The Value of Navigation Dredged Material to Ecosystem Restoration and Coastal Resiliency

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Miami Harbor GRR & EIS

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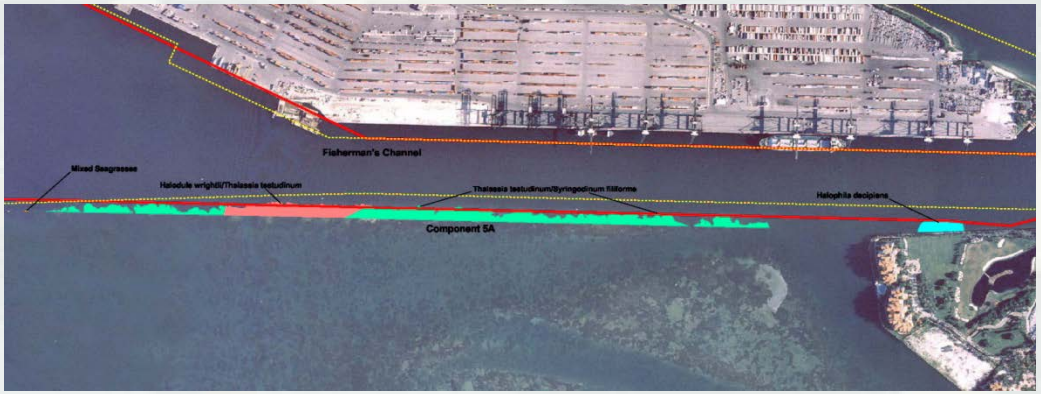
- Project Feasibility Study 1990-2004
- Unavoidable impacts to seagrass beds* south of Fisherman's Channel
  - 0.2 acres direct impact.
  - Up to an additional 7.7 acres due to side slope sloughing.
- Compensatory mitigation required for unavoidable impacts. What to do?



- **Grow in shallow areas*
- *Support a large variety of marine species*
- *T&E; EFH*
- *Stabilize shorelines*
- *Reduce wave impact*

Previous Hole Projects

- 1994 Miami-Dade DERM (Milano & Deis, 2006)
- 2.6 acre dredge hole in north Biscayne Bay filled with dredged material from PortMiami expansion 1993-1995.
  - Partially successful – filling. Did not cap with finer grained material. Insufficient $$.
  - 12,597 planting units. Max survival of transplants – 60%

Finding the JTMA Site

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"Filling Program for Dredged Depression in North Biscayne Bay." Inventory of Fill Areas (Coastal Tech 1994)

TABLE 2.1

PHYSICAL CHARACTERISTICS OF

POTENTIAL FILLING AREAS IN NORTH BISCAYNE BAY

FILL AREA	WATER DEPTH (ft)	SURFACE AREA (acres)	BOTTOM MATERIAL	AMBIENT DEPTH (ft)	MAXIMUM CURRENT VELOCITY (ft/sec)	SUSPENDED SOLIDS (mg/l)	ESTIMATED FILL RQD.	FILL TYPE	POTENTIAL ENVIRONMENTAL BENEFIT
II-A	7.0	10	Sandy	2.0-5.0	0.2	10	46,000cy	Dredge Spoil	Seagrass Growth
II-B	7.0-8.0	46	Sandy	4.0-6.0	0.2	10	300,000cy	Dredge Spoil	Seagrass Growth
II-C	8.0	3	Muddy	6.0	0.2	8	3,000cy	Coarse Sand	Mud cap
III-A	13.0-17.0	18	Muddy	3.0-6.0	0.3	5	290,000cy	Const. Debris	Artific. Reef
III-B	16.0-24.0	16	Muddy	5.0-6.0	0.3	6	360,000cy	Const. Debris	Artific. Reef
III-C	4.0-7.0	4	Muddy	2.0-3.0	0.3	7	19,000cy	Dredge Spoil	Seagrass Growth
IV-A	7.0-8.0	4	Muddy	1.0-3.0	1.0	13	31,000cy	Dredge Spoil	Seagrass Growth
IV-B	7.0-8.0	31	Sandy	4.0-6.0	1.0	6	150,000cy	Dredge Spoil	Seagrass Growth

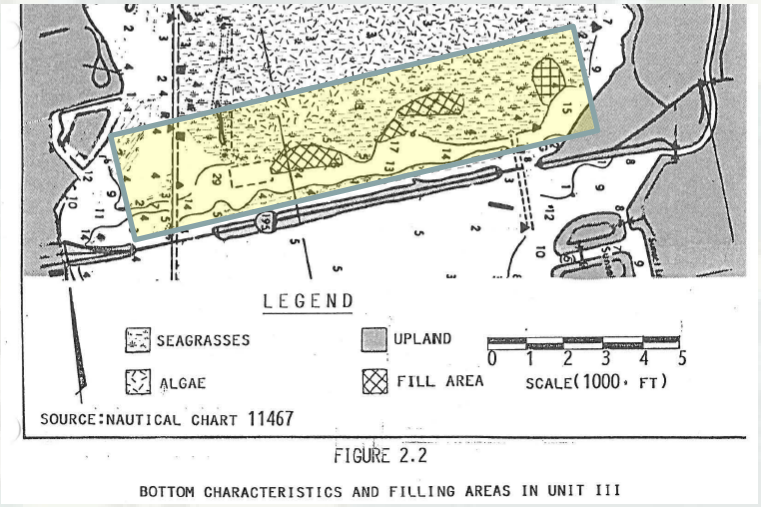

FIGURE 2.2

BOTTOM CHARACTERISTICS AND FILLING AREAS IN UNIT III

“Julia Tuttle Dredge Hole”

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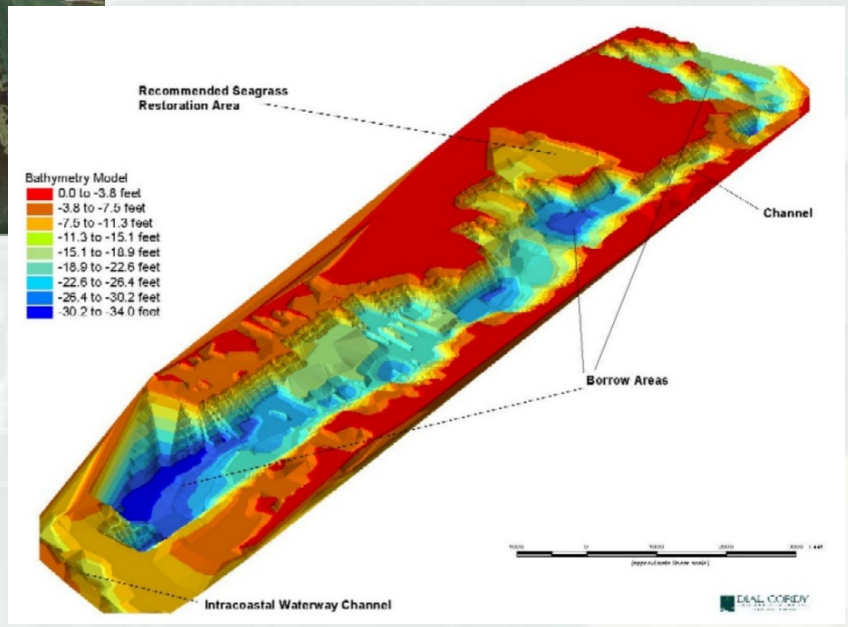

Julia Tuttle Causeway

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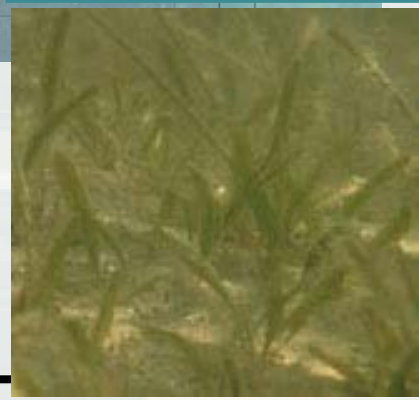
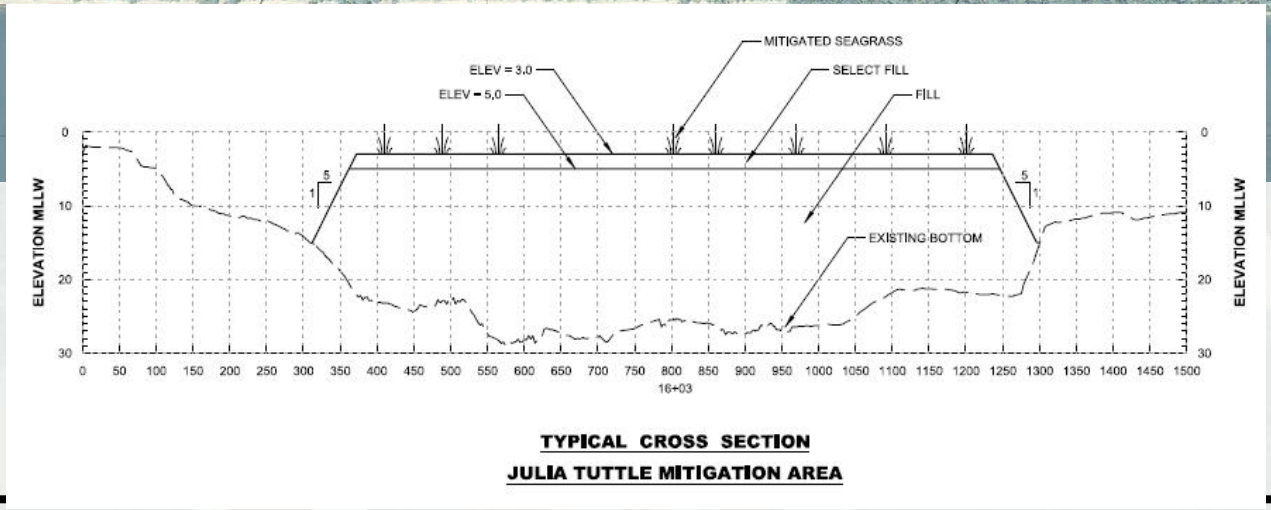
- Hole was dredged in Biscayne Bay circa 1959 as fill material for the Julia Tuttle Causeway from Miami to Miami Beach.
- Low sediment inflow in the Bay made it unlikely that the hole would repair itself to be able to support seagrass

Photos - http://miamiarchives.blogspot.com/2013/07/julia-tuttle-causeway-opens-dec-12-1959.html

- 31 acres available, Required to build 16.6 acres.
- Select fill cap (5 to 10% fines) to -4ft MLLW +/- 0.5ft
- "Design/Build" in the specifications





TYPICAL CROSS SECTION
JULIA TUTTLE MITIGATION AREA

Seagrass Planting

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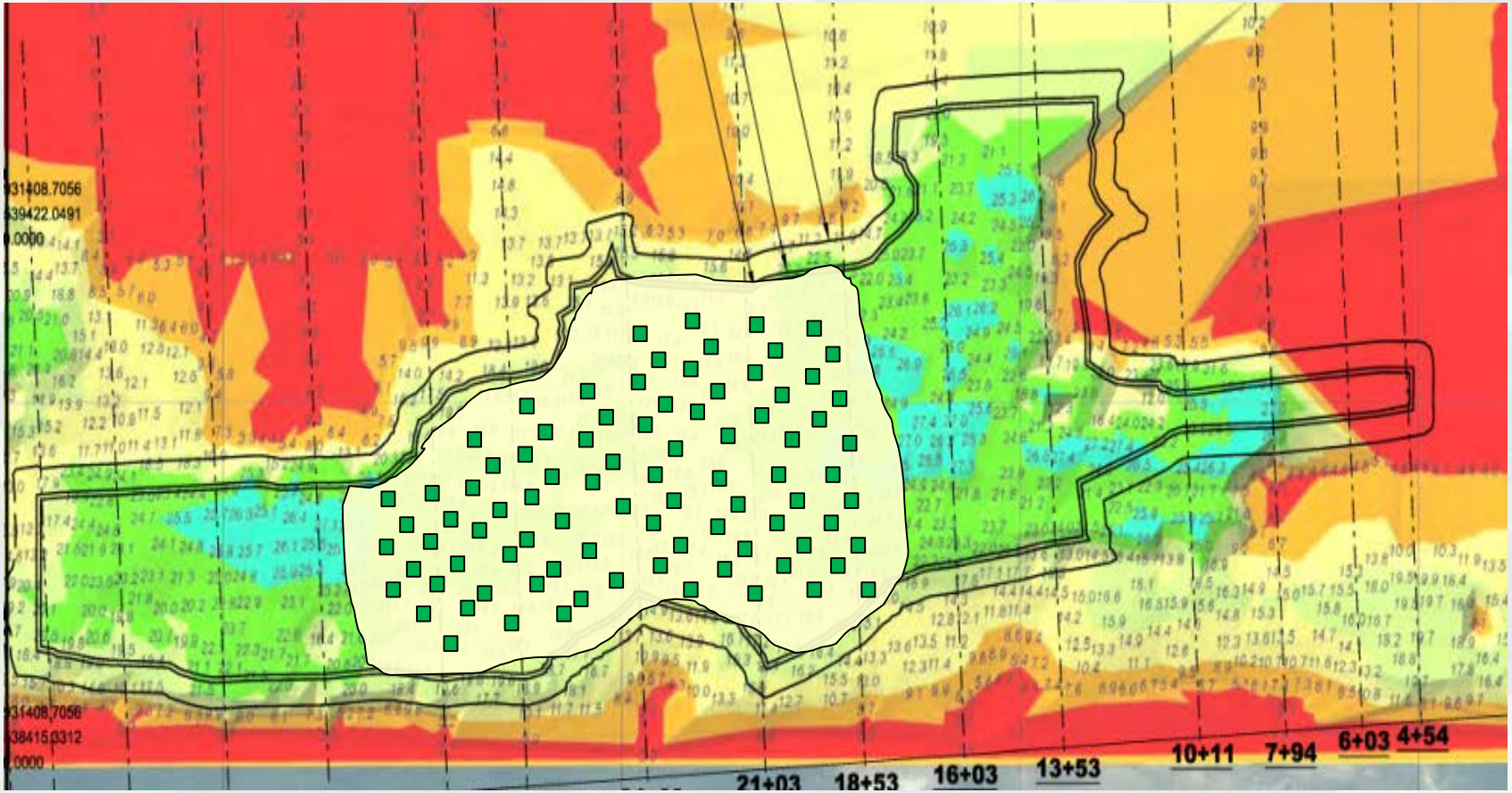
FDEP Permit required 7.15 acres of the 14.3 acre site to be planted with harvest from adjacent beds



Site Design

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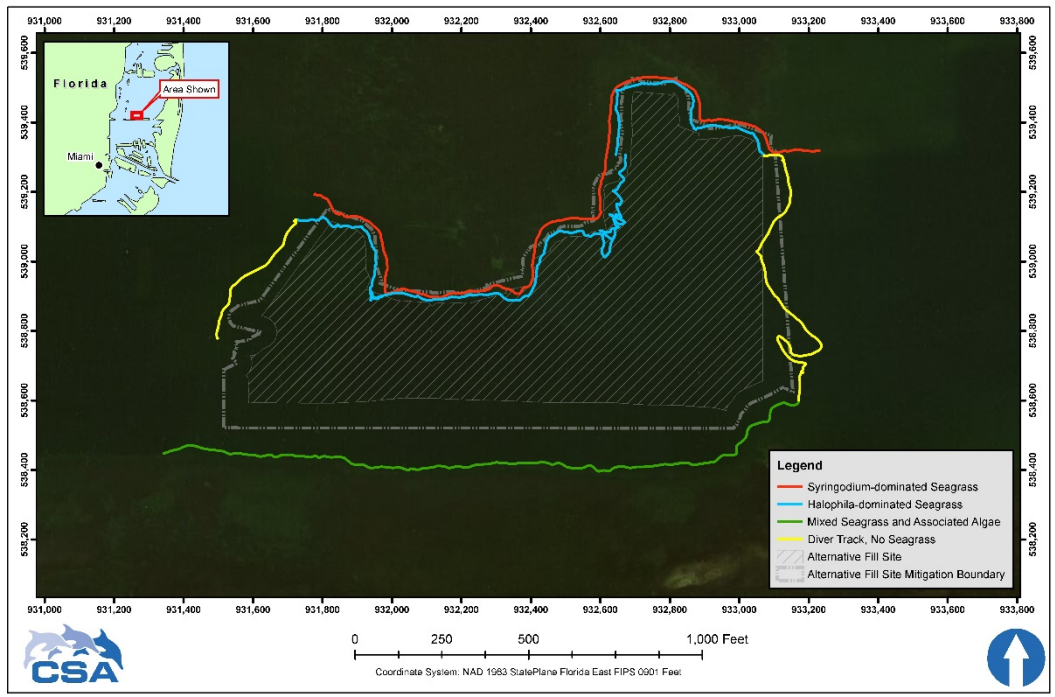
- Confirm existing seagrass boundary
- ID presence of Johnson's seagrass (*Halophila johnsonii*)
- Develop harvesting and planting plans



Construction of the Site

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January 18, 2014 Google Earth Photo

Base Fill

- 560,000 CY of excavated dredged material placed in the JTMA hole to create 16.99 acres of seagrass habitat instead of placement in Ocean Dredged Material Disposal Site (~600 ft of water)
- 1,192 scow loads from Jan 8, 2014 to Oct 19, 2014.
- Loads limited to <1,000 CY/scow due to depth limitations accessing the site from the IWW.

Transport & Placement

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~5.0 mile one way trip
Through 3 bridges in the Intracoastal Waterway

Base Material Complete

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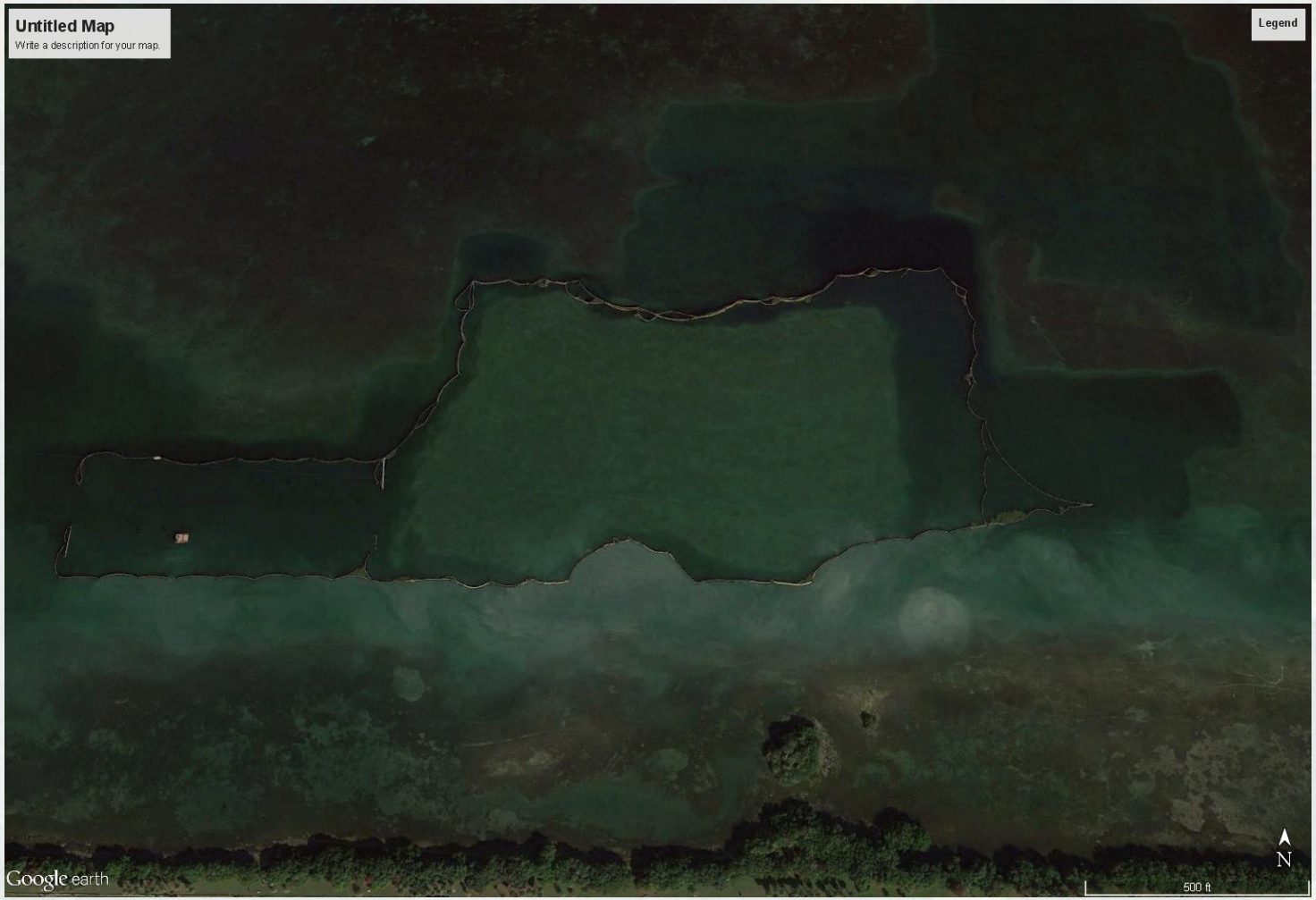

December 15, 2014 Google Earth Photo

Select Fill Deployment

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Mined Material <5% fines

Loaded on barges and transported to the site

Gee Whiz:

- 285 barge loads
- 114,425 tons
- 5,500 dump trucks
- CEMEX Krome Quarry in Miami

Placing Select Fill

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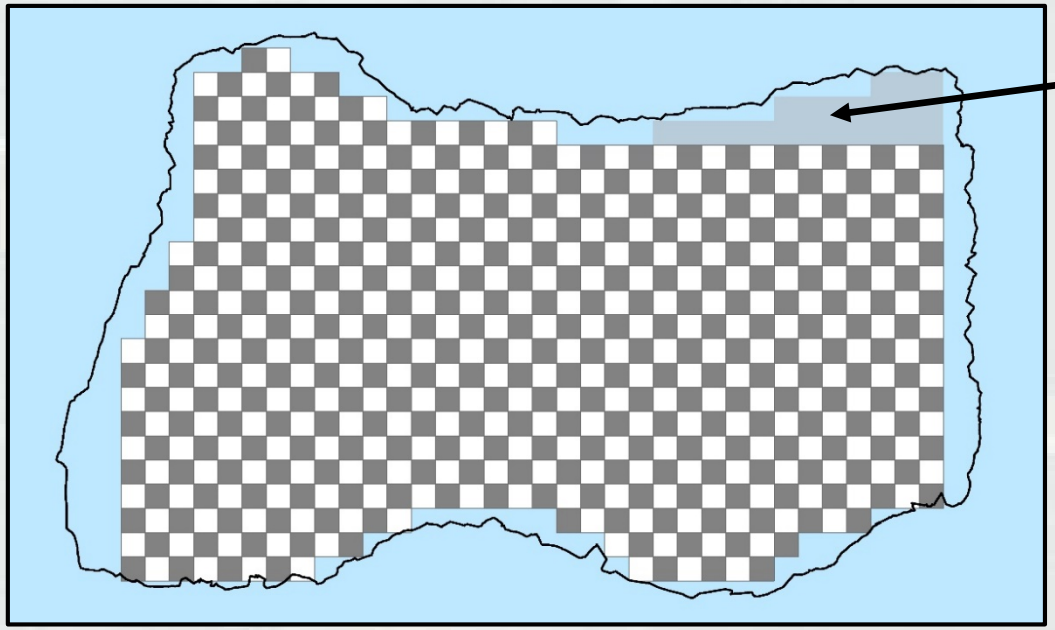
Dredged material was capped with 85,000 CY upland mined “select fill”

Load #1 placed Jan 8, 2015 and Load #285 was placed on July 7, 2015. 180 Days of active filling.

Site Layout

Checkerboard

- > 14 acres of seafloor
- 580 plots, ea. 100 m^2
- > 7 acres planted plots (290)
- Fixed corner stakes
- 100 Planting Units $plot^{-1}$
- 29,000 PU



Donor Site Selection

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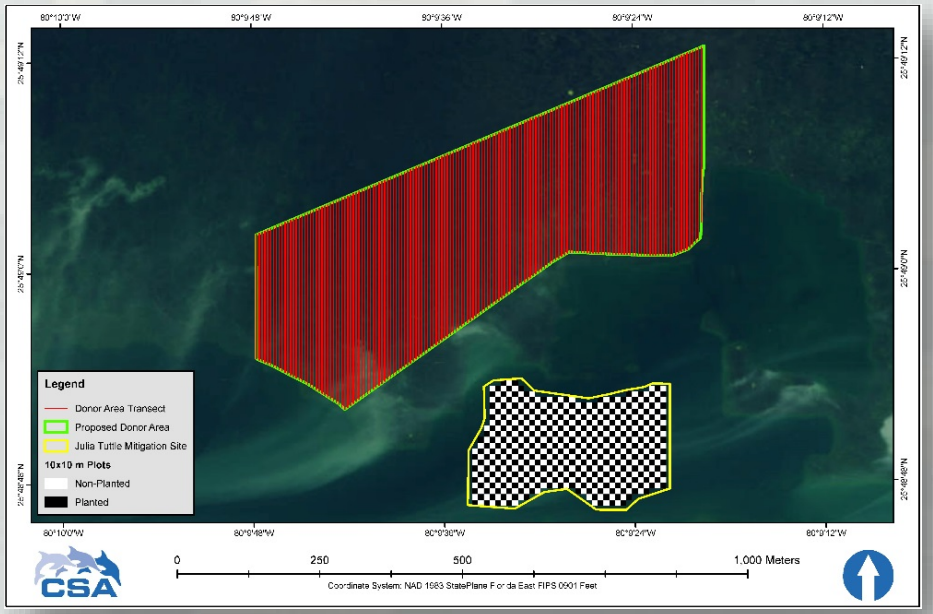
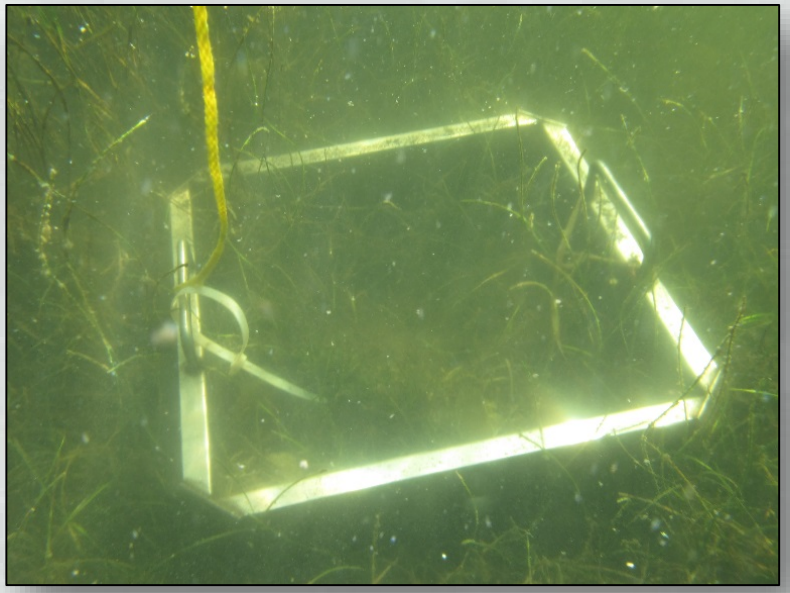
- Joint survey - FDEP, USACE, and CSA
- “Proximal” and adjacent to the JTMS
- Area of ~273,000 m^2 selected
- Target species, *Syringodium filiforme*



Harvesting

- 0.25 m^2 harvest plots
- ~ every 2 m along 100 m transects
- “Cookie cutters” used
- Stored *in situ* in large mesh bags



PU Assembly

- Material sorted in flow-through table
- *Syringodium filiforme* (aerial and sediment rhizomes w/ apicals)
- Non-target seagrass discarded
- 4-5 rhizome apicals + staple = 1 PU
- QC checks on apical counts per planting tray (100 PU)
- Mean = 4.1 apicals PU^{-1}

Planting

- Divers inserted 1 PU m^{-2}
- PU Buried just beneath the sediment surface
- Manatees observed eating PUs

Bird Stake Installation

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- Each bird stake marked by plot number
- 1,160 stakes (corners of planted plots)
- Roost ~0.3 m (1 ft.) above water surface (mean high tide)

USCG Mitigation

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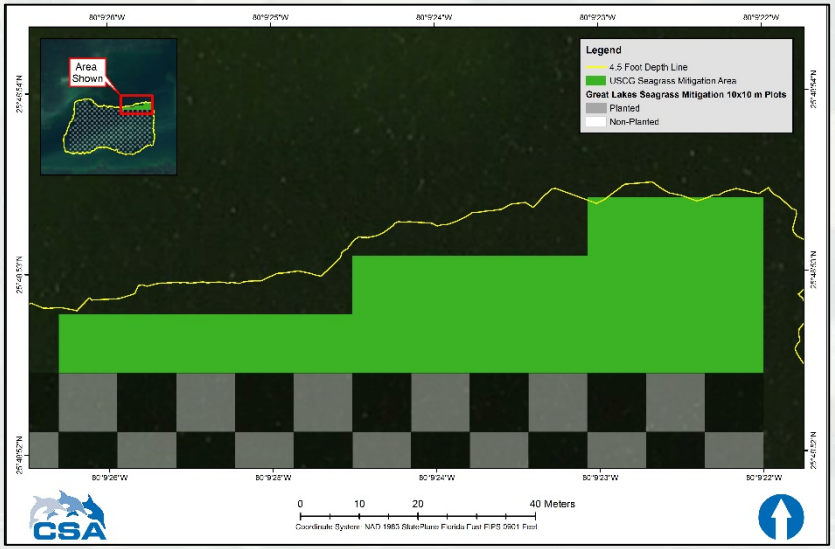
- Mitigation for dredging at the Miami Beach Coast Guard

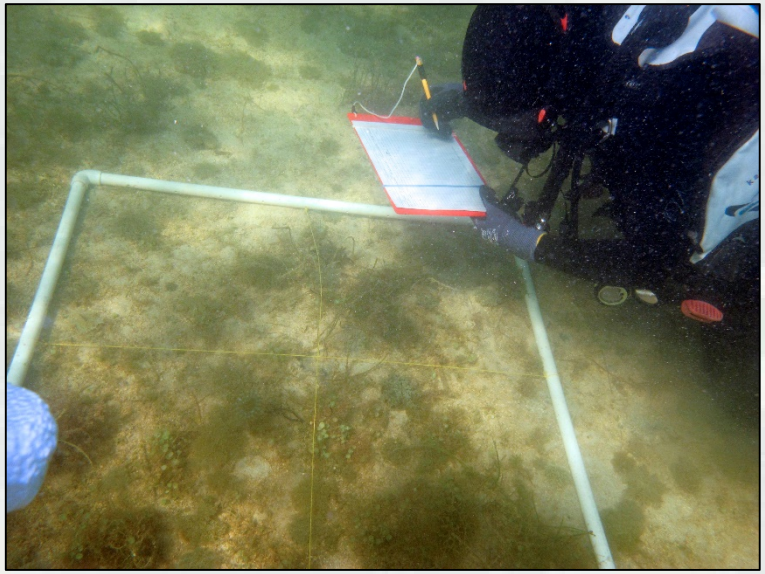


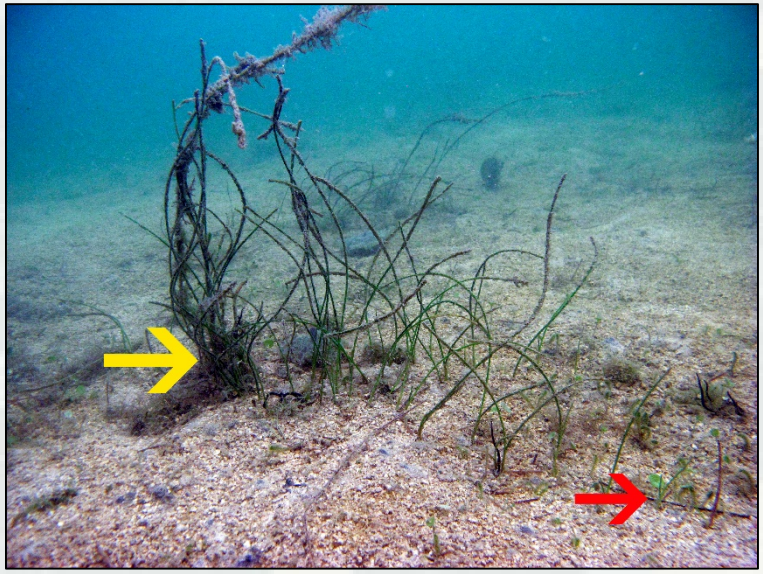
- Opportunity to increase seagrass habitat restoration at JTMS

- 0.54 acres, conterminous 10 m x 10 m plots planted (no checkerboard)

Monitoring

- Survival survey
  - Miami Harbor mitigation: 5 Y by Miami-Dade County
  - USCG mitigation: 5 Y by CSA





Initial Results ~ 30 Days

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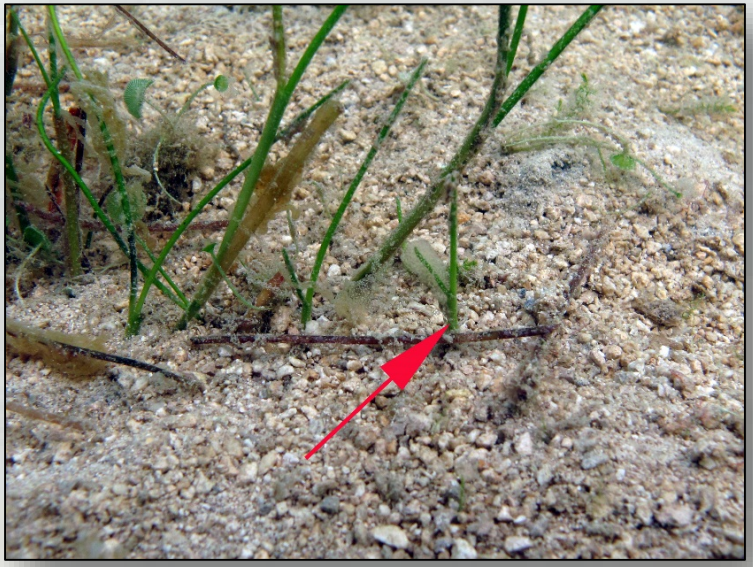
- Miami Harbor PUs – 97.6% survival
- USCG PUs – 98.2% survival
- Baseline USCG data
  - Mitigation Site: 1% Total Seagrass; 13.8% Macroalgae
  - Reference Site: 55.0% Total Seagrass; 1.0 % Macroalgae



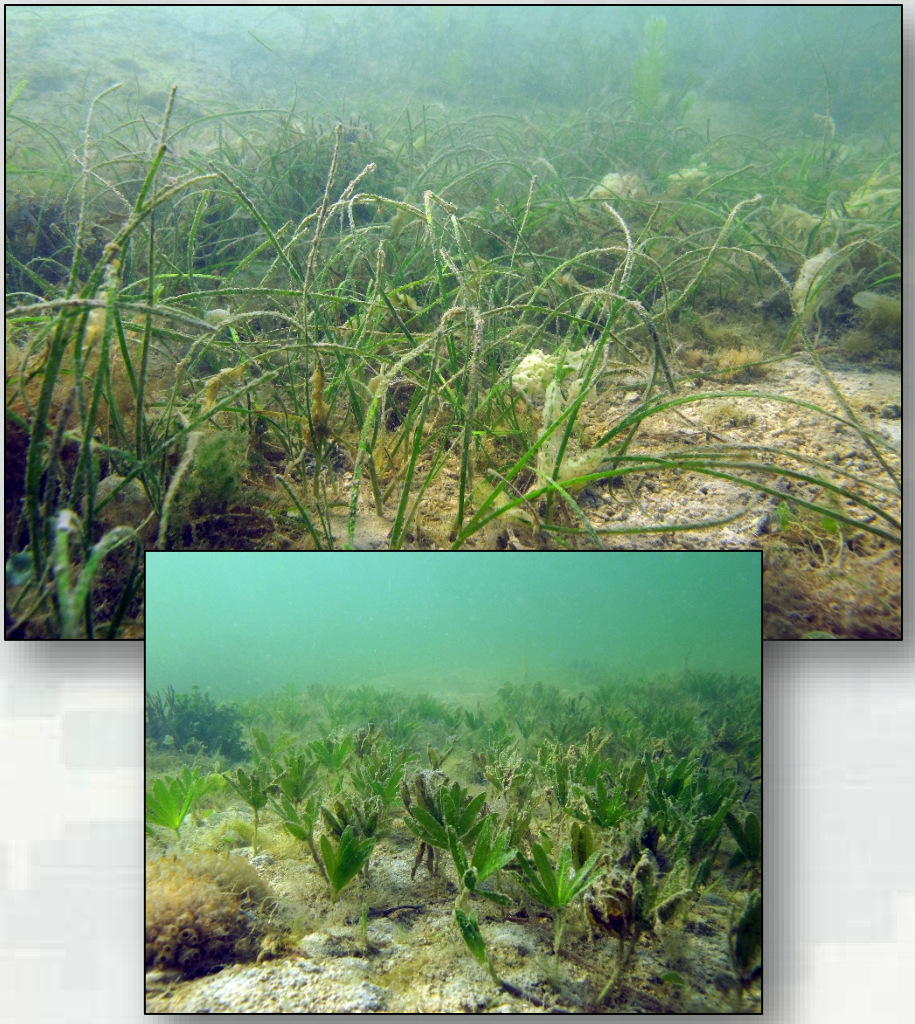
Collateral colonization

Volunteer seagrass

- *H. wrightii*
- *S. filiforme*
- *H. decipiens*
- *H. englemanii*
- *T. testudium*

Macroalgae

- *Halimeda*
- *Batophora*
- *Caulerpa*



Future

- Quantify recovery trajectory species^{-1}
- Compare seagrass cover and density
- Assess overcompensation response
- Seasonality of aerial runners

Questions?

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Thank You to all the team members that helped make this project a success!