



FOLLY BEACH GROIN REHABILITATION 2nd ANNUAL MONITORING REPORT

July 2021

Permit # 2017-00730

Prepared for:

The City of Folly Beach, SC
P.O. Box 48, Folly Beach, SC 29439

Prepared by:

Elko Coastal Consulting, Inc.
P.O. Box 1451, Folly Beach, SC 29439



July 2, 2021

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FOLLY BEACH GROIN REHABILITATION ANNUAL MONITORING REPORT

July 2021

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This document summarizes the 2nd annual monitoring for the City of Folly Beach's groin rehabilitation (# 2017-00730) for nine groins between 8th St. East and 14th St. East (just south of the Washout). The project area includes approximately 5,000 feet of shoreline. The groin rehabilitation was conducted in conjunction with a U.S. Army Corps of Engineers (USACE) nourishment of approximately 27,000 feet of shoreline. In total, the USACE's contractor placed 1.2 million cubic yards (cy) along Folly Beach.

Groin rehabilitation began in March 2018 and rock-work was completed in July 2018. An important element of the groin rehabilitation project was dune planting and fencing installation. Dune planting as well as post/ropes were completed in March 2019 (following the nourishment).

The USACE nourishment began in July 2018 and was completed in December 2018. Hurricanes Florence and Michael both delayed the project. Additional losses and erosion by Florence and Michael resulted in the USACE placing additional material and extending the fill footprint.

DHEC OCRM Monitoring Conditions for Permit # 2017-00730, as amended in March 17, 2020 include:

1. Annual Beach Profile Surveys (18): 13 new wading depth beach profiles, plus 5 traditional Coastal Council/OCRM monuments (2 survey lines per groin cell)
2. Beach Sediment Samples: Complete
3. Annual Aerial Photographs
4. Compaction: Waived by USFWS due to total erosion of nourished berm
5. Escarpment Formation during turtle nesting season: Annual/ongoing by the Folly Turtle Team

Background

As stated in the permit application, the purpose of the Folly Beach Groin Rehabilitation Project was to "develop a long-term beach preservation strategy such that the restored beach and dune system is not lost between periodic renourishments" for the section of beach between 8th St. E. and 14th St. E.

The location of this project was immediately updrift of a successful groin rehabilitation project of similar length constructed in 1993. The 1993 project had been so effective that several rows of dunes had been restored in this region (Figure 1, top). Primary and secondary dune elevations commonly exceeded 12 ft NAVD88. In fact, so much sand volume accumulated in this region that it "filled" the design nourishment template used for the U.S. Army Corps of Engineers' beach nourishment project. As a result, small volumes of sand were placed downdrift of the rehabilitated groin field (between the Center Street pier and 7th St. E.) during federal renourishment projects. Significant storm protection existed in this healthy beach area. In contrast, the beach within the rehabilitated groin field was low in elevation, lacking dunes, susceptible to overtopping and erodes rapidly following renourishment (Figure 1, bottom).

The rationale for the 2018 groin rehabilitation project was to locate the groin field updrift of a healthy beach to minimize the effect of downdrift impacts. If downdrift erosion was to occur as a result of the rehabilitated groin field, the downdrift beach could essentially withstand a certain

degree of erosion without losing its storm protection function.

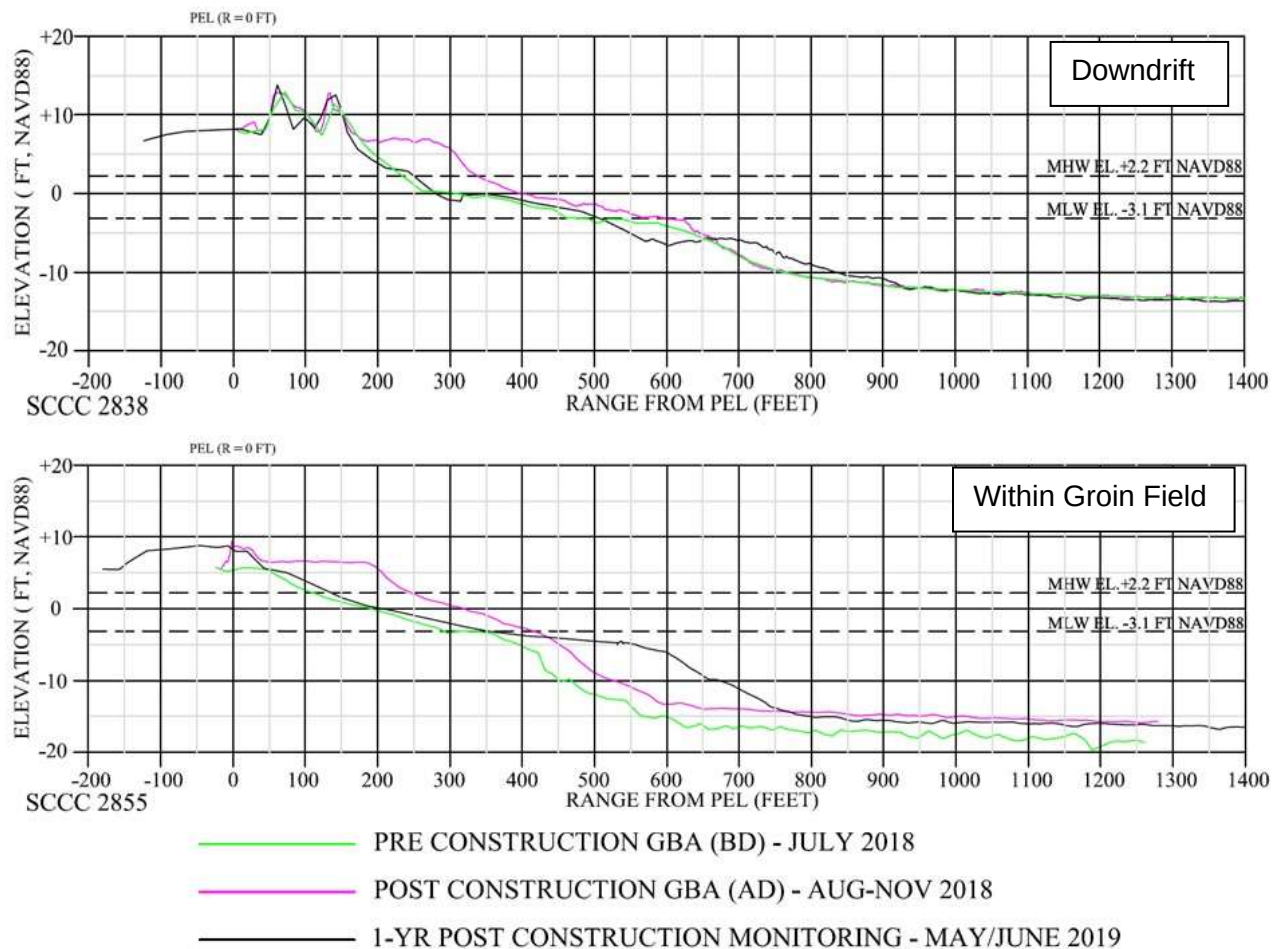


Figure 1. Examples of beach profiles prior to groin rehabilitation, top: healthy beach with several row of high dunes downdrift of the rehabilitated groin field at 2838 (between 5th and 6th St. E.), and bottom: erosional, low elevation beach within the groin field at 2855 (between 11th and 12th St. E.).

Methods

Beach Profile Surveys

The thirteen additional monitoring profiles relative to the groin field are illustrated in Figure 2. Each were surveyed to wading depth. Five additional Coastal Council/OCRM monuments located within or adjacent to the groin field were surveyed to the depth of closure using both topographic and hydrographic techniques.

Beach profile surveys within the monitoring area collected in July 2018, Aug-Nov 2018, June 2019, April 2020, and June 2021 are provided in Appendix A. Pre-construction survey data was collected on the beach in June 2018 while post-fill project data was collected in a phased approach upon section completion. Only the 28-series Coastal Council/OCRM profiles were collected in June 2019. In 2021, a total of 31 profile surveys were conducted at existing Coastal Council/OCRM monuments for Folly's annual monitoring. Five of those profiles lie within and/or adjacent to the groin field and are included in this analysis.

The upland portion of the profiles was conducted by RTK GPS standard land surveying techniques using the state of South Carolina's Virtual Reference Station (VRS) as a base station, and extended seaward to a wading depth deep enough to ensure overlap with the offshore portion of

the profile survey. Profile data points were collected at a maximum interval of 20 feet and at all significant elevation changes such as dunes, berms, scarp lines, seawalls, or sand bars.

The offshore portion of the survey was conducted by hydrographic techniques using a vessel mounted fathometer along with kinematic GPS. Data points were continuously collected during the hydrographic work. The beach and offshore work met the technical standards for surveying established by USACE in their standards for hydrographic surveying.

Aerial Photographs

Aerial photos were taken with a drone in May 2020 and June 2021 and are presented in Appendix B.

Results

Rapid Post-Nourishment Profile Equilibration

Following construction, the constructed beach nourishment equilibrated rapidly to more mild-sloping natural profiles due to significant wave/water level conditions during and immediately after fill placement. In addition to Florence and Michael, a high-water event on November 23- 24, 2018, recorded water levels up ~8.8 feet MLLW (see the 2020 monitoring report). Wave conditions were also energetic during the November episode. As a result, the nourishment berm equilibrated rapidly and material moved nearshore (which is a standard storm response).

Shoreline Change

The distance from the baseline to the mean high water (MHW) line was measured for each profile to understand the influence of the new groin field on shoreline contour changes after beach nourishment construction. Note that the Perpetual Easement Line (PEL) is generally spatially concurrent with the state baseline on Folly Beach, and the terms PEL and baseline are often used interchangeably to refer to the line between public and private beach.

Shoreline position is plotted in Appendix A and tabulated below (Table 1). During this second monitoring interval from April 2020 to June 2021, the average shoreline change within the monitored area was -32.4 ft. Average shoreline change reduced from -73.5 ft during the first monitoring interval (Nov 2018-April 2020). During this second monitoring interval, the greatest shoreline change (-59.7 ft) occurred at 9Eg2, in the westernmost groin cell. While shoreline retreat was greatest at 2843 over the last two monitoring intervals, the beach remains wider here than the rest of the groin field at over 140 ft (Table 1).

Overall, MHW retreat slowed during this monitoring interval. The shoreline advanced by 15.5 ft/yr at profile 2860, between 12th and 13th Ave. E (Appendix A). At profile 12Eg1, MHW retreat slowed from 67 ft/yr during the last monitoring interval to 25.2 ft/yr this time.

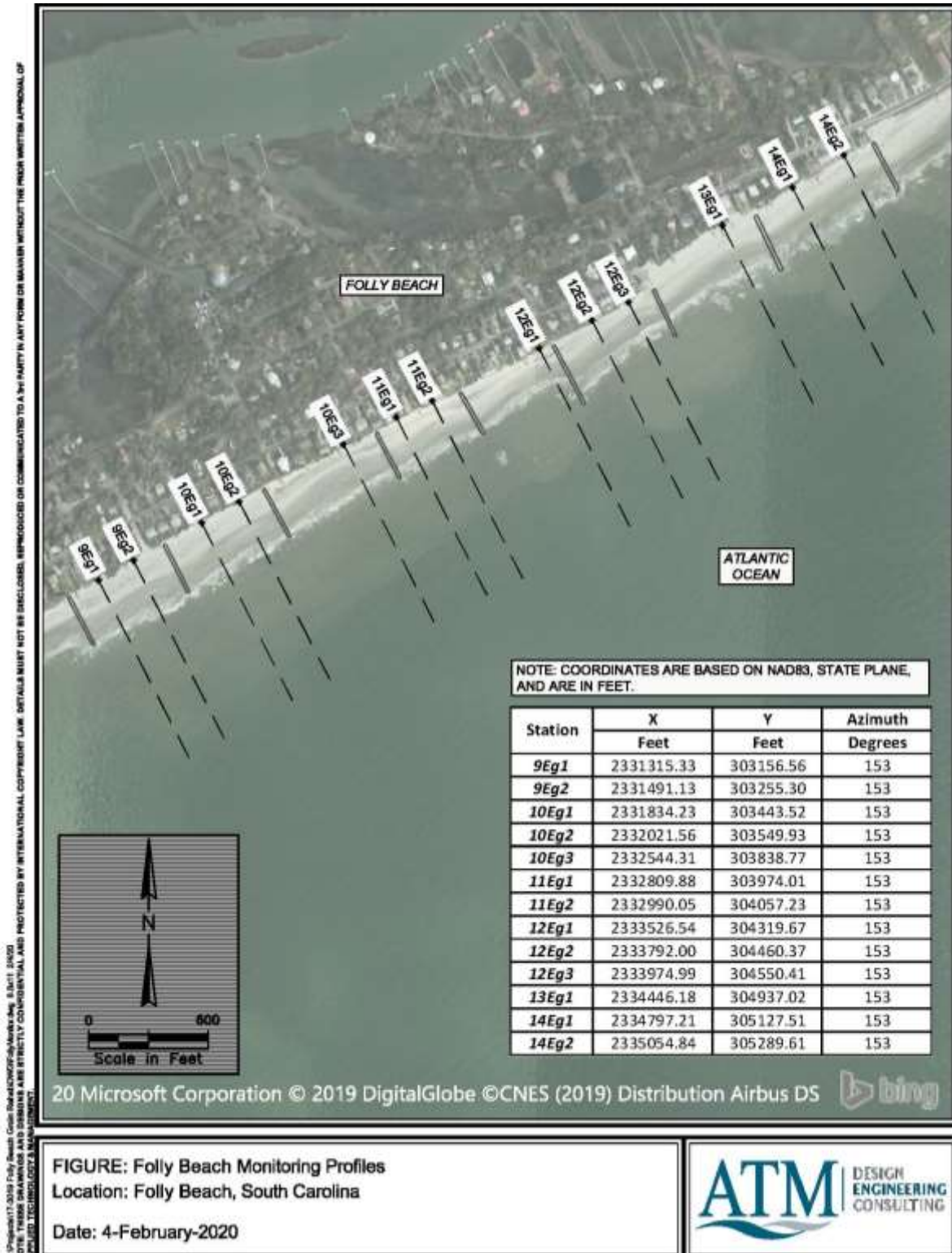


Figure 2. Professional drawing of the rehabilitated groin field depicting the nine rehabilitated groins as short, tubular polygons and the required thirteen additional profile lines are shown as dashed lines. Coordinates of the starting point for each monitoring line and their azimuth are included.

Table 1. Shoreline change measured between 2018 and 2021 between the baseline and mean high water (MHW) line. Survey line locations (Mon. No.) are depicted in Figure 2. Bold numbers are discussed in the text.

	Distance from Baseline to MHW (ft)			MHW Change (ft/yr)	
Mon. No.	Aug-Nov 2018	April 2020	June 2021	2018-2021	2020-2021
2843	333.9	181.4	143.1	-74.2	-33.7
9Eg1	240.7	177.3	123.1	-45.7	-47.7
9Eg2	248.2	179.1	111.3	-53.2	-59.7
10Eg1	232.5	159.5	111.2	-47.2	-42.5
10Eg2	249.4	156.4	101.4	-57.6	-48.4
2850	262.3	171.1	119.4	-55.6	-45.5
10Eg3	251.4	142.3	110.0	-55.0	-28.4
11Eg1	257.7	145.7	122.8	-52.5	-20.1
11Eg2	242.7	128.6	98.7	-56.0	-26.3
2855	246.6	127.1	104.9	-55.1	-19.6
12Eg1	255.2	111.5	82.9	-67.0	-25.2
12Eg2	222.4	128.4	80.8	-55.1	-41.9
12Eg3	194.3	100.3	53.1	-54.9	-41.6
2860	206.1	93.3	110.9	-37.0	15.5
13Eg1	212.3	99.0	89.2	-47.9	-8.6
14Eg1	221.4	117.9	64.0	-61.2	-47.4
14Eg2	220.9	110.5	59.0	-63.0	-45.3
2863	241.5	113.2	94.2	-57.3	-16.7
Avg.				-55.3	-32.4

Volume Changes

The sand volume at each monument was calculated from the beach profile surveys. The limits of the sand volume calculation were from the starting point of each monitoring line, tabulated in Figure 2. The starting point is also illustrated as a dashed vertical line on the beach profile cross sections in Appendix A. It was located generally landward of the PEL/baseline and captured at least some of the dune field. Volume was calculated from this starting point out to -5ft NAVD88. Unit volumes in cubic yards per foot (cy/ft) were calculated at each monument profile line then multiplied by half the distance to the stations on either side (effective distance) to determine the total volume between profiles in cubic yards (cy).

During the first monitoring interval, the profiles within and adjacent to the groin field gained some volume through dune accretion but mostly lost volume due to post-nourishment berm erosion (equilibration). During this monitoring interval, the sand volume within the groin field increased by about 18,000 cy/yr (Table 2). Compare this to a loss of just over 180,000 cy during the first monitoring interval.

Even the downdrift region, represented by profile 2843 where erosion was anticipated, gained 4,730 cy/yr during this monitoring interval (Table 2). The greatest volume loss during this

monitoring interval (-3,230 cy/yr) occurred between 13 and 14th Ave E.

Dune growth was measured and observed throughout the rehabilitated groin field (Appendix A). The downdrift profile 2843 gained several feet of dune elevation over the last three years (Figure 3). As noted above, most of the beach within the rehabilitated groin field did not have a dune prior to this project. The beach eroded to the seawalls between renourishment events. In June 2021, a remarkable amount of dune growth was observed along the entire rehabilitated groin field project area (Figure 4).

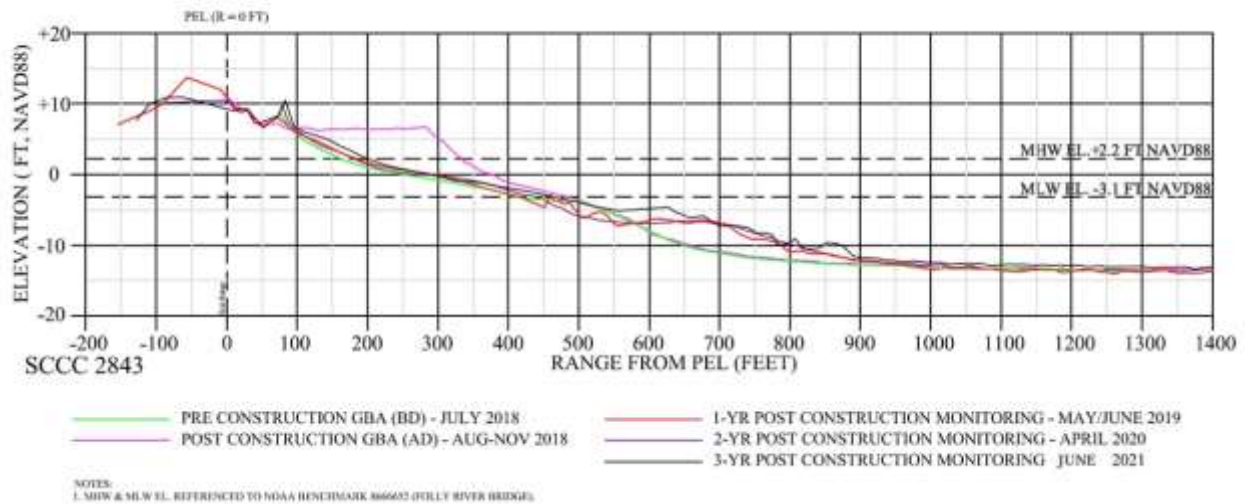


Figure 3. Cross-sectional plot of the elevation of profile 2843 between July 2018 and June 2021



Figure 4. Photograph of the dune system at 11th St. E, looking west. Taken on June 22, 2021.

Summary

The average MHW shoreline change in the monitored area was -32.4 ft between April 2020 and June 2021. The greatest shoreline change in the westernmost groin cell. Shoreline advancement was measured at profile 2860 in the eastern portion of the groin field. The total volume change (above -5 ft NAVD88, ~wading depth) within the monitoring area was a gain of about 18,000 cy. Significant dune growth was observed and measured during this monitoring interval.

Table 2. Unit volume (cy/lf) at each profile within the groin field in 2018 and 2021, as well as the volume change between profiles (cy).

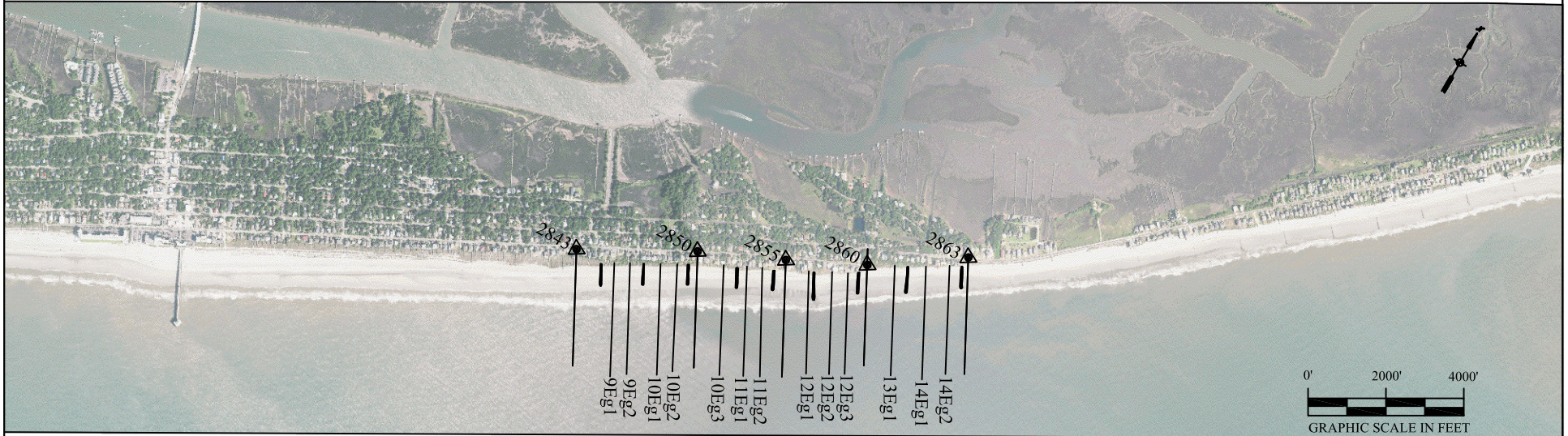
Mon. No.	Unit Volume (cy/lf)			Vol Chg (cy)	
	2018	Apr-20	June -21	2018-2021	2020-2021
2843	166.4	120.4	130.2		
				-11,735	4,730
9Eg1	129.4	108.4	117.8		
				-3,015	1,654
9Eg2	131.5	106.1	113.2		
				-8,030	2,992
10Eg1	136.5	105.5	113.8		
				-5,939	1,565
10Eg2	145.6	106.9	113.2		
				-7,422	2,514
2850	146.3	107.3	120.7		
				-9,800	3,671
10Eg3	147.4	107.5	115.6		
				-8,807	2,631
11Eg1	147.9	111.0	120.5		
				-5,595	1,972
11Eg2	142.7	103.2	113.6		
				-9,076	2,884
2855	141.9	101.1	110.1		
				-11,143	3,199
12Eg1	145.7	90.6	103.0		
				-11,409	1,789
12Eg2	130.2	97.5	97.0		
				-7,369	-800
12Eg3	116.0	84.3	76.9		
				-9,951	-1,374
2860	154.0	115.1	111.1		
				-14,278	-1,722
13Eg1	140.3	108.6	102.8		
				-15,425	-3,230
14Eg1	126.3	97.0	86.6		
				-12,161	-2,678
14Eg2	124.0	90.8	83.6		
				-11,210	-1,696
2863	153.6	106.3	99.2		
				-11,735	4,730
Total				-162,364	18,102

Appendix A

Beach Profile Survey and Cross-Sections

FOLLY BEACH GROIN REHABILITATION ANNUAL MONITORING: JUNE 2021

Permit # 2017-00730



Imagery provided by NAIP

PREPARED FOR: ELKO COASTAL CONSULTING, INC.
P.O. BOX 1451
FOLLY BEACH, SC. 29439

SHEET INDEX:

SHT 1: COVER PAGE & SITE OVERVIEW
SHT 2: SURVEY CONTROL & SURVEY NOTES
SHT 3 - 5: MHW POSITION
SHT 6 - 21: BEACH PROFILES

SHEET: 01 OF 12	SCALE: AS SHOWN	FILE: 2021 Folly Beach Groins Monitoring sheet 1.dwg		ELKO COASTAL CONSULTING, INC. P.O. BOX 1451 FOLLY BEACH, SC. 29439	TITLE: FOLLY BEACH GROIN REHABILITATION ANNUAL MONITORING: JUNE 2021 Permit # 2017-00730 COVER PAGE & SITE OVERVIEW
		DESIGN: REV:			
		DRAWN: SBM			
		APPROVED: RAR			

SURVEY CONTROL TABLE				
NAME	EASTING	NORTHING	ELEVATION	AZIMUTH
2843	2,330,807.06	303,064.39	9.79	61.70
2850	2,332,164.90	303,821.63	6.59	61.70
2855	2,333,200.58	304,295.37	6.70	61.70
2860	2,334,137.20	304,766.60	8.82	61.70
2863	2,335,209.29	305,501.60	7.98	61.70
NOTES:				
1. Monument names reference SCCC designations. (Ref. sht.3-5 for plan view.)				
2. Coordinates reference South Carolina State Plane (Single Zone) NAD 83 and NAVD 88.				
3. Azimuth reference degrees clockwise from Geodetic (True) North.				
4. Control information Obtained from National Geodetic Survey (NGS).				

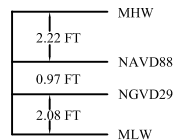
SURVEY NOTES

- 3-YR POST CONSTRUCTION (2021) MONITORING SURVEY CONDUCTED BY ELKO CONSULTING, INC (TOPO: JUNE 14-17, 2021 HYDRO: JUNE 15 & 17, 2021).
- 2-YR POST CONSTRUCTION (2020) MONITORING SURVEY CONDUCTED BY ELKO CONSULTING, INC (TOPO: APRIL 20-22 & 27, 2020 HYDRO: APRIL 27 & 28, 2020).
- POST CONSTRUCTION (2018) MONITORING SURVEY CONDUCTED BY GBA (AUG - NOV 2018)
- SURVEYS CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
- SURVEYS REFERENCE NAVD88 (VERTICAL) AND SOUTH CAROLINA STATE PLANE (NAD83) COORDINATES (SINGLE ZONE).
- UNITS ARE IN INTERNATIONAL FEET.
- HORIZONTAL AND VERTICAL POSITIONING OBTAINED USING TRIMBLE SPS RTK.
- SOUNDINGS OBTAINED BY A KNUDSEN ECHOSOUNDER OPERATED AT 200KHz ON "SURVEY VESSEL ONE" (2020).

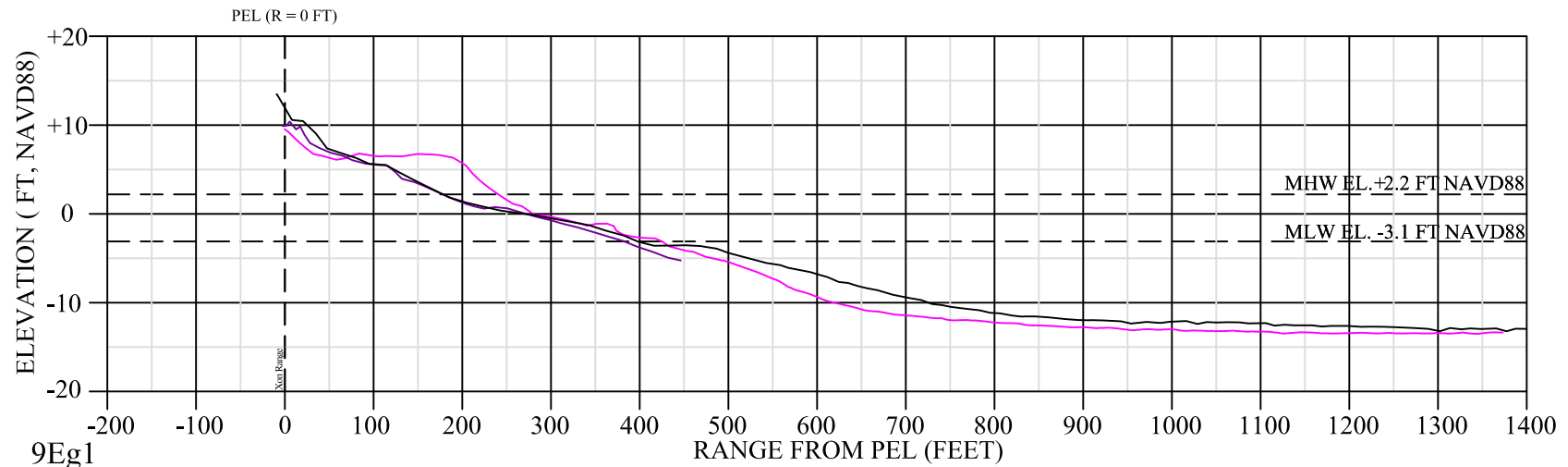
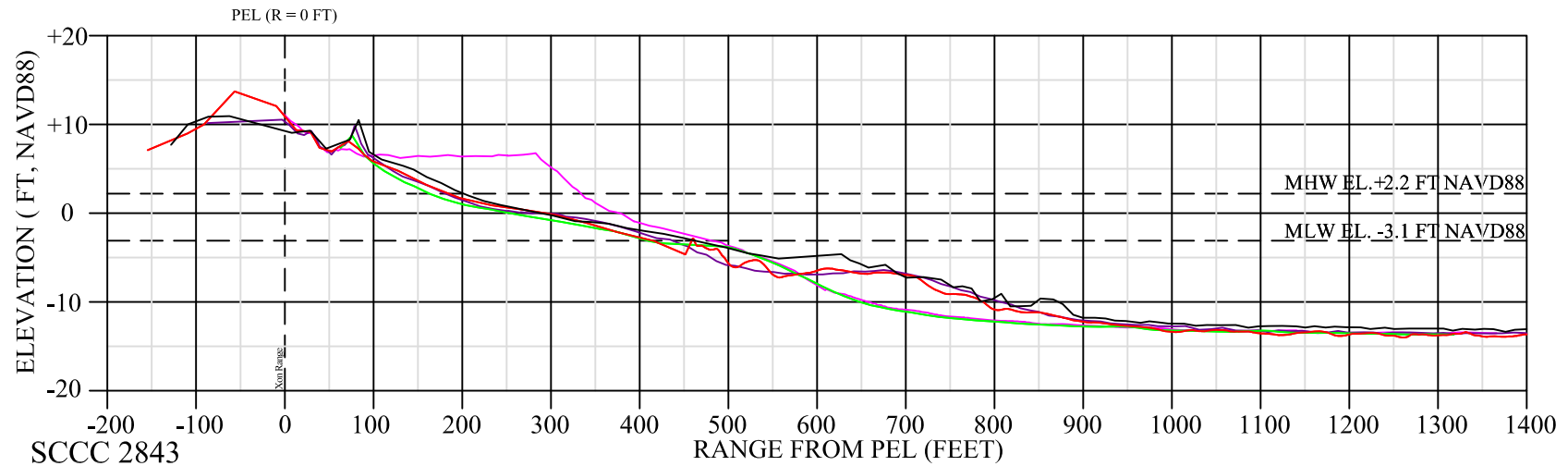
ANALYSIS NOTES

- VOLUMES CALCULATED WITHIN THE LIMITS OF THE POST-CONSTRUCTION (AD) SURVEY OR THE PEL, IF THE BD SURVEY EXTENDED BEYOND THE PEL, AND THE APPARENT DEPTH OF CLOSURE (DOC) OF -5 FT AS DETERMINED BY VISUAL INSPECTION.
- VOLUMES CALCULATED USING THE AVERAGE-END-AREA METHODOLOGY.
- SHORELINE DISTANCES DETERMINED AS THE STRAIGHT LINE MEASUREMENT BETWEEN MONITORING AZIMUTHS AT THE INTERSECTIONS WITH THE MHW CONTOUR. (PERPENDICULAR DISTANCES BETWEEN THE MONITORING AZIMUTHS USED FOR PROFILES OUTSIDE THE BD SURVEY LIMITS.)

RELATIONSHIP BETWEEN NAVD88 AND MHW,
MLW & NGVD29 FOR NOAA BENCHMARK 8666652
(FOLLY RIVER BRIDGE) AS DEFINED BY NGS.



SHEET: 02 OF 12	SCALE: AS SHOWN	FILE: 2021 Folly Beach Groins Monitoring sheet 2_4-12.dwg		ELKO COASTAL CONSULTING, INC. P.O. BOX 1451 FOLLY BEACH, SC. 29439		TITLE: FOLLY BEACH GROIN REHABILITATION ANNUAL MONITORING: JUNE 2021 Permit # 2017-00730 SURVEY CONTROL & SURVEY NOTES
		DESIGN: REV:				
		DRAWN: SBM				
		APPROVED: RAR				



— PRE CONSTRUCTION GBA (BD) - JULY 2018
 — 1-YR POST CONSTRUCTION MONITORING - MAY/JUNE 2019

— POST CONSTRUCTION GBA (AD) - AUG-NOV 2018
 — 2-YR POST CONSTRUCTION MONITORING - APRIL 2020

— 3-YR POST CONSTRUCTION MONITORING - JUNE 2021

NOTES:

1. MHW & MLW EL. REFERENCED TO NOAA BENCHMARK 8666652 (FOLLY RIVER BRIDGE).

4 OF 12

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1"=200' H

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2021 Folly Beach Groins
Monitoring sheet 2_4-12.dwg

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DRAWN: SBM

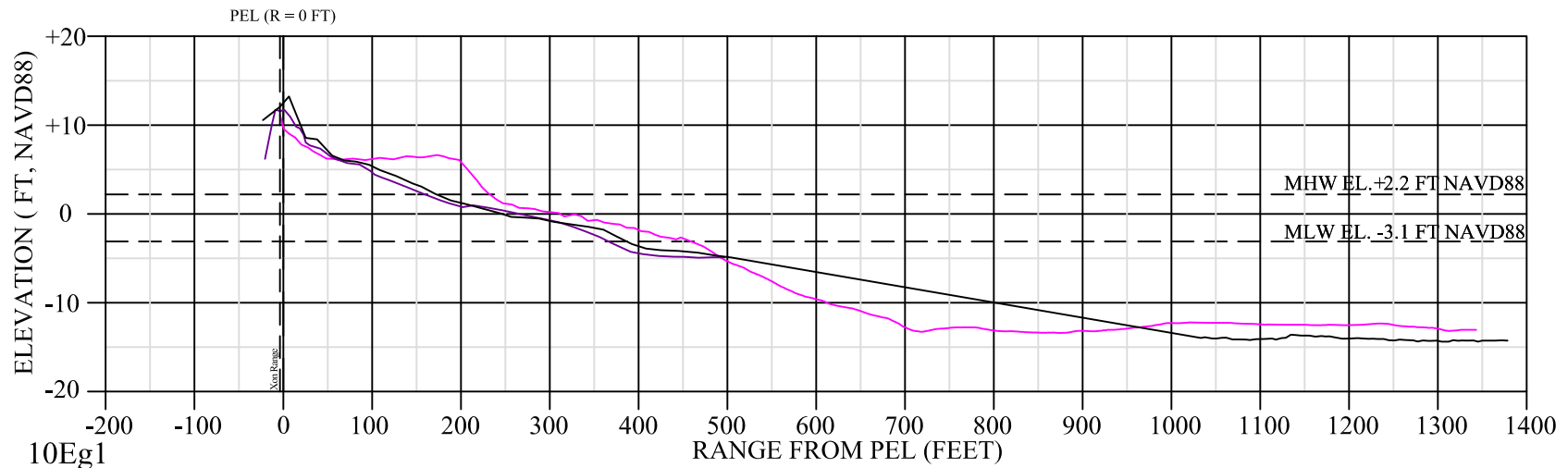
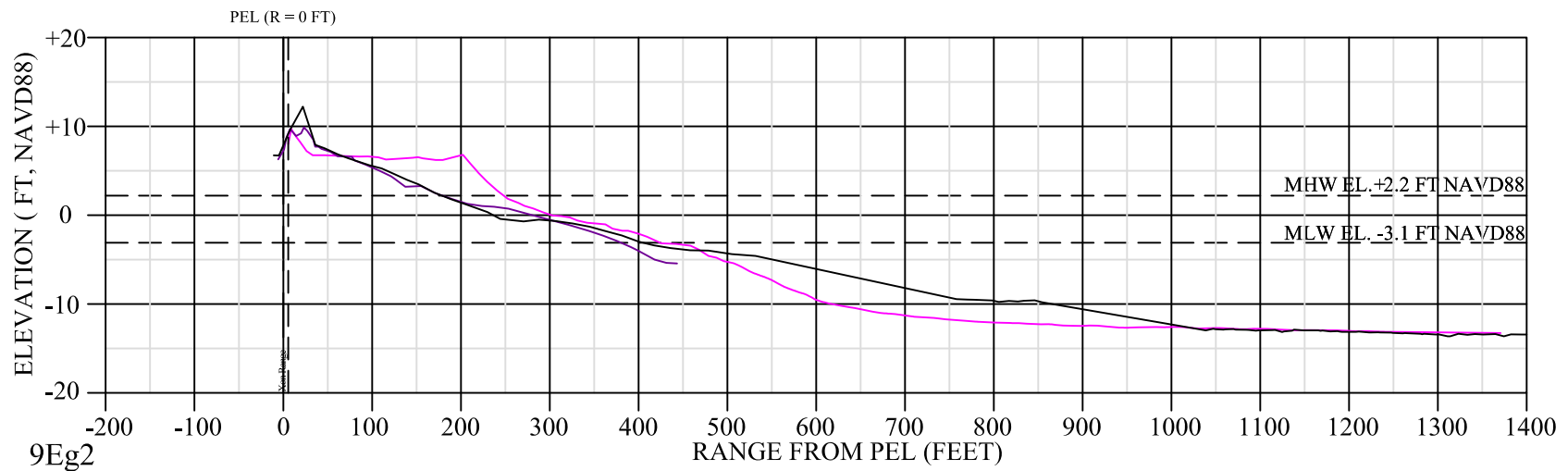
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P.O. BOX 1451
FOLLY BEACH, SC. 29439

TITLE:

FOLLY BEACH GROIN REHABILITATION
ANNUAL MONITORING: JUNE 2021
Permit # 2017-00730
BEACH PROFILES SCCC 2843 & 9Eg1



POST CONSTRUCTION GBA (AD) - AUG-NOV 2018

2-YR POST CONSTRUCTION MONITORING - APRIL 2020

3-YR POST CONSTRUCTION MONITORING - JUNE 2021

NOTES:

1. MHW & MLW EL. REFERENCED TO NOAA BENCHMARK 8666652 (FOLLY RIVER BRIDGE).

5

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1"=200' H

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2021 Folly Beach Groins

Monitoring sheet 2_4-12.dwg

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DRAWN: SBM

APPROVED: RAR



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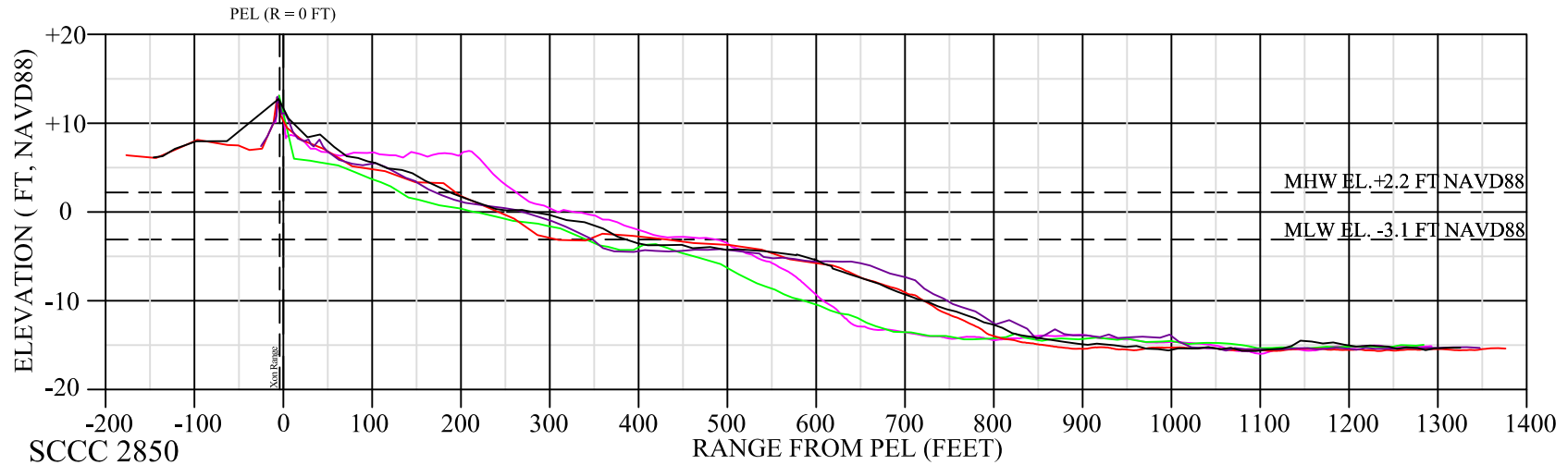
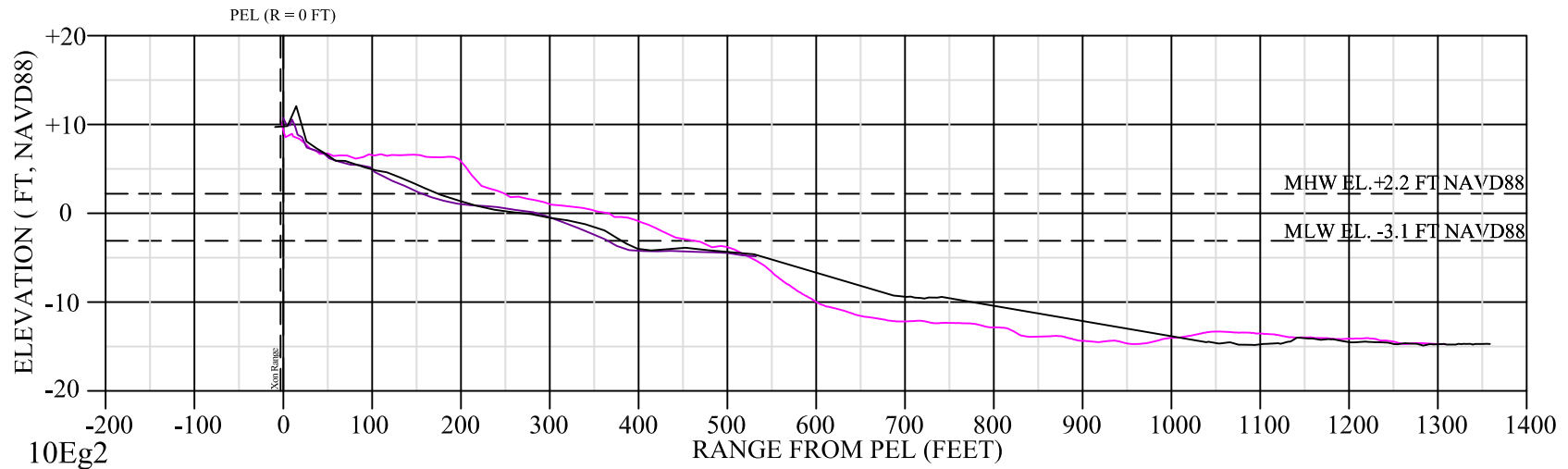
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FOLLY BEACH GROIN REHABILITATION

ANNUAL MONITORING: JUNE 2021

Permit # 2017-00730

BEACH PROFILES SCCC 9Eg2 & 10Eg1



PRE CONSTRUCTION GBA (BD) - JULY 2018

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2-YR POST CONSTRUCTION MONITORING - APRIL 2020

3-YR POST CONSTRUCTION MONITORING - JUNE 2021

NOTES:
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6 OF 12

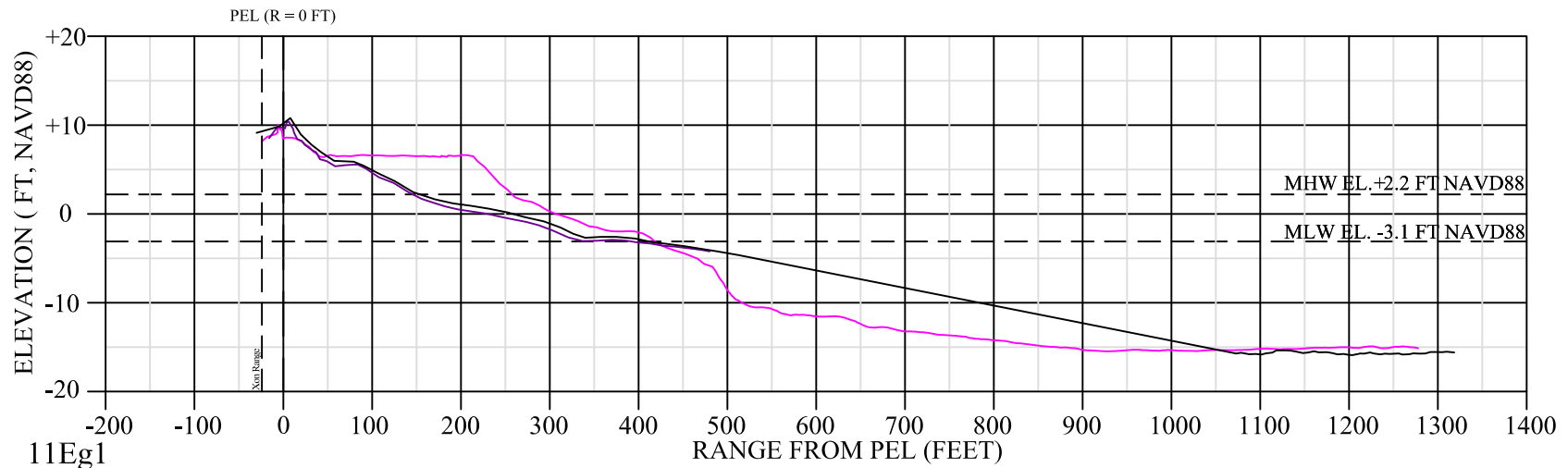
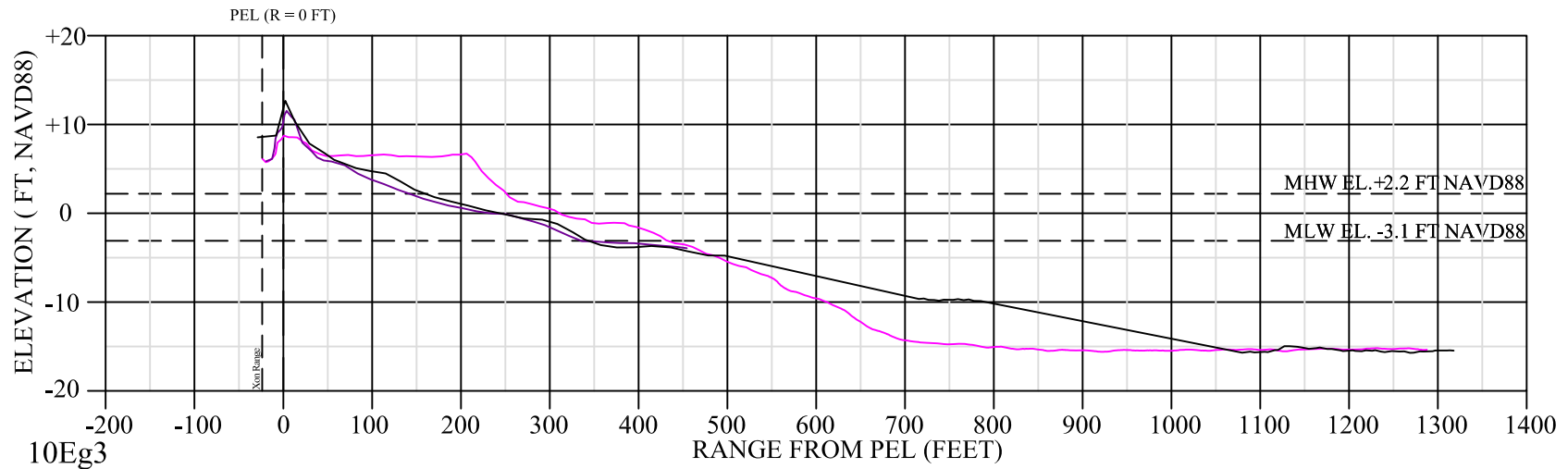
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1"=200' H

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Monitoring sheet 2_4-12.dwg
DESIGN: REV:
DRAWN: SBM
APPROVED: RAR



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FOLLY BEACH, SC. 29439

TITLE:
FOLLY BEACH GROIN REHABILITATION
ANNUAL MONITORING: JUNE 2021
Permit # 2017-00730
BEACH PROFILES SCCC 10Eg2 & 2850



POST CONSTRUCTION GBA (AD) - AUG-NOV 2018

2-YR POST CONSTRUCTION MONITORING - APRIL 2020

3-YR POST CONSTRUCTION MONITORING - JUNE 2021

NOTES:

1. MHW & MLW EL. REFERENCED TO NOAA BENCHMARK 8666652 (FOLLY RIVER BRIDGE).

7 OF 12

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2021 Folly Beach Groins
Monitoring sheet 2_4-12.dwg

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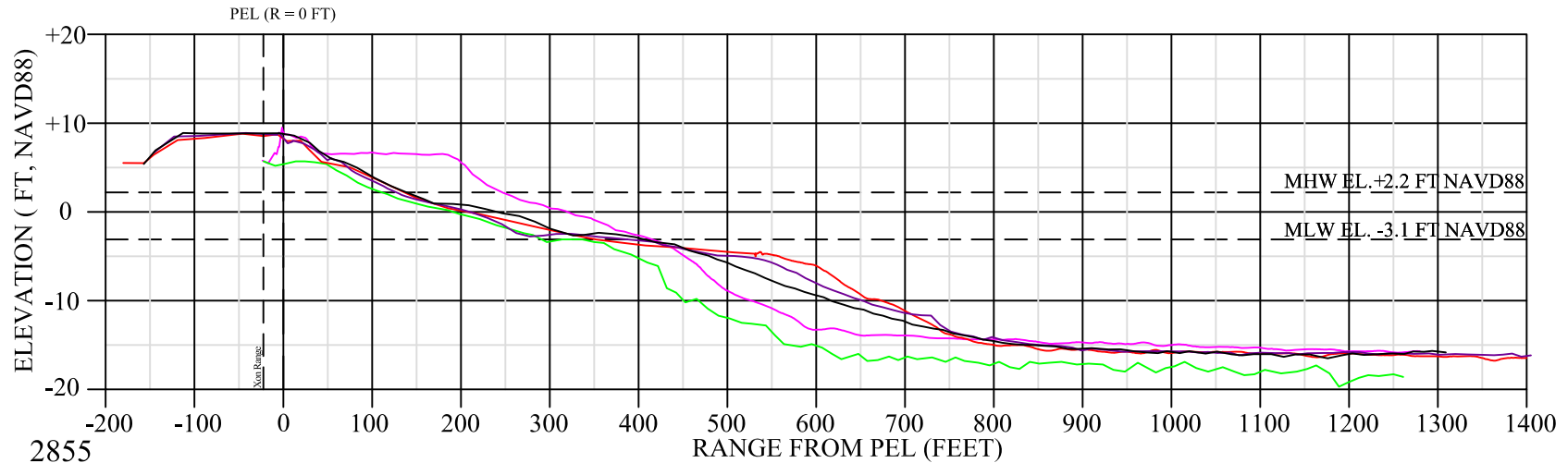
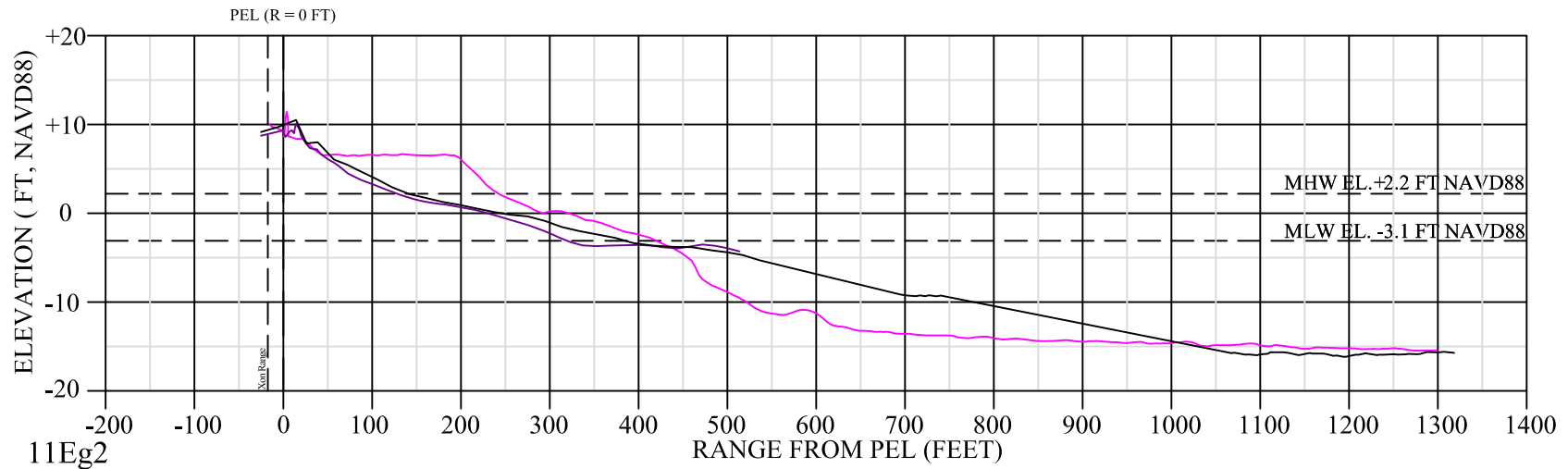
APPROVED: RAR



ELKO COASTAL CONSULTING, INC.
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FOLLY BEACH GROIN REHABILITATION
ANNUAL MONITORING: JUNE 2021
Permit # 2017-00730
BEACH PROFILES SCCC 10Eg3 & 11Eg1



— PRE CONSTRUCTION GBA (BD) - JULY 2018
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— 3-YR POST CONSTRUCTION MONITORING - JUNE 2021

NOTES:

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18 OF 12

SHEET:

SCALE:

FILE:

2021 Folly Beach Groins

Monitoring sheet 2_4-12.dwg

DESIGN:

REV:

DRAWN: SBM

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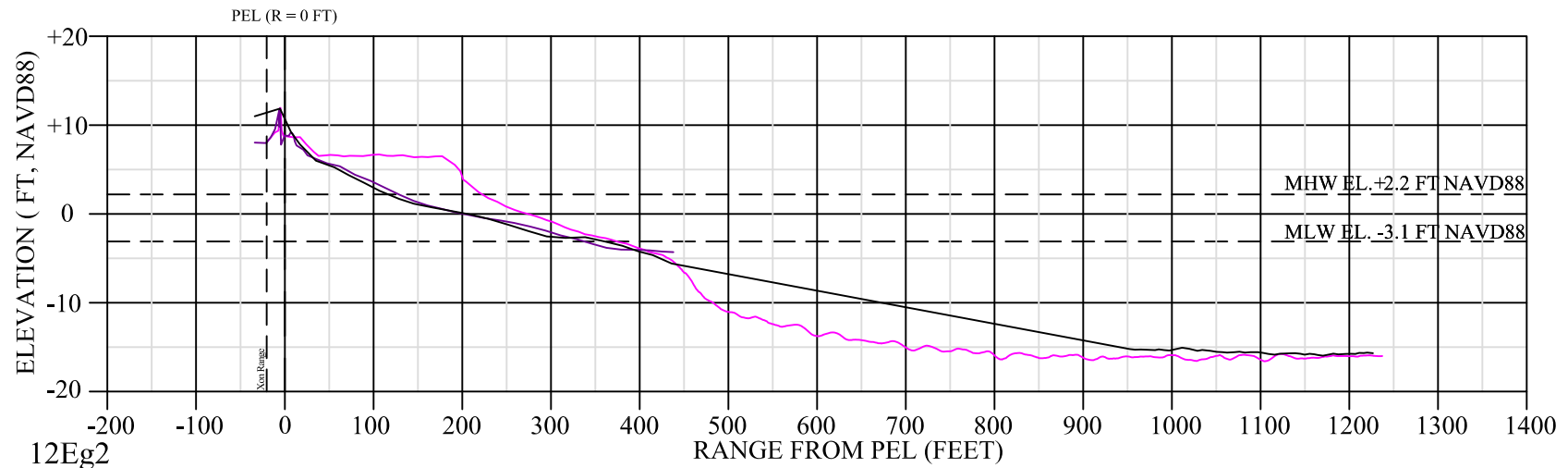
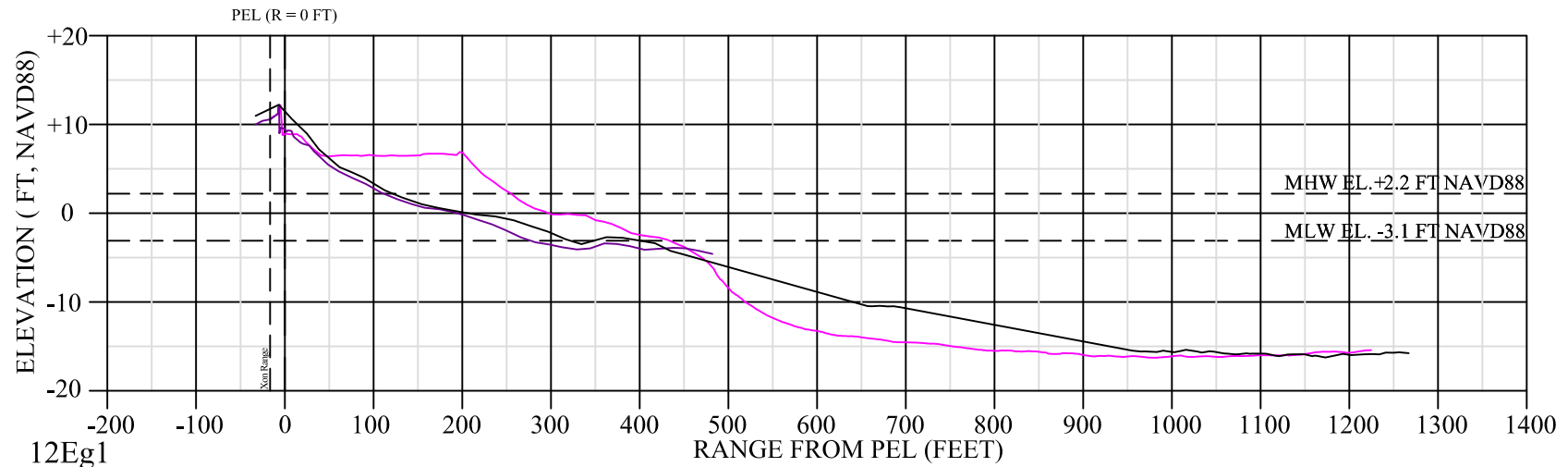
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FOLLY BEACH GROIN REHABILITATION

ANNUAL MONITORING: JUNE 2021

Permit # 2017-00730

BEACH PROFILES SCCC 11Eg2 & 2855



POST CONSTRUCTION GBA (AD) - AUG-NOV 2018

2-YR POST CONSTRUCTION MONITORING - APRIL 2020

3-YR POST CONSTRUCTION MONITORING - JUNE 2021

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9 OF 12

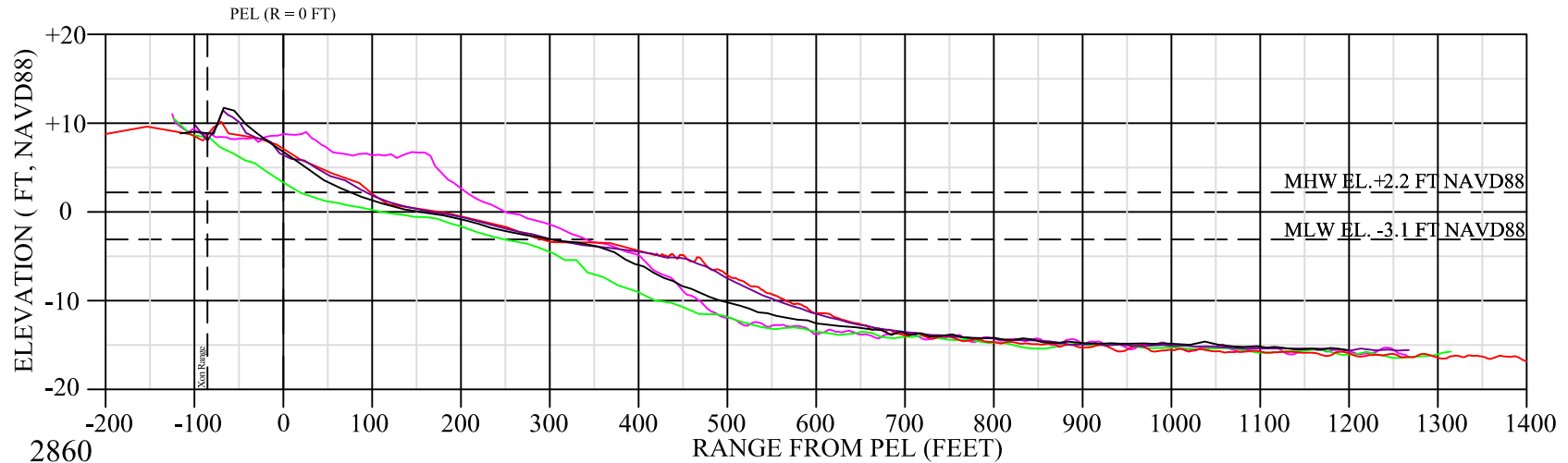
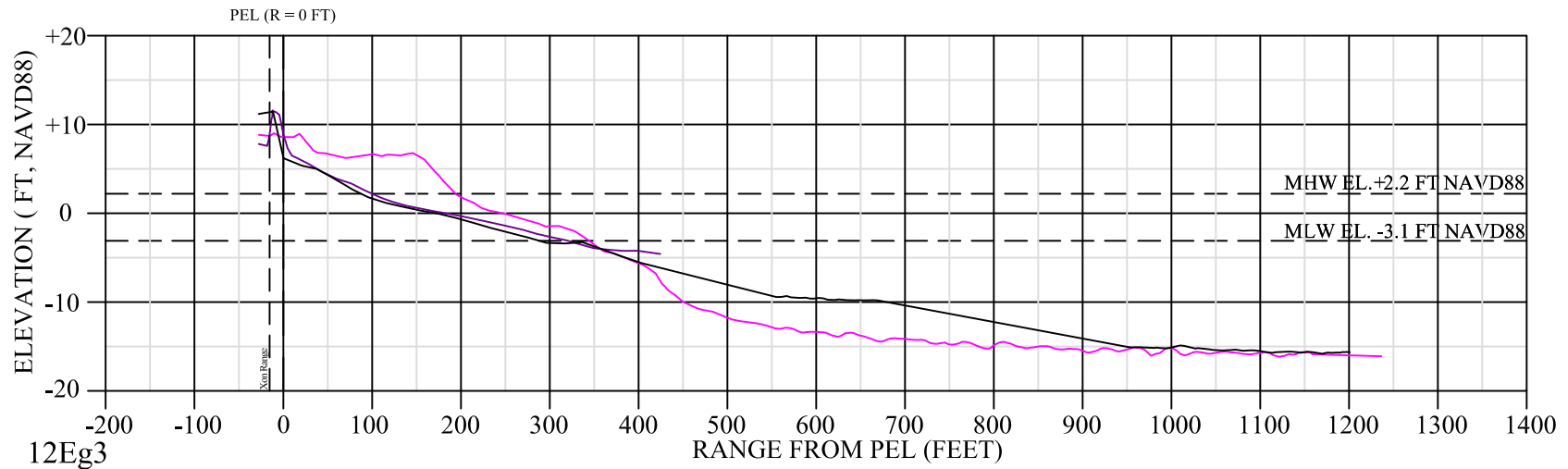
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DRAWN: SBM
APPROVED: RAR



ELKO COASTAL CONSULTING, INC.
P.O. BOX 1451
FOLLY BEACH, SC. 29439

TITLE:
FOLLY BEACH GROIN REHABILITATION
ANNUAL MONITORING: JUNE 2021
Permit # 2017-00730
BEACH PROFILES SCCC 12Eg1 & 12Eg2



— PRE CONSTRUCTION GBA (BD) - JULY 2018
 — 1-YR POST CONSTRUCTION MONITORING - MAY/JUNE 2019

— POST CONSTRUCTION GBA (AD) - AUG-NOV 2018
 — 2-YR POST CONSTRUCTION MONITORING - APRIL 2020

— 3-YR POST CONSTRUCTION MONITORING - JUNE 2021

NOTES:

1. MHW & MLW EL. REFERENCED TO NOAA BENCHMARK 8666652 (FOLLY RIVER BRIDGE).

10 OF 12

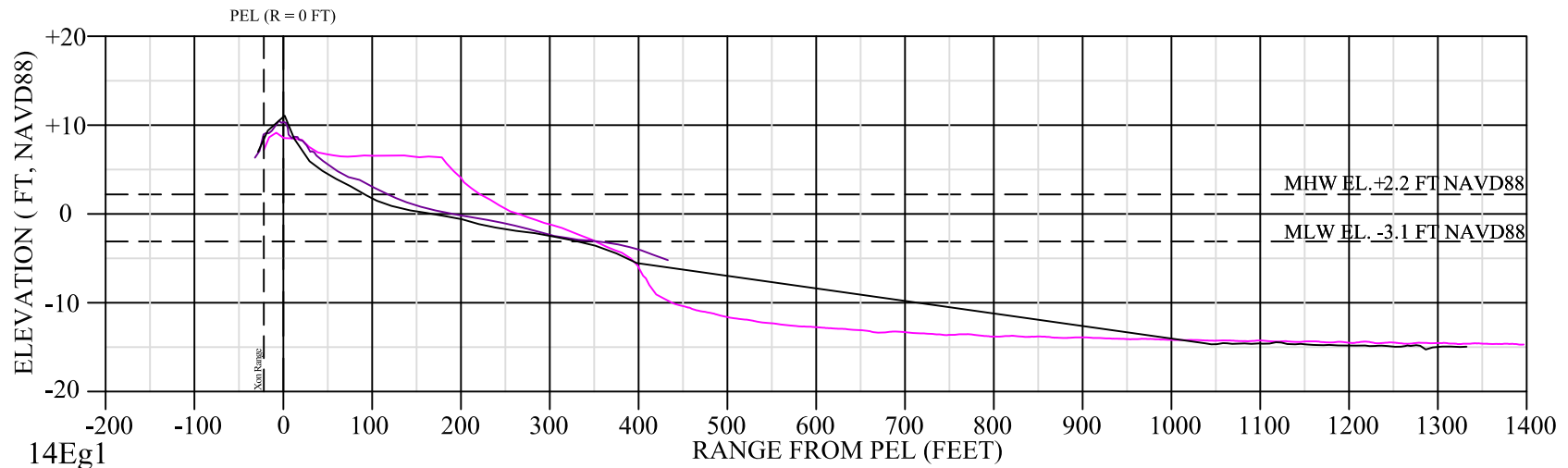
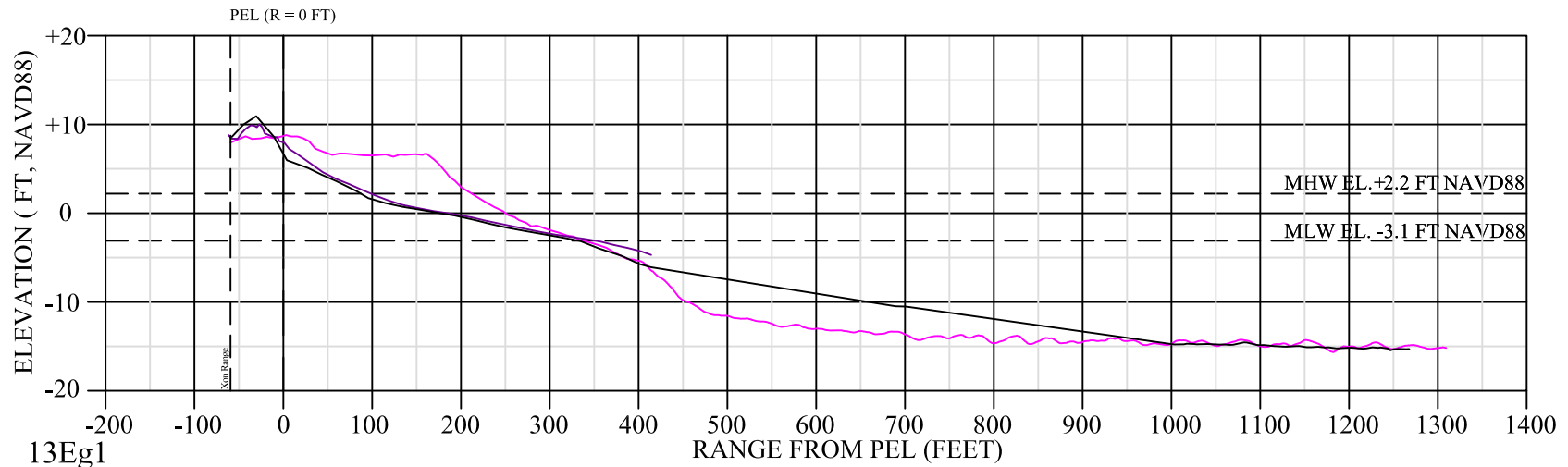
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1"=200' H

SCALE:
FILE:
2021 Folly Beach Groins
Monitoring sheet 2_4-12.dwg
DESIGN: REV:
DRAWN: SBM
APPROVED: RAR



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Permit # 2017-00730
BEACH PROFILES SCCC 12Eg3 & 2860



POST CONSTRUCTION GBA (AD) - AUG-NOV 2018

2-YR POST CONSTRUCTION MONITORING - APRIL 2020

3-YR POST CONSTRUCTION MONITORING - JUNE 2021

NOTES:

1. MHW & MLW EL. REFERENCED TO NOAA BENCHMARK 8666652 (FOLLY RIVER BRIDGE).

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SHEET:

SCALE:

1"=20' V

1"=200' H

FILE:

2021 Folly Beach Groins

Monitoring sheet 2_4-12.dwg

DESIGN:

REV:

DRAWN: SBM

APPROVED: RAR



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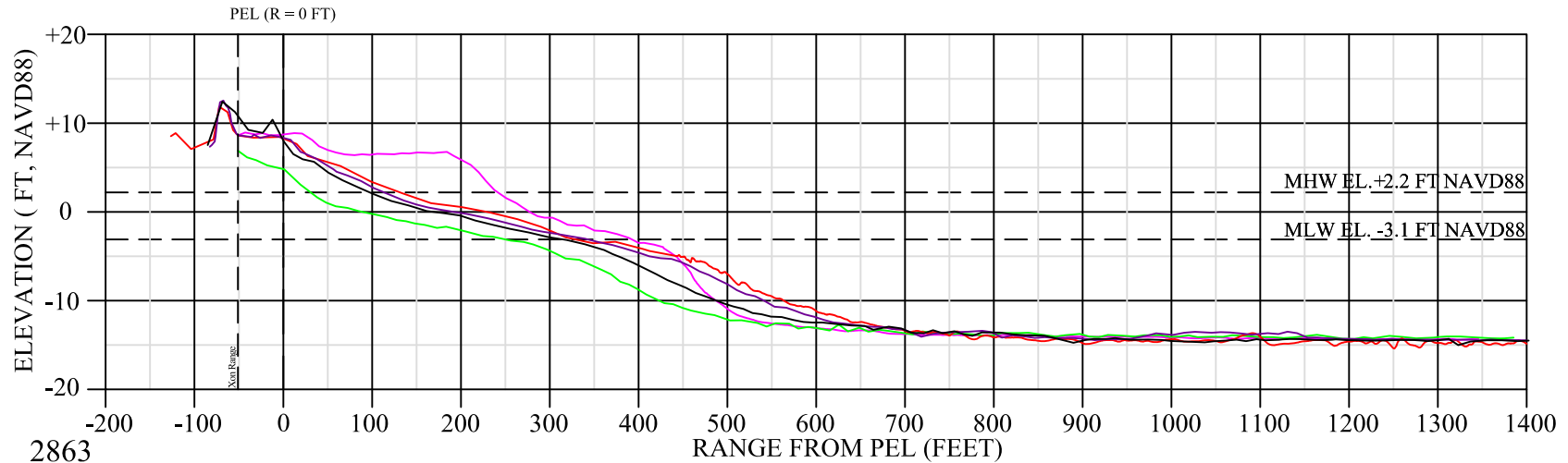
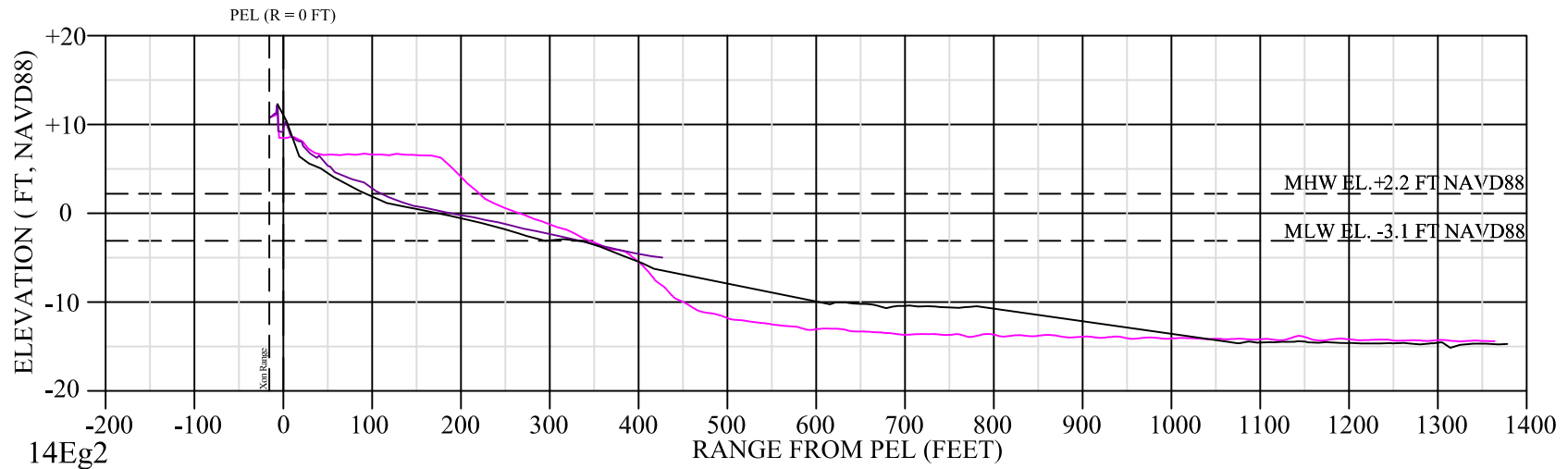
TITLE:

FOLLY BEACH GROIN REHABILITATION

ANNUAL MONITORING: JUNE 2021

Permit # 2017-00730

BEACH PROFILES SCCC 3Eg1 & 14Eg1



PRE CONSTRUCTION GBA (BD) - JULY 2018

POST CONSTRUCTION GBA (AD) - AUG-NOV 2018

1-YR POST CONSTRUCTION MONITORING - MAY/JUNE 2019

2-YR POST CONSTRUCTION MONITORING - APRIL 2020

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12 OF 12 SHEET:	SCALE: 1"=20' V 1"=200' H		ELKO COASTAL CONSULTING, INC. P.O. BOX 1451 FOLLY BEACH, SC. 29439		TITLE: FOLLY BEACH GROIN REHABILITATION ANNUAL MONITORING: JUNE 2021 Permit # 2017-00730 BEACH PROFILES SCCC 14Eg2 & 2863

Appendix B: Aerial Photos (June 2021)

Folly Groin Rehabilitation

Permit # 2017-00730

Photos available digitally upon request



Figure 1. Aerial photo of the rehabilitated groin field in June 2021 looking southwest at groins #21 (near Washout) to #29 (between 8th and 9th St. E.). Note the dune vegetation and wide backbeach within the dune field.



Figure 2. Aerial photo of the rehabilitated groin field in June 2021 looking northeast at groins #28 (near 9th St. E.) to #21 (near Washout). Note the advancing dune field, sand fencing and wide backbeach.



Figure 3. Oblique aerial photo of the west end of the rehabilitated groin field in June 2021 looking south at groins #28 and #29 (between 8th and 9th St. E.). The concrete cap groins that were rehabilitated by the Army Corps in 1993 are visible in the background east of the pier. No downdrift impacts were observed.



Figure 4. Groin 21 in June 2021 This groin is closest to the Washout by profile 2863.



Figure 5. Groin 22 in June 2021



Figure 6. Groin 23 in June 2021.



Figure 7. Groin 24 in June 2021.



Figure 8. Groin 25 in June 2021.



Figure 9. Groin 26 in June 2021.



Figure 10. Groyne 27 in June 2021.



Figure 11. Groyne 28 in June 2021.



Figure 12. Groin 29 in June 2021. This is the most downdrift (westernmost) groin by profile 2843.