

CARLYLE LAKE

WATER QUALITY

REPORT

for

1997

U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
ENVIRONMENTAL QUALITY SECTION - Water Quality

Ted Postol, Section Chief
Tori Foerste, Environmental Engineer
Donna Zoeller, Environmental Technician
Ron Frerker, Chemist

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WATER QUALITY MONITORING PROGRAM

Carlyle Lake, Carlyle, IL

1.0 GENERAL OVERVIEW

Carlyle Lake is within the Kaskaskia River basin in central Illinois. The lake serves as a heavy recreational usage lake and as a water supply to numerous communities. The land surrounding the lake is used predominately for agriculture. Surrounding communities have existing industrial/commercial operations and residents which discharge wastewaters into municipal wastewater treatment plants which ultimately discharge treated water into the Kaskaskia River basin. Agricultural runoff and municipal wastewater treatment facilities are the primary potential source of pollution into the Carlyle Lake watershed. Additional sources are marinas, recreational watercraft discharges and effluent from nearby subdivisions and golf course.

Water quality monitoring was conducted during 1997 to assure the safe conditions for human recreation, wildlife and aquatic life was maintained and managed within the lake system. The 1997 water quality monitoring program began in March and continued through December. Monitoring was conducted on six week intervals for a total of six sampling/analysis events. Four sampling stations are sampled during each sampling event with one site selected for quality control duplication and denoted as C-15. The locations of the four sampling stations are depicted in the lake map in Appendix A.

2.0 WATER QUALITY ASSESSMENT CRITERIA

The water quality assessment criteria is based upon the State of Illinois regulatory limits for certain contaminants and generally accepted criteria for sustaining adequate aquatic plant and animal growth. The sampling and analysis conducted for Carlyle Lake reflects the minimal set of parameters needed to indicate the current status of water quality for the lake system.

The following parameters were analyzed in FY97 sampling at Carlyle Lake: alkalinity, total organic carbon (TOC), iron, manganese, ammonia-nitrogen, nitrate-nitrogen, orthophosphate, total phosphate, silica, total suspended solids (TSS), total volatile suspended solids (TVSS), fecal coliform and fecal streptococcus bacteria, pH, temperature, dissolved oxygen, specific conductance, oxidation-reduction potential (ORP), chlorophyll, pheophytin-a, atrazine and alachlor.

The Illinois Environmental Protection Agency in Title 35, Subtitle B, C. and D classify water quality criteria based on end usage. Subpart B contains regulations for general use water, while subpart C and D delineate those for public and food processing water and secondary contact and indigenous aquatic life standards, respectively. These standards are used to determine the aquatic water quality of the lake. Table 2.1 provides a listing of

the regulatory limits for the parameters analyzed where a limit has been established.

TABLE 2.1

**State of Illinois
Water Quality Standards**

PARAMETER	LIMIT
Alkalinity	≥ 20 mg/l
Ammonia Nitrogen	15 mg/l
Nitrate-Nitrogen	10 mg/l
Iron	1.0 mg/l
Manganese	0.05 mg/l
Phosphorous as Phosphate	0.05 mg/l
Fecal Coliform	< 200 colonies/100 ml
Chloride, Chronic	230 mg/l
Chloride, Acute	860 mg/l
pH	Range: 6.5 to 9.0
DO	> 5.0 mg/l
Atrazine	0.003 mg/l (Drinking Water Standard)
Alachlor	0.002 mg/l (Drinking Water Standard)

Monitoring of the alkalinity provides the measurement of the buffering capacity of lake water as well as the effect on the toxicity of certain pollutants in the water (i.e., algae blooms and decay). Ammonia nitrogen is monitored so that the effects on fish spawning, hatching, growth rate and pathologic changes in gills, liver and kidney tissue can be related to the detected levels of ammonia nitrogen. Nitrate-nitrogen degrades to nitrite or produces ammonia which has a detrimental effect on aquatic life and therefore is monitored to assure levels are below the regulatory "safe" limit. The metals manganese and iron are nutrients for both plant and animals. Phosphate is analyzed as phosphorus and is monitored due to the potential for uptake by nuisance algae. Levels of phosphate can indicate the potential for rapid growth of algae (algae bloom) which can cause serious oxygen depletion during the algae decay process. Serious oxygen depletion has a major effect on aquatic life. Photosynthetic activity can be hindered by the levels of total suspended solids. Total suspended solids concentrations which cause the photosynthetic activity to be reduced by more than 10% from the seasonably established norm, would have a detrimental effect on aquatic life. Silica, chlorophyll and pheophytin-a are monitored to provide indicators of algae growth and therefore potential oxygen depletion activity. Total volatile solids indicate the presence of organics in suspension and therefore additional demand levels of oxygen. Fecal coliform bacteria is monitored for the protection of human health as it relates to full body contact of lake waters. pH and dissolved oxygen are monitored for the protection of aquatic life. Atrazine and Alachlor herbicides are commonly used agricultural chemicals which can be readily transported by rainfall runoff. Both compounds are suspected of causing cancer and therefore are monitored for the protection of human and aquatic health.

3.0 SPECIAL STUDIES

The collection of sediments at all lake sites was continued in 1997. This study is being conducted to establish baseline levels. There is not a regulation for sediments. The composition of sediments vary for different areas. The data may provide supplemental information as to the relative amount of contaminants transported by sediments versus contaminants dissolved in the water column. This study will provide useful information into what contaminants bottom fish and other aquatic life are ingesting. It would also give an indication into what reactions take place during lake turnover. Lake turnover can have an effect on the oxidizing of metals. Trend analysis of this data will be performed every five years. The parameters analyzed include: fourteen (14) priority pollutant metals, total phosphate (TPO₄), Kjeldahl nitrogen, nitrate-N (NO₃), total solids, total organic carbon (TOC), chlorinated pesticides and PCB's. The results for chlorinated pesticides and PCB analysis were below the detectable limits for 1997.

4.0 WATER QUALITY MONITORING RESULTS

The laboratory analytical results for water samples are summarized in Table C-1, Appendix C. Analytical results of detected levels are plotted in graphical form on Graphs C-1a through C-1h, Appendix C.

Field collected analytical results are summarized in Table D-1 through D-3, Appendix D. A graphical presentation of field results are presented in Graphs D-1a through D-3, Appendix D.

Laboratory results for sediment samples are summarized in Table E-1, Appendix E.

5.0 SUMMARY OF MONITORING RESULTS

The seasonal change brought on a gradual lake stratification during the summer months. The stratification was less dramatic than previous years and therefore overall sudden detrimental water quality changes such as algae blooms and dramatic dissolved oxygen reductions were not experienced in the lake system.

Bacteria levels were elevated in the early spring and could be attributed to surface water runoff carrying additional wildlife wastes into the lake during a time of seasonably increasing temperatures. Bacteria levels decreased to within acceptable limits throughout the remainder of the year.

The metals manganese and iron were seen at slightly elevated levels within the lake waters but no evidence exists that demonstrate the levels are detrimental to the overall lake system at this time.

The 1997 phosphate results demonstrate that levels are above the required standard. The increased levels of phosphate in combination with nitrogen and other lake conditions such as temperature, pH and stagnant lake conditions can lead to increased algae growth. The resulting detrimental effects of algae toxins and oxygen depletion could result in health problems for fish and land animals utilizing the water supply.

The monitoring program for Carlyle Lake during FY97 revealed a good water quality when compared to limits established by the Illinois Environmental Protection Agency (IEPA) for general use, secondary contact and indigenous aquatic life. Agricultural nutrient runoffs are primary concerns for the lake water quality. Better land management practices, erosion control and buffering zones are methods to reduce these contaminants from entering the lake. The St. Louis District personnel will continue working with lake personnel, area communities and agencies in implementation of educational and implementation planning to bring about the use of better management techniques which will improve the lake water quality.

6.0 PLANNED 1998 STUDIES

The Carlyle Lake water quality monitoring was continued in FY97. A total of six sampling events were conducted between March and November on approximately six week intervals. Carlyle Lake provides water supply to many communities and is a high usage recreational lake. The monitoring of water quality is imperative to assure the water quality is within acceptable limits for the designated usages.

During FY97 one new real time thermistor system was installed within the lake near the Hazlet State Park. The system will be utilized by the St. Louis District and lake personnel to assist with tracking and monitoring of fish spawning. In addition, the new system will assist the St. Louis District in assessing and predicting changes in water quality as they relate to temperature stratification. A temperature profile is being obtained from the system which is set up to read water temperature from the lake surface to a maximum depth of thirty-five (35') feet. An existing real time thermistor system located near the Boulder Access Area of Carlyle Lake was upgraded during FY97. The system was replaced with a new data collection platform (dcp) and a thermistor string for profiling the water temperature from one (1') foot to four (4') foot depth. Currently the St. Louis District is preparing to post the Carlyle Lake thermistor systems daily data on the internet website to aid the lake personnel and general public in accessing the data during FY98.

Recent recreational and residential development in the vicinity of Carlyle Lake has warranted the need for adding two (2) additional water quality monitoring sites. The two (2) sites proposed are in the vicinity of the governor's Run Golf Course and the adjoining new subdivision. Two (2) additional tributary sampling sites are proposed for sediment sampling during FY98. Sediment sampling from the two (2) tributary streams will provide a baseline analysis of inflowing sediments so that future environmental impacts from upgradient sources can be determined.

An additional lake sampling site is proposed for sampling in the vicinity of Cole's Creek which, prior to lake construction, had crude oil producing wells. The area is suspected to have natural gas and crude oil leakage into the lake bottom as a result of

improperly plugged crude oil wells. The lake sampling site would be analyzed for the standard list of parameters, total recoverable petroleum hydrocarbons (TRPH) and oil and grease. Data will be reviewed in an attempt to determine if possible leaking wells are having a detrimental environmental effect on the water quality of the lake.

Planning for the removal of underground storage tanks (USTs) located at the West Dam Marina was initiated during FY97. Total removal of the existing system is planned for FY98. The removal and remediation of the area surrounding the system will assure the water quality of the lake is not impacted by leaking USTs.