

# 2019 CENTRAL MARCO BEACH REGRADE PROJECT 2.5-YEAR MONITORING SUMMARY

April 2022

DEP PERMIT 0235209-008-JM  
USACOE PERMIT SAJ-2016-01224(IP-WDD)

COLLIER COUNTY

PREPARED BY  
HUMISTON & MOORE ENGINEERS  
HM File No. 23065



*Date of photograph January 5, 2022*

SUBMITTED TO:  
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION



**Main Office:**  
5679 Strand Court  
Naples, FL 34110  
Phone 239 594 2021  
Fax 239 594 2025  
e-mail :  
[mail@humistonandmoore.com](mailto:mail@humistonandmoore.com)

**2019 CENTRAL MARCO BEACH REGRADE PROJECT  
2.5-YEAR POST-CONSTRUCTION MONITORING SUMMARY**

**April 2022**

**DEP PERMIT 0235209-008-JM  
USACOE PERMIT SAJ-2016-01224(IP-WDD)**

**COLLIER COUNTY**

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# 2019 CENTRAL MARCO BEACH REGRADE PROJECT 2.5-YEAR MONITORING SUMMARY

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## DEP PERMIT 0235209-008-JM USACOE PERMIT SAJ-2016-01224(IP-WDD)

### INTRODUCTION

This report by Humiston & Moore Engineers (H&M) presents the analysis of the monitoring survey conducted from January 4<sup>th</sup> to January 13<sup>th</sup>, 2022. This monitoring survey was conducted approximately 2.5 years after the completion of the Central Marco Island Regrade Project constructed from February 4 to April 17, 2019. The pre-construction and post-construction monitoring surveys were conducted by Sea Diversified, Inc. (SDI) based on the requirements of the State of Florida Department of Environmental Protection (DEP) permit number 0235209-008-JM dated June 27, 2016; U.S. Army Corps of Engineers (USACOE) permit number SAJ-2016-01224 (IP-WDD) issued August 6, 2018; and in conjunction with the United States Fish and Wildlife Service (FWS) Biological Opinion dated January 4, 2018, Terms and Conditions 1. Recent DEP permit history is summarized in **Table 1**.

**Table 1. Permit History for DEP Permit Number 0235209-008**

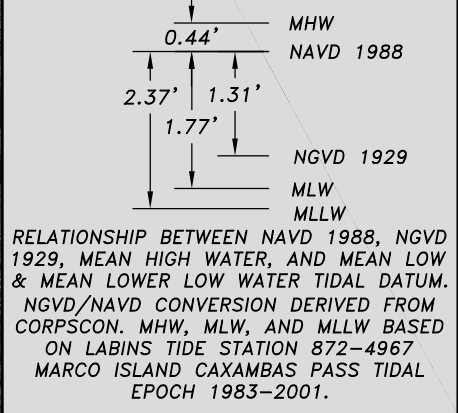
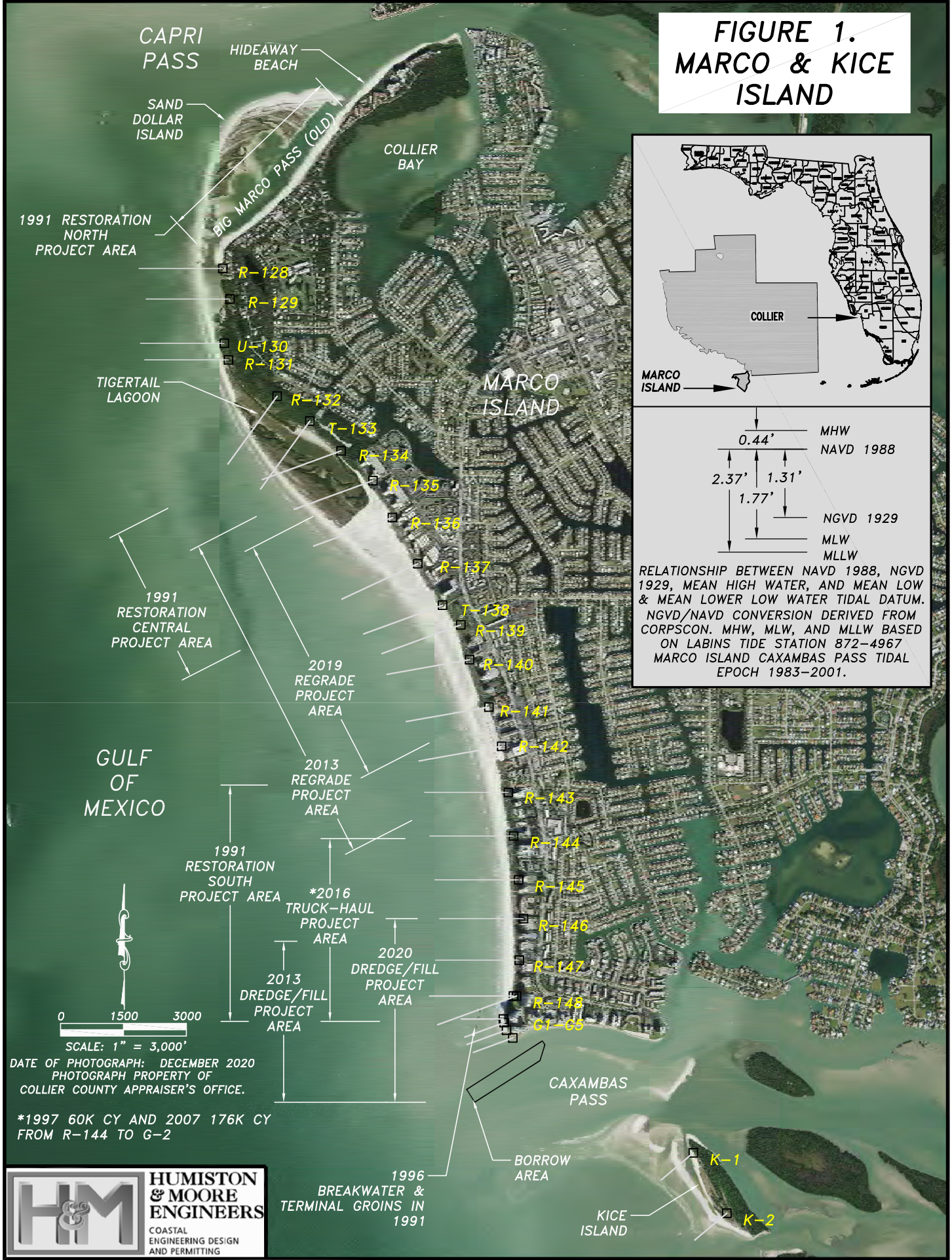
Permit Modification Number	Date of Issuance	Description of Modification
-001	December 22, 2005	Authorized Beach Nourishment with Sand from Caxambas Pass
-002	December 27, 2006	Added Regrading from R-135.5 to R-144
-003	October 11, 2012	Authorized Continued Maintenance (-001 Expired in 2010)
-004	December 18, 2012	De Minimis Exemption for Groin Repair
-005	February 8, 2013	Added Regrading from R-134.5 to R-143
-006	February 21, 2013	Letter of Consent Issuance (10-year borrow area easement)
-007	February 22, 2016	Authorized Upland Sand Source
-008	June 27, 2016	Authorized Central Marco Regrade Project

The Central Marco Island Beach Regrade Project area is located in Collier County on the southwest coast of Florida as shown in **Figure 1**. The 2019 project included the regrading of the beach from monument R-135 south to R-141, and the excavation of the shoreline swash zone region to provide the sand needed to regrade the beach. The project was constructed by Earthtech Enterprises, Inc. on behalf of Collier County. In March and April 2020, approximately 4,000 cubic yards of sand was placed near monument R-141 with sand dredged from the Caxambas Pass Borrow Area as part of the South Marco Nourishment Project near the Madeira Condominium in coordination with the agent for the project, Turrell, Hall & Associates (THA), authorized under DEP Consent Order OGC Case No. 19-1445 dated December 18, 2019. Both the Central Marco and South Marco project areas are included within the limits of a nourishment project constructed in 1991 with the placement of over one million cubic yards of sand along three sections of Marco Island's shoreline, and a regrading project conducted in 2013. The regrading of the beach berm in 2013 was limited to grading upland of mean high water and had limited success.





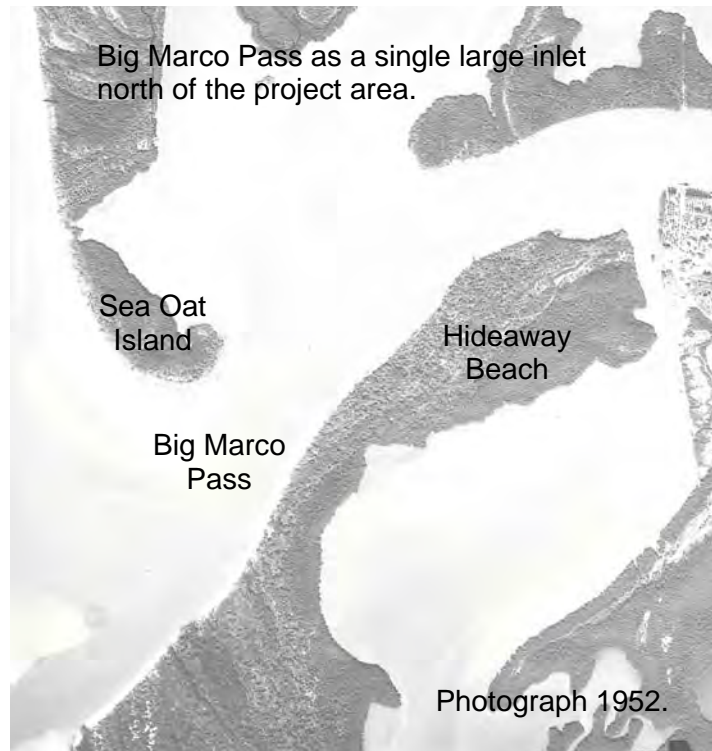
**FIGURE 1.  
MARCO & KICE  
ISLAND**



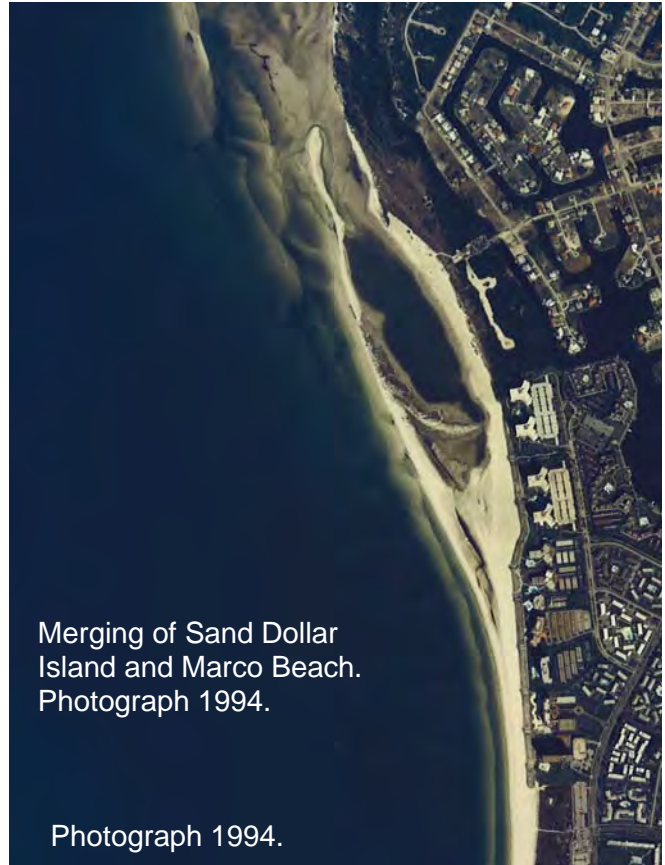


## BACKGROUND

Prior to 1967, Big Marco Pass was a single large inlet north of Marco Island and the project area. In 1967 Sea Oat Island was breached creating a small inlet north of Big Marco Pass. The new inlet was named Capri Pass as it was directly west of the Isle of Capri, and was separated from the much larger Big Marco Pass by an island, formerly the south end of Sea Oat Island, named Coconut Island.



This dynamic system continued to change significantly over the years, because Capri Pass was unobstructed by an ebb shoal, such as the extensive shoal existing west of Big Marco Pass. Capri Pass grew as it captured more of the tidal prism from the Big Marco River, and other interior tidal waterways, but primarily grew due to erosion, and the southward migration of Coconut Island. As Capri Pass became dominant, the ebb shoal west of Big Marco Pass began to erode migrating onshore creating Tigertail Island to the north and feeding Marco Beach to the south.



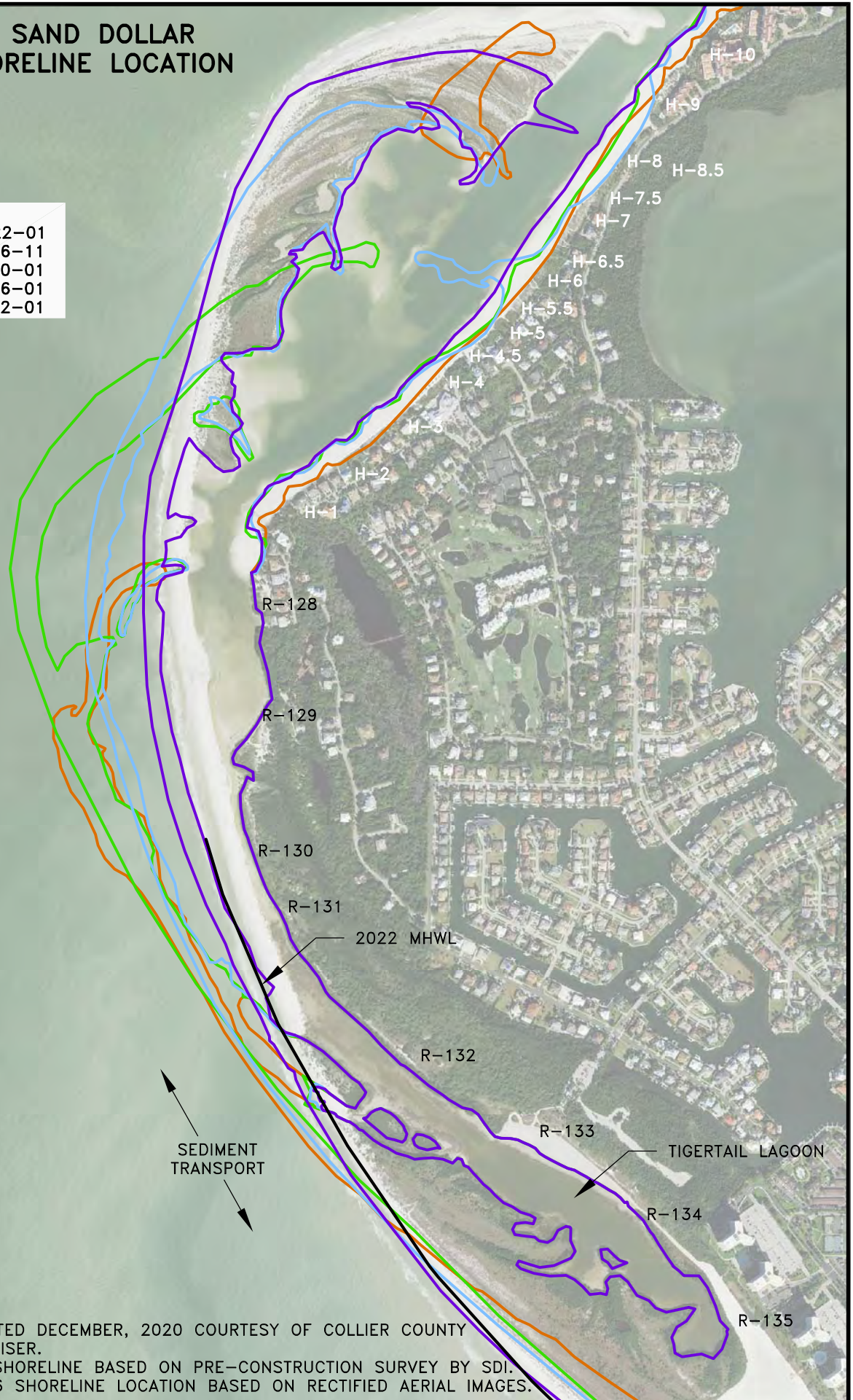
In 1991 the Marco Island beach restoration project placed approximately 575,000 cubic yards of sand on the central section of Marco Island beaches while the sand migrating from the (old) Bid Marco Pass ebb shoal continued to feed the beach to the south and Sand Dollar Island to the north. The progression of the Sand Dollar Island shoreline from 2002 to 2022 is depicted in **Figure 2**. Since approximately 2006, the westward extent of the shoreline has begun to recede to the east as the island continues to expand to the northeast adjacent to Hideaway Beach and continues feeding beaches of Marco Island to the south. These natural processes created an uncharacteristically wide and low beach south of Tigertail Lagoon, and over the years the wide beach became subject to ponding.





**FIGURE 2. SAND DOLLAR ISLAND SHORELINE LOCATION 2002-2022**

LEGEND	
	2022-01
	2016-11
	2010-01
	2006-01
	2002-01



**NOTES:**

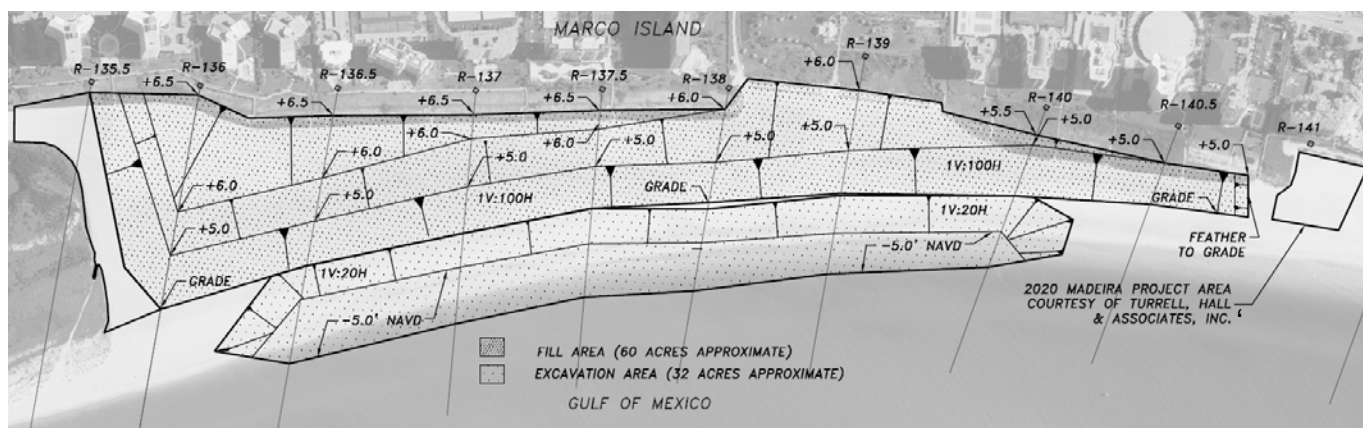
1. PHOTOGRAPH DATED DECEMBER, 2020 COURTESY OF COLLIER COUNTY PROPERTY APPRAISER.
2. JANUARY 2019 SHORELINE BASED ON PRE-CONSTRUCTION SURVEY BY SDI.
3. 2002 THRU 2016 SHORELINE LOCATION BASED ON RECTIFIED AERIAL IMAGES.

## DESIGN AND CONSTRUCTION

Prior to project construction, ponding occurred in the project area where rapid sand accumulation established a wide low-lying beach profile between the landward dune area and the mean high-water line. This area was periodically raked and lacked dune vegetation. This low-lying ponding area would result in algae growing along the wet berm and impacted both the environmental and recreational values of the beach. This ponding created environmental concerns for shorebird and sea turtle nesting habitat and impacted public use of the beach. The design was implemented to reduce ponding by raising the grade for improved percolation and incorporating a seaward slope throughout the project area. The fill template in the permitted design extended from R-135.5 south to R-141.3, but was truncated by approximately 500 feet at the south end prior to construction to include only the beach seaward of the Erosion Control Line and the beach along properties having construction agreements with Collier County. Both the Madeira Condominium and the Marriott elected not to participate. In March and April 2020, approximately 4,000 cubic yards of sand dredged from the South Marco authorized borrow area in Caxambas Pass were placed on the upland portion of the beach profile seaward of the Madeira Condominium near R-141 during the 2020 South Marco Island Nourishment Project. The 4,000 cubic yards of sand placed at Madeira was required by the DEP under a consent order to resolve a coastal construction control line violation.

The 2019 project, shown in **Figure 3**, included the regrading of the beach from monument R-135.5 south to R-140.8, and the excavation of the shoreline swash zone region to -5 feet NAVD to provide the sand needed to improve and build the beach profile. This regrade and building of the beach profile established an intermediate berm with a progressive seaward slope to reduce ponding by creating an approximate landward elevation of 6.5 feet NAVD along the dune area generally descending to approximately 3 feet NAVD at the seaward edge, and a foreshore slope of 1:20 vertical to horizontal to -5 feet NAVD. The area of excavation was an area experiencing accretion, as the proposed excavation restored the seaward slope to an approximate 2009 condition. Also, the north and south ends of the area of excavation were offset from the ends of the grading area to minimize the potential for impacting adjacent areas.

**Figure 3. Central Marco Island Regrade Project - 2019 Design Plan**



In 2016, approximately 23,380 cubic yards of sand were placed within the project fill template from reference monument R-135.5 south to T-138. The sand was dredged from the Hideaway Beach nearshore borrow area as part of the Hideaway Beach Erosion Control Project – Phase III (DEP Permit 0309260-006) and was placed on the upland portion of the beach to an elevation of approximately +5 NAVD.

On February 4, 2019, Earthtech Enterprises, Inc. commenced construction on the north end of the Central Marco Regrade Project, completing the excavation and subsequent placement of approximately 190,000 cubic yards of sand in just over two months on April 17, 2019. Prior to construction, the Collier County Environmental staff located burrowing owl and tortoise nests in the upland portion of the fill



template. The placement was coordinated with FWC to follow appropriate protocol and establish suitable buffers to protect the burrowing owl nests and tortoise nests.

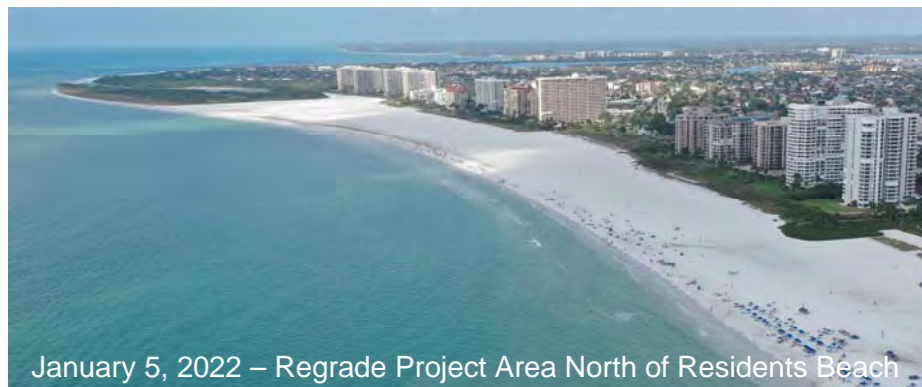
In March 2020, Florida Dredge & Dock (FD&D) commenced construction at the south end of the Central Marco Regrade Project near R-141, shown in **Figure 3**. FD&D placed approximately 4,000 cubic yards of sand on the beach and conducted rough grading. The final grading was overseen by THA, the engineer of record for the Madeira fill project.

### MONITORING SURVEY DATA

The analysis in this monitoring report is based on data from the surveys listed below and shown graphically in the beach profiles contained in **Appendix A**. The physical monitoring area shown in **Figure 4** includes DEP reference monuments R-130 south to R-146 on Sand Dollar and Marco Island.

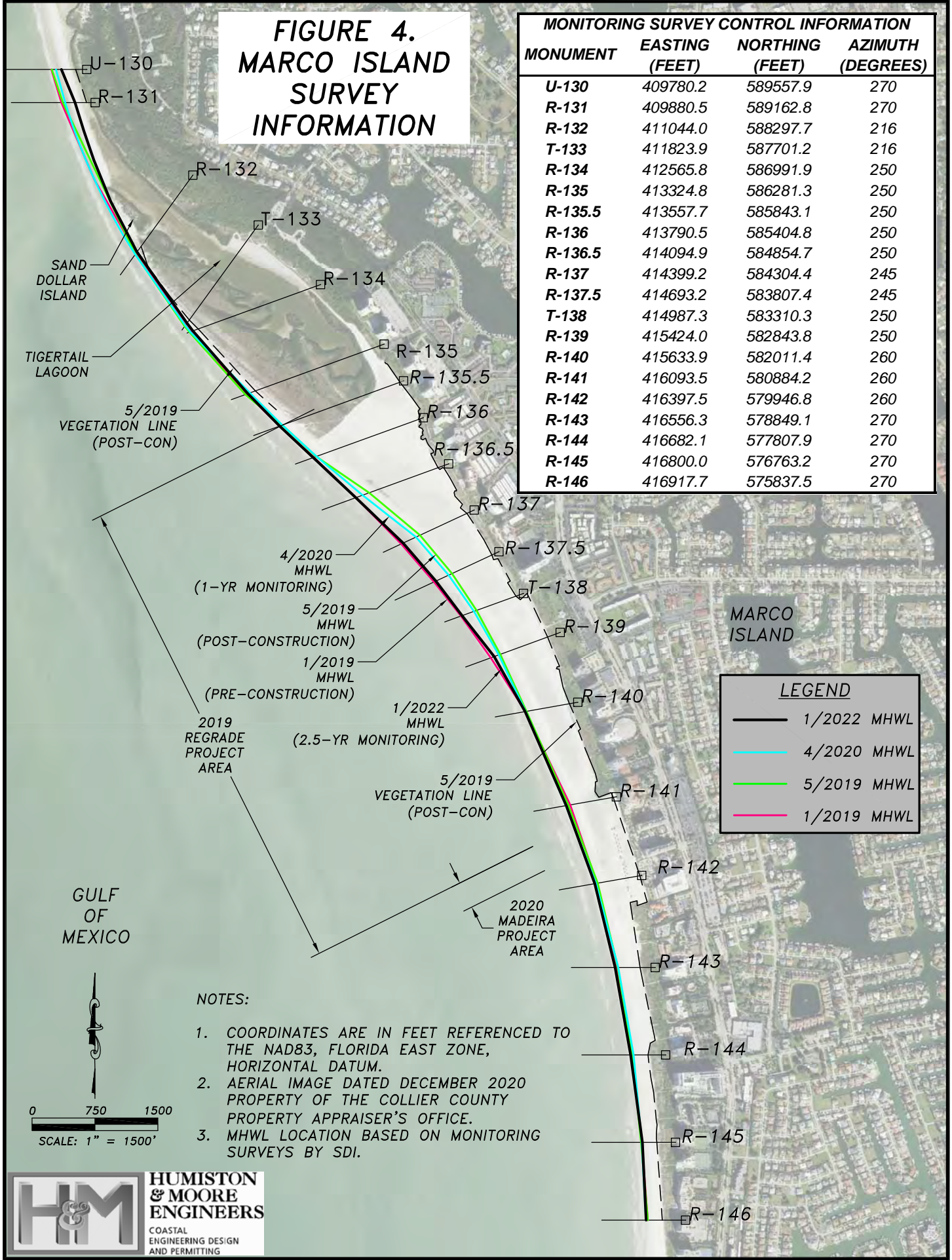
- Pre-construction monitoring survey conducted from January 8 to 18, 2019 by Sea Diversified, Inc. (SDI).
- Post-construction monitoring survey conducted from May 22 to 23, 2019 by SDI.
- One-year monitoring survey conducted from April 15 to 23, 2020 by SDI.
- 2.5-year monitoring survey conducted from January 4 to January 13, 2022 by SDI.

The survey report for the 2.5-year monitoring survey is provided in **Appendix B** and is included with the survey information submitted electronically with this report to the DEP, USACOE, and FWS.



**FIGURE 4.  
MARCO ISLAND  
SURVEY  
INFORMATION**

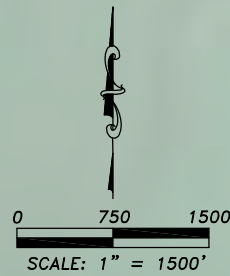
MONUMENT	EASTING (FEET)	NORTHING (FEET)	AZIMUTH (DEGREES)
U-130	409780.2	589557.9	270
R-131	409880.5	589162.8	270
R-132	411044.0	588297.7	216
T-133	411823.9	587701.2	216
R-134	412565.8	586991.9	250
R-135	413324.8	586281.3	250
R-135.5	413557.7	585843.1	250
R-136	413790.5	585404.8	250
R-136.5	414094.9	584854.7	250
R-137	414399.2	584304.4	245
R-137.5	414693.2	583807.4	245
T-138	414987.3	583310.3	250
R-139	415424.0	582843.8	250
R-140	415633.9	582011.4	260
R-141	416093.5	580884.2	260
R-142	416397.5	579946.8	260
R-143	416556.3	578849.1	270
R-144	416682.1	577807.9	270
R-145	416800.0	576763.2	270
R-146	416917.7	575837.5	270



**LEGEND**

- 1/2022 MHWL
- 4/2020 MHWL
- 5/2019 MHWL
- 1/2019 MHWL

- NOTES:**
- COORDINATES ARE IN FEET REFERENCED TO THE NAD83, FLORIDA EAST ZONE, HORIZONTAL DATUM.
  - AERIAL IMAGE DATED DECEMBER 2020 PROPERTY OF THE COLLIER COUNTY PROPERTY APPRAISER'S OFFICE.
  - MHWL LOCATION BASED ON MONITORING SURVEYS BY SDI.



**HUMISTON  
& MOORE  
ENGINEERS**  
COASTAL  
ENGINEERING DESIGN  
AND PERMITTING

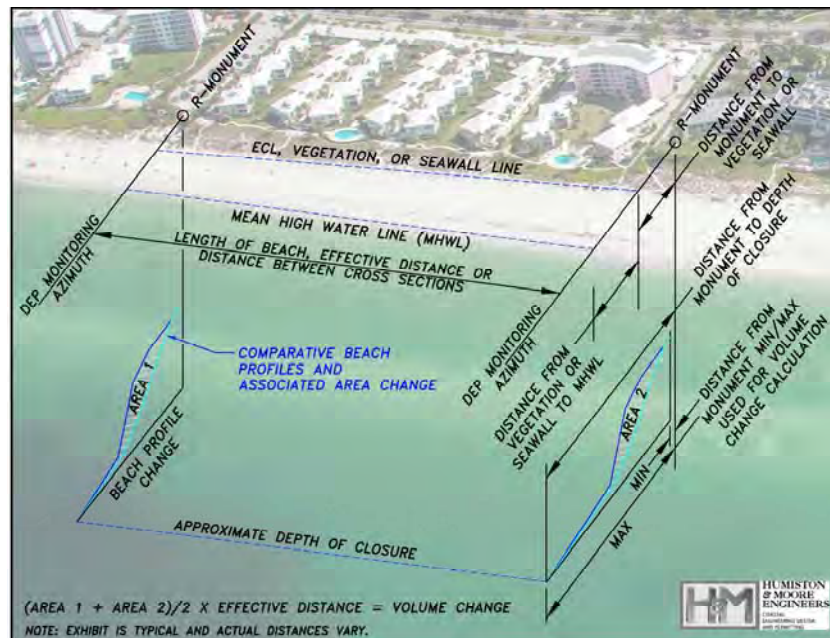


## SHORELINE AND VOLUME CHANGE

Shoreline and volumetric change were determined at each monument based on the surveys conducted for the January 2019 pre-construction, May 2019, April 2020, and January 2022 post-construction monitoring surveys along the azimuths shown in **Figure 4**. Shoreline change is the distance between the horizontal position of the mean high-water elevation on the beach face for different surveys while volumetric change compares the change in the volume of sand between surveys. By convention, positive values indicate accretion and negative values indicate erosion. Surveys collected within the project limits were collected at a higher frequency and include beach profiles at R and half-R monuments, whereas surveys collected beyond the project to the north and south are limited to R-monuments.

**Figure 5** is a schematic depiction of the elements involved in the analysis of shoreline and volume change in this report. Two adjacent DEP reference monuments and associated monitoring azimuths are shown along with the mean high-water line (MHWL), and approximate depth of closure (DOC). Also shown are comparative beach profiles at the adjacent monuments and the associated area change between the monitoring survey profiles to be compared. Shoreline change is the difference in the beach width for different monitoring surveys. Volumetric change, determined by the formula shown (at the bottom of the figure) for the average end area method, utilizes the cross-sectional area change for different monitoring surveys at adjacent monuments and the length of beach between those monument profiles. The comparative profiles are analyzed from the post-construction vegetation line to the approximate (DOC) as shown in the figure.

**Figure 5. Schematic Diagram for Typical Shoreline and Volumetric Change Analysis**



The change in shoreline position was measured as horizontal movement of the mean high water elevation of +0.44 feet NAVD (+1.75' NGVD) where the elevation intersects the beach slope. As part of the volumetric analysis, the offshore limits used are based on the intersection of the pre and post-construction profiles and the -11.8 feet NAVD (-10.5' NGVD) DOC<sup>1</sup> contour as described and used in previous Collier County monitoring reports for consistency. Alterations in DOC were made as appropriate to account for unusual volumetric changes occurring e.g. temporary conditions such as movement of the offshore bar. The upland limit for volumetric change analysis was determined by the location of the 2019

<sup>1</sup> Depth of closure in coastal engineering terminology typically means the depth beyond which no change in bottom elevation is seen from normal coastal processes measured by monitoring surveys. The depth of -11.8 feet NAVD was established early as part of the monitoring of Collier County beaches. In cases of sand accumulation or loss beyond -11.8 feet NAVD, the analysis is conducted further offshore to ensure analysis of data within profile closure.

post-construction vegetation line for consistency between the results of the monitoring surveys. These limits are shown graphically on the beach profiles in **Appendix A**. Volumetric change, determined by the average end area method, utilizes the cross-sectional area change for different monitoring surveys at adjacent monuments and the length of beach between those monument profiles shown in **Table 2**. The last column designates the monitoring section limits used in this report (Sand Dollar Island, North of the Project Area; Project Area; Dredge Template; and South of Project Area) by grouping DEP reference monuments.

**Table 2. Volume Change – Distance between Monuments**

DEP Reference Monument Range		Distance Between Profiles (Feet)	Section of Monitoring Area
U-130	to R-131	413	Sand Dollar Island (North of Project Area)
R-131	to R-132	<b>2,007</b>	
R-132	to T-133	1,043	
T-133	to R-134	99	
R-134	to R-135	1,000	
R-135	to R-135.5	548	
R-135.5	to R-136	553	Project Extent
R-136	to R-136.5	693	
R-136.5	to R-137	774	
R-137	to R-137.5	598	
R-137.5	to T-138	519	
T-138	to R-139	611	
R-139	to R-140	762	
R-140	to R-141	1,235	
R-141	to R-142	987	South of Project Area
R-142	to R-143	1,033	
R-143	to R-144	1,055	
R-144	to R-145	1,051	
R-145	to R-146	929	
<b>Total Length of Beach:</b>		<b>15,910</b>	

Dredge Template

The distances between profiles shown in **Table 2** represent the different lengths of the pre-construction MHWL between adjacent monuments due to the varying azimuths as shown in **Figure 4**. In the following sections of this report, corresponding values between those shown in the Tables and report text are highlighted in blue for ease of reference. The volumes in cubic yards (CY) shown in the tables were rounded to the nearest value of 10, and distances are shown in feet rounded to the nearest whole number.

**Figure 4** shows the pre-construction, post-construction, one-year, and 2.5-year monitoring survey MHWL locations for the monitoring area overlaid on an ortho-rectified aerial image acquired in December 2020, 20 months post-construction. The shoreline recession on Sand Dollar Island near monuments U-130 and R-131 and the shoreline recovery from R-136 south to R-140 is evident in **Figure 4**. The shoreline recession near U-130 and R-131 is due to overwash of Sand dollar Island from high frequency storms/fronts, the extensive overwash is evident in the beach profiles provided in **Appendix A**, and the center of Sand Dollar Island also feeds the beaches to the north and south.

**Table 3a** shows the shoreline (or beach width) change for DEP reference monuments R-130 to R-146 on Sand Dollar and Marco Island with the project extent shaded in gray and the dredge template extent shaded in darker gray. Columns 2 thru 5 (C2-C5) show the pre-construction, post-construction, one-year, and 2.5 year beach widths at each monument determined by the distance from the 2019 post-construction vegetation line to the MHWL. Columns 6 thru 8 (C6-C8) show the shoreline change between subsequent monitoring surveys. Columns C9 and C10 show change from the pre and post-construction surveys to the most recent monitoring survey.

**Table 3a. Beach Width – Shoreline Change**

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Monument	Beach Width (Feet)				Shoreline Change (Feet)				
	Pre 1/2019	Post 5/2019	1-Year 4/2020	2.5-Year 1/2022	Pre to Post	Post to 1-Yr	1-Year to 2.5-Yr	Pre to 2.5-Yr	Post to 2.5-Yr
U-130	290	284	232	168	-6	-52	-64	-122	-116
R-131	321	304	278	158	-17	-27	-120	-163	-146
R-132	46	63	67	-18	17	4	-85	-64	-81
T-133	68	83	70	37	15	-13	-33	-31	-46
R-134	80	94	83	51	14	-11	-32	-29	-43
R-135	110	126	69	95	16	-57	26	-15	-31
R-135.5	1,527	1,496	1,494	1,526	-31	-2	32	-1	30
R-136	1,328	1,298	1,293	1,336	-30	-5	43	8	38
R-136.5	1,044	873	959	1,043	-171	86	84	-1	170
R-137	864	617	671	840	-247	54	169	-24	223
R-137.5	760	524	569	735	-236	45	166	-25	211
T-138	697	500	531	684	-197	31	153	-13	184
R-139	721	601	620	678	-120	18	58	-43	77
R-140	534	521	531	537	-13	9	6	3	16
R-141	518	542	572	568	24	30	-4	50	26
R-142	521	510	531	545	-11	21	14	24	35
R-143	271	263	260	296	-8	-3	36	25	33
R-144	193	188	172	206	-5	-16	34	13	18
R-145	181	188	180	172	7	-8	-8	-9	-16
R-146	171	171	193	192	0	22	-1	21	21
<b>Range</b>	<b>Average Beach Width (Feet)</b>				<b>Average Shoreline Change (Feet)</b>				
<b>N. of Project U-130 to R-135</b>	153	159	133	82	6	-26	-51	-71	-77
<b>Project Area R-135.5 to R-141</b>	888	775	804	883	-113	30	79	-5	108
<b>S. of Project R-142 to R-146</b>	267	264	267	282	-3	3	15	15	18

**Table 3b** shows the volume change for DEP reference monuments R-130 to R-146 on Sand Dollar and Marco Island with the project extent shaded in gray, and the dredge template extent shaded in darker gray. Columns 2 thru 4 (C2-C4) show the volume change between subsequent surveys while Columns C5 and C6 show the change from the pre and post-construction surveys to the most recent survey.

**Table 3b. Volume Change**

C1		C2	C3	C4	C5	C6
Volume Change (CY)						
Monument Range		Pre to Post Jan 2019 to May 2019	Post to 1-Yr May 2019 to Apr 2020	1-Yr to 2.5-Yr Apr 2020 to Jan 2022	Pre to 2.5-Yr Jan 2019 to Jan 2022	Post to 2.5-Yr May 2019 to Jan 2022
U-130	to R-131	-2,460	-7,510	-6,520	-16,480	-14,030
R-131	to R-132	-6,780	-21,340	<b>-45,630</b>	-73,750	-66,970
R-132	to T-133	-540	-6,390	-18,910	-25,840	-25,310
T-133	to R-134	-70	-480	-1,080	-1,630	-1,560
R-134	to R-135	-2,810	-1,940	-8,410	-13,160	-10,350
R-135	to R-135.5	4,610	-5,500	2,210	1,320	-3,290
R-135.5	to R-136	26,610	-6,330	5,370	25,640	-970
R-136	to R-136.5	24,900	9,700	12,120	46,710	21,810
R-136.5	to R-137	-20,480	24,490	30,340	34,350	54,830
R-137	to R-137.5	-33,930	18,860	31,380	16,310	50,240
R-137.5	to T-138	-24,220	10,560	27,270	13,620	37,830
T-138	to R-139	-12,390	4,240	26,600	18,450	30,840
R-139	to R-140	-2,170	1,750	22,510	22,090	24,260
R-140	to R-141	4,480	13,130	13,510	31,120	26,640
R-141	to R-142	290	11,880	6,820	18,990	18,700
R-142	to R-143	250	4,900	9,650	14,810	14,550
R-143	to R-144	-1,760	5,040	9,060	12,340	14,100
R-144	to R-145	-1,660	2,900	7,410	8,660	10,320
R-145	to R-146	-1,760	4,900	5,590	8,730	10,500
Monument Range		Total Volume Change (CY)				
North of Project U-130 to R-135.5		-8,050	<b>-43,160</b>	<b>-78,340</b>	-129,540	<b>-121,510</b>
Project Area R-135.5 to R-141		-36,910	<b>88,280</b>	<b>175,920</b>	<b>227,280</b>	<b>264,180</b>
South of Project R-141 to R-146		-4,930	<b>17,740</b>	<b>31,710</b>	<b>44,540</b>	<b>49,470</b>

## North of the Project Area

The beach north of the project area lost an average of almost 50 feet (-51) in width in the most recent monitoring period from April 2020 to January 2022, and a total of 80,000 cubic yards (-78,340) of sand. Monument R-131 and R-132 lost 120 and 85 feet (-120,-85), respectively, while the majority of the volumetric loss occurred in the same reach between monument R-131 and R-132 losing 45,000 cubic yards (-45,630) of sand<sup>2</sup> in this most recent monitoring period. The rate of volumetric loss for the reach has remained relatively consistent since the previous monitoring period, decreasing slightly from 47,000 (-43,160/0.9) cubic yards per year in the previous monitoring period to 45,000 cubic yards per year (-78,340/1.8) of sand per year in the most recent monitoring period. The reach has lost 120,000 cubic yards (-121,510) since construction, consistent with the background recession of the island depicted in **Figure 2** showing the pre-construction shoreline position of Sand Dollar Island from 2002 to 2019. The high erosion, particularly further north, is a result of ongoing island spreading and overwash into the lagoon area. The wider vegetated area further south experienced significantly less erosion.

## Project Area Extents

The beach within the project extents gained an average of 80 feet (79) in width in the most recent monitoring period from April 2020 to January 2022, and a total of 176,000 cubic yards (175,920) of sand. Monuments within the dredge template extents from R-137 and R-138 gained approximately 160 feet (169,166,153), and while there was volumetric gain throughout the project extents in the most recent monitoring period, the majority of the gain in the southern portion of the reach was in the nearshore. The rate of volumetric gain for the reach has remained consistent since the previous monitoring period. The area experienced a gain of 98,000 cubic yards per year (88,280/0.9) in the previous monitoring period and 97,000 cubic yards per year (175,290/1.8) of sand per year in the most recent monitoring period. The reach has gained a total of over 260,000 cubic yards (264,180) of sand since construction representing a gain of 230,000 cubic yards (227,280) since the pre-construction condition. **Figure 6a and 6b** show the same MHWL location for the project area overlaid on comparative aerial images acquired pre-construction in December 2018 and post-construction in November 2019, December 2020 and January 2022. The area of excavation in the swash zone region has nearly recovered to the pre project condition in 2.5 years. As part of the natural processes, the seaward portion of the beach berm will experience overwash and buildup of sand. Given the expansive wide berm upland of the active beach area, this results in ponding upland of the elevated seaward berm. This, however, can be managed through minor grading and ongoing beach cleaning operations. (Refer to temporary ponding near the shoreline in the January 2022 image from approximately R-136.5 south to R-140 in **Figure 6b**.)

## South of Project Area

The beach south of the project area gained an average of 15 feet (15) in width in the most recent monitoring period from April 2020 to January 2022, and a total of 32,000 cubic yards (31,710) of sand. Monuments in the northern half of the reach show moderate gains in beach width while the southern half shows relatively negligible losses in width during the most recent monitoring period; there were volumetric gains throughout the reach. The rate of volumetric gain for the reach has remained relatively consistent since the previous monitoring period, indicating 19,000 (17,740/0.9) cubic yards per year in the previous monitoring period and 18,000 cubic yards per year (31,710/1.8) of sand per year in the most recent monitoring period. The reach has gained a total of 50,000 cubic yards (49,470) of sand since construction representing a gain of 45,000 cubic yards (45,540) since the pre-construction condition.

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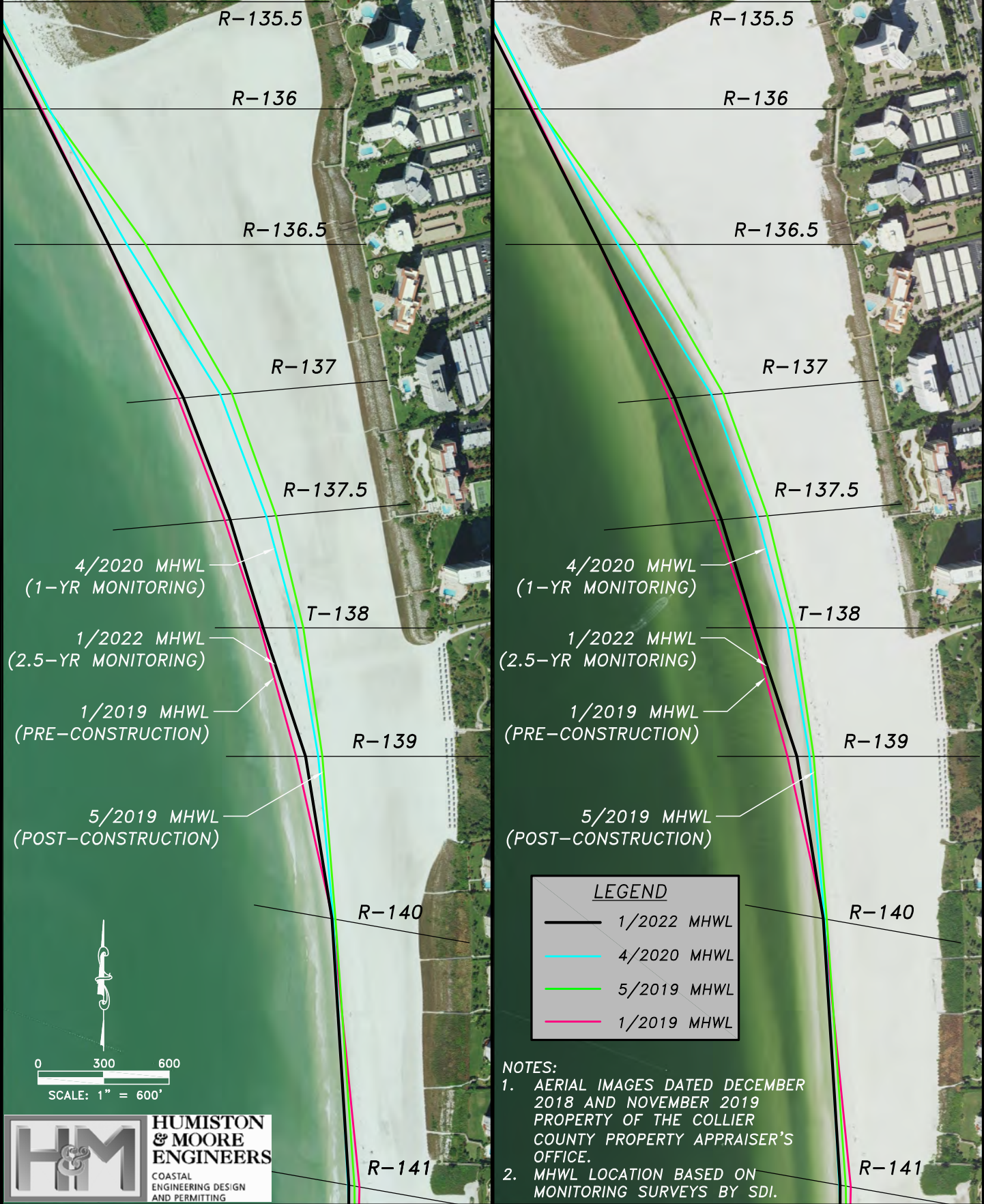
<sup>2</sup> The reach between monument R-131 and R-132 represent approximately 12% (2,007/15,910) of the overall length of the monitoring area as shown in Table 2. The distance between the monuments of over 2,000 feet is nearly double the representation of the other reaches in the monitoring area, potentially skewing volumetric change comparisons.



# FIGURE 6a. SURVEYED MHWL LOCATIONS

PRE-CONSTRUCTION PHOTO  
DECEMBER 2018

7-MONTH POST-CONSTRUCTION PHOTO  
NOVEMBER 2019



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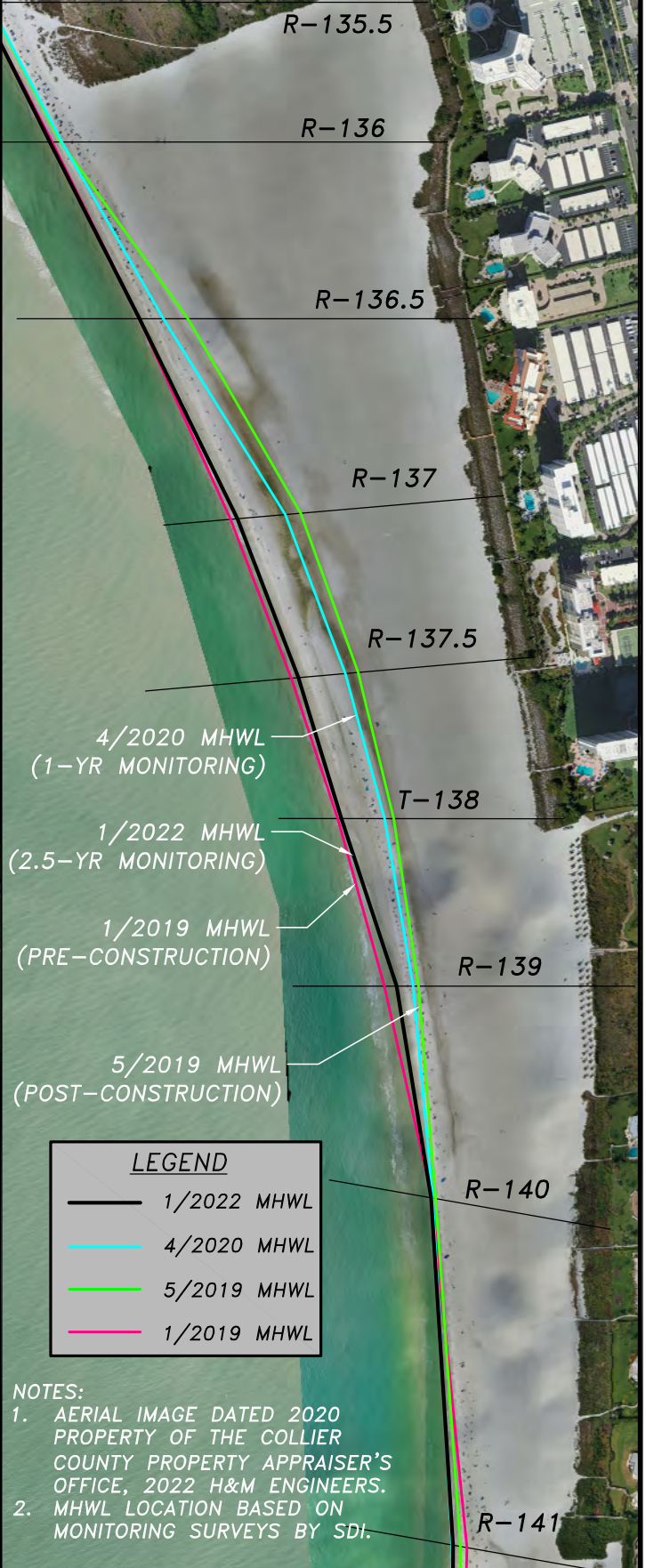
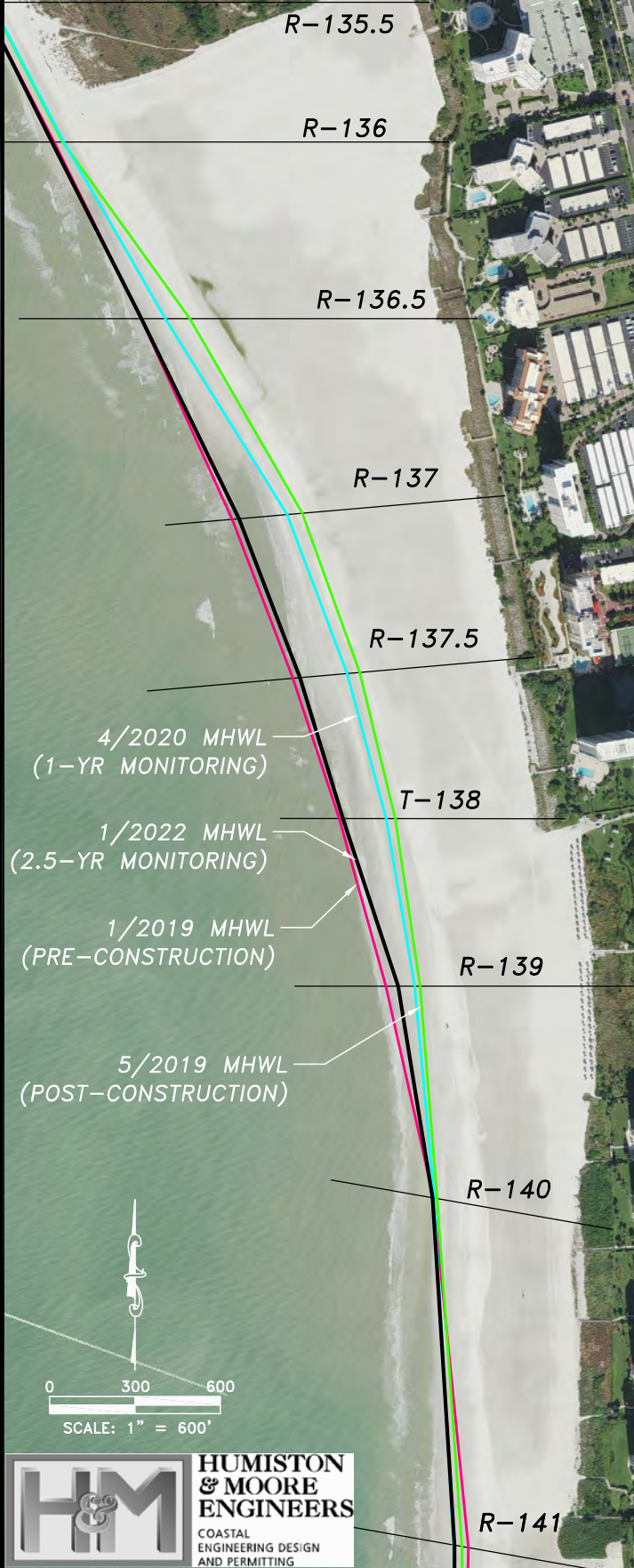
- LEGEND**
- 1/2022 MHWL
  - 4/2020 MHWL
  - 5/2019 MHWL
  - 1/2019 MHWL
- NOTES:**
1. AERIAL IMAGES DATED DECEMBER 2018 AND NOVEMBER 2019  
PROPERTY OF THE COLLIER COUNTY PROPERTY APPRAISER'S OFFICE.
  2. MHWL LOCATION BASED ON MONITORING SURVEYS BY SDI.



# FIGURE 6b. SURVEYED MHWL LOCATIONS

1.5 YEAR POST-CONSTRUCTION  
PHOTO DECEMBER 2020

2.5 YEAR POST-CONSTRUCTION PHOTO  
JANUARY 2022



LEGEND	
	1/2022 MHWL
	4/2020 MHWL
	5/2019 MHWL
	1/2019 MHWL

**NOTES:**

1. AERIAL IMAGE DATED 2020 PROPERTY OF THE COLLIER COUNTY PROPERTY APPRAISER'S OFFICE, 2022 H&M ENGINEERS.
2. MHWL LOCATION BASED ON MONITORING SURVEYS BY SDI.

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## AERIAL IMAGES

The 2022 rectified aerial image files normally acquired late in the previous year and provided by the Collier County Property Appraiser's Office, in Mr. Sid format referenced to the NAD83 datum in feet Florida East Zone and will be submitted to the Department on upon availability, usually in spring. Oblique aerial images acquired on January 2022 are shown within the report.

## ENVIRONMENTAL

In addition to complying with the FWS Biological Opinion (FWSBO) dated January 4, 2018 *the permittee has reviewed the specific Reasonable and Prudent Measures (RPMs) and Terms and Conditions in the Revised Statewide Programmatic Biological Opinion (SPBO) dated 13 March 2015 and the Piping Plover Programmatic Biological Opinion (3PBO) dated 22 May 2013, and agreed to follow the measures included to minimize impacts to nesting sea turtles and the piping plover.* Collier County (permittee) is currently conducting the sea turtle nesting monitoring program headed by Maura Kraus ([MauraKraus@colliergov.net](mailto:MauraKraus@colliergov.net)) and the shorebird monitoring program headed by Christopher D'Arco ([ChristopherDarco@colliergov.net](mailto:ChristopherDarco@colliergov.net)). The programs include the following:

- Sea turtle nesting monitoring is an ongoing program with the County including escarpment surveys.
- Shorebird monitoring will be conducted by the County including breeding and non-breeding birds, piping plovers and red knots.
- Compaction testing and subsequent tilling<sup>3</sup> is conducted by the County.
- Results of the surveys are submitted to the appropriate agencies.
- Educational material including signage, flyers, kiosks, etc. are continually reviewed and improved in part by County staff.
- The pre-construction meeting was held on January 10, 2019. Shorebird and sea turtle monitoring procedures during construction were discussed and implemented accordingly.
- The County continues to make every effort in order to maintain compliance with the conditions of the FWS BO, SPBO, 3PBO, and the conditions of the associated Corps and DEP permits.

Sea turtle monitoring reports, lighting guidelines, and Fish and Wildlife Conservation Commission Codes and Technical Reports are posted on the County website:

<http://www.colliergov.net/your-government/divisions-f-r/parks-and-recreation/sea-turtle-protection/publications-reports>

The Collier County Coastal Zone Management provides information to the public on a wide variety of coastal programs and projects:

<http://www.colliergov.net/your-government/divisions-a-e/coastal-zone-management>

And information on protected species:

<http://www.colliergov.net/your-government/divisions-a-e/environmental-services/protected-species>

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<sup>3</sup> Per FFWCC and the FWS tilling will be conducted within 250 feet of the current MHWL.

## CONCLUSIONS & RECOMMENDATIONS

The Central Marco Island Regrade project commenced on February 4, 2019 and was completed on April 17, 2019 prior to sea turtle nesting activity in the area. Buffer zones were established for burrowing owls and gopher tortoises prior to fill operations by Collier County staff in coordination with FWC. The 2.5-year monitoring survey was conducted in January 2022 by SDI. During the Central Marco Island Regrade project, sand was mechanically dredged from the swash zone region to -5 feet NAVD and was subsequently placed on the upland beach. The fill was graded in an effort to reduce ponding along the Central Marco Island Beach from approximately monument R-135 south to R-140.8 by establishing a positive slope from the dune region seaward to mean high water. The 2020 South Marco Island Renourishment Project took place in the winter of 2020. At that time, approximately 4,000 cubic yards of sand were placed and graded near monument R-141 for the Madeira Condominium. This was overseen by THA under separate contract in March and April 2020.

The shoreline and volume change analysis shows the beach has maintained a similar erosion and accretion trend as documented prior to the project. The area north of the project is generally erosional, as identified by the average 50 foot (Table 3a; -51) shoreline loss and associated total volumetric loss of 80,000 cubic yards (Table 3b; -78,340) of sand in the most recent monitoring period. The erosion occurs primarily at the north end of this reach, where Sand Dollar Island continues to migrate landward into the lagoon area. Erosion at the monuments immediately adjacent to the project is comparatively small. The shift in the MHWL is evident in the aerial exhibits provided in **Figures 4, 6a and 6b**.

The project area is generally accretional, as the 2022 MHWL is nearing the location of the pre-construction MHWL. The 2022 MHWL is on average 5 feet (-5) landward of the January 2019 location, representing an increase of over 200 feet from the post construction condition. The volume of sand within the borrow area has returned to its pre-construction condition. Accretion has also continued, downdrift and south of the project area, as there was an almost 45,000 cubic yard gain since the pre-construction survey (Table 3b; 44,540); there was an associated average gain in beach width of 15 feet (Table 3a; 15) since the pre-construction survey.

The raised beach berm along Central Marco Beach provides improved resiliency to the coastal region providing a higher level of storm protection and beach fill for habitat. As the beach continues to accrete, natural processes rework the seaward side. This results in mounding of higher berm levels and valleys along the seaward side that continue to create ponding near the shoreline. This, however, is a much more manageable area than prior to the project and is recommended to be addressed with periodic grading as part of the ongoing beach cleaning operation. The ponding area is evident landward of the berm in the cross sections provided in **Appendix A** and in the January 2022 image in **Figure 6b**.

**The project fill area has remained elevated with positive seaward slope. The ponding that was previously observed throughout the wide beach berm rarely occurs. Within the areas of continued accretion, onsite monitoring of the beach is recommended to determine if minor grading of the beach berm is required. Continued annual monitoring shall occur to further evaluate the ongoing changes in this evolving beach system.**



## REFERENCES

APTIM, Storm Damage Report: Hurricane Irma Collier County, FL, November 2017

Atkins, South Marco Island Beach Renourishment Project 2014 One-Year Post Construction Monitoring Report, February 2015

Coastal Engineering Consultants Inc., Hideaway Beach Erosion Control Project – Phase III 2016 Annual Monitoring and Post-Construction Report, September 9, 2016

Coastal Planning & Engineering, Inc., South Marco Island Beach Renourishment 2013 Post-Construction and Beach Monitoring Report, August 7, 2013

Florida Department of Environmental Protection, JCP South Marco Island Beach Renourishment Project, Permit 0235209-008-JC, June 22, 2016

Humiston & Moore Engineers, Central Marco Beach Regrade Project 2020 One-Year Post Construction Monitoring Summary, August 2020

Humiston & Moore Engineers, Marco Island Central Beach Regrading Numerical Modeling and Analysis, August 2015

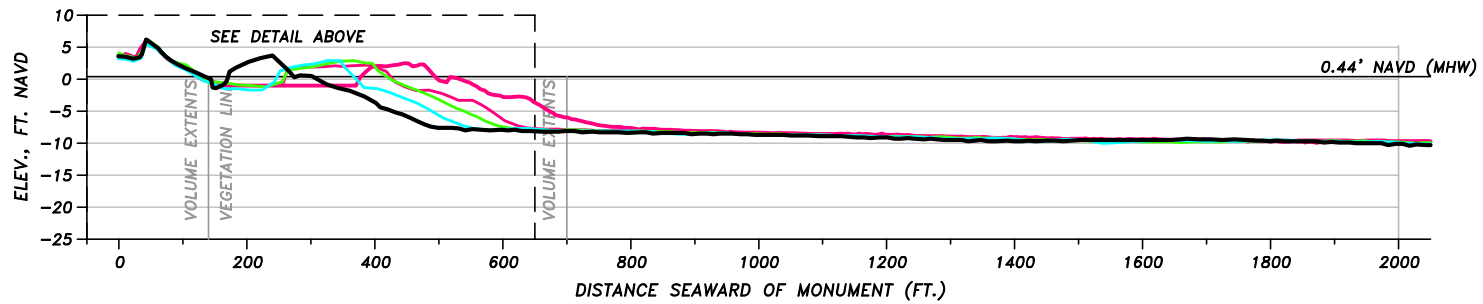
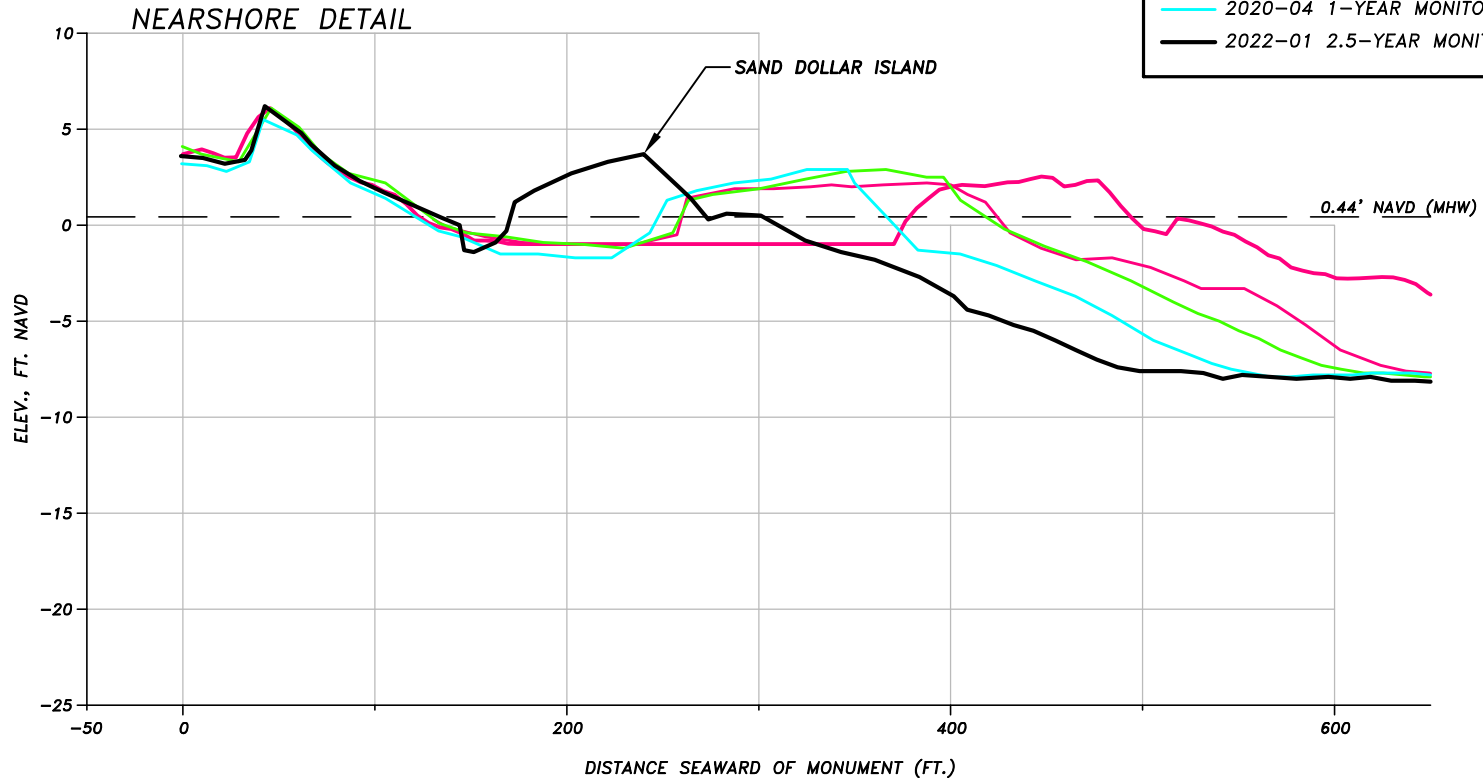
Humiston & Moore Engineers, South Marco Beach Nourishment Project 2021 Annual Construction Monitoring Summary, April 2021


## **APPENDIX A**

### **BEACH PROFILES**

# BEACH PROFILE: U-130

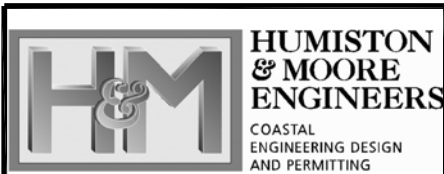
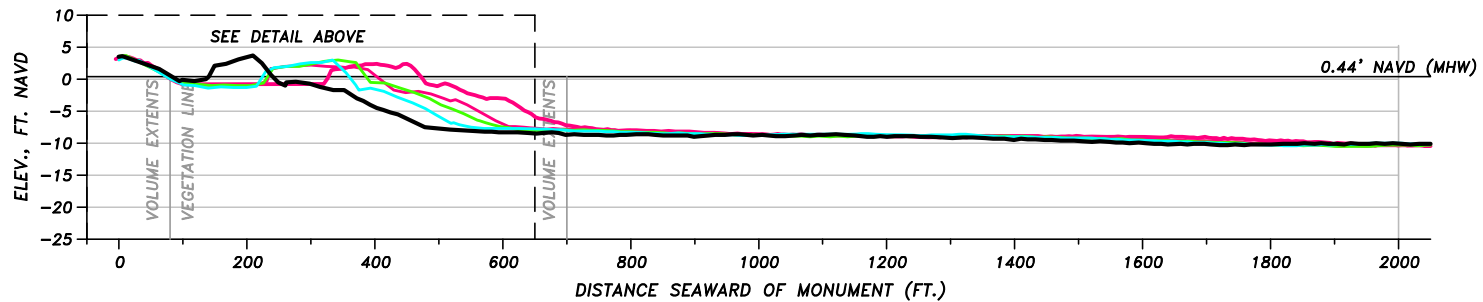
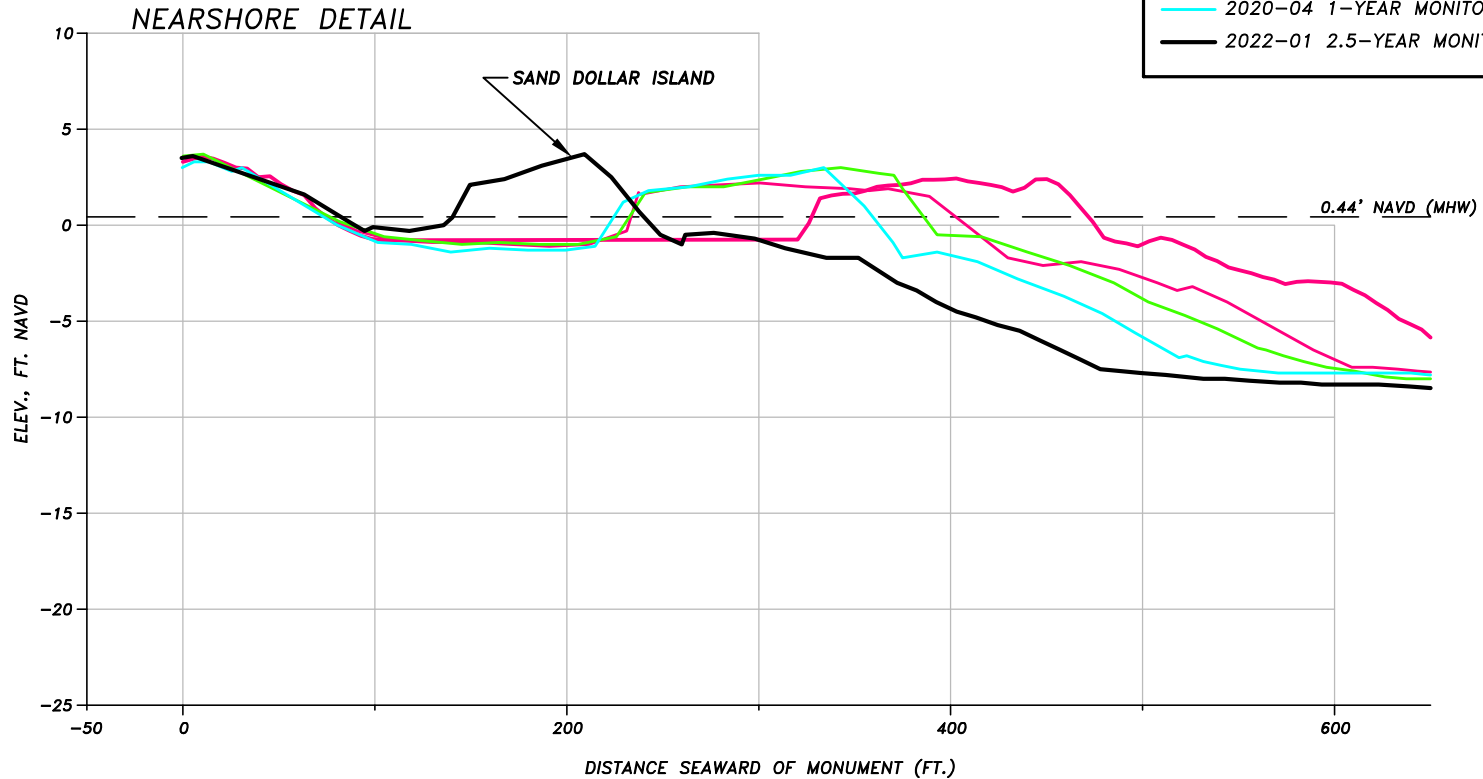
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	<b>HUMISTON &amp; MOORE ENGINEERS</b>		CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		5679 STRAND COURT NAPLES, FL 34110 FAX: (239) 594 2025 PHONE: (239) 594 2021
	COASTAL ENGINEERING DESIGN AND PERMITTING		FOR: COLLIER COUNTY		
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	JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC		

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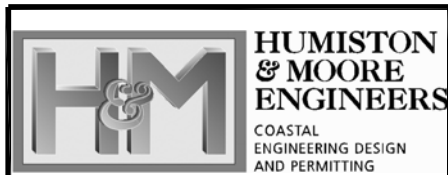
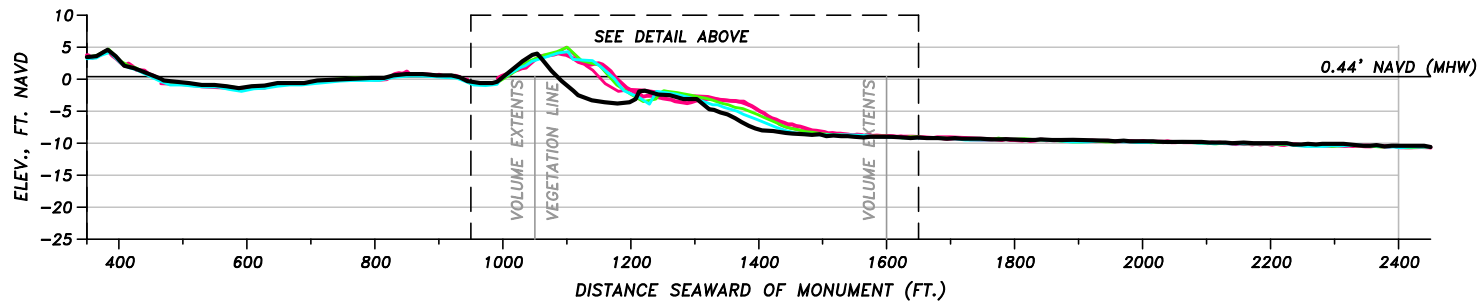
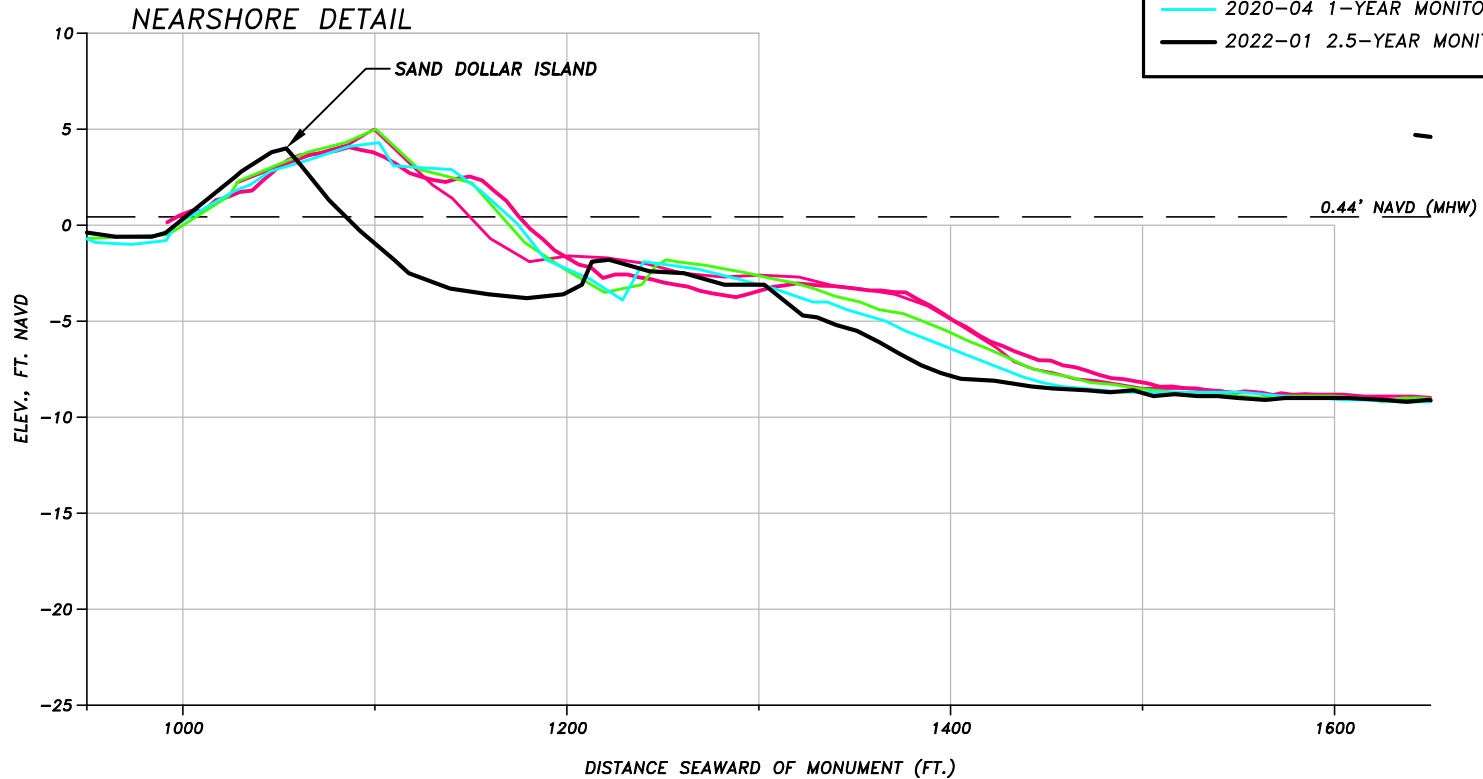


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# BEACH PROFILE: R-132

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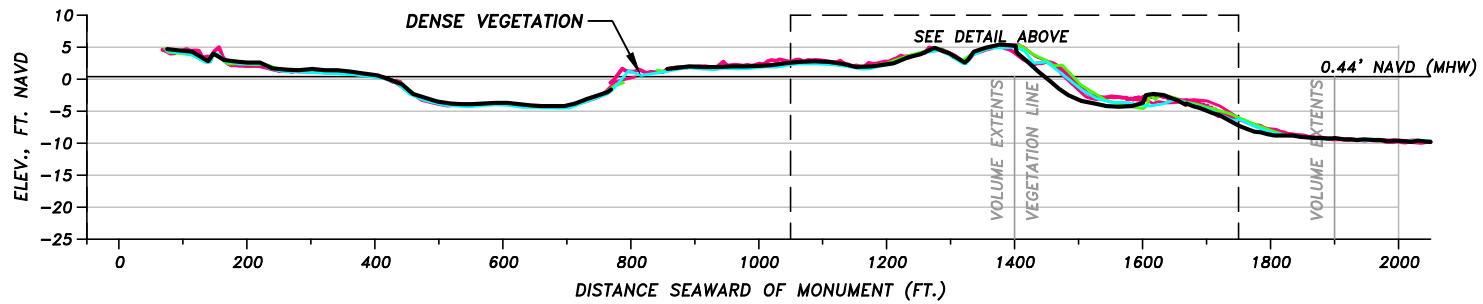
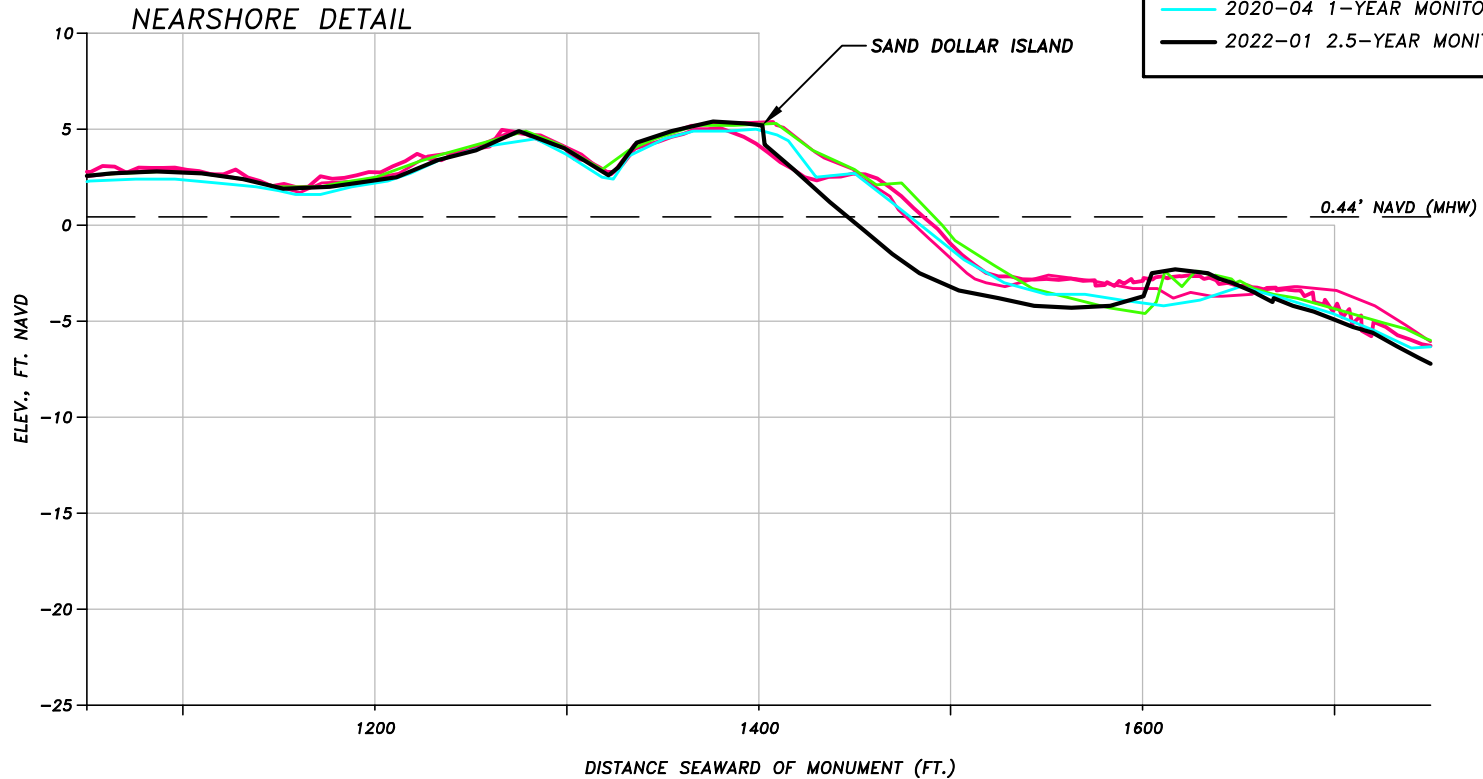
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JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

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# BEACH PROFILE: T-133

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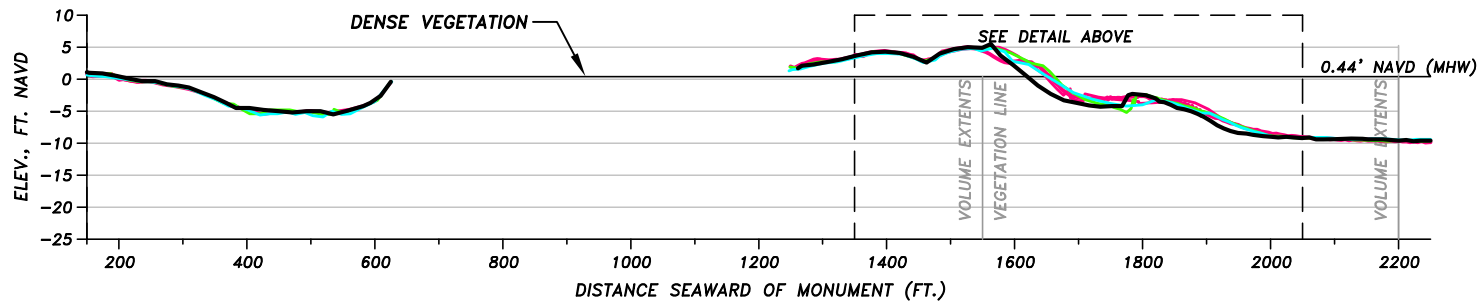
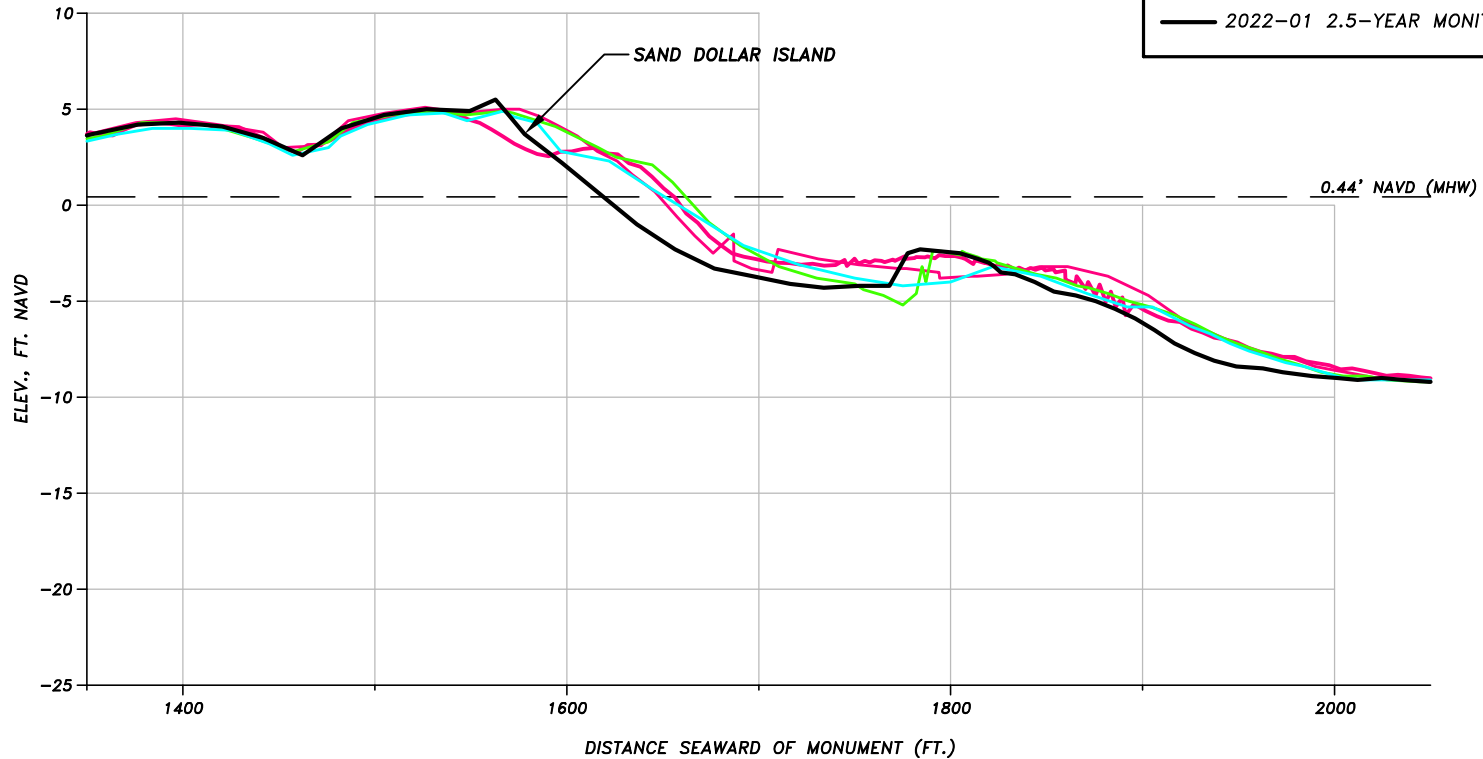



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# BEACH PROFILE: R-134

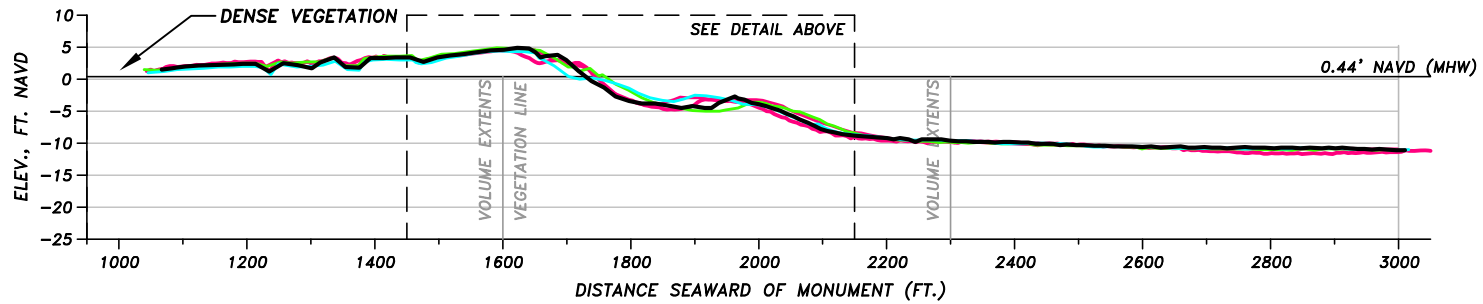
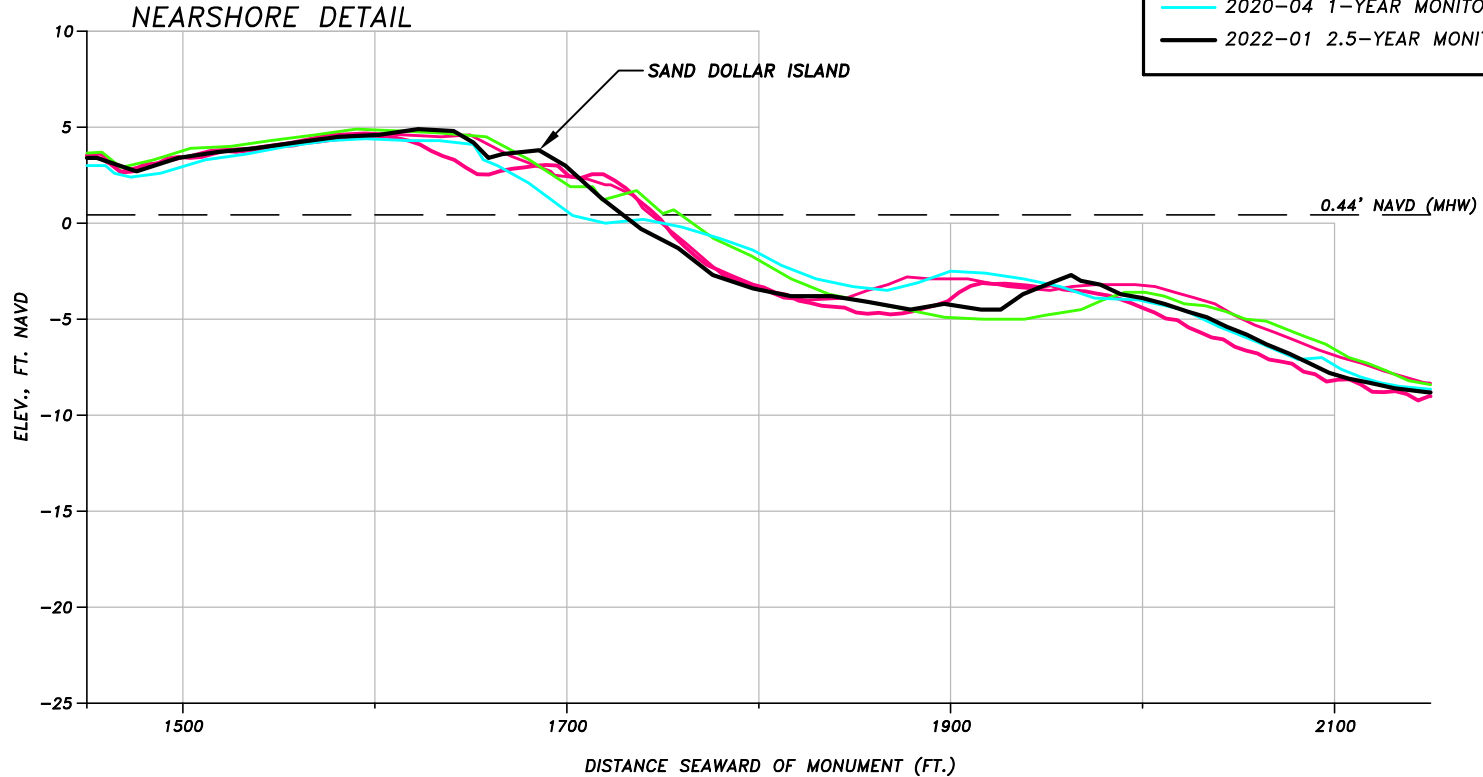
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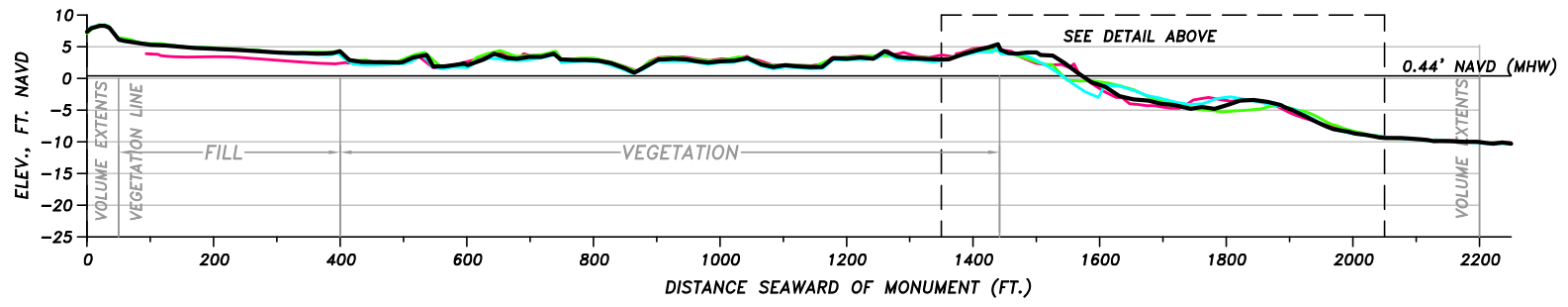
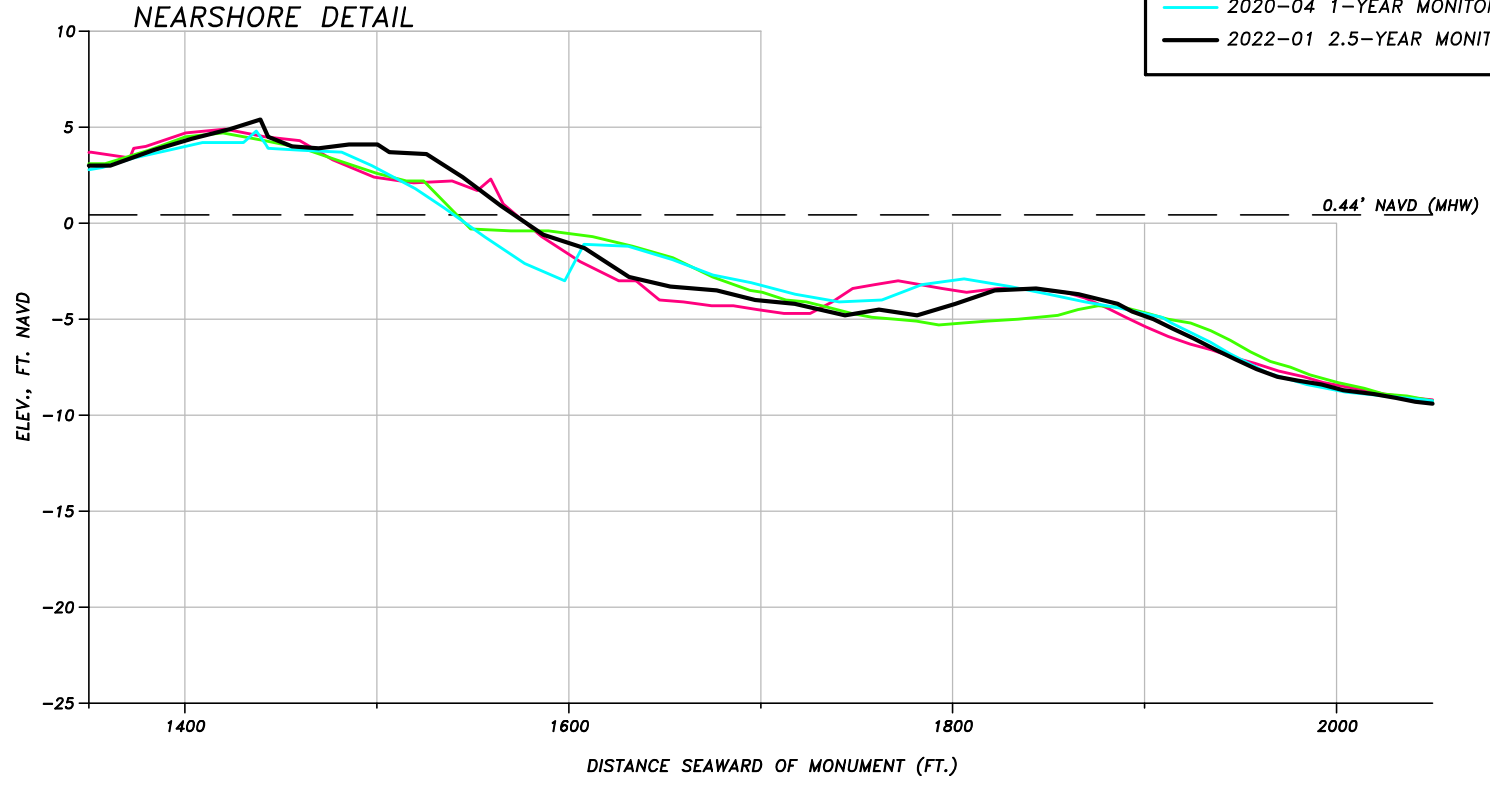



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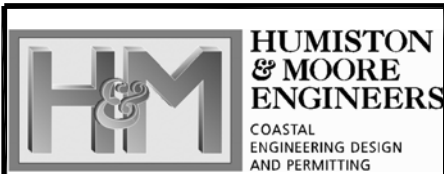
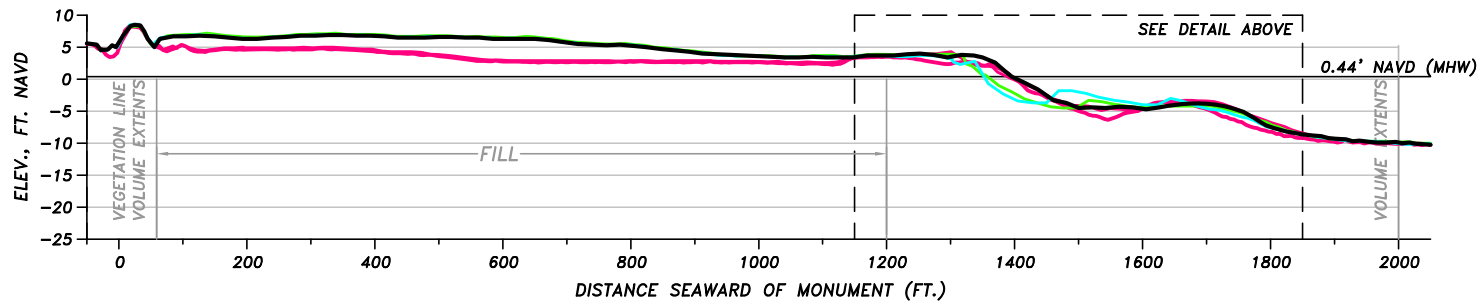
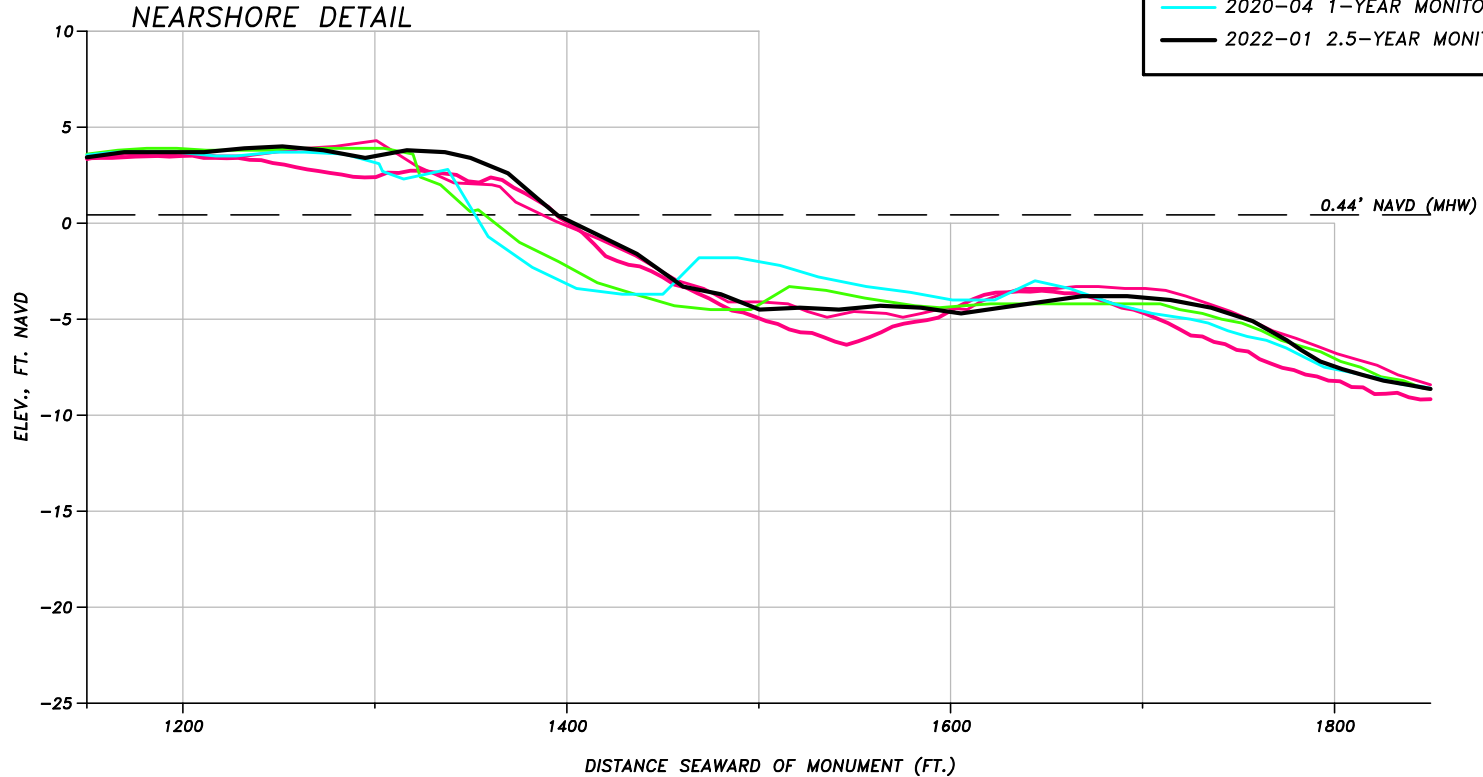
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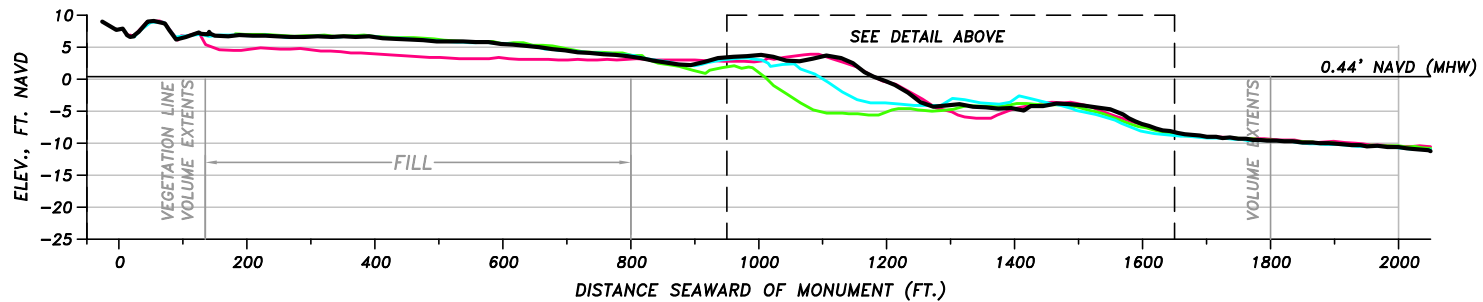
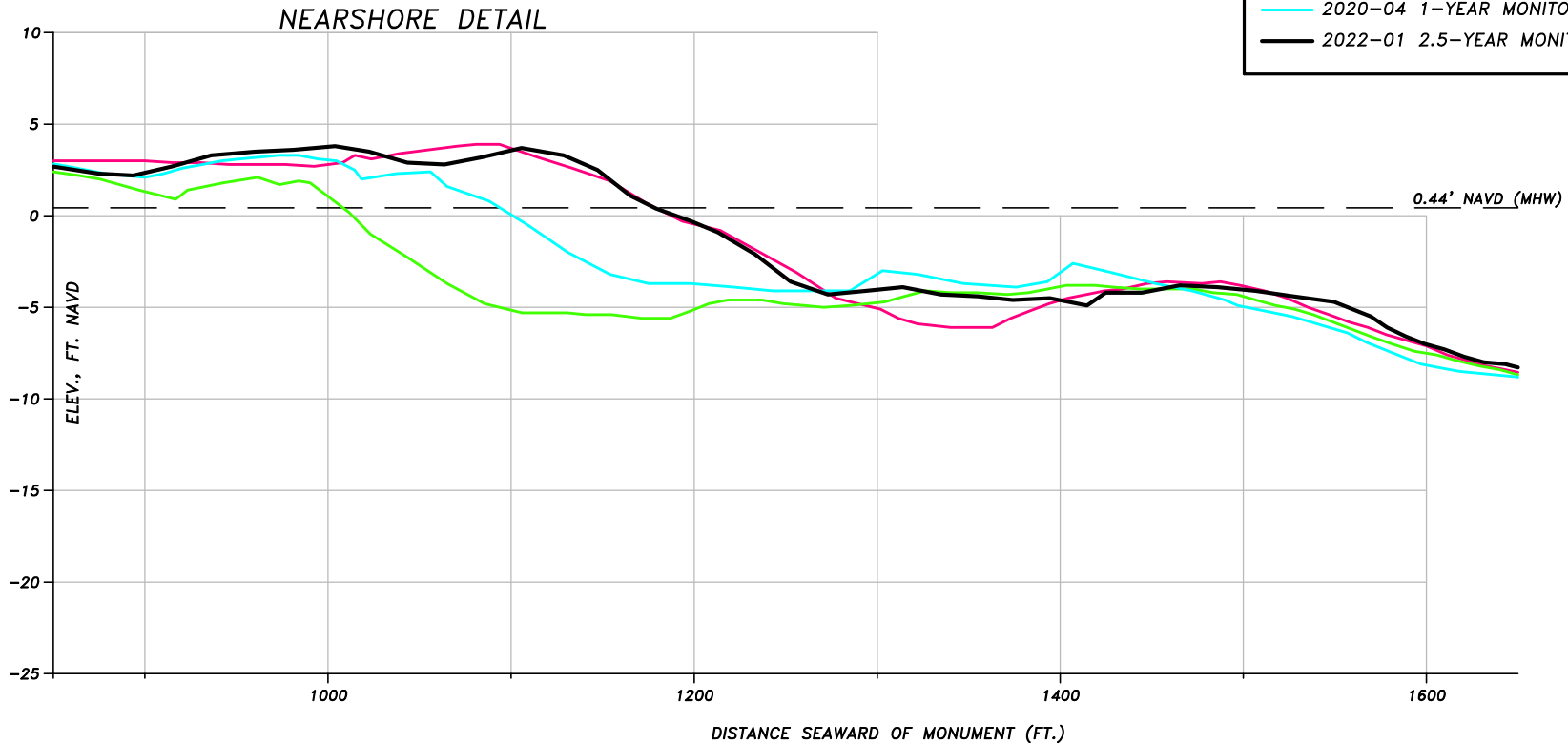


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# BEACH PROFILE: R-136.5

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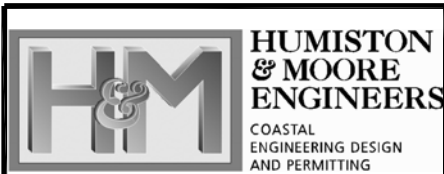
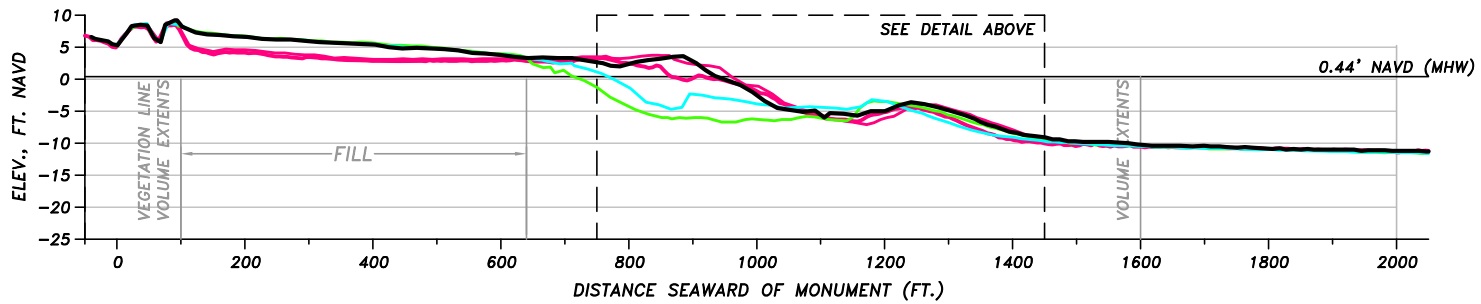
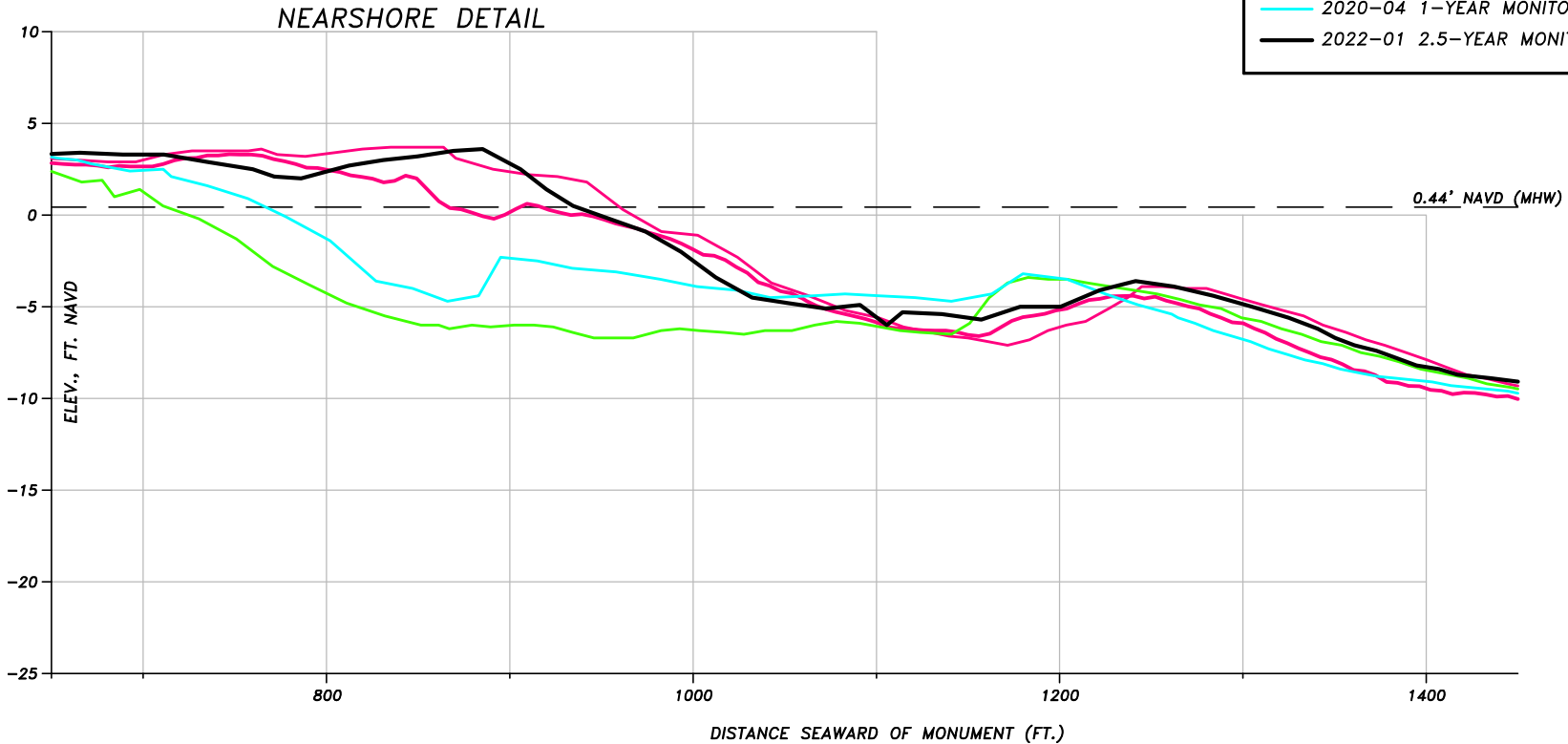


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PHONE: (239) 594 2021

# BEACH PROFILE: R-137

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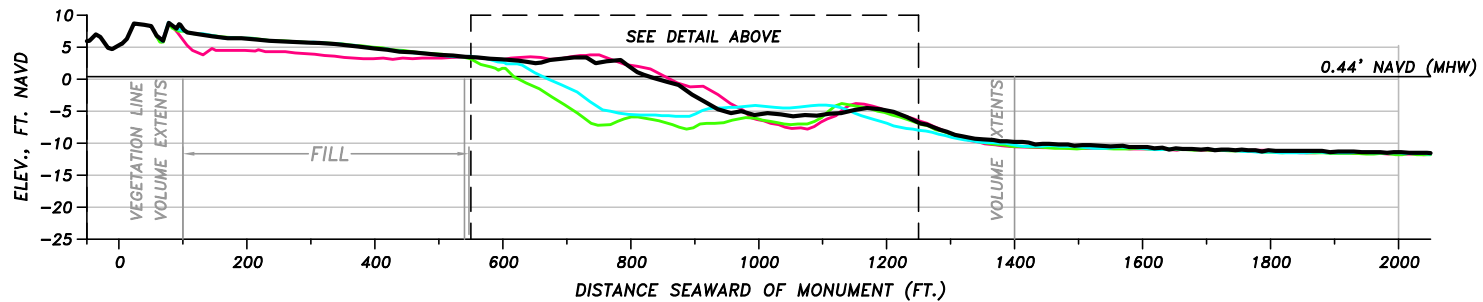
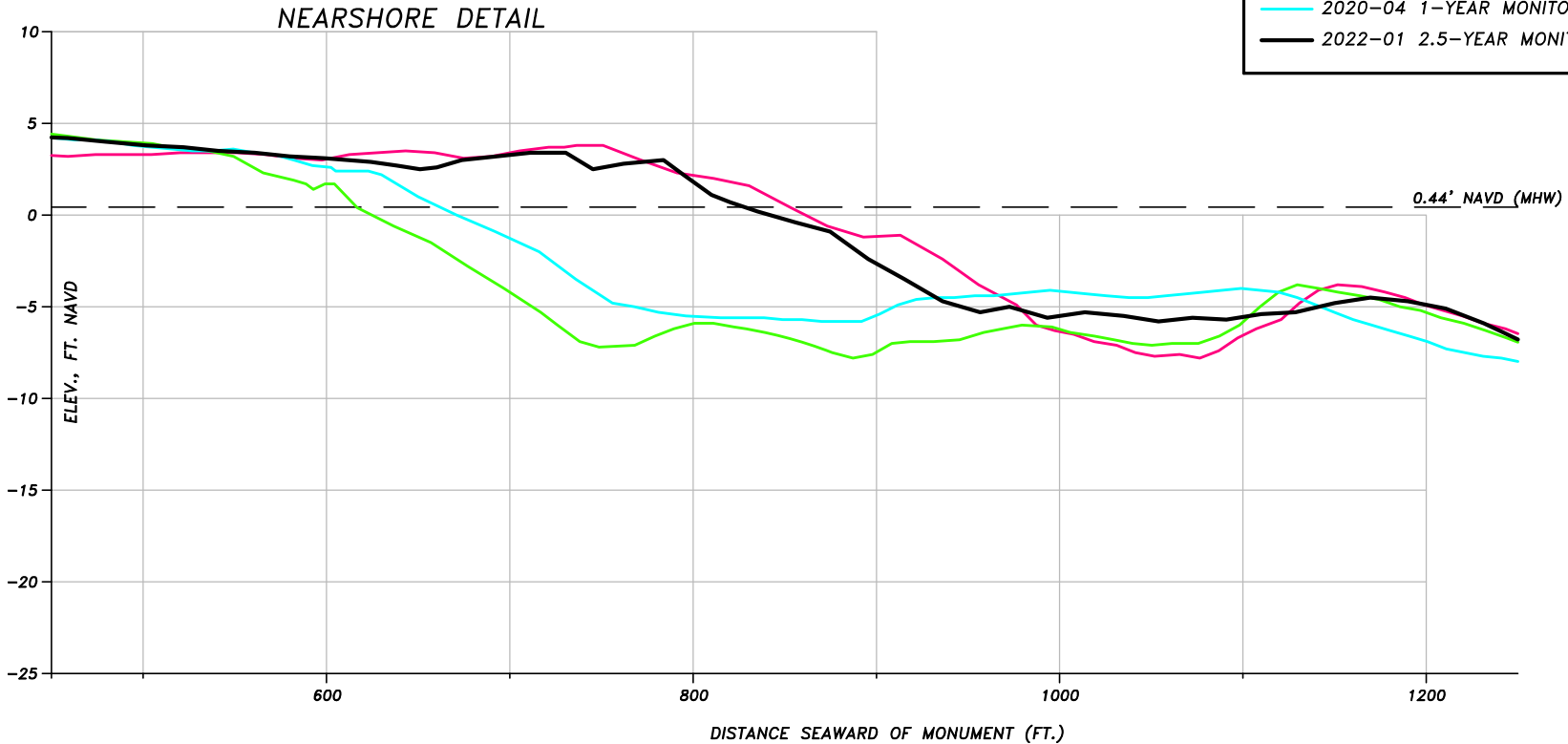
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JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
 NAPLES, FL 34110  
 FAX: (239) 594 2025  
 PHONE: (239) 594 2021



# BEACH PROFILE: R-137.5

SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: lime;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI

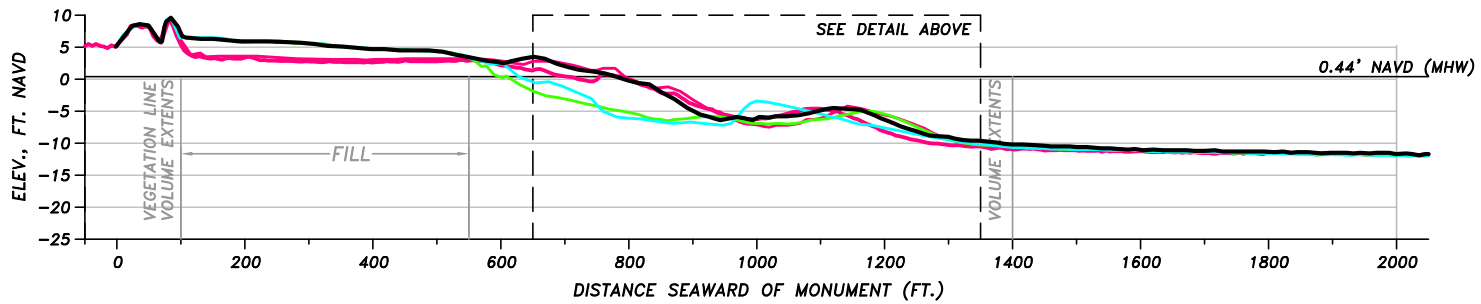
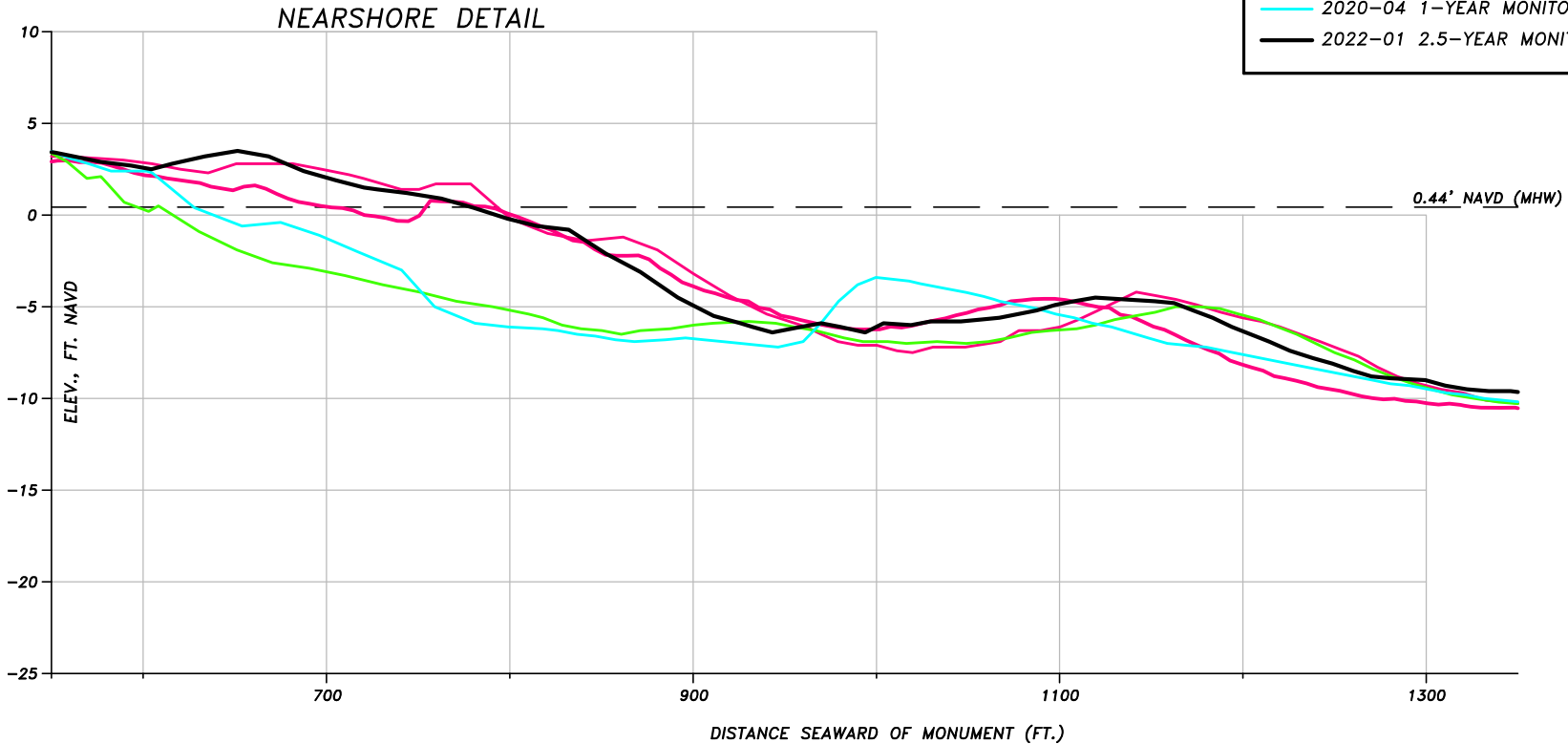


CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
NAPLES, FL 34110  
FAX: (239) 594 2025  
PHONE: (239) 594 2021

# BEACH PROFILE: T-138

SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI

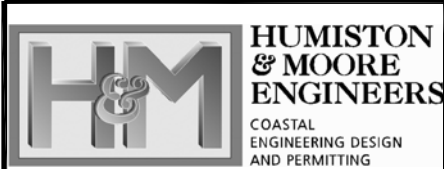
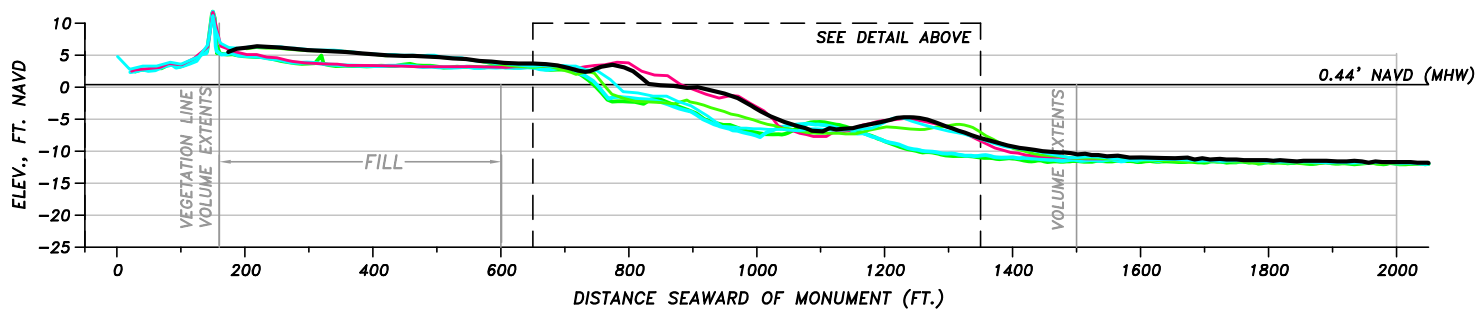
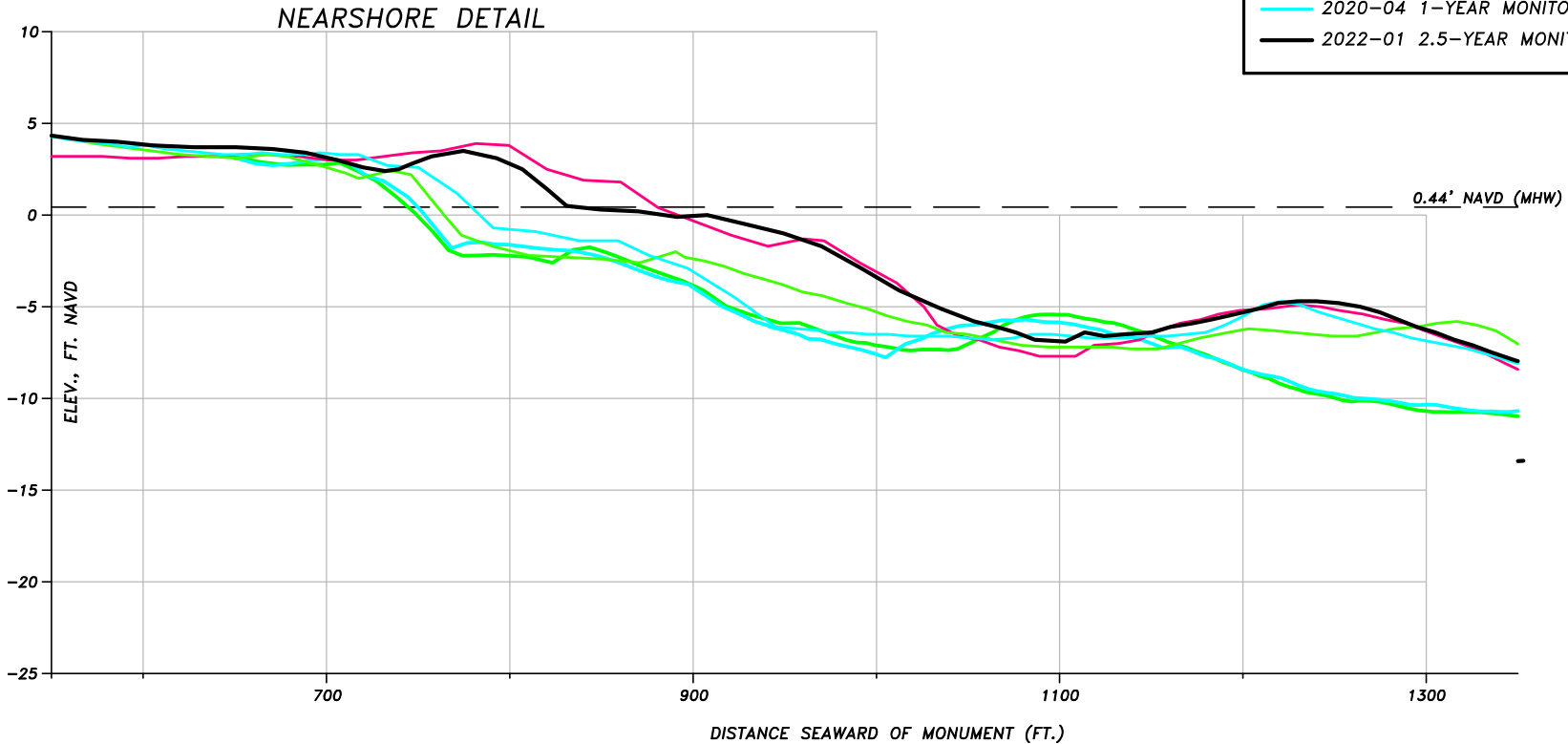


CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
 NAPLES, FL 34110  
 FAX: (239) 594 2025  
 PHONE: (239) 594 2021

# BEACH PROFILE: R-139

SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI

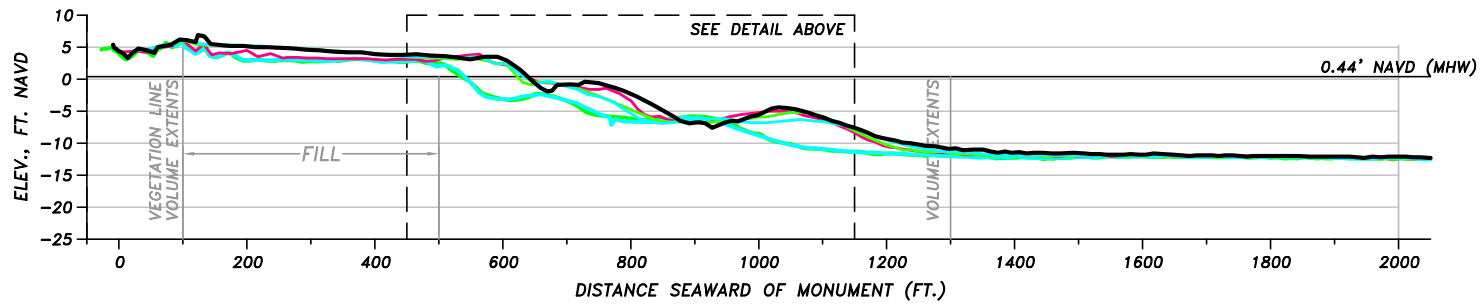
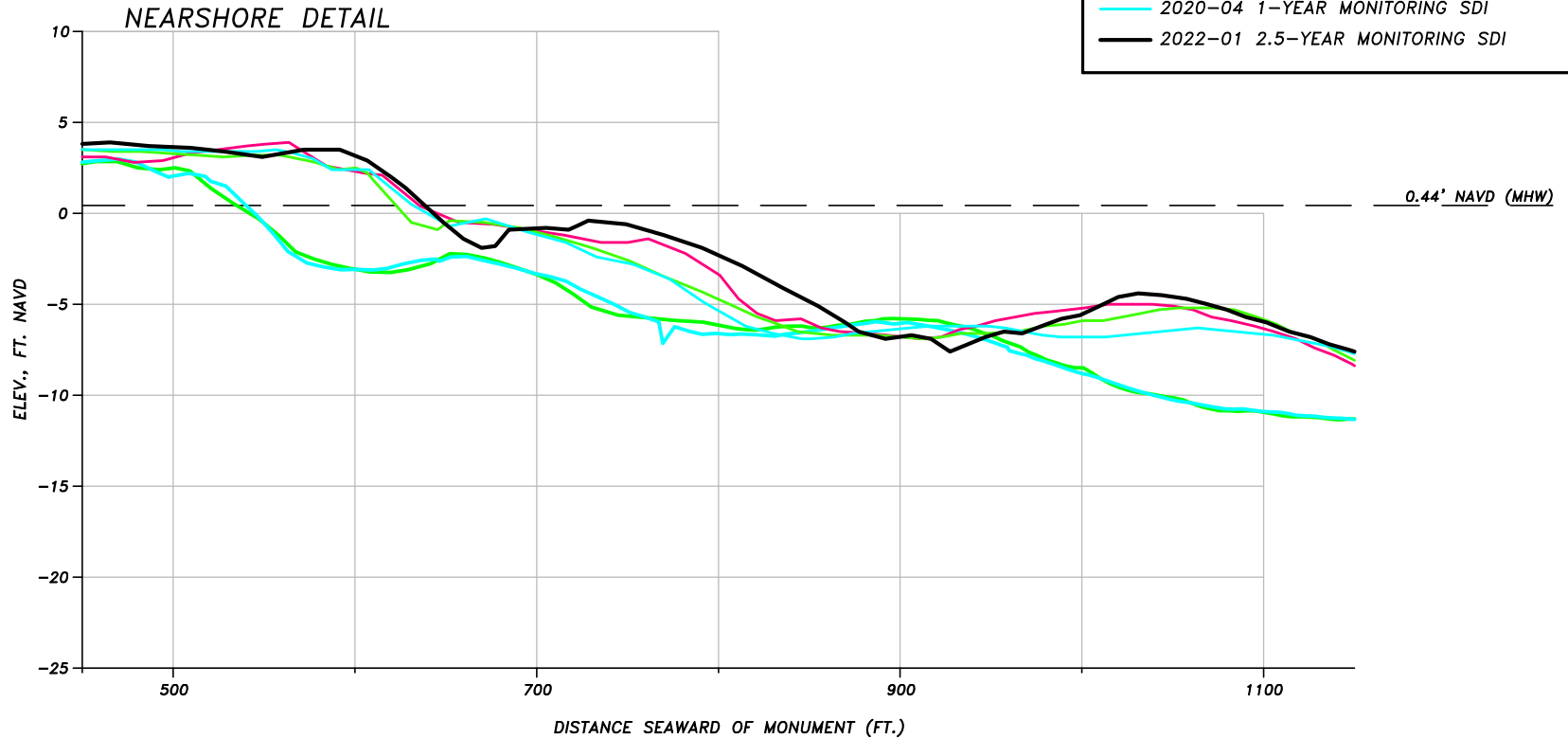


CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
 NAPLES, FL 34110  
 FAX: (239) 594 2025  
 PHONE: (239) 594 2021

# BEACH PROFILE: R-140

SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI

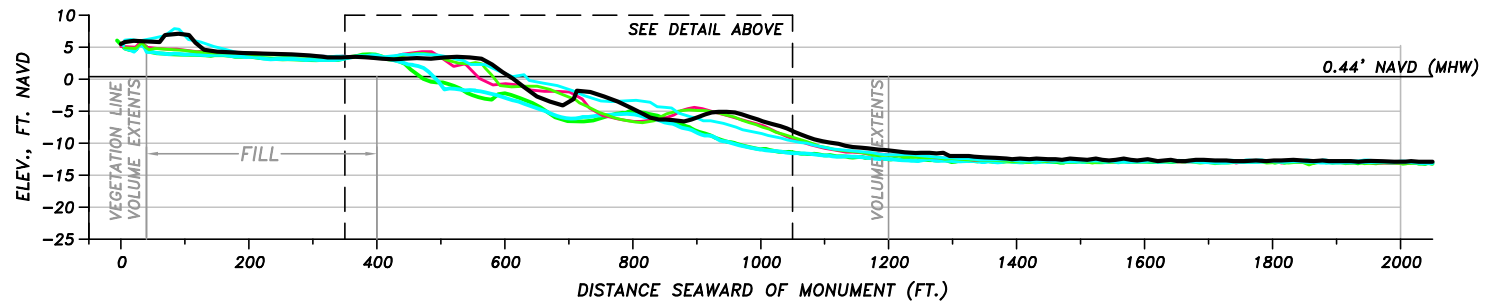
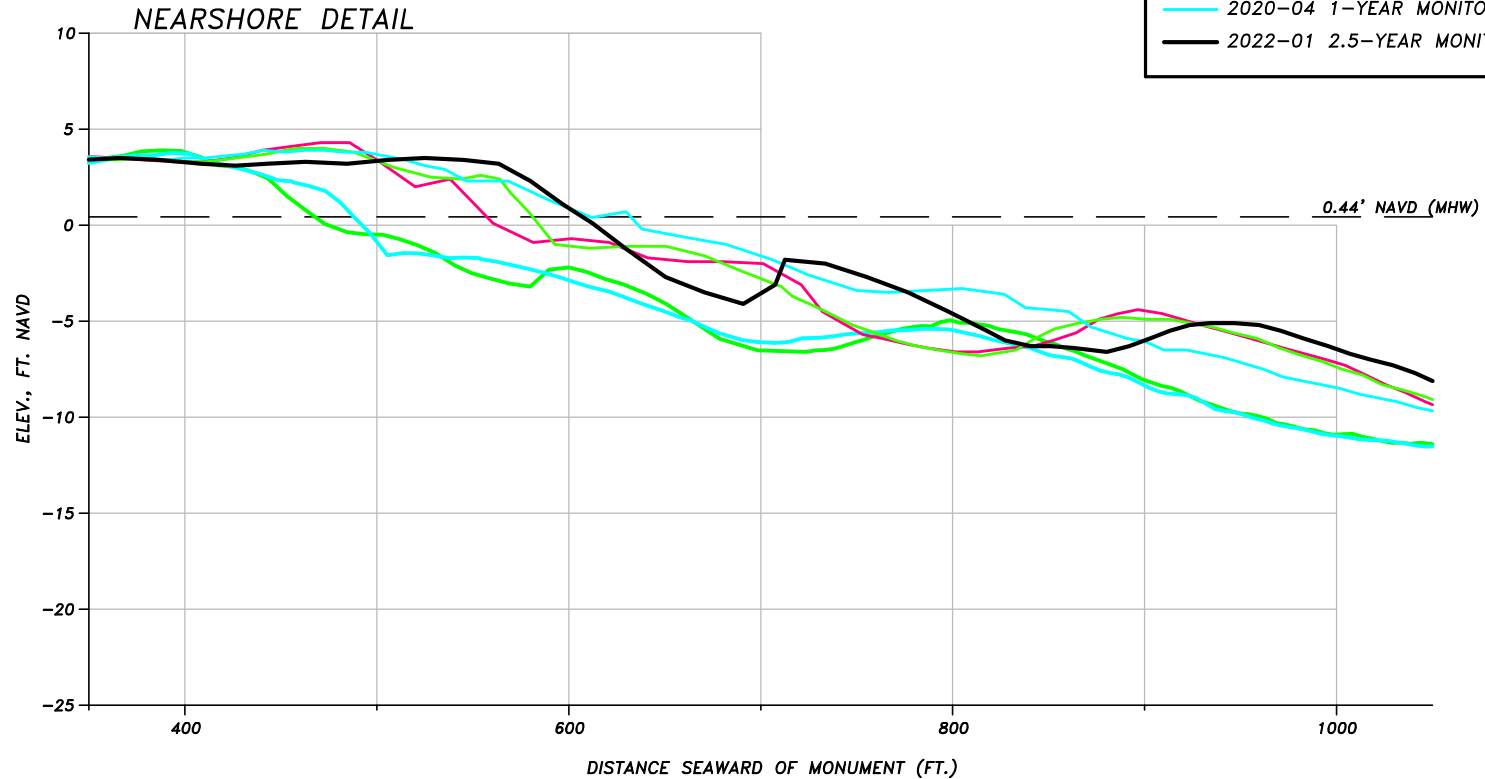


CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
 NAPLES, FL 34110  
 FAX: (239) 594 2025  
 PHONE: (239) 594 2021

# BEACH PROFILE: R-141

SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI

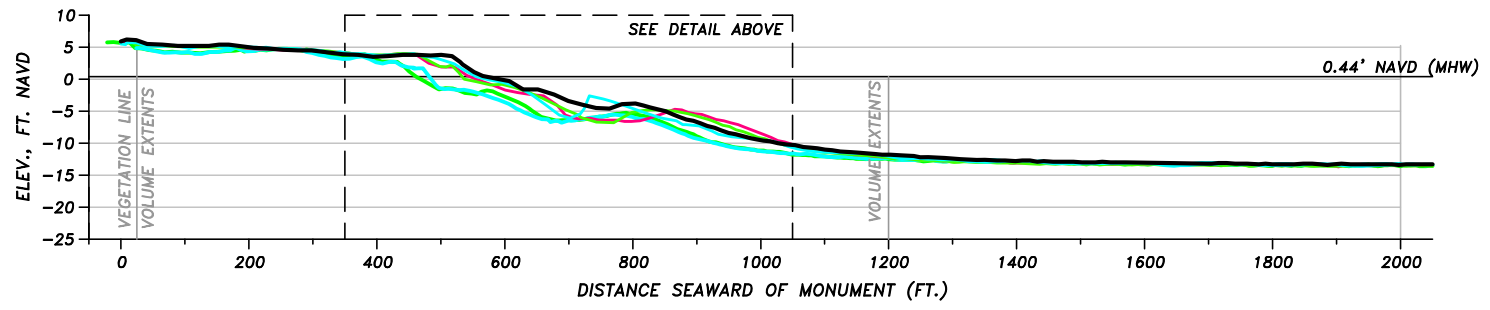
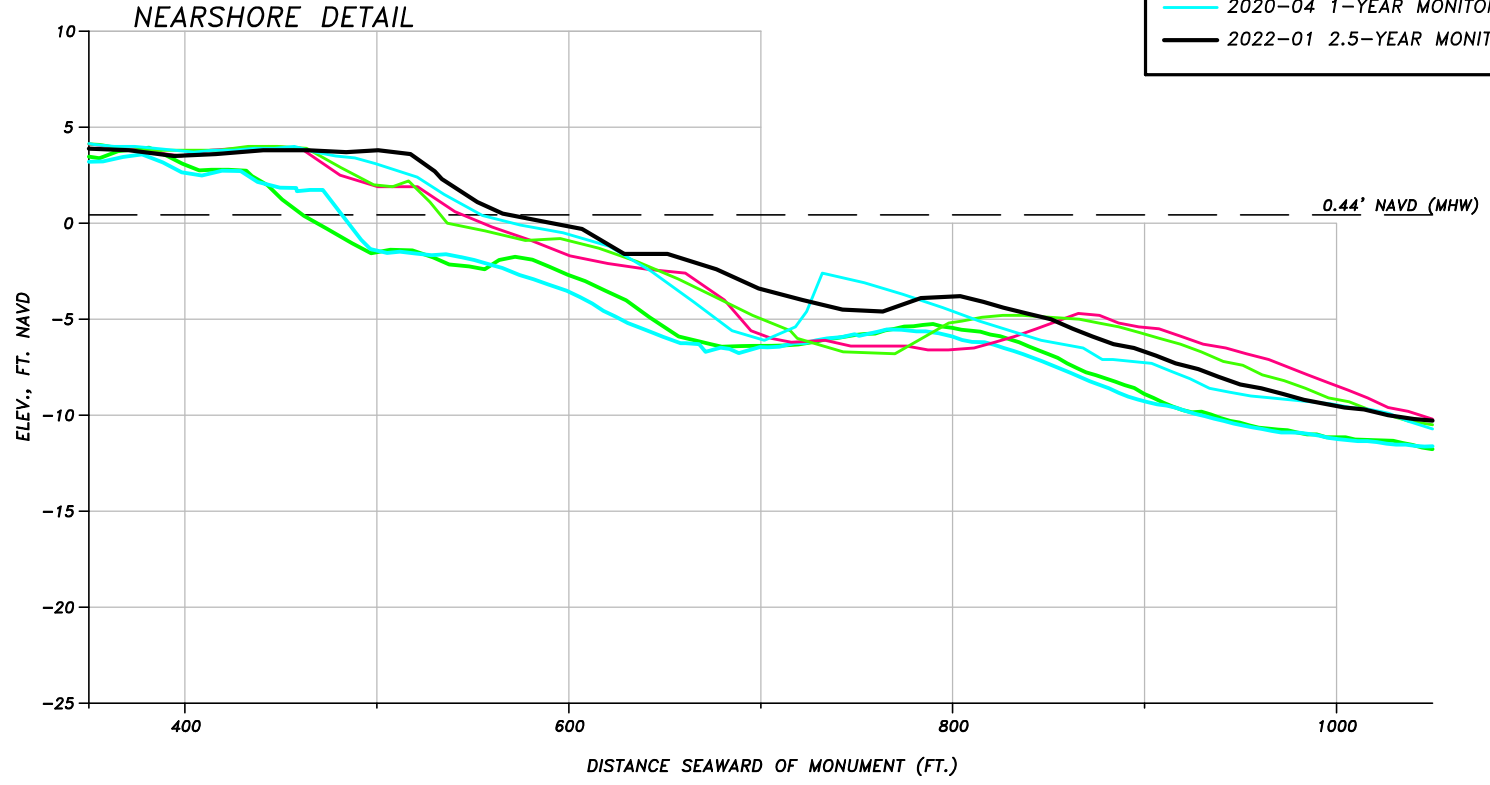



CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
 NAPLES, FL 34110  
 FAX: (239) 594 2025  
 PHONE: (239) 594 2021

# BEACH PROFILE: R-142

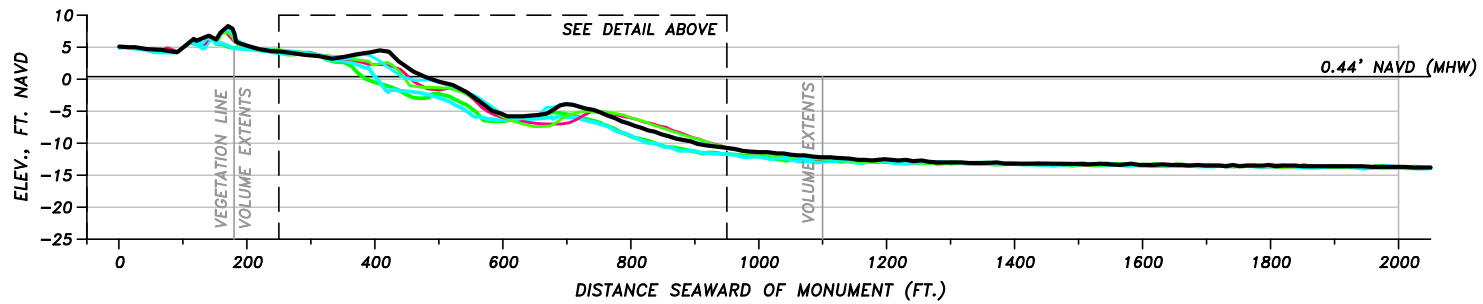
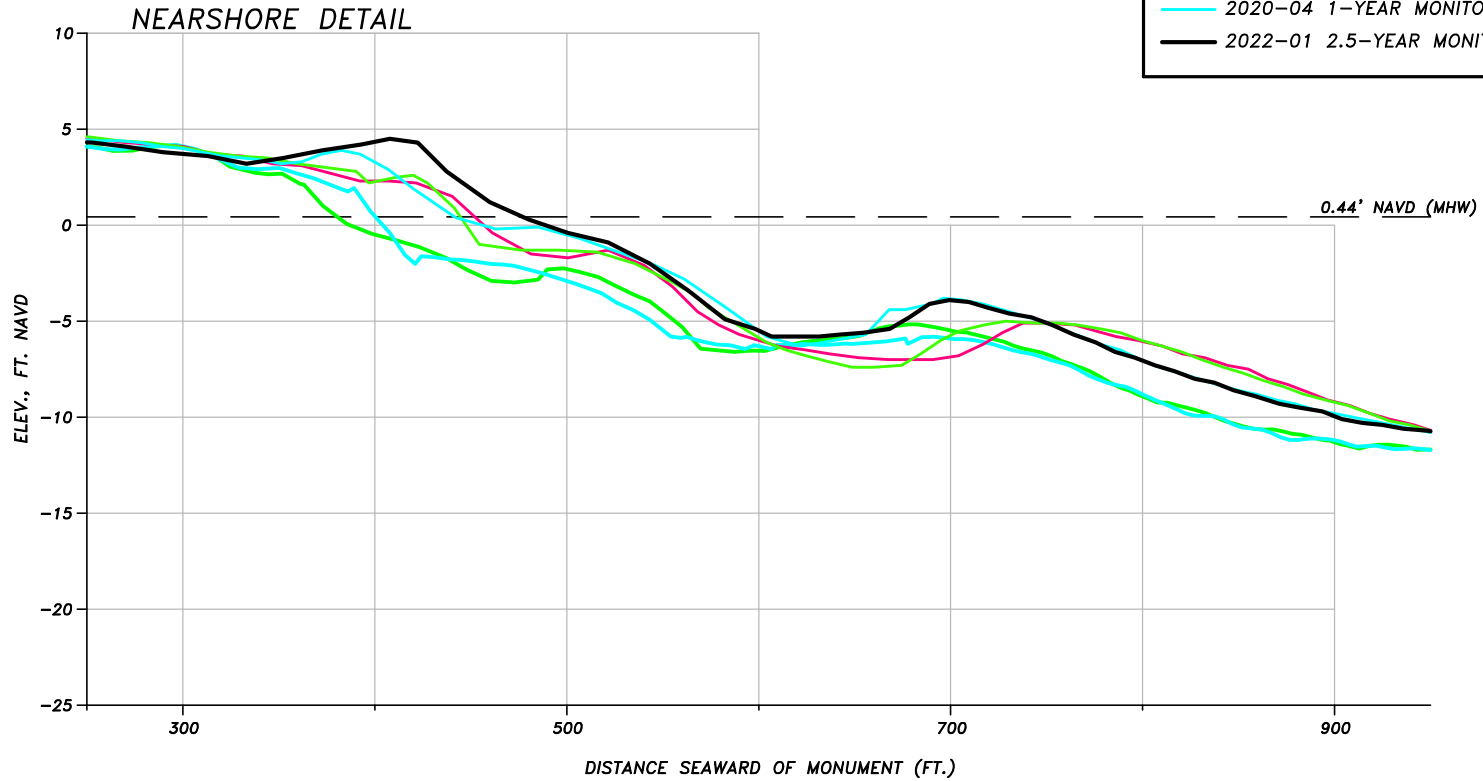
SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI



 <p><b>HUMISTON &amp; MOORE ENGINEERS</b> COASTAL ENGINEERING DESIGN AND PERMITTING</p>	CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		5679 STRAND COURT NAPLES, FL 34110 FAX: (239) 594 2025 PHONE: (239) 594 2021	
	FOR: COLLIER COUNTY			
	DATE: 1/22/22	FILE: XSEC		SCALE: SHOWN
	JOB FILE: 29018	DATUM: NAVD		FIGURE: X-SEC

# BEACH PROFILE: R-143

SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI

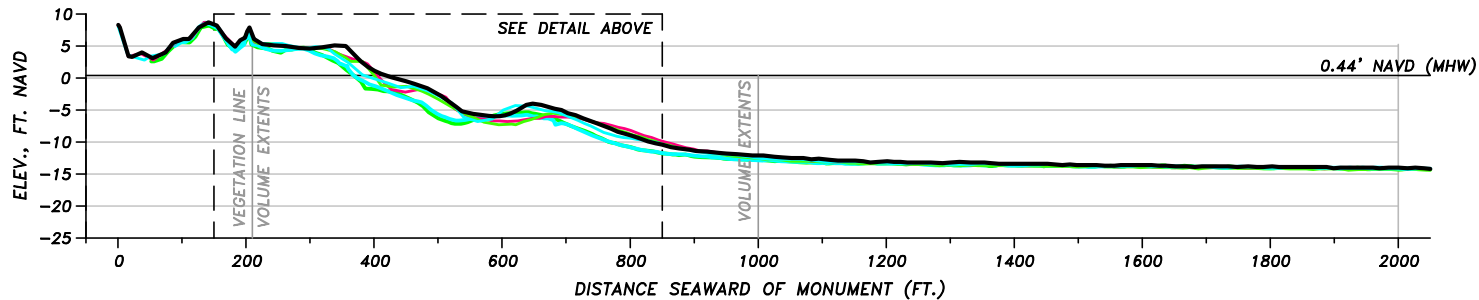
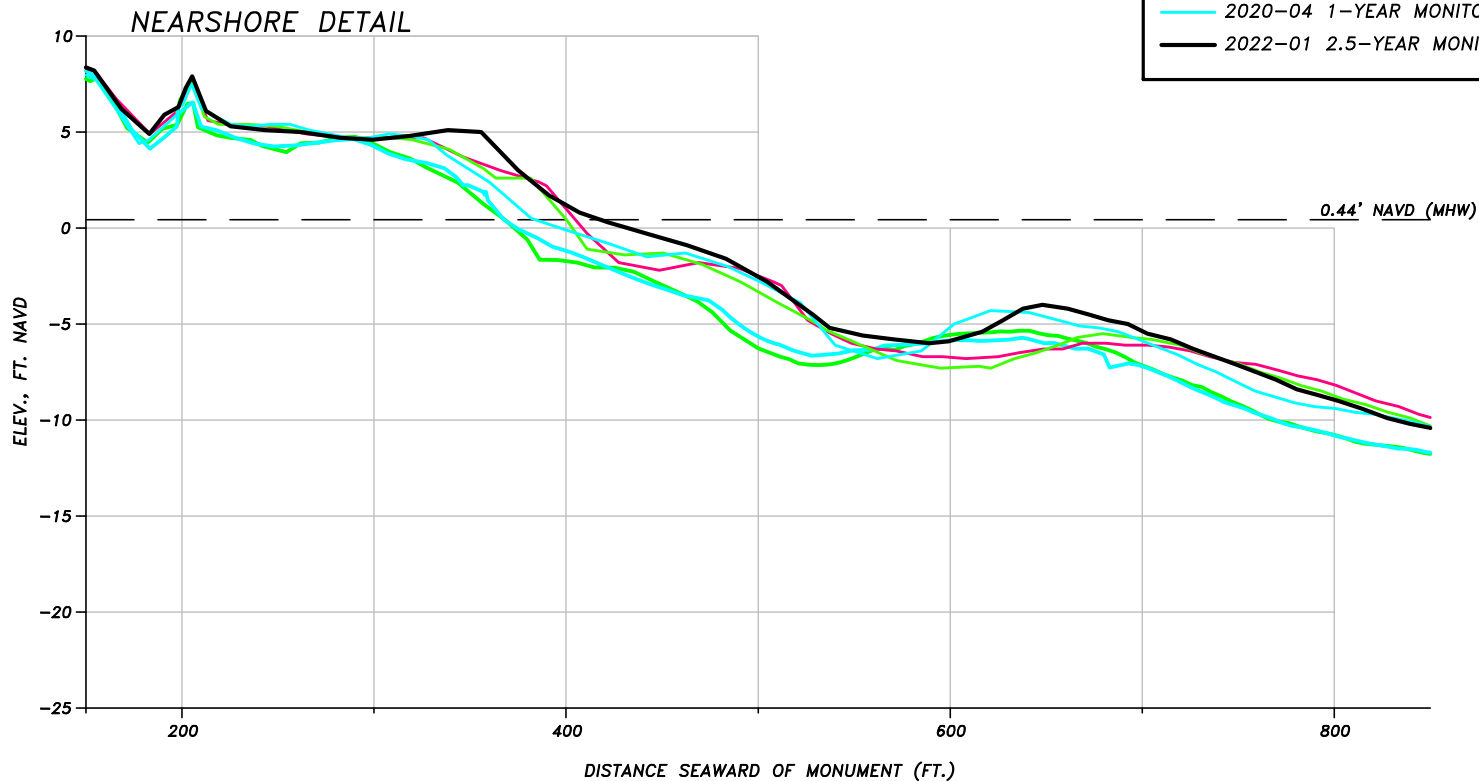


CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
NAPLES, FL 34110  
FAX: (239) 594 2025  
PHONE: (239) 594 2021

# BEACH PROFILE: R-144

SURVEY LEGEND	
<span style="color: red;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI



**HUMISTON  
& MOORE  
ENGINEERS**  
COASTAL  
ENGINEERING DESIGN  
AND PERMITTING

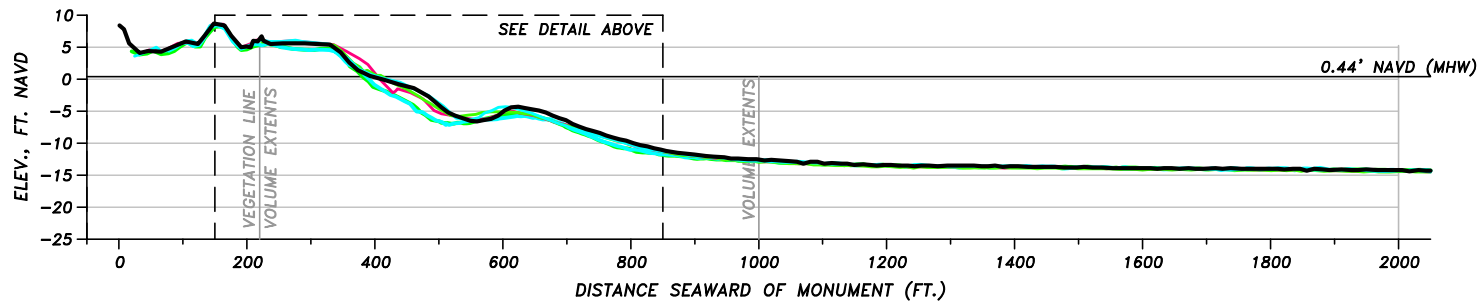
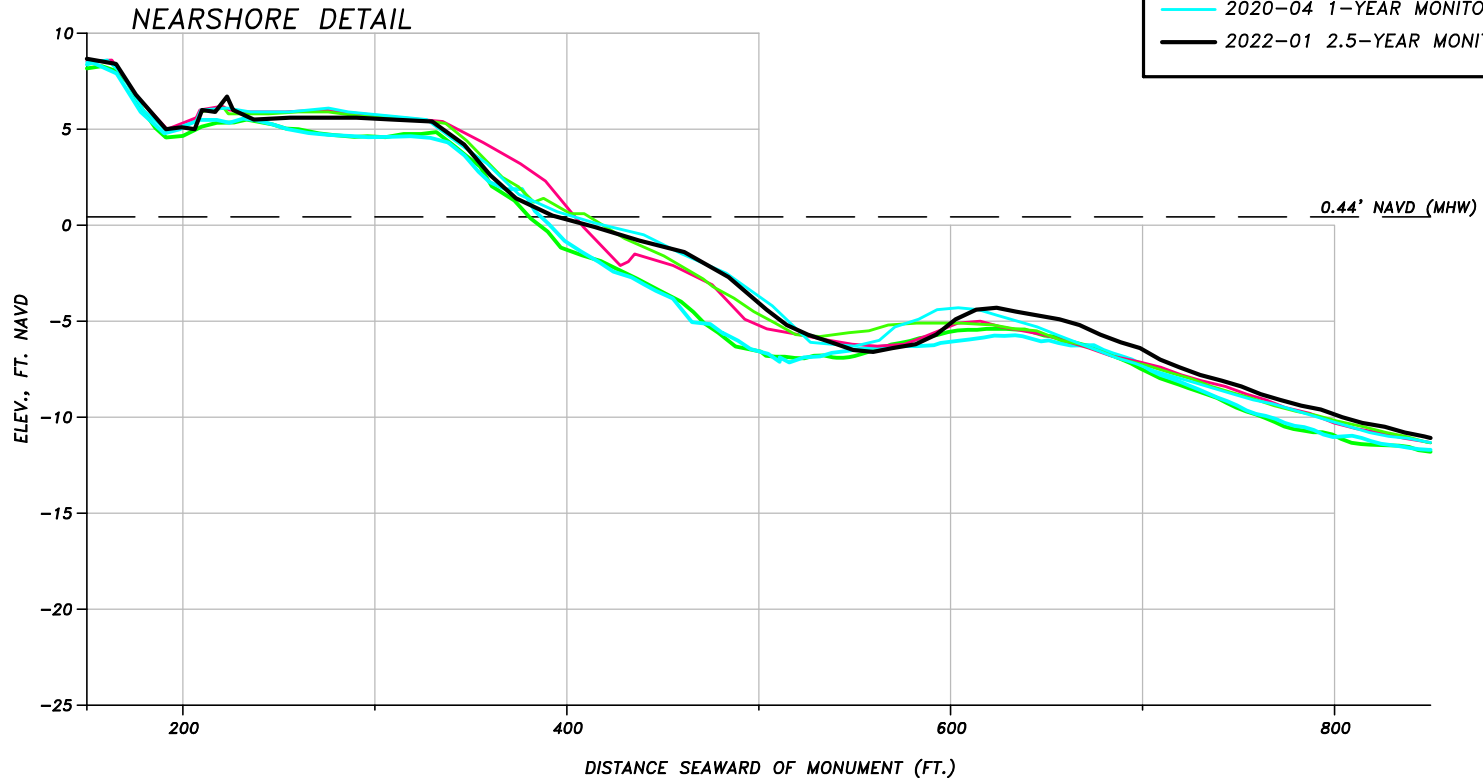
CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
NAPLES, FL 34110  
FAX: (239) 594 2025  
PHONE: (239) 594 2021



# BEACH PROFILE: R-145

SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI

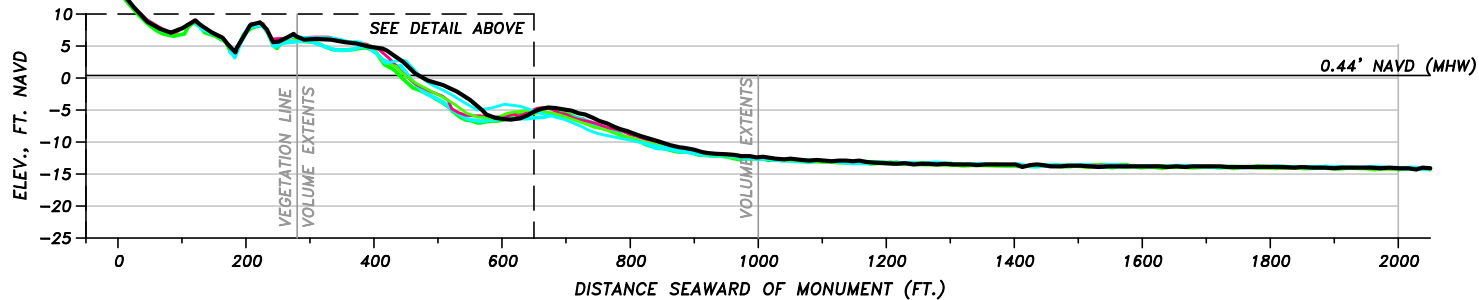
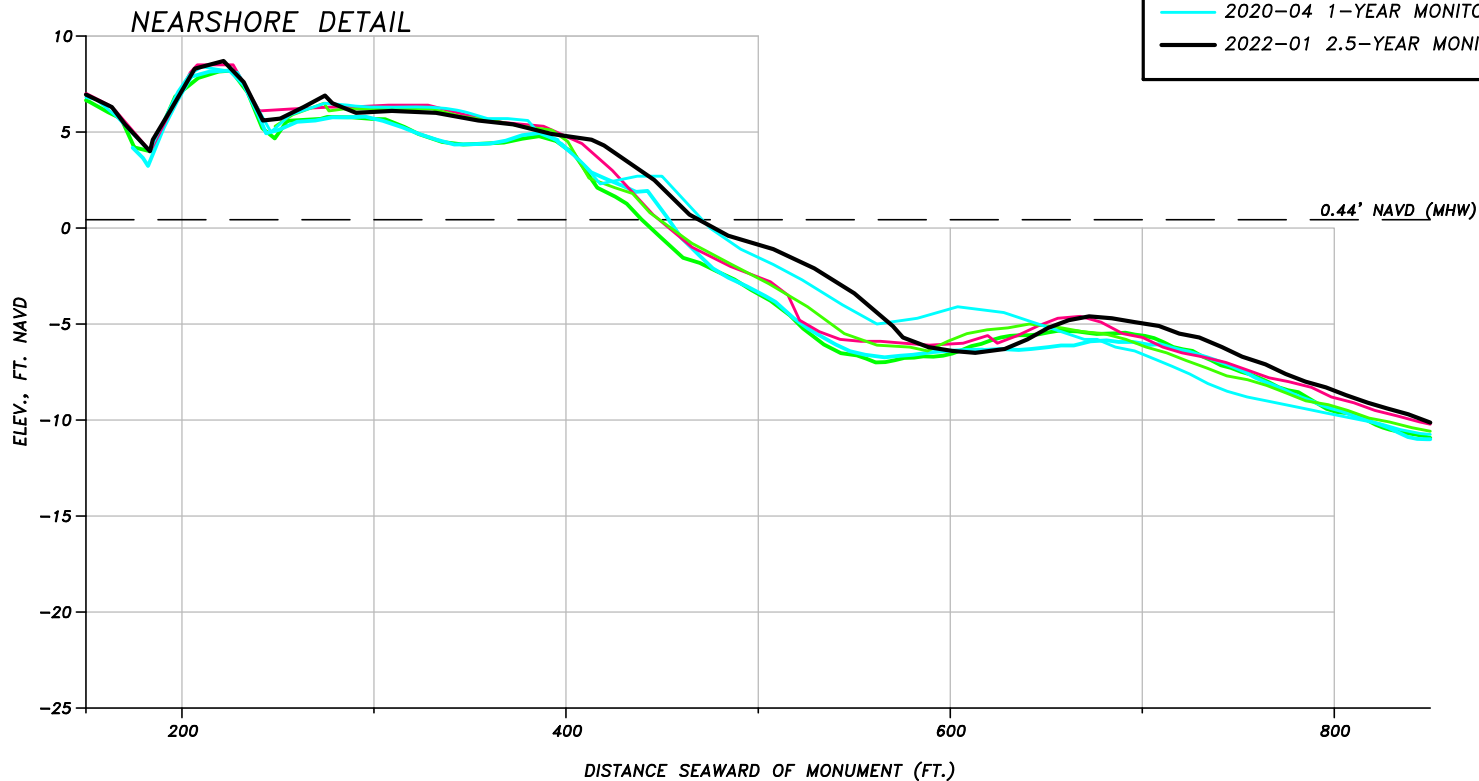


CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
NAPLES, FL 34110  
FAX: (239) 594 2025  
PHONE: (239) 594 2021

# BEACH PROFILE: R-146

SURVEY LEGEND	
<span style="color: magenta;">—</span>	2019-01 PRE-CONSTRUCTION MONITORING SDI
<span style="color: green;">—</span>	2019-05 POST-CONSTRUCTION MONITORING SDI
<span style="color: cyan;">—</span>	2020-04 1-YEAR MONITORING SDI
<span style="color: black;">—</span>	2022-01 2.5-YEAR MONITORING SDI



**HUMISTON  
& MOORE  
ENGINEERS**  
COASTAL  
ENGINEERING DESIGN  
AND PERMITTING

CENTRAL MARCO ISLAND REGRADE PROJECT BEACH PROFILE CROSS SECTIONS		
FOR: COLLIER COUNTY		
DATE: 1/22/22	FILE: XSEC	SCALE: SHOWN
JOB FILE: 29018	DATUM: NAVD	FIGURE: X-SEC

5679 STRAND COURT  
NAPLES, FL 34110  
FAX: (239) 594 2025  
PHONE: (239) 594 2021

**APPENDIX B**  
**SURVEY REPORT**



**SEA Diversified, Inc.**  
 160 Congress Park Drive, Suite 114  
 Delray Beach, Florida 33444  
 Phone: 561-243-4920

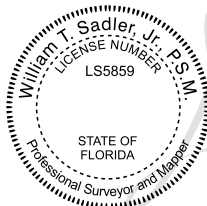
## **SURVEYOR’S CERTIFICATION & NOTES**

**Survey Title:** Collier County South & Central Marco Island 2022  
**Physical Monitoring Topographic & Hydrographic Survey**  
**Date of Report:** February 18, 2022  
**Prepared for:** Humiston & Moore Engineers  
**Prepared by:** Sea Diversified, Inc.  
 (SDI Project Number 21-2954)  
**Date of Survey:** January 4, 2022 – January 13, 2022  
**Survey Location:** FDEP Range Monuments R-130 to R-148  
 including R-135.5, R-136.5, R-137.5 and  
 G-1 to G-5, K-1, K-2 and Borrow Area, totaling 29 beach profiles

### **Notes:**

1. This survey report was prepared to accompany the digital data files (ASCII X, Y, Z) submitted to Humiston and Moore Engineers pertaining to the Collier County 2022 Physical Monitoring Survey “South & Central Marco” Topographic & Hydrographic Survey. The purpose of the survey was to collect topographic and bathymetric data at Florida Department of Environmental Protection (FDEP) profile control points R-130 to R-148 including R-135.5, R-136.5, R-137.5 and G-1 to G-5, K-1, K-2 and Borrow Area, totaling 29 beach profiles.
2. This survey report is not valid without the signature and the original raised seal of a Florida Licensed Surveyor and Mapper.
3. The information depicted herein represents the results of the survey on the dates indicated and can only be considered as indicating the general conditions existing at the time.
4. Horizontal data are in feet and relative to the Florida State Plane Coordinate System based on the Transverse Mercator Projection for Florida, East Zone (0901), North American Datum (NAD) of 1983, 1990 Adjustment. Vertical data are in feet and relative to the North American Vertical Datum of 1988 (NAVD 88).
5. Bathymetric data was collected using a Trimble Real-Time Kinematic (RTK) Global Positioning System (GPS) and an Odom Echotrac CV100 sounder with integrated TSS Model DMS-05 motion sensor. Horizontal position accuracy was verified using published profile control points. The sounder was calibrated prior to the start of the survey following manufacturer recommended procedures.
6. RTK tides were applied in real-time during bathymetric data collection. For redundancy tides were observed at a tide staff set to 0.0 feet relative to NAVD 88. The tide staff was attached to a wood pile and relative to FDEP Range Monument R-144 with the following published elevation of 8.86 feet NAVD 88.
7. Topographic data was collected using a combination of Real-Time Kinematic (RTK) GPS and level, rod and chain methodologies.
8. Onshore / offshore profile surveys were collected in accordance with the Monitoring Standards for Beach Erosion Control Projects prepared by the Florida Department of Environmental Protection (FDEP), Bureau of Beaches and Coastal Systems (BBCS), dated October 2014.

I hereby certify that the Topographic / Hydrographic survey is based on a recent field survey conducted under my personal direction and is true and accurate to the best of my knowledge and belief and meets the Standards of Practice set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 5J-17, Florida Administrative Code, pursuant to Section 472.027, Florida Statutes.



Digitally signed by William T. Sadler  
 DN: cn=William T. Sadler,  
 o=Sea Diversified, Inc.,  
 email=wts@seadiv.com,  
 c=US  
 Date: 2022.02.19 09:38:05  
 -05'00'

**William T. Sadler Jr., P.E., P.S.M.**  
 Florida Registration Number 5859  
 Sea Diversified Inc. LB Number 7342

**Date**