

4.12. Lake Jessie

Background

Physical and chemical characteristics specific to Lake Jessie are presented here in the context of relevant regulatory criteria and requirements (Table 4-24). Lake Jessie (WBID 1521K), a lake in the WHCL Southern Chain, is hydrologically connected to lakes Mariana and Idylwild via constructed canals (Photo 4-14, Figure 4-47). In 2005, Lake Jessie was declared verified impaired based on elevated TSI values (>60). A TMDL was adopted for the Southern Chain of the WHCL, including Lake Jessie (FDEP 2007), and Lake Jessie was subsequently delisted from impairment by FDEP in 2010. Based on the modeled external TP load to Lake Jessie, a 50 percent reduction in TP load (114 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 Cannon for the period of 1997 to 2007 and corresponding EPA NNC water quality targets are listed in Table 4-24. To comply with the NNC, concentration reductions of 44 percent for TP and 29 percent for chlorophyll *a* are required.

A summary of water quality statistics for Lake Jessie is presented in Table 4-25. Lake Jessie historically received point source discharges from a WWTF. While the effluent discharges have been eliminated, the discharges resulted in nutrient and sediment accumulation in the lake bottom. In response to the TMDL, Polk County District implemented a stormwater treatment area at Derby Avenue (Photo 4-14). The median chlorophyll *a*, TN and TP concentrations continue to exceed the NNC targets provided by EPA for Lake Jessie. Chlorophyll *a* concentrations in Lake Jessie fluctuate but are elevated above 20 µg/L the majority of the time (Figure 4-48). However, a statistically significant decline in chlorophyll *a* concentrations from 1983 to 2007 was observed (seasonal Kendall-Tau, $p < 0.001$). Since 1983, *Hydrilla* eradication projects have been completed treating over 40 percent of the lake surface area in some years. Improvements in water quality of the lake Jessie, which is located adjacent to a headwater lake, could result in benefit farther downstream.

The Lake Jessie watershed is 783 acres in size and includes 617 acres (79 percent) of developed lands compared to 166 acres (21 percent) of undeveloped lands. The 2000-2007 median color value (20 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 130 feet in October 2006. Bathymetry data are available for Lake Jessie for the October 2006 water level elevation (Figure 4-49). A water level of 130 feet was reported in August 2010, indicating similar water level conditions when compared to 2006. Changes in overall surface area, water depth, and volume of the lake due to water elevation fluctuations should be considered during the development and implementation of water quality restoration projects.

Water Quality Restoration Project Selection and Priorities

Based on Lake Jessie water quality and the surrounding watershed characteristics, four potential water quality restoration projects were identified using the WHCL WQMP decision key (Figure 4-50). 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

Lake-Specific Restoration Projects

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

Table 4-24. Physical, chemical, and regulatory characteristics of Lake Jessie.

Physical			
Location in chain	Southern	High infiltration soils (acres)	408 (52 percent)
Relation to other lakes	Adjacent to Headwater	Developed land (acres)	617 (79 percent)
Watershed area (acres)	783	Undeveloped land (acres)	166 (21 percent)
Lake area (acres)*	194	Median water depth (feet)*	3.1
Perimeter (feet)*	11,621	Maximum water depth (feet)*	12.2
Surface area: lake volume ratio*	0.12	Volume (acre-feet)*	1,546
Watershed to surface area ratio*	4.04		
Water Chemistry			
Locally-derived: acidic or alkaline	Alkaline	Clear or colored	Clear
Geometric mean chlorophyll <i>a</i> (µg/L)	28	NNC chlorophyll <i>a</i> target (µg/L)	20
Geometric mean TN (mg/L)	0.94	NNC TN target (mg/L)	1.00
Geometric mean TP (mg/L)	0.54	NNC TP target (mg/L)	0.030
Regulatory Data			
Impaired	Yes	TMDL status	Required†
Chlorophyll <i>a</i> trend	Decreasing**	TP concentration reduction required	44 percent

*at a water level elevation of 130 feet

†TMDL adopted

**presented in section 5.0

Photo 4-14. Lake Jessie.



Table 4-25. Lake Jessie water quality summary for 1997 to 2007.

Parameter	N	Minimum	Median	Maximum
Chlorophyll <i>a</i> (µg/L)	103	11	27	61
Color (PCU)	27	10	20	64
Conductivity (µmhos/cm)	25	187	207	238
Dissolved oxygen (mg/L)	25	6.9	8.67	11.83
pH	25	6.84	7.76	8.75
Secchi depth (feet)	104	1.7	2.3	4.2
Total nitrogen (mg/L)	105	0.53	1.02	1.88
Total phosphorus (mg/L)	101	0.01	0.061	0.279

Figure 4-47. Lake Jessie and associated watershed.

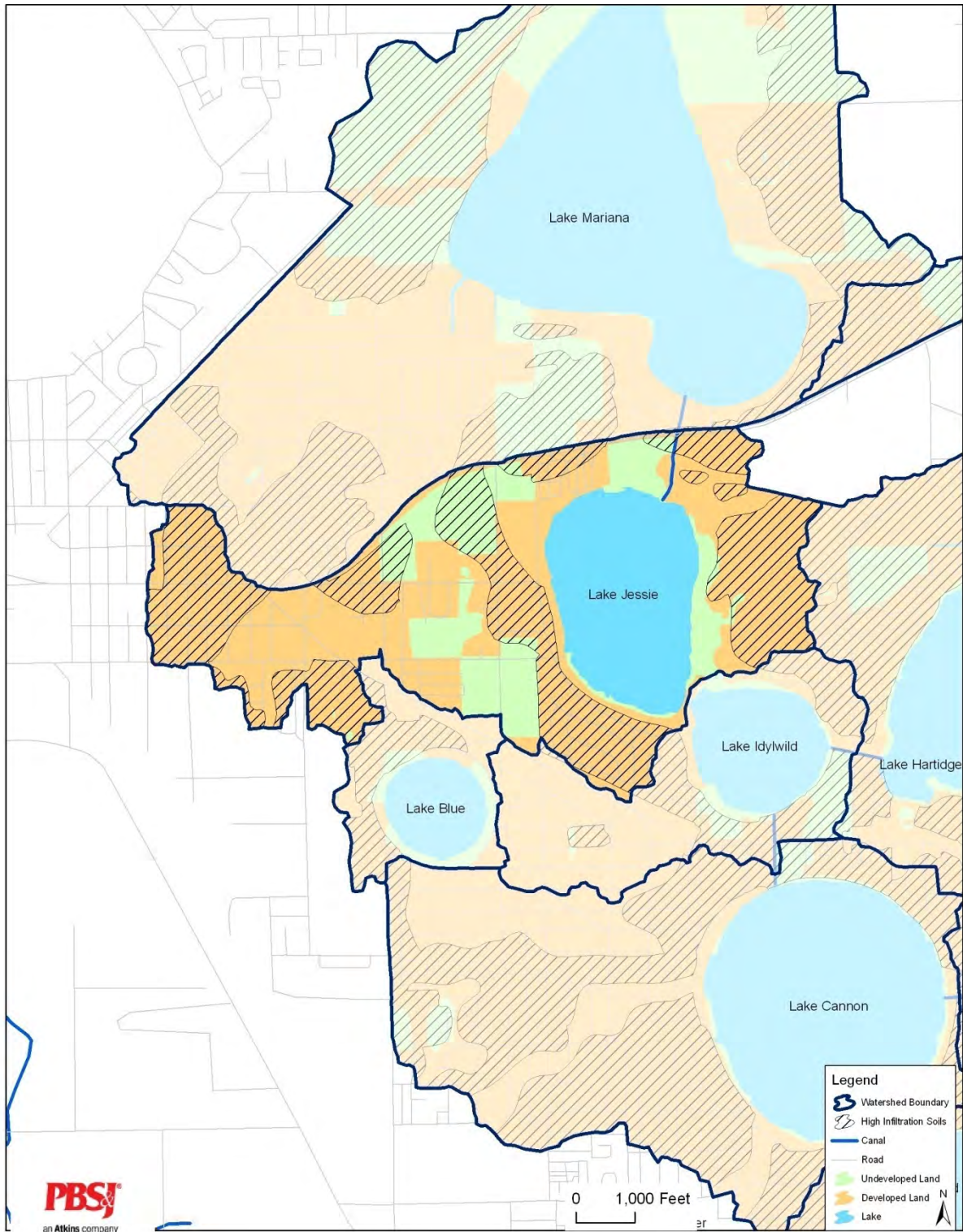


Figure 4-48. Lake Jessie chlorophyll a concentrations and *Hydrilla* treatment history using available data from 1983 to 2007.

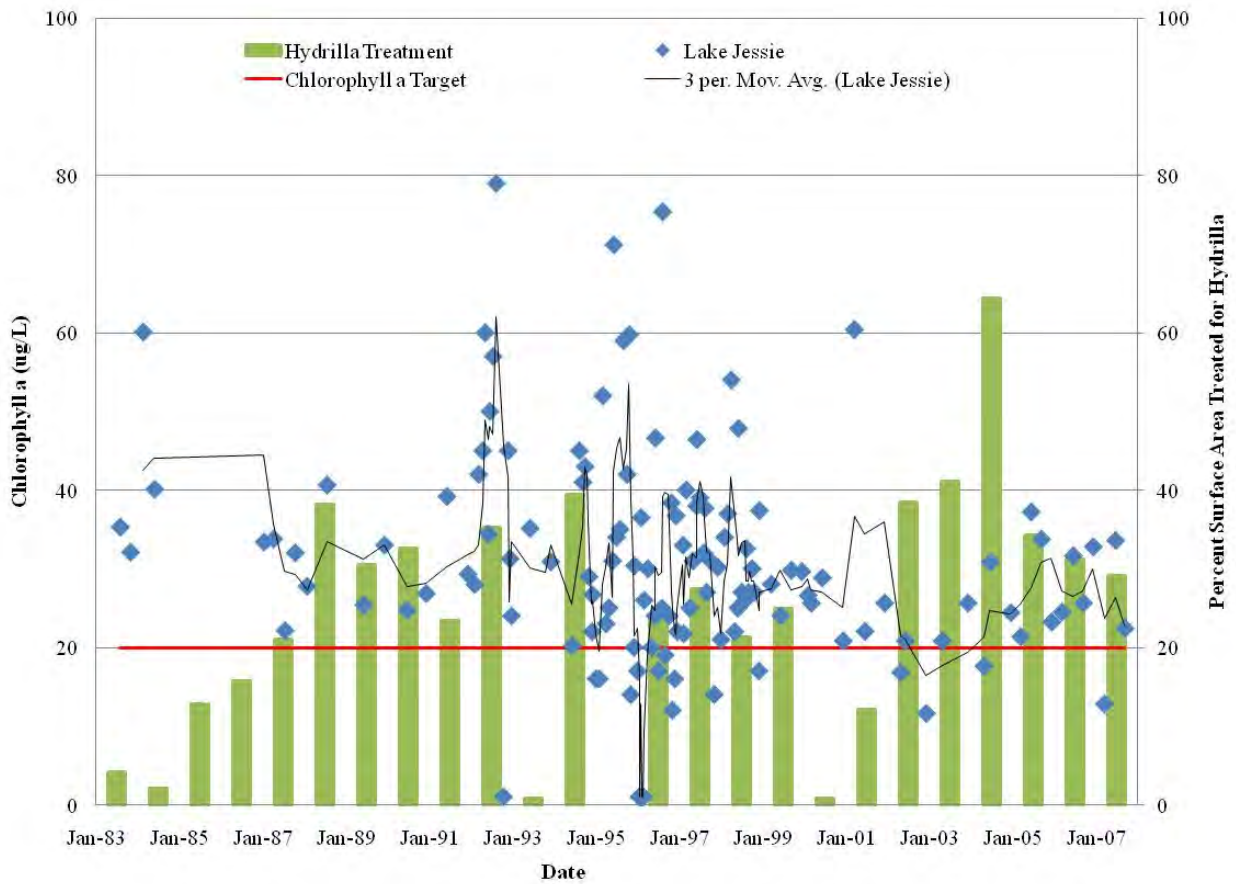


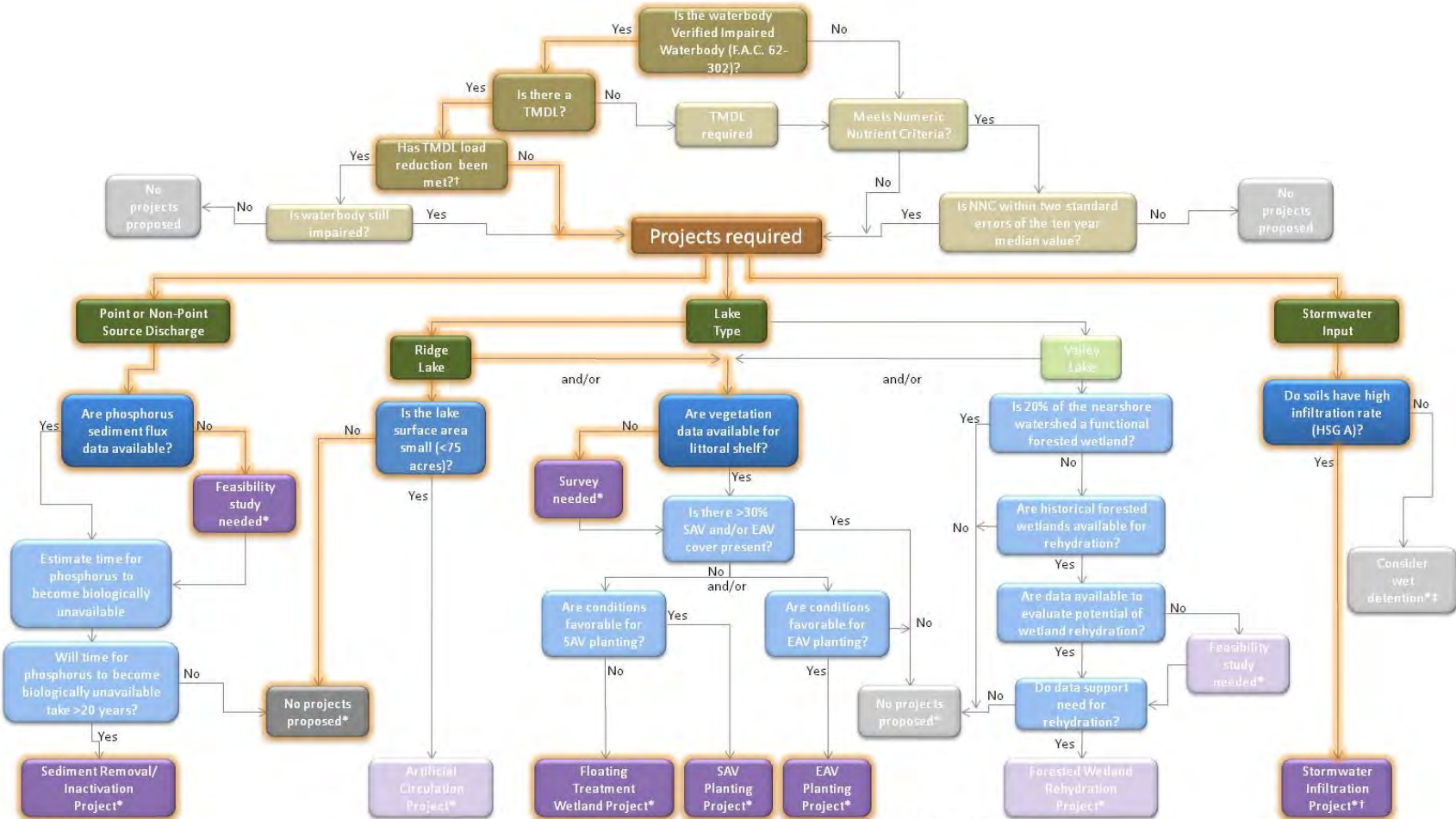
Figure 4-49. Lake Jessie bathymetry (October 2006) at water level elevation = 130 feet (Polk County Water Atlas).



Photo 4-15. Lake Jessie stormwater treatment project at Derby Avenue.



Figure 4-50. Lake Jessie 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 Jessie watershed has approximately 408 acres (52 percent of the watershed) classified as high infiltration soils. A TMDL has been established for Lake Jessie, and as such, the SIA design should be focused on satisfying the TMDL requirements. SIA projects would need to encompass approximately 12 percent (133 acres) of the watershed in order to accomplish an annual 114 kg reduction in TP loads to Lake Jessie. Acres of SIA estimated to meet the TP NNC was 139 (12 percent of the watershed) for a 44 percent phosphorus reduction in Lake Jessie to meet its NNC. Fifty-two 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 Jessie from the 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 Jessie, *Hydrilla* eradication occurs frequently attributing to the continued degradation in water quality. A survey of existing SAV cover in Lake Jessie 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 1997-2007 median secchi depth in Lake Jessie (2.3 feet) indicated that SAV planting should not occur in water depths greater than 2 feet. The maximum planting effort could result in vegetation cover of approximately 9 percent of the lake bottom (17 acres). Due to the extensive organic material located in Lake Jessie, 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: \$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 Jessie 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 Jessie 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.