2007 Lake Water Quality Study

Westwood Lake and Crane Lake

Prepared by
Bassett Creek Watershed Management Commission

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Executive Summary

Since 1970, water quality has been monitored in ten major lakes under the management of the Bassett Creek Watershed Management Commission (Commission). The main objective of this program is to detect changes or trends in lake water quality over time that will help determine the effects from changing land use patterns within the watershed as well as the Commission's efforts to maintain and improve water quality. The Bassett Creek Watershed Management Commission adopted its current watershed management plan in 2004. The second generation plan complies with the provisions of the Minnesota Rules Chapter 8410, the Metropolitan Surface Water Management Act, the Water Resources Management Policy Plan, and other regional plans. The Commission's Plan sets the vision and guidelines for managing surface water within the boundaries of the BCWMC.

This report summarizes the results of water quality monitoring during 2007 in Westwood Lake in St. Louis Park and Crane Lake in Minnetonka. The lakes were monitored for both chemical (Appendices A and C) and biological (Appendices B and D) water quality parameters, the latter including phytoplankton, zooplankton and macrophytes (aquatic plants). Monitoring results are summarized by lake and include a description of the results along with graphical representations of the data.

The conclusions from 2007 water quality monitoring are as follows:

Crane Lake

- Water quality status of Crane Lake was eutrophic (nutrient rich) to hypereutrophic (very nutrient rich) during the 2007 growing season.

- Vegetation (submerged and floating leaf) was found throughout the lake and emergent vegetation was present along the entire shoreline.

- Crane Lake is classified as a Level III water body—meaning its water quality should support fishing, aesthetic viewing, and wildlife observation activities. The level III goals are: (1) average summer total phosphorus concentration not to exceed 75 μg/L, (2) average summer chlorophyll *a* concentration not to exceed 40 μg/L, and (3) average Secchi disc transparency of at least 0.9 meters. In 2007, the average summer total phosphorus concentration was 72.5 μg/L , the average chlorophyll *a,* concentration was 17.1 µg/L, and the average Secchi disc transparency was 0.9 meters. Crane Lake met all three goals during 2007.

- Historical records indicate water quality has improved since 1990. BCWMC's phosphorus goal was only met 33 percent of the 1975 through 1990 period, but was met 67 percent of the 1991 through 2007 period. BCWMC's chlorophyll *a* goal was only met 44 percent of the 1975 through 1990 period, but was met 83 percent of the 1991 through 2007 period. BCWMC's Secchi disc goal was met 73 percent of the 1977 through 1990 period and 75 percent of the 1991 through 2007 period.

Westwood Lake

- Water quality status of Westwood Lake was eutrophic (nutrient rich) to hypereutrophic (very nutrient rich) during the 2007 growing season.

- Vegetation (submerged and floating leaf) was found throughout the lake and emergent vegetation was present along the entire shoreline.

- Westwood Lake is classified as a Level II water body—meaning its water quality should support all recreational activities, except full body contact activities. Recreational activities include: sail boating, water skiing, motor boating, canoeing, wind surfing, and jet skiing. Level II goals are (1) Maximum total phosphorus (TP) concentration of 45 ug/L, (2) maximum chlorophyll *a* concentration of 20 ug/L, and (3) Minimum Secchi disc (SD) transparency of 1.4 meters (4.6 feet). In 2007, the lake's summer average chlorophyll *a* concentration of 11.6 µg/L attained the BCWMC's goal for Westwood Lake. The lake's summer average total phosphorus concentration of 47 µg/L and the lake's average summer Secchi disc transparency of 1.3 meters did not attain the BCWMC's Level II goals for the lake, but both were very close (i.e., phosphorus within 2 µg/L and Secchi disc within 0.14 meters or 0.5 feet of the goal).

- Historical records indicate the lake's water quality has improved since 1977. Average summer total phosphorus concentrations have declined from 340 µg/L in 1977 to 47 µg/L in 2007. Average summer chlorophyll *a* concentrations have declined from 50 µg/L in 1982 to 12 µg/L in 2007. Average summer Secchi disc transparency has increased from 0.8 meters in 1977 to 1.3 meters in 2007. Despite the water quality improvements occurring during the period of record, the lake continues to be rich in nutrients due to the impacts of stormwater runoff from its urbanized watershed. BCWMC's Level II goal attainment during the period of record was 58 percent for total phosphorus, 83 percent for chlorophyll *a*, and 8 percent for Secchi disc transparency. Although the BCWMC's goal for Secchi disc transparency was only attained once during the period of record (i.e., during 2001), average summer values were within 0.2 meters or 0.7 feet of the goal about 75 percent of the time.

2007 Lake Water Quality Study
Crane Lake and Westwood Lake

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 Introduction

Since 1970, when the Bassett Creek Water Management Commission (Commission) and its predecessor, the Bassett Creek Flood Control Commission, were formed, water quality conditions in the ten major lakes have been periodically monitored. The Commission's policy is to preserve water quality conditions, and to improve them where possible. Nonpoint source pollution (pollutants transported by stormwater runoff) is the predominant cause of lake water quality degradation. The objective of the lake monitoring program is to detect changes or trends in water quality over time, thereby determining the effect of changing land use patterns in the watershed and the effectiveness of the Commission's efforts to prevent water quality degradation in the lakes.

In 1991, the Commission established an annual lake water quality monitoring program that generally followed the recommendations of the Metropolitan Council (Osgood, 1989a) for a "Level 1, Survey and Surveillance" data collection effort. The lake sampling program generally involves monitoring of ten lakes on a 4-year rotating basis, three or four lakes per year. However, some of the lakes, including Lost Lake and Sunset Hill (Cavanaugh) Lake have been eliminated from the program. Major lakes include the following water bodies, with prior monitoring years indicated parenthetically:

Table 1 Lakes Monitored in the Basset Creek Watershed Commission Area (Years with sampling data are in parenthesis)

• Crane (1977, 1982, 1993, 1997, 2001, 2007)	• Sunset Hill (Cavanaugh) (1977, 1982, 1994, 1998)
• Lost (1977, 1982, 1993, 1997)	• Sweeney[2] (1977, 1982, 1985, 1992, 1996, 2000, 2001, 2002, 2003, 2004, 2005, 2006[1])
• Medicine (1977, 1982, 1983, 1984, 1988, 1994[1], 1999[1], 2006[1])	• Twin (1977, 1982, 1992, 1996, 2000, 2005)
• Northwood (1972, 1977, 1982, 1992, 1996, 2000, 2005)	• Westwood[2] (1977, 1982, 1993, 1997, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007)

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[1] Monitoring performed jointly with Three Rivers Park District (formerly Suburban Hennepin Regional Park District).

[2]Includes monitoring by citizens as a part of Citizens Assisted Monitoring Program (CAMP)

Wirth Lake is currently monitored annually by the Minneapolis Park and Recreation Board. Hence, Wirth Lake is not included in the Commission's lake monitoring program. Medicine Lake is currently monitored annually by the Three Rivers Park District (Three Rivers). The Commission periodically participates with Three Rivers to monitor at a second site at Medicine Lake. Westwood Lake, Sweeney Lake, and Parkers Lake have been monitored annually since 2000 by citizen volunteers participating in the Metropolitan Council's Citizens Assisted Monitoring Program (CAMP). Crane Lake was monitored nearly annually by Ridgedale Center during 1975 through 1994.

The lake sampling program occasionally includes limited monitoring for other water bodies, which has included the following ponds and the year sampled in parenthesis:

- Courtland, East Ring, and West Ring Ponds (1993)
- Grimes Pond (1996)
- North Rice and South Rice Ponds (1994, 1998)

South Rice Lake also has been included in the CAMP since 2000.

This report presents the results of the water quality monitoring in 2007 of Crane Lake and Westwood Lake (Locations shown on Figure 1). The lakes were monitored for water quality and biota, specifically phytoplankton, zooplankton, and macrophytes (aquatic plants). Monitoring results are summarized in the following pages, including a narrative description of the results as well as a graphical summary. More detailed data can be found in the appendices of the report.

The discussion of water quality conditions focuses on the three principal nutrient-related water quality indicators: total phosphorus (TP) concentrations, chlorophyll *a* concentrations, and Secchi disc transparency. Phosphorus is a nutrient that usually limits the growth of algae. Chlorophyll *a* is the primary photosynthetic pigment in lake algae; therefore, the concentration in a lake water sample indicates the amount of algae present in the sampled area of the lake. Secchi disc transparency is a measure of water clarity, and is inversely related to algal abundance.

The water quality conditions were classified as to trophic state, based on the TP concentration, chlorophyll *a* concentration, and Secchi disc transparency (Table 2).

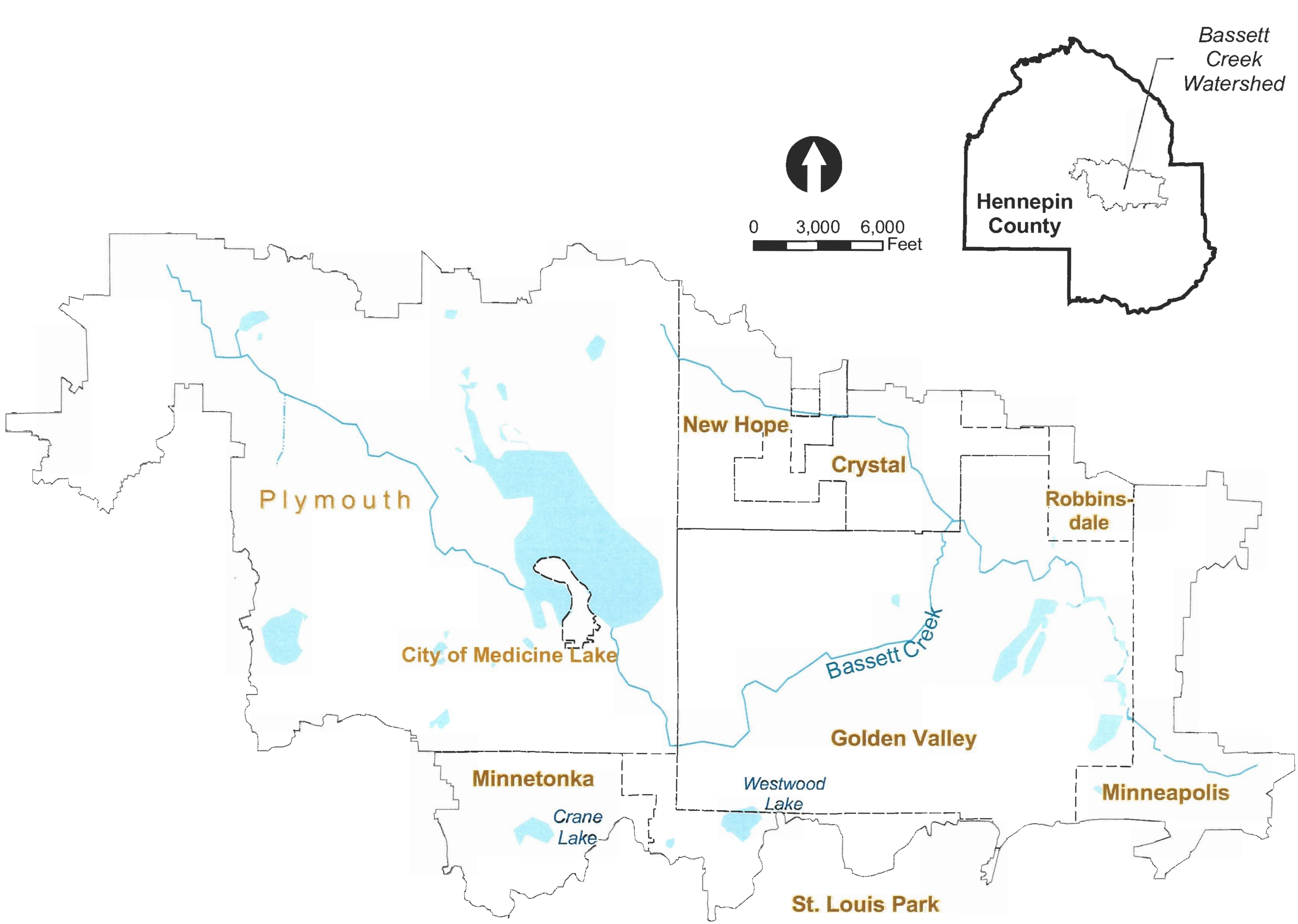

Figure 1: Location of Lakes included in 2007 Water Quality Study (Crane Lake and Westwood Lake)

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Table 2 Trophic State Classifications for Total Phosphorus, Chlorophyll *a*, and Secchi Disc Transparency

Trophic State	Total Phosphorus	Chlorophyll *a*	Secchi Disc Transparency
Oligotrophic (nutrient poor)	less than 10 µg/L	less than 2 µg/L	greater than 15 ft (4.6 m)
Mesotrophic (moderate nutrient levels)	10 µg/L – 24 µg/L	2 µg/L - 7.5 µg/L	15 ft - 6.6 ft (4.6 m - 2.0 m)
Eutrophic (nutrient rich)	24 µg/L – 57 µg/L	7.5 µg/L - 26 µg/L	6.6 ft – 2.8 ft (2.0 m - 0.85 m)
Hypereutrophic (extremely nutrient rich)	greater than 57 µg/L	greater than 26 µg/L	less than 2.8 ft (0.85 m)

In addition to chemically based water quality parameters, biological data were compiled and evaluated in this study as well. Phytoplankton, zooplankton and macrophyte (aquatic plant) data can help determine the health of aquatic systems and can also indicate changes in nutrient status over time. Biological communities in lakes interact with each other and influence both short- and long-term variations in observed water quality.

Phytoplankton (algae) – form the base of the food web in lakes and directly influence fish production and recreational use. Chlorophyll *a*, the main pigment found in algae, is a general indicator of algal biomass in lake water. The identification of species and their abundance provides additional information about the health of a lake and can indicate changes in lake status as algal populations change over time. Different algal species provide varying levels of "food quality" and thus can affect the growth of zooplankton in a lake. Larger algal species that are difficult to consume or those of low food quality are less desirable for zooplankton and can limit overall productivity in a lake.

Zooplankton (microscopic crustaceans) – are vital to the health of a lake ecosystem because they feed upon the phytoplankton and are food themselves for many fish species. Protection of the lake's zooplankton community through proper water quality management practices protects the lake's fishery. Zooplankton are also important to lake water quality. The zooplankton community is comprised of three groups: Cladocera, Copepoda, and Rotifera. If present in abundance, large Cladocera can decrease the number of algae and improve water transparency within a lake.

Macrophytes (vascular aquatic plants) – grow in the shallow (littoral) area of a lake. Macrophytes are a natural part of lake communities and provide many benefits to fish, wildlife and people. Macrophytes are primary producers in the aquatic food web, providing food for other life forms in and around the lake.

2.0 Methods

2.1 Water Quality Sampling

Samples were collected from representative lake sampling stations (i.e., located at the deepest location in each lake basin) on 6 occasions. The lakes were monitored from April through September as follows:

- One sample was collected within two weeks of ice out
- One sample was collected in June
- One sample was collected in mid-July
- One sample was collected in mid-August
- One sample was collected in late-August
- One sample was collected in late September

Table 3 lists the water quality parameters and specifies at what depths the samples or measurements were collected. Dissolved oxygen, temperature, specific conductance, pH, and Secchi disc transparency (Secchi depth) were measured in the field, water samples were analyzed in the laboratory for total phosphorus, soluble reactive phosphorus, total nitrogen, and chlorophyll *a*. Sampling and analysis of water quality parameters were completed by Three Rivers Park District. Phytoplankton and zooplankton samples were collected by Three Rivers Park District (see ecosystem data) and were delivered to Barr Engineering for analysis.

During 2007, Westwood Lake was sampled on 8 occasions during May through September by citizen volunteers participating in the Metropolitan Council's CAMP program. During each sample event, Secchi disc transparency and temperature were measured in the field and water samples were analyzed in the laboratory for total phosphorus, total Kjeldahl nitrogen, and chlorophyll *a*.

Table 3
Lake Water Quality Parameters

Parameters	Depth (Meters)	Sampled or Measured During Each Sample Event
Dissolved Oxygen	Surface to bottom profile at approximately one half meter intervals	X
Temperature	Surface to bottom profile at approximately one half meter intervals	X
Specific Conductance	Surface to bottom profile at approximately one half meter intervals	X
Secchi Disc	—	X
Total Phosphorus	Surface samples	X
Soluble Reactive Phosphorus	Surface samples	X
Total Nitrogen (or Nitrogen Species Needed to Determine Total Nitrogen)	Surface samples	X
pH	Surface to bottom profile at approximately one half meter intervals	X
Chlorophyll *a*	Surface samples	X

2.2 Ecosystem Data

Ecosystem data were collected from April to September 2007. Phytoplankton and zooplankton samples were collected by Three Rivers Park District and analyzed by Barr Engineering.

- **Phytoplankton—**A surface water sample was collected during each water quality sampling event from Crane Lake and Westwood Lake. Sample analysis included identification and enumeration of species.
- **Zooplankton—**A zooplankton sample was collected (i.e., bottom to surface tow) during each water quality sample event during the period April through September. Sample analysis included identification and enumeration of species.
- **Macrophytes—**Macrophyte (aquatic plant) surveys were completed during June and August.

3.0 Crane

3.1 Site Description

Crane Lake (also known as Dayton Pond) and its watershed are located entirely within the city limits of Minnetonka, Minnesota. The lake has a surface area of 30 acres, a maximum depth of 1.5 meters (5 feet), and an estimated mean depth of 1 meter (3.3 feet). Crane Lake is surrounded by a cattail marsh which provides excellent waterfowl habitat, but which also serves to restrict recreation. The lake is bordered by residential areas to the south and east, by Highway 394 to the north, and by Ridgedale to the west. The Crane Lake watershed is 353 acres. The Crane Lake outlet is located on the north side of the lake and discharges water from Crane Lake to Oak Knoll Pond. After discharging from Oak Knoll Pond, water passes through a series of culverts and channels, and eventually discharges to Medicine Lake in the city of Plymouth.

3.2 Goal

The BCWMC's goal for Crane Lake is a management classification of Level III, meaning its water quality should support fishing, aesthetic viewing, and wildlife observation activities. Level III goals are (1) Maximum total phosphorus concentration of 75 ug/L, (2) maximum chlorophyll *a* concentration of 40 ug/L, and (3) Minimum Secchi disc transparency of 0.9 meters (3 feet). Crane Lake has met BCWMC chlorophyll *a* and Secchi disc goals the majority of the time (chlorophyll *a* 70 percent and Secchi disc 73 percent) and has met total phosphorus goals nearly half of the time (48 percent).

3.3 Watershed and Lake Management Plan

In 1995 the BCWMC completed the *Crane Lake Watershed and Lake Management Plan* with specific recommendations to improve the overall health of the Lake. The Crane Lake Plan divides the Crane Lake watershed into seven drainage districts: Ramada Inn, Ridgedale South Pond, Ridgedale Northeast Pond, Crane Lake Direct, West Frontage Road, East Frontage Road, and Joy Lane. Each drainage district was evaluated for nutrient removal efficiency under existing conditions and under proposed improved conditions. As part of the Crane Lake Plan, site-specific structural best management practices for each drainage district were evaluated. The evaluation determined that implementing management practices from the Ramada Inn Drainage District or the Joy Lane Drainage District would result in Crane Lake meeting the BCWC's Level III water quality goals. Discussions with DNR indicated it might not be feasible to obtain a DNR permit for a detention pond within the eastern portion of Crane Lake (Joy Lane Drainage District). Hence, the plan recommended construction of a wet detention basin within the Ramada Inn Drainage District. The BCMC's 10-year CIP includes the BMP's recommended in the Crane Lake Plan.

3.4 Water Quality

3.4.1 Temperature and Dissolved Oxygen

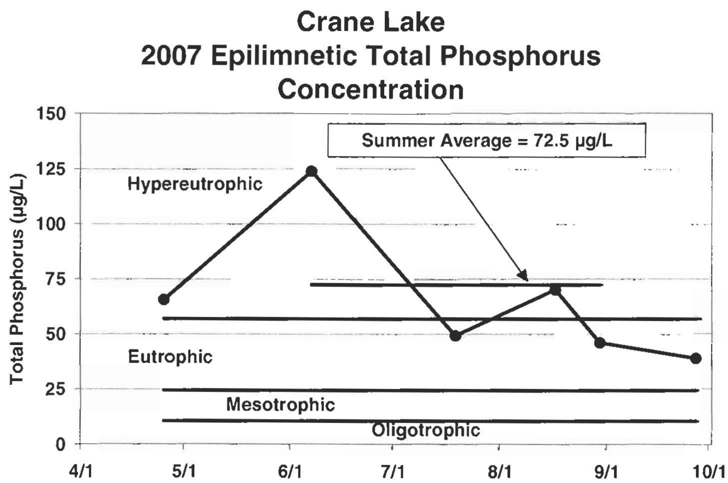
Temperature and dissolved oxygen concentrations indicate the lake water is generally mixed throughout the growing season (polymictic) (Appendix A). Dissolved oxygen measurements show the lake was well oxygenated, but that the water layer immediately above the sediments was nearly depleted of oxygen (i.e., <1 mg/L) during approximately half of the sampling events.

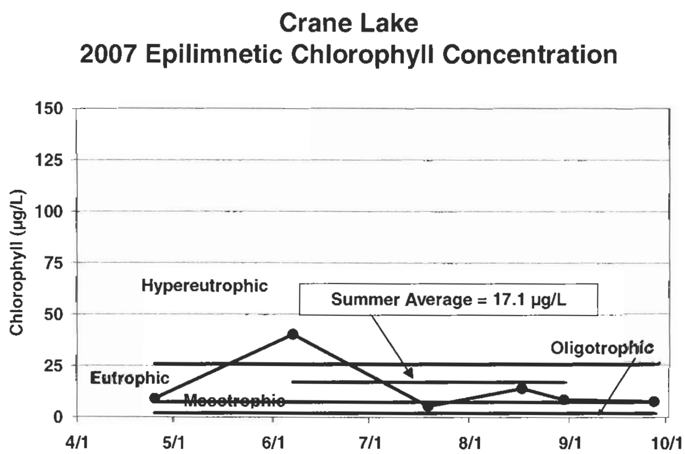
3.4.2 Surface Total Phosphorus, Chlorophyll *a* and Secchi Depth

Total phosphorus, chlorophyll *a* and Secchi depth data are graphically summarized in Figure 2. The 2007 summer average total phosphorus concentration averaged 72.5 μg/L, and was in the hypereutrophic (very nutrient rich) range for lake trophic status. The 2007 summer average chlorophyll *a* concentration averaged 17.1 μg/L and was in the eutrophic (nutrient rich) range for lake trophic status. The 2007 summer average Secchi disc transparency averaged 0.9 meters (3 feet) and was in the upper eutrophic (nutrient rich) range for lake trophic status. The data show that the 2007 average summer total phosphorus, chlorophyll *a*, and Secchi disc values attained BCWMC's Level III goal for the lake.

Total phosphorus and chlorophyll *a* concentrations increased during April through early June and then decreased throughout the remainder of the growing season, except for an increase in mid-August.

The increase in both phosphorus and chlorophyll during June is likely due to internal loading rather than watershed runoff. As shown in Table 4, little precipitation occurred during this period and precipitation was consistently below normal. During both April and June, dissolved oxygen measurements were less than 1 mg/L near the lake's bottom. Under anoxic conditions, phosphorus from sediments is released to the overlying waters. The data indicate sediment phosphorus release occurred during the April through June period. This internal loading nearly doubled the lake's phosphorus concentration. The increase in lake phosphorus concentrations resulted in a four-fold increase in chlorophyll concentration.





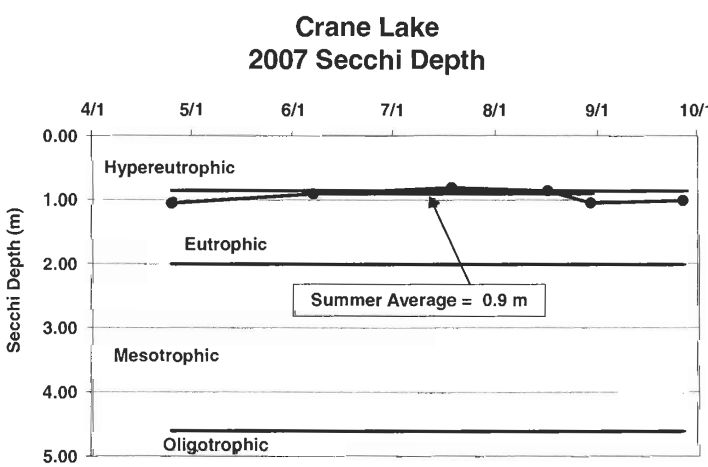


Figure 2 Nutrient Related Water Quality Parameters in Crane Lake 2007

Table 4 2007 Precipitation (Minneapolis/St. Paul, MN)

Month	Precipitation (inches)	Departure From Normal (inches)
January	0.31	-0.73
February	1.37	0.58
March	3.64	1.78
April	1.11	-1.2
May	1.99	-1.25
June	2.05	-2.29
July	3.29	-0.75
August	9.32	5.37
September	6.04	3.35

The August increase occurred shortly after two major rainstorms which conveyed stormwater runoff to the lake. The storms totaled 3.78 inches of precipitation. The data indicate the lake is sensitive to the addition of stormwater runoff due to its shallow depth and small volume which result in a minimal capacity to buffer the impacts of the increased nutrients found in stormwater runoff conveyed to the lake. The data also indicate the lake's algal growth was limited by phosphorus concentrations. Increased phosphorus due to stormwater runoff resulted in increased chlorophyll (algal biomass) and decreased phosphorus concentrations resulted in decreased chlorophyll (algal biomass).

Secchi disc transparency changed very little during the 2007 growing season. The lake's water transparency ranged from a high of 1.05 meters (3.5 feet) in April to a low of 0.8 meters (2.6 feet) in mid-July. The maximum depth of the lake is 1.5 meters (5 feet).

3.5 Historical Trends

Historical water quality trends are shown on Figure 3. During the period of record, the lake's total phosphorus concentrations have generally been within the hypereutrophic trophic category due to the addition of nutrients from the lake's urbanized watershed during storm events. Improved water quality has been observed since 1990 and phosphorus concentrations have been lower. BCWMC's phosphorus goal was only met 33 percent of the 1975 through 1990 period, but was met 67 percent of the 1991 through 2007 period.

Improved water quality since 1990 has generally resulted in chlorophyll *a* concentrations within the eutrophic trophic category. Prior to 1990, the lake's average summer chlorophyll *a* concentration was generally within the hypereutrophic category. BCWMC's chlorophyll *a* goal was only met 44 percent of the 1975 through 1990 period, but was met 83 percent of the 1991 through 2007 period.

Reduced total phosphorus and chlorophyll *a* concentrations since 1990 have resulted in only a slight improvement in Secchi disc transparency. BCWMC's Secchi disc goal was met 73 percent of the 1977 through 1990 period and 75 percent of the 1991 through 2007 period.

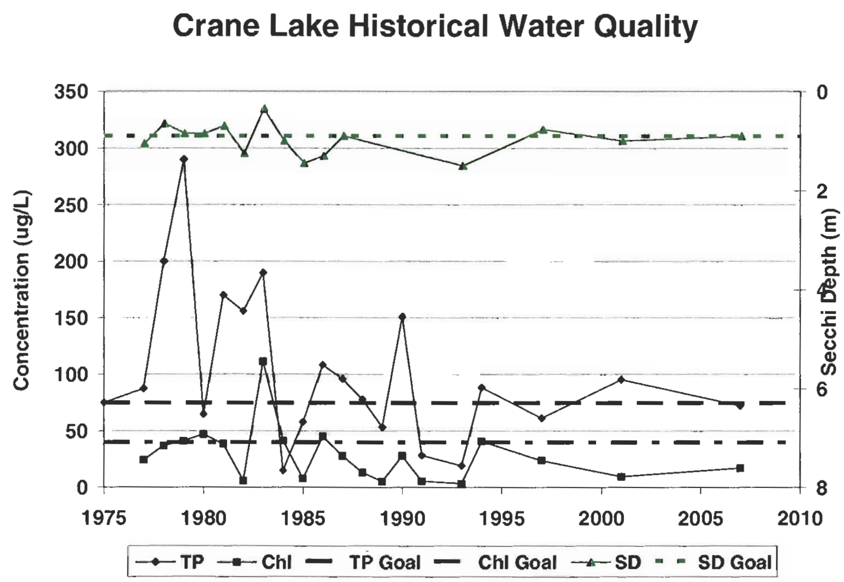


Figure 3 Historical Water Quality Data in Crane Lake

3.6 Biota

Three components of lake biota are presented herein: phytoplankton, zooplankton, and macrophytes. Fisheries status is managed by the Department of Natural Resources and is not covered in this report.

3.6.1 Phytoplankton

Phytoplankton, also called algae, are single celled aquatic plants naturally present in lakes. They derive energy from sunlight (through photosynthesis) and from dissolved nutrients found in lake water. They provide food for several types of animals, including zooplankton, which are eaten by fish. A phytoplankton population in balance with the lake's zooplankton is ideal for fish production. An inadequate phytoplankton population reduces the lake's zooplankton population and adversely impacts the lake's fishery. Excess phytoplankton, however, reduce the lake's water clarity.

The 2007 phytoplankton data confirmed the presence of algal booms during the spring and early summer period. Highest numbers of phytoplankton occurred during the April through June period and lower numbers were observed during July through September (See Figure 4).

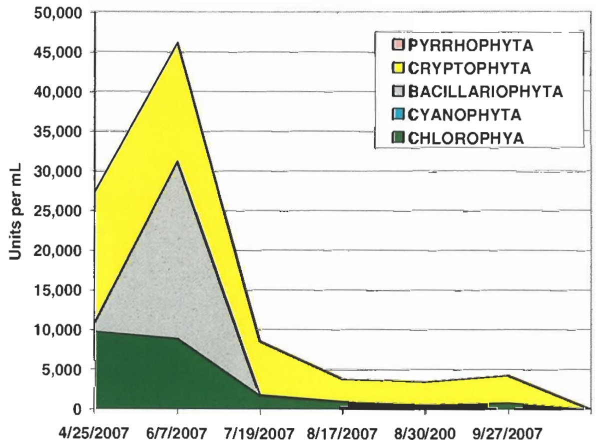


Figure 4 2007 Crane Lake Phytoplankton Data Summary by Division

3.6.2 Zooplankton

Zooplankton are microscopic animals that feed on particulate matter, including algae, and are, in turn, eaten by fish. Healthy zooplankton communities are characterized by balanced densities (number per meter squared) of the three major groups of zooplankton: Cladocera, Copepods, and Rotifers. Fish predation, however, may alter community structure and reduce the numbers of larger bodied zooplankters (i.e., larger bodied Cladocera).

All three groups of zooplankton were well represented in Crane Lake during 2007 (See Figure 5). In general, numbers of zooplankton declined from April through August, then increased during September. Fish predation during the spring through summer period caused larger Cladocera to diminish during the April through mid-August period and disappear by late August. Thus, only small Cladocera were found during late August and September. The lake is shallow and there is no "refuge" for zooplankton to hide from fish predation. Hence, fish predation removes the larger animals, leaving the smaller animals to dominate the community.

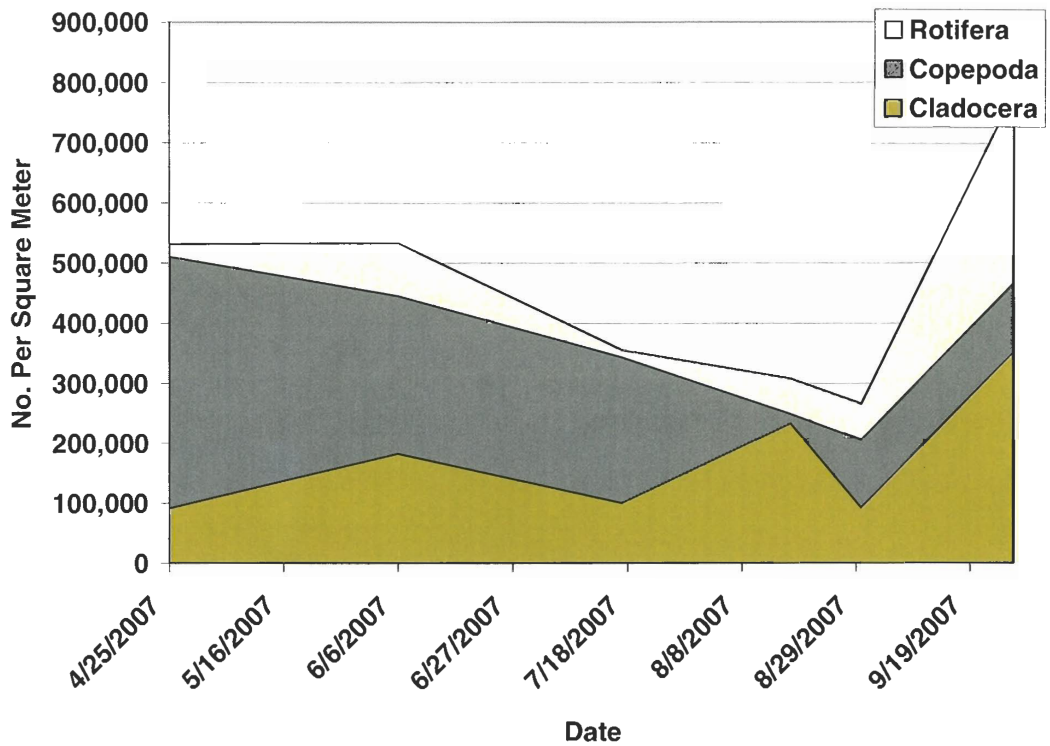


Figure 5 2007 Crane Lake Zooplankton Data Summary by Division

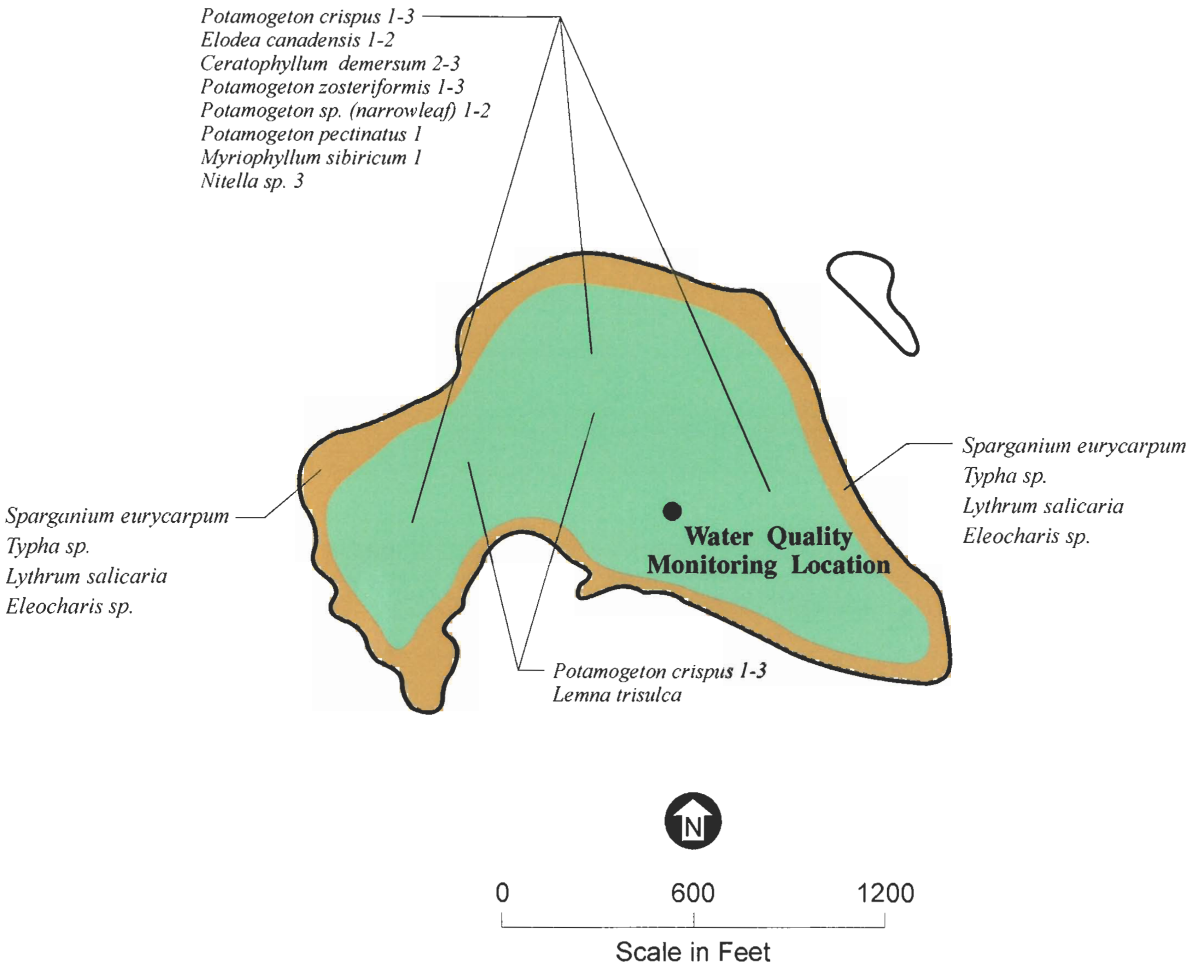
3.6.3 Macrophytes

Vegetation (submerged and floating leaf) was found throughout the lake and emergent plants were present along the entire shore. A total of 13 species were found in June and 12 species were found in August . Although nearly all of the plants were native species, two non native species, purple loosestrife (*Lythrum salicaria*) and curlyleaf pondweed (*Potamogeton crispus*) were present. Both species are undesirable because they displace native species and provide a poorer quality habitat than native species. Curlyleaf pondweed dies off around the fourth of July and, hence, was not observed in the August survey. Submerged vegetation densities ranged from light to heavy. In general, plant growth was less dense in the center of the lake and on the eastern side (See Figures 6 and 7).

3.7 Conclusion

- Water quality status of Crane Lake was eutrophic (nutrient rich) to hypereutrophic (very nutrient rich) during the 2007 growing season.

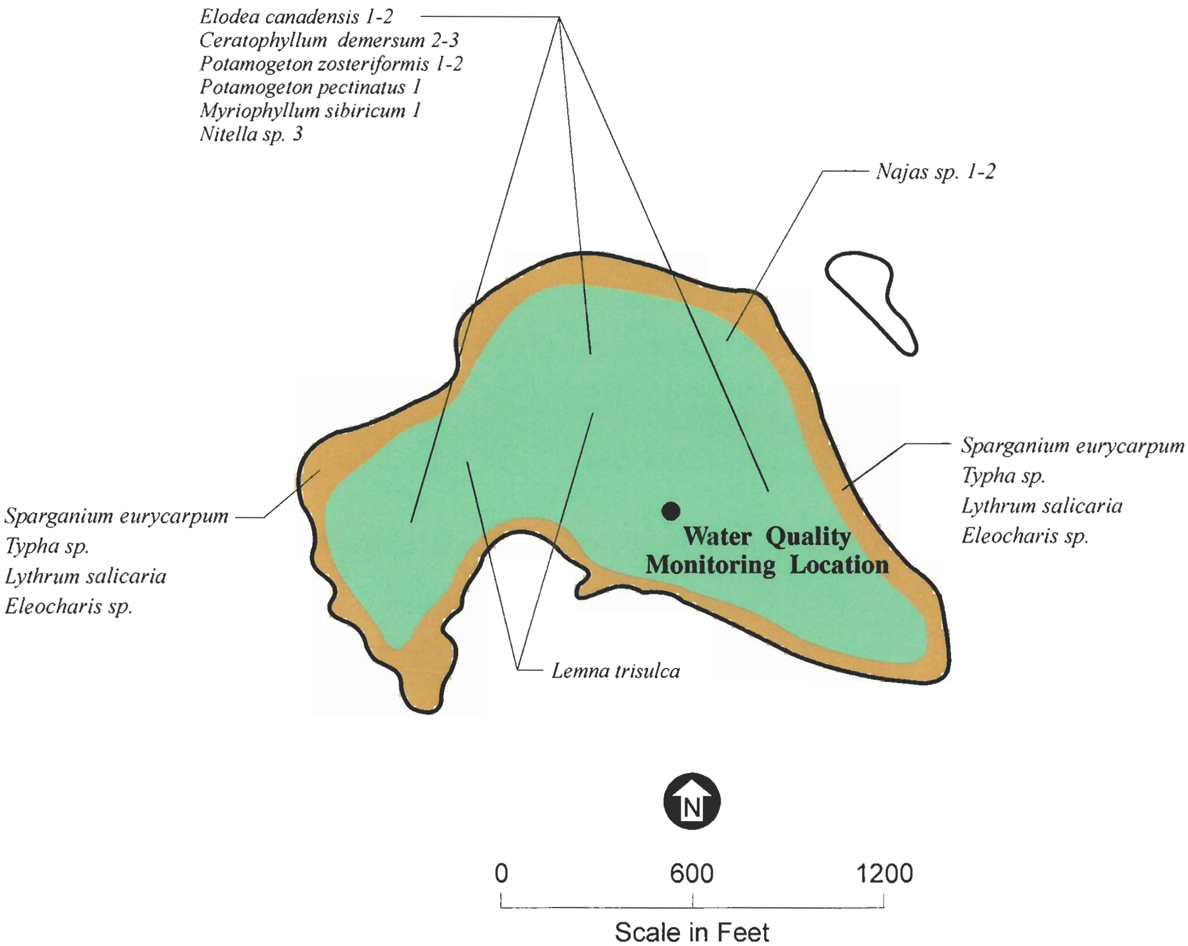
- Vegetation (submerged and floating leaf) was found throughout the lake and emergent vegetation was present along the entire shoreline.



- Macrophytes found in entire water body, less dense in center and on eastern side.
- Macrophyte densities estimated as follows: 1=light; 2=moderate; 3= heavy
- *Wolffia columbiana* (Common watermeal) and *Spirodela polyrhiza* (Large duckweed) present on the lake in light density floating on top of *Potamogeton crispus* (Curly leaf pondweed).

		Common Name	Scientific Name
Submerged Aquatic Plants:		Curly leaf pondweed	*Potamogeton crispus*
		Flatstem pondweed	*Potamogeton zosteriformis*
		Coontail	*Ceratophyllum demersum*
		Elodea	*Elodea canadensis*
		Narrow leaf pondweed	*Potamogeton sp. (narrowleaf)*
		Sago pondweed	*Potamogeton pectinatus*
		Northern water milfoil	*Myriophyllum sibiricum*
		Stonewort	*Nitella sp.*
Floating Leaf:		Star duckweed	*Lemna trisulca*
		Common watermeal	*Wolffia columbiana*
		Large duckweed	*Spirodela polyrhiza*
Emergent:		Giant burreed	*Sparganium eurycarpum*
		Cattail	*Typha sp.*
		Purple loosestrife	*Lythrum salicaria*
		Needle rush	*Eleocharis sp.*
No Aquatic Vegetation Found:			

CRANE LAKE MACROPHYTE SURVEY
June 3, 2007



- Macrophytes found in entire water body, less dense in center and on eastern side.
- Macrophyte densities estimated as follows: 1=light; 2=moderate; 3= heavy
- *Wolffia columbiana* (Common watermeal) and *Spirodela polyrhiza* (Large duckweed) present on the lake in light density.

	Common Name	Scientific Name
Submerged Aquatic Plants:	Flatstem pondweed	*Potamogeton zosteriformis*
	Coontail	*Ceratophyllum demersum*
	Elodea	*Elodea canadensis*
	Sago pondweed	*Potamogeton pectinatus*
	Northern water milfoil	*Myriophyllum sibiricum*
	Stonewort	*Nitella sp.*
	Bushy pondweed	*Najas sp.*
Floating Leaf:	Star duckweed	*Lemna trisulca*
	Common watermeal	*Wolffia columbiana*
	Large duckweed	*Spirodela polyrhiza*
Emergent:	Giant burreed	*Sparganium eurycarpum*
	Cattail	*Typha sp.*
	Purple loosestrife	*Lythrum salicaria*
	Needle rush	*Eleocharis sp.*
No Aquatic Vegetation Found:		

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CRANE LAKE MACROPHYTE SURVEY
August 14, 2007

- Crane Lake is classified as a Level III water body—meaning its water quality should support fishing, aesthetic viewing, and wildlife observation activities. The level III goals are: (1) average summer total phosphorus concentration not to exceed 75 µg/L, (2) average summer chlorophyll *a* concentration not to exceed 40 µg/L, and (3) average Secchi disc transparency of at least 0.9 meters. In 2007, the average summer total phosphorus concentration was 72.5 µg/L , the average chlorophyll *a,* concentration was 17.1 µg/L, and the average Secchi disc transparency was 0.9 meters. Crane Lake met all three goals during 2007.

- Historical records indicate water quality has improved since 1990. BCWMC's phosphorus goal was only met 33 percent of the 1975 through 1990 period, but was met 67 percent of the 1991 through 2007 period. BCWMC's chlorophyll *a* goal was only met 44 percent of the 1975 through 1990 period, but was met 83 percent of the 1991 through 2007 period. BCWMC's Secchi disc goal was met 73 percent of the 1977 through 1990 period and 75 percent of the 1991 through 2007 period.

4.0 Westwood Lake

4.1 Site Description

Westwood Lake is located southwest of the interchange of Highways 394 and 169, in St. Louis Park (Figure 1). It has an open water surface area of approximately 38 acres (15 hectares) and a maximum depth of 5 feet (1.5 meters). The lake is encircled by a cattail marsh. Westwood Lake's watershed area is about 305 acres (123.4 hectares) excluding the lake's water surface and landlocked areas. Most of the watershed lies within the city of St. Louis Park; areas north of the lake and west of Highway 169 lie within the cities of Golden Valley and Minnetonka, respectively.

4.2 Goal

The BCWMC's goal for Westwood Lake is a management classification of Level II, meaning its water quality should support all recreational activities, except full body contact activities. Recreational activities for these water bodies include: sail boating, water skiing, motor boating, canoeing, wind surfing, and jet skiing. Level II goals are (1) Maximum total phosphorus concentration of 45 µg/L, (2) maximum chlorophyll *a* concentration of 20 µg/L, and (3) Minimum Secchi disc transparency of 1.4 meters (4.6 feet). Westwood Lake has met BCWMC phosphorus and chlorophyll *a* goals the majority of the time (phosphorus 58 percent and chlorophyll *a* 83 percent). However, the Secchi disc transparency goal has only been met 8 percent of the time (only during 2001).

4.3 Watershed and Lake Management Plan

In 1995 the BCWMC completed the *Westwood Lake Watershed and Lake Management Plan* with specific recommendations to improve the overall health of the Lake. The Westwood Lake Plan divides the Westwood Lake watershed into three drainage districts: Flag Avenue, Westwood Lake Direct, and Westmoreland Lane. Each drainage district was evaluated for nutrient removal efficiency under existing conditions and under proposed improved conditions. As part of the Westwood Lake Plan, site-specific structural best management practices for each drainage district were evaluated. The evaluation determined the following recommendations.

- The Westwood Lake Drainage District contributes 34 percent of the stormwater phosphorus load to the lake. Stormwater runoff drains directly to Westwood Lake, primarily by overland flow. There is little opportunity available for treatment of flows, therefore, construction of wet-detention basins is not recommended. Severe bank erosion has been observed at the outfall draining the commercial area east of Vernon Avenue South. Diversion of this runoff away from the lake would decrease the suspended solids and phosphorus load to the lake, and eliminate further bank erosion. It is recommended that the runoff from this area be diverted to the MN/DOT storm sewer system directly north of the property, and that the bank be stabilized with riprap to prevent further erosion.

- A sanitary sewer line crosses under the southwest corner of the lake. It is recommended that regular inspection and maintenance be performed on this line to prevent accidental spills. If upgrades or changes are planned for the sanitary sewer system, it is recommended that this line be moved away from the lake.

- The Flag Avenue Drainage District contributes 48 percent of the stormwater phosphorus load to the lake. Stormwater runoff from the 92 acres west of Highway 169 is treated by Kilmer Pond. The discharge from Kilmer Pond joins the storm sewer system draining the 52 acres of single-family residences directly west of the lake. This runoff previously entered the lake untreated, and has been observed to carry much debris and litter to the lake. However, a wet detention pond and skimmer were constructed during 2006 at the outlet of the Flag Avenue storm sewer system. This pond, located at Westdale Park, should reduce the amount of phosphorus, suspended sediments, and litter entering the lake.

4.3 Water Quality

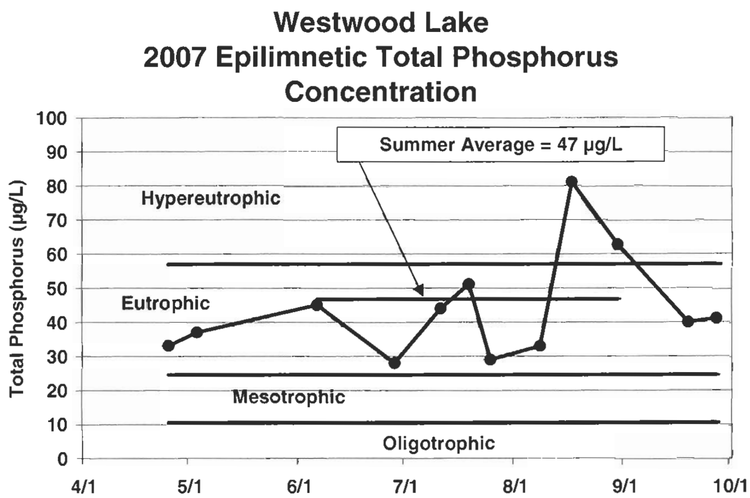
4.3.1 Temperature and Dissolved Oxygen

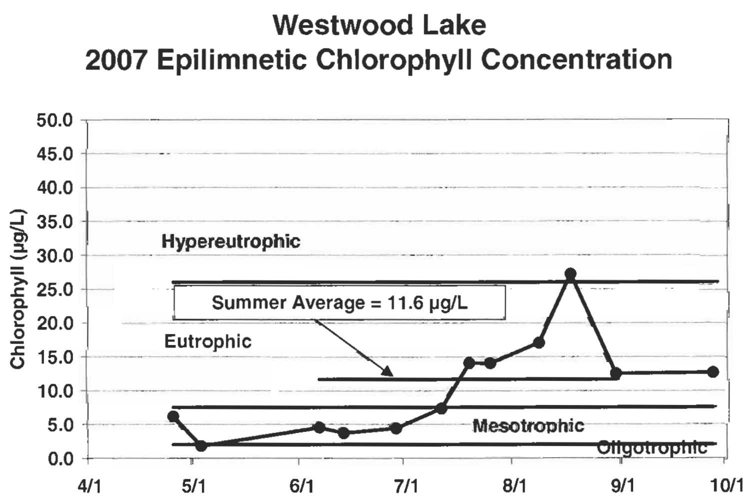
Temperature and dissolved oxygen concentrations indicate the lake water is generally mixed throughout the growing season (polymictic) (Appendix C). Dissolved oxygen measurements show the lake was well oxygenated, but that the water layer immediately above the sediments was nearly depleted of oxygen (i.e., <1 mg/L) during June through September.

4.3.2 Surface Total Phosphorus, Chlorophyll *a* and Secchi Depth

Total phosphorus, chlorophyll *a* and Secchi depth data are graphically summarized in Figure 8. The 2007 summer average total phosphorus and chlorophyll *a* concentrations averaged 47 and 11.6 μg/L, respectively, and Secchi disc transparency averaged 1.26 meters (4 feet). The lake is 1.5 meters (5 feet) deep. All three parameters were in the eutrophic (nutrient rich) range for lake trophic status. The data show that the 2007 average summer chlorophyll *a* value attained BCWMC's Level II goal for the lake. The 2007 average summer total phosphorus and Secchi disc values did not attain BCWMC's Level II goal for the lake, but both were close to the goal (i.e., phosphorus within 2 μg/L and Secchi disc within 0.14 meters or 0.5 feet of the goal).

The lake's water quality (total phosphorus and chlorophyll *a* concentrations and Secchi disc transparency) varied seasonally in 2007, degrading from spring through summer and improving during the late summer through fall period. The lake's phosphorus concentration generally increased from 33 μg/L in spring to 81 μg/L in mid-August, although several fluctuations occurred during this period. Phosphorus concentrations then decreased to 41 μg/L in late September. Similarly, the lake's chlorophyll *a* concentration increased from 6.1 μg/L in spring to 27.2 μg/L in mid-August, then decreased to 12.6 μg/L in late September. The lake's Secchi disc water transparency decreased from 1.7 meters in spring to 0.9 meters in mid-August, then increased to 1.1 meters in late September. The maximum depth of the lake is about 1.5 meters (5 feet), although a depth of 1.7 meters was noted in spring. Peak phosphorus and chlorophyll *a* concentrations and minimum Secchi disc transparency occurred within a week after two major August rainstorms which conveyed stormwater runoff to the lake. The storms totaled 3.78 inches of precipitation. The data indicate the lake is sensitive to the addition of stormwater runoff due to its shallow depth and small volume which result in a minimal capacity to buffer the impacts of the increased nutrients found in stormwater runoff conveyed to the lake. The data underscore the importance of stormwater treatment to minimize phosphorus loads to the lake. To mitigate stormwater impacts to the lake, the Bassett Creek Water Management Commission constructed a stormwater treatment pond in 2006 to treat the Flag Avenue storm sewer system.





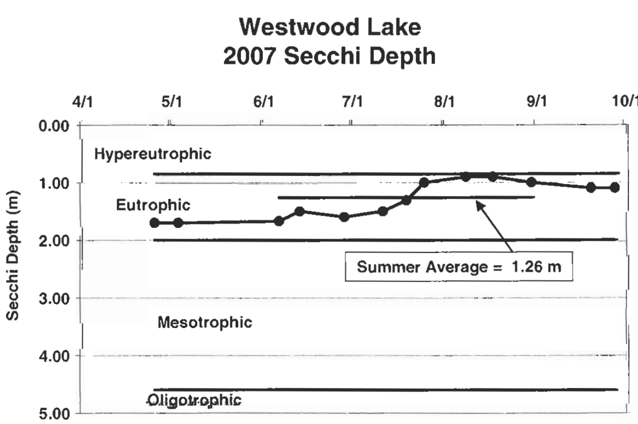


Figure 8 Nutrient Related Water Quality Parameters in Westwood Lake 2007.

4.4 Historical Trends

Historical water quality trends are shown on Figure 9. Comparing 2007 data with the period of record data indicates the lake's water quality has improved. Average summer total phosphorus concentrations have declined from 340 μg/L in 1977 to 47 μg/L in 2007. Average summer chlorophyll *a* concentrations have declined from 50 μg/L in 1982 to 12 μg/L in 2007. Average summer Secchi disc transparency has increased from 0.8 meters in 1977 to 1.3 meters in 2007. The lake is about 1.5 meters (5 feet deep). Despite the water quality improvements occurring during the period of record, the lake continues to be rich in nutrients due to the impacts of stormwater runoff from its urbanized watershed. BCWMC's Level II goal attainment during the period of record was was 58 percent for total phosphorus, 83 percent for chlorophyll *a*, and 8 percent for Secchi disc transparency. Although the BCWMC's goal for Secchi disc transparency was only attained during 2001, average summer values were within 0.2 meters or 0.7 feet of the goal about 75 percent of the time.

During the period of record, the lake's total phosphorus concentrations have fluctuated more widely than chlorophyll *a* concentrations and Secchi disc transparency. The data indicate the lake is sensitive to the addition of stormwater runoff which increases its phosphorus concentration. The data further indicate increases in the algae within the lake's water column (chlorophyll *a*) are generally not proportional to phosphorus increases. It is likely that algae attached to the lake's plant community (periphyton) use a portion of the phosphorus within the lake's water column, thus mitigating chlorophyll *a* increases when the lake's phosphorus concentration increases. Secchi disc transparency changes were generally proportional to changes in chlorophyll *a*, indicating changes in the lake's transparency were generally caused by changes in the lake's algal community.

During the period of record, average summer phosphorus concentrations declined from a high of 340 μg/L in 1977 to a low of 24 μg/L in 2001, then increased to a peak of 188 μg/L in 2006, and declined to 47 μg/L in 2007. During this same period, average summer chlorophyll *a* concentrations were consistently less than 20 μg/L, except for 1982 and 2001 when values of 50 and 29 μg/L were observed. Average summer Secchi disc values fluctuated between 1.0 and 1.3 meters, except for a low value of 0.8 meters in 1977 and a high value of 1.6 meters in 2001.

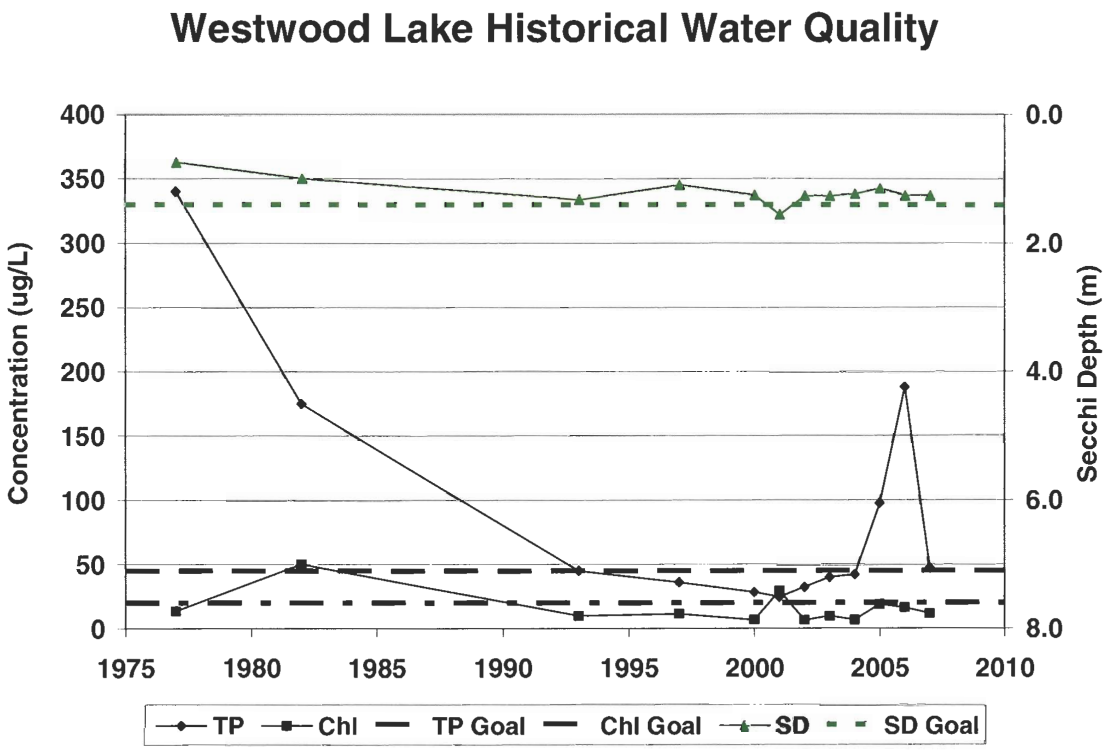


Figure 9 Historical Water Quality in Westwood Lake.

4.5 Biota

Three components of lake biota are presented herein: phytoplankton, zooplankton, and macrophytes. Fisheries status is managed by the Department of Natural Resources and is not covered in this report.

4.5.1 Phytoplankton

Phytoplankton, also called algae, are single celled aquatic plants naturally present in lakes. They derive energy from sunlight (through photosynthesis) and from dissolved nutrients found in lake water. They provide food for several types of animals, including zooplankton, which are eaten by fish. A phytoplankton population in balance with the lake's zooplankton is ideal for fish production. An inadequate phytoplankton population reduces the lake's zooplankton population and adversely impacts the lake's fishery. Excess phytoplankton, however, reduce the lake's water clarity.

The 2007 phytoplankton data indicated the presence of algal booms during the spring and late summer period. Highest numbers of phytoplankton occurred during the April 25 and August 30 sample periods when the numbers of phytoplankton were approximately 3 times higher than at other times during 2007. Green algae and cryptomonads were generally dominant in 2007, except for mid-August when blue green algae predominated. The species shift in the algae community to blue greens corresponded with rapid increases in phosphorus and chlorophyll concentrations and a decline in the lake's water transparency (See Figures 8 and 10).

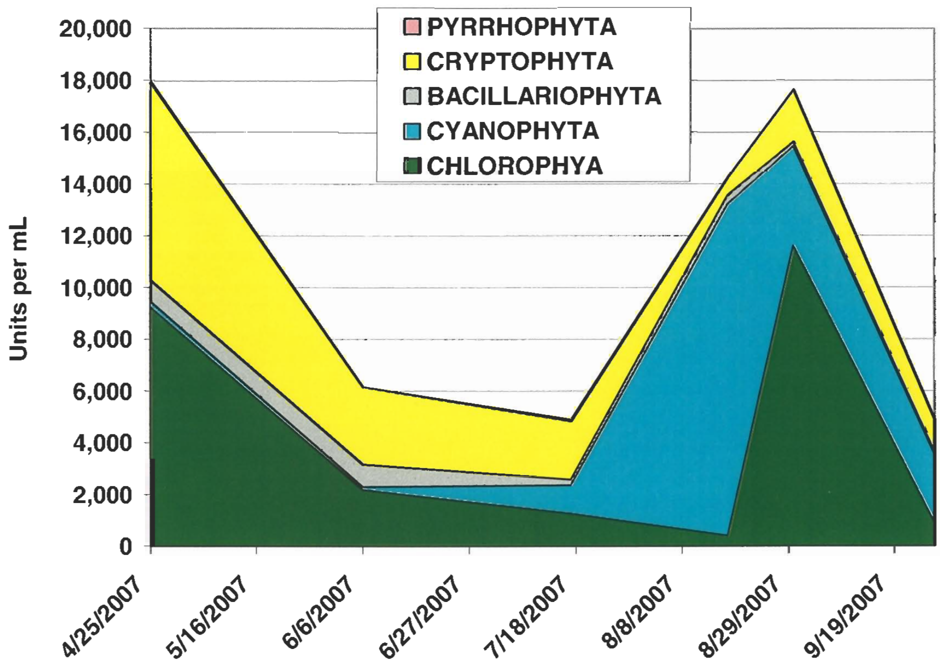


Figure 10 2007 Westwood Lake Phytoplankton Data Summary by Division

4.5.2 Zooplankton

Zooplankton are microscopic animals that feed on particulate matter, including algae, and are, in turn, eaten by fish. Healthy zooplankton communities are characterized by balanced densities (number per meter squared) of the three major groups of zooplankton: Cladocera, Copepods, and Rotifers. Fish predation, however, may alter community structure and reduce the numbers of larger bodied zooplankters (i.e., larger bodied Cladocera).

All three groups of zooplankton were represented in Westwood Lake during 2007 (See Figure 11). Highest numbers of zooplankton were observed during spring and late summer. A rapid decline in zooplankton occurred during the April through early June period. The decline is attributed to fish predation, particularly by the newly hatched young of year fish class. The data suggest fish predation kept the lake's zooplankton numbers relatively low during June through mid-August. Zooplankton numbers increased rapidly in late summer. The late summer increase is attributed to the increase in lake fertility occurring in mid-August. The increase corresponded with an increase in total phosphorus and chlorophyll *a* concentrations and phytoplankton numbers occurring shortly after two major rainstorms conveyed stormwater runoff to the lake.

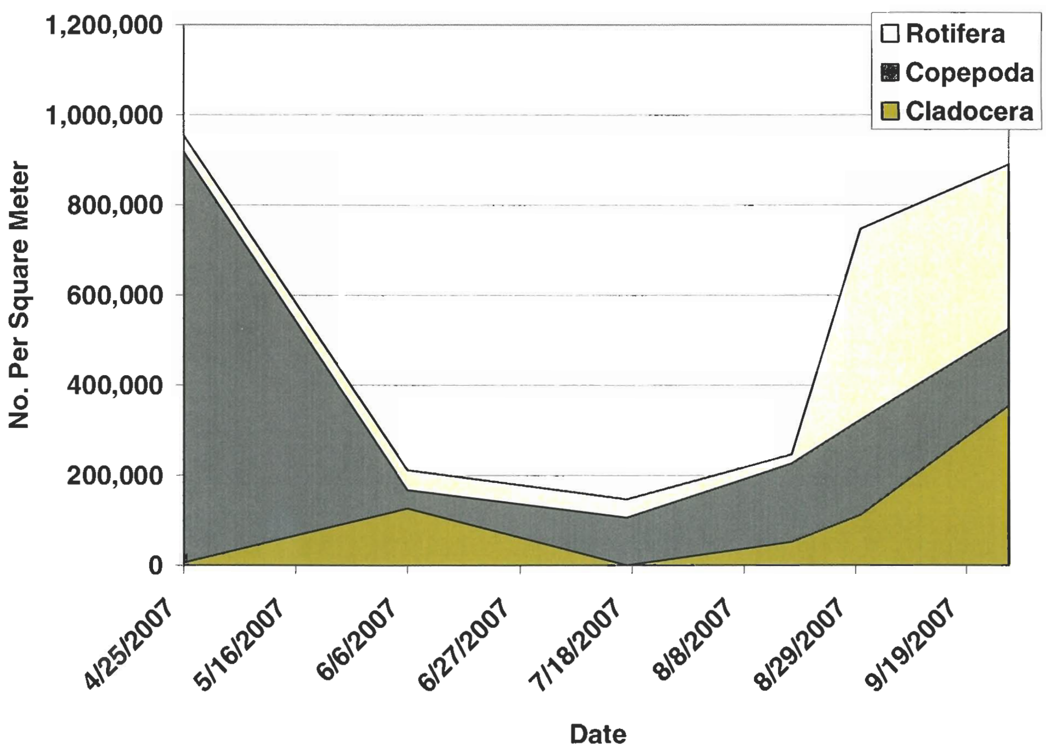


Figure 11 2007 Westwood Lake Zooplankton Data Summary by Division

4.5.3 Macrophytes

Vegetation (submerged and floating leaf) was found throughout the lake and emergent plants were present along the entire shore. A total of 10 species were found in June and 7 species were found in August. Submerged vegetation densities ranged from light to heavy. Although nearly all of the plants were native species, two non native species, purple loosestrife (*Lythrum salicaria*) and curlyleaf pondweed (*Potamogeton crispus*) were present. Both species are undesirable because they displace native species and provide a poorer quality habitat than native species. Curlyleaf pondweed dies off in late June or early July and, hence, was not observed in the August survey. In June, densest areas of curlyleaf pondweed were found in the center of the lake. Sporadic growths of purple loosestrife were found along the edge of the lake mixed with cattail (See Figures 12 and 13).

4.6 Conclusions

- Water quality status of Westwood Lake was eutrophic (nutrient rich) to hypereutrophic (very nutrient rich) during the 2007 growing season.

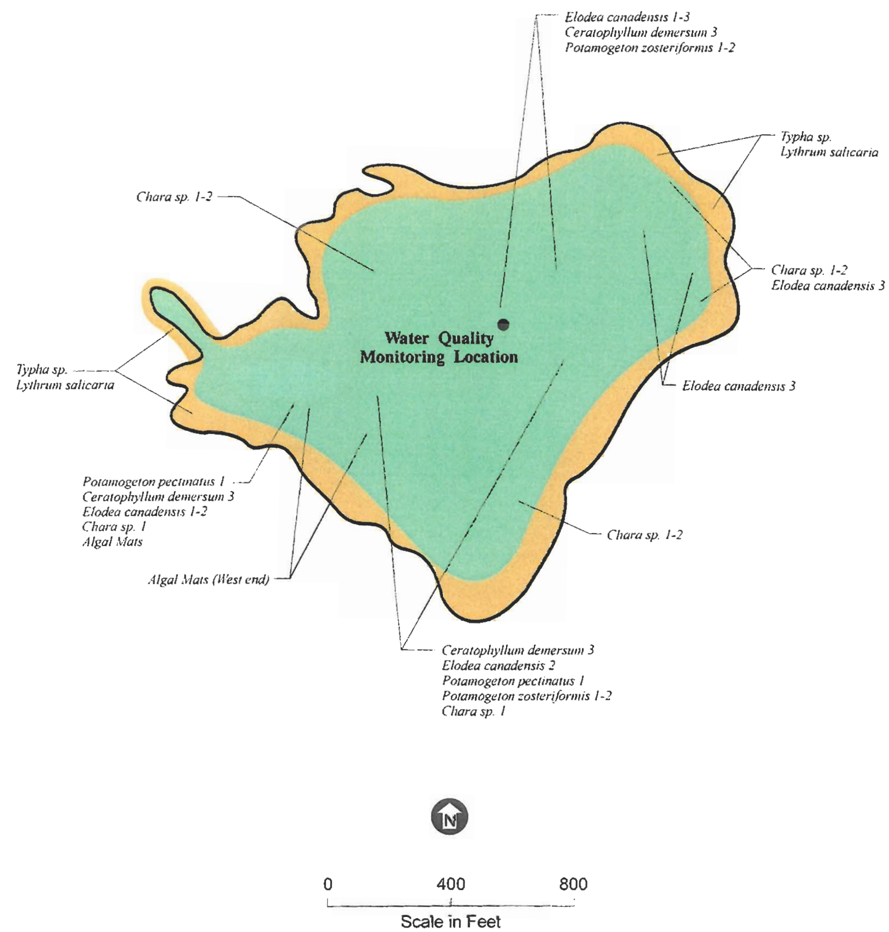
- Vegetation (submerged and floating leaf) was found throughout the lake and emergent vegetation was present along the entire shoreline.

- Westwood Lake is classified as a Level II water body—meaning its water quality should support all recreational activities, except full body contact activities. Recreational activities for these water bodies include: sail boating, water skiing, motor boating, canoeing, wind surfing, and jet skiing. Level II goals are (1) Maximum total phosphorus concentration of 45 µg/L, (2) maximum chlorophyll *a* concentration of 20 µg/L, and (3) Minimum Secchi disc transparency of 1.4 meters (4.6 feet). In 2007, the lake's summer average chlorophyll *a* concentration of 11.6 µg/L attained the BCWMC's goal for Westwood Lake. The lake's summer average total phosphorus concentration of 47 µg/L and the lake's average summer Secchi disc transparency of 1.3 meters did not attain the BCWMC's goal for the lake, but both were very close (i.e., phosphorus within 2 µg/L and Secchi disc within 0.14 meters or 0.5 feet of the goal).

- Historical records indicate the lake's water quality has improved since 1977. Average summer total phosphorus concentrations have declined from 340 µg/L in 1977 to 47 µg/L in 2007. Average summer chlorophyll *a* concentrations have declined from 50 µg/L in 1982 to 12 µg/L in 2007. Average summer Secchi disc transparency has increased from 0.8 meters in 1977 to 1.3 meters in 2007. Despite the water quality improvements occurring during the period of record, the lake

- Macrophytes found throughout entire water body.
- Macrophyte densities estimated as follows: 1 = light; 2 = moderate; 3 = heavy.
- Sporadic growths of *Lythrum salicaria* (Purple loosestrife) along edge of lake mixed with *Typha sp.* (Cattail).
- Submerged plant growth near center, mostly *Ceratophyllum demersum* (Coontail).

	Common Name	Scientific Name
Submerged Aquatic Plants:	Flatstem pondweed Sago pondweed Coontail Elodea Muskgrass	*Potamogeton zosteriformis* *Potamogeton pectinatus* *Ceratophyllum demersum* *Elodea canadensis* *Chara sp.*
Floating Leaf:		
Emergent:	Cattail Purple loosestrife	*Typha sp.* *Lythrum salicaria*
No Aquatic Vegetation Found:		

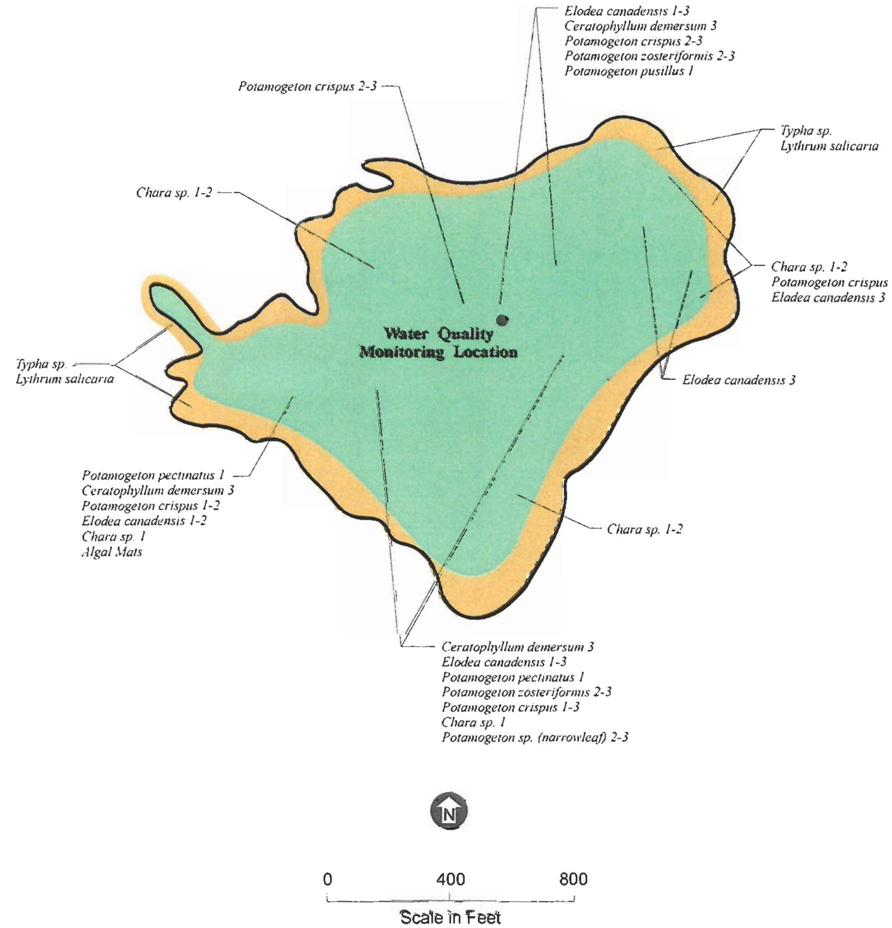


WESTWOOD LAKE
August 14, 2007

P:\Mpls\23 MN\27\23270511\MovedFromMpls P\Lake Macrophyte Maps\Westwood\1997\Westwood Lake August 2007 CDR RLG 01-31-08

- Macrophytes found throughout entire water body.
- Macrophyte densities estimated as follows: 1 = light; 2 = moderate; 3 = heavy.
- More dense areas of *Potamogeton crispus* (Curly leaf pondweed) in center of lake.
- Sporadic growths of *Lythrum salicaria* (Purple loosestrife) along edge of lake mixed with *Typha sp.* (Cattail).

	Common Name	Scientific Name
Submerged Aquatic Plants:	Flatstem pondweed	*Potamogeton zosteriformis*
	Sago pondweed	*Potamogeton pectinatus*
	Coontail	*Ceratophyllum demersum*
	Elodea	*Elodea canadensis*
	Muskgrass	*Chara sp.*
	Curly leaf pondweed	*Potamogeton crispus*
	Narrowleaf pondweed	*Potamogeton sp. (narrowleaf)*
	Small pondweed	*Potamogeton pusillus*
Floating Leaf:		
Emergent:	Cattail	*Typha sp.*
	Purple loosestrife	*Lythrum salicaria*
No Aquatic Vegetation Found:		



WESTWOOD LAKE
June 3, 2007

P:\Mpls\23 MN\27\23270511\MovedFromMpls P\Lake Macrophyte Maps\Westwood\1997\Westwood Lake June 2007 CDR RLG 01-31-08 continues to be rich in nutrients due to the impacts of stormwater runoff from its urbanized watershed. BCWMC's Level II goal attainment during the period of record was 58 percent for total phosphorus, 83 percent for chlorophyll *a*, and 8 percent for Secchi disc transparency. Although the BCWMC's goal for Secchi disc transparency was only attained during 2001, average summer values were within 0.2 meters or 0.7 feet of the goal about 75 percent of the time.

5.0 References

Bassett Creek Water Management Commission. 1993. *Draft Water Quality Management Plan.*

Bassett Creek Water Management Commission. 1995a. *Westwood Lake Watershed and Lake Management Plan.*

Bassett Creek Water Management Commission. 1995b. *Crane Lake Watershed and Lake Management Plan.*

Bassett Creek Water Management Commission. 1997. *1997 Lake Water Quality Study: Crane Lake, Lost Lake, and Westwood Lake.*

Bassett Creek Water Management Commission. 2004. *Water Quality Management Plan.*

Metropolitan Council Environmental Services. 2007. 2000-2007 Westwood Lake CAMP Data.

Osgood, R., A. 1989a. *An evaluation of Lake and Stream Monitoring Programs in the Twin Cities Metropolitan Area.* Metropolitan Council Publication No. 590-89-128.

Osgood, R., A. 1989b. *1989 Study of the Water Quality of 20 Metropolitan Area Lakes.* Metropolitan Council Publication No. 590-89-130.

Osgood, R. A. 1989c. *Assessment of Lake Use-Impairment in the Twin Cities Metropolitan Area.* Metropolitan Council Publication No. 590-89-130.

Ridgedale Center. 1977. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center November 1975-October 1976*

Ridgedale Center. 1978. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January 1977-December 1977*

Ridgedale Center. 1979. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January 1978-December 1978*

Ridgedale Center. 1980. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1979*

Ridgedale Center. 1981. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1980*

Ridgedale Center. 1982. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1981*

Ridgedale Center. 1983. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1982*

Ridgedale Center. 1984. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1983*

Ridgedale Center. 1985. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1984*

Ridgedale Center. 1986. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1985*

Ridgedale Center. 1987. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1986*

Ridgedale Center. 1988. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1987*

Ridgedale Center. 1989. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1988*

Ridgedale Center. 1990. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1989*

Ridgedale Center. 1991. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1990*

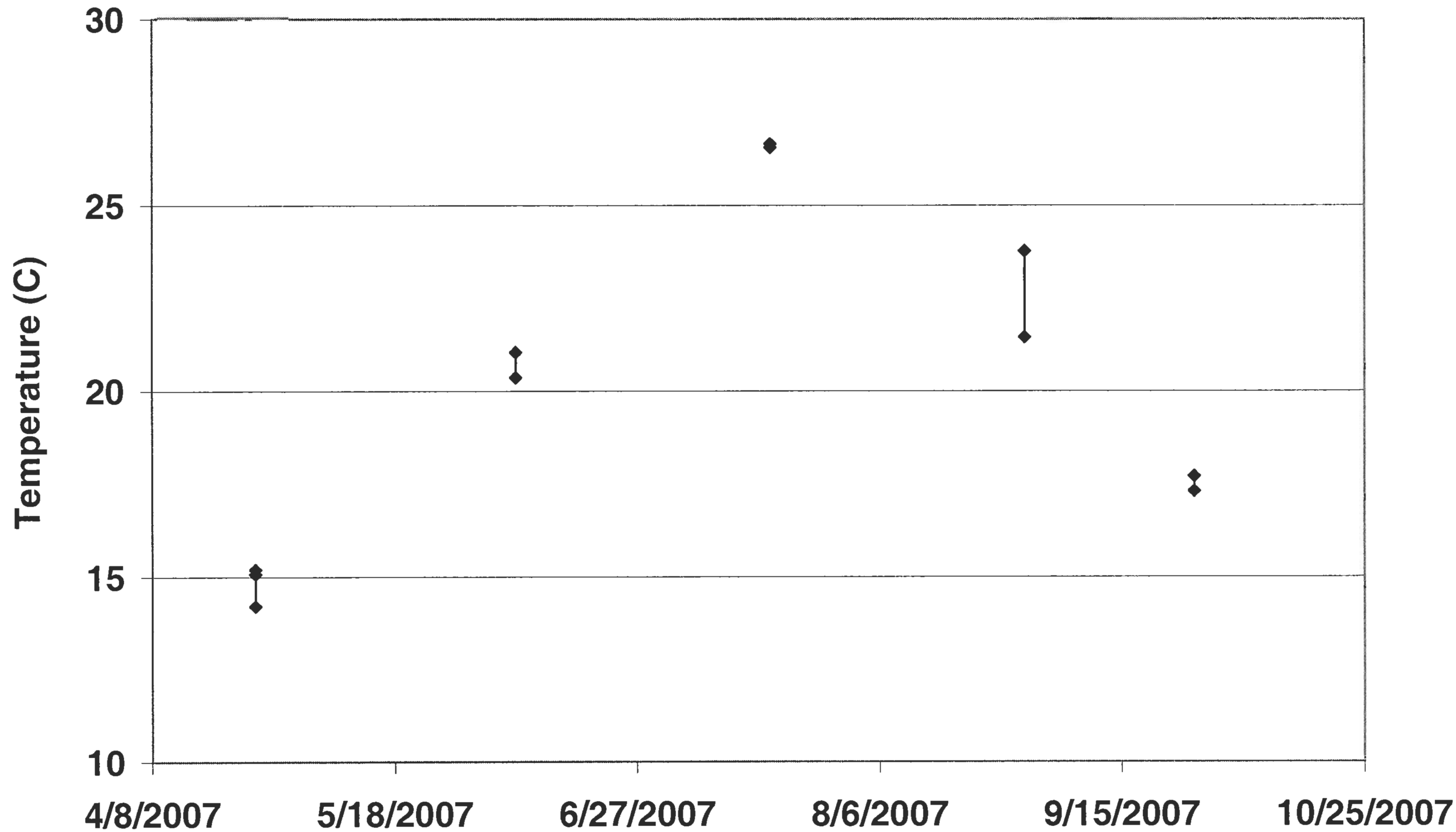
Ridgedale Center. 1992. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1991*

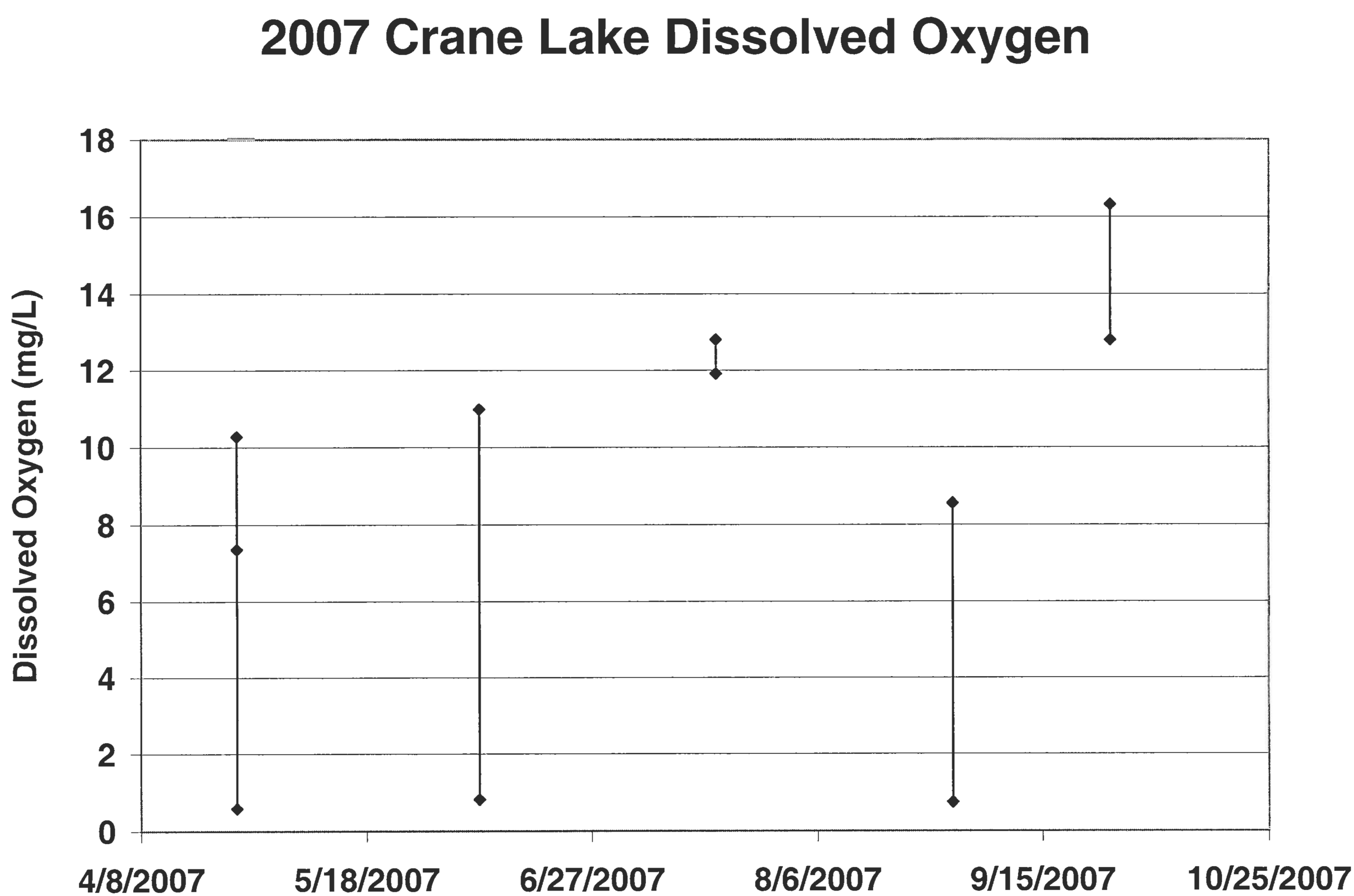
Ridgedale Center. 1995. *Water Quality Monitoring of Stormwater Treatment Facilities – Ridgedale Center January-December 1994*

Appendix A

Crane Lake Data

2007 Crane Lake Temperature





2007 Crane Lake Dissolved Oxygen
Dissolved Oxygen (mg/L)
18
16
14
12
10
8
6
4
2
0
4/8/2007
5/18/2007
6/27/2007
8/6/2007
9/15/2007
10/25/2007

2007 Crane Lake

Date	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	D. O. (mg/L)	% D. O.	Temp (°C)	Sp. Cond. (mS/cm @ 25°C)	Total P (µg/L)	SRP (µg/L)	Total Nitrogen (mg/L)	pH (S.U.)
04/25/07	0	1.05	9.1	--	--	--	--	65.6	1.03	0.874	--
	0.5		--	10.28	102.6	15.2	1.004	--	--	--	7.47
	1.1		--	7.36	73.3	15.08	1.004	--	--	--	7.35
	1.2		--	0.59	5.8	14.21	1.056	--	--	--	7.18
06/07/07	0	0.90	40.3	--	--	--	--	123.9	4	1.02	--
	0.2		--	10.99	123.7	21.04	0.984	--	--	--	8.11
	0.8		--	0.82	9.1	20.36	1.005	--	--	--	7.22
07/19/07	0	0.80	5.4	--	--	--	--	49.4	13.37	1.014	--
	0.5		--	12.81	160.4	26.65	1.338	--	--	--	8.71
	1.0		--	11.92	148.9	26.56	1.336	--	--	--	8.61
08/17/07	0	0.85	14.1	--	--	--	--	70.3	9.47	0.59	--
08/30/07	0	1.04	8.7	--	--	--	--	46.2	7.26	0.67	--
	0.2		--	8.56	157.3	23.77	1.05	--	--	--	8.52
	1.0		--	0.75	16.8	21.45	1.46	--	--	--	7.51
09/27/07	0	1.00	7.8	--	--	--	--	39.1	5.35	0.781	7.76
	0.6		--	12.8	134.6	17.7	0.721	--	--	--	7.84
	1.1		--	16.32	170.3	17.3	0.72	--	--	--	

Appendix B

Crane Lake Biota Data

CRANE LAKE

0-2 METERS
STANDARD INVERTED MICROSCOPE ANALYSIS METHOD

DIVISION	TAXON	4/25/2007 units/mL	6/7/2007 units/mL	7/19/2007 units/mL	8/17/2007 units/mL	8/30/2007 units/mL	9/27/2007 units/mL
CHLOROPHYTA (GREEN ALGAE)	*Ankistrodesmus falcatus*	115	0	0	0	0	0
	Ankistrodesmus Brauni	0	0	0	0	0	0
	Chlamydomonas globosa	8,788	8,203	1,493	747	230	689
	Coelastrum microporum	0	0	0	0	0	0
	Crucigenia sp.	0	0	0	0	0	0
	Lagerheimia sp.	0	0	0	0	0	0
	Oocystis parva	0	0	0	0	0	0
	Pandorina morum	0	0	0	0	0	0
	Rhizoclonium hierglyphicum	115	0	0	0	0	0
	Schroederia Judayi	0	558	57	0	0	0
	Scenedesmus sp.	0	0	0	0	0	0
	Selenastrum minutum	689	0	0	0	0	0
	Sphaerocystis Schroeteri (Colony)	0	0	0	57	0	0
	Tetraedron minimum	0	0	0	0	0	0
	Tetraedron muticum	0	0	0	0	0	0
	CHLOROPHYTA TOTAL	**9,707**	**8,761**	**1,551**	**804**	**230**	**689**
CHRYSOPHYTA (YELLOW-BROWN ALGAE)							
	CHRYSOPHYTA TOTAL	**0**	**0**	**0**	**0**	**0**	**0**
CYANOPHYTA (BLUE-GREEN ALGAE)							
	Anabaena affinis	0	0	57	0	0	0
	Anabaena flos-aquae	0	0	0	0	0	0
	Aphanizomenon flos-aquae	0	0	57	0	0	0
	Coelosphaerium Naegelianum	0	0	0	0	0	0
	Merismopedia tenuissima	0	0	0	0	0	0
	Merismopedia sp.	0	0	0	0	0	0
	Microcystis aeruginosa	0	0	0	0	57	0
	Microcystis incerta	0	80	0	0	115	0
	Oscillatoria Agardhii	0	0	57	0	0	57
	Oscillatoria limnetica	115	0	632	115	57	230
	Phormidium mucicola	0	0	0	459	0	0
	CYANOPHYTA TOTAL	**0**	**80**	**115**	**0**	**172**	**0**
BACILLARIOPHYTA (DIATOMS)							
	Asterionella formosa	0	0	0	0	0	0
	Cocconeis placentula	57	0	0	0	0	0
	Cymbella sp.	57	80	0	0	0	0
	Fragilaria capucina	57	80	0	0	0	0
	Fragilaria crotonensis	172	0	0	0	0	0
	Gomphonema olivaceum	115	80	0	0	115	0
	Melosira granulata	0	21,504	0	0	0	0
	Navicula sp.	287	0	0	0	0	0
	Nitzschia sp.	0	0	0	0	0	0
	Stephanodiscus Hantzschii	0	319	0	0	0	0
	Stephanodiscus sp.	0	159	0	0	0	0
	Synedra ulna	345	159	115	115	57	57
	Unidentified Diatom	115	0	0	0	0	0
CRYPTOPHYTA (CRYPTOMONADS)							
	BACILLARIOPHYTA TOTAL	**1,091**	**22,380**	**115**	**115**	**172**	**57**
	Cryptomonas erosa	16,542	14,973	6,777	2,872	2,872	3,504
EUGLENOPHYTA (EUGLENOIDS)							
	CRYPTOPHYTA TOTAL	**16,542**	**14,973**	**6,777**	**2,872**	**2,872**	**3,504**
PYRRHOPHYTA (DINOFLAGELLATES)							
	EUGLENOPHYTA TOTAL	**0**	**0**	**0**	**0**	**0**	**0**
	Ceratium hirundinella	0	0	0	0	0	0
	Peridinium cinctum	0	0	0	0	0	0
	PYRRHOPHYTA TOTAL	**0**	**0**	**0**	**0**	**0**	**0**
	TOTALS	**27,339**	**46,194**	**8,558**	**3,791**	**3,446**	**4,250**

CRANE LAKE

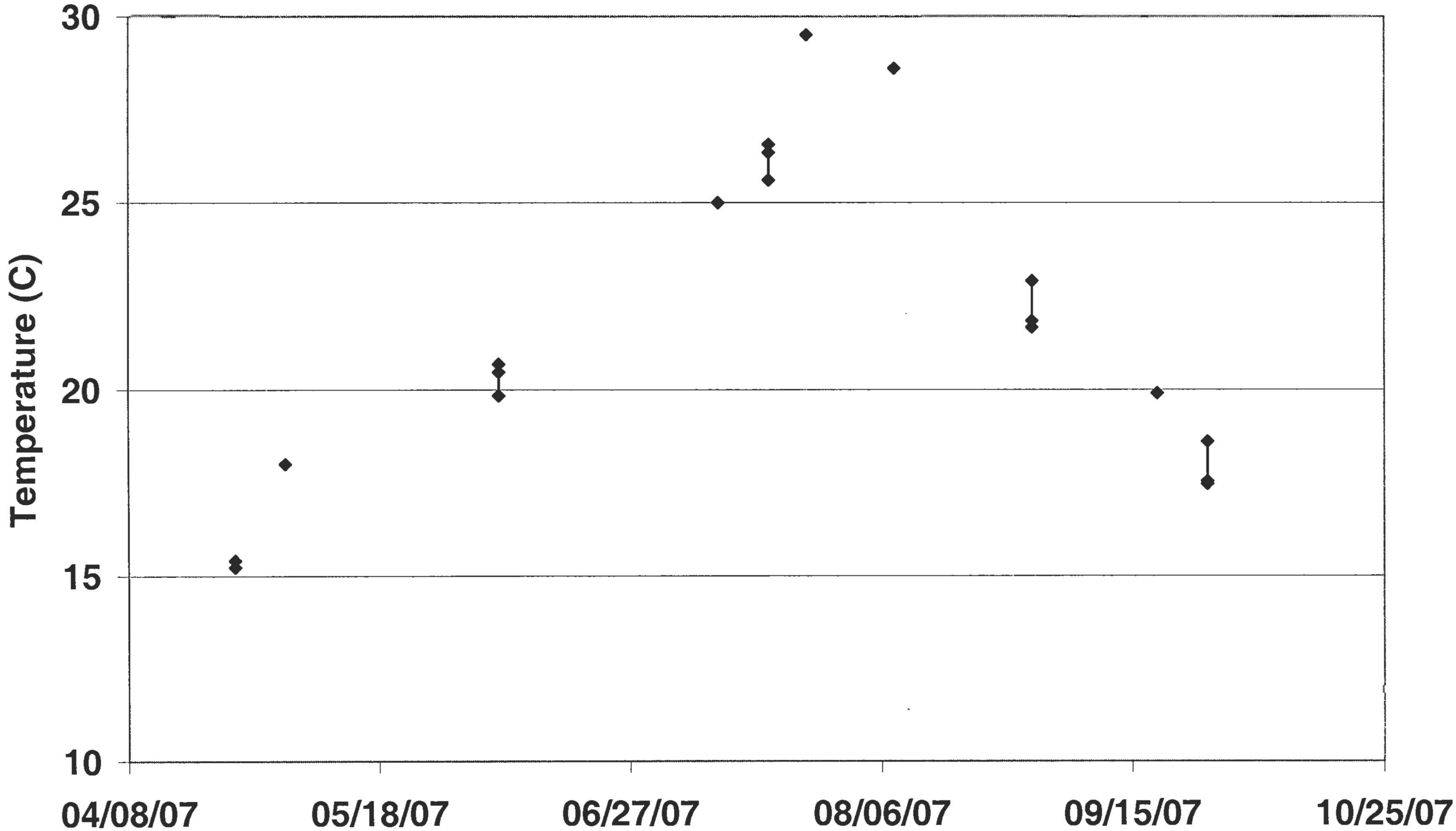
ZOOPLANKTON ANALYSIS

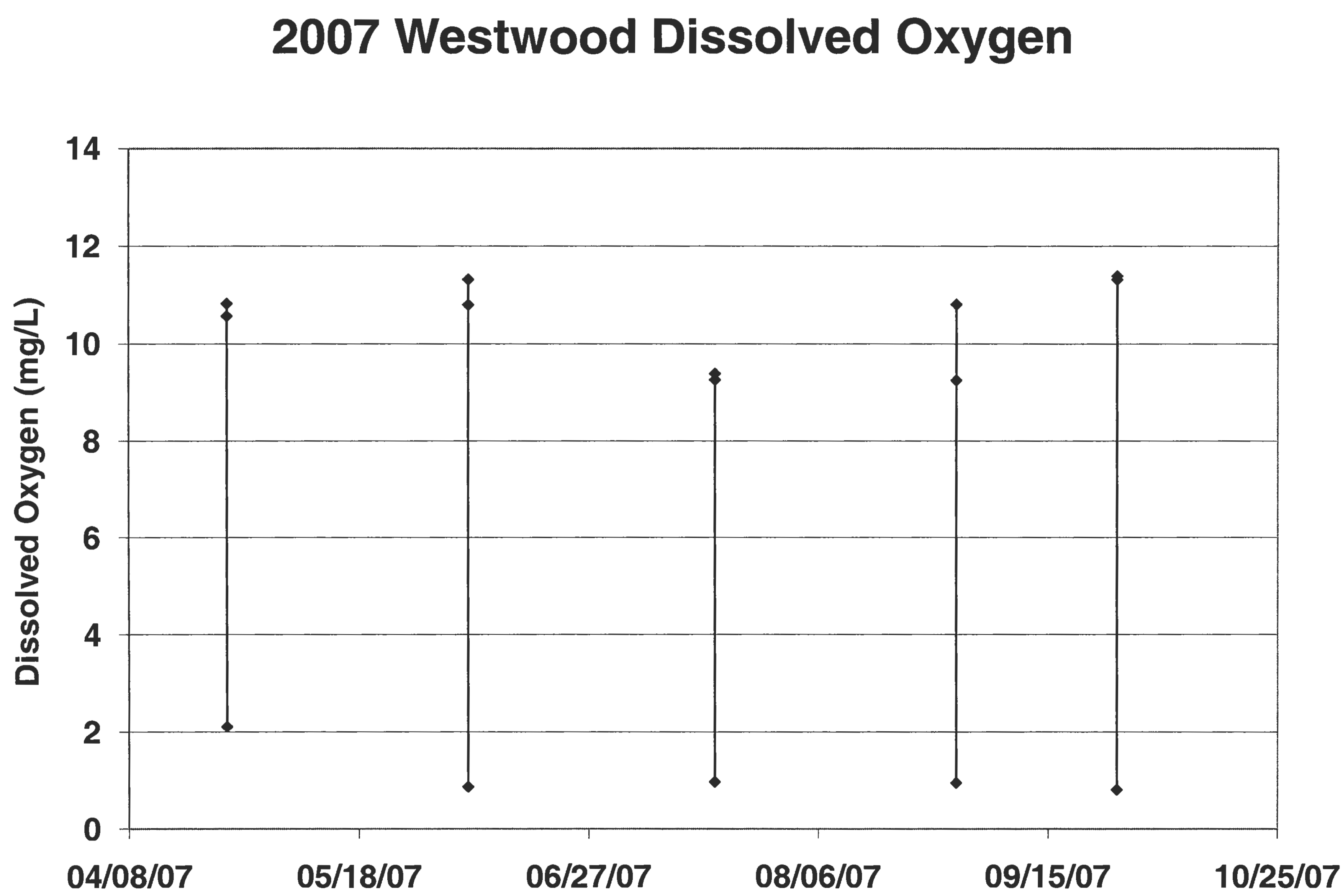
DIVISION	TAXON	Vertical Tow (m) 04/25/07 #/m2	06/06/07 #/m2	07/17/07 #/m2	8/17/2007 #/m2	8/30/2007 #/m2	9/27/2007 #/m2
CLADOCERA	*Bosmina longirostris*	24,934	95,493	17,772	153,849	33,157	133,690
	Ceriodaphnia sp.	4,156	15,915	47,393	15,915	59,683	203,010
	Chydorus sphaericus	4,156	31,831	0	0	0	4,951
	Daphnia galeata mendotae	41,557	31,831	35,545	10,610	0	9,903
	Daphnia pulex	16,623	0	0	0	0	0
	Daphnia retrocurva	0	0	0	0	0	0
	Diaphanosoma leuchtenbergianum	0	0	0	53,052	0	0
	Immature Cladocera	0	7,958	0	0	0	0
	CLADOCERA TOTAL	**91,425**	**183,028**	**100,709**	**233,427**	**92,840**	**351,555**
COPEPODA	*Cyclops sp.*	303,366	55,704	71,089	10,610	13,263	44,563
	Diaptomus sp.	0	0	0	0	0	0
	Nauplii	116,360	206,901	171,799	5,305	99,472	69,321
	COPEPODA TOTAL	**419,726**	**262,605**	**242,888**	**15,915**	**112,734**	**113,884**
ROTIFERA	*Asplanchna priodonta*	0	0	0	37,136	0	0
	Brachionus havanaensis	0	0	0	0	0	
	Filinia longiseta	0	0	0	0	0	0
	Keratella cochlearis	12,467	0	0	0	19,894	0
	Keratella quadrata	0	7,958	0	0	0	0
	Keratella serrulata	0	0	0	0	0	0
	Kellicottia bostoniensis.	4,156	0	0	0	0	0
	Lecane sp.	4,156	0	0	0	0	0
	Polyarthra vulgaris	0	79,577	11,848	21,221	33,157	311,943
	Trichocerca multicrinis	0	0	0	0	6,631	4,951
	Immature Unidentified Rotifer	0	0	0	0	0	0
	ROTIFERA TOTAL	**20,779**	**87,535**	**11,848**	**58,357**	**59,683**	**316,894**
	TOTALS	**531,930**	**533,168**	**355,445**	**307,699**	**265,258**	**782,333**

Appendix C

Westwood Lake Data

2007 Westwood Temperature




2007 Westwood Dissolved Oxygen
Dissolved Oxygen (mg/L)
14
12
10
8
6
4
2
0
04/08/07
05/18/07
06/27/07
08/06/07
09/15/07
10/25/07

2007 Westwod Lake

Date	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	D. O. (mg/L)	% D. O.	Temp (°C)	Sp. Cond. (mS/cm @ 25°C)	Total P (µg/L)	SRP (µg/L)	Total Nitrogen (mg/L)	pH (S.U.)
4/25/2007[1]	0	1.70	6.1	--	--	--	--	33.1	0.01	1.032	--
	0.453		--	10.83	108.5	15.42	0.441	--	--	--	7.6
	1.043		--	10.57	105.9	15.42	0.441	--	--	--	7.6
	1.688		--	2.11	21	15.24	0.469	--	--	--	7.15
4/25/2007[2]	0.5	1.6	6.2	--	--	15.5	--	36	--	--	--
5/3/2007[2]	0.5	1.7	1.8	--	--	18	--	37	--	--	--
6/6/2007[1]	0	1.67	4.5	--	--	--	--	45	2.16	1.101	--
	0.216		--	11.32	126.3	20.69	0.303	--	--	--	9.23
	1.018		--	10.8	120	20.48	0.307	--	--	--	9.12
	1.671		--	0.87	9.5	19.84	0.379	--	--	--	7.79
6/13/2007[2]	0.5	1.5	3.7	--	--	--	--	--	--	--	--
6/28/2007[2]	0.5	1.6	4.4	--	--	--	--	28.0	--	--	--
7/11/2007[2]	0.5	1.5	7.3	--	--	25	--	44.0	--	--	--
7/19/2007[1]	0	1.31	14.0	--	--	--	--	51.1	14.55	1.408	--
	0.364		--	9.39	117	26.55	0.428	--	--	--	8.61
	1.042		--	9.26	115	26.34	0.429	--	--	--	8.66
	1.246		--	0.97	11.8	25.6	0.497	--	--	--	7.77
7/25/2007[2]	0.5	1.0	14.0	--	--	29.5	--	29	--	--	--
8/08/2007[2]	0.5	0.9	17.0	--	--	28.6	--	33	--	--	--

2007 Westwod Lake

Date	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	D. O. (mg/L)	% D. O.	Temp (°C)	Sp. Cond. (mS/cm @ 25°C)	Total P (µg/L)	SRP (µg/L)	Total Nitrogen (mg/L)	pH (S.U.)
8/17/2007[1]	0	0.90	27.2	--	--	--	--	81.1	9.06	1.46	--
8/30/2007[1]	0	1.00	12.5	--	--	--	--	62.7	6.64	1.48	--
	0.342		--	10.81	146.3	22.92	0.4086	--	--	--	8.55
	1.049		--	9.25	122.8	21.85	0.4074	--	--	--	8.68
	1.347		--	0.95	13	21.68	0.4752	--	--	--	8.14
9/19/2007[2]	0.5	1.1	--	--	--	19.9	--	40	--	--	--
9/27/2007[1]	0		12.6	--	--	--	--	41.1	4.47	1.484	--
	0.524	1.10	--	11.32	121.1	18.6	0.344	--	--	--	8.22
	1.098		--	11.39	119.1	17.46	0.342	--	--	--	8.26
	1.534		--	0.81	8.5	17.53	0.365	--	--	--	8.13

[1]BCWMC Monitoring Program (Sampled by Three Rivers Park District)
[2]Citizen Assisted Monitoring Program (CAMP)

Appendix D

Westwood Lake Biota Data

WESTWOOD LAKE

SURFACE

STANDARD INVERTED MICROSCOPE ANALYSIS METHOD

DIVISION	TAXON	4/25/2007 units/mL	6/6/2007 units/mL	7/17/2007 units/mL	8/17/2007	8/30/2007 units/mL	9/27/2007 units/mL
CHLOROPHYTA (GREEN ALGAE)	*Ankistrodesmus falcatus*	1,551	0	57	0	0	0
	Ankistrodesmus Brauni	0	0	0	0	0	0
	Chlamydomonas globosa	7,294	2,183	1,034	115	11,372	862
	Coelastrum microporum	0	0	0	0	0	0
	Crucigenia sp.	0	0	0	0	0	0
	Lagerheimia sp.	0	0	0	0	0	0
	Oocystis parva	0	0	0	0	0	0
	Pandorina morum	0	0	0	0	0	0
	Schroederia Judayi	0	0	0	0	0	0
	Scenedesmus quadricauda	0	0	0	0	57	0
	Scenedesmus sp.	172	0	57	0	0	0
	Selenastrum minutum	230	0	57	287	115	57
	Sphaerocystis Schroeteri (Colony)	0	0	0	0	0	0
	Tetraedron minimum	0	0	57	0	0	0
	Tetraedron muticum	0	0	0	0	57	0
	CHLOROPHYTA TOTAL	**9,247**	**2,183**	**1,264**	**402**	**11,602**	**919**
CHRYSOPHYTA (YELLOW-BROWN ALGAE)	**CHRYSOPHYTA TOTAL**	**0**	**0**	**0**	**0**	**0**	**0**
CYANOPHYTA (BLUE-GREEN ALGAE)	*Anabaena affinis*	0	0	172	0	57	0
	Anabaena flos-aquae	0	0	0	0	0	0
	Aphanizomenon flos-aquae	0	0	0	0	57	57
	Coelosphaerium Naegelianum	0	0	0	0	0	0
	Cylindrospermopsis raciborski	0	0	0	0	57	0
	Merismopedia tenuissima	0	0	0	919	574	0
	Merismopedia sp.	0	0	0	0	0	0
	Microcystis aeruginosa	0	0	632	10,281	862	632
	Microcystis incerta	230	115	287	1,608	2,240	1,953
	Oscillatoria Agardhii	0	0	0	0	0	0
	Oscillatoria limnetica	0	0	230	459	0	172
	Phormidium mucicola	0	230	0	57	0	0
	CYANOPHYTA TOTAL	**230**	**115**	**1,091**	**12,808**	**3,848**	**2,642**
BACILLARIOPHYTA (DIATOMS)	*Asterionella formosa*	0	0	0	0	0	0
	Cocconeis placentula	0	230	172	57	57	0
	Cymbella sp.	57	0	0	0	0	0
	Cymatopleura solea	0	0	57	0	0	0
	Fragilaria capucina	0	0	0	0	0	0
	Gomphonema olivaceum	0	57	0	57	0	57
	Melosira granulata	0	0	0	0	0	0
	Navicula sp.	230	172	0	0	0	0
	Nitzschia sp.	0	0	0	0	0	0
	Stephanodiscus Hantzschii	57	0	0	115	0	0
	Stephanodiscus sp.	0	0	0	0	115	0
	Synedra ulna	459	402	0	115	0	57
	Unidentified Diatom	0	0	172	0	0	0
	BACILLARIOPHYTA TOTAL	**804**	**862**	**230**	**345**	**172**	**115**
CRYPTOPHYTA (CRYPTOMONADS)	*Cryptomonas erosa*	7,639	2,987	2,240	689	2,010	1,206
	CRYPTOPHYTA TOTAL	**7,639**	**2,987**	**2,240**	**689**	**2,010**	**1,206**
EUGLENOPHYTA (EUGLENOIDS)	**EUGLENOPHYTA TOTAL**	**0**	**0**	**0**	**0**	**0**	**0**
PYRRHOPHYTA (DINOFLAGELLATES)	*Ceratium hirundinella*	0	0	0	0	0	0
	Peridinium cinctum	57	0	57	0	0	0
	PYRRHOPHYTA TOTAL	**57**	**0**	**57**		**0**	**0**
	TOTALS	**17,977**	**6,146**	**4,882**	**14,244**	**17,633**	**4,882**

WESTWOOD LAKE

ZOOPLANKTON ANALYSIS

DIVISION	TAXON / Vertical Tow (m)	04/25/07 #/m2	06/06/07 #/m2	07/17/07 #/m2	8/17/2007 #/m2	8/30/2007 #/m2	9/27/2007 #/m2
CLADOCERA	*Bosmina longirostris*	5,128	121,753	0	10,257	22,282	205,309
	Ceriodaphnia sp.	0	0	0	10,257	11,141	11,406
	Chydorus sphaericus	0	0	0	10,257	66,845	102,655
	Daphnia galeata mendotae	0	4,509	0	10,257	0	0
	Daphnia pulex	0	0	0	0	0	0
	Daphnia retrocurva	0	0	0	0	0	0
	Diaphanosoma leuchtenbergianum	0	0	0	10,257	0	0
	Immature Cladocera	0	0	0	0	11,141	34,218
	CLADOCERA TOTAL	**5,128**	**126,263**	**0**	**51,283**	**111,408**	**353,588**
COPEPODA	*Cyclops sp.*	384,624	0	32,538	0	33,422	22,812
	Diaptomus sp.	0	4,509	0	10,257	22,282	0
	Nauplii	528,216	36,075	73,211	164,106	155,971	148,279
	COPEPODA TOTAL	**912,840**	**40,584**	**105,749**	**174,363**	**211,676**	**171,091**
ROTIFERA	*Asplanchna priodonta*	15,385	0	0	0	0	0
	Brachionus havanaensis	0	0	0	0	89,127	
	Filinia longiseta	0	0	0	0	11,141	0
	Keratella cochlearis	20,513	22,547	16,269	20,513	267,380	125,467
	Keratella quadrata	0	13,528	0	0	0	0
	Keratella serrulata	0	0	0	0	0	0
	Kellicottia bostoniensis.	0	0	8,135	0	22,282	0
	Lecane sp.	0	9,019	8,135	0	11,141	22,812
	Polyarthra vulgaris	0	0	8,135	0	22,282	205,309
	Trichocerca multicrinis	0	0	0	0	0	11,406
	Immature Unidentified Rotifer	0	0	0	0	0	0
	ROTIFERA TOTAL	**35,898**	**45,094**	**40,673**	**20,513**	**423,351**	**364,994**
	TOTALS	**953,866**	**211,941**	**146,422**	**246,159**	**746,435**	**889,674**