NOAA Habitat Conservation
Conserving Habitat for Future Generations

Multiple Benefits of Living Shorelines & Marsh Restoration: Case Studies and Results from Robust Monitoring

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Stella Wilson
U.S. Department of Commerce | NOAA
National Marine Fisheries Service,
Deepwater Horizon Program
Gulf Breeze, FL
Estelle.Wilson@noaa.gov

NOAA FISHERIES SERVICE

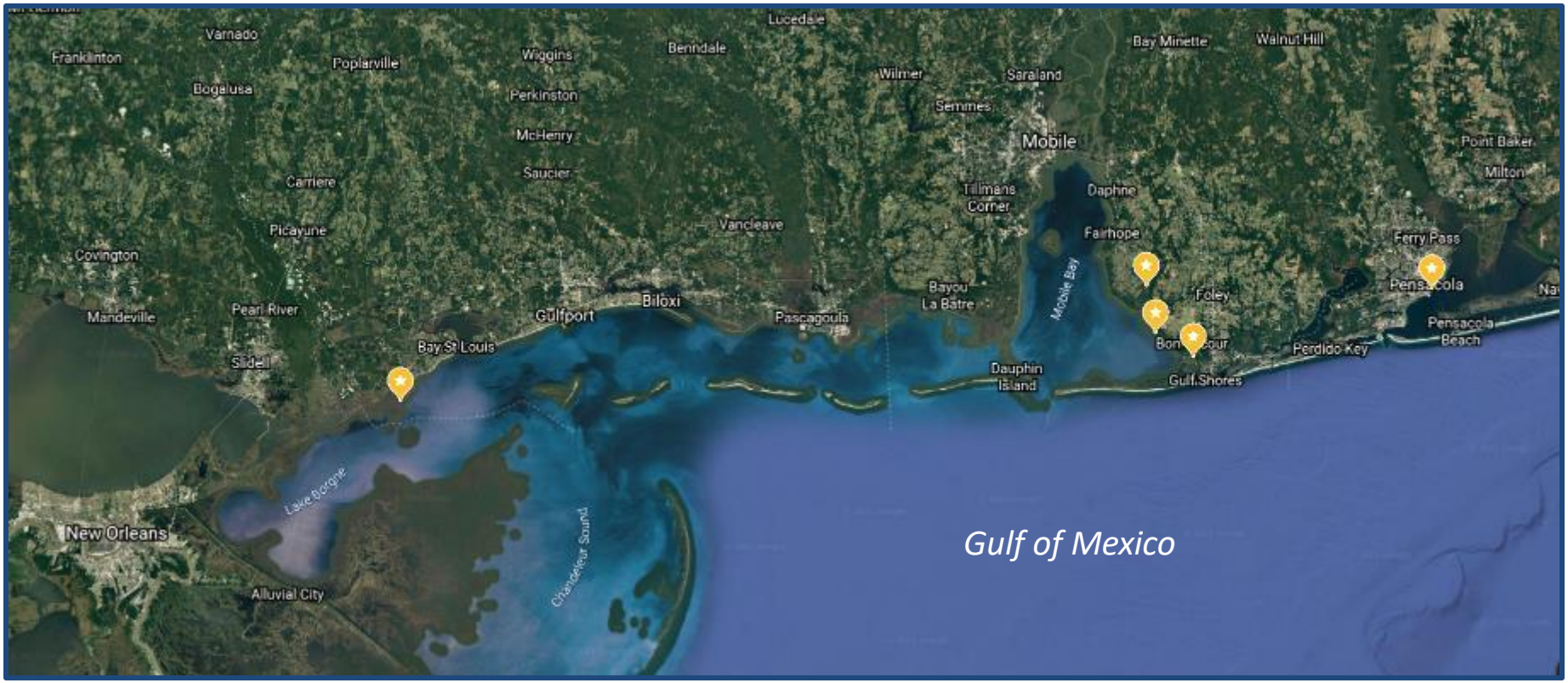
Background: Deepwater Horizon Oil Spill

- 2010: BP Deepwater Horizon Oil Spill occured
- 2011: BP Framework Agreement – up to $1B for “early” restoration
- 2012: RESTORE Act is signed into law
- 2014: NRDA Phase III Early Restoration Plan/EIS
- 2015: Settlement Agreement
- 2017-Current: Project Construction / Monitoring

Programmatic Goals

- Phase III Early Restoration Plan / EIS
  - In accordance with the Oil Pollution Act of 1990 (OPA) and the National Environmental Policy Act (NEPA),
  - Create and Improve Wetlands
  - Protect Shorelines and Reduce Erosion
  - Conserve Habitat
- RESTORE Act Bucket 2 Comprehensive Plan
  - Restore and Conserve Habitat
  - Replenish and Protect Living Coastal and Marine Resources
  - Enhance Community Resilience

Project Locations



Project Status

Project Name	Location	Cost	Status
Pensacola Bay Living Shoreline	Pensacola Bay, FL	$10M	Construction
Swift Tract Living Shoreline	Mobile Bay, AL	$5M	O&M
Fish River Marsh Restoration	Weeks Bay, AL	$1M	E&D
Oyster Bay Marsh Restoration	Oyster Bay, AL	$775k	E&D
Hancock Co. Marsh LS Restoration	Heron Bay & MS Sound, MS	$50M	O&M

Multiple Project Goals & Objectives

- Project **Goals**:
  - Restore the extent, functionality and resiliency of Gulf Coast wetlands
  - Provide secondary production
  - Protect shorelines from erosion
- **Objectives**:
  - Restore natural hydrology to 250 acres of wetlands
  - Provide 100 acres of benthic habitat
  - Create 65 acres of marsh habitat
  - Reduce annual rate of shoreline/wetland loss

Hancock County Marsh Living Shoreline in MS Sound

Hancock County Marsh Living Shoreline

Performance Criteria	Pre-project (baseline)	2018	2019	2020
Median shoreline erosion loss is less than existing erosion rate	3-10 ft/yr	2.2 ft/yr (Phase 1 BW)	0.9 ft/yr (Phase 1 BW)	0.8 ft/yr (average all 3 BWs)
At least 10 bivalves per m2	0	479 (Phase 1 BW)	1 (average all 3 BWs)*	364 (average all 3 BWs)
Infauna / Epifauna at least 84 g ww per m2	0	379 (Phase 1 BW)	51 (average all 3 BWs)*	172 (average all 3 BWs)

**major freshwater event at project site*

Tropical Activity at Hancock Co. Site

Storm Name	Date of Impact to the Project	Maximum Water Level[a] (feet MLLW)
Hurricane Nate	10/8/2017	7.3
Hurricane Michael	10/8/2018	4.7
Hurricane Barry	7/13/2019	4.8
Tropical Storm Olga	10/26/2019	4.5
Tropical Storm Cristobal	6/7/2020	7.4
Hurricane Hanna	7/25/2020	3.9
Hurricane Laura	8/27/2020	4.5
Hurricane Marco	8/24/2020	3.5
Hurricane Sally	9/16/2020	5.4
Tropical Storm Beta	9/21/2020	4.6
Hurricane Delta	10/9/2020	5.2
Hurricane Zeta	10/28/2020	9.9

Notes:

a. Water levels are verified results from NOAA tide gauge 8747437 located at the Bay Waveland Yacht Club in Waveland, Mississippi.

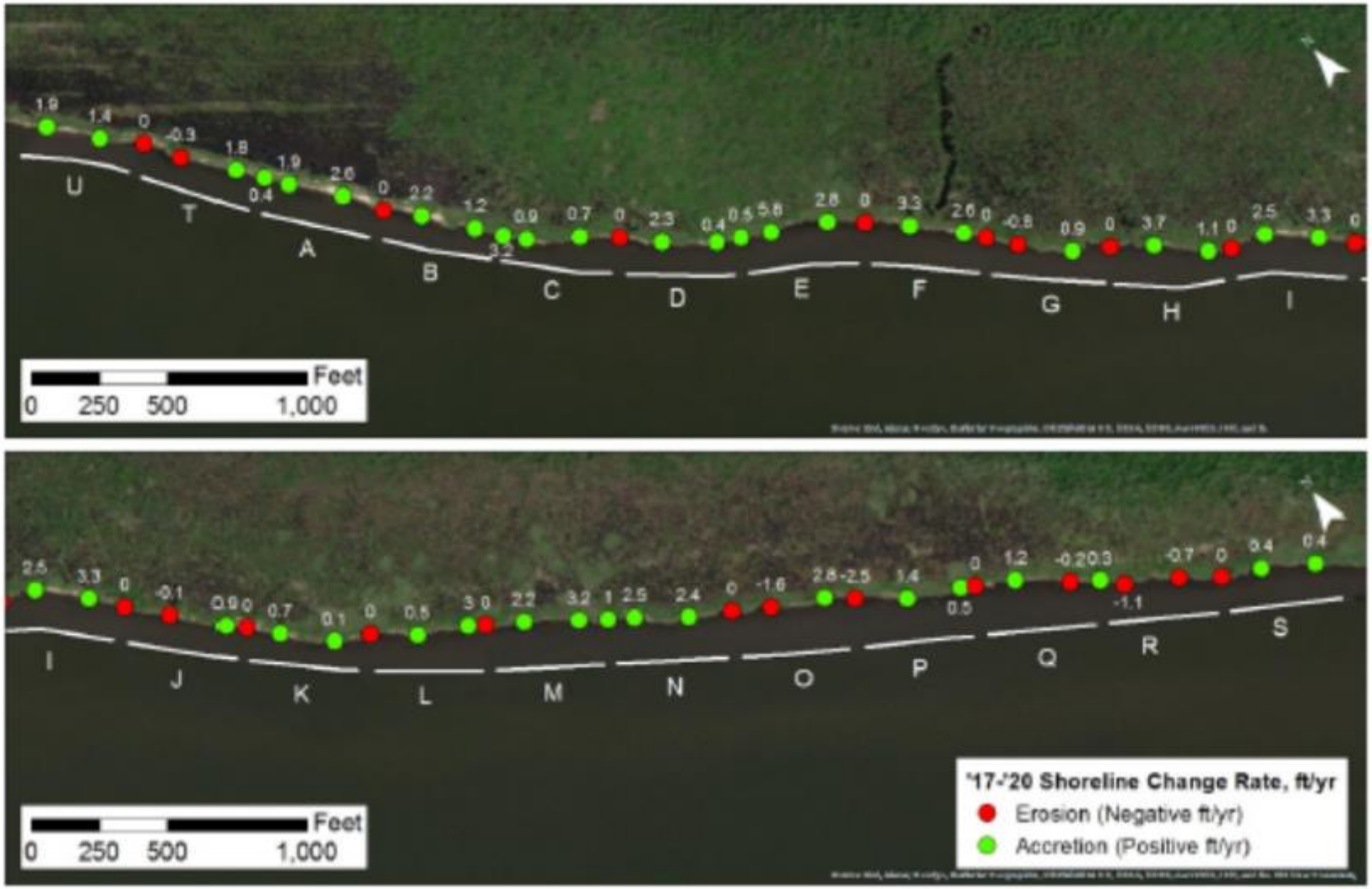
MLLW: mean lower low water

Swift Tract Living Shoreline

Swift Tract Living Shoreline

Project Performance Parameter	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)	Year 4 (2020)
Bivalve Density: At least 10 bivalves per m^2	Meets Fully (40.5 bivalves per m^2)	Meets Fully (234.4 bivalves per m^2)	Meets Fully (99.7 bivalves per m^2)	Meets Fully (608.3 bivalves per m^2)
Invertebrates: At least 84 g wet weight per m^2	Meets Fully (337.6 g wet weight per m^2)	Meets Fully (1031.8 g wet weight per m^2)	Meets Fully (900.6 g wet weight per m^2)	Meets Fully (551.2 g wet weight per m^2)
Shoreline edge position: Median loss is less than existing erosion rates (-1.9 ft/yr)	--	Meets Fully (+3.8 ft/yr)	--	Meets Fully (+1.2 ft/yr)

Swift Tract LS Shoreline Post-Construction Erosion Rates



Example of Sediment Accretion at the Project Site

Conclusions & Lessons Learned from four Years of Monitoring at these two Project Sites

- Living shorelines are effective at reducing wave energy and shoreline loss
- Living shorelines provide benthic habitat for fish, invertebrates, and other marine organisms
- Project goals can be competing
  - sediment accretion vs. benthic habitat
  - Wave energy dissipation vs. benthic habitat

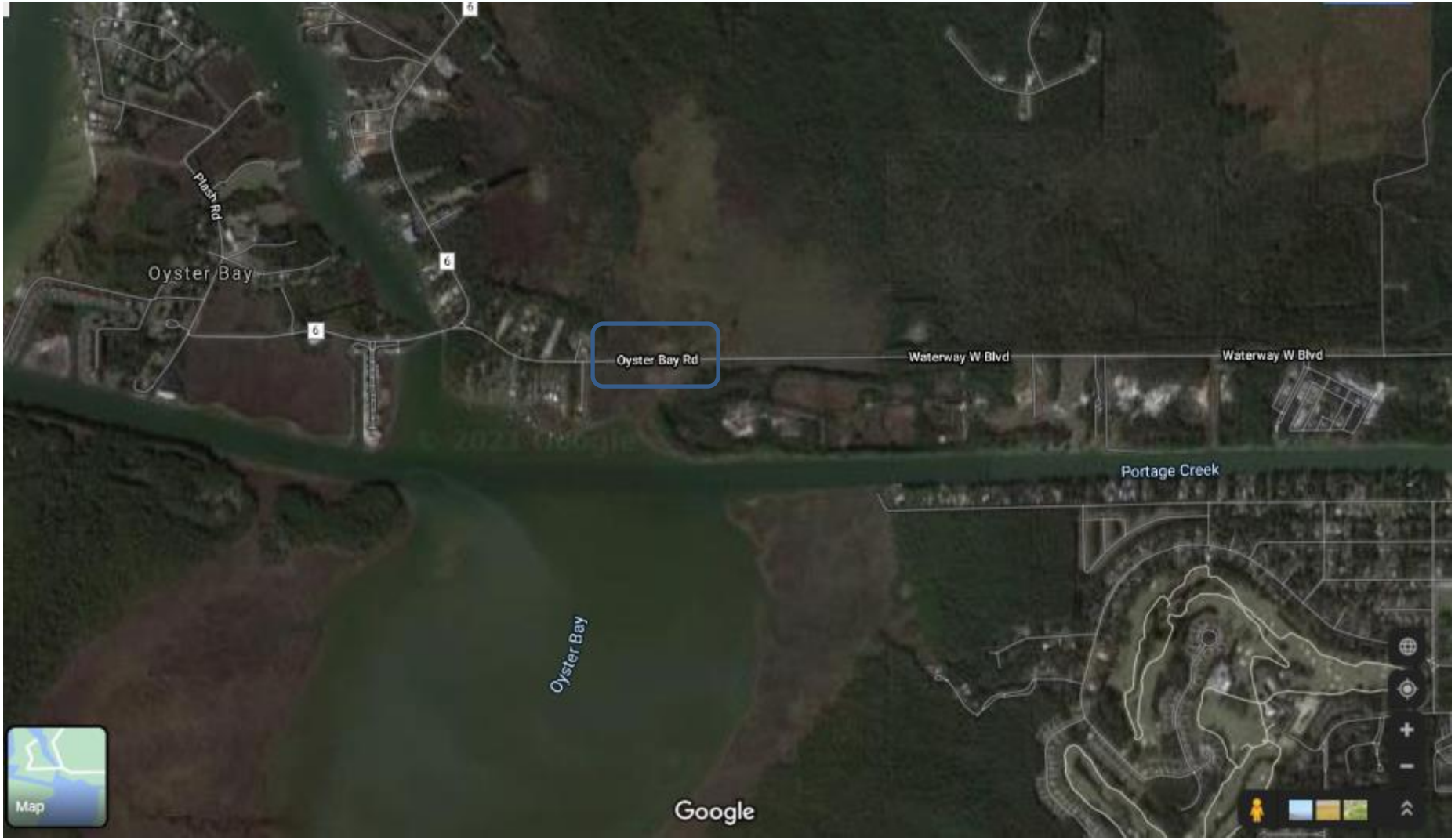
Pensacola Bay Living Shoreline

Pensacola Bay Living Shoreline

Activity	Output	Short-term outcome	Long-term outcome
• Construct breakwater structures	• Approximately 3.5 acres of breakwaters are built	• Oysters and other bivalves settle and grow • Other invertebrate infauna and epifauna colonize • Erosion of created salt marsh is minimized	• Reefs are sustained for at least 7 years • Oysters and other bivalves settle and grow • Reefs support a benthic community • Shoreline erosion is reduced to protect created salt marsh habitat
• Create new salt marsh through placement of sediments • Plant native salt marsh vegetation	• Approximately 9 acres of salt marsh habitat are created	• Sediments consolidate to achieve designed elevation. • Native salt marsh vegetation is established	• Salt marsh is sustained for at least 7 years

Project Greenshores Phase I

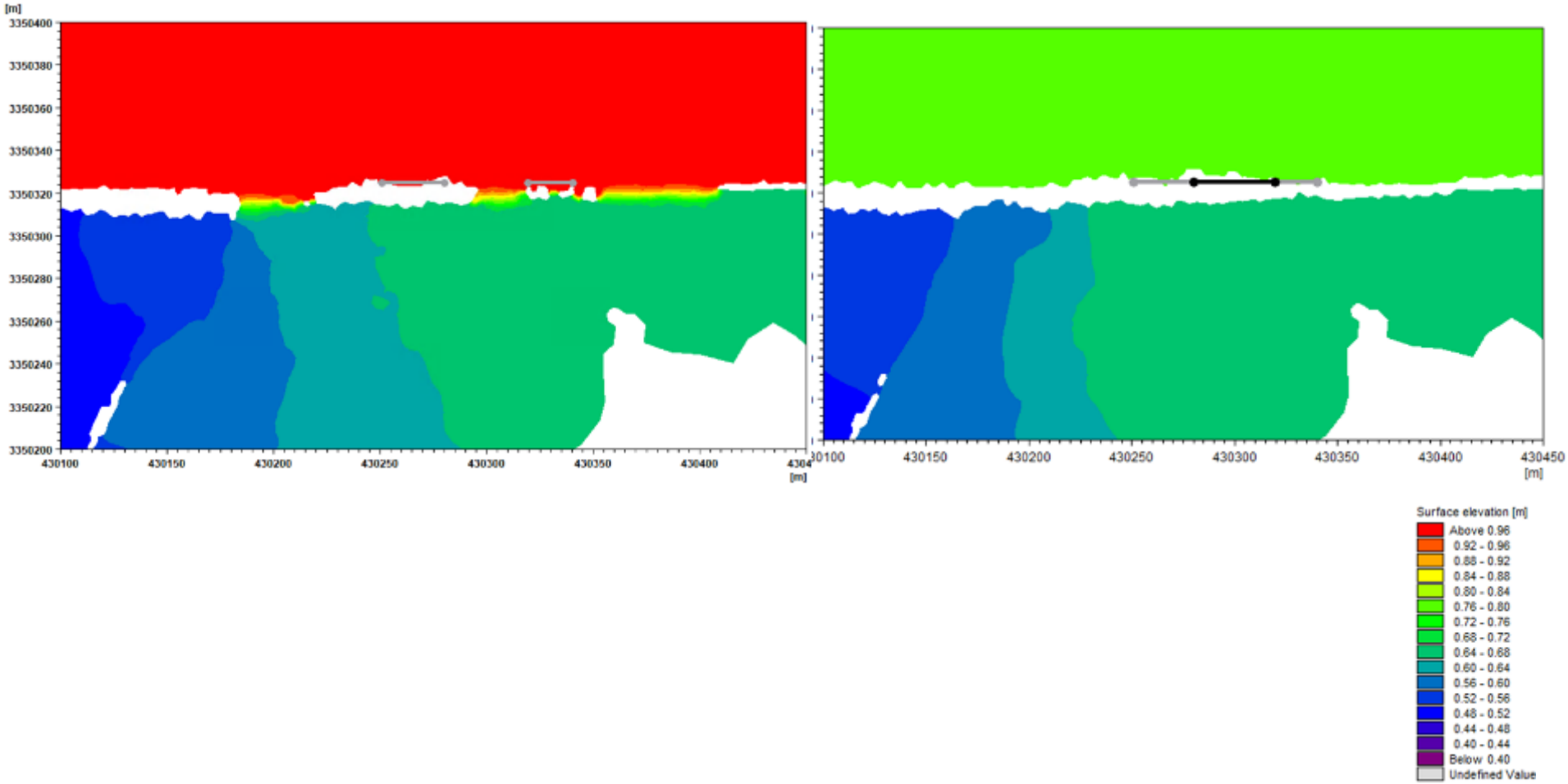
Oyster Bay Marsh Restoration



Oyster Bay – existing conditions

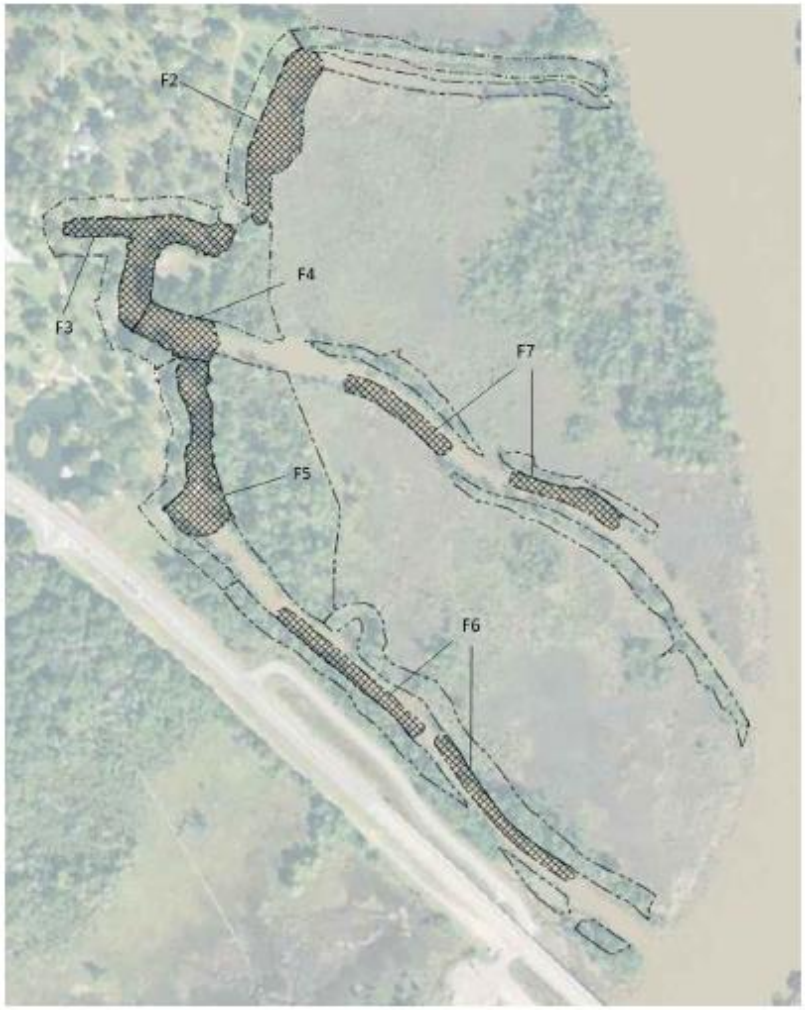
Oyster Bay
50-year, 24-hour event peak water surface elevation

Existing conditions vs. Project Design

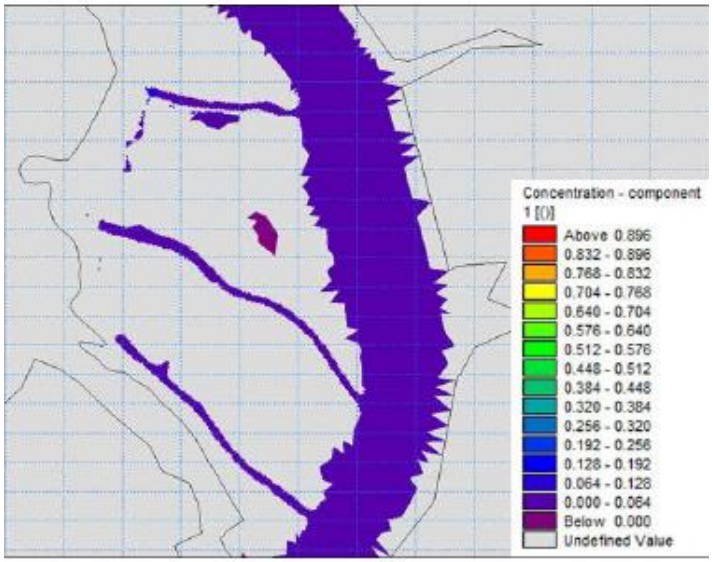


Fish River Marsh Restoration

Fish River Marsh Restoration



Fill and/or Borrow Area	Zone	Area (ac.)	Existing Habitat Type	Anticipated Habitat Type
B1, B5, B6, B8, and B9	Spoil Piles	5.6	Upland	Marsh
B2, B3, B4, B7 and B10	Upland	7.2	Upland	Marsh
F2, F3, F4 and F5	Western Canals	3.5	Canal	Marsh
F6 and F7	Eastern Canals	0.7*	Canal	Marsh



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