DOCTORS PASS MAINTENANCE DREDGING
2023 POST-CONSTRUCTION MONITORING SUMMARY

August 2023

DEP PERMIT 0331817-005-JC
USACOE PERMIT SAJ-2004-8754

COLLIER COUNTY

PREPARED BY
HUMISTON & MOORE ENGINEERS
HM File No. 29018

SUBMITTED TO:
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

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COASTAL ENGINEERING DESIGN AND PERMITTING

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INTRODUCTION

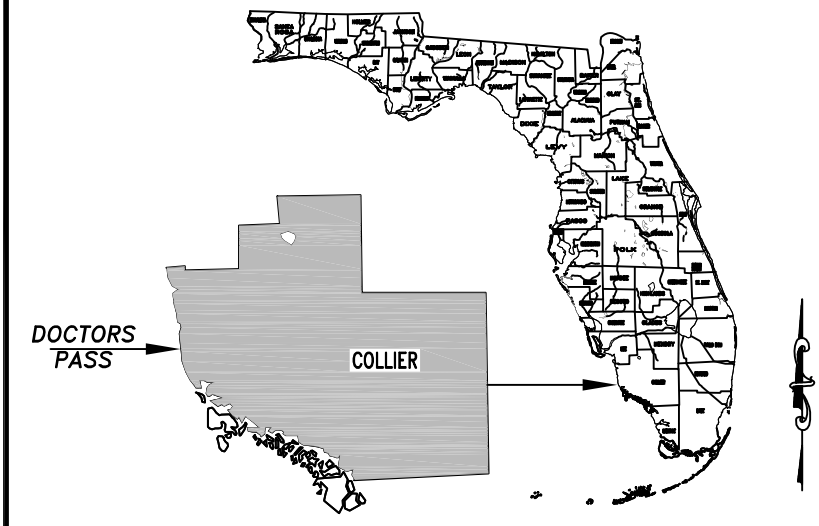

Doctors Pass – May 18, 2023

This report by Humiston & Moore Engineers (H&M) presents the analysis of a monitoring survey conducted from November 2 to December 9, 2022. This monitoring survey was conducted approximately one month after the passing of Hurricane Ian on September 28, 2022, and six months after the March/April 2022 dredging project. The 2022 dredging of Doctors Pass commenced on March 21 and was completed on April 20, 2022. The pre and post-construction surveys were conducted by Park Coastal Surveying, LLC (Park). The 6-month monitoring survey was conducted by APTIM Environmental and Infrastructure, LLC (APTIM) based on the requirements of the State of Florida Department of Environmental Protection (DEP) permit number 0331817-001-JC dated October 2, 2015 (superseding permit 0235740-001-JC), U.S. Army Corps of Engineers (USCOE) permit number SAJ-2004-8754(MOD-KDS), and the DEP Physical Monitoring Plan, prepared by APTIM Environmental & Infrastructure (APTIM), approved by DEP on August 25, 2017 and included in **Appendix A**. Recent DEP permit history is summarized in **Table 1**.

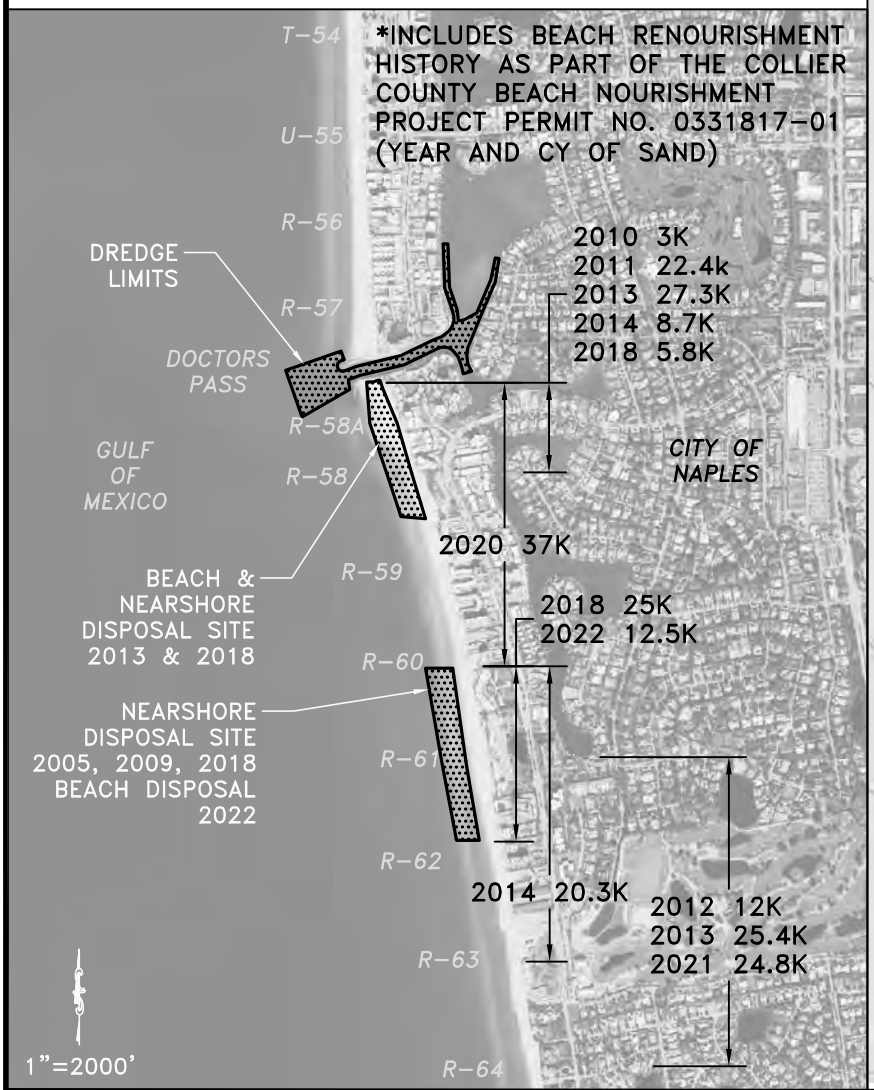
Table 1. Permit History for DEP Permit Number 0331817-001 (2015-2022)

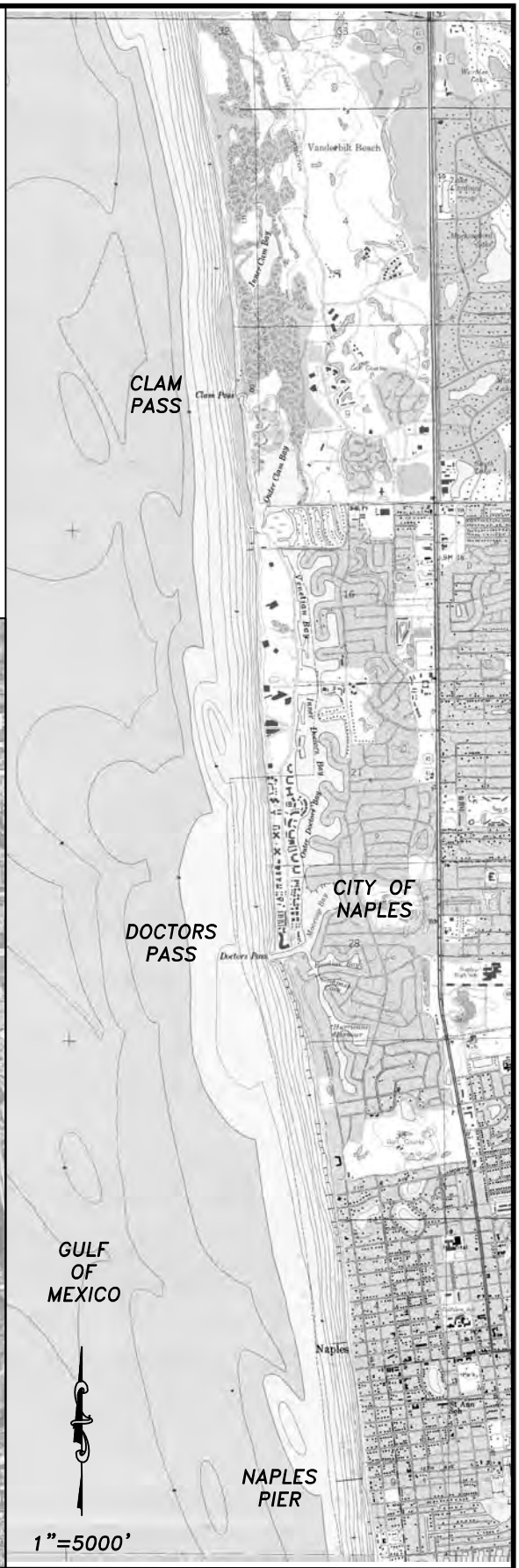
Modification Number	Date of Issuance	Description of Modification
001-JC	10/02/15	Combines Doctor Pass Dredging and Collier County Nourishment Project.
002-JN	10/23/15	Change Biological Monitoring Plan Approval Date.
003-JN	01/08/16	Authorizes Dune Maintenance Work.
004-JM	10/02/15	Adds Clam Pass Park to County Nourishment. Allows Beach Placement of Sand Dredged from Doctors Pass from R-58 to R-79.
005-EM	07/23/18	Modifies the Biological Monitoring Plan.

Doctors Pass is located in the City of Naples, Collier County, on the southwest coast of Florida as shown in **Figure 1**. In 1959-1960, improvements were made to the pass involving the dredging of a larger and deeper channel and the construction of rock jetties. In the years following these improvements, a variety of projects have been completed including maintenance dredging of the inlet, with placement on the downdrift beaches and nearshore, south of the pass. The most recent project, constructed in March and April 2022, included the dredging of 12,535 cubic yards of sand from Doctors Pass with disposal south of the inlet on the beach between DEP reference monuments R-60 and R-61.8, located approximately 3,000 feet south of the inlet. The project was constructed by Waterfront Property Services, LLC (Gator Dredging) on behalf of Collier County in coordination with APTIM, the Engineer of Record for the project as described in the *Completion and Certification Statement* as provided in **Appendix B**.



DATE OF PHOTOGRAPH: DECEMBER 2022.
PHOTOGRAPH PROPERTY OF
COLLIER COUNTY APPRAISER'S OFFICE.





HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	DOCTORS PASS MAINTENANCE DREDGING PROJECT LOCATION MAP		
	FOR: COLLIER COUNTY		
	DATE: 5/27/23	FILE: LOC MAP	SCALE: SHOWN
	JOB: 25-026	DATUM: NONE	FIGURE: 1

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HURRICANE IAN

Collier County was impacted by Hurricane Ian as a Category 4 major storm on September 28, 2022, causing significant damage to public infrastructure, private property, and public lands. The path of the storm along with intense hurricane force winds, slow forward speed (9 mph), and high storm surge subjected Collier County to large scale impacts ranging from the gulf beaches to the mainland.

Figure 2a shows the track of Hurricane Ian approaching and landfalling in southwest Florida. The unique combination of factors including wind speeds in excess of 155 mph, position, track and slow forward movement of 9 mph resulted in extreme storm surge levels along the coastal barrier islands of Collier County and southwest Florida. **Figure 2b** provides documented storm water levels from Wiggins Pass south to Marco Island. USGS deployed over 175 sensors between the Florida Keys and the Panhandle prior to Hurricane Ian's landfall. These sensors were deployed as part of a FEMA/National Hurricane Center (NHC) mission to document and better understand storm surge. The high storm surge produced by Hurricane Ian over a long duration from the slow-moving storm has resulted in significant morphologic changes including flattening of the beach and dune areas. For the most part, eroded sand has not left the system, but some was overwashed landward covering gulf front parcels and inland roadways with sand. It is typical for sand to also be eroded into the nearshore during early phases of the storm, and also when surge levels decline.

Figure 2a. Hurricane Ian Track

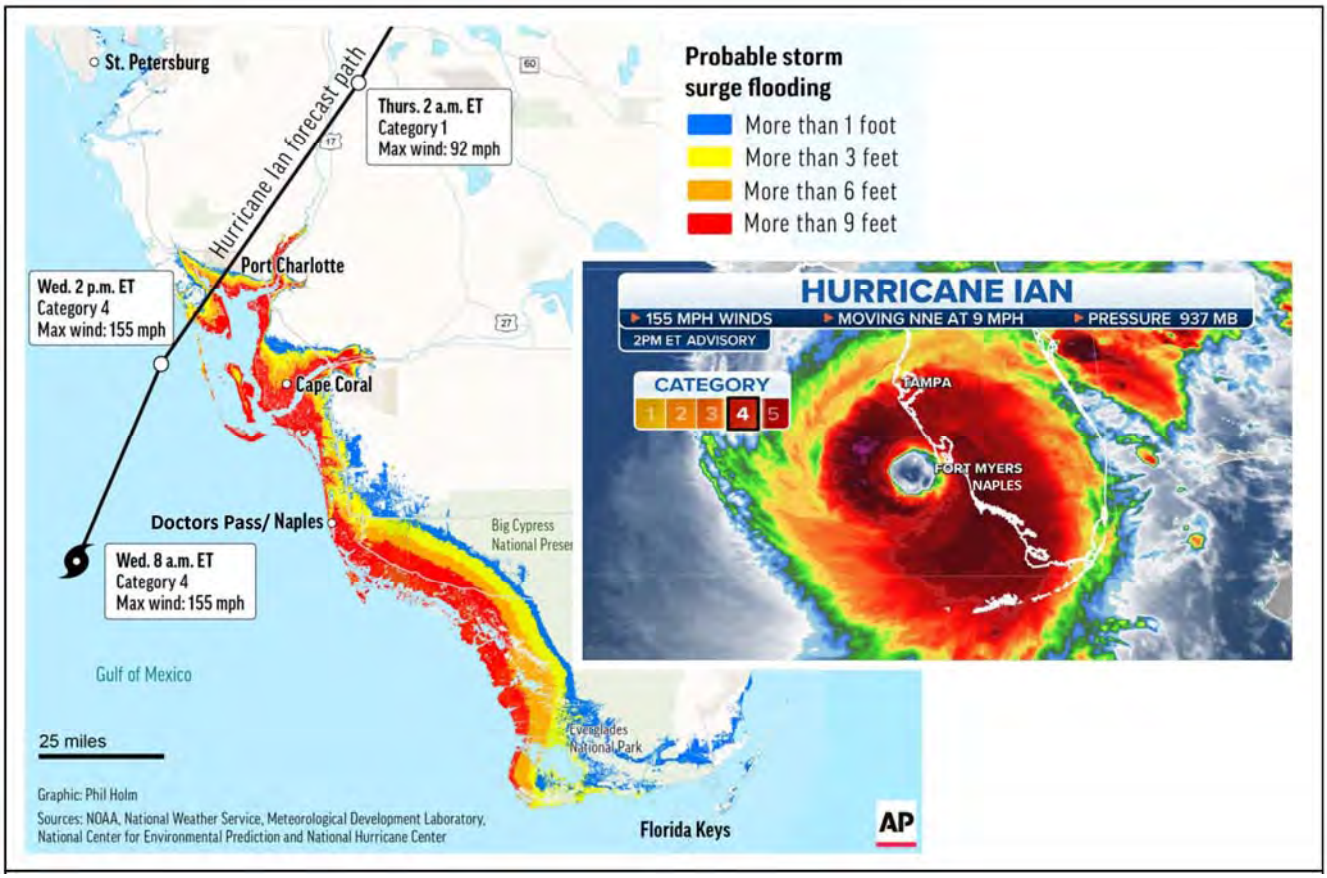


Figure 2b. Documented Surge Data

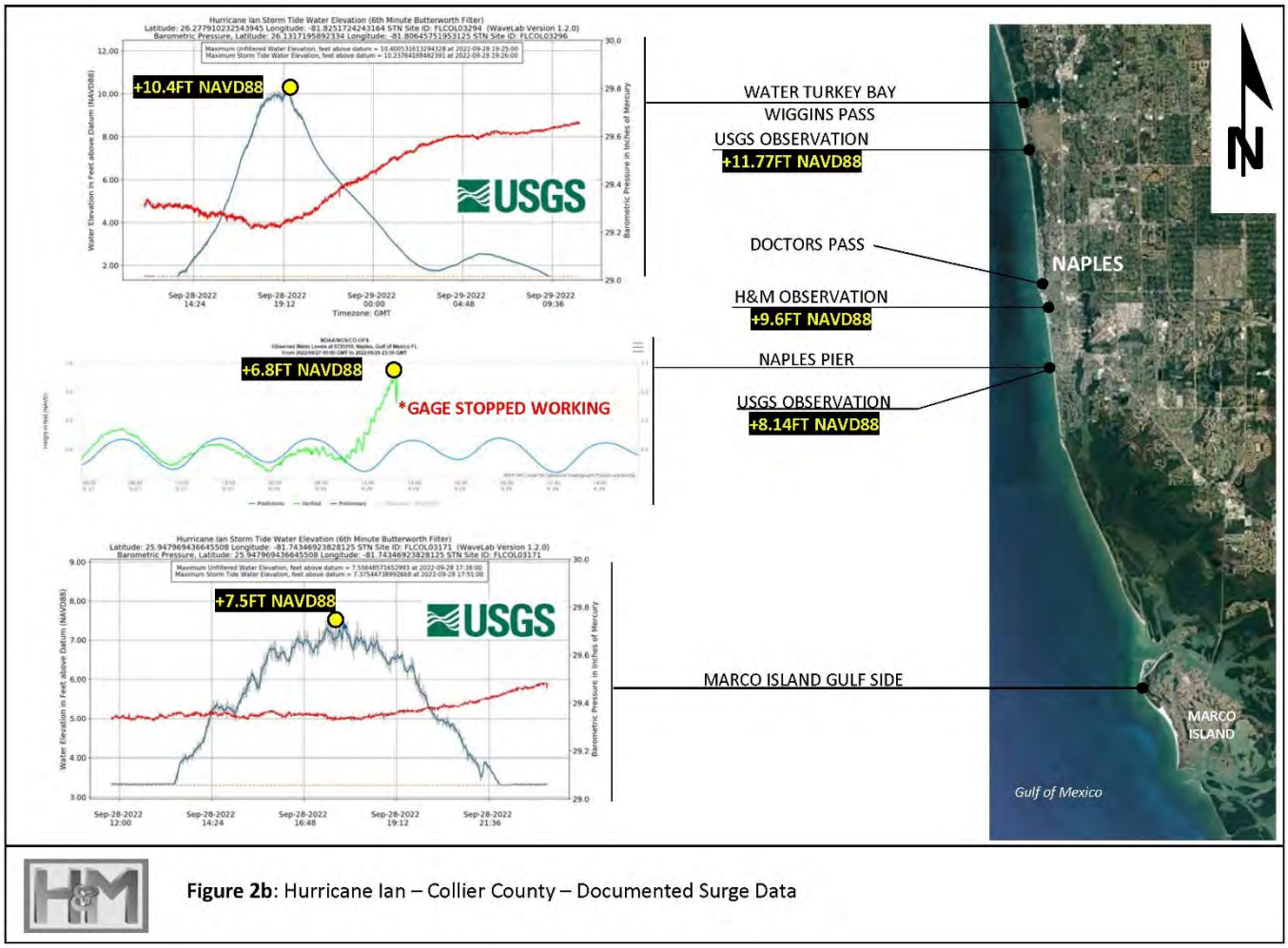
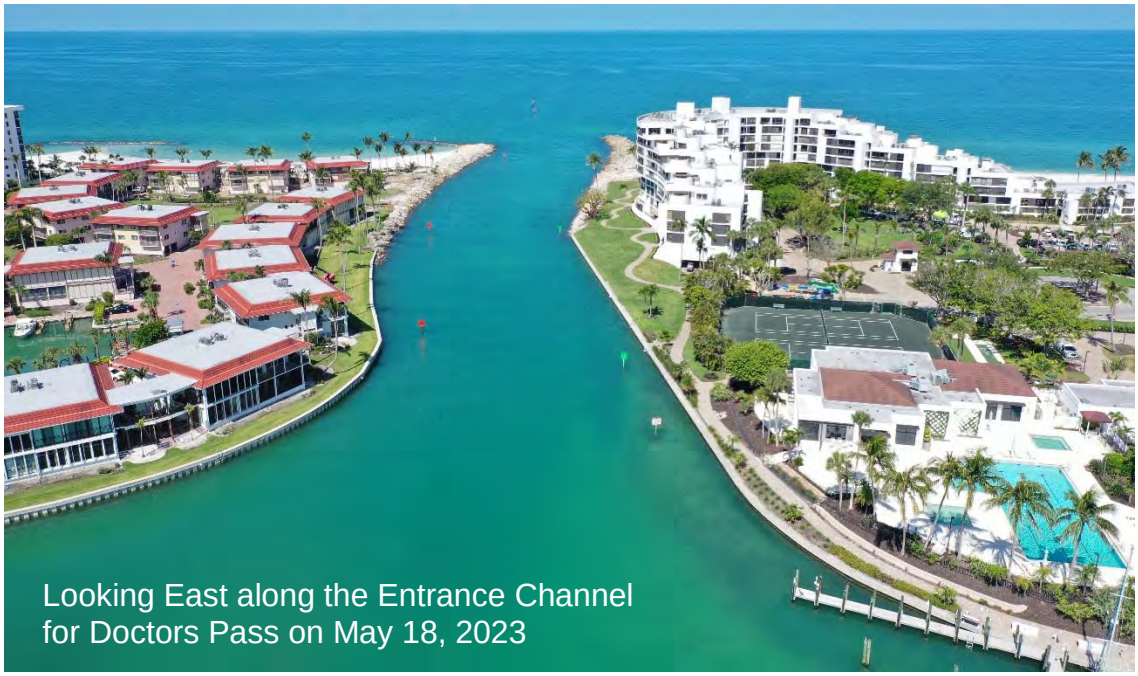


Figure 2b: Hurricane Ian – Collier County – Documented Surge Data



BACKGROUND

Project history is described as follows (major storm tracks from 2004 to 2017 are shown in **Appendix C**:

- 1960: Channel widened, and jetties constructed.
- 1966: Channel dredging and improvement of the jetties.
- 1974: Maintenance dredging begins on a two to four-year cycle with material placed south of the inlet.
- 1996: Construction of the Collier County Beach Restoration Project placing approximately 1.2 million cubic yards of sand between Monuments R-21 and R-79.
- 1996: Inlet sediment impoundment basin dredged, and the north jetty extended 75 feet.
- 1997: Inlet Management Plan adopted with a minimum average annual bypassing goal of 10,000 cubic yards.
- 2002: Approximately 9,000 cubic yards was dredged from the inlet and placed in the nearshore between monuments R-60 to R-62.
- 2004-August: Hurricane Charley impacted the area on August 13 with landfall approximately 20 miles north of Doctors Pass.
- 2005-October: The center of Hurricane Wilma passed south of the project area, with landfall approximately 30 miles south of Doctors Pass.
- 2005: Collier Beach Restoration Project placed 667,600 cubic yards of sand from R-21 to R-79.
- 2005-November: Approximately 53,600 cubic yards dredged and placed in the nearshore approximately a half mile south of the inlet near Lowdermilk Park between DEP reference monuments R-60 and R-62.
- 2008-August: Tropical Storm Fay passed to the south.
- 2009-April: Approximately 33,000 cubic yards of sand were dredged and placed in the nearshore between DEP reference monuments R-60 and R-62.
- 2010: The Emergency Truck Haul Project for Naples Beach distributed approximately 3,000 cubic yards of sand from monument R-58A to R-58.
- 2011-April: Over 3,000 tons of armor stone were added to the north jetty to widen the landward 160 feet of the jetty by 5 feet, increase the height of the seaward 240 feet to +6.0 feet NAVD, create a 2:1 (H:V) slope along the south side, and increase the seaward extent of the footprint by 4 feet on the seaward end. The beach immediately south of the pass from reference monument R-58 north to the south jetty was nourished with over 22,000 cubic yards of truck hauled sand.
- 2012-June: Tropical Storm Debby impacted the west coast of Florida.
- 2012: The Emergency Truck Haul Project for Naples Beach distributed approximately 12,000 cubic yards of sand from monument R-61 to R-63.5.
- 2013-October: Dredging of approximately 43,400 cubic yards of sand placed south of the inlet along the beach from the jetty to DEP reference monument R-58.
- 2013-December: The Collier Beach Renourishment Project distributed approximately 66,000 cubic yards of sand from monument R-58A to R-69 with a segmented fill template.
- 2014-December: The Collier Beach Renourishment Project distributed approximately 52,300 cubic yards of sand from monument R-58A to R-78 with a segmented fill template.
- 2015-October. Permit 0331817-001-JC issued combining the Doctors Pass Dredging with the Collier County Nourishment project.
- 2016-January: The City of Naples experienced a meteotsunami[1] in January 2016. A graph of the observed water levels at the Naples Tide Station on January 17, 2016 documenting the meteostunami is included in **Appendix C**.

[1] Meteotsunamis have the characteristics similar to earthquake-generated tsunamis but are caused by air pressure disturbances often associated with fast moving weather systems, such as squall lines. These disturbances can generate waves in the ocean that travel at the same speed as the overhead weather system. Development of a meteotsunami depends on several factors such as the intensity, direction, and speed of the disturbance as it travels over a water body with a depth that enhances wave magnification. NOAA 2015. (As with a tsunamis and wind generated waves, wavelength and celerity decrease as it moves into shallow water, increasing wave steepness and causing the wave to break.)

- 2017-September: Hurricane Irma impacted Collier County as the eye passed over the County on September 10 as a Category 3 major hurricane. The storm track is documented in **Appendix C** including brief descriptions of major storms impacting Collier County beach since 2004.
- 2018-June: The construction of the erosion control structures south of the jetty and rehabilitation of the south jetty shown in the aerial photograph below. The structures consisted of a jetty spur, breakwater and detached permeable groin as well as a rehabilitated groin at the south end of the project area near monument R-58.
- 2018-June/July: Pre-Construction survey for the Doctors Pass dredging project was conducted.
- 2018-September: Completion of the 2018 Doctors Pass Dredging project with a pay quantity of 37,262 cubic yards[2] based on the amount of sand dredged from the inlet. The sand was subsequently placed in nearshore disposal areas south of the inlet.
- 2018-December: The City of Naples experienced a meteotsunami. A graph of the observed water levels at the Naples Tide Station on December 20, 2018 documenting the meteotsunami is included in **Appendix C** along with the storm tracks of the major storms impacting Collier County since 2004.
- 2019-December: Park Shore beach, north of the inlet, was nourished with approximately 130,000 cubic yards of truck hauled sand from R-42 south to R-54.
- 2020-March: The Collier County 2020 Physical Monitoring Survey was conducted for FDEP Range Monuments R-10 to R-84 by SDI.
- 2020-April: The 18-month monitoring survey for the Doctors Pass dredging project was conducted by SDI.
- 2020-December: The beach from the south jetty south to R-60 was nourished with approximately 37,400 cubic yard of truck hauled sand in November and December. Tropical Storm Eta impacted the area during the construction in November.
- 2021-January: The Collier Beach Nourishment Project Monitoring survey was conducted.
- 2021-February: The 2.5-year post-dredge monitoring survey of the inlet for the Doctors Pass dredging project was conducted by SDI.
- 2022 – From March to April Doctors Pass was dredged placing sand on the beach south of the inlet near Lowdermilk Park.
- 2022 – The post-construction monitoring survey was conducted in April.
- 2022 – Hurricane Ian impacted Collier County as the eye passed north of the County on September 28 as a Category 5 major hurricane**.**
- 2022 – The post-Ian monitoring survey was conducted in November and December.

The beach renourishment history for the *Collier County Beach Nourishment Project* for the reach south of Doctors Pass is summarized in **Figure 1** overlaid on the rectified aerial image.

[2] Pay quantity (2018) based on the *As-Built Certification* by APTIM.

DESIGN PLAN

The permitted dredge template includes the sections listed below in **Figure 4** with the associated dredge depth, and the sections are shown overlaid on an aerial image. The 2022 dredge template included only the Settling Basin and Entrance Channel; the Turning Basin and East/West Channels were not dredged as part of the 2022 project.

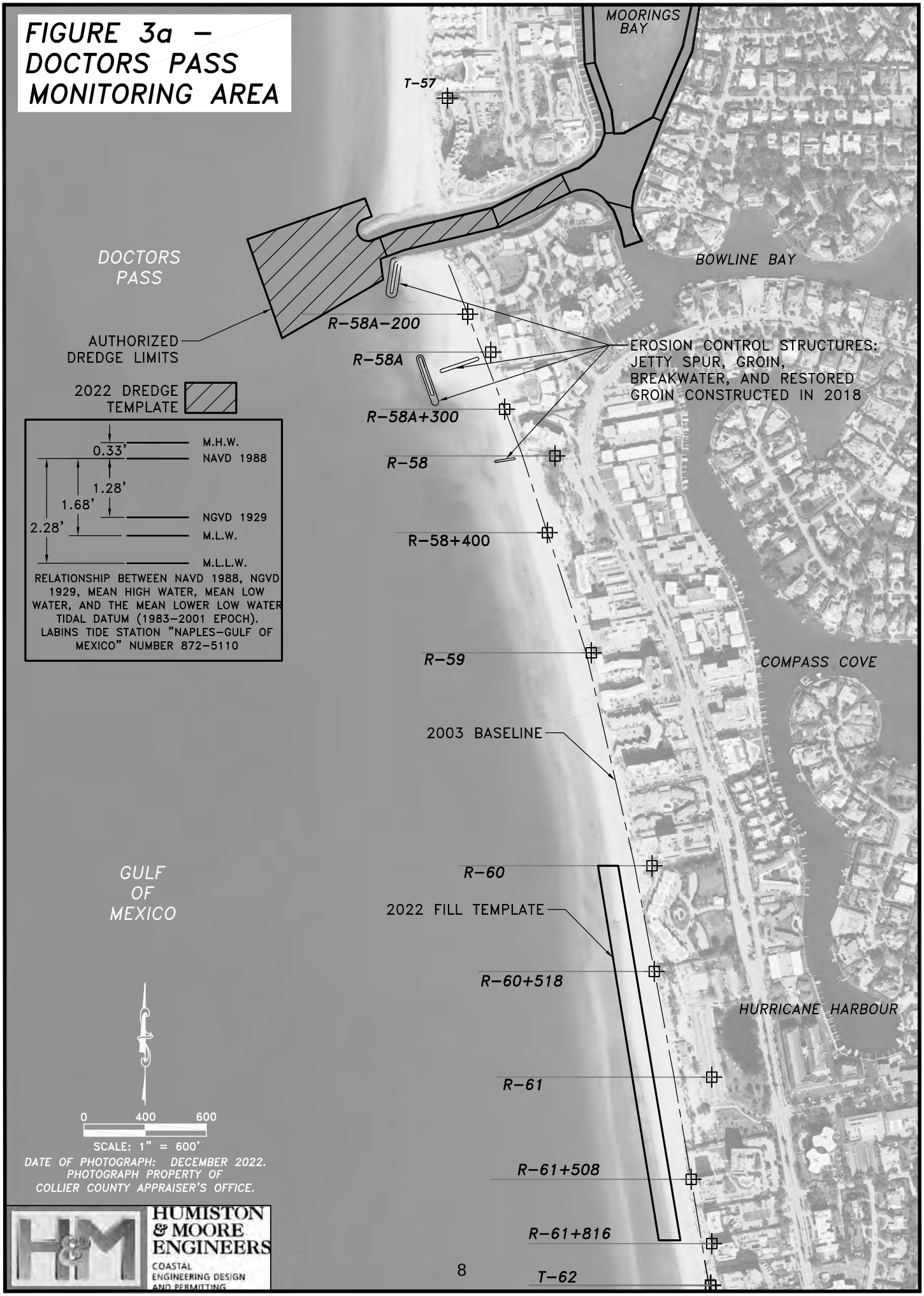
Figure 4: Dredge Template Limits, Section Names, and Permitted Dredge Depth

Dredge Template Section	*Permitted Dredge Depth (Feet NGVD)*	*(Feet NAVD)*
***Settling Basin**	*-14.0*	*-15.3*
***Entrance Channel - West**	*-9.0*	*-10.3*
***Entrance Channel - East**	*-8.0*	*-9.3*
***Turning Basin**	*-8.0*	*-9.3*
***West Channel - South**	*-8.0*	*-9.3*
***West Channel - North**	*-7.0*	*-8.3*
***East Channel**	*-7.0*	*-8.3*
***South Channel**	*-7.0*	*-8.3*

*Settling Basin is permitted with a one-foot over-dredge allowance to -16.3 NAVD.

The monitoring area shown in **Figures 3a and 3b** includes DEP reference monuments R-58A-200 to T-62 on the south side of Doctors Pass and 77 Inlet Stations for the Settling Basin, Turning Basin, Entrance Channel, as well as the West and East Channels. The sand dredged from the permitted template in 2022 was placed between R-60 and R-61+800 south of the inlet, as described in the *Completion and Certification Statement* enclosed as **Appendix B**. Additionally, **Figures 3a and 3b** show the permitted limits of the disposal areas for the 2022 project.

FIGURE 3a – DOCTORS PASS MONITORING AREA



DATE OF PHOTOGRAPH: DECEMBER 2022.
PHOTOGRAPH PROPERTY OF COLLIER COUNTY APPRAISER'S OFFICE.

HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

FIGURE 3b: DREDGE LIMITS & CROSS SECTION MONITORING STATIONS

CONTROL INFORMATION							
STATION	NORTHING (FEET)	EASTING (FEET)	AZIMUTH (DEGREES)	STATION	NORTHING (FEET)	EASTING (FEET)	AZIMUTH (DEGREES)
EC0+00	669515.4	388244.3	161	TB1	670216.3	390061.1	202
EC1+00	669548.1	388338.8	161	TB2	670238.8	390005.5	202
EC2+00	669580.8	388433.3	161	TB3	670261.3	389949.8	202
EC3+00	669613.5	388527.8	161	TB4	670283.7	389894.2	202
EC4+00	669646.2	388622.3	161	E11+63	670368.4	390186.1	113
EC5+00	669678.9	388716.8	161	E12+39	670438.4	390216.3	113
EC5+83	669706.1	388795.6	160	E13+16	670508.5	390246.4	113
EC6+46	669728.2	388854.1	159	E14+11	670595.6	390284.5	114
EC7+08	669750.3	388912.7	163	E15+06	670682.7	390322.6	106
EC8+00	669771.8	389001.6	166	E15+67	670743.2	390332.4	99
EC9+00	669795.2	389098.8	166	E16+29	670803.7	390342.2	99
EC10+00	669818.7	389196.0	166	E16+90	670864.3	390351.9	99
EC11+00	669842.2	389293.3	166	E17+51	670924.8	390361.7	99
EC11+86	669862.3	389376.8	160	W0+00	670276.7	389935.3	85
EC12+43	669887.2	389428.1	154	W0+52	670328.8	389930.9	83
EC13+00	669912.0	389479.5	154	W1+06	670382.0	389921.7	75
EC14+00	669955.5	389569.5	154	W1+83	670454.8	389896.2	71
EC15+00	669999.1	389659.5	154	W2+60	670527.5	389870.8	71
EC15+70	670029.6	389722.6	154	W3+38	670600.3	389845.4	72
E0+00	669292.0	390238.0	64	W3+56	670617.9	389840.1	80
E0+34	669323.0	390223.0	68	W4+25	670686.9	389837.5	88
E0+72	669359.0	390211.0	77	W5+25	670786.9	389833.8	88
E1+24	669410.0	390204.0	79	W6+25	670886.8	389830.0	88
E1+41	669426.5	390199.8	76	W7+25	670986.7	389826.3	88
E1+89	669473.0	390188.0	72	W8+12	671074.0	389823.0	89
E2+36	669517.0	390171.0	63	W9+10	671171.7	389822.2	90
E3+24	669591.0	390123.5	57	W10+08	671269.5	389821.5	90
E4+12	669665.0	390076.0	64	W11+06	671367.2	389820.7	90
E4+85	669733.9	390052.3	71	W12+03	671465.0	389820.0	90
E5+71	669815.5	390024.0	73	W12+71	671532.5	389820.0	90
E6+59	669900.3	390001.0	85	W13+38	671600.0	389820.0	94
E6+78	669918.9	390002.6	105	W14+26	671687.0	389828.0	95
E7+64	669997.7	390038.7	113	W15+13	671774.0	389836.0	95
E8+56	670082.7	390072.5	112	W16+00	671861.0	389844.0	94
E9+10	670133.3	390092.6	112	W16+88	671948.5	389848.8	93
E9+75	670193.8	390116.7	112	W17+76	672036.0	389853.5	93
E10+10	670226.2	390129.6	112	W18+63	672123.5	389858.3	93
E10+51	670264.1	390144.7	112	W19+51	672211.0	389863.0	93
E11+35	670342.4	390175.8	112				

2022 DREDGE TEMPLATE

DREDGE LIMITS

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DATE OF PHOTOGRAPH: DECEMBER 2022. PHOTOGRAPH PROPERTY OF COLLIER COUNTY APPRAISER'S OFFICE.

R-58A

0 150 300
SCALE: 1" = 300'

MONITORING SURVEY DATA

This report analyzes the post-Ian, or the 6-month post-construction survey in comparison to the immediate post-construction survey for the inlet and beaches as well as changes relative to the pre-construction survey. The surveyor's certification is attached as **Appendix D-1,** the inlet profiles are provided in **Appendix D-2**, and the beach profiles in **Appendix D-3**. The analysis in this monitoring report is based on data from the surveys listed below conducted for the scope of survey (or portion of) shown in **Figures 3a and 3b**:

- Pre-construction survey conducted on March 29, 2022 by Park Coastal Surveying, LLC (Park) on behalf of APTIM.
- Post-construction survey conducted on April 22, 2022 by Park on behalf of APTIM.
- Post-Ian Monitoring Survey conducted from November 2 to December 9, 2022 by APTIM Environmental and Infrastructure, LLC.[3]

The scope of the pre and post construction surveys for the 2022 project was limited to the Settling Basin and Entrance Channel, as no dredging occurred in the Turning Basin, West or East Channel. Below is the most recent survey of the Turning Basin, West and East Channel since the post-Ian survey; it is shown on the inlet profiles included in **Appendix D-2** for comparison purposes:

- 2.5 year post-construction survey conducted in February 2021 by SDI.

Also shown on the inlet profiles provided in **Appendix D-2,** two surveys to provide information on the location of rock within the dredge template limits:

- Post-construction survey conducted in October 2013 by SDI.
- Post-Construction survey conducted in September 2018 by Terraquatic, Inc. (TAQ).

INLET SURVEY ANALYSIS

Figure 3b shows the dredge limits, the location of the inlet survey stations, and the associated positioning control information overlaid on a December 2022 aerial image. The associated inlet cross-sections for these survey stations are shown in **Appendix D-2** and delineated by section in **Table 2**.

Table 2. Monitoring Area – Station Range

Dredge Template Section	Station Range			Permitted Dredge Depth (Feet NAVD)
***Settling Basin**	EC0+00	to	EC6+17	-15.3
Entrance Channel - West	EC6+17	to	EC11+86	-10.3
Entrance Channel - East	EC11+86	to	EC15+70	-9.3
****Turning Basin**	E6+78	to	E11+35	-9.3
West Channel - South	W0+00	to	W3+56	-9.3
West Channel - North	W3+56	to	W8+12	-8.3
West Channel	W8+12	to	W19+51	No Dredging
East Channel	E11+35	to	E17+51	-8.3
South Channel	E0+00	to	E4+12	No Dredging
South Channel	E4+85	to	E6+78	-8.3

*Settling Basin is permitted with a one-foot over-dredge allowance to -16.3 NAVD.
**Turning Basin includes Stations TB-1 to TB-4

[3] This monitoring survey was conducted on behalf of Collier County to document the changes along the coast due to Hurricane Ian ranging from Reference Monument R-1 south to R-148 on Marco Island including Wiggins and Doctors Pass. This survey did not include intermediate monuments.

A bathymetric contour map showing the results of the March 2022 pre-construction survey is shown in **Figure 5a** while the bathymetric contour map showing the results of the April and November 2022 post-construction monitoring surveys, including the survey station locations and dredge limits, are shown in **Figures 5b and 5c**. Darker shades of blue indicate greater water depths ranging to approximately -16 NAVD. 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 shown in feet are rounded to the nearest whole number.

Looking North along the West (left) and East (right) Channels of the Doctors Pass Dredging Complex on May 18, 2023

Lowdermilk Park on May 18, 2023

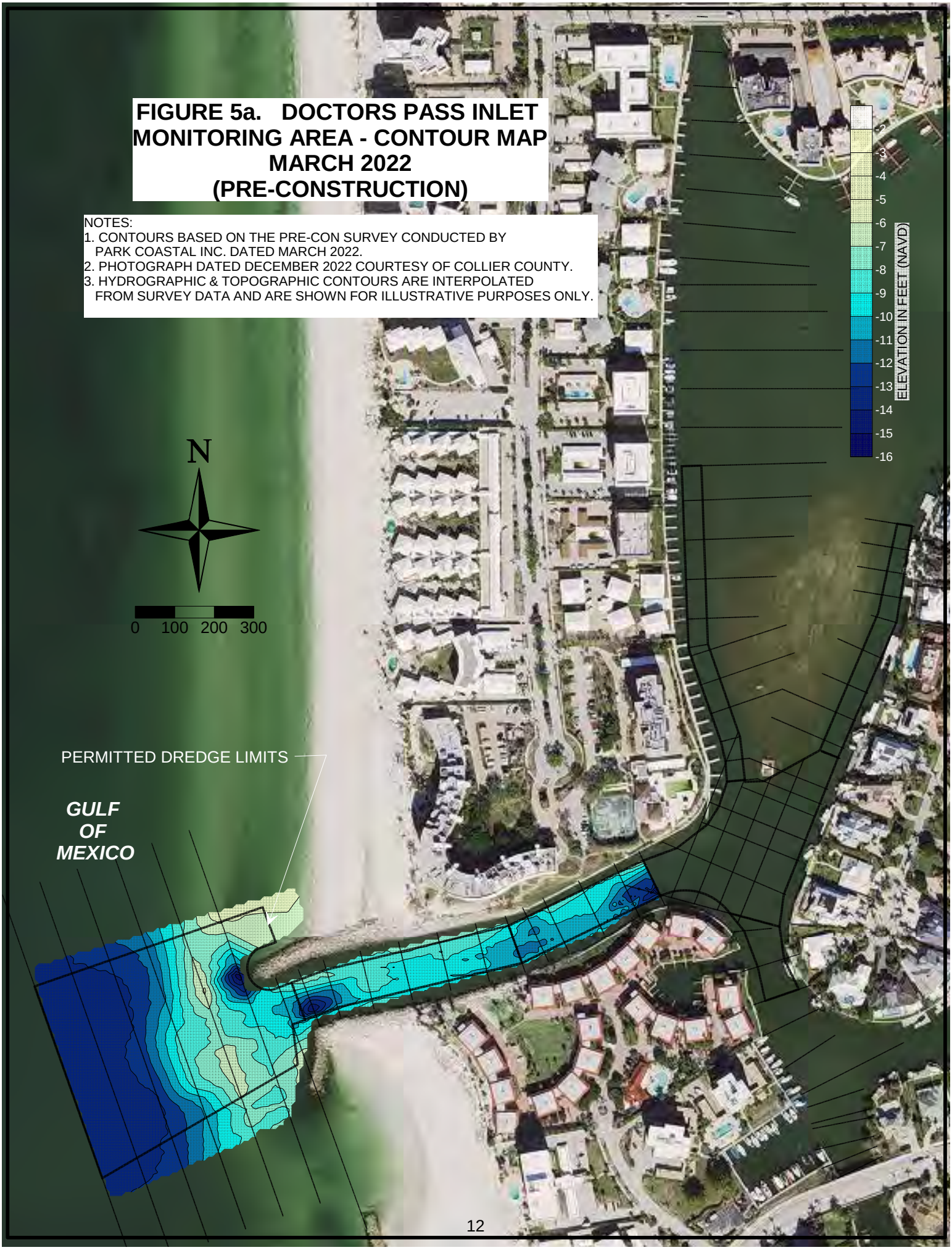
FIGURE 5a. DOCTORS PASS INLET MONITORING AREA - CONTOUR MAP MARCH 2022 (PRE-CONSTRUCTION)
NOTES:
1. CONTOURS BASED ON THE PRE-CON SURVEY CONDUCTED BY PARK COASTAL INC. DATED MARCH 2022.
2. PHOTOGRAPH DATED DECEMBER 2022 COURTESY OF COLLIER COUNTY.
3. HYDROGRAPHIC & TOPOGRAPHIC CONTOURS ARE INTERPOLATED FROM SURVEY DATA AND ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.
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-3
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-6
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-10
-11
-12
-13
-14
-15
-16
ELEVATION IN FEET (NAVD)
N
0 100 200 300
PERMITTED DREDGE LIMITS
GULF OF MEXICO

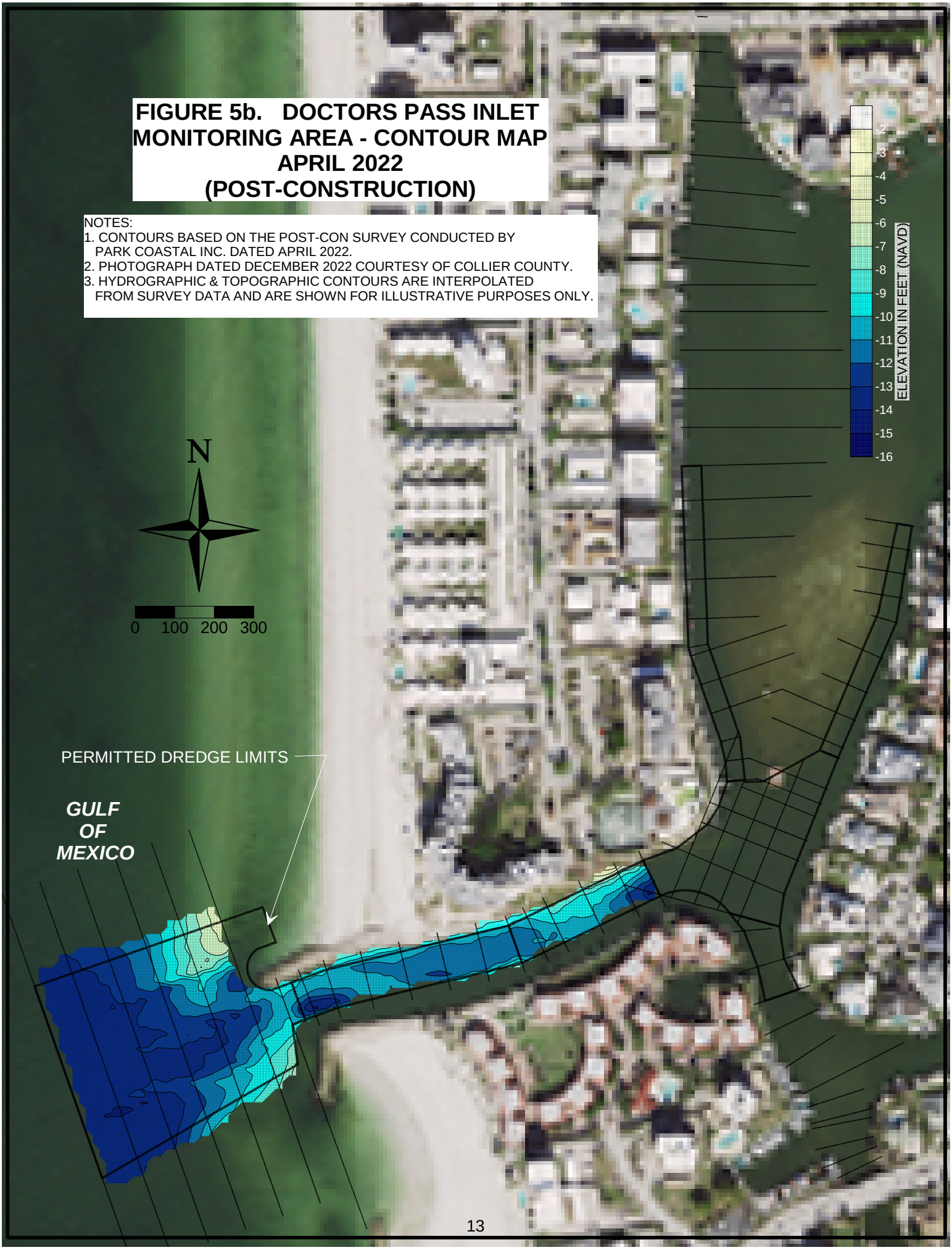
FIGURE 5b. DOCTORS PASS INLET MONITORING AREA - CONTOUR MAP APRIL 2022 (POST-CONSTRUCTION)
NOTES:
1. CONTOURS BASED ON THE POST-CON SURVEY CONDUCTED BY PARK COASTAL INC. DATED APRIL 2022.
2. PHOTOGRAPH DATED DECEMBER 2022 COURTESY OF COLLIER COUNTY.
3. HYDROGRAPHIC & TOPOGRAPHIC CONTOURS ARE INTERPOLATED FROM SURVEY DATA AND ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.
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-15
-16
ELEVATION IN FEET (NAVD)
N
0 100 200 300
PERMITTED DREDGE LIMITS
GULF OF MEXICO


FIGURE 5c. DOCTORS PASS INLET MONITORING AREA - CONTOUR MAP NOVEMBER 2022 (POST-IAN)
NOTES:
1. CONTOURS BASED ON THE POST-IAN MONITORING SURVEY CONDUCTED BY APTIM DATED NOVEMBER 2022.
2. PHOTOGRAPH DATED NOVEMBER 2019 COURTESY OF COLLIER COUNTY.
3. HYDROGRAPHIC & TOPOGRAPHIC CONTOURS ARE INTERPOLATED FROM SURVEY DATA AND ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
ELEVATION IN FEET (NAVD)
N
0 100 200 300
PERMITTED DREDGE LIMITS
GULF OF MEXICO

In order to interpret monitoring data to determine the advisability of maintenance dredging, it is important to understand there are areas within the channel template having never been dredged down to the permitted depth because of the presence of rock in those areas. This report utilizes the 2013, 2018 and 2022 project post-construction surveys to estimate the amount of rock in each section, in order to estimate the amount of material a dredging contractor could reasonably be expected to remove without dredging rock. Due to the uneven surface, or horizon of rock, there are practical limits to a residual amount of material left on top of rock after dredging. Furthermore, because of these conditions there will be some variation to the residual quantity of material, including the rock as determined from successive post-construction surveys.

The total undredged volume of material (rock and sand) for each template section is shown in **Table 3a**. Columns C2 thru C4 show the undredged volume for the October 2013, September 2018, and April 2022 post-construction surveys. Comparing the post-construction volumes provides an indication of the volume of rock contained in each section: The lowest volume for each station within the template represents the estimated amount of rock and is shown in column C5. There are approximately 25,000 cubic yards (24,790) of rock located within the template limits; furthermore, over 96% (23,810/24,790) of the rock within the template is in the Settling Basin.

Table 3a. Doctors Pass Inlet – Dredge Template Rock Volume (CY)

Column C1	C2	C3	C4	C5
Dredge Template Section	**Post-Con Volume 10/2013**	**Post-Con Volume 9/2018**	**Post-Con Volume 4/2022**	**Rock Volume 2013-2022**
Settling Basin	23,810	30,640	36,090	**23,810**
Ent. Ch. - West	630	530	50	50
Ent. Ch. - East	0	30	160	0
Turning Basin	640	960		640
West Ch. - South	250	370	No	250
West Ch. - North	230	30	Survey	30
East Channel	220	10	Data	10
South Channel	350	0		0
Total:	26,130	32,570	36,300	**24,790**

Columns C2 thru C4 represent the undredged volume measured by the 2013, 2018, and 2022 post-construction surveys. The lowest value between the surveys, shown in column C5, represents the approximate upper surface of rock within the dredge template.

The total undredged volume of material (rock and sand) for each template section is shown again in **Table 3b**. Columns C3 and C4 show the undredged volume for the April 2022 post-construction survey, and the November 2022 post-Ian surveys. Column C2 in **Table 3b** is the volume of rock from column C5 in **Table 3a**. The volume of sand available for dredging shown in **Table 3b** is the template volume (shown in columns C3 and C4) less the volume of rock (shown in column C2). The volume of sand available for dredging in April 2022 and November 2022 is shown in final two columns of **Table 3b**.

There were approximately 12,500 cubic yards (12,440) of sand available within the template above the rock in April 2022. This undredged material can be seen near the Settling Basin rock in Stations EC0+00 east to EC5+83 provided in **Appendix D-2**. It should be noted: the rock surface is uneven, and it may not be possible to remove all the sand from over this uneven surface. There were approximately 25,500 cubic yards (25,410) of sand available within the template above the rock in November 2022. The majority of available sand is located within the Settling Basin, Entrance Channel - West, Turning Basin, and West Channel - South; totaling approximately 24,580 cubic yards (16,830 + 720 + 5,820 + 1,210) of sand, representing 97% of the 25,410 cubic yards available.

Table 3b. Doctors Pass Inlet – Dredge Template and Available Sand Volume (CY)

Column C1	C2	C3	C4	C3-C2	C4-C2
Dredge Template Section	**Rock Volume 2013-2022**	**Template Volume (CY) Post-Con 4/2022**	**6-Month 11/2022**	**Available Volume (CY) Post-Con 4/2022**	**6-Month 11/2022**
Settling Basin	23,810	36,090	40,640	12,280	**16,830**
Ent. Ch. - West	50	50	770	0	**720**
Ent. Ch. - East	0	160	20	160	20
Turning Basin	640		6,460		**5,820**
West Ch. - South	250	No	1,460	No	**1,210**
West Ch. - North	30	Survey	320	Survey	290
East Channel	10	Data	440	Data	430
South Channel	0		90		90
Total:	24,790	36,300	50,200	**12,440**	**25,410**

The values in the final two columns represent the difference between total available quantity calculated from survey data shown in columns C3-C4, and the rock volumes estimated from the 2013, 2018 and 2022 post-construction dredging surveys shown in column C2. This is the approximate amount of sand to potentially be removed without removing rock.

The volumes shown in **Tables 3a and 3b** represent the actual volume of material within the limits of the dredge template including the over-dredge template. These volumes do not necessarily represent pay or dredged volumes as in the case of a "box cut". A "box cut" allows the contractor to dredge the bottom of the channel depth horizontally beyond the toe of the side-slope shown on the plans, essentially removing material from outside the channel template at the base of the channel, provided there is up-slope material able to fall, or slough off the top of the slope and fall into the area dredged beyond and outside of the toe of the slope. The over-dredge template allows the contractor to potentially dredge the entire design template by removing sand just beyond and beneath the design template in lieu of attempting to dredge along a side slope. Using a box cut is commonly applied in the dredging industry for this type of work to maximize the pay potential for the contractor, and to accommodate for dredging equipment logistics. As mentioned previously, some of the undredged material consists of rock and will not be removed.

The volume change from the April 2022 post-construction survey to the November 2022 post-Ian monitoring survey is shown in **Table 3c**. The total volume change of Doctors Pass Inlet from April 2022 to November 2022 was 5,280 cubic yards over the roughly 6-month span between surveys. The rate of volumetric change of the inlet is approximately 10,500 cubic yards of sand per year (5,280/0.5) consistent with long-term shoaling at the inlet.

Table 3c. Doctors Pass Inlet – Volume Change within the Dredge Template

Dredge Template Section	**Volume Change (CY) 4/2022-11/2022**
Settling Basin	4,550
Entrance Channel - West	730
Entrance Channel - East	
Turning Basin	Not Dredged in 2022 (No 4/2022 Survey Data)
West Channel - South	
West Channel - North	
East Channel	
South Channel	
Total:	**5,280**

Figure 6a is a contour change map illustrating volumetric gain from sand accumulation shown ranging from dark blue to brown, within the Settling Basin and Entrance Channel (extent of the post-construction survey) for the most recent monitoring period from April 2022 to November 2022. (Note: elevation changes of less than one foot are not shown). The largest changes in elevation occurred in the Settling Basin southwest of the north jetty. Changes within the Entrance Channel show accumulation at the west end and loss of sand at the east end near the Turning Basin. The accumulation shown at the west end of the Entrance Channel indicates elevation change since the post-construction condition and does not necessarily represent material within the dredge template as can be seen on the profiles provided in **Appendix D-2**. Due to the availability of survey data for the Turning Basin, east and West Channel, **Figure 6b**, another contour change map, shows changes from the previous monitoring survey in February 2021 to November 2022. This portion of the monitoring area was not dredged in 2022. Although not significant, accumulation can be seen at the northern portion of the Turning Basin and in the northern portion of the East Channel.


Looking East at the Turning Basin of the Doctors Pass Dredging Complex on May 18, 2023

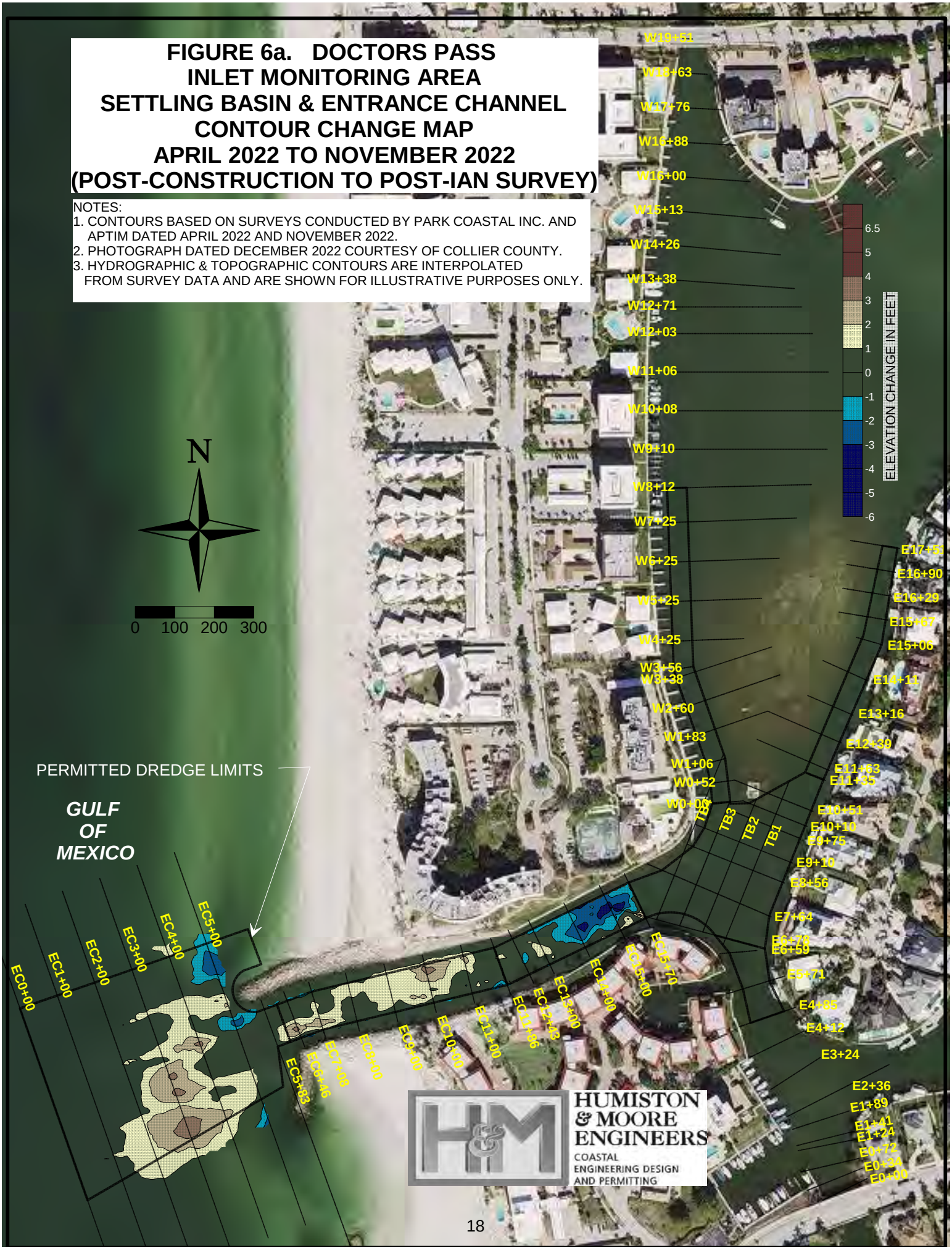


FIGURE 6a. DOCTORS PASS
INLET MONITORING AREA
SETTLING BASIN & ENTRANCE CHANNEL
CONTOUR CHANGE MAP
APRIL 2022 TO NOVEMBER 2022
(POST-CONSTRUCTION TO POST-IAN SURVEY)
NOTES:
1. CONTOURS BASED ON SURVEYS CONDUCTED BY PARK COASTAL INC. AND APTIM DATED APRIL 2022 AND NOVEMBER 2022.
2. PHOTOGRAPH DATED DECEMBER 2022 COURTESY OF COLLIER COUNTY.
3. HYDROGRAPHIC & TOPOGRAPHIC CONTOURS ARE INTERPOLATED FROM SURVEY DATA AND ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.
N
0 100 200 300
ELEVATION CHANGE IN FEET
6.5
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
PERMITTED DREDGE LIMITS
GULF OF MEXICO
W19+51
W18+63
W17+76
W16+88
W16+00
W15+13
W14+26
W13+38
W12+71
W12+03
W11+06
W10+08
W9+10
W8+12
W7+25
W6+25
W5+25
W4+25
W3+56
W3+38
W2+60
W1+83
W1+06
W0+52
W0+00
TB4
TB3
TB2
TB1
E17+51
E16+90
E16+29
E15+67
E15+06
E14+11
E13+16
E12+30
E11+83
E11+35
E10+51
E10+10
E9+75
E9+10
E8+56
E7+64
E6+78
E6+59
E5+71
E4+85
E4+12
E3+24
E2+36
E1+89
E1+41
E1+24
E0+72
E0+36
E0+00
EC0+00
EC1+00
EC2+00
EC3+00
EC4+00
EC5+00
EC5+83
EC6+46
EC7+08
EC8+00
EC9+00
EC10+00
EC11+00
EC11+86
EC12+43
EC13+00
EC14+00
EC15+00
EC15+79
HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

FIGURE 6b. DOCTORS PASS INLET MONITORING AREA TURNING BASIN, EAST & WEST CHANNEL CONTOUR CHANGE MAP FEBRUARY 2021 TO NOVEMBER 2022 (PRE-CONSTRUCTION TO POST-IAN SURVEY)

NOTES:
1. CONTOURS BASED ON SURVEYS CONDUCTED BY SDI AND APTIM DATED FEBRUARY 2021 AND NOVEMBER 2022.
2. PHOTOGRAPH DATED DECEMBER 2022 COURTESY OF COLLIER COUNTY.
3. HYDROGRAPHIC & TOPOGRAPHIC CONTOURS ARE INTERPOLATED FROM SURVEY DATA AND ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.

Figure 7 depicts the location of a centerline profile through the Settling Basin and Entrance Channel in plan view and the associated cross-section. The rectified image shown in **Figure 7**, acquired on December 2022, shows the approximate location of shoals near the mouth of the inlet, outlined for clarity. The March 2022 pre-construction, April 2022 post-construction, and the November 2022 post-Ian monitoring survey profiles are shown on the cross-section as well as the 2013 and 2018 post-construction profiles to indicate the location of rock. This profile extends from the west edge of the Settling Basin to the northeast end of the Entrance Channel. Accumulation of material is evident in the Settling Basin from Station EC3+00 to EC4+00, and the scouring effects of Hurricane Ian are visible at the east end of the Entrance Channel.

Figures 7. Settling Basin and Entrance Channel Cross Section

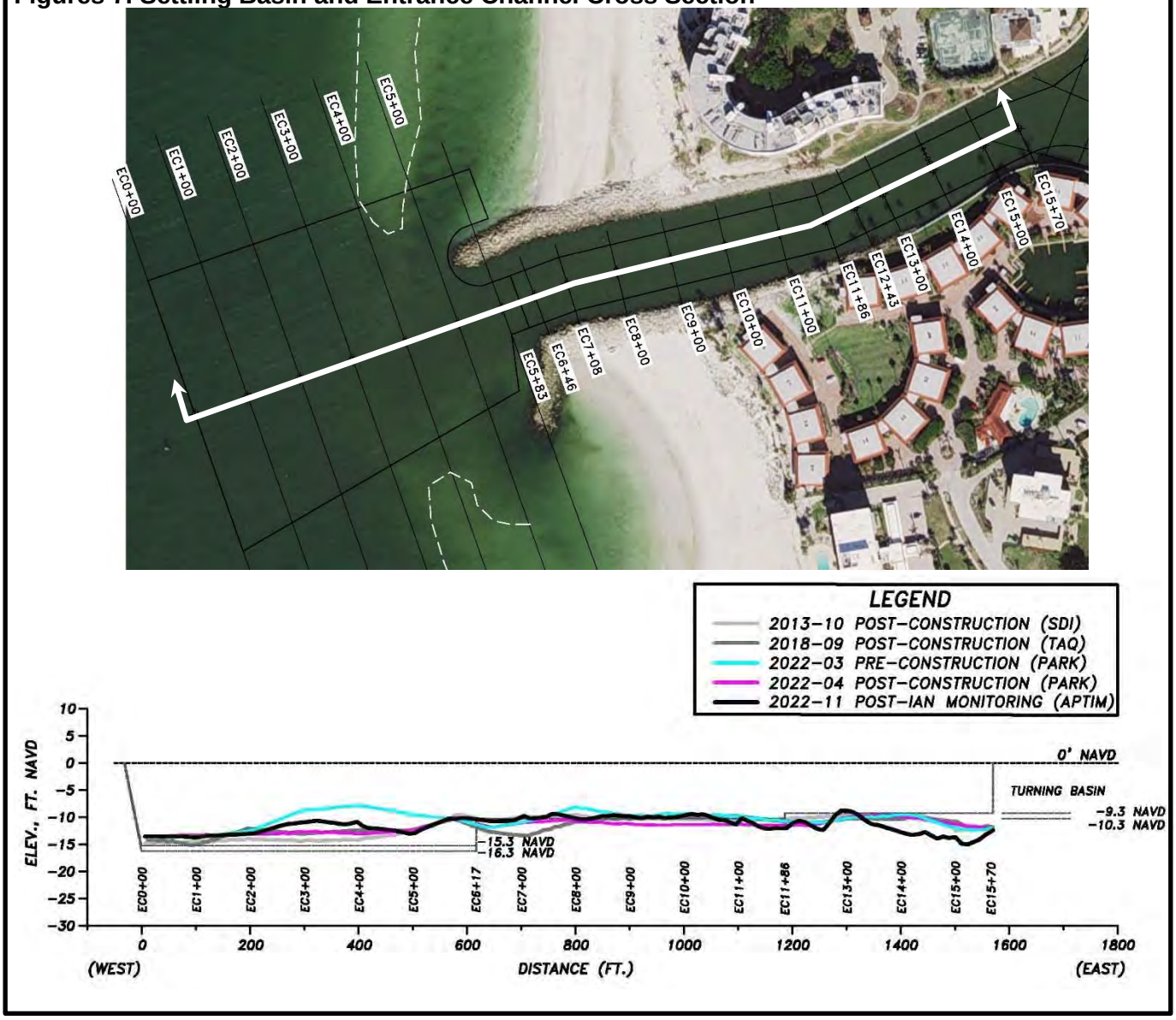


Figure 8 shows a contour map of the elevations greater than -5.0 mean low water (MLW) or -6.7 NAVD, a random elevation used to expose relatively shallow areas in the channel. There are two main locations within the dredge template having elevations greater than -5.0 mean low water. The first is the north end of the Turning Basin, corresponding with the accumulation noted in **Figure 6b**, and the second area is a continuation of the first along the east side of the West Channel. Both the majority of the Turning Basin and West Channel contain elevations below -5 feet MLW. Note, bathymetric profiles of the West (Station W8+12 north to W12+03) and South Channels (Station E0+00 north to E4+85) outside of the dredge template are provided in **Appendix D-2.**

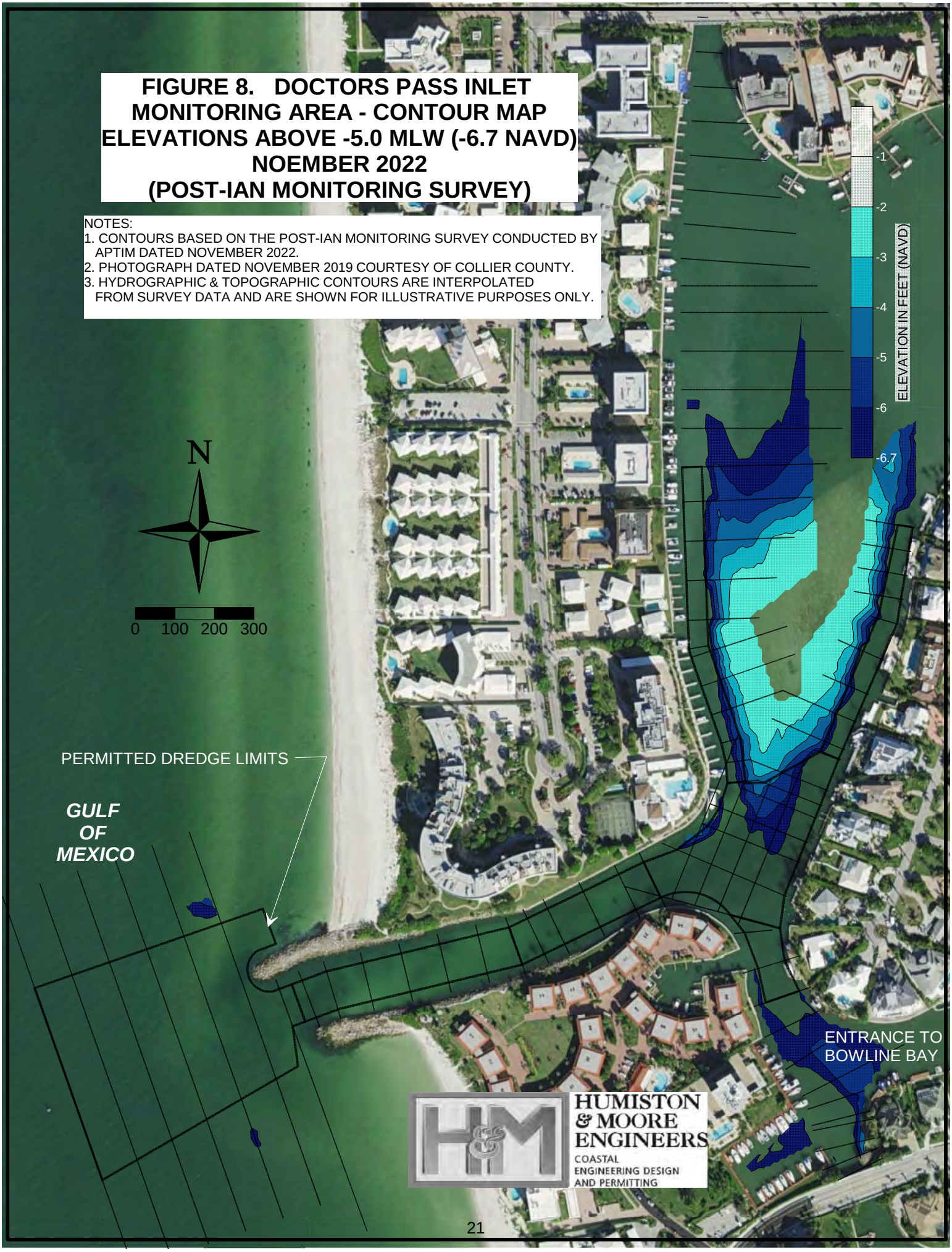


FIGURE 8. DOCTORS PASS INLET MONITORING AREA - CONTOUR MAP ELEVATIONS ABOVE -5.0 MLW (-6.7 NAVD) NOEMBER 2022 (POST-IAN MONITORING SURVEY)
NOTES:
1. CONTOURS BASED ON THE POST-IAN MONITORING SURVEY CONDUCTED BY APTIM DATED NOVEMBER 2022.
2. PHOTOGRAPH DATED NOVEMBER 2019 COURTESY OF COLLIER COUNTY.
3. HYDROGRAPHIC & TOPOGRAPHIC CONTOURS ARE INTERPOLATED FROM SURVEY DATA AND ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.
-1
-2
-3
-4
-5
-6
-6.7
ELEVATION IN FEET (NAVD)
N
0 100 200 300
PERMITTED DREDGE LIMITS
GULF OF MEXICO
ENTRANCE TO BOWLINE BAY
HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

BEACH SURVEY ANALYSIS

The beach south of the south jetty for Doctors Pass was surveyed from the DEP Reference Monument R-58A-200 south to T-62. The pre-construction, post-construction, and post-Ian monitoring surveys for the beach profiles are shown in **Appendix D-3**.

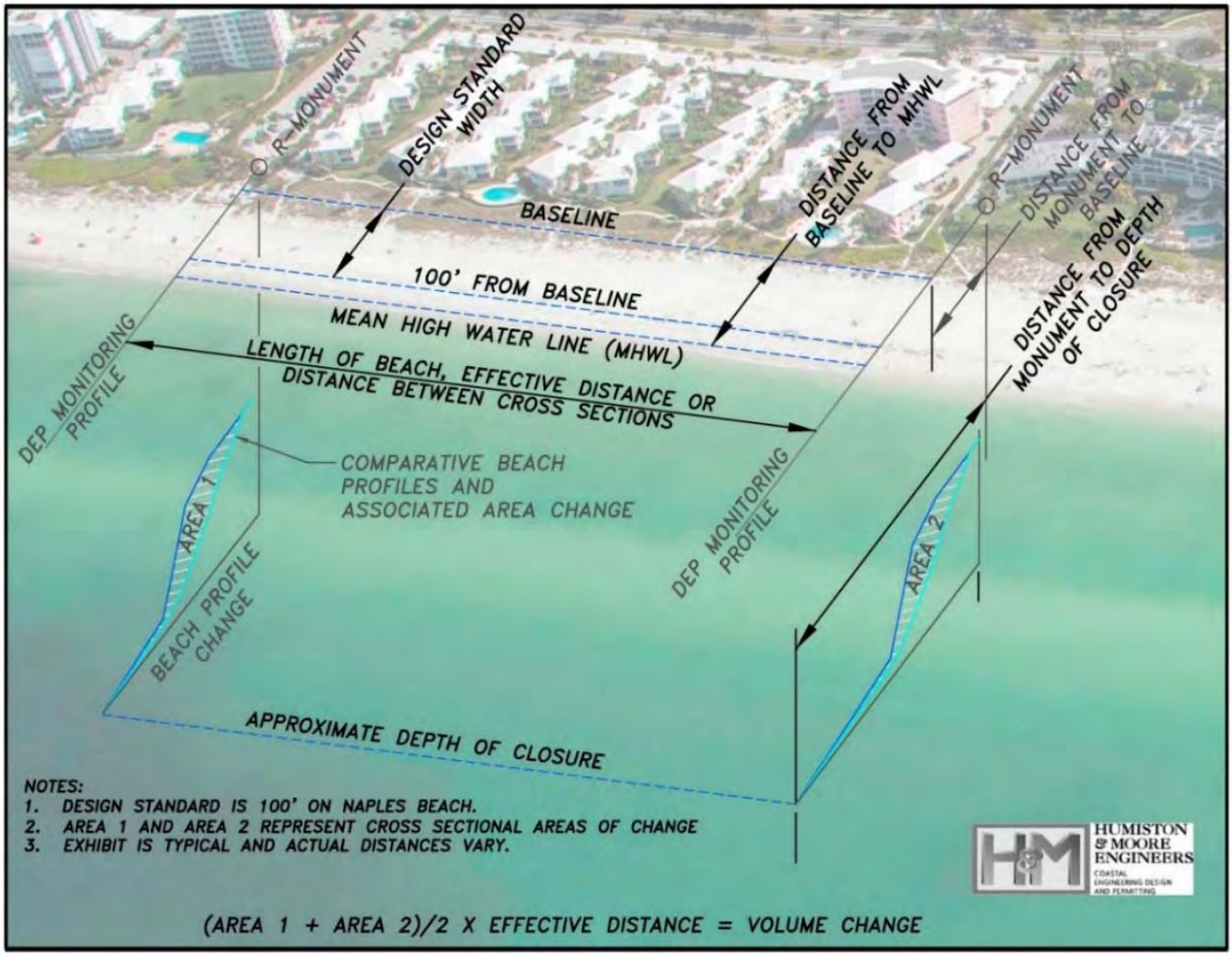
The 2006 Collier Renourishment Project established a *Design Standard* beach width of 100' for the section of beach analyzed in this report, based on a fixed baseline established in 2003. The baseline shown in **Figure 3a and 3b** was set at the seawall, edge of vegetation, building line or equivalent, at each monument, and the beach width was determined by the distance from the baseline to the mean high water elevation of +0.33 NAVD (+1.61 NGVD) at each DEP reference monument. Thus, the baseline was established at approximate 1,000-foot intervals to evaluate future beach conditions. This dry sandy beach width was then compared to the *Design Standard* for each DEP reference monument surveyed in the most recent monitoring survey.

The section of beach adjacent to and south of Doctors Pass (from the south jetty to R-58) has been nourished in the past; however, a *Design Standard* beach width of 100 feet or more was not sustainable at this location. The erosion control structures were completed in 2018, prior to the 2018 dredging of Doctors Pass, and are intended to work in conjunction with the beach disposal immediately south of Doctors Pass for improved beach sustainability. This would require sand placement on an average of approximately 40,000 cubic yards on a 4-year cycle from maintenance dredging of Doctors Pass. Consequently, the performance of the structures will be based on the volumetric analysis described by the approved monitoring plan associated with the *Doctors Pass Erosion Control Structures Project* (DEP permit 0338231-002-JN)**.** Although the beach width and shoreline change are discussed in this report, the analysis of beach width vs. the *Design Standard* is addressed in the *Collier County Beach Nourishment Project Annual Monitoring Summary*[4] (DEP permit 0331817-001-JC). To date, the structures have performed well in reducing the rate of sand loss in the project area.

[4] Collier County Beach Nourishment Project 2023 Annual Monitoring Report (Permit No. 0331817-001-JC) is due to be published and submitted to DEP later this year.

Figure 9 is a schematic depiction of the elements involved in the analysis of shoreline and volume change in this report for beach profiles R-58A to R-62. (This case shows a beach width greater than the *Design Standard*.) Two adjacent DEP reference monuments and associated monitoring azimuths are shown along with the baseline, *Design Standard* width (100 feet), mean high water line (MHWL), and approximate depth of closure[5] (DOC). Also shown are comparative beach profiles at the adjacent monuments and the associated area change between the monitoring surveys to be compared. Shoreline change is the difference in the "Distance from the Baseline to MHWL" 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.

Figure 9. Schematic Diagram for Typical Shoreline and Volumetric Change Analysis



[5] Depth of closure (DOC) is the depth beyond which changes in bottom elevation are considered to be negligible and is the point at which profile lines for different surveys should therefore merge or "close". A depth of -11.3 feet NAVD has historically been used by Collier County for the seaward limit of volume change computation.

Shoreline and volumetric change were determined at each monument for the pre, post-construction, and monitoring surveys. Shoreline change is the distance between the location of the mean high-water elevation 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). The nearshore limit used for the determination of the volume of sand was the baseline while the offshore limit was the intersection of the post-construction profile and the -11.3 NAVD (-10.0 NGVD) estimated (DOC) used in previous monitoring reports for Collier County. The effective distance (shown in column 3 of **Table 4a**) used to compute volume, or the distance along the beach between beach profiles, is the perpendicular distance between monument profile lines. The volumetric change was computed utilizing the average end area method. The distance from the baseline to the shore normal limit used for the volumetric analysis determined by the estimated DOC is shown in the last column of **Table 4a**. These volumetric limits are also shown graphically on the beach profiles included in **Appendix D-3**. Sand dredged from Doctors Pass in 2018 was placed in two sections of the coastline shown in **Table 4a**: from the jetty south to monument R-58+400, and near Lowdermilk Park from monument R-60 south to R-61+816 denoted as "2018 North Fill Template" and "2018 South Fill Template", respectively, in the first column of **Table 4a**. The 2020 nourishment project, extents also shown in **Table 4a**, placed approximately 37,400 cubic yards of sand from the jetty south to R-60. The 2022 project *placed sand at Lowdermilk Park between R-60.1 to R-61.0. Additional material was pushed down the beach towards R-61+800.*[6]

Table 4a. Beach – Distance between Monuments and Distance to Depth of Closure

Fill Template Extents	Monument	Shore Parallel Distance to Adjacent Monument (Feet)	Shore Perpendicular Distance from Baseline to DOC (Feet)
2018 (North) Fill Template	R-58A-200	458	800
	R-58A	300	760
	R-58A+300	245	700
	R-58	396	641
2020 Fill Template	R-58+400	619	590
	R-59	1071	575
	R-60	527	515
2018 (South) and 2022 Fill Templates	R-60+518	527	562
	R-61	508	615
	R-61+508	319	600
	R-61+816	207	552
	T-62	-	580

- Offshore limits may be adjusted from the typical elevation (-11.3 NAVD) to accomodate structure location, and offshore profile changes (e.g. changes due to dredging).
- Although shown from R-60 to T-62 for clarity and conformance with **Table 3b and 3c**, the 2022 project fill actual extents are from R-60.1 to R-61.8.

Beach width for the pre-construction, post-construction, and post-Ian surveys and the corresponding shoreline change for each monument in the monitoring area is shown in **Table 4b** while the associated volume change is shown in **Table 4c.** Throughout the 2022 monitoring, monuments with beach widths near or below the *Design Standard* (72-103) are R-58A+300 and R-58, located in dynamic areas in close proximity to structures. All other monuments remained above the *Design Standard* as well as the average widths for the 2022 fill area (126) and beach to the north (116). In spite of significant upland losses due to Hurricane Ian, and loss of average beach width (-10 and -7); considering the entire beach profile (upland and offshore), the monitoring area gained volume from the pre-construction to post-Ian condition (17,630 and 7,350). These changes are evident on the beach profiles provided in **Appendix D-3**.

[6] Completion Statement provided in **Appendix D-1**.

Table 4b. Beach - Shoreline Change

DEP Monument	Beach Width (Feet)			Shoreline Change (Feet)		
	3/2022 Pre-Con	4/2022 Post-Con	11/2022 Post-Ian	3/2022 to 4/2022	4/2022 to 11/2022	3/2022 to 11/2022
R-58A-200	119	114	116	-5	2	-3
R-58A	188	176	182	-12	6	-6
R-58A+300	**94**	**91**	**72**	-3	-19	-22
R-58	**103**	**78**	**94**	-25	16	-9
R-58+400	105	100	-	-5	-	-
R-59	128	117	117	-12	1	-11
R-60	106	123	114	17	-9	8
R-60+518	138	187	-	49	-	-
R-61	162	181	156	19	-25	-6
R-61+508	139	125	-	-14	-	-
R-61+816	135	129	-	-6	-	-
T-62	131	119	108	-12	-11	-23
Averages (Feet)						
R-58A to R-59	123	113	**116**	-10	1	**-10**
R-60 to R-62	135	144	**126**	9	-15	**-7**

- Beach Width = Distance from the Baseline to the MHWL.
- Gray shading indicate the 2022 nourishment extents.
- Although shown from R-60 to T-62 for clarity and conformance with **Table 3a and 3c**, the 2022 project fill actual extents are from R-60.1 to R-61.8.

Table 4c. Beach - Volume Change

Monument Range			Volume Change (Cubic Yards)		
			3/2022 to 4/2022	4/2022 to 11/2022	3/2022 to 11/2022
R-58A-200	to	R-58A	-1,050	5,800	4,750
R-58A	to	R-58A+300	100	930	1,030
R-58A+300	to	R-58	120	760	880
R-58	to	R-58+400	-3,680	8,730	4,820
R-58+400	to	R-59	-4,040		
R-59	to	R-60	3,040	3110	6150
R-60	to	R-60+518	6,380	-550	8010
R-60+518	to	R-61	7,090		
R-61	to	R-61+508	1,880		
R-61+508	to	R-61+816	-70	-3520	-660
R-61+816	to	T-62	-240		
Totals (Cubic Yards)					
R-58A to R-59			-5,510	19,330	**17,630**
R-60 to R-62			15,040	-4,070	**7,350**

- Monument range R-58A to T-58 includes the distance from the south jetty to T-58.
- Gray shading indicate the 2022 nourishment extents.
- Although shown from R-60 to T-62 for clarity and conformance with **Table 3b and 3c**, the 2022 project fill actual extents are from R-60.1 to R-61.8.

Figure 10 shows the location of the MHWL for the pre-construction, post-construction, and post-Ian monitoring surveys, as well as the location of the 2003 Baseline. The gain in beach width from R-60 south due to the 2022 dredging project and the subsequent accelerated equilibration due to Hurricane Ian is evident. It should also be noted; the 2003 baseline was established in approximately 1,000-foot increments without consideration to changes between monuments therefore comparisons to the *Design Standard* at intermediate monuments could be misleading. Design quantities for fill projects consider other factors as well as erosion or accretion including the existing beach width, advance nourishment requirements, predicted erosion prior to construction, storm losses, tapers, gaps, berm height, design life, and estimated end losses.


FIGURE 10: DOWNDRIFT SHORELINE LOCATION
JETTY SPUR
BREAKWATER
GROIN
GROIN REHABILITATION
2003 BASELINE
R-60
R-58A-200
R-58A
R-58A+300
R-58
R-58+400
R-59
R-60+518
R-61
R-61+508
R-61+816
T-62
LOWDERMILK BEACH PARK
LEGEND
2022-03 PRE-CON (PARK)
2022-04 POST-CON (PARK)
2022-11 POST-IAN (APTIM)
2003 BASELINE
0 125 250
SCALE: 1" = 250'
DATE OF PHOTO 12/2022
HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

AERIAL IMAGES

The 2023 rectified aerial image files required under the monitoring plan and provided by the Collier County Property Appraiser's Office, in Mr. Sid format referenced to the NAD83 datum in feet Florida East Zone, were submitted to the Department on March 31, 2023.

ENVIRONMENTAL

The permittee has reviewed the specific Reasonable and Prudent Measures (RPMs) and Terms and Conditions in the Revised Statewide Programmatic Biological Opinion dated 13 March 2015 and the Piping Plover Programmatic Biological Opinion 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@colliergovfl.net) and the shorebird monitoring program headed by Christopher D'Arco (ChristopherDarco@colliergovfl.net).

The programs include the following:

- Sea turtle nesting monitoring is an ongoing program with the County including escarpment surveys.
- Shorebird monitoring has been conducted by the County, as the program is transitioned from the Conservancy of Southwest Florida, including breeding and non-breeding birds, piping plovers and red knots.
- Compaction testing and subsequent tilling 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.
- Pre-construction meetings are held prior to the start of any project. Shorebird and sea turtle monitoring procedures during construction are discussed and implemented accordingly.
- In 2013 the County adopted and implemented a hardbottom biological monitoring plan including annual reporting and agency submittal.
- The County continues to make every effort in order to maintain compliance with the conditions of the SPBO and the P3BO, 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

The 2022 project was constructed from March to April 2022. There were no impacts to seagrass, hardbottom reef habitat, historical items, archeological materials, cultural resources, shorebirds or manatees. The completion documents provided in **Appendix C** were submitted to the DEP on June 7, 2022.

CONCLUSIONS & RECOMMENDATIONS

The 2022 dredging of Doctors Pass, conducted from March to April 2022, removed approximately 12,500 cubic yards of sand from the Settling Basin and Entrance Channel and placed the sand on the beach, south of the jetty and near Lowdermilk Park Beach. A pre-construction survey of the inlet and beach was conducted in March 2002, post-construction survey in April 2022, and a Post-Ian monitoring survey in November 2022.

Based on the November 2022 survey there is approximately 25,000 cubic yards (Table 3b; 25,410) of sand available within dredge template above the apparent rock layer. Based on the progressive surveys along the inlet stations within the Settling Basin, shoaling appears to be increasing along the nearshore bar. This bar extends from north of the inlet across the Settling Basin.

Doctors Pass has been dredged six times in the last 20 years as shown in **Table 5** with sand placed in the nearshore and then on the beach beginning in 2013. A total of approximately 188,000 cubic yards have been dredged and placed south of the inlet since 2002 yielding an infilling rate for the Doctors Pass dredge template of approximately 9,000 per year (188,000-9,000[7]/2022-2002). In the 6 months since the 2022 dredging project there has been an infilling rate of approximately 10,500 cubic yard per year (5,280/0.5), slightly more than the average 20-year shoaling rate of approximately 9,000 per year.

Table 5. Doctors Pass Dredging 2002-2022

Year	Disposal	Sand Placement	Contractor	Dredge	Volume (CY)
2002					**9,000**
2005	Nearshore	R-60 to R-62	Subaqueous Services, LLC	16-inch Hydralic	53,600
2009					32,500
2013	Onshore	Inlet to R-60	Orion Dredging Services	14-inch Hydraulic	43,400
2018	Nearshore	Inlet to R-58.5 & R-60 to R-61.8	Ferreira Construction	18-inch Hydraulic	37,000
2022	Beach	R-60 to R-61.8	Gator Dredging	18-inch Hydraulic	12,500
				Total (CY):	**188,000**

As a consequence of Hurricane Ian an emergency berm is being constructed throughout most of the developed Collier County shoreline, including the beach segment from R-58A south thru the monitoring area. The upland berm extends landward to the baseline having a crest elevation of +6.0 feet NAVD.

The monitoring area includes the beach immediately south of the inlet from the south jetty to monument T-62[8]. During the most recent dredging event, the sand dredged from the inlet was placed on the beach near Lowdermilk Park. In spite of the impact from Hurricane Ian, the average beach width is over the *Design Standard* of 100 feet within the monitoring area, and general volumetric gain since the pre-construction survey. **The dynamic beach in the vicinity of R-58A+300 and R-58 should be monitored closely while project monitoring continues according to the physical monitoring plan provided in Appendix A. No dredging is recommended at this time.**

[7] 9,000 cubic yards represents accumulation occurring prior to 2002.

[8] The section of beach discussed in this report will also be discussed in the *Collier County Beach Nourishment Project Annual Monitoring Summary* and will be further discussed in the *Doctors Pass Erosion Control Structures Monitoring Summary* due to be submitted later this year.

REFERENCES

APTIM, As-Built Certification by Professional Engineer, January 2022

Atkins, Doctors Pass 2014 1-Year Post-construction Engineering Monitoring Report, January 2015

Atkins, Doctors Pass 2013 Engineering Monitoring Report, April 2013

Coastal Planning and Engineering, Inc., Wiggins Maintenance Dredging, Collier County Beach Nourishment from an Upland Sand Source and Doctors Pass North Jetty Rehabilitation Projects 2011 Post-construction Report, June 2011

Coastal Planning and Engineering, Inc., North County Passes: Wiggins, Doctors, and Clam Passes 2010 Engineering Report, October 2010

Coastal Planning and Engineering, Inc, Wiggins and Doctors Passes 2009 Maintenance Dredging Post-Construction Report, July 2009

Coastal Planning and Engineering, Inc., Physical Monitoring Plan for the Doctors Pass Maintenance Dredging Project, March 2005

Florida Department of Environmental Protection, Doctors Pass Inlet Maintenance Dredging, Permit 0235740-001-JC, August 12, 2005

Florida Department of Environmental Protection, Doctors Pass Inlet Maintenance Dredging, Permit 0331817-001-JC, October 2, 2015

Florida Department of Environmental Protection Bureau of Beaches and Coastal Systems, Strategic Beach Management Plan for the Southwest Gulf Coast Region, April 2020

Humiston & Moore Engineers, Collier County Beach Nourishment Project 2022 Post-Construction Monitoring Summary, April 2022

Humiston & Moore Engineers, Doctors Pass Maintenance Dredging 2.5 Year Post-Construction Monitoring Summary, March 2021

Humiston & Moore Engineers, Doctors Pass Erosion Control Structures Project 2022 Post-Construction Monitoring Summary, December 2022

US Army Corps of Engineers, Department of the Army Permit SAJ-2004-8754 (IP-SJF)

APPENDIX A

PHYSICAL MONITORING PLAN

APPROVED AUGUST 25, 2017

APPROVED
Physical Monitoring Plan
Permit#: 0331817-004-JM
Approved: August 25, 2017
Beaches Inlets and Ports Program

Attachment No. 37-1
Physical Monitoring Plan
August 2017

Physical monitoring of the Collier County Beach Renourishment Project requires the acquisition of project-specific data to include, at a minimum, topographic/bathymetric surveys of the beach, offshore, and borrow site areas. The monitoring data is necessary in order for both the project sponsor(s) and the Department to regularly observe and assess, with quantitative measurements, the performance of the project, any adverse effects which have occurred (e.g. to adjacent shorelines), and the need for any adjustments, modifications, or mitigative response to the project. The scientific monitoring process also provides the project sponsor(s) and the Department, information necessary to plan, design, and optimize subsequent follow-up projects; potentially reducing the need for and costs of unnecessary work, as well as potentially reducing any environmental impacts that may have occurred or be expected.

This plan is a detailed Monitoring Plan required by FDEP (Permit No. 0331817-004-JM). Dredging of Doctors Pass is anticipated to occur every 4 years. Specific requirements are as follows:

a. Pre-construction topographic and bathymetric profile surveys of the beach and offshore shall be conducted within 90 days prior to commencement of construction. Surveys conducted for purposes of construction bidding and contracting may be used to provide pre-construction conditions. When only a partial project is constructed, pre-construction surveys can be limited to the construction area plus 5,000 feet north and south or to the edge of the nearest inlet.

Post-construction topographic and bathymetric profile surveys of the beach and offshore shall be conducted within 60 days following completion of construction of the project. Surveys conducted for purposes of construction contracting and payment may be used to provide immediate post-construction conditions. When only a partial project is constructed, post-construction surveys can be limited to the construction area plus 5,000 feet north and south or to the edge of the nearest inlet.

Thereafter, topographic and bathymetric monitoring surveys shall be conducted biennially until the next beach nourishment event or the expiration of the project design life, whichever occurs first. The monitoring surveys shall be conducted during a winter or spring month and repeated as close as practicable during that same month of the year. If the time period between the immediate post-construction survey and the first annual monitoring survey is less than six months, then Collier County may request a postponement of the first monitoring survey until the following winter or spring. If the monitoring survey falls within 6 months of construction, it may substitute for the pre-construction survey. In the event that a post-storm survey of the project monitoring area is conducted, this post-storm survey may serve as a biennial monitoring survey.

The monitoring area shall include profile surveys at each of the Department of Environmental Protection's reference monuments within the bounds of the beach fill area

and along up to 5,000 feet on the adjacent shoreline on both sides of the beach fill area. For this project, this will include DEP reference monuments in Collier County from R-17 to R-84 inclusive. An intermediate profile is established south of Doctors Pass, and labeled R-58A.

FDEP profile lines R-58A, R-58, R-59, R-60, R-60+518, R-61, R-61+408, R-61+816, and R-62 shall be surveyed within 90 days prior to commencement of a Doctors Pass dredging operation and within 60 days following the completion of a dredging operation. Only the profiles associated with the disposal area used and one profile to the south needs to be surveyed. These profiles shall be integrated with annual monitoring where practical.

Additional lines are to be surveyed within 90 days prior to commencement of a renourishment project in the Park Shore extension area (near Clam Pass between R-42 to R-43+500) and within 60 days following the completion of placement. Bathymetric and topographic surveys in the vicinity of Clam Pass in support of nourishment of the extended Park Shore placement area (near Clam Pass) will take place in Segments A and B at approximately 100 foot intervals and at intermediate points between existing R-monuments. Special survey lines shall be surveyed in the vicinity of Clam Pass Park to document the potential impact to inlet stability by beach nourishment in the extended Park Shore reach, inlet dredging disposal within the south Clam Pass disposal area, or natural forces. Additional beach profile surveys will be taken at R-41+470, R-42-250 and R-42+500. The cross sections in Segment A (inlet throat) include station 0+00, 1+00, 2+00 and 3+00. Segment B consists of Stations 4+10, 5+10 and 6+10. These segments should be the first to show instability in the inlet due to various causes. The survey will occur pre- and post-construction and 1-year and 2- year post construction of the Nourishment Project in Clam Pass Park north of R-44+500, or until the next maintenance dredging of Clam Pass, whichever occurs first.

Profile surveys shall extend landward to the seawalls or 50 feet landward of the 5.0' contour line. Profile surveys will extend seaward to the –14.3' NAVD contour or 2,000 feet from the shoreline, whichever is the greater distance. All work activities and deliverables shall be conducted in accordance with the Department's May 2014 *Monitoring Standards for Beach Erosion Control Projects, Sections 01000 - Beach Profile Topographic Surveying* and *01100 - Offshore Profile Surveying.*

b. Bathymetric surveys of borrow area T1 are not required. Borrow Area T1 is located approximately thirty-three (33) miles to the northwest and offshore of the placement area, outside of State waters, and is not covered under the State permit requirements. No post-construction survey of Borrow Area T1 is planned, other than the survey performed by the dredger using a registered Florida surveyor.

c. Bathymetric surveys of Doctors Pass are required pre- and post-construction as well as annually for monitoring purposes. A pre-construction bathymetric profile survey of Doctors Pass and Moorings Bay shall be conducted within 90 days prior to

commencement of a dredging operation. A post-construction bathymetric profile survey shall be conducted within 60 days following the completion of a dredging operation. If the Contractor's pay survey of the inlet meets the requirements of post-construction survey as stated below, Contractor's pay survey(s) will be submitted as the post-dredge survey. These surveys can be integrated with annual monitoring where required. Between dredging operations, monitoring surveys shall be conducted biennially until the permit expires. The monitoring surveys shall be conducted during the same month that the previous post-construction survey was taken. The monitoring area shall include channel profile surveys at the lines appearing in Figure 1 and on Tables 1-5. As a minimum, profile surveys shall extend to the limits indicated in Figure 1 and on Tables 1-5. All work activities and deliverables shall be conducted in accordance with the Department's May 2014 *Monitoring Standards for Beach Erosion Control Projects, Sections 01000 – Beach Profile Topographic Surveying* and *01100 – Offshore Profile Surveying.*

d. The Permittee shall submit electronically an engineering report and the monitoring data to the Division of Water Resource Management within 90 days following completion of the post-construction survey or biennial monitoring survey. The survey data and control information shall be submitted electronically in accordance with the Department's paperless initiative, in an ASCII format stored as specified in the Department's May 2014 *Monitoring Standards for Beach Erosion Control Projects, Sections 01000 - Beach Profile Topographic Surveying* and *01100 - Offshore Profile Surveying.*

The report will summarize and discuss the data, the performance of the beach fill project, and identify erosion and accretion patterns within the monitored area. Results should be analyzed for patterns, trends, or changes between surveys and cumulatively since project construction. In addition, the report shall include a comparative review of project performance to performance expectations and identification of adverse impacts attributable to the project. The report shall specifically include:

- The record of volume and location of beach nourishment and beach placement of inlet sand bypassing material.
- The volume and percentage of advance nourishment lost since the last beach nourishment project as measured landward of the MHW line of the most recent survey;
- The most recent MHW shoreline positions (feet) in comparison with the design beach width at each individual monument location;
- The MHW shoreline position changes (feet) relative to the pre-construction survey at each individual monument location for all the monitoring periods;
- The total measured remaining volume (cy) in comparison with the total predicted remaining volume (cy) above the MHW line and above the Depth of Closure for the entire project area over the successive monitoring periods; and,
- Other shoreline position and volumetric analysis the Permittee or engineer deem useful in assessing, with quantitative measurements, the performance of the project.

The report shall include computations, tables and graphic illustrations of volumetric and shoreline position changes for the monitoring area. An appendix shall include superimposed plots of the two most recent beach profile surveys, the design profile and pre- and post-construction beach profile at each individual monument location.

The approved Monitoring Plan can be revised at any later time by written request of Collier County and with the written approval of the Department. If the project is constructed in separable reaches or if one or more reach is eliminated, the monitoring limits shall be modified, accordingly.

When evaluating the performance of beach renourishment in the extended Park Shore Placement Area (near Clam Pass) the following should be taken into consideration: The purpose of nourishment in Clam Pass Park is to restore erosion losses since 1999 by maintaining a beach width from the baseline of 80 feet, while the purpose of Clam Pass dredging is to restore the alignment of Clam Pass to the previously approved location and to conduct periodic maintenance dredging of a portion of the Clam Pass Channel in order to maintain tidal exchange between Clam Bay and the Gulf of Mexico. A number of parameters are provided in the NRPA Management Plan (2014) for consideration for determining whether to consider maintenance dredging. These include tidal range data, cross sectional areas in Sections A, B and C of the inlet and flood shoal, volume of shoaled material, inlet length and ebb shoal location. The amount of sand to be dredged during each maintenance dredge event will be based on a pre-construction survey conducted prior to each maintenance event. The inlet throat (Segment A) will be graded as necessary to shape the inlet so that it closely mimics the natural inlet cross section at stable inlet conditions. The beach-compatible sand will be placed north of the Pass, along Pelican Bay Beach, and south of the Pass, along Clam Pass Park Beaches. Analysis of post-nourishment physical monitoring data will evaluate shoaling rates within the Clam Pass dredging template including Sections A, B and C. The shoaling rates and inlet stability parameters will be compared to critical conditions as identified in the Clam Pass NRPA Management Plan.

f. Monitoring reports and data will be submitted to the FDEP, Division of Water Resources Management, JCP Compliance Officer, in Tallahassee. The report and individual submittals will be labeled at the top of each page: "This monitoring information is submitted in accordance the approved Monitoring Plan for Permit No. [XXXXX-XXX-JC] for the monitoring period [XX]."

Physical Monitoring Summary

Monitoring Task	Pre-Project	Post-Project	1st Year	2nd Year	3rd Year	4th Year
Beach Profile Surveys[1,2] R-17 to R-84	X	X[4]		X		X
Bathymetric Surveys[3] Borrow Area T1		X				
Bathymetric Surveys Doctors Pass	X	X				
Bathymetric Surveys [5] Clam Pass	X	X	X	X		
Monitoring Report		X		X		X

[1]Surveys from R-17 to R-21 may be conducted as part of the Wiggins Pass Maintenance Dredging Project during years when surveys are required by both projects.
[2]Intermediate profile R-58A included.
[3]Borrow Area T1 resides in Federal Waters, and the County requires the Contractor to conduct a post-construction survey by a Florida registered surveyor.
[4]When only a partial project is constructed, pre- and post-construction surveys can be limited to the construction area plus 5,000 feet north and south or to the edge of the nearest inlet.
[5]Clam Pass is surveyed when sand is placed by nourishment activities north of R-44+500

Reference

Bureau of Beaches and Coastal Systems (BBCS), *Monitoring Standards for Beach Erosion Control Projects,* May 2014.

Turrell, Hall & Associates, Inc., 2014. Clam Bay NRPA Management Plan, Version 6.5, November 2014.

APPENDIX B

COMPLETION AND CERTIFICATION STATEMENT

APTIM
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Tel: +1 561 391 8102
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631020769

June 7, 2022

JCP Compliance Officer
Florida Department of Environmental Protection
Beaches, Inlets and Ports
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Subject: **Completion and Certification Statement for 2021/2022 Wiggins Pass and Doctors Pass Maintenance Dredging Project FDEP Permit No. 0142538-018-JC, FDEP Permit No. 0331817-001-JC, USACE Permit No. SAJ-2004-07621 (IP-MJD), and USACE Permit No. SAJ-2003-12405 (SP-MMB)**

Dear JCP Compliance Officer:

This letter is being provided in compliance with General Condition No. 11 of the subject permits. This letter is a statement of completion and certification for inlet dredging and beach disposal as described in the permit. This statement is based upon infrequent site visits by the engineer, construction observations by the County inspectors, and the contractor's construction reports and surveys.

All locations and elevations specified by the permit have been verified; the activities authorized by the permit have been performed in compliance with the plans and specifications approved as a part of the permit, and all conditions of the permit. Minor differences between dredge cuts, fill disposed, and the permitted plans are documented in the attached as-built survey plots. The signed and sealed as-built bathymetry and profiles are included in Attachment A. The horizontal limits of dredging are shown in Attachment B.

The County contracted Waterfront Property Services, LLC. (Gator Dredging) to perform the maintenance dredging of Wiggins Pass and Doctors Pass. The project commenced on January 26, 2022 at Wiggins Pass. The last day of dredging in Wiggins Pass occurred on March 10, 2022. On March 11, 2022, the contractor began mobilization to Doctors Pass. Dredging began at Doctors Pass on March 21, 2022. The project dredging was completed on April 20, 2022. Demobilization was completed on April 28, 2022. Notice of substantial project completion was sent on April 28, 2022.

At both inlets, dredging did not extend west to the edge of the permit limits due to weather. Weather caused some delays. The major bypassing bar/shoals were dredged.

Dredged material was removed by Gator Dredging's hydraulic pipeline dredge, Brittyn B, with an 18" ID and 20" OD system. All dredged material was disposed of in the nearshore adjacent to both inlets. The dredge removed material from the channel 24 hours a day. Gator Dredging submitted daily Quality Control (QC) reports to the engineer, which included: pertinent project information, daily dredge plots, and dredge tracking data. A summary of the daily dredge tracking data is included in Attachment B. Turbidity monitoring occurred up to three times a day during daylight hours when the dredge was

operational. The turbidity monitoring results were submitted weekly via email to JCP Compliance, including any exceedances report. Additional monitoring and coordination with County turtle monitors were necessary to complete the project.

Wiggins Pass was dredged according to the permitted limits and depths. The measured dredge volume of material from Wiggins Pass was 66,033 CY (Table 1). The volume of material eligible for pay was 65,043 CY. Approximately 21,413 CY of material was measured north of the inlet on the beach and in the nearshore of Barefoot Beach and 16,747 CY of material was placed south of the inlet on the beach and in the nearshore of Delnor-Wiggins State Park.

Based on the Contractor's daily reports, approximately 39,000 CY and 26,000 CY of material was placed respectively on Barefoot Beach and Delnor Wiggins State Park. This is close to the bid amount. The measured amount differs due to sea conditions during construction, which also lead to a curtailment of dredging short of the western channel limits.

The Wiggins Pass project area extends from Stations 11+00 to C-23 and south to C-32 (Attachment B). The disposal areas extend from R-12.3 to R-14.25 and R-18.2 to R-19.8 on either side of Wiggins Pass. See Attachment B for the precise horizontal extent.

Table 1. Wiggins Pass Volume Summary

Wiggins Pass	
	Volume Within Dredge Template (CY)
Exterior Channel	52,070
Interior Channel	13,963
Total Dredged in Channel	66,033
Barefoot Beach*	21,413
Delnor-Wiggins State Park*	16,747
Net Volume Change:	38,160

*Disposal volumes don't account for changes due to alongshore and offshore transport.

The volume change measured in Table 1 between the January 2022 pre-construction survey and the February/March 2022 post-construction survey. Dredged volumes represent amount removed and disposal volumes represent the quantities measured in each permitted disposal area.

The contracted bid volume at Doctors Pass was 25,700 CY. This volume avoided the rock substrate located within the settling basin. The post-construction volume measured within the template was 12,535 CY (Table 2). Fill material placed south of the inlet on the beach and nearshore at Lowdermilk Park was 14,092 CY.

The dredge was damaged beyond immediate repair before all the settling basin was dredged and the project was terminated before the start of sea turtle nesting season.

APTIM

Table 2. Doctors Pass Volume Summary

Doctors Pass	
	Volume Within Dredge Template (CY)
Settling Basin: EC 0+00 to EC 6+46	11,146
Entrance Channel: EC 6+46 to EC 15+70	1,389
Total Dredged in Channel	12,535
Lowdermilk Park Disposal: R-60 to R-61.8	14,092

Volume changes are measured between the January 2022 and April 2022 surveys.

Doctors Pass dredging extends west to east EC1+00 to EC12+00. The dredged material was placed at Lowdermilk Park between R-60.1 to R-61.0. Additional material was pushed down the beach towards R-61+800.

The post-construction surveys of the two project areas showed that no significant impacts to the project area were observed. Placement of material from the channels occurred mostly within the permitted disposal areas. There was no evidence of impacts to nearshore hardbottom nor disposal of unsuitable material in either location.

The areas surveyed and elevation of the cutterhead are provided in Attachment B. The drawings show the elevations by color coding and the limits of each days work. These drawings also show the location and elevations for the rocks encountered and avoided by dredging. Some rocks made it through to the beach, which were collected by the contractor.

Sediment samples of the dredged material were collected at both Wiggins Pass and Doctors Pass during construction and will be provided when returned from the laboratory. These samples were tested for compliance with the sediment QA/QC plan. A summary of sediment characteristics and granularmetric reports for each sample are being collected including selected carbonate measurements.

Please call me if you have any questions.

Sincerely,

Stephen Keehn, P.E., FL PE License No. 34857
Senior Coastal Engineer
Aptim Environmental & Infrastructure, LLC

Please Reply To: Steve Keehn: 561.361.3151
E-Mail Address: Stephen.Keehn@aptim.com

Enclosures

Attachment A - 2021/2020 Wiggins Pass and Doctors Pass Survey Drawings
Attachment B - 2022 Progress, Dredge Tracking Elevation and Rock Map
Attachment C - Sediment Laboratory Results (Pending)

cc: Andrew Miller, Collier County
FDEP, South District, Ft. Myers, Florida
Nicole Sharp, P.E., APTIM

APPENDIX C

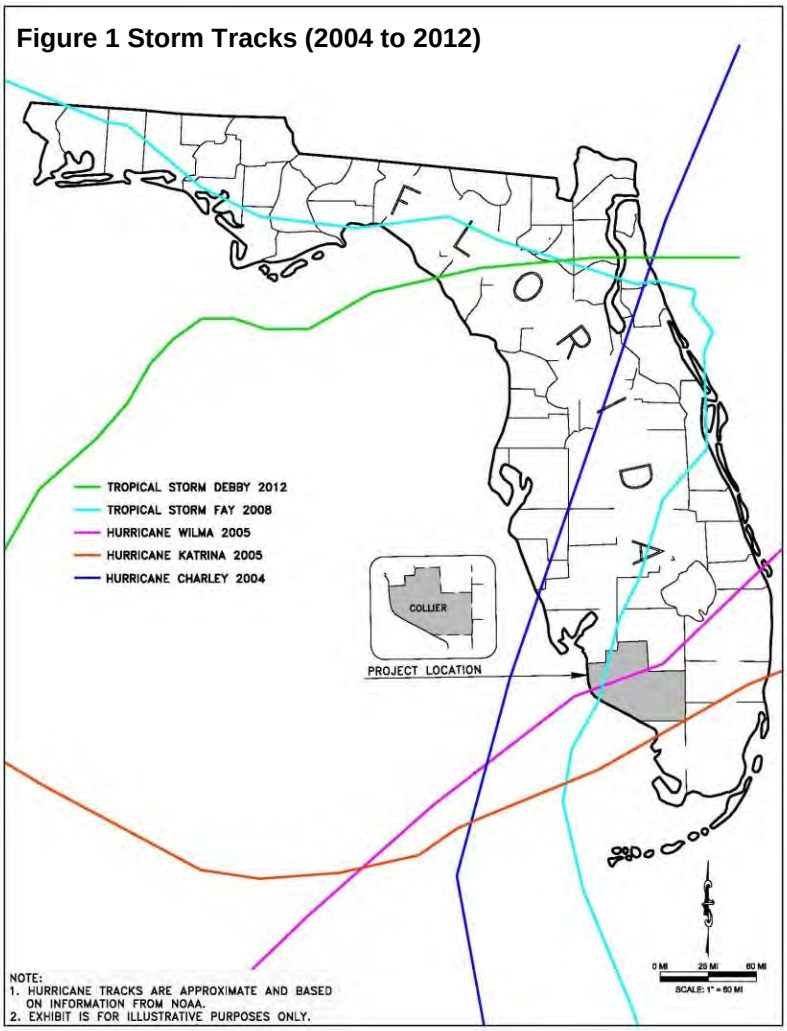
MAJOR STORM INFORMATION

Major Storm Events near Collier County

From 2004 to 2015, five major storms have made landfall near Collier County having the potential to disrupt coastal processes and change the beach topography in the project vicinity. Each storm's track can be seen in **Figure 1**.

[1]**Hurricane Charlie** (9-15 August 2004) Charley was the strongest hurricane to hit Florida since Hurricane Andrew in 1992. Before Charley made landfall on August 13 near Cayo Costa, which is just north of Captiva, it had made landfall in Cuba as a category 2. The storm decreased to a category 1 while making landfall in Cuba but then increased steadily as it made its way to Florida's southwest coast. Charley hit Florida as a category 4 hurricane with maximum sustainable winds of 150 mph. Hurricane Charley was a small storm in size but caused great damage to Florida's southwest coast.

Figure 1 Storm Tracks (2004 to 2012)



[2]**Hurricane Katrina** (23-30 August 2005) Hurricane Katrina is one of the most devastating hurricanes making landfall in the United States. Katrina was the making of three storms in the Atlantic Ocean and made landfall over the Bahamas as a Tropical Strom. While heading to Florida's east coast the storm strengthened to a category 1 hurricane just before making landfall near Miami-Dade County. The storm weakened to a tropical storm while passing over the peninsula. After spending six hours on land with winds estimated up to 70 mph, the storm entered the Gulf of Mexico just north of Cape Sable on August 26. Not soon after entering the Gulf, Hurricane Katrina grew in size and ultimately hitting the United States again in Louisiana as a category 5.

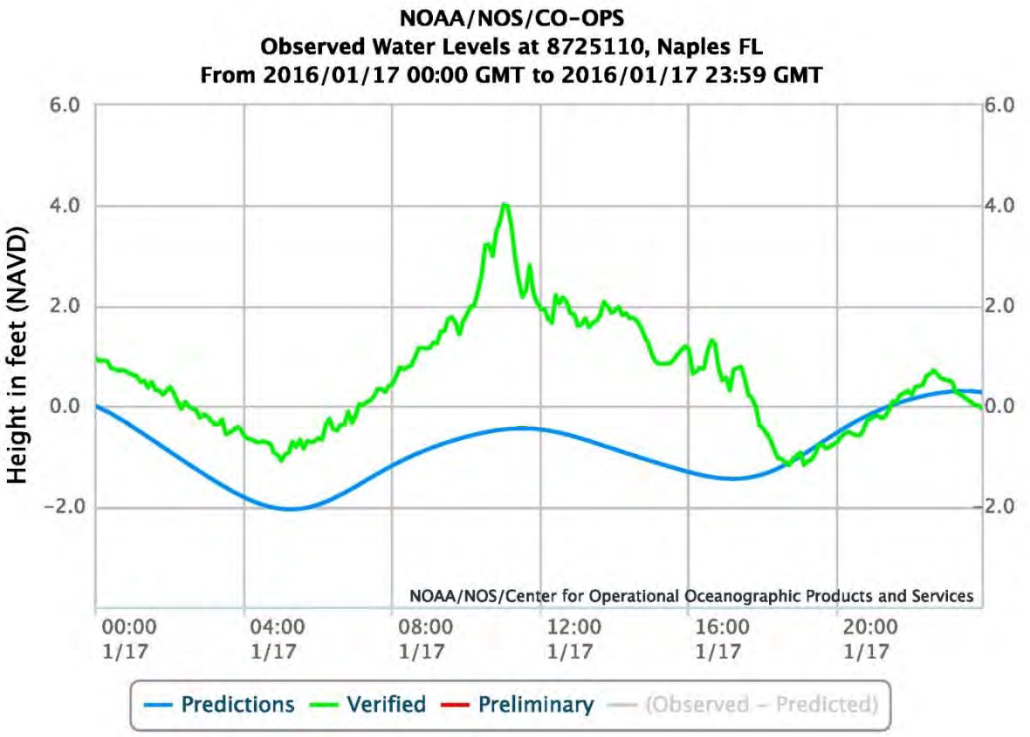
[3]**Hurricane Wilma** (15-25 October 2005) Hurricane Wilma was the strongest hurricane recorded for 2005 with winds up to 185 mph. Forming in the Caribbean Sea, Hurricane Wilma reached a category 5 hurricane over open waters. Wilma then decreased to a category 4 just before hitting the Yucatan Peninsula of Mexico. After passing over land, the winds decreased to 100 mph. After a brief increase over the Gulf of Mexico, Wilma entered the U.S. near Cape Romano (just south of the project area) as a category 3 hurricane on October 24. Wilma caused ten tornadoes while making landfall in the U.S. and caused damage to the surrounding coastline.

[4]**Tropical Storm Fay** (15-26 August 2008) Tropical storm Fay made landfall in Florida a record setting four times. After passing over the Florida Keys with winds up to 50 mph the storm slightly increased to 65 mph winds before making landfall just south of Marco Island on August 19. Rainfall estimates in Florida reached over 27 inches causing severe flooding. Storm surge and prevailing winds by the slow moving storm caused moderate coastline erosion along southwest Florida.

[5]**Tropical Storm Debby** (23-27 June 2012) Tropical Storm Debby reached a peak wind speed of 65 mph while in the Gulf of Mexico. After forming in the middle of the Gulf of Mexico, the storm headed north. After influence from a low pressure, the storm then turned west and eventually made landfall in Florida near Steinhatchee on August 26. Winds were recorded at 40 mph when making landfall on Florida's west coast. Although the storm hit northern end of the peninsula, it is recorded that Pinellas and Charlotte Counties' beaches lost 10 to 15 feet of shoreline.

The City of Naples experienced a meteotsunami[1] in January 2016. A graph of the observed water levels at the Naples Tide Station on January 17, 2016 documenting the meteotsunami is shown in **Figure 2**.

Figure 2. Observed Water Level in Naples Florida on January 17, 2016.



[5] **Hurricane Irma** (August 30-Septmeber 11, 2017) Tropical Storm Irma formed in the far eastern Atlantic Ocean, just west of the Cape Verde Islands, on the morning of August 30th. Over the

[1] Meteotsunamis have the characteristics similar to earthquake-generated tsunamis, but are caused by air pressure disturbances often associated with fast moving weather systems, such as squall lines. These disturbances can generate waves in the ocean that travel at the same speed as the overhead weather system. Development of a meteotsunami depends on several factors such as the intensity, direction, and speed of the disturbance as it travels over a water body with a depth that enhances wave magnification. NOAA 2015

following 30 hours Irma intensified into a major hurricane with highest sustained winds of 115 MPH, a category-3 storm on the Saffir-Simpson Hurricane Wind Scale.

As Irma began to approach the northern Leeward Islands on September 4th and 5th, the hurricane rapidly intensified while moving over warmer water and into a more moist atmosphere. The storm became a rare category-5 hurricane on September 5th, with maximum sustained winds of 185 MPH. This made Irma the strongest hurricane ever observed in the open Atlantic Ocean, and one of only 5 hurricanes with measured winds of 185 MPH or higher in the entire Atlantic basin. Over the next few days Irma continued moving west, passing through the northeast Leeward Islands, Virgin Islands, and just north of the islands of Puerto Rico and Hispaniola, while maintaining its category-5 winds.

The storm finally "weakened" to a category-4 hurricane on September 8th, but still had devastating winds of 155 MPH while moving through the southern Bahamas. Irma intensified to a category-5 level once again that evening, with top winds of 160 MPH, as it approached the northern coast of Cuba. Irma moved west along or just inland from the northern coast of Cuba on September 9th. This interaction with land disrupted Irma's structure a bit, as a hurricane requires plenty of deep warm water beneath the storm's center to maintain the extremely low pressure and strong winds. Thus Irma weakened slightly to a category-3 hurricane with winds of 125 MPH.
Resilient Irma made a final attempt to re-intensify while crossing the open waters of the Florida Straits. The storm quickly reached category-4 intensity with 130 MPH winds early in the morning of September 10th, while approaching the vulnerable Florida Keys.

The major hurricane made landfall near Marco Island in southwest Florida around 3 pm EDT on September 10th, as a category-3 storm with 115 MPH. Naples, Florida reported a peak wind gust of 142 MPH. Irma moved quickly northward, just inland from the west coast of Florida on September 10th and 11th. When Irma first developed in the far eastern Atlantic, despite its strength, its wind field was quite small. As the storm approached Florida, however, its wind field expanded dramatically. As Irma hit Florida, tropical storm force winds extended outward up to 400 miles from the center, and hurricane force winds extended up to 80 miles. Hurricane force wind gusts (i.e. 74 MPH or more) were reported along much of the east coast of Florida, from Jacksonville to Miami. In addition to the long periods of heavy rain and strong winds, storm surge flooding also occurred well away from the storm center, including the Jacksonville area, where strong and persistent onshore winds had been occurring for days before Irma's center made its closest approach.

By the time the minimal hurricane reached northwest Florida (on the morning of September 11th), the wind gusts across south Georgia and northwest Florida were generally in the 45 to 60 MPH range (Fig. 8). Conditions improved rapidly once the storm center passed by as strong, dry southwest winds aloft made the system asymmetric, with nearly all of the rain and most of the strongest winds being along and north of the poorly-defined center. Irma weakened to a tropical storm in south Georgia in the afternoon, and further into a tropical depression while moving north across central Georgia in the evening. See the **Figure 3** in this section showing the 2017 storm tracks.

According to the National Weather Service, wind gusts over 50 mph and heavy rain impacted the Naples area on Thursday December 20, 2018. At approximately 1:30 pm another meteotsumami hit the Naples area with wave heights momentarily increasing by 3 feet over the projected level and decreasing rapidly over the next hour. **Figure 4** shows the predicted and actual water levels on December 20, 2018.

Figure 3. Hurricane Tracking Chart for 2017.

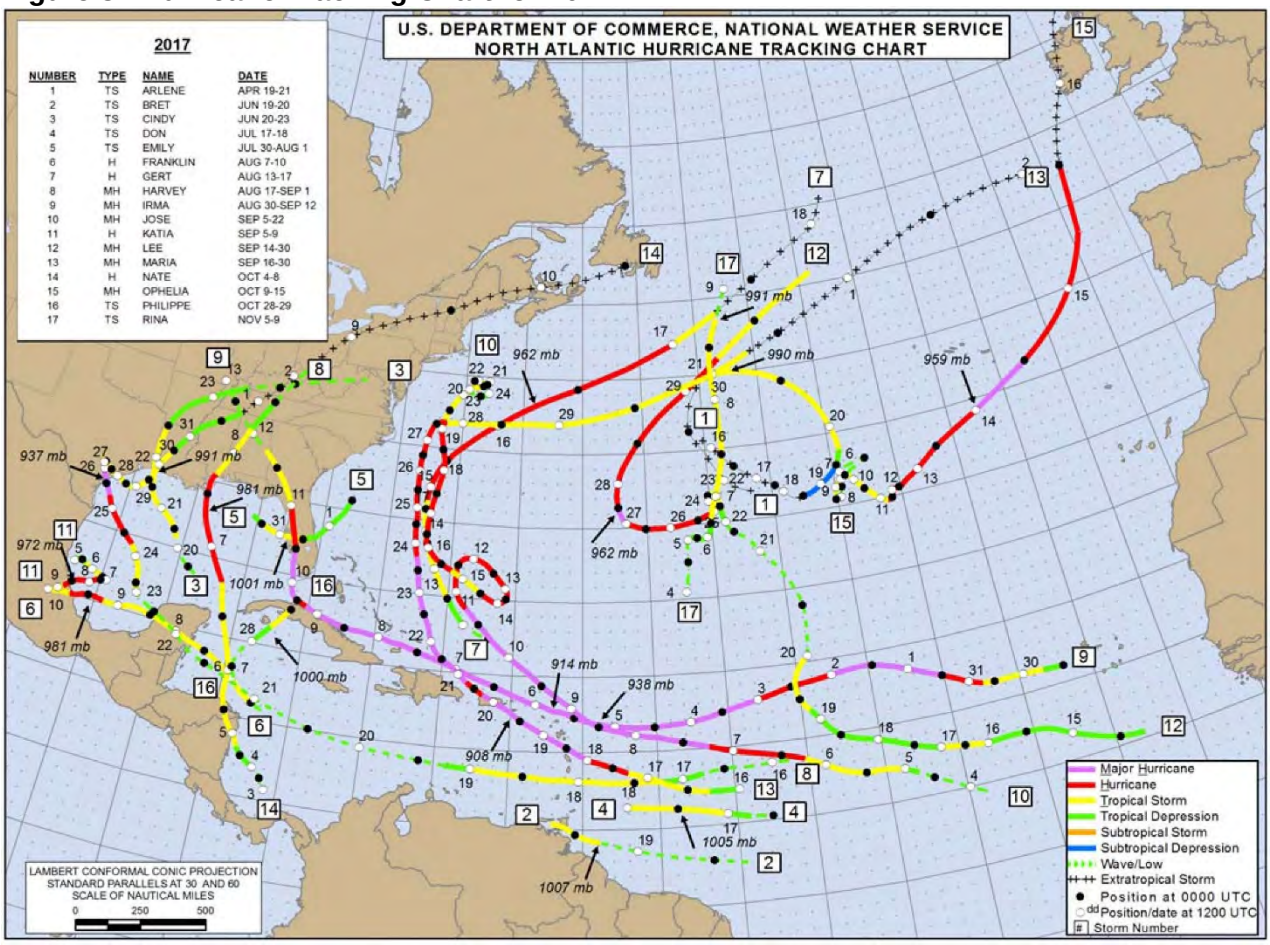
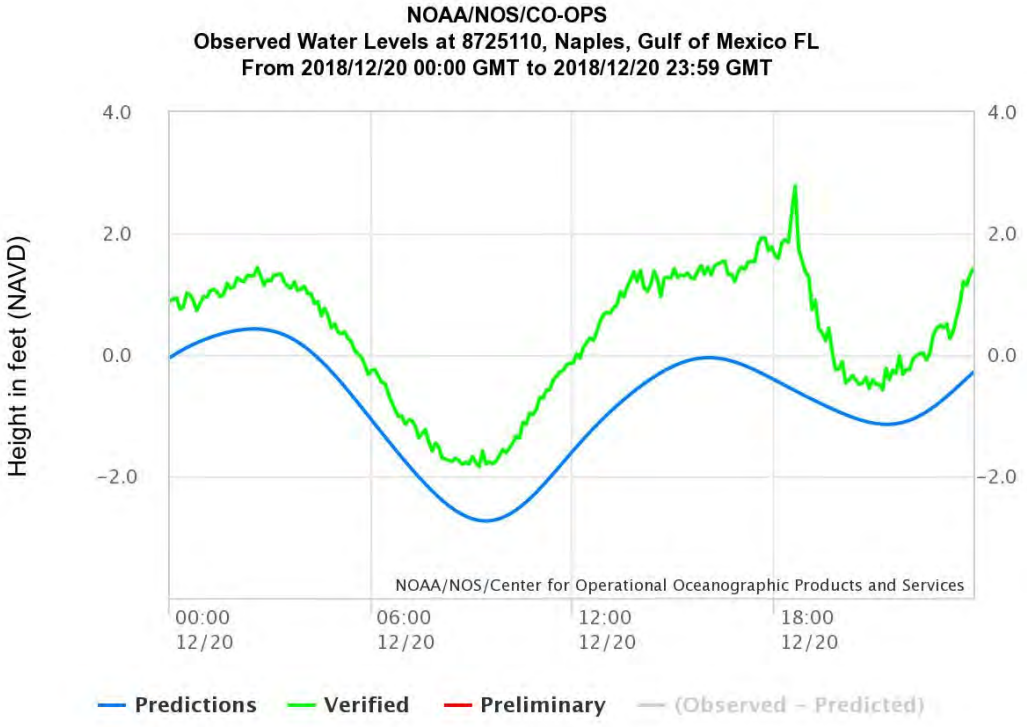


Figure 4. Observed Water Level in Naples Florida on December 20, 2018.



References

[1] Blake E.R., D.P. Brown, R.J. Pasch, "Tropical Cyclone Report Hurricane Charley," National Hurricane Center, September 2011, http://www.nhc.noaa.gov/.

[2] Brown D.P., R.D. Knabb, and J.R. Rhome, "Tropical Cyclone Report Hurricane Katrina," National Hurricane Center, December 2005, http://www.nhc.noaa.gov/.

[3] Blake E.R. and H.D Cobb III et. al, "Tropical Cyclone Report Hurricane Wilma," National Hurricane Center, January 2006, http://www.nhc.noaa.gov/.

[4]Beven, J.L. and S.R Stewart, "Tropical Cyclone Report Tropical Storm Fay," National Hurricane Center, February 2009, http://www.nhc.noaa.gov/.

[5]Kimberlain T.B., "Tropical Cyclone Report Tropical Storm Debby," National Hurricane Center, January 2013, http://www.nhc.noaa.gov/.

[6]National Oceanic and Atmospheric Administration, "Detailed Meteorological Summary on Hurricane Irma, Hurricane Irma Synopsis" National Weather Service, January 2018, https://www.weather.gov

Naples Daily News, Scientists: Waves that surprised SWFL beachgoers last week caused by rare meteotsunami, December 27, 2018

APPENDIX D-1

SURVEYOR CERTIFICATION

Survey Report Notes and Certification

Survey Title:	2022 Collier County Post Hurricane Ian Topographic and Hydrographic Survey Report
Prepared Date:	January 2023
Prepared For:	Collier County Coastal Zone Management
Prepared By:	APTIM Environmental & Infrastructure, LLC
Dates of Survey:	November 2nd, 2022 to December 9th, 2022
Survey Location:	FDEP monuments R-1 through R-89, H-1 through H-16, and R-128 through R-148 including required intermediate profiles.

Notes:

1. This survey report has been prepared to accompany Survey Maps entitled "2022 Collier County Post Hurricane Ian Topographic and Hydrographic Survey Report" prepared by APTIM Environmental & Infrastructure, LLC

2. The survey is neither valid nor complete without both the survey report and described survey maps. Digital data files encompassing the following have also been provided to FDEP in the following formats listed:

   - *Monument Information Report* ***(Appendix 1)***
   - *Federally Compliant Metadata* ***(Appendix 2)***
   - *ASCII file containing xyz profile data points. Data provided in NAVD 88* ***(Appendix 3)***
   - *ASCII files containing the profile data processed into the FDEP distance and depth format, (NAVD 88) including headers* ***(Appendix 4)***
   - *Profile Plots* ***(Appendix 5)***
   - *PDF copies of project field books with computations and reductions* ***(Appendix 6)***
   - *Digital Ground Photography* ***(Appendix 7)***

3. This map and report or the copies thereof are not valid without an original raised seal or a digital signature file by the certifying professional surveyor and mapper who shall retain and original hard copy of the signed and sealed map or report.

4. The information on this map represents the results of the survey on the dates indicated and can only be considered as indicating the general conditions existing at the time.

5. Additions or deletions to survey maps or reports by other than signing party or parties is prohibited without written consent of the signing party or parties.

6. The coordinates are in feet based on the vertical and horizontal data that was collected and presented relative to the North American Vertical Datum of 1988 (NAVD 88) and the Florida State Plane Coordinate System based on the Transverse Mercator Projection, East Zone, North American Datum of 1983 (NAD 83/2011).

7. Vertical measurements are based on FDEP second order monuments A05, A10, A11, A15, A25-2 1987 ADJ, A25 RM4-ADJ, and 872 4991 D TIDAL per published FDEP coordinates.

8. Bearings are based on a grid North bearing

9. Lands were not abstracted for rights-of-way, easements, ownership, or other instruments of record.

10. Underground and subaqueous improvements and/or utilities were not located as part of this survey and should be field verified prior to any dredging or construction activities.

11. Refer to APTIM field book #525 for the onshore portion and APTIM Navigational field book #49 for the offshore portion. (Provided Digital Copies Only)

12. Aids to navigation were not located during this survey.

13. Soundings were collected using a Teledyne Echotrac E20, Single Frequency, survey grade sounder. The sounder was calibrated prior to the start of the survey following manufacturers recommended procedures.

14. Survey plan views are intended to be viewed at a scale of 1”/400’ or smaller.

15. This survey was conducted for Collier County Coastal Zone Management for use as a Topographic and Hydrographic Beach Post Hurricane Monitoring Survey.

16. *Ref. Pt.* (Reference Point) is a term used in the monument information report referring to any location that can be defined by horizontal coordinates and is used as range point 0+00 for profile control. Reference Points may not necessarily be the location of a set control monument.

17. *NO RTK* is a term used in the monument information report referring to monuments that were not found and/or not located by GNSS due to overhead cover, deep burial, or impenetrable obstacle.

Certification:

I hereby certify that this hydrographic and topographic survey is true and correct to the best of my knowledge and belief as delineated under my direction. I further certify that it meets the minimum technical standards set forth in Chapter 5J-17, adopted by the Florida board of professional surveyors and mappers, pursuant to section 472.027 of the Florida Statutes.

Michael Lowiec, PSM LS6846

Digitally signed by Michael Lowiec, PSM LS6846
Date: 2023.01.30 11:58:37 -05'00'

Michael Lowiec, P.S.M. Date
Florida Professional Surveyor and Mapper
LS #6846
APTIM Coastal Planning & Engineering, LLC
C.O.A. LB# 4028
6401 Congress Ave. Suite #140 Boca Raton, Florida 33487

APPENDIX D-2

CROSS SECTIONS - INLET

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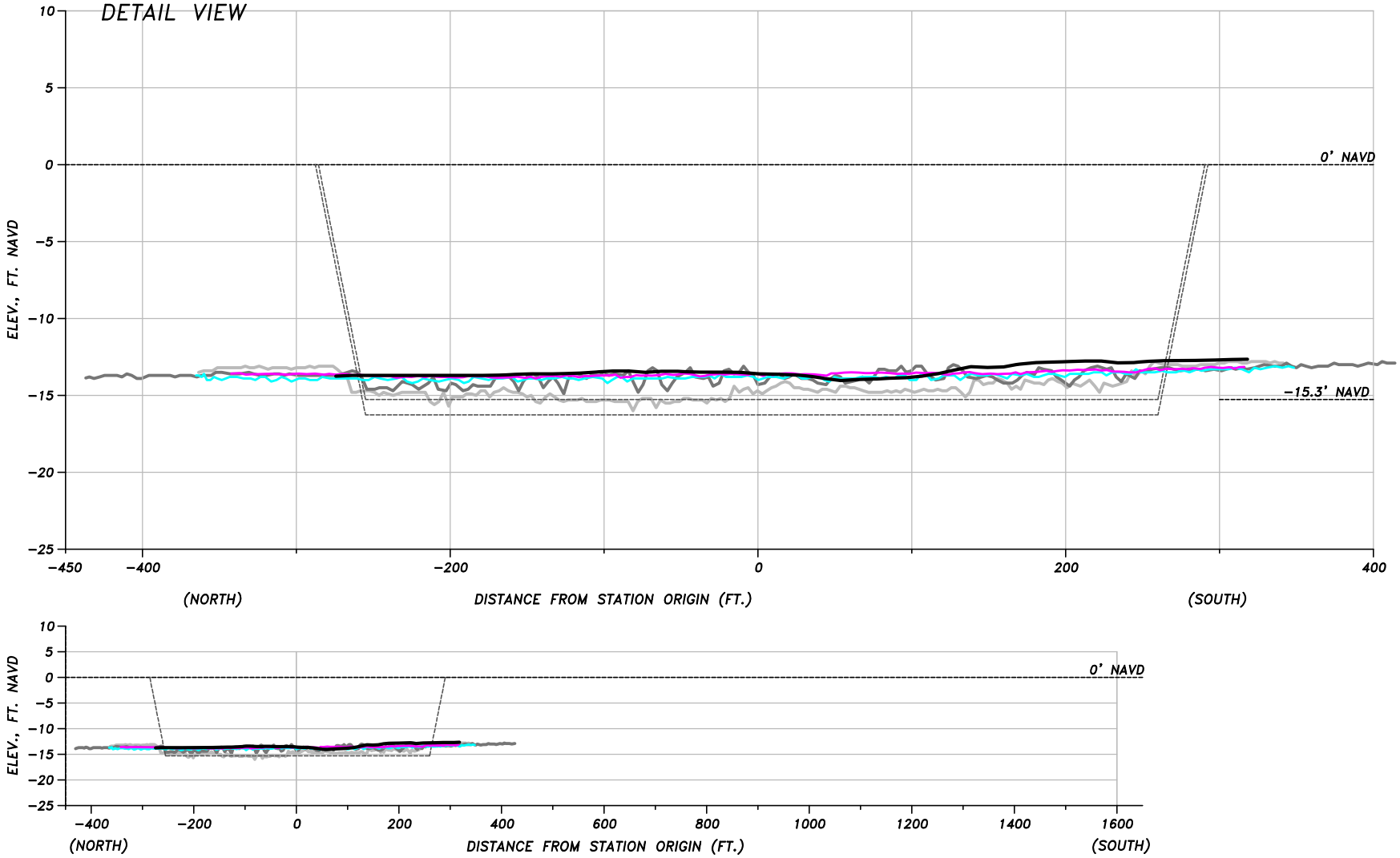

HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
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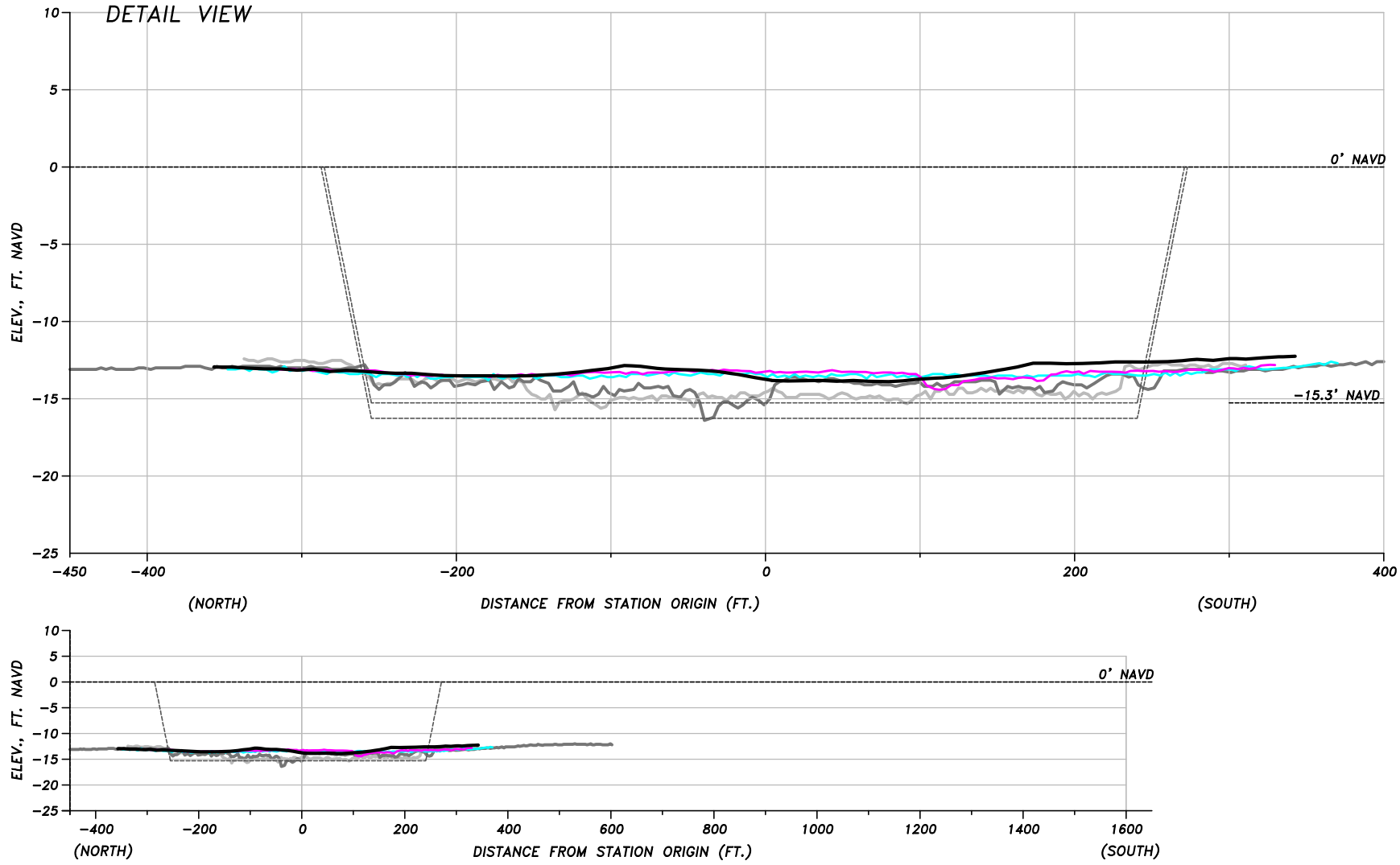
STATION: EC1+00



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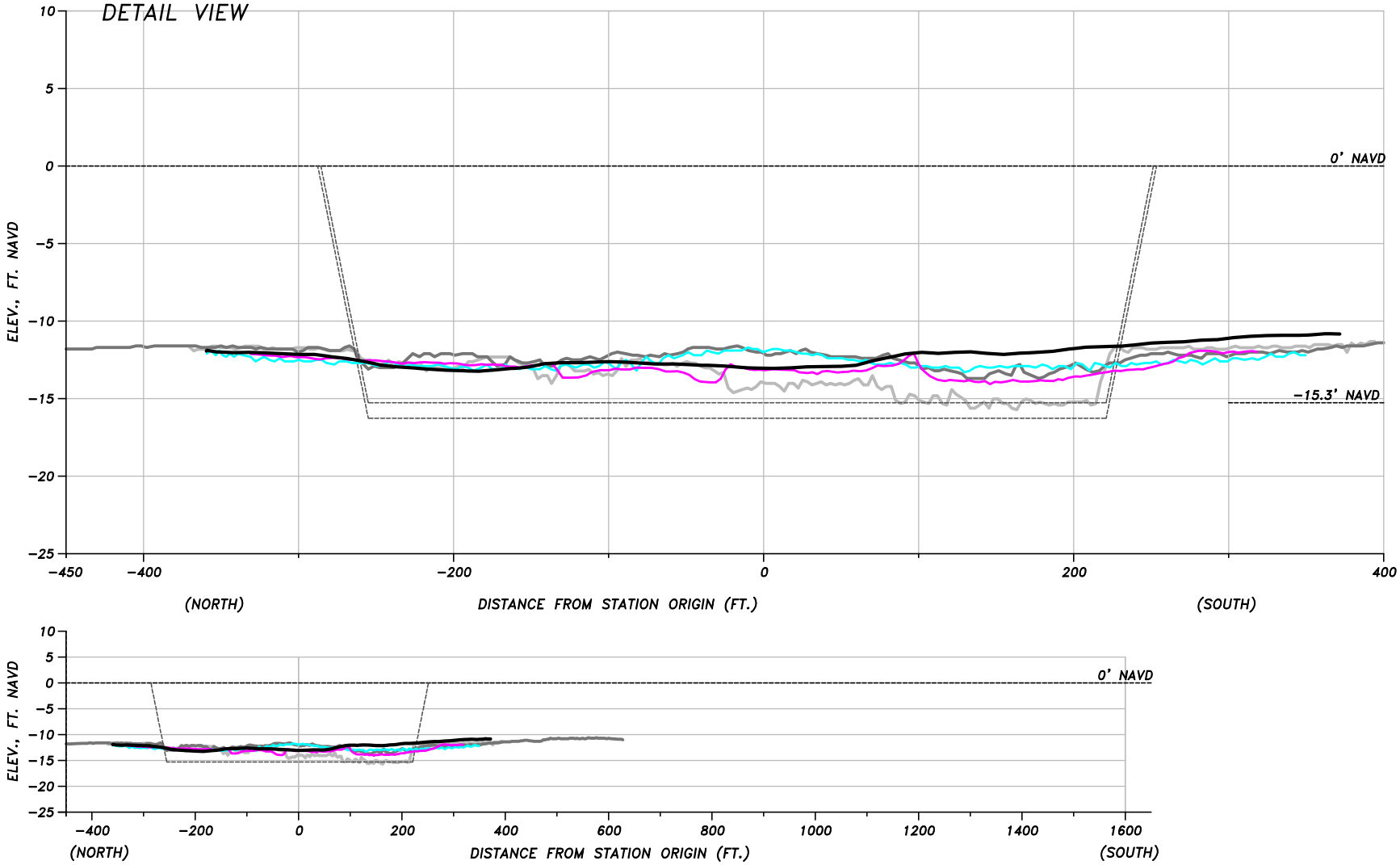

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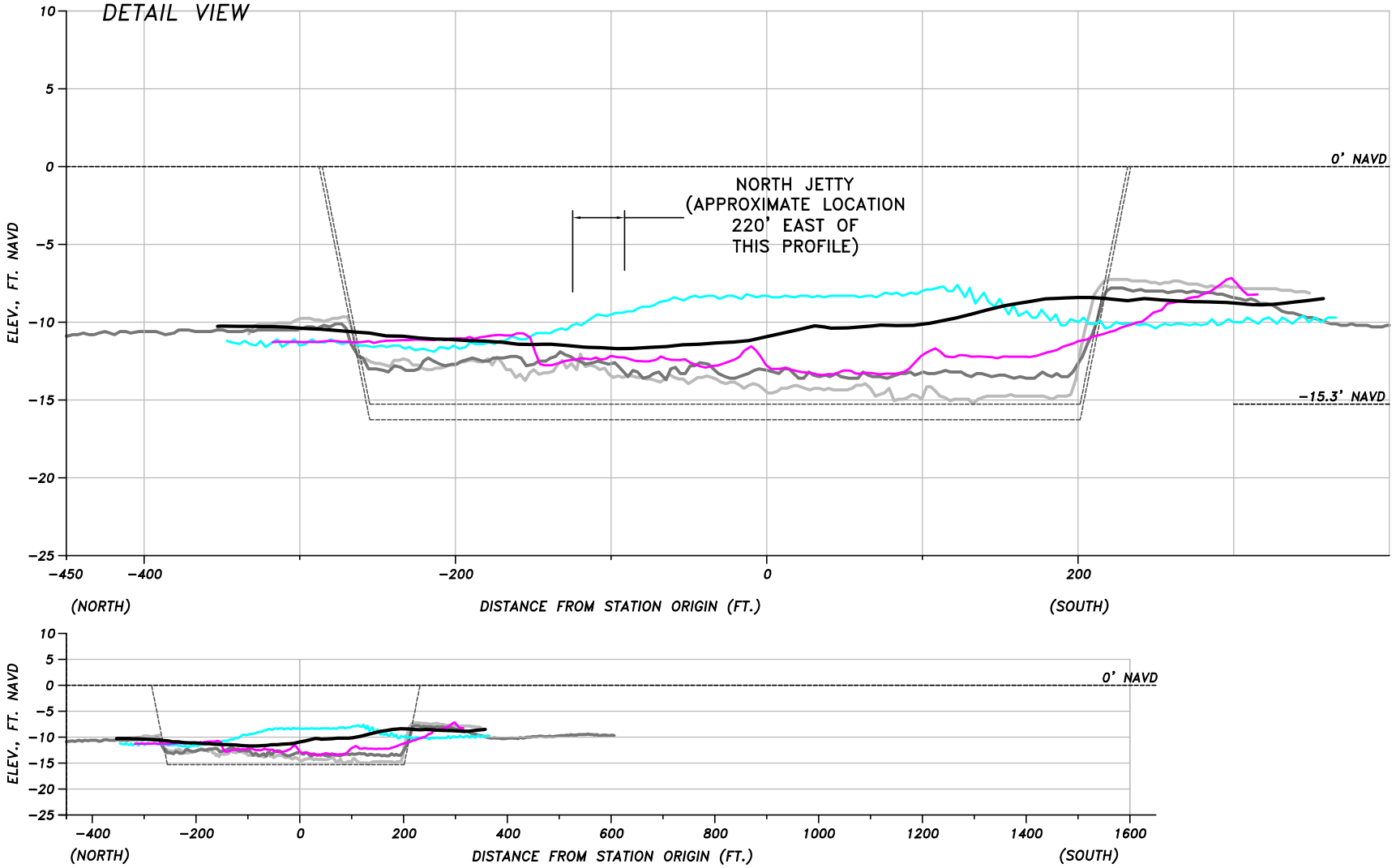

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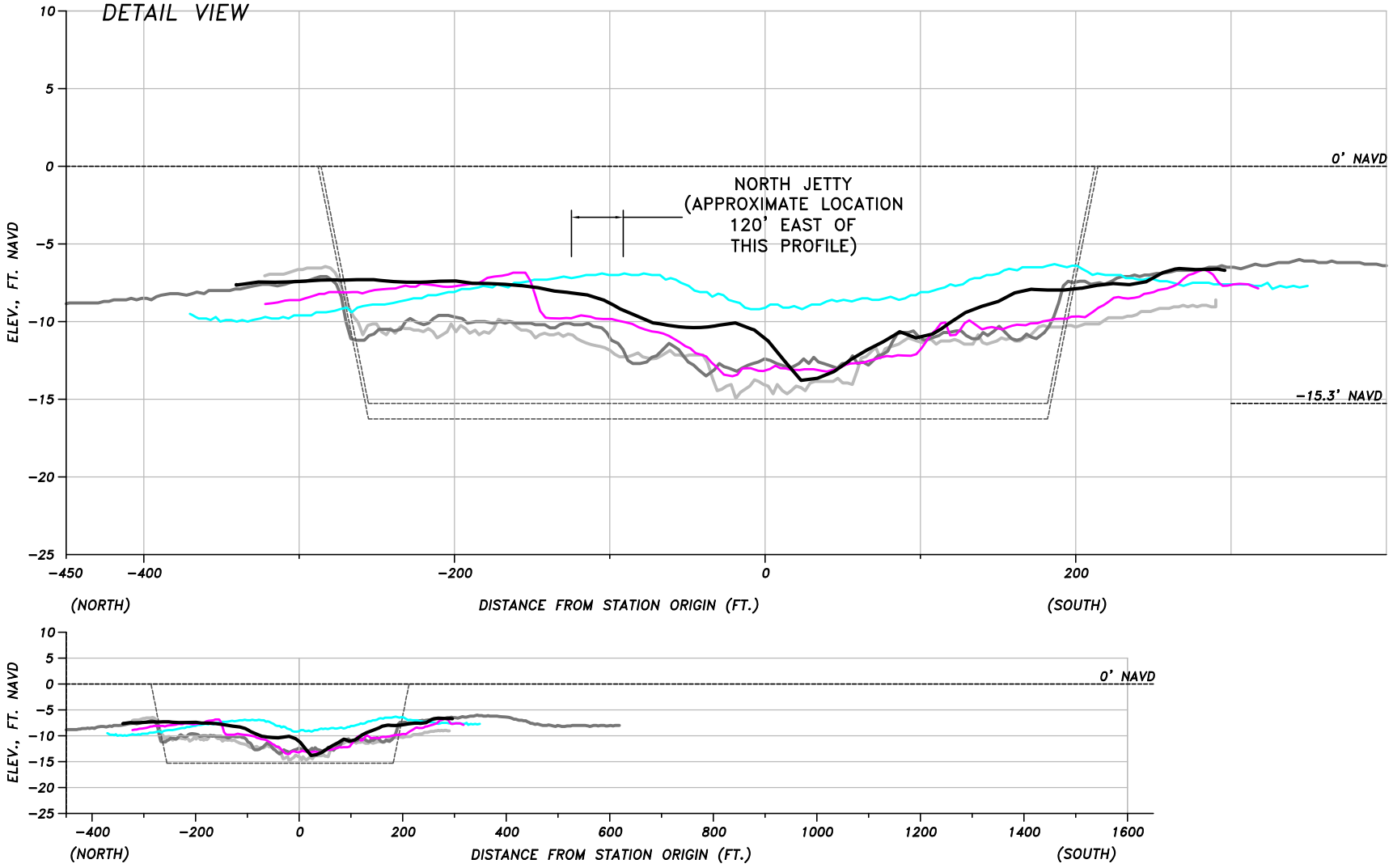

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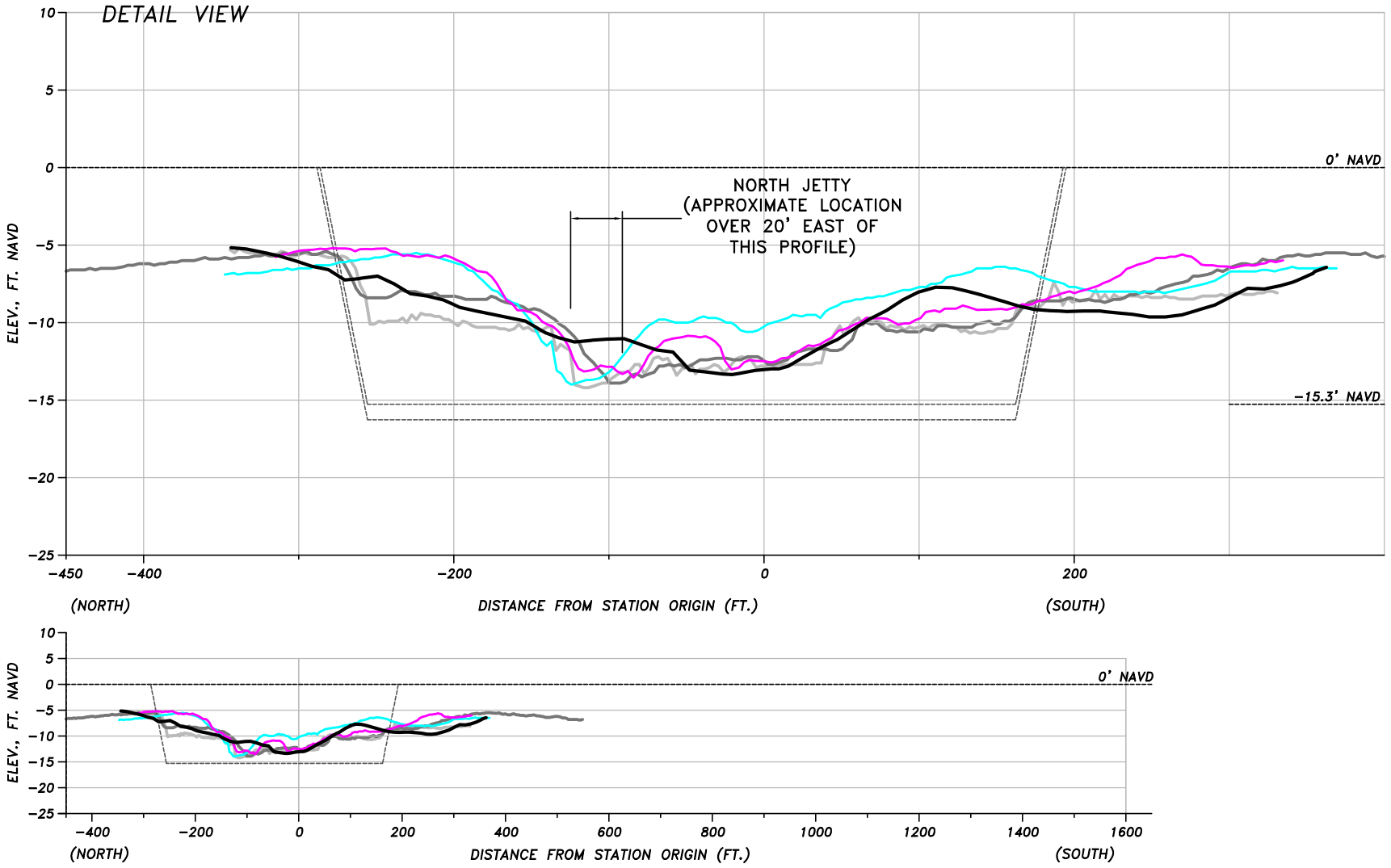

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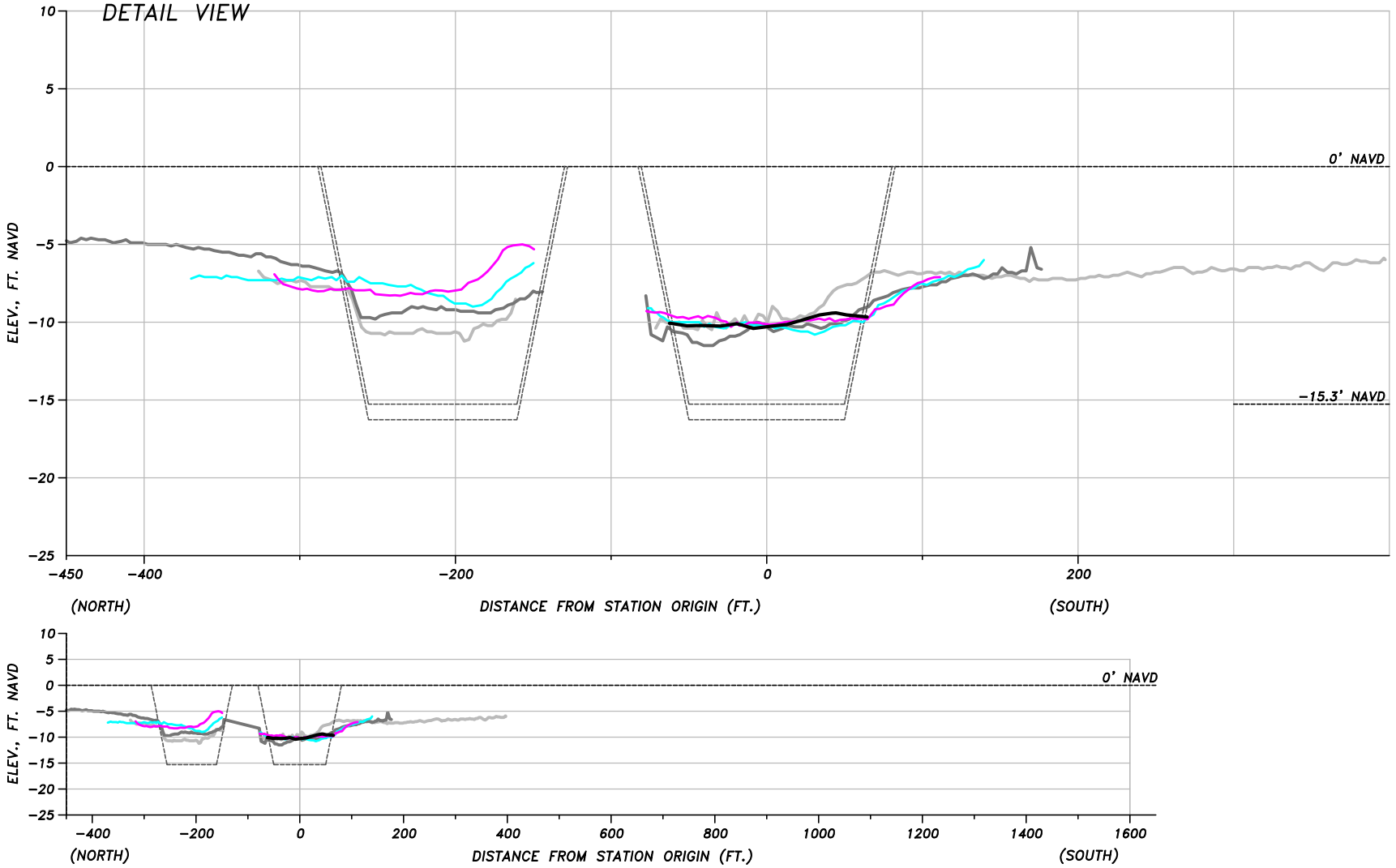

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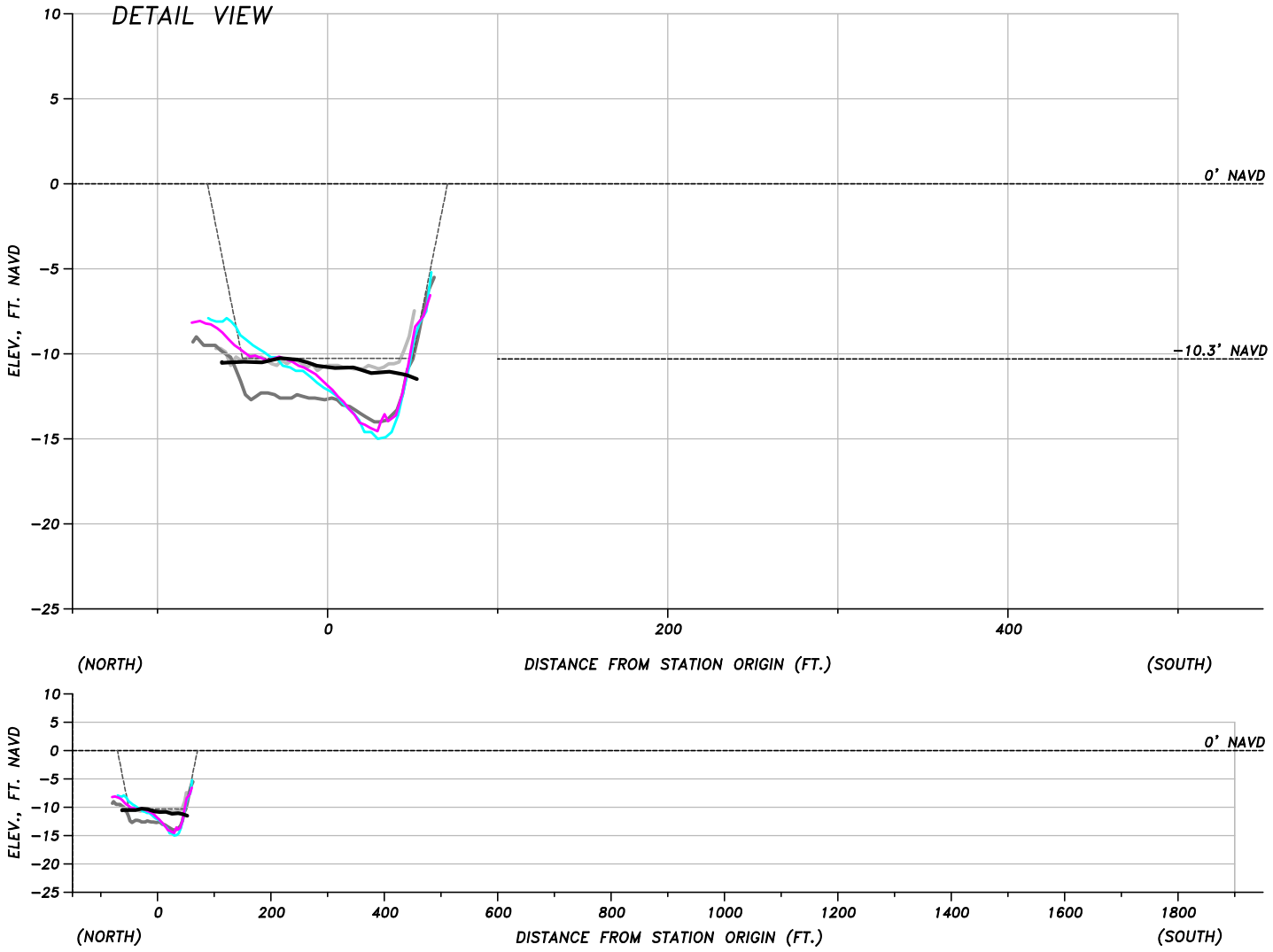

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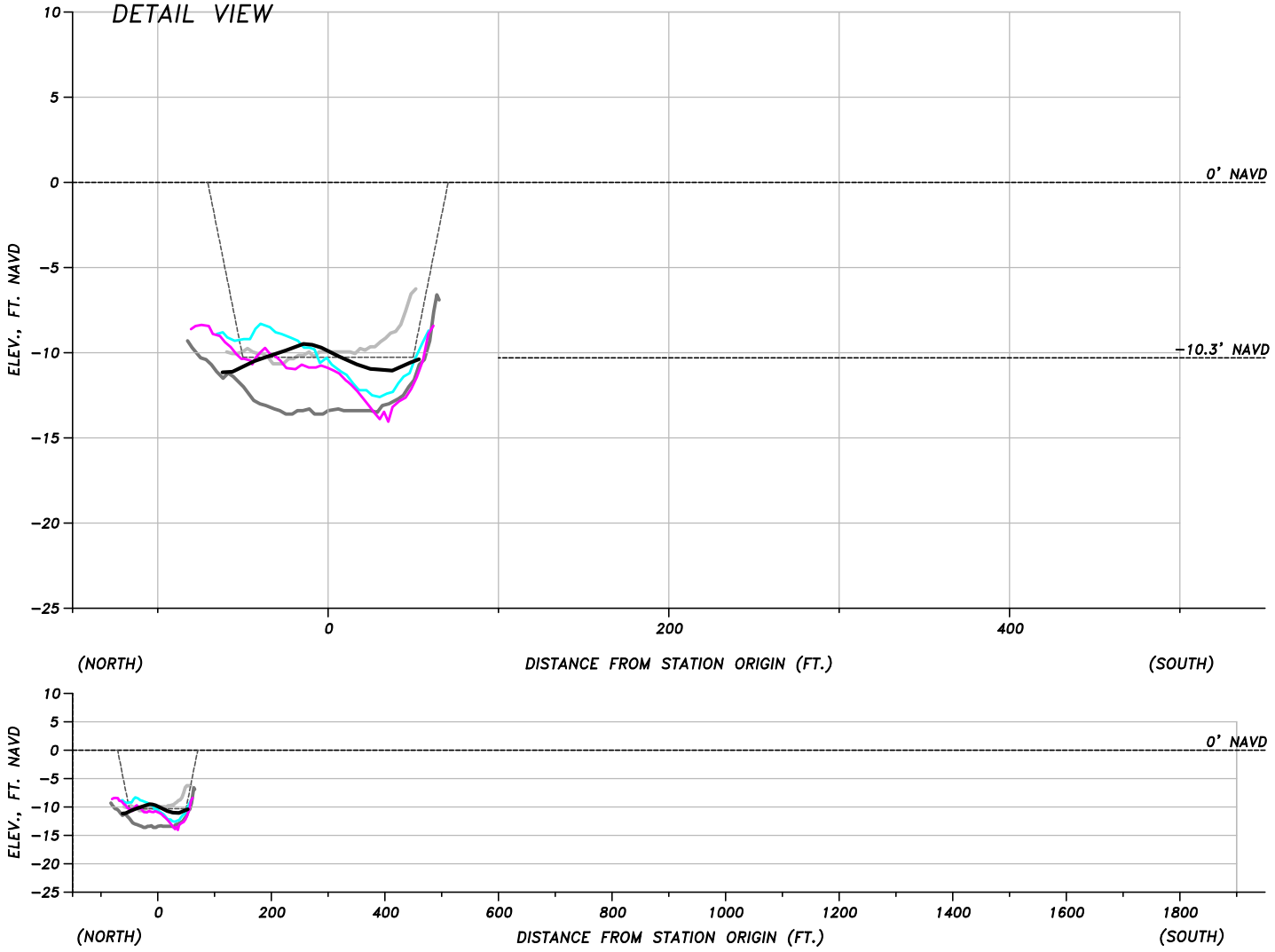

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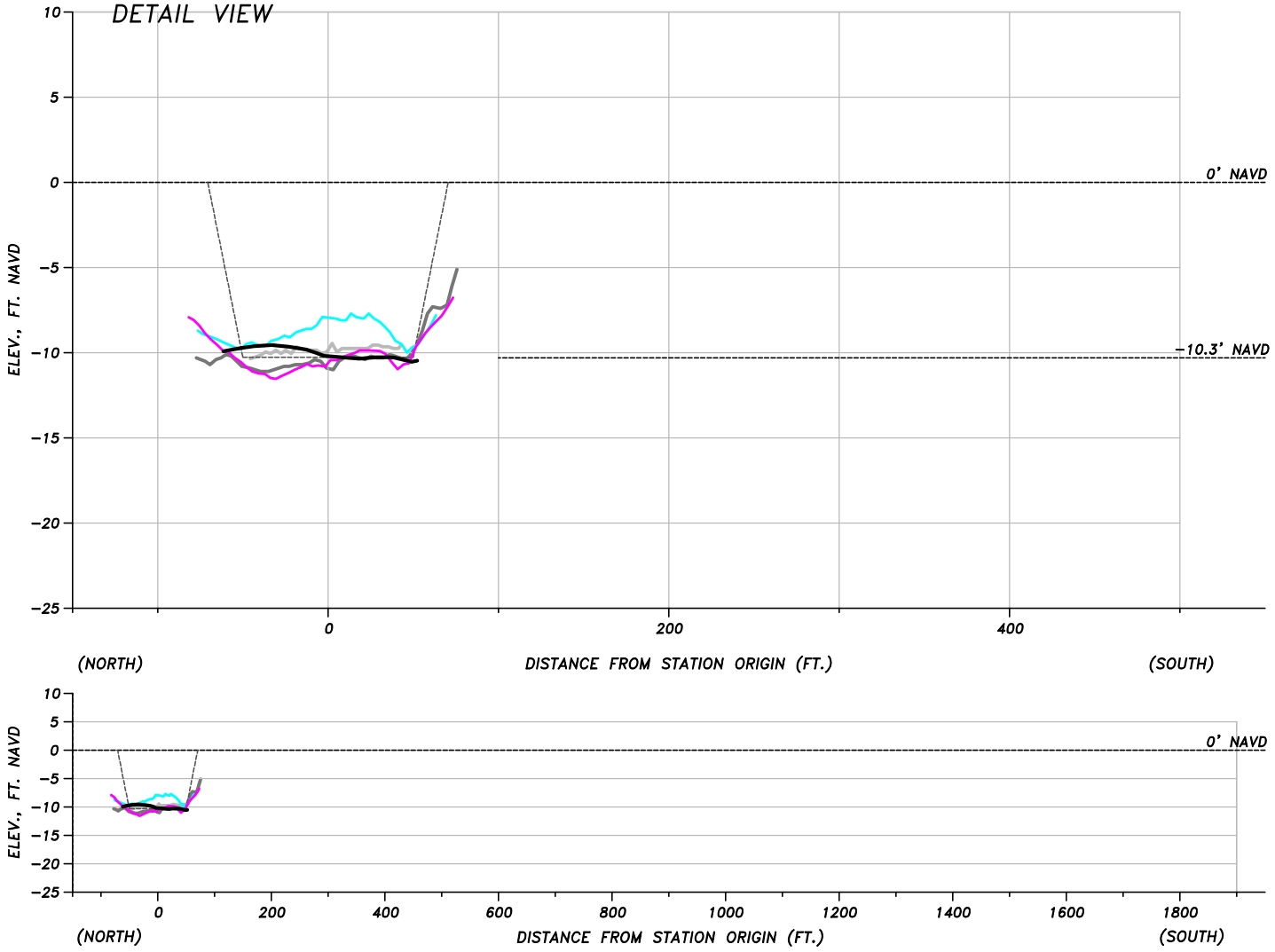

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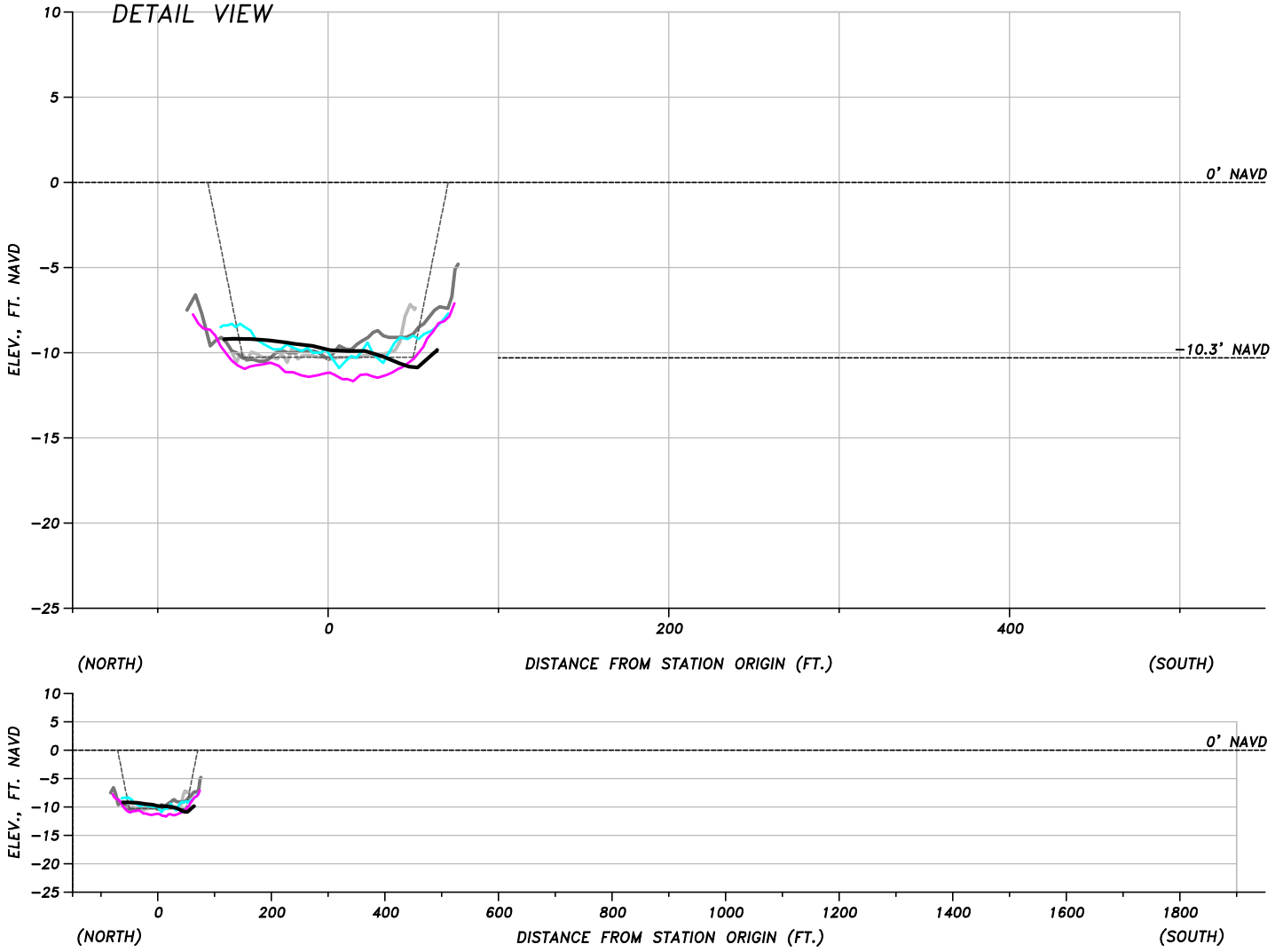

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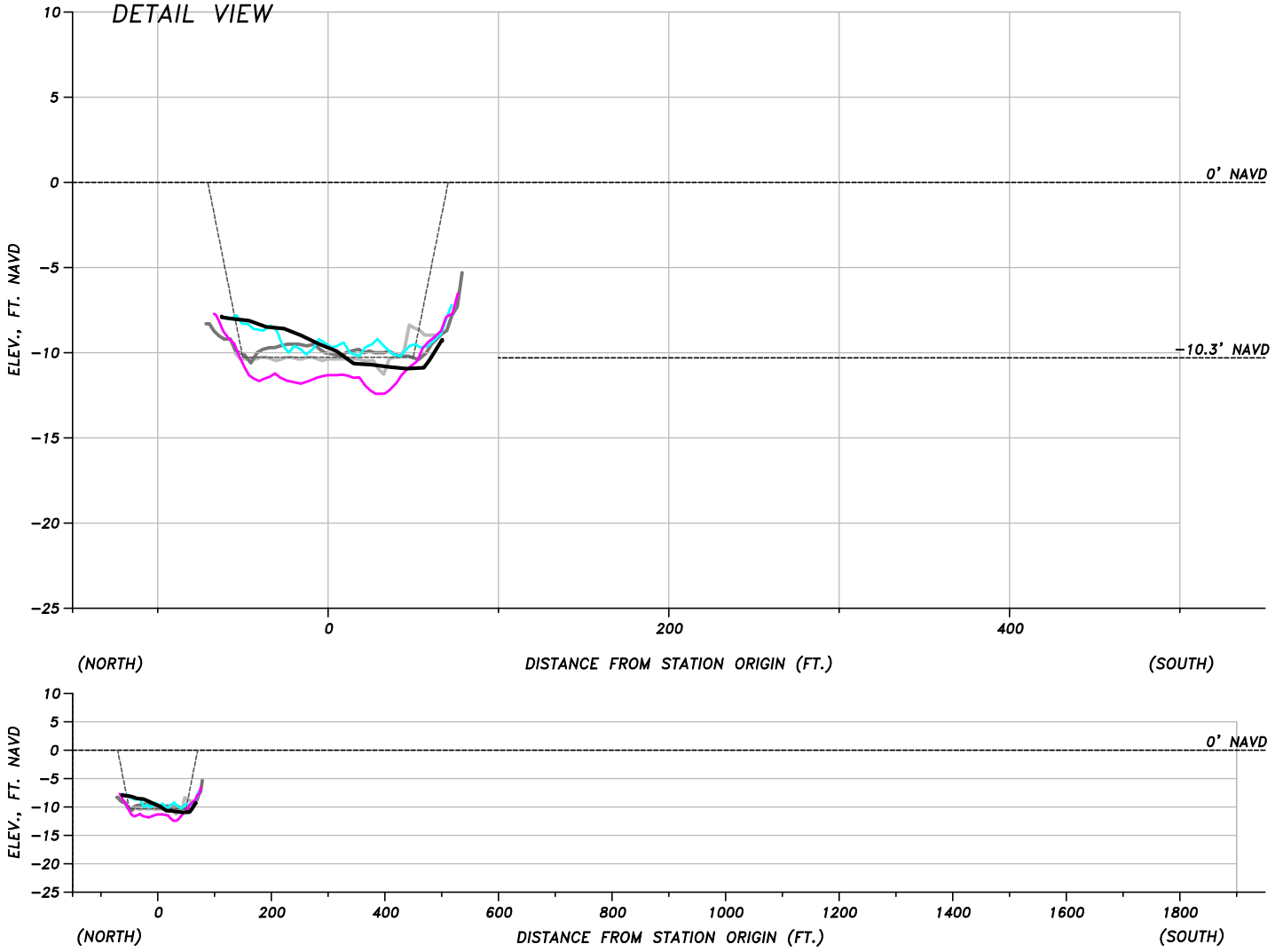

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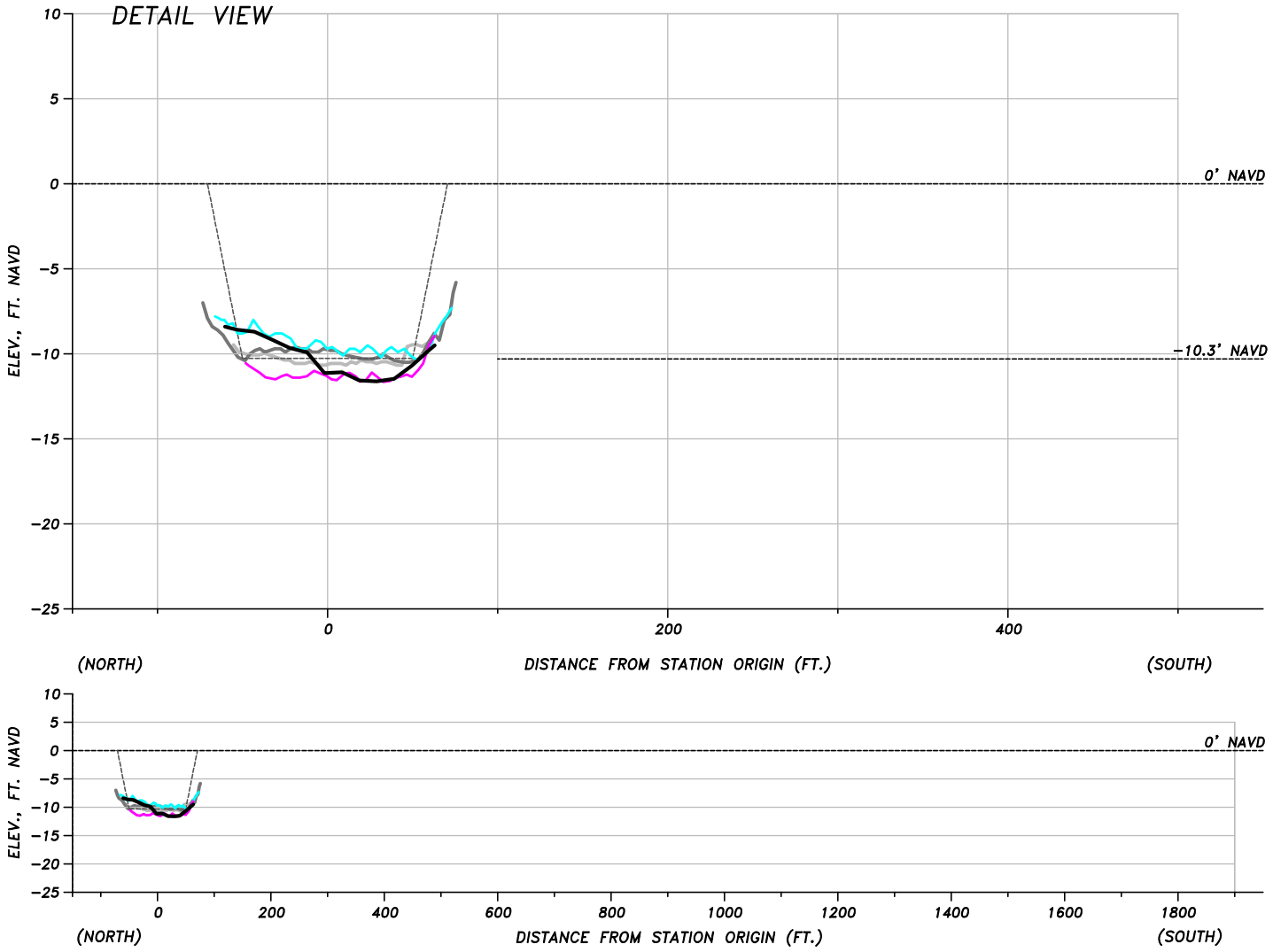

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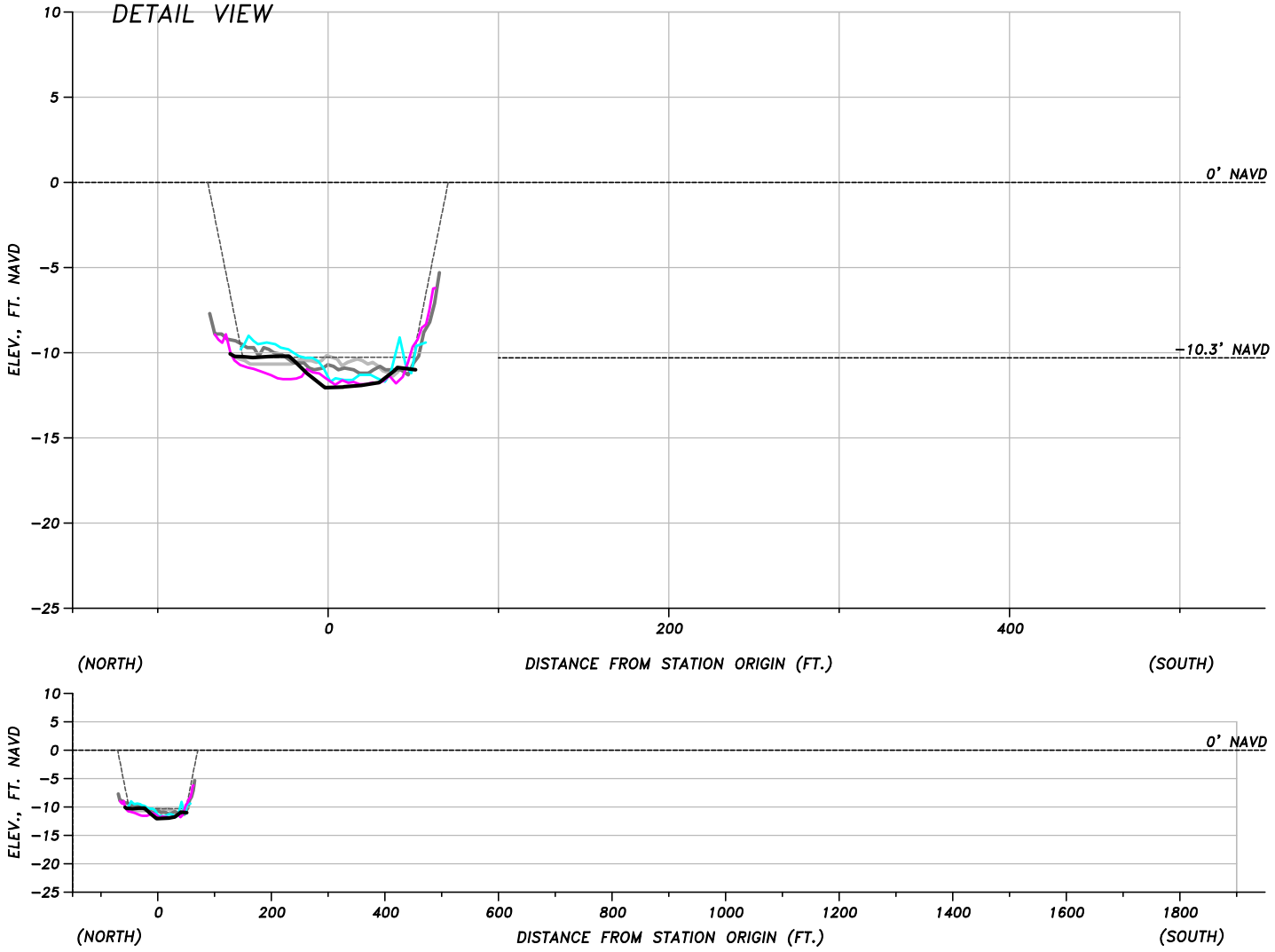

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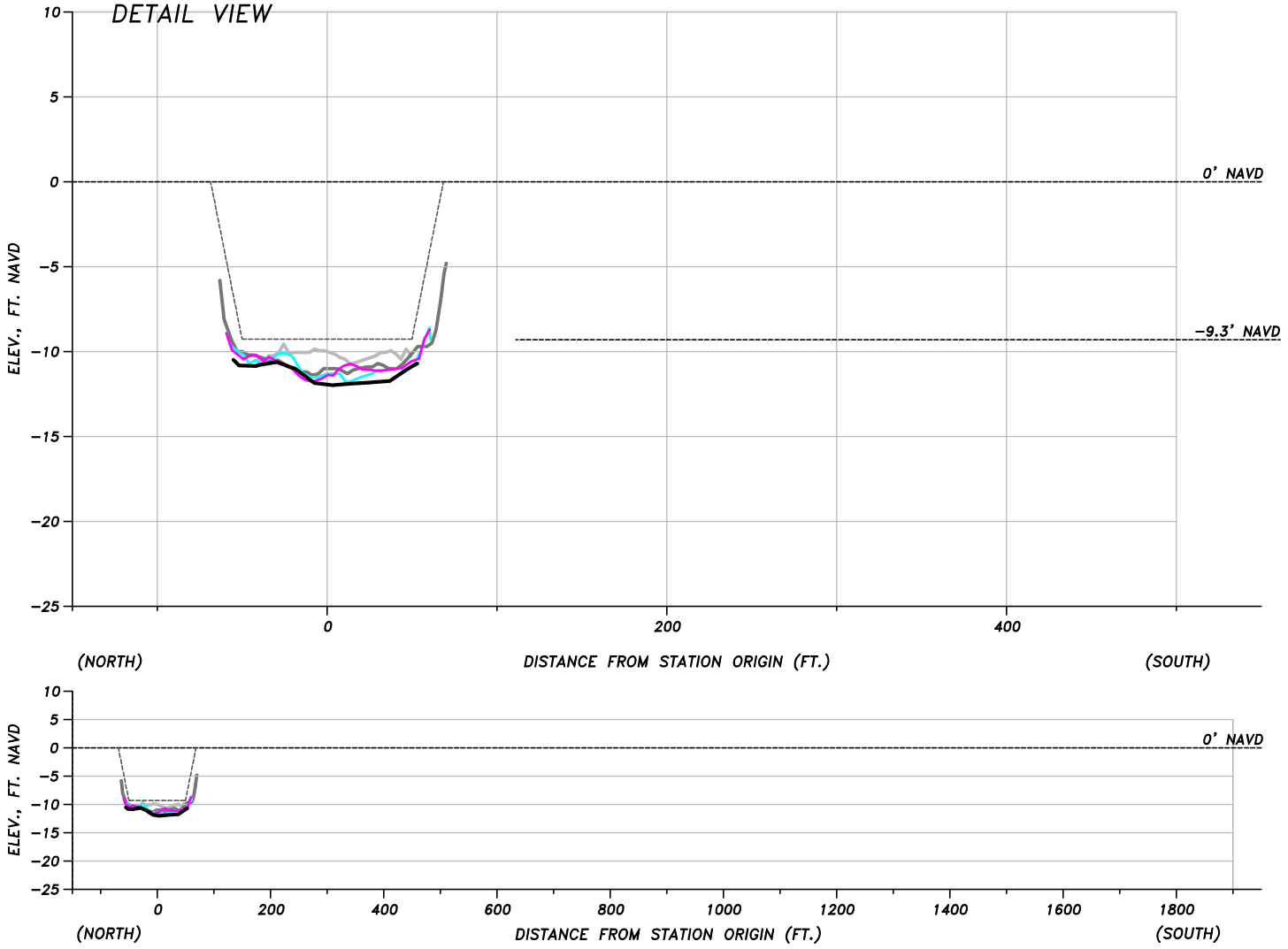

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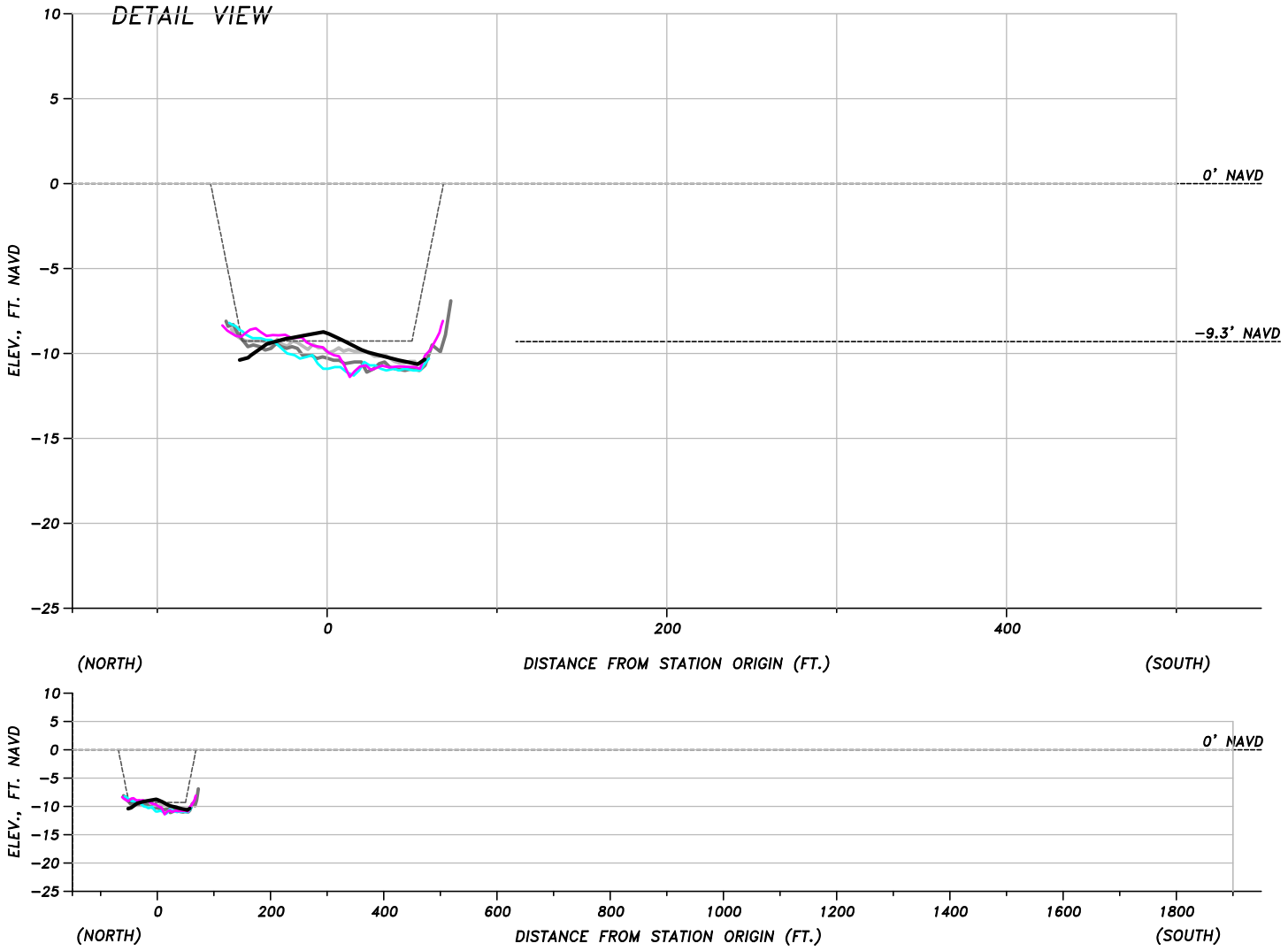

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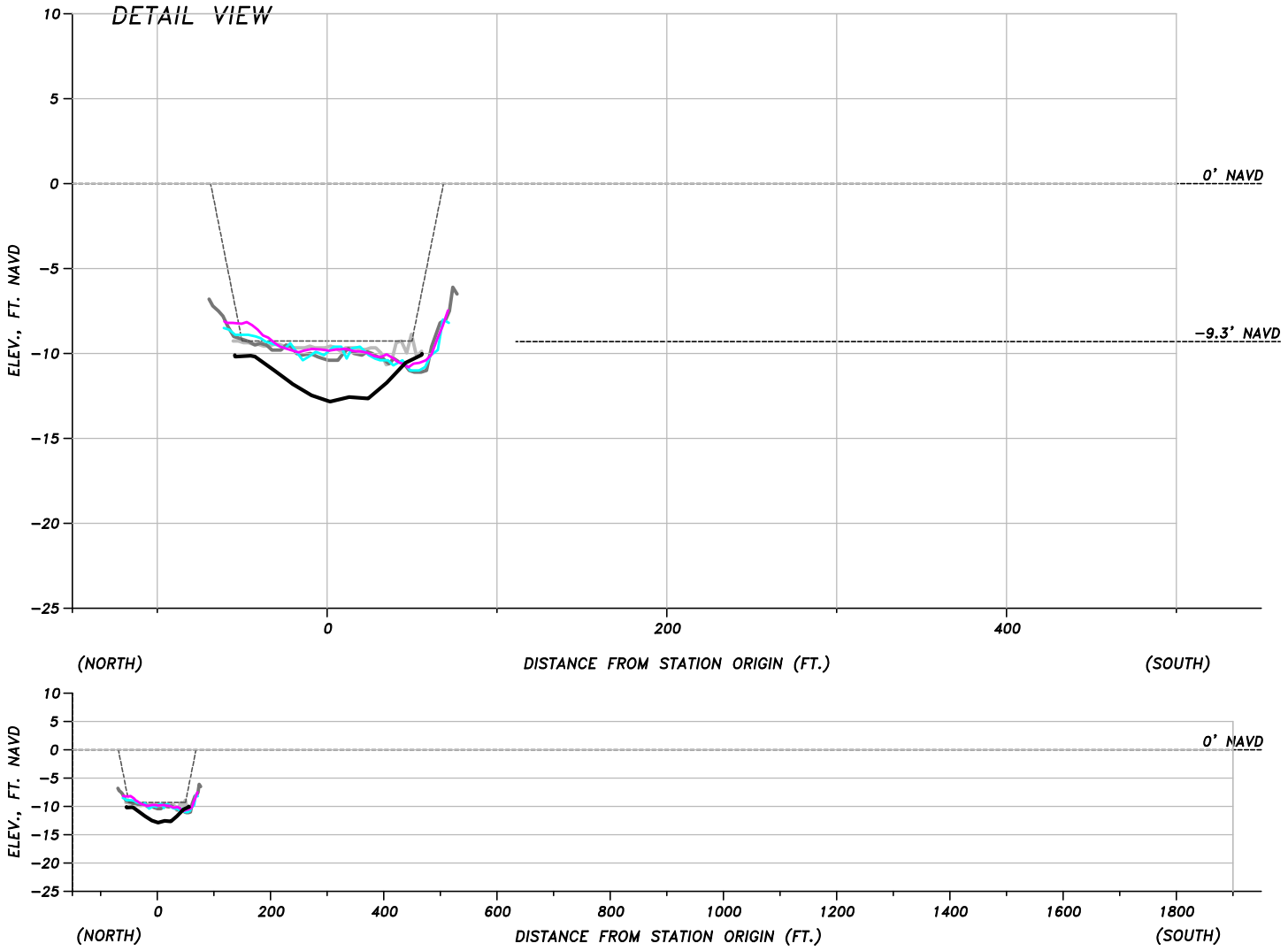

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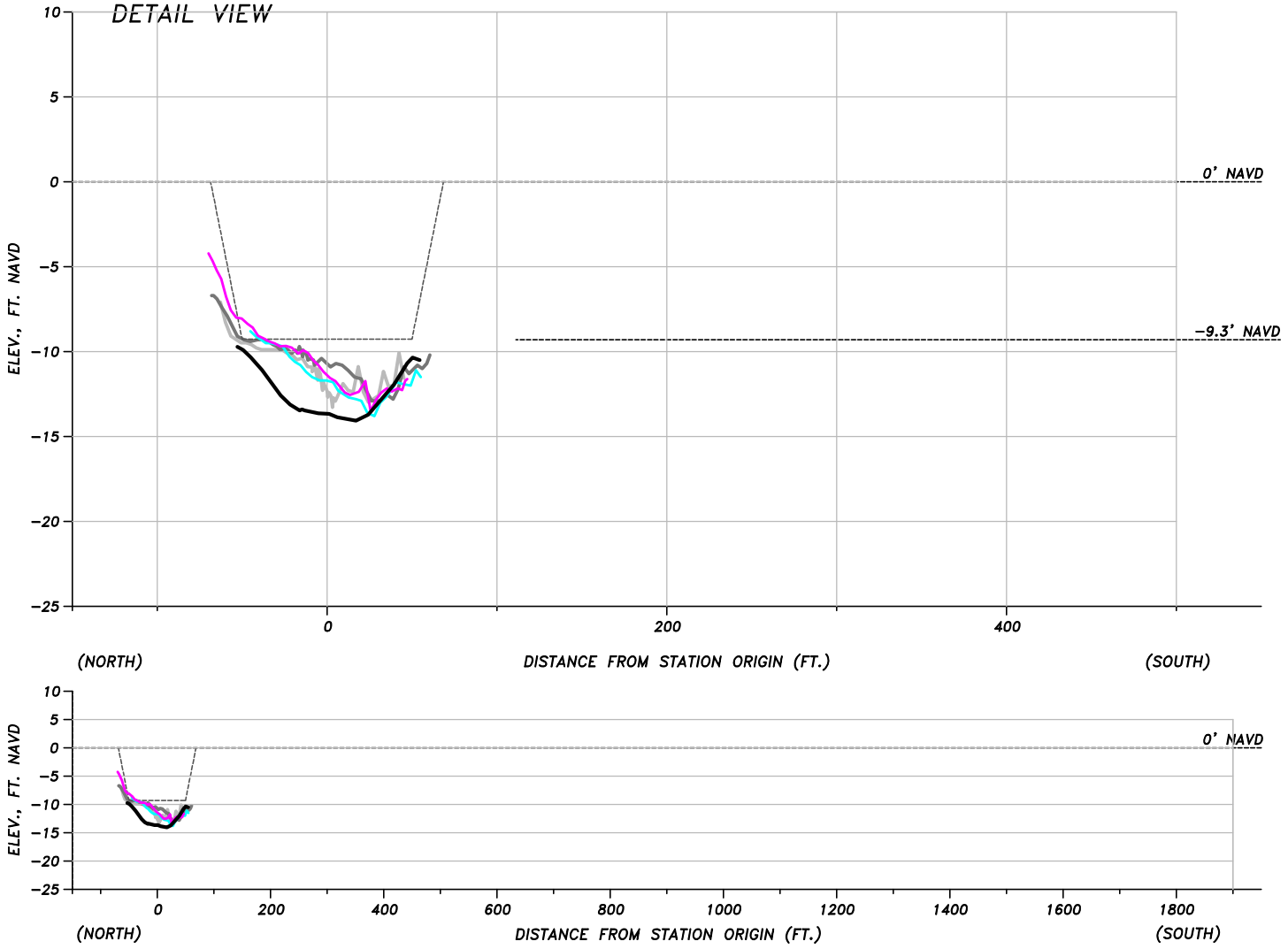

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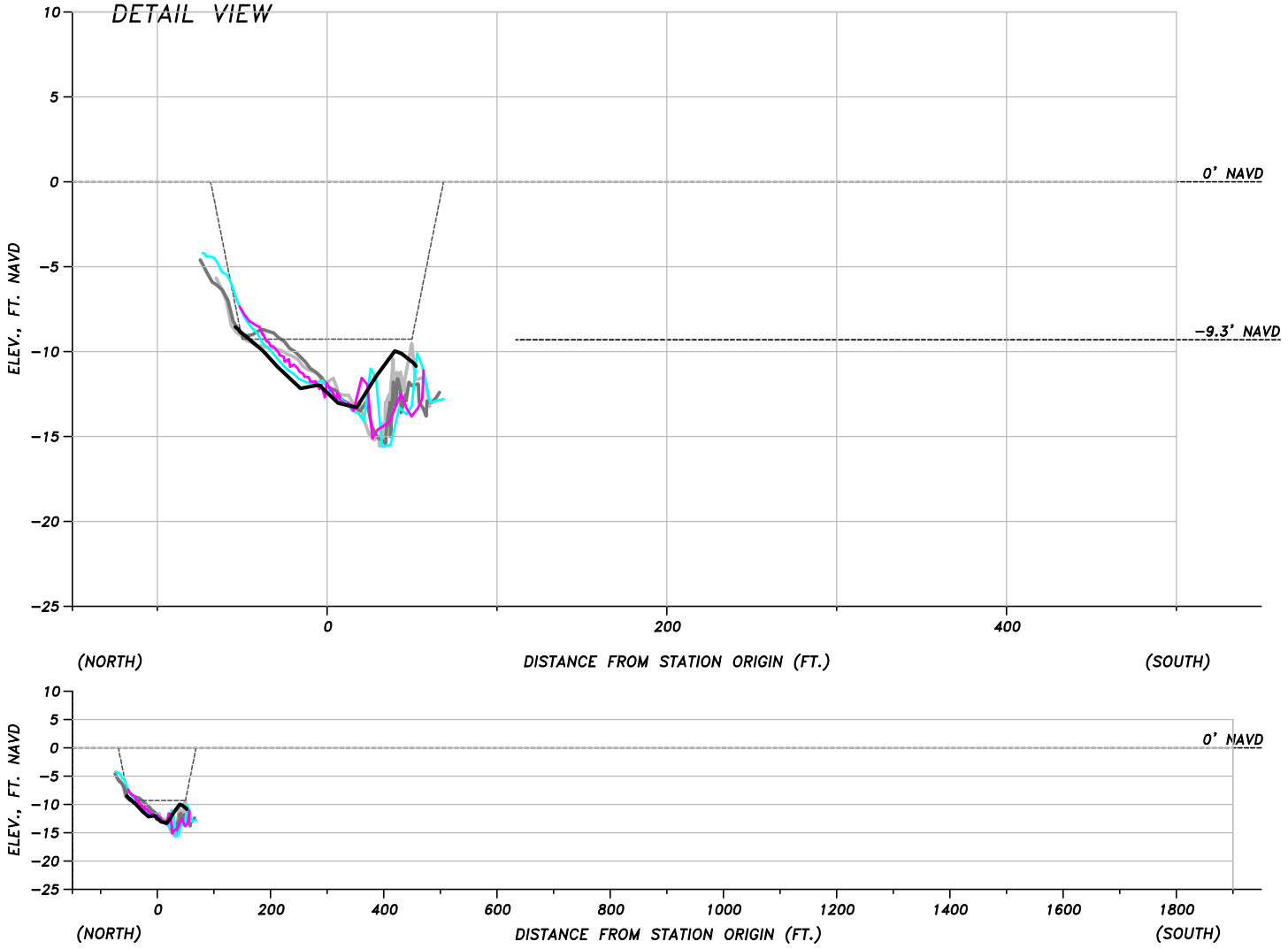

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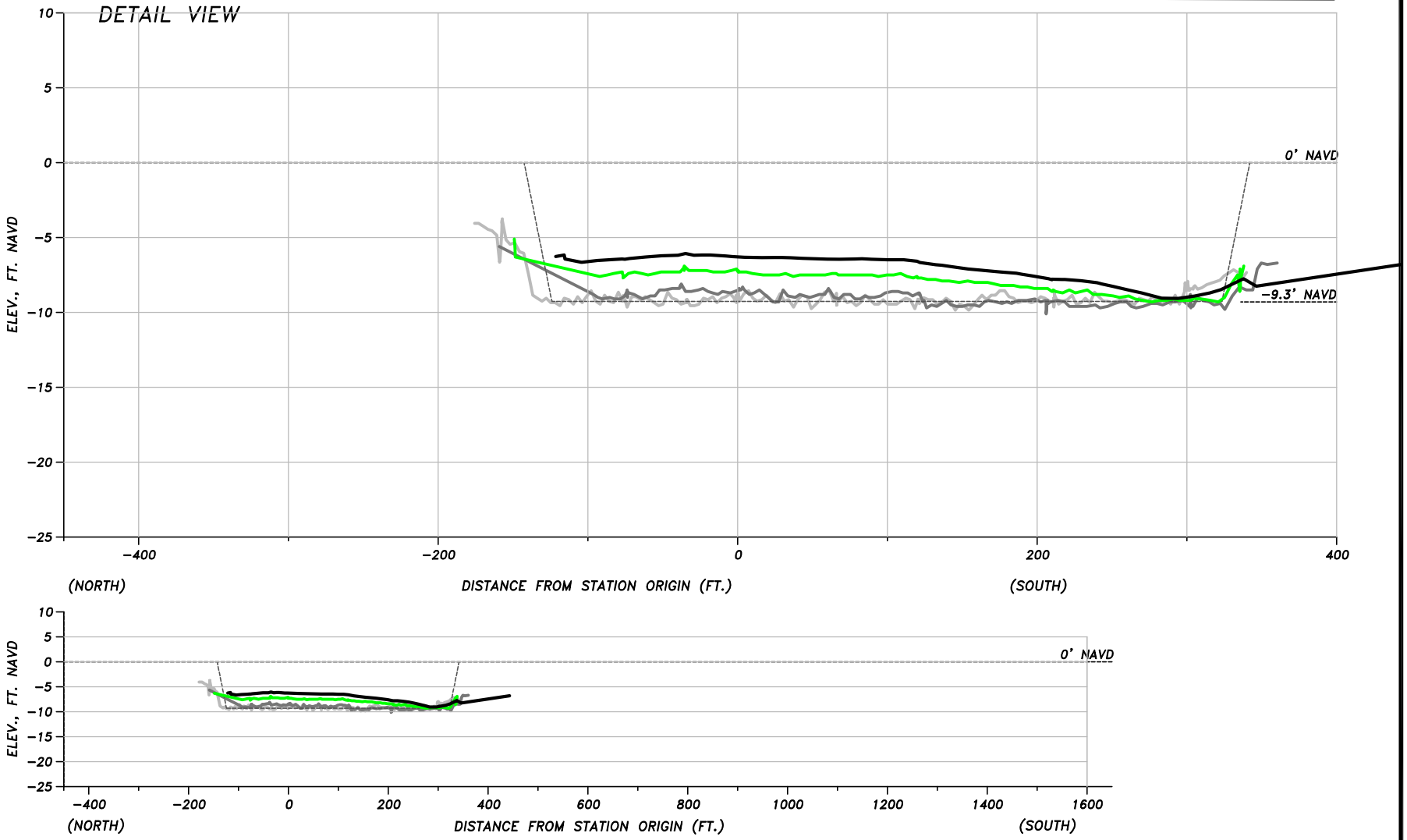

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COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
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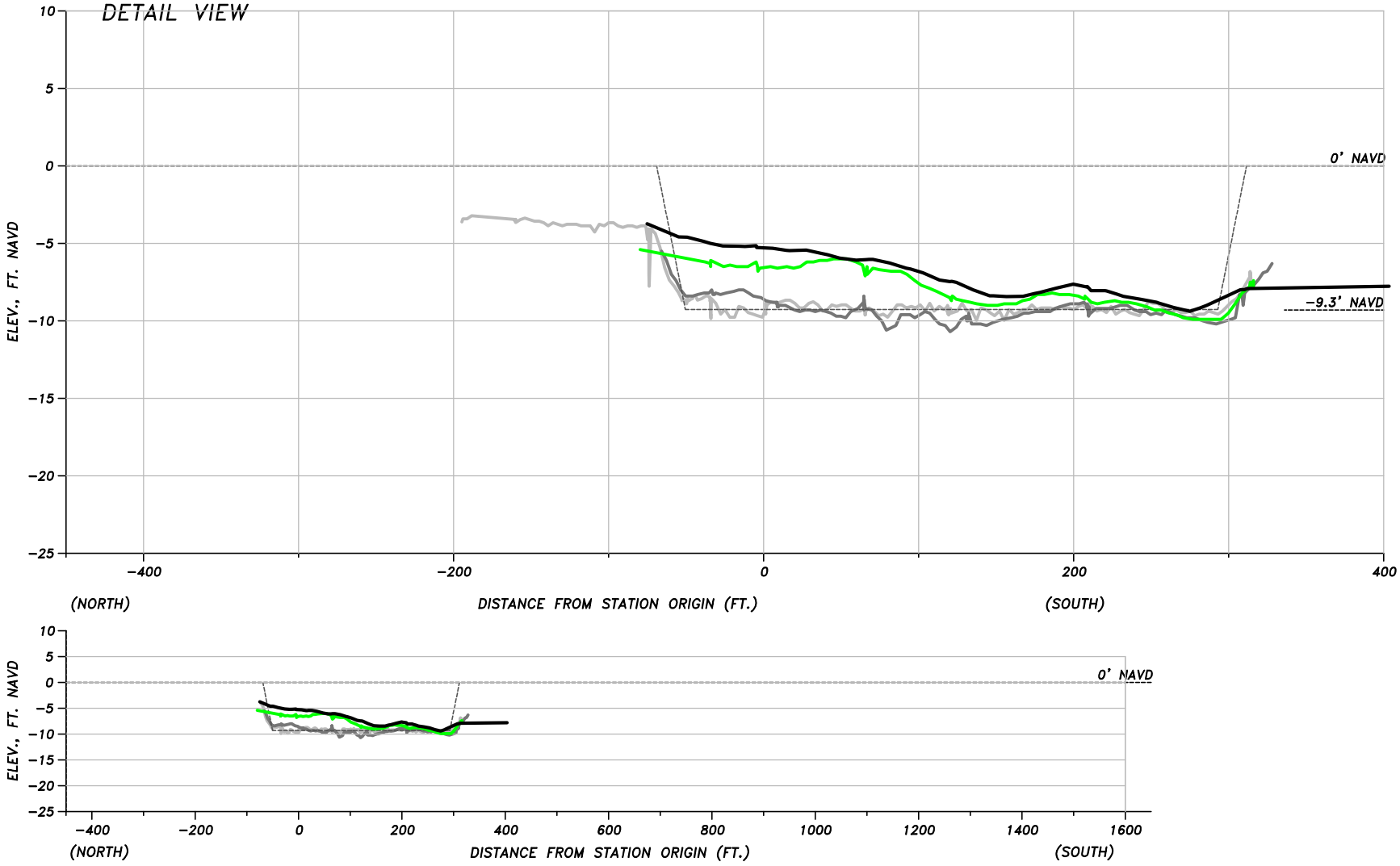

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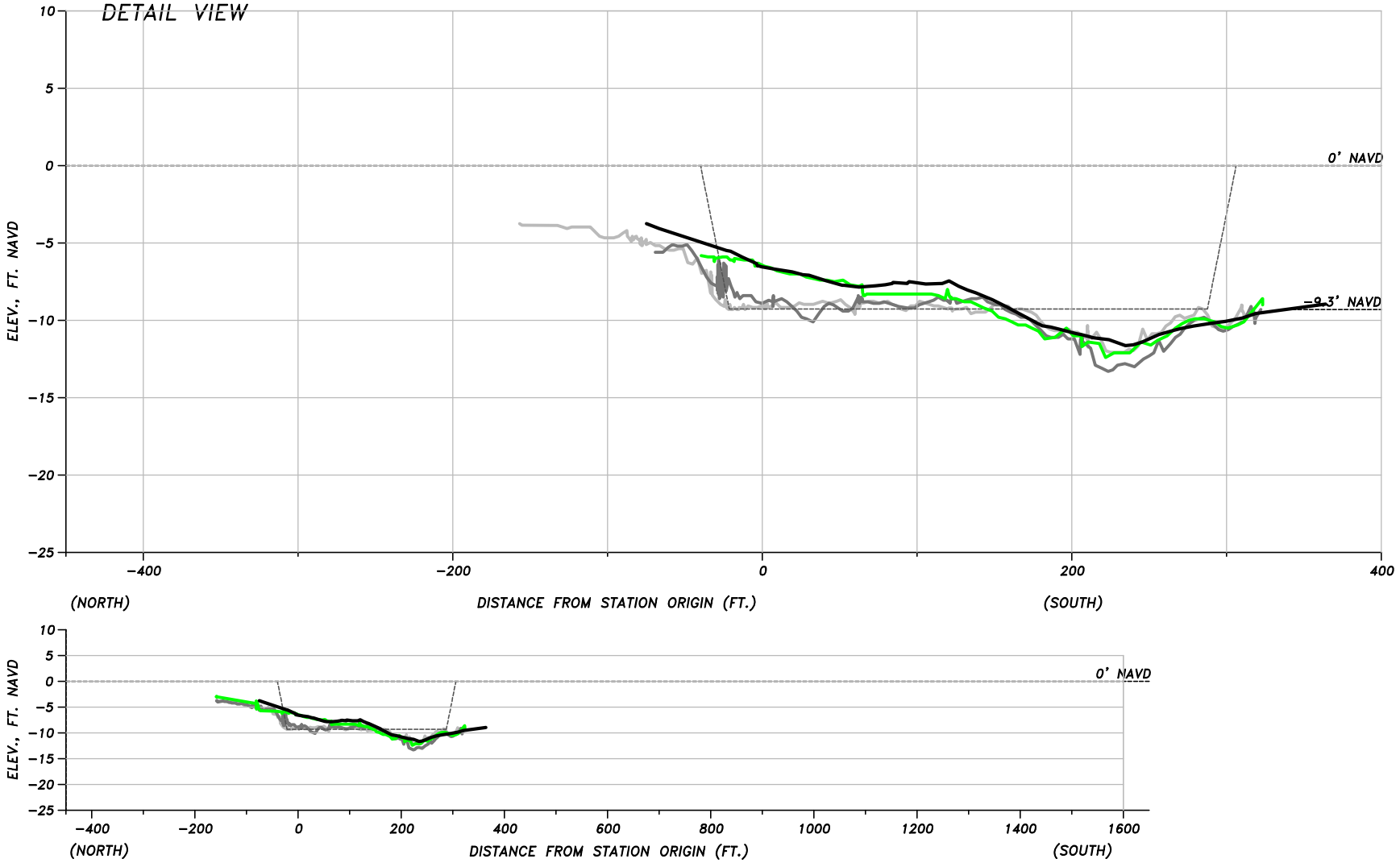

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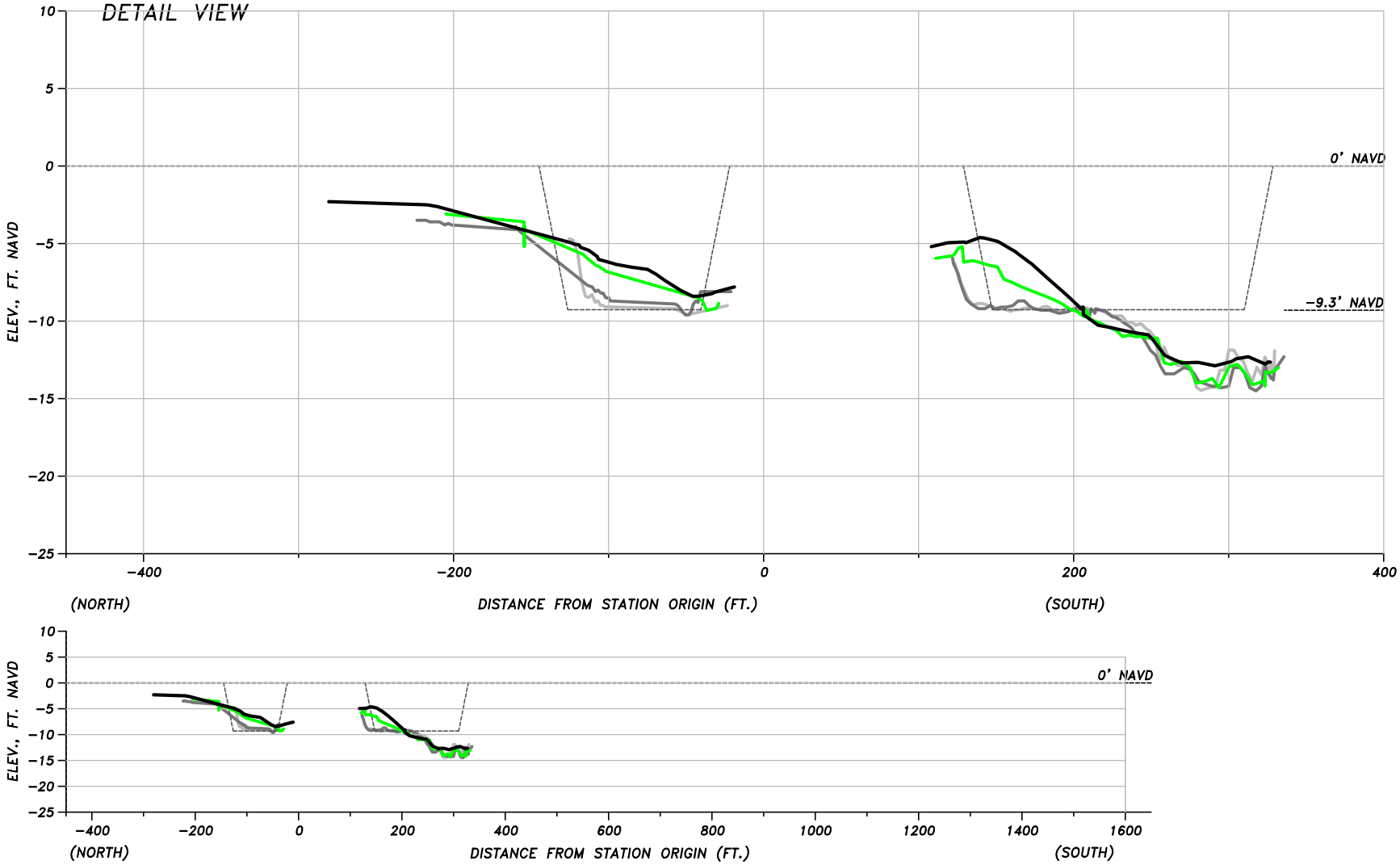
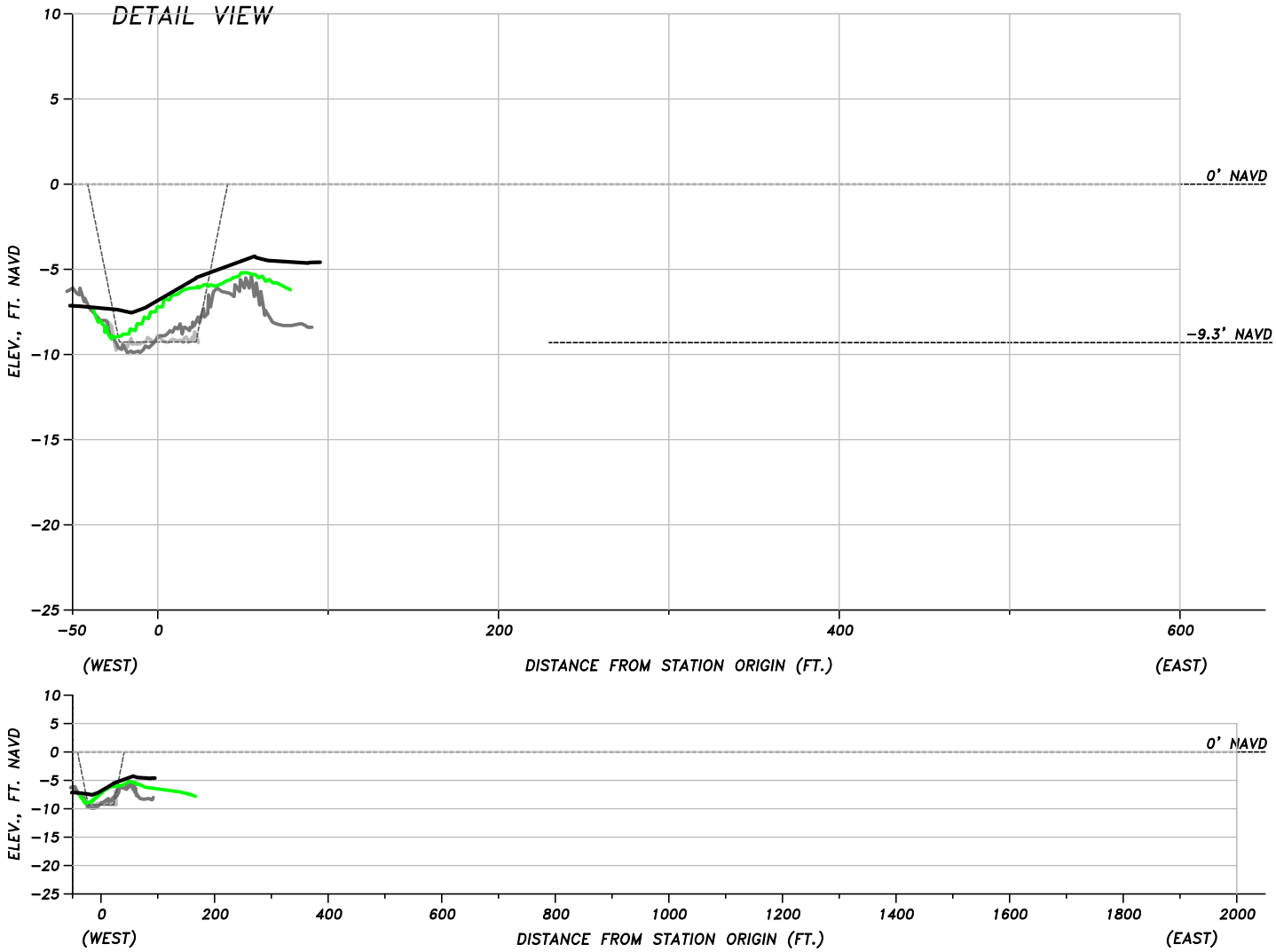
STATION: TB4



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594–2025
PHONE: (239) 594–2021
www.humistonandmoore.com

STATION: W0+00



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594–2025
PHONE: (239) 594–2021
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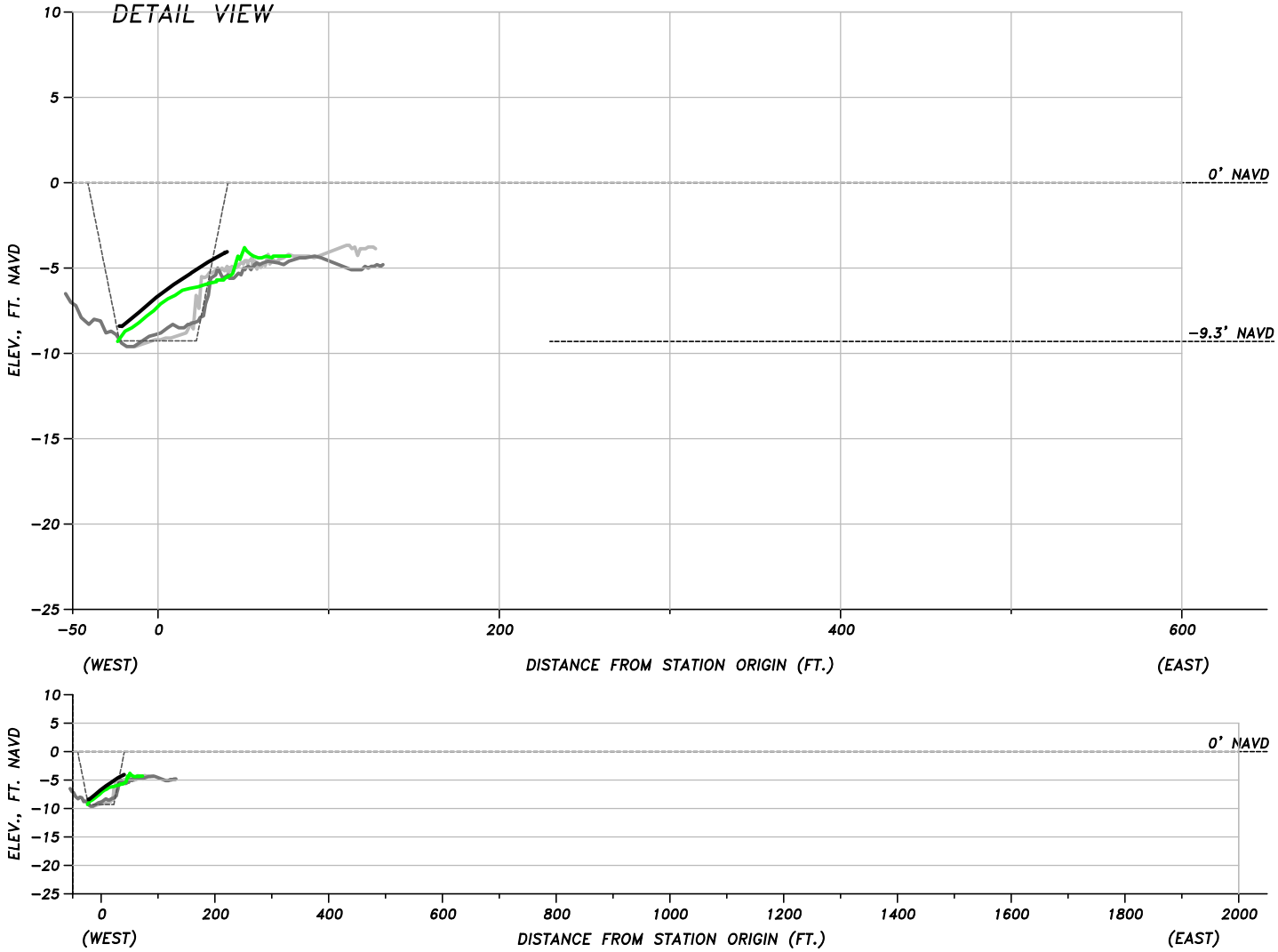
STATION: W0+52



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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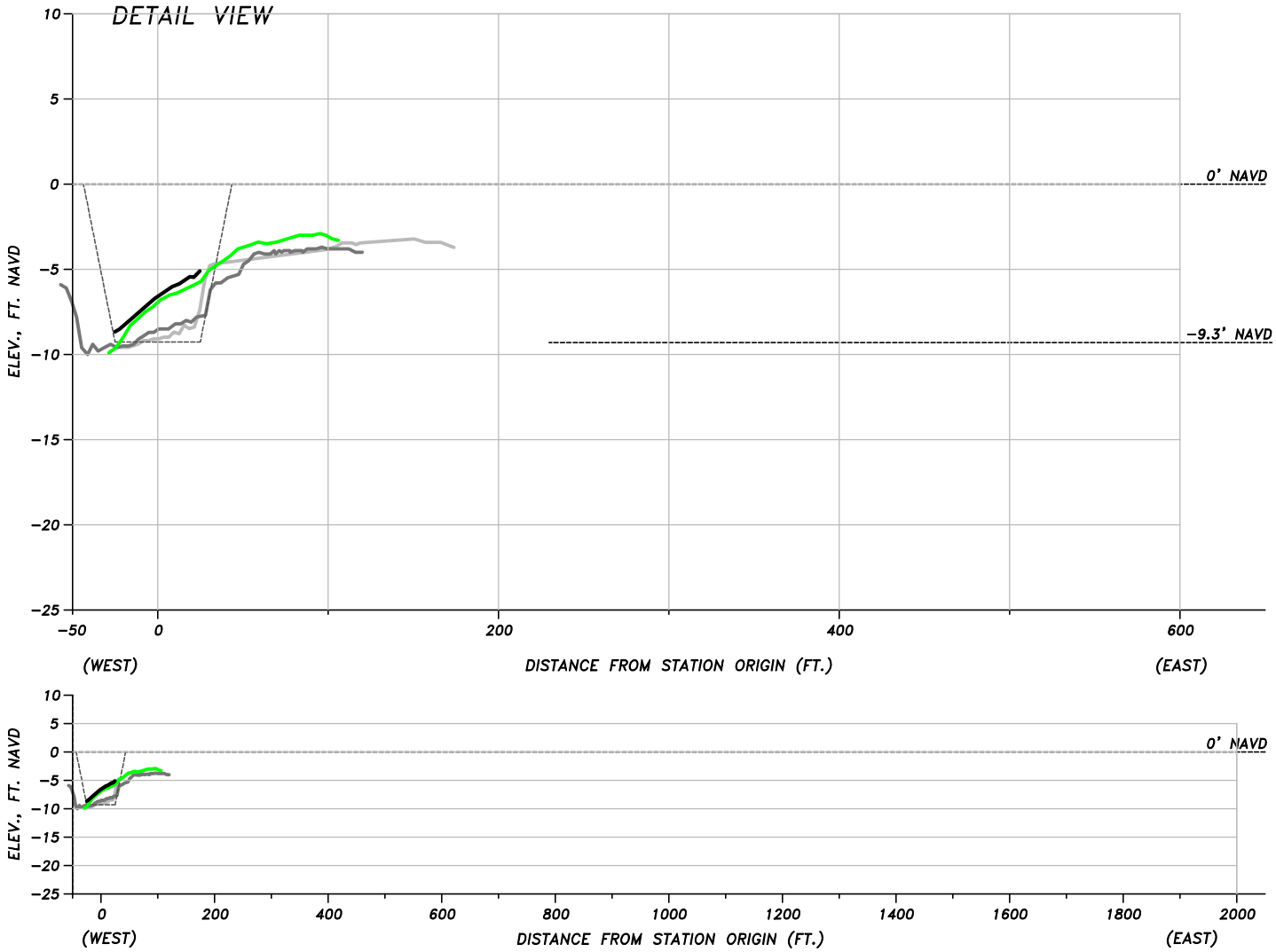
STATION: W1+06



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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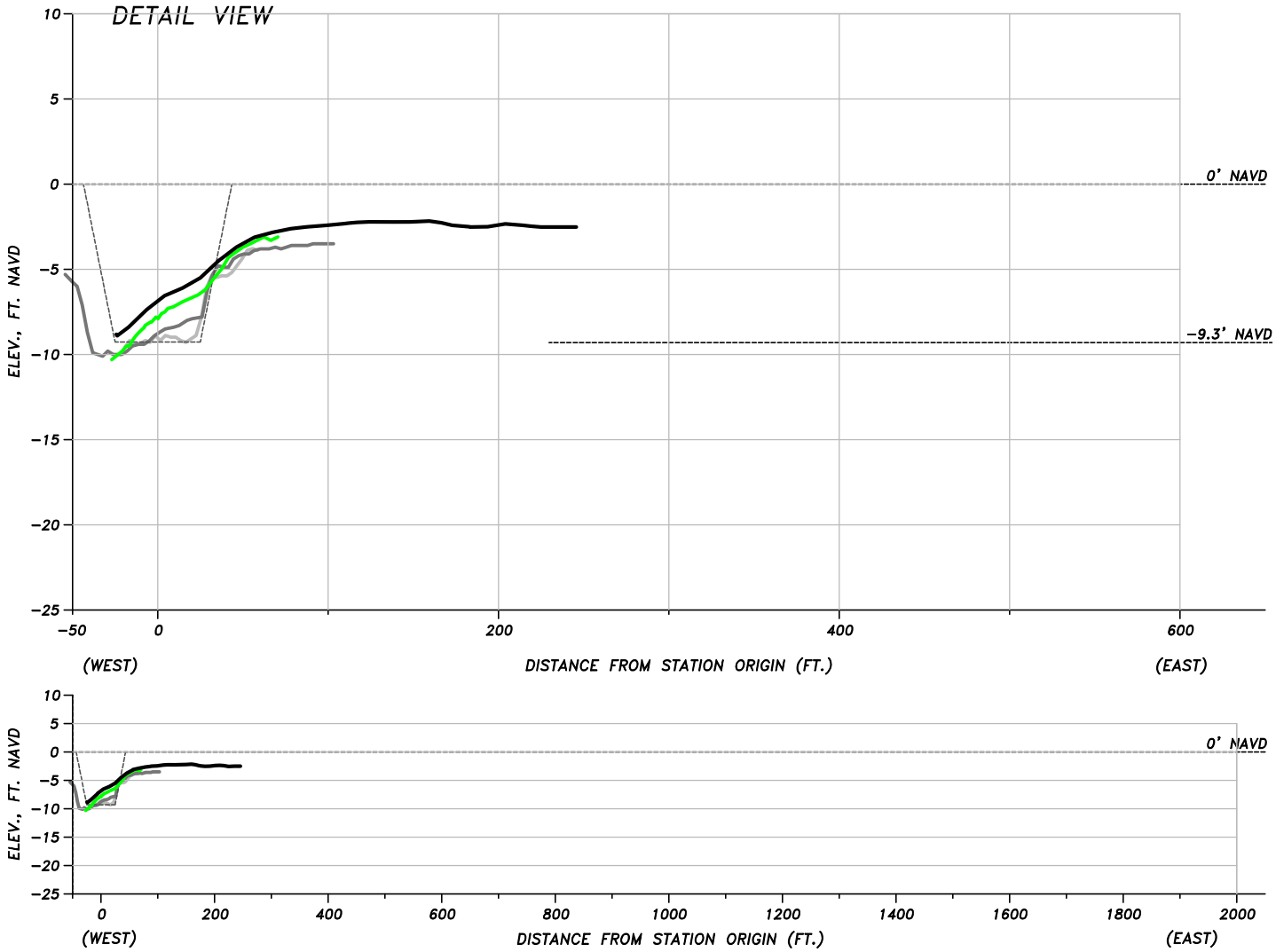
STATION: W1+83



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594–2025
PHONE: (239) 594–2021
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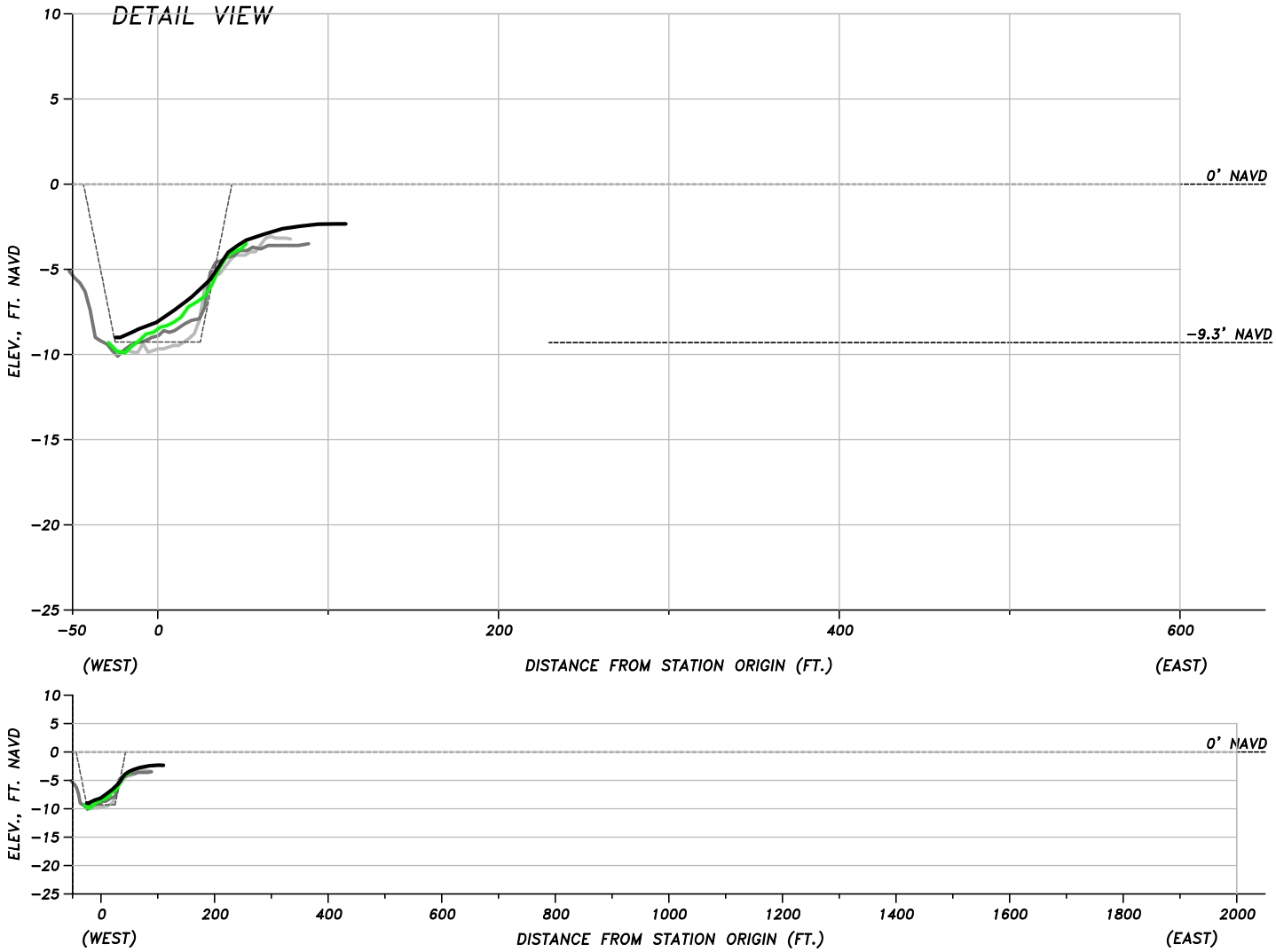
STATION: W2+60



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594–2025
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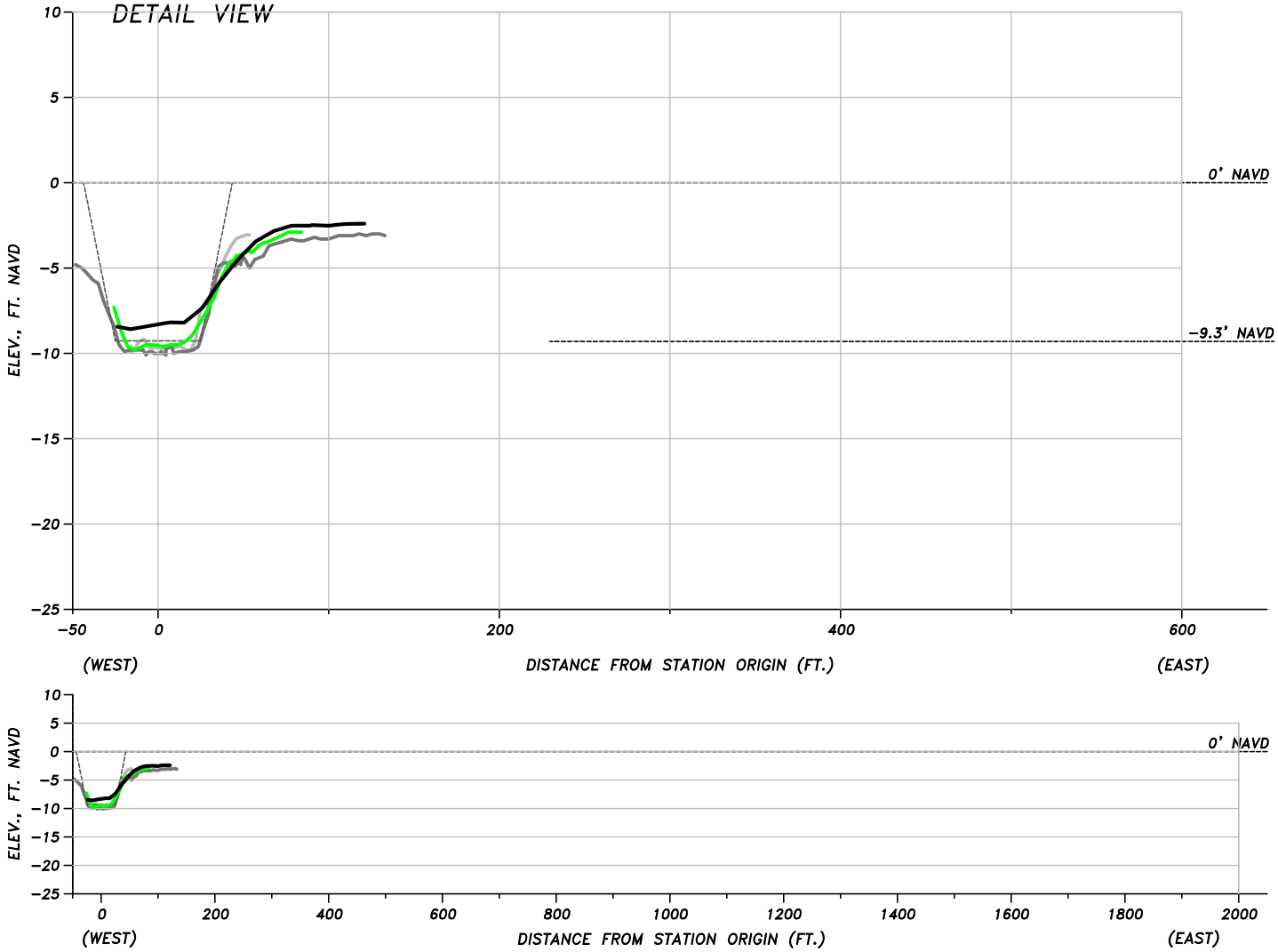
STATION: W3+38



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594–2025
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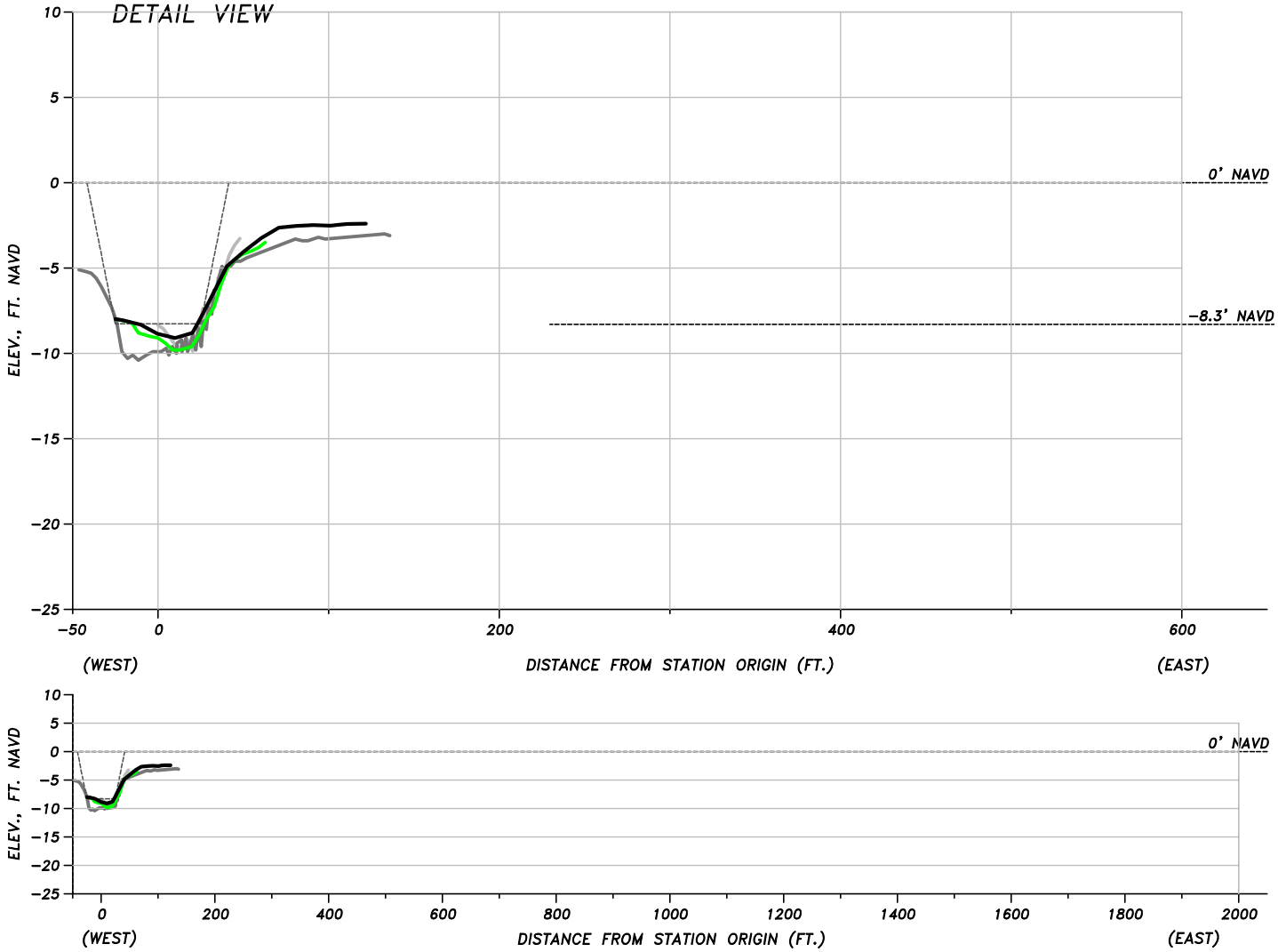
STATION: W3+56



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594–2025
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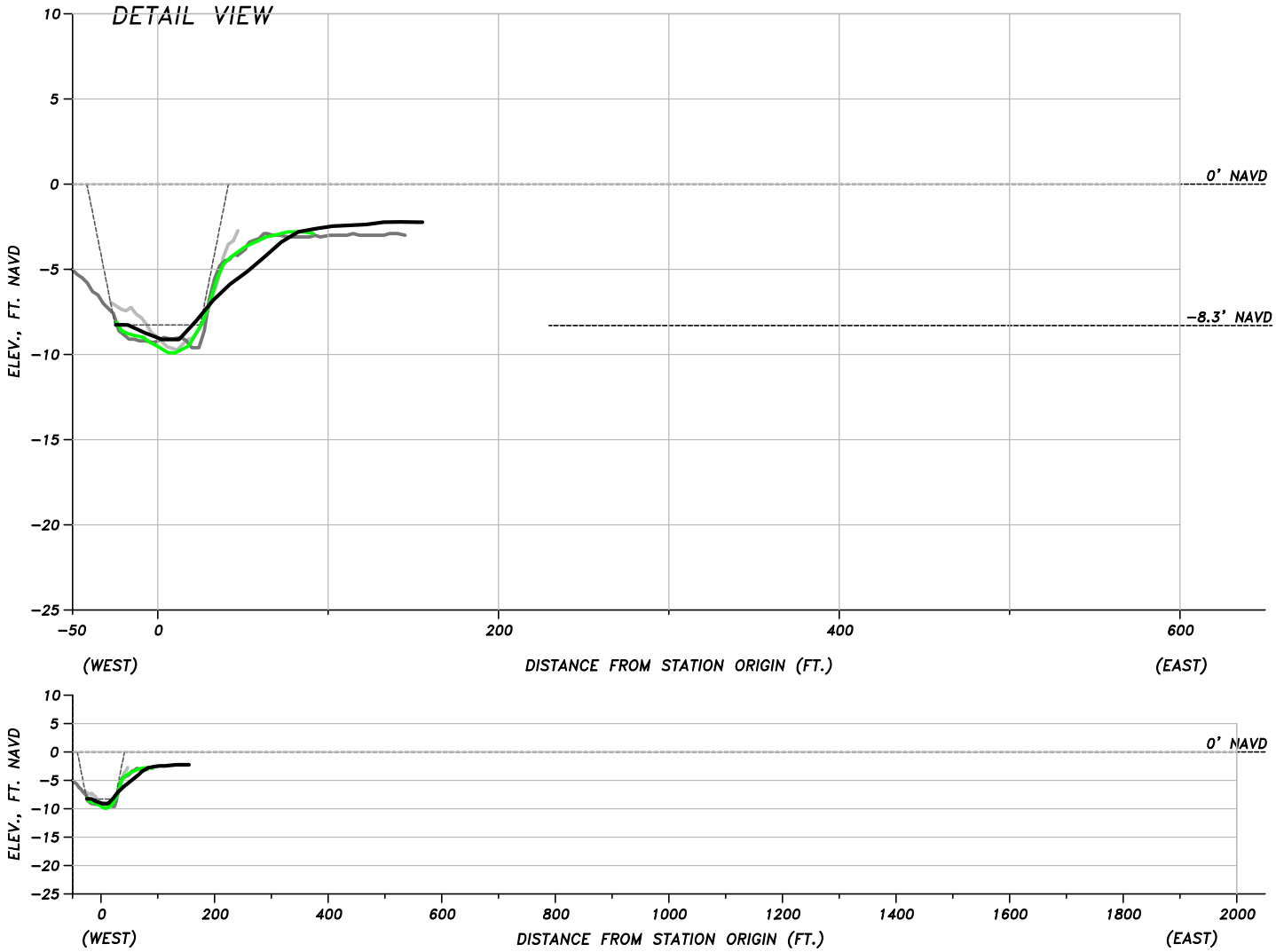
STATION: W4+25



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
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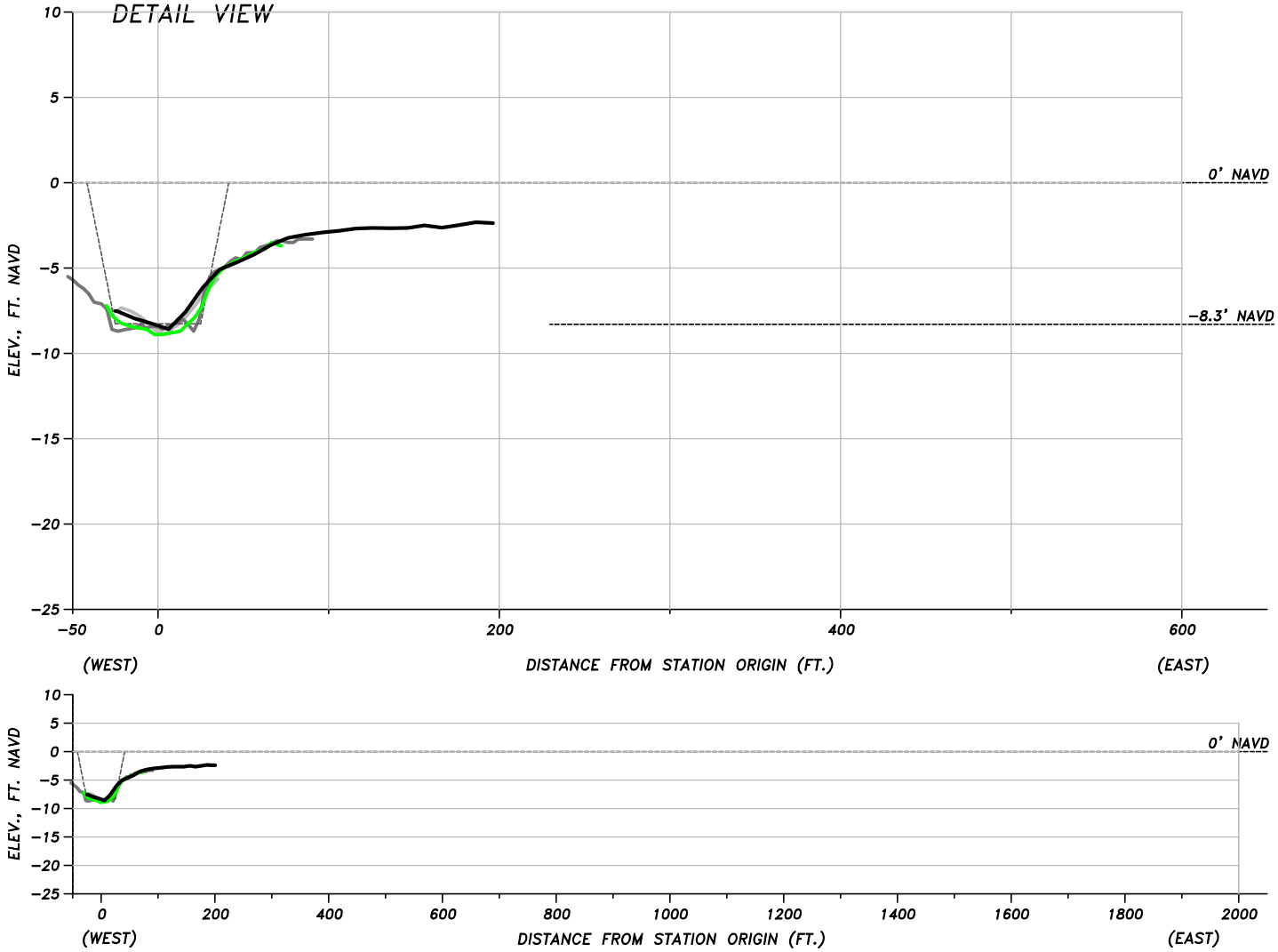
STATION: W5+25



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594-2025
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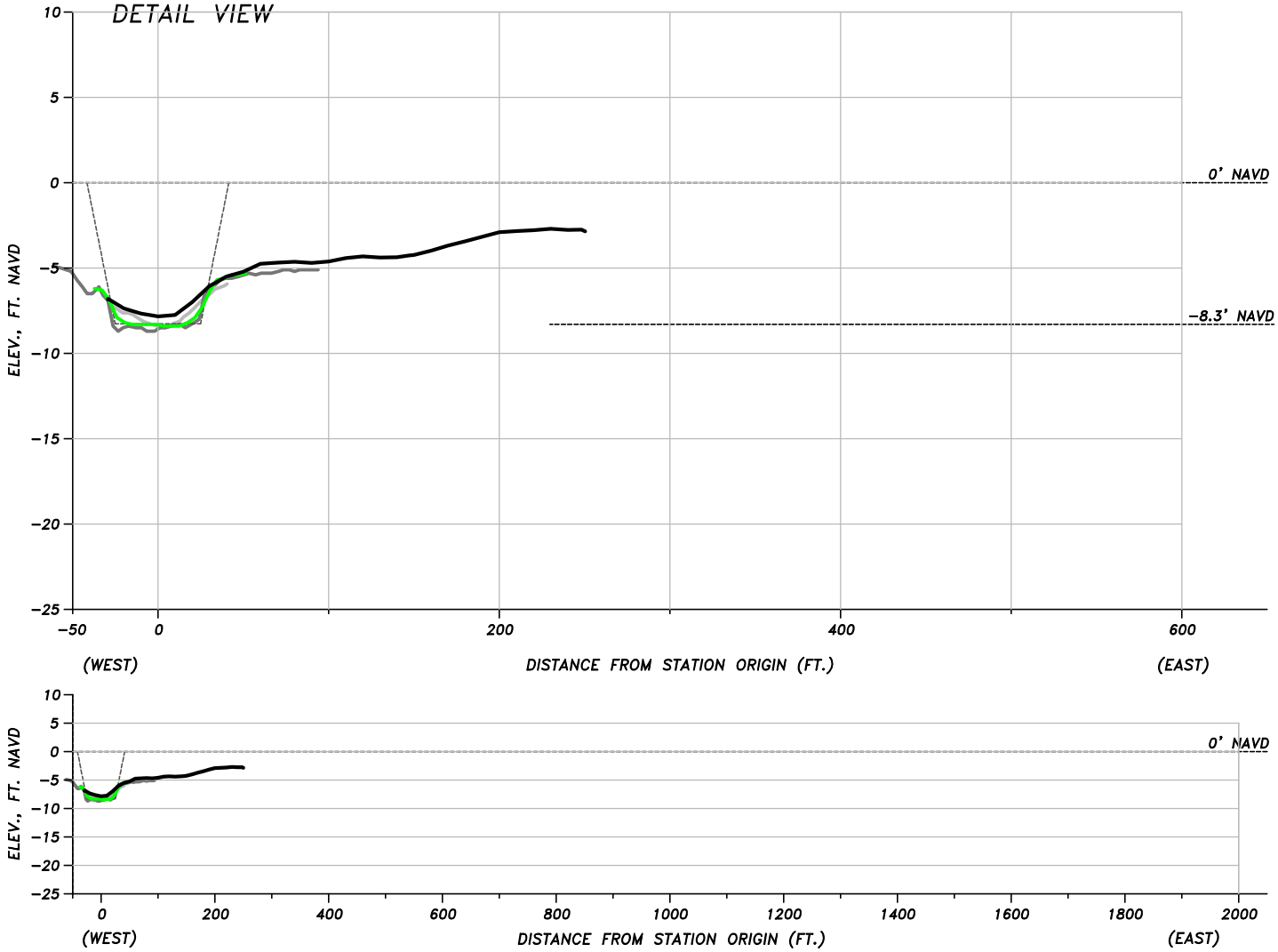
STATION: W6+25



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594–2025
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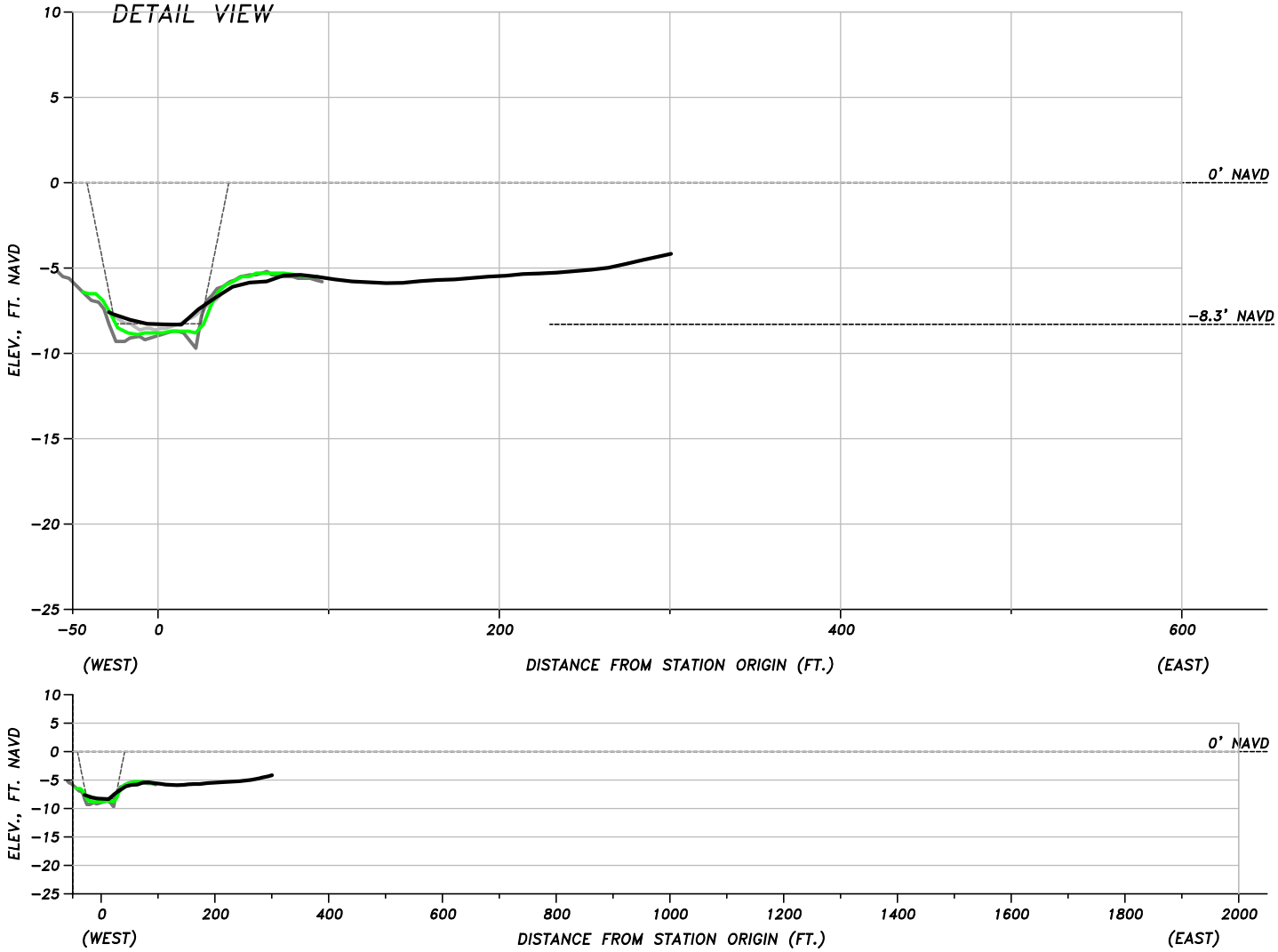
STATION: W7+25



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594-2025
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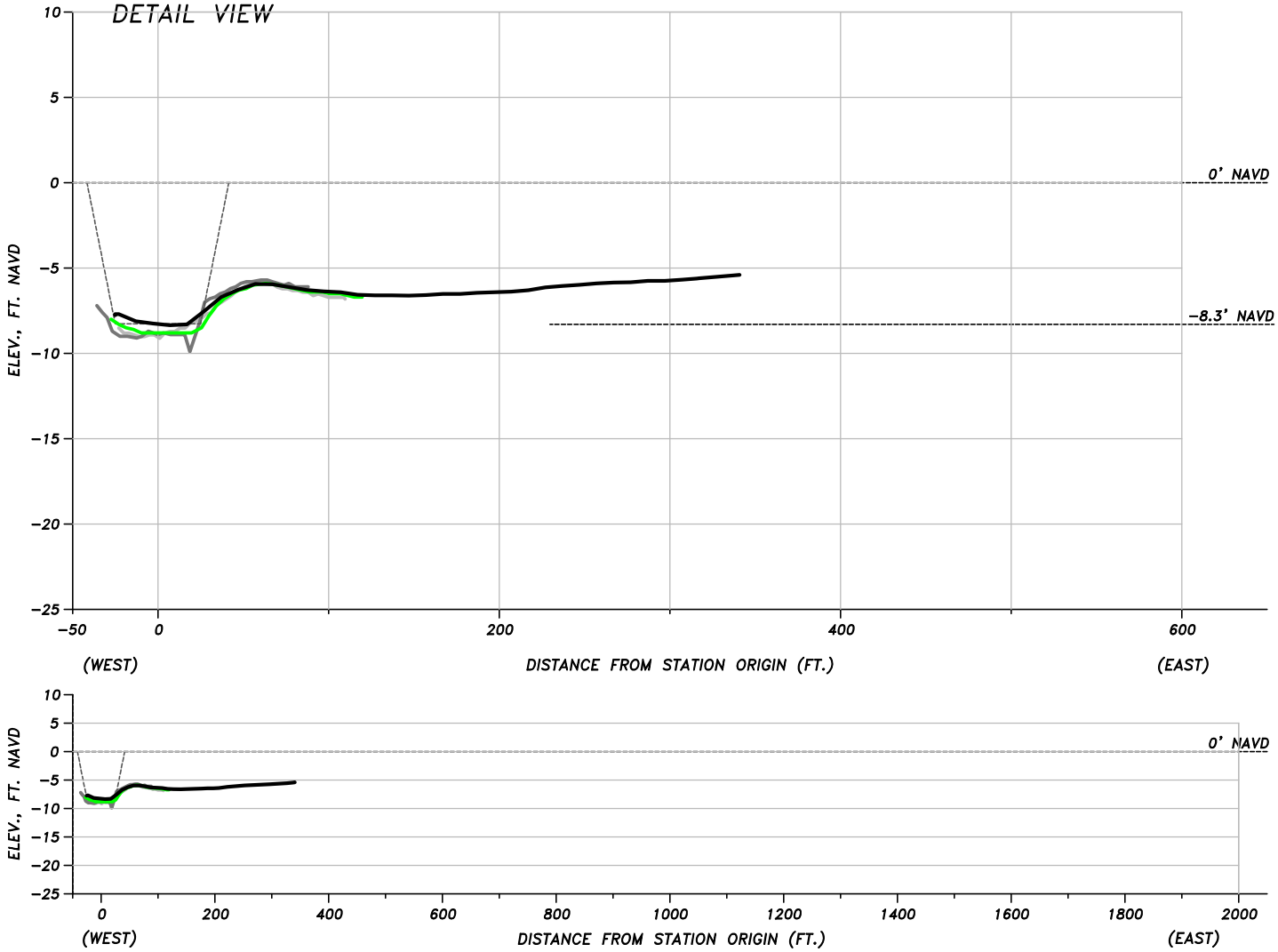
STATION: W8+12



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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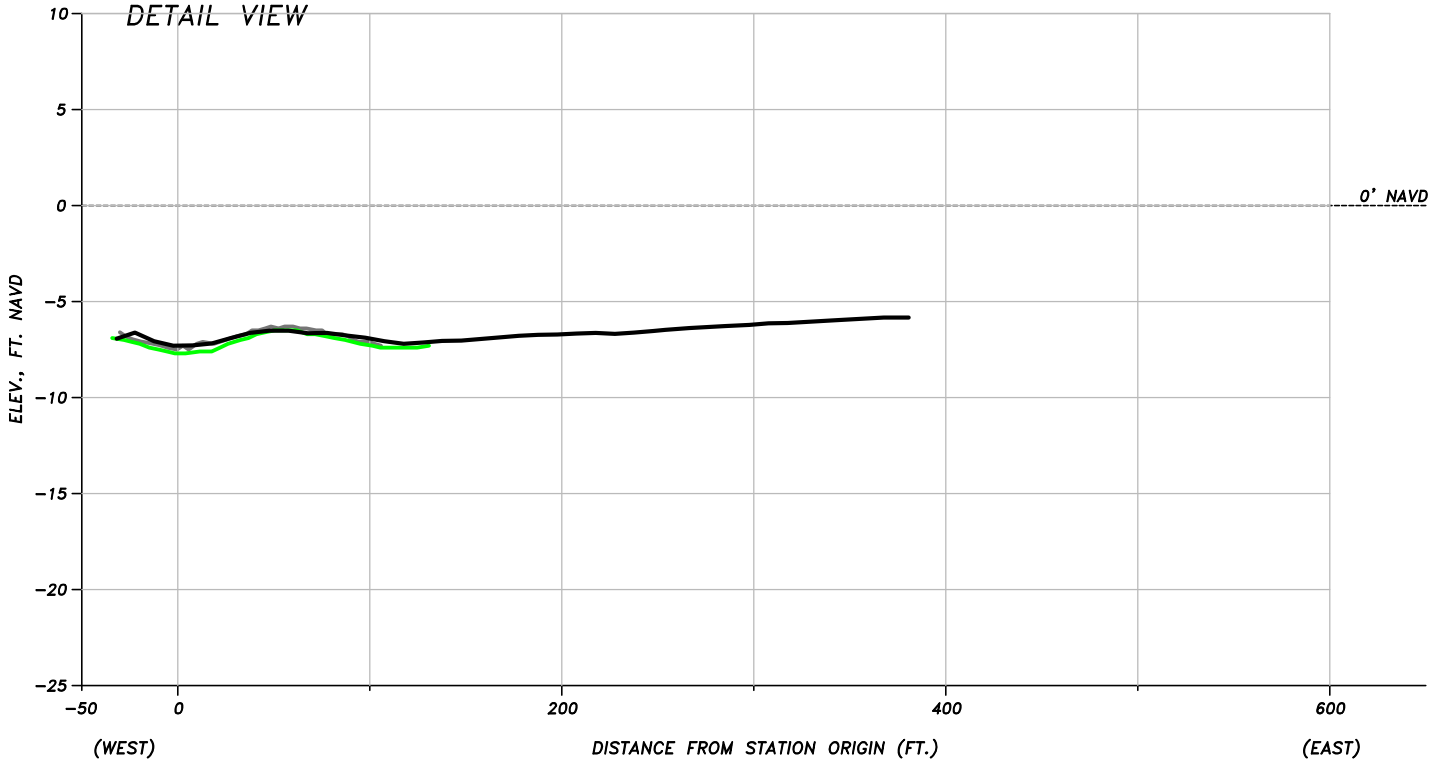
STATION: W9+10

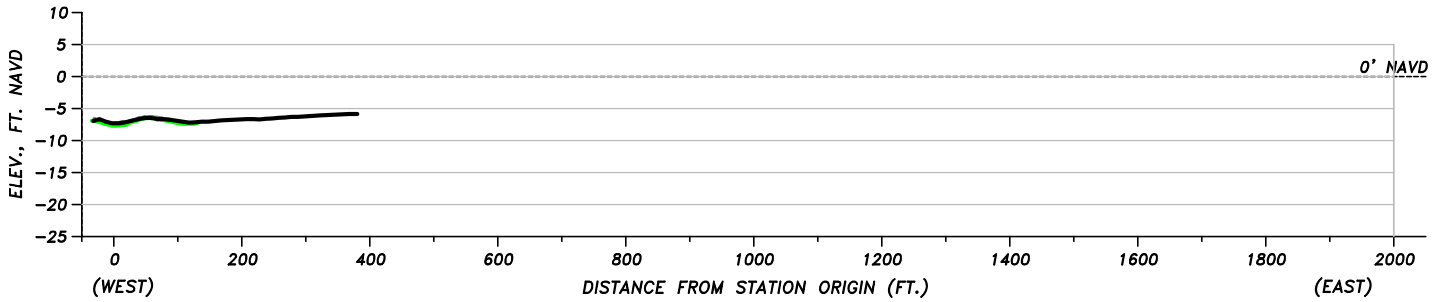
LEGEND

2018-09 POST-CONSTRUCTION (TAQ)

2021-02 MONITORING (SDI)

2022-11 POST-IAN MONITORING (APTIM)





HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
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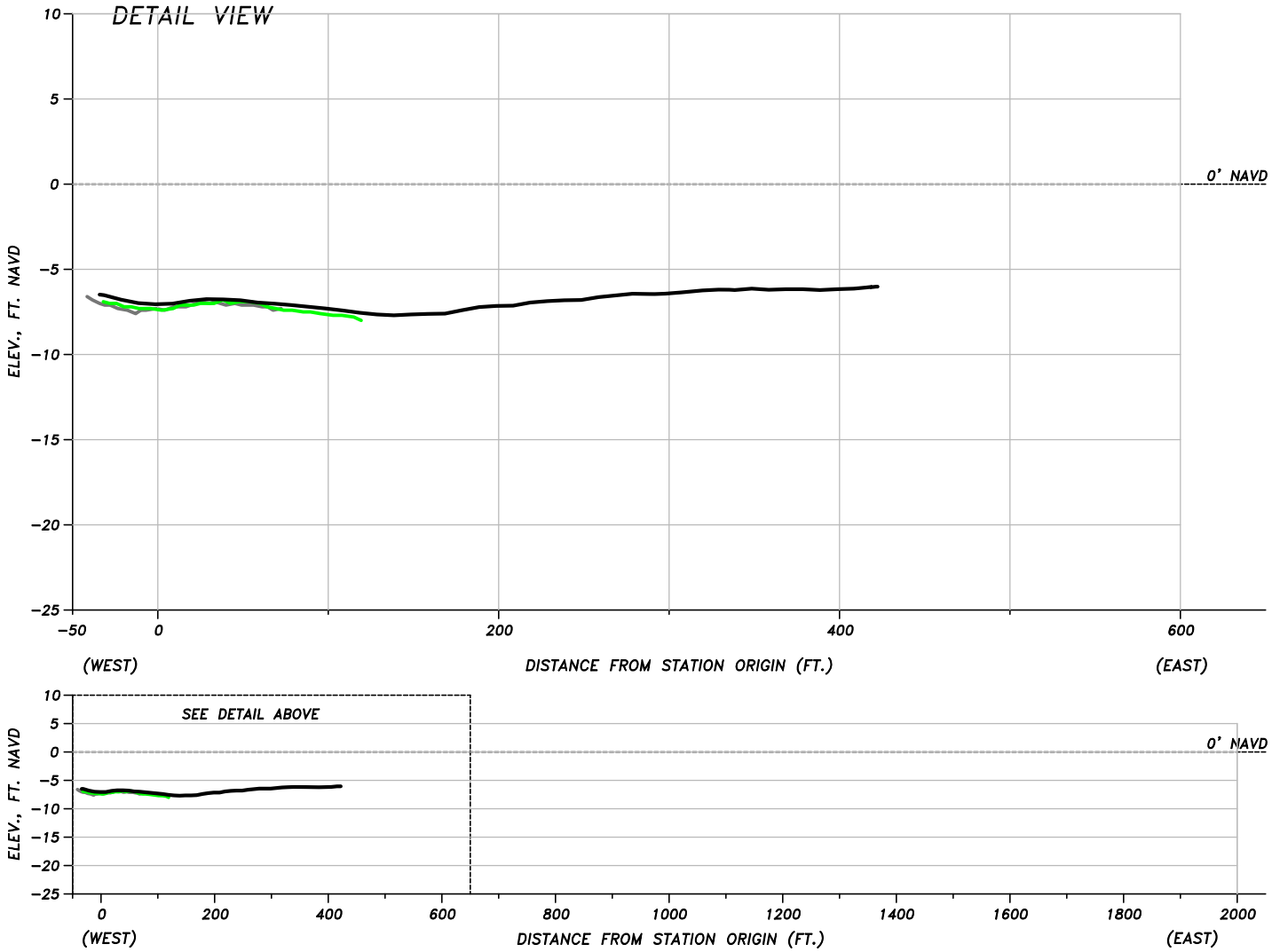
STATION: W10+08



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
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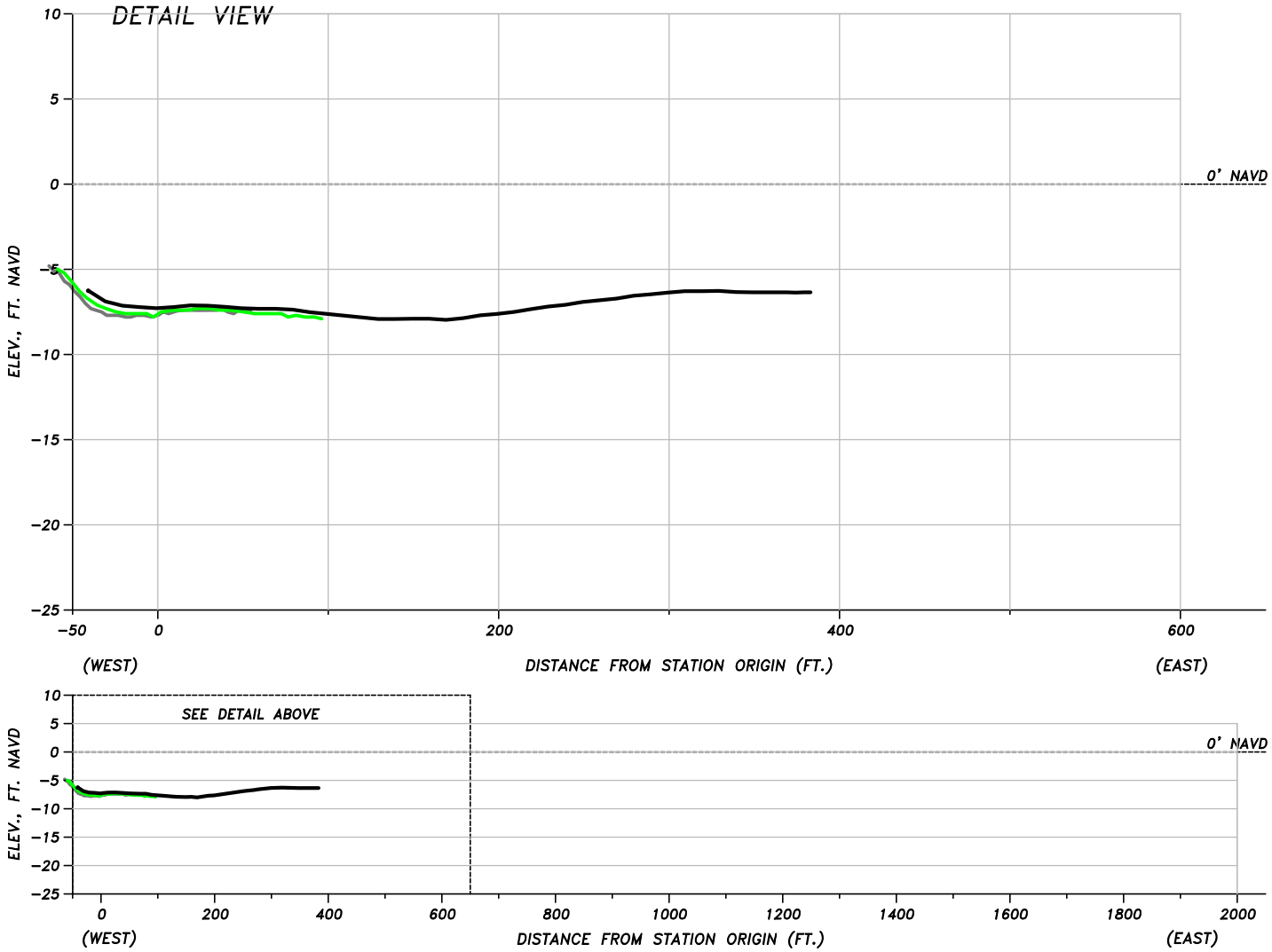
STATION: W11+06



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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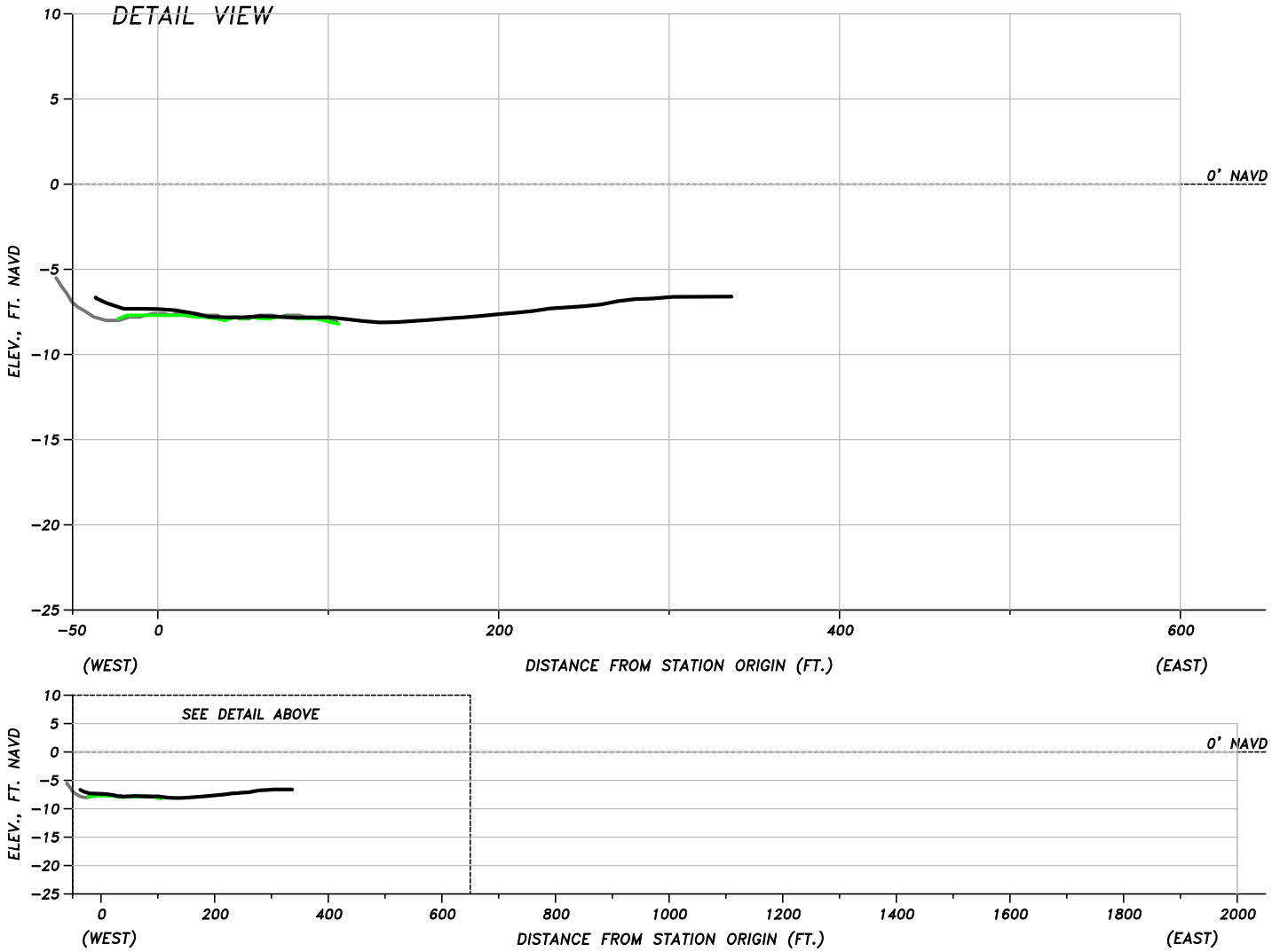
STATION: W12+03



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
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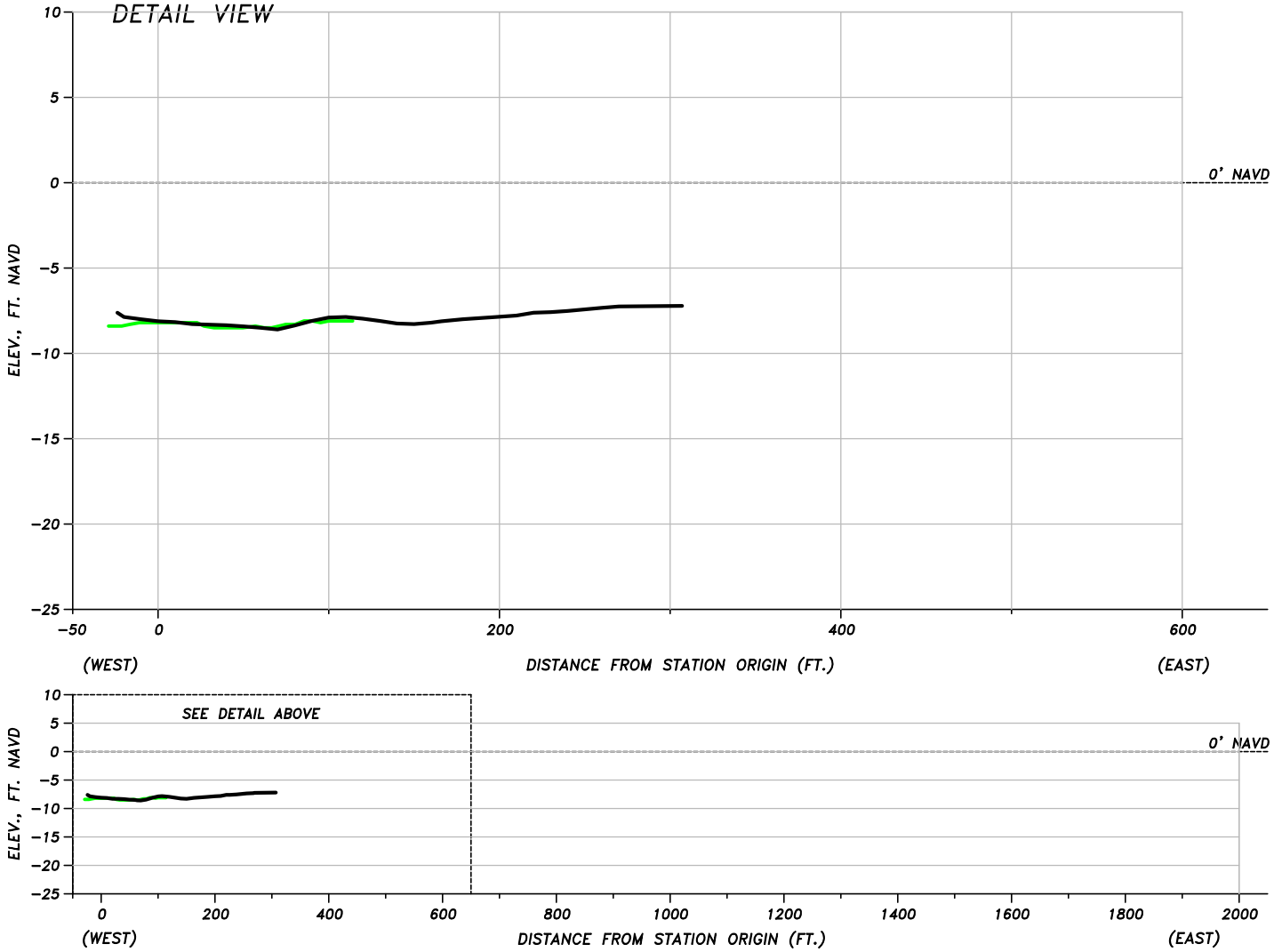
STATION: W12+71

LEGEND

2021-02 MONITORING (SDI)
2022-11 POST-IAN MONITORING (APTIM)



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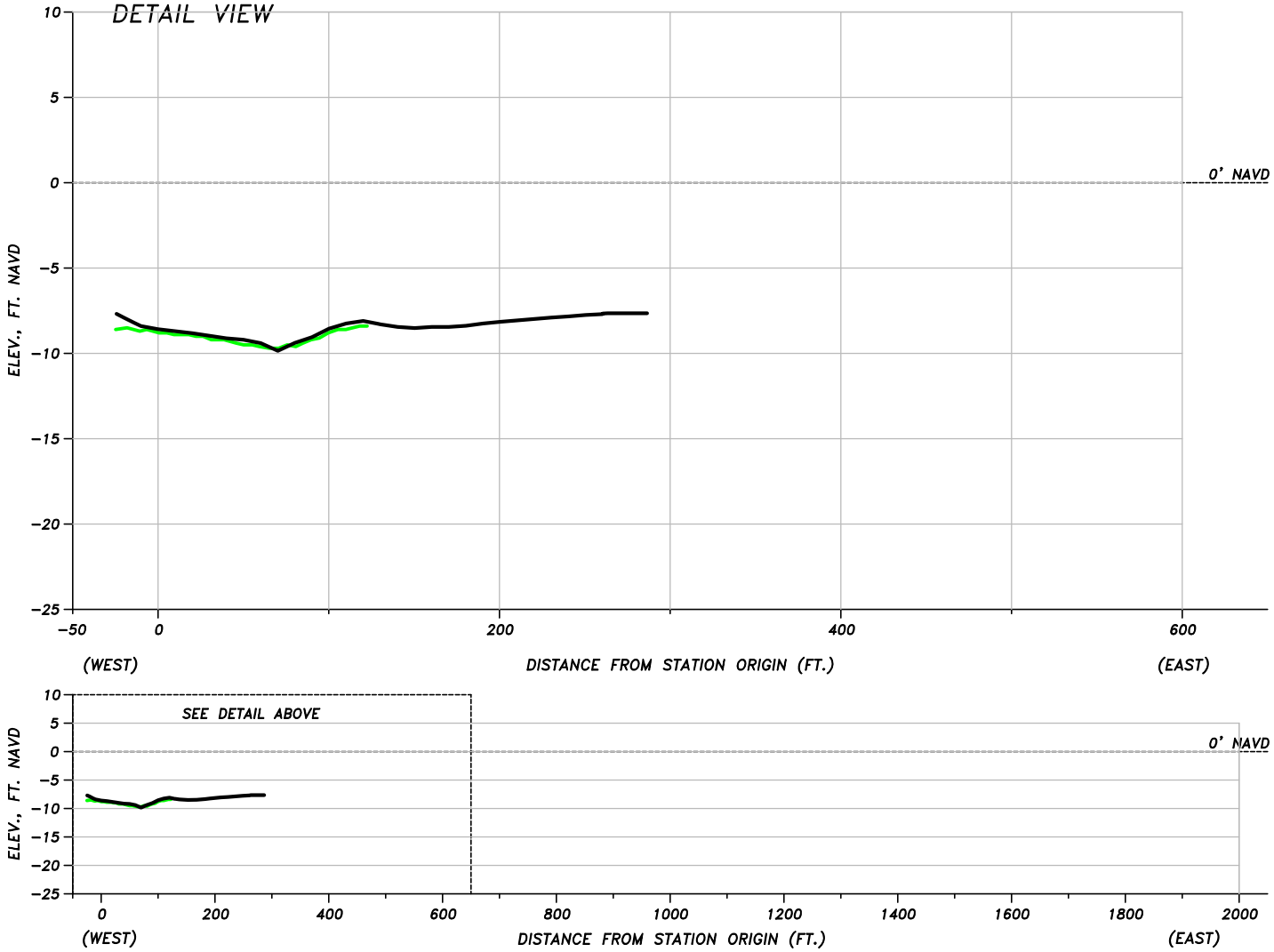
COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

STATION: W13+38

LEGEND

2021-02 MONITORING (SDI)
2022-11 POST-IAN MONITORING (APTIM)



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COASTAL ENGINEERING DESIGN AND PERMITTING

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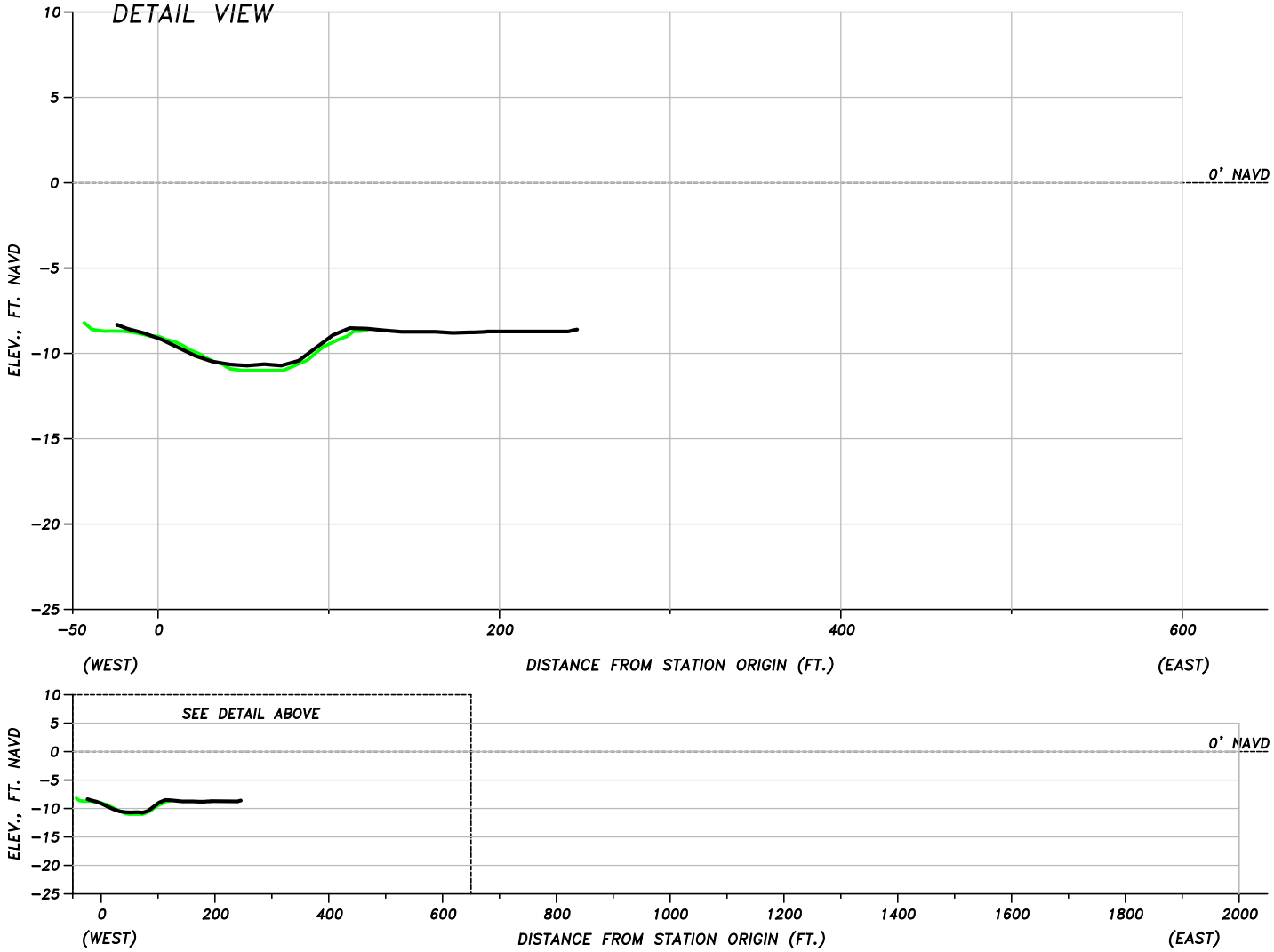
COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

STATION: W14+26

LEGEND

2021-02 MONITORING (SDI)
2022-11 POST-IAN MONITORING (APTIM)



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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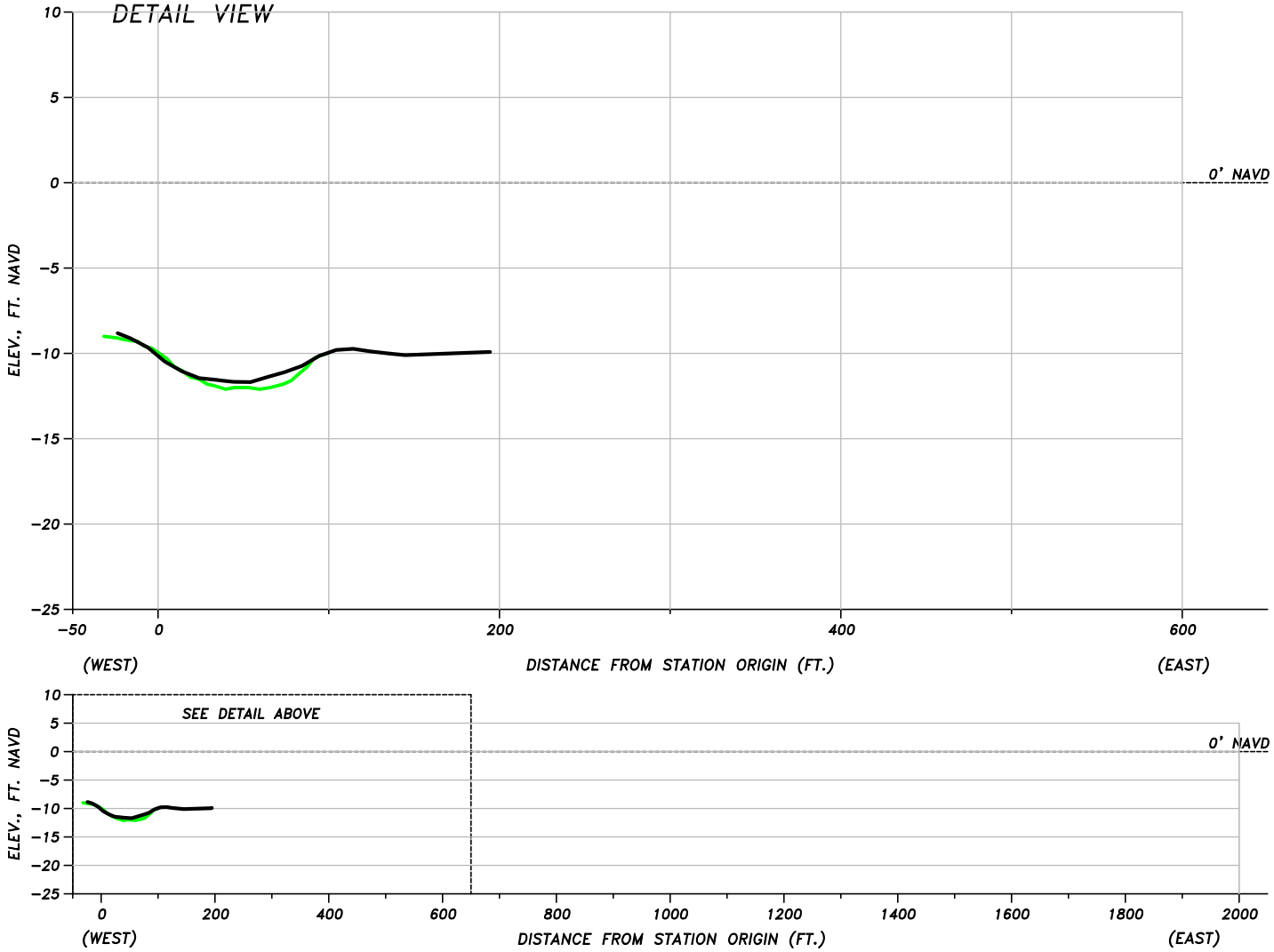
STATION: W15+13

LEGEND

2021-02 MONITORING (SDI)
2022-11 POST-IAN MONITORING (APTIM)



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

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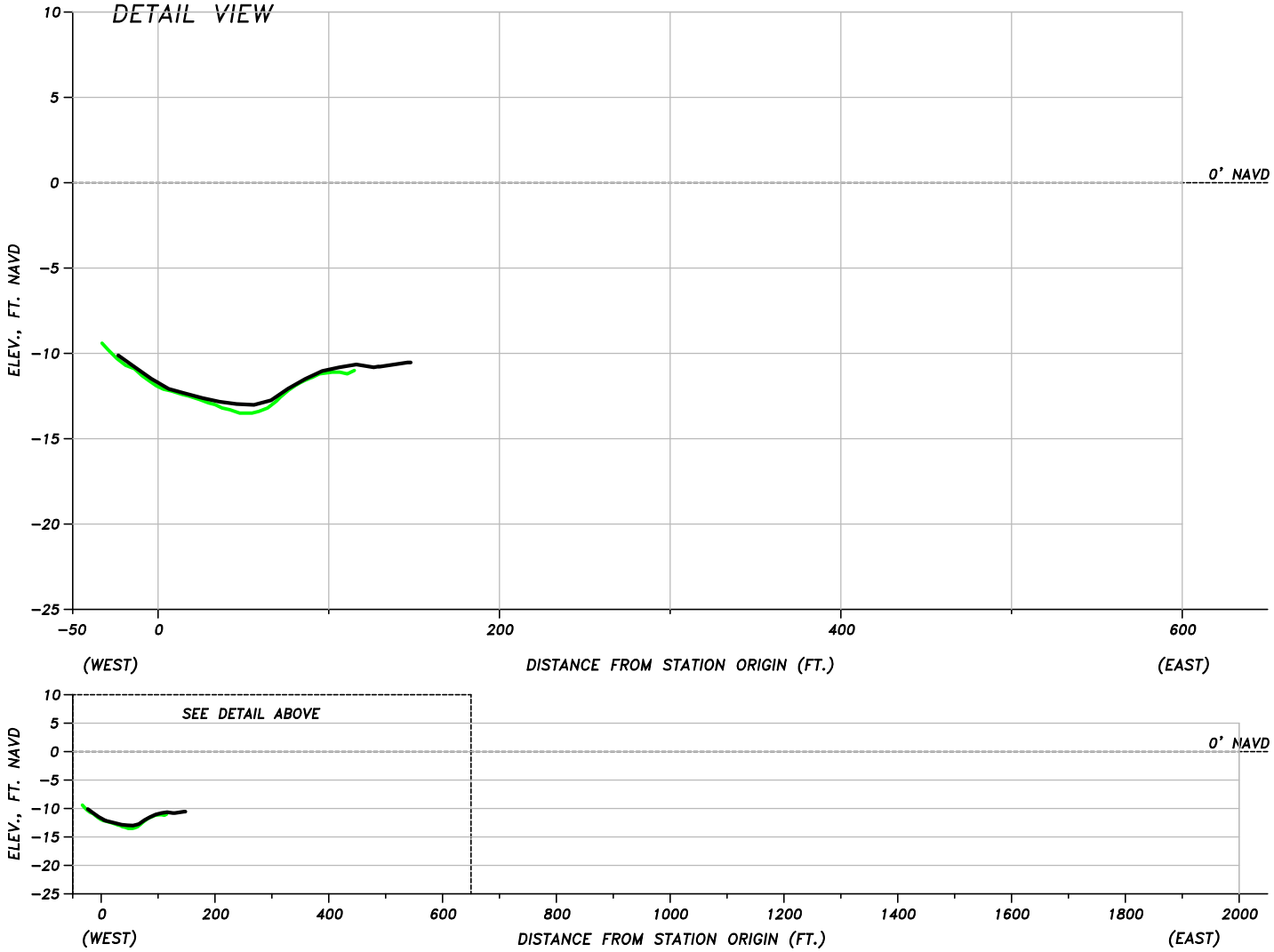
STATION: W16+00

LEGEND

2021-02 MONITORING (SDI)
2022-11 POST-IAN MONITORING (APTIM)



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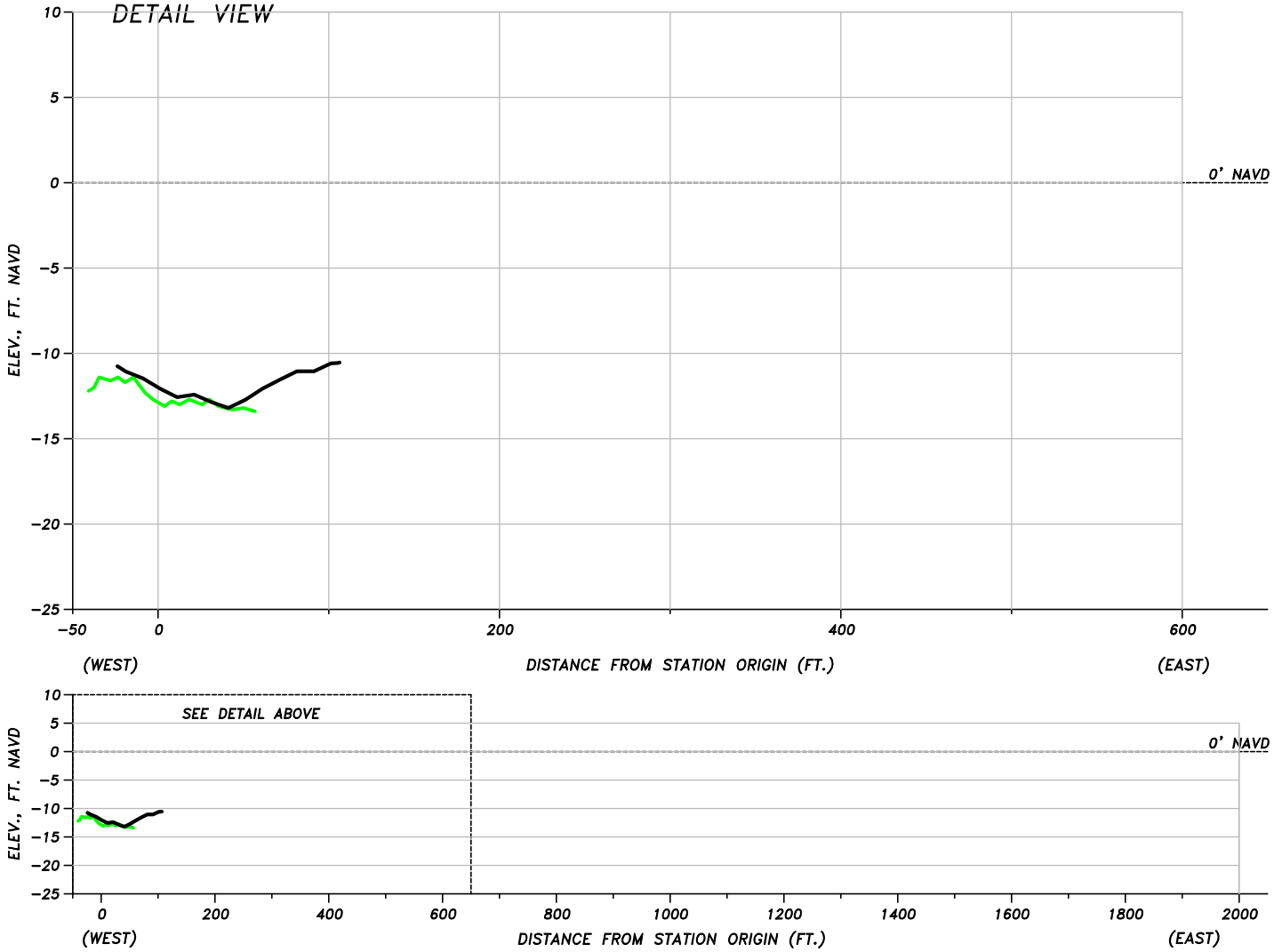
COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

STATION: W16+88

LEGEND

2021-02 MONITORING (SDI)
2022-11 POST-IAN MONITORING (APTIM)



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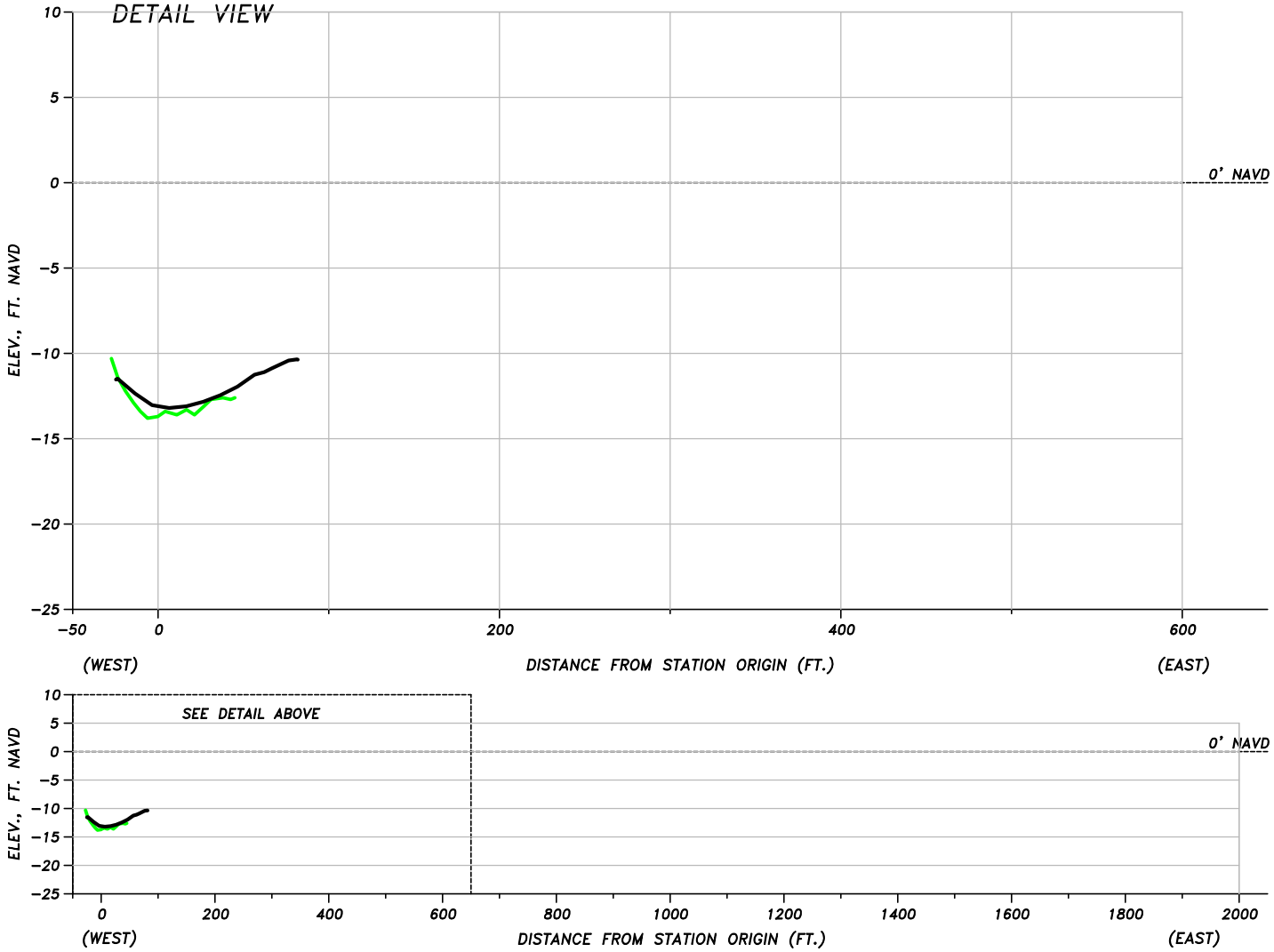
COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

STATION: W17+76

LEGEND

2021-02 MONITORING (SDI)
2022-11 POST-IAN MONITORING (APTIM)



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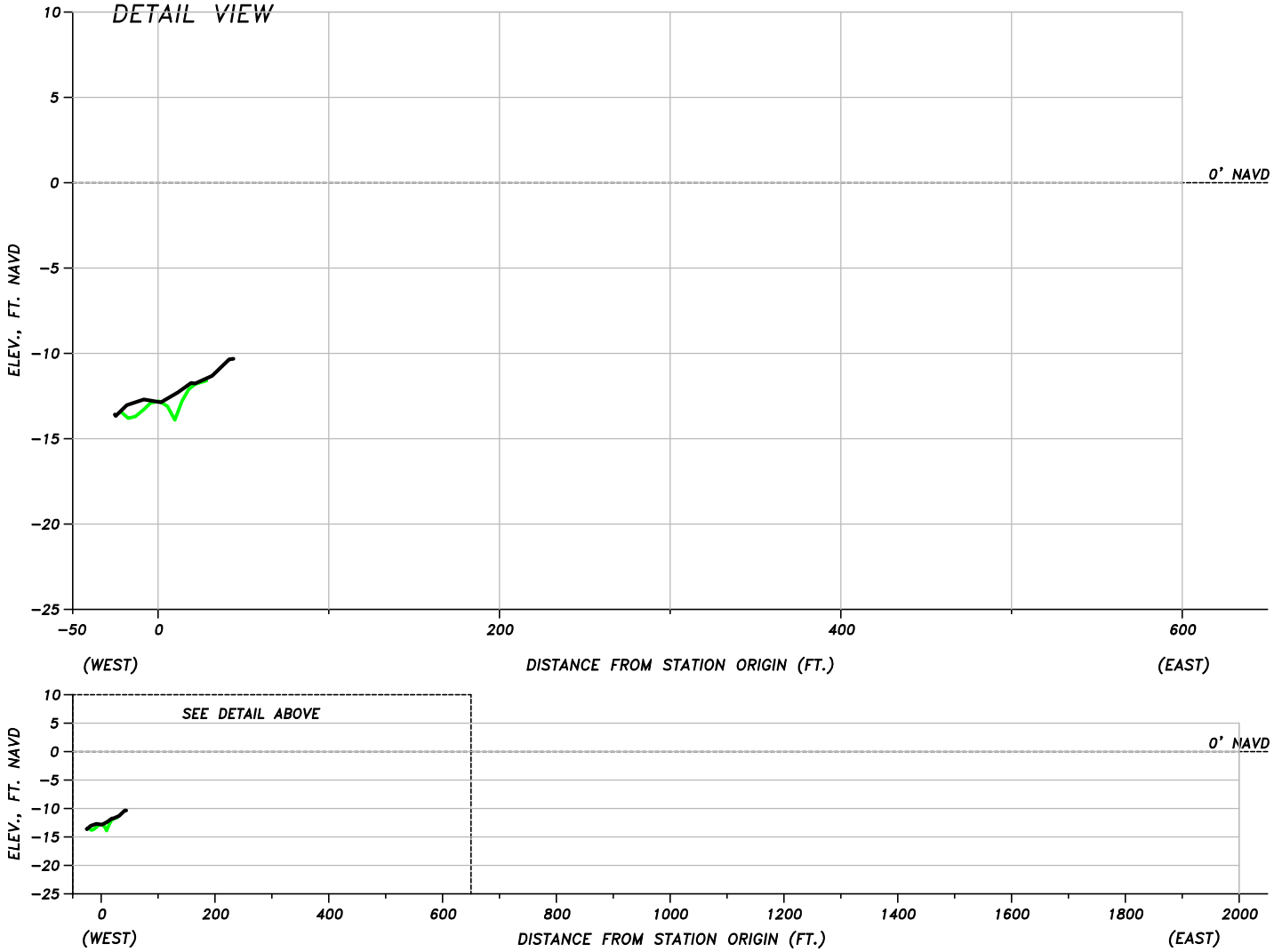
COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

STATION: W18+63

LEGEND

2021-02 MONITORING (SDI)
2022-11 POST-IAN MONITORING (APTIM)



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594-2025
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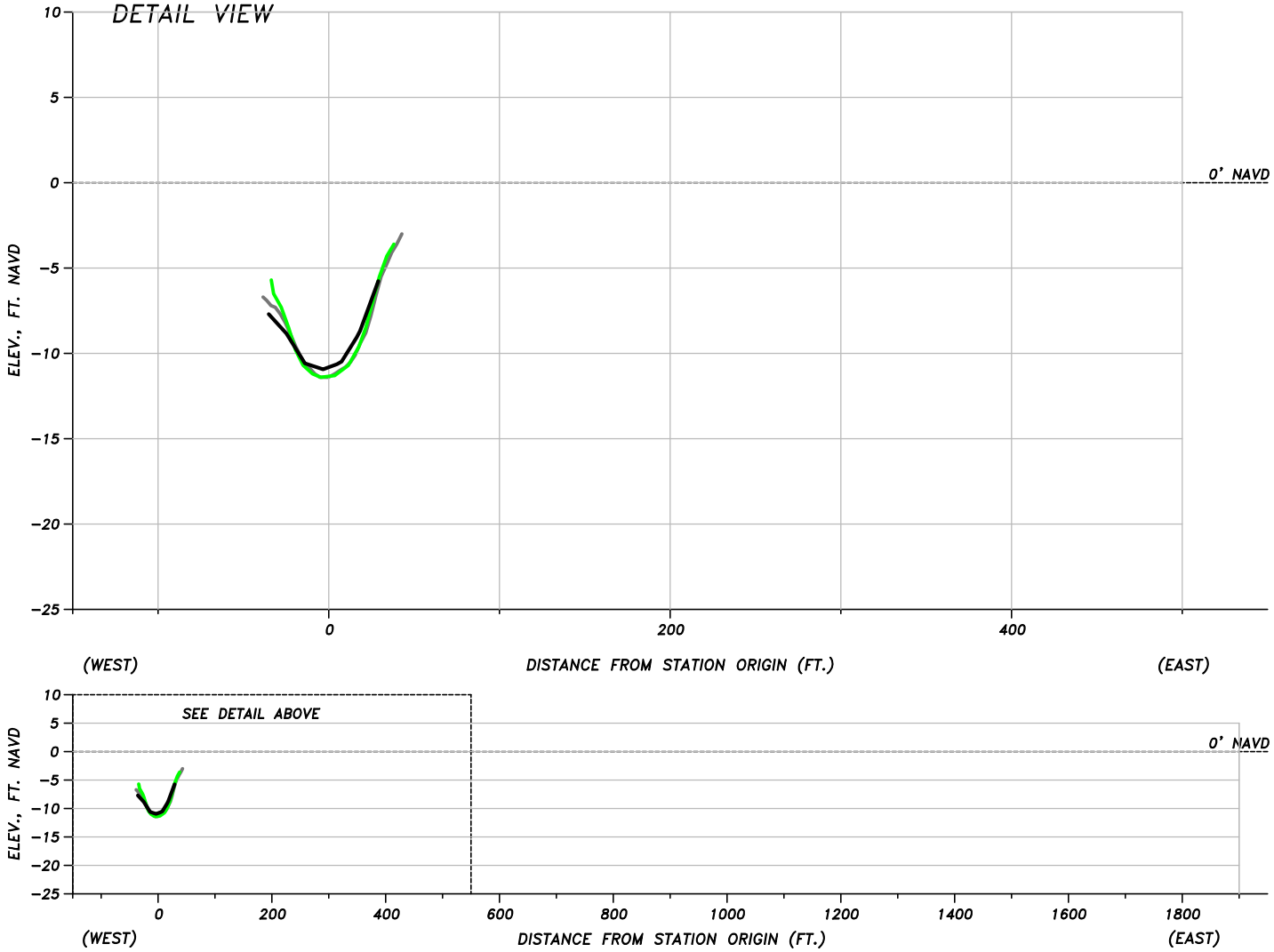
STATION: E0+34



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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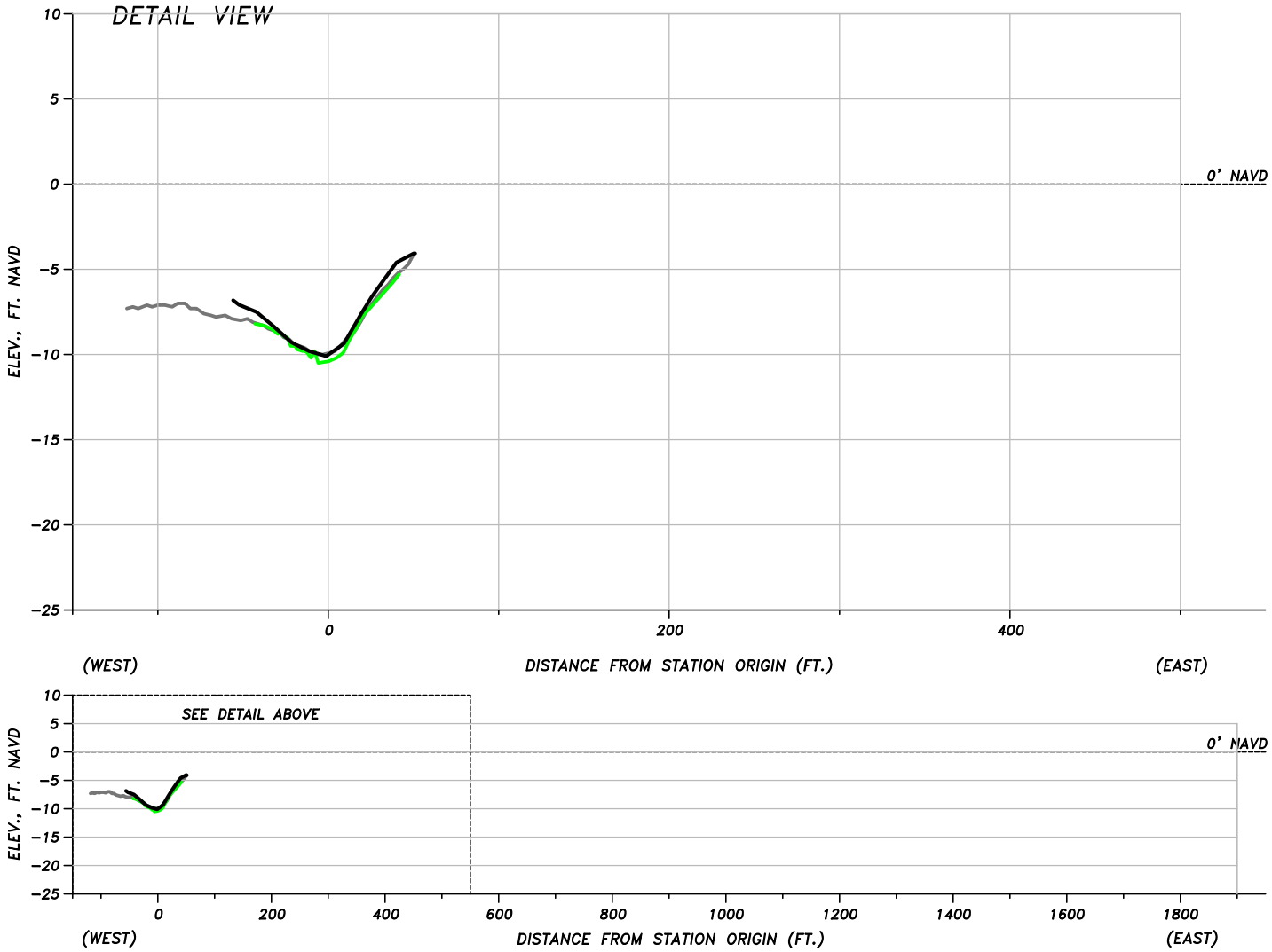
STATION: E0+72



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COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

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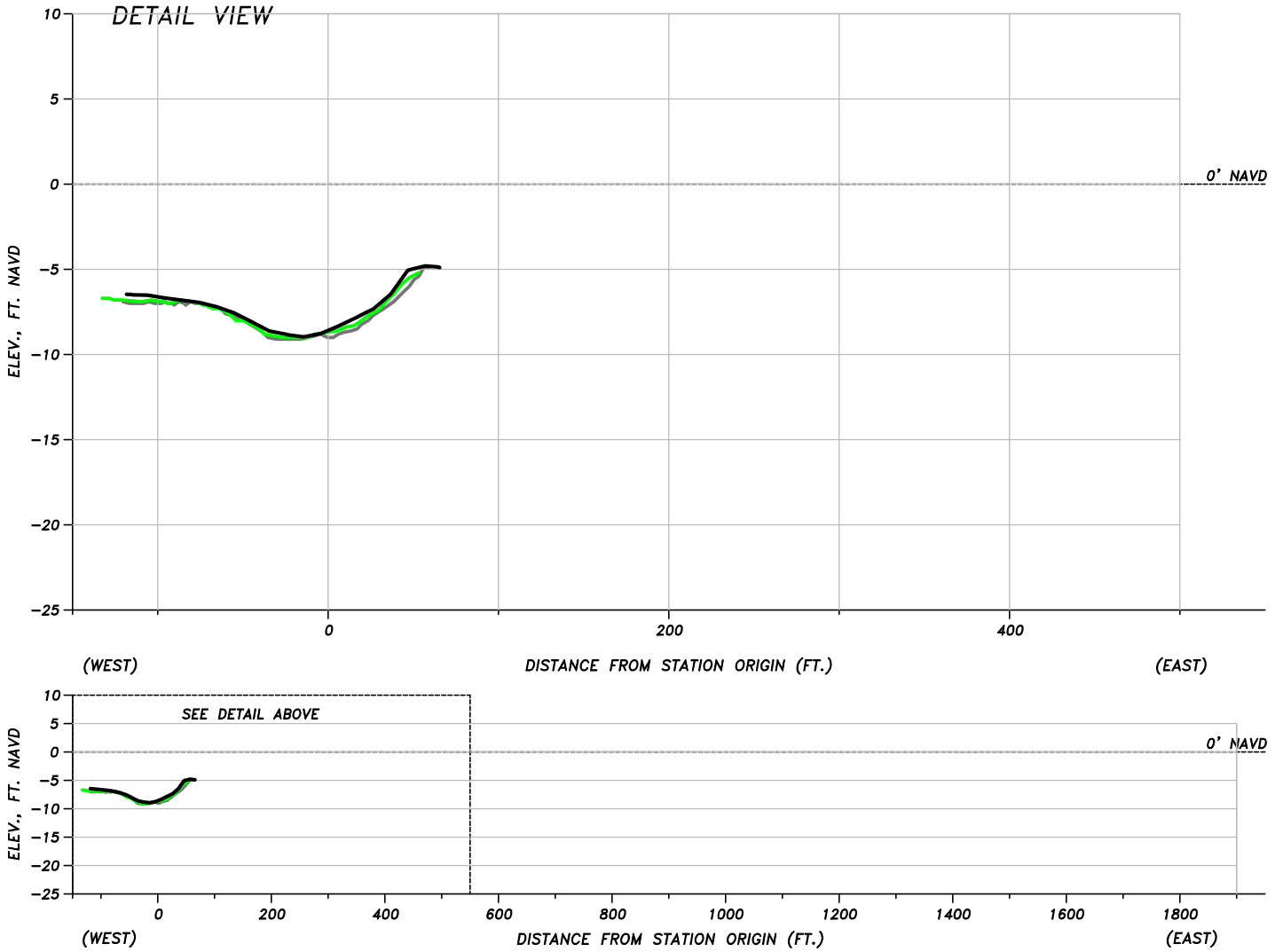
STATION: E1+24

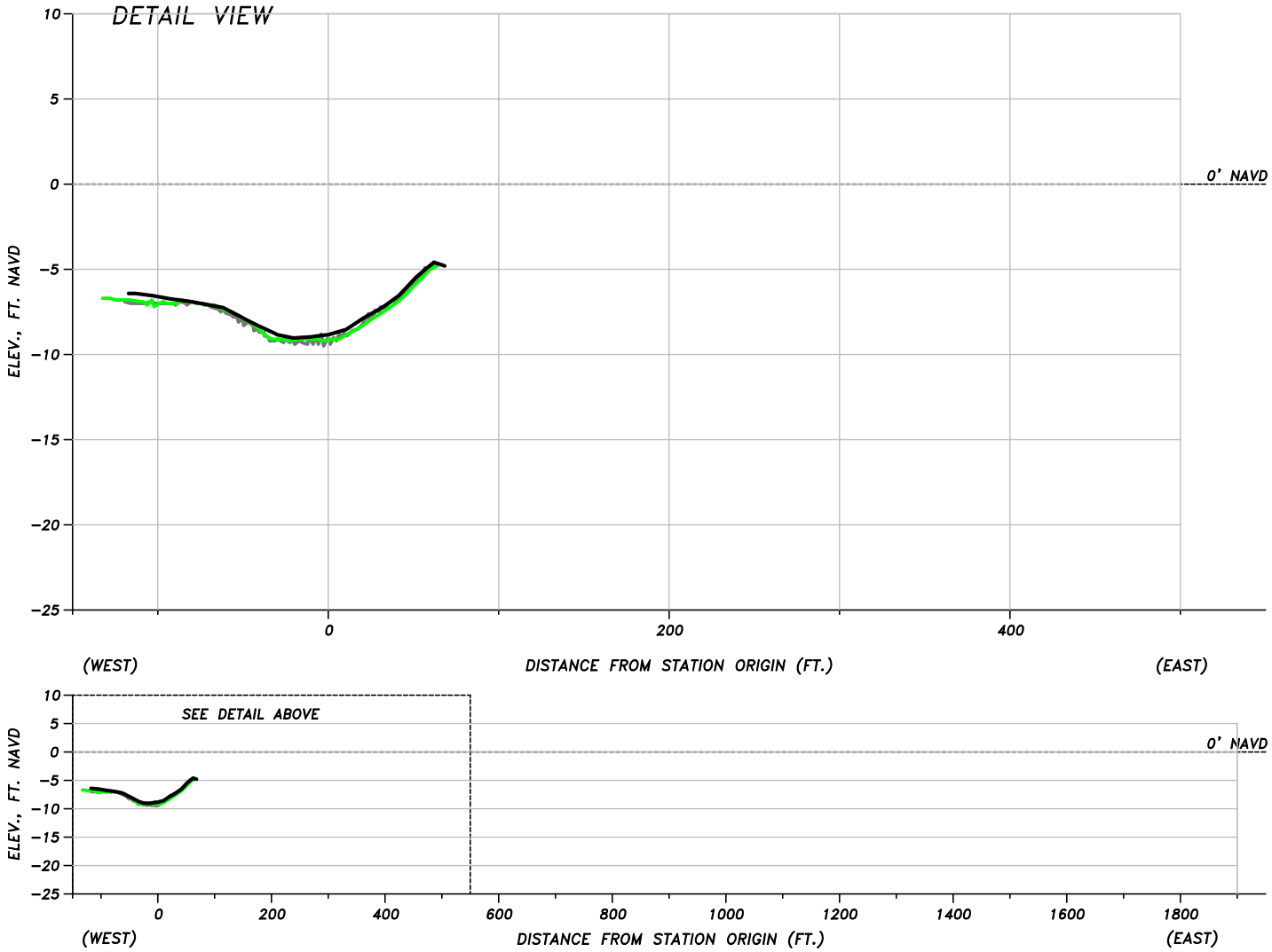


HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
www.humistonandmoore.com

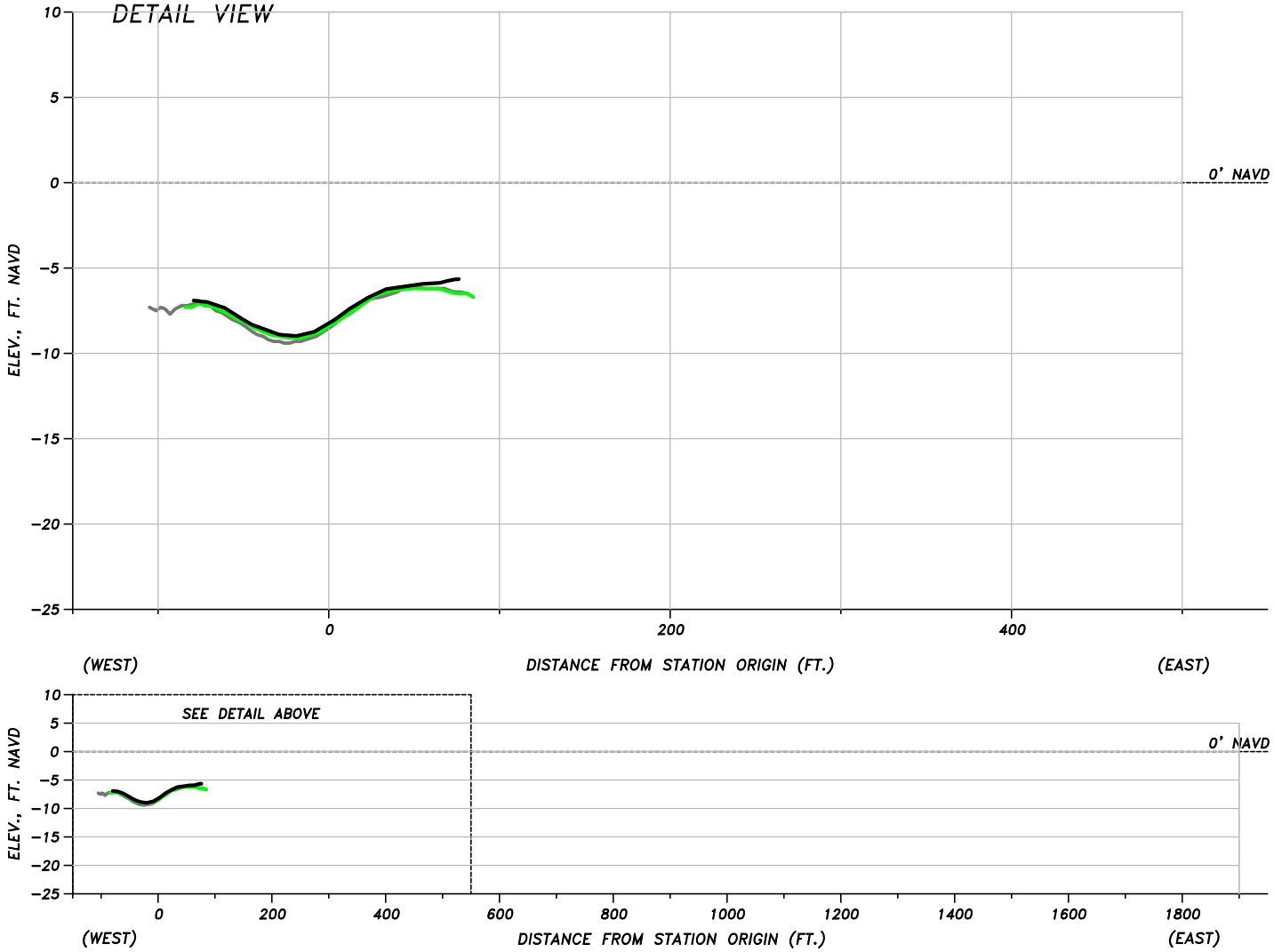
STATION: E1+41



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
www.humistonandmoore.com

STATION: E1+89



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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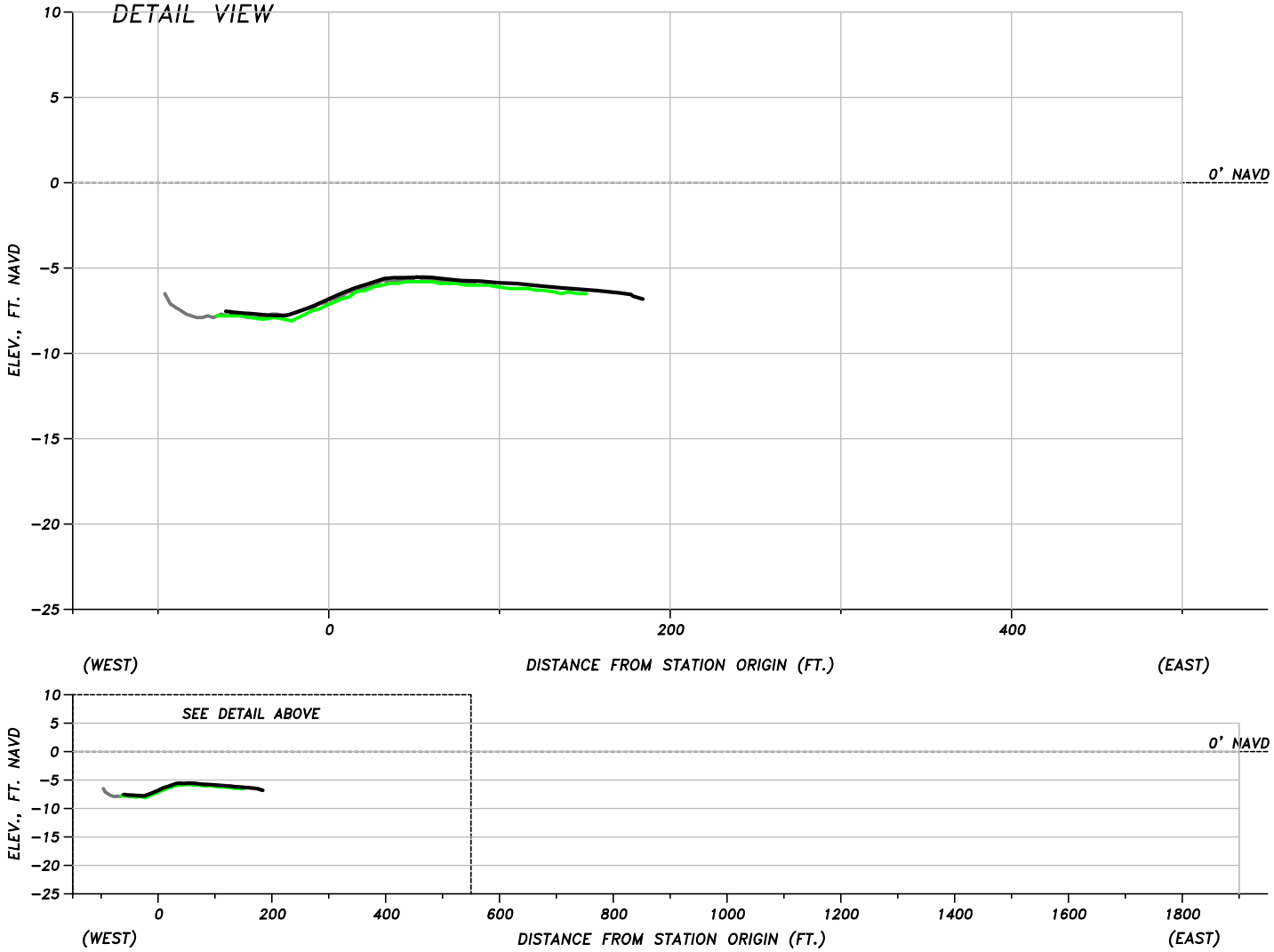
STATION: E2+36

LEGEND

2018-09 POST-CONSTRUCTION (TAQ)

2021-02 MONITORING (SDI)

2022-11 POST-IAN MONITORING (APTIM)

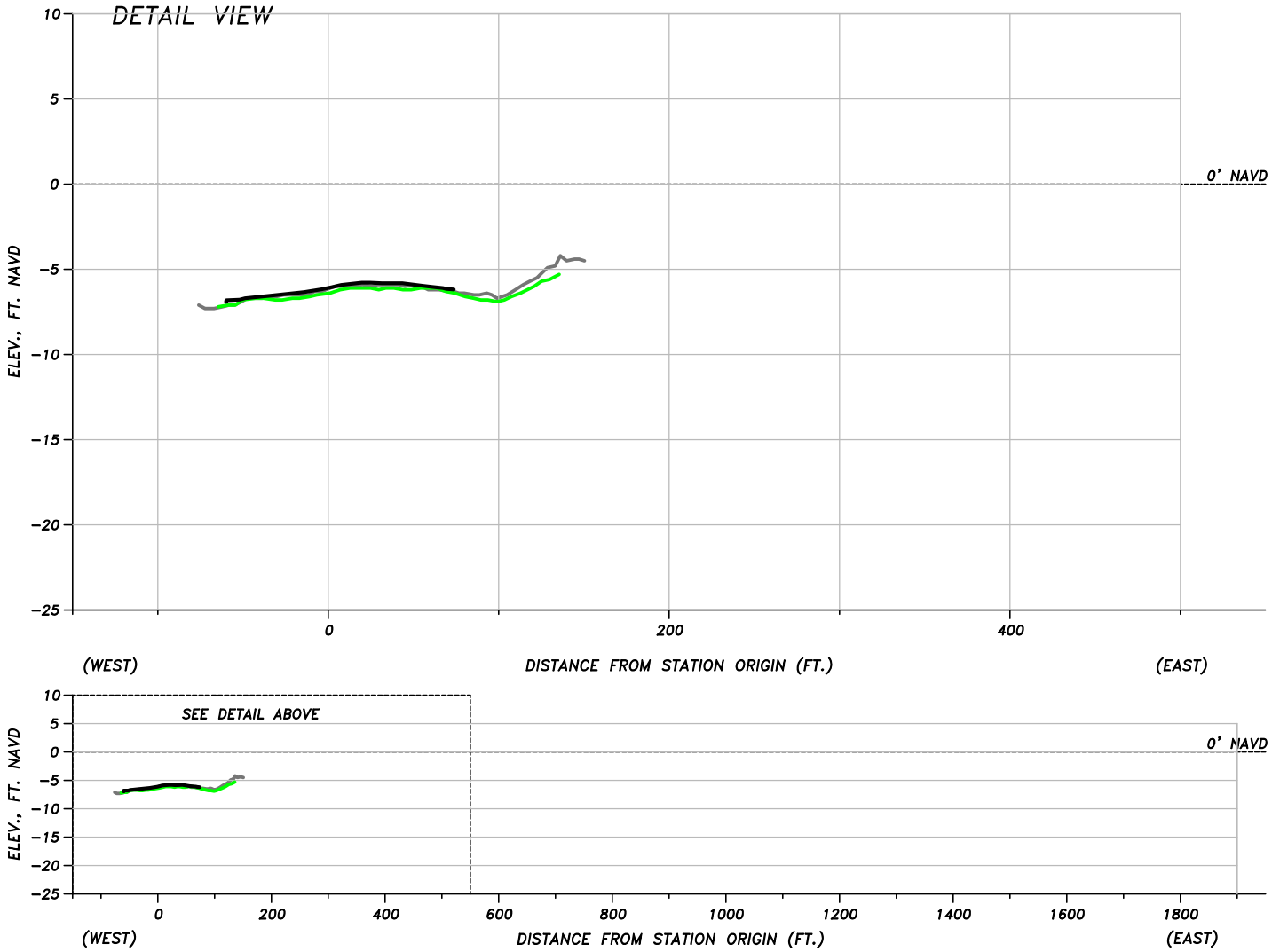


HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
www.humistonandmoore.com

STATION: E3+24



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
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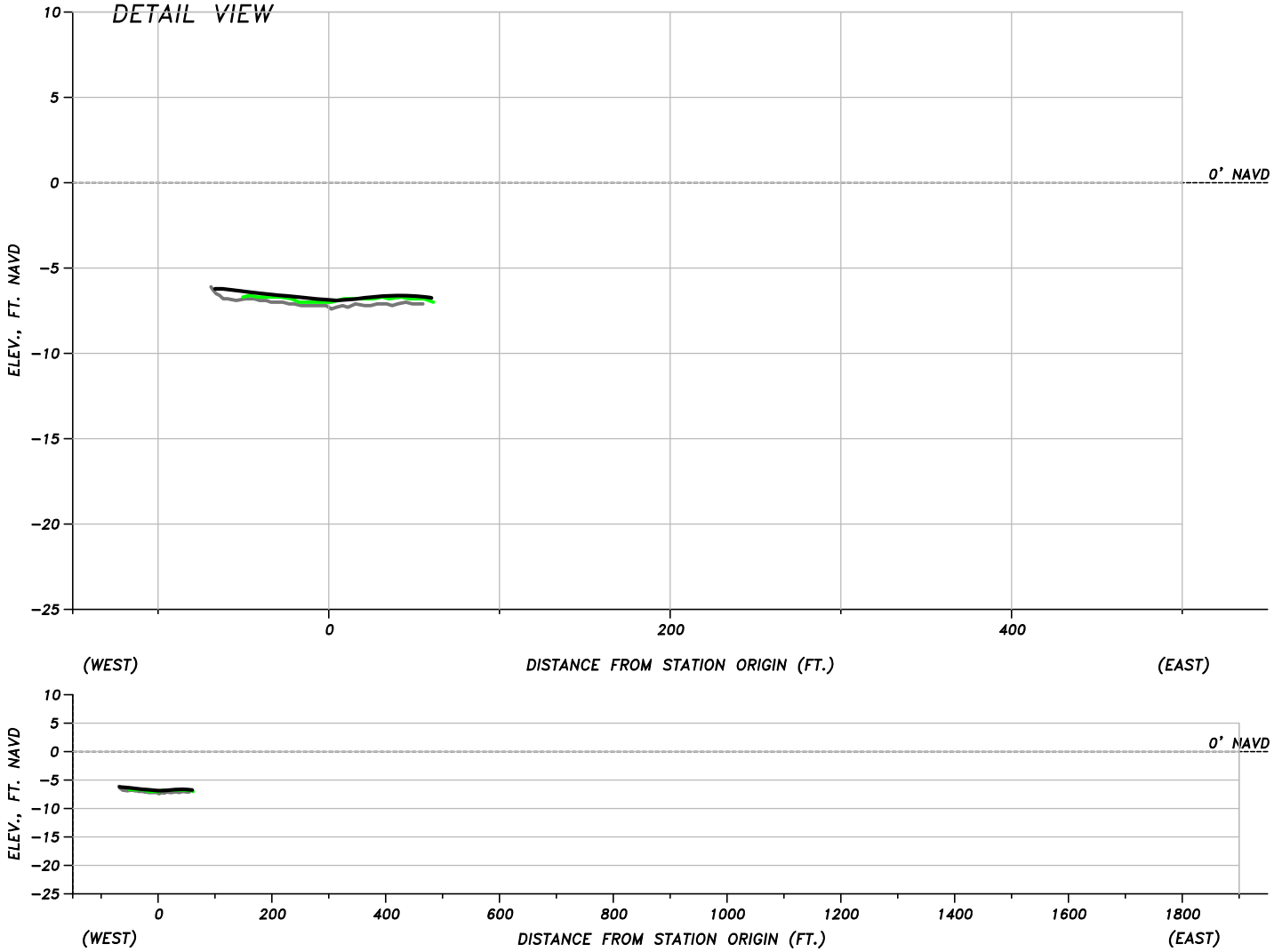
STATION: E4+12

LEGEND

2018-09 POST-CONSTRUCTION (TAQ)

2021-02 MONITORING (SDI)

2022-11 POST-IAN MONITORING (APTIM)



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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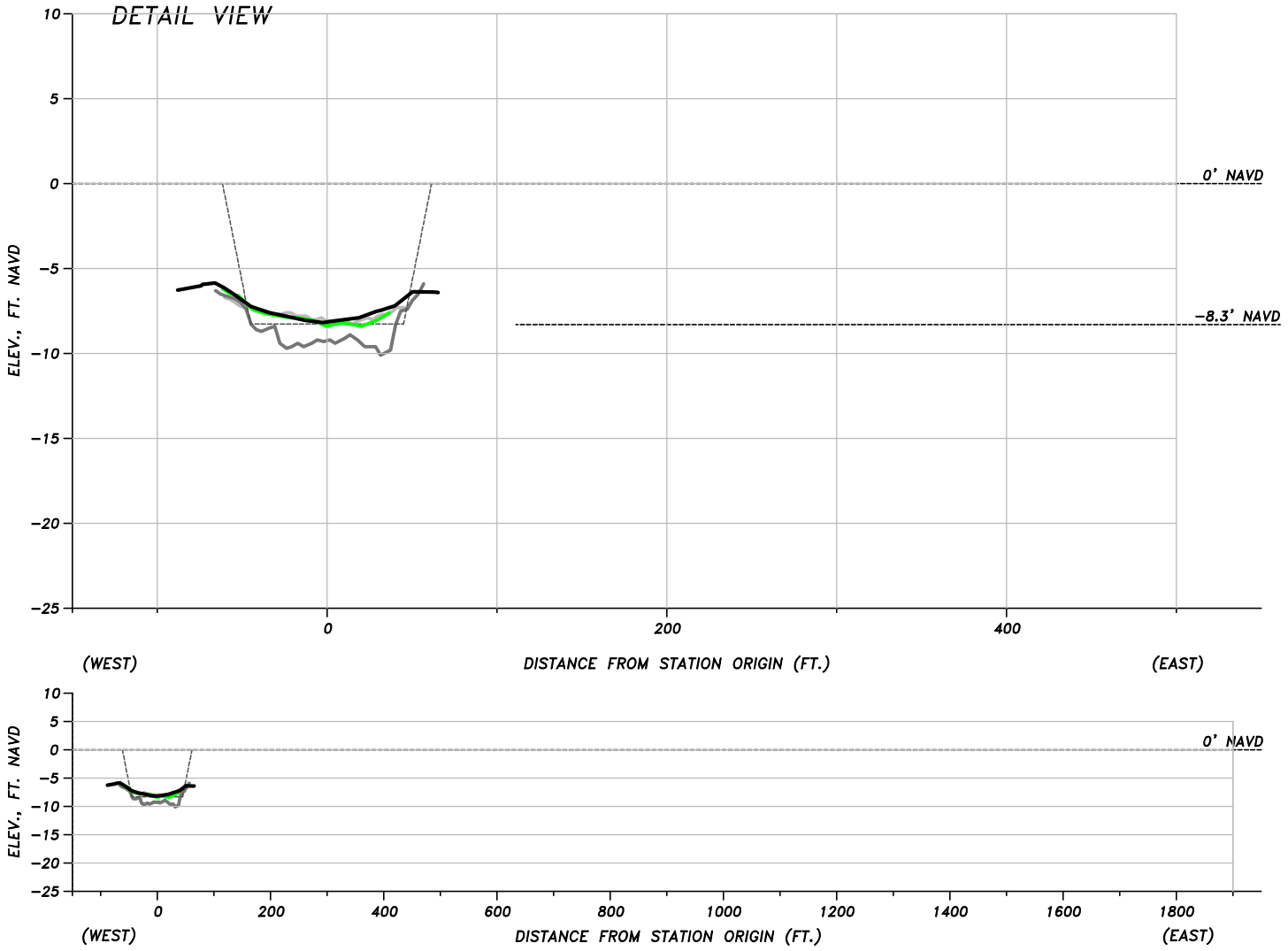
STATION: E4+85



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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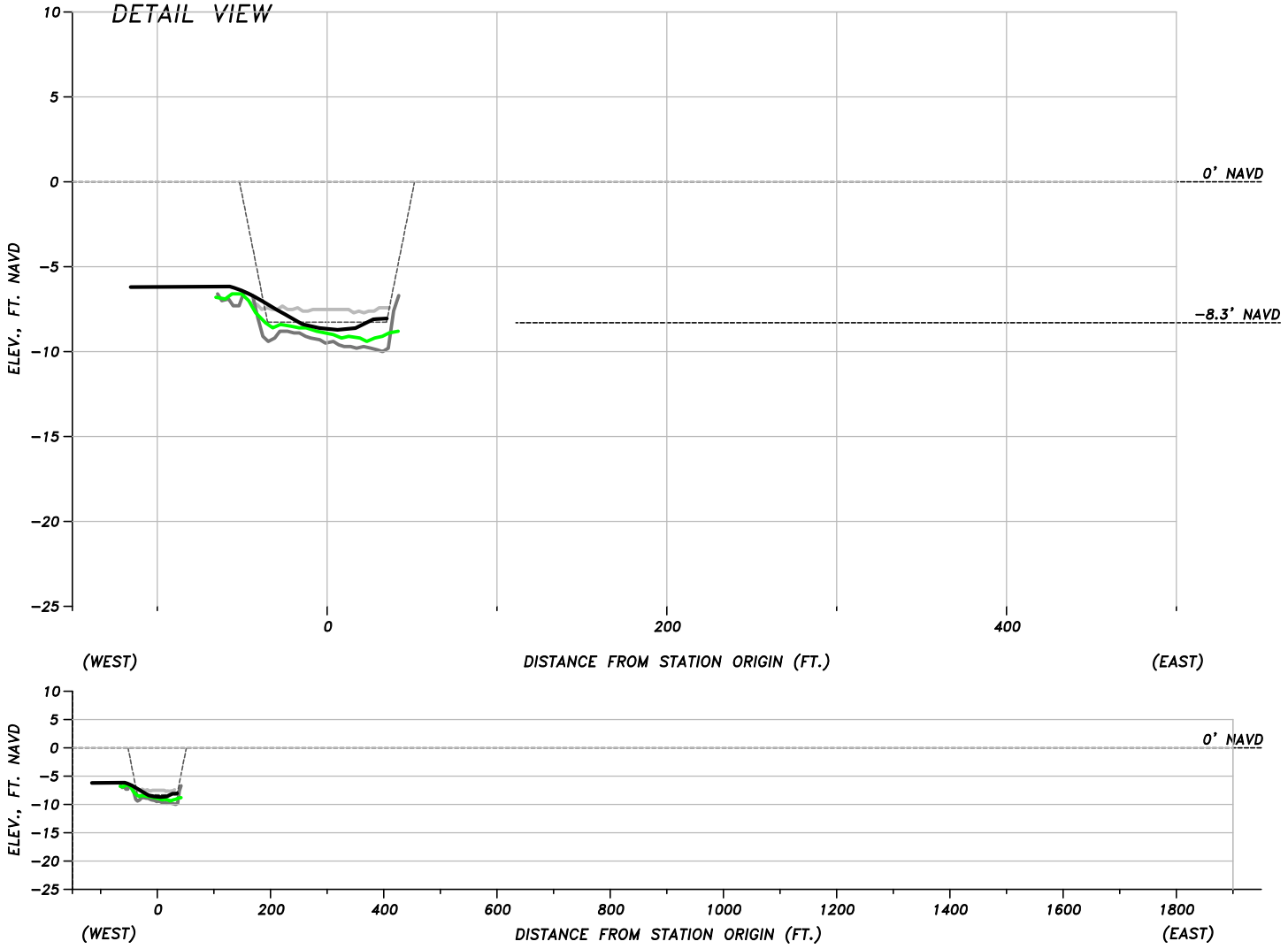
STATION: E5+71



HUMISTON & MOORE ENGINEERS
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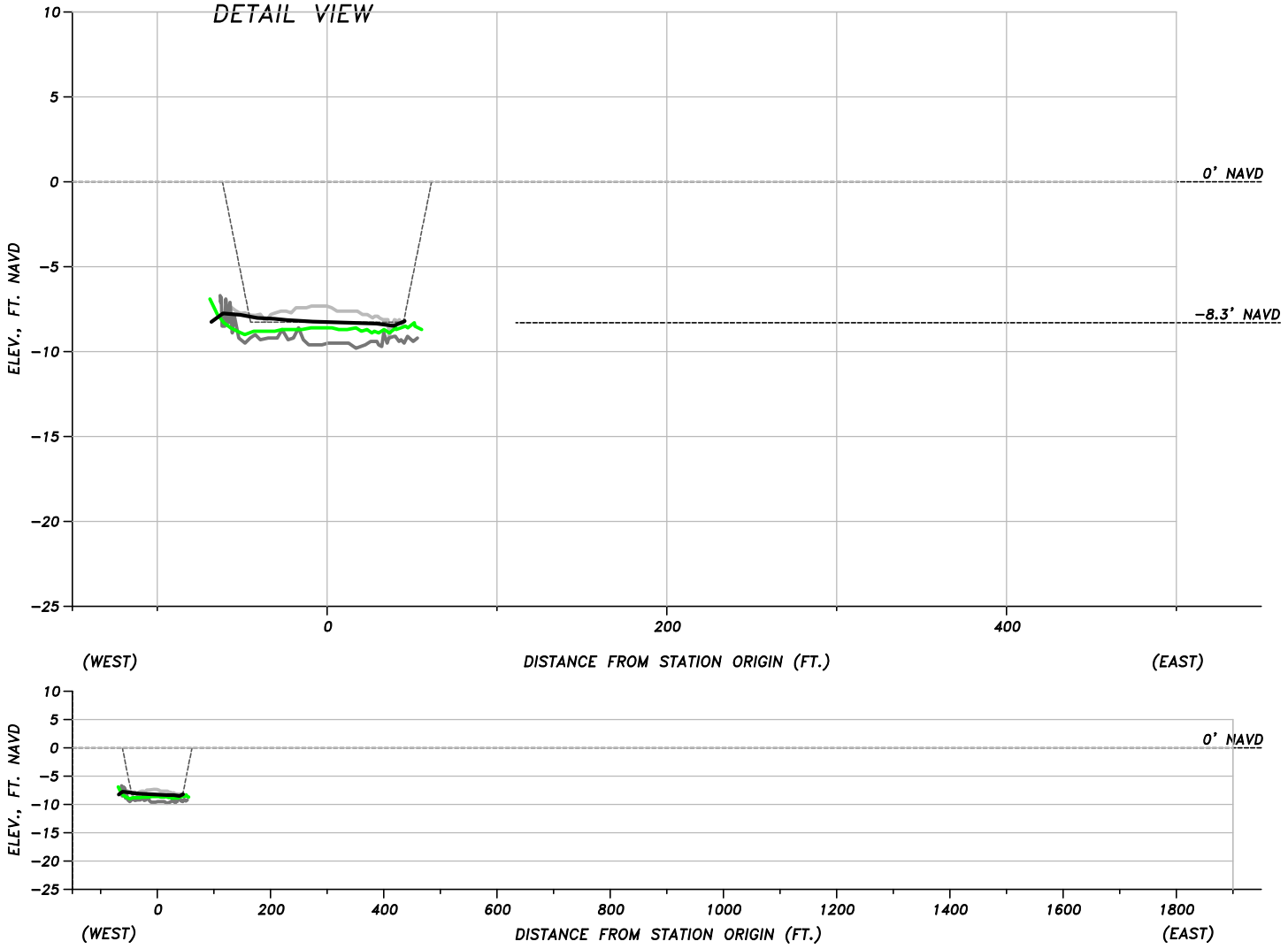
COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

STATION: E6+59



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594–2025
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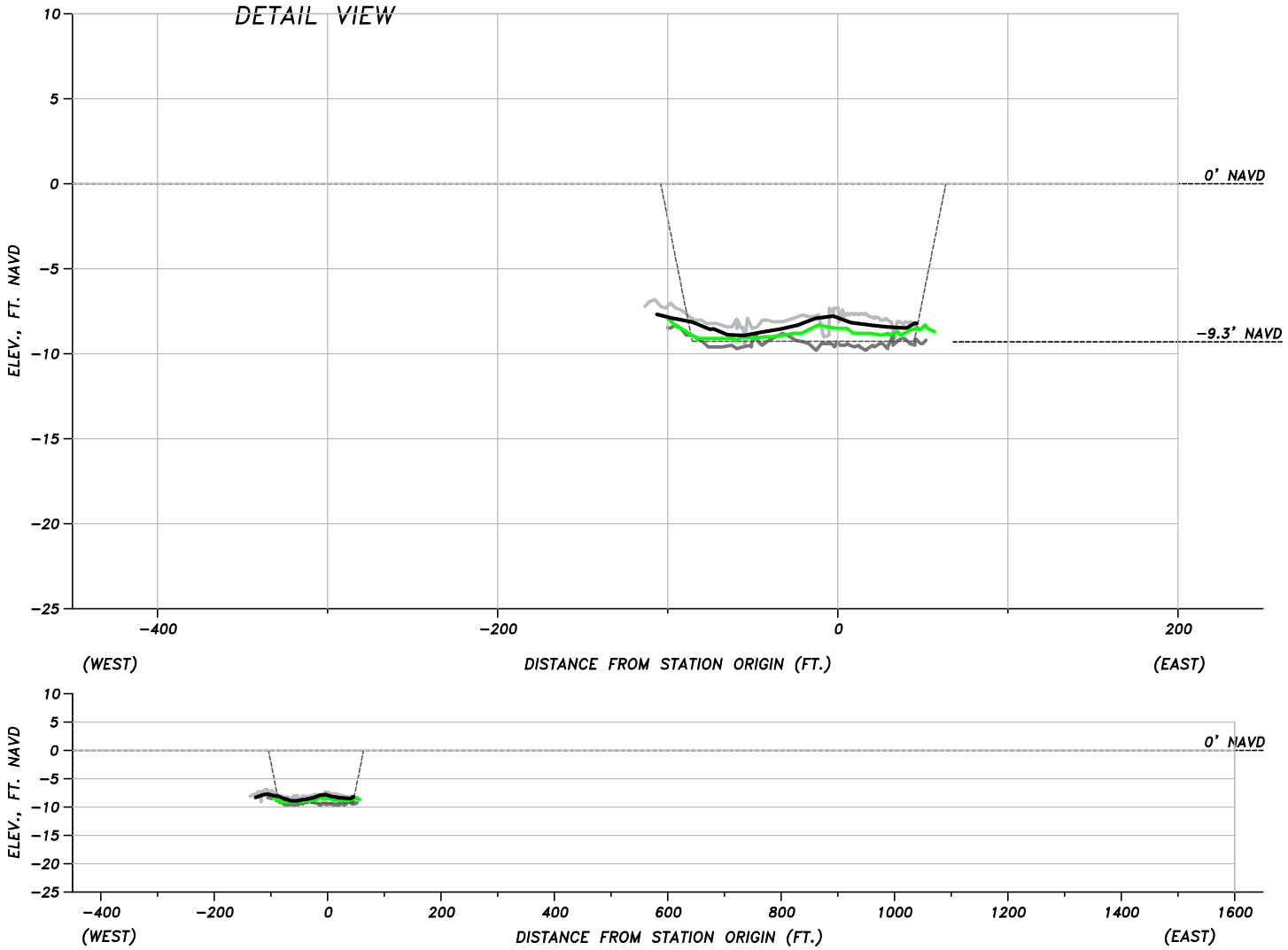
STATION: E6+78



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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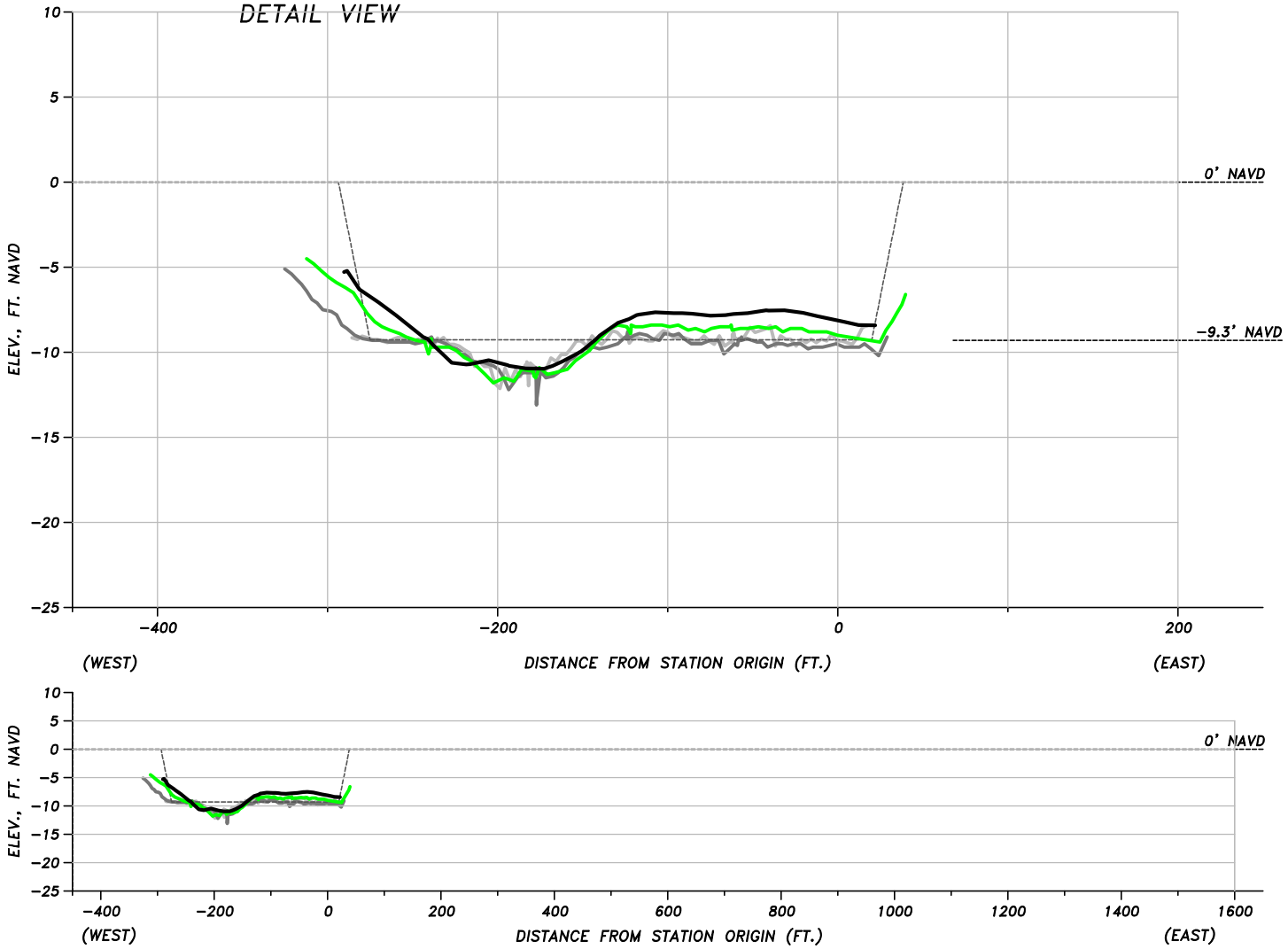
STATION: E7+64



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
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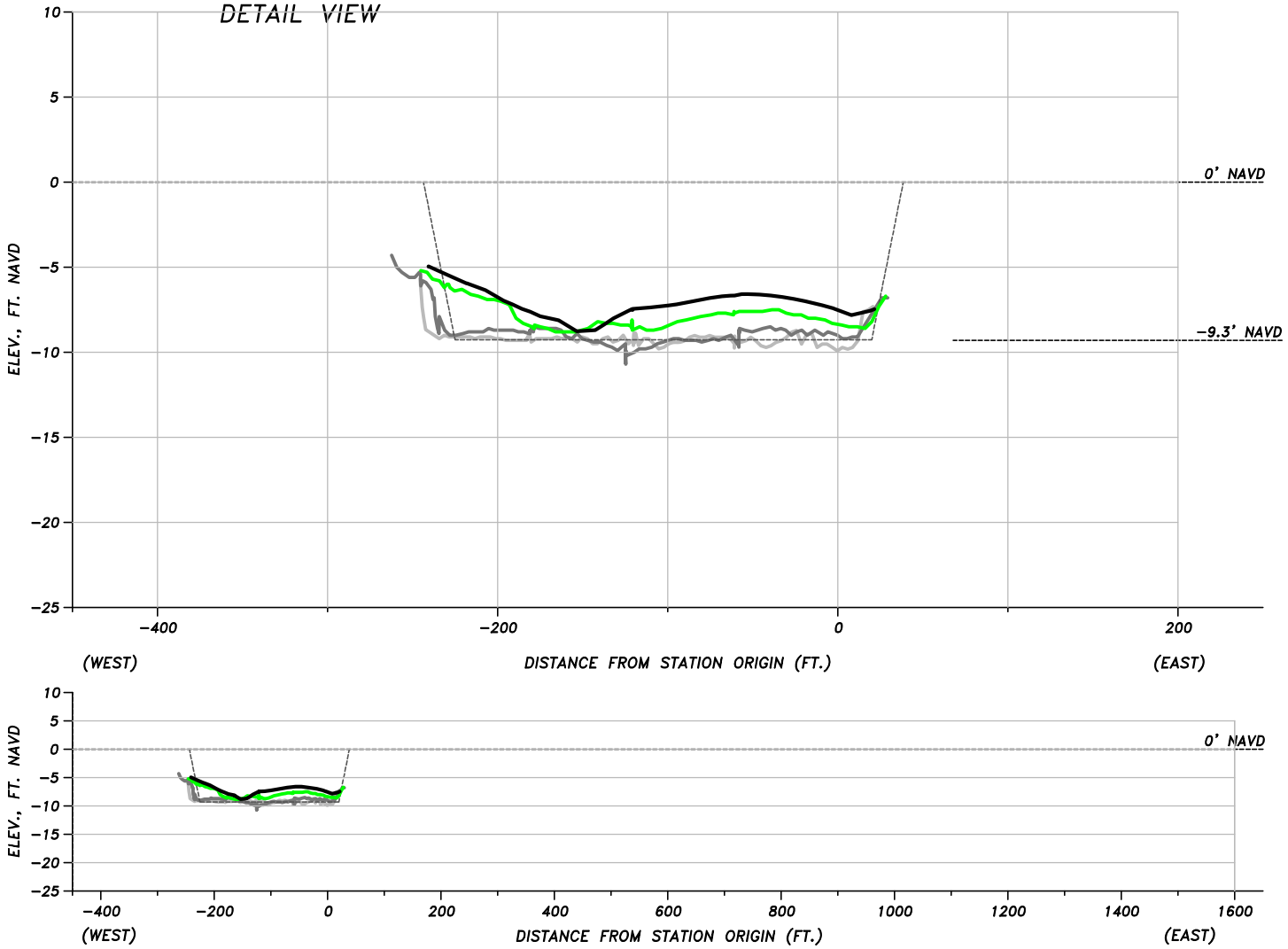
STATION: E8+56



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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FAX: (239) 594–2025
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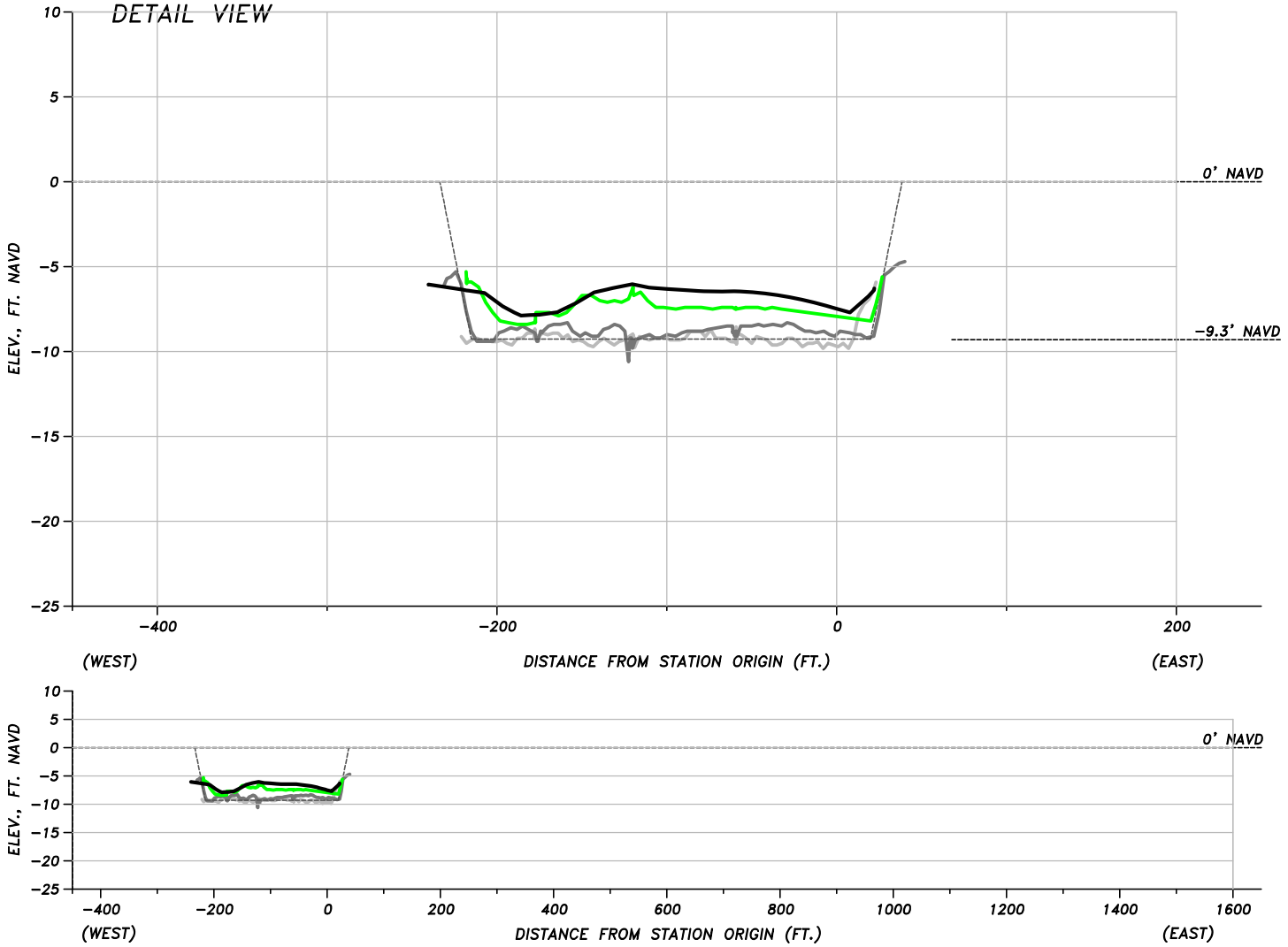
STATION: E9+10



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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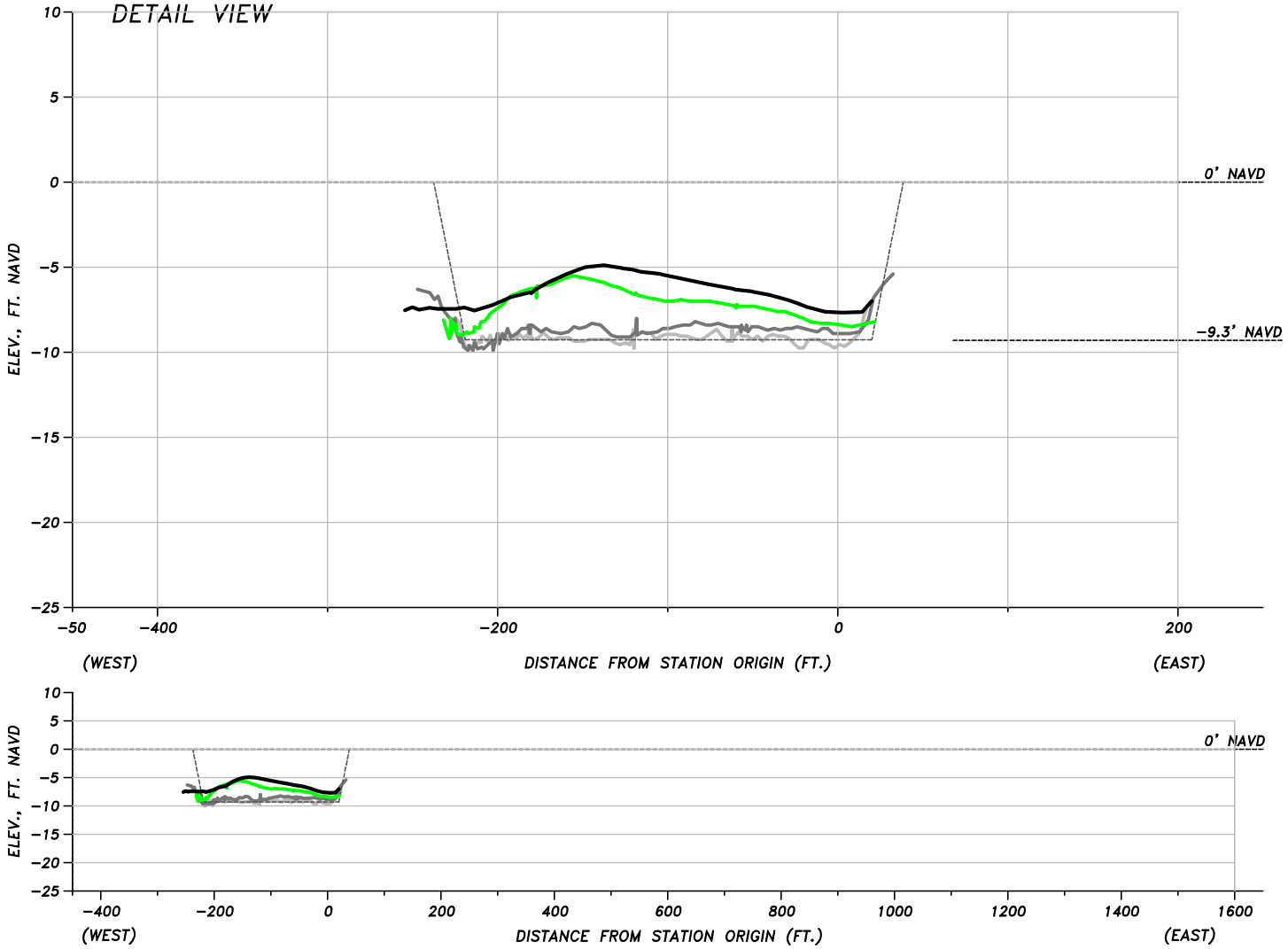
STATION: E9+75



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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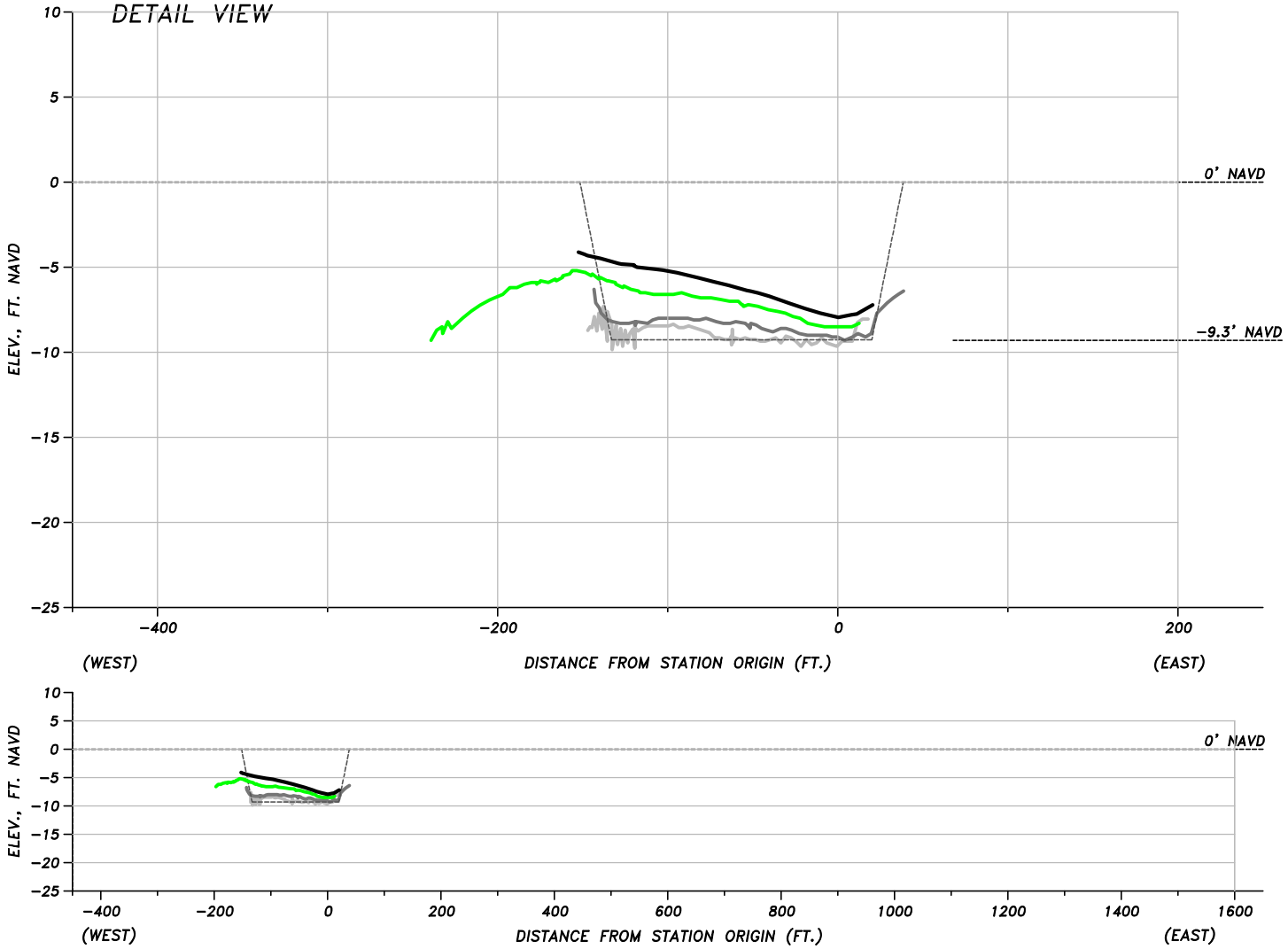
STATION: E10+10



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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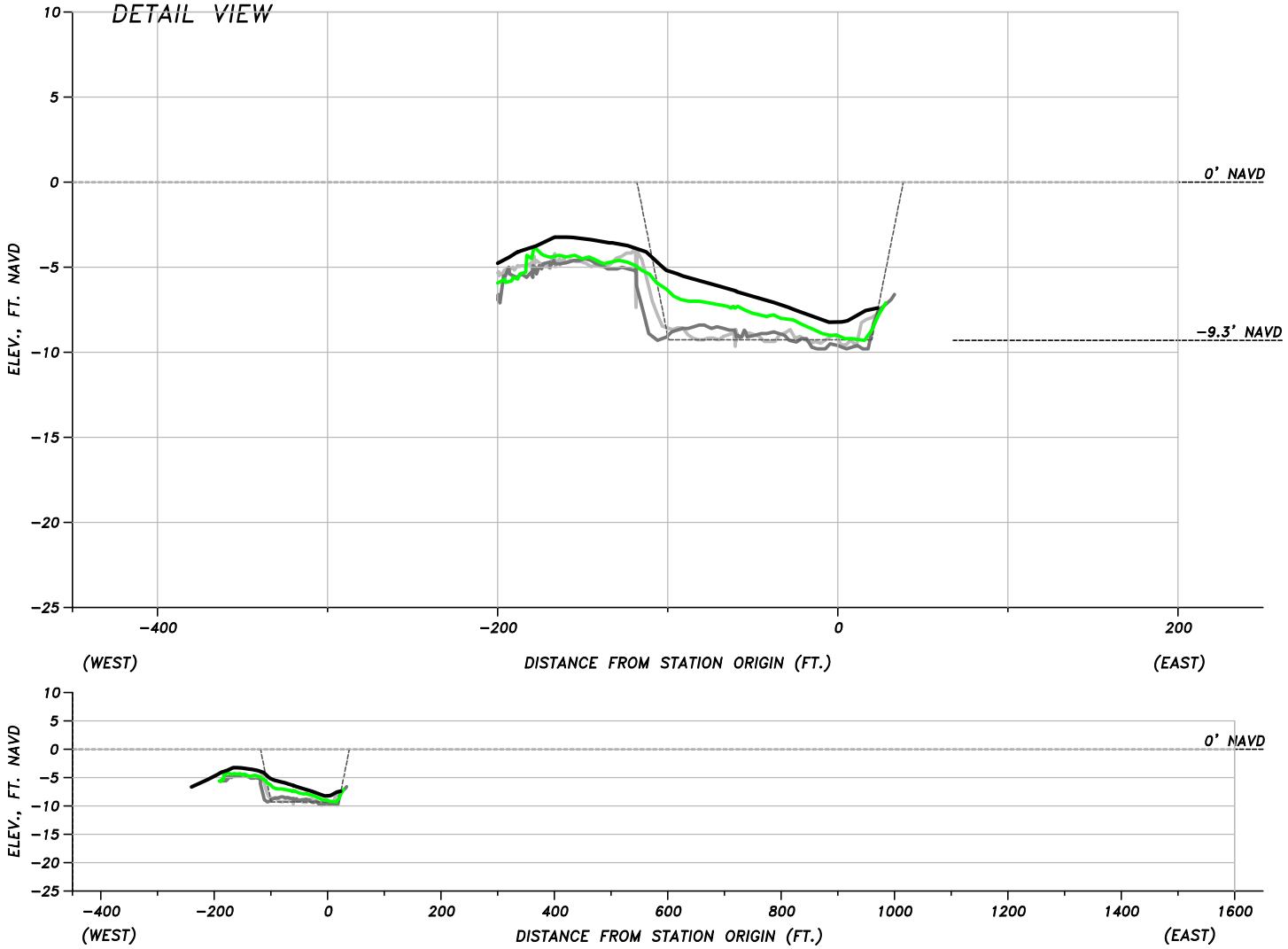
STATION: E10+51



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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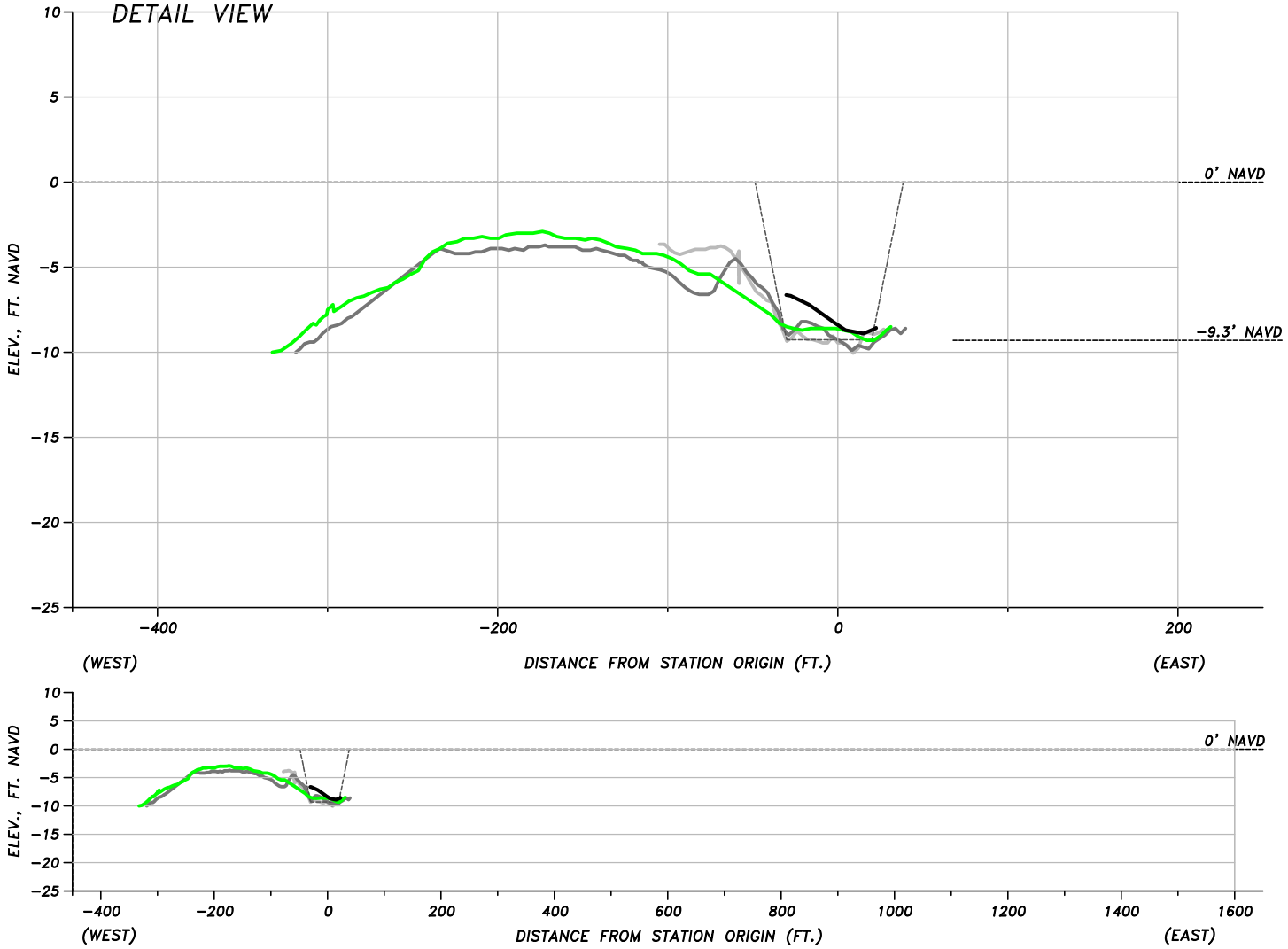
STATION: E11+35



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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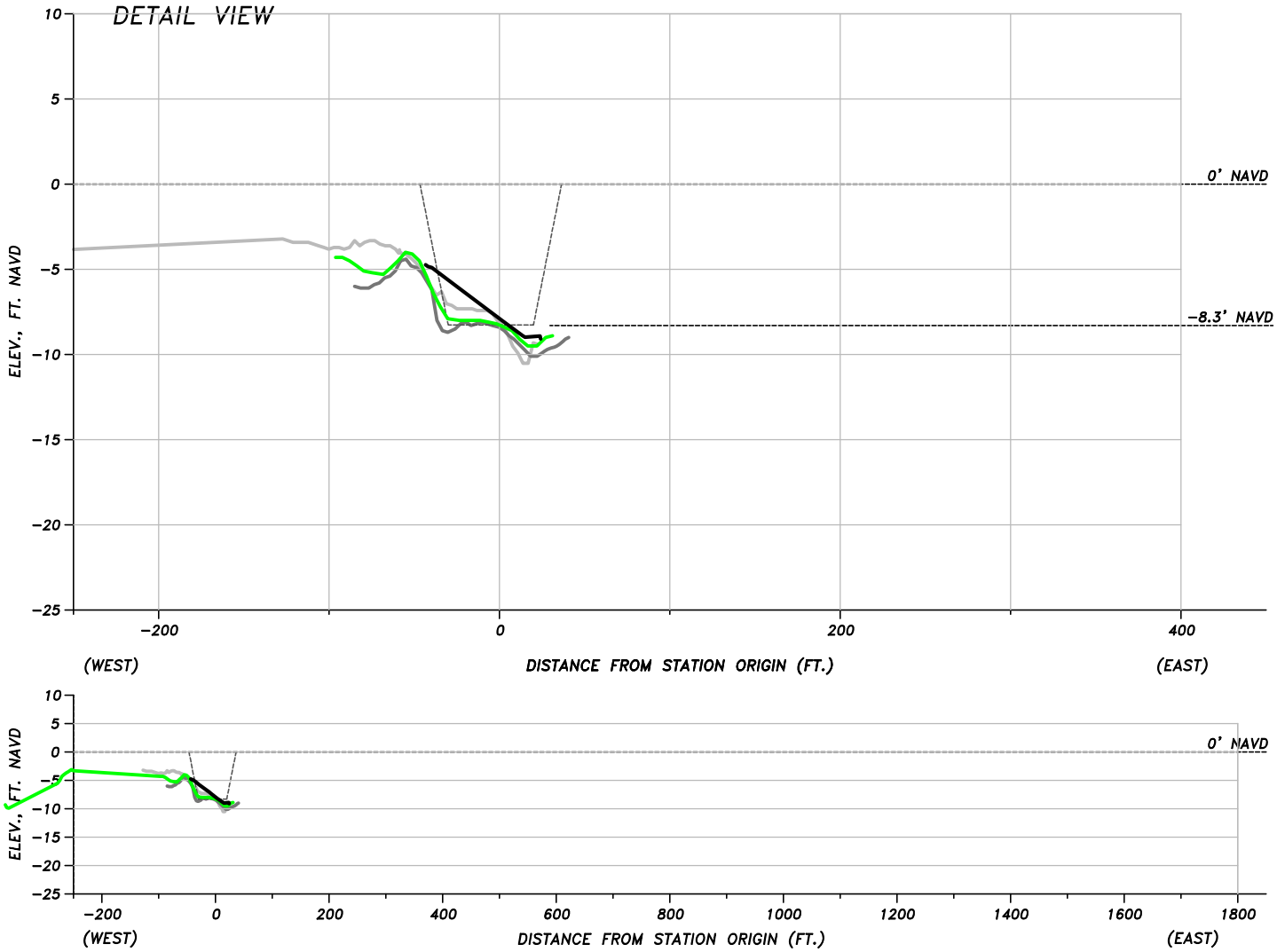
STATION: E11+63



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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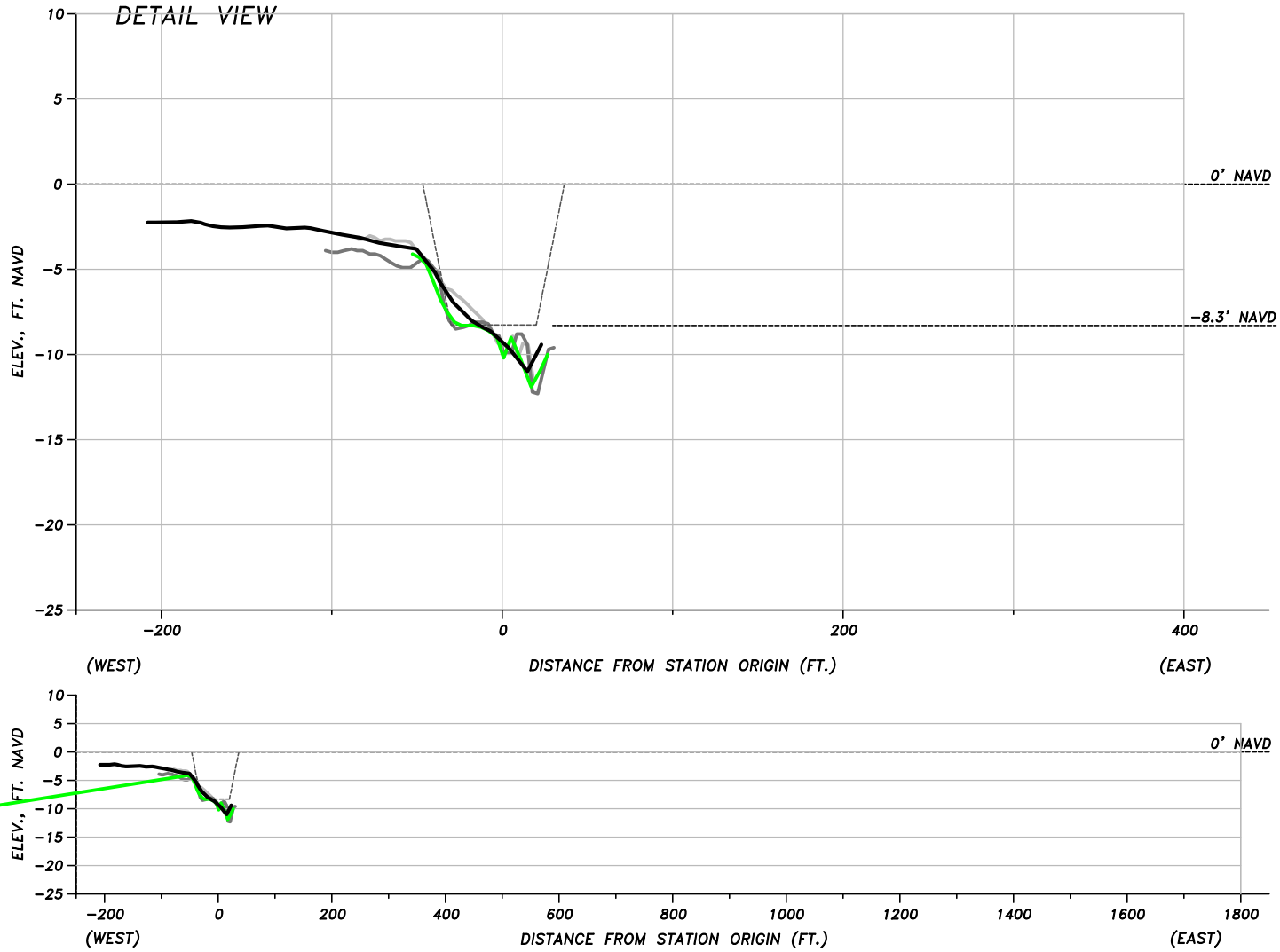
STATION: E12+39



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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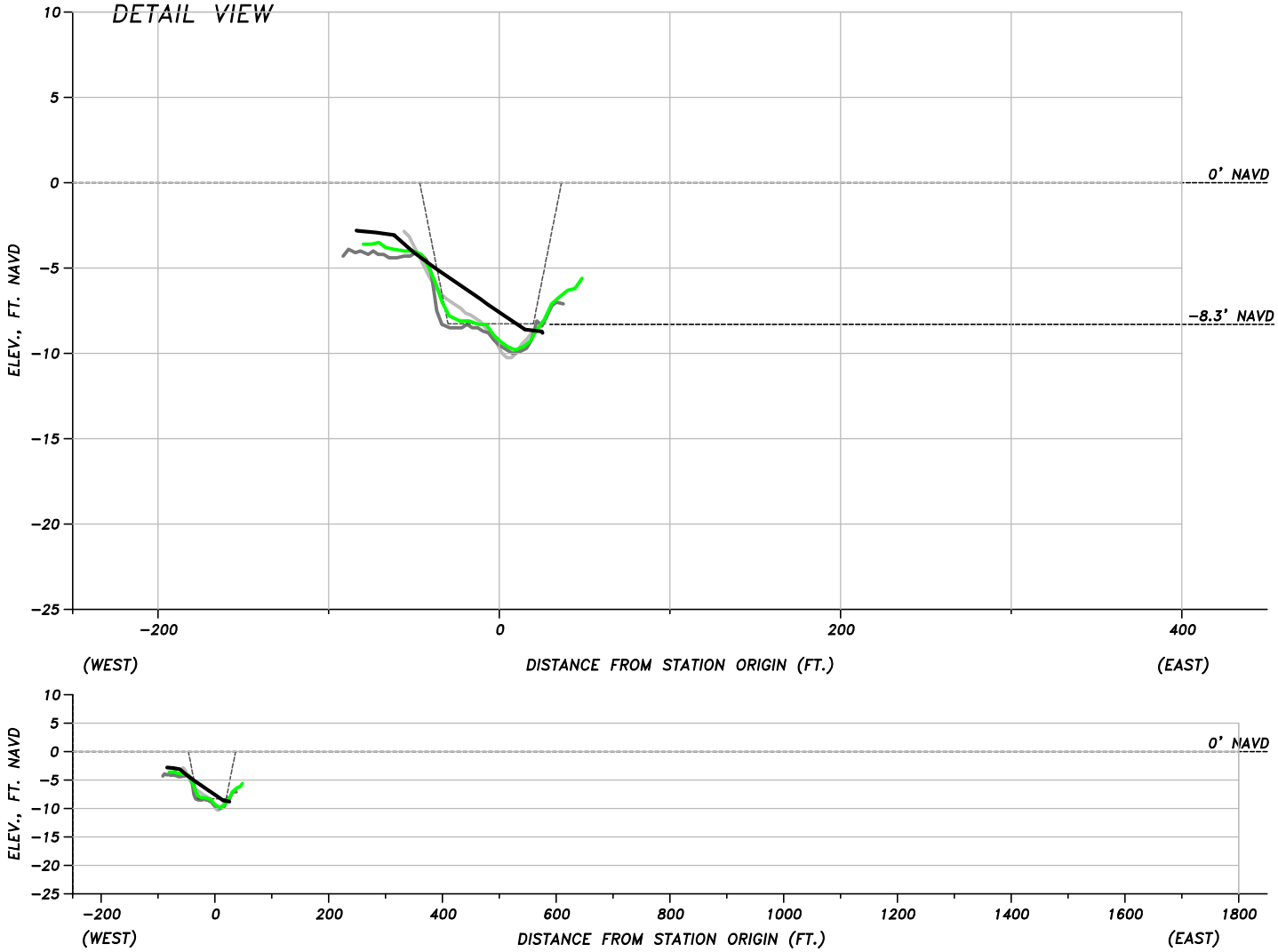
STATION: E13+16



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

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NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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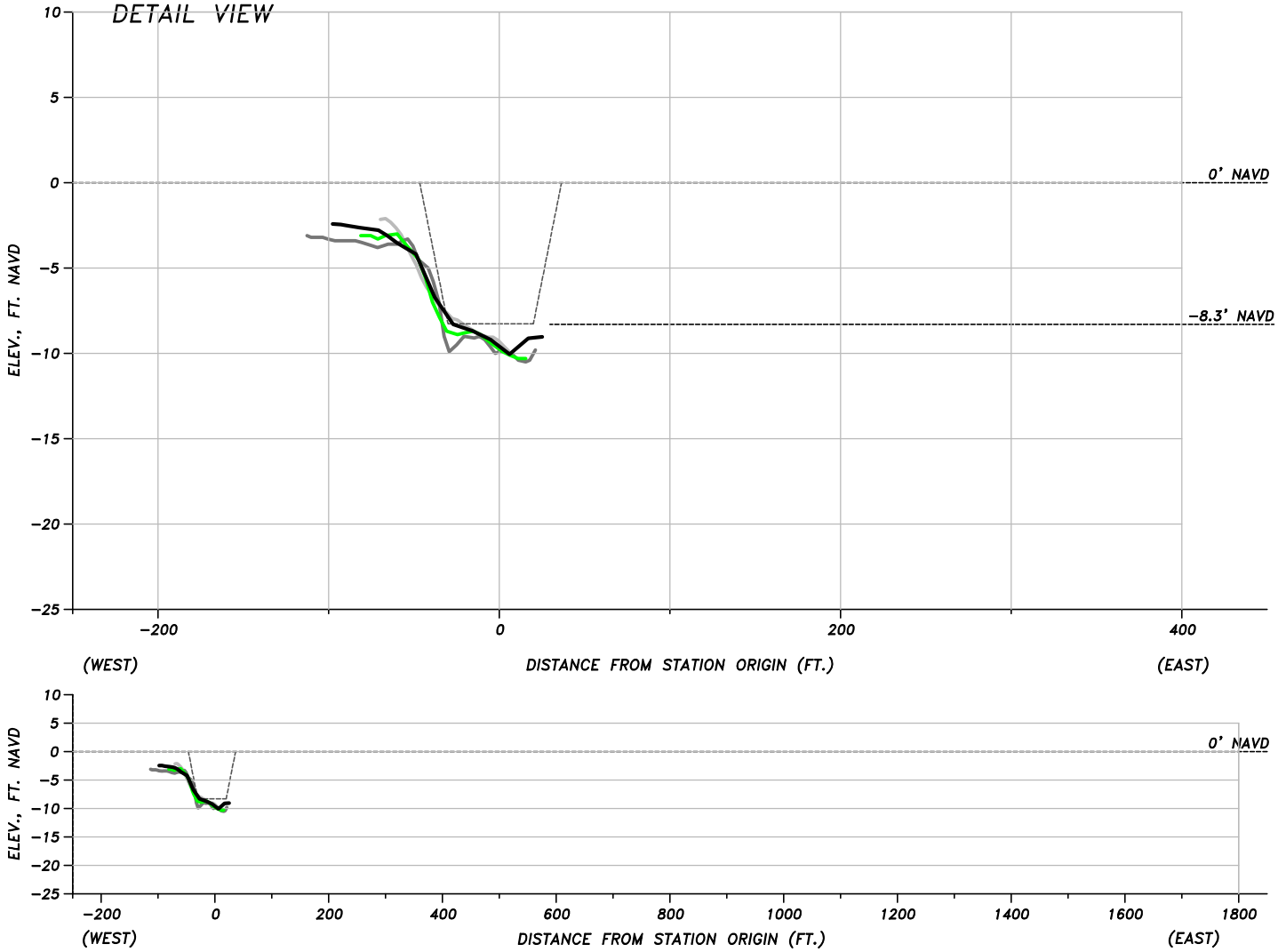
STATION: E14+11



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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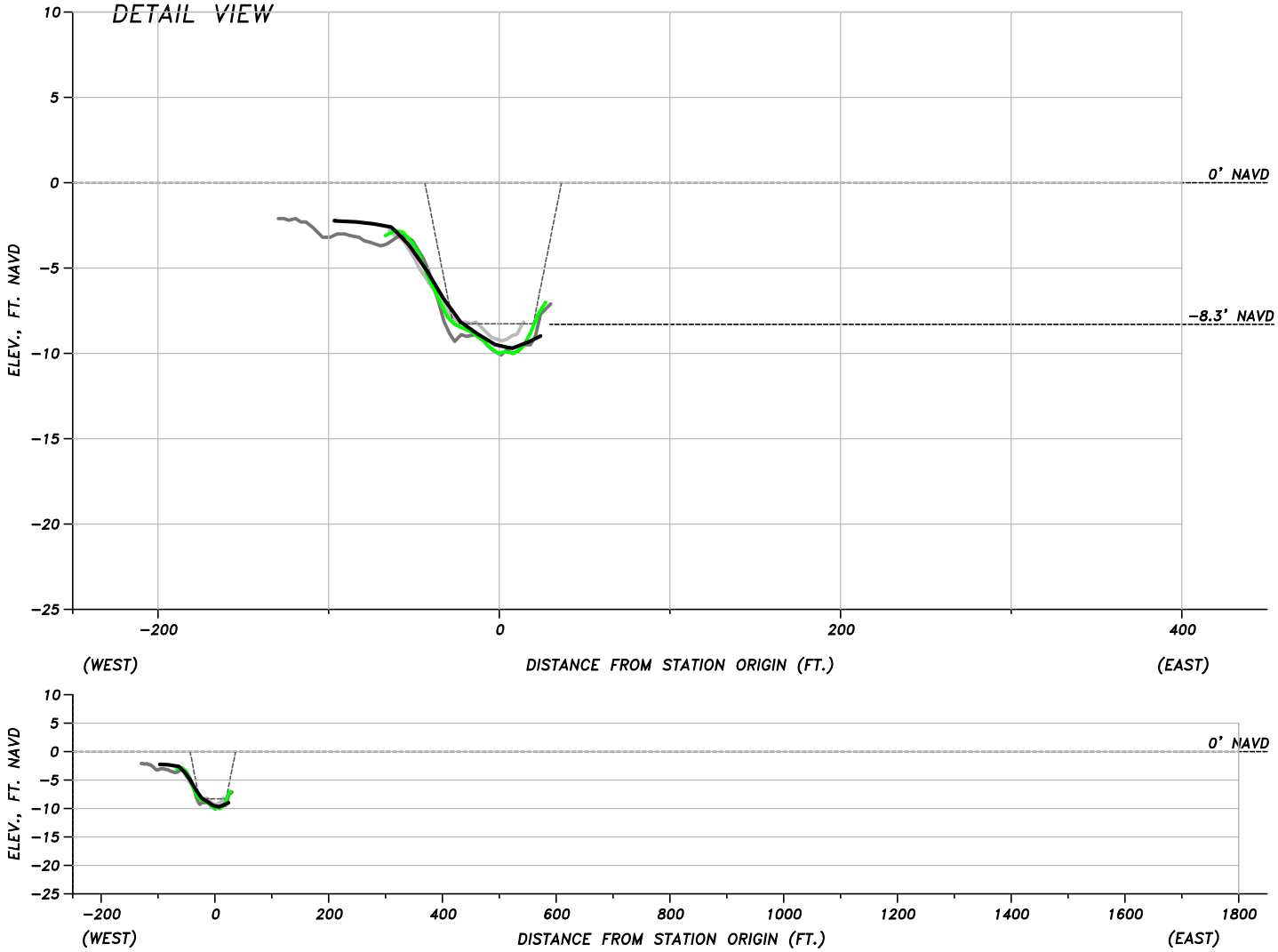
STATION: E15+67



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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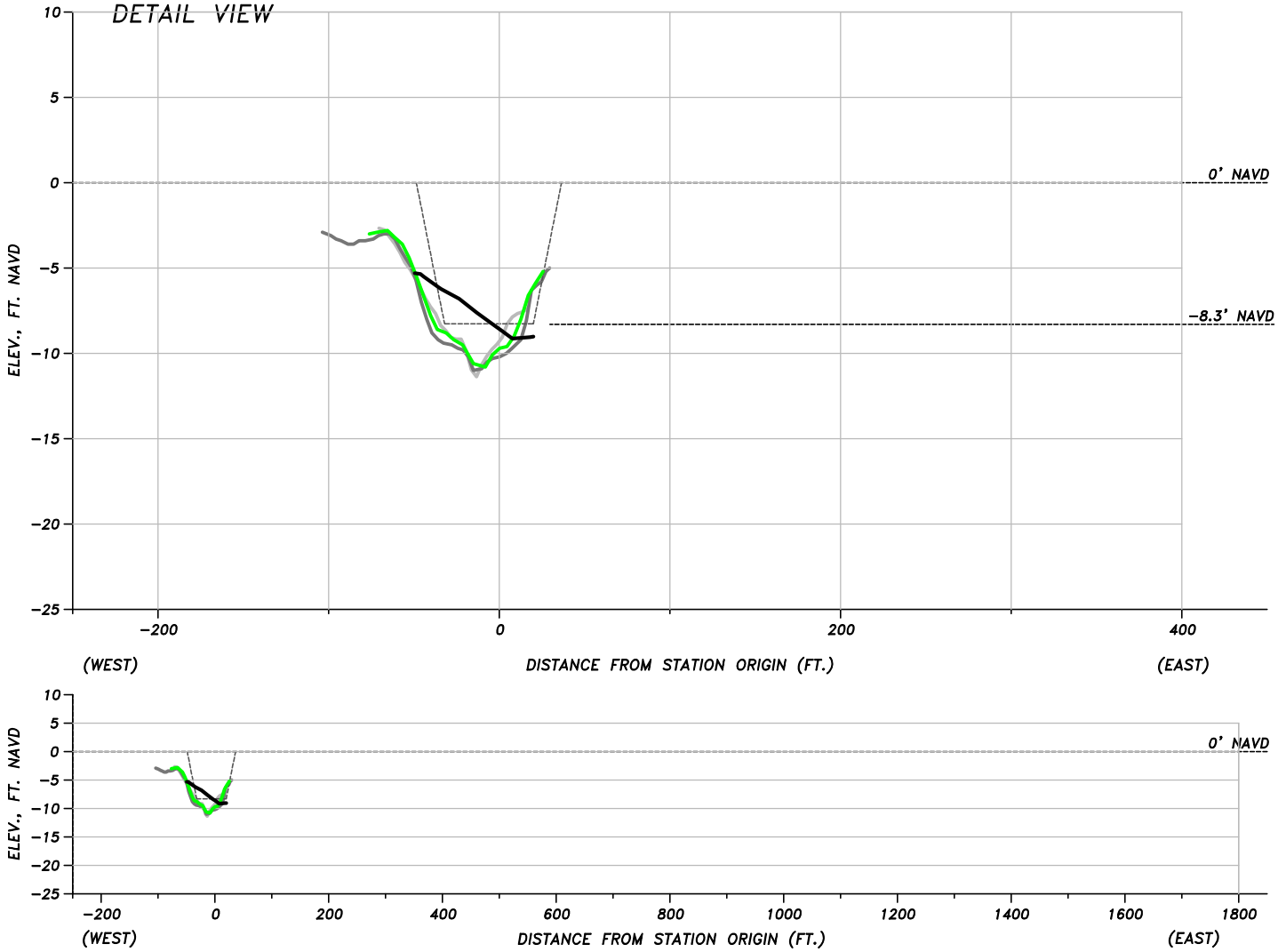
STATION: E15+06



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
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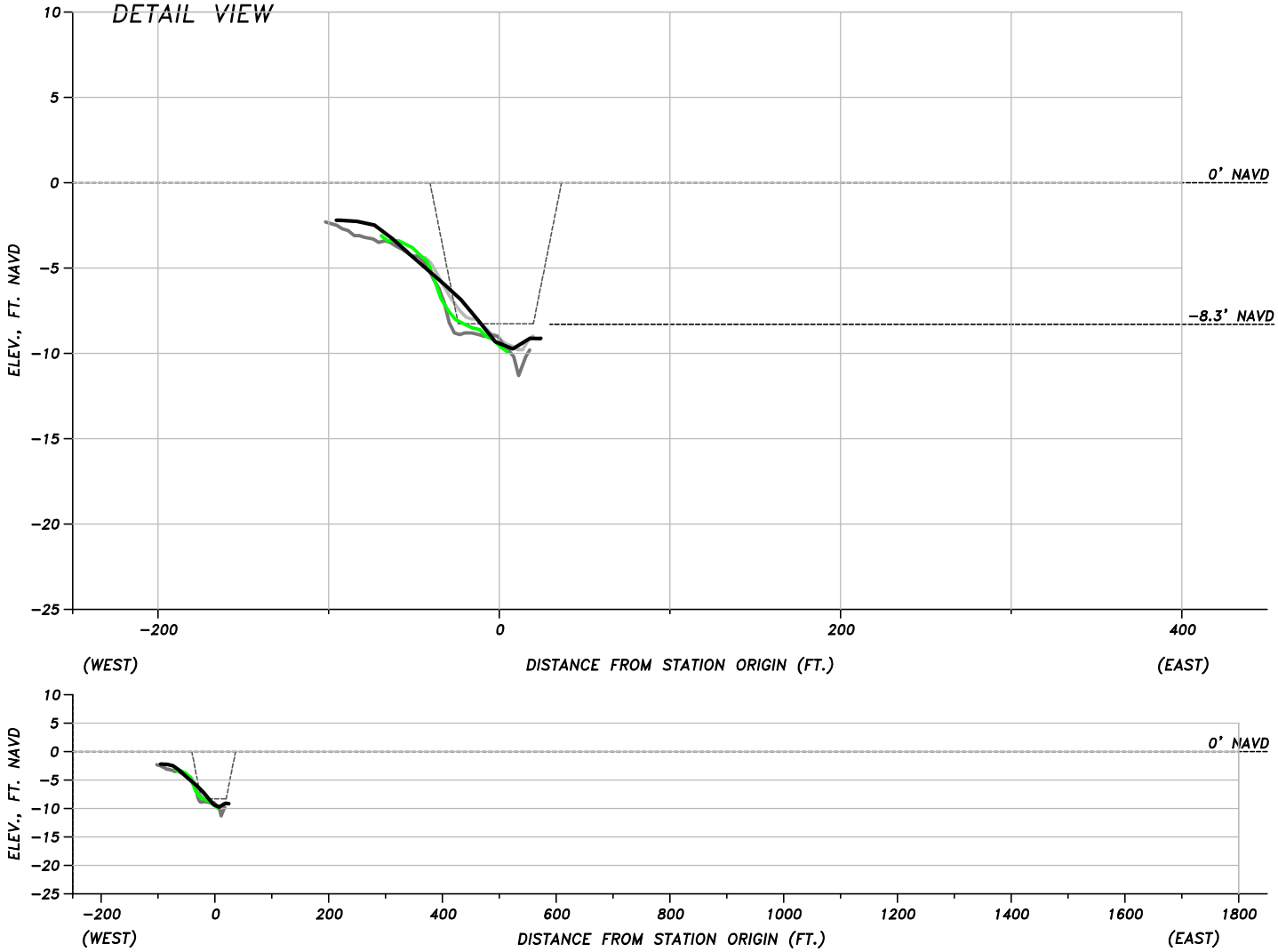
STATION: E16+29



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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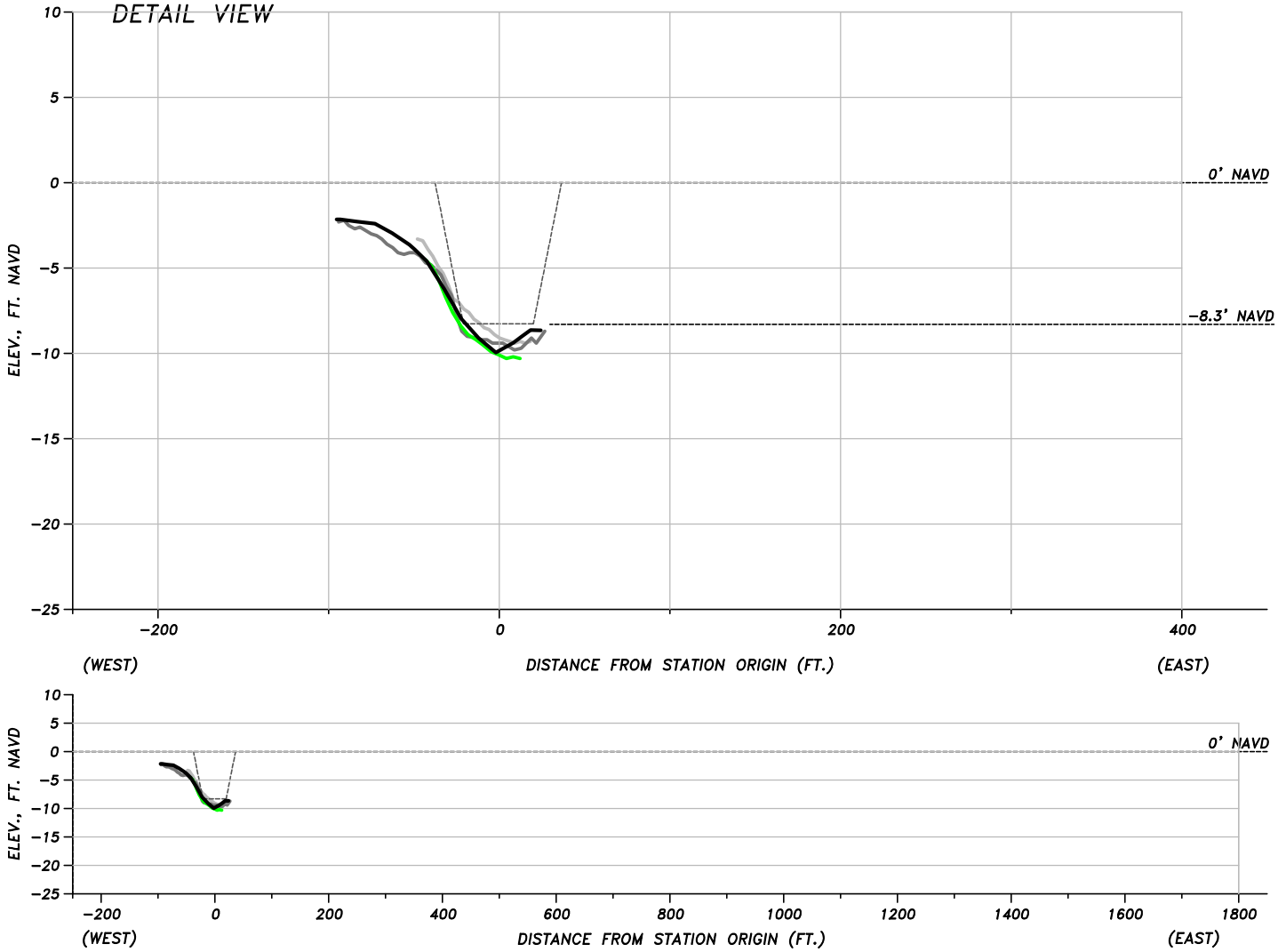
STATION: E16+90



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
	JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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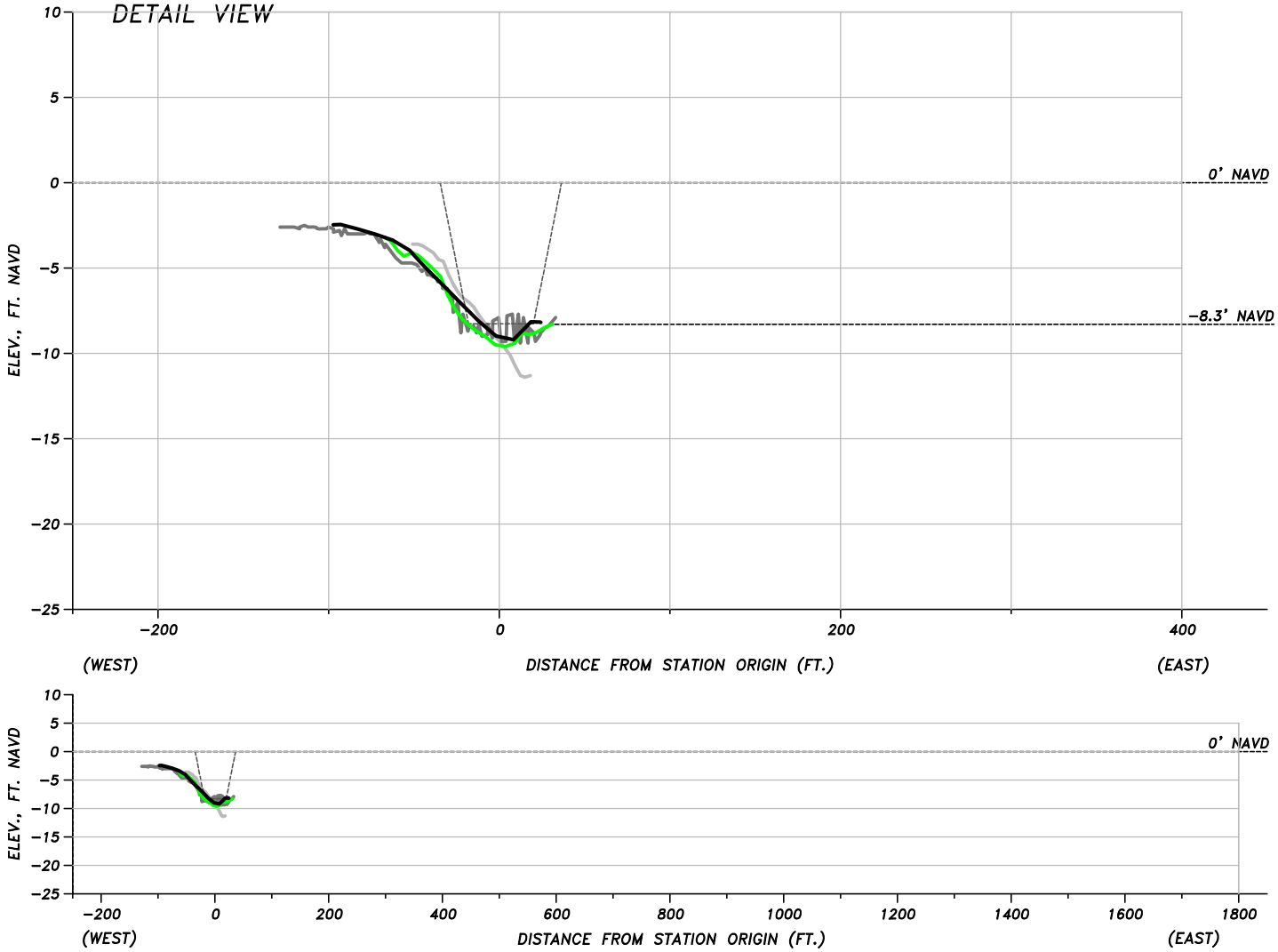
STATION: E17+51



HUMISTON & MOORE ENGINEERS
COASTAL ENGINEERING DESIGN AND PERMITTING

COLLIER COUNTY MONITORING DOCTORS PASS SURVEY PROFILE		
FOR: COLLIER COUNTY		
DATE: 5/2/23	FILE: SECTION	SCALE: SHOWN
JOB:29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
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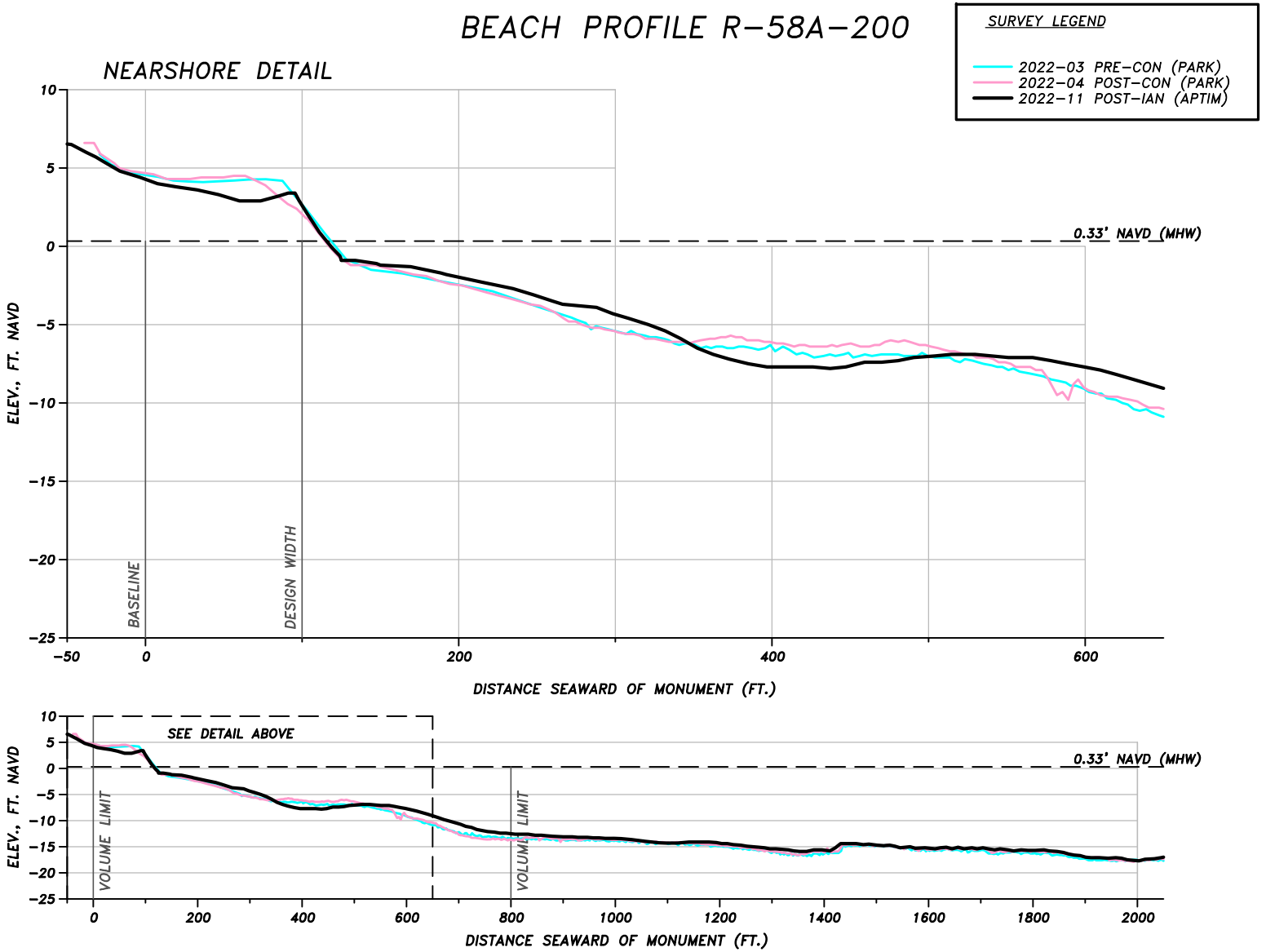
APPENDIX D-3

CROSS SECTIONS - BEACH

BEACH PROFILE R-58A-200



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY BEACH MONITORING BEACH PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
	JOB: 29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
NAPLES, FL 34110
FAX: (239) 594-2025
PHONE: (239) 594-2021
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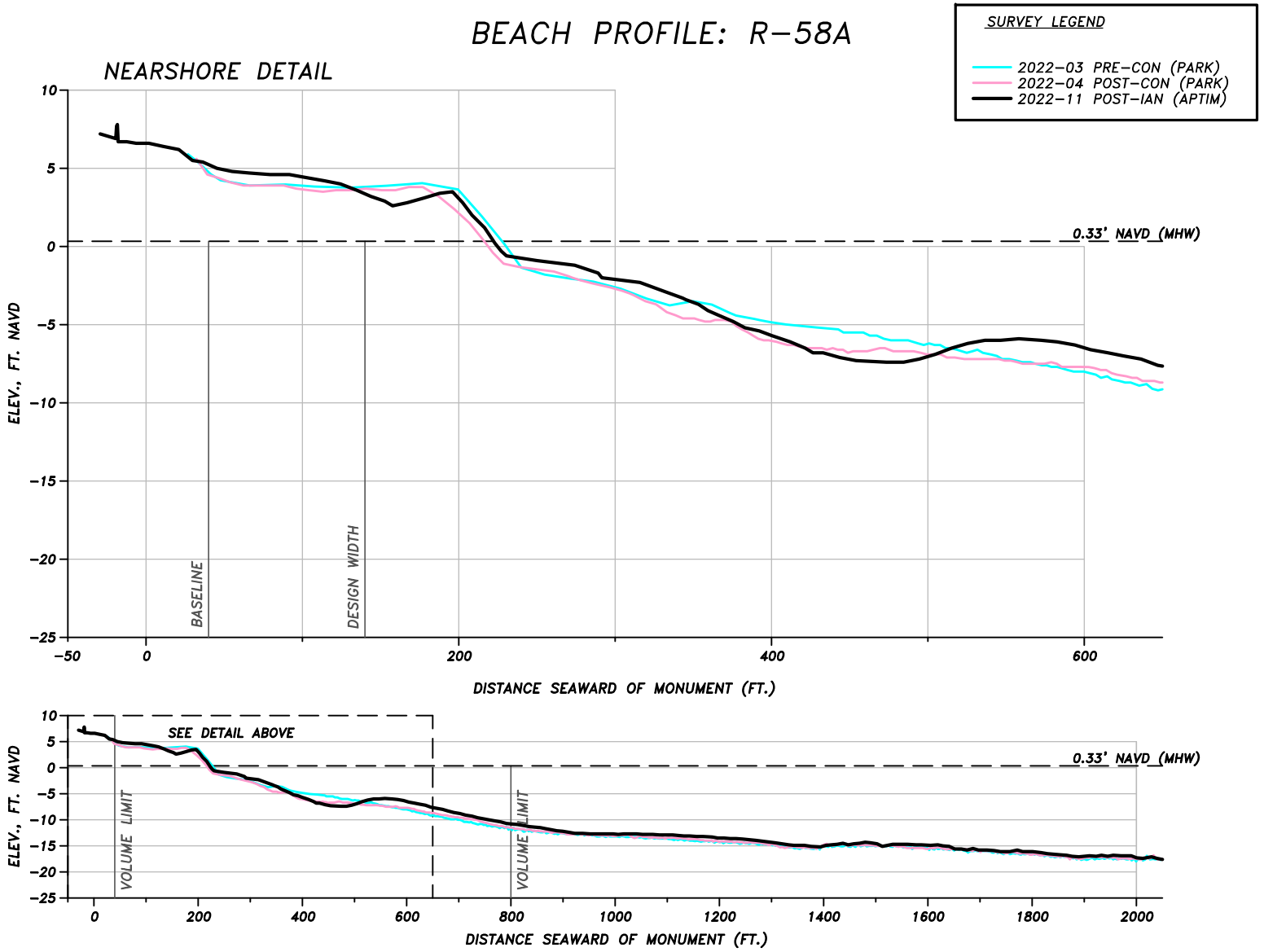
BEACH PROFILE: R-58A



HUMISTON & MOORE ENGINEERS COASTAL ENGINEERING DESIGN AND PERMITTING	COLLIER COUNTY BEACH MONITORING BEACH PROFILE		
	FOR: COLLIER COUNTY		
	DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
	JOB: 29018	DATUM: NAVD	FIGURE:

5679 STRAND COURT
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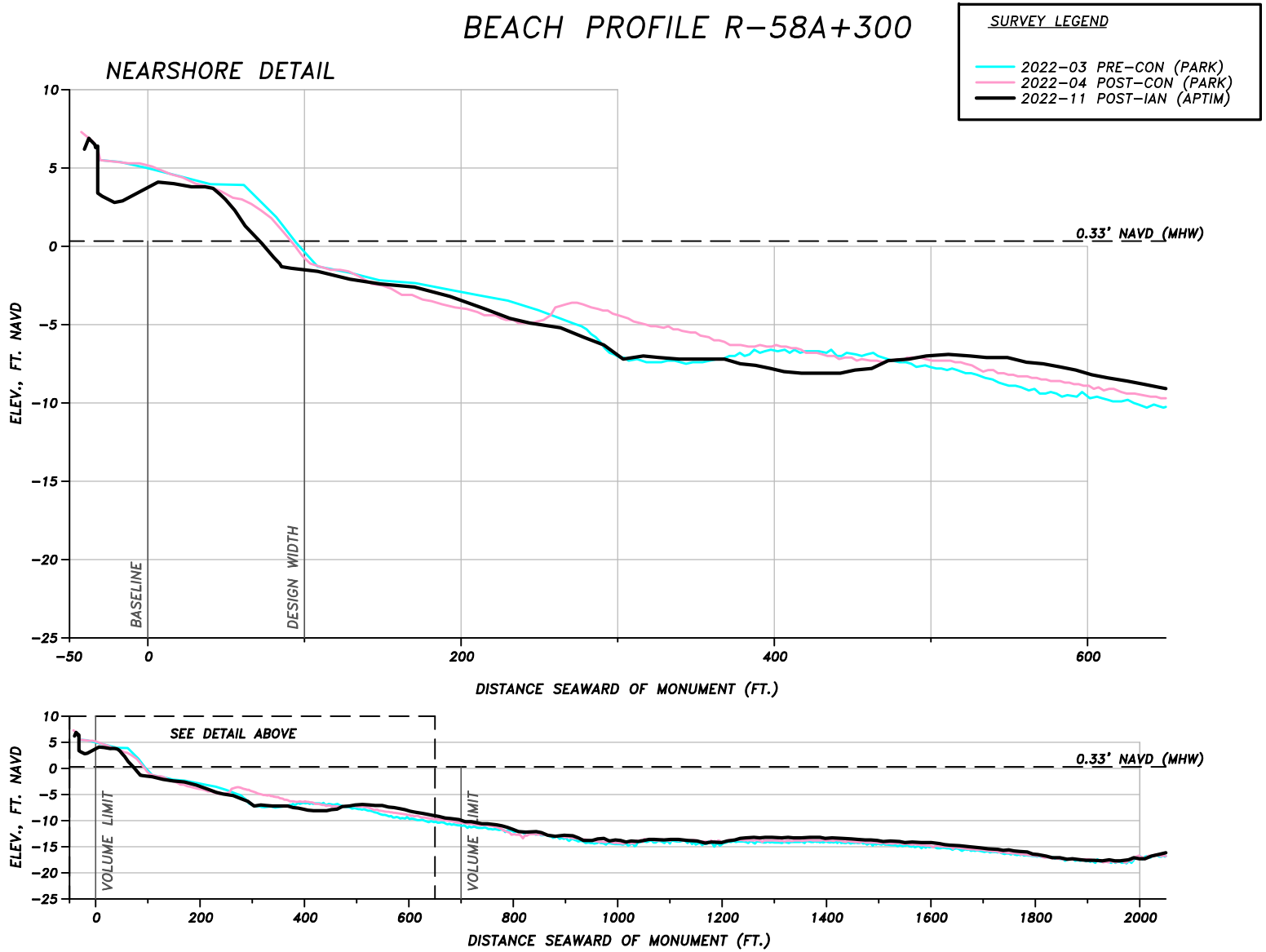
BEACH PROFILE R-58A+300



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	FOR: COLLIER COUNTY		
	DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
	JOB: 29018	DATUM: NAVD	FIGURE:

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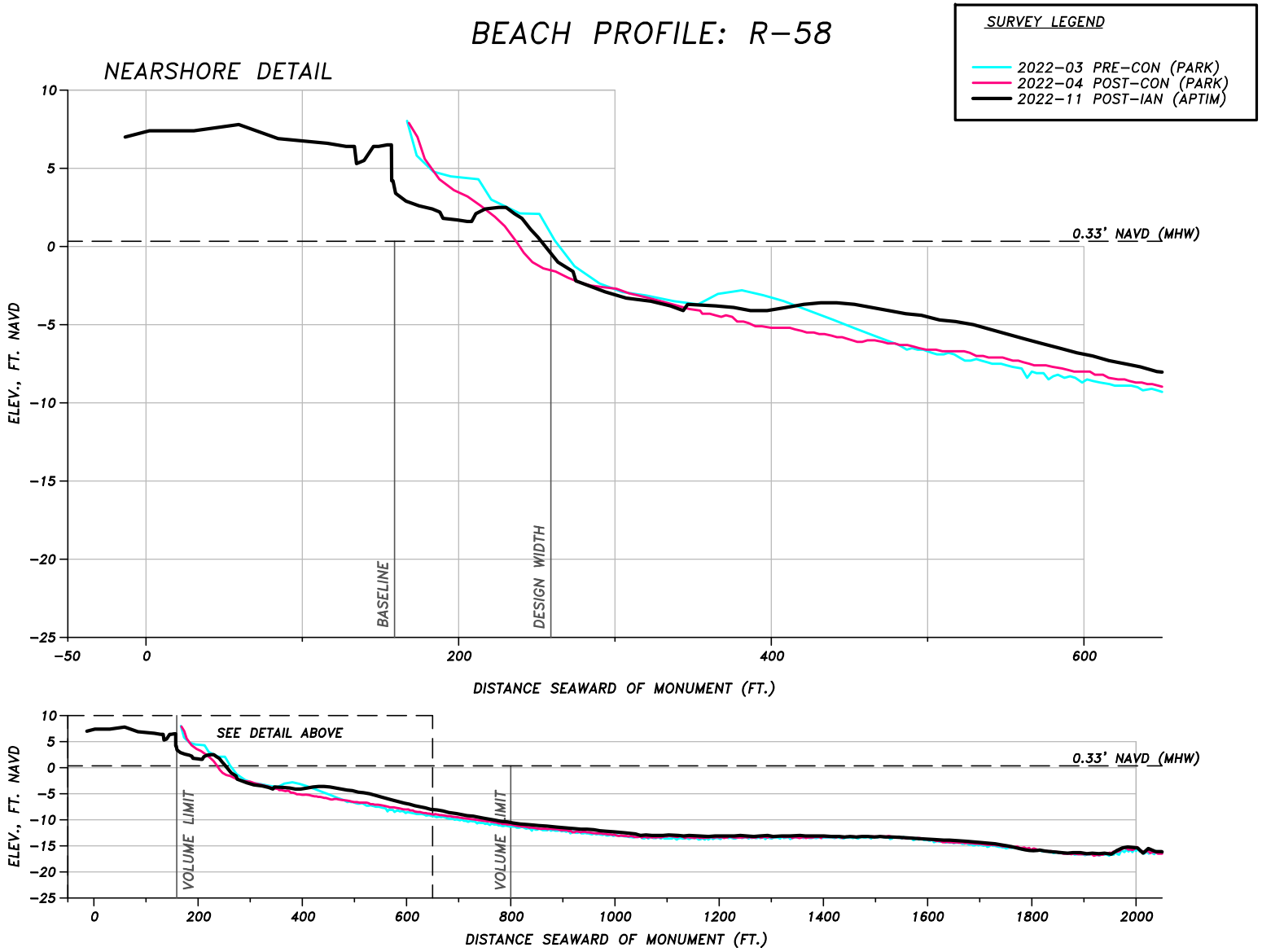
BEACH PROFILE: R-58



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	FOR: COLLIER COUNTY		
	DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
	JOB: 29018	DATUM: NAVD	FIGURE:

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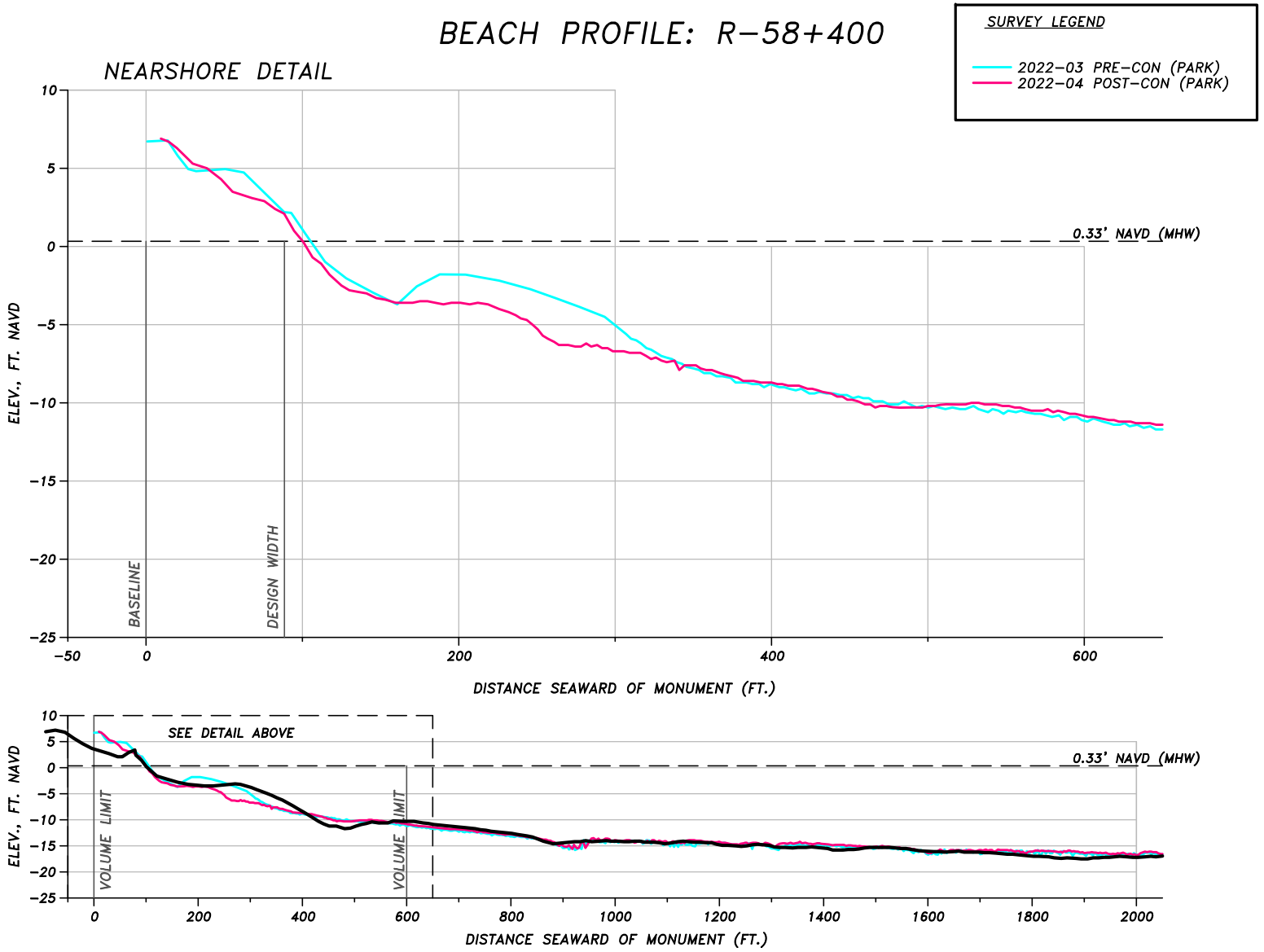
BEACH PROFILE: R-58+400



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COLLIER COUNTY BEACH MONITORING BEACH PROFILE		
FOR: COLLIER COUNTY		
DATE: 10/25/18	FILE: SECTION	SCALE: SHOWN
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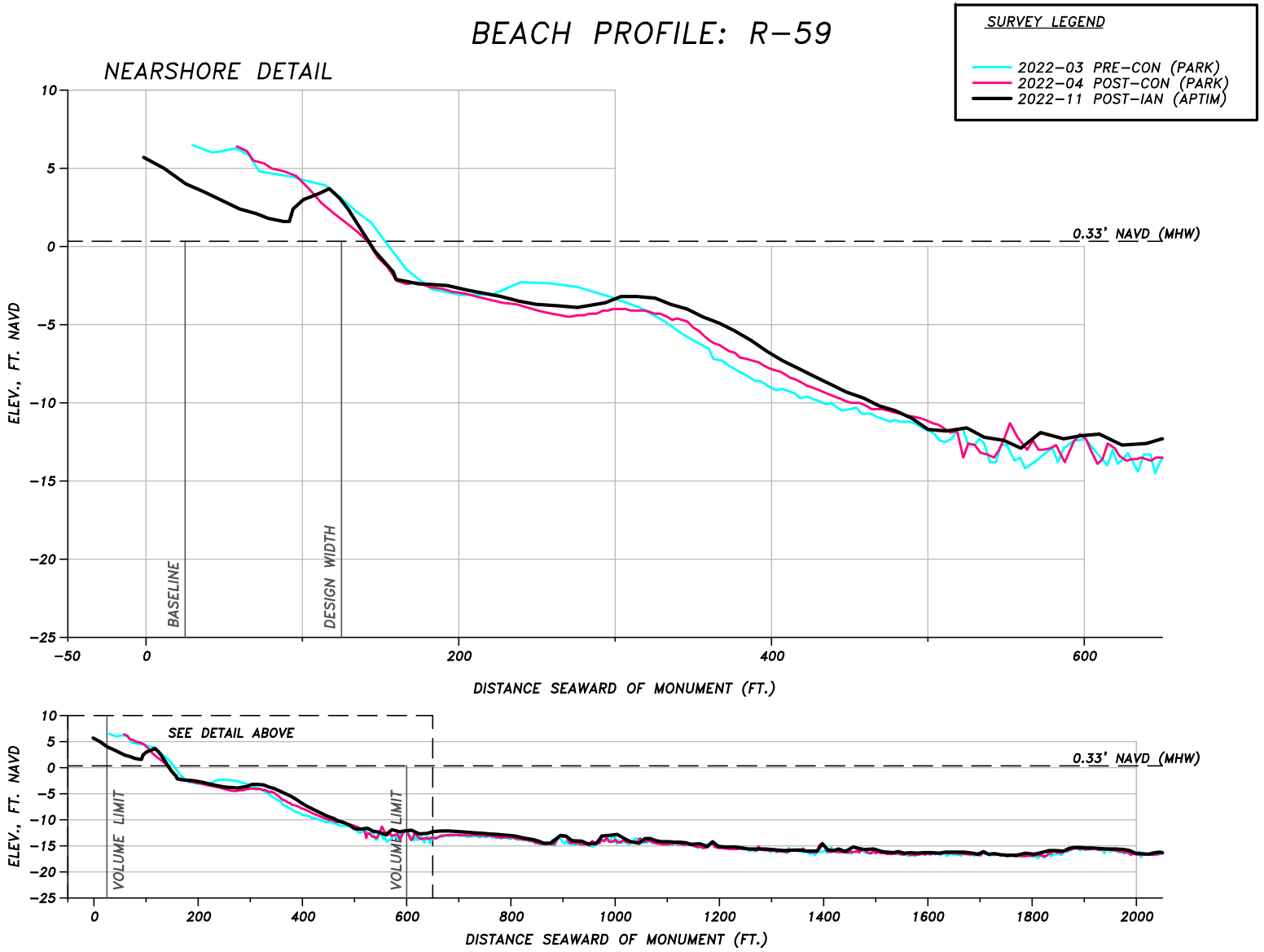
BEACH PROFILE: R-59



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COLLIER COUNTY BEACH MONITORING BEACH PROFILE		
FOR: COLLIER COUNTY		
DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
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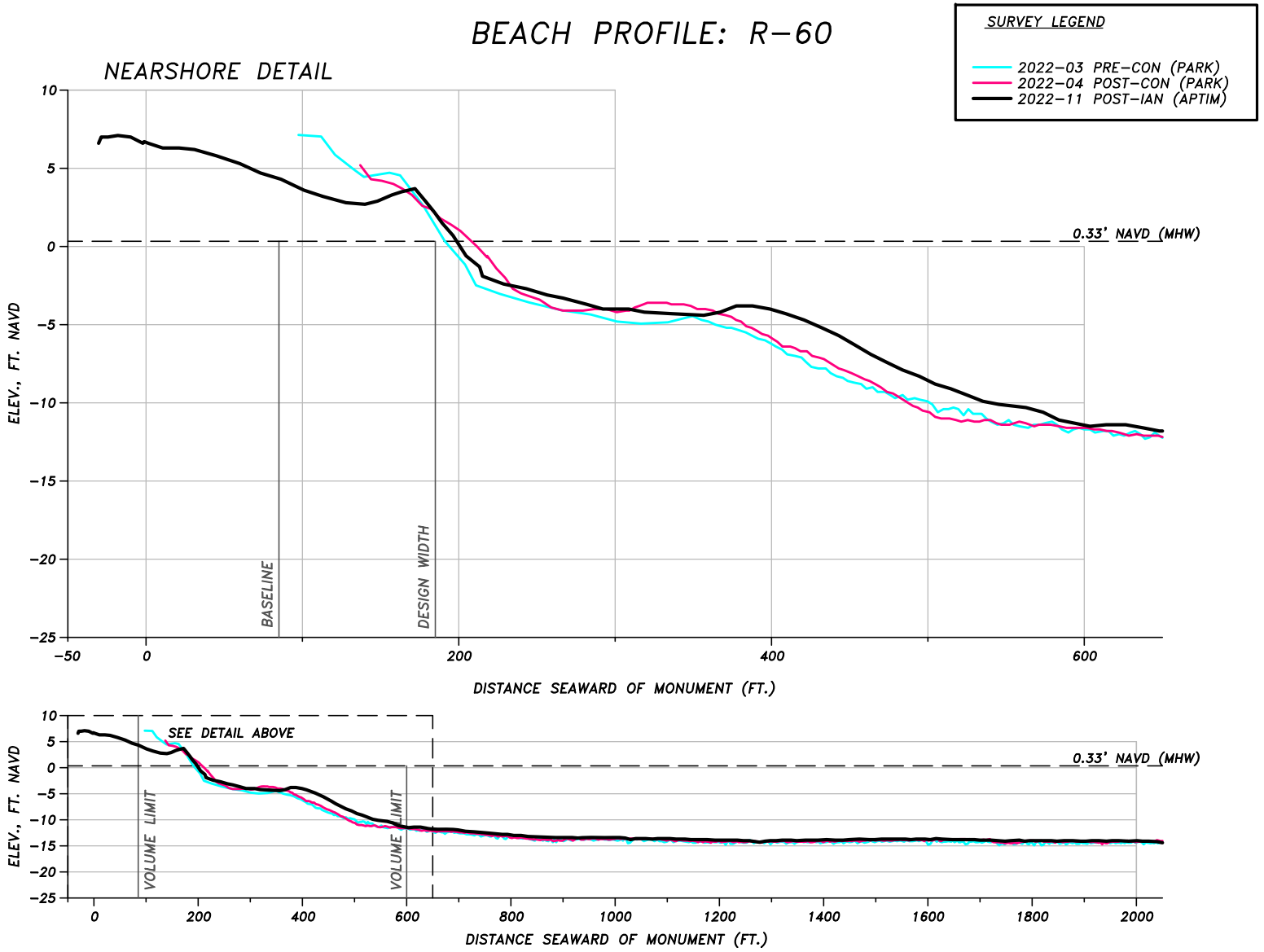
BEACH PROFILE: R-60



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	FOR: COLLIER COUNTY		
	DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
	JOB: 29018	DATUM: NAVD	FIGURE:

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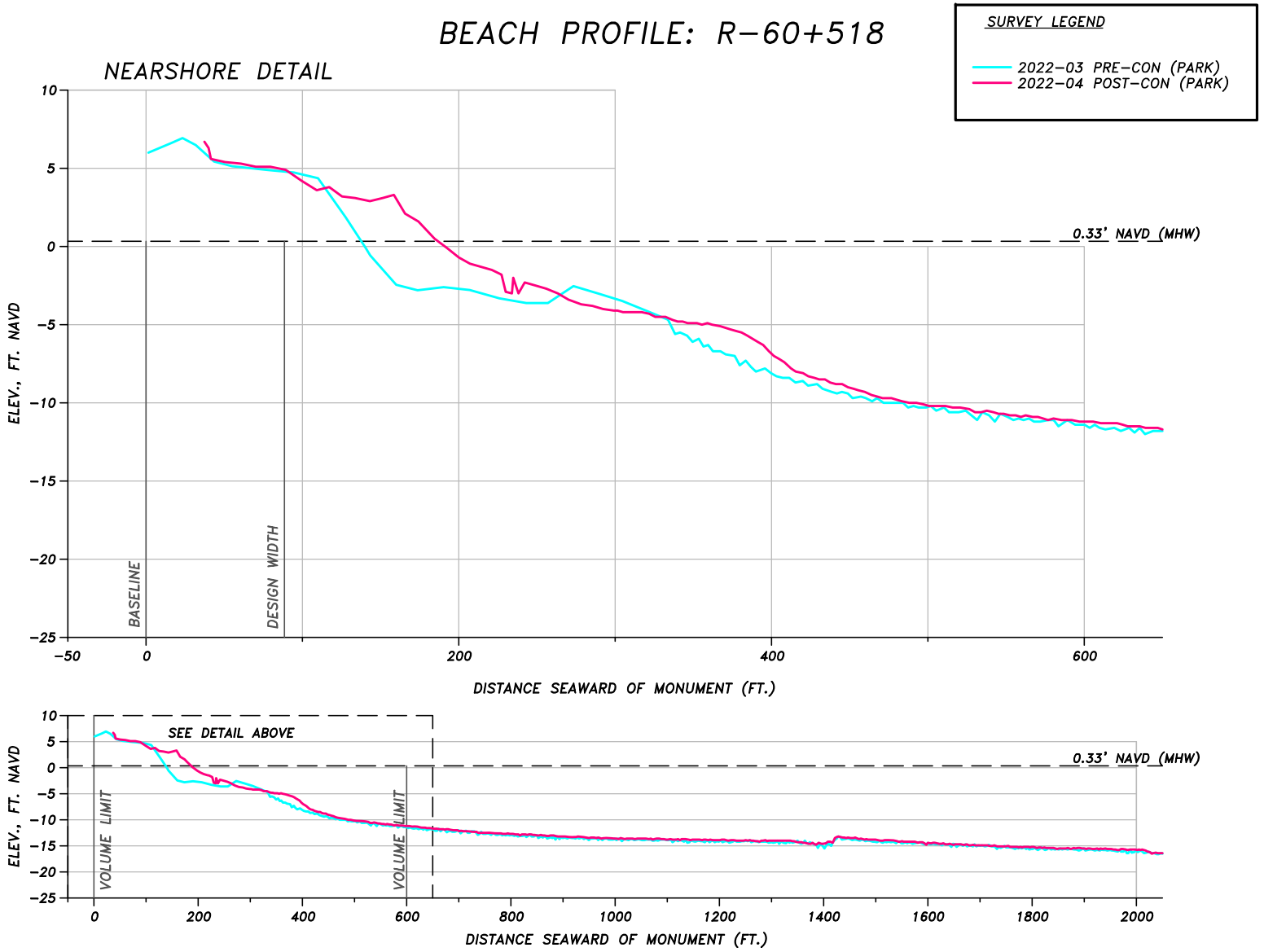
BEACH PROFILE: R-60+518



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FOR: COLLIER COUNTY		
DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
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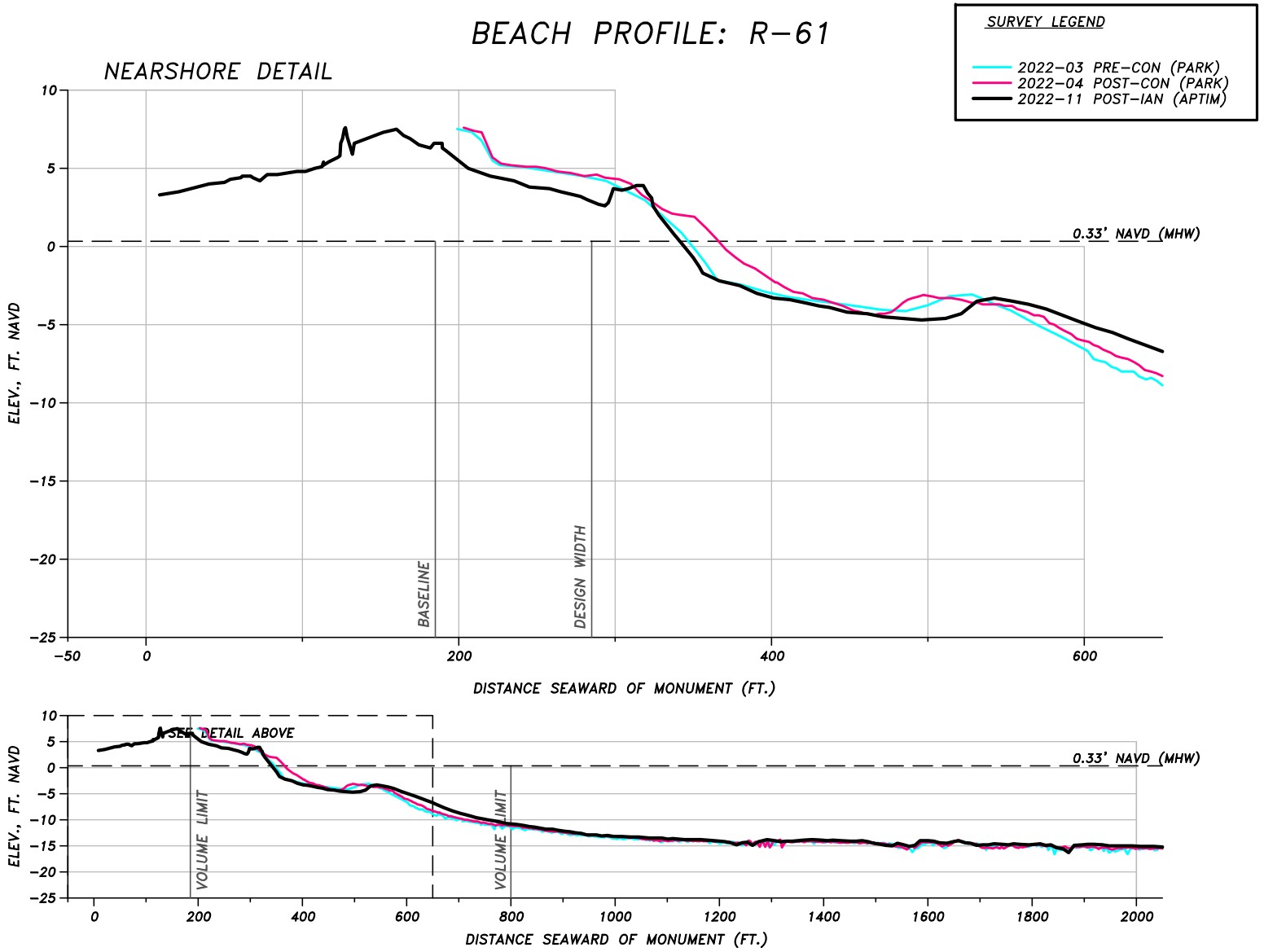
BEACH PROFILE: R-61



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	FOR: COLLIER COUNTY		
	DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
	JOB: 29018	DATUM: NAVD	FIGURE:

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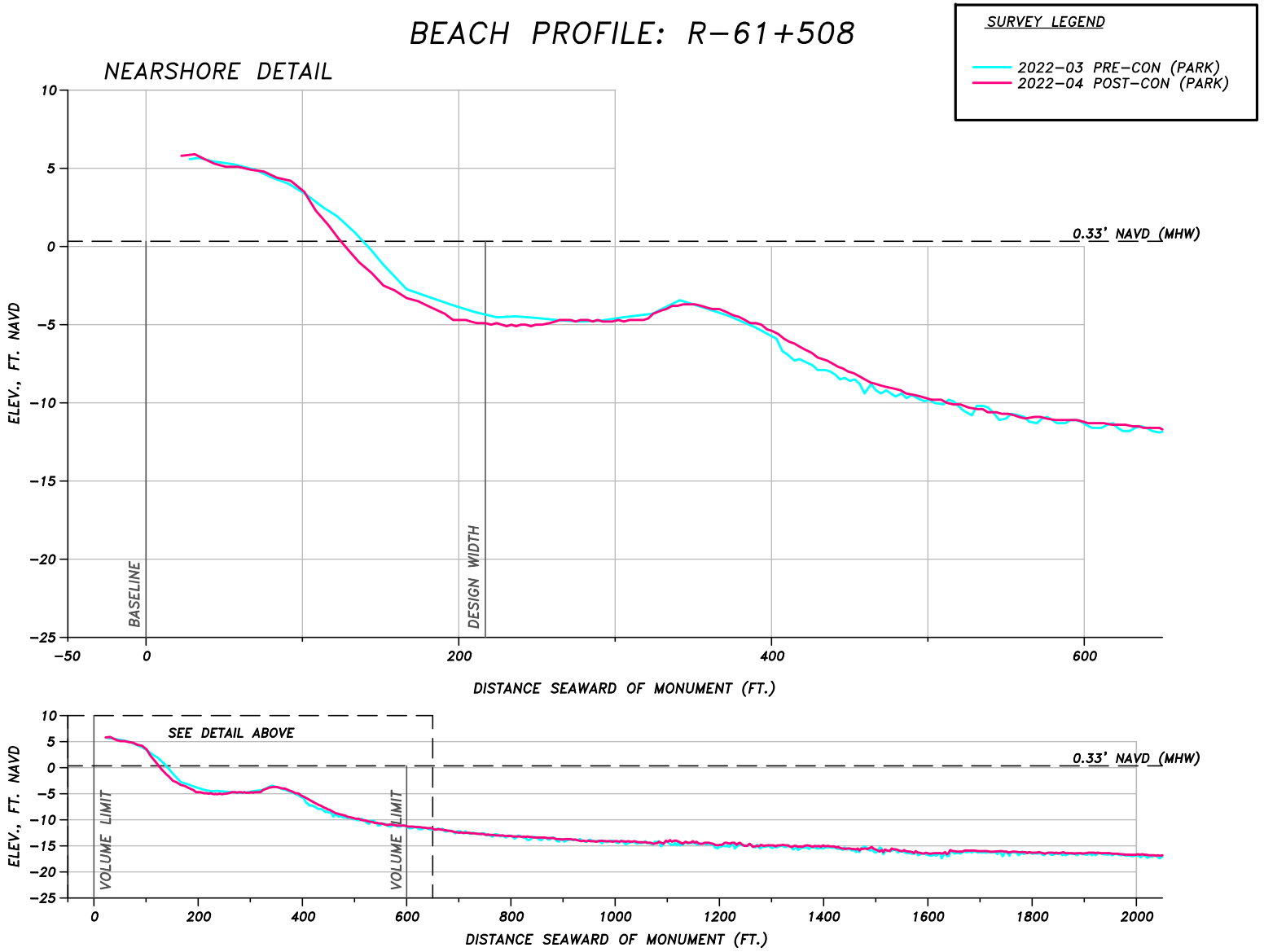
BEACH PROFILE: R-61+508



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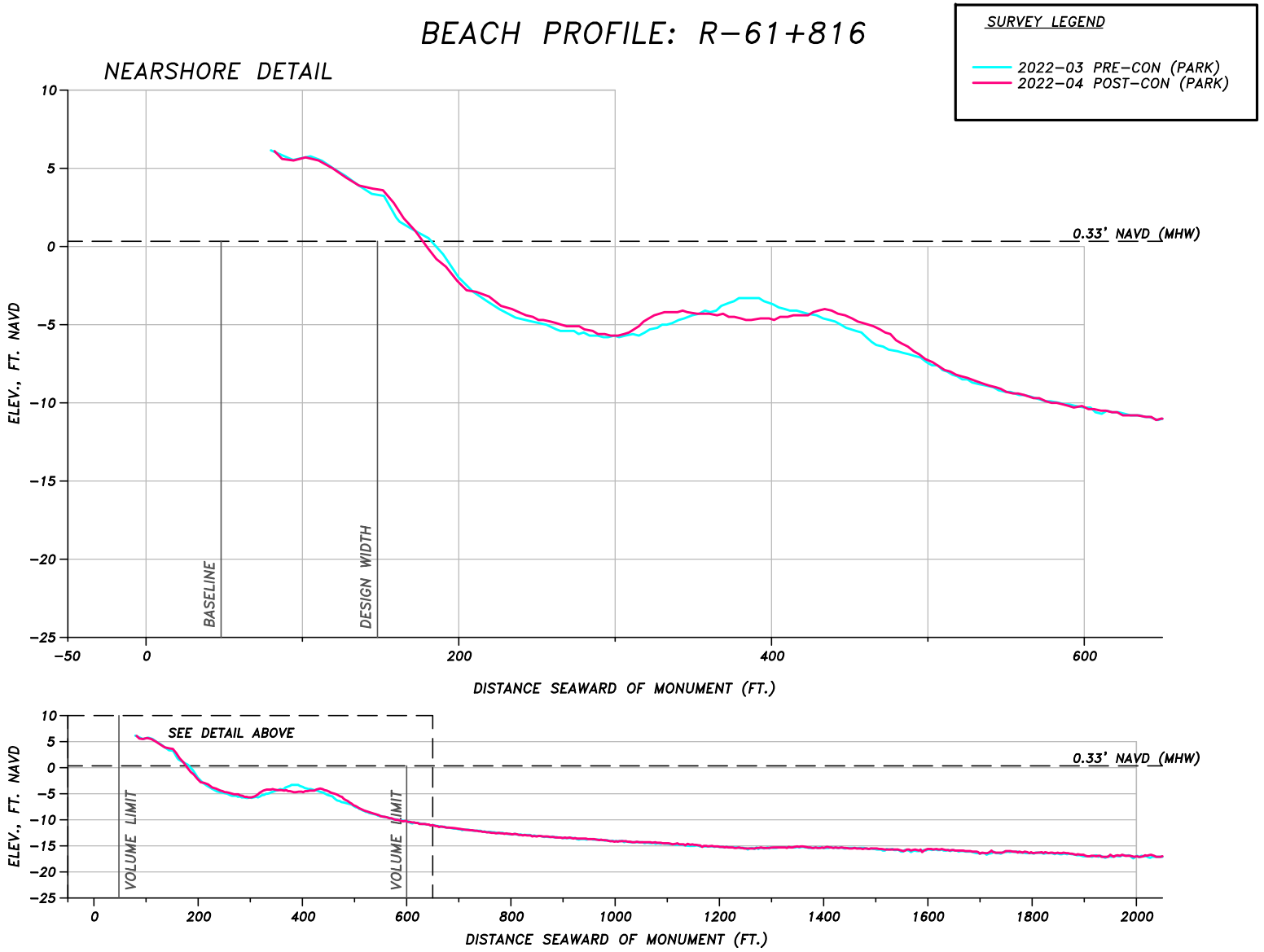
BEACH PROFILE: R-61+816



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FOR: COLLIER COUNTY		
DATE: 05/10/23	FILE: SECTION	SCALE: SHOWN
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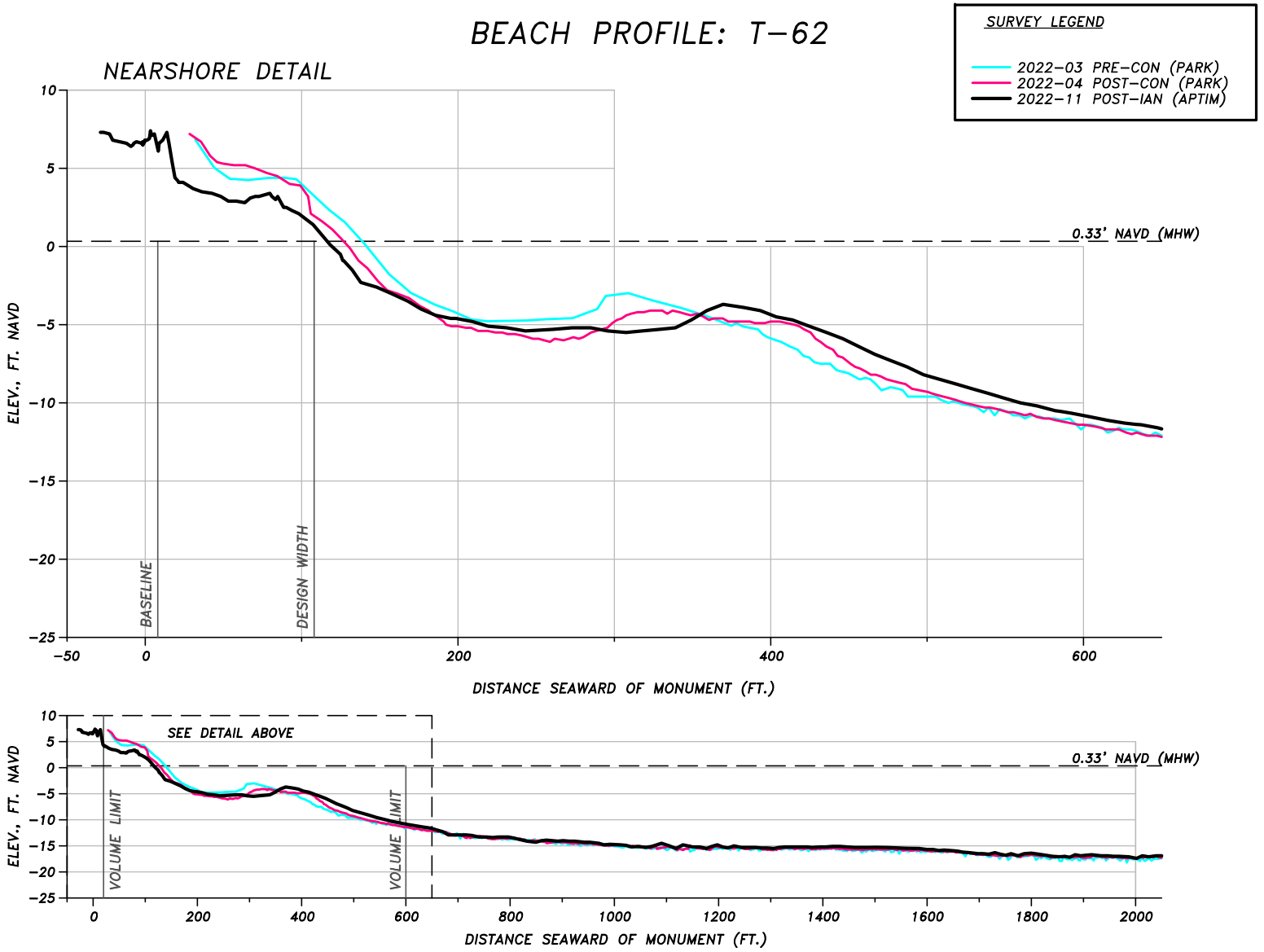
BEACH PROFILE: T-62



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	FOR: COLLIER COUNTY		
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