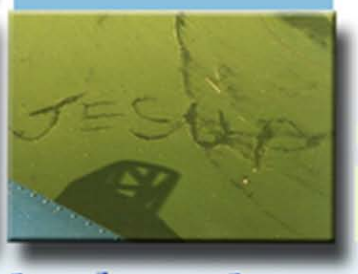

ADDENDUM

Lake Jesup Interagency Restoration Strategy

January 2011

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LAKE JESUP INTERAGENCY RESTORATION STRATEGY ADDENDUM

January 2011

1. INTRODUCTION

The Lake Jesup Interagency Restoration Strategy (Strategy) is an important document because it commits the St. Johns River Water Management District (SJRWMD), Florida Department of Environmental Protection (FDEP) and Florida Fish and Wildlife Conservation Commission (FWC) to the restoration of Lake Jesup. The Strategy maintains a focus on the phases a shallow lake undergoes in response to external nutrient load reduction and facilitates appropriate timing and planning of cost-effective restoration projects using an adaptive management framework. Several important events have occurred since the document was initially endorsed in January 2008 whose implications to the timeline and the narrative of the Strategy needed to be addressed.

Purpose for this Addendum

- To insure the Strategy adequately addresses recent events related to Lake Jesup.

Objectives

1) To modify the Strategy to address these recent events:
    - The Lake Jesup Basin Management Action Plan spreads the reduction of external phosphorus loads over 15 years rather than the five years as initially proposed
    - Improved management of reuse water and sludge disposal to reduce phosphorus export from Site 10 was incorporated into a new FDEP permit
    - Construction of new SR46 high-span bridge
    - The feasibility phase of cost-effective regional TP projects is almost complete and regional project lists updated
2) Address incorporation of any new Pollutant Load Reduction Goals (PLRGs) and Total Maximum Daily Loads (TMDLs) scheduled for completion by 2014
3) Provide a new timeline with parallel efforts identified as replacement for previously sequential activities

2. BACKGROUND

The original Lake Jesup Interagency Restoration Strategy described a two phase and seven-step process for restoring the lake to its designated use (Class III Freshwater). The Strategy followed a set of sequential steps that have been well documented in limnologic literature as appropriate for shallow, subtropical lakes with a large urbanized watershed. Tasks were recommended for each step and agency responsibilities assigned. The following summary lists the seven steps, their phases and provides a brief statement on recommended actions to achieve each goal.

Two Phase and Seven-Step Process for Lake Jesup Restoration

PHASE 1

1. Develop and Adopt the Basin Management Action Plan (BMAP).
2. Implement reduction of external phosphorus (P) loads.
   - *i) Pursue fertilizer regulation and build an outreach program.*
   - *ii) Identify sites with high rates of nutrient loading.*
   - *iii) Pursue large-scale regional treatment projects where phosphorus removal is most cost-effective.*
3. Reduce nutrients in the lake water column*.
   - *i) Complete preliminary studies and pilot projects that can potentially lead to rapid implementation of in-lake nutrient reduction following external load reduction.*
   - *ii) If necessary, fund temporary in-lake installations such as floating wetlands.*
   - *iii) Examine other methods for removal of P from the water column.*

PHASE 2

4. If necessary, implement additional projects to improve water clarity.
   - *i) Support targeted dredging in areas conducive to habitat restoration.*
   - *ii) Evaluate various dewatering approaches, including relatively new and rapid on-site sediment dewatering.*
5. Implement projects to increase native vegetation and reduce exotic species abundance.

   No further plans have been developed at this point.
6. Implement projects to establish healthy fish and wildlife habitat and populations.

   No further plans have been developed at this point.

PHASES 1 AND 2

7. Monitor water quality, vegetation and fish populations.

<u>OTHER PROJECTS AND RECOMMENDATIONS</u>

- Strategic dredging in the northern neck of the lake concurrent with SR46 bridge and reconnection.
- Complete studies to address gaps in nutrient loading source information.
- Incorporate monitoring completed as part of City of Sanford's Site 10 permit.

* *<u>Water column</u> is defined as the water above the point at which sampling equipment begins to encounter resistance from thick sediments or hard bottom. When the lake level is at or below this sediment surface, no sampling is completed*

The remainder of the original strategy provided conceptual plans and estimated costs for regional projects that could be used by stakeholders with nutrient reduction allocations in the BMAP. The intent for these projects was to provide the lowest cost per pound of P removed within the constraints of the Lake Jesup watershed. Stakeholders with allocations too small to be economically feasible could share the cost of these projects and receive credit for meeting their required reductions, even if the projects were not within their political boundaries.

The strategy document was endorsed by Kirby Green, Executive Director of SJRWMD; Michael Sole, Secretary of FDEP; and Kenneth Haddad, Executive Director of FWC in January 2008.

3. RECENT EVENTS AND THEIR IMPLICATIONS

Several important developments in the Lake Jesup restoration process have occurred since the first strategy was endorsed in January 2008.

The BMAP for the Total Maximum Daily Load (TMDL) was adopted with a longer duration for external nutrient load reduction implementation than anticipated, 15 years as opposed to five.

FDEP issued a new permit to the City of Sanford eliminating wastewater treatment plant residual applications to Site 10 on the northeastern shore of the lake.

The causeway bridge on SR46 was removed and replaced with a high span bridge over the entire floodplain.

Finally, several of the regional projects proposed in the first document have been evaluated for efficacy and P removal costs from both the tributaries and the lake water column.

The impact of these changes is discussed in this section.

BMAP extended to 15-year implementation

The focus of this BMAP was to achieve reductions in external P loads. Due to several technical uncertainties that required additional information before being addressed, the required reductions were spread over a 15-year timeframe with a phased approach that assigns equal portions of the required reductions in each of three five-year periods. The BMAP currently addresses the first third of the required P reductions. Concurrent with project implementation, water quality monitoring will be used to track the reductions achieved by projects and the lake's response to the reduction in external P loading and to determine what additional actions, if any, should be taken to achieve the TMDLs. A research plan was also included in the BMAP to provide the additional data to refine the TMDL and BMAP allocations in future cycles, as necessary.

Monitoring results to date for Site 10

The City of Sanford was issued a new operation permit by FDEP for the North Water Reclamation Facility, (Permit No. FL0020141) on November 6, 2009. This permit authorizes land application of reclaimed water in public access areas as well as on Site 10 for agricultural irrigation. The permit included a prohibition on land application of wastewater residuals as well as a required surface water monitoring program to determine potential water quality impacts of this past practice on Lake Jesup. Six sites were chosen for sampling on a quarterly basis. Of the six sites, Sites 3 and 4 are located closest to Lake Jesup. The sampling results reported for the first two quarters of 2010 for Sites 3 and 4 are shown below.

Site 3:

Parameter	1st Quarter	2nd quarter
pH (std. units)	6.0	6.05
CBOD5 (mg/L)	2.4	2.7
TSS (mg/L)	21	2.81
Ammonia Nitrogen (mg/L)	0.060	0.17
Total Kjeldahl Nitrogen (mg/L)	2.4	2.3
Total Nitrogen (mg/L)	2.4	2.4
Total Phosphorus (mg/L)	2.6	0.6

Site 4:

Parameter	1st Quarter	2nd quarter
pH (std. units)	6.2	6.64
CBOD5 (mg/L)	<2.0	7.3
TSS (mg/L)	2.51	14
Ammonia Nitrogen (mg/L)	0.071	0.053
Total Kjeldahl Nitrogen (mg/L)	2.1	1.8
Total Nitrogen (mg/L)	4.3	1.8
Total Phosphorus (mg/L)	2.7	1.8

It is difficult to determine a trend with only two sampling events thus far, but the results for the second quarter appear to be the same or lower than the first quarter for both Total Nitrogen and Total Phosphorus. Wastewater residuals application to the site was discontinued in August 2008 and one would expect to see a downward trend in nutrients over time.

The City is also required to sample storm event runoff from a tributary near Pond B-2, which is near Site 4. The results reported thus far are shown in the table below:

Tributary near Pond B-2

Parameter	1st Quarter	2nd quarter
pH (std. units)	6.1	6.94
CBOD5 (mg/L)	9.7	9.9
TSS (mg/L)	510	210
Total Nitrogen (mg/L)	6.7	6.6
Ammonia Nitrogen (mg/L)	--	0.59
Total Kjeldahl Nitrogen (mg/L)	6.4	4.8
Total Phosphorus (mg/L)	3.4	2.2

Results from this monitoring will be useful in developing appropriate Event Mean Concentrations (EMCs) for this site in the next round of watershed nutrient loading models and the potential development of techniques to reduce nutrient export to the lake.

Effect of new SR46 bridge

SJRWMD added an additional sediment sampling site to the sediment nutrient flux study, already underway, to explore changes in sediment transport following the removal of the SR46 bridge causeway. This study will be complete in September 2011. Further, SJRWMD and FWC will continue to assess natural erosion of the area known as Channel B.

Summary of Regional P Removal Feasibility Studies

Alum Tributary Treatment

A project completed September 2010, by Environmental Research and Design, Inc. (ERD), indicates that the project's objective to remove 4-6 metric tons of P could be accomplished by alum treatment of tributaries discharging into Lake Jesup. ERD's final report recommends an alum treatment system on Howell Creek that would remove approximately 4 metric tons per year. An additional system on either Gee Creek or Soldiers Creek System together, would remove another 1-2 metric tons of P per year. The report also indicates construction costs for an alum treatment system are roughly equal for all three tributaries in spite of large discharge differences. The deciding factor on tributary system construction selection would be based on land availability and distance to Lake Jesup. The majority of the load to the lake comes from areas close to the lake, but suitable uplands may not be available within this part of the watershed. The full report is available at
://publicfiles.dep.state.fl.us/DEAR/BMAP/MiddleStJohns/Lake_Jesup/Lake_Jesup_Interagency_Restoration_Strategy/

Floating Phosphorus Treatment

The use of aquatic plants, contained but floating within a water body, to remove nutrients from the water column has been studied extensively over the last several decades. This technique can be a relatively low cost and low maintenance treatment option compared to removal processes that rely on chemical reactions. Further, they eliminate the need to procure uplands and expensive building/environmental permits. One drawback is the large amount of plant volume and surface area that may be required to obtain high levels of treatment, but the lower cost and improved aesthetics make it a viable option in many cases.

There is another technical issue with the use of biological systems for removal of nutrients. Stormwater draining into lakes from tributaries is typically high in inorganic, biologically available forms of P and N that rapidly stimulate algal growth. Once the water reaches a lake, however, the readily available nutrients are quickly converted into organic forms within the food web. High nutrient loads favor algae populations, leading to algae blooms and later to increased deposition of organic sediments. Further, removal of less biologically available organic nutrients from the water column becomes much more difficult. Consequently, treatment in the watershed is the preferred option.

Recognizing the need to evaluate alternative techniques for P removal in urban, hypereutrophic lakes such as Lake Jesup with limited uplands for traditional treatment, the District issued a request for proposals to design and test a prototype to meet these multiple objectives. It needed to use some kind of floating biological treatment in conjunction with other treatment processes that might reduce the required treatment footprint, fit within the constraints of a small tributary or

stormwater pond, be cost-effective and provide an aesthetic alternative to typical mechanical systems. The prototype also needed to be independent of land-based power. The Center for Wetlands at the University of Florida was awarded the contract to evaluate a floating P removal system combining a biologic unit with at least one physical adsorptive media unit and using solar power to operate pumps.

After several months testing different configurations and materials in mesocosms and laboratory experiments, a two-unit process was built that used plant and biofilter uptake first, followed by phosphorus adsorption using a commercially available media – Phos-X™. This system was named the Floating Island Treatment System (FITS) and exhibited consistent PO_4 treatment efficiencies between 40% and 100%. The final five-week optimization experiment during the late spring and early summer showed average PO_4 and TP removal efficiencies of 96% and 84%, respectively. The projected annual removal rate was between 10 and 20 kg P/m^2/yr. This translates to a treatment area of approximately 50 m^2 (~540 sq ft) required to treat one metric ton of P every year. The full report is available at ://publicfiles.dep.state.fl.us/DEAR/BMAP/MiddleStJohns/Lake_Jesup/Lake_Jesup_Interagency_Restoration_Strategy/

Because this project was primarily a proof-of-concept study, accurate cost estimates for capital and Operations and Maintenance (O&M) cannot be determined. However, preliminary estimates place the costs in the lower range of those typically found in P removal processes. This is primarily possible through the use of recyclable Phos-X, the relatively low maintenance costs and the open sharing of process details, thus eliminating costs associated with patent rights. Based on the success of the prototype in overall P removal, SJRWMD is looking for interested stakeholders to assist with additional optimization of the floating structure so that final cost estimates can be determined accurately.

Phragmites Harvest for Phosphorus Removal & Floodplain Management

This study assessed the potential for P removal at Lake Jesup through the harvest of *Phragmites australis* (Cav.)Trin. ex Steud. (common reed) that dominates portions of Lake Jesup's littoral zone. P storages and flows within the plant biomass, soils, and waters of the system were also investigated. *P. australis* nutrient content, intra-plant nutrient translocation, and regrowth following small-scale harvests were investigated to determine repeated harvest potential and the appropriate season for harvest to maximize P removal. Harvest during months with peak P storage in living aboveground biomass may remove 23.5 kg P/ha (20.3 lb P/acre) permanently from the Lake Jesup system. Senesced aboveground biomass would provide a supplemental P removal between 10 – 36% after harvest of living plants. Large quantities of nitrogen (N) (107.66 – 250.48 kg TKN/ha) and accompanying biomass (19.09 – 45.19 MT wet biomass/ha) would also be removed. Litterbag studies examined the *in situ* decomposition of harvested litter and showed P loss over the first 3½ months of more than 81% of the available aboveground P. Therefore, cutting without plant removal would negate the majority of potential P removal accomplished via harvesting.

Additional work is required to study the long-term effects of large-scale harvest and to provide more accurate estimates of the cost per pound P removed. However, preliminary results indicate that this might be one of the lowest cost removal options.

Another important result from the study indicates a large store of P exists in the marsh soils near agricultural land use activities. P content in the soil was comparable to a medium level waste water treatment wetland, and storage in the vegetation was in the range found in high nutrient load treatment wetlands. This finding indicates the need to better quantify overland flow into the lake from nearby agricultural operations.

This study also provided some insights on using seasonal harvests as a permanent *Phragmites* removal option that would eliminate the nutrient recycling issues and rapid regrowth associated with using herbicide or burning as a treatment method. The full report is available at ://publicfiles.dep.state.fl.us/DEAR/BMAP/MiddleStJohns/Lake_Jesup/Lake_Jesup_Interagency_Restoration_Strategy/

Pay-for-Performance Project

In April 2007, AquaFiber Technologies Corporation was selected by the SJRWMD to construct a Pay-for-Performance project outlined in the original Lake Jesup Interagency Strategy document. This project evaluates potential for sustainable removal of a minimum of 1.0 MT/year of P and demonstration of full-scale feasibility to achieve a minimum P removal rate of 15MT/year. AquaFiber began water treatment operations on April 18, 2009. Year 1 was focused on phased technology development and system testing. AquaFiber achieved stable effluent flow and treatment by the end of the first operational year. The AquaFiber facility has now been operational for two years. To date, AquaFiber has conducted two transport/disposal events with SJRWMD payment for 2,795 lbs of phosphorus. SJRWMD payment for P removal is restricted to P transported and properly disposed of outside of the Lake Jesup basin. The SJRWMD verified P removal and transport by conducting a mass balance analysis on phosphorus transported out of the lake basin and comparing those calculations to the independent wet chemistry data of both SJRWMD and AquaFiber. Large quantities of phosphorus continue to be processed and stored at the AquaFiber Lake Jesup site in preparation for transport out of the basin. AquaFiber is projecting that they will achieve or exceed the 1MT phosphorus removal target for Year 2 operations.

Treatment efficiencies from the Year 2 of operations (12 months) are summarized in the table below. These summary data were provided by AquaFiber. These data were calculated from water samples that were collected hourly, composited over 7 days, and analyzed weekly by an independent NELAP-Accredited water testing laboratory (n=51 composite water samples). The AquaFiber data presented in the table below were supported by independent water monitoring by the SJRWMD and District-contracted independent laboratory analysis.

TP Treatment Efficiency Summary: AquaFiber Lake Jesup Project (4/18/2010 to 04/18/2011)

	TP-in (Lake Influent, mg/L)	TP-out (Post Treatment Effluent, mg/L)	% TP Reduction
Annual Average	0.193	0.026	82.5
Minimum	0.058	0.002	46.3
Maximum	0.607	0.070	99.5

As a requirement of their FDEP permit, AquaFiber conducted Whole Effluent Toxicity (WET) testing monthly for the first four months after stable effluent flow and treatment was achieved. No process-related toxicity issues were observed. As a result of these findings, testing is now conducted on a quarterly basis. The results of the WET tests showed that after AquaFiber nutrient removal and treatment, the lake water showed reduced toxicity compared to control water samples drawn from Lake Jesup.

Potential Regional Projects Updated

Seminole County contracted with Camp, Dresser and McKee to develop preliminary plans and cost estimates for additional P treatment projects within the county. They evaluated twelve projects at designated locations in the Gee, Soldier, Six Mile, Bear Gully and Howell Creek watersheds. These projects recommend several traditional treatment options with a wide range of treatment and cost efficiencies.

Project Description	Watershed	TP Reduction, lbs/yr
Bear Gully Canal Regional Treatment Pond	Bear Gully Canal	53-154
Bear Gully Canal Regional Treatment Pond	Bear Gully Canal	1-32
Preserve at Eagle Lake HOA Pond	Six Mile Creek	229
Esterson Borrow Pit	Lake Jesup	554
Gee Creek Regional Treatment Pond	Gee Creek	74-1,175
Howell Creek Alum Facility	Howell Creek	1,856
Northgate Subdivision Retention Pond		10
Red Bug Lake Regional Stormwater Facility	Howell Creek	3-85
Six Mile Creek Regional Treatment Pond	Six Mile Creek	331-961
Soldiers Creek Regional Treatment Pond	Soldiers Creek	20-626
SR417 Borrow Pit	Six Mile Creek	31-181
Winding Hollow Subdivision Rehydrated	Gee Creek	279

More detailed descriptions of these projects can be found at the end of this Addendum. These projects will be considered by stakeholders for future implementation.

4. PLANNING FOR NEW POLLUTANT LOAD REDUCTION GOALS/TOTAL MAXIMUM DAILY LOADS

Gaps in Water Quality Information

Nitrogen Fixation Results

Two different studies were conducted to quantify the rates of N-fixation occurring in Lake Jesup. Seminole County conducted a single day test in August 2006 to verify that N-fixation loaded a significant amount of nitrogen and SJRWMD conducted tests during 2007and 2008 to quantify the seasonal and diurnal fluctuations in N-fixation rates. The results from these studies are presented

below and confirm that estimates of nitrogen loading from N-fixation made in the Lake Jesup TMDL.

The preliminary study completed by PBS&J for Seminole County estimated an excess TN value of 1.84 mg/L, which corroborates the in-lake data and the TMDL estimates.

Researchers from Florida International University (FIU) estimated 128.6 MT N were fixed and loaded to Lake Jesup during the study (334 d). This equates to 140.5 MT N per year by direct proportions disregarding seasonal variation (334 d scaled to 365 d). In FDEP's TMDL, the input by N.fixation was estimated as an average between 173 and 252 MT N per year. The measured values in this study ranged from 71.3 MT N/yr to 262.7 MT N/yr, which brackets the TMDL range. The TMDL suggests that droughts caused higher nitrogen fixation rates to be used for 1999 and 2001 (p74, 2nd paragraph) and that this was due to higher DOC and possibly higher TP (paragraph 2) which is typically an appropriate assumption in a model. However, FIU did not find that any of these factors affected N-fixation in Jesup, mainly because P is in excess constantly, is never limiting and therefore does not affect N.fixation rates.

These results will be incorporated into future PLRG and TMDL development. However, because the estimates used in the original TMDL were close to the recently measured rates, overall reductions required are unlikely to change substantially. The full report is available at ://publicfiles.dep.state.fl.us/DEAR/BMAP/MiddleStJohns/Lake_Jesup/Lake_Jesup_Interagency_Restoration_Strategy/

Sediment Nutrient Releases

Two different studies have been conducted to assess the amount and nutrient content of sediment resuspension in Lake Jesup. Seminole County conducted a study of diffusive flux and sediment oxygen demand in September 2006. SJRWMD has a multi-year contract with FIU to evaluate nutrient cycling through sediment release and resuspension.

Seminole County's Lake Jesup *in situ* assessment of sediment nutrient diffusion and sediment oxygen demand was completed by HydroO2, Inc. in September 25 – 29, 2006, utilizing the *in situ* SOD/Nutrient Flux chamber method. Five representative sites were selected for nutrient diffusion measurements. Results indicated that NH_3 exhibited approximately 7,000 lb NH3/day in upward diffusion and dissolved P was close to 600 lbs/day in September. More details about this study can be found at the end of this report. These results will be compared to the SJRWMD nutrient cycle study when it is complete in October, 2011.

Groundwater Inputs

Seminole County, in partnership with the District, has conducted an evaluation of hydrologic and nutrient loadings from groundwater seepage entering Lake Jesup. ERD. initiated this project in summer 2009. Information collected included groundwater quality and quantity data that can be utilized to improve water and nutrient budgets and models. Forty seepage meters were installed initially, although several were vandalized and stolen. Ultimately, data from 24 seepage meters were utilized throughout the duration of the fieldwork, which was completed in July 2010.

Results indicate several areas of potential groundwater seepage with appreciable P concentrations. The full report is available at

://publicfiles.dep.state.fl.us/DEAR/BMAP/MiddleStJohns/Lake_Jesup/Lake_Jesup_Interagency_Restoration_Strategy/. A follow-up study is in progress to better differentiate between nutrient loads from groundwater and the nutrients potentially in the seepage meters from the flocculant sediments. This study will be complete summer of 2012.

Load Sources and Attenuation (County and Municipality Allocations)

The Lake Jesup BMAP stakeholders worked with FDEP to create a monitoring strategy to track water quality trends (both P and N) in the lake and its tributaries, determine nutrient inputs to the lake, track inflow and outflow trends from each jurisdiction, and collect necessary information on nutrient loads to support future refinement of the TMDL and BMAP. Monitoring stations have been established to provide a more comprehensive representation of nutrient loading from respective jurisdictions and attempt to address attenuation of loads as they move through the watershed.

As part of the water quality monitoring plan, the City of Sanford is expanding monitoring on Site 10. Site 10 was used for wastewater treatment plant residual and reclaimed water disposal. The city has ceased residuals application on the site and is working with local stakeholders on agreements to accept the reclaimed water for reuse. At the time Lake Jesup nutrient TMDLs were developed, Site 10 was considered a regular industrial land area and the event mean concentrations for TN and TP applied to the site may have potentially underestimated the nutrient loading from the site. As part of the overall Lake Jesup TMDL re-evaluation, FDEP will re-evaluate nutrient loadings from the site using the available site-specific monitoring data.

In addition, several entities have completed research studies or are implementing studies that will provide information needed to reduce the current technical uncertainties associated with the BMAP. Twenty research projects are included in the BMAP that have been or will be completed by the Cities of Orlando and Oviedo, Orange and Seminole Counties, and the SJRWMD.

The information from the monitoring strategy and research studies will provide valuable information to understand the key uncertainties in the basin. The appropriate data will be provided to FDEP for consideration in the re-evaluation of the TMDL, according to the watershed assessment cycle. If the TMDL is revised, the BMAP will be revisited and the allocations recalculated. While the BMAP includes the allocations for each entity for the entire 15-year implementation period based on the current TMDL, these allocations will likely be adjusted in the future.

As a part of BMAP follow-up, FDEP, the basin working group (BWG), and technical stakeholders will track implementation efforts and monitor water quality in Lake Jesup. The results will be used to evaluate whether the plan is effectively reducing external TP loading and the lake's response. The BWG will meet at least every 12 months to discuss implementation issues, consider new information, and determine what other management strategies are needed to meet the TMDLs and Lake Jesup's restoration goals, if necessary. This information will be summarized in an annual report compiled by FDEP and made available to the public.

SJRWMD Pollutant Load Reduction Goal Schedule

Work on a final Lake Jesup pollutant load reduction goal (PLRG) will begin when the sediment nutrient cycle study is complete (September 2011) and a revised watershed loading model with corrections and updates uncovered during the BMAP process has been simulated. Because Lake Jesup's in-lake responses to loads are complex, the PLRG may not be finalized until the District's

CE-QUAL-ICM water quality model can be simulated. CE-QUAL-ICM is a finite volume eutrophication model that can be used to calculate 3-dimensional water quality variables. The model can be applied to any surface water system, including mixed dimensions (e.g. a river discharging to an estuary). It incorporates 22 state variables that include multiple forms of algae, carbon, nitrogen, phosphorus, dissolved oxygen sediment oxygen demand and sediment-water nutrient flux. With or without this model, the PLRG recommendations should be complete in time to serve as a support for revisions of the FDEP TMDL. The CE-QUAL-ICM model is currently linked and running with the EFDC hydrodynamic model for the lower St. Johns River basin. The EFDC model has been completed for the Middle St. Johns River basin and work to incorporate the CE-QUAL water quality model should begin soon.

FDEP TMDL Modeling Schedule

The Lake Jesup TMDL and BMAP were developed with the best information available at the time (2004-2005 and 2006-2009, respectively). During these processes, a number of significant data gaps were identified. The data gaps, which most concern the stakeholders, are related to nitrogen-fixation and nutrient fluxes between the water column and sediments in Lake Jesup. There is some concern these processes are contributing a significant portion of the nutrient load, and in turn contributing to thelake's impairment. SJRWMD and Seminole County have completed research studies to quantify nitrogen-fixation in the lake, see above. Seminole County has also completed a sediment diffusion study and SJRWMD has a sediment nutrient flux study underway. The results from these efforts should provide some of the detail necessary to improve the TMDL in the next iteration.

In order to move forward with this BMAP, FDEP staff committed to reevaluating the TMDL in Year 5 (2014) of BMAP implementation using the pertinent data collected from the monitoring plan and research studies. It will be important for FDEP to prioritize the recalculation of the Lake Jesup TMDL at this time to create a more accurate picture of the nutrient sources in the watershed. Once the TMDL has been revised, the next phase of the BMAP will be implemented and the allocations will be updated, as necessary, to reflect the new information from the TMDL.

Update on Other Activities Completed or In Progress

Native Vegetation Restoration

Seminole County and the Florida Fish and Wildlife Conservation Commission (FWC) are working together to plant native aquatic vegetation on the north shore of Lake Jesup in the vicinity of the 417 Bridge. One hundred twenty thousand plants have been planted along approximately 15,000 feet of shoreline. Species planted include bulrush, cord grass, pickerel weed and cypress trees. The bulrush was placed in open water areas to provide littoral habitat where none currently exists while the other plants were placed in the transitional zone to replace invasive/exotic plants with a more diverse and desirable plant community.

Lake Jesup currently has a very limited amount of submersed aquatic vegetation (SAV), which provides valuable habitat for fish/wildlife. While there are several hundred acres that could potentially support SAV, conditions in the lake have prevented its growth. The FWC has been working on establishing eelgrass, a desirable native submersed plant, in Lake Jesup for several

years. In 2010, a successful test planting was conducted, and a larger scale planting is scheduled for November 2011.

Update Lake Jesup QUAL2K Water Quality Model

Scott Lowe, HDR, is currently updating a previously developed water quality model. Additional storm event and other actual water quality data have being incorporated into model dataset, thus improving the accuracy of the model. Final simulations are waiting on results of ERD Groundwater Seepage Study to incorporate into the model. Completion of update is anticipated in early 2011. QUAL2K (or Q2K) is a river and stream water quality model developed for EPA and simulates steady state flow that includes conventional pollutants (nitrogen, phosphorus, dissolved oxygen, BOD, sediment oxygen demand, algae), ph, periphyton and pathogens.

Changes in Targeted Dredging Process

FWC was pursuing a project to dredge about 10% of the soft sediments from strategic areas of the lake to expedite habitat restoration. However, the plans for handling the dredged sediments required impoundment of wetland areas that added a large mitigation requirement to a project cost that was already over budgets allocated for the project. Since then, several alternatives for eliminating the impoundment component have been evaluated or conceptualized.

The FWC has approved funding for engineering and design for a dredging project on Lake Jesup. The project being considered for Lake Jesup is the restoration of the historic hydrologic connection between the St. Johns River and Lake Jesup. The project would involve removing approximately 50,000 cubic yards of fill and organic sediment from the eastern segment of the old river channel (channel “B”) via hydraulic dredge. The goal would be increasing water exchange in the northern portion of the lake which should increase water exchange and improve water quality enough to establish submersed aquatic vegetation in the vicinity of the channel. The main impediment to the project is lack of a suitable tract of land to contain the sediment while it is dewatered.

The FWC is currently funding an evaluation of rapid dewatering technology through the University of Florida to determine if the process is viable and economical. The main benefit of the rapid dewatering process is the elimination of the need for large tracts of land for spoil dewatering. If it proves practical, it would be ideal for use on a lake such as Lake Jesup which doesn’t have suitable land for spoil disposal nearby. We expect the rapid dewatering evaluation to be completed by December 2011.

If the rapid dewatering technology proves viable, the FWC will begin engineering design for the channel B dredging project including surveying the channel, volume calculations, contaminant testing and permitting.

5. REVISED TIMELINE AND RESPONSIBILITIES

The timeline was revised to indicate those activities that were parallel in the original restoration strategy that have been replaced by sequential or overlapping schedules. This change has been made to accommodate the lengthened period for external nutrient reductions and promotes more rapid development of in-lake habitat improvements. It does not address any changes to the BMAP

to allow for in-lake reduction projects, which is a more complicated issue requiring completion of several ongoing studies before an assessment can be made.

Revisions to the timeline are summarized in the table at the end of this report. Assignment of agency responsibilities remains unchanged.

6. CONCLUSIONS

Change in Status Updates and Meeting Schedule

Regular updates that are currently provided twice a year will change to an annual schedule. A tabular form with brief updates and links to additional information was preferred by the agency representatives and the stakeholders that receive the updates. These tables will include hyperlinks to online reports whenever possible. Additional information provided by contributors will be included with the update as appendices.

This interagency group will meet on a schedule closely linked to BMAP meetings, but with a separate agenda and meeting time.

Upcoming Milestones

The next meeting of the Lake Jesup BMAP stakeholders is planned for July 2011. Annual updates will precede this meeting and all future annual meetings. Interagency meetings will be held as appropriate in response to additional changes or as milestones are reached.

TIMELINE FOR ACTION PLAN (proposed/accepted 6/23/10)

Milestone	BMAP allocations; projects prioritized	Fertilizer ordinances; Pilot project and feasibility	Project design; Permitting Construction begins	External load reduced by 3.4 MT/yr	External load reduced to full TMDL	In-lake TP reduced to 0.094 mg/L	In-lake TDS < 250 mg/L	SAV > 15%	SAV > 40%
Action Step	**FY09**	**FY10**	**FY11-13**	**FY14**	**FY24**	**FY27**	**FY28**	**FY29**	**FY30**
Develop the Basin Management Action Plan (BMAP)	**X**	**X**							
Reduce external phosphorus loads		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Remove nutrients stored in the lake water column				**X**	**X**	**X**	**X**	**X**	**X**
If necessary, implement projects to further improve water clarity			**X**	**X**	**X**	**X**	**X**	**X**	**X**
If necessary, implement projects to increase native vegetation, control exotic species and enhance sport fish populations		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Monitor water quality, vegetation, and fish populations	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Appendix: Fact Sheets

Bear Gully Canal Regional Treatment Pond

Project Description: Convert existing 14.7 acre borrow pit to 16.2 acre off-line pond to accept discharge from Bear Gully Canal tributary. County currently has a drainage easement over the existing borrow pit.

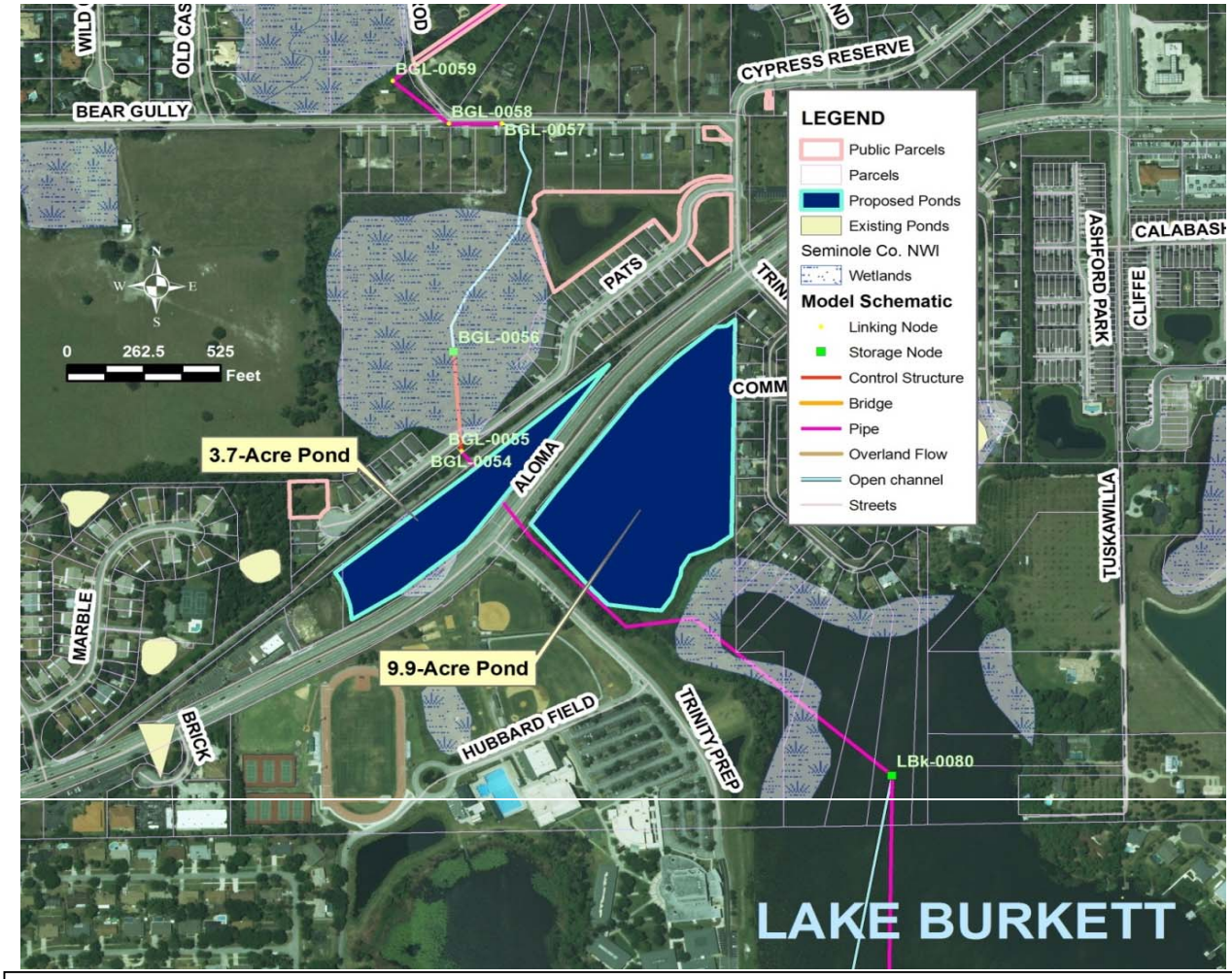
Upstream Tributary Area: 1,098 acres
Affected Jurisdictions (% net TP load): Seminole County (64.5%), FDOT (3.1%), Turnpike Authority (13%)
Receiving Water Bodies: Bear Gully Canal, Lake Jesup
Proposed Treatment Type: Wet Detention
Available Land for Treatment: 20.4 acres
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: none
Existing Net TP Load (lbs/yr): 432
Range of Estimated Total TP Reduction[1] (lbs/yr): 82 to 238
Range of Estimated County TP Reduction[1] (lbs/yr): 53 to 154
Estimated Conceptual Capital Cost: $303,000
Benefit Cost Ratio ($/lb TP removed): $661 per lb to $227 per lb (based on total estimated TP reduction)

Notes: Also provides treatment for agricultural and natural/wetland upstream areas (19.3% of net TP load)

1 - TP Reduction was calculated using two different methods. The first value was obtained using the Walker method (Walker, W. W., Jr. (1981). "Empirical methods for predicting eutrophication in impoundments; Report 1, Phase 1: Data base development," Technical Report E-81-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS., NTIS No. AD A101 553.). The second value was obtained using the methodology to estimate TP removal for wet detention as presented in the "Evaluation of Current Stormwater Design Criteria in the State of Florida" (Harper, 2007) prepared for FDEP.

CDM

Bear Gully Lake Regional Treatment Pond



Project Description: Construct 3.7 ac on-line pond upstream of Bear Gulley Lake on FDOT-owned property OR construct 9.9 ac off-line pond downstream of Lake Burkett.

Upstream Tributary Area: 1,499 acres
Affected Jurisdictions (% net TP load): Seminole County (11.6%), Orange County (62.3%), FDOT (1.3%), OOCEA (2.6%), Turnpike Authority (1.8%)
Receiving Water Bodies: Bear Gully Lake, Lake Jesup
Proposed Treatment Type: Wet Detention
Available Land for Treatment: 4.9 acres for 3.7 ac pond (owned by FDOT); 11.7 ac for 9.9 ac pond (owned by Trinity Preparatory)
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: none
Existing Net TP Load (lbs/yr): 693
Range of Estimated Total TP Reduction[1] (lbs/yr): 6 to 278 (3.7 acre pond)/23 to 342 (9.9 acre pond)
Range of Estimated County TP Reduction[1] (lbs/yr): 1 to 32 (3.7 acre pond)/3 to 40 (9.9 acre pond)
Estimated Conceptual Capital Cost: $329,000 / $1,878,000 (includes land acquisition)
Benefit Cost Ratio ($/lb TP removed): $4,480 per lb to $97 per lb / $4,855 per lb to $325 per lb (based on total estimated TP reduction)
Notes: Also provides treatment for agricultural and natural/wetland upstream areas (20.4% of net TP load)

1 - TP Reduction was calculated using two different methods. The first value was obtained using the Walker method (Walker, W. W., Jr. (1981). "Empirical methods for predicting eutrophication in impoundments; Report 1, Phase 1: Data base development," Technical Report E-81-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS., NTIS No. AD A101 553.). The second value was obtained using the methodology to estimate TP removal for wet detention as presented in the "Evaluation of Current Stormwater Design Criteria in the State of Florida" (Harper, 2007) prepared for FDEP.

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Preserve at Eagle Lake HOA Pond

Project Description: Utilize Preserve at Eagle Lake HOA pond for treatment[1]. Re-route low flows from Six Mile Creek tributary to 19.6-ac pond.

Upstream Tributary Area: 1,085 acres
Affected Jurisdictions (% net TP load): Seminole County (16%), Sanford (54.1%), FDOT (2.4%), Turnpike Authority (16.3%)
Receiving Water Bodies: Six Mile Creek, Lake Jesup
Proposed Treatment Type: Wet Detention
Available Land for Treatment: 24.6 acres
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: none
Existing Net TP Load (lbs/yr): 382
Range of Estimated Total TP Reduction (lbs/yr): 229
Range of Estimated County TP Reduction[1] (lbs/yr): 37
Estimated Conceptual Capital Cost: $210,000
Benefit Cost Ratio ($/lb TP removed): $249 per lb (based on total estimated TP reduction)

Notes: Also provides treatment for agricultural and natural/wetland upstream areas (11.2% of net TP load)

1 - This project would require a use agreement between the County and the HOA. Terms of such an agreement would include the County providing long-term maintenance and park amenties such as walkways and benches in exchange for use of the pond.

CDM

Esterson Borrow Pit

Project Description: Expand existing borrow pit into 43.3-ac off-line pond. Re-route low flows from Mellonville Ave. and Oak Way roadside ditches into pond for water quality treatment.

Upstream Tributary Area: 2,597 acres
Affected Jurisdictions (% net TP load): Seminole County (34%), Sanford (24.5%), Turnpike Authority (3.9%)
Receiving Water Bodies: Lake Jesup
Proposed Treatment Type: Wet Detention
Available Land for Treatment: 131 acres (private property)
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: none
Existing Net TP Load (lbs/yr): 924
Range of Estimated Total TP Reduction (lbs/yr): 554
Range of Estimated County TP Reduction (lbs/yr): 188
Estimated Conceptual Capital Cost: $4,490,000 (includes land acquisition)
Benefit Cost Ratio ($/lb TP removed): $577 per lb (based on total estimated TP reduction)

Notes: Also provides treatment for agricultural and natural/wetland upstream areas (37.7% of net TP load)

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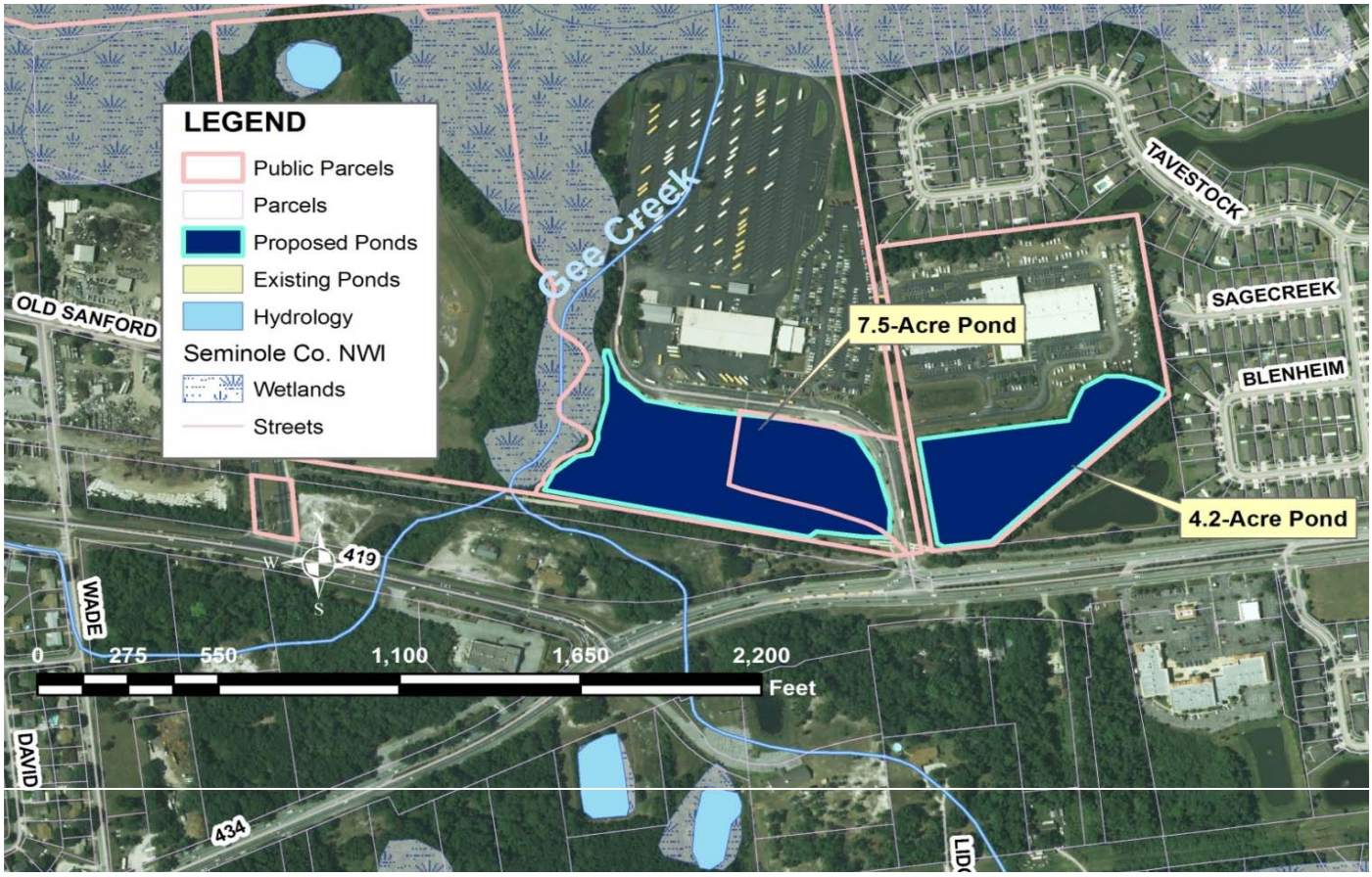
Gee Creek Regional Treatment Pond



Project Description: Construct 11.7-ac off-line pond on County-owned (school board) land to treat Gee Creek outflow before discharging into Lake Jesup.

Upstream Tributary Area: 9,622 acres
Affected Jurisdictions (% net TP load): Seminole County (8.2 %), Alatamonte Springs (1.8%), Casselberry (27.9%), Longwood (12.8%), Winter Springs (24.4%), FDOT (2.7%)
Receiving Water Bodies: Gee Creek, Lake Jesup
Proposed Treatment Type: Wet Detention
Available Land for Treatment: 53.6 acres
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: none
Existing Net TP Load (lbs/yr): 2,939
Range of Estimated Total TP Reduction[1] (lbs/yr): 74 to 1,175
Range of Estimated County TP Reduction[1] (lbs/yr): 6 to 97
Estimated Conceptual Capital Cost: $3,306,000 (includes land acquisition)
Benefit Cost Ratio ($/lb TP removed): $2,477 per lb to $155 per lb (based on total estimated TP reduction)

Notes: Also provides treatment for agricultural and wetland upstream areas (22.2% of net TP load)

1 - TP Reduction was calculated using two different methods. The first value was obtained using the Walker method (Walker, W. W., Jr. (1981). "Empirical methods for predicting eutrophication in impoundments; Report 1, Phase 1: Data base development," Technical Report E-81-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS., NTIS No. AD A101 553.). The second value was obtained using the methodology to estimate TP removal for wet detention as presented in the "Evaluation of Current Stormwater Design Criteria in the State of Florida" (Harper, 2007) prepared for FDEP.

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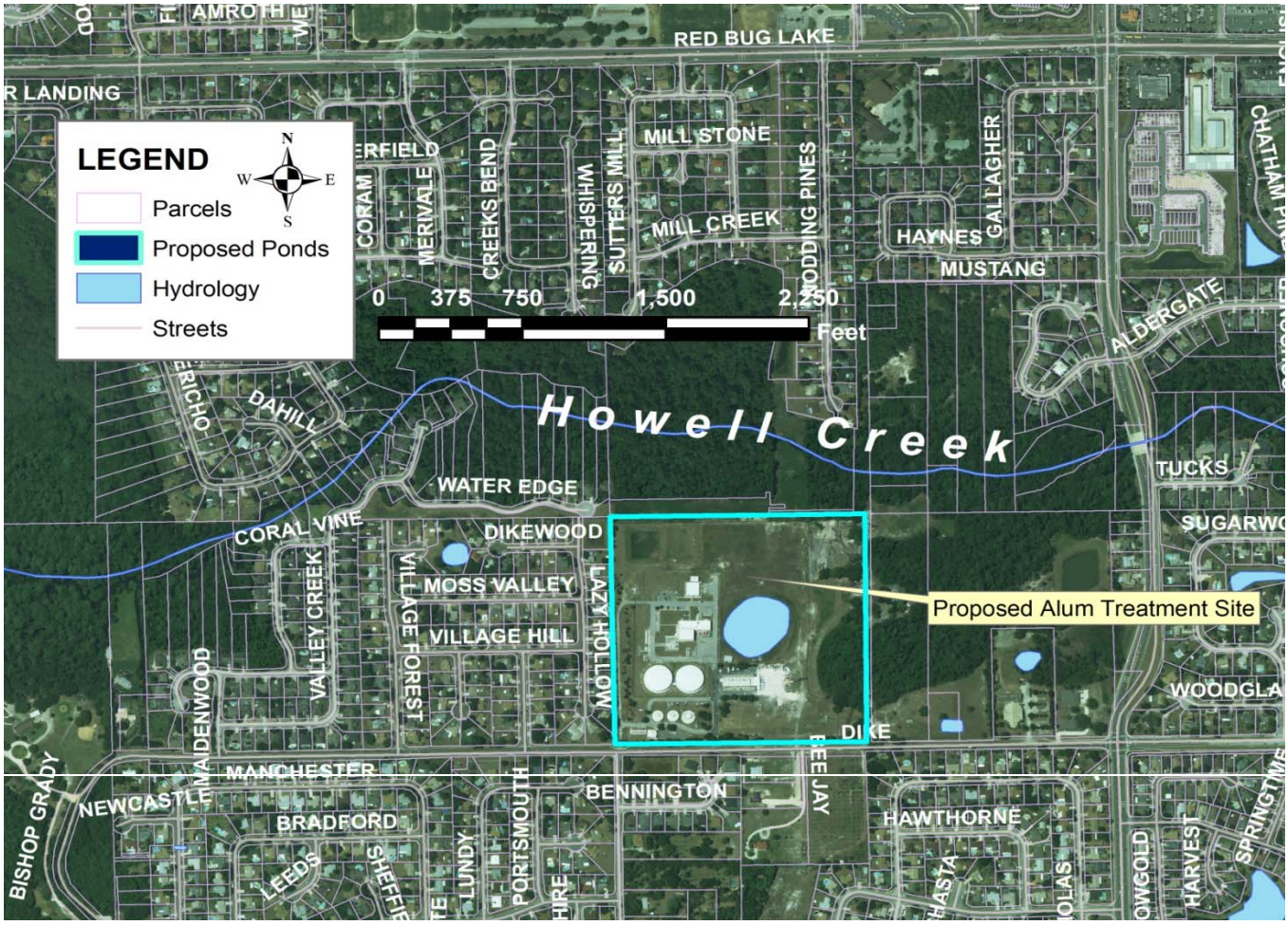
Howell Creek Alum Facility



Project Description: Alum chemical treatment at County Water Treatment Plant south of Howell Creek, just downstream of Lake Howell.

Upstream Tributary Area: 391 acres (Lake Howell surface area)
Affected Jurisdictions (% net TP load): Seminole County, Orange County, City of Orlando
Receiving Water Bodies: Howell Creek, Lake Jesup
Proposed Treatment Type: Non-Contributing Subbasin
Available Land for Treatment: N/A
Verified Water Quality Impairment: None
Draft Verified Water Quality Impairment: Howell Creek below Lake Howel (fecal coliform)
Estimated Total TP Reduction (lbs/yr): 1,856

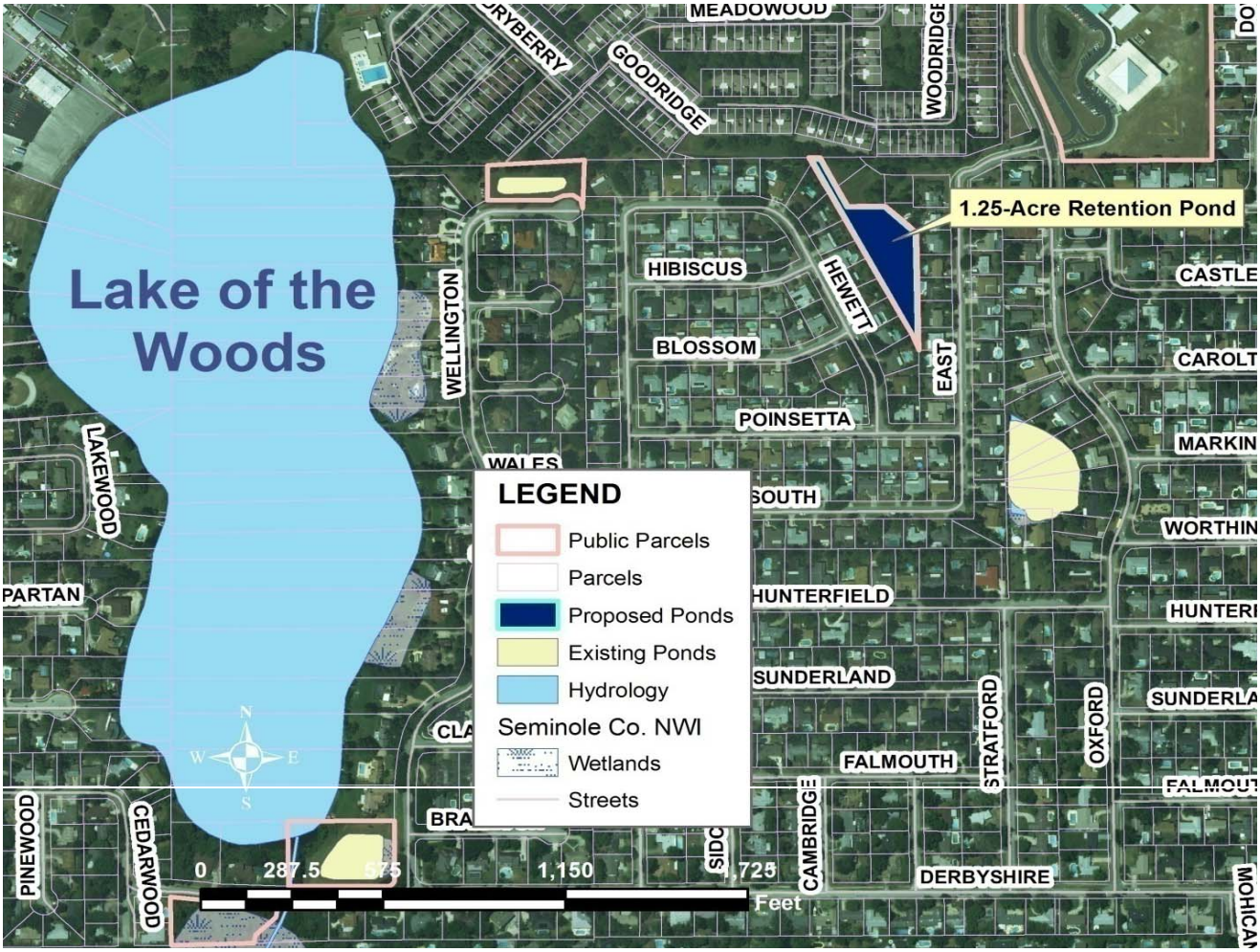
Estimated Conceptual Cost[1]: $603,000
Benefit Cost Ratio ($/lb TP removed): $47 per lb TP

Notes:

1 - Conceptual capital costs were esitmated based on values for construction cost per acre treated and O&M cost per acre treated presented in "Alum Treatment of Stormwater: An Innovative BMP for Urban Runoff Problems" (Harper et. al., 1999).

CDM

Northgate Subdivision Retention Pond



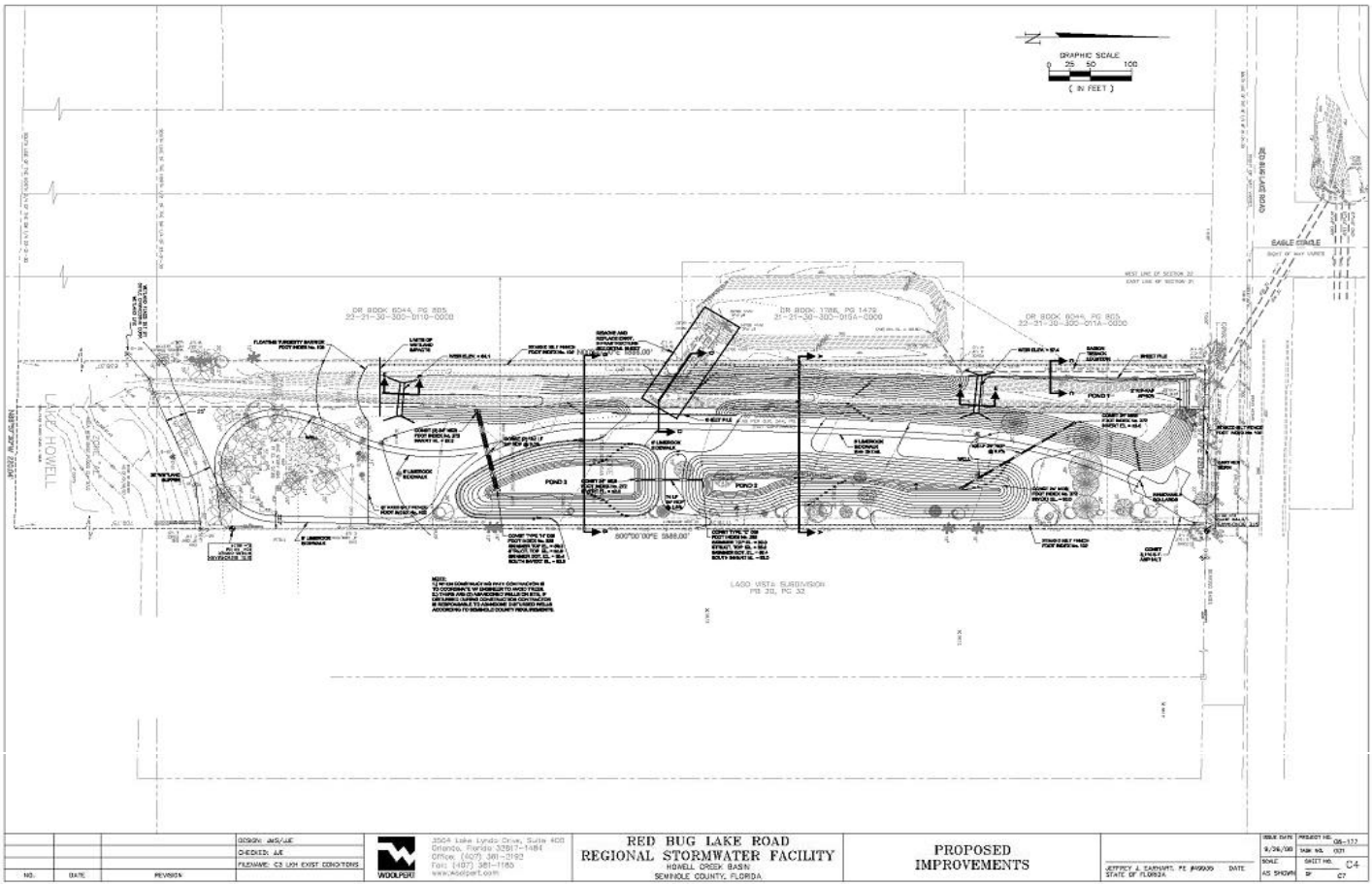
Project Description: Construct 1.25-ac off-line retention area on County property to capture and treat runoff from Northgate Subdivision.

Upstream Tributary Area: 55 acres
Affected Jurisdictions: Seminole County
Receiving Water Bodies: Lake of the Woods
Proposed Treatment Type: Retention
Available Land for Treatment: 1.4 acres
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: Lake of the Woods(nutrients (TSI))
Existing Net TP Load (lbs/yr): 10
Estimated Total TP Reduction (lbs/yr): 10
Estimated County TP Reduction (lbs/yr): 10

Estimated Conceptual Cost: $199,000
Benefit Cost Ratio ($/lb TP removed): $1,400 per lb

CDM

Red Bug Lake Road Regional Stormwater Facility



Project Description: Construct wet detention treatment train (wet detention) on County easement upstream of Lake Howell to capture and treat runoff from Deer Run Subdivision (project already under design).

Upstream Tributary Area: 1,163 acres
Affected Jurisdictions (% net TP load): Seminole County (52.4%), Casselberry (38%), FDOT (0.1%)
Receiving Water Bodies: Lake Howell, Lake Jesup
Proposed Treatment Type: Wet Detention
Available Land for Treatment: 6 acres
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: Lake Howell (nutrients (historic TSI))
Existing Net TP Load (lbs/yr): 205
Range of Estimated Total TP Reduction[1] (lbs/yr): 3 to 85
Range of Estimated County TP Reduction[1] (lbs/yr): 2 to 44

Estimated Conceptual Cost: $450,000
Benefit Cost Ratio ($/lb TP removed): $9,775 per lb to $331 per lb

Notes: Also provides treatment for natural /wetland upstream areas (10% of net TP load)

1 - TP Reduction was calculated using two different methods. The first value was obtained using the Walker method (Walker, W. W., Jr. (1981). "Empirical methods for predicting eutrophication in impoundments; Report 1, Phase 1: Data base development," Technical Report E-81-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS., NTIS No. AD A101 553.). The second value was obtained using the methodology to estimate TP removal for wet detention as presented in the "Evaluation of Current Stormwater Design Criteria in the State of Florida" (Harper, 2007) prepared for FDEP.

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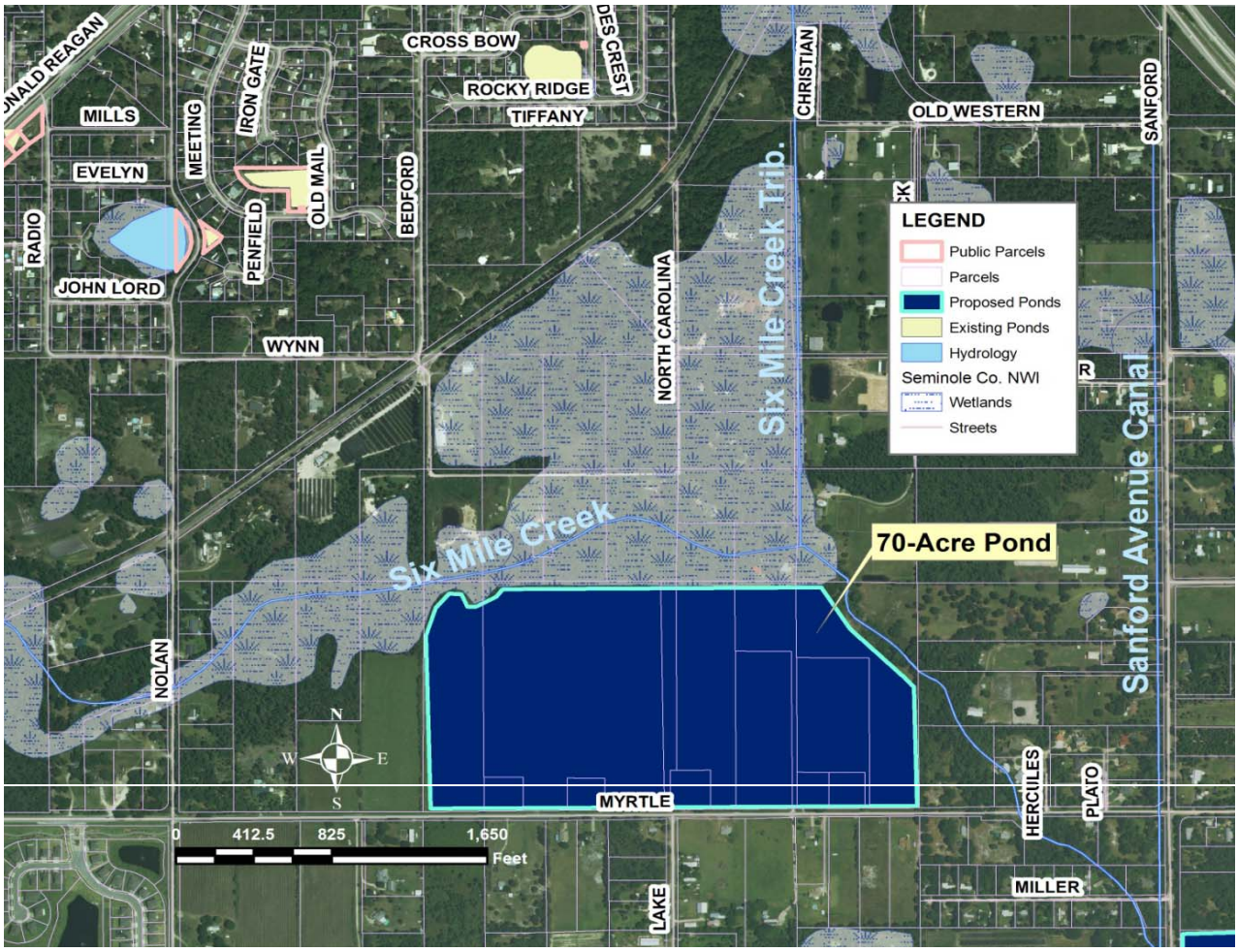
Six Mile Creek Regional Treatment Pond



Project Description: Construct 70-ac off-line pond to treat Six Mile Creek outflow before discharging into Lake Jesup.

Upstream Tributary Area: 5,272 acres
Affected Jurisdictions (% net TP load): Seminole County (26.2%), Lake Mary (8.5%), Sanford (37.9%), FDOT (2.0%), Turnpike Authority (5.6%)
Receiving Water Bodies: Six Mile Creek, Lake Jesup
Proposed Treatment Type: Wet Detention
Available Land for Treatment: 72.5 acres (private property)
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: none
Existing Net TP Load (lbs/yr): 1,741
Range of Estimated Total TP Reduction[1] (lbs/yr): 331 to 961
Range of Estimated County TP Reduction[1] (lbs/yr): 87 to 252
Estimated Conceptual Capital Cost: $12,589,000 (includes land acquisition)
Benefit Cost Ratio ($/lb TP removed): $8,354 per lb to $803 per lb (based on total estimated TP reduction)
Notes: Also provides treatment for agricultural and natural/wetland upstream areas (19.9% of net TP load)

1 - TP Reduction was calculated using two different methods. The first value was obtained using the Walker method (Walker, W. W., Jr. (1981). "Empirical methods for predicting eutrophication in impoundments; Report 1, Phase 1: Data base development," Technical Report E-81-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS., NTIS No. AD A101 553.). The second value was obtained using the methodology to estimate TP removal for wet detention as presented in the "Evaluation of Current Stormwater Design Criteria in the State of Florida" (Harper, 2007) prepared for FDEP.

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Soldiers Creek Regional Treatment Pond

Project Description: Convert existing 7.5 acre pond on County owned property to 9.6 acre pond. An additional 12.9 acre pond on County owned property downstream is optional to provide a combined 22.5 acres of treatment.

Upstream Tributary Area: 4,698 acres

Affected Jurisdictions (% net TP load): Seminole County (37.3%), City of Lake Mary (40.1%), City of Sanford (0.2%), FDOT (0.4%)

Receiving Water Bodies: Soldiers Creek, Lake Jesup

Proposed Treatment Type: Wet Detention

Available Land for Treatment: 11.6 acre for 9.6 ac pond; 25.3 ac for 12.9 ac pond

Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)

Draft Verified Water Quality Impairment: None

Existing Net TP Load (lbs/yr): 1,559

Range of Estimated Total TP Reduction[1] (lbs/yr): 20 to 626 (9.6 acre pond)/59 to 739 (22.5 acre treatment train)

Range of Estimated County TP Reduction[1] (lbs/yr): 8 to 233 (9.6 acre pond)/22 to 275 (22.5 acre treatment train)

Estimated Conceptual Capital Cost: $288,000/ $2,57,3000

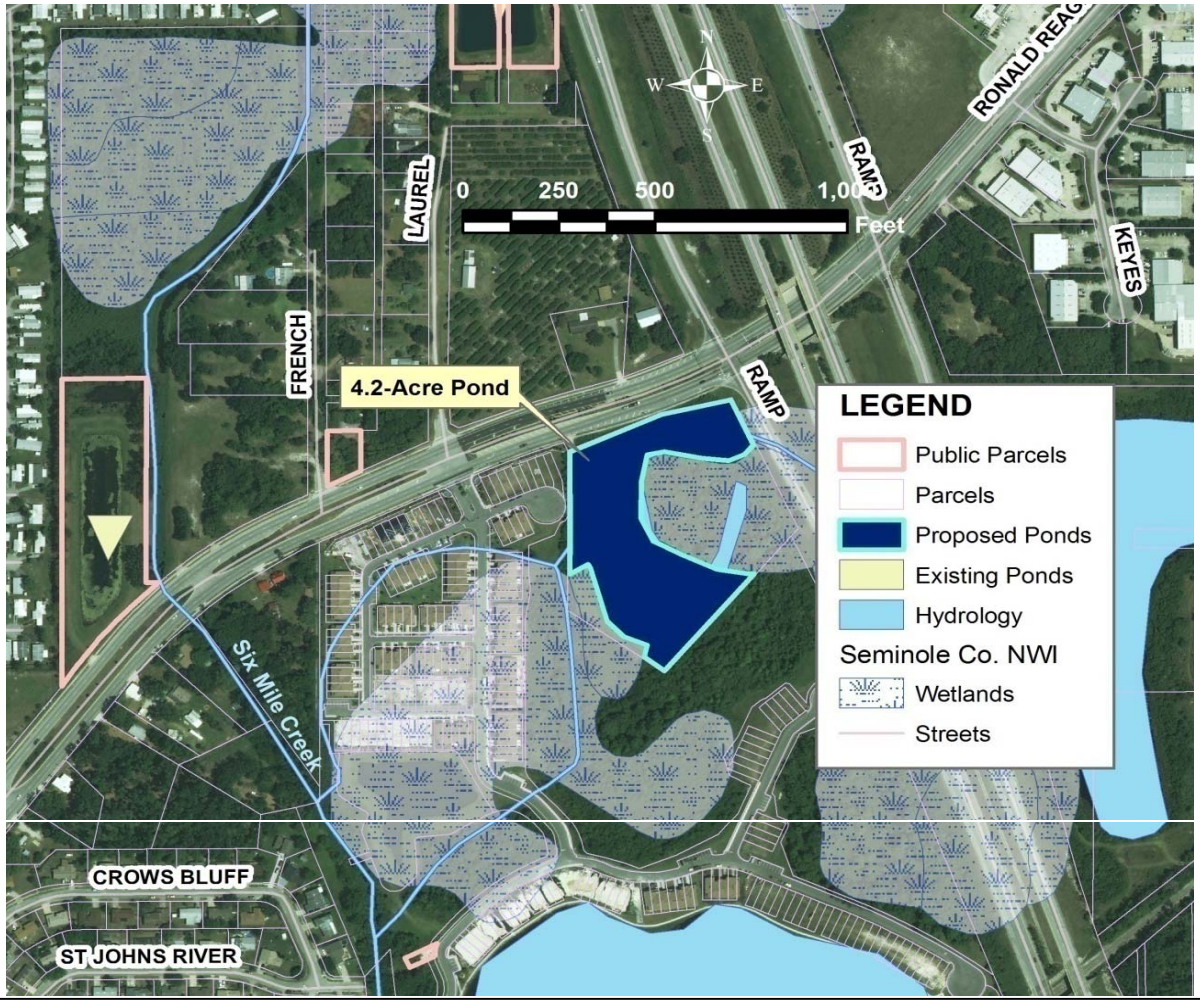
Benefit Cost Ratio ($/lb TP removed): $1,875 per lb to $51 per lb / $3,258 per lb to $261 per lb (based on total estimated TP reduction)

Notes: Also provides treatment for agricultural and natural/wetland upstream areas (22.1% of net TP load)

1 - TP Reduction was calculated using two different methods. The first value was obtained using the Walker method (Walker, W. W., Jr. (1981). "Empirical methods for predicting eutrophication in impoundments; Report 1, Phase 1: Data base development," Technical Report E-81-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS., NTIS No. AD A101 553.). The second value was obtained using the methodology to estimate TP removal for wet detention as presented in the "Evaluation of Current Stormwater Design Criteria in the State of Florida" (Harper, 2007) prepared for FDEP.

CDM

SR417 Borrow Pit



Project Description: Expand existing borrow pit into 4.2-ac off-line pond on FDOT-owned land. Re-route low flows from Six Mile Creek tributary east along Ronald Reagan Blvd. to 4.2-ac pond.

Upstream Tributary Area: 1,085 acres
Affected Jurisdictions (% net TP load): Seminole County (16%), Sanford (54.1%), FDOT (2.4%), Turnpike Authority (16.3%)
Receiving Water Bodies: Six Mile Creek, Lake Jesup
Proposed Treatment Type: Wet Detention
Available Land for Treatment: 7.2 acres
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: none
Existing Net TP Load (lbs/yr): 382
Range of Estimated Total TP Reduction[1] (lbs/yr): 31 to 181
Range of Estimated County TP Reduction[1] (lbs/yr): 5 to 29
Estimated Conceptual Cost: TBD
Benefit Cost Ratio ($/lb TP removed):

Notes: Also provides treatment for agricultural and natural/wetland upstream areas (11.2%)

1 - TP Reduction was calculated using two different methods. The first value was obtained using the Walker method (Walker, W. W., Jr. (1981). "Empirical methods for predicting eutrophication in impoundments; Report 1, Phase 1: Data base development," Technical Report E-81-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS., NTIS No. AD A101 553.). The second value was obtained using the methodology to estimate TP removal for wet detention as presented in the "Evaluation of Current Stormwater Design Criteria in the State of Florida" (Harper, 2007) prepared for FDEP.

CDM

Winding Hollow Subdivision

Project Description: Re-hydrate 31-acre wetland on City of Winter Springs property; re-route discharge from No Name Creek into re-hydrated wetland.

Upstream Tributary Area: 2,810 acres
Affected Jurisdictions (%net TP load): Seminole County (18.9%), Casselberry (1.8%), Winter Springs (47%), FDOT(0.9%)
Receiving Water Bodies: Gee Creek, Lake Jesup
Proposed Treatment Type: Wetland Re-hydration
Available Land for Treatment: 31 acres
Verified Water Quality Impairment: Lake Jesup (nutrients and unionized ammonia)
Draft Verified Water Quality Impairment: none
Existing Net TP Load (lbs/yr): 797
Estimated Total TP Reduction (lbs/yr): 279
Estimated County TP Reduction (lbs/yr): 53

Estimated Conceptual Cost: $357,000
Benefit Cost Ratio ($/lb TP removed): $330 per lb TP removed

Notes: Also provides treatment for agricultural and natural/wetland upstream areas (31.3% of net TP load). Determination would need to be made if wetland is considered to be waters of the State by FDEP.

CDM