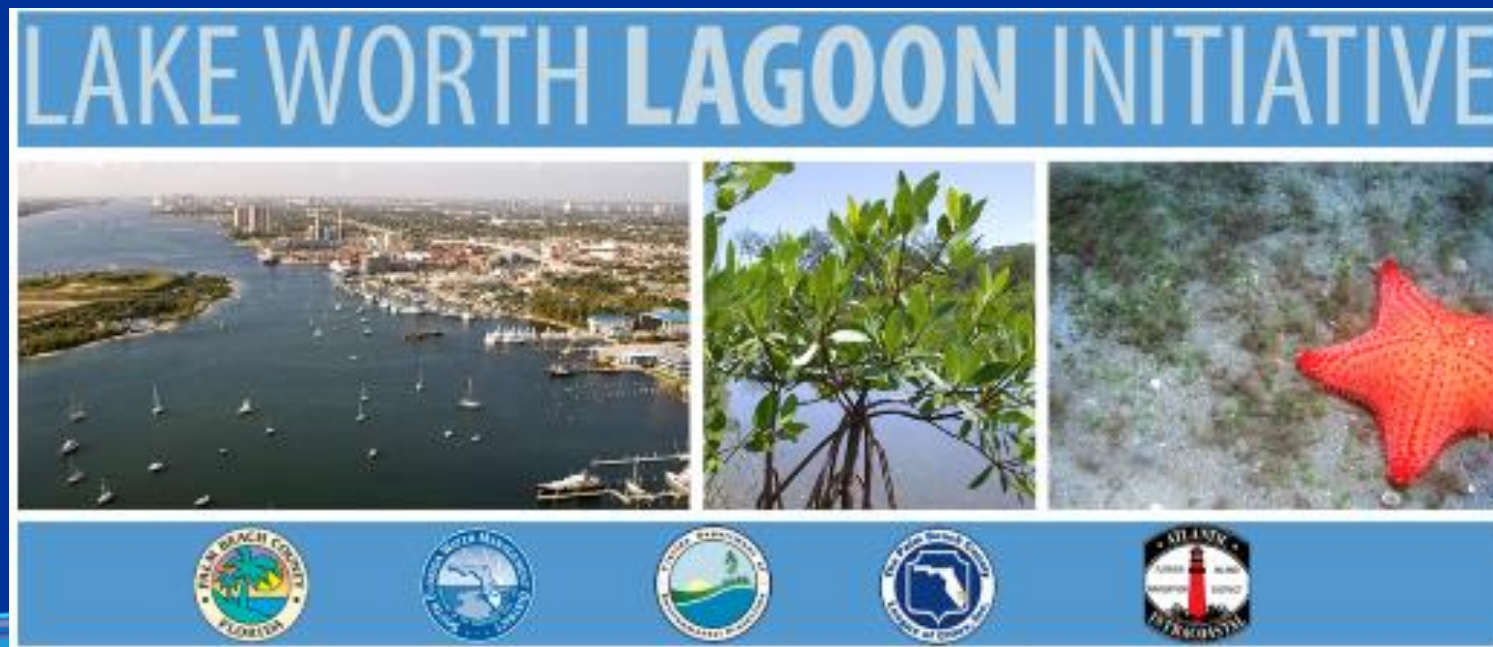


2021 LWL Management Plan and LWLI Legislative Request

April 29, 2021



Mayra Ashton
Palm Beach County
Environmental Resources Management
mashton@pbcgov.org
561-233-2451

2021 Lake Worth Lagoon Management Plan Public Review

The screenshot shows the website for Palm Beach County's Environmental Resources Management. At the top left is the Palm Beach County logo with the tagline "Discover the Palm Beaches... the Best of Everything". A search bar is located at the top right. The main navigation menu includes: Home, Natural Resources, I Want To, Business/Regulation, Lake Worth Lagoon Initiative, Trail Tales, HIDDEN WILD Film, and Contact Us. The central content area features a red arrow pointing to the text "MANAGEMENT PLAN UPDATE". Below this, it states: "The DRAFT version of the Lake Worth Lagoon Management Plan is available for public review. Alternative formats can be provided upon request. Deadline to submit comments via email to mashton@pbcgov.org is May 20, 2021". A large blue banner below reads "LAKE WORTH LAGOON INITIATIVE". Underneath the banner are three images: a wide view of the lagoon with many sailboats, a mangrove tree, and a red starfish on a sandy beach. At the bottom of the page, there are five logos for partner organizations: Palm Beach County, South Florida Water Management District, Florida Department of Environment & Natural Resources, The Palm Beach County League of Cities, and Atlantic Florida Inland District.

**ACCESS PLAN AT
LWLI.ORG**

**DEADLINE TO SUBMIT
COMMENTS - MAY 20, 2021**

**EMAIL COMMENTS -
MASHTON@PBCGOV.ORG**

QUESTIONS- 561-233-2451



lake worth
LAGOON



LAKE WORTH LAGOON **MANAGEMENT PLAN**

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Research and Monitoring

P#
Financing and Implementation

P#
List of Acronyms

P#
Summaries of Action Plan Costs and Timelines

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 Completed Projects P#

 Ongoing and Potential Projects P#

REMAINING
PAGE #S WILL
BE FINALIZED AT
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Green sea turtle swimming in Lake Worth Lagoon. (Photo credit: PBC-ERM)

Cover photo: Sunset view from Singer Island (Photo credit: Kim Seng)



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LAKE WORTH LAGOON WATERSHED MAP



DRAFT

←
Click to toggle between Lake Worth Lagoon watershed map and LWL hydrology map.

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STATE OF THE LAGOON

Highly urbanized and altered by more than a century of human activities to facilitate navigation, flood control and development, the Lake Worth Lagoon is an underappreciated asset. Asked to suggest adjectives that best describe it, participants in a 2020 Lagoon Perceptions and Priorities survey offered words like “forgotten,” “misunderstood,” and “taken for granted.” In a nod to its inherent value, they also noted the Lagoon is “stunning,” “accessible” and “a treasure.”

Originally a freshwater lake, early pioneers followed by community boosters transformed Lake Worth into an estuary. Saltwater from the Atlantic Ocean enters through the Lake Worth and South Lake Worth Inlets. Freshwater is funneled to the Lagoon from three major drainage canals (C-17, C-51, and C-16), which together collect runoff from more than 305,000 acres of land. The C-51 canal alone delivers nearly 60% of the Lagoon’s freshwater flows (see Figure 1.1). In addition, the Atlantic Intracoastal Waterway carves a nautical highway through the entire length of the Lagoon as it traverses the East Coast.

These features have in effect created three sub-Lagoons. The highest ecological diversity and most intense recreational usage occurs in the Northern Lagoon, where the Lake Worth Inlet brings salty and cleansing tides that support large seagrass beds. The Southern Lagoon also benefits from proximity to the ocean, albeit through a smaller, more constricted inlet. Markedly diminished water quality, biodiversity and recreational activities characterize the Central Lagoon, located farthest away from tidal flushing and on the receiving end of most canal freshwater discharges.

The sprawling watershed - 42 times the size of the Lagoon itself, with a 2020 population estimated at more than 1 million - has an enormous impact on the Lagoon’s health, and complicates efforts to manage it holistically. The presence of 30 local municipalities, a large unincorporated area, and multiple federal, state and local water management districts, all contributing runoff to the Lagoon, compound the enormous

challenges confronting Lagoon managers. For decades, water management of the Lagoon watershed has largely focused on its role in flood control rather than its intrinsic ecological value. Dramatic fluctuations in the timing and volume of freshwater discharges result in water that is too



INTRODUCTION

Just 20 miles long, the Lagoon punches above its weight in ecological and economic value. A 2019 Economic Valuation study estimated the value of recreational uses and business activities related to the Lagoon at \$813.9 million per year. The total value of tangible and intangible benefits associated with the Lagoon is estimated at \$5.37 billion.¹

The Lagoon is an aquatic playground for fishing, diving, paddle sports and birdwatching enthusiasts, with a world-renowned SCUBA destination, the Phil Foster Park Snorkel Trail, just steps from shore. It is a nursery and foraging area for threatened and endangered fish and wildlife as diverse as sea turtles, goliath groupers, American oystercatchers and manatees. And it is home to the bustling Port of Palm Beach, ranked among the state’s top five ports in cargo value. The successful co-existence of these distinctly differing personalities in a compact estuary of just 11.3 square miles is a testament to the Lagoon’s resilience.

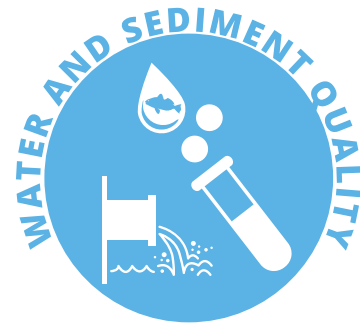


CLICK IMAGE TO ZOOM IN. CLICK AGAIN TO ZOOM OUT.

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INDEX OF ACTIONS AND ACTION PLANS



WATER QUALITY

WQ-1 Expand Water Quality Monitoring **Renamed from 2013 Plan*

WQ-2 Develop a Watershed-Based Modeling Program **NEW*

WQ-3 Implement Best Management Practices for Drainage Canals **NEW*

WQ-4 Monitor and Assess Ways to Reduce Bacterial Contamination and Harmful Algal Blooms **NEW*

WQ-5 Identify and Assess the Impacts of Emerging Contaminants **NEW*

WQ-6 Manage Freshwater Inflows to Optimize Environmental Benefits **NEW*

WASTEWATER

WW-1 Assess and Reduce Occurrence of Sewer Overflows **Renamed from 2013 Plan*

WW-2 Identify Priority Areas for Conversion of Septic Systems to Central Sewer **Renamed from 2013 Plan*

STORMWATER

SW-1 Reduce Stormwater Runoff from Urban Landscapes **NEW*

SW-2 Expand Use of Green Infrastructure and LID Practices **Renamed from 2013 Plan*

SEDIMENT MANAGEMENT

SE-1 Assess and Manage Sediment Loading **Renamed from 2013 Plan*

HE-1 Create, Protect and Monitor Hardbottom Habitats **NEW*

HE-2 Restore, Create and Protect Intertidal Habitats **Renamed from 2013 Plan*

HE-3 Maintain and Expand Seagrass Habitats **Renamed from 2013 Plan*

HE-4 Acquire Ecologically Significant Submerged and Intertidal Lands **Renamed from 2013 Plan*

FW-1 Continue Implementing Palm Beach County's Manatee Protection Plan **Renamed from 2013 Plan*

FW-2 Continue Sea Turtle Monitoring **Renamed from 2013 Plan*

FW-3 Continue Fisheries Monitoring **Renamed from 2013 Plan*

FW-4 Manage and Monitor Shorebird Habitat **Renamed from 2013 Plan*

FW-5 Implement Remote Tracking Technologies for Fish and Wildlife Monitoring **NEW*

CC-1 Conduct a Vulnerability Analysis of Resources at Risk from Climate Change **NEW*

CC-2 Improve Resiliency of Critical Habitats to Climate Change and SLR **NEW*

PO-1 Foster Public Awareness and Engagement **NEW*

PO-2 Promote Youth Education and Engagement **NEW*

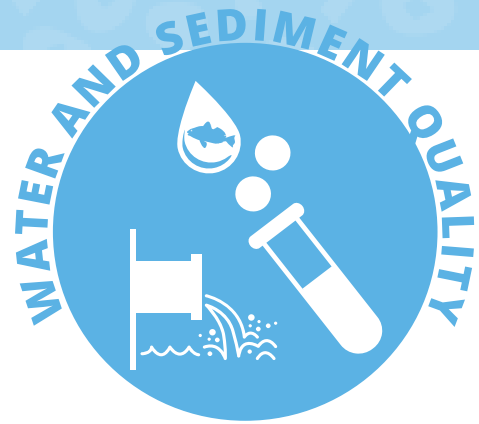


PU-1 Ensure Adequate and Appropriate Public Access to the Lagoon **NEW*

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WATER AND SEDIMENT QUALITY ACCOMPLISHMENTS AT A GLANCE



Two sampling units were installed in 2019 in the Central Lagoon near the C-51 Canal to transmit near-continuous data about salinity and other water quality parameters.

SEE ACTION WQ-1



A nutrient autosampler installed in 2019 at the S-155 structure will facilitate calculations of nutrient loading from the C-51 canal into the Lagoon.

SEE ACTION WQ-1



Health advisories due to bacterial contamination were posted at Phil Foster Park 16 times from 2016-2020—9.9% of the time that samples were taken.

SEE ACTION WQ-4



A 2020 study by a Florida Atlantic University student on the abundance and variation of microplastics in surface waters of the Lagoon found an average of 8.6 microplastic pieces per liter.

SEE ACTION WQ-5



Initial mapping of areas with high density septic systems throughout the County was conducted in 2019.

SEE ACTION WW-2



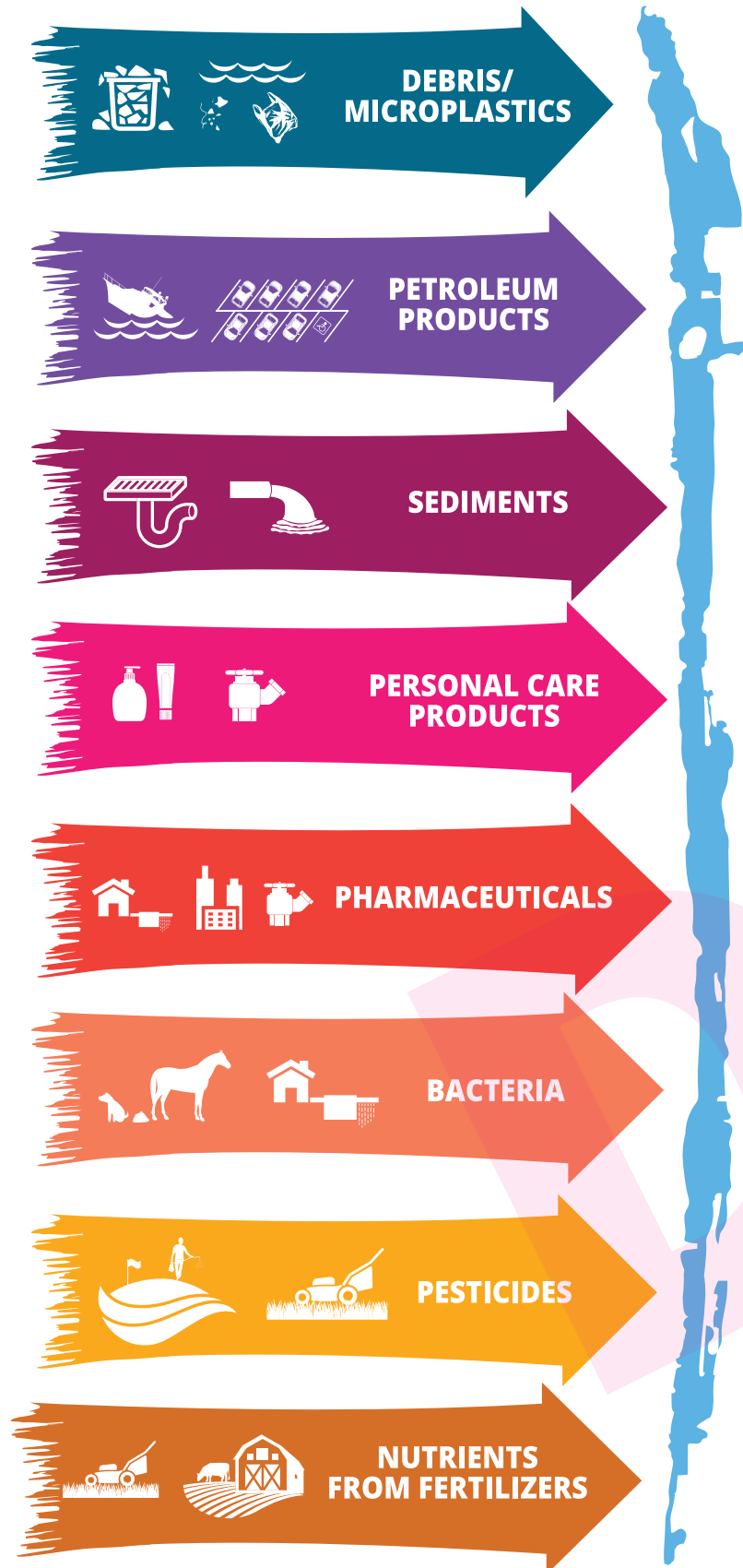
21 projects incorporating Green Infrastructure design elements were completed or underway in Palm Beach County as of 2020.

SEE ACTION SW-2





LAND-BASED SOURCES OF POLLUTION TO THE LAKE WORTH LAGOON



SOURCE: PBC-ERM

WQ-2 DEVELOP A WATERSHED-BASED MODELING PROGRAM

ACTION: Develop a watershed modeling strategy and deploy an appropriate suite of modeling tools to inform management actions that consider the needs of all the Lake Worth Lagoon Estuary’s living resources.

IMPORTANCE:

Modeling that takes into account the full range of parameters that contribute to ecosystem health will enable watershed-scale management strategies that benefit and support the Lagoon’s varied living resources.

RELATED ACTIONS:

WQ-1, WQ-6, SE-1, HE-3

BACKGROUND:

Palm Beach County is committed to a watershed management approach that considers the varied and sometimes contradictory needs of the living resources of the Lake Worth Lagoon. Oysters in the Central Lagoon, for example, benefit from a reliable infusion of freshwater, while turtle grass in the Northern Lagoon requires consistently salty water to flourish.

Development of a comprehensive suite of modeling tools is a critical step in building the robust scientific foundation needed to determine optimal conditions for diverse species, and to implement

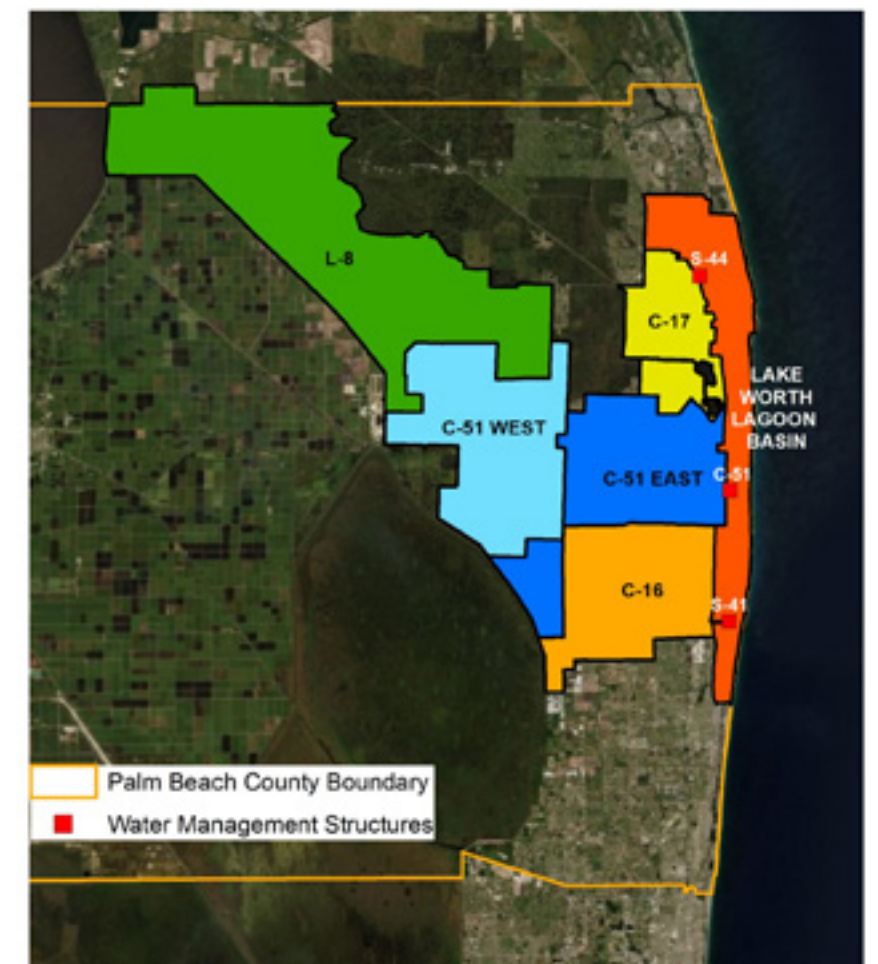
watershed-scale management strategies to support them (see Figure 1.1).

This Action Plan proposes a watershed-based modeling program for the Lagoon that employs at least two different modeling approaches:

- A pollutant loading model that simulates freshwater, sediments, nutrients and other inputs to the Lagoon from the watershed. This tool can assist in better understanding water management operations and system dynamics, identifying problems and evaluating potential solutions.
- In addition to estimating current pollutant loads, this model would predict changes resulting from implementation of Best Management Practices (BMPs) or other nutrient reduction measures. A robust non-point source monitoring network that

measures pollutant concentrations and water flows from multiple areas in the watershed would facilitate accurate nutrient loading calculations.

FIGURE 1.1 LAKE WORTH LAGOON WATERSHED CONSISTS OF 6 MAJOR DRAINAGE BASINS



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- A hydrodynamic model of the Lake Worth Lagoon itself can assess the physical and meteorological factors that influence the Lagoon’s ecological resources and help evaluate concepts to improve conditions.

Various historical modeling efforts have addressed some of these elements in a piecemeal fashion.

Modeling of estimated pollutant loads is required for all entities (including cities and counties) holding NPDES permits for point-source discharges, defined under the Clean Water Act as “any discernible, confined and discrete conveyance, such as a pipe, ditch, channel, tunnel, conduit, discrete fissure, or container.”

Additionally, the Federal Emergency Management Agency (FEMA) utilizes modeling to update local flood maps and set flood insurance rates.

Hydrodynamic modeling of the Lagoon was first conducted by the South Florida Water Management District (SFWMD) in 1996. The model was also calibrated and applied for flow scenario evaluations in the Lagoon in 2002.

At the County’s request in 2019, SFWMD provided recommendations for improvements to the original hydrodynamic model to support detailed salinity assessments under a variety of scenarios. Specifically, the following data needs were identified to establish accurate boundary conditions for the model:

- *Tidal information at the offshore boundary*

Confirmation is needed to ensure that the East Coast tidal database utilized in the 2002 model has been updated. An alternative would be to use tidal data collected at the Lake Worth Pier, when available, supplemented by the East Coast database as needed.

- *Freshwater inflow*

Gaged flows at structures S155, S44, and S41 should be used. In addition, contribution of the LWL watershed also should be included. Previously, the District’s Regional Hydrological Model was used to provide the flow information.

- *Meteorological forcing*

Wind, rainfall, and evaporation data should be collected at nearby weather stations and applied at the water surface.

- *Salinity data*

Salinity data collected in the lagoon should be compared with the model results as a further validation of the model.

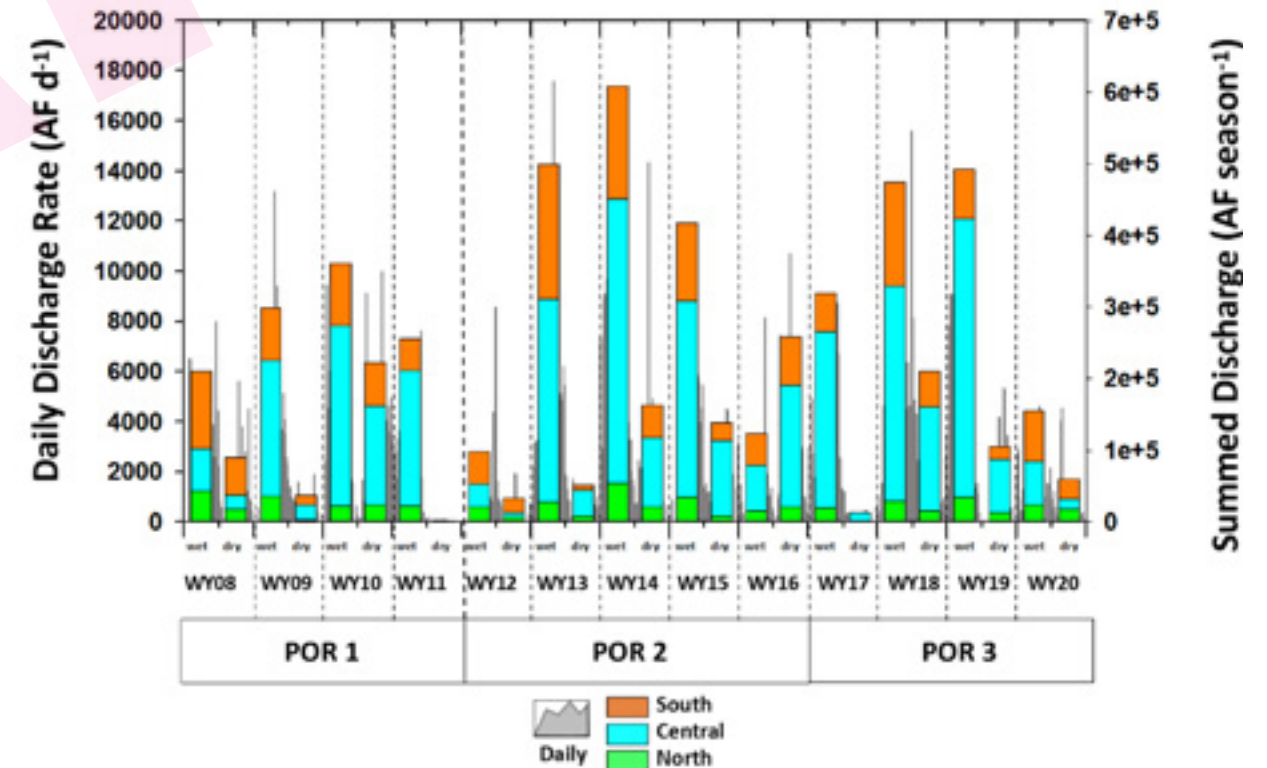
Once the model is successfully updated it can be used to assess a range of physical and meteorological factors that influence the Lagoon’s ecological resources, including the following priority concerns:

- The ecological impacts of widely fluctuating freshwater discharges (see Figure 1.2).
- Precise flushing rates for the entire Lagoon and for different segments of the Lagoon, along with the relationship between freshwater discharges and flushing rates.
- Sea level rise based on NOAA’s high, medium and low projections, with associated salinity responses.
- Sedimentation rates at specific locations, utilizing and comparing historic versus current bathymetry data.

In late 2020, the County submitted a document titled “Lake Worth Lagoon Estuary Freshwater Flows at S-155A” to the U.S. Army Corps of Engineers.

This document formally requested that the Corps establish a Performance Measure for freshwater flows to the Lagoon from Lake Okeechobee as part of upcoming revisions to the Lake Okeechobee System Operating Manual (LOSOM). The Performance Measure will require use of a predictive model. While limited to evaluations of discharges from Lake Okeechobee - which constitute a small fraction of the total freshwater funneled to the Lagoon - the model will nevertheless serve as a useful surrogate (pilot) for a larger, more robust model that can address watershed-scale needs. It incorporates the use of optimal salinity ranges for two key indicator species in the Lagoon - seagrasses and oysters. The model would be used to manage freshwater discharges

FIGURE 1.2 DAILY INFLOW TO LAGOON



Time of series of daily discharge rate (C17 + C51 + C16; acre-feet d-1; grey; left axis) from 5/1/07 to 4/30/20. and stacked bars for seasonal average discharge (right axis). Total discharge in the wet (May-Oct) and dry (Nov-Apr) seasons was the sum of C17 (green), C51 (cyan), and C16 (orange). The 13 WY record was divided into three periods of record (POR) to evaluate patterns and trends.

SOURCE: Coastal Ecosystems LLC

to avoid salinity extremes and maintain salinities at the desired optimal ranges of these organisms - 15 parts per thousand (ppt) for the Central Lagoon to accommodate salinity needs for oysters, and 20 ppt for the Northern Lagoon to accommodate salinity needs for seagrass.

APPROACH:

STEP 1 Develop a Scope of Work to determine data needs and develop two predictive watershed models:

- A model for estimating current pollutant loading from the watershed and potential reductions from implementation of BMPs and other water quality improvements.
- A hydrodynamic estuary model assessing physical and meteorological influences on Lagoon ecology, incorporating the existing data sets and boundary information recommended by SFWMD.

Explore partnerships to finance model development, including grant funding and in-kind support from SFWMD for the models and regional research consortiums or area universities to gather and analyze datasets.

STEP 2 Utilize the models to determine the optimal water quality conditions and salinities to support the full range of the Lagoon’s ecological resources, by simulating various water management scenarios.

STEP 3 Develop additional modeling tools as needed to address specific management needs.

TIMEFRAME:

STEPS 1 and 2 can be initiated in 2022 if funding is secured.

STEP 3 to occur as additional models are needed to understand and address specific aspects of watershed management.

COST ESTIMATE:

- Step 1 \$
- Step 2 \$-\$\$
- Step 3 \$-\$\$\$

EVALUATING PROGRESS:

Design and implementation of hydrodynamic model

REGULATORY NEEDS:

None

FUNDING:

County budget appropriation, state or federal grants, direct or in-kind support from regional research consortiums or area universities

POTENTIAL PARTNERS:*

PBC, SFWMD, FDEP, NOAA, FAU or other research institutions

**Listed Agencies have not committed funds and are subject to Agencies’ budget approvals*



Interns in the Green Futures program assist county staff with monitoring water quality. (Photo credit: PBC-ERM)

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SUMMARY ACTION PLAN COSTS AND TIMELINE



WATER AND SEDIMENT QUALITY SUMMARY

WATER QUALITY		
WQ-1 EXPAND WATER QUALITY MONITORING	TIMELINE	ESTIMATED COST
Step 1 Continue water quality monitoring and trend analysis	2021-2031	\$
Step 2 Increase frequency of monitoring or add parameters to pinpoint impairments or specific issues of concern	2022-2031	\$\$\$
Step 3 Develop Additional Monitoring Plans to Address Management Needs	2022-2031	\$\$-\$\$\$
WQ-2 DEVELOP A WATERSHED-BASED MODELING PROGRAM	TIMELINE	ESTIMATED COST
Step 1 Develop two predictive watershed models: model for estimating pollutant loading from the watershed and a hydrodynamic estuary model for the Lagoon	2022-2024	\$\$\$
Step 2 Utilize Model to determine optimal water quality conditions and salinities and apply into water management decisions	2023-2031	\$
Step 3 Develop additional modeling tools as needed to address specific management needs	2023-2031	\$\$\$
WQ-3 IMPLEMENT BEST MANAGEMENT PRACTICES FOR DRAINAGE CANALS	TIMELINE	ESTIMATED COST
Step 1 Establish working group to develop standardized guidelines for non-structural BMPs	2021-2023	\$
Step 2 Adoption of BMPs by partner agencies and organizations	2022-2028	\$
Step 3 Evaluate reductions in nutrients and sediments over time	2023-2031	\$
WQ-4 MONITOR AND ASSESS WAYS TO REDUCE BACTERIAL CONTAMINATION AND HARMFUL ALGAL BLOOMS	TIMELINE	ESTIMATED COST
Step 1 Sample for Harmful Algal Blooms, including blue-green algae and red tides, in addition to bacterial contaminants that could pose a health risk to marine life and the public	2021-2031	\$-\$\$\$
Step 2 Understand the current factors contributing to Harmful Algal Blooms in the Lagoon, and potential problem species in the future due to climate change	2023-2028	\$\$-\$\$\$
Step 3 Identify sources of bacterial contamination at Phil Foster Park and other recreation areas in the Lagoon	2022-2031	\$\$-\$\$\$
Step 4 Increase public education and awareness of Harmful Algal Blooms and waterborne pathogens, and ways to reduce exposure	2022-2031	\$
WQ-5 Identify and Assess the Impacts of Emerging Contaminants	Timeline	Estimated Cost
Step 1 Implement sampling and analysis to assess scope and distribution of microplastics in the watershed and LWL	2021-2031	\$-\$\$
Step 2 Track ongoing research on Emerging Contaminants and support localized research	2021-2031	\$
Step 3 Support education on Emerging Contaminants, reduction of plastic pollution and pharmaceuticals and personal care products (PPCP's)	2021-2031	\$
WQ-6 MANAGE FRESHWATER INFLOWS TO OPTIMIZE ENVIRONMENTAL BENEFITS	TIMELINE	ESTIMATED COST
Step 1 Evaluate and implement modifications to operational protocols for drainage canals and water control structures to reduce damaging freshwater pulses and velocities, as well as nutrient and sediment loading	2022-2031	\$\$
Step 2 Support modifications to canal operations to reduce dramatic fluctuations in flows that contribute to salinity extremes. Develop long-term water management plan to maintain optimal salinity ranges for oysters and seagrasses.	2023-2031	\$\$
Step 3 Support modifications to existing Stormwater Treatment Areas to improve storage capacity, nutrient reduction and sediment containment	2023-2031	\$-\$\$
Step 4 Identify potential new Stormwater Treatment Areas and Water Conservation areas in the western C-51 basin and elsewhere in the LWL watershed to capture, treat and gradually release freshwater downstream	2023-2031	\$-\$\$

ESTIMATED COSTS KEY:		
\$	\$0-\$25,000	
\$\$	\$25,000-\$100,000	
\$\$\$	\$100,000-\$500,000	
\$\$\$\$	\$500,000-\$1,000,000	
\$\$\$\$\$	More than \$1,000,000	



2022 Lake Worth Lagoon Initiative Legislative Funding Request

Task	Start Date	End Date
Application Period	May 1, 2021	July 31, 2021
Selection Committee Meeting -Applicant Presentations and Ranking		August 19, 2021
LWLI Steering Committee Meeting -Announce project ranking		October 20, 2021
2022 Legislative Session Opens	January 2022	March 2022
Funding becomes available pending agreement with FDEP	July 1, 2022	At FDEP's discretion (12-24 months typically)

Applications- LWLI.org Questions- call 561-233-2400 or email ERM-LWLI@pbcgov.org



LWLI Legislative Funding Request Project Ranking Criteria

- **Turn dirt projects-** projects that are ready to go.
- **Bang for the buck component-** tangible or measurable expectations for water quality or habitat improvements to the Lagoon and its watershed.
- **Local commitment-** does the proposed project have at minimum 50/50 cost match funding committed to the project.
- **Consistency-** with the goals, specific action plans or program areas identified in the **Lake Worth Lagoon Management Plan.**



Environmental Resources Management

MANAGEMENT PLAN **UPDATE**

The **DRAFT version** of the Lake Worth Lagoon Management Plan is available for public review.

Alternative formats can be provided upon request.

Deadline to submit comments via email to mashton@pbcgov.org is May 20, 2021

LAKE WORTH LAGOON INITIATIVE

