City) had moderate amounts of sediment. The other 18 lakes (20 sites) are considered to have minimal amounts of suspended sediments.

Nitrogen

Nitrogen is generally found in surface waters in the form of ammonia (NH3), nitrite (NO2), nitrate (NO3), and organic nitrogen. Organic nitrogen is determined by subtracting NH3 nitrogen from the TKN measurements. Organic nitrogen content can indicate the relative abundance of organic matter (algae and other vegetative matter) in water, but has not been shown to be directly used as a growth nutrient by planktonic algae. Nitrogen is an essential nutrient for plant and animal growth, but it can cause algal blooms in surface waters and create public health problems at high concentrations. The Illinois Pollution Control Board (IPCB) (1990) has set standards for nitrate not to exceed 10 mg/L nitrate nitrogen or 1 mg/L nitrite nitrogen for public water-supply and food processing waters.

Nitrate is readily used by algae as a nutrient to approximately the same extent as ammonia. If the sum of NO_2 and NO_3 nitrogen concentrations exceeds 0.30 mg/L, it may

stimulate algal growth. NH3 is a natural end product of decomposed organic material. It can exist in water in two forms as ionized (NH_4+ and ammonium) and un-ionized (NH3 ammonia). High levels of ammonia can be toxic to aquatic organisms, but the level of toxicity depends on water temperature and pH. The IPCB (1990) stipulates an ammonia nitrogen limitation of 15 mg/L.

Ammonia Nitrogen. The surface water ammonia nitrogen levels ranged from concentrations that were lower than detectable (0.01 mg/L) at four sites (Mattoon - Site 2, Red Hills, Tecumseh, and Whoopie Cat) to 0.67 mg/L at Walton Park Lake. With the exception of Walton Park Lake and Lake Loami, all the other 23 sites (21 lakes) had ammonia nitrogen levels < 0.2 mg/L.

Ammonia concentrations in the bottom waters can be more important in that the NH3 will rapidly be oxidized to nitrite/nitrate after lake turnover occurs. The observed bottom water NH_3 levels ranged from 0.01 mg/L at Harrisburg Holding Reservoir - South to 12.0 mg/L at Wesslyn Lake. No water sample near the lake bottom exceeded the IPCB's ammonia nitrogen limitation (15 mg/L).

Nitrite/Nitrate Nitrogen. The sum of nitrite and nitrate (NO_2 + NO_3) nitrogen for 11 lakes was under the detection limit (0.01 mg/L) in both surface and bottom water samples. The highest concentrations (1.1-1.5 mg/L) were found in Lake Mingo, Palmyra-Modesto City Lake, and Lake Paradise - Sites 1 and 2. None of the NO2/NO3 levels exceeded IPCB standards.

Total Kjeldahl Nitrogen. TKN represents the sum of NH3, NH_4^+, and organic nitrogen present in water. For the lake surface waters, TKN ranged from 0.081 mg/L (Lake Mattoon - Site 2) to 0.97 mg/L (Walton Park Lake), while TKN for bottom waters ranged from 0.22 mg/L (Lake Mattoon - Site 2) to 12.8 mg/L (Wesslyn Lake).

Total Phosphorus

TP represents all forms of phosphorus in water. Dissolved phosphorus is the soluble portion of TP. Phosphorus, an essential plant nutrient, occurs in natural waters and wastewaters almost solely as phosphates. In relatively uncontaminated lakes, the TP of lake surface waters is generally in the range of 0.01 and 0.03 mg/L (Hutchinson, 1967; APHA, AWWA, and WEF, 1992). Phosphorus is frequently the limiting nutrient in a lake ecosystem. Excessive concentrations of TP, like nitrate, can cause noxious growths of algae and other aquatic plants, and TP levels of 0.03 mg/L have been shown to cause nuisance algae/plant growth. The IPCB (1990) stipulates that "Phosphorus as P shall not exceed 0.05 mg/L in any reservoir or lake, or in any system at the point where it enters any reservoir or lake."

TP values of the 25 surface water samples collected ranged from under the detection limit of 0.001 mg/L (Wesslyn and Whoopie Cat Lakes) to 0.207 mg/L (Christopher - Old Reservoir). Four samples (Christopher - Old Reservoir, Lake Mattoon - Site 2, Walton Park Lake, and Waterloo Lake) exceeded the standard of 0.05 mg/L, while the other 21 samples were < 0.3 mg/L of TP. The TP concentrations for the bottom waters were between 0.005 mg/L (Clear Lake) and 3.05 mg/L (Wesslyn Lake, which may have been an atypical sample).

pH

The pH value is a measure of the acidity of water: values < 7.0 indicate acidic water, and values > 7.0 indicate basic (or alkaline) water. A pH of 7.0 is exactly "neutral." Although rain water in Illinois is acidic (pH about 4.4), most of the lakes can offset this acidic input by an abundance of natural buffering compounds in the lake water and the watershed. One species of carbonate, carbonic acid, usually controls pH to a great extent and is consumed by algae and other plants for growth. A rise in pH can occur due to photosynthetic uptake of carbonic acid and cause water to become more basic. Values >

8.0 in Illinois lakes are usually indicative of photosynthetic demand of carbon dioxide. Most Illinois lakes have a pH between 6.5 and 9.0. The IPCB (1990) standard of pH for general-use water quality is also in a range between 6.5 and 9.0, except for natural causes.

The pH levels at the 23 lake surface waters ranged from 7.3 (Paradise - Site 1) to 9.9 (Greenville Old City). In fact, three lakes (Christopher - Old, Greenville Old City, and Red Hills State Park) had pH > 9.0. The pH values of the surface water in 13 lakes were between 8.0 and 9.0. Photosynthetic activities occurred in almost all lakes.

Except for Red Hills State Park Lake, where both surface and bottom waters had pH levels of 9.1, all lakes showed lower pH values for bottom waters than for surface waters. Bottom water pH values were more than three units lower in Greenville Old City Lake, while in eight lakes the differences in the surface and bottom water pH values were less than 1.0. The pH levels in the 25 lake sites ranged from 6.4 (Lake Tecumseh) to 9.1 (Red Hills State Park Lake). Ten sites had bottom water samples with a pH > 7.0, and six other sites had pH values equal to 7.0.

Alkalinity

Alkalinity is a measure of water's acid-neutralizing capacity. It is expressed in terms of an equivalent amount of calcium carbonate ($CaCO_3$). Alkalinity is mainly the result of carbonates, bicarbonates, and hydroxide ions in water. Total alkalinity is the amount of acid required to bring water to a pH of 4.5. Phenolphthalein alkalinity is the amount of acid needed to bring water to a pH of 8.3.

Lakes with low alkalinity are or have the potential to be susceptible to acid rain damage. However, Illinois lakes usually have high alkalinity and thus are well buffered from the impacts of acid rain.

Phenolphthalein Alkalinity. Surface waters at only eleven sites had phenolphthalein alkalinity, ranging from 6 (Johnston City and Mingo Lakes) to 33 (Christopher - Old

Reservoir) mg/L as $CaCO_3$. It was almost nonexistent in lake bottom waters, except in Red Hills State Park Lake (18 mg/L as CaCO>3).

Total Alkalinity. Total alkalinity as CaCC>3 of 25 lake site surface waters was between 26 mg/L (Lake Tecumseh) and 169 mg/L (Clear Lake). These values are typical of Illinois lakes. With only seven exceptions, lake bottom waters had higher total alkalinity than the lake surface waters. Of the 25 sites sampled, total alkalinity as CaCO3 for bottom waters ranged from 16 mg/L (Lake Tecumseh) to 220 mg/L (Christopher - Old Reservoir).

Chemical Oxygen Demand

The COD is a measure of the oxygen requirement of the organic content of a sample that is susceptible to oxidation by a strong chemical oxidant. The COD test is less time-consuming than the biochemical oxygen demand (BOD) test and can be related empirically to BOD. BOD is related to biological processes that occur when bacteria feeding on dead animal and plant matter and animal wastes consume oxygen during the decomposition process. The COD result is typically slightly greater than that for the BOD test, because the COD test includes some materials that are not readily biologically degradable. Domestic and industrial wastewaters usually have high COD levels.

Illinois Lake Assessment Criteria (IEPA, 1978) state that COD values >30 mg/L indicate a high magnitude of organic enrichment from plant and algal material and that COD values between 20 and 30 mg/L are considered moderate organic enrichment. COD levels for surface waters at 25 lake sites ranged from 8 mg/L (Clear Lake) to 28 mg/L (Greenville Old City Lake and Lake Loami). Although high COD concentrations were found in Walton Park Lake (27 mg/L), no sample can be considered highly enriched (>30 mg/L of COD). Five lakes (Greenville Old City, Loami, Walton Park, Christopher - Old, and Harrisburg) are classified as having moderate organic enrichment. COD levels for bottom waters ranged from 11 mg/L (Paradise - Site 2 and Whoopie Cat Lakes) to 80 mg/L (Wesslyn Lake).

Chlorophyll

All green plants contain chlorophyll *a*, which constitutes approximately one to two percent of the dry weight of plankton's algae (APHA, AWWA, and WEF, 1992). Other pigments that occur in phytoplankton include chlorophyll *b* and *c*, xanthophylls, phycobilius, and carotenes. The important chlorophyll degradation products in water are the chlorophyllides, pheophorbides, and pheophytines. The concentration of photosynthetic pigments is used extensively to estimate phytoplanktonic biomass. The presence or absence of the various photosynthetic pigments is used, among other features, to identify the major algal groups present in the water body.

In the 23 lakes studied, chlorophyll *a* ranged from 2.14 µg/L in Harrisburg Holding Reservoir - South (2.81 µg/L in Clear Lake) to 192.24 /ig/L in Lake Mattoon - Site 2. High chlorophyll *a* (152.57 µg/L) was also observed in Greenville Old City Lake. Chlorophyll *b* ranged from 0.15 µg/L (Clear Lake) to 27.00 µg/L (Johnston City Lake). Three lakes (Greenvile Old City, Palmyra-Modesto City, and Vienna Correctional Center) had no chlorophyll c, and the highest concentration (11.61 µg/L) was observed at Lake Mattoon - Site 2. Pheophytin *a* was found in seven lakes (Mingo, Palmyra-Modesto, Whoopie Cat, Tecumseh, Vernor, Walton Park, and Wesslyn), ranging from 0.27 µg/L to 3.92 µg/L.

Trophic State

Eutrophication is a normal process that affects every body of water from its time of formation. As a lake ages, the degree of enrichment from nutrient materials increases. In general, the lake traps a portion of the nutrients originating in the surrounding drainage basin. In addition, precipitation, dry fallout, and ground-water inflow are the other contributing sources.

A wide variety of indices of lake trophic conditions have been proposed in the literature used for this study. Indices have been based on Secchi disc transparency, nutrient concentrations, hypolimnetic oxygen depletion, and biological parameters,

including chlorophyll *a*, species abundance, and diversity. The USEPA suggests in its *Clean Lakes Program Guidance Manual* (1980) the use of four parameters as trophic indicators: Secchi disc transparency, concentrations of chlorophyll *a*, phosphorus, and carbon in water.

In addition, the lake trophic state index (TSI) developed by Carlson (1977) on the basis of Secchi disc transparency (SD), chlorophyll *a* (CHL), and surface water total phosphorus (TP) can be used to evaluate a lake's trophic state. The TSI number can be calculated from SD in meters (m), CHL in micrograms per liter (µg/L), and TP in µg/L as follows:

on the basis of SD,	TSI = 60 -14.41 In (SD)	(1)
on the basis of CHL,	TSI = 9.81 In (CHL) + 30.6	(2)
on the basis of TP,	TSI = 14.42 In (TP) + 4.15	(3)

The index is based on the amount of algal biomass in surface water, using a scale of 0 to 100. Each increment of ten in the TSI represents a theoretical doubling of biomass in the lake. The advantages and disadvantages of using the TSI were discussed by Hudson et al. (1990). The accuracy of Carlson's index is often diminished by water coloration or suspended solids other than algae. Applying TSI classification to lakes that are dominated by rooted aquatic plants may indicate less eutrophication than actually exists.

A TSI is derived from the average of three calculated results using formulas (l)-(3) for every monitored lake site. It is used to define the trophic state of a lake as indicated in table 2, which is modified from Carlson (1977). The values of TSI and trophic state for 25 lake sites are listed in table 1. Three lakes (Christopher - Old, Greenville Old City, and Mattoon - Site 2) are classified as hypereutrophic, and a majority of the lakes (15 lakes, 16 sites) are eutrophic. Three lakes (Jaycees, Tecumseh, and Vienna Correctional Center) are mesotrophic. The other three lakes (Clear, Wesslyn, and Whoopie Cat) can be considered oligotrophic based on the average of three TSIs. Based on SD and CHL calculations, they can be classified as either eutrophic or mesotrophic. Carlson (1977)

Table 2. Quantitative Definition of Lake Trophic State

Trophic state	*Secchi disc transparency (inches)*	*(m)*	*Chlorophyll a (µglL)*	*Total phosphorus - lake surface (µg/L)*	*TSI*
Oligotrophic	>157	>4.0	<2.6	<12	<40
Mesotrophic	79-157	2.0-4.0	2.6-7.2	12-24	40-50
Eutrophic	20-79	0.5-2.0	7.2-55.5	24-96	50-70
Hypertrophic	<20	<0.5	>55.5	>96	>70

pointed out that phosphorus and chlorophyll TSIs should match closely in lakes that are phosphorus-limited. Because none of the lakes in this study are phosphorus-limited, only winter TP concentration (instead of whole year TP concentration) should be used in trophic state classification (USEPA, 1980).

Lake Sediment Quality

Lake sediment can act both as sinks and as potential sources (such as phosphorus and metals) impacting lake water quality. Its metal and/or organic chemical toxicities can directly affect the presence of aquatic animals and plants on the lake bottom. Lake sediments, if and when dredged, should be carefully managed to prevent surface water and groundwater contamination.

While there are no regulatory agencies that promulgate sediment quality standards, sediment quality in Illinois is generally assessed using the Classification of Illinois Lake Sediments report developed by Kelly and Hite (1981). For the study they collected 273 individual sediment samples from 63 lakes across Illinois during the summer of 1979. On the basis of each parameter measured, they defined "elevated levels" as concentrations of one to two standard deviations greater than the mean value, and "highly elevated levels" as concentrations greater than two standard deviations from the mean. A statistical classification of Illinois lake sediment developed by Kelly and Hite is shown in table 3. It should be noted that in this classification lake sediment data are considered to be elevated based on a statistical comparison of levels found in 1979 and not on toxicity data. Therefore, elevated or highly elevated levels of parameters do not necessarily indicate a human health risk.

Results of surficial sediment analyses for each studied lake are listed in illustration A. An inspection of sediment results of Lake Paradise - Site 2 reveals that nutrient values and metal contents were extremely low, while concentrations of solids due to sand and

Table 3. Classification of Illinois Lake Sediments

Constituent, mg/kg	*Below normal*	*Normal*	*Elevated*	*Highly elevated*
Total Kjeldahl nitrogen	<1650	1650-5775	5775-7850	>8750
Total phosphorus	<225	225-1175	1175-1650	>1650
Volatile solids (%)	<5	5-13	13-17	>17
Arsenic		<27	27-41	>41
Cadmium		<1.8	1.8-2.6	>2.6
Chromium	<14	14-30	30-38	>38
Copper		<100	100-150	>150
Iron	< 18000	18000-36000	36000-45000	>45000
Lead	<15	15-100	100-150	>150
Manganese		<3000	3000-3900	>3900
Mercury		<0.25	0.25-0.40	>0.40
Zinc	<50	50-175	175-250	>250

gravel were high. It was a poor sample location adjacent to the intake. Therefore this sample is not included for data analysis.

Table 4 presents the number and percentage of 24 monitored lake sites having elevated and highly elevated levels of specific parameters, as well as the minimum and maximum values for each parameter. Most of the sediment samples collected from the 23 lakes can be classified in the normal range for Illinois lakes. Fifty percent of samples contained TKN below normal concentrations (<1650 mg/kg). The most prevalent metals were iron, with ten lakes having elevated and highly elevated levels (41.6% of the total lakes monitored), and cadmium, with eight lakes having highly elevated levels (33.3%). In contrast, a 1989 lake assessment program (IEPA, 1991), showed copper (26 of 69 lakes assessed, 37.7%) and chromium (21 lakes, 30.4%) to be the most prevalent metals.

The data in illustration A and table 4 indicate that Wesslyn Lake has the best sediment quality, while Vernor Lake and Red Hills State Park Lake have the worst.

Table 5 presents a comparison of sediment qualities measured in 1979 and 1993 for four lakes (East Fork, Harrisburg, Mattoon, and Paradise). In general, the nutrient concentrations increased with time, but there is no general trend for changes in metals concentrations.

SUMMARY

This report is a summary of all data collected in 1993 for 25 sites in 23 lakes. The data are presented in the form of individual listings and maps for each lake (Illustration A). Each lake summary contains a lake map, morphological data, watershed information, information on lake impairments and water quality problems, analytical results of lake water and sediment qualities, and the lake trophic status. The results of physical and chemical characteristics of lake water samples and sediment quality are discussed in this report. On the basis of only one observation per lake site, it is concluded that four lakes (Clear, Whoopie Cat, Wesslyn [surface sample only], and Tecumseh) have the highest

Table 4. Sediment Results of 23 Lakes (24 samples) Monitored

	Minimum		Maximum		Number (%) of lakes classified as elevated	Number (%) of lakes classified as highly elevated
	value	*lake*	*value*	*lake*		
Phosphorus-P, mg/kg	319	Wesslyn	1409	Greenville	2(8.3)	0(0.0)
Kjeldahl-N, mg/kg	1.8	Tecumseh	5852	Red Hills	1(4.1)	0(0.0)
Vol. solids, %	3.5	Harrisburg HR-South	19.6	Vernor	1(4.1)	1(4.1)
Arsenic, mg/kg	5.4	Wesslyn	52.1	Red Hills	0(0.0)	1(4.1)
Cadmium, mg/kg	1K	16 lakes	18	Harrisburg	0(0.0)	8(33.3)
Chromium, mg/kg	12	Harrisburg HR-North	30	Vienna C.C.*	0(0.0)	0(0.0)
Copper, mg/kg	12	Wesslyn	760	Vernor	1(0.0)	2(8.3)
Iron, ing/kg	1900	Harrisburg City	51000	Vernor	9(37.5)	1(4.1)
Lead, mg/kg	14	Wesslyn	60	Vernor	0(0.0)	0(0.0)
Manganese; mg/kg	250	Wesslyn	2800	Vienna C.C.*	0(0.0)	0(0.0)
Mercury, mg/kg	0.1K	18 lakes	0.1	6 lakes	0(0.0)	0(0.0)
Zinc, mg/kg	41	Wesslyn	122	Mingo	0(0.0)	0(0.0)

* Note: Vienna Correctional Center

Table 5. Time Effect on Surficial Sediment Quality of Four Lakes

	East Fork Lake		*Lake Harrisburg*		*Lake Mattoon*		*Lake Paradise*	
Parameter, mg/kg	*1979*	*1993*	*1979*	*1993*	*1979*	*1993*	*1979*	*1993*
Volatile solids, (%)	5.0	10.4	9.7	10.6	8.50	11.2	11.14	11.6
Total Phosphorus	420	666	815	1124	753	1186	850	975
Total Kjeldahl-N	1600	4052	3350	2272	2925	3630	3600	4400
Arsenic	6.4	10.6	17.0	15.3	7.9	9.4	8.3	6.9
Cadmium	0.5	1K	1.0	18	0.5	1K	1.0	1K
Chromium	13	19	24	26	24	18	30	23
Copper	13	36	27	26	23	18	28	25
Iron	21,000	37,000	47,000	45,000	30,000	27,000	35,000	31,000
Lead	25	33	50	51	40	21	40	27
Manganese	2600	2200	2900	2200	1370	1000	820	748
Mercury	0.055	0.10	0.125	0.1K	0.063	0.1K	0.100	0.10
Zinc	49	71	120	96	92	61	120	90

Note: Average of two samples collected at site 2 (deepest point) of each lake in 1979.

water quality. Three other lake sites, (Greenville Old City Lake, Christopher - Old Reservoir, Lake Mattoon - Site 2) have poor water quality yet serve as public water-supply sources. Four lakes (Greenville Old City, Red Hills State Park, Vernor, and Harrisburg) have poor bottom sediment quality. Further investigations of these last four lakes are recommended.

Based on the lake use support assessment, eight lakes, viz, Clear Lake, Harrisburg Holding Reservoir - North, Harrisburg Holding Reservoir - South, Lake Mingo, Lake Tecumseh, Vienna Correctional Center Lake, Wesslyn Lake, and Whoopie Cat Lake, could sustain full use overall. Seven lakes, namely, Greenville Old City Lake, Harrisburg Lake, Johnston City Lake, Lake Mattoon, Red Hills State Park Lake, Vernor Lake, and Waterloo City Reservoir, have poorer quality characteristics and are capable of providing partial support of designated uses with moderate impairment. All other lakes included in this investigation fall between these two general characterizations.

REFERENCES

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF). 1992. *Standard Methods for the Examination of Water and Wastewater.* American Public Health Association, Washington, D.C.

Burns, A.J. 1991. *Lake water quality program - southern Illinois lakes.* IEPA, IEPA/WPRC/91-210, 44p.

Carlson, R.E. 1977. "A trophic state index for lakes," *Limnology and Oceanography,* 22(2):361-369.

Hudson, H.L., J. J. Clark, and R.J. Kirschner. 1990. *Lake water quality assessment program - northeastern Illinois lakes.* Northeastern Illinois Planning Commission, Chicago, IL, 83p.

Hutchinson, G.E. 1967. *A Treatise on Limnology, Vol II, Introduction to Lake Biology and the Limnoplankton.* John Wiley & Sons, Inc., New York, NY. 1115p.

Illinois Environmental Protection Agency. 1978. *Assessment and classification of Illinois Lakes*, Vol. II. IEPA, Springfield, IL, 358p.

Illinois Environmental Protection Agency. 1987. *Quality assurance and field method manual,* IEPA, Springfield, IL.

Illinois Environmental Protection Agency. 1991. *Lake Water Quality Assessment Grant.* Final Report, IEPA, Springfield, IL, 62p.

Illinois Environmental Protection Agency. 1994. Illinois Water Quality Report: 1992-1993. IEPA, Springfield, IL.

Illinois Pollution Control Board. 1990. *Rules and Regulations, Title 35: Environmental Protection, Subtitle C: Water Pollution,* Chapter I. IEPA, Springfield, IL, 195p.

Kelly, M.H. and R.L. Hite. 1981. *Chemical Analysis of Surficial Sediments from 63 Illinois Lakes, Summer 1979.* IEPA, Springfield, IL, 92p.

Lin, S.D., and R.K. Raman. 1993. *Illinois Lake Quality Assessment -1992.* Illinois State Water Survey Contract Report 553, Champaign, IL, 78p.

Raman, R.K., and S.D. Lin. 1993. *Lake water quality problems and how a small utility overcame them.* Lake Waves, 22(3): 1-2.

U.S. Environmental Protection Agency. 1980. *Clean lakes program guidance manual.* EPA-440/5-81-003, Washington, DC, 103p. + appendices.

U.S. Environmental Protection Agency. 1990. *The lake and reservoir restoration guidance manual.* 2nd ed. USEPA, Washington, DC, 326p.

Illustration A. Lake Assessment Information and Water and Sediment Quality Data for 23 Illinois Lakes

Abbreviations

Under *Usages and Impairments:*

Full:	full support
F/Th:	full/threatened
P/Mi:	partial/minor
P/Mo:	partial/moderate
(1), (2), (3), (4):	from low to high level of use
P:	potential for increased use
I:	increasing trend of use
D:	decreasing trend of use

Under *Water Quality Problems* and *Causes of Quality Problems:*

M/N:	minimal/none
S:	slight
M:	moderate
H:	high or substantial

Under other headings:

WTP:	wastewater treatment plant
IDOT:	Illinois Department of Transportation
BDOH:	Illinois Department of Health
CMS:	Central Management Services
CRP:	conservation reserve program
FSA:	Food Security Act
USD A:	United States Department of Agriculture
WRDGC:	Water Reclamation District of Greater Chicago

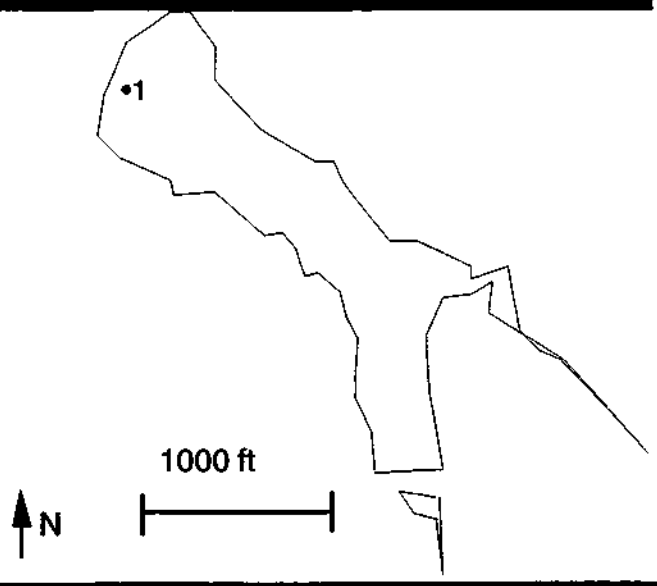
Note: Under *General,* the map indicates the location of one or more sampling sites for the lake in question.

Christopher New Reservoir

Fulton County Map Code: RNS

City of Christopher
211 N. Thomas, Christopher, IL 62822
618/724-2011

General



Lake Location		2.5 miles NW of Christopher
Deepest Point	Latitude	38° 00' 20"
	Longitude	89° 06' 08"
Lake Surface Area, acres		43.2
Length of Shoreline, miles		2.2
Maximum Depth, feet		23
Average Depth, feet		8.2
Lake Storage Capacity, acre-feet		354
Watershed Drainage Area, acres		592
Hydraulic Retention Time, years		0.555
Lake Type		Dammed stream
Year Constructed		1922,1931
Ownership		Public
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed

Unique Features

The lake served asabackupwatersupply source until 1971. Water was being pumped into Old Reservoirto supplement The treatment system has since been abandoned.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access

No. of Visitors per Year <25,000

Lake Use Support

Overall	P/Mi
Aquatic Life	Full
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (4), P Low power boating - (4)
IDOC drained the lake and stocked 7 years ago.

Recreational Facilities

One gravel boat ramp

Shoreline Usage, %

Woodland	90
Cropland	10

Watershed Drainage Area Usage, %

Cropland	47	Wetland	9
Woodland	25	Pasture/grassland	4
Wildlife	13	Other	2

Water Quality Problems

Problems

Sediment deposition	S
Algal blooms	M
Aquatic macrophytes	H
Water level fluctuation	M/N
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Bluegiil, bass, channel catfish

Causes of Quality Problems

Potential Pollution Sources

Cropland runoff, woodland runoff

Causes of Impairment

Suspended solid	S
Nutrients	S

400bs.of$CuSO_4$ applied in 1993 to control moss along shoreBna

Sources of Impairment

Agriculture	M
Pasture	S

Christopher New Reservoir

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
	Grassed waterway, acre	7	Erosion control
	Grade stabilization structure	1	Gully erosion control
	Ponds	3	Recreation & erosion control
	Permanent vegetative cover, acre	240	CRP& woodland
	Conservation cropping system, acre	200	Soil tilth & erosion control
	Livestock exclusion, acre	100	

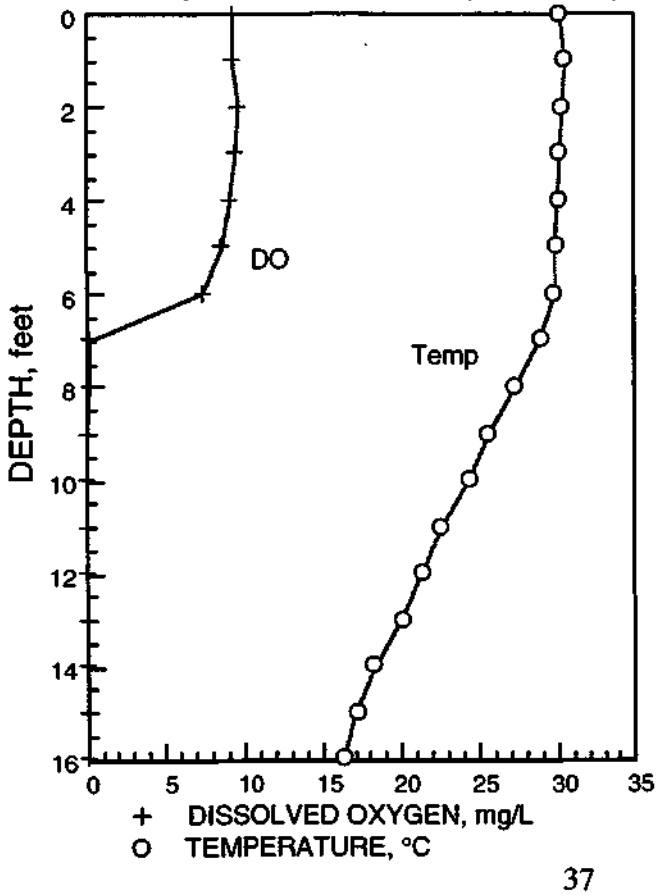
Tillage. %

No-till	5	Mulch till with ≥ 30% residue	33
Moldboard	4	Mulch till with < 30% residue	5
Woodland	25	Pasture/hayland	4
Wildlife	13	Wetland	9
Other	2		

Water and Sediment Qualities

Sampling Date		07/30/93
Site Number		**1**
Water Depth of Site, feet		**16**
Secchi Disc Transparency, inches		**34**
Chlorophyll *a*,	**µg/L**	43.39
Chlorophyll *b*,	**µg/L**	4.98
Chlorophyll c,	**µg/L**	0.98
Pheophytin a,	**µg/L**	0.00
Trophic State Index		59.8
Trophic State		Eutrophic

DO & Temperature Profiles (Time, 10:10)



Water Quality (K: less than detection value)

	1	14
Depth, feet		
Total Suspended Solids, mg/L	6	12
Volatile Suspended Solids, mg/L	4	6
Turbidity, NTU	3.7	15
$N0_2/N0_3$-Nitrogen, mg/L	0.01 K	0.01
Ammonia Nitrogen, mg/L	0.12	0.29
Total Kjeldahl Nitrogen, mg/L	0.40	0.29
Total Phosphorus, mg/L	0.024	0.196
Alkalinity, mg $CaCO_3$/L		
Total	**94**	134
Phenolphthalein	**16**	**0**
Field pH	**8.8**	**6.7**
Chemical Oxygen Demand, mg/L	**15**	**26**

Sediment Quality

(mg/kg. ppm, K: less than detection value)

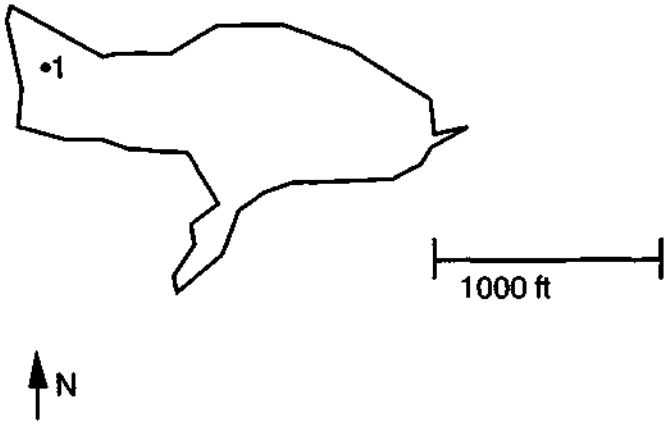
Phosphorus-P.ppm	628
Kjeldahl-N,ppm	507
Solids, % wet	30.2
Vol. solids, %	8.6
TOC, %	3.1
Arsenic, ppm	12.0
Barium, ppm	218
Cadmium, ppm	1K
Chromium, ppm	29
Copper, ppm	27
Iron, ppm	42,000
Lead, ppm	34
Manganese, ppm	955
Mercury, ppm	0.10
Nickel, ppm	26
Potassium, ppm	2100
Silver, ppm	1
Zinc, ppm	96

Christopher Old Reservoir

Franklin County Map Code: RNZO

City of Christopher
211 N. Thomas, Christopher, IL 62822
618/724-2011

General



Lake Location	1 mile NW of Christopher	
Deepest Point	Latitude	37° 59' 07"
	Longitude	89° 04' 09"
Lake Surface Area, acres		**19.8**
Length of Shoreline, miles		**1.6**
Maximum Depth, feet		**18**
Average Depth, feet		**8**
Lake Storage Capacity, acre-feet		**158**
Watershed Drainage Area, acres		325
Hydraulic Retention Time, years		**-**
Lake Type		Dammed stream
Year Constructed		**1900**
Ownership		
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed

Unique Features

The lake served as water supply source to the town until 1907, and the treatment system has since been abandoned.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access

No. of Visitors per Year <25,000

Lake Use Support

Overall	P/Mi
Aquatic Life	Full
Swimming	P/Mo
Recreation	P/Mo

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (4) trolling motors only

Recreational Facilities

Boat ramp (gravel), picnic area, pavilion, pier with wheelchair access, restroom facilities

Shoreline Usage, %

Woodland	**100**

Watershed Drainage Area Usage, %

Cropland	68
Pasture	7
Woodland	19
Wetland	5
Other	1

Water Quality Problems

Problems

Sediment deposition	S
Algal blooms	S
Aquatic macrophytes	M/N
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Excellent

Major Types of Fish

Bluegill, crappie, bass, redear (all except bluegill was stocked 10 years ago)

Causes of Quality Problems

Potential Pollution Sources

Cropland runoff, woodland runoff, sediment in lake (slight)

Causes of impairment

Nutrients	M	Siltation	S
Thermal modification			M
Noxious aquatic plants			M

Sources of Impairment

Agriculture	M
Nonirrigated crop production	M
Pasture	S
Herbicide/algicide applications	M

Christopher Old Reservoir

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
	Grassed waterway, acre	5	Erosion control
	Ponds	3	Livestock water & erosion control
	Permanent vegetative cover, acre	125	Pasture/woodland
	Conservation cropping system, acre	250	Erosion control
	Livestock exclusion, acre	5	

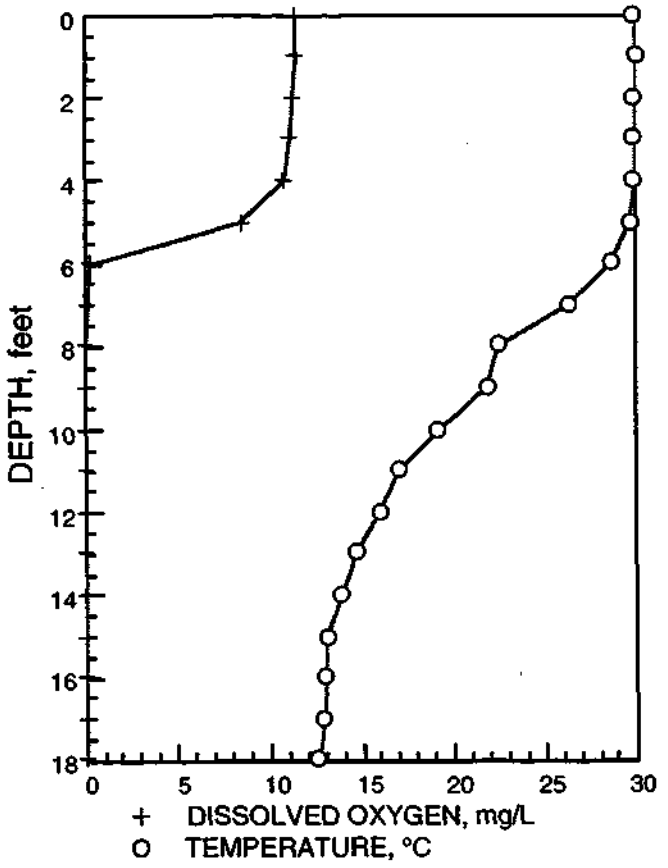
Tillage, %

No-till	15	Mulch till with ≥ 30% residue	19
Moldboard plow	15	Mulch till with < 30% residue	19
Woodland	19	Pasture/hayland	7
Wetland	5	Other	1

Water and Sediment Qualities

Sampling Date		07/30/93
Site Number		**1**
Water Depth of Site, feet		**18**
Secchi Disc Transparency, inches		**26**
Chlorophyll a,	**µg/L**	78.57
Chlorophyll *b*,	**µg/L**	5.00
Chlorophyll *c*,	**µg/L**	0.67
Pheophytin a,	**µg/L**	0.00
Trophic State Index		73.4
Trophic State		Hyptertrophic

DO & Temperature Profiles (Time, 09:00)



Water Quality (K: less than detection value)

Depth, feet	1	16
Total Suspended Solids, mg/L	**11**	**2**
Volatile Suspended Solids, mg/L	**5**	**1K**
Turbidity, NTU	**11**	**-**
NO_2/NO_3-Nitrogen, mg/L	**0.01K**	**0.01K**
Ammonia Nitrogen, mg/L	**0.10**	**5.6**
Total Kjeldahl Nitrogen, mg/L	0.58	**5.6**
Total Phosphorus, mg/L	0.207	2.42
Alkalinity, mg $CaCO_3$/L		
Total	**106**	220
Phenolphthalein	**33**	**0**
Field pH	**9.4**	7.0
Chemical Oxygen Demand, mg/L	23	37

Sediment Quality

(mg/kg ppm, K: less than detection value)

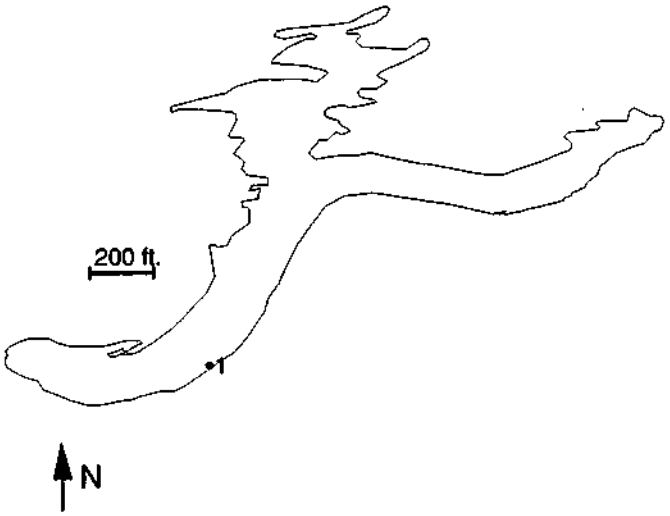
Phosphorus-P,ppm	**1063**
Kjeldahl-N,ppm	764
Solids, % wet	20.3
Vol. solids, %	**11.2**
TOC, %	**3.1**
Arsenic, ppm	**10.0**
Barium, ppm	247
Cadmium, ppm	**1K**
Chromium, ppm	**24**
Copper, ppm	**39**
Iron, ppm	38,000
Lead, ppm	**33**
Manganese, ppm	1700
Mercury, ppm	**0.1K**
Nickel, ppm	**24**
Potassium, ppm	2000
Silver, ppm	1K
Zinc, ppm	91

Clear Lake

Vermilion County Map Code: RBR

Illinois Department of Conservation
R.R. #1, Box 374, Oakwood, IL 61858
217/442-4915

General



Lake Location		2 miles W of Danville
Deepest Point	Latitude	40° 08'18"
	Longitude	87° 42'09"
Lake Surface Area, acres		38.5
Length of Shoreline, miles		**3.2**
Maximum Depth, feet		**5.3**
Average Depth, feet		**16.5**
Lake Storage Capacity, acre-feet		635
Watershed Drainage Area, acres		**50**
Hydraulic Retention Time, years		**1**6.96
Lake Type		Coal strip-mining
Year Constructed		**1**939
Ownership		State
Inflowing Streams		-
Outflowing Streams		-

Unique Features

The lake is in a state park. Water is extremely clear. Secchi disc readings exceed 18 ft. most of the time. Trout stocking is successful.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access (state boat and fishing licenses are required)

No. of Visitors per Year >200,000

Lake Use Support

Overall	Full
Aquatic Life	Full
Swimming	Full
Recreation	Full

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (4), No power boating - (4)
Canoeing and kayaking - (2)
Picnicking - (2)
Waterfowl observation - (2)

Recreational Facilities

Boat ramp, boat rental, bicycle trail, camping facilities, concession stand, park, picnic area, hiking, horse trails, hunting

Shoreline Usage, %

Pasture or grassland	30
Woodland	70

Watershed Drainage Area Usage, %

Pasture or grassland	20
Woodland	70
Roads and parking lots	10

Water Quality Problems

Problems

Suspended sediment	M/N
Sediment deposition	M/N
Algal blooms	M/N
Aquatic macrophytes	S
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	No
At different times of the year?	No

Fishing Fair

Major Types of Fish

Largemouth bass, channel catfish, sunfish, walleye, rainbow trout, carp, shad, crappie (Lake is stocked yearly with catfish, bass. Trout stocking is being resumed.)

Causes of Quality Problems

Potential Pollution Sources

Pasture and woodland runoffs

Causes of Impairment

Suspended solids	S
Noxious aquatic plants	S

Sources of Impairment

Pasture	S

Clear Lake

Lake Protection Management

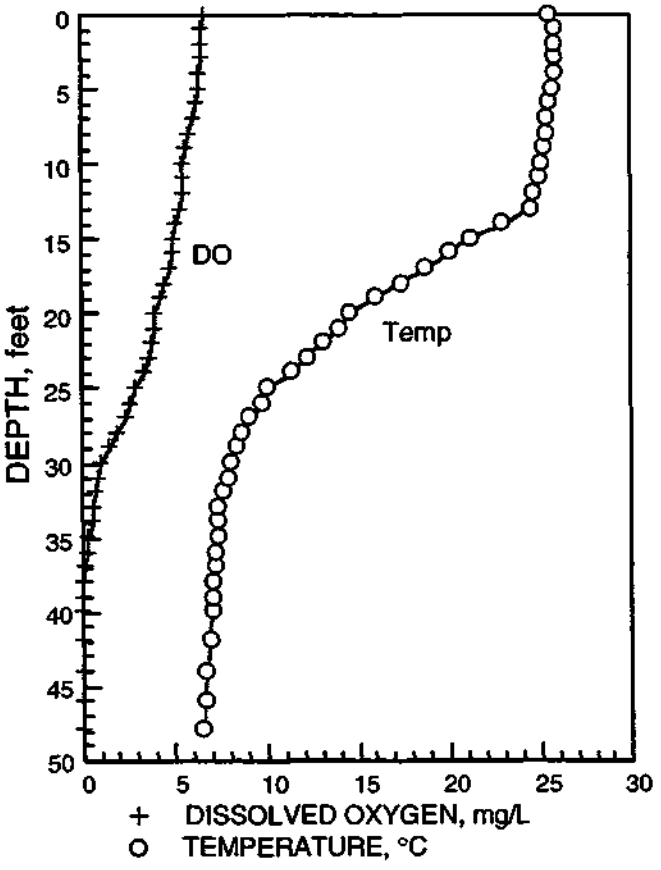
Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

Comments: Clear Lake is a strip mine pond located within Kickapoo State Park. There is no agricultural drainage.

Water and Sediment Qualities

Sampling Date	08/12/93
Site Number	**1**
Water Depth of Site, feet	**48**
Secchi Disc Transparency, inches	155
Chlorophyll *a*, µg/L	2.81
Chlorophyll *b*, µg/L	0.15
Chlorophyll *c*, µg/L	0.34
Pheophytin *a*, µg/L	0.00
Trophic State Index	28.6
Trophic State	Oligotrophic

DO & Temperature Profiles (Time, 11:00)



Water Quality (K: less than detection value)

Depth, feet	1	46
Total Suspended Solids, mg/L	**2**	**3**
Volatile Suspended Solids, mg/L	**1**	**1**
Turbidity, NTU	**0.8**	**0.4**
NO/NOj-Nitrogen, mg/L	0.01	0.02
Ammonia Nitrogen, mg/L	0.03	0.06
Total Kjeldahl Nitrogen, mg/L	0.55	0.57
Total Phosphorus, mg/L	0.001	0.005
Alkalinity, mg $CaCO_3$/L		
Total	169	175
Phenolphthalein	**0**	**0**
Field pH	**7.9**	**7.6**
Chemical Oxygen Demand, mg/L	8	18

Sediment Quality
(mg/kg ppm, K; less than detection value)

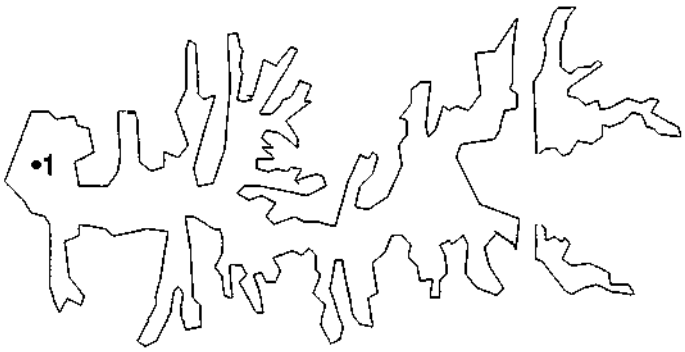
Phosphorus-P,ppm	488
Kjeldahl-N,ppm	1173
Solids, % wet	22.6
Vol. solids, %	9.1
TOC, %	-
Arsenic, ppm	5.5
Barium, ppm	78
Cadmium, ppm	1K
Chromium, ppm	20
Copper, ppm	20
Iron, ppm	33,000
Lead, ppm	24
Manganese, ppm	742
Mercury, ppm	0.1**K**
Nickel, ppm	**36**
Potassium, ppm	1700
Silver, ppm	**1K**
Zinc, ppm	**86**

East Fork Lake

Richland County Map Code: RCC

City of Olney
300 Whittle Avenue, Olney, IL 62450
618/395-7302

General



N

Lake Location		0.5 miles N of Olney
Deepest Point	Latitude	38° 45' 46"
	Longitude	88° 06' 58"
Lake Surface Area, acres		935
Length of Shoreline, miles		**25**
Maximum Depth, feet		**40**
Average Depth, feet		**15**
Lake Storage Capacity, acre-feet		**14,000**
Watershed Drainage Area, acres		9,882
Hydraulic Retention Time, years		**1.403**
Lake Type		Dammed stream
Year Constructed		1970
Ownership		Public
Inflowing Streams		East Fork Creek
Outflowing Streams		East Fork Creek

Unique Features

The lake serves as the primary water supply source for Olney.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned butentire shoreline not public access

No. of Visitors per Year 25,000 -100,000

Lake Use Support

Overall	F/Th
Aquatic Life	Full
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage

Potable water supply - (4)
Industrial water supply - (4)

Recreational Lake Usage

Fishing-(4)	High power boating-(4)
Swimming - (2)	Water skiing - (4)
Saiiboating-(3)	Waterfowl hunting-(3)
Camping - (4)	Waterfowl observation - (3)
Picnicking - (4)	

Recreational Facilities

Boat ramps (2), boat rental, camping facilities (2), parks (2), picnic area (recreational facilities are heavily used by residents and visitors)

Shoreline Usage, %

Cropland	45	Residential/lawns	15
Woodland	28	Pasture or grassland	5
Wetland	2	Recreational development	5

Watershed Drainage Area Usage, %

Cropland	70
Pasture or grassland	10
Woodland	10
Other	10

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	M
Algal blooms	S
Aquatic macrophytes	S
Taste and/or odor	M/N
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Walleye, redear, largemouth bass, catfish, bluegill, crappie

Causes of Quality Problems

Potential Pollution Sources

Runoff (cropland, woodland, pasture/grassland, lawn/golf course), livestock operation, shoreline erosion, sediment in lake

Causes of impairment

Pesticides	S	Organic/DO depletion	M
Nutrients	M	Thermal modification	M
Siltation	M	Oil and grease	S
Pathogens	S	Suspended solids	M
Taste/odor	S	Noxious aquatic plants	S

Sources of Impairment

Agriculture	M	Nonpoint sources	S
Pasture	S	Petroleum activities	S
Construction	S	Herbicide/algicide appl.	S

East Fork Lake

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
1985-1986	Terrace, linear ft	7,000	Water quality
	Grassed waterway, acre	10	Water quality
	Grade stabilization structure	2	Water quality
	Held border strip, ft.	5,000	Water quality
	Permanent vegetative cover, acre	60	Erosion control
	Tree planting, acre	10	Erosion control

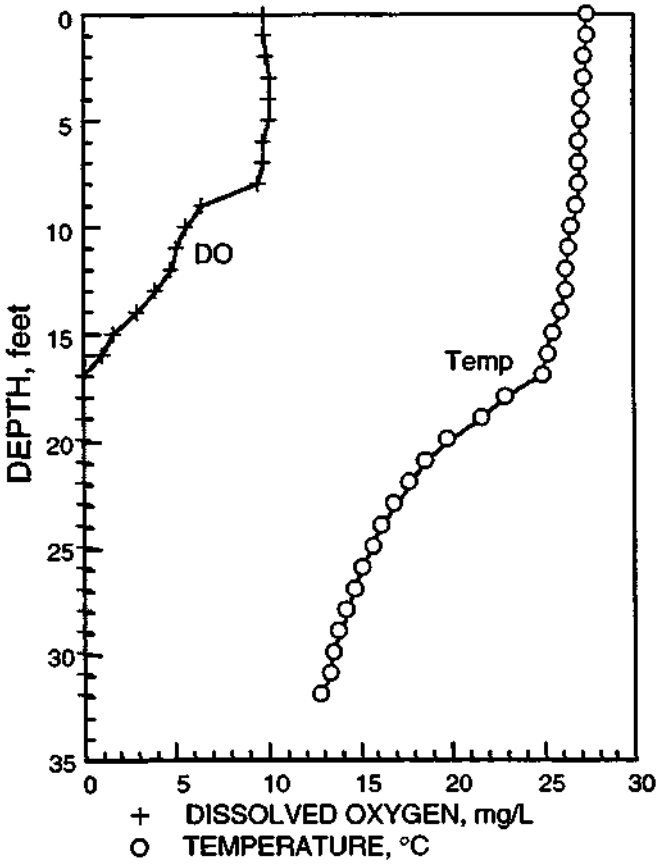
Tillage, %

No-till	30	Mulch till with <30% residue	5
Crop rotation	15	Chisel or disc till with <30% residue	20
Woodland	10	Pasture/hayland	10
Other	10		

Water and Sediment Qualities

Sampling Date	08/11/93
Site Number	1
Water Depth of Site, feet	32
Secchi Disc Transparency, inches	36
Chlorophyll *a*, µg/L	47.17
Chlorophyll *b*, µg/L	2.10
Chlorophyll c, µg/L	0.66
Pheophytin *a*, µg/L	0.00
Trophic State Index	56.6
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 10:00)



Water Quality (K: less than detection value)

Depth, feet	1	30
Total Suspended Solids, mg/L	8	13
Volatile Suspended Solids, mg/L	3	7
Turbidity, NTU	0.4	1.9
$N0_2/N0_3$-Nitrogen, mg/L	0.01K	0.01K
Ammonia Nitrogen, mg/L	0.02	1.9
Total Kjeldahl Nitrogen, mg/L	0.68	1.9
Total Phosphorus, mg/L	0.012	0.599
Alkalinity, mg $CaCO_3$/L		
Total	59	116
Phenolphthalein	8	0
Field pH	8.7	7.0
Chemical Oxygen Demand, mg/L	13	16

Sediment Quality
(mg/kg: ppm, K: less than detection value)

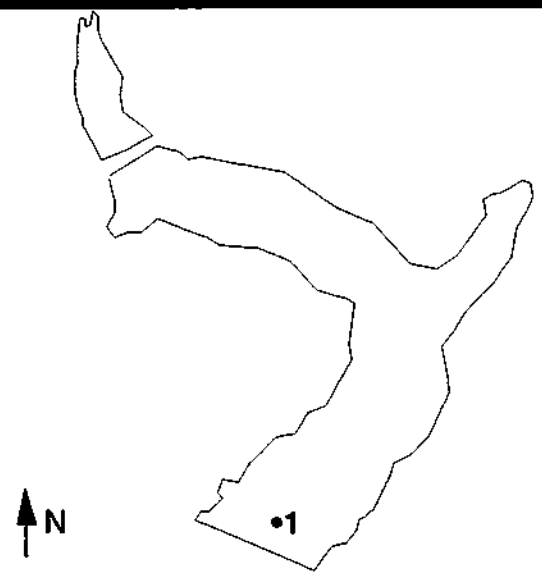
Phosphorus-P,ppm	666
Kjeldahl-N,ppm	4052
Solids, % wet	27.2
Vol. solids, %	10.4
TOC, %	-
Arsenic, ppm	10.6
Barium, ppm	231
Cadmium, ppm	1K
Chromium, ppm	19
Copper, ppm	36
Iron, ppm	37,000
Lead, ppm	33
Manganese, ppm	2200
Mercury, ppm	0.10
Nickel, ppm	25
Potassium, ppm	1600
Silver, ppm	1K
Zinc, ppm	71

Greenville Old City (Patriot's) Lake

Kingsbury Park District
Box 462, Greenville, IL 62246
618/664-4449

Bond County Map Code: ROY

General



Lake Location		1 mile W of Greenville
Deepest Point	Latitude	38° 53' 31"
	Longitude	89° 24' 49"
Lake Surface Area, acres		25.1
Length of Shoreline, miles		**1.5**
Maximum Depth, feet		**17**
Average Depth, feet		**7.4**
Lake Storage Capacity, acre-feet		**186**
Watershed Drainage Area, acres		**880**
Hydraulic Retention Time, years		0.364
Lake Type		Dammed stream
Year Constructed		1930s
Ownership		Public
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed

Unique Features

More than 50 percent of the lake surface in the deep end was covered with duckweed and blue-green algal scum.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access

No. of Visitors per Year < 25,000

Lake Use Support

Overall	P/Mi
Aquatic Life	Full
Swimming	P/Mo
Recreation	P/Mo

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (1)
No power boating - (1)
Picnicking - (3)
(Swimming abandoned since 1977)

Recreational Facilities

Boat rental, park, picnic area, and four shelters. Hiking and picnicking are the major recreational uses.

Shoreline Usage, %

Woodland	90
Recreational development	10

Watershed Drainage Area Usage, %

Cropland	30	Pasture or grassland	25
Woodland	14	Recreational development	11
Wetland	4	Wildlife	12
Other	4		

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	M
Algal blooms	H
Aquatic macrophytes	M/N
Water level fluctuation	M/N

Major fish kill, summer 1988

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Poor

Major Types of Fish

Catfish, bluegill, redearsunfish, green sunfish, black and yellow bullhead. Catfish is stocked on an annual basis. The trout stocking program was resumed in 1993 on an annual basis.

Causes of Quality Problems

Potential Pollution Sources

Runoff (cropland, pasture/grassland, woodland), livestock operations

Causes of impairment

Nutrients	H	Organic/DO depletion	H
Siltation	M	Thermal modification	H
Noxious aquatic plants			H

Sources of Impairment

Agriculture	M
Pasture	M
Range land	S

Greenville Old City Lake

Lake Protection Management

Treatment Date	Type and Extent of Treatment	Reason for Treatment
1986	Terrace	Erosion control
	Grassed waterway	Erosion control
	Pond	Erosion/water quality
1987	Livestock exclusion	CRP water quality
1986	Permanent vegetative cover	Erosion control

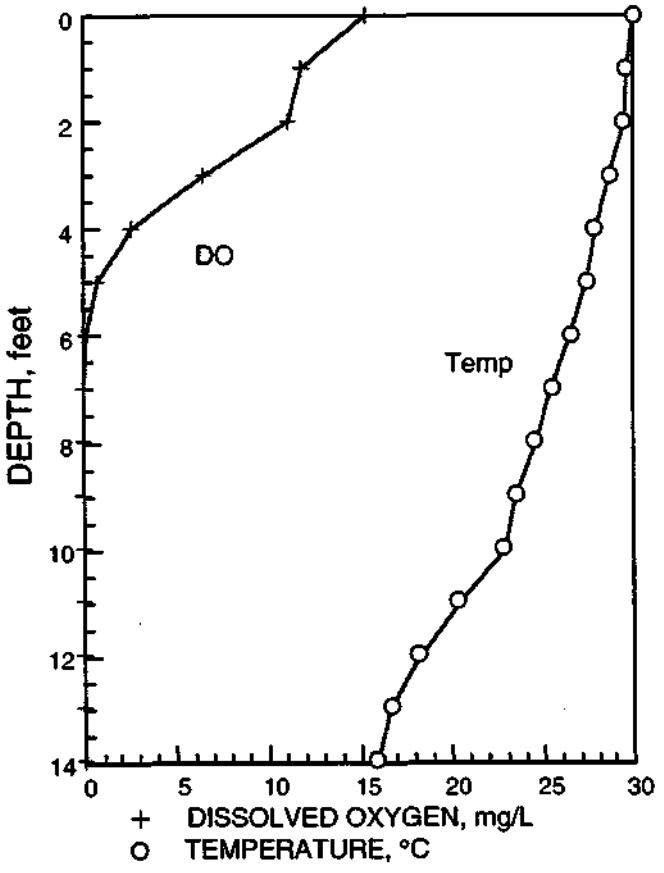
Tillage, %

No-till	10	Mulch till with ≥30% residue	7
Moldboard plow	3	Mulch till with <30% residue	10
Woodland	14	Pasture/hayland	25
Park	11	Wetland	4
Wildlife	12	Others (roads, farmsteads, waterway)	4

Water and Sediment Qualities

Sampling Date	08/18/93
Site Number	**1**
Water Depth of Site, feet	**14**
Secchi Disc Transparency, inches	20
Chlorophyll a, µg/L	152.57
Chlorophyll *b*, µg/L	7.78
Chlorophyll *c*, µg/L	0.00
Pheophytin a, µg/L	0.00
Trophic State Index	74.0
Trophic State	Hypertrophic

DO & Temperature Profiles (Time, 10:00)



Water Quality (K: less than detection value)

Depth, feet	1	12
Total Suspended Solids, mg/L	**17**	**27**
Volatile Suspended Solids, mg/L	**9**	**14**
Turbidity, NTU	**25**	20
$N0_2/N0_3$-Nitrogen, mg/L	0.02	0.01**K**
Ammonia Nitrogen, mg/L	0.07	**3.9**
Total Kjeldahl Nitrogen, mg/L	0.60	**-**
Total Phosphorus, mg/L	**0.111**	1.65
Alkalinity, mg $CaCO_3$/L		
Total	104	142
Phenolphthalein	**28**	**0**
Field pH	**9.9**	**6.8**
Chemical Oxygen Demand, mg/L	28	28

Sediment Quality
(mg/kg ppm, K; less than detection value)

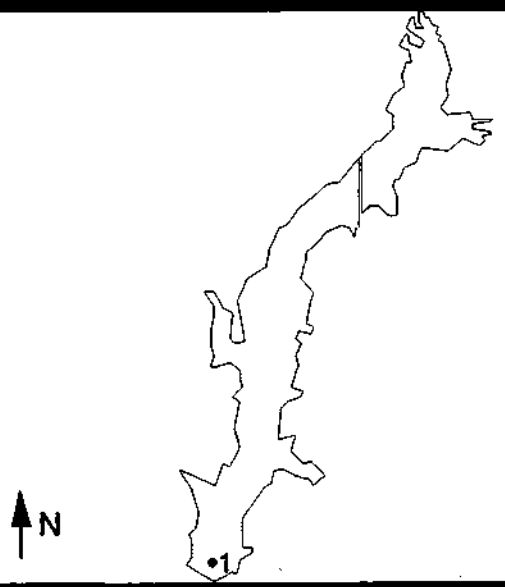
Phosphorus-P,ppm	**1409**
Kjeldahl-N,ppm	2286
Solids, % wet	28.0
Vol. solids, %	12.1
TOC, %	**-**
Arsenic, ppm	8.1
Barium, ppm	284
Cadmium, ppm	**1K**
Chromium, ppm	**25**
Copper, ppm	**38**
Iron, ppm	29,000
Lead, ppm	31
Manganese, ppm	1000
Mercury, ppm	0.10
Nickel, ppm	21
Potassium, ppm	2100
Silver, ppm	**1K**
Zinc, ppm	**98**

Lake Harrisburg

Saline County Map Code: RAI

City of Harrisburg
110 East Locust, Harrisburg, IL 62946
618/252-6344

General



Lake Location		8 miles NW of Harrisburg
Deepest Point	Latitude	37° 50' 12"
	Longitude	88" 38' 05"
Lake Surface Area, acres		209
Length of Shoreline, miles		**6.5**
Maximum Depth, feet		**30**
Average Depth, feet		**10**
Lake Storage Capacity, acre-feet		2,090
Watershed Drainage Area, acres		3,456
Hydraulic Retention Time, years		0.694
Lake Type		Dammed stream
Year Constructed		**1**949
Ownership		Public
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed

Unique Features

The lake served as a water supply source until 1982. City is currently using Saline Valley Conservancy District.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access

No. of Visitors per Year < 25,000

Lake Use Support

Overall	P/Mi
Aquatic Life	Full
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage

Industrial water supply (Kerr-McGree Coal Co. pumps water from the lake for coal washing)

Recreational Lake Usage

Fishing - (4)
Low power (<5 Hp) boating - (3)
Camping - (3)
Picnicking - (3)

Recreational Facilities

One boat ramp, camping facilities, park, picnic area

Shoreline Usage, %

Woodland	99+
Residential	<1

About 40 to SO summer cottages along the west shore, very few along the east shore. East shore is steep (erosion exists).

Watershed Drainage Area Usage, %

Cropland	66
Residential/lawns	5
Woodland	14
Pasture or grassland	8
Wetland	7

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	M
Aquatic macrophytes	S
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Bass, catfish, crappie, bluegill, shad

Causes of Quality Problems

Potential Pollution Sources

Runoff (cropland, woodland), septic tanks, sediment in lake

Causes of Impairment

Nutrients	M
Siltation	M
Thermal modification	M

Sources of Impairment

Nonpoint sources	M
Agriculture	M
Timber harvesting	S
Petroleum activities	S

Lake Harrisburg

Lake Protection Management

Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

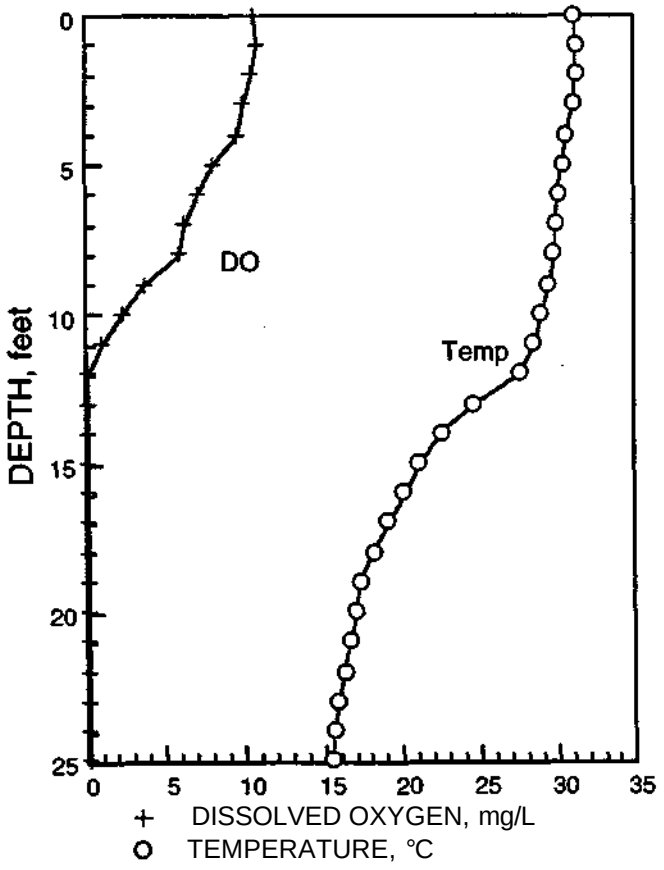
Tillage, %

No-till	13	Mulch till with ≥ 30% residue	50
Woodland	14	Mulch till with <30% residue	3
Wetland	7	Pasture/hayland	8
Other - urban	5		

Water and Sediment Qualities

Sampling Date	07/13/93
Site Number	**1**
Water Depth of Site, feet	**25**
Secchi Disc Transparency, inches	**26**
Chlorophyll a, µg/L	44.71
Chlorophyll *b*, µg/L	4.42
Chlorophyll c, µg/L	**1.72**
Pheophytin a, µg/L	0.00
Trophic State Index	58.8
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 09:00)



Water Quality (K: less than detection value)

Depth, feet	1	23
Total Suspended Solids, mg/L	**8**	11
Volatile Suspended Solids, mg/L	**4**	**4**
Turbidity, NTU	**2.8**	**1.8**
NO_2/NO_3-Nitrogen, mg/L	0.01	0.01**K**
Ammonia Nitrogen, mg/L	0.02	**1.0**
Total Kjeldahl Nitrogen, mg/L	**0.81**	**1.6**
Total Phosphorus, mg/L	0.014	0.691
Alkalinity, mg $CaCO_3$/L		
Total	104	138
Phenolphthalein	**29**	**0**
Field pH	**8.9**	**6.9**
Chemical Oxygen Demand, mg/L	21	21

Sediment Quality

(mg/kg: ppm, K: less than detection value)

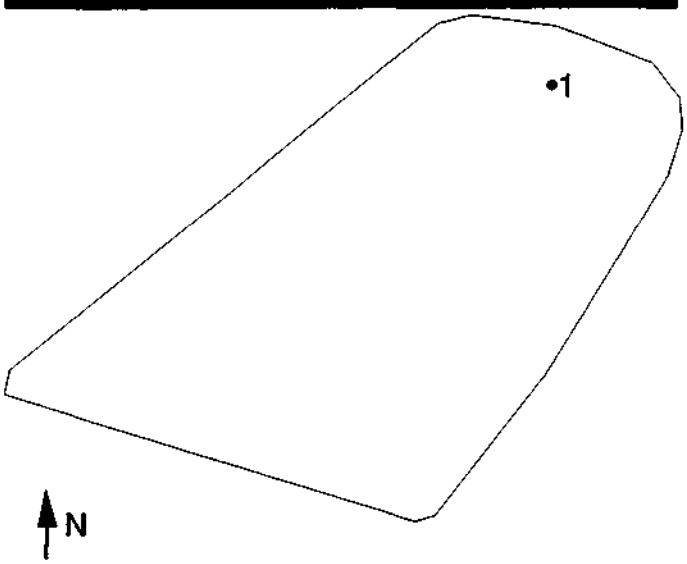
Phosphorus-P,ppm	1124
Kjeldahl-N,ppm	2272
Solids, % wet	26.3
Vol. solids, %	10.6
TOC, %	2.2
Arsenic, ppm	15.3
Barium, ppm	274
Cadmium, ppm	**18**
Chromium, ppm	**26**
Copper, ppm	**26**
Iron, ppm	45,000
Lead, ppm	**51**
Manganese, ppm	2200
Mercury, ppm	0.1**K**
Nickel, ppm	**32**
Potassium, ppm	**1**900
Silver, ppm	**1K**
Zinc, ppm	96

Hanisburg Holding Reservoir - North

Saline County Map Code: RAG-N

City of Harrisburg
110 East Locust, Hanisburg, IL 62946
618/252-6344

General



Lake Location 1 mile N of Harrisburg
Deepest Point Latitude 37° 45' 46"
Longitude 88° 31' 36"
Lake Surface Area, acres 31
Length of Shoreline, miles 1.6
Maximum Depth, feet 22.5
Average Depth, feet 1.6
Lake Storage Capacity, acre-feet 403
Watershed Drainage Area, acres 0
Hydraulic Retention Time, years -
Lake Type Side channel
Year Constructed 1915-20
Ownership Public
Inflowing Streams None
Outflowing Streams Saline Middle Fork Creek
Unique Features
Water is pumped from Saline Middle Fork Creek to augment waterflow in Middle Fork Creek into which Harrisburg WWTP effluent is discharged.

Usages and Impairments

Public Access Yes
Entire lake bottom publicly owned and entire shoreline public access, unlimited free access

No. of Visitors per Year < 25,000
Lake Use Support
Overall Full
Aquatic Life Full
Swimming Full
Recreation Full

Non-recreational Lake Usage
Wastewater flow augmentation - (2)

Recreational Lake Usage
Fishing - (4)
Low power (electric only) boating - (4)

Recreational Facilities
None

Shoreline Usage, %
Leveed shoreline (partly rip-rapped) 100

Watershed Drainage Area Usage, %
Side channel impoundment

Water Quality Problems

Problems
Suspended sediment M
Sediment deposition M

Differences in Turbidity and Water Quality
In different portions of lake? No
At different times of the year? No
Fishing Good
Major Types of Fish
Bass, catfish, crappie, bluegill, shad, (never stocked)

Causes of Quality Problems

Potential Pollution Sources
Sediment in lake
(Pumps automatically pump water from the creek when the reservoir level falls below a pre-set level. Water quality is tied to the quality of Saline Creek)

Causes **of Impairment**
Suspended solids M

Sources of Impairment
Nonpoint sources M
Agriculture M
Source unknown M

Harrisburg Holding Reservoir - North

Lake Protection Management

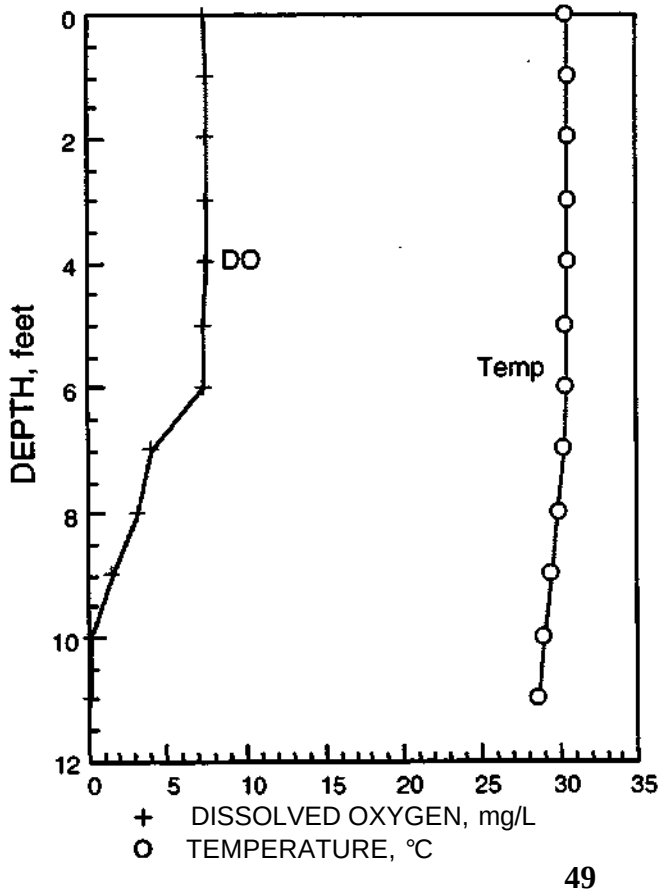
Treatment Date	Type and Extent of Treatment	Reason for Treatment
	Not applicable	

Comment Reservoir is totally leveed. There is no drainage area.

Water and Sediment Qualities

Sampling Date	07/13/93
Site Number	**1**
Water Depth of Site, feet	**11**
Secchi Disc Transparency, inches	**25**
Chlorophyll a, µg/L	9.08
Chlorophyll *b*, µg/L	**1.43**
Chlorophyll *c*, µg/L	0.27
Pheophytin a, µg/L	0.00
Trophic State Index	**51.6**
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 10:00)



Water Quality (K: less than detection value)

Depth, feet	1	9
Total Suspended Solids, mg/L	**8**	**15**
Volatile Suspended Solids, mg/L	**4**	**4**
Turbidity, NTU	**2.9**	**3.9**
NO_2NO_3Nitrogen, mg/L	**0.01**	**0.01**
Ammonia Nitrogen, mg/L	0.02	0.02
Total Kjeldahl Nitrogen, mg/L	0.70	0.54
Total Phosphorus, mg/L	0.009	0.008
Alkalinity, mg $CaCO_3$/L		
Total	**94**	**87**
Phenolphthalein	**0**	**0**
Field pH	**8.2**	**7.4**
Chemical Oxygen Demand, mg/L	11	12

Sediment Quality

(mg/kg ppm, K: less than detection value)

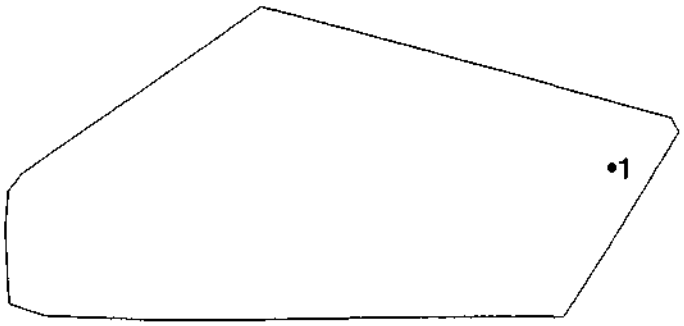
Phosphorus-P,ppm	320
Kjeldahl-N,ppm	**680**
Solids, % wet	**54.7**
Vol. solids, %	**6.3**
TOC,%	**1.6**
Arsenic, ppm	**8.4**
Barium, ppm	123
Cadmium, ppm	**8**
Chromium, ppm	**12**
Copper, ppm	**82**
Iron, ppm	19,000
Lead, ppm	**22**
Manganese, ppm	773
Mercury, ppm	**0.1K**
Nickel, ppm	**19**
Potassium, ppm	1000K
Silver, ppm	1K
Zinc, ppm	73

Harrisburg Holding Reservoir - South

City of Harrisburg
110 East Locust, Harrisburg, IL 62946
618/252-6344

SalineCounty MapCode: RAG-S

General



Lake Location		1 mile N of Harrisburg
Deepest Point	Latitude	37° 45' 29"
	Longitude	88° 31'48"
Lake Surface Area, acres		**36**
Length of Shoreline, miles		**1.5**
Maximum Depth, feet		22.5
Average Depth, feet		**13**
Lake Storage Capacity, acre-feet		468
Watershed Drainage Area, acres		**0**
Hydraulic Retention Time, years		**-**
Lake Type		Side Channel
Year Constructed		**191**5-20
Ownership		Public
Inflowing Streams		None
Outflowing Streams		Saline Middle Fork Creek

Unique Features

Thelake is corriected to Hanisburg Hddng Reservoir-Nlorth by apipe advert These two reservoirs are pumped storage reservoirs for flow augmentation to Middle Fork Creek when needed.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access

No. of Visitors per Year < 25,000

Lake Use Support

Overall	Full
Aquatic Life	Full
Swimming	Full
Recreation	Full

Non-recreational Lake Usage

Wastewater flow augmentation - (2)

Recreational Lake Usage

Fishing - (4)

Low power (electric only) boating - (4)

Recreational Facilities

None

Shoreline Usage, %

Leveed shoreline (partly rip-rapped) 100

Watershed Drainage Area Usage, %

Side channel impoundment

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	M

Differences in Turbidity and Water Quality

In different portions of lake?	No
At different times of the year?	No

Fishing Good

Major Types of Fish

Bass, catfish, crappie, bluegill, shad, (never stocked)

Causes of Quality Problems

Potential Pollution Sources

Sediment in lake

Causes of Impairment

Suspended solids	S

Sources of Impairment

Nonpoint sources	M
Agriculture	M
Source unknown	M

Harrisburg Holding Reservoir - South

Lake Protection Management

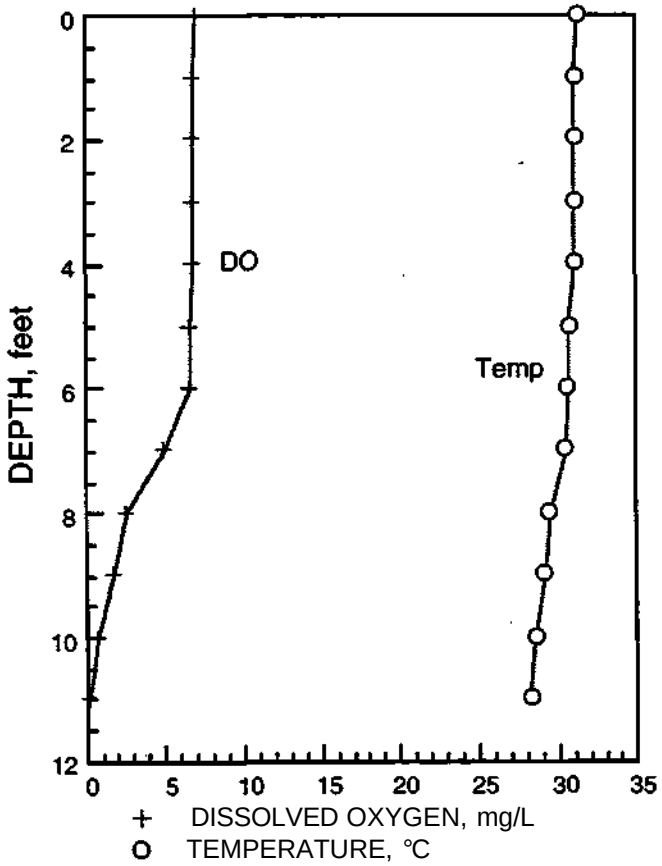
Treatment Pate	Type and Extent of Treatment	Reason for Treatment
	Not applicable	

Comment Reservoir is totally leveed. There is no drainage area.

Water and Sediment Qualities

Sampling Date	07/13/93
Site Number	**1**
Water Depth of Site, feet	**14**
Secchi Disc Transparency, inches	31
Chlorophyll *a*, µ.g/L	2.14
Chlorophyll *b*, µ.g/L	0.28
Chlorophyll *c*, µg/L	0.16
Pheophytin *a*, µg/L	0.00
Trophic State Index	**51.0**
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 11:00)



Water Quality (K: less than detection value)

Depth, feet	1	12
Total Suspended Solids, mg/L	**9**	**6**
Volatile Suspended Solids, mg/L	**2**	**2**
Turbidity, NTU	**3.6**	**4.2**
NO_2/NO_3yNitrogen, mg/L	0.03	0.03
Ammonia Nitrogen, mg/L	0.01	0.01
Total Kjeldahl Nitrogen, mg/L	0.58	0.63
Total Phosphorus, mg/L	0.026	0.026
Alkalinity, mg $CaCO_3$/L		
Total	**96**	102
Phenolphthalein	**0**	**0**
Field pH	**7.9**	**7.3**
Chemical Oxygen Demand, mg/L	10	13

Sediment Quality

(mg/kg: ppm, K: less than detection value)

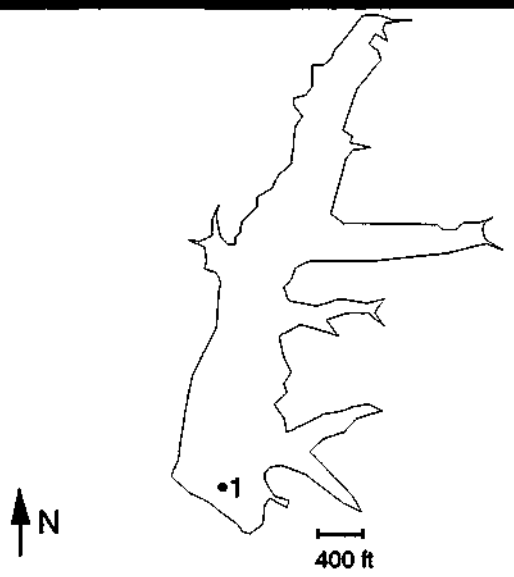
Phosphorus-P,ppm	498
Kjeldahl-N,ppm	1395
Solids, % wet	38.2
Vol. solids, %	8.3
TOC, %	**4.1**
Arsenic, ppm	**6.1**
Barium, ppm	189
Cadmium, ppm	12
Chromium, ppm	**26**
Copper, ppm	**95**
Iron, ppm	32,000
Lead, ppm	**35**
Manganese, ppm	867
Mercury, ppm	0.1**K**
Nickel, ppm	**38**
Potassium, ppm	2000
Silver, ppm	**1K**
Zinc, ppm	101

Jaycees Lake (Lake Jaycee)

Jefferson County Map Code: RNU

City of Mt. Vernon
1100 Main Street, Mt. Vernon, IL 62864
618/242-5000

General



Lake Location		2.5 miles N of Mt. Vernon
Deepest Point	Latitude	38° 22' 11"
	Longitude	88° 53' 55"
Lake Surface Area, acres		**92**
Length of Shoreline, miles		**3.6**
Maximum Depth, feet		**40**
Average Depth, feet		**20**
Lake Storage Capacity, acre-feet		**1840**
Watershed Drainage Area, acres		**1670**
Hydraulic Retention Time, years		0.649
Lake Type		Dammed stream
Year Constructed		1909 (1922 dam raised)
Ownership		Public
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed
Unique Features		

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access

No. of Visitors per Year < 25,000

Lake Use Support

Overall	F/Th
Aquatic Life	Full
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage

Potable water supply - (4)
Industrial water supply - (3)
Cooling water - (2)

Recreational Lake Usage

Fishing- (2)
Waterskiing - (2)

Recreational Facilities

One boat ramp, park and picnic area are closed. Recreational facilities are declining due to vandalism.

Shoreline Usage, %

Residential/lawns	40
Pasture or grassland	15
Woodland	25

Watershed Drainage Area Usage, %

Cropland	50
Woodland	25
Pasture or grassland	25

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	M
Algal blooms	S
Aquatic macrophytes	M
Water level fluctuation	S
Fish kills	S

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Fair

Major Types of Fish

Largemouth bass, bluegill, crappie, carp, shad, sunfish, (not stocked)

Causes of Quality Problems

Potential Pollution Sources

Runoff (cropland, pasture/grassland, woodland), septic tanks, sediment in lake, old and active oil wells.

Causes of Impairment

Nutrients	M	Organic/DO depletion	M
Siltation	M	Thermal modification	M
Oil & grease	S	Suspended solids	M
Taste & odor	S		

Sources of Impairment

Agriculture	M	Nonpoint sources	M
Oil wells	S	Pasture	M

Jaycees Lake (Lake Jaycee)

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
	Grassed waterway, acre	5	Erosion control
	Ponds	5	Erosion control/water quality
	Conservation cropping system, acre	324	Erosion control

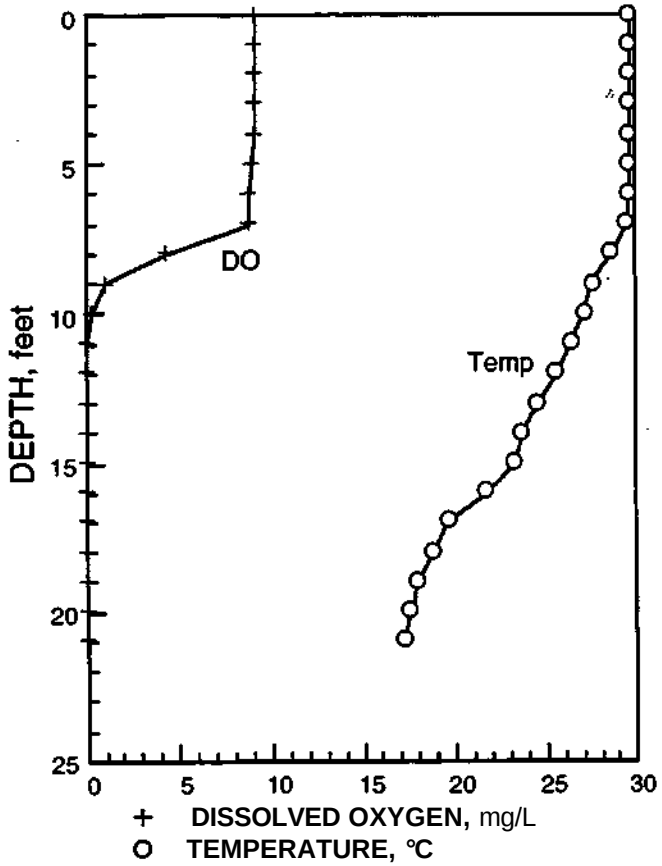
Tillage, %

Crop rotation	25	Mulch till with ≥ 30% residue	20
Moldboard plow	5	Pasture/hayland	25
Woodland	25		

Water and Sediment Qualities

Sampling Date		07/14/93
Site Number		**1**
Water Depth of Site, feet		**21**
Secchi Disc Transparency, inches		**34**
Chlorophyll *a*,	**µg/L**	30.04
Chlorophyll *b*,	**µg/L**	2.31
Chlorophyll *c*,	**µg/L**	**1.77**
Pheophytin *a*,	**µg/L**	0.00
Trophic State Index		45.3
Trophic State		Mesotrophic

DO & Temperature Profiles (Time, 09:40)



Water Quality (K: less than detection value)

Depth, feet	1	19
Total Suspended Solids, mg/L	**5**	**61**
Volatile Suspended Solids, mg/L	**4**	**15**
Turbidity, NTU	**5.3**	**16**
$NO_2/N0_3$-Nitrogen, mg/L	**-**	0.03
Ammonia Nitrogen, mg/L	**-**	0.77
Total Kjeldahl Nitrogen, mg/L	**0.57**	**1.6**
Total Phosphorus, mg/L	0.007	0.018
Alkalinity, mg $CaCO_3$/L		
Total	**37**	**96**
Phenolphthalein	**0**	**0**
Field pH	**7.6**	**6.8**
Chemical Oxygen Demand, mg/L	17	20

Sediment Quality
(mg/kg: ppm, K: less than detection value)

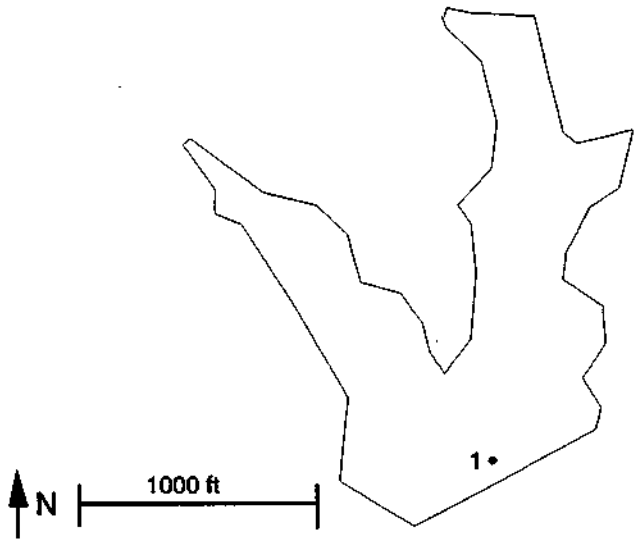
Phosphorus-P,ppm	**741**
Kjeldahl-N,ppm	**1840**
Solids, % wet	30.0
Vol. solids, %	**11.1**
TOC,%	**1.6**
Arsenic, ppm	**7.5**
Barium, ppm	203
Cadmium, ppm	**16**
Chromium, ppm	**22**
Copper, ppm	**24**
Iron, ppm	40,000
Lead, ppm	**51**
Manganese, ppm	960
Mercury, ppm	**0.1K**
Nickel, ppm	**32**
Potassium, ppm	1200
Silver, ppm	1K
Zinc, ppm	**84**

Johnston City Reservoir

Williamson County Map Code: RNZE

Johnston City
500 Washington Ave., Johnston City, IL 62951
618/983-5223

General



Lake Location		3.5 miles E of Johnston City
Deepest Point	Latitude	37° 48' 06"
	Longitude	88° 51' 59"
Lake Surface Area, acres		**64**
Length of Shoreline, miles		**1.8**
Maximum Depth, feet		**13**
Average Depth, feet		**6**
Lake Storage Capacity, acre-feet		**384**
Watershed Drainage Area, acres		**2464**
Hydraulic Retention Time, years		0.137
Lake Type		Dammed strean
Year Constructed		1921
Ownership		Public
Inflowing Streams		Lake Creek
Outflowing Streams		Lake Creek

Unique Features

The lake was abandoned as a water supply source. Dam collapsed in about 1979. Dam was reconstructed and lake was refilled 8 years ago. The gob pile (Freeman Coal Co.) spilled into the lake about 7 years ago and is still in the lake.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, no special fee for fishing other than IDOC permit.

No. of Visitors per Year about 600

Lake Use Support

Overall	P/Mo
Aquatic Life	P/Mi
Swimming	P/Mi
Recreation	P/Mo

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (3) P.I.
No power boating - (2)
Size and number limits are imposed for fishing

Recreational Facilities

One boat ramp, picnic area. Lake is used only for fishing.

Shoreline Usage, %

Woodland	100

Watershed Drainage Area Usage, %

Cropland	35
Woodland	33
Pasture or grassland	25
Wetland/wildlife	4
Other	3

Water Quality Problems

Problems

Suspended sediment	H
Algal blooms	S
Aquatic macrophytes	M/N
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Catfish, crappie, bass, bluegill, stripers

Causes of Quality Problems

Potential Pollution Sources

Mining, shoreline erosion, sediment in lake

Causes of Impairment

Nutrients	M	Siltation	M
Thermal modification	M	Gob pile	M

Sources of Impairment

Agriculture	M
Resource extraction	H
Mine tailings	H

Johnston City Reservoir

Lake Protection Management

Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

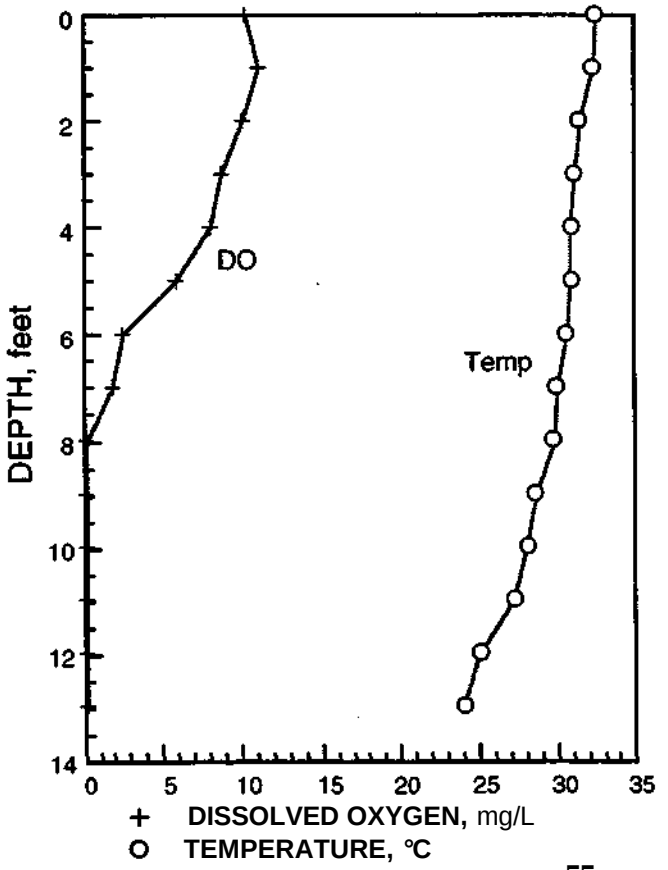
Tillage, %

No-till	10	Mulch till with ≥ 30% residue	5
Moldboard plow	3	Chisel or disc till with<30% residue	12
Crop rotation	5	Pasture/hayland	25
Woodland	33	Wetland	2
Wildlife	2	Other	3

Water and Sediment Qualities

Sampling Date	07/12/93
Site Number	**1**
Water Depth of Site, feet	**13**
Secchi Disc Transparency, inches	**24**
Chlorophyll *a*, µg/L	88.11
Chlorophyll *b*, µg/L	27.00
Chlorophyll *c*, µg/L	2.14
Pheophytin *a*, µg/L	0.00
Trophic State Index	60.0
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 13:30)



Water Quality (K: less than detection value)

Depth, feet	1	11
Total Suspended Solids, mg/L	**40**	**19**
Volatile Suspended Solids, mg/L	12	10
Turbidity, NTU	**3.9**	**4.5**
NO_2/NO_3-Nrtrogen, mg/L	0.01K	0.03
Ammonia Nitrogen, mg/L	0.04	0.23
Total Kjeldahl Nitrogen, mg/L	0.54	0.23
Total Phosphorus, mg/L	0.016	0.028
Alkalinity, mg $CaCO_3$/L		
Total	**83**	106
Phenolphthalein	**6**	**0**
Field pH	**8.5**	**7.0**
Chemical Oxygen Demand, mg/L	**17**	**19**

Sediment Quality
(mg/kg: ppm, K; less than detection value)

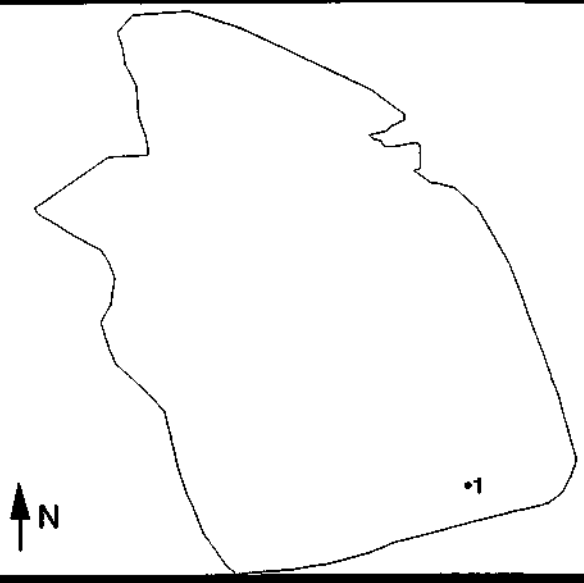
Phosphorus-P,ppm	692
Kjeldahl-N,ppm	2430
Solids, % wet	22.3
Vol. solids, %	**11.7**
TOC,%	**1.8**
Arsenic, ppm	**13.1**
Barium, ppm	**197**
Cadmium, ppm	**17**
Chromium, ppm	**28**
Copper, ppm	**38**
Iron, ppm	41,000
Lead, ppm	**47**
Manganese, ppm	555
Mercury, ppm	**0.1K**
Nickel, ppm	31
Potassium, ppm	1700
Silver, ppm	**1K**
Zinc, ppm	104

Lake Loami

Sangamon County Map Code: REY

Village of Loami
Box 74, Loami, IL 62661
217/624-3111

General



Lake Location		SW edge of Loami
Deepest Point	Latitude	39° 40' 17"
	Longitude	89° 53' 38"
Lake Surface Area, acres		**10**
Length of Shoreline, miles		**0.51**
Maximum Depth, feet		**16**
Average Depth, feet		**7.1**
Lake Storage Capacity, acre-feet		**71**
Watershed Drainage Area, acres		**53**
Hydraulic Retention Time, years		**-**
Lake Type		Side channel
Year Constructed		1957-58
Ownership		Public
Inflowing Streams		Pumped from Lick Creek
Outflowing Streams		Lick Creek

Unique Features

This is a side channel impoundment off of Lick Creek. The lake serves as a water supply source currently and will be abandoned soon. It received 750 lbs. of $CuSO_4$ each application fourtimes during the summers of 1979 to 1983 to control taste and odor in finished waters. Since 1984, CuSO, application has been reduced significantly. Destratifier was not functioning during this monitoring.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited access

No. of Visitors per Year < 25,000

Lake Use Support

Overall	F/Th
Aquatic Life	Full
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage

Potable water supply - (4)

Recreational Lake Usage

Fishing- (2)

No power boating - (1)

Recreational Facilities

Boat ramp (gravel). Residents use the lake occasionally for bank fishing.

Shoreline Usage, %

Pasture or grassland	60
Road and unused land	30
Recreational development	10

Watershed Drainage Area Usage, %

Cropland	77
Wetland	16
Wildlife	6
Pasture or grassland	1

Water Quality Problems

Problems

Suspended sediment	S
Sediment deposition	S
Algal blooms	H
Aquatic macrophytes	S
Taste and/or odor	M
Water level fluctuation	M
Fish kills	S

Differences in Turbidity and Water Quality

In different portions of lake?	No
At different times of the year?	Yes
Fishing	Poor

Major Types of Fish

Catfish, bluegill, largemouth bass, crappie, carp

Causes of Quality Problems

Potential Pollution Sources

Cropland runoff, pasture/grassland runoff

Causes of Impairment

Nutrients	H
Organic enrichment/DO depletion	H
Thermal modification	M

Sources of Impairment

Agriculture	M
Herbicide/algicide application	M

Lake Loami

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
	Terrace, linearft	1200	Sediment retention
	Permanent vegetative cover, acre	1	Erosion control
1985	Conservation cropping system, acre	12.5	Erosion control
1990	Conservation reserve program, acre	4	Wildlife/erosion control

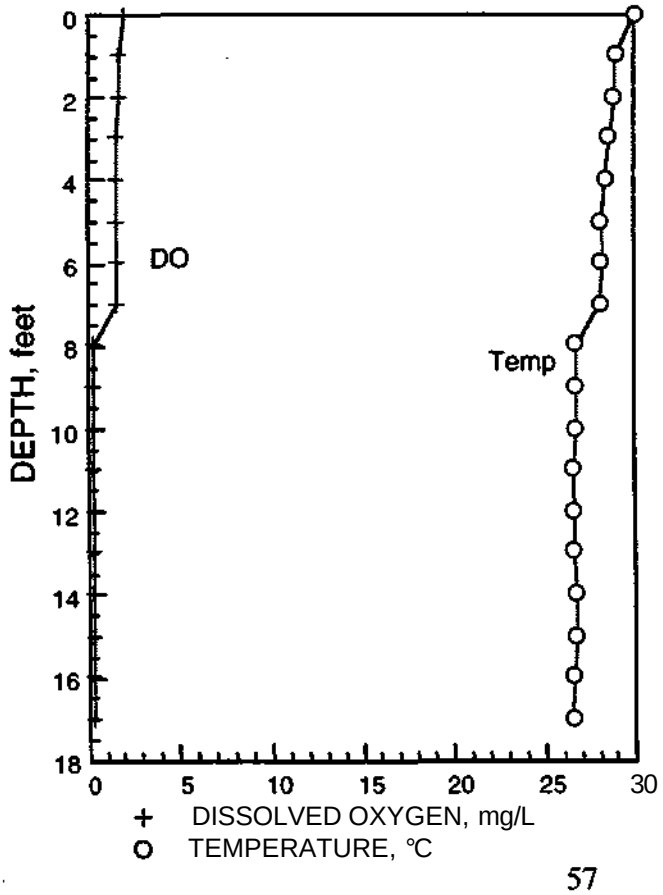
Tillage, %

Park	33	Mulch till with ≥ 30% residue	16
Crop rotation	18	Mulch till with <30% residue	10
Wetland (lake)	16	Pasture/hayland	1
Wildlife (CRP)	6		

Water and Sediment Qualities

Sampling Date	08/19/93
Site Number	**1**
Water Depth of Site, feet	**17**
Secchi Disc Transparency, inches	**19**
Chlorophyll *a*, µg/L	37.15
Chlorophyll *b*, µg/L	6.28
Chlorophyll *c*, µg/L	2.43
Pheophytin *a*, µg/L	0.00
Trophic State index	62.8
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 11:30)



Water Quality (K: less than detection value)

Depth, feet	1	15
Total Suspended Solids, mg/L	**33**	**24**
Volatile Suspended Solids, mg/L	**28**	12
Turbidity, NTU	23	11
$N0_2/N0_3$-Nitrogen, mg/L	**0.01K**	0.01
Ammonia Nitrogen, mg/L	0.23	0.26
Total Kjeldahl Nitrogen, mg/L	0.59	0.51
Total Phosphorus, mg/L	0.027	0.048
Alkalinity, mg $CaCO_3$/L		
Total	**98**	114
Phenoiphthalein	**0**	**0**
Field pH	**7.7**	**7.2**
Chemical Oxygen Demand, mg/L	28	29

Sediment Quality

(mg/kg ppm, K: less than detection value)

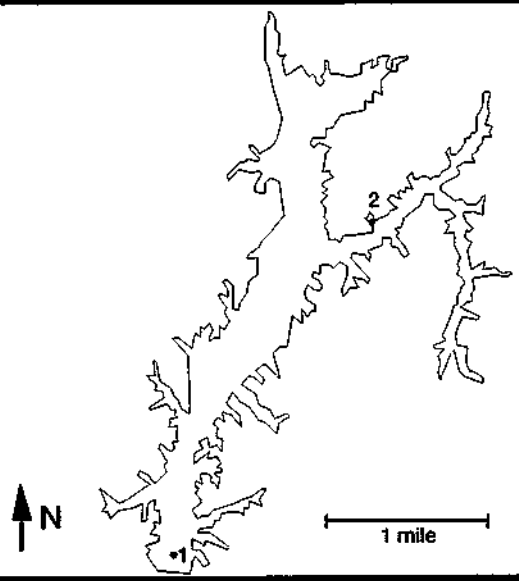
Phosphorus-P,ppm	537
Kjeldahl-N,ppm	1090
Solids, % wet	43.7
Vol. solids, %	**6.6**
TOC, %	-
Arsenic, ppm	**7.1**
Barium, ppm	**18.9**
Cadmium, ppm	**1K**
Chromium, ppm	25
Copper, ppm	**73**
Iron, ppm	27,000
Lead, ppm	**24**
Manganese, ppm	529
Mercury, ppm	**0.1K**
Nickel, ppm	24
Potassium, ppm	1300
Silver, ppm	1K
Zinc, ppm	71

Lake Mattoon

Shelby-Coles-Cumberland Counties Map Code: RCF

City of Mattoon
208 N. 19th St., Mattoon, IL 61938
217/235-5654

General



Lake Location		**11** miles S of Mattoon
Deepest Point	Latitude	39° 20' 00"
	Longitude	88° 28' 50"
Lake Surface Area, acres		765
Length of Shoreline, miles		**45**
Maximum Depth, feet		**35**
Average Depth, feet		10.5
Lake Storage Capacity, acre-feet		8037
Watershed Drainage Area, acres		25,650
Hydraulic Retention Time, years		0.376
Lake Type		Dammed stream
Year Constructed		**1959**
Ownership		Public
Inflowing Streams		Little Wabash
Outflowing Streams		Little Wabash

Unique Features

The lake serves as a secondary water supply source to the City of Mattoon. The lake is downstream of Lake Paradise on Little Wabash River. The lake also serves as a water supply source for Neoga.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access; yearly boat pass ($10/up to **1**2 hp, **$1**2/up to **1**9 hp, $15/up to 49 hp, $40/up to 100 hp, $45/>100 hp).

No. of Visitors per Year 25,000 -100,000

Lake Use Support

Overall	P/Mi
Aquatic Life	Full
Swimming	P/Mo
Recreation	P/Mi

Non-recreational Lake Usage

Potable water supply - (4)

Recreational Lake Usage

Fishing - (4) High power boating - (4)
Swimming - (2) Water skiing - (4)
Sailboating - (3) Waterfowl hunting - (2)
Camping- (3) (No jet skis allowed)

Recreational Facilities

One boat ramp, camping facilities, marina.
Annual events are basstoumament, sailboat regatta.

Shoreline Usage, %

Cropland	9	Residential/lawns	75
Woodland	10	Pasture or grassland	5
Wetland	1		

Watershed Drainage Area Usage, %

Cropland	99
Other	1

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	M
Algal blooms	M
Taste and/or odor	M
Water level fluctuation	M
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes
Fishing	Good

Major Types of Fish

Crappie, bass, bluegill, muskie, catfish, stocked 10 years ago.

Causes of Quality Problems

Potential Pollution Sources

Urban storm drainage, runoff cropland, pasture/ grassland, woodland, lawn/golf course, septic tanks, streambankerosion, sediment in lake, waterfowl, oil wells

Causes **of Impairment**

Nutrients	M	Organic/DO depletion	M
Siltation	S	Thermal modification	M
Pathogens	S	Suspended solids	M
Taste & odor	M	Noxious aquatic plants	S

Sources of Impairment

Storm sewers	S	Nonpoint sources	S
Pasture	S	Nonirnigated crop production	M
Feedlots	S	Petroleum activities	S
Recreation	S		

Lake Mattoon - Site 1

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
1984	Terrace, linear ft	80,000	All: for reduction of sedimentation and erosion control
	Grassed waterway, acre	125	
	Grade stabilization structure	34	
to	Water & sediment control basins	306	
	Conservation tillage, acre	5,800	
	Contour forming, acre	900	
1993	Critical area planting, acre	25	

Tillage. %

No-till	12	Mulch till with ≥ 30% residue	38
Moldboard plow	4.5	Mulch till with <30% residue	45
Ridge-till	0.5		

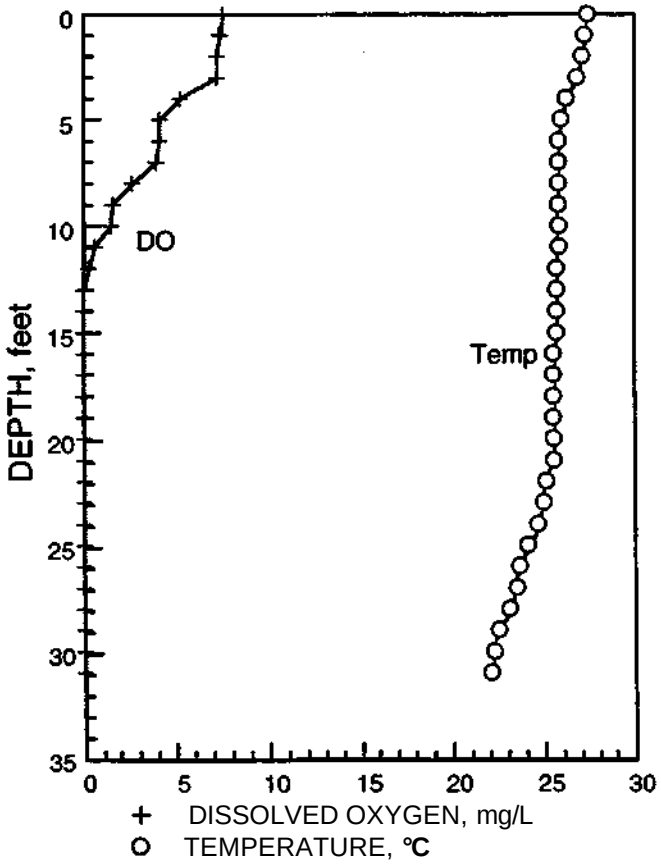
Water and Sediment Qualities

Sampling Date		08/10/93
Site Number		**1**
Water Depth of Site, feet		31
Secchi Disc Transparency, inches		**22**
Chlorophyll *a*,	**µg/L**	99.32
Chlorophyll *b*,	**µ.g/L**	6.33
Chlorophyll *c*,	**µg/L**	4.67
Pheopnytin *a*,	**µ.g/L**	0.00
Trophic State Index		6.58
Trophic State		Eutrophic

Water Quality (K: less than detection value)

Depth, feet	**1**	**29**
Total Suspended Solids, mg/L	**15**	**15**
Volatile Suspended Solids, mg/L	**9**	**12**
Turbidity, NTU	0.8	3.3
NO_2/$N0_3$-Nitrogen, mg/L	0.01**K**	0.01**K**
Ammonia Nitrogen, mg/L	0.02	**2.6**
Total Kjeldahl Nitrogen, mg/L	0.68	**2.6**
Total Phosphorus, mg/L	0.030	0.499
Alkalinity, mg $CaCO_3$/L		
Total	116	149
Phenolphthalein	**0**	**0**
Field pH	8.1	**7.0**
Chemical Oxygen Demand, mg/L	12	14

DO & Temperature Profiles (Time, 14:30)



Sediment Quality

(mg/kg: ppm, K: less than detection value)

Phosphorus-P,ppm	946
Kjeldahl-N,ppm	3750
Solids, % wet	28.9
Vol. solids, %	**10.4**
TOC, %	**-**
Arsenic, ppm	**9.4**
Barium, ppm	216
Cadmium, ppm	**1K**
Chromium, ppm	**18**
Copper, ppm	**18**
Iron, ppm	27,000
Lead, ppm	21
Manganese, ppm	1000
Mercury, ppm	**0.1K**
Nickel, ppm	**18**
Potassium, ppm	1400
Silver, ppm	**1K**
Zinc, ppm	**61**

Lake Mattoon - Site 2

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
1984	Terrace, linear ft	80,000	All: for reduction of sedimentation and erosion control
	Grassed waterway, acre	125	
	Grade stabilization structure	34	
to	Water & sediment control basins	306	
	Conservation tillage, acre	5,800	
	Contour forming, acre	900	
1993	Critical area planting, acre	25	

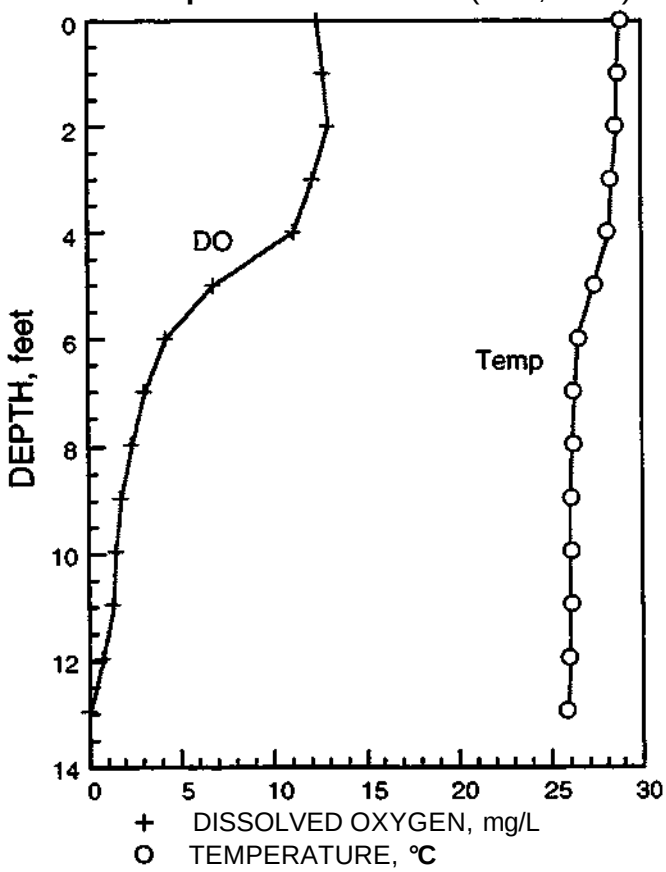
Tillage. %

No-till	12	Mulch till with ≥ 30% residue	38
Moldboard plow	4.5	Mulch till with <30% residue	45
Ridge-till	0.5		

Water and Sediment Qualities

Sampling Date		**08/10/93**
Site Number		**2**
Water Depth of Site, feet		**13**
Secchi Disc Transparency, inches		12
Chlorophyll *a*,	**µg/L**	192.24
Chlorophyll *b*,	**µg/L**	12.49
Chlorophyll *c*,	**µg/L**	**11.61**
Pheophytin *a*,	**µg/L**	0.00
Trophic State Index		77.4
Trophic State		Hypertrophic

DO & Temperature Profiles (Time, 15:00)



Water Quality (K: less than detection value)

Depth, feet	1	11
Total Suspended Solids, mg/L	**25**	21
Volatile Suspended Solids, mg/L	**14**	11
Turbidity, NTU	**2.9**	1.1
$N0_2/N0_3$-Nitrogen, mg/L	**0.01**	0.03
Ammonia Nitrogen, mg/L	0.01**K**	0.22
Total Kjeldahl Nitrogen, mg/L	**0.081**	0.22
Total Phosphorus, mg/L	0.125	0.098
Alkalinity, mg $CaCO_3$/L		
Total	**26**	124
Phenolphthalein	**18**	**0**
Field pH	9.0	**7.3**
Chemical Oxygen Demand, mg/L	16	14

Sediment Quality
(mg/kg: ppm, K: less than detection value)

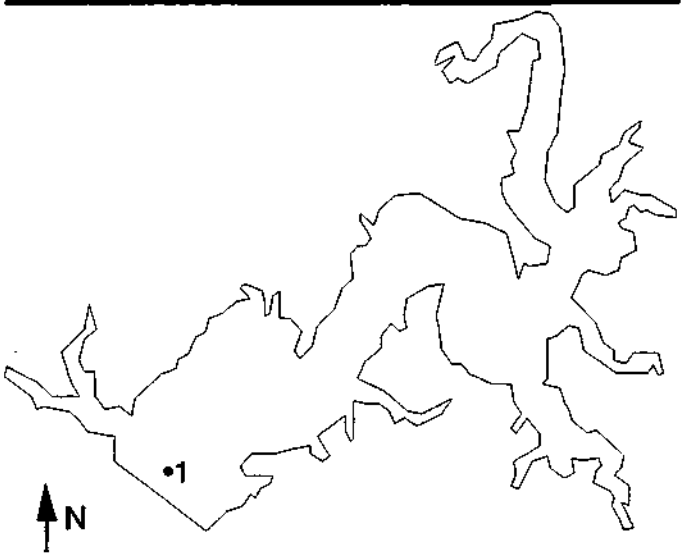
Phosphorus-P,ppm	**1186**
Kjeldahl-N,ppm	3630
Solids, % wet	33.4
Vol. solids, %	11.2
TOC, %	-
Arsenic, ppm	**6.4**
Barium, ppm	207
Cadmium, ppm	**1K**
Chromium, ppm	23
Copper, ppm	23
Iron, ppm	32,000
Lead, ppm	22
Manganese, ppm	909
Mercury, ppm	0.1**K**
Nickel, ppm	22
Potassium, ppm	**1**900
Silver, ppm	**1K**
Zinc, ppm	**86**

Lake Mingo

Vermilion County Map Code: RBN

Vermilion County Conservation District
R.R. 1, Box 217, Danville, IL 61832
217/442-1691

General



Lake Location		5 miles N of Mingo
Deepest Point	Latitude	40° 12' 27"
	Longitude	87° 43' 59"
Lake Surface Area, acres		**170**
Length of Shoreline, miles		**7.8**
Maximum Depth, feet		**35**
Average Depth, feet		13.5
Lake Storage Capacity, acre-feet		2,295
Watershed Drainage Area, acres		**11**,430
Hydraulic Retention Time, years		-
Lake Type		Dammed stream
Year Constructed		**1981**
Ownership		Public
Inflowing Streams		Windfall Creek
Outflowing Streams		Windfall Creek

Unique Features

Vermilion County Conservation District is one of five in the state, but similar to Forest Preserve District of Chicago.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited access during the park hours, fee assessed as per the schedule: daily fee ($5/in county, $10/out of county), season pass (regular $50/in county, $75/out of county; senior citizen & disabled - $30)

No. of Visitors per Year 100,000 - 200,000

Lake Use Support

Overall	Full
Aquatic Life	Full
Swimming	Full
Recreation	Full

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing- (4) Swimming (seasonal) - (2)
Sailboatjng- (1) Low power (<10hp) boating- (3)
Picnicking - (3) Waterfowl hunting - (2)

Recreational Facilities

Swimming beach, one boat ramp, boat rental, concession stand, park, picnic area, marina (small), hiking, during Vermilion County hunting and fishing days: lumberjack show, biathalon, and triathalon (swimming, bicycling, running).

Shoreline Usage, %

Woodland	**100**

Watershed Drainage Area Usage, %

Cropland	78
Park	15
Pasture	2
Wetland and water	2
Woodland	3

Water Quality Problems

Problems

Suspended sediment	S
Sediment deposition	S
Algal blooms	M
Aquatic macrophytes	S
Water level fluctuation	M/N
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Largemouth bass (6/day, >15"), walleye (6/d, >14"), bluegill and redear sunfish (25/d), channel catfish (6/d), crappie, yellow bass, gizzard shad, Walleye and channel catfish are stocked annually. Walleye fishing is not very successful.

Causes of Quality Problems

Potential Pollution Sources

Runoff (cropland, pasture/grassland, woodland), livestock operations, streambank erosion, rough fish (gizzard shad, under control)

Causes of Impairment

Nutrients	M
Siltation	S
Thermal modification	M

Sources of Impairment

Nonpoint sources	M
Pasture	S

Aquathol-K and CuSO, are used to control duckweed and filamentous algae in the beach and dock areas.

Lake Mingo

Lake Protection Management

Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

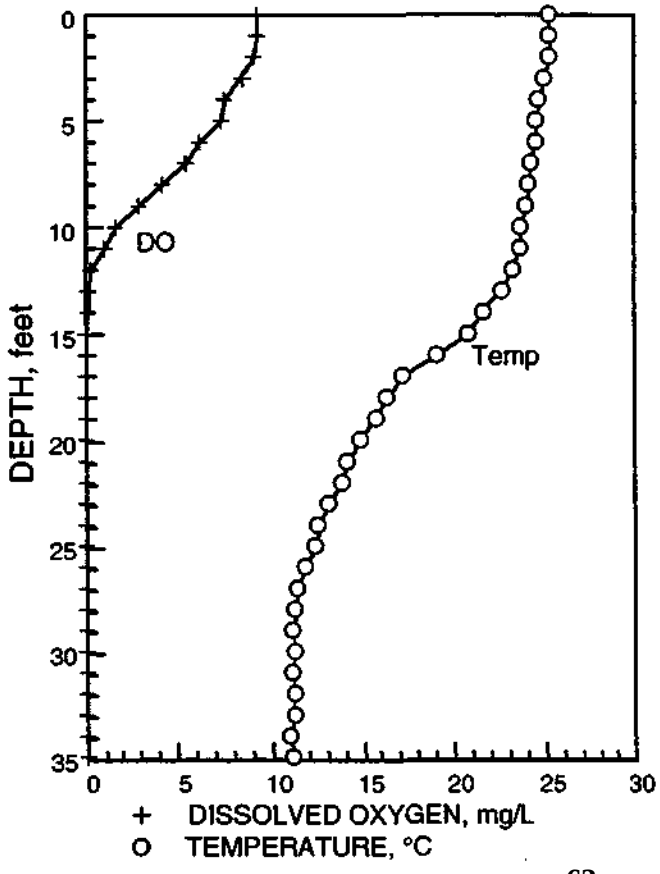
Tillage. %

No-till	15	Mulch till with ≥30% residue	18
Moldboard plow	10	Mulch till with <30% residue	35
Woodland	3	Pasture/hayland	2
Park	15	Wetland	1
Other - water	1		

Water and Sediment Qualities

Sampling Date	08/12/93
Site Number	**1**
Water Depth of Site, feet	**35**
Secchi Disc Transparency, inches	33
Chlorophyll *a*, µg/L	35.24
Chlorophyll *b*, µg/L	3.42
Chlorophyll *c*, µg/L	3.09
Pheophytin *a*, µg/L	0.27
Trophic State Index	**51.9**
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 09:30)



Water Quality (K: less than detection value)

Depth, feet	1	33
Total Suspended Solids, mg/L	**11**	**9**
Volatile Suspended Solids, mg/L	**6**	**4**
Turbidity, NTU	**2.6**	2.3
NO_2NO_3-Nitrogen, mg/L	**1.5**	**0.1K**
Ammonia Nitrogen, mg/L	0.02	**1.9**
Total Kjeldahl Nitrogen, mg/L	**0.61**	**1.9**
Total Phosphorus, mg/L	0.005	0.100
Alkalinity, mg $CaCO_3$yL		
Total	104	163
Phenolphthalein	**6**	**0**
Field pH	**8.4**	**7.0**
Chemical Oxygen Demand, mg/L	18	26

Sediment Quality

(mg/kg: ppm, K: less than detection value)

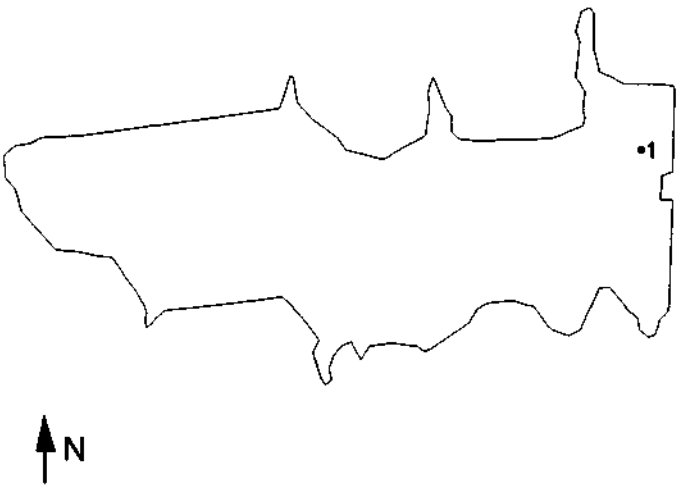
Phosphorus-P,ppm	**818**
Kjeldahl-N,ppm	3684
Solids, % wet	**30.0**
Vol. solids, %	**12.2**
TOC, %	**-**
Arsenic, ppm	**7.1**
Barium, ppm	**169**
Cadmium, ppm	**1K**
Chromium, ppm	**28**
Copper, ppm	**27**
Iron, ppm	38,000
Lead, ppm	**19**
Manganese, ppm	**876**
Mercury, ppm	**0.1K**
Nickel, ppm	33
Potassium, ppm	3200
Silver, ppm	**1K**
Zinc, ppm	122

Palmyra - Modesto City Lake

Macoupin County Map Code: RDZP

Paimyra-Modesto Water Commission
R.R. 1, Box 28AA, Palmyra, IL 62674
217/436-2426

General



Lake Location	1.5 miles E of Palmyra	
Deepest Point	Latitude	39° 26' 45"
	Longitude	89° 59' 07"
Lake Surface Area, acres		**35**
Length of Shoreline, miles		**1.1**
Maximum Depth, feet		**26**
Average Depth, feet		**15**
Lake Storage Capacity, acre-feet		525
Watershed Drainage Area, acres		1760
Hydraulic Retention Time, years		**0.412**
Lake Type		Dammed stream
Year Constructed		1964
Ownership		Public
Inflowing Streams		None
Outflowing Streams		Nasa Creek

Unique Features

The lake is the primary water supply source to the cities of Palmyra and Modesto. Terry Lake (6 acres) acts as a sediment basin for the lake. A mechanical destratifier has been successfully operated for several years.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access - free

No. of Visitors per Year <25,000

Lake Use Support

Overall	P/Mi
Aquatic Life	Full
Swimming	P/Mi
Recreation	Full

Non-recreational Lake Usage

Potable water supply - (4)
Agricultural water supply - (2)

Recreational Lake Usage

Fishing- (2)
Low power boating - (3)

Recreational Facilities

One boat ramp

Shoreline Usage, %

Cropland	60
Woodland	30
Pasture or grassland	10

Watershed Drainage Area Usage, %

Cropland	80
Residential/lawns	2
Park	8
Woodland	3
Pasture or grassland	2
Wetland/wildlife	5

Water Quality Problems

Problems

Suspended sediment	S
Sediment deposition	S
Algal blooms	S
Aquatic macrophytes	M/N
Taste and/or odor	S
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Catfish, bass, crappie, carp, bluegill, (stocked annually with catfish)

Causes of Quality Problems

Potential Pollution Sources

Runoff (cropland, pasture/grassland, woodland, lawn/golf course)

Causes **of Impairment**

Pesticides	S	Organic/DO depletion	M
Siltation	S	Thermal modification	S
Taste/odor	S	Suspended solids	S

Sources of Impairment

Agriculture	**M**
Pasture	**S**

Palmyra - Modesto City Lake

Lake Protection Management

Treatment Date	Type and Extent of Treatment			Reason for Treatment
5/89,6/90	Terrace,	linear ft	3200	Erosion control
(Planned 1993)	Terrace,	linear ft	(1400)	Water quality
8/86	Grassed waterway,	acre	23	Erosion control
8/86	Field border stripping,	ft	5000	Erosion control
8/90	Permanent vegetative cover,	acre	20	Erosion control/water quality

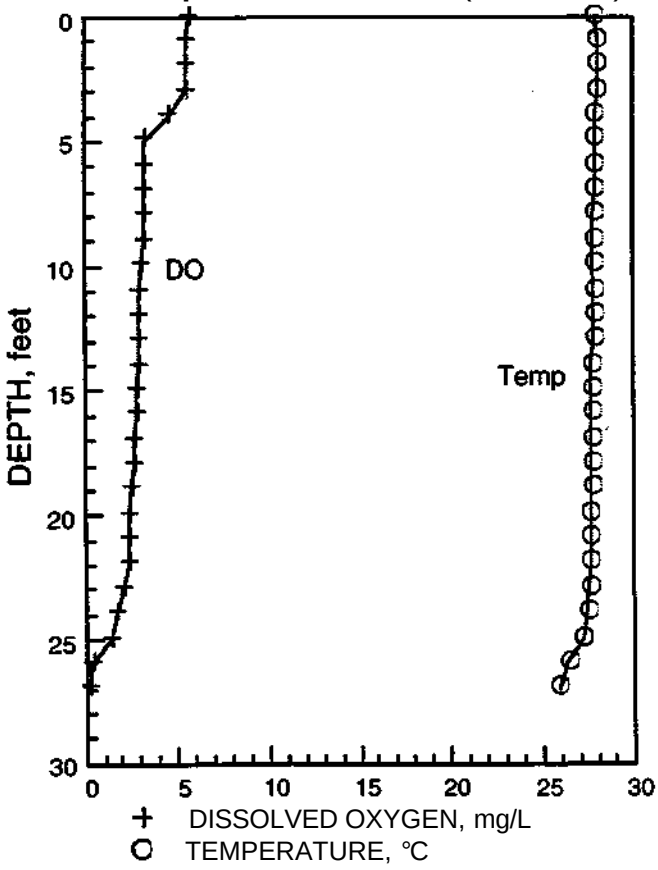
Tillage. %

Moldboard plow	8	Chisel or disc till with ≥ 30% residue	20
Park	8	Chisel or disc till with <30% residue	52
Woodland	3	Pasture/hayland	2
Wetland (lake)	4	Wildlife	1
Other (residential, roads)	2		

Water and Sediment Qualities

Sampling Date		08/19/93
Site Number		**1**
Water Depth of Site, feet		**27**
Secchi Disc Transparency, inches		**47**
Chlorophyll *a,*	**µg/L**	21.81
Chlorophyll *b,*	**µg/L**	8.32
Chlorophyll *c,*	**µg/L**	0.00
Pheophytin *a,*	**µg/L**	0.31
Trophic State Index		56.9
Trophic State		Eutrophic

DO & Temperature Profiles (Time, 09:00)



Water Quality (K: less than detection value)

	1	25
Depth, feet		
Total Suspended Solids, mg/L	**4**	21
Volatile Suspended Solids, mg/L	**2**	**4**
Turbidity, NTU	**6**	9.3
NO/NOg-Nitrogen, mg/L	1.4	1.5
Ammonia Nitrogen, mg/L	0.04	0.23
Total Kjeldahl Nitrogen, mg/L	0.63	0.53
Total Phosphorus, mg/L	0.028	0.057
Alkalinity, mg CaCO/L		
Total	**77**	**75**
Phenolphthalein	**0**	**0**
Field pH	**7.4**	**6.9**
Chemical Oxygen Demand, mg/L	12	13

Sediment Quality

(mg/kg: ppm, K: less than detection value)

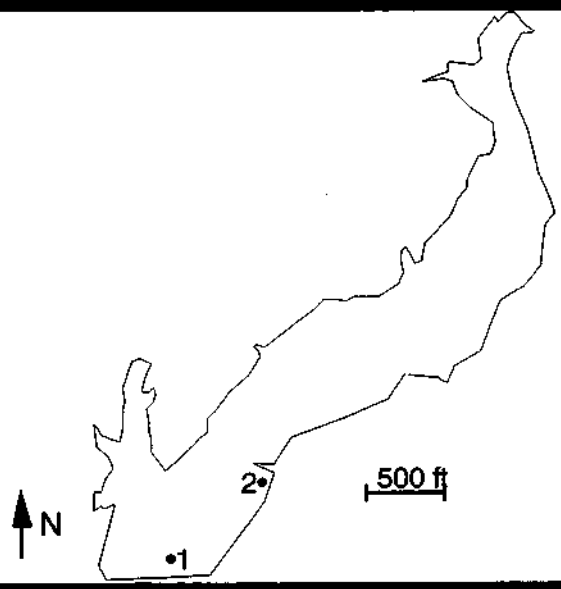
Phosphorus-P,ppm	544
Kjeldahl-N,ppm	1022
Solids, % wet	34.2
Vol. solids, %	**7.8**
TOC, %	-
Arsenic, ppm	**7.6**
Barium, ppm	242
Cadmium, ppm	**1K**
Chromium, ppm	**26**
Copper, ppm	**72**
Iron, ppm	31,000
Lead, ppm	31
Manganese, ppm	904
Mercury, ppm	0.1**K**
Nickel, ppm	**27**
Potassium, ppm	1900
Silver, ppm	**1K**
Zinc, ppm	**86**

Lake Paradise

Coles County Map Code: RCG

City of Mattoon
208 N. 19th St., Mattoon, IL 61938
217/235-5634

General



Lake Location		3.6 miles SW of Mattoon
Deepest Point	Latitude	39° 24' 48"
	Longitude	88° 25' 38"
Lake Surface Area, acres		**176**
Length of Shoreline, miles		**4.1**
Maximum Depth, feet		**19**
Average Depth, feet		**7.5**
Lake Storage Capacity, acre-feet		**1**,320
Watershed Drainage Area, acres		**11,580**
Hydraulic Retention Time, years		**0.137**
Lake Type		Dammed stream
Year Constructed		
Ownership		
Inflowing Streams		Little Wabash River
Outflowing Streams		Little Wabash River

Unique Features

The lake serves as the primary water supply source for Mattoon. The stream was dammed 3 times at the same location making the impoundment bigger each time. A mechanical destratifier was installed near the intake at 15 ft depth during November 1992.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned but entire shoreline not public owned, unlimited access; no jet skis allowed, 10 hp limit, fee charged ($10/yearly pass, $3/d weekend)

No. of Visitors per Year <25,000

Lake Use Support

Overall	F/Th
Aquatic Life	Full
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage

Potable water supply - (4),
Industrial Water Supply - (4)

Recreational Lake Usage

Fishing - (3)
Low power boating - (1)
Picnicking- (2)

Recreational Facilities

One boat ramp, park, picnic area

Shoreline Usage, %

Residential and developed	60
Pasture or grassland	20
Woodland	20

Watershed Drainage Area Usage, %

Cropland	85
Woodland	4
Pasture or grassland	5
Wetland	5
Residential	1

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	M
Algal blooms	S
Aquatic macrophytes	S
Taste and/or odor	M
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Crappie, largemouth bass, bluegill, muskie, catfish, (stocked 10 years ago)

Causes of Quality Problems

Potential Pollution Sources

Urban storm drainage runoff (cropland, pasture/ grassland, woodland, lawn/golf course), septictanks, streambankerosion, sediment in lake, waterfowl, oil wells

Causes **of** Impairment

Nitrate	S	Organic/DO Depletion	M
Nutrients	M	Thermal modification	M
Siltation	S	Suspended solids	M
Pathogens	S	Taste and odor	M
Oil/grease	S	Noxious aquatic plants	S

Sources of Impairment

Storm sewer	S	Nonpoint sources	S
Pasture	S	Nonirrigated crop prod.	M
Urban runoff	S	Petroleum activities	S
Dam construction	S		

Lake Paradise - Site 1

Lake Protection Management

Treatment Date	Type and Extent of Treatment	Reason for Treatment
1984-1993	Terrace	P.L. 566 & Conservation compliance
1984-1993	Grassed waterway	P.L. 566 & Conservation compliance
1984-1993	Grade stabilization structure	P.L. 566 & Conservation compliance
1986-1992	Permanent vegetative cover	CRP project
1984-1993	Diversion	P.L. 566 & Conservation compliance
1984-1993	Conservation cropping system	P.L. 566 & Conservation compliance

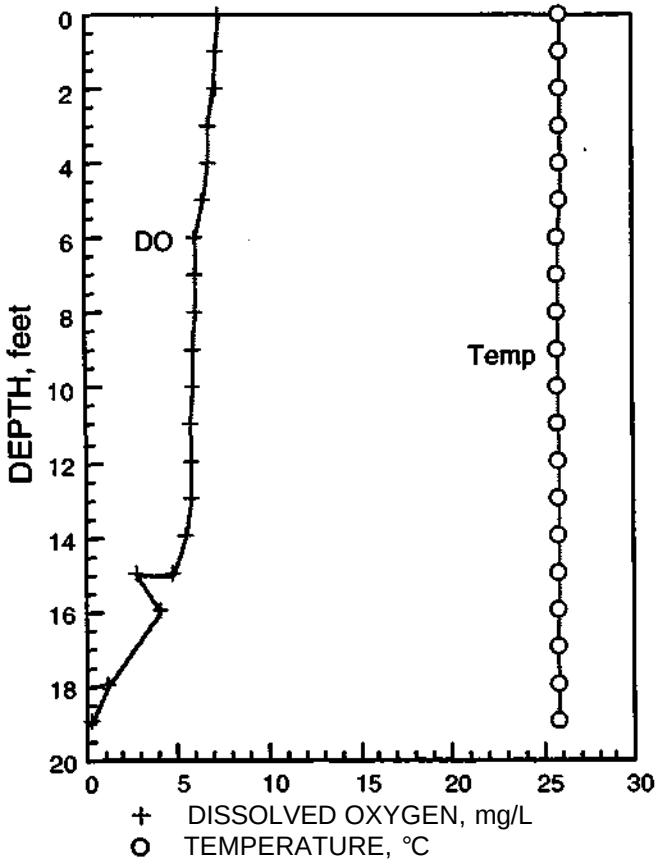
Tillage. %

No-till	9	Mulch till with ≥ 30% residue	25
Moldboard plow	2	Mulch till with <30% residue	49
Woodland	4	Wetland	5
Pasture	5	Residential	1

Water and Sediment Qualities

Sampling Date		08/10/93
Site Number		**1**
Water Depth of Site, feet		**19**
Secchi Disc Transparency, inches		18
Chlorophyll *a*,	µg/L	82.24
Chlorophyll *b*,	**µg/L**	**11**.21
Chlorophyll *c*,	**µg/L**	2.34
Pheophytin *a*,	**µg/L**	0.00
Trophic State Index		64.9
Trophic State		Eutrophic

DO & Temperature Profiles (Time, 11:00)



Water Quality (K: less than detection value)

Depth, feet	1	17
Total Suspended Solids, mg/L	10	**18**
Volatile Suspended Solids, mg/L	**6**	**7**
Turbidity, NTU	**1.7**	**1.7**
NO_2/NO_3-Nitrogen, mg/L	1.3	1.3
Ammonia Nitrogen, mg/L	0.05	0.09
Total Kjeldahl Nitrogen, mg/L	0.58	0.57
Total Phosphorus, mg/L	0.022	0.014
Alkalinity, mg $CaCO_3$/L		
Total	130	134
Phenolphthalein	**0**	**0**
Field pH	**7.3**	**7.2**
Chemical Oxygen Demand, mg/L	10	12

Sediment Quality

(mg/kg: ppm, K: less than detection value)

Phosphorus-P,ppm	975
Kjeldahl-N,ppm	4400
Solids, % wet	31.5
Vol. solids, %	11.6
TOC, %	
Arsenic, ppm	6.9
Barium, ppm	208
Cadmium, ppm	**1K**
Chromium, ppm	23
Copper, ppm	25
Iron, ppm	31,000
Lead, ppm	**27**
Manganese, ppm	748
Mercury, ppm	0.10
Nickel, ppm	23
Potassium, ppm	2100
Silver, ppm	1K
Zinc, ppm	90

Lake Paradise - Site 2

Lake Protection Management

Treatment Date	Type and Extent of Treatment	Reason for Treatment
1984-1993	Terrace	P.L. 566 & Conservation compliance
1984-1993	Grassed waterway	P.L. 566 & Conservation compliance
1984-1993	Grade stabilization structure	P.L. 566 & Conservation compliance
1986-1992	Permanent vegetative cover	CRP project
1984-1993	Diversion	P.L. 566 & Conservation compliance
1984-1993	Conservation cropping system	P.L. 566 & Conservation compliance

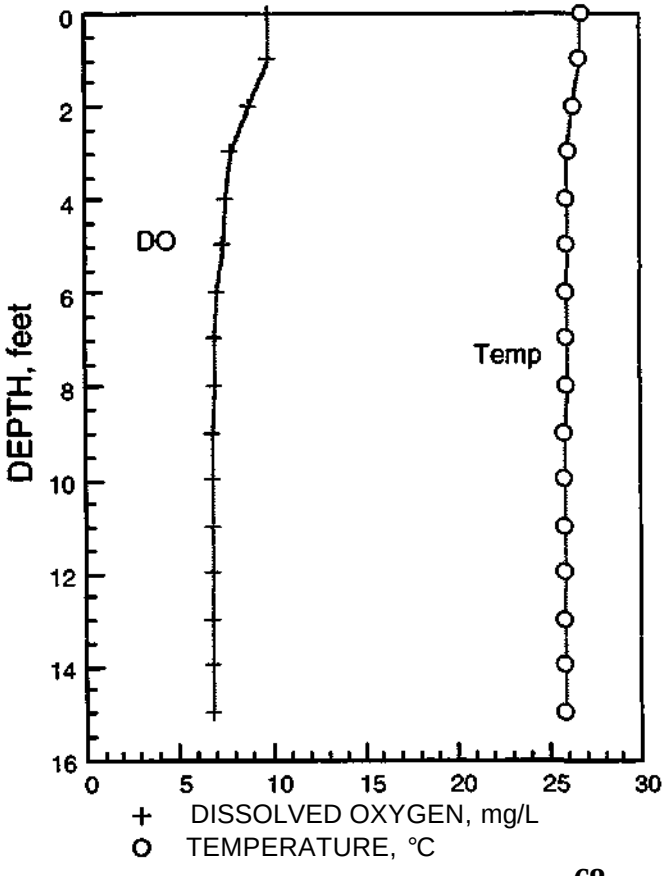
Tillage. %

No-till	9	Mulch till with ≥ 30% residue	25
Moldboard plow	2	Mulch till with <30% residue	49
Woodland	4	Wetland	5
Pasture	5	Residential	1

Water and Sediment Qualities

Sampling Date		**08/10/93**
Site Number		**2**
Water Depth of Site, feet		**15**
Secchi Disc Transparency, inches		**16**
Chlorophyll a,	**µg/L**	86.26
Chlorophyll *b*,	**µg/L**	13.62
Chlorophyll *c*,	**µg/L**	2.27
Pheophytin *a*,	**µg/L**	0.00
Trophic State Index		62.8
Trophic State		Eutrophic

DO & Temperature Profiles (Time, 11:45)



Water Quality (K: less than detection value)

	1	13
Depth, feet		
Total Suspended Solids, mg/L	**27**	**37**
Volatile Suspended Solids, mg/L	**13**	**14**
Turbidity, NTU	0.5	**2.8**
NO_2/NO_3-Nitrogen, mg/L	**1.1**	1.1
Ammonia Nitrogen, mg/L	0.07	0.14
Total Kjeldahl Nitrogen, mg/L	0.73	0.79
Total Phosphorus, mg/L	0.013	0.020
Alkalinity, mg $CaCO_3$/L		
Total	132	128
Phenolphthalein	**0**	**0**
Field pH	**8.2**	**7.5**
Chemical Oxygen Demand, mg/L	10	11

Sediment Quality

(mg/kg ppm, K: less than detection value)

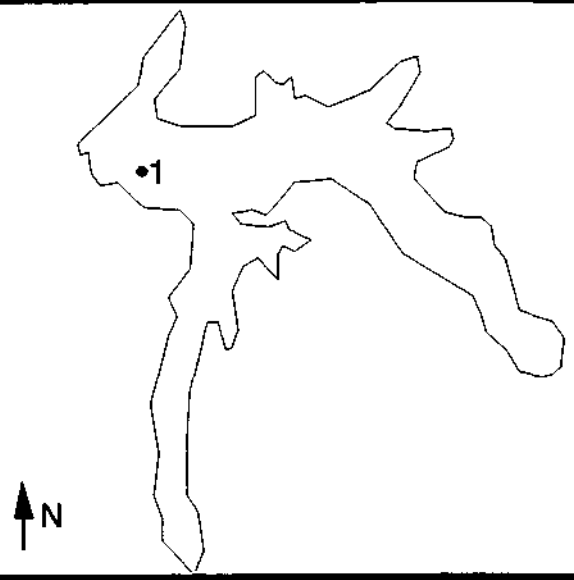
Phosphorus-P,ppm	**85**
Kjeldahl-N,ppm	159
Solids, % wet	73.2
Vol. solids, %	1.0
TOC, %	-
Arsenic, ppm	2.5
Barium, ppm	**15**
Cadmium, ppm	**1K**
Chromium, ppm	**5**
Copper, ppm	**5**
Iron, ppm	6300
Lead, ppm	10K
Manganese, ppm	**148**
Mercury, ppm	0.1**K**
Nickel, ppm	5K
Potassium, ppm	1000K
Silver, ppm	**1K**
Zinc, ppm	15

Red Hills State Park Lake

Illinois Department of Conservation
Rt. 2, Box 252A, Sumner, IL 62466
618/936-2469

Lawrence County Map Code: RBB

General



Lake Location		2 miles NE of Sumner
Deepest Point	Latitude	38° 43' 40"
	Longitude	87° 47' 05"
Lake Surface Area, acres		**40**
Length of Shoreline, miles		**2.4**
Maximum Depth, feet		**27**
Average Depth, feet		**8**
Lake Storage Capacity, acre-feet		320
Watershed Drainage Area, acres		**980**
Hydraulic Retention Time, years		0.326
Lake Type		Dammed stream
Year Constructed		**1954**
Ownership		State
Inflowing Streams		Muddy Creek (tributary to Embarras)
Outflowing Streams		Muddy Creek

Unique Features

It is a spring fed lake. All the watershed area is undisturbed. Most of it is owned by IDOC. Private lands are in CRP. There is alleged to be a one-room cave, the entrance to which is under water.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access, only trolling motor allowed

No. of Visitors per Year > 200,000

Lake Use Support

Overall	P/Mi
Aquatic Life	Full
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (4) No power boating - (4)
Sailboating - (1) Picnicking - (4)
Camping - (4) Waterfowl observation - **(1)**

Recreational Facilities

Boat ramp; boat rental, camping facilities (class A & D), concession stand, park, picnic area, horse trail, hunting, hiking, Gold Settlers Day: weekend in late April

Shoreline Usage, %

Woodland	100

Watershed Drainage Area Usage, %

Woodland	61
Conservation Reserve Program	30
Water	6
Pasture or grassland	3

Water Quality Problems

Problems

Suspended sediment	S
Sediment deposition	S
Algal blooms	M
Aquatic macrophytes	S
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Largemouth bass, redear, bluegill, crappie, catfish, (stocked annually with 1000 channel catfish)

Causes of Quality Problems

Potential Pollution Sources

Campground wastewatertreatment plant effluent is discharged into the lake, woodland runoff, oil wells

Causes of Impairment

Nutrients	S	Oil and grease	S
Siltation	S	Noxious aquatic plants	S

Sources of Impairment

Nonpoint sources	S
Petroleum activities	S

Used aquashade to shade out algae

Red Hills State Park Lake

Lake Protection Management

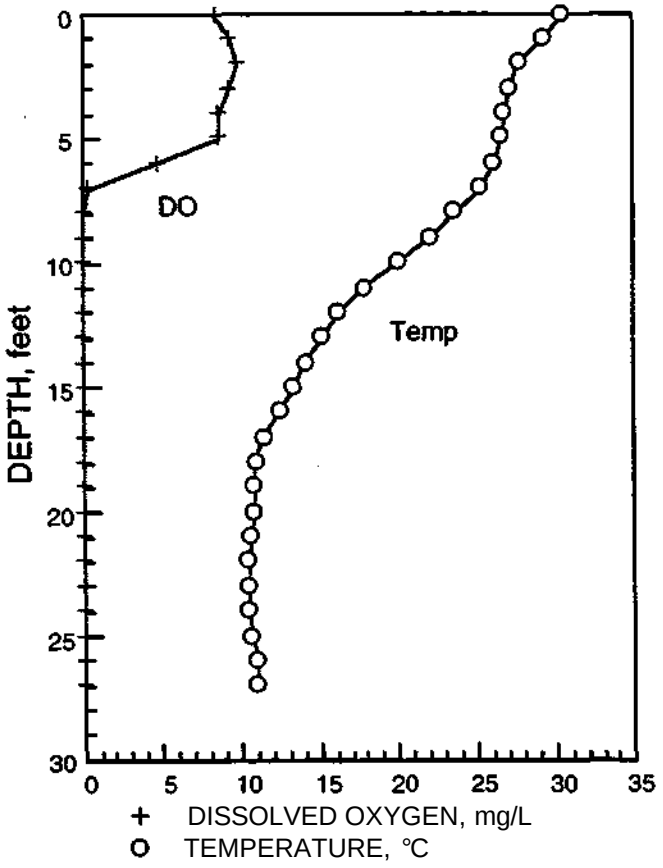
Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

Tillage. %	
Woodland	61
Pasture/hayland	3
CRP	30
Water	6

Water and Sediment Qualities

Sampling Date		08/11/93
Site Number		**1**
Water Depth of Site, feet		27.5
Secchi Disc Transparency, inches		**19**
Chlorophyll *a*,	µg/L	42.55
Chlorophyll *b*,	**µ.g/L**	**1.42**
Chlorophyll *c*,	**µ.g/L**	0.53
Pheophytin *a*,	**µ.g/L**	0.00
Trophic State Index		57.9
Trophic State		Eutrophic

DO & Temperature Profiles (Time, 13:13)



Water Quality (K: less than detection value)

Depth, feet	1	25
Total Suspended Solids, mg/L	**11**	10
Volatile Suspended Solids, mg/L	**6**	**5**
Turbidity, NTU	**1.9**	**1.3**
NO_2/NO_3-Nitrogen, mg/L	0.01**K**	0.01**K**
Ammonia Nitrogen, mg/L	0.01**K**	0.09
Total Kjeldahl Nitrogen, mg/L	0.66	0.62
Total Phosphorus, mg/L	0.009	0.015
Alkalinity, mg $CaCO_3$/L		
Total	**55**	**57**
Phenolphthalein	**20**	**18**
Field pH	**9.1**	**9.1**
Chemical Oxygen Demand, mg/L	16	17

Sediment Quality

(mg/kg: ppm, K: less than detection value)

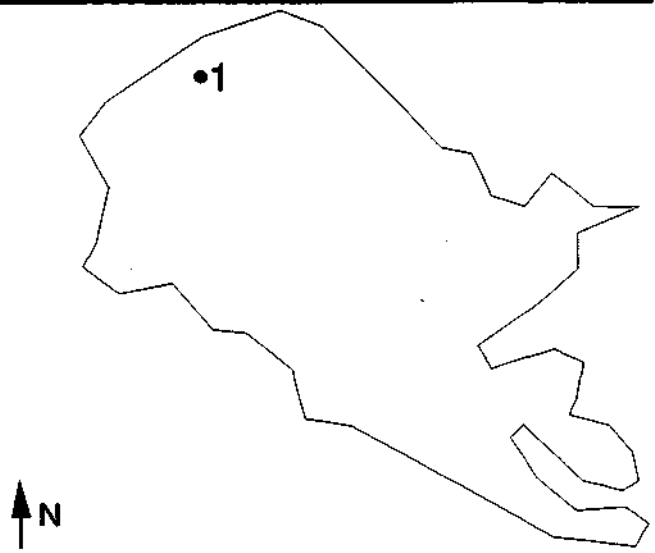
Phosphorus-P,ppm	612
Kjeldahl-N,ppm	15852
Solids, % wet	18.5
Vol. solids, %	14.5
TOC, %	-
Arsenic, ppm	52.1
Barium, ppm	263
Cadmium, ppm	**1K**
Chromium, ppm	**18**
Copper, ppm	21
Iron, ppm	39,000
Lead, ppm	**33**
Manganese, ppm	1600
Mercury, ppm	0.1**K**
Nickel, ppm	25
Potassium, ppm	1300
Silver, ppm	**1K**
Zinc, ppm	**88**

Lake Tecumseh

Hardin County Map Code: RZ-Z99Z

U.S. Forest Service
910 S. Commercial, Harrisburg, IL
618/253-7114

General



Lake Location	3 miles NE of Elizabethtown	
Deepest Point	Latitude	37° 28' 56"
	Longitude	88° 19' 49"
Lake Surface Area, acres		**13**
Length of Shoreline, miles		**0.49**
Maximum Depth, feet		**12**
Average Depth, feet		**4.1**
Lake Storage Capacity, acre-feet		**53**
Watershed Drainage Area, acres		**90**
Hydraulic Retention Time, years		**-**
Lake Type		Dammed stream
Year Constructed		**1970**
Ownership		Public
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed
Unique Features		

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access

No. of Visitors per Year

Lake Use Support

Overall	Full
Aquatic Life	Full
Swimming	Full
Recreation	Full

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (2), D

No power boating (electric) - (1)

Recreational Facilities

Boat ramp (earth ramp). Road to the lake is very rough

Shoreline Usage, %

Woodland	100

Watershed Drainage Area Usage, %

Woodland and roads	100

Water Quality Problems

Problems

Suspended sediment	M/N
Sediment deposition	M/N
Algal blooms	S
Aquatic macrophytes	M

Differences in Turbidity and Water Quality

In different portions of lake?	No
At different times of the year?	Yes

Fishing Fair

Major Types of Fish

Largemouth bass, sunfish, catfish, crappie, bluegill

Causes of Quality Problems

Potential Pollution Sources

Woodland runoff

Causes of Impairment

Nutrients	S

Sources of Impairment

Surface runoff	S

Lake Tecumseh

Lake Protection Management

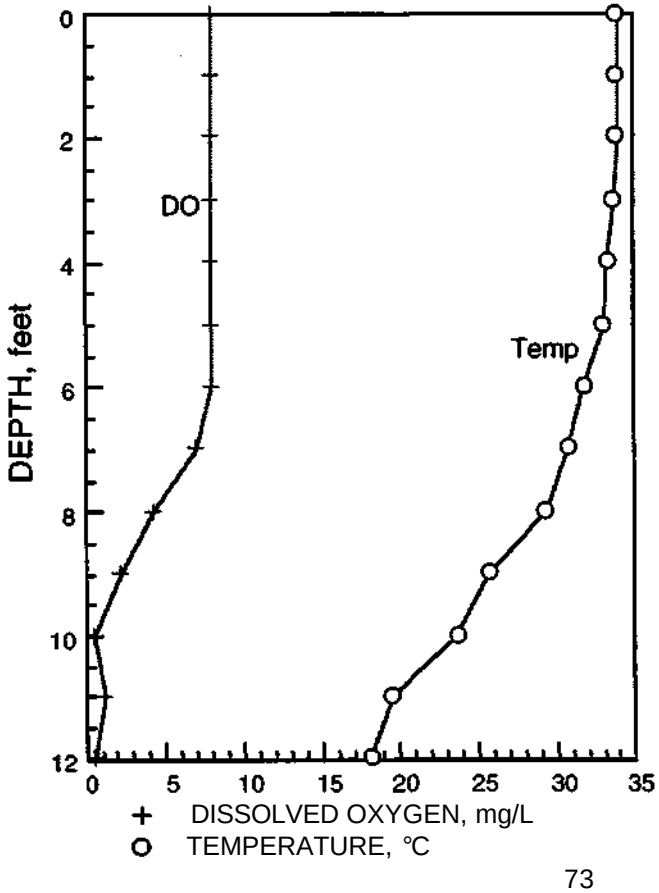
Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

Comments: The lake is located in the U.S. forest preserve area (100% woodland).

Water and Sediment Qualities

Sampling Date		07/13/93
Site Number		**1**
Water Depth of Site, feet		**12**
Secchi Disc Transparency, inches		**95**
Chlorophyll *a*,	**µg/L**	3.89
Chlorophyll *b*,	**µg/L**	**1.41**
Chlorophyll *c*,	**µg/L**	**1.49**
Pheophytin *a*,	**µg/L**	0.78
Trophic State Index		41.9
Trophic State		Mesotrophic

DO & Temperature Profiles (Time, 15:20)



Water Quality (K: less than detection value)

Depth, feet	1	10
Total Suspended Solids, mg/L	**4**	**17**
Volatile Suspended Solids, mg/L	**3**	**11**
Turbidity, NTU	**1.5**	**2**
NO_2/NO_3-Nitrogen, mg/L	0.02	0.01**K**
Ammonia Nitrogen, mg/L	0.01**K**	0.03
Total Kjeldahl Nitrogen, mg/L	0.76	0.67
Total Phosphorus, mg/L	0.008	0.008
Alkalinity, mg $CaCC_3$/L		
Total	**26**	**16**
Phenolphthalein	**0**	**0**
Field pH	7.7	**6.4**
Chemical Oxygen Demand, mg/L	**18**	**18**

Sediment Quality

(mg/kg ppm, K: less than detection value)

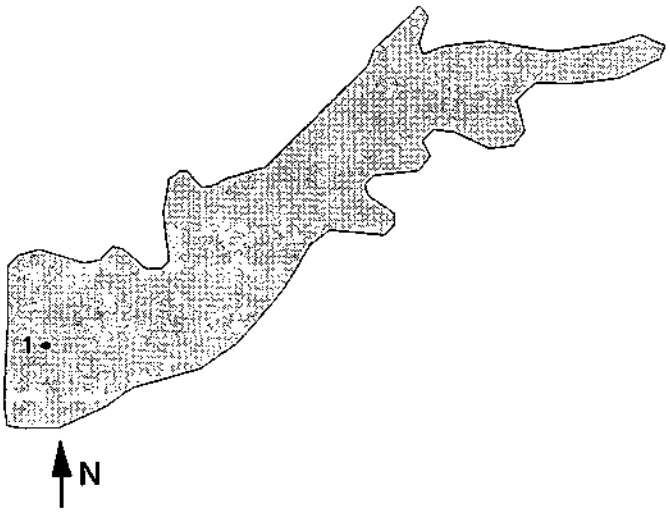
Phosphorus-P,ppm	422
Kjeldahl-N,ppm	**1.8**
Solids, % wet	36.3
Vol. solids, %	**6.0**
TOC, %	**2.0**
Arsenic, ppm	11.5
Barium, ppm	167
Cadmium, ppm	13
Chromium, ppm	**20**
Copper, ppm	**22**
Iron, ppm	32,000
Lead, ppm	33
Manganese, ppm	765
Mercury, ppm	0.1**K**
Nickel, ppm	**23**
Potassium, ppm	1000K
Silver, ppm	**1K**
Zinc, ppm	72

Vernor Lake (Olney Old Reservoir)

City of Olney
300 Whittle Ave., Olney, IL 62450
618/395-7302

Richland County Map Code: RCA

General



Lake Location		2 miles N of Olney
Deepest Point	Latitude	38° 45' 46"
	Longitude	88° 06' 09"
Lake Surface Area, acres		**36**
Length of Shoreline, miles		**2.4**
Maximum Depth, feet		**29**
Average Depth, feet		**15**
Lake Storage Capacity, acre-feet		**540**
Watershed Drainage Area, acres		**300**
Hydraulic Retention Time, years		**1**.802
Lake Type		Dammed stream
Year Constructed		**1**905
Ownership		Public
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed tributary to Fox Creek

Unique Features
None

Usages and Impairments

Public Access Yes
Entire lake bottom publicly owned but entire shoreline not public access, unlimited access - free charged, 9.9 hp limit

No. of Visitors per Year <25,000

Lake Use Support

Overall	P/Mi
Aquatic Life	F/Th
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage
Potable water supply - (4)

Recreational Lake Usage
Fishing - (3) year round
Low power boating - (3)
Picnicking - (2)

Recreational Facilities
One boat ramp, picnic area. Facilities are marginal because of the other two larger lakes owned by the city.

Shoreline Usage, %

Residential (except the dam) developed	99

Watershed Drainage Area Usage, %

Cropland	50
Residential	10
Pasture or grassland	20
Woodland	10
Recreation development (golf course)	10

Water Quality Problems

Problems

Suspended sediment	M
Algal blooms	M
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Fair

Major Types of Fish
Largemouth bass, catfish, bluegill, crappie, (catch and release is advised)

Causes of Quality Problems

Potential Pollution Sources
Urban storm drainage, runoff (cropland, pasture/ grassland, woodland, lawn/golf course), septic tank, sediment in lake, oil wells

Causes **of Impairment**

Nutrients	M	Organic/DO depletion	M
Siltation	M	Thermal modification	M
Oil/grease	S	Suspended solids	M

Sources of Impairment

Urban runoff	S	Nonpoint sources	M
Pasture	S	Irrigated golf course	S
Algicide	S	Petroleum activities	S

Vernor Lake (Olney Old Reservoir)

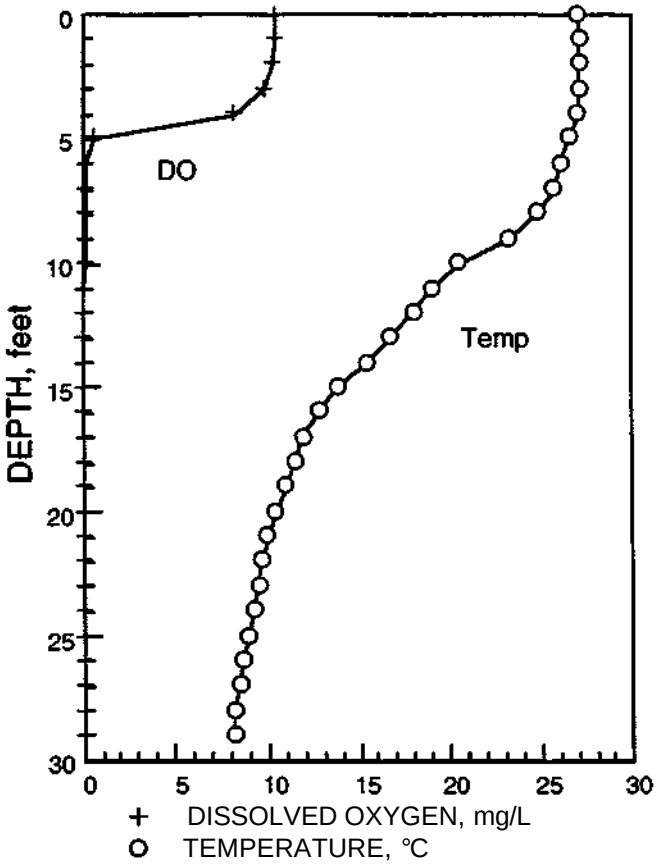
Lake Protection Management

Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

Water and Sediment Qualities

Sampling Date		08/11/93
Site Number		1
Water Depth of Site, feet		29
Secchi Disc Transparency, inches		32
Chlorophyll *a*,	**µ.g/L**	54.84
Chlorophyll *b*,	**µ.g/L**	6.05
Chlorophyll *c*,	**µ.g/L**	0.81
Pheophytin *a*,	**µ.g/L**	2.74
Trophic State Index		61.7
Trophic State		Eutrophic

DO & Temperature Profiles (Time, 08:30)



Water Quality (K: less than detection value)

Depth, feet	1	27
Total Suspended Solids, mg/L	**11**	**15**
Volatile Suspended Solids, mg/L	**6**	**12**
Turbidity, NTU	**0.2**	**5**
NO_2/NO_3-Nitrogen, mg/L	0.02	-
Ammonia Nitrogen, mg/L	0.07	**7.2**
Total Kjeldahl Nitrogen, mg/L	0.78	**7.2**
Total Phosphorus, mg/L	0.028	1.72
Alkalinity, mg $CaCO_3$/L		
Total	**75**	167
Phenolphthalein	**12**	**0**
Field pH	**9.0**	6.8
Chemical Oxygen Demand, mg/L	17	30

Sediment Quality

(mg/kg: ppm, K: less than detection value)

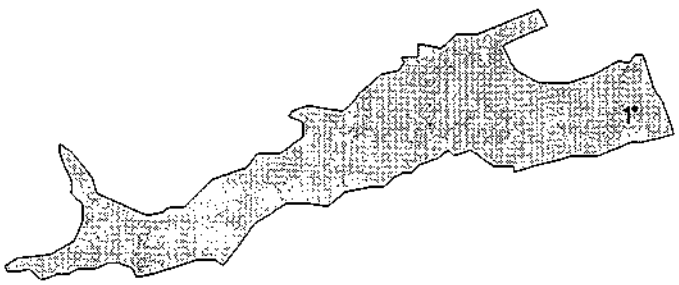
Phosphorus-P,ppm	960
Kjeldahl-N,ppm	1010
Solids, % wet	13.7
Vol. solids, %	19.6
TOC, %	-
Arsenic, ppm	16.8
Barium, ppm	332
Cadmium, ppm	**1K**
Chromium, ppm	16
Copper, ppm	760
Iron, ppm	37,000
Lead, ppm	60
Manganese, ppm	1300
Mercury, ppm	0.10
Nickel, ppm	**22**
Potassium, ppm	1300
Silver, ppm	**1K**
Zinc, ppm	115

Vienna Correctional Center Lake

Illinois Department of Corrections
Box 200, Vienna, IL 62995
618/658-8371

Johnson County Map Code: RAT

General



N

Lake Location		7 miles E of Vienna
Deepest Point	Latitude	37° 24' 45"
	Longitude	88° 45' 37"
Lake Surface Area, acres		**70**
Length of Shoreline, miles		**2.5**
Maximum Depth, feet		**22**
Average Depth, feet		**11**
Lake Storage Capacity, acre-feet		770
Watershed Drainage Area, acres		**500**
Hydraulic Retention Time, years		-
Lake Type		Dammed stream
Year Constructed		**1964**
Ownership		state
Inflowing Streams		None
Outflowing Streams		Tributary of Bay Creek

Unique Features

The lake serves as a water supply source to the Vienna Correctional Center.

Usages and Impairments

Public Access No

Entire lake bottom publicly owned but shoreline is not easily accessible. Access to the lake and its surrounding areas are strictly controlled for security reasons.

No. of Visitors per Year <25,000

Lake Use Support

Overall	Full
Aquatic Life	Full
Swimming	Full
Recreation	Full

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (3)
No power boating - (1)

Recreational Facilities

One boat ramp, picnic area

Shoreline Usage, %

Industrial	5	Pasture or grassland	55
Woodland	35	Wetland	5

Watershed Drainage Area Usage, %

Cropland	26
Pasture or grassland	42
Woodland	15
Water and park	11
Wetland and wildlife	6

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	H
Algal blooms	H
Aquatic macrophytes	S
Taste and/or odor	M
Water level fluctuation	H
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing **Good**

Major Types of Fish

Bass, bluegill, crappie

Causes of Quality Problems

Potential Pollution Sources

Industrial effluent, storm drainage, runoff (feedlot, pasture/grassland) livestock operations, sediment in lake

Causes of Impairment

Nutrients	H	Organic/DO depletion	H
Siltation	H	Suspended solids	M
Pathogens	M	Noxious aquatic plants	H
Taste/odor	H		

Sources of Impairment

Point source	H	Nonpoint sources	H
Storm sewers	H	Pasture	H
Feedlots	H	Animal holding area	H
Construction	S		

Vienna Correctional Center Lake

Lake Protection Management

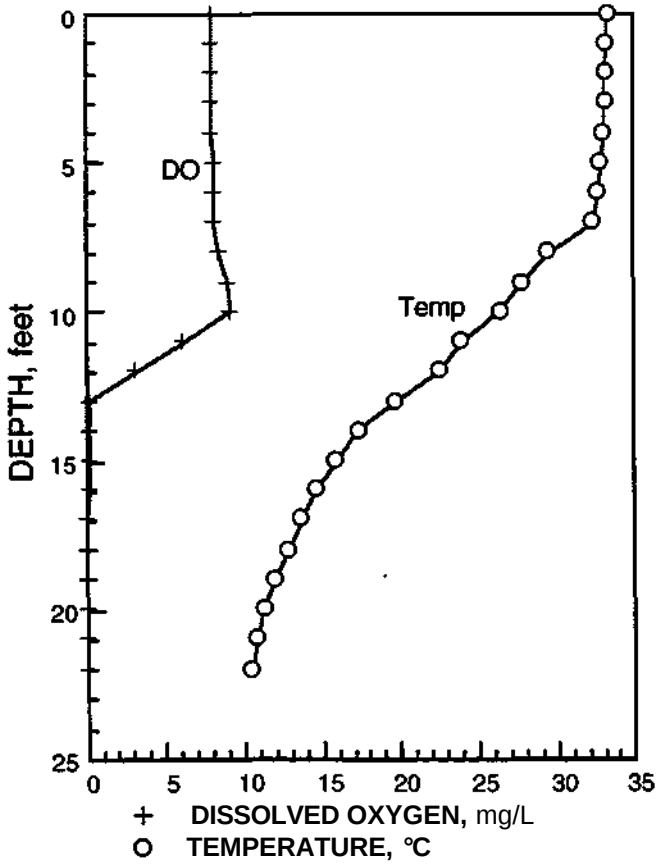
Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

Tillage. %			
No-till	7	Mulch till with ≥ 30% residue	3
Crop rotation	13	Mulch till with <30% residue	3
Woodland	15	Pasture/hayland	42
Park	1	Wetland	4
Wildlife	2	Other-water	10

Water and Sediment Qualities

Sampling Date		07/12/93
Site Number		**1**
Water Depth of Site, feet		22
Secchi Disc Transparency, inches		**110**
Chlorophyll *a*,	µg/L	28.48
Chlorophyll *b*,	µg/L	16.64
Chlorophyll *c*,	**µg/L**	0.00
Pheophytin *a*,	**µg/L**	0.00
Trophic State Index		46.3
Trophic State		Mesotrophic

DO & Temperature Profiles (Time, 16:00)



Water Quality (K: less than detection value)

Depth, feet	1	20
Total Suspended Solids, mg/L	**3**	**26**
Volatile Suspended Solids, mg/L	**2**	**14**
Turbidity, NTU	0.1	**7.8**
NO_2/NC_3-Nitrogen, mg/L	**0.01K**	0.01**K**
Ammonia Nitrogen, mg/L	0.20	0.15
Total Kjeldahl Nitrogen, mg/L	0.86	0.78
Total Phosphorus, mg/L	0.006	0.011
Alkalinity, mg $CaCO_3$/L		
Total	**39**	**55**
Phenolphthalein	**0**	**0**
Field pH	**7.4**	**6.8**
Chemical Oxygen Demand, mg/L	**16**	**14**

Sediment Quality

(mg/kg. ppm, K: less than detection value)

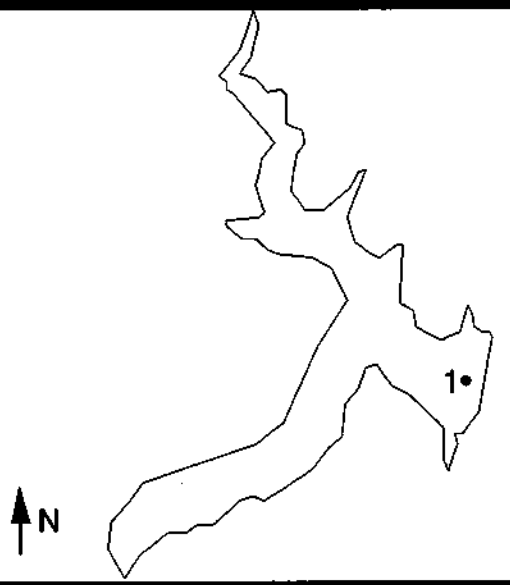
Phosphorus-P,ppm	1115
Kjeldahl-N,ppm	**1964**
Solids, % wet	20.7
Vol. solids, %	12.7
TOC, %	-
Arsenic, ppm	23.5
Barium, ppm	357
Cadmium, ppm	21
Chromium, ppm	**30**
Copper, ppm	123
Iron, ppm	51,000
Lead, ppm	**45**
Manganese, ppm	2800
Mercury, ppm	0.1
Nickel, ppm	**36**
Potassium, ppm	1400
Silver, ppm	**1**
Zinc, ppm	110

Walton Park Lake

Montgomery County Map Code: ROU

City of Litchfield
Box 424, Litchfield, IL 62056
217/324-4801

General



Lake Location		0.75 miles S of Litchfield
Deepest Point	Latitude	39° 09' 26"
	Longitude	89° 35' 33°
Lake Surface Area, acres		**25**
Length of Shoreline, miles		**2.3**
Maximum Depth, feet		**11**
Average Depth, feet		**6**
Lake Storage Capacity, acre-feet		**150**
Watershed Drainage Area, acres		1302
Hydraulic Retention Time, years		**0.154**
Lake Type		Dammed stream
Year Constructed		Late 1800s
Ownership		Public
Inflowing Streams		Long Branch
Outflowing Streams		Long Branch, into Shoal Creek

Unique Features

The lake originally served asa watersupply source. Ice blocks were harvested and stored in ice houses for subsequent sale.

Usages and Impairments

Public Access Yes

Entire lake bottom pubilcly owned and entire shoreline public access, unlimited free access, only trolling motors allowed.

No. of Visitors per Year >200,000

Lake Use Support

Overall	P/Mi
Aquatic Life	P/Mi
Swimming	P/Mi
Recreation	P/Mi

Non-recreational Lake Usage

Agricultural water supply, irrgation - (2)
Stormwater detention - (1)

Recreational Lake Usage

Fishing - (4)
Picnicking - (4)
Waterfowl observation - (2)
No power boating - (1)
Low power boating - (4)

Recreational Facilities

Boat ramp (gravel), park, picnic area, baseball diamonds, pavilions, shelters, horseshoe posts, volleyball nets, basketball courts, childrens playground, handicap fishing dock

Shoreline Usage, %

Residential	25	Industrial/commercial	5
Woodland	15	Recreation development	54
Pasture	1		

Watershed Drainage Area Usage, %

Cropland	80	Pasture or grassland	5
Park	2	Urban/residential	8
Woodland	3	Wetland	2

Water Quality Problems

Problems

Suspended sediment	M
Sediment deposition	H
Algal blooms	S
Aquatic macrophytes	M/N
Water level fluctuation	M
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	Yes
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Catfish, largemouth bass, crappie, redear, hybrid bluegill, carp, stocked annually with channel catfish by IDOC.

Causes of Quality Problems

Potential Pollution Sources

Industrial (oil and fuel), runoff (cropland, pasture/ grassland, woodland, lawn), septic tanks, streambank erosion, sediment in lake, rough fish (carp)

Causes of Impairment

Siltation	M	Organic/DO depletion	M
Taste/odor	M	Thermal modification	M
Suspended solids			M

Sources of Impairment

Irrigated crop production	S
Lake shoreline erosion	S

Walton Park Lake

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
	Grassed waterway, acre	20	Erosion control
	Grade stabilization structures	5	Erosion control
	Pond	1	Livestock water
	Diversions	20	Water quality
	Livestock exclusions	7	

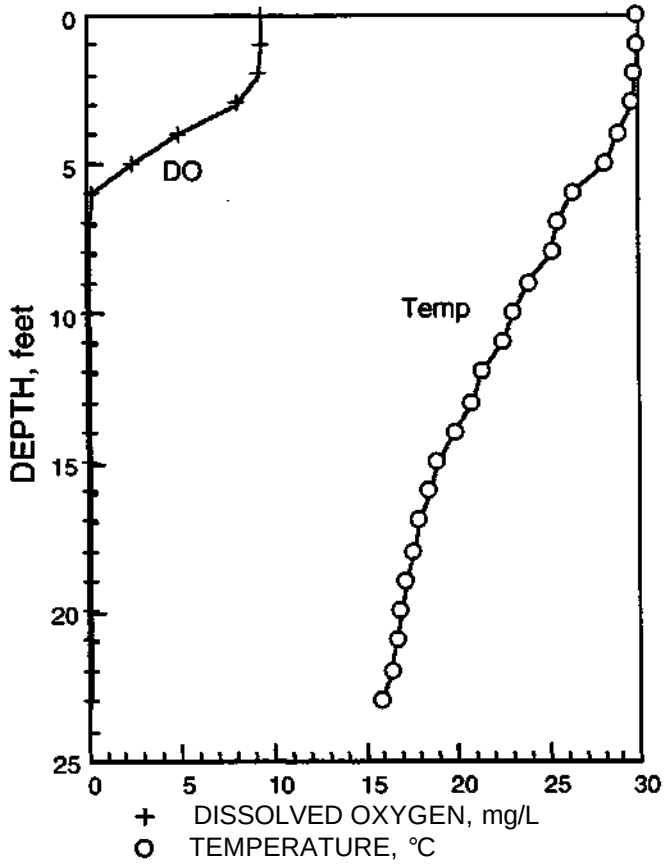
Tillage. %

No-till	10	Mulch till with ≥ 30% residue	20
Moldboard plow	11	Mulch till with <30% residue	13
Crop rotation	12	Chisel or disc till with ≥30% residue	14
Park	2	Pasture/hayland	5
Woodland	3	Wetland	2

Water and Sediment Qualities

Sampling Date	08/18/93
Site Number	**1**
Water Depth of Site, feet	**11**
Secchi Disc Transparency, inches	**20**
Chlorophyll *a*, µg/L	29.13
Chlorophyll *b*, µg/L	3.89
Chlorophyll *c*, µg/L	0.28
Pheophytin *a*, µg/L	3.50
Trophic State Index	67.9
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 14:30)



Water Quality (K: less than detection value)

Depth, feet	1	9
Total Suspended Solids, mg/L	**22**	**32**
Volatile Suspended Solids, mg/L	**7**	**9**
Turbidity, NTU	**12**	**10**
$N0_2/N0_3$-Nitrogen, mg/L	0.01 **K**	0.01**K**
Ammonia Nitrogen, mg/L	0.67	**0.12**
Total Kjeldahl Nitrogen, mg/L	0.97	**0.81**
Total Phosphorus, mg/L	0.098	0.146
Alkalinity, mg $CaCO_3$/L		
Total	**104**	**98**
Phenolphthalein	**0**	**0**
Field pH	**8.2**	**6.7**
Chemical Oxygen Demand, mg/L	**27**	**31**

Sediment Quality
(mg/kg ppm, K; less than detection value)

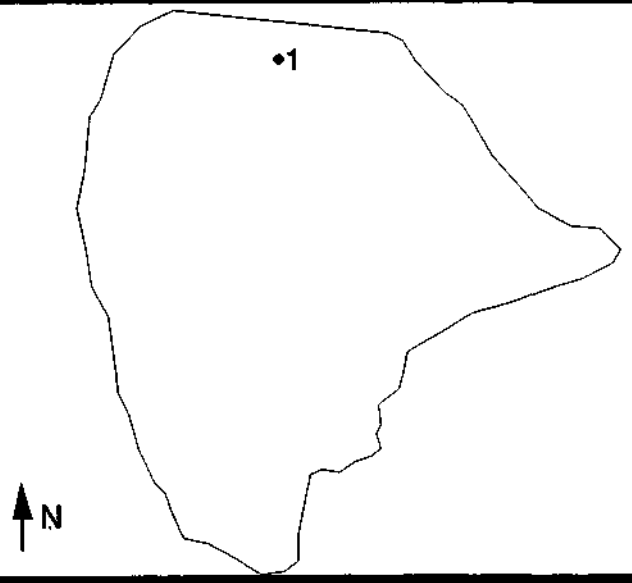
Phosphorus-P,ppm	754
Kjeldahl-N,ppm	**1110**
Solids, % wet	**38.0**
Vol. solids, %	**10.5**
TOC, %	**-**
Arsenic, ppm	**7.5**
Barium, ppm	297
Cadmium, ppm	**1K**
Chromium, ppm	**27**
Copper, ppm	**32**
Iron, ppm	27,000
Lead, ppm	**37**
Manganese, ppm	480
Mercury, ppm	0.1**K**
Nickel, ppm	23
Potassium, ppm	1800
Silver, ppm	1K
Zinc, **ppm**	106

Waterloo City Reservoir

Monroe County Map Code: RJH

City of Waterloo
104 W. 4th St., Waterloo, IL 62298
618/939-8661

General



Lake Location		2 miles SW of Waterloo
Deepest Point	Latitude	38° 48' 52"
	Longitude	90° 09' 36"
Lake Surface Area, acres		**29**
Length of Shoreline, miles		**1.0**
Maximum Depth, feet		**23**
Average Depth, feet		**14**
Lake Storage Capacity, acre-feet		**406**
Watershed Drainage Area, acres		530
Hydraulic Retention Time, years		**0.919**
Lake Type		Dammed stream
Year Constructed		1962
Ownership		Public
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed

Unique Features

The lake serves as one of three water supply sources. Water is pumped from Fountain Creek. Water can also be pumped into either Korte Lake or Schorr Lake.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access.

No. of Visitors per Year <25,000

Lake Use Support

Overall	P/Mi
Aquatic Life	Full
Swimming	P/Mo
Recreation	P/Mo

Non-recreational Lake Usage

Potable water supply - (4), P, I (500,000 gpd)

Recreational Lake Usage

Fishing - (4)

Recreational Facilities

Boat ramp (gravel), bank and boat fishing (electric trawlers only)

Shoreline Usage, %

Cropland	40
Pasture or grassland	35
Woodland	25

Watershed Drainage Area Usage, %

Cropland	75
Woodland	10
Recreation development	5
Water/wetland	9
Residential	1

Water Quality Problems

Problems

Suspended sediment	S
Sediment deposition	S
Algal blooms	S
Aquatic macrophytes	S
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	No
At different times of the year?	Yes

Fishing Fair

Major Types of Fish

Channel catfish, crappie, bluegill, bass, carp (lake has not been stocked in 10 years)

Causes of Quality Problems

Potential Pollution Sources

Urban storm drainage, runoff (cropland, pasture/grassland, woodland, lawn), sediment in lake, rough fish

Causes of Impairment

Nutrients	S	Organic/DO depletion	S
Siltation	S	Thermal modificiation	M
		Suspended solids	M

Sources of Impairment

Agriculture	M	Nonpoint sources	M
Pasture	M	Land development	S
Surface runoff	S	Algicide application	M

Waterloo City Reservoir

Lake Protection Management

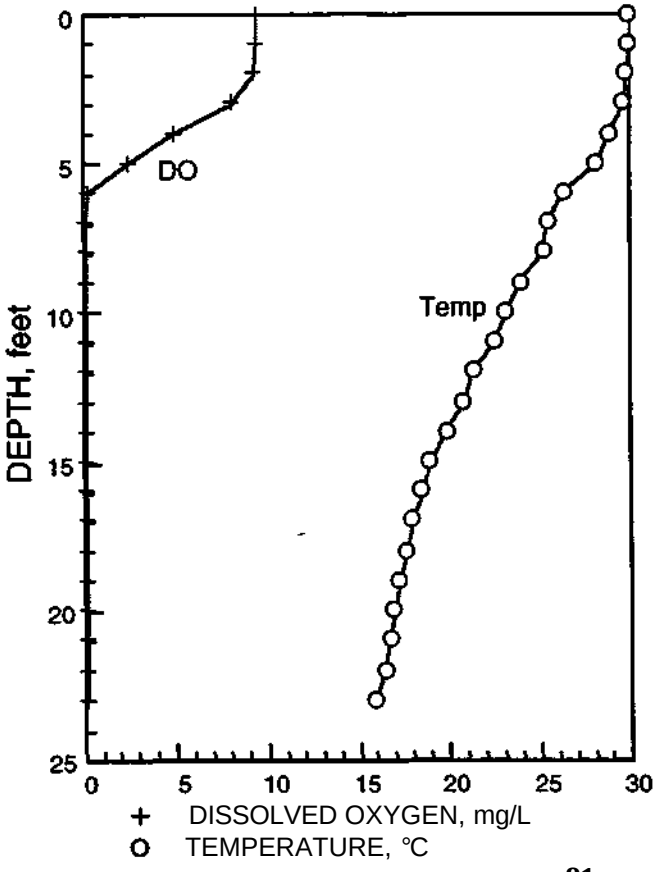
Treatment Date	Type and Extent of Treatment		Reason for Treatment
4/89	Terrace, linear ft.	1800	Erosion control
1969	Permanent vegetative cover, acre	21	Erosion control & park in urban subdivisions

Tillage. %			
No-till	15	Chisel or disc till with ≥30% residue	20
Woodland	10	Chisel or disc till with <30% residue	40
Park	5	Wildlife	2
Other-water	8	Residential	1

Water and Sediment Qualities

Sampling Date	07/29/93
Site Number	**1**
Water Depth of Site, feet	**23**
Secchi Disc Transparency, inches	31
Chlorophyll *a*, µg/L	32.93
Chlorophyll *b*, µg/L	9.75
Chlorophyll *c*, µg/L	**1.23**
Pheophytin *a*, µg/L	0.00
Trophic State Index	69.6
Trophic State	Eutrophic

DO & Temperature Profiles (Time, 11:30)



Water Quality (K: less than detection value)

Depth, feet	1	21
Total Suspended Solids, mg/L	**23**	**28**
Volatile Suspended Solids, mg/L	**6**	**18**
Turbidity, NTU	**14**	**26**
NO_2/NO_3-Nitrogen, mg/L	0.01**K**	0.01**K**
Ammonia Nitrogen, mg/L	**0.18**	**1.3**
Total Kjeldahl Nitrogen, mg/L	0.30	**1.3**
Total Phosphorus, mg/L	0.199	0.739
Alkalinity, mg $CaCO_3$/L		
Total	**71**	171
Phenolphthalein	**12**	**0**
Field pH	**8.8**	**7.0**
Chemical Oxygen Demand, mg/L	12	14

Sediment Quality

(mg/kg: ppm, K: less than detection value)

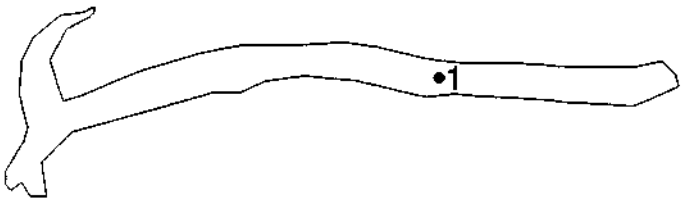
Phosphorus-P,ppm	633
Kjeldahl-N,ppm	452
Solids, % wet	39.4
Vol. solids, %	**6.1**
TOC, %	3.0
Arsenic, ppm	10.0
Barium, ppm	251
Cadmium, ppm	**1K**
Chromium, ppm	**22**
Copper, ppm	225
Iron, ppm	32,000
Lead, ppm	**25**
Manganese, ppm	1300
Mercury, ppm	0.1**K**
Nickel, ppm	**26**
Potassium, ppm	2300
Silver, ppm	1K
Zinc, **ppm**	80

Wesslyn Lake

Perry County Map Code: RNZA

Illinois Department of Conservation
Rt. 1, Box 290, Pinckneyville, IL 62274
618/357-2574

General



N

Lake Location		4 miles S of Pinkneyville
Deepest Point	Latitude	38° 01' 50"
	Longitude	89° 24' 29"
Lake Surface Area, acres		24.2
Length of Shoreline, miles		**3.3**
Maximum Depth, feet		**4.4**
Average Depth, feet		22
Lake Storage Capacity, acre-feet		**532**
Watershed Drainage Area, acres		**120**
Hydraulic Retention Time, years		-
Lake Type		Coal strip - mine
Year Constructed		**1950**
Ownership		State
Inflowing Streams		None
Outflowing Streams		None

Unique Features

Named after a nearby farmer. It is a long, narrow, and deep lake.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access.

No. of Visitors per Year 100,000 to 200,000

Lake Use Support

Overall	Full
Aquatic Life	Full
Swimming	Full
Recreation	Full

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (4), P, I
Low power boating - (3)
Camping - (3)
Waterfowl observation - (1)
Picnicking - (3)

Recreational Facilities

One boat ramp, camping facilities, picnic area, horseback riding, hunting (deer, rabbits, squirrels, wild quails, dove, muchroom)

Shoreline Usage, %

Woodland	100

Watershed Drainage Area Usage, %

Cropland	51
Woodland	42
Wetland/wildlife	5
Park/water	2

Water Quality Problems

Problems

Suspended sediment	M/N
Sediment deposition	M/N
Algal blooms	M
Aquatic macrophytes	M
Water level fluctuation	M
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	No
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Largemouth bass, bluegill, redear, crappie, catfish

Causes of Quality Problems

Potential Pollution Sources

Cropland runoff

Causes of Impairment

Nutrients	S

Sources of Impairment

Nonpoint source	S

Wesslyn Lake

Lake Protection Management

Treatment Date	Type and Extent of Treatment		Reason for Treatment
1970	Pond	1	
1984	Grassed waterway, acre	3	Erosion control
1984	Field border strip, ft.	2,600	
1984	Conservation cropping system	500	
1989	Critical area planting, acre	15	
1989	Grade stabilization structure	1	Erosion control

Tillage. %

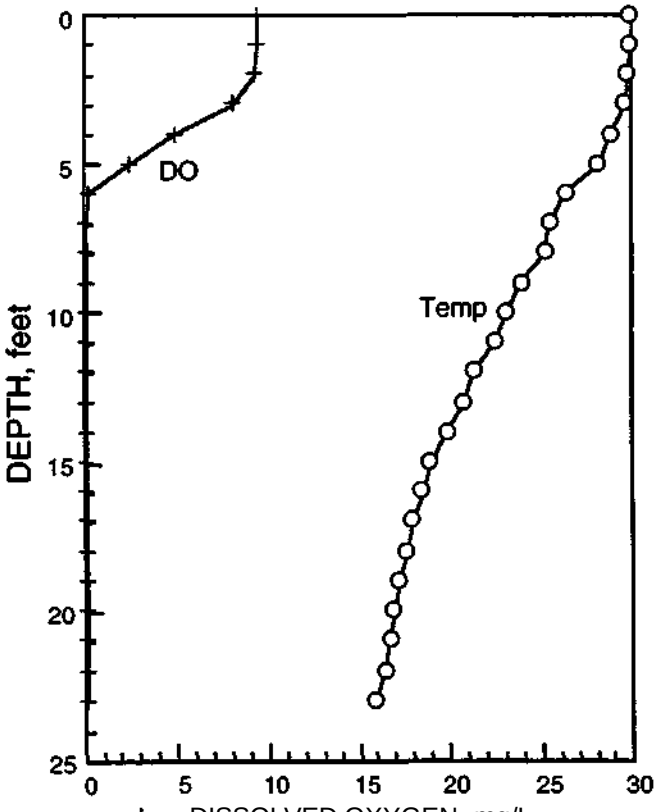
No-till	13	Mulch till with >30% residue	31
Woodland	42	Mulch till with <30% residue	1
Park	1	Chisel or disc till >30% residue	5
Wetland	2.5	Chisel or disc till <30% residue	1
Wildlife	2.5	Other-water	1

Comments: 10% (500 acres) of all cropland is in a crop rotation. All woodland is in a park.

Water and Sediment Qualities

Sampling Date		07/29/93
Site Number		**1**
Water Depth of Site, feet		35
Secchi Disc Transparency, inches		52
Chlorophyll *a*,	**µg/L**	8.34
Chlorophyll *b*,	**µg/L**	10.88
Chlorophyll *c*,	**µg/L**	**1**.79
Pheophytin *a*,	**µg/L**	3.92
Trophic State Index		37.2
Trophic State		Oligotrophic

DO & Temperature Profiles (Time, 15:30)



Water Quality (K: less than detection value)

Depth, feet	1	23
Total Suspended Solids, mg/L	**2**	**8**
Volatile Suspended Solids, mg/L	**1K**	**8**
Turbidity, NTU	**1.4**	**-**
$NO_2/N0_3$-Nitrogen, mg/L	0.01	0.04
Ammonia Nitrogen, mg/L	0.13	12
Total Kjeldahl Nitrogen, mg/L	0.37	12.8
Total Phosphorus, mg/L	0.001K	3.05
Alkalinity, mg $CaCO_3$/L		
Total	85	157
Phenolphthalein	10	**0**
Field pH	**8.6**	7.0
Chemical Oxygen Demand, mg/L	14	80

Sediment Quality

(mg/kg: ppm, K: less than detection value)

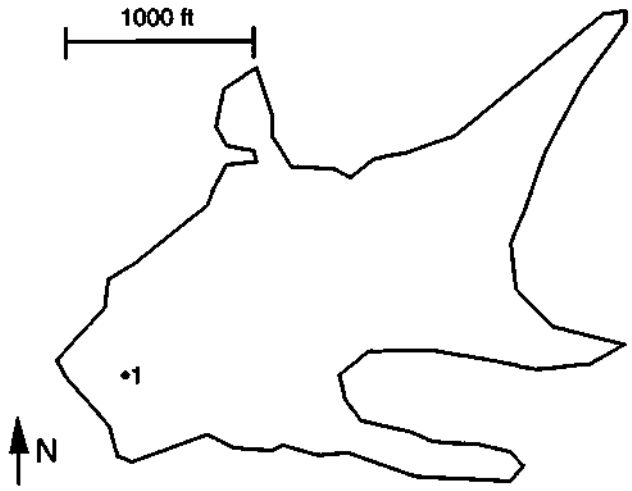
Phosphorus-P,ppm	319
Kjeldahl-N,ppm	557
Solids, % wet	56.0
Vol. solids, %	3.8
TOC,%	**1.6**
Arsenic, ppm	**5.4**
Barium, ppm	175
Cadmium, ppm	**1K**
Chromium, ppm	17
Copper, ppm	12
Iron, ppm	19,000
Lead, ppm	**14**
Manganese, ppm	250
Mercury, ppm	0.1**K**
Nickel, ppm	15
Potassium, ppm	1000K
Silver, ppm	**1K**
Zinc, ppm	41

Whoopie Cat Lake

Hardin County Map Code: RAZM

U.S. Forest Service
901 S. Commercial St., Harrisburg, IL
618/253-7114

General



Lake Location	3 miles NE of Elizabethtown	
Deepest Point	Latitude	37° 28' 30"
	Longitude	88' 19' 57"
Lake Surface Area, acres		26.5
Length of Shoreline, miles		**1.6**
Maximum Depth, feet		**33**
Average Depth, feet		**12**
Lake Storage Capacity, acre-feet		338
Watershed Drainage Area, acres		360
Hydraulic Retention Time, years		-
Lake Type		Dammed stream
Year Constructed		**1**977
Ownership		U.S. Forest Service
Inflowing Streams		Unnamed
Outflowing Streams		Unnamed

Unique Features

The lake was buitt by Job Corps. The dam leaks and seeps through stratified rock. Trees died. Root system withered, causing leak. Bentonite grouting was done twice, in 1991 and 1992.

Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access, unlimited free access

No. of Visitors per Year <25,000

Lake Use Support

Overall	Full
Aquatic Life	Full
Swimming	Full
Recreation	Full

Non-recreational Lake Usage

None

Recreational Lake Usage

Fishing - (3) Boating (electric only) - (2)
Swimming-(1) Picnicking - (2)
Camping - (2) Waterfowl observation - (3)

Recreational Facilities

Boat ramp, picnic area (primitive). Lake was used heavily for fishing (stocked once by IDOC)

Shoreline Usage, %

Woodland	100

Watershed Drainage Area Usage, %

Woodland	100

Water Quality Problems

Problems

Suspended sediment	M/N
Sediment deposition	M/N
Algal blooms	S
Aquatic macrophytes	M
Water level fluctuation	M
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	No
At different times of the year?	Yes

Fishing Good

Major Types of Fish

Largemouth bass, sunfish, catfish, crappie, bluegill, minnows

Causes of Quality Problems

Potential Pollution Sources

Woodland runoff, shoreline erosion

Causes of Impairment

Siltation S

Sources of Impairment

Surface runoff S

Whoopie Cat Lake

Lake Protection Management

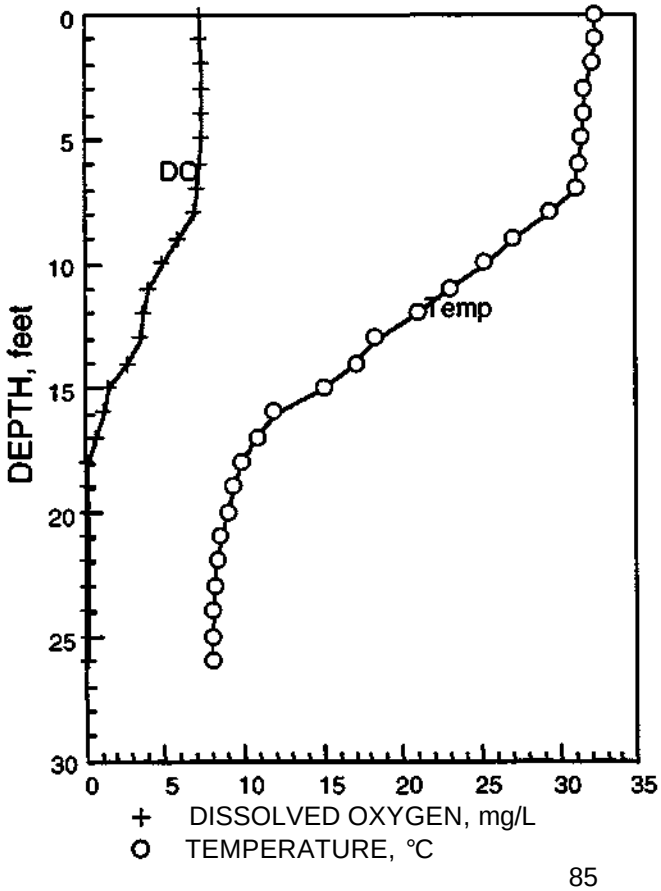
Treatment Date	Type and Extent of Treatment	Reason for Treatment
	None	

Comments: The lake is located in the U.S. forest preserve area (100% woodland)

Water and Sediment Qualities

Sampling Date		07/13/93
Site Number		**1**
Water Depth of Site, feet		**26**
Secchi Disc Transparency, inches		**133**
Chlorophyll *a*,	**µg/L**	8.54
Chlorophyll *b*,	**µ.g/L**	**1.80**
Chlorophyll *c*,	**µg/L**	**1.63**
Pheophytin *a*,	**µg/L**	0.43
Trophic State Index		32.9
Trophic State		Oligotrophic

DO & Temperature Profiles (Time, 14:30)



Water Quality (K: less than detection value)

Depth, feet	1	24
Total Suspended Solids, mg/L	**2**	**19**
Volatile Suspended Solids, mg/L	**1**	**9**
Turbidity, NTU	1.2	**1.4**
$N0_2/N0_3$-Nitrogen, mg/L	0.01**K**	0.01**K**
Ammonia Nitrogen, mg/L	0.01**K**	0.10
Total Kjeldahl Nitrogen, mg/L	0.63	0.70
Total Phosphorus, mg/L	0.001**K**	0.014
Alkalinity, mg $CaCO_3$/L		
Total	**79**	**89**
Phenolphthalein	**0**	**0**
Field pH	**7.7**	**6.8**
Chemical Oxygen Demand, mg/L	**16**	11

Sediment Quality

(mg/kg: ppm, K: less than detection value)

Phosphorus-P.ppm	585
Kjeldahl-N,ppm	1593
Solids, % wet	**28.2**
Vol. solids, %	10.3
TOC,%	**1.8**
Arsenic, ppm	**9.3**
Barium, ppm	219
Cadmium, ppm	**17**
Chromium, ppm	**26**
Copper, ppm	22
Iron, ppm	43,000
Lead, ppm	**47**
Manganese, ppm	1200
Mercury, ppm	**1K**
Nickel, ppm	**34**
Potassium, ppm	2400
Silver, ppm	**1K**
Zinc, ppm	79

Appendix A. Water Temperature (° C) and Dissolved Oxygen (mg/L) Data for 25 Illinois Lake Sites

Depth (feet)	Christopher New 7/30/93		Christopher Old 7/30/93		Clear 8/12/93		East Fork 8/11/93		Greenville 8/18/93	
	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
0	30.2	9.4	29.9	11.5	25.5	6.7	27.4	9.8	30.0	15.3
1	30.5	9.4	30.0	11.5	25.8	6.5	27.4	9.9	29.6	11.9
2	30.3	9.7	29.9	11.3	25.8	6.5	27.3	10.0	29.5	11.1
3	30.2	9.5	29.9	11.1	25.8	6.5	27.3	10.1	28.7	6.6
4	30.1	9.2	29.9	10.9	25.8	6.4	27.2	10.1	27.9	2.6
5	29.9	8.6	29.7	8.5	25.7	6.4	27.1	10.1	27.4	0.8
6	29.8	7.4	28.7	0.4	25.6	6.2	27.0	9.8	26.5	0.2
7	28.9	0.3	26.4	0.2	25.4	6.1	27.0	9.8	25.5	0.1
8	27.3	0.2	22.5	0.1	25.4	5.9	27.0	9.6	24.6	0.1
9	25.6	0.1	21.9	0.1	25.3	5.7	26.9	6.5	23.5	0.1
10	24.4	0.1	19.2	0.1	25.1	5.6	26.6	5.7	22.8	0.1
11	22.6	0.1	17.0	0.1	24.9	5.5	26.4	5.1	20.4	0.1
12	21.3	0.1	16.0	0.1	24.7	5.5	26.3	4.8	18.2	0.1
13	20.0	0.1	14.7	0.1	24.5	5.4	26.2	4.0	16.7	0.1
14	18.2	0.1	13.9	0.1	23.0	5.1	26.0	2.9	15.9	0.1
15	17.1	0.1	13.1	0.1	21.2	5.0	25.5	1.7		
16	16.3	0.1	13.0	0.1	20.0	4.9	25.2	1.0		
17			12.9	0.1	18.8	4.8	24.9	0.1		
18			12.6	0.1	17.4	4.6	23.0	0.1		
19					16.0	4.3	21.7	0.1		
20					14.6	4.0	19.8	0.1		
21					14.0	3.9	18.6	0.1		
22					13.1	3.8	17.8	0.1		
23					12.2	3.7	16.9	0.1		
24					11.4	3.4	16.1	0.1		
25					10.1	3.0	15.7	0.1		
26					9.8	2.6	15.1	0.1		
27					9.1	2.3	14.7	0.1		
28					8.6	2.0	14.3	0.1		
29					8.3	1.5	13.9	0.1		
30					8.1	1.1	13.5	0.1		
31					7.9	0.9	13.4	0.1		
32					7.7	0.8	12.9	0.1		
33					7.4	0.7				
34					7.3	0.6				
35					7.3	0.4				
36					7.2	0.3				
37					7.2	0.2				
38					7.1	0.1				
39					7.1	0.1				
40					7.0	0.1				
42					6.9	0.1				
44					6.7	0.1				
46					6.6	0.1				
48					6.5	0.1				

Appendix A. Continued

Depth (feet)	Harrisburg 7/13/93		Harrisburg Holding-North 7/13/93		Harrisburg Holding-South 7/13/93		Jaycees 7/14/93		Johnston City 7/12/93	
	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
0	31.2	10.7	30.5	7.5	31.3	6.9	29.6	9.1	32.5	10.4
1	31.3	10.8	30.6	7.6	31.1	6.8	29.6	9.2	32.4	11.1
2	31.3	10.5	30.6	7.6	31.1	6.8	29.6	9.2	31.5	10.2
3	31.1	10.0	30.6	7.6	31.1	6.8	29.6	9.1	31.2	8.9
4	30.7	9.7	30.6	7.6	31.1	6.8	29.6	9.1	30.9	8.1
5	30.4	8.2	30.5	7.5	30.8	6.7	29.6	9.0	30.9	6.0
6	30.1	7.2	30.5	7.4	30.7	6.7	29.6	8.9	30.7	2.6
7	29.9	6.3	30.3	4.1	30.5	4.9	29.5	8.8	30.0	1.9
8	29.8	5.9	29.9	3.2	29.5	2.6	28.6	4.4	29.8	0.3
9	29.5	3.8	29.5	1.5	29.2	1.7	27.5	1.0	28.7	0.2
10	29.0	2.5	29.0	0.3	28.6	0.7	27.1	0.3	28.1	0.2
11	28.5	1.1	28.7	0.2	28.2	0.3	26.4	0.1	27.2	0.2
12	27.6	0.2					25.6	0.1	25.0	0.2
13	24.6	0.2					24.6	0.1	24.0	0.2
14	22.5	0.2					23.7	0.1		
15	21.1	0.2					23.3	0.1		
16	20.1	0.2					21.7	0.1		
17	19.1	0.2					19.6	0.1		
18	18.1	0.2					18.8	0.1		
19	17.3	0.2					17.9	0.1		
20	17.0	0.2					17.5	0.1		
21	16.6	0.2					17.1	0.1		
22	16.3	0.2								
23	15.9	0.2								
24	15.6	0.2								
25	15.5	0.2								

Appendix A. Continued

Depth	*Loami* 8/19/93		*Mattoon-Site 1* 8/10/93		*Mattoon-Site 2* 8/10/93		*Mingo* 8/12/93		*Palmyra-Modesto* 8/19/93	
(feet)	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
0	30.0	2.1	27.4	7.5	28.8	12.5	25.2	9.3	27.9	5.7
1	29.0	1.8	27.3	7.4	28.7	12.7	25.3	9.3	28.0	5.5
2	28.9	1.8	27.2	.7.3	28.6	13.0	25.3	9.2	28.0	5.6
3	28.6	1.7	26.9	7.3	28.3	12.2	25.0	8.5	28.0	5.5
4	28.4	1.6	26.3	5.2	28.2	11.2	24.7	7.6	27.9	4.5
5	28.2	1.6	26.0	4.1	27.4	6.8	24.6	7.4	27.9	3.3
6	28.2	1.6	25.9	4.1	26.5	4.2	24.5	6.3	27.9	3.2
7	28.1	1.7	25.9	3.9	26.3	3.1	24.3	5.6	27.9	3.3
8	26.7	0.4	25.9	2.7	26.2	2.4	24.1	4.2	27.8	3.2
9	26.7	0.3	25.8	1.7	26.1	1.8	24.0	2.9	27.8	3.2
10	26.7	0.3	25.8	1.5	26.1	1.5	23.7	1.7	27.8	3.1
11	26.6	0.3	25.8	0.6	26.1	1.4	23.6	1.0	27.8	3.0
12	26.6	0.3	25.7	0.3	26.0	0.8	23.3	0.4	27.8	2.9
13	26.6	0.3	25.7	0.1	25.9	0.1	22.6	0.2	27.8	2.9
14	26.7	0.3	25.7	0.1			21.6	0.2	27.7	2.9
15	26.7	0.3	25.7	0.1			20.8	0.1	27.7	2.8
16	26.6	0.3	25.6	0.1			19.1	0.1	27.7	2.8
17	26.5	0.3	25.6	0.1			17.2	0.1	27.7	2.7
18			25.6	0.1			16.3	0.l	27.7	2.6
19			25.6	0.1			15.7	0.1	27.7	2.5
20			25.6	0.1			14.8	0.1	27.6	2.4
21			25.5	0.1			14.2	0.1	27.6	2.3
22			25.1	0.1			13.8	0.1	27.6	2.3
23			24.9	0.1			13.1	0.1	27.5	2.1
24			24.7	0.1			12.6	0.1	27.4	1.6
25			24.1	0.1			12.4	0.1	27.2	1.4
26			23.6	0.1			11.8	0.1	26.4	0.3
27			23.5	0.1			11.4	0.1	25.9	0.2
28			23.1	0.1			11.3	0.1		
29			22.5	0.1			11.1	0.1		
30			22.2	0.1			11.2	0.1		
31			22.1	0.1			11.1	0.1		
32							11.2	0.1		
33							11.2	0.1		
34							11.0	0.1		
35							11.1	0.1		

Appendix A. Continued

Depth (feet)	Paradise-Site 1 8/10/93		Paradise-Site 2 8/10/93		Red-Hills State 8/11/93		Tecumseh 7/13/93		Vernor 8/11/93	
	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
0	26.0	7.4	26.8	9.8	30.5	8.4	33.9	7.9	27.0	10.4
1	26.0	7.3	26.7	9.9	29.3	9.4	33.9	7.9	27.1	10.5
2	26.0	7.2	26.4	8.8	27.7	9.8	33.9	8.0	27.1	10.3
3	26.0	6.8	26.1	7.8	27.1	9.3	33.7	8.0	27.1	9.8
4	26.0	6.8	26.0	7.6	26.8	8.7	33.3	8.0	27.0	8.3
5	26.0	6.5	26.0	7.4	26.6	8.7	33.0	8.0	26.5	0.6
6	25.9	6.1	26.0	7.1	26.1	4.7	31.8	8.0	26.1	0.2
7	25.9	6.1	26.0	7.0	25.3	0.4	30.8	6.9	25.7	0.2
8	25.9	6.1	26.0	7.0	23.6	0.1	29.3	4.3	24.8	0.2
9	25.9	6.0	25.9	6.9	22.1	0.1	25.7	2.2	23.3	0.2
10	25.9	6.0	25.9	6.9	20.0	0.1	23.7	0.6	20.5	0.2
11	25.9	5.9	25.9	6.9	17.8	0.1	19.6	1.2	19.0	0.1
12	25.9	5.9	25.9	6.9	16.2	0.1	18.1	0.5	18.0	0.1
13	25.9	5.8	25.9	6.9	15.2	0.1			16.7	0.1
14	25.9	5.6	25.9	6.9	14.1	0.1			15.5	0.1
15	25.9	4.8	25.9	6.9	13.3	0.1			13.8	0.1
16	25.9	4.1			12.4	0.1			12.8	0.1
17	25.8	2.8			11.4	0.1			11.9	0.1
18	25.9		1..2		10.9	0.1			11.5	0.1
19	25.8	0.4			10.8	0.1			11.0	0.1
20					10.8	0.1			10.4	0.1
21					10.6	0.1			10.0	0.1
22					10.5	0.1			9.6	0.1
23					10.5	0.1			9.5	0.1
24					10.5	0.1			9.2	0.1
25					10.6	0.1			9.0	0.1
26					11.0	0.1			8.6	0.1
27					11.0	0.1			8.5	0.1
28									8.2	0.1
29									8.2	0.1

Appendix A. Concluded

Depth	Vienna Corr. Ctr. 7/12/93		Walton Park 8/18/93		Waterloo City 7/29/93		Wesslyn 7/29/93		Whoopie Cat 7/13/93	
(feet)	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
0	33.3	7.9	29.5	5.6	29.9	9.5	32.1	9.6	32.3	7.3
1	33.2	7.9	29.4	4.8	29.9	9.5	32.2	9.7	32.4	7.3
2	33.1	8.0	29.3	3.4	29.8	9.3	32.2	9.7	32.1	7.4
3	33.1	8.0	29.1	2.4	29.6	8.1	32.1	9.8	31.7	7.5
4	33.0	8.0	28.8	1.2	28.8	5.0	31.9	10.0	31.6	7.5
5	32.9	8.1	28.5	0.5	28.2	2.5	31.6	10.0	31.5	7.4
6	32.7	8.2	28.1	0.2	26.4	0.3	31.1	9.9	31.3	7.3
7	32.4	8.2	28.0	0.1	25.5	0.2	30.5	10.2	31.1	7.2
8	29.5	8.5	26.9	0.1	25.2	0.2	29.2	8.1	29.4	6.9
9	27.8	9.0	26.1	0.1	23.9	0.2	28.2	6.8	27.1	6.0
10	26.4	9.2	25.5	0.1	23.1	0.2	26.3	2.6	25.3	4.9
11	23.9	6.1	25.4	0.1	22.5	0.2	23.5	0.6	23.0	4.1
12	22.5	3.1			21.3	0.2	21.8	0.1	21.1	3.7
13	19.7	0.2			20.8	0.2	19.9	0.1	18.4	3.6
14	17.3	0.2			19.9	0.2	18.1	0.1	17.1	2.8
15	15.9	0.2			18.9	0.2	16.2	0.1	15.2	1.6
16	14.6	0.2			18.5	0.2	14.8	0.1	12.0	1.3
17	13.7	0.1			17.9	0.2	13.9	0.1	10.9	0.7
18	12.8	0.1			17.6	0.2	12.1	0.1	9.9	0.3
19	12.0	0.1			17.2	0.2	11.2	0.1	9.5	0.2
20	11.2	0.1			16.9	0.2	11.0	0.1	9.0	0.2
21	10.8	0.1			16.7	0.2	10.7	0.1	8.6	0.2
22	10.5	0.1			16.4	0.2	10.0	0.1	8.4	0.2
23					15.9	0.2	9.7	0.1	8.2	0.2
24							9.6	0.1	8.1	0.2
25							9.4	0.1	8.0	0.2
26							9.0	0.1	8.0	0.2
27							9.0	0.1		
28							8.8	0.1		
30							8.6	0.1		
31							8.7	0.1		
32							8.6	0.1		
33							8.7	0.1		
34							8.8	0.1		
35							8.9	0.1		