



Save Our Indian River Lagoon Project Plan Funded Muck Removal Projects, Brevard County, Florida

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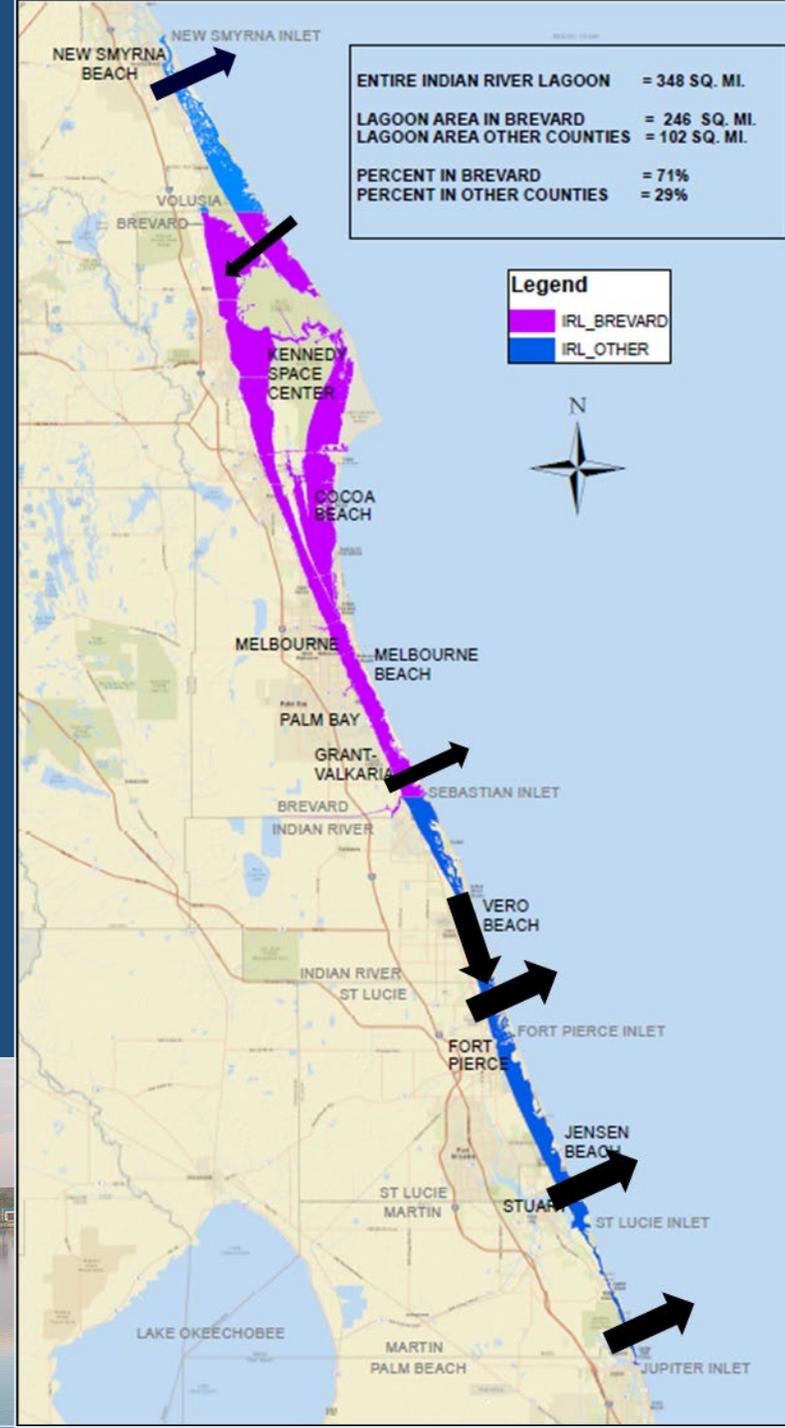




Background

Indian River Lagoon (IRL)

- 156-mile long estuary comprised of 3 waterbodies
 - Mosquito Lagoon
 - Indian River
 - Banana River
- 5 counties border the lagoon
 - 71% within Brevard County
- Diverse ecosystems
- Vital economic source



Background

Health of the Indian River Lagoon (IRL)

- 2011 algal superbloom
- 2011 secondary bloom
- 2012 brown tide
- 2013 brown tide
- 2013 unusual mortalities
- 2015-2016 brown tide
- 2016 extensive fish kill
- 2017-2018 brown tide
- 2020 algae bloom, fish kills
- 2020 – 2022 unusual mortality event (manatees)
- 2023 blue-green algae blooms, localized fish kills
- >60-80% loss of seagrass beds



Source: Connor Wong, Florida Institute of Technology

72 Community
Projects
Completed!

164 Home
Owner Projects
Completed!

2023 Save Our Indian River Lagoon Project Status

as of December 31, 2022

178,579 lbs/year
of nitrogen load
reduced

12,000 lbs/year of
phosphorus load
reduced

Public Education & Engagement



Budget: \$3,530,000
TN Reduction: 33,709 lbs/year
Average Cost/lb TN: \$105
Projects Completed: 1
Projects in Construction: 4
Projects in Design: 0

WWTF Upgrades for Reclaimed Water



Budget: \$27,617,223
TN Reduction: 73,959 lbs/year
Average Cost/lb TN: \$383
Projects Completed: 2
Projects in Construction: 2
Projects in Design: 2

Rapid Infiltration Basin/ Sprayfield Upgrades



Budget: \$82,207
TN Reduction: 317 lbs/year
Average Cost/lb TN: \$259
Projects Completed: 1
Projects in Construction: 0
Projects in Design: 0

Package Plant Connections



Budget: \$2,016,627
TN Reduction: 1,442 lbs/year
Average Cost/lb TN: \$1,398
Projects Completed: 1
Projects in Construction: 0
Projects in Design: 0

Smoke Testing/ Sewer Lateral Repairs



Budget: \$1,454,498
TN Reduction: 5,196 lbs/year
Average Cost/lb TN: \$235
Projects Completed: 3
Projects in Construction: 1
Projects in Design: 0

Septic to Sewer by Extension



Budget: \$120,100,160
TN Reduction: 95,381 lbs/year
Average Cost/lb TN: \$1,256
Projects Completed: 3
Projects in Construction: 8
Projects in Design: 21

Septic to Sewer by Quick Connects



Budget: \$11,200,379
TN Reduction: 21,446 lbs/year
Average Cost/lb TN: \$522
Home owner projects
Projects Completed: 46
Contracted Projects: 64

Septic Upgrades



Budget: \$29,243,590
TN Reduction: 37,981 lbs/year
Average Cost/lb TN: \$770
Home owner projects
Projects Completed: 118
Contracted Projects: 249

Stormwater Projects



Budget: \$65,721,812
TN Reduction: 282,678 lbs/year
Average Cost/lb TN: \$242
Projects Completed: 38
Projects in Construction: 2
Projects in Design: 8

Aquatic Vegetation Harvesting



Budget: \$2,200,496
TN Reduction: 29,691 lbs/year
Average Cost/lb TN: \$68
Projects Completed: 4
Projects in Construction: 1
Projects in Design: 2

Muck Removal & Interstitial Treatment



Budget: \$160,387,061
TN Reduction: 702,036 lbs/year
Projects Completed: 4
Projects in Construction: 2
Projects in Design: 9

Oyster Bars



Budget: \$9,809,545
TN Reduction: 24,699 lbs/year
Average Cost/lb TN: \$397
Projects Completed: 8
Projects in Construction: 6
Projects in Design: 0

Planted Shorelines



Budget: \$130,455
TN Reduction: 544 lbs/year
Average Cost/lb TN: \$240
Projects Completed: 6
Projects in Construction: 1
Projects in Design: 1

Clam Restoration



Budget: \$60,000
TN Reduction: 1,000 lbs/year
Average Cost/lb TN: \$60
Projects Completed: 0
Projects in Construction: 1
Projects in Design: 0

2017-2022 Revenue = \$299.1M

2017-2022 Expenditures = \$57.8M

Save
OUR
LAGOON

\$258.3M in more projects underway!

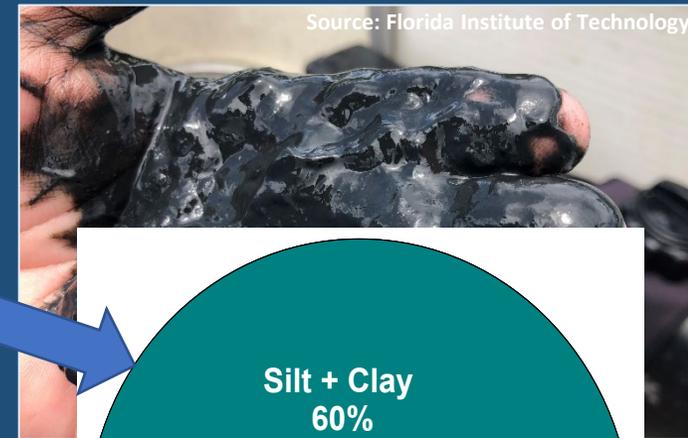




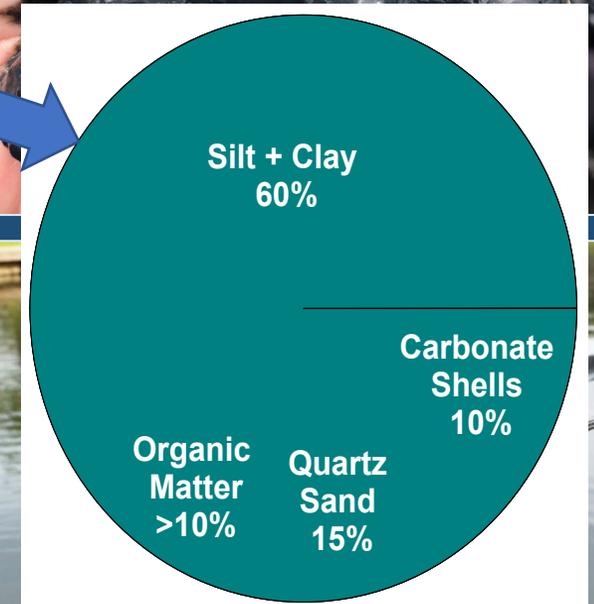
What is IRL Muck?

Fine-grained, organic-rich sediment

- 10–30% OM and >60% silt and clay with a high water content (porosity >0.9)
- IRL muck:
 - (1) Easily resuspended → blocks light from seagrass
 - (2) Consumes oxygen
 - (3) Characterized by a death of biota
 - (4) Continually releases large quantities of dissolved nitrogen (N) and phosphorus (P)
 - (5) Favors deeper, low-energy areas



Source: Florida Institute of Technology

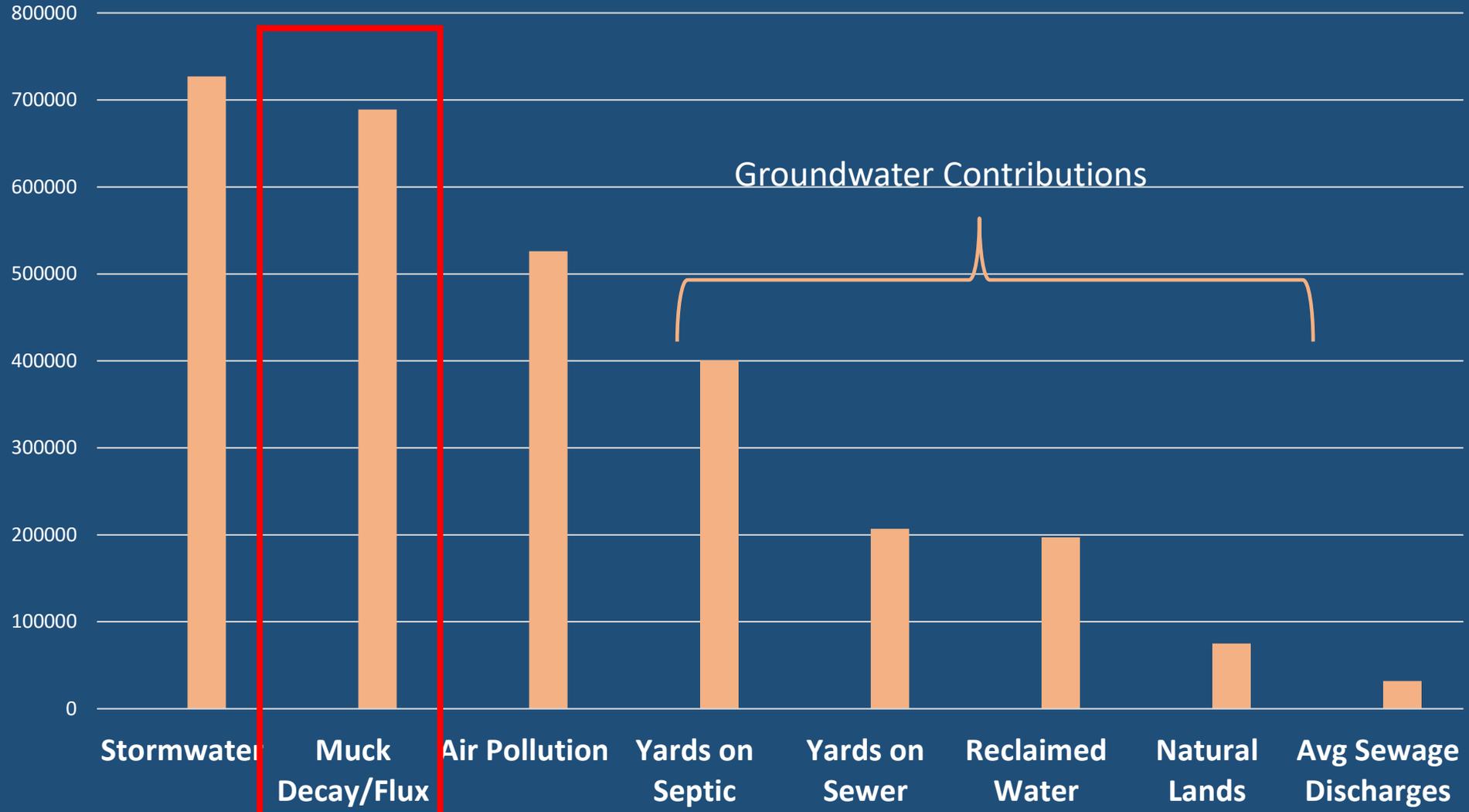


Source: Florida Institute of Technology



Nitrogen Sources in Brevard's IRL Watershed

Pounds of Total Nitrogen





SOIRL Environmental Dredging Projects

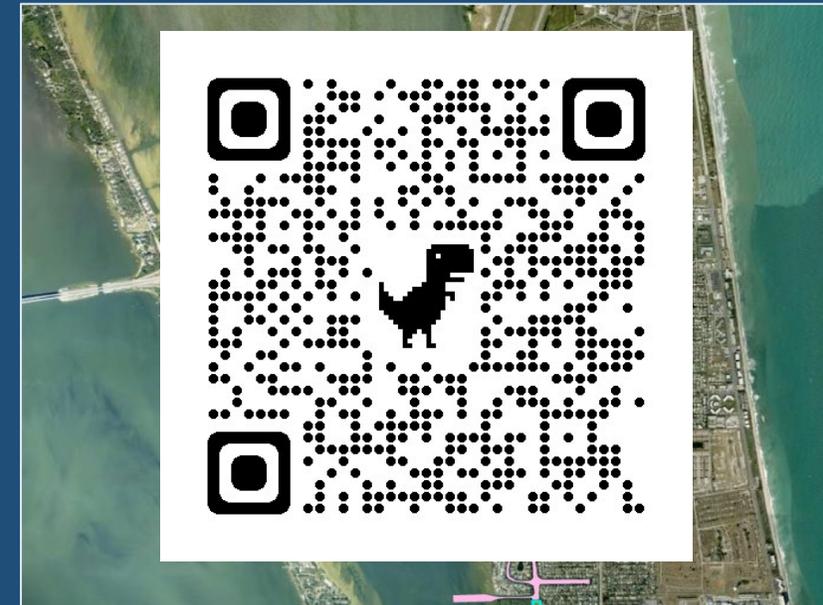
- Completed projects:
 - **Turkey Creek:** 22 acres, ~236,000 CY muck removed
 - **Mims Boat Ramp:** 9.15 acres, ~30,935 CY muck removed
 - **Cocoa Beach:** 60 acres, ~111,000 CY muck removed
 - **Sykes Creek Phase 1:** 60 acres, ~76,000 CY muck removed
- Ongoing projects:
 - **Grand Canal:** 97 acres, 478,700 CY total
 - ~290,000 CY removed to date



SOIRL Environmental Dredging Projects

Upcoming and Future Projects

- **Sykes Creek Phase 2:** 120 acres, >560,000 CY muck
- **Eau Gallie Northeast:** 73 acres, ~376,600 CY muck
- **Canaveral South:** 65 acres, ~737,880 CY muck
- **Pineda BRL:** 28 acres, ~195,000 CY muck
- **Patrick Space Force Base:** 26 acres, ~205,000 CY muck
- **Titusville Railroad East and West:** 70 acres, ~901,000 CY muck
- **Sunnyland Canals:** 16 acres, ~104,000 CY muck





Interstitial Water Treatment

Overview

- Removing nitrogen and phosphorus from the water “squeezed” out of muck
- Not required by permit
- Contractor required to meet effluent nutrient concentration requirements
 - Means and methods left to Contractor
 - **Must be proven technology**
- Performance targets
 - Nitrogen – 3000 ppb (3 mg/L)
 - Phosphorus – 75 ppb (0.075 mg/L)
- Pay for Performance

Aug 14, 2023 at 11:23:45 AM
Pineda Cswy
Satellite Beach FL 32937
United States



Interstitial Water Treatment Challenges

- Treating brackish water
 - Ions interact with other ions used in more traditional stormwater and wastewater treatment
- Variable organic decomposition rates
 - Results from the sun heating the geotubes
- Differences in sediment characteristics when the dredge moves
- Rainfall





Interstitial Water Treatment

Lessons Learned

- Number of variables that influence effluent treatment options
 - Sediment characteristics
 - DMMA size/configuration
 - Production rates
 - TN and TP concentrations in muck/interstitial water
- Requires ability to make real time adjustments
 - Fluctuations in water quality parameters (temperature/pH/DO)
- Performance based payment creates incentive for meeting targets
 - Grace period for Contractors during startup
- Available technologies
 - Tailored to fit the needs of muck dredge projects





Grand Canal Environmental Dredging and Treatment of Interstitial Water

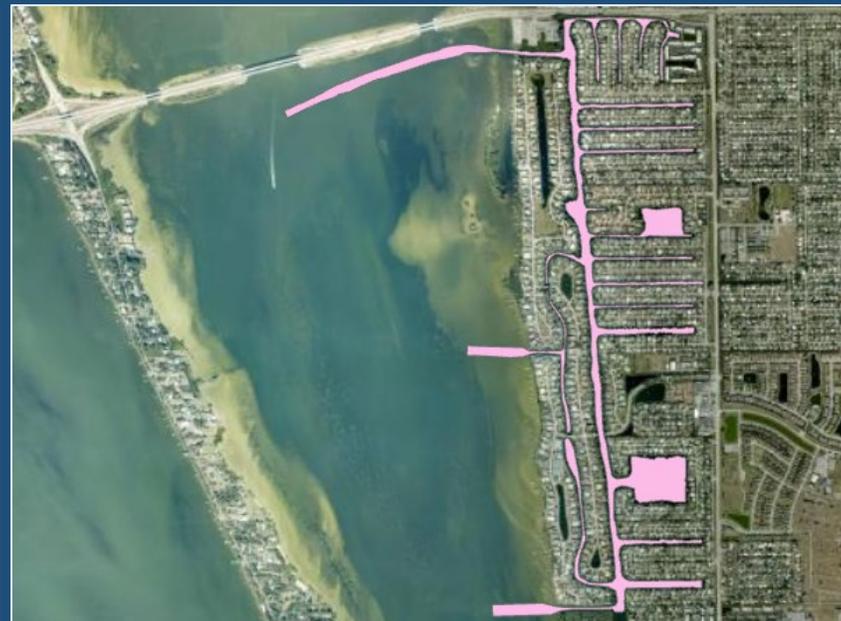
- Remove nutrient-rich muck
 - Hydraulic dredge
 - Residential canals + open water
 - ~478,700 cubic yards of muck
 - ~290,000 CY dredged to date
- Dredge Material Management Area
 - Dredge slurry
 - De-water muck
 - Test and dispose dried material at a permitted disposal site
 - Effluent treated and returned to waterbody
 - Nitrogen removal: >2,200,000 lbs N
 - Phosphorus removal: >470,000 lbs P





Grand Canal Challenges

- Small area for DMMA (~6-9 acres)
- Constituents of Concern (COCs)
- Heavy metals
- Complex dredge template
- Manatee closure dates (December 1st -March 15th)

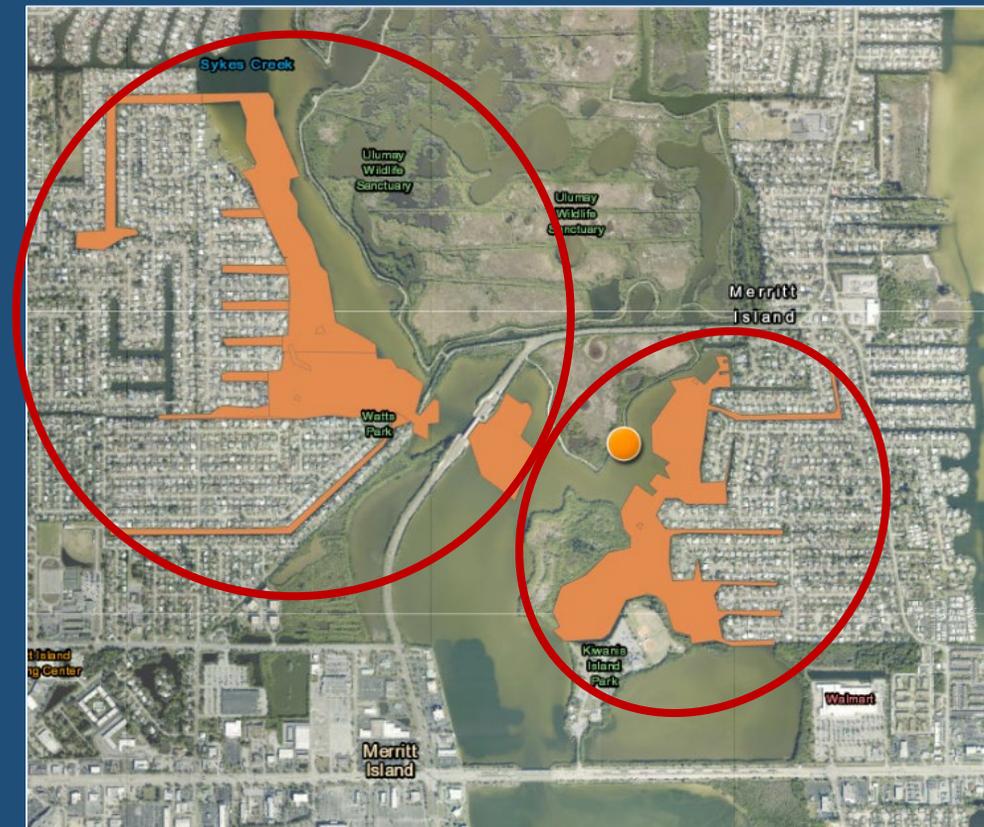




Sykes Creek Environmental Dredging and Treatment of Interstitial Water

- Permitted ~661,000 cubic yards
 - Phase 1 – Removed ~76,000 CY of muck
 - Phase 2 – Has not commenced
 - Estimated 560,000 CY of muck
- Phase 1 Challenges
 - Land for DMMA
 - Complex dredge template
 - Unexpected material (clay)

Nitrogen removal: >3,010,000 lbs N
Phosphorus removal: >650,000 lbs P





Project Challenges

- Regulatory Requirements
 - Can significantly impact cost and schedule
- Space
 - DMMA sites
 - Final disposal locations
- Effluent Treatment
 - Coupling existing technologies from other industries with muck dredging
 - Variable environmental conditions
- Chemical Constituents
 - Heavy metals
 - Constituents of Concern
- Measuring success



Year Added	Project Number	Project Name	Responsible Entity	Sub-Lagoon	Total Nitrogen Reduction (pounds per year)	Cost per Pound per Year of Total Nitrogen Removed	Total Phosphorus Reduction (pounds per year)	Cost per Pound per Year of Total Phosphorus Removed	Plan Funding
Original	2016-10a	Canaveral South**>	Brevard County	Banana	35,305	\$416	1,925	\$7,636	\$14,700,000
Original	2016-5a	Pineda Banana River Lagoon**>	Brevard County	Banana	14,994	\$455	686	\$9,949	\$6,825,000
Original	2016-11a	Patrick Space Force Base**>	Brevard County	Banana	11,830	\$607	382	\$18,783	\$7,175,000
Original	168a	Cocoa Beach Golf**^>	Brevard County	Banana	38,416	\$556	2,058	\$10,374	\$21,350,000
Original	2016-06a	Titusville Railroad West**>	Brevard County	North IRL	13,965	\$226	588	\$5,357	\$3,150,000
Original	2016-07a	National Aeronautics and Space Administration Causeway East**>	Brevard County	North IRL	21,825	\$457	1,047	\$9,527	\$9,975,000
Original	2016-04a	Rockledge A**>	Brevard County	North IRL	3,777	\$1,158	825	\$5,303	\$4,375,000
Original	2016-08a	Titusville Railroad East**>	Brevard County	North IRL	7,409	\$543	227	\$17,731	\$4,025,000
Original	54a	Eau Gallie Northeast**>	Brevard County	North IRL	4,548	\$1,924	1,482	\$5,904	\$8,750,000
2017	41a	Grand Canal Muck Dredging+ [#]	Brevard County	Banana	10,469	\$251	1,396	\$1,882	\$2,626,600
2017	42a	Sykes Creek Muck Dredging+	Brevard County	Banana	19,635	\$240	2,618	\$1,797	\$4,705,428
2018	70a	Cocoa Beach Muck Dredging – Phase III+	City of Cocoa Beach	Banana	4,095	\$336	780	\$1,764	\$1,376,305
2018	71	Merritt Island Muck Removal – Phase 1+	Brevard County	Banana	8,085	\$957	1,540	\$5,022	\$7,733,517
2018	72a	Muck Removal of Indian Harbour Beach Canals+	City of Indian Harbour Beach	Banana	3,780	\$961	720	\$5,044	\$3,631,815
2018	2016-3a	Muck Re-dredging in Turkey Creek+ ^{>}	Brevard County	Central IRL	4,728	\$45	221	\$973	\$215,000
2019	101	Cocoa Beach Muck Dredging Phase II-B+	City of Cocoa Beach	Banana	6,300	\$939	840	\$7,045	\$5,917,650
2020	144	Satellite Beach Muck Dredging+	City of Satellite Beach	Banana	3,885	\$485	518	\$3,638	\$1,884,225
2022	223	Spring Creek Dredging+	City of Melbourne	North IRL	154	\$520	21	\$3,813	\$80,080
2023	236	Sunnyland Canals Muck Removal+	Sunnyland Beach Property Owners Association	Central IRL	10,030	\$520	336	\$15,523	\$5,215,600
-	-	Total	-	-	223,230	\$509 (average)	18,210	\$6,244 (average)	\$113,711,220

Note: The projects highlighted in green and marked with an asterisk were identified in the original plan. The projects highlighted in tan and marked with a plus sign were added to the plan as part of an annual update.

^ The Cocoa Beach Golf project is not fully funded at this time. A total of \$21,350,000 is available and Brevard County is looking for options to fund the remaining \$12,775,000 for dredging plus associated interstitial water treatment.

In 2021, contingency funding was approved to add Berkeley Canal to the Grand Canal project.

> Flux Rate from Fox, 2022.



Join us in Brevard County!

Explore our future opportunities for environmental dredging

- Be a part of the solution to restore environmental integrity to the Indian River Lagoon
- Contact us today:
 - Abbey Gering – Abigail.gering@brevardfl.gov
 - Jeanne Allen – Jeanne.allen@brevardfl.gov
 - Agustin Sebastian – Agustin.Sebastian@brevardfl.gov



Links to Learn More

- <https://brevardbocc.maps.arcgis.com/apps/MapSeries/index.html?appid=4051c47af44f4667b27fe19825de9e2e>
- <https://www.brevardfl.gov/SaveOurLagoon/ProjectPlan>

