



Collier County™
POLLUTION CONTROL
LIVE GREEN. SAVE BLUE.

Stormwater Lake Evaluation & Recommendations for Kings Lake



October 6, 2020

Prepared by: **Collier County Pollution Control**

Prepared for: **Kings Lake Homeowners Association**

Table of Contents

Background:	3
Onsite Evaluations:	4
The Bigger Neighborhood – Haldeman Creek Upper:	5
Site-Specific Recommendations – Kings Lake Community:	5
Lake Management:	5
Landscape Management:.....	7
General Recommendations:	8
Appendix A: Littoral Shelf Plantings.....	10
Appendix B: Contacts and Contributors.....	15

Background:

The President of the Kings Lake Master Homeowner's Association (HOA) contacted Pollution Control staff (PCS) in December 2018 looking for help with lake management and littoral plantings. The primary goal of the current lake committee is to reduce resident complaints while improving lake health. Kings Lake has four man-made stormwater detention lakes (Figure 1). Kings Lake, Prince Lake and Lake 4 are visually connected waterbodies. Duchess Lake is connected via underground pipes to Lake 4. All four lakes were dug between 1974 and 1985. Littoral plantings were not required at that time. PCS has performed three onsite inspections and presented educational information at the two most recent Kings Lake Annual Meetings.

The current lake manager is Dean Crivellaro of Ecological Control & Management, Inc (Appendix B). Dean reported a reduction of chemical applications in recent years that he attributes to the increase in spikerush. Aquatic dyes have been used with some success. Hydrilla was a regular nuisance plant and sonar treatments were needed frequently. Dean reported less phytoplankton blooms in recent years. Water clarity and visible lake health have improved since the increase in aquatic plants.

Kings Lake maintenance staff physically remove vegetation from the lake on a regular basis. Mechanical harvesting, removal with machinery, has also been done a number of times over the years. Aerators and floating islands were installed but showed little aesthetic improvements, according to the lake manager and HOA president. It is unknown if they improved the water quality. The aerators and floating islands have since been removed or abandoned. Review of past pollution complaints revealed an algae bloom in 1994 and a bloom with dead fish in 1996.



Figure 1: Lakes in Kings Lake

Onsite Evaluations:

Pollution Control completed onsite evaluations in December 2018, February 2020, and August 2020. There is a small buffer strip of taller vegetation next to the water to prevent grass clippings from getting into the lake; however, grass clippings were observed in the water during the August inspection (Figure 2).

All lakes have growth of *Chara* and spikerush (Figure 3). Both of these species are generally considered beneficial natives. Kings Lake has dense sections of spikerush which is the cause of most of the resident complaints.

Wildlife including fish and waterfowl were observed during the inspection. Residents feed the ducks and other waterfowl, so they approach humans eagerly. The HOA has educated residents about not feeding the waterfowl. Bald eagles, otters, and a variety of wading birds were also noted by community leaders.

Staff did not inspect the stormwater management system. It appears that the main roads have valley gutters that carry runoff to the lakes. According to drainage plans, all road runoff eventually flows into Lake 4 and outfalls to the Lakewood community. The lake perimeters were not evaluated in entirety as they are mostly private property. Lake bank erosion is not a major concern but there were small washouts noted under the turf in a few locations. The lake levels fluctuate little, less than two feet, between rainy



Figure 2: Grass clippings in lakes



Figure 3: Dense spikerush with patches of *Chara*

season and dry season. The lake bank slopes are quite gradual.

The common grounds are managed by the HOA, which has contracted with Molter Landscaping for the last seven years. Molter reports that the common landscape areas are fertilized two to four times per year with a zero-phosphorus fertilizer and irrigated with water from Kings Lake. Each homeowner is responsible for managing the landscape and irrigation of their lot. Irrigation overspray was observed at private residences during the evaluations.

The Bigger Neighborhood – Haldeman Creek Upper:

All the stormwater from Kings Lake eventually drains into Haldeman Creek, which then flows to Naples Bay and ends up in the Gulf of Mexico. Neither Haldeman Creek nor Naples Bay meet state water quality standards. This means the water is not suitable for its intended use of recreation and wildlife habitat. Copper, nutrient, and bacterial pollution are all concerns in the waterbodies downstream of Kings Lake.

Copper-based algaecide applications can lead to copper pollution. Nutrient pollution often comes from poorly managed grass clippings, vegetative debris, and fertilizer. Unmanaged pet and wildlife feces contribute to bacteria and nutrient pollution. County ordinance states it is unlawful to discharge pollutants into any surface water, lake, pond, drainage ditch, or into a stormwater management system. Kings Lake is encouraged to proactively address any water quality issues. The Kings Lake community can improve water quality in their lakes and downstream waterbodies with proper landscape and lake management.

Site-Specific Recommendations – Kings Lake Community:

Lake Management:

1. Develop a good water quality testing and trend analysis program. Past water samples were taken at varied depths and locations and analyzed by different laboratories. To be able to compare data, samples must be taken consistently with the same procedure. Involvement in the Lakewatch program is a good option.

Lakewatch is a citizen science program with standardized sampling procedures. The Lakewatch program will provide an annual summary report along with a 5-year statistical analysis that can be used to evaluate long term nutrient trends. Please note that Lakewatch is not useful for event driven analysis such as an algae bloom or fish kill. Additionally, if information is wanted about dissolved oxygen, pH, clarity, bacteria, algae, etc., an environmental firm or lake management company should be contracted.

2. Request that your lake contractor provide the dissolved oxygen, temperature, pH, and clarity data to you on a monthly basis.
3. Continue and/or expand physical/mechanical harvesting of plants. Although, Kings Lake has had fragmenting submerged aquatic vegetation such as *Hydrilla* and Bladderwort, *Chara* is the most common nuisance plant currently. *Chara* does not fragment and is best managed through mechanical removal and offsite disposal.
4. Use aquatic dyes when mechanical harvesting options are not possible.
5. For optimum lake health and water quality, 30% total cover of each lake should be made up of aquatic plants. This should include littoral plantings which should be a design feature in the same way as any landscape planting bed. Use landscape design principles and the additional information on littoral plantings found in **Appendix A**.
6. Planting projects in Duchess Lake are more complicated since it is surrounded by private single-family homes. Implement an incentive program that will encourage homeowners to [create rain gardens](#) or [landscape buffers between homes](#). Find interested homeowners that will allow backyard conversions of the lake banks. A couple good example lots might lead to other interested neighbors converting their yards.
7. Identify properties with erosion occurring under turf by walking all lake banks. Encourage owners to plant a buffer higher on the bank and add more plants in those locations. Doing this will slow the flow of water from the lot and decrease erosion.
8. Contact [Collier Mosquito Control District](#) (239-436-1000) for assistance with mosquito control. Free mosquitofish are currently available to stock the lakes.
9. Discourage residents from feeding the wildlife. The increased bird (often exotic) population leads to bacteria pollution and increased foraging that can damage newly installed lake plantings.
10. If there are concerns about muck, review the Hagan Engineering September 2011 report. Use the [Beginner's Guide to Water Management](#) to understand muck deposition. Dredging is often not warranted until poor water quality results in regular algae blooms and fish kills. Other nutrient management strategies should be evaluated prior to dredging. Obtain the GPS coordinates from the work done for the existing Hagan report. Use the depths and coordinates to build a proper bathymetry of the three lakes studied prior to dredging.
11. If chemical treatment of algae is required, do not use copper-based algaecides unless there is no other option. Copper is a heavy metal that has degraded the health of the waters downstream of the Kings Lake community.

12. If water trend data shows that the lakes have depleted dissolved oxygen then [aeration](#) can be helpful, particularly in waterbodies that are over 10 ft deep. If aeration is planned in the future, the Hagen 2011 report should be used for picking the locations. i.e. Prince Lake may not benefit from aeration since it's quite shallow. Aeration of Kings Lake would be best in the northeastern region of that lake whereas the northern most area would be most beneficial in Duchess Lake.
13. If water trend data shows the lakes have excess nutrients, dissolved oxygen impairments, or clarity issues, [circulation](#) can be beneficial. Long distance circulators work in deep and shallow ponds. They inhibit mosquitos, reduce muck and nutrients, and increase dissolved oxygen and water clarity.

Landscape Management:

1. Stop irrigation overspray into lakes or hard surfaces. Irrigation overspray was observed during the site visit, this is a violation of the [local irrigation ordinance](#) and is a primary cause of algae in lakes. Irrigation contractors should keep the common area irrigation systems maintained to minimize overspray. Encourage homeowners to do the same. Ongoing violations of the irrigation ordinance should be reported to Utility Code Enforcement at (239) 252-2380 or Collier 311.
2. Replace invasive plants such as the oyster plants and umbrella trees (near front entrance and tennis courts) with Florida Friendly Landscaping™ ([FFL](#)). Landscaping was only evaluated in the common areas near the front entrance and the tennis courts; therefore, other invasive plants may be present. Shade tolerant ground cover is recommended for the common grounds around tennis courts. For help with FFL projects, contact UF/IFAS staff at (239) 252-4800.
3. Verify that the fertilizer being applied throughout the community has zero phosphorus or the area has a recent soil test showing that phosphorus is needed. This is required by the [Collier County's Fertilizer and Urban Landscaping Ordinance No. 2019-18](#). The recommended fertilizer formula for the entire landscape is 8-0-12 + micronutrients. Do not over apply fertilizer. Application of a proper fertilizer product two or three times a year should meet most landscape nutrient needs.
4. Actively verify that landscape professionals applying fertilizer (in common areas and for single family homes) are Green Industry Best Management Practices (GI-BMP) certified. The Fertilizer Ordinance requires that every individual fertilizer applicator must have this certification or the associated license on their person while applying fertilizer. This can be verified at www.dontoverfeed.com. Kings Lake maintenance staff should also have the GI-BMP certification.
5. Although there are many signs in Kings Lake, pet waste disposal is not convenient. Find locations to install pet waste bags and trash receptacles to promote proper disposal.
6. Provide oversight to single family home landscaping practices. Ideas include:

- a. Consider providing an approved list of landscape contractors that are knowledgeable about landscaping, the impacts landscaping has on the stormwater lakes, and the Fertilizer and Irrigation Ordinances. Creation and maintenance of this list could be part of the tasks performed by the landscape committee.
- b. Develop a model landscape contract for common areas and single-family homes. Use the UF/IFAS model, [FFL Management Contract](#) as a guide. This model clearly outlines landscape methods that will protect stormwater and improve lake health.
- c. Create a landscape education and enforcement team to monitor streets for grass clippings and over-irrigation.
- d. Ensure, per state law and local ordinance, that all automated irrigation systems have a [functioning rain sensor](#) and no irrigation is occurring while it's raining.
- e. Encourage FFL practices such as minimizing St. Augustine grass and replacing it with [groundcovers](#) that require less fertilizer and irrigation.
- f. Create an incentive program for single-family homes to modify landscapes near stormwater inlets and roads. Nutrient needy fruit and palm trees are not ideal near hard surfaces or inlets. Such plants often need regular fertilization and pesticide applications. Help with identification of problem sites can be coordinated through UF/IFAS Extension (239-252-4800).
- g. Schedule a FFL for Homeowner's Associations workshop for the community. Contact UF/IFAS to schedule (239-252-4800) and/or encourage the community to attend FFL relevant [UF/IFAS workshops](#).

General Recommendations:

It is crucial to understand the connection between the landscape maintenance and the lakes. Maintaining a healthy lake is impossible without proper practices and management of the landscape. There must be coordinated efforts between all the entities that manage those parts of Kings Lake.

1. Communicate with both the landscapers and lake maintenance contractors about your goals and expectations. Communicate what activities are being done and the reasons for doing so with the residents.
2. Incorporate as many of the Florida-Friendly Landscaping practices as possible and become a [FFL Certified Community](#).

3. Use dontoverfeed.com to find classes on GI-BMP and understand the local fertilizer regulations.
4. Get the community involved to place inlet markers (Figure 4) on storm drains, especially in the high traffic areas of the neighborhood. This will inform the community that stormwater drains to the lakes. All supplies for installation can be obtained from Pollution Control staff (contact Kamila Perez or Samantha Gibson 239-252-2502).
5. Evaluate the condition of all gutters and downspouts, especially on waterfront properties. Downspouts can be directed to vegetated buffers or rain gardens prior to flowing into the lake. This will allow for nutrient uptake by buffer plants prior to discharge to the lakes. Slowing the flow from the landscape will also help reduce erosion.
6. Manage nutrient inputs across the entire landscape. All vegetative materials contribute nutrients when they decompose. Ensure that grass clippings and leaf litter are not entering the inlets.
7. Contact Pollution Control if additional brochures, flyers, or education is needed for the community. Presentations can be catered to individual community needs and conducted at HOA meetings.
8. Contact us at Pollution_Control@colliercountyfl.gov, 239-252-2502 or visit our website www.LiveGreenSaveBlue.com for additional resources.



Figure 4: Example inlet marker

Appendix A: Littoral Shelf Plantings

When planting littorals:

1. Make littoral plantings a design feature and incorporate general landscape design techniques. A variety of color, texture, and dimensions can make the littoral landscape beds more aesthetically appealing.
2. Communicate. Although treating exotics such as torpedo grass is good, overtreatment or non-specific treatment will kill the good, new, and bad littoral plants. Before planting, speak with both the landscapers and lake maintenance contractors to ensure that accidental herbicide application does not occur.
3. Prior to planting, assign a long-term maintenance and management of the littoral plantings to a specific entity. Many lake managers are not accustomed to weed removal or herbicide application in littoral shelves. Similarly, many landscape contractors won't perform tasks near water.
4. Always consider the maximum plant height and width before installing plants. Obstructed views can lead to community complaints.
5. Be mindful of the time of year that you begin planting. Rapidly rising water levels in the late spring can drown freshly installed plants. The dry season may kill plants due to lack of water. Newly installed littoral plants should be carefully maintained and monitored for sixty days after planting in the same manner as any landscape bed.
6. [Test the soil](#) along your lake banks prior to planting littorals. Nutrient deficiencies in soil will affect littoral plant health.
7. Whenever possible obtain a warranty on plant installations.
8. Use the [Florida Association of Native Nurseries](#) website to locate native plants from nurseries around the state. Use the scientific names provided. Even Central Florida plant species do not always do well in the subtropical climate of Collier County.
9. Plant diversity is essential for visual appeal and it creates a stronger habitat. Monocultures of any one plant can lead to landscape devastation if a particular pest gets established. Incorporate a variety of species native and FFL alike.
10. For littoral plantings, use woody trees and shrubs that will live longer, absorb more nutrients, and prevent erosion by stabilizing soils.

11. Install test plantings prior to a large-scale planting project. Test plots can help guide plant choices and proper placement of plants.
12. Do not over prune grasses. Annual spring pruning after florescence is more than adequate. Many grasses will reseed if allowed.
13. Build up to the 30% total lake coverage of plants. An initial goal for lake health and visual appeal can be 10% of the shoreline planted with native and FFL plants.

Rough calculations of the total lake perimeter are approximately 15,582 linear feet. 10% of the shoreline would be 1,558 feet of planted shoreline. The 10% coverage should include a variety of plants not just a linear swath. These calculations do not take current plant density into account. An environmental consultant or engineering firm can be consulted if an accurate plant coverage assessment is desired.

14. The proposed planting figure below (Figure 5) offers potential locations for concentrating littoral plants. These regions were picked based on shoreline imagery, proximity to structures, and aesthetic value. Community buy-in is strongly suggested before deciding on final planting areas. Woody plants are great options to mix with the current aquatic vegetation. Installing a canopy of



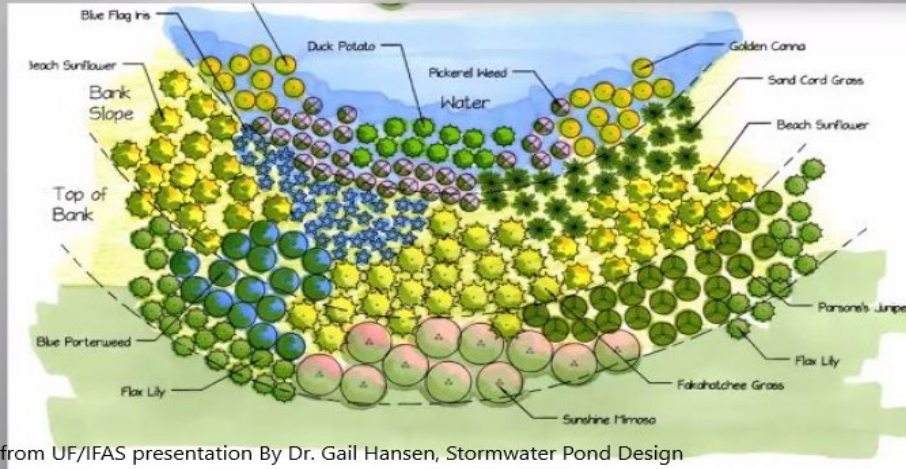
Figure 5: Proposed planting areas

Sabal Palms and Royal Palm ([Roystonea regia](#), Zone C or D) will offer layers and texture to increase visual appeal. Other subcanopy options include: Dahoon holly ([Ilex cassine](#), Zone C or D); Button bush ([Cephalanthus occidentalis](#), Zone C); Silver Sea Oxeye ([Borreria arborens](#), Zone C); and Leather fern ([Acrostichum danaeifolium](#) or [Acrostichum aureum](#), Zone A or B).

15. Herbaceous options include: Florida Gamagrass ([Tripsacum floridanum](#), Zone D); Muhly grass ([Muhlenbergia capillaris](#), Zone D); Cord grass ([Spartina patens](#) or [S. bakeri](#), Zone D or C); Scorpion's Tail ([Heliotropium angiospermum](#), Zone D or C); and Duckpotato ([Sagittaria latifolia](#), [Sagittaria lancifolia](#) Zone B).
16. Instead of installing more spikerush consider a Juncus species (Zone C or B). [J. roemerianus](#) is planted most often but [J. megacephalus](#) and [J. effusus](#) recruit naturally. They often don't prefer to be as deep as spikerush so a combination of the two will offer color and texture contrast.
17. For the shallow Prince Lake consider installing waterlilies. Lilies typically appeal to more people than dense mats of *Chara*. Lily species to consider include: [Nymphaea odorata](#), [N. Mexicana](#), [N. elegans](#) and [Nuphar advena](#). The lilies will decrease the sunlight *Chara* needs to thrive.
18. Additional attractive species to consider in the upland regions along with the littoral plantings include: [Dwarf Firebush](#), [Jatropha](#), [Horizontal Cocoplum](#), [Dune Sunflower](#), [Pineland Lantana](#), [Sunshine Mimosa](#), [Necklace pod](#), [Heliconia](#), [Coreopsis lanceolata](#), [Asclepias spp.](#), [African Iris](#), and the [native Blue Porterweed](#).
19. Use the gentle slope diagram below (Figure 6) as a proposed planting guide. All of the lakes in Kings Lake have gentle slopes that should allow a variety of plants.
20. Use pine straw mulch to define landscape beds and provide a structured appearance for the planting beds. Unlike other mulches, pine straw will not easily float away when water levels rise.

Gentle slope:

- Beach Sunflower
- Blue Flag Iris
- Blue Porterweed
- Fakahatchee Grass



Slide taken from UF/IFAS presentation By Dr. Gail Hansen, Stormwater Pond Design

Figure 6: Example littoral planting design

21. Consider adding architectural features (Figure 7) along with the littoral plantings for Area 4 & 6. Those areas in particular could easily be transitioned into scenic park type areas. Bench seats and similar architectural features will make the areas feel more like a park and increase community appeal.



Figure 7: Example photo of possible scenic design

22. Additional planting and design resources include:

- a. [Landscape Design: Analyzing Site Conditions ENH1165](#)
- b. [Florida Friendly Plants for Stormwater Pond Shorelines ENH1215](#)
- c. [Littoral Zones Website](#)
- d. [General Guidelines for Planting a Littoral Zone \(Table 1\)](#)

Appendix B: Contacts and Contributors

Chuck Nuechterlein, HOA Master President
kwnuech@gmail.com

Bill Wolfenden, Lake Committee Chair
billwolfenden1@gmail.com

Nancy Payton, Lake Committee
nancyannepayton@gmail.com

Mary LeGault, Lake Committee
marylegault@comcast.net

Anthony Phillips, Kings Lake Property Maintenance
phillipsaw2280@gmail.com

Dean Crivellaro, Lake Manager
Ecological Control & Management, Inc.
ecocntmgt@yahoo.com

Joseph Molter, Landscape Manager (Common grounds only)
Molter Landscape
molterlandscape@gmail.com