

**FT PIERCE INLET  
SEDIMENT BUDGET  
(WITH UNIFORM ANNUAL  
SAND PLACEMENT RATES)  
[2021]**

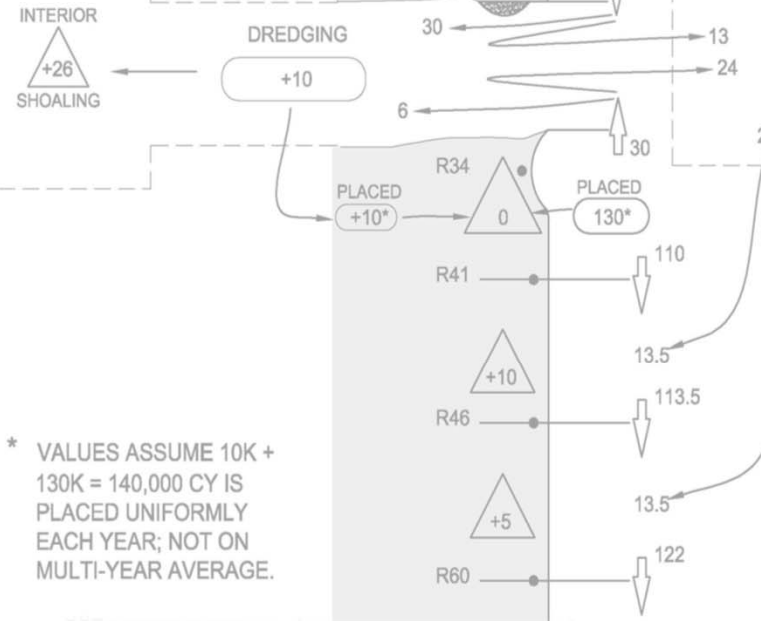
VALUES ARE 1000'S OF  
CUBIC YARDS PER YEAR

# Ft. Pierce Inlet Sediment Trap: Using New- and Low-Tech Tools to Inform Coastal Processes

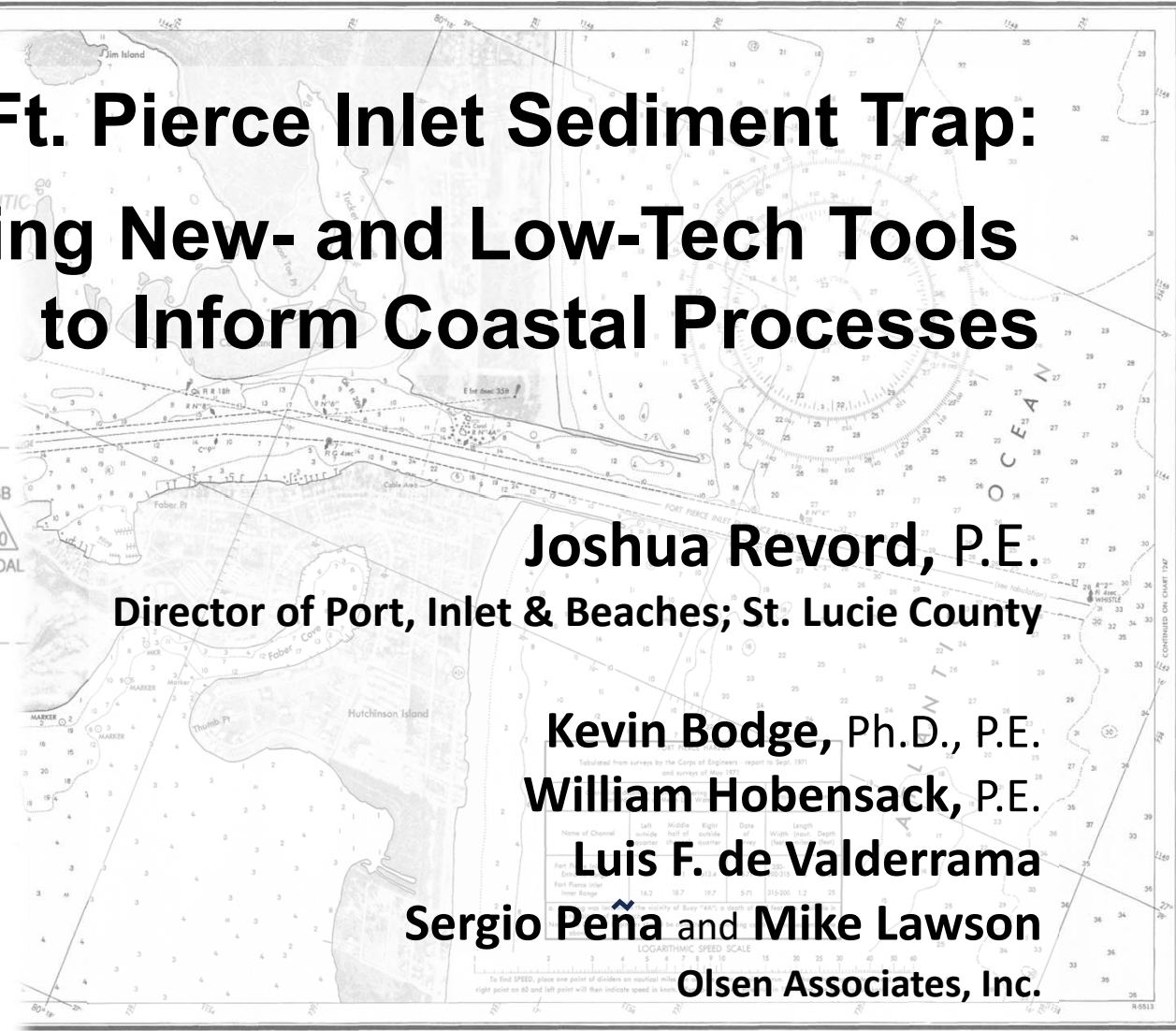
**Joshua Revord, P.E.**  
Director of Port, Inlet & Beaches; St. Lucie County

**Kevin Bodge, Ph.D., P.E.**  
**William Hobensack, P.E.**

**Luis F. de Valderrama**  
**Sergio Peña and Mike Lawson**  
Olsen Associates, Inc.



\* VALUES ASSUME 10K + 130K = 140,000 CY IS PLACED UNIFORMLY EACH YEAR; NOT ON MULTI-YEAR AVERAGE.



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U. S. DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
NATIONAL OCEAN SURVEY

FATHOMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
FEET	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
METERS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

FORT PIERCE HARBOR  
SOUNDINGS IN FEET - SCALE 1:10,000  
C&GS 582  
NOT FOR SALE

## Phase 1 Sediment Trap – Ft. Pierce Inlet, FL

(constructed Nov 2021 – July 2022)

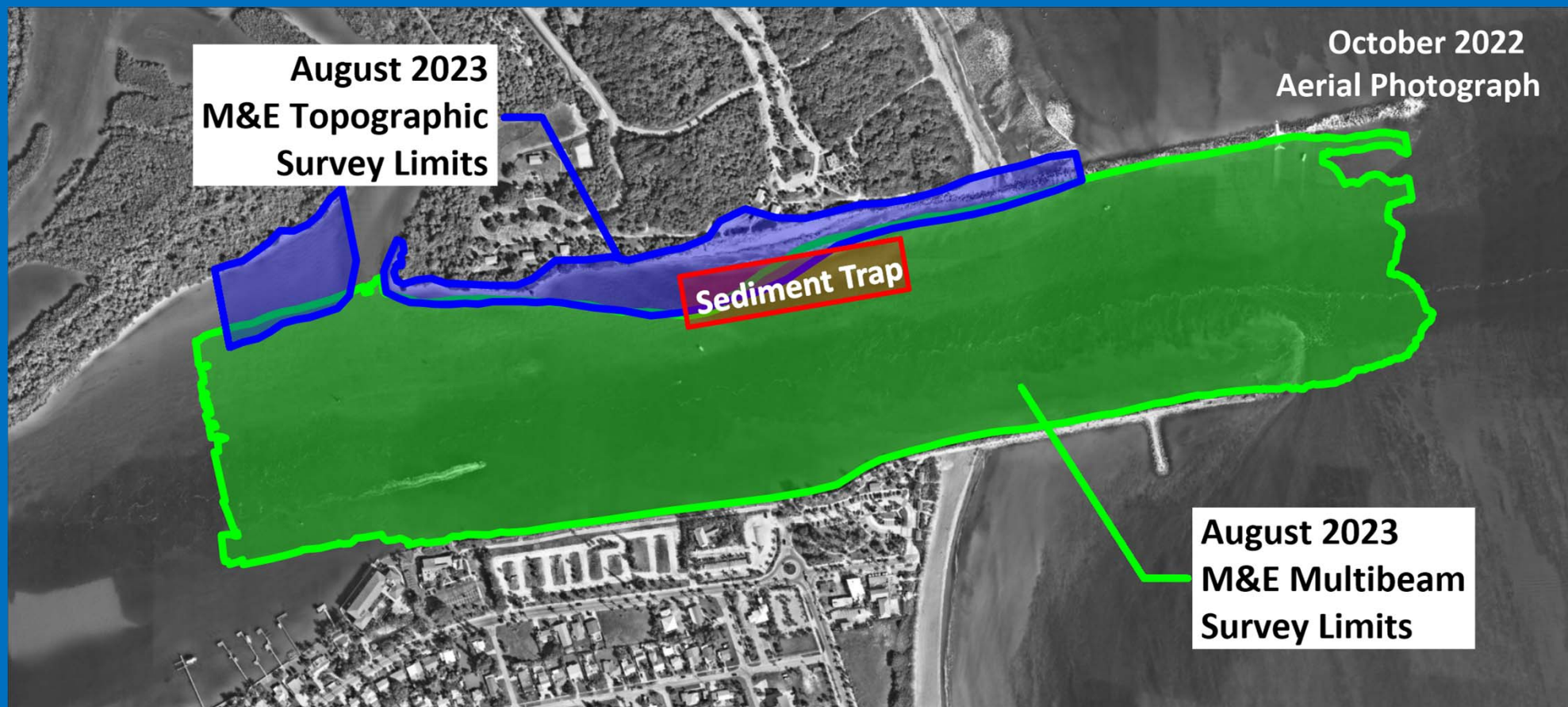
October 2022



Phase 1 Trap: ~ 850' x 250' to -32' NAVD; 62,000 CY max capacity (40,000 cy nominal)

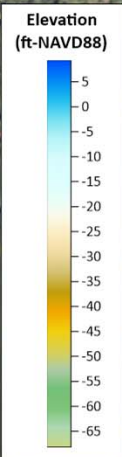
# Phase 1 Sediment Trap – Ft. Pierce Inlet, FL

Physical Monitoring Survey Scope



# August 2023: 1-Yr Post-Construction (High-Res Multibeam 3d Image)

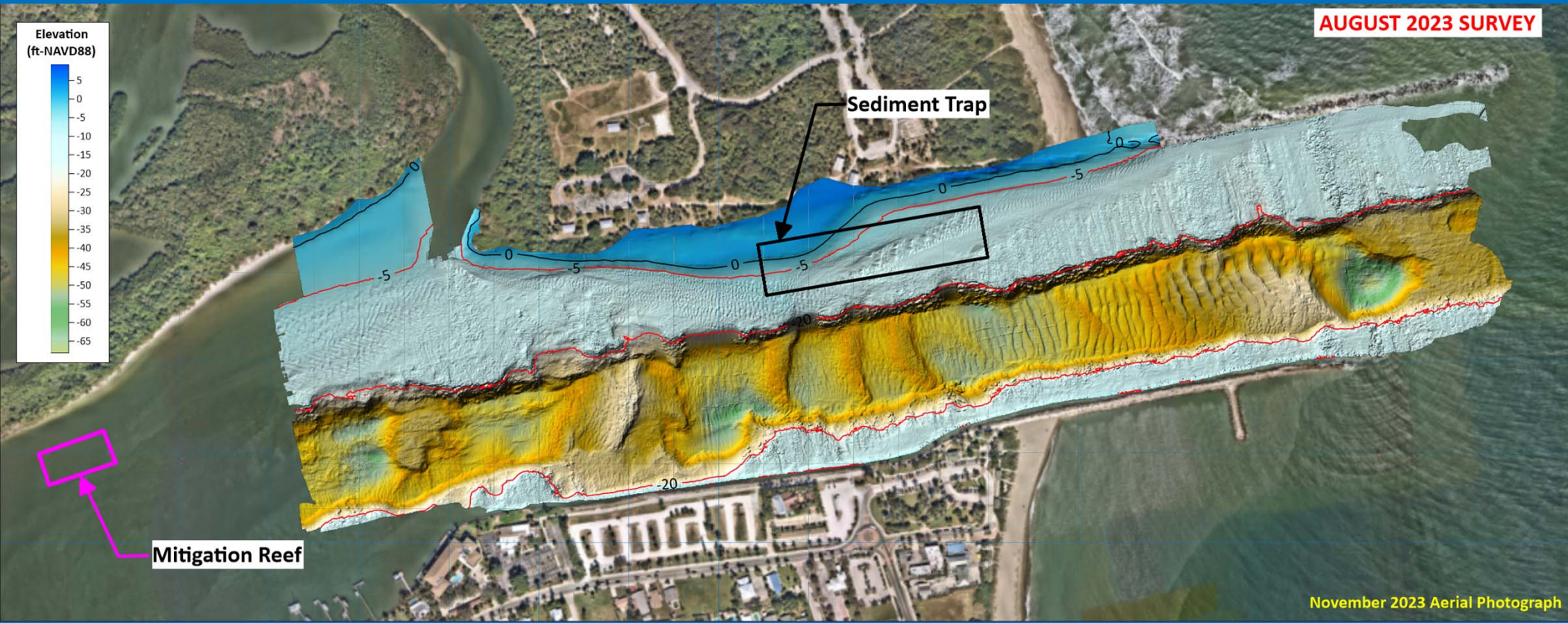
**AUGUST 2023 SURVEY**



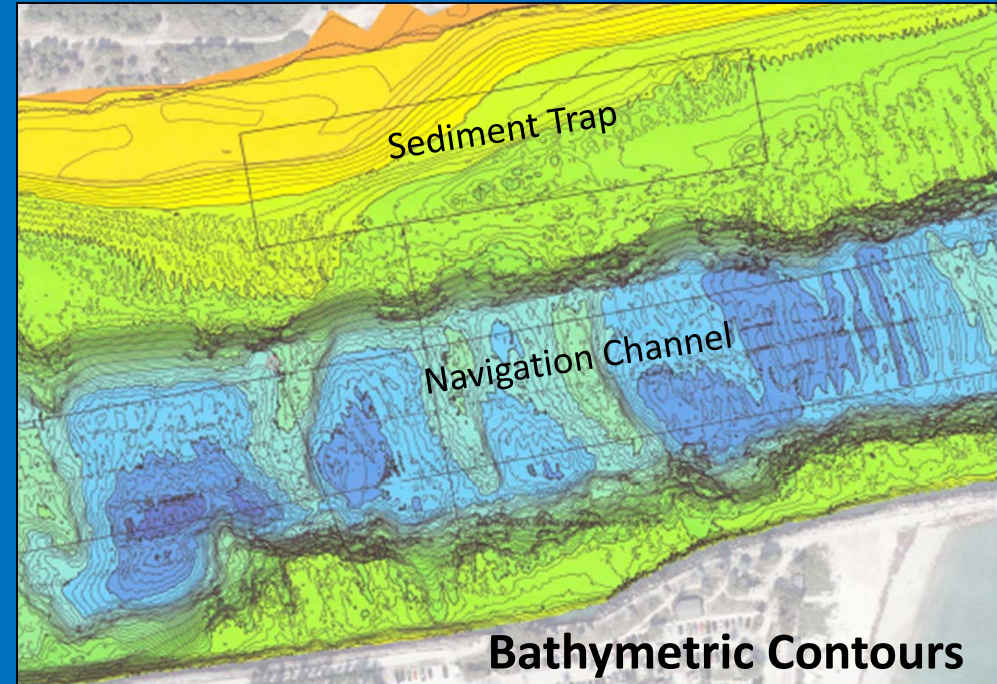
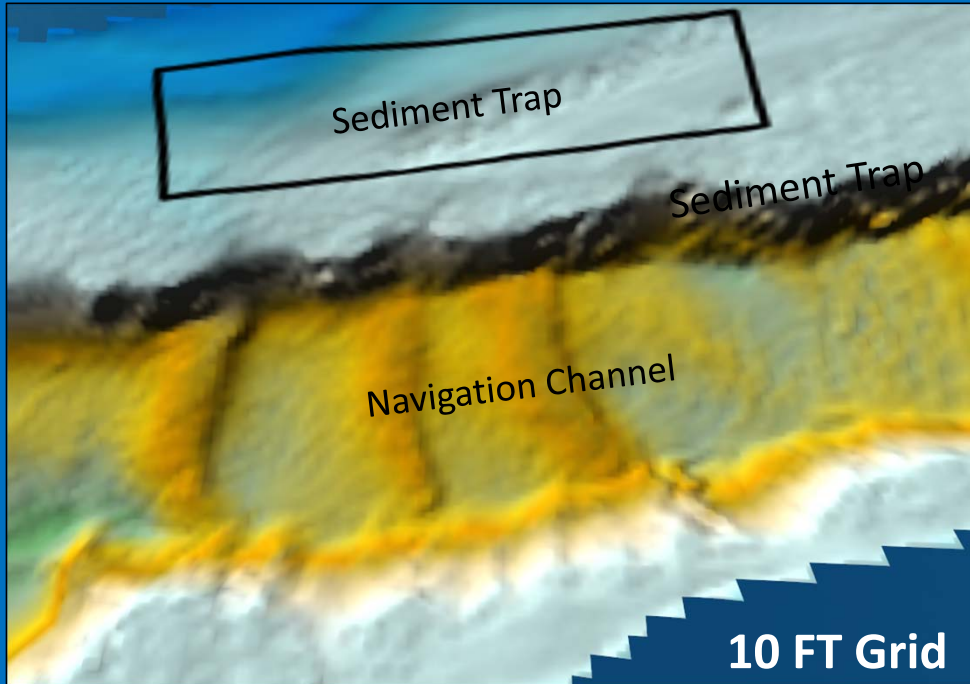
**Sediment Trap**

**Mitigation Reef**

November 2023 Aerial Photograph



## Standard-Resolution vs High Resolution Data Interpolation

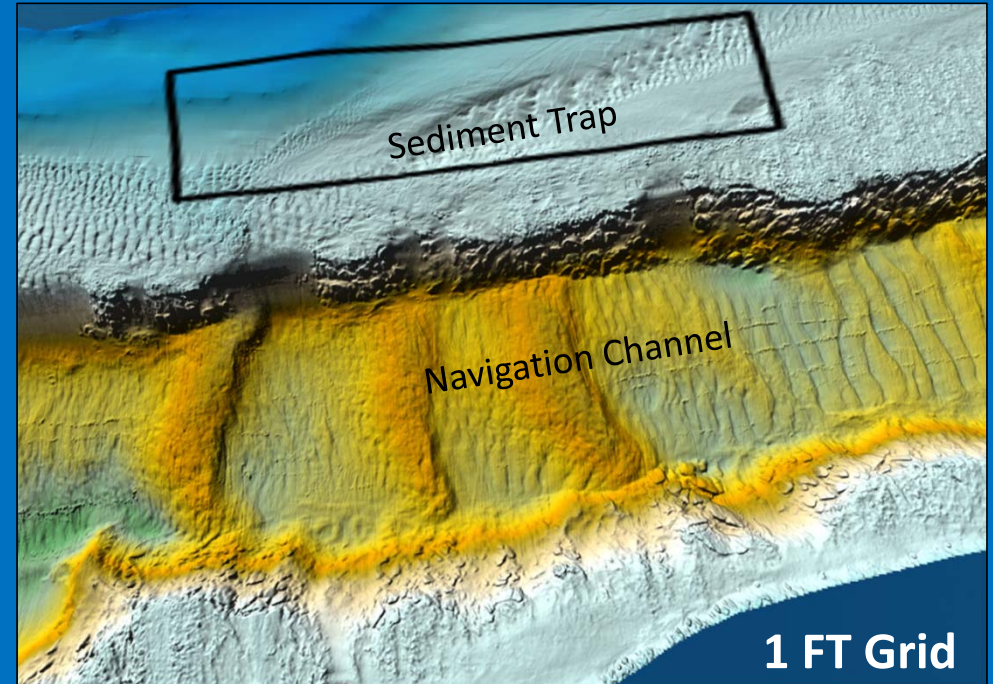
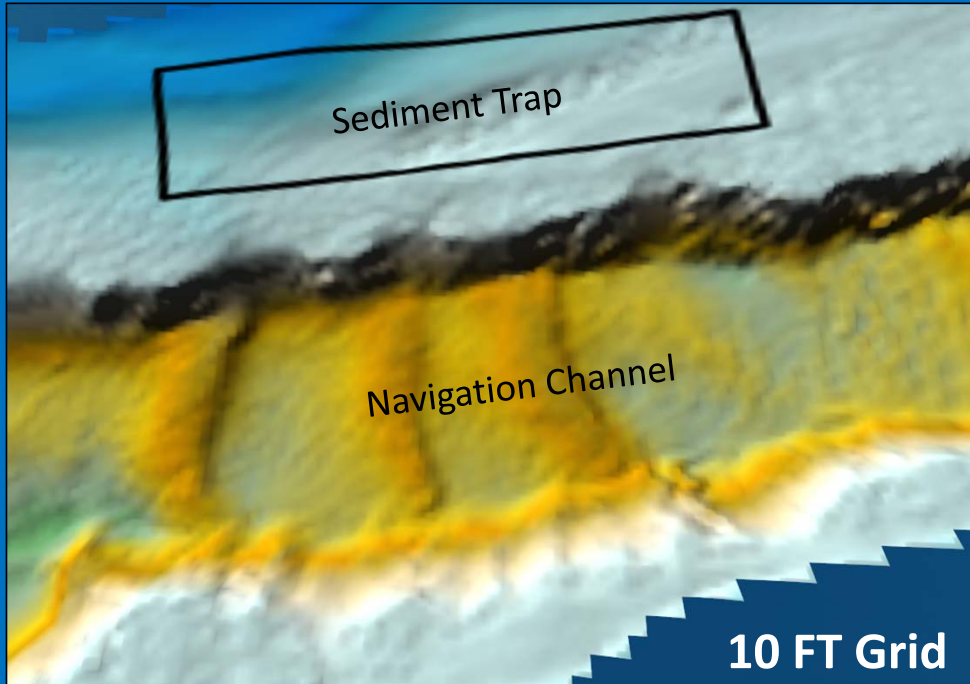


At right: High-quality bathymetric multibeam contour map

Morgan & Eklund, Inc.

At left: 3d image of standard resolution provided by multibeam survey

## Standard-Resolution vs High Resolution Data Interpolation



**At right: 3d image of high-resolution data**  
(developed from full multibeam point cloud)

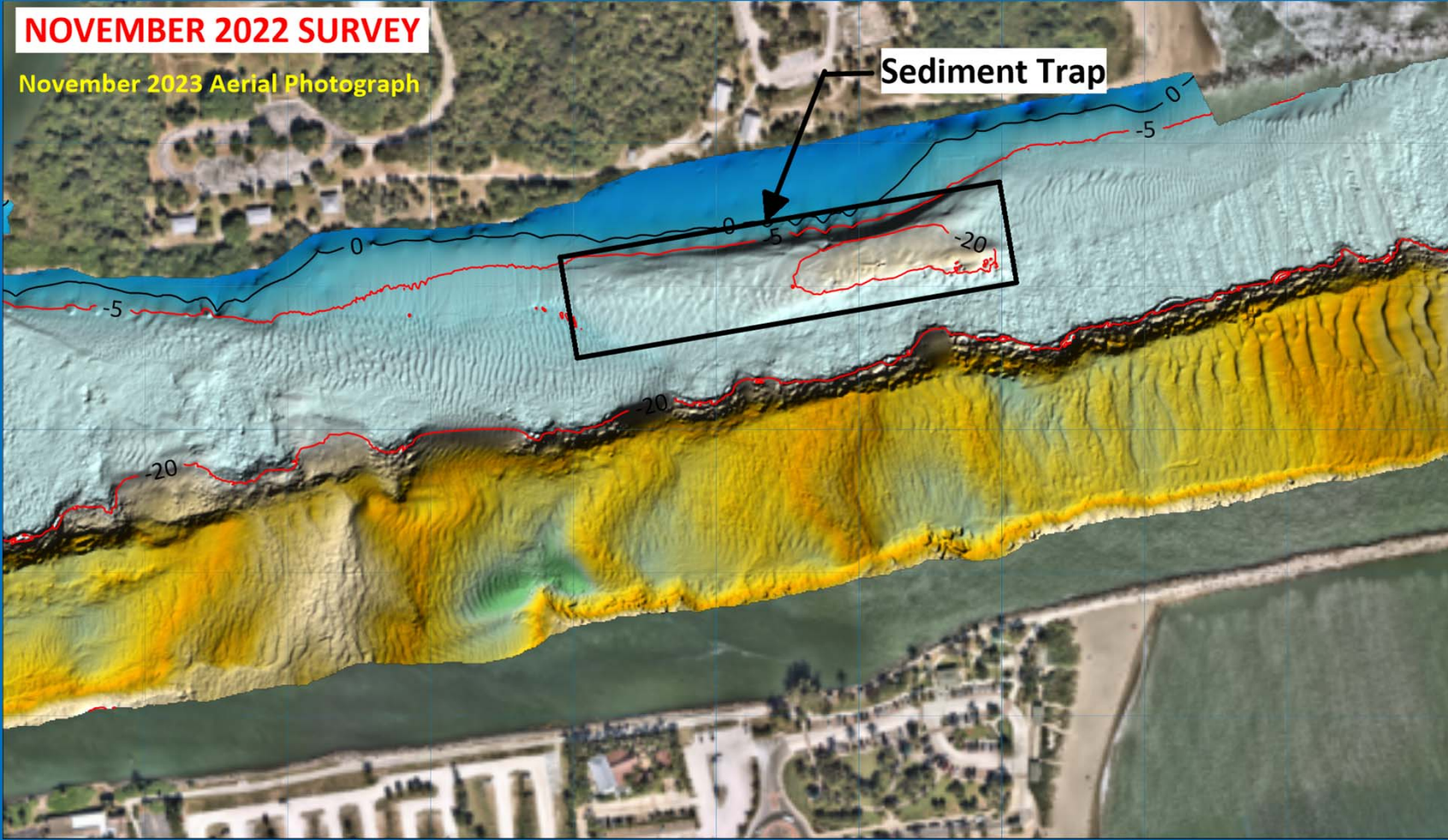
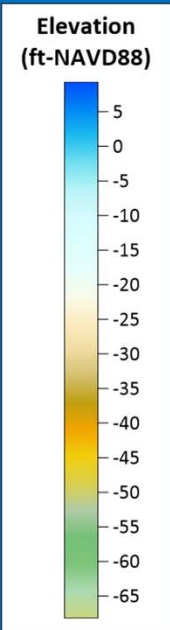
**At left: 3d image of standard resolution provided by multibeam survey**

# 3-MONTHS POST CONSTRUCTION

**NOVEMBER 2022 SURVEY**

November 2023 Aerial Photograph

Sediment Trap



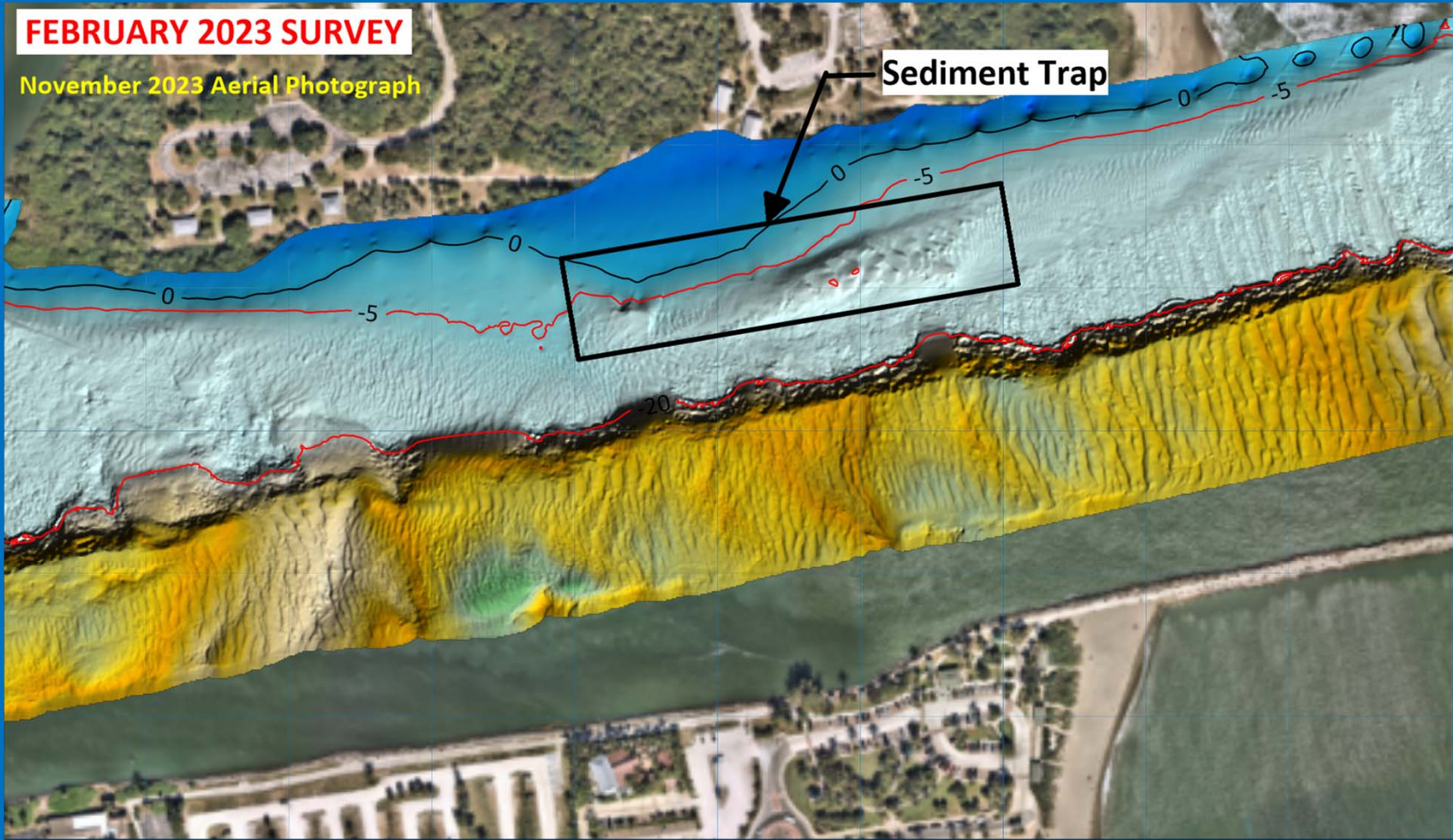
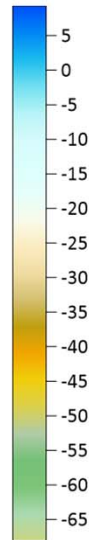
# 6-MONTHS POST CONSTRUCTION

**FEBRUARY 2023 SURVEY**

November 2023 Aerial Photograph

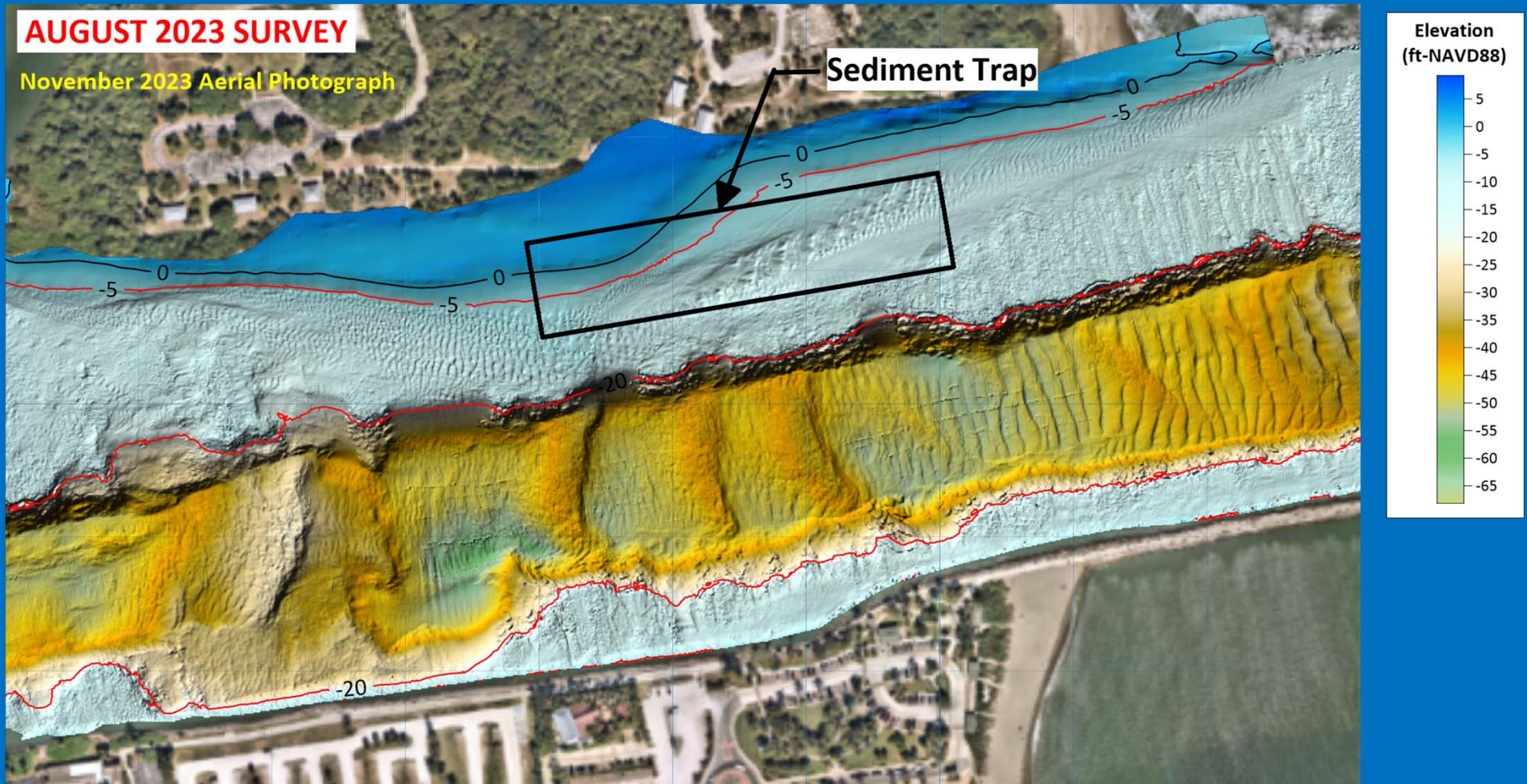
**Sediment Trap**

Elevation  
(ft-NAVD88)





## 12-MONTHS POST CONSTRUCTION



Contrary to common conjecture, the sediment trap did not infill from a single, simple sediment transport pathway from leakage through the [net updrift] north jetty. Instead, it infilled from both the west and east through complex processes.

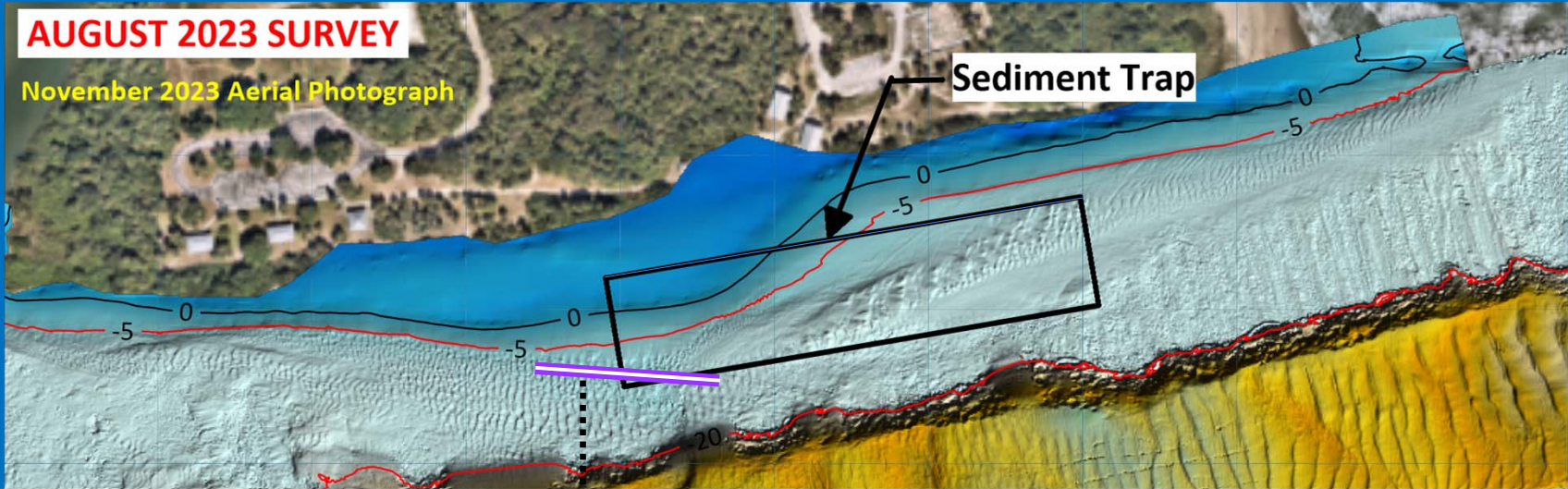
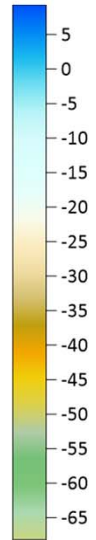
# 12-MONTHS POST CONSTRUCTION

**AUGUST 2023 SURVEY**

November 2023 Aerial Photograph

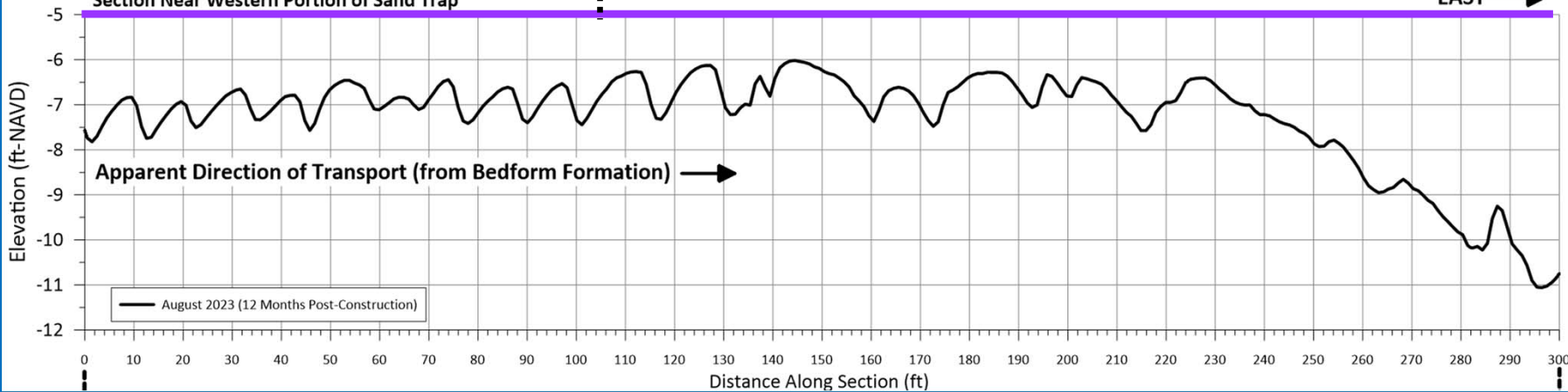
**Sediment Trap**

Elevation  
(ft-NAVD88)



Section Near Western Portion of Sand Trap

EAST →



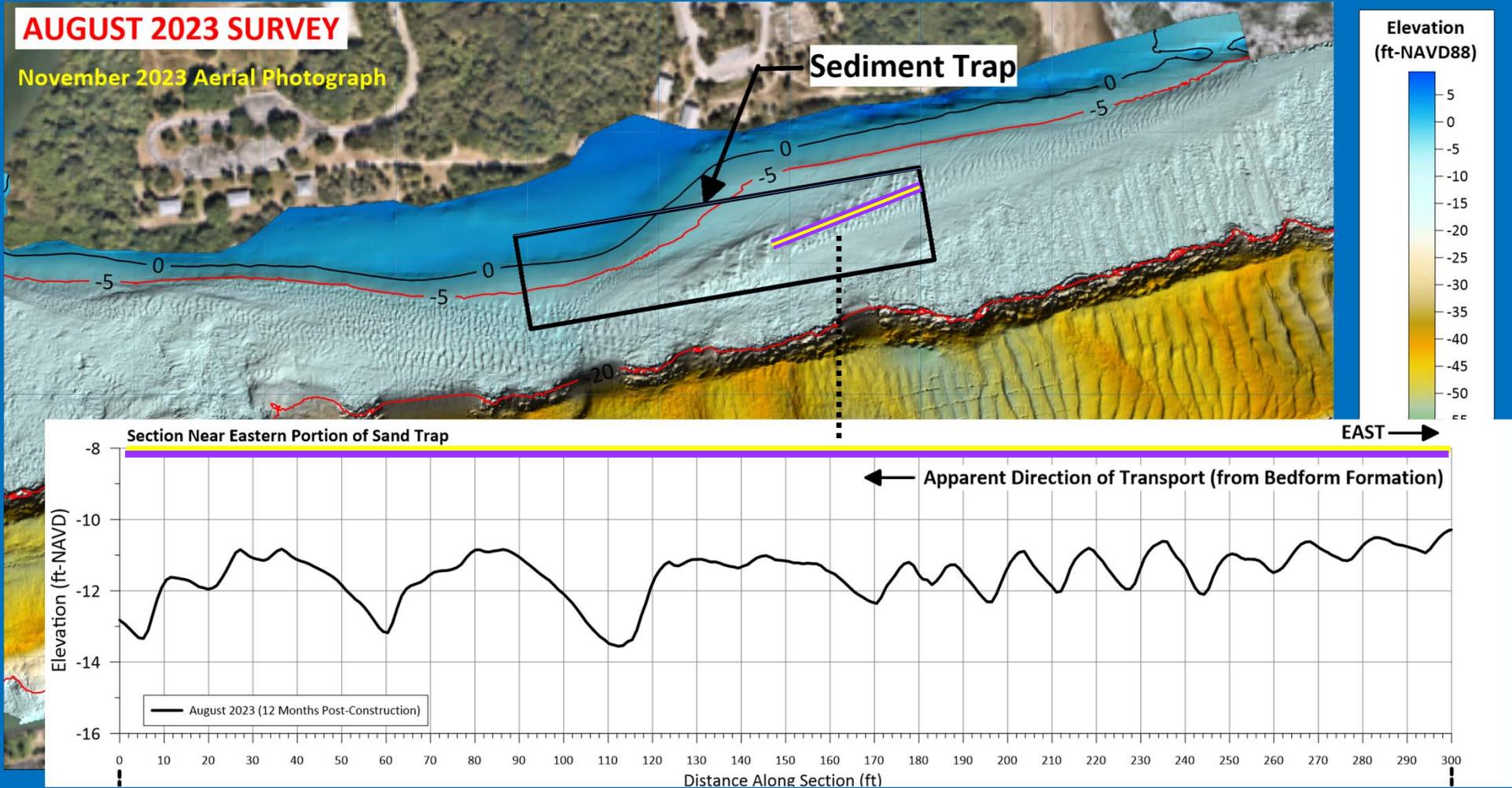
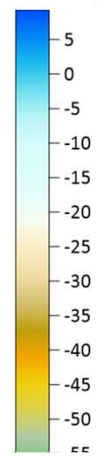
# 12-MONTHS POST CONSTRUCTION

**AUGUST 2023 SURVEY**

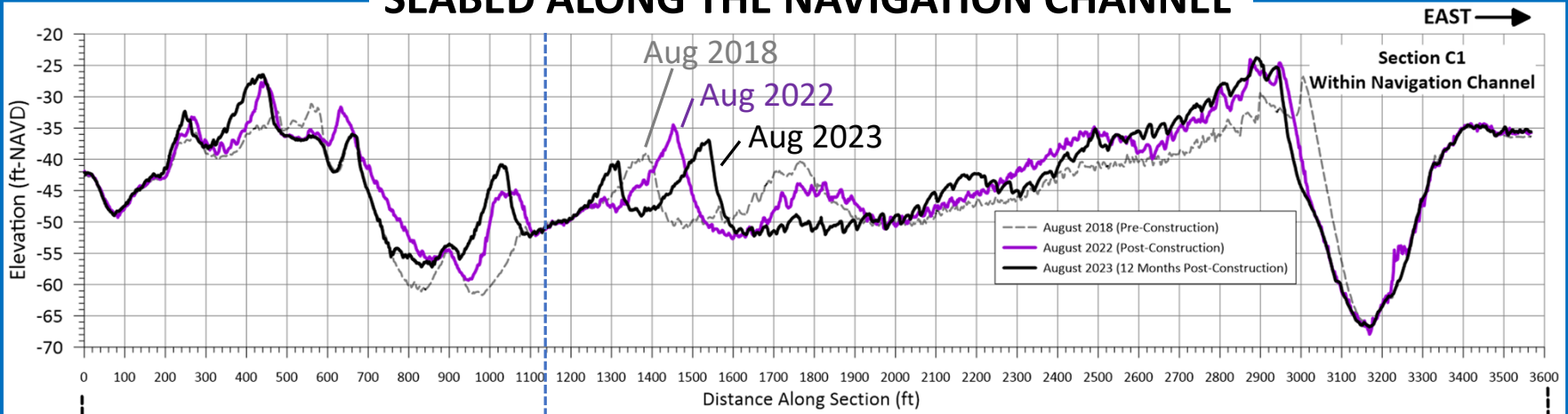
November 2023 Aerial Photograph

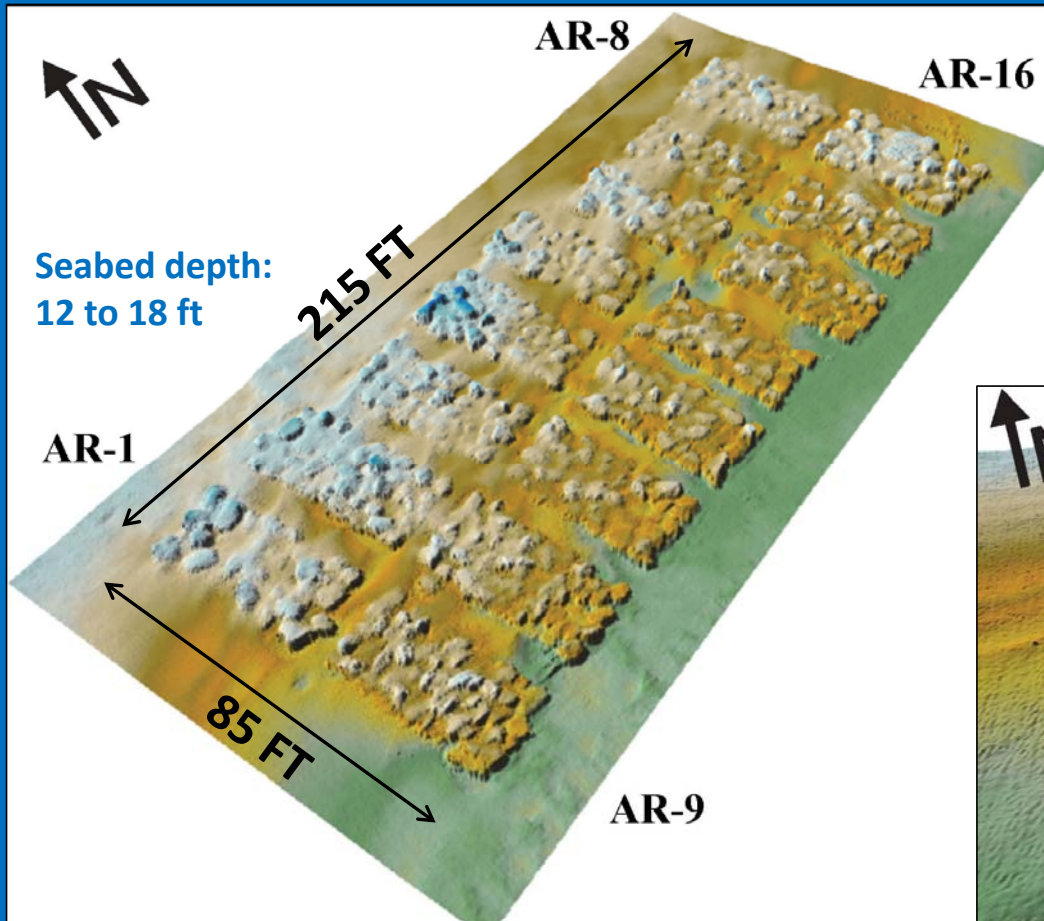
**Sediment Trap**

Elevation  
(ft-NAVD88)



# SEABED ALONG THE NAVIGATION CHANNEL

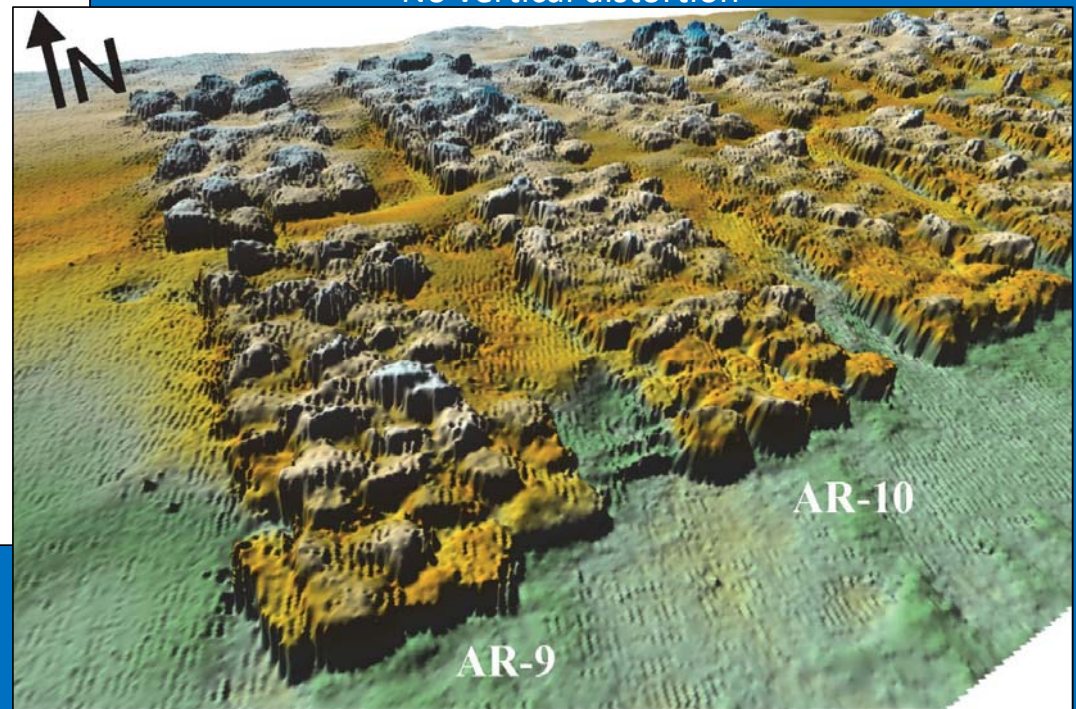




## MITIGATION REEF MONITORING

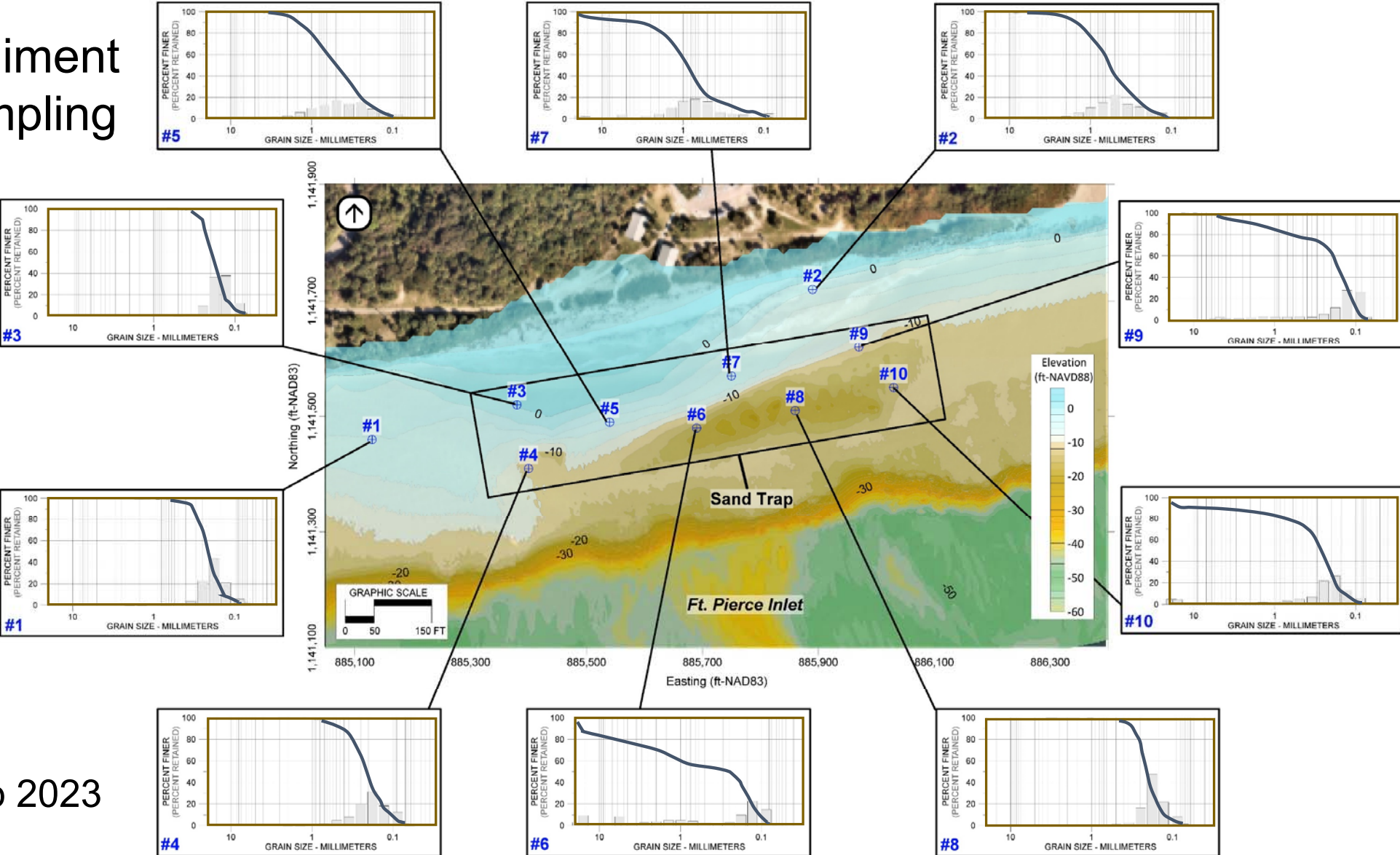
Diver Measurements (CSA) = 0.330 Acres  
 Multibeam Measure (OAI) = 0.329 Acres

Multibeam data gridding = 0.1 ft  
 No vertical distortion



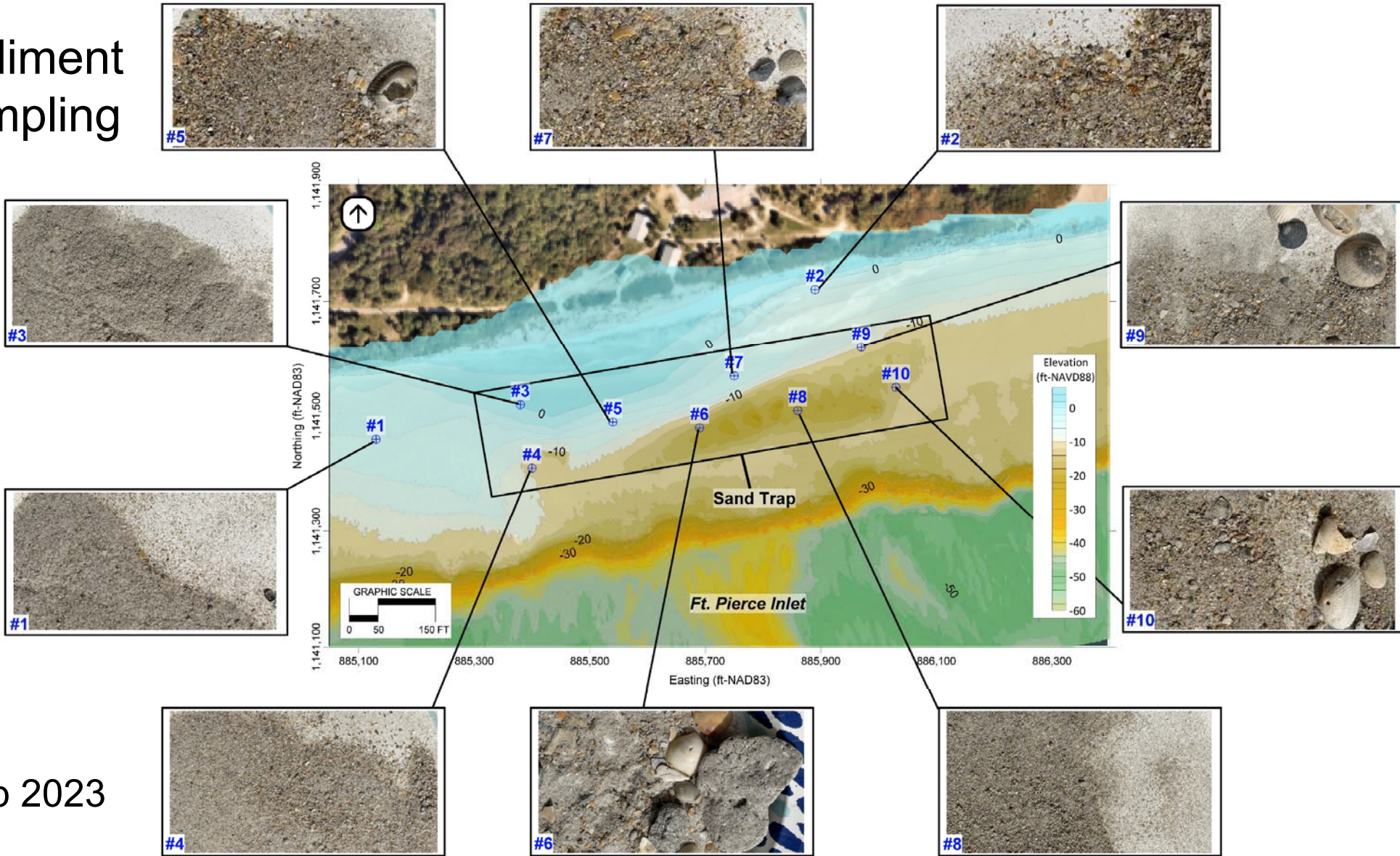
*August 2023 Monitoring*

# Sediment Sampling



Feb 2023

# Sediment Sampling

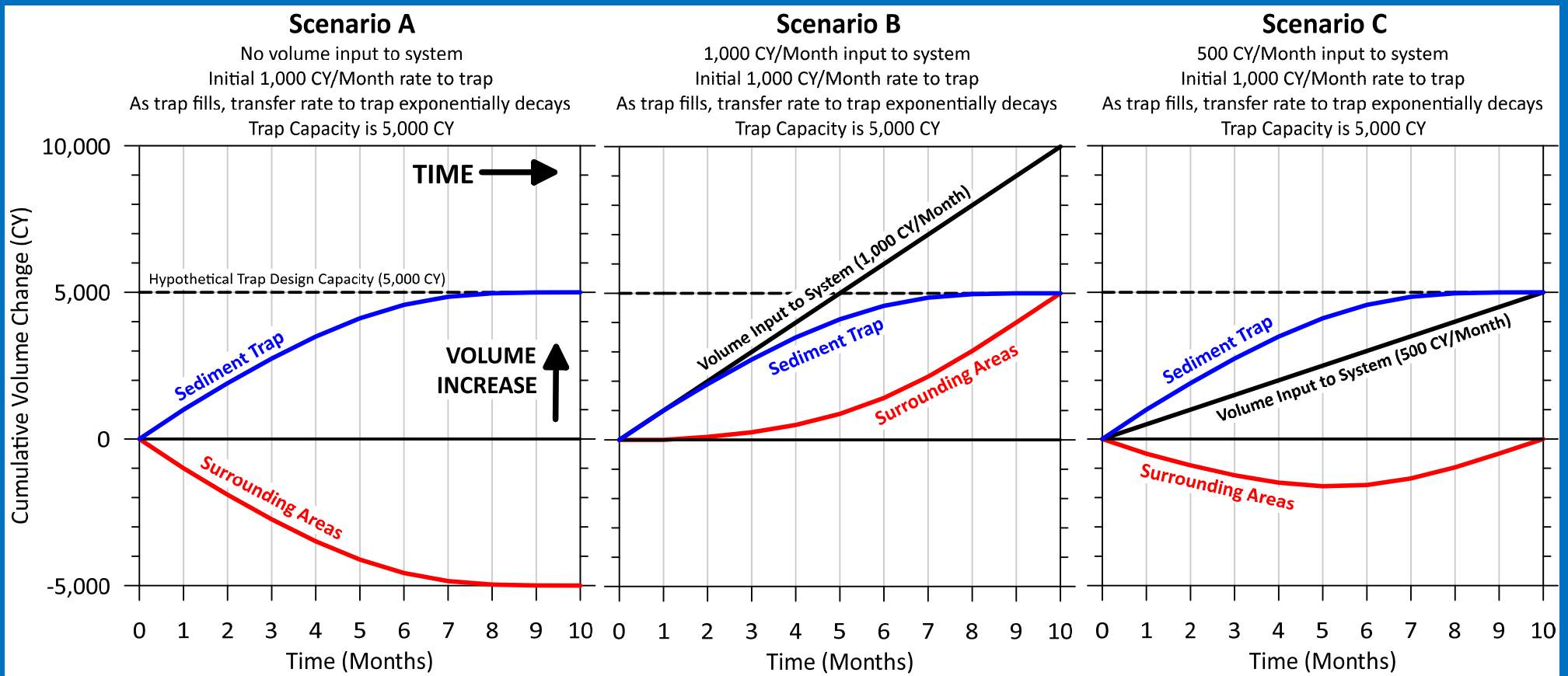


Feb 2023

**Sand Input = 0 cy / month**

**Input = 1000 cy/month**

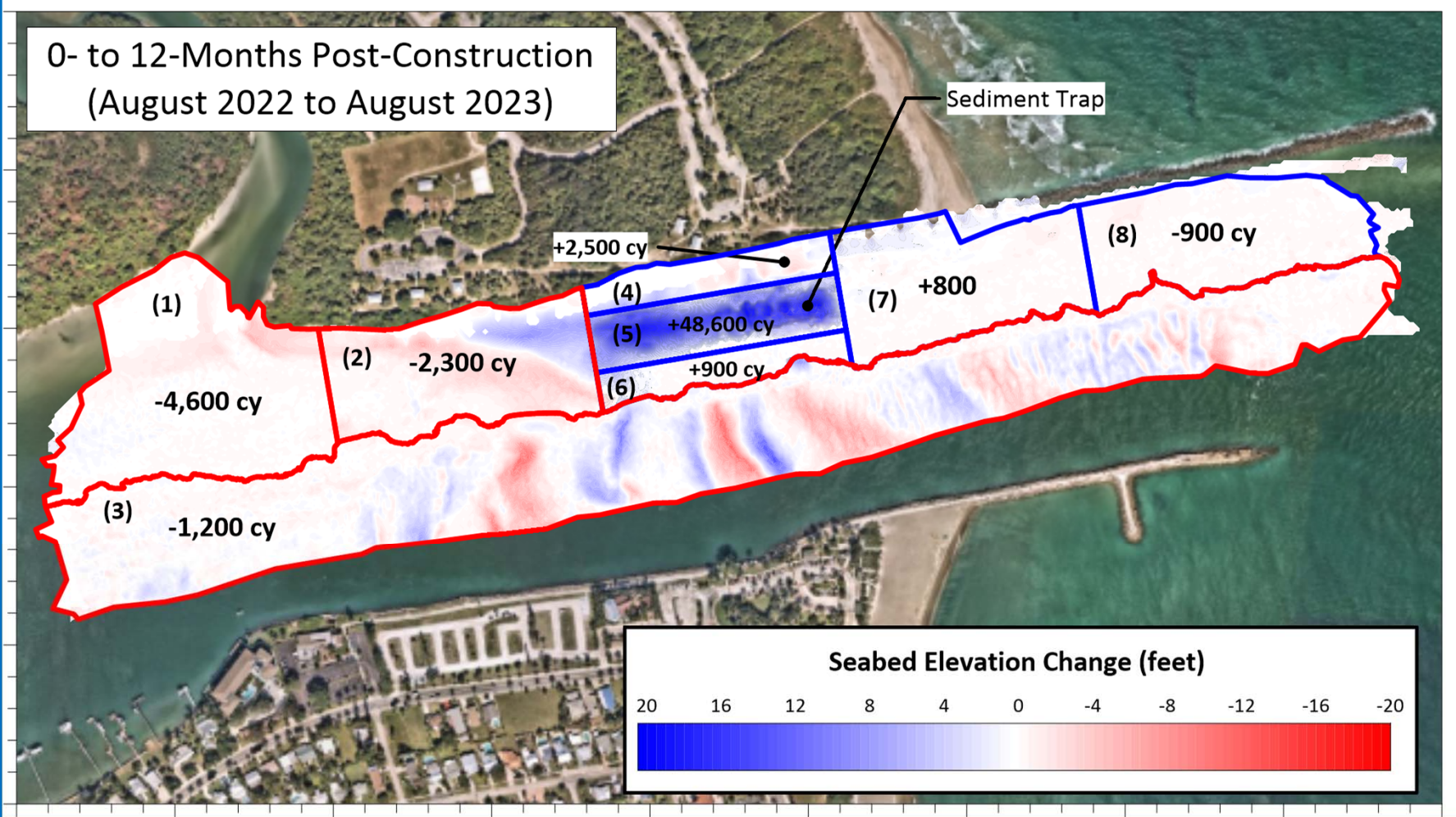
**Input = 500 cy/month**

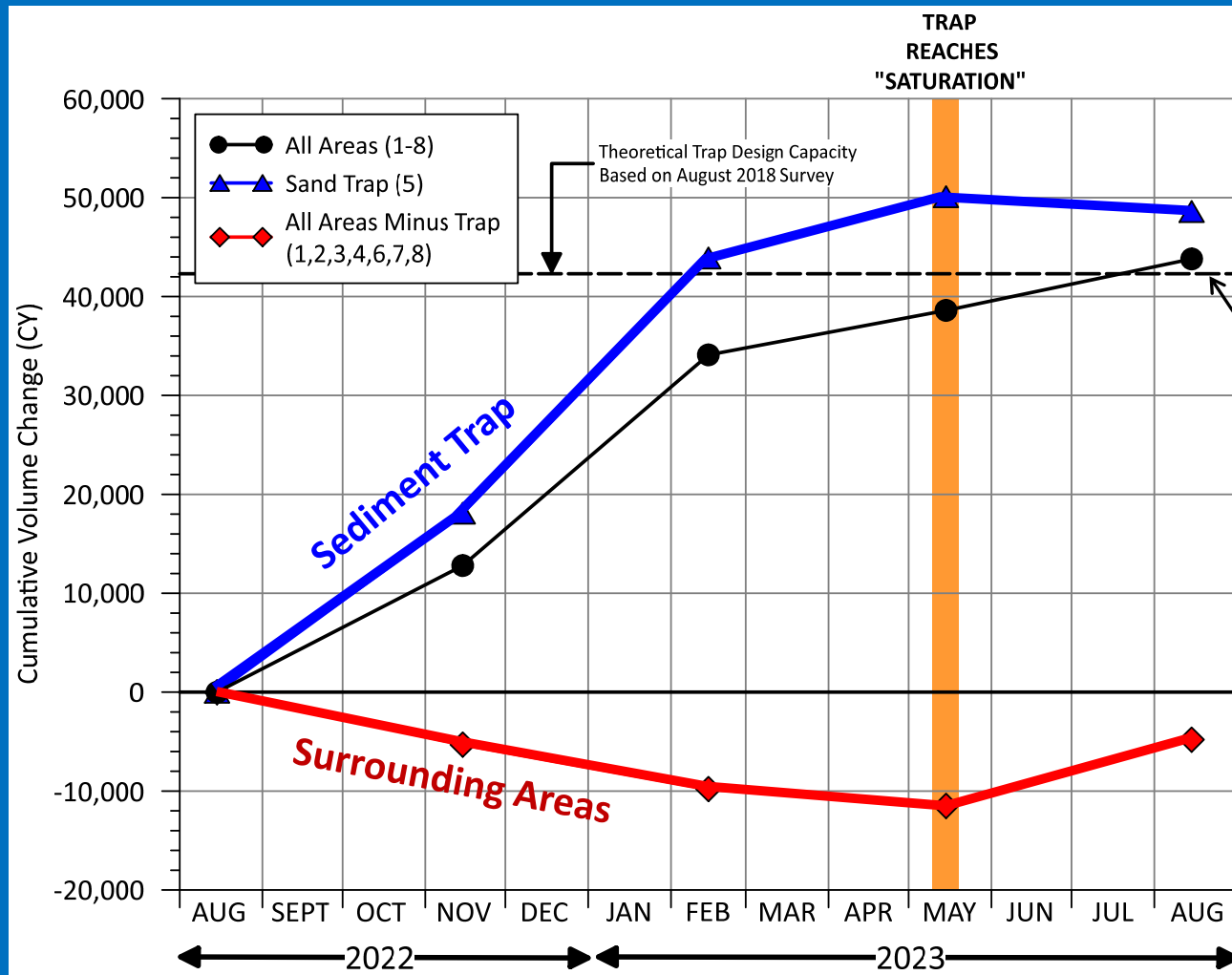


**Cumulative VOLUME change across monitoring area.  
Example scenarios (math models).**



0- to 12-Months Post-Construction  
(August 2022 to August 2023)





## Measured Cumulative Volume change.

12-month value Sand Input:  
**44,000 CY / YEAR**

Sediment Budget (2018, 2021):  
Predicted  
**43,000 CY / YEAR**

The measured cumulative volume change looks like "Scenario C" in the previous mathematical thought models; and the apparent volume of sand-transport input to the system matches the 2018-2021 sediment budget prediction.

*The temporal history of the location of the sand beach along the north bank of the inlet – which shifts east & west – was unknown, relative to the location of the Phase 1 Sand Trap.*

Jan 2015



Nov 2022

***We gathered & overlaid 54 unique aerial photos & surveys, from 1950 to November 2023 (73 years).***

***The locations of the sand beach were recorded for each image.  
The most frequent data spans the last 20 to 40 years.***

1142000N

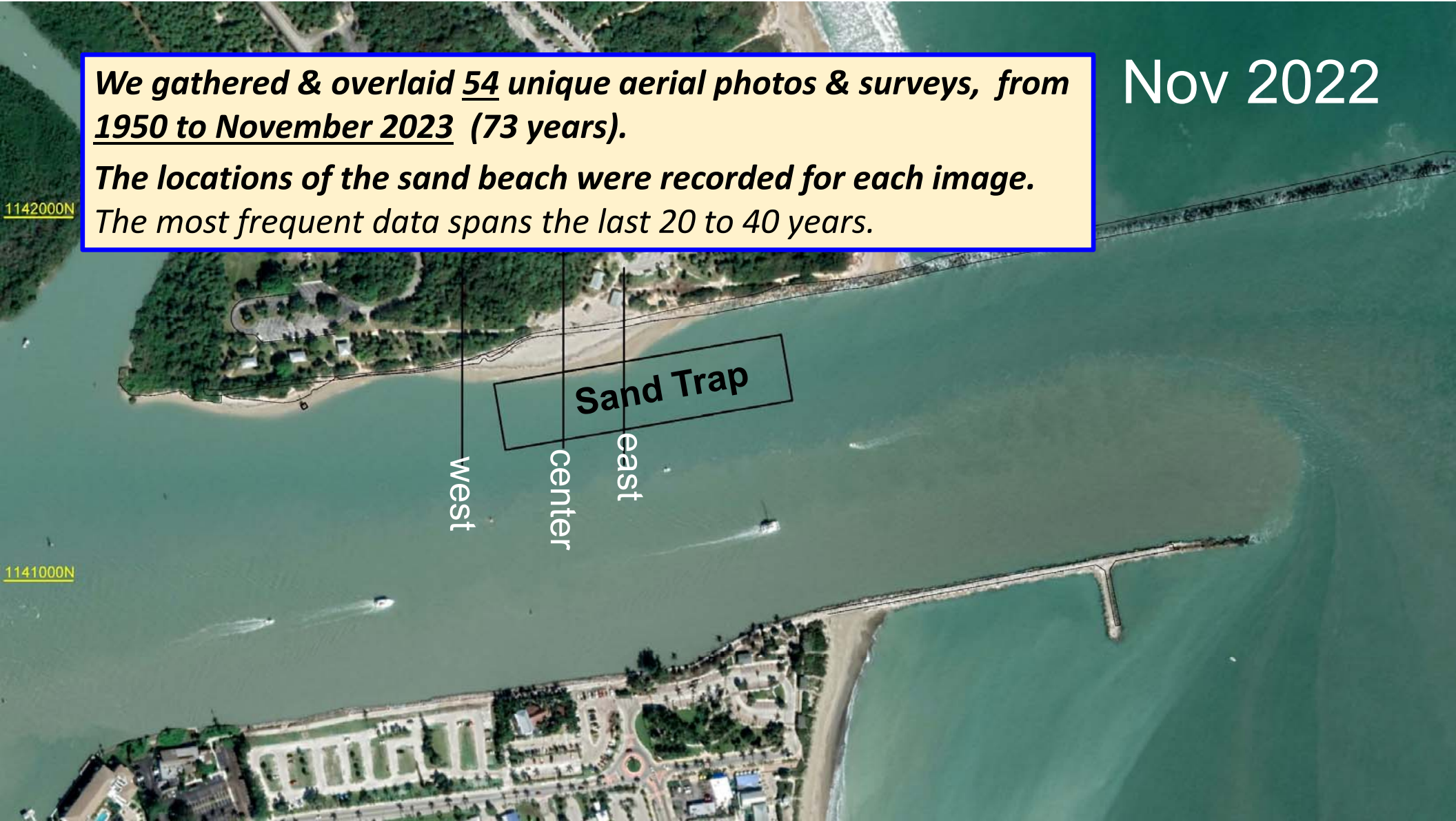
1141000N

west

center

east

Sand Trap



Nov 2023

1142000N

1141000N

west

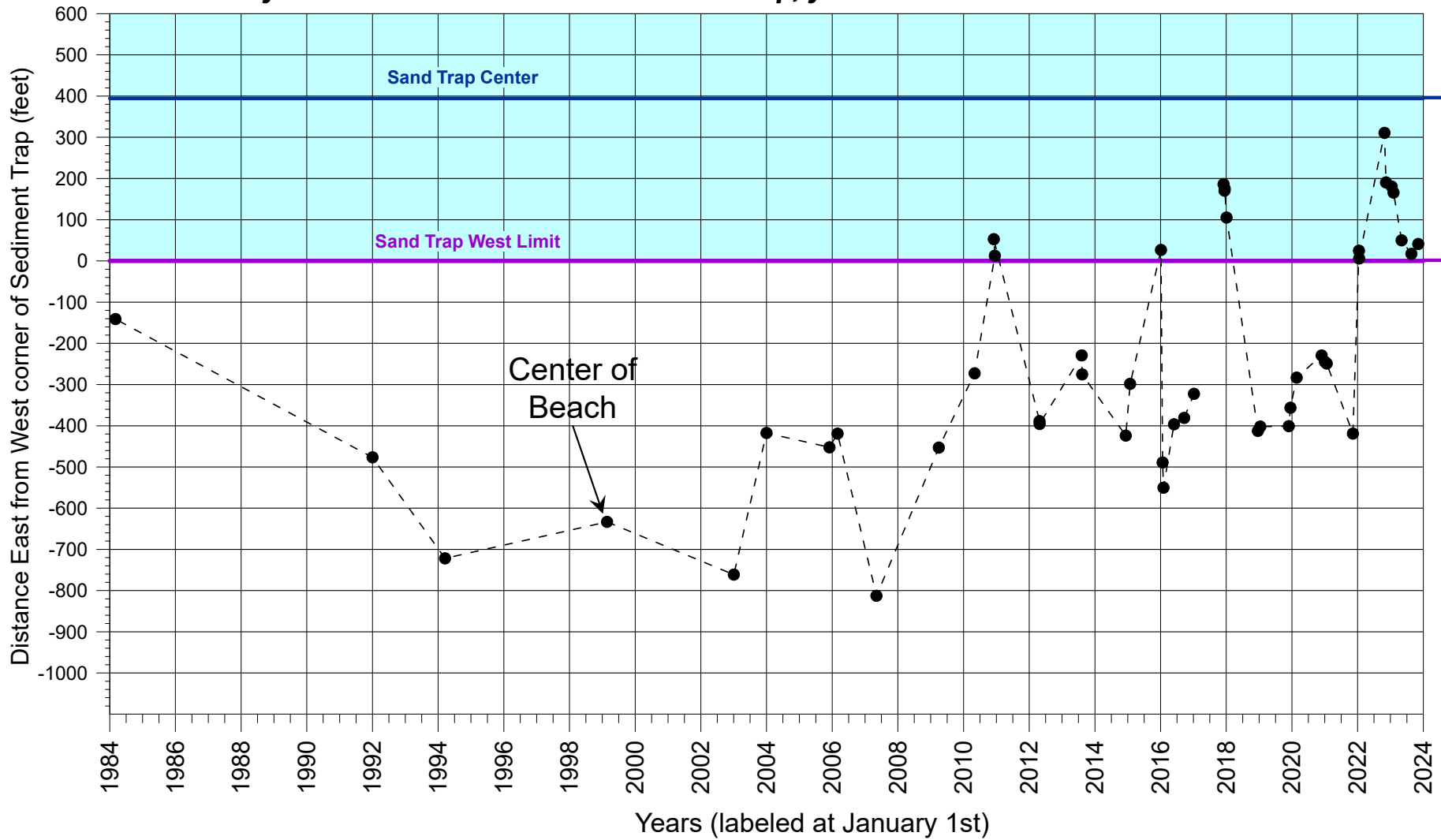
center

east

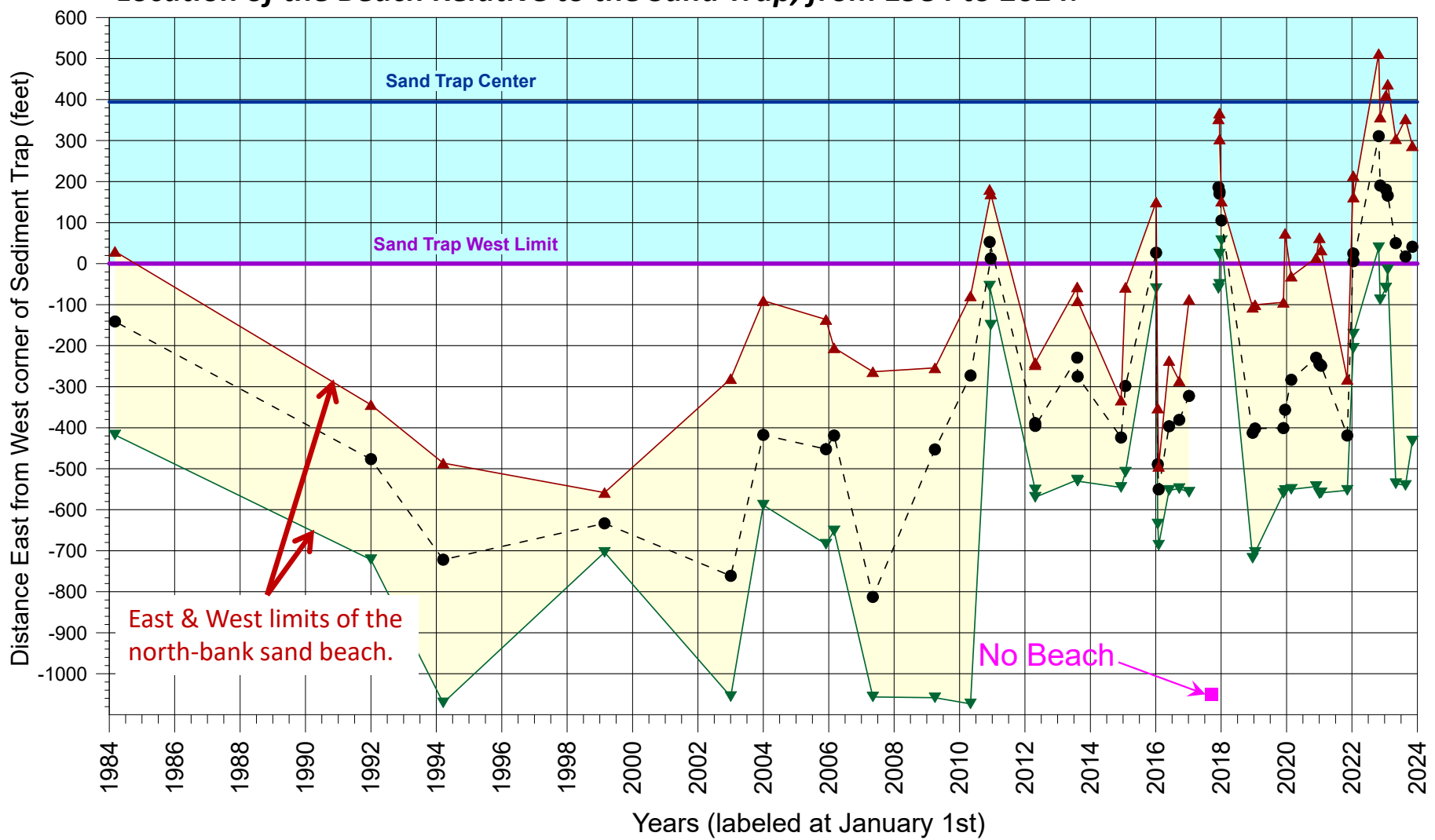
Sand Trap

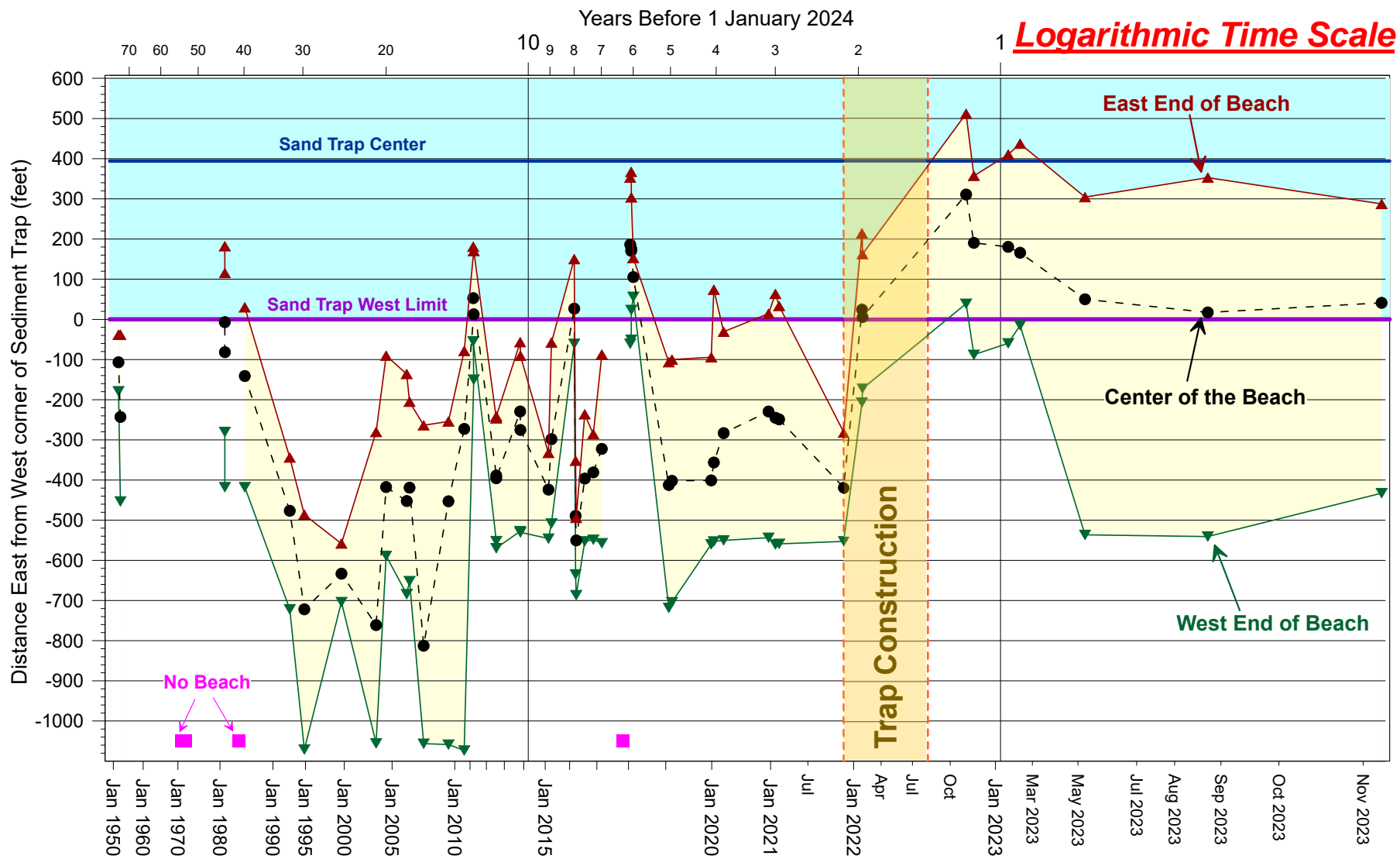


**Location of the Beach Relative to the Sand Trap, from 1984 to 2024.**



**Location of the Beach Relative to the Sand Trap, from 1984 to 2024.**







Sept 2016

*This plume from the south beach around the south jetty was observed to occur in 50% of the photos during which flood tide conditions might occur; i.e., statistically significant occurrence.*

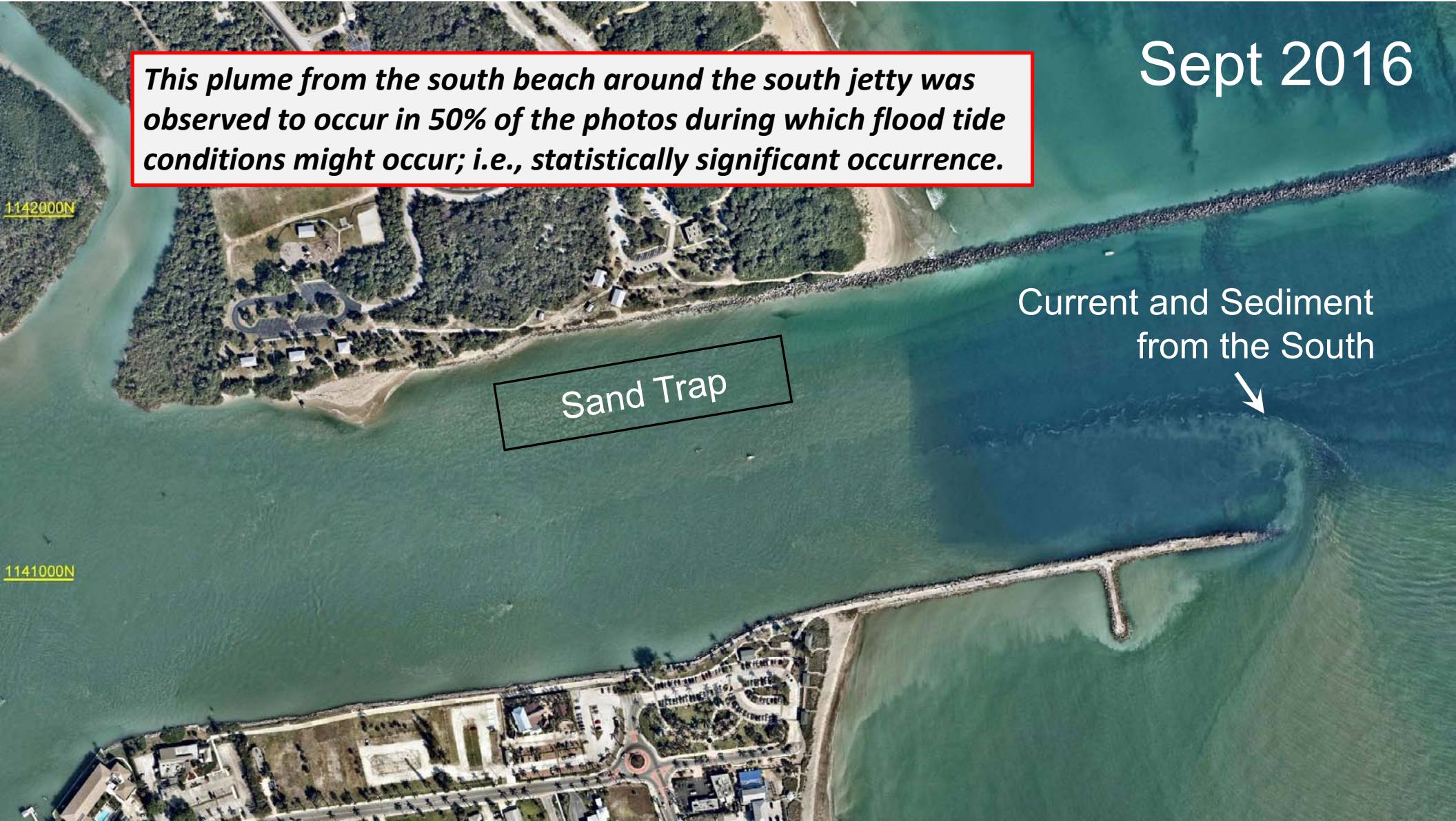
Sand Trap

Current and Sediment from the South



1142000N

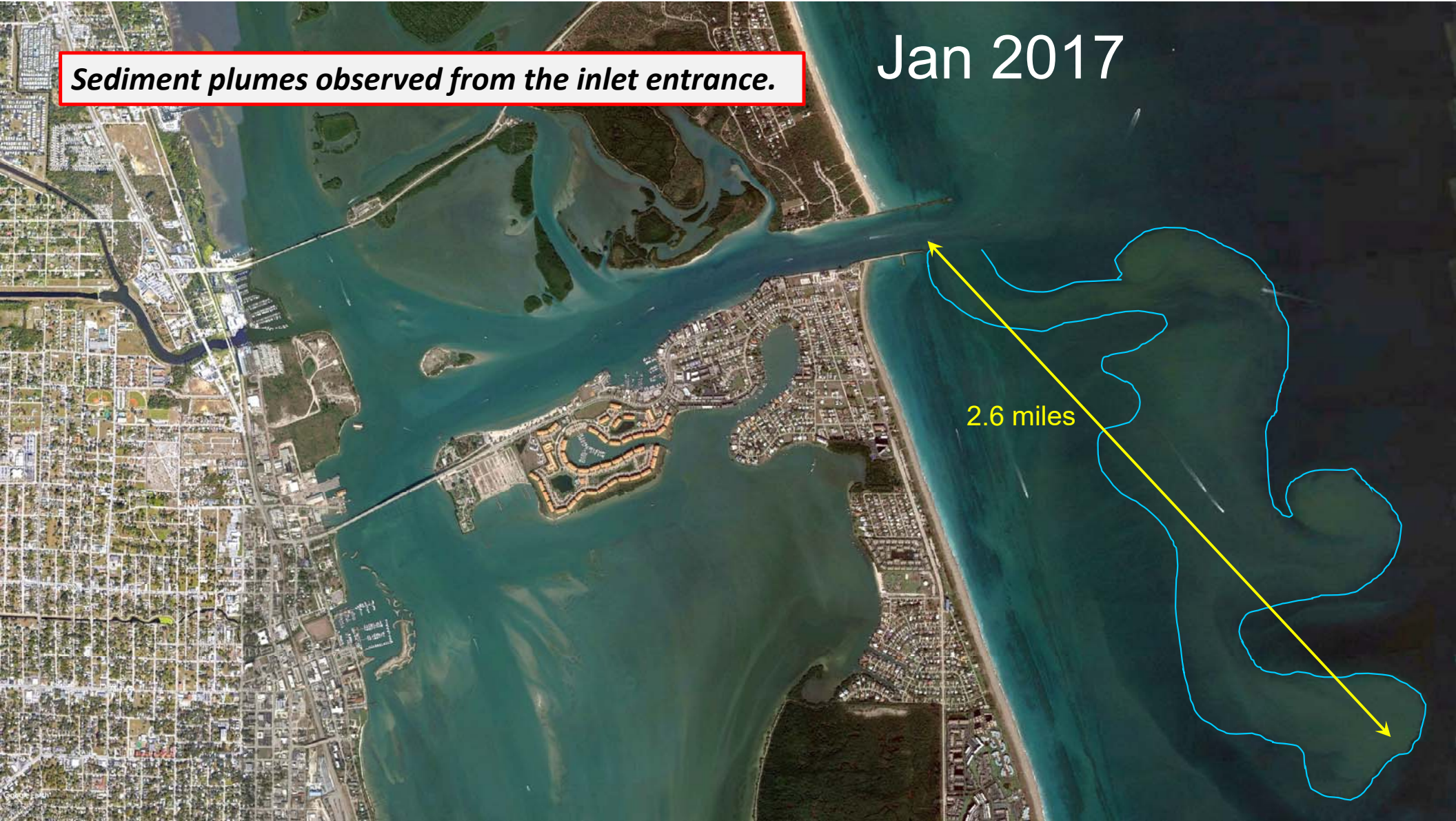
1141000N



**Sediment plumes observed from the inlet entrance.**

Jan 2017

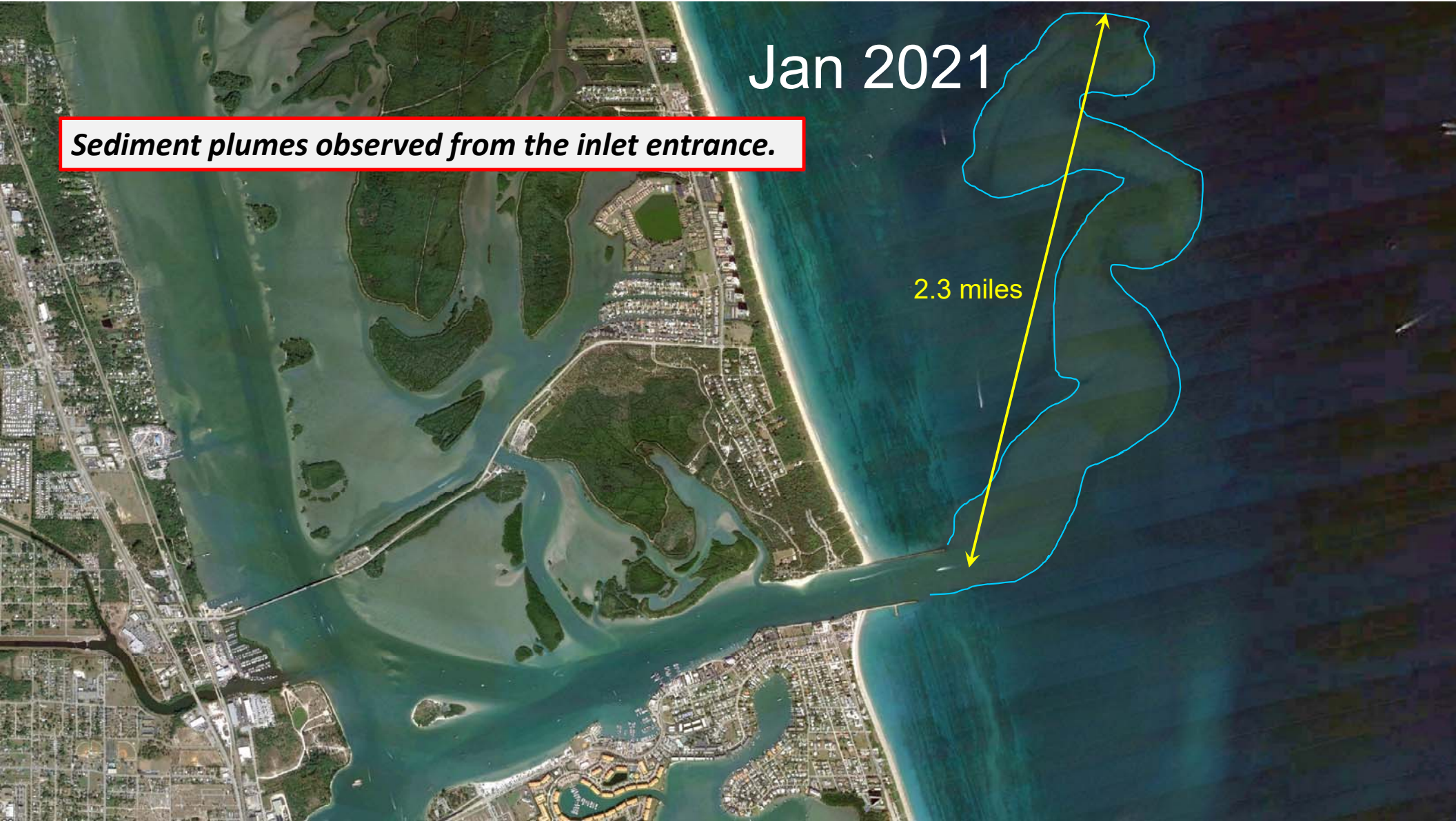
2.6 miles



Jan 2021

***Sediment plumes observed from the inlet entrance.***

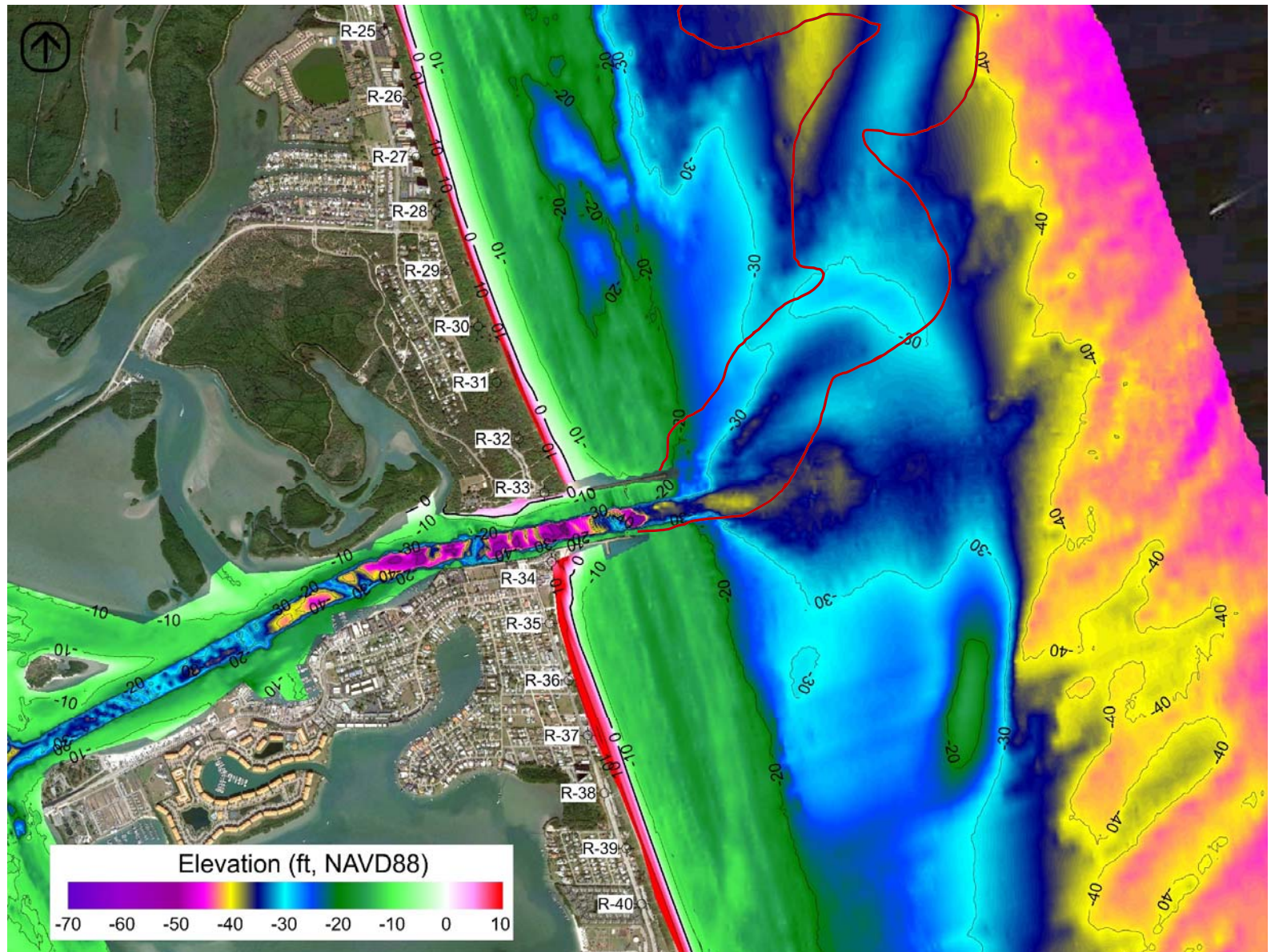
2.3 miles



# Bathymetry June 2023

The sediment plumes extend well beyond the inlet's unusual ebb shoal platform.

Overall Summary:  
Beyond numerical models, there is much to be learned from *observation of the prototype* via modern high-resolution bathymetric survey tools (and high-tech interpretation thereof) as well as from simple models and classical interpretation of historical aerial photographs and surveys.



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**Olsen Associates, Inc.**

**FORT PIERCE HARBOR**  
Tabulated from surveys by the Corps of Engineers report to Sept. 1971 and survey of May 1971

Name of Channel	Controlling depths to channels, varying from seaward to land at Mean Low Water			Date of Survey	Project Dimensions		
	Left outside corner	Middle half of channel	Right inside corner		Width (feet)	Length (miles)	Depth (feet)
Fort Pierce Inlet Entrance Range	18.0	23.1	13.4	5/71	200-315	1.6	27-25
Fort Pierce Inlet Inner Range	16.7	18.7	19.7	5/71	315-200	1.2	25

\* Shoaling was located in the vicinity of buoy "JAT" a depth of 25.8 feet was available in the remainder of the reach.  
Note: The Corps of Engineers should be consulted for changing conditions subsequent to the above.

