

# KINGS BAY

## RESTORATION PROJECT

*Kings Bay Restoration Project  
Produces Immediate Results  
For Outstanding Florida Waters*

### **ANNUAL REPORT 2016-2017**

[www.KingsBayRestorationProject.com](http://www.KingsBayRestorationProject.com)  
[www.SaveCrystalRiver.com](http://www.SaveCrystalRiver.com)





“Kings Bay and The Crystal River is an Outstanding Florida Water. They are also a Priority Water Body for the Southwest Florida Water Management District. This special designation comes with special responsibilities.”



# Saving Our Natural Resources

**W**e love our environmental treasures. Our appreciation is far beyond the value to our quality of life. We swim, boat, ski, fish, scallop, watch, photograph and appreciate the wildlife and landscapes that let us move beyond busy lives and daily demands into something bigger and more beautiful.


This Outstanding Florida Waterway will be outstanding again.

Over the years, Kings Bay and Crystal River have been threatened, diminished and impacted by an overgrowth of an invasive algae—*Lyngbya*.

But, we're changing that. With the resources and support provided by public and private sector partners and the community we're attacking the things that negatively impact Kings Bay, Crystal River and the one-of-a-kind springshed that comprise this coastal system. We're removing the toxic algae that blocks sunlight and depletes oxygen in the water choking native grasses and aquatic life while reducing habitat and food for fish, turtles, manatees and the other living things that need clear water and sunlight to live.







“Kings Bay and Crystal River are the only place in the United States where visitors can legally swim with manatees. Families, visitors, and local residents enjoy this unique opportunity along with scalloping, fishing, canoeing, kayaking and a wide variety of coastal activities.”

## Fact:

Clean water and a healthy shoreline pumped \$200+ million into Citrus County in 2015. This translates into significant tax revenues for the State of Florida.

## Heritage & Economy

Crystal River is a community defined by water. It starts with the river for which the city is named and includes the natural wonder at its heart — Kings Bay.

- Kings Bay is fed by 70+ springs and more than 40 seeps that feed 600 million gallons of fresh water a day into this incredible body of fresh water sitting only 6 miles from the Gulf of Mexico.
- It is a first magnitude Florida spring system
- Kings Bay is a leading winter refuge for the Florida manatee.

These natural resources are our heritage, but they are also key to our economy. Kings Bay, Crystal River and the springs that comprise our 600-acre watershed are the heart of our economic vitality; tourism, restaurants, boating, fishing, canoeing, kayaking and more. Crystal River is also the only place in the United States where visitors can legally swim with manatees.



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# Before

## What Happened to the Water in Kings Bay?

During the 1993 “No-Name” storm, salt water killed acres of invasive *hydrilla* that was choking the bay. But, when it died and fell to the bottom, it completely covered the native grasses. The dead material decayed and bacterial decomposition created a low oxygen environment. This was the perfect condition for the invasive blue-green algae called *Lyngbya* to invade and quickly cover the bottom with its slimy filaments and prevent the native grasses from returning.

*Lyngbya* creates many problems such as:

- Reduces oxygen in the water due to the decomposition process
- Turns the water cloudy and green when numerous filaments break apart & float to the surface
- Clogs springs and reduces water flow
- Blocks sunlight and crowds out native grasses that provide food and shelter to manatees & other wildlife
- Toxic if ingested by manatees or pets
- Produces a “rotten egg” smell
- Gives some people skin rashes and respiratory problems

The bottom line: *Lyngbya* provides an unhealthy habitat for fish, shellfish, crabs, and people. Doing so impacts recreational and commercial fishing, crabbing, and enjoyment of the natural resources.





# After

## How Does Native Eelgrass Help Solve this Problem?

Once the *Lyngbya* and dead detrital material is vacuumed from the bottom of a restoration area, a native variety of eelgrass called “Rock Star” is planted in the clean sand.

Once the planted eelgrass begins to flourish, the habitat begins to change:

- The eelgrass produces large quantities of oxygen needed by aquatic animals into the water.
- Oxygenated water inhibits *Lyngbya* growth because *Lyngbya* can't survive high oxygen conditions.
- Eelgrass outcompetes *Lyngbya* for nutrients in the water taking up nitrogen and phosphorus – improving water quality.
- Native grasses provide food and shelter for thousands of aquatic organisms.
- And, once roots are established and interwoven, it is difficult for herbivores to damage and remove the grass beds.

The result is a meadow of beautiful, undulating grass that creates a healthy habitat in the clear, clean water.





# Follow the Restoration Process



## Remove

*Lyngbya* is hydraulically vacuumed from the river bottom and transported to land via floating hoses for processing.



LEFT: *Lyngbya* is mechanically separated from other suspended material. RIGHT: The remaining liquids are filtered through Geotube bags where a patented polymer mixture is added to facilitate removal of nearly 100% of the phosphorus and about 50% of the nitrogen from the water. Clean water escapes through tiny mesh holes and is collected and returned to the river.

## Aerial View of the Project





# Restore



Rock Star Eelgrass plants are planted in small groups in the clean sand and covered by cages to protect them from predators until their roots become established. The plants will grow up to 7 feet in all directions. The roots intertwine to secure Eelgrass in the soil. Areas that are too shallow for the use of cages, are planted using a specially developed pelletized plant with a patented vessel called a Jeb Boat.

# Maintain



Monthly maintenance of the cages is done by hand and by divers using a suction hose to clean excess algae growth and *Lyngbya* from them. This allows light to penetrate the cages and reach the grass leaves. Any damaged or overturned cages are repaired or replaced.



# *Another patented process breaks ground in Crystal River*



Some areas are too shallow to use protective cages. So, special planting pellets were developed for these areas to enable mass planting. A patented Jeb Boat mechanically plants the eelgrass pellets in the shallow area.







# Fact:

Underwater grasses are crucial to the health and cleanliness of a water body.

- Filters the water, removing excess nutrients
- Generates oxygen used by aquatic animals
- Reduces erosion
- Provides food and shelter for fish, shellfish, and other aquatic life





# The Science, Ecology, And Economics Behind The Project

## **FAQ: What is so bad about *Lyngbya*?**

According to a 2014 study published in The Society for Freshwater Science, the abundance of *Lyngbya* in a water body coincides with a decreased carrying capacity for fish and significantly alters the dynamics of freshwater ecosystems (Hudon, et. al. 2014) *Lyngbya* and the decaying detrital material on the bottom of the river reduces the amount of sunlight essential to the growth of native grasses.

## **FAQ: Why is planting native grass important in Kings Bay?**

Estuarine habitats are among some of the fastest disappearing ecosystems on earth (Mcleod et. al., 2011) The reduction in seagrass beds lowers nature's capacity for carbon storage which has serious implications for human populations that depend on these ecosystems for food, livelihoods, and coastal protection. A 2016 study by researchers at MIT Sea Grant, EPA, Boston University, and others found that as a whole, mangrove, salt marsh, and seagrass ecosystems are estimated to be disappearing from 2 to 15 times faster than terrestrial forests.

## **FAQ: Why was “Rock Star” eelgrass selected to be planted in the Kings Bay Restoration Project?**

The eelgrass used in the KBRP is a salt-tolerant freshwater species that survived high salt concentrations and turbidity from Hurricane Hermine in September 2016. The Rock Star eelgrass beds recovered quickly after exposure to events like unnaturally high salt water, high turbidity, and increased nutrient exposure. (Caloosahatchee River Science Workshop Nov. 2013)

## **FAQ: What kinds of planting units were used in the Kings Bay Restoration Project & why?**

There were three different types of planting units used in the project: 4” peat pots, peat pellets, and GrowSAV Safe Pots. Once the detrital material and *Lyngbya* were removed to expose the natural sand sediment, 4” peat pots were planted and covered with protective herbivory exclusion cages. In areas too shallow to allow the use of protective cages, specialized pellets of grass were planted in thick groups using a patented planting vessel called a Jeb boat. And, in areas where the soil was too loose to hold the peat pots and grass pellets, a patented planting device called a GrowSAV Safe Pot was used to anchor the grass into the soft soil until the roots could get established, preventing fish, crabs, and other predators from pulling the units from the soil.





**FAQ: What's been done to ensure the eelgrass can become established?**

Key to the success of the KBRP was the use of the patented herbivory exclusion cages, especially to protect the newly planted grasses from manatees. A 2004 study in Kings Bay published in the *Journal of Plant Management* indicated that the success of any future larger-scale transplant efforts in Kings Bay is contingent upon adequate protection from manatees. (Hauxwell, et. al, 2004.)

**FAQ: Why is eelgrass important to the ecosystem food chain?**

Seagrasses produce large amounts of oxygen and harbor millions of microscopic plant and animal plankton that form the basis of the aquatic food chain. Zooplankton (microscopic animals) live in grasses and are an essential link in the food chain. The more eelgrass we plant, the greater the abundance of zooplankton. The result is a substantial increase in the health and biodiversity of the ecosystem. Zooplankton love to eat algae. The more zooplankton, the better the water clarity. One acre of seagrass can support 5 million grazers that remove algae and excess nutrients from the water column. (Hoffman, et.al., 2010).





**FAQ: What are some of the benefits of these critical grass fields?**

Grass beds provide nursery areas and feeding grounds for many species of fish including those of commercial and sports fishing value. Seagrass meadows provide homes for fish and shellfish, trap valuable sediment and provide critical benefits such as maintenance of biodiversity, water-quality control, & shore-line protection that are directly used or beneficial to humans. Grass meadows remove and recycle excess nutrients such as Nitrogen and Phosphorus from the water column, provides habitat and protection from predators for more than 44 species of fish, and a natural carbon sink in both plant tissue and sediments, reducing the effects of climate change. In fact, the presence and abundance of seagrasses are indicators of the overall environmental quality of an ecosystem. (Terrados and Borum)

**FAQ: How much food can a meadow of seagrass provide?**

According to the Smithsonian Marine Station at Fort Pierce, a single acre of seagrass can produce over 10 tons of leaves per year. This vast biomass provides food, habitat,

and nursery areas for a myriad of adult and juvenile vertebrates and invertebrates. Further, a single acre of seagrass may support as many as 40,000 fish, and 50 million small invertebrates. Because seagrasses support such high biodiversity, and because of their sensitivity to changes in water quality, they have become recognized as important indicator that reflect the overall health of coastal ecosystems.

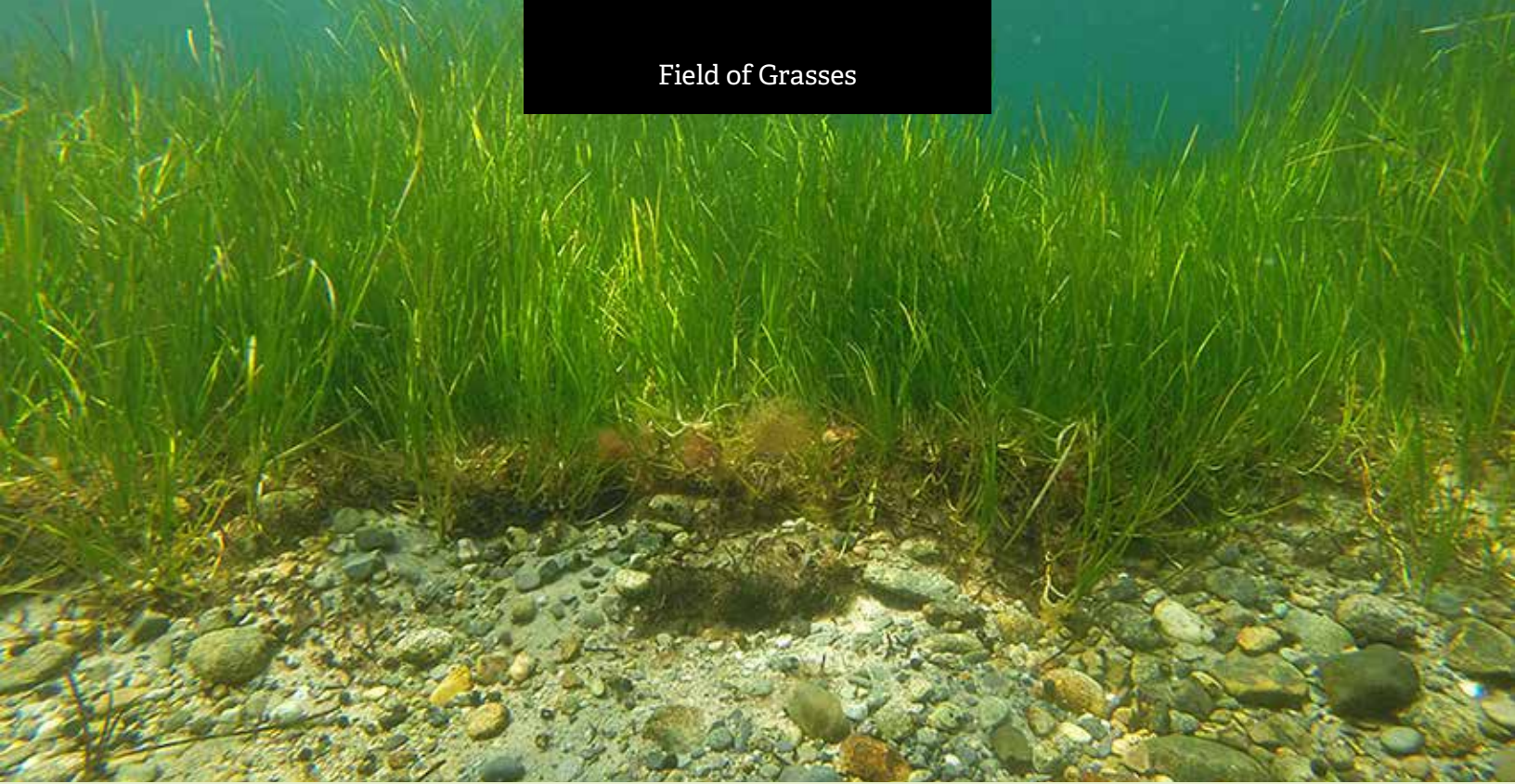
**FAQ: How does the loss of seagrass affect a community economically?**

Economically, Florida's 2.7 million acres of seagrass supports both commercial and recreational fisheries that provide a wealth of benefits to the state's economy. According to the Florida Dept. of Environmental Protection, Florida's seagrass beds supported commercial harvests of fish and shellfish valued at over \$124 billion. They estimated that each acre has an economic value of approximately \$20,500 per year, which equals \$55.4 billion annual to the state.

**FAQ: How does opening spring vents help get rid of *Lyngbya*?**

The Kings Bay Restoration Project has resulted in the opening of more than 100 new spring vents, creating an inhospitable environment for *Lyngbya* growth. Increasing flow velocity in Florida spring systems has been found to have a negative impact on *Lyngbya* growth in the Florida Spring Systems even in the presence of higher nitrogen content (King 2012).





**FAQ: Is the Kings Bay Restoration Project process working?**

The Kings Bay Restoration Project is working! The results of the first year's monitoring indicated that most of the entire planting unit deployment survived the transplanting process (97% survival). This survival rate is better than the average global success rate for transplanting seagrasses, considered to be  $\leq 50\%$  (Fonseca et al. 1998). The initial biological response of transplanted eelgrass indicate that the relocation methods were successful in alleviating undue stress and, at one year, the survival rate of relocated plants exceeds the target rate of 80%. Other indicators of success include:

- The protective exclusion cages were effective at protecting the new grasses from herbivory.
- All three forms of plantings (peat pots, peat pellets, and specially designed inverted peat pots called Safe Pots) are expanding beyond their original planting sites. Vegetative runners extend well beyond the cage limits.
- Over the entire site, SAV cover was generally above 50%.
- The biological survey data shows no signs of plant stress to inhibit growth.
- Grasses are absorbing dissolved nutrients from the water, evident by high level of growth rate and leaf production.
- Leaves and Rhizomes are generating oxygen bubbles which inhibits *Lyngbya* growth.
- Plants are providing habitat for small grazers (zooplankton & invertebrates)
- Plants are providing forage for herbivores
- We are seeing increased animal utilization of the restored areas
- Numerous species of fish & crustaceans have now been observed to inhabit restored areas including: mullet, snook, snapper, tarpon, redfish, bass, gar, panfish, trout, catfish, blue crabs, sheepshead, crayfish, shrimp, etc.

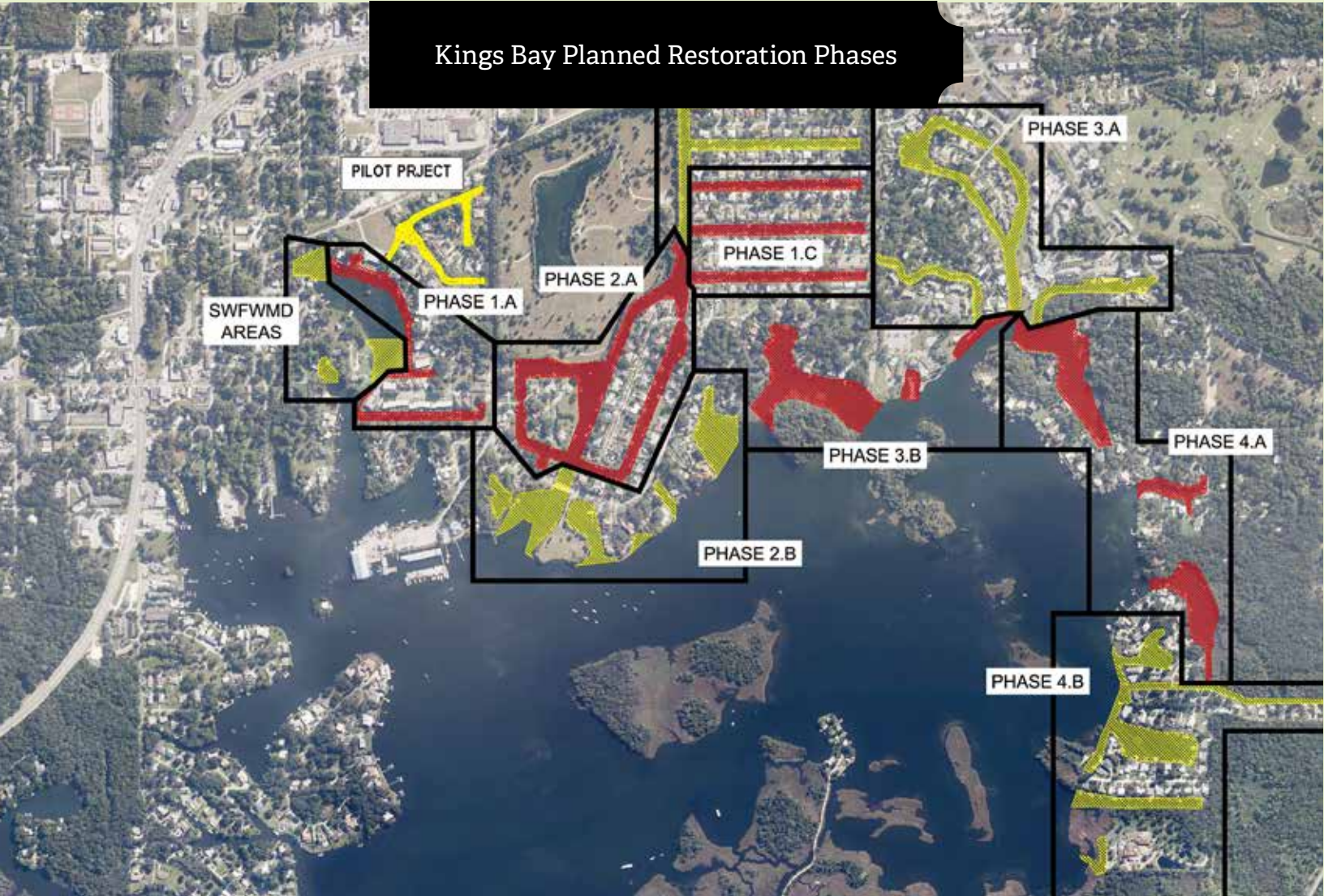


**FAQ: What is one of the biggest problems faced during the restoration effort?**

According to the Smithsonian Museum of Natural History, boat anchors and propellers can leave "scars" in a seagrass bed—killing sections of the seagrass and fragmenting the habitat. This fragmentation of seagrass beds can increase erosion around the edges. The Florida Keys National Marine Sanctuary and NOAA note that propeller damage will fragment the grass bed and severely restrict the movement of marine wildlife. This can create barren areas where aquatic life once flourished. Carelessness can quickly impair this precious resource – a propeller scar cut into seagrass today can be identified for up to seven years or longer.

**FAQ: What's Next?**

Save Crystal River's restoration project includes more than 80 acres of residential canals. To date, we have completed the restoration of approximately 11 acres in the Hunter Springs Basin area and surrounding canals. The next phase of restoration is scheduled in the 7 canals adjacent to Three Sisters Springs, a major first magnitude springs and a primary manatee wintering site.







## Fact:

At the bottom of the aquatic food chain are microscopic animals called zooplankton. Zooplankton live in abundance in eelgrass and are an essential link in the aquatic food chain. The more eelgrass we plant, the greater the abundance of zooplankton. The result is a substantial increase in the health and biodiversity of the eco system. One of the foods Zooplankton love is algae, the more zooplankton the better the water clarity. Seagrass beds provide nursery areas and feeding grounds for many species of fish including those of commercial and sports fishing value.



## Fact:

- More than 11.62 acres of canals restored – about 9 football fields
- 16,279+ cubic yards of *Lyngbya* removed
- 37,932 native “Rock Star” plants planted
- More than 100 new spring vents opened and identified
- Pilot Project grasses withstood Hurricane Hermine & saltwater intrusion



## The Results

The Kings Bay Restoration Project produces immediate results for Outstanding Florida Waters.

Some of the indicators of project success include: improved water clarity, decreased invasive algae in areas populated by eelgrass, spreading fields of desirable submerged aquatic vegetation, greatly increased numbers and variety of fish species in restored areas, and the ecosystem and aquatic food chain is becoming healthy again. As the beauty and health of the river improves, so will the economy that depends on it.



# Saving Crystal River For Generations To Come

Our community is collectively focused on education, outreach and action. From top to bottom, east to west, north to south we're working in neighborhoods and in our own homes and businesses to make sure that our resources are restored and protected.

Some of what we've done:

- Citrus County Commissioners passed a stronger fertilizer ordinance.
- City of Crystal River has eliminated septic tanks along waterfront properties & installed a central sewer system throughout the city.
- Stormwater projects have helped control run-off into the bay.
- A pipeline from the City of Crystal River water treatment and re-use project will transport wastewater to Duke Energy to eliminate pumping thousands of gallons of water every day from the aquasphere.
- New construction laws require homeowners to build swales preventing yard debris and runoff from discharging directly into the river.
- Dive shop owners are putting aquariums of eelgrass in their businesses to help educate the public about the restoration project.





*Duke Energy's Mariculture Center provided eelgrass and instructions to residents for planting in the waterways behind their homes.*

All 600 students at Crystal River Primary School spent EcoWeek learning about eelgrass. Every classroom is now growing an "Eelgrass Farm". Nearly 2,000 plants from the school will be planted near Hunter Springs Park in Kings Bay by 5th graders in May.



Volunteers from META joined with SCR and Duke Energy's Mariculture Center to rake *Lyngbya* and plant eelgrass.



Duke Energy's Mariculture Center provided eelgrass and instructions to residents for planting in the waterways behind their homes.



Gator Dredging, SCR, and Sea & Shoreline held numerous onsite tours for individuals interested in how the Kings Bay Restoration Project works.



# Working With The Community To Restore Kings Bay

## EcoWeek

Crystal River Primary School has achieved the Green Flag Award from the National Wildlife Federation. This school is one of the very few in the state to achieve this award. As a focus for community engagement, these students and their teachers have enthusiastically embraced their ownership for the future of our resources. For one full week, we worked through show and tell, songs and activities that allowed students to see what happens to our Outstanding Florida Waters. These are the stewards of tomorrow. These students now know how their commitment will shape the future of the water and our community.

## Eelgrass Event with Duke Energy

Duke Energy has been a tireless supporter of cleaner coastal water. They have hosted, along with Save Crystal River community events to educate and engage the people who live on the water and the people who don't. During this event, volunteers taught Citrus County coastal residents how to harvest, grow and plant eelgrass. This eelgrass was grown in mats at Duke Energy's Crystal River Mariculture Center and transported to Kings Bay Park for the event. The Duke Maricultural Center has grown thousands of eelgrass plants for coastal residents to plant in the water of their "back yard."

## Eelgrass Planting Event with META

The Manatee Eco Tour Operators Association (META) understand both the ecological and the economic importance of restoring and maintaining the Kings Bay ecosystem. META volunteers joined Duke Energy, Save Crystal River, and volunteers from the US Fish and Wildlife Service to rake and remove detrital material from approved areas and plant large quantities of eelgrass provided by Duke Energy in several designated locations under the jurisdiction of the wildlife service. Several META members have also helped educate students at the primary school during EcoWeek and have planted eelgrass aquariums in their tour shops to educate visitors about the importance of the restoration project.

## Tours of the Site

Local city and county officials, House and Senate elected officials, State Agencies, Local and State civic groups and associations toured the Project site to understand the process and the benefits first hand.





*From Sun Rise to Sun Set, the beauty above the water in Kings Bay is now being reflected below. Thank you to all who support and participate in this effort to make the Kings Bay Restoration Project a reality.*



# THANK YOU TO OUR SPONSORS, PARTNERS & SUPPORTERS



Sea and Shoreline llc.

Florida Department of Environmental Protection  
Southwest Florida Water Management District  
Duke Energy  
Gator Dredging  
Sea & Shoreline, LLC  
Riegel USA  
Citrus County School System  
Citrus County Board of County Commissioners  
City of Crystal River  
Ground Fog Productions  
WEDU  
Citrus County Chamber of Commerce  
Citrus County Tourist Development Council  
Citrus County Chronicle  
Kings Bay Rotary Club  
Manatee Ecotourism Association (META)  
Homosassa River Restoration Project

## 2016 Mayor's Award and City of Crystal River Mayor's Proclamation in Support and Appreciation of Save Crystal River's Work on the Kings Bay Restoration Project

### LETTERS OF SUPPORT RECEIVED FROM:

Hernando County Board of County Commissioners  
Marion County Board of County Commissioners  
Crystal River Main Street  
Economic Development Council  
Senator Jack Latvala  
Senator John Legg  
Seven Rivers Community Hospital  
US Fish and Wildlife Service  
SWFWMD  
WEDU-TV: Featured Kings Bay Restoration Project  
on their Science Series,  
Quest  
Citrus County Chamber of Commerce

Citrus County BOCC Commissioners  
Citrus County School Board  
Citrus County Tourist Development Council  
Citrus County Chronicle  
Crystal River City Council  
City of Crystal River Waterfronts Advisory Board  
Homosassa River Restoration Project  
Former State Senator Charlie Dean  
Former Representative Jimmie T. Smith  
Manatee EcoTourism Association  
Riegel USA  
Kings Bay Rotary Club



# KINGS BAY RESTORATION PROJECT

## REMOVE

Invasive algae that has overtaken native grasses and habitats

**11.62** acres of canals cleaned ... roughly equivalent to 9 football fields

**16,279+** cubic yards of Lyngbya removed

**95%+** amount of phosphorus pollution removed from treated water tested

**50%+** amount of nitrogen pollution removed from treated water tested

**34** number of weeks for mobilization, vacuum dredging, and planting

## RESTORE

Healthy ecosystems will be replanted into clean canals

**100** new, previously unidentified spring vents opened and flowing  
**37,932** native "Rock Star" grasses planted

## MAINTAIN

Newly planted grasses to prevent recurrence of algae overgrowth

**Improve** water quality

**Provide** food & shelter for native species

**885** manatee friendly patented exclusion cages protecting the grasses

**Pilot Project** withstood Hurricane Hermine and significant saltwater intrusion.

## WHAT'S NEXT?

**About 75**

acres still to be cleaned and restored

**July 2, 2023**

target completion date – Crystal River's 100th Year Anniversary



**Clean Water Means Business**

[www.kingsbayrestorationproject.com](http://www.kingsbayrestorationproject.com)





# OUR GOAL

THIS



Not This



**Clean Water Means Business**



# KINGS BAY

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# RESTORATION

## PROJECT

Visit us for project updates and to see how you too can help

[www.kingsbayrestorationproject.com](http://www.kingsbayrestorationproject.com)  
[savecrystalriver.com](http://savecrystalriver.com)

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