

State of Biscayne Bay

Presentation to the Biscayne Bay Watershed Management Advisory Board

December 6, 2021

Pamela Sweeney Senior Manager, Water Resources Section

Water Resources Coordination Division RER-Division of Environmental Resources Management (DERM)

www.miamidade.gov/BiscayneBay









Overview

• Where have we been?

- Natural history
- Management planning efforts

What are we facing?

- Current State of the Bay
- Seagrass loss, Fish kills, Algal blooms

Where are we headed?

Addressing water quality issues • County initiatives • In partnership



Where have we been?

Land of the Miccosukee, Seminole, and Tequesta People

Kissimmee-Okeechobee-Everglades watershed originally drained ~ 18,000 square miles of land

"Watershed is an area of land that drains to a common endpoint." (UF-IFAS)

Water-dominated "River of Grass" (Pa-hay-okee)

Biscayne Bay was formed between 5,000 – 2,400 years ago

Diverse flora and fauna

Nutrient poor (oligotrophic) system

Abundant water supply, providing sheetflow to the coast



Estimated Pre-drainage System Landscape (c.1850)



Current System Landscape (1995)



HistoryMiami, Munroe Collection



Miami Canal, S-26 sofia.usgs.gov





-Southeast Florida Climate Compact



Outstanding Florida Waters & Outstanding National Resource Waters



Common Themes throughout <u>Management Planning Efforts</u>

- Water Quality, Quantity, and Clarity
 - Nutrient enrichment and bacteriological indicators from canal discharges and stormwater runoff
 - Agricultural inputs
 - Turbidity
 - Reduction in freshwater sheetflow and changes in groundwater inputs
 - Coastal construction
 - Recreational uses
- Habitat Loss
 - Seagrass
 - Hardbottom (i.e., sponges, corals)
 - Mangroves & Coastal Wetlands
- Quantifying Biscayne Bay's Economic Value
- Public Access

Miami-Dade County Monitoring and Regulatory Programs

- Coastal Habitat Restoration
- Offshore & Artificial Reef
- Surface Water Quality Monitoring
- Submerged Aquatic Vegetation
- Groundwater Monitoring
- Water Quality/Pollution
 Investigations
- Compliance & Enforcement
- Regulation of work in Biscayne Bay, coastal and freshwater wetlands
- Regulation of wastewater infrastructure
- Regulation of stormwater infrastructure
- National Pollution Discharge Elimination System – Co-permittee









-Provide habitat, shelter & food

- -Cycle nutrients
- -Stabilize shorelines
- -Colonize sediment buildup
- -Prevent erosion
- -Oxygenate the water column
- -Carbon sequestration & Mangroves:
 - -3.7 lbs/acre/day of carbon (1336 lbs/acre/yr)
 -One of the most effective carbon sinks of any natural system









What are we facing?

The Complicated Story of Biscayne Bay Collapse and Recovery: What are the issues? What impacts <u>water quality</u> – and why does it matter?

Stormwater Runoff

Pet waste Gas and oil Landscape waste Trash Industrial uses Agriculture Construction Wastewater

Aged sanitary sewer lines Septic systems Fertilizer & other chemicals

Non-compliance & illicit issues

Nutrient Enrichment







The Complicated Story of Biscayne Bay Collapse and Recovery: What impacts have occurred?

-Nitrogen -Phosphorus -Bacteria -Heavy metals -Herbicides -Environmental Pollutants of Concern

-Seagrass Die-offs -Algal Blooms -micro (phytoplankton & macro -Fish Kills



Three major seagrass loss events:

-Barnes Sound/Manatee Bay (2005-2008) -Anadyomene Bloom Area (2005 – 2015) -North Biscayne Bay (2013 – 2017) -91 km² area with seagrass

-70% seagrass lost in this area

- Resulting in 64 km² loss





- How are nutrients available in the system?
 - Three main sources of freshwater received by the bay
 - Canal discharge (~40%)
 - Submarine groundwater discharge (~10%)
 - Precipitation (~50%)
- Snake Creek, Little River, and Miami River delivered more than 50% of the bay's total freshwater contribution from 1994-2002 (Caccia and Boyer, 2007)



Biscayne Bay Report Card 2021



Juvenile French angelfish and juvenile highhet in seagrass habitat. Credit Photo FOEP () scayne Say Aquasic Preserves

The Combined Water Quality Score, a graphic representation of only water quality indicators baywide, indicates poor water quality conditions in several canals and the julia Tuttle Basin as well as North Central Inshare and Menatee Bay. Generally, scores for phasphorous, nitrogen, and chiaraphyli-a tend to be fair to poor along the coastline.





August 2020

Fish Kills August 2020 and 2021

Seagrass loss = loss of primary productivity & ability to continue to assimilate nutrients

- Seagrasses support the ability of the estuary to be resilient.
- The resilience of this basin to withstand novel stresses (atmospheric events, changes in water management, etc) without ecological impacts is reduced.

Confluence of Events:

Event Date	Days	Flows	Winds	Air Temp	Water Temp	DO surface	Nutrients
19 May -12 Jun	25	2000-2500 cfs	5-10 m/s	<30 °C (25-28)	27-30 °C	2-7 mg/L	Highest
4 -11 Aug (Fish kill)	8	1800-2000 cfs	< 3.5 m/s	>30 °C	29-33 °C	0.2-3 mg/L	High
12-15 Nov	4	>6000 cfs	~ 5 m/s	<30 °C (25-28)	26-27 °C	7-9 mg/L (FIU Buoy)	Unknown
*Data: Flows (SFWMD), Winds & Temp (NOAA), DO & Nutrients (DERM Monthly Surface Water Monitoring Program)							

August 2020

August 2021

- Low tides
- Low winds
- High resilience time in basin
- Higher water temps
- Higher air temps
 - High flow -Low dissolved oxygen (DO)
 - -High nutrients
 - -Deposition of organic matter
- Turbid

-

- Bottom-dwelling fish
- Narrow spatial extent (2 basins)

- Low winds
- High residence time
- Higher water temps
- Flow
- Low DO- mostly at surface several days
- Clear
- Not limited to bottom dwelling fish
- Broader spatial extent (4 basins)

North Biscayne Bay Fish Kill (week of 10 Aug 2020)

Northern Biscayne Bay Fish Kill:

August 2020





- Water low in dissolved oxygen (DO) is conveyed from Little River to the Bay
- 2.0 mg/L DO is considered hypoxic, or devoid of oxygen
- Aug = DO in the Little River and Bay were near, at, or below levels considered hypoxic
- DO at LR01 in July is likely higher as sampling occurred at high tide when river mixes with bay
- Note: May = represents dry season conditions
- * May and June sampling events were reduced due to COVID19





- Nutrient-laden water is conveyed from Little River to the Bay.
- 0.012 mg/L = DEP Numeric Nutrient Criteria for this region
- TP ranges between 2x 4x criteria at the point Little Rivers reaches the Bay
- Median represents wet season data over last 10 years June sampling (6/1/20):
- Immediately followed 1) May rains (5/26-5/28) & opening of structure for wet season
- Captures highest TP June-August
- * May and June sampling events were reduced due to COVID19



Bigger Picture: Little River Plume Study (Conducted Aug. 27th 2020)

<u>Objective</u>: Characterize water quality moving from Little River to the Bay during low tide and evaluate the mixing zone (seawater and freshwater layers).



- Total N, Total P, and Chlorophyll-a:
 - Exceed DEP's Numeric Nutrient Criteria (NNC) for Northern North Bay (NNB) well into the Julia Tuttle Basin
 - TN & TP appear to be inversely correlated with salinity (i.e., as salinity increases, nutrient concentrations decrease)
 - Chl-a may be correlated with salinity (i.e., as salinity increases, chl-a generally increases), potential metabolism of nutrients by marine phytoplankton

Numeric Nutrient Criteria (NNB)			
TN mg/L	TP mg/L	CHL a (µg/L)	
0.3	0.012	1.7	

STATION	SALINITY	CHL-A (mg/L)	TN	ТР
S27A West	0.3	9.3	1.04	0.029
S27B East	0.3	9.5	1.04	0.022
1-F	10.9	7.6	0.85	0.022
2-F	15.4	8.9	0.75	0.015
3-S	28.4	12.3	0.55	0.012



Where are we headed?

Biscayne Bay Watershed Management Advisory Board: What are the Project Teams & What is their Function?

Biscayne Bay Task Force Recommendations Allowed Us To:

- IDENTIFY DATA GAPS THAT WILL HELP US CREATE NUTRIENT REDUCTION PLANS AND HABITAT RESTORATION PLANS
- PRIORITIZE WATER QUALITY ISSUES AND HOT SPOTS
- PRIORITIZE INFRASTRUCTURE PROJECTS, INCLUDING STORMWATER AND WASTEWATER PROJECTS



Biscayne Bay Actions Steps to Recovery Benchmark Mid-Term (M) Actions highlighted in yellow are Immediate (I) Short-Term (S) Between one and three years Greater than three years Less than one year completed or in progress Action Type Actions that require further Actions that require Actions that can be accomplished collaboration at the municipal. additional policy administratively within the County considerations state, or federal level WATER QUALITY BENCHMARK 1A Establish science-based, pollutant load reduction goals and interim targets Short-Term (S) Develop, implement and continuously monitor and demonstrate progress toward meeting 1A's pollutant load 18 Short-Term (S) reduction goals and interim targets 10 Activate additional Department of Regulatory and Economic Resources' (RER) resource management functions Immediate (I) County should conduct an immediate assessment of land-based hotspot areas prioritized based on existing, known Immediate (I) impairments Review, develop (as needed), implement and enforce local ordinances and policies to attain pollution load reduction Short-Term (S) 18 goals set forth in the Watershed Restoration Plan (WRP) Coordinate, staff and provide an annual budget for comprehensive, centralized Biscayne Bay Watershed data and 18 Immediate (I) research coordination and data management infrastructure 1G Undertake and secure funding for new pilot projects and research projects focused on reducing pollutant loads. Immediate (I) Elevate and further amend the Comprehensive Develop Master Plan (CDMP) to further include Biscavne Bay Mid-Term (M) 11 watershed management planning elements 11 Conduct a climate change vulnerability assessment for Biscayne Bay Short-Term (S) Initiate and fund studies that illuminate specific knowledge gaps for application toward watershed restoration Immediate (I) 1K Pass a county wide fertilizer ordinance Short-Term (S) 1L Increase compliance of all marinas and commercial operations along waterways Immediate (I) Continue to monitor the progress of the October 7th, 2015 Consent Agreement between FP&L and Immediate (I) Miami-Dade County

	GOVERNANCE	
2A	Establish by ordinance a Biscayne Bay Watershed Management Board (WMB)	Immediate (I)
2B	The Mayor should appoint a Chief Bay Officer (CBO) and request funding for the position	Immediate (I)
2C	The WMB will, with technical and community recommendations, review, recommend funding for and implement the Watershed Restoration Plan (WRP)	Short-Term (S)
2D	Develop a formal partnership in the form of a Memorandum of Understanding (MOU) with the SFWMD	Immediate (I)
2E	Enable the alignment and coordination of County departments that takes a holistic, comprehensive approach to Biscayne Bay recovery and resilience	Immediate (I)
2F	Develop a formal partnership in the form of a Memorandum of Understanding (MOU) with the Miami River Commission	Immediate (I)

	INFRASTRUCTURE	BENCHMARK
ЗA	Increase compliance with existing laws to result in the immediate connection of ~12,000 properties to the sewer system	Short-Term (S)
3B	Develop and enforce septic system design criteria with design parameters	Short-Term (S)
3C	Initiate a mandatory septic system registration and inspection program	Mid-Term (M)
ЗD	Undertake immediate efforts to identify and eliminate all root causes of Sanitary Sewer Overflows (SSO) including inflow and infiltration. Accelerate sewer infrastructure maintenance and upgrades	Short-Term (S)
ЗE	Develop and expedite a Condition Assessment and Asset Management Action Plan to document the condition of the County's wastewater system assets and certify all historical "As Builts" and/or those not already certified with a focus on identifying horizontal and vertical locations of main wastewater transmission lines	Short-Term (S
ЗF	Enforce the existing code and update the stormwater design criteria to improve effectiveness and include advances in stormwater treatment technologies	Short-Term (S
3G	Develop a plan to prioritize the retrofitting of stormwater infrastructure within basins with the most substantial water quality and/or habitat degradation issues	Short-Term (S
3H	Eliminate direct and indirect stormwater discharges to Biscayne Bay	Mid-Term (M)
31	Set policy that all As-Builts/Record Drawings are done and certified by a Florida Professional Surveyor and Mapper qualified and registered to do work in Miami-Dade County	Short-Term (S
3J	Set policy to require during the design phase of future construction that all existing utilities are designated and located vertically and horizontally	Short-Term (S
зк	Ensure that new infrastructure projects to address coastal flooding and storm surge that are cost-shared by the County adhere to the recommendations of this Task Force and prioritize Biscayne Bay health and resilience	Short-Term (S)

WATERSHED HABITAT RESTORATION AND NATURAL INFRASTRUCTURE

4A	Develop ecologically acceptable living shoreline design options that are consistent with the existing Biscayne Bay Aquatic Preserve Act	Immediate (I)
4B	Raise awareness of the value of mangroves through a homeowner education campaign	Short-Term (S)
4C	Increase enforcement of existing rules for protecting existing mangroves and mangrove shorelines	Short-Term (S)
4D	Identify vulnerable properties along the coastline and partner with municipalities to focus on public properties and private property owners to create a voluntary Mangrove Protection and Restoration Zone Program	Short-Term (S)
4E	Prioritize existing and identify new green and blue infrastructure approaches and restoration projects	Immediate (I)
4F	Continue to work with SFWMD and to have the State of Florida allocate the funds necessary to ensure the timely commencement of construction of the Cutler Flow Way in accordance with the project timeline in the Integrated Delivery Schedule	Immediate (I)
4G	Continue to advocate for funding to support the Biscayne Bay Southern Everglades Ecosystem Restoration (BBSEER) project (also known as the BBCW / C-111)	Mid-Term (M)
4H	Establish seagrass targets and maintenance requirements	Short-Term (S)
41	Accelerate green infrastructure solutions for flooding, resiliency and water quality	Short-Term (S)

MARINE DEBRIS

5A	Create a comprehensive marine debris prevention, reduction, and removal program within DERM and to adequately fund and staff the program	Short-Term (S)
5B	Establish a marine debris working group to promote collaboration on ways to reduce marine debris	Short-Term (S)
5C	Through the Mlami-Dade County Police Department, direct the Marine Patrol Unit to prioritize its commitment to the enforcement of all applicable laws having a nexus to the environmental health of the Bay and its tributaries	Short-Term (S)
5D	Conduct an analysis of marine debris in Biscayne Bay	Short-Term (S)
5E	Adopt a target maximum input level policy for trash	Short-Term (S)
5F	Evaluate the various existing stormwater outfail systems throughout the county to determine their effectiveness at preventing debris from entering Biscayne Bay	Mid-Term (M)
	Identify and establish dedicated and recurring funding sources to pay for marine debris prevention and removal	Income Alexandra

Partnership with Florida Department of Environmental Protection Coral Reef Protection Grant(\$10M) + Matching from MDC (\$10M) -Major Program Areas: 1- Water Quality Characterization: – Miami River, Little River, Biscayne Canal 2- Stormwater: -Pilot projects (new technology) -Enhanced maintenance (existing technology) 3- Wastewater: -Septic to sewer conversions & education -"Smart" manhole covers 4- Habitat Restoration



With gratitude for your service and leadership

Thank you to DERM staff & our partners