4.0 Lake-Specific Restoration Projects

Lakes in the WHCL for which restoration projects are proposed are individually characterized in this section of the WQMP (in alphabetical order). Physical, chemical, and regulatory characteristics are presented in table format and maps illustrating land use and topography are provided for each lake. Watershed boundaries for each lake were identified using 2008 DOQQs, hydraulic structure connectivity, and topography from the Peace Creek Digital Terrain Model, as described in Section 3.4. Those sub-basins contributing to each lake were grouped to delineate the contributing drainage area. The decision key presented earlier is included for each lake, with the path to projects highlighted for that particular lake. Finally, proposed restoration projects specific to each lake are listed and described.

Developed and undeveloped lands and high and low infiltration soils are identified for each lake watershed in each of the lake sections to illustrate that development has occurred primarily on high infiltration soils into which rainfall historically percolated. Consequently, much of the former ground water infiltration is now surface water runoff due to developed, impervious surfaces. However, all developed areas are not necessarily impervious (e.g. orange groves and pasture) and all undeveloped areas are not necessarily "natural areas" (e.g. orange groves and pasture). Land use cover data were obtained from the SWFWMD (2006) and may not be consistent with more recent 2010 aerial photography.

4.1. Lake Blue

Background

Physical and chemical characteristics specific to Lake Blue are presented here in the context of relevant regulatory criteria and requirements (Table 4-1). Lake Blue (WBID 1521Q) contributes to the WHCL Southern Chain and connects to Lake Cannon via a constructed canal and a gated structure that restricts flow between lakes (Photo 4-1, Figure 4-1). In 2010, Lake Blue was declared verified impaired based on elevated TSI values (> 60), indicating a nutrient impairment. A TMDL is required for Lake Blue to calculate load reductions necessary to satisfy the TSI criteria. The TP, TN, and chlorophyll *a* geometric mean for Lake Blue for the period of 1997 to 2007 and corresponding EPA NNC water quality targets are listed in Table 4-1. To comply with the NNC, concentration reductions of 85 percent for TP, 62 percent for TN, and 90 percent for chlorophyll *a* are required.

A summary of water quality statistics for Lake Blue is presented in Table 4-2. The minimum recorded chlorophyll *a*, TN, and TP concentrations exceed the NNC targets provided by EPA for Lake Blue. Chlorophyll *a* concentrations in Lake Blue have fluctuated but have remained consistently elevated above 6 µg/L (Figure 4-2). A statistically significant trend in chlorophyll *a* concentrations from 1987 to 2007 was not observed (seasonal Kendall-Tau, $p > 0.10$). An inverse relationship between lake levels and chlorophyll *a* concentrations may suggest sediment resuspension resulting in a decline in water quality. No water quality improvement projects have been implemented in Lake Blue to restore water quality. Due to the hydrologic isolation of Lake

Blue from the Southern Chain by a gated structure, improvements in water quality of the lake would result in little benefit farther downstream.

The Lake Blue watershed is 116 acres in size and includes 94 acres (81 percent) of developed lands compared to 22 acres (19 percent) of undeveloped lands. The 2000-2007 median color value (30 PCU) was below 40 PCU indicating it is a clear (non-colored) lake and specific conductivity data indicate the lake is acidic. The lake area, perimeter, water depth, and volume statistics are based on a water level elevation of 149 feet in May 2006. Bathymetry data are available for Lake Blue for the May 2006 water level elevation (Figure 4-3). A water level of 148 feet was reported in August 2010, reflecting a 1.0 foot decrease 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 Blue water quality and the surrounding watershed characteristics, five potential water quality restoration projects were identified using the WHCL WQMP decision key (Figure 4-4). The highlighted path in 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 4-1. Physical, chemical, and regulatory characteristics of Lake Blue.

Physical			
Location in chain	Southern	**High infiltration soils (acres)**	55 (47 percent)
Relation to other lakes	Isolated	**Developed land (acres)**	94 (81 percent)
Watershed area (acres)	116	**Undeveloped land (acres)**	22 (19 percent)
Lake area (acres)*	54	**Median water depth (feet)***	5.6
Perimeter (feet)*	5,800	**Maximum water depth (feet)***	10.5
Surface area: lake volume ratio*	0.13	**Volume (acre-feet)***	401
Watershed to surface area ratio*	2.15		
Water Chemistry			
Locally-derived: acidic or alkaline	Acidic	**Clear or colored**	Clear
Geometric mean chlorophyll *a* (µg/L)	62	**NNC chlorophyll *a* target (µg/L)**	6
Geometric mean TN (mg/L)	2.22	**NNC TN target (mg/L)**	0.85
Geometric mean TP (mg/L)	0.102	**NNC TP target (mg/L)**	0.015
Regulatory Data			
Impaired	Yes	**TMDL status**	Required
Chlorophyll *a* trend	No trend**	**TP concentration reduction required**	85 percent

*at a water level elevation of 149 feet
**presented in section 5.0

Table 4-2. Lake Blue water quality characteristics over the period of 1997 to 2007.

Parameter	N	Minimum	Median	Maximum
Chlorophyll *a* (µg/L)	32	29	79	153
Color (PCU)	25	20	30	38
Conductivity (µmhos/cm)	39	127	145	294
Dissolved oxygen (mg/L)	39	1.4	7.88	13.06
pH	39	5.6	7.6	9.3
Secchi depth (feet)	32	0.6	1.0	2.0
Total nitrogen (mg/L)	43	1.16	2.35	4.03
Total phosphorus (mg/L)	39	0.047	0.101	0.189

Photo 4-1. Water control structure at southern end of Lake Blue.

Figure 4-1. Lake Blue and associated watershed.

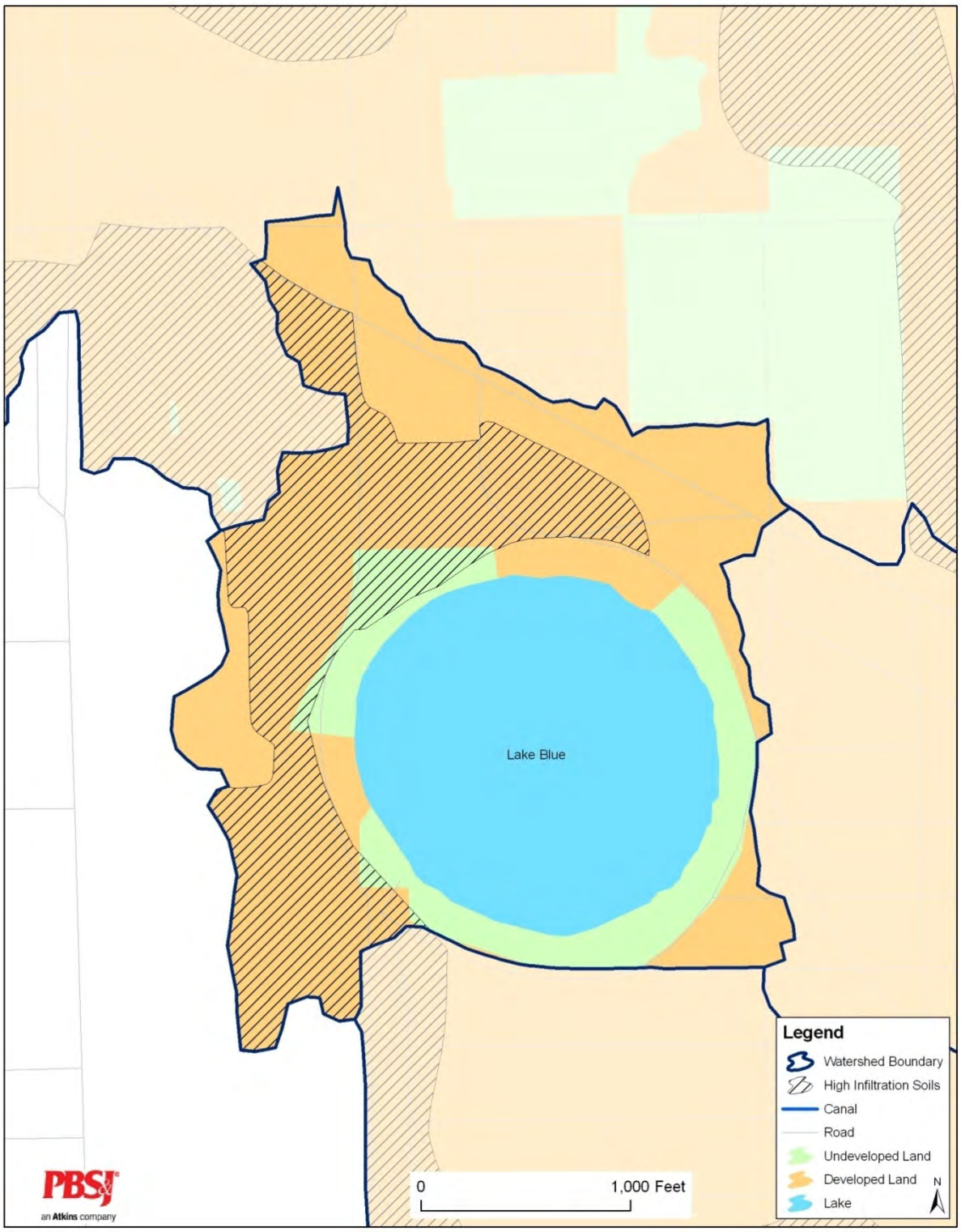


Figure 4-2. Lake Blue chlorophyll *a* concentrations with available data from 1987 to 2007.

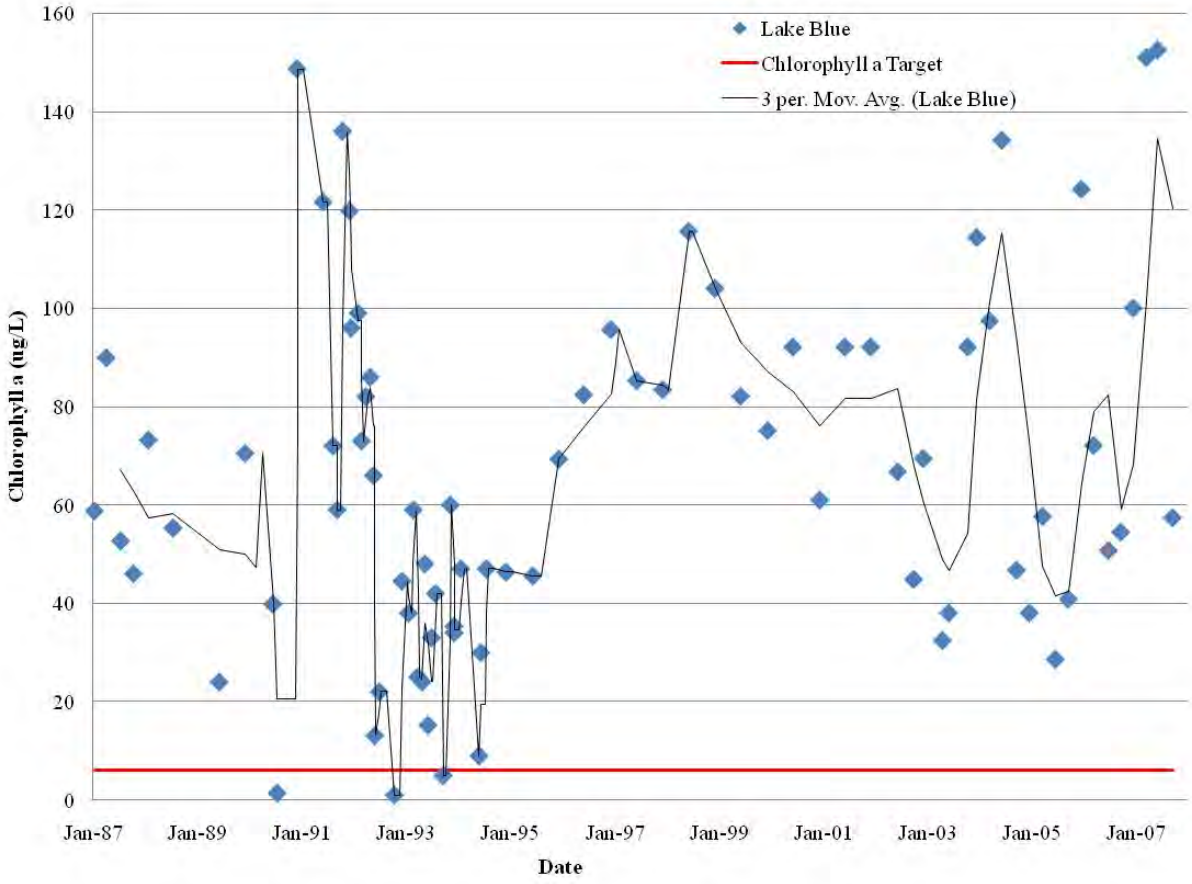


Figure 4-3. Lake Blue bathymetry (May 2006) at water level elevation = 149 feet (Polk County Water Atlas).

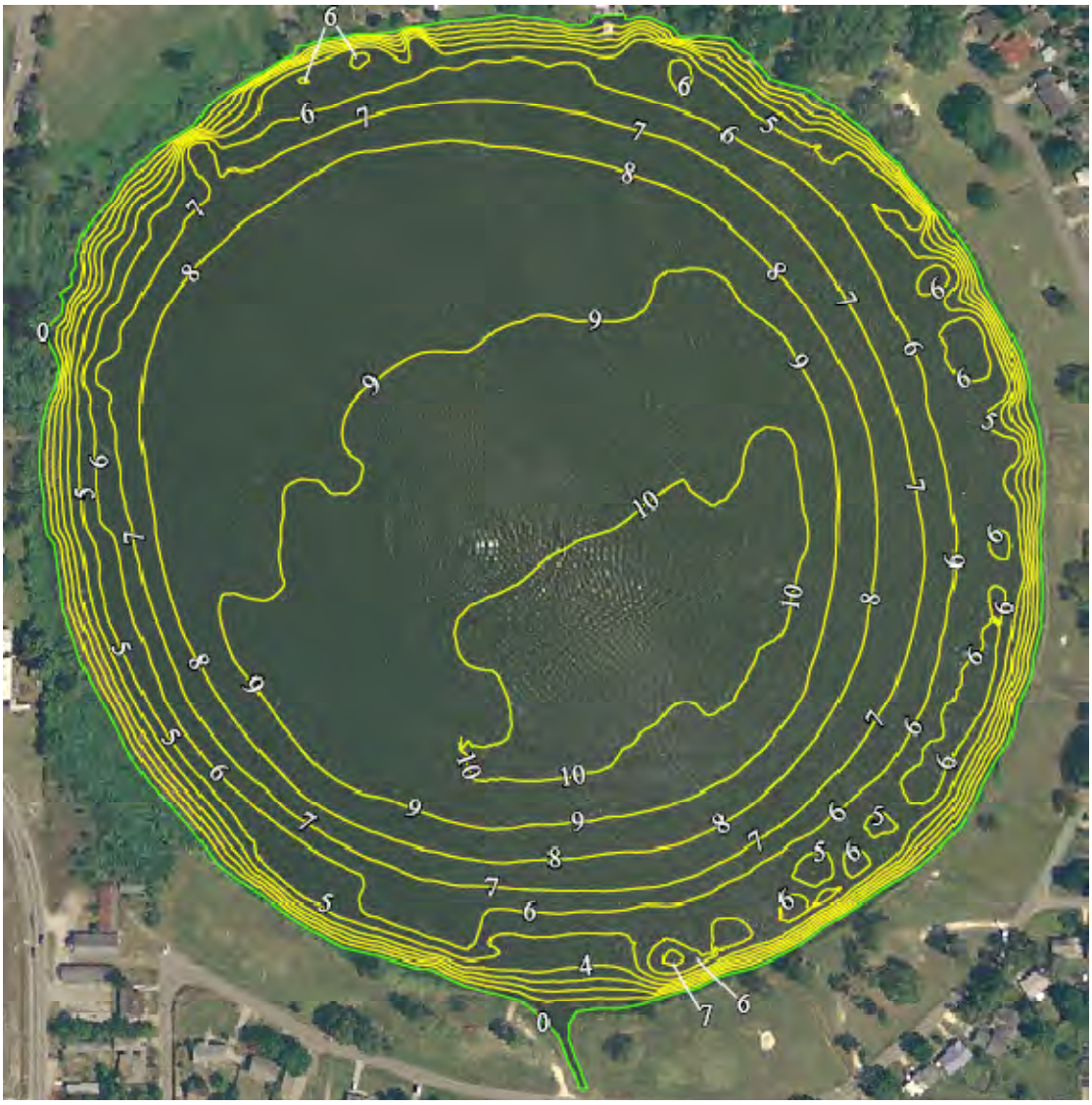
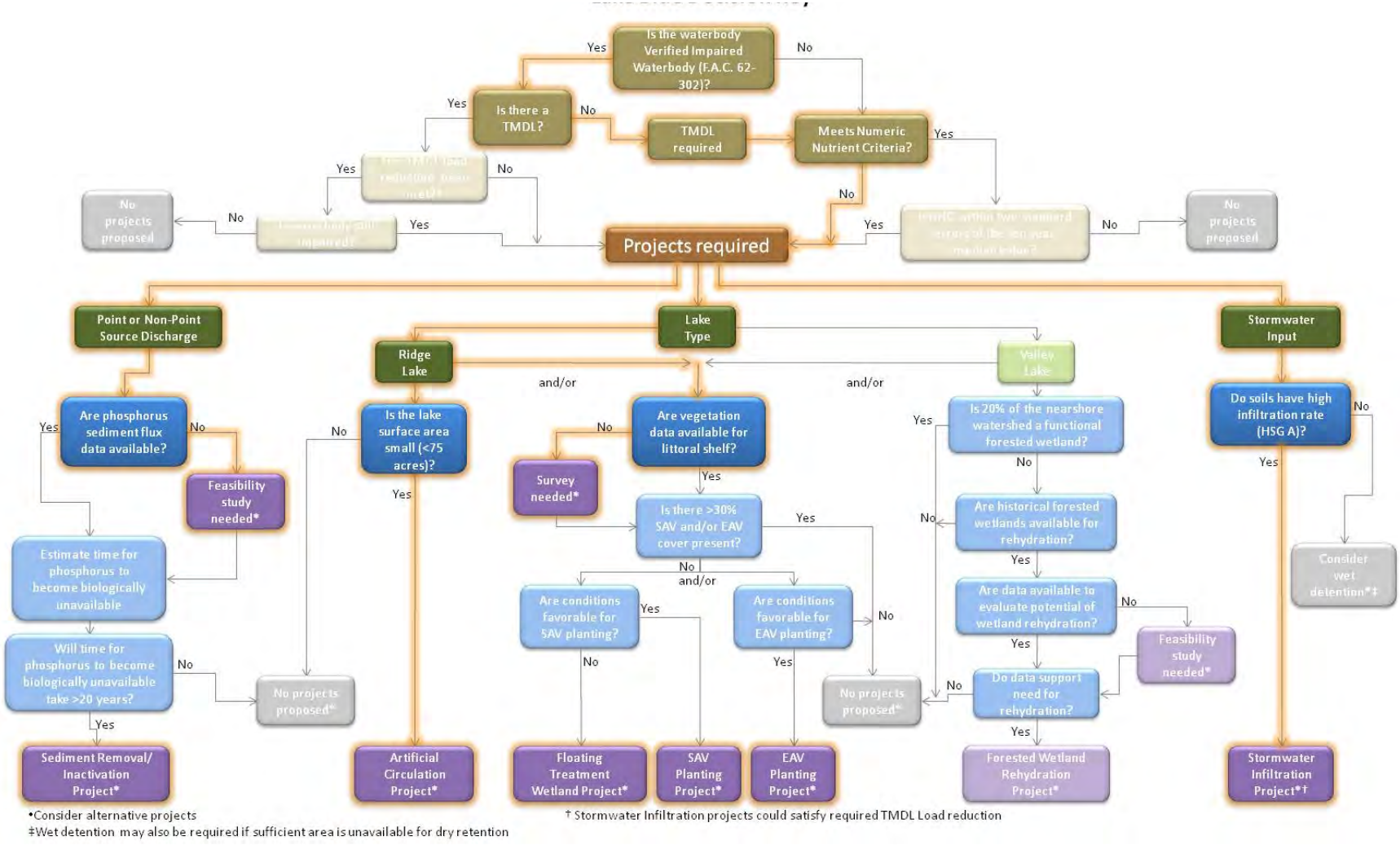


Figure 4-4. Lake Blue decision key: highlighted path shows decision process.



Project 1: Stormwater Infiltration Areas (SIAs)

The Lake Blue watershed has approximately 55 acres (47 percent of the watershed) classified as high infiltration soils. Lake Blue does not have a TMDL, therefore, SIA acres estimates were calculated using data from the PLRG (USF 2005). The SIA estimate for Lake Blue was 70 acres (approximately 60 percent of the watershed) to meet a 90 percent PLRG. Acres of SIA estimated to meet the TP NNC was 78 (67 percent of the watershed) for an 85 percent phosphorus reduction in Lake Blue to meet its NNC. Forty-seven percent of the watershed is characterized by high infiltration soils; therefore, it may not be feasible to satisfy the load reductions through SIA implementation.

Project 2: Sediment Removal/Inactivation

Non-point source discharges to Lake Blue 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

Hydrilla infestations have not been a chronic problem in Lake Blue. A survey of existing SAV cover in Lake Blue 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.

The 1997-2007 median secchi depth for Lake Blue was 1.0 feet indicating that SAV plants should not be planted in water depths greater than 2 feet. The maximum planting effort could result in vegetation cover of approximately 4 percent of the lake bottom (2 acres).

Cost Estimate: $20,000 (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 Blue 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 Blue is recommended due to the lack of sufficient data at this time. Based on the results of the 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.

Project 5: Artificial Circulation

The project design is based the system configuration developed by SolarBee®. Each circulation pump is assumed to effectively circulate 16 to 20 acres. The surface area of Lake Blue is 54 acres requiring the purchase and installation of three SB10000 v 18 machines.

Cost Estimate: $160,000 (estimate by Solar Bee®).