4.3. Lake Conine

Background

Physical and chemical characteristics specific to Lake Conine are presented here in the context of relevant regulatory criteria and requirements (Table 4-5). Lake Conine (WBID 1488U), a lake in the WHCL Northern Chain, is hydrologically connected to lakes Rochelle and Smart via constructed navigable canals (Photo 4-3, Figure 4-9). In 2005, Lake Conine was declared verified impaired based on elevated TSI values (>60). A TMDL is required for Lake Conine to calculate load reductions necessary to satisfy the TSI criteria. 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 4-5. To comply with the NNC, concentration reductions of 48 percent for TP, 22 percent for TN, and 37 percent for chlorophyll *a* are required.

A summary of water quality statistics for Lake Conine is presented in Table 4-6. Lake Conine historically received point source discharges from four WWTF (Birds Eye, Pipping Packing Company, Florida Citrus Salads, and the City of Winter Haven). In 1992, the City of Winter Haven WWTF terminated discharges to the lake. While the effluent discharges have been eliminated, the discharges resulted in nutrient and sediment accumulation in the lake bottom. Sediment inactivation in Lake Conine was completed in the mid-1990's to address the legacy internal phosphorus loads. While water quality improvements were observed, nutrient concentrations continue to be elevated. Since 1998, *Hydrilla* eradication projects have been completed annually treating over 40 percent of the lake surface area in some years. The median chlorophyll *a*, TN and TP concentrations continue to exceed the NNC targets provided by EPA for Lake Conine. Chlorophyll *a* concentrations in Lake Conine are elevated above 20 µg/L but improvements in water quality have been observed due to previous water quality restoration projects (Figure 4-10). A statistically significant decline in chlorophyll *a* concentrations from 1987 to 2007 was observed (seasonal Kendall-Tau, $p<0.001$). The combination of the elimination of point source discharges and alum treatment (completed in 1995) has improved water quality when compared to the previous water quality conditions. Additionally, the City of Winter Haven acquired a large parcel of undeveloped land along the southeastern rim of the lake for the construction of a wetland treatment project designed to improve lake water quality. Improvements in water quality of the lake Conine as a headwater lake could result in benefit farther downstream.

Consistent with reducing external nutrient loads, the City has an approved grant from SWFWMD and FDEP to design and construct a project on the south side of Lake Conine on approximately 34 acres of City property to treat stormwater from the Lake Conine watershed, as well as provide a new nature park. The project is in the design and permitting phase and should be under construction in the spring of 2011. The project will be similar to the recently completed Lake Hartridge Nature Park Project which also received funds from the 319 program.

The Lake Conine watershed is 447 acres in size and includes 316 acres (71 percent) of developed lands compared to 131 acres (29 percent) of undeveloped lands. The 2000-2007 median color value (30 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 125 feet in June 2007. Bathymetry data are available for Lake Conine for the June 2007 water level elevation (Figure 4-11). A water level of 126 feet was reported in August 2010, reflecting a 1.0 foot increase in water elevation when compared to 2006. 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 Conine water quality and the surrounding watershed characteristics, four potential water quality restoration projects were identified using the WHCL WQMP decision key (Figure 4-12). The decision key presents the factors on which yes/no decisions were based and used to identify and select water quality improvement projects. In addition to the approved stormwater treatment project (described above), 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

Table 4-5. Physical, chemical, and regulatory characteristics of Lake Conine.

Physical			
Location in chain	Northern	**High infiltration soils (acres)**	288 (65 percent)
Relation to other lakes	Immediate	**Developed land (acres)**	316 (71 percent)
Watershed area (acres)	447	**Undeveloped land (acres)**	131 (29 percent)
Lake area (acres)*	231	**Median water depth (feet)***	9.9
Perimeter (feet)*	16,458	**Maximum water depth (feet)***	20.0
Surface area to lake volume ratio*	0.12	**Volume (acre-feet)***	1,928
Watershed to surface area ratio*	1.94		
Water Chemistry			
Locally-derived: acidic or alkaline	Alkaline	**Clear or colored**	Clear
Geometric mean chlorophyll *a* (ug/L)	32	**NNC chlorophyll *a* target (ug/L)**	20
Geometric mean TN (mg/L)	1.28	**NNC TN target (mg/L)**	1.00
Geometric mean TP (mg/L)	0.057	**NNC TP target (mg/L)**	0.030
Regulatory Data			
Impaired	Yes	**TMDL status**	Required
Chlorophyll *a* trend	Decreasing	**TP concentration reduction required**	48 percent

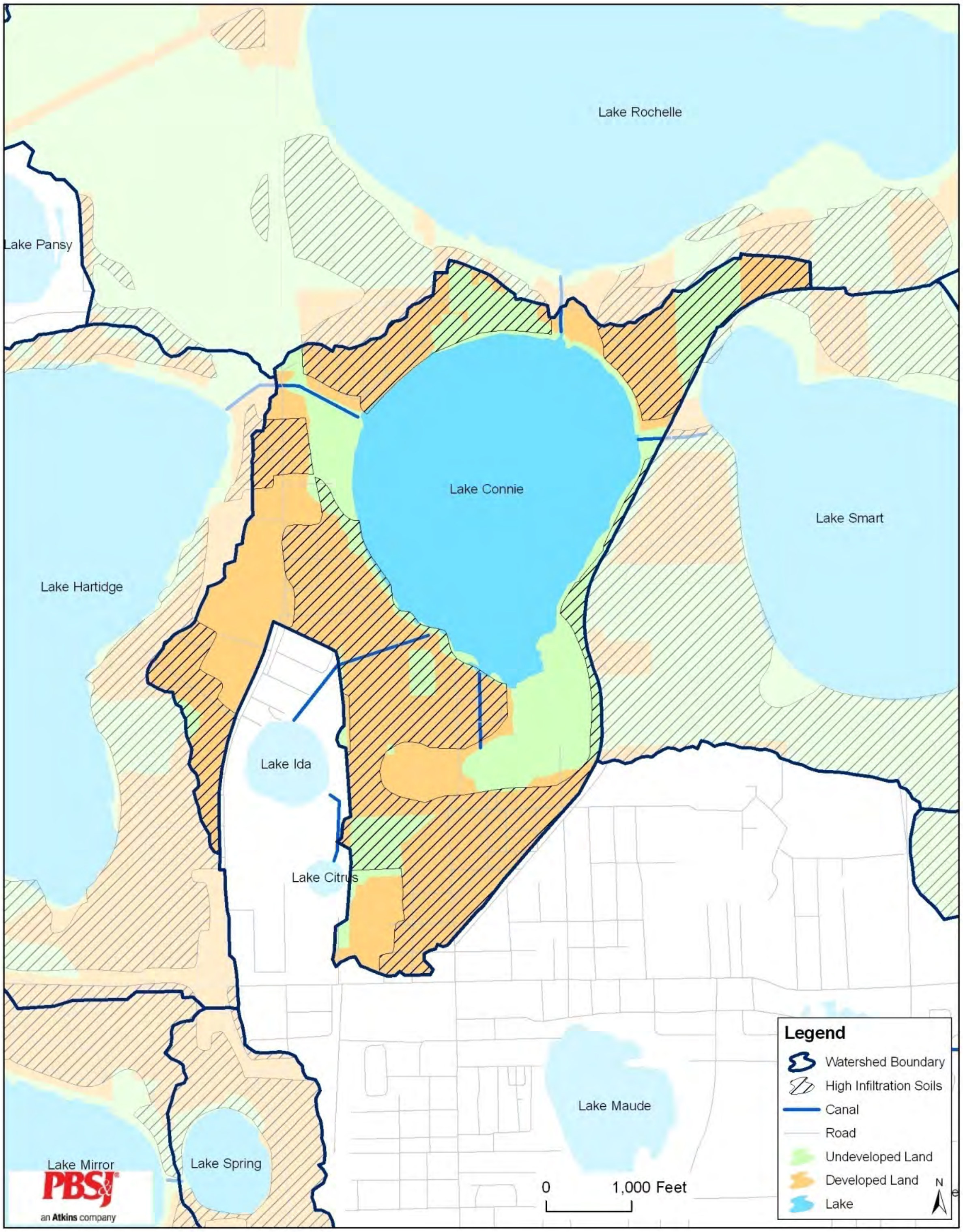
*at a water level elevation of 125 feet
**presented in section 5.0

Photo 4-3. View from western shoreline of Lake Conine.

Table 4-6. Lake Conine water quality summary for 1997 to 2007.

Parameter	N	Minimum	Median	Maximum
Chlorophyll *a* (µg/L)	84	3	39	79
Color (PCU)	70	5	30	70
Conductivity (µmhos/cm)	31	198	229	275
Dissolved oxygen (mg/L)	31	5.95	8.82	13.88
pH	31	7.32	8.22	9.21
Secchi depth (feet)	87	0.9	1.8	3.3
Total nitrogen (mg/L)	89	0.62	1.33	2.62
Total phosphorus (mg/L)	85	0.014	0.073	0.163

Figure 4-9. Lake Conine and associated watershed.



PBSJ
an Atkins company

Figure 4-10. Lake Conine chlorophyll *a* concentrations and *Hydrilla* treatment history using available data from 1983 to 2007. Previous water quality improvement projects are identified.

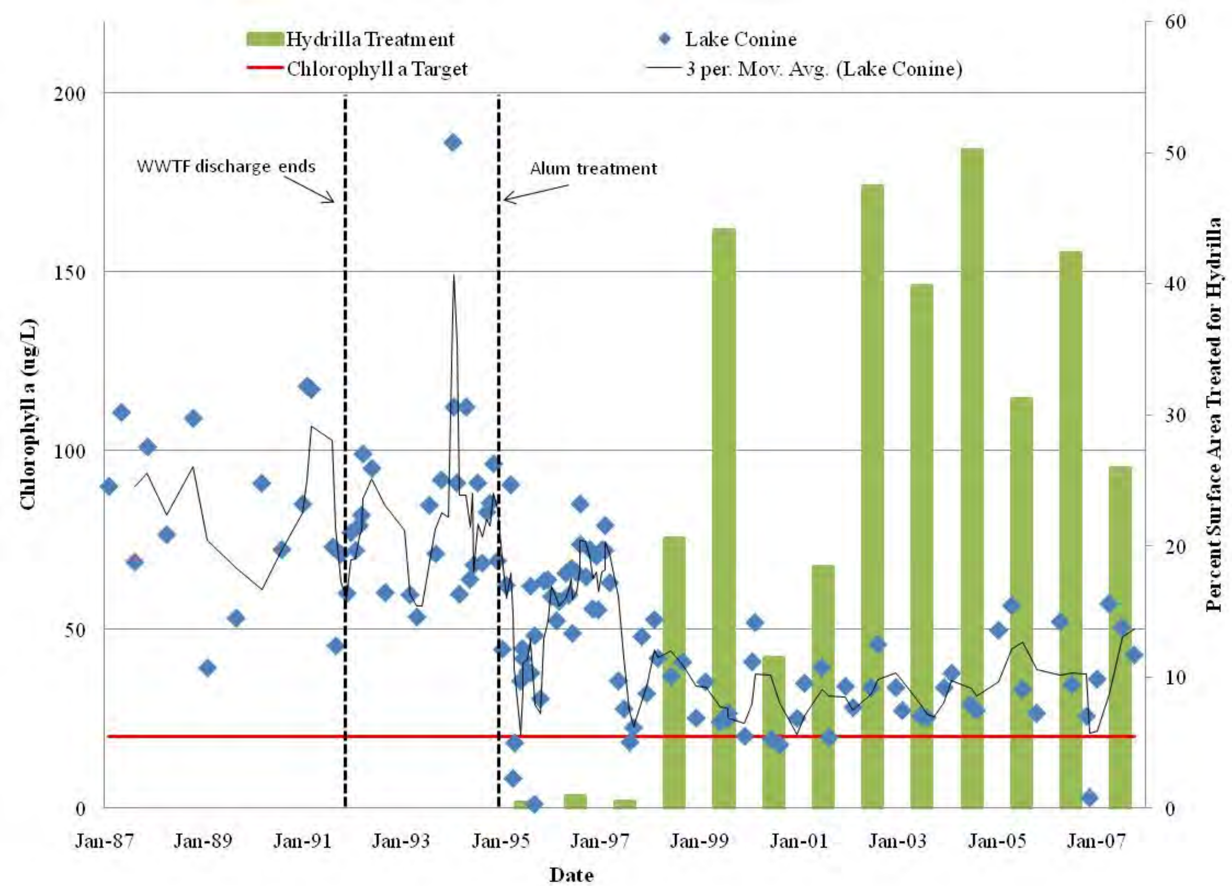
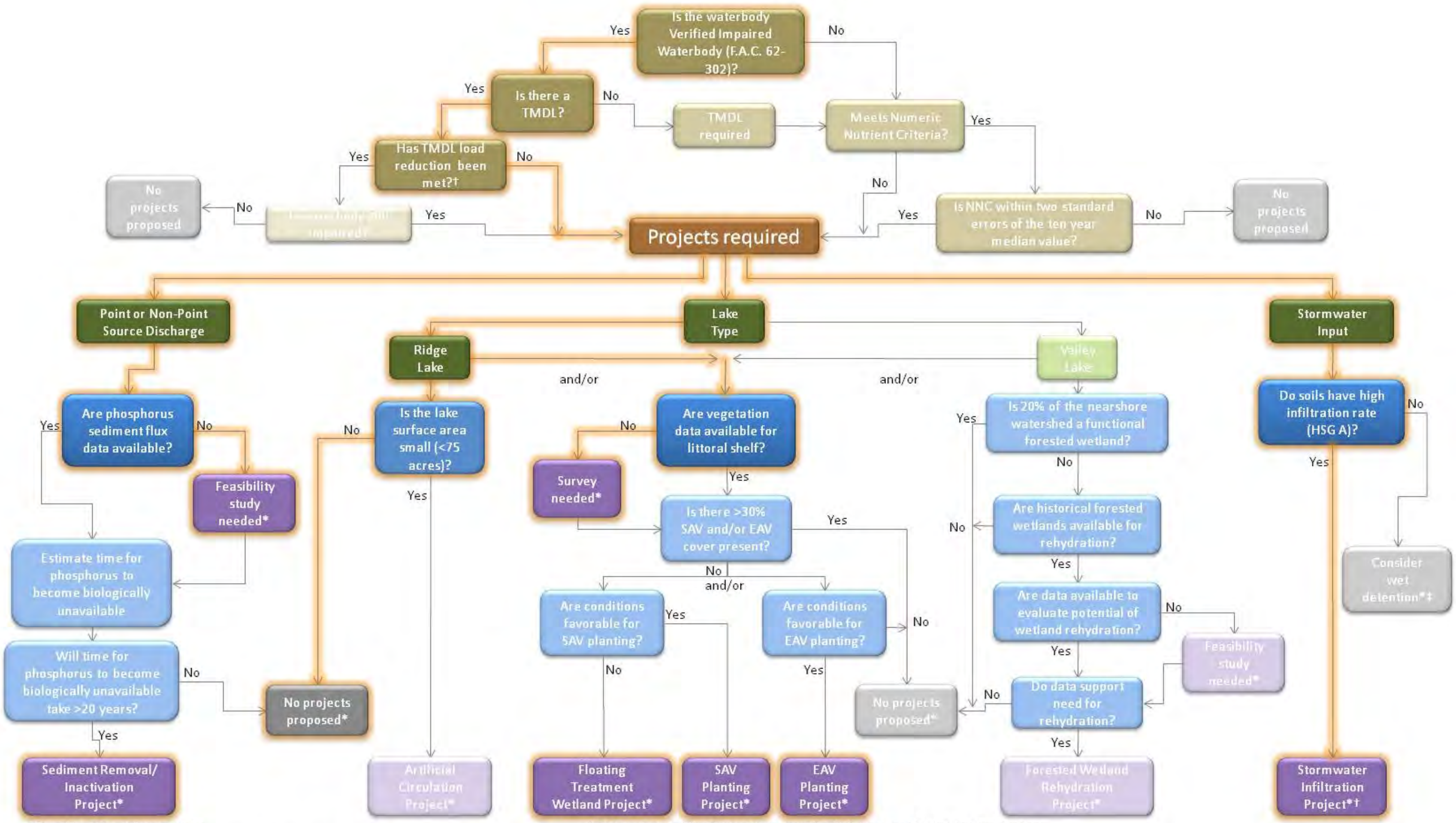


Figure 4-11. Lake Conine bathymetry (June 2007) at water level elevation = 125 feet (Polk County Water Atlas).

Figure 4-12. Lake Conine 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 Conine watershed has approximately 288 acres (65 percent of the watershed) classified as high infiltration soils. The Northern Chain was not included in the PLRG study (USF 2005), therefore a TMDL has not been completed for Lake Conine and data to estimate SIA acres for TP load reduction are not available at this time. SIA implementation could have the additional benefit of increasing storage to supplement dry season lake levels and a reduction in stormwater loads that can be later applied to the required TMDL TP load reduction. As such, SIA design should be focused on recharging the surficial aquifer. The City of Winter Haven and SWFWMD have already purchased land along the southern rim of Lake Conine for the construction of a wetland treatment project designed to reduce external nutrient loads entering the lake via stormwater.

Project 2: Sediment Removal/Inactivation

Historical point source discharges to Lake Conine from the multiple WWTFs require further evaluation of the potential internal phosphorus load from the lake bottom sediments. Sediment inactivation in Lake Conine was previously completed in the mid-1990's to address the legacy internal phosphorus loads. While water quality improvements were observed, nutrient concentrations continue to be elevated. Alum treatment has been shown to control phosphorus loading from sediments for approximately two to twenty years; therefore, subsequent restoration actions may be required. Presently, sufficient data are not available to calculate the phosphorus decay rate and the time at which the phosphorus will become biologically unavailable in the lake sediments. The recommended feasibility study is required to determine whether sediment removal/inactivation is necessary.

Cost Estimate: $10,000.

Project 3: SAV Planting or FTWs

SAV Planting

In Lake Conine, *Hydrilla* eradication occurs frequently attributing to the continued degradation in water quality. A survey of existing SAV cover in Lake Conine 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 Conine (1.8 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 7 percent of the lake bottom (16 acres). Due to the extensive organic material located in Lake Conine, 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 Conine 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 EAV surrounding Lake Conine is recommended due to the lack of sufficient data at this time. Based on the results of the EAV survey, conclusions and recommendations regarding emergent aquatic or woody vegetation planting can be determined. If limited EAV 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.