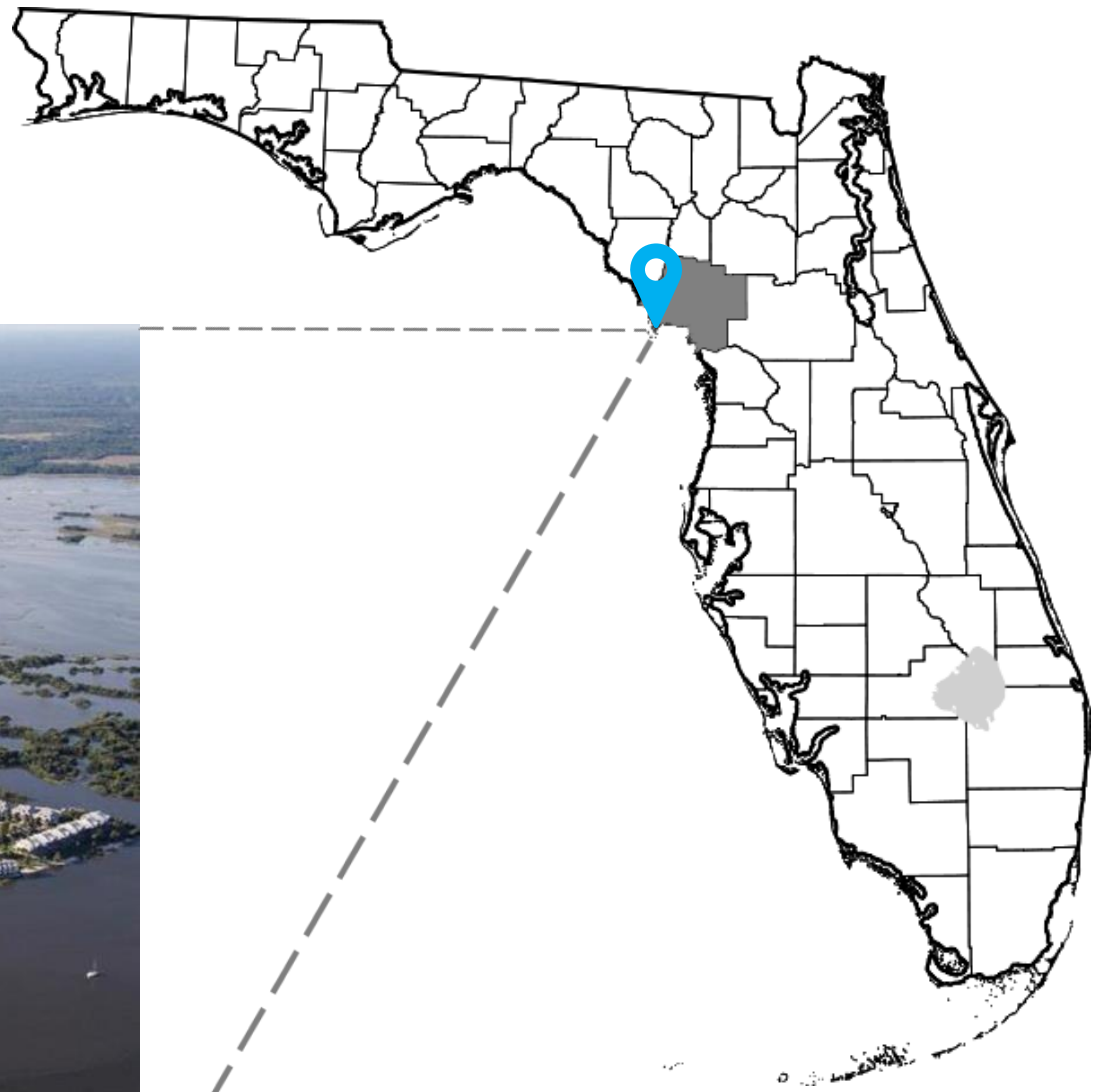
Nature-based Solutions to Coastal Hazards in Florida's Gulf of Mexico

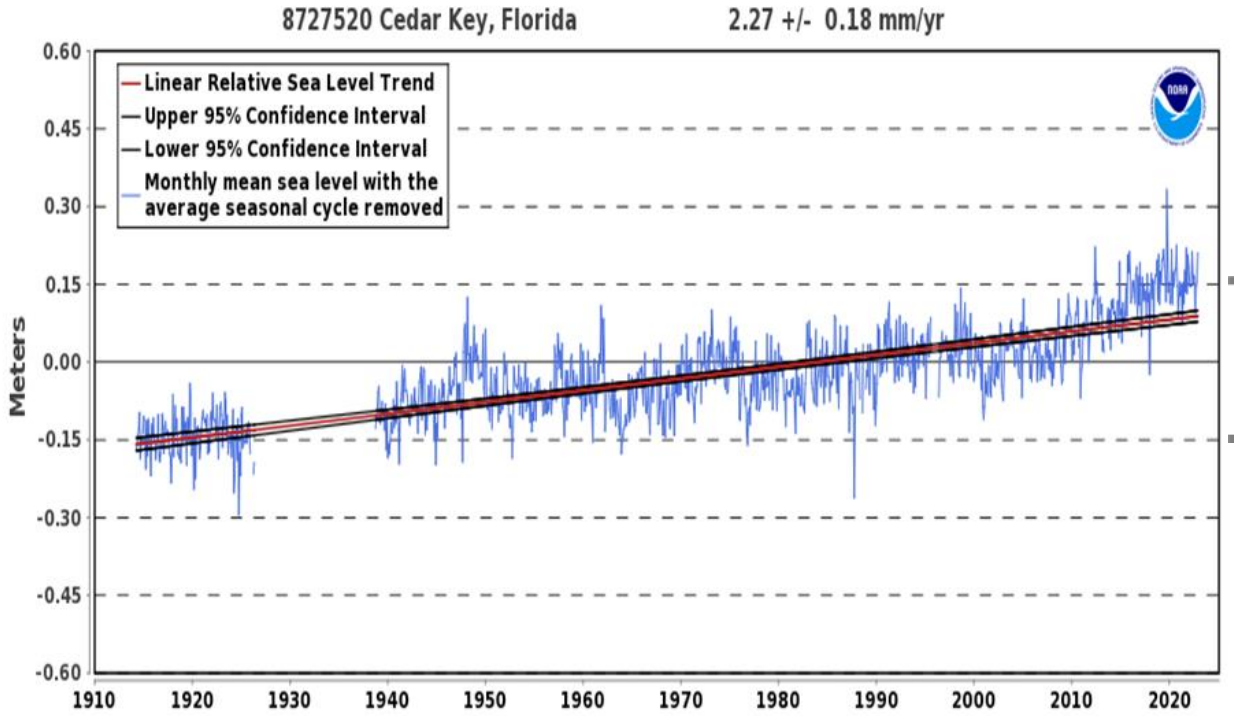
Haley Cox

Florida Sea Grant, UF/IFAS Nature Coast Biological Station

Cedar Key, Florida



Sea Level Rise

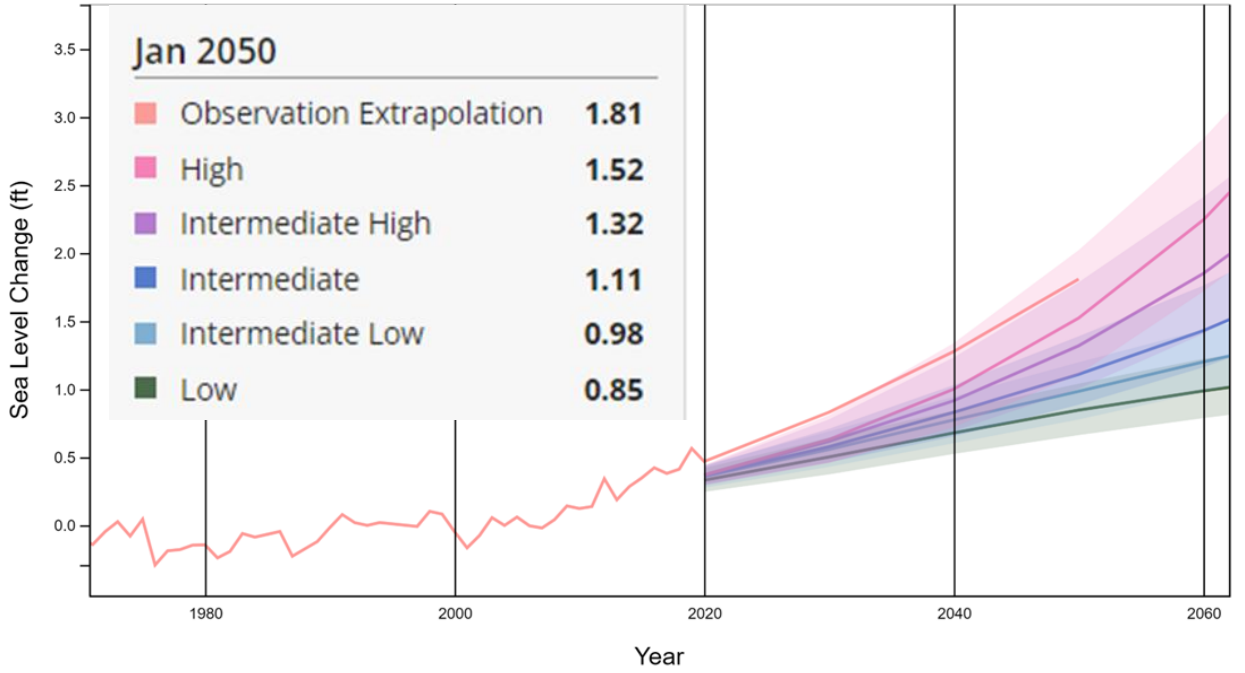


30 cm (11.8 inches)

Cedar Key is experiencing the fourth-highest rate of sea level rise acceleration in the U.S. (NOAA).

- Observed trends outpace extreme scenarios from models.

Interagency Sea Level Rise Scenario Tool localslr.org



Storms and Flooding

- Frequency and intensity of extreme events
- Stormwater and tidal flooding

Coverage of Hurricane Idalia, Aug. 2023

@jimcantore via X® and The Weather Channel


1961
1974
1994
Whidden Ave
Palmetto Dr
SW 139th Ln
9th St
7th St
6th St
5th St
4th St
3rd St
2nd St
1st St
Cedar Key
24
365 Ct
SW 136th Ave
Airport Rd
Daughtry Bayou
2016
Cedar Key
Daughtry Bayou
Rapid shoreline erosion rates

UF-Cedar Key Community Collaboration 2016-2022

Living Shoreline Benefits

LSLs are nature-based alternatives to armored shorelines (hardened infrastructure) that can:

- Reduce erosion
- Attenuate wave energy
- Protect and improve water quality
- Enhance fisheries habitat and biodiversity

Funding Sources

Living shoreline projects in Daughtry Bayou were funded through:

- FDEP Resilience Planning Grant
- EPA Gulf of Mexico Program Grant
- FWC State Wildlife Grant

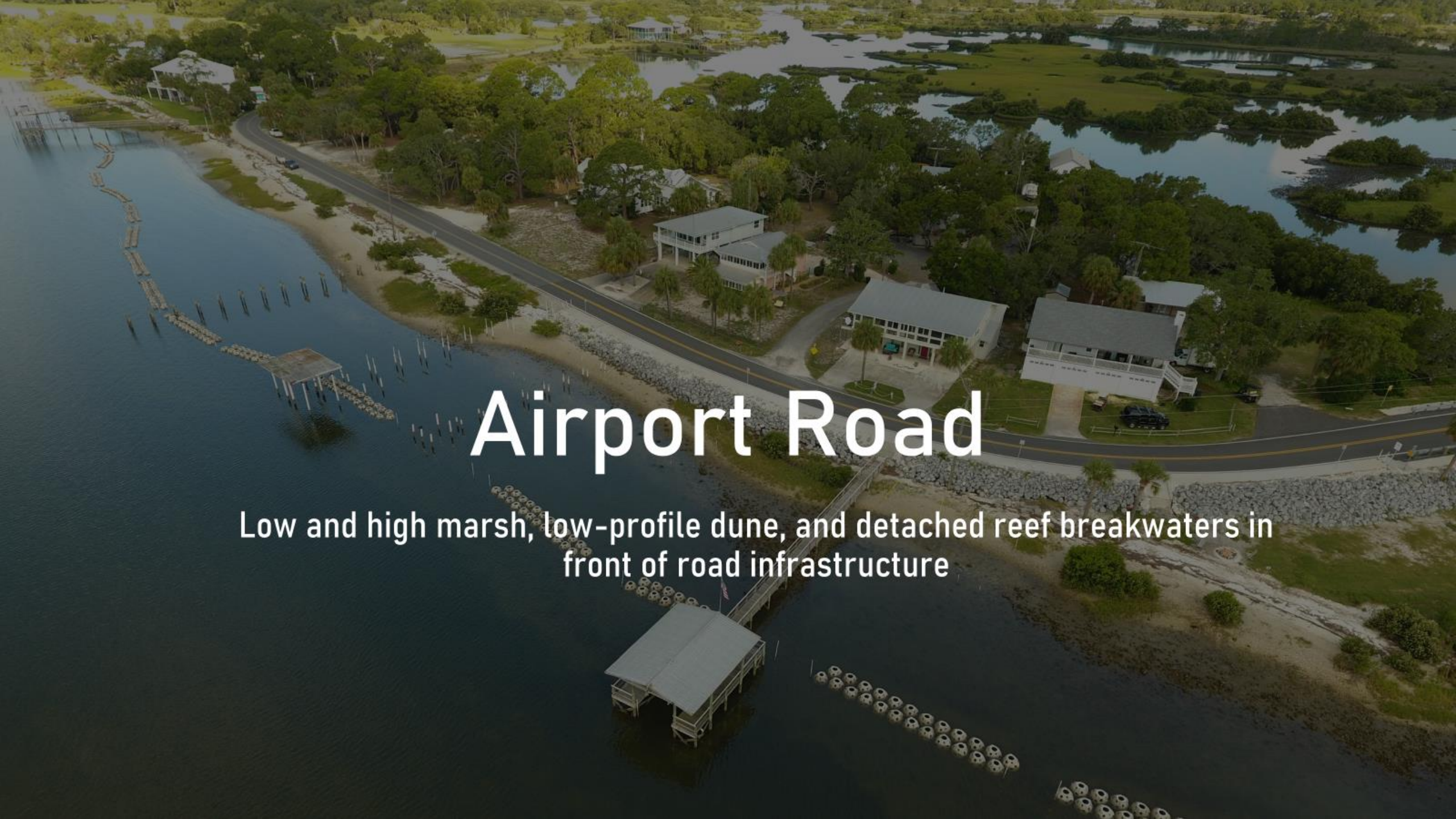
Joe Rains Beach

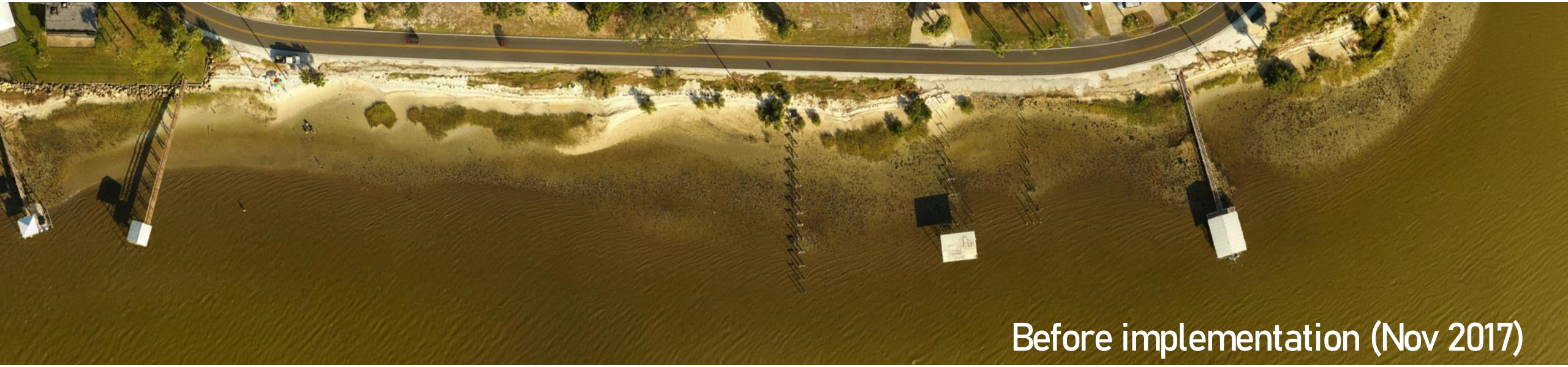
Low and high marsh with sill in front of bulkhead


Before implementation Sept 2016


Dredging in 2017
reopened Tyree Canal
June 2023

Effects of Hurricane Idalia (2023)


Airport Road
Low and high marsh, low-profile dune, and detached reef breakwaters in front of road infrastructure

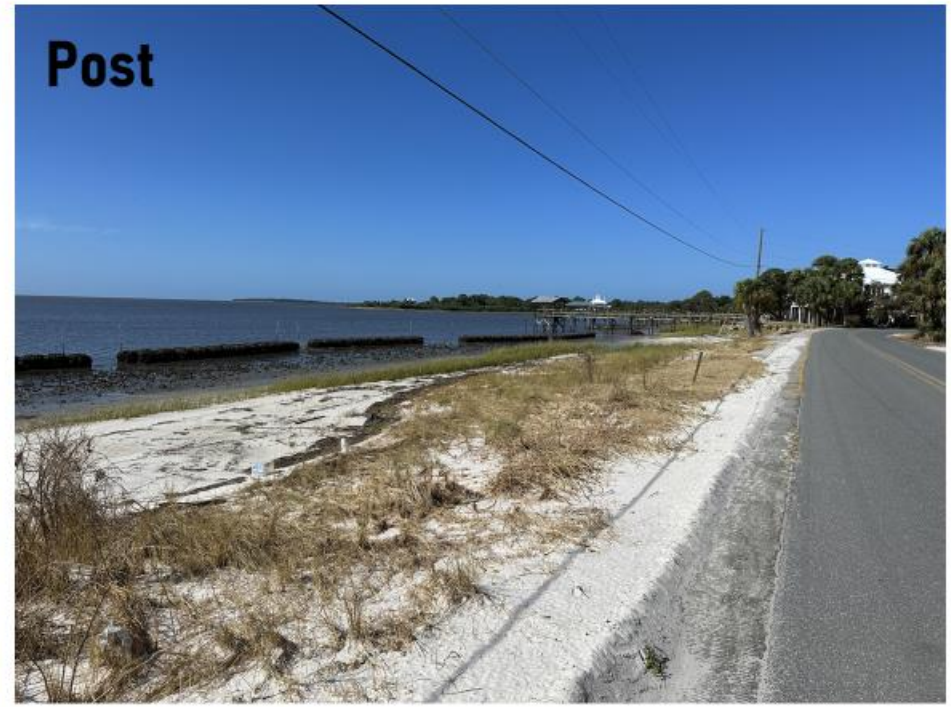

Before implementation (Nov 2017)

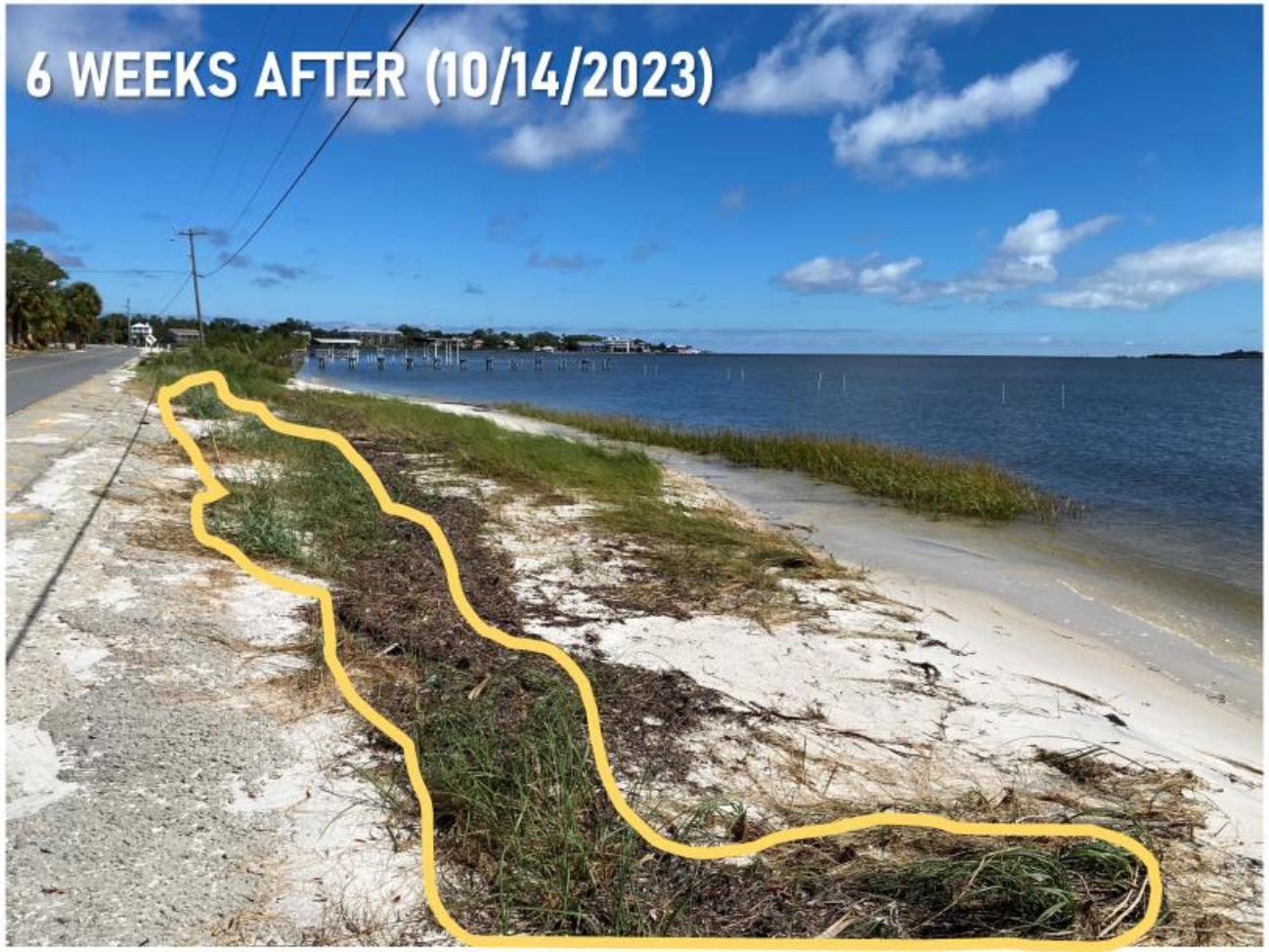

June 2023

Airport Road before and after Hurricane Idalia

Little to no loss of sand, but signs of redistribution along shoreline are visible.

Signs of salt stress in dune/high marsh vegetation from inundation.

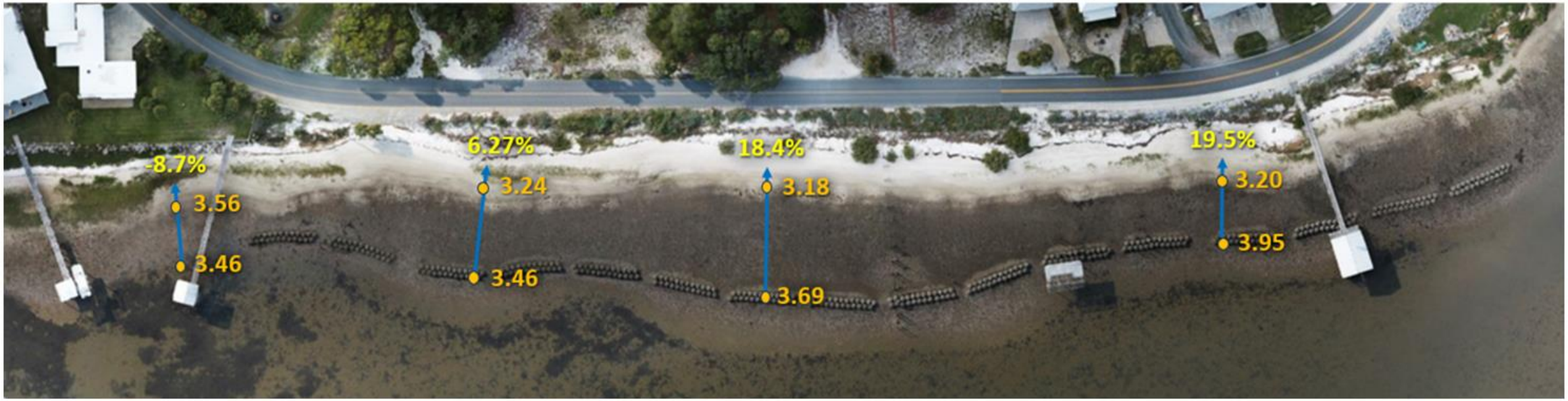




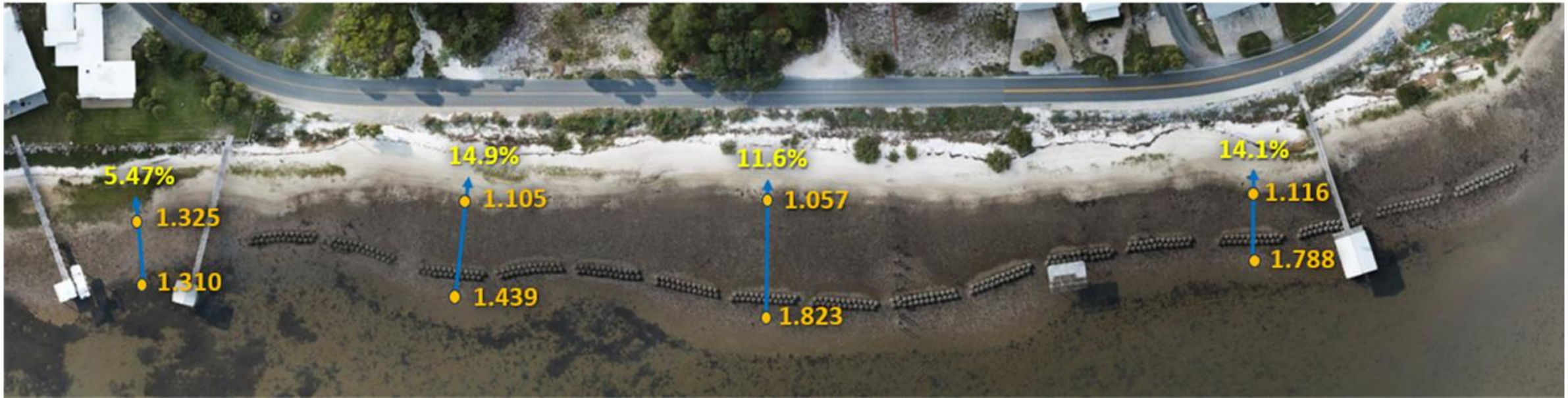
Dune and high marsh vegetation on Airport Road recovering from salt stress after Idalia, particularly *Panicum amarum* (bitter panicgrass).

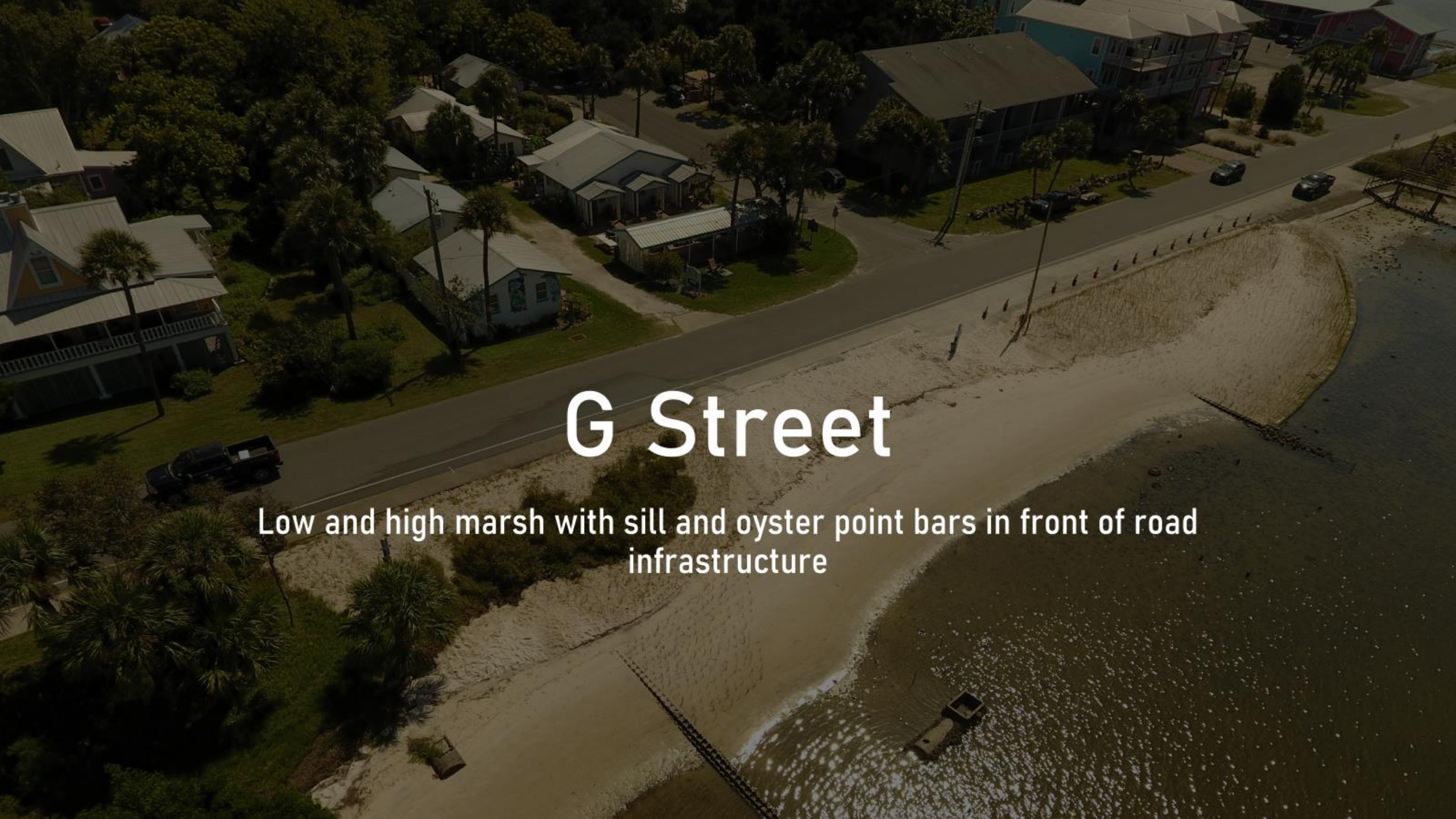

5 DAYS AFTER (9/4/2023)
Wave gauge

Maximum incident **wave height** and attenuation along Airport Road, ft



Maximum incident **wave power** and attenuation along Airport Road, kW/m





G Street

Low and high marsh with sill and oyster point bars in front of road infrastructure


G Street (2016)
G Street (2023)
Living shoreline intervention
Shoreline recession
outside project area

Aug 2023 (During Idalia)

Oct 2023 (6 weeks post-Idalia)


Aug 2023 (Pre-Idalia)


Sept 2023 (Post-Idalia)


Oct 2023 (6 weeks after Idalia)


G Street after Idalia
Living shoreline protected "toe" of hardened infrastructure
No erosion
Erosion outside project area

Maximum incident **wave height** and attenuation along G Street, ft

Maximum incident **wave power** and attenuation along G Street, kW/m

Successes

- Built community partnerships through co-design process
- Shorelines remained intact and protected road infrastructure
- Minimal losses of vegetation and sediment
- Preliminary data suggests that wave attenuation occurs during surge events

Acknowledgements: Dr. Savanna Barry, Dr. Mark Clark, Dr. Elix Hernandez

Sea Grant FLORIDA

UF IFAS UNIVERSITY of FLORIDA

NATURE COAST BIOLOGICAL STATION

SOIL, WATER, AND ECOSYSTEM SCIENCES

Continued Collaboration

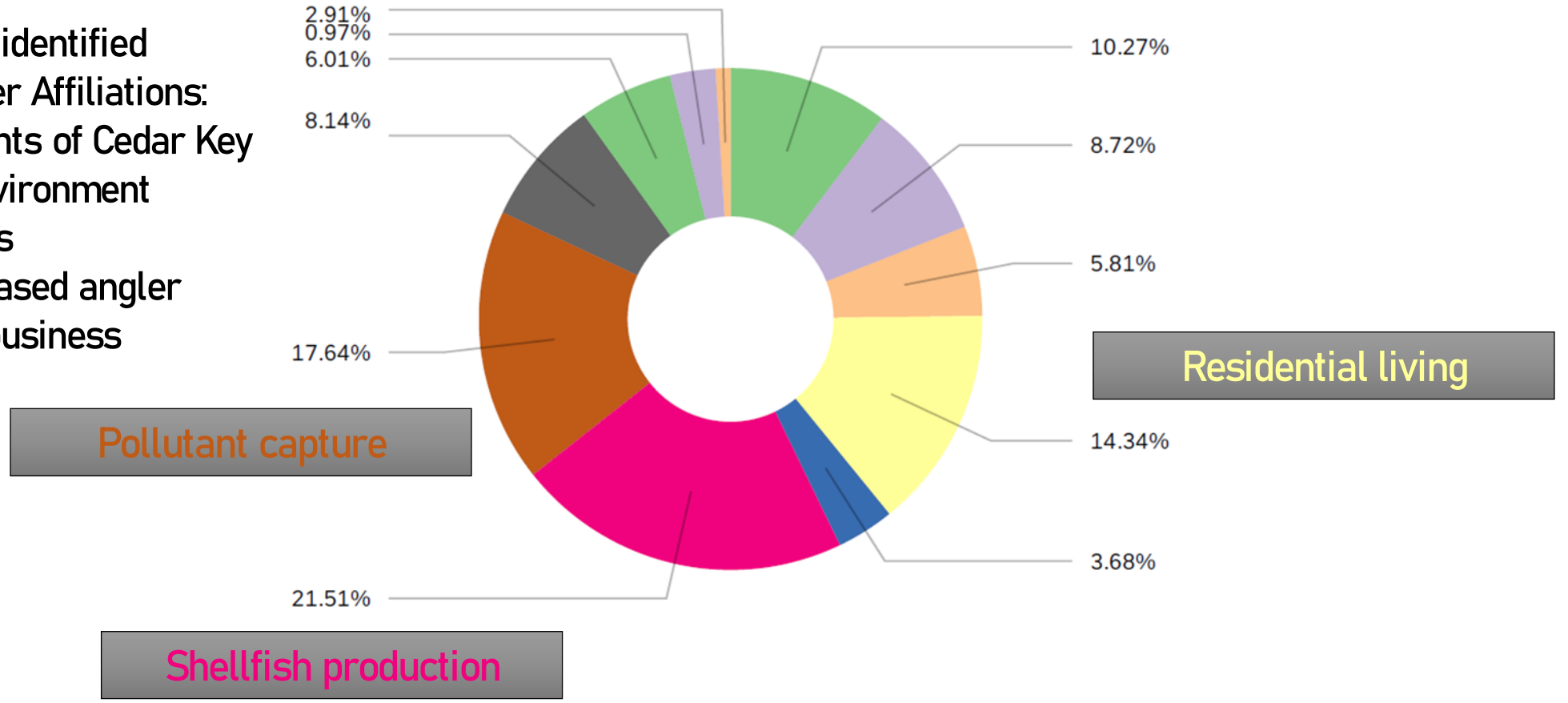
Cedar Key ShOREs: Shoreline **O**ptions for **R**esilience and **E**quity

- Funded by National Academy of Sciences (NAS) Gulf Research Program (GRP)
- Planning grant awarded in 2022
- Interdisciplinary project team: Micheal Allen, Eban Bean, Carla Brisotto, Jessica Bruso, Sue Colson, Mark Clark, Jiayang Li, Thomas Ruppert, Jason von Meding, & Xiao Yu

Critical shoreline functions to safeguard:

Top 5 Self-identified Stakeholder Affiliations:

1. Residents of Cedar Key
2. The environment
3. Tourists
4. Boat-based angler
5. Local business



Community Workshops

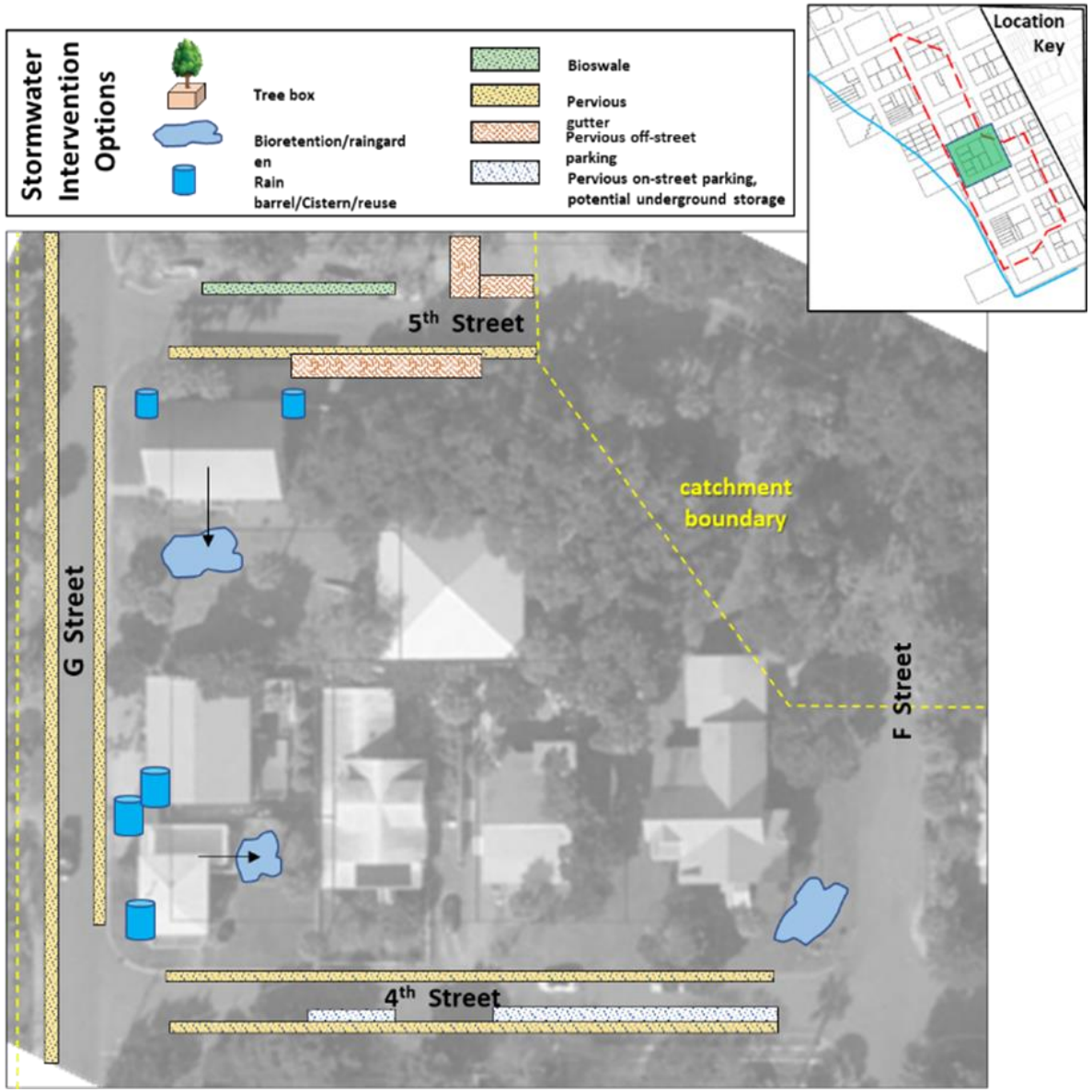
Shoreline

- Focused on reducing erosion and restoring historic shoreline morphology

Stormwater

- Introduced GSI concepts and options for Cedar Key

Conceptual Design



Outcomes

Stormwater retrofits to existing infrastructure:

- Inline check valves installed in 2023 (after workshop)
- Operation TRAP – Catch basin filters (LittaTrap™) installed to prevent trash/debris pollution

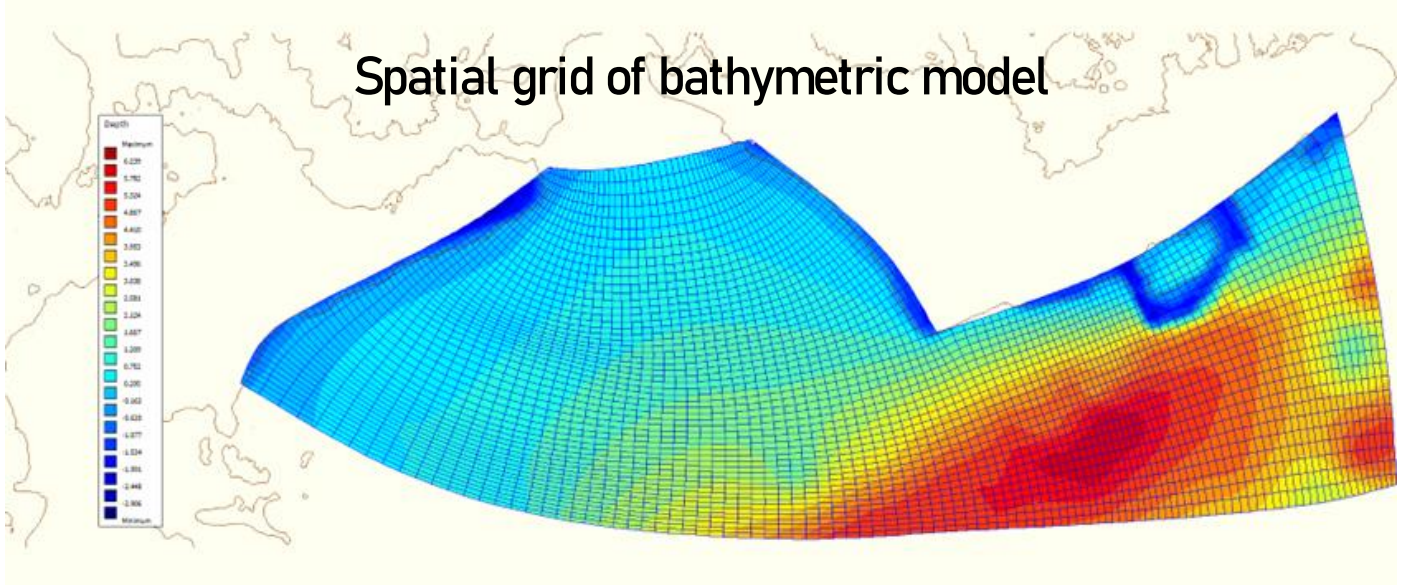
Next Steps

NATIONAL ACADEMIES Sciences Engineering Medicine

GULF RESEARCH PROGRAM

Now funded for Phase II

- Hydrodynamic and stormwater modeling
- Continual refinement of designs
- Permitting



Nortek Eco™ (ADCP)

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