Savage Lake

Lake Status Report

Prepared for
Ramsey-Washington Metro Watershed District

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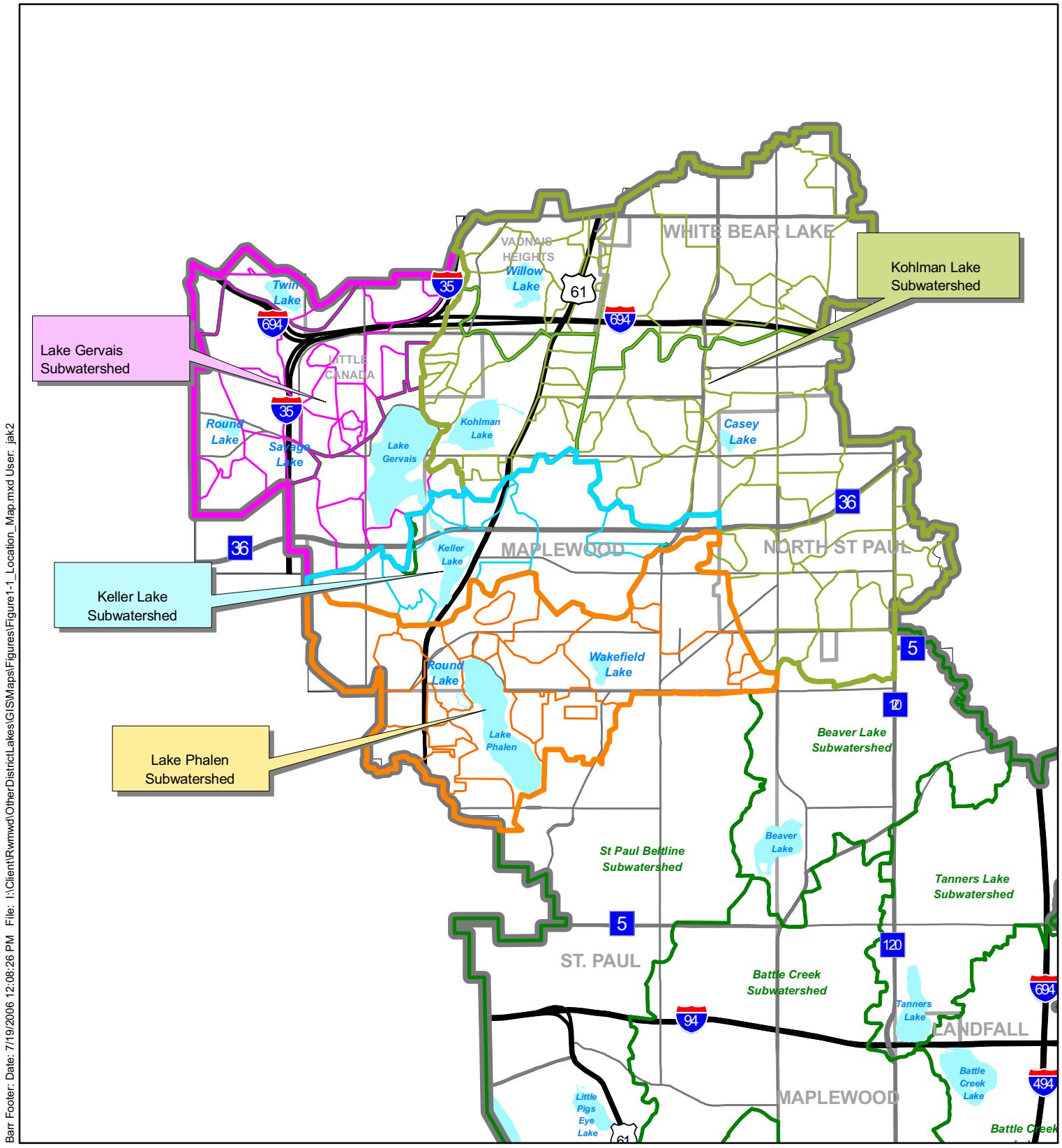
1.0 Introduction

One of the primary goals of the Ramsey-Washington Metro Watershed District (District) is to maintain or improve the quality of surface waters to meet or exceed the water quality necessary to support the District's designated beneficial uses. In 1997 the District established beneficial use categories based on desired recreational activities for a waterbody; and revisited again with the 2006 update as part of the development of the *Ramsey-Washington Metro Watershed District Watershed Management Plan* (Plan) (Barr, 1997; Barr, 2006 [draft]),. The recreational-use categories are ranked from Level 1 through Level 5, with Level 1 water bodies having the highest number of recreational uses and best water quality.

In order to help achieve desired water quality goals established in Plan, many of the lakes within the District have been studied in Strategic Lake Management Plans (SLMPs). However, for many of the smaller lakes within the District, SLMPs have not yet been completed and District water quality goals have not been re-evaluated. Because of limited lake information and water quality data, the development of a complete SLMP would not be possible for many of these small water bodies. Instead, a Lake Status Report (LSR) will be developed and recommendations will be made to outline future studies for these lakes.

The purpose of this LSR is to summarize and evaluate the available information for Savage Lake which has not been previously studied and to determine appropriate water quality goals based on the current and desired recreational uses, as outlined in the Plan, and through discussion with District staff. The watershed areas tributary to Savage Lake has already been modeled as part of the development of the larger Phalen Chain of Lakes SLMP (Barr, 2004 [Draft]). Figure 1-1 shows the location of Savage Lake.

The Plan (Barr, 2006 [draft]) includes preliminary water quality goals and management classes for each of the District-managed lakes. The water quality goals are defined in terms of total phosphorus (TP), chlorophyll *a* (Chl *a*), and Secchi disc (SD). The goals outlined in the Plan will remain preliminary until an SLMP or other similar study, such as this LSR, is completed and appropriate goals are determined. The preliminary goals are consistent with either the Minnesota Pollution Control Agency's (MPCA) proposed draft criteria for shallow lakes in the North Central Hardwood Forests (CHF) ecoregion (MPCA, 2005), or the goals listed in the 1997 Plan.



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Feet
6,000 0 6,000

Figure 1-1

Location Map

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For lakes, the District management classes are identified as either "Improvement" or "Prevent further degradation." An "Improvement" class is warranted if the public perceives a need for water quality improvement and there are feasible management options that will accomplish water quality improvement. A "Prevent further degradation" class is assigned when current water quality meets the goals set for the lake. A "Prevent further degradation" class does not, however, imply inaction. Rather, development requirements, fisheries, shoreline, and macrophyte management; as well as additional water quality improvement projects; are pursued for the lake as opportunities and budgets allow.

For wetlands, the District has developed management Classes A, B, and C, based on a recent inventory and assessment of wetlands within the District. The wetland classification is based on the estimated quality of the wetland, with management Class A being the highest quality wetlands. Water bodies classified as "Water Quality Pond" are constructed treatment ponds only.

Additional classifications of the water bodies based on water quality include the Impaired Waters List under Section 303(d) of the *Federal Clean Water Act* (CWA). Those water bodies that do not meet the water quality standards established under the CWA are included on this list and future development of total maximum daily loads (TMDL) is required. The Minnesota Department of Natural Resources (MDNR) has developed another ecological management classification system for Minnesota lakes (Schupp, 1992) that is based on parameters such as lake size, depth, chemical fertility, and growing season length.

Table 1-1 summarizes the goals and classifications of Savage Lake. Note that for District-managed wetlands there are no water quality goals established. Additionally, note that the 2006 Preliminary RWMWD Water Quality Goals are those listed in the Plan (Barr, 2006 [draft]). The 2006 Proposed RWMWD Water Quality Goals are the result of this LSR and evaluation of the information available for the Lake.

Table 1-1 Summary of RWMWD Recreational-Use Level (2006 Draft Plan), Preliminary RWMWD Water Quality Goals (2006 Draft Plan), Proposed RWMWD Goals (Result of LSR), and Management Class (2006 Draft Plan) as well as 303(d) Impaired Waters and MDNR Ecological Management Class

Water Body	RWMWD Use Level	2006 Preliminary RWMWD Water Quality Goal	2006 Proposed RWMWD Water Quality Goal	RWMWD Management Class	303(d) Impaired Waters Pollutant	MDNR Ecological Class
Savage Lake	N/A	N/A	N/A	Wetland Management Class B (West of 35E)/C (East of 35E)	N/A	N/A

2.0 Lake Status Summary

2.1 Savage Lake

2.1.1 Lake and Watershed Characteristics

2.1.1.1 Description of Savage Lake

Savage Lake is located just south of the intersection of Little Canada Road and Interstate Highway 35E (I-35E) in Little Canada (Township 29, Range 22, Sections 6&7), and is actually bisected by I-35E. Because it is divided by the highway, the eastern and western basins of the lake are connected by a pipe that flows from the west basin into the southwest corner of the eastern basin.

Although called a lake, Savage Lake is actually a 27-acre wetland, as it is not classified as lacustrine under the Cowardin system (Cowardin, 1979) used by the District to categorize waterbodies as lakes or wetlands. For this reason, it is considered a district-managed water body rather than a district-managed lake. It is also classified as Protected Public Water in the MDNR Public Waters Inventory (62-8P/62-147W). The West Savage Lake is 17.4 acres while East Savage Lake is 9.6 acres.

The maximum depth of the western portion of Savage Lake is 5.9 feet, while in the eastern portion the maximum depth recorded is 5.7 feet. Approximate bathymetric contours have been created using lake survey data gathered by the District in 2002 and can be seen in Figure 2-1. The primary outlets of both basins are located on the respective eastern shores. The outlet from West Savage Lake is a 30-inch pipe. The outlet of East Savage Lake was replaced in 2004 and is currently an 18-inch RCP with a flared-end section and an overflow riser pipe. The new outlet established a NWL of 894.1 feet MSL. However, at this elevation, residents felt that water levels in Savage Lake were too low. In order to raise the NWL, permission from the MDNR and all adjacent property owners was obtained. In 2006, a wall was constructed in the riser of the outlet structure that raised the NWL to 895.1 feet MSL. Figure 2-2 shows East and West Savage Lake as well as the primary outlet located in the east basin.

The critical 100-year flood elevation was determined to be 896.5 feet MSL during the development of the District *Watershed Management Plan* (Barr, 1997; Barr, 2006 [draft]) although with the increase in the NWL, the extent of the critical 100-yr flood elevation has likely changed and additional modeling will be required to determine the new elevation. Figure 2-3 shows the extent of the 100-year critical flood for Savage Lake.

2.1.1.2 Watershed Characteristics

The Savage Lake watershed (including the lake surface area) covers a 253-acre area south of Little Canada Road and east of Rice Street. It discharges to Gervais Creek and is part of the larger Gervais Lake watershed. Institutional and low-density residential land uses are the major land uses with the breakdown within the watershed as follows: Commercial (3.3%), High-density residential (7.3%), Highway (6.5%), Institutional (20.2%), Low-density residential (48.3%), Natural/Park/Open (4.1%), and Open water (10.3%). Savage Lake is included in the open water land use category. See Figure 2-4 for a map of the watershed land uses.

Drainage from the watershed flows to the east. There are four storm sewer outfalls into the western basin of Savage Lake and one outfall identified on the east basin (per the District survey, 2002). The drainage pattern in the watershed can be seen in Figure 2-5.

2.1.1.3 Recreational-Uses

Because it is actually a wetland, the District has not assigned a recreational use category to the Lake and the current Plan has no recreational uses listed. The city of Little Canada's Nadeau Wildlife Area is adjacent to the southwest shore of the western basin of Savage Lake. It is a 5-acre wetland with diverse vegetation providing wildlife habitat and educational opportunities, and the City of Little Canada has recently shown interest in wetlands management in relation to the Nadeau Wildlife Area.

Comments made during a meeting with local residents indicated that people do paddle and canoe on Savage Lake. Visits to Savage Lake indicated that residents along the lake may also use the lake for fishing. Residents of Savage Lake have received lake information from the District regarding their lake concerns and many residents have interest in learning more.

Legend

Depth

- 0 - 1 ft
- 1 - 2 ft
- 2 - 3 ft
- 3 - 4 ft
- 4 - 5 ft
- 5+ ft

N

Feet

250 0 250

Figure 2-1

Savage Lake
Approximate Bathymetry

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(a)

(b)

(c)

Figure 2-2
East Savage Lake (a), West Savage Lake (b), and the Primary Outlet of Savage Lake at the time of installation (c) (Photos (a) and (b) taken August 2006, Photo (c) taken February 2004)

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Legend

Flood Elevation = 896.5 ft MSL

N

Feet

200 0 200

Figure 2-3

Savage Lake
Critical Flood Elevation

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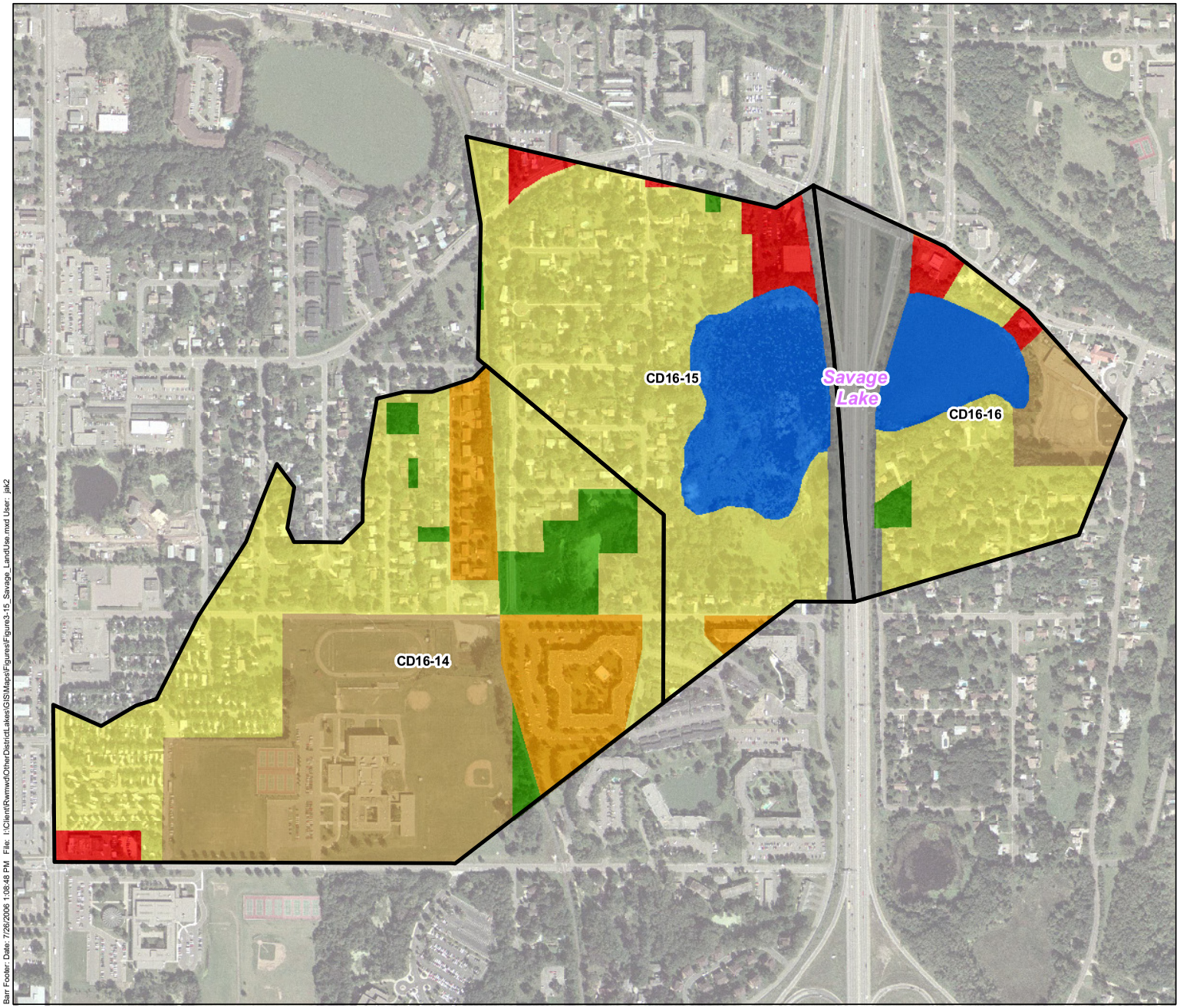

Legend

Land Use

- Commercial
- Highway
- High-Density Residential
- Institutional
- Office/Industrial
- Low-Density Residential
- Natural/Park/Open
- Open Water
- Savage Lake Subwatersheds

N

Feet
500 0 500

Figure 2-4

Savage Lake Watershed
Land Use

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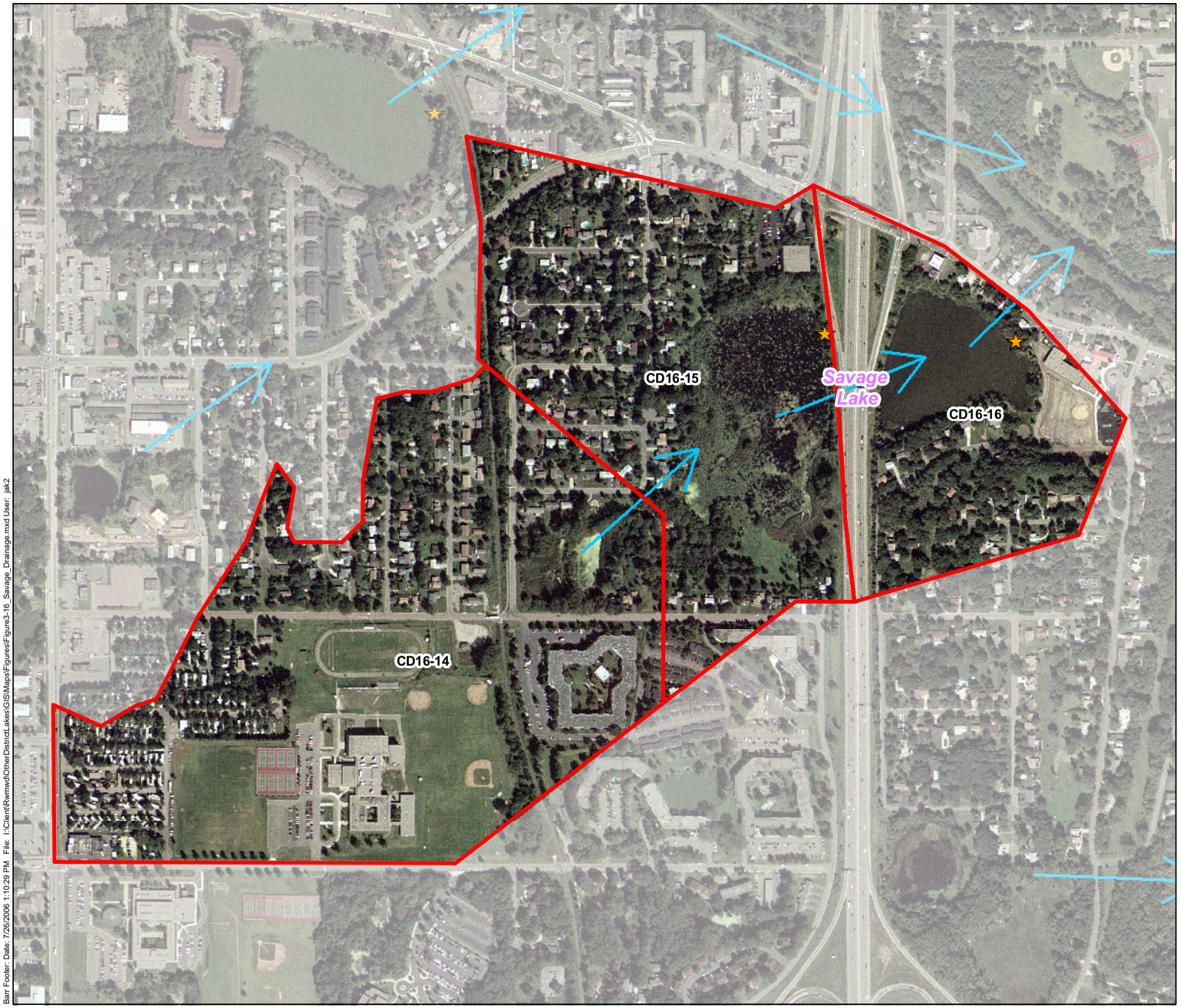

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- Savage Lake Subwatersheds
- Primary Outlet
- Flow Direction

Feet
500 0 500

Figure 2-5

Savage Lake Watershed
Subwatersheds and Drainage

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2.1.2 Water Quality Data

2.1.2.1 Water Quality Analysis

There is no water quality data for Savage Lake. Additionally, there is no information on fishery, macroinvertebrates, phytoplankton, or zooplankton.

2.1.2.2 P8 Modeling Results

The P8 Model of the Savage Lake watershed was run for wet, dry, and average climatic conditions. Water and total phosphorus loads to Savage Lake were determined for each climatic period. The results of this modeling are summarized in Table 2-1.

Table 2-1 P8 Estimated Watershed Runoff and TP Loads to Savage (East and West) Lake under Wet, Dry, and Average Climatic Conditions

Climatic Condition (Water Year)	Parameter		Load
Wet (10/1/01-9/30/02)	Flow	ac-ft	217.45
	TP	lbs	154.12
Average (10/1/00-9/30/01)	Flow	ac-ft	252.98
	TP	lbs	144.58
Dry (10/1/88-9/30/89)	Flow	ac-ft	161.22
	TP	lbs	109.08

It is important to note that climatic condition periods were selected based on depths of precipitation over a 17-month period that included the summer before the water year of interest because it is assumed that the water and TP load to the lake during this period affects the following year's spring TP concentration. During the 12-month period from October through September (the water year), however, the water load to the lake was slightly higher during the average year than the wet year. Conversely, the TP load was higher in the wet year than in the average year over this 12-month period due to the fact that higher TP loading is often associated with the smaller, more frequent storm events like the ones that occurred between October 2001 and September 2002.

2.1.3 Recommendations

2.1.3.1 Water Quality Goals

As previously mentioned, Savage Lake is actually not a district-managed lake but rather a wetland. Therefore, no preliminary District water quality goals have been established for Savage Lake. In

general, the District's approach to managing wetlands is to achieve no net loss of acreage, function, and value.

According to the District's wetlands management classification, the western portion of Savage Lake falls into Management Class B while the eastern basin is Management Class C (Barr, 2006 [draft]). Wetlands under Management Class B are considered high-quality wetlands that should be protected from development and other pressures of increased use, including indirect effects. This classification requires the maintenance of natural buffers to help retain wetland function as well as stormwater pretreatment (Minimum = 25 feet, Average = 50 feet). Wetlands in Management Class C are lower quality, less significant wetlands than those in Management Class B, although still requiring stormwater pretreatment and protective buffers (Minimum = 12.5 feet, Average = 25 feet).

The Minnesota Lake Eutrophication Analysis Procedure (MINLEAP) is a screening tool for estimating lake conditions and for identifying "problem" lakes. In addition, MINLEAP modeling has been done in the past to identify Minnesota Lakes which may be better or worse than they "should be" based on their location, watershed area and lake basin morphometry.

Results from MINLEAP analysis suggest that the expected water quality in a minimally impacted lake, similar to Savage Lake (based on its location within the Central Hardwood Forest ecoregion and with its basic basin and watershed characteristics), would be expected to be within the following ranges for TP, Chl *a*, and SD; respectively: 47 to 88 µg/L, 13 to 49 µg/L, and 0.6 to 1.4 meters.

2.1.3.2 Recreational-Use Level

Because the Nadeau Wildlife Area is adjacent to Savage Lake, recreational-uses of Savage Lake should include canoeing, picnicking, and aesthetic and wildlife viewing. There are also educational opportunities available in the park area. However, because Savage Lake is actually a District-managed wetland, it is not assigned a District recreational-use level.

2.1.3.3 Further Studies

If the District identifies water quality in Savage Lake as a high priority, the first recommendation would be to collect additional lake information, including concurrent water quality, macrophyte, and fishery data, as there is currently no data available for Savage Lake related to these parameters.

3.0 Conclusions

In summary, there is little information available with regards to water quality, macrophytes, and fisheries for Savage Lake, which is actually managed as a District wetland. Because of limited information, updated District water quality management goals cannot be established. Table 3-1 below summarizes the proposed District recreational-use levels, water quality goals, and management classes based on evaluation of the data available for each lake.

Table 3-1 Summary of the Proposed RWMWD Recreational-Use Level, Water Quality Goals, and Management Class

Water Body	RWMWD Use Level	2006 RWMWD Water Quality Goal	RWMWD Management Class
Savage Lake	N/A	N/A	Wetland Management Class B/C

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