

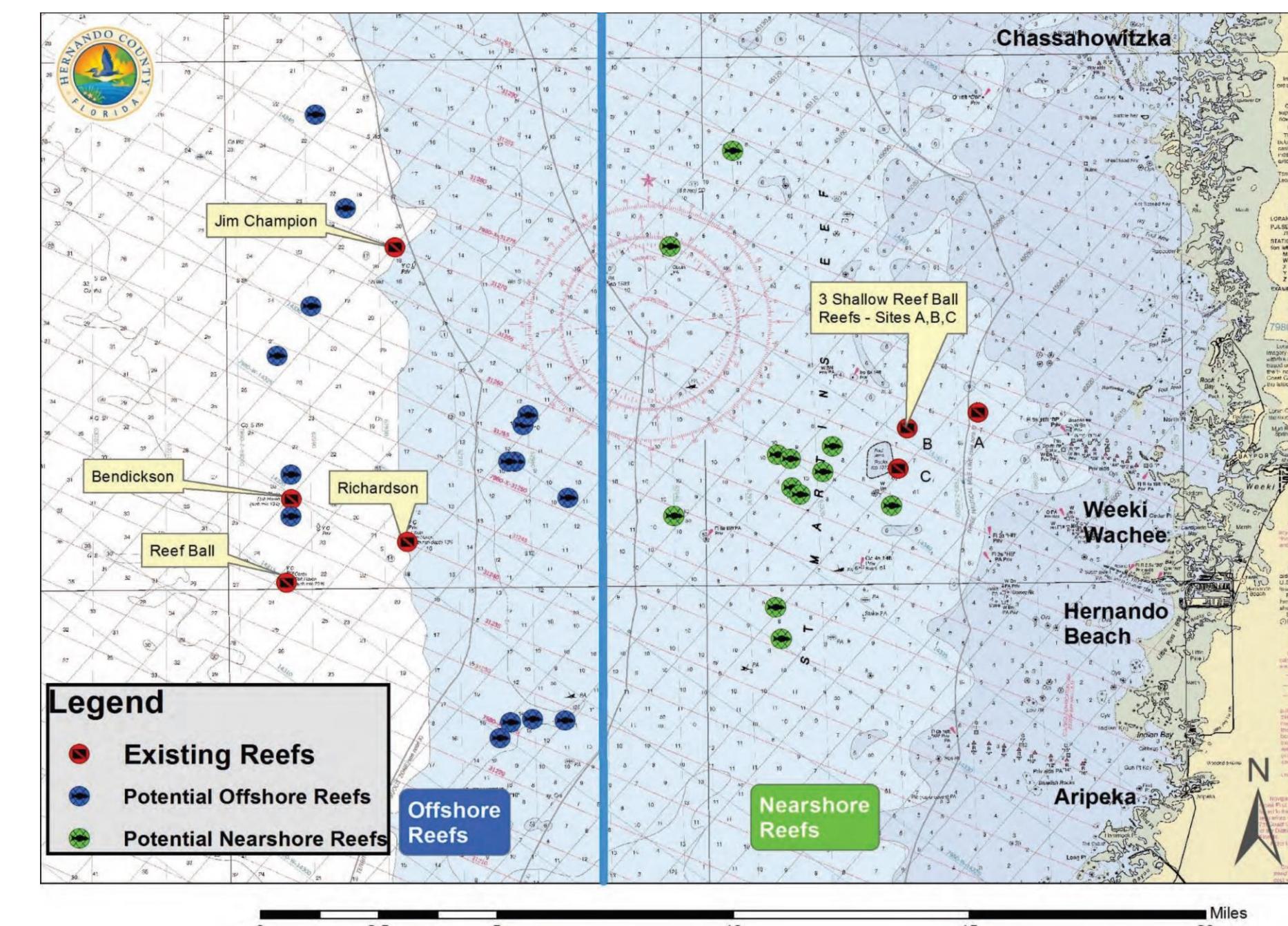


# Hernando County Artificial Reef Project Overview

## Project Objectives

### Objectives

- Ten new artificial reefs will be designed and planned within the marine and coastal waters of Hernando County.
- This will expand Hernando County's existing artificial reef network and increase opportunities for fishing and diving.
- This phase of the project focuses on planning and permitting.
  - *No construction will occur as part of this project.*

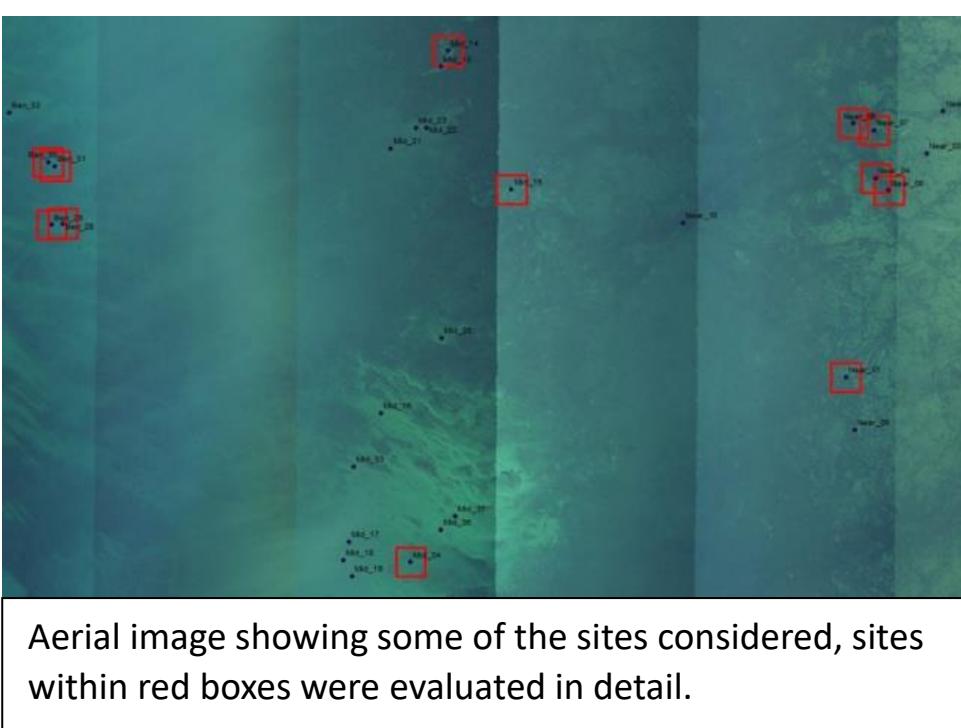


## Project Overview

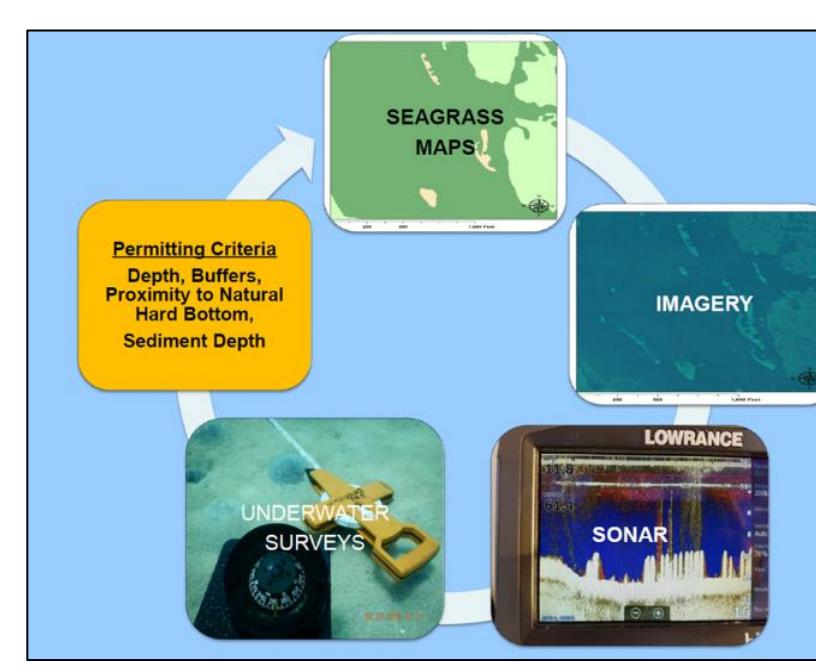
### Overview

- Planning, design, and preconstruction monitoring of 10 new artificial reef sites.
  - Within the marine waters of Hernando County.
  - Located 8 to 25 nautical miles offshore.
  - Selected to enable their use by a wide variety of stakeholders.
  - Assist in connecting previous artificial reefs with natural seagrass and hardbottom habitats.
  - Varying materials and forms will be considered on their environmental benefit and feedback from stakeholders.

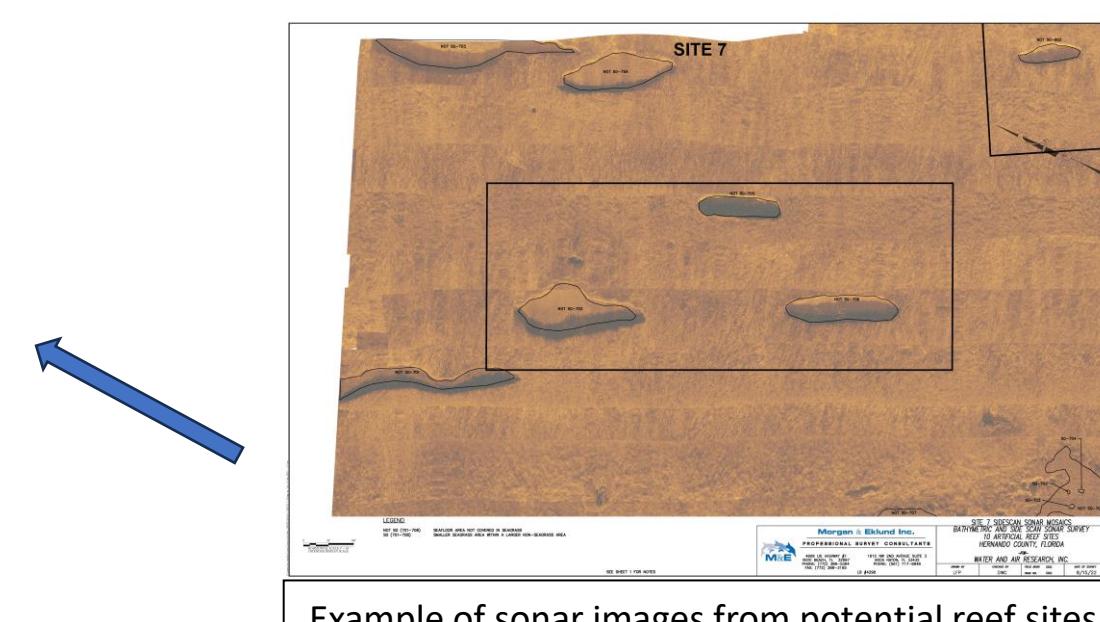
## New Artificial Reef Site Evaluations



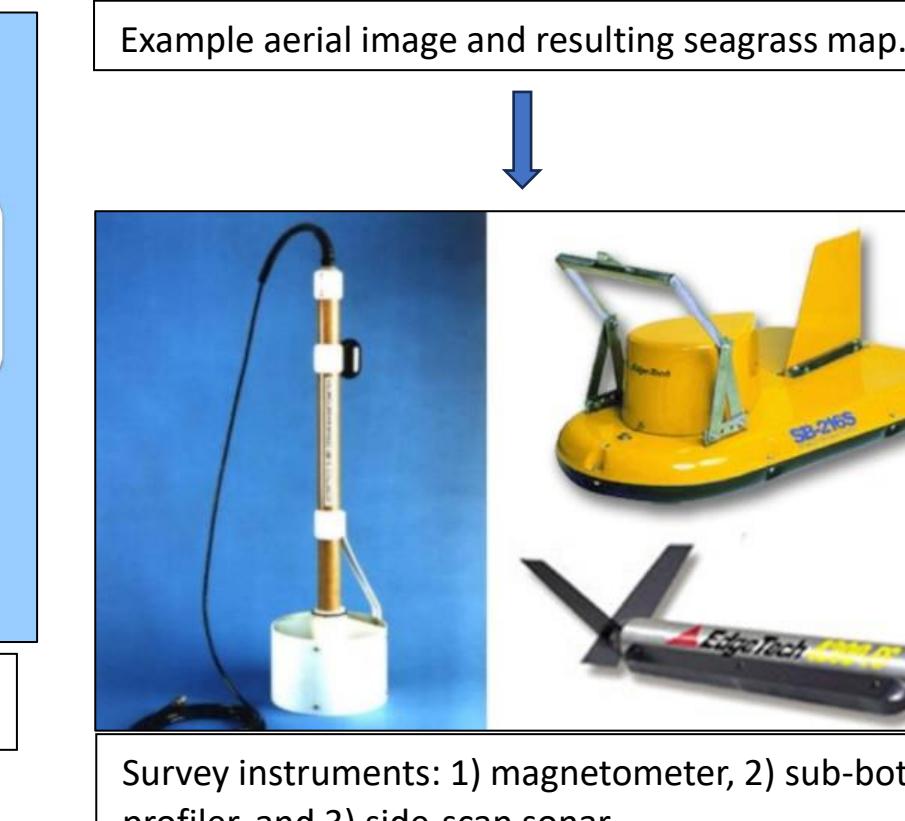
Aerial image showing some of the sites considered, sites within red boxes were evaluated in detail.



Diver surveys confirmed suitable areas.



Example of sonar images from potential reef sites.



Survey instruments: 1) magnetometer, 2) sub-bottom profiler, and 3) side-scan sonar.

## Examples of Similar Existing Hernando County Artificial Reefs



2017 Bendickson Reef Expansion

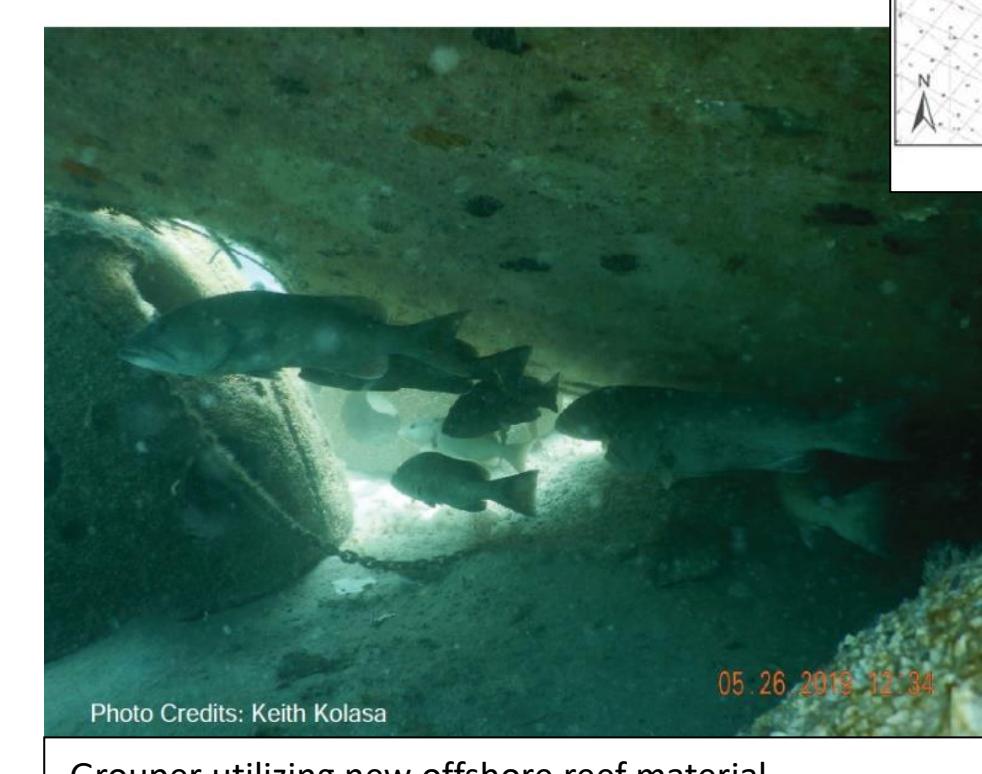
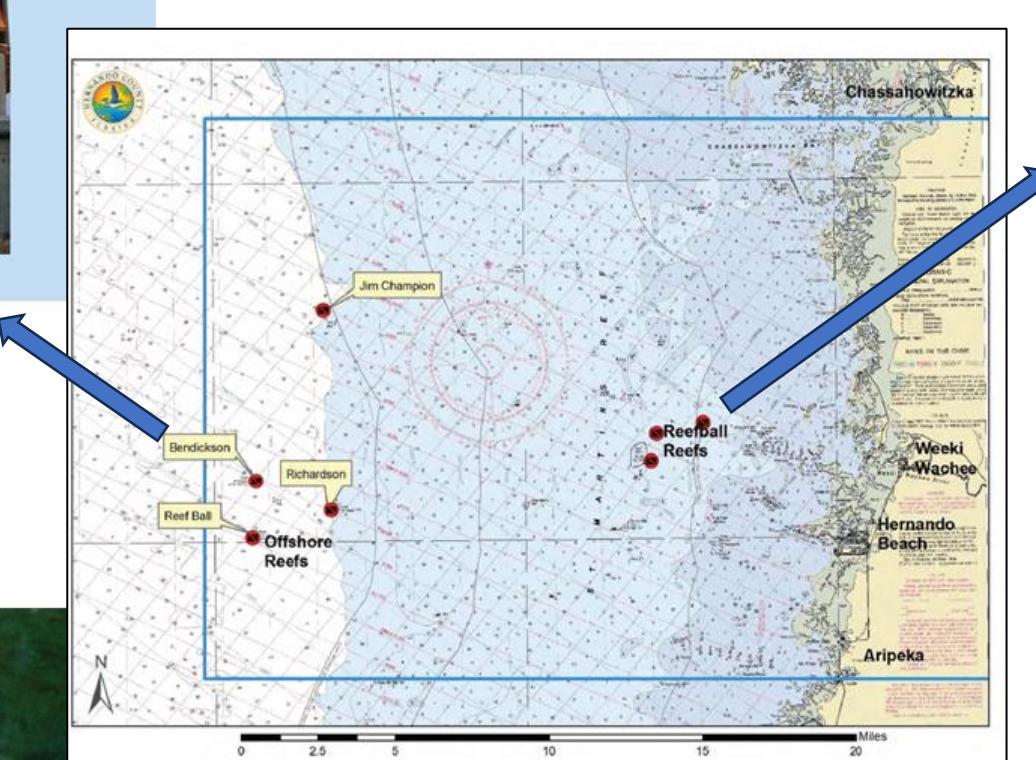


Photo Credits: Keith Kolasa  
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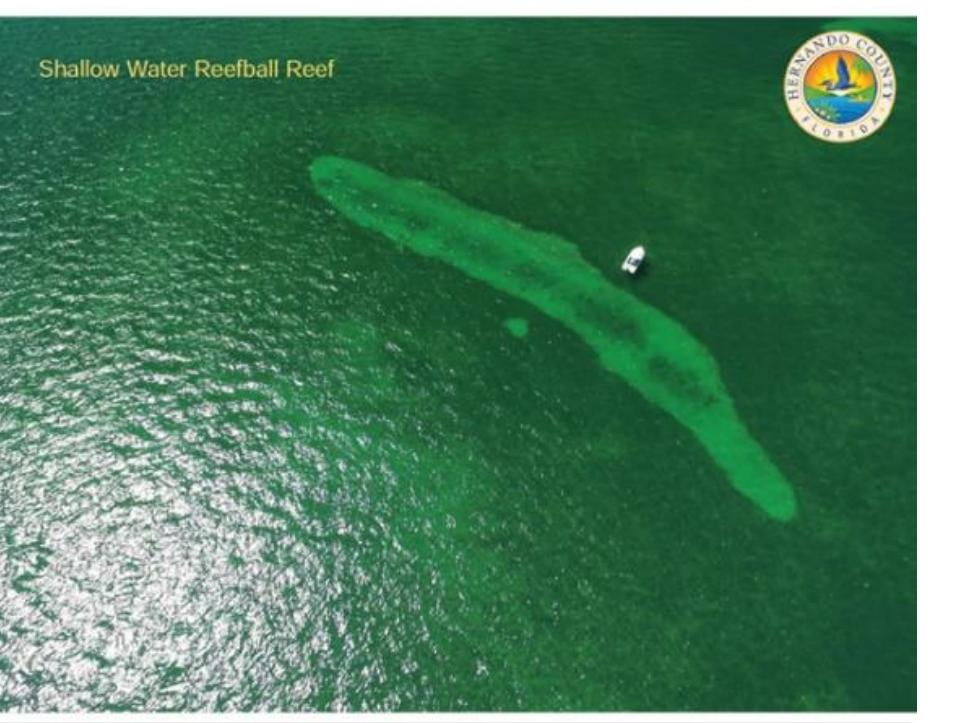
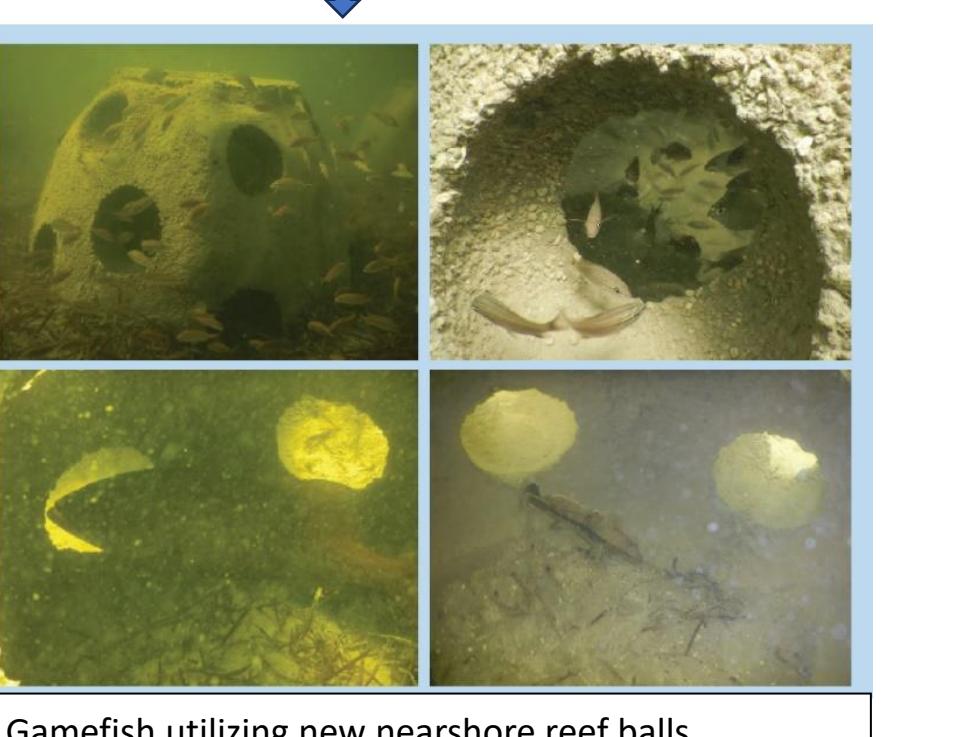


Image showing aerial view of nearshore reef ball site.



Gamefish utilizing new nearshore reef balls.



# Hernando County Artificial Reef Project Next Steps

## Proposed Reef Materials

Florida Rule 62-330.600 specifies that reef materials **may include** "clean concrete or rock, clean steel boat hulls, other clean, heavy gauge steel products with a thickness of 1/4 inch or greater, and prefabricated structures that are a mixture of clean concrete and heavy gauge steel."

Rule 62-330.600 **prohibits** use of "white goods" (inoperative and discarded refrigerators, freezers, ranges, water heaters, washers, and other similar domestic and commercial appliances), asphalt, tires, and other polluting materials.

While various materials are commonly used for artificial reefs, such as limestone boulders or re-purposed concrete materials, manufactured concrete reef modules have proven to provide cost-effective and ecologically sound artificial reef habitat. Various manufacturers offer reef materials in numerous shapes and sizes, which may be further evaluated and considered in the final design phase.

Reef Ball modules (Image below from Reef Ball Foundation) are concrete reef modules which have been successfully installed throughout Florida.

	WIDTH	HEIGHT	WEIGHT	CONCRETE VOLUME	SURFACE AREA	# OF HOLES
Goliath - Booster Ring	6' 6" (2 m)	3' (0.91 m)	4000 - 6000 lbs (1800 - 2727 kg)	1.3 yd <sup>3</sup> (0.99 m <sup>3</sup> )	180 ft <sup>2</sup> (16.7 m <sup>2</sup> )	15 - 25
Goliath Ball	6' (1.83 m)	4'10" (1.46 m)	4000 - 6000 lbs (1818 - 2727 kg)	1.3 yd <sup>3</sup> (0.99 m <sup>3</sup> )	230 ft <sup>2</sup> (21.4 m <sup>2</sup> )	25 - 40
Super Ball	6' (1.83 m)	4'6" (1.37 m)	4000 - 6000 lbs (1818 - 2727 kg)	1.3 yd <sup>3</sup> (0.99 m <sup>3</sup> )	190 ft <sup>2</sup> (17.6 m <sup>2</sup> )	22 - 34
UltraBall	5' (1.52 m)	3'10" (1.83 m)	3000 - 4000 lbs (1360 - 1818 kg)	0.75 yd <sup>3</sup> (0.57 m <sup>3</sup> )	150 ft <sup>2</sup> (14 m <sup>2</sup> )	22 - 34
Reef Ball	6' (1.83 m)	3'8" (1.12 m)	3000 - 4200 lbs (1360 - 1905 kg)	0.75 yd <sup>3</sup> (0.57 m <sup>3</sup> )	130 ft <sup>2</sup> (12 m <sup>2</sup> )	22 - 34
Pallet Ball	4' (1.22 m)	2'11" (0.88 m)	1200 - 1800 lbs (544 - 816 kg)	0.33 yd <sup>3</sup> (0.25 m <sup>3</sup> )	75 ft <sup>2</sup> (7 m <sup>2</sup> )	15 - 20
Bay Ball	3' (0.91 m)	2' (0.61 m)	375 - 750 lbs (170 - 340 kg)	0.16 yd <sup>3</sup> (0.12 m <sup>3</sup> )	40 ft <sup>2</sup> (3.7 m <sup>2</sup> )	11 - 16
Mini-Bay Ball	2'6" (0.76 m)	1'9" (0.53 m)	250 - 400 lbs (113 - 181 kg)	0.09 yd <sup>3</sup> (0.07 m <sup>3</sup> )	30 ft <sup>2</sup> (2.8 m <sup>2</sup> )	9 - 14
Lo-Pro Ball	2' (0.61 m)	1'6" (0.46 m)	100 - 200 lbs (45 - 90 kg)	0.05 yd <sup>3</sup> (0.04 m <sup>3</sup> )	17 ft <sup>2</sup> (1.6 m <sup>2</sup> )	8 - 12
Oyster Ball	1'6" (0.46 m)	1' (0.30 m)	40 - 60 lbs (18 - 27 kg)	0.016 yd <sup>3</sup> (0.012 m <sup>3</sup> )	8 ft <sup>2</sup> (0.74 m <sup>2</sup> )	6 - 8

## Project Benefits

New artificial reef sites will be selected to enable their use by a wide variety of users and will assist in connecting the previously installed artificial reefs with the natural seagrass and hardbottom habitats offshore of Hernando County.

The reefs will enhance and increase nature-based tourism within the County.

Recreational objectives include enhancement of scuba diving and snorkeling reefs, and enhancement of recreational fishing.



## Next Steps (and time frame):

- Permit Applications (ongoing)
  - State (DEP, FWC)
  - Federal (USACE, USCG)
- Completion of 60% Design Plans (ongoing)
- Permit Approval for Sites (2024)
- Baseline Monitoring Plan for Sites (2024)
- Permit Approvals and Completion of Final Design Plans (2024)
- Post Monitoring Plan for Sites (2024-2025)
- Baseline Monitoring and Report for Sites (2024-2025)

## Next Project (starting 2025 or tbd):

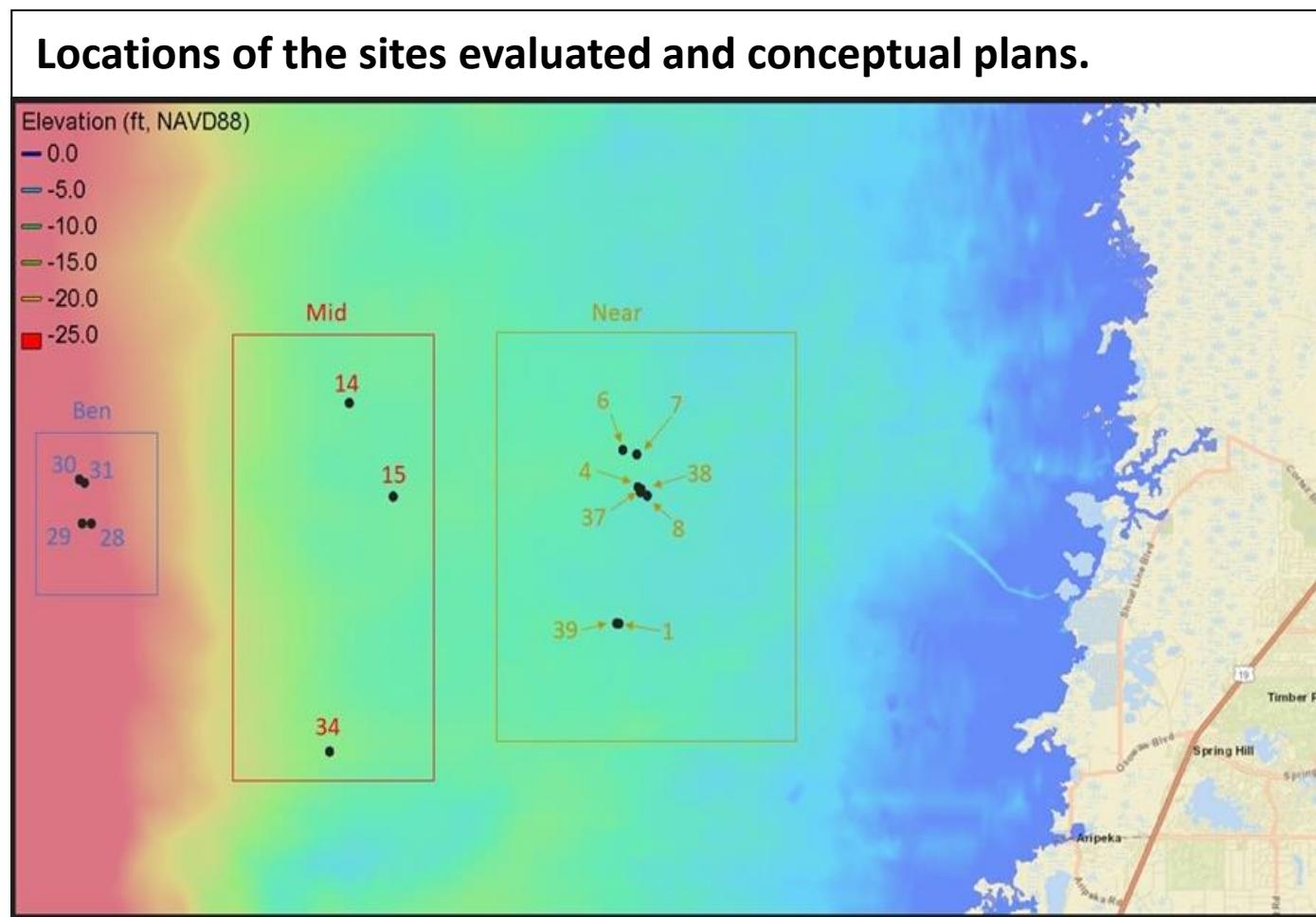
Utilize Grant Funding to Bid, Award, and Construct Ten New Artificial Reef Sites.



Deployment example from 2017 Bendickson Reef Expansion (Photo Credit: Keith Kolasa).



# Nearshore Artificial Reef Site Conceptual Designs



## Conceptual Design Summary to help prioritize selection of sites for reef construction.

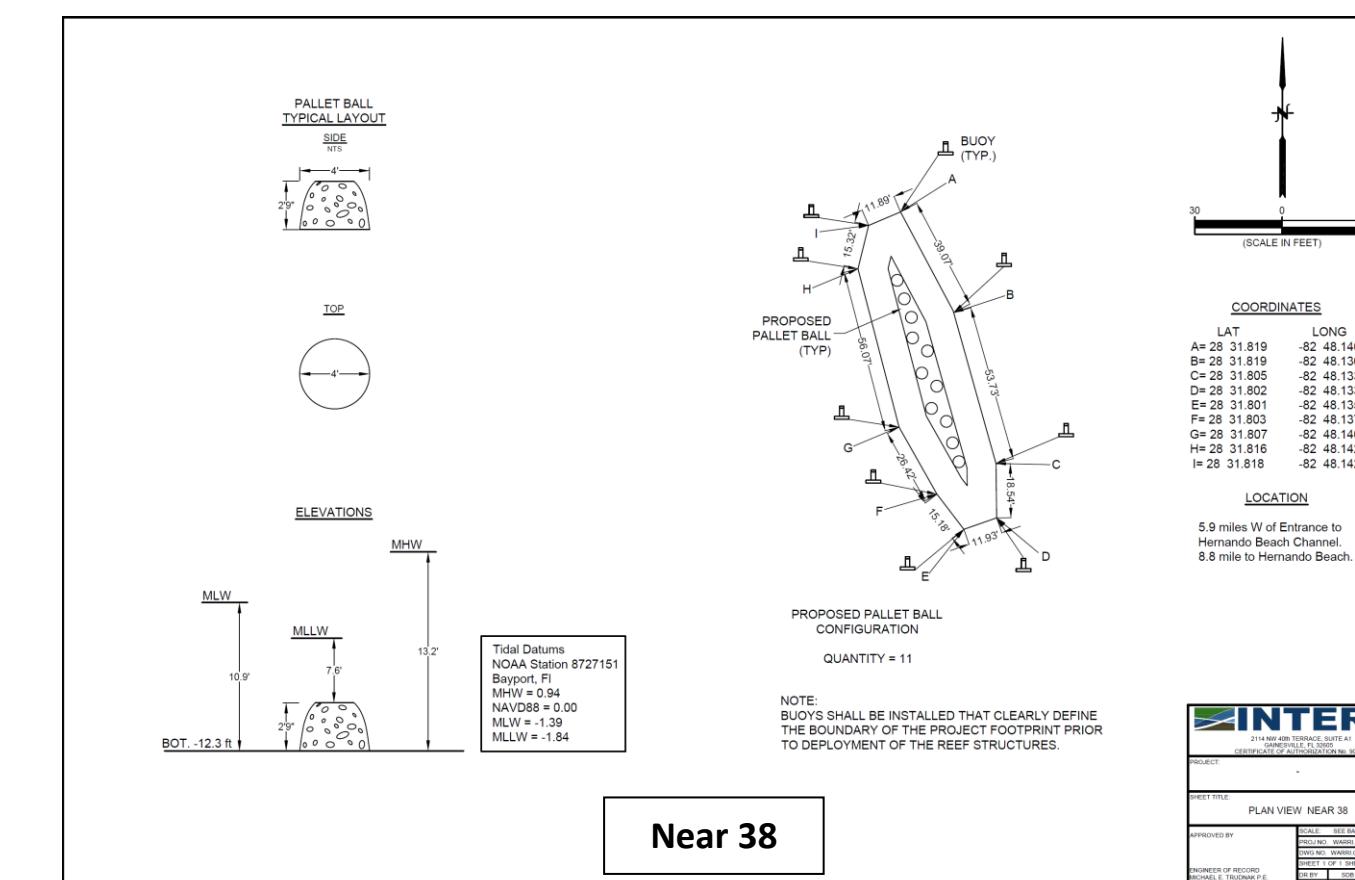
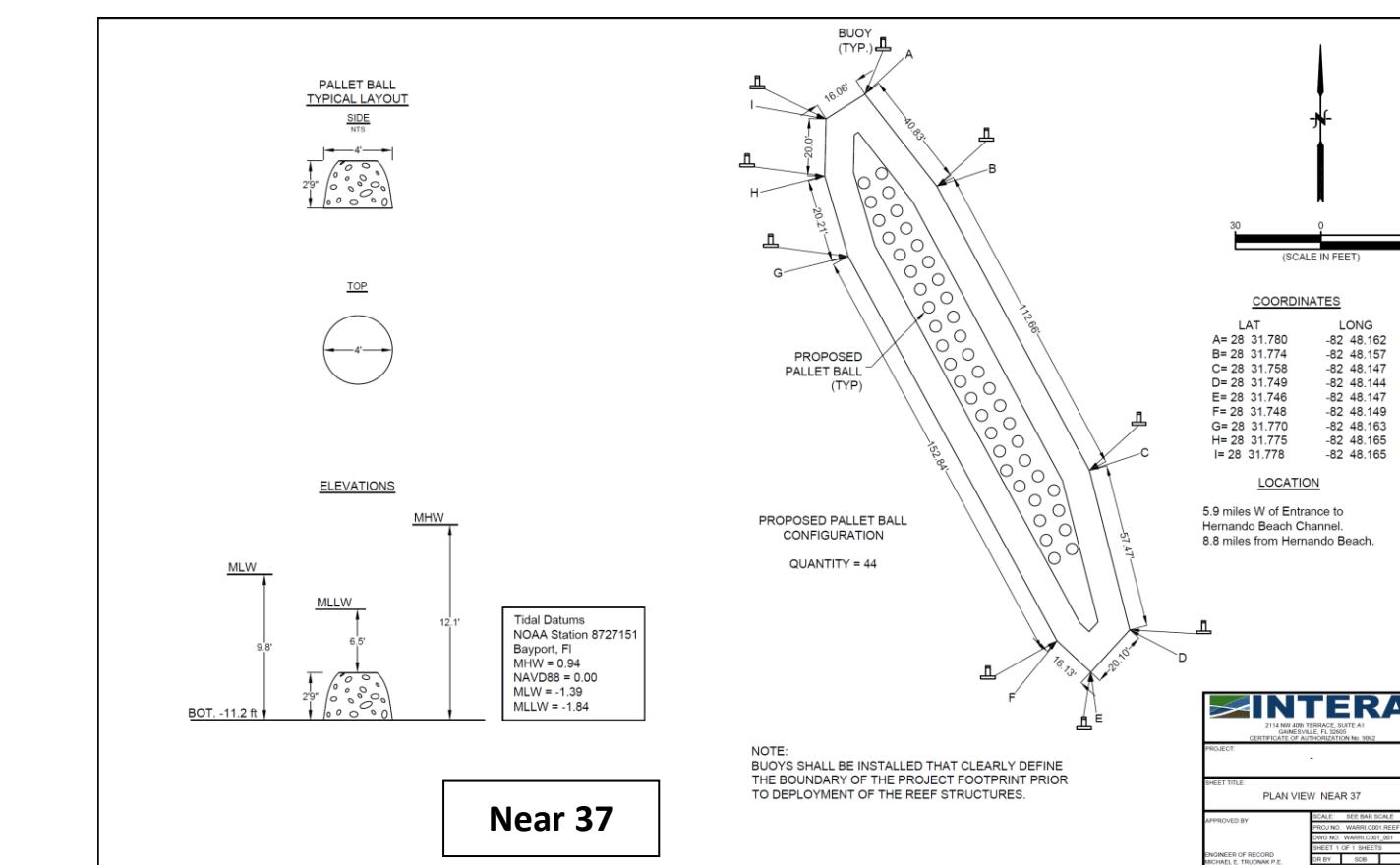
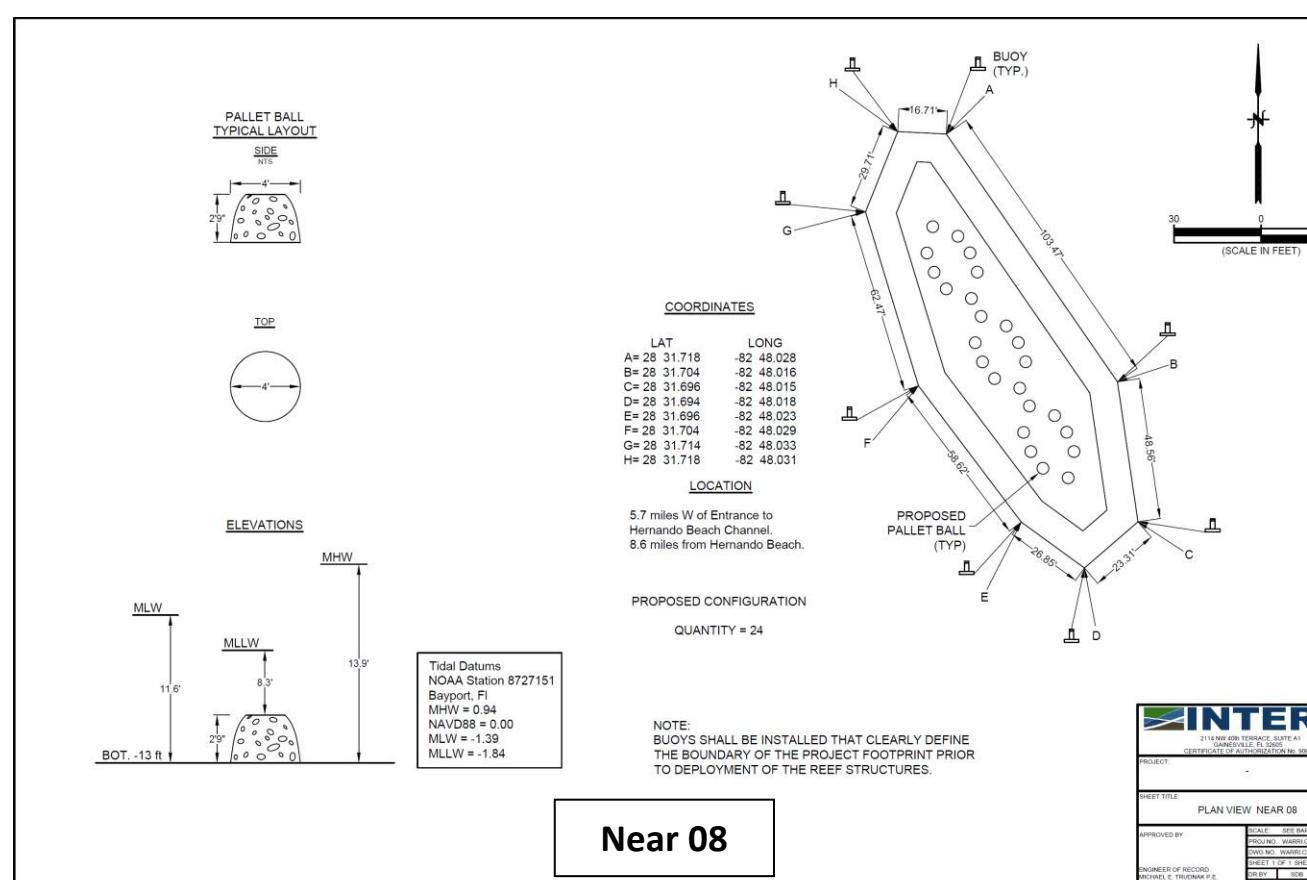
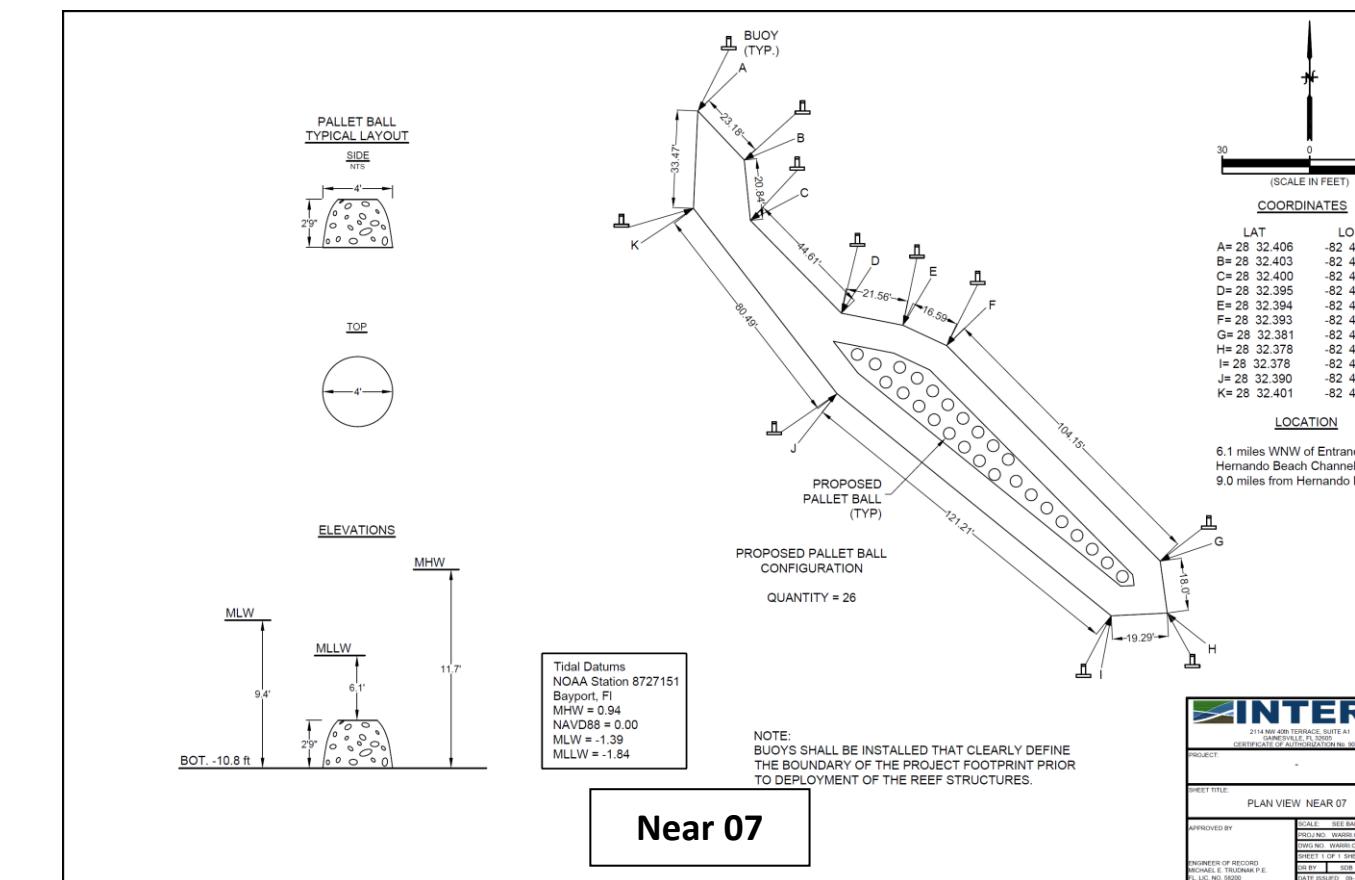
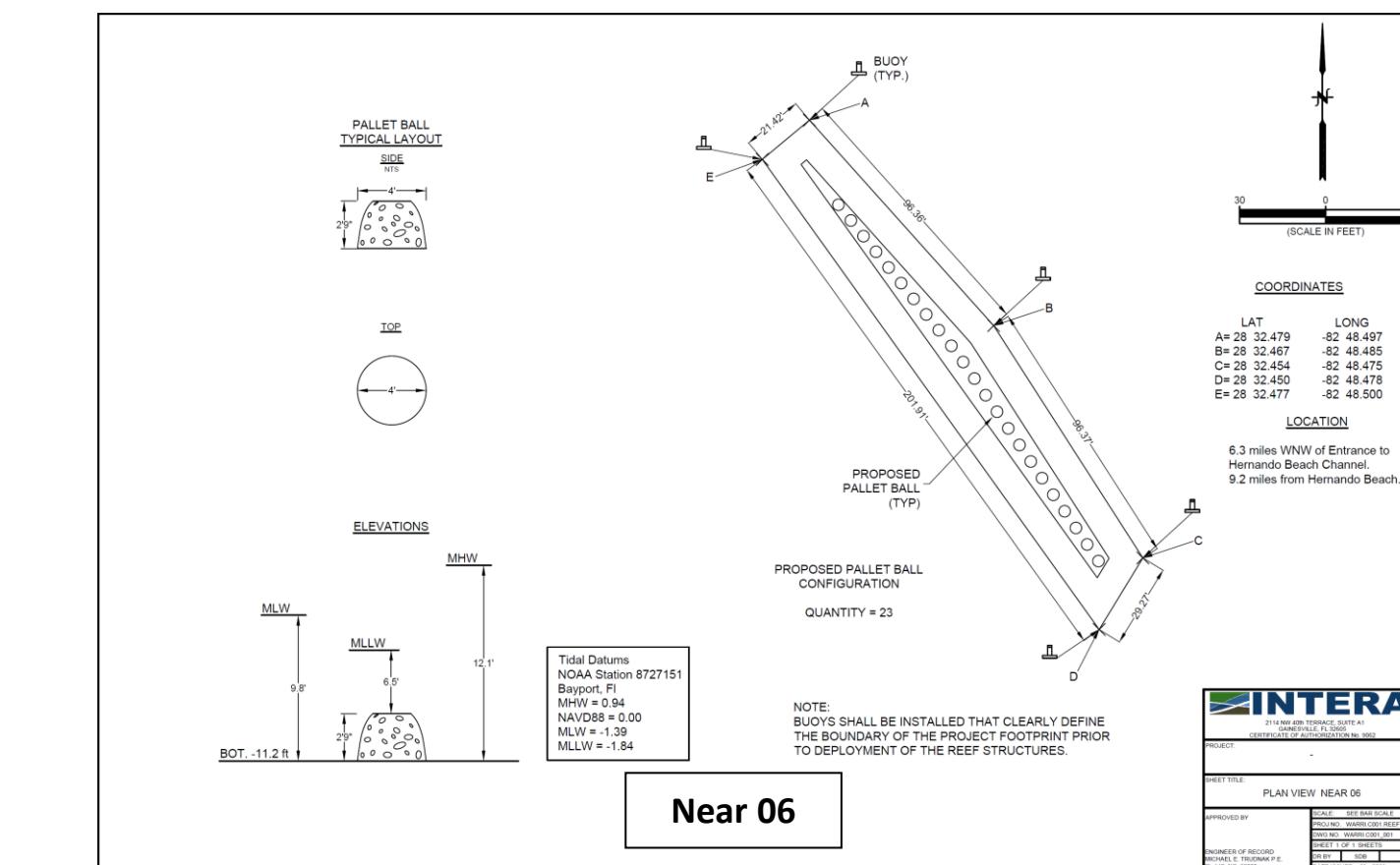
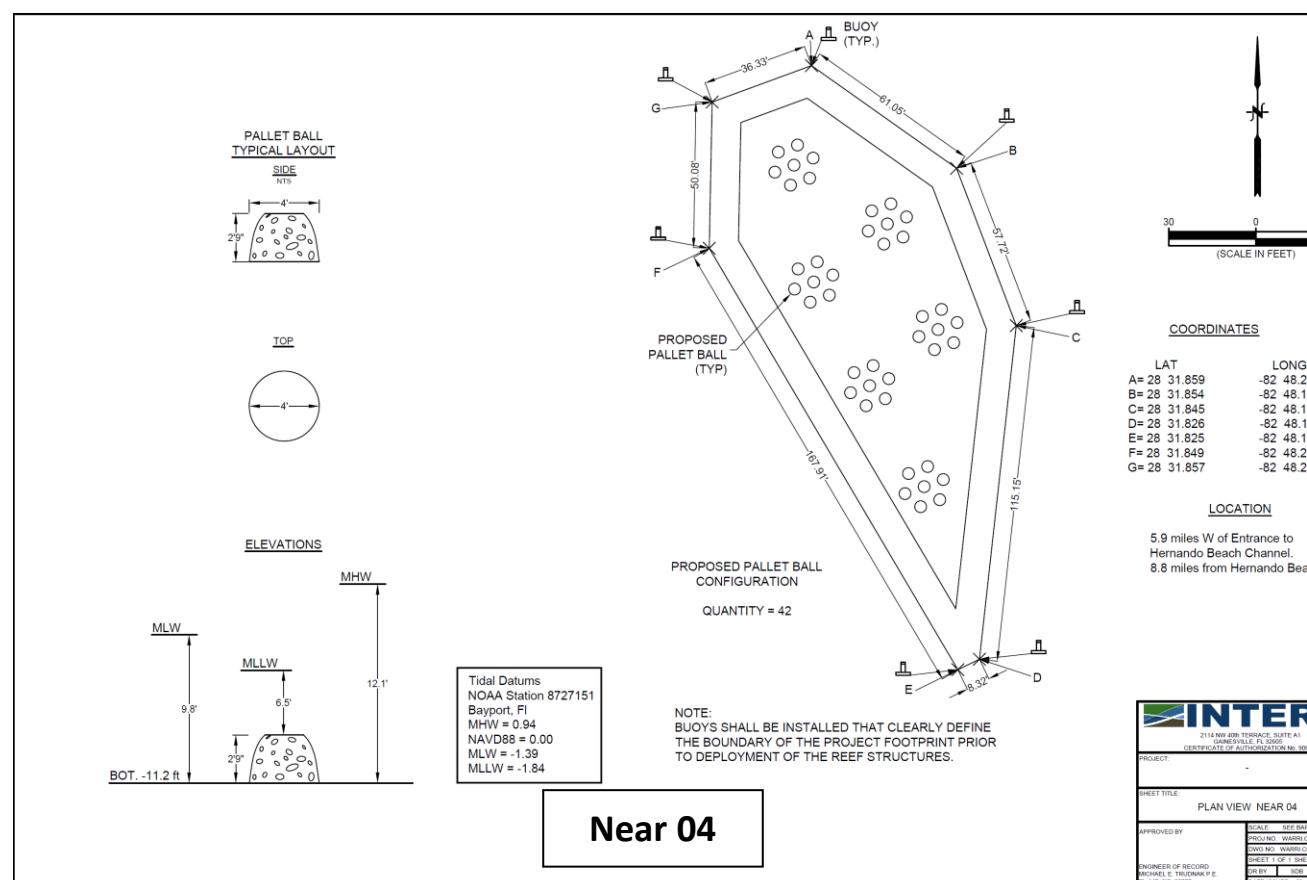
- All nearshore sites can use the more economical Pallet Balls; however, the small site sizes limit nearshore reef design possibilities.
- Nearshore sites 01\* and 39\* are too narrow for reef construction when including a 10-ft offset from the site boundary.
- Sites Near 06 and 38 are narrow, with space for only a single row of modules.
- Sites Near 07 and 37 are slightly wider, allowing for a double row of modules.
- Sites Near 04 and 08 offer more space to diversify the designs with clusters of balls.

\* Nearshore sites 01 and 39 discontinued from further design and permitting consideration.

Site	Bottom Elevation (ft NAVD88)	Water Depth (ft) <sup>1,2</sup>	Reef Module	Reef Height (ft)	Vertical Clearance (ft) <sup>1,2</sup>	General Location Relative to Hernando Beach Channel Entrance Markers
Near 01	-11.2	9.4	Pallet	2.9	6.5	6.5 miles WSW
Near 04	-11.2	9.4	Pallet	2.9	6.5	5.9 miles W
Near 06	-11.2	9.4	Pallet	2.9	6.5	6.3 miles WNW
Near 07	-10.8	9.0	Pallet	2.9	6.1	6.1 miles WNW
Near 08	-11.2	9.4	Pallet	2.9	6.5	5.7 miles W
Near 37	-11.2	9.4	Pallet	2.9	6.5	5.9 miles W
Near 38	-12.3	10.5	Pallet	2.9	7.6	5.9 miles W
Near 39	-11.8	10.0	Pallet	2.9	7.1	6.5 miles WSW

<sup>1</sup>Relative to MLLW (-1.84 ft NAVD88)

<sup>2</sup>Average high tide adds 2.78 ft to the water depth and vertical clearance (MHW = +0.94 ft NAVD88)



## Range of Potential Reef Construction Costs for a Typical Week-long Pallet Ball Project.

Item	Maximum Production Scenario	Average Production Scenario	Minimum Production Scenario
Reef balls/trip <sup>1</sup>	8	7	6
Trips/day	3	2	2
Days	4	4	3
Total number of trips	12	8	6
Total number of reef balls	96	56	36
Cost of reef balls <sup>1</sup>	\$28,800	\$16,800	\$10,800
Installation costs (\$2200/trip)	\$26,400	\$17,600	\$13,200
Mobilization/demobilization cost <sup>2</sup>	\$2,200	\$2,200	\$2,200
Total Cost	\$57,400	\$36,600	\$26,200

<sup>1</sup>Assumes use of 1300-lb Pallet Balls, costing \$300/ball

<sup>2</sup>Cost associated with a 1-week project (mobilization/demobilization plus 3-4 days of installation)

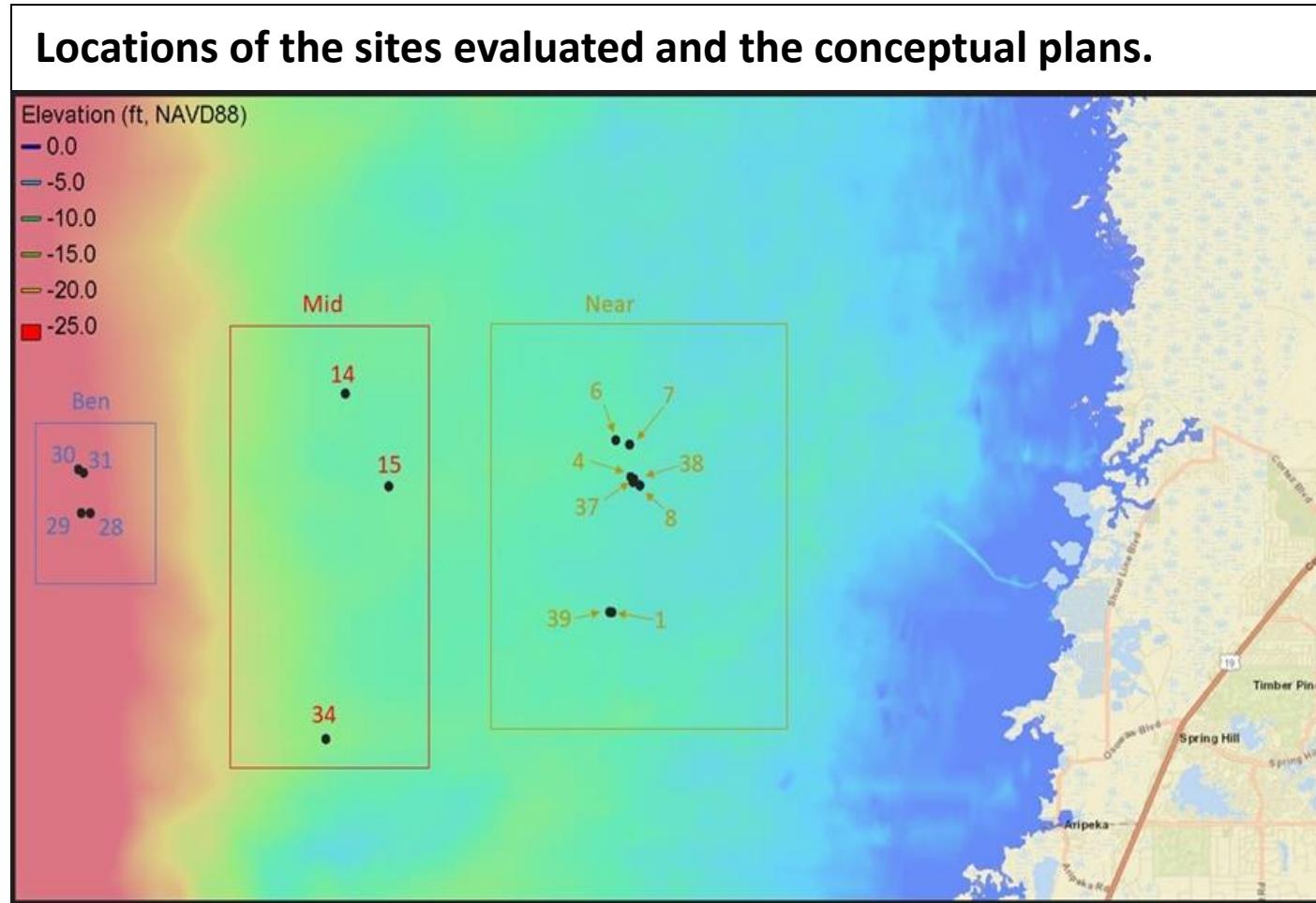
## Summary of Nearshore Site Construction Time Requirements.

Site	Number of Pallet Balls	Description	Trips Required <sup>1</sup>	Days Required <sup>1</sup>
Near 01	0	0	0	0
Near 04	42	6 clusters of 7 balls	6	3
Near 06	23	1 single row	3.3	1.6
Near 07	26	1 single-double row	3.7	1.9
Near 08	24	3 clusters of 8 balls	3.4	1.7
Near 37	44	1 wavy double row	6.3	3.1
Near 38	11	1 wavy single row	1.6	0.8
Near 39	0	0	0	0
Total	170	-	24.3	12.1

<sup>1</sup>Based on 7 balls per trip and 2 trips per day



# Midshore & Offshore Artificial Reef Site Conceptual Designs



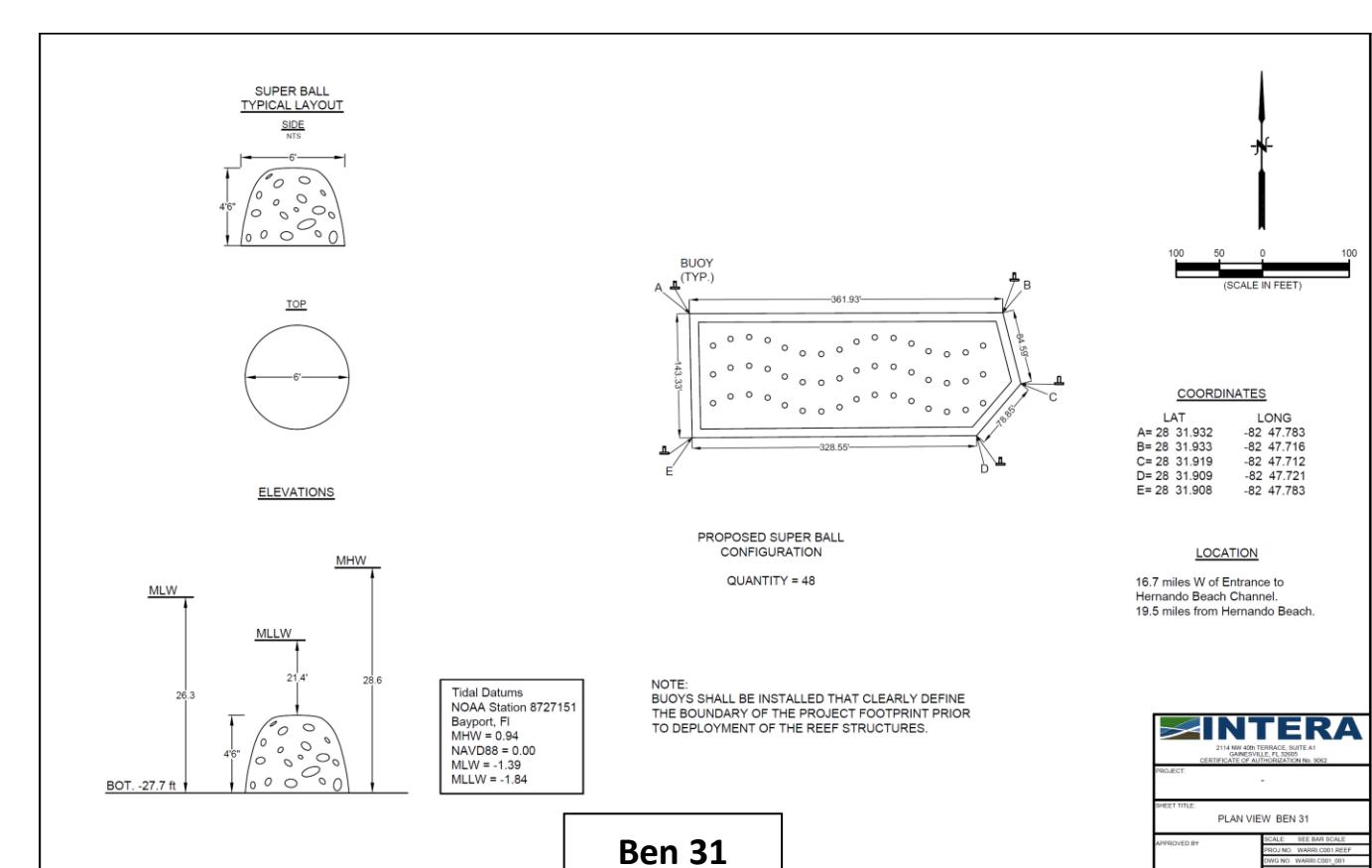
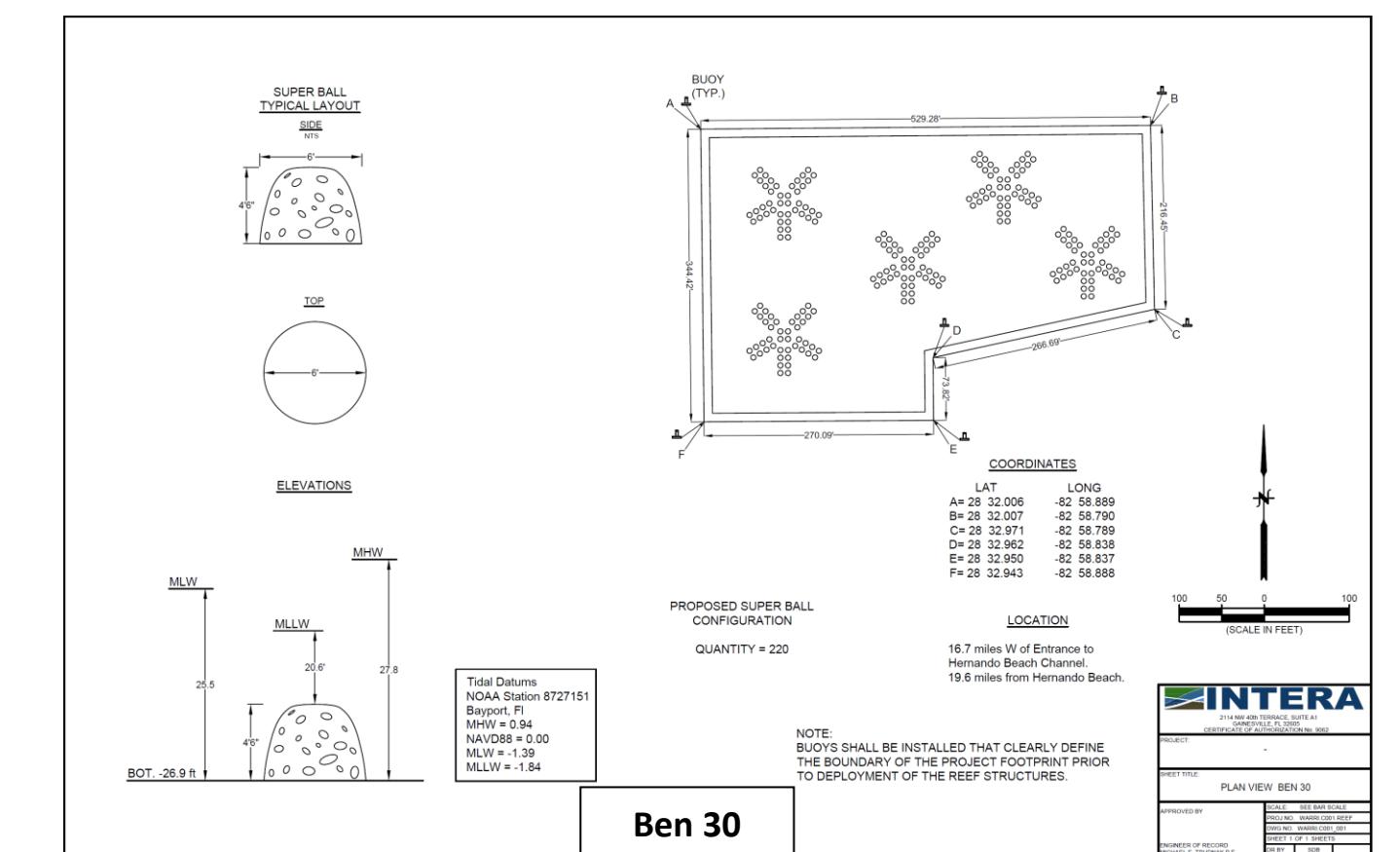
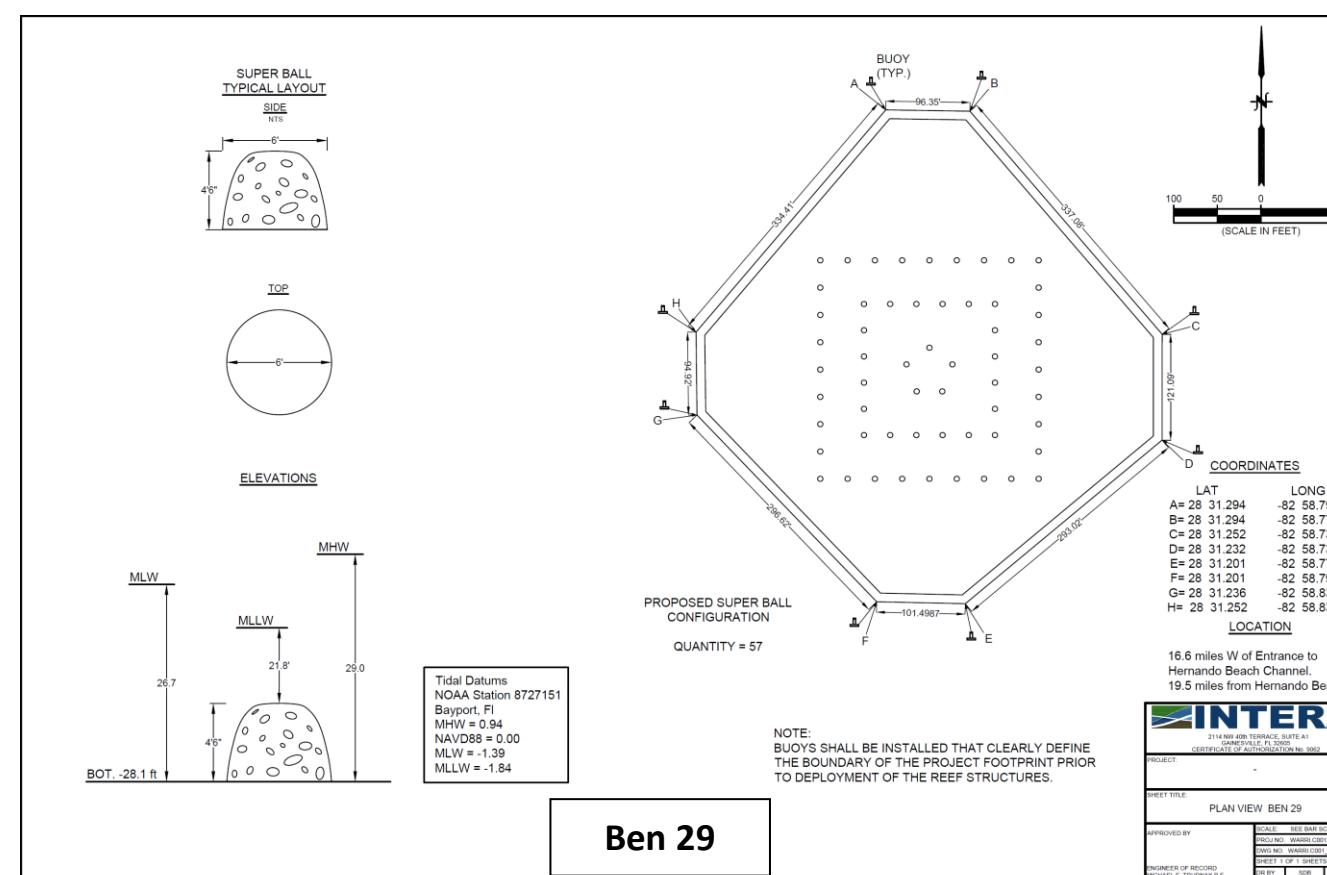
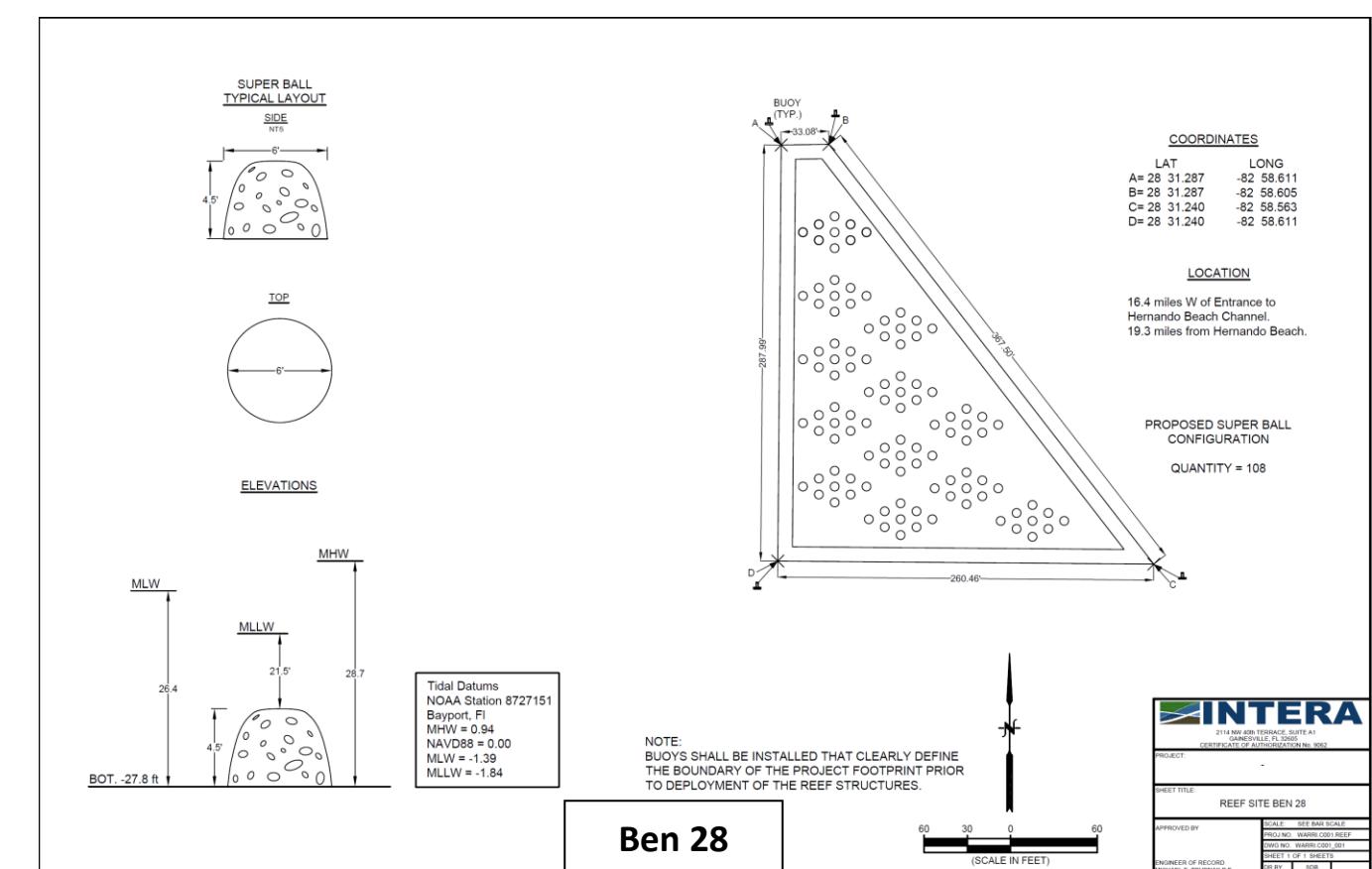
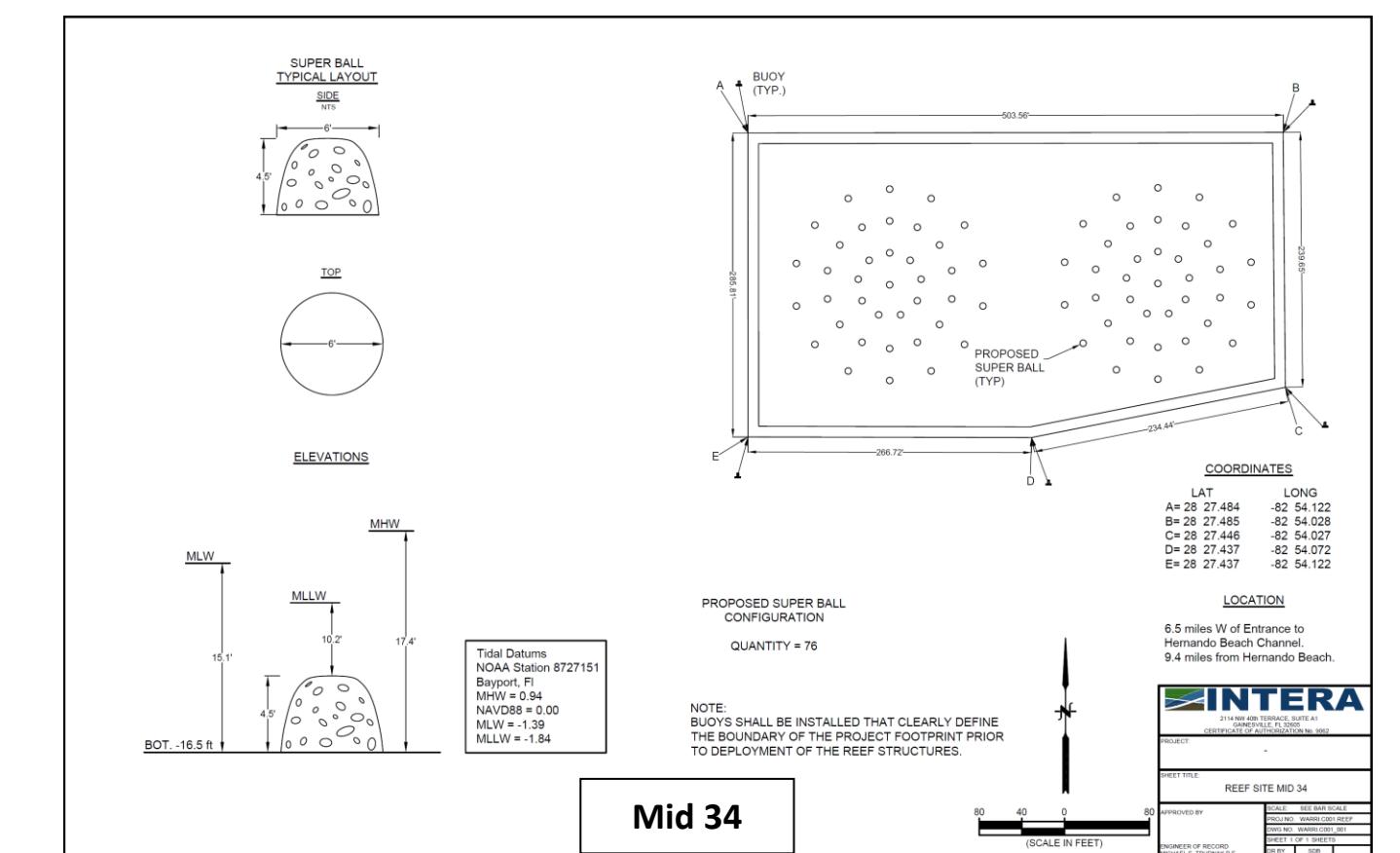
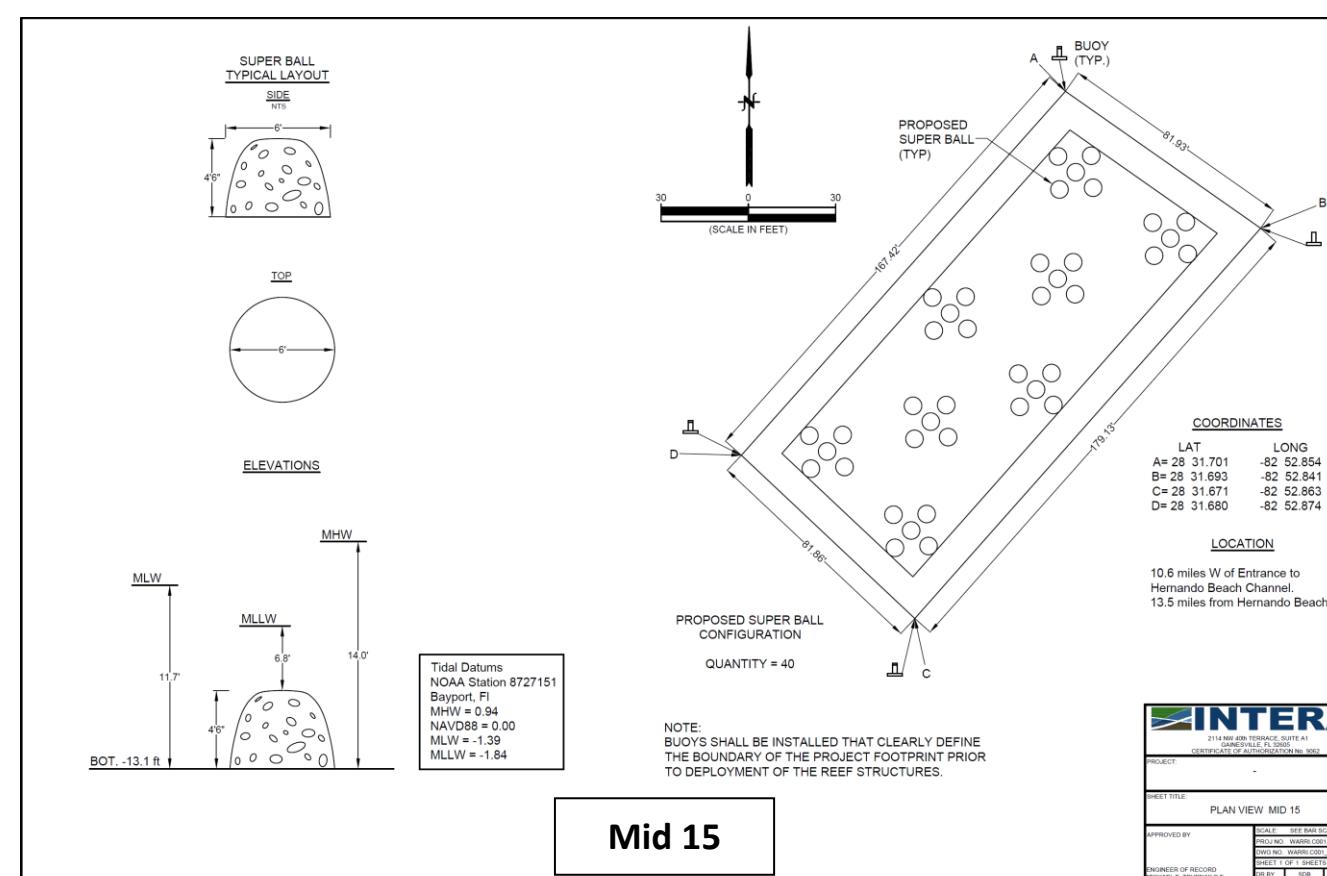
## Conceptual Design Summary to help prioritize selection of sites for reef construction.

- All midshore and offshore sites are sufficiently large for scalable clusters of Super Balls. Though more expensive, the added height of these and the slightly deeper waters offer more variability in the reefs as compared to the nearshore sites.
- Of the 4 offshore sites, Ben 29 and Ben 30 are the largest and have the acreage and depth for the County's Veterans Reef concept.
- The conceptual designs for the midshore and offshore sites used Super Balls only; however, final reef design may consider appropriately designed combinations of Super, Ultra, Reef, and/or Pallet balls to yield more economical and variable reefs.
- Midshore site 14 discontinued from further design and permitting consideration.

Site	Bottom Elevation (ft NAVD88)	Water Depth (ft) <sup>1</sup>	Reef Module	Reef Height (ft)	Vertical Clearance (ft) <sup>1,2</sup>	General Location Relative to Hernando Beach Channel Entrance Markers
Mid 14	-13.3	11.5	Super	4.5	7.0	11.7 miles WNW
Mid 15	-13.1	11.3	Super	4.5	6.8	10.6 miles W
Mid 34	-16.5	14.7	Super	4.5	10.2	6.5 miles WSW
Ben 28	-27.8	26.0	Super	4.5	21.5	16.4 miles W
Ben 29	-28.1	26.3	Super	4.5	21.8	16.6 miles W
Ben 30	-26.9	25.1	Super	4.5	20.6	16.7 miles W
Ben 31	-27.7	25.9	Super	4.5	21.4	16.6 miles W

<sup>1</sup>Relative to MLLW (-1.84 ft NAVD88)

<sup>2</sup>Average high tide adds 2.78 ft to the water depth and vertical clearance (MHW = +0.94 ft NAVD88)



## Construction Costs for a Typical 3-Day Installation for a Super Ball Project.

Item	Super Balls Only	Ultra Balls Only
Balls per trip <sup>1</sup>	40	57
Cost of balls <sup>2</sup>	\$28,000	\$32,775
Barge cost	\$20,000	\$20,000
Materials loading cost	\$2,200	\$3,200
Installation cost	\$8,000	\$8,000
Total cost	\$58,200	\$63,975

<sup>1</sup>Assumes 100-ton barge capacity and average Super Ball and Ultra Ball weights of 5,000 and 3,500 lbs.

<sup>2</sup>Based on \$700 per Super Ball and \$575 per Ultra Ball.

## Summary of Mid & Offshore Site Construction Time Requirements.

Site	Description	Number of Balls	Trips Using Super Balls Only	Trips Using Ultra Balls Only
Mid 14	2 large concentric rectangles	58	1.5	1.0
Mid 15	8 clusters of 5 balls	40	1.0	0.7
Mid 34	2 clusters (concentric circles) of 38 balls	76	1.9	1.3
Ben 28	12 clusters (diamonds) of 9 balls	108	2.7	1.9
Ben 29	2 concentric squares plus pentagon center	57	1.4	1.0
Ben 30	5 clusters (5-legged pattern) of 44 balls	220	5.5	3.9
Ben 31	3 wavy rows of 16 balls	48	1.2	0.8
Total	-	607	15	11
Cost	-	-	\$873,000	\$703,725

<sup>1</sup>Based on 40 Super Balls or 57 Ultra Balls per trip and costs per trip for typical 3 day installation.