

4.4. Lake Eloise

Background

Physical and chemical characteristics specific to Lake Eloise are presented here in the context of relevant regulatory criteria and requirements (Photo 4-4). Lake Eloise (WBID 1521B) is located in the WHCL Southern Chain and is hydrologically connected to lakes Lulu, Summit, Winterset and Little Lake Eloise via constructed canals (Figure 4-13). Canals to lakes Winterset and Lulu are navigable. Lake Eloise was initially declared verified impaired based on elevated TSI values (>40), indicating a nutrient impairment in 2005. Later in 2005, a paleolimnological review of Lake Eloise supported the decision to remove the lake from the impaired list based on the evidence that the lake was historically eutrophic and assigned a revised TSI threshold of 60. In 2010, Lake Eloise was again declared verified impaired based on elevated TSI values (>60), indicating a nutrient impairment. A TMDL is required for Lake Eloise to calculate load reductions necessary to satisfy the TSI criteria. The TP, TN, and chlorophyll *a* geometric mean for Lake Eloise for the period of 1997 to 2007 and corresponding EPA NNC water quality targets are listed in Table 4-7. To comply with the NNC, concentration reductions of 17 percent for TP, 18 percent for TN, and 39 percent for chlorophyll *a* are required.

A summary of water quality statistics for Lake Eloise is presented in Table 4-8. In June 1975, point source discharges to Lake Eloise from Cypress Gardens WWTF were eliminated. The point source discharge resulted in the annual addition of approximately 30 kg TP and 85 kg TN to the lake. Recently, *Hydrilla* eradication treatment projects have been completed within the lake. In 2007, 100 percent of the lake surface area was reported to have been treated for *Hydrilla* infestation. The median chlorophyll *a*, TN and TP concentrations exceed the NNC targets provided by EPA for Lake Eloise. Chlorophyll *a* concentrations in Lake Eloise have fluctuated but have remained consistently elevated above 20 µg/L (Figure 4-14). A statistically significant trend in chlorophyll *a* concentrations from 1983 to 2007 was not observed (seasonal Kendall-Tau, $p > 0.10$). No water quality improvement projects have been implemented in Lake Eloise to restore water quality. Lake Eloise is located adjacent to Lake Lulu which discharges water directly to the Wahneta Farms Drain Canal. Therefore, water quality improvements in the lake would result in benefits to one lake farther downstream.

The Lake Eloise watershed is 843 acres in size and includes 711 acres (84 percent) of developed lands compared to 132 acres (16 percent) of undeveloped lands (Table 4-7). The 2000-2007 median color value (15 PCU) was below 40 PCU indicating the lake is a clear (non-colored) lake and specific conductivity data indicate the lake is alkaline. The lake area, perimeter, water depth, and volume statistics are based on a water level elevation of 129 feet in June 2007. Bathymetry data are available for Lake Eloise for the June 2007 water level elevation (Figure 4-15). A water level of 130 feet was reported in July 2010, reflecting a 1.0 foot increase in water elevation when compared to 2007. The subsequent changes in overall surface area, water depth, and volume of the lake should be considered during the development and implementation of water quality restoration projects.

Water Quality Restoration Project Selection and Priorities

Based on Lake Eloise water quality and the surrounding watershed characteristics, four potential water quality restoration projects were identified using the WHCL WQMP (Figure 4-16). The decision key presents the factors on which yes/no decisions were based and used to identify and select water quality improvement projects. Projects to address water quality, nutrient and sediment loading, and reduced lake levels are proposed. The projects are listed in order of priority, based on expected water quality improvements. A detailed discussion of the potential water quality restoration implications for each project can be found in Section 3.0.

- Project 1: Stormwater Infiltration Areas (SIAs)
- Project 2: Sediment Removal/Inactivation
- Project 3: SAV Planting/Management or FTWs
- Project 4: EAV Planting/Management

Lake-Specific Restoration Projects

Table 4-7. Physical, chemical, and regulatory characteristics of Lake Eloise.

Physical			
Location in chain	Southern	High infiltration soils (acres)	683 (81 percent)
Relation to other lakes	Adjacent to Terminal	Developed land (acres)	711 (84 percent)
Watershed area (acres)	843	Undeveloped land (acres)	132 (16 percent)
Lake area (acres)*	1,170	Median water depth (feet)*	9.9
Perimeter (feet)*	42,551	Maximum water depth (feet)*	17.8
Surface area to lake volume ratio*	0.09	Volume (acre-feet)*	12,645
Watershed to surface area ratio*	0.72		
Water Chemistry			
Locally-derived: acidic or alkaline	Alkaline	Clear or colored	Clear
Geometric mean chlorophyll <i>a</i> (ug/L)	33	NNC chlorophyll <i>a</i> target (ug/L)	20
Geometric mean TN (mg/L)	1.23	NNC TN target (mg/L)	1.00
Geometric mean TP (mg/L)	0.036	NNC TP target (mg/L)	0.030
Regulatory Data			
Impaired	Yes	TMDL status	Required
Chlorophyll <i>a</i> trend	No trend**	TP concentration reduction required	17 percent

*at a water level elevation of 129 feet

**presented in section 5.0

Photo 4-4. Lake Eloise



Table 4-8. Lake Eloise water quality summary for 1997 to 2007.

Parameter	N	Minimum	Median	Maximum
Chlorophyll <i>a</i> (µg/L)	47	12	31	83
Color (PCU)	35	5	15	50
Conductivity (µmhos/cm)	30	230	267	346
Dissolved oxygen (mg/L)	30	6.7	9.04	13.45
pH	30	7.27	8.18	9.47
Secchi depth (feet)	50	1.3	2.2	5.3
Total nitrogen (mg/L)	50	0.38	1.32	1.78
Total phosphorus (mg/L)	44	0.004	0.038	0.108

Figure 4-13. Lake Eloise and associated watershed.

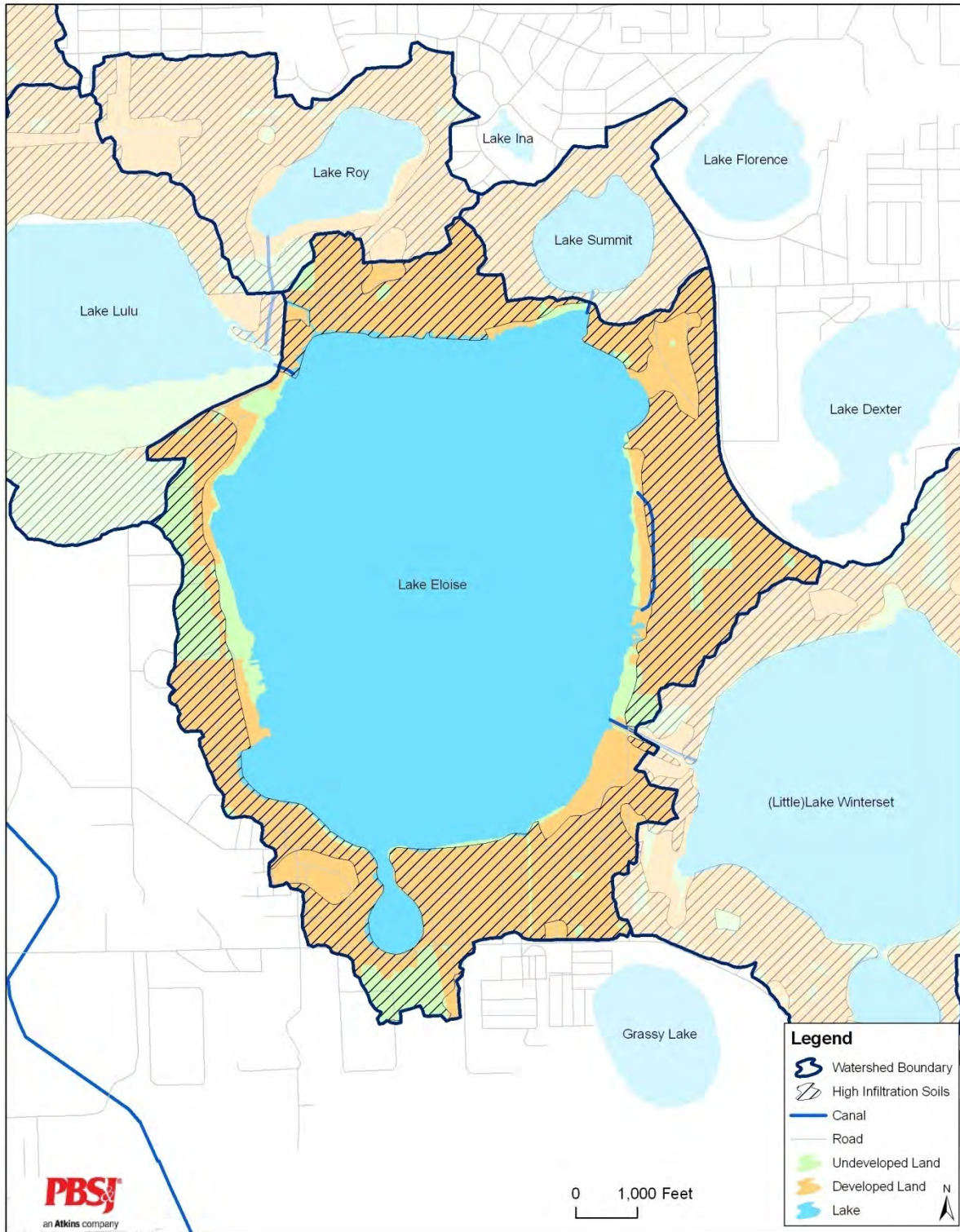


Figure 4-14. Lake Eloise chlorophyll a concentrations and *Hydrilla* treatment history using available data from 1983 to 2007.

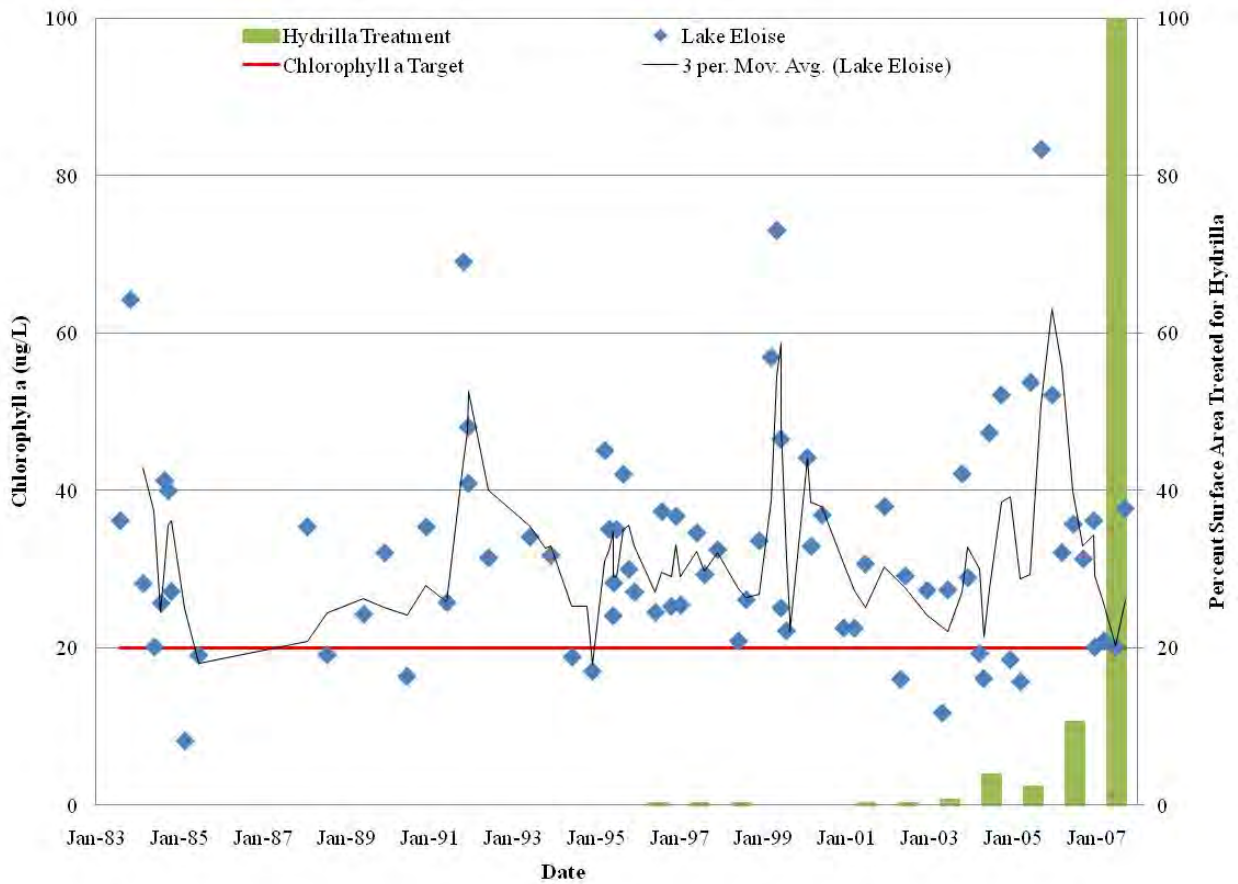
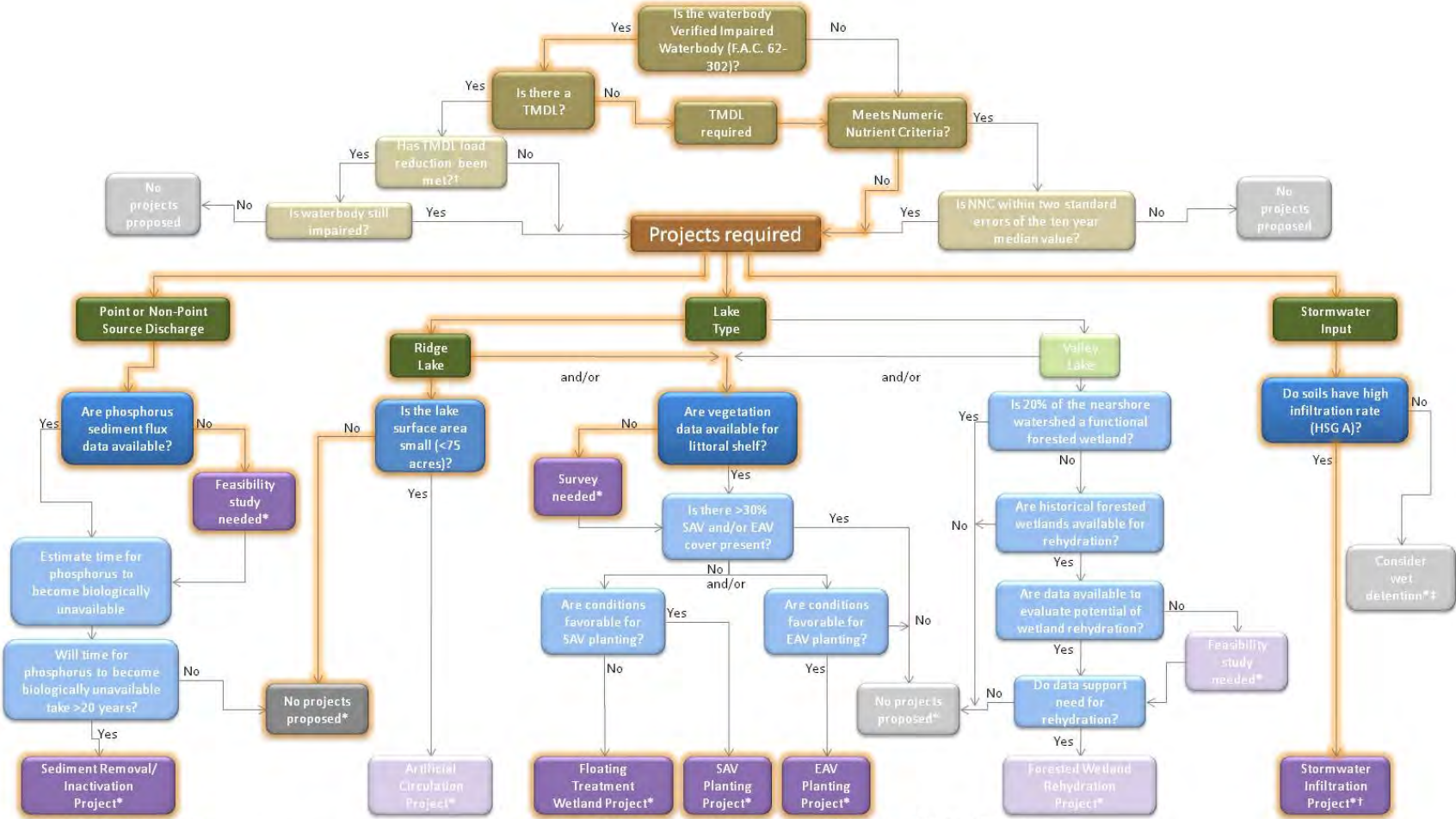


Figure 4-15. Lake Eloise bathymetry (June 2007) at water level elevation = 129 feet (Polk County Water Atlas).



Figure 4-16. Lake Eloise decision key: highlighted path shows decision process.



*Consider alternative projects

‡Wet detention may also be required if sufficient area is unavailable for dry retention

† Stormwater Infiltration projects could satisfy required TMDL Load reduction

Project 1: Stormwater Infiltration Areas (SIAs)

The Lake Eloise watershed has approximately 683 acres (81 percent of the watershed) classified as high infiltration soils. Lake Eloise does not have a TMDL, therefore, SIA acres estimates were calculated using data from the PLRG (USF 2005). The SIA estimate for Lake Eloise was 10 acres (approximately one percent of the watershed) to meet a 31 percent PLRG. Acres of SIA estimated to meet the TP NNC were 6.4 (one percent of the watershed) for a 17 percent phosphorus reduction in Lake Eloise to meet its NNC. Eighty-one percent of the watershed is characterized by high infiltration soils; therefore, it may be feasible to satisfy the load reductions through SIA implementation.

Project 2: Sediment Removal/Inactivation

Historical point source discharges to Lake Eloise from the Cypress Gardens WWTF will require further evaluation of the potential internal phosphorus load from the lake bottom sediments. Presently, sufficient data are not available to evaluate the internal phosphorus load and calculate the phosphorus decay rate and the time at which the phosphorus will ultimately become biologically unavailable in the lake sediments. A feasibility study is required to determine whether sediment removal/inactivation is necessary to reduce internal phosphorus loads to the lake.

Cost Estimate: \$10,000.

Project 3: SAV Planting or FTWs

SAV Planting

In Lake Eloise, *Hydrilla* eradication has been completed over as much as 100 percent of the lake surface area attributing to the continued degradation in water quality. A survey of existing SAV cover in Lake Eloise is recommended due to the lack of sufficient data to calculate percent lake cover. Based on the results of the SAV survey, conclusions regarding SAV planting can be determined. If SAV cover is less than 30 percent, lake conditions should be evaluated to assess if additional SAV is viable based on the soil condition, water clarity and water depth. *Hydrilla* harvesting may be required for successful establishment of selected SAV plants.

SAV plants should not be planted in water depths greater than 2 feet based on the median secchi depth values. The median secchi depth from 1997-2007 in Lake Eloise was 2.2 feet. The maximum planting effort could result in vegetation cover of approximately 5 percent of the lake bottom (57 acres). Due to the extensive organic material located in Lake Eloise, it is recommended that SAV planting be performed after sediment removal/inactivation, if completed. If sediment removal is completed, the planting area would need to be recalculated using updated bathymetry data.

Cost Estimate: \$275,000 (estimate based on previous purchase and installation cost of \$0.90 per plant provided by EarthBalance®, additional funds included for maintenance).

FTWs

If the feasibility study indicates that more than 30 percent of Lake Eloise has SAV cover, FTW may be considered. The installation of floating mats with appropriate aquatic vegetation would be expected to assimilate nutrients from the water column.

Project 4: EAV Planting

A survey of existing shoreline vegetation surrounding Lake Eloise is recommended due to the lack of sufficient data at this time. Based on the results of the shoreline survey, conclusions and recommendations regarding emergent aquatic or woody vegetation planting can be determined. If limited shoreline vegetation is present, shoreline conditions should be evaluated to assess if vegetation planting is viable based on the soil conditions, slope, water level inundation frequency and wave disturbance.