4.24. Lake Summit

Background

Physical and chemical characteristics specific to Lake Summit are presented here in the context of relevant regulatory criteria and requirements (Table 4-48). Lake Summit (WBID 1521M), a lake in the WHCL Southern Chain, is hydrologically connected to Lake Eloise via a constructed navigable canal (Photo 4-27, Figure 4-98). Lake Summit has not been identified as impaired; therefore, no TMDL is required. The NNC are performance based, and an exceedance more than once every three years results in non-compliance. Limited data were available to compare the geometric means to the EPA NNC based on the EPA data requirements. However, the NNC targets for TN and TP are within two times the standard error of the ten year median TN and TP concentrations. The results of this comparison indicate that a slight degradation in water quality in Lake Summit could result in an impairment designation. Therefore, water quality restoration projects are recommended for Lake Summit as a preventative action. The TP, TN, and chlorophyll *a* geometric mean for Lake Summit for the period of 1997 to 2007 and corresponding EPA NNC water quality targets are listed in Table 4-48.

A summary of water quality statistics for Lake Summit is presented in Table 4-49. The median chlorophyll *a*, TN and TP concentrations are below the NNC targets provided by EPA for Lake Summit. Chlorophyll *a* concentrations in Lake Summit are variable with values peaking above 20 µg/L (Figure 4-99). 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 Summit to restore water quality. Several *Hydrilla* eradication projects have been implemented in Lake Summit treating greater than 50 percent of lake surface area in some years. Lake Summit is an intermediate lake; therefore, improvements in water quality of the lake could result in some benefit farther downstream.

The Lake Summit watershed is 123 acres in size and includes 120 acres (98 percent) of developed lands compared to 3 acres (2 percent) of undeveloped lands. The 2000-2007 median color value (15 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 August 2009. Bathymetry data are available for Lake Summit for the August 2009 water level elevation (Figure 4-100). 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 Summit water quality and the surrounding watershed characteristics, five potential water quality restoration projects were identified using the WHCL WQMP decision key (Figure 4-101). 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
- Project 5: Artificial Circulation

Table 4-48. Physical, chemical, and regulatory characteristics of Lake Summit.

Physical			
Location in chain	Southern	**High infiltration soils (acres)**	122 (99 percent)
Relation to other lakes	Intermediate	**Developed land (acres)**	120 (98 percent)
Watershed area (acres)	123	**Undeveloped land (acres)**	3 (2 percent)
Lake area (acres)*	67	**Median water depth (feet)***	14.8
Perimeter (feet)*	9,378	**Maximum water depth (feet)***	26.1
Surface area: lake volume ratio*	0.09	**Volume (acre-feet)***	758
Watershed to surface area ratio*	1.84		
Water Chemistry			
Locally-derived: acidic or alkaline	Alkaline	**Clear or colored**	Clear
Geometric mean chlorophyll *a* (µg/L)	15	**NNC chlorophyll *a* target (µg/L)**	20
Geometric mean TN (mg/L)	0.89	**NNC TN target (mg/L)**	1.00
Geometric mean TP (mg/L)	0.027	**NNC TP target (mg/L)**	0.030
Regulatory Data			
Impaired	No	**TMDL status**	NA
Chlorophyll *a* trend	No trend**	**TP concentration reduction required**	NA

*at a water level elevation of 129 feet
**presented in section 5.0
NA- Not applicable

Photo 4-27. Lake Summit.

Table 4-49. Lake Summit water quality summary for 1997 to 2007.

Parameter	N	Minimum	Median	Maximum
Chlorophyll *a* (µg/L)	40	4	14	42
Color (PCU)	25	10	15	20
Conductivity (µmhos/cm)	24	234	265	312
Dissolved oxygen (mg/L)	24	6.98	8.89	9.83
pH	24	7.18	8.00	9.23
Secchi depth (feet)	44	1.5	4.2	11.8
Total nitrogen (mg/L)	44	0.63	0.84	1.64
Total phosphorus (mg/L)	40	0.01	0.028	0.081

Figure 4-98. Lake Summit and associated watershed.

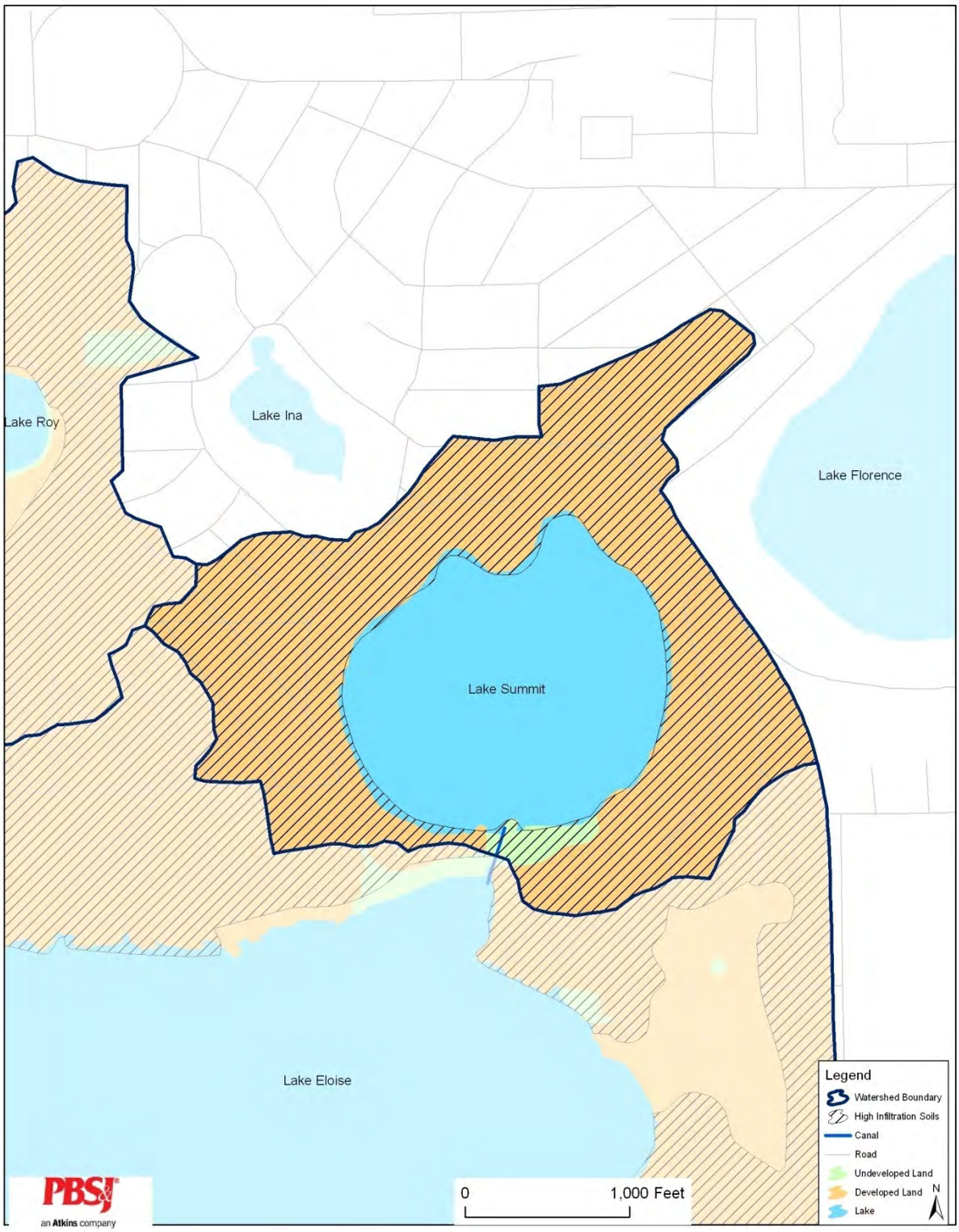


Figure 4-99. Lake Summit chlorophyll *a* concentrations and *Hydrilla* treatment history using available data from 1983 to 2007.

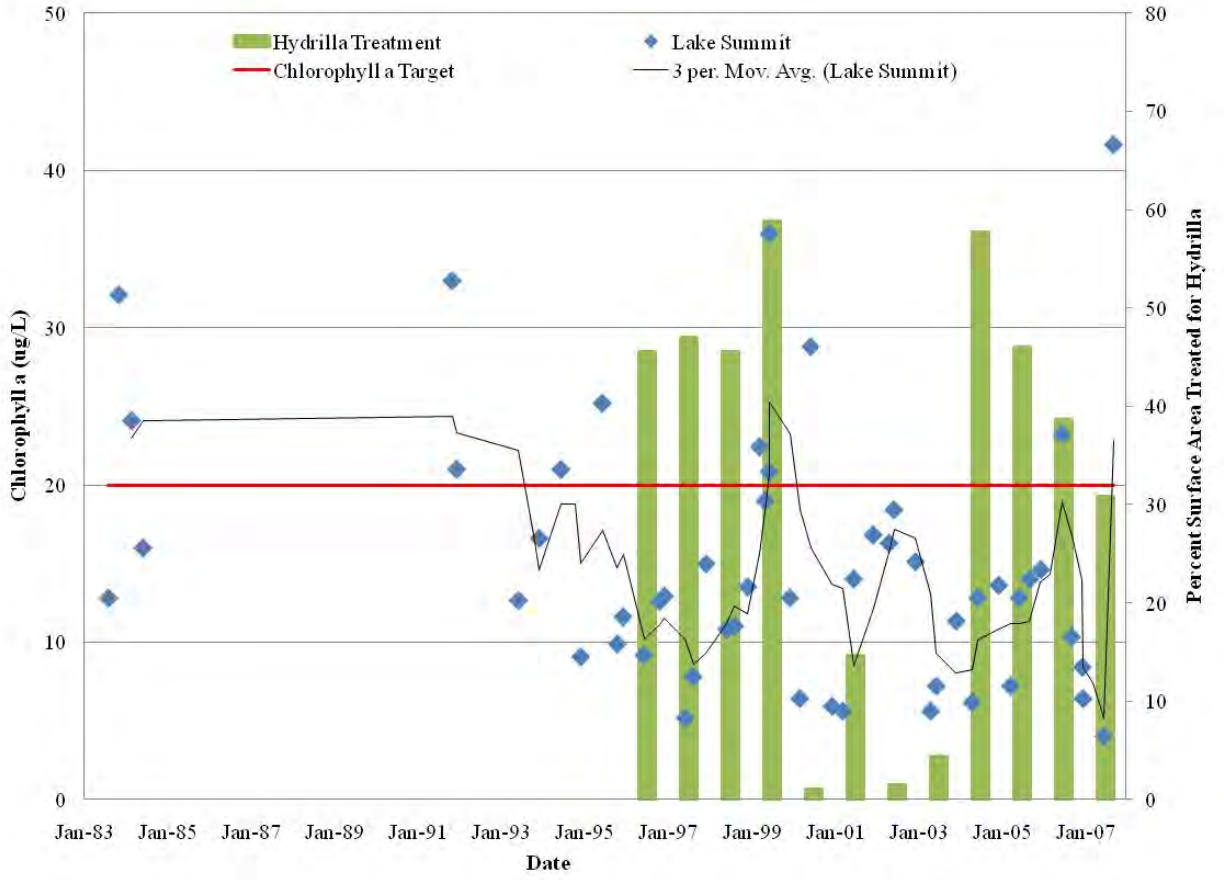


Figure 4-100. Lake Summit bathymetry (August 2009) at water level elevation = 129 feet (Polk County Water Atlas).

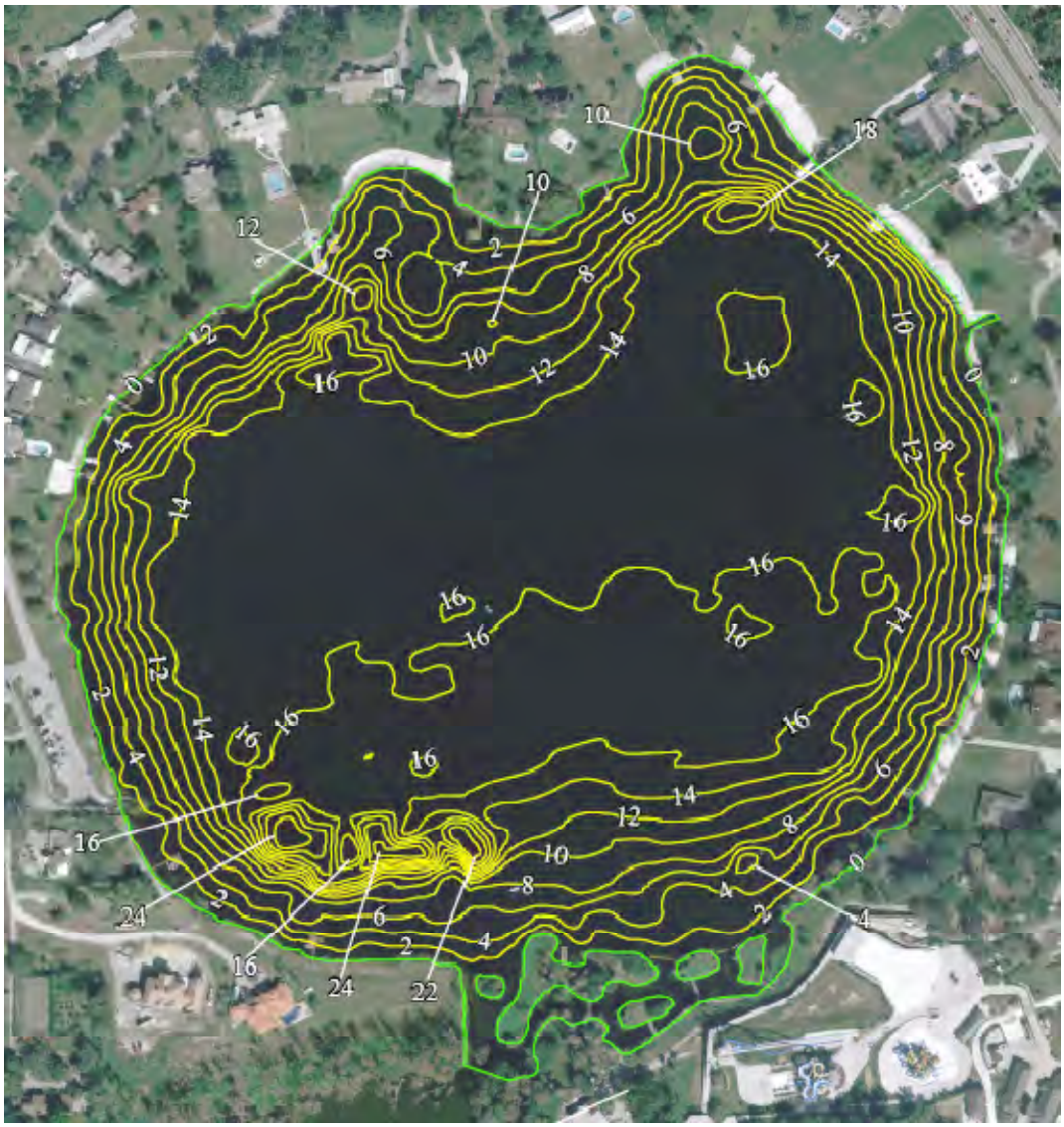
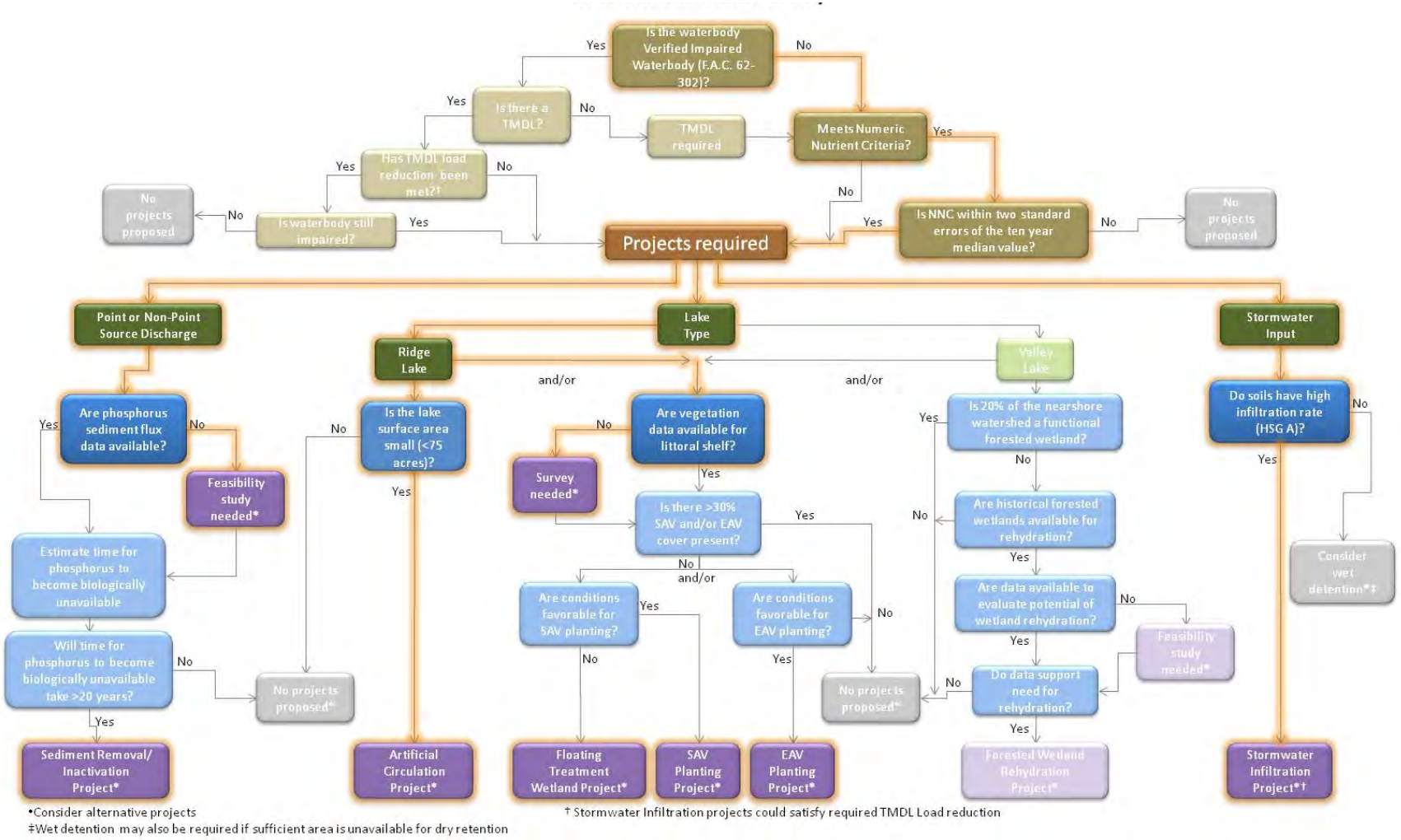


Figure 4-101. Lake Summit decision key: highlighted path shows decision process.



Project 1: Stormwater Infiltration Areas (SIAs)

Within the Lake Summit watershed has approximately 122 acres (99 percent of the watershed) classified as high infiltration soils. A TMDL is not required for Lake Summit due to the unimpaired status; therefore, SIA acres estimates were calculated using data from the PLRG (USF 2005). The SIA estimate for Lake Summit was 2 acres (approximately one percent of the watershed) to meet an 11 percent PLRG. The TP geometric mean for Lake Summit is below the NNC; therefore, acres of SIA estimated to meet the TP NNC were not calculated. SIA design should be focused on recharging the surficial aquifer. SIA implementation could have a double 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 (if necessary).

Project 2: Sediment Removal/Inactivation

Non-point source discharges to Lake Summit 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 Summit, *Hydrilla* eradication has been completed over as much as 59 percent of the lake surface area attributing to the continued degradation in water quality. A survey of existing SAV cover in Lake Summit 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 4 feet based on the median secchi depth values (4.2 feet). The maximum planting effort should result in vegetation cover of approximately 18 percent of the lake bottom (12 acres).

Cost Estimate: $70,000 (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 Summit 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 Summit 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.

Project 5: Artificial Circulation

The project design is based on the assumption that the system configuration developed by SolarBee® for Lake Blue is applicable for Lake Summit. Each circulation pump is assumed to effectively circulate 16 to 20 acres. The surface area of Lake Summit is 67 acres requiring the purchase and installation of four SB10000 v 18 machines.

Cost Estimate: $215,000 (estimate based on cost provided for Lake Blue by Solar Bee®).