DIAGNOSTIC/FEASIBILITY STUDY FOR SPRING AND PRIOR LAKES
SCOTT COUNTY, MINNESOTA

PRIOR LAKE/SPRING LAKE WATERSHED DISTRICT

Prepared by:

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July 1993

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FOREWORD

This limnological study of Spring and Prior Lakes was conducted in response to local concerns over poor water quality. The project was a joint endeavor between many levels of government. Funding was provided from the Prior Lake/Spring Lake Watershed District. The U.S. Environmental Protection Agency through the Clean Lakes Program provided 50% cost share for the project. The State of Minnesota Pollution Control Agency provided project management and technical review.

This report contains two separate sections, the Diagnostic Study, and the Feasibility Report. The diagnostic portion of the report provides a description of the watershed, a compilation of both existing and new water quality data, develops numerical water quality goals, and the necessary water quality improvements to meet the water quality goals. The Feasibility Report compiles and evaluates remedial alternatives. The alternatives are reviewed as to their technical feasibility, cost, and their expected benefit. Ultimately, the feasibility report offers a group of alternatives which provide a feasible, cost-effective plan to meet the performance standards developed in the Diagnostic Study.

EXECUTIVE SUMMARY

This report presents the results and recommended Implementation Plan for the Diagnostic/Feasibility Study on Prior and Spring Lakes. The project was a joint effort and was funded by the Prior Lake/Spring Lake Watershed District (PS/SLWD) and EPA through a 50% cost share in the Clean Lakes Program. The State of Minnesota's Pollution Control Agency (PCA) provided technical review and project management.

DIAGNOSTIC STUDY

The Diagnostic Study included a 12-month water quality monitoring program and subsequent data and land use assessments which characterized the sources of water quality problems on the lakes. The Feasibility Study evaluates the various alternatives for water quality improvement and develops the Implementation Plan for the project.

Spring, Upper Prior, and Lower Prior Lakes are important recreational resources. Spring Lake is a focal point for the planned Regional Park which will include a swimming beach. Upper and Lower Prior Lakes are connected, have public access and swimming beaches.

Algal blooms are the primary problems restricting desired uses of Spring and Upper Prior Lakes. These blooms are excessive during the growing season with chlorophyll-a concentrations averaging 45 µg/l and 35 µg/l for Spring and Upper Prior Lakes, respectively. Blooms of this magnitude place both lakes in the worst 33% of lakes in the Central Hardwoods Region. Lower Prior Lake has much better water quality and is in the best 33% of lakes in the Central Hardwoods Region.

Primary productivity (algal growth) in Upper Prior and Lower Prior Lakes is clearly limited by the availability of phosphorus. Primary productivity in Spring Lake is not always phosphorus-limited. This is due to extremely high phosphorus concentrations in Spring Lake, making it overly abundant. Even though Spring Lake is not always phosphorus-limited, phosphorus is still the primary pollutant targeted for reductions for several reasons:

- Phosphorus levels can be reduced to the point where it again becomes limiting.
- It is generally easier to reduce phosphorus than other nutrients.

- The algal species dominating Spring Lake are blue-greens which can fix their own nitrogen.

- Reducing nitrogen without equal or greater reductions of phosphorus could give a greater competitive advantage to blue-green algae.

- Primary productivity in Upper Prior Lake, which receives 55% of its phosphorus budget from Spring Lake, is clearly phosphorus-limited.

The direct watershed area to Spring Lake encompasses 13,250 acres. This large watershed gives Spring Lake a relatively short hydraulic residence time of 1.3 years. The western portion of the direct watershed to Spring Lake is dominated by agricultural land uses. These uses consist primarily of row crops. Approximately 23% of the direct watershed to Spring Lake is highly erodible soils. Streams from these watersheds contribute 41% of the total phosphorus load to Spring Lake. Because of the large amount of highly erodible land and the high phosphorus loading to Spring Lake, these subwatersheds were classified as high priority for implementation of agricultural Best Management Practices (BMPs).

Internal phosphorus loading is significant in Spring Lake. Internal loading is estimated to contribute 33% of the total phosphorus load in Spring Lake. Internal loading causes the buildup of soluble reactive phosphorus within Spring Lake. This form of phosphorus is the most readily available form for algal uptake. Approximately 60% of the phosphorus in Spring Lake is soluble. Management of soluble phosphorus and internal loading in Spring Lake will be important for improving Upper Prior Lake as well as Spring Lake.

Upper Prior Lake has a relatively small lake volume. This gives the lake a short hydraulic residence time of 0.2 years and means that controlling external phosphorus sources are particularly important for improving the lake. Prior Lake receives 55% of its phosphorus from Spring Lake. Thirty-five percent of the remaining phosphorus load comes from the direct drainage area to Upper Prior Lake. Much of the shoreline is highly developed. Lawn maintenance to the water's edge is a common practice. In addition, city areas south of the lake are heavily developed. Few opportunities exist for stormwater system retrofits or for new stormwater quality basins. Public education will be important for urban areas surrounding Upper Prior Lake.

The water quality of Lower Prior Lake is fairly good. However, there are significant development pressures, particularly along the north shore of the lake. Wise development will be important in maintaining the quality of Lower Prior Lake.

FEASIBILITY STUDY

In the Feasibility Study, a number of alternatives were evaluated to reach phosphorus concentration goals. These alternatives range from administrative alternatives such as fertilizer management education programs to structural alternatives such as wetland restoration. Each option was evaluated for potential water quality benefits, estimated initial and long-term (operation and maintenance) costs, and technical feasibility. The most technically sound and cost-effective options were incorporated into the Implementation Plan for improving the lakes.

Special consideration was given to alternatives that address problems and reduce pollutant loadings at their source, and to alternatives that have the potential to reduce runoff as well as phosphorus. The Feasibility Study also identifies numerous existing water quality initiatives by the PL/SLWD and other local agencies. The Implementation Plan was designed to complement these existing initiatives, particularly land development regulations. Parts of the PL/SLWD are currently experiencing rapid urban development. Areas without sewer are being developed as single family 10-acre lots. The Implementation Plan improves regulation of this transition through revised wet pond design criteria, by developing methods for ensuring maintenance of water quality facilities, and by public education efforts. The final plan includes the following elements:

- A public information/education program which will focus on fertilizer management, yard waste management, septic system maintenance, enlisting public support, and improving non-point source pollution prevention practices by local landowners.

- Amendments to the District's 509 Plan including revisions to water quality pond design criteria, clarification of responsibilities for maintaining stormwater facilities, and amendments to protect landlocked basins.

- A fertilizer management incentive program to encourage agricultural operators in the priority watersheds to utilize soil tests and manage agricultural nutrients that will achieve profitable crop production and reduce nutrient runoff.

- Promotion of no-till farming through the purchase of a no-till drill for use by farmers in the priority watershed.

- Promotion of aquascaping as a means of establishing residential shoreline buffers.

- Modifications to existing stormwater basins to improve phosphorus sedimentation and reduce phosphorus loading to the lakes.

- The restoration of four priority wetland areas to reduce the phosphorus load to Spring Lake, provide flood storage, and wildlife habitat.

- A ferric chloride chemical feed system to reduce the inflow of dissolved phosphorus from County Ditch 13 to Spring Lake.

- Aeration of Spring Lake to reduce internal cycling of phosphorus.

- Development of lake-wide aquatic macrophyte management plans to facilitate long-term comprehensive aquatic macrophyte management following treatment of Eurasian water milfoil.

- Improvements to a northern pike spawning area on Lower Prior Lake.

The estimated cost of implementing the plan over the six-year project duration is $774,070. Implementation of the plan will reduce phosphorus loading to Spring Lake, Upper Prior Lake, and Lower Prior Lake by 40%, 30%, and 20%, respectively. These reductions will significantly reduce the frequency and severity of algal blooms. A reduction in algal blooms will also decrease the volume of organic matter which contributes to sediment oxygen demand. Reducing algal blooms will also increase water clarity. The improved conditions will be sufficient to change Spring Lake from non-supporting to partially supporting swimming. Water clarity in Upper Prior Lake will increase by an estimated 0.8 feet.

One consequence of improving water clarity may be an increase in the growth of aquatic macrophytes (weeds). Increased light penetration may allow weed growth into deeper waters. This should be viewed as improving the biological health and diversity of the lakes. This change will also be addressed as part of the aquatic macrophyte management plans.

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SECTION I

INTRODUCTION

Spring Lake, Upper Prior Lake, and Lower Prior Lake are a chain of lakes located in Scott County, Minnesota southwest of the Minneapolis- St. Paul metropolitan area. The lakes have provided an important recreational resource since the area was first settled in the mid-1800s. This study was conducted to identify the existing and potential sources of water quality degradation and to improve the three lakes by reducing the occurrence of blue-green algae blooms on the lakes. Spring lake was previously studied in depth by Osgood (1983). This study builds on the work completed by Osgood and included a comprehensive monitoring program for Upper and Lower Prior Lakes. Results of this investigation are presented in two studies, a diagnostic study and a feasibility study.

The diagnostic study describes the lakes and their watershed. The study also includes a comprehensive water quality monitoring program. The goals of this study are to characterize and quantify the sources contributing to water quality degradation, and develop numerical water quality goals for the lake. The feasibility study compares potential remedial alternatives and develops an implementation plan with management activities to meet the numerical goals.

This study is presented in four major sections. A description of the lakes and their watershed is compiled, including information such as local land use and potential point and non-point pollution sources. Secondly, a detailed limnological assessment is made utilizing previously collected data, data from the current monitoring program, and water quality computer simulations. Lastly, a water quality assessment is made which defines numerical water quality goals. These goals are used to develop an implementation plan.

SECTION 2

WATERSHED DESCRIPTION

The following section provides a description of the Prior Lake-Spring Lake Watershed. It has been divided into three major topics, a description of the lakes, a description of the land, and a summary of known or potential pollution sources.

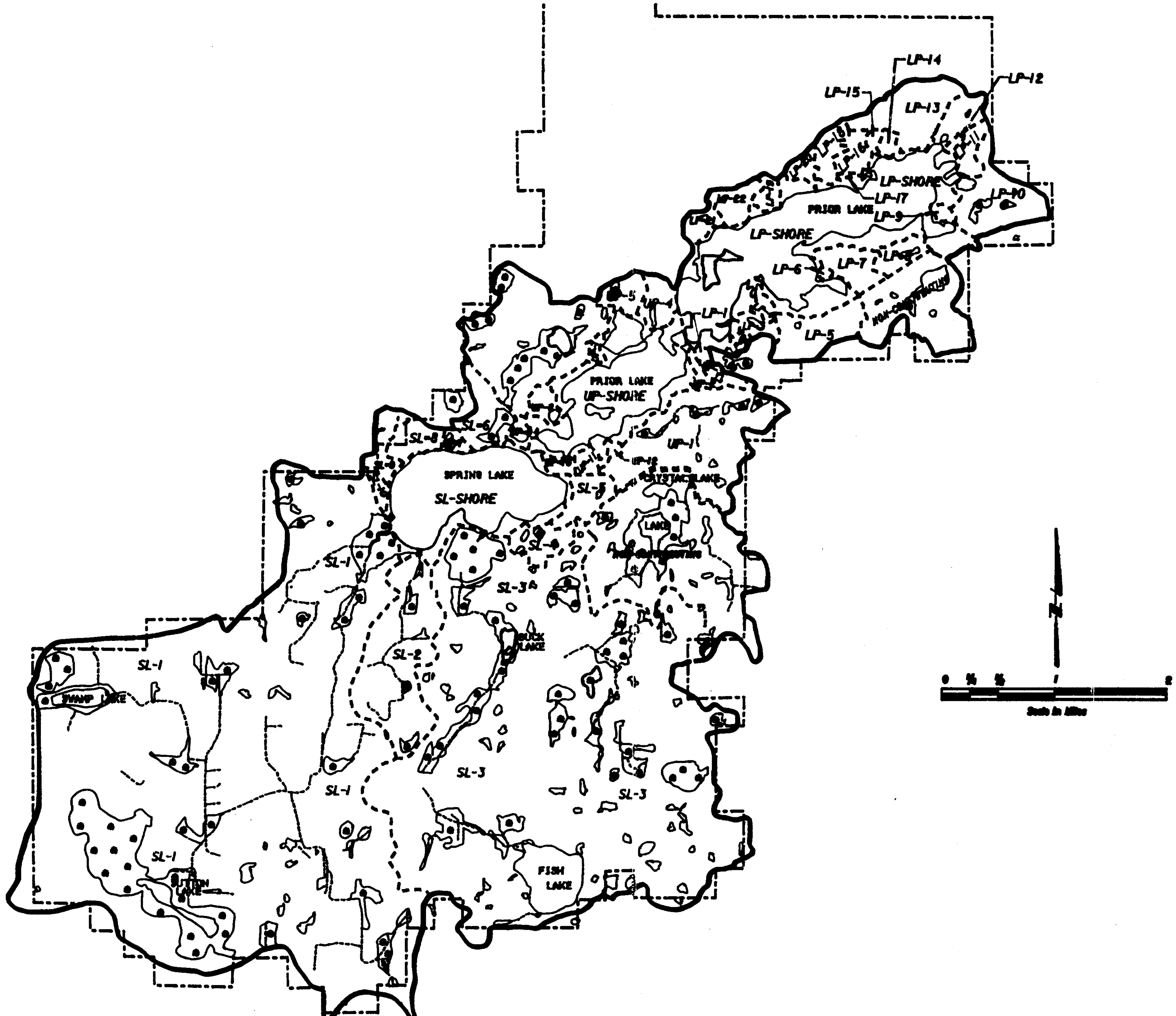
LAKE DESCRIPTION

Spring Lake, Upper and Lower Prior Lakes are all contained within the Prior Lake-Spring Lake Watershed District (Table 2-1, Figure 2-1). The 42 square mile watershed lies within Scott County, Minnesota, some 20 to 30 miles southwest of Minneapolis. The watershed is bounded by the Lower Minnesota River, Sand Creek, and Credit River Watersheds. The nearest city is Prior Lake with a population of about 10,000.

TABLE 2-1

LOCATION OF STUDY SITE

Name	Spring	Upper Prior	Lower Prior
County	Scott	Scott	Scott
Latitude	44°42'03"	44°42'55"	44°44'05"
Longitude	93°28'13"	93°26'40"	93°24'25"
Township, Range	T114N, R22W, Sections 4,5,8,9,10	T114N, R22W, Sections 2,3,4	T115N, R21W, Section 30
		T115N, R22W, Sections 34,35	T115N, R22W, Sections 25,26,35,36
Department of Natural Resources I.D. Number	70-0054	70-0072	70-0026



JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	*Prior Lake/Spring Lake Watershed* **Lakes and Watershed**	2-1

Physical Description

Spring Lake, Upper Prior Lake, and Lower Prior Lake are a chain of lakes. Spring Lake is physically separate from Upper Prior while Upper and Lower Prior Lakes were originally one body of water. The construction of the Chicago, Milwaukee, St. Paul and Pacific Railroad causeway across a narrow section of Prior Lake over a number of years effectively separated it into two lakes by 1930. Since then, the two have been connected only by a narrow channel of water.

Of the three lakes existing today, Lower Prior has the greatest surface area and maximum depth (Table 2-2). Spring Lake, however, has the greatest mean depth. Upper Prior Lake is the smallest of the three in surface area, depth, and volume.

TABLE 2-2

PHYSICAL DESCRIPTION OF SPRING LAKE, UPPER PRIOR LAKE, AND LOWER PRIOR LAKE

Parameter	Spring Lake		Upper Prior		Lower Prior	
Surface Area in ac (ha)	631	(255.3)	340	(137.6)	827	(334.8)
Maximum Length in mi (km)	1.6	(2.57)	1.5	(2.41)	3.0	(4.83)
Mean Width in mi (km)	0.62	(1)	0.35	(0.57)	0.43	(0.69)
Shoreline Length in mi (km)	5.0	(8.1)	6.8	(11.0)	15.1	(24.3)
Maximum Depth in ft (m)	34	(10.4)	43	(13.1)	56	(17.1)
Mean Depth in ft (m)	18	(5.63)	8	(2.4)	13	(4.1)
Volume in ac-ft (m^3)	11,674	(14.4×10^6)	2,675	(3.3×10^6)	11,107	(13.7×10^6)
Number of Inlets	2		2		1	
Number of Outlets	1		1		1	
Thermocline	Yes		Yes		Yes	
Direct Watershed:Lake Ratio	21		10		2.5	

Lake Uses

In this section, current uses of the three lakes are compared to historical uses. In addition, lake use are compared to uses on other lakes in the area.

Historical Uses. The area around Spring and Prior Lakes has never had much industrial activity. A small grist and mill dam operated between Spring and Prior Lakes during the 1800s.

The lakes have a long history of recreational use. The Grainwood Resort opened in 1879, only four years after Prior Lake Village was incorporated. The railroad continued to bring visitors and many smaller resorts were started, including Fish Point, Schraeder's, and Spring Lake Pavilion (Paul Durand, personal communication). Many of the resorts were pictured on postcards: Fish Point (1907), Grainwood Landing (1906-1910), and Spranks Resort (1910-1940).

By 1940, Spring Lake had 59 cottages, 5 resorts, and more than 125 boats used for fishing, boating, and other recreational purposes. Upper Prior had 96 cottages and cabins, 5 resorts, and 150 boats. Lower Prior had 90 cottages, 2 resorts, and more than 150 boats (Department of Conservation, 1940).

Current Uses. Spring and Prior Lakes are heavily utilized for recreational purposes due to their proximity to a large urban population. There are over 2,000,000 residents of the Minneapolis-St. Paul metropolitan area and another 200,000 living in cities within a 50-mile radius.

All three lakes are classified as Group I water resources by the Prior Lake-Spring Lake Watershed District. They have the highest degree of District importance due to regional recreational significance, support of high body contact uses, game fishing resources, and high accessibility (Prior Lake-Spring Lake Watershed District, 1986).

There are four public boat ramps on the lakes: one on the northeast end of Lower Prior, one on the southwest end of Upper Prior, and two on Spring Lake: one to the southwest and one to the north. The latter is located in Spring Lake Regional Park. A swimming beach is planned as part of the regional park, however, the poor existing water quality in Spring Lake limits the value of starting a beach.

Spring Lake Regional Park (162 ha) is part of a network of 54 planned regional parks, park reserves, and special use sites within the metropolitan area (Metropolitan Development Guide, Volume 2, pages 15-16). The majority of these parks have existing or proposed boat ramps and swimming beaches. Recreational facilities are also found at many of the remaining 942 lakes within the seven counties of the Metropolitan Area.

Overall, 16.5 million water-related occasions take place annually in the metropolitan region (Osgood, 1983). The Minnesota Department of Natural Resources (DNR) conducted a use survey of Spring, Upper, and Lower Prior Lakes in 1981 (Table 2-3). Fishing was the predominant use of the lakes, ranging from 127.59 person-hours/acre on Upper Prior to 50.42 person-hours/acre on Lower Prior. Most fishing was by boat. Fishing pressure has doubled on metropolitan area lakes judging by creel census (Gilbertson, personal communication). The level of use on Spring, Upper, and Lower Prior Lakes is particularly high. For example, the fishing use on White Bear, Bald Eagle, and Peltier Lakes in the northern metropolitan area is 32.8, 36.4, and 40.3 person-hours/acre, respectively (MDNR, 1987, 1989a, 1989b). Although no creel census have been conducted on Spring or Prior Lakes, they appear to have experienced the same increase in pressure. The DNR data does not include the category of swimming.

Two established swimming beaches exist: Sand Pointe on the north shore of Lower Prior Lake, and Watzl's Point at the southern end. During the summer season, an average of 350 people swim at Sand Pointe during a weekday, and the number increases to 650/day on the weekends. Watzl's Point Beach has 75 swimmers/day during the week and 200/day on the weekend. On an annual basis, visitor occasions at Sand Pointe Beach average from 29,600 to 47,900 and from 8,800 to 12,350 at Watzl's Point.

The beach at Spring Lake Park would increase the total recreational use of the lakes considerably if the estimate of 92,000 annual user occasions by the year 2000 is accurate (Metropolitan Council, 1987). However, "Swimming has not been popular in the lake for some time. Further lake degradation may adversely affect activities on the lakeshore and fishing (Osgood, 1983)."

Use of Other Local Lakes. The Prior Lake chain is "sandwiched" between other recreational use lakes within a 50-mile (80 km) radius. Ten or fifteen miles to the north lie a number of Twin Cities lakes, such as Minnetonka, Calhoun, and Harriet. Forty miles to the south and southeast between Mankato and Faribault lie a number of lakes such as Lake Elysian, Eagle Lake, Lake Washington, and Madison Lake. Between these two sets of lakes, the Prior Lake chain represents the only major recreational opportunity.

TABLE 2-3

PERSON-HOURS OF RECREATIONAL USE/ACRE
(Person-Hours/Acre)

	Mid-May to Mid-September 1981 Spring	Upper Prior	Lower Prior
Fishing	63.73	127.59	50.42
Runabouts	8.01	54.24	56.99
Water Skiing	1.87	8.43	4.77
Sailing	1.08	2.61	4.09
Canoes/Rowboats	0	0.87	1.78
Pontoon/Houseboats	0.87	8.47	6.55
Inflatable Rafts	0	0	0.27
Paddleboats	0.5	0.57	0.82
Jet Skis	0.15	0	0.34
Windsurfers	0	0.14	0
Breakdown of Fishing			
Boat	94.6%	46%	85.8%
Dock	2.5	6	7.5
Bank	2.9	88	6.7

Gilbertson, 1988, personal communication.

LAND DESCRIPTION

The watershed contributing runoff to Prior and Spring Lakes is shown in Figure 2-1. The watershed area is approximately 15,000 acres and is divided into subwatersheds as shown. Subwatershed areas are listed in Table 2-4. Most of the watershed lies in agricultural areas to the south of Spring Lake.

TABLE 2-4

SUBWATERSHED AREAS (ACRES)

Spring Lake		Upper Prior		Lower Prior	
SL-1	5,312	UP-1	589.6	LP-1	10.4
2	1,140	2	19.7	2	18.8
3	3,884	3	36.7	3	38.1
4	112	4	74.7	4	20.5
5	95	5	65.3	5	168.4
6	141	6	615.5	6	7.1
7	26	7	19.4	7	106.6
8	86	8	50.6	8	65.9
9	63	9	25.9	9	15.9
10	35	10	25	10	291.4
Shoreland	126	11	27.6	11	51.6
		12	15.5	12	8.6
		Shoreland	235.1	13	440.3
				14	21.9
				15	14.5
				16	64
				17	6.7
				18	55.8
				19	38.2
				20	35
				21	47.4
				22	72.6
				Shoreland	497
Total	**11,020**		**1,800.6**		**2,096.7**

Land Uses

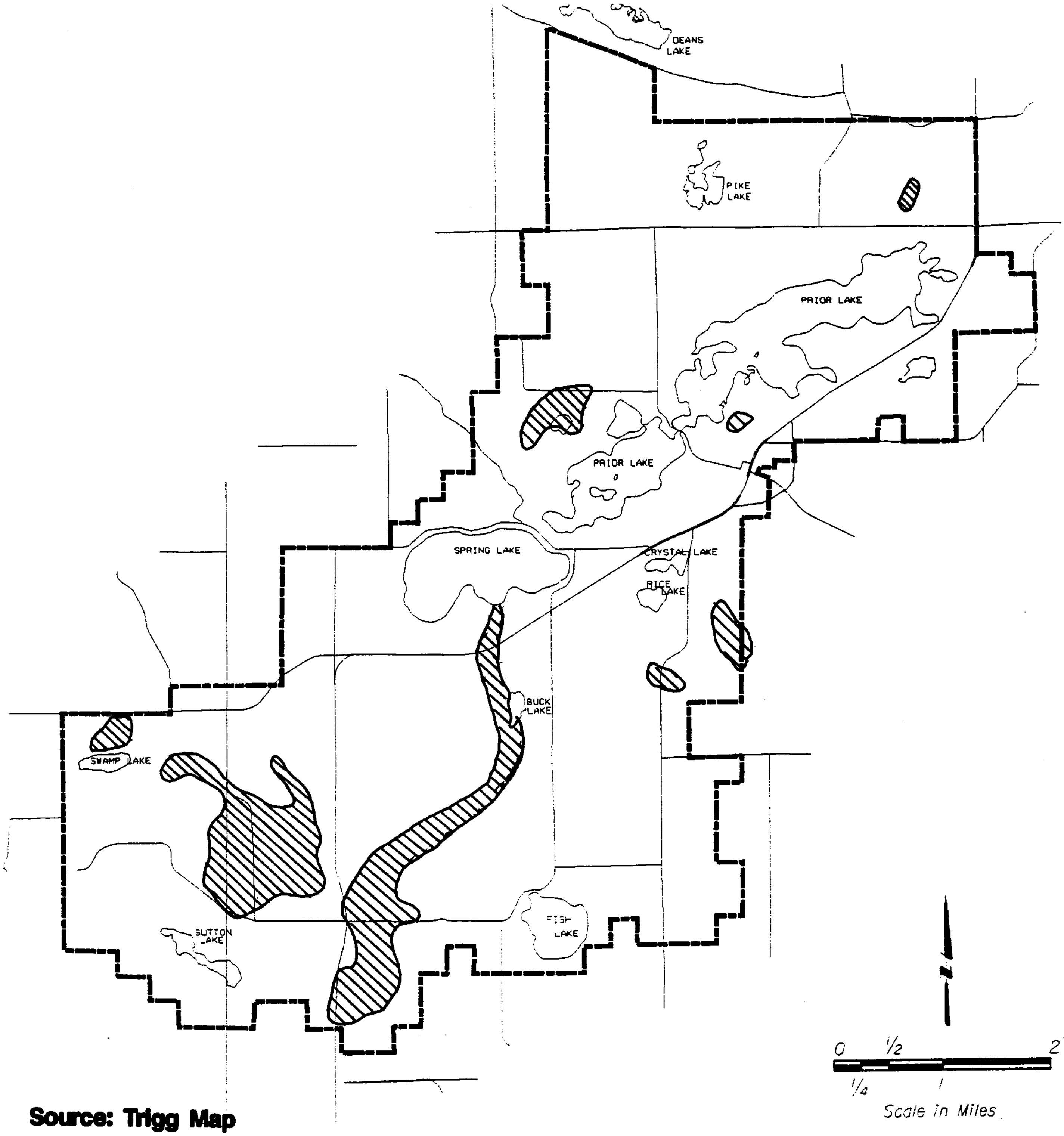
Historical Land Uses. Most of the land within the Prior-Spring Lake Watershed has been used for agriculture since the area was settled. Aerial photographs taken in 1951 and published as part of the 1955 soil survey show lakeshore development restricted to the southeast shore of Upper Prior Lake near what is now downtown Prior Lake. Less than 5 percent of the shoreline of the three lakes appeared developed then.

Historically, the watershed was covered with hardwood forests and contained numerous wetlands. Figure 2-2 shows the locations of historical wetlands as observed by the original land surveys conducted in 1855.

Current Land Uses. The biggest single land use within the Prior-Spring Watershed is agricultural (44 percent), but much of the northern part of the watershed has been developed. Aerial photographs taken in 1983 showed the opposite of the 1951 photographs, with less than 5 percent of the shoreline of the three lakes remaining undeveloped. A watershed reconnaissance completed in April 1993 confirmed the high degree of existing shoreline development. Most shoreline residents maintain lawns to the water's edge and many have installed sand blankets.

Current land use for each of the subwatersheds shown in Figure 2-1 is listed in Table 2-5. The existing land use map is presented as Figure 2-3. The Spring Lake subwatersheds as a group are predominantly agricultural (55 percent). The direct watershed to Upper Prior is mostly open area (50 percent), while Lower Prior is mostly single family residential (49 percent). Urban developments are primarily residential located adjacent to natural amenities with limited commercial industrial developments within the Prior Lake city limits. The predominate type of residential development in the District is the single family home with concentrations oriented toward Spring and Prior Lakes, wooded slopes, and ponding areas. Commercial/industrial use is scattered along Highway 13 through the City of Prior Lake consisting of warehousing, storage of construction equipment, and service-oriented businesses. Rural land use is mainly agricultural-related with farm size being about 150 acres. Crop and pasture lands are both utilized with the main crops being corn and soybeans and cattle grazing for pasture. There are isolated land areas throughout the Watershed District due to the hilly moraine topography which makes the land unsuitable or too expensive for development. These areas are considered natural environment with these lands sometimes being dedicated as parks or public open space.

Historic Wetlands (1855)



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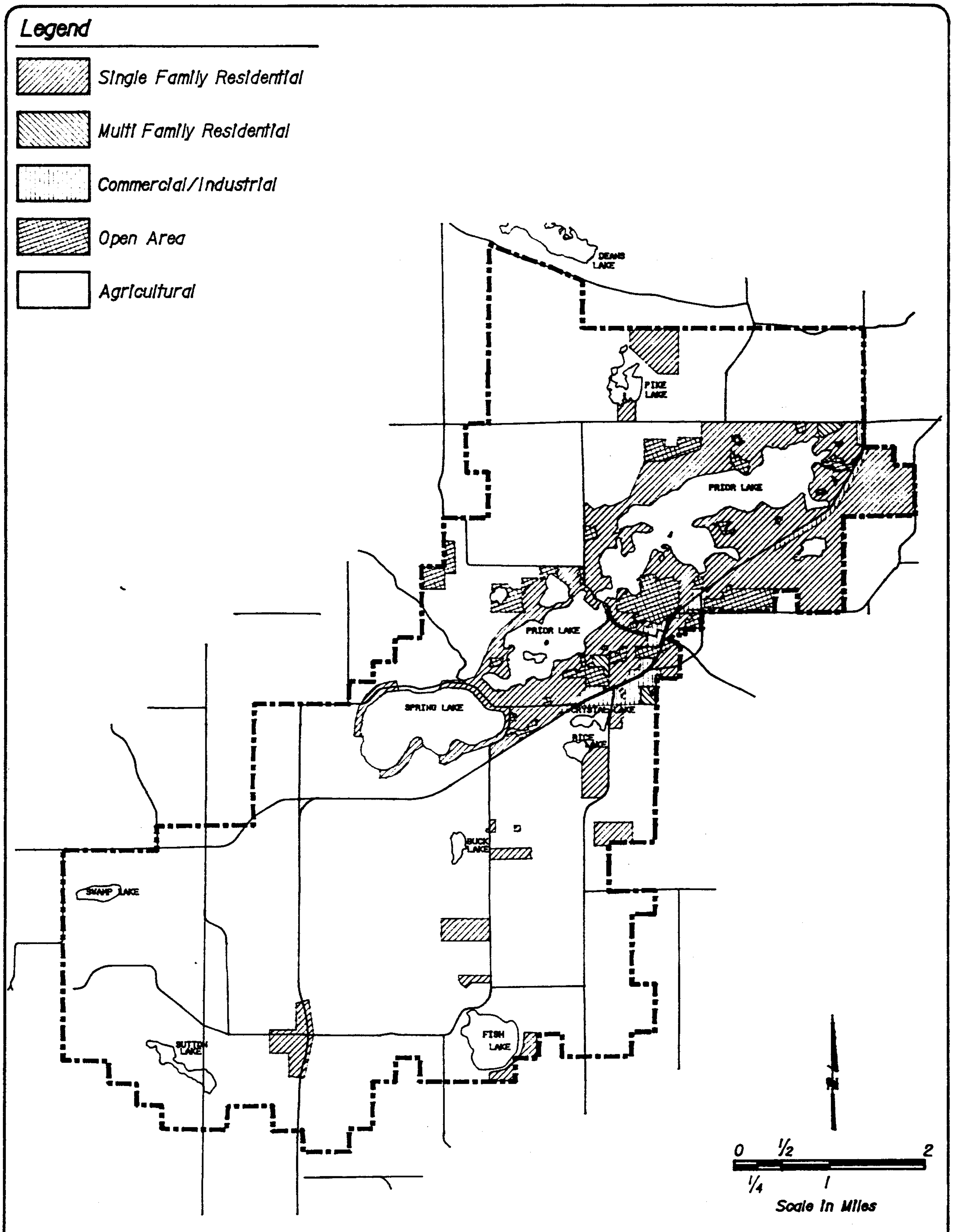
JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	Historic Wetlands	2-2



JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	*Prior Lake/Spring Lake Watershed* *EXISTING LAND USE MAP*	*figure* **2-3**

TABLE 2-5

CURRENT SUBWATERSHED LAND USE

Totals	Spring Lake	Upper Prior	Lower Prior	Watershed
Area (acres)	10,992	1,800	2,094.7	14,886.7
Open Water (%)	9.7	4.6	1.3	7.9
Undeveloped/Open	17.9	49.7	20.2	22.1
Wooded	6.2	5.4	14.6	7.3
Range	0.0	0.0	4.4	0.6
Pasture	0.0	0.0	0.0	0.0
Crop	55.3	16.1	7.4	43.8
Single Family Residential	10.6	20.6	48.8	17.2
Multi-Family Residential	0.0	0.0	0.0	0.0
Mixed Urban	0.0	0.0	0.0	0.0
Commercial/Industrial	0.3	3.6	2.3	1.0

Recent trends of land use patterns within the District indicate intense residential development for the municipality of Prior Lake especially adjacent to the lakes. Agriculture has experienced a modest decline in cropland acres and in the number of farms. However, much of the soil within the District is classified by the Soil Conservation Service as good farmland with an area by Sutton's Lake as a prime agricultural area, so agriculture should remain a priority land use in the rural area despite the decline. Existing land use maps prepared by Scott County and the City of Prior Lake were used to prepare Figure 2-3.

Future Land Use. Future land use plans from the City of Prior Lake and Scott County Comprehensive Plans indicate recent trends in land use should continue within the District. The City of Prior Lake's intense residential development will continue with the population predicted to be 15,750 by the year 2000 by the Metropolitan Development Framework Plan. The comprehensive plan indicates a need for commercial services area, industrial land, and public open space. The land area outside the urban growth for the City but yet within the City limits shall remain agricultural if so desired. The main emphasis area of growth for the City of Prior Lake in the next few years is predicted to be on the northwest side of Lower Prior Lake. The City plans to promote development in existing developments and to discourage scattered urbanization.

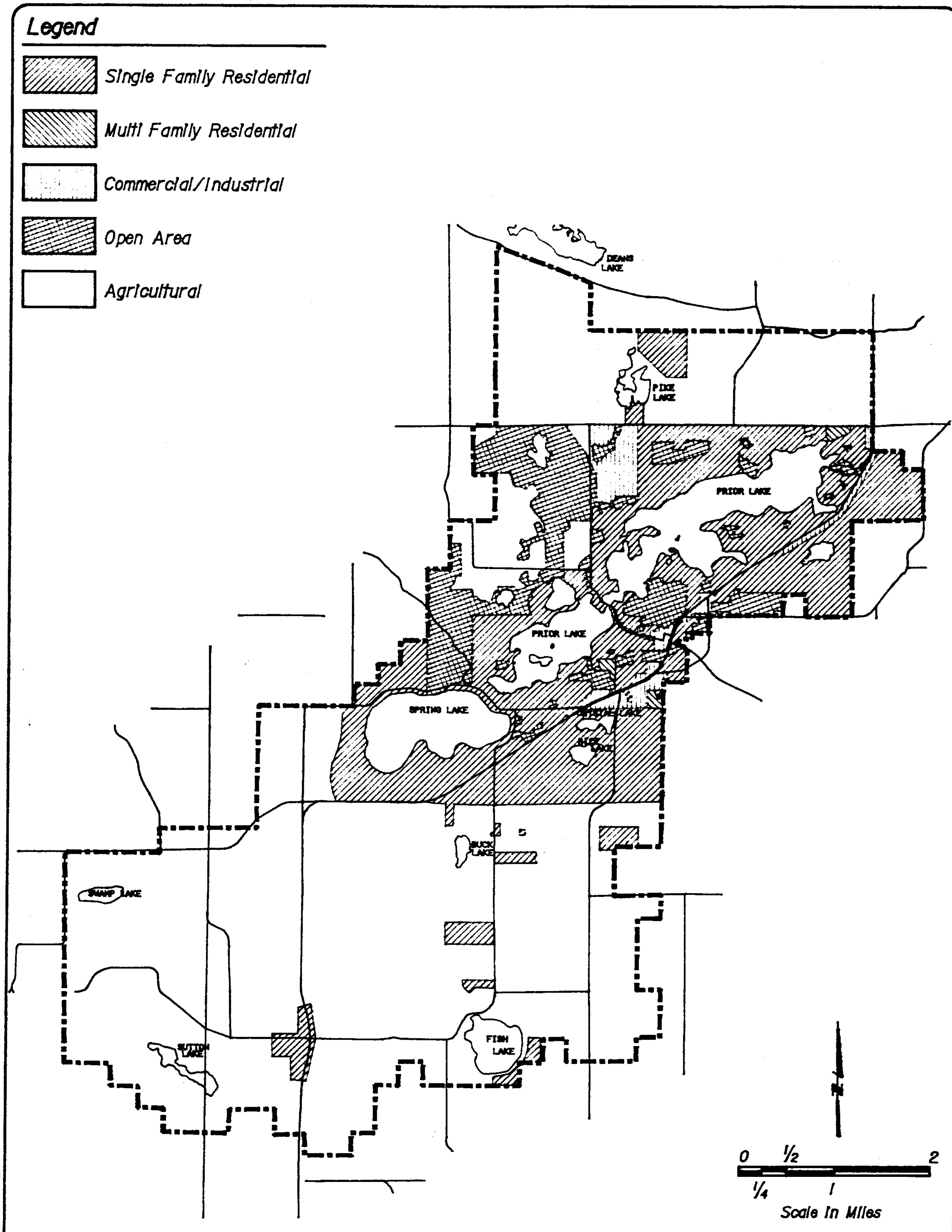
The Scott County Planning Department, as indicated in their comprehensive plan, will discourage the development of rural land into residential subdivisions and attempt to preserve agricultural land outside of city limits. The land south of the City of Prior Lake in the District is zoned A-2 for Spring Lake Township and A-1 for Sand Creek Township. A-2 and A-1 zoning requires a minimum of 10 acres/lost and 40 acres/lot, respectively, for a building permit, thus encouraging agricultural land use. Rural land should remain an agricultural land use barring intense pressure to urbanize which is not foreseen.

In summary, the land use in the District is seen as basically urban dominated in the area around Spring and Prior Lakes with rural land use dominating south of the lakes. Future land use is seen as more residential urban growth around the lakes especially the northwest area of Lower Prior Lake with an emphasis on preserving agricultural land outside the city limits within the District. Scott County and the City of Prior lake have prepared future land use maps of the watershed area. This information is summarized in Figure 2-4.

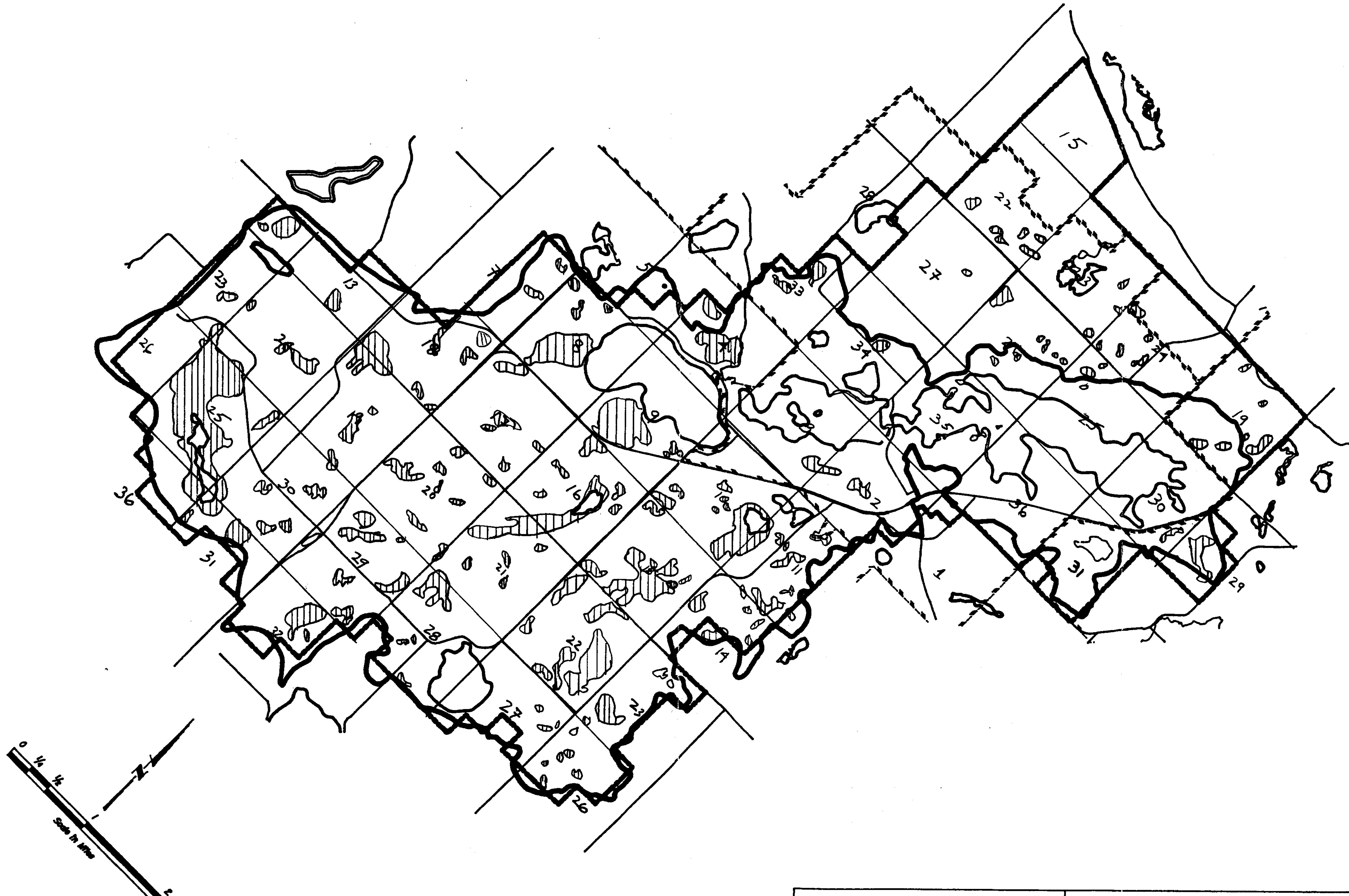
Wetlands. Scott County has lost over 80 percent of its original wetlands to development, farming, or degradation. Thus, it was determined that a preliminary inventory of restorable wetlands would be useful, and that wetland restoration may be an important implementation element.

To determine potentially restorable wetlands, several sources were compiled and combined to complete one map for the District. This map shows restorable wetlands in the District with particular emphasis placed on the southern portion of the District (Figure 2-5). The sources used are the DNR Protected Wetland Inventory (PWI) included as Figure 2-6, Metropolitan Council aerial photographs from 1990, SWCD section/wetland maps, and visual survey.

The restorable wetlands map was developed such that mapped wetlands only show relative size and location in the District. A total of 2,040 acres of potentially restorable wetlands exist in the District. A final source may be used to confirm the existence of previous wetlands in years past by comparing the inventory to the historic Trygg map shown as Figure 2-2. While the scale of the Trygg map limits comparison, large wetland areas confirm the existence of many of the wetlands on the restorable wetlands inventory.



JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	*Prior Lake/Spring Lake Watershed* FUTURE LAND USE MAP	*figure* **2-4**



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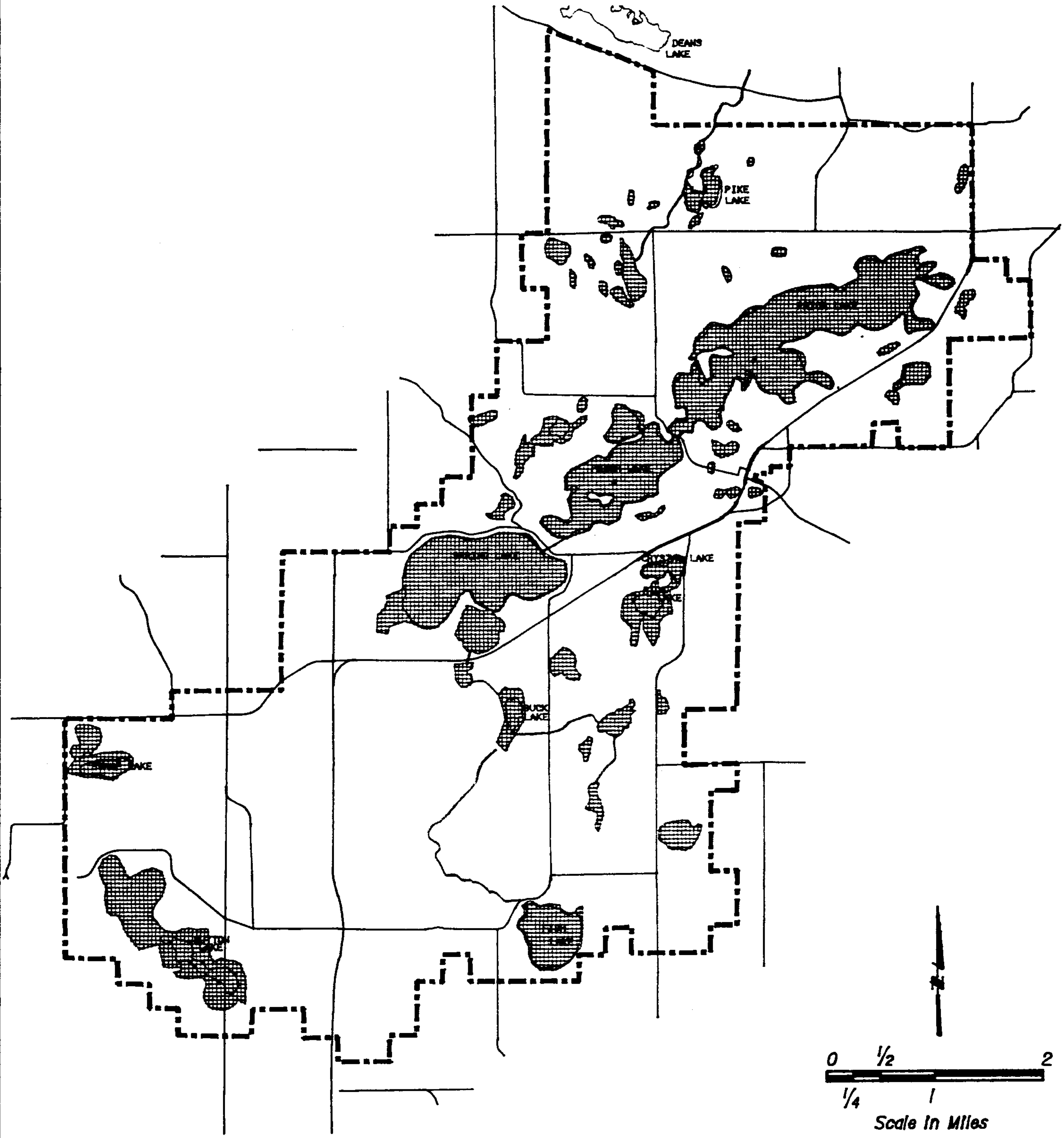


JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	*Prior Lake/Spring Lake Watershed* *DNR PROTECTED WATERS MAP*	*figure* **2-6**

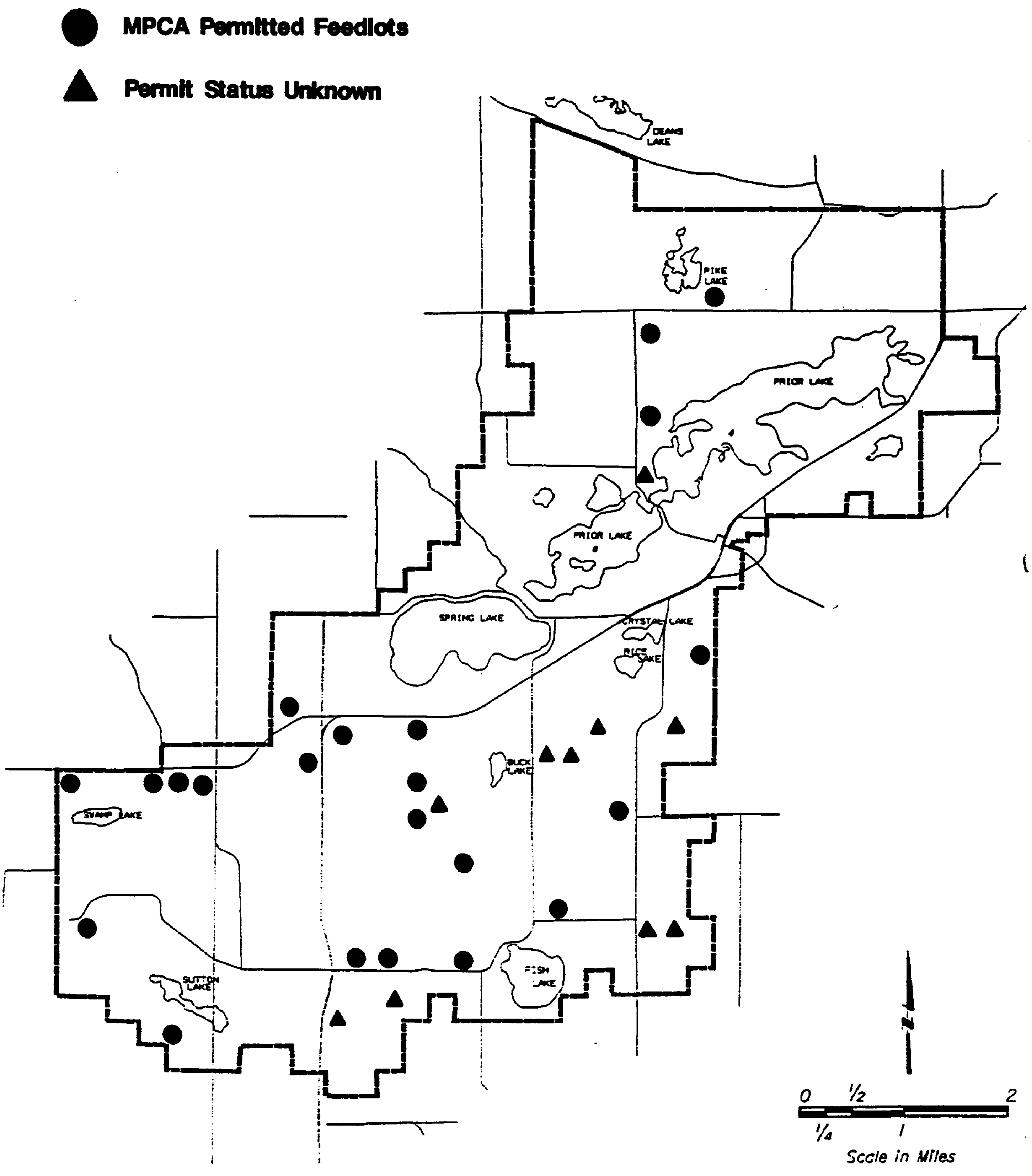
The District has stated in its 509 plan that wetland restoration is a priority for the District. As stated in the District goals, one of several priorities relating to wetland restoration is "to maintain and improve all existing natural and artificial watercourses." The overall benefit for these wetlands can be recognized by their use for water quality, flood control, and habitat restoration.

Feedlots. Data on permitted feedlots were obtained from the MPCA. This database has been stored on computer by section number and is included in Appendix A. Permitted sites are labeled on the feedlot map (Figure 2-7). MPCA-permitted feedlots are required to operate without polluting surface waters. These sites are all confirmed to have low contamination potential through watershed reconnaissance conducted in April 1993. The potential for surface water pollution was determined by the number of animals, land slope, and the feedlot's proximity to a surface waterbody.

Non-permitted feedlot information was obtained from the Scott SWCD and from a 1977 feedlot survey. Inspection was performed in April 1993 to determine which sites still existed. Currently operating feedlots were noted on maps and given surface water pollution potential ratings of high, medium, or low relative to the number of animals present, current condition of the feedlot, land slope, and proximity to surface waterbodies. Table 2-6 was developed as a result of the inspection. Additional feedlots not present in the 1977 SWCD survey were noted, given a rating, and added to the map. Feedlots found in the April 1993 inspection are shown in Figure 2-7. The permit status of the observed feedlots is also shown on the figure.

The inspection found only one feedlot that had a high potential for pollution in the watershed. This feedlot is located below the discharge point from Lower Prior Lake and outside the project area. In addition, the number of feedlots in the study area has decreased from 43 feedlots in 1977 to 22 feedlots in 1993. The current number of feedlots includes two feedlots which were not in existence in 1977.

Septic Systems. The status of on-site septic systems was investigated by contacting both the City of Prior Lake and Scott County. Most of the City of Prior Lake is connected to sanitary sewer. There are only 120 on-site septic systems in the City. Nine of these systems serve commercial facilities. The City estimates that one failing system is found and corrected about every other year. The jurisdiction for the City encompasses both Upper



JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	Feedlots	2-7

TABLE 2-6

FEEDLOT INVENTORY

Location	Animals Visible 1993	Animals Visible 1977	Feedlot Condition	Land Slope	Distance to Channel Flow (ft)	Rating	Comments
T114, R23, S36	65	20	Partial Vegetation	Steep	300	Medium	Drains to Sutton Lake.
T114, R23, S14	15	1	Minimum Vegetation	Flat	50	Low	Drains to Swamp Lake; 1977 survey showed landlocked.
T114, R23, S13, SW1/4	--	0	Vegetated	Flat	--	Low	Distance to channel flow is extreme.
T114, R23, S13, NW1/4, SE1/4	--	0	Vegetated	Flat	--	Low	Distance to channel flow is extreme.
T114, R23, S13, NE1/4, SE1/4	--	0	Well Vegetated	Flat	100	Low	Condition of feedlot shows little use.
T114, R22, S18	70	20	No Vegetation	Flat	1,000	Low	Distance to ditch is extreme overland.
T114, R22, S29, NW1/4	50	0	Medium Vegetation	Flat	2,000	Low	Low use at present.
T119, R22, S29, NE1/4	35	2	Medium Vegetation	Flat	2,100	Low	Low use at present.
T114, R22, S28	36	30	No Vegetation	Medium	1,600	Medium	Drains to Fish Lake.
T114, R22, S22	--	20	Partial Vegetation	Medium	2,000	Low	Drains to wetland on north.
T114, R22, S15, SE1/4	20	20	Partial Vegetation	Flat	3,000	Low	No change since 1972 survey.
T114, R22, S21	84	3	No Vegetation	Medium	3,800	Low	Change in animal use; limited space keeps vegetation low.
T114, R22, S20	57	--	No Vegetation	Flat	4,200	Low	Low usage since 1977 survey.
T114, R22, S17, SE1/4	--	15	Well Vegetated	Flat	100	Medium	Pheasant cage; animals well-concealed; wetland near cage; long distance to ditch.
T114, R22, S17, NW1/4	25	15	Well Vegetated	Flat	3,400	Low	Pasture.
T114, R22, S17, NE1/4	42	25	Well Vegetated	Flat	1,800	Low	Low use over large area.
T114, R22, S11	100	--	Partial Vegetation	Flat	1,200	Medium	Less use than 1977 survey.
T115, R22, S23	--	50	No Vegetation	Steep	200	High	Gully through feedlot flows directly to Pike Lake.
T115, R22, S26	--	30	Partial Vegetation	Flat	50	Low	Area is landlocked.

and Lower Prior Lakes. Most of Spring Lake is in the orderly annexation area for the City, thus services may be extended to areas surrounding Spring Lake in the future.

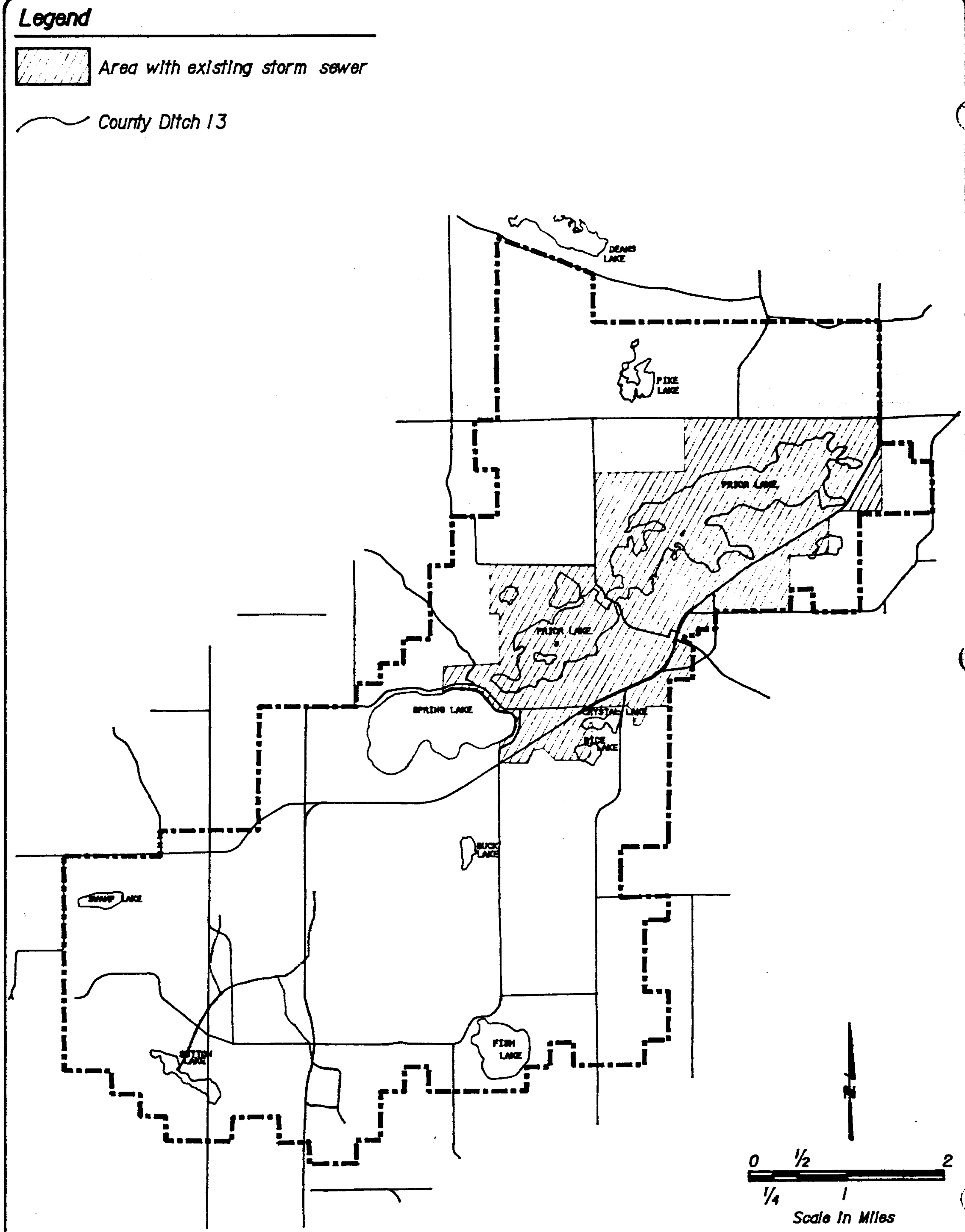
Currently, most of the area surrounding Spring Lake is in Scott County jurisdiction. Scott County inspects septic systems during installation and tracks the pumping frequency for each system in the county. If a system is pumped three times in one year, the county sends the owner a letter informing them that their system may be failing. The county currently does not have the staff to inspect for failing systems and generally identifies failing systems by complaints. It is estimated that 15 to 20 failing systems are found and corrected county-wide each year.

Impacts to the lakes from septic systems will be potentially greatest surrounding Spring Lake. Areas surrounding Upper and Lower Prior Lakes are connected to the sanitary sewer serving the City of Prior Lake. Osgood (1983) estimated that 3 percent of the phosphorus budget in Spring Lake is due to septic systems. Osgood counted 117 on-site systems within 300 feet of Spring Lake and used this number to estimate the loading. This count was updated using 1990 aerial photos to 95 homes. The count included only those homes outside the sanitary sewer service area. The decrease in the number of homes counted may be due to expansion of sewer services or to differences in counting techniques. In either case, the loading from septic systems has not increased since 1983.

Since the study completed by Osgood, Scott County has started tracking pumping frequency. Thus due to proactive tacking of system performance, the low loading estimate by Osgood and reduction of the number of homes utilizing on-site systems; septic system inputs are not considered a significant problem for the three lakes.

Ditches. Only one county ditch is located in the Watershed District (County Ditch 13). The location of this ditch is shown on Figure 2-8. Remaining ditches in the District are privately owned.

Tile Lines. Watershed reconnaissance was performed April 24, 1993 to identify known tile lines. The reconnaissance was performed in early spring to maximize the visibility of tile inlets. However, only six markers were observed in the fields. The markers could indicate the presence of tile inlets or rocks. Due to the small number of markers observed, no conclusions could be drawn or map prepared.



JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	*Prior Lake/Spring Lake Watershed* STORM SEWER MAP	*figure* **2-8**

Local Geology

Surficial geology is the product of glaciers coming from two different directions–the northeast and the northwest. The Superior lobe approached from the northeast bringing a reddish-brown, sandy drift, eroded from the bedrock of the Lake Superior region. Ice coming from the northeast deposited a gray clay calcareous drift eroded from North Dakota, Manitoba, and northwest Minnesota. The hills, ridges, and kettle lakes were formed as the Des Moines lobe began to stagnate and melt. This resulted in an irregular topography called an ice stagnation and disintegration moraine. In some areas of the watershed, this unconsolidated surficial material exceeds 500 feet in thickness. It lies about 400 feet deep under Spring, 300 feet deep under Upper Prior, and 200 feet deep under Lower Prior.

Hydrogeology. Bedrock formations in the Prior Lake-Spring Lake Watershed range from the 470 million year old Prairie due Chien group to the 500+ million year old Ironton and Galesville sandstones.

The Prairie du Chien group surrounds most of Upper and Lower Prior Lakes. Its sandstone and dolomite range from 0 to 250+ feet in thickness. Together with the Jordan Sandstone, the Prairie du Chien group constitute the major aquifer unit in the Twin Cities metropolitan area.

Older bedrock, including the Jordan Sandstone, St. Lawrence, Franconia, Ironton and Galesville Sandstone formations, occur in a mile-wide band from Pike Lake south through Upper Prior and Spring Lake where then fan out to the southwest. The Ironton and Galesville Sandstones are an important aquifer beyond the limits of the Prairie du Chien/Jordan aquifer.

The bedrock topography follows the bedrock formations with higher elevation values outside the narrow band of older bedrock.

Ice-contact stratified drift and glacial till compose most of the surficial sediments in the watershed and range from 100 to 500+ feet thick. Bedrock aquifers in the watershed are highly susceptible to contamination to the north, west, and south of the Spring/Prior Lake chain and moderately susceptible to the southeast.

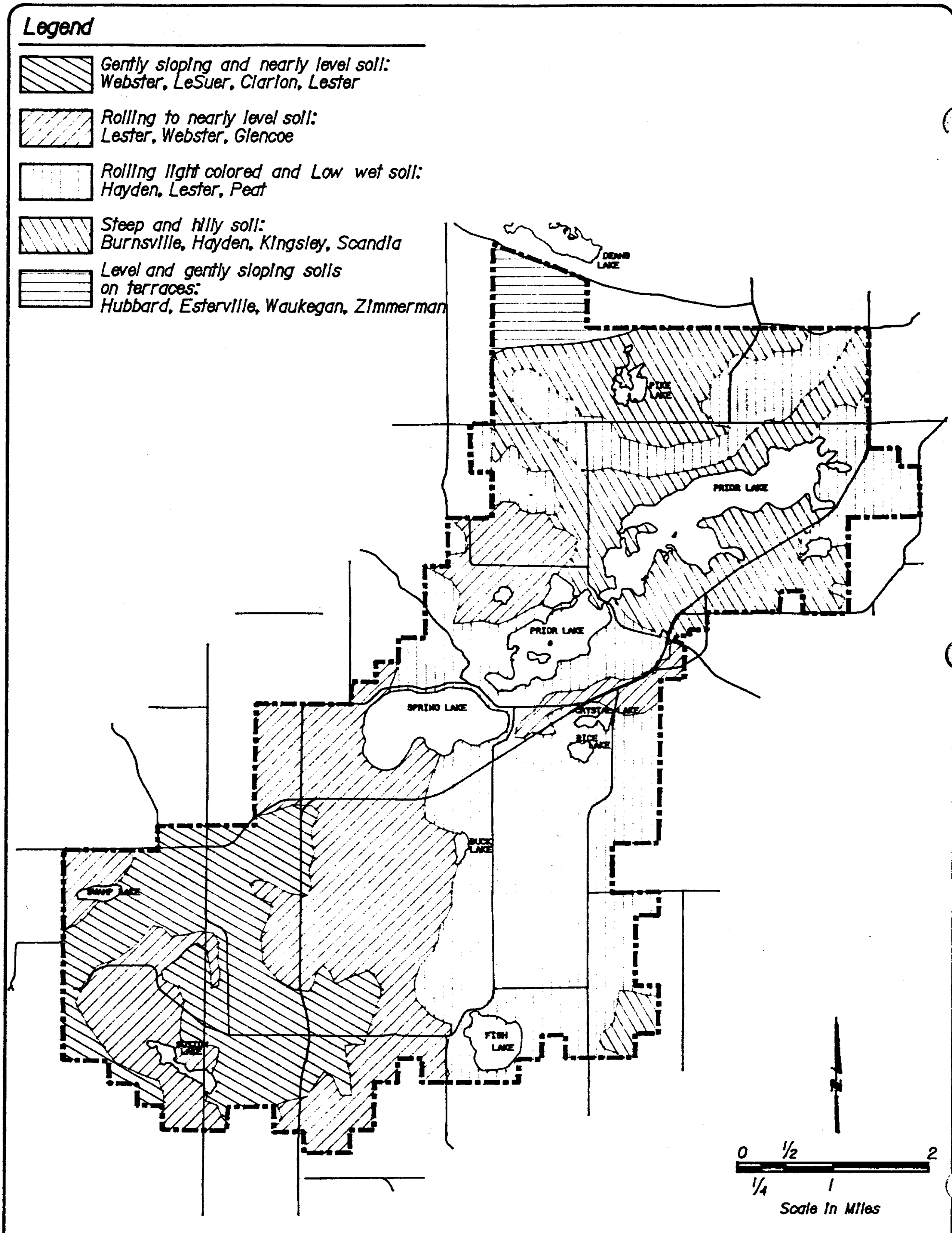
Groundwater movement within the watershed is from southeast to the northwest. The water table is at an elevation of 850 feet along the southeast lakeshore and about 800 feet along the northwest shores. The bottom of Spring Lake is at about 887 feet, Upper Prior is about 856 feet, and Lower Prior is about 843 feet. All three lakes have surface elevation well above the groundwater table.

Soils

A comprehensive survey of soils in this area was published by the SCS (1955). A more generalized update was completed in 1980. Approximately 11 different types of soils are found within the Prior Lake-Spring Lake Watershed District. The factors that influence the different soil formations include climate, vegetation, parent material, relief, and time.

The Burnsville-Hayden-Kingsley and Scandia Series occur in the terminal morainic hills. They are a mixture of red and gray glacial drift and were formed under a native vegetation of oak forests. The Clarion Series is well drained, undulating to rolling soils, and formed under tall prairie grasses. The Glenco Series are very poorly drained upland soils, high in organic matter, and are found under a natural vegetation of grass, sedges, reeds, and a few willows. The Hayden Series are light-colored, well-drained soils found naturally under mixed hardwood forests. The Lester Series is moderately dark colored soil, originally developed under tall prairie grasses. The LeSueur Series are moderately well-drained, dark-colored soils associated with hardwood forests. Peat and Muck Series are organic soils located in very poorly drained depressions. The last soil type, the Webster Series, are dark-colored soils, found on nearly level upland flats. They are poorly drained and have an original vegetation of tall prairie grasses and marsh bunch grasses.

These soils have been grouped into four dominant soil associations. All are known to occur in the District (Figure 2-9). Around Lydia and Sutton Lakes, the dominant group is the Webster-LeSueur-Clarion-Lester Association. South of Spring Lake is found the Lester-Webster-Glencoe Association. The Hayden-Lester-Peat Bogs Association runs from the northwest to southeast between Spring Lake and Lower Prior Lake. And lastly, the Burnsville-Hayden-Kingsley-Scandia Association is found around Upper Prior Lake and Pike Lake.



JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	*Prior Lake/Spring Lake Watershed* **SOIL ASSOCIATION MAP**	*figure* **2-9**

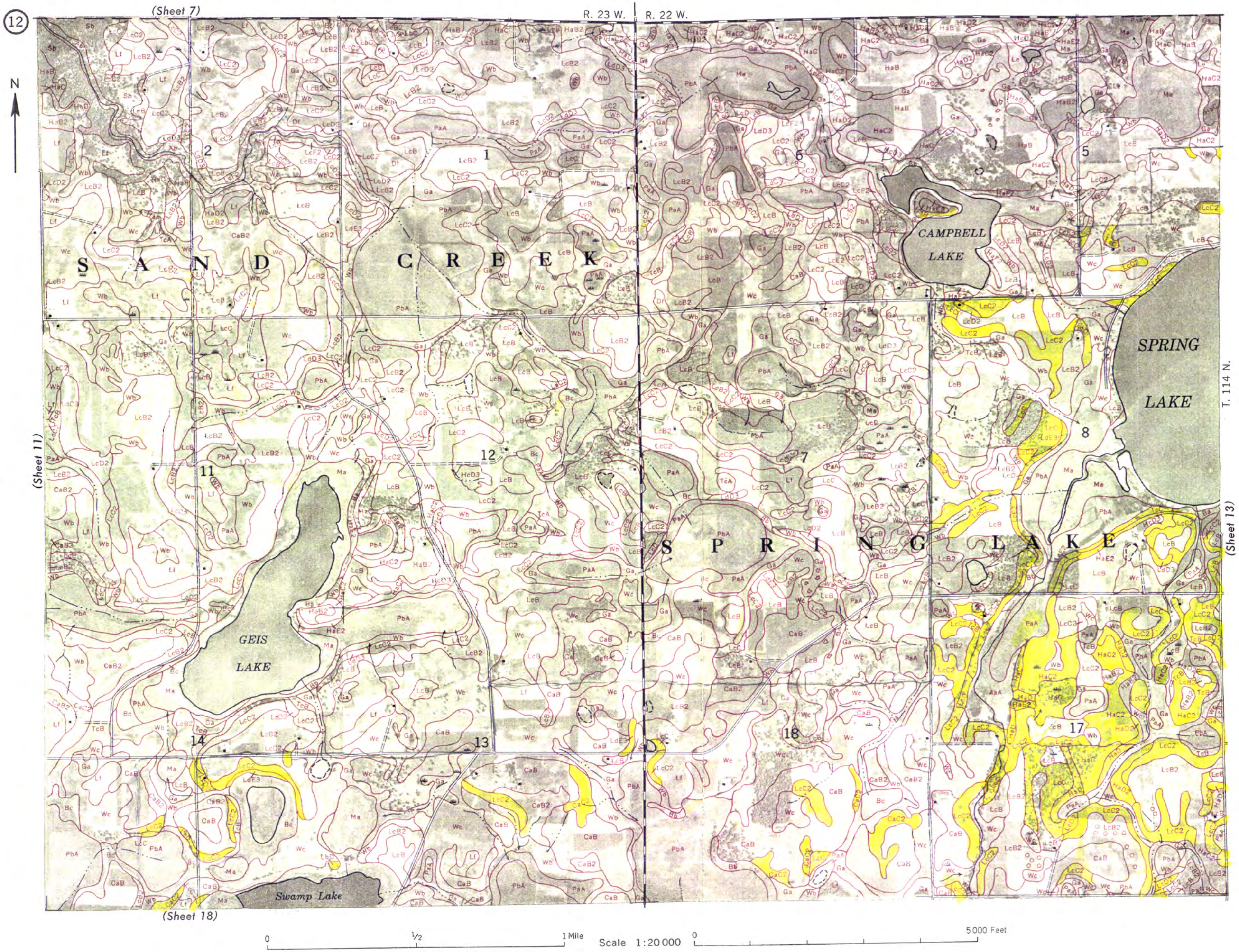
Many of the soils in the watershed are high in organic content. Surficial peat deposits occur to the south of Spring Lake and along Wilson Creek, the major inlet to Spring Lake.

The erosion potential in the watershed is classified as moderate-severe around Spring Lake and severe around Upper and Lower Prior Lakes based on soil types and slope (Prior Lake-Spring Lake Watershed District, 1986).

Highly Erodible (HEL) Soils. These soils are an important part of the overall land use section because of the potential for erosion and the relationship to water quality. In cooperation with the Scott SWCD, information on the HEL soils was gathered for the southern portion of the watershed. The information used to investigate erodible soils in the watershed included the Scott County Soil Survey (Figures 2-10 through 2-13), the highly erodible soil map unit list from Scott County SWCD, and Scott County SWCD section maps locating highly erodible fields. Figures 2-10 through 2-13 show the highly erodible soils within the southern portion of the District. There are 10 soil series listed as highly erodible soils in Scott County (Table 2-7). Of these associations, six are found in the Watershed District.

Results of the investigation found 3,410 acres of highly erodible soils out of the 14,550 acres in the southern portion of the watershed. Therefore, approximately 23 percent of the southern watershed is composed of highly erodible soils.

Scott County SWCD and SCS is currently finalizing farm program plans which limit the amount of soil lost in highly erodible fields to what is known as T. Implementation of these plans is required by 1995. The factor of T is termed to be the amount of allowable soil loss on a ton per acre per year basis which will maintain soil productivity. On most of the soils in the District, T is a soil loss of approximately 5 tons per acre per year. With current crop rotations used in the District, many soil losses exceed 60 tons per acre per year. If the amount of soil lost from highly erodible soil in the watershed drops to T, there will be an 92 x 23 = 21 percent decrease in soil loss per year in the southern portion of the watershed. This reduction in soil loss will have direct water quality benefits.



Range, township, and section corners shown on this map are indefinite.

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1951.

Figure 2–10 Highly Erodible soils

Figure 2-11 Highly Erodible soils

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1951.

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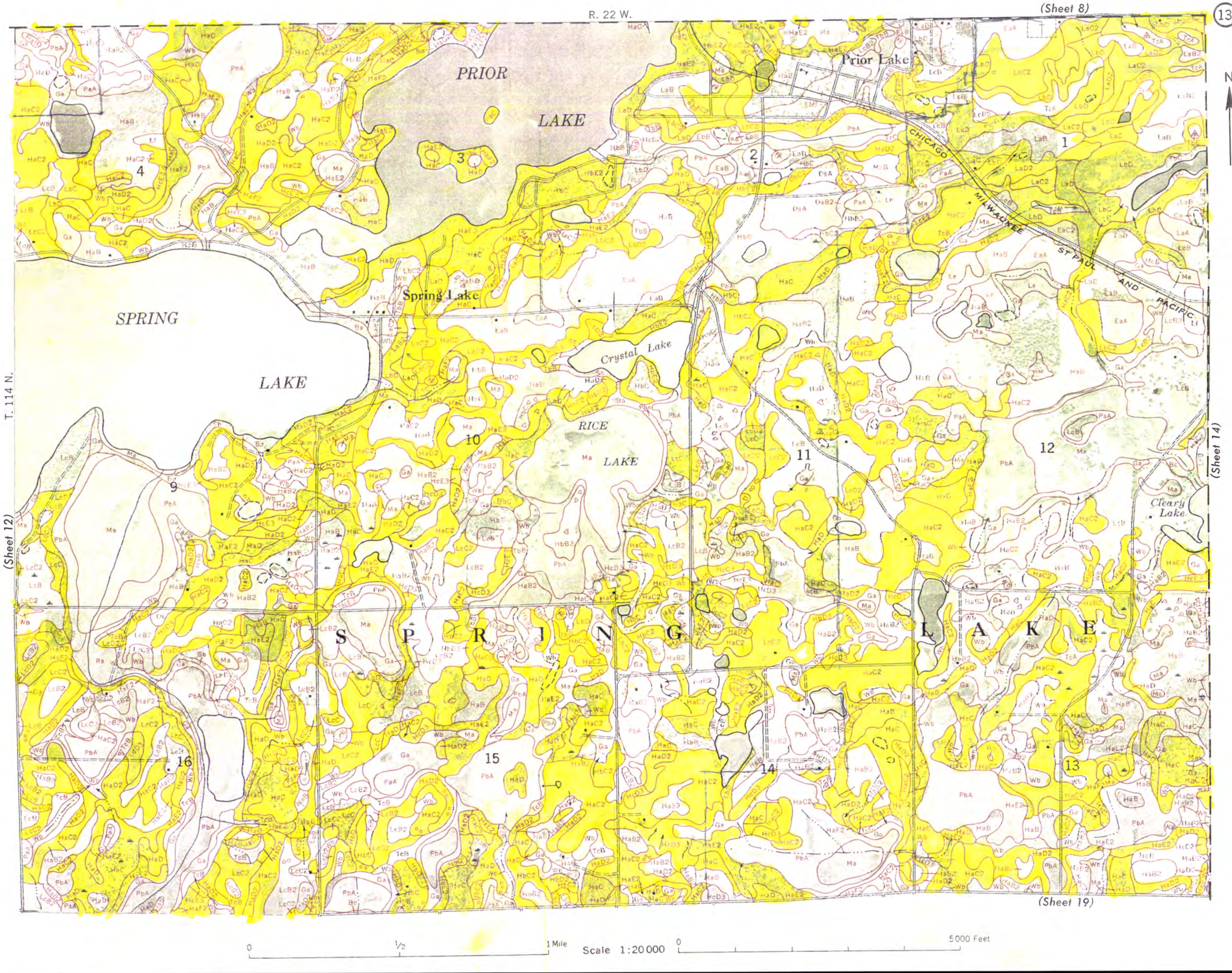

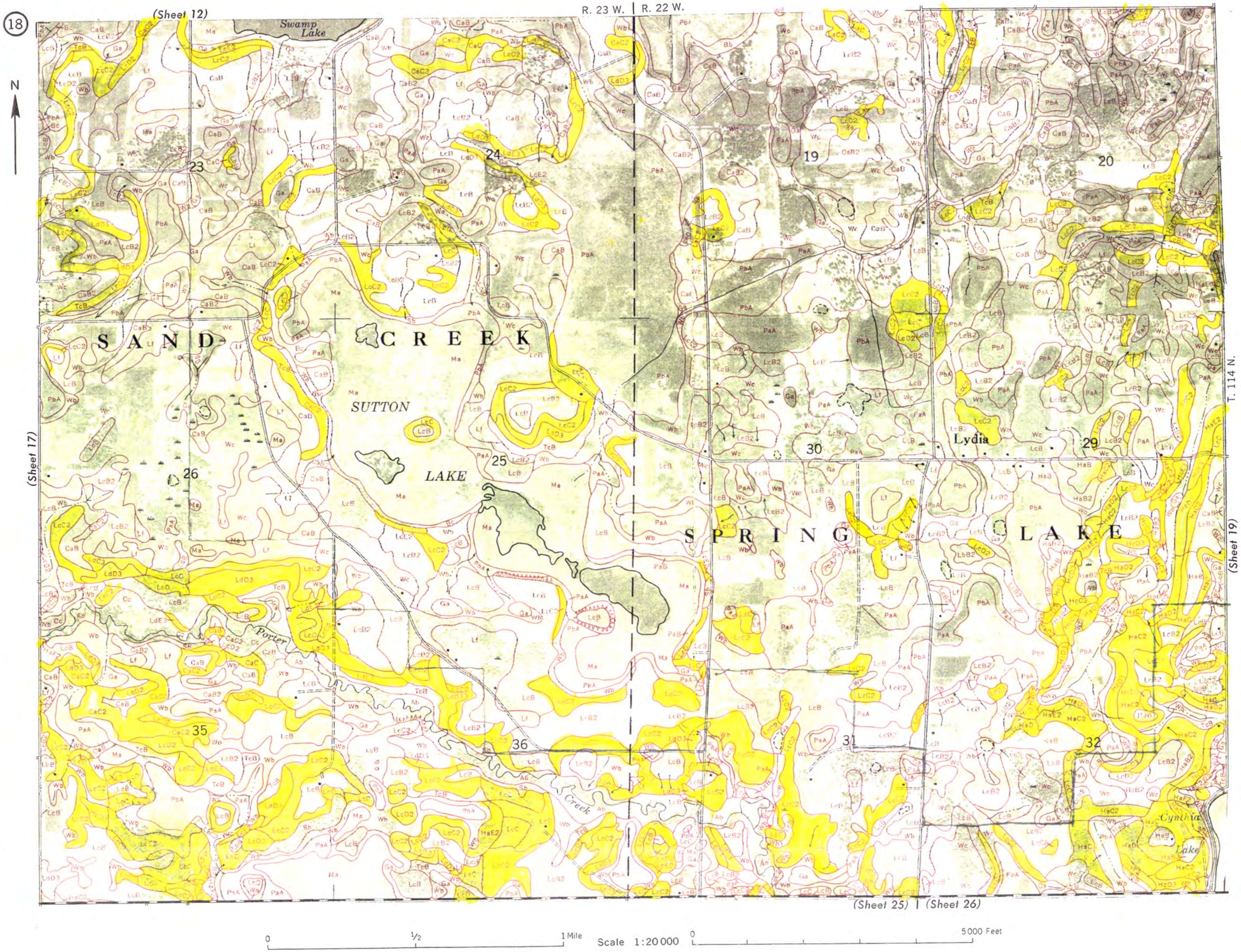

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Figure 2-12 Highly Erodible soils

SCOTT COUNTY, MINNESOTA

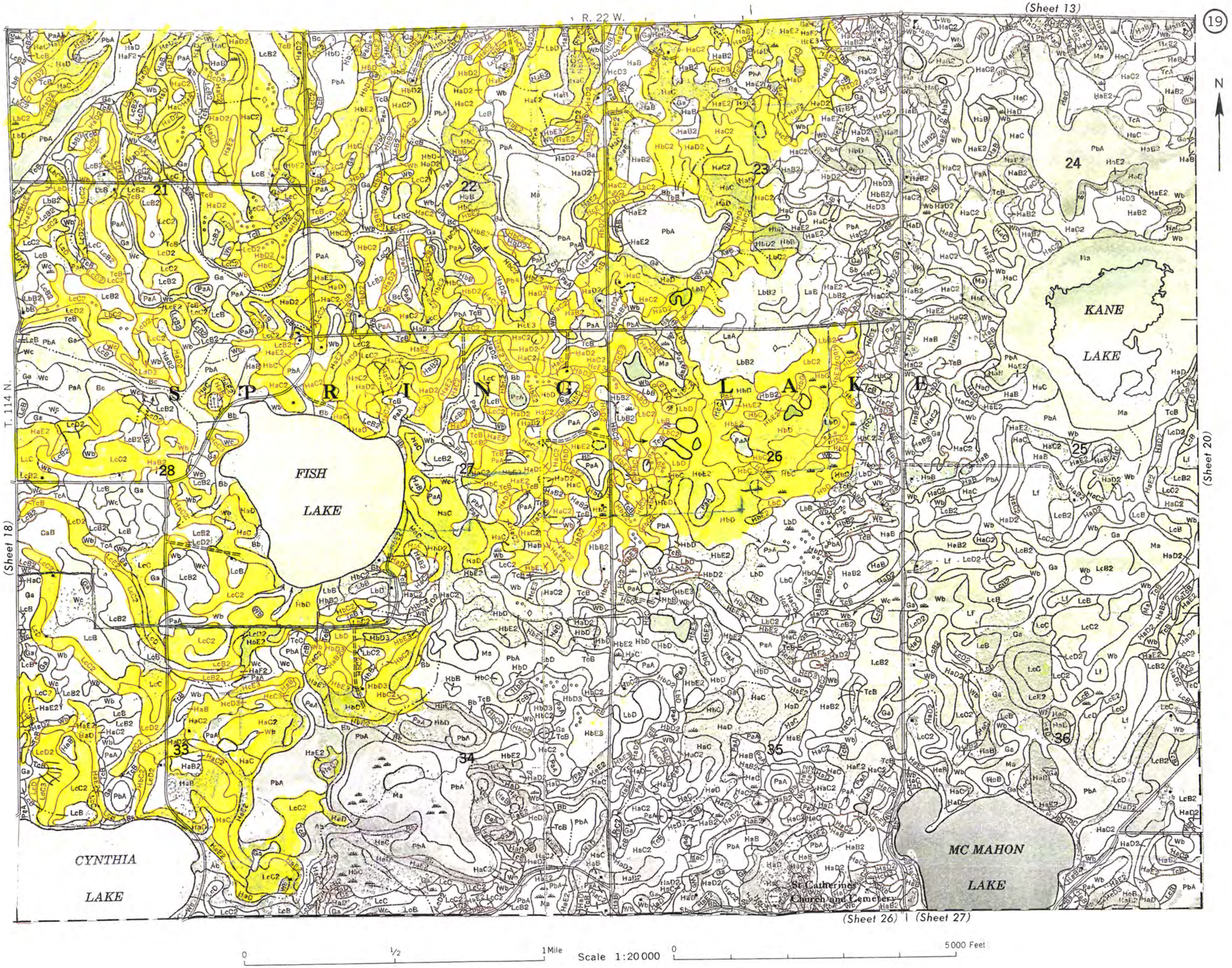


Figure 2–13 Highly Erodible soils

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1951

Range, township, and section corners shown on this map are indefinite.

TABLE 2-7

HIGHLY ERODIBLE SOILS

Symbol	Map Unit Name	Slope (percent)	T
BdC	Burnsville	6-12	5
BdC2	Burnsville Moderately Eroded	6-12	5
BdD	Burnsville	12-18	5
BdD2	Burnsville Moderately Eroded	12-18	5
BdE2	Burnsville Slightly/Moderately Eroded	18-25	5
BdF	Burnsville	25-50	5
BeD3	Burnsville Severely Eroded	12-18	5
BeE3	Burnsville Severely Eroded	18-25	5
CaC	Clarion Silt Loam	6-12	5
CaC2	Clarion Silt Loam Moderately Eroded	6-12	5
CbC3	Clarion Soils Severely Eroded	6-12	5
DaC2	Dakota Loam Moderately Eroded	6-12	4
DbC2	Dakota Sandy Loam Moderately Eroded	6-12	3
EaC	Estherville Loam	6-12	3
EaC2	Estherville Loam Moderately Eroded	6-12	3
EbC	Estherville Gravelly Sandy Laom	6-12	3
EbC2	Estherville Gravelly Sandy Loam Moderately Eroded	6-12	3
HaC	Hayden Loam	6-12	5
HaC2	Hayden Loam Moderately Eroded	6-12	5
HaD	Hayden Loam	12-18	5
HaD2	Hayden Loam Moderately Eroded	12-18	5
HaE2	Hayden Loam Slightly/Moderately Eroded	18-25	5
HaF2	Hayden Loam Slightly/Moderately Eroded	25-35	5
HbC	Hayden Sandy Loam	6-12	5
HbC2	Hayden Sandy Loam Moderately Eroded	6-12	5
HbD	Hayden Sandy Loam	12-18	5
HbD2	Hayden Sandy Loam Moderately Eroded	12-18	5
HbD3	Hayden Sandy Clay Loam Severely Eroded	12-18	5
HbE2	Hayden Sandy Loam Slightly/Moderately Eroded	18-25	5
HbE3	Hayden Sandy Clay Loam Severely Eroded	18-25	5
HbF2	Hayden Sandy Loam Slightly/Moderately Eroded	25-35	5
HcC3	Hayden Soils Severely Eroded	6-12	5
HcD3	Hayden Soils Severely Eroded	12-18	5
HcE3	Hayden Soils Severely Eroded	18-25	5
LaC	Lakeville Loam	6-12	3
LaC2	Lakeville Loam Moderately Eroded	6-12	3
LaD	Lakeville Loam	12-18	3
LaD2	Lakeville Loam Moderately Eroded	12-18	3
LbC	Lakeville-Burnsville	6-12	3
LbC2	Lakeville-Burnsville Moderately Eroded	6-12	3
LbD	Lakeville-Burnsville	12-50	3
LcC	Lester Silt Loam	6-12	5
LcC2	Lester Silt Loam Moderately Eroded	6-12	5

TABLE 2-7

HIGHLY ERODIBLE SOILS (Continued)

Symbol	Map Unit Name	Slope (percent)	T
LcD	Lester Silt Loam	12-18	5
LcD2	Lester Silt Loam Moderately Eroded	12-18	5
LcE2	Lester Silt Loam Slightly/Moderately Eroded	18-25	5
LcF2	Lester Silt Loam Slightly/Moderately Eroded	25-35	5
LdC3	Lester Soils Severely Eroded	6-12	5
LdD3	Lester Soils Severely Eroded	12-18	5
LdE3	Lester Soils Severely Eroded	18-25	5
LdF3	Lester Soils Severely Eroded	25-35	5
Sb	Strepland-Hayden-Lester Materials	--	5
Ta	Terrace Escarpments	--	5
TbC	Terril Sandy Loam	6-12	5
TbD	Terril Sandy Loam	12-18	5
TbE	Terril Sandy Loam	18-25	5
TcC	Terril Silt Loam	6-12	5
TcD	Terril Silt Loam	12-18	5
TcE	Terril Silt Loam	18-25	5
WaC2	Waukegan Silt Loam	6-12	4
WaD2	Waukegan Silt Loam	12-18	4

Climate

Minnesota has a continental climate characterized by hot, wet summers and cold, dry winters. The Prior Lake Watershed District has an automatic rain gage in downtown Prior Lake, and the National Oceanic and Atmospheric Administration receives information from nearby weather stations in Chaska, Jordan, and the Minneapolis-St. Paul Airport.

The coldest month at Prior Lake is usually January and the warmest, July. There are usually 167 days between killing frosts. June is usually the wettest month and January the driest. Annual precipitation has averaged 27.97 inches from 1951-1980, with about 4.5 inches falling in June (Table 2-8). The project ran from October 1988 to September 1989. The weather conditions during most of this time tended to be drier and cooler than normal.

Demographics

Population Data. Due to its proximity to the Minneapolis-St. Paul metropolitan area, Scott County is experiencing population growth at a much faster pace than the metropolitan area as a whole (Table 2-9). Within Scott County, this increase has been concentrated within the Credit River, Prior Lake, and Spring Lake townships. Growth in Prior Lake Township is first numerically and second percentage-wise. The City of Prior Lake is first in growth among Scott County municipalities both numerically and percentage-wise (Table 2-10).

TABLE 2-8

CLIMATE
(PRIOR-SPRING WATERSHED DISTRICT GAUGE)

	1951-1980 Averages				October 1988-September 1989	
Month	Temperature (°F)*	Precipitation (in)†	Wind Direction**	Evaporation (in)††	Temperature (°F)	Precipitation (in)
JAN	11.0	0.71	NW	0.32	18.2	0.15
FEB	17.1	0.77	NW	0.37	6.2	0.02
MAR	28.4	1.59	NW	0.88	22.4	1.11†††
APR	45.4	2.34	NW	1.8	44.7**	2.63†††
MAY	57.7	3.60	SE	3.05	53.9	3.04
JUN	66.8	4.52	SE	4.1	62.8	3.33
JUL	70.9	3.98	S	5.75	69.6	2.98
AUG	68.5	3.80	SE	5.7	64.6	5.16
SEP	59.4	2.67	S	4.4	56.8	1.15
OCT	49.2	1.88	SE	3.1	40.1	0.55
NOV	32.9	1.27	NW	1.4	28.0	2.19
DEC	18.9	0.84	NW	0.4	16.2	0.11
Average	43.9		NW		40.3	
Total		27.97		31		22.42

* From Jordan, Minnesota.
** Extrapolated from Minneapolis-St. Paul Airport.
† Extrapolated from Chaska, Jordan, and Minneapolis-St. Paul Airport.
†† From SCS Hydrology Guide.
††† From Don Benson gauge.

TABLE 2-9

SELECTED AREA POPULATIONS (COMMUNITY PROFILES, 1984)

	1970	1980	Percent Change	1983 Estimate
Metropolitan Area	1,874,612	1,985,873	5.9	2,032,847
Scott County	32,423	43,784	35	47,420
Credit River Township	1,165	2,360	102.6	2,480
Prior Lake Township	4,127	7,284	76.5	8,140
Spring Lake Township	1,527	2,570	68.3	2,670

TABLE 2-10

CITY POPULATIONS (>2000) IN SCOTT COUNTY

	1970	1980	Percent Change	1983 Estimate
Prior Lake	4,127	7,284	76.5	8,140
Savage	3,115	3,954	26.9	4,670
Shakopee	7,716	9,941	28.8	10,780
Belle Plaine	2,328	2,754	18.3	2,940
Jordan	1,836	2,663	45.0	2,870

Projections by the State Demography Unit (Minnesota Department of Energy Planning and Development, 1983) predict continued rapid expansion in Scott County into the next century (Table 2-11).

TABLE 2-11

PROJECTED POPULATION OF SCOTT COUNTY

1980 - 43,784	
1985 - 48,752	11.35% increase
1990 - 54,418	11.62% increase
1995 - 60,052	10.35% increase
2000 - 65,251	8.66% increase
2005 - 69,663	6.76% increase
2010 - 73,479	5.48% increase

A current population estimate (1986) of 51,847 by the Metropolitan Council was in line with these projections. These figures indicate that Scott County is expected to grow at a rate over twice that of the State of Minnesota as a whole. Scott County will also grow three to six times faster than Development Region 11, which includes Anoka, Carver, Hennepin, Ramsey, Washington, Scott, and Dakota Counties. In this, Scott County reflects the trend of declining inner city population and increasing suburban population.

Currently (1986), Prior Lake is estimated to have a population of 9,710. By the year 2000, the City of Prior Lake is predicted to have 15,750 people, more than double the 1980 population.

The rapid growth in Scott County and Prior Lake population is reflected in an increase in housing construction. In 1970, there were 1,124 housing units in the City of Prior Lake. The number had grown to 2,560 by 1980, a 127.8 percent increase. Housing units totaling 2,845 by 1982 were expected. By far, the largest increase was in the one-unit detached type, an increase of 84.6 percent.

The number of housing units in Spring Lake Township (which includes part of the City of Prior Lake) has also increased dramatically, from 446 units in 1970 to 783 units in 1980, an increase of 75.6 percent. Housing units totaling 813 were expected by 1982.

The increases in Prior Lake will not be distributed evenly around the lakes. Rather, the North Shore and west neighborhoods will see the most growth (Figure 2-2). The City of Prior Lake is therefore planning significant expansion of public utilities to these two areas (Figure 2-3).

Development in Prior Lake will put increasing pressure on the lakes through increased storm and sanitary sewers at the same time as demand for recreation increases.

Economy of Area. The median family annual income in Scott County was higher than that of the State of Minnesota as a whole by about $3,500. Incomes in Prior Lake were higher still, about $9,000 more than the state median (Table 2-12).

TABLE 2-12

MEDIAN FAMILY INCOME

	1979	1982	1983	1979-1983 Increase	1982-1983 Increase
Scott County	22,821	27,072	28,396	24.4%	4.9%
Prior Lake	26,614	31,966	33,790	27.0%	5.7%
State-Wide	19,959	24,027	24,714	23.8%	2.9%

(Table based on Minnesota State Planning Agency, 1985.)

Employment in the area is mostly confined to the education and service industries. Only one major industrial employer, Prior Lake Machine with 26 employees, is listed for the area (Minnesota Department of Energy and Economic Development, 1987).

Prior Lake has two sites within city limits that are zoned for industrial use: one of 360 acres and the other of 150 acres.

Public Access. Although no public transit systems run within a mile of the lakes (Osgood, 1983), the public has easy access via Highway 13. Interstate Highways 35, 94, and 494, as well as U.S. Highway 169, are not far away. The lakes are only about 25 miles away from Minneapolis.

POLLUTION SOURCES

Point Sources

There are no known point sources of pollution on any of the three lakes (Metropolitan Development Guide, pages 108-109). The Metropolitan Development Guide's section on Water Quality set goals for pollutants in surface water runoff (Table 2-13).

TABLE 2-13

WATER QUALITY GOALS FOR SURFACE RUNOFF

Total Phosphorus	0.1 mg/l
Total Nitrogen	2 mg/l
Total Suspended Solids	30 mg/l
Chemical Oxygen Demand	50 mg/l
Chloride	100 mg/l
Lead	50 mg/l

Wastewater from the City of Prior Lake is treated at the Blue Lake plant north of the watershed. The interceptor was installed about 1980. Previous to that, the City had a small treatment plant located southeast of town on County Road 12 (Benson, 1989, personal communication). Investigation of this point source showed that the discharge was to the Credit River Watershed and not the Prior Lake/Spring Lake project area.

Non-Point Sources

Non-point sources of pollution to Spring and Prior Lakes include input from urban areas via storm sewers and runoff, and agricultural sources. Snow melt and early spring storm events contribute most to the annual runoff from agricultural areas because of frozen ground and largely dormant vegetation.

Out of 13,978 rural acres in the Spring Lake Watershed, 42.6 percent or 5,955 acres were adequately treated to control pollution problems. The study, conducted in 1977 in conjunction with the Scott County SCWD, listed four land uses (Table 2-14).

TABLE 2-14

LAND USE IN SPRING LAKE WATERSHED

	Total	Adequate Treatment
Crop	8,776	3,123
Pasture	2,104	1,105
Forest	1,873	936
Other	1,225	791
TOTAL	13,987	5,955

The sediment load in tons per year was estimated at 18,286 or 1.3 tons/acre/year. There were 43 feed lots listed, with 1,652 animal units. Most of these feed lots were listed as completely controlling their pollution potential by 1977. The 1993 survey revealed a 50 percent decrease in the number of feedlots and much lower usage in the existing feedlots.

There is also a sod farm to the north of Sutton Lake. It is between Roads 10 and 79, only a few hundred feet from a branch of Wilson Creek, which flows from Sutton Lake to Spring Lake.

A previous study on Spring Lake (Osgood, 1983) found that the inputs of phosphorus to Spring Lake were primarily from two sources: internal loading and surface runoff (Table 2-15). The total phosphorus load was 3,947 kg.

TABLE 2-15

SPRING LAKE PHOSPHORUS SOURCES (1981-1982)

Source	Percent Total Input
Atmosphere	6
Groundwater	4
Nearshore Septic System	3
Internal Loading	33
Surface Runoff	54

SECTION 3

LIMNOLOGIC ASSESSMENT

INTRODUCTION

This section provides an assessment of the water quality and ecology of Lower Prior, Upper Prior, and Spring Lakes. Historical data for the lakes is presented to provide a reference for the current analysis. Where possible, this data was evaluated for water quality trends. Because Spring Lake was studied extensively by the Metropolitan Council in 1982 (Osgood, 1983) the sampling program for this study focused on Lower and Upper Prior Lakes. The limnologic assessment for Spring Lake was conducted using the data collected during the Metropolitan Council's study. The methodology for this study is presented including site selection, field methods, laboratory methods, and quality control procedures. The results of the lake water quality and biologic monitoring program are presented followed by the results of the stream monitoring and hydrologic analysis. This section concludes with a brief summary of key results and a trophic state assessment for the three lakes.

Historic Water Quality

The historical data search for Lower Prior, Upper Prior, and Spring Lakes included a data retrieval from the Environmental Protection Agency (EPA) STORET data archive system and a file search of the fisheries lake survey files of the Minnesota Department of Natural Resources (MDNR). The data retrieval from the STORET system revealed water quality data as far back as 1948 (Apendix A). However, data from 1948-67 was very limited in analytical scope and sporadic in frequency. The file search of the MDNR's files revealed extensive netting and trap data on the fish populations of these lakes. Additional water quality and biologic data for Spring Lake was obtained from the Metropolitan Council.

Table 3-1 provides a summary of annual means for the water quality data. Although water quality samples were generally taken during the ice-free season, the values in Table 3-1 do not represent a true growing season or annual time-weighted average. These values are simply the arithmetic mean of the data from each year.

TABLE 3-1

ANNUAL AVERAGE SURFACE WATER QUALITY

Year	Nitrogen (mg/l)	Ammonia (mg/l)	Nitrogen (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)	Soluble Phosphorus (mg/l)	Chl-a (µg/l)	Transparency (m)	TN:TP
Lower Prior Lake									
1968	1.28	0.13	1.21	0.08	0.125	0.043			10.3
1969	1.24	0.16	1.20	0.05	0.040	0.018			31.0
1972	0.75	0.07	0.67	0.08	0.018	0.005			41.7
1979			0.78		0.021				
1980		0.10	1.14	0.01	0.042		10.2	2.09	27.5
1981			0.91		0.020			2.00	
1984		0.08	1.13	0.12	0.024		10.5	2.96	51.8
Upper Prior Lake									
1968		0.20		0.46	0.160	0.060			
1969		0.05		0.08	0.060	0.035			
1979			1.25		0.040				
1980	2.19	0.08	2.15	0.04	0.064	0.018	51.3	1.00	34.0
1981	2.06	0.26	1.98	0.08	0.063	0.021	67.8	0.73	32.9
1984	2.01	0.22	1.88	0.13	0.079		62.2	0.88	25.5
Spring Lake									
1954	3.84				0.171				22.5
1979			1.73		0.098				
1980		0.54	1.93	0.05	0.238	0.188	19.3	1.68	8.3
1981		0.21	2.64	0.12	0.289	0.085	48.3	1.55	9.5
1982		0.16	1.96	0.17	0.124	0.073	39.5	1.93	17.2
1984		0.23	2.17	0.17	0.100		73.2	1.00	23.4

Lower Prior Lake. The historic data indicate that Lower Prior Lake has the best water quality data of the three study lakes. Water quality data has been recorded for Lower Prior Lake as far back as 1968; however, sampling has primarily consisted of a sporadic collection of surface water samples only during the ice-free season. Figure 3-1 shows the growing season average (June to September) total phosphorus (TP) and chlorophyll-a for the years with sufficient data. The TP and chlorophyll-a concentrations observed for Lower Prior Lake were better than the ecoregion mean (Central Hardwood Forest) and correspond to a trophic status of mesoeutrophic.

Heiskary and Wilson (1990) gave an equation to predict growing season average chlorophyll-a from growing season average TP for phosphorus-limited lakes. The predicted chlorophyll-a from this equation is 16 μg/l for 1980 and 7 μg/l for 1984. These values are reasonably close to the observed chlorophyll-a concentrations of 10 μg/l and 13 μg/l for 1980 and 1984, respectively. This suggests that most of the phytoplankton production can be explained by the availability of phosphorus. The total nitrogen to total phosphorus ratios (TN:TP) from Table 3-1 greater than 10 also suggests that primary productivity in Lower Prior Lake was limited by the availability of phosphorus during these years (Smith, 1979).

Substantial Secchi disk transparency (SDT) data has been recorded for Lower Prior Lake. Figure 3-2 shows the SDT data from June 1980 to June 1988. The observed seasonal minimum SDT generally occurred in late summer when algae populations were probably at their seasonal peak. The growing season averages SDT for 1980, 1981, and 1984 were 2.4 m, 2.1 m, and 2.3 m, respectively. These values are better than the ecoregion mean.

Historic temperature data for Lower Prior Lake indicate that the lake does stratify during the summer. Figure 3-3 shows evidence of thermal stratification in mid-May, deepening of the thermocline throughout the summer, followed by lake turnover in late September. The well-mixed surface layer extends to 22 feet deep in mid- to late summer. The available data indicate that the lake is dimictic.

Lower Prior Lake has a maximum depth of 17.1 m and a surface area:maximum depth ratio of 19.6:1. These morphometric characteristics also suggest that the lake is dimictic (Heiskary and Wilson, 1990).

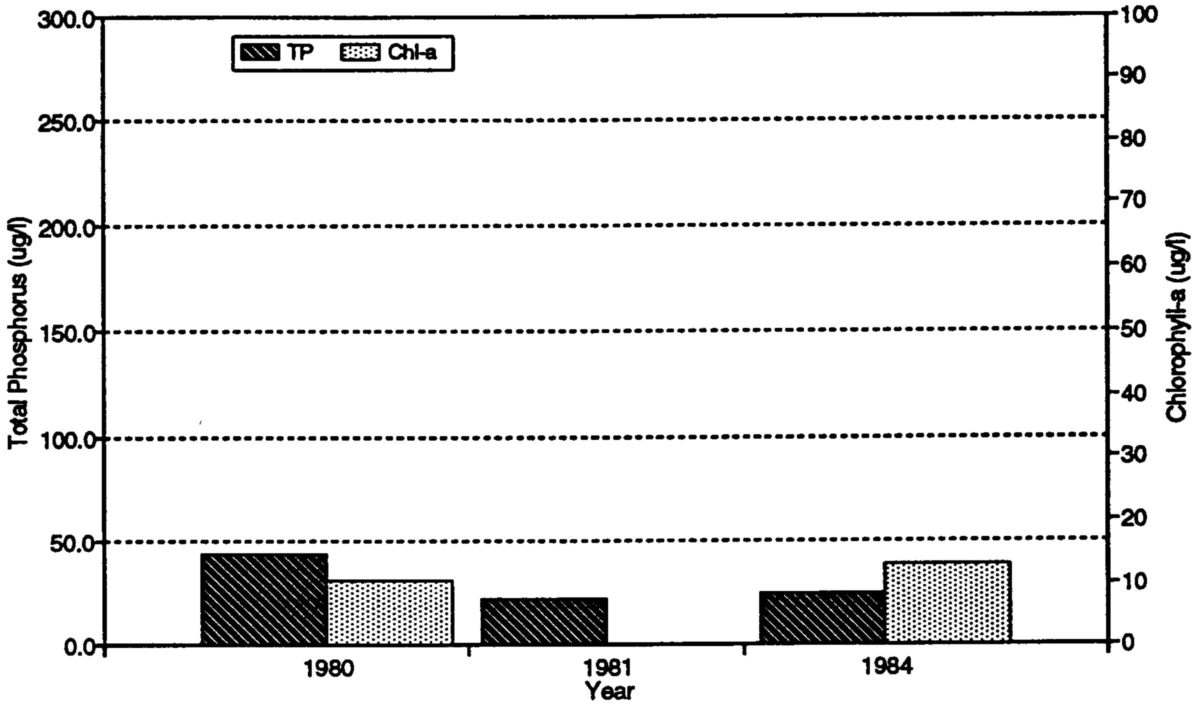


Figure 3-1: Historic Growing-Season TP and Chl-a for Lower Prior Lake

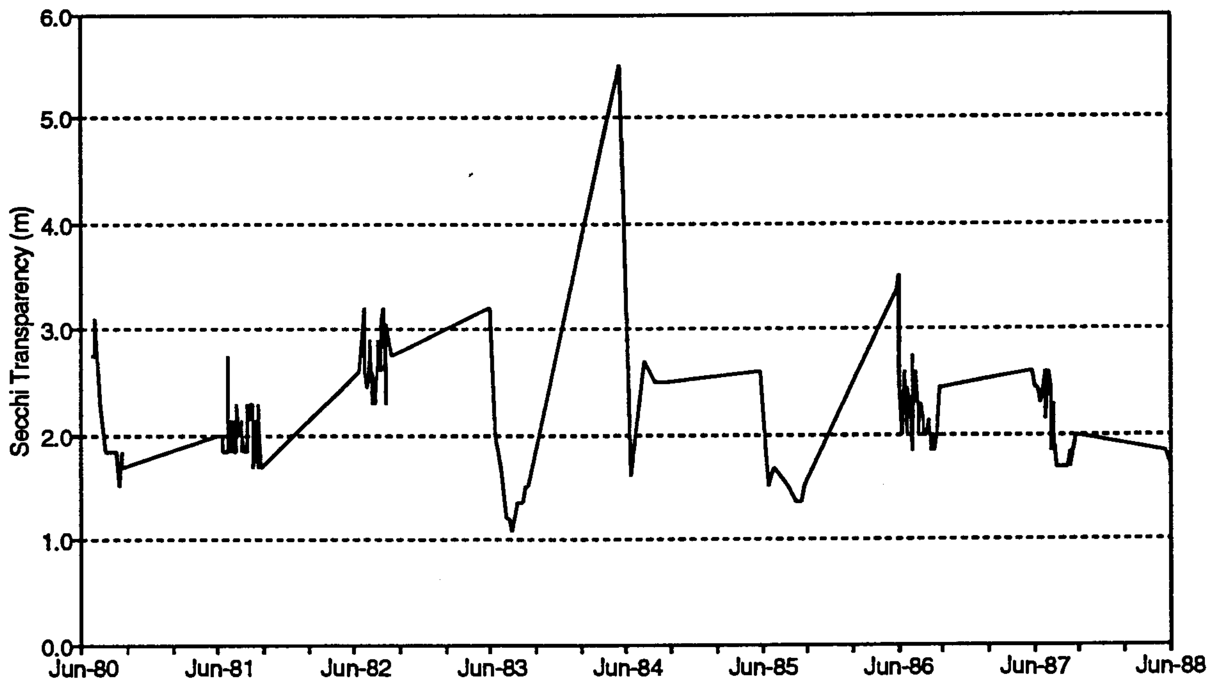


Figure 3-2: Historic Secchi Transparency Trends for Lower Prior Lake

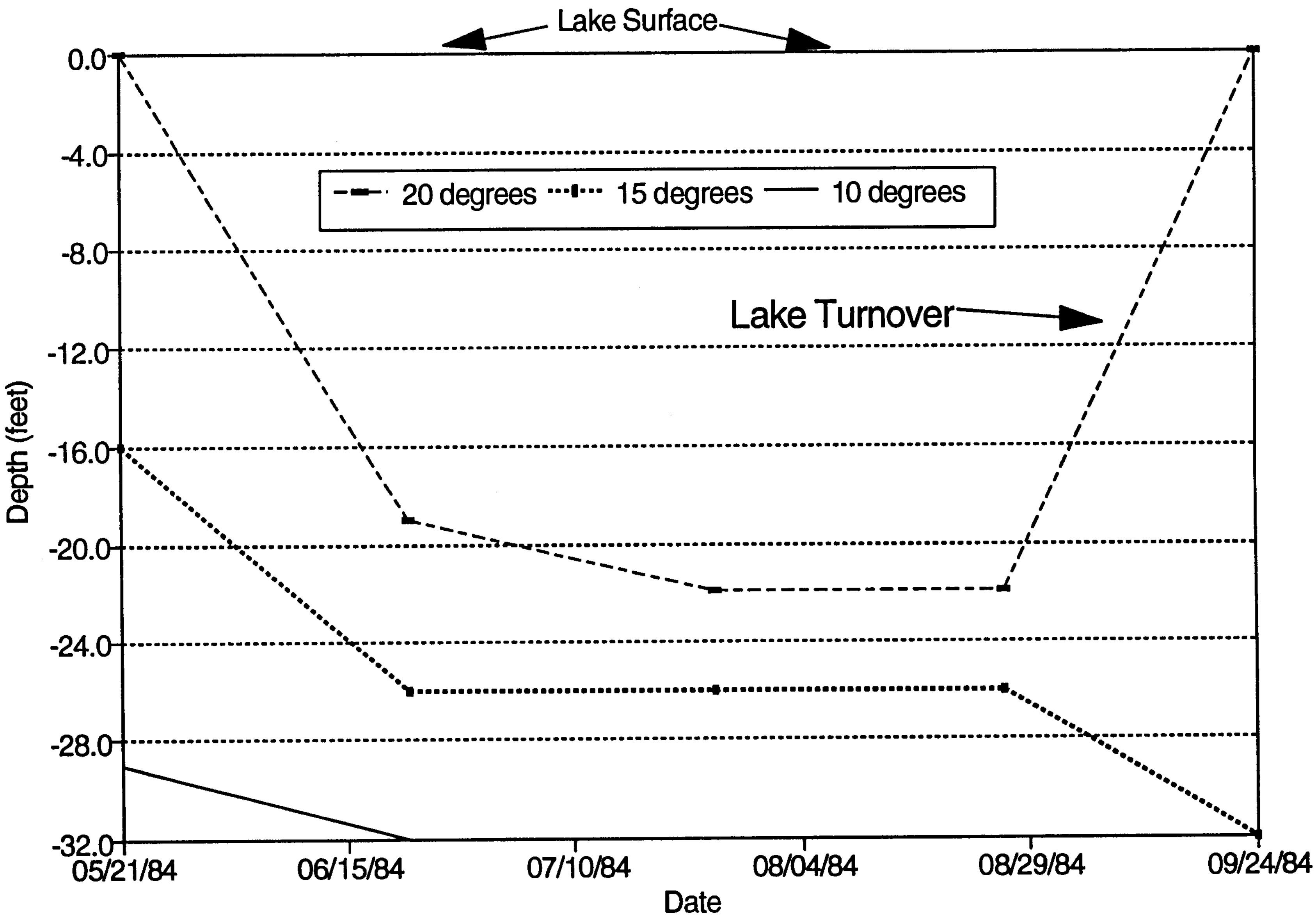


Figure 3-3: Thermal Stratification of Lower Prior Lake

At spring turnover, the lake is well-oxygenated throughout the water column. However, after the lake becomes thermally stratified, dissolved oxygen (DO) in the hypolimnion can no longer be replenished from the atmosphere. By the end of June, DO concentrations in the hypolimnion are less than 1 mg/l. Because DO concentrations this low are lethal to fish, the activity of fish is confined to the epilimnion. A DO concentration below 1 mg/l may also accelerate sediment phosphorus release.

Upper Prior Lake. Historic data for Upper Prior Lake indicate that its water quality is worse than Lower Prior Lake, but better than Spring Lake. The water quality data recorded for Upper Prior Lake dates back to 1968. The sampling frequency was sporadic, similar to that of Lower Prior Lake. Figure 3-4 shows the historic growing season average TP and chlorophyll-a for Upper Prior Lake. The figure indicates TP has remained fairly constant while chlorophyll-a has fluctuated. The observed growing season TP and chlorophyll-a concentrations for Upper Prior Lake place it in the trophic status of eutrophic-hypereutrophic. In the past decade, the water quality of Upper Prior Lake has been below the ecoregion mean for the Central Hardwood Forest Ecoregion.

Secchi disk transparency trends for Upper Prior Lake are shown in Figure 3-5. A strong seasonal pattern is evident for SDT with values declining significantly from spring to late summer. The growing season averages SDT for 1980, 1981, and 1984 were 1.0, 0.9, and 0.9 m, respectively. Upper Prior Lake had the lowest average SDT of all three study lakes. A least-squares fit of the log-transformed SDT and chlorophyll-a yielded a correlation with an r-squared value of 0.81 and is close to literature correlations (Heiskary and Wilson, 1990).

This suggests that most of the light attenuation in Upper Prior Lake is due to algal abundance. The TN:TP ratios greater than 10 from Table 3-1 suggest that algal productivity is limited by the availability of phosphorus. Therefore, controlling the availability of phosphorus should improve water clarity.

The lake surface area:maximum depth ratio of 10.5:1 suggests that the lake is dimictic. This is confirmed by historic temperature profiles (Figure 3-7). The epilimnion of Upper Prior Lake is shallower than that of Lower Prior Lake. This is probably due to the greater light attenuation. The high algal abundance of Upper Prior Lake limits the extent of solar heating of the lake.

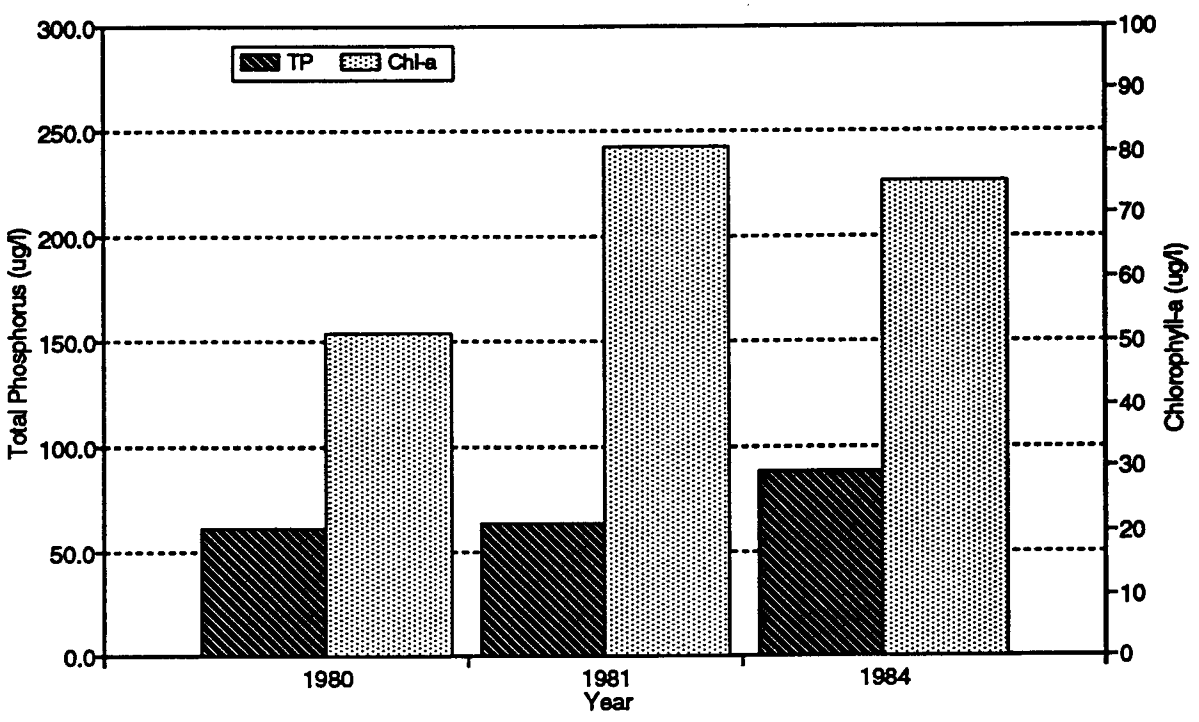


Figure 3-4: Historic Growing-Season TP and Chl-a for Upper Prior Lake

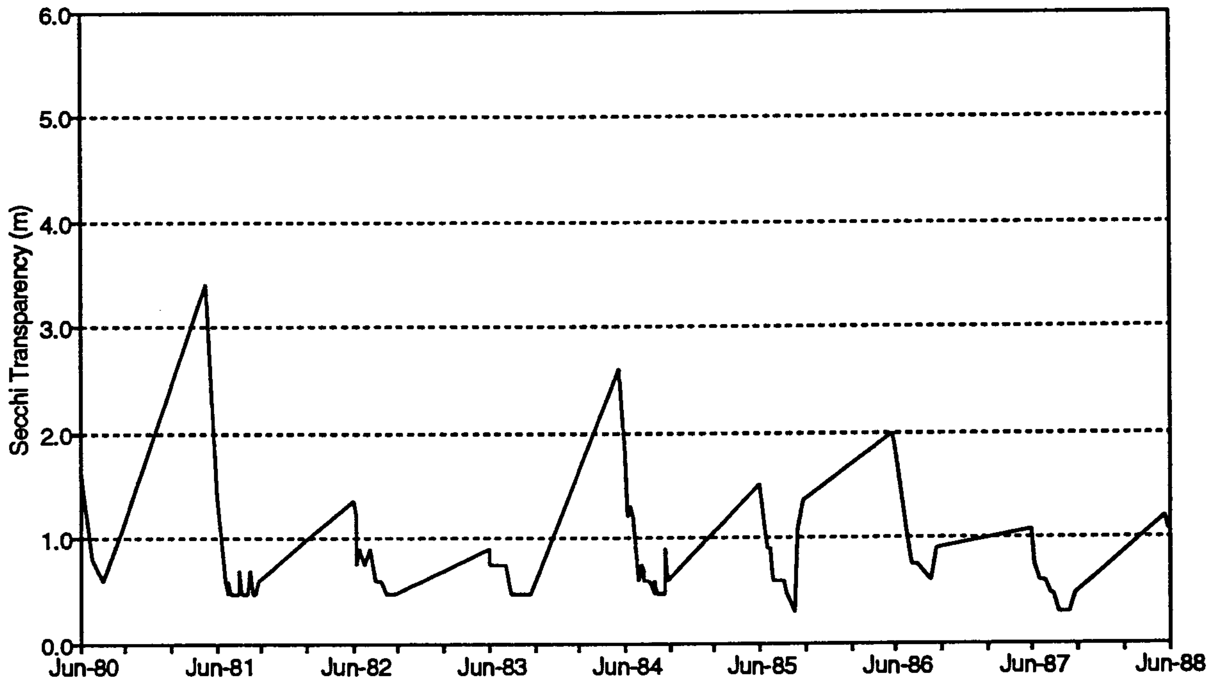


Figure 3-5: Historic Secchi Transparency Trends for Upper Prior Lake

When the lake stratifies, DO concentrations in the epilimnion decline to less than 1 mg/l by late June. Consequently, fish activity is confined to the well-oxygenated epilimnion. The fraction of Upper Prior Lake's volume that is well-oxygenated is smaller than that of Lower Prior Lake due to its shallower stratification.

Spring Lake. Historic growing season average TP and chlorophyll-a for Spring Lake are given in Figure 3-8. The water quality of Spring Lake has been the poorest of the three study lakes. The observed TP and chlorophyll-a place the lake trophic status in the eutrophic-hypereutrophic category. In fact, the Trophic State Index based on phosphorus (TSI-P) for 1980 and 1981 is off the scale (1-100) (Carlson, 1977). However, chlorophyll-a concentrations for these years were well below what would be expected for the observed TP concentrations. This is probably the result of limitation of algal productivity by something other than phosphorus. Regardless, both chlorophyll-a and TP concentrations for Spring Lake were well above the ecoregion mean for the Central Hardwood Forest Ecoregion. The lake's water quality characteristics are more typical of a lake in the Western Cornbelt Plains Ecoregion. Considering the agricultural character of the direct drainage area, this may be a more appropriate ecoregion classification for this lake.

Total phosphorus concentrations have been extremely high in the past. However, the growing season averages for 1982 and 1984 were nearly half of what they were for 1980 and 1981. Total phosphorus concentrations in the lake may be declining as the watershed character shifts from agricultural to residential, but more data is needed to establish this with certainty.

While TP concentrations have decreased, chlorophyll-a appears to have increased. The highest average chlorophyll-a occurred in 1984 when TP concentrations were the lowest. Chlorophyll-a may have been lower in 1980-82 due to nitrogen limitation. The TN:TP ratios less than 10 from Table 3-1 support this hypothesis. However, in 1984, phosphorus had declined sufficiently to become the limiting nutrient.

Dissolved phosphorus (DP) concentrations averaged 86 µg/l for the 1982 growing season. This suggests that algal productivity was not phosphorus-limited. It also suggests that there was a significant source of soluble phosphorus. Figure 3-9 shows that epilimnetic concentrations of phosphorus increased throughout the summer. This pattern is typical of lakes that stratify and mix intermittently. Internal loading of phosphorus may be a significant source for lakes that temporarily stratify, form an anoxic layer near the

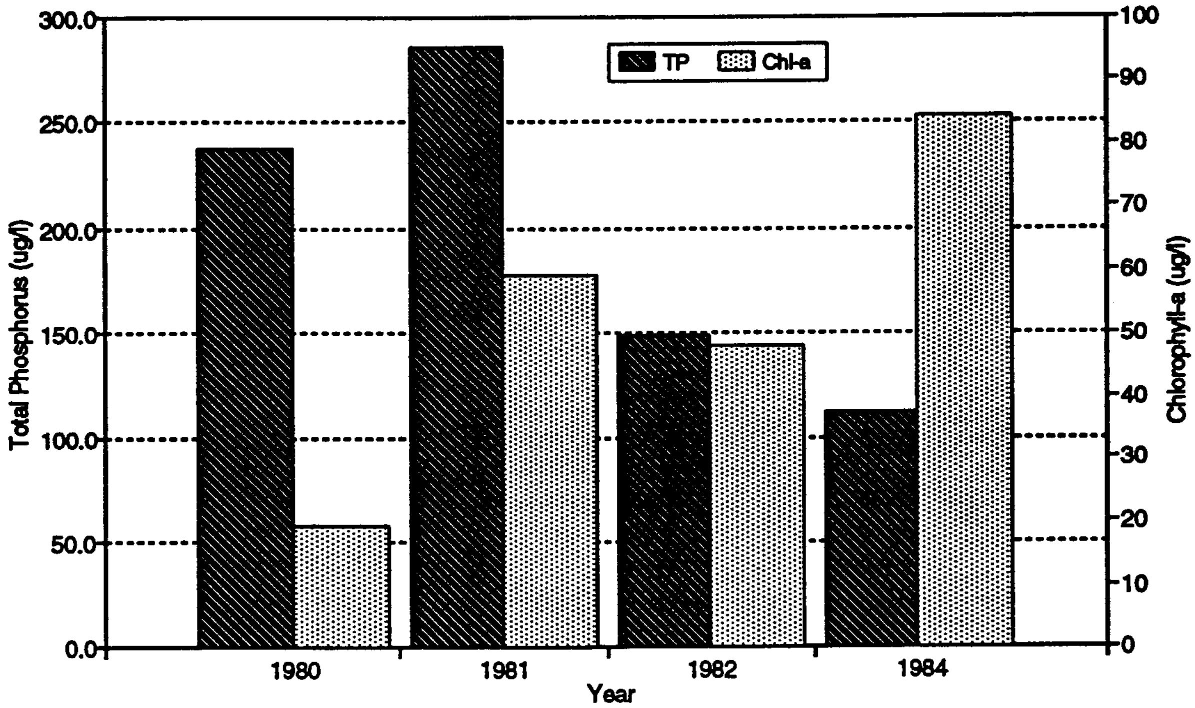


Figure 3-8: Historic Growing-Season TP and Chl-a for Spring Lake

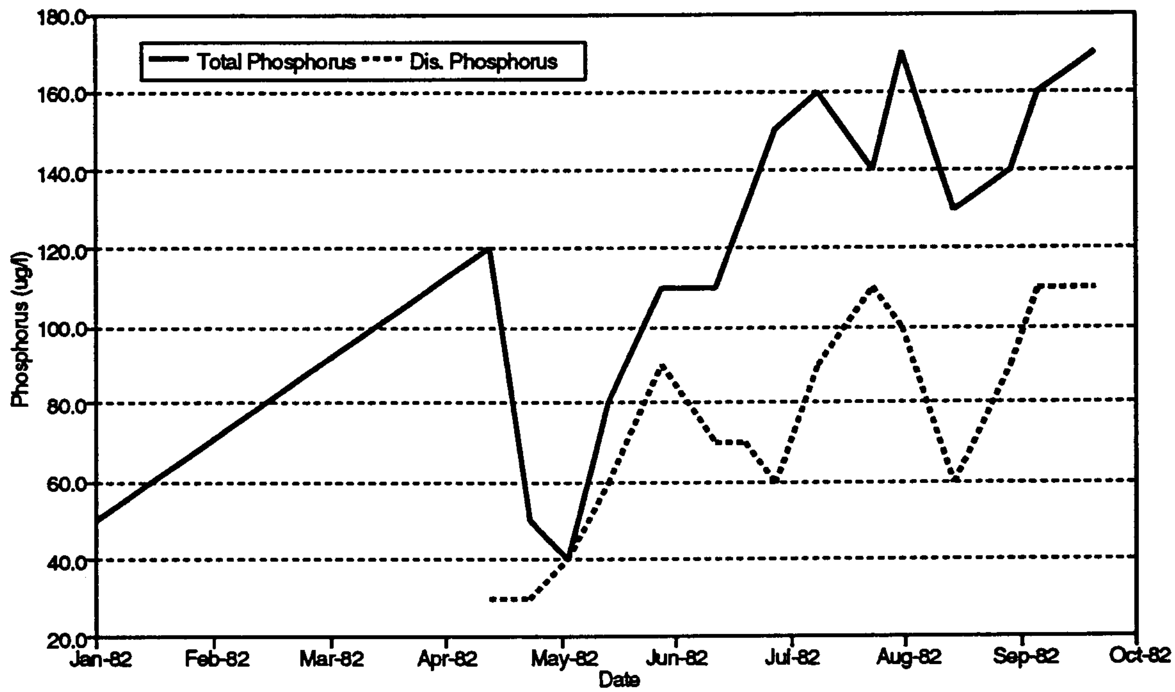


Figure 3-9: Spring Lake Surficial Phosphorus Trends

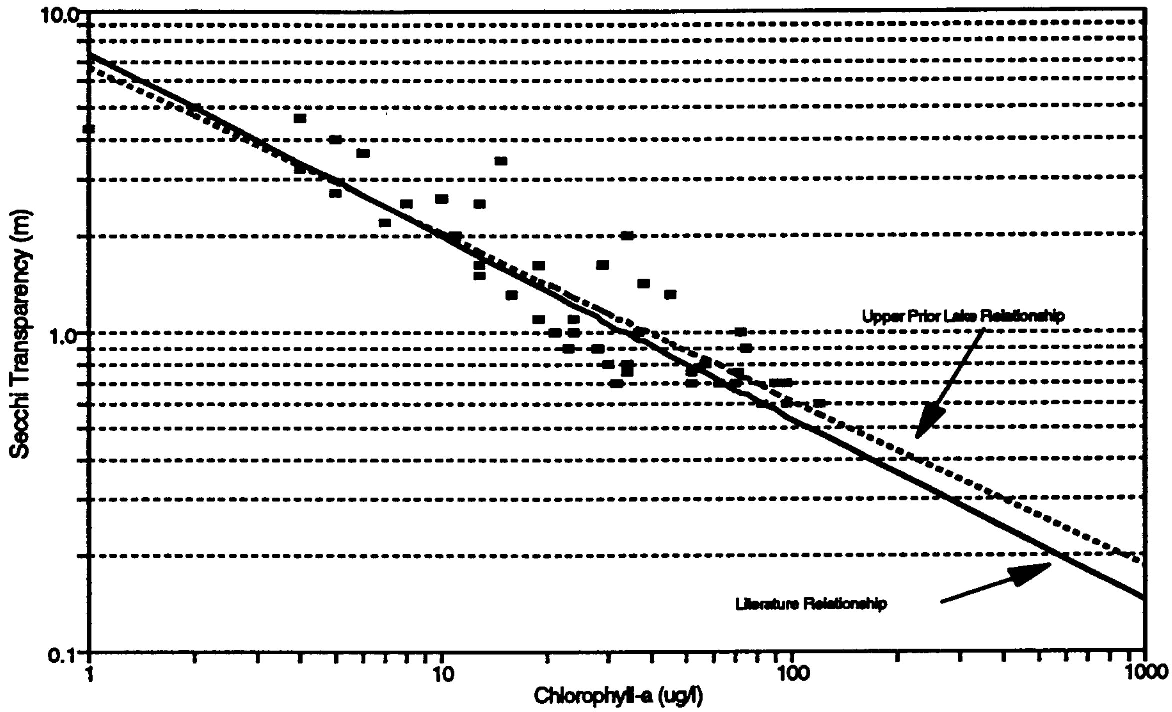


Figure 3-6: Chlorophyll-a - Secchi Transparency Relationship for Upper Prior Lake

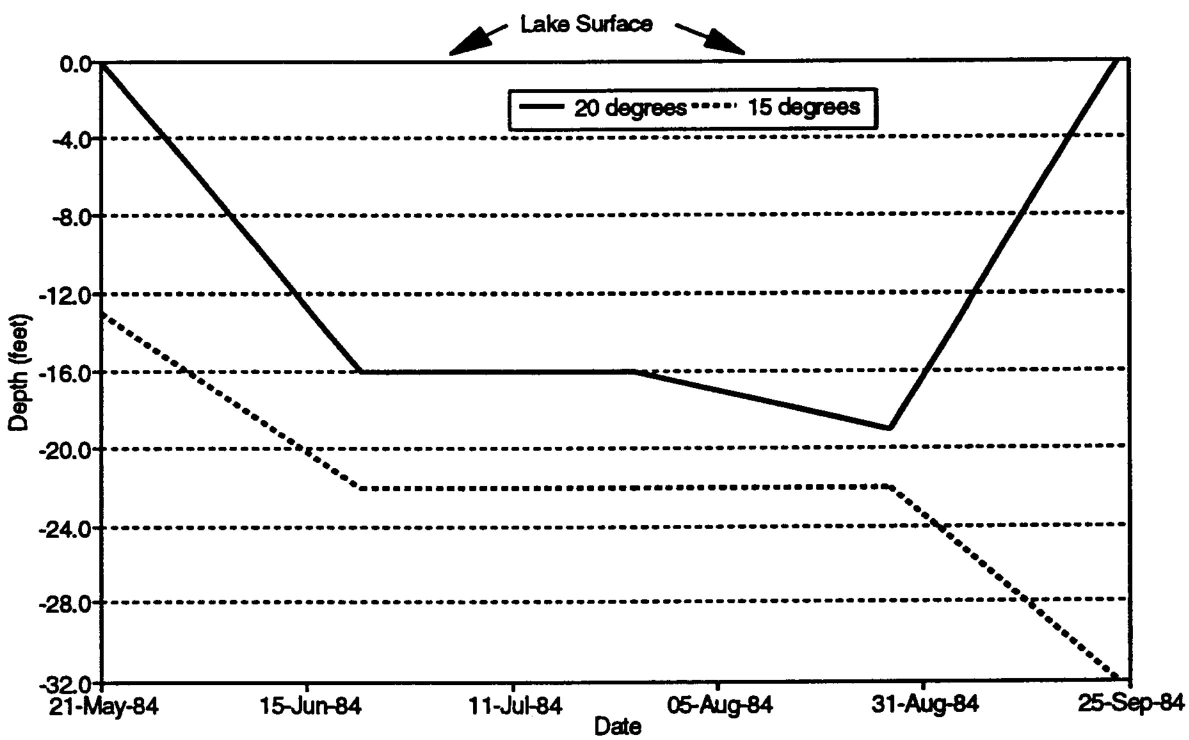


Figure 3-7: Thermal Stratification of Upper Prior Lake

sediments (allowing for phosphorus release from the sediments), and mix with the upper layers at a later date (Larsen et al., 1981). Internal loading from the sediments is further suggested by the extreme increase in hypolimnetic phosphorus (Figure 3-10). Osgood (1983) conducted a comprehensive water quality monitoring program on Spring Lake in 1982. Based on the estimates of external TP loading, water column TP concentrations, and monitored outflow, the internal TP load was calculated to account for 33 percent (1,302 kg) of the total annual load. Osgood (1983) attributed most of this internal load to algal dynamics. He considered Spring Lake polymictic and without anaerobic conditions. Subsequent review of DO and temperature profiles collected by Osgood show that the lake is actually intermictic with anaerobic conditions occurring intermittently but the 5 meter and greater depths (Figures 3-12 and 3-13). A typical value for anaerobic sediment phosphorus release is 9 (±4) mg/m^2/day. At this release rate, the load to Spring Lake is expected to be 651 (±280) kg. Therefore, most of the internal load can be explained by conventional anaerobic sediment phosphorus release. In addition, recent research (Welch et al., 1988 and MWCC, 1993) has documented sediment phosphorus release in aerobic shallow lakes. Oxic release rates easily account for the remainder of the internal load. Welch et al. (1988) gives the probable mechanism for internal loading in shallow eutrophic aerobic lakes as iron redox enhanced by temporary anoxic conditions at the sediment-water interface brought on by microbial decomposition which is stimulated by increasing temperature.

Secchi disk transparency trends for Spring Lake are presented in Figure 3-11. As with Upper and Lower Prior Lakes, there is a strong seasonal pattern in SDT. The annual recorded maximum typically occurs in Spring Lake and values decline to an annual minimum in late summer. This pattern is the result of seasonal algal population dynamics. Growing season average SDT is somewhat better than expected for the observed chlorophyll-a

The highest SDT reading for all three lakes was recorded on Spring Lake. The high water clarity in the spring of 1981 is unexpected, especially considering the exceptionally high TP of 289 μg/l for the 1981 growing season. The SDT readings following this maximum decline rapidly to near zero and then fluctuate widely throughout the season. This type of boom and bust population dynamics indicate a severely perturbed ecosystem and probably a strong predator-prey relationship.

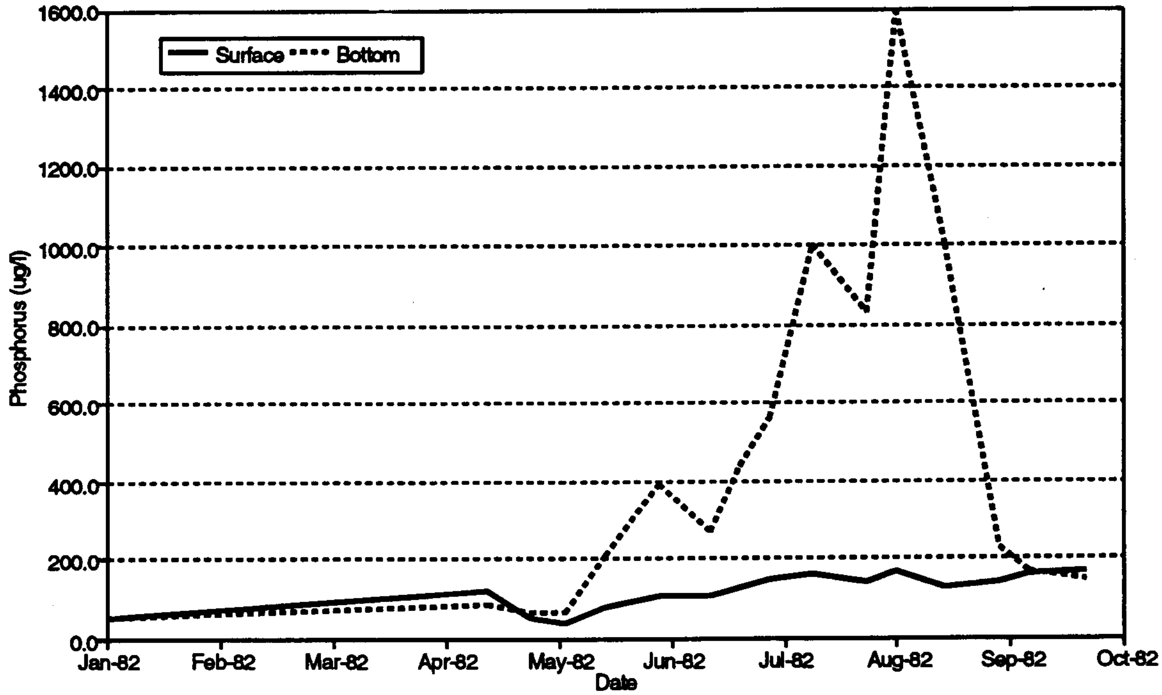


Figure 3-10: Epilimnetic and Hypolimnetic TP for Spring Lake

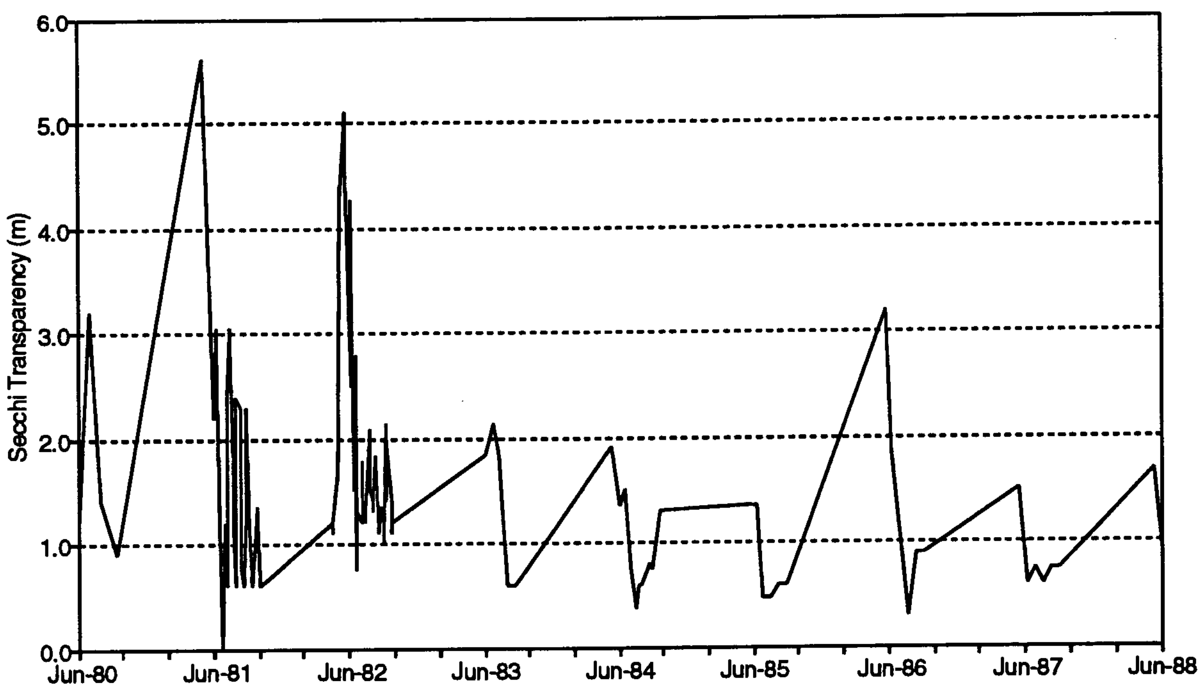


Figure 3-11: Historic Secchi Transparency Trends for Spring Lake

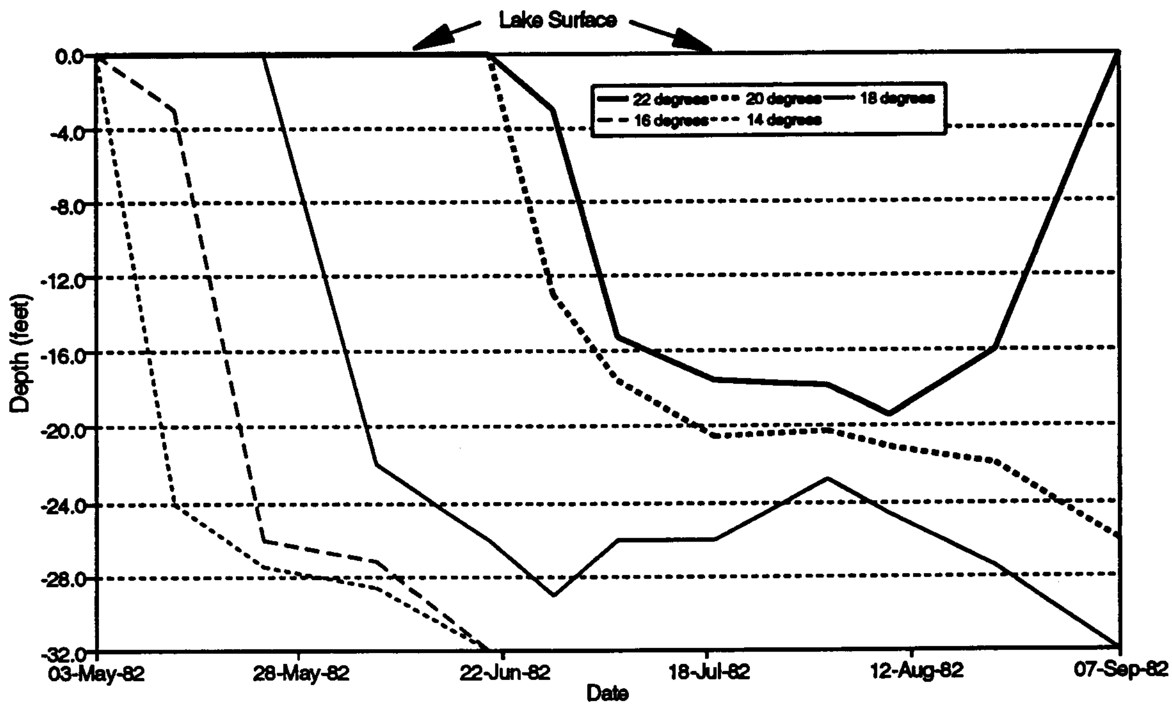


Figure 3-12: Thermal Stratification of Spring Lake

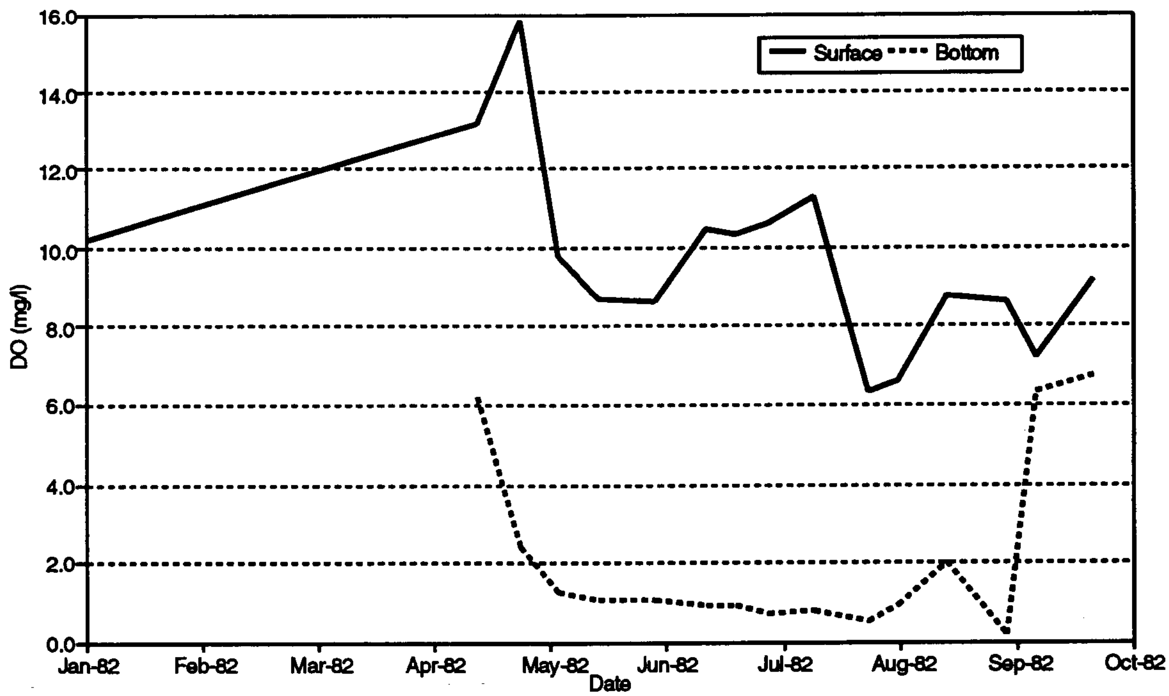


Figure 3-13: Spring Lake Dissolved Oxygen

The surface area:maximum depth ratio of 24.5:1 suggests that Spring Lake stratifies and mixes intermittently (Heiskary and Wilson, 1990). The data presented in Figure 3-12 show that the lake was weakly stratified in 1982 from late May through August. Dissolved oxygen is rapidly depleted in the bottom waters of the lake. In June, low DO (<2 mg/l) was present from depths of 5 m to the maximum depth of 10.4 m (Figure 3-13).

Historical Biologic Data

Historic data on the biology of Upper and Lower Prior Lakes consists of fisheries data collected by the MDNR in 1972, 1982, and 1987. The biology of Spring Lake has been studied more extensively by Osgood (1983). Historical data for Spring Lake includes information on the abundance and community composition for zooplankton and phytoplankton as well as fisheries data. Catch rates for surveys conducted by the MDNR are reported in Appendix B. Table 3-2 lists the fish species that were reported for the three study lakes.

TABLE 3-2

REPORTED FISH SPECIES

Northern Pike	Yellow Bullhead
Carp	Bullhead sp.
Bluntnose Minnow	Bluegill
Fathead Minnow	Green Sunfish
Golden Shiner	Pumpkinseed
Spotfin Shiner	Hybrid Sunfish
Minnow sp.	Largemouth Bass
Longnose Sucker	Black Crappie
White Sucker	White Crappie
Northern Redhorse Sucker	Crappie sp.
Black Bullhead	Yellow Perch
Brown Bullhead	Walleye
	Johnnie Darter

Lower Prior Lake. Catches in Lower Prior Lake were comprised mostly of bluegill, black and white crappies, yellow perch, and walleye. Species composition was similar to Upper Prior Lake, but catch rates for northern pike, pumpkinseed, and hybrid sunfish were lower. Catch rates for walleye were significantly higher than the local median, while rates for black and yellow bullhead were significantly below the local median. Yellow bullhead catch rates increased from 1972 to 1982, and then decreased in 1987. An opposite trend was seen for black crappie. Yellow perch numbers have decreased and walleye numbers have increased from 1972 to 1987.

Spawning conditions during the 1972 and 1982 surveys were reported as poor to fair for northern pike and walleye. Table 3-3 lists the reported spawning conditions for all three study lakes. The spawning conditions in Lower Prior Lake were best suited for panfish. Inadequate reproductive success by northern pike and walleye have been compensated by stocking of these species. Table 3-4 gives the stocking history of the three study lakes. From 1970 to 1974, Lower Prior Lake was occasionally stocked wit northern pike fingerlings and yearlings. Northern pike stocking in the early 1980s included adult fish. The MDNR has also aggressively stocked the lake with walleye on an annual basis.

In general, more nutrient-rich lakes are more biologically productive with higher fish yields. However, increasing eutrophication tends to alter the forage base, dissolved oxygen distribution, and other important factors. Eutrophic conditions favor a fish community composition of rough fish and other less desirable species.

The growing season average TP of 20-42 μg/l observed for Lower Prior Lake is below the mean for bass/panfish/walleye lakes in the Central Hardwood Forest Ecoregion (Heiskary and Wilson, 1990). Edward et al. (1983) indicate that peak feeding for walleyes occurs in lakes with Secchi disk transparencies between 1 and 2 m, whereas the average for Lower Prior is generally above 2 m. The MPCA DO standard of 5.0 mg/l applies to bass, walleye, and northern pike. There is no record of any winterkills on Lower Prior Lake.

Upper Prior Lake. Catches on Upper Prior Lake were comprised mostly of black bullhead, bluegill, black and white crappie, and yellow perch. Catch rates were significantly higher than the local medians for white sucker, bluegill, black and white crappie, yellow perch, and walleye. Bluegill catch rates increased from 1972 to 1982 and then decreased in 1987. An opposite trend was seen for black bullhead and yellow perch. White sucker and walleye numbers have increased over time.

Spawning conditions in Upper Prior Lake were reported as poor to fair for walleye. Conditions for northern pike improved significantly from poor in 1972 to good/excellent in 1982. As in Lower Prior Lake, spawning conditions were best suited to panfish. The stocking history of Upper Prior Lake is indistinguishable from that of Lower Prior Lake.

TABLE 3-3

SPAWNING CONDITIONS

	SPRING LAKE		*UPPER PRIOR LAKE*		*LOWER PRIOR LAKE*	
FISH SPECIES	**1973**	**1982**	**1972**	**1982**	**1972**	**1982**
Northern Pike	Good	Poor	Poor	Good-Excellent	Poor	Poor
Panfish	Excellent	Good	Good	Excellent	Good	Good-Excellent
Largemouth Bass	Fair	Good	Fair	Good	Fair	Good
Walleye	Fair	Fair	Poor	Poor-Fair	Poor	Fair

TABLE 3-4

FISH STOCKING

Year	Fish Species	Size	Number Stocked Spring Lake	Number Stocked Upper/Lower Prior Lake
1970	Northern Pike	YRL	82	
1970	Walleye	FGL	1,100	1,210
1971	Northern Pike	FGL		1,040
1971	Walleye	FGL	130	1,820
1973	Northern Pike	FGL		9,780
1973	Walleye	FGL	12,675	
1974	Northern Pike	FGL	7,680	5,760
1974	Walleye	FGL	4,284	7,446
1975	Walleye	FRY	189,000	
1975	Walleye	FGL		6,675
1976	Walleye	FRY	193,000	
1976	Walleye	FGL		10,655
1977	Walleye	FRY	190,200	
1977	Walleye	FGL		5,759
1978	Walleye	FRY	188,000	
1978	Walleye	FGL		8,020
1979	Walleye	FRY	380,000	
1979	Walleye	FGL		3,506
1980	Northern Pike	FGL		600
1980	Northern Pike	ADL		33
1980	Walleye	FRY	345,000	
1980	Walleye	YRL		7,315
1981	Northern Pike	FGL		69
1981	Northern Pike	FRY		5,000
1981	Walleye	FRY	345,000	7
1981	Walleye	FGL		6,795
1982	Northern Pike	ADL		186
1982	Walleye	FRY	335,000	
1982	Walleye	FGL		8,316
1983	Northern Pike	ADL		186
1983	Walleye	FRY	335,000	
1983	Walleye	YRL	6,565	
1984	Walleye	FGL	5,254	11,587
1985	Walleye	FGL	5,999	8,675
1986	Walleye	FGL		25,705
1987	Walleye	YRL		8,952

FRY = Fry
FGL = FIngerlings
YRL = Yearlings
ADL = Adults

Table 3-4 lists a composite stocking history for Upper and Lower Prior Lakes. Stocking of these lakes has generally attempted to compensate for inadequate northern pike and walleye reproduction.

Upper and Lower Prior Lakes are only separated by a narrow causeway and fish may move freely between the lakes, but the more eutrophic conditions of Upper Prior Lake affect the habitat suitability of the lake. The growing season average TP of 63-79 µg/l observed for Upper Prior Lake brackets the mean for bass/panfish/walleye lakes in the Central Hardwood Forest Ecoregion. The Secchi disk transparency for the lake averages below 1 m, which is below the 1-2 m range of peak feeding for walleyes. Since Upper Prior Lake has more shallow stratification than Lower Prior Lake, there is a smaller oxygenated refuge when the bottom waters become anoxic. However, there is no record of winterkill occurring on Upper Prior Lake.

Spring Lake. Catch rates for Spring Lake indicate that planktivores such as bluegills, black and white crappie, and yellow perch are relatively abundant as well as black bullheads. Piscivorous fish are relatively sparse despite an aggressive walleye stocking program. Catch rates for golden shiner, white sucker, pumpkinseed, black and white crappie, and yellow perch exceed local medians. Yellow perch and northern pike populations were seen to vary inversely with each other. This population behavior is common among predator-prey relationships. Based on gill net information, black and white crappie numbers have decreased over time, while the population of the more eutrophic-tolerant black bullhead increased. Minnesota Department of Natural Resources records indicate that between 1969 and 1983, approximately 273,340 lbs of carp and 5,730 lbs of bullheads were removed from Spring Lake.

Spawning conditions in Spring Lake were judged to be fair for walleyes, but walleye reproduction was too low to support MDNR fishery goals. Therefore, the lake was stocked aggressively with walleye fry and fingerlings on an annual basis. Panfish spawning conditions were deemed to be good to excellent.

The highly eutrophic condition of Spring Lake has a definite effect on the habitat suitability of the lake. Growing season average TP of 113-289 µg/l is well above the mean for bass/panfish/walleye lakes in the Central Hardwood Forest Ecoregion. These concentrations are closer to the mean for a rough fish lake. There have been a few reported fish kills due to columnaris disease, which is more prevalent in highly eutrophic lakes. There have been no winterkills reported for Spring Lake.

Phytoplankton

Phytoplankton dynamics of Spring Lake have been previously detailed by Osgood (1983). The algal population was composed primarily of diatoms in the early spring of 1982. By late April, the algal community was composed primarily of green algae, cell counts were quite low (approximately 100 cells/ml), and Secchi disk transparency was at its highest recorded level. In June, the community composition shifts to dominance by blue-green algal species and cell counts increased steadily to a late summer maximum of about 50,000 cells/ml.

Osgood (1983) found that phytoplankton dynamics of Spring Lake were characterized by flake blooms of Aphanizomenon. Generally, these flake blooms are believed to form an oxic sediment-water interface in the presence of large daphnia. This study further suggests that these blooms play an important role in nutrient cycling by transporting nutrients from the sediment-water interface to the epilimnetic waters.

Zooplankton

The details of zooplankton community dynamics were given by Osgood (1983). The cladoceran community was dominated by Daphnia pulicaria, D. galeata mendotae, and Chydraus. The spring increase in D. pulicaria was related to a rapid decrease in chlorophyll-a and was followed by the appearance of Aphanizomenon flakes. D. pulicaria declined to low levels in August with corresponding decreases in Aphenizomenon. In September, D. galeata mendotae became the dominant cladoceran. The increase in this species spurred a second flake bloom of Aphanizomenon.

Copepod abundance seemed to be related to the quality of food with pulses just following blooms of diatoms or flagellates. Rotifers were abundant only briefly. The rotifer Conochilus was abundant when filamentous blue-greens were at their maxima.

METHODS

Site Selection

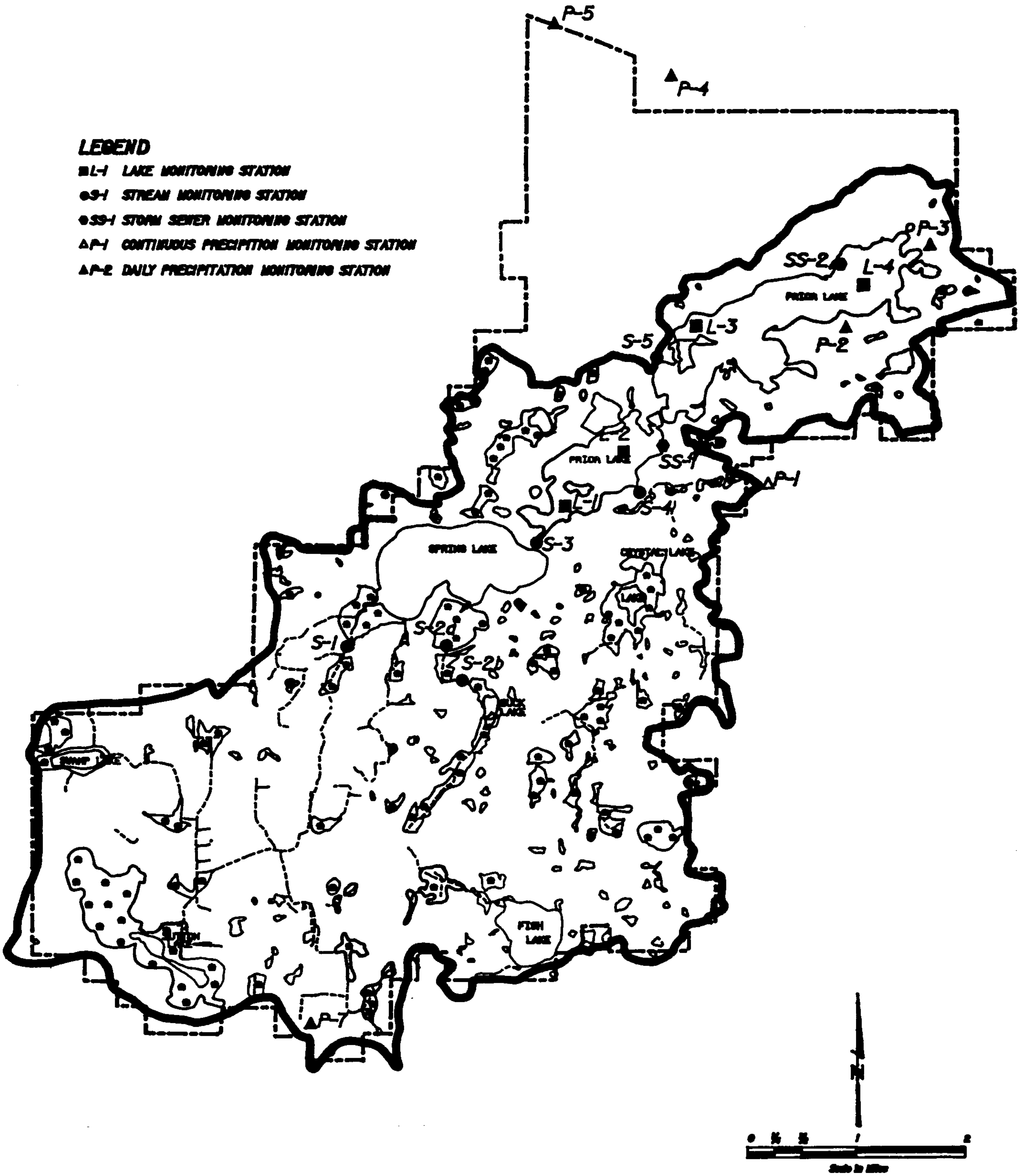
Lake Monitoring. Samples were collected from four lake monitoring stations within Upper and Lower Prior Lakes (two stations in each lake) in order to evaluate in-lake nutrient dynamics and lake trophic status. Lake stations were selected to correspond to the deeper areas of the lakes and to provide representative samples (Figure 3-14 and Map 1).

Upper Prior Lake has two stations. Station L-1 was located about 460 m southwest of Twin Isle in about 9 m of water. Station L-2 was located towards the northeastern end of the lake and has a water depth of about 9 m.

Lower Prior Lake also has two lake monitoring stations. Station L-3 was sited north of Martinson Island in about 15 m of water. Station L-4 was located near the northeastern end of the lake at a water depth of 8 m.

Stream Monitoring. Five stream stations were monitored to evaluate nutrient loading impacts to the Prior Lake-Spring Lake system (Figure 3-14). Two stream stations were established on the main tributaries to Spring Lake. Station S-1 was located on County Ditch 13 under Highway 13 and Station S-2 was located on the stream discharging from Fish and Buck Lakes to Spring Lake near Highway 13. The Spring Lake outlet to Upper Prior Lake was selected as Station S-3. Station S-4 was sited on the stream discharging from Rice and Crystal Lakes and the outlet from Lower Prior Lake was Station S-5.

Storm Sewer Monitoring. At least 48 separate storm sewers discharge to the three study lakes. Due to the prohibitive costs, all of these storm sewers could not be monitored. Instead, two representative sites were selected (Figure 3-14). Station SS-1 was located at the outlet of a storm sewer in the northeast corner of Upper Prior Lake. This storm sewer drains an area northeast of the lake that is primarily characterized by low to medium density residential land use. Station SS-2 was located at the outlet of a dry sedimentation basin to Lower Prior Lake. This basin is utilized by the Sand Point development along the northern shore of the lake.



JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	*Prior Lake/Spring Lake Watershed* *Monitoring Sites*	**3-14**

Field Methods

Sample Containers and Handling. Water quality samples were collected in a 500 ml nalgene plastic bottle with a teflon-lined cap supplied and stored at the laboratory. Cleaning of bottles was accomplished by washing with laboratory detergent (Labtone–no phosphates, no enzymes, no NTA) followed by deionized water (Type I ASTM Standards) rinsing. Sample bottles were rinsed with the sampled water prior to sample collection. Sample bottles were labeled with marking tape and a permanent, waterproof marker. Labels contained information such as sample description, location, date, time, and type of preservative. Generally, four bottles are collected for each sample analysis, and another labeled 'Nutrient' which was later treated with sulfuric acid for the preserved nutrient analysis. Two other bottles are labeled 'Algae' and 'Zooplankton' and were later preserved on-site with Lugol's and two percent formaldehyde, respectively. All samples were handled in accordance with EPA-approved methods.

Information on all samples received was entered into the laboratory check-in log. Samples were labeled with a code number and stored in refrigerators at 4 degrees C until all analysis was complete. Samples were then stored for an additional thirty days before they were discarded.

Lake Monitoring Procedures. Lake samples were collected monthly from September through April, and biweekly May through August. Lake contour maps and depth finder were used to locate sampling sites (Figure 3-8). Once anchored at a specific site, field analysis and collection begin by entering notes and data in a field book. Date, time, sampling crew, weather conditions, dissolved oxygen, temperature, pH readings, Secchi depth, and any unusual observations were recorded in this book.

Generally, the dissolved oxygen (DO) and temperature profile was obtained first. A DO/temperature meter is used for this. This meter is calibrated before each use. The probe was lowered to the bottom of the sampling site and the depth read on one meter calibrated cable. This measurement also confirmed depth finder reading. Dissolved oxygen and temperature readings were recorded at one meter intervals from bottom to surface. A Secchi disc reading was obtained by lowering the disc on the shaded side of the boat until it disappeared and raised until it just appears, reading the calibrated rope (in tenths of a meter) at the surface water level. Surface water samples were collected using a two meter vertical surface compositor. The sample was emptied into a 2-liter glass container and then distributed between the various bottles described earlier. A bottom sample, and/or any other specified depth was obtained using a Kemmerer water sampler with a calibrated rope marked every meter. Samples taken at each depth were poured into their respective labeled bottles. At the same time samples were collected, a beaker was filled so that the pH can be measured at that depth. pH is measured using a field pH meter. The meter was calibrated before each use with pH buffers of 4, 7, and 10. An algae sample was obtained by collecting a representative surface grab sample of the sampling site. A zooplankton sample was collected by lowering a plankton net with a "Wisconsin" type bucket to the bottom and raising it slowly to the surface to obtain a vertical tow of the sampling site. The organisms were preserved with a 2 percent formalin solution. All samples were placed in a cooler with ice packs immediately after collection, and were taken directly to the laboratory. Sample processing such as filtration, thus took place within several hours of collection.

Submerged aquatic plants were sampled both visually and using the standard grapple devised by the MDNR (Krosch, 1989). The entire shoreline around the lake was sampled using the grapple and boat. Spacing between sampling sites ranged from 100 to 1,000 feet.

The grapple method involves casting the device from 15 to 25 feet in each of the four cardinal directions at each sample site. The length of the cast is dependent upon depth, i.e., the deeper the water, the longer the cast. The grapple is then pulled along the bottom and raised. Each species present is then recorded.

Stream Monitoring Procedure. Stream sampling sites were sampled and gauged at the sites indicated on Figure 3-8. A sample was collected at mid-stream and mid-depth.

Dissolved oxygen and temperature were measured by placing the probe of the DO/temperature meter (which was calibrated daily) at mid-stream, mid-depth, or where practical. All information including date, time, sampling crew, weather conditions, dissolved oxygen, temperature, observations, and gauging information were recorded in a field book or individual stream information sheets. Stream gauging was accomplished by using a velocity meter and measuring a cross-sectional area of the stream with it at a distance of 60 percent the full water column above the sediments. This velocity/area methods was then calculated to give flow of the stream in cubic feet per second. A staff gauge reading or water level below a bench mark was measured to record a stream water elevation. This was later used for water velocity information in a stage/discharge calculation after sufficient data is collected on the stream site. Streams were measured by physically wading the stream bed.

Analytical Methods

The analytical procedures used in this project are summarized in Table 3-5. Both EPA method reference number (U.S. EPA, 1982) and the corresponding STORET reference number are provided where applicable.

TABLE 3-5

ANALYTICAL METHODS

Parameter	EPA Method	STORET No.
Alkalinity	310.1	00410
Chlorophyll-a	1002-G[b]	32211
Conductivity, Specific	120.1	00095
Nitrogen, Nitrate + Nitrite	353.2	Total 00630
Nitrogen, Total Kjeldahl	351.2	00625
Oxygen, Dissolved	360.1	00300
pH	150.1	00400
Phosphorus, Total	365.2	00665
Phosphorus, Dissolved Reactive	365.2	00299
Solids, Total Suspended	160.2	00530
Temperature	170.1	00010
Zooplankton	B-2501-77[a]	70946
Phytoplankton	B-1501-77[a]	60050

[a]USGS (1979)
[b]APHA (1985)

For phytoplankton analyses, two meter composite samples were taken at both lake locations and immediately preserved with Lugol's solution. Bottles were stored in coolers and sent to the laboratory where they were refrigerated until enumerated.

A Zeiss binocular compound light microscope equipped with an ocular grid, 1 ml Sedgwick/Rafter counting cell, and 1 ml Stinson/Whipple pipette was used in slide preparation. Counts were made at 100x and identifications made at either 100x or 400x. Depending on the concentration of cells, either the entire S/R cell was counted or strips were counted and total numbers of cells calculated. In order to maintain consistency, one analyst was used for all phytoplankton analysis during the course of the project.

Analysis is performed after measuring the volume of the preserved concentrate. After drawing 1 ml of the preserved sample with a Stinson-Whipple pipette, the aliquot is dispensed into a 1 ml Sedgwick-Rafter counting cell and placed on the microscope stage. A count of the entire Sedgwick-Rafter cell is made and the zooplankters are classified to class and/or genus. A Bausch and Lomb dissecting microscope is used in counting. Upon completion of the count, the total number of individuals per cubic meter is then calculated using EPA Method B-2501-77 (EPA, 1977).

Quality Assurance/Quality Control

Quality Assurance Objective. The overall quality assurance (QA) objective for this project is to provide for all reasonable actions to prevent erroneous data from being produced, and in the event that errors do occur, that they are identified, corrected, and suspected data are not used as a basis for conclusions and subsequent actions.

Based on records for the analytical measurement system employed, Table 3-6 details the precision, accuracy, and completeness objectives for the individual parameters.

TABLE 3-6

QUALITY ASSURANCE RESULTS

Parameter	Precision (SD)	Accuracy (Percent)	Completeness (Percent)
Alkalinity	±4.2	97	100
Chlorophyll-a	±8	--	95
Conductivity	±8.5	--	99
Nitrogen, Nitrate + Nitrite	±0.02	91	95
Nitrogen, Total Kjeldahl	±0.2	98	95
Oxygen, Dissolved	±0.1	--	100
pH	±0.1	--	100
Phosphorus, Total	±0.022	98	98
Phosphorus, Dissolved Reactive	±0.0022	98	95
Solids, Total Suspended	±5.5	--	95
Temperature	±1	--	100

Sample Custody. Samples collected by field personnel were returned directly to the laboratory. Upon approval, samples were logged into the laboratory sample tracking system. No formal "chain-of-custody" procedures were used as the results were not for legal purposes.

Calibration. All instruments are inspected, maintained, and calibrated as part of service agreements with either the manufacturer or with Tonka Technical Labs, Minneapolis, Minnesota.

Field Instruments

YSI Dissolved Oxygen/Temperature Meter Model 57. Instrument is calibrated on a daily basis and batteries and permeable membranes are checked as a part of routine maintenance. The instrument is inspected by Tonka Technical Labs semi-annually.

YSI Conductivity Meter Model 33. Instrument is calibrated before each use. Batteries, probe, and cable are inspected on a routine maintenance. The instrument is inspected by Tonka Technical Labs annually.

Analytical Measurement Field pH Meter. Instrument is calibrated before each use with certified buffers. The instrument is inspected by Tonka Technical Labs annually.

Laboratory Instruments

Beckman Spectrophotometer Model 34. Maintenance procedures include replacing the pump tubes as needed, cleaning the flow cell daily, periodically checking the resolution and wave length accuracy, and adjusting for electrical bridge shift. The instrument is inspected by manufacturer annually.

Technicon Autoanalyzer II. Maintenance procedures include replacing pump tubes as needed and cleaning filters before each use. The instrument is inspected every two years by manufacturer.

Sartorius Analytical Balance. Instrument is cleaned and calibrated by Northern Balance annually.

Beckman pH Meter Zeromatic 55-3. Instrument is calibrated before each use with certified buffers. Instrument is inspected by Tonka Technical Labs semi-annually.

Zeiss High Beam and Stereo Microscopes. Instruments are cleaned and inspected by North Central Instruments annually.

Data determined to be valid will be reported to the STORET system by the laboratory coordinator.

Other types of data, such as land use information, is stored in a separate location. Hard copies of all information, if available, are collected and stored.

Quality Control Checks. Several procedural quality control checks are used. These include replication of at least 10 percent of samples, spike sample analysis of at least 10 percent of samples, reagent blanks, and use of calibration standards. The results of these checks are maintained in a quality assurance laboratory record. Summaries of these results are calculated at least once per year.

Performance Audits. External audits for purposes of quality assurance are conducted. These include participation in the U.S. EPA Reference Sample Program and the Twin Cities Round Robin Inter-Laboratory Quality Control Program.

Preventative Procedures. Equipment used is routinely maintained to minimize failure and reduce down time. Backup equipment is available in many cases. Field equipment is cleaned and checked after each use and any repair or maintenance required is conducted immediately.

Data Precision, Accuracy, and Completeness. Results of Internal Quality Control Checks are recorded in a laboratory QA/QC record book. On at least an annual basis, results of these checks are summarized for each parameter routinely tested to determine data precision and accuracy. Records of data completeness are available through the data validation process. A monitoring of these parameters is made daily as results are recorded in the laboratory QA/QC book.

Corrective Action. In the event of QA/QC problems being identified using the various methods described, the laboratory coordinator would report to the project manager. Assignment would then be made to an individual responsible for diagnosis and ultimately, corrective action. A post-remediation evaluation would then be conducted.

QA Reporting. Records of QA/QC checks and other procedures are maintained and permanently stored. On at least an annual basis, a summary of QA/QC performance will be made which identifies, where applicable, for each parameter:

- Precision, as standard deviation
- Accuracy, as percent
- Completeness, as percent

RESULTS

This section presents the results from the current water quality investigation on Lower and Upper Prior Lakes. This section also includes the results of the biological survey of these two lakes and the results of stream monitoring.

Lower Prior Lake Water Quality

Nutrients. The TP concentrations in Lower Prior Lake were the lowest of all three study lakes. Epilimnetic TP concentrations remained fairly steady at about 45-50 μg/l throughout the monitoring period (Figure 3-15). The growing season epilimnetic TP was 45 μg/l. This is close to the observed growing season average for 1980 (42 μg/l), but higher than those observed for 1981 and 1984 (20 μg/l and 25 μg/l, respectively). Figure 3-15 also shows that the hypolimnetic TP concentrations were similar to the epilimnetic concentrations during winter, but concentrations increase steadily to more than 450 μg/l in mid-summer. This pattern of increasing hypolimnetic TP throughout the growing season is characteristic of lakes that have significant internal phosphorus. As the bottom waters become anoxic, biochemical recycling of phosphorus from the sediments may increase dramatically.

The form of this increased hypolimnetic phosphorus is primarily soluble reactive phosphorus (SRP). Concentrations of SRP in the hypolimnion typically accounted for about 67 percent of the TP. This observation is consistent with common explanations of the mechanism of sediment phosphorus release. Generally, SRP is assimilated rapidly by phytoplankton. However, while the hypolimnetic concentrations increased to about 300 μg/l in August, the epilimnetic concentrations remained around 10-15 μg/l throughout the monitoring period (Figure 3-16). This difference was due to stratification which prevented the phosphorus-rich hypolimnetic waters from mixing with the epilimnion during the growing season. The epilimnetic growing season average SRP for Lower Prior Lake was 12 μg/l.

The availability of phosphorus is most likely the limiting factor to algal growth. The TN:TP ratios observed for Lower Prior Lake ranged from 20:1 to 35:1 (Figure 3-17). Several field studies have found that ratios greater than about 15:1 to 20:1 indicate phosphorus-deficient phytoplankton (Sakamoto, 1966; Smith, 1979).

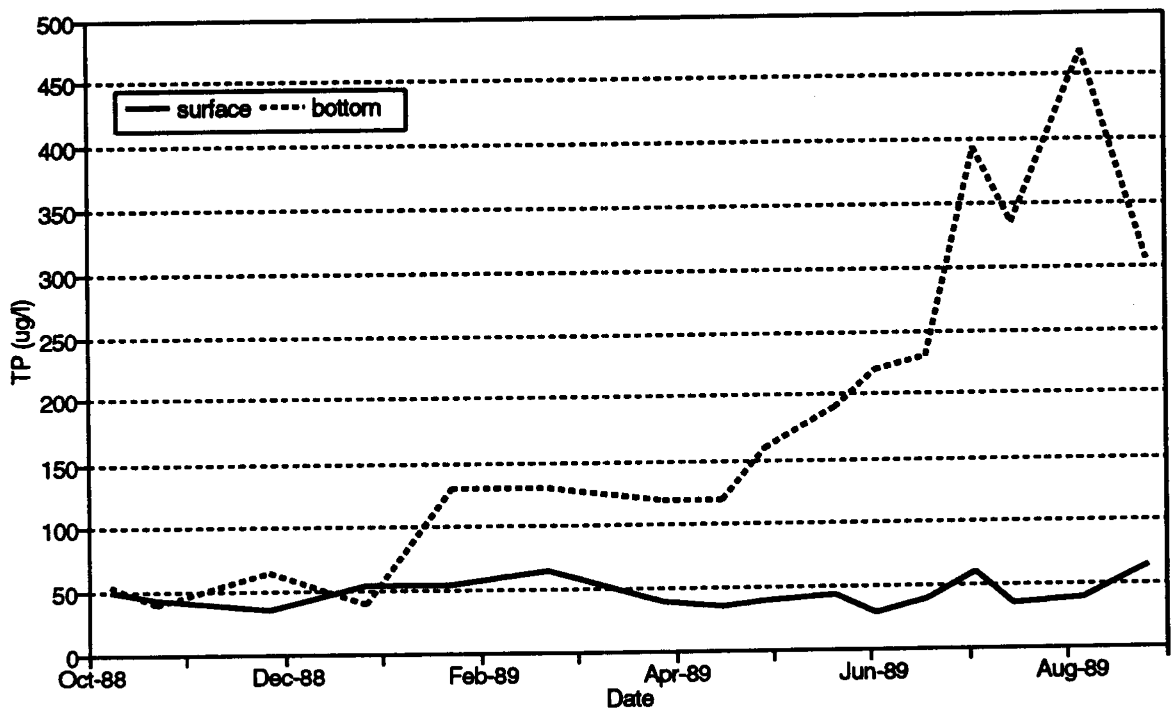


Figure 3-15: Average Surface and Bottom TP for Lower Prior Lake

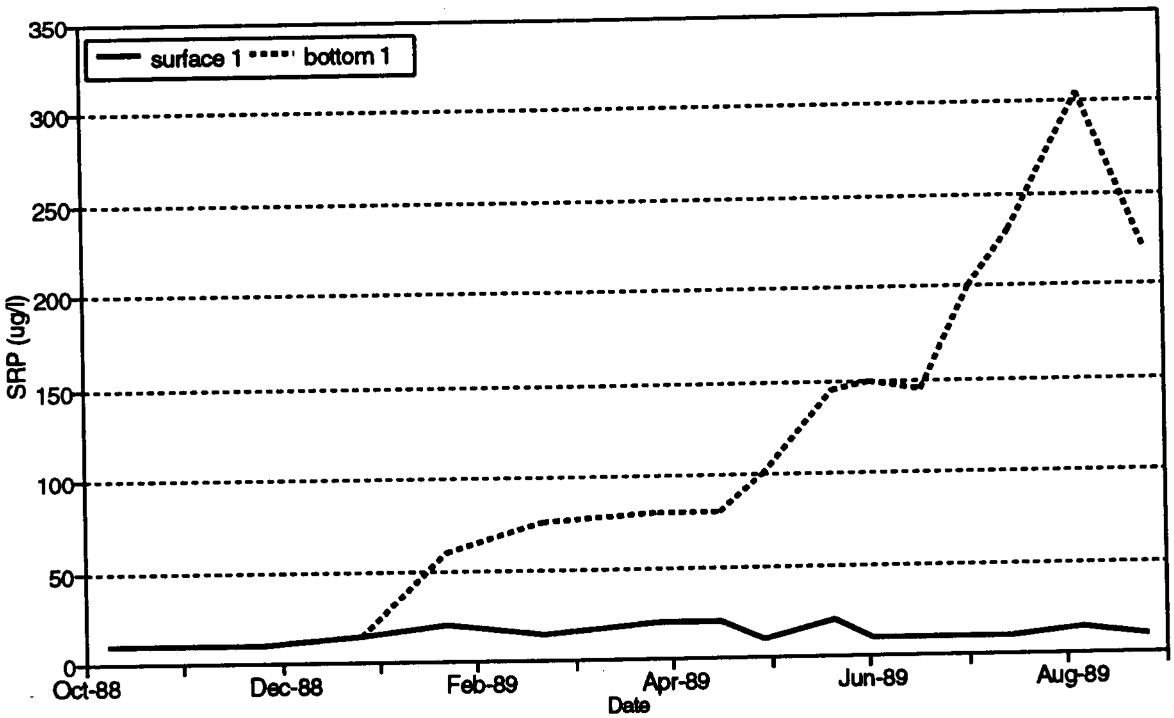


Figure 3-16: Average Surface and Bottom SRP for Lower Prior Lake

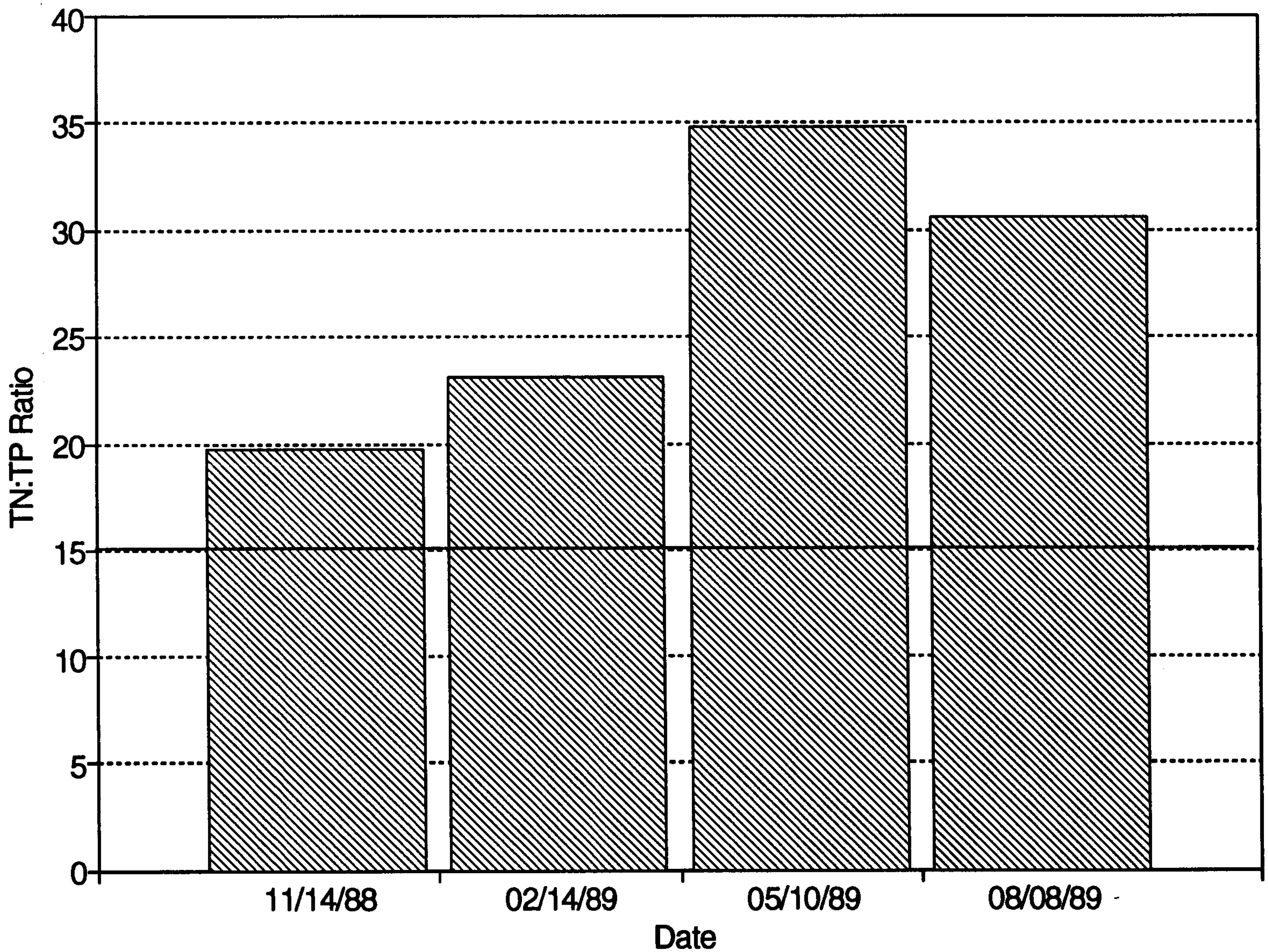


Figure 3-17: Average Surface TN:TP Ratios for Lower Prior Lake

Chlorophyll-a. Chlorophyll-a is a pigment that is present in all phytoplankton. Since this parameter is easy to measure, it is often used as a surrogate for algal abundance. Chlorophyll-a concentrations in Lower Prior Lake are the lowest of the three study lakes. For most of the monitoring period, concentrations of chlorophyll-a were about 4 µg/l (Figure 3-19). However, concentrations increase to about 18 µg/l in late summer. The growing season average chlorophyll-a for Lower Prior Lake was 7.9 µg/l. This is slightly lower than the historical growing season averages.

Secchi Disk Transparency. Secchi disk transparency (SDT) for Lower Prior Lake was excellent during the winter, exceeding 6 m on one occasion (Figure 3-19). After ice-out, SDT decreased to about 2 m. Secchi disk transparency for Lower Prior Lake fluctuated between 1-3 m throughout the growing season. The growing season average SDT for Lower Prior Lake of 2.24 m is similar to the historical growing season average SDT from the early 1980s.

Temperature. Figure 3-20 shows that in the fall of 1988, the water column of Lower Prior Lake was isothermal (the same temperature from top to bottom). During winter, the lake was weakly stratified, with cooler water at the surface and warmer water at the bottom. In March, the lake was isothermal again. The lake became strongly stratified during the summer, with surface temperatures reaching 26°C and bottom temperatures remaining below 6°C.

This seasonal pattern of thermal stratification during winter and summer, and mixing in spring and fall, is commonly referred to as dimictic. Dimictic behavior is often observed for deep to moderately deep temperate lakes. The mixing status of the lake is expected to have a significant effect on lake productivity. Dimictic lakes are expected to have stable or declining epilimnetic phosphorus concentrations over the course of the summer, assuming external supply is relatively low. This appears to be the case for Lower Prior Lake. While internal loading of phosphorus does occur in the anoxic hypolimnion (as discussed previously), most of this phosphorus remains in hypolimnion, unavailable for algal uptake.

Dissolved Oxygen. Dissolved oxygen (DO) concentrations in the hypolimnion decreased rapidly in winter, and again after spring turnover (Figure 3-21). Hypolimnetic DO remained below 1 mg/l throughout the summer. Dissolved oxygen is being consumed by microbial respiration of organic detritus. When the lake stratified and hypolimnetic DO

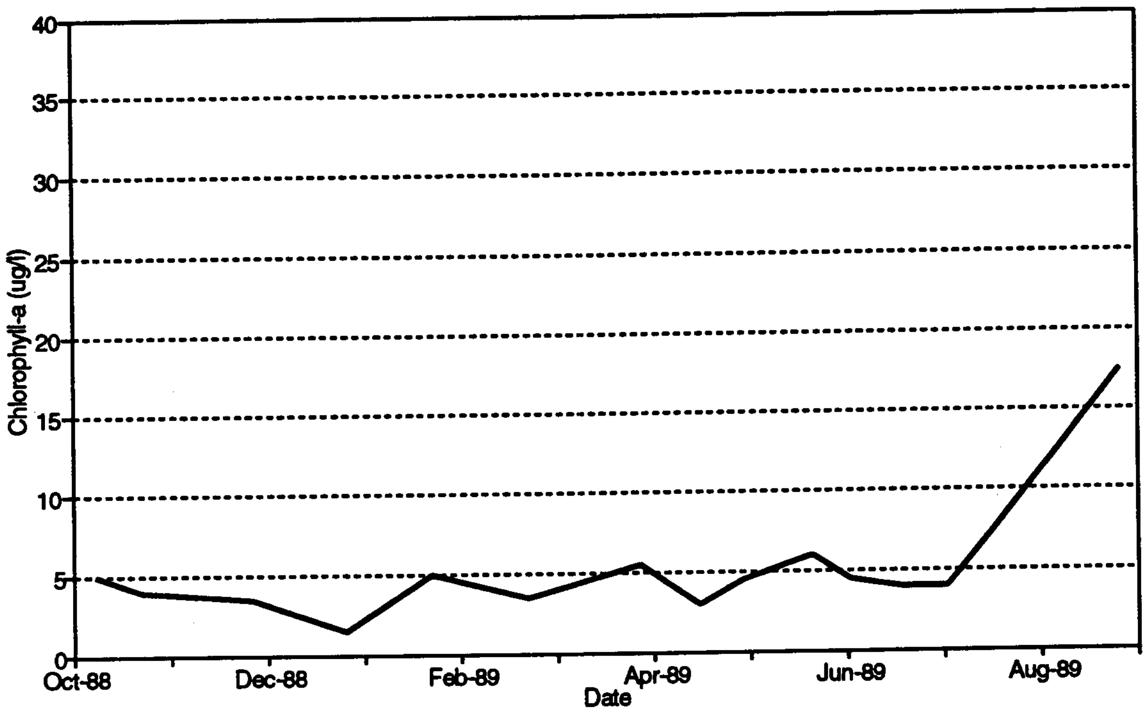


Figure 3-18: Average Chlorophyll-a for Lower Prior Lake

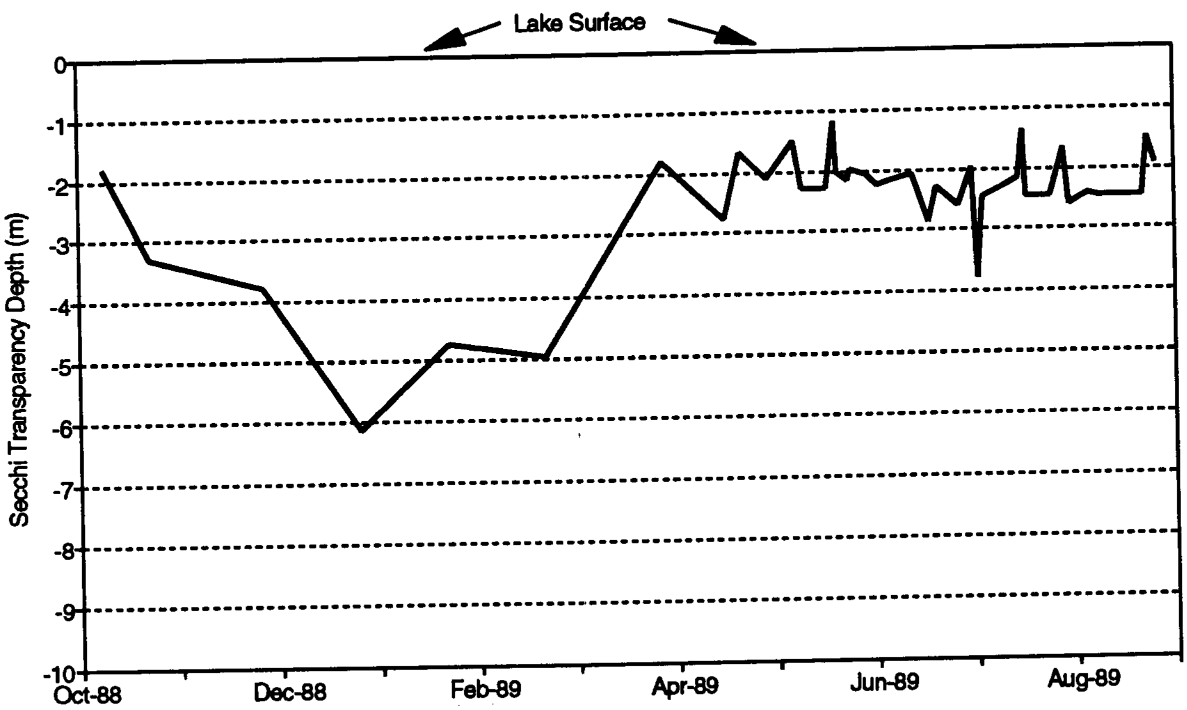


Figure 3-19: Secchi Transparency Trends for Lower Prior Lake

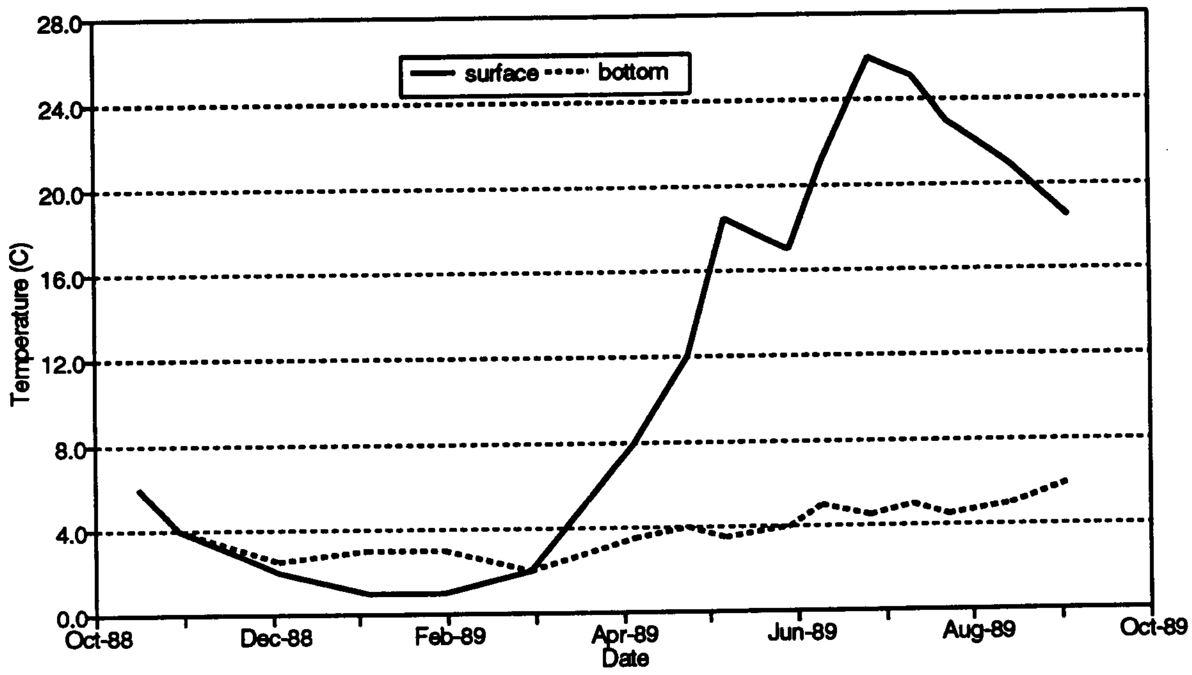


Figure 3-20: Surface and Bottom Temperature for Lower Prior Lake

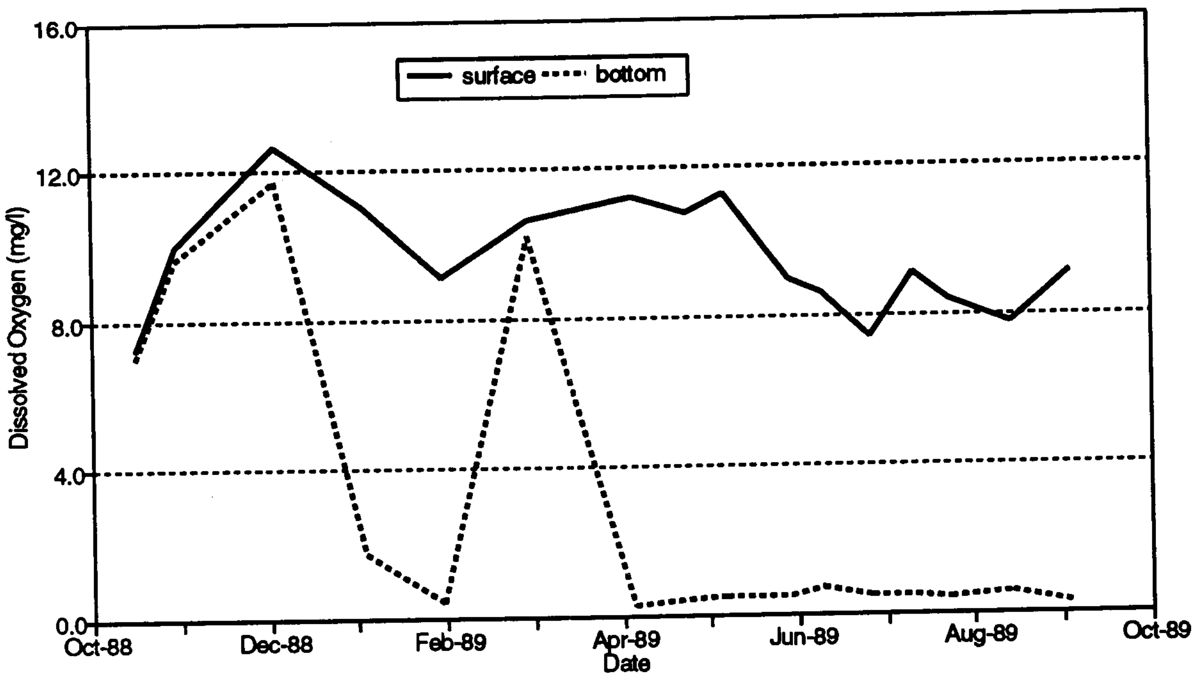


Figure 3-21: Surface and Bottom DO for Lower Prior Lake

was no longer being replenished through mixing with the epilimnion, the concentration decreased rapidly. Epilimnetic DO concentrations remained high for several reasons: 1) the epilimnetic oxygen depletion rate is probably lower, 2) during the ice-free season, atmospheric oxygen can exchange across the air-water interface, and 3) oxygen is a byproduct of photosynthetic activity in the photic zone.

Generally, DO concentrations below 5 mg/l are lethal to fish. Therefore, when the lake is stratified, fish are restricted to the well-oxygenated epilimnetic waters. Dissolved oxygen also influences the biogeochemical cycling of nutrients (such as nitrogen and phosphorus) and important minor metals (such as iron and manganese). When anoxic conditions exist in the overlying water column, the release rates of these elements from the sediments are often highly accelerated.

Upper Prior Lake Water Quality

Nutrients. The TP concentrations in Upper Prior Lake were higher than Lower Prior Lake, but not as high as Spring Lake. Epilimnetic TP concentrations were fairly steady throughout winter at about 80 µg/l (Figure 3-22). Epilimnetic concentrations increased to an observed maximum of 155 µg/l in early March (under ice) and then declined to its observed minimum in late April. Epilimnetic TP averaged 81 µg/l for the growing season. This is fairly similar to the historic growing season average TP. Initially, the hypolimnetic TP concentration was the same as the epilimnetic concentration in the fall of 1988. However, hypolimnetic TP increased throughout the monitoring period to a maximum concentration of about 950 µg/l in late summer. In contrast to the steadily increasing trend observed for hypolimnetic TP in Lower Prior lake, hypolimnetic TP in Upper Prior Lake decreased sharply on two occasions (once in January and once in April).

The seasonal pattern for SRP was quite similar to that observed for TP (Figure 3-23). Hypolimnetic SRP increased throughout the monitoring period to a maximum concentration of nearly 600 µg/l in late summer. Like the trend observed for TP, hypolimnetic SRP also dropped sharply in January and April. Increases in hypolimnetic SRP generally accounted for 50-60 percent of the hypolimnetic TP. Epilimnetic SRP remained quite low at about 10-15 µg/l. The growing season average epilimnetic SRP was 11 mg/l.

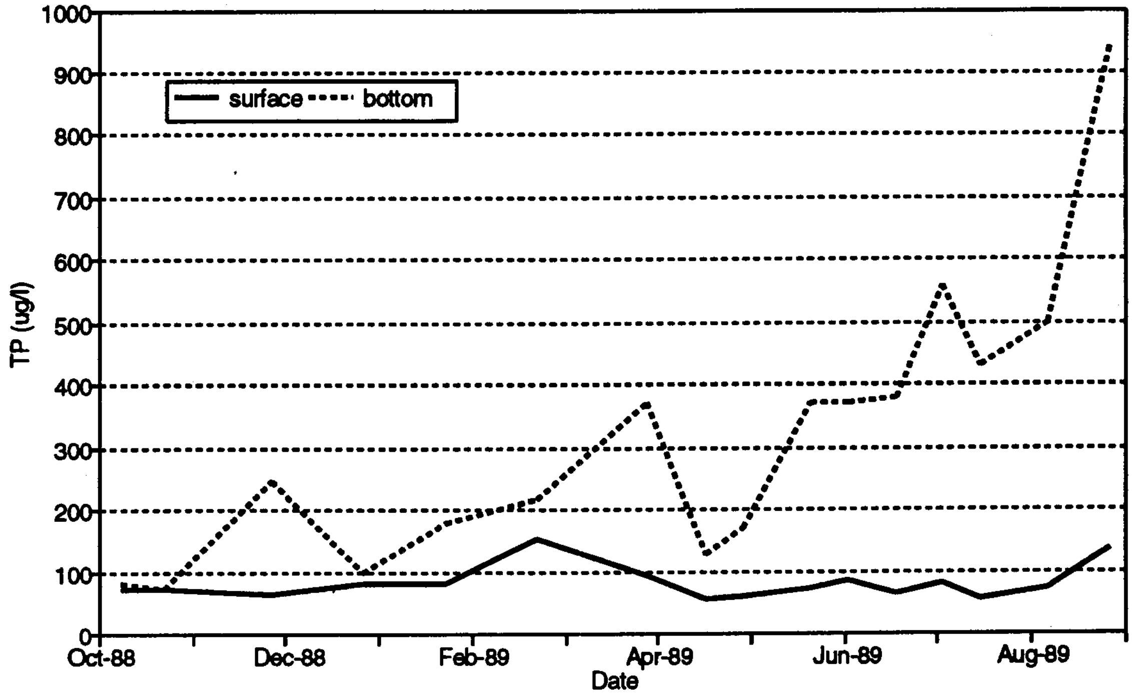


Figure 3-22: Average Surface and Bottom TP for Upper Prior Lake

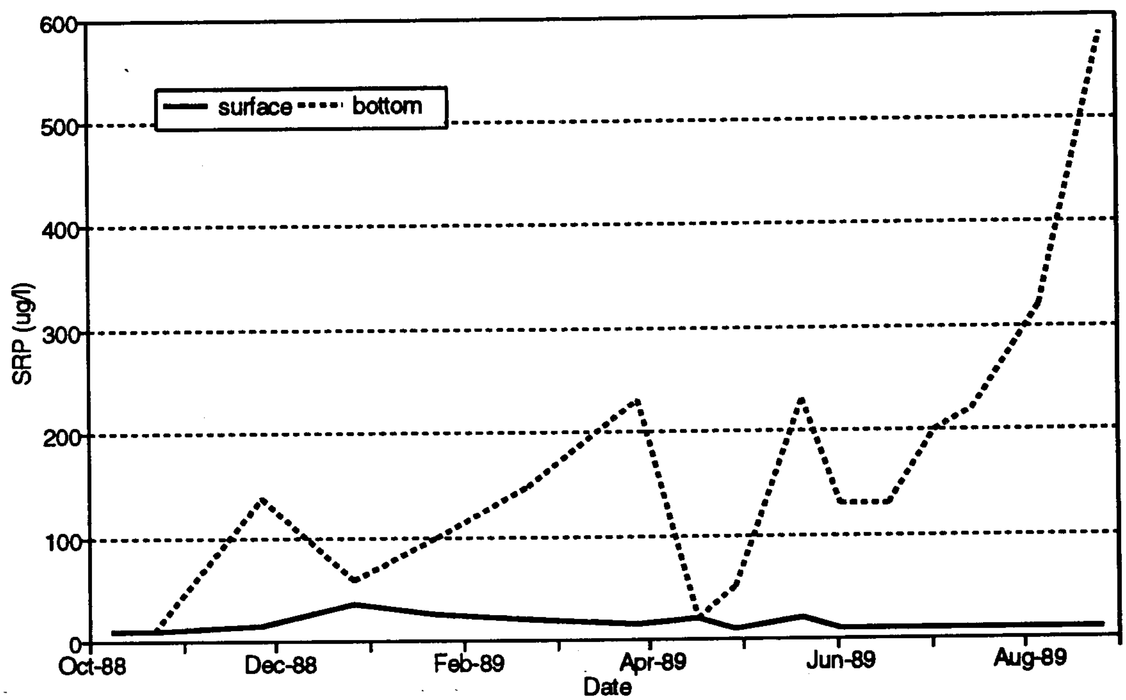


Figure 3-23: Average Surface and Bottom SRP for Upper Prior Lake

The fact that epilimnetic SRP was so low suggests that the availability of phosphorus may be limiting algal growth in Upper Prior Lake. This hypothesis is further supported by the TN:TP ratios observed for the lake (Figure 3-24). TN:TP ratios ranged from 28:1 to 38:1. TN:TP ratios this high have been found to indicate phosphorus-deficient phytoplankton (Sakamoto, 1966; Smith, 1979).

Chlorophyll-a. The concentration of the photosynthetic pigment chlorophyll-a is often used as a surrogate measure of algal abundance. Chlorophyll-a concentrations in Upper Prior Lake fluctuated widely throughout the year (Figure 3-25). The minimum chlorophyll-a concentration of 3 μg/l occurred in January. In early March, an under-ice algal bloom resulted in a chlorophyll-a concentration of 40 μg/l. However, this algal bloom crashed after ice-out. Chlorophyll-a concentration rose throughout the growing season and peaked at 70 μg/l in late summer. The growing season average chlorophyll-a was 35 mg/l. This is significantly lower than historical growing season average chlorophyll-a, which ranged from 50 μg/l to 80 μg/l.

Secchi Disk Transparency. Secchi disk transparency for Upper Prior Lake was generally the poorest of the three study lakes. However, in mid-winter SDT was better than 4 m and just after ice-out SDT was better than 3 m (Figure 3-26). The growing season average SDT was 0.95 m, which is comparable to the historic growing season average SDT (0.9-1.0 m). SDT data was strongly correlated with chlorophyll-a concentrations (as shown previously in Figure 3-_). This suggests that most of the transparency reduction in Upper Prior Lake can be attributed to increases in algal abundance.

Temperature. Figure 3-27 shows that Upper Prior Lake is dimictic. In the fall of 1988, the water column was isothermal. The lake was inversely stratified in winter with cooler water overlying warmer water. After mixing in spring, the lake became strongly stratified during the summer. Epilimnetic temperatures reached a high of 26°C, while hypolimnetic temperatures remained below 8°C. This thermal stratification prevents the elevated hypolimnetic phosphorus from mixing with the epilimnion and accelerating algal growth.

Dissolved Oxygen. Dissolved oxygen concentrations in the hypolimnion and epilimnion declined to very low levels in winter. Epilimnetic oxygen concentration recovered rapidly after ice-out, but hypolimnetic DO remained less than 1 mg/l (Figure 3-28).

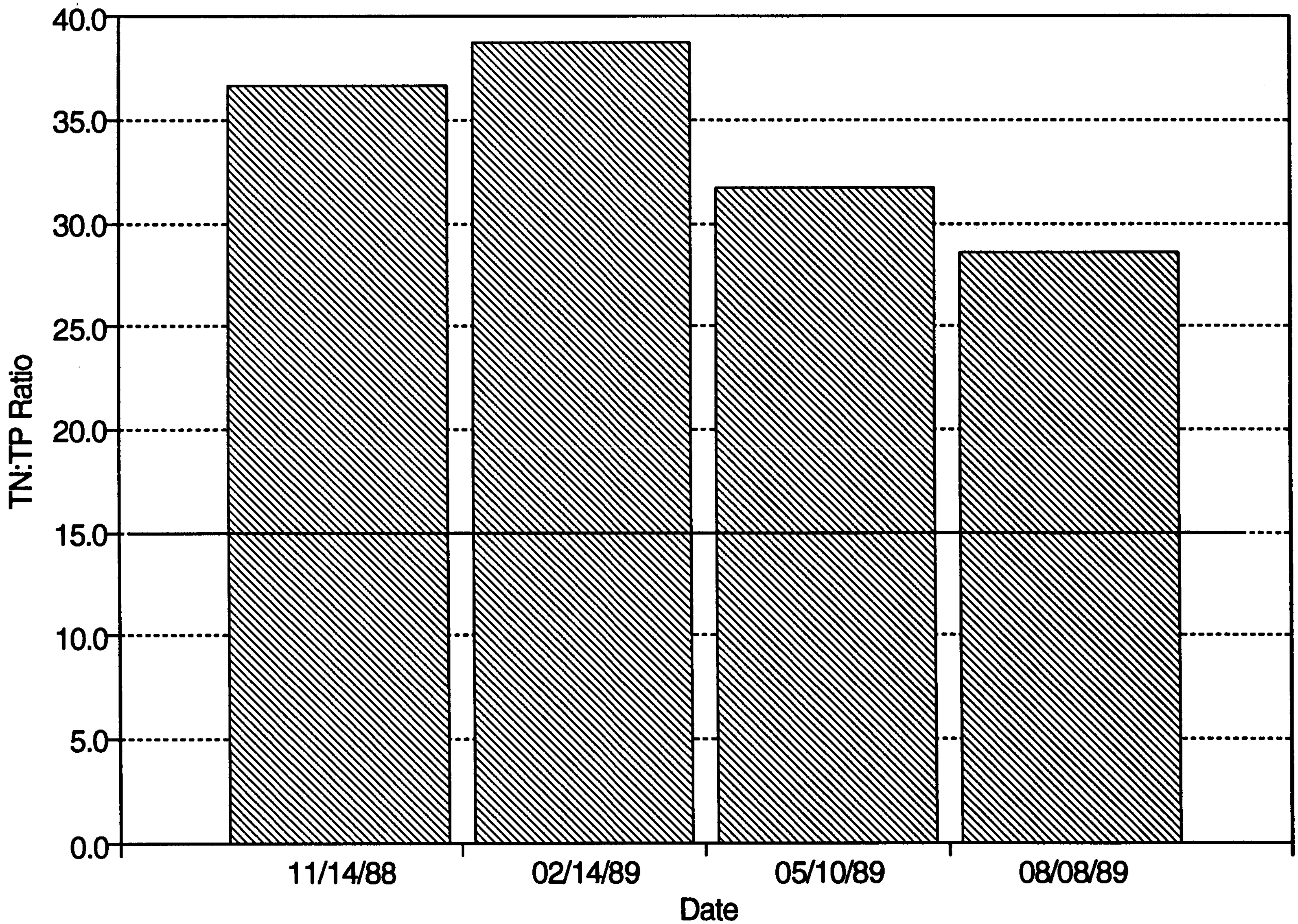


Figure 3-24: Average Surface TN:TP Ratio for Upper Prior Lake

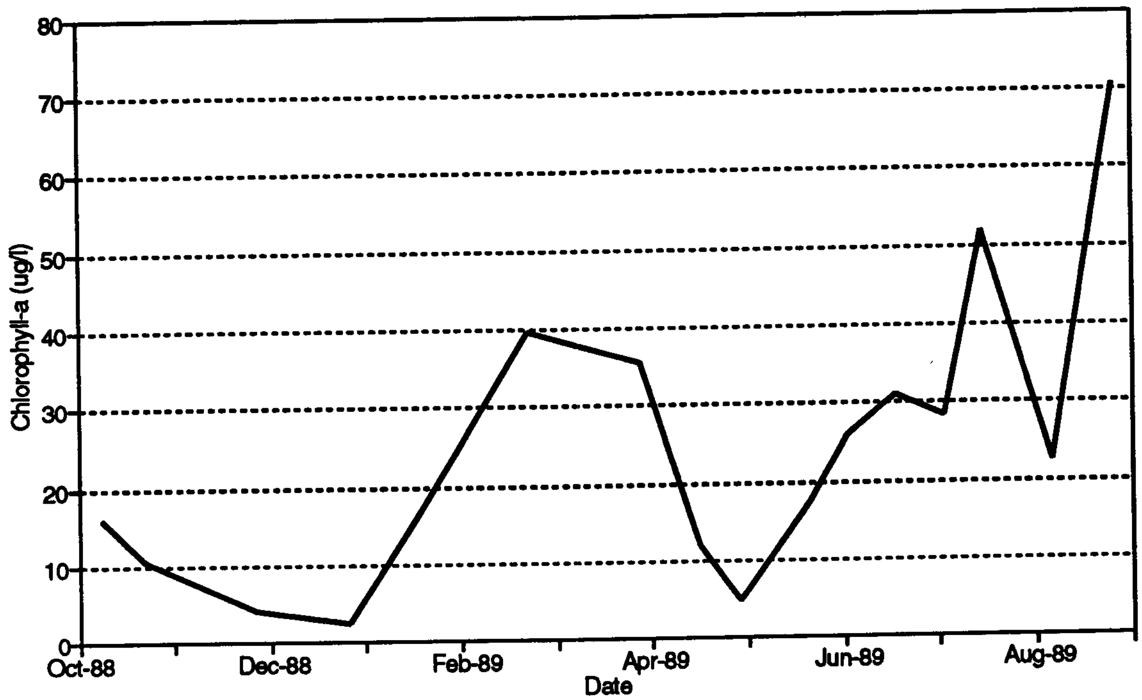


Figure 3-25: Average Chlorophyll-a for Upper Prior Lake

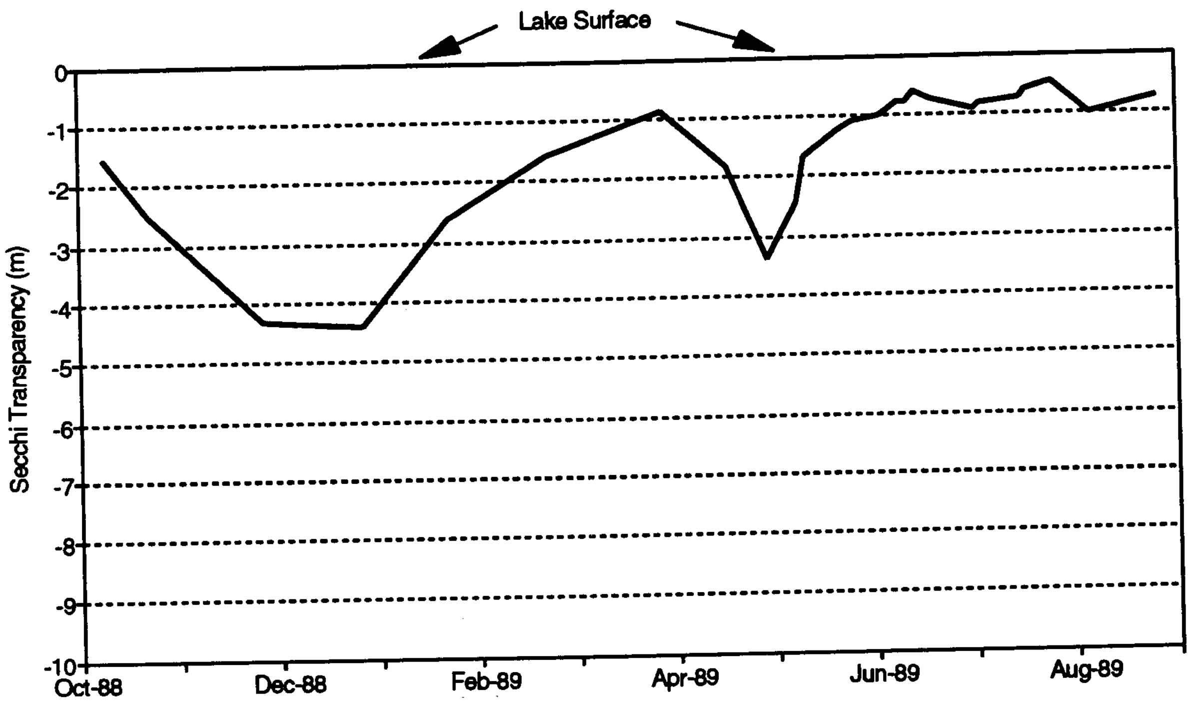


Figure 3-26: Secchi Transparency Trends for Upper Prior Lake

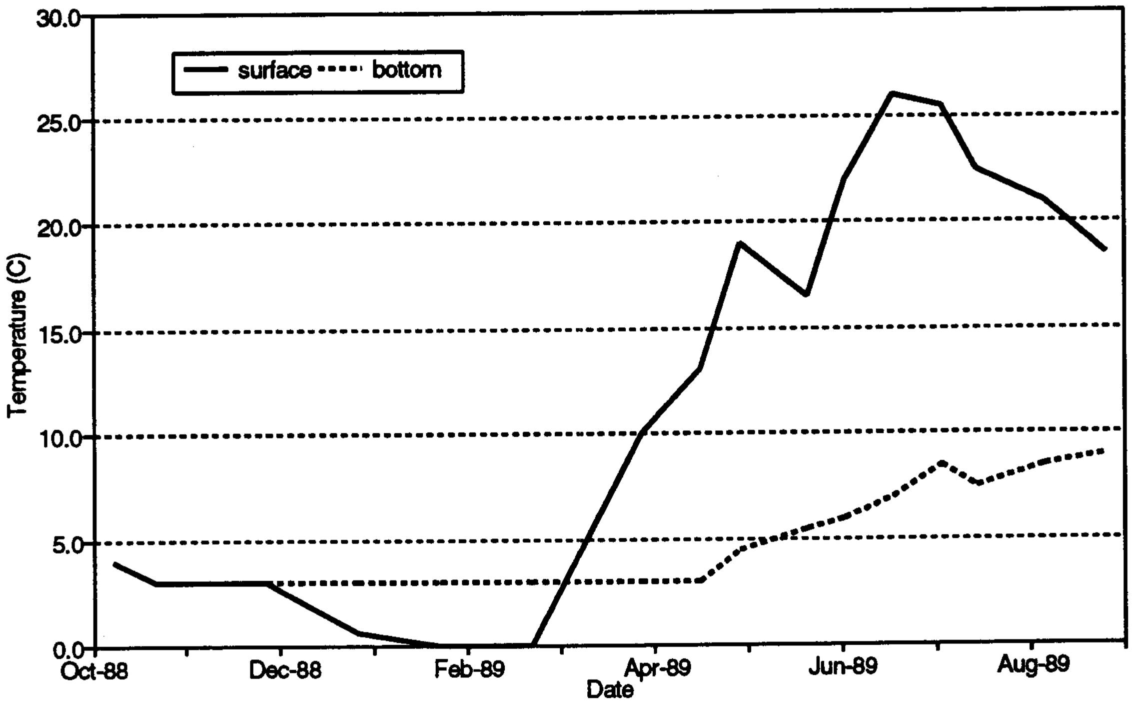


Figure 3-27: Surface and Bottom Temperature for Upper Prior Lake

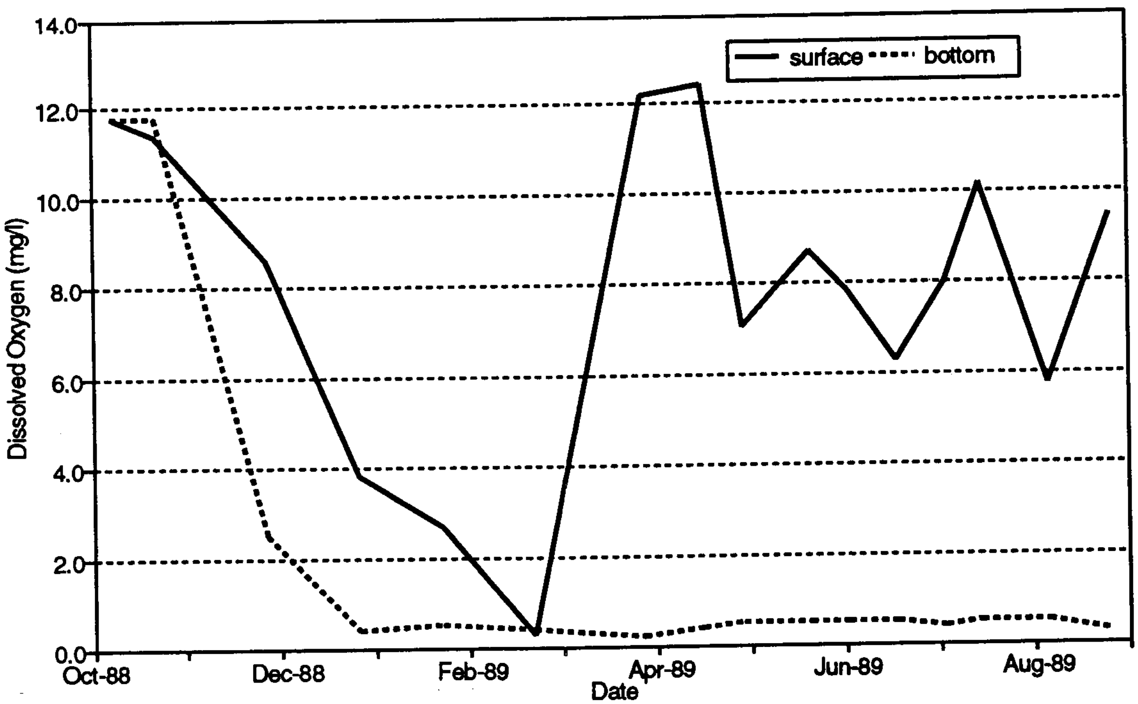


Figure 3-28: Surface and Bottom Dissolved Oxygen for Upper Prior Lake

The DO concentrations in late winter were well below the 5.0 mg/l state standard throughout the water column. Dissolved oxygen concentrations are stressful to gamefish. The low DO may also accelerate the release of phosphorus and other nutrients from the sediments.

Lower Prior Lake Biology

Phytoplankton. A total of 21 genera of phytoplankton were observed over the course of this study for Lower Prior Lake (Table 3-7). There was little difference in community composition or all counts between the two lake stations. Therefore, an average of the data from these two stations was used for this analysis. Figure 3-29 shows the average phytoplankton cell counts for Lower Prior Lake throughout the monitoring period. Algal cell counts were low from mid-winter through ice-out and then rose sharply in May. It was at this time that blue-green algae were first observed. Figure 3-30 shows that while blue-greens were present by spring, they did not dominate the community composition until late June. The chlorophyll-a concentrations in Lower Prior Lake were quite low until the increase in late August, which corresponds to the blue-green algal bloom. In contrast to Spring Lake, Lower Prior Lake did not have flake blooms of Aphanizomenon. In fact, Aphanizomenon was not observed for Lower Prior on any occasion.

Zooplankton. Invertebrates were collected and classified into four major groups including copepods, cladocerans, nauplii, and ostracods. Some cladocerans were further delineated as Daphnia or Bosmina genera. Zooplankton density in Lower Prior Lake was generally less than Upper Prior Lake. This may be the result of decreased food availability or increased predation. The zooplankton community was generally dominated by copepods. Ostacods composed only a very small portion of the community.

Zooplankton populations were highest in fall at about 80 organisms per liter (Figure 3-31). The lowest zooplankton population occurred in March. Copepods dominated the community composition throughout the year (Figure 3-32). However, nauplii composed about 40 percent of the community in April and cladocerans composed about 40 percent of the community in July.

TABLE 3-7

PHYTOPLANKTON OF LOWER PRIOR LAKE*

Cyanophyta	**(Blue-Green)**
Anabaena	
Aphanocapsa	
Gleocystis	
Merismopedia	(Agmenellum)
Microcystis	
Oscillatoria	
Sphaerocystis	
Chlorophyta	**(Green)**
Chloroella	
Clostrerium	
Cosmarium	
Golenkinia	
Pediastrum	
Scenedesmus	
Spinocosmarium	
Staurastrum	
Bacillariophyceae	**(Diatoms)**
Asterionella	
Fragilaria	
Melosira	
Navicula	
Stephanodiscus	
Synedra	
Euglenophyta	**(Euglenoids)**
Euglena	
Chrysophyta	**(Yellow-Green)**
Dinobryon	
Pyrrhophyta	**(Dinoflagellates)**
Ceratium	

*All names taken from Prescott, 1978.

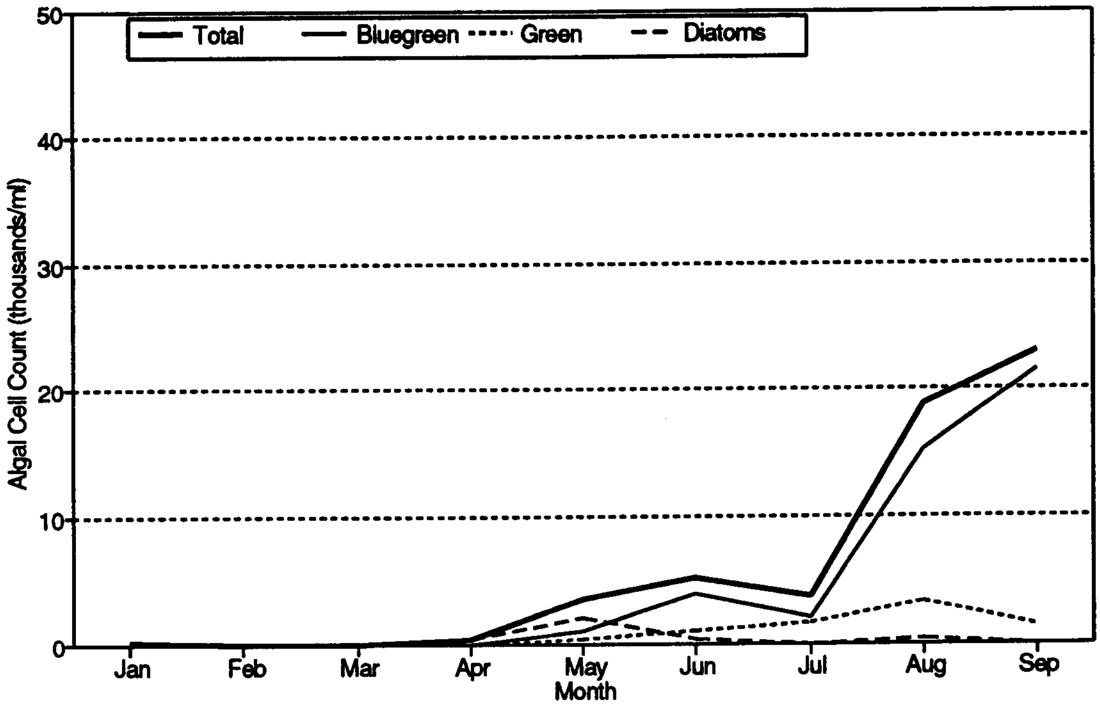


Figure 3-29: Lower Prior Lake Phytoplankton Cell Counts

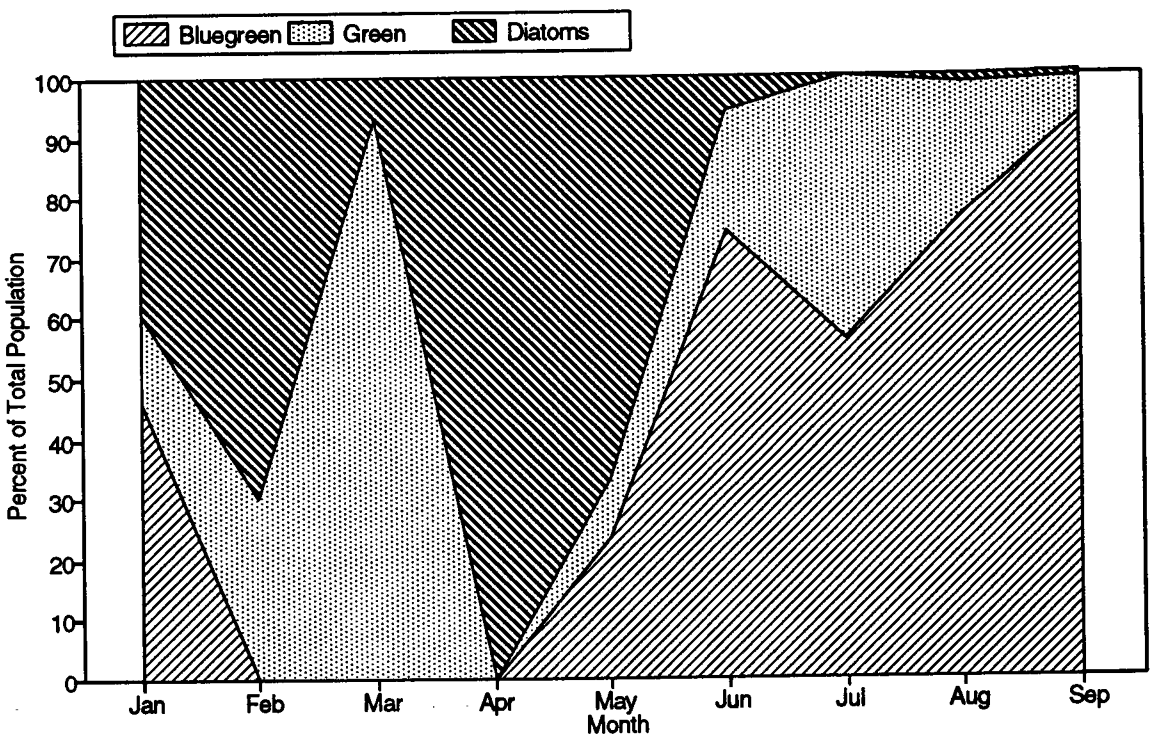


Figure 3-30: Lower Prior Lake Phytoplankton Community Composition

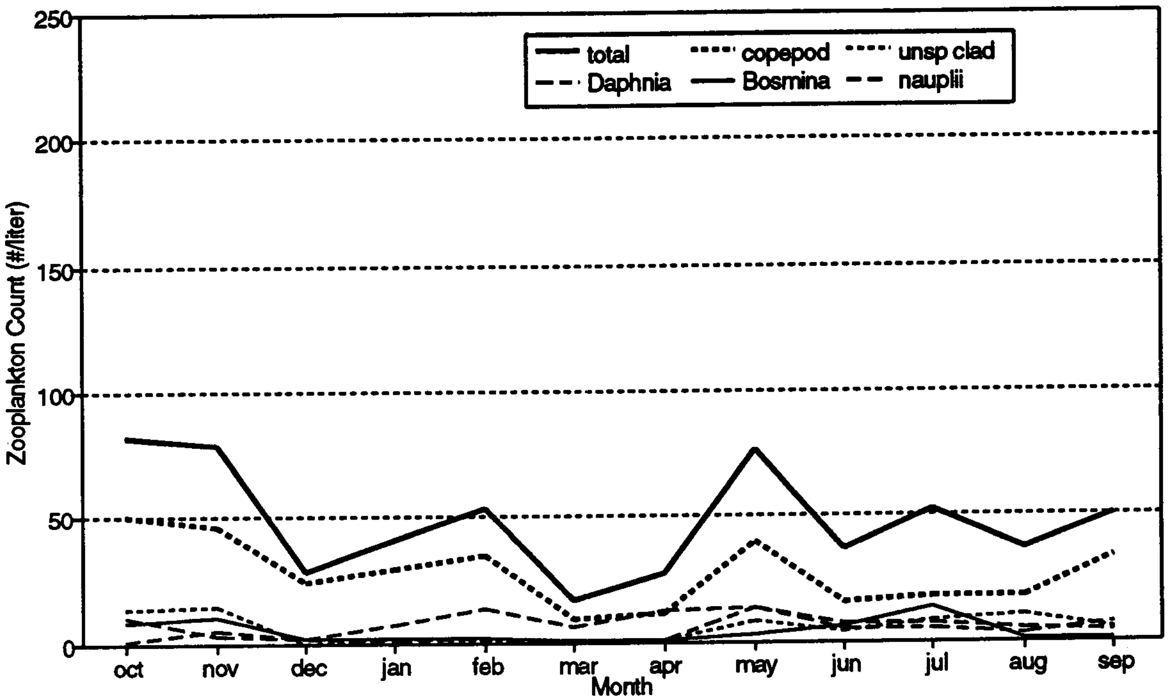


Figure 3-31: Zooplankton Counts for Lower Prior Lake

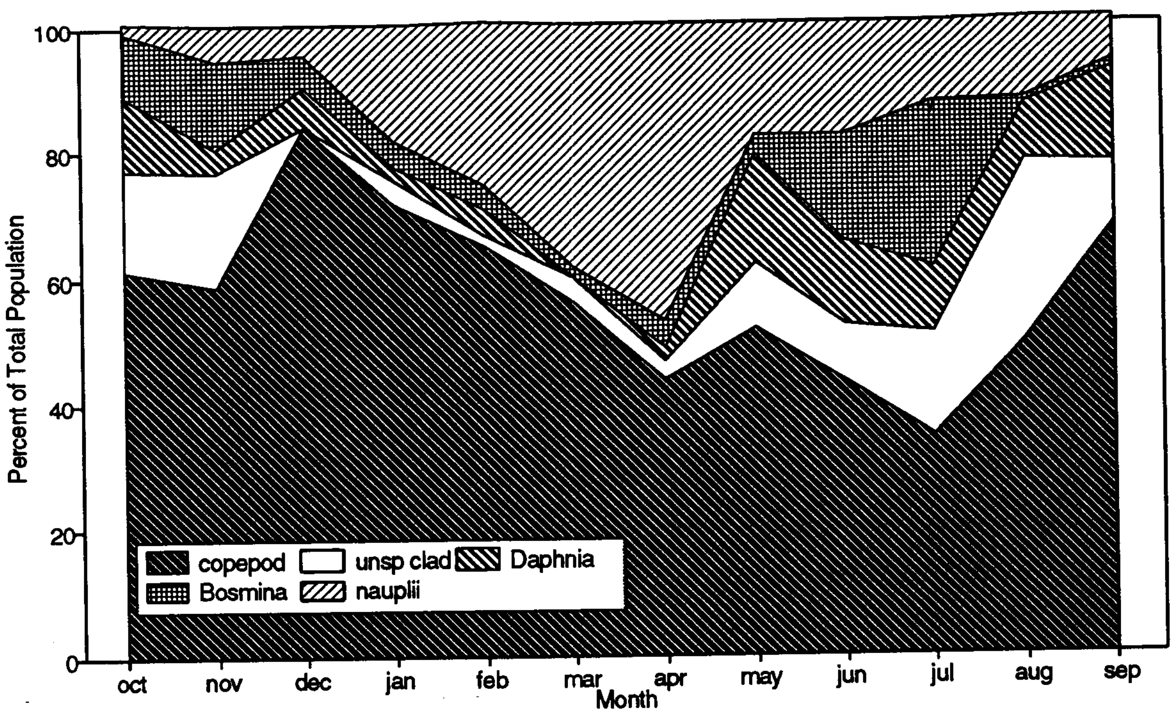


Figure 3-30: Zooplankton Community Composition for Lower Prior Lake

Macrophytes. A survey of aquatic macrophytes was conducted in September 1989 as part of the Phase I Diagnostic Study. This survey identified plant species present and delineated plant communities for Upper and Lower Prior Lakes. The five macrophyte communities that were identified are listed below:

- **Myriophyllum exalbescens/Potamogeton community:**

  Dominated by M. exalbescens.

  Other members may include Potamogeton crispus, P. Richardsonii, P. spirillus, P. strictifolius, P. zosteriformis, Ceratophyllum demersum, Elodea canadensis, Chara, Najas sp.

- **Ceratophyllum demersum community:**

  Dominated by C. demersum.

  Other members may include Myriophyllum exalbescens, Chara, Potamogeton zosteriformis.

- **Potamogeton community:**

  Dominated by Potamogeton sp.

  Other members may include Ceratophyllum demersum, Chara, Myriophyllum exalbescens, Najas sp., P. crispus, P. filiformis, P. natans, P. nodosus, P. pectinatus, P. Richardsonii, P. strictifolius, P. zosteriformis, Vallisneria americana.

- **Potamogeton/Ceratophyllum community:**

  Codominated by Potamogeton and Ceratophyllum demersum.

  Other members may include Myriophyllum exalbescens, Potamogeton crispus, P. nodosus, P. pectinatus, P. spirillus, P. zosteriformis.

- Ceratophyllum/Myriophyllum community:

  Codominated by Ceratophllum demersum and Myriophyllum exalbescens.

  Other members may include Potamogeton nodosus, P. pectinatus.

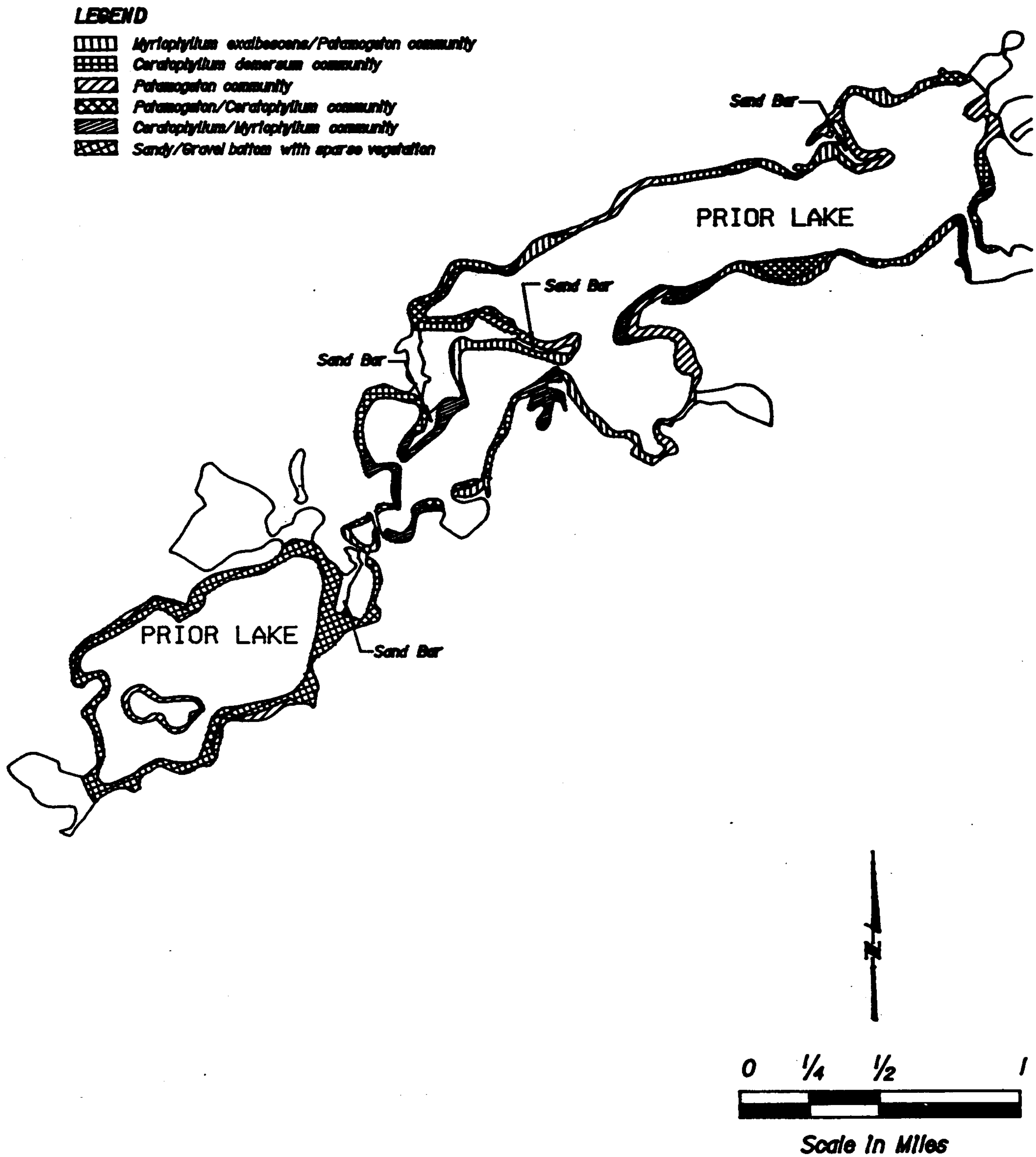
All names taken from "Key to the Common Aquatic Plants of Minnesota" (MNDOC, 1968).

Figure 3-33 shows the distribution of these plant communities. Although the lines on this map appear to indicate abrupt changes, the transition between communities is actually more gradual.

Lower Prior Lake is characterized by a more diverse macrophyte community than Upper Prior Lake (Table 3-8). Based on historical data, this community is also quite dynamic. A survey conducted in 1973 identified 16 species (Hanson, 1973), eight of which were present during the current survey. A 1982 MDNR survey indicated that two species had become established since the previous survey (P. crispus and Vallisneria americana) and three species that were previously present were now gone (P. praelongus, P. Robbinsii, and Nuphaea tetragona). By 1989, four other species from the 1973 survey were absent; however, there were six new species of Potamogeton. Thus, it appears that while the species composition has changed, the community has remained quite diverse.

Upper Prior Lake Biology

Phytoplankton. A total of 24 genera of phytoplankton were observed over the course of this study on Upper Prior Lake (Table 3-9). There was little difference between the two lake stations in terms of community composition and cell counts. Therefore, an average of the data from these stations was used for this analysis. Figure 3-34 shows the phytoplankton cell counts for Upper Prior Lake throughout the monitoring period. Algal cell counts were generally low from early winter to mid-spring. During this period, the algal community was composed primarily of diatoms, green algae, and Euglena. The blue-green algae, Shaerocystis, was observed in March and again in May. In June, the algal community was very diverse with 15 genera present. Blue-green algae began to dominate the community in June and continued their dominance throughout the growing season. Peaks in chlorophyll-a tended to correspond with blue-green algal blooms. In contrast to Spring Lake, Upper Prior Lake did not have flake blooms of Aphanizomenon. In fact,



JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.	Prior Lake/Spring Lake Watershed **Map of Macrophyte Communities**	3-33

TABLE 3-8

MACROPHYTES COMMON IN UPPER AND LOWER PRIOR LAKES

	Upper Prior Lake	Lower Prior Lake
Ceratophyllum demersum	X	X
Chara		X
Elodea canadensis		X
Myriophyllum exalbescens		X
Najas sp.		X
Potamogeton crispus	X	X
Potamogeton filiformis		X
Potamogeton Friesii	X	
Potamogeton natans		X
Potamogeton nodosus		X
Potamogeton pectinatus	X	X
Potamogeton Richardsonii		X
Potamogeton spirillus		X
Potamogeton strictifolius		X
Potamogeton zosteriformis		X
Vallisneria americana		X

TABLE 3-9

PHYTOPLANKTON OF UPPER PRIOR LAKE*

Cyanophyta	**(Blue-Green)**
Anabaena	
Aphanocapsa	
Gleocystis	
Merismopedia (Agmenellum)	
Microcystis	
Oscillatoria	
Sphaerocystis	
Chlorophyta	**(Green)**
Chloroella	
Clostrerium	
Cosmarium	
Golenkinia	
Pediastrum	
Scenedesmus	
Spinocosmarium	
Staurastrum	
Bacillariophyceae	**(Diatoms)**
Asterionella	
Fragilaria	
Melosira	
Navicula	
Stephanodiscus	
Synedra	
Euglenophyta	**(Euglenoids)**
Euglena	
Chrysophyta	**(Yellow-Green)**
Dinobryon	
Pyrrhophyta	**(Dinoflagellates)**
Ceratium	

***All names taken from Prescott, 1978.**

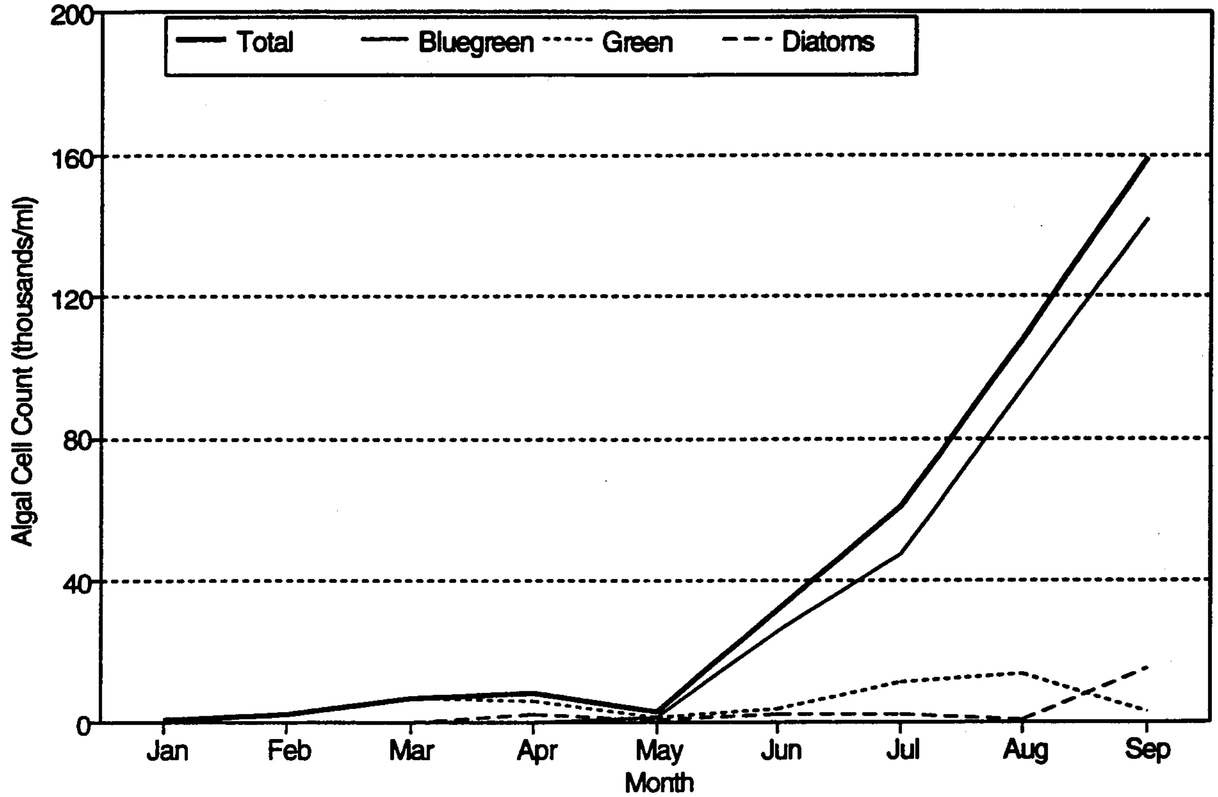


Figure 3-34: Upper Prior Lake Phytoplankton Cell Counts

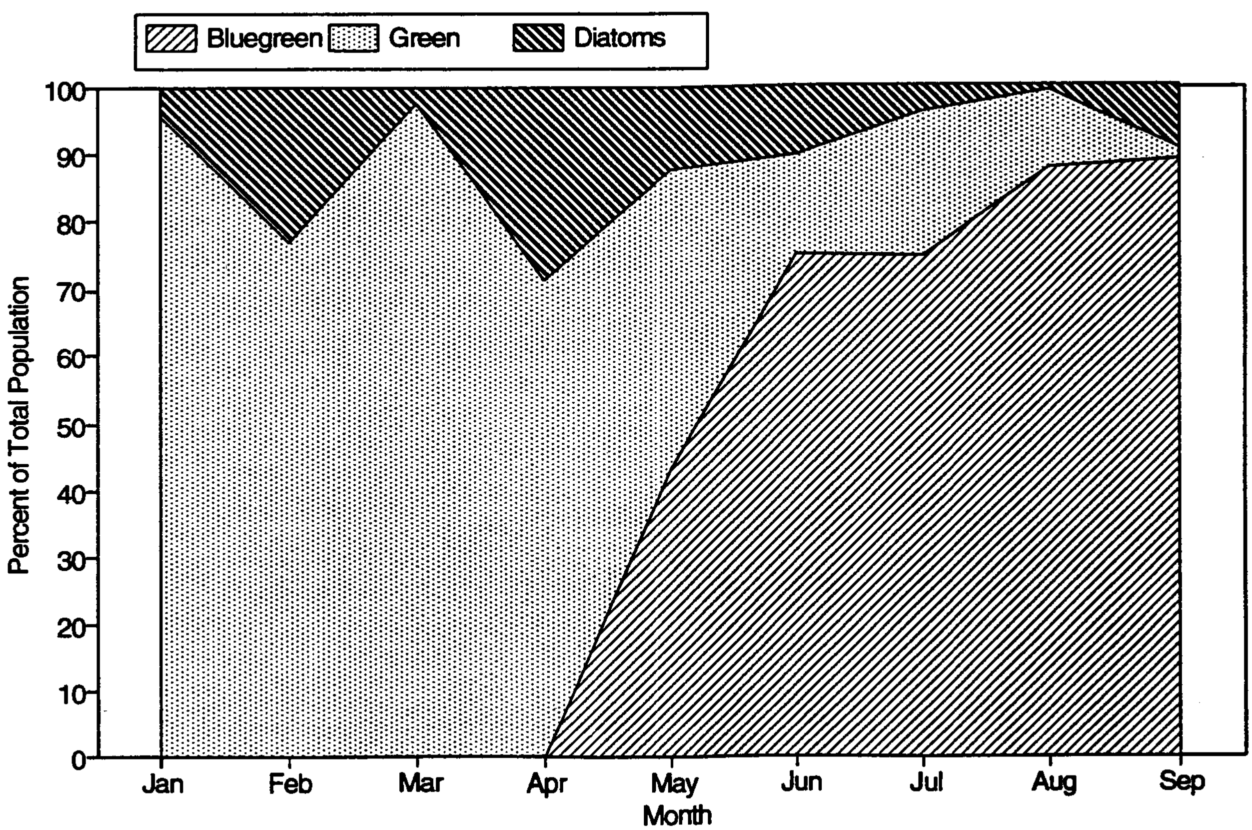


Figure 3-35: Upper Prior Lake Phytoplankton Community Composition

Aphanizomenon was not observed in Upper Prior Lake on any occasion. The dominant blue-green algae in Upper Prior Lake is usually Anabaena.

Zooplankton. Zooplankton in Upper Prior Lake were collected, classified, and quantified. Zooplankton density for Upper Prior Lake was generally higher than that of Lower Prior Lake. This may be due to increased availability of quality food or decreased predation. The zooplankton community was dominated by copepods. Ostracods accounted for only a small percentage of the community composition. Figure 3-36 shows that the maximum zooplankton population (225 organisms/liter) occurred in fall and the minimum (35 organisms/liter) occurred in March. The community composition is generally dominated by copepods (Figure 3-37).

Macrophytes. Only four macrophyte species were observed for Upper Prior Lake (Table 3-8). The macrophyte community for this lake is much less diverse than that of Lower Prior Lake. The community diversity is closer to that of Spring Lake (five species). The 1982 MDNR survey observed six species of macrophytes including Lemna sp. and Myriophyllum exalbescens in addition to the four species found during the 1989 survey. The macrophyte community of Upper Prior and Spring Lakes may be less diverse due to the more eutrophic conditions and lower water clarity. Most plants were collected in less than 7 feet of water. Although no quantitative measurements were made, field observations indicate that Upper Prior Lake had lower plant biomass and more areas devoid of vegetation than Lower Prior Lake.

Streamflow Monitoring

Staff gauge measurements were taken biweekly throughout the monitoring period when water was flowing. A stage-discharge relationship for each station was established by correlating staff gauge measurements to periodic, concurrent flow measurements. Total annual flow was calculated by integrating the instantaneous flow rate data using Euler's method.

Flow only occurred at site S-1 from March to May, site S-2 had flow from March to August, and the Spring Lake outlet (S-3) had flow from April to July. Flow occurred sporadically at site S-4. There was no discharge recorded for the outlet of Lower Prior Lake (S-5) during the study period. Table 3-10 shows the monitored flow for all stations and compares the

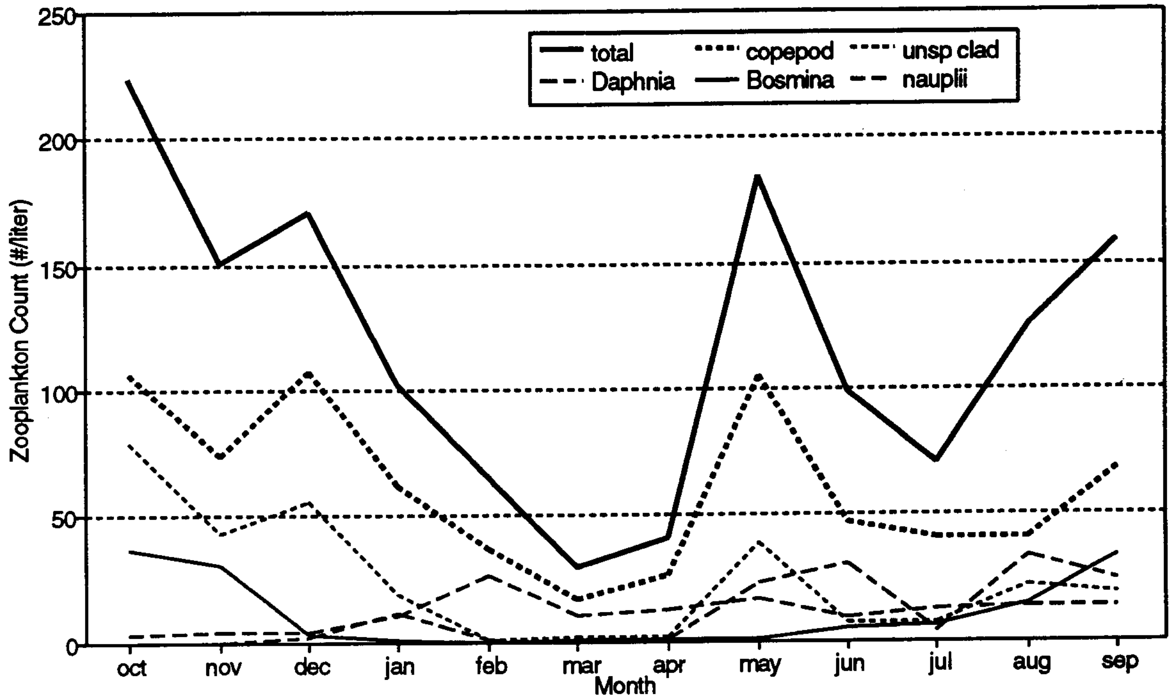


Figure 3-36: Zooplankton Counts for Upper Prior Lake

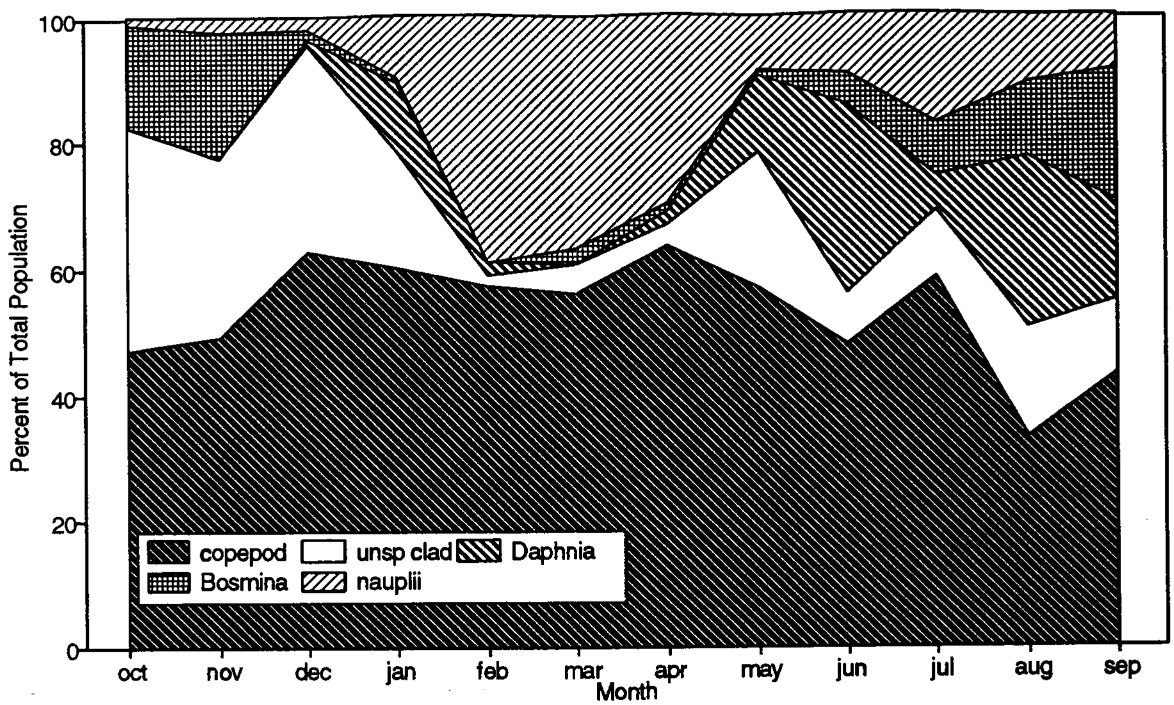


Figure 3-37: Zooplankton Community Composition for Upper Prior Lake

monitored runoff coefficients (RC) for S-1, S-2, and S-4 to the land use-weighted literature values.

TABLE 3-10

MONITORED STREAMFLOW AND RUNOFF COEFFICIENTS

Station	Monitored Flow (ac-ft)	Area (ac)	Monitored RC	Land Use-Weighted Literature RC
S-1	349	5,312	0.06	0.43
S-2	548	3,884	0.12	0.42
S-3	575			
S-4	137	1,772	0.07	0.42
S-5	0			

The monitored RCs for these subwatersheds were much lower than the values reported in the literature. Literature values for cropland (a major land use in the S-1 and S-2 subwatersheds) average about 0.39 with a range from 0.20 to 0.66 depending upon rainfall intensity and cover conditions (Schwab, 1981). Monitored coefficients were probably lower than the literature values for two reasons. First, the lack of high flow event data may have resulted in an underestimate of the total flow. Second, the drought which occurred in the previous year left the hydrologic storage in watershed ponding areas well below capacity. Therefore, much of the runoff was captured or infiltrated upstream of the monitoring stations.

Storm Sewer Flow Monitoring

Storm sewer flows were monitored using ISCO automatic sampling equipment equipped with pressure transducers. The transducers recorded the water depth and converted this data to an equivalent flow based on the discharge characteristics of a temporary weir. This flow data was integrated to obtain the total volume of flow for the monitored events. Site SS-1 monitored runoff from a 56-acre mixed urban area. The area drained includes subwatersheds UP-2 and UP-3 (Figure 2-1). There is one pond in the monitored area located in UP-3 west of City Hall. Site SS-2 monitored runoff from 62 acres consisting of both undeveloped and single family residential areas. The area drained includes subwatersheds LP-18 and LP-17 (Figure 2-1). A dry pond composed of two segments is located in subwatershed LP-17 adjacent to the park.

Runoff from several storm events was monitored. Storm sewer monitoring data was used to develop runoff hydrographs. Site SS-1, with more impervious area, was expected to have greater runoff volume, higher peak flow rates, and a faster response time. However, the hydrographs for the two monitoring sites show some departures from the expected behavior (Figures 3-39 and 3-39). The most notable difference was the faster response time from the SS-2 monitoring site. On June 21, the first flow at SS-2 occurred within 10 hours of the start of the rain event and a second flow occurred about 40 hours later. Only one flow occurred at site SS-1 at 115 hours.

Apparently, the dry pond upstream of SS-2 provides virtually no significant storage of runoff, whereas the pond above SS-1 had the storage capacity to delay runoff for this event. Undoubtedly, there are some differences in precipitation patterns across the watershed but the difference between the two monitored areas is probably small due to their relatively close proximity to each other. Although the response time observed for runoff at these stations was counterintuitive, the peak flow rate and flow volume were larger for SS-1 as expected.

The next significant rain event (>1.0 inches) occurred on July 17, 1989. The hydrographs for each station for this event were similarly shaped with nearly identical peak flow rates and response times; however, SS-1 fluctuated more than SS-2 (Figures 3-40 and 3-41). The faster response time at both stations for this event are probably due, in part, to differences in storm event characteristics. Furthermore, site SS-1 may have a faster response time due to the storage capacity in the watershed being diminished by several small rain events (<1.0 inches) between June 21 and July 17.

Monitored precipitation and runoff volumes were used to calculate runoff coefficients. Table 3-11 shows the monitored runoff, precipitation, and RC. The monitored RCs are also compared to land use-weighted literature values for RC.

The monitored RCs for sites SS-1 and SS-2 were within the range of values reported in the literature for single family residential and mixed urban land use, respectively.

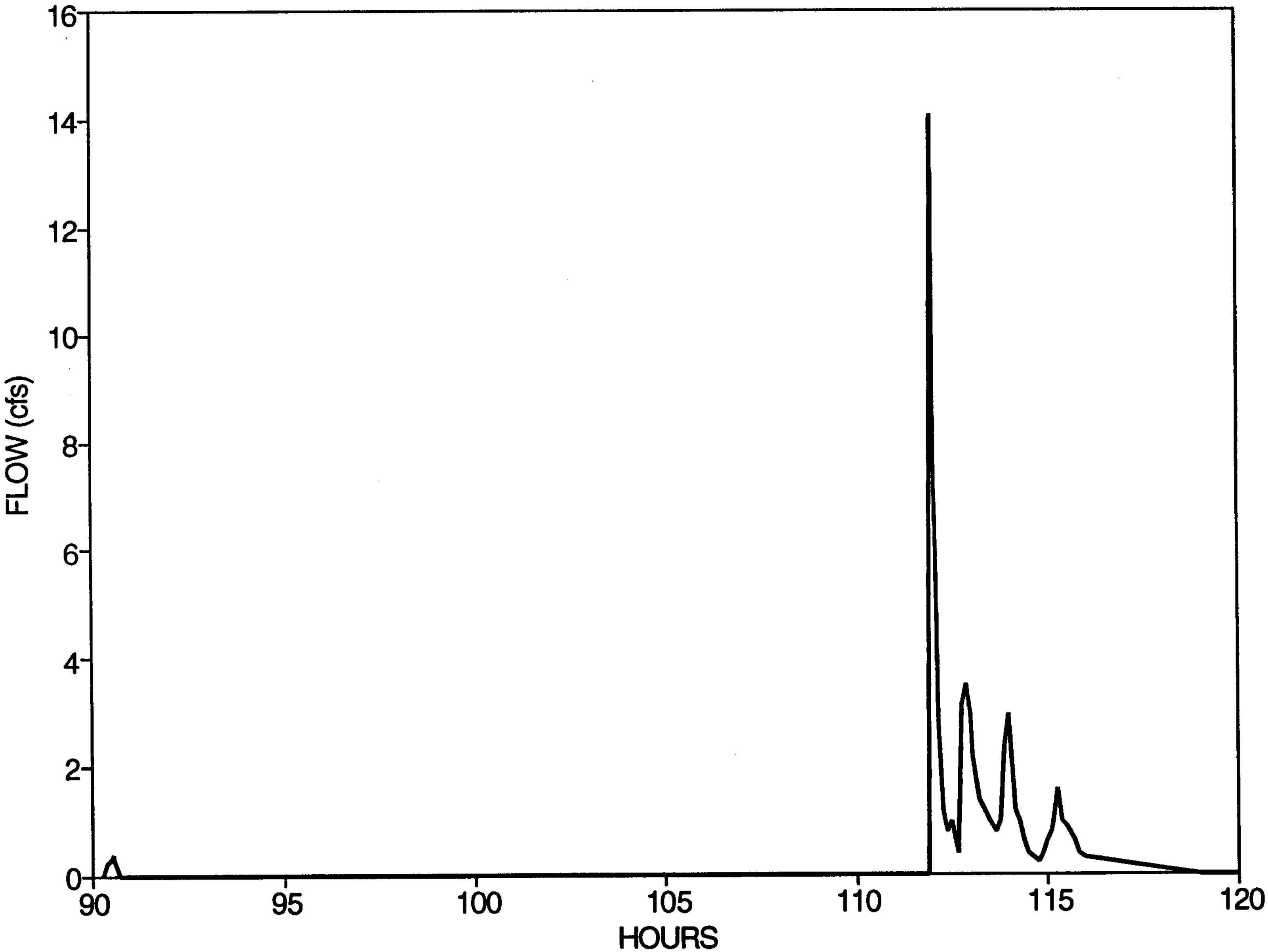


Figure 3-38: Downtown Area Hydrograph for Site SS-1, 6/21/89

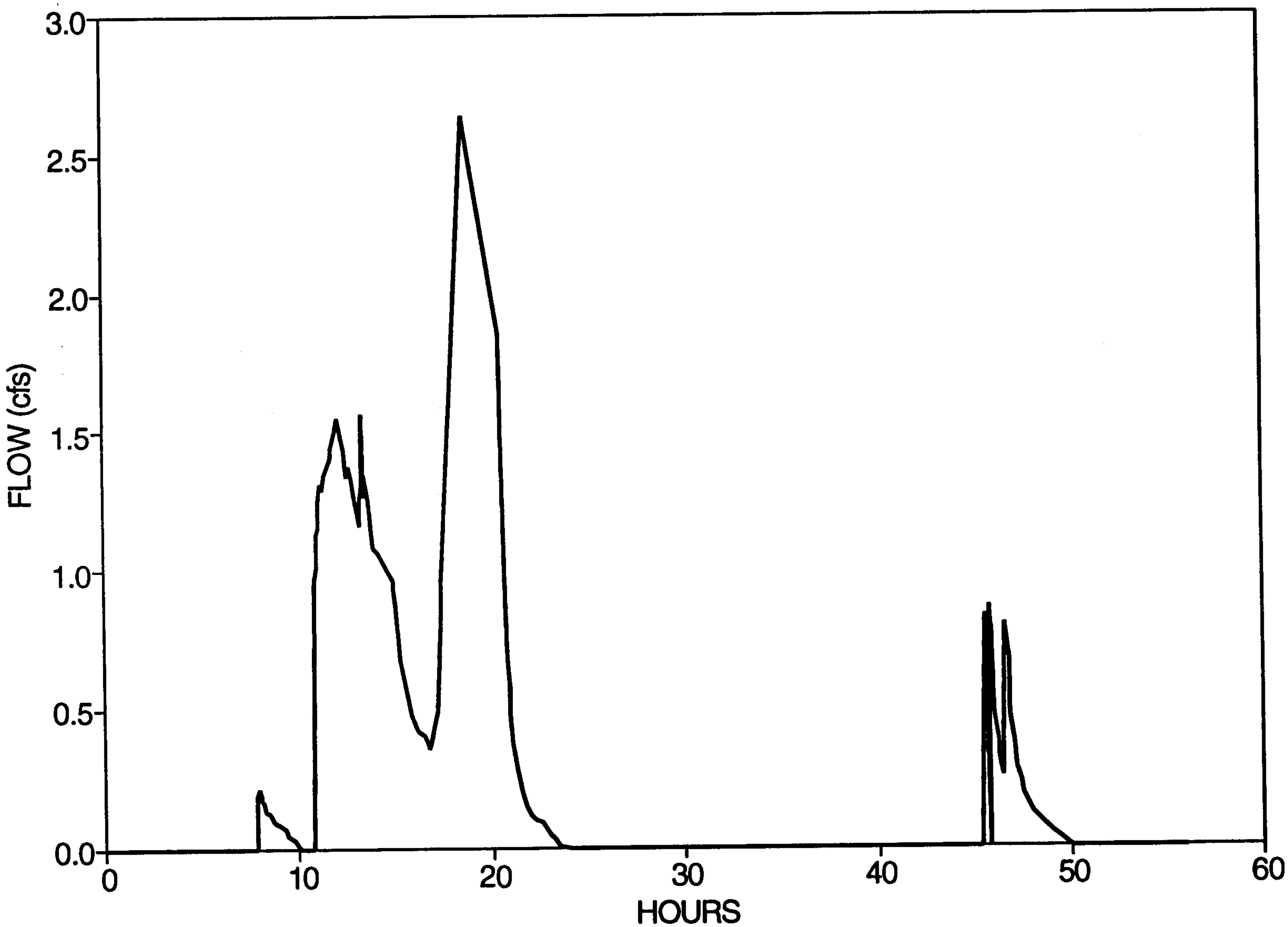


Figure 3-39: Sand Pointe Hydrograph for Site SS-2, 6/21/89

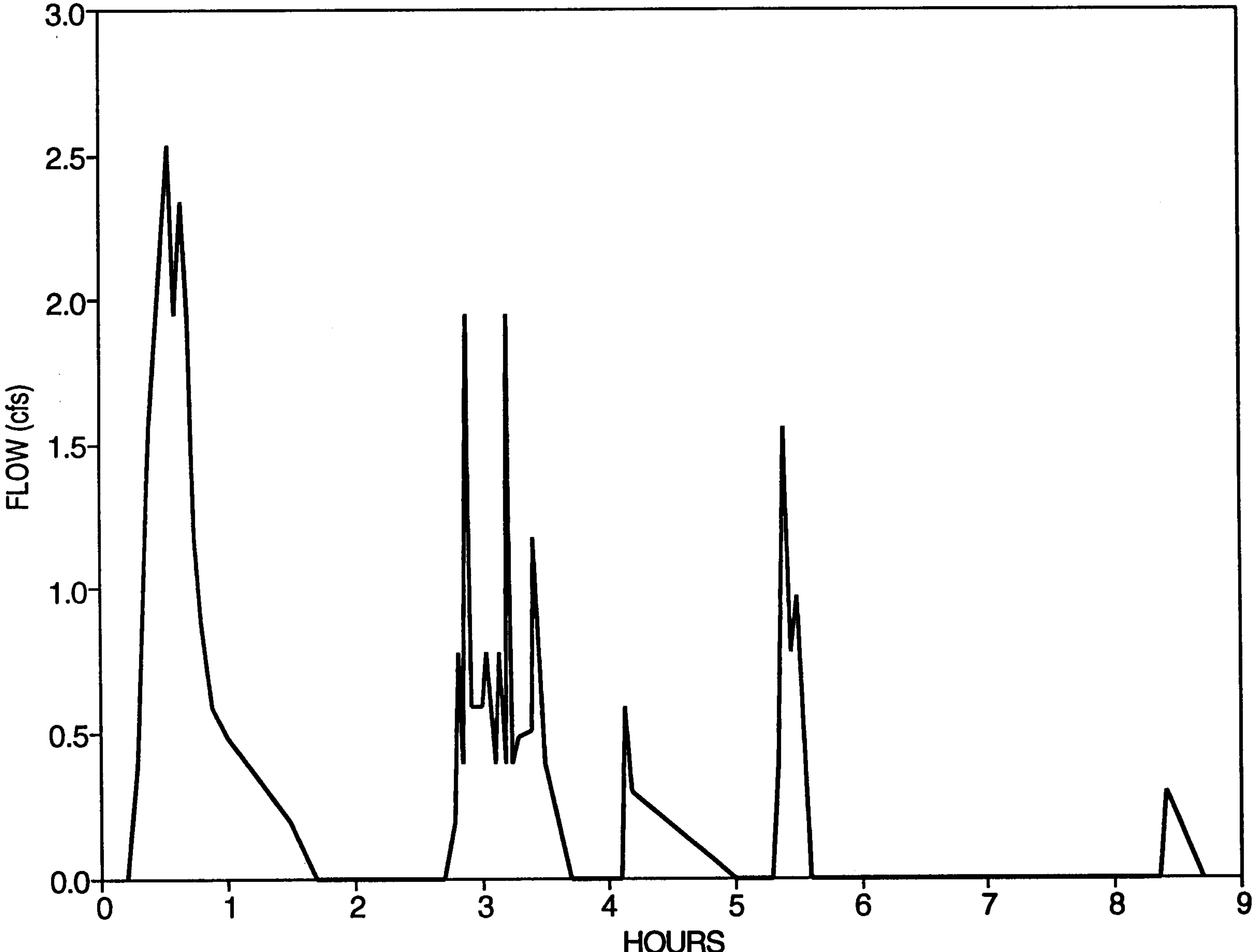


Figure 3-40: Downtown Area Hydrograph for Site SS-1, 7/17/89, last 9 hrs

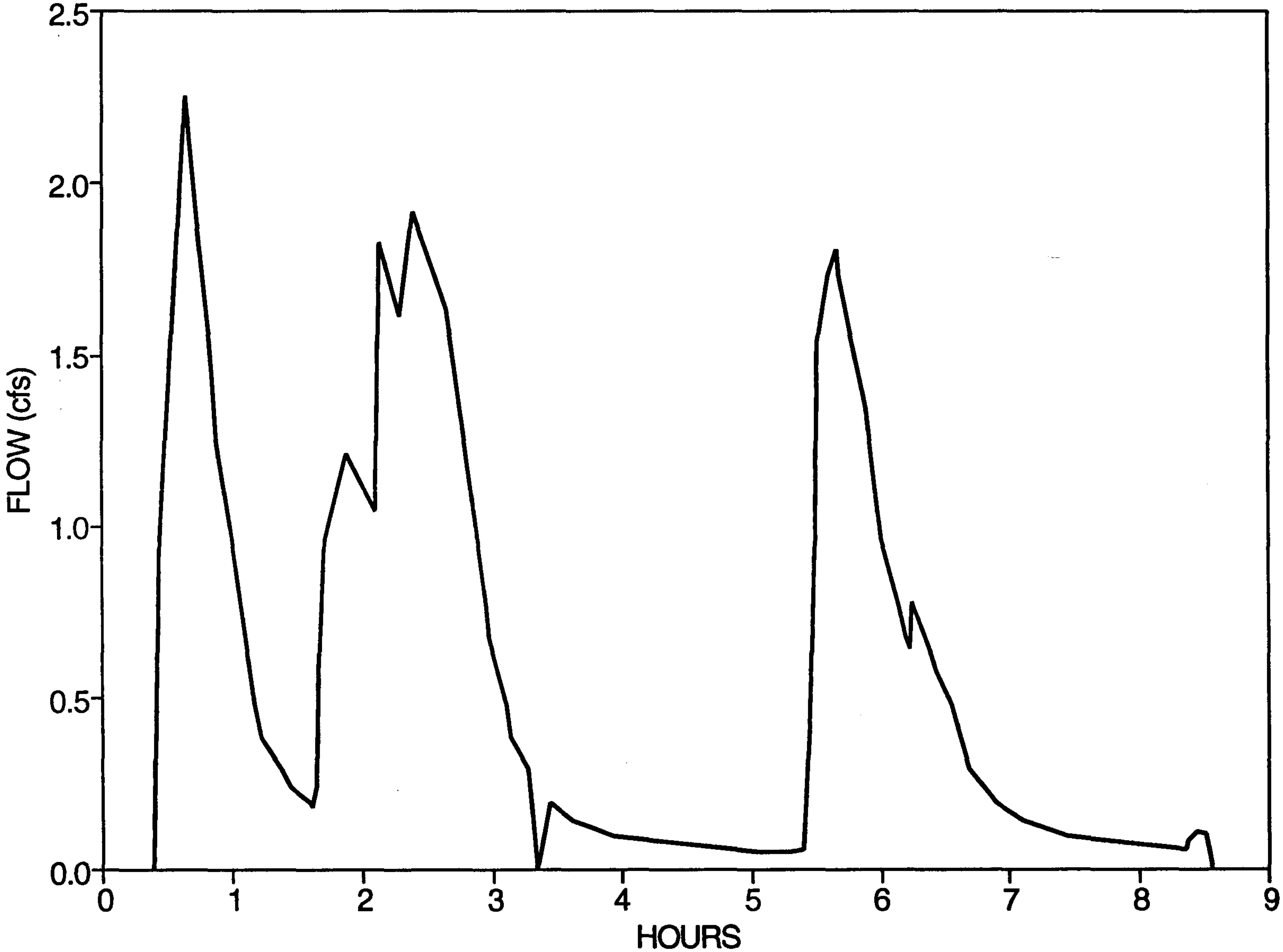


Figure 3-41: Sand Pointe Hydrograph for Site SS-2, 7/17/89

TABLE 3-11

MONITORED STORM SEWER FLOW AND RUNOFF COEFFICIENTS

Station	Date	Monitored Flow (ac-ft)	Area (ac)	Precipitation (inches)	Monitored RC	Literature RC
SS-1	6/26/89	0.619	56	1.19	0.11	
	7/18/89	1.725	56	0.93	0.40	
	8/21/89	1.525	56	2.67	0.12	
Average					**0.21**	**0.17-0.45**
SS-2	4/26/89	1.371	62	1.64	0.16	
	6/21/89	1.247	62	1.05	0.22	
	7/17/89	0.412	62	0.36	0.22	
Average					**0.20**	**0.15-0.93**

Stream Water Quality

Average TP concentrations for the monitored streams are shown in Figure 3-42. The values recorded at site S-1 on July 18 (3,520 µg/l) and at site S-3 on July 12 (1,760 µg/l) were suspected of being data outliers and are not shown. These two data points lie well outside the upper 95 percent confidence interval and do not appear to be reasonable considering the character and flow regime at the monitoring sites.

The arithmetic mean TP concentrations for S-1 and S-2 were 346 µg/l and 519 µg/l, respectively. Much of the phosphorus in these streams was soluble. On average, about 56 percent of the phosphorus in S-1 was in he form of SRP, while SRP comprised about 68 percent of the TP in S-2. The average (volume-weighted) streamflow concentration to Spring Lake was 388 µg/l. This compares favorably to the value of 368 µg/l calculated by Osgood (1983) and the WERM modeled value of 355 µg/l. The outlet for Spring Lake (S-3) had an arithmetic mean concentration of 135 µg/l. This is well below Osgood's (1989) estimate of 238 µg/l but fairly close to the annual average lake surface concentration of 124 µg/l. The arithmetic mean TP concentration for S-4 was 179 µg/l. Flow response time for this stream was much faster than expected. As a result, sample collection usually missed

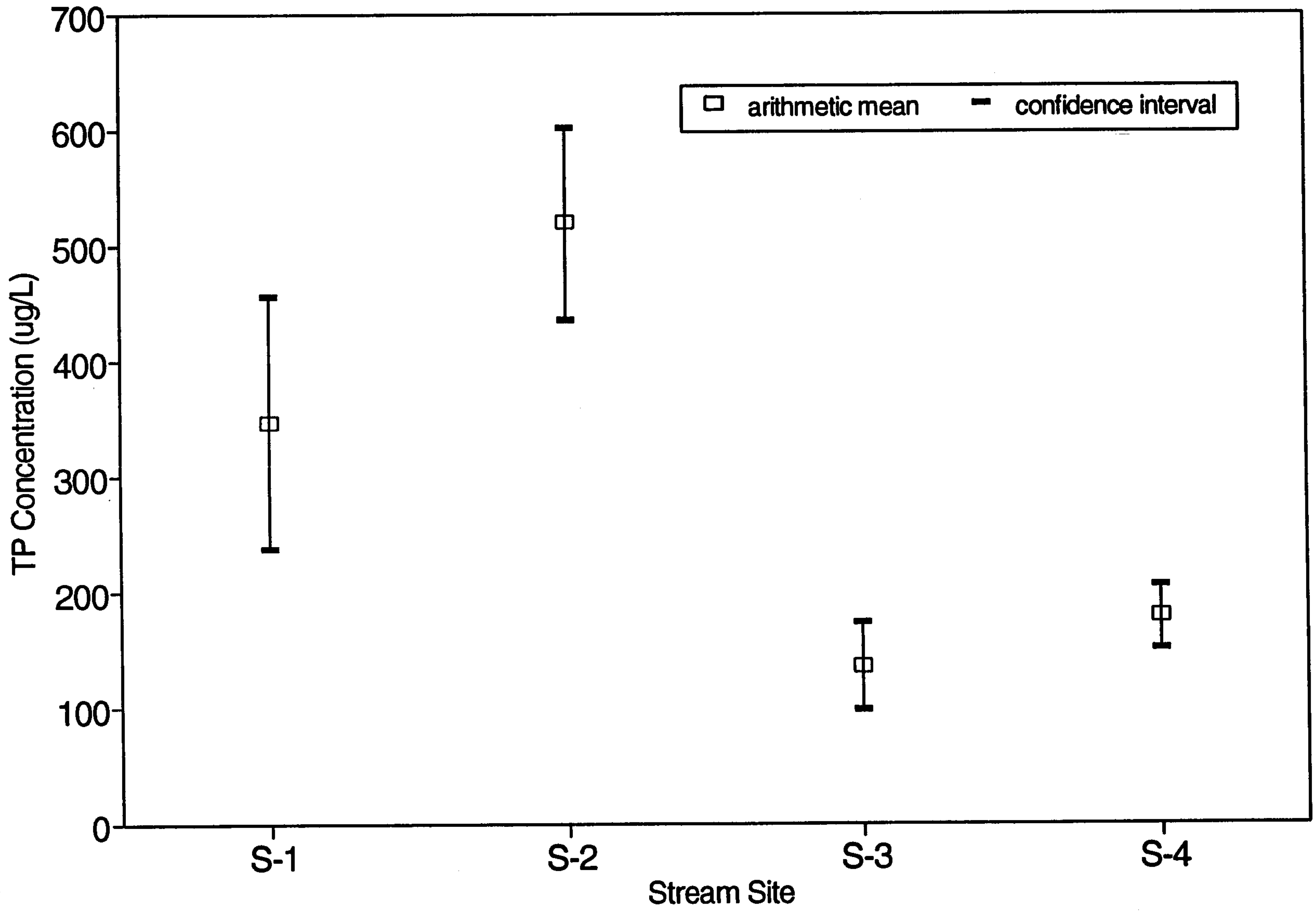


Figure 3-42: Average Stream TP Concentrations for Prior Lake/Spring Lake Watershed

higher than the observed arithmetic mean. The low concentration could also be due to sedimentation of pollutants in the Crystal/ Rice Lake complex.

Based on the average monitored TP concentrations and the monitored flow volumes, the TP loads for County Ditch 13 (S-1) and the Fish/Buck Lake stream (S-2) were 328 lbs/yr and 773 lbs/yr, respectively. The total stream flow input of 1,101 lbs/yr is well below the 1981-82 estimate of 4,655 lbs/yr (Osgood, 1983). The calculated areal loading for County Ditch 13 is only 0.06 lbs/ac-yr. This is far below the most likely range of values for agricultural land of 0.36-0.45 lbs/ac-yr reported by Mulcahy (1990). The most likely reason for the poor agreement with literature values is an underestimation of the runoff volume as a result of the lack of high flow data and the drought conditions. Due to the shortcomings of the monitoring data, the hydrologic and phosphorus budgets for Spring Lake (presented in Section 4) are based on the Metropolitan Council's study.

Stormwater Quality

Flow-weighted TP, SRP, and TSS concentration observed at the two storm sewer monitoring sites are shown in Table 3-12. The average TP concentration for SS-1 was 1,665 µg/l, which is markedly higher than the reported value for mixed urban land use of 872 µg/l (Montgomery, 1989). The areal loading rate for SS-1 was 2.0 lbs/ac-yr, which is higher than the most likely range for urban storm sewers of 0.8-1.34 lbs/ac-yr given by Mulcahy (1990). Subsequent field reconnaissance revealed that road construction activities in this subwatershed had commenced in early summer after the project was underway. This may explain the high TP and TSS concentrations observed at this site. Under normal conditions, the TP and TSS concentrations are expected to be closer to literature values.

Total phosphorus concentrations at site SS-2 averaged 430 µg/l. This value is significantly lower than the reported value for residential areas of 726 µg/l (Montgomery, 1989). The areal loading rate for SS-2 was 0.50 lbs/ac-yr, which is lower than the most likely range for urban storm sewers given by Mulcahy (1990). This difference may be explained by the location of dry stormwater basins upstream of this monitoring site. These basins may provide some water quality benefits for the runoff.

TABLE 3-12

STORMWATER QUALITY

Date	SS-1 TP (µg/l)	SS-1 SRP (µg/l)	SS-1 TSS (mg/l)	SS2 TP (µg/l)	SS2 SRP (µg/l)	SS2 TSS (mg/l)
3/28	1,300	330	292	600	340	70
5/1	--	--	--	490	140	98
6/26	1,910	100	117	260	70	94
7/19	1,300	70	252	370	150	37
8/28	2,150	60	1,214	--	--	--

CONCLUSIONS

A comprehensive water quality investigation of Upper and Lower Prior Lakes was conducted from October 1988 to September 1989. This study is complimented by the water quality investigation of Spring Lake conducted in 1982. Tables 3-13, 3-14, and 3-15 provide a water quality summary for Lower Prior, Upper Prior, and Spring Lakes, respectively. This assessment was based on the growing season epilimnetic water quality. In general, Lower Prior Lake had the best water quality of the three study lakes and Spring Lake had the poorest water quality.

The growing season average TP, chlorophyll-a, and Secchi disk transparency for Lower Prior Lake were 46 µg/l, 7.9 µg/l, and 2.24 m, respectively. These values are typical of lakes in the North Central Hardwood Forest Ecoregion. The mean TSI for this lake was 53, which places it in the mesotrophic-eutrophic category. The water quality of Lower Prior Lake was in the 67 percentile for the North Central Hardwood Forest Ecoregion.

The growing season average TP, chlorophyll-a, and Secchi disk transparency for Upper Prior Lake were 81 µg/l, 35 µg/l, and 0.95 m, respectively. These values are poorer than the typical range for North Central Hardwood Forest Ecoregion lakes. The mean TSI for this lake was 65, which places this lake in the eutrophic-hypereutrophic category. The water quality of Upper Prior Lake was in the 33 percentile for North Central Hardwood Forest Ecoregion lakes. In addition, observed oxygen conditions in Upper Prior during late

TABLE 3-13

LOWER PRIOR LAKE WATER QUALITY SUMMARY
(Based on 1989 Growing Season Average Surface Concentrations)

Parameter	Units	Mean	n	Min	Max	Std Dev	Typical NCHF Range
Total Phosphorus	µg/l	46	13	30	70	14	23-50
Soluble Reactive P	µg/l	12	13	10	20	4	
Chlorophyll-a	µg/l	7.9	14	4	21	5.2	5-22
Secchi Disk	m	2.24	38	1.22	4.00	0.52	1.5-3.2
Total Kjeldahl N	mg/l	1.05	2	0.80	1.30	0.35	<0.6-1.2
Nitrate+Nitrite N	mg/l	0.02	2	0.02	0.02	0.00	<0.01
Ammonia-N	mg/l	0.01	2	0.01	0.01	0.00	
TN:TP Ratio	22.3						
TSIP (TP)	59						
TSIC (Chl-a)	51						
TSIS (Secchi)	48						
TSI (Mean)	53						
Percentile Rank	67						

TABLE 3-14

UPPER PRIOR LAKE WATER QUALITY SUMMARY
(Based on 1989 Growing Season Average Surface Concentrations)

Parameter	Units	Mean	n	Min	Max	Std Dev	Typical NCHF Range
Total Phosphorus	µg/l	81	14	50	140	25	23-50
Soluble Reactive P	µg/l	11	14	10	20	4	
Chlorophyll-a	µg/l	35	14	16	71	18	5-22
Secchi Disk	m	0.95	23	0.46	2.44	0.42	1.5-3.2
Total Kjeldahl N	mg/l	1.55	2	1.50	1.60	0.07	<0.6-1.2
Nitrate+Nitrite N	mg/l	0.02	2	0.02	0.02	0.00	<0.01
Ammonia-N	mg/l	0.02	2	0.01	0.02	0.01	
TN:TP Ratio	19.4						
TSIP (TP)	68						
TSIC (Chl-a)	65						
TSIS (Secchi)	61						
TSI (Mean)	65						
Percentile Rank	33						

TABLE 3-15

SPRING LAKE WATER QUALITY SUMMARY
(Based on 1982 Growing Season Average Surface Concentrations)

Parameter	Units	Mean	n	Min	Max	Std Dev	Typical NCHF Range	Typical WCBP Range
Total Phosphorus	µg/l	149	33	80	300	36	23-50	65-150
Soluble Reactive P	µg/l	86	11	60	110	19		
Chlorophyll-a	µg/l	46	38	11	89	24	5-22	30-80
Secchi Disk	m	1.65	40	0.76	4.27	0.65	1.5-3.2	0.5-1.0
Total Kjeldahl N	mg/l	2.09	33	1.50	3.18	0.33	<0.6-1.2	1.3-2.7
Nitrate+Nitrite N	mg/l	0.08	3	0.06	0.11	0.02	<0.01	0.01-0.02
Ammonia-N	mg/l	0.10	3	0.04	0.16	0.06		

TN:TP Ratio	14.6	
TSIP (TP)	76	71
TSIC (Chl-a)	68	66
TSIS (Secchi)	53	55
TSI (Mean)	72*	
Percentile Rank	14 (NCHF)	48 (WCBP)

[a] Calculated using only TSIP and TSIC.

winter of 1989 were low throughout the water column and extremely close to fishkill conditions.

The growing season average TP and chlorophyll-a for Spring Lake were 149 µg/l and 46 µg/l, respectively. These values were well above the typical range for the North Central Hardwood Forest Ecoregion. In fact, these values were more typical of lakes in the Western Cornbelt Plains. This is probably due to the agricultural character of the Spring Lake watershed. Secchi disk transparency for Spring Lake was 1.65 m. This value is much better than is expected for a lake with a TP of 149 µg/l and a chlorophyll-a of 46 mg/l. The reason for this is probably due to the colonial behavior of the dominant phytoplankton, Aphanizomenon. Secchi disk transparency is generally a poor predictor of trophic status in lakes dominated by Aphanizomenon. The mean TSI for Spring Lake (based on TP and chlorophyll-a) was 72. This places Spring Lake in the hypereutrophic category. The water quality of Spring Lake was only in the 14th percentile for North Central Hardwood Forest Ecoregion lakes but for Western Cornbelt Plain lakes, its ranking was 48.

It appears that Spring Lake was nitrogen limited rather than phosphorous limited in 1980 to 1982. However, nuisance algal blooms were primarily caused by blue green algae which can fix nitrogen. Thus, reducing phosphorous so that it is limiting will be an important management goal. Management for nitrogen may only provide an additional competitive advantage to blue green algae. The primary reason that nitrogen is limiting is that phosphorus in over abundant. Observed nitrogen concentrations in Spring Lake were in the typical range for WCBP lakes indicating that nitrogen limitation was not caused by low availability of nitrogen. Finally, most of the phosphorous observed in Spring Lake was in the dissolved form. Thus, the implementation plan should emphasize management practices which reduce or control dissolved phosphorous. The management of SRP in Spring Lake will also be important for improving Upper Prior Lake.

The monitored stream flows were much lower than what would be expected for these subwatersheds in a normal year. The runoff coefficients for S-1, S-2, and S-4 were 0.06, 0.12, and 0.07, respectively. These values are well below those given in literature (Schwab, 1981). The most likely reason for the low observed flows was the lack of data collected during high flow events and drought conditions. As a result of the low estimate of flow, the TP export rates from these subwatersheds were also much lower than expected. The TP export rates were 0.06 lbs/ac-yr for S-1, 0.19 lbs/ac-yr for S-2, and 0.04 lbs/ac-yr for S-4.

The monitored discharge load from Spring Lake (S-3) was 211 lbs/yr and the Prior Lake outlet (S-5) did not discharge during the monitoring period.

The average monitored runoff coefficient was 0.20 for storm sewer SS-1 and 0.21 for storm sewer SS-2. These runoff coefficients are in reasonable agreement with literature values (Montgomery, 1989). However, the TP export rate for SS-1 of 2.0 lbs/ac-yr was higher than the most likely range for urban storm sewers of 0.8-1.34 lbs/ac-yr given in literature (Mulcahy, 1990). Construction activities in this subwatershed probably contributed to the high pollutant loading. The TP export rate for SS-2 was below the most likely range at 0.50 lbs/ac-yr.

SECTION 4

HYDROLOGIC AND NUTRIENT MODELING

INTRODUCTION

This section presents the development of the hydrologic and nutrient budgets for Spring, Upper Prior, and Lower Prior Lakes. These data were utilized in the formulation of the in-lake phosphorus models.

Monitored stream flow and loading was significantly lower than expected based on in-lake TP concentrations and literature values. While annual precipitation for the monitoring year was nearly normal (26 inches). The previous year was a drought year with only 18.7 inches of precipitation. Due to the drought, hydrologic storage in watershed pond areas was well below capacity; therefore, runoff and pollutant loads were probably captured upstream.

The Watershed Eutrophication Reduction Management (WERM) model was used to calculate runoff and loading for average year conditions using land use-weighted runoff coefficients and TP concentrations. The model was formulated using the watershed management areas delineated in the Prior Lake/Spring Lake Watershed Management Plan (JMM, 1991). Figure 4-1 (see also Map 1) shows the flow diagram for the model and Table 4-1 gives the characteristics of each subwatershed. Since in-lake water quality data for Spring Lake was not collected through this study, the model for this lake could not be calibrated. Therefore, the model and budgets developed by Osgood (1983) were utilized.

HYDROLOGIC BUDGETS

Spring Lake

The 1982 annual hydrologic budget for Spring Lake, as developed by Osgood (1983) is presented in Table 4-2.

Inflow. Precipitation in 1982 was about 9 percent higher than the normal 26 inches. Annual direct precipitation input to Spring Lake was 1,542 ac-ft in 1982. Surface inflows were 4,681 ac-ft and accounted for about 50 percent of the total annual hydrologic input. The

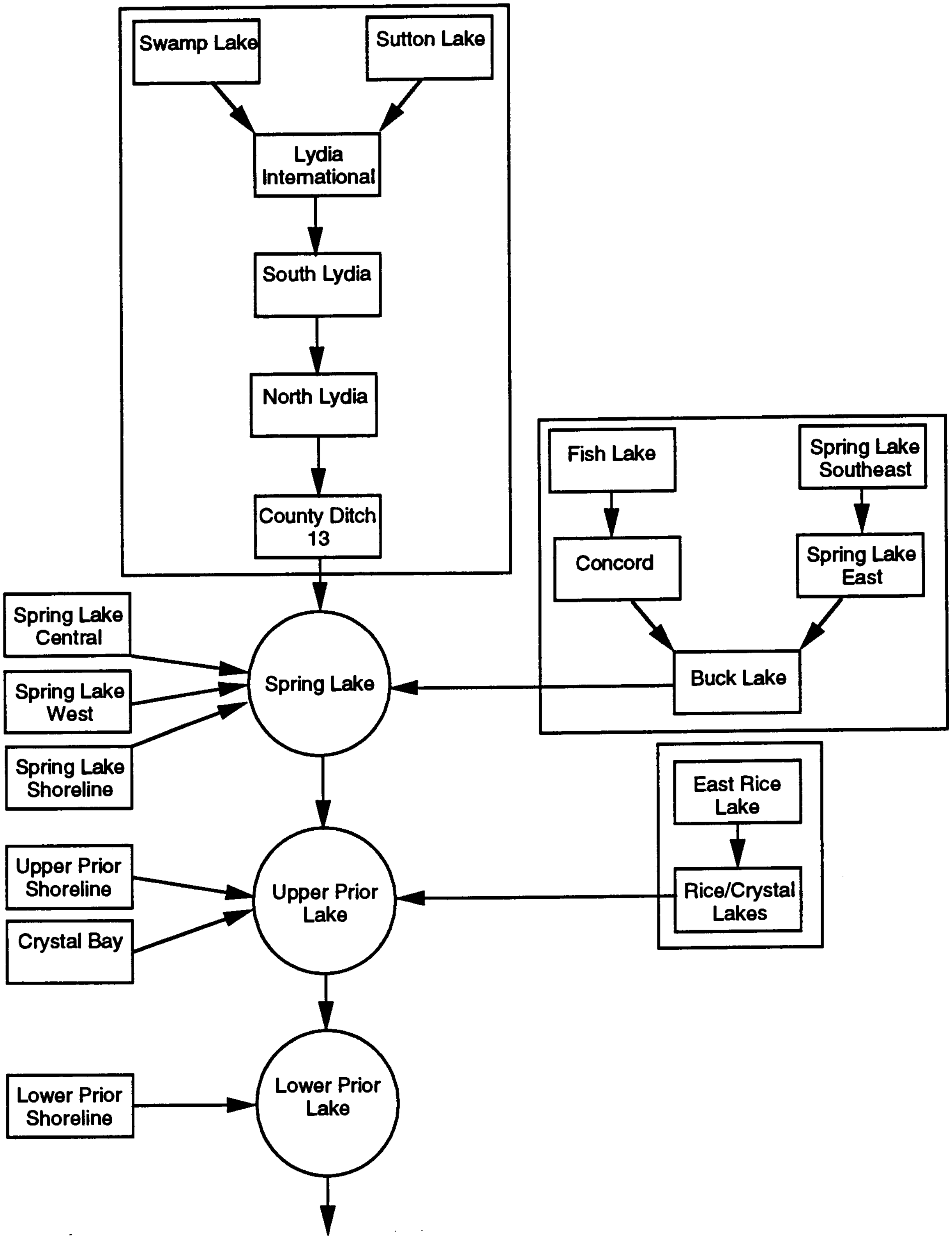


FIGURE 4-1
FLOW CHART FOR PRIOR LAKE/SPRING LAKE WATERSHED MODEL

TABLE 4-1

SUBWATERSHED CHARACTERISTICS

	Percent Land Use							
	Open Water	Open Undeveloped	Wooded	Cropland	Single Family Residential	Single Family Residential	Commercial/ Industrial	Area (acres)
Swamp Lake	30	0	3	60	7	0	0	352
Sutton Lake	38	4	8	50	2	0	0	1,402
Lydia International	7	18	4	65	6	0	0	1,184
South Lydia	5	14	1	72	8	0	0	678
North Lydia	3	12	8	70	6	1	0	838
County Ditch B	15	11	4	64	6	0	0	858
Fish Lake	33	14	6	38	9	0	0	659
Concord	8	16	2	66	8	0	0	672
Spring Lake Southeast	20	9	14	48	9	0	0	557
Spring Lake East	29	7	10	27	27	0	0	749
Buck Lake	15	10	5	49	20	0	1	1,350
Spring Lake Central	1	5	1	85	8	0	0	326
Spring Lake West	1	18	5	68	4	0	4	378
Spring Lake	47	6	7	27	8	4	1	1,741
East Rice Lake	10	20	4	47	19	0	0	461
Rice/Crystal Lake	15	14	10	19	36	1	5	883
Crystal	21	17	25	30	2	5	0	627
Upper Prior	36	10	2	6	18	26	2	1,427
Lower Prior	34	10	10	5	15	25	1	2,970

groundwater contribution was calculated as a budget residual. Based on this analysis, the annual groundwater input for 1982 was 3,043 ac-ft.

TABLE 4-2

HYDROLOGIC BUDGET FOR SPRING LAKE (OSGOOD, 1983)

	Volume (ac-ft)
Precipitation	1,542
Surface Inflow	4,681
Groundwater	3,043
Total Inflow	9,266
Evaporation	1,630
Surface Outflow	7,224
Groundwater	160
Total Outflow	9,015
Storage Change	+251

A WERM model with literature values for runoff coefficients (RCs) was developed for comparison with Osgood's model, and also to proportion of hydrologic loading from Osgood's model between inflow streams. Runoff calculations from WERM indicate that inflows were much higher than Osgood's estimate. In fact the surface inflow calculated by WERM totally accounts for the budget residual. WERM indicates that 36 percent of the surface inflow is derived from the Fish/Buck Lake discharge and 45 percent comes from County Ditch 13. The total hydrological input predicted by WERM of 9,883 ac-ft compares favorably with Osgood's estimate of 9,266 ac-ft.

Outflow. Evaporation accounted for a loss of 1,630 ac-ft from Spring Lake in 1982. This is approximately 18 percent of the total hydrologic output. Surface outflow accounted for about 80 percent of the total annual hydrologic output of 9,015 ac-ft. The WERM comparison model estimated a total output of 9,883 ac-ft for a normal year.

Groundwater drainage comprised only 2 percent of the total hydrologic output from Spring Lake. Total hydrologic output was exceeded by total hydrologic input by 251 ac-ft. This difference was the measured change in storage volume. The hydraulic residence time of Spring Lake is 1.4 years.

Upper Prior Lake

The WERM model was developed by JMM (1989) and was based on the PONDNET model developed by Walker (1987). The components of WERM include hydrologic and phosphorous budgets as well as an in-lake phosphorous model.

Surface inflow in calculated by multiplying the annual precipitation by a runoff coefficient and the subwatershed area. The model can be calibrated to the observed flow by specifying a runoff coefficient calculated from monitored flow data; otherwise a default coefficient is calculated based on literature values for different land use types. These flows are then routed into the downstream subwatershed or basin. WERM also accounts for direct precipitation to the lake surface and evaporation. Change in storage is assumed to be negligible and net outflow is calculated as surface inflow plus direct precipitation minus evaporation.

Surface inflow of phosphorous is calculated by multiplying the runoff volume by the phosphorous concentration. The model will calculate a default concentration for each subwatershed based upon literature values for various land use types unless the user specifies a monitored runoff concentration.

The Upper and Lower Prior Lake WERM models utilized literature values for runoff coefficients, because the monitored flow data appeared low. The observed low flow was probably due to the drought conditions.

Literature values were also used for runoff TP concentrations, except for the inflow of Upper Prior Lake from Spring Lake which was set equal to the observed annual average surface concentration for Spring Lake of 124 ug/l.

Inflow. Upper Prior Lake receives about 6 percent of its annual hydrologic input from direct precipitation in a normal year. WERM predicts that under these conditions, the Spring Lake outlet contributes 8,411 ac-ft, about 70 percent of the total hydrologic input to Upper Prior Lake. The Rice/Crystal Lake discharge (stream station S-4) only contributes about 9 percent and other direct runoff sources account for 14 percent of the annual hydrologic input.

Outflow. The regional evaporation rate is about 28 in/yr. At this rate, the evaporative loss from Upper Prior is 793 ac-ft/yr. WERM assumes that the net change in storage is zero. While the lake level fluctuates, over a long period the steady state assumption is probably valid. During the monitored year however, there was no discharge from Lower Prior Lake and consequently Upper Prior Lake. Based on the steady state assumption, WERM predicts an outflow of 11,174 ac-ft/yr. This accounts for 93 percent of the total annual hydrologic output. This discharge rate results in a hydraulic residence time of only about three months.

Lower Prior Lake

Inflow. Normally, direct precipitation accounts for 12 percent of the hydrologic input to Lower Prior Lake. This lake receives surface inflow from the discharge of Upper Prior Lake as well as numerous storm sewers that drain the area surrounding the lake. The monitored runoff coefficients from the area surrounding the lake were fairly similar to the modeled coefficient. The total surface inflow to Lower Prior Lake is 13,112 ac-ft/yr under normal conditions. Runoff from shoreline areas accounts for 15 percent of the surface inflow, while the discharge from Upper Prior Lake accounts for 85 percent of the surface inflow.

Outflow. Evaporation typically accounts for a loss of about 1,930 ac-ft/yr. This loss represents about 13 percent of the annual hydrologic output for Lower Prior Lake. Surface discharge from the outlet is a major hydrologic loss under normal conditions. The average annual discharge volume from 1983-86 was 7,600 ac-ft. The outlet structure, constructed in the early 1980s, resulted in several years of no discharge. During the monitoring year, Lower Prior Lake did not discharge from the outlet. Lake levels for this year were well below the discharge elevation due to the previous year's drought. A hydrologic balance for a normal year predicts that approximately 12,950 ac-ft of discharge will occur. However, it appears that groundwater seepage may account for a significant portion of this discharge. The difference between the predicted normal year discharge and observed average annual discharge of 5,350 ac-ft may be groundwater seepage.

Past studies have investigated the possibility of significant groundwater drainage from the lake (Frellsen, 1940; Mayer, 1951). The extent of groundwater drainage from Lower Prior lake is uncertain but there is evidence to suggest that significant drainage occurs through the sandy bottom area of Candy Cove.

The normal year hydrologic budgets for Upper and Lower Prior Lakes is presented in Table 4-3. The hydraulic residence times are estimated as 0.2 years and 0.8 years for Upper and Lower Prior Lakes respectively.

TABLE 4-3

UPPER AND LOWER PRIOR LAKE HYDROLOGIC BUDGETS (Normal Year)

	Upper Prior (ac-ft)	Lower Prior (ac-ft)
Precipitation	748	1,771
Upstream Inflow	8,411	11,174
Direct Runoff	3,557	1,938
Total Input	**11,966**	**14,883**
Evaporation	794	1,930
Discharge	11,174	12,953 [a]
Total Output	**11,968**	**14,883**

[a] A significant but unknown fraction of the discharge from Lower Prior Lake probably occurs as groundwater seepage.

NUTRIENT BUDGETS

Spring Lake

The 1982 annual TP load for Spring Lake, as developed by Osgood (1983), is presented in Table 4-4.

TABLE 4-4

PHOSPHORUS BUDGET FOR SPRING LAKE (OSGOOD, 1983)

	lbs/yr
<u>Input</u>	
Atmospheric	480
Surface Inflow	4,684
Septic Leakage	273
Groundwater (Net Input)	326
Internal	2,860
<u>Output</u>	
Discharge	4,686
Sedimentation	3,937

Input. The annual TP load for Spring Lake in 1982 was estimated to be 8,680 lbs. External sources accounted for 67 percent of this loading and the remaining 33 percent was derived from internal loading mechanisms. The external sources were further partitioned into atmospheric, surface inflow, septic leakage, and groundwater sources.

Surface inflows contributed 4,684 lbs of TP or about 80 percent of the external load. The flow-weighted mean TP concentration of the stream inflow was 368 µg/l. There are two major stream inputs to Spring Lake: the Fish Lake-Buck Lake discharge stream and County Ditch 13. These two streams drain the majority of the watershed. Based on area and land-use type, these subwatersheds account for about 76% of the surface inflow. Osgood used the drainage densities to calculate relative loading from monitored and unmonitored subwatersheds. Therefore, TP export rates can be back-calculated for the subwatersheds. The combined TP export rate from these subwatersheds is 0.38 lbs/ac-yr. Mulcahy (1990) indicates that the typical range of TP export from agricultural land in the Twin Cities metropolitan area is 0.36-0.45 lbs/ac.

More than 50% of the annual TP load is in the soluble reactive form. Much of the SRP probably comes from internal loading mechanisms.

Output. The major phosphorus sinks for Spring Lake are surface discharge to Upper Prior Lake and sedimentation. In 1982, an estimated 4,686 lbs of TP were discharged from Spring Lake to Upper Prior Lake. Using this estimate, the flow-weighted mean TP concentration of the discharge would have been 238 µg/l. This appears to be incongruent with the observed annual average surface concentration for TP of 124 µg/l. Therefore, the discharge to Upper Prior Lake was recalculated using a TP concentration of 124 ug/l. This gives a TP discharge from Spring Lake to Upper Prior Lake of 2,834 lbs/yr. The discharge concentration is generally expected to be similar to the surface concentration. The estimated removal by sedimentation was 3,937 lbs/yr or about 45 percent of the TP output.

Upper Prior Lake

Input. The TP load to Upper Prior Lake was estimated to be 5,147 lbs/yr. Table 4-5 shows the phosphorous budget for Upper Prior Lake. Spring Lake is a major source of nutrients to Upper Prior Lake. Based on the observed annual surface concentrations of Spring Lake, about 2,834 lbs/yr are discharged to Upper Prior Lake and about 55% of this is in the form of SRP. Only about 8 percent of the TP input comes from the Rice Lake-Crystal lake discharge stream (stream site S-4). The remaining 37 percent of the TP load is derived from drainage of the shoreline areas and direct precipitation. The TP export rates for the Rice Lake-Crystal Lake subwatershed and the direct drainage shoreline areas are 0.29 lbs/ac-yr and 0.89 lbs/ac-yr, respectively. The former export rate falls just below the most likely range of occurrence for urban open creeks of 0.3-0.8 lbs/ac-yr, while the latter falls just below the most likely range for urban storm sewers of 0.9-1.5 lbs/ac-yr (Mulcahy, 1990).

TABLE 4-5

PHOSPHORUS BUDGET FOR UPPER PRIOR LAKE

	lbs/yr
Input	
Spring Lake Discharge (S-3)	2,834
Rice/Crystal Discharge (S-4)	391
Shoreline Drainage	1,821
Atmospheric	101
Output	
Surface Outlet	2,486
Sedimentation	2,659

Output. The major phosphorus sinks for Upper Prior Lake are surface discharge to Lower Prior lake and sedimentation. WERM estimates that 2,486 lbs of phosphorus are discharged per year from Upper Prior. The flow-weighted mean TP concentration of this discharge is 82.2 μg/l. This is very close to the observed surface TP concentration of 81 μg/l. Sedimentation processes account for a net loss of 2,659 lbs/yr, yielding a phosphorus retention of 52 percent.

Lower Prior Lake

Input. The TP load to Lower Prior lake is estimated to be 5,450 lbs/yr. Table 4-6 presents the phosphorous budget for Lower Prior Lake. The discharge from Upper Prior Lake contributes 2,486 lbs/yr, which is 46 percent of the total load. The remaining 54 percent is derived from direct drainage of the surrounding shoreline area and direct precipitation. The shoreline area is mostly drained by storm sewers. There are more than 20 storm sewers discharging to the lake. Only two of these sites were monitored. The TP export rates from the monitored storm sewers were 2.0 lbs/ac-yr for SS-1 and 0.51 lbs/ac-yr for SS-2. These values were above and below the most likely range of export values for urban storm sewers of 0.9-1.5 lbs/ac-yr (Mulcahy, 1990). As mentioned in Section 3, the high TP loading observed at SS-1 may have been due to the construction activities in that subwatershed and the low export rate observed at SS-2 may have been due to pollutant removal by the upstream dry basins. The observed export rates probably bracket the actual average export rate for the shoreline drainage area. WERM predicts that the export rate for the entire shoreline drainage area is 1.27 lbs/ac-yr.

Output. During the course of the monitoring program, Lower Prior Lake never discharged via the surface outlet. In fact, Lower Prior Lake did not discharge from the outlet for several years in the late 1980s. Evidence suggests that groundwater drainage is a significant hydrologic sink; however, there is no quantitative data. Never the less, groundwater drainage is probably a significant sink for phosphorus also. WERM estimates that 1,522 lbs of phosphorus are discharged from Lower Prior Lake in a normal year. The relative amounts discharging via surface and groundwater in a normal year is uncertain. Sedimentation processes account for a removal of 3,929 lbs/yr, yielding a phosphorus retention of 72 percent.

TABLE 4-6

PHOSPHORUS BUDGET FOR LOWER PRIOR LAKE

	lbs/yr
<u>Input</u>	
Upper Prior Lake Discharge	2,486
Shoreline Drainage	2,716
Atmospheric	248
<u>Output</u>	
Discharge[a]	1,522
Sedimentation	3,929

[a] Surface and groundwater discharge.

5450

IN-LAKE MODELING

Modeling of in-lake TP concentrations was conducted for each of the three study lakes to further assess the impact of phosphorus loading on the water quality of the lakes. Numerous empirical models have been developed. Most of these models are based on the mass balance equation with the only significant difference being the formulation of the phosphorus sedimentation coefficient.

The second order phosphorus decay model developed by Walker, 1987) was selected for Upper and Lower Prior Lakes due to its wide applicability to midwestern lakes. This model along with mass balance is the basis for the WERM model (JMM, 1989). This model has the additional advantage of a watershed loading component which allows for in-lake TP estimates with limited data. Hard copies of the WERM spreadsheets have been included in Appendix C.

Since in-lake data were not collected for Spring Lake during this study, the WERM model could not be calibrated. Therefore, the Dillon-Rigler model utilized by Osgood (1983) is presented.

Spring Lake

The Dillon-Rigler model is formulated as follows:

$$P = \frac{L(1 - R_p)}{q_s}$$

where P is the predicted in-lake phosphorus concentration, L is the areal phosphorus load (g/m-yr), Rp is the phosphorus retention coefficient, and q_s is the areal water load (m/yr). Using the estimated external load of 5.763 lbs/yr, the model was found to significantly underestimate the in-lake TP. The budget residual (the difference between observed and predicted outflow) of 2,860 lbs/yr was attributed to internal loading sources (Osgood, 1983). If this additional load is included, the model predicts an in-lake TP of 112 µg/l, which is fairly close to the time and volume-weighted annual average concentration of 118 µg/l (the annual average surface concentration was 124 µg/l). Figure 4-2 shows the in-lake response to various TP loads. The model predicts that an in-lake concentration of about 80 µg/l can be achieved by reducing the TP load to 6,000 lbs/yr.

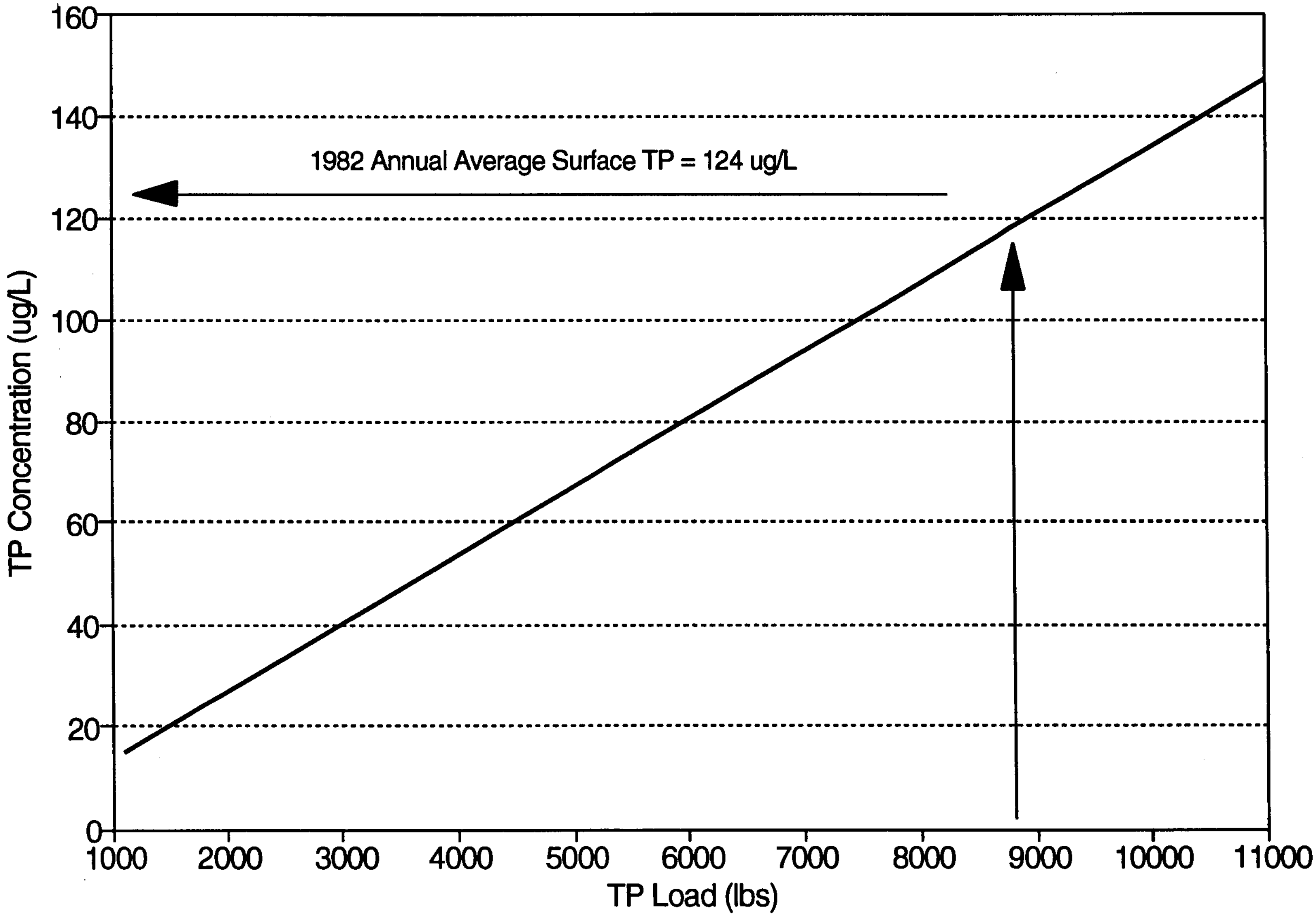


Figure 4-2: Loading-Response Curve for Spring Lake

Upper Prior Lake

The second-order decay phosphorus model is formulated as follows:

$$P = \frac{(1 + 4A_1TP_i)^{0.5} - 1}{2\,A_1T}$$

$$A_1 = (0.56/F_{OT})\,(Qs/Qs + 13.3)$$

where P is the predicted in-lake phosphorus concentration, P_i is the influent phosphorus concentration, T is the hydraulic residence time, F_{OT} is the faction of the TP that is in the form of ortho-phosphorus, Qs is the overflow rate, and 0.56 and 13.3 are empirical constants. Using the estimated TP loading of 5,147 lbs/yr, this model predicts an in-lake TP concentration of 82 µg/l. This prediction is very close to the observed time-weighted annual average surface TP concentration of 84 µg/l.

An important feature of this model for Upper Prior Lake is the consideration of the effect that the chemical form of the phosphorus input has on the in-lake concentration. About 60 percent of the phosphorus load from Spring Lake to Upper Prior is received in the form of SRP. This form of phosphorus is readily available for algal uptake and is not as effectively removed by sedimentation. Figure 4-3 shows the in-lake response to various TP loads for three different influent compositions.

This figure shows that in-lake TP for Upper Prior Lake can be significantly reduced just by changing the form of the influent phosphorus from SRP to particulate phosphorus. If the TP concentration of Spring Lake were reduced to 70 µg/l and the SRP reduced to 15 percent of the TP, Upper Prior Lake could be expected to attain an annual average in-lake concentration of 58 µg/l.

Lower Prior Lake

Using the estimated annual TP load of 5,450 lbs/yr, the second-order decay model predicts an in-lake TP concentration for Lower Prior Lake of 43 µg/l. This prediction compares favorably with the observed annual time-weighted average surface concentration of 48 µg/l. Figure 4-4 shows the in-lake response of Lower Prior Lake to various TP loads. If the

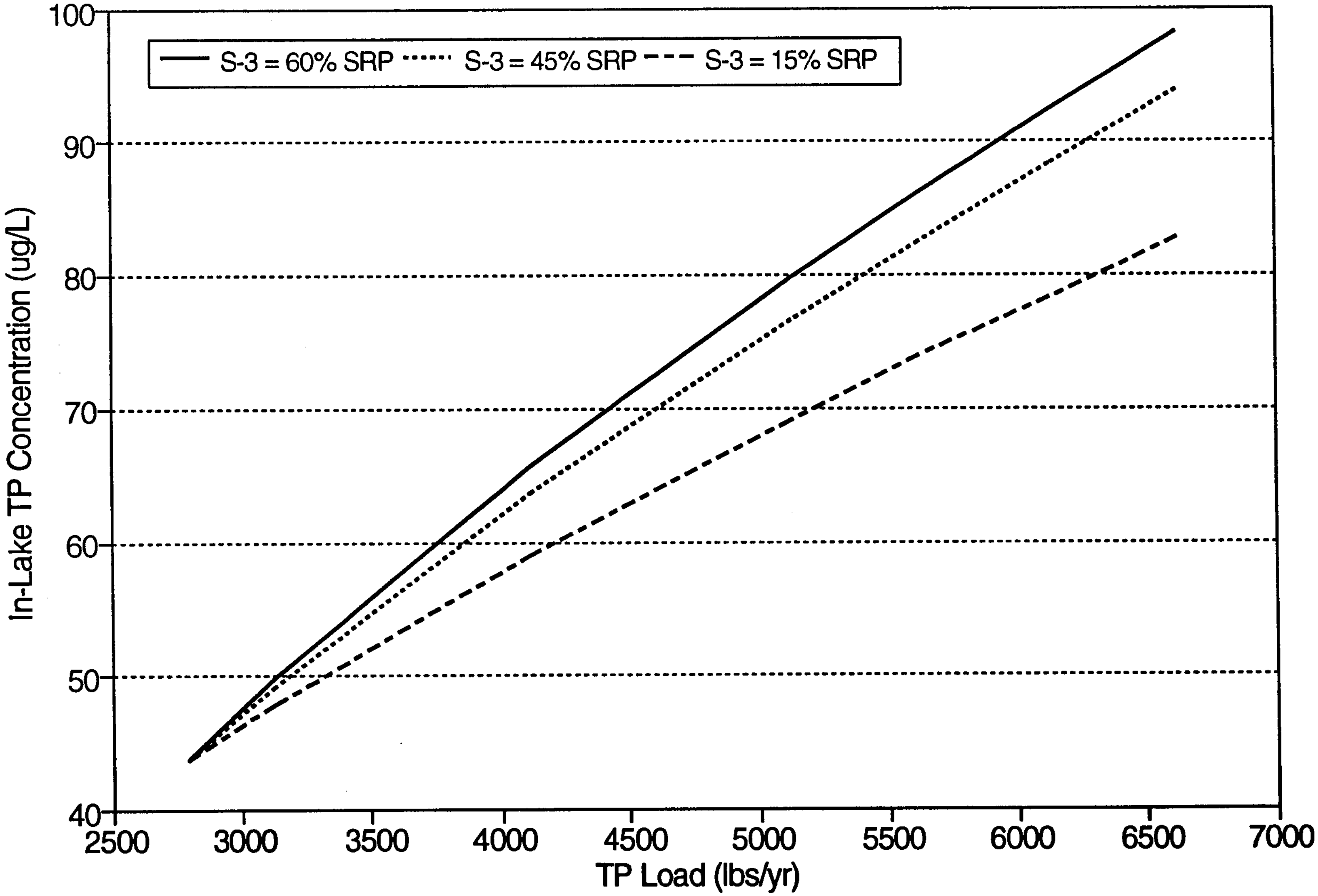


Figure 4-3: Loading-Response Curve for Upper Prior Lake

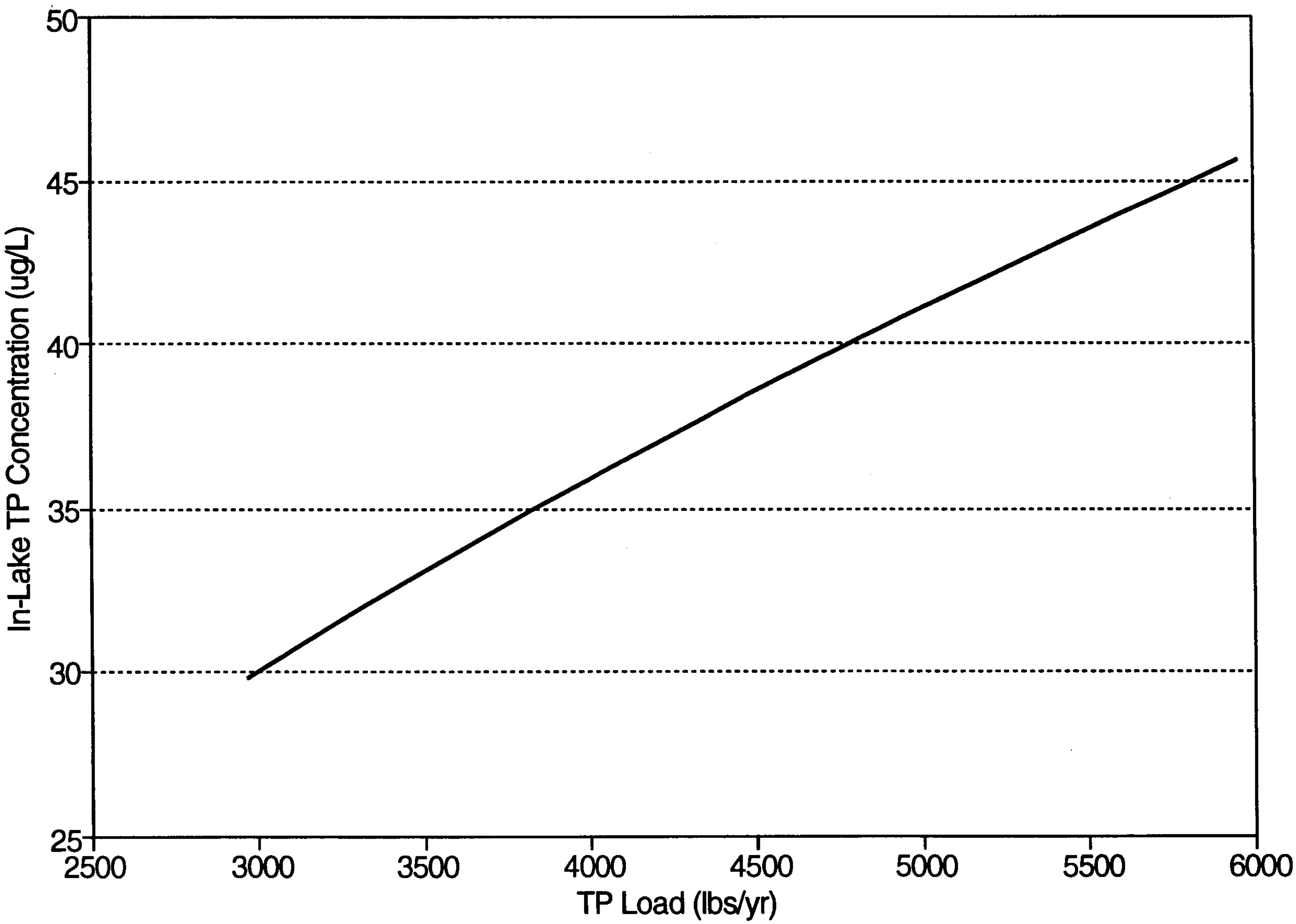


Figure 4-4: Loading-Response Curve for Lower Prior Lake

TP load to the lake were reduced to 4,500 lbs/yr, the model predicts that the lake will attain an in-lake concentration of about 40 μg/l.

SECTION 5

WATER QUALITY ASSESSMENT

INTRODUCTION

In this section, an assessment is made of the water quality of Spring, Upper Prior, and Lower Prior Lakes. The current condition of these lakes is evaluated to determine which desired uses may be impaired. In addition, current water quality data are compared to ecoregion mean values to further assess the potential for water quality improvements. Numerical goals are established for improving conditions for desired uses based on reasonable attainability considering the individual basin and watershed characteristics.

IMPAIRED USES

Spring Lake

Monitoring showed that Spring Lake was nutrient enriched and hypereutrophic. Nutrient enrichment contributes for severe blue green algal blooms. These blooms limit water clarity, cause aesthetic problems, and impair swimming. In addition, toxic algal blooms have historically been observed on the lake. The perceived recreational suitability (Heiskary and Wilson, 1990) based on a trophic state of 72 equates to user perception of nonsupporting swimming.

Hypereutrophic conditions also impair fisheries. Spawning conditions in Spring Lake were considered fair by MDNR for walleye. However, the growing season average TP of 113-289 μg/l is well above the mean for bass/pan fish/walleye lakes in the Central Hardwoods Forest Region of 60 μg/l (Heiskary and Wilson, 1990). The observed concentrations are closer to the mean for a rough fish lake. Additionally, the dominant blue green algal species, Aphanizomenon is poor food quality and may impair the fishery.

Nutrient enrichment of Spring Lake also impairs uses in Upper Prior Lake by discharging phosphorous, particularly dissolved phosphorous to Upper Prior Lake.

Upper Prior Lake

Upper Prior Lake is also nutrient enriched although not to the extent of Spring Lake. The degree of nutrient enrichment in Upper Prior Lake makes the lake eutrophic-hypereutrophic. The nutrient rich eutrophic conditions cause algal blooms, limit water clarity and detract from general aesthetics. In fact, water clarity in Upper Prior Lake was the lowest of all three study lakes. These conditions combine to limit swimming. The trophic state of the lake of 65 places Upper Prior lake border line partially swimming to nonsupport swimming for user expectations (Heiskary and Wilson, 1990).

Similar to Spring Lake the observed eutrophic conditions on Upper Prior may impair the fishery. The observed average TP concentration of 82 μg/l is higher than the 75th percentile for the fishery ecological class bass/panfish/walleye in the Central Hardwood Forest Ecoregion. The fishery in Upper Prior Lake may also be impaired by low oxygen conditions. Dissolved oxygen conditions throughout the water column in late winter of 1989 were close to fishkill conditions. This may be due to physical characteristics of the lake since the lake has a high surface area to volume ratio. However, nutrient enrichment and algal blooms also contribute to oxygen depletion by increasing sediment oxygen demand.

Lower Prior Lake

Lower Prior lake was in relatively good shape. Slight nutrient enrichment makes the lake mesotrophic to eutrophic. The lake had only minor aesthetic problems with algal blooms. The observed trophic state index of 53 equates to user expectations for supporting swimming. Currently the major constraint restricting desired uses is caused by the invasion of the aquatic plant eurasian water milfoil. This infestation is currently being monitored and managed jointly by MDNR and the District.

WATER QUALITY GOALS

Water quality improvement goals for all three lakes include improvements in aesthetics, recreational suitability, and fishery. To meet these goals numerical goals were developed for reducing TP, and chlorophyll-a, as well as for improving secchi transparency. Assessment of potential attainability was completed by comparing monitored lake conditions, with ecoregion mean values for lakes with similar morphometric characteristics. The MINLEAP model was run using the physical characteristics of each lake to determine the range of TP, Chlorophyll-a, and secchi transparency conditions for similar lakes. Results of the modeling are presented in Tables 5-1 through 5-3. These results show that Spring and Upper Prior Lake generally had lower water quality than similar lakes. Lower Prior Lake had better water quality than similar lakes. This is probably due to the sedimentation of nutrients and sediment in Spring and Upper Prior Lakes upstream of Lower Prior Lake.

Spring Lake

Heiskary and Wilson (1989) suggest an in lake TP concentration of 70 to 90 µg/l as a reasonable goal for the WCBP ecoregion. The MINLEAP model results (Table 5-1) show that while this range is below the median TP concentrations for lakes similar to Spring it is still within the lower range of concentrations observed for WCBP lakes. Osgood (1983) states that to achieve significant improvements in Spring lake the TP loading would need to be reduced by 1,500 kg (3,300 lbs). Using the loading response curve in Section 5 this reduction will result in a new in-lake TP concentration of approximately 70 µg/l. The likelihood of obtaining this goal is good since most, 58%, of the TP in Spring Lake is in dissolved form. Walker (1992) showed that chemical addition systems, such as ferric chloride systems, are extremely effective in controlling dissolved phosphorous. Alternatives for improving the lakes are discussed in detail in the feasibility study. However, the potential for successful remedial activities for treating dissolved phosphorous increases the probability of obtaining an in-lake TP concentration of 70 µg/l. Therefore, the six year TP reduction goal for Spring Lake was set at 70 µg/l.

Reduction of SRP in Spring Lake benefits Upper Prior Lake as well as Spring Lake. Modeling in Section 4 showed that if the TP concentration of Spring Lake were reduced to 70 µg/l and the SRP reduced to 15 % of the TP, Upper Prior Lake could be expected to attain

TABLE 5-1

MINLEAP MODEL RESULTS FOR SPRING LAKE

	Observed	Predicted CHF	Predicted WCBP
Total Phosphorus (μg/l)	149	44(± 16)	101(± 40)
Chlorophyll-a (μg/l)	46	17(± 11)	56(± 38)
Secchi Transparency (meters)	1.6	1.5(± 0.6)	0.7(± 0.3)

TABLE 5-2

MINLEAP MODEL RESULTS FOR UPPER PRIOR LAKE

	Observed	Predicted
Total Phosphorus (μg/l)	81	76 (± 21)
Chlorophyll-a (μg/l)	35	37 (± 20)
Secchi Transparency (meters)	1.0	0.9 (± 0.3)

TABLE 5-3

MINLEAP MODEL RESULTS FOR LOWER PRIOR LAKE

	Observed	Predicted
Total Phosphorus (μg/l)	46	53 (±17)
Chlorophyll-a (μg/l)	7.9	22 (±13)
Secchi Transparency (meters)	2.2	1.3 (±0.5)

an annual average in-lake concentration of 58 µg/l. Thus, an additional goal for Spring Lake is to reduce SRP to 15% of TP. With control of internal loading in this is a reasonable goal for Spring Lake since SRP is less than 15% TP in Upper Prior lake.

Reducing the TP concentration in Spring Lake from 149 µg/l to 70 µg/l will reduce to chance of nuisance as well as toxic algal blooms. The reduction will also likely affect algal species diversity giving Aphanizomenon less of a competitive advantage. In the short-term this may decrease water clarity as the colonial Aphanizomenon is replaced by other algal species. Because of this, reaching 70 µg/l TP should not be viewed as the final goal. Following the initial six-year project plans should be completed to further improve Spring Lake. Reducing the in-lake TP concentration to 70 µg/l will also improve the fishery. The CHF ecoregion mean for bass/ pan fish walleye is 80 µg/l TP.

Upper Prior Lake

MINLEAP model results for Upper Prior Lake shows that the existing conditions for Upper Prior Lake is similar to the observed conditions for the monitored year. This means that Upper Prior Lake had similar water quality conditions to most lakes with similar physical characteristics in the CHF ecoregion. To improve Upper Prior Lake to fully support swimming a TP concentration less than 50 µg/l is necessary. The MINLEAP model results show that lakes with physical characteristics similar to Upper Prior typically range from 55 to 95 µg/l. In addition, reducing the in-lake concentration from 81 to 50 µg/l TP requires an TP load reduction of 1,200 kg TP (2,400 lbs). This reduction may be unrealistic given the MINLEAP model results and the relatively small volume of the lake. A more realistic goal which will improve the desired uses is 55 µg/l TP. This reduction gives a TSI of 60 which is borderline fully supporting and partially supporting swimming. A TP concentration of 55 µg/l gives a chlorophyll-a concentration and secchi transparency of 22 µg/l and 1.25 m, respectively (Heiskary and Wilson, 1990). In addition, the frequency and severity of nuisance algal blooms will decrease.

Additional goals for Upper Prior Lake include maintaining dissolved oxygen (DO) conditions to support game fish and prevent winterkills. During late winter of the monitored year DO conditions throughout the water column were close to winterkill conditions.

Lower Prior Lake

Lower Prior Lake is currently meeting it's desired uses except for the impacts of Eurasian water milfoil. However, Heiskary and Wilson (1989) suggest an in-lake TP concentration of 40 μg/l to meet desired uses for lakes in the CHF ecoregion. Thus, goals established for Lower Prior Lake include protection of the existing water quality and uses, and reduction of the current TP concentration from 46 μg/l to less than 40 μg/l.

Additional Goals

A number of shoreline areas surrounding the three lakes are routinely threatened by high waterlevels in the spring of each year. Thus, the evaluation of alternative remedial activities will also include discussion of runoff reduction benefits for both water quality and water quantity goals.

NECESSARY WATER QUALITY IMPROVEMENTS

Pollutant loading reductions will be necessary to attain the water quality goals above. The in-lake models presented in Section 4 were used to determine the necessary TP loading reductions for meeting the numerical in-lake TP concentration goals for each lake. This evaluation begins with Spring Lake since discharge from Spring Lake are important sources of phosphorous for both Upper Prior and Lower Prior Lakes. Any attempt to improve the three lakes must begin with Spring Lake and the upper watershed.

The in-lake TP concentration goal for Spring Lake is 70 μg/l. Using Osgood's (1983) model a TP load reduction of 3,480 lbs/yr is required to achieve an in-lake concentration of 70 μg/l. This reduction corresponds to approximately 40 percent of the total estimated load. Loading reductions for Spring Lake should target SRP since this form is overabundant and is the form of phosphorous most readily available for algal uptake. Achieving the goal of TP equal to 70 μg/l and SRP equal to 15% of TP will result in a loading reduction to Upper Prior Lake of 1,290 lbs/yr and an in-lake concentrations of 58 μg/l. Thus, the necessary additional loading reduction to meet the in-lake goal of TP equal to 55 μg/l for Upper Prior lake is 240 lbs/yr.

To reach an in-lake TP concentration of 40 µg/l or less for lower Prior Lake requires a 20 percent reduction in TP load or 1,021 lbs/yr. This reduction will be meet with the improvements to Spring and Upper Prior Lakes.

CONCLUSIONS

Impaired uses in Spring and Upper Prior Lakes include aesthetics, recreation, and swimming. Upper and Lower Prior Lakes are also currently impaired by eurasian water milfoil. This problem is currently being treated by MDNR and the District. Goals for the lakes include improving Spring Lake to partially supporting swimming, Upper Prior Lake to borderline fully supporting/ partially supporting swimming as well as protecting and improving the quality of Lower Prior Lake. To achieve these goals management must begin in Spring Lake and the upper watershed. Total phosphorous loading to Spring Lake must be reduced by about 40% with most of the reduction in the form of dissolved phosphorous (SRP). To meet the goals for Upper Prior and Lower Prior TP loading to the lakes must by reduced by 30 % and 20 % respectively.

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FEASIBILITY STUDY FOR SPRING AND PRIOR LAKES
SCOTT COUNTY, MINNESOTA

PRIOR LAKE/SPRING LAKE WATERSHED DISTRICT

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SECTION 1

INTRODUCTION

This document presents and develops the Implementation Plan for the Spring, Upper Prior, And Lower Prior Lakes Water Quality Project. The project is a cooperative effort between the Prior Lake - Spring Lake Watershed District (PL/SLWD), the Minnesota Pollution Control Agency (MPCA), and the U.S. Environmental Protection Agency.

The Implementation Plan is based on the findings of the Diagnostic Study for the Lakes. A summary of the findings are provided below. Specific findings and detailed watershed descriptions are given in the Diagnostic Study.

SUMMARY OF DIAGNOSTIC STUDY

The monitoring portion of the Diagnostic Study for Spring Lake was conducted by Osgood (1983). Monitoring for Upper and Lower Prior Lakes was conducted between October of 1988 and September of 1989. The study included lake and stream monitoring, analysis of existing and historical water quality data, evaluation of land uses within the watershed, and preparation of water quality models for the Lakes and their watersheds.

Several observations were made during the Diagnostic Study which are pertinent to the development of the Implementation Plan. These are summarized as follows:

- Algal blooms are the primary problem restricting desired uses of both Spring and Upper Prior lakes. These blooms are excessive during the growing season with chlorophyll-a concentrations averaging 46 μg/l and 35 μg/l for Spring Lake and Upper Prior Lake, respectively. According to Heiskary and Wilson (1990), blooms of this magnitude place the lakes in the highest 25th percentage of lakes in the Central Hardwoods Region.

- A majority of the total phosphorous (TP) in Spring Lake is in soluble form. This is probably due to an overabundance of phosphorous as well as internal loading.

- Primary productivity in Upper Prior and Lower Prior Lakes is clearly limited by phosphorus. Spring Lake is not always phosphorus-limited. This is due to the extremely high concentrations of phosphorus in Spring, making it overly abundant. Even though Spring Lake is not always phosphorus-limited, phosphorus is still the primary pollutant targeted for reduction for several reasons. First, phosphorus levels can be reduced to the point where it again becomes limiting; second, it is generally easier to reduce phosphorus than other nutrients; third, the algal species which dominate Spring Lake are blue greens which can fix their own nitrogen; forth, reducing nitrogen without equal or greater reductions of phosphorous could give a greater competitive advantage to blue green algae; and most importantly primary productivity in Upper Prior Lake which receives 55% of its phosphorous budget is clearly phosphorous limited.

- Temperature and dissolved oxygen data show that Spring Lake is intermittic while Upper and Lower Prior Lakes are dimictic..

- The direct watershed area to Spring Lake is substantial, encompassing the 13,250 acres. This large watershed gives Spring Lake a relatively short hydraulic residence time of 1.3 years.

- The western portion of the direct watershed to Spring Lake is dominated by agricultural land uses. These uses consist primarily of row crops and 22 feedlots. The number of feedlots has decreased substantially from 43 facilities observed in 1977. None of the feedlots observed in 1993 were considered as having a significant potential for impacting surface water quality.

- Approximately 23 percent of the direct watershed to Spring Lake is highly erodible soils.

- The rolling topography of the direct watershed to Spring Lake historically created numerous wetlands. Most of these wetlands have either been drained or significantly altered. Thus, numerous opportunities exist for wetland restoration.

- Internal loading is significant for Spring Lake. Internal loading is estimated by mass balance and sedimentation as contributing 33 percent of the total phosphorous load to Spring Lake.

- The Buck Lake and County Ditch 13 streams contribute 41% of the total phosphorous load to Spring Lake. Because of the large amount of highly erodible land and the high loading to Spring Lake these subwatershed were classified as high priority for agricultural Best Management Practices (BMPs).

- Upper Prior Lake receives 55% of its phosphorous load from Spring Lake and 35% from shoreline areas. Approximately 60% of the phosphorous received from Spring Lake is in soluble form. This form of phosphorous is the form most readily available of algal uptake. Thus, management of soluble phosphorous in Spring Lake will be important for improving Upper Prior Lake.

- Upper Prior Lake has a relatively small lake volume. This gives the lake a very short hydraulic residence time of 0.2 years and means that controlling external sources of phosphorous are particularly important for improving the Lake.

- The shoreline area for Upper and Lower Prior Lakes is within the City of Prior Lake. Much of the shoreline has already been developed. Lawn maintenance to the waters edge is a common practice. In addition, city areas south of the lakes are heavily developed and few opportunities exist for stormwater system retrofits or for new new water quality basins. Thus, public education will be important for urban areas.

- The water quality of Lower Prior Lake was fairly good. However, there are signficant development pressures, particularly along the north shore of the lake. Wise development will be important for maintaining the quality of Lower Prior Lake.

- Since completion of the macrophyte surveys for Upper and Lower Prior Lakes the nuisance weed eurasian water milfoil has invaded the lakes.

- The Lakes are important recreational resources for the area. All are located close to the Twin Cities Metropolitan area and have boat access. Upper and Lower Prior Lakes also have swimming. The current water quality conditions for Spring Lake do not support swimming, however, a beach is planned as part of the Spring Lake Regional Park.

The Feasibility Study and Implementation Plan are developed based on the above findings.

SECTION 2

PAST AND CURRENT MANAGEMENT STRATEGIES

This section presents the past and current water resources management strategies employed by the various jurisdictions on the Prior and Spring Lakes watersheds. The local governing bodies with jurisdiction and environmental programs include the PLSLWD, city of Prior Lake, and Scott County.

PRIOR LAKE/SPRING LAKE WATERSHED DISTRICT

The PLSLWD has adopted standards for the control of stormwater runoff, water quality, soil erosion, sedimentation, groundwater presentation, and enhancement of unique features. The following presents a summary of these policies and standards. For a more complete description of District policies and standards, the reader is referred to the District's approved Water Resources Management Plan (PLSLWD, 1991). In addition to the following standards, the District serves as the Local Governing Unit (LGU) for implementation of the Wetlands Conservation Act in areas outside the jurisdiction of the city of Prior Lake. Within the city of Prior Lake, the District serves in concert with the City.

District Standards

The standards listed below apply in general to the policy area of stormwater runoff, water quality, soil erosion, sedimentation, groundwater, preservation and enhancement of unique features, aesthetics, and fish and wildlife habitat. Although most of the standards relate clearly to a single policy area, many do serve multiple purposes. Where conflicts in purpose exist between standards, trade-off evaluations may be needed to determine how to best accomplish the multiple goals and policies of the District.

Stormwater Runoff.

1. The level of service to be provided by conveyors shall be a municipal policy, subject to the requirement that the level of service (primary capacity) shall at times be adequate for the proper performance of affected ponds and other storage areas.

2. Consistent with state and federal regulations, the District requires that the level of protection (secondary capacity) along all conveyors, streams, and channels and around all wetlands, ponds, detention basins, and lakes be based on the critical duration 100-year (regional) flood.

3. Land use adjacent to floodplains shall be regulated in accordance with state floodplain zoning regulations (including freeboard surcharge).

4. Peak stormwater discharge from any single watershed or group of subwatersheds tributary to a conveyor, wetland, pond, detention basin, or lake shall be limited to the discharges shown in this management plan or–if not shown in this plan–to an amount approved by the District.

5. In areas where stormwater conveyance systems are not fully developed, the normal and flood levels reported in the plan are generally intended to guide detailed design; these levels may be modified as long as adequate volume can be provided, discharge requirements can be met, an adequate level of protection results, and water quality management standards can be met (i.e., as long as the intent of this plan is unchanged).

Water Quality.

1. To maintain and improve water quality within its boundaries, the District will require all parties to implement the water quality management practices discussed in the Water Quality Framework Plan.

2. The District will exercise review and permitting authority over all developments and improvements constructed in the directly tributary subwatersheds of resources in water quality Group I or in cases where the water quality classification has not been determined, where the District determines that the classification should be upgraded, or where the classification is disputed by adjacent municipalities.

3. The District will exercise review and permitting authority over all development and improvements constructed in the directly tributary subwatersheds of resources in water quality Group II.

4. The District will rely upon municipal water quality management plans, as approved by the District, to implement water quality management practices for resources in water quality Group III.

5. To provide a uniform water quality data base throughout the District, the District will establish and define standards, specifications, and criteria for collecting and analyzing water quality samples; all water quality monitoring programs within the District must comply with these minimum standards.

Soil Erosion and Sedimentation.

1. The District will require erosion and sediment control plans to be prepared and submitted for review and approval as part of the permitting processes for all construction projects (1) that disturb 1 acre or more of vegetated cover, or (2) that affect critical erosion areas (regardless of size).

2. The water resources management plan adopted by each municipality must include procedures for submitting, reviewing, approving, and enforcing erosion and sediment control plans as required by District standards.

3. Erosion control plans will implement the best management practices for the site conditions involved and shall consider erosion resulting from flowing water, wave action, and wind.

Groundwater. Water resources management plans adopted by each municipality will include land use development guidelines for groundwater recharge through infiltration of precipitation and for protection of groundwater quality through the control of land use and development.

Unique Features and Aesthetics. The District considers preservation of unique features and aesthetics to be a necessary part of development, redevelopment, or improvements proposed within the District. Further, the District will require that municipal water resource management plans identify and include guidelines for preserving unique features and aesthetics.

Fish and Wildlife

Preserving and enhancing fish and wildlife habitat in the urban environment are desirable goals as the intensity of land use increases. The District shall require that municipal water resources management plans include guidelines for enhancing habitat through open space and water resources planning.

District Criteria

The District has adopted the following minimum criteria to ensure that projects and activities conform to the District's standards for water resources management. In general, the criteria are not intended to dictate or pre-empt the design process; rather, they are intended as minimum requirements for obtaining District approvals. Each municipal water resources management plan will incorporate criteria consistent with these minimum requirements.

Stormwater Runoff.

1. A hydrograph method based on sound hydrologic theory will be used to analyze stormwater runoff for the design or analysis of flows in conveyors, streams, and channels and flows to ponds and wetlands.

2. Detention basins will be designed to handle runoff events with a 1 percent probability of occurring (100-year frequency event). If it is determined that retention of the 100-year frequency event is not practical, maximum retention volume shall be used.

3. Analysis of flood levels and storage volumes for detention basins will be based on the range of rainfall and snowmelt durations to identify the duration that produces the critical (highest) flood level.

4. Lateral conveyors will be designed to provide:

   a. Primary capacity for a short-duration rainfall (generally less than 1 hour) that is not less than a 2-year frequency rainfall and normally not greater than a 10-year frequency rainfall.

   b. Secondary capacity for at least a 100-year frequency rainfall.

5. Outflow conveyors will be designed to provide:

   a. Primary capacity for at least a 10-year frequency rainfall.

   b. Secondary capacity for the critical duration 100-year frequency rainfall or snowmelts.

6. The relationship between flood storage volume, flow capacity, and outflow conveyor size will be optimized to provide the best balance between volume and capacity based on site conditions, impacts on water quality, and impacts on downstream conveyors and detention basins.

Water Quality. The water quality criteria are listed below under the major categories of structures and methods used to maintain or improve water quality: on-site detention basins, erosion and sediment control, control of streambank erosion and streambed degradation, grit chambers, regional detention basins, and sediment collection and nutrient entrapment.

On-Site Detention Basins. Although the District's policy is to manage its water resources using the regional detention basin concept, sound management occasionally requires the use of on-site detention basins to meet stormwater runoff and water quality objectives. When on-site detention basins are required, these basins will:

1. Conform to the stormwater runoff criteria.

2. Have water quality features designed to handle a 2-year (50 percent probability) event. For convenience, the 2-year runoff event (volume and peak discharge) may be estimated–for the design of water quality features only–to be 0.7 times the 10-year frequency event or 0.8 times the 5-year frequency event.

3. Provide an average detention time of at least 4 hours for a runoff event with a 50 percent probability of occurrence (2-year frequency). Variances may be granted in accordance with District Rule I.

4. Have an outlet control structure that effectively prevents floating debris and oil from entering the downstream conveyor system.

Erosion and Sediment Control. On construction sites where grading disturbs more than 1 acre, the construction plans will:

1. Provide specific measures to control erosion based on the grade and length of the slopes on the site.

    a. Silt fences along the toe of slopes that have a grade of less than 3 percent and are less than 400 feet long from top to toe shall be supported by sturdy metal or wooden posts at intervals of 4 feet or less.

    b. Flow lengths up-slope from each silt fence shall not exceed 400 feet for slopes that have a grade of less than 3 percent and are more than 400 feet long from top to toe.

    c. Silt fences along the toe of slopes that have a grade of 3 to 10 percent and are less than 200 feet long from top to toe shall be supported by sturdy metal or wooden posts at intervals of 4 feet or less.

    d. Flow lengths up-slope from each silt fence shall not exceed 200 feet for slopes that have a grade of 3 to 10 percent and are more than 200 feet long from top to toe.

    e. Diversion channels or dikes and pipes shall be provided to intercept all drainage at the top of slopes that have a grade of more than 10 percent and are less than 100 feet long from top to toe. Silt fencing along the toe of said slopes shall be supported by sturdy metal or wooden posts at intervals of 4 feet or less.

f. Diversion channels or dikes and pipes shall be provided to intercept all drainage at the top of slopes that have grades of more than 10 percent and are more than 100 feet long from top to toe. Also, diversion channels or diked terraces and pipes shall be provided across said slopes if needed to ensure that the maximum flow length does not exceed 100 feet. Silt fencing along the toe of said slopes shall be supported by sturdy metal or wooden posts at intervals of 4 feet or less.

2. Require that silt fences be supplemented and supported with hay bales staked with at least two sturdy metal or wooden posts per bail in all areas where minor runoff (less than 1 cfs) may be concentrated.

3. Route flows from diversion channels or pipes to sedimentation basins or appropriate energy dissipaters to prevent transport of sediment to outflow or lateral conveyors and to prevent erosion and sedimentation when runoff flows into the conveyors.

4. Provide that site access roads be graded or otherwise protected with silt fences, diversion channels, or dikes and pipes to prevent sediment from exiting the site via the access roads. Primary site access roads shall be surfaced with crushed rock for 50 feet where they adjoin existing paved roadways.

5. Require that soils tracked from the site by motor vehicles be cleaned from paved roadway surfaces throughout the duration of construction.

6. Assure that silt fences and diversion channels or dikes and pipes will be used and maintained for the duration of site construction. If construction operations interfere with these control measures, the silt fences, diversion channels, or dikes and pipes may be removed or altered as needed but shall be restored to serve their intended function at the end of each day.

7. Specify that disturbed areas be revegetated or mulched permanently or temporarily if it can be reasonably anticipated that significant additional grading will not occur within 30 calendar days. A schedule of significant grading work will be required as part of the erosion and sedimentation control plan.

8. Require that temporary or permanent mulch be disc-anchored and applied at a uniform rate or not less than 2 tons per acre.

9. Provide a temporary vegetative cover consisting of a suitable, fast-growing, dense grass-seed mix spread at 1.5 times the usual rate per acre. If temporary cover is to remain in place beyond the present growing season, two-thirds of the seed mix shall be composed of perennial grasses.

10. Specify a permanent vegetative cover consisting of sod or a suitable grass-seed mixture or a combination thereof. Seeded areas shall be either mulched or covered by fibrous blankets to protect seeds and limit erosion.

11. Provide temporary on-site sedimentation basins that conform to the criteria for on-site detention basins whenever other erosion and sedimentation control practices are inadequate.

12. Employ soil conservation practices that limit soil loss–after development–to not more than 0.5 tons/acre/year based on the universal soil loss equation.

Control of Streambank Erosion and Streambed Degradation. Streambank erosion and streambed degradation control measures will:

1. Be employed whenever the net sediment transport for a reach of stream is greater than zero or whenever the stream's natural tendency to form meanders directly threatens to damage structures, utilities, or natural amenities in public areas.

2. Be discouraged–except for cases mentioned in item 1–whenever the streambank erosion control measures tend to restrict or interfere with a stream's natural tendency to form meanders by erosion and subsequent deposition.

3. Include effective energy dissipation devices or stilling basins to prevent streambank or channel erosion at all stormwater outfalls specifically.

   a. Outfalls with outlet velocities of less than 4 fps that project flows downstream into the channel in a direction at least 30 degrees from the normal generally shall not require energy dissipaters or stilling basins, but they may need some riprap protection.

   b. Energy dissipaters shall be sized to provide an average outlet velocity of no more than 6 fps, unless riprap is also used. In the latter case, the average outlet velocity may be increased to 8 fps.

   c. Riprap stilling basins shall not be used where outlet velocities exceed 8 fps.

4. Specify riprap consisting of natural angular stone suitably graded by weight for the anticipated velocities.

5. Provide riprap to an adequate depth below the channel grade and to a height above the outfall or channel bottom so as to ensure that the riprap will not be undermined by scour or rendered ineffective by displacement.

6. Specify that riprap be placed over a suitably graded filter material or filter fabric to ensure that soil particles do not migrate through the riprap and reduce its stability.

7. Require that streambank stabilization and streambed control structures be designed based on the unique site conditions present. District review of these structures will consider such factors as the need for the work, the adequacy of design, unique or special site conditions, energy dissipation, the potential for adverse effects, contributing factors, preservation of natural processes, and aesthetics.

Grit Chambers. Grit chambers for pre-settlement of stormwater will:

1. Be defined as environmental catchbasins or equivalent structure with a 3-foot sump to collect grit.

2. Provide convenient access for equipment and maintenance personnel to the chamber site and into the chamber itself and be cleaned at least three times a year (spring, summer, and fall).

Regional Detention Basins. Regional detention basins will:

1. Conform to stormwater runoff criteria or an approved City stormwater plan.

2. Have water quality features designed based on a 5-year (20 percent probability) event. For convenience, the 5-year runoff event (volume and peak discharge) may be estimated–for the design of water quality features only–to the 0.85 times the 10-year frequency event.

3. Provide an average detention time of at least 4 hours for a runoff event with a 20 percent probability of occurrence (5-year return period). Variances may be granted in accordance with District Rule I.

4. Include an outlet control structure that effectively prevents floating debris and oil from entering the downstream conveyor system.

5. Where appropriate outlet structures will be designed and constructed to provide effective barriers to fish migration.

Sediment Collection and Nutrient Entrapment. Wetlands used for sediment collection and nutrient entrapment will conform to the criteria for on-site or regional detention basins (whichever are appropriate).

CITY OF PRIOR LAKE

The city of Prior Lake has programs for street sweeping, construction erosion control, septic systems, and the Wetlands Conservation Act. In addition, the City recently past a Shorelands District ordinance, and is in the process on developing a City-wide water quality management plan.

Street sweeping is based on an informal schedule with an emphasis on spring. Depending on snow and rainfall conditions, the City sweeps twice each spring and once in the fall. The City owns a street sweeper.

The construction erosion control program requires site inspections. Grading inspections are completed by the engineering department while new home inspections are completed by the inspections department. In lake areas, erosion control measures must be in place in order to receive footing inspections. Additionally, the City has the authority to issue stop work orders for violations of construction erosion control.

There are 120 on-site sewage treatment systems within the City. Nine of these systems serve commercial establishments. The City population served by on-site systems is 311 people. Thus, a majority of the City is served by sanitary sewer. Inspections are completed for complaints and new systems.

SCOTT COUNTY

Scott County has programs for street sweeping, construction erosion control, and septic systems. Street sweeping consists of sweeping sanded intersections during the spring. The County has recently started a construction erosion control program for home sites greater than 2.5 acres in addition to the on-going program for plats and subdivisions. The program includes both plan review and inspection. Inspections are completed by County building inspectors for home sites and by township engineers for plats and subdivisions.

The septic system maintenance program includes site inspections, licensing of septage pumpers, and the tracking of pumping frequency. New systems are inspected at the time of permit issuance and during construction for a total of two to three inspections. Pumping records from licensed pumpers are tracked to determine possible failing systems. If a particular system is pumping three or more times in a year, the County sends a letter to the homeowner stating that the system may be failing.

SCOTT COUNTY SWCD

On July 25, 1941, under the Minnesota Soil and Water Conservation District Law, the Scott Soil and Water Conservation District was organized. All lands within the boundaries of Scott County are in the District, including all cities and townships.

Governed by an elected group of five supervisors, SWCDs operate from annual and comprehensive work plans indicating local conservation priorities, resource treatment needs, and construction schedules. The District is authorized to conduct survey and demonstration projects, public information activities, and to implement any necessary practices within its boundaries.

Programs Administered by SWCDs

Local SWCD Programs. The SWCD earns money to support other District programs by:

- Selling trees for conservation projects
- Charging for services such as identifying and staking wetlands
- Renting out a tree planter and mulch anchoring disk
- Selling conservation construction material such as mulch netting and staples
- Signing grant agreements with other units of government such as the U.S. Fish and Wildlife Service and DNR

BWSR Programs. These programs have been established by the state to assist the District in protecting their community's soil and water resources. Because these programs were developed in response to the needs expressed through SWCDs, many of them fit in well with the resource needs of the District. It is important to note that the

District evaluates its resource needs through annual planning meetings with citizen and unit of government input.

General Services Grant. BWSR annually allocates funds to the SWCD for expenditures necessary to the operation of the District.

Erosion, Sediment Control, and Water Quality Cost-Share Program. SWCDs receive an annual allocation from BWSR to provide up to 75 percent cost-sharing to landowners for installation of soil and water conservation practices.

Special Project Programs. SWCDs can apply to the BWSR for special project funds to cost-share on demonstration projects, innovative projects, long-term agreements, and nonstructural erosion control practices.

Streambank, Lakeshore, and Roadside (SLR) Erosion Program. The SLR Program provides grants to local units of government for control of erosion along streambanks, lakeshores, and roadsides. Local units apply for project funds through the SWCD.

Reinvest in Minnesota Reserve (RIM Program). A land retirement program that pays landowners to retire marginal agricultural land. It includes wetland restoration, riparian lands, and sensitive groundwater area payment provisions, among others. The land must be retired under 20-year or permanent easements. The program is administered locally by the SWCDs.

Local Water Resources Protection and Management Program (LWRPMP). Counties apply to the BWSR for base grants and competitive challenge grants for implementation of local water plan initiatives. The SWCD is involved in plan development and implementation.

Wetland Programs. During the 1991 legislative session, three new wetland options were approved in law; the option of 1) enrolling land into a permanent wetland preserve; 2) enrolling land as a wetland preservation area; or 3) enrolling land in the Wetland establishment and Restoration Program. The SWCD administers this program locally and is currently taking applications for the permanent wetland preserves option.

Special Programs.

Rural Rainfall Monitoring. This program is a cooperative effort between the BWSR, SWCDs, and the State Climatology Office to monitor precipitation in a statewide network. Individual observers spaced at 12-mile intervals report monthly precipitation totals to the local SWCD, which forwards the information to the state climatologist. The SWCD has eight monitors in Scott County.

Observation Well Program. The DNR provides funds to the SWCD to monitor water levels in selected wells. The objective is to increase the quantity of groundwater data throughout Minnesota. The SWCD monitors ten wells in Scott County.

Relationships with Units of Government, Organizations, and Agencies

SWCDs work with a wide variety of other organizations, including counties, watershed districts, watershed management organizations, state and federal agencies, and local sportsmen clubs. It is important that these partnerships are continued in order for the smooth and efficient operation of the environmental programs in the SWCD.

Programs.

Federal. Federal programs include the Soil Conservation Service (SCS), Agricultural; Conservation and Stabilization Service (ASCS); U.S. Fish and Wildlife Service (USFWS). These programs provide 1) technical assistance to the SCS on the implementation of the 1990 Federal Farm Bill. This includes preparing conservation compliance plans, Swampbuster and Sodbuster compliance determinations, and Conservation Reserve Program sign-ups and implementation; 2) provide technical assistance to the ASCS Office on Agricultural Conservation Program sign-ups; 3) provide technical assistance to the USFWS on survey, design, and construction supervision on USFWS-funded projects and contact landowners on wetland restoration projects.

State. These programs include the Department of Natural Resources (DNR); Metropolitan Council (MC); Minnesota Pollution Control Agency (MPCA); and the Board of Water and Soil Resources (BWSR). These programs 1) provide assistance to the DNR on water appropriation permits, well monitoring, rainfall monitoring, and wildlife management; 2) assist BWSR with the administration of Reinvest in Minnesota

Program, Permanent Wetland Preserve Program, State Cost-Share Program, and Conservation Tillage Demonstration Program; 3) assist MPCA with evaluation of feedlots for pollution potential; and 4) assist MC by providing membership on the Lower Minnesota Technical Advisory Group, provide land use information on Scott County watersheds, review Environmental Assessment Worksheets and Department of Housing and Urban Development applications for environmental concerns.

County. Although SWCDs are independent local units of government as established by M.S. 103C, they have very close ties to county government. Since SWCDs doe not have taxing authority, they must rely on county government to supplement their operating expenses. SWCDs must submit an annual budget to the county board. Most county boards treat their SWCD like other county departments and fund it on a relative scale with other county departments. Recently, the SWCD budget has been included with Scott County Planning Office budget.

The SWCD is insured for errors and omissions under the county policy. The county attorney acts as the attorney for the SWCD. When questions arise with legal implications, the SWCD consults with the county attorney.

From a planning standpoint and a resource protection standpoint, it makes sense that SWCDs and counties work closely toward common goals. By using the county's taxing authority and ordinance functions, the SWCD is able to accomplish some things it would be unable to do alone such as 1) assist with the review of erosion and sediment control plans for development activities; 2) provide technical assistance for the preparation of the County Groundwater Plan, and County Shoreland Management Ordinance; 3) provide soils information to applicants of the Ag Preserve Program; 4) review sites where application of sewage sludge is proposed; and 5) complete site investigations for variance requests where steep slopes, wetlands, and protected waterbodies are involved.

Local. These programs include Water Management Organizations (WMO), Townships, Fish Lake Sportsmen Club (FLSC), Scott County Pheasants Forever (PF), Cities, County Extension Service (CES). These programs 1) provide technical assistance to townships by reviewing developments, road projects, and mining operations and providing comments for erosion control; 2) assist townships and cities with the administration of the Wetland Conservation Act of 1991, serve on Technical Evaluation Panels as required by the Act, and identify and delineate wetlands on sites proposed for development; 3) administer cost-share funds from the local sportsmen clubs for wildlife habitat projects; 4) act as an advisory member on all WMOs in Scott County; 5) assist Pheasants Forever with the distribution of seed for food plots, grass, and tree plantings; and 6) distribute a joint newsletter with the CES office and provide information on conservation tillage, fertilizer, and pesticide management.

Educational Activities

The Scott SWCD has a comprehensive education program. Activities include 1) radio program on conservation activities; 2) annual Outdoor Education Day for all sixth grade students in the county; 3) select a Scott County "Conservation Cooperator" annually; 4) hold a conservation essay and poster contest each year; 5) provide a booth at the Scott County Fair on SWCD programs; 6) promote "Soil Stewardship Week" and "Arbor Day"' and 7) make presentations on soil conservation and water quality resource concerns.

Legal Obligations of the SWCD

Minnesota Statutes Chapter 103C is the enabling legislation for the formation of SWCDs. M.S. 103C.101 Subd. 10 of this chapter identifies SWCDs as governmental subdivisions, which means SWCDs are subject to the state laws that apply to all units of local government.

To assist SWCDs in dealing with legal matters, M.S. 103C.321 Subd. 4 indicates that "The county attorney of the county where the major portion of the district is located or one otherwise employed by the board shall be the attorney for the district and its supervisors."

All activities of an SWCD are governed by state or federal laws and sometimes both. These activities range from the way employees and supervisors conduct themselves on the job to how the district spends its funds.

SECTION 3

PROJECT GOALS

This section summarizes the discussion of water quality goals in Section 5 of the Diagnostic Study. The reiteration of the water quality goals is intended as a reference point for the following sections.

The primary qualitative water quality goals for area lakes are improvement of aesthetic quality, reduction of nuisance/toxic blue-green algal blooms, and improvement of fishing. In order to meet these goals, phosphorus loading must be reduced. Phosphorus concentration goals were established based on the qualitative goals and desired uses of the lakes. Phosphorus concentration goals are 70 µg/l, 55 µg/l, and 40 µg/l for Spring, Upper Prior, and Lower Prior Lakes. The necessary phosphorus load reductions to meet the in-lake concentrations are 3,480 lbs/year, 1,290 lbs/year, and 1,021 lbs/year for Spring, Upper Prior, and Lower Prior Lakes, respectively. Section 4 evaluates remedial alternatives for meeting these goals.

SECTION 4

EVALUATION OF ALTERNATIVES

In this section, remedial alternatives are evaluated for improving the water quality of Spring, Upper Prior, and Lower Prior Lakes. Each alternative is described, evaluated as to its water quality benefit, technical feasibility and if appropriate, cost estimates for implementation and maintenance are provided.

Narrative descriptions for each alternative are provided in this section. A more detailed description and conceptual design will be provided in Section 5 for those alternatives which will be incorporated into the final Implementation Plan.

Alternatives focus on problems identified in the Diagnostic Study. Problems identified include internal total phosphorus (TP) loading in Spring Lake, high TP and soluble reactive phosphorus (SRP) loadings from County Ditch 13 and Buck Lake subwatersheds, TP and SRP loadings from Spring Lake to Upper Prior Lake and subsequently to Lower Prior Lake, and low winter dissolved oxygen (DO) conditions in Upper Prior Lake.

Primary productivity in Spring Lake was limited by nitrogen rather than phosphorus in the early 1980s. Limitation of primary productivity by nitrogen was due to the fact that phosphorus concentrations were so elevated that nitrogen became limiting, rather than limitation from low nitrogen availability. From a management perspective the reduction of phosphorus is still the primary goal. First, phosphorus concentrations can be reduced below the point where phosphorus again becomes the primary limiting nutrient. Secondly, the feasibility of reducing phosphorus is better than the feasibility of reducing nitrogen. Finally most of the TP loading to Upper Prior Lake comes from Spring Lake, and Upper Prior Lake is clearly phosphorus limited. By reducing phosphorus concentrations in Spring Lake much of the Upper Prior Lake goal will be met.

POTENTIAL REMEDIAL ALTERNATIVES

Potential remedial alternatives are categorized as administrative management practices, non-structural management practices, and structural management practices. The last category includes alternatives for correcting specific problems and improving the existing drainage system. The benefit of some alternatives may be affected by other alternatives. However, the estimate of benefit is calculated for each alternative independently. For those alternatives selected for implementation, these interrelationships will be addressed to estimate the overall impact of the Implementation Plan. For this reason, the impact of the plan will be more or less the combination of its elements.

Remedial alternatives selected for consideration are as follows:

Administrative Management Practices:
- Water Quality Pond Design Standards
- Fertilizer management
- Yard waste management
- Septic system maintenance
- Ensuring maintenance of stormwater facilities

Non-Structural Management Practices:
- Agricultural BMPs
- Street Sweeping
- Chemical Algae Control
- Sediment Sealing
- Aquascaping
- Stream Buffers

Structural Management Practices:
- Water Quality Basins
- Wetland Restoration
- Chemical Treatment
- Lake Aeration

ADMINISTRATIVE MANAGEMENT PRACTICES

It is generally recognized that the most economical means of controlling surface water degradation is to prevent contamination at the source rather than treat runoff following contamination. Administrative management practices and protection efforts are excellent means of preventing pollution at the source. Protection efforts are particularly important for the PL/SL WD where rapid urbanization is taking place. The District and other local agencies have implemented numerous regulations for wise development such as runoff rate control and wet pond design criteria. The following investigates ways to improve these efforts.

Water Quality Pond Design Standards

Water Quality Benefit. The District's water quality ponding standards for new development could be strengthened by the adoption of different performance based construction guidelines. The District's current standards are a composite of standards from different sources. The standards utilized by the District are largely based on recommendations made by the Metropolitan Council only a few years ago. These ponds generally have 50% phosphorus removal efficiencies. Removal efficiencies for constructed basins in the District could be improved to about 70% by adopting the design/construction standards recommended by Walker, 1987. Standards recommended by Walker are:

- A permanent pool ("dead storage") volume below the principal spillway (normal outlet) which is greater than or equal to the runoff from a 2.5-inch, critical duration storm over the entire contributing drainage area, assuming full development.

- A permanent pool average depth (basin volume/basin area) which is ≥ 4 feet, with a maximum depth of ≤ 10 feet.

- An emergency spillway (emergency outlet) adequate to control the 1% frequency/critical duration rainfall event.

- Basin side slopes above the normal water level that are no steeper than 3:1, and preferably flatter. A basin shelf with a minimum width of 10 feet and 1 foot deep below the normal water level is recommended to enhance wildlife habitat, reduce potential safety hazards, and improve access for long-term maintenance.

- To prevent short-circuiting, the distance between major inlets and the normal outlet should be maximized.

- The flood pool ("live storage") volume above the principal spillway should be adequate so that the peak discharge rates from the 2-year and 100-year frequency critical duration storms are no greater than predevelopment basin watershed conditions.

- Retarding peak discharges for the more frequent storms can be achieved through a principal spillway design which may include a perforated vertical riser, small orifice retention outlet, or compound weir.

Technical Feasibility. The technical feasibility for changing design standards is good. The change can be made by revising the 509 Plan. Revising construction standards have a greater technical feasibility than adopting new performance standards. Construction standards specify the calculation methods and water quality pond requirements that meet know performance standards. This simplifies the review process for both the developer and the reviewer. The District currently utilizes this approach for water quality pond design requirements. These requirements could be changed to incorporate the new standards.

Estimated Costs. Since the District already enforces water quality pond design criteria the costs of incorporating new criteria would be minor.

Fertilizer Management

Single family residential areas, city parks, and cropland are areas which can be critical to a lake's non-point nutrient loading. Reduction of high phosphorus fertilizers used in those areas may be beneficial. This alternative would include gaining the commitment of local cities to use no fertilizers on City-owned properties unless soil tests indicate the need for nutrients. A public education program aimed at local residents would also be initiated to provide information on proper fertilizer management, emphasizing the use of non-phosphorus fertilizers unless soil tests indicate phosphorus is needed. The Scott County Extension Service could also supply information or hold workshops regarding fertilizer use and lawn care from an environmental perspective. Guidance and funding for soil testing would also be provided. Funding would be supplied only for soil testing completed at the University of Minnesota laboratory. Soil testing can also be promoted for agricultural areas. Additionally, manure testing and proper application can be promoted.

Another means of promoting fertilizer management on agricultural lands is by hiring a farm consultant to assist local farmers with integrated fertilizer and pest management. This professional would be available to farmers in the watershed free of charge. Scott County Extension personnel could also be utilized to develop nutrient management plans. These professionals inspect the farmland, review soil tests, and make recommendations to the farmer regarding volumes of fertilizer needed. Generally their investigation and recommendations take the guess work out of fertilizer management. In addition, this type of management generally reduces the amounts of fertilizer applied. This benefits the environment and saves the farmer money.

Proper fertilizer management on agricultural lands can also be promoted through education, demonstration projects, and funding soil and manure tests. The extension service or local SWCD can provide interpretation of soil and manure test results.

Reducing the availability of fertilizer to wash off with runoff from agricultural lands can be accomplished by using equipment which applies (or bands) the fertilizer deep within the soil. This reduces the availability of nutrients, particularly phosphorus, to wash away with surface runoff. Additionally, since a large portion of the fertilizer remains in the field, this practice can also increase crop yields. One suggested means of promoting this practice is by making the necessary equipment available for trial use free of charge. This could be accomplished by purchasing one or two deep banders and having them available locally.

Water Quality Benefits. Benefits of good fertilizer management are difficult to measure in the urban environment. Very few studies have been conducted which quantify the reductions in loadings due to this technique. Larson and Anhorn (1990) found very little difference in stormwater runoff quality comparing areas with and without fertilizer ordinances. However, the benefits in reducing fertilizer costs are clear. Although difficult to quantify, the incorporation of residential fertilizer management does provide a defined action taken by individual residents to protect water quality. Therefore, from the standpoint of a public participation/education action alone, this alternative may offer benefits.

Fertilizer management on agricultural land is an effective means of reducing nutrient losses. Using proper rates, placement, and timing of fertilizer applications can reduce nitrogen and phosphorus losses from cropland by 50 to 90% (MPCA, 1989). It is estimated that one fertilizer bander can cover up to 1,500 acres per year. Mulcahy (1990) recommends middle range phosphorus export rates of 0.36 to 0.45 lbs/ac/year for agricultural land in the Twin Cities area. Osgood (1983) showed an areal TP loading rate of 0.38 lbs/ac/year for streams draining to Spring Lake. Banding in combination with other aspects of fertilizer management at a 50% reduction can reduce phosphorus losses by 285 lbs/year, or 0.19 lbs/ac/year. However, the primary reason for making a bander available (if selected) is for education and trial use, not to supply farmers with equipment.

Technical Feasibility. Other area cities have implemented licensing of commercial fertilizer applicators in order to control phosphorus. The feasibility of reducing the use of high phosphorus fertilizers by individual urban homeowners will, however, be a direct result of an effective public information effort. Compliance monitoring is quite difficult. Cooperation and commitment of local residents will be important. Therefore, the best means of promoting fertilizer management in the urban environment is through education programs.

The success of fertilizer management with a consultant or extension on agricultural land will depend on the cost savings to the farmer. In the Spring Lake watershed where farms are relatively small this savings may not be substantial. Thus, hiring a farm consultant for the project is not recommended. Utilization of extension personnel has good technical feasibility. An important part of any program to promote fertilizer management on cropland will be education. Local demonstrations prior to offering incentives will provide project exposure and demonstrate potential water quality benefits as well as cost savings from fertilizer management. Fertilizer management workshops are also an excellent means of promoting the project and educating the public.

Purchasing equipment to deep band fertilizer could both increase farm yields and reduce fertilizer mobility. The technical feasibility of this approach is fair. However, a local group will have to maintain and schedule the use of the equipment. Farm implement dealers have indicated that maintenance of this equipment can be substantial and that it can only be used during very dry conditions.

Estimated Costs. Both the urban and agricultural programs will be supported by an education program. The public education program which accompanies this element would include two workshops for urban fertilizer management, four workshops for agricultural nutrient management, urban and agricultural fact sheets, soil testing, and a fertilizer management demonstration. Each workshop will require 60 hours of in-kind service from extension. At $20/hour plus 20% for materials the in-kind cost for each workshop is $1,440. Fact sheets will require 40 hours from extension. At $20/hour plus 20% for materials the in-kind cost for fact sheets is $960.

Soil tests at the University of Minnesota cost $7 each. The District could promote soil testing by offering to pay for soil tests for individuals and farmers in the watershed. The University of Minnesota has bags for collecting and submitting the samples. Individuals wishing to take advantage of the payment could drop their samples at the District office. The District would then forward the samples to the laboratory with the required payment. Results of the analysis will be sent to the home of the individual. These results will include fertilizer volume recommendations based on the existing nutrients found in the sample as well as crop needs.

Costs to the District for promoting soil testing include $7 per sample plus $2-3 dollars for postage and handling. At $10 a sample, $2,000 will support the analysis of approximately 200 soil samples. Efforts for postage and handling will be in-kind service. The final number of samples sponsored will be determined in the Implementation Plan Section 5. Priority will be given to those who participate in the education programs. Manure testing could be promoted with a similar effort and local extension offices could provide interpretation of results. The cost for manure tests is $20. The small number of significant feedlot producers remaining in the watershed makes it feasible to approach the individual producers to promote nutrient management.

The Clearwater River Watershed District non-point program offered $10/acre for farmers participating in fertilizer management demonstration projects. However, to insure participation, $20/acre is suggested for a demonstration. In the CD 13 and Buck Lake subwatersheds at least one demonstration should be completed prior to offering incentives throughout the subwatersheds. Assuming that a minimum, 20-acre plots with a 20-acre control is needed, the payment for a demonstration project is $800/year. Incentives at $10/acre could be utilized in the years following the demonstration projects. Additional effort would be necessary for administering the demonstrations and incentives, and for extension to develop the management plans. These efforts are estimated as 40 hours per year for the demonstration project, and 0.2 hours per acre per year for the incentive program. At $20/hour this gives an in-kind service value of $800 for the demonstrations and $4/year for each acre in an incentive program. Effort will also be required for extension to develop press releases, papers, and a fact sheet regarding the results of the demonstration. This effort will require 60 hours. At $20/hour plus 20% for materials promoting the results of the demonstration will cost $1,440.

Costs for supplying a fertilizer bander include the initial capital cost for purchasing the equipment, costs to maintain the equipment, and labor to schedule and distribute the equipment. The cost for a new 12 row bander which can cover up to 150 acres/day is $25,000. Annual maintenance on this machine is estimated at $2,000. The effort for scheduling and distributing is estimated at 2 hours per event. The primary fertilizer application period would probably be limited to a six to eight week period which would therefore take 60 to 80 hours. At $35/hr the estimated cost is $2,100 to $2,800. At 150 acres per day, the equipment could be used on approximately 4,500 acres per year. However, the actual usage will probably be much less because the equipment cannot be used when the soil is wet. An estimate of 1,500 acres per year is more reasonable.

The total cost for the various elements of the fertilizer program are given in Table 4-1.

TABLE 4-1

SUMMARY OF ESTIMATED COSTS FOR FERTILIZER MANAGEMENT

Element	COST	
	Initial	Long-Term
Education		
Workshops	$1,440	$1,440
Fact Sheets	$960	--
Soil Testing	$10/sample	$10/sample
Soil Demonstrations	$3,040/demonstration	--
Incentives	$10.2/acre	$10.2/acre
Fertilizer Equipment	$29,800	$4,800

Yard Waste Management

Site surveys in this watershed indicated that yard wastes (leaves and grass clippings) were being deposited directly in the lake as well as detention basins and wetlands which drain to the lakes. Storm sewer outfall grates were commonly found clogged, especially with grass clippings. This activity certainly increases the nutrient loading to the lakes, creates a stormwater conveyance nuisance, and detracts from general aesthetics.

Over the past several years, solid waste management has become a very important topic in this area. Most residents recycle cans, paper, and glass and are very aware of efforts to reduce waste flows to area landfills. In addition, State law has banned yard waste from disposal in land fills or resource recovery facilities since January 1, 1990. It may be these conditions which prompt deposition of yard wastes in basins.

Several approaches can be utilized to encourage proper yard waste management. The first is to encourage management on-site through backyard composting and mulching. A wide variety of mulching lawn mowers are currently available. In addition, the Extension Service is currently providing education services on backyard composting and this program could be promoted through public education.

A second approach is to provide the public with a convenient alternate disposal site. There are also commercial yard waste haulers. However, additional deposition sites, possibly municipal or neighborhood compost sites may be appropriate. Given the recent interest in recycling, local residents may be receptive to this alternative.

Proper yard waste disposal can also be encouraged through signage. Signs can be posted, or stenciled on sidewalks to inform residents that debris deposited in basins and curbs flows directly into surface water bodies. This approach is currently being utilized by the City of Eagan.

Local ordinance restricting the deposition of yard wastes within basins may also be appropriate. Concurrent education and public information programs would have to be created to inform local residents of the appropriate deposition sites, the reasons for proper yard waste management, and the regulations which apply.

Water Quality Benefits. A major source of phosphorus in the urban environment is from leaves and grass clippings which are directly deposited on streets. A study of storm water runoff into Minneapolis lakes found that phosphorus levels were reduced by 30 to 40% when street gutters were kept free of yard debris (Shapiro and Pfannkuch, 1973). This large benefit could be realized for Upper and Lower Prior lakes since the direct drainage areas are largely composed of urban land uses. Assuming that 20% of residents participate in an organized effort to improve yard waste management, TP loadings to Upper and Lower Prior Lakes could be reduced by 110 to 144 lbs/year and 160 to 220 lbs/year, respectively.

Technical Feasibility. The success of a yard waste program, if pursued, would hinge largely on the effectiveness of the accompanying public information program. The feasibility of establishing a composting site is fair since a number of logistics are necessary for running an operation and because of the potential for disposal of trash other than yard waste at the site. Enforcement of local ordinances, possibly including fines, may improve implementation. However, enforcement in itself may be difficult to implement.

The technical feasibility for a successful education program is good. Education incorporating mulching mowers, on-site composting, signage, workshops, Adopt-A-Highway, and street sweeping offers a comprehensive means of approaching the public. The City of Robbinsdale is currently using the street sweeper operator to reduce disposal of debris in streets. When the operator sees a yard where debris has been deposited in the street, the operator skips the curb in front of the home and writes a note to the resident explaining why street cleaning was not performed. A similar effort could be initiated in Prior Lake.

Estimated Costs. Since new composting facilities are not recommended, costs associated with the creation of an organized yard waste management program will largely be for public education. The yard waste education effort will consist of two workshops, development of fact sheets, coordination of volunteers, identification of areas for signage, and coordination of street sweeping notices.

Two workshops will be scheduled for the project duration. Workshops will be sponsored by Scott County Extension. The level of effort required is 60 hours per workshop. At $20/hour plus 20% for supplies the in-kind cost of the two workshops is $2,880. Fact sheets will require 20 hours to develop. At $20/hour plus 20% for supplies fact sheets will cost $480. Coordination of volunteer groups will require 20 hours annually by the District administrator. At $20/hour plus 20% for materials this in-kind effort will cost $480/year. Coordination of signage and street sweeping efforts will require 32 hours during the first year and 10 hour/year for each additional year. At $20/hour plus 20% for materials this in-kind effort will cost $770 initially and $240 for each additional year. Table 4-2 summarizes the cost of the yard waste education program.

TABLE 4-2

**SUMMARY OF IN-KIND COSTS
FOR YARD WASTE EDUCATION**

Element	COST Initial	Long-Term	AGENCY
Workshops	$2,880	--	Extension
Fact Sheets	$480	--	Extension
Volunteer Coordination	$480	$480	PL/SL WD
Sweeping and Signage	$770	$240	Prior Lake
Total	$6,050	$2,160	

Septic System Maintenance

Failing individual sewage treatment systems can contribute pollutants to surface water bodies. Osgood's (1983) study showed that only 3% of the TP loading to Spring Lake came from septic systems. In addition, most of the homes around Upper and Lower Prior Lakes are connected to sanitary sewer. Scott County administers the shoreline and septic system regulations surrounding Spring Lake and has recently started a new project which tracks the frequency of pumping as a means of identifying system failure. Therefore, the effort for septic system maintenance is largely for education.

Water Quality Benefit. The primary benefit of a septic system maintenance education program will be failure prevention. While the number of systems which fail each year is small, most of these failures can be prevented with proper maintenance.

Technical Feasibility. The technical feasibility of an education program is good. In recent years the general public has become increasingly aware of environmental degradation. In addition, a number of innovative systems, such as low flush toilets and water saving shower heads, are now widely available for reducing the hydraulic loading to septic systems.

Estimated Costs. Costs for developing a septic system education program will consist of developing fact sheets and workshops. Two workshops will be scheduled for the project duration. Workshops will be sponsored by Scott County. The level of effort required is 60 hours per workshop. At $20/hour plus 20% for supplies, the in-kind cost of the two workshops is $2,880. Fact sheets will require 20 hours to develop. At $20/hour plus 20% for supplies fact sheets will cost $480. Total in-kind cost for the septic system education program is $3,360.

Ensuring Maintenance of Stormwater Facilities

Stormwater quality facilities require periodic maintenance in order to maintain operating efficiencies. These devices can fill with sediment and debris or the structural integrity can depreciate. Investigation of maintenance efforts in the District revealed that the responsibility for maintenance is not clear. This alternative would investigate options for insuring the continued maintenance of stormwater quality facilities. The first step will include an inventory of existing basins. The District has been requiring water quality basins since it's inception. The number of existing basins and their quality is unknown. The second step will consist of evaluating the condition of the basins. Additionally, the amount of sediment accumulation since basin construction will be estimated. This information will be utilized to identify existing maintenance needs, determine average maintenance costs, and reasonable escrow amounts for developers to cover future maintenance requirements.

Water Quality Benefits. The numerical water quality benefit of maintaining stormwater quality facilities is indeterminate without a detailed analysis. Clearly the decreasing efficiency of such devices will have detrimental effects on water quality, and contradicts the goal of maintaining existing water quality. Without maintenance, the benefit of installing the device in the first place will be eliminated.

Technical Feasibility. The mechanisms are currently in place for ensuring maintenance through the 509 Planning process. The District could make it clear through this process that escrow funds are required for future maintenance. As another approach, the District could require a maintenance plan for each new water quality pond.

Estimated Costs. District costs for clarifying maintenance responsibilities in the 509 Plan are minimal. The District Engineer in conjunction with the legal council can determine the necessary plan amendments. Other costs include advertising and holding a public hearing. However, this amendment could be "packaged" with other changes to reduce the number of hearings.

Costs for completing the inventory and analysis of existing conditions are shown in Table 4-3. These costs are not for maintenance activities, but for program development and are therefore grant eligible.

TABLE 4-3

ESTIMATED COSTS FOR WATER QUALITY BASIN INVENTORY

In-Kind Service		
PL/SL WD	20 hours at $20/hour	$400
Prior Lake	20 hours at $20/hour	$400
Task 1: Historic Permit Review		
Professional	2 hours at $74/hour	$148
Associate Professional	32 hours at $55/hour	1,760
Expenses		100
Task 2: Base Map		
Professional	2 hours at $74/hour	$74
Associate Professional	8 hours at $55/hour	440
Expenses		100
Task 3: Field Reconnaissance		
Professional	8 hours at $74/hour	$592
Associate Professional	16 hours at $55/hour	880
Assistant Professional	120 hours at $40/hour	4,800
Expenses		500
Task 4: Final Map		
Professional	2 hours at $74/hour	$148
Associate Professional	8 hours at $55/hour	440
Drafting	40 hours at $55/hour	2,200
Expenses		1,500
Task 5: Technical Memorandum		
Professional	4 hours at $74/hour	$296
Associate Professional	16 hours at $55/hour	880
Word Processing	6 hours at $50/hour	300
Expenses		150
Task 6: Project Management and Quality Control		
Professional	12 hours at $74/hour	$890
Associate Professional	4 hours at $60/hour	240
Administrator	12 hours at $55/hour	660
Total Cash		$17,098
Project Total (In-Kind and Cash)		$17,898

NON-STRUCTURAL MANAGEMENT PRACTICES

Agricultural BMPs

Approximately 6,000 acres of the County Ditch 13, Buck Lake, and Spring Lake Central watersheds are under agricultural production. These creeks contribute about 40% of the phosphorus to Spring Lake and have been designated as priority watersheds for the implementation plan (Map 2). Thus, agricultural management practices will be important for improving the water quality of Spring Lake.

Agricultural activities in the watershed include row crop production and hayland. The diagnostic study found that the number of feedlots has decreased significantly in the past 16 years. Additionally, much of these watersheds are composed of highly erodible soils. The 1990 Federal Farm Bill requires farmers receiving subsidies and utilizing highly erodible land to implement a farm conservation plan by 1995. Therefore, future agricultural impacts to the lakes from row crop production may be reduced without additional action. The ASCS also has 75% cost sharing available for conservation practices.

Portions of the watershed are owned by developers who are leasing the land for agricultural production until economics make development profitable. There is not much incentive for long-term stewardship on these lands. One means of increasing participation is to personally request developers who are leasing land for agriculture to include provisions for utilizing conservation practices in their leases.

Alternatives analyzed for the priority watersheds include fertilizer management (as discussed earlier) and conservation tillage. These efforts are expected to have the greatest impact on Spring Lake. Conservation tillage and fertilizer management are promoted because they may represent a cost savings to the farmer, and are therefore easier to promote.

Conservation Tillage

Conservation tillage is an effective management practice for reducing soil erosion and sediment-associated nutrients in runoff. A tillage system is classified as "conservation tillage" if it leaves 30% residue cover on the soil surface after planting.

Water Quality Benefits. The effectiveness of conservation tillage is dependent on the amount of residue left on the soil as well as the direction of the rows and contours. Erosion control is provided by the crop residues shielding the soil surface from raindrop impact. This increases infiltration and slows surface runoff.

Soil loss reduction from conservation tillage typically ranges from 60-98% (EPA, 1990). No-till practices have an even higher soil loss reduction of 80-98%. Additionally, typical phosphorus loss reductions are from 40-90% for conservation tillage and 50-95% for no-till. No effect has been found for nitrogen losses to streams and lakes. However, conservation tillage may increase the leaching of nitrates to groundwater (MPCA, 1989).

It is estimated that one no-till drill can plant 1,100 to 1,600 acres per year. Phosphorus export for row crops ranges from 0.36-0.45 lbs/ac/year (Mulcahy). The watershed export rate from this monitoring study was 0.38 lbs/ac/year. Therefore, 1,100 acres in no-till at a 50% reduction can reduce loading by 209 lbs TP/year, or 0.19 lbs/ac/year. This benefit is conservative because it is expected that once farmers try the equipment, private ownership and use will increase. The long term goal will be to educate farmers, increase private ownership, and private utilization of conservation equipment. To meet the phosphorus reduction goal of 3,460 lbs TP/year, approximately 18,200 acres would require conservation tillage (three times the agricultural land in the watershed). This demonstrates that the phosphorus reduction goals cannot be met by conservation tillage alone.

Technical Feasibility. The technical feasibility of conservation tillage is good. The equipment is widely available through distributors and conservation tillage has been shown to save time, fuel, and labor. The ASCS currently has a cost share program promoting no-till planting. An incentive of $15/acre is offered for no-till planting. Other forms of conservation tillage are not eligible. No-till planters are expensive and farmers generally have a large investment in their existing equipment. Thus, one means of promoting the use of conservation tillage is by making the equipment available for trial use.

A number of Soil and Water Conservation Districts across the state are currently making equipment available for use. In Nobles County, the SWCD has purchased two no-till drills and have had great success (Dan Livdahl, Nobles County SWCD, personal communication). In 1992, they planted 3,200 acres with this equipment and have seen an increase in the number of private operators purchasing their own equipment. To maximize utilization, they rented tractors. Due to the heavy weight of the drills, it was more effective to rent tractors and adjust them once, rather than adjusting each individual farmer's tractor.

Carver County SWCD recently completed the first year of a similar program and planted 1,100 acres with one drill. In Carver County, the SWCD did not supply an operator and tractor. Instead, they picked up and delivered the drill to the farm. By being responsible for pick up and delivery they prevented equipment down time. One person was kept busy half time during the planting period. It will also be necessary to have a vehicle and trailer available. At the public meeting operators in the District stated that this approach would be more effective than hiring an operator and renting a tractor.

Estimated Costs. Costs for promoting the use of the no-till equipment includes initial capital costs for purchasing the equipment, annual maintenance, trailer rental, vehicle use, and labor for scheduling and coordinating use of the equipment. No-till drills cost between $16,000 and $40,000, depending on the number of planting rows. Because of the small fields in the watershed it may be beneficial to purchase a smaller drill. Carver County purchase a 15 foot drill at $28,000. Estimated annual maintenance costs are $2,000. Over a 8 week planting period, labor is estimated at 160 hours. At $20 per hour, the estimated cost is $3,200 for labor. Trailer rental is estimated at $500/year. Vehicle use would be about 40 miles per day. At $0.28/mile the cost is $450 for the 8 week period. Total estimated costs are given in Table 4-4. All costs are cash costs. The SWCD would serve as the location for the temporary employee, and office responsible for coordination and scheduling equipment use.

TABLE 4-4

ESTIMATED COST FOR NO-TILL DRILL EQUIPMENT PROGRAM

Element	COST Initial	COST Long-Term
No-Till Drill	$28,000	$2,000
Labor	$3,200	$3,200
Trailer Rental	$500	$500
Vehicle	$450	$450

Some of these costs could be covered by a small users fee. Carver County charges $8/acre as does a local cooperative. Thus, a fee of $6/acre would both encourage use and cover the annual expenses. A $100 dollar deposit for use would also be beneficial.

Street Cleaning

Water Quality Benefits. The benefits of street sweeping are mixed. Although large particles are removed, the smaller particles which typically contain high levels of phosphorus remain. Some indications are that the removal of larger particles may make the smaller particles more mobile. According to Hack and Oberts (1983), the effectiveness of street sweeping on solids removal ranges from 0-80%, and for phosphorus removal, from 0-40%. In northern climates in areas directly tributary to a lake, regular street sweeping is more effective. Oberts (1982) predicts a 50% reduction in total suspended sediments (TSS) and 30% reduction in TP in the Minneapolis-St. Paul area through mechanical street sweeping.

The direct drainage surrounding Spring Lake is largely rural. However, areas around Upper and Lower Prior are largely urban and have curb and gutter. The City of Prior Lake already has a street sweeping program and owns a street sweeper. The City sweeps twice each spring and once in the fall. Due to the existing program and the uncertainty of benefits additional street sweeping is not considered cost effective and was not evaluated further.

Chemical Algae Control

Blooms of various kinds of algae cause nuisance problems in all aquatic habitats. The main nuisance problems associated with algal blooms involve the interference with recreation, undesirable conditions in public water supplies, toxic algal blooms, and the lowering of the lake's aesthetic value. Algae blooms are a significant problem on Spring and Upper Prior Lakes. These blooms detract from the lake's aesthetic value, are sometimes toxic, and have reduced recreational opportunities on the lake.

Management of these algal blooms with algacides may be considered. The most widely employed algacide is copper sulfate ($CuSO_4$) (EPA, 1988). In a dissolved form, copper is toxic to most types of algae.

Copper sulfate is applied to the lake surface at a concentration of about 1.0 mg/l in one of two different forms. One form of copper sulfate is in a liquid formulation which is sprayed over the surface of the lake, while the other is in a solid or granular formulation which is placed in burlap or nylon bags to dissolve as they are towed behind a boat. The former technique provides better control over actual application concentrations.

Water Quality Benefits. The most direct benefit of chemical algae control would be short-term control of the lake's algal population. This would increase the lake's aesthetic and recreational values. Experience has shown that most lakes require multiple applications each summer for acceptable control.

Technical Feasibility. Assuming proper concentrations of copper are attained, this technique is generally quite successful in eradicating algae from a lake by inhibiting algal photosynthesis and altering nitrogen metabolism.

The use of copper sulfate, as mentioned earlier, has short-lived results in many areas. Regrowth of algae is often reported within two to three weeks after application of the copper sulfate so additional applications are often needed. This is especially true in lakes like Spring and Upper Prior Lake with relatively short hydrologic residence times. In addition, copper sulfate has some undesirable effects on fish inhabiting the lake. Copper is very toxic to many fish species found in Minnesota.

Estimated Costs. The costs for copper sulfate application are quite variable; however, a general range of $200-$500 per acre is estimated. Applying this factor to the entire surface of Spring Lake would result in an estimated total cost of about $126,000-$315,000 per application.

Sediment Sealing in the Lake

Results of the Diagnostic Study indicate that phosphorus, particularly soluble reactive phosphorus, is released from the anoxic hypolimnion of Spring Lake during intermittent summer stratification. As oxygen concentrations approach zero at the sediment-water interface, chemical conditions change and phosphorus is released into the hypolimnion. When the lake "turns over" (mixes), this phosphorus is mixed with surficial water and is available for uptake by phytoplankton.

Chemical treatment options are available to limit this release of phosphorus. Compounds such as aluminum sulfate (alum), calcium carbonate (lime), ferric salt (iron), and bentonite have been successfully used to reduce phosphorus cycling in lakes. After introduction into the water column, these chemicals precipitate. As they settle phosphorus binds to particles and is removed to the sediments. The settling particles, or floc, develop a barrier at the sediment/water interface which impedes the future release of phosphorus. Documented effectiveness of in-lake treatments with alum are from 5 to 15 years.

To be optimally effective, chemical treatment must be accompanied by a reduction of external phosphorus loading to the lake. If loadings are not reduced, the effects of the chemical addition may be lost within a few years and the lake will return to the pre-treatment condition.

Water Quality Benefits. In general, chemical treatment can have two major effects on a lake. In the short-term, these chemicals can effectively remove phosphorus and particulates from the water. This will increase the water clarity and improve the aesthetics of the lake. These additions can also have the extended effect of preventing phosphorus release from sediment. Sediment sealing is important to use in conjunction with reducing nutrient loading to the lake. Sediment sealing reduces the effects of historical phosphorus loadings.

Preliminary results from an application of spent lime to Sucker Lake indicates that a 1-inch barrier of spent lime can eliminate phosphorus release during anoxic conditions (Schuler, 1991). The same results were found utilizing sediments from Sucker Lake in microcosm laboratory experiments. Control of phosphorus sediment release will have significant water benefits on Spring Lake where 33% of the phosphorus loading is estimated as internal. However, due to the short hydraulic residence time and large external load, a comprehensive plan to reduce both external and internal sources is essential for Spring Lake. In addition, the short hydraulic residence time of Spring Lake may limit the effective life span of the treatment by depositing a new layer of phosphorus rich sediment on top of the seal.

Internal loading is 2,860 lbs/year TP for Spring Lake. Sediment sealing benefits range from 75 to 85% control. This gives a TP reduction of 2,145 to 2,430 lbs/year. An additional benefit is that most of this reduction would be SRP.

Technical Feasibility. Laboratory studies have shown that alum, which has been used on numerous lake quality projects in Minnesota, is very effective in reducing phosphorus levels in the water column and in retarding sediment release of phosphorus under anoxic conditions (Cooke and Kennedy, 1988). Redox conditions do not affect phosphorus sorption by aluminum and retardation has been noted for over one year. Calcium carbonate also is not affected by redox conditions. The flocculant layers, however, may be susceptible to scouring and resuspension. Spent lime is largely a chemical barrier. Thus, scouring and resuspension are not considered significant problems.

There are two concerns regarding alum treatment. First, alum treatment causes a drop in pH which can have an adverse effect on aquatic organisms. Second, aluminum, a major component of alum, can be harmful at high concentrations to some organisms. Thus, bench tests would be necessary to determine the optimum treatment doses prior to utilization in the lake.

Similar treatment results can be expected with lime treatment, although in-lake phosphorus removal is not as good as alum treatment. However, lime has added benefits to alum. Lime addition will increase the buffering capacity of the lake. In fact, lime is often used to treat lakes which have become acidified due to acid rain. In addition, lime has no toxic effects, and may improve the lake environment by adding calcium.

Iron is an effective treatment alternative, particularly in lakes that are iron deficient and well oxygenated. In Spring Lake, anoxic conditions in the deeper waters may cause the sediment seal created by the precipitating iron to break down and become ineffective. However, Walker (1992) found that ferric chloride addition to Lambert Creek reduced peak phosphorus concentrations in Pleasant Lake from 190-220 µg/l to 100-140 µg/l. Pleasant Lake experiences seasonal DO depletion in the hypolimnion and aeration was not used.

Bentonite has a lower sorptive capacity for phosphorus than does alum and relatively low and poor settling characteristics may require additional processing to make treatment feasible. Thus, the use of bentonite was not evaluated further.

Application of the sealant by boat has historically been used for bottom sealing in order to maintain good control over aerial coverage and dosage. A manifold can be attached to the distribution system so that the chemical can be introduced in the deeper waters. This will limit drifting of the chemical and allow for more uniform application.

Spring Lake is relatively large, with a surface area of 631 acres. This may affect the feasibility of chemical treatment by increasing the amount of time required to treat the entire lake. For example, assuming a boat speed of about 2 miles per hour (mph) for alum and 0.5 mph for lime, and a treatment distribution system covering a width of 10 feet, it would take approximately 0.5 hours for alum and 2.0 hours for lime to treat one acre of water surface. One additional hour can be added because the chemical tank on-board will require periodic refilling. Therefore, the total time required to treat 630 acres is approximately 120-200 eight-hour days for alum and lime, respectively. This is obviously an unrealistic task. Assuming that treatment would be completed within a 30-day period, a total of three to eight boats would be required. The availability of this equipment is unlikely.

A viable option to reduce the cost of chemical treatment is to only treat the deeper portions of Spring Lake that exhibit intermittent summer stratification and anoxic conditions. This area is estimated at approximately 450 acres.

The required dose of alum or lime is dependent on the pH and buffering capacity of the lake. Field tests are required to identify maximum dosages that will not adversely affect the lake. Literature values for chemical treatment are about 2.5 tons of alum per acre

(EPA, 1988), and 20 tons of calcium carbonate (lime) per acre (personal communication, Dave Schuler, St. Paul Water Utility).

Estimated Costs. The discussion of the feasibility of sediment sealing on Spring Lake identified several options for evaluation. These options are:

1. Treatment of target areas or the entire lake
2. Alum or lime treatment

The comparison of the chemical costs of partial treatments as well as between alum and lime treatments are summarized in Table 4-5. Alum appears to be more cost-effective. However, the price used for lime was based on the assumption that the lime would be purchased. One of the by products of water treatment from the St. Paul Water Utility is spent lime. If this material were supplied by the Water Utility, chemical costs would not be necessary. Partial treatment was considered for 450 acres. The assumption was also made that treatment would occur in spring or fall when phosphorus content is at its lowest. Operation costs for application by is summarized in Table 4-5. The cost estimate for lime application of $250/truck load and alum addition of $300/acre was obtained from a firm experienced with lime and alum addition. Truck size was assumed as 1,200 gallons, and the specific weight of spent lime supplied by the SPWU was 11.0 lbs/gal.

Based on Table 4-5 alum addition is more cost effective. Thus, the optimum combination for chemical treatment of Spring Lakes is:

- Alum
- Treatment of a 300-acre target area in each lake
- Treatment during spring or fall

The overall cost including permitting, administration and specifications for sediment sealing is detailed in Table 4-6.

TABLE 4-5

ESTIMATED APPLICATION COSTS FOR SEDIMENT SEALING FOR SPRING LAKE

Treatment Area	Alum/Lime Required (Tons)	Estimated Cost Alum/Lime ($)
450 Acres	1,125/9,000	$135,000/$350,000
Entire Lake (630 acres)	1,575/12,600	$141,000/$490,000

TABLE 4-6

ESTIMATED COSTS FOR SEDIMENT SEALING IN SPRING LAKE

Task 1: Obtain Permits		
Labor		
District Engineer	20 hrs at $70	$ 1,400
Associate Environmental Scientist	60 hrs at $50	3,000
Supplies, Fees, etc.		300
Task 2: Pre-Application Testing		
Senior Engineer	4 hrs at $85	$ 360
Environmental Scientist	16 hrs at $63	1,000
Technician	40 hrs at $35	1,400
Support	8 hrs at $40	320
Supplies		200
Miscellaneous (travel, freight, etc.)		200
Task 3: Specifications, Administration, and Construction Supervision		
Environmental Scientist	60 hrs at $73	$4,380
District Engineer	40 hrs at $70	2,800
Support	40 hrs at $50	2,000
Travel		200
Task 4: Application of Alum		
Mobilization		$ 5,000
Application		135,000
Total Estimated Costs		**$157,560**

Aquascaping

Field observations conducted during the study found that most of the shoreline surrounding both Upper and Lower Prior Lakes consisted of manicured lawns. This alternative looks at aquascaping as a means of promoting unmowed buffers or revegetated areas along the shoreline.

Water Quality Benefits. Shoreline erosion was not observed. Thus, the primary benefits from establishing shoreline buffers is filtration of runoff from lawns prior to discharge into the lakes. Shoreline buffers may also help prevent accidental discharge of lawn clippings and fertilizer into the lakes. Other benefits include improvements to aquatic habitat and a deterrent for geese to enter lawns. Geese prefer easy access to and from lakes.

There is not much literature on the numerical TP loading reductions from shoreline buffer strips in urban areas. Dillaha (1988) found that an experimental 30-foot wide vegetative filter strip receiving shallow uniform flow from cropland removed 87% of incoming suspended solids, 82% of incoming phosphorus, and 76% of incoming nitrogen. Similar benefits may be realized from shoreline buffers in urban areas. However, Dillaha noted that in practice, vegetative filter strips are unlikely to function as well due to the tendency for flow to channelize. The USEPA (1980) reported an 85% reduction in suspended solids for filter strips with an average detention time of 20 minutes. Other studies have found that sediment trapping efficiencies vary from 30 to 50% (Non-Point Source Task Force, 1983).

The diagnostic study found that shoreline areas around Upper Prior and Lower Prior Lake contributed 1,800 and 2,700 lbs TP /year, respectively. Much of this enters the lakes through storm sewers. However, converting these estimates to TP areal loading rates gives 1.3 lbs/ac/year and 0.91 lbs/ac/year for the Upper and Lower Prior Lake direct drainage areas respectively. Assuming an average lot depth of 150 feet, 1,000 feet of shoreline potentially receives sheet flow from 3.4 acres. Assuming a 50% TP loading reduction and an areal load rate of 1.0 lbs TP/ac/year gives a TP loading reduction of 1.7 lbs TP per 1,000 feet shoreline buffer per year.

Technical Feasibility. The feasibility of establishing shoreline buffers through aquascaping will depend on public participation. Most lake residents prefer clean access to lakes and do not wish to have their view impaired. Participation may be increased through education and convincing the public that buffers will not obstruct their view. Feasibility may also increase by approaching individual property management firms since these firms control shoreline areas at rental facilities such as apartments.

Estimated Cost. Efforts for establishing shoreline buffers should focus on education. Education efforts include a workshop, fact sheets and demonstrations. The workshop will require 60 hours from extension. A $20/hour plus 20% materials the cost in-kind of the workshop is $1,440. Fact sheets will require 20 hours from extension at $20/hour plus 20% materials for an in-kind cost of $480. Demonstrations will be promoted by offering 75% cost share grants (not to exceed $1,000 per grant) to local residents for aquascaping. Two demonstrations will be promoted for both Upper and Lower Prior Lakes.

Stream Buffer Strips

This alternative reviews the benefits of stream vegetated buffers and assesses the potential for enforcing ditch set back requirements.

Water Quality Benefits. The water quality benefits for establishing stream bank buffers is similar to the benefits described above for shoreline buffers. Effectiveness of stream buffers would depend on the size of the runoff contributing area. To be effective buffers should only receive sheet flow, and thus the contributing watershed should be small. Assuming that a buffer can receive sheet flow from a 100 to 200 foot long slope above the buffer means that 1 acre of buffer 50 foot wide will treat 3 to 4 acres. At a 30% loading reduction and a loading rate of 0.38 lbs TP/ac/year, the benefit is 0.34 to 0.46 lbs TP/acre of buffer. A 50% load reduction would be unlikely since most ditches in the watershed have some natural vegetated areas, because of the potential for channelized flow through the buffer, and finally because ditch law currently requires only a small setback of 16 feet (1 rod).

Technical Feasibility. The technical feasibility of this alternative depends on the approach. County Ditch 13 is the only public ditch in the District. Thus, enforcement of ditch law set backs will not cover most ditches. In addition, County Ditch 13 was constructed prior to the new ditch law which requires setbacks. Thus, the technical feasibility of enforcing ditch law is poor. Ditch setbacks can also be promoted by supporting the acquisition of riparian easements through the RIM program. RIM currently pays about $1,000/ac for easements. The program has not been very successful because land values in the area have increased and even with easements the land owner is responsible for taxes. Participation in this program could be increased by supplementing the easement payments. The District currently has miles of private ditches where additional buffer width would be beneficial. Areas in agriculture would have higher priority for easement acquisition than areas already in permanent vegetation. Obtaining riparian easement by supporting RIM has good technical feasibility.

Estimated Costs. Costs are not estimated for enforcing ditch setback due to the low technical feasibility. Costs for obtaining riparian easements include the RIM easement cost of $1,000/acre plus an additional $2,000/acre to bring the easement price closer to property values. Additional costs may be necessary for establishing vegetation, grading to prevent channelized flow through the riparian area and for periodic weed nuisance weed control. These costs are approximately $1,000/acre for vegetation and $1,000/ac for grubbing and grading. These activities will not be necessary for most areas. To develop a cost seeding and grading was assumed necessary on 30% of the easement area. This gives a total cost per acre of $3,600. With a 50 foot easement on either side of a channel, one acre will be sufficient to obtain a 528 foot long riparian zone.

STRUCTURAL CONTROLS

New Storm Water Basins

The City of Prior Lake was contacted regarding the potential for constructing storm water quality basins. The locations of these basins are shown on Map 2 along with other basin improvement projects identified during field reconnaissance for the diagnostic study. Three of these basins were selected for evaluation because they drain to Upper Prior Lake, as well as the existing interest for constructing basins in these locations. The remaining two basins were selected because they are currently wet/dry basins and could easily be converted to wet ponds. In general, the opportunities for wet basins on outfalls to Upper Prior Lake is limited because of urban development.

Water Quality Basin 1

Water quality basin 1 is located south of Upper Prior Lake (Map 2). The City of Prior Lake would like to rebuild the outlet of this basin to provide additional runoff storage and water quality benefits. These benefits would be realized by converting the basin to an extended detention basin with an additional two feet of storage. Engineering plans and specifications, and construction bids have already been completed. However, the project was canceled when construction bids came in at 2.5 times the engineer's cost estimate. Since engineering and costs have already been completed, this project may still offer a cost effective water quality alternative.

Water Quality Benefits. Water quality benefits were estimated using the WERM model. WERM is a modification of the PONDNET model by Walker. Total phosphorus removal effectiveness of the pond basin was modeled for existing conditions and for improved conditions with 2 feet of additional pond depth. The resulting net increase in TP removal is 28 lbs/year. A secondary benefit of this alternative is flood storage.

Technical Feasibility. The technical feasibility of modifying this basin is good. The engineering, plans, specification and bids have already been completed.

Estimated Cost. Bids have already been received for the project. The low bid was about $85,000. A portion of this amount was for designing the berm to support a road. Assuming that cost of the project would be born by others, the grant portion of the project cost would be $60,000.

Water Quality Basin 2

This basin is located just west of basin 1 (Map 2) and drains to the same channel ultimately discharging to Upper Prior Lake. The City of Prior Lake has been investigating conversion of this basin for extended detention by modifying the outlet and adding an additional 1.2 feet of ponding depth.

Water Quality Benefits. Water quality benefits were estimated using the WERM model. WERM is a modification of the PONDNET model by Walker. Total phosphorus removal effectiveness of the pond basin was modeled for existing conditions and for the improved conditions with 1.2 feet of additional pond depth. The resulting net increase in TP removal is 3 lbs/year. A secondary benefit of this alternative is flood storage.

Technical Feasibility. The technical feasibility of converting this basin is good. Construction requirements would be simpler than for basin 1. Construction of basin 2 would consist of a low berm and outlet pipe. Engineering has not been completed.

Estimated Cost. Costs include project administration, engineering, and construction. Project costs are given in Table 4-7. The total project cost is $6,660. This cost assumes that the City of Prior Lake will acquire easements through subdivision development regulations.

Water Quality Basin 3

This basin is located south of basin 1 along the main outflow channel from Crystal Lake. This is a new basin and is located in a depressional area where an average pond depth of 4 feet is possible. Drainage from the basin flows north to Upper Prior Lake.

Water Quality Benefits. The TP load reductions were estimated using the WERM model and an average basin depth of 4 feet. The estimated loading reduction is 16 lbs TP/year. The small benefit is due to the large watershed size and to the presence of the Crystal/Rice

Lake complex immediately upstream. These lakes provide significant sedimentation of pollutants prior to discharging to the proposed location for basin 3.

TABLE 4-7

ESTIMATED COSTS FOR IMPROVEMENTS TO WATER QUALITY BASIN 2

Task 1: Contract Administration (5% Construction)	$270
Task 2: Engineering and Construction Supervision (20% Construction)	$1,100
Task 3: Construction	
Mobilization	$1,000
Pipe	240
Fill	1,500
Rip-Rap	2,500
Erosion Control	50
Total	$6,660

A second and probably more important benefit for this basin is runoff storage for reducing downstream flooding.

Technical Feasibility. The technical feasibility of this alternative is good. The site is located at a road intersection and outflow from the area is controlled by a pipe under the road. Necessary modifications include changing the outlet to a riser pipe.

Estimated Cost. Efforts to create a basin at this location include contract administration by the City, purchase of easements, engineering and modification of the outlet. Table 4-8 is a detailed cost estimate. The total cost for the basin is estimated as $17,040.

Water Quality Basin 4

Water quality basin 4 is currently a wet/dry basin. The basin is located at the end of Beach Street on the north side of Lower Prior Lake (Map 2). The basin could easily be converted to a wet pond by excavating a ponding area below the current outlet pipe invert.

TABLE 4-8

ESTIMATED COSTS FOR IMPROVEMENTS TO WATER QUALITY BASIN 3

Task 1: Contract Administration (10% Construction)	$500
Easements 5 acre at $2,000	10,000
Task 2: Engineering and Construction Supervision (15% Construction)	$1,500
Task 3: Construction	
Mobilization	$1,000
Pipe	900
Earthwork	2,000
Rip-Rap	640
Erosion Control	500
Total	$17,040

Water Quality Benefits. Water quality benefits were estimated using the WERM model. The basin is approximately 0.25 acres in size. A wet pond average depth of 1.5 feet following improvements was assumed. The predicted TP removal by the improved wet pond is 10 lbs TP/year. Total phosphorus removal efficiency of the improved pond is 20%.

Technical Feasibility. The technical feasibility of the pond improvement is good. The only necessary construction activity is excavation.

Estimated Cost. Costs included in the project are city administration, and construction. Construction consists of excavating 650 cubic yards of material at $6/cy, mobilization at $1,000, and revegetation at $750 for a total construction cost of $5,650. Administration at 10% construction cost by the city results in an in-kind service of $560 and a total project cost of $6,210.

Water Quality Basin 5

Water quality basin 5 consists of improving the wet/dry pond at Sand Pointe Park. This basin drains south to Lower Prior Lake. The basin could easily be converted to a wet pond by excavating an area below the existing outlet pipe.

Water Quality Benefit. Water quality benefits were estimated using the WERM model. The basin is approximately 0.5 acres in size. A wet pond average depth of 1.5 feet following improvements was assumed. The predicted TP removal by the improved wet pond is 13.4 lbs TP/year. Total phosphorus removal efficiency of the improved pond is 33%.

Technical Feasibility. The technical feasibility of converting the basin from a construction standpoint is good. However, there are safety issues. The pond is currently located in a high use area of the park. Sides of the basin are steep. Any effort to convert this basin for standing water should include fencing.

Estimated Cost. Costs included in the project are city administration, and construction. Table 4-9 presents the project costs. Total cost for the project is $10,340.

TABLE 4-9

ESTIMATED COSTS FOR IMPROVEMENTS TO WATER QUALITY BASIN 5

Task 1: Contract Administration (10% Construction)		$940
Task 2: Construction		
Mobilization		$1,000
Excavation	800 cy at $6/cy	2,400
Erosion Control		500
Revegetation		1,500
Fence		4,000
Total		$10,340

Wetland Restoration

Wetland restoration is a popular alternative for environmental enhancement and water quality improvements. In fact, numerous funding mechanisms have been developed to promote wetland restoration. The State of Minnesota has the Reinvest in Minnesota (RIM) Permanent Wetlands Replacement Program, the U.S. Fish and Wildlife Service also has a program and the Soil Conservation Service (SCS) has a new program which started in 1992. These programs generally pay for all or part of specific construction costs as well as purchasing easements for specific property rights. The RIM program purchases the most property rights. However, the easements are permanent and the land owner is still responsible for property taxes. Thus, these programs are at times difficult to sell to the property owner. This may be particularly true in the suburban area of the project lakes.

Participation in these programs could be improved with additional monetary support by the District and the Grant program. For example, before the U.S. Fish and Wildlife can participate the land owners must already be willing to participate. The District through the grant program could initiate these early phases of obtaining landowner support. In addition, the District could improve participation through education and supplemental payments for easements.

An additional means of promoting wetland restoration is through the Minnesota Department of Transportation (MDOT). The Minnesota Department of Transportation is required to replace or mitigate wetlands they have impacted through construction activities. Therefore, they are always looking for wetland restoration projects and may be willing to fund a large part of the construction costs.

The following section discusses the opportunities for wetland restoration. The discussion focuses on restoration efforts in the Spring Lake watershed. The diagnostic study identified a number of potential projects. Prior to calculating numerical TP reduction benefits these projects are screened according to the following criteria:

- Proximity to Spring Lake. Locations closer to Spring Lake were preferred because of greater hydrologic and water quality benefits.

- Contributing watershed area. Wetland restoration areas that receive runoff from a contributing watershed are preferred to those that only consist of converting agricultural land back to wetland.

- Subwatershed. Wetland restoration areas located in subwatersheds that do not have much existing ponding, such as the Spring Lake Central subwatershed are preferred to restorations in the Buck Lake or County Ditch 13 subwatersheds were existing wetlands/basins already provide some sedimentation of pollutants.

- Number of property owners. To simplify obtaining easements, locations with few property owners are preferred. While restoration of previous water levels in Buck Lake, Sutton Lake and areas along County Ditch 13 will restore a greater number of acres, and these locations along drainage ways will treat a larger contributing watershed, they are not prioritized for restoration under this program because of the number of property owners. Obtaining easements along ditches with multiple property owners can be difficult and politically contentious. In addition, Ditch Law may make restoration along County Ditch 13 difficult. Because of the potential for disrupting the entire lake restoration project politically contentious projects were initially avoided.

Based on the above screening criteria, five restoration projects were prioritized for closer evaluation. Numerous additional restoration projects are potentially available and should be pursued. The ability to obtain easements was not investigated since negotiation of easements is beyond the scope of the Phase I report. The locations of the 5 priority projects are shown on Map 2. Wetland restoration option A will be inundated by option B. Thus, if option B is pursued option A is not necessary.

Water Quality Benefits. The amount of TP removal will be dependent on the size and location of each restored wetland. For estimating project benefits the WERM model was utilized for each wetland restoration alternative individually. A one foot ponding depth was assumed to represent restoration to historical water levels.

The predicted benefits of the restorable wetlands along the two creeks are given in Table 4-10. Phosphorus removal benefits were predicted using the WERM model which uses an empirical relationship for sedimentation. Wetland functions are complex involving biological interactions as well as sedimentation. However, the restoration of more constant water levels in these wetlands will have two water quality benefits. First, re-establishment of past water levels will promote greater sedimentation, and limit the export or erosion of materials which have previously accumulated in the wetlands. Secondly, a more stable water level will limit the exposure of wetland soils to oxidation and subsequent flushing of dissolved phosphorus (Walker, 1992).

Technical Feasibility. Once consent is received from effected landowners, the technical feasibility of a wetland restoration is good. A berm with a controlled outlet, such as a weir, is necessary to create the impoundment. A comprehensive engineering study is necessary to determine wetland impacts and effects of flooding.

Estimated Costs. Costs involved with the wetland restoration are largely for obtaining easements and permits, hydrologic analyses, engineering, and construction. The existing easement payment for RIM Permanent Wetlands Replacement Program is approximately $1,000/ac. Participation in RIM could be increased by subsidizing the payment for RIM easements an additional $2,000 per acre. This approach would save duplication of effort and pool resources for obtaining easements.

TABLE 4-10

TOTAL PHOSPHOROUS LOADING REDUCTION BENEFITS FOR WETLAND RESTORATION OPTIONS

Restoration Option	Surface Area (Acres)	TP Reduction (lbs/year)	Easement Cost	Total Cost
Option A	4.5	120	$13,500	$38,300
Option B	22	210	$66,000	$90,800
Option C	2.5	45	$7,500	$8,500
Option D	0.5	12	$1,500	$2,500
Option E	4.0	50	$12,000	$13,000

Subsidizing RIM payments would create a total easement cost of $3,000/acre. Table 4-10 gives the easement costs for each individual restoration project assuming a cost of $3,000/acre. Construction costs if completed through RIM will be approximately $1,000 for options C, D, and E. Options A and B will require more in-depth engineering and construction because of the contributing watershed. For these restorations, engineering is estimated as $4,800 and construction as $20,000.

Chemical Addition System

Another alternative to reduce phosphorus levels in Spring Lake is to facilitate precipitation of phosphorus with the use of various chemical precipitants. A mechanical feed system meters a dose of precipitant into the stream. The precipitant causes flocculation, which precipitates phosphorus and solids to the sediments. Various chemicals can be used in the system including iron, lime, and alum, with each having advantages and disadvantages.

Iron is relatively inexpensive, removes phosphorus effectively, and has an additional benefit of adding iron to the basins sediments. This sedimentary iron residual has been shown to reduce the release of phosphorus from sediments during periods of low dissolved oxygen. Lime is also inexpensive and creates a healthy carbonate residual in the basin, but is less effective than iron as a precipitant. Alum is rather expensive, but is the most effective in removing phosphorus in solids from the water column. Alum, however, has the additional disadvantage of decreasing the pH of the system and increasing the aluminum concentration in the basin sediments. These conditions can be harmful to aquatic life.

Currently, St. Paul Water Utility uses iron addition at various points in its chain of lakes treatment system. This program has been successful in cost effectively reducing in-lake phosphorus concentrations without adversely affecting the aquatic habitat of the treatment lakes. Walker (1992) observed an average ortho-phosphorus reduction of 68% with a ferric chloride addition system on Lambert Creek. For these reasons, iron is the recommended chemical for use in this alternative. With an iron addition system constructed at the Districts sedimentation basin on County Ditch 13 land would not have to be purchased and precipitation from the chemical addition system could occur in Spring Lake.

Water Quality Benefits. The primary benefit of the incorporation of a chemical precipitation system is to increase the rate of precipitation of soluble phosphorus. Standard detention basins typically have little effect at removing soluble phosphorus. St. Paul Water Utility has been adding iron to its treatment chain of lakes for a number of years. Monitoring of their system has shown decreases of 43-81% of the influent SRP although results from jar tests have shown 80% reduction. The average field monitored loading reduction was 68% (Walker, 1992). Sixty-eight % removal of SRP from the inflow of County Ditch 13 is 890 lbs/year.

Ferric chloride addition also has the added benefit of increasing iron in the lake sediments which might limit sediment phosphorus release. Walker (1992) found that maintaining DO concentrations above 1 mg/l and Fe/P (total iron /total phosphorus) ratios above 3 were sufficient to control phosphorus cycling in Vadnais Lake. The ratio in Spring Lake is currently unknown, however, lake monitoring in 1993 includes iron. Ferric chloride additions above Pleasant Lake reduced seasonal peaks in phosphorus cycling and yearly maximum concentrations from 190-220 μg/l to 100-140 μg/l. No aeration was utilized on Pleasant Lake even though the lake experiences seasonal DO depletion. Thus, ferric chloride addition appears successful without aeration. Aeration, may make the chemical addition of ferric chloride more efficient in Spring Lake.

Technical Feasibility. The technical feasibility of constructing an iron addition system is good. Available technology will enable the iron to be precisely metered into the system, dependent on stream flow volume. In addition, the system can be constructed at the site of the District's sedimentation basin on County Ditch 13 thereby avoiding the need for land acquisition.

Estimated Costs. The primary costs associated with the ferric chloride feed system is the programming for dosing, construction of the feed equipment, containment structure, electrical controls, and the electrical hook-up. The cost of the electrical hook-up is dependent on the final site of the feed equipment. For this estimate, 1,500 feet of electrical line was used.

Annual costs include electricity, maintenance, and the ferric chloride. Maintenance costs are fairly high with this type of system because of the corrosiveness of ferric chloride. Total operations and maintenance costs are estimated as $7,400/year.

Estimated construction costs are detailed in Table 4-11.

Lake Aeration

Monitored data indicates that Spring, Upper Prior and Lower Prior Lakes experienced depressed DO during the summer and winter months. This condition can allow the release of phosphorus from the sediment. In Spring Lake this phosphorus is periodically mixed with the surface waters and contributes to internal loading and nuisance algal blooms. In fact, Osgood (1983) estimates that internal loading in Spring Lake contributes 33% of the TP budget. During the late spring, DO concentrations in Upper Prior Lake dropped to levels which threaten the fisheries of the lake. Both lakes may benefit from aeration. Aeration in Spring Lake would be beneficial for controlling internal loading, while aeration in Upper Prior Lake may improve fisheries. However, review of historical information found no record of fish kills in Upper Prior Lake.

ESTIMATED COSTS FOR FERRIC CHLORIDE FEED SYSTEM

Task 1: Permits, Design, and Programming		
Labor		
Engineer	80 hrs at $70	$ 5,600
Environmental Scientist	20 hrs at $67	1,340
Support	16 hrs at $45	720
		350
Task 2: Construction and Materials		
Mobilization		$ 1,500
1-5,000-Gallon Tank	1 at $4,000	4,000
Pump	2 at $1,200 each	2,400
Back-Pressure Valve	2 at $600 each	1,200
PVC Plumbing		500
Containment Structure		4,000
Installation	80 at $50/hr	4,000
Electrical Controls		4,000
Electrical Hook-Up	1,500 ft at $3/ft + $270	4,770
Flood Protection		2,000
Total		**$36,380**
Annual Operations and Maintenance		
Ferric Chloride		$ 4,400
Electricity		1,000
Maintenance		2,000
Total Per Year		**$7,400**

Possible aeration methods include hypolimnetic aeration, and a pump and baffle system (Cascade). Hypolimnion aeration most commonly employs an airlift device to mix cold hypolimnetic water with air, the air is separated from the water and released through a hose to the lake surface, and the water is aerated by contact with the air and returned to the hypolimnion. There is no intention to destratify the lake (EPA, 1988).

A second common method of aeration, a well as the one preferred by the MDNR, is a pump and baffle system. Water is pumped from the lake and is discharged at the top of a shore-based cascade which acts to aerate the water. The water is then returned to the lake at the shoreline or piped to a more distant deep water discharge point.

Another potential system for aeration in diffuse aeration of the hypolimnion. This method consists of placing diffuser pipes along the bottom of the lake and pumping air into the pipes which then diffuses into the surrounding water. These systems have relatively high capital and energy costs. However, these systems provide a better distribution of aeration and are practical in lakes such as Spring Lake where large areas of the hypolimnion need aeration. To control internal loading approximately 340 acres of the lake bottom should be aerated. This estimate was obtained using the summer anoxic zones monitored by Osgood (1983). This system is also more appropriate in shallow lakes. However, the system will destratify the lake. Destratification will be beneficial for Spring Lake. Spring Lake is has weak stratification and is intermictic which contributes to internal loading.

Water Quality Benefits. Maintaining adequate DO levels in the hypolimnion of the lakes will reduce phosphorus release from the sediments. Walker (1992) found that maintaining DO concentrations above 1 mg/l and Fe/TP ratios above 3 were sufficient to control phosphorus cycling. Aeration could be combined with iron addition on inflow streams to control phosphorus sediment release. Internal TP loading is estimated as 2,860 lbs/year. Eighty % control of internal loading will result in a loading decrease of 2,290 lbs TP/year. Increased DO concentrations will also improve the aquatic environment for fish habitat.

Technical Feasibility. Numerous aeration system designs have been used in Minnesota lakes. The technical feasibility of constructing an aeration system for Spring Lake is good. The best system to control internal loading in Spring Lake is a diffuse aerator. Much of the equipment for constructing a diffuse aerator is manufactured locally. Some of the design parameters of importance include ease of maintenance and consideration of bottom sediments. Disturbing bottom sediment will increase water turbidity. The diffuse aeration system will be constructed such that the diffuser pipes will be suspended 18 inches above the sediments thereby preventing sediment turbulence. Maintenance can be made easier by installing the diffuser pipe with floatation tubes. When maintenance is needed the compressors can be used to inflate the floatation tubes and bring the pipe to the surface. Housing for the compressors can be constructed on the property for the Spring Lake Regional Park thereby avoiding the need to purchase easements.

The technical feasibility of constructing an aerator for fishery benefit on Upper Prior Lake is fair. Since the purpose of an aerator on Upper Prior Lake is to prevent winter fill kill only a small aerator capable of providing a refuge area for fish is necessary. Potential problems with aerators on Upper Prior Lake include safety due to open ice, and obtaining land. Most of the shoreline surrounding Upper Prior Lake is developed.

Estimated Costs. A specialty engineer in the manufacturing and construction of diffuse aerators was contacted to develop a cost estimate for the construction of the aeration system on Spring Lake. The estimate to aerate 340 acres is $152,000. This cost covers engineering, construction supervision, and construction. Equipment includes 3-40 hp compressors and the diffuser pipe. Additional costs include contract administration, permitting and construction of housing and installation of power line. Contract administration by the District will require 120 hours at $20/hour plus 20% for material for a total in-kind service of $2,880. Permitting will require 80 hours by a professional scientist at $74/hour for a cash cost of $5,920. Housing is estimated to cost $4,000 and power line $1,500. Thus, the total estimated construction cost of the project is $166,300. Long-term operation and maintenance will depend on the amount of time the system is in operation. Energy costs are estimated as $5,000/month. Based on the monitoring data aeration will be necessary for 4 to 5 months each summer. Thus, operation will cost $20,000 to $25,000 per year. Land purchase for siting aeration systems will not be necessary since the equipment can be located on park property.

A small aerator on Upper Prior Lake can be constructed for $25,000 to $35,000. Energy costs for the small aerator would cost approximately $1,000/year.

SUMMARY OF REMEDIAL ALTERNATIVES

A summary of the remedial alternatives is listed in Table 4-12. To aid in selecting project elements for the final plan, the cost per pound TP removed was calculated for each alternative. These costs were calculated assuming a 10-year design life with annual operational costs included. Alternatives were also ranked for hydrologic benefits and SRP reduction benefits. Runoff reduction and flood storage is a secondary goal of the project. Based on this analysis, the most cost-effective and beneficial alternatives for controlling external loading are conservation tillage, wetland restoration, yard waste education, and the ferric chloride chemical addition system. Agricultural fertilizer management, aquascaping, and improvements to water quality basin option 4 also provide cost-effective phosphorus removal.

Sediment sealing is more cost-effective than aeration for controlling internal loading in Spring Lake. However, aeration has a better technical feasibility. Based on this analysis, the most cost-effective and beneficial alternatives are the conservation tillage, wetland restoration, ferric chloride addition, and either sediment sealing or aeration of Spring Lake to control internal loading.

TABLE 4-12
COMPARISON OF REMEDIAL ALTERNATIVES

Project Element	Phosphorous Reduction (lbs/yr)	Hydrologic Benefit	SRP Benefit	Technical Feasbility	Cost ($)	Cost Effectiveness ($/Lbs TP Reduction)*
Pond Standards	Water Quaity Protection	Yes	Fair	Good	-0-	N/A
Urban Fertilizer Education	Benefits Not Quanitified	No	Good	Good	9,360	N/A
Agricultural Fertilizer Education	Benefits Not Quantified	No	Good	Good	16,880	N/A
Fertilizer Management						
Incentives	0.19 lbs/acre	No	Good	Good	10/acre	53
Bander	285	No	Good	Fair	29,800 (4,800/yr)	19
Yard Waste Education	110	No	Fair	Fair	8,210	8
Septic System Education	Benefits Not Quantified	No	Good	Good	3,360	N/A
Stormwater Basin Inventory	Water Quality Protection	N/A	N/A	Good	17,898	N/A
Conservation Tillage Equipment	209	Yes	Fair	Good	28,000	13
Street Cleaning	Benefits Not Quantified	No	Poor	Fair	N/A	N/A
Chemical Algae Control	No Nutrient Reduction Benefit	No	Poor	Poor	126,000+	N/A
Sediment Sealing	2145 - 2,430	No	Good	Fair	157,520	6 -7
Aqua-Scaping	2.5	No	Fair	Good	1,000	59
Stream Buffer Strips	0.34 - 0.46/acre	Yes	Fair	Good	3,600	780 - 1,060

TABLE 4-12
COMPARISON OF REMEDIAL ALTERNATIVES

Project Element	Phosphorous Reduction (lbs/yr)	Hydrologic Benefit	SRP Benefit	Technical Feasbility	Cost ($)	Cost Effectiveness ($/Lbs TP Reduction)*
Water Quality Basins						
Option 1	28	Yes	Fair	Good	60,000	214
Option 2	3	Yes	Fair	Good	6,660	222
Option 3	16	Yes	Fair	Good	17,040	106
Option 4	10	No	Fair	Good	6,210	62
Option 5	13	No	Fair	Good	10,340	80
Wetland Restoration						
Option A	120	Yes	Fair	Good	38,300	32
Option B	200	Yes	Fair	Good	90,800	45
Option C	45	Yes	Fair	Good	8,500	19
Option D	12	Yes	Fair	Good	2,500	21
Option E	51	Yes	Fair	Good	13,000	25
Chemical Addition System	890	No	Good	Good	36,380 (7,400/yr)	12
Spring Lake Aeration	2,290	No	Good	Good	166,300 (25,000/yr)	18
Upper Prior Lake Aeration	No Nutrient Reduction Benefit (Prevents Fish Kills)	No	No	No	35,000	N/A

* Cost over 10 years

SECTION 5

RECOMMENDED IMPLEMENTATION PLAN

INTRODUCTION

The following section describes the recommended Water Quality Management Plan. The plan is based on the future considerations, constraints, and alternatives evaluated in Section 4. In addition, several selection principles were utilized in determining the "best" alternatives (Table 5-1).

TABLE 5-1

SELECTION PRINCIPLES

- Alternative must be cost-effective.
- Alternative must have a public participation or good water quality benefit.
- Alternative must have a high level of technical feasibility.
- Where possible, alternatives should be implemented through the 509 plan process.
- Alternatives which also have a hydrologic benefit are preferred.

The recommended plan is organized by first providing a detailed description of the plan elements, estimating overall project effectiveness, and then providing the project schedule and budget. This plan was developed to meet target TP reduction goals of 3,480 lbs/year to Spring Lake. Meeting this goal will also substantially reduce TP loads to Upper and Lower Prior Lakes. After meeting the goal for Spring Lake an additional 240 lbs TP/year reduction is necessary to meet the goals for Upper Prior Lake.

Existing water quality protection programs in the watershed have an impact on the selection of elements for the implementation plan. The District and local municipalities have already implemented many protection efforts and source controls. These programs are discussed in detail in Section 2 of the Feasibility Study and include:

- Shoreline Ordinances
- Construction Erosion Control

- Minimum lot sizes of 10 acres where sewer will not be provided
- Water quality and quantity controls for new development
- Administration of the Wetlands Conservation Act
- Development of a City-Wide Water Quality Management for the City of Prior Lake
- Agricultural BMPs through the SCS, ASCS, and local SWCDs
- New system for tracking septic system compliance

In addition, the District recently repaired the sediment basin located on County Ditch 13. Evaluation of this basin using the WERM model showed that the basin has a TP removal effectiveness of 350 lbs/year.

The Implementation Plan was developed to build on these existing efforts and to avoid duplication of effort. In addition, since the watershed is changing from agriculture to urban uses, the plan focuses on protection efforts for urban development. Water quality protection efforts include 509 plan amendments, education programs, and an inventory of existing basins.

The most cost-effective remedial alternatives were conservation tillage, wetland restoration, ferric chloride addition, and sediment sealing in Centerville Lake. However, aeration of Spring Lake has a higher technical feasibility. Additional watershed treatment alternatives which have high technical feasibility include fertilizer management, aquascaping, and improvements to water quality basins 1 and 4.

PLAN ELEMENTS

The Implementation Plan is divided into ten project elements. These are:

- **Public Information/Education Program**
  - Fertilizer Management
  - Yard Waste Management
  - Septic System Maintenance
- **509 Plan Amendments**
  - Revisions to the wet pond design standards
  - Ensuring Maintenance of Stormwater Facilities

- **Fertilizer Management Incentive Program**
- **Conservation Tillage Equipment**
- **Aquascaping**
- **Water Quality Basin Improvements**
- **Wetland Restoration**
- **Ferric Chloride Chemical Feed System**
- **Aeration of Spring Lake**
- **Lake-Wide Aquatic Macrophyte Management Plans**
- **Improvements to MDNR Spawning Area**
- **Continued Monitoring**

Public education was selected as an element to keep the public informed and to teach the public common methods for reducing non-point source pollution. Additionally, public education is critical for promoting public participation in the other plan elements.

Fertilizer management and conservation tillage were selected since these practices have the potential for reducing nutrients at the source. In addition, both practices are cost-effective, have the potential to save farmers money, and may be continued as a practice after the project is complete.

The 509 Plan amendments were incorporated for additional watershed protection since urban growth is expected to increase in the watershed.

Aquascaping was selected because of the large number of residential lawns which are mowed to the waters edge surrounding Upper and Lower Prior Lakes. The element provides aquatic habitat benefits, and education as well as phosphorous reduction benefits.

Improvements to water quality basins 1 and 4 were selected because they drain to Upper and Lower Prior Lakes respectively. Yard waste management and improvements to basin 1 were the only projects identified which directly provided substantial benefits to Upper Prior Lake.

Wetland restoration efforts are included to control the phosphorus loads from the priority agricultural subwatersheds. These efforts are expected to control primarily particulate phosphorus and sediment. Restored wetlands will also provide flood storage and wildlife habitat benefits.

One of the findings of the study was that the concentrations of soluble phosphorus in Spring Lake was high. Therefore, the ferric chloride chemical feed system was added to the plan. The high soluble phosphorus concentrations made the feasibility of the feed system good. Additionally, the wetland restoration alternatives primarily control particulate phosphorus.

Aeration in Spring Lake was added because it is more technically feasible than sediment sealing. Aeration is also a cost-effective means of controlling internal loading of nutrients especially phosphorus. In Centerville Lake, 33% of the phosphorus loading is from internal sources. Walker (1992) found that the combination of ferric chloride and aeration was effective for controlling internal phosphorus cycling. However, aeration may not be necessary with ferric chloride addition. An evaluation will be made in project year three concerning implementation of aeration. Sediment jar tests will also be completed in year three to better define the feasibility of sediment sealing. Sediment sealing is much more cost-effective than aeration and therefore warrants additional consideration in project year three. However, existing conditions indicate aeration has more long-term benefits. Thus, the initial plan was developed with aeration as an element.

The develop of lake-wide aquatic macrophyte management plans were added to the overall implementation plan because of the current problems with Eurasian water milfoil. The District and MDNR are currently treating the lakes to kill the weed. However, treatment disrupts the lake ecosystem, and a management plan is necessary for developing a long-term solution, and for revegetating the lakes following treatment. Revegetating the lakes or promoting the growth of species such as sago pondweed and coontail, which can compete with Eurasian water milfoil, will improve the biological diversity of the lake and may prevent reinfestation of Eurasian water milfoil.

One of the goals of the project is to improve fisheries. In 1972 and 1982 MDNR ranked the Northern Pike spawning conditions in Lower Prior Lake as poor. MDNR has since established a spawning area on the lake. The area was used in 1992 and 1993, however, habitat in the spawning area is poor. The area requires some changes to improve spawning conditions. Thus, this element was added to improve fisheries in Lower Prior Lake.

Finally, additional monitoring was included to determine the effectiveness of the plan and provide a means of monitoring progress so that plan can be adjusted if needed. Aeration of Upper Prior Lake was not included. While Upper Prior Lake experienced oxygen depletion during the monitored year there has been no history of fish kills.

The following provides a detailed description of each plan element.

Public Information/Education Program

Public information and education will be an important element of this project. Education will be used to support other project elements and will be the primary mechanism for promoting different fertilizer management techniques, yard waste management techniques, local permit requirements, and ways that the public can get involved. The main goal of the education program will be to inform the local public that they are primarily responsible for the success of the lake restoration efforts through the reduction of non-point source pollutant loadings.

The public information program will be implemented using the MPCA document, *Community Information Outreach for the Clean Water Partnership* (June 30, 1989) for guidance. The education program will be comprised of three programs: fertilizer management, yard waste management, and septic system maintenance programs, plus a baseline effort and miscellaneous activities. These efforts are described below and were previously outlined in Section 4.

Fertilizer Management Education. The fertilizer management education program will include elements for both urban and agricultural fertilizer management. These elements include:

- Workshops for urban fertilizer management to be given by extension in project years one and four.
- Urban fertilizer management fact sheets.
- Agricultural fertilizer management fact sheets.

- Agricultural fertilizer management demonstration.
- 200 free soil tests for urban residents during project years one through three.
- Annual agricultural fertilizer management workshops following completion of the demonstration project and beginning in project year three.
- 200 free soil tests for project years four through six for farmers who participate in the fertilizer workshops.

In addition, as part of the baseline education program volunteers, will be solicited to sell low or no phosphorus fertilizers.

Yard Waste Management Education. The yard waste management education effort will target primarily shoreline and urban residents. Elements of the yard waste education program include:

- Yard waste and shoreline management workshops to be given by extension in project years one and five
- Yard waste management fact sheets
- Posting of signage on storm sewer grates by volunteers and coordinated by the City of Prior Lake
- Utilization of street sweeping to educate home owners regarding the disposal of debris in streets

If 20% of the urban residents surrounding Upper Prior Lake participant in yard waste management TP loading to Upper Prior Lake may be reduced by 110 lbs/year.

Septic System Maintenance Education. The septic system maintenance education program will focus on the shoreline residents surrounding Spring Lake. Elements of the program include:

- Septic system maintenance workshops to be given by Scott County in project years one and three
- Septic system maintenance fact sheets

Baseline Program. The baseline education program will include coordination efforts by the District Administrator, and the following special projects:

- Annual news letters
- Press releases
- Project tours for project years one and six
- Meetings and conferences
- Project slide show
- Shoreline Management Workshops to be coordinated with the aquascaping project element
- Shoreline management fact sheets
- Contests

Several additional elements covered under the baseline program are soliciting volunteer groups to participate in the Minnesota Clean Rivers Program; tracking the acreage, creating displays, and summarizing the public education monitoring questionnaire. Implementation of a citizens' watch program for exotic plant species (Eurasian water milfoil) will also be coordinated with the baseline program. In addition, a $100 reward will be offered for the first individual who positively identifies and reports the location of Eurasian water milfoil in Spring Lake.

One project newsletter will be published each year. The newsletters will cover progress, informative data, tips on reducing phosphorus loading from residential areas, project activities, and information on how to get involved. These newsletters will not be mailed due to the large number of residents in the watershed. Instead, copies of the newsletters will be supplied to cities, counties, and other organizations for distribution.

Costs and responsibilities for the combined Public Education/Information Committee Program are detailed in Table 5-2.

TABLE 5-2

COST ESTIMATE AND LEVEL OF EFFORT FOR THE PUBLIC INFORMATION/EDUCATION PROGRAM

Element	In-Kind Hours	In-Kind Cost ($)	Cash ($)	Responsible Agency
Fertilizer Management				
Urban Workshops (2)	120	2,880	--	Scott County Extension
Fact Sheets	40	960	--	Scott County Extension
Demonstration	100	3,040	1,600	Scott County Extension
Soil Tests	90	3,600	8,400	PL/SLWD
Farm Workshops (4)	240	5,760	--	Scott County Extension
Yard Waste Management				
Workshops (2)	120	2,880	--	Scott County Extension
Fact Sheets	20	480	--	Scott County Extension
Signage and Sweeping	82	1,970	--	City of Prior Lake
Coordination of Volunteers	120	2,880	--	PL/SLWD
Septic System Maintenance				
Workshops (2)	120	2,880	--	Scott County
Fact Sheets	20	480	--	Scott County
Baseline				
General	240	4,800	1,200	PL/SLWD
Newsletters (6)	480	9,600	3,000	PL/SLWD
Slide Program	100	2,000	200	PL/SLWD
Displays	40	800	--	PL/SLWD
Press Releases	60	1,200	--	PL/SLWD
Tours	40	800	400	PL/SLWD
Meetings and Conferences	32	640	200	PL/SLWD
Schools	60	1,200	--	PL/SLWD
Contests	10	200	20	PL/SLWD
Shoreline Workshop (1)	60	1,440	--	Scott County Extension
Shoreline Fact Sheet	20	480	--	Scott County Extension
TOTAL	**2,094**	**50,970**	**15,200**	

Amendments to the 509 Plan

Performance Standards. The District wet pond development standards will be improved by adopting standards for water quality ponds by Walker (1987). These standards are described in detail in Section 4, page 4-3.

Maintenance of the Existing Drainage System. There are two project elements regarding system maintenance. The first concerns the maintenance of current landlocked basins. Since these areas are land-locked, they do not discharge phosphorus through surface runoff. It is also unlikely that these areas contribute significant phosphorus loads to the lakes through groundwater discharge. Phosphorus has a tendency to adsorb to sediments and is not very mobile in groundwater. Therefore, it is recommended that the District adopt a policy to preserve the condition of land-locked basins unless it is demonstrated that phosphorus loading is not increased. Implementation of this policy will be possible through enforcement of the Wetlands Conservation Act, and through the review and approval of drainage improvement projects.

The second element is clarification maintenance responsibilities for stormwater treatment facilities. As stated in section 4, the responsibility for maintenance in the current 509 Plan is unclear. The first step is the completion of the stormwater basin inventory and analysis discussed in Section 4. The estimated 1993 cost of this inventory is $17,900.

Fertilizer Management Incentive Program

The fertilizer/nutrient demonstration and incentive program will encourage agricultural operators in the priority watersheds to utilize soil tests and manage agricultural nutrients that will:

- Achieve profitable crop production
- Reduce nutrient runoff

The first year of the program will be utilized to find an operator for a demonstration project. An incentive payment of $20/ac/year up to 40 acres will be offered to encourage participation in the demonstration. The demonstration will be installed and monitored during project years two and three. The size of the plot will be 40 acres with 20 acres planted with the operators usual fertilizer management methods, and the other 20 acres per a nutrient management plan developed by Scott County Extension.

An incentive program will also be started in year three for soil testing and nutrient management. Incentive payments will be made in the amount of $10 per acre for each acre treated with a nutrient management plan. The target acreage goal for year three will be 200 acres. This level of effort will be continued for years four, five, and six with a target addition of 200 acres per year. By year six a total of 800 acres could receive incentives. The following policies will apply for participation in the demonstration and incentive programs:

- Soil tests must be taken before spring planting and the University of Minnesota Soil Testing Laboratory must be utilized for fertilizer recommendation rates.

- The farmer agrees to use realistic yield goals agreed upon by the farmer and the project staff.

- The farmer is required to bring the soil analysis to the fertilizer seminars or to local extension or SWCD offices to develop a nutrient management plan.

- The farmer agrees to report soil test results and application rates by providing project staff with copies of all soil analysis, fertilizer bills, and/or manure analysis results as documentation of compliance with this practice. All items must be submitted by June 30 of that year.

- Project staff will certify practice completion by conducting a field visit and review of above mentioned documentation.

- Project sponsors will pay the farmer after harvest and upon certification of practice completion.

- All crops produced remain the property of the farmer.

- The farmer agrees to allow public disclosure of information gathered as part of this practice.

- Farmers are eligible for a maximum participation of two years.

The maximum participation of two years was established to allow participation by a greater number of farmers. This program will allow up to 1,200 acres of participation during the six-year project duration. The TP reduction benefit from fertilizer management calculated in section 4 was 0.19 lbs TP/year. Thus, the total reduction for treatment of 1,200 acres is 228 lbs TP/year. At $10/ac incentive payments will cost $2,000; $4,000; $6,000; and $8,000 for project years three through six, respectively. Administering the program will require approximately 0.2 hours/ac/year. At $20/hour this amounts to an in-kind service of $800; $1,600; $2,400; and $3,200 for project years three through six.

Conservation Tillage Equipment

No-till farming will be promoted by purchasing a no-till drill for watershed farmers to use. To facilitate operation, a part-time person will be hired to pick up and deliver the drill. The goal will be to plant 1,100 ac/year. Planting 1,100 ac/year will reduce loading by 209 lbs TP/year. This effort will also be promoted through the education program. For example, records of costs and yields for several participating farmers will be kept to demonstrate the before and after benefits or no-till farming. These results will be published in newsletters and presented at workshops. Costs of the program are estimated at $28,000 for the drill, and $6,150/year for operations and maintenance. To offset operations and maintenance costs a charge of $6/ac will be assessed.

Aquascaping

Aquascaping will be promoted as a means of establishing residential shoreline buffers. This practice will also improve aquatic habitat and public education. To promote aquascaping 75% cost share grants up to a maximum of $1,000 will be made available to shoreline residents to establish naturally vegetated buffers. A total of five grants will be available at a total project cost of $5,000, one for Spring Lake and two each for Upper and Lower Prior Lakes. Attempts will be made to solicit one resident from both the north and south side of Upper and Lower Prior Lake. The total phosphorous loading reduction benefit from aquascaping is expected to be negligible. This effort is largely for education.

Water Quality Basin 1 Improvement

Basin 1 is located south of Upper Prior Lake in the City of Prior Lake. This alternative consists of converting the basin to an extended detention basin and adding an additional 2 feet of detention storage. Engineering, specification and bids have already been completed for the project. The estimated phosphorous loading reduction from the improvement is 28 lbs TP/year. Estimated cost of the project is $60,000.

Water Quality Basin 4 Improvement

Basin 4 is located at the end of Beach Street on the north side of Lower Prior Lake. The basin is currently a wet/dry basin. Under current conditions the basin has a very low phosphorous removal efficiency. Improvement to the pond include excavation below the existing outlet pipe invert to provide wet storage and increase the phosphorous removal efficiency. The phosphorous removal benefits of this alternative is 10 lbs TP/year. The estimated cost of the project is $6,210.

Wetland Restoration

Numerous potential wetland restoration projects were identified in the diagnostic study. Five of these projects were evaluated in section 4 of the feasibility as priority projects (Map 2). All are economical projects and should be pursued. However, restoration of Option A is not necessary if Option B wetland is restored. Option B provides greater TP reduction benefits and will be pursued as a priority over Option A. Monitoring will be completed in year three and six following restoration of either option C or E wetland to determine water quality benefits from wetland restoration. Two monitoring years are scheduled to document long term benefits and year to year variability.

Estimated costs in 1993 dollars for these projects are given in Table 5-3. The analysis completed in Section 4 showed that the most economical means of pursuing wetland restoration is by subsidizing existing programs such as the RIM Permanent Wetlands Replacement Program. A cost of $2,000/acre in addition to the $1,000/acre already available for RIM easements was utilized to develop the program costs in Table 5-3. RIM payments are in-kind contributions.

TABLE 5-3

ESTIMATED COSTS FOR PRIORITY WETLAND RESTORATION PROJECTS

Project	In-Kind ($)	Cash ($)	Total ($)
Option A	4,500	9,000	$38,300
Option B	22,000	44,000	90,800
Option C	2,500	5,000	8,500
Option D	500	1,000	2,500
Option E	4,000	8,000	13,000

Additional project costs will be necessary for advertising and soliciting participants and for additional site visits. The District Administrator will require 40 hours annually for the first three project years to attend meetings and assist with solicitation of easements. At $20/hour this gives an in-kind service of $800/year. Additional site investigation will require 24 hours by the District Engineer for a cost of $1,320.

Ferric Chloride Chemical Addition System

The ferric chloride chemical feed system will be installed along County Ditch 13 at the outlet of the existing sediment basin. Performance will be evaluated at the end of three years, and a determination made of the additional benefits from aeration of Spring Lake. Costs for the system include an initial $36,380 for capital costs and an additional annual cost of $7,400 for operations, maintenance, and chemicals. Treatment of County Ditch 13 inflows will remove 890 lbs TP/year primarily as SRP. Additional benefits include increasing iron (Fe) in the lake sediments.

Spring Lake Aeration

To control internal loading in Spring Lake an aeration system may be added to the project in year four. Prior to installing the aeration system, monitoring will be completed in project year three to determine the effectiveness of the ferric chloride system. Walker (1992) showed that ferric chloride addition was effective in reducing peak phosphorus concentrations without aeration. Thus, ferric chloride addition may be cost effective without aeration of Spring Lake. Cost of the aeration system was estimated as $166,300 plus $25,000 annual costs.

Lake-Wide Aquatic Macrophyte Management Plan

To facilitate long-term comprehensive aquatic macrophyte management lake by lake Aquatic Macrophyte Management Plans will be developed. The DNR will be utilized for much of this effort. Development of the plans will involve detailed aquatic macrophyte surveys of each lake following treatment of milfoil. This information along with lake depths and species requirements will be utilized to determine priority aquatic macrophyte management areas, methods and species. Development of the plan will include a number of public hearings. Efforts for developing the plan include 500 hours from MDNR and 80 hours from an Environmental Scientist and 120 hours from field ecologists. At $20/hour MDNR efforts will have an in-kind cost of $10,000. Outside services for the scientist and ecologist will cost $12,520.

Improvements to MDNR Spawning Area

This element will improve habitat conditions in the spawning area. Northern pike prefer shallow flooded grassy areas for spawning. The spawning area includes a number of trees and shrubs. Removal of this vegetation will improve spawning conditions. The effort required is approximately two days for a field crew of three. At $20/hour the cost of improving the spawning area is $960.

Post-Implementation Monitoring

To evaluate the effectiveness of the Implementation Plan, additional monitoring will be conducted. This program will address the following primary issues:

- Changes in lake water quality
- Effectiveness of the restoration projects

A proposed monitoring plan is provided as follows:

Lake Monitoring. Monitoring will be conducted on Spring and Upper Prior Lake eight times during project year three growing season to determine the effectiveness of the watershed treatments. Samples will be taken at two sample depths representing a surface composite and the hypolimnion. The parameters to be analyzed are given in Table 5-4. In addition, dissolved oxygen and temperature profiles will be completed on each sampling date. In addition, monthly DO profiles will be completed on Upper Prior Lake in project year three to further document DO depletion and the potential for fish kills. Data gathered from year three monitoring will also be utilized to determine the necessity of aeration in Spring Lake. Sediment microcosm experiments on Spring Lake sediment will also be completed in project year three. Resulting data will be utilized to better define the feasibility of sediment sealing. If sediment sealing could be used to control internal loading instead of aeration, the project could save approximately $96,000 in O&M costs and $22,000 in construction costs. The 1993 cost estimate for microcosm experiments is $7,000.

TABLE 5-4

WATER QUALITY PARAMETERS FOR LAKE MONITORING

Total Phosphorus	Total Suspended Solids
Soluble Reactive Phosphorus	Chlorophyll-a
Total Iron	Secchi Disk Transparency

All three lakes will be monitored in project year six to determine the combined effectiveness of the improvement program. Monitoring will be conducted eight times during the growing season. Samples will be analyzed for the parameters in Table 5-4 as well as dissolved oxygen, conductivity, and temperature.

Estimated costs for the lake monitoring program is $7,500 and $9,500 for the year three and year six programs, respectively.

Wetland Monitoring. Monitoring of the one restored wetland will be completed during years three and six of the project. Monitoring will be completed above and below the wetland during five rain events. These events will correspond with snow melt, spring, early summer, mid-summer, and late summer. Automatic equipment will be utilized to collect flow-weighted mean and first-flush samples. Samples will be analyzed for parameters listed in Table 5-5. Estimated costs for wetland monitoring are $12,000 for each of the two years.

TABLE 5-5

WETLAND SAMPLING PARAMETERS

Total Phosphorus	Total Suspended Solids
Soluble Reactive Phosphorus	Total Iron

Ferric Chloride System Monitoring. Monitoring of the effectiveness of the ferric chloride addition system will be completed during project year three. Monitoring will consist of stream sampling above and below the addition system. Samples will be analyzed for TP, SRP, pH, and Total Iron. Sampling will be conducted 12 times between March and October. Cost of the ferric chloride system monitoring is estimated as $3,500 in 1993 dollars.

Public Education Analysis. To monitor the effectiveness of the public education program, a questionnaire will be distributed to a sample of watershed residents during the third year of the program. The results will be utilized to adjust education efforts for the remaining three years of the project. The questionnaire will be designed to determine if resident has heard of the program, if they participated, and if the program had an effect on their activities which affect non-point source pollutant loadings. The PL/SLWD will provide this effort as an in-kind service. The effort will consist of 40 hours. At $20/hour plus 20% for materials the in-kind cost of the survey is $960.

Costs for the monitoring program in 1993 dollars are estimated in Table 5-6. The costs include a monitoring report in year three. This report is necessary to analyze the year three monitoring data, and to make decisions regarding Spring Lake aeration and effectiveness of the projects.

TABLE 5-6

ESTIMATED COSTS FOR POST-IMPLEMENTATION MONITORING

Project	Estimated Cost
Lake Monitoring	$17,000
Wetland Monitoring	24,000
Ferric Chloride	3,500
Public Education Analysis	960
Year Three Monitoring Report	4,000
Microcosm Experiments	7,000

OVERALL PROJECT BENEFITS

The estimated benefits of the various alternatives evaluated in Section 4 were computed individually for each option, and are presented in Table 5-7. Phosphorus reduction benefits given in Table 5-7 reflect the total number of acres for which the incentive program will be applied. Numerical values for water quality improvements were developed for most of the plan elements. However, quantifying benefits is not possible with most administrative and educational efforts. The effectiveness of these efforts is dependent on enforcement and participation. Therefore, it is not possible to numerically predict the entire benefit from implementing the plan. However, most of the plan elements provide significant benefits and the administrative efforts build upon existing protection efforts and protect watershed features that enhance water quality. Predicted benefits in Table 5-7, show that the six-year project goals of reducing TP loading by 3,480 lbs/year to Spring Lake will be met. However, reducing TP loading in the direct watershed to Upper Prior Lake was not met. Therefore, the reduction goal for Spring Lake was increased by 800 lbs TP/year so that the overall loading to Upper Prior Lake was met. The TP loading reductions to Lower Prior Lake are met by meeting the goals for Spring Lake and Upper Prior Lake.

TABLE 5-7

TOTAL PHOSPHORUS REDUCTION BENEFITS FOR INDIVIDUAL IMPLEMENTATION PLAN ELEMENTS

Plan Element	Spring	TP Reduction[a] (lbs/year) Upper Prior	Lower Prior
Repaired Sediment Basin	350	--	--
Public Information/Education Program	--	--	--
Fertilizer Management Incentives	228	--	--
509 Plan Amendments	--	--	--
Conservation Tillage Equipment	209	--	--
Basin 1 Improvements	--	28	--
Basin 4 Improvements	--	--	10
Wetland Restoration	317	--	--
Ferric Chloride Chemical Feed System	890	--	--
Aeration of Spring	2,290	--	--
Continued Monitoring	--	--	--
Total	4,284	28[b]	10[b]

[a] At year six of program.

[b] Improvements to Spring Lake will reduce loadings to Upper and Lower Prior Lakes by an additional 1,510 and 1,020 lbs TP/year, respectively.

A phosphorus export rate of 0.19 lbs/ac/year from the monitoring data was used to determine the export from agricultural lands. A 50% reduction in phosphorus export from cropland was utilized to determine TP loading reductions for fertilizer incentives. The predicted benefits from this practice is conservative since TP reductions from fertilizer management typically ranges from 40 to 90%. Wetland restoration benefits were estimated by the WERM model as presented in Section 4. Total phosphorus reduction for aeration and ferric chloride addition were calculated manually. The benefit of ferric chloride addition was a 68% reduction in SRP (Walker 1992), while the benefit of aeration was estimated as 80% reduction of internal loading. No numerical benefit was assumed for the education program.

Overall Pollutant Loading

The net effect of the implementation plan will be a reduction in the overall phosphorus and sediment loading to Spring Lake. The combination of the restored sediment basin, conservation tillage, fertilizer management, wetland restoration, and ferric chloride addition will reduce external TP loads by approximately 2,000 lbs/year. This is approximately 40% of the watershed TP load estimated by Osgood (1983). In addition, the combination of aeration and iron addition in Spring Lake will significantly reduce phosphorus loading within the lake.

In addition to the reduced pollutant loadings to the project Lakes, there will be a decrease in pollutant loadings to the Minnesota River.

Lake Quality

Regardless of the reduction in subwatershed loadings, wetland removal efficiencies, and overall loading to the lakes, the most vital component to be considered is the overall change in the quality of the lakes. As detailed in the Diagnostic Study, the quality of both lakes will be dependent upon the concentration of phosphorus in the lakes. Long term TP concentration goals of 70 μg/l, 55 μg/l, and 40 were set for Spring, Upper Prior and Lower Prior Lakes, respectively. Based on the calculated loading reductions from the Implementation Plan, the modeling predicts average TP concentrations of 60 μg/l, 55 μg/l and 40 μg/l for Spring, Upper Prior, and Lower Prior Lakes, respectively. These estimates meet or exceed the project goals.

The reduction in algae blooms on the lakes is the goal which prompts the need for reducing phosphorus concentrations. The net effect of the project on algal blooms is an important consideration in evaluating the overall project benefits. Completing the implementation plan will reduce chlorophyll-a in Spring Lake from 46 μg/l to 25 μg/l (Heiskary and Wilson, 1990). In Upper Prior Lake the project will reduce the average chlorophyll-a concentration from 35 to 22 μg/l. These reductions will significantly reduce the frequency and severity of algal blooms. A reduction in algal blooms will also decrease the volume of organic matter which contributes to sediment oxygen demand. This is particularly important in Upper Prior Lake where the short hydraulic residence time of 0.3 years may allow flushing of the lake once external loads are significantly reduced. Reducing algal blooms will also increase water clarity. In fact, the improved conditions will be sufficient to change Spring Lake from non-supporting to partially supporting swimming. Water clarity in Upper Prior Lake is estimated to increase by 0.8 feet.

One of the consequences of improving water clarity may be an increase in the growth of aquatic macrophytes (weeds). Increased light penetration may allow weed growth into deeper waters. This consequence should, however, be viewed as improving the biological health and diversity of the lakes. This change will be addressed as part of the aquatic macrophyte management plans.

LEGAL AUTHORITY AND REQUIRED PERMITS

The PL/SLWD has the legal authority to implement the recommended 509 Plan amendments. Project sponsors also have the legal authority to raise the necessary capital and commit resources to the project. Public hearings and commitments by the various governing boards will be necessary before Phase 2 implementation. Permits required for construction elements are summarized in Table 5-8.

TABLE 5-8

REQUIRED PERMITS

Project	MDNR Permit	ACOE Permit
Basin 1 Improvements	X	X
Basin 4 Improvements	--	--
Aquascaping	X	--
Wetland Restoration	X	X
Ferric Chloride Feed System	X	--
Aeration	X	--

OPERATIONS AND MAINTENANCE

Some projects recommended for implementation require operation and maintenance costs. Projects requiring O &M costs during the first 10 years include the no-till drill, the ferric chloride system, and the aeration system. Operations and maintenance costs were included in the cost analysis of each alternative if required within a 10 year period. The total six year project budget for grant submittal, however, does not include O & M costs for the ferric chloride and aeration systems since these cost are not grant eligible. Water quality basin improvements and wetland restoration projects will require periodic maintenance. However, maintenance needs are not expected for 10 years. To identify maintenance needs these projects will be inspected at least once every five years. The aquascaping projects may also require periodic maintenance. This maintenance will be the responsibility of the home owner for a period of 10 years. One inspection will be completed once every five years to insure home owner maintenance.

ROLES AND RESPONSIBILITIES OF PROJECT PARTICIPANTS

The Prior Lake/Spring Lake Watershed District will have primary responsibility for Phase 2 implementation project. Additional sponsors will likely include the City of Prior Lake, Scott County SWCD, Scott County Extension, Scott County, Board of Soil and Water Resources, and MDNR.

Roles and responsibilities of the project sponsors have been identified in Tables 5-2, and the milestone schedule Table 5-9.

PROJECT SCHEDULE

A proposed implementation schedule has been developed for the six-year project duration. The proposed milestone schedule is presented in Table 5-9.

PROJECT BUDGET

The budget for the Prior Lake/Spring Lake improvement project has been established based on the estimated project costs and schedule. The estimated costs for the project elements calculated in Section 4 are based on 1993 costs. Because of the relatively long implementation schedule, an annual inflation rate of 5% was incorporated into outside services and construction projects to produce the six year project budget. Incentive payments and in-kind services were not adjusted by the inflation factor. Table 5-10 presents the budget for each of the project elements. A detailed budget spreadsheet is given in Appendix D.

TABLE 5-9

MILESTONE SCHEDULE FOR THE PRIOR LAKE/SPRING LAKE IMPROVEMENT PROJECT

Activity	Timeframe 1-6 Years	Responsible Group
Public Information/Education		
Baseline	1-6	PL/SLWD
Urban Fertilizer Workshops	1,4	Scott County Extension
Farm Fertilizer Workshops	3,4,5,6	Scott County Extension
Fertilizer Demonstrations	2,3	Scott County Extension
Soil Tests	1-6	PL/SLWD
Fact Sheets	1	Scott County/Scott County Extension
Newsletter	1-6	PL/SLWD
Slide Program	1	PL/SLWD
Displays	1	PL/SLWD
Press Releases	1-6	PL/SLWD
Tours	1,6	PL/SLWD
Yard Management Workshops	1,5	Scott County Extension
Coordination of Volunteers	1-6	PL/SLWD
Signage and Sweeping Notices	1-6	City of Prior Lake
Meetings/Conferences	1,6	PL/SLWD
Area Schools	1-6	PL/SLWD
Contests	1,2	PL/SLWD
Septic Maintenance Workshops	2,5	Scott County
Shoreline Workshop	2	Scott County Extension
Shoreline Fact Sheets	1	Scott County Extension
Fertilizer Management Incentives	3,4,5,6	Scott County Extension
Conservation Tillage Equipment	1-6	Scott County SWCD
Water Quality Basin Inventory	1	PL/SLWD
Aquatic Vegetation Management Plans	4	PL/SLWD and MDNR
Wetland Restoration	1-6	PL/SLWD, Scott County SWCD, BWSR
Ferric Chloride Addition	1-6	PL/SLWD
Spring Lake Aeration	4	PL/SLWD
Basin 1 Improvement	3	City of Prior Lake
Basin 4 Improvement	5	City of Prior Lake
Aquascaping	2-6	PL/SLWD/Scott County Extension
Spawning Area	2	MDNR
Monitoring	3,6	PL/SLWD
General Administration	1-6	PL/SLWD
Reports	1-6	PL/SLWD

TABLE 5-10

PRIOR LAKE/SPRING LAKE
BUDGET BY PROJECT ELEMENT

Element	Cost ($)
General Administration	43,020
Public Information/Education	66,170
Water Quality Basin Inventory	17,900
Fertilizer Management Incentives	28,000
Conservation Tillage Equipment	28,000
Aquascaping	5,000
Water Quality Basin Improvements	67,770
Wetland Restorations	117,690
Ferric Chloride Addition System	38,200
Aeration System	212,190
Lake-Wide Macrophyte Management Plans	25,220
Improvements to Northern Pike Spawning Area	960
Post-Implementation Monitoring	68,170
Preparation of Reports	55,780
Total	774,070

An overall administrative element was added to the project to covers costs incurred for the administration of the project grant. The presentation of reimbursement requests, attending project meetings, working with MPCA and EPA staff, recordkeeping, and report progress to MPCA and EPA will be included under this project element. The budgeted monthly effort for general grant administration is 12 hours per month at $20/hr and 20% other direct costs. The resulting annual in-kind budget for general administration is $3,456. An additional four hours per month will be necessary from outside services at $65 per hour for a total of $3,120 per year.

An element for reports was also added to the project budget. Progress reports, as required by the project grant, will be prepared by District staff under this budget element. The estimated person-hours required annually are 40 hours. At $20/hour plus 20% for materials the estimated in-kind cost is $960/year. Forty hours of outside services will also be necessary each year. Based on a cost rate of $74 per hour, a total outside labor cost of $2,960 annually is anticipated plus $200 annually for supplies and travel. This element includes an additional $7,000 for development of the Phase 2 work plan, and $15,000 (1993 dollars) for the final project report.

Operation/Maintenance. Operation and maintenance costs associated with the projects will be incurred for the ferric chloride addition system and the aeration system. These costs are not grant eligible and therefore are not included in the budget, are estimated at $7,400 per year for the ferric chloride system and $25,000 for the aeration system. Over the six year project duration O & M costs will equal $144,580.

PROJECT FUNDING

The funding for the Prior Lake/Spring Lake project will be a combination of grant, in-kind, and local cash services. Since no decision has yet been made to pursue a Phase 2 project, it is premature to include the financial commitments of the local project sponsors. Prior to any grant submittal, however, financial commitments of all sponsors will be developed negotiated and approved. Local project sponsors will likely include the PL/SLWD, the City of Prior Lake, Scott County Extension, Scott County, Scott County SWCD, MDNR, and the Board of Water and Soil Resources. The total estimated project cost is $774,070. A 50% cost share will be requested from grants. In-kind local services total $134,100. The local 50% share of $387,035 minus in-kind services gives a necessary cash contribution by local sponsors of $252,935. Local sponsors would also be responsible for O&M costs of $144,580 for the project duration.

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Appendix A

MONTGOMERY WATSON

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

DESCRIPTIVE PARAGRAPH

AREA: 279 HA	SHORE L: 4.70 MI	ECOL CLASS: 4-1973 -			
AV DEPTH: 4.9 M	USE OF SHORELINE:	MGMT CLASS: 3-1973 -			
MX DEPTH: 12 M	FOR 30% AGR 5%	ROUGHFISH: 2		LANDSAT TYPE: -	
VOL: 1.37E07 M3	MUN 65% MRSH 0%	WQ INDEX: -		CHLOR IND: -	
LITTORAL: 55 %	# DWELL: 36-1980	SENS IND: -		SECCHI IND: -	
DEPTH ROOTED	# RESORTS: -	RANK IND: -		T-PHOS IND: -	
VEG: 4 M	AC/MI: 147	PROBLEMS:	SOME SMRKL 1973		
DOM SHOL SOIL:	DWELL/MI: 8		HVY ALGAE BLMS 1973		
SAND-SAND	AC/DWELL: 19				
PUB ACC #: 1	WTRSHED AREA: 18.0 SQ MI				
ADMIN: DNR-E	GEOM REG: - - - -				
POPULATION	SLU: - - - -				
1 MI: 0	LAND USE: WTR 5% MRSH 5%				
5 MI: 5998	FOR 6% CUL 59% RES 6%	LKMAP: C796			
10 MI: 24553	URB 1% PASTURE/OPEN 18%	QUAD1: PRIOR LAKE			

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

INITIAL DATE				48/09/18	54/07/12	73/07/09	73/07/09	73/07/09	73/07/09	73/07/09	73/07/09	73/07/09
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	5	10	15	17	20	22
00010	WATER	TEMP	CENT			25.3$	25.0$	25.0$	24.7$	24.4$	22.2$	18.9$
00011	WATER	TEMP	FAHN			77.5	77.0	77.0	76.5	76.0	72.0	66.0
00029	FIELD	IDENT	NUMBER	300	300	300	300	300	300	300	300	300
00078	TRANSP	SECCHI	METERS	.76	1.22	.91						
00300	DO		MG/L			6.2	7.8	7.2	6.7		4.0	.0
00301	DO	SATUR	PERCENT			73.8$	92.9$	85.7$	79.8$		45.5$	.0$
00410	T ALK	CACO3	MG/L		158							
00600	TOTAL N	N	MG/L		3.84							
00665	PHOS-TOT		MG/L P		.171							
00945	SULFATE	SO4-TOT	MG/L		20							

INITIAL DATE				73/07/09	73/07/09	73/07/09	79/07/18	79/07/30	79/08/14	79/08/18	79/09/08	79/09/26
INITIAL TIME							1930	2030		2030	2030	
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				25	30	33	0	0	0	0	0	0
00005	VSAMPLOC	DEPTH	% OF TOT				0		0		0	0
00008	LAB	IDENT.	NUMBER				123990		123205		123388	123530
00010	WATER	TEMP	CENT	17.2$	15.6$	14.4$						
00011	WATER	TEMP	FAHN	63.0	60.0	58.0						
00029	FIELD	IDENT	NUMBER	300	300	300	201	201	201	201	201	201
00078	TRANSP	SECCHI	METERS				.74	.94		.91	.94	
00080	COLOR	PT-CO	UNITS				30		45		30	30
00300	DO		MG/L	.0	.0							
00301	DO	SATUR	PERCENT	.0$	.0$							
00625	TOT KJEL	N	MG/L				1.890J		1.700J		1.770J	1.570J
00665	PHOS-TOT		MG/L P				.068		.095		.107	.101
74041	WQF	SAMPLE	UPDATED				870130	870130		870130	870130	

INITIAL DATE				79/10/26	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03
INITIAL TIME				1900	1015	1015	1015	1015	1015	1015	1015	1015
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	3	6	9	13	16	19	22
00010	WATER	TEMP	CENT		19.5	19.5	19.0	18.0	17.0	14.0	13.0	12.0
00011	WATER	TEMP	FAHN		67.1$	67.1$	66.2$	64.4$	62.6$	57.2$	55.4$	53.6$
00029	FIELD	IDENT	NUMBER	201	401	401	401	401	401	401	401	401

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE				79/10/26	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03
INITIAL TIME				1900	1015	1015	1015	1015	1015	1015	1015	1015
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	3	6	9	13	16	19	22
00078	TRANSP	SECCHI	METERS	1.14		1.20						
00095	CNDUCTVY	AT 25C	MICROMHO			360						
00098	VSAMPLOC	DEPTH	METERS		.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300	DO		MG/L		11.0	11.0	10.4	10.0	4.2	.0	.0	.0
00301	DO	SATUR	PERCENT		117.0$	117.0$	110.6$	105.3$	43.3$	.0$	.0$	.0$
00403	PH	LAB	SU			8.5						
00625	TOT KJEL	N	MG/L			1.640						
00630	NO2&NO3	N-TOTAL	MG/L			.05K						
00665	PHOS-TOT		MG/L P			.120						
00666	PHOS-DIS		MG/L P			.080						
32210	CHLRPHYL	A	UG/L			4.10						
74041	WQF	SAMPLE	UPDATED	870130		870213						

INITIAL DATE				80/06/03	80/06/03	80/07/07	80/07/07	80/07/07	80/07/07	80/07/07	80/07/07	80/07/07
INITIAL TIME				1015	1015	1035	1035	1035	1035	1035	1035	1035
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				29	32	0	3	6	9	13	16	19
00010	WATER	TEMP	CENT		12.0	22.0	21.0	21.0	20.5	20.0	18.0	17.5
00011	WATER	TEMP	FAHN		53.6$	71.6$	69.8$	69.8$	68.9$	68.0$	64.4$	63.5$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS				3.20					
00095	CNDUCTVY	AT 25C	MICROMHO	420			425					
00098	VSAMPLOC	DEPTH	METERS	9.00	10.00	.00	1.00	2.00	3.00	4.00	5.00	6.00
00300	DO		MG/L		.0	8.4	8.4	8.0	7.4	6.6	2.5	1.0
00301	DO	SATUR	PERCENT		.0$	95.5$	93.3$	88.9$	80.4$	71.7$	26.3$	10.3$
00403	PH	LAB	SU	7.3			7.8					
00410	T ALK	CACO3	MG/L				196					
00610	NH3+NH4-	N TOTAL	MG/L				.540					
00612	UN-IONZD	NH3-N	MG/L				.014$					
00619	UN-IONZD	NH3-NH3	MG/L				.017$					
00625	TOT KJEL	N	MG/L				2.180					
00630	NO2&NO3	N-TOTAL	MG/L				.05					
00665	PHOS-TOT		MG/L P				.290					
00666	PHOS-DIS		MG/L P				.240					
00900	TOT HARD	CACO3	MG/L				234					
32210	CHLRPHYL	A	UG/L				12.00					
74041	WQF	SAMPLE	UPDATED				870213					

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE			80/07/07	80/07/07	80/07/07	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05
INITIAL TIME			1035	1035	1035	1120	1120	1120	1120	1120	1120
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			22	29	32	0	0.983999	3	6	9	13
00010 WATER	TEMP	CENT	17.0		11.0	23.5		23.5	23.5	23.5	23.5
00011 WATER	TEMP	FAHN	62.6$		51.8$	74.3$		74.3$	74.3$	74.3$	74.3$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00076 TURB	TRBIDMTR	HACH FTU					10.0				
00078 TRANSP	SECCHI	METERS						1.40			
00095 CNDUCTVY	AT 25C	MICROMHO		465			440	440			
00098 VSAMPLOC	DEPTH	METERS	7.00	9.00	10.00	.00	.30	1.00	2.00	3.00	4.00
00300 DO		MG/L	.2		.2	7.0		6.8	6.8	6.6	6.5
00301 DO	SATUR	PERCENT	2.1$		1.8$	80.5$		78.2$	78.2$	75.9$	74.7$
00403 PH	LAB	SU		7.3				8.8			
00530 RESIDUE	TOT NFLT	MG/L					7				
00535 RESIDUE	VOL NFLT	MG/L					5				
00625 TOT KJEL	N	MG/L						1.740			
00630 NO2&NO3	N-TOTAL	MG/L						.05K			
00665 PHOS-TOT		MG/L P						.250			
00666 PHOS-DIS		MG/L P						.210			
00940 CHLORIDE	TOTAL	MG/L					20				
01002 ARSENIC	AS,TOT	UG/L					11				
01007 BARIUM	BA,TOT	UG/L					65				
01022 BORON	B,TOT	UG/L					.2				
01027 CADMIUM	CD,TOT	UG/L					.3				
01034 CHROMIUM	CR,TOT	UG/L					.3				
01042 COPPER	CU,TOT	UG/L					5				
01045 IRON	FE,TOT	UG/L					50K				
01051 LEAD	PB,TOT	UG/L					4				
01055 MANGNESE	MN	UG/L					200.0				
01067 NICKEL	NI,TOTAL	UG/L					9				
01092 ZINC	ZN,TOT	UG/L					12				
01105 ALUMINUM	AL,TOT	UG/L					51				
32210 CHLRPHYL	A	UG/L						21.00			
71900 MERCURY	HG,TOTAL	UG/L					.2				
74041 WQF	SAMPLE	UPDATED						870213			

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

	INITIAL DATE			80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/09/15	80/09/15
	INITIAL TIME			1120	1120	1120	1120	1120	1120	1120	1000	1000
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			16	19	22	26	29	29.52	32	0	3
00010	WATER	TEMP	CENT	23.5	23.5	23.0	23.0	17.0		16.0	19.0	19.0
00011	WATER	TEMP	FAHN	74.3$	74.3$	73.4$	73.4$	62.6$		60.8$	66.2$	66.2$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00076	TURB	TRBIDMTR	HACH FTU						10.0			
00078	TRANSP	SECCHI	METERS									.90
00095	CNDUCTVY	AT 25C	MICROMHO					495	499			360
00098	VSAMPLOC	DEPTH	METERS	5.00	6.00	7.00	8.00	9.00	9.00	10.00	.00	1.00
00300	DO		MG/L	6.5	6.2	6.8	1.0	.0		.0	5.8	5.0
00301	DO	SATUR	PERCENT	74.7$	71.3$	78.2$	11.5$	.0$		.0$	61.7$	53.2$
00403	PH	LAB	SU					7.2				8.4
00530	RESIDUE	TOT NFLT	MG/L						2			
00535	RESIDUE	VOL NFLT	MG/L						1			
00625	TOT KJEL	N	MG/L									2.140
00630	NO2&NO3	N-TOTAL	MG/L									.05K
00665	PHOS-TOT		MG/L P									.290
00666	PHOS-DIS		MG/L P									.220
00940	CHLORIDE	TOTAL	MG/L						22			
01002	ARSENIC	AS,TOT	UG/L						12			
01007	BARIUM	BA,TOT	UG/L						150			
01022	BORON	B,TOT	UG/L						.1			
01027	CADMIUM	CD,TOT	UG/L						.3			
01034	CHROMIUM	CR,TOT	UG/L						.6			
01042	COPPER	CU,TOT	UG/L						4			
01045	IRON	FE,TOT	UG/L						100			
01051	LEAD	PB,TOT	UG/L						5			
01055	MANGNESE	MN	UG/L						3200.0			
01067	NICKEL	NI,TOTAL	UG/L						9			
01092	ZINC	ZN,TOT	UG/L						8			
01105	ALUMINUM	AL,TOT	UG/L						2			
32210	CHLRPHYL	A	UG/L									40.00
71900	MERCURY	HG,TOTAL	UG/L						.2			
74041	WQF	SAMPLE	UPDATED									870213

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE	80/09/15	80/09/15	80/09/15	80/09/15	80/09/15	80/09/15	80/09/15	80/09/15	81/05/07
INITIAL TIME	1000	1000	1000	1000	1000	1000	1000	1000	1055
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	6	9	13	16	19	22	29	32	0
00010 WATER TEMP CENT	19.0	19.0	19.0	19.0	19.0	19.0		18.5	14.5
00011 WATER TEMP FAHN	66.2$	66.2$	66.2$	66.2$	66.2$	66.2$		65.3$	58.1$
00029 FIELD IDENT NUMBER	401	401	401	401	401	401	401	401	401
00078 TRANSP SECCHI METERS									5.60
00095 CNDUCTVY AT 25C MICROMHO							360		435
00098 VSAMPLOC DEPTH METERS	2.00	3.00	4.00	5.00	6.00	7.00	9.00	10.00	.00
00300 DO MG/L	4.8	4.7	4.7	4.8	4.7	4.5		3.4	9.8
00301 DO SATUR PERCENT	51.1$	50.0$	50.0$	51.1$	50.0$	47.9$		35.8$	94.2$
00403 PH LAB SU							8.4		8.2
00410 T ALK CACO3 MG/L									193
00610 NH3+NH4- N TOTAL MG/L									.140
00612 UN-IONZD NH3-N MG/L									.006$
00619 UN-IONZD NH3-NH3 MG/L									.007$
00625 TOT KJEL N MG/L									1.800
00630 NO2&NO3 N-TOTAL MG/L									.10
00665 PHOS-TOT MG/L P									.108
00666 PHOS-DIS MG/L P									.084
32210 CHLRPHYL A UG/L									4.60

INITIAL DATE	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07
INITIAL TIME	1055	1055	1055	1055	1055	1055	1055	1055	1055
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	3.28	6.56	9.84	13.12	16.4	19.68	22.96	26.24	29.52
00010 WATER TEMP CENT	14.0	14.0	13.5	13.5	13.0	13.0	13.0	13.0	12.5
00011 WATER TEMP FAHN	57.2$	57.2$	56.3$	56.3$	55.4$	55.4$	55.4$	55.4$	54.5$
00029 FIELD IDENT NUMBER	401	401	401	401	401	401	401	401	401
00095 CNDUCTVY AT 25C MICROMHO									435
00098 VSAMPLOC DEPTH METERS	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
00300 DO MG/L	9.8	9.2	8.9	8.5	18.2	8.1	7.6	7.2	5.6
00301 DO SATUR PERCENT	94.2$	88.5$	84.0$	80.2$	171.7$	76.4$	71.7$	67.9$	51.9$
00403 PH LAB SU									7.9
00665 PHOS-TOT MG/L P									.095

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

INITIAL DATE			81/05/07	81/06/05	81/06/05	81/06/05	81/06/05	81/06/05	81/06/05	81/06/05	81/06/05
INITIAL TIME			1055	1024	1024	1024	1024	1024	1024	1024	1024
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			32.8	0	3.28	6.56	9.84	13.12	16.4	19.68	22.96
00010 WATER	TEMP	CENT	12.0	20.5	20.5	20.0	19.5	19.5	19.0	18.0	17.0
00011 WATER	TEMP	FAHN	53.6$	68.9$	68.9$	68.0$	67.1$	67.1$	66.2$	64.4$	62.6$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS		2.20							
00095 CNDUCTVY	AT 25C	MICROMHO		445							
00098 VSAMPLOC	DEPTH	METERS	10.00	.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300 DO		MG/L	1.8	11.3	11.1	10.6	9.7	9.3	8.6	6.3	4.0
00301 DO	SATUR	PERCENT	16.7$	122.8$	120.7$	115.2$	103.2$	98.9$	91.5$	66.3$	41.2$
00403 PH	LAB	SU		8.5							
00625 TOT KJEL	N	MG/L		1.820							
00665 PHOS-TOT		MG/L P		.101							
00666 PHOS-DIS		MG/L P		.053							
32210 CHLRPHYL	A	UG/L		42.00							

INITIAL DATE			81/06/05	81/06/05	81/06/05	81/06/12	81/06/17	81/06/26	81/06/27	81/07/03	81/07/06
INITIAL TIME			1024	1024	1024	1700	1700	1518	0001	1600	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			26.24	29.52	32.8	0	0	0	0	0	0
00008 LAB	IDENT.	NUMBER							123987		123075
00010 WATER	TEMP	CENT	14.5	13.5	13.0						
00011 WATER	TEMP	FAHN	58.1$	56.3$	55.4$						
00029 FIELD	IDENT	NUMBER	401	401	401	201	201	201	201	201	201
00078 TRANSP	SECCHI	METERS				3.05	1.22	.00		1.22	
00080 COLOR	PT-CO	UNITS							5		30
00095 CNDUCTVY	AT 25C	MICROMHO		500							
00098 VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00						
00300 DO		MG/L	.5	.3	.2						
00301 DO	SATUR	PERCENT	4.8$	2.8$	1.9$						
00403 PH	LAB	SU		7.7							
00625 TOT KJEL	N	MG/L							7.520J		2.530J
00665 PHOS-TOT		MG/L P		.375					.548		.990

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE			81/07/07	81/07/07	81/07/07	81/07/07	81/07/07	81/07/07	81/07/07	81/07/07	81/07/07
INITIAL TIME			1030	1030	1030	1030	1030	1030	1030	1030	1030
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	3.28	6.56	9.84	13.12	16.4	19.68	22.96	26.24
00010 WATER	TEMP	CENT	28.5	28.5	26.0	23.0	22.0	20.5	20.0	19.5	19.5
00011 WATER	TEMP	FAHN	83.3$	83.3$	78.8$	73.4$	71.6$	68.9$	68.0$	67.1$	67.1$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS	.60								
00095 CNDUCTVY	AT 25C	MICROMHO	360								
00098 VSAMPLOC	DEPTH	METERS	.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
00300 DO		MG/L	14.7	13.5	8.5	5.1	3.7	2.8	2.0	.3	.3
00301 DO	SATUR	PERCENT	186.1$	170.9$	103.7$	58.6$	42.0$	30.4$	21.7$	3.2$	3.2$
00403 PH	LAB	SU	8.6								
00410 T ALK	CACO3	MG/L	141								
00610 NH3+NH4-	N TOTAL	MG/L	.140								
00612 UN-IONZD	NH3-N	MG/L	.031$								
00619 UN-IONZD	NH3-NH3	MG/L	.038$								
00625 TOT KJEL	N	MG/L	3.160								
00630 NO2&NO3	N-TOTAL	MG/L	.05K								
00665 PHOS-TOT		MG/L P	.130								
00666 PHOS-DIS		MG/L P	.030								
32210 CHLRPHYL	A	UG/L	135.00								

INITIAL DATE			81/07/07	81/07/07	81/07/08	81/07/08	81/07/15	81/07/19	81/07/23	81/07/24	81/07/29
INITIAL TIME			1030	1030	1210	1630	1930	0001	1730	1800	1300
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			29.52	32.8	0	0	0	0	0	0	0
00008 LAB	IDENT.	NUMBER						123116			
00010 WATER	TEMP	CENT	19.0	18.5							
00011 WATER	TEMP	FAHN	66.2$	65.3$							
00029 FIELD	IDENT	NUMBER	401	401	201	201	201	201	201	201	201
00078 TRANSP	SECCHI	METERS			.61	2.44	3.05		1.83	1.22	.61
00080 COLOR	PT-CO	UNITS						20			
00095 CNDUCTVY	AT 25C	MICROMHO	475								
00098 VSAMPLOC	DEPTH	METERS	9.00	10.00							
00300 DO		MG/L	.2	.2							
00301 DO	SATUR	PERCENT	2.1$	2.1$							
00403 PH	LAB	SU	7.2								

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			81/07/07	81/07/07	81/07/08	81/07/08	81/07/15	81/07/19	81/07/23	81/07/24	81/07/29
INITIAL TIME			1030	1030	1210	1630	1930	0001	1730	1800	1300
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			29.52	32.8	0	0	0	0	0	0	0
00625 TOT KJEL	N	MG/L						1.640J			
00665 PHOS-TOT		MG/L P	.270					.094			

INITIAL DATE			81/08/01	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04
INITIAL TIME			1430	1040	1040	1040	1040	1040	1040	1040	1040
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	3.28	6.56	9.84	13.12	16.4	19.68	22.96
00010 WATER	TEMP	CENT		25.0	24.5	24.0	24.0	23.5	22.5	22.5	21.0
00011 WATER	TEMP	FAHN		77.0$	76.1$	75.2$	75.2$	74.3$	72.5$	72.5$	69.8$
00029 FIELD	IDENT	NUMBER	201	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS	.76	2.40							
00095 CNDUCTVY	AT 25C	MICROMHO		420							450
00098 VSAMPLOC	DEPTH	METERS		.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300 DO		MG/L		7.8	7.0	6.4	5.7	4.3	1.9	1.5	.3
00301 DO	SATUR	PERCENT		92.9$	82.4$	75.3$	67.1$	49.4$	21.6$	17.0$	3.3$
00403 PH	LAB	SU		8.1							7.5
00625 TOT KJEL	N	MG/L		1.720							
00665 PHOS-TOT		MG/L P		.170							.290
00666 PHOS-DIS		MG/L P		.110							
32210 CHLRPHYL	A	UG/L		25.00							

INITIAL DATE			81/08/04	81/08/04	81/08/04	81/08/14	81/08/19	81/08/25	81/08/29	81/08/30	81/09/02
INITIAL TIME			1040	1040	1040	1417	1630	1030	0001	1830	1055
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			26.24	29.52	32.8	0	0	0	0	0	0
00008 LAB	IDENT.	NUMBER							123452		
00010 WATER	TEMP	CENT	20.0	18.5	18.0						21.0
00011 WATER	TEMP	FAHN	68.0$	65.3$	64.4$						69.8$
00029 FIELD	IDENT	NUMBER	401	401	401	201	201	201	201	201	401
00078 TRANSP	SECCHI	METERS				2.29	.76	.61		1.37	2.30
00080 COLOR	PT-CO	UNITS							25		
00095 CNDUCTVY	AT 25C	MICROMHO									355
00098 VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00						.00
00300 DO		MG/L	.2	.2	.2						8.0
00301 DO	SATUR	PERCENT	2.2$	2.1$	2.1$						88.9$
00403 PH	LAB	SU									8.2
00410 T ALK	CACO3	MG/L									171

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			81/08/04	81/08/04	81/08/04	81/08/14	81/08/19	81/08/25	81/08/29	81/08/30	81/09/02
INITIAL TIME			1040	1040	1040	1417	1630	1030	0001	1830	1055
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			26.24	29.52	32.8	0	0	0	0	0	0
00610 NH3+NH4-	N TOTAL	MG/L									.360
00612 UN-IONZD	NH3-N	MG/L									.023$
00619 UN-IONZD	NH3-NH3	MG/L									.028$
00625 TOT KJEL	N	MG/L							1.720J		1.820
00630 NO2&NO3	N-TOTAL	MG/L									.20
00665 PHOS-TOT		MG/L P							.264		.195
00666 PHOS-DIS		MG/L P									.150
32210 CHLRPHYL	A	UG/L									35.00

INITIAL DATE			81/09/02	81/09/02	81/09/02	81/09/02	81/09/02	81/09/02	81/09/02	81/09/02	81/09/02
INITIAL TIME			1055	1055	1055	1055	1055	1055	1055	1055	1055
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			3.28	6.56	9.84	13.12	16.4	19.68	22.96	26.24	29.52
00010 WATER	TEMP	CENT	21.0	21.0	21.0	21.0	21.0	21.0	21.0	20.5	20.0
00011 WATER	TEMP	FAHN	69.8$	69.8$	69.8$	69.8$	69.8$	69.8$	69.8$	68.9$	68.0$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00095 CNDUCTVY	AT 25C	MICROMHO									355
00098 VSAMPLOC	DEPTH	METERS	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
00300 DO		MG/L	6.8	6.4	5.7	5.3	5.2	5.2	4.7	4.7	1.3
00301 DO	SATUR	PERCENT	75.6$	71.1$	63.3$	58.9$	57.8$	57.8$	52.2$	51.1$	14.1$
00403 PH	LAB	SU									7.8
00665 PHOS-TOT		MG/L P									.310

INITIAL DATE			81/09/02	81/09/05	81/09/13	81/09/20	81/09/27	81/10/10	82/01/19	82/01/19	82/01/19
INITIAL TIME			1055	1530	1510	1333	1641	1330	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			32.8	0	0	0	0	0	0	3	26
00008 LAB	IDENT.	NUMBER					123618				
00010 WATER	TEMP	CENT	19.5						1.5		2.0
00011 WATER	TEMP	FAHN	67.1$						34.7$		35.6$
00029 FIELD	IDENT	NUMBER	401	201	201	201	201	201	401	401	401
00078 TRANSP	SECCHI	METERS		1.22	.61	.91	1.37	.61			
00080 COLOR	PT-CO	UNITS					5K				
00095 CNDUCTVY	AT 25C	MICROMHO							425		460
00098 VSAMPLOC	DEPTH	METERS	10.00						.00	1.00	8.00
00300 DO		MG/L	.3						10.2		
00301 DO	SATUR	PERCENT	3.2$						71.8$		

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			81/09/02	81/09/05	81/09/13	81/09/20	81/09/27	81/10/10	82/01/19	82/01/19	82/01/19
	INITIAL TIME			1055	1530	1510	1333	1641	1330	0001	0001	0001
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			32.8	0	0	0	0	0	0	3	26
00403	PH	LAB	SU							7.5		7.5
00625	TOT KJEL	N	MG/L					46.300J		1.440		
00665	PHOS-TOT		MG/L P					3.460		.050		.050
00666	PHOS-DIS		MG/L P							.040		
31613	FEC COLI	M-FCAGAR	/100ML								1K	
31673	FECSTREP	MFKFAGAR	/100ML								45	
32210	CHLRPHYL	A	UG/L							12.00		
82028	RATIO	FEC COL	FEC STRP								.02$	

	INITIAL DATE			82/01/19	82/01/19	82/01/19	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22
	INITIAL TIME			0002	0002	0003	0001	0001	0001	0001	0001	0001
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	13	0	0	3	6	9	13	16
00010	WATER	TEMP	CENT	1.0	2.0	1.0	6.5	6.5	6.0	6.0	6.0	6.0
00011	WATER	TEMP	FAHN	33.8$	35.6$	33.8$	43.7$	43.7$	42.8$	42.8$	42.8$	42.8$
00029	FIELD	IDENT	NUMBER	402	402	403	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS				1.20					
00094	CNDUCTVY	FIELD	MICROMHO				480	485	490	490	490	490
00098	VSAMPLOC	DEPTH	METERS	.00	4.00	.00	.00	1.00	2.00	3.00	4.00	5.00
00300	DO		MG/L	10.9		11.2	13.2	13.0	11.4	10.8	10.2	9.7
00301	DO	SATUR	PERCENT	76.8$		78.9$	105.6$	104.0$	91.2$	86.4$	81.6$	77.6$
00403	PH	LAB	SU				8.3					
00623	KJELDL N	DISS	MG/L				1.560					
00625	TOT KJEL	N	MG/L	1.460		1.460	1.660					
00665	PHOS-TOT		MG/L P	.050	.050	.060	.123					
00666	PHOS-DIS		MG/L P				.033					
31613	FEC COLI	M-FCAGAR	/100ML					1K				
31673	FECSTREP	MFKFAGAR	/100ML					3				
32210	CHLRPHYL	A	UG/L	15.00		1.90	80.00					
82028	RATIO	FEC COL	FEC STRP					.3$				

	INITIAL DATE			82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22
	INITIAL TIME			0001	0001	0001	0001	0001	0002	0002	0002	0002
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			19	22	26	29	32	0	3	6	9
00010	WATER	TEMP	CENT	6.0	5.5	5.5	5.5	5.5	6.5	6.0	6.0	6.0
00011	WATER	TEMP	FAHN	42.8$	41.9$	41.9$	41.9$	41.9$	43.7$	42.8$	42.8$	42.8$

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22
	INITIAL TIME			0001	0001	0001	0001	0001	0002	0002	0002	0002
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			19	22	26	29	32	0	3	6	9
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	402	402	402	402
00078	TRANSP	SECCHI	METERS						1.10			
00094	CNDUCTVY	FIELD	MICROMHO	490	500	500	500	500				
00098	VSAMPLOC	DEPTH	METERS	6.00	7.00	8.00	9.00	10.00	.00	1.00	2.00	3.00
00300	DO		MG/L	9.3	8.8	8.6	7.8	6.2	13.4	12.8	12.2	12.2
00301	DO	SATUR	PERCENT	74.4$	68.8$	67.2$	60.9$	48.4$	107.2$	102.4$	97.6$	97.6$
00403	PH	LAB	SU				8.0		8.3			
00625	TOT KJEL	N	MG/L						1.760			
00665	PHOS-TOT		MG/L P				.090		.110			
32210	CHLRPHYL	A	UG/L						74.00			

	INITIAL DATE			82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/04/22	82/05/03	82/05/03	82/05/03
	INITIAL TIME			0002	0002	0002	0003	0003	0003	0001	0001	0001
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			13	16	19	0	3	6	0	3	6
00010	WATER	TEMP	CENT	6.0	5.5	5.5	6.0	6.0	6.0	13.0	13.0	13.0
00011	WATER	TEMP	FAHN	42.8$	41.9$	41.9$	42.8$	42.8$	42.8$	55.4$	55.4$	55.4$
00029	FIELD	IDENT	NUMBER	402	402	402	403	403	403	401	401	401
00078	TRANSP	SECCHI	METERS				1.20			1.70		
00094	CNDUCTVY	FIELD	MICROMHO							405	410	410
00098	VSAMPLOC	DEPTH	METERS	4.00	5.00	6.00	.00	1.00	2.00	.00	1.00	2.00
00300	DO		MG/L	11.4	10.8	9.6	13.4	12.6	12.2	15.8	15.8	15.4
00301	DO	SATUR	PERCENT	91.2$	84.4$	75.0$	107.2$	100.8$	97.6$	149.1$	149.1$	145.3$
00403	PH	LAB	SU		8.1		8.3			8.9		
00623	KJELDL N	DISS	MG/L							1.770		
00625	TOT KJEL	N	MG/L				1.960			2.310		
00665	PHOS-TOT		MG/L P		.100		.100			.053		
00666	PHOS-DIS		MG/L P							.033		
31613	FEC COLI	M-FCAGAR	/100ML								1K	
31673	FECSTREP	MFKFAGAR	/100ML								2	
32210	CHLRPHYL	A	UG/L				64.00			20.00		
82028	RATIO	FEC COL	FEC STRP								.5$	

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

INITIAL DATE			82/05/03	82/05/03	82/05/03	82/05/03	82/05/03	82/05/03	82/05/03	82/05/03	82/05/03
INITIAL TIME			0001	0001	0001	0001	0001	0001	0001	0001	0002
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			9	13	16	19	22	26	29	32	0
00010 WATER	TEMP	CENT	12.5	12.0	10.0	10.0	9.5	9.0	8.5	8.0	13.5
00011 WATER	TEMP	FAHN	54.5$	53.6$	50.0$	50.0$	49.1$	48.2$	47.3$	46.4$	56.3$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	402
00078 TRANSP	SECCHI	METERS									1.60
00094 CNDUCTVY	FIELD	MICROMHO	420	425	435	440	455	465	470	475	
00098 VSAMPLOC	DEPTH	METERS	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	.00
00300 DO		MG/L	16.0	15.6	15.4	12.3	10.2	7.4	5.5	2.4	16.0
00301 DO	SATUR	PERCENT	148.1$	144.4$	136.3$	108.9$	87.9$	63.8$	46.2$	20.2$	150.9$
00403 PH	LAB	SU							8.0		8.8
00625 TOT KJEL	N	MG/L									1.560
00665 PHOS-TOT		MG/L P							.070		.050
32210 CHLRPHYL	A	UG/L									21.00

INITIAL DATE			82/05/03	82/05/03	82/05/03	82/05/03	82/05/03	82/05/03	82/05/03	82/05/03	82/05/03
INITIAL TIME			0002	0002	0002	0002	0002	0002	0003	0003	0003
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			3	6	9	13	16	19	0	3	6
00010 WATER	TEMP	CENT	13.5	13.5	12.5	10.0	9.0	9.0	13.0	13.0	13.0
00011 WATER	TEMP	FAHN	56.3$	56.3$	54.5$	50.0$	48.2$	48.2$	55.4$	55.4$	55.4$
00029 FIELD	IDENT	NUMBER	402	402	402	402	402	402	403	403	403
00098 VSAMPLOC	DEPTH	METERS	1.00	2.00	3.00	4.00	5.00	6.00	.00	1.00	2.00
00300 DO		MG/L	15.8	15.8	15.3	13.0	10.0	6.0	15.6	15.4	15.0
00301 DO	SATUR	PERCENT	149.1$	149.1$	141.7$	115.0$	86.2$	51.7$	147.2$	145.3$	141.5$
00403 PH	LAB	SU					8.5		8.9		
00625 TOT KJEL	N	MG/L							1.640		
00665 PHOS-TOT		MG/L P					.050		.060		
32210 CHLRPHYL	A	UG/L							23.00		

INITIAL DATE			82/05/03	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13
INITIAL TIME			0003	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			9	0	3	6	9	13	16	19	22
00010 WATER	TEMP	CENT	10.0	16.0	16.0	15.5	15.0	15.0	15.0	15.0	14.5
00011 WATER	TEMP	FAHN	50.0$	60.8$	60.8$	59.9$	59.0$	59.0$	59.0$	59.0$	58.1$

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE				82/05/03	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13
INITIAL TIME				0003	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				9	0	3	6	9	13	16	19	22
00029	FIELD	IDENT	NUMBER	403	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS		4.40							
00094	CNDUCTVY	FIELD	MICROMHO		410	425	425	435	435	435	435	445
00098	VSAMPLOC	DEPTH	METERS	3.00	.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300	DO		MG/L	9.0	9.8	9.5	9.0	9.0	8.2	7.5	6.7	5.8
00301	DO	SATUR	PERCENT	79.6$	98.0$	95.0$	88.2$	88.2$	80.4$	73.5$	65.7$	55.8$
00403	PH	LAB	SU		8.4							
00623	KJELDL N	DISS	MG/L		1.780							
00625	TOT KJEL	N	MG/L		1.570							
00665	PHOS-TOT		MG/L P		.037							
00666	PHOS-DIS		MG/L P		.047							
31613	FEC COLI	M-FCAGAR	/100ML			1K						
31673	FECSTREP	MFKFAGAR	/100ML			5						
32210	CHLRPHYL	A	UG/L		5.40							
82028	RATIO	FEC COL	FEC STRP			.2$						

INITIAL DATE				82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/13
INITIAL TIME				0001	0001	0001	0002	0002	0002	0002	0002	0002
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				26	29	32	0	3	6	9	13	16
00010	WATER	TEMP	CENT	13.5	10.0	9.0	16.0	16.0	15.5	15.5	15.0	15.0
00011	WATER	TEMP	FAHN	56.3$	50.0$	48.2$	60.8$	60.8$	59.9$	59.9$	59.0$	59.0$
00029	FIELD	IDENT	NUMBER	401	401	401	402	402	402	402	402	402
00078	TRANSP	SECCHI	METERS				4.30					
00094	CNDUCTVY	FIELD	MICROMHO	450	495	495						
00098	VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00	.00	1.00	2.00	3.00	4.00	5.00
00300	DO		MG/L	4.4	1.6	1.2	9.5	9.1	8.4	8.1	7.2	6.8
00301	DO	SATUR	PERCENT	41.5$	14.2$	10.3$	95.0$	91.0$	82.4$	79.4$	70.6$	66.7$
00403	PH	LAB	SU		7.9		8.4					
00625	TOT KJEL	N	MG/L				1.440					
00665	PHOS-TOT		MG/L P		.070		.050					
32210	CHLRPHYL	A	UG/L				5.50					

70-0054
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LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

INITIAL DATE			82/05/13	82/05/13	82/05/13	82/05/13	82/05/13	82/05/24	82/05/24	82/05/24	82/05/24
INITIAL TIME			0002	0003	0003	0003	0003	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			19	0	3	6	9	0	3	6	9
00010 WATER	TEMP	CENT	14.5	16.0	16.0	15.5	15.5	17.0	17.0	17.0	17.0
00011 WATER	TEMP	FAHN	58.1$	60.8$	60.8$	59.9$	59.9$	62.6$	62.6$	62.6$	62.6$
00029 FIELD	IDENT	NUMBER	402	403	403	403	403	401	401	401	401
00078 TRANSP	SECCHI	METERS						5.10			
00094 CNDUCTVY	FIELD	MICROMHO						415	430	435	435
00098 VSAMPLOC	DEPTH	METERS	6.00	.00	1.00	2.00	3.00	.00	1.00	2.00	3.00
00300 DO		MG/L	5.8	9.0	8.6	7.9	7.0	8.7	8.5	8.2	8.2
00301 DO	SATUR	PERCENT	55.8$	90.0$	86.0$	77.5$	68.6$	89.7$	87.6$	84.5$	84.5$
00403 PH	LAB	SU	8.3	8.4				8.3			
00410 T ALK	CACO3	MG/L						171			
00610 NH3+NH4-	N TOTAL	MG/L						.340			
00612 UN-IONZD	NH3-N	MG/L						.020$			
00615 NO2-N	TOTAL	MG/L						.040			
00619 UN-IONZD	NH3-NH3	MG/L						.025$			
00620 NO3-N	TOTAL	MG/L						.410			
00623 KJELDL N	DISS	MG/L						2.180			
00625 TOT KJEL	N	MG/L		1.400				1.670			
00665 PHOS-TOT		MG/L P	.050	.040				.080			
00666 PHOS-DIS		MG/L P						.063			
31613 FEC COLI	M-FCAGAR	/100ML							1K		
31673 FECSTREP	MFKFAGAR	/100ML							6		
32210 CHLRPHYL	A	UG/L		2.20				5.70			
82028 RATIO	FEC COL	FEC STRP							.2$		

INITIAL DATE			82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24
INITIAL TIME			0001	0001	0001	0001	0001	0001	0001	0002	0002
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			13	16	19	22	26	29	32	0	3
00010 WATER	TEMP	CENT	17.0	17.0	16.5	16.0	16.0	12.0	11.0	17.0	17.0
00011 WATER	TEMP	FAHN	62.6$	62.6$	61.7$	60.8$	60.8$	53.6$	51.8$	62.6$	62.6$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	402	402
00078 TRANSP	SECCHI	METERS								5.10	
00094 CNDUCTVY	FIELD	MICROMHO	435	435	445	450	450	495	510		
00098 VSAMPLOC	DEPTH	METERS	4.00	5.00	6.00	7.00	8.00	9.00	10.00	.00	1.00

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24
	INITIAL TIME			0001	0001	0001	0001	0001	0001	0001	0002	0002
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			13	16	19	22	26	29	32	0	3
00300	DO		MG/L	7.8	7.6	6.3	5.5	3.1	1.6	1.0	8.2	8.0
00301	DO	SATUR	PERCENT	80.4$	78.4$	63.0$	55.0$	31.0$	14.8$	9.0$	84.5$	82.5$
00403	PH	LAB	SU						7.8		8.2	
00625	TOT KJEL	N	MG/L								1.680	
00665	PHOS-TOT		MG/L P						.210		.080	
32210	CHLRPHYL	A	UG/L								5.00	

	INITIAL DATE			82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24	82/05/24
	INITIAL TIME			0002	0002	0002	0002	0002	0003	0003	0003	0003
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			6	9	13	16	19	0	3	6	9
00010	WATER	TEMP	CENT	17.0	17.0	17.0	17.0	16.0	17.0	17.0	17.0	17.0
00011	WATER	TEMP	FAHN	62.6$	62.6$	62.6$	62.6$	60.8$	62.6$	62.6$	62.6$	62.6$
00029	FIELD	IDENT	NUMBER	402	402	402	402	402	403	403	403	403
00098	VSAMPLOC	DEPTH	METERS	2.00	3.00	4.00	5.00	6.00	.00	1.00	2.00	3.00
00300	DO		MG/L	7.8	7.4	7.1	6.1	4.9	8.2	8.1	7.8	7.4
00301	DO	SATUR	PERCENT	80.4$	76.3$	73.2$	62.9$	49.0$	84.5$	83.5$	80.4$	76.3$
00403	PH	LAB	SU					8.1	8.3			
00625	TOT KJEL	N	MG/L						2.120			
00665	PHOS-TOT		MG/L P					.090	.100			
32210	CHLRPHYL	A	UG/L						2.70			

	INITIAL DATE			82/05/25	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07
	INITIAL TIME			1130	0001	0001	0001	0001	0001	0001	0001	0001
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	0	3	6	9	13	16	19	22
00010	WATER	TEMP	CENT		18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
00011	WATER	TEMP	FAHN		64.4$	64.4$	64.4$	64.4$	64.4$	64.4$	64.4$	64.4$
00029	FIELD	IDENT	NUMBER	202	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS	4.57	2.50							
00094	CNDUCTVY	FIELD	MICROMHO		435	445	445	450	450	450	450	450
00098	VSAMPLOC	DEPTH	METERS		.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300	DO		MG/L		8.6	8.6	8.4	8.2	8.0	8.0	8.0	7.8
00301	DO	SATUR	PERCENT		90.5$	90.5$	88.4$	86.3$	84.2$	84.2$	84.2$	82.1$
00403	PH	LAB	SU		8.3							
00623	KJELDL N	DISS	MG/L		2.120							
00625	TOT KJEL	N	MG/L		2.130							

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			82/05/25	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07
INITIAL TIME			1130	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	3	6	9	13	16	19	22
00665 PHOS-TOT		MG/L P		.113							
00666 PHOS-DIS		MG/L P		.093							
31613 FEC COLI	M-FCAGAR	/100ML			1						
31673 FECSTREP	MFKFAGAR	/100ML			2						
32210 CHLRPHYL	A	UG/L		18.00							
82028 RATIO	FEC COL	FEC STRP			.5$						

INITIAL DATE			82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07	82/06/07
INITIAL TIME			0001	0001	0001	0002	0002	0002	0002	0002	0002
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			26	29	32	0	3	6	9	13	16
00010 WATER	TEMP	CENT	17.5	13.5	13.0	18.0	18.0	18.0	18.0	17.5	17.5
00011 WATER	TEMP	FAHN	63.5$	56.3$	55.4$	64.4$	64.4$	64.4$	64.4$	63.5$	63.5$
00029 FIELD	IDENT	NUMBER	401	401	401	402	402	402	402	402	402
00078 TRANSP	SECCHI	METERS				2.50					
00094 CNDUCTVY	FIELD	MICROMHO	460	480	480						
00098 VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00	.00	1.00	2.00	3.00	4.00	5.00
00300 DO		MG/L	7.6	1.2	1.0	7.5	7.4	7.2	7.1	7.0	7.0
00301 DO	SATUR	PERCENT	78.4$	11.3$	9.4$	78.9$	77.9$	75.8$	74.7$	72.2$	72.2$
00403 PH	LAB	SU		7.7		8.2					8.2
00625 TOT KJEL	N	MG/L				1.640					
00665 PHOS-TOT		MG/L P		.390		.130					.120
32210 CHLRPHYL	A	UG/L				15.00					

INITIAL DATE			82/06/07	82/06/07	82/06/07	82/06/07	82/06/08	82/06/21	82/06/21	82/06/21	82/06/21
INITIAL TIME			0002	0003	0003	0003	1030	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			19	0	3	6	0	0	3	6	9
00010 WATER	TEMP	CENT	17.5	18.0	18.0	18.0		19.0	19.0	19.0	19.0
00011 WATER	TEMP	FAHN	63.5$	64.4$	64.4$	64.4$		66.2$	66.2$	66.2$	66.2$
00029 FIELD	IDENT	NUMBER	402	403	403	403	202	401	401	401	401
00078 TRANSP	SECCHI	METERS		2.50			4.27	1.70			
00094 CNDUCTVY	FIELD	MICROMHO						355			
00098 VSAMPLOC	DEPTH	METERS	6.00	.00	1.00	2.00		.00	1.00	2.00	3.00
00300 DO		MG/L	5.9	8.2	7.8	7.4		10.5	10.3	10.0	9.4
00301 DO	SATUR	PERCENT	60.8$	86.3$	82.1$	77.9$		111.7$	109.6$	106.4$	100.0$
00403 PH	LAB	SU		8.3				8.6			

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			82/06/07	82/06/07	82/06/07	82/06/07	82/06/08	82/06/21	82/06/21	82/06/21	82/06/21
INITIAL TIME			0002	0003	0003	0003	1030	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			19	0	3	6	0	0	3	6	9
00410 T ALK	CACO3	MG/L						172			
00610 NH3+NH4-	N TOTAL	MG/L						.090			
00612 UN-IONZD	NH3-N	MG/L						.012$			
00615 NO2-N	TOTAL	MG/L						.010K			
00619 UN-IONZD	NH3-NH3	MG/L						.014$			
00620 NO3-N	TOTAL	MG/L						.050			
00623 KJELDL N	DISS	MG/L						1.460			
00625 TOT KJEL	N	MG/L		1.500				2.010			
00665 PHOS-TOT		MG/L P		.080				.110			
00666 PHOS-DIS		MG/L P						.067			
31613 FEC COLI	M-FCAGAR	/100ML							1K		
31673 FECSTREP	MFKFAGAR	/100ML							1K		
32210 CHLRPHYL	A	UG/L		15.00				51.00			
82028 RATIO	FEC COL	FEC STRP							1$		

INITIAL DATE			82/06/21	82/06/21	82/06/21	82/06/21	82/06/21	82/06/21	82/06/21	82/06/21	82/06/21
INITIAL TIME			0001	0001	0001	0001	0001	0001	0001	0002	0002
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			13	16	19	22	26	29	32	0	3
00010 WATER	TEMP	CENT	19.0	19.0	19.0	18.5	18.0	17.5	17.0	19.0	19.0
00011 WATER	TEMP	FAHN	66.2$	66.2$	66.2$	65.3$	64.4$	63.5$	62.6$	66.2$	66.2$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	402	402
00078 TRANSP	SECCHI	METERS								1.50	
00094 CNDUCTVY	FIELD	MICROMHO							355		
00098 VSAMPLOC	DEPTH	METERS	4.00	5.00	6.00	7.00	8.00	9.00	10.00	.00	1.00
00300 DO		MG/L	9.2	9.2	7.7	4.7	1.9	1.2	.9	9.5	9.4
00301 DO	SATUR	PERCENT	97.9$	97.9$	81.9$	49.5$	20.0$	12.4$	9.3$	101.1$	100.0$
00403 PH	LAB	SU	8.5		8.4		8.0	7.8	7.7	8.5	
00625 TOT KJEL	N	MG/L								2.240	
00665 PHOS-TOT		MG/L P						.270		.140	
32210 CHLRPHYL	A	UG/L								70.00	

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

INITIAL DATE			82/06/21	82/06/21	82/06/21	82/06/21	82/06/21	82/06/21	82/06/21	82/06/21	82/06/21
INITIAL TIME			0002	0002	0002	0002	0002	0003	0003	0003	0003
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			6	9	13	16	19	0	3	6	9
00010 WATER	TEMP	CENT	19.0	19.0	19.0	18.5	18.5	19.0	19.0	19.0	18.5
00011 WATER	TEMP	FAHN	66.2$	66.2$	66.2$	65.3$	65.3$	66.2$	66.2$	66.2$	65.3$
00029 FIELD	IDENT	NUMBER	402	402	402	402	402	403	403	403	403
00078 TRANSP	SECCHI	METERS						2.70			
00098 VSAMPLOC	DEPTH	METERS	2.00	3.00	4.00	5.00	6.00	.00	1.00	2.00	3.00
00300 DO		MG/L	9.0	8.4	8.0	7.8	7.3	7.8	7.7	7.1	6.3
00301 DO	SATUR	PERCENT	95.7$	89.4$	85.1$	82.1$	76.8$	83.0$	81.9$	75.5$	66.3$
00403 PH	LAB	SU					8.3	8.4			
00625 TOT KJEL	N	MG/L						1.880			
00665 PHOS-TOT		MG/L P					.090	.130			
32210 CHLRPHYL	A	UG/L						11.00			

INITIAL DATE			82/06/23	82/06/29	82/06/29	82/06/29	82/06/29	82/06/29	82/06/29	82/06/29	82/06/29
INITIAL TIME			1130	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	3	6	9	13	16	19	22
00010 WATER	TEMP	CENT		22.0	22.0	21.5	20.5	20.0	19.5	19.0	18.5
00011 WATER	TEMP	FAHN		71.6$	71.6$	70.7$	68.9$	68.0$	67.1$	66.2$	65.3$
00029 FIELD	IDENT	NUMBER	202	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS	.76	2.80							
00094 CNDUCTVY	FIELD	MICROMHO		475	475	480	480	490	495	495	500
00098 VSAMPLOC	DEPTH	METERS		.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300 DO		MG/L		10.3	9.2	7.7	5.6	4.7	3.8	3.5	2.2
00301 DO	SATUR	PERCENT		117.0$	104.5$	85.6$	60.9$	51.1$	40.4$	37.2$	23.2$
00403 PH	LAB	SU		8.6						8.1	
00623 KJELDL N	DISS	MG/L		1.410							
00625 TOT KJEL	N	MG/L		1.870							
00665 PHOS-TOT		MG/L P		.127						.130	
00666 PHOS-DIS		MG/L P		.070							
31613 FEC COLI	M-FCAGAR	/100ML			2						
31673 FECSTREP	MFKFAGAR	/100ML			30						
32210 CHLRPHYL	A	UG/L		44.00							
82028 RATIO	FEC COL	FEC STRP			.07$						

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

INITIAL DATE			82/06/29	82/06/29	82/06/29	82/06/29	82/06/29	82/06/29	82/06/29	82/06/29	82/06/29
INITIAL TIME			0001	0001	0001	0002	0002	0002	0002	0002	0002
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			26	29	32	0	3	6	9	13	16
00010 WATER	TEMP	CENT	18.0	18.0	17.0	22.5	22.5	22.5	20.0	20.0	19.0
00011 WATER	TEMP	FAHN	64.4$	64.4$	62.6$	72.5$	72.5$	72.5$	68.0$	68.0$	66.2$
00029 FIELD	IDENT	NUMBER	401	401	401	402	402	402	402	402	402
00078 TRANSP	SECCHI	METERS				2.20					
00094 CNDUCTVY	FIELD	MICROMHO	505	505	530						
00098 VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00	.00	1.00	2.00	3.00	4.00	5.00
00300 DO		MG/L	1.7	1.2	.9	10.9	10.8	9.0	5.5	4.8	2.8
00301 DO	SATUR	PERCENT	17.9$	12.6$	9.3$	123.9$	122.7$	102.3$	59.8$	52.2$	29.8$
00403 PH	LAB	SU		7.6		8.7					8.1
00625 TOT KJEL	N	MG/L				2.040					
00665 PHOS-TOT		MG/L P		.440		.120					.180
32210 CHLRPHYL	A	UG/L				28.00					

INITIAL DATE			82/06/29	82/06/29	82/06/29	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07
INITIAL TIME			0003	0003	0003	0001	0001	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	3	6	0	3	6	9	13	16
00010 WATER	TEMP	CENT	22.0	22.0	22.0	24.0	24.0	24.0	24.0	23.5	21.5
00011 WATER	TEMP	FAHN	71.6$	71.6$	71.6$	75.2$	75.2$	75.2$	75.2$	74.3$	70.7$
00029 FIELD	IDENT	NUMBER	403	403	403	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS	1.30			1.20					
00094 CNDUCTVY	FIELD	MICROMHO				450					
00098 VSAMPLOC	DEPTH	METERS	.00	1.00	2.00	.00	1.00	2.00	3.00	4.00	5.00
00300 DO		MG/L	10.1	9.6	9.6	10.6	10.3	10.0	9.6	7.8	4.3
00301 DO	SATUR	PERCENT	114.8$	109.1$	109.1$	124.7$	121.2$	117.6$	112.9$	89.7$	47.8$
00403 PH	LAB	SU	8.6			8.9					
00623 KJELDL N	DISS	MG/L				1.780					
00625 TOT KJEL	N	MG/L	3.180			2.790					
00665 PHOS-TOT		MG/L P	.300			.147					
00666 PHOS-DIS		MG/L P				.060					
31613 FEC COLI	M-FCAGAR	/100ML					1				
31673 FECSTREP	MFKFAGAR	/100ML					2				
32210 CHLRPHYL	A	UG/L	22.00			89.00					
82028 RATIO	FEC COL	FEC STRP					.5$				

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

INITIAL DATE				82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07
INITIAL TIME				0001	0001	0001	0001	0001	0002	0002	0002	0002
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				19	22	26	29	32	0	3	6	9
00010	WATER	TEMP	CENT	18.5	18.0	18.0	17.0	17.0	23.0	23.0	23.0	23.0
00011	WATER	TEMP	FAHN	65.3$	64.4$	64.4$	62.6$	62.6$	73.4$	73.4$	73.4$	73.4$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	402	402	402	402
00078	TRANSP	SECCHI	METERS						1.60			
00094	CNDUCTVY	FIELD	MICROMHO	470			495					
00098	VSAMPLOC	DEPTH	METERS	6.00	7.00	8.00	9.00	10.00	.00	1.00	2.00	3.00
00300	DO		MG/L	1.1	.9	.7	.7	.7	9.0	8.9	8.2	7.6
00301	DO	SATUR	PERCENT	11.6$	9.5$	7.4$	7.2$	7.2$	103.4$	102.3$	94.3$	87.4$
00403	PH	LAB	SU	8.4			7.8		8.8			
00625	TOT KJEL	N	MG/L						2.240			
00665	PHOS-TOT		MG/L P	.140			.560		.150			
32210	CHLRPHYL	A	UG/L						46.00			

INITIAL DATE				82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/19
INITIAL TIME				0002	0002	0002	0003	0003	0003	0003	1150	0001
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				13	16	19	0	3	6	9	0	0
00010	WATER	TEMP	CENT	22.5	20.5	18.5	23.0	23.0	22.5	22.0		24.5
00011	WATER	TEMP	FAHN	72.5$	68.9$	65.3$	73.4$	73.4$	72.5$	71.6$		76.1$
00029	FIELD	IDENT	NUMBER	402	402	402	403	403	403	403	202	401
00078	TRANSP	SECCHI	METERS				1.80				1.37	1.30
00094	CNDUCTVY	FIELD	MICROMHO									405
00098	VSAMPLOC	DEPTH	METERS	4.00	5.00	6.00	.00	1.00	2.00	3.00		.00
00300	DO		MG/L	6.4	2.1	.7	7.6	7.0	6.1	5.3		11.3
00301	DO	SATUR	PERCENT	72.7$	22.8$	7.4$	87.4$	80.5$	69.3$	60.2$		132.9$
00403	PH	LAB	SU		8.6		8.8					9.0
00410	T ALK	CACO3	MG/L									167
00610	NH3+NH4-	N TOTAL	MG/L									.040
00612	UN-IONZD	NH3-N	MG/L									.014$
00615	NO2-N	TOTAL	MG/L									.010K
00619	UN-IONZD	NH3-NH3	MG/L									.017$
00620	NO3-N	TOTAL	MG/L									.050
00623	KJELDL N	DISS	MG/L									1.610
00625	TOT KJEL	N	MG/L				2.040					2.570

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/07	82/07/19
INITIAL TIME			0002	0002	0002	0003	0003	0003	0003	1150	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			13	16	19	0	3	6	9	0	0
00665 PHOS-TOT		MG/L P		.140		.140					.157
00666 PHOS-DIS		MG/L P									.087
32210 CHLRPHYL	A	UG/L				23.00					76.00

INITIAL DATE			82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19
INITIAL TIME			0001	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			3	6	9	13	16	19	22	26	29
00010 WATER	TEMP	CENT	24.5	24.0	24.0	23.5	23.0	21.0	19.0	18.0	17.0
00011 WATER	TEMP	FAHN	76.1$	75.2$	75.2$	74.3$	73.4$	69.8$	66.2$	64.4$	62.6$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00094 CNDUCTVY	FIELD	MICROMHO	415	425	425	440	445	465	490	505	520
00098 VSAMPLOC	DEPTH	METERS	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
00300 DO		MG/L	10.4	8.6	8.2	3.2	2.2	1.2	1.1	1.0	1.0
00301 DO	SATUR	PERCENT	122.4$	101.2$	96.5$	36.8$	25.3$	13.3$	11.7$	10.5$	10.3$
00403 PH	LAB	SU				8.8			8.0		
00665 PHOS-TOT		MG/L P				.130			.400		
31613 FEC COLI	M-FCAGAR	/100ML	1K								
31673 FECSTREP	MFKFAGAR	/100ML	2								
32210 CHLRPHYL	A	UG/L				56.00					
82028 RATIO	FEC COL	FEC STRP	.5$								

INITIAL DATE			82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19
INITIAL TIME			0001	0002	0002	0002	0002	0002	0002	0002	0003
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			32	0	3	6	9	13	16	19	0
00010 WATER	TEMP	CENT	17.0	25.0	25.0	24.5	24.0	24.0	23.0	20.0	25.0
00011 WATER	TEMP	FAHN	62.6$	77.0$	77.0$	76.1$	75.2$	75.2$	73.4$	68.0$	77.0$
00029 FIELD	IDENT	NUMBER	401	402	402	402	402	402	402	402	403
00078 TRANSP	SECCHI	METERS		1.30							1.40
00094 CNDUCTVY	FIELD	MICROMHO	530								
00098 VSAMPLOC	DEPTH	METERS	10.00	.00	1.00	2.00	3.00	4.00	5.00	6.00	.00
00300 DO		MG/L	.8	10.3	9.7	8.2	5.5	2.4	1.0	.7	11.1
00301 DO	SATUR	PERCENT	8.2$	122.6$	115.5$	96.5$	64.7$	28.2$	11.5$	7.6$	132.1$
00403 PH	LAB	SU	7.6	9.0					8.3		9.1
00625 TOT KJEL	N	MG/L		2.120							2.260
00665 PHOS-TOT		MG/L P	1.020	.150					.250		.140

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19	82/07/19
	INITIAL TIME			0001	0002	0002	0002	0002	0002	0002	0002	0003
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			32	0	3	6	9	13	16	19	0
32210	CHLRPHYL	A	UG/L		70.00							67.00

	INITIAL DATE			82/07/19	82/07/19	82/07/19	82/07/20	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02
	INITIAL TIME			0003	0003	0003	0930	0001	0001	0001	0001	0001
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			3	6	9	0	0	3	6	9	13
00010	WATER	TEMP	CENT	25.0	25.0	24.5		24.5	24.5	24.5	24.5	24.5
00011	WATER	TEMP	FAHN	77.0$	77.0$	76.1$		76.1$	76.1$	76.1$	76.1$	76.1$
00029	FIELD	IDENT	NUMBER	403	403	403	202	401	401	401	401	401
00078	TRANSP	SECCHI	METERS				1.22	2.10				
00094	CNDUCTVY	FIELD	MICROMHO					425	425	430	430	430
00098	VSAMPLOC	DEPTH	METERS	1.00	2.00	3.00		.00	1.00	2.00	3.00	4.00
00300	DO		MG/L	11.0	10.4	8.6		6.3	6.1	5.9	5.8	5.4
00301	DO	SATUR	PERCENT	131.0$	123.8$	101.2$		74.1$	71.8$	69.4$	68.2$	63.5$
00403	PH	LAB	SU					8.6				
00623	KJELDL N	DISS	MG/L					1.900				
00625	TOT KJEL	N	MG/L					1.800				
00665	PHOS-TOT		MG/L P					.137				
00666	PHOS-DIS		MG/L P					.107				
31613	FEC COLI	M-FCAGAR	/100ML						2			
31673	FECSTREP	MFKFAGAR	/100ML						2			
32210	CHLRPHYL	A	UG/L					17.00				14.00
82028	RATIO	FEC COL	FEC STRP						1$			

	INITIAL DATE			82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02
	INITIAL TIME			0001	0001	0001	0001	0001	0001	0002	0002	0002
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			16	19	22	26	29	32	0	3	6
00010	WATER	TEMP	CENT	23.5	21.0	18.5	16.0	16.0	16.0	25.0	25.0	25.0
00011	WATER	TEMP	FAHN	74.3$	69.8$	65.3$	60.8$	60.8$	60.8$	77.0$	77.0$	77.0$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	402	402	402
00078	TRANSP	SECCHI	METERS							1.70		
00094	CNDUCTVY	FIELD	MICROMHO	445	475	515	545	545	545			
00098	VSAMPLOC	DEPTH	METERS	5.00	6.00	7.00	8.00	9.00	10.00	.00	1.00	2.00
00300	DO		MG/L	1.2	.7	.7	.6	.6	.5	7.4	7.2	7.2
00301	DO	SATUR	PERCENT	13.8$	7.8$	7.4$	6.0$	6.0$	5.0$	88.1$	85.7$	85.7$
00403	PH	LAB	SU		8.3			7.6		8.7		

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02
INITIAL TIME	0001	0001	0001	0001	0001	0001	0002	0002	0002
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	16	19	22	26	29	32	0	3	6
00625 TOT KJEL N MG/L							1.920		
00665 PHOS-TOT MG/L P		.190			.830		.130		
32210 CHLRPHYL A UG/L							26.00		

INITIAL DATE	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/02	82/08/10
INITIAL TIME	0002	0002	0002	0002	0003	0003	0003	0003	0001
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	9	13	16	19	0	3	6	9	0
00010 WATER TEMP CENT	25.0	25.0	23.5	22.0	25.0	25.0	25.0	25.0	23.0
00011 WATER TEMP FAHN	77.0$	77.0$	74.3$	71.6$	77.0$	77.0$	77.0$	77.0$	73.4$
00029 FIELD IDENT NUMBER	402	402	402	402	403	403	403	403	401
00078 TRANSP SECCHI METERS					1.50				1.40
00094 CNDUCTVY FIELD MICROMHO									425
00098 VSAMPLOC DEPTH METERS	3.00	4.00	5.00	6.00	.00	1.00	2.00	3.00	.00
00300 DO MG/L	7.2	7.0	1.2	.8	7.3	6.7	6.0	5.9	6.6
00301 DO SATUR PERCENT	85.7$	83.3$	13.8$	9.1$	86.9$	79.8$	71.4$	70.2$	75.9$
00403 PH LAB SU			8.5		8.6				8.2
00623 KJELDL N DISS MG/L									1.590
00625 TOT KJEL N MG/L					1.800				1.860
00665 PHOS-TOT MG/L P			.160		.160				.170
00666 PHOS-DIS MG/L P									.100
32210 CHLRPHYL A UG/L					18.00				40.00

INITIAL DATE	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10
INITIAL TIME	0001	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	3	6	9	13	16	19	22	26	29
00010 WATER TEMP CENT	23.0	23.0	23.0	23.0	23.0	22.5	19.0	17.5	16.5
00011 WATER TEMP FAHN	73.4$	73.4$	73.4$	73.4$	73.4$	72.5$	66.2$	63.5$	61.7$
00029 FIELD IDENT NUMBER	401	401	401	401	401	401	401	401	401
00094 CNDUCTVY FIELD MICROMHO	430	430	435	435	430	430	520	525	545
00098 VSAMPLOC DEPTH METERS	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
00300 DO MG/L	6.4	6.1	6.1	5.9	5.8	6.1	1.6	1.2	1.1
00301 DO SATUR PERCENT	73.6$	70.1$	70.1$	67.8$	66.7$	69.3$	17.0$	12.4$	11.0$
00403 PH LAB SU				8.1			7.9		
00665 PHOS-TOT MG/L P				.150			.190		
31613 FEC COLI M-FCAGAR /100ML	1K								

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10
INITIAL TIME			0001	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			3	6	9	13	16	19	22	26	29
31673 FECSTREP	MFKFAGAR	/100ML	9								
32210 CHLRPHYL	A	UG/L				36.00					
82028 RATIO	FEC COL	FEC STRP	.1$								

INITIAL DATE			82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10	82/08/10
INITIAL TIME			0001	0002	0002	0002	0002	0002	0002	0002	0003
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			32	0	3	6	9	13	16	19	0
00010 WATER	TEMP	CENT	16.5	23.0	23.0	23.0	23.0	23.0	23.0	22.0	23.0
00011 WATER	TEMP	FAHN	61.7$	73.4$	73.4$	73.4$	73.4$	73.4$	73.4$	71.6$	73.4$
00029 FIELD	IDENT	NUMBER	401	402	402	402	402	402	402	402	403
00078 TRANSP	SECCHI	METERS		1.30							1.40
00094 CNDUCTVY	FIELD	MICROMHO	545								
00098 VSAMPLOC	DEPTH	METERS	10.00	.00	1.00	2.00	3.00	4.00	5.00	6.00	.00
00300 DO		MG/L	.9	6.4	6.3	5.4	5.5	5.7	5.8	5.3	6.4
00301 DO	SATUR	PERCENT	9.0$	73.6$	72.4$	62.1$	63.2$	65.5$	66.7$	60.2$	73.6$
00403 PH	LAB	SU	7.0	8.2					8.2		8.1
00625 TOT KJEL	N	MG/L		2.120							1.920
00665 PHOS-TOT		MG/L P	1.600	.170					.160		.190
32210 CHLRPHYL	A	UG/L		36.00							28.00

INITIAL DATE			82/08/10	82/08/10	82/08/10	82/08/17	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23
INITIAL TIME			0003	0003	0003	1430	0001	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			3	6	9	0	0	3	6	9	13
00010 WATER	TEMP	CENT	23.0	22.0	21.5		23.5	23.0	23.0	23.0	23.0
00011 WATER	TEMP	FAHN	73.4$	71.6$	70.7$		74.3$	73.4$	73.4$	73.4$	73.4$
00029 FIELD	IDENT	NUMBER	403	403	403	202	401	401	401	401	401
00078 TRANSP	SECCHI	METERS				1.83	1.20				
00094 CNDUCTVY	FIELD	MICROMHO					380	405	405	410	415
00098 VSAMPLOC	DEPTH	METERS	1.00	2.00	3.00		.00	1.00	2.00	3.00	4.00
00300 DO		MG/L	5.9	6.6	5.1		8.8	8.8	7.7	7.6	7.1
00301 DO	SATUR	PERCENT	67.8$	75.0$	56.7$		101.2$	101.2$	88.5$	87.4$	81.6$
00403 PH	LAB	SU					8.9				8.8
00410 T ALK	CACO3	MG/L					171				
00610 NH3+NH4-	N TOTAL	MG/L					.160				
00612 UN-IONZD	NH3-N	MG/L					.046$				

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			82/08/10	82/08/10	82/08/10	82/08/17	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23
	INITIAL TIME			0003	0003	0003	1430	0001	0001	0001	0001	0001
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			3	6	9	0	0	3	6	9	13
00615	NO2-N	TOTAL	MG/L					.010K				
00619	UN-IONZD	NH3-NH3	MG/L					.056$				
00620	NO3-N	TOTAL	MG/L					.100				
00623	KJELDL N	DISS	MG/L					1.460				
00625	TOT KJEL	N	MG/L					1.970				
00665	PHOS-TOT		MG/L P					.133				
00666	PHOS-DIS		MG/L P					.063				
31613	FEC COLI	M-FCAGAR	/100ML						1			
31673	FECSTREP	MFKFAGAR	/100ML						8			
32210	CHLRPHYL	A	UG/L					39.00				39.00
82028	RATIO	FEC COL	FEC STRP						.1$			

	INITIAL DATE			82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23
	INITIAL TIME			0001	0001	0001	0001	0001	0001	0002	0002	0002
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			16	19	22	26	29	32	0	3	6
00010	WATER	TEMP	CENT	22.0	21.5	20.0	19.0	17.0	16.0	23.5	23.0	23.0
00011	WATER	TEMP	FAHN	71.6$	70.7$	68.0$	66.2$	62.6$	60.8$	74.3$	73.4$	73.4$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	402	402	402
00078	TRANSP	SECCHI	METERS							1.20		
00094	CNDUCTVY	FIELD	MICROMHO	435	450	480	520	550	565			
00098	VSAMPLOC	DEPTH	METERS	5.00	6.00	7.00	8.00	9.00	10.00	.00	1.00	2.00
00300	DO		MG/L	3.4	2.1	2.1	2.1	2.1	2.0	7.8	7.2	6.8
00301	DO	SATUR	PERCENT	38.6$	23.3$	22.8$	22.3$	21.6$	20.0$	89.7$	82.8$	78.2$
00403	PH	LAB	SU		8.3			7.5		8.9		
00625	TOT KJEL	N	MG/L							1.660		
00665	PHOS-TOT		MG/L P		.170			1.000		.130		
32210	CHLRPHYL	A	UG/L							39.00		

	INITIAL DATE			82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/09/01
	INITIAL TIME			0002	0002	0002	0002	0003	0003	0003	0003	1010
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			9	13	16	19	0	3	6	9	0
00010	WATER	TEMP	CENT	23.0	23.0	23.0	21.0	23.5	23.0	23.0	23.0	
00011	WATER	TEMP	FAHN	73.4$	73.4$	73.4$	69.8$	74.3$	73.4$	73.4$	73.4$	
00029	FIELD	IDENT	NUMBER	402	402	402	402	403	403	403	403	202
00078	TRANSP	SECCHI	METERS					1.10				1.37

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/08/23	82/09/01
INITIAL TIME			0002	0002	0002	0002	0003	0003	0003	0003	1010
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			9	13	16	19	0	3	6	9	0
00098 VSAMPLOC	DEPTH	METERS	3.00	4.00	5.00	6.00	.00	1.00	2.00	3.00	
00300 DO		MG/L	6.8	4.6	3.6	1.3	7.6	7.6	7.4	5.6	
00301 DO	SATUR	PERCENT	78.2$	52.9$	41.4$	14.4$	87.4$	87.4$	85.1$	64.4$	
00403 PH	LAB	SU			8.6		8.9				
00625 TOT KJEL	N	MG/L					2.000				
00665 PHOS-TOT		MG/L P			.130		.130				
32210 CHLRPHYL	A	UG/L					40.00				

INITIAL DATE			82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07
INITIAL TIME			0001	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	3	6	9	13	16	19	22	26
00010 WATER	TEMP	CENT	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
00011 WATER	TEMP	FAHN	68.0$	68.0$	68.0$	68.0$	68.0$	68.0$	68.0$	68.0$	68.0$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS	1.20								
00094 CNDUCTVY	FIELD	MICROMHO	390	400	400	400	400	400	405	410	425
00098 VSAMPLOC	DEPTH	METERS	.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
00300 DO		MG/L	8.6	8.6	8.2	8.1	8.1	7.9	7.8	7.6	.6
00301 DO	SATUR	PERCENT	93.5$	93.5$	89.1$	88.0$	88.0$	85.9$	84.8$	82.6$	6.5$
00403 PH	LAB	SU	8.7					8.7			
00623 KJELDL N	DISS	MG/L	1.470								
00625 TOT KJEL	N	MG/L	2.250								
00665 PHOS-TOT		MG/L P	.140					.150			
00666 PHOS-DIS		MG/L P	.087								
31613 FEC COLI	M-FCAGAR	/100ML		4							
31673 FECSTREP	MFKFAGAR	/100ML		4							
32210 CHLRPHYL	A	UG/L	87.00								
82028 RATIO	FEC COL	FEC STRP		1$							

INITIAL DATE			82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07
INITIAL TIME			0001	0001	0002	0002	0002	0002	0002	0002	0002
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			29	32	0	3	6	9	13	16	19
00010 WATER	TEMP	CENT	19.0	18.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
00011 WATER	TEMP	FAHN	66.2$	64.4$	68.0$	68.0$	68.0$	68.0$	68.0$	68.0$	68.0$
00029 FIELD	IDENT	NUMBER	401	401	402	402	402	402	402	402	402

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/07
INITIAL TIME			0001	0001	0002	0002	0002	0002	0002	0002	0002
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			29	32	0	3	6	9	13	16	19
00078 TRANSP	SECCHI	METERS			1.00						
00094 CNDUCTVY	FIELD	MICROMHO	465	550							
00098 VSAMPLOC	DEPTH	METERS	9.00	10.00	.00	1.00	2.00	3.00	4.00	5.00	6.00
00300 DO		MG/L	.3	.2	9.6	9.4	8.8	8.8	8.7	8.4	8.4
00301 DO	SATUR	PERCENT	3.2$	2.1$	104.3$	102.2$	95.7$	95.7$	94.6$	91.3$	91.3$
00403 PH	LAB	SU	8.1		8.7						8.7
00625 TOT KJEL	N	MG/L			2.320						
00665 PHOS-TOT		MG/L P	.230		.170						.150
32210 CHLRPHYL	A	UG/L			86.00						

INITIAL DATE			82/09/07	82/09/07	82/09/07	82/09/07	82/09/07	82/09/14	82/09/15	82/09/15	82/09/15
INITIAL TIME			0003	0003	0003	0003	0003	1500	0001	0001	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	3	6	9	13	0	0	3	6
00010 WATER	TEMP	CENT	20.0	20.0	20.0	20.0	19.5		19.0	19.0	19.0
00011 WATER	TEMP	FAHN	68.0$	68.0$	68.0$	68.0$	67.1$		66.2$	66.2$	66.2$
00029 FIELD	IDENT	NUMBER	403	403	403	403	403	202	401	401	401
00078 TRANSP	SECCHI	METERS	1.10					2.13	1.40		
00094 CNDUCTVY	FIELD	MICROMHO							385	395	395
00098 VSAMPLOC	DEPTH	METERS	.00	1.00	2.00	3.00	4.00		.00	1.00	2.00
00300 DO		MG/L	9.8	9.6	9.6	9.6	9.6		7.2	7.1	6.8
00301 DO	SATUR	PERCENT	106.5$	104.3$	104.3$	104.3$	102.1$		76.6$	75.5$	72.3$
00403 PH	LAB	SU	8.8						8.4		
00623 KJELDL N	DISS	MG/L							1.570		
00625 TOT KJEL	N	MG/L	2.400						2.220		
00665 PHOS-TOT		MG/L P	.130						.157		
00666 PHOS-DIS		MG/L P							.107		
31613 FEC COLI	M-FCAGAR	/100ML								3	
31673 FECSTREP	MFKFAGAR	/100ML								20	
32210 CHLRPHYL	A	UG/L	86.00						69.00		
82028 RATIO	FEC COL	FEC STRP								.2$	

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

	INITIAL DATE			82/09/15	82/09/15	82/09/15	82/09/15	82/09/15	82/09/15	82/09/15	82/09/15	82/09/15
	INITIAL TIME			0001	0001	0001	0001	0001	0001	0001	0001	0002
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			9	13	16	19	22	26	29	32	0
00010	WATER	TEMP	CENT	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	18.5
00011	WATER	TEMP	FAHN	66.2$	66.2$	66.2$	66.2$	66.2$	66.2$	66.2$	66.2$	65.3$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	402
00078	TRANSP	SECCHI	METERS									1.50
00094	CNDUCTVY	FIELD	MICROMHO	395	395	400	400	405	405	405	405	
00098	VSAMPLOC	DEPTH	METERS	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	.00
00300	DO		MG/L	6.4	6.4	6.3	6.4	6.2	6.2	6.3	6.3	6.8
00301	DO	SATUR	PERCENT	68.1$	68.1$	67.0$	68.1$	66.0$	66.0$	67.0$	67.0$	71.6$
00403	PH	LAB	SU			8.4			8.4			8.3
00625	TOT KJEL	N	MG/L									1.920
00665	PHOS-TOT		MG/L P			.170			.170			.150
32210	CHLRPHYL	A	UG/L			67.00						68.00

	INITIAL DATE			82/09/15	82/09/15	82/09/15	82/09/15	82/09/15	82/09/15	82/09/15	82/09/15	82/09/15
	INITIAL TIME			0002	0002	0002	0002	0002	0002	0003	0003	0003
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			3	6	9	13	16	19	0	3	6
00010	WATER	TEMP	CENT	18.5	18.5	18.5	18.5	18.5	18.0	18.0	18.0	18.0
00011	WATER	TEMP	FAHN	65.3$	65.3$	65.3$	65.3$	65.3$	64.4$	64.4$	64.4$	64.4$
00029	FIELD	IDENT	NUMBER	402	402	402	402	402	402	403	403	403
00078	TRANSP	SECCHI	METERS							2.00		
00098	VSAMPLOC	DEPTH	METERS	1.00	2.00	3.00	4.00	5.00	6.00	.00	1.00	2.00
00300	DO		MG/L	6.7	6.8	6.4	6.5	6.4	5.8	7.0	6.8	6.3
00301	DO	SATUR	PERCENT	70.5$	71.6$	67.4$	68.4$	67.4$	61.1$	73.7$	71.6$	66.3$
00403	PH	LAB	SU				8.3			8.3		
00625	TOT KJEL	N	MG/L							1.960		
00665	PHOS-TOT		MG/L P				.160			.150		
32210	CHLRPHYL	A	UG/L							34.00		

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE				82/09/15	82/09/30	82/09/30	82/09/30	82/09/30	82/09/30	82/09/30	82/09/30	82/09/30
INITIAL TIME				0003	0001	0001	0001	0001	0001	0001	0001	0001
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				9	0	3	6	9	13	16	19	22
00010	WATER	TEMP	CENT	17.0	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
00011	WATER	TEMP	FAHN	62.6$	61.7$	61.7$	61.7$	61.7$	61.7$	61.7$	61.7$	61.7$
00029	FIELD	IDENT	NUMBER	403	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS		1.40							
00094	CNDUCTVY	FIELD	MICROMHO		395	400	405	405	405	405	405	405
00098	VSAMPLOC	DEPTH	METERS	3.00	.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300	DO		MG/L	5.6	9.2	9.0	8.7	8.5	8.4	8.2	8.2	8.0
00301	DO	SATUR	PERCENT	57.7$	92.0$	90.0$	87.0$	85.0$	84.0$	82.0$	82.0$	80.0$
00403	PH	LAB	SU		8.5							
00623	KJELDL N	DISS	MG/L		1.340							
00625	TOT KJEL	N	MG/L		1.960							
00665	PHOS-TOT		MG/L P		.170							
00666	PHOS-DIS		MG/L P		.110							
31613	FEC COLI	M-FCAGAR	/100ML			1						
31673	FECSTREP	MFKFAGAR	/100ML			27						
32210	CHLRPHYL	A	UG/L		62.00							
82028	RATIO	FEC COL	FEC STRP			.04$						

INITIAL DATE				82/09/30	82/09/30	82/09/30	82/09/30	82/09/30	82/09/30	82/09/30	82/09/30	82/09/30
INITIAL TIME				0001	0001	0001	0002	0002	0002	0002	0002	0002
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				26	29	32	0	3	6	9	13	16
00010	WATER	TEMP	CENT	16.5	16.5	16.0	16.5	16.5	16.5	16.5	16.5	16.5
00011	WATER	TEMP	FAHN	61.7$	61.7$	60.8$	61.7$	61.7$	61.7$	61.7$	61.7$	61.7$
00029	FIELD	IDENT	NUMBER	401	401	401	402	402	402	402	402	402
00078	TRANSP	SECCHI	METERS				1.10					
00094	CNDUCTVY	FIELD	MICROMHO	410	410	420						
00098	VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00	.00	1.00	2.00	3.00	4.00	5.00
00300	DO		MG/L	7.8	7.7	6.7	9.1	8.9	8.4	8.1	7.8	7.4
00301	DO	SATUR	PERCENT	78.0$	77.0$	67.0$	91.0$	89.0$	84.0$	81.0$	78.0$	74.0$
00403	PH	LAB	SU		8.5		8.5					8.5
00625	TOT KJEL	N	MG/L				2.140					
00665	PHOS-TOT		MG/L P		.150		.180					.160
32210	CHLRPHYL	A	UG/L				70.00					

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE				82/09/30	82/09/30	82/09/30	82/09/30	82/09/30	83/06/06	83/07/01	83/07/19	83/08/09
INITIAL TIME				0002	0003	0003	0003	0003	1330	0950	1025	1100
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				19	0	3	6	9	0	0	0	0
00010	WATER	TEMP	CENT	16.5	16.5	16.5	16.5	16.0				
00011	WATER	TEMP	FAHN	61.7$	61.7$	61.7$	61.7$	60.8$				
00029	FIELD	IDENT	NUMBER	402	403	403	403	403	202	202	202	202
00078	TRANSP	SECCHI	METERS		1.20				1.83	2.13	1.83	.61
00098	VSAMPLOC	DEPTH	METERS	6.00	.00	1.00	2.00	3.00				
00300	DO		MG/L	7.0	8.9	8.4	8.1	7.6				
00301	DO	SATUR	PERCENT	70.0$	89.0$	84.0$	81.0$	76.0$				
00403	PH	LAB	SU		8.5							
00625	TOT KJEL	N	MG/L		2.180							
00665	PHOS-TOT		MG/L P		.190							
32210	CHLRPHYL	A	UG/L		53.00							

INITIAL DATE				83/08/31	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21
INITIAL TIME				0845	1035	1035	1035	1035	1035	1035	1035	1035
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	3	6	9	13	16	19	22
00010	WATER	TEMP	CENT		18.0	17.5	17.5	17.5	17.0	15.0	14.5	13.0
00011	WATER	TEMP	FAHN		64.4$	63.5$	63.5$	63.5$	62.6$	59.0$	58.1$	55.4$
00029	FIELD	IDENT	NUMBER	202	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS	.61	1.90							
00095	CNDUCTVY	AT 25C	MICROMHO		385						385	
00098	VSAMPLOC	DEPTH	METERS		.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300	DO		MG/L		12.8	13.1	13.2	13.0	12.2	8.1	7.1	5.6
00301	DO	SATUR	PERCENT		134.7$	135.1$	136.1$	134.0$	125.8$	79.4$	68.3$	52.8$
00403	PH	LAB	SU		8.9						8.6	
00410	T ALK	CACO3	MG/L		172							
00610	NH3+NH4-	N TOTAL	MG/L		.090							
00612	UN-IONZD	NH3-N	MG/L		.019$							
00619	UN-IONZD	NH3-NH3	MG/L		.023$							
00625	TOT KJEL	N	MG/L		1.680						1.600	
00630	NO2&NO3	N-TOTAL	MG/L		.40							
00665	PHOS-TOT		MG/L P		.050						.050	
32210	CHLRPHYL	A	UG/L		29.00							

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
/TYPA/AMBNT/LAKE
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

	INITIAL DATE			84/05/21	84/05/21	84/05/21	84/06/12	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22
	INITIAL TIME			1035	1035	1035	1400	1047	1047	1047	1047	1047
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			26	29	32	0	0	3	6	9	13
00010	WATER	TEMP	CENT	13.0	12.0	11.5		24.0	23.0	22.5	22.0	22.0
00011	WATER	TEMP	FAHN	55.4$	53.6$	52.7$		75.2$	73.4$	72.5$	71.6$	71.6$
00029	FIELD	IDENT	NUMBER	401	401	401	202	401	401	401	401	401
00078	TRANSP	SECCHI	METERS				1.37	1.50				
00095	CNDUCTVY	AT 25C	MICROMHO		440			375				
00098	VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00		.00	1.00	2.00	3.00	4.00
00300	DO		MG/L	5.1	1.6	.6		13.1	11.5	9.8	9.5	7.4
00301	DO	SATUR	PERCENT	48.1$	14.8$	5.4$		154.1$	132.2$	111.4$	108.0$	84.1$
00403	PH	LAB	SU		8.1			8.8				
00625	TOT KJEL	N	MG/L		1.800			1.720				
00665	PHOS-TOT		MG/L P		.060			.110				
32210	CHLRPHYL	A	UG/L					60.00				

	INITIAL DATE			84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/07/05	84/07/25	84/07/26
	INITIAL TIME			1047	1047	1047	1047	1047	1047	0915	1200	1040
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			16	19	22	26	29	32	0	0	0
00010	WATER	TEMP	CENT	20.5	20.0	19.5	18.0	17.0	13.0			25.0
00011	WATER	TEMP	FAHN	68.9$	68.0$	67.1$	64.4$	62.6$	55.4$			77.0$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	202	202	401
00078	TRANSP	SECCHI	METERS							.76	.38	.60
00095	CNDUCTVY	AT 25C	MICROMHO		405				435			315
00098	VSAMPLOC	DEPTH	METERS	5.00	6.00	7.00	8.00	9.00	10.00			.00
00300	DO		MG/L	1.8	.7	.3	.3	.2	.2			11.1
00301	DO	SATUR	PERCENT	19.6$	7.6$	3.2$	3.2$	2.1$	1.9$			132.1$
00403	PH	LAB	SU		7.8				7.7			8.5
00410	T ALK	CACO3	MG/L									134
00610	NH3+NH4-	N TOTAL	MG/L									.050
00612	UN-IONZD	NH3-N	MG/L									.008$
00619	UN-IONZD	NH3-NH3	MG/L									.010$
00625	TOT KJEL	N	MG/L		1.950				3.100			2.300
00630	NO2&NO3	N-TOTAL	MG/L									.05K
00665	PHOS-TOT		MG/L P		.180				.420			.080
32210	CHLRPHYL	A	UG/L									97.00

(SAMPLE CONTINUED ON NEXT PAGE)

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/07/05	84/07/25	84/07/26
INITIAL TIME	1047	1047	1047	1047	1047	1047	0915	1200	1040
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	16	19	22	26	29	32	0	0	0
82903 DPTH BOT AT SITE METERS									10.5

INITIAL DATE	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26
INITIAL TIME	1040	1040	1040	1040	1040	1040	1040	1040	1040
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	3	6	9	13	16	19	22	26	29
00010 WATER TEMP CENT	24.5	24.0	24.0	24.0	23.0	21.5	21.0	20.0	16.5
00011 WATER TEMP FAHN	76.1$	75.2$	75.2$	75.2$	73.4$	70.7$	69.8$	68.0$	61.7$
00029 FIELD IDENT NUMBER	401	401	401	401	401	401	401	401	401
00095 CNDUCTVY AT 25C MICROMHO					350				
00098 VSAMPLOC DEPTH METERS	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
00300 DO MG/L	10.2	5.9	4.0	3.1	.3	.1	.1	.1	.1
00301 DO SATUR PERCENT	120.0$	69.4$	47.1$	36.5$	3.4$	1.1$	1.1$	1.1$	1.0$
00403 PH LAB SU					8.1				
00625 TOT KJEL N MG/L					1.450				
00665 PHOS-TOT MG/L P					.030				

INITIAL DATE	84/07/26	84/08/10	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27
INITIAL TIME	1040	0950	1100	1100	1100	1100	1100	1100	1100
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	32	0	0	3	6	9	13	16	19
00010 WATER TEMP CENT	15.5		23.0	22.0	22.0	22.0	22.0	21.5	21.5
00011 WATER TEMP FAHN	59.9$		73.4$	71.6$	71.6$	71.6$	71.6$	70.7$	70.7$
00029 FIELD IDENT NUMBER	401	202	401	401	401	401	401	401	401
00078 TRANSP SECCHI METERS		.61	.80						
00095 CNDUCTVY AT 25C MICROMHO	475		340						420
00098 VSAMPLOC DEPTH METERS	10.00		.00	1.00	2.00	3.00	4.00	5.00	6.00
00300 DO MG/L	.1		8.0	6.4	5.3	4.4	4.4	4.2	4.0
00301 DO SATUR PERCENT	1.0$		92.0$	72.7$	60.2$	50.0$	50.0$	46.7$	44.4$
00403 PH LAB SU	6.9		8.4						8.2
00625 TOT KJEL N MG/L	7.000		2.550						2.050
00665 PHOS-TOT MG/L P	1.060		.100						.060
32210 CHLRPHYL A UG/L			97.00						
82903 DPTH BOT AT SITE METERS			11.0						

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE

INITIAL DATE				84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/09/04	84/09/24	84/09/24	84/09/24
INITIAL TIME				1100	1100	1100	1100	1100	0900	1107	1107	1107
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				22	26	29	32	36	0	0	3	6
00010	WATER	TEMP	CENT	20.0	18.5	17.0	16.0	16.0		15.0	15.0	15.0
00011	WATER	TEMP	FAHN	68.0$	65.3$	62.6$	60.8$	60.8$		59.0$	59.0$	59.0$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	202	401	401	401
00078	TRANSP	SECCHI	METERS						.76	1.30		
00095	CNDUCTVY	AT 25C	MICROMHO				510			355		
00098	VSAMPLOC	DEPTH	METERS	7.00	8.00	9.00	10.00	11.00		.00	1.00	2.00
00300	DO		MG/L	.3	.1	.1	.1	.1		8.2	8.2	8.0
00301	DO	SATUR	PERCENT	3.3$	1.1$	1.0$	1.0$	1.0$		80.4$	80.4$	78.4$
00403	PH	LAB	SU				6.9			8.6		
00410	T ALK	CACO3	MG/L							151		
00610	NH3+NH4-	N TOTAL	MG/L							.560		
00612	UN-IONZD	NH3-N	MG/L							.051$		
00619	UN-IONZD	NH3-NH3	MG/L							.061$		
00625	TOT KJEL	N	MG/L				11.500			2.600		
00630	NO2&NO3	N-TOTAL	MG/L							.05		
00665	PHOS-TOT		MG/L P				1.200			.160		
32210	CHLRPHYL	A	UG/L							83.00		
82903	DPTH BOT	AT SITE	METERS							10.9		

INITIAL DATE				84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	85/05/22
INITIAL TIME				1107	1107	1107	1107	1107	1107	1107	1107	
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				9	13	16	19	22	26	29	32	0
00010	WATER	TEMP	CENT	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	
00011	WATER	TEMP	FAHN	59.0$	59.0$	59.0$	59.0$	59.0$	59.0$	59.0$	59.0$	
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	202
00078	TRANSP	SECCHI	METERS									1.37
00095	CNDUCTVY	AT 25C	MICROMHO							360		
00098	VSAMPLOC	DEPTH	METERS	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	
00300	DO		MG/L	7.9	7.5	7.0	7.1	7.1	7.1	7.0	7.0	
00301	DO	SATUR	PERCENT	77.5$	73.5$	68.6$	69.6$	69.6$	69.6$	68.6$	68.6$	
00403	PH	LAB	SU							8.5		
00625	TOT KJEL	N	MG/L							2.350		
00665	PHOS-TOT		MG/L P							.140		

70-0054
44 42 05.0 093 28 20.0 3
LAKE: SPRING AT PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 255.3 HECTARE M 070433
/TYPA/AMBNT/LAKE
MEAN DEPTH: 5.6 M MAX DEPTH: 10.4 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

	85/06/12	85/07/01	85/07/22	85/08/13	85/09/03	86/05/28	86/06/19	86/07/10	86/07/29
INITIAL DATE	85/06/12	85/07/01	85/07/22	85/08/13	85/09/03	86/05/28	86/06/19	86/07/10	86/07/29
INITIAL TIME						1135	1430	1305	0830
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	202	202	202	202	202	202	202	202	202
00078 TRANSP SECCHI METERS	1.37	.46	.46	.61	.61	3.20	1.83	1.07	.30
74041 WQF SAMPLE UPDATED						870108	870108	870108	870108

INITIAL DATE	86/08/18	86/09/11	87/05/25	87/06/16	87/07/07	87/07/28	87/08/18	87/09/10	88/05/25
INITIAL TIME	1300	0945	1045	1315	1120	1215	1120	1050	1530
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	202	202	202	202	202	202	202	202	202
00078 TRANSP SECCHI METERS	.91	.91	1.52	.61	.76	.61	.76	.76	1.68
74041 WQF SAMPLE UPDATED	870108	870108	871218	871229	871218	871218	871218	871218	881118
84141 LAKE CND PHYSICAL CODE			2	4	4	4	4	4	
84142 LAKE REC SUITABL. CODE			4	4	5	4	4	4	

INITIAL DATE	88/06/14	88/07/07	88/07/28	88/08/16	88/09/05
INITIAL TIME	1045	1205	0950	0915	1035
MEDIUM	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0
00029 FIELD IDENT NUMBER	202	202	202	202	202
00078 TRANSP SECCHI METERS	.76	.91	.76	.61	.91
74041 WQF SAMPLE UPDATED	881118	881118	881118	881118	881118
84141 LAKE CND PHYSICAL CODE	4	3	4	4	4
84142 LAKE REC SUITABL. CODE	4	3	4	4	4

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

DESCRIPTIVE PARAGRAPH

AREA: 138 HA	SHORE L: 6.20 MI	ECOL CLASS: 6-1972 -	
AV DEPTH: 2.4 M	USE OF SHORELINE:	MGMT CLASS: 3-1972 -	
MX DEPTH: 13 M	FOR 10% AGR 20%	ROUGHFISH: 1	LANDSAT TYPE: -
VOL: 3.33E06 M3	MUN 70% MRSH 0%	WQ INDEX: -	CHLOR IND: -
LITTORAL: 94 %	# DWELL: 194-1972	SENS IND: -	SECCHI IND: -
DEPTH ROOTED	# RESORTS: 3-1972	RANK IND: -	T-PHOS IND: -
VEG: 2 M	AC/MI: 55	PROBLEMS: ALGAE 1972	
DOM SHOL SOIL:	DWELL/MI: 34		
SAND	AC/DWELL: 2		
PUB ACC #: 1	WTRSHED AREA: 23.4 SQ MI		
ADMIN: DNR-E	GEOM REG: - - - -		
POPULATION	SLU: - - - -		
1 MI: 0	LAND USE: WTR 6% MRSH 5%		
5 MI: 5998	FOR 6% CUL 54% RES 10%	LKMAP: B291	
10 MI: 43824	URB 2% PASTURE/OPEN 16%	QUAD1: PRIOR LAKE	

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
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AREA: 137.6 HECTARE M 070433
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21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

INITIAL DATE			48/09/16	48/09/16	48/09/16	63/06/13	63/06/13	68/08/20	68/08/20	68/08/20	69/05/21
INITIAL TIME			0000	0000	0000	1530	1535	1330	1330	1350	1100
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	3	42	0	0	1	20	1	1
00010 WATER	TEMP	CENT	22.2$		8.9$			22.8$	17.2$	23.9$	
00011 WATER	TEMP	FAHN	72.0		48.0			73.0	63.0	75.0	
00029 FIELD	IDENT	NUMBER		300				102	102	105	105
00071 TURB	HLGE	JCU						37.0	78.0	29.0	3.9
00078 TRANSP	SECCHI	METERS		.91							
00080 COLOR	PT-CO	UNITS						25	25	15	25
00095 CNDUCTVY	AT 25C	MICROMHO									320
00300 DO		MG/L	8.5		.0			11.8	.0	12.6	5.0
00301 DO	SATUR	PERCENT	96.6$		.0$			135.6$	.0$	148.2$	
00310 BOD	5 DAY	MG/L						18.0	8.0	15.0	4.0
00403 PH	LAB	SU	8.4					8.5	7.1	8.4	8.4
00410 T ALK	CACO3	MG/L	128					120	180	120	150
00500 RESIDUE	TOTAL	MG/L						260	370	230	230
00505 RESIDUE	TOT VOL	MG/L						110	110	99	110
00530 RESIDUE	TOT NFLT	MG/L						25	130	19	8
00535 RESIDUE	VOL NFLT	MG/L						18	35	16	5
00605 ORG N	N	MG/L						2.700	2.700	2.200	1.300
00610 NH3+NH4-	N TOTAL	MG/L						.200	5.500	.140	.050K
00612 UN-IONZD	NH3-N	MG/L						.027$	.022$	.016$	
00615 NO2-N	TOTAL	MG/L						.020	.020K	.020K	.020K
00619 UN-IONZD	NH3-NH3	MG/L						.032$	.027$	.020$	
00620 NO3-N	TOTAL	MG/L						.440	.020K	.020K	.060
00665 PHOS-TOT		MG/L P						.160	.780	.150	.070
00666 PHOS-DIS		MG/L P						.060	.420	.060	.040
00900 TOT HARD	CACO3	MG/L						130	170	130	180
00940 CHLORIDE	TOTAL	MG/L									12
31505 TOT COLI	MPN CONF	/100ML						70		120	50
31615 FEC COLI	MPNECMED	/100ML				68	45	20K		20	20K
38260 MBAS		MG/L						.38	.10K	.30	.32

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

	INITIAL DATE			69/05/21	69/05/21	69/05/21	69/05/21	69/05/21	69/05/21	72/08/08	72/08/08	72/08/08
	INITIAL TIME			1101	1120	1125	1130	1133	1140			
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			1	1	1	1	20	1	0	5	10
00010	WATER	TEMP	CENT							21.4$	21.4$	21.4$
00011	WATER	TEMP	FAHN							70.5	70.5	70.5
00029	FIELD	IDENT	NUMBER	106	104	101	102	102	103	300	300	300
00071	TURB	HLGE	JCU				4.1	6.2				
00078	TRANSP	SECCHI	METERS							.69		
00080	COLOR	PT-CO	UNITS				25	25				
00095	CNDUCTVY	AT 25C	MICROMHO				320	320				
00300	DO		MG/L				8.0	2.8		5.4	4.6	4.6
00301	DO	SATUR	PERCENT							60.0$	51.1$	51.1$
00310	BOD	5 DAY	MG/L				3.8	2.8				
00403	PH	LAB	SU				8.5	8.4				
00410	T ALK	CACO3	MG/L				150	160				
00500	RESIDUE	TOTAL	MG/L				230	210				
00505	RESIDUE	TOT VOL	MG/L				120	110				
00530	RESIDUE	TOT NFLT	MG/L				7	11				
00535	RESIDUE	VOL NFLT	MG/L				5	6				
00605	ORG N	N	MG/L				1.200	1.200				
00610	NH3+NH4-	N TOTAL	MG/L				.050	.140				
00615	NO2-N	TOTAL	MG/L				.020K	.020K				
00620	NO3-N	TOTAL	MG/L				.060	.070				
00665	PHOS-TOT		MG/L P				.050	.080				
00666	PHOS-DIS		MG/L P				.030	.030				
00900	TOT HARD	CACO3	MG/L				170	180				
00940	CHLORIDE	TOTAL	MG/L				12	13				
31505	TOT COLI	MPN CONF	/100ML	220	80	20	110		50			
31615	FEC COLI	MPNECMED	/100ML	20K	80	20K	20		50			
38260	MBAS		MG/L				.31	.01K				

	INITIAL DATE			72/08/08	72/08/08	72/08/08	72/08/08	72/08/08	72/08/08	72/08/08	79/07/10	79/08/19
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			15	16	20	22	25	35	40	0	0
00005	VSAMPLOC	DEPTH	% OF TOT								0	
00008	LAB	IDENT.	NUMBER								123873	123260
00010	WATER	TEMP	CENT	20.6$	20.0$	13.1$	11.4$	9.7$	7.5$	7.2$		

(SAMPLE CONTINUED ON NEXT PAGE)

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE				72/08/08	72/08/08	72/08/08	72/08/08	72/08/08	72/08/08	72/08/08	79/07/10	79/08/19
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				15	16	20	22	25	35	40	0	0
00011	WATER	TEMP	FAHN	69.0	68.0	55.5	52.5	49.5	45.5	45.0		
00029	FIELD	IDENT	NUMBER	300	300	300	300	300	300	300	201	201
00080	COLOR	PT-CO	UNITS								20	20
00300	DO		MG/L	2.7		1.3	.0	.0	.0	.0		
00301	DO	SATUR	PERCENT	30.0$		12.3$	.0$	.0$	.0$	.0$		
00625	TOT KJEL	N	MG/L								1.140J	1.350J
00665	PHOS-TOT		MG/L P								.047	.032

INITIAL DATE				80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03	80/06/03
INITIAL TIME				1110	1110	1110	1110	1110	1110	1110	1110	1110
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	3	6	9	13	16	19	22	26
00010	WATER	TEMP	CENT	20.5	20.5	20.0	19.5	19.0	17.5	13.0	10.5	8.5
00011	WATER	TEMP	FAHN	68.9$	68.9$	68.0$	67.1$	66.2$	63.5$	55.4$	50.9$	47.3$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS		1.60							
00095	CNDUCTVY	AT 25C	MICROMHO		320							
00098	VSAMPLOC	DEPTH	METERS	.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
00300	DO		MG/L	9.6	9.6	9.4	9.1	1.0	.0	.0	.0	.0
00301	DO	SATUR	PERCENT	104.3$	104.3$	102.2$	96.8$	10.6$	.0$	.0$	.0$	.0$
00403	PH	LAB	SU		8.3							
00625	TOT KJEL	N	MG/L		2.040							
00630	NO2&NO3	N-TOTAL	MG/L		.05K							
00665	PHOS-TOT		MG/L P		.050							
00666	PHOS-DIS		MG/L P		.020							
32210	CHLRPHYL	A	UG/L		29.00							
74041	WQF	SAMPLE	UPDATED		870213							

INITIAL DATE				80/06/03	80/06/03	80/07/04	80/07/07	80/07/07	80/07/07	80/07/07	80/07/07	80/07/07
INITIAL TIME				1110	1110		1115	1115	1115	1115	1115	1115
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				32	36	0	0	3	6	9	13	16
00008	LAB	IDENT.	NUMBER			123090						
00010	WATER	TEMP	CENT		7.0		23.0	21.0	21.0	20.5	18.0	17.0
00011	WATER	TEMP	FAHN		44.6$		73.4$	69.8$	69.8$	68.9$	64.4$	62.6$
00029	FIELD	IDENT	NUMBER	401	401	201	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS					.80				
00080	COLOR	PT-CO	UNITS			20						

(SAMPLE CONTINUED ON NEXT PAGE)

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE	80/06/03	80/06/03	80/07/04	80/07/07	80/07/07	80/07/07	80/07/07	80/07/07	80/07/07
INITIAL TIME	1110	1110		1115	1115	1115	1115	1115	1115
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	32	36	0	0	3	6	9	13	16
00095 CNDUCTVY AT 25C MICROMHO	430				355				
00098 VSAMPLOC DEPTH METERS	10.00	11.00	.00	.00	1.00	2.00	3.00	4.00	5.00
00300 DO MG/L		.0		9.9	9.8	9.0	8.4	1.2	.7
00301 DO SATUR PERCENT		.0$		113.8$	108.9$	100.0$	91.3$	12.6$	7.2$
00403 PH LAB SU	7.0				8.2				
00410 T ALK CACO3 MG/L					163				
00610 NH3+NH4- N TOTAL MG/L					.080				
00612 UN-IONZD NH3-N MG/L					.005$				
00619 UN-IONZD NH3-NH3 MG/L					.006$				
00625 TOT KJEL N MG/L			1.900J		2.160				
00630 NO2&NO3 N-TOTAL MG/L					.05K				
00665 PHOS-TOT MG/L P			.072		.080				
00666 PHOS-DIS MG/L P					.030				
00900 TOT HARD CACO3 MG/L					200				
32210 CHLRPHYL A UG/L					57.00				
74041 WQF SAMPLE UPDATED					870213				

INITIAL DATE	80/07/07	80/07/07	80/07/07	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05
INITIAL TIME	1115	1115	1115	1215	1215	1215	1215	1215	1215
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	22	32	36	0	0.983999	3	6	9	13
00010 WATER TEMP CENT	10.0		5.0	24.0		24.0	24.0	24.0	24.0
00011 WATER TEMP FAHN	50.0$		41.0$	75.2$		75.2$	75.2$	75.2$	75.2$
00029 FIELD IDENT NUMBER	401	401	401	401	401	401	401	401	401
00076 TURB TRBIDMTR HACH FTU					10.0				
00078 TRANSP SECCHI METERS						.60			
00095 CNDUCTVY AT 25C MICROMHO		460			361	350			
00098 VSAMPLOC DEPTH METERS	7.00	10.00	11.00	.00	.30	1.00	2.00	3.00	4.00
00300 DO MG/L	.8		.7	8.3		8.1	7.9	7.8	7.8
00301 DO SATUR PERCENT	7.1$		5.5$	97.6$		95.3$	92.9$	91.8$	91.8$
00403 PH LAB SU		7.2				8.4			
00530 RESIDUE TOT NFLT MG/L					10				
00535 RESIDUE VOL NFLT MG/L					8				
00625 TOT KJEL N MG/L						2.540			
00630 NO2&NO3 N-TOTAL MG/L						.05K			
00665 PHOS-TOT MG/L P						.060			
00666 PHOS-DIS MG/L P						.010			

(SAMPLE CONTINUED ON NEXT PAGE)

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			80/07/07	80/07/07	80/07/07	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05
INITIAL TIME			1115	1115	1115	1215	1215	1215	1215	1215	1215
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			22	32	36	0	0.983999	3	6	9	13
00940 CHLORIDE	TOTAL	MG/L					24				
01002 ARSENIC	AS,TOT	UG/L					8				
01007 BARIUM	BA,TOT	UG/L					65				
01022 BORON	B,TOT	UG/L					.1				
01027 CADMIUM	CD,TOT	UG/L					.2				
01034 CHROMIUM	CR,TOT	UG/L					.3				
01042 COPPER	CU,TOT	UG/L					3				
01045 IRON	FE,TOT	UG/L					50				
01051 LEAD	PB,TOT	UG/L					2				
01055 MANGNESE	MN	UG/L					100.0				
01067 NICKEL	NI,TOTAL	UG/L					10				
01092 ZINC	ZN,TOT	UG/L					12				
01105 ALUMINUM	AL,TOT	UG/L					4				
32210 CHLRPHYL	A	UG/L						82.00			
71900 MERCURY	HG,TOTAL	UG/L					.2				
74041 WQF	SAMPLE	UPDATED						870213			

INITIAL DATE			80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/09/15	80/09/15
INITIAL TIME			1215	1215	1215	1215	1215	1215	1215	1045	1045
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			16	19	22	26	32	32.8	36	0	3
00010 WATER	TEMP	CENT	24.0	23.5	23.0	15.0			8.0	18.5	18.5
00011 WATER	TEMP	FAHN	75.2$	74.3$	73.4$	59.0$			46.4$	65.3$	65.3$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00076 TURB	TRBIDMTR	HACH FTU						54.0			
00078 TRANSP	SECCHI	METERS									1.00
00095 CNDUCTVY	AT 25C	MICROMHO					470	510			320
00098 VSAMPLOC	DEPTH	METERS	5.00	6.00	7.00	8.00	10.00	10.00	11.00	.00	1.00
00300 DO		MG/L	7.8	7.5	.2	.0			.0	4.0	3.9
00301 DO	SATUR	PERCENT	91.8$	86.2$	2.3$	.0$			.0$	42.1$	41.1$
00403 PH	LAB	SU					6.9				7.7
00530 RESIDUE	TOT NFLT	MG/L						2			
00535 RESIDUE	VOL NFLT	MG/L						2			
00625 TOT KJEL	N	MG/L									2.120
00630 NO2&NO3	N-TOTAL	MG/L									.01
00665 PHOS-TOT		MG/L P									.060
00666 PHOS-DIS		MG/L P									.010

(SAMPLE CONTINUED ON NEXT PAGE)

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/08/05	80/09/15	80/09/15
INITIAL TIME			1215	1215	1215	1215	1215	1215	1215	1045	1045
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			16	19	22	26	32	32.8	36	0	3
00940 CHLORIDE	TOTAL	MG/L						24			
01002 ARSENIC	AS,TOT	UG/L						6			
01007 BARIUM	BA,TOT	UG/L						62			
01022 BORON	B,TOT	UG/L						.2			
01027 CADMIUM	CD,TOT	UG/L						.3			
01034 CHROMIUM	CR,TOT	UG/L						1			
01042 COPPER	CU,TOT	UG/L						3			
01045 IRON	FE,TOT	UG/L						350			
01051 LEAD	PB,TOT	UG/L						5			
01055 MANGNESE	MN	UG/L						1800.0			
01067 NICKEL	NI,TOTAL	UG/L						9			
01092 ZINC	ZN,TOT	UG/L						7			
01105 ALUMINUM	AL,TOT	UG/L						6			
32210 CHLRPHYL	A	UG/L									37.00
71900 MERCURY	HG,TOTAL	UG/L						.2			
74041 WQF	SAMPLE	UPDATED									870213

INITIAL DATE			80/09/15	80/09/15	80/09/15	80/09/15	80/09/15	80/09/15	80/09/15	80/09/15	80/09/15
INITIAL TIME			1045	1045	1045	1045	1045	1045	1045	1045	1045
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			6	9	13	16	19	22	26	29	32
00010 WATER	TEMP	CENT	18.5	18.5	18.5	18.5	18.5	18.5	18.5	16.5	
00011 WATER	TEMP	FAHN	65.3$	65.3$	65.3$	65.3$	65.3$	65.3$	65.3$	61.7$	
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00095 CNDUCTVY	AT 25C	MICROMHO									450
00098 VSAMPLOC	DEPTH	METERS	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
00300 DO		MG/L	3.8	3.8	3.8	3.7	3.7	3.7	3.4	.0	
00301 DO	SATUR	PERCENT	40.0$	40.0$	40.0$	38.9$	38.9$	38.9$	35.8$	.0$	
00403 PH	LAB	SU									6.8

INITIAL DATE			80/09/15	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07
INITIAL TIME			1045	1155	1155	1155	1155	1155	1155	1155	1155
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			36	0	3.28	6.56	9.84	13.12	16.4	19.68	22.96
00010 WATER	TEMP	CENT	8.5	15.0	15.0	14.5	14.0	14.0	14.0	13.5	13.5
00011 WATER	TEMP	FAHN	47.3$	59.0$	59.0$	58.1$	57.2$	57.2$	57.2$	56.3$	56.3$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401

(SAMPLE CONTINUED ON NEXT PAGE)

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			80/09/15	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07	81/05/07
	INITIAL TIME			1045	1155	1155	1155	1155	1155	1155	1155	1155
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			36	0	3.28	6.56	9.84	13.12	16.4	19.68	22.96
00078	TRANSP	SECCHI	METERS		3.40							
00095	CNDUCTVY	AT 25C	MICROMHO		280							
00098	VSAMPLOC	DEPTH	METERS	11.00	.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300	DO		MG/L	.0	9.4	9.3	9.2	8.4	8.1	7.7	6.7	6.1
00301	DO	SATUR	PERCENT	.0$	92.2$	91.2$	88.5$	80.8$	77.9$	74.0$	63.2$	57.5$
00403	PH	LAB	SU		8.3							
00410	T ALK	CACO3	MG/L		96							
00610	NH3+NH4-	N TOTAL	MG/L		.280							
00612	UN-IONZD	NH3-N	MG/L		.014$							
00619	UN-IONZD	NH3-NH3	MG/L		.018$							
00625	TOT KJEL	N	MG/L		1.880							
00630	NO2&NO3	N-TOTAL	MG/L		.15							
00665	PHOS-TOT		MG/L P		.060							
00666	PHOS-DIS		MG/L P		.060							
32210	CHLRPHYL	A	UG/L		15.00							

	INITIAL DATE			81/05/07	81/05/07	81/05/07	81/05/07	81/06/05	81/06/05	81/06/05	81/06/05	81/06/05
	INITIAL TIME			1155	1155	1155	1155	1117	1117	1117	1117	1117
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			26.24	29.52	32.8	36.08	0	3.28	6.56	9.84	13.12
00010	WATER	TEMP	CENT	13.5	13.0	12.0	11.0	21.5	21.0	20.5	20.0	19.5
00011	WATER	TEMP	FAHN	56.3$	55.4$	53.6$	51.8$	70.7$	69.8$	68.9$	68.0$	67.1$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS					1.40				
00095	CNDUCTVY	AT 25C	MICROMHO			390		395				
00098	VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00	11.00	.00	1.00	2.00	3.00	4.00
00300	DO		MG/L	5.6	4.3	1.7	.5	11.0	10.5	9.8	8.3	6.3
00301	DO	SATUR	PERCENT	52.8$	40.6$	15.7$	4.5$	122.2$	116.7$	106.5$	90.2$	67.0$
00403	PH	LAB	SU			7.6		8.1				
00625	TOT KJEL	N	MG/L					1.360				
00665	PHOS-TOT		MG/L P			.129		.029				
00666	PHOS-DIS		MG/L P					.011				
32210	CHLRPHYL	A	UG/L					38.00				

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

INITIAL DATE			81/06/05	81/06/05	81/06/05	81/06/05	81/06/05	81/06/05	81/06/05	81/06/25	81/07/05
INITIAL TIME			1117	1117	1117	1117	1117	1117	1117	1230	1230
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			16.4	19.68	22.96	26.24	29.52	32.8	36.08	0	0
00010 WATER	TEMP	CENT	17.5	16.0	15.0	13.5	13.0	13.0	13.0		
00011 WATER	TEMP	FAHN	63.5$	60.8$	59.0$	56.3$	55.4$	55.4$	55.4$		
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	201	201
00078 TRANSP	SECCHI	METERS								.61	.46
00095 CNDUCTVY	AT 25C	MICROMHO				420					
00098 VSAMPLOC	DEPTH	METERS	5.00	6.00	7.00	8.00	9.00	10.00	11.00		
00300 DO		MG/L	1.8	.2	.2	.2	.2	.2	.2		
00301 DO	SATUR	PERCENT	18.6$	2.0$	2.0$	1.9$	1.9$	1.9$	1.9$		
00403 PH	LAB	SU				7.6					
00665 PHOS-TOT		MG/L P				.155					

INITIAL DATE			81/07/07	81/07/07	81/07/07	81/07/07	81/07/07	81/07/07	81/07/07	81/07/07	81/07/07
INITIAL TIME			1130	1130	1130	1130	1130	1130	1130	1130	1130
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	3.28	6.56	9.84	13.12	16.4	19.68	22.96	26.24
00010 WATER	TEMP	CENT	27.5	27.5	27.0	23.0	21.0	20.0	19.5	18.0	16.0
00011 WATER	TEMP	FAHN	81.5$	81.5$	80.6$	73.4$	69.8$	68.0$	67.1$	64.4$	60.8$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS	.60								
00095 CNDUCTVY	AT 25C	MICROMHO	330								415
00098 VSAMPLOC	DEPTH	METERS	.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
00300 DO		MG/L	10.6	10.0	8.3	.5	.4	.3	.3	.3	.3
00301 DO	SATUR	PERCENT	130.9$	123.5$	102.5$	5.7$	4.4$	3.3$	3.2$	3.2$	3.0$
00403 PH	LAB	SU	8.7								7.4
00410 T ALK	CACO3	MG/L	132								
00610 NH3+NH4-	N TOTAL	MG/L	.140								
00612 UN-IONZD	NH3-N	MG/L	.035$								
00619 UN-IONZD	NH3-NH3	MG/L	.043$								
00625 TOT KJEL	N	MG/L	2.560								
00630 NO2&NO3	N-TOTAL	MG/L	.05K								
00665 PHOS-TOT		MG/L P	.080								.270
00666 PHOS-DIS		MG/L P	.020								
32210 CHLRPHYL	A	UG/L	98.00								

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

INITIAL DATE	81/07/07	81/07/07	81/07/07	81/07/11	81/07/15	81/07/22	81/08/01	81/08/04	81/08/04
INITIAL TIME	1130	1130	1130	1135	1210	1330	1140	1130	1130
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	29.52	32.8	36.08	0	0	0	0	0	3.28
00010 WATER TEMP CENT	14.0	13.0	13.0					25.0	25.0
00011 WATER TEMP FAHN	57.2$	55.4$	55.4$					77.0$	77.0$
00029 FIELD IDENT NUMBER	401	401	401	201	201	201	201	401	401
00078 TRANSP SECCHI METERS				.46	.46	.46	.46	.70	
00095 CNDUCTVY AT 25C MICROMHO								290	
00098 VSAMPLOC DEPTH METERS	9.00	10.00	11.00					.00	1.00
00300 DO MG/L	.3	.3	.3					10.8	10.8
00301 DO SATUR PERCENT	2.9$	2.8$	2.8$					128.6$	128.6$
00403 PH LAB SU								8.3	
00625 TOT KJEL N MG/L								1.820	
00665 PHOS-TOT MG/L P								.060	
00666 PHOS-DIS MG/L P								.010	
32210 CHLRPHYL A UG/L								98.00	

INITIAL DATE	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04	81/08/04
INITIAL TIME	1130	1130	1130	1130	1130	1130	1130	1130	1130
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	6.56	9.84	13.12	16.4	19.68	22.96	26.24	29.52	32.8
00010 WATER TEMP CENT	25.0	24.0	24.0	23.0	21.0	17.5	16.0	14.0	13.5
00011 WATER TEMP FAHN	77.0$	75.2$	75.2$	73.4$	69.8$	63.5$	60.8$	57.2$	56.3$
00029 FIELD IDENT NUMBER	401	401	401	401	401	401	401	401	401
00095 CNDUCTVY AT 25C MICROMHO							420		
00098 VSAMPLOC DEPTH METERS	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
00300 DO MG/L	10.6	9.2	7.6	1.3	.3	.3	.3	.2	.2
00301 DO SATUR PERCENT	126.2$	108.2$	89.4$	14.9$	3.3$	3.1$	3.0$	1.9$	1.9$
00403 PH LAB SU							6.8		
00665 PHOS-TOT MG/L P							.530		

INITIAL DATE	81/08/04	81/08/08	81/08/15	81/08/23	81/09/02	81/09/02	81/09/02	81/09/02	81/09/02
INITIAL TIME	1130	1310	1130	1230	1155	1155	1155	1155	1155
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	36.08	0	0	0	0	3.28	6.56	9.84	13.12
00010 WATER TEMP CENT	13.0				21.5	21.0	21.0	21.0	21.0
00011 WATER TEMP FAHN	55.4$				70.7$	69.8$	69.8$	69.8$	69.8$

(SAMPLE CONTINUED ON NEXT PAGE)

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			81/08/04	81/08/08	81/08/15	81/08/23	81/09/02	81/09/02	81/09/02	81/09/02	81/09/02
INITIAL TIME			1130	1310	1130	1230	1155	1155	1155	1155	1155
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			36.08	0	0	0	0	3.28	6.56	9.84	13.12
00029 FIELD	IDENT	NUMBER	401	201	201	201	401	401	401	401	401
00078 TRANSP	SECCHI	METERS		.46	.46	.46	.70				
00095 CNDUCTVY	AT 25C	MICROMHO					300				
00098 VSAMPLOC	DEPTH	METERS	11.00				.00	1.00	2.00	3.00	4.00
00300 DO		MG/L	.2				8.0	7.2	6.8	6.4	6.1
00301 DO	SATUR	PERCENT	1.9$				88.9$	80.0$	75.6$	71.1$	67.8$
00403 PH	LAB	SU					8.1				
00410 T ALK	CACO3	MG/L					135				
00610 NH3+NH4-	N TOTAL	MG/L					.360				
00612 UN-IONZD	NH3-N	MG/L					.019$				
00619 UN-IONZD	NH3-NH3	MG/L					.023$				
00625 TOT KJEL	N	MG/L					2.280				
00630 NO2&NO3	N-TOTAL	MG/L					.05				
00665 PHOS-TOT		MG/L P					.085				
00666 PHOS-DIS		MG/L P					.005				
32210 CHLRPHYL	A	UG/L					90.00				

INITIAL DATE			81/09/02	81/09/02	81/09/02	81/09/02	81/09/02	81/09/02	81/09/02	81/09/05	81/09/12
INITIAL TIME			1155	1155	1155	1155	1155	1155	1155	1200	1310
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			16.4	19.68	22.96	26.24	29.52	32.8	36.08	0	0
00010 WATER	TEMP	CENT	21.0	21.0	20.0	20.0	15.0	14.0	13.5		
00011 WATER	TEMP	FAHN	69.8$	69.8$	68.0$	68.0$	59.0$	57.2$	56.3$		
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	201	201
00078 TRANSP	SECCHI	METERS								.46	.46
00095 CNDUCTVY	AT 25C	MICROMHO					420				
00098 VSAMPLOC	DEPTH	METERS	5.00	6.00	7.00	8.00	9.00	10.00	11.00		
00300 DO		MG/L	5.9	5.4	1.7	.4	.3	.3	.3		
00301 DO	SATUR	PERCENT	65.6$	60.0$	18.5$	4.3$	2.9$	2.9$	2.8$		
00403 PH	LAB	SU					7.0				
00665 PHOS-TOT		MG/L P					.880				

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
/TYPA/AMBNT/LAKE/BIO
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

	INITIAL DATE			81/09/18	81/09/27	82/06/07	82/06/12	82/06/16	82/06/23	82/07/04	82/07/08	82/07/16
	INITIAL TIME			1330	1200	1200	1330	1215	1240	1310	1515	1100
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	201	201	201	201	201	201	201	201	201
00078	TRANSP	SECCHI	METERS	.46	.61	1.37	1.22	.76	.91	.76	.76	.91

	INITIAL DATE			82/07/24	82/08/02	82/08/16	82/09/01	82/09/25	83/06/04	83/06/10	83/06/16	83/06/27
	INITIAL TIME			1600	1910	1340	1410	1510	1300	1330	1230	1420
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	201	201	201	201	201	201	201	201	201
00078	TRANSP	SECCHI	METERS	.76	.61	.61	.46	.46	.91	.76	.76	.76

	INITIAL DATE			83/07/10	83/07/17	83/07/25	83/07/30	83/08/06	83/08/14	83/08/20	83/08/26	83/09/05
	INITIAL TIME			1340	1210	1440	1127	1240	1100	1120	1500	1300
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	201	201	201	201	201	201	201	201	201
00078	TRANSP	SECCHI	METERS	.76	.76	.61	.61	.46	.46	.46	.46	.46

	INITIAL DATE			83/09/13	83/09/19	83/09/28	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21
	INITIAL TIME			1110	1200	1215	1155	1155	1155	1155	1155	1155
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	0	0	0	3	6	9	13	16
00010	WATER	TEMP	CENT				18.0	18.0	18.0	18.0	16.0	14.0
00011	WATER	TEMP	FAHN				64.4$	64.4$	64.4$	64.4$	60.8$	57.2$
00029	FIELD	IDENT	NUMBER	201	201	201	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS	.46	.46	.46	2.60					
00095	CNDUCTVY	AT 25C	MICROMHO				375					405
00098	VSAMPLOC	DEPTH	METERS				.00	1.00	2.00	3.00	4.00	5.00
00300	DO		MG/L				9.3	9.4	9.5	9.5	7.2	4.4
00301	DO	SATUR	PERCENT				97.9$	98.9$	100.0$	100.0$	72.0$	42.3$
00403	PH	LAB	SU				8.7					8.2
00410	T ALK	CACO3	MG/L				174					
00610	NH3+NH4-	N TOTAL	MG/L				.110					
00612	UN-IONZD	NH3-N	MG/L				.016$					
00619	UN-IONZD	NH3-NH3	MG/L				.020$					

(SAMPLE CONTINUED ON NEXT PAGE)

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			83/09/13	83/09/19	83/09/28	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21
	INITIAL TIME			1110	1200	1215	1155	1155	1155	1155	1155	1155
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	0	0	0	3	6	9	13	16
00625	TOT KJEL	N	MG/L				1.420					1.350
00630	NO2&NO3	N-TOTAL	MG/L				.30					
00665	PHOS-TOT		MG/L P				.045					.040
32210	CHLRPHYL	A	UG/L				10.00					

	INITIAL DATE			84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/06/06	84/06/15	84/06/22	84/06/22
	INITIAL TIME			1155	1155	1155	1155	1155	1420	0936	1225	1225
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			19	22	26	29	32	0	0	0	3
00010	WATER	TEMP	CENT	13.0	12.0	12.0	11.0	10.0			24.5	24.0
00011	WATER	TEMP	FAHN	55.4$	53.6$	53.6$	51.8$	50.0$			76.1$	75.2$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	201	201	401	401
00078	TRANSP	SECCHI	METERS						1.83	1.22	1.30	
00095	CNDUCTVY	AT 25C	MICROMHO					415			370	
00098	VSAMPLOC	DEPTH	METERS	6.00	7.00	8.00	9.00	10.00			.00	1.00
00300	DO		MG/L	3.4	2.6	2.1	.4	.3			11.4	11.3
00301	DO	SATUR	PERCENT	32.1$	24.1$	19.4$	3.6$	2.7$			134.1$	132.9$
00403	PH	LAB	SU					7.7			8.7	
00625	TOT KJEL	N	MG/L					2.150			1.700	
00665	PHOS-TOT		MG/L P					.011			.130	
32210	CHLRPHYL	A	UG/L								45.00	

	INITIAL DATE			84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22
	INITIAL TIME			1225	1225	1225	1225	1225	1225	1225	1225	1225
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			6	9	13	16	19	22	26	29	32
00010	WATER	TEMP	CENT	24.0	23.0	21.0	20.0	19.0	16.5	13.5	11.0	11.0
00011	WATER	TEMP	FAHN	75.2$	73.4$	69.8$	68.0$	66.2$	61.7$	56.3$	51.8$	51.8$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00095	CNDUCTVY	AT 25C	MICROMHO					370				430
00098	VSAMPLOC	DEPTH	METERS	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
00300	DO		MG/L	11.1	8.2	2.6	.5	.3	.2	.2	.2	.2
00301	DO	SATUR	PERCENT	130.6$	94.3$	28.9$	5.4$	3.2$	2.0$	1.9$	1.8$	1.8$
00403	PH	LAB	SU					7.7				7.1
00625	TOT KJEL	N	MG/L					1.800				3.200
00665	PHOS-TOT		MG/L P					.120				.360

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

INITIAL DATE			84/06/25	84/07/04	84/07/10	84/07/16	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26
INITIAL TIME			1600	1320	1530	1349	1206	1206	1206	1206	1206
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	0	0	0	3	6	9	13
00010 WATER	TEMP	CENT					25.0	25.0	25.0	24.5	23.5
00011 WATER	TEMP	FAHN					77.0$	77.0$	77.0$	76.1$	74.3$
00029 FIELD	IDENT	NUMBER	201	201	201	201	401	401	401	401	401
00078 TRANSP	SECCHI	METERS	1.22	.91	.61	.76	.70				
00095 CNDUCTVY	AT 25C	MICROMHO					390				
00098 VSAMPLOC	DEPTH	METERS					.00	1.00	2.00	3.00	4.00
00300 DO		MG/L					10.0	9.5	7.5	4.0	.2
00301 DO	SATUR	PERCENT					119.0$	113.1$	89.3$	47.1$	2.3$
00403 PH	LAB	SU					8.5				
00410 T ALK	CACO3	MG/L					151				
00610 NH3+NH4-	N TOTAL	MG/L					.040				
00612 UN-IONZD	NH3-N	MG/L					.006$				
00619 UN-IONZD	NH3-NH3	MG/L					.007$				
00625 TOT KJEL	N	MG/L					1.820				
00630 NO2&NO3	N-TOTAL	MG/L					.05K				
00665 PHOS-TOT		MG/L P					.050				
32210 CHLRPHYL	A	UG/L					62.00				
82903 DPTH BOT	AT SITE	METERS					13.1				

INITIAL DATE			84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26
INITIAL TIME			1206	1206	1206	1206	1206	1206	1206	1206	1206
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			16	19	22	26	29	32	36	39	42
00010 WATER	TEMP	CENT	22.0	19.5	15.0	13.5	12.0	10.5	10.0	10.0	10.0
00011 WATER	TEMP	FAHN	71.6$	67.1$	59.0$	56.3$	53.6$	50.9$	50.0$	50.0$	50.0$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00095 CNDUCTVY	AT 25C	MICROMHO		390						475	
00098 VSAMPLOC	DEPTH	METERS	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00
00300 DO		MG/L	.2	.1	.1	.1	.1	.1	.1	.1	.1
00301 DO	SATUR	PERCENT	2.3$	1.1$	1.0$	.9$	.9$	.9$	.9$	.9$	.9$
00403 PH	LAB	SU		7.6						7.0	
00625 TOT KJEL	N	MG/L		2.100						8.000	
00665 PHOS-TOT		MG/L P		.050						.980	

70-0072
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LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

INITIAL DATE			84/07/26	84/08/02	84/08/10	84/08/15	84/08/23	84/08/27	84/08/27	84/08/27	84/08/27
INITIAL TIME			1500	1430	1700	1300	1400	1222	1222	1222	1222
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	0	0	0	0	3	6	9
00010 WATER	TEMP	CENT						23.0	22.0	22.0	22.0
00011 WATER	TEMP	FAHN						73.4$	71.6$	71.6$	71.6$
00029 FIELD	IDENT	NUMBER	201	201	201	201	201	401	401	401	401
00078 TRANSP	SECCHI	METERS	.61	.61	.61	.61	.46	.60			
00095 CNDUCTVY	AT 25C	MICROMHO						340			
00098 VSAMPLOC	DEPTH	METERS						.00	1.00	2.00	3.00
00300 DO		MG/L						9.6	7.4	6.3	6.0
00301 DO	SATUR	PERCENT						110.3$	84.1$	71.6$	68.2$
00403 PH	LAB	SU						8.5			
00625 TOT KJEL	N	MG/L						2.300			
00665 PHOS-TOT		MG/L P						.070			
32210 CHLRPHYL	A	UG/L						120.00			
82903 DPTH BOT	AT SITE	METERS						10.5			

INITIAL DATE			84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/08/31	84/09/10
INITIAL TIME			1222	1222	1222	1222	1222	1222	1222	1130	1315
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			13	16	19	22	26	29	32	0	0
00010 WATER	TEMP	CENT	22.0	22.0	21.5	17.0	13.0	12.0	11.0		
00011 WATER	TEMP	FAHN	71.6$	71.6$	70.7$	62.6$	55.4$	53.6$	51.8$		
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	201	201
00078 TRANSP	SECCHI	METERS								.46	.46
00095 CNDUCTVY	AT 25C	MICROMHO			345				475		
00098 VSAMPLOC	DEPTH	METERS	4.00	5.00	6.00	7.00	8.00	9.00	10.00		
00300 DO		MG/L	5.7	4.3	2.3	.4	.2	.2	.1		
00301 DO	SATUR	PERCENT	64.8$	48.9$	25.6$	4.1$	1.9$	1.9$	.9$		
00403 PH	LAB	SU			8.1				7.0		
00625 TOT KJEL	N	MG/L			2.350				7.500		
00665 PHOS-TOT		MG/L P			.070				.880		

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

INITIAL DATE			84/09/21	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24
INITIAL TIME			1400	1218	1218	1218	1218	1218	1218	1218	1218
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	3	6	9	13	16	19	22
00010 WATER	TEMP	CENT		15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
00011 WATER	TEMP	FAHN		59.0$	59.0$	59.0$	59.0$	59.0$	59.0$	59.0$	59.0$
00029 FIELD	IDENT	NUMBER	201	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS	.46	.90							
00095 CNDUCTVY	AT 25C	MICROMHO		335							
00098 VSAMPLOC	DEPTH	METERS		.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
00300 DO		MG/L		5.5	5.5	5.5	5.4	5.4	5.3	5.3	5.0
00301 DO	SATUR	PERCENT		53.9$	53.9$	53.9$	52.9$	52.9$	52.0$	52.0$	49.0$
00403 PH	LAB	SU		8.2							
00410 T ALK	CACO3	MG/L		151							
00610 NH3+NH4-	N TOTAL	MG/L		.510							
00612 UN-IONZD	NH3-N	MG/L		.021$							
00619 UN-IONZD	NH3-NH3	MG/L		.026$							
00625 TOT KJEL	N	MG/L		2.150							
00630 NO2&NO3	N-TOTAL	MG/L		.05							
00665 PHOS-TOT		MG/L P		.100							
32210 CHLRPHYL	A	UG/L		74.00							
82903 DPTH BOT	AT SITE	METERS		12.0							

INITIAL DATE			84/09/24	84/09/24	84/09/24	84/09/24	84/09/30	85/06/05	85/06/24	85/06/29	85/07/04
INITIAL TIME			1218	1218	1218	1218	1600	1400	1215	1400	1215
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			26	29	32	36	0	0	0	0	0
00010 WATER	TEMP	CENT	15.0	14.0	10.0	9.0					
00011 WATER	TEMP	FAHN	59.0$	57.2$	50.0$	48.2$					
00029 FIELD	IDENT	NUMBER	401	401	401	401	201	201	201	201	201
00078 TRANSP	SECCHI	METERS					.61	1.52	1.07	.91	.91
00095 CNDUCTVY	AT 25C	MICROMHO				510					
00098 VSAMPLOC	DEPTH	METERS	8.00	9.00	10.00	11.00					
00300 DO		MG/L	4.8	2.7	.5	.3					
00301 DO	SATUR	PERCENT	47.1$	26.0$	4.4$	2.6$					
00403 PH	LAB	SU				7.2					
00625 TOT KJEL	N	MG/L				11.000					
00665 PHOS-TOT		MG/L P				1.500					

70-0072
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LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

INITIAL DATE	85/07/14	85/08/09	85/08/20	85/09/06	85/09/18	85/09/30	86/06/01	86/06/08	86/07/06
INITIAL TIME	1030	1230	1000	1320	1500	1215	1550	1337	1210
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	201	201	201	201	201	201	201	201	201
00078 TRANSP SECCHI METERS	.61	.61	.46	.30	1.07	1.37	1.98	1.83	1.07
74041 WQF SAMPLE UPDATED							870108	870108	870108

INITIAL DATE	86/07/16	86/07/22	86/08/06	86/09/07	86/09/25	87/06/03	87/06/17	87/07/02	87/07/16
INITIAL TIME	1540	1510	1310	1500	1200	1700	1530	1430	1430
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	201	201	201	201	201	201	201	201	201
00078 TRANSP SECCHI METERS	.91	.76	.76	.61	.91	1.07	.76	.61	.61
74041 WQF SAMPLE UPDATED	870108	870108	870108	870108	870108	871120	871120	871120	871120
84141 LAKE CND PHYSICAL CODE						2	3	3	3
84142 LAKE REC SUITABL. CODE						2	2	2	2

INITIAL DATE	87/07/29	87/08/07	87/08/19	87/09/01	87/09/15	87/09/27	88/06/01	88/06/06	88/06/16
INITIAL TIME	1330	1300	1640	1220	1240	1530	1530	1030	1155
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	201	201	201	201	201	201	201	201	201
00078 TRANSP SECCHI METERS	.46	.46	.30	.30	.30	.46	1.22	1.07	1.07
74041 WQF SAMPLE UPDATED	871120	871120	871120	871120	871120	871120	881118	881118	881118
84141 LAKE CND PHYSICAL CODE	3	4	3	3	3	3	3	3	3
84142 LAKE REC SUITABL. CODE	3	3	3	3	3	3	2	2	2

INITIAL DATE	88/07/08	88/07/18	88/07/21	88/07/27	88/08/06	88/08/13	88/08/30	88/09/14	88/09/25
INITIAL TIME	1210	1300	1324	1304	1222	0957	1624	1336	1330
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	201	201	201	201	201	201	201	201	201
00078 TRANSP SECCHI METERS	.61	.46	.46	.46	.30	.30	.30	.46	.76
74041 WQF SAMPLE UPDATED	881118	881118	881118	881118	881118	881118	881118	881118	881118
84141 LAKE CND PHYSICAL CODE	3	3	3	3	3	3	3	3	3
84142 LAKE REC SUITABL. CODE	2	2	2	2	2	2	2	2	2

70-0072
44 42 55.0 093 26 40.0 3
LAKE: UPPER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 137.6 HECTARE M 070433
MEAN DEPTH: 2.4 M MAX DEPTH: 13.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/BIO

INITIAL DATE				88/10/02
INITIAL TIME				1550
MEDIUM				WATER
DEPTH-FT(SMK)				0
00029	FIELD	IDENT	NUMBER	201
00078	TRANSP	SECCHI	METERS	1.07
74041	WQF	SAMPLE	UPDATED	881118
84141	LAKE CND	PHYSICAL	CODE	3
84142	LAKE REC	SUITABL.	CODE	2

THAT'S ALL FOLKS

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

DESCRIPTIVE PARAGRAPH

AREA: 335 HA	SHORE L: 13.02 MI	ECOL CLASS: 6-1972 -	
AV DEPTH: 4.1 M	USE OF SHORELINE:	MGMT CLASS: 3-1972 -	
MX DEPTH: 17 M	FOR 10% AGR 3%	ROUGHFISH: 1	LANDSAT TYPE: -
VOL: 1.39E07 M3	MUN 87% MRSH 0%	WQ INDEX: -	CHLOR IND: -
LITTORAL: 46 %	# DWELL: 470-1972	SENS IND: -	SECCHI IND: -
DEPTH ROOTED	# RESORTS: 4-1972	RANK IND: -	T-PHOS IND: -
VEG: 7 M	AC/MI: 64	PROBLEMS: ALGAE 1972	
DOM SHOL SOIL:	DWELL/MI: 38		
SAND	AC/DWELL: 2		
PUB ACC #:0	WTRSHED AREA: 28.7 SQ MI		
ADMIN: DNR-E	GEOM REG: - - - -		
POPULATION	SLU: - - - -		
1 MI: 0	LAND USE: WTR 8% MRSH 4%		
5 MI: 2215	FOR 7% CUL 47% RES 15%	LKMAP: B291	
10 MI: 130463	URB 3% PASTURE/OPEN 15%	QUAD1: PRIOR LAKE	

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
/TYPA/AMBNT/LAKE/TISSUE/BIO
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE				48/09/16	68/08/20	68/08/20	68/08/20	68/08/20	68/08/20	68/08/20	69/05/21	69/05/21
INITIAL TIME				0000	1055	1055	1125	1155	1225	1230	1241	1246
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				4	0	30	1	1	1	25	1	1
00010	WATER	TEMP	CENT		22.2$	14.4$	22.2$	22.2$	23.3$	20.0$		14.4$
00011	WATER	TEMP	FAHN		72.0	58.0	72.0	72.0	74.0	68.0		58.0
00029	FIELD	IDENT	NUMBER	300	112	112	104	107	110	110	102	112
00071	TURB	HLGE	JCU		13.0	23.0	12.0	10.0	15.0	35.0		2.8
00078	TRANSP	SECCHI	METERS	1.37								
00080	COLOR	PT-CO	UNITS		10	10	10	10	10	15		15
00095	CNDUCTVY	AT 25C	MICROMHO									300
00300	DO		MG/L		7.8		7.9	7.9	8.2	.0		7.1
00301	DO	SATUR	PERCENT		88.6$		89.8$	89.8$	94.3$	.0$		68.3$
00310	BOD	5 DAY	MG/L		3.5	6.6	7.8	6.5	6.5	7.3		3.5
00403	PH	LAB	SU		7.9	7.0	8.1	7.9	8.0	7.3		8.3
00410	T ALK	CACO3	MG/L		120	170	120	110	120	150		140
00500	RESIDUE	TOTAL	MG/L		190	220	210	210	210	290		180
00505	RESIDUE	TOT VOL	MG/L		70	62	88	83	85	85		110
00530	RESIDUE	TOT NFLT	MG/L		8	5	7	4	8	78		3
00535	RESIDUE	VOL NFLT	MG/L		6	3	5	6	5	22		2
00605	ORG N	N	MG/L		1.100	.790	1.000	1.100	1.100	1.900		1.000
00610	NH3+NH4-	N TOTAL	MG/L		.050K	2.700	.130	.230	.110	1.600		.050K
00612	UN-IONZD	NH3-N	MG/L		.002$	.007$	.007$	.008$	.005$	.013$		.002$
00615	NO2-N	TOTAL	MG/L		.020K	.020K	.020K	.020K	.020K	.020		.020K
00619	UN-IONZD	NH3-NH3	MG/L		.002$	.009$	.009$	.010$	.006$	.015$		.003$
00620	NO3-N	TOTAL	MG/L		.040	.020K	.100	.070	.020K	.020K		.040
00665	PHOS-TOT		MG/L P		.280	.360	.070	.060	.090	.200		.050
00666	PHOS-DIS		MG/L P		.070	.290	.040	.030	.030	.050		.030
00900	TOT HARD	CACO3	MG/L		120	170	130	130	120	150		170
00940	CHLORIDE	TOTAL	MG/L									12
31505	TOT COLI	MPN CONF	/100ML		210		20	20	40		80	50
31615	FEC COLI	MPNECMED	/100ML		20K		20K	20K	20K		20K	20K
38260	MBAS		MG/L		.10K	.10K	.35	.35	.35	.10K		.24

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

	INITIAL DATE			69/05/21	69/05/21	69/05/21	69/05/21	69/05/21	69/05/21	69/05/21	69/05/21	69/05/21
	INITIAL TIME			1255	1301	1312	1320	1328	1332	1336	1344	1350
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			30	20	1	1	1	1	1	1	1
00010	WATER	TEMP	CENT	10.0$						13.9$		
00011	WATER	TEMP	FAHN	50.0						57.0		
00029	FIELD	IDENT	NUMBER	112	112	104	103	105	108	107	106	109
00071	TURB	HLGE	JCU	2.8		2.1				1.8		
00080	COLOR	PT-CO	UNITS	20		15				15		
00095	CNDUCTVY	AT 25C	MICROMHO	320		300				300		
00300	DO		MG/L	.0	3.7	5.5				6.8		
00301	DO	SATUR	PERCENT	.0$						65.4$		
00310	BOD	5 DAY	MG/L	1.3		3.7				2.4		
00403	PH	LAB	SU	7.5		8.2				8.3		
00410	T ALK	CACO3	MG/L	150		140				140		
00500	RESIDUE	TOTAL	MG/L	210		180				210		
00505	RESIDUE	TOT VOL	MG/L	100		100				100		
00530	RESIDUE	TOT NFLT	MG/L	4		2				3		
00535	RESIDUE	VOL NFLT	MG/L	3		2				3		
00605	ORG N	N	MG/L	.980		1.100				1.100		
00610	NH3+NH4-	N TOTAL	MG/L	.540		.250				.160		
00612	UN-IONZD	NH3-N	MG/L	.003$						.008$		
00615	NO2-N	TOTAL	MG/L	.060		.020K				.020K		
00619	UN-IONZD	NH3-NH3	MG/L	.004$						.009$		
00620	NO3-N	TOTAL	MG/L	.190		.020				.020		
00665	PHOS-TOT		MG/L P	.040		.030				.040		
00666	PHOS-DIS		MG/L P	.010		.010K				.010		
00900	TOT HARD	CACO3	MG/L	170		170				170		
00940	CHLORIDE	TOTAL	MG/L	12		12				12		
31505	TOT COLI	MPN CONF	/100ML			50	130	130	80	50	170	170
31615	FEC COLI	MPNECMED	/100ML			20K	20	50	20K	20K	80	20
38260	MBAS		MG/L	.10K		.30				.25		

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
/TYPA/AMBNT/LAKE/TISSUE/BIO
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE				69/05/21	69/05/21	69/05/21	69/05/21	72/07/31	72/07/31	72/07/31	72/07/31	72/07/31
INITIAL TIME				1356	1406	1410	1415					
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				1	30	20	1	0	5	10	15	16
00010	WATER	TEMP	CENT	10.0$	14.4$	10.0$		26.4$	25.6$	25.3$	24.7$	24.4$
00011	WATER	TEMP	FAHN	50.0	58.0	50.0		79.5	78.0	77.5	76.5	76.0
00029	FIELD	IDENT	NUMBER	110	110	110	111	300	300	300	300	300
00071	TURB	HLGE	JCU	1.9	3.6	3.2						
00078	TRANSP	SECCHI	METERS					2.36				
00080	COLOR	PT-CO	UNITS	15	20	15						
00095	CNDUCTVY	AT 25C	MICROMHO	294	310	290						
00300	DO		MG/L	6.1	.2	6.9		4.2	6.8	6.4		
00301	DO	SATUR	PERCENT	54.0$	1.9$	61.1$		51.2$	82.9$	76.2$		
00310	BOD	5 DAY	MG/L	3.1	1.8	1.3						
00403	PH	LAB	SU	8.3	7.6	8.1		8.5				
00410	T ALK	CACO3	MG/L	140	170	150		118				
00500	RESIDUE	TOTAL	MG/L	200	210	200						
00505	RESIDUE	TOT VOL	MG/L	100	90	110						
00530	RESIDUE	TOT NFLT	MG/L	4	4	3						
00535	RESIDUE	VOL NFLT	MG/L	4	3	3						
00600	TOTAL N	N	MG/L					.75				
00605	ORG N	N	MG/L	.960	1.000	1.100		.600				
00610	NH3+NH4-	N TOTAL	MG/L	.160	.440	.260		.070				
00612	UN-IONZD	NH3-N	MG/L	.006$	.005$	.006$		.012$				
00615	NO2-N	TOTAL	MG/L	.020K	.020K	.020K		.005				
00619	UN-IONZD	NH3-NH3	MG/L	.007$	.006$	.007$		.014$				
00620	NO3-N	TOTAL	MG/L	.020	.080	.060		.075				
00625	TOT KJEL	N	MG/L					.670				
00630	NO2&NO3	N-TOTAL	MG/L					.08				
00665	PHOS-TOT		MG/L P	.040	.040	.030		.018				
00666	PHOS-DIS		MG/L P	.020	.010	.010						
00671	PHOS-DIS	ORTHO	MG/L P					.005K				
00900	TOT HARD	CACO3	MG/L	160	170	160						
00940	CHLORIDE	TOTAL	MG/L	11	11	11		4				
00945	SULFATE	SO4-TOT	MG/L					10				
31505	TOT COLI	MPN CONF	/100ML	20K			20K					
31615	FEC COLI	MPNECMED	/100ML	20K			20K					
38260	MBAS		MG/L	.24	.10K	.10K						

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

INITIAL DATE				72/07/31	72/07/31	72/07/31	72/07/31	72/07/31	72/07/31	79/07/09	79/07/15	79/07/17
INITIAL TIME										1100		1000
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				20	22	25	30	39	42	0	0	0
00005	VSAMPLOC	DEPTH	% OF TOT							0	0	
00008	LAB	IDENT.	NUMBER							123848	123968	
00010	WATER	TEMP	CENT	20.6$	16.7$	13.1$	12.5$	8.9$	8.3$			
00011	WATER	TEMP	FAHN	69.0	62.0	55.5	54.5	48.0	47.0			
00029	FIELD	IDENT	NUMBER	300	300	300	300	300	300	201	202	201
00078	TRANSP	SECCHI	METERS							2.13		2.13
00080	COLOR	PT-CO	UNITS							10	10	
00300	DO		MG/L	4.6	2.0	.4	.1					
00301	DO	SATUR	PERCENT	51.1$	20.6$	3.8$	.9$					
00625	TOT KJEL	N	MG/L							.820J	.770J	
00665	PHOS-TOT		MG/L P							.018	.010	
74041	WQF	SAMPLE	UPDATED							870130		870130

INITIAL DATE				79/07/24	79/07/30	79/08/06	79/08/15	79/08/15	79/08/21	79/08/27	79/09/06	79/09/13
INITIAL TIME				0930	1100	1530	1500		1200	1500	0900	0930
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	0
00005	VSAMPLOC	DEPTH	% OF TOT			0		0			0	
00008	LAB	IDENT.	NUMBER			123108		123294			123386	
00029	FIELD	IDENT	NUMBER	201	201	201	201	202	201	201	201	201
00078	TRANSP	SECCHI	METERS	1.98	2.29	2.44	2.13		2.29	2.29	2.29	2.29
00080	COLOR	PT-CO	UNITS			15		15			10	
00625	TOT KJEL	N	MG/L			.630J		.970J			1.000J	
00665	PHOS-TOT		MG/L P			.014		.019			.030	
74041	WQF	SAMPLE	UPDATED	870130	870130	870130	870213		870130	870130	870130	870130

INITIAL DATE				79/09/18	79/09/18	79/09/18	79/09/18	79/09/28	80/06/28	80/06/30	80/07/08	80/07/10
INITIAL TIME				0059	0059	0059	1330	1300	0930		1300	1630
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				81	121	122	0	0	0	0	0	0
00005	VSAMPLOC	DEPTH	% OF TOT					0				
00008	LAB	IDENT.	NUMBER	128826	128824	128825		123508		123942		
00010	WATER	TEMP	CENT									27.0
00011	WATER	TEMP	FAHN									80.6$

(SAMPLE CONTINUED ON NEXT PAGE)

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE	79/09/18	79/09/18	79/09/18	79/09/18	79/09/28	80/06/28	80/06/30	80/07/08	80/07/10
INITIAL TIME	0059	0059	0059	1330	1300	0930		1300	1630
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	81	121	122	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	100	100	100	201	201	201	201	201	101
00076 TURB TRBIDMTR HACH FTU									.4
00078 TRANSP SECCHI METERS				1.68	1.68	2.74		2.74	3.10
00080 COLOR PT-CO UNITS					15		5K		5K
00098 VSAMPLOC DEPTH METERS							.00		.00
00300 DO MG/L									9.8
00301 DO SATUR PERCENT									121.0$
00403 PH LAB SU									8.2
00410 T ALK CACO3 MG/L									140
00605 ORG N N MG/L									.590
00610 NH3+NH4- N TOTAL MG/L									.090
00612 UN-IONZD NH3-N MG/L									.008$
00619 UN-IONZD NH3-NH3 MG/L									.010$
00625 TOT KJEL N MG/L					.470J		1.000J		.680
00630 NO2&NO3 N-TOTAL MG/L									.01K
00665 PHOS-TOT MG/L P					.037		.053		.028
01004 ARSENIC TISMG/KG WET WGT	.01	.01	.02						
32211 CHLRPHYL A UG/L CORRECTD									3.00
39105 PERCENT FAT HEX EXTR	.3	1.7	7.5						
71930 MERCURY TISMG/KG WET WGT	.05	.05	.07						
71936 LEAD TISMG/KG WET WGT	.18	.55	.28						
71937 COPPER TISMG/KG WET WGT	.41	.86	.90						
71939 CR-FISH UG/G OR MG/KG WT	.15	.16	.11						
71940 CADMIUM TISMG/KG WET WGT	.005	.03	.06						
74041 WQF SAMPLE UPDATED				870130	870130	870131		870131	
81614 NO.INDV. IN THE SAMPLE	5	5	5						
81903 DPTH BOT AT SITE FEET									27.0
84005 FISH SPECIES F &WL	BGS	C	C						
84007 ANATOMY ALPHA CODE	WHORG	WHORG	WHORG						

INITIAL DATE	80/07/10	80/07/10	80/07/10	80/07/10	80/07/10	80/07/10	80/07/10	80/07/24	80/08/07
INITIAL TIME	1630	1630	1630	1630	1630	1630	1630	1500	1500
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	3	6	9	13	16	19	22	0	0
00008 LAB IDENT. NUMBER								123190	
00010 WATER TEMP CENT	27.0	26.0	25.0	23.5	23.0	21.5	20.0		
00011 WATER TEMP FAHN	80.6$	78.8$	77.0$	74.3$	73.4$	70.7$	68.0$		

(SAMPLE CONTINUED ON NEXT PAGE)

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
/TYPA/AMBNT/LAKE/TISSUE/BIO
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			80/07/10	80/07/10	80/07/10	80/07/10	80/07/10	80/07/10	80/07/10	80/07/24	80/08/07
	INITIAL TIME			1630	1630	1630	1630	1630	1630	1630	1500	1500
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			3	6	9	13	16	19	22	0	0
00029	FIELD	IDENT	NUMBER	101	101	101	101	101	101	101	201	201
00078	TRANSP	SECCHI	METERS								2.29	1.83
00080	COLOR	PT-CO	UNITS								20	
00098	VSAMPLOC	DEPTH	METERS	1.00	2.00	3.00	4.00	5.00	6.00	7.00	.00	
00300	DO		MG/L	9.8	10.0	10.4	10.0	9.4	6.9	2.8		
00301	DO	SATUR	PERCENT	121.0$	122.0$	123.8$	114.9$	108.0$	76.7$	30.4$		
00625	TOT KJEL	N	MG/L								1.080J	
00665	PHOS-TOT		MG/L P								.053	
74041	WQF	SAMPLE	UPDATED								870131	870131

	INITIAL DATE			80/08/14	80/08/29	80/09/05	80/09/08	80/09/08	80/09/08	80/09/08	80/09/08	80/09/08
	INITIAL TIME			1215	1500	1400	1455	1455	1455	1455	1455	1455
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	0	0	0	3	6	9	13	16
00008	LAB	IDENT.	NUMBER			123631						
00010	WATER	TEMP	CENT				23.3	23.3	23.3	23.3	22.7	22.1
00011	WATER	TEMP	FAHN				73.9$	73.9$	73.9$	73.9$	72.9$	71.8$
00029	FIELD	IDENT	NUMBER	201	201	201	101	101	101	101	101	101
00076	TURB	TRBIDMTR	HACH FTU				1.3					
00078	TRANSP	SECCHI	METERS	1.83	1.83	1.83	1.80					
00080	COLOR	PT-CO	UNITS			10	5K					
00098	VSAMPLOC	DEPTH	METERS			.00	.00	1.00	2.00	3.00	4.00	5.00
00300	DO		MG/L				9.3	9.4	9.3	9.3	9.1	9.1
00301	DO	SATUR	PERCENT				106.9$	108.0$	106.9$	106.9$	104.6$	103.4$
00403	PH	LAB	SU				8.3					
00410	T ALK	CACO3	MG/L				140					
00605	ORG N	N	MG/L				1.380					
00610	NH3+NH4-	N TOTAL	MG/L				.100					
00612	UN-IONZD	NH3-N	MG/L				.009$					
00619	UN-IONZD	NH3-NH3	MG/L				.011$					
00625	TOT KJEL	N	MG/L			1.240J	1.480					
00630	NO2&NO3	N-TOTAL	MG/L				.01					
00665	PHOS-TOT		MG/L P			.016	.050					
32211	CHLRPHYL	A UG/L	CORRECTD				17.30					
74041	WQF	SAMPLE	UPDATED	870131	870131	870131						
81903	DPTH BOT	AT SITE	FEET				40.0					

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

INITIAL DATE			80/09/12	80/09/20	80/09/23	81/06/06	81/06/15	81/06/20	81/06/27	81/06/28	81/06/30
INITIAL TIME			1645	1600	1500	1800	1900	1830	0722	1900	0001
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	0	0	0	0	0	0	0
00008 LAB	IDENT.	NUMBER			123766				123602		123994
00029 FIELD	IDENT	NUMBER	201	201	201	202	202	202	201	202	203
00078 TRANSP	SECCHI	METERS	1.52	1.83	1.68	1.98	1.98	1.83	1.83	1.83	
00080 COLOR	PT-CO	UNITS			10				10		0
00098 VSAMPLOC	DEPTH	METERS			.00						
00625 TOT KJEL	N	MG/L			1.340J				.920J		1.000J
00665 PHOS-TOT		MG/L P			.050				.025		.009
74041 WQF	SAMPLE	UPDATED	870131	870131	870131						

INITIAL DATE			81/07/01	81/07/04	81/07/08	81/07/09	81/07/18	81/07/18	81/07/26	81/07/26	81/08/02
INITIAL TIME			1200	0930	1400	1030	1000	1100	0800	1700	1000
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	0	0	0	0	0	0	0
00008 LAB	IDENT.	NUMBER							123603	123194	
00029 FIELD	IDENT	NUMBER	202	201	202	201	202	201	201	202	201
00078 TRANSP	SECCHI	METERS	2.74	1.98	2.13	1.83	2.13	1.83	1.83	2.29	1.98
00080 COLOR	PT-CO	UNITS							10	10	
00625 TOT KJEL	N	MG/L							.830J	.920J	
00665 PHOS-TOT		MG/L P							.013	.016	

INITIAL DATE			81/08/02	81/08/08	81/08/09	81/08/11	81/08/17	81/08/22	81/08/22	81/08/29	81/08/30
INITIAL TIME			1030	1500	0900	1300	1000	0001	1815	0001	1800
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	0	0	0	0	0	0	0
00029 FIELD	IDENT	NUMBER	202	202	201	202	201	201	202	201	202
00078 TRANSP	SECCHI	METERS	1.98	2.13	1.83	1.98	1.83	1.83	2.29	2.13	2.29

INITIAL DATE			81/08/31	81/09/04	81/09/05	81/09/05	81/09/12	81/09/12	81/09/19	81/09/19	81/09/29
INITIAL TIME			0001	0001	1100	1200	0900	1230	1200	1400	1730
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			0	0	0	0	0	0	0	0	0
00008 LAB	IDENT.	NUMBER	123583	123604							
00029 FIELD	IDENT	NUMBER	203	201	202	201	201	202	201	202	201
00078 TRANSP	SECCHI	METERS			2.29	1.68	1.83	2.13	1.68	2.29	1.68

(SAMPLE CONTINUED ON NEXT PAGE)

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE				81/08/31	81/09/04	81/09/05	81/09/05	81/09/12	81/09/12	81/09/19	81/09/19	81/09/29
INITIAL TIME				0001	0001	1100	1200	0900	1230	1200	1400	1730
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	0
00080	COLOR	PT-CO	UNITS	10	10							
00625	TOT KJEL	N	MG/L	.770J	1.000J							
00665	PHOS-TOT		MG/L P	.034	.020							

INITIAL DATE				82/06/22	82/07/02	82/07/04	82/07/12	82/07/14	82/07/16	82/07/23	82/07/23	82/08/02
INITIAL TIME				1900	0001	1630	1900	1930	0001	0001	1900	1900
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	202	201	202	202	202	201	201	202	202
00078	TRANSP	SECCHI	METERS	2.59	3.20	2.59	2.44	2.74	2.90	2.29	2.59	2.29

INITIAL DATE				82/08/06	82/08/09	82/08/13	82/08/14	82/08/23	82/08/27	82/08/28	82/09/04	82/09/08
INITIAL TIME				0001	1000	0001	1400	1600	0001	1700	1800	1600
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	201	202	201	202	202	201	202	202	202
00078	TRANSP	SECCHI	METERS	2.74	2.90	2.59	3.05	3.20	2.29	3.05	2.90	2.90

INITIAL DATE				82/09/17	83/06/07	83/06/14	83/06/17	83/06/26	83/07/02	83/07/06	83/07/18	83/07/26
INITIAL TIME				1700	1900	1930	1830	1900	1900	1900	1700	1700
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	202	202	202	202	202	202	202	202	202
00078	TRANSP	SECCHI	METERS	2.74	3.20	2.59	1.98	1.83	1.68	1.68	1.22	1.22

INITIAL DATE				83/08/01	83/08/08	83/08/15	83/08/20	83/08/28	83/09/05	83/09/10	84/05/21	84/05/21
INITIAL TIME				1800	1500	1530	1500	1430	1530	1500	1130	1130
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	3
00010	WATER	TEMP	CENT								17.0	17.0
00011	WATER	TEMP	FAHN								62.6$	62.6$
00029	FIELD	IDENT	NUMBER	202	202	202	202	202	202	202	401	401
00078	TRANSP	SECCHI	METERS	1.07	1.22	1.37	1.37	1.37	1.52	1.52	5.50	
00095	CNDUCTVY	AT 25C	MICROMHO								375	
00098	VSAMPLOC	DEPTH	METERS								.00	1.00
00300	DO		MG/L								8.3	8.3
00301	DO	SATUR	PERCENT								85.6$	85.6$

(SAMPLE CONTINUED ON NEXT PAGE)

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
/TYPA/AMBNT/LAKE/TISSUE/BIO
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			83/08/01	83/08/08	83/08/15	83/08/20	83/08/28	83/09/05	83/09/10	84/05/21	84/05/21
	INITIAL TIME			1800	1500	1530	1500	1430	1530	1500	1130	1130
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			0	0	0	0	0	0	0	0	3
00403	PH	LAB	SU								8.5	
00410	T ALK	CACO3	MG/L								157	
00610	NH3+NH4-	N TOTAL	MG/L								.140	
00612	UN-IONZD	NH3-N	MG/L								.012$	
00619	UN-IONZD	NH3-NH3	MG/L								.014$	
00625	TOT KJEL	N	MG/L								1.150	
00630	NO2&NO3	N-TOTAL	MG/L								.25	
00665	PHOS-TOT		MG/L P								.020	
32210	CHLRPHYL	A	UG/L								1.30	

	INITIAL DATE			84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/05/21	84/06/22
	INITIAL TIME			1130	1130	1130	1130	1130	1130	1130	1130	1155
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			6	9	13	16	19	22	26	29	0
00010	WATER	TEMP	CENT	17.0	17.0	16.5	15.5	14.0	12.0	12.0	11.0	24.0
00011	WATER	TEMP	FAHN	62.6$	62.6$	61.7$	59.9$	57.2$	53.6$	53.6$	51.8$	75.2$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS									1.60
00095	CNDUCTVY	AT 25C	MICROMHO				365			370		370
00098	VSAMPLOC	DEPTH	METERS	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	.00
00300	DO		MG/L	8.3	8.3	8.2	8.4	7.4	6.2	5.7	2.4	9.1
00301	DO	SATUR	PERCENT	85.6$	85.6$	82.0$	82.4$	71.2$	57.4$	52.8$	21.6$	107.1$
00403	PH	LAB	SU				8.5			8.2		8.7
00625	TOT KJEL	N	MG/L				1.150			1.100		1.080
00665	PHOS-TOT		MG/L P				.030			.020		.035
32210	CHLRPHYL	A	UG/L									12.00

	INITIAL DATE			84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22
	INITIAL TIME			1155	1155	1155	1155	1155	1155	1155	1155	1155
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			3	6	9	13	16	19	22	26	29
00010	WATER	TEMP	CENT	23.5	23.0	23.0	22.0	21.0	20.0	19.0	16.0	13.0
00011	WATER	TEMP	FAHN	74.3$	73.4$	73.4$	71.6$	69.8$	68.0$	66.2$	60.8$	55.4$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00095	CNDUCTVY	AT 25C	MICROMHO					375				
00098	VSAMPLOC	DEPTH	METERS	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
00300	DO		MG/L	9.4	9.3	8.9	8.4	6.6	5.1	2.7	.4	.3

(SAMPLE CONTINUED ON NEXT PAGE)

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE			84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22	84/06/22
INITIAL TIME			1155	1155	1155	1155	1155	1155	1155	1155	1155
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			3	6	9	13	16	19	22	26	29
00301 DO	SATUR	PERCENT	108.0$	106.9$	102.3$	95.5$	73.3$	55.4$	28.7$	4.0$	2.8$
00403 PH	LAB	SU					8.5				
00625 TOT KJEL	N	MG/L					1.150				
00665 PHOS-TOT		MG/L P					.020				

INITIAL DATE			84/06/22	84/06/22	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26	84/07/26
INITIAL TIME			1155	1155	1142	1142	1142	1142	1142	1142	1142
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			32	36	0	3	6	9	13	16	19
00010 WATER	TEMP	CENT	12.0	12.0	25.0	25.0	25.0	25.0	24.5	24.0	23.5
00011 WATER	TEMP	FAHN	53.6$	53.6$	77.0$	77.0$	77.0$	77.0$	76.1$	75.2$	74.3$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS			2.70						
00095 CNDUCTVY	AT 25C	MICROMHO	400		345						345
00098 VSAMPLOC	DEPTH	METERS	10.00	11.00	.00	1.00	2.00	3.00	4.00	5.00	6.00
00300 DO		MG/L	.3	.3	8.1	7.9	7.9	7.7	8.0	7.0	3.5
00301 DO	SATUR	PERCENT	2.8$	2.8$	96.4$	94.0$	94.0$	91.7$	94.1$	82.4$	40.2$
00403 PH	LAB	SU	7.6		8.3						8.0
00410 T ALK	CACO3	MG/L			145						
00610 NH3+NH4-	N TOTAL	MG/L			.020						
00612 UN-IONZD	NH3-N	MG/L			.002$						
00619 UN-IONZD	NH3-NH3	MG/L			.002$						
00625 TOT KJEL	N	MG/L	1.750		1.100						1.000
00630 NO2&NO3	N-TOTAL	MG/L			.05K						
00665 PHOS-TOT		MG/L P	.050		.010						.010K
32210 CHLRPHYL	A	UG/L			8.40						
82903 DPTH BOT	AT SITE	METERS			9.9						

INITIAL DATE			84/07/26	84/07/26	84/07/26	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27
INITIAL TIME			1142	1142	1142	1200	1200	1200	1200	1200	1200
MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)			22	26	29	0	3	6	9	13	16
00010 WATER	TEMP	CENT	20.0	16.0	13.5	23.0	23.0	23.0	22.5	22.5	22.5
00011 WATER	TEMP	FAHN	68.0$	60.8$	56.3$	73.4$	73.4$	73.4$	72.5$	72.5$	72.5$
00029 FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078 TRANSP	SECCHI	METERS				2.50					
00095 CNDUCTVY	AT 25C	MICROMHO			390						335

(SAMPLE CONTINUED ON NEXT PAGE)

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

	INITIAL DATE			84/07/26	84/07/26	84/07/26	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/08/27
	INITIAL TIME			1142	1142	1142	1200	1200	1200	1200	1200	1200
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			22	26	29	0	3	6	9	13	16
00098	VSAMPLOC	DEPTH	METERS	7.00	8.00	9.00	.00	1.00	2.00	3.00	4.00	5.00
00300	DO		MG/L	.2	.1	.1	7.4	7.4	7.4	7.4	7.4	7.3
00301	DO	SATUR	PERCENT	2.2$	1.0$	.9$	85.1$	85.1$	85.1$	84.1$	84.1$	83.0$
00403	PH	LAB	SU			7.5	8.4					8.4
00625	TOT KJEL	N	MG/L			1.600	1.150					1.100
00665	PHOS-TOT		MG/L P			.020	.025					.020
32210	CHLRPHYL	A	UG/L				15.00					
82903	DPTH BOT	AT SITE	METERS									10.2

	INITIAL DATE			84/08/27	84/08/27	84/08/27	84/08/27	84/08/27	84/09/24	84/09/24	84/09/24	84/09/24
	INITIAL TIME			1200	1200	1200	1200	1200	1155	1155	1155	1155
	MEDIUM			WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	DEPTH-FT(SMK)			19	22	26	29	32	0	3	6	9
00010	WATER	TEMP	CENT	22.0	22.0	17.0	14.0	13.0	15.0	15.0	15.0	15.0
00011	WATER	TEMP	FAHN	71.6$	71.6$	62.6$	57.2$	55.4$	59.0$	59.0$	59.0$	59.0$
00029	FIELD	IDENT	NUMBER	401	401	401	401	401	401	401	401	401
00078	TRANSP	SECCHI	METERS						2.50			
00095	CNDUCTVY	AT 25C	MICROMHO				395		325			
00098	VSAMPLOC	DEPTH	METERS	6.00	7.00	8.00	9.00	10.00	.00	1.00	2.00	3.00
00300	DO		MG/L	6.9	5.8	.4	.2	.1	8.0	7.8	7.6	7.7
00301	DO	SATUR	PERCENT	78.4$	65.9$	4.1$	1.9$	.9$	78.4$	76.5$	74.5$	75.5$
00403	PH	LAB	SU				7.5		8.3			
00410	T ALK	CACO3	MG/L						148			
00610	NH3+NH4-	N TOTAL	MG/L						.080			
00612	UN-IONZD	NH3-N	MG/L						.004$			
00619	UN-IONZD	NH3-NH3	MG/L						.005$			
00625	TOT KJEL	N	MG/L				2.000		1.150			
00630	NO2&NO3	N-TOTAL	MG/L						.05			
00665	PHOS-TOT		MG/L P				.050		.030			
32210	CHLRPHYL	A	UG/L						16.00			
82903	DPTH BOT	AT SITE	METERS						10.0			

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
/TYPA/AMBNT/LAKE/TISSUE/BIO
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	84/09/24	85/06/05	85/06/30	85/07/14
INITIAL TIME	1155	1155	1155	1155	1155	1155	1430	1400	1050
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	13	16	19	22	26	29	0	0	0
00010 WATER TEMP CENT	15.0	15.0	15.0	15.0	15.0	15.0			
00011 WATER TEMP FAHN	59.0$	59.0$	59.0$	59.0$	59.0$	59.0$			
00029 FIELD IDENT NUMBER	401	401	401	401	401	401	203	203	203
00078 TRANSP SECCHI METERS							2.59	1.52	1.68
00095 CNDUCTVY AT 25C MICROMHO						345			
00098 VSAMPLOC DEPTH METERS	4.00	5.00	6.00	7.00	8.00	9.00			
00300 DO MG/L	7.8	7.7	7.7	7.6	7.6	7.5			
00301 DO SATUR PERCENT	76.5$	75.5$	75.5$	74.5$	74.5$	73.5$			
00403 PH LAB SU						8.4			
00625 TOT KJEL N MG/L						.950			
00665 PHOS-TOT MG/L P						.020			

INITIAL DATE	85/08/15	85/09/06	85/09/18	85/09/30	86/06/03	86/06/10	86/06/17	86/06/24	86/07/01
INITIAL TIME	1300	1340	1530	1230	1700	1300	1300	1100	1830
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	203	203	203	203	204	204	204	204	204
00078 TRANSP SECCHI METERS	1.52	1.37	1.37	1.52	3.35	3.51	2.44	1.98	2.59
74041 WQF SAMPLE UPDATED					870729	870729	870729	870729	870729

INITIAL DATE	86/07/06	86/07/07	86/07/14	86/07/16	86/07/21	86/07/22	86/07/28	86/08/05	86/08/06
INITIAL TIME	1200	1700	1900	1600	1830	1510	1800	1830	1330
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	203	204	204	203	204	203	204	204	203
00078 TRANSP SECCHI METERS	1.98	2.44	2.29	1.83	2.74	1.98	2.59	2.29	1.98
74041 WQF SAMPLE UPDATED	870108	870729	870729	870108	870729	870108	870729	870729	870108

INITIAL DATE	86/08/12	86/08/19	86/08/20	86/08/26	86/09/03	86/09/07	86/09/10	86/09/17	86/09/23
INITIAL TIME	1900	1930	1240	1300	1800	1530	1000	1700	1100
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	204	204	203	204	204	203	204	204	204
00078 TRANSP SECCHI METERS	2.29	2.13	1.98	1.98	2.13	1.83	1.98	1.83	1.98

(SAMPLE CONTINUED ON NEXT PAGE)

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE	86/08/12	86/08/19	86/08/20	86/08/26	86/09/03	86/09/07	86/09/10	86/09/17	86/09/23
INITIAL TIME	1900	1930	1240	1300	1800	1530	1000	1700	1100
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
74041 WQF SAMPLE UPDATED	870729	870729	870108	870729	870729	870108	870729	870729	870729

INITIAL DATE	86/09/25	86/09/30	86/10/06	87/05/27	87/06/06	87/06/12	87/06/17	87/06/20	87/06/27
INITIAL TIME	1230	1730	1600	1900	1400	1900	1540	1300	1500
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	203	204	204	204	204	204	203	204	204
00078 TRANSP SECCHI METERS	1.98	2.44	2.44	2.59	2.59	2.44	2.44	2.44	2.29
74041 WQF SAMPLE UPDATED	870108	870729	870729	871218	871218	871218	871120	871218	871218
84141 LAKE CND PHYSICAL CODE				2	2	2	1	2	2
84142 LAKE REC SUITABL. CODE				2	2	2	1	2	2

INITIAL DATE	87/07/02	87/07/06	87/07/14	87/07/16	87/07/19	87/07/27	87/07/29	87/08/01	87/08/07
INITIAL TIME	1453	1900	1800	1600	1330	1400	1300	1430	1220
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	203	204	204	203	204	204	203	204	203
00078 TRANSP SECCHI METERS	2.29	2.44	2.59	2.13	2.59	2.44	1.83	2.29	1.83
74041 WQF SAMPLE UPDATED	871120	871218	871218	871120	871218	871218	871120	871218	871120
84141 LAKE CND PHYSICAL CODE	1	2	2	2	2	2	2	2	2
84142 LAKE REC SUITABL. CODE	1	2	2	2	2	2	2	2	2

INITIAL DATE	87/08/07	87/08/14	87/08/19	87/08/20	87/08/29	87/09/01	87/09/04	87/09/10	87/09/15
INITIAL TIME	1700	1800	1630	1600	1800	1300	1800	1730	1220
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0	0	0	0
00029 FIELD IDENT NUMBER	204	204	203	204	204	203	204	204	203
00078 TRANSP SECCHI METERS	1.98	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.83
74041 WQF SAMPLE UPDATED	871218	871218	871120	871218	871218	871120	871218	871218	871120
84141 LAKE CND PHYSICAL CODE	2	2	2	2	2	2	2	2	2
84142 LAKE REC SUITABL. CODE	2	2	2	2	2	2	2	2	2

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
/TYPA/AMBNT/LAKE/TISSUE/BIO
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

INITIAL DATE				87/09/18	87/09/30	88/06/01	88/06/10	88/06/15	88/06/16	88/06/22	88/06/27	88/07/03
INITIAL TIME				1700	1500	1500	1600	1800	1100	1630	1700	1630
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	204	203	203	203	204	203	204	204	204
00078	TRANSP	SECCHI	METERS	1.68	1.98	1.83	1.68	1.98	1.68	1.98	1.98	1.83
74041	WQF	SAMPLE	UPDATED	871218	871120	881118	881118	881209	881118	881209	881209	881209
84141	LAKE CND	PHYSICAL	CODE	2	2	3	3	2	3	2	2	2
84142	LAKE REC	SUITABL.	CODE	2	2	2	2	2	2	2	2	2

INITIAL DATE				88/07/08	88/07/10	88/07/17	88/07/21	88/07/24	88/07/31	88/08/06	88/08/07	88/08/13
INITIAL TIME				1230	1600	1530	1335	1600	1400	1250	1500	0928
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	203	204	204	203	204	204	203	204	203
00078	TRANSP	SECCHI	METERS	1.98	1.83	1.68	1.83	1.68	1.68	1.52	1.83	1.52
74041	WQF	SAMPLE	UPDATED	881118	881209	881209	881118	881209	881209	881118	881209	881118
84141	LAKE CND	PHYSICAL	CODE	3	2	2	3	2	2	3	2	3
84142	LAKE REC	SUITABL.	CODE	2	2	2	2	2	2	2	2	2

INITIAL DATE				88/08/14	88/08/21	88/08/27	88/08/30	88/09/02	88/09/10	88/09/14	88/09/18	88/09/25
INITIAL TIME				1600	1500	1500	1637	1600	1400	1348	1400	1300
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	204	204	204	203	204	204	203	204	204
00078	TRANSP	SECCHI	METERS	1.68	1.52	1.52	1.37	1.52	1.52	1.37	1.52	1.52
74041	WQF	SAMPLE	UPDATED	881209	881209	881209	881118	881209	881209	881118	881209	881209
84141	LAKE CND	PHYSICAL	CODE	2	2	3	3	3	3	3	3	3
84142	LAKE REC	SUITABL.	CODE	2	2	2	2	2	2	2	2	2

INITIAL DATE				88/09/25	88/10/01	88/10/02	88/10/09	88/10/14	88/10/19
INITIAL TIME				1337	1400	1610	1400	1500	1500
MEDIUM				WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)				0	0	0	0	0	0
00029	FIELD	IDENT	NUMBER	203	204	203	204	204	204
00078	TRANSP	SECCHI	METERS	1.37	1.68	1.37	1.83	1.98	2.13
74041	WQF	SAMPLE	UPDATED	881118	881209	881118	881209	881209	881209
84141	LAKE CND	PHYSICAL	CODE	3	2	3	2	2	2

(SAMPLE CONTINUED ON NEXT PAGE)

70-0026 LPR
44 44 05.0 093 24 25.0 3
LAKE: LOWER PRIOR IN PRIOR LAKE
27139 MINNESOTA SCOTT
AREA: 334.8 HECTARE M 070433
MEAN DEPTH: 4.1 M MAX DEPTH: 17.1 M
21MINNL 800412 HQ 07020012
0000 FEET DEPTH

/TYPA/AMBNT/LAKE/TISSUE/BIO

(SAMPLE CONTINUED FROM PREVIOUS PAGE)

INITIAL DATE	88/09/25	88/10/01	88/10/02	88/10/09	88/10/14	88/10/19
INITIAL TIME	1337	1400	1610	1400	1500	1500
MEDIUM	WATER	WATER	WATER	WATER	WATER	WATER
DEPTH-FT(SMK)	0	0	0	0	0	0
84142 LAKE REC SUITABL. CODE	2	2	2	2	2	2

Appendix B

MONTGOMERY WATSON

LOWER PRIOR LAKE WATER QUALITY DATA
Nutrient Data

DATE	DEPTH (m)	Org N mg/l	NH3 mg/l	TKN mg/l	NO2+NO mg/l	TP mg/l	DP-ORTH mg/l
10/31/88	0					0.06	0.01
10/31/88	8					0.06	0.01
10/31/88	12					0.07	0.01
10/31/88	15.5					0.07	0.01
10/31/88	0					0.04	0.01
10/31/88	4.5					0.05	0.01
10/31/88	6.5					0.04	0.01
10/31/88	8.5					0.04	0.01
11/14/88	0	0.7	0.12	0.8	0.08	0.04	0.01
11/14/88	8			0.8	0.08	0.05	0.01
11/14/88	12					0.04	0.01
11/14/88	16	0.7	0.12	0.8	0.08	0.04	0.01
11/14/88	0	0.8	0.04	0.8	0.1	0.05	0.01
11/14/88	5			0.8	0.1	0.04	0.01
11/14/88	8					0.03	0.01
11/14/88	9.5	0.8	0.04	0.8	0.1	0.04	0.01
12/19/88	0.5					0.04	0.01
12/19/88	8					0.04	0.01
12/19/88	12					0.04	0.01
12/19/88	16					0.1	0.01
12/19/88	0.5					0.03	0.01
12/19/88	4					0.03	0.01
12/19/88	6					0.03	0.01
12/19/88	8					0.03	0.01
01/18/89	0.5					0.05	0.02
01/18/89	7					0.05	0.02
01/18/89	10					0.04	0.02
01/18/89	14					0.05	0.02
01/18/89	0.5					0.06	0.01
01/18/89	3					0.04	0.01
01/18/89	5					0.04	0.01
01/18/89	6					0.03	0.01
02/14/89	0.5	1.1	0.13	1.2	0.16	0.04	0.02
02/14/89	8			1	0.16	0.06	0.04
02/14/89	12					0.07	0.05
02/14/89	16	1	1.2	2.2	0.1	0.22	0.1
02/14/89	0.5	1	0.03	1	0.18	0.07	0.02
02/14/89	4			0.9	0.16	0.04	0.01
02/14/89	6					0.04	0.01
02/14/89	9	0.9	0.04	0.9	0.2	0.04	0.02

LOWER PRIOR LAKE WATER QUALITY DATA
Nutrient Data

DATE	DEPTH (m)	Org N mg/l	NH3 mg/l	TKN mg/l	NO2+NO mg/l	TP mg/l	DP-ORTH mg/l
03/16/89	0.5					0.08	0.02
03/16/89	8					0.05	0.02
03/16/89	12					0.08	0.04
03/16/89	16					0.19	0.13
03/16/89	0.5					0.05	0.01
03/16/89	4					0.06	0.01
03/16/89	6					0.04	0.02
03/16/89	9					0.07	0.02
04/21/89	0.5					0.04	0.02
04/21/89	4					0.04	0.02
04/21/89	6					0.04	0.02
04/21/89	8					0.04	0.02
04/21/89	0.5					0.04	0.02
04/21/89	8					0.04	0.02
04/21/89	12					0.12	0.06
04/21/89	16					0.2	0.14
05/10/89	0.5	1.5	0.06	1.6	0.02	0.04	0.02
05/10/89	4	0.8	0.06	0.9	0.02	0.04	0.02
05/10/89	6					0.06	0.02
05/10/89	8	0.8	0.06	0.9	0.02	0.04	0.02
05/10/89	0.5	0.7	0.06	0.8	0.02	0.03	0.14
05/10/89	8	0.8	0.09	0.9	0.02	0.04	0.02
05/10/89	12					0.08	0.02
05/10/89	16	0.9	1.1	2	0.02	0.2	0.02
05/23/89	0.5					0.04	0.01
05/23/89	4					0.06	0.01
05/23/89	7					0.04	0.01
05/23/89	10					0.06	0.01
05/23/89	0.5					0.04	0.01
05/23/89	9					0.05	0.01
05/23/89	12					0.1	0.03
05/23/89	16					0.26	0.19
06/14/89	0.5					0.04	0.02
06/14/89	5					0.04	0.02
06/14/89	10					0.07	0.02
06/14/89	16					0.31	0.26
06/14/89	0.5					0.05	0.02
06/14/89	6					0.04	0.02
06/14/89	8					0.05	0.02
06/14/89	10					0.07	0.03

LOWER PRIOR LAKE WATER QUALITY DATA
Nutrient Data

DATE	DEPTH (m)	Org N mg/l	NH3 mg/l	TKN mg/l	NO2+NO mg/l	TP mg/l	DP-ORTH mg/l
06/26/89	0.5					0.03	0.01
06/26/89	5					0.04	0.01
06/26/89	7					0.04	0.01
06/26/89	9					0.08	0.01
06/26/89	0.5					0.03	0.01
06/26/89	5					0.04	0.01
06/26/89	10					0.07	0.01
06/26/89	16					0.36	0.29
07/12/89	0.5					0.04	0.01
07/12/89	5					0.05	0.01
07/12/89	10					0.03	0.01
07/12/89	16					0.36	0.28
07/12/89	0.5					0.05	0.01
07/12/89	6					0.07	0.01
07/12/89	8					0.08	0.01
07/12/89	9					0.1	0.01
07/27/89	0.5					0.07	0.01
07/27/89	6					0.02	0.01
07/27/89	11					0.04	0.01
07/27/89	16					0.54	0.36
07/27/89	0.5					0.05	0.01
07/27/89	6					0.01	0.01
07/27/89	8					0.17	0.01
07/27/89	10					0.25	0.04
08/08/89	0.5	1.3	0.01	1.3	0.02	0.04	0.01
08/08/89	7			1.4	0.02	0.07	0.01
08/08/89	8					0.23	0.03
08/08/89	9	1.1	0.62	1.7	0.02	0.19	0.06
08/08/89	0.5	0.8	0.01	0.8	0.02	0.03	0.01
08/08/89	6			1.3	0.02	0.23	0.01
08/08/89	11					0.08	0.02
08/08/89	16	0.3	3.2	3.5	0.02	0.48	0.4

LOWER PRIOR LAKE WATER QUALITY DATA
Nutrient Data

DATE	DEPTH (m)	Org N mg/l	NH3 mg/l	TKN mg/l	NO2+NO mg/l	TP mg/l	DP-ORTH mg/l
08/30/89	0.5					0.04	0.01
08/30/89	6					0.07	0.01
08/30/89	11					0.13	0.07
08/30/89	16					0.53	0.41
08/30/89	0.5					0.04	0.02
08/30/89	8					0.05	0.01
08/30/89	9					0.06	0.01
08/30/89	10					0.41	0.2
09/19/89	0.5					0.07	0.01
09/19/89	8					0.08	0.01
09/19/89	12					0.16	0.09
09/19/89	16					0.53	0.43
09/19/89	0.5					0.06	0.01
09/19/89	4					0.07	0.01
09/19/89	6					0.07	0.01
09/19/89	9					0.08	0.01

LOWER PRIOR LAKE

DATE	Secchi (m) site 1	site 2
10/31/88	1.9	1.75
11/14/88	3.5	3.1
12/19/88	4	3.5
01/18/89	6.5	5.8
02/14/89	5.7	3.75
03/16/89	5.4	4.5
04/21/89	2	1.6
05/10/89	2.5	3
05/15/89	1.68	
05/23/89	2.1	2.1
06/01/89	1.52	
06/03/89	2.29	
06/10/89	2.29	
06/13/89	1.22	
06/14/89	2	2
06/17/89	2.13	
06/18/89	1.98	
06/23/89	2.13	1.98
06/26/89	2.2	2.3
07/01/89	2.13	
07/07/89	2.29	1.83
07/12/89	2.9	2.8
07/14/89	2.29	
07/21/89	2.59	
07/25/89	1.98	
07/27/89	4	3.5
07/28/89	2.44	
08/04/89	2.29	
08/08/89	1.9	2.4
08/10/89	1.37	
08/11/89	2.44	
08/18/89	2.44	
08/22/89	1.68	
08/24/89	2.59	
08/30/89	2.4	2.4
09/02/89	2.44	
09/15/89	2.44	
09/17/89	1.52	
09/19/89	2	1.9
	4201	4202

LOWER PRIOR LAKE

DATE	corrected Chl a** (ppb) SITE 1	SITE 2
10/31/88	6	4
11/14/88	4	4
12/19/88	4	3
01/18/89	2	1
02/14/89	3	7
03/16/89	2	5
04/21/89	5	6
05/10/89	3	3
05/23/89	4	5
06/14/89	6	6
06/26/89	4	5
07/12/89	4	4
07/27/89	4	4
08/08/89	8	6
08/30/89	12	13
09/19/89	21	14

LOWER P RIOR LAKE WATER QUALITY DATA
Cond,DO, BOD,pH,Residue,Temp

DATE	Cond (umhos/cm)	DEPTH (m)	DO (mg/l)	pH (su)	TEMP (C)
10/31/88	230	0	7.2	7.5	6
10/31/88	230	0.5	7.2		6
10/31/88	230	1	7		6
10/31/88	230	2	7		6
10/31/88	230	3	7		6
10/31/88	230	4	7		6
10/31/88	230	5	7		6
10/31/88	235	6	7		6
10/31/88	235	7	7		6
10/31/88	235	8	7	7.5	6
10/31/88	235	9	7		6
10/31/88	235	10	7		6
10/31/88	235	11	7		6
10/31/88	235	12	7		6
10/31/88	235	13	7		6
10/31/88	235	14	7		6
10/31/88	235	15	6.8		6
10/31/88	235	15.5	6.8	7.5	6
10/31/88	235	16	6		6
10/31/88	210	0	12.2	7.7	5
10/31/88	210	0.5	12.2		5
10/31/88	220	1	10.4		5
10/31/88	220	2	10.4		5
10/31/88	220	3	10.4		5
10/31/88	220	4	10.4		5
10/31/88	220	4.5	10.4	7.7	5
10/31/88	220	5	10.4		5
10/31/88	220	6	10.4		5
10/31/88	220	6.5	10.4		5
10/31/88	220	7	10.4		5
10/31/88	220	8	10.4		5
10/31/88	220	8.5	10.4	7.7	5
10/31/88	220	9	10.4		5
11/14/88	299	0	10	7.9	4
11/14/88		0.5	10		4
11/14/88		1	9.7		4
11/14/88		2	9.7		4
11/14/88		3	9.7		4
11/14/88		4	9.7		4
11/14/88		5	9.7		4
11/14/88		6	9.6		4
11/14/88		7	9.5		4
11/14/88		8	9.5	7.9	4
11/14/88		9	9.7		4
11/14/88		10	9.7		4
11/14/88		11	9.7		4
11/14/88		12	9.5		4
11/14/88		13	9.5		4
11/14/88		14	9.6		4
11/14/88		15	9.6		4
11/14/88	305	16	9	7.9	4
11/14/88		16.25			
11/14/88	317	0	10.4	8	3.5
11/14/88		0.5	10.4		3.5
11/14/88		1	10.2		3.5
11/14/88		2	10.2		3.5
11/14/88		3	10.2		3
11/14/88		4	10.2		3
11/14/88		5	10.2	8	3
11/14/88		6	10		3
11/14/88		7	10		3
11/14/88		8	10		3
11/14/88		9	9.5		3
11/14/88	329	9.5	9	8	3
11/14/88		10	9		3

LOWER PRIOR LAKE WATER QUALITY DATA
Cond,DO,BOD,pH,Residue,Temp

DATE	Cond (umhos/cm	DEPTH (m)	DO (mg/l)	pH (su)	TEMP (C)
12/19/88	337	0.5	12.6	8	2
12/19/88	335	1	12.4		2.5
12/19/88	337	2	12.4		2
12/19/88	337	3	12.3		2
12/19/88	337	4	12.2		2
12/19/88	337	5	12.2		2
12/19/88	337	6	12.4		2
12/19/88	337	7	12.4		2
12/19/88	337	8	12.1	8	2
12/19/88	337	9	12.1		2
12/19/88	345	10	12.3		2
12/19/88	345	11	12.3		2
12/19/88	345	12	12.2		2
12/19/88	345	13	12		2.5
12/19/88	345	14	11.7		2.5
12/19/88	345	15	2.7		2.5
12/19/88	366	16	1.6	7.7	2.5
12/19/88	335	0.5	13.6	8.1	2.5
12/19/88	333	1	13.7		3
12/19/88	333	2	13.9		3
12/19/88	333	3	14		3
12/19/88	341	4	13.9	8.1	3
12/19/88	341	5	13.9		3
12/19/88	348	6	13.2		3
12/19/88	356	7	7.6		3
12/19/88	359	8	3.5	8	3.5
01/18/89	336	0.5	11	7.9	1
01/18/89	345	1	10.6		2
01/18/89	345	2	10.6		2.5
01/18/89	345	3	10.6		2.5
01/18/89	345	4	10.6		2.5
01/18/89	345	5	10.6		2.5
01/18/89	351	6	10.6		2.5
01/18/89	351	7	10.2	7.9	2.5
01/18/89	351	8	10.2		2.5
01/18/89	351	9	10.2		2.5
01/18/89	348	10	10.2		3
01/18/89	348	11	9.4		3
01/18/89	348	12	7.9		3
01/18/89	348	13	6.7		3
01/18/89	348	14	1.7	7.9	3
01/18/89	336	0.5	12.8	8.1	1
01/18/89	343	1	12.6		2.5
01/18/89	348	2	12.6		3
01/18/89	348	3	12.4	8.1	3
01/18/89	356	4	11		3
01/18/89	356	5	10.4		3
01/18/89	364	6	8	8.1	3

LOWER P RIOR LAKE WATER QUALITY DATA
Cond,DO,BOD,pH,Residue,Temp

DATE	Cond (umhos/cm)	DEPTH (m)	DO (mg/l)	pH (su)	TEMP (C)
02/14/89	350	0.5	9.1	7.7	1
02/14/89	355	1	8.8		3
02/14/89	355	2	8.7		3
02/14/89	355	3	8.3		3
02/14/89	365	4	7.9		3
02/14/89	365	5	7.5		3
02/14/89	365	6	6.8		3
02/14/89	365	7	6.4		3
02/14/89	365	8	4.8	7.7	3
02/14/89	365	9	3.9		3
02/14/89	370	10	3.5		3
02/14/89	370	11	5.5		3
02/14/89	370	12	3.1		3
02/14/89	370	13	0.4		3
02/14/89	380	14	0.4		3
02/14/89	390	15	0.5		3
02/14/89	435	16	0.6	7.6	3
02/14/89	350	0.5	11.4	7.9	1
02/14/89	360	1	11.4		2.5
02/14/89	365	2	11.4		3
02/14/89	365	3	11.2		3
02/14/89	370	4	10.8	8	3
02/14/89	370	5	9.9		3
02/14/89	380	6	9.6		3
02/14/89	390	7	5.2		4
02/14/89	395	8	5.2		4
02/14/89	395	9	0.6	7.7	4
03/16/89	210	0.5	10.6	7.5	2
03/16/89	355	1	10.8		3
03/16/89	365	2	11		3
03/16/89	365	3	10.8		3
03/16/89	370	4	11		3
03/16/89	370	5	10.8		3
03/16/89	370	6	10.6		3
03/16/89	370	7	10.4		3
03/16/89	370	8	10.3	7.6	3
03/16/89	375	9	10.3		2.5
03/16/89	375	10	10.3		2.5
03/16/89	375	11	10.2		2
03/16/89	385	12	10		2
03/16/89	385	13	10		2
03/16/89	390	14	10.2		2
03/16/89	410	15	10		1
03/16/89	425	16	10.7	7.5	1
03/16/89	315	0.5	10.4	7.7	0
03/16/89	360	1	10		1.5
03/16/89	365	2	9.5		3
03/16/89	370	3	9.3		3
03/16/89	370	4	8.7	7.6	3
03/16/89	380	5	8.4		3
03/16/89	390	6	8.2		3
03/16/89	385	7	7.5		3.5
03/16/89	390	8	3.9		3.5
03/16/89	390	9	0.5	7.6	3.5

LOWER PRIOR LAKE WATER QUALITY DATA
Cond,DO, BOD,pH,Residue,Temp

DATE	Cond (umhos/cm	DEPTH (m)	DO (mg/l)	pH (su)	TEMP (C)
04/21/89	350	0.5	11.6	8.2	8
04/21/89	350	1	11.2		8
04/21/89	350	2	11.2		8
04/21/89	350	3	11.2		8
04/21/89	350	4	11.2	8.2	8
04/21/89	350	5	11.2		8
04/21/89	350	6	10.8		7
04/21/89	350	7	10		7
04/21/89	350	8	9.3	8.1	7
04/21/89	355	0.5	11.2	8.2	8
04/21/89	355	1	11.4		8
04/21/89	355	2	11.4		8
04/21/89	355	3	11.4		8
04/21/89	360	4	11.2		7.5
04/21/89	360	5	11.4		7.5
04/21/89	360	6	10.2		6
04/21/89	365	7	8.8		5.5
04/21/89	370	8	7.4	8	5
04/21/89	370	9	6		4.5
04/21/89	380	10	4.5		4
04/21/89	380	11	0.5		4
04/21/89	380	12	0.5		4
04/21/89	380	13	0.4		4
04/21/89	385	14	0.3		3.5
04/21/89	385	15	0.3		3.5
04/21/89	385	16	0.3	7.4	3.5
05/10/89	360	0.5	10.8	8.5	13
05/10/89	365	1	10.8		13
05/10/89	370	2	10.8		11.5
05/10/89	360	3	11		10
05/10/89	355	4	10.8	8.5	9
05/10/89	355	5	10.8		9
05/10/89	355	6	9.9		9
05/10/89	355	7	9.9		9
05/10/89	355	8	9.3	8.4	9
05/10/89	360	0.5	10.8	8.4	12
05/10/89	360	1	10.8		11.5
05/10/89	360	2	10.8		11.5
05/10/89	360	3	11		10
05/10/89	360	4	10.6		10
05/10/89	360	5	10.2		10
05/10/89	360	6	10		10
05/10/89	360	7	10		9.5
05/10/89	365	8	9.5	8.4	9
05/10/89	365	9	7.8		8.5
05/10/89	385	10	1.2		6
05/10/89	385	11	0.5		4.5
05/10/89	380	12	0.4		4
05/10/89	380	13	0.4		4
05/10/89	380	14	0.4		4
05/10/89	395	15	0.4		3.5
05/10/89	395	16	0.3	7.6	3.5

LOWER P RIOR LAKE WATER QUALITY DATA
Cond,DO, BOD,pH,Residue,Temp

DATE	Cond (umhos/cm)	DEPTH (m)	DO (mg/l)	pH (su)	TEMP (C)
05/23/89	365	0.5	11	8.7	18.5
05/23/89	365	1	10.8		18.5
05/23/89	365	2	10.8		18.5
05/23/89	365	3	10.8		18.5
05/23/89	380	4	10.5	8.7	14.5
05/23/89	380	5	8.4		12
05/23/89	365	6	4.9		10.5
05/23/89	375	7	3.1		10
05/23/89	375	8	2.1		10
05/23/89	365	9	1.6		10.5
05/23/89	365	10	0.6	7.8	10.5
05/23/89	365	0.5	11.3	8.6	18.5
05/23/89	365	1	11.2		18.5
05/23/89	370	2	11.2		18
05/23/89	405	3	11.2		13.5
05/23/89	370	4	10.8		13
05/23/89	370	5	9.2		11
05/23/89	365	6	9.2		10
05/23/89	370	7	7.6		9.5
05/23/89	365	8	5.9		9
05/23/89	370	9	4.3	7.9	8
05/23/89	380	10	0.3		6.5
05/23/89	395	11	0.3		4.5
05/23/89	400	12	0.2		4
05/23/89	395	13	0.2		3.5
05/23/89	395	14	0.5		3.5
05/23/89	400	15	0.5		3.5
05/23/89	400	16	0.5	7.3	3.5
06/14/89	365	0.5	9	8.5	17
06/14/89	365	1	8.9		17
06/14/89	365	2	8.9		17
06/14/89	370	3	8.9		17
06/14/89	370	4	8.9		17
06/14/89	365	5	7.9	8.5	14.5
06/14/89	380	6	7.9		11
06/14/89	365	7	5.4		10
06/14/89	370	8	2.4		9
06/14/89	370	9	0.5		8
06/14/89	385	10	0.5		6
06/14/89	390	11	0.5		5
06/14/89	395	12	0.5		4.5
06/14/89	400	13	0.5		4
06/14/89	400	14	0.5		4
06/14/89	400	15	0.5		4
06/14/89	405	16	0.5	7.2	4
06/14/89	365	0.5	9.1	8.4	17
06/14/89	365	1	9		17
06/14/89	370	2	9		17
06/14/89	370	3	9		17
06/14/89	370	4	9		17
06/14/89	370	5	8.8		17
06/14/89	380	6	6.3	8.5	16
06/14/89	405	7	0.4		12
06/14/89	380	8	0.4		11
06/14/89	385	9	0.4		10
06/14/89	385	10	0.4	7.6	10

LOWER P RIOR LAKE WATER QUALITY DATA
Cond,DO,BOD,pH,Residue,Temp

DATE	Cond (umhos/cm)	DEPTH (m)	DO (mg/l)	pH (su)	TEMP (C)
06/26/89	370	0.5	8.7	8.6	21.5
06/26/89	370	1	8.6		21.5
06/26/89	370	2	8.6		21.5
06/26/89	370	3	8.6		21.5
06/26/89	385	4	8		20
06/26/89	385	5	6.6	8.5	17.5
06/26/89	385	6	1.8		16
06/26/89	405	7	0.4		12
06/26/89	400	8	0.4		12
06/26/89	380	9	0.5	7.6	11.5
06/26/89	375	0.5	8.6	8.4	21
06/26/89	375	1	8.7		21
06/26/89	375	2	8.5		21
06/26/89	375	3	8.5		21
06/26/89	385	4	7.4		19
06/26/89	380	5	7.5	8.5	15
06/26/89	380	6	7.4		11.5
06/26/89	375	7	3.8		10
06/26/89	380	8	0.4		8
06/26/89	370	9	0.5		8
06/26/89	385	10	0.5		6
06/26/89	390	11	0.5		5
06/26/89	395	12	0.6		4.5
06/26/89	390	13	0.6		5
06/26/89	400	14	0.7		5
06/26/89	405	15	0.8		5
06/26/89	405	16	0.8	7.2	5
07/12/89	365	0.5	7.4	8.4	26
07/12/89	365	1	7.4		26
07/12/89	365	2	7.2		26
07/12/89	365	3	7		26
07/12/89	370	4	6.1		25
07/12/89	385	5	4.8	8.4	19
07/12/89	385	6	5.1		13.5
07/12/89	380	7	3		10.5
07/12/89	380	8	0.3		9
07/12/89	380	9	0.3		8
07/12/89	385	10	0.3		6.5
07/12/89	395	11	0.4		5.5
07/12/89	400	12	0.4		5
07/12/89	400	13	0.4		4.5
07/12/89	400	14	0.5		4.5
07/12/89	405	15	0.4		5
07/12/89	410	16	0.5	7.1	4.5
07/12/89	355	0.5	7.5	8.4	25.5
07/12/89	360	1	7.4		25.5
07/12/89	365	2	7.4		25
07/12/89	365	3	7		25
07/12/89	375	4	6.1		24.5
07/12/89	380	5	4.2		22
07/12/89	395	6	1	7.8	18
07/12/89	395	7	0.2		15.5
07/12/89	390	8	0.3		13
07/12/89	395	9	0.4	7.4	11.5

LOWER P RIOR LAKE WATER QUALITY DATA
Cond,DO, BOD,pH,Residue,Temp

DATE	Cond (umhos/cm)	DEPTH (m)	DO (mg/l)	pH (su)	TEMP (C)
07/27/89	350	0.5	9.1	8.2	25
07/27/89	360	1	9		25
07/27/89	365	2	9		24.5
07/27/89	365	3	9		24
07/27/89	370	4	7.8		22.5
07/27/89	355	5	5.9		20
07/27/89	365	6	4	7	14.5
07/27/89	370	7	1.5		11
07/27/89	380	8	0.4		8.5
07/27/89	380	9	0.4		7.5
07/27/89	395	10	0.4		6.5
07/27/89	405	11	0.4		5.5
07/27/89	405	12	0.4		5
07/27/89	405	13	0.5		5
07/27/89	405	14	0.5		5
07/27/89	415	15	0.5		5
07/27/89	415	16	0.7	6.9	5
07/27/89	350	0.5	9.4	8.2	25.5
07/27/89	355	1	9.5		25.5
07/27/89	360	2	9.5		25
07/27/89	360	3	9.3		25
07/27/89	370	4	9.1		24.5
07/27/89	380	5	5.6		22.5
07/27/89	405	6	0.6	7.8	19.5
07/27/89	410	7	0.4		16.5
07/27/89	405	8	0.5		13
07/27/89	400	9	0.5		12
07/27/89	420	10	0.5	7.7	12
08/08/89	310	0.5	8	8.4	23
08/08/89	310	1	8		23
08/08/89	310	2	8		23
08/08/89	315	3	7.4		22.5
08/08/89	315	4	7.5		22.5
08/08/89	315	5	7.5		22.5
08/08/89	315	6	7		22
08/08/89	360	7	0.3	8.2	18
08/08/89	360	8	0.4		14
08/08/89	365	9	0.4	7.5	12
08/08/89	355	0.5	8.4	8.6	23
08/08/89	355	1	8.4		23
08/08/89	355	2	8.2		23
08/08/89	360	3	8.3		22.5
08/08/89	360	4	8		22.5
08/08/89	365	5	6.6		22
08/08/89	390	6	0.4	8.2	16
08/08/89	385	7	0.3		12
08/08/89	380	8	0.3		9.5
08/08/89	385	9	0.3		8
08/08/89	385	10	0.3		6.5
08/08/89	405	11	0.3		5.5
08/08/89	400	12	0.3		4.5
08/08/89	410	13	0.4		4.5
08/08/89	410	14	0.4		4.5
08/08/89	415	15	0.5		4.5
08/08/89	425	16	0.5	7.6	4.5

LOWER P RIOR LAKE WATER QUALITY DATA
Cond,DO, BOD,pH,Residue,Temp

DATE	Cond (umhos/cm)	DEPTH (m)	DO (mg/l)	pH (su)	TEMP (C)
08/30/89	345	0.5	7.8	8.4	21
08/30/89	350	1	7.8		21
08/30/89	350	2	7.6		21
08/30/89	350	3	7.6		21
08/30/89	350	4	7.7		21
08/30/89	350	5	7.2		21
08/30/89	395	6	0.4	7.9	17.5
08/30/89	400	7	0.4		12
08/30/89	390	8	0.4		9
08/30/89	380	9	0.4		9
08/30/89	400	10	0.5		6
08/30/89	405	11	0.5		5.5
08/30/89	405	12	0.5		5
08/30/89	415	13	0.5		5
08/30/89	420	14	0.6		5
08/30/89	430	15	0.6		5
08/30/89	450	16	0.5	7	5
08/30/89	350	0.5	8	8.3	21
08/30/89	350	1	7.9		21
08/30/89	350	2	8.1		21
08/30/89	350	3	7.9		21
08/30/89	350	4	7.9		21
08/30/89	350	5	7.8		21
08/30/89	350	6	7.3		21
08/30/89	350	7	6.5		21
08/30/89	410	8	0.4	8.5	16.5
08/30/89	430	9	0.5		13
08/30/89	440	10	0.5	7.3	12
09/19/89	340	0.5	9.1	8.2	18.5
09/19/89	350	1	9.1		18.5
09/19/89	350	2	9.1		18.5
09/19/89	350	3	9		18.5
09/19/89	350	4	8.9		18.5
09/19/89	355	5	7.6		18
09/19/89	360	6	4.8		17
09/19/89	375	7	0.2		15
09/19/89	385	8	0.3	7.2	11
09/19/89	385	9	0.3		9
09/19/89	385	10	0.3		8
09/19/89	390	11	0.3		7
09/19/89	405	12	0.3		6
09/19/89	415	13	0.3		6
09/19/89	415	14	0.3		6
09/19/89	420	15	0.3		6
09/19/89	430	16	0.3	6.6	5.5
09/19/89	335	0.5	9.2	8.9	18.5
09/19/89	340	1	9.2		18.5
09/19/89	340	2	9.1		18.5
09/19/89	350	3	9.1		18.5
09/19/89	350	4	9.1	8.9	18.5
09/19/89	350	5	9		18.5
09/19/89	350	6	8.6		18.5
09/19/89	355	7	5.2		17.5
09/19/89	355	8	0.7		17.5
09/19/89	370	9	0.3	8.4	16.5

UPPER PRIOR LAKE WATER QUALITY DATA
Nutrient Data

DATE	DEPTH (m)	Org N mg/l	NH3 mg/l	TKN mg/l	NO2+NO mg/l	TP mg/l	DP mg/l
10/31/88	0					0.08	0.01
10/31/88	3					0.09	0.01
10/31/88	5					0.09	0.01
10/31/88	6					0.09	0.01
10/31/88	0					0.06	0.01
10/31/88	3.5					0.08	0.01
10/31/88	5					0.08	0.01
10/31/88	6.5					0.08	0.01
11/14/88	0	1.5	1	2.5	0.06	0.06	0.01
11/14/88	6			2.6	0.06	0.07	0.01
11/14/88	9					0.08	0.01
11/14/88	11.5	1.6	1	2.6	0.06	0.07	0.01
11/14/88	0	1.5	0.98	2.5	0.06	0.08	0.01
11/14/88	3			2.7	0.06	0.08	0.01
11/14/88	5					0.08	0.01
11/14/88	6.5	1.6	0.98	2.6	0.06	0.06	0.01
12/19/88	0.5					0.08	0.02
12/19/88	6					0.08	0.02
12/19/88	10					0.13	0.06
12/19/88	13					0.25	0.14
12/19/88	0.5					0.05	0.01
12/19/88	3					0.09	0.01
12/19/88	5					0.06	0.01
12/19/88	7					0.06	0.01
01/18/89	0.5					0.1	0.05
01/18/89	5					0.09	0.05
01/18/89	7					0.1	0.05
01/18/89	10					0.1	0.06
01/18/89	0.5					0.06	0.02
01/18/89	3					0.06	0.02
01/18/89	5					0.05	0.02
01/18/89	7					0.06	0.02
02/14/89	0.5	1.9	1.3	3.2	0.1	0.09	0.02
02/14/89	6			3.1	0.1	0.11	0.06
02/14/89	9					0.12	0.06
02/14/89	12	1.3	2.1	3.4	0.02	0.18	0.1
02/14/89	0.5	1.6	1.2	2.8	0.1	0.07	0.03
02/14/89	2			2.8	0.1	0.07	0.03
02/14/89	4					0.07	0.04
02/14/89	6	1.4	1.2	2.6	0.08	0.09	0.03

UPPER PRIOR LAKE WATER QUALITY DATA
Nutrient Data

DATE	DEPTH (m)	Org N mg/l	NH3 mg/l	TKN mg/l	NO2+NO mg/l	TP mg/l	DP mg/l
03/16/89	0.5					0.2	0.01
03/16/89	6					0.11	0.04
03/16/89	9					0.13	0.06
03/16/89	12					0.22	0.15
03/16/89	0.5					0.11	0.03
03/16/89	2					0.12	0.03
03/16/89	3					0.09	0.06
03/16/89	5					0.08	0.04
04/21/89	0.5					0.1	0.02
04/21/89	6					0.11	0.01
04/21/89	9					0.11	0.01
04/21/89	12					0.37	0.23
04/21/89	0.5					0.09	0.01
04/21/89	3					0.11	0.01
04/21/89	5					0.1	0.01
04/21/89	7					0.1	0.01
05/10/89	0.5	1.2	0.35	1.6	0.04	0.05	0.02
05/10/89	4	1.7	0.4	2.1	0.04	0.07	0.02
05/10/89	8					0.07	0.02
05/10/89	12	1.9	3.7	5.6	0.02	0.13	0.02
05/10/89	0.5	1.4	0.37	1.8	0.04	0.06	0.02
05/10/89	3	1.7	0.34	2	0.04	0.08	0.02
05/10/89	5					0.08	0.02
05/10/89	7	1.8	0.43	2.2	0.04	0.08	0.02
05/23/89	0.5					0.06	0.01
05/23/89	4					0.06	0.01
05/23/89	6					0.1	0.03
05/23/89	7					0.11	0.04
05/23/89	0.5					0.06	0.01
05/23/89	4					0.08	0.01
05/23/89	8					0.08	0.01
05/23/89	13					0.17	0.05
06/14/89	0.5					0.08	0.02
06/14/89	5					0.08	0.02
06/14/89	9					0.26	0.1
06/14/89	13					0.37	0.23
06/14/89	0.5					0.07	0.02
06/14/89	5					0.06	0.02
06/14/89	6					0.06	0.02
06/14/89	7					0.06	0.02

UPPER PRIOR LAKE WATER QUALITY DATA
Nutrient Data

DATE	DEPTH (m)	Org N mg/l	NH3 mg/l	TKN mg/l	NO2+NO mg/l	TP mg/l	DP mg/l
06/26/89	0.5					0.09	0.01
06/26/89	5					0.05	0.01
06/26/89	9					0.23	0.02
06/26/89	13					0.37	0.13
06/26/89	0.5					0.08	0.01
06/26/89	3					0.06	0.01
06/26/89	5					0.08	0.01
06/26/89	7					0.12	0.02
07/12/89	0.5					0.07	0.01
07/12/89	4					0.11	0.01
07/12/89	7					0.29	0.04
07/12/89	13					0.38	0.13
07/12/89	0.5					0.06	0.01
07/12/89	5					0.09	0.01
07/12/89	6					0.09	0.01
07/12/89	7					0.19	0.02
07/27/89	0.5					0.07	0.01
07/27/89	5					0.14	0.01
07/27/89	10					0.35	0.1
07/27/89	13					0.56	0.2
07/27/89	0.5					0.09	0.01
07/27/89	4					0.09	0.01
07/27/89	6					0.18	0.02
07/27/89	7					0.3	0.06
08/08/89	0.5	1.6	0.01	1.6	0.02	0.06	0.01
08/08/89	5			1.7	0.02	0.07	0.01
08/08/89	9					0.2	0.06
08/08/89	13	4.6	3.8	8.4	0.02	0.43	0.22
08/08/89	0.5	1.5	0.02	1.5	0.02	0.05	0.01
08/08/89	4			1.6	0.02	0.06	0.01
08/08/89	5					0.06	0.01
08/08/89	6	1.4	0.24	1.6	0.02	0.09	0.01
08/30/89	0.5					0.07	0.01
08/30/89	6					0.09	0.01
08/30/89	9					0.28	0.12
08/30/89	13					0.5	0.32
08/30/89	0.5					0.08	0.01
08/30/89	3					0.07	0.01
08/30/89	5					0.09	0.01
08/30/89	6					0.08	0.01
4201 09/19/89	0.5					0.14	0.01
4202 09/19/89	8					0.12	0.01
09/19/89	10					0.59	0.34
09/19/89	13					0.94	0.58
4202 09/19/89	0.5					0.13	0.01
09/19/89	3					0.15	0.01
09/19/89	4					0.12	0.01
09/19/89	6					0.12	0.01

UPPER PRIOR LAKE
Dissolved Oxygen

SITE 1

DO (mg/l)

Depth (m)	10/31/88	11/14/88	12/19/88	01/18/89	02/14/89	03/16/89	04/21/89	05/10/89	05/23/89	06/14/89	06/26/89	07/12/89	07/27/89	08/08/89	08/30/89	09/19/89
0.5	11.8	11.4	8.6	3.8	2.7	0.3	12.2	12.4	7.1	8.7	7.8	6.3	8	10.2	5.8	9.5
1	11.8	11.2	8.6	3.3	1.8	0.3	12.2	12.4	7.1	8.6	7.7	6.1	7.5	9.5	5.2	9.5
2	11.8	11	8.2	2.5	0.8	0.3	12.3	12.4	7.1	8.6	6.8	6.1	7	9.3	5.1	8.9
3	11.8	11.6	8	2.5	0.8	0.3	12.3	12.2	5	8.5	1.2	1.2	0.7	7.5	4.5	7.8
4	11.8	11.4	7.9	2.4	0.4	0.3	10.6	10.5	2.5	6.5	0.3	0.2	0.3	3	3.5	2.3
5	11.8	11.6	7.9	1.9	0.4	0.3	9.1	9.4	0.7	4.8	0.4	0.2	0.3	0.3	0.4	0.3
6	11.8	11.8	7.8	1.8	0.4	0.3	5.4	8.1	0.5	0.5	0.3	0.3	0.3	0.3	0.3	0.3
7	11.8	11.6	6.9	0.7	0.4	0.3	0.5	6.3	0.5	0.5	0.5	0.3	0.4	0.3	0.3	0.3
8	11.8	11.6	6	0.7	0.4	0.3	0.4	3.9	0.5	0.5	0.5	0.4	0.4	0.3	0.4	0.3
9	11.8	11.6	5.3	0.7	0.4	0.3	0.3	0.6	0.5	0.5	0.5	0.4	0.4	0.3	0.4	0.3
10	11.8	11.8	3.2	1.3	0.4	0.3	0.3	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3
11	11.8	11.8	2.8	0.7	0.4	0.4	0.2	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3
12	11.8	11.8	2.5	0.4	0.5	0.4	0.2	0.4	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.3
13			1.9		0.6	0.5	0.2		0.5	0.5	0.7	0.5	0.5	0.5	0.5	0.3

SITE 2

Depth (m)	10/31/88	11/14/88	12/19/88	01/18/89	02/14/89	03/16/89	04/21/89	05/10/89	05/23/89	06/14/89	06/26/89	07/12/89	07/27/89	08/08/89	08/30/89	09/19/89
0.5	11	11.2	12.2	7.2	3.7	0.6	12.2	12.5	7.4	8.6	9.8	7.1	8.9	9	6.2	9.6
1	11	11.2	11.6	6.5	3.7	0.6	12.2	12.5	7.4	8.5	9.4	6.6	8.8	9	6.2	9.6
2	11	11.2	11.6	6.1	3.4	0.5	12.2	12.7	7.4	8.5	8	6.1	8.5	8	6	9.5
3	11	11.2	11.3	6	1.8	0.5	12.2	12.2	7.4	8.4	5.2	5.1	7.2	8	5.8	9.4
4	11	11.2	11.2	5.9	2.7	0.5	12	9.9	6.8	8	1	0.3	0.3	8.1	5.5	9.2
5	11	11	11	5.4	2.6	0.5	11.2	9.4	1.2	4.6	0.4	0.3	0.3	0.5	4.3	8.9
6	11	11	11	5.2	3.8	0.5	8	9	0.6	1.6	0.4	0.3	0.5	0.4	0.4	8.4
7		10.4	7	1.8			7.2	7.4	0.5	0.4	0.4	0.4	0.4			

UPPER PRIOR LAKE
Temp (°C)

SITE 1

Depth (m)	10/31/88	11/14/88	12/19/88	01/18/89	02/14/89	03/16/89	04/21/89	05/10/89	05/23/89	06/14/89	06/26/89	07/12/89	07/27/89	08/08/89	08/30/89	09/19/89
0.5	4	3	3	0.5	0	0	10	13	19	16.5	22	26	25.5	22.5	21	18.5
1	4	3	3	2	2	1.5	10	12	19	16.5	22	26	25.5	22	21	18.5
2	4	3	3	3	3	2	10	10	19	16.5	21	26	25.5	22	21	18
3	4	3	3	3	3	2.5	9	10	17	16.5	19	24.5	24	21	21	18
4	4	3	3	3	3	2.5	8	9	14.5	16	17	18.5	20.5	21	20.5	16.5
5	4	3	3	3	3	2.5	8	9	13	16	15	15	16.5	17.5	19	16
6	4	3	3	3	3	3	6.5	9	11.5	13.5	13	13	13	13	15.5	16
7	4	3	3	3	3	3	5	8	9.5	11	12	11.5	11	11	12	15.5
8	4	3	3	3	3	3	4	7	8	9	9.5	9	9	9.5	10	13
9	4	3	3	3	3	3	3	6	6.5	7	6.5	8	8	8.5	9	10.5
10	4	3	3	3	3	3	3	4	5	6	6	7	8	8	8.5	9.5
11	4	3	3	3	3	3	3	3.5	4.5	5.5	6	7	8	7.5	8.5	9
12	4	3	3	3	3	3	3	3	4.5	5.5	6	7	8.5	7.5	8.5	9
13			3		3	3	3		4.5	5.5	6	7	8.5	8	8.5	9

SITE 2

Depth (m)	10/31/88	11/14/88	12/19/88	01/18/89	02/14/89	03/16/89	04/21/89	05/10/89	05/23/89	06/14/89	06/26/89	07/12/89	07/27/89	08/08/89	08/30/89	09/19/89
0.5	4	3	2.5	1	1	0.5	9	13	19	17	21	26	26	23	21.5	18.5
1	4	3	3	2.5	3	2	9	12	19	17	20	26	26	22.5	21	18.5
2	4	3	3	3	3	3	9	11.5	19	17	20	25.5	26	22	21	18.5
3	4	3	3	3	3	3	9	10	19	17	17.5	25	25.5	22	21	18.5
4	4	3	3	3	3	3	9	9.5	18.5	17	17	24	22.5	22	21	18.5
5	4	3	3	3	3	3	8	9.5	13.5	16.5	16.5	19	19.5	21	20.5	18.5
6	4	3	3	3.5	3	3	8	9.5	12	16	16	16	17.5	17.5	20.5	18
7	4	3	3	3.5			7.5	9.5	11.5	15	16	15.5	16			

UPPER PRIOR LAKE

4202

DATE	Secchi (m) site 1	site 2
10/31/88	1.6	1.5
11/14/88	2.5	2.5
12/19/88	5	3.6
01/18/89	4.25	4.6
02/14/89	2	3.2
03/16/89	1	2.2
04/21/89	0.75	1
05/10/89	1.6	2
05/23/89	4	2.7
06/01/89	2.44	
06/03/89	1.68	
06/14/89	1.1	1.3
06/18/89	1.07	
06/26/89	0.9	1.1
07/02/89	0.76	
07/05/89	0.76	
07/07/89	0.61	
07/12/89	0.7	0.8
07/25/89	0.91	
07/27/89	0.8	0.9
08/08/89	0.7	0.75
08/10/89	0.61	
08/18/89	0.46	
08/30/89	1	1
09/19/89	0.7	0.75

4201

UPPER PRIOR LAKE

DATE	corrected Chl a** (ppb) SITE 1	SITE 2
10/31/88	19	13
11/14/88	8	13
12/19/88	2	6
01/18/89	1	4
02/14/89	34	4
03/16/89	72	7
04/21/89	34	37
05/10/89	13	11
05/23/89	5	5
06/14/89	19	16
06/26/89	28	24
07/12/89	32	30
07/27/89	34	23
08/08/89	52	52
08/30/89	24	21
09/19/89	70	71

Stream Water Quality for PL/SL Watershed

*** TP Concentration (~~mg~~ µg/L) ***

	S-1	S-2	S-3	S-4
03/28/89	600	800		260
04/04/89	290	600	100	230
04/04/89	250	550	130	140
04/05/89	240	520	180	140
04/06/89	230	470	140	160
04/21/89		210		
04/27/89	150	220		130
04/28/89	160	240	90	140
04/29/89	150	240	130	120
05/10/89	290	600	100	230
05/23/89	160	420	60	130
06/07/89		390	240	
06/12/89		850	60	
06/13/89		490	70	
06/14/89		470	150	150
07/12/89				200
07/18/89		810	80	210
07/21/89			150	
07/21/89		570	340	
08/22/89	810	690		260
08/23/89	590	530		
08/24/89	510	770		
08/25/89	420	460		
average	346	519	135	179
	207	195	75	51
upper 95	455	602	173	205
lower 95	238	436	97	152

Prior-Spring Lake Stream Monitoring

STREAM

Date	SITE S1 flow rate (cfs)	SRP (mg/l)	TP (mg/l)	SITE S2 Flow(cfs)	SRP(mg/L)	TP(mg/L)	SITE S3 Flow(cfs)	SRP(mg/L)	TP(mg/L)	SITE S4 Flow(cfs)	SRP(mg/L)	TP(mg/L)
03/28/89	20.9	0.51	0.6	8.55	0.7	0.8	0	0	0	0.56	0.19	0.26
04/04/89	2.1	0.13	0.29	5.12	0.42	0.6	0.25	0.06	0.1	0.03	0.2	0.23
04/21/89	0	0	0	0.28	0.1	0.21	0	0	0	0	0	0
05/10/89	2.1	0.13	0.29	5.12	0.42	0.6	0.25	0.06	0.1	0.03	0.2	0.23
05/23/89	0.35	0.06	0.16	0.8	0.33	0.42	5.13	0.01	0.06	0.47	0.07	0.13
06/07/89	0	0	0	3.3	0.16	0.39	8.4	0.02	0.24	0	0	0
07/12/89	0	0	0	0	0	0	0.03	0.28	1.76	0.75	0.005	0.2
08/22/89	1.75	0.53	0.81	0.22	0.54	0.69	0	0	0	1.52	0.18	0.26

Prior-Spring Lake Storm Sewer Monitoring

Site	TSS(mg/L)	SRP(mg/L)	TP(mg/L)	SRP/TP
3/28/89				
SS-1	292	0.33	1.3	0.254
SS-2	70	0.34	0.6	0.567
5/1/89				
SS-1				
SS-2	98	0.14	0.49	0.286
6/26/89				
SS-1	147	0.1	1.91	0.052
SS-2	94	0.07	0.26	0.269
7/19/89				
SS-1	252	0.07	1.3	0.054
SS-2	37	0.15	0.37	0.405
8/22/89				
SS-1	1214	0.06	2.15	0.028
SS-2				

STORM SEWER

APRIL 26,1989

*****	SS-1******	*************	*******	******	SS-2******	*************	*******
Time	Flow	Time (hrs)	Flow (cfs)	Time	Flow	Time (hrs)	Flow (cfs)
0	0	0	0	0	0	0	0
9.9	0	4.95	0	9.5	0	4.75	0
10	77	5	0.7392	9.6	96	4.8	0.9216
10.1	38	5.05	0.3648	9.65	192	4.825	1.8432
10.2	14	5.1	0.1344	9.7	198	4.85	1.9008
10.25	12	5.125	0.1152	9.75	192	4.875	1.8432
10.3	47	5.15	0.4512	9.9	160	4.95	1.536
10.35	10	5.175	0.096	10	129	5	1.2384
10.4	7	5.2	0.0672	10.1	10	5.05	0.096
10.45	1	5.225	0.0096	10.2	98	5.1	0.9408
10.5	7	5.25	0.0672	10.25	80	5.125	0.768
10.55	2	5.275	0.0192	10.5	60	5.25	0.576
10.6	1	5.3	0.0096	11	33	5.5	0.3168
10.8	0	5.4	0	11.4	25	5.7	0.24
11.6	0	5.8	0	11.5	27	5.75	0.2592
11.7	34	5.85	0.3264	11.6	31	5.8	0.2976
11.75	1	5.875	0.0096	11.7	33	5.85	0.3168
11.8	19	5.9	0.1824	11.8	35	5.9	0.336
11.85	3	5.925	0.0288	11.9	32	5.95	0.3072
11.9	7	5.95	0.0672	12	30	6	0.288
11.95	3	5.975	0.0288	12.5	21	6.25	0.2016
12	1	6	0.0096	13	13	6.5	0.1248
12.1	0	6.05	0	13.5	10	6.75	0.096
12.15	1	6.075	0.0096	14	8	7	0.0768
12.2	5	6.1	0.048	14.5	7	7.25	0.0672
12.25	2	6.125	0.0192	15	5	7.5	0.048
12.3	1	6.15	0.0096	15.5	4	7.75	0.0384
12.4	1	6.2	0.0096	16	2	8	0.0192
12.5	0	6.25	0	16.5	2	8.25	0.0192
				17	1	8.5	0.0096
				17.5	0.5	8.75	0.0048
				17.8	0	8.9	0
				6.6	0	15.3	0
				6.75	99	15.375	0.9504
				7	174	15.5	1.6704
				7.1	191	15.55	1.8336
				7.2	205	15.6	1.968
				7.7	192	15.85	1.8432
				8	100	16	0.96
				8.5	135	16.25	1.296
				9	105	16.5	1.008
				9.3	103	16.65	0.9888
				9.4	104	16.7	0.9984
				9.5	106	16.75	1.0176
				9.6	108	16.8	1.0368
				9.75	123	16.875	1.1808
				10	155	17	1.488
				10.25	172	17.125	1.6512
				10.4	182	17.2	1.7472
				10.5	172	17.25	1.6512
				10.75	160	17.375	1.536
				11	136	17.5	1.3056
				11.25	150	17.625	1.44
				11.4	161	17.7	1.5456
				11.5	156	17.75	1.4976
				11.75	149	17.875	1.4304

JUNE 21,1989

******	SS-1******	*************	*******
Time	Flow	Time (hrs)	Flow (cfs)
0	0	0	0
24	0	24	0
24	0	48	0
24	0	72	0
18.3	0	90.3	0
18.4	0.5	90.4	0.195
18.5	0.75	90.5	0.2925
18.55	1	90.55	0.39
18.6	0.75	90.6	0.2925
18.7	0.3	90.7	0.117
18.75	0	90.75	0
15.9	0	111.9	0
16	36	112	14.04
16.1	20	112.1	7.8
16.13	15	112.13	5.85
16.2	7	112.2	2.73
16.3	3	112.3	1.17
16.4	2	112.4	0.78
16.5	2.5	112.5	0.975
16.6	2	112.6	0.78
16.7	1	112.7	0.39
16.8	8	112.8	3.12
16.9	9	112.9	3.51
17	7.5	113	2.925
17.1	5.5	113.1	2.145
17.25	3.5	113.25	1.365
17.5	2.5	113.5	0.975
17.7	2	113.7	0.78
17.8	2.5	113.8	0.975
17.9	6	113.9	2.34
18	7.5	114	2.925
18.1	6	114.1	2.34
18.2	3	114.2	1.17
18.3	2.5	114.3	0.975
18.4	1.5	114.4	0.585
18.5	1	114.5	0.39
18.75	0.5	114.75	0.195
18.9	1	114.9	0.39
19	1.5	115	0.585
19.1	2	115.1	0.78
19.2	2.5	115.2	0.975
19.25	4	115.25	1.56
19.4	2.5	115.4	0.975
19.5	2.25	115.5	0.8775
19.7	1.5	115.7	0.585
19.85	1	115.85	0.39
20	0.75	116	0.2925
23	0	119	0
24	0	120	0

******	SS-2******	*************	*******
Time	Flow	Time (hrs)	Flow (cfs)
0	0	0	0
15.6	0	7.8	0
15.63	18	7.815	0.1728
15.7	19.5	7.85	0.1872
15.8	20	7.9	0.192
15.9	22	7.95	0.2112
16	20	8	0.192
16.1	19	8.05	0.1824
16.2	18	8.1	0.1728
16.4	17	8.2	0.1632
16.7	14	8.35	0.1344
17	13	8.5	0.1248
17.5	10	8.75	0.096
18	8.5	9	0.0816
18.5	7	9.25	0.0672
19	5	9.5	0.048
19.5	3	9.75	0.0288
20	1	10	0.0096
20.3	0	10.15	0
21.65	0	10.825	0
21.9	100	10.95	0.96
22	105	11	1.008
22.1	118	11.05	1.1328
22.2	120	11.1	1.152
22.35	130	11.175	1.248
22.5	137	11.25	1.3152
22.6	134	11.3	1.2864
23	140	11.5	1.344
23.5	147	11.75	1.4112
23.7	150	11.85	1.44
24	157	12	1.5072
0.4	161	12.2	1.5456
1	149	12.5	1.4304
1.3	139	12.65	1.3344
1.4	143	12.7	1.3728
1.5	140	12.75	1.344
2	129	13	1.2384
2.5	121	13.25	1.1616
2.65	130	13.325	1.248
2.7	137	13.35	1.3152
2.9	163	13.45	1.5648
3	132	13.5	1.2672
3.1	140	13.55	1.344
3.4	130	13.7	1.248
3.6	120	13.8	1.152
3.9	112	13.95	1.0752
4.3	111	14.15	1.0656
5.9	100	14.95	0.96
6	97	15	0.9312
6.2	90	15.1	0.864
6.4	80	15.2	0.768
6.7	70	15.35	0.672
7.9	50	15.95	0.48
8.5	44	16.25	0.4224
9	42	16.5	0.4032
9.5	38	16.75	0.3648

JULY 17, 1989

******	SS-1******	***************	*******	******	SS-2******	***************	*******
Time	Flow	Time (hrs)	Flow (cfs)	Time	Flow	Time (hrs)	Flow (cfs)
0	0	0	0	0	0	0	0
0.2	0	0.2	0	0.8	0	0.4	0
0.3	1	0.3	0.39	0.9	100	0.45	0.96
0.4	4	0.4	1.56	1.3	235	0.65	2.256
0.55	6.5	0.55	2.535	1.5	192	0.75	1.8432
0.6	5	0.6	1.95	1.65	160	0.825	1.536
0.65	6	0.65	2.34	1.7	150	0.85	1.44
0.7	5	0.7	1.95	1.8	130	0.9	1.248
0.75	3	0.75	1.17	2	100	1	0.96
0.8	2.25	0.8	0.8775	2.2	70	1.1	0.672
0.9	1.5	0.9	0.585	2.35	50	1.175	0.48
1	1.25	1	0.4875	2.45	40	1.225	0.384
1.5	0.5	1.5	0.195	2.75	30	1.375	0.288
1.7	0	1.7	0	2.9	25	1.45	0.24
2.7	0	2.7	0	3.2	20	1.6	0.192
2.8	0.5	2.8	0.195	3.25	19	1.625	0.1824
2.83	2	2.83	0.78	3.3	25	1.65	0.24
2.85	1	2.85	0.39	3.35	60	1.675	0.576
2.9	5	2.9	1.95	3.45	100	1.725	0.96
2.93	1.5	2.93	0.585	3.8	126	1.9	1.2096
3	1.5	3	0.585	4.2	109	2.1	1.0464
3.05	2	3.05	0.78	4.3	190	2.15	1.824
3.1	1	3.1	0.39	4.6	168	2.3	1.6128
3.15	2	3.15	0.78	4.8	200	2.4	1.92
3.2	1	3.2	0.39	5.3	170	2.65	1.632
3.21	5	3.21	1.95	5.8	100	2.9	0.96
3.25	1	3.25	0.39	5.85	90	2.925	0.864
3.3	1.25	3.3	0.4875	5.9	80	2.95	0.768
3.4	1.3	3.4	0.507	5.95	70	2.975	0.672
3.42	3	3.42	1.17	6.1	60	3.05	0.576
3.5	1	3.5	0.39	6.2	50	3.1	0.48
3.7	0	3.7	0	6.3	40	3.15	0.384
4.1	0	4.1	0	6.55	30	3.275	0.288
4.15	1.5	4.15	0.585	6.7	0	3.35	0
4.2	0.75	4.2	0.2925	6.9	20	3.45	0.192
5	0	5	0	7.25	15	3.625	0.144
5.3	0	5.3	0	7.9	10	3.95	0.096
5.35	1	5.35	0.39	10.1	5	5.05	0.048
5.4	4	5.4	1.56	10.6	5	5.3	0.048
5.45	2	5.45	0.78	10.8	6	5.4	0.0576
5.5	2.5	5.5	0.975	10.9	40	5.45	0.384
5.6	0	5.6	0	11	100	5.5	0.96
8.35	0	8.35	0	11.05	160	5.525	1.536
8.4	0.75	8.4	0.2925	11.2	180	5.6	1.728
8.5	0.5	8.5	0.195	11.35	188	5.675	1.8048
8.6	0.25	8.6	0.0975	11.4	180	5.7	1.728
8.7	0	8.7	0	11.6	160	5.8	1.536
9.1	0	9.1	0	11.8	140	5.9	1.344
9.15	1.5	9.15	0.585	12	100	6	0.96
9.2	0.5	9.2	0.195	12.3	80	6.15	0.768
9.45	0.5	9.45	0.195	12.4	70	6.2	0.672
9.5	2	9.5	0.78	12.45	67	6.225	0.6432
9.55	0.75	9.55	0.2925	12.5	81	6.25	0.7776
9.6	4	9.6	1.56	12.8	65	6.4	0.624
9.65	3	9.65	1.17	12.9	60	6.45	0.576
9.7	8	9.7	3.12	13.1	50	6.55	0.48
9.75	3	9.75	1.17	13.25	40	6.625	0.384
9.8	12	9.8	4.68	13.4	30	6.7	0.288
9.85	3	9.85	1.17	13.8	20	6.9	0.192
9.9	6	9.9	2.34	14.2	15	7.1	0.144
9.95	2	9.95	0.78	14.9	10	7.45	0.096
10	1.5	10	0.585	16.7	6	8.35	0.0576
10.4	1.25	10.4	0.4875	16.75	9	8.375	0.0864
10.8	0.5	10.8	0.195	16.8	10	8.4	0.096
10.85	6	10.85	2.34	16.85	11	8.425	0.1056
10.9	1	10.9	0.39	16.9	11.5	8.45	0.1104
11	1	11	0.39	17	11	8.5	0.1056
11.05	3	11.05	1.17	17.1	WEIR BLO	8.55	0

AUGUST 21, 1989

******	SS-1******	*************	*******
Time	Flow	Time (hrs)	Flow (cfs)
0	0	0	0
9.8	0	9.8	0
9.85	25	9.85	9.75
9.9	22	9.9	8.58
9.95	29	9.95	11.31
10.5	13	10.5	5.07
10.7	11	10.7	4.29
10.8	9	10.8	3.51
11	6	11	2.34
11.05	4	11.05	1.56
11.1	6	11.1	2.34
11.2	3	11.2	1.17
11.3	2	11.3	0.78
11.4	6	11.4	2.34
11.5	8	11.5	3.12
11.55	0	11.55	0
11.6	17	11.6	6.63
12	8	12	3.12
12.25	6	12.25	2.34
12.55	5	12.55	1.95
13	2.5	13	0.975
13.3	2	13.3	0.78
13.5	11	13.5	4.29
13.55	13	13.55	5.07
13.6	11	13.6	4.29
13.7	7	13.7	2.73
13.8	4	13.8	1.56
13.9	3.5	13.9	1.365
14	3	14	1.17
14.5	2.5	14.5	0.975
15	2	15	0.78
16	1.5	16	0.585
17	1.5	17	0.585
18	1.25	18	0.4875
19	1	19	0.39
24	0.5	24	0.195

CRITTERS

LAKE PRIOR
SITE 1
DATE 10/31/88

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	745	0.00019
Diatoms	Total	700	0.00060
TOTAL CELLS/ML		1445	
TOTAL CC/L		0.000793	

SITE PL1	ZOOPLANKTON	#/mL of Conc.	#/m^3 of to
	COPEPODS	91	90123.67
	UNSPEC. CLADOCE	67	66354.79
	DAPHNIA		0
	BOSMINA	26	25749.62
	NAUP./METANAUPLI	3	2971.11
	TOTAL	167	185199.2

LAKE PRIOR
SITE 2

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	1014	0.00026
Diatoms	Total	792	0.00068
TOTAL CELLS/ML		1806	
TOTAL CC/L		0.000941	

SITE PL2	ZOOPLANKTON	#/mL of Conc.	#/m^3 of to
	COPEPODS	102	120862.5
	UNSPEC. CLADOCE	77	91239.3
	DAPHNIA		0
	BOSMINA	40	47397.04
	NAUP./METANAUPLI	2	2369.852
	TOTAL	221	261868.6

LAKE PRIOR
SITE 3

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	5476	0.00175
Green	Total	3434	0.00130
Diatoms	Total	23	0.00002
TOTAL CELLS/ML		8933	
TOTAL CC/L		0.003065	

SITE PL3	ZOOPLANKTON	#/mL of Conc	#/m^3 of to
	COPEPODS	136	68740.49
	UNSPEC. CLADOCE	30	15163.34
	DAPHNIA	31	15668.79
	BOSMINA	22	11119.79
	NAUP./METANAUPLI	1	505.4448
		220	111197.9

LAKE PRIOR
SITE 4

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	6286	0.00190
Green	Total	2560	0.00114
Diatoms	Total	623	0.00021

SITE PL4	ZOOPLANKTON	#/mL of Conc	#/m^3 of to
	COPEPODS	33	31064.8
	UNSPEC. CLADOCE	11	10354.93
	DAPHNIA	4	3765.43
	BOSMINA	5	4706.788
	NAUP./METANAUPLI	2	1882.715
		55	51774.66

CRITTERS

LAKE PRIOR
SITE 1
DATE 11/14/88

PHYTOPLANKTON	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	553	0.00014
Diatoms	Total	477	0.00041
TOTAL CELLS/ML		1030	
TOTAL CC/L		0.0005515	

SITE PL1

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	125	69318.15
UNSPEC. CLADOCER	54	29945.441
DAPHNIA		0
BOSMINA	14	7763.6328
NAUP./METANAUPLIU	5	2772.726
TOTAL	198	109799.95

LAKE PRIOR
SITE 2
DATE 11/14/88

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	776	0.00020
Diatoms	Total	477	0.00041
TOTAL CELLS/ML		1253	
TOTAL CC/L		0.0006084	

SITE PL2

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	82	78401.209
UNSPEC. CLADOCER	58	55454.513
DAPHNIA		0
BOSMINA	55	52586.177
NAUP./METANAUPLIU	5	4780.5615
TOTAL	200	191222.46

LAKE PRIOR
SITE 3
DATE 11/14/88

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	3908	0.00010
Green	Total	431	0.00007
Diatoms	Total	31	0.00003
TOTAL CELLS/ML		4370	
TOTAL CC/L		0.0001926	

SITE PL3

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	114	57409.648
UNSPEC. CLADOCER	26	13093.428
DAPHNIA	9	4532.3406
BOSMINA	30	15107.802
NAUP./METANAUPLIU	13	6546.7142
TOTAL	192	96689.933

LAKE PRIOR
SITE 4
DATE 11/14/88

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	3908	0.00010
Green	Total	277	0.00006
Diatoms	Total	7	0.00001
TOTAL CELLS/ML		4192	
TOTAL CC/L		0.0001697	

SITE PL4

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	48	34659.072
UNSPEC. CLADOCER	21	15163.344
DAPHNIA	2	1444.128
BOSMINA	9	6498.576
NAUP./METANAUPLIU	4	2888.256
TOTAL	84	60653.376

CRITTERS

LAKE PRIOR
SITE 1
DATE 12/19/88

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	53	0.00001
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		53	
TOTAL CC/L		1.35E-05	

SITE PL1	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	199	132637.6
	UNSPEC. CLADOCER	152	101311.1
	DAPHNIA	0	0
	BOSMINA	2	1333.041
	NAUP./METANAUPLIU	3	1999.562
	TOTAL	356	237281.3

LAKE PRIOR
SITE 2
DATE 12/19/88

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	259	0.00007
Diatoms	Total	43	0.00004
TOTAL CELLS/ML		302	
TOTAL CC/L		0.000103	

SITE PL2	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	72	81201.24
	UNSPEC. CLADOCER	9	10150.18
	DAPHNIA	3	3383.385
	BOSMINA	4	4511.18
	NAUP./METANAUPLIU	4	4511.18
	TOTAL	92	103757.1

LAKE PRIOR
SITE 3
DATE 12/19/88

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	0	0.00000
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		0	
TOTAL CC/L		0.00000	

SITE PL3	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	83	46946.19
	UNSPEC. CLADOCER		0
	DAPHNIA	6	3393.701
	BOSMINA	5	2828.084
	NAUP./METANAUPLIU	5	2828.084
	TOTAL	99	55996.06

LAKE PRIOR
SITE 4
DATE 12/19/88

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	0	0.00000
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		0	
TOTAL CC/L		0	

SITE PL4	ZOOPLANKTON	AVG #/mL of Conc.
	COPEPODS	sample decayed
	UNSPEC. CLADOCER	due to lack
	DAPHNIA	of preservative
	BOSMINA	
	NAUP./METANAUPLIUS	

CRITTERS

LAKE PRIOR
SITE 1
DATE 1/18/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	154	0.00004
Diatoms	Total	15	0.00001
TOTAL CELLS/ML		169	
TOTAL CC/L		5.23E-05	

	#/ml of Conc	#/m^3 of tow
COPEPODS	141	95024
UNSPEC. CLADOCE	49	33022
DAPHNIA	21	14152
BOSMINA	1	674
NAUP./METANAUPLI	0	0
	212	142872

LAKE PRIOR
SITE 2
DATE 1/18/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	561	0.00014
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		561	
TOTAL CC/L		0.000143	

SITE PL2

ZOOPLANKTON	#/ml of Conc	#/m^3 of tow
COPEPODS	32	28167
UNSPEC. CLADOCE	5	4401
DAPHNIA	9	7922
BOSMINA	1	880
NAUP./METANAUPLI	23	20245
	70	61616

LAKE PRIOR
SITE 3
DATE 01/18/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	1	0.00000
Diatoms	Total	3	0.00001
TOTAL CELLS/ML		4	
TOTAL CC/L		5.43E-06	

SITE PL3

ZOOPLANKTON	#/ml of Conc	#/m^3 of tow
COPEPODS	81	42334
UNSPEC. CLADOCE	4	2091
DAPHNIA	3	1568
BOSMINA	5	2613
NAUP./METANAUPLI	16	8362
	109	56967

LAKE PRIOR
SITE 4
DATE 1/18/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	205	0.00005
Green	Total	10	0.00000
Diatoms	Total	8	0.00001
TOTAL CELLS/ML		223	
TOTAL CC/L		6.89E-05	

SITE PL4

ZOOPLANKTON	#/ml of Conc	#/m^3 of tow
COPEPODS	15	14682
UNSPEC. CLADOCE	1	979
DAPHNIA	0	0
BOSMINA	1	979
NAUP./METANAUPLI	7	6852
	24	23491

CRITTERS

LAKE PRIOR
SITE 1
DATE 2/14/89

PHYTOPLANKTO GENUS		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	3315	0.00085
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		3315	
TOTAL CC/L		0.000846	

SITE PL1	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	61	29364
	UNSPEC. CLADOCE	2	963
	DAPHNIA	2	963
	BOSMINA	0	0
	NAUP./METANAUPLI	16	7702
	TOTAL	81	38991

LAKE PRIOR
SITE 2
DATE 2/14/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	515	0.00013
Diatoms	Total	445	0.00007
TOTAL CELLS/ML		960	
TOTAL CC/L		0.000205	

SITE PL2	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	38	45121
	UNSPEC. CLADOCE	1	1187
	DAPHNIA	1	1187
	BOSMINA	0	0
	NAUP./METANAUPLI	37	43934
	TOTAL	77	91429

LAKE PRIOR
SITE 3
DATE 2/14/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	0	0.00000
Diatoms	Total	4	0.00001
TOTAL CELLS/ML		4	
TOTAL CC/L		0.00001	

SITE PL3	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	74	33395
	UNSPEC. CLADOCE	2	903
	DAPHNIA	4	1805
	BOSMINA	4	1805
	NAUP./METANAUPLI	17	7672
		101	45580

LAKE PRIOR
SITE 4
DATE 2/14/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	6	0.00000
Diatoms	Total	4	0.00001
TOTAL CELLS/ML		10	
TOTAL CC/L		8.43E-06	

SITE PL4	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	61	35237
	UNSPEC. CLADOCE	2	1155
	DAPHNIA	4	2311
	BOSMINA	4	2311
	NAUP./METANAUPLI	34	19640
	TOTAL	105	60653

CRITTERS

LAKE PRIOR
SITE 1
DATE 3/16/89

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	12214	0.00358
Diatoms	Total	205	0.00018
TOTAL CELLS/ML		12419	
TOTAL CC/L		0.003753	

SITE PL1 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	7	2799
UNSPEC. CLADOCER	0	0
DAPHNIA	0	0
BOSMINA	1	400
NAUP./METANAUPLI	3	1200
TOTAL	11	4399

LAKE PRIOR
SITE 2
DATE 3/16/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	407	0.00010
Diatoms	Total	15	0.00001
TOTAL CELLS/ML		422	
TOTAL CC/L		0.000117	

SITE PL2 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	32	29576
UNSPEC. CLADOCER	3	2773
DAPHNIA	0	0
BOSMINA	1	924
NAUP./METANAUPLI	22	20333
TOTAL	58	53606

LAKE PRIOR
SITE 3
DATE 3/16/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	18	0.00000
Diatoms	Total	3	0.00000
TOTAL CELLS/ML		21	
TOTAL CC/L		0.000007	

SITE PL3 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	44	12973
UNSPEC. CLADOCER	3	885
DAPHNIA	0	0
BOSMINA	2	590
NAUP./METANAUPLI	12	3538
TOTAL	61	17985

LAKE PRIOR
SITE 4
DATE 3/16/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	8	0.00000
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		8	
TOTAL CC/L		2.04E-06	

SITE PL4 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	15	5295
UNSPEC. CLADOCER	1	353
DAPHNIA	0	0
BOSMINA	0	0
NAUP./METANAUPLI	26	9178
TOTAL	42	14826

CRITTERS

LAKE PRIOR
SITE 1
DATE 04/21/89

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	5923	0.00216
Diatoms	Total	2508	0.00647
TOTAL CELLS/ML		8431	
TOTAL CC/L		0.008636	

SITE PL1

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	76	24765
UNSPEC. CLADOCER	1	326
DAPHNIA	3	978
BOSMINA	0	0
NAUP./METANAUPLIU	30	9776
TOTAL	110	35844

LAKE PRIOR
SITE 2
DATE 4/21/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	5938	0.00152
Diatoms	Total	2293	0.00560
TOTAL CELLS/ML		8231	
TOTAL CC/L		0.007111	

SITE PL2

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	33	27232
UNSPEC. CLADOCER	3	2476
DAPHNIA	1	825
BOSMINA	1	825
NAUP./METANAUPLIU	18	14854
TOTAL	56	46212

LAKE PRIOR
SITE 3
DATE 4/21/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	0	0.00000
Diatoms	Total	415	0.00010
TOTAL CELLS/ML		415	
TOTAL CC/L		0.000100	

SITE PL3

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	46	8581
UNSPEC. CLADOCER	6	1119
DAPHNIA	0	0
BOSMINA	5	933
NAUP./METANAUPLIU	45	8394
TOTAL	102	19026

LAKE PRIOR
SITE 4
DATE 4/21/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	0	0.00000
Diatoms	Total	492	0.00012
TOTAL CELLS/ML		492	
TOTAL CC/L		0.000119	

SITE PL4

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	35	14742
UNSPEC. CLADOCER	1	421
DAPHNIA	3	1264
BOSMINA	3	1264
NAUP./METANAUPLIU	40	16848
TOTAL	82	34539

CRITTERS

LAKE PRIOR
SITE 1
DATE 5/10/89

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	2092	0.00053
Diatoms	Total	657	0.00181
TOTAL CELLS/ML		2749	
TOTAL CC/L		0.002347	

SITE PL1

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	175	95473
UNSPEC. CLADOCE	13	7092
DAPHNIA	28	15276
BOSMINA	0	0
NAUP./METANAUPLI	25	13639
TOTAL	241	131480

LAKE PRIOR
SITE 2
DATE 5/10/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	2292	0.00059
Diatoms	Total	624	0.00145
TOTAL CELLS/ML		2916	
TOTAL CC/L		0.002038	

SITE PL2

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	202	177807
UNSPEC. CLADOCE	20	17605
DAPHNIA	29	25527
BOSMINA	0	0
NAUP./METANAUPLI	40	35209
TOTAL	291	256147

LAKE PRIOR
SITE 3
DATE 5/10/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	480	0.00098
Green	Total	383	0.00004
Diatoms	Total	2699	0.00163
TOTAL CELLS/ML		3562	
TOTAL CC/L		0.002648	

SITE PL3

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	116	43276
UNSPEC. CLADOCE	18	6715
DAPHNIA	18	6715
BOSMINA	1	373
NAUP./METANAUPLI	30	11192
TOTAL	183	68271

LAKE PRIOR
SITE 4
DATE 5/10/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	0	0.00000
Green	Total	61	0.00002
Diatoms	Total	780	0.00132
TOTAL CELLS/ML		841	
TOTAL CC/L		0.001334	

SITE PL4

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	54	37042
UNSPEC. CLADOCE	5	3430
DAPHNIA	4	2744
BOSMINA	2	1372
NAUP./METANAUPLI	55	37728
TOTAL	120	82315

CRITTERS

LAKE PRIOR
SITE 1
DATE 5/23/89

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	2707	0.00416
Green	Total	522	0.00014
Diatoms	Total	169	0.00069
TOTAL CELLS/ML		3398	
TOTAL CC/L		0.004985	

SITE PL1	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	100	70355
	UNSPEC. CLADOCE	84	59098
	DAPHNIA	29	20403
	BOSMINA	4	2814
	NAUP./METANAUPLI	6	4221
	TOTAL	223	156892

LAKE PRIOR
SITE 2
DATE 5/23/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	2554	0.00398
Green	Total	184	0.00004
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		2738	
TOTAL CC/L		0.004024	

SITE PL2	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	88	75040
	UNSPEC. CLADOCE	85	72481
	DAPHNIA	35	29845
	BOSMINA	2	1705
	NAUP./METANAUPLI	16	13644
	TOTAL	226	192715

LAKE PRIOR
SITE 3
DATE 5/23/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	2031	0.00245
Green	Total	614	0.00007
Diatoms	Total	2846	0.00217
TOTAL CELLS/ML		5491	
TOTAL CC/L		0.004680	

SITE PL3	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	55	17209
	UNSPEC. CLADOCE	18	5632
	DAPHNIA	30	9387
	BOSMINA	11	3442
	NAUP./METANAUPLI	9	2816
	TOTAL	123	38486

LAKE PRIOR
SITE 4
DATE 5/23/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	1907	0.00253
Green	Total	461	0.00004
Diatoms	Total	2046	0.00197
TOTAL CELLS/ML		4414	
TOTAL CC/L		0.004541	

SITE PL4	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	157	61972
	UNSPEC. CLADOCE	41	16184
	DAPHNIA	85	33552
	BOSMINA	12	4737
	NAUP./METANAUPLI	9	3553
	TOTAL	304	119997

CRITTERS

LAKE PRIOR
SITE 1
DATE 6/14/89

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	10892	0.03180
Green	Total	3569	0.00083
Diatoms	Total	2676	0.00198
TOTAL CELLS/ML		17137	
TOTAL CC/L		0.03461	

SITE PL1 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	47	21929
UNSPEC. CLADOCE	10	4666
DAPHNIA	20	9331
BOSMINA	0	0
NAUP./METANAUPLI	8	3733
TOTAL	85	39658

LAKE PRIOR
SITE 2
DATE 6/14/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	9045	0.02646
Green	Total	3460	0.00078
Diatoms	Total	2553	0.00148
TOTAL CELLS/ML		15058	
TOTAL CC/L		0.028722	

SITE PL2 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	89	61204
UNSPEC. CLADOCE	21	14441
DAPHNIA	58	39885
BOSMINA	0	0
NAUP./METANAUPLI	6	4126
TOTAL	174	119656

LAKE PRIOR
SITE 3
DATE 6/14/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	2215	0.00727
Green	Total	1446	0.00037
Diatoms	Total	369	0.00151
TOTAL CELLS/ML		4030	
TOTAL CC/L		0.00915	

SITE PL3 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	37	7124
UNSPEC. CLADOCE	3	578
DAPHNIA	13	2503
BOSMINA	4	770
NAUP/METANAUPLIU	15	2888
TOTAL	72	13864

LAKE PRIOR
SITE 4
DATE 6/14/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	4615	0.01479
Green	Total	968	0.00025
Diatoms	Total	277	0.00113
TOTAL CELLS/ML		5860	
TOTAL CC/L		0.016167	

SITE PL4 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	52	30594
UNSPEC. CLADOCE	13	7649
DAPHNIA	21	12355
BOSMINA	14	8237
NAUP./METANAUPLI	31	18239
TOTAL	131	77074

CRITTERS

LAKE PRIOR
SITE 1
DATE 6/26/89

PHYTOPLANKTO GENUS		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	42523	0.12721
Green	Total	2692	0.00072
Diatoms	Total	2107	0.00213
TOTAL CELLS/ML		47322	
TOTAL CC/L		0.130056	

SITE PL1

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	128	51189
UNSPEC. CLADOCE	10	3999
DAPHNIA	71	28394
BOSMINA	16	6399
NAUP./METANAUPLI	46	18396
TOTAL	271	108376

LAKE PRIOR
SITE 2
DATE 6/26/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	40912	0.14185
Green	Total	4200	0.00106
Diatoms	Total	1692	0.00118
TOTAL CELLS/ML		46804	
TOTAL CC/L		0.14409	

SITE PL2

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	68	55179
UNSPEC. CLADOCE	9	7303
DAPHNIA	51	41385
BOSMINA	16	12983
NAUP./METANAUPLI	14	11360
TOTAL	158	128211

LAKE PRIOR
SITE 3
DATE 6/26/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	4492	0.01547
Green	Total	846	0.00023
Diatoms	Total	277	0.00029
TOTAL CELLS/ML		5615	
TOTAL CC/L		0.01599	

SITE PL3

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	27	10398
UNSPEC. CLADOCE	5	1926
DAPHNIA	7	2696
BOSMINA	25	9628
NAUP./METANAUPLI	8	3081
TOTAL	72	27727

LAKE PRIOR
SITE 4
DATE 6/26/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	4480	0.01392
Green	Total	677	0.00019
Diatoms	Total	184	0.00020
TOTAL CELLS/ML		5341	
TOTAL CC/L		0.014312	

SITE PL4

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	27	14730
UNSPEC. CLADOCE	5	2728
DAPHNIA	2	1091
BOSMINA	11	6001
NAUP./METANAUPLI	4	2182
TOTAL	49	26732

CRITTERS

LAKE PRIOR
SITE 1
DATE 7/12/89

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	72321	0.27137
Green	Total	1923	0.00047
Diatoms	Total	1692	0.00061
TOTAL CELLS/ML		75936	
TOTAL CC/L		0.272446	

SITE PL1	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	32	14930
	UNSPEC. CLADOCE	4	1866
	DAPHNIA	1	467
	BOSMINA	4	1866
	NAUP./METANAUPLI	8	3733
	OSTRACODS	2	933
	TOTAL	51	23795

LAKE PRIOR
SITE 2
DATE 7/12/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	62043	0.21815
Green	Total	1614	0.00045
Diatoms	Total	1861	0.00101
TOTAL CELLS/ML		65518	
TOTAL CC/L		0.21961	

SITE PL2	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	164	96990
	UNSPEC. CLADOCE	13	7688
	DAPHNIA	10	5914
	BOSMINA	18	10645
	NAUP./METANAUPLI	49	28979
	OSTRACODS	2	1183
	TOTAL	256	151400

LAKE PRIOR
SITE 3
DATE 7/12/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	1677	0.00417
Green	Total	677	0.00018
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		2354	
TOTAL CC/L		0.00435	

SITE PL3	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	34	14526
	UNSPEC. CLADOCE	13	5554
	DAPHNIA	8	3418
	BOSMINA	21	8972
	NAUP./METANAUPLI	10	4272
	TOTAL	86	36741

LAKE PRIOR
SITE 4
DATE 7/12/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	2614	0.00980
Green	Total	830	0.00022
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		3444	
TOTAL CC/L		0.010024	

SITE PL4	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	42	26957
	UNSPEC. CLADOCE	17	10911
	DAPHNIA	7	4493
	BOSMINA	65	41719
	NAUP./METANAUPLI	21	13479
	OSTRACODS	3	1926
	TOTAL	155	99484

CRITTERS

LAKE PRIOR
SITE 1
DATE 7/27/89

PHYTOPLANKTO GENUS		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	26288	0.00927
Green	Total	23584	0.00794
Diatoms	Total	2922	0.00106
TOTAL CELLS/ML		52794	
TOTAL CC/L		0.017214	

SITE PL1	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	63	23795
	UNSPEC. CLADOCE	19	7176
	DAPHNIA	11	4155
	BOSMINA	12	4532
	NAUP./METANAUPLI	25	9442
	TOTAL	130	49100

LAKE PRIOR
SITE 2
DATE 7/27/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	29814	0.00454
Green	Total	17368	0.00576
Diatoms	Total	2230	0.00081
TOTAL CELLS/ML		49412	
TOTAL CC/L		0.011099	

SITE PL2	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	40	28057
	UNSPEC. CLADOCE	17	11924
	DAPHNIA	7	4910
	BOSMINA	8	5611
	NAUP./METANAUPLI	10	7014
	TOTAL	82	57518

LAKE PRIOR
SITE 3
DATE 7/27/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	3167	0.01072
Green	Total	2000	0.00054
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		5167	
TOTAL CC/L		0.011260	

SITE PL3	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	45	13809
	UNSPEC. CLADOCE	23	7058
	DAPHNIA	16	4910
	BOSMINA	7	2148
	NAUP./METANAUPLI	11	3376
	TOTAL	102	31301

LAKE PRIOR
SITE 4
DATE 7/27/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	615	0.01224
Green	Total	2969	0.00080
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		3584	
TOTAL CC/L		0.013034	

SITE PL4	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	35	16848
	UNSPEC. CLADOCE	22	10590
	DAPHNIA	18	8665
	BOSMINA	2	963
	NAUP./METANAUPLI	13	6258
		90	43324

CRITTERS

LAKE PRIOR
SITE 1
DATE 8/8/89

PHYTOPLANKTO	GENUS	AVG #/mL	tot vol (cc/L)
Bluegreen	Total	172900	0.02108
Green	Total	27146	0.00932
Diatoms	Total	1184	0.00043
TOTAL CELLS/ML		201230	
TOTAL CC/L		0.030825	

SITE PL1	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	31	11479
	UNSPEC. CLADOCE	33	12220
	DAPHNIA	22	8146
	BOSMINA	8	2962
	NAUP./METANAUPLI	14	5184
	TOTAL	108	39991

LAKE PRIOR
SITE 2
DATE 8/8/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	34809	0.00275
Green	Total	3850	0.00132
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		38659	
TOTAL CC/L		0.004076	

SITE PL2	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	66	52951
	UNSPEC. CLADOCE	31	24871
	DAPHNIA	25	20057
	BOSMINA	10	8023
	NAUP./METANAUPLI	17	13639
	TOTAL	149	119542

LAKE PRIOR
SITE 3
DATE 8/8/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	13137	0.01169
Green	Total	2845	0.02311
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		15982	
TOTAL CC/L		0.034792	

SITE PL3	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	96	28883
	UNSPEC. CLADOCE	38	11433
	DAPHNIA	13	3911
	BOSMINA	0	0
	NAUP./METANAUPLI	22	6619
	TOTAL	169	50845

LAKE PRIOR
SITE 4
DATE 8/8/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	5231	0.00558
Green	Total	9284	0.00302
Diatoms	Total	0	0.00000
TOTAL CELLS/ML		14515	
TOTAL CC/L		0.008607	

SITE PL4	ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
	COPEPODS	18	9242
	UNSPEC. CLADOCE	16	8215
	DAPHNIA	1	513
	BOSMINA	0	0
	NAUP./METANAUPLI	14	7189
	OSTRACODS	1	513
	TOTAL	50	25673

CRITTERS

LAKE PRIOR
SITE 1
DATE 8/30/89

PHYTOPLANKTO GENUS		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	95085	0.01475
Green	Total	10014	0.00333
Diatoms	Total	690	0.00025
TOTAL CELLS/ML		105789	
TOTAL CC/L		0.018327	

SITE PL1

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	36	22128
UNSPEC. CLADOCE	27	16596
DAPHNIA	43	26431
BOSMINA	13	7991
NAUP./METANAUPLI	5	3073
TOTAL	124	76220

LAKE PRIOR
SITE 2
DATE 8/30/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	74352	0.01537
Green	Total	11518	0.00385
Diatoms	Total	915	0.00034
TOTAL CELLS/ML		86785	
TOTAL CC/L		0.019555	

SITE PL2

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	66	78368
UNSPEC. CLADOCE	29	34434
DAPHNIA	67	79555
BOSMINA	33	39184
NAUP./METANAUPLI	28	33247
LEPTODORA KINDTI	1	1187
TOTAL	224	265976

LAKE PRIOR
SITE 3
DATE 8/30/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	21124	0.01039
Green	Total	584	0.00016
Diatoms	Total	1155	0.00043
TOTAL CELLS/ML		22863	
TOTAL CC/L		0.010971	

SITE PL3

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	23	11210
UNSPEC. CLADOCE	13	6336
DAPHNIA	5	2437
BOSMINA	1	487
NAUP./METANAUPLI	3	1462
TOTAL	45	21933

LAKE PRIOR
SITE 4
DATE 8/30/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	21470	0.01220
Green	Total	799	0.00016
Diatoms	Total	225	0.00008
TOTAL CELLS/ML		22494	
TOTAL CC/L		0.012447	

SITE PL4

ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	35	22577
UNSPEC. CLADOCE	22	14191
DAPHNIA	9	5805
BOSMINA	1	645
NAUP./METANAUPLI	5	3225
OSTRACODS	3	1935
TOTAL	75	48378

CRITTERS

LAKE PRIOR
SITE 1
DATE 9/19/89

PHYTOPLANKTO GENUS		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	141606	0.02113
Green	Total	2875	0.00069
Diatoms	Total	15151	0.00585
TOTAL CELLS/ML		159632	
TOTAL CC/L		0.027682	

SITE PL1 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	103	69414
UNSPEC. CLADOCE	17	11457
DAPHNIA	25	16848
BOSMINA	51	34370
NAUP./METANAUPLI	8	5391
TOTAL	204	137481

LAKE PRIOR
SITE 2
DATE 9/19/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	141494	0.02061
Green	Total	2491	0.00057
Diatoms	Total	13983	0.00564
TOTAL CELLS/ML		157968	
TOTAL CC/L		0.026824	

SITE PL2 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	40	67742
UNSPEC. CLADOCE	15	25403
DAPHNIA	19	32177
BOSMINA	19	32177
NAUP./METANAUPLI	13	22016
TOTAL	106	179516

LAKE PRIOR
SITE 3
DATE 9/19/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	16675	0.00625
Green	Total	1399	0.01329
Diatoms	Total	107	0.00044
TOTAL CELLS/ML		18181	
TOTAL CC/L		0.019981	

SITE PL3 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	62	15296
UNSPEC. CLADOCE	3	740
DAPHNIA	15	3701
BOSMINA	1	247
NAUP./METANAUPLI	7	1727
OSTRACODS	3	740
TOTAL	91	22450

LAKE PRIOR
SITE 4
DATE 9/19/89

PHYTOPLANKTON		AVG #/mL	tot vol (cc/L)
Bluegreen	Total	26631	0.00550
Green	Total	1399	0.00324
Diatoms	Total	61	0.00025
TOTAL CELLS/ML		28091	
TOTAL CC/L		0.008984	

SITE PL4 ZOOPLANKTON	#/mL of Conc	#/m^3 of tow
COPEPODS	52	52844
UNSPEC. CLADOCE	9	9146
DAPHNIA	11	11179
BOSMINA	1	1016
NAUP./METANAUPLI	5	5081
OSTRACODS	3	3049
TOTAL	81	82315

Appendix C

MONTGOMERY WATSON

WATERSHED EUTROPHISM REDUCTION MANAGEMENT (WERM07) MODEL
Prior Lake Baseline Model (7/12/93)
D. Felstul 1988 based on formulas developed by W. Walker 1987
<hit alt-b to clear BMP section>

USER INPUT..........	UNITS	Upper and Lower Prior Lakes				
subwatershed name	-	E Rice L	R/C	Crystal	UP	LP
subwatershed area	acres	461	883	627	1427	2970
basin area	acres	0.0001	63	0.0001	340	827
mean depth	feet	0.1	4	0.1	8	13
% open water		10	15	21	36	34
% open/undeveloped		20	14	17	10	10
% wooded		4	10	25	2	10
% rangeland		0	0	0	0	0
% pasture		0	0	0	0	0
% cropland		47	19	30	6	5
% sgl-fam. resid.		19	36	2	18	15
% mult-fam. resid.		0	1	5	26	25
% mixed urban		0	0	0	0	0
% commer. / indust.		0	5	0	2	1
additional flow	ac-ft/yr	0	383	0	10095	11134
additional TP load	lbs/yr	0	374	0	3589	2486
annual precipitation	inches	25.7	25.7	25.7	25.7	25.7
lost to evap or infilt	inches	28	28	28	28	28
OUTPUT SUMMARY............						
annual outflow volume	ac-ft	383.2	1048.0	635.9	11134.1	12913.5
annual outflow TP load	lbs	374.0	390.5	365.2	2486.3	1521.5
outflow TP conc	ppb	359.1	137.1	211.3	82.2	43.3
TP removal efficiency	%	0.0	65.7	0.0	51.7	72.1
ANNUAL PHOSPHORUS BUDGET.....						
TP runoff mass	lbs	374.0	765.3	365.2	1556.8	2964.1
additional/upstream	lbs	0.0	374.0	0.0	3588.7	2486.3
total TP inflow	lbs	374.0	1139.3	365.2	5145.5	5450.4
net sedimentation	lbs	0.0	748.8	0.0	2659.2	3928.9
mass outflow	lbs	374.0	390.5	365.2	2486.3	1521.5
ANNUAL WATER BUDGET..........						
H2O runoff volume	ac-ft	383.206	811.84	635.896	1832.73	3709.09
additional/upstream	ac-ft	0	383.205	0	10094.7	11134.1
total H2O inflow	ac-ft	383.206	1195.05	635.896	11927.4	14843.2
outflow volume	ac-ft	383.205	1048.05	635.896	11134.1	12913.5
HYDRAULIC PARAMETERS.........						
basin volume	ac-ft	1E-05	252	1E-05	2720	10751
relative volume	inches	0.0	8.0	0.0	38.1	74.5
residence time	years	0.00	0.24	0.00	0.24	0.83
residence time	days	0	88	0	89	304
annual overflow rate	feet	3832053	16.6356	6358959	32.7472	15.6149
inflow TP conc	ppb	359	351	211	159	135
outflow TP conc	ppb	359	137	211	82	43
Nr (P reaction rate)	-	1.3E-06	3.98862	5.9E-07	1.80031	6.59679
1-Rp (TP export)	-	1	0.39081	1	0.51763	0.32086
MISC. RUNOFF PARAMETERS......						
runoff TP	ppb	359	347	211	313	294
runoff ortho-P / TP	ratio	0.412	0.327	0.314	0.517	0.252
annual unit runoff	inches	9.98	11.03	12.17	15.41	14.99
annual unit loading	lbs/ac	0.812	0.866	0.582	1.091	0.998
LAND USE PARAMETERS..........						
runoff total P calc	ppb	359	347	211	313	294
runoff coefficient		0.388	0.429	0.473	0.600	0.583
dissolved/total P	ratio	0.521	0.414	0.397	0.334	0.319

SPRING LAKE OUTPUT

8410.7	SL hydro output (ac-ft)
2833.0	SL TP mass output (lbs)
1650	SL SRP mass output (lbs)
58	%SRP/TP for SL
124	SL avg TP (ug/L)
72	SL avg SRP (ug/L)
55	% UPSTREAM/TOT for UP

WATERSHED EUTROPHISM REDUCTION MANAGEMENT (WERM07) MODEL
Prior Lake Implementation Plan Model (7/13/93)
D. Felstul 1988 based on formulas developed by W. Walker 1987
<hit alt-b to clear BMP section>

USER INPUT..........	UNITS	Upper and Lower Prior Lakes				
subwatershed name	-	E Rice L	R/C	Crystal	UP	LP
subwatershed area	acres	461	883	627	1427	2970
basin area	acres	0.0001	63	0.0001	340	827
mean depth	feet	0.1	4	0.1	8	13
% open water		10	15	21	36	34
% open/undeveloped		20	14	17	10	10
% wooded		4	10	25	2	10
% rangeland		0	0	0	0	0
% pasture		0	0	0	0	0
% cropland		47	19	30	6	5
% sgl-fam. resid.		19	36	2	18	15
% mult-fam. resid.		0	1	5	26	25
% mixed urban		0	0	0	0	0
% commer. / indust.		0	5	0	2	1
additional flow	ac-ft/yr	0	383.205	0	10095	11134
additional TP load	lbs/yr	0	373.979	0	2356	1748
annual precipitation	inches	25.7	25.7	25.7	25.7	25.7
lost to evap or infilt	inches	28	28	28	28	28
OUTPUT SUMMARY............						
annual outflow volume	ac-ft	383.2	1048.0	635.9	11134.1	12913.5
annual outflow TP load	lbs	374.0	390.5	365.2	1747.8	1394.4
outflow TP conc	ppb	359.1	137.1	211.3	57.8	39.7
TP removal efficiency	%	0.0	65.7	0.0	55.3	70.4
ANNUAL PHOSPHORUS BUDGET.....						
TP runoff mass	lbs	374.0	765.3	365.2	1556.8	2964.1
additional/upstream	lbs	0.0	374.0	0.0	2355.7	1747.8
total TP inflow	lbs	374.0	1139.3	365.2	3912.5	4711.8
net sedimentation	lbs	0.0	748.8	0.0	2164.8	3317.5
mass outflow	lbs	374.0	390.5	365.2	1747.8	1394.4
ANNUAL WATER BUDGET..........						
H2O runoff volume	ac-ft	383.206	811.84	635.896	1832.73	3709.09
additional/upstream	ac-ft	0	383.205	0	10094.7	11134.1
total H2O inflow	ac-ft	383.206	1195.05	635.896	11927.4	14843.2
outflow volume	ac-ft	383.205	1048.05	635.896	11134.1	12913.5
HYDRAULIC PARAMETERS.........						
basin volume	ac-ft	1E-05	252	1E-05	2720	10751
relative volume	inches	0.0	8.0	0.0	38.1	74.5
residence time	years	0.00	0.24	0.00	0.24	0.83
residence time	days	0	88	0	89	304
annual overflow rate	feet	3832053	16.6356	6358959	32.7472	15.6149
inflow TP conc	ppb	359	351	211	121	117
outflow TP conc	ppb	359	137	211	58	40
Nr (P reaction rate)	-	1.3E-06	3.98862	5.9E-07	2.27716	5.70289
1-Rp (TP export)	-	1	0.39081	1	0.47854	0.34015
MISC. RUNOFF PARAMETERS......						
runoff TP	ppb	359.04	346.804	211.294	312.516	294.003
runoff ortho-P / TP	ratio	0.41167	0.3269	0.31395	0.31091	0.25169
annual unit runoff	inches	9.97931	11.0304	12.1664	15.4097	14.9882
annual unit loading	lbs/ac	0.81159	0.8665	0.58229	1.09083	0.99815
LAND USE PARAMETERS..........						
runoff total P calc	ppb	359.04	346.804	211.294	312.516	294.003
runoff coefficient		0.3883	0.4292	0.4734	0.5996	0.5832
dissolved/total P	ratio	0.5211	0.4138	0.3974	0.334	0.3186

SPRING LAKE OUTPUT

8410.7	SL hydro output (ac-ft)
1600.0	SL TP mass output (lbs)
233	SL SRP mass output (lbs)
15	%SRP/TP for SL
70	SL avg TP (ug/L)
10	SL avg SRP (ug/L)
41	% UPSTREAM/TOT for UP

Appendix D

MONTGOMERY WATSON

PL SL Clean Lakes																				
			1994		1995		1996		Year 3 TOTAL	PL-SL budget		1997		1998		1999		Second 3 year total		
Element		type Service																		
			In-kind	Cash	In-kind	cash	In-kind	cash	In-kind	Cash	Total	In-kind	cash	In-kind	cash	In-kind	cash	In-kind	cash	Total
Public Education																				
	Baseline		800	200	800	200	800	200	2400	600	3000	800	200	800	200	800	200	2400	600	3000
	Urban Fert Workshops		1440						1440	0	1440	1440						1440	0	1440
	Farm Fert Workshops						1440		1440	0	1440	1440		1440		1440		4320	0	4320
	Fert Demonstrations				800	800	2240	800	3040	1600	4640									
	soils tests		600	1400	600	1400	600	1400	1800	4200	6000	600	1400	600	1400	600	1400	1800	4200	6000
	News Letter		1600	500	1600	500	1600	500	4800	1500	6300	1600	500	1600	500	1600	500	4800	1500	6300
	Materials/Fact Sheets		2400						2400	0	2400							0	0	0
	Slide Program		2000	200					2000	200	2200							0	0	0
	Displays		800						800	0	800							0	0	0
	Press Releases		200		200		200		600	0	600	200		200		200		600	0	600
	Tours		400	200					400	200	600					400	200	400	200	600
	Yard Workshops		1440						1440	0	1440			1440				1440	0	1440
	Coord of Volunteers		480		480		480		1440	0	1440	480		480		480		1440	0	1440
	Signage &sweeping notices		770		240		240		1250	0	1250	240		240		240		720	0	720
	Meetings Conferences		320	100					320	100	420					320	100	320	100	420
	Area Schools		200		200		200		600	0	600	200		200		200		600	0	600
	Contests		100	100	100	100			200	200	400							0	0	0
	Shoreline workshop				1440				1440	0	1440									
	septic workshops				1440				1440	0	1440			1440				1440	0	1440
								total	29250	8600	37850						Total	21720	6600	28320
Fertilizer Management																				
	Incentives						800	2000	800	2000	2800	1600	4000	2400	6000	3200	8000	7200	18000	25200
								Total	800	2000	2800						Total	7200	18000	25200
Agri-BMPs																				
	Conservation Tillage			28000						28000	28000							0	0	0
WQ Basin Inventory			800	17098					800	17098	17898									
Aquatic Vegetation Plan												10000	15,218					10000	15218.1383	25218.1383
Wetlands Restoration																				
admin			800		800		800		2400	0	2400									
Site investigation				1388		727.65														
easements					29000	58000			29000	58000	87000							0	0	0
engineering						5292			0	5292	5292									
construction					3000	20000			3000	20000	23000									
								Total	34400	83292	117692						Total	0	0	0
Ferric Chloride Add																				
permits & engineering				8410.5						8410.5	8410.5									
construction				29788.5					0	29788.5	29788.5									
chemicals,O&M				3700		8158.5		8566.425	0	20424.925	20424.925		8994.74625		9444.48356		9916.70774	0	28355.9376	28355.9376
								Total w/o Chem	0	38199	38199									
Spring Aeration																				
permits & admin									0	0	0	2880	7195.797					2880	7195.797	10075.797
Design & Engineering									0	0	0		32551.2574					0	32551.2574	32551.2574
Construction									0	0	0		169563.122					0	169563.122	169563.122
Energy									0	0	0		30387.6563		31907.0391		33502.391	0	95797.0863	95797.0863
																	Total W/O O&M	2880	209310.176	212190.176
Dry Basin 4 Conversion									0	0	0									
Construction									0	0	0			560	7210.99083			560	7210.99083	7770.99083
Basin 1 Improvement								60000	0	60000	60000									
Aqua-Scaping						5000			0	5000	5000									
Spawning Area						960			0	960	960									
Monitoring								39359.25	0	39359.25	39359.25						28812.0563	0	28812.0563	28812.0563
General Administration			3456	3276	3456	3439.8	3456	3611.79	10368	10327.59	20695.59	3456	3792.3795	3456	3981.99848	3456	4181.0984	10368	11955.4764	22323.4764
Reports			960	10668	960	3483.9	960	3658.095	2880	17809.995	20689.995	960	3840.99075	960	4033.04974	960	24336.1368	2880	32210.1863	35090.1863
Total			19566	101327	45116	99903.35	13816	111529.135	78498	310645.835	389143.835	25898	238261.694	15816	23326.039	13896	67729.2915	55608	329317.024	384925.024
									391257.485											
										50%	194571.918								50%	192462.512
										IN-KIND	78498								IN-KIND	55608
										local cash	116073.918								Local cash	136854.512
										Plus O&M	20425								Plus O&M	124153.024
										Total Local	136498.918							w/o O&M	total local cost	252928.43
																			Total Project	774068.859
																		With O&M	Local Cash	387506.464