2009

Lakes Management Report

Five Year Update

May 2009

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Section 1.
INTRODUCTION

1.1 Purpose

The City of Winter Park has 23 lakes and ponds under active management, 21 natural water bodies and two large retention ponds at Lake Island Park that also provide recreational functions. These water bodies range in size from less than an acre to over 450 acres, and from isolated sinkhole ponds to the Winter Park chain of Lakes, an interconnected system made up of six lakes in Winter Park and Maitland that are joined by navigable canals. Depending on their size, and location, recreational opportunities on the lakes can be as intensive as water skiing and wakeboarding, or as relaxing as bird watching. The City's lakes are essential to the ecological integrity of the area, and have a significant impact on the value of nearby properties and the quality of life in the surrounding community.

At 224 acres Lake Virginia is the largest lake entirely within Winter Park.

The purpose of this report is to provide an overview of condition of the City's aquatic resources, to update water quality information that has been presented in previous reports, and to provide information on management efforts that have been undertaken to date. The report also provides information related to public access, and a guide for all residents to help protect the health and natural beauty of the City's lakes.

1.2 Geographic Setting

Most of the City of Winter Park lies within what is known as the Howell Branch Drainage Basin. Howell Branch Creek (also known as Howell Creek) is a tributary of the St. Johns River. All of the land area that contributes runoff to Howell Branch is referred to as its drainage basin. A map of the City showing major water features and drainage basin boundaries is contained in Figure 1-1. There are approximately 17 square miles of land that drain to Howell Branch before it leaves Winter Park. Winter Park alone has over 2,300 stormwater inlets and 46 miles of stormwater pipes.

The headwaters of the Howell Branch system are near the Amway Arena in downtown Orlando. The creek flows through numerous Orlando lakes, connected by open channels or culverts, as it makes its way to Lake Sue, which lies partially within Winter Park. Lake Sue flows into a natural section of the creek that meanders through Mead Garden on its way to Lake Virginia. Lake Virginia and the rest of the Winter Park Chain of Lakes are essentially wide spots in Howell Branch Creek. After leaving

Venetian Canal connects Lakes Osceola and Maitland

FIGURE 1-1

Basin and City Limit Lines
- Drainage Basin Lines
- City Limit Line

Jurisdictions
- Eatonville
- Maitland
- Orlando
- Winter Park
- Orange County
- Seminole County

F

WEKIVA BASIN

HOWELL BRANCH BASIN

ECONLOCKHATCHEE BASIN

LAKE LOVE
LAKE CHARITY
LAKE MINNEHAHA
LAKE WAUMPI
LAKE LUCIEN
LAKE SYBELIA
LAKE VENUS
LAKE JACKSON
LAKE NINA
LAKE HARVEST
HOWELL BRANCH CREEK
LAKE SHADOW
CULVERT
LAKE HUNGERFORD
LAKE CATHERINE
LAKE LILY
LAKE EULALIA
ISLAND
LAKE MAITLAND
LAKE KING
PARK LAKE
LAKE GEM
LAKE WILBAR
LAKE KNOWLES
LAKE WILDERNESS
LAKE BELL
STREAM
POND
LAKE SUMERSET
LAKE FRANCIS
LAKE OSCEOLA
LAKE SUANNE
LAKE KILARNEY
LAKE SYLVAN
LAKE MENDSEN
EMERALD SPRINGDS BASIN
LAKE ROSE
LAKE MIZELL
LAKE FAIRVIEW
LAKE MIDGET
LITTLE LAKE FAIRVIEW
DRAINAGE DITCH
LAKE VIRGINIA
LAKE BERRY
LAKE SARAH
MARSH
WHISPER LAKE
LAKE DANIEL
LAKE SILVER
LAKE WINYAH
LAKE CHELTON
LAKE SPIER
LAKE SUE
LAKE COMPTON
LAKE ESTELLE
LAKE FOREST
LAKE BALDWIN
LAKE ROWENA
LAKE FORMOSA
LAKE IVANHOE
LAKE CAY DEE

Winter Park, via Lake Maitland, the creek flows under Howell Branch Road, through Lake Howell and eventually to Lake Jessup. Lake Jessup, which is fed by several other tributaries, empties into the St. Johns River east of Osteen.

Chain of lakes outfall weir at Howell Branch Road.

A portion of the City drains to another St. Johns River Tributary, the Econlockhatchee River. Some areas east of Lakemont Avenue, Lake Spier and Lake Baldwin lie within the Econlockhatchee River drainage basin, and flow out of the City through a series of culverts and open channels.

Section 2.
LAKES MANAGEMENT PROGRAM

2.1 Aquatic Plant Management

Hydrilla infestation on Lake Osceola in the late 1960's.

Overview: Plants are an important part of our environment. They provide us with food, building products, medicine, shade and beauty. Aquatic environments rely on plants as much as we do to remain healthy and vibrant. Just like on land though, aquatic plants can grow in areas or ways that impede the use and enjoyment of our resources. Exotic (non-native) plants can even be detrimental to the ecology of a water body. How we balance human interests with the ecological needs of the lakes and streams will determine the long-term health and usefulness of our waterways. The two questions that are frequently asked of lake managers are: "*Why don't you just kill all the weeds in the lake?"* and "*Why don't you stop poisoning the lake and let nature take its course?"* These two questions point up the competing interests of lake users, and the difficulty in developing a management plan that satisfies all parties.

Aquatic plants provide food and shelter for a wide range of aquatic organisms. They also protect water quality by producing oxygen and absorbing nutrients from the water column. Emergent plants that grow along the shoreline and shallows of a lake provide essential erosion control that can save our valuable lakefront land, and reduce turbidity in the lake. These plants also provide feeding areas for many native bird species. For these reasons, killing all the plants in a lake is unwise. We would end up with poor fish and wildlife populations, frequent and severe algae blooms (rapid, massive growths of algae due to excessive nutrients) and eroded banks.

Airboat rake used to remove floating plants.

Although vegetation in general is good for a lake, we also cannot leave nature to its own devices in urban lakes. There are two main reasons for this. First, a number of non-native aquatic plants have been introduced to Florida. These plants have no natural enemies here, and grow out of control if left alone. Plants like hydrilla and water hyacinth can completely cover the surface of a lake, preventing any recreational uses. When infestations reach this level, the plants also can cause massive fish kills due to oxygen depletion (caused by decaying plant material, and the isolation of the lake from the light and air above).

Second, large inputs of nutrients from stormwater runoff (which carries sediment, leaves and fertilizers) have enriched our lakes to the point that even native plant species can grow out of control. Plants like cattail or even pickerelweed can form dense monocultures that reduce wildlife diversity and create huge muck deposits in shallow areas of the lake. An effective plant management program is needed to prevent rapid degradation of our lakes.

Herbicide Program: The City routinely treats the lakes and city owned shorelines to control invasive, exotic plants such as hydrilla, torpedo grass and water hyacinth, and noxious native plants like cattails. We also perform treatments to manage populations of certain beneficial native plants such as pondweed so that boating access can be maintained. All of the herbicides used are approved by the state, and federal governments for use in aquatic environments. Modern aquatic herbicides breakdown rapidly into natural compounds, and have no residual effect on the lake. The toxicity of these compounds to fish and wildlife is very low, and no adverse effects occur when used according to the approved label instructions. All herbicide applications in Winter Park are performed by state licensed pesticide applicators, with aquatic pesticide certification.

Triploid Grass Carp have been stocked in some lakes to help reduce herbicide costs.

Some of the herbicides have use restrictions related to swimming and irrigation. When treatments are performed in your area, City crews will place a notice on your door detailing when the treatment will occur, and any restrictions associated with the herbicide being used. When the treatment is performed an orange bicycle type flag will be placed on your beachfront. You should refrain from swimming (keep pets out of the lake as well) or using lake water for irrigation while the flag is in place. Use restrictions vary for different herbicides, but generally are from 3 to 14 days. Restrictions for swimming are often shorter than restrictions for irrigation. In these cases, notice flags will be left up for the longer restriction period.

Hydrilla, an invasive exotic plant forms dense underwater stands.

The City's plant management permits allow for the spraying of 50 foot wide access corridors for residents to access open water from their boathouse or dock. The permit conditions require that residents request this service before it can be performed. The service is limited to submersed aquatic plants such as pondweed, and does not include emergent shoreline vegetation such as torpedo grass, cattail or pickerel weed. Call the lakes division at (407) 599-3599 to request treatment.

2.2 Water Quality Monitoring Program

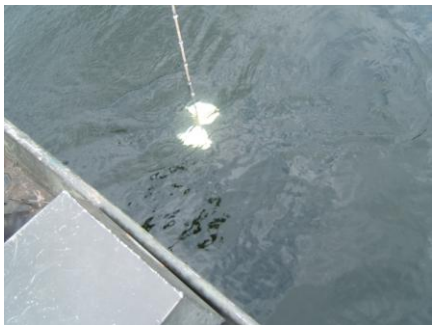
The City monitors 22 permanent ambient water quality stations on 21 lakes and the outfall canal. These stations are monitored monthly for a wide range of water quality parameters. The following parameters are measured in the field:

- Secchi Disk Transparency
- Water Temperature
- pH
- Dissolved Oxygen
- Conductivity (an indirect measurement of dissolved solids in water)
- Oxidation Reduction Potential (ORP)

Lake samples are then collected and transported to the City's laboratory to be analyzed for the following parameters:

- Turbidity
- Chlorophyl a (an indirect measurement of algae in the water column)
- Nitrate and Nitrite (NOx)
- Total Kjedahl Nitrogen (TKN – when combined with NOx gives Total N)
- Total Phosphorus
- Fecal Coliform Bacteria

In addition to these stations, six stations at two parks (Dinky Dock on Lake Virginia, and Fleet Peeples Park on Lake Baldwin) are monitored bi-weekly for bacterial contamination. Additional temporary stations, or parameters, are added as needed to facilitate specific studies, or to determine the cause of unusual conditions that may be observed.



Secchi disk used to measure water clarity.

Data collected since 1998 is stored in an electronic database. This format allows easy access to any combination of stored information and facilitates rapid analysis of conditions and trends in the lakes' water quality. Information from the City's monitoring program is included on Orange County's water atlas website:

http://www.orange.wateratlas.usf.edu/

2.3 Stormwater Management

In the late 1960's, Winter Park citizens began to observe a decline in the water quality of our lakes. The Lakes and Waterways Advisory Board was formed in 1967 in part to develop solutions to the deterioration of our lakes. Stormwater discharges into our lakes were recognized as a major source of pollution, leading to a City ordinance in the late

Stormdrain leaf traps prevent debris from entering our lakes

1970's requiring on-site stormwater retention ponds for new commercial developments. Later, zoning regulations were modified to require on-site stormwater retention for new and redeveloped residential properties as well. Beginning in 1987 the City of Winter Park began an aggressive program to keep leaves, litter and other large debris out of the lakes. More frequent street sweeping was instituted, especially during the springtime leaf fall season. In addition, about 130 leaf traps were installed over a period of several years on most large stormwater outfalls, which prevent leaves, grass, litter and other large debris from entering the lakes. While it is recognized that these leaf traps did not remove small particles or dissolved pollution in stormwater, they could be installed quickly and cheaply. They exclude tremendous quantities of contamination from the lakes and are making a significant long-term beneficial impact on lake water quality.

In 1989, the City of Winter Park passed a Stormwater Ordinance, which became the centerpiece of the effort for the recovery of our lakes. Perhaps the most important aspect of this ordinance was the establishment of a stormwater utility; a funding mechanism intended to pay for the construction and operation of new lakes cleanup projects. Every residential and commercial property in the City pays a stormwater utility fee, which is related to the amount of impervious (paved) surface area. This fee currently averages about $10 per home per month, which raises Citywide about $2 million per year. By direction of the City Commission, 41% of these funds are designated for the construction of new capital projects and the remainder for the operation and maintenance of existing stormwater treatment projects. This funding mechanism is essential to the recovery of our lakes, providing a dedicated funding source that cannot be used for other purposes. Capital projects that have been and will be funded by the stormwater utility are described later in this report.

The Vacuum truck is used to maintain stormwater treatment

Project Selection Criteria: Winter Park has been actively planning and constructing stormwater treatment projects since 1989. During that time, the following general priorities have been followed in evaluating and selecting potential projects:

- Treat stormwater inflows to the lakes rather than lake water itself, since pollutant concentrations are higher in stormwater and treatment systems are simpler to install in a confined area, making treatment easier and more cost effective;

- Focus on large stormwater outfall pipes, which are generally the greatest source of pollution;

- Emphasize projects on the Chain of Lakes, which are Winter Park's largest lakes with the highest visibility, the most extensive recreational use, and the greatest number of lakefront homes;

- Concentrate on the "headwaters" to the Chain of Lakes, especially Lake Virginia, since through normal flow patterns, cleaned-up water from this lake will flow downstream to the rest of the Chain;

- Concentrate on stormwater runoff from commercial areas which typically have a very high percentage of impervious area and proportionally higher pollutant loads.

Over the years, we have adjusted these priorities as conditions have changed and we have learned from experience. As we complete more projects, these priorities will continue to be modified. We have already begun moving toward treating Non-chain Lakes and smaller outfalls. The current five year plan has focuses in part on looking at alternatives to the stormdrain traps on most of the small landlocked lakes in the city. Once the majority of the stormwater runoff is treated in some manner, the City may shift focus to projects that treat in-lake pollution: lake water itself and/or lake sediments.

Retrofit Options: If Winter Park were to be developed from scratch today, significant acreage (as much as 10% of the total land area) would be dedicated to stormwater retention ponds. Unfortunately, stormwater pollution issues were not understood many years ago, and most existing development in the area does not have allowances for stormwater management. With little undeveloped land available, Winter Park often cannot use systems like retention ponds that require large plots of land, forcing us to employ less land intensive technologies, such as alum injection or underground systems. As more experience is gained in the cleanup of urban lakes in Florida and around the United States, promising new technologies will emerge. We will continue to look for new, more efficient and cost-effective systems to improve our lakes.

Mead Garden alum injection station

There are many different technologies available now for treating stormwater pollution before it enters our lakes including the following:

- **Alum (or other chemical) Injection** - Alum is a flocking agent. When injected into stormwater it binds with phosphorus and sediments as it forms a heavier than water floc. The floc then settles to the bottom taking the

pollutants out of the water column. Some stations have floc collection systems to remove the floc from the environment.

- **Traditional Retention or Detention Ponds** - Retention ponds hold all stormwater that enters. Water can only leave through percolation or evaporation. Detention ponds slow down water so that sediments can settle out, and algae and bacteria can breakdown other pollutants. Retention/Detention systems retain storms up to a certain volume, and then act as detention systems for volumes above the design amount.

Traditional wet retention/detention pond

- **Exfiltration Systems** - Stormwater is allowed to percolate into the ground through large perforated pipes buried beneath the street. Weirs built into the system contain the water to be treated.

- **Centrifugal or Vortex Type Water-Solids Separators** - Water enters a circular chamber, and must pass trough a screen before discharging. The circular motion of the water helps pull sediments to a sump in the center. Smaller and lighter particles are trapped by the screen. The circular action of the water helps clean the screen, and keep the system from clogging.

- **Baffle Boxes** – Underground chambers with vertical walls, or baffles, that trap sediment as stormwater passes through. Water must build up behind the baffle until it is high enough to flow over. This slows the flow and allows sediments to settle.

Existing Stormwater Retrofits: Since the creation of the stormwater utility in 1989, numerous capital projects have been funded; many of which have been completed and others that are currently being designed or are under construction. Table 2-1 lists the location and type of existing retrofits constructed under the stormwater utility program.

Table 2-1. Completed stormwater utility retrofit projects

Retrofit Name/Description	Lake/Water Body Treated
Mead Garden Alum Injection Station	Howell Creek/Lk.Virginia
Virginia North Alum Injection Station (2 Outfalls)	Lk. Virginia
Morse Blvd. Alum Injection Station (3 Outfalls)	Lake Osceola
Webster Ave. Alum Injection Station	Lake Osceola
Courtland Ave. Alum Injection Station (5 Outfalls)	Lake Mizell
9th Grade Center Retention/Detention Pond	Lake Virginia

Table 2.1 (continued)

North Park Avenue CDS Liquid/Solid Separator	Lake Maitland
Lake Island Park Detention Pond	Drainage Well/Aquifer
Lake Island Interconnect Retention/Detention Pond	Lake Killarney
Laurel Road Dry Retention/Detention Pond	Lake Virginia
Elizabeth Drive CDS Liquid/Solid Separator	Lake Osceola
Sunnyside Exfiltration System	Lake Maitland
Trismen/Lakewood Exfiltration & CDS Separator	Lake Osceola
Public Safety Building CDS Liquid/Solid Separator	Lake Virginia
Chelton Circle Baffle Boxes (4 outfalls)	Lake Chelton
Via Tuscany/Via Lugano Exfiltration System	Lake Maitland
City Hall Retention/Detention Pond	Lake Virginia
City/Windsong Joint Retention Pond	Lake Mizell
Lake Sue Ave./Winter Park Rd. CDS	Lake Virginia
Green Cove Road Retrofit (2 CDS units)	Lake Maitland
McKean Circle Retrofit	Lake Mtlnd./Venetian Canal
Pine Tree Outfall (Via Lombardi) CDS	Lake Maitland
Lakeview Drive Retrofits (1 CDS, 2 Baffle Boxes)	Lake Virginia
Banchory Road Exfiltration	Lake Berry
Mead Garden Clay Pit Retention Ponds	Lake Virginia/Howell Creek
Osceola Ct. Baffle Box	Lake Osceola
North Park Avenue Exfiltration	Lake Maitland
Lake Sylvan Aeration	Lake Sylvan
New York Ave Exfiltration	Lake Maitland
Elizabeth Drive Baffle Box	Lake Osceola
WP Racquet Club Pond Aeration	WP Racquet Club Pond
Lake Wilbar Aeration	Lake Wilbar
Lake Island Aeration (Funded by Florida FWCC)	Lake Island
Lake Forrest Aeration	Lake Forrest
Lake Virginia Sediment P Deactivation	Lake Virginia
Palmer Avenue Baffle Box	Lake Osceola
Moss Ln./Venetian Way Baffle Box	Howell Creek
Tuscany Oaks Baffle Box	Lake Tuscany
Central Utilities Compound Retention Ponds	Howell Creek
Pennsylvania New England Exfiltration	Lake Virginia
Lake Island Stormwater Reuse	Lake Killarney
Glencoe Road Baffle Box	Howell Creek/Lake Virginia
WP Welcome Center Exfiltration	Lake Virginia
Bryan Ave./Sylvan Dr. CDS	Lake Osceola

Planned Retrofits: Table 2-2 lists projects that are currently under design, under construction, or listed in the current Five Year Plan. Projects that are listed in the Five Year Plan, but are not currently funded, and underway may be shifted, canceled or modified. Projects could be delayed or cancelled based on funding constraints, or

logistical problems discovered during study or design phases. Projects may also be accelerated if outside funding (grants) becomes available, or other circumstances favor early construction.

Table 2-2. Stormwater projects that are currently underway or are planned.

Project Name	Water Body Treated	Status
Alexander Pl. Baffle Box	Lake Osceola	Under Construction
Lake Temple Aeration	Lake Temple	Under Construction
Balmoral Road Baffle Boxes (2)	Lake Berry	Funded - In Design
Howard Drive Baffle Box	Lake Forrest	Funded – In Design
Lk. Bell Baffle Box/Inlet Baskets	Lake Bell	Funded – In Design
Virginia Drive Retrofits	Lake Virginia	Funded – In Design
Minnesota/Clay Retention Pond	Lake Killarney	Funded- In Planning
Dixie Parkway Retrofit	Lake Maitland	Planned - 2010
Lake Sue Baffle Boxes	Lake Sue	Planned - 2010
North New York Phase II	Lake Maitland	Planned - 2010
Lake Sylvan Baffle Box(es)	Lake Sylvan	Planned - 2012
Alum Station Upgrades	TBD	Planned - 2012
Golf Course Exfiltration	Maitland/Osceola	Planned - 2013

2.4 Public Outreach Program

The city's lake and stormwater management programs cannot succeed without the assistance of residents and business owners in Winter Park. In order to increase awareness about the problems caused by stormwater runoff, and to educate residents on ways they can help protect the lakes, the City has developed a public outreach program that includes the following components:

- Inlet Signing Program – Installs signs on stormdrain inlets advising people that the system drains to our lakes.

- A bi-annual newsletter "*The Winter Park Waterways*" that is dedicated to lake, stormwater and environmental protection issues.

- Public Event Attendance – Lakes or Stormwater Division staff man booths for public events or attend meetings of various interest groups to disseminate information.

- The "*Winter Park Update*" newsletter carries information on proper waste disposal and other important environmental information.

Section 3
WATER QUALITY UPDATE

3.1 Evaluating Water Quality

Trophic State and Eutrophication: Trophic state is a measure of lake productivity based on the amount of algal biomass in the water column. While it may sound like a good thing, too much productivity in a lake leads to poor water quality and eutrophication. Eutrophication is the process in which a lake becomes nutrient enriched and the chemical, physical and biological characteristic of the lake change. Over long periods of time, this process will change a lake from open water to a bog or marsh. While eutrophication occurs naturally, urbanization and the effects of stormwater runoff can greatly accelerate the process. Most of the changes in the lakes characteristics are a result of increased plant production which in turn is caused by increased levels of nutrients.

The Trophic State Index (TSI) is a calculation that can be performed to represent the trophic state of a lake. The index is useful for comparing the trophic condition of a lake over time, and to a limited extent, in comparing the conditions of different lakes. The trophic state of a lake is broken down into four classifications, **oligotrophic, mesotrphic, eutrophic** and **hypereutrophic**. Lakes that are oligotrophic have very low productivity and are usually characterized by clear water and minimal growth of aquatic plants. Mesotrophic lakes have moderate productivity and increased populations of fish and aquatic plants. Eutrophic and hypereutrophic lakes have very high productivity and typically experience frequent or chronic, heavy algae blooms.

Interpreting the importance of TSI values is somewhat subjective. The State of Florida uses a general guideline to estimate the quality of a lake based on TSI. Under this guideline, TSI values under 60 represent good water quality, values between 60 and 70 represent fair water quality, and values 70 and above represent poor water quality. Other rating systems are based on evaluating the trophic condition based on TSI. Under one of these systems TSI values less than 50 indicate oligotrophic conditions, values between 50 and 60 indicate mesoeutrophic conditions, values 61 to 70 indicate eutrophic conditions and values over 70 indicate hypereutrophic conditions.

```
|---Oligotrophic---|-----Mesotrophic-----|----Eutrophic----|----Hypereutrophic---->
TSI 0              50                    60                70
|-----------------Good----------------------|--------Fair-------|----------Poor--------->
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One factor that the Trophic State Index does not use in determining the condition of a lake is the biomass of aquatic macrophytes (vascular plants and large nonplanktonic algae). This is a missing feature since the trophic state of a lake is meant to express overall productivity and aquatic macrophytes can comprise a substantial amount of the productivity in a lake. For this reason the trophic state index values should only be used

as an indicator of water quality, not the overall trophic condition in lakes which have abundant aquatic macrophytes.

Current Lake Conditions: TSI can be calculated using chlorophyll a, secchi disk transparency, nitrogen, phosphorous, or a combination of two or more of these parameters. For this report TSI was estimated using either chlorophyll a, or secchi disk transparency. Chlorophyll a TSI values for the chain of lakes from 1995, 2003 (last report update) and 2008 are shown in Table 3-1. TSI values for the other lakes in Winter Park, based on Secchi Disk values, are shown in Table 3-2. It should be noted that while the TSI of many of our lakes indicates oligotrophic conditions, most of these lakes have an abundance of native, aquatic plants and are actually more productive than the water quality indicators may show. Having healthy, native plant populations provides a good balance between having clear, safe water for swimming and boating, providing abundant wildlife habitat and maintaining healthy, sustainable fisheries.

Table 3-1. W.P. Chain of Lakes Chlorophyll a TSI values for 2008.

Water Body	1995 TSI	2003 TSI	2008 TSI	Current Trophic State
Lake Maitland	50	62	45	Oligotrophic
Lake Mizell	55	54	22	Oligotrophic
Lake Osceola	58	58	47	Oligotrophic
Lake Virginia	61	56	48	Oligotrophic

Table 3-2. Lake TSI (Secchi Disk) values for 1995, 2003 and 2008.

Water Body	1995 TSI	2003 TSI	2008 TSI	Current Trophic State
Lake Baldwin	46	39	28	Oligotrophic
Lake Bell	N/A	N/A	38	Oligotrophic
Lake Berry	46	49	46	Oligotrophic
Lake Chelton	28	33	39	Oligotrophic
Lake Forrest	51	41	55	Mesotrophic
Lake Grace	36	55	60	Mesotrophic
Lake Killarney	51	46	48	Oligotrophic
Lake Knowles	39	29	26	Oligotrophic
Lake Midget	68	60	63	Eutrophic
Lake Rose	43	50	26	Oligotrophic
Lake Spier	45	38	30	Oligotrophic
Lake Sue	63	61	50	Mesotrophic
Lake Sylvan	52	49	52	Mesotrophic
Lake Temple	52	39	44	Oligotrophic
Lake Tuscany	49	36	42	Oligotrophic
Lake Wilbar	56	57	60	Mesotrophic
W.P.R.C. Pond	44	36	36	Oligotrophic

3.2 Water Clarity Trends and Fact Summaries for Winter Park Lakes

The following pages contain informational summaries for each lake in Winter Park, and graphs that indicate water quality trends in those lakes. The graphs indicate annual average clarity based on monthly Secchi disk readings. A Secchi disk is a standard 8 inch black and white disk that is lowered into the water column of a lake to measure clarity. The Secchi depth, or secchi disk transparency, is the depth at which the disk just disappears from sight. The graphs show how far down in the water column the disk can be seen. The lower the bar (higher value), the clearer the water column. Important features on the graphs are explained below. This data is taken from the City's data base back through 1998. Any earlier data shown may have come from a variety of sources. Collection and analysis methods for earlier data are not known. This data, if available, is still useful for looking at trends over longer periods of time

Trend lines are shown on each graph. This line represents a statistical analysis called linear regression. This calculation determines the probability that the observed data are due to random variations, or represent a valid trend. In traditional population statistics, R^2 values of 0.9 or higher represent valid trends; lower values are considered to be due to random variations. Environmental data frequently contain high variances, and scientists looking at water quality data often accept lower R^2 values as representing actual trends in water quality data. The actual cut off for accepting the validity of a trend is somewhat subjective. For purposes of this report R^2 values under 0.4 are considered to be due to random variation, and do not represent a valid trend. Values between 0.4 and 0.7 are considered to represent moderate trends, and values above 0.7 are considered to represent strong water quality trends.

LAKE BALDWIN

Surface Area:
188 acres

Drainage Basin:
522 acres

Average Depth:
11 feet (approx.)

OHW Elevation:
91.5 feet

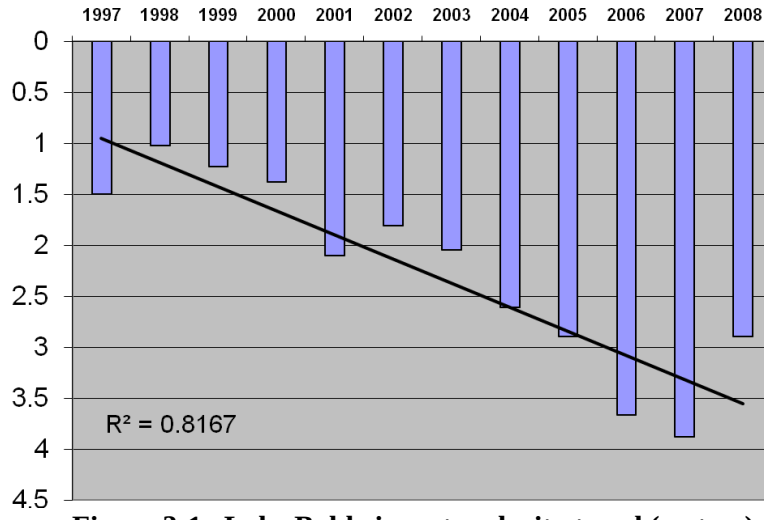


Figure 3-1. Lake Baldwin water clarity trend (meters)

General Information: Most of Lake Baldwin lies within the City of Orlando. Less than ten percent of the lake's surface area lies within Winter Park. Lake Baldwin is one of two Winter Park Lakes that lie outside of the Howell Branch Creek drainage basin (Lake Spier is the other). Water flows to Lake Baldwin from groundwater seepage, and from numerous outfalls outside of the City of Winter Park. Water flows from Lake Baldwin to the Econlockhatchee River system through a series of ditches, canals, and the Little Econlockhatchee River. There is a large park, Fleet Peeples Park, located on the shore of the Winter Park portion of the lake. The park has a boat ramp for accessing the lake. Winter Park does not allow the use of internal combustion engines on the lake, but fishing boats may be launched as long as oars or electric motors are used. The City of Orlando has not set any use restrictions for Lake Baldwin, but currently the only access point is through the Winter Park's ramp.

Water Quality: Water quality in Lake Baldwin is primarily affected by stormwater runoff. Statistical analysis of annual average Secchi disk transparency data (Fig. 3-1) from 1997 through 2008 shows a strong improvement in water clarity. Improvements may be attributed to the Baldwin Park stormwater treatment systems and the re-establishment of aquatic plants in the lake.

Management Efforts: As most of Lake Baldwin lies within the City of Orlando, Winter Park's management efforts have been limited to aquatic plant management and bacterial monitoring of the beach area at Fleet Peeples Park. Most of the lake's drainage basin lies within Baldwin Park (the former Orlando Naval Training Center property). During the redevelopment of this property, the owners will have to meet current state and local standards for stormwater management. Since the old navy base was built prior to any stormwater management rules, it is possible that future discharges to Lake Baldwin will be cleaner than in the past.

LAKE BELL

Size:
35 acres

Drainage Basin:
Not Determined

Average Depth:
12 feet (approx.)

OHW Elevation:
89.4 feet

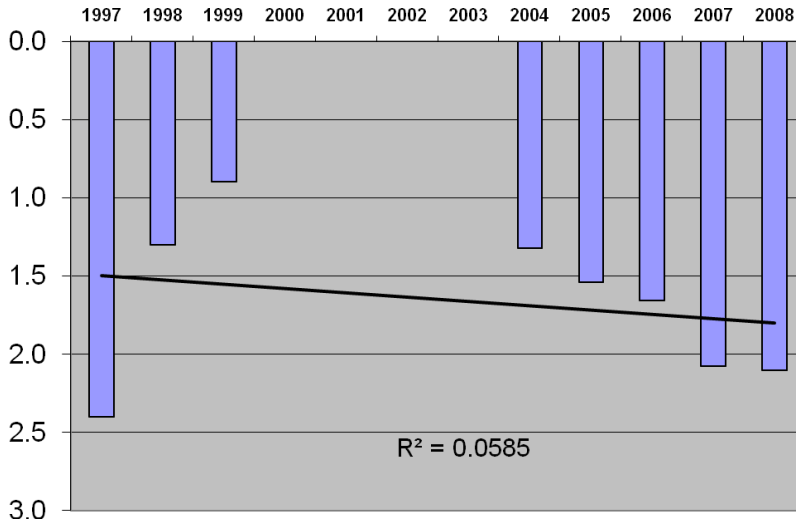


Figure 3-2. Lake Bell Secchi Disk Transparency (meters)

General Information: Lake Bell is a water table lake. The water level is dependent on the elevation of ground water in the area. Ground water elevations are ultimately dependent on rainfall. There are no permanent surface inflows to Lake Bell, however it does receive flow from an adjacent borrow pit during high water conditions. When the water elevation is high, water flows out through a ditch and culvert system, into Lake Killarney to the south. The normal elevation of Lake Killarney is 82.8, nearly six feet below Lake Bell. The lake is shared with the Town of Eatonville with approximately 90% of the surface area lying within Winter Park.

Water Quality: Water quality in Lake Bell is primarily affected by stormwater runoff. In the late 90's the lake was experiencing a noticeable decline in water clarity (Fig. 3-2). Since 2004, however, the clarity of Lake Bell has been improving. Trend analysis for the period of record (1997 through 2008) shows no significant change in water clarity over that time.

Management Efforts: The City is in the process of installing baffle boxes and inlet baskets on all of the outfalls to the lake that lie within Winter Park. It is hoped that these new treatment systems will result in continued improvements in water clarity on the lake. Other activities on the lake include exotic plant control. The lake has had problems with hydrilla infestations in the past, periodic control is needed. Recently a small number of triploid grass carp were released into the lake to assist with the control of hydrilla re-growth. Residents around the Lake have formed the Friends of Lake Bell organization to help protect the lake. In addition to providing a voice of advocacy on public issues that could affect the lake, the group also performed a very successful re-vegetation of the lake which has help to improve water clarity conditions

LAKE BERRY

Size:
68 acres

Drainage Basin:
441 acres

Average Depth:
10 feet (approx.)

OHW Elevation:
70.2 feet

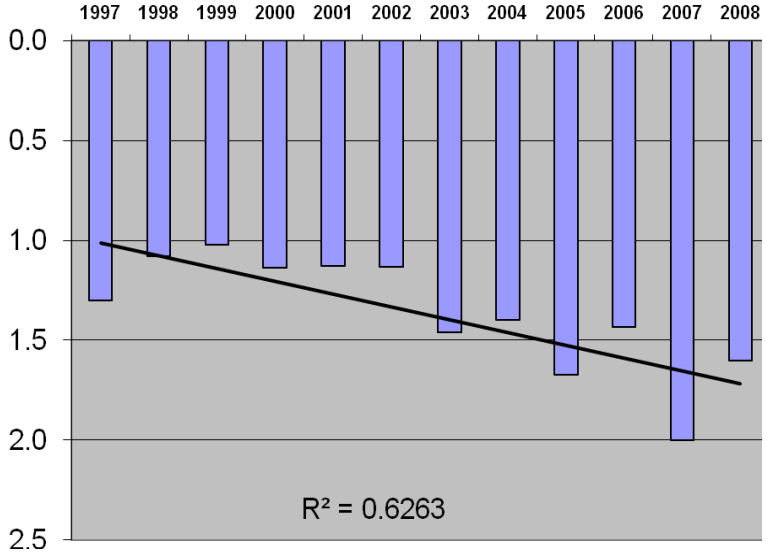


Figure 3-3. Lake Berry water clarity trend (meters)

General Information: Lake Berry has no permanent inflows and the water level is dependent on the elevation of ground water in the area. Water enters through ground water seepage and rainfall runoff. When the water elevation is high, water flows out through a ditched wetland system, into Lake Virginia. The normal elevation of Lake Virginia is 66.5, nearly four feet below Lake Berry. Recent development within the basin (the Windsong sub-division) was required to meet state and city stormwater treatment requirements. A portion of the basin, along the western shore of the lake, remains undeveloped. Approximately 30 percent of Lake Berry's drainage basin either meets current stormwater treatment requirements, or is undeveloped.

Water Quality: Water quality in Lake Berry is primarily affected by stormwater runoff. Annual average Secchi disk transparency data (Fig. 3-3) from 1997 through 2008 show a positive statistical trend toward improving water clarity.

Management Efforts: The City has installed leaf traps in the past to help slow the amount of organic material entering the lake. Due to the large size of the outfalls, only one of the four traps has worked very well. The City has recently begun replacing the traps with more efficient retrofits. A large exfiltration system under Banchory Road (between Lakemont and Langholm) was constructed in 2008 and two additional treatment systems for Balmoral Road drainage are currently in design. Construction is tentatively scheduled for 2009. In the intervening period, the Lake Berry basin has been identified as a high priority basin for street sweeping activities. Other activities on the lake include exotic plant control. Water hyacinth and hydrilla are two noxious, non-native plants that occur in Lake Berry. Left untreated, these plants can render entire lakes impassable to boats. The lake is surveyed quarterly, and plants are sprayed as needed. The lakes division also responds to resident reports of nuisance plants in the lake.

LAKE CHELTON

Size:
4.6 acres

Drainage Basin:
10 acres

Average Depth:
12 feet (approx.)

OHW Elevation:
80 feet (approx.)

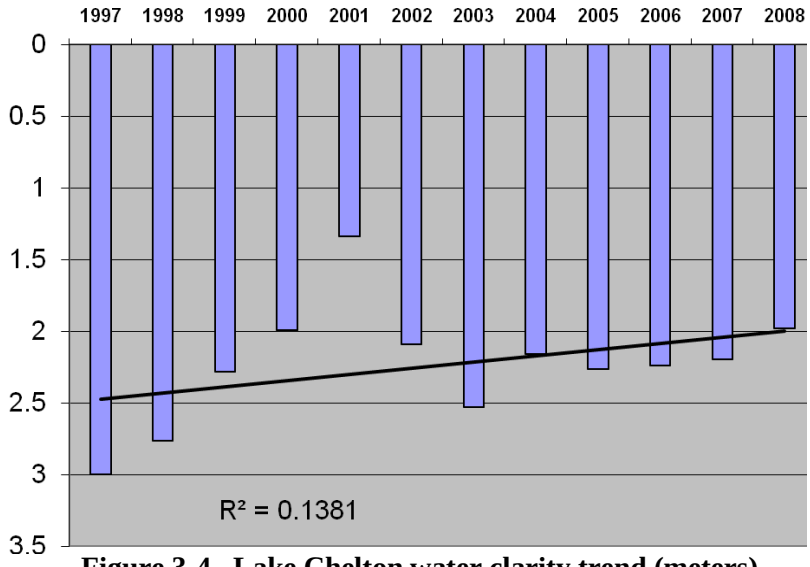


Figure 3-4. Lake Chelton water clarity trend (meters)

General Information: Lake Chelton is a sinkhole lake. The water level in the lake is dependent on groundwater levels, which are ultimately dependent on rainfall. Four stormwater outfalls convey runoff to Lake Chelton. There are no permanent surface inflows to, or outfalls from, the lake. The land between the lake and Lake Chelton Circle is a city park, and offers passive recreational opportunities for residents of the surrounding neighborhood.

Water Quality: Water quality in Lake Chelton is primarily affected by stormwater runoff. Annual average Secchi disk transparency data (Fig. 3-4) from 1997 through 2008 show no statistical trend. While water quality has remained good, there has been a measured decline in clarity over the period of record.

Management Efforts: Until recently, the city maintained leaf traps on all four outfalls to help slow the amount of organic material entering the lake. Due to the size of the outfalls, and the steep slopes, only one of the four traps worked very well. The traps were replaced with underground baffle boxes, which catch the leaves at the top of the bank, where velocities are much lower than at the lake. It is hoped the new systems will help improve water clarity in the lake over the next few years. Other management efforts conducted on the lake focus on the maintenance of shoreline vegetation, including the spraying and removal of exotic species, and the planting of native plants.

LAKE FORREST

Size:
3.8 acres

Drainage Basin:
35 acres

Average Depth:
10 feet (approx.)

OHW Elevation:
100.8 feet

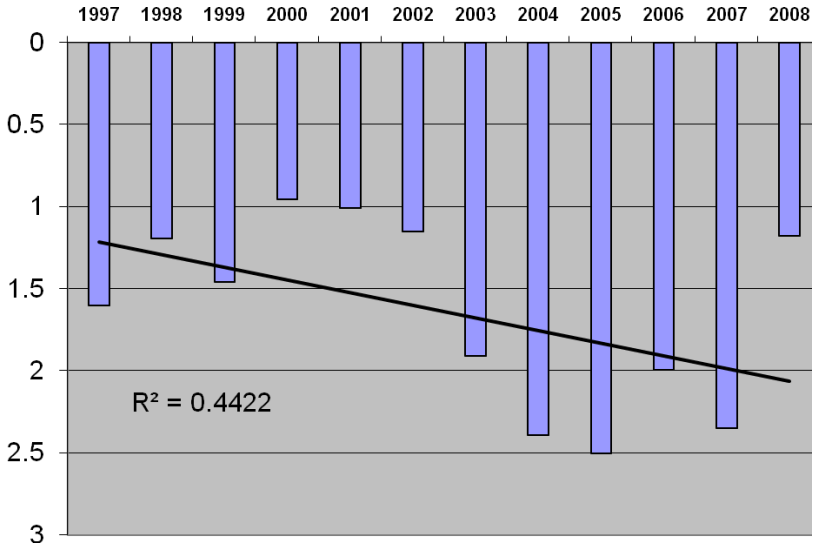


Figure 3-5. Lake Forrest water clarity trend (meters)

General Information: Lake Forrest appears to be a geologically older, sinkhole lake. The water level in the lake is dependent on groundwater levels, which are ultimately dependent on rainfall. Four stormwater outfalls convey runoff to Lake Forrest. There are no permanent surface inflows to the lake. High water levels are controlled by a drainage well on the eastern side of the lake that conveys water to the aquifer once the lake level exceeds the control elevation (100.8 feet above sea level). There is no public access to Lake Forrest, and access for management purposes is over private property.

Water Quality: Water quality in Lake Forrest is primarily affected by stormwater runoff, although the timing of algae blooms indicate that internal cycling of phosphorus may be contributing significant loads during part of the year. Annual average Secchi disk transparency data (Fig. 3-5) from 1997 through 2008 show a positive statistical trend toward improving water clarity.

Management Efforts: The city maintains leaf traps on all four outfalls to help slow the amount of organic material entering the lake. Due to the size of the outfalls, and the steep slopes, the traps are only marginally effective, removing 20 to 70 percent of the leaf load. The efficiency of the traps is significantly affected by the size of the rainfall event (volume of runoff), and the amount of leaves on the ground at the time of the storm.

Other management activities include the installation of an aeration system in 2000 to reduce filamentous algae blooms, and infestations of floating plants such as floating fern (*Salvinia rotundifolia*) and duckweed (*Lemna minor*).

LAKE GRACE

Size:
1.3 acres

Drainage Basin:
7 acres

Average Depth:
9 feet (approx.)

OHW Elevation:
101.6 feet

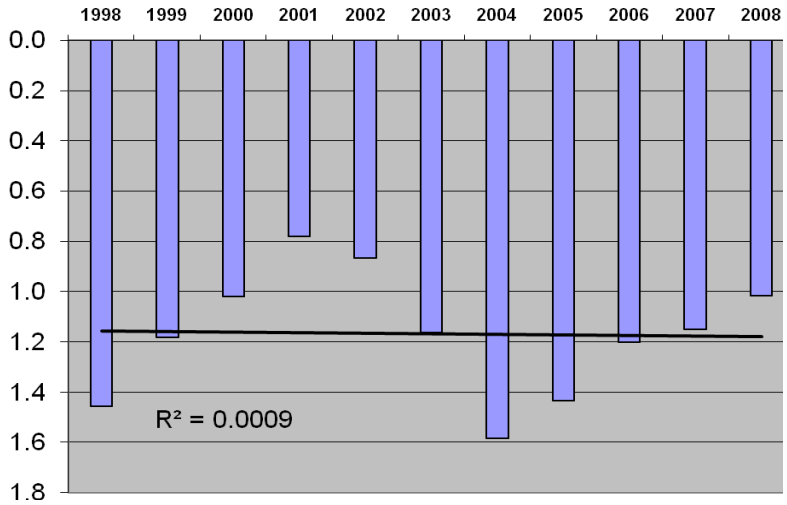


Figure 3-6 Lake Grace water clarity trend (meters)

General Information: Like nearby Lake Forrest, Lake Grace appears to be a geologically older, sinkhole lake. The water level in the lake is dependent on groundwater levels, which are ultimately dependent on rainfall. Three stormwater outfalls convey runoff to Lake Forrest. There are no permanent surface inflows to the lake. Lake Grace is connected to Lake Forrest by a culvert, and high water levels are controlled by a drainage well on the eastern side of Lake Forrest that conveys water to the aquifer once the lake level exceeds the control elevation (101.6 feet above sea level).

Water Quality: Water quality in Lake Grace is heavily affected by stormwater runoff from within its own 7 acre drainage basin. Even though the basin seems small compared to some of the larger lakes, it is over five times the area of the lake. Statistical analysis of monthly Secchi disk data from 1998 through 2008 indicates no apparent trend in water clarity.

Management Efforts: The city maintains leaf traps on the two of the stormwater outfalls to help slow the amount of organic material entering the lake. Due to the size of the outfalls, and the steep slopes, the traps are only marginally effective, removing 20 to 70 percent of the leaf load (depending on the magnitude of the rain event). The third outfall receives treated runoff from a newer subdivision, and does not need a trap. The underground depth of the stormwater system in the Quail Hollow subdivision prevents the installation of cost effective stormwater treatment systems. The City has been experimenting with inlet baskets for leaf and debris removal, and may consider them for the Lake Grace basin if an efficient maintenance program can be developed for them.

Other management activities include the installation of an aeration system in 2000 to reduce infestations of floating plants, primarily the floating fern (*Salvinia rotundifolia*). Prior to the installation of the aeration system, it was common for 50 to 75 percent of the surface of Lake Grace to be covered with the small, floating plants. Controlling the plants required numerous herbicide treatments every year.

LAKE KILLARNEY

Size:
234 acres

Drainage Basin:
1,070 acres

Average Depth:
9 feet (approx.)

OHW Elevation:
82.8 feet

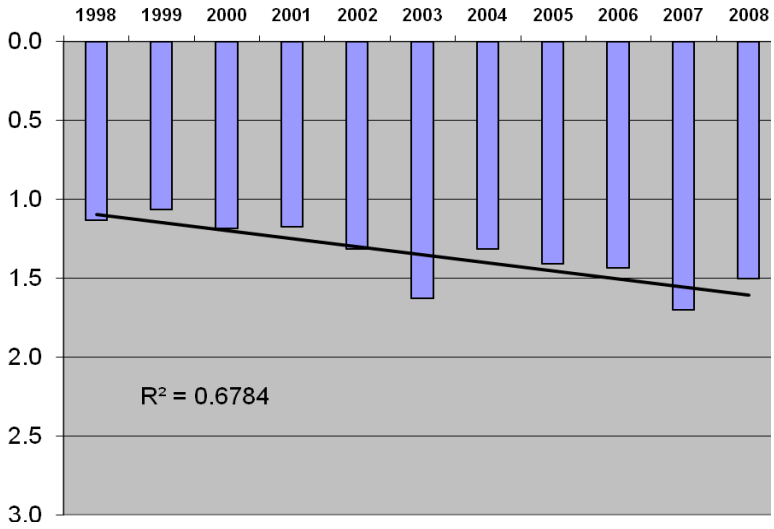


Figure 3-7. Lake Killarney water clarity trend (meters)

General Information: Approximately 60 percent of the surface area of Lake Killarney lies within Winter Park. The remainder is in unincorporated Orange County, and management efforts are split between the county and the city. Water levels in the lake appear to be dependent on groundwater levels, but there may be undocumented, small magnitude springs in the lake. The water level in the lake does not fluctuate drastically during droughts, as other lakes in the area do. High water levels are controlled by drainage well in the southwest corner of the lake, and an outfall structure located in a cove off of the north side of the lake. Water leaving Lake Killarney flows through pipes to Lake Gem in Maitland. From there the water flows through open channels to Park Lake and then to Lake Maitland.

Water Quality: Water quality in Lake Killarney is primarily affected by stormwater runoff. Annual average Secchi disk transparency data (Fig. 3-7) from 1998 through 2008 show a positive statistical trend toward improving water clarity.

Management Efforts: Ten of 13 stormwater outfalls on Winter Park side of Lake Killarney have leaf/debris traps to reduce the amount of organic material and sediments entering the lake. Two of the three large outfalls to the lake have additional treatment systems installed. The Gay Road outfall has a large baffle box structure to remove sediments, and the City of Winter Park recently completed a stormwater project that directs, dirty, first flush runoff water from a section of 17-92 into the ponds at Lake Island Park. This water previously ran, untreated, into Lake Killarney through the Beachview Avenue outfall. Winter Park is currently working with Orange County to design a treatment system in the area around Minnesota Avenue and Clay Street that will provide treatment for a large commercial area that drains to Lake Killarney through an outfall at the end of Shoreview Avenue.

LAKE KNOWLES

Size:
7.7 acres

Drainage Basin:
51 acres

Average Depth:
15 feet (approx.)

OHW Elevation:
76.7 feet

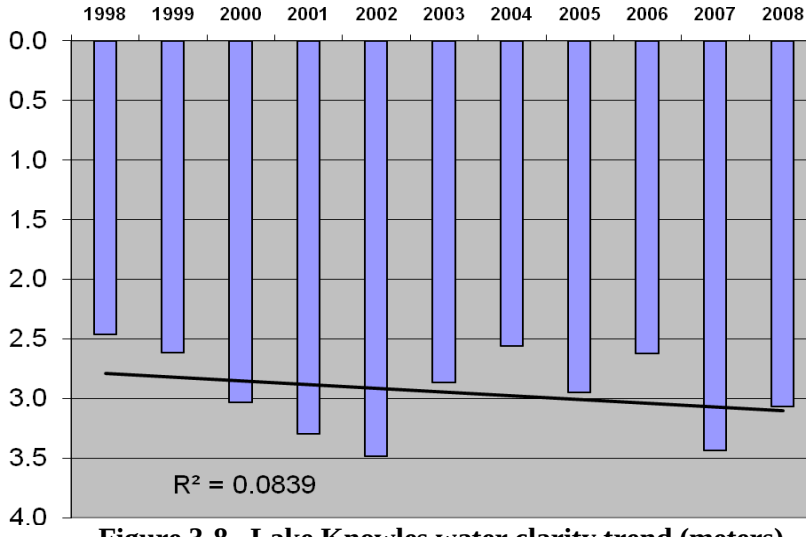


Figure 3-8. Lake Knowles water clarity trend (meters)

General Information: Lake Knowles is a small deep lake with consistently clear water. The nearly round shape and deep water of the lake indicate that it was most likely formed by a sinkhole. The fact that the water is generally very clear indicates that it is probably younger (in geological terms) than other sinkhole lakes in the area. Lake Knowles is a water table lake. Water levels in the lake are dependent on groundwater levels, which are ultimately dependent on rainfall. Recent droughts have resulted in extreme drops in the level of water in Lake Knowles. While the low water conditions are inconvenient, and sometimes unsightly, drought does help the lake cleanse itself of organic material. The wide water level fluctuations in Lake Knowles help to maintain the lake's exceptional water quality.

Water Quality: Water quality in Lake Knowles is primarily affected by stormwater runoff. Annual average Secchi disk transparency data (Fig. 3-8) from 1998 through 2008 show a consistent condition of good water quality over the ten year period.

Management Efforts: The city maintains leaf traps on all eight outfalls to help slow the amount of organic material entering the lake. Because none of the outfalls are very large, and the slopes around the lake are not steep, the leaf traps on this lake work relatively well. The traps may eventually be replaced, but it is currently not a high priority.

The land between Lake Knowles and the surrounding streets is a city park, providing tranquil recreational opportunities to the surrounding areas. Lakes division crews maintain extensive stands of native aquatic plants around the lake. These plants add the natural beauty of the park, and attract wildlife, particularly birds, to the park. Periodic, drastic fluctuations in water levels significantly change the plant stand and affect wildlife viewing opportunities.

LAKE MAITLAND

Surface Area:
451 acres

Drainage Basin:
1374 acres

Average Depth:
13 feet (approx.)

OHW Elevation:
66.5 feet

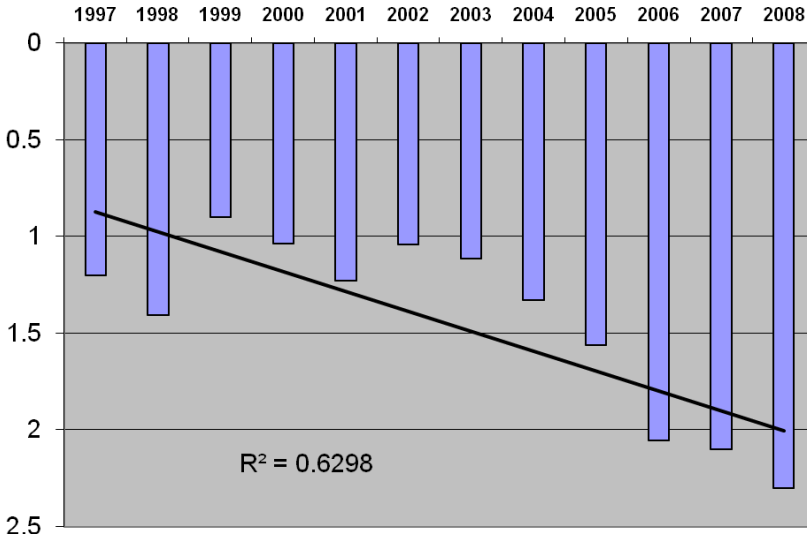


Figure 3-9. Lake Maitland water clarity trend (meters)

General Information: Part of the Howell Branch Creek system, Lake Maitland is the lower most lake in the Winter Park chain of lakes. Approximately 75 percent of the surface area of Lake Maitland lies within Winter Park. The remainder of the lake is in the City of Maitland. Lake Osceola is the most immediate upstream lake in Winter Park, but Lake Maitland also receives surface flow from Lake Minnehaha and Park Lake, both of which are in Maitland. Water leaves Lake Maitland via Howell Branch Creek, and flows over a control weir at Howell Branch Road. As with most lakes in this area, Lake Maitland is a water table lake, and its level is dependent on rainfall, surface flow and groundwater levels. Lakes Osceola and Minnehaha are accessible from Lake Maitland by navigable canal.

Water Quality: Water quality in Lake Maitland is strongly affected by two sources, stormwater runoff and flow from the three upstream lakes. Annual average Secchi disk transparency data (Fig. 3-9) from 1997 through 2008 show a positive statistical trend toward improving water clarity.

Management Efforts: A coordinated plant management program has been established between the City of Winter Park and the City of Maitland. Under this program the City of Winter Park performs plant management activities on the entire lake, and bills Maitland for work performed in their areas of the lake. Major plant control efforts focus on controlling exotic plants such as hydrilla and water hyacinth. Occasional control of native plants like pondweed is required to maintain boating access.

Stormwater retrofits currently in place on Lake Maitland include exfiltration systems at North Park Avenue, Sunnyside Drive and North New York Avenue. There are also CDS structures installed at McKean Circle and Green Cove Road (2 outfalls), Via Lombardi and North Park Avenue. Additional retrofits that are in the current five year plan include treatment systems for the outfalls draining the Dixie Parkway and Summerland Avenue areas.

LAKE MIDGET

Size:
1.0 acres

Drainage Basin:
40 acres

Average Depth:
5 feet (approx.)

OHW Elevation:
85.1 feet

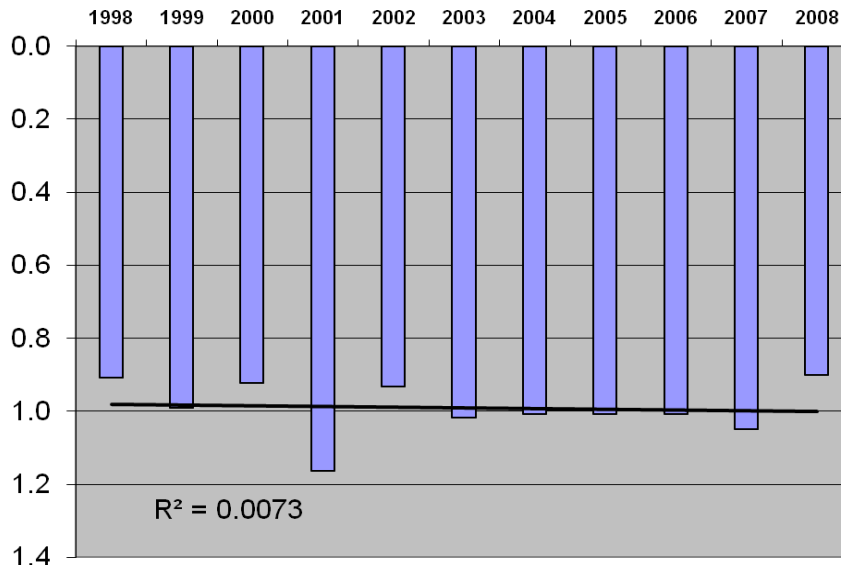


Figure 3-10. Lake Midget water clarity trend (meters)

General Information: Lake Midget appears to be a small, geologically older sinkhole pond. The lake receives stormwater runoff from a basin 70 times its surface area. The runoff enters the lake through five outfalls, including one large system off Denning Drive. Because of the size of the drainage basin, large amounts of leaves and debris are deposited in the lake. The land between the lake and the surrounding streets is a city park.

Water Quality: Water quality in Lake Midget is primarily affected by stormwater runoff. Annual average Secchi disk transparency data (Fig. 3-10) from 1998 through 2008 show no changes in water clarity over the period of record.

Management Efforts: Due to the large drainage basin, frequent trash removal is required. Lakes division crews clean the shoreline every two weeks. Leaf traps are maintained on four of the outfalls, but the large system off Denning Drive is too big for a trap to be effective. The lakes crews also maintain extensive stands of native aquatic plants around the lake. These plants add the natural beauty of the park, and attract wildlife, particularly birds. The lake was enlarged to reduce flooding on Denning Drive, and to improve the aesthetics of the lake, and recently a significant portion of the drainage basin was diverted to Howell Creek through a new treatment system at Mead Garden. Even with the reduction in the drainage basin, a large area still drains to the lake and due to the frequent input of stormwater, algae blooms are a problem on the lake during the warmer months. Algae are currently treated as needed. An aerating fountain installed in 2000 seems to have reduced the frequency of algae blooms.

LAKE MIZELL

Surface Area:
60.5 acres

Drainage Basin:
258 acres

Average Depth:
14 feet (approx.)

OHW Elevation:
66.5 feet

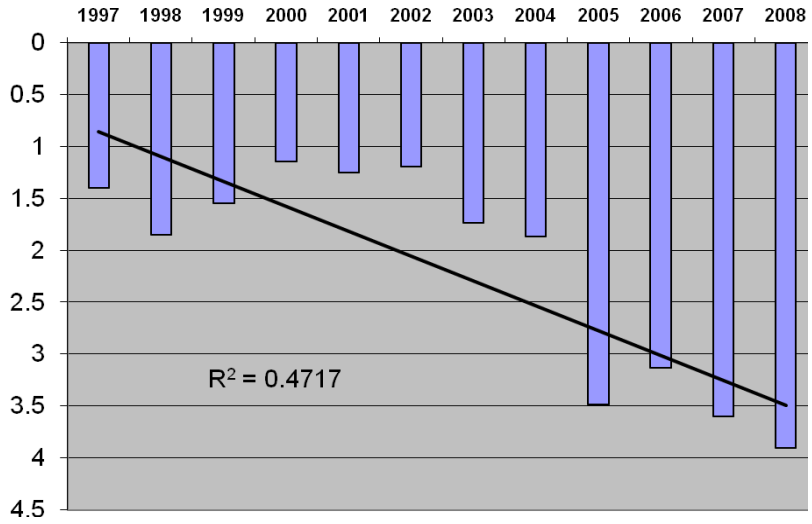


Figure 3-11. Lake Mizell water clarity trend (meters)

General Information: Part of the Howell Branch Creek system, Lake Mizell is offline of the main creek system, connected to Lake Virginia by the Genius Canal, a short navigable channel. Water enters Lake Mizell from six stormwater outfalls, groundwater seepage and, under certain low water conditions, through the canal from Lake Virginia. Water leaves Lake Mizell via the canal and flows to Lake Virginia, then to the lower lakes in the chain. As with most lakes in this area, Lake Mizell is a water table lake, and its level is dependent on rainfall, surface flow and groundwater levels.

Water Quality: Water quality in Lake Mizell is primarily affected by stormwater runoff. Annual average Secchi disk transparency data (Fig. 3-11) from 1997 through 2008 show a positive statistical trend toward improving water clarity.

Management Efforts: Stormwater retrofits currently in place on Lake Mizell include leaf traps on four of the six outfalls, and an alum station that treats five of the six lines. The City of Winter Park worked with the developer of the Windsong subdivision to provide treatment on the sixth outfall by runoff water through one of their retention ponds.

Additional management efforts on the lake include the treatment of nuisance aquatic plants, and the maintenance of a system of buoys that demarcate the no wake zone established for shoreline protection.

LAKE OSCEOLA

Surface Area:
156 acres

Drainage Basin:
567 acres

Average Depth:
14 feet (approx.)

OHW Elevation:
66.5 feet

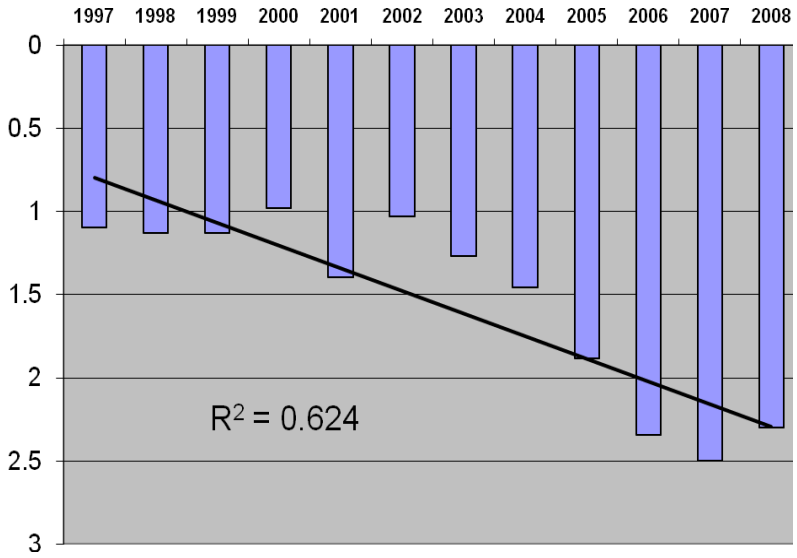


Figure 3-12. Lake Osceola water clarity trend (meters)

General Information: Part of the Howell Branch Creek system, Lake Osceola is the middle lake in the Winter Park chain of lakes. The lake receives water from stormwater runoff, groundwater seepage and flow from Lake Virginia via the Fern Canal. Water leaves Lake Osceola through the Venetian Canal, which flows to Lake Maitland. The canals to Lakes Virginia and Maitland are both navigable, and provide access to a total of five lakes in Winter Park and Maitland. A prominent City landmark, and eco-tourism business, the Scenic Boat Tour, is based on Lake Osceola, at the east end of Morse Boulevard.

Water Quality: Water quality in Lake Osceola is influenced primarily by stormwater runoff and flow received from Lake Virginia. Statistical analysis of annual average Secchi disk transparency values from 1997 through 2008 (Fig. 3-12) shows a positive trend toward improving water clarity.

Management Efforts: Stormwater retrofits currently in place on Lake Osceola include two alum stations, one at Morse Boulevard that treats three outfalls, and the other at Webster Avenue that that includes a large in-line baffle box for debris removal. There is also a CDS unit at Elizabeth Drive, and a large exfiltration system at Trismen Terrace and Lakewood Drive. A new baffle box on Palmer Avenue was recently constructed and baffle box system is currently being designed for the outfalls at Alexander Place.

Additional management efforts on the lake include the treatment of nuisance aquatic plants, and the maintenance of a system of buoys that demarcate the no wake zone established for shoreline protection.

LAKE ROSE

Size:
1.1 acres

Drainage Basin:
4.3 acres

Average Depth:
30+ feet (approx.)

OHW Elevation:
88.6 feet

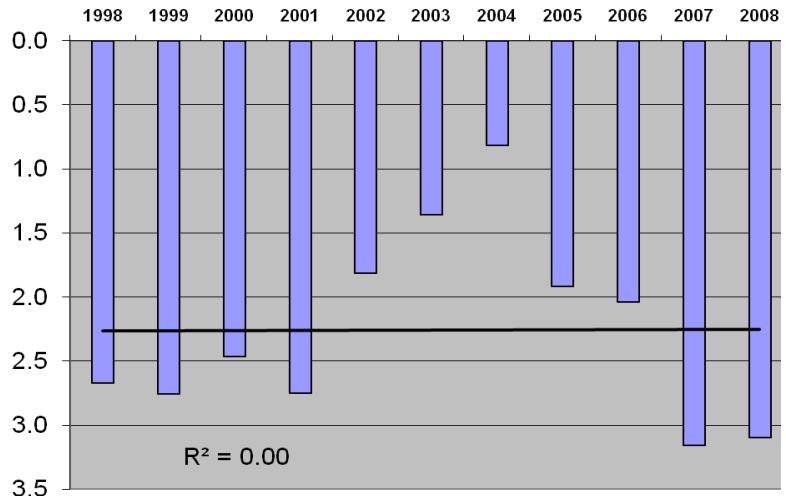


Figure 3-13. Lake Rose water clarity trend (meters)

General Information: Lake Rose is a recent sinkhole pond formed in 1981. The sinkhole destroyed a home, several businesses and part of Denning Drive. The road was repaired, but the remainder of the pond was left to fill with groundwater, and become Winter Park's newest lake. The lake is now located in the southeast corner of Lake Island Park.

Water Quality: Water quality in Lake Rose is primarily affected by stormwater runoff, but may also be influenced by groundwater sources since the lake is very deep. From 2002 to 2004, Lake Rose experienced a significant reduction in water clarity (Fig. 3-13). Diagnostic tests were run, but the cause of the decline was not determined. In 2005, the water clarity recovered, and continued to improve through 2008. Trend analysis for the period of record (1998 through 2008) shows no significant change in water clarity over that time.

Management Efforts: Currently management activities on Lake Rose are limited to aquatic plant management activities, including control of exotic species, and the installation of native shoreline plants.

LAKE SPIER

Size:
26 acres

Drainage Basin:
35 acres

Average Depth:
10 feet (approx.)

OHW Elevation:
90.5 feet

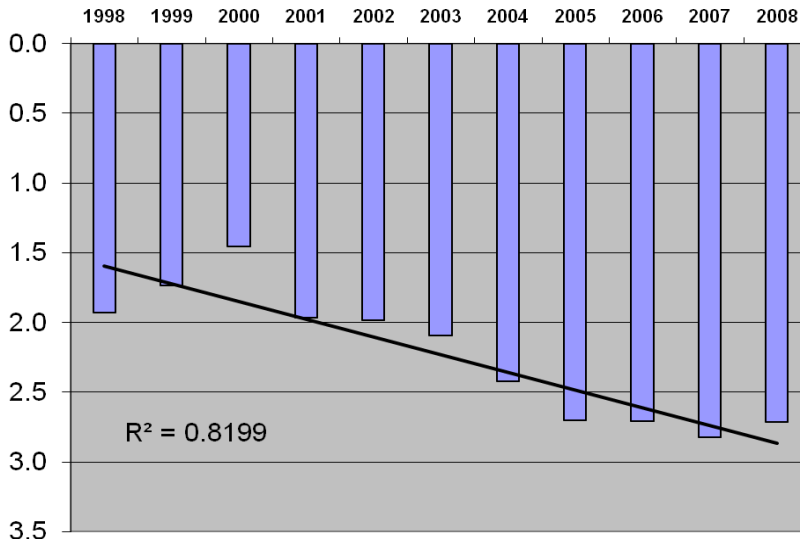


Figure 3-14. Lake Spier water clarity trend (meters)

General Information: Lake Spier is one of two Winter Park lakes that are not in the Howell Branch Creek Basin. Lake Spier (and Lake Baldwin) lie within the Econlockhatchee River drainage basin. Water enters the lake through stormwater runoff and groundwater seepage. Water leaves Lake Spier through a drainage well located on the south shore of the lake, and possibly through a culvert connection to Lake Baldwin.

Water Quality: Stormwater runoff is the biggest factor affecting water quality in Lake Spier. Annual average Secchi disk transparency data (Fig. 3-14) from 1998 through 2008 show a positive statistical trend toward improving water clarity.

Management Efforts: Lake Spier's small drainage basin, relative to the lake's surface area, probably helps to protect the lake from excessive nutrient enrichment. A small swale and debris screen on Glenridge Way helps to treat runoff from the largest outfall to the lake. Other Management activities include periodic aquatic plant control treatments.

LAKE SUE

Surface Area:
142 acres

Drainage Basin:
450 acres

Average Depth:
10 feet

OHW Elevation:
71.5 feet

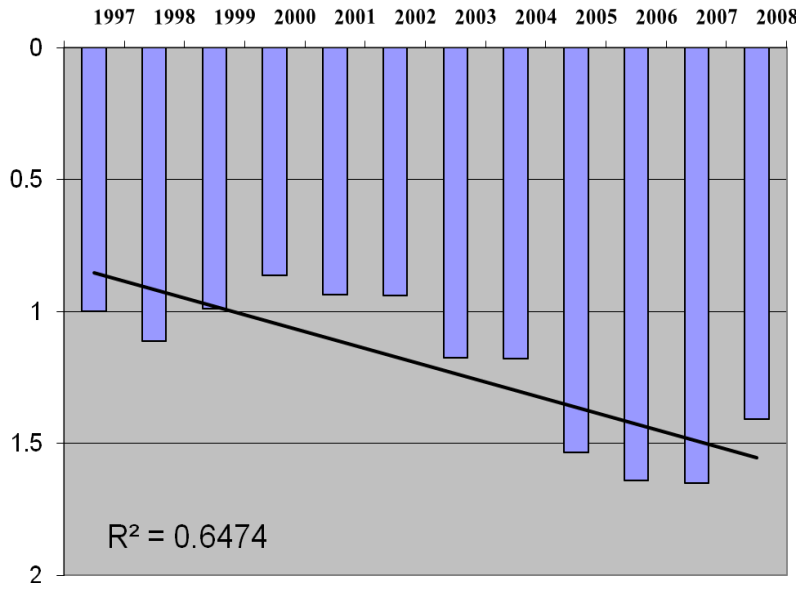


Figure 3-15 Lake Sue water clarity trend (meters)

General Information: Lake Sue is the uppermost lake in the Winter Park chain of lakes. Approximately 30 percent of the surface area of Lake Sue lies within Winter Park. The remainder of the lake is split between Orange County and the City of Orlando. Lake Sue is part of the Howell Branch Creek system, and receives water from Lake Rowena, the most immediate upstream lake. Water leaves Lake Sue via the creek, and flows through Mead Garden, and into Lake Virginia. Lake Sue is a water table lake, and its level is dependent on rainfall, surface flow and groundwater levels. Lake Sue does not have deepwater access to other lakes. Lake Rowena upstream is accessible by small boats, and Lake Virginia only by canoe or kayak (portages may be required during low water periods).

Water Quality: Water quality in Lake Sue is heavily affected by flow from upstream lakes and stormwater runoff from within its own 450 acre drainage basin. Statistical analysis of monthly Secchi disk data from 1997 through 2008 indicates a moderate trend toward improved water clarity.

Management Efforts: A coordinated plant management program has been established between the City of Winter Park, The City of Orlando and Orange County. Under this program the City of Winter Park performs plant management activities on the entire lake, and bills Orlando and Orange County for work performed in their areas of the lake. Major plant control efforts focus on controlling exotic plants such as hydrilla and water hyacinth. Occasional control of native plants like pondweed is required to maintain boating access. Stormwater management within the Winter Park portion of the drainage basin consists of leaf and sediment traps at all of the outfalls from Winter Park, and street sweeping to prevent materials from entering the stormwater system. The City of Orlando is in the process of installing several stormwater treatment systems in this basin, upstream of Lake Sue. These projects should help the improving water quality trend in Lake Sue to continue.

LAKE SYLVAN

Size:
16.3 acres

Drainage Basin:
87 acres

Average Depth:
20 feet (approx.)

OHW Elevation:
72.0 feet

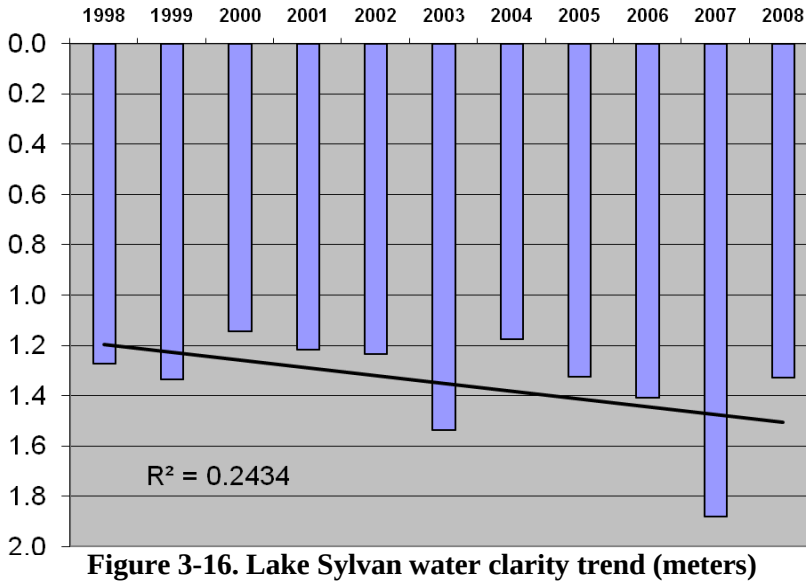


Figure 3-16. Lake Sylvan water clarity trend (meters)

General Information: The shape and depth of Lake Sylvan indicate that it was likely formed by a sinkhole. The lake has no permanent inflows, and water levels are dependent on rainfall and groundwater seepage. There are no surface outflows from the lake.

Water Quality: Water quality in Lake Sylvan is influenced by two sources, stormwater runoff and internal loading. Annual average Secchi disk transparency data (Fig. 3-16) from 1998 through 2008 show a slight trend toward improving water clarity.

Management Efforts: An aeration system was installed in Lake Sylvan to help reduce internal phosphorus cycling. The city maintains leaf traps on all six stormwater outfalls that discharge to Lake Sylvan. The effectiveness of these traps varies depending on the size of the outfall pipes and the velocity of the runoff as it reaches the trap/lake. The Five Year Plan contains projects to replace the larger traps with more efficient treatment devices where possible.

LAKE TEMPLE

Size:
3.1 acres

Drainage Basin:
10 acres

Average Depth:
6 feet (approx.)

OHW Elevation:
Not determined

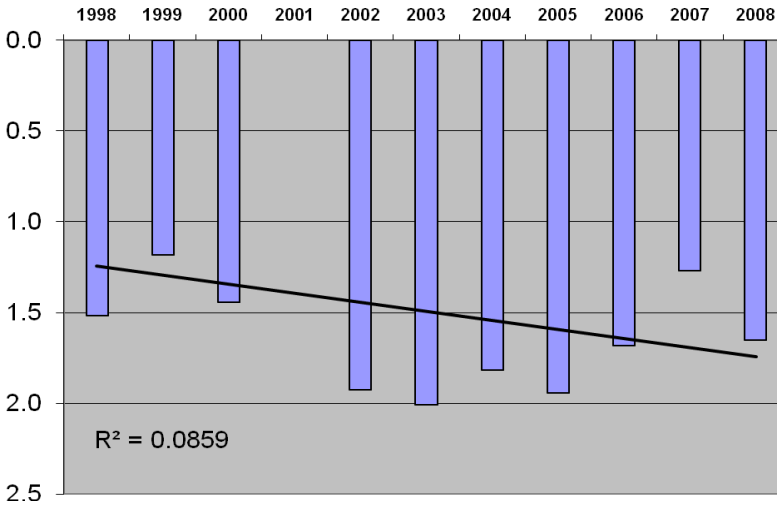


Figure 3-17. Lake Temple water clarity trend (meters)

General Information: Lake Temple is a small muck bottom pond near Howell Branch Road. The lake receives water from groundwater seepage, overflow from Lake Tuscany and a single stormwater outfall. Water leaves the lake during high water conditions through a culvert to Howell Branch Creek. Due to the fact that the lake is relatively shallow, and the bottom is gently sloped, small drops in water level result in large areas of lake bottom being exposed.

Water Quality: Water quality in Lake Temple is primarily affected by stormwater runoff, but may also be influenced by internal nutrient cycling from the highly organic sediments. Although annual average Secchi disk transparency data (Fig. 3-17) from 1998 through 2008 show a slight improvement in water clarity, there is no statistically valid trend on the lake.

Management Efforts: The city maintains a recently installed a leaf trap on the single outfall to Lake Temple. The lake's muck bottom, and the tendency for water levels to fluctuate significantly, results in periodic infestations of floating aquatic plants. These plants generally include floating fern (*Salvinia rotundifolia*) and duckweed (*Lemna minor*), and are treated as needed. At the time this report was written, repairs to the trap and outfall, and the installation of an aeration system were underway. The project was hindered by high water conditions that had persisted since Tropical Storm Fay in 2008.

LAKE TUSCANY

Size:
2.2 acres

Drainage Basin:
10 acres

Average Depth:
12+ feet (approx.)

OHW Elevation:
Not determined

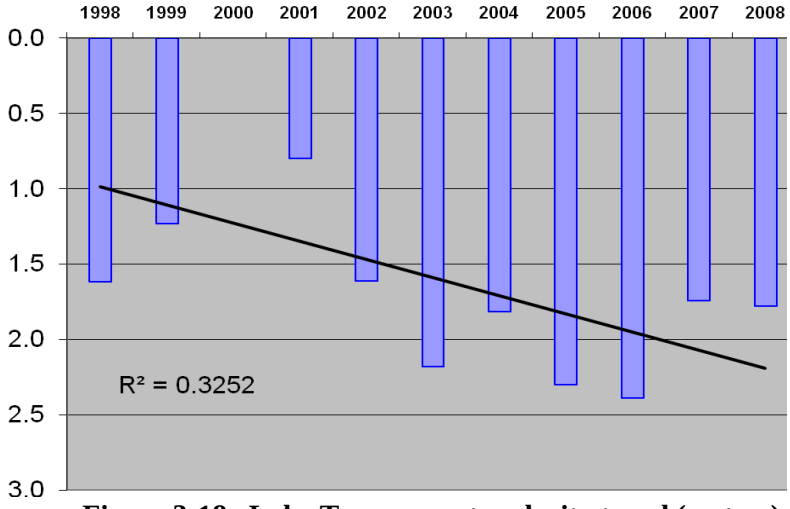


Figure 3-18. Lake Tuscany water clarity trend (meters)

General Information: Lake Tuscany is a small, organic muck bottom, sinkhole pond. The lake receives water from groundwater seepage, and two stormwater outfalls. Water leaves the lake during high water conditions through a culvert to Lake Temple.

Water Quality: Stormwater runoff is the primary factor affecting water quality in Lake Tuscany but at certain times of the year (fall turnover and spring warm up), water clarity may also be influenced by internal nutrient cycling from the highly organic sediments. Although annual average Secchi disk transparency data (Fig. 3-18) from 1998 through 2008 show a slight improvement in water clarity, there is no statistically significant trend on the lake over that time period.

Management Efforts: A baffle box has been constructed on one of the two outfalls treating a significant portion of the runoff to the lake. The city maintains a leaf trap on the other stormwater outfall to Lake Tuscany. The lake's muck bottom, occasionally leads to some aquatic plant problems. The tendency for water levels to fluctuate significantly can cause lily pads (*Nymphea odorata*) to pull out of the bottom and float during high water conditions. A non-native plant, the burhead sedge (*Scirpus cubensis*) occurs on the lake and has a tendency to form floating tussocks that can become quite large, and can be blown around the lake by wind. The City assists with these issues when possible, but the homeowners are primarily responsible for aquatic plant maintenance on private shorelines (permits may be required), and the City has little access to the lake for bringing in equipment.

LAKE VIRGINIA

Surface Area:
224 acres

Drainage Basin:
944 acres

Average Depth:
14 feet (approx.)

OHW Elevation:
66.5 feet

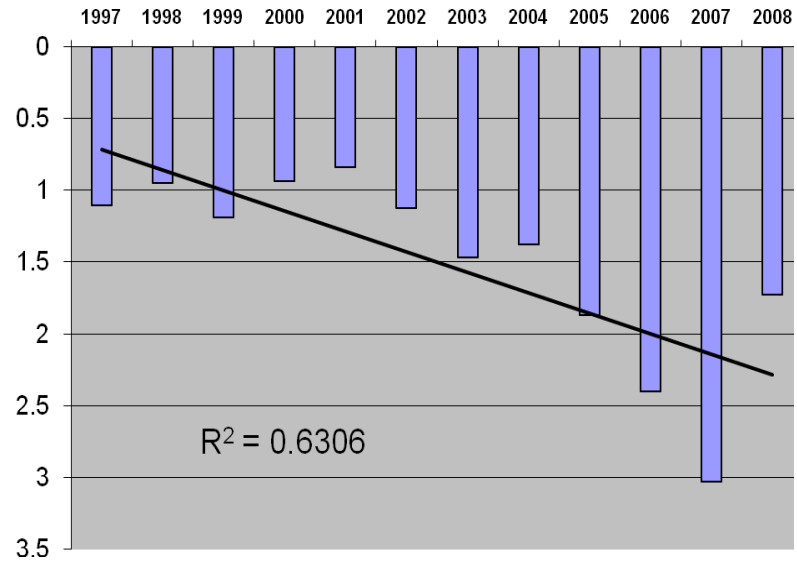


Figure 3-19. Lake Virginia water clarity trend (meters)

General Information: Part of the Howell Branch Creek system, Lake Virginia receives stream flow from Lake Sue, upstream, and flows to Lake Osceola down stream via the Fern Canal. Rollins College is located on the north shore of Lake Virginia, as is Dinky Dock Park. The Dinky Dock facilities include a health department permitted swimming beach, a boat ramp, trailer parking and restrooms. Lake Virginia is a popular fishing and water skiing lake.

Water Quality: Water Quality in Lake Virginia is influenced by three sources, flow from upstream lakes, stormwater runoff and internal nutrient recycling. Statistical analysis of annual average Secchi disk data from 1997 through 2008 indicates a positive trend of improving water quality.

Management Efforts: Stormwater retrofits currently in place on Lake Virginia include an alum station at Rollins College that treats two outfalls from the downtown area, and a large wet detention pond behind the 9th Grade Center School on Pennsylvania Avenue. A retention pond at Dinky Dock Park was recently modified to improve treatment, new leaf, sediment and debris traps were added along Lakeview Drive to treat water from the areas at Oxford, French and Antoinette Avenues. A whole lake alum application was performed in early 2007 to deactivate phosphorus in the lake's sediments, which account for over 30% of the total phosphorus load to the lake. This project will be funded in part by a grant from the State of Florida.

Additional management efforts on the lake include the treatment of nuisance aquatic plants, maintenance of a system of buoys that demarcate the no wake zone established for shoreline protection and maintenance of the boat ramp and swimming beach at Dinky Dock Park.

LAKE WILBAR

Size:
1.1 acres

Drainage Basin:
14 Acres

Average Depth:
5 feet (approx.)

OHW Elevation:
88.5 feet

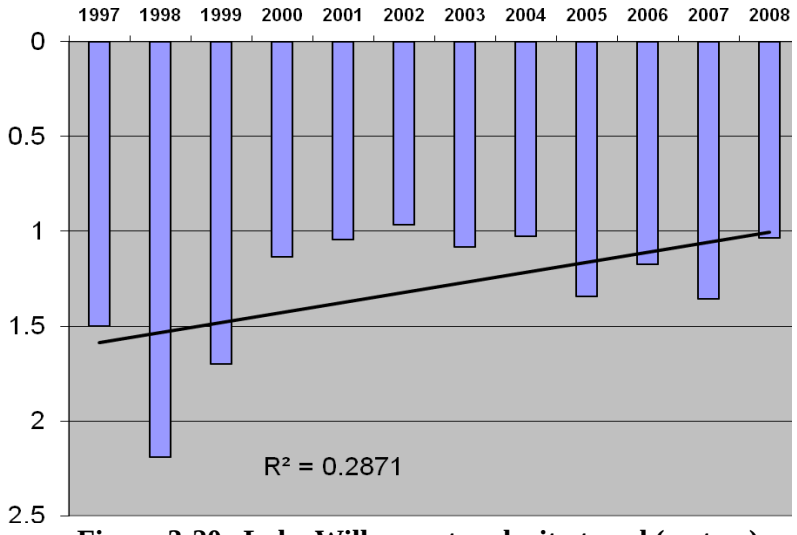


Figure 3-20. Lake Wilbar water clarity trend (meters)

General Information: Lake Wilbar is a small, organic muck bottom, sinkhole pond. The lake receives water from groundwater seepage, and three stormwater outfalls. Water leaves the lake during high water conditions through a culvert to Lake Knowles. The land between the lake and Wilbar Circle is a city park.

Water Quality: Water quality in Lake Wilbar is primarily affected by stormwater runoff. Annual average Secchi disk transparency data (Fig. 3-20) from 1997 through 2008 show a slight apparent trend toward lower water clarity.

Management Efforts: The city maintains leaf traps on all four stormwater outfalls to Lake Wilbar. An aeration system has been installed to reduce the frequency of filamentous algae blooms. Lakes division crews also maintain native plant stands around the shoreline to enhance water quality and wildlife value.

W. P. RACQUET CLUB POND

Size:
1.4 acres

Drainage Basin:
4.3 acres

Average Depth:
6 feet (approx.)

OHW Elevation:
not determined

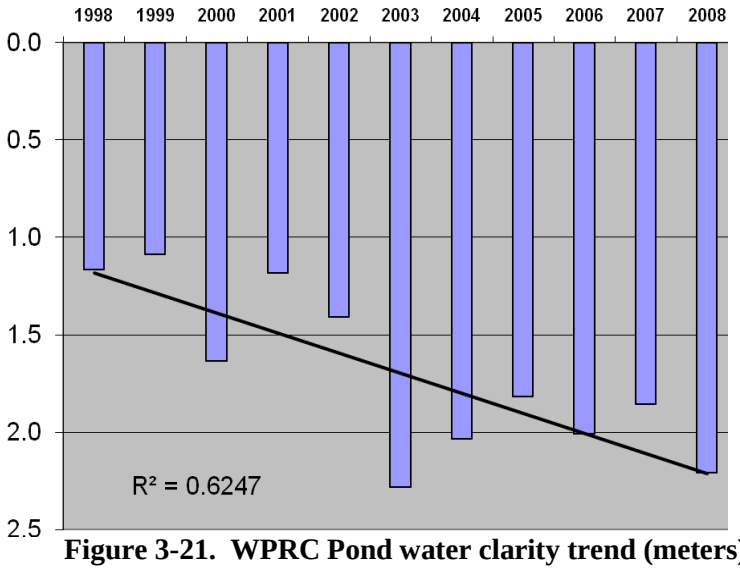


Figure 3-21. WPRC Pond water clarity trend (meters)

General Information: The unnamed pond north of the entrance to the Winter Park Racquet Club has two stormwater outfalls discharging to it. One drains water from the racquet club's retention pond, and the other from the neighborhoods to the east of Via Tuscany. Water is automatically pumped from the pond during high water condition to Howell Branch Creek by a permanent underground pump station.

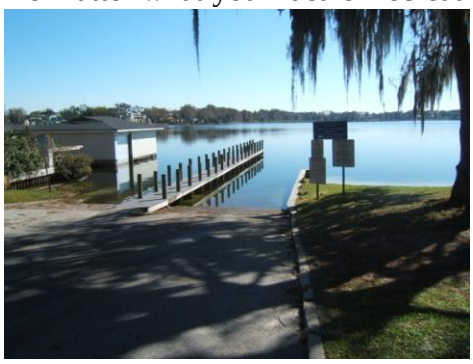
Water Quality: The largest factor affecting water quality in this pond is stormwater runoff. Annual average Secchi disk transparency data (Fig. 3-21) from 1998 through 2008 show a positive statistical trend toward improving water clarity.

Management Efforts: The city maintains leaf traps on the two stormwater outfalls to the pond. An aeration system has been installed to reduce the frequency of filamentous algae blooms. Street improvements included curbing to help channel water to the trap structures rather than flowing over the banks of the pond. This was done to reduce bank erosion and turbidity and sedimentation within the pond. Lakes division crews also maintain native plant stands on the eastern shore along Via Tuscany.

Section 4.
RESIDENTS' GUIDE TO LAKE USE AND PROTECTION

4.1 Public Use and Access

The City of Winter Park encourages all residents to use and enjoy our aquatic resources. No matter what your idea of recreation on a lake is, the waters in and around Winter Park can offer what you seek. The chain of lakes is a popular boating and skiing destination for residents who prefer active recreational activities. The chain is also popular among area anglers, most of whom ply the waters of the chain early in the morning, or during the week, when boat traffic is lighter. The chain, as well as many of our smaller lakes, offer excellent fishing for largemouth bass, black crappie, bluegill, redbreast sunfish and catfish.



Boat ramp at Dinky Dock Park provides access to the Chain of Lakes.

Figure 4-1 shows public access points on the chain of lakes, and the locations of the canals connecting the lakes. Remember that a Winter Park boat sticker or day pass is required before launching motorboats in any City lake.

Fishermen who prefer quieter surroundings can try their luck at Lake Baldwin. The ramp at Fleet Peeples Park on Lakemont Avenue can accommodate most fishing boats. The City Commission has designated the lake a "no motor boat lake" so you'll have to use your electric motors, or oars (fishing boats with gas engines may be launched but only electric, sail or manual power may be used). The status as a no motor lake is somewhat tentative since most of the lake is within the City of Orlando, and they have not made any decisions on the future use of the lake. For the time being, however, Lake Baldwin offers a peaceful alternative. People who like to sail, canoe and kayak will also enjoy the quiet surroundings.

Swimming beach and dock at Dinky Dock Park on Lake Virginia

Lake Island Park provides recreational and wildlife viewing opportunities.

Walkers, joggers and wildlife enthusiasts also have many of opportunities to enjoy our lakes. Lake Island Park features a recreational trail around a scenic five acre pond system. The shoreline plantings attract

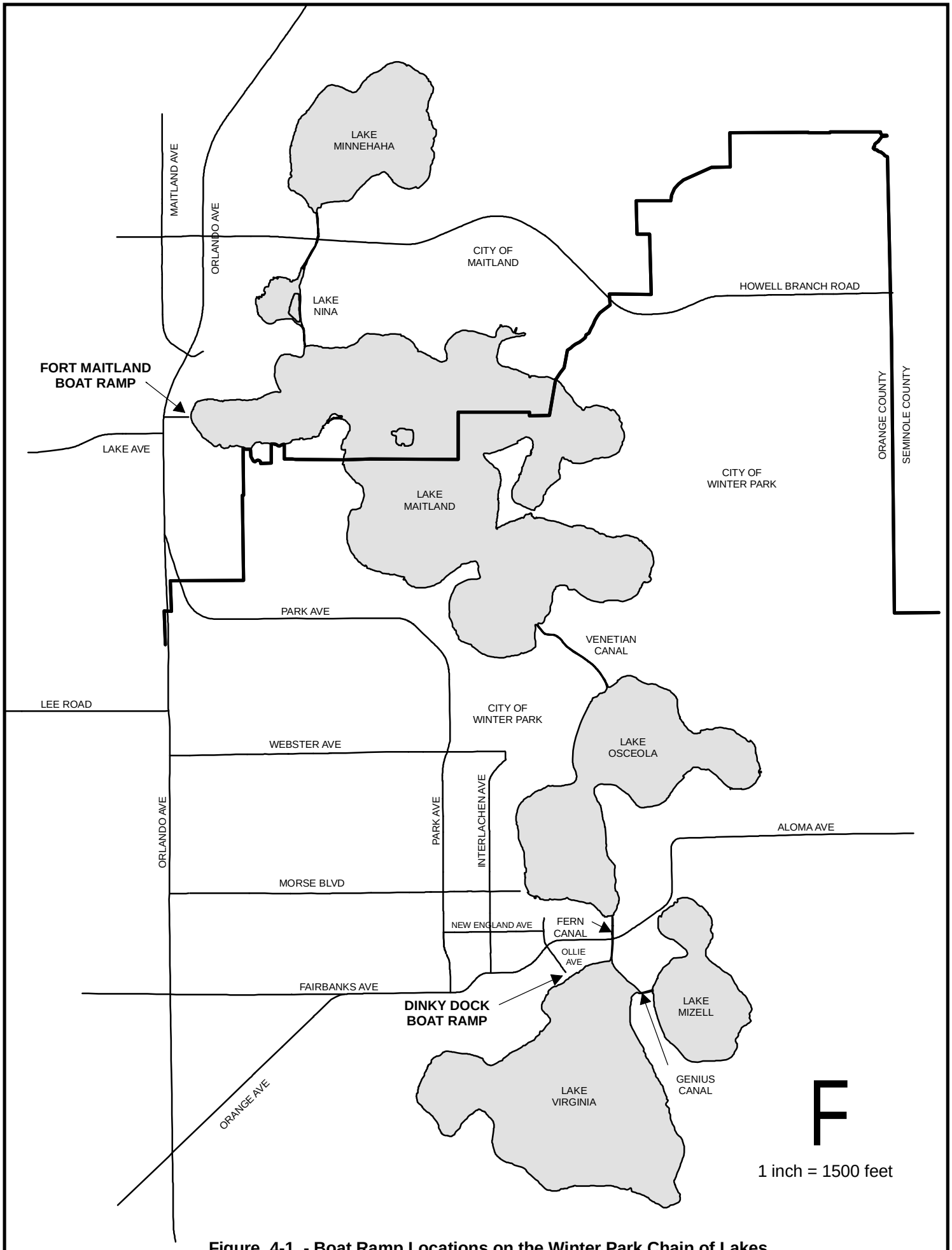


Figure 4-1 - Boat Ramp Locations on the Winter Park Chain of Lakes

Observation deck on Lake Maitland at Kraft Azalea Gardens

numerous species of birds. The City maintains parks around lakes, Chelton, Knowles, Wilbar and Midget. Residents from the surrounding neighborhoods can enjoy walking around the lakes or sitting in the parks taking in the views. For those not within walking distance of these parks, Dinky Dock Park on Lake Virginia (shown in Figure 4-1), and Kraft Azalea Garden on Lake Maitland (on Alabama Drive off of Palmer Avenue) offer parking and numerous viewing opportunities. Kraft Azalea Garden is home to a rookery of numerous aquatic bird species that nest there every spring. From the park's pedestrian dock, visitors may catch a glimpse of great blue herons, snowy egrets, river otters and American alligators.

4.2 Health and Safety

Periodically, the news media report on cases of primary amoebic meningoencephalitis (PAM), bacteriological infections, toxic algae and attacks by wildlife. While these reports are often sensationalized, they remind us that there are always risks associated with recreational use of natural water bodies. Infections and illnesses caused by swimming in area lakes are not frequent, but there is a potential for them to occur. The following information will provide you with the facts about these potential health threats so you can minimize your risks, and continue to enjoy the area's incredible water resources.

Health and safety warnings are posted at beaches as conditions warrant.

Amoebas: The amoeba that causes PAM is a naturally occurring organism in most freshwaters worldwide. It is a microscopic protozoan that lives in the sediment/water interface and feeds mostly on detritus (decayed organic material). When water temperatures are below 80 degrees (F), the organism exists in a cyst form that does not pose any risk to swimmers. As the water warms above that mark, the amoeba changes into a free swimming form that is capable of causing the infection. Even in warm waters, infection is rare, but there are ways to further safeguard your health while using the local waterways. Swim in deeper clear water when possible, wear ear and nose plugs and do not allow children to dive or play roughly in warm, shallow water areas. Although weather patterns can cause variations in water temperatures, our lakes are typically above 80 degrees from early June until early October. The City posts the beaches at Dinky Dock and Fleet Peeples Park with informational signs whenever water temperatures exceed 80 degrees.

Algae: Toxic algae refers to a group of single celled organisms known as cyanobacteria (formerly called blue-green algae). As reported in the news some of these organisms are capable of producing a wide range of toxins ranging from liver and neurological toxins to agents that cause eye, skin or sinus irritations. Cyanobacteria levels in a lake are often tied to nutrient concentrations. These are the same organisms responsible for green looking water in most cases. While there currently are no standards for cyanobacteria levels in place in the U.S., Winter Park's lakes usually have levels below what is considered potentially harmful. Swimmers should avoid water that looks excessively murky or that has a visible scum on the surface.

Bacteria and Other Microscopic Pests: Bacterial infections ranging from ear infections, to gastrointestinal discomfort to skin infections can occur in almost any aquatic environment, even in poorly maintained pools and hot tubs. Ear infections seem to affect some people more than others. If you are prone to these infections ask your doctor to recommend an after swim ear wash and use it each time you get out of the water. Gastrointestinal problems are usually related to ingestion of lake water, and can be caused by bacteria or protozoans such as giardia. Most people know not to intentionally drink lake water, but accidentally swallowing a mouthful is not an uncommon occurrence. Generally these small amounts do not cause problems, and stomach discomfort might just as likely be from the picnic lunch as from the lake water but if you experience discomfort after swimming, a trip to the doctor may be the prudent thing to do. Skin infections from contact with natural waters are fairly uncommon, but can be severe in some cases. Do not swim if you have open cuts or scrapes, as these wounds can provide easier access to microscopic bacteria. Rinsing, or showering with potable water after a trip to the lake can also help to reduce the potential for infection.

Alligators and Other Wildlife: Wild animals can be very beautiful and intriguing, and the desire to interact with them is often strong, and can be enhanced if the animals appear to be interested in, or unafraid of people. Intentionally interacting with wildlife, however, can be dangerous to humans and to the animals and in many cases, is against State law. Never feed wild animals of any kind. Feeding encourages them to lose their fear of humans which often leads to bites, scratches or other potentially dangerous injuries to people. Animals that become dependent on easy handouts can end up with serious health problems because the human food that replaces their natural diet rarely contains the specific nutritional content they need to remain healthy. Animals that become a nuisance or threat to humans usually end up being destroyed, so if you love animals and wildlife, it best to observe from a distance.

In lakes, alligators are of particular concern to many residents. To avoid confrontations always be aware of your surroundings when on or near waterways, and avoid densely overgrown areas. If you come across an alligator in the wild, you should calmly move away from the area. Feeding alligators any time of the year is illegal and dangerous. Feeding causes the animals to lose their natural fear of humans, and increases the frequency and severity of aggressive behavior.

During the months of spring, residents should be aware that alligators will become more active in area lakes as they begin mating and nesting. Alligators typically breed from April through June, and can become more aggressive during this period than they are the rest of the year. Males become increasingly territorial as the breeding season approaches, and often travel from lake to lake in search of mates. A large alligator can cover as much as twenty miles over land in a night, showing up unexpectedly in lakes that did not previously have any alligators. Most alligator aggression is channeled into threat displays intended to scare away potential rivals rather than into physical attacks. Male threat displays include raising their tail out of the water and/or bellowing (a low frequency growl that often causes the water around them to vibrate vigorously). Female alligators that are guarding nests or young often will open their mouths to warn off anyone who gets too close, and may even run out of the water with their mouths open to scare off intruders. Alligators that are cornered, or feel physically threatened, may hiss loudly. This hissing often precedes a defensive attack.

Alligators that threaten humans or pets, or do not exhibit fear of people (do not leave an area when people approach, or actually come closer) should be reported to the Florida Fish and Wildlife Conservation Commission. The nuisance alligator hotline number is 866-392-4286. Please be aware that alligators removed under this program are typically destroyed, and that larger animals may be killed on site for safety reasons.

4.3 Protecting Our Lakes

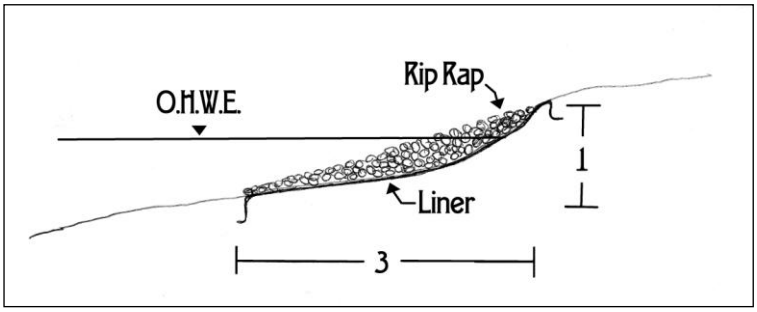
All of the land area that contributes runoff to a lake is referred to as its drainage basin. There are approximately 17 square miles of land that drain to the Winter Park Chain of Lakes, through Howell Branch Creek and the City's own drainage system. Winter Park alone has over 2,300 stormwater inlets and 46 miles of stormwater pipes. Even properties that are many miles away from a water body can have an impact on that water body. As you can imagine what happens in the 17 square miles draining to our lakes can have serious impacts on our water quality. What we put on our lawns and in our streets can make its way to our waterways very quickly. The City's management programs can go only so far without the help of our residents.

Shoreline vegetation protects against erosion and provides habitat to aquatic organisms.

Lake Shore Management: Residents who live along our lakes and streams can have a direct impact on the quality of these systems and can also be greatly affected by changes to them. To help minimize adverse impacts and promote healthy shoreline and near shore areas, the City has enacted rules related to shoreline management that cover aquatic plant removal, revetment construction and the placement of structures such as docks and boathouses. Additionally the State of Florida regulates these activities within Winter Park to varying degrees. A summary of the rules covering shorelines is provided below. Questions related to lakeshore protection and

permitting may be directed to the Lakes Division at **(407) 599-3599**, or by e-mail to tegan@cityofwinterpark.org

Aquatic Vegetation - City rules related to shoreline vegetation removal are now identical to the State of Florida's regulations. Under both City and State rules, homeowners may clear limited access corridors from their shore out to open water without a permit. The width of the access corridor may be 50 feet or 50% of the lake frontage, whichever is **less**. No additional allowance for docks or boathouses is provided, so any clearing for these structures must be included in this allowance. Under City rules, the exempted access corridor may be cleared by any legal method without any permitting required (note that turbidity curtains are required for jetting and other mechanical removal). The State does require a permit for the access corridor if herbicides are used, but not for other methods of clearing. One other change that has occurred is at the State level. The job of regulating shorelines has been transferred from the Department of Environmental Protection to the Florida Fish and Wildlife Conservation Commission. All of the FDEP staff and equipment involved in invasive plant management was transferred as well, so the contacts and procedures for obtaining and complying with your state permits have not changed.



Shoreline revetments must have slopes no steeper than 3:1.

Revetments and Seawalls - Two recent changes were made to the seawall section of the Waterways Code. First the minimum slope has been changed from 2:1 to 3:1 (horizontal to vertical). This means that for every foot of height, the revetment must extend three feet horizontally. The second change requires that all properties requesting permits to construct or repair seawalls or revetments must meet the current shoreline vegetation requirements as a condition of the permit. Vertical seawalls are not permitted, and property owners must demonstrate that an existing erosion problem is present before any revetment will be authorized.

Docks and Boathouses - Docks and boathouses require a site plan approval and a building permit before any construction may begin. The purpose of the City's dock ordinance is to protect traditional views and shoreline aesthetics. With that goal, docks and boathouses are allowed within the guidelines shown in Table 4-1. The Lakes and Waterways Advisory Board has the authority to further restrict dock construction to meet the stated goal of the ordinance.

Table 4-1. Current dock/boathouse allowances and restrictions.

Dock Parameter	Allowed
Total Area	600 square feet (max.), includes boat slip(s).
Length	30 feet (max.) from ordinary high water line (OHW)*, 50 feet (max.) from OHW on Lake Killarney
Height of Roof	11(max.) above the deck.
Height of Deck	1.0 foot (min.) above OHW, 2.0 feet (max.) above OHW
Side Yard Setback(s) **	10 feet (min.)

* OHW elevations can be found in the lake profiles in Section 3.

** Side yard setback may be reduced to 5 feet without a variance if a signed letter of no objection is obtained from the affected, adjacent property owner.

Lawn Maintenance: Every year in February and March our beautiful canopy of oak trees shed their leaves to make way for new growth. Once on the ground many leaves find their way to our stormwater systems where they are eventually carried to our lakes. These leaves contain nutrients such as nitrogen and phosphorus, which are good for the trees, but can cause serious problems in our lakes. Although leaves are natural, and a certain percentage of them would make it to the lakes under any conditions, our system of road, sidewalks, driveways and drainage facilities act as conduits carrying huge volumes of leaves directly into the area lakes.

Excessive nutrient loads can lead to unwanted algae growth

During rest of the year, lawn mowing, and vegetation trimming activities contribute to the load of organic material. When clippings are left on paved surfaces, they will, like the oak leaves, wind up in our stormwater system, and eventually in our lakes. This excess of organic material releases large amounts of phosphorus very quickly, fueling unwanted algae growth. Residents can help protect the area's lakes in the following ways.

- Never blow grass clippings, leaves or other debris into the streets or storm drains. If you use a lawn service, it is very important to make sure they do not blow debris off your property.
- Sweep leaves, lawn clippings and other debris off of sidewalks and driveways.

- Bag leaves, or place in flower beds as mulch, so that they are not easily washed or blown back onto the paved surfaces.
- Keep the curb/gutter area of the street in front of your house clean. The City has street sweepers, but they can't hit every street every day. During the leaf fall period, a large number of leaves can collect in just one day. If a rainstorm happens before the street sweeper comes by, those leaves will be carried to the nearest lake.

Fertilizer and Pesticide Use: Natural materials like leaves and grass clippings are not the only threats to water quality in our lakes. Lawn care and home pest control products can enter our lakes if they are not used properly and carefully. Many weed killers and insecticides are extremely toxic to aquatic life. Always follow the label directions when using any pesticide, and never use pesticides within thirty feet of a lake, ditch or stream. Check weather forecasts before applying any outdoor pesticides, and refrain from using them if windy conditions exist, or if rain is expected within 24 to 48 hours. Clean up any spills immediately, and always dispose of unwanted pesticides at an approved household hazardous waste facility (see additional information below).

- **Orange County's 12100 Young Pine Road Facility during normal operation hours (Mon. through Sat. 9-4)**

- **Or you can check for periodic amnesty days that are held in various locations around the County**

- **More information is available at the County's website:** http://www.orangecountyfl.net/cms/DEPT/utilities/household_hazardous_waste_disposal.htm

Fertilizers are used to help our lawns and shrubs grow, but the very compounds that help our landscapes, can cause excessive plant and algae growth in our lakes. Florida soils hold phosphorus very well, and rarely need any to be added. Homeowners in Winter Park should insist on phosphorus free fertilizers from their retailers and lawn care companies (most large commercial lawn care companies already use phosphorus free fertilizers, but many smaller companies do not). More is not better, and extra fertilizer often washes away before it can be used by your plants. Keep fertilizer off of all paved surfaces, and sweep or wash off any that ends up on your sidewalk or driveway.

Exotic Birds: Feeding the ducks on a sunny afternoon can be a fun and relaxing way to pass the time, but feeding these exotic birds can contribute to significant pollution problems on your lake. Domestic birds that are released into a lake spend their entire lives on the lake, and all of their wastes end up in the water column. Waste from these birds contains high levels of fecal coliform

Feeding exotic birds can lead to serious lake problems.

bacteria that pose human health risks, and nutrients (such as nitrogen and phosphorus) that can fuel unwanted algae growth. When people feed bread or grain to the ducks, they are effectively importing nutrients into the lake basin, and because the birds are often overfed, they produce many times more waste than native birds. Non-native species also displace native wildlife by destroying feeding areas, competing for nesting space and spreading disease. Introducing exotic wildlife into any area is against state law. There are many beautiful, native birds in Winter Park. They won't always be where you are, waiting to be viewed, but catching a glimpse of a stately great blue heron or a colorful wood duck can be much more rewarding than looking at farm birds. Please resist the urge to feed the birds, get a field guide and enjoy our native wildlife.

Reporting Non-Stormwater Discharges: Non-stormwater discharges are anything other than rainwater that is entering our stormwater system (streets, inlets and pipes). Many non-stormwater discharges are harmless. Sprinkler over-spray and groundwater seepage are common in Florida. Some discharges, on the other hand, can be very harmful to our lakes. Oil or antifreeze from car maintenance, dumping of unwanted household hazardous waste and even blowing yard debris into an inlet are examples of potentially harmful non-stormwater discharges. If you suspect a non-stormwater discharge is occurring, call the Lakes Division at (407) 599-3599. If you see non-stormwater discharges of a serious nature (oil or other potentially toxic material being dumped) during evening or weekend hours call (407) 644-1212.

New Environmental Hotlines: In addition to the City contacts above, Floridians now have a new tool for protecting the state's natural resources. The Florida Department of Environmental Protection (DEP) recently announced that most cell phone customers in Florida can dial #DEP to report environmental crimes, including illegal dumping of hazardous materials, construction debris, oil drums and biological waste.

"We need all citizens to help protect Florida's environment by reporting environmental crimes, such as illegal dumping of wastewater, to the proper authorities," said DEP Division of Law Enforcement Director Henry Barnet. Callers can also report environmental crimes to the Environmental Crimes Hotline at the State Warning Point by calling 1 (877) 272-8335 or 1 (877) 2-SAVE-FL. General environmental inquiries should be directed to DEP district offices during business hours (local office # (407) 894-7555.

For more information on DEP's Division of Law Enforcement, visit
www.dep.state.fl.us/law

Car Care and Lakes: Most people wouldn't automatically associate their car with our lakes, but there are several aspects of automobile use and maintenance that can affect our waterways. Keeping your car in good working order reduces the amount of oil, coolant and fuels that end up on our streets, where they are easily carried away by stormwater. Even parking can have an impact on stormwater management. In order to facilitate efficient street sweeping, parked cars, trashcans, etc. should be removed from the curb lines to allow street sweepers to pass as scheduled.

Car washing is an activity that must be performed from time to time, but one that can add an unnecessary load of nutrients, chemicals and sediment to our stormwater system. To avoid this potential impact to our lakes, pull your car onto your own lawn for washing. You will be helping the area lakes, and watering you lawn at the same time. If you don't have an accessible lawn area, consider taking your vehicle to a commercial car wash. These facilities recycle water and send waste products to the sanitary sewer system for treatment.

The City appreciates your cooperation and we believe that by working together, the high level of water quality in our lakes can be maintained.

Lake Berry

DEFINITIONS

Algae: Algae are simple photosynthetic organisms that do not have all of the distinct organs that land plants have. Algae may be single celled plankton, or large multi-cellular structures like seaweed.

Biomass: Living and recently dead biological material. In lakes the term is often used to refer to the total amount of plant material in the water column.

BMP (Best Management Practice): The most appropriate retrofit available for the particular system.

Chlorophyll a: A plant pigment used in photosynthesis. When measured in the water column, chlorophyll a gives an indirect measure of the amount of algae in, and the productivity of a lake.

Drainage Basin: The area surrounding a lake from which stormwater flows to the lake. Flow may be overland or through conveyance systems such as pipes or ditches.

Eutrophication: The natural process by which lakes become nutrient enriched and over long periods of time may change from open water to marsh systems. This process may be greatly accelerated by urbanization and stormwater runoff.

Exotic: Not native or indigenous to the area.

Fecal Coliform Bacteria: Type of bacteria found in the digestive tract of warm blooded animals. These bacteria are potential human pathogens, and can be an indicator of sewer or septic tank contamination

Nitrogen: An element common in plant fertilizers. Nitrogen is one of the components of stormwater runoff that promote excessive plant and algae growth in lakes.

OHW (Ordinary High Water) Elevation: The elevation to which a lake rises during a normal rainfall year. The OHW is statistically determined over time if stage is available. The OHW can also be estimated using plant and soil indicators.

Outfall: A stormwater outfall is the lake end of a pipe or ditch that carries stormwater runoff. An outfall from a lake or pond is a structure that allows water to flow out of that lake to a downstream water body, or to the aquifer in the case of a drainage well.

Oxidation Reduction Potential (ORP): A measure of the reactive potential (reducing or oxidizing) of the water column. Negative ORP conditions are favorable for the release of phosphorus from the sediments into the water column.

pH: A measure of the acidity of the water column.

Phosphorus: An element common in plant fertilizers. Phosphorus is one of the components of stormwater runoff that promote excessive plant and algae growth in lakes.

Retrofit: An improvement to an existing system. Usually used in this report to refer to a treatment system added to an existing stormwater conveyance.

Revetment: Any type of shoreline armoring intended to provide erosion protection and/or wave energy dissipation.

Secchi Disk/Secchi Depth: A secchi disk is a standard 8 inch black and white disk that is lowered into the water column of a lake to measure clarity. The Secchi depth, or secchi disk transparency, is the depth at which the disk just disappears from sight.

Stormdrain Trap/Leaf Trap: An enclosure constructed at the lake end of an outfall pipe for the purpose of stopping leaves, trash or other debris from entering the lake.

Stormwater/Stormwater Runoff: Rainfall of sufficient volume that it runs off of the surface where it fell. Stormwater runoff is usually greater from paved (impervious) surfaces like rooftops and driveways than it is from unpaved (pervious) surfaces like lawns.

Stormwater Utility: A fee charged to property owners to manage stormwater runoff that is generated on their property, and enters a City maintained treatment or conveyance system.

TKN: Total Kjeldhal Nitrogen is a measure of the combined organic forms of nitrogen in the water column. Combining the TKN results with the amount of inorganic nitrogen gives the total nitrogen value.

Trophic State and TSI: Trophic State is a measure of the biological productivity in a lake. The Trophic State Index or TSI is a calculation used to set a numeric value to the trophic state for comparison.