2015

Osceola County Lakes Management Plan

ADOPTED

Osceola County BoCC
September 14, 2015

Osceola County Lakes Management Plan

Prepared by:
Community Development Department
Community Resources Office
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The Mission of Osceola County's Lakes Management Program is to protect, enhance, conserve, restore, and manage the County's aquatic resources. We accomplish this through education, coordination with other agencies, and maintenance and management of lake systems. Activities include hydrologic management, habitat preservation and enhancement, aquatic plant management, water quality improvement, and provision of recreational opportunities. Our goal is to improve, enhance and sustain lake ecosystem health, while avoiding impacts to downstream systems, for the benefit of the fish and wildlife resources and the residents of, and visitors to, Osceola County.

Cover photo: Lake Gentry

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Alligator Lake, as seen from the canal coming out of Lake Lizzie

With its abundant natural resources and location in the world's premier tourist destination, Osceola County is uniquely positioned to provide a vast array of water-related recreational activities. The County has more than 50 named lakes, which provide habitat for a variety of wildlife, as well as recreational opportunities and scenic beauty. Wildlife calling our lakes home includes largemouth bass, black crappie, bluegill, redear sunfish, sandhill cranes, Everglade snail kites, limpkins and alligators, to name a few. As for bald eagles, Florida has the highest nesting population in the lower 48 states, and Osceola County has the highest nesting population in Florida, making us a prime location for viewing these majestic birds.

Osceola's lake system is one of our greatest natural assets.

Recreational opportunities include boating, water skiing, jet skiing, boat racing, sightseeing, kayaking, bird-watching, and ecotourism. And fishing. Osceola is world renowned for its bass tournaments, which, along with duck hunting, airboat rides, and wildlife viewing, contribute over $7 million annually to the Osceola County economy.

Our lakes have environmental importance, they improve our quality of life, and they are vital to our economy. Osceola County is committed to protecting our lakes for generations to come.

This Lakes Management Plan provides a guide to lake management activities performed by Osceola County, in cooperation with state agencies and other partners. The plan includes

a brief history of alterations to the hydrologic connections between lakes that have impacted how the lakes function for flood control, and the subsequent effects these alterations have had on water quality and habitat management. It describes resources, both internal and external, available to the County for lake-related programs and activities. Some of these resources are agencies with state or federal mandates for lake management. Others are less formal, including non-profits, environmental groups, and civic-minded residents concerned with the health of the County's lakes. A discussion of water quality is presented in the context of the varying methodologies used to determine water quality; the Lake Okeechobee Basin Management Action Plan (BMAP); recently adopted Total Maximum Daily Loads (TMDL) for Lakes Kissimmee, Cypress, Jackson, and Marian; and the implications for Osceola County relative to the BMAP and TMDLs. The plan also describes best management practices the County does or could employ to lessen the impacts of human activities on our natural resources, including the lakes.

The plan then focuses on lakes or groups of lakes in Osceola County, as follows:

- Lake Tohopekaliga
- East Lake Tohopekaliga, Lake Ajay, Lake Runnymede
- Cypress Lake
- Lake Hatchineha
- Lake Kissimmee
- Alligator Chain of Lakes, Lake Gentry
- Lake Marian and Lake Jackson
- Lake Joel, Lake Myrtle, Lake Preston

For each lake or group of lakes, information is presented about lake characteristics, water quality, BMPs, aquatic plant management, existing and planned recreational amenities, and current and future management activities.

The Lakes Management Plan identifies lake-related opportunities, problems, solutions, and recommendations for programs, activities, and funding sources. Public involvement was sought throughout the process to gain meaningful participation in lake management activities.

Water Quality

According to Florida Department of Environmental Protection (FDEP) measurements, there are 47 impairments listed for Osceola County water bodies, 18 for mercury and the rest for low dissolved oxygen, high fecal coliform levels, and nutrient impairments. Lakes Kissimmee, Cypress, Marian, and Jackson are included on a federal list of impaired waters, known as the *303(d)* list, and Total Maximum Daily Loads (TMDLs) have been adopted to limit pollutants entering these lakes. (In lieu of TMDL limits, a Nutrient Reduction Plan has been adopted for Lake Toho.)

It was also in 2013 that the method to assess impairment was changed from Trophic State Index (TSI) to Numeric Nutrient Criteria (NNC), a more accurate measure given the characteristics of Osceola lakes. This methodology measures lake clarity (color) and establishes corresponding targets for chlorophyll-a, nitrogen, and phosphorus. All Osceola County lakes have high color levels, and therefore have default chlorophyll-a targets of 20 parts per billion. Lakes Kissimmee, Jackson, Cypress, and Marian exceed the chlorophyll-a target. Under the NNC limits, Lake Tohopekaliga and East Lake Tohopekaliga do not exceed the chlorophyll-a target and therefore are considered unimpaired for chlorophyll-a.

Concentration limits for nitrogen and phosphorus were set using TSI limits, which are lower than NNC limits. Consequently, nitrogen and phosphorus reduction requirements are higher for lakes Kissimmee and Marian, and phosphorus reduction requirements are higher for Cypress Lake. For Lake Jackson, nitrogen and phosphorus reduction requirements are lower. (Table 1.)

Lakes Management Activities

The County's lake-related activities are performed by staff in two departments: Community Development and Public Works. Programs managed by Community Development's Natural Resources Section include administration of the National Pollutant Discharge Elimination System (NPDES) permit; the Community Rating System (CRS), which is part of the National Flood Insurance Program (NFIP); boat ramp and navigation sign maintenance; capital projects for boat ramp renovations and amenities; and management of concessionaires at boat ramps.

Anticipated expenditures over the next 16 years for programs managed by the Natural Resources Section total approximately $448,000 per year, which includes improvements to 12 County-maintained boat ramps. The boat ramp improvement plan was approved by the Board of County Commissioners based on a pay-as-you-go basis, which matches expenditures per year to anticipated revenue.

Lake-related activities in Public Works include capital expenditures to improve drainage and water quality. Public Works also manages the Municipal Separate Stormwater Sewer System (MS4); the water quality sampling program; and the Lake Tohopekaliga Nutrient Reduction Plan (NRP). Public Works participates in the Lake Okeechobee BMAP and will participate in upcoming BMAPs for lakes Kissimmee, Cypress, Jackson, and Marian.

Public Works has identified water quality projects needed to comply with FDEP impaired water rules and the Lake Okeechobee BMAP, at a cost of $15 million. Additional projects likely will be needed in the next 10 years.

The County does not act alone in lakes management. Because the lakes in Osceola County are considered *waters of the state*, coordination among numerous government agencies is necessary to ensure successful lake management. Our partners include:

- South Florida Water Management District (SFWMD)
- U.S. Army Corps of Engineers (ACOE)
- Florida Fish and Wildlife Conservation Commission (FWC)
- Florida Department of Environmental Protection (FDEP)
- U.S. Fish and Wildlife Service (USFWS)

Table 1. Water Quality, Osceola County Lakes, 1999 to 2009.

Lake	Chlorophyll-a			Total Phosphorus			Total Nitrogen		
	Consecutive 3-year average	Status[1]	Reduction required	Reduction Required			Reduction Required		
				NNC	TMDL	Difference	NNC	TMDL	Difference
Cypress	37.5	Impaired	46.7%	26%	35%	9%	26%	5%	-19%
East Toho	3.8	Unimpaired	None	None	N/A	N/A	None	N/A	N/A
Jackson	31.6	Impaired	36.7%	73%	25%	-48%	45%	20%	-25%
Kissimmee	22.0	Impaired	9.1%	9%	17%	8%	9%	15%	6%
Marian[2]	62.9	Impaired	68.2%	—	53%	53%	—	55%	55%
Toho	15.2	Unimpaired	None	None	N/A	N/A	None	N/A	N/A

1 Maximum concentration is 20 µg/L (20 micrograms per liter or parts per billion)
2 Data from 1997-2007—insufficient data after 2007
Source: Atkins 2013, FDEP 2013

Recommendations

This Plan recommends strategies aimed at ensuring the long-term health and recreational value of the County's lakes, including:

- Improving water quality
- Ensuring safe and adequate lake access
- Education, outreach, and public involvement
- Regulations—adoption, enforcement, and compliance
- Funding

These recommendations are consistent with the County's Comprehensive Plan; the Land Development Code; and state and federal policies for water quality, flood control, and natural resource protection.

Improving water quality. The single most important strategy for improving water quality in Osceola's lakes is stormwater management. The recommendations in this document take into consideration that the underlying causes of lake impairment are alterations to the natural system for flood control, and the impact of stormwater runoff. Canals and flood control structures have reduced the spatial extent of the lakes, cutting them off from cleansing interaction with wetlands. Existing flood control and stormwater management systems also can introduce pollutants and sediment into the lakes.

The 2014 Master Surface Water Management Plan Update (MSWMPU) includes projects to improve stormwater systems and provide water quality treatment for runoff discharged to area lakes, including those Osceola County lakes characterized as impaired.

Ensuring safe access and navigation. Another side effect of flood control is the accumulation of muck and an overabundance of aquatic plants. To improve navigation and lake access, the Plan recommends identification of navigation hazards, aquatic plant treatment, dredging, and debris removal.

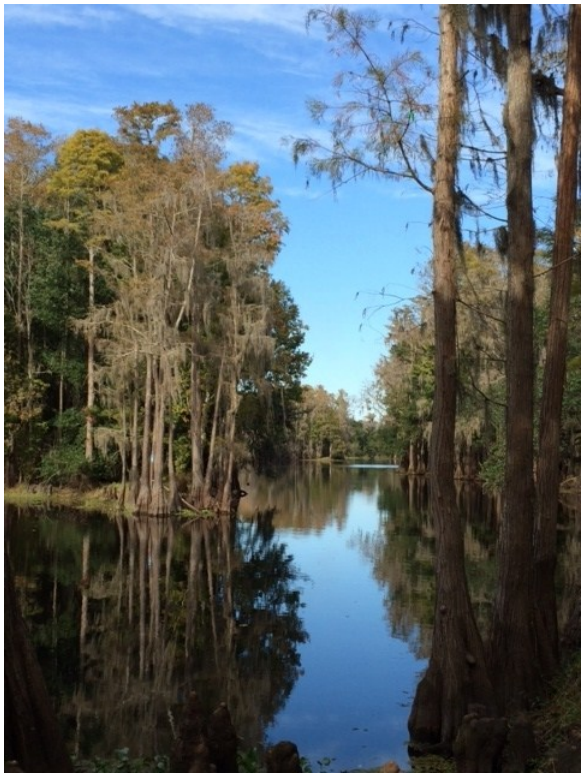
Education, outreach, and public involvement. Osceola County engages the public on lake-related issues in a number of ways. The County hosts an annual public meeting for FWC to present management plans and interact with the public. In 2013, the County held a public meeting to receive input on the boat ramp renovation plan, which subsequently was adopted by the Board of County Commissioners.

The County works with many stakeholder groups to provide information about lake recreation and management activities. These groups also provide valuable feedback the County uses to assess problems, address user needs, and make informed planning choices.

Stakeholders also are some of our best volunteers, participating in litter clean-ups, environmental education activities, and water quality sampling. Recent events include lake clean-up days on Lake Tohopekaliga and in Buenaventura Lakes.

To keep the public involved as the County implements this Plan, the County could hold quarterly open house forums, inviting the public and agency representatives to hear about the progress and to provide input;

Boat docks at SFWMD C-31 canal in Partin Triangle Park



Shingle Creek looking north from Hwy 192

establish a stakeholder working group that meets regularly to coordinate with staff on lake management issues; or even appoint a Lakes Advisory Board that would oversee implementation.

Regulations and enforcement. The County has adopted ordinances to protect lakes, including an Illicit Discharge Ordinance, adopted in 2008, which is designed to protect waterways by prohibiting anything but rainwater to be introduced into the stormwater system. Earlier this year, the County adopted a Fertilizer Management Ordinance, which regulates application of fertilizer. Implementing these ordinances requires both education and enforcement.

Compliance activities for the County's NPDES permit include public education, outreach, and involvement; detecting and eliminating illicit discharge; controlling construction site runoff and post construction runoff; and preventing pollution. Enforcing the County ordinances, and ensuring compliance with the NPDES permit are labor-intensive activities that will become more labor intensive as regulations increase and as development occurs.

Funding. Existing funding for lakes management comes from the County's General Fund, which provides for two staff plus operational support (repairs, supplies, etc.). The Boating Improvement Fund (revenue from vessel registration fees), and other fees (airboat concessionaire fees, caretaker fees, cell tower lease fees) fund boat ramp improvements. Estimated funding from these sources for FY 2014-2015 is $58,400. The Boat Ramp Master Plan identified over $4 million in needed boat ramp improvements, so identifying additional funding sources will be necessary to complete those improvements in a timely manner. For other activities, such as dredging and aquatic plant management, no County funding is allocated at the present time.

This Plan promotes a more long-term, proactive approach to lakes management, and existing funding falls short of what is needed. Additional funding for dredging ($50,000) and aquatic plant management ($125,000) has been requested starting with the FY 2015-2016 budget to address some of the issues identified in this Plan. To address water quality, Public Works is in the process of evaluating the County's stormwater program to identify projects that would be necessary to stay in compliance with NNC, TMDL, and NPDES requirements. Potential funding sources also will be evaluated. The County adopted a Stormwater Assessment Ordinance in 2009, but an assessment has not yet been set. A stormwater assessment could fund activities related to water quality compliance and stormwater operations and maintenance. The assessment also could fund lake management activities that address stormwater impacts to lakes. If a stormwater assessment is not adopted, a Municipal

Services Benefit Unit (MSBU) specifically for lakes management activities should be considered.

In addition to the budget request for dredging and aquatic plant management and the potential stormwater assessment or lakes management MSBU, other funding sources to be considered include cell tower lease fees (a source identified in the Boat Ramp Master Plan) and grants (including grants that may be offered because of the recently-passed Water and Land Conservation Amendment), for which having dedicated local funding would make the County a more competitive candidate. Even the Tourist Development Tax could be a potential funding source for certain tourism-related projects. Finally, homeowners who live on private lakes have expressed an interest in assessments to provide funding for lake management – the County could use MSBUs as a mechanism for collecting such assessments as requested. Finding adequate funding through these and other sources is key to implementing the recommendations of this and other plans to preserve and protect the County's water resources.

During a fishing tournament, boats go through the lock at the south end of Lake Tohopekaliga

Introduction

Shingle Creek, near Lake Tohopekaliga

Osceola's lake systems include the Upper Kissimmee Basin (East Lake Tohopekaliga, Lake Tohopekaliga, and the Alligator Chain of Lakes) and the Middle Basin (lakes Kissimmee, Hatchineha, and Cypress). The lakes are a prime attraction for the County's 300,000 residents, as well as the six million tourists who visit each year. Recreational activities on and around the lakes contribute significantly to the local and state economy. Wildlife associated with lakes and wetlands attract visitors from around the world.

The purpose of this Plan is to:

- **Identify issues**
- **Evaluate resources**
- **Recommend solutions**
- **Encourage public involvement**
- **Justify state and federal appropriations for restoration and enhancement**

An array of outdoor activities including fishing, hunting, boating, air boating, canoeing, kayaking, bird-watching and photography can be enjoyed on County lakes. In 2009, the Florida Office of Greenways and Trails designated the Shingle Creek Paddling Trail an official State-recognized trail, which undoubtedly will increase the economic value of this aquatic-based resource to the County.

Alterations to the lake system

Long before Osceola County was established as a county in 1887, its lakes, streams, and sloughs naturally moved water from central Florida, down the Kissimmee River, and into Lake Okeechobee. Today the Kissimmee Chain

of Lakes is a highly altered system, which creates unique challenges for present-day management.

In the late 1880s, the United States government began the largest non-studied ecological project in the world, the draining of central and south Florida. Hamilton Disston, as a contractor of the government, began digging ditches and canals connecting lakes and aquatic systems for the purpose of increasing the amount of land useable for farming and development. The South Port Canal, connecting Lake Tohopekaliga to Cypress Lake, was completed in 1882, and the St. Cloud Canal, connecting East Lake Tohopekaliga to Lake Tohopekaliga, was completed in 1884 (Atkins, 2013). Throughout the late nineteenth and early twentieth centuries, the chain of lakes, the natural connections, and the man-made canals formed a transportation hub for riverboats, fueling a cattle, sugar, and lumber-based economy. After devastating hurricanes of 1926 and 1928, the Herbert Hoover Dike was constructed on the south rim of Lake Okeechobee, further altering natural drainage patterns (USACOE, 2014).

Flood control

With technology and transportation improvements in the mid-twentieth century, managing the Kissimmee Chain of Lakes and the Kissimmee River for flood control became a priority. In 1949, the U.S. Army Corps of Engineers (USACE) implemented the Central and Southern Florida (C&SF) Project, and the agency now known as the South Florida Water Management District (SFWMD) became the local operator. The St. Cloud Canal gated spillway (S-59) and the South Port Canal gated spillway (S-61) were completed in 1963 (Atkins, 2013). Figure 1 depicts the system of canals and water control structures in the Upper Kissimmee Basin that comprise the primary flood control system operated by the SFWMD. The lakes in the Middle Basin are regulated by the S-65 Structure and their associated watershed.

The majority of Osceola's lakes are managed by multiple agencies for a variety of purposes, including flood control, habitat protection, and maintaining fisheries. The Kissimmee Basin C&SF flood control project was authorized to protect lands adjacent to the lakes and along the Kissimmee River from frequent and prolonged flooding. All other management activities are constrained by this purpose. The SFWMD operates the system pursuant to a series of federal laws passed by Congress beginning in 1948 and overseen by the USACE. Lake level fluctuations have been modified to accommodate the Everglade Snail Kite, in accordance with the Endangered Species Act. The system in the Upper Basin was designed in 1956, based on land uses at that time, with construction occurring from 1960 to 1965. This situation has the potential to exacerbate flooding in the Upper Kissimmee Basin.

Drainage projects associated with this flood control system have contributed to many of the current lake management challenges (Atkins, 2013). While stabilized lake levels have provided a predictable schedule for flood protection, they also have spurred development in floodplains and contributed to the proliferation of invasive aquatic plant species. Osceola County's Community Development and Public Works departments work cooperatively with local, state, and federal agencies on policy and management activities to mitigate the impacts of past drainage projects and to enhance lake resources.

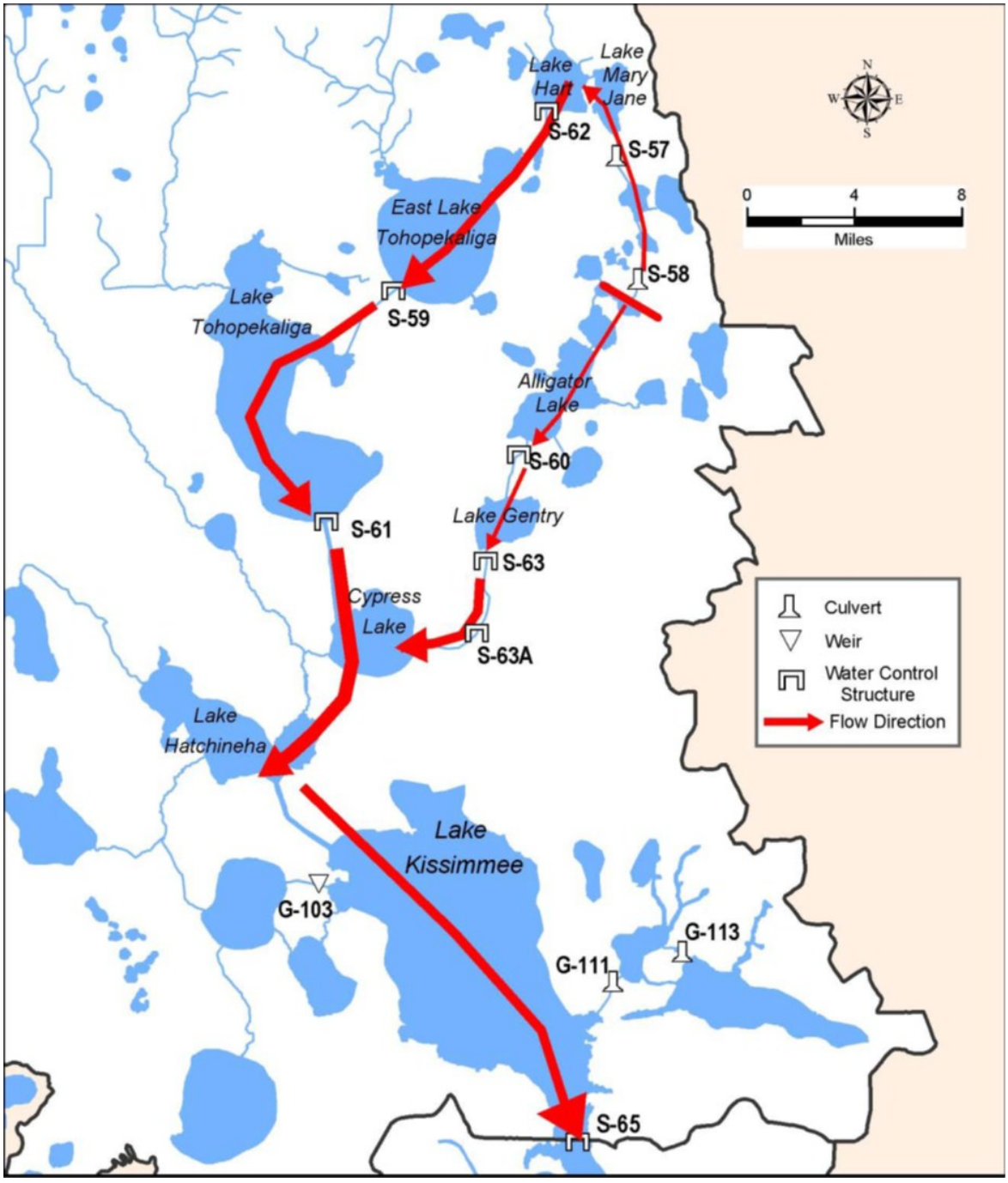
Because many lake management activities are linked to stormwater management, this plan will reference best management practices for

stormwater management, past and current County stormwater projects, and recommendations made in the County's 2014 Master Surface Water Management Plan Update (MSWMPU).

County policies addressing lake management

Osceola County approved its current *Comprehensive Plan* in 2010. The Comprehensive Plan provides overarching

Figure 1. Direction of Flow through Primary Flood Control System Operated by the SFWMD (Kissimmee Chain of Lakes Long Term Management Plan, 2011).



policies by which Osceola County will move forward to 2025. The Comprehensive Plan Conservation Element includes objectives and policies for protecting our natural environment, of which lakes management is an integral part. Specifically, the element calls for the County to responsibly use, enhance, protect, and restore natural resources including air, water, land, wildlife, and wildlife habitats, including:

- Enforce NPDES BMPs
- Buffer significant natural resources (including surface water) from the impacts of development
- Monitor the health of lakes and rivers and protect surface waters from pollution
- Cooperate with state and federal agencies to ensure proper approval is given for alteration adjacent to surface waters
- Support periodic drawdowns of the Kissimmee Chain of Lakes to maintain, enhance, and restore the surface water and fisheries habitats
- Participate in development of the Kissimmee Chain of Lakes Long-Term Management Plan
- Pursue funding for removal of exotic plant vegetation
- Establish a safe development line and prohibit use of fill and construction of non-water dependent structures waterward of the line
- Require setbacks for septic systems
- Require removal of exotic and nuisance plant species by non-mechanical means
- Provide public access to water bodies
- Cooperate with SFWMD, FDEP, and FWC to restore the Kissimmee River system
- Classify and protect wetlands
- Educate the public about the environment
- Control soil erosion
- Participate in and support efforts of USFWS, FWC, water management districts, USACOE, and Florida DOACS to protect wildlife habitat
- Coordinate with SFWMD on the Northern Everglades Plan, the Lake Okeechobee and Estuary Watershed Basin Rule, and the Lake Okeechobee Watershed Protection plan

In addition, in 2014, Osceola County Board of County Commissioners established four goals in its *Strategic Plan*. This Plan sets the County's future vision, strategic goals, and an action plan for the short and long term. This Lakes Management Plan furthers each of the four Strategic Plan goals:

1. Grow and diversify the County's economy
    - Improve water quality and lake habitat to enhance ecotourism
2. Cost effective and high performing County government
    - Partner with state and federal agencies on lake management activities
    - Continue the water quality monitoring program to evaluate trends
3. Upgrade County infrastructure and transportation network
    - Upgrade county boat ramps
    - Continue to improve stormwater infrastructure
    - Implement wetland restoration projects
4. Create great neighborhoods for the future
    - Continue to acquire conservation lands
    - Implement restoration projects to increase property values and improve quality of life

Approximately 34% of the total land coverage in Osceola County is lakes, wetlands, and streams (CDM Smith, 2014). These water resources will continue to provide ecosystem services, but only if the County invests in management activities to improve and sustain their environmental health.

Lake Management Activities

East Lake Fish Camp

Lake management refers to activities undertaken to protect or improve water quality; maintain desirable aquatic plants while minimizing invasive plant species; manage habitat for desirable fish and wildlife species; employ stormwater best management practices to protect the watershed; and promote public participation in management activities and the effects those activities have on recreation. It is a common practice in Florida to pair a lakes management plan with a stormwater management plan because of the amount of rainfall in Florida and the negative impacts stormwater runoff can have on lakes. It is also important to note that many different local, state, and federal agencies have mandated responsibilities that can affect the management of a lake. Some of these agencies have conflicting management goals, which can complicate lake management strategies. Following is a description of activities conducted by the County and through other agencies and organizations.

Since the County's lakes are waters of the state, Osceola does not provide direct management of the lakes. However, the County participates in several working groups that provide technical guidance and stakeholder input to State and Federal agencies responsible for management. The County has a role in surface water management by providing and managing recreational and stormwater infrastructure. Lake-related recreational infrastructure and maintenance are budgeted and managed by the Community Development Department. The Public Works Department maintains and retrofits existing stormwater facilities and

implements new projects to reduce the volume and improve the quality of stormwater before it reaches the lakes. In addition, the Osceola County Extension Office in the Community Development Department provides education on best management practices (BMPs) for both urban and rural areas designed to improve water quality. Below is a discussion of each department and the resources that contribute to the lakes management in Osceola County.

County Activities

Community Development. Within the Community Development Department, Natural Resources, Parks, and Planning and Design all play a role in lake management. In Natural Resources, two employees—a Lakes Advocate and a Natural Resource Specialist—work on lake management activities. All lake maintenance-related activities are managed and budgeted in Community Development. Projects in fiscal year 2013/2014 included:

- Granada boat ramp renovation (Lake Tohopekaliga)
- Cypress Lake boat ramp renovation (Cypress Lake)
- Overstreet Landing observation pier construction (Lake Kissimmee)
- Boat ramp maintenance (12 boat ramps)
- Airboat maintenance
- Navigation sign maintenance

The Natural Resource Specialist performs technical, administrative, and reporting duties related to the NPDES permit and NFIP. The Natural Resource Specialist works with engineering and inspection staff throughout the County to ensure compliance with local ordinances as well as state and federal laws protecting surface water bodies from runoff and pollutants.

Osceola County Parks maintains 12 public boat ramps (Figure 2) to provide lake access for motorized and non-motorized vessels. Most of these ramps have been in place for more than 30 years, with a few (ramps at Cypress Lake and Lake Marian) dating back to the 1940s and 1950s, respectively. Opportunities to make improvements to accommodate increased parking and access at tournaments should be important considerations moving forward.

In 2013, the County assessed all 12 boat ramps and developed a long-term master plan for renovation and maintenance. The principles guiding this plan included:

- Increase accessibility
- Accommodate multiple ramp users (motorized and non-motorized vessels)
- Incorporate multiple uses (picnic facilities, trails, wildlife viewing)
- Use low impact design to improve water quality and wildlife habitat
- Improve aesthetics
- Accommodate fluctuating water levels
- Decrease maintenance costs
- Expand safety measures

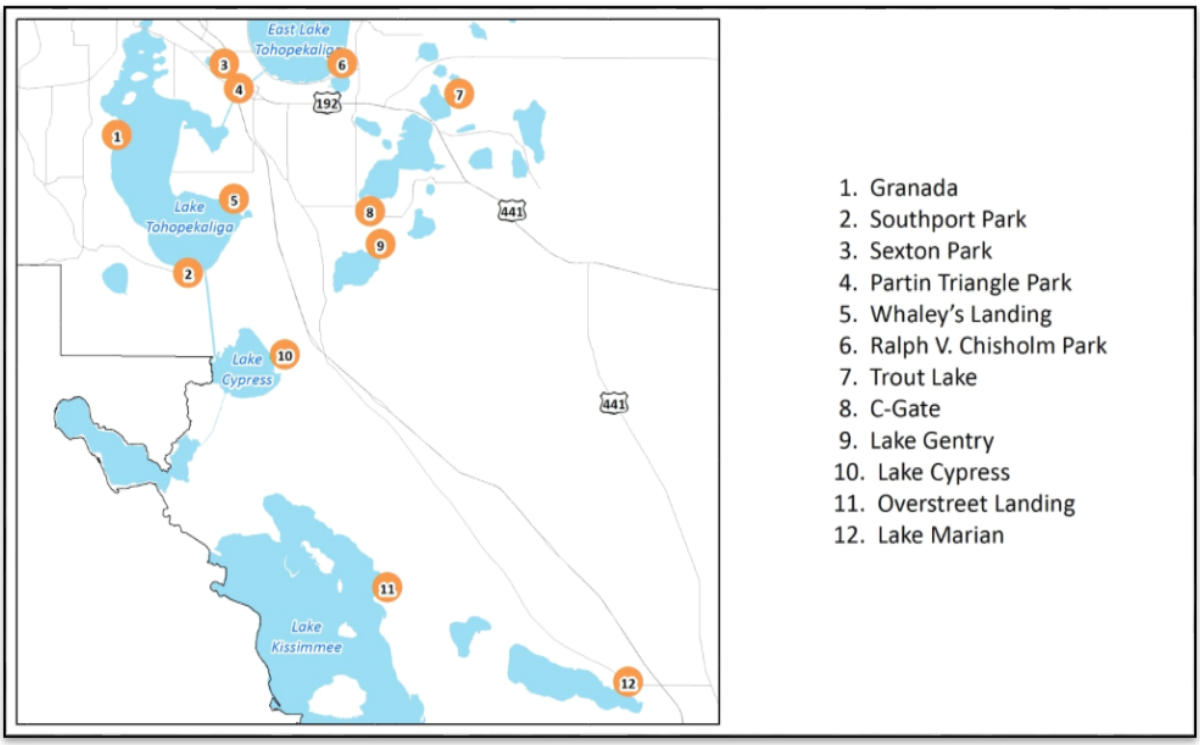
The *Boat Ramp Master Plan* was approved by the Board of County Commissioners in 2013. Construction will occur over the next 15 years, starting with the Granada and Cypress Lake boat ramps.

Monthly, staff inspects each boat ramp for an extensive list of safety items. If issues are identified with the ramp or surrounding park amenities, the Parks staff is notified and corrections are made. If problems cannot be resolved with in-house staff resources, then appropriate budgetary steps will be taken.

Parks focuses primarily on land management activities on properties purchased through the Conservation Lands program, but Parks staff also manages properties along Shingle Creek and on the shores of Lakes Tohopekaliga, East Lake Tohopekaliga, Lake Runnymede, Trout Lake, Bay Lake, and Lake Lizzie. The environmental restoration and recreational components of these properties contribute to the health and enjoyment of these lakes.

In addition to boat ramps, the County operates

Figure 2. Boat Ramps Maintained by Osceola County Parks



a number of parks located on lakes and other water bodies, providing residents and visitors with access to lake-related recreation. Co-located parks and boat ramps include Partin Triangle Park, Southport Park, Ralph V. Chisholm Park, and Lake Marian Park. Privately owned air-boating concessions have agreements with the County to operate from the Partin Triangle Park and Southport Park. Private paddling concessions exist on Shingle Creek and are planned for Lake Tohopekaliga in the near future.

Since 2005, the County has acquired, restored, and made available to the public nearly 3,300 acres of property through its Conservation Lands Program. Many of these properties are located on lakes and other water bodies. Located on the west side of Lake Runnymede, the Lake Runnymede Conservation Area offers hiking and organized youth group camping. Shingle Creek Regional Park offers hiking and biking trails, as well as access to Shingle Creek for canoeing and kayaking. At the recently opened Twin Oaks Conservation Area, visitors can hike, ride horseback, launch canoes or kayaks, picnic, fish, and observe a vast assortment of wildlife and wading birds from the observation pier at Goblet's Cove on Lake Tohopekaliga.

Planning and Design maintains the Comprehensive Plan (Comp Plan) for Osceola County. The Comp Plan Conservation Element includes policies identifying the *safe development line* (SDL), which is established at an elevation of one foot above the highest regulated elevation of the lake managed by the SFWMD (which includes most of the public access lakes), except Lake Tohopekaliga, which is one and a half feet above this level due to its unique characteristics. The Conservation Element also contains policies that promote surface water protection, encourage participation in the Kissimmee Chain of Lakes Long Term Master Plan, and ensure public access to waterways. The Stormwater Management Element identifies level of service (LOS) standards, design standards, and regulation of stormwater facilities and

discharges, floodplain protection, and intergovernmental coordination, including funding and partnership opportunities.

Public Works. Osceola County Public Works manages stormwater infrastructure—planning, design, construction, inspections, maintenance, and permit compliance for over 400 stormwater ponds, 70 miles of ditches and canals in the urban area, over 2,000 lane miles of roadway drainage, and all structures within these systems. Proper maintenance of stormwater infrastructure is essential to the functional integrity of the stormwater system. Lower levels of service for maintenance increase the potential for pollutant loading and flooding. Rapid growth in Osceola County, combined with inadequate funding to construct and maintain stormwater systems, means that the systems are no longer able to assimilate and treat at the designed standards.

The Road and Bridge Department is responsible for inspections and maintenance of primary drainage, open conveyances, culverts, and roadway systems, including ponds permitted for County projects. They also perform limited street-sweeping, which reduces the amount of nutrients entering the lakes.

The Stormwater Department has two full-time employees, a Stormwater Program Manager and a Senior Inspector. Stormwater Department responsibilities include management of public stormwater facilities; analysis of current stormwater functions and quality; review of related legislation and rules; planning; and capital improvement projects. Capital projects can address both water quality (health, environment) and water quantity (flooding) issues.

This department also is responsible for compliance of the County stormwater facilities. To comply with the 1972 Clean Water Act and to ensure that County water quality is measured using appropriate methodologies, staff coordinates with state and federal agencies on the listing of impaired waterbodies, Total Maximum Daily Load (TMDL) development, and development and implementation of Basin Management Action Plans (BMAP) and Numeric Nutrient Criteria (NNC). This team also developed and implemented a water quality monitoring program for County outfalls, where samples are collected at 25 sites monthly or as flow permits.

To plan and implement cost-effective projects to address both water quality and flood protection, Osceola County has funded comprehensive surface water and basin management plans. Early basin plans focused primarily on flood control; however, more recent plans have a greater focus on water quality improvements to improve our lakes and remain compliant with new regulations. Plans include:

- Master Surface Water Management Plan (1992)
- Master Surface Water Management Plan updates (2006 and 2014)
- Analysis and management plans of the following sub-basins:
    - Pleasant Hill (1993 and 1996)
    - East City Ditch (1997)
    - Gator Bay (2001)
    - Bass Slough and Fish Lake (2003)
    - Boggy Creek (2005)
    - Ox Pond (2007)
    - Fanny Bass Slough (2014)

The 2014 Master Surface Water Management Plan Update (MSWMPU) included the following components relevant to this Lake Management Plan:

- Existing tributary area delineation and associated best management practices (BMPs)
- Regulatory framework
- Water quality data evaluation
- Existing land use refinement
- Pollutant load analysis

Observation pier on Lake Marian

- Problem identification
- Basin prioritization
- Project recommendations

Rather than reiterate information from the MSWMPU, this Plan will refer to the MSWMPU where appropriate.

The County also has recognized the importance of securing dedicated funding sources for surface water management. A Stormwater Utility was recommended in the 2004, 2005, and 2009 reports as listed below.

- NPDES Phase II Program Assessment and Cost Analysis Summary Report (July 2004)
- Stormwater Utility Feasibility Report (2004)
- Osceola County Cost of Service Report (November 2005)
- Osceola County Stormwater Utility Assessment Policies and Procedures Manual (February 2009)
- Osceola County Stormwater Utility Assessment Report (August 2009)

Although a Stormwater Utility Ordinance was passed in 2009, an assessment was not set, due in part to economic stress. This may be an area that the County chooses to revisit as the economy recovers and as water quality regulations increase.

The Stormwater team completed a Water Quality Targets Report, which analyzed portions of the Kissimmee Chain of Lakes in detail and set alternative nutrient load targets. These findings were presented and new targets were negotiated with the Florida Department of Environmental Protection (FDEP). More information on the findings of this report relative to Lake Tohopekaliga can be found in Section 4 of this Plan.

The Stormwater team worked with a group of local stakeholders to develop the State's first Nutrient Reduction Plan (NRP). The plan was developed in lieu of the State establishing a TMDL for Lake Tohopekaliga and East Lake Tohopekaliga. Additional information on the NRP is located in Section 3 of this Plan. Public Works is working on or has implemented a number of stormwater management and improvement projects as part of the Lake Tohopekaliga NRP (Table 2). Kissimmee and St. Cloud also have implemented projects (Table 3), and both the County and Kissimmee have street sweeping programs.

Additional stormwater projects not associated with the NRP include the Chisholm Regional Park Treatment Facility (wet detention pond and treatment train) and the Kissimmee View Regional Treatment Facility (wet detention pond).

UF/IFAS/Osceola County Extension.
Approximately 46% of land use in Osceola County is in agricultural production (CDM Smith 2014). The University of Florida/Institute

of Food and Agricultural Sciences (UF/IFAS) Extension Office provides research and educational programming on aquatic plant management, best management practices, and environmental stewardship.

Interagency initiatives. The County participates in a number of interagency working groups concerned with lakes management:

- Kissimmee Chain of Lakes Long Term Management Plan
- Kissimmee Basin Modeling and Operations Study
- South Florida Water Management District Water Resources Advisory Commission (WRAC)
- Aquatic Plant Management Interagency Working Group
- Local Mitigation Strategy Working Group
- Lake Tohopekaliga NRP
- Lake Okeechobee BMAP

Other Activities

Florida Department of Environmental Protection (FDEP). The County works cooperatively with FDEP on lake-related activities, including:

- Total Maximum Daily Loads (TMDLs) and Basin Management Action Plans (BMAPs)
- Numeric Nutrient Criteria (NNC)
- Environmental Resource Permitting
- Draft Unified Statewide Stormwater Rule
- Recent and/or proposed changes to the State of Florida's water quality standards
- New Phase II requirements for the National Pollutant Discharge Elimination System (NPDES) program
- Lake Okeechobee Protection Plan
- Lake Tohopekaliga NRP

Florida Fish and Wildlife Conservation Commission (FWC). The mission of the FWC is, "Managing fish and wildlife resources for their long-term well-being and the benefit of people." The County works with FWC on various activities such as managing aquatic plants; increasing opportunities for boating; promoting tourist activities such as fishing, hunting, and wildlife viewing (with wildlife observation piers located on Lake Toho at Twin Oaks, a planned pier on Lake Kissimmee at Overstreet Landing, and an eagle's nest observation park on Kings Highway); and promoting boater safety.

The FWC Invasive Plant Management Section is responsible for managing invasive aquatic plants in Florida's public waterways. In fiscal year 2013/2014, FWC spent nearly $8 million on aquatic plant control in Osceola County's publicly accessed lakes and waterways. FWC also issues aquatic plant management permits for individual lakefront homeowners on publicly accessed lakes and lakes with no public access. (FWC is responsible for maintaining open navigation across public access lakes, not for individual lakefront

Table 2. Lake Tohopekaliga NRP Projects Implemented by Osceola County.

Project
Wet Detention Ponds
JYP widening Parnell St. to Osceola Parkway Pond A
Narcoossee Road IB – Pond 2 and 3
Narcoossee Road III – Pond C3A & C3B
Narcoossee Road III – Pond D3
Narcoossee Road III – Pond E1
Stewart Street Regional Pond retrofit
Stormwater Reuse
Lake Tohopekaliga Restoration project (fka Judge Farms)
East Lake Reserve reuse
Neptune Road reuse
Waterside Vista reuse
Bellalago and Isles of Bellalago reuse
Poinciana Commerce Center reuse
Kissimmee Bay reuse
Remington reuse
Eagle Lake reuse
La Quinta Inn reuse

homeowners' access, but they do issue permits for homeowners to create access at their own expense.) The County has renewed its permits to perform aquatic plant management along the shoreline of properties it manages on Lake Tohopekaliga, East Lake Tohopekaliga, Shingle Creek, and Boggy Creek. These permits are valid until November 2016.

Osceola County staff meet regularly with FWC on aquatic plant management, fisheries management, and environmental resource management issues. Because aquatic plant management is a critical issue in Osceola County, FWC conducts two public meetings annually. The County hosts these meetings in the Commission Chambers, thus providing adequate seating and web-casting to ensure the widest possible participation.

In the past, FWC has used a fisheries management tool called an *extreme drawdown*. Since many of Osceola County's lakes are part of the C&SF Project for flood control, and thus are managed within a narrow elevation fluctuation range, they accumulate dead plant material (muck) on the lake bottom that does not adequately decompose because lake levels do not drop sufficiently to expose the plant material to sunlight and oxygen. To conduct an extreme drawdown, FWC applies for permits from the US Army Corps of Engineers to deviate from the lake level regulation schedule and from the FDEP to scrape and dispose of the muck. Drawdowns typically are scheduled between January and May, before the rainy season begins, so that progress is not hampered by rainfall. The last drawdown occurred in 2004 in Lake Tohopekaliga.

Water Management Districts. Osceola County lies within the jurisdiction of two water management districts: the South Florida Water Management District (SFMWD) covers the western part of the County, and the St. Johns River Water Management District (SJRWMD) covers the east. Most of the land mass and lakes are in the SFWMD. These lakes comprise the C&SF Project built by the US Army Corps of Engineers and managed by the SFWMD, and they are highly altered by this project.

The County has been a partner in the Kissimmee Chain of Lake Long-Term Management Plan process since 2003. While the plan was placed on hold in October 2013, the County continues to move forward with recommended management measures, such as land acquisition and construction of regional stormwater retention and detention systems. The Lake Tohopekaliga Regional Water Storage Facility project is an example of a regional project that would provide water quality, water supply, and water storage benefits to the local area, as well as to the greater Kissimmee Okeechobee Everglade watershed.

Nine-County Coalition. After four hurricanes hit Central Florida in 2004, Osceola County was invited to join the County Coalition for Responsible Management of Lake Okeechobee, St. Lucie and Caloosahatchee Estuaries, and Lake Worth Lagoon, also known as the Nine-County Coalition. This is a multi-agency advisory group organized primarily for the purpose of coordinating with the SFWMD, US Army Corps of Engineers, FDEP, and the Florida Legislature to address a variety of issues dealing with the health and welfare of

Table 3. Lake Tohopekaliga NRP Projects Implemented by Kissimmee and St. Cloud.

City	Project Name	Project Type
Kissimmee	Expansion of Civic Center Pond	Wet detention treatment
Kissimmee	Lakefront Park redevelopment	Stormwater treatment, including rain
St. Cloud	Lakeshore reclaim augmentation	Stormwater harvesting

lakes, estuaries, and riverine systems within the 16 county-jurisdiction of the SFWMD. The County attends quarterly meetings and supports the Nine-County Coalition's annual legislative agenda.

Cities of Kissimmee and St. Cloud. Osceola County has long enjoyed a mutually beneficial relationship with the City of Kissimmee in managing Lake Tohopekaliga, and with the City of St. Cloud in managing stormwater-related projects (such as the NRP); stormwater-related education and outreach; Lake Tohopekaliga clean-up; pondweed education and outreach activities (for East Lake Tohopekaliga); and grant opportunities (such as for littoral restoration of Kissimmee Civic Center pond).

Lakewatch. Florida Lakewatch is a volunteer water quality program operating under the guidance of UF/IFAS. The program, in existence since 1986, is recognized as the largest lake monitoring program in the United States, with over 1,800 trained volunteers monitoring more than 600 lakes, rivers, and coastal sites.

Volunteers must have access to a boat and must complete a training program, where they learn techniques for taking water quality samples, filtering lake water to obtain algae samples, and taking Secchi disk readings (for water clarity). Once certified, volunteers take a water sample monthly for two years. The following lakes are monitored or have been monitored by Lakewatch volunteers.

Ajay	Brick	Cecile
Coon	Fell's Cove	Trout
Jackson	Lizzie	Shingle Creek
Alligator	Buck	Center
Cypress	Fish	Hatchineha
Kissimmee	Marian	Toho
Boggy Cove	Cat	Hinden
Live Oak	Gentry	Harmony Estates
East Toho	Runnymede	(retention pond)

Family Boating Association. The Family Boating Association formed in 2013 to monitor and advise governmental authorities with responsibility for Osceola County lakes. The association effectively organized their members around the issue of pondweed treatment in East Lake Tohopekaliga. They have expressed their willingness to work with the County on other lake management issues, and the County is grateful for their participation.

Goblet's Cove on Lake Tohopekaliga

Public Involvement

Following is a description of the some of the ways Osceola County engages with other agencies and the public on lake-related issues.

Public meetings. The County works with other agencies to provide a venue for public meetings. Several times per year, FWC holds public meetings to present their hydrilla management plan for the Kissimmee Chain of Lakes. In the past few years, this plan has

been of particular interest to anglers, duck hunters, and wildlife viewers, who advocate for a level of management that provides fish habitat, foraging for ducks, and protection of the Everglade snail kite. In 2013, a record number of recreational boaters attended the meeting to express their desire that aquatic plants be more aggressively managed for safe navigation. This is one example of the many public meetings that are held by various agencies that manage Central Florida lakes.

In March 2013, the County held a public meeting to discuss boat ramp renovation plans, and the Boat Ramp Master Plan has since been adopted by the Board of County Commissioners.

Stakeholder groups. The County works with a stakeholder groups to provide information about lake recreation and management activities. These groups also provide valuable feedback the County uses to assess problems, address user needs, and make informed planning choices. Stakeholders often are our best volunteers, participating in litter clean-up events, environmental education activities, and water quality sampling.

Stakeholder groups include the following:

Environmental Advocacy

- Kissimmee Valley Audubon
- Audubon of Florida
- The Nature Conservancy
- The Native Plant Society

Recreational Groups

- Kissimmee Valley Airboat Association
- Various Angler Associations
- Teen Sportfishing Association
- Family Boating association
- Marsh Landing, LLC
- United Waterfowlers
- Heroes on the Water

Other

- UF/IFAS Master Gardeners, Master Environmentalists, and Lakewatch
- Horticulture and Natural Resources Advisory Committee
- Community Vision

Speaking engagements. Osceola County staff seek out opportunities to speak at local meetings and associations. The following are a list of recent presentations and speaking engagements:

- Leadership Osceola
- Leadership Legends
- Central Florida Lake Management Society
- Family Boating Association
- Realtors' Association (floodplains and insurance)
- Lakewatch Annual Meeting
- Neighborhood Watch meetings
- Florida Erosion and Sedimentation Control Inspectors Training

Community events. Examples include:

- Buenaventura Lakes community clean-up
- Great Outdoor Day lake clean-up on Lake Tohopekaliga (see photos below)

Water Quality

Lake Ajay

Overview

Lakes are managed in a number of ways to protect water quality. New development must comply with state regulations for stormwater management. City and County governments must meet state National Pollution Discharge Elimination System (NPDES) permit guidelines. The herbicides applied by the Florida Fish and Wildlife Conservation Commission (FWC) to combat invasive plants must be approved for application in lakes by the U.S. Environmental Protection Agency (EPA) and the Florida Department of Agriculture and Consumer Services (FDACS).

In a 2004 *Stakeholder Values Survey* conducted by the SFWMD, 87% of Kissimmee Chain of Lakes users surveyed said that lakes should be managed to protect water quality.

Multiple water resource agencies are managing the lakes, each with their own set of goals. Consequently, each agency may be adhering to different water quality parameters. Further complicating the situation are water body classifications, as well as regulations and methodologies for determining water quality impairment.

The 1972 Clean Water Act requires the State of Florida to classify surface water bodies according to their designated use. Table 4 lists surface water classifications and their definitions. All lakes in Osceola County are designated as Class III, which means that they are managed for fish consumption, recreation,

propagation and maintenance of a healthy, well-balanced population of fish and wildlife.

Stages of eutrophication in lakes. A newly formed lake is nutrient-poor and is described as *oligotrophic*. It typically has clear water, few if any plants, and no algae or fish. As a lake ages, it becomes more productive. Microorganisms, algae, and plant material form the basis of the food web, and fish begin to appear in the lake. This aging process or growth in production is called *eutrophication*. A lake that has a medium level of nutrients is called *mesotrophic*. The water is usually clear, and plant abundance is low. A *eutrophic* lake has a high degree of nutrients and supports an abundance of aquatic plants. Lastly, a *hypereutrophic* lake has an overabundance of nutrients and can be characterized as having frequent and severe algal blooms. It is generally accepted that eutrophication is accelerated by man-made alterations and inputs into a lake, but even in a natural state, a lake's water quality is affected by factors including watershed topography, hydrology, soils, erosion, and vegetation.

Stormwater. Osceola County straddles two major watersheds: the Upper St. Johns River Basin in the eastern part of the County, and the Kissimmee Basin in the middle to western part of the County. Most of the County's lakes are in the Kissimmee Basin, which means that stormwater runoff flowing into these lakes eventually moves south. The average rainfall is 52 inches per year (University of Florida, 2014). If soils are sandy, the land mass will absorb rainfall and replenish the aquifer. For soils that are more claylike, or if the land has been developed without water management facilities, the rainfall will run off to the nearest waterbody, taking sediment, nutrients, and other elements with it.

Measuring water quality. To comply with the Federal Clean Water Act, the Florida Department of Environmental Protection (FDEP) is required to measure the degree of eutrophication to assess impairment. Currently, there are 47 impairments listed for Osceola County water bodies, 18 of which are for mercury. A final TMDL for the state of Florida (FDEP, 2013) has been developed to establish allowable loadings and needed reductions of mercury into Florida's fresh and marine waters.

The other 29 impairments are a mixture of low dissolved oxygen, high fecal coliform levels, and several variations of nutrient impairments.

Table 4. Lake Classifications and Uses

Class	Definition
Class I – Potable water supplies	Fourteen general areas throughout the state including: impoundments and associated tributaries, certain lakes, rivers, or portions of rivers, used as a source of potable water
Class II – Shellfish propagation or harvesting	General coastal waters where shellfish harvesting occurs
Class III – Fish consumption, recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife	The surface waters of the state are Class III unless listed in Rule 62-302.400, Florida Administrative Code (FAC)
Class IV – Agricultural water supplies	Generally located in agricultural areas around Lake Okeechobee
Class V – Navigation, utility, and industrial use	Currently, there are no designated Class V bodies of water

Source: FDEP.

One type of nutrient impairment is determined by assessing water quality using a method called the Trophic State Index (TSI). The TSI methodology is based on algal driven systems, not macrophytic (plant) based systems, as found in the majority of Osceola County. This methodology was used by FDEP from 1990 until 2013. Osceola County waters were assessed under these criteria, and in 2006, seven Osceola County water bodies were determined to be impaired and placed on the Federal list of impaired lakes (known as the 303(d) list). When the lakes were reassessed in 2010, Osceola County and the City of Kissimmee challenged the impairment listing of Lake Tohopekaliga. Led by Osceola County, a group of local stakeholders developed the *Lake Tohopekaliga Nutrient Reduction Plan* (NRP) for the Lake Tohopekaliga watershed (including East Lake Tohopekaliga) in lieu of the state setting regulatory nutrient loading targets.

Lakes Kissimmee, Cypress, Marian, and Jackson remained on the 2006 303(d) list of impaired waters, and in 2013, Total Maximum Daily Loads (TMDL) were adopted for these lakes. It was also in 2013 that the method to assess impairment was changed from using TSI. During the County's next assessment cycles (2014 and 2015) impairment will be determined using the Numeric Nutrient Criteria (NNC) methodology, supplemented by FDEP's narrative criteria. Numeric Nutrient Criteria measures a lake's clarity, and depending on that clarity and the availability of water sampling data, establishes a numeric target for chlorophyll-a, nitrogen, and phosphorus. All Osceola County lakes have high color levels and therefore have a default chlorophyll-a target of 20 µg/L (20 micrograms per liter or parts per billion). Lakes Kissimmee, Jackson, Cypress, and Marian exceed the chlorophyll-a target using both TSI and NNC (Table 5). The TMDLs were determined using TSI; therefore, the nutrient concentrations of total nitrogen (TN) and total phosphorus (TP) were set lower than the NNC limits. Using the TSI measurement increased many of the County's nutrient reduction requirements for TN and TP of Lake Kissimmee and Lake Marian, as well as TP for Cypress Lake. Using the NNC, there is insufficient data to determine what the reductions in TP and TN should be for Lake Marian (Tables 6 and 7). Under the new NNC, Lake Tohopekaliga and East Lake Tohopekaliga do not exceed the chlorophyll-a target at this time; therefore, they would not be declared impaired for nutrients under the new rules.

As noted in the *Osceola County Lakes Water Quality Targets Technical Note* (Atkins, 2013), the data referenced in these tables point to a number of issues relative to water quality assessment methods, pollutant load targets, nutrient reduction goals, historical hydrological modifications, and the potential benefits of hydrologic restoration. A more thorough analysis of these issues can be found in the Atkins report, including a discussion of hydrological modifications and the potential benefits of restoration.

Historic photos of Cypress Lake compared to recent photos demonstrate a dramatic reduction in spatial extent of the lake as a result of construction of the Central and Southern Florida Project (C&SF) system and the subsequent lake level regulation schedule (Figure 3). All six lakes examined in the Atkins report are part of the C&SF system and have been reduced in size from 2% (East Lake Tohopekaliga) to 21% (Lake Kissimmee) (Atkins, 2013). Reductions in the spatial extent of the lakes have implications for water quality having to do with interactions with wetlands and re-suspension of sediments. Because of the limits to high water levels required by the lake level regulation schedule, the lakes no longer experience the historic lake-wetland interactions seen prior to the 1940s. These interactions are beneficial to water quality because of the moderating influence of tannins on algal growth rates (Atkins, 2013). Further impacting water quality is the re-suspension of sediments due to wave action

Table 5. Summary of three-year average values for chlorophyll-a during 1999 to 2009 for Osceola County lakes.

Lake	Chlorophyll-a NNC Target (μg/L)	Three-year average Chlorophyll-a level (μg/L)	Percent Chlorophyll-a reduction required	Impairment Status
Cypress	20	37.5	46.7%	Impaired
East Lake Toho	20	3.8	0%	Unimpaired
Jackson	20	31.6	36.7%	Impaired
Kissimmee	20	22	9.1%	Impaired
Marian	ID	ID	ID	ID
Marian*	20	62.9	68.2%	Impaired
Lake Toho	20	15.2	0%	Unimpaired

Table 6. Difference between NNC and TMDL reductions required for Total Phosphorus.

Lake	NNC TP concentration reduction required	TMDL TP concentration reduction required	Difference between TMDL & NNC
Cypress	26%	35%	+9%
East Lake Toho	0%	N/A	N/A
Jackson	73%	25%	-48%
Kissimmee	9%	17%	+8%
Marian*	ID	53%	+53%
Lake Toho	0%	N/A	N/A

Table 7. Difference between NNC and TMDL reductions required for Total Nitrogen.

Lake	NNC TN concentration reduction required	TMDL TN concentration required	Difference between TMDL & NNC
Cypress	26%	5%	-19%
East Lake Toho	0%	N/A	N/A
Jackson	45%	20%	-25%
Kissimmee	9%	15%	+6%
Marian	ID	55%	+55%
Lake Toho	05	N/A	N/A

*data from 1997-2007
ID—Insufficient data
Atkins, 2013, FDEP 2013

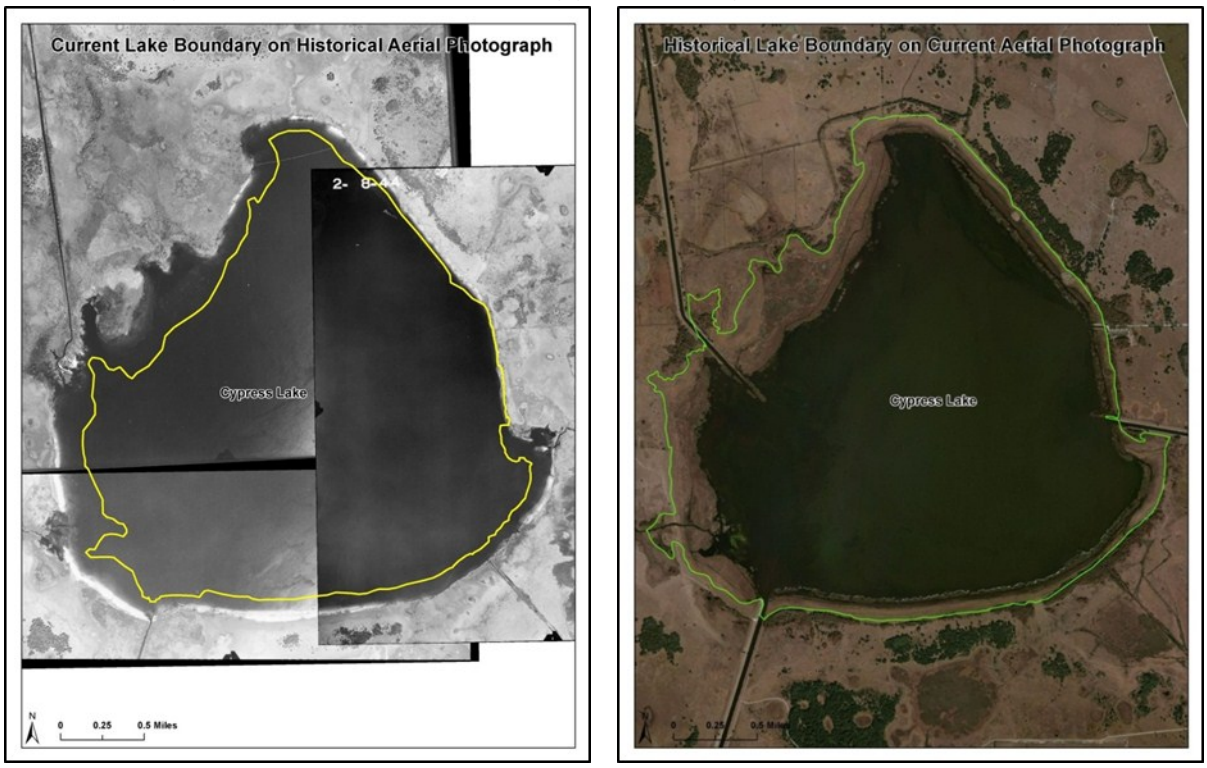
that affects bottom sediments more frequently in smaller lakes than larger lakes. Re-suspension of sediments contributes to increased phosphorus levels.

These historic alterations and their effect on water quality were presented to FDEP during development of the TMDLs for the Lower Kissimmee Chain of Lakes. Due to these findings, FDEP agreed to perform additional lake and lake sediment studies on several lakes in the Kissimmee Chain to determine nutrient loading rates prior to flood control alterations. In addition, language was added to the TMDL rule that protects the County from being required to exceed historic loading rates.

A Statement of Estimated Regulatory Costs (SERC) was published with the proposed TMDLs for the lower Kissimmee Chain of Lakes. Estimates for implementation of the TMDLs were more than $65 million per year for the first five-year cycle. The goal of the Clean Water Act is to restore surface waters. In the Kissimmee Chain, where the hydrology and natural lake systems have changed significantly, lake restoration means much more than meeting nutrient loading requirements. It should be the County's goal to determine and implement improvements that provide restoration benefits, not merely strive to meet load reductions.

Research, partnerships, and creative thinking will be needed to achieve restoration goals. Water quality improvements of this magnitude require a cooperative approach and more than just stormwater retrofits. Changes will need to be addressed on a large scale, including changes in development regulations, fertilizer use, stormwater reuse, residential best management practices, and supporting funding requests for agricultural best management practices. These opportunities are addressed further in this Plan.

Figure 3. Comparison of historical photo of Cypress Lake (1940s) with current boundary and current photo (2008) with historical boundary. Cypress Lake has experienced a 21% reduction in surface area (from 3,962 acres to 3,136 acres) (Atkins, 2013).



Declining water quality degrades the County's natural resources, making them undesirable for tourism and future growth and impacting the health and well-being of the County's residents. Urban growth without appropriate stormwater best management practices can have a negative effect on water quality. But it is important to note that water quality has improved dramatically since the 1980s, when two wastewater treatment facilities in Orange County discharged 30 million gallons of effluent per day into Shingle Creek (Wegener et. al 1973) and 7.5 million gallons of effluent per day into Boggy Creek (City of Orlando Wastewater Division). Effluent discharges were discontinued in 1988 when the Conserv I and Conserv II Water Reclamation Plants went into operation. These are improvements; however, the allowed nutrients in reclaimed wastewater can be 6 to 10 times higher than the surface water nutrient standards, which makes the discharge and inappropriate use of reclaimed water a significant nutrient loading source.

The County's 2014 *Master Surface Water Management Plan Update* includes an analysis of County efforts to improve water quality in its lakes and lake tributaries through compliance with state and federal water quality standards and best management practices. In it, the authors described and assessed the impacts of current water quality mandates, described the current water conditions of the County's water bodies, and estimated pollutant loads to identify areas of high loading.

Best Management Practices

The purpose of this section is to define Best Management Practices (BMPs) available to Osceola County for managing stormwater to improve lake health. The *Bass Slough Basin Stormwater Management Plan*, written by Inwood Consulting Engineers in 2003 under contract with Osceola County, included an evaluation of current and potential future BMPs. Best Management Practices include structural controls, non-structural controls, and operation and maintenance procedures used in stormwater management to reduce pollutant loads into receiving waters (Inwood 2003). These controls would improve the health of Osceola County lakes by providing storage for, and reducing pollutants in, stormwater runoff. It should be noted that BMPs are site-specific, and not all BMPs listed would be appropriate in every case.

Following are descriptions and characteristics of existing and recommended Osceola County BMPs. These descriptions are abbreviated, since a more thorough discussion can be found in the source material referenced throughout this section.

- **Stormwater ponds.** The purpose of a stormwater pond is to provide a catchment area to store and provide treatment to stormwater runoff. Ponds may be either retention or detention ponds. Retention ponds are designed to retain the water and allow it to infiltrate, thus providing attenuation of runoff as well as water quality treatment. Detention ponds detain stormwater runoff for a length of time to achieve attenuation and water quality treatment until it is discharged to another receiving body or storm sewer system. Supplemental BMPs for pond development include creation of a low maintenance zone around the pond at the water's edge. This zone not only filters pollutants prior to entering the water, but also captures trash and protects the pond slopes, which are very costly to repair.
- **Wetlands.** The Florida Department of Environmental Protection defines wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in

saturated soils." Wetlands provide storage and treatment for stormwater, as well as fish and wildlife habitat. Downstream water quality is improved because wetlands retain sediments, metals, nutrients, and organic material.

Engineered wetlands can be incorporated into developments as parks, for natural resources conservation, or as other recreational amenities. Types of engineered wetlands include shallow marsh, extended detention wetland, pond/wetland system, and pocket wetland.

Wetland restoration, which re-establishes hydrology, plants, and soils on previously disturbed sites, is a component of the County's environmental conservation lands management program.

- **Swales.** Swales, both grassed and vegetated, are broad, shallow channels constructed to convey stormwater. As part of a stormwater management system, their design is site-specific and governed by state and local regulations. Swales are designed to temporarily hold stormwater runoff until it infiltrates, evaporates, or is discharged to other stormwater management features. They reduce velocity, and the vegetation improves water quality through nutrient uptake.
- **Stormwater reuse.** Stormwater reuse is a practice that uses surface detention ponds or other water storage systems to capture stormwater and recycle it for non-potable needs, such as irrigation. Stormwater reuse reduces demand on potable water sources and reduces nutrient loading (Clark, 2008). Small-scale reuse can be incorporated into a development's irrigation plan. Currently, Osceola County has nine known small-scale reuse operations, including the County's stormwater reuse system for Neptune Road landscaping. An example of a large-scale stormwater reuse facility can be found in the City of Apopka where in 2008, the City constructed a 120-million gallon reservoir and pump station at the Northwest Recreation Complex. The Lake Toho Restoration Initiative includes a stormwater reuse component that would provide water quality, supply, and storage benefits to the local area as well as the greater Kissimmee/ Okeechobee/ Everglades watershed.
- **Bioretention.** Bioretention uses soil and plant material to remove pollutants from stormwater. Bioretention systems are designed to direct stormwater runoff over a grassed buffer area into a ponding area planted with woody and herbaceous plants. Water quality is improved because stormwater pollutants are removed by physical and biological process. Velocity is slowed, water and sediments are retained, nutrients are used by the plant material, and water infiltrates or evaporates. Because of its aesthetic qualities, it is a BMP that should be considered in County parks and facilities. Rain gardens, such as those in Kissimmee Lakefront Park on Lake Tohopekaliga, are an example of bioretention systems.
- **Sediment traps.** Sediments traps, such as baffle boxes, are designed to treat the initial flow of stormwater by collecting debris and sediment in a multi-chamber device, often with a screen that separates and keeps leaves out of the system. The purpose of sediment traps is to remove debris and sediments. These devises require routine maintenance. They are appropriate for areas where land availability is constrained or where a significant amount of trash is known to flow into sensitive water bodies.
- **Exfiltration.** This BMP consists of an excavated area filled with coarse media and large diameter pipes that provide subsurface storage of a specific volume of

stormwater. Stormwater infiltrates directly into the subsurface, providing not only treatment but also recharge to the aquifer. This technique may not be widely applicable due to low infiltration capacity of soils in some basins of Osceola County.

- **Impervious area reduction measures.** Reducing impervious areas generates less runoff, reduces non-point source pollution, and increases aquifer recharge. Examples of this BMP include grassed overflow parking, grass areas between curb and sidewalk, pavers, and pervious pavements. This BMP can be maintenance -intensive, so appropriate uses may be in County parks and public facilities. The County's land development code (LDC) encourages developers to incorporate impervious areas into a project's overall stormwater management plan.
- **Debris baskets/inlet screens.** This BMP integrates small metal woven baskets into stormwater inlets to trap large debris such as leaves and trash. The baskets can be accessed by a manhole to be emptied. Since intense and frequent maintenance is required to remove accumulated debris from these baskets, this type of BMP is more appropriate in residential areas with limited options for treatment and in places where there is direct discharge to a water body.
- **Vegetated buffers and filter strips/re-vegetation.** This BMP is designed to prevent sediment erosion, one of the primary components of Total Suspended Solids (TSS) in stormwater runoff. Re-vegetating areas near stormwater inlet structures using sod and other plant material minimizes sediment erosion. Where property is available, vegetated buffers with widths at least 30 feet can slow stormwater runoff velocities, reduce sediment to nearby water bodies, provide nutrient uptake by plants, provide habitat for wildlife, and improve aesthetics.
- **Street sweeping.** Street sweeping removes debris and pollution that accumulates on roads and parking lots before it reaches water bodies in stormwater runoff. Not only does this practice improve aesthetics, it reduces pollutant loads to downstream stormwater management systems, thus reducing maintenance and increasing operational life. It is one of the most cost-efficient ways to reduce pollutant loading. Expansion of the street sweeping program in Osceola County should be considered, particularly in residential areas with large canopy trees.
- **Public education.** There is much the public can do help maintain water quality. The County provides education and builds awareness with information on our website, classes conducted by the UF/IFAS Osceola Extension Office, outreach at community events, and continuing education for County employees. Examples include:
  - Florida Friendly landscaping
  - Proper irrigation techniques
  - Master Gardener Program
  - Certified pesticide application
  - Florida Master Naturalist Program
  - Native Plant Society
  - FDEP Stormwater Erosion and Sedimentation Control Inspectors training
  - Exhibits and educational signage

County Ordinances

In addition to stormwater requirements for new development, which are contained in the land development code, the County has enacted two ordinances aimed at improving water quality.

Fertilizer ordinance. In 2014, the County drafted a fertilizer ordinance to meet the requirements of the NPDES permit. The Board of County Commissioners adopted the

ordinance in January 2015. Enforcement during the first year of implementation will focus on education conducted by the NPDES Coordinator.

Illicit discharge ordinance. Adopted in November 2008, the illicit discharge ordinance prohibits discharge of petroleum products, solid waste or sewage, chemicals, laundry waste (such as the washing machine discharge shown in the photo below), and numerous other pollutants into the stormwater system.

Other

Other ways to support lake improvement involve citizen action, much like Lakewatch volunteers contribute by monitoring water quality. These include, among other things, watching for navigation hazards—shoaling, aquatic plan infestations, damaged navigation signs, and debris that obstructs passage in canals, creeks, and streams—as well as watching for illicit discharges from pipes into water bodies. These activities fall under the purview of various County departments, but are of a nature that are not always apparent during planned inspections or surveys. From the County's new mobile app, MyOsceola.org, residents can click on a lake, comment on anything they feel the County needs to know, and have the information transferred to the appropriate County department.

Aquatic Plant Management

Introduction. Aquatic plants are important for a healthy lake ecosystem. They provide habitat and food for fish, reptiles, waterfowl, and other wildlife. Plants stabilize shorelines and riverbeds by preventing erosion. They produce oxygen and regulate temperature. Desirable plant habitat can be disrupted by exotic, invasive plant species, causing an imbalance that negatively affects the natural functioning of ecosystems. Native plant species that form a monoculture (where one species comprises more than 85% of an area) also can become problematic and require management.

Exotic invasive species common to the Central Florida area include hydrilla, water lettuce, water hyacinth, and hygrophila. Native species that have recently become problematic include water primrose (in Lake Tohopekaliga) and Illinois Pondweed (in East Lake Tohopekaliga). Fueled by the sub-tropical climate, with its long growing season and abundant rainfall, these species have become highly problematic. They have proven to be highly adaptable, even developing resistance to herbicides.

Nuisance and exotic, invasive plants can result in deterioration of fish and wildlife habitat; decreasing water quality; impacts to boating, fishing, and other forms of recreation; reduction in property values associated with deteriorated wildlife habitat; impacts to flood control systems; and impediments to navigation.

Responsibilities. The County receives many inquiries from citizens about who is responsible for aquatic plant management in area lakes. The answer is everyone. Many exotic, invasive species can be transported easily from lake to lake on boat propellers. Care should be taken when planting backyard, shoreline vegetation so that only native plants are used.

In Florida, FWC is charged with managing aquatic plants in public, navigable waterways. In Osceola County, FWC works with the SFWMD to implement the aquatic plant management program, with an emphasis on

hydrilla and other invasive, exotic plant species. Each year, FWC conducts two public meetings in Central Florida to obtain stakeholder input on the previous year's management activities, as well as to inform them of the upcoming year's activities. Stakeholders include recreational boaters as well as anglers, hunters, bird watchers, environmental organizations, and state and federal agencies.

Osceola County does not have a dedicated funding source for aquatic plant management. In 2002, the County was awarded a $598,700 grant from U.S. EPA to manage invasive aquatic vegetation in the Kissimmee River Basin. Project goals were to reduce density of targeted invasive exotic plant species by 33% in select areas of Shingle Creek and Boggy Creek, and to perform routine maintenance on Buenaventura Lakes detention ponds to ensure a 50% open water rate.

The County also received a $1.9 million U.S. EPA grant to conduct research on biological, chemical, and mechanical controls for hydrilla and hygrophila. The grant concluded in 2012, and the research results can be found in the *Final Report on the Demonstration Project on Hydrilla and Hygrophila in the Upper Kissimmee Chain of Lakes* (Foerste and Hatzell 2012).

Osceola County can apply for permits to manage aquatic plants on the shoreline of property it owns or manages (for example, at boat ramps). The County has received permits to treat exotic, invasive species in public boat ramp basins and along the shorelines of its properties. Herbicide is applied by a licensed technician. The County does not have a large-scale aquatic plant treatment program for any County lakes, but rather works in concert with FWC and SFWMD in managing aquatic plants to preserve recreational opportunities. In 2013, the County successfully petitioned the Tourist Development Council (TDC) for funding to treat Illinois Pondweed in East Lake Tohopekaliga. The decision to seek funding for aquatic plant treatment independently of the FWC was made for safety and economic reasons. Illinois Pondweed, a native species, had become so problematic that boaters were being stranded, causing numerous calls to the Sheriff's Department. Additionally, the prevalence of Pondweed was seen as an impediment to recreation, including bass fishing tournaments, ecotourism, and powerboat races scheduled in the area. A simultaneous funding effort explored by FWC to use unallocated 2012/2013 funds resulted in the treatment of 1,350 acres of Pondweed in October 2013. Initial results were positive, and the lake will be reassessed in 2015 to determine whether additional treatment is necessary.

Areas not supported by FWC funding include approximately six miles of canals; areas in Shingle Creek and Boggy Creek where navigation is impeded; 12 County boat ramp basins; and planned canoe/kayak trails from Cherokee Point to Twin Oaks Conservation Area. Currently, funding is not budgeted for staff to conduct routine inspections of the lakes for aquatic plant infestation. The County is working toward adding website contacts, increase web apps and other forms of social media to allow people who encounter navigation hazards and of aquatic plant infestation to report them to the County.

Lake Management Plans

The lake management plans discussed in this section focus on the Kissimmee Chain of Lakes (Lake Tohopekaliga, East Lake Tohopekaliga, Cypress Lake, Lake Hatchineha, Lake Kissimmee, and Lake Gentry) and the Alligator Chain of Lakes (Lake Joel, Lake Preston, and Lake Myrtle). The reasons for this distinction are:

- The economic significance of these lakes
- Their role in flood protection
- The regional nature of lake management activities performed by multiple agencies
- Recreation amenities

Each section addresses the physical attributes of the lake, water quality, BMPs for sustainability, aquatic plant management, recreational amenities, and budgeted and forecasted management activities.

Lake Tohopekaliga

Looking toward downtown Kissimmee from Lake Tohopekaliga

While Lake Tohopekaliga (or Lake Toho) is the second largest lake in the County after Lake Kissimmee, it could easily be considered the most important because of its location, size, fish and wildlife resources, and economic importance relative to its recreational value. Lake size ranges from 18,810 acres at low pool to 22,019 acres at high pool. (Low pool and high pool are regulated by the USACOE regulation schedule.) Regulated lake levels, which fluctuate between 52 and 55 feet NGVD29 (National Geodetic Vertical Datum of 1929), are controlled by the lake outfall gates at S-61 operated by the SFWMD. A table showing the lake level regulation schedule can be found in Appendix E. Water depth ranges from zero to 13 feet, with an average depth of six feet (KCOL LTMP, 2011).

In 1998, Lake Toho was designated a Fish Management Area (FMA) through an agreement between Osceola County and the Florida Fish and Wildlife Conservation Commission (FWC). An FMA is a pond, lake, or other water body established for the management of freshwater fish as a cooperative effort with the local county (FWC, 2014). Makinson and Paradise islands were purchased and protected as components of the FMA. (Makinson Island is maintained by Osceola County Parks.)

The lake is renowned for its largemouth bass, black crappie, bluegill, redear sunfish and warmouth fisheries. The lake attracts more than 82,000 visitors annually, generating nearly $2.7 million in spending and contributing $405,000 in wages (Bell, 2006).

A popular bird-watching destination, Lake Toho has two sites on the Great Florida Birding and Wildlife Trail: Makinson Island and

Kissimmee Lakefront Park. The lake has become a primary nesting and foraging habitat for the Everglade snail kite; it serves as a refuge for the snail kite during drought conditions in Lake Okeechobee (KCOL LTMP, 2011). The snail kite's breeding season is between January and June. The bird nests over open water in a variety of woody vegetation. Any disturbance to snail kites or their nests is prohibited by State and Federal law (FWS Quick Facts, 2014). Because of this, management activities—including construction of boat ramps and navigation signs, fluctuations in lake levels, and the timing of vegetation management—are adjusted so as not to impact snail kite habitat.

The lake lies entirely within the County's Urban Growth Boundary (UGB), with the western and northern shorelines highly urbanized. Kissimmee is located on its northern and northwestern shores. Residents and visitors to the area are able to enjoy recreational opportunities from this downtown location—strolling through Kissimmee Lakefront Park, fishing from the pier at Brinson Park, or launching boats from the newly renovated boat ramp. Lake Toho is central to Osceola County's cultural heritage.

Water Quality

As mentioned in Section 3, methodologies for assessing lake water quality have changed. Osceola County complies with all state and federal regulations to assess water quality and implement BMPs to improve water quality in its lake and downstream water bodies.

In 2010, the Florida Department of Environmental Protection (FDEP) placed Lake Toho on the impaired waters list. Osceola County and the City of Kissimmee challenged this designation, and a subsequent independent analysis resulted in a change to the listing. Osceola County and its partners developed a Nutrient Reduction Plan (NRP) for Lake Toho, and thus a TMDL (Total Maximum Daily Load) was not adopted for the lake.

The purpose of the Lake Toho NRP is to document local efforts that achieve nutrient reductions; identify research needs; and provide additional time to assess the complex relationships within the lake, including the relationships among nutrients, Trophic State Index (TSI), hydrilla, and other factors. Implementation of the initial NRP began in February 2012 and will continue through May 2016. The NRP has the flexibility to adapt as needed to reflect research and monitoring findings as well as legislation. Appropriate target-setting based on solid science is critical so the County can determine an appropriate restoration path for the lakes and use its limited resources efficiently. Upon FDEP adoption of the NRP, Lake Toho was removed from the Federal 303(d) list. The NRP covered both Lake Toho and East Lake Toho; therefore, no TMDL is required for either lake at this time.

Lake Toho is currently listed on the State impaired waters list due to an imbalance of flora and fauna (hydrilla abundance). The lake also is impaired for mercury in fish; therefore, safe fish consumption rates are established by the FWC. Mercury impairment and associated BMPs are discussed in Section 3.

Lake Toho is classified as a "colored lake," measuring 77 on the Platinum Cobalt Unit Scale. The lake falls below target levels for chlorophyll-a, Total Phosphorus, and Total Nitrogen, as can be seen in Table 8, so no nutrient

Table 8. Current Nutrient Targets and Reductions Required for Lake Tohopekaliga using Numeric Nutrient Criteria (NNC).

Nutrient	NNC Target	Actual Three-Year Consecutive Average (1999-2009)	Reduction Required
Chlorophyll-a	20 µg/L	15.2 µg/L	0%
Total Phosphorus	0.157 mg/L	0.047 mg/L	0%
Total Nitrogen	2.25 mg/L	1.072 mg/L	0%

Source: Atkins, 2013

reductions would be required if it continues to meet these parameters through 2016 and is not found to be impaired by a different causative pollutant. Note that the consecutive three-year averages are only snapshots of conditions during a short period of time, and nutrient reassessments are cyclic.

Trending analysis allows for a better picture of overall changes in water quality and gives the County an opportunity to address negative trends before the next assessment cycle to avoid a new impairment listing. Trending analysis for Lake Toho was completed in 2013. Data for the lake show a slight increase in Total Nitrogen concentrations over time. More detailed information on Lake Toho trends can be found in the 2014 *Master Surface Water Management Plan Update* (MSWMPU).

Best Management Practices

Lake Toho is a Class III lake, meaning that it must be protected for fish consumption, recreation, and maintenance of a healthy, well -balanced population of fish and wildlife. Recent County acquisitions of conservation properties along Shingle Creek, Twin Oaks, Cherokee Point, and Scotty's Cove offer opportunities to implement wetland restoration, which would improve the lake's water quality.

In addition to projects planned in the NRP, additional structural BMPs will be needed to meet downstream TMDLs. The MSWMPU identifies stormwater improvement alternatives that could improve drainage and reduce nitrogen and phosphorus loading into Lake Toho. Additionally, the MSWMPU recommends projects previously cited in the Bass Slough basin study.

Aquatic Plant Management

Large-scale aquatic plant management for Lake Toho is performed by the FWC. The 2013/2014 aquatic plant management plan for hydrilla called for 3,000 acres to be treated using Aquathol K and Diquat herbicides. Areas treated in 2013/2014 are shown in Figure 4. In addition to hydrilla, the FWC has contracted for the mechanical removal of lugwigia in the northern section of the lake, as well as treatment of cattails in Goblet's Cove. The County treats for hydrilla near County properties and boat ramps.

Recreational Amenities

The public is able to access Lake Toho from many locations, including multiple locations managed by the County. The County manages three boat ramps located directly on Lake Toho and one boat ramp on the C-31 canal leading to the lake. Kayakers and canoeists are able to launch from any of these boat ramp locations as well as from properties on Shingle Creek, Twin Oaks Conservation Area, and Scotty's Cove Conservation Area.

Makinson Island. Makinson Island is a 132-acre property managed by Osceola County, offering primitive camping, hiking and passive

recreational opportunities such as wildlife viewing.

Twin Oaks Conservation Area. Twin Oaks Conservation Area is a 399-acre property purchased by the County's Environmental Lands Conservation Program. The property provides protection and enhancement of water resources, flood storage, and wildlife habitat. Recreational opportunities include paddling, hiking, horseback riding, fishing, picnicking, and bird-watching.

Shingle Creek Regional Park. Located on Shingle Creek (a tributary of Lake Toho) is the Shingle Creek Regional Park, comprising over 1,300 acres of protected corridor, including Babb Landing, Steffee Landing, and the Steffee Homestead. Recreational opportunities include biking, hiking, fishing, paddling, picnicking, bird-watching, and nature photography.

Granada Boat Ramp. Granada Boat Ramp is located at the end of Ridgeway Drive, Kissimmee, on the west side of Lake Toho. Improvements to the Granada Boat Ramp were budgeted for fiscal year 2013/2014 and are currently in the design and permitting stage. The ditch will be re-routed through a created wetland area that will provide water quality treatment to reduce nutrients and sediments into the boat channel. The plant palate for both upland and wetland plants will consist of Florida native plants, so that no irrigation is required. As with all planned improvements to County boat ramps, a floating dock and gangway will be installed to accommodate fluctuating lake levels. Additional amenities will include picnic tables, a solar powered compacting trash can, a kiosk, rope bollard fencing, and a standard boat ramp entryway. (Figure 5.)

Southport Park Boat Ramp. The Southport Park Boat Ramp is located on 2001 Southport Road, Kissimmee on the south end of Lake Toho. Improvements to the Southport Park Boat Ramp will be coordinated with passive parks improvements planned for Southport Park and the concessionaire's improvements per contract. The boat ramp improvements include floating docks and gangways, an ADA

Figure 4. 2013/2014 Hydrilla Treatment Plan for Lake Tohopekaliga.

restroom and parking space, improved traffic flow, area for canoe launching, bank fishing and boat tie ups, and a boat ramp standard entryway. (Figure 6.)

Partin Triangle Park Boat Ramp. This boat ramp is located at 2830 Neptune Road, Kissimmee on the C-31 canal. While improvements for this ramp are not scheduled until 2018, a new gangway and two floating docks recently were installed by an airboat concessionaire that is under contract with the County. The larger of the two docks is used by the concessionaire during business hours and is otherwise available to the general public. The smaller dock is always open to the public. (Figure 7.)

Whaley's Boat Ramp. Whaley's Boat Ramp is located at the end of Lake Tohopekaliga Road, St. Cloud on the east side of Lake Toho. Improvements at Whaley's Boat Ramp include a floating dock and gangway, a pier, picnic table, kiosk, and ADA parking space and boat ramp standard entryway. (Figure 8.)

Planned Management Activities

Listed below are near- and long-term planned management activities.

Fiscal Year 2013/2014

- Installed 7 new navigational waterway markers
- Removed 26 navigational waterway markers
- Updated 18 navigational waterway markers with permit and ordinance numbers.
- Renovated Granada Boat Ramp
- Dredged Granada Boat Ramp Basin

Long-Term Management Activities

- Renovate Whaley's Boat Ramp
- Renovate Southport Park Boat Ramp
- Dredge Shingle Creek where it outfalls to Lake Toho
- Navigation markers for the Partin Triangle Boat Ramp (new markers that will require permitting)
- Replace T10 Idle Speed No Wake Navigational Marker (sign only)*
- Replace T16 Idle Speed No Wake Navigational Marker (sign only)*
- Replace T16 Resume Normal Safe Operation Navigational Marker (sign only) *

*These markers are faded and the signs need to be replaced. This activity will not require permitting.

Long-Term Recreational Plans

- Extended paddling trail
- Additional amenities on Makinson Island
- Amenities on Paradise Island

Figure 5. Granada Boat Ramp Improvements.

Figure 6. Southport Park Boat Ramp Improvements.

Figure 7. Partin Triangle Park Boat Ramp Improvements.

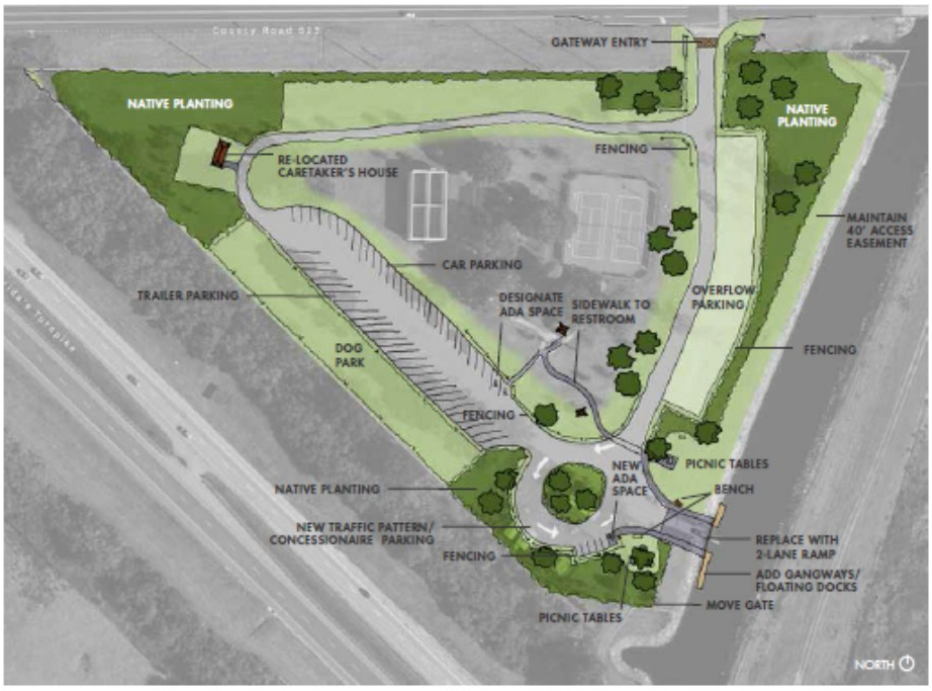
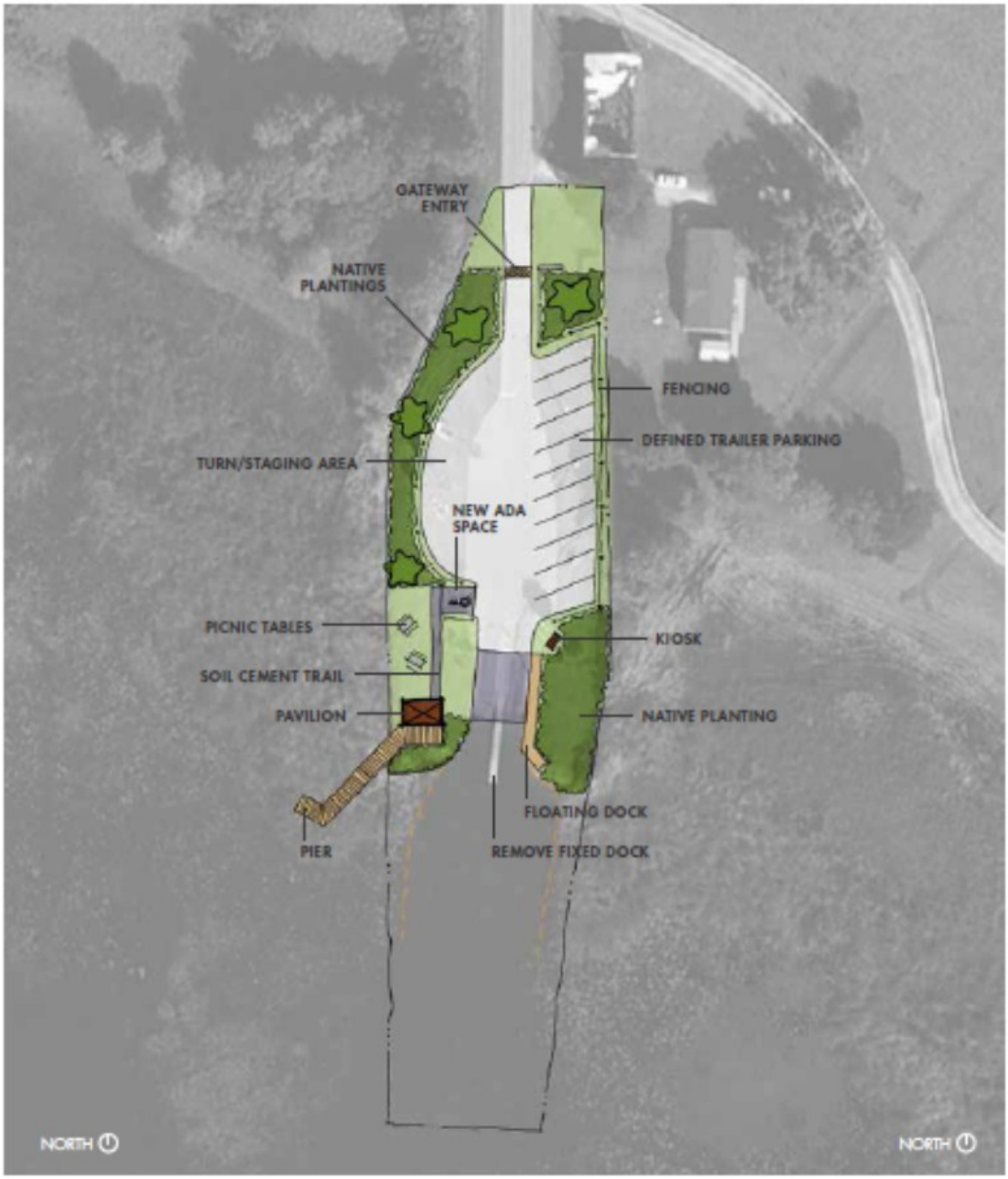


Figure 8. Whaley's Boat Ramp Improvements.



East Lake Tohopekaliga, Lake Runnymede, and Lake Ajay

East Lake Toho, taken from the Chisholm Park boat ramp

East Lake Tohopekaliga (also known as East Lake and East Lake Toho), Lake Runnymede to the south, and Lake Ajay to the north are hydrologically connected. East Lake Toho is an urban recreational lake (KCOL LTMP) with extensive residential shoreline development. Urban recreational lake is not an official designation, but rather a description that differentiates its common uses from those of Lake Toho. Boating and jet skiing are more common on East Lake Toho, while hunting and fishing are more common on Lake Toho. East Lake levels fluctuate between 55 and 58 feet NGVD29, and lake area measures 12,125 acres at high pool. Lake levels are controlled by the S -59 water control structure located on the C-31 canal between East Lake Toho and Lake Toho. The water depth ranges from zero to 16 feet and averages 9.9 feet (KCOL LTMP, 2011).

Contributing water bodies include Boggy Creek, Lake Ajay, and lakes Hart and Lake Mary Jane in Orange County. East Lake Toho receives stormwater runoff from Lake Myrtle, Lake Joel, Lake Hart, Lake Mary Jane, the Boggy Creek Basin, Ox Pond Ditch Basin, Jim Branch Basin, Lake Ajay Basin, Hidden Lake Basin, St. Cloud Basin, Narcoossee Basin, and Runnymede Basin.

In 1998, East Lake Toho was designated as a FMA through an agreement between Osceola County and the FWC. The lake is known for its largemouth bass, black crappie, bluegill, redear sunfish, and warmouth fisheries. Wildlife enthusiasts are attracted to East Lake Toho to view bald eagles, Florida sandhill cranes, Everglade snail kites, limpkins, and alligators. Recreational uses include fishing,

Table 9. Current Nutrient Targets and Reductions Required for East Lake Tohopekaliga using Numeric Nutrient Criteria (NNC).

Nutrient	NNC Target	Actual Three-Year Consecutive Average (1999-2009)	Reduction Required
Chlorophyll-a	20 µg/L	3.8 µg/L	0%
Total Phosphorus	0.157 mg/L	0.02 mg/L	0%
Total Nitrogen	2.25 mg/L	0.696 mg/L	0%

Source: Atkins, 2013

boating, water skiing, jet skiing, boat racing, sightseeing, kayaking, and ecotourism.

As in Lake Toho, East Lake Toho provides nesting and foraging habitat for the endangered Everglade snail kite and serves as a refuge for the Everglade snail kite during drought conditions in Lake Okeechobee Management activities are adjusted as necessary so as not to impact snail kite habitat.

Located to the southeast of East Lake Toho and connected by a canal is Lake Runnymede. The shoreline of this 300-acre lake is dominated by a monoculture of wax myrtle. The Lake Runnymede Conservation Area is bordered by Rummell Road to the north and west, a canal connecting to Lake Runnymede and East Lake Toho to the west, and to the east by a modular home community. The County acquired this Conservation Area in 2007 and opened it to the public in 2010 as part of the Land Conservation Program. Birdwatchers are drawn here to see owls, woodpeckers, black and white warblers, yellow warblers, vireos, summer tanagers, and other warblers. In the past, the lake shoreline habitat was more open and contained predominantly grass species. Restoration activities to thin out the wax myrtle along the shoreline will make it more suitable for wildlife species such as the Florida sandhill crane that depend on this type of habitat for nesting (Lake Runnymede Conservation Area Management Plan and Design, 2012).

Lake Ajay receives flow from lakes located in Orange County through the C-29A canal. For purposes of this Lakes Management Plan, issues relative to Lake Ajay will be included in sections pertaining to East Lake Toho.

Water Quality

East Lake Toho is a mesotrophic lake and is lower in algal productivity than Lake Toho. East Lake Toho is classified as a “colored lake” measuring 55 on the Platinum Cobalt Unit scale. It has a consecutive 3-year chlorophyll-a average of 3.8 µg/L, which is below the NNC target of 20 µg/L. (Table 9.) The levels for Total Phosphorus and Total Nitrogen are below the NNC target levels as well. East Lake Toho was included in the NRP for Lake Toho, so a TMDL was not required.

Best Management Practices

East Lake Toho is a Class III lake, meaning that it must be protected for fish consumption, recreation, and maintenance of a healthy, well -balanced population of fish and wildlife. Recommendations for water quality improvement include restoring and/or enhancing wetland areas and implementing stormwater engineering projects recommended in the MSWMPU.

The County-owned and maintained Ralph V. Chisholm Park offers an opportunity for restoration of a 156-acre site on the southeastern shore of East Lake Toho. The site consists of multiple pavilions, picnic tables and

grills, restrooms, a two-lane boat ramp and swimming beach area. There is an opportunity to install two to three wet retention ponds that would provide water quality treatment in an area where little treatment currently exits. A conservation area to the east will be designed for passive recreation and eventually connected to the Lake Runnymede Conservation Area to the south. The boat ramp area will be renovated beginning in 2017, and bahia grass areas will be replaced with native plants to reduce maintenance mowing, provide habitat for wildlife and reduce nutrient flow into the lake. Additionally, cattle currently leased on the site will be removed and a bioswale will be created to define traffic lanes and to treat stormwater runoff in the parking lot. The 2014 MSWMPU also recommends implementation of projects identified in the 2005 Boggy Creek Basin Stormwater Management Plan.

Aquatic Plant Management

According to the Draft Kissimmee Chain of Lakes Long-Term Management Plan, hydrilla is not a major management concern on East Lake Toho, but other rooted and floating aquatic plants can be problematic because of stabilized water levels (KCOL LTMP, 2011). In addition to cattail, pickerelweed, water primrose and tussocks, Illinois pondweed (a native aquatic plant) is the species that recreational users cite as hindering boating and jet skiing.

In the spring of 2012, approximately 634 acres of Illinois pondweed were treated (FWC Annual Report). At the time, it was estimated that 1,200 acres of pondweed were present in the lake. In September 2013, Osceola County worked with the Family Boating Association, the FWC, and SFWMD on a plan to treat 1,350 acres of pondweed. Treatment occurred in October 2013, using liquid Aquathol K™ herbicide (Figure 9). The FWC funded this treatment using their contractors.

In July 2013, Osceola County worked with the SFWMD to spray the beach at Chisholm Park. This effort would be enhanced by harvesting or burning the plant material. Recommend this expenditure be budgeted for FY 2014/2015 and routinely each year.

The canals between Orange Avenue and Edgewater Drive and between Edgewater Drive and Lakeview Drive provide access to East Lake Toho and Lake Runnymede. In the original plat of Runnymede Shores, the streets and canals were recorded on June 17, 1959 (PB1, PG 383) prior to formation of the SFWMD. These streets, homes and private canals lie within the unincorporated County boundaries, but stormwater runoff flows into the canals from nearby neighborhoods located in the City of St. Cloud. The canals are frequently clogged by floating, emergent and submerse vegetation. The canals could be improved by a continuous program of aquatic plant management.

Recreational Amenities

The public is able to access East Lake Toho from three boat ramps—Ralph V. Chisholm Park, the St. Cloud Marina, and East Lake Fish Camp. The boat ramp at Ralph V. Chisholm Park is an Osceola County facility located at

Figure 9. Pondweed Treatment Area on East Lake Tohopekaliga, October 2013.

4700 Chisholm Park Trail, St. Cloud, that offers free boat launching and a public swimming area. There is a two-lane boat ramp flanked by two floating aluminum docks. Park area amenities include restrooms, pavilions, picnic tables, and grills. The master plans for park and boat ramp improvements are complete. Phase I of boat ramp improvements were scheduled to begin in October 2015, with completion by 2017. Phase II, scheduled for 2021, includes an observation pier. Current plans call for this park to be annexed into the City of St. Cloud, and the County is coordinating with St. Cloud to provide to the City the boat ramp improvement plans for this park. (Figure 10.)

Planned Management Activities

Listed below are near- and long-term planned management activities.

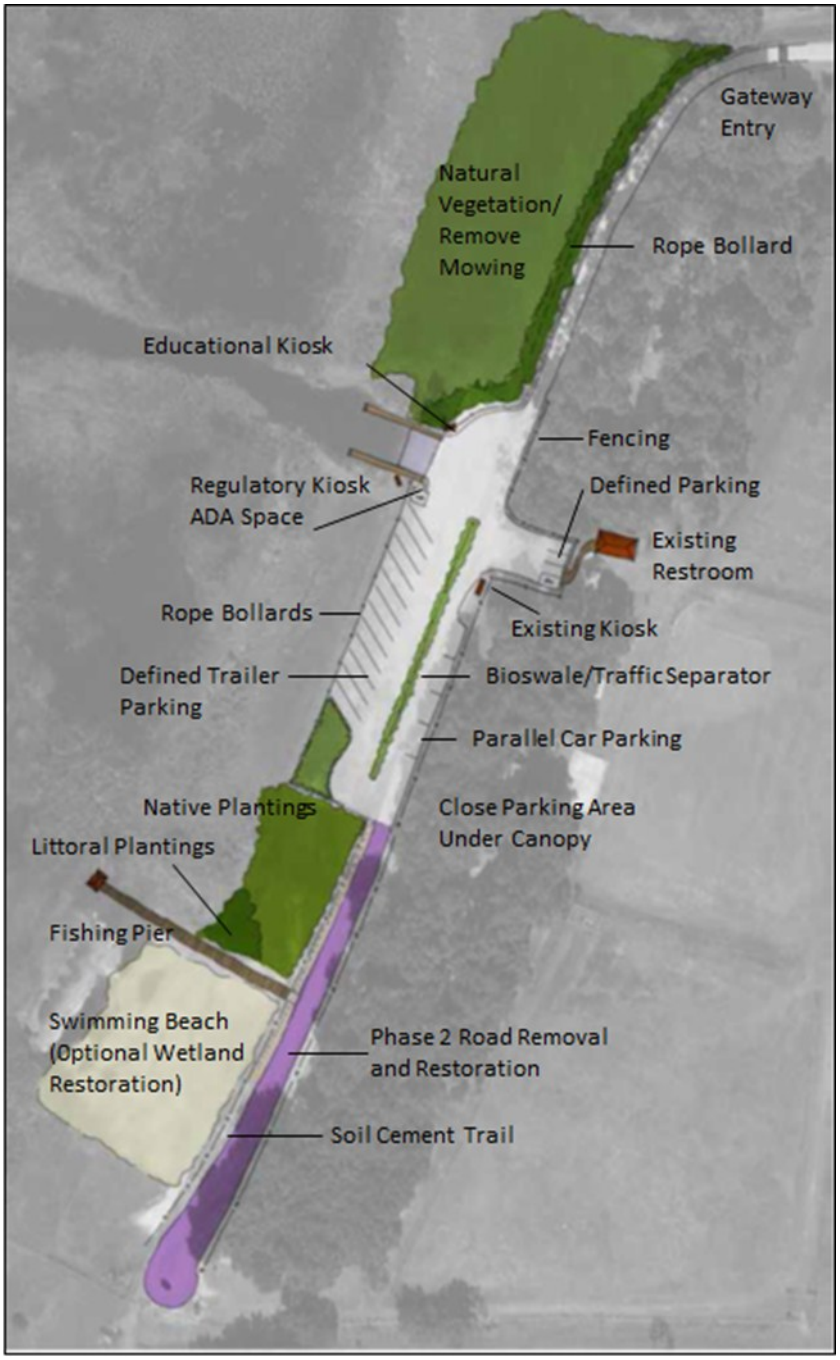
Fiscal Year 2013/2014

- Installed 4 new navigational waterway markers
- Removed 28 navigational waterway markers that are located in areas that the County has no authority to restrict boating
- Updated 18 navigational waterway markers with permit and ordinance numbers
- Treated 1,350 acres of pondweed (FWC)
- Re-treated or treated additional acres in 2014 (TDC funding)

Long-Term Management Activities

- Work with property owners to establish a dedicated funding source to treat aquatic vegetation in canals

Figure 10. Chisholm Park Boat Ramp Improvements.



Cypress Lake

Cypress Lake is a 4,097-acre lake with an average depth ranging from 3.5 feet to 7.1 feet (FDEP, 2013). Lake levels are managed by the S-65 structure on Lake Kissimmee and range from 49 feet NGVD29 at low pool to 52.5 feet NGVD29 at high pool. Much of the surrounding shoreline is owned and managed by the SFWMD and was purchased to meet the Kissimmee River restoration requirements, as well as to increase the littoral zone to benefit of fish and wildlife. Boaters are able to navigate to this lake using the C-35 canal from Lake Toho and C-36 canal from Lake Hatchineha. The County also maintains a boat ramp, located at 3301 Lake Cypress Road, Kenansville.

Cypress Lake is designated by the FWC as a Fish Management Area, and the lake is known for its largemouth bass, black crappie, bluegill, redear sunfish, and warmouth fisheries. Endangered species such as the Everglade snail kite and the whooping crane use the lake for nesting and foraging. Recreational activities include boating, fishing, duck hunting, air-boating, wildlife viewing, and nature photography.

Water Quality

In 2006, Cypress Lake was placed on the Federal 303(d) list of impaired water bodies, and in 2013, a TMDL was adopted for the lake. Cypress Lake is classified as a “colored lake,” measuring 90 on the Platinum Cobalt Unit scale. It is impaired for chlorophyll-a, Total Phosphorus and Total Nitrogen. As highlighted in Section 3 (Water Quality), different methods for assessing impairments produce different water quality targets. Phosphorus

Table 10. Difference between NNC and TMDL Reductions Required for Total Phosphorus and Total Nitrogen for Cypress Lake.

Nutrient	NNC Reduction Required	TMDL Reduction Required	Difference in % between TMDL and NNC
Total Phosphorus	26%	35%	+9%
Total Nitrogen	26%	5%	-19%

Source: Atkins, 2013 and FDEP, 2013.

concentration reduction targets for Cypress Lake are greater using the Trophic State Index (TSI) methodology to determine TMDLs versus the NNC methodology. Conversely, Nitrogen concentration reduction targets are less using the TSI methodology to determine TMDLs versus the NNC methodology. (Table 10.)

A Basin Management Action Plan (BMAP) would be the next step in dealing with water quality for this lake. The County will participate in the BMAP process when it moves forward.

Best Management Practices

Property in Osceola County surrounding Cypress Lake is located outside of the Urban Growth Boundary of both Osceola and Polk counties. When the BMAP process begins, the County will implement additional BMPs (as recommended in the MSWMP) to achieve nutrient reduction targets.

Aquatic Plant Management

Large-scale aquatic plant management for Cypress Lake is performed by the FWC. The 2013/2014 aquatic plant management plan for hydrilla called for 500 acres to be treated using Aquathol K, Clipper and Diquat herbicides. The area to be treated is shown in Figure 11.

Recreational Amenities

Boaters can travel to Cypress Lake from Lake Toho through the C-35 canal and from lakes south of Cypress Lake by the C-36 canal. Residents and visitors can also launch their vessels from the County maintained boat ramp on Cypress Lake Road. Shoaling has occurred in an area approximately 1,000 feet from the C -35 canal. When the lake is at low pool (49 feet NGVD29), the depth in this area is as low as 6 inches. The extent of the shoaling measures approximately 140 feet long by 60 feet wide.

Figure 11. 2013/2014 Hydrilla Treatment Plan for Cypress Lake.

Stakeholders have requested that the area be dredged. Osceola County discussions with the South Florida Water Management District and Army Corps of Engineers have not resulted in any agency action to dredge this area. The South Florida Water Management District has treated the cattails to improve visibility. The County will install waterway markers alerting boaters of the hazard.

Improvements to the Cypress Lake Boat Ramp were budgeted for fiscal year 2013/2014 and are currently in the design and permitting stage. A floating dock and gangway will be installed to accommodate fluctuating lake levels. Additional amenities will include a kiosk and a standard boat ramp entryway. (Figure 12.)

Planned Management Activities

Listed below are near- and long-term planned management activities.

Fiscal Year 2013/2014

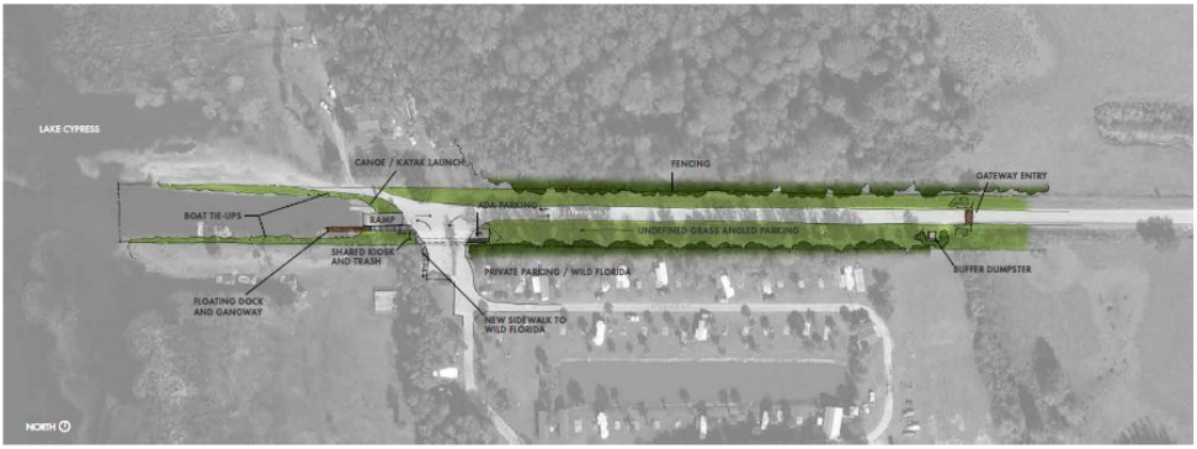
- Installed 1 new navigational waterway marker
- Updated 2 navigational waterway markers with permit and ordinance numbers
- Renovated Cypress Lake Boat Ramp

Long-Term Management Activities

- Dredge shoal where the C-35 canal meets Cypress Lake
- Replace C01 Idle Speed No Wake Navigational Marker*
- Replace C01 Resume Normal Safe Operation Navigational Marker*
- Replace C02 Idle Speed No Wake Navigational Marker*
- Replace C02 Resume Normal Save Operation Navigational Marker*
- Install Navigational Markers designating shoal

*These markers are faded and the signs need to be replaced. This activity will not require permitting.

Figure 12. Cypress Lake Boat Ramp Improvements.



Lake Hatchineha

While this 6,665-acre lake is located in Osceola County, all surrounding land is located in Polk County. Lake levels are managed by the SFWMD at the S-65 structure, which regulates Lake Hatchineha, Cypress Lake, and Lake Kissimmee at levels between 49 and 52.5 feet NGVD29.

Water Quality

Lake Hatchineha is considered eutrophic and has been identified by FDEP as impaired for nutrients. A TMDL has not yet been adopted. Because a majority of the direct basin runoff draining into Lake Hatchineha lies within Polk County, water quality sampling is performed by Polk County, the FWC, Lakewatch, and the SFWMD.

Best Management Practices

The Lake Hatchineha sub-basin spans Osceola and Polk counties. The sub-basin area within Osceola County comprises 4,005 acres of agriculture, 8,648 acres of natural land use, 1,806 acres of urban land use, and the lake (CDM Smith, 2014). The urban land use that directly contributes to the lake is the Poinciana development. However, the larger watershed encompasses the Upper Kissimmee Chain of Lakes.

The 2014 MSWMPU identified areas where the County could improve water quality in Lake Hatchineha by expanding existing dry ponds and converting to wet-detention ponds (CDM Smith, 2014).

Aquatic Plant Management

Large-scale aquatic plant management for Lake Hatchineha is performed by the FWC. The 2013/2014 aquatic plant management plan for hydrilla was to treat 400 acres using Aquathol K, Clipper and Diquat herbicides. The area to be treated is shown in Figure 13.

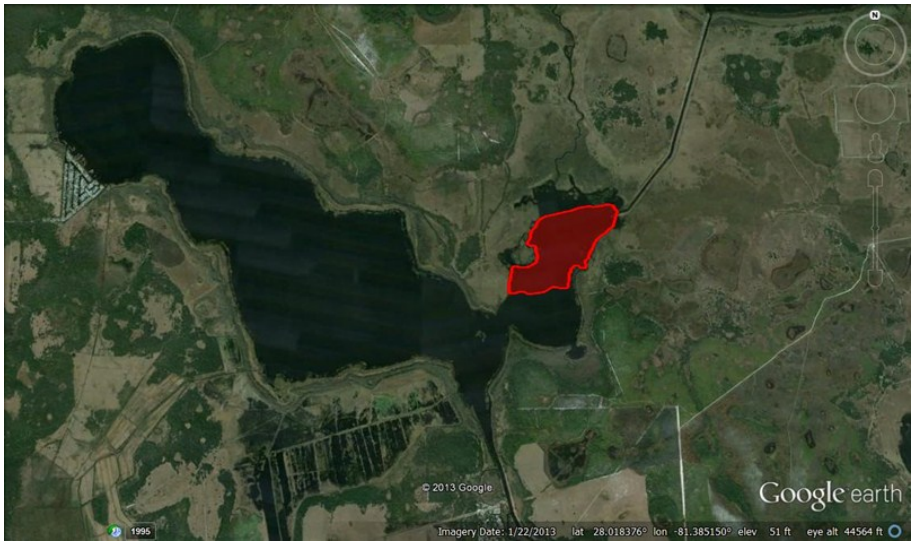
Recreational Amenities

Osceola County has no boat ramps located on Lake Hatchineha. Residents and visitors can access the lake through the C-36 canal from Cypress Lake or the C-37 canal from Lake Kissimmee. Additionally, there are private boat ramps located within Polk County.

Management Activities

There are no lake management activities planned by Osceola County on Lake Hatchineha.

Figure 13. 2013/2014 Hydrilla Treatment Plan for Lake Hatchineha.



Lake Kissimmee

At nearly 35,000 acres, Lake Kissimmee is the largest in the Kissimmee Chain of Lakes. It is regulated at the S-65 structure between 49 and 52.5 feet NGVD29. As with Cypress Lake and Lake Hatchineha, it does not have the same development pressures as other lakes in the County because it is located outside the urban growth boundaries of both Osceola and Polk counties. Additionally, much of the surrounding shoreline is in public ownership, primarily by the SFWMD.

Similar to Lake Toho and East Lake Toho, Lake Kissimmee provides nesting and foraging habitat for the Everglade snail kite and serves as a refuge for the snail kite during drought conditions in Lake Okeechobee (KCOL LTMP, 2011). Management activities such as construction of boat ramps and navigation signs, fluctuations in lake levels, and the timing of vegetation management are adjusted so as not to impact snail kite habitat.

Water Quality

In 2006, Lake Kissimmee was placed on the Federal 303(d) list of impaired waters, and a TMDL was adopted in 2013. As noted in Section 3, the methodology used to assess water quality from 1990 until 2013 was the TSI. In the next assessment cycle (2014-2015), water quality will be assessed using Numeric NNC. The methods produce different reduction targets. Since the TMDL was adopted in 2013, and therefore codified in Florida Statutes, the County will be held to a greater reduction target in phosphorus and nitrogen for Lake Kissimmee than would be the case if NNC had been used. Lake Kissimmee exceeds the chlorophyll-a level

Table 11. Difference between NNC and TMDL Reductions Required for Total Phosphorus and Total Nitrogen for Lake Kissimmee.

Nutrient	NNC Reduction Required	TMDL Reduction Required	Difference in % between TMDL and NNC
Total Phosphorus	9%	17%	+8
Total Nitrogen	9%	15%	+6

Source: Atkins, 2013 and FDEP, 2013.

using both TSI and NNC, and chlorophyll-a must be reduced by 9.09%. Table 11 indicates that the phosphorus and nitrogen reductions required by TMDL limits (using TSI) is greater than it would be using NNC.

The County will participate in the BMAP process when it moves forward to achieve the water quality goals set by the TMDL.

Best Management Practices

There are no recommended structural alternatives suggested in the 2014 MSWMPU for the basins surrounding Lake Kissimmee. When the BMAP process begins, Osceola will work with FDEP to achieve nutrient reduction targets.

Aquatic Plant Management

Large-scale aquatic plant management for Lake Kissimmee is performed by the Florida Fish and Wildlife Conservation Commission. In FY 2013/2014, 575 acres of hydrilla were treated using Aquathol K, Clipper and Diquat herbicides. The treatment area is shown in Figure 14.

Recreational Amenities

The public is able to access Lake Kissimmee from the boat ramp at Overstreet Landing, located at 4800 Joe Overstreet Road, Kenansville. This facility consists of a three-lane boat ramp with two floating docks. Park area amenities include restrooms, pavilions,

Figure 14. 2013/2014 Hydrilla Treatment Plan for Lake Kissimmee.

and grills. The master plans for park and boat ramp improvements are complete, and an observation pier will be constructed in the near future. Additional improvements to parking will begin in 2016. Future options to expand access to Lake Kissimmee will be evaluated. Boaters are able to access Lake Kissimmee in Polk County from the Coleman Landing boat ramp.

Planned Management Activities

Listed below are near- and long-term planned management activities.

Fiscal Year 2013/2014

- Installed 1 new navigational marker
- Retrofitted 3 existing navigational markers
- The planned observation pier construction has been delayed due to budget constraints

Long-Term Management Activities

- Implement the boat ramp master plan for Overstreet Landing boat ramp

Lake Kissimmee

Cypress trees on Lake Gentry

The Alligator Chain of Lakes includes 11 lakes, six of which are part of the C&SF Project system (Alligator, Brick, Center, Gentry, Lizzie, and Trout). The remaining five are connected to the C&SF system by private canals. There are two water control structures, S-60 and S-58. S-60 is the primary structure, located on the C-33 canal between Alligator Lake and Lake Gentry. Historically, there was no connection between Alligator Lake and Lake Gentry. The C-33 canal was constructed as part of the C&SF system, as was the C-34 canal between Lake Gentry and Cypress Lake. The lakes and their surface areas are listed in Table 12.

Table 12. Alligator Chain of Lakes

Lake	Acres
Alligator	3,406
Bay	110
Brick	616
Buck	378
Center	410
Gentry	1,791
Live Oak	375
Lizzie	792
Pearl	103
Sardine	98
Trout	273
Total Acres	8,352

Recreational uses include fishing, hunting, boating, canoeing, kayaking and wildlife viewing.

Water Quality

The Alligator Chain of Lakes and Lake Gentry are considered mesotrophic (KCOL LTMP,

2011). There are no TMDLs adopted for lakes in the Alligator Chain.

Best Management Practices

Designating preservation areas is an example of a non-structural BMP. Lake Lizzie Preserve (984 acres), located on the southern end of Lake Lizzie, is designated an Important Bird Area (IBA) by the Audubon Society. Preserving areas in their natural state preserves habitat and protects the lake.

The 2014 MSWMPU recommends that two baffle boxes be installed on the north side of Bass Highway to provide treatment for runoff from the residential development located on the north shore of Lake Lizzie (CDM Smith, 2014 pp 6-18).

Aquatic Plant Management

Aquatic plant management performed by the FWC is limited to the six lakes connected by the C&SF system that have public access. Hydrilla and other nuisance aquatic plants are not generally a significant management problem; the FWC treated 15 acres of hydrilla in Alligator Lake and 92 acres of other various aquatic plants throughout the chain between July 2011 and June 2012.

Residents on Live Oak Lake have reported that hydrilla has become so pervasive, that recreational boating is not possible (meeting with Daniel Blackford, 10/14/2013). Lakefront homeowners are permitted to manage aquatic plants along 50% of their lakefront or 50 linear feet, whichever is less. This is generally done to open up an area around a boat dock and to create a trail to open water.

Recommendations for aquatic plant management in Section 5 of this document may offer opportunities for the County and homeowners to work cooperatively with the FWC for a joint permit to treat an area within the lake.

Recreational Amenities

The public can access the Alligator Chain of Lakes from two locations: the Trout Lake boat ramp, located on 6719 Bass Highway in St. Cloud and the C-Gate Boat Ramp on the C-33 canal south of Alligator Lake, which is located on Hickory Tree Road in St. Cloud.

Improvements to the boat ramp at Trout Lake will begin in 2015 with design and permitting. Construction, which will take place in 2016, includes a floating dock, defined parking, a pavilion, picnic tables, and restrooms (Figure 15). For C-Gate, improvements to the boat ramp will begin in 2018. These include drainage improvements, a pavilion, and improved parking (Figure 16).

Air boating on Lake Kissimmee

Access to Lake Gentry is via the Smith's Landing boat ramp. The master plan for this location is complete, and work will begin in 2017. The ramp at this location will be replaced, and other improvements include a floating dock, pavilion, kiosk and ADA parking space. Additionally, wetland shrubs that have encroached into the channel will be removed to improve access (Figure 17).

At over 1,000 acres, the Lake Lizzie Conservation Area borders sections of lakes Lizzie, Trout, and Bay, offering multiple lake views and hiking trails through interconnecting wetlands and upland pine forests. Picnicking, horseback riding trails, organized youth camping, and wildlife observation are among the recreational activities available.

Planned Management Activities

Listed below are near- and long-term planned management activities.

Fiscal Year 2013/2014

- Installed 4 new navigational markers on Trout Lake
- Retrofitted 12 existing navigational markers
- Removed 10 navigational markers.
- Obtained permit for 2 existing navigational markers on the canal between Trout Lake and Coon Lake

Long-Term Management Activities

- Implement boat ramp master plan for Trout Lake Boat Ramp
- Implement boat ramp master plan for C-Gate Boat Ramp
- Implement boat ramp master plan for Smith Boat Ramp (Lake Gentry)

Figure 15. Trout Lake Boat Ramp Improvements.

Figure 16. C-Gate Boat Ramp Improvements.

Figure 17. Smith's Landing Boat Ramp Improvements on Lake Gentry.

Lake Marian and Lake Jackson

Lake Marian

Lake Marian is a 5,739 acre lake located outside the County's Urban Growth Boundary in Kenansville. There is little development on this lake, and the Three Lakes Wildlife Management Area surrounds much of the northwestern shoreline. It is connected by the G-111 and G-113 canals to Lake Jackson, which is connected to Lake Kissimmee by the Jackson canal. These structures are operated by FWC.

Lake Jackson is 1,020 acres and is nearly surrounded by the Three Lakes Wildlife Management Area and private agricultural lands on its northwest shoreline.

Lake levels for Lake Jackson range from 53.3 to 56 feet NGVD29, and lake levels for Lake Marian range from 58.5 to 62 feet NGVD29. The 2014 rainy season did not result in a significant amount of rainfall for the southern portion of Osceola County, so this area of the County went into the dry season with lower than normal lake levels.

Water Quality

In 2006, Lake Marian and Lake Jackson were placed on the Federal 303(d) list of impaired water bodies, and in 2013 a TMDL was adopted. As noted in Section 3, the methodology used to assess water quality impairment from 1990 until 2013 was the Trophic State Index (TSI). In the next assessment cycle (2014-2015), impairments will be assessed using Numeric Nutrient Criteria (NNC). The methods produce different reduction targets. Since the TMDL was adopted in 2013, and therefore codified in Florida Statute, the County will be held to a greater reduction target in Total Phosphorus (TP) and Total Nitrogen (TN) for Lake Marian

Table 13. Difference between NNC and TMDL reductions required for Total Phosphorus and Total Nitrogen for Lake Marian.

Nutrient	NNC Reduction Required	TMDL Reduction Required	Difference in % between TMDL and NNC
Total Phosphorus	Insufficient data	53	+53
Total Nitrogen	Insufficient data	55	+55

Source: Atkins, 2013 and FDEP, 2013.

Table 14. Difference between NNC and TMDL reductions required for Total Phosphorus and Total Nitrogen for Lake Jackson.

Nutrient	NNC Reduction Required	TMDL Reduction Required	Difference in % between TMDL and NNC
Total Phosphorus	73%	25%	+48%
Total Nitrogen	45%	55%	-25%

Source: Atkins, 2013 and FDEP, 2013.

than would be the case if NNC had been used. Conversely, the targets for both Total Phosphorus and Total Nitrogen are less in Lake Jackson using the TSI method for assessing TMDLs. (Tables 13 and 14.)

The County will participate in the BMAP process when it moves forward to help achieve the water quality goals of the TMDL for Lakes Marian and Jackson.

Best Management Practices

There are no recommended structural alternatives suggested in the 2014 Master Surface Water Management Plan Update. When the BMAP process begins, the County will work with FDEP to achieve reduction targets for chlorophyll-a, phosphorus, and nitrogen.

Aquatic Plant Management

In November 2013, the FWC harvested 21 acres of knotweed to enhance habitat for fish and wildlife and improve recreational access to parts of Lake Jackson. To mechanically harvest the knotweed, water from Lake Marian was allowed to flow into Lake Jackson. Lake levels in Lake Marian dropped 3 inches, prompting a reaction from boat owners who keep their boats in the canals at Lake Marian Paradise. A meeting with the Kenansville Association resulted in a planned workshop to improve communication between lake management agencies and the community.

Recreational Amenities

The public is able to access Lake Marian at the County-owned Lake Marian Boat Ramp (no fee) located on Lakeside Boulevard, Kenansville, as well as the Lake Marian Paradise boat ramp (fee). They can access Lake Jackson at the Three Lakes Wildlife Management Area boat ramp (fee). Amenities at the Lake Marian Boat Ramp include a fishing pier, picnic tables, and restrooms. The master plan for the Lake Marian Boat Ramp is complete, and improvements include the addition of a floating boat dock, a pavilion, picnic tables, native plantings, standard County gateway entry, and an airboat launching area. (Figure 18.)

Planned Management Activities

Listed below are near- and long-term planned management activities.

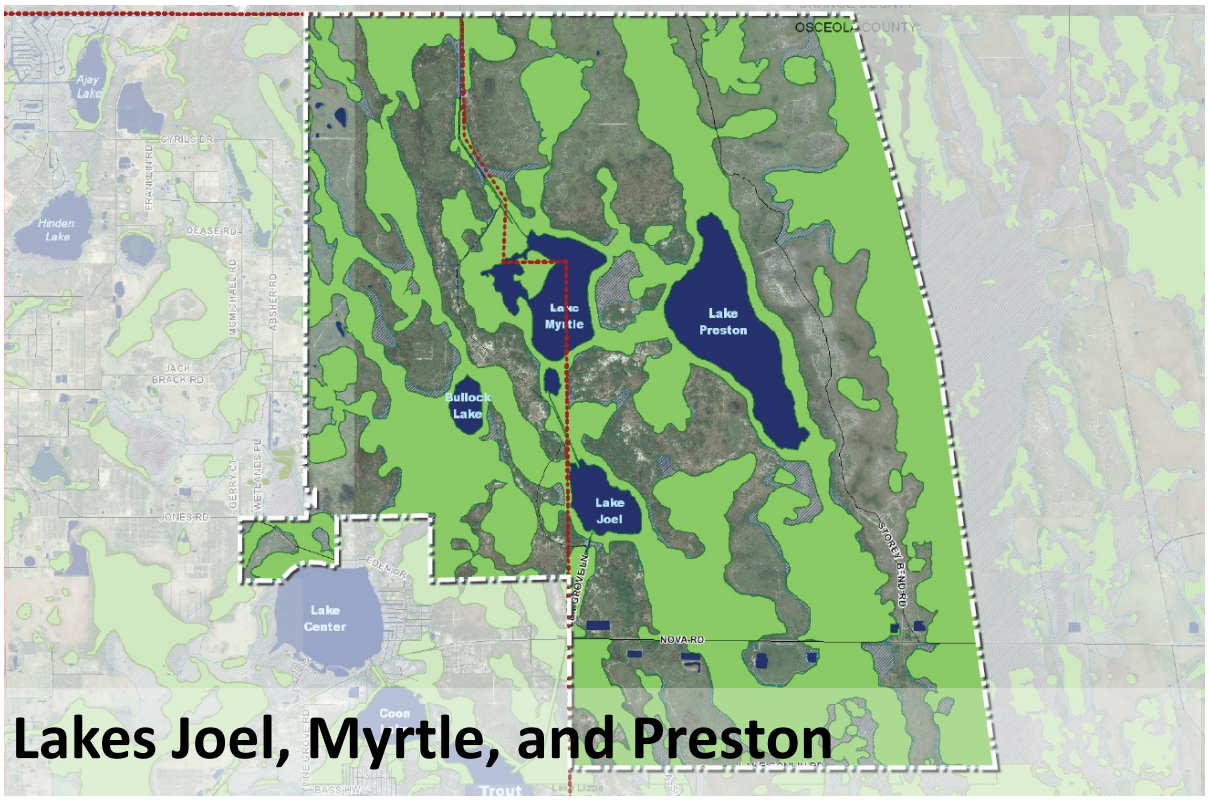
Fiscal Year 2013/2014

- Installed one new navigational marker on Lake Marian
- Retrofitted 14 existing navigational markers on Lake Marian

Long-Term Management Activities

- Lake Marian Boat Ramp Master Plan will be implemented in 2015
- Boat basin will be dredged in 2016

Figure 18. Lake Marian Boat Ramp Improvements.



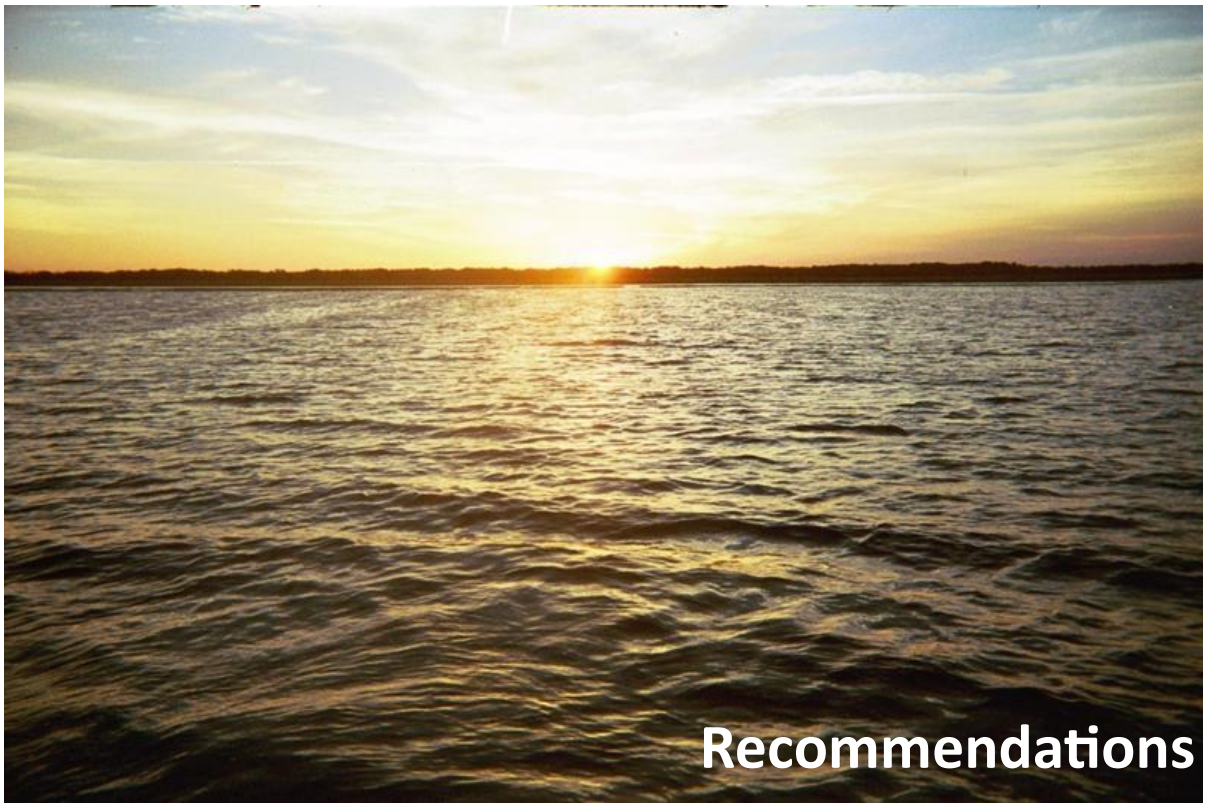
Lakes Joel, Myrtle, and Preston

Lakes Joel, Myrtle, and Preston are located within the County's Urban Growth Boundary (UGB), but at present they are surrounded by undeveloped private property belonging to Deseret Ranches. Topographically, these lakes are at the top of the C&SF system and are managed at the S-57 structure on C-30 canal between 60 and 62 feet NGVD29. They discharge north to Lake Mary Jane in Orange County through the S-57 structure. Lake Joel is 217 acres, Lake Myrtle is 543 acres and Lake Preston is 690 acres.

The lakes are located within the Northeast District, an area for which a Conceptual Master Plan (CMP) was adopted in 2010. The hydrology of this area was summarized in the CMP: "The southern portion of the Econ Swamp and the forested wetlands connected to Lakes Preston, Joel, Myrtle, and Bullock are significant resources within the planning area. The four lakes on-site lie at the northernmost end of the Kissimmee Chain of Lakes, ultimately discharging into the Kissimmee River, Lake Okeechobee and the Florida Everglades, and provide wildlife habitat for federally listed wildlife species… All of the lakes except Bullock are connected to one another and others outside the planning area as part of the water management system used for flood control in the South Florida Water Management District (SFWMD)."

Northeast District policies require habitat management plans for preserved wetland habitat ; land development codes that protect natural resources; wetland protection, including buffers; and prohibition of non-water dependent structures waterward of the safe development line.

These lakes are mesotrophic and are not considered impaired. Because the land surrounding the lakes is owned by Deseret Ranches, the County has not implemented any Best Management Practices. No aquatic plant management activity has taken place. There is no public access or planned management activities at this time.



Recommendations

Sunrise on Lake Kissimmee

Summary

The purpose of this section of the management plan is to articulate the actions that Osceola County could take to address water quality (thereby protecting the watershed), aquatic plants, access to fishing and other recreation, and public involvement in lake management activities. The Plan recommends strategies for improving water quality; ensuring safe and adequate lake access; education, outreach, and public involvement strategies; regulations, including adoption and enforcement of County regulations as well as compliance with NPDES regulations; and funding strategies.

Water quality and lake access

Water quality. Lakes Kissimmee, Cypress, Marian and Jackson are impaired for nutrients, the most problematic impairment in terms of cost and scrutiny by the State. Osceola County Public Works has identified approximately $15 million worth of water quality projects that need to be completed in order to comply with the FDEP impaired water rules and the Lake Okeechobee BMAP (CDMSmith, 2014). Over the next ten years, there likely will be more projects added to that list. A dedicated funding source, such as a stormwater utility, could address those needs by providing a funding source for:

- Structural BMPs to improve water quality and drainage (safety)
- Reduction of nutrients that fertilize shoreline and floating vegetation (thus impacting aquatic plant management)
- Implementation of maintenance programs (routine maintenance)
- Illicit discharge enforcement (compliance)
- Construction site pollution prevention programs (compliance)
- Public education programs

Aquatic plant management. Large-scale aquatic plant treatment is performed by FWC. There are aquatic plant management needs in certain areas of the County not covered by the FWC work plan. These include approximately six miles of canals; areas in Shingle Creek and Boggy Creek where navigation is impeded; 12 County boat ramp basins; and a plan for canoe/kayak trails from Cherokee Point to Twin Oaks Conservation Area. Annual funding of $50,000 would provide for aquatic plant management for areas not supported by FWC funding.

Pondweed treatment performed in East Lake during October 2013 will be monitored, and if additional treatment is required, Osceola County will contract with a herbicide applicator company or work with FWC because the County does not have the equipment nor personnel necessary to perform this treatment.

Dredging and debris removal. To improve navigation and drainage, staff has identified a need for dredging and debris removal. Boat basins associated with County boat ramps are scheduled to be dredged as the Boat Ramp Master Plan is implemented. But some areas are problematic during the dry season, and consequently would benefit from dredging. One such area is in Cypress Lake where the C-35 canal outfalls into the lake; another is where Shingle Creek outfalls into Lake Tohopekaliga. Additionally, the County recognizes that routine debris removal is required in response to storm damage and to maintain navigation. Recommended funding for dredging and debris removal is $125,000 annually.

The County's Lakes Advocate will work with FWC and SFWMD; Lakewatch volunteers; boating, fishing, and fowlers associations; residents; and County staff to identify navigation hazards as they occur in the lakes. Depending on the nature of the hazard (i.e. navigational lights, shoaling, debris) the appropriate budget funds, or appropriate agencies, will be identified and the hazard will be mitigated.

Fisheries management. The County does not have a direct role in managing fisheries in the lakes. The County does however, have Fish Management Area (FMA) agreements with FWC for Lake Tohopekaliga, East Lake Tohopekaliga, Cypress Lake, Lake Hatchineha, Lake Kissimmee, Lake Jackson, and Lake Marian. Through these agreements, FWC is responsible for:

- Conducting routine fish population sampling and evaluations
- Conducting routine surveys of anglers and lake users
- Installing fish attracting devices
- Establishing fishing regulations (size, limits)
- Conducting regular law enforcement patrols
- Installing signage to inform the public of FMA programs and regulations
- Developing and implementing fisheries habitat enhancement projects
- Working with appropriate agencies to maintain or improve water quality

Osceola County is responsible for:

- Public parking at all County-maintained boat ramps located on designated FMA lakes
- Maintenance of County boat ramps on designated FMA lakes
- Enforcing County ordinances relative to public access and use on designated FMA lakes

Recreational amenities. The County provides boating access for anglers (and other recreational users) from 12 County-maintained boat ramps. In 2013, the Board of County Commissioners approved a plan to improve safety and access at County-managed boat ramps. The 12 County-maintained boat ramps are between 30 and 50 years old and require improvements for safety, ADA access, and

mechanisms to accommodate fluctuating lake levels. Boat ramp improvements will take place as prescribed in the Boat Ramp Master Plan over the next 15 years or longer, depending on identified revenues.

Education, outreach, and public involvement

To keep the public informed about lakes management, particularly about actions they can take to minimize pollution entering the lakes as well as the proliferation of invasive plant species, the County has educational programs, information on the website, and regularly scheduled events. Additionally, the County's lakes cover a vast area, more than staff can monitor. Residents and visitors provide valuable eyes on the lake, and the County has developed a mobile app for the public to report any issues they encounter. Continuing these outreach and educational activities, and providing information and education about our illicit discharge ordinance and recently passed fertilizer ordinance, is an effective way to minimize problems and identify issues as they occur.

Lakes management involves a wide variety of stakeholders with specific, at times conflicting, needs. Everyone should have a voice in balancing the goals for Osceola County's lakes. All the interests previously described deserve to be heard and their opinions considered.

Options for involving the public as the County implements this Plan include:

- Holding quarterly open house forums. County staff could coordinate quarterly forums, inviting the public and agency representatives to hear about the progress and to provide input. Invite the public, all stakeholder groups, and state and federal agency representatives, to discuss implementation of the Lakes Plan, update the public and one another on their activities, and receive public input. This option would be open to all interested parties, rather than having a defined membership, and thus would offer the broadest opportunity for participation and collaboration.
- Establishing a stakeholder working group that meets regularly to coordinate with staff on lake management issues. This group could be modeled after the existing framework of groups, such as FWC Hydrilla Management Group, which is well attended by the stakeholders. An informal group of stakeholders could be flexible at hearing concerns from residents, prioritizing them, working with staff on grant opportunities and still presenting its findings and recommendations to the BOCC, as needed.
- Appointing a Lakes Advisory Board that would oversee implementation. The County had previously established a Lakes Management Advisory Committee (LMAC) comprising nine members, including representation from the cities of Kissimmee and St. Cloud, environmental groups, user groups, lakes associations, and state agencies. This Committee lasted from 2007 to 2010. The Committee's primary activity was to act as a forum for interested people and groups to provide input.

Regulations and enforcement

The County has adopted ordinances to protect lakes, including an Illicit Discharge Ordinance, adopted in 2008, which is designed to protect waterways by prohibiting anything but rainwater to be introduced into the stormwater system. Earlier this year, the County adopted a Fertilizer Management Ordinance, which regulates application of fertilizer. Implementing these ordinances requires both education and enforcement.

Compliance activities for the County's NPDES permit include public education, outreach, and involvement; detecting and eliminating illicit discharge; controlling construction site runoff

and post construction runoff; and preventing pollution. Enforcing the County ordinances, and ensuring compliance with the NPDES permit are labor-intensive activities that will become more labor intensive as regulations increase and as development occurs.

Community Development staff are responsible for boat ramp improvements and inspections; navigation sign maintenance; and overseeing lake management activities, including dredging, aquatic plant management, debris removal. They also are responsible for administering the County's NPDES permit, which covers a wide range of activities including illicit discharge and fertilizer ordinance inspections and compliance activities, outreach, and education. With passage of the fertilizer management ordinance in January 2015, new requirements of the next NPDES permit due in 2017, and an increase in building permits in the County, there will be increased demands on Community Development staff, and additional staff may be required. The State has suggested to NPDES Phase II permit holders that their next permit will require relating outreach, inspections, and other activities to the water quality of impaired waterbodies in the community. Osceola County has four new nutrient impaired waterbodies added since the current NPDES permit was approved.

Funding

Existing funding. Existing funding for lakes management comes from the County's General Fund, which provides for two staff plus operational support (repairs, supplies, etc.). The Boating Improvement Fund (revenue from vessel registration fees), and other fees (airboat concessionaire fees, caretaker fees, cell tower lease fees) fund boat ramp improvements. Estimated funding from these sources for FY 2014-2015 is $58,400. The Boat Ramp Master Plan identified over $4 million in needed boat ramp improvements, so identifying additional funding sources will be necessary to complete those improvements in a timely manner. For other activities, such as dredging and aquatic plant management, no County funding is allocated at the present time.

OSCEOLA COUNTY'S NPDES PROGRAM

The National Pollutant Discharge Elimination System (NPDES) stormwater permitting program was developed by the U.S. Environmental Protection Agency (EPA). The program was developed in two phases. Phase I addresses large and medium municipal storm sewer systems, as well as industrial and large-scale construction activity. Phase II addresses municipal storm sewer systems not regulated under Phase I and small-scale construction activity.

Osceola has a Municipal Separate Storm Sewer System (MS4) NPDES permit to discharge stormwater to waters of the state (lakes and streams). This permit is issued by the Florida Department of Environmental Protection. The County's first MS4 permit was issued in 2003. Each permit is in effect for 5 years. An audit was conducted in 2012, and the County was determined to be in compliance. The current permit began in 2013.

The permit consists of six minimum control measures the County must implement for best management practices:

- **Public education and outreach,**
- **Public participation and involvement,**
- **Illicit discharge detection and elimination,**
- **Construction site run off control,**
- **Post construction run off control, and**
- **Pollution prevention.**

This Plan promotes a more long-term, proactive approach to lakes management, and existing funding falls short of what is needed. Additional funding for dredging ($50,000) and aquatic plant management ($125,000) has been requested starting with the FY 2015-2016 budget to address some of the issues identified in this Plan.

In addition to this budget request for dredging and aquatic plant management, the County should look for additional funding sources, such as cell tower lease fees (a source identified in the Boat Ramp Master Plan). Grants (including grants that may be offered because of the recently-passed Water and Land Conservation Amendment) are another potential funding source, and having dedicated local funding would help the County in securing grants. Even the Tourist Development Tax might be a potential funding source for certain tourism-related projects. Finally, homeowners who live on private lakes have expressed an interest in assessments to provide funding for lake management – the County could use MSBUs as a mechanism for collecting such assessments as requested. Finding adequate funding through these and other sources is key to implementing the recommendations of this and other plans to preserve and protect the County's water resources.

Stormwater utility. To address water quality, Public Works is in the process of evaluating the County's stormwater program to identify projects that would be necessary to stay in compliance with NNC, TMDL, and NPDES requirements. Potential funding sources also will be evaluated. The County adopted a Stormwater Assessment Ordinance in 2009, but an assessment has not yet been set. A stormwater assessment could fund activities related stormwater operations and improvements, lake restoration projects, permit compliance, and enforcement of pollution prevention programs. For example, projects identified in the 2014 Master Surface Water Management Plan Update, projects to meet pollution reduction targets for TMDLs, education, and enforcement of illicit discharges and construction site pollution programs potentially could be funded from a stormwater assessment.

More than 800 communities nationwide, including three counties and nine cities in Central Florida, have created stormwater utilities to build and maintain the infrastructure needed to accommodate the stormwater that otherwise pollutes water bodies. Revenue generated by a stormwater utility can be used for compensation, professional services (engineering), other contractual services (laboratory fees), repair and maintenance (aquatic weeds, pond maintenance), operating supplies (fuel, chemicals, signs) and capital outlay (land, construction, machinery and heavy equipment). Additionally, having a stormwater utility enhances eligibility for federal and state grants for water quality projects because grant applicants are awarded points over applicants that do not have a stormwater utility.

While it is not an all-inclusive list of stormwater needs, the 2014 Master Surface Water Management Plan Update recommends some projects to improve drainage and provide water quality treatment for runoff that is discharged to area lakes, including those Osceola County lakes that are characterized as impaired.

Both Kissimmee and St. Cloud have stormwater utilities. The neighboring counties of lake and Polk have established a stormwater utility, as have 17 cities within Polk County. The cities of Orlando, Maitland, Winter Park, and Apopka in Orange County, as well as Casselberry, Oviedo, and Altamonte Springs in Seminole, also have established stormwater utilities. In an area such as Central Florida, with so many lakes and opportunities for eco-tourism based activities, a stormwater utility is a practical option for improving and

maintaining the infrastructure needed to protect the environment and maintain a level of service expected in a vibrant and growing community. Additional information on stormwater utility benefits and feasibility can be found in the 2009 Osceola County Stormwater Utility Assessment Report.

Community Development will coordinate closely with Public Works as they evaluate the stormwater program and the potential for funding. Stormwater and lakes management activities should be closely coordinated, and stormwater management is critical to maintaining water quality. While a separate funding source (such as an MSTU or MSBU) could be established for lakes management, one funding source for these activities could streamline services and establish benefits more clearly.

If the Stormwater Utility is not funded, a separate mechanism for lakes management, either an MSTU or an MSBU, is recommended.

MSTU. A Municipal Services Taxing Unit (MSTU) is a mechanism by which the County could fund specific services from a levy of ad valorem taxes within all or a portion of the unincorporated area. Taxes levied under an MSTU are dedicated to the specific services for which the MSTU was adopted. The millage rate is determined by dividing the cost of the annual work program by the taxable value of all properties within the unit. An MSTU is counted toward the constitutional millage limits of 10 mills for local governments.

MSBU. A Municipal Services Benefit Unit (MSBU) is a mechanism similar to an MSTU, but where the revenue in an MSTU comes from ad valorem (value) taxes, MSBU revenue comes from non-ad valorem (non-value) assessments. The County could adopt MSBUs to pay for specific projects, dividing the costs among the properties benefitting from the projects.

Many local governments also have programs whereby residents can request MSBUs for their communities. The local government collects the assessment and administers the MSBU. This could be used to the benefit of homeowners on private lakes, allowing them a mechanism to collect assessments for lakes management activities (because private lakes are not maintained by the state or the County).

Establishing an MSBU takes approximately one year. Procedural elements must be completed by December 31 so that noticing and budgeting is completed by October 1 of the following year for projects to proceed.

Grants. There are a number of grant programs that could provide additional funding for lakes management, including three summarized below.

Florida Boating Improvement Fund Grant.

This is a competitive grant program administered by FWC with a pool of money allocated out of the fuel sales tax and $1 from each recreational vessel registration fee. it is about $1.25 million annually. This funding source is divided into several categories of interest to Osceola County, including recreational channel marking, derelict vessel removal, public launching facilities and docks. It appears Osceola County has never received one of these grants. In FY2014/15 Polk County received $59,265 to help construct the Lake Hancock Boat Ramp. Osceola County should be able to position itself to apply for and receive this grant to assist in implementing the Boat Ramp Master Plan. The rules of the grant allow for applicants to use the county-retained portion of vessel registration fees as part of the required match.

FDEP 319 Clean Water and TMDL Grants.

These are competitive Federal U.S. EPA grants, administered by FDEP as pass-through grants, for use in communities with impaired water bodies, of which Osceola County has several. These grant opportunities are primarily for Stormwater quality improvement projects. Osceola County has applied for and received

such grants in the past. The Stormwater and Lakes Management Sections would work closely to prepare appropriate and successful grant applications to help fund water quality projects. These grants require a match and extra points are provided when there is a dedicated funding source in the jurisdiction applying for the grant.

Florida Communities Trust (FCT) Grant.

This is a competitive grant program administered by FDEP and funded through Florida Forever (Amendment 1). It is intended to protect, among other things, "traditional working waterfronts" through the acquisition and protection of those properties. Osceola County has received FCT grants to help acquire portions of the Shingle Creek Regional Park. FCT funds could be used to acquire land for additional boat ramp locations, amenities and water quality BMPs.

Conclusion

The County's lakes are some of its greatest natural assets. The health of these lakes is of vital importance to all County residents. What we do today has a significant impact on what the lakes will be tomorrow, and what we will pass on to future generations. Working together with the community, the County can implement the strategies in this Plan to improve water quality, protect wildlife habitat, and maximize opportunities to enjoy the lakes.

Canoeing on Shingle Creek

Appendix A—References

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Appendix B—Acronyms and Abbreviations

BMP	Best Management Practice
C&SF Project	Central and Southern Florida Flood Control Project
CRS	Community Rating System
FDEP	Florida Department of Environmental Protection
FMA	Fish Management Area
FWC	Florida Fish and Wildlife Commission
IFAS	Institute of Food and Agricultural Sciences
KCOL LTMP	Kissimmee Chain of Lakes Long Term Management Plan
LMP	Lakes Management Plan
mg/L	milligrams per liter or parts per million
µg/L	micrograms per liter or parts per billion
MS4	Municipal Separate Storm Sewer System
MSL	Mean Feet Above Sea Level
MSWMP	Master Surface Water Management Plan
NGVD29	National Geodetic Vertical Datum of 1929
NPDES	National Pollution Discharge Elimination System
NNC	Numeric Nutrient Criteria
PCU	Platinum Cobalt Unit
SFWMD	South Florida Water Management District
SJRWMD	St. Johns River Water Management District
TMDL	Total Maximum Daily Loads
TN	Total Nitrogen
TP	Total Phosphorus
USACE	U.S. Army Corps of Engineers
UF	University of Florida
UGB	Urban Growth Boundary
WBID	Water Body ID (Identification)

Appendix C—Definitions

Chlorophyll-a – the pigment present in plants that makes them appear green. Chlorophyll-a concentrations in surface water bodies give an indirect measure of algal mass.

Class I Lake – a surface water classification required by the Clean Water Act that determines the level of protection for potable water supplies.

Class II Lake - a surface water classification required by the Clean Water Act that determines the level of protection for shellfish propagation or harvesting.

Class III Lake – a surface water classification required by the Clean Water Act that determines the level of protection for fish consumption, recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife.

Class IV Lake – a surface water classification required by the Clean Water Act that determines the level of protection for agricultural water supplies.

Class V Lake – a surface water classification required by the Clean Water Act that determines the level of protection for navigation, utility and industrial use. There are no Class V Lakes in Florida.

Eutrophic – describes a lake that has a high degree of nutrients and supports an abundance of aquatic plants.

Eutrophication – the aging process of a lake, by which the water becomes enriched in nutrients.

Fish Management Area – a pond, lake or other body of water established for the management of freshwater fish as a cooperative effort with the local county.

High Pool – refers to a measurement in the lake level regulation schedule mandated by the U.S. Army Corps of Engineers and maintained by the South Florida Water Management District. High pool, also known as winter pool, is the highest level in the range.

Hypereutrophic – describes a lake that has an overabundance of nutrients and can be characterized as having frequent and severe algal blooms.

Low Pool – refers to a measurement in the lake level regulation schedule mandated by the U.S. Army Corps of Engineers and maintained by the South Florida Water Management District. Low pool, also known as summer pool, is the lowest level in the range.

Mesotrophic – describes a lake that has a medium level of nutrients. Water is usually clear and plant abundance is low.

National Geodetic Vertical Datum of 1929 (NGVD29) – The vertical control datum used by the National Geodetic Survey for vertical control. A synonym for Sea Level Datum of 1929.

Nitrogen – a nutrient needed for plant growth.

Nutrients – elements essential for plant growth. In the context of this Lakes Management Plan, nutrients will refer to nitrogen and phosphorus.

Oligotrophic – describes a lake that has a low level of nutrients. Water is very clear and there are few plants.

Phosphorus – a nutrient that allows plants to photosynthesize sunlight and is essential to cellular growth and reproduction.

Platinum Cobalt Color Scale – a color scale using an index of 1,000 color units to measure the color or clarity of water.

Platinum Cobalt Unit (PCU) – the color units in the Platinum Cobalt Color Scale. The EPA classifies Florida lakes that measure more than 40 PCUs as colored lakes. All lakes in Osceola County are classified as colored lakes.

Shoaling – the dynamic process of sediment build up and movement that produces shallow water conditions. These conditions could present a danger to boat traffic, either through excessive boat traffic, wave action, or stormwater flow patterns.

TMDLs – the maximum amount of a pollutant that a water body or water segment can assimilate from all sources without exceeding water quality standards (as defined in Florida Law, Chapter 99-223, Laws of Florida).

Trophic State Index (TSI) – a measure of biological productivity determined by measuring total nitrogen, total phosphorus, water clarity and chlorophyll-a.

Appendix D—Water and Navigation Control Districts

Waterway and Navigation Control Districts have existed in Polk County since 1919 and in Orange County since 1959 as a result of legislative action. In Orange County, the Waterway and Navigation Control Districts are now referred to as Lakes Advisory Boards and are funded through an MSTU or MSBU. The Lake Region Lakes Management District (LRLMD) in Polk County is a special taxing district, created in 1919 after a special election. A thorough review of these Districts can be found in a Memorandum dated December 20, 2013, to Dave Tomek and Mary Beth Salisbury (Tolley, 2013). Conclusions for the purpose of this document are:

- The formation of a Lakes Advisory Board with special assessment authority does not appear to require Legislative action (10 Lake Advisory Boards in Orange County were not legislative actions).
- Legislative action does not provide a funding source. A separate action is required (special election or Board of County Commission action).
- Both the Orange County model and the Polk County LRLMD model use special taxing districts to fund projects. In the case of Orange County, the lake advisory boards provide recommendations for projects funded through their MSBU/MSTU to the Orange County Board of County Commissioners who approve or deny the projects, and if approved, are then administered by the Orange County Environmental Protection Division and follow standard Orange County procurement services policies. It is important to note that the funds collected from the MSTU or MSBU are used exclusively for projects within the MSTU or MSBU.
- The elected officials of the Polk County LRLMD have budgetary authority over the funds they collect through their legislatively-established charter. This District has the authority to levy taxes, change the millage rate, issue bonds, and enter into contractual arrangements for procurement of goods and services.
- A County-created Lakes Advisory Board that is not associated with an MSBU or MSTU is likely to function much like the Polk County Lake Access Lakes Advisory Committee and provide a forum for communication on lake-related projects.
- Obtaining consensus on individual lake projects with no dedicated funding may be difficult for one County-wide Lakes Advisory Board. The administration of multiple lake advisory boards may impact staffing.

Appendix E—Regulated Lake Levels

Lake	Low Pool	High Pool	Acres at High Pool	Max Depth	Mean Depth
Ajay	55	58	1,415*	**	**
Alligator	62	64	3,775	25	8
Brick	62	64	1,292	18	6.1
Center	62	64	556	9	3.4
Coon	62	64	271	**	**
Cypress	49	52.5	5,470	10.5	4.8
East Lake Tohopekaliga	55	58	12,125	18	9.9
Gentry	59.5	61.5	1,947	18.5	7.8
Hatchineha	49	52.5	**	10.5	4.8
Joel	60	62	797	10	4.2
Kissimmee	49	52.5	34,948	18.5	7.4
Lizzie	62	64	897	21	5.5
Myrtle	60	62	715	10	2.5
Preston	60	62	1,238	10	4.3
Tohopekaliga	52	55	22,019	13	6.1
Trout	62	64	609	11	3.5

***Lake Ajay elevation at low pool**
****Data not available**
Source: KCOL LTMP, 2011 and Florida Lakes Gazetteer Part III, 1969