

Executive Summary

The Winter Haven Chain of Lakes (WHCL) is at the headwaters of the larger Peace River – Charlotte Harbor watershed. The lakes are located in central Florida, an area of rapid urbanization and commensurate high stormwater runoff and associated nutrient loadings to the lakes. A Water Quality Management Plan (WQMP) was developed for the WHCL to ensure long-term water quality protection and compliance with state and federal water quality regulations. Lakes in the WHCL are shown in Figure ES-1 and lakes for which a TMDL has been adopted are identified.

This WQMP presents a compilation of information relevant to water quality in the 25 lakes, an analysis of water quality and water quality trends, and proposed restoration projects and priorities for the lakes. One of the primary features of this plan is the recommendation of scientifically proven methods for managing lakes as an integrated ecological systems rather than managing based on nutrient inputs alone. Recommendations were also made in consideration of management projects implemented in the past that have had successful results. More specifically, this WQMP:

- Characterizes water quality associated with lakes in the WHCL
- Identifies restoration projects to address water quality issues
- Links restoration projects to lakes based on individual water quality needs
- Provides recommendations for lake restoration priorities

Importantly, 18 of the 25 lakes in the WHCL are designated as impaired by FDEP. Among the impaired lakes, five exhibit improving trends in water quality, while the remaining 13 exhibit declining (or no) trends in water quality. Three of the unimpaired lakes had declining trends in water quality, and none had improving trends. Stormwater treatment projects have been implemented for seven lakes (Howard, May, Lulu, Hartridge, Jessie, Cannon, and Mariana) in the WHCL to reduce nutrient loads to the lakes. Lake Hartridge is the only lake not impaired due to high nutrient levels and all but Cannon and Jessie exhibit improving trends in water quality.

While traditional stormwater treatment projects can successfully reduce external phosphorus loadings to the lakes, historic point and nonpoint source runoff and subsequent sediment accumulation in some lakes resulted in internal phosphorus loads that existing stormwater projects cannot treat. Consequently, both traditional and non-traditional water quality management projects are proposed to address both external and internal phosphorus loading to the WHCL in this WQMP.

In addition to nutrients and chlorophyll *a* (algal growth), factors affecting quality in the WHCL include long-term land use and hydrologic alterations, stormwater runoff, historic point source discharges (particularly phosphorus), extent of submerged aquatic vegetation (SAV) and emergent aquatic vegetation (EAV), lake water levels, and hydrologic connections to forested wetlands and other lakes. A decision key was developed for the WHCL as a means of selecting these projects. These components are therefore included as part of a holistic lake management approach for the WHCL. The link between water quality issues and lake-specific water quality

restoration projects for the WHCL are presented in the context of state and federal regulations, as well as lake management science.

A priority matrix was developed to rank lakes by management needs. Lake priorities were based on water quality (e.g. impairment status and chlorophyll trends), required phosphorus reductions, and lake connections and location. Lakes most likely to benefit from a project were also considered. Lakes were grouped into five tiers based on rank and are summarized below (first tier lakes are the highest priorities).

- **First Tier:** Lakes Mariana, Idyllwild, Little Hamilton, Spring, Haines, and Rochelle are all designated as impaired and were the highest ranked lakes for water quality restoration projects.
- **Second Tier:** Lakes Cannon, Smart, Middle Hamilton, Howard, and Eloise.
- **Third Tier:** These five lakes are designated as impaired and only one of the lakes (Jessie) exhibited a decreasing trend in chlorophyll *a*, while Lakes Mirror, Blue, May, and Lulu all exhibited a decreasing chlorophyll *a* trend.
- **Fourth Tier:** Lakes Summit, Conine, Shipp, Roy, and Hartridge.
- **Fifth Tier:** Lakes Henry, Winterset, Hamilton, and Fannie, none of which are designated impaired or have trends in chlorophyll *a*.

Several projects were proposed as part of the WHCL WQMP, including Stormwater Infiltration Areas (SIAs) that reduce direct runoff and associated external nutrient loads into lakes and redirect surface water flows into ground water. Sediment inactivation/removal projects are proposed to reduce internal phosphorus loading. Other projects, such as planting SAV and EAV provide sustainable means of phosphorus removal and immobilization. Non-native species control, especially for *Hydrilla*, should continue, and maintaining native SAV cover of at least 30 percent is also important. Forested wetland hydration is proposed for valley lakes (historically colored due to forest flooding) in instances in which more color may inhibit the growth of algae. Whole lake aeration in smaller lakes could decrease algae productivity in lakes. Sediment, SIA, and SAV and EAV projects were proposed for all lakes, but not always with the same priority, while forest rehydration, lake aeration, and Floating Treatment Wetlands (FTWs) were proposed for only a few lakes. Projects were ranked lake by lake based on the relative likelihood of improving water quality in a lake. Cost was not a part of the rankings, but relative magnitudes of restoration costs were provided as a means of comparison.

The WQMP is consistent with the Winter Haven Chain of Lakes Surface Water Improvement and Management (SWIM) Plan, state and federal regulations, and a local preference for managing lakes as part of an overall interconnected water resource. This report also relies heavily on previously completed lake studies and reports for the WHCL. The WQMP was developed with cooperative funding from the Southwest Florida Water Management District (SWFWMD) and City of Winter Haven. Restoration projects and planning level cost estimates for the recommended projects are included in this WQMP.