

4.18. Lake Mirror

Background

Physical and chemical characteristics specific to Lake Mirror are presented here in the context of relevant regulatory criteria and requirements (Table 4-36). Lake Mirror (WBID 1521G) is located in the Southern Chain of the WHCL and is hydrologically connected to lakes Cannon and Spring via constructed navigable canals (Photo 4-21, Figure 4-73). In 2005, Lake Mirror was declared verified impaired based on elevated TSI values (>60). A TMDL was adopted for the Southern Chain of the WHCL, including Lake Mirror (FDEP 2007), and Lake Mirror was subsequently delisted from impairment by FDEP in 2010. Based on the modeled external TP load to Lake Mirror, a 27.5 percent reduction in TP load (15.9 kg TP/year) is required to comply with the TSI criteria of 60 (FDEP 2007). The TP, TN, and chlorophyll *a* geometric mean for Lake Mirror for the period of 1997 to 2007 and corresponding EPA NNC water quality targets are listed in Table 4-36. To comply with the NNC, concentration reductions of 44 percent for TP, 24 percent for TN, and 48 percent for chlorophyll *a* are required.

A summary of water quality statistics for Lake Mirror is presented in Table 4-37. The median recorded chlorophyll *a*, TN, and TP concentrations exceed the NNC targets provided by EPA for Lake Mirror. Chlorophyll *a* concentrations in Lake Mirror have fluctuated but have remained consistently elevated above 20 µg/L (Figure 4-74). 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 Mirror to restore water quality. *Hydrilla* eradication projects have been implemented in Lake Mirror treating greater than 40 percent of the lake surface area in some years. Lake Mirror is an intermediate lake so improvements in water quality of the lake could result in some benefit farther downstream.

The Lake Mirror watershed is 163 acres in size and includes 144 acres (88 percent) of developed lands compared to 19 acres (12 percent) of undeveloped lands. The 2000-2007 median color value (17 PCU) was below 40 PCU indicating it 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 December 2009. Bathymetry data are available for Lake Mirror for the December 2009 water level elevation (Figure 4-75). A water level of 130 feet was reported in July 2010, reflecting a 1.0 foot increase in water elevation when compared to 2009. 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 Mirror water quality and the surrounding watershed characteristics, four potential water quality restoration projects were identified using the WHCL WQMP decision key (Figure 4-76). 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.

Lake-Specific Restoration Projects

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

Table 4-36. Physical, chemical, and regulatory characteristics of Lake Mirror.

Physical			
Location in chain	Southern	High infiltration soils (acres)	138 (84 percent)
Relation to other lakes	Intermediate	Developed land (acres)	144 (88 percent)
Watershed area (acres)	163	Undeveloped land (acres)	19 (12 percent)
Lake area (acres)*	127	Median water depth (feet)*	10.7
Perimeter (feet)*	9,189	Maximum water depth (feet)*	13.6
Surface area: lake volume ratio*	0.12	Volume (acre-feet)*	1,045
Watershed to surface area ratio*	1.28		
Water Chemistry			
Locally-derived: acidic or alkaline	Alkaline	Clear or colored	Clear
Geometric mean chlorophyll <i>a</i> (µg/L)	38	NNC chlorophyll <i>a</i> target (µg/L)	20
Geometric mean TN (mg/L)	1.32	NNC TN target (mg/L)	1.00
Geometric mean TP (mg/L)	0.054	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	44 percent

*at a water level elevation of 129 feet
 **presented in section 5.0

† TMDL adopted

Photo 4-21. View of north shoreline of Lake Mirror.



Table 4-37. Lake Mirror water quality summary for 1997 to 2007.

Parameter	N	Minimum	Median	Maximum
Chlorophyll <i>a</i> (µg/L)	35	9	32	85
Color (PCU)	27	10	17	80
Conductivity (µmhos/cm)	25	190	209	240
Dissolved oxygen (mg/L)	25	6.68	8.73	11.34
pH	25	7.11	8.16	9.36
Secchi depth (feet)	38	0.9	2.1	4.4
Total nitrogen (mg/L)	38	0.86	1.41	2.24
Total phosphorus (mg/L)	34	0.006	0.040	0.080

Figure 4-73. Lake Mirror and associated watershed.

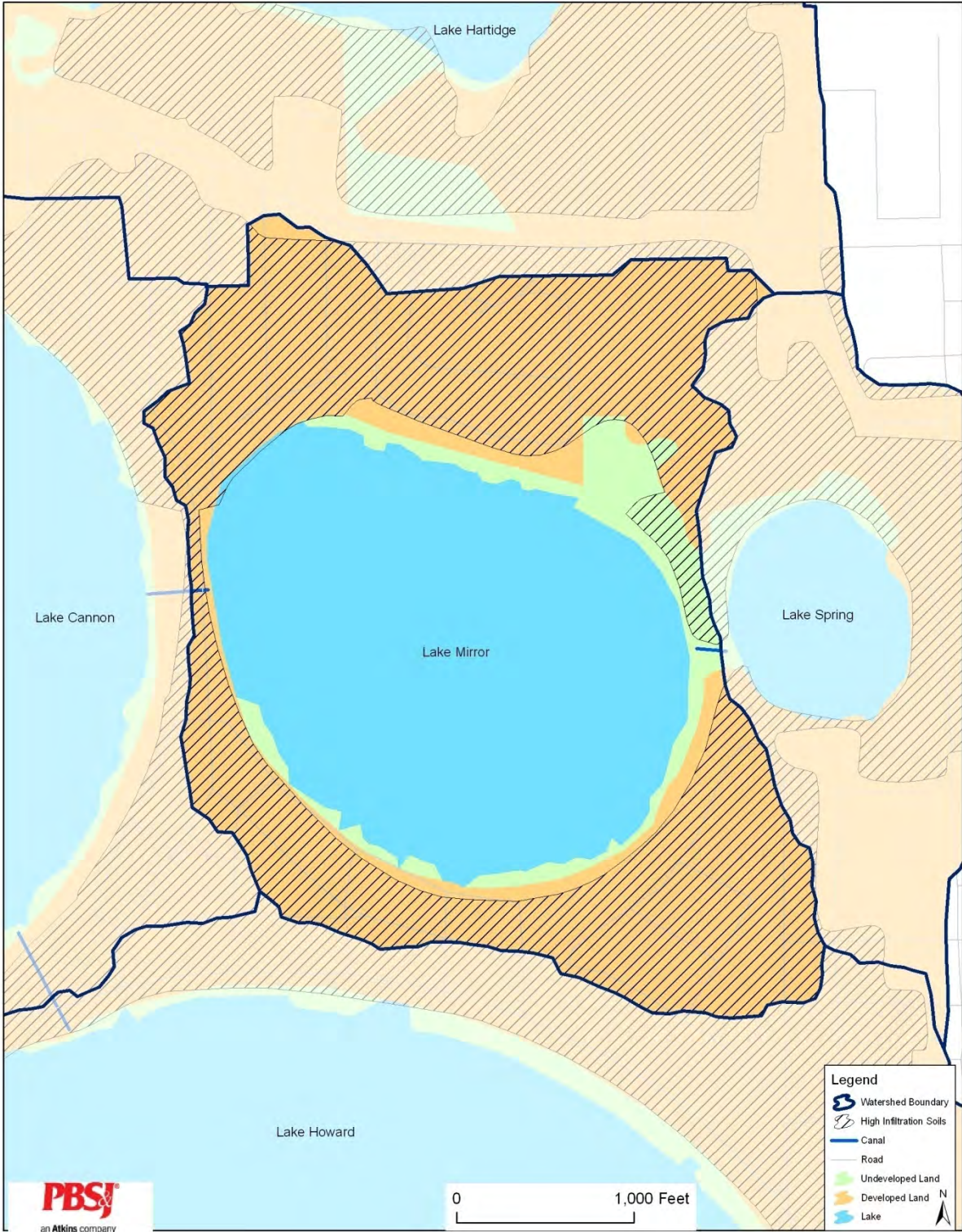


Figure 4-74. Lake Mirror chlorophyll a concentrations and *Hydrilla* treatment history using available data from 1983 to 2007.

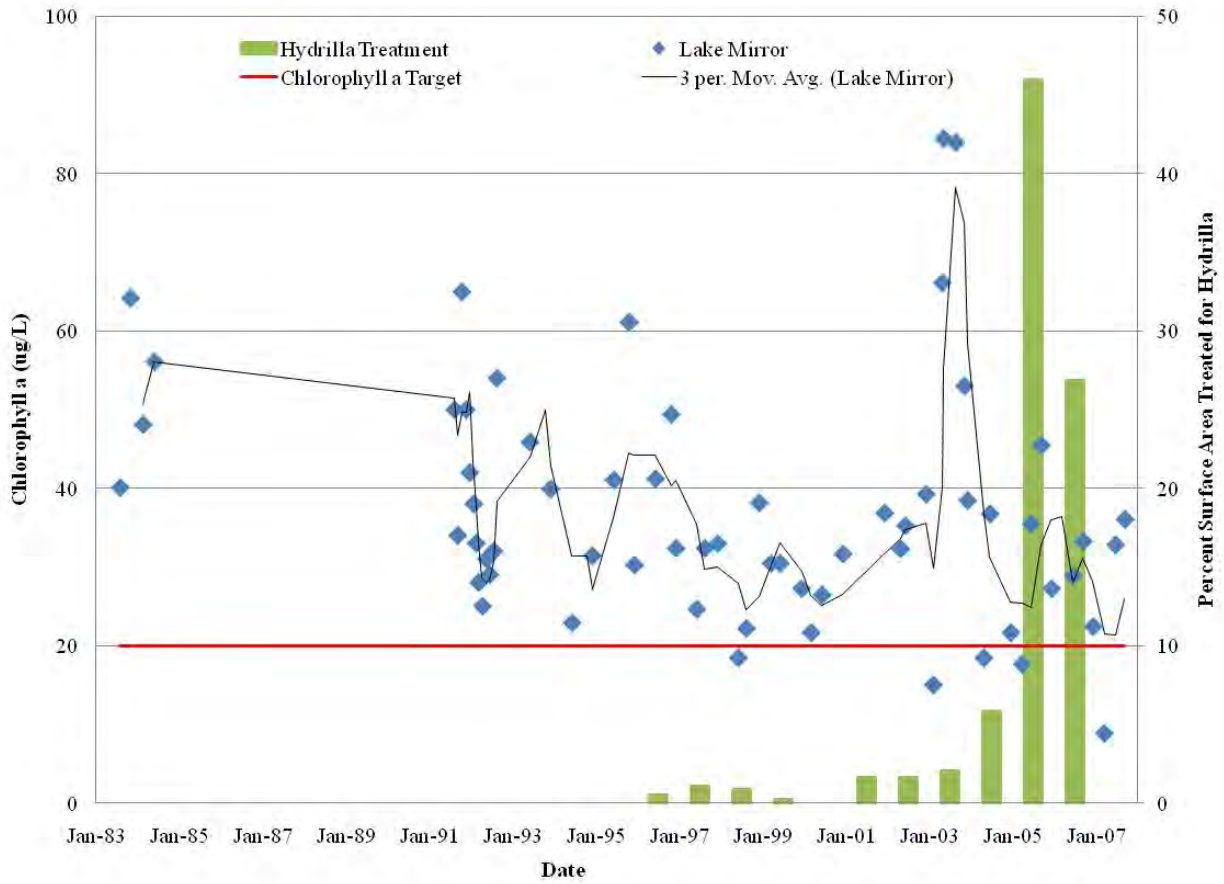
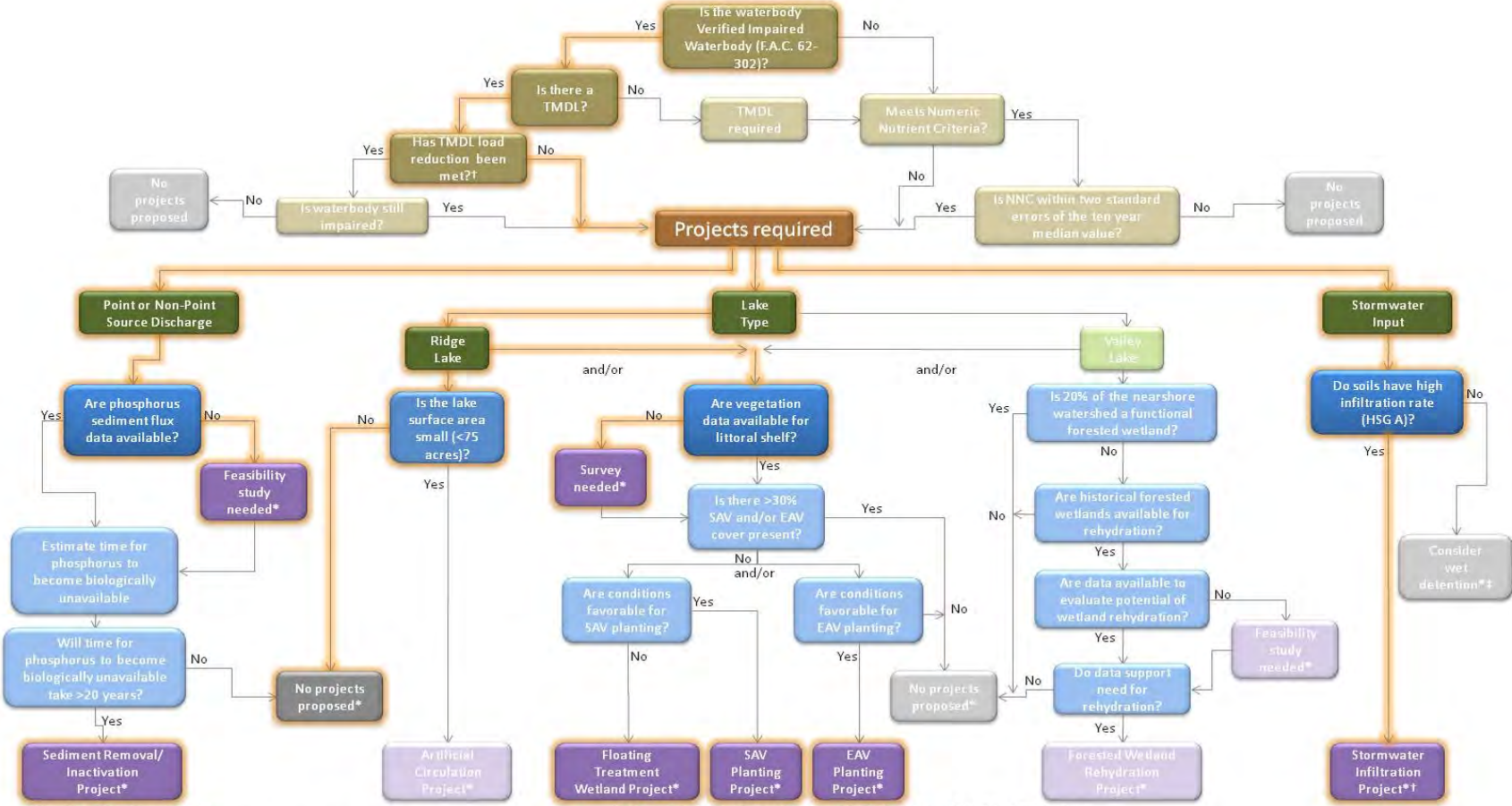


Figure 4-75. Lake Mirror bathymetry (December 2009) at water level elevation = 129 feet (Polk County Water Atlas).



Figure 4-76. Lake Mirror 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 Mirror watershed has approximately 138 acres (84 percent of the watershed) classified as high infiltration soils. A TMDL has been established for Lake Mirror, and as such, the SIA design should be focused on satisfying the TMDL requirements. SIA projects would need to encompass approximately three percent (five acres) of the watershed in order to accomplish an annual 15.9 kg reduction in TP loads to Lake Mirror. Acres of SIA estimated to meet the TP NNC was ten (six percent of the watershed) for a 17 percent phosphorus reduction in Lake Mirror to meet its NNC. Eighty-four percent of the watershed is characterized by high infiltration soils; therefore, it may be feasible to satisfy the TMDL load reductions through SIA implementation.

Project 2: Sediment Removal/Inactivation

Non-point source discharges to Lake Mirror may have resulted in substantial internal nutrient loads due to phosphorus release from 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 Mirror, as much as 46 percent of the lake surface has been treated for *Hydrilla* eradication. A survey of existing SAV cover in Lake Mirror 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.

The median secchi depth from 1997-2007 in Lake Mirror was 2.1 feet indicating that SAV should not be planted in water depths greater than 2 feet. The maximum planting effort should result in vegetation cover of approximately 12 percent of the lake bottom (15 acres).

Cost Estimate: \$100,000 (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 Mirror 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 Mirror 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 and inundation frequency and wave disturbance.