

LAKE TIBET SUB-BASINS 1 AND 2 CURRENT CONDITIONS UPDATE

Final Report – February 2021



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EXECUTIVE SUMMARY

A 2007 report prepared by Environmental Research & Design, Inc. (ERD) for the Orange County Environmental Protection Division (OCEPD) titled “Butler Chain-of-Lakes Hydrologic/Nutrient Budgets and Management Plan” indicated that discharges from Lake Tibet Sub-basins 1 and 2 contain elevated concentrations of total phosphorus compared with similar drainage basins discharging into other lakes within the Butler Chain-of-Lakes. Lake Tibet Sub-basins 1 and 2 are located on the west side of Lake Tibet and contain approximately 994 acres of residential and golf course area. The golf course area uses reclaimed wastewater from the South Water Reclamation Facility for irrigation purposes.

A previous project to further evaluate Sub-basins 1 and 2, titled “Lake Tibet Sub-basins 1 and 2 Nutrient Source Evaluation”, was conducted by ERD from 2008-2009 for the Windermere Water and Navigation Control District (WWNCD) and OCEPD, with a Final Report issued in September 2010. This project concluded that both reclaimed irrigation water and fertilizers have a significant impact on concentrations and loadings of nitrogen and phosphorus in Sub-basins 1 and 2. Multiple recommendations were provided to reduce nutrient loadings discharging to Lake Tibet, but few of the recommendations were adopted. During 2018, golf course personnel indicated that they have implemented improvements to both fertilizer and reuse applications, including a computer-controlled irrigation process, which have potential to reduce off-site loadings. Prior to implementing recommendations from the 2010 report, WWNCD and OCEPD desired to evaluate current conditions to evaluate potential impacts from the implemented practices.

Field monitoring was conducted within Sub-basins 1 and 2 by ERD from October 2018-August 2019 to characterize the quantity and quality of various discharges within the two basins and to identify potential sources for the elevated total phosphorus concentrations observed at the basin outfalls. Sample collection and flow monitoring activities were conducted on a biweekly basis over the 10-month monitoring program at the same sites used in the 2010 study plus multiple additional sites, with 8 monitoring sites in Sub-basin 1 and 9 monitoring sites in Sub-basin 2. The field monitoring program included discharge measurements and collection and analysis of surface water samples for general parameters and phosphorus species. The monitoring program generated a total of 372 surface water samples and 2,232 field measurements, excluding discharge. Hydrologic and phosphorus budgets were developed for each of the two sub-basins, and management options are discussed.

Measured rainfall during the monitoring program was similar to the normal rainfall commonly observed in the Central Florida area during the period from October 2018-August 2019. A constant discharge was observed from the golf course area into Lake Tibet which averaged approximately 4.1 cfs from the two sub-basins, equivalent to approximately 2.62 mgd. The golf course applies an average of 1.00 inch/week of reuse water for irrigation.

Substantial increases in mass loadings occurred during migration through the golf course area compared with upstream basin areas. Calculated areal mass loadings of total phosphorus increased by approximately 2,967% during migration through Sub-basin 1 compared with phosphorus loadings entering the golf course from upstream areas. A 157% increase in areal phosphorus loadings was monitored in Sub-basin 2 during migration through the golf course. Increases in mass loadings were also observed for nitrogen species in the golf course area, with a 761% increase in areal loadings in Sub-basin 1 and a 368% increase in Sub-basin 2. In spite of the information contained in the 2010 Report regarding golf course impacts to Lake Tibet, both volumetric and mass loadings discharging from the golf course have increased since 2010.

The results of the field and laboratory investigations conducted in the 2010 and 2020 studies indicate that both reclaimed irrigation water and fertilizers appear to have a significant impact on concentrations of both nitrogen and phosphorus in surface water and groundwater within the golf course area. Reclaimed irrigation water used within the basin is characterized by elevated levels of total phosphorus which are 5-10 times higher than commonly observed in untreated stormwater runoff and 150 times higher than phosphorus concentrations in Lake Tibet. In addition, a large percentage of the total phosphorus in reclaimed water is present as soluble phosphorus, ammonia, and NO_x which represents a readily available source of phosphorus and nitrogen to downstream waterbodies.

Recommendations were developed to improve water quality characteristics in discharges from Sub-basins 1 and 2 to Lake Tibet, and many of these recommendations were also contained in the 2010 Report. These recommendations include:

1. Adjustment of fertilizer schedules to recognize nutrient loadings in reclaimed irrigation water;
2. Review current nitrogen application schedules to minimize nitrogen losses to surface water and groundwater;
3. Utilize on-site surface waterbodies for irrigation purposes before supplementing with reclaimed water;
4. Although recent modifications have improved the efficiency of the golf course irrigation system, overspray onto surface water and impervious surfaces was still observed;
5. Establish littoral zone and submerged vegetation in golf course waterbodies to assist in nutrient uptake;
6. Eliminate applications of herbicides and algaecides to on-site waterbodies; and
7. Implement chemical nutrient removal process in strategic golf course ponds, as necessary.

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