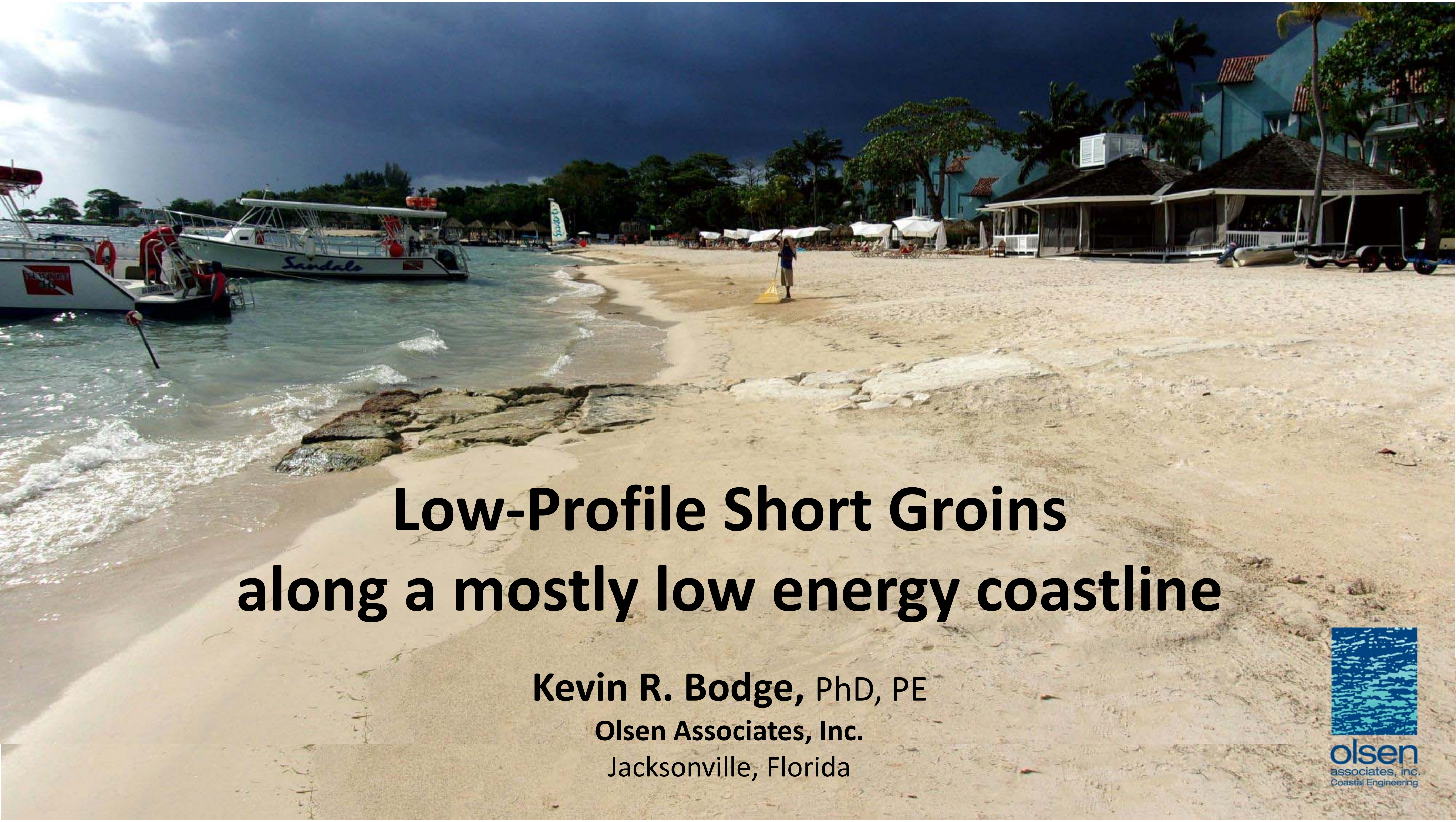


# Low-Profile Short Groins along a mostly low energy coastline

**Kevin R. Bodge,** PhD, PE
**Olsen Associates, Inc.**
Jacksonville, Florida

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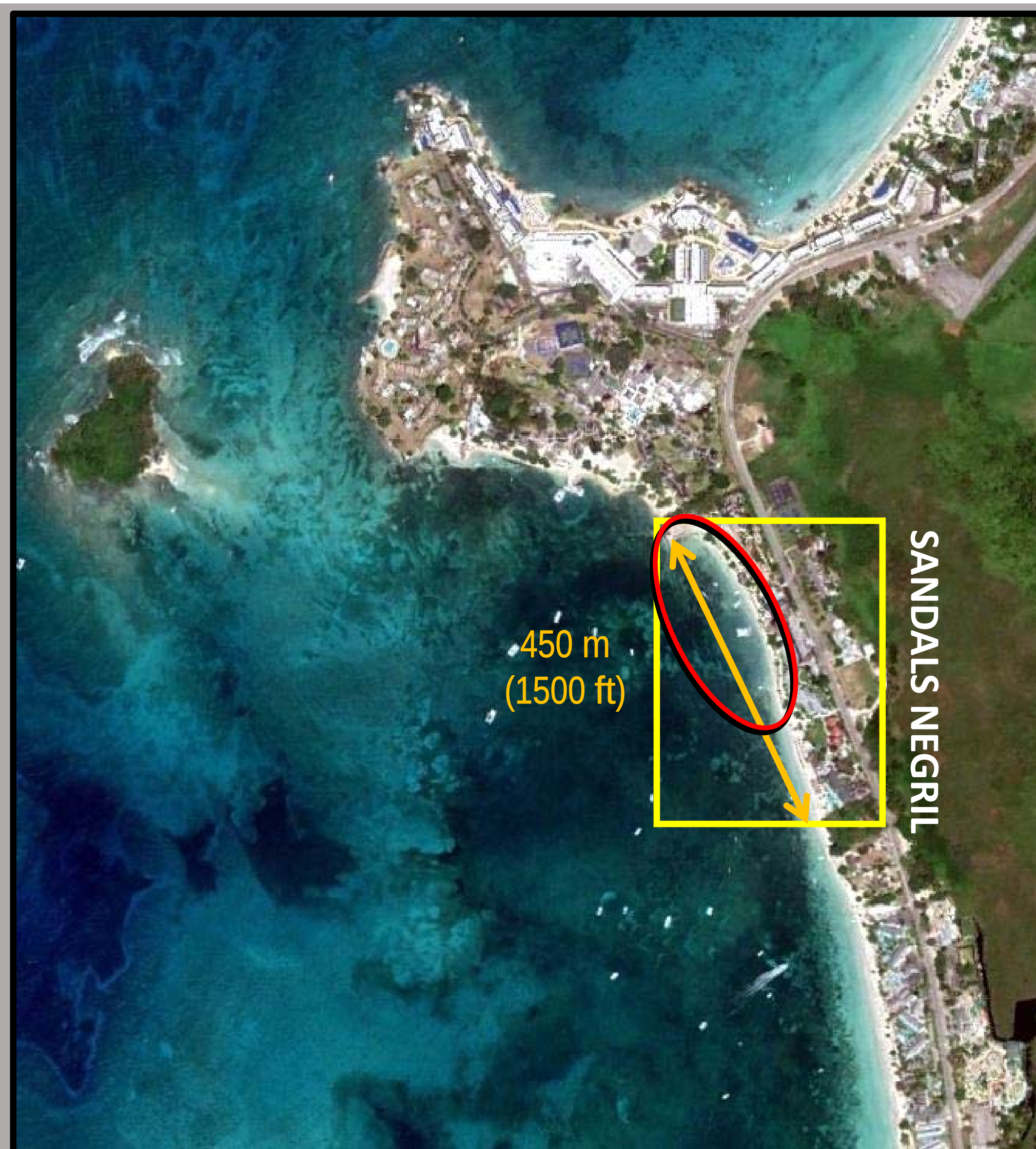
associates, inc.
Coastal Engineering


USA
Western Caribbean
Cancun & Cozumel
Cuba
Bahamas
Turks & Caicos
Puerto Rico
Cayman Islands
Haiti
Belize Barrier Reef
Jamaica
Dominican Republic
Central America
Honduras Bay Islands
Bonaire
Curacao
Aruba
South America


CUBA
SANDALS
NEGRIL BEACH
(2020)
Montego
Bay
JAMAICA
HAITI
SANDALS
SOUTH COAST,
WHITEHOUSE
(2016 - 17)
Kingston
olsen
associates, inc.
Coastal Engineering


N
NEGRIL BEACH


450 m
(1500 ft)
SANDALS NEGRIL

Tide Range ~ 0.6 m (2 ft)

Wave Height < 0.2 m (0.65 ft) typical daily;
at oblique angle (both directions)

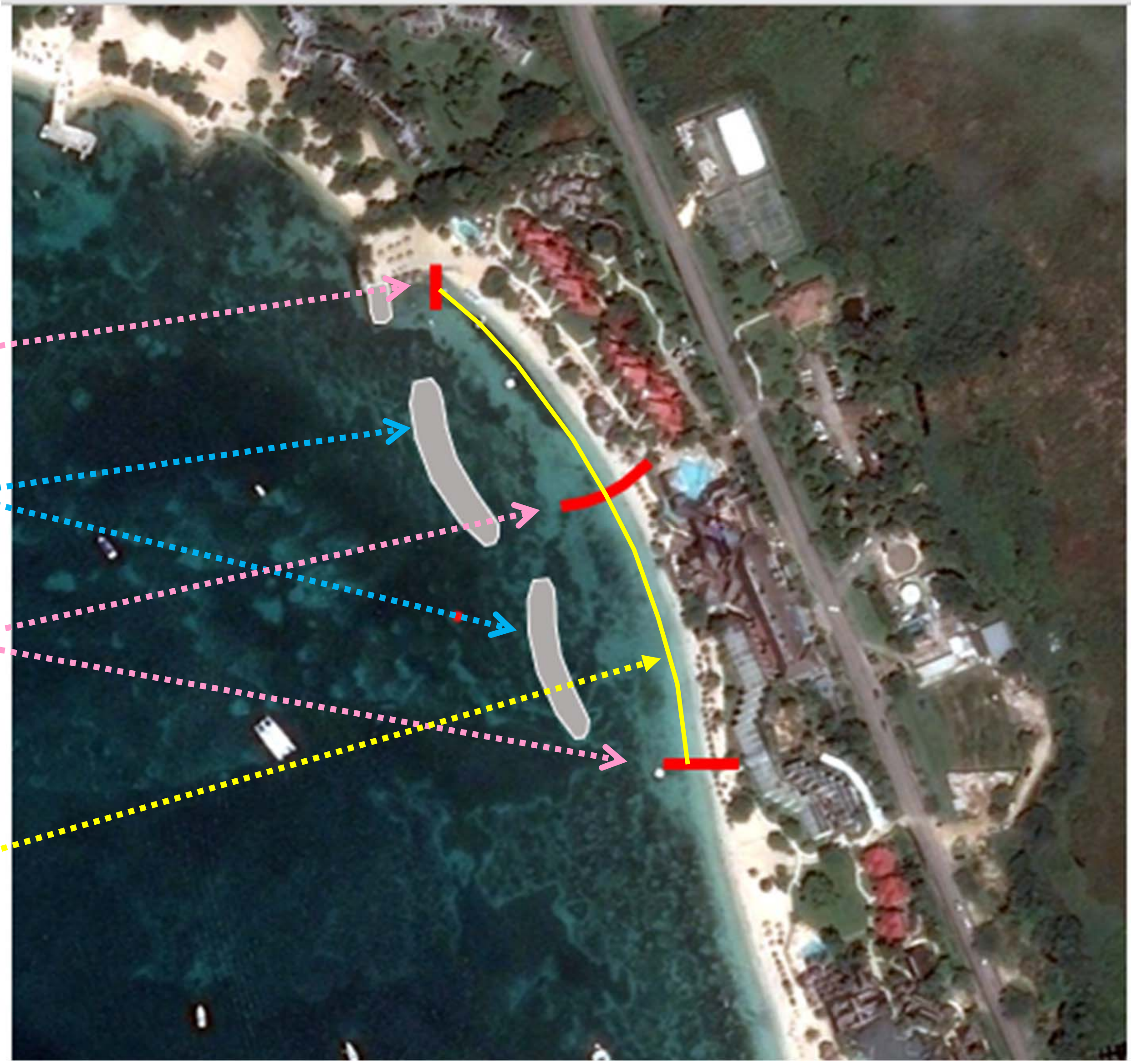
Storm Waves ~ 1 m (3.3 ft)... both directions

Upland Beach Berm: +1.1 m (+3.6 ft)

Mean Sea Level: 0.0 m ( 0 ft )

Ambient Seabed: -1.5 m (-5 ft)

# Originally Proposed Plan
(by others)

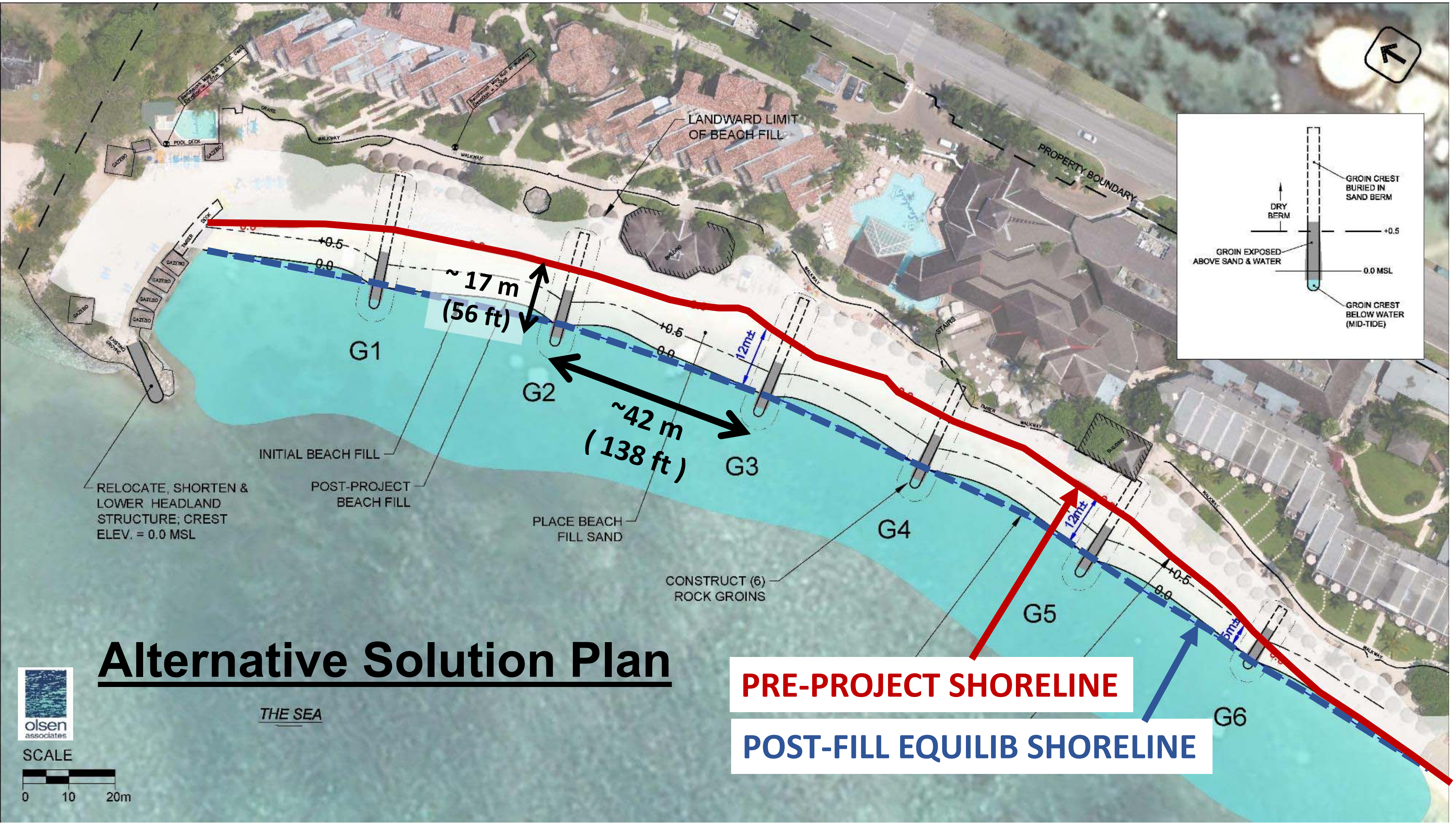


Relocate spur groin to shore

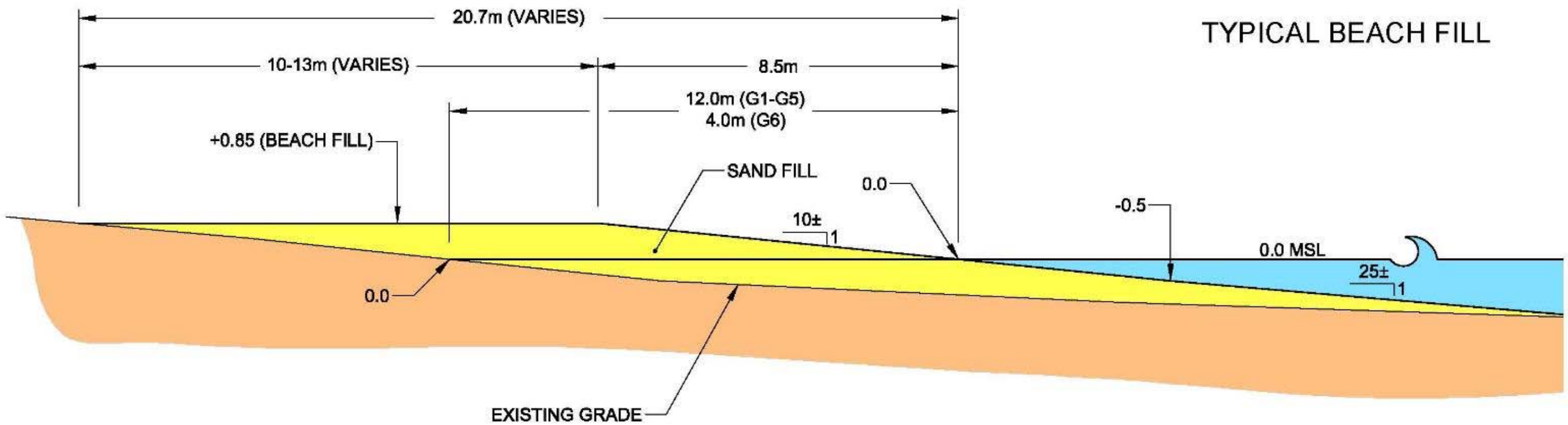
Two semi-emergent rock breakwaters atop seagrass beds

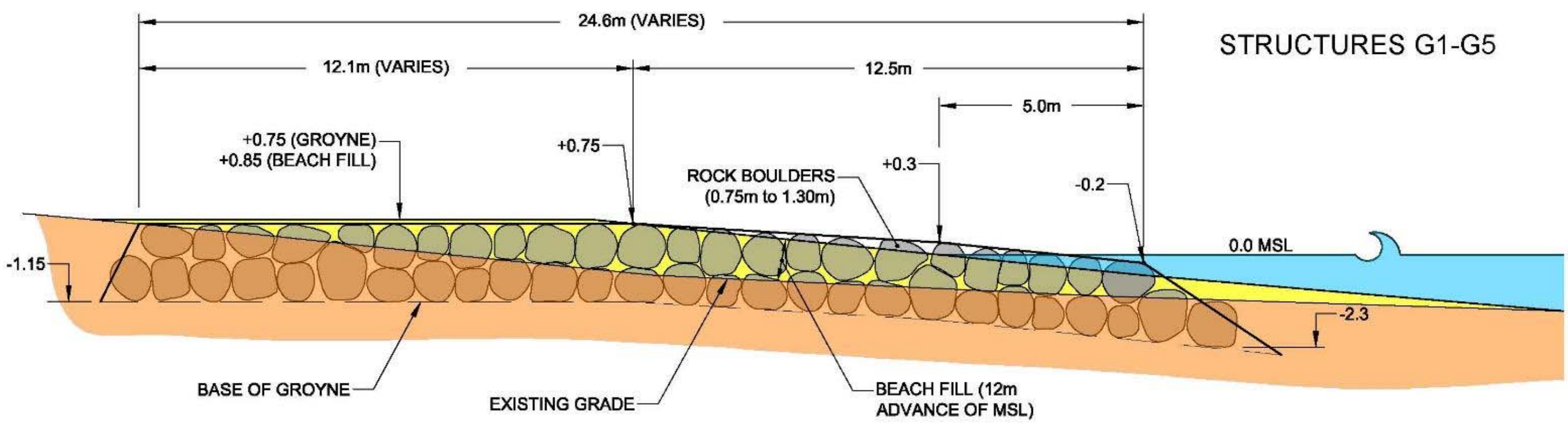
Conventional Rock groins

Beach fill



LANDWARD LIMIT OF BEACH FILL
PROPERTY BOUNDARY
GROIN CREST BURIED IN SAND BERM
DRY BERM
+0.5
GROIN EXPOSED ABOVE SAND & WATER
0.0 MSL
GROIN CREST BELOW WATER (MID-TIDE)
+0.5
0.0
~ 17 m
(56 ft)
~42 m
( 138 ft )
12m±
12m±
5m±
G1
G2
G3
G4
G5
G6
INITIAL BEACH FILL
POST-PROJECT BEACH FILL
RELOCATE, SHORTEN & LOWER HEADLAND STRUCTURE; CREST ELEV. = 0.0 MSL
PLACE BEACH FILL SAND
CONSTRUCT (6) ROCK GROINS
Alternative Solution Plan
THE SEA
olsen associates
SCALE
0 10 20m
PRE-PROJECT SHORELINE
POST-FILL EQUILIB SHORELINE




# Alternative Solution Plan

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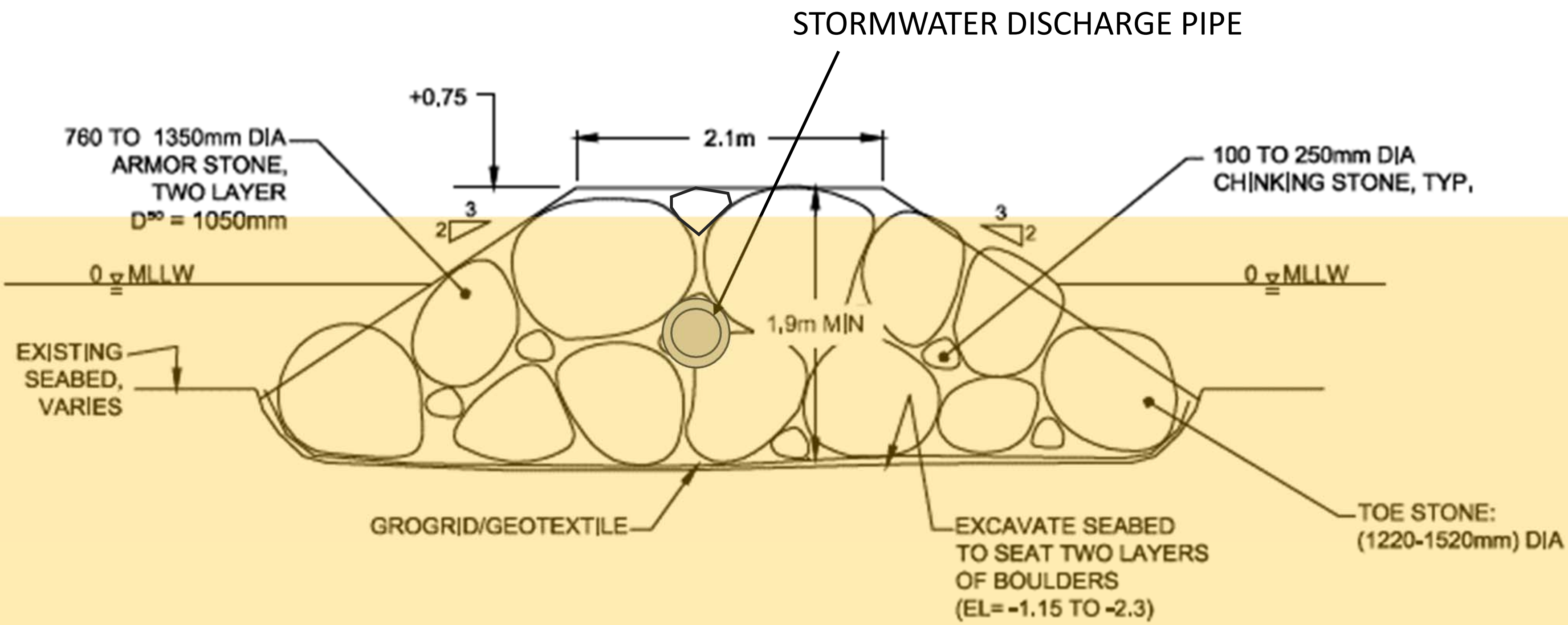
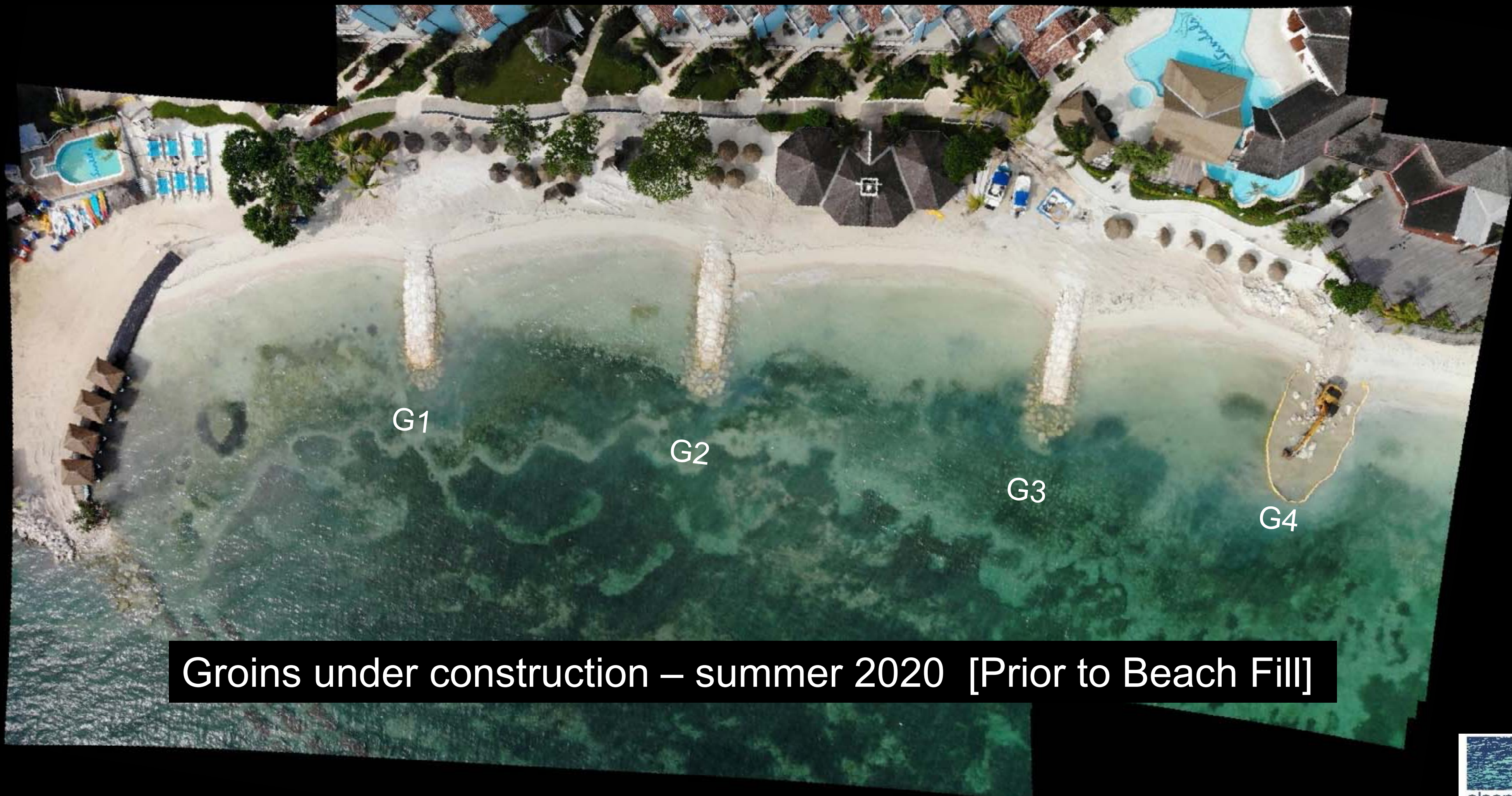

STORMWATER DISCHARGE PIPE
+0.75
2.1m
760 TO 1350mm DIA ARMOR STONE, TWO LAYER D50 = 1050mm
100 TO 250mm DIA CHINKING STONE, TYP.
3
2
0 MLLW
1.9m MIN
EXISTING SEABED, VARIES
GROGRID/GEOTEXTILE
EXCAVATE SEABED TO SEAT TWO LAYERS OF BOULDERS (EL= -1.15 TO -2.3)
TOE STONE: (1220-1520mm) DIA


Summer 2020 - Construction


Summer 2020 - Construction

**Summer 2020 - Construction**


G1
G2
G3
G4
Groins under construction – summer 2020  [Prior to Beach Fill]

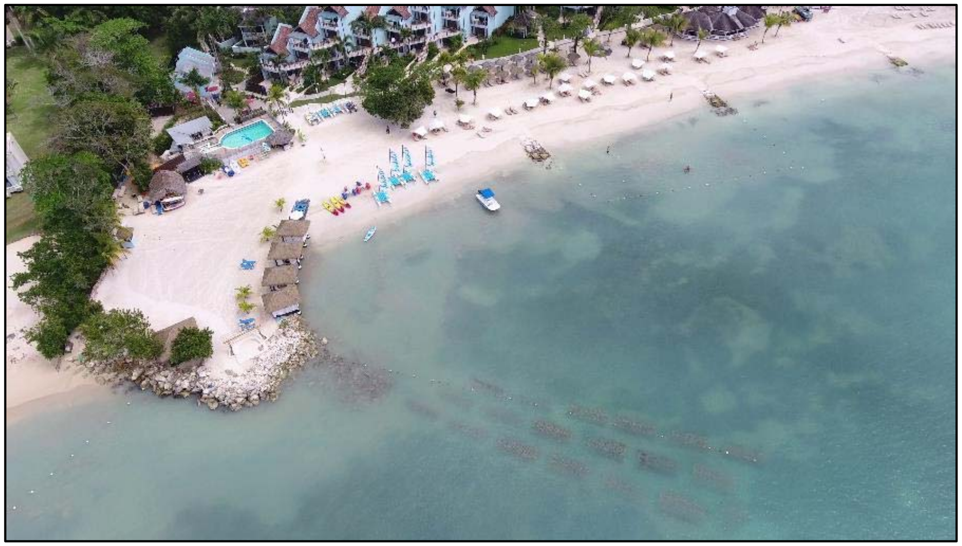
G1
G2
G3
G4
G5
G6 (buried)
April 2021 (6-month post-construction)


May 2021 -  7 months post-construction

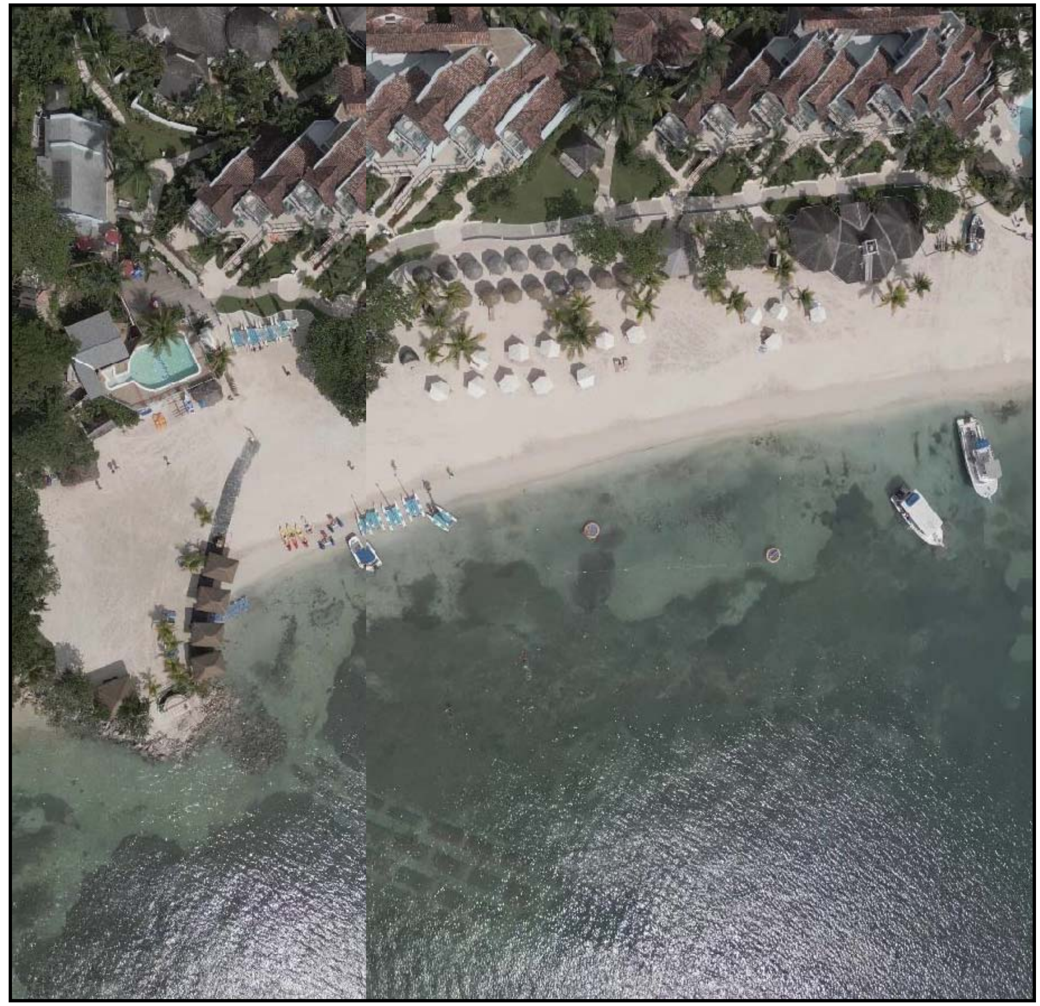
**May 2021 - 7 months post-construction**


May 2021 - 7 months post-construction
Pre-Project

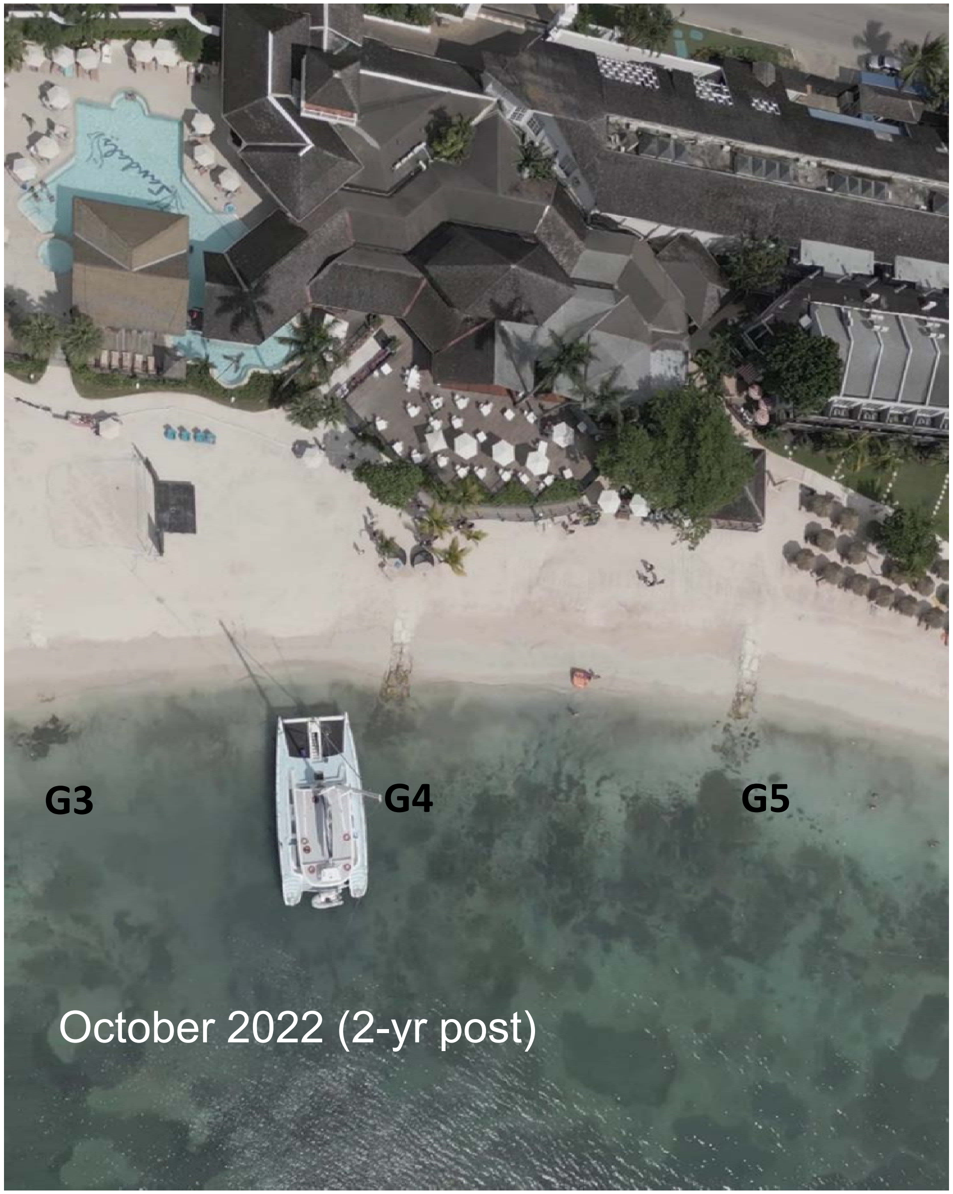

Groin field area
October 2021 (1-yr post-construction)
olsen
associates

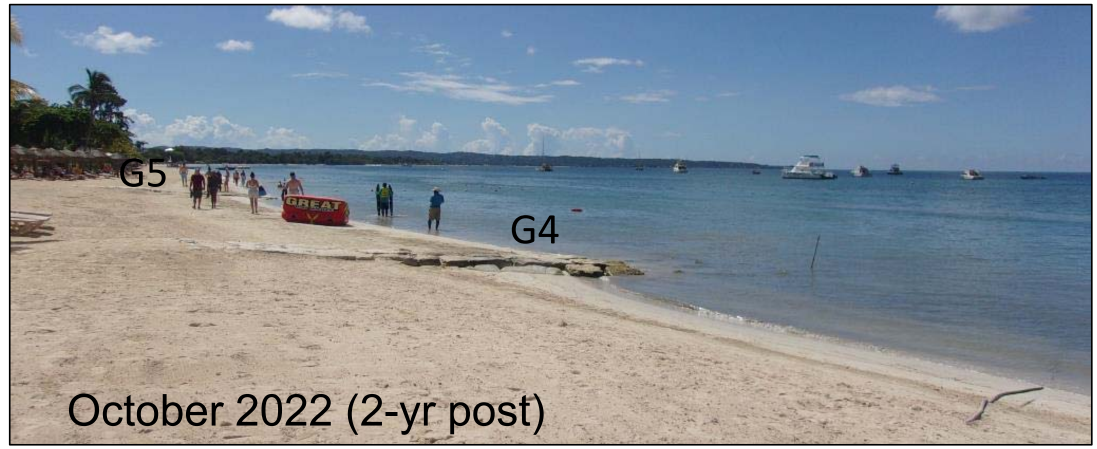


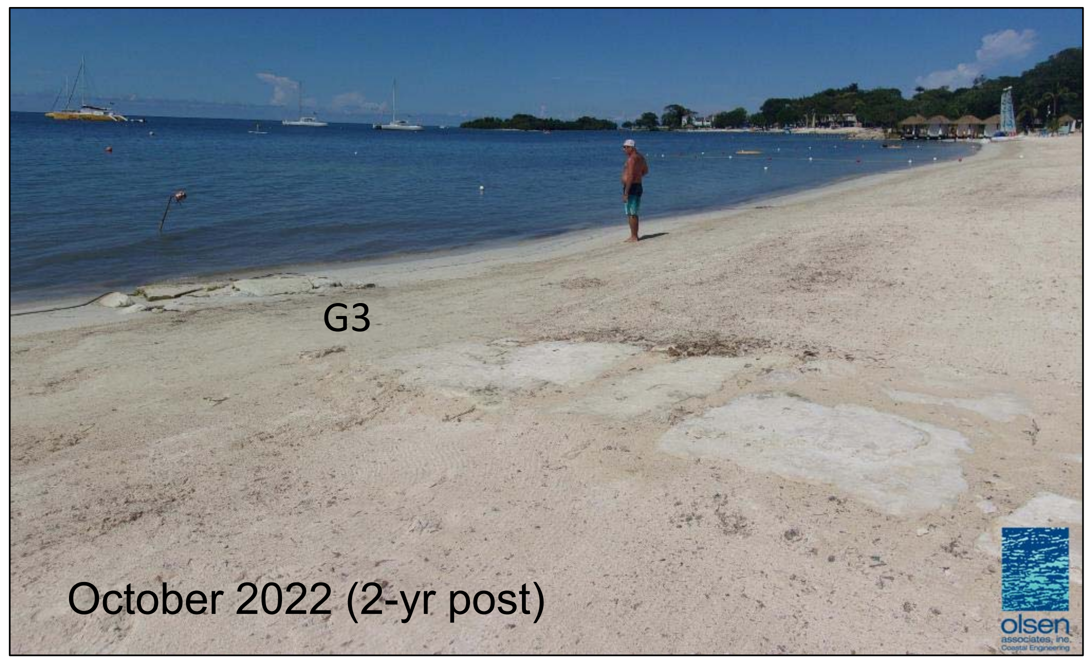
**FEB 2022**
**16 Months Post-Construction**

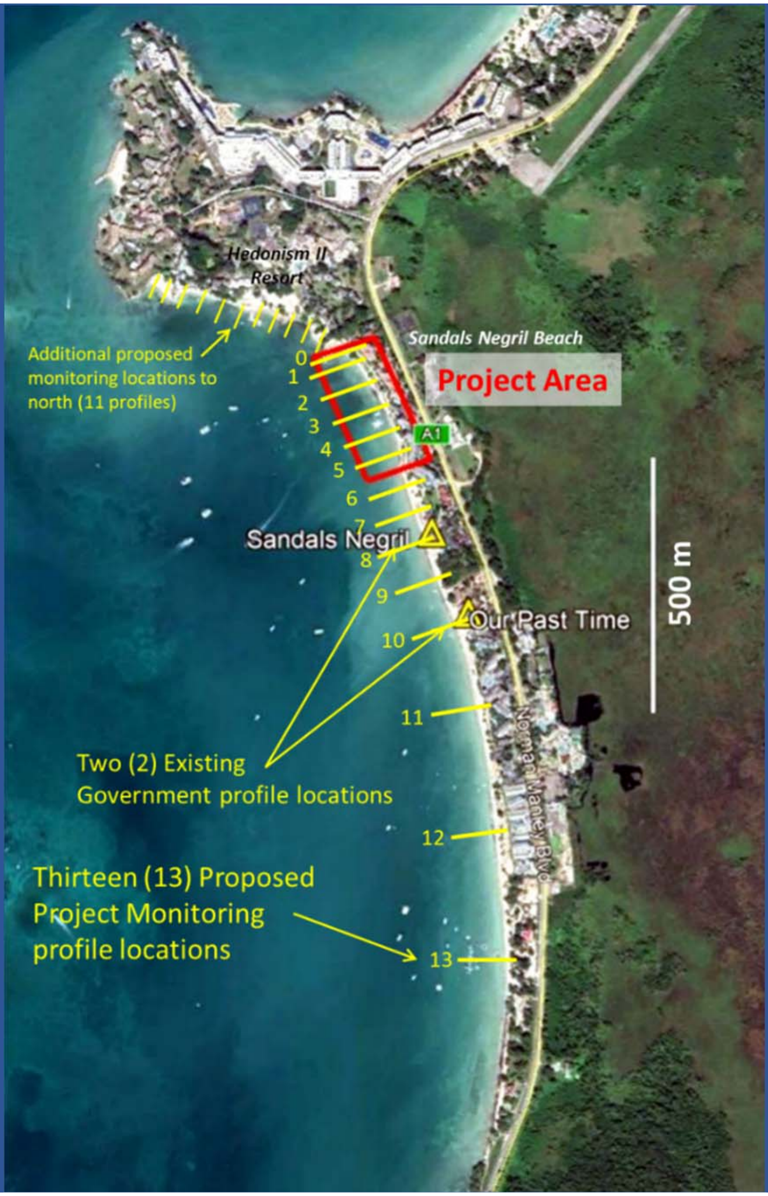


**0CT 2022**
**24 Months Post-Construction**


G3
G4
G5
October 2022 (2-yr post)


G5
G4
October 2022 (2-yr post)

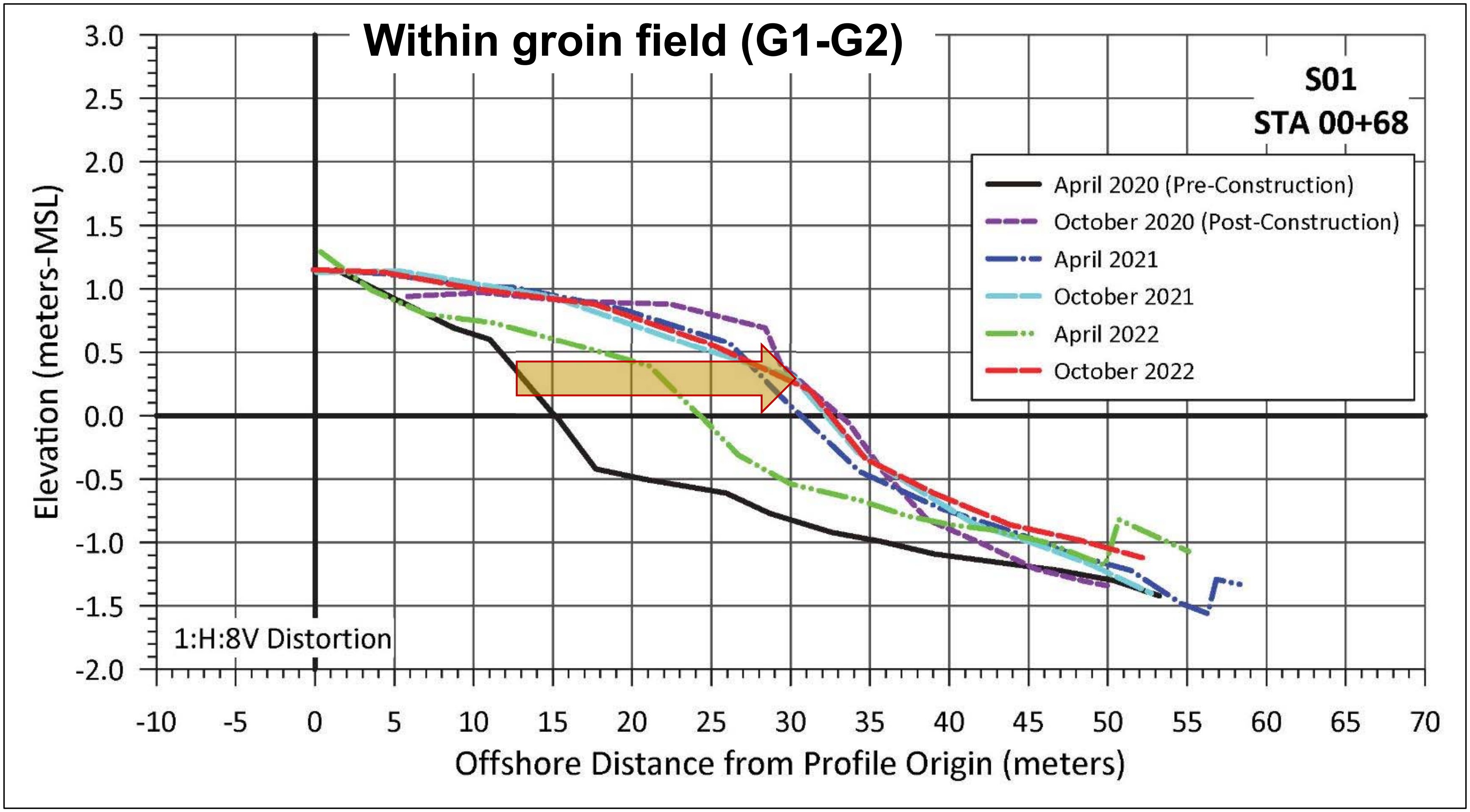

G3
October 2022 (2-yr post)

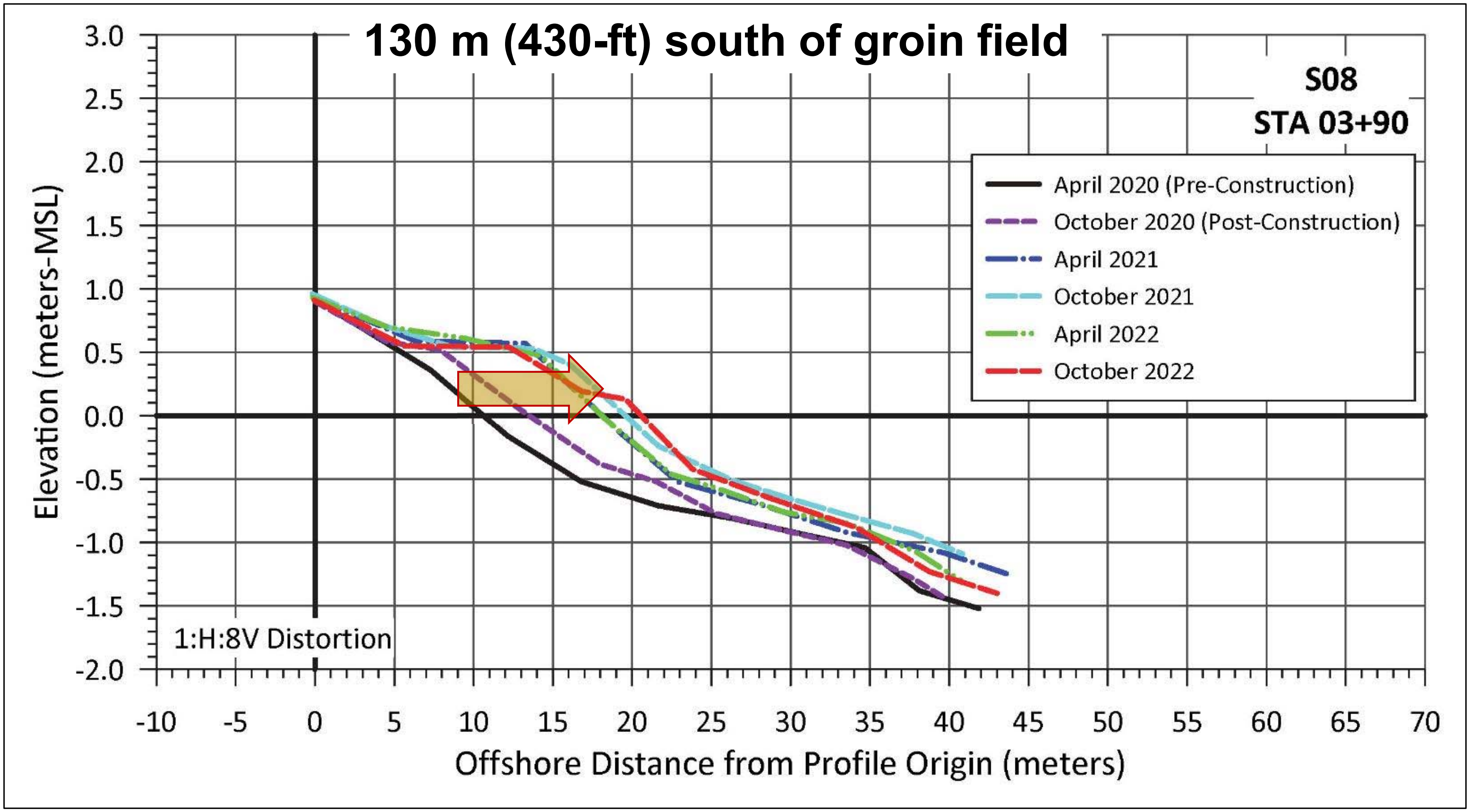


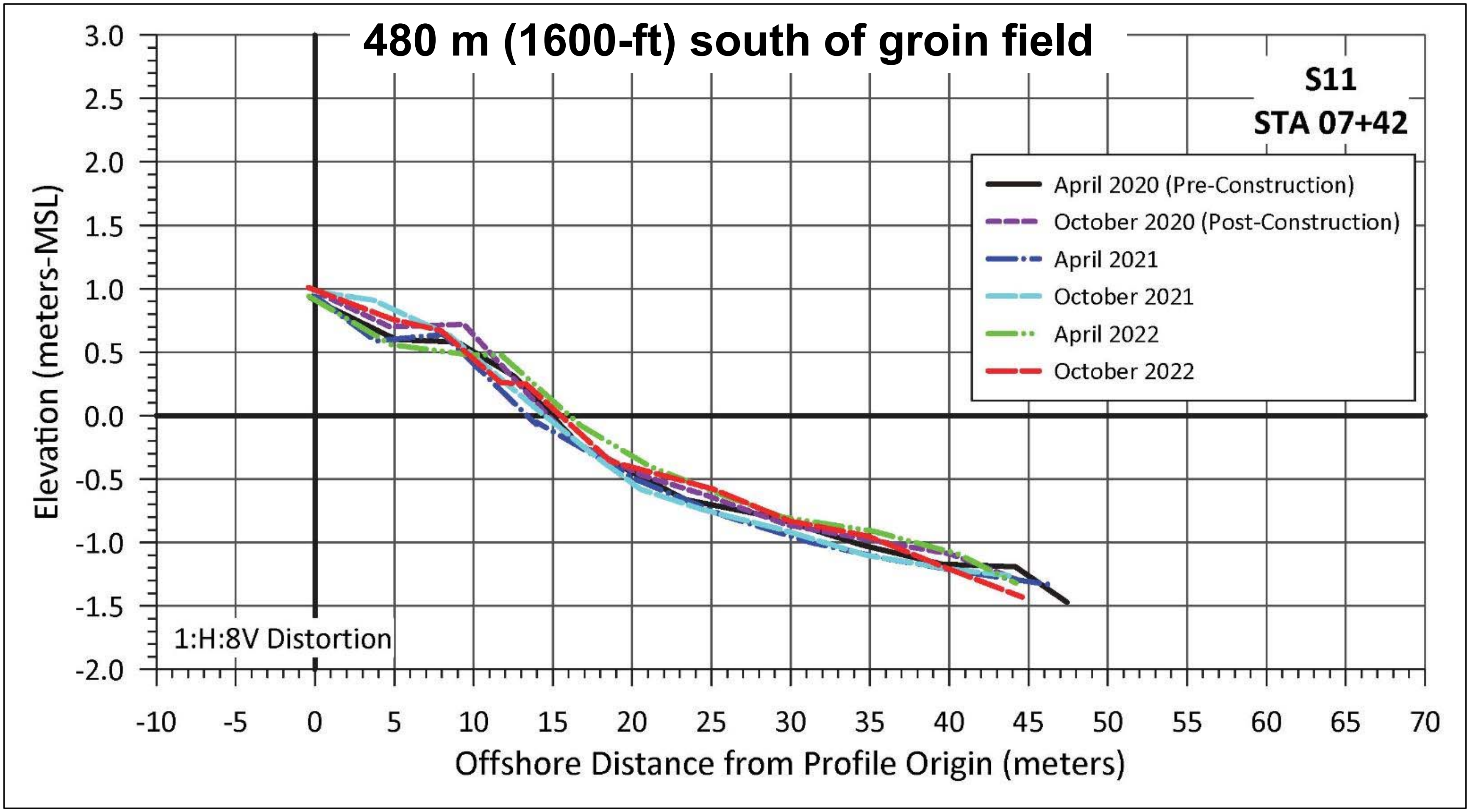

## Beach Monitoring Program

- 24 beach profile transects, from 0.5 km west to 1 km south of project
- April 2020 – Oct 2022
  0.5-Yrs Pre- to 2-Yrs Post-Construction

About 9 storm events occurred during the 2-yr post-construction monitoring.


Within groin field (G1-G2)
S01
STA 00+68
April 2020 (Pre-Construction)
October 2020 (Post-Construction)
April 2021
October 2021
April 2022
October 2022
1:H:8V Distortion
Elevation (meters-MSL)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
Offshore Distance from Profile Origin (meters)


130 m (430-ft) south of groin field
S08
STA 03+90
April 2020 (Pre-Construction)
October 2020 (Post-Construction)
April 2021
October 2021
April 2022
October 2022
1:H:8V Distortion
Elevation (meters-MSL)
Offshore Distance from Profile Origin (meters)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70



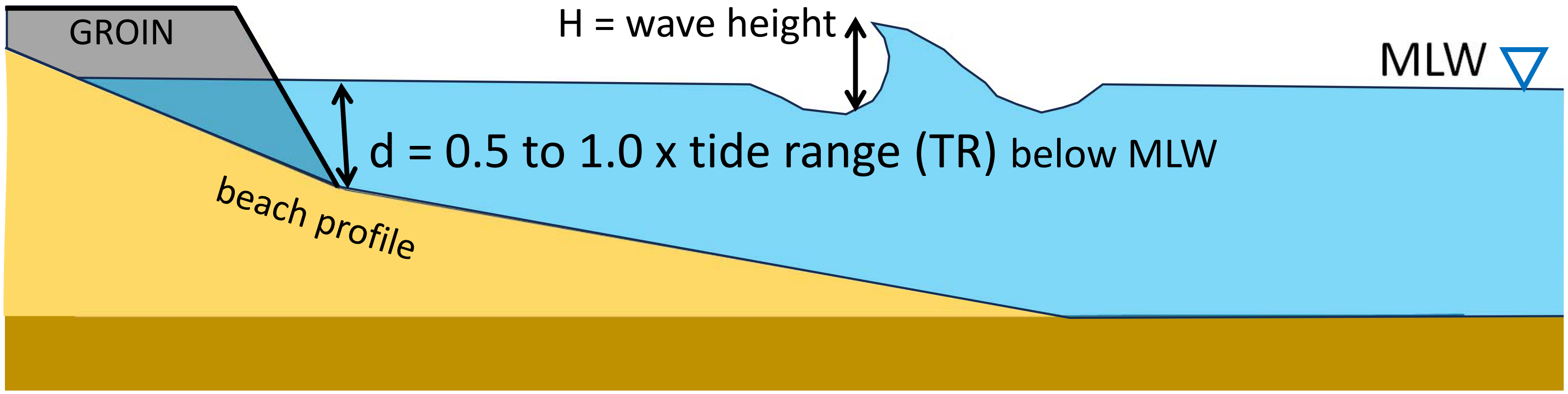
480 m (1600-ft) south of groin field
S11
STA 07+42
April 2020 (Pre-Construction)
October 2020 (Post-Construction)
April 2021
October 2021
April 2022
October 2022
Elevation (meters-MSL)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
1:H:8V Distortion
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
Offshore Distance from Profile Origin (meters)

# Net Beach Volume Changes ($m^3$)

| | 6-months CONSTRXN (April 2020 – Oct 2020) | 24-months POST-CONSTRXN (Oct 2020 – Oct 2022) |
|---|---|---|
| West of Groin Field (360 m) | +100 | -400 |
| Groin Field (290 m) | +6,570 | +780 |
| South of Groin Field (270 m) | +530 | +2,340 |
| Far-field South of Groins (270 to 1000 m south) | +700 | +1,430 |
| TOTAL | +7,900 | +4,150 |

*PLACED*

## *Why might this work?*




breaking wave index

**If H << r x d …** then breaking ("surf zone") occurs *landward* of groin

**H << 0.8 x (0.5 to 1.0 x TR)**

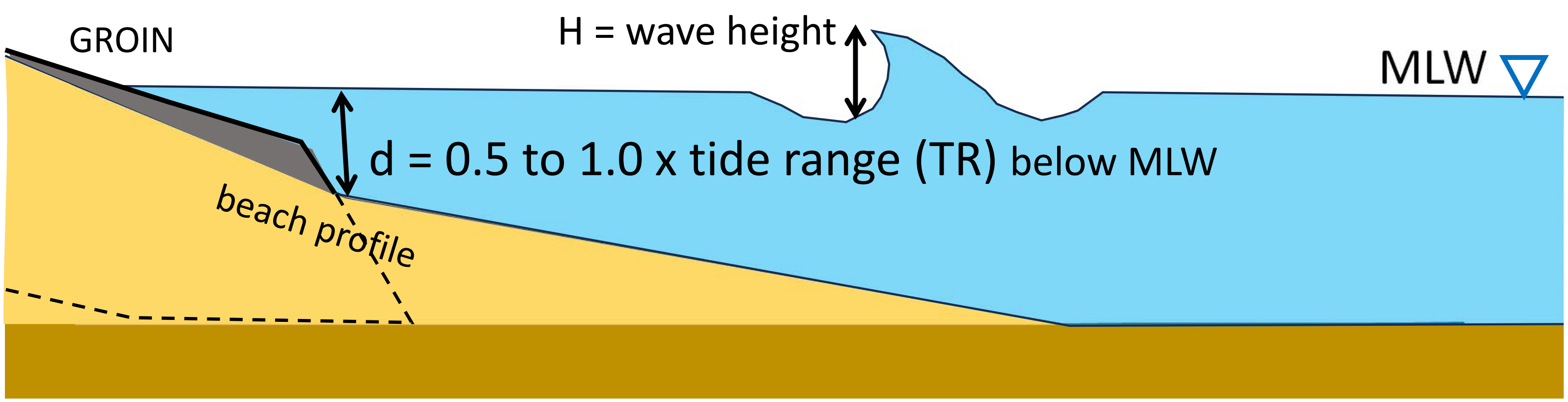
$$\frac{H}{TR} << 0.4 \text{ to } 0.8$$

At these sites….

$$\frac{H = 0.2\ m}{TR = 0.6\ m} = 0.33$$

so *daily* wave breaking occurs *landward* of groins

## *Why might this work?*




breaking wave index

**If H << r x d** … then breaking ("surf zone") occurs *landward* of groin

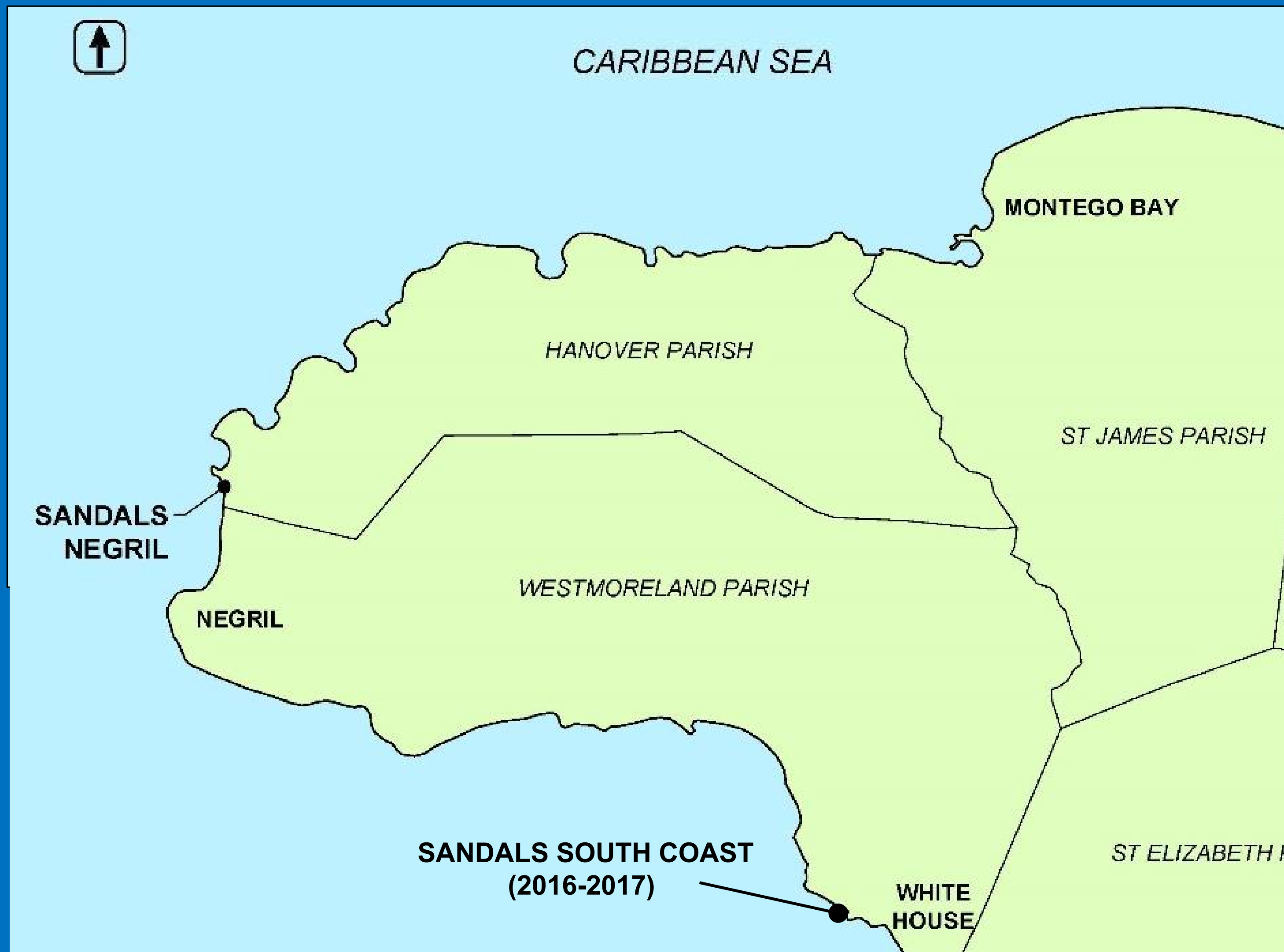
$$H << 0.8 \times (0.5 \text{ to } 1.0 \times TR)$$

$$\frac{H}{TR} << 0.4 \text{ to } 0.8$$

At these sites….

$$\frac{H}{TR} = \frac{0.2\ m}{0.6\ m} = 0.33$$

so *daily* wave breaking occurs *landward* of groins

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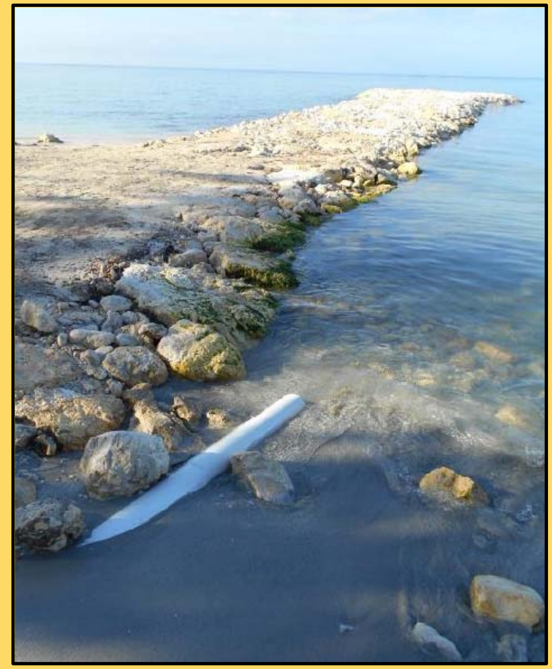
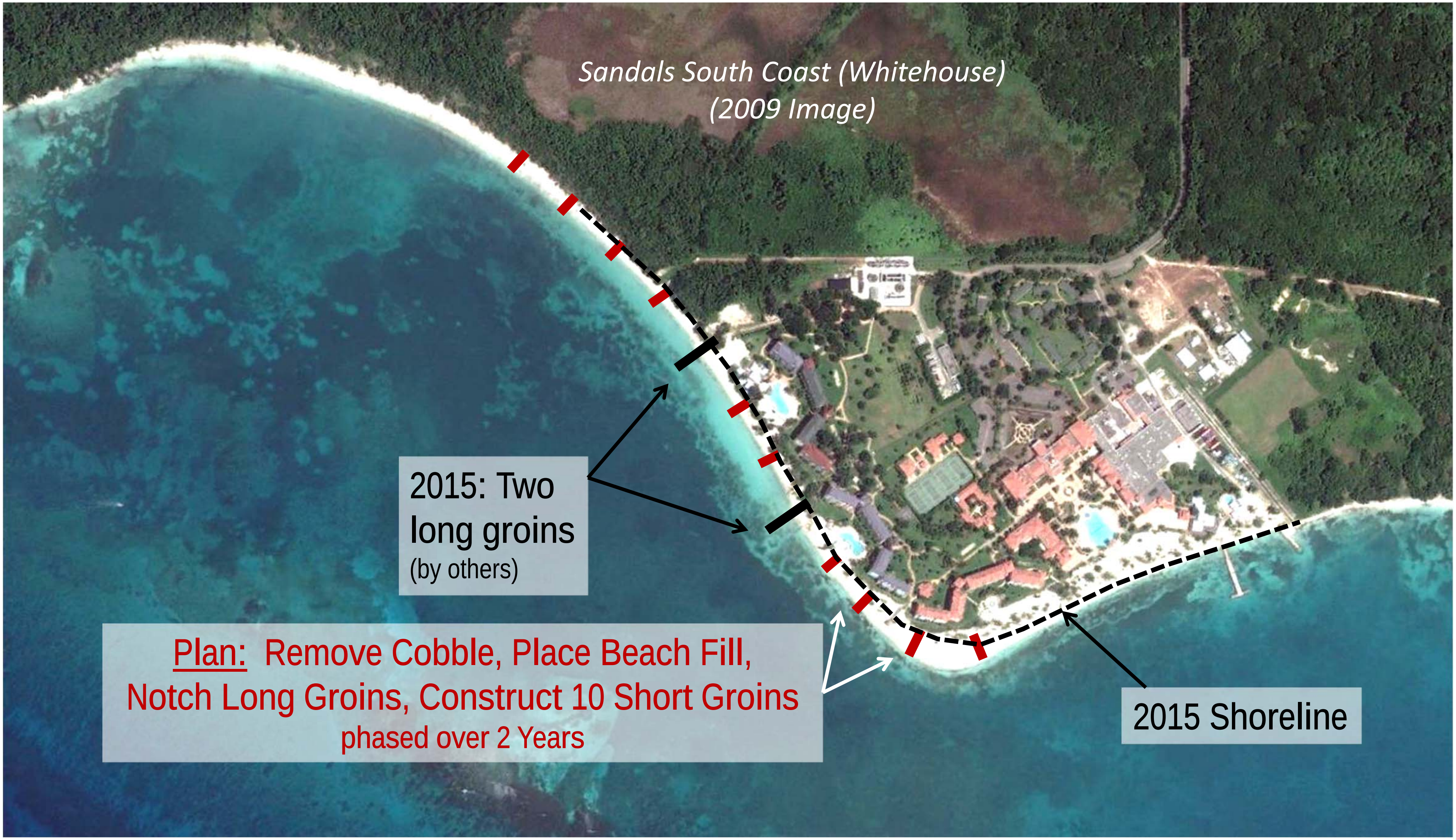
Sandals South Coast (Whitehouse)
(2009 Image)
N
500 m
(1640 ft)
Google Earth
Image © 2024 Maxar Technologies


Sandals South Coast (Whitehouse)
(2009 Image)
N

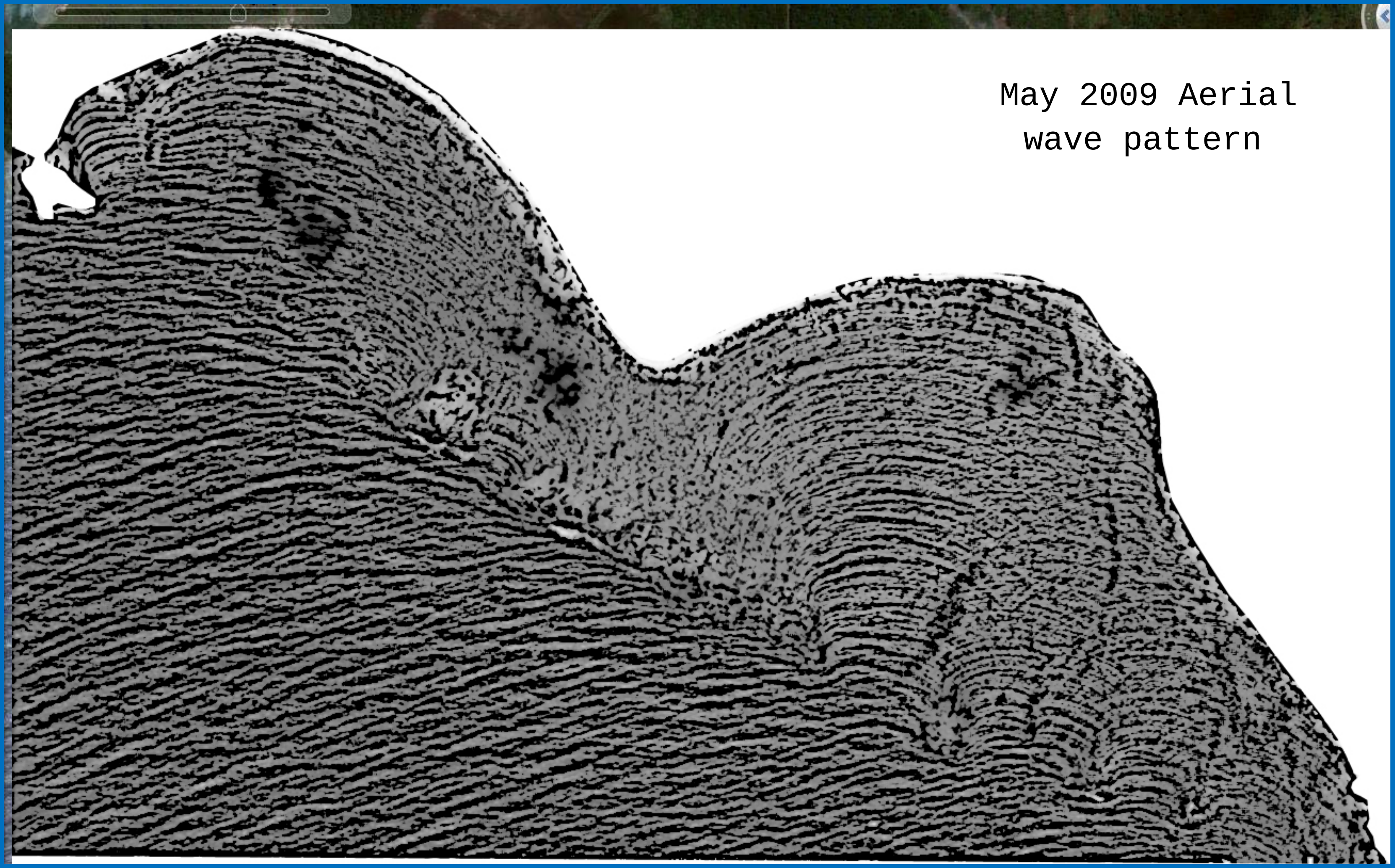

Sandals South Coast (Whitehouse)
(2009 Image)
2015: Two
long groins
(by others)
2015 Shoreline

**November 2015**





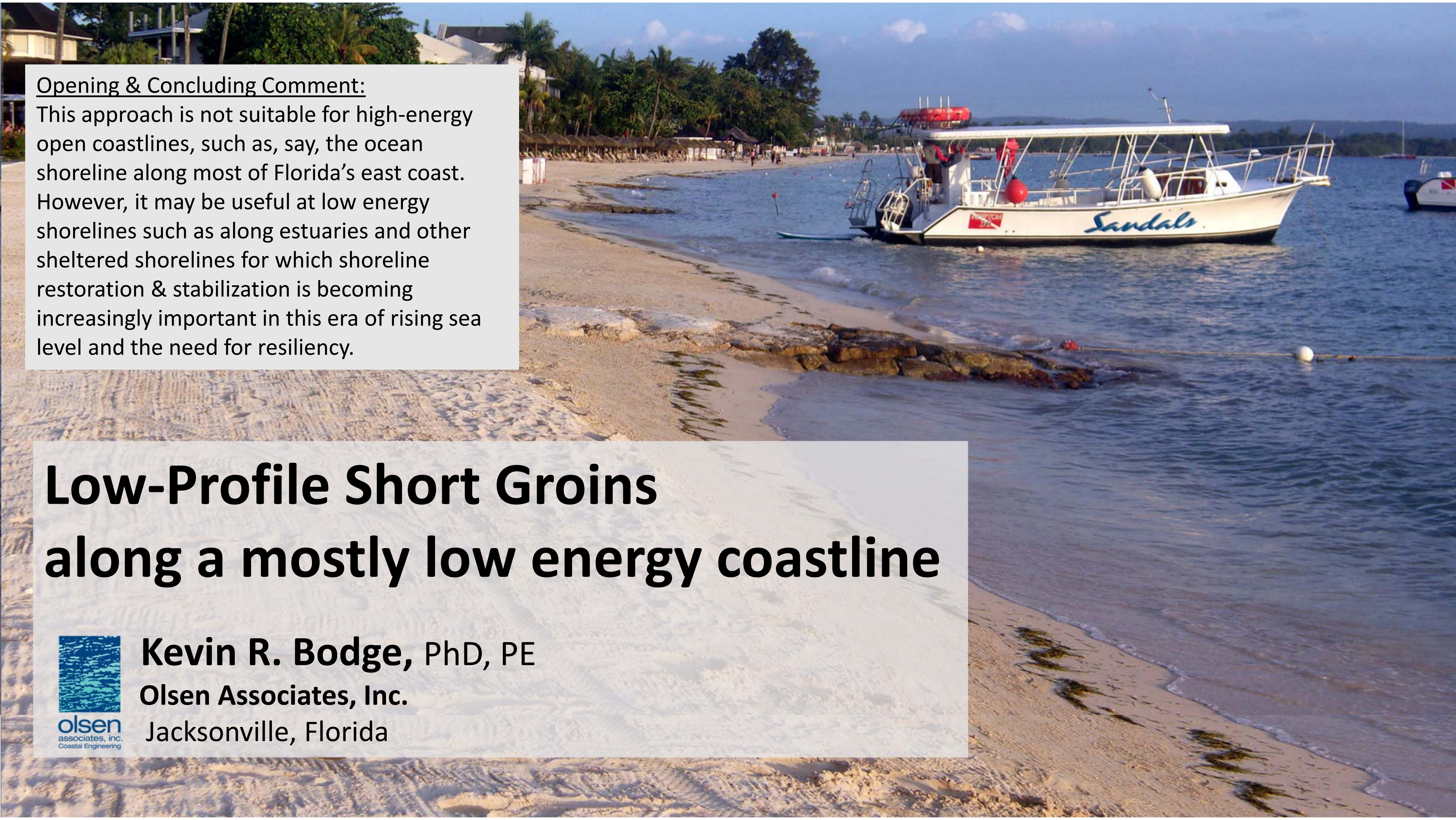
Sandals South Coast (Whitehouse)
(2009 Image)
2015: Two
long groins
(by others)
Plan: Remove Cobble, Place Beach Fill,
Notch Long Groins, Construct 10 Short Groins
phased over 2 Years
2015 Shoreline


May 2009 Aerial
wave pattern

*March 2016*


May 2021


November 2023




<u>Opening & Concluding Comment:</u>
This approach is not suitable for high-energy open coastlines, such as, say, the ocean shoreline along most of Florida's east coast. However, it may be useful at low energy shorelines such as along estuaries and other sheltered shorelines for which shoreline restoration & stabilization is becoming increasingly important in this era of rising sea level and the need for resiliency.

# Low-Profile Short Groins along a mostly low energy coastline

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