LEE COUNTY BLIND PASS RESTORATION PROJECT

1-YEAR MONITORING REPORT

Prepared for:

Lee County Government
1500 Monroe Street 3rd Floor
Fort Myers, FL 33901

and

Florida Department of Environmental Protection
3900 Commonwealth Boulevard
Tallahassee, FL 32399-3000

February 21, 2011
CEC File No. 10.058

Prepared by:

COASTAL
ENGINEERING
CONSULTANTS
INC

This monitoring information is submitted in accordance with Specific Condition No. 45 of the approved Physical Monitoring Plan for Permit No. 0265943-001-JC for the monitoring period August 2009 through October 2010.

COASTAL ENGINEERING CONSULTANTS INC

A CECI GROUP COMPANY

CECI Group Services
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03-01-11P12:07 RCVD

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	JCP Compliance Officer	
COMPANY	FDEP Bureau of Beaches & Coastal Systems	
ADDRESS	3900 Commonwealth Blvd. Mail Station 300	
	Tallahassee, FL 32399-3000	
FAX #		***Tel.#*** (850) 414-7716

FROM	Michael T. Poff, P.E.
DIVISION	Coastal
DATE	02/22/2011
CEC #	**10.058**
SUBJECT: Blind Pass Restoration Project (JCP No. 0265943-001-JC)	

We are transmitting herewith: *FedEx 866837204727*16

QTY	DATE	REF.	DESCRIPTION
2	02/22/2011	10.058	Blind Pass 1-Year Monitoring Report

COMMENTS:

Dear Charlotte,

Enclosed is the Blind Pass Restoration Project 1-Year Monitoring Report. It is submitted in accordance with Specific Condition No. 45 of the approved Physical Monitoring Plan for Permit No. 0265943-001-JC for the monitoring period August 2009 through October 2010. If you have any questions, please do not hesitate in contacting Michael Poff at 239-643-2324 ext. 126.

Sincerely,

Vadim Alymov

cc: CEPD

I:\DATA\2010\10058\Trans\10058 Monitoring Report JCP 2011-02-22.doc

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1.0 INTRODUCTION

In 2009, Lee County completed construction of the Blind Pass restoration project by opening previously closed Blind Pass. A location map of the project area is presented in Figure 1. This report summarizes the results of the post-construction and first year physical monitoring surveys. The work was performed by Coastal Engineering Consultants (CEC). Funding for the monitoring and report was provided by the Florida Department of Environmental Protection (FDEP), Captiva Erosion Prevention District, and Lee County.

The Contractor, Energy Resources, Inc. (Energy Resources), began mobilizing on December 1, 2008 and finished demobilizing on December 12, 2009. Based upon progress surveys during construction, a total of approximately 148,000 cubic yards of sand were excavated and placed in three areas. Between December 3, 2008 and July 31, 2009, Energy Resources excavated and placed approximately 105,100 cubic yards on the beach fill (Sanibel Island) between R-112 and just south of R-114. Between December 3 and April 7, 2009, Energy Resources excavated and placed approximately 31,800 cubic yards in the nearshore immediately seaward of the Sanibel Island beach fill between R-112 and just south of R-114. Between March 20 and April 10, 2009, Energy Resources excavated and placed approximately 11,100 cubic yards in the containment cell just south of the Blind Pass Bridge between R-109 and R-110, all of which was hauled away to a disposal site from April 10 to May 5, 2009, to be used by the City of Sanibel Public Works Department.

Between October 14 and 19, 2010, CEC conducted the permit required physical monitoring surveys including beach profiles from R-106 to R-118, inlet cross sections from Station 0+00 to 35+00 for Wulfert Channel and from Station 0+50 to 5+00 for Roosevelt Channel, ebb shoal cross sections from Station 196+00 to 226+00, hydraulic measurements of the tides in the Gulf of Mexico and Pine Island Sound and current measurements in Blind Pass, Dinkins Bayou, and Roosevelt Channel.

By comparing the post-construction (August-September 2009) and the 1st year surveys (October 2010), CEC computed shoreline and volumetric changes and analyzed changes in hydraulic parameters and tidal prism. CEC compared the measured conditions to the design features to assess project performance.

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CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: FIGURE 1
BLIND PASS LOCATION MAP

DATE: 1/11/11	SCALE: AS NOTED		
DRAWN: VVA	F.B.		
CHECKED: MTP	PG.		
SEC.	TWP.	RNG.	
ACAD NO. Location Map.dwg			
REF. NO. 10.058	NO.	DATE	BY	REVISION DESCRIPTION

SHEET 1 OF 1
FILE NO.: 10058

2.0 SCOPE OF WORK

The contracted Scope of Work included the following components.

Pass and Ebb Shoal Survey: Conduct 1st year monitoring hydrographic surveys of the ebb shoal complex and interior waters of Blind Pass to document the inlet shoreline position, infilling and migration rates, and the development of the ebb shoal. The survey lines shall be spaced no greater than 200 feet apart, and will be aligned parallel to the shoreline. The alignment spacing shall be sufficient to document the channel position and shoal formation. The work shall extend 1,000 ft either side of the pass or to the Mean High Water (MHW) line, whichever is less. The seaward extent of the surveys shall be a minimum of 3,000 feet offshore and 600 feet inland past the work area. Data points shall be collected at a maximum spacing of 25 feet.

Beach Profiles: Conduct 1st year monitoring hydrographic surveys of the beach profiles including the active beach zone along the shoreline at each reference monument (R monument) from R106, north of Blind Pass, to R118, south of the fill area and will include half monuments from R110.5 to R113.5. All control information shall be field verified. The surveys shall be utilized to identify the shoreline position, average beach width, and sediment transport rates in the vicinity of Blind Pass. The beach portion of the profile survey shall extend from a minimum of 150 feet landward of the monument or from the edge of a building or road, whichever is the most seaward, to a wading depth deep enough to provide a 50-foot overlap with the offshore portion of the profile survey where environmental conditions allow. Profile data points along the beach portion of the profile survey shall be collected at a maximum interval of 25 feet and at all breaks in grade. The offshore portion of the profile survey shall extend from as close to shore as safely possible to provide at least a 50-foot overlap with the beach portion of the profile survey where environmental conditions allow to length of at least 1,500 feet from the MHW line or an elevation of -15 feet NAVD88, whichever is more landward. Profile data points along the offshore portion of the profile survey shall be collected at a maximum interval of 25 feet. The beach and offshore portions of the profile survey shall be collected within 7 days of each other for each profile line.

Hydraulic Monitoring: Conduct the hydraulic monitoring coinciding with the bathymetric and beach profile surveys. Concurrent measurements of tidal amplitude shall be obtained within the project area in Pine Island Sound and the Gulf of Mexico. Current velocities shall be measured within the Blind Pass channel throat and two additional locations in the interior system. One location will be the entrance to Roosevelt Channel and the other will be the entrance to Dinkins Bayou. The inlet hydraulics data set shall be obtained for a minimum 30-day period.

3.0 EQUIPMENT AND QA/QC PROCEDURES

3.1 Survey Report

The Survey Report is presented in Appendix 1.

3.2 Equipment

Upland: CEC employed two Leica 1200 RTK GPS systems for the upland surveys along with a Leica SR530 base station. These systems are capable of delivering RTK positions with coordinate accuracy of ±10mm+2ppm. CEC constructed a custom backpack to allow us to collect data seaward of the mean high water line, while protecting the equipment from the elements, and also served as a flotation device allowing the operator data collection access in water up to 5 feet deep.

Offshore: The survey vessel used for this work was an 18-foot fiberglass hull powered by an outboard. An Innerspace 456 depth sounder was used with a side mounted transducer. The GPS antenna utilized the same side mount bracket as the transducer to place it directly above the transducer. A Leica GPS SR530 series rover unit was integrated with the on-board computer system. The Hypack 2009 software package was the hydrographic guidance program utilized.

3.3 QA/QC Procedures

CEC employs an advanced QA/QC program to ensure our work meets the FDEP accuracy standards. CEC upland field crews utilize RTK systems for data collection. CEC also incorporates the necessary equipment on the survey vessel to collect bathymetric survey data "Real-Time". To meet the specification calling for an approximate 50-foot overlap in data between the boat and the upland crew, CEC implements the following procedure. Utilizing "Real-Time" data collection, the boat crew immediately accounts for the tide correction, as well as the draft, squat, roll and pitch variables, and reports measured water depth in NAVD88 at each profile with the upland crew. This gives the upland crew, who simultaneously collects the upland and nearshore profile data, the necessary information to achieve the "overlap" specification.

Upland Data Collection: CEC mobilized one operator and GPS rover unit to collect survey data from the approximate mean high water line landward to the existing dune while an additional operator with the waterproof backpack and unit collected data just landward of the mean high water seaward to wading depth or approximately -5 feet NAVD88. The recorded data was maintained within tolerances of ±3.00 feet horizontal and ±0.16 feet vertical. QA/QC procedures were maintained by both comparison of values with higher accuracy and by repeat measurement.

The Leica SR530 base station was setup on a suitable control point for GPS observations, either a point with provided GPS coordinates or a point with coordinates derived from observations performed during monumentation. The point designation, record coordinates, and the GPS model and antenna height were logged in the field book. At least one check shot was recorded for each RTK rover on a point with known coordinates as well as periodic checks throughout the day ensuring integrity of the data.

An electronic list of R-monument coordinates and profile azimuths was loaded into the rover units and measurements were recorded along the azimuth line at intervals no greater than 25 feet or wherever geographical features dictated. The measurements were taken landward along the azimuth line to the location of the R-mon and a measurement was taken on the R-mon when possible. The extent of the vegetation line and prominent features such as seawalls and/or asphalt roads where also noted in the data collection. The measurements were taken seaward along the azimuth line to a minimum depth of –5.0 feet NAVD88, or as far as conditions dictated, to maintain a minimum of 50 feet of overlap with the data being collected by the offshore survey crew. This data was then compiled and merged with the offshore data to produce the profile drawings.

Offshore Data Collection: All survey equipment was properly calibrated and operated in accordance with FDEP standards. Bar checks to calibrate the fathometer were performed for verification of accuracy at the beginning and end of each survey day. A direct depth measurement check was conducted and recorded at both shallow and maximum depths relative to the work area at the beginning and end of each survey day, and more frequently if necessary. If sea conditions precluded performing the bar check at the end of the day, sea conditions and indication of inability to perform the depth check was recorded and reported. If the day's final bar check was not possible as a result of adverse sea conditions, then the last survey line was repeated during the next day of survey to verify the measurements. Latency checks were conducted periodically throughout the survey period. The latency corrections were calculated and adjustments were made to the data using the Hypack subroutines.

Bathymetric survey data collection was conducted in calm seas. Maximum wave heights during the data collection period were less than 2 feet. The data was collected at intervals not exceeding 25 feet and at all grade breaks along the profile sufficient to accurately describe the bathymetry at the profile locations. The beach profile survey extended seaward to a minimum of 1,500 feet from the MHW or to –15 feet NAVD88, whichever was reached first. The seaward extent of the ebb shoal survey extended to a minimum of 3,000 feet offshore.

The vertical accuracy of the profile data meets or exceeds the GPS-derived heights (0.2 to 0.5 feet) standard. The horizontal positioning system accuracy of the data was within 2 feet and the off-line horizontal deviation was within 30 feet. Manual tide readings were collected periodically throughout the survey as a check for the tides measured by the RTK GPS.

Bathymetric survey data collection was performed as close in time as possible with the upland topographic survey data collection. This significantly increased the efficiency by conducting the work with the same base station set-up. Safety was also increased by having both crews visible to each other at all times. Difference in time between the onshore and offshore data was no greater than 7 days.

3.4 Data Reduction and Deliverables

The profile measurement data from the upland and offshore surveys were merged together using the Hypack 2009 subroutines. The digital data is provided in Appendix 2, Survey Data, in ASCII format arranged and including all information as required by FDEP specifications and in "x,y,z" format. The processed data was exported into AutoCAD and individual profiles were plotted to the specified scale. Copies of the profiles and cross sections are included in Appendices 3 and 4, respectively.

4.0 PHYSICAL MONITORING

4.1 Depth of Closure

The offshore depth beyond which the net sediment transport does not result in significant changes in mean water depth is known as the depth of closure (DOC). According to Birkemeier (1985), the depth of closure can be estimated as

$$h_c = 1.75H_c - 57.9\left(\frac{H_e^2}{gT_e^2}\right) \qquad (1)$$

where H_e is the effective wave height which is exceeded during only 12 hours per year, T_e is the associated period, and g is the acceleration due to gravity.

Wave data were obtained from the Wave Information Studies (WIS) project (Hubertz, 1992), which produces a high-quality online database of hindcast, nearshore wave conditions covering U.S. coastlines (http://chl.erdc.usace.army.mil/). The acquired data cover a 20-year period from January 1, 1980 through December 31, 1999. The time interval of the data is one hour.

Wave data at WIS station 290 (WIS-290), the nearest to Blind Pass located approximately 10 miles south-west of the pass, were utilized to calculate the depth of closure. Since the WIS data covered a 20-year period, the effective wave height and its corresponding period were calculated for each year and then averaged to obtain values representative over the 20-year period, which resulted in the effective wave height of 11.5 feet and wave period of 8.2 seconds. The depth at WIS-290 is approximately 52 feet. According to the dispersion relationship (Dean and Dalrymple, 1991), the 8.2-second wave is approximately 282 feet long in 52-foot water. This yields an h/L ratio of 0.2 (where h is the depth and L is the wave length) indicating that the wave is an intermediate water wave. In order to calculate the effective wave parameters for shallow water waves whose interaction with bottom is more significant, the STWAVE model was used to propagate the 11.5-foot 8.2-second wave closer to the shore. The calculated effective wave height and period near Blind Pass were on the order of 8.8 feet and 8.3 seconds, respectively. Plugging these values in the equation above yields a depth of closure of -13.3 feet NAVD88. Coastal Planning & Engineering (CPE) reported a depth of closure of -13 feet NAVD88 for their Captiva and Sanibel Islands Beach Renourishment Project (CPE, 2007), thus verifying the above calculations.

4.2 Beach Profiles

Appendix 3 presents the beach profiles measured between R-106 and R-118 at each R-monument for the 2009 post-construction and 1st year monitoring surveys. The survey dates are presented in Table 1.

TABLE 1. SURVEY DATES

Survey	2009 Post-Construction	2010 1st year Monitoring
Beach Profiles	September 16, 2009	October 12-19, 2010
Blind Pass	August 25-27, 2009	October 12-19, 2010
Ebb Shoal	August 25, 2009	October 12-14, 2010

* N/S denotes Not Surveyed

Table 2 presents the 2009 and 2010 shoreline positions at mean high water (MHW = 0.28 feet NAVD88) along with the shoreline changes between the two surveys.

TABLE 2. SHORELINE POSITIONS AND CHANGES AT MHW BETWEEN 2009 SURVEY AND 2010 SURVEY

MON	POST-CON POSITION 2009 (FT)	1st YEAR MONITORING POSITION 2010 (FT)	2009-2010 SHORELINE CHANGE (FT)	2009-2010 AVERAGE SHORELINE CHANGE (FT)	
R-106	533.3	531.2	-2.1	23.1	**Updrift of Blind Pass**
R-107	154.0	166.1	12.1		
R-108	262.6	277.6	15.0		
R-109	305.2	372.5	67.3		
Blind Pass					
R-110	156.4	132.6	-23.8	-73.0	**Downdrift of Blind Pass**
R-110.5	294.6	233.4	-61.2		
R-111	208.5	74.0	-134.5		
R-111.5	259.0	186.5	-72.5		
R-112	209.3	157.8	-51.5	-70.5	**Beach Fill**
R-112.5	604.2	532.4	-71.9		
R-113	355.4	254.1	-101.3		
R-113.5	306.6	217.2	-89.4		
R-114	266.8	228.3	-38.5		
R-115	52.4	61.3	8.9	14.5	**Downdrift of Beach Fill**
R-116	78.7	93.5	14.8		
R-117	67.0	68.3	1.3		
R-118	282.4	315.6	33.2		

A summary of the shoreline changes based on the comparisons between the 2009 and 2010 surveys at the R-monuments is presented below.

Updrift of Blind Pass: The beach north of Blind Pass, extending from R-106 to R-109, advanced on average approximately 23.1 feet between September 2009 and October 2010. The range of shoreline change measured at MHW was from 2.1 feet of recession at R-106 to 67.3 feet of advance at R-109. This is attributed to the net longshore transport from north to south.

Downdrift of Blind Pass: The beach south of Blind Pass, extending from R-110 to R-112, receded on average approximately 73.0 feet between September 2009 and October 2010. The range of shoreline change measured at MHW was from 134.5 feet of recession at R-111 to 23.8 feet of recession at R-110. This significant shoreline recession is attributed to the shoreline adjusting to the reopened inlet.

Beach Fill: The 2009 downdrift beach fill extends from R-112 to just south of R-114 (Figure 1). The segment's shoreline measured at MHW receded on average approximately 70.5 feet between

September 2009 and October 2010. The range of shoreline change was from 101.3 feet of recession at R-113 to 38.5 feet of recession at R-114. This significant shoreline recession is attributed to the beach fill undergoing profile adjustment and the shoreline adjusting to the reopened inlet.

Downdrift of Beach Fill: The beach south of the beach fill, extending from just south of R-114 to R-118, advanced on average approximately 14.5 feet between September 2009 and October 2010. The range of shoreline change measured at MHW was from 1.3 feet of advance at R-117 to 33.2 feet of advance at R-118. This shoreline advance is attributed to the beach fill diffusion.

Tables 3 and 4 present volumetric changes to MHW and DOC, respectively, calculated from comparing the August 2009 and September 2010 monitoring surveys.

TABLE 3. VOLUMETRIC CHANGES TO MHW BETWEEN 2009 SURVEY AND 2010 SURVEY

MON	AREA (CY/FT)	AVG AREA (CY/FT)	LENGTH (FT)	VOLUME (CY)	TOTAL VOLUMES (CY)	
R-106	-2.4				12,762	**Updrift of Blind Pass**
		0.5	1,101	555		
R-107	3.4					
		3.3	1,310	4,380		
R-108	3.3					
		9.0	866	7,827		
R-109	14.8					
Blind Pass						
R-110	-5.9				-5,928	**Downdrift of Blind Pass**
		-6.2	529	-3,253		
R-110.5	-6.4					
		-4.1	480	-1,984		
R-111	-1.9					
		-1.3	411	-545		
R-111.5	-0.8					
		-0.4	401	-145		
R-112	0.0				-7,078	**Beach Fill**
		-1.1	600	-688		
R-112.5	-2.3					
		-4.4	601	-2,623		
R-113	-6.4					
		-5.8	449	-2,603		
R-113.5	-5.2					
		-3.3	356	-1,164		
R-114	-1.3					
		0.3	1,162	389		

MON	AREA (CY/FT)	AVG AREA (CY/FT)	LENGTH (FT)	VOLUME (CY)	TOTAL VOLUMES (CY)	
R-115	2.0				5,027	**Downdrift of Beach Fill**
		1.4	1,146	1,564		
R-116	0.7					
		-0.3	1,065	-361		
R-117	-1.4					
		3.2	1,089	3,435		
R-118	7.7					

TABLE 4. VOLUMETRIC CHANGES TO DOC BETWEEN 2009 SURVEY AND 2010 SURVEY

MON	AREA (CY/FT)	AVG AREA (CY/FT)	LENGTH (FT)	VOLUME (CY)	TOTAL VOLUMES (CY)	
R-106	-7.2				5,551	**Updrift of Blind Pass**
		-1.3	1,101	-1,403		
R-107	4.6					
		2.0	1,310	2,668		
R-108	-0.6					
		5.0	866	4,287		
R-109	10.5					
Blind Pass						
R-110	60.2				-5,771	**Downdrift of Blind Pass**
		36.5	529	19,288		
R-110.5	12.8					
		-9.6	480	-4,608		
R-111	-32.0					
		-26.3	411	-10,818		
R-111.5	-20.7					
		-24.0	401	-9,634		
R-112	-27.3				-69,115	**Beach Fill**
		-35.7	600	-21,426		
R-112.5	-44.1					
		-42.7	601	-25,635		
R-113	-41.2					
		-34.9	449	-15,645		
R-113.5	-28.6					
		-18.0	356	-6,410		
R-114	-7.5					
		-5.3	1,162	-6,133		

MON	AREA (CY/FT)	AVG AREA (CY/FT)	LENGTH (FT)	VOLUME (CY)	TOTAL VOLUMES (CY)	
R-115	-3.1				13,715	**Downdrift of Beach Fill**
		0.6	1,146	727		
R-116	4.4					
		4.9	1,065	5,209		
R-117	5.4					
		12.8	1,089	13,912		
R-118	20.1					

Figures 2 and 3 present contour maps based on the September 2009 and October 2010 beach profile survey data, respectively. The figures depict the limits of dredging and fill placement. Figure 4 presents a morphology change map depicting changes in elevations that occurred between the two surveys.

A summary of the volumetric changes to MHW and DOC is presented below.

Updrift of Blind Pass: The beach north of Blind Pass, extending from R-106 to R-109, accreted approximately 12,800 cubic yards above MHW and accreted approximately 5,600 cubic yards to DOC between September 2009 and October 2010. It is noted that the majority of the accretion is related to the measured changes at R-109 (Table 4) which are depicted in Figure 4 to be up to 5 feet of vertical gain. The significant accretion is attributed to the terminal groin located at R-109 (Figure 1). The changes between R-106 and R-108 varied from minor erosion to minor accretion on the order of 1 to 2 feet of gain or loss.

Downdrift of Blind Pass: The beach south of Blind Pass, extending from R-110 to R-112, eroded approximately 5,900 cubic yards above MHW and eroded approximately 5,800 cubic yards to DOC between September 2009 and October 2010. It is noted, significant deposition occurred at R-110 below MHW attributed to sediment transport off the adjacent beaches into the channel and onto the ebb shoal as it started to reform.

Beach Fill: The downdrift beach fill, extending from R-112 to just south of R-114, eroded approximately 7,100 cubic yards above MHW and eroded approximately 69,100 cubic yards to DOC between September 2009 and October 2010. The erosion below MHW out to DOC is attributed to the sediment transport both on to the ebb shoal and diffusion alongshore.

Downdrift of Beach Fill: The beach south of the beach fill, extending from just south of R-114 to R-118, accreted approximately 5,000 cubic yards above MHW and accreted approximately 13,700 cubic yards to DOC between September 2009 and October 2010. The accretion is attributed to beach fill diffusion.

Ebb Shoal: Based on the morphologic changes comparison and review of the ebb shoal cross sections, the ebb shoal experienced moderate changes of up to 2.0 feet, except within the dredge footprint where significant shoaling occurred.

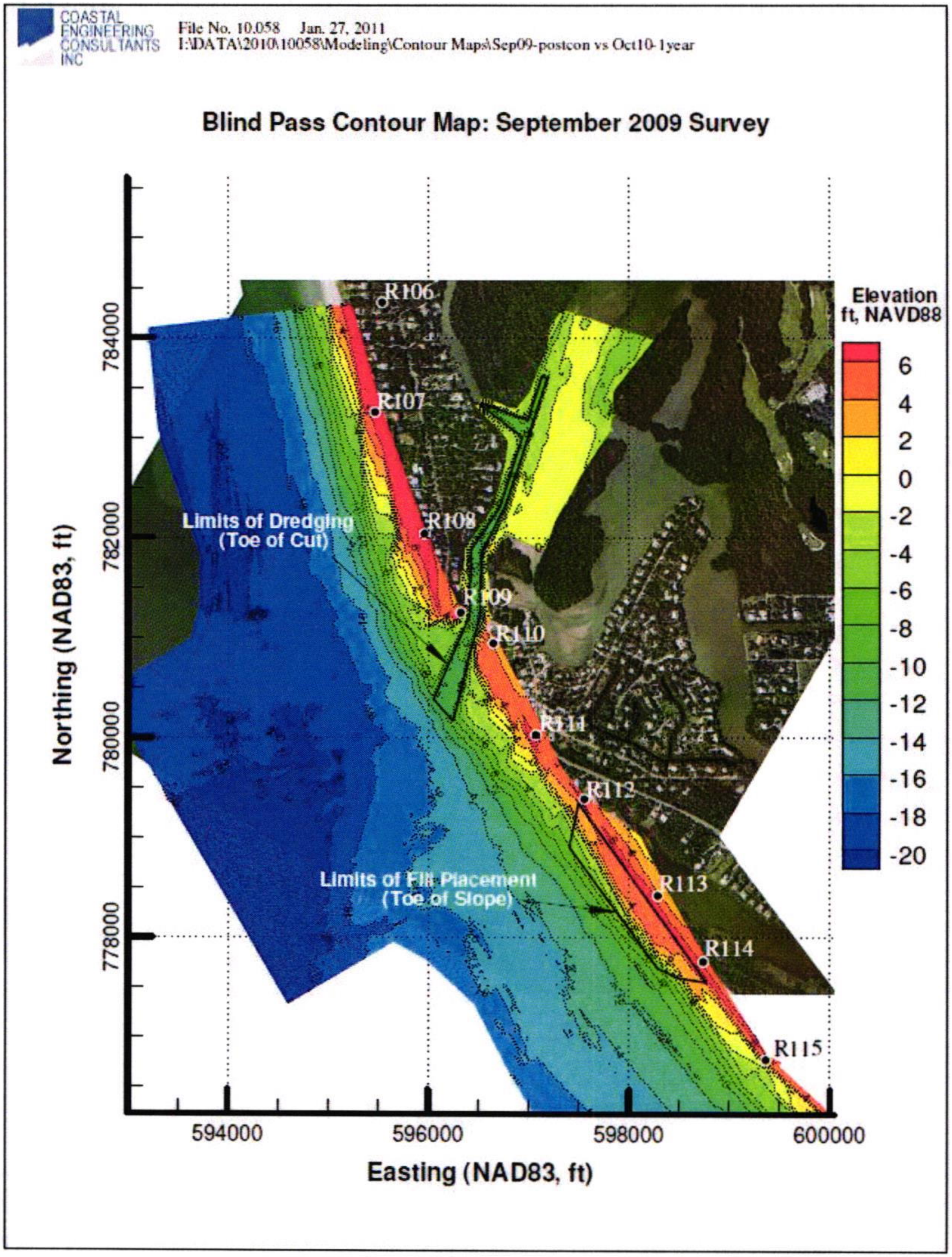

FIGURE 2
SEPTEMBER 2009 CONTOUR MAP

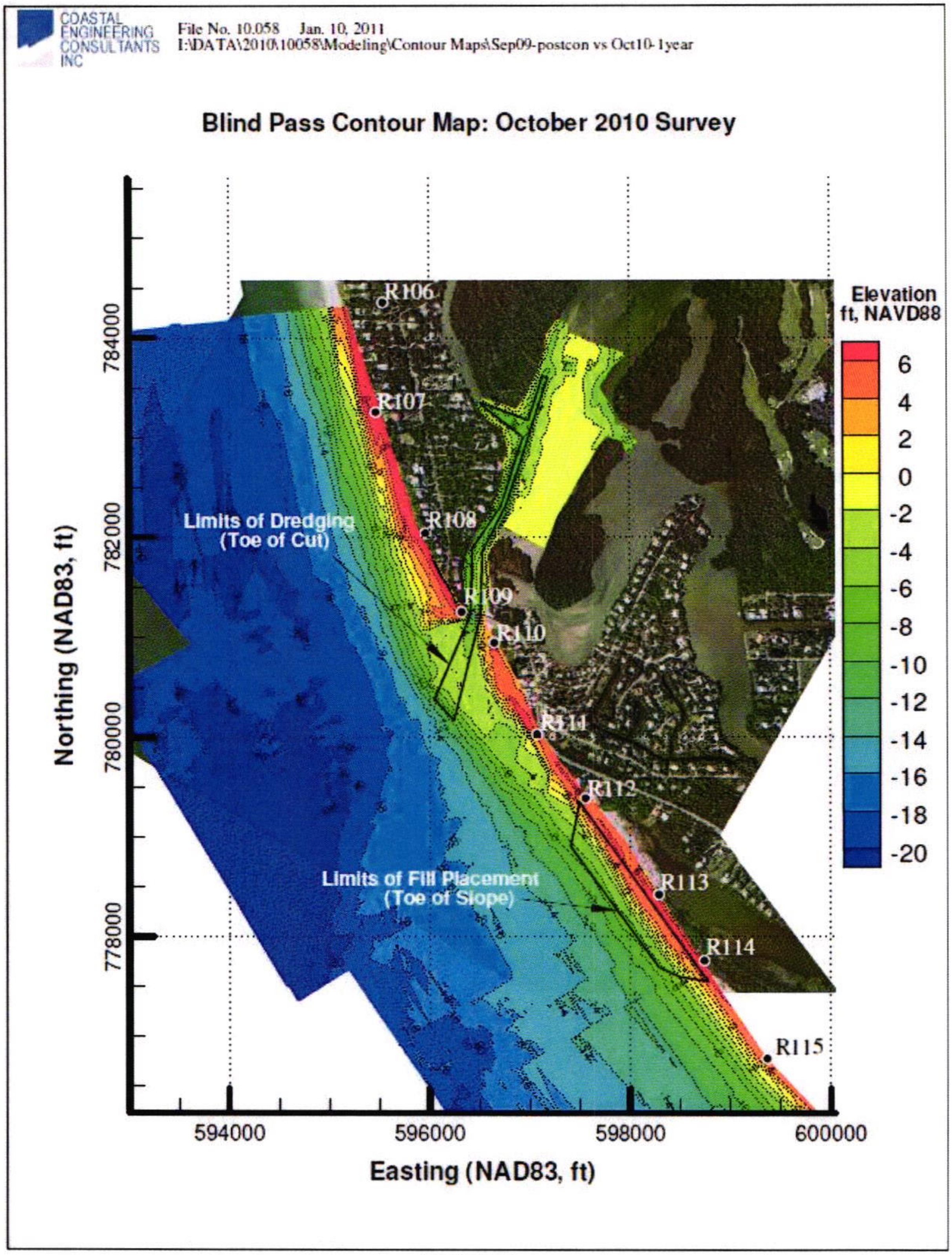

FIGURE 3
OCTOBER 2010 CONTOUR MAP

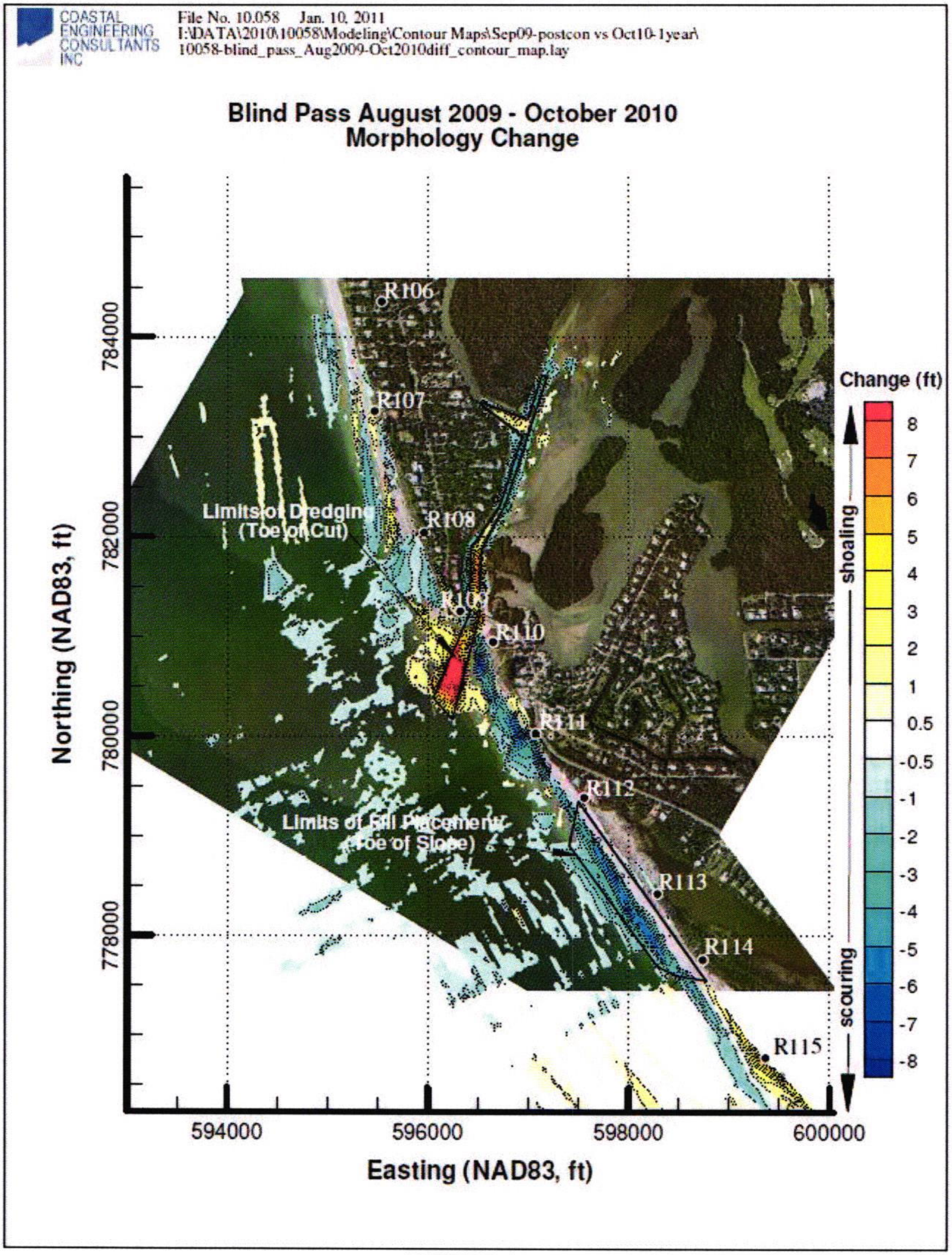

FIGURE 4
MORPHOLOGIC CHANGES BETWEEN SEPTEMBER 2009 AND OCTOBER 2010

4.3 Blind Pass and Ebb Shoal

Appendix 4 presents the Blind Pass cross sections surveyed in August 2009 (post-construction) and October 2010 (1-year monitoring). The restoration template and stations are depicted in Figure 1. It should be noted that in some cases the existing boat docks precluded survey data collection to the MHW line.

Table 5 presents the overall volumetric changes within the dredge template calculated from comparing the August 2009 and October 2010 monitoring surveys. The total volume change within the restoration template was approximately 67,100 cubic yards, of which 60,300 cubic yards were within the design cut and 6,800 cubic yards were within the overdredge tolerance.

TABLE 5. VOLUMETRIC CHANGES WITHIN DREDGE TEMPLATE BETWEEN 2009 SURVEY AND 2010 SURVEY

STA	AREA (CY/FT)	AVG AREA (CY/FT)	LENGTH (FT)	VOLUME (CY)
WULFERT CHANNEL				
0+00	15.6			
		52.0	200	10,396
2+00	88.3			
		81.5	200	16,304
4+00	74.7			
		57.7	200	11,534
6+00	40.6			
		30.8	200	6,158
8+00	20.9			
		17.0	200	3,390
10+00	13.0			
		15.4	200	3,077
12+00	17.8			
		20.2	200	4,043
14+00	22.6			
		21.5	200	4,304
16+00	20.4			
		12.2	200	2,444
18+00	4.0			
		3.8	200	765
20+00	3.6			
		2.3	200	468
22+00	1.0			
		0.9	200	171
24+00	0.7			
		0.4	200	73
26+00	0.1			
		0.1	200	21
28+00	0.2			

STA	AREA (CY/FT)	AVG AREA (CY/FT)	LENGTH (FT)	VOLUME (CY)
		1.6	200	326
30+00	3.1			
		2.8	200	567
32+00	2.6			
		3.6	200	717
34+00	4.6			
		2.9	100	291
35+00	1.2			
ROOSEVELT CHANNEL				
0+50	10.2			
		7.1	150	1,064
2+00	4.0			
		3.6	200	723
4+00	3.3			
		2.6	100	263
5+00	2.0			
TOTAL				**67,101**

Based on the October 2010 survey, the total volume within the Blind Pass restoration template was approximately 90,400 cubic yards (Table 6), of which 72,600 cubic yards were within the design cut and 17,800 cubic yards were within the overdredge tolerance.

TABLE 6. VOLUME WITHIN DREDGE TEMPLATE AFTER OCTOBER 2010 MONITORING SURVEY

STA	AREA (CY/FT)	AVG AREA (CY/FT)	LENGTH (FT)	VOLUME (CY)
WULFERT CHANNEL				
0+00	16.0			
		54.7	200	10,937
2+00	93.3			
		91.0	200	18,194
4+00	88.6			
		76.8	200	15,355
6+00	65.0			
		56.3	200	11,257
8+00	47.6			
		33.3	200	6,660
10+00	19.0			
		23.6	200	4,720
12+00	28.2			
		28.5	200	5,704
14+00	28.8			
		25.4	200	5,070
16+00	21.9			

STA	AREA (CY/FT)	AVG AREA (CY/FT)	LENGTH (FT)	VOLUME (CY)
		15.3	200	3,068
18+00	8.8			
		6.7	200	1,335
20+00	4.5			
		3.5	200	696
22+00	2.4			
		2.4	200	473
24+00	2.3			
		1.2	200	241
26+00	0.1			
		0.4	200	72
28+00	0.6			
		2.4	200	474
30+00	4.1			
		4.3	200	867
32+00	4.5			
		5.3	200	1,053
34+00	6.0			
		4.7	100	468
35+00	3.4			
ROOSEVELT CHANNEL				
0+50	15.3			
		12.2	150	1,831
2+00	9.1			
		7.6	200	1,527
4+00	6.1			
		4.2	100	417
5+00	2.2			
TOTAL				**90,421**

4.4 Hydraulic Monitoring

4.4.1 Hydraulic Monitoring Data

The field work for the 2010 hydraulic monitoring was performed between October 13, 2010 and November 15, 2010. Water elevation data were collected using MactoTide tide gauges at two locations: in the Gulf of Mexico approximately 3,800 feet south of Blind Pass (W82°10'57.4", N26°28'20.7") in 15.9-foot deep water and in Pine Island Sound approximately 2.7 miles northeast of the pass (W82°08'58.5", N26°30'29.7") in 12.0-foot deep water. Current velocity data were collected using Nortek Aquadopp current profilers at three Blind Pass locations, in Wulfert Channel (W82°10'56.9",.2") in approximately 6-foot deep water, near the entrance to Roosevelt Channel (W82°10'55.0", N26°29'18.5") in approximately 7-foot deep water, and near the entrance to Dinken Bayou (W82°10'40.9", N26°29'15.7") in approximately 6-foot deep water. The Nortek Aquadopp current profilers were capable of measuring currents throughout the water column at 20-inch (50 cm) increments. It allowed for more detailed information about the vertical structure of the current profile. The profilers were installed approximately 1 foot above the bottom. The location map depicting the instrument is presented in Figure 5.

It is noted that the Dinkins Bayou current profiler stopped working properly and recording accurate current measurements on November 3, 2010.

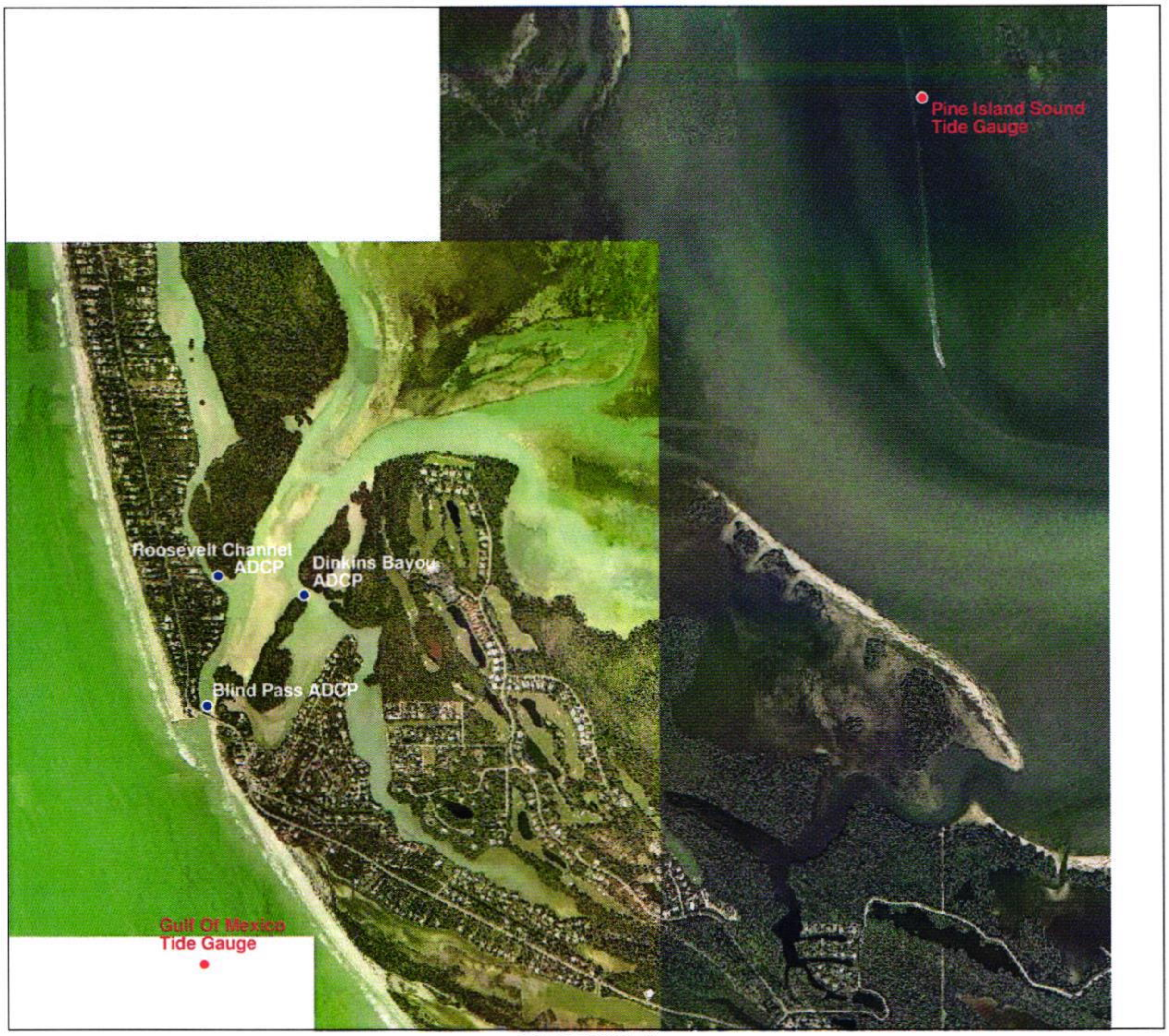

FIGURE 5
LOCATION MAP OF TIDE GAUGES AND CURRENT PROFILERS (ADCP)

The hydraulic results of the monitoring event are shown below in Figures 6 through 9. A new moon was observed on November 6, 2010 and a full moon occurred on October 23, 2010. The measured tidal range on the Gulf of Mexico side was 3.6 feet and 2.7 feet during the new moon and full moon, respectively; the maximum tidal range, 4.4 feet, occurred on November 5, 2010. According to the meteorological data obtained from NOAA's station in Venice, Florida, on that day the wind blowing from north-north-west reached speeds up to 27 mph. In Pine Island Sound, the tidal ranges during the new moon and full moon were 3.0 feet and 2.5 feet, respectively; the maximum tidal range, 3.3 feet, occurred on November 5, 2010. The average phase lags between the two locations were approximately 80 minutes and 115 minutes for the peak flood tide and peak ebb tide, respectively. The maximum current velocity in Wulfert Channel, 5.3 feet/sec, occurred on November 5, 2010. The average peak velocities over a 33-day period between October 13, 2010 and November 15, 2010 were 1.3 feet/sec and 1.1 feet/sec for the flood and ebb tidal phases, respectively.

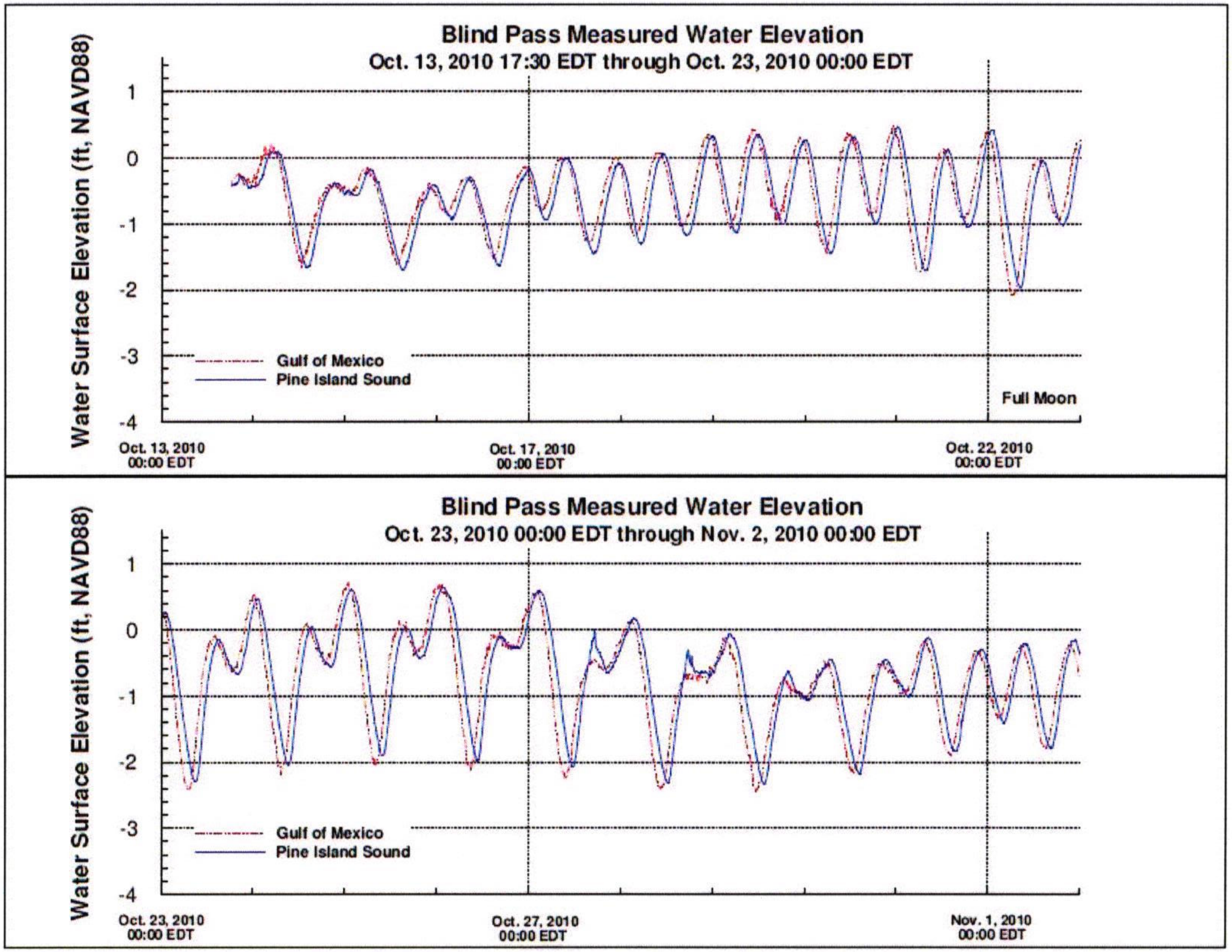

FIGURE 6
WATER SURFACE ELEVATIONS MEASURED BETWEEN OCTOBER 13 AND NOVEMBER 2, 2010 IN GULF OF MEXICO AND PINE ISLAND SOUND

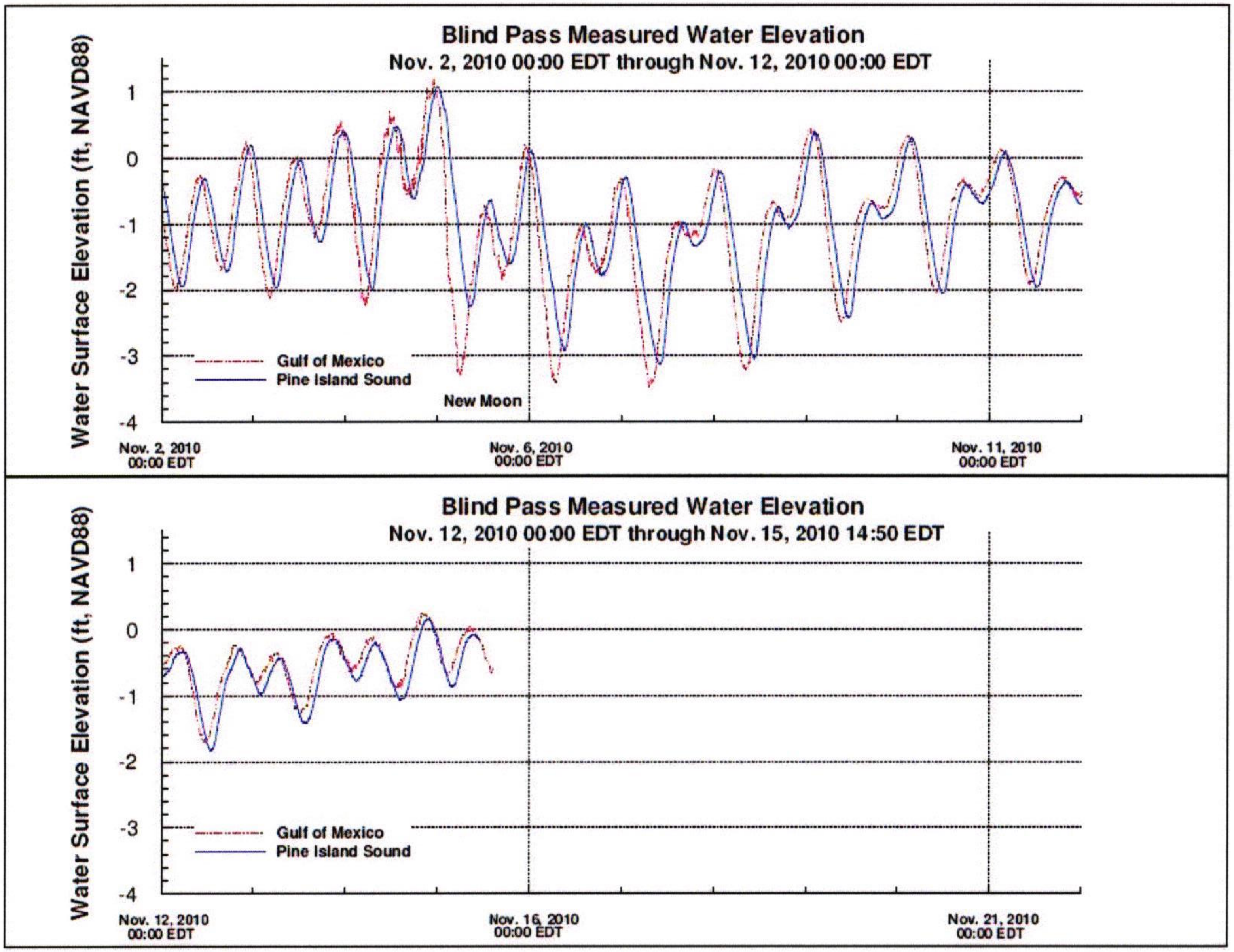

FIGURE 7
WATER SURFACE ELEVATIONS MEASURED BETWEEN NOVEMBER 2 AND NOVEMBER 15, 2010 IN GULF OF MEXICO AND PINE ISLAND SOUND

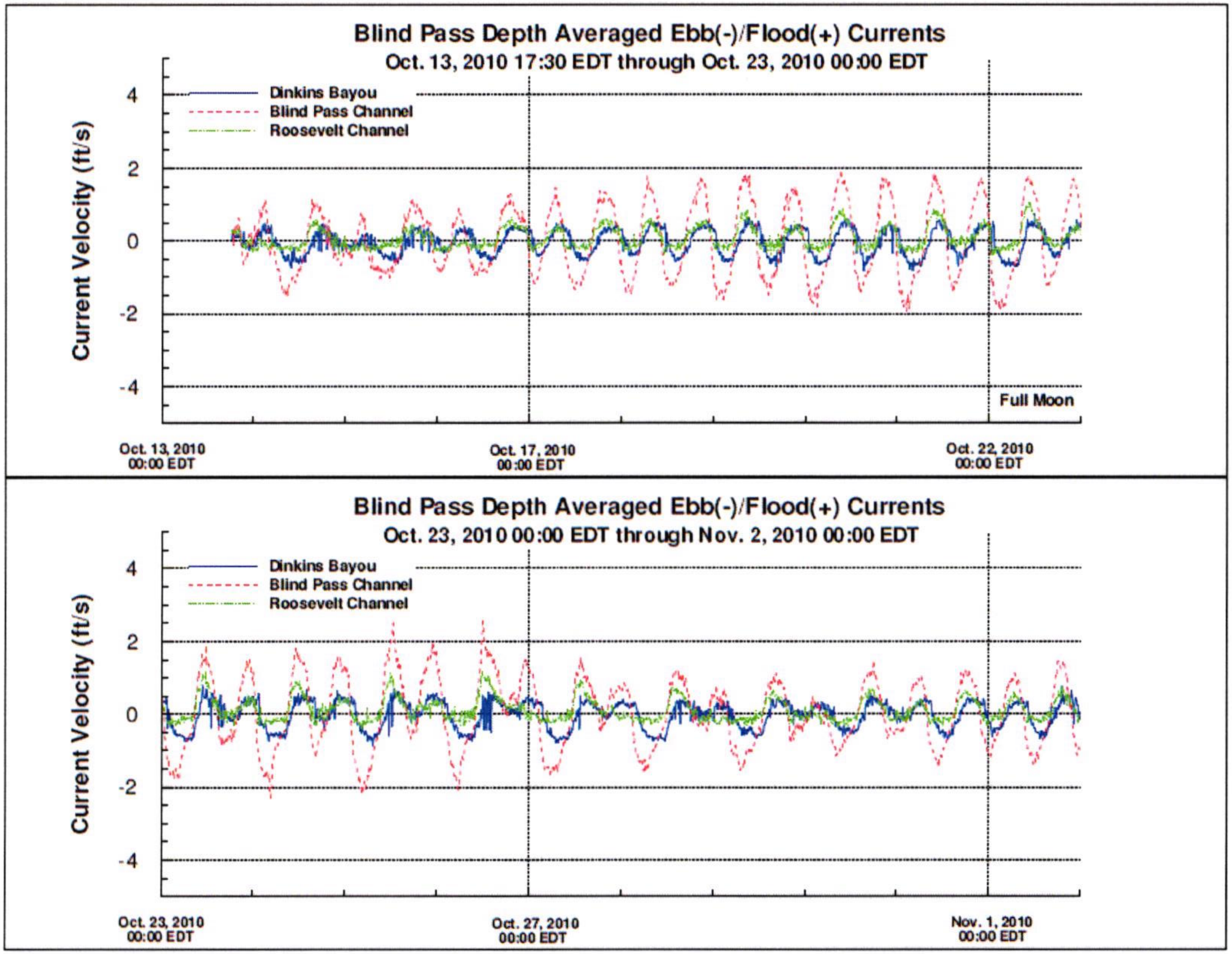

FIGURE 8
DEPTH AVERAGED CURRENT VELOCITIES MEASURED BETWEEN OCTOBER 13 AND NOVEMBER 2, 2010 IN BLIND PASS CHANNEL, DINKINS BAYOU, AND ROOSEVELT CHANNEL

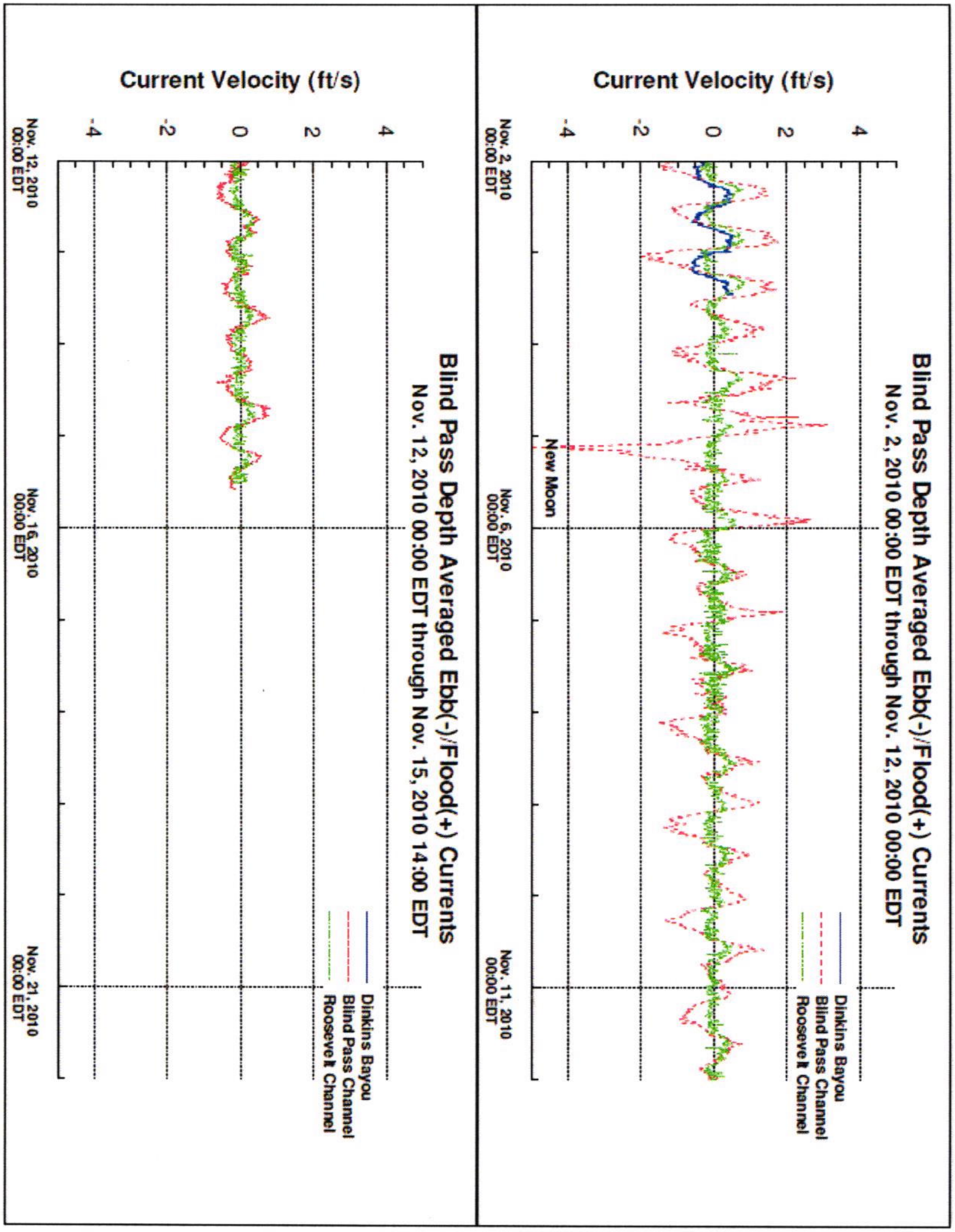

FIGURE 9
DEPTH AVERAGED CURRENT VELOCITIES MEASURED BETWEEN NOVEMBER 2 AND NOVEMBER 15, 2010 IN BLIND PASS CHANNEL, DINKINS BAYOU, AND ROOSEVELT CHANNEL

4.4.2 Summary of Hydraulic Measurements

Tide near Blind Pass is of a mixed nature which can be thought of as a transitional tide occurring between areas of semi-diurnal and diurnal tides. Table 7 presents major tidal constituents in the area based on ADCIRC tidal database.

TABLE 7. DOMINANT TIDAL CONSTITUENTS

CONSTITUENT	PERIOD (HR)	AMPLITUDE (FT)
M_2	12.4206	0.77
K_1	23.9345	0.48
O_1	25.8193	0.47
S2	12.0000	0.31

Table 8 provides a summary of the hydraulic conditions observed between October 9 and November 15, 2009. The tidal prism for this period was calculated to equal approximately $43.9 \cdot 10^6$ ft^3 using the following Keulegan (1951) expression:

$$P = \left(\frac{TV_{\max} A_c}{\pi C} \right) \qquad (2)$$

where

P = tidal prism (ft^3)
T = tidal period (s)
V_{max} = maximum velocity (ft/s)
A_c = cross-sectional area (ft^2) below MSL (= -0.6 ft NAVD88).
C = parameter (0.86)

TABLE 8. SUMMARY OF HYDRAULIC PARAMETERS

PARAMETER	2010 1-YEAR MONITRING
Maximum Tidal Range† (ft)	3.3
Maximum Tidal Range†† (ft)	4.4
Peak Current Velocity††† (ft/s)	2.4§
Cross-section Area††† (ft^2)	1,105
Tidal Prism††† (ft^3)	$4.4 \cdot 10^7$

† Pine Island Sound
†† Gulf of Mexico
††† Blind Pass
§ Peak current velocity of 5.3 ft/s that occurred on November 5, 2010 was excluded from consideration because according to the meteorological data obtained from NOAA's station in Venice, Florida, the wind blowing from north-northwest reached speeds up to 27 mph on that day, and this current velocity was not typical.

According to the Post-Construction and 6-Month Monitoring Report (CEC, 2010), the calculated tidal prism based on the 2009 post-construction survey was approximately $7.71 \cdot 10^7$ cubic feet. This indicates that approximately thirteen months after the post-construction survey, the tidal prism reduced by approximately 43%.

5.0 PROJECT PERFORMANCE

Erickson Consulting Engineers (ECE) designed the Blind Pass restoration project in 2006 (ECE, 2006) and recommended Alternative F as the "preferred alternative" that was constructed in 2009. ECE performed a tidal hydraulics analysis to predict post-construction hydraulic parameters including an "average tidal prism" at Blind Pass which was defined as the average daily tidal prism over a 14-day period which included the spring and neap tidal cycles. CEC utilized post-construction hydraulic measurements over a 28-day period between October 10, 2009 and November 8, 2009 and 1-year monitoring hydraulic measurements over a 33-day period between October 13, 2010 and November 15, 2010, which included two spring and two neap tidal cycles, to compute the post-construction and 1-year monitoring average ebb and flood tidal prisms and compare them to the average ebb and flood tidal prisms predicted by ECE (2006). Equation 2 was used to compute the average ebb and flood tidal prisms for the 2009 post-construction and 2010 1-year monitoring conditions with the exception of the V_{max} velocity parameter that was replaced with the average peak ebb and flood velocities, respectively. Table 9 presents a comparison analysis between the predicted and measured hydraulic parameters.

TABLE 9. COMPARISON ANALYSIS OF HYDRAULIC PARAMETERS

PARAMETER	LOCATION	PREDICTED CONSTR. DESIGN†	2009 POST-CON MEASURED	2010 1-YEAR MONITORING MEASURED
Average Peak Flood Current Velocity (ft/s)	Wulfert Channel	3.8	2.7	1.3
	Roosevelt Channel	N/A	1.1	0.6
	Dinkins Bayou	N/A	0.6	0.4
Average Peak Ebb Current Velocity (ft/s)	Wulfert Channel	4.1	2.9	1.1
	Roosevelt Channel	N/A	0.3	0.2
	Dinkins Bayou	N/A	0.6	0.5
Average Peak Flood Phase Lag†† (min)	Between Gulf of Mexico and Pine Island Sound	N/A	72	80
Average Peak Ebb Phase Lag†† (min)	Between Gulf of Mexico and Pine Island Sound	N/A	110	115
Cross-section Area (ft^2)	Wulfert Channel	1,500	1,165	1,105
Average Flood Tidal Prism (ft^3)	Wulfert Channel	$9.0 \cdot 10^7$	$5.2 \cdot 10^7$	$2.4 \cdot 10^7$
Average Ebb Tidal Prism (ft^3)	Wulfert Channel	$11.0 \cdot 10^7$	$5.6 \cdot 10^7$	$2.0 \cdot 10^7$

N/A denotes Not Available

† According to ECE (2006)

The comparison analysis demonstrates that the measured daily average peak flood and ebb current velocities were 71% of the ECE design (2006) velocities. Further, the predicted average flood tidal prism was approximately 73% larger than the average flood tidal prism computed based on the measured hydraulic parameters. Similarly, the predicted average ebb tidal prism was approximately 96% larger than the post-construction average ebb tidal prism. One of the reasons for the significant difference is that the design cross-sectional critical area was 29% larger compared to the critical cross-sectional area based on the August 2009 post-construction survey.

The 2010 1-year monitoring cross-sectional area decreased by approximately 4% compared to the post-construction cross section. However, due to the significant reduction in average peak ebb and flood velocities, the average flood and ebb tidal prisms decreased by approximately 54% and 64%, respectively.

According to Mehta et al. (1991), the stable cross-sectional area at Blind Pass is about 1,345 square feet and 1,615 square feet based on averaged and more extreme conditions, respectively. The 2010 1-year monitoring cross-sectional area, 1,105 square feet, does not fall within the stable cross-sectional area range.

6.0 CONCLUSION

This report describes the 1-year physical monitoring results of Lee County's Blind Pass restoration project completed in 2009. The information presented herein provides the necessary data for both Lee County and FDEP to regularly observe and assess, with quantitative measurements, the performance of the project, any adverse effects which have occurred, and the need for any adjustments, modifications, or mitigative response to the project. The monitoring process also provides the County and FDEP 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.

The data used in the physical monitoring analysis included beach profile surveys conducted in September 2009 and October 2010, ebb shoal surveys conducted in August 2009 and October 2010, Blind Pass surveys conducted in August 2009 and October 2010, and hydraulic measurements performed in October-November 2010.

The 1-year monitoring survey demonstrated significant shoaling of Blind Pass since construction completion. A total volume of approximately 67,100 cubic yards was deposited within the Blind Pass restoration template through natural sediment movement between August 2009 (post-construction) and October 2010. Based on the October 2010 survey, a total volume of approximately 90,400 cubic yards was within the template.

Based on the volumetric analysis of the contour map of morphologic changes, approximately 64,000 cubic yards of accretion occurred over the ebb shoal and channel exterior including the dredge footprint (Figure 10). Further, the extent of the ebb shoal growth ranged from approximately 500 feet north of the dredge template centerline to approximately 400 feet south of dredge template centerline. The significance of the ebb shoal growth outside the dredge footprint ranged from approximately 3.5 feet of accretion north of the template to approximately 2 feet of accretion south of the template.

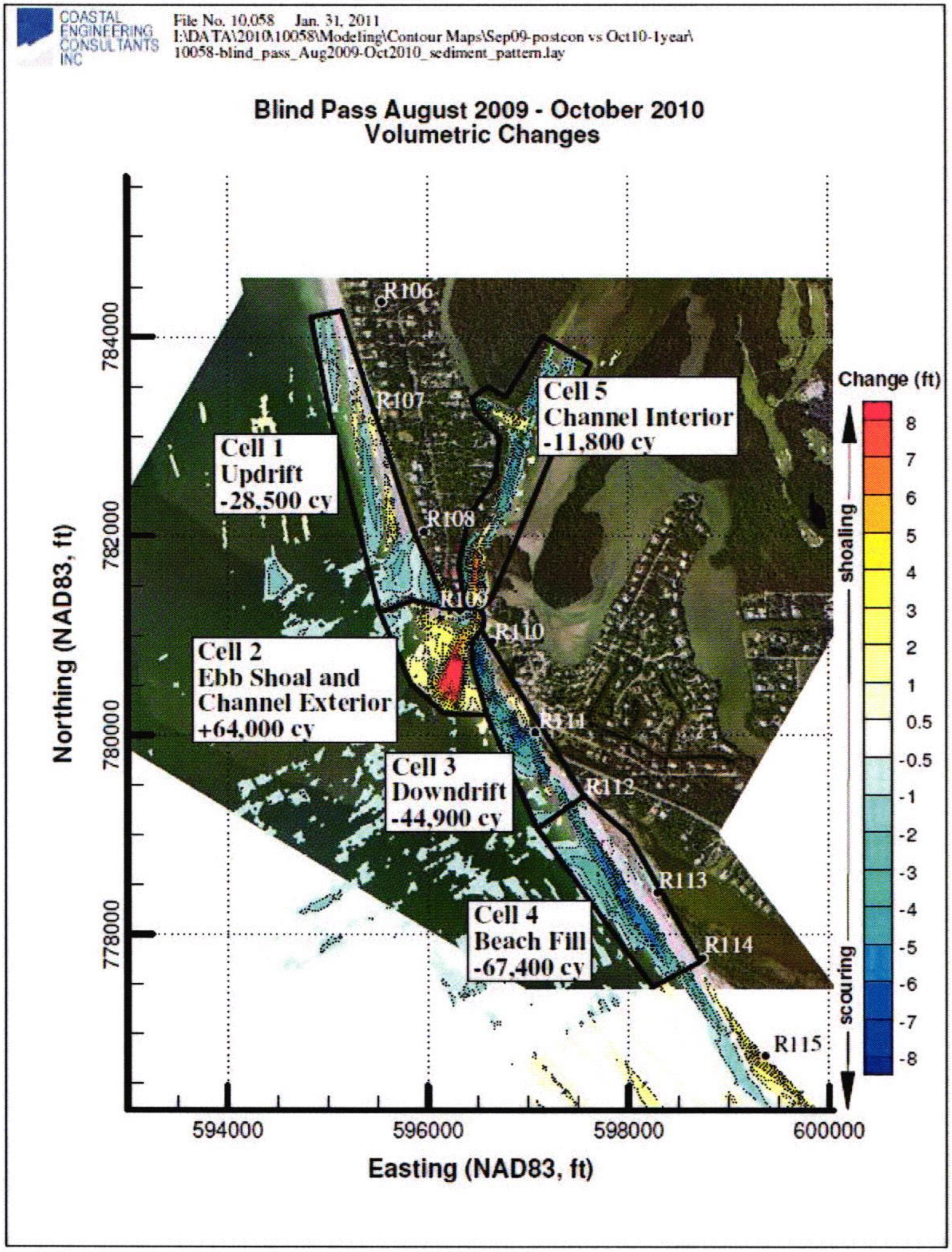

FIGURE 10
VOLUMETRIC CHANGES BETWEEN SEPTEMBER 2009 AND OCTOBER 2010 BASED ON CONTOUR MAP OF MORPHOLOGIC CHANGES

As depicted in Figure 10, approximately 28,500 cubic yards of erosion occurred along the updrift side of the pass. Downdrift of the pass, approximately 44,900 cubic yards of erosion was calculated. Along the beach fill shoreline segment, approximately 67,400 cubic yards of erosion occurred. Within the Blind Pass interior, approximately 11,800 cubic yards of erosion was calculated.

The maximum tidal ranges measured between October 13 and November 15, 2010 in the Gulf of Mexico and Pine Island Sound were 4.4 feet and 3.3 feet, respectively. The maximum current velocity measured at Blind Pass during this period was approximately 5.3 feet/sec. These conditions occurred on November 5, 2010 as a result of strong wind from north-northwest that reached speeds up to 27 mph. After excluding this episodic event, the typical maximum tidal ranges and current velocity were 3.6 feet (Gulf of Mexico), 3.0 feet (Pine Island Sound), and 2.4 feet/sec (Blind Pass).

The maximum tidal prism calculated based on typical hydraulic parameters excluding the episodic event was approximately $4.4 \cdot 10^7$ cubic feet, approximately 43% smaller than the tidal prism calculated based on post-construction hydraulic parameters.

A comparison analysis between the hydraulic parameters measured after post-construction in 2009 and during 1-year monitoring in 2010 indicate that the 1-year monitoring cross-sectional area decreased by approximately 4% compared to the post-construction cross section. However, due to the significant reduction in average peak ebb and flood velocities, the average flood and ebb tidal prisms decreased by approximately 54% and 64%, respectively. Further, the 1-year monitoring cross-sectional area, 1,105 square feet, does not fall within the stable cross-sectional area range predicted by Mehta et al. (1991) equal to 1,345 square feet and 1,615 square feet based on averaged and more extreme conditions, respectively.

Based on the physical monitoring surveys, there were no documented adverse impacts to the natural resources or coastal system within the project area as a result of construction.

After completing these analyses, CEC renders the following recommendations:

1. Modify the physical monitoring plan to include additional cross sections between the 200-foot stations where existing boat docks preclude survey data collection to the MHW line;
2. Modify the physical monitoring plan to include additional channels including extending the survey lines from Station 42+00 and into the marked navigation channel within Pine Island Sound; and the cross-over channel in the vicinity of Station 36+00 into Dinkins Bayou;
3. Pursue the permit modification request aggressively to obtain authorization for a) dredging the sediment basin along with the channel, thereby enhancing project performance by affording the opportunity to sustain the design cross-sectional area over a longer period of time; and b) shifting the beach fill south, thereby enhancing project performance by reducing or eliminating the fill from transporting south to north back into the dredge template;
4. Upon receipt of the state and federal permit modifications and upon confirmation by additional physical monitoring of reduced inlet cross-sectional area and hydraulic parameters, proceed with the maintenance dredging of the pass to achieve the design cross-sectional area and hydraulic efficiency.

7.0 REFERENCES

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APPENDIX 1

BLIND PASS 12-MONTH MONITORING SURVEY REPORT

Coastal Engineering Consultants (CEC) utilized multiple Real Time Kinematic (RTK) Global Positioning Systems (GPS) for the Twelve Month Monitoring Survey conducted in October 2010. All GPS base station control referenced during this survey was previously established by Florida Department of Environmental Protection (FDEP) Bureau of Beaches and Coastal Systems (BBCS) and meets or exceeds Geospatial Positioning Accuracy Standards, Range VIII.

CEC occupied several FDEP "A monuments" (2nd order control) at the beginning of the project (December 1, 2008) and tied in all existing FDEP "R monuments" within the project area. BBCS provided CEC an x,y,z coordinate file of the monumentation previously observed by BBCS. CEC collected GPS static observations on each GPS base point to confirm the coordinates listed on BBCS's monument control list. Horizontal and vertical positions of all found monuments were verified and documented.

The Hydrographic surveys were conducted utilizing boat-mounted echo sounding equipment. The upland and surf zone portion of the Project was surveyed with pack-mounted GPS RTK rovers. All "R monument" and intermediate beach profiles and were collected on the State Plane Coordinate System Grid, Florida West Zone and survey data was collected along FDEP established grid bearings as outlined in the project Scope of Work prepared by Lee County. The horizontal and vertical datums were North American Datum (NAD) of 1983/1990 Adjustment and North American Vertical Datum (NAVD) of 1988, respectively.

All survey control was established as part of the upland topographic survey control work and conducted in accordance with the FDEP Monitoring Standards for Beach Erosion Control Projects. These surveys meet the requirements set forth in Chapter 5J-17 (F.A.C.) Florida Administrative Code.

COASTAL ENGINEERING CONSULTANTS, INC.
FLORIDA BUSINESS AUTHORIZATION NO. LB 2464

Richard J. Ewing, P.S.M.
Professional Surveyor and Mapper
Florida Certificate No. 5295
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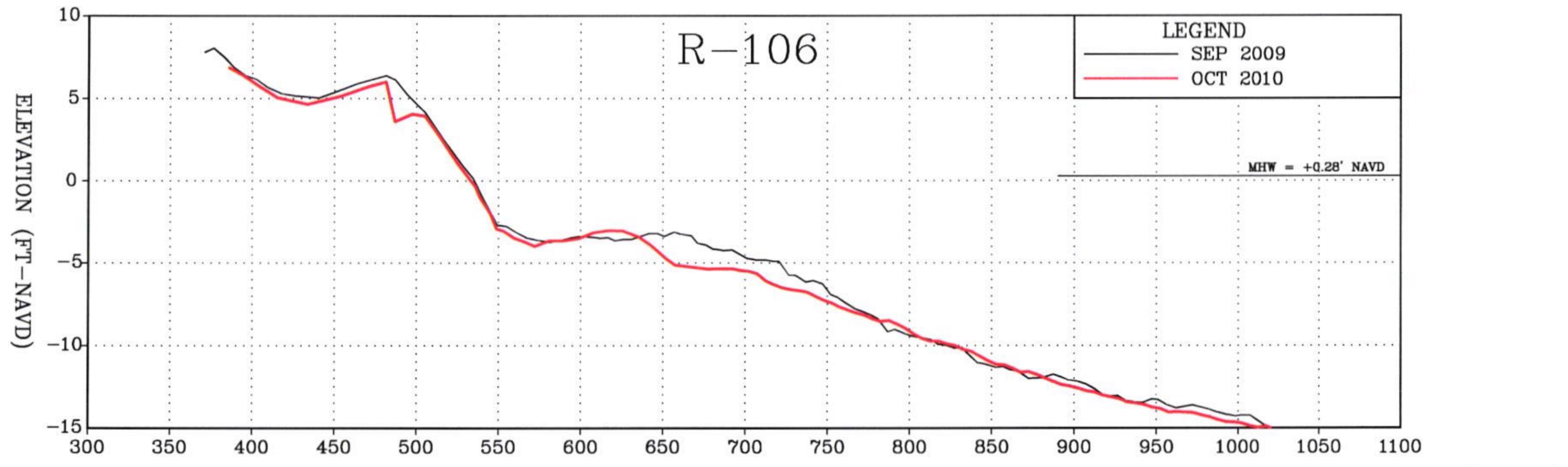
LICENSED SURVEYOR AND MAPPER
CEC FILE NO. 10.058
LAST DAY OF FIELD SURVEY: 10-19-2010
DATE OF SIGNATURE: 2-21-2011

APPENDIX 2

SURVEY DATA

APPENDIX 3

BEACH PROFILES



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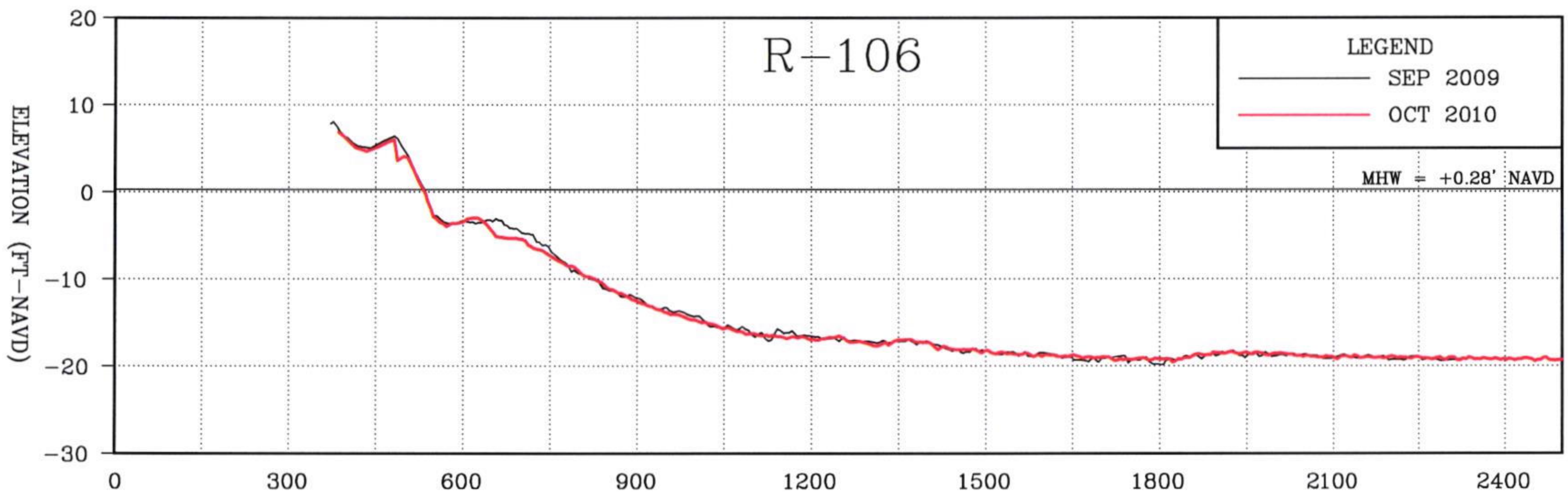

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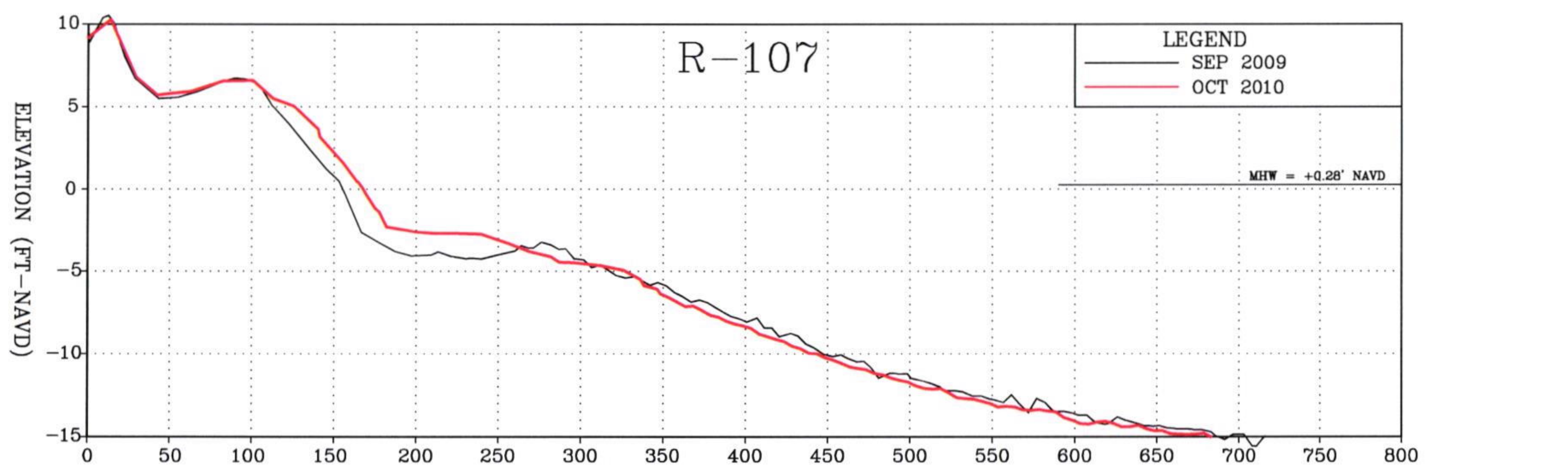

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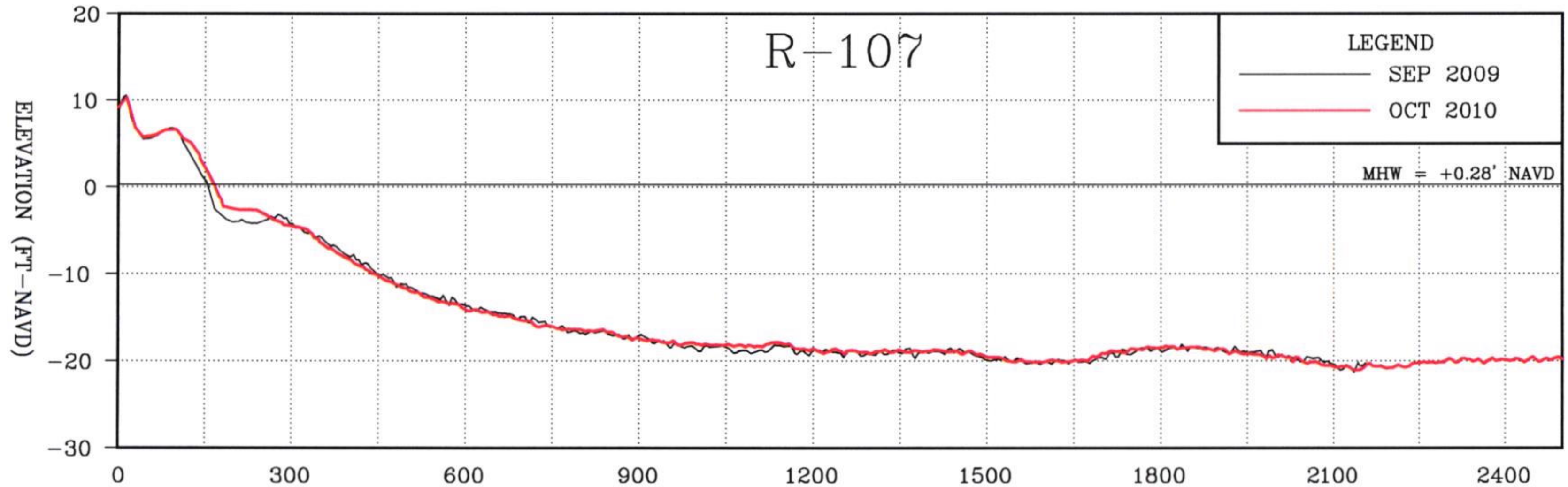

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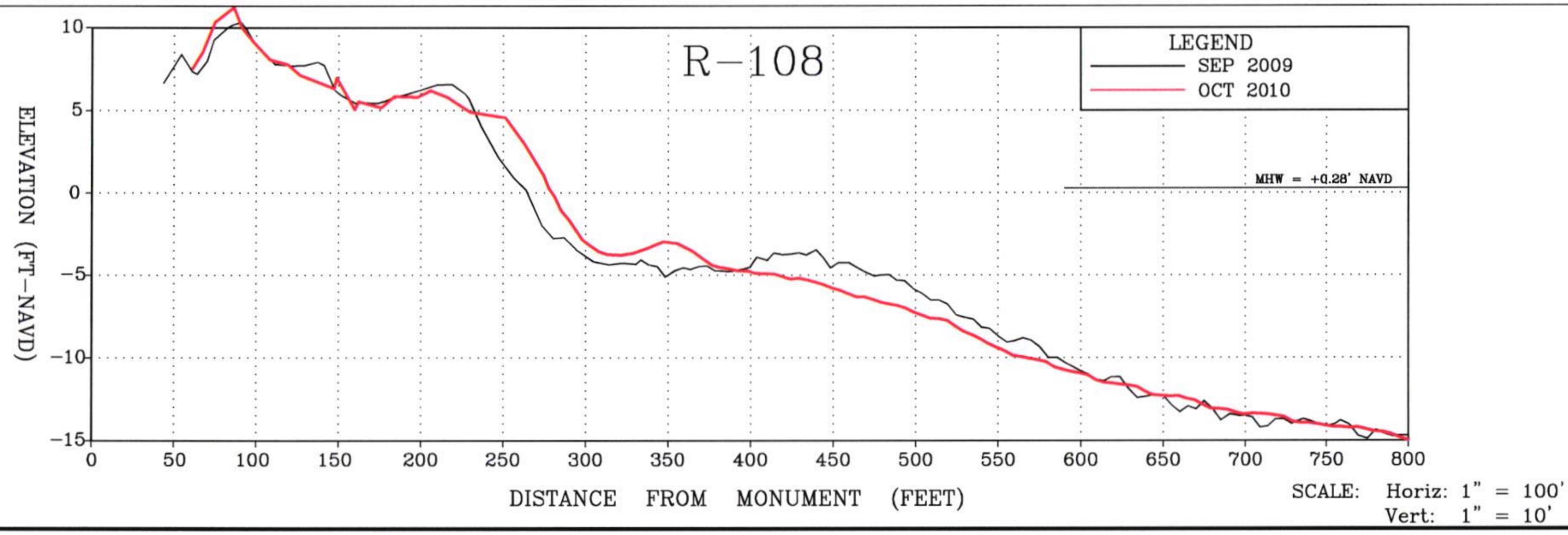

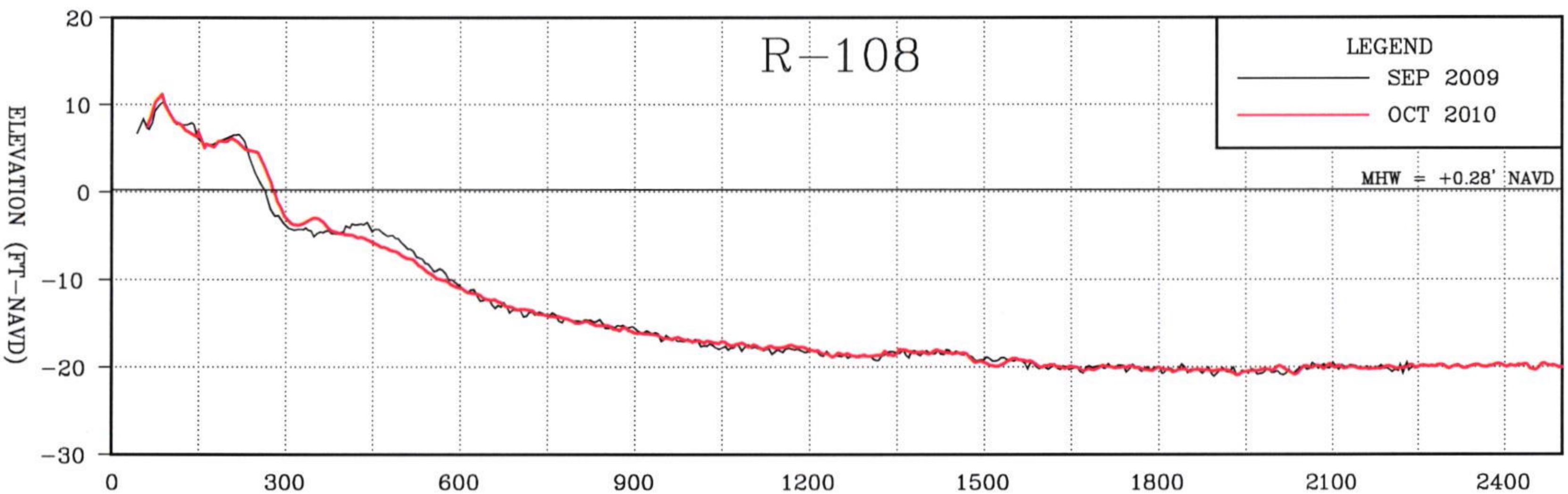

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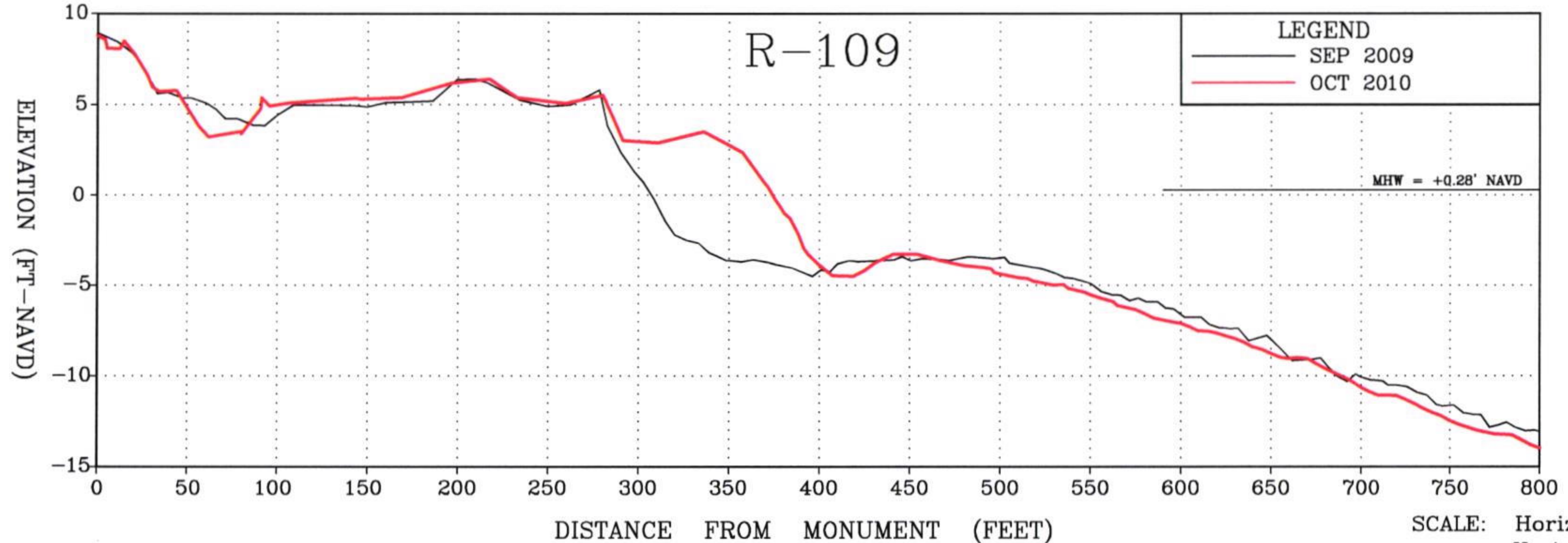

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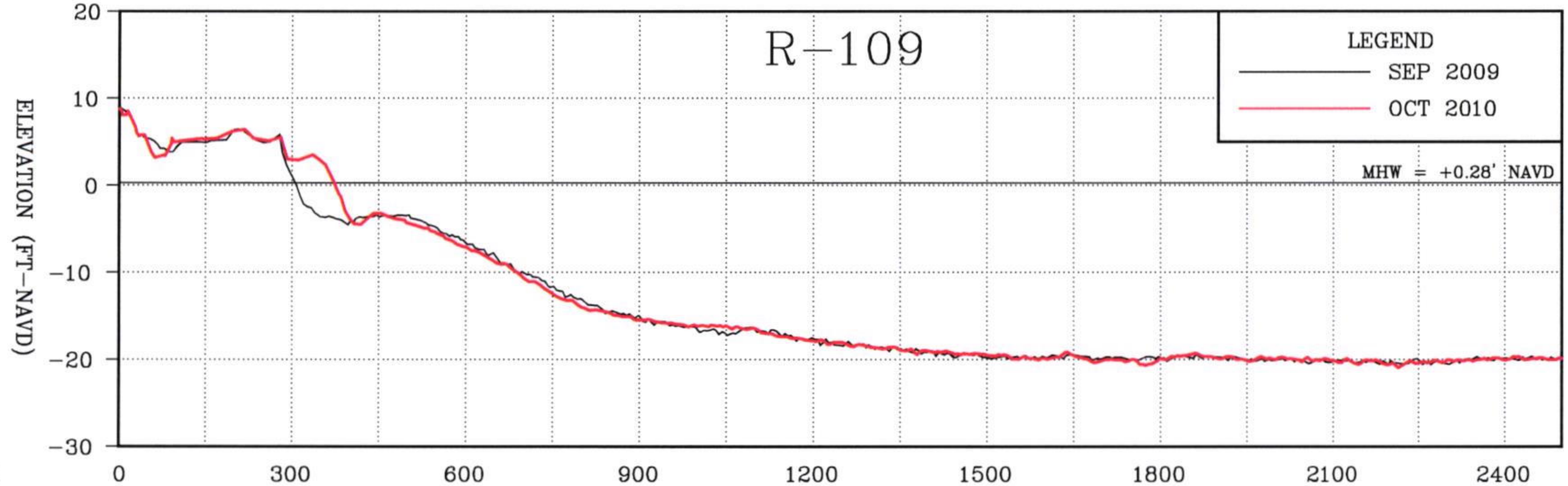

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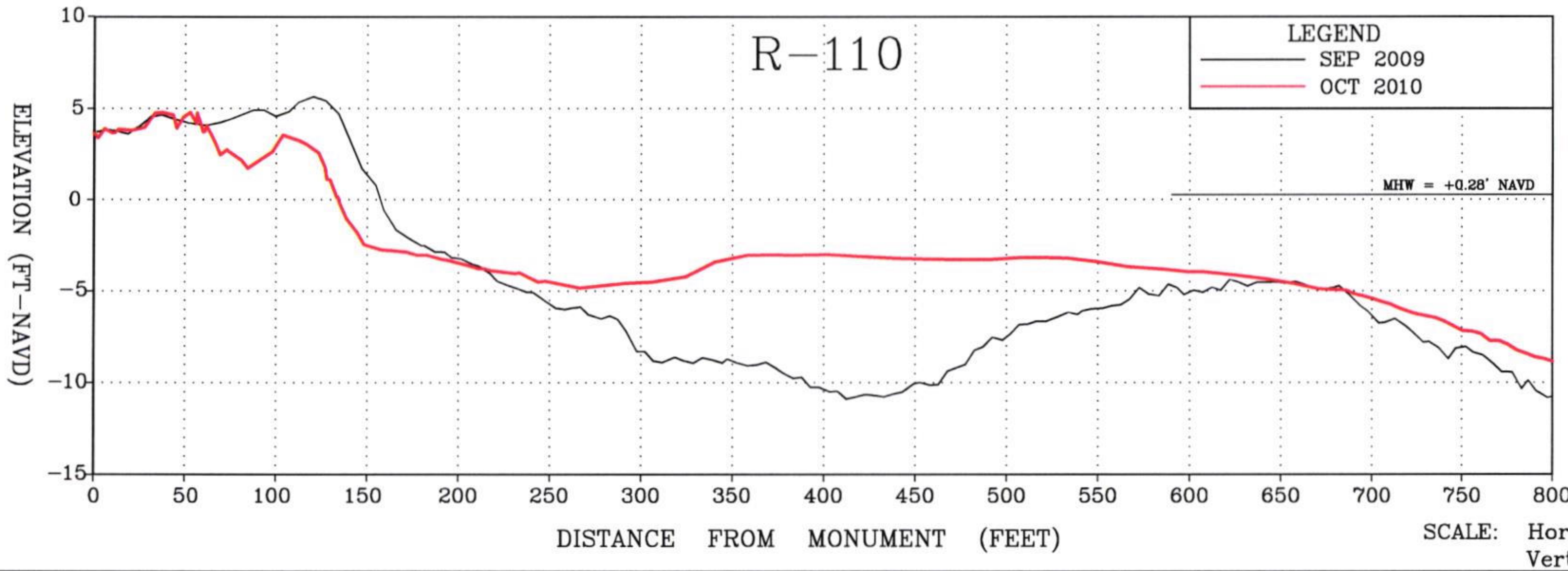

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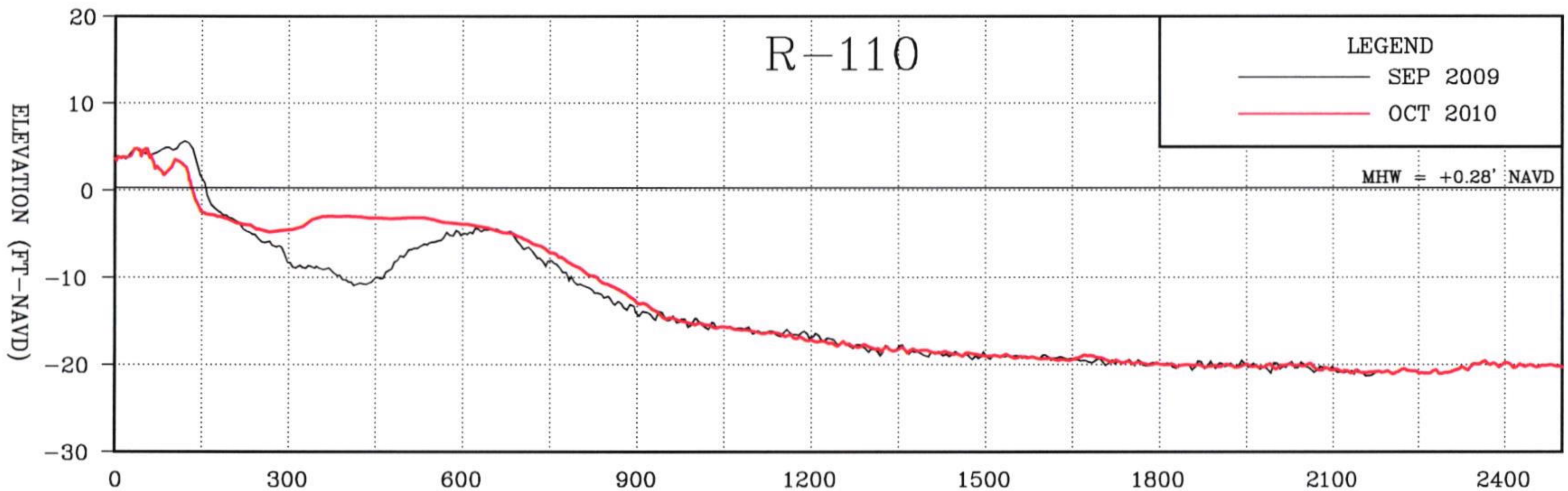

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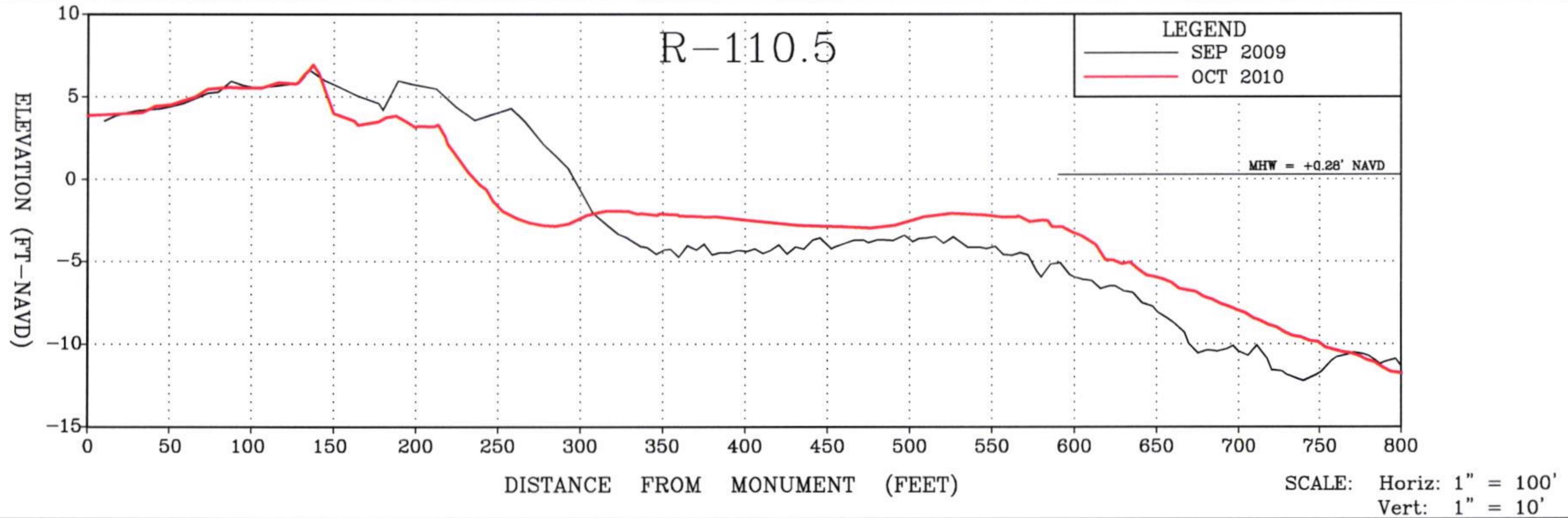
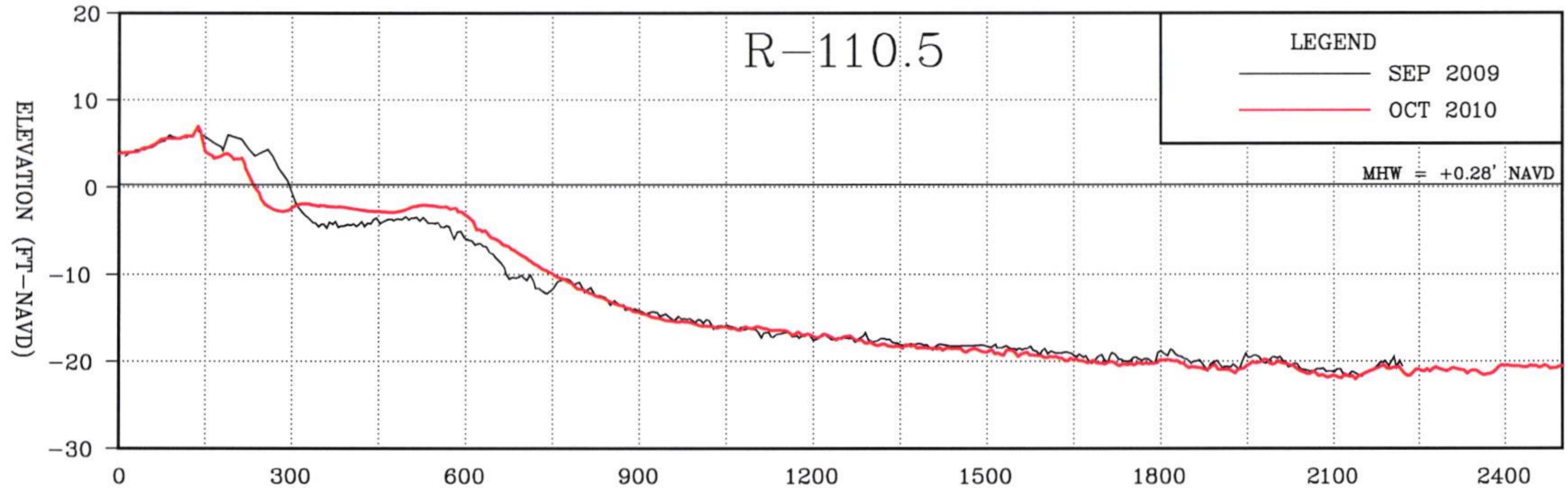
CHECKED: MTP	PG.		
SEC.	TWP.	RNG.	
ACAD NO. 10058 RMON XSEC.DWG			
REF. NO. 10058			

NO.	DATE	BY	REVISION DESCRIPTION

SHEET OF
FILE NO.: 10058





NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC.
   CEC JOB NO. 10.058

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PLANNING SERVICES

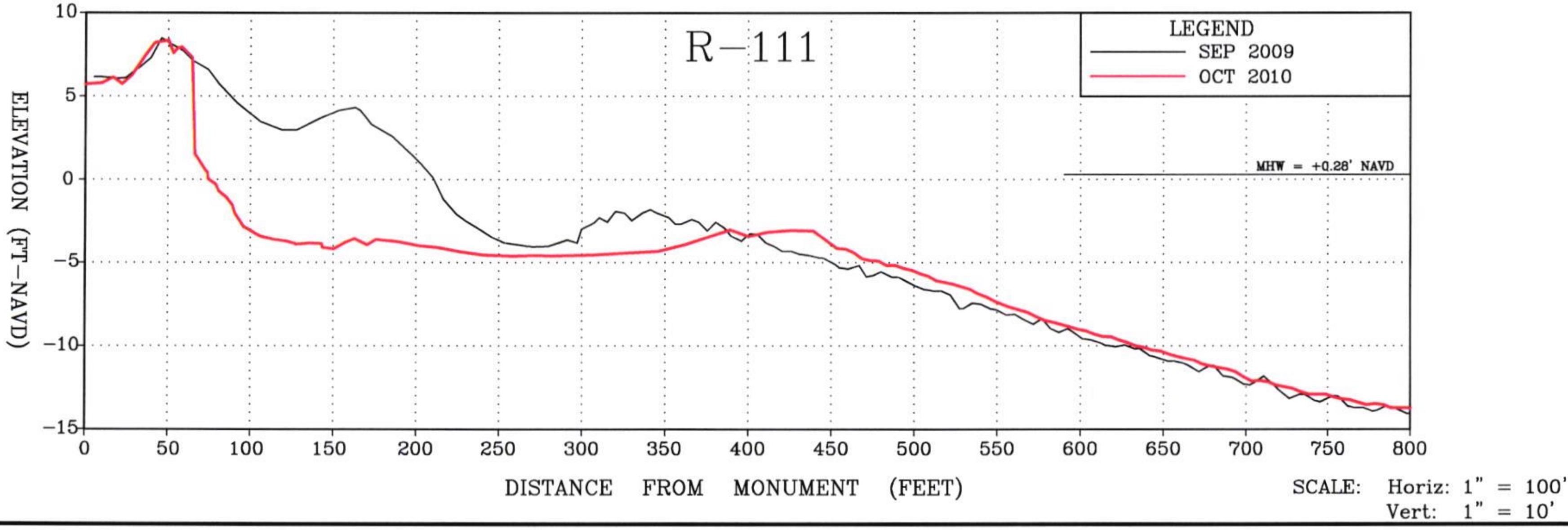
PHONE: (239)643-2324
FAX: (239)643-1143
www.coastalengineering.com
E-Mail: engcollier@cecifl.com

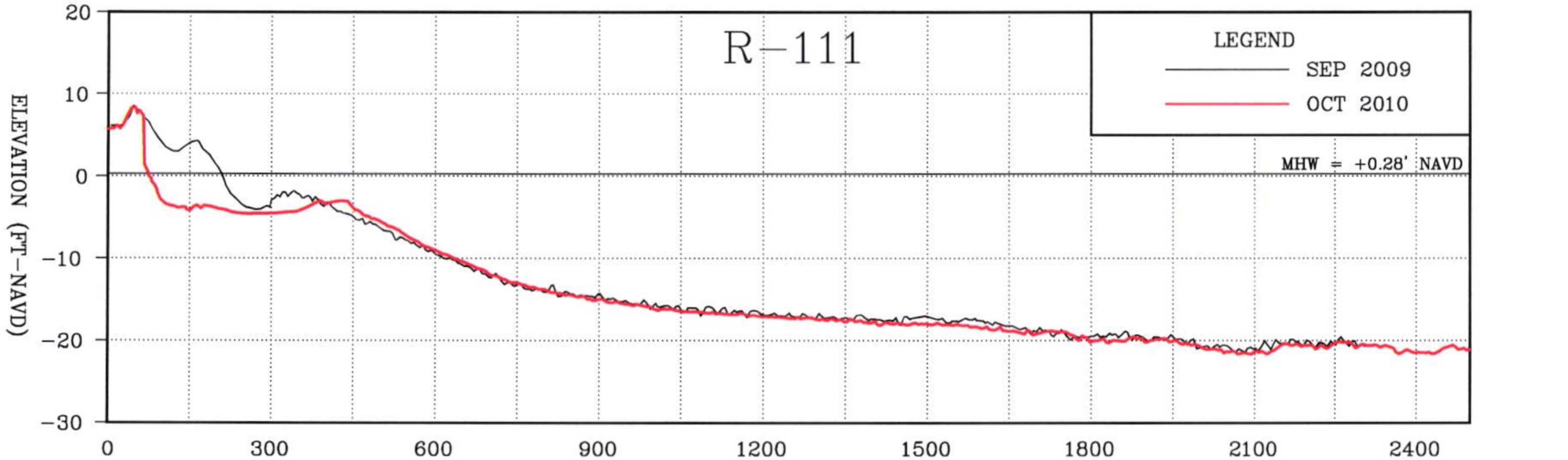
SHEET OF
FILE NO.: 10058

CLIENT:	LEE COUNTY
TITLE:	R-110.5 MONITORING SURVEY

DATE: NOV 19, 2010		SCALE: AS SHOWN	
DRAWN: SDB		F.B.	
CHECKED: MTP		PG.	
SEC.	TWP.	RNG.	
ACAD NO.	10058 RMON XSEC.DWG		
REF. NO.	10058		

NO.	DATE	BY	REVISION DESCRIPTION





NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC. CEC JOB NO. 10.058

SHEET OF
FILE NO.: 10058

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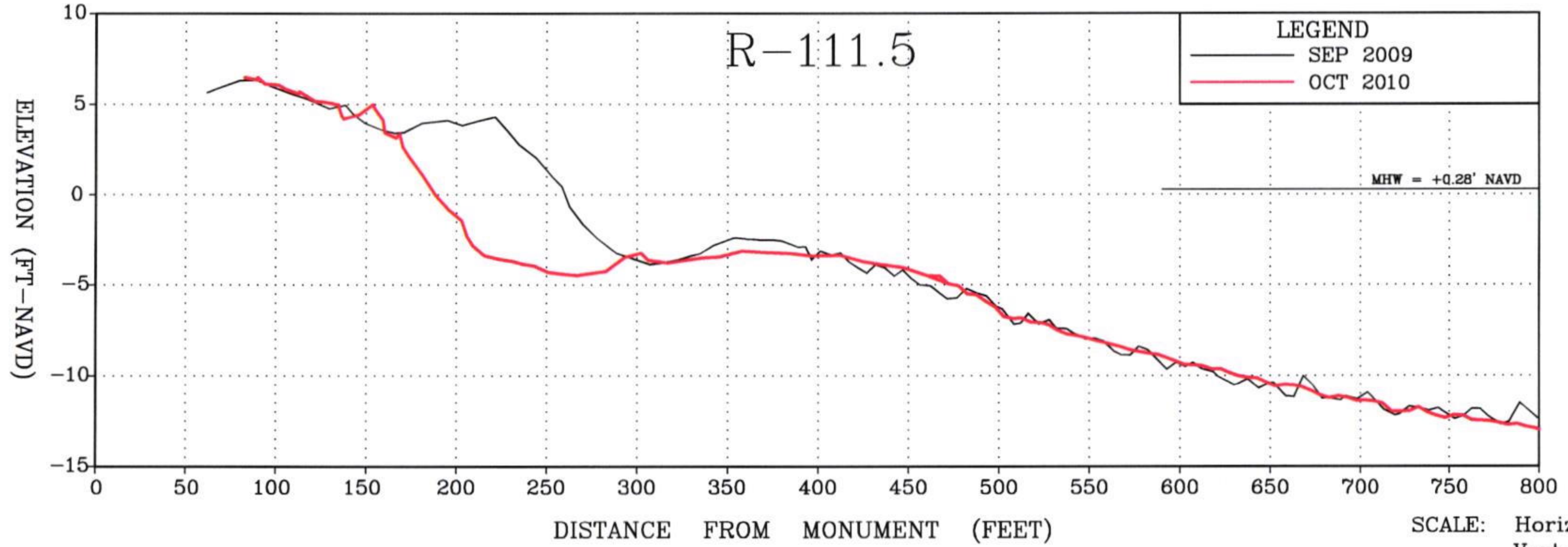
E–Mail: engcollier@cecifl.com

CLIENT: LEE COUNTY

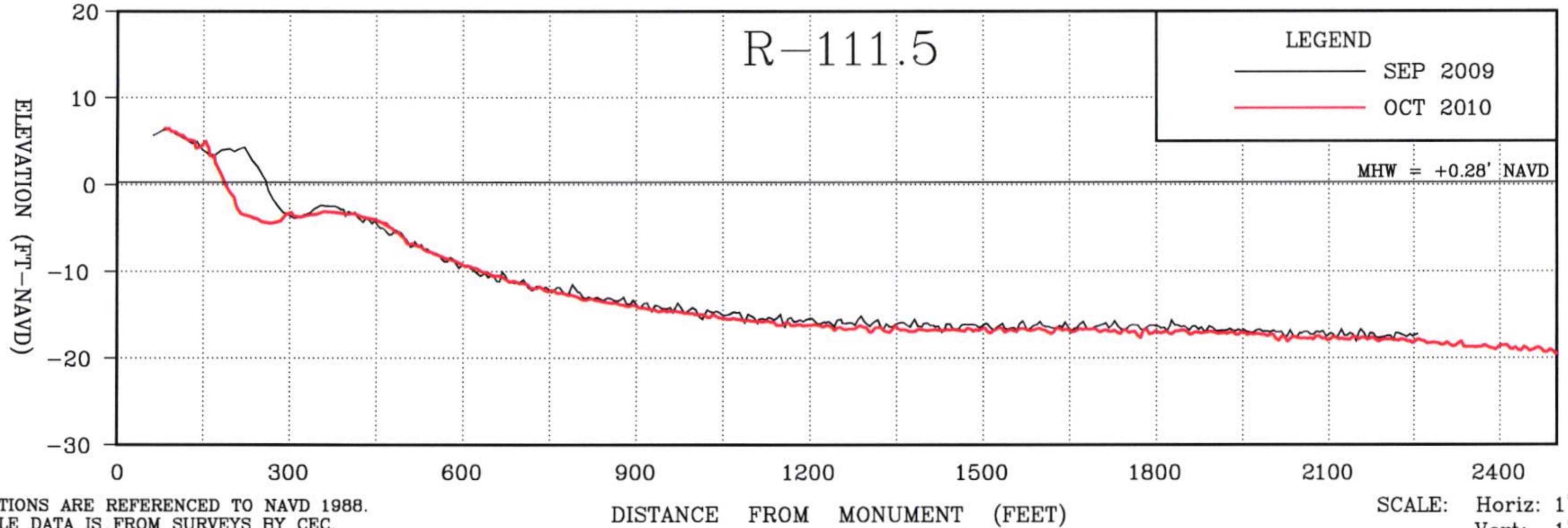
TITLE: R–111 MONITORING SURVEY

DATE: NOV 19, 2010		SCALE: AS SHOWN	
DRAWN: SDB		F.B.	
CHECKED: MTP		PG.	
SEC.	TWP.	RNG.	
ACAD NO. 10058 RMON XSEC.DWG			
REF. NO. 10058			

NO.	DATE	BY	REVISION DESCRIPTION



SCALE: Horiz: 1" = 100'
Vert: 1" = 10'



SCALE: Horiz: 1" = 300'
Vert: 1" = 20'

NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC.
   CEC JOB NO. 10.058

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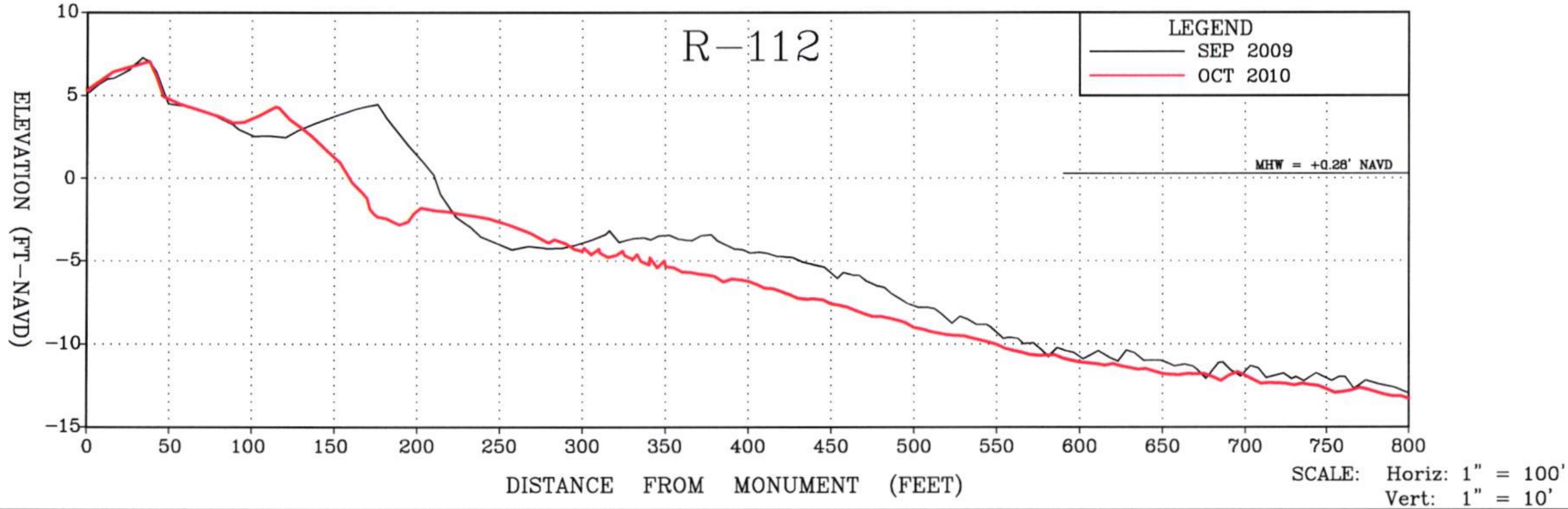
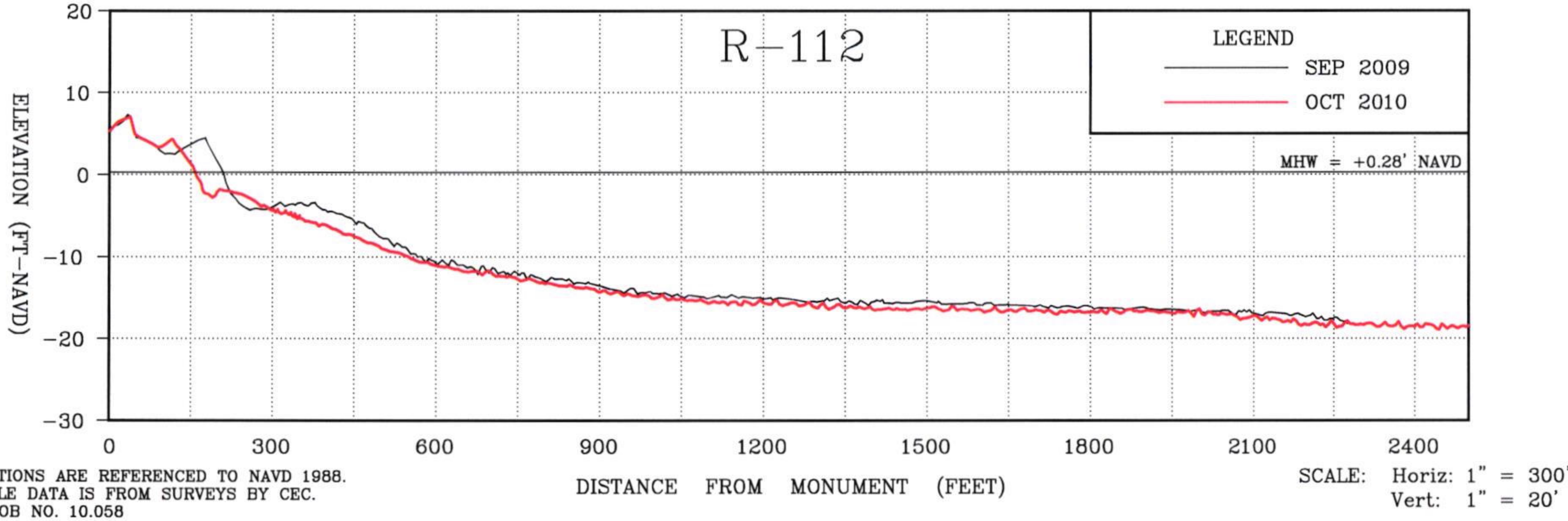
CLIENT: LEE COUNTY		DATE: NOV 19, 2010	SCALE: AS SHOWN
TITLE: R–111.5 MONITORING SURVEY		DRAWN: SDB	F.B.
		CHECKED: MTP	PG.
		SEC.	TWP. / RNG.
		ACAD NO. 10058 RMON XSEC.DWG	
		REF. NO. 10058	

NO.	DATE	BY	REVISION DESCRIPTION

SHEET OF
FILE NO.: 10058





NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC.
   CEC JOB NO. 10.058

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FAX: (239)643-1143
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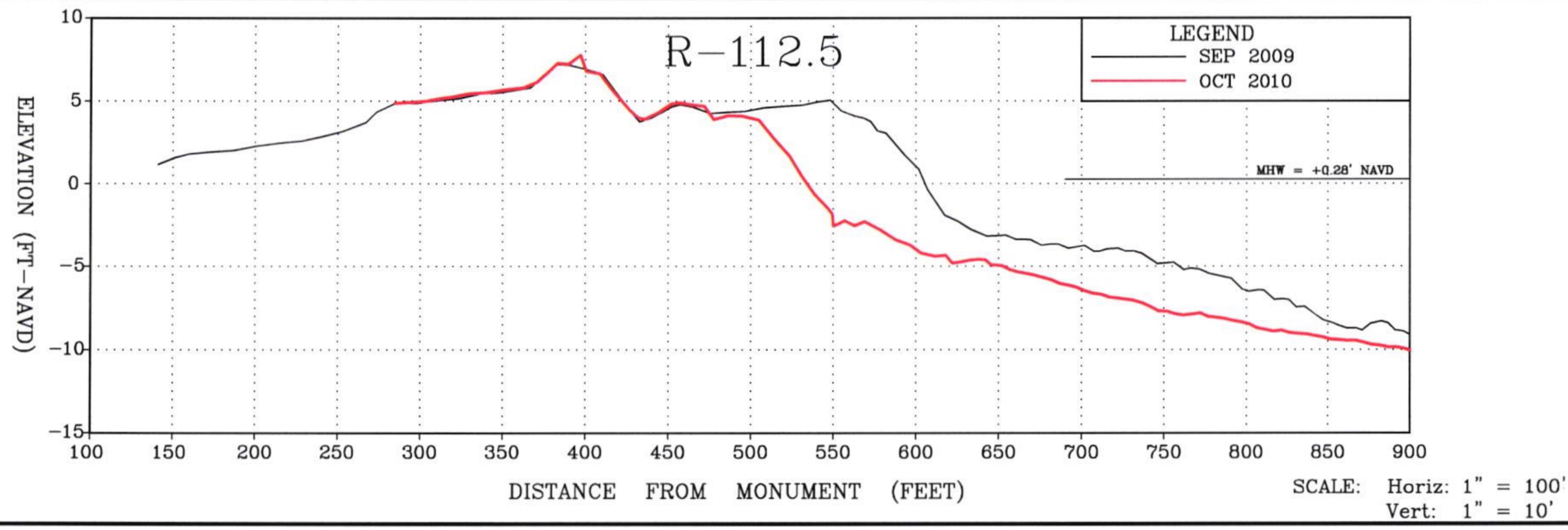
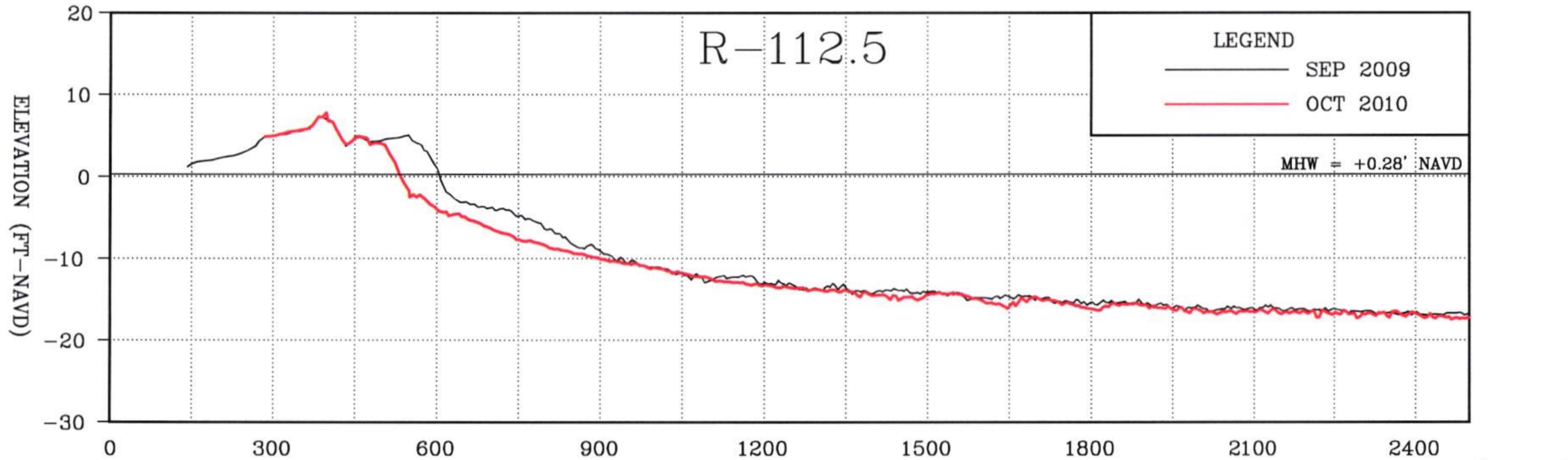
E-Mail: engcollier@cecifl.com

CLIENT:	LEE COUNTY
TITLE:	R-112 MONITORING SURVEY
DATE:	NOV 19, 2010
SCALE:	AS SHOWN
DRAWN:	SDB
F.B.	
CHECKED:	MTP
PG.	
SEC.	
TWP.	
RNG.	
ACAD NO.	10058 RMON XSEC.DWG
REF. NO.	10058
SHEET	OF
FILE NO.:	10058

NO.	DATE	BY	REVISION DESCRIPTION





NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC. CEC JOB NO. 10.058

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FAX: (239)643-1143
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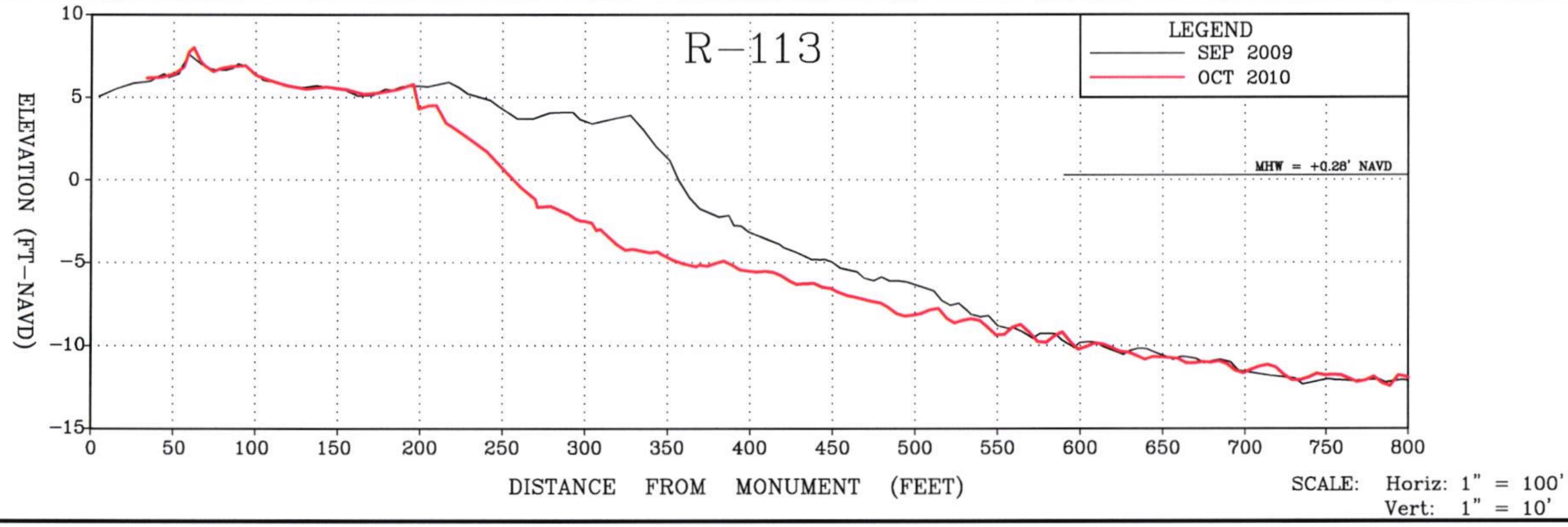
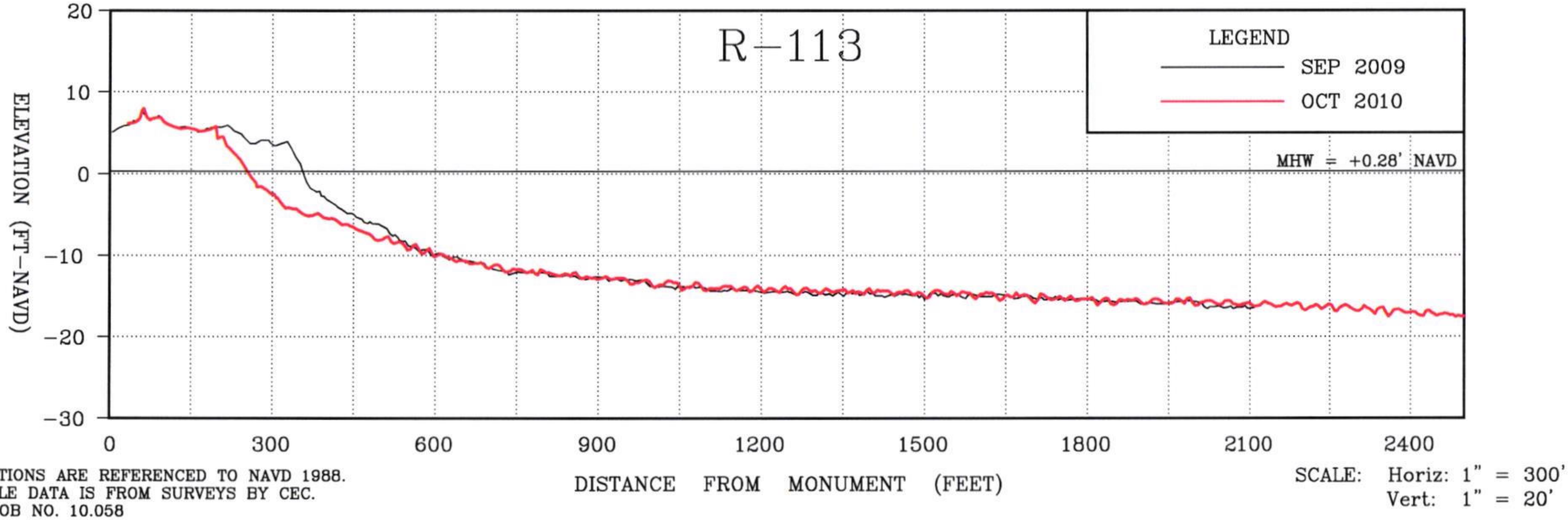
SHEET OF
FILE NO.: 10058

CLIENT: LEE COUNTY		DATE: NOV 19, 2010	SCALE: AS SHOWN
TITLE: R–112.5 MONITORING SURVEY		DRAWN: SDB	F.B.
		CHECKED: MTP	PG.
		SEC. / TWP.	RNG.
		ACAD NO. 10058 RMON XSEC.DWG	
		REF. NO. 10058	

NO.	DATE	BY	REVISION DESCRIPTION





NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC. CEC JOB NO. 10.058

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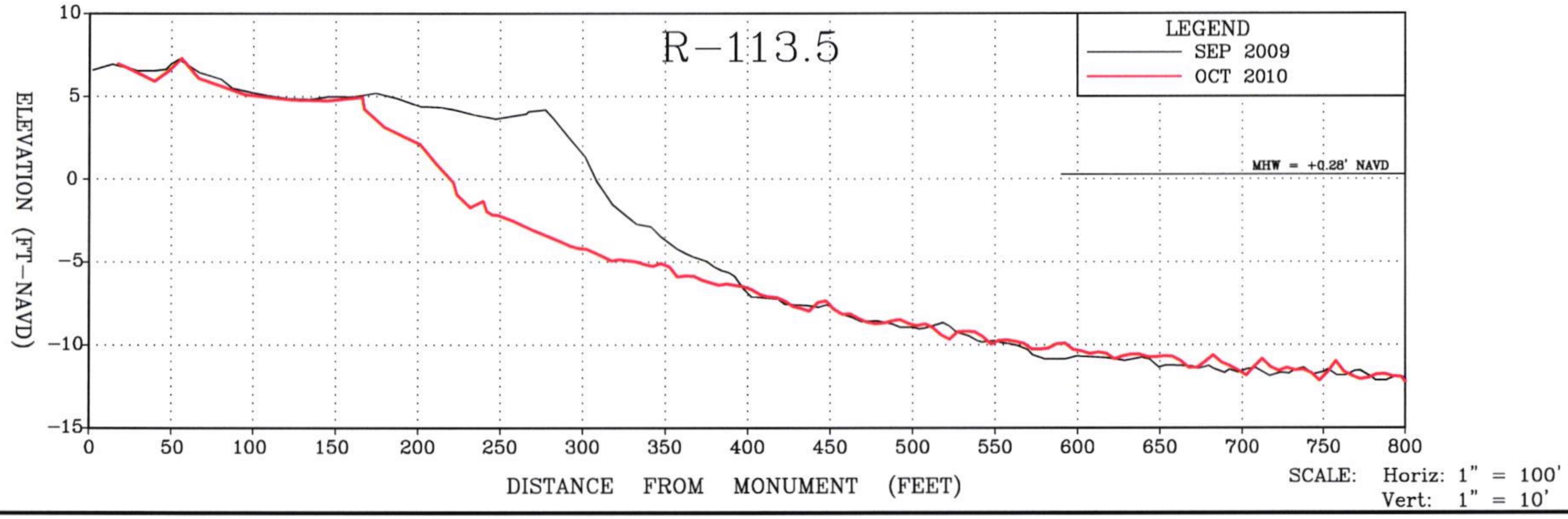
SHEET OF

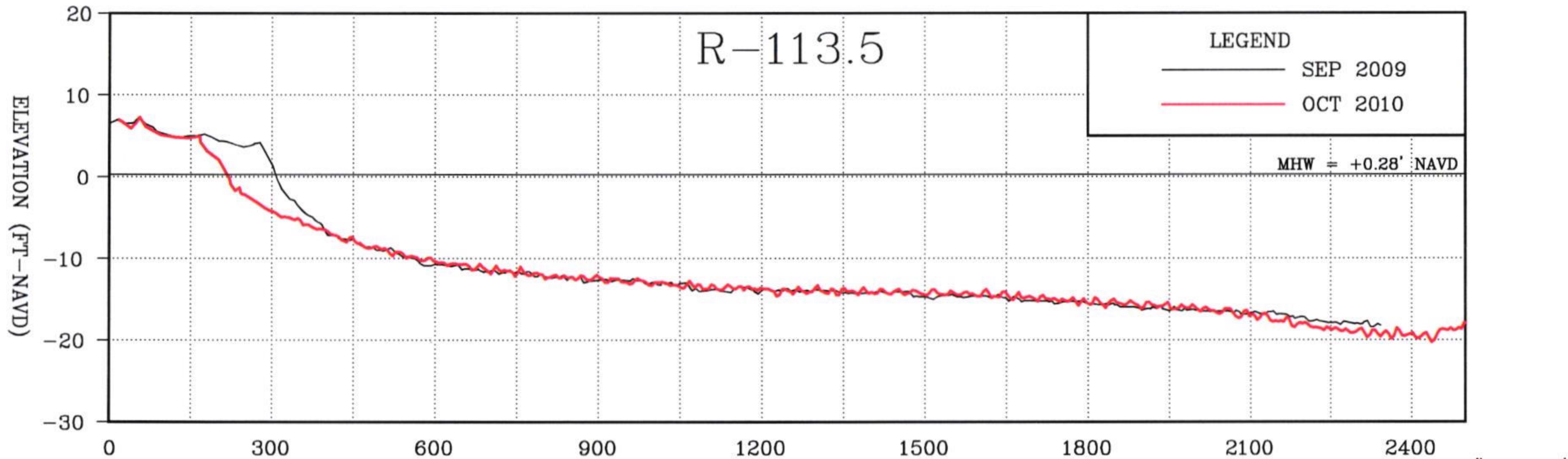
FILE NO.: 10058

CLIENT:	LEE COUNTY
TITLE:	R-113 MONITORING SURVEY

DATE: NOV 19, 2010	SCALE: AS SHOWN		
DRAWN: SDB	F.B.		
CHECKED: MTP	PG.		
SEC.	TWP.	RNG.	
ACAD NO.	10058 RMON XSEC.DWG		
REF. NO.	10058		

NO.	DATE	BY	REVISION DESCRIPTION





NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC. CEC JOB NO. 10.058

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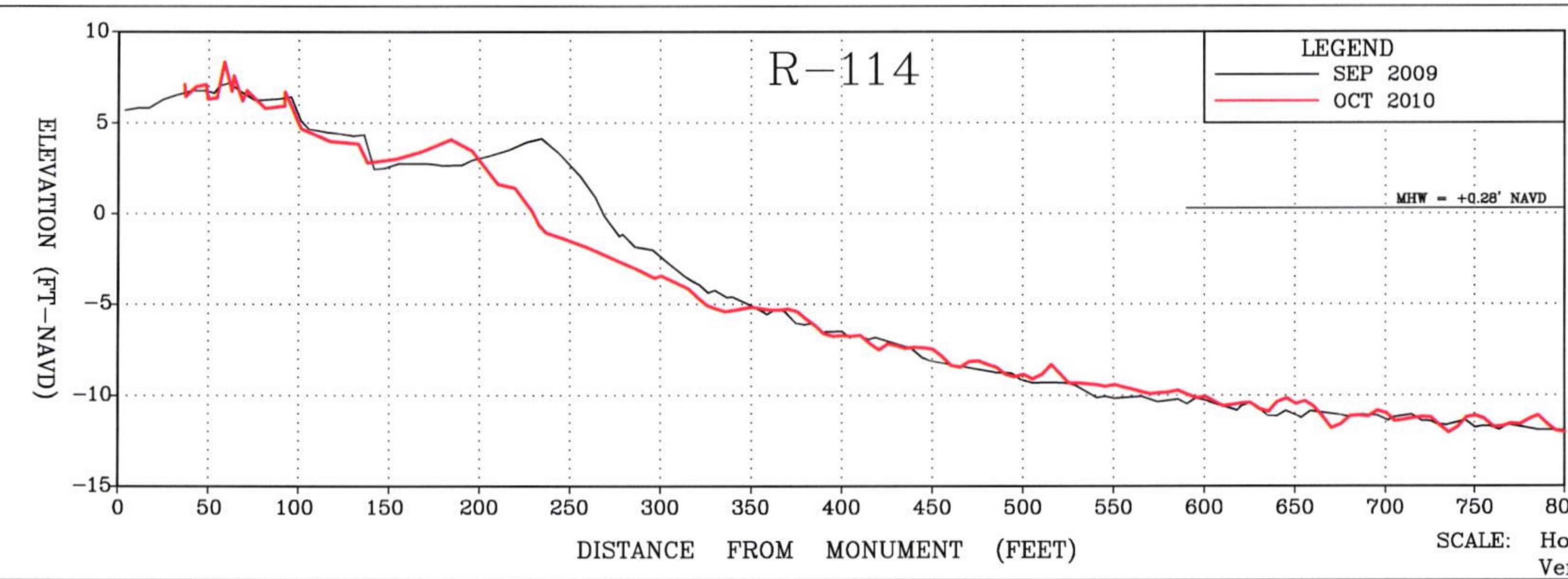
SHEET OF
FILE NO.: 10058

CLIENT: LEE COUNTY

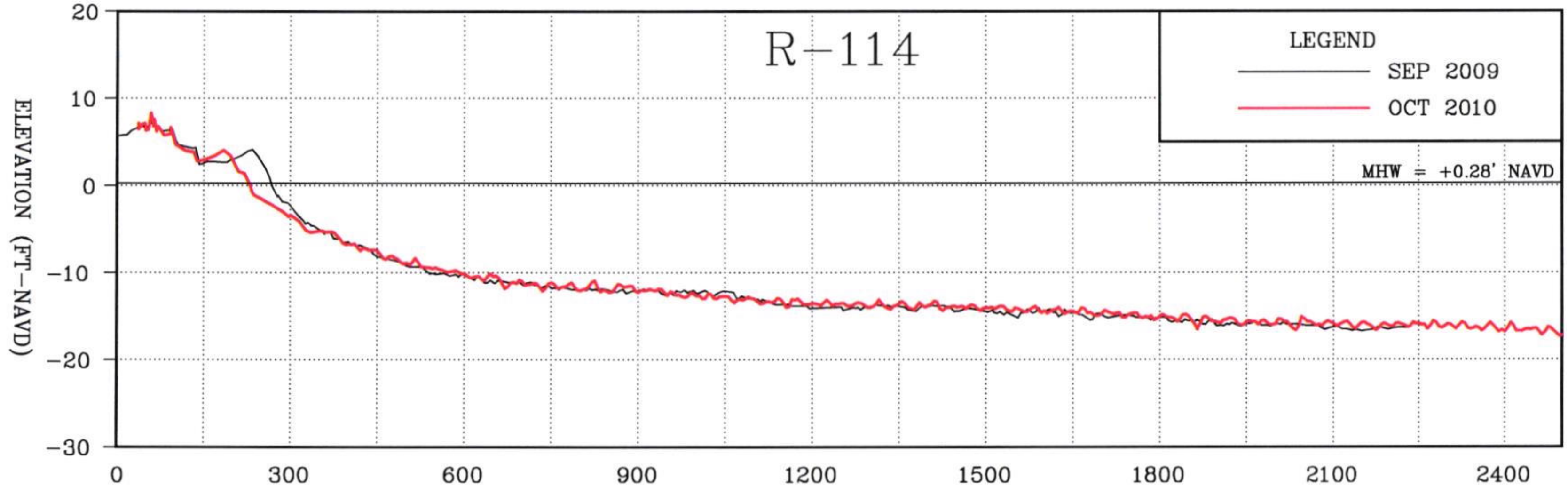
TITLE: R-113.5 MONITORING SURVEY

DATE: NOV 19, 2010		SCALE: AS SHOWN	
DRAWN: SDB		F.B.	
CHECKED: MTP		PG.	
SEC.	TWP.	RNG.	
ACAD NO. 10058 RMON XSEC.DWG			
REF. NO. 10058			

NO.	DATE	BY	REVISION DESCRIPTION



SCALE: Horiz: 1" = 100'
Vert: 1" = 10'



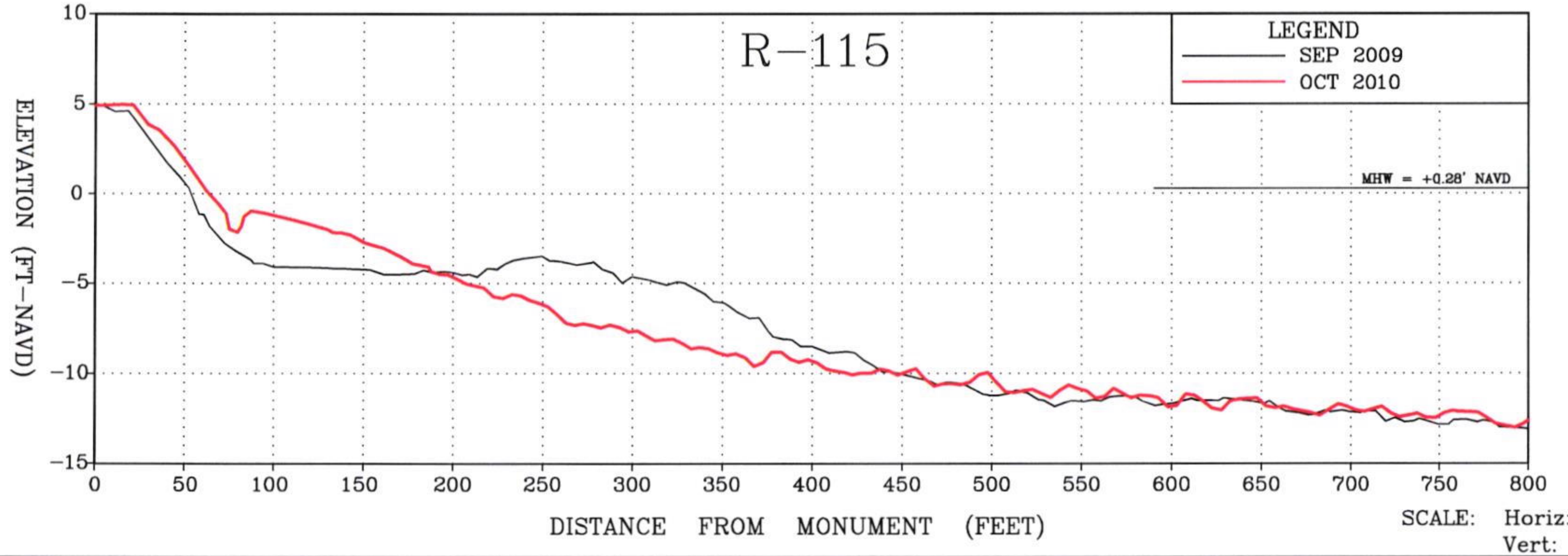
SCALE: Horiz: 1" = 300'
Vert: 1" = 20'

NOTES:

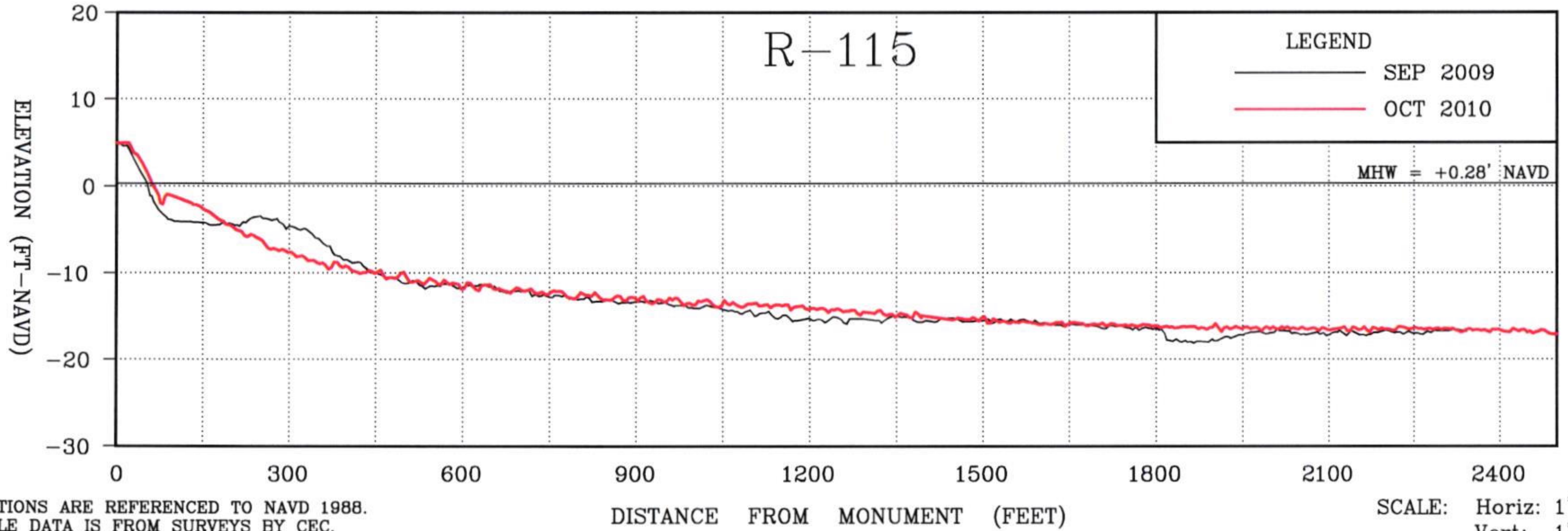
1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC.
   CEC JOB NO. 10.058

SHEET OF	FILE NO.: 10058	
COASTAL ENGINEERING CONSULTANTS INC. A CECI GROUP COMPANY Serving Florida Since 1977	CIVIL ENGINEERING SURVEY & MAPPING COASTAL ENGINEERING ENVIRONMENTAL PLANNING SERVICES	
3106 SOUTH HORSESHOE DRIVE NAPLES, FLORIDA 34104	PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: engcollier@cecifl.com	
CLIENT:	LEE COUNTY	
TITLE:	R-114 MONITORING SURVEY	
DATE: NOV 19, 2010	SCALE: AS SHOWN	
DRAWN: SDB	F.B.	
CHECKED: MTP	PG.	
SEC.	TWP.	RNG.
ACAD NO.	10058 RMON XSEC.DWG	
REF. NO.	10058	

NO.	DATE	BY	REVISION DESCRIPTION



SCALE: Horiz: 1" = 100'
Vert: 1" = 10'



SCALE: Horiz: 1" = 300'
Vert: 1" = 20'

NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC.
   CEC JOB NO. 10.058

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FAX: (239)643-1143
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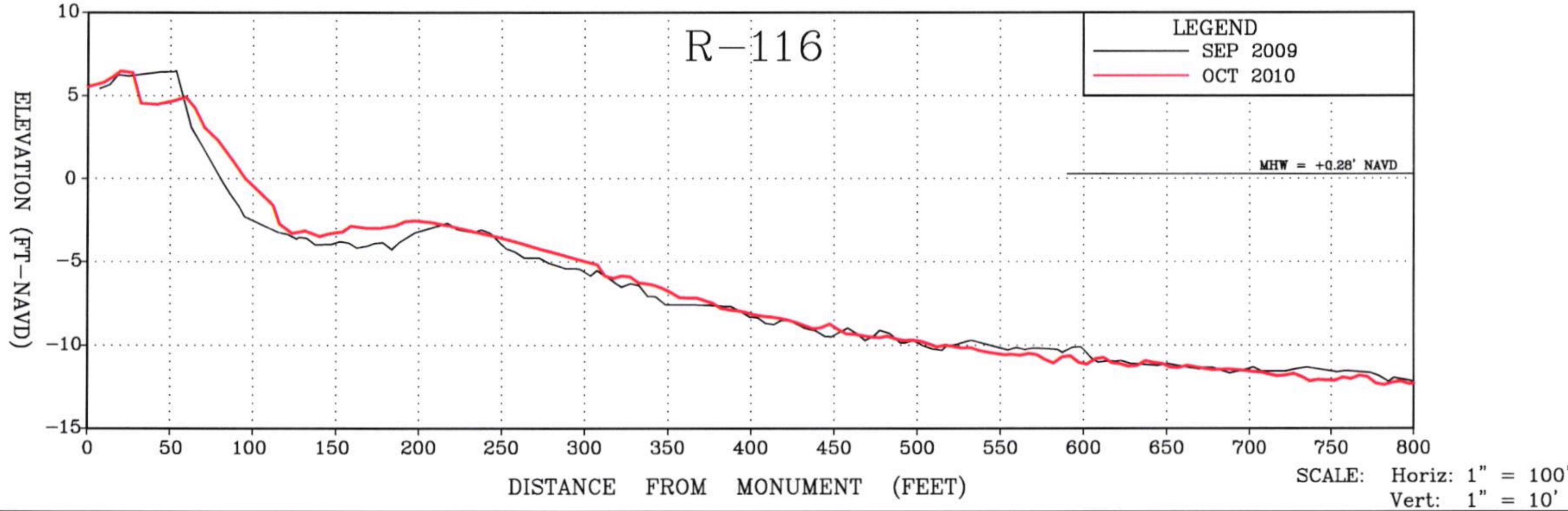
SHEET OF
FILE NO.: 10058

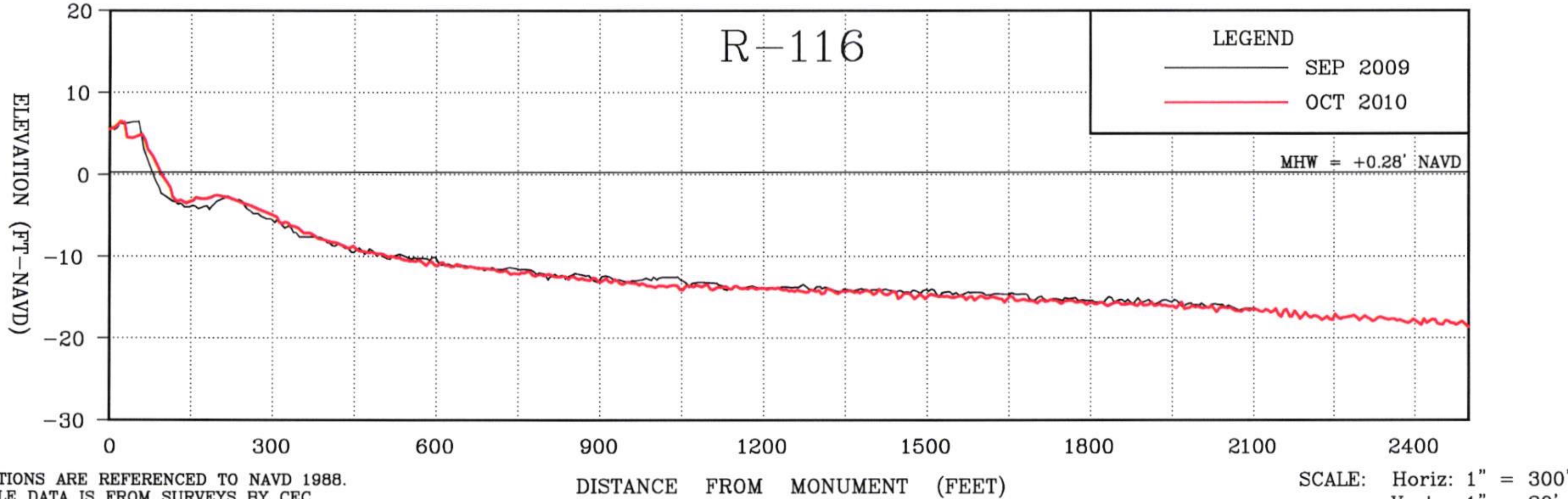
CLIENT: LEE COUNTY

TITLE: R-115 MONITORING SURVEY

DATE: NOV 19, 2010		SCALE: AS SHOWN	
DRAWN: SDB		F.B.	
CHECKED: MTP		PG.	
SEC.	TWP.	RNG.	
ACAD NO. 10058 RMON XSEC.DWG			
REF. NO. 10058			

NO.	DATE	BY	REVISION DESCRIPTION





NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC. CEC JOB NO. 10.058

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FAX: (239)643-1143
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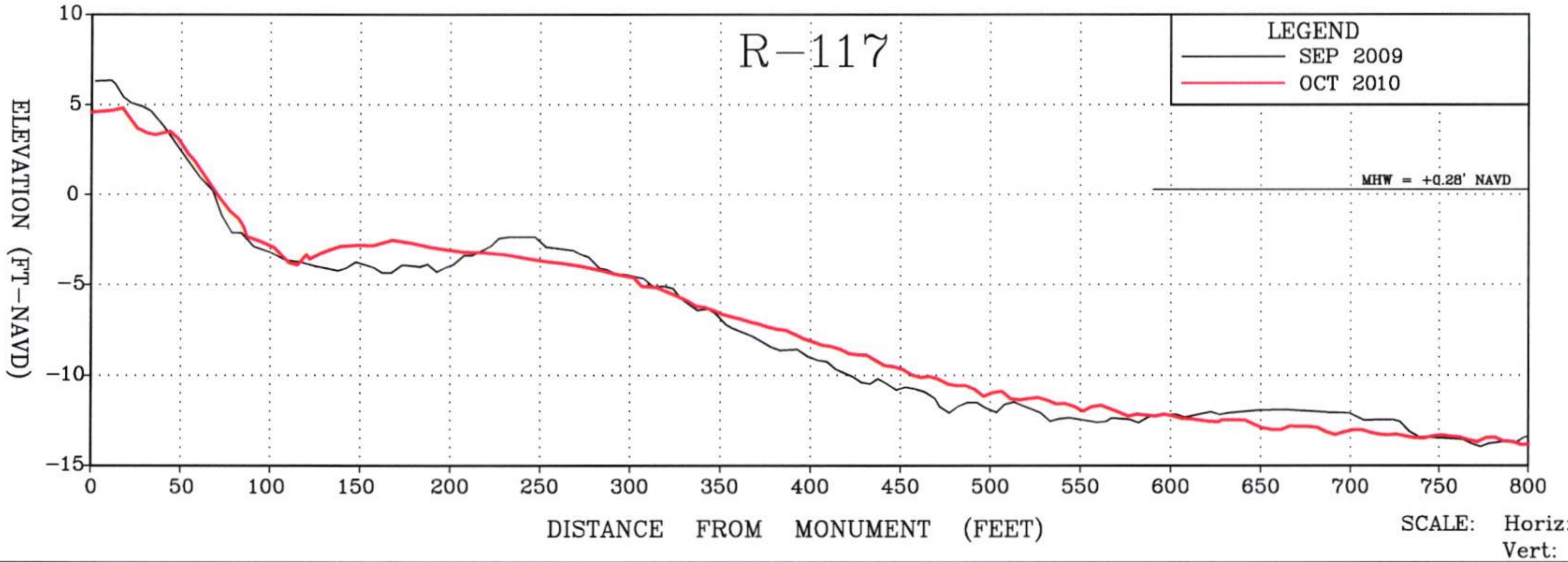
E-Mail: engcollier@cecifl.com

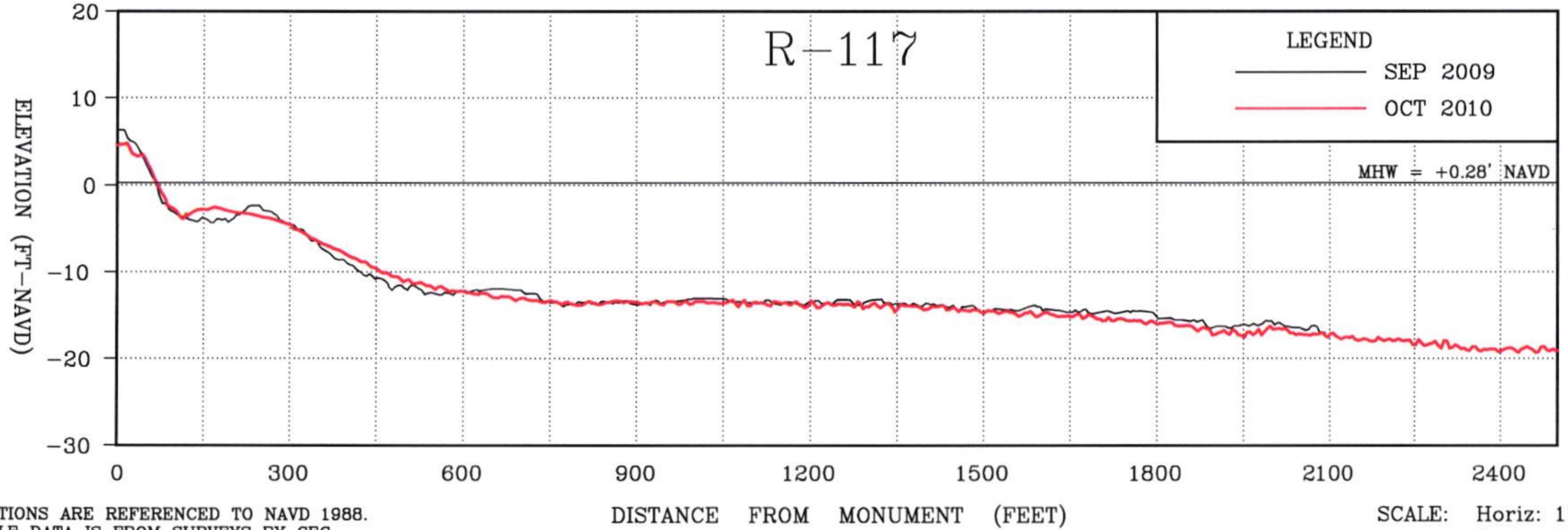
CLIENT: LEE COUNTY	DATE: NOV 19, 2010	SCALE: AS SHOWN	
TITLE: R-116 MONITORING SURVEY	DRAWN: SDB	F.B.	
	CHECKED: MTP	PG.	
	SEC.	TWP.	RNG.
	ACAD NO. 10058 RMON XSEC.DWG		
	REF. NO. 10058		

NO.	DATE	BY	REVISION DESCRIPTION

SHEET OF
FILE NO.: 10058



SCALE: Horiz: 1" = 100'
Vert: 1" = 10'



SCALE: Horiz: 1" = 300'
Vert: 1" = 20'

NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC.
   CEC JOB NO. 10.058

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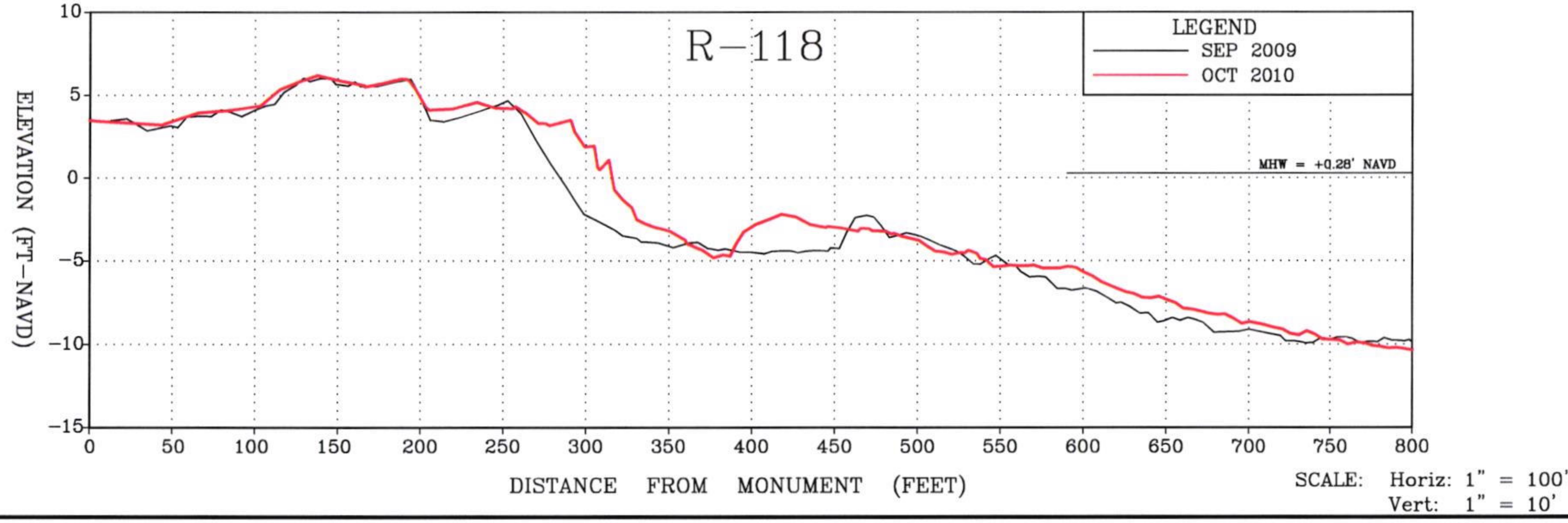
SHEET OF
FILE NO.: 10058

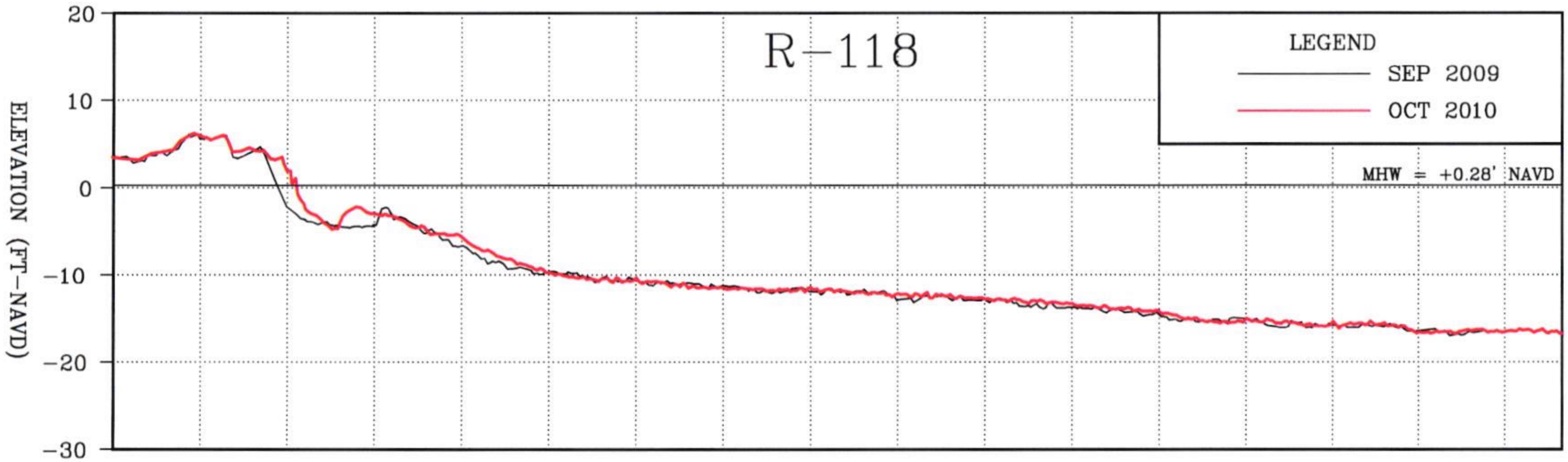
CLIENT: LEE COUNTY

TITLE: R–117 MONITORING SURVEY

DATE: NOV 19, 2010		SCALE: AS SHOWN	
DRAWN: SDB		F.B.	
CHECKED: MTP		PG.	
SEC.	TWP.	RNG.	
ACAD NO. 10058 RMON XSEC.DWG			
REF. NO. 10058			

NO.	DATE	BY	REVISION DESCRIPTION





NOTES:

1. ELEVATIONS ARE REFERENCED TO NAVD 1988.
2. PROFILE DATA IS FROM SURVEYS BY CEC. CEC JOB NO. 10.058

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SHEET OF
FILE NO.: 10058

CLIENT: LEE COUNTY

TITLE: R−118 MONITORING SURVEY

DATE: NOV 19, 2010	SCALE: AS SHOWN		
DRAWN: SDB	F.B.		
CHECKED: MTP	PG.		
SEC.	TWP.	RNG.	
ACAD NO. 10058 RMON XSEC.DWG			
REF. NO. 10058			

NO.	DATE	BY	REVISION DESCRIPTION

APPENDIX 4

BLIND PASS AND EBB SHOAL CROSS SECTIONS

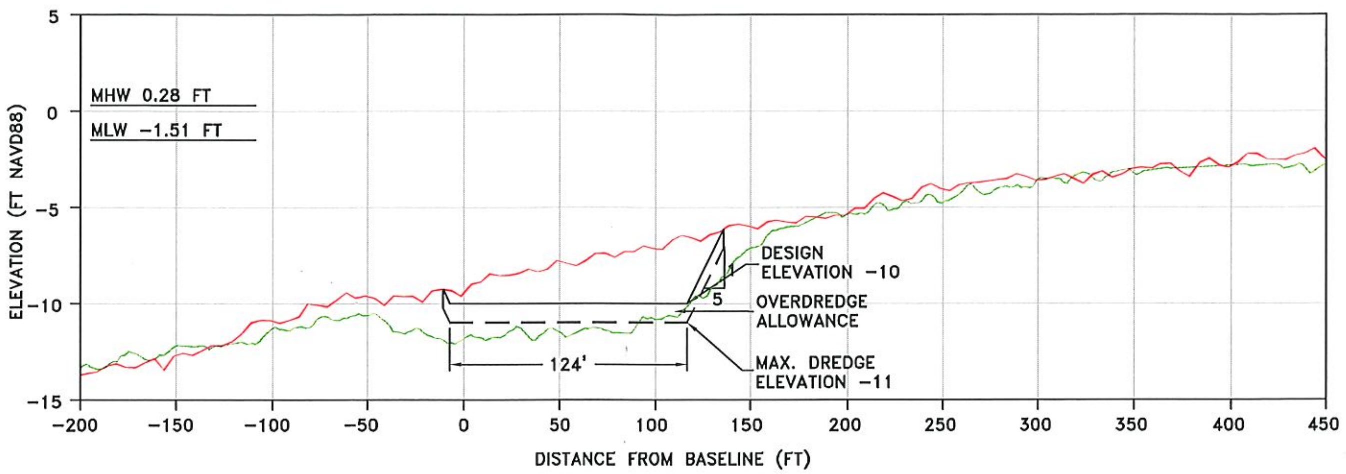
COASTAL ENGINEERING CONSULTANTS INC. A CECI GROUP COMPANY Serving Florida Since 1977. 3106 SOUTH HORSESHOE DRIVE NAPLES, FLORIDA 34104	CIVIL ENGINEERING SURVEY & MAPPING COASTAL ENGINEERING REAL ESTATE APPRAISAL PLANNING SERVICES. PHONE: (239)643-2324 FAX: (239)643-1143 www.coastalengineering.com E-Mail: engcollier@ceclfl.com	CLIENT: LEE COUNTY BOARD OF COMMISSIONERS	DATE: 2/22/11 SCALE: AS NOTED
		TITLE: BLIND PASS AND EBB SHOAL	DRAWN: VVA F.B.
			CHECKED: MTP PG.
			SEC. TWP. RNG.
			ACAD NO. Location Map.dwg
			REF. NO. 10.058

NO.	DATE	BY	REVISION DESCRIPTION

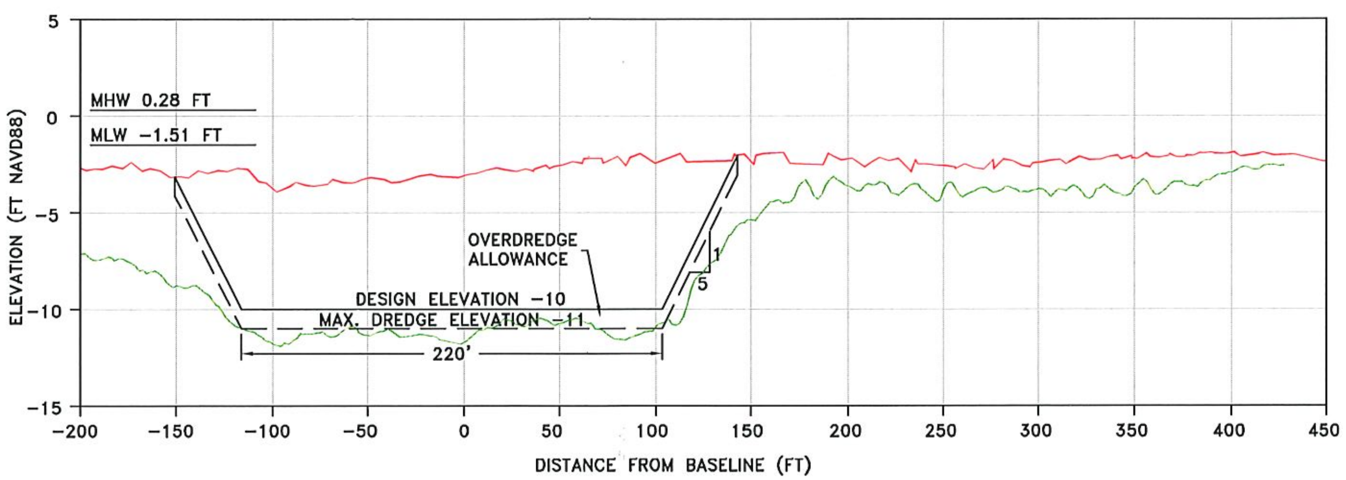
SHEET 1 OF
FILE NO.: 10058

SCALE:
H: 1" = 100'
V: 1" = 10'

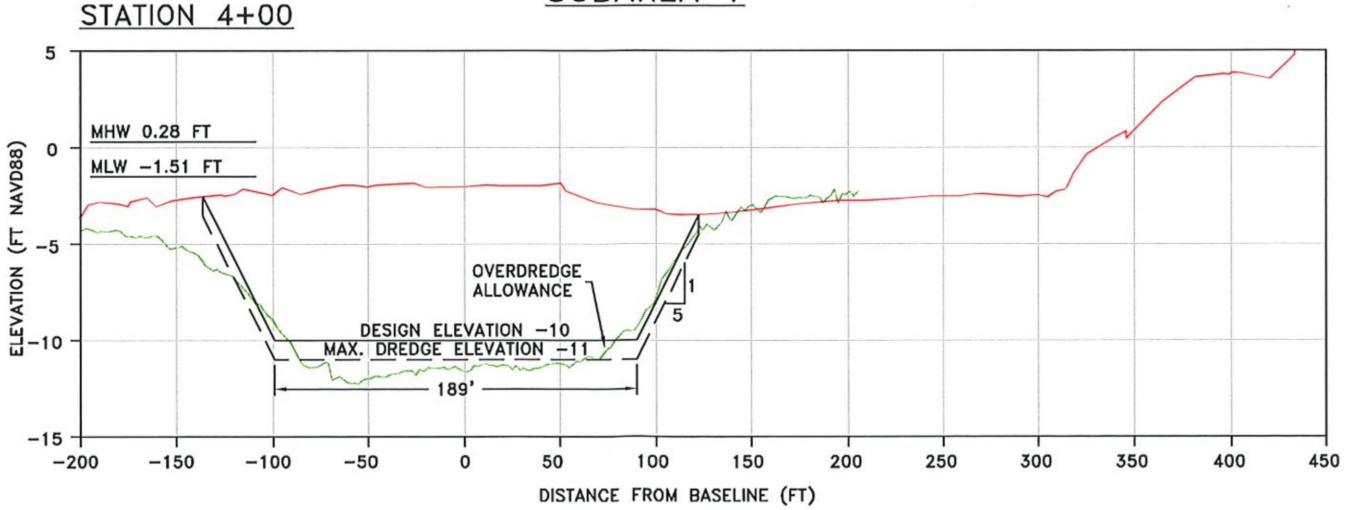
SUBAREA 1



SUBAREA 1

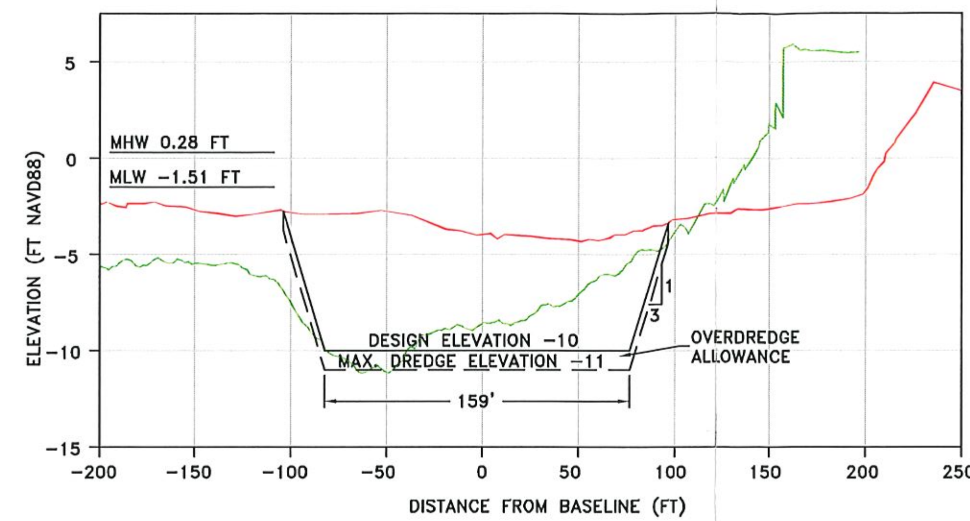


SUBAREA 1

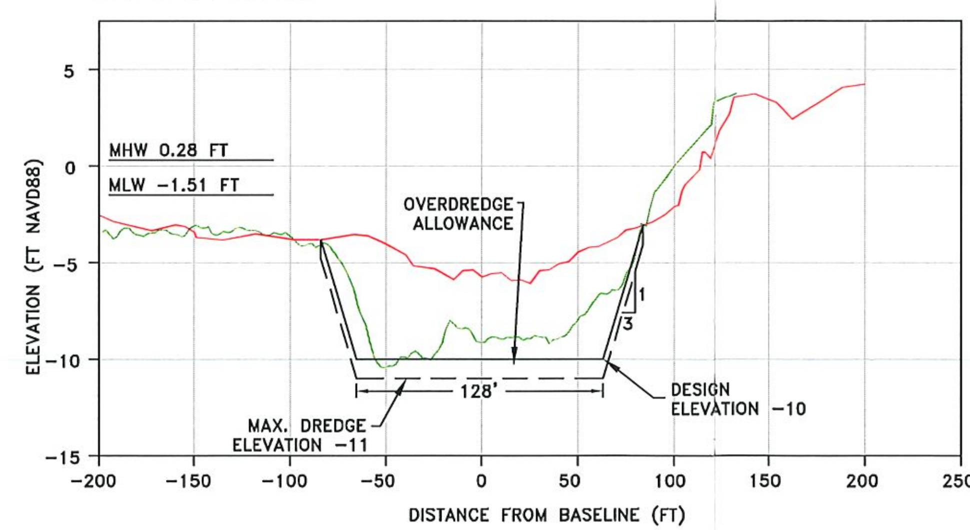


LEGEND
SURVEY CONDUCTED OCTOBER 19, 2010
SURVEY CONDUCTED AUGUST 25, 2009

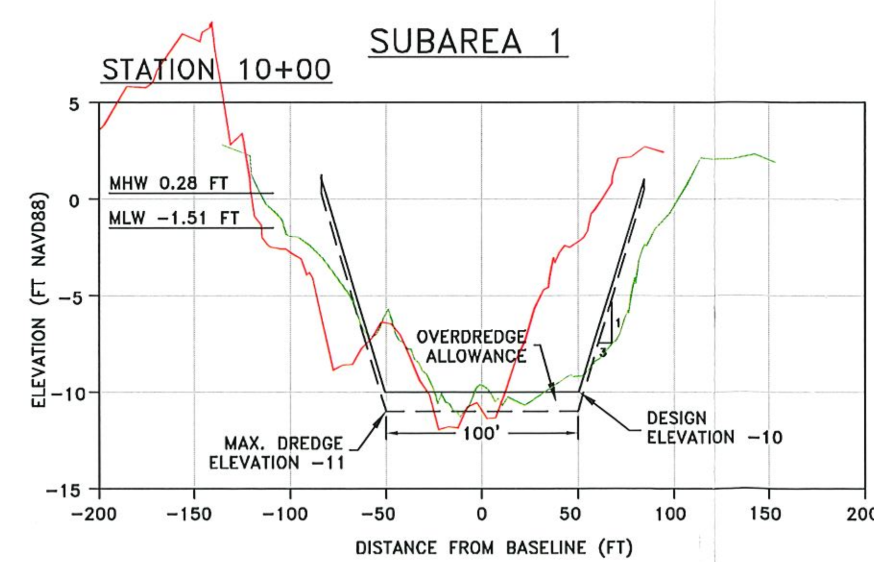
SUBAREA 1



SUBAREA 1



SUBAREA 1



NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058_XSEC POST CON_APPENDIX 2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION CROSS SECTIONS STA 0+00 TO 10+00

CIVIL ENGINEERING
SURVEY & MAPPING
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PHONE: (239)643-2324
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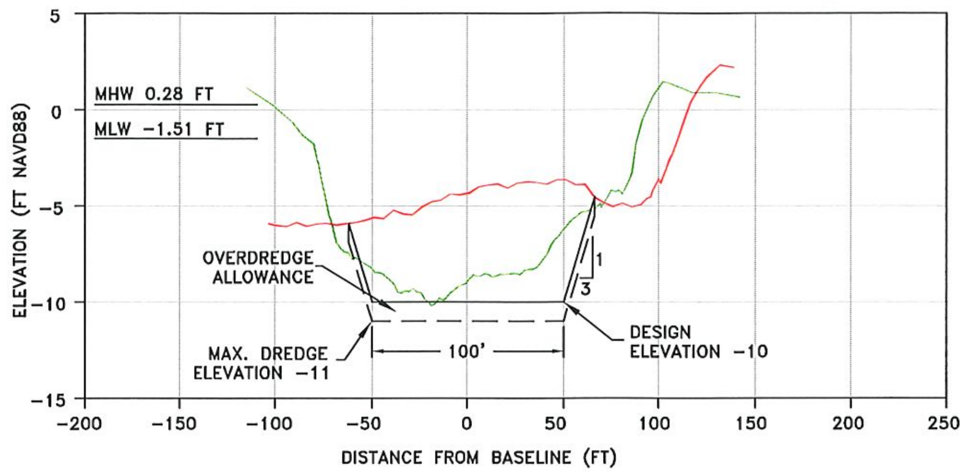
3106 SOUTH HORSESHOE DRIVE
NAPLES, FLORIDA 34104

SHEET 1 OF
FILE NO.: 10058

SCALE:
H: 1" = 100'
V: 1" = 10'

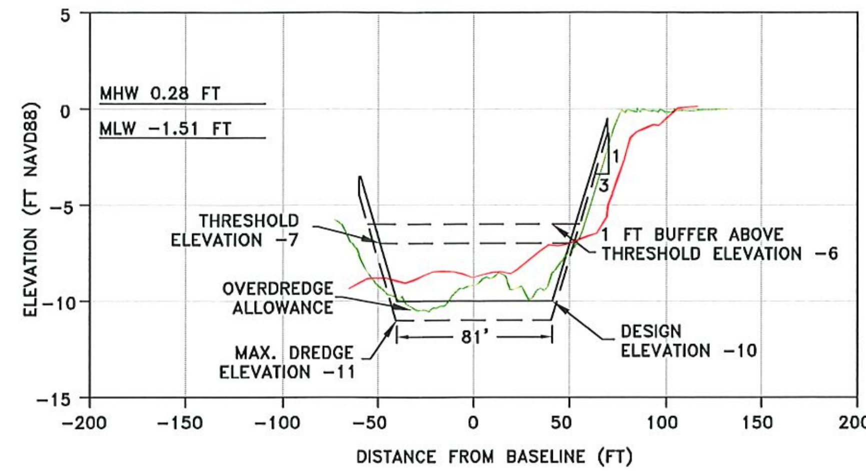
SUBAREA 1

STATION 12+00



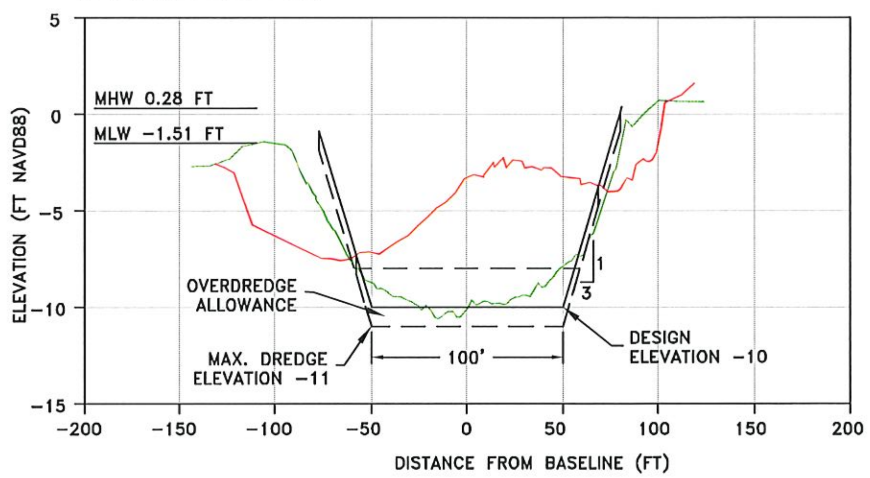
SUBAREA 3

STATION 18+00



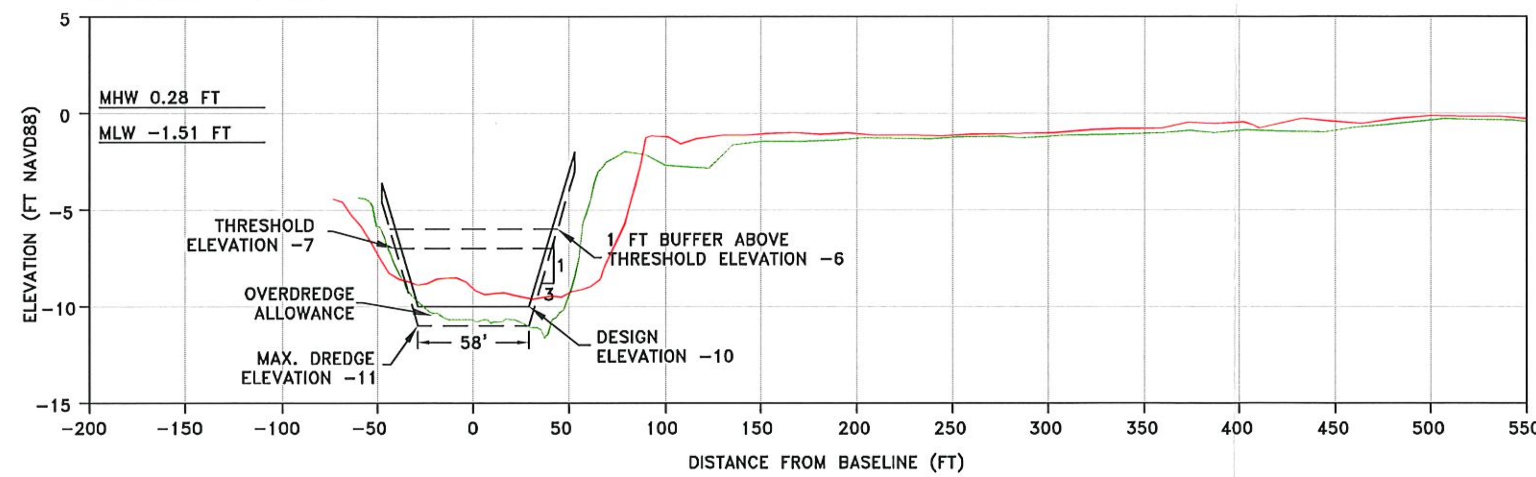
SUBAREA 1

STATION 14+00



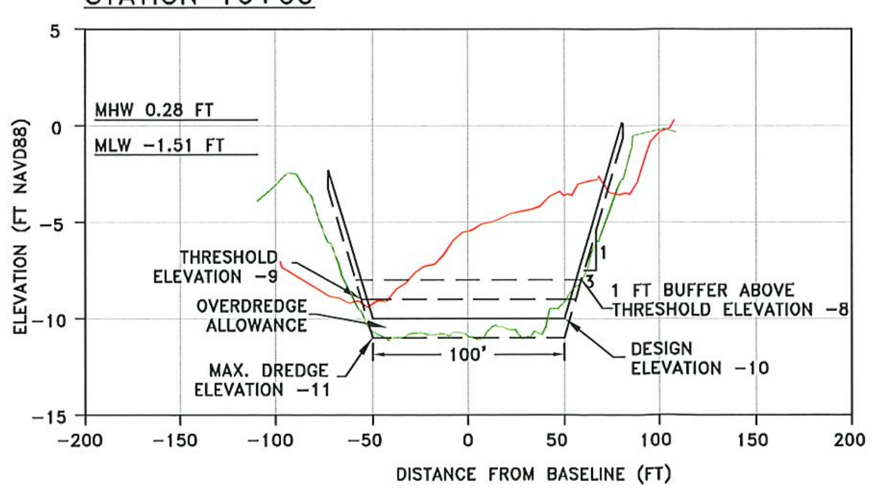
SUBAREA 3

STATION 20+00



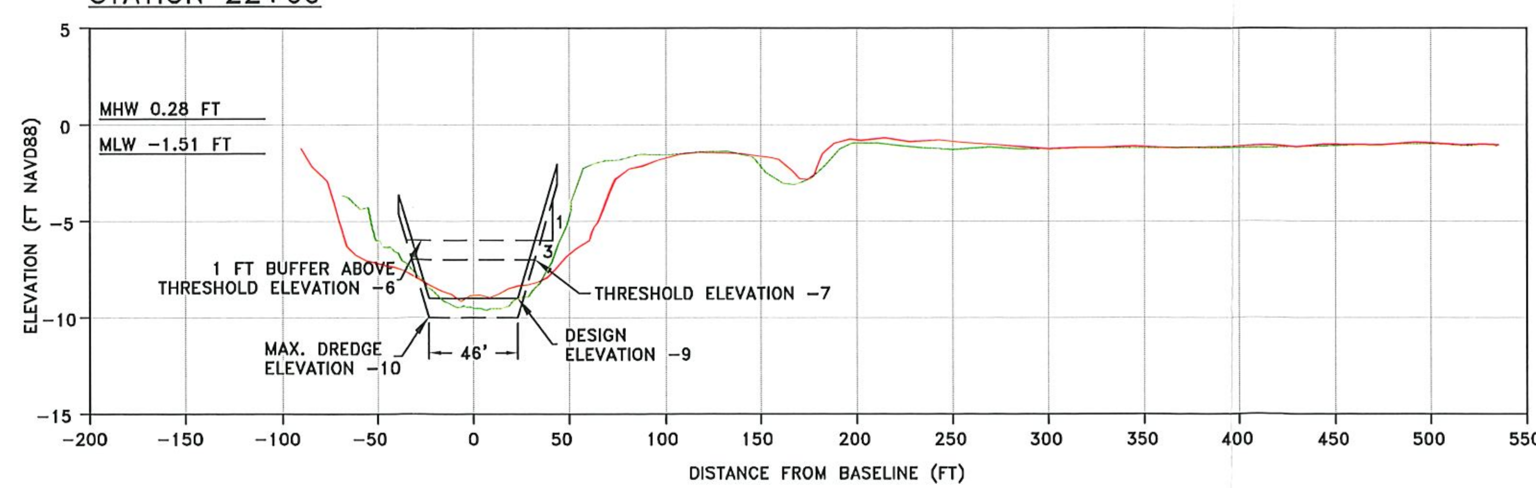
SUBAREA 2

STATION 16+00



SUBAREA 4

STATION 22+00



LEGEND

SURVEY CONDUCTED OCTOBER 19, 2010

SURVEY CONDUCTED AUGUST 25, 2009

NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058_XSEC POST CON_APPENDIX 2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION CROSS SECTIONS STA 12+00 TO 22+00

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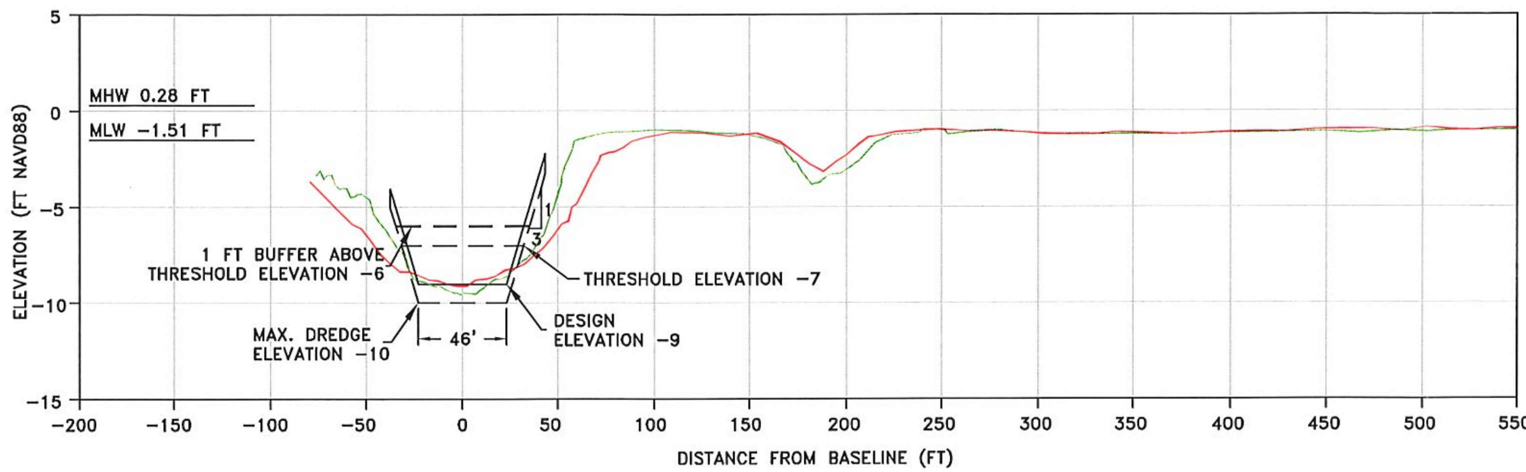
SHEET 2 OF
FILE NO.: 10058

SCALE:
H: 1" = 100'
V: 1" = 10'

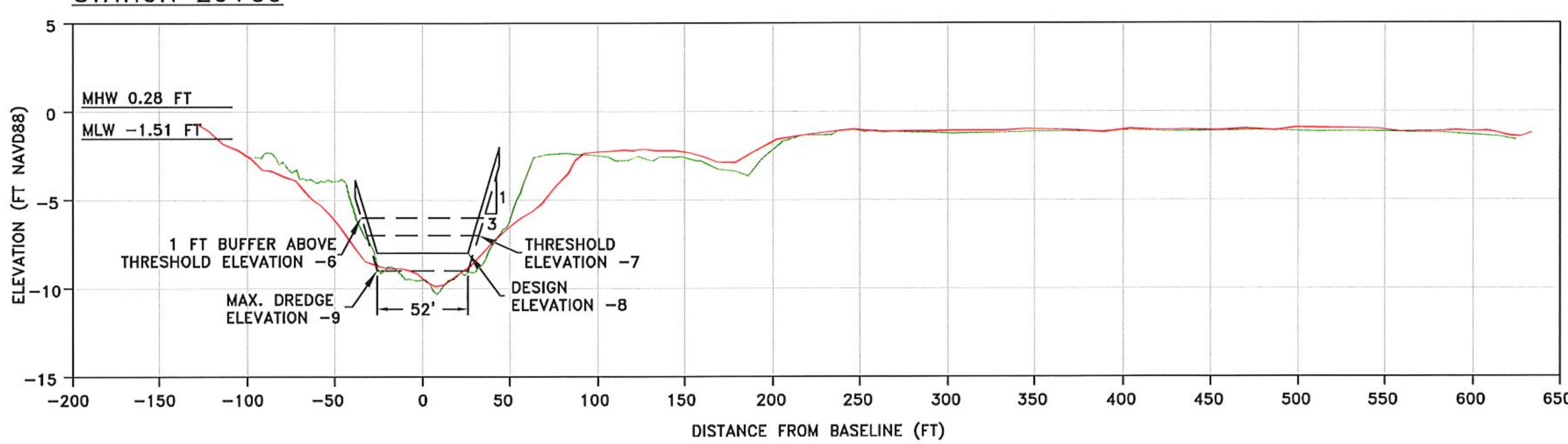
SUBAREA 4

STATION 24+00



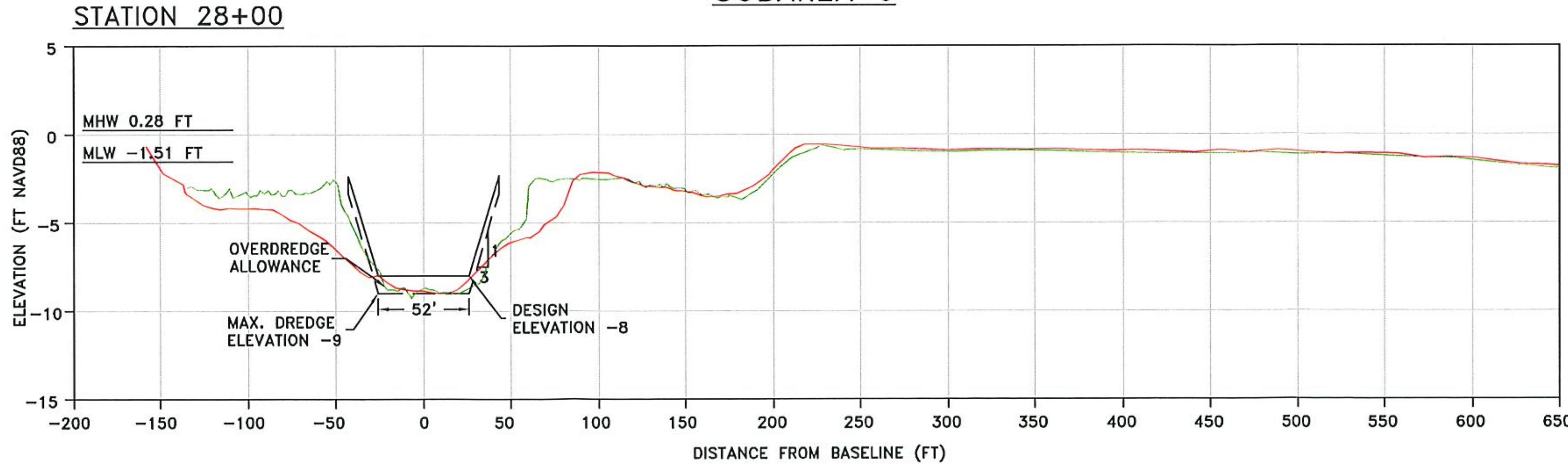
SUBAREA 5

STATION 26+00



SUBAREA 6

STATION 28+00



LEGEND

SURVEY CONDUCTED OCTOBER 19, 2010

SURVEY CONDUCTED AUGUST 25, 2009

NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
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ACAD NO. 10058_XSEC POST CON APPENDIX 2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION
CROSS SECTIONS
STA 24+00 TO 28+00

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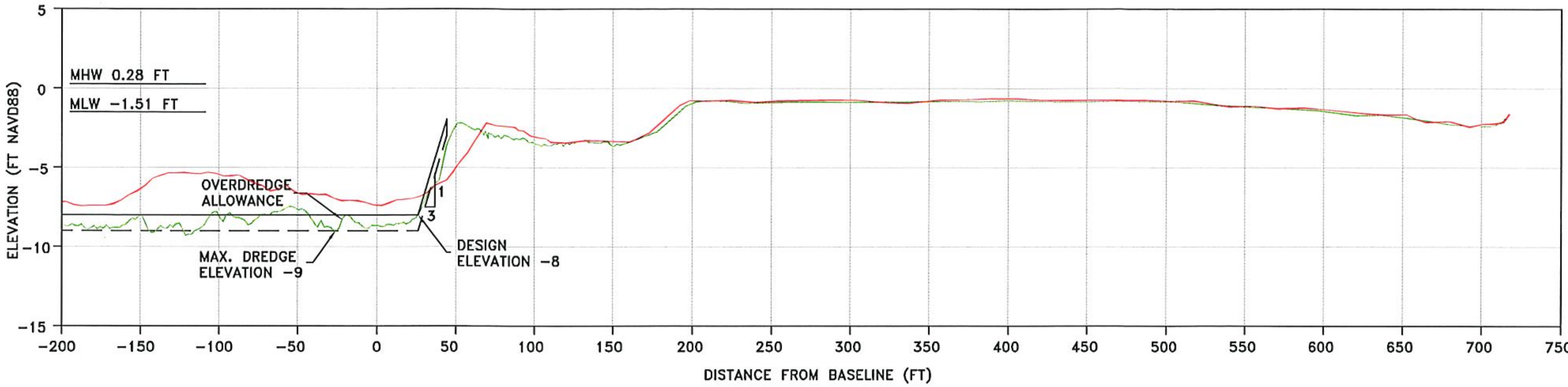
SHEET 3 OF
FILE NO.: 10058

SCALE:
H: 1" = 100'
V: 1" = 10'

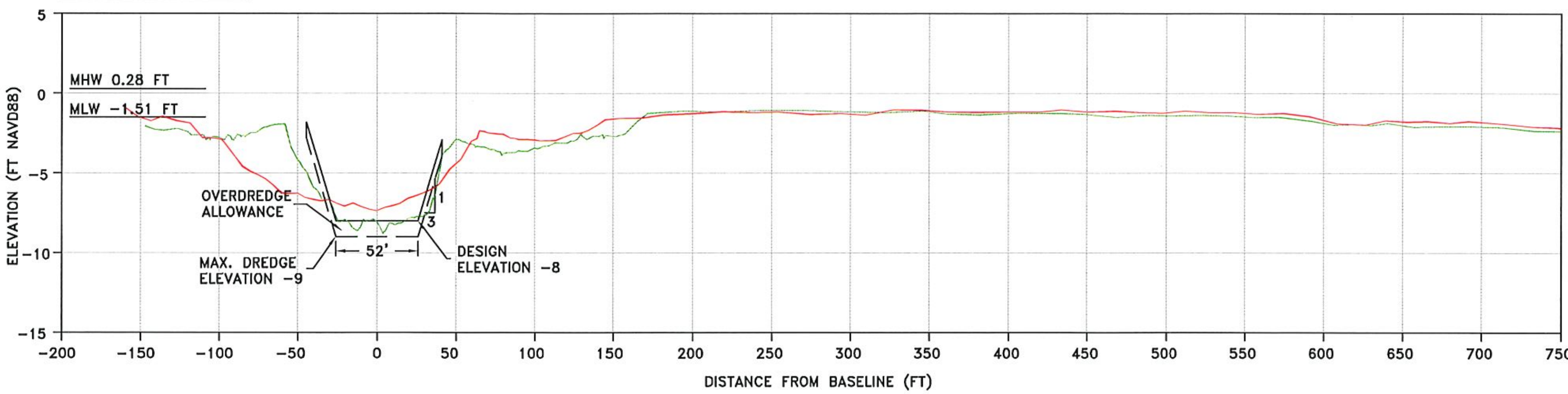
SUBAREA 6

STATION 30+00



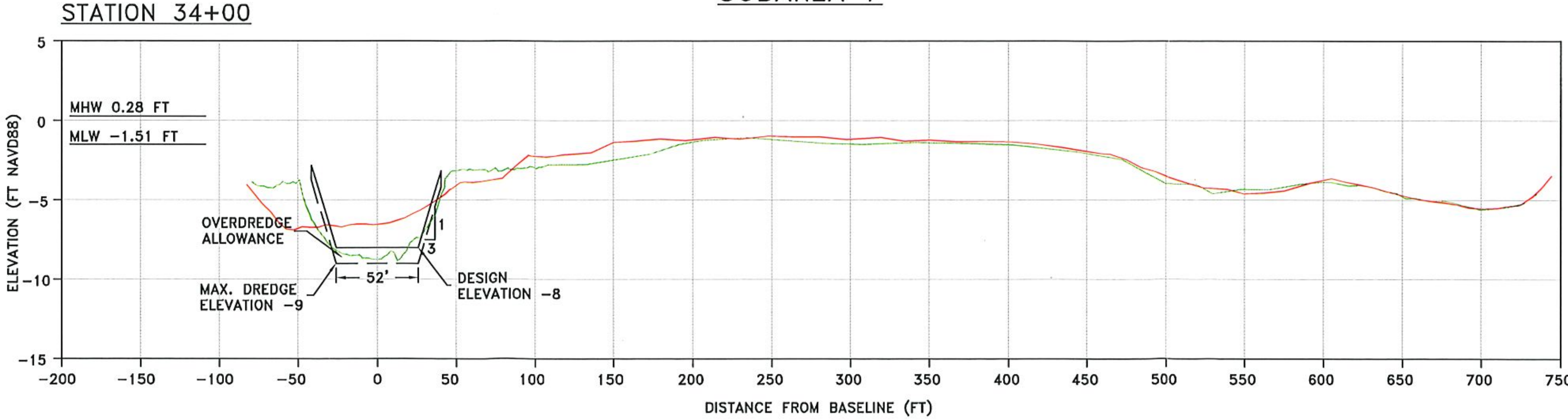
SUBAREA 6

STATION 32+00



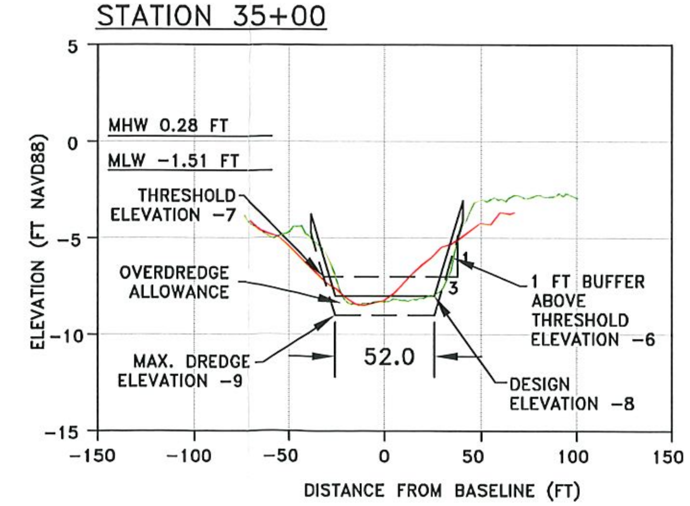
SUBAREA 7

STATION 34+00



SUBAREA 7

STATION 35+00



LEGEND

SURVEY CONDUCTED OCTOBER 19, 2010
SURVEY CONDUCTED AUGUST 25, 2009

NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058_XSEC POST CON APPENDIX 2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION CROSS SECTIONS STA 30+00 TO 35+00

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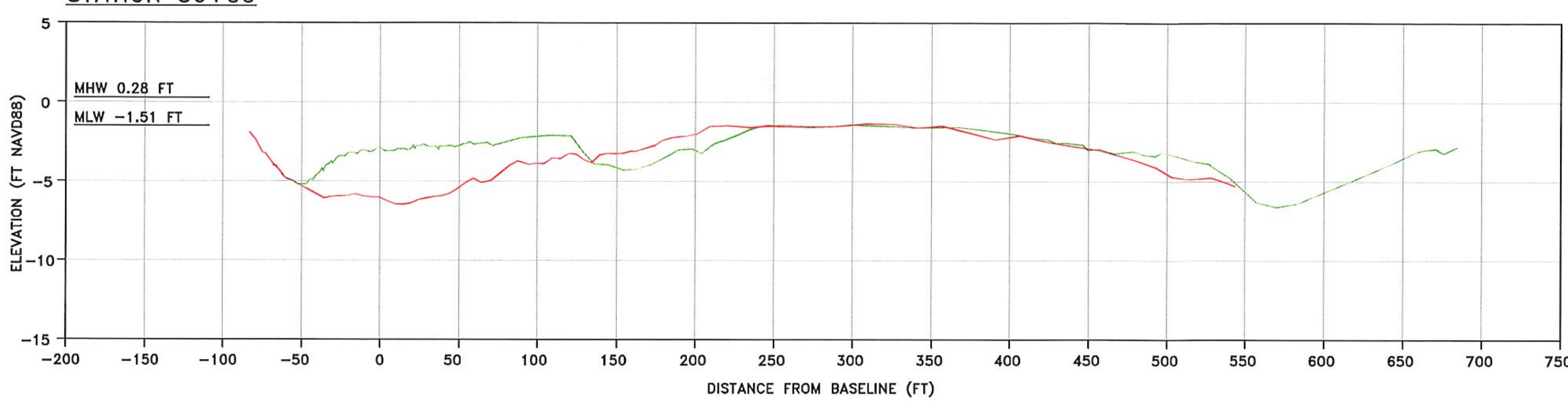
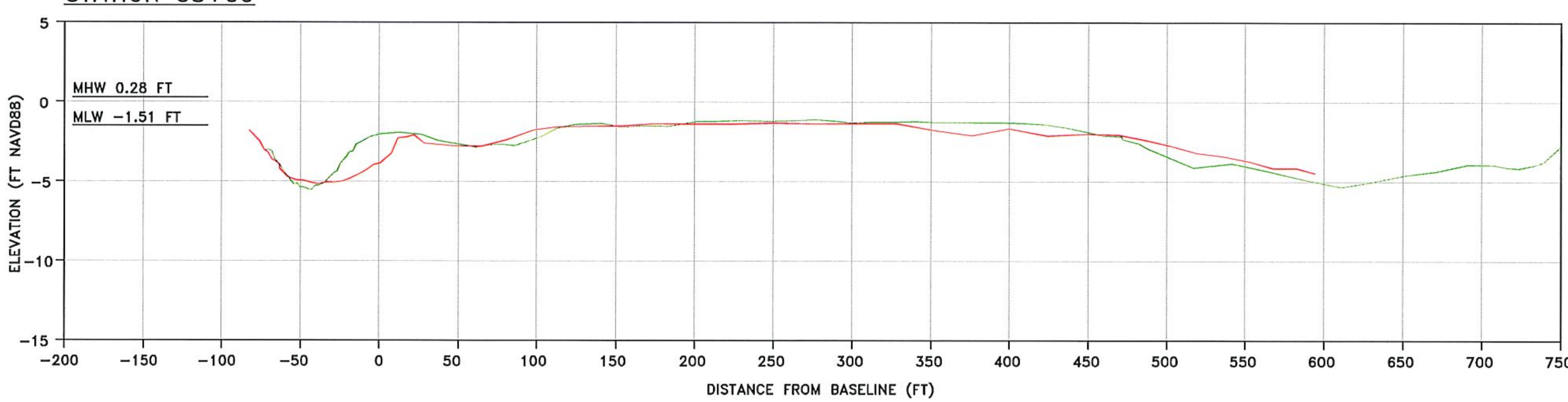
SHEET 4 OF
FILE NO.: 10058

SCALE:
H: 1" = 100'
V: 1" = 10'

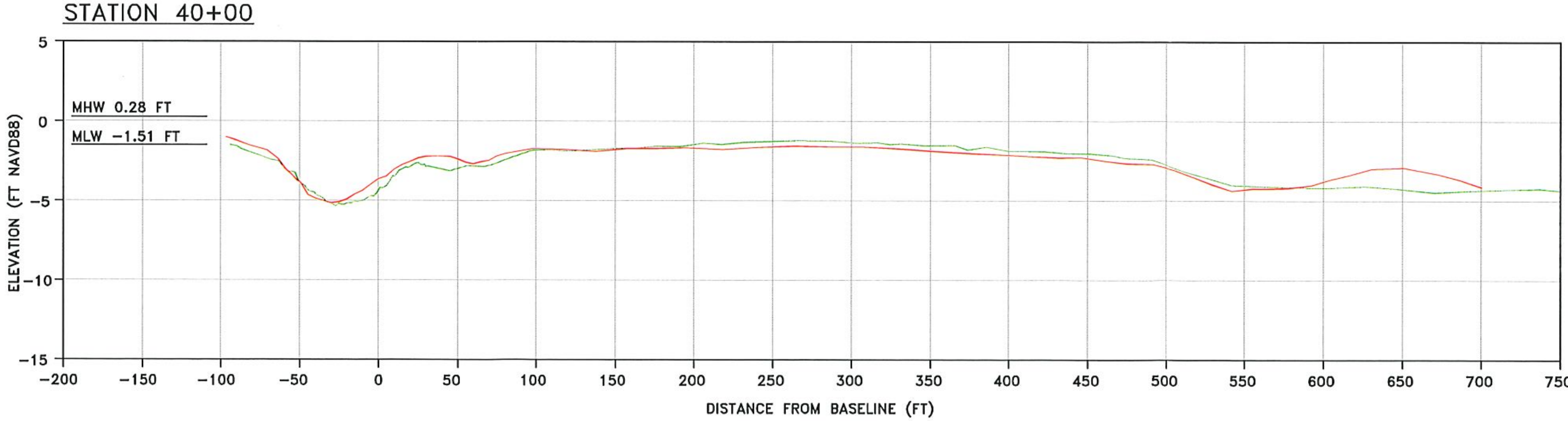
STATION 36+00



STATION 38+00



STATION 40+00



LEGEND

- SURVEY CONDUCTED OCTOBER 19, 2010
- SURVEY CONDUCTED AUGUST 25, 2009

NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058 XSEC POST CON APPENDIX 2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION CROSS SECTIONS STA 36+00 TO 40+00

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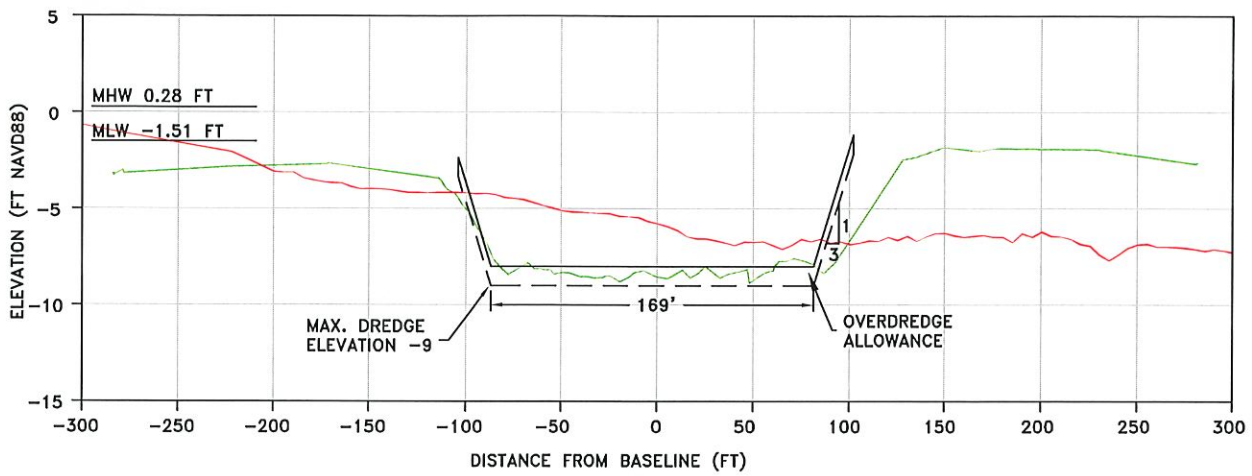
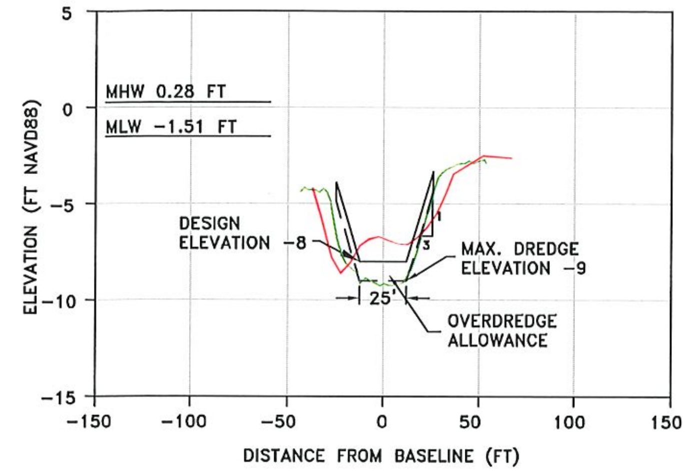
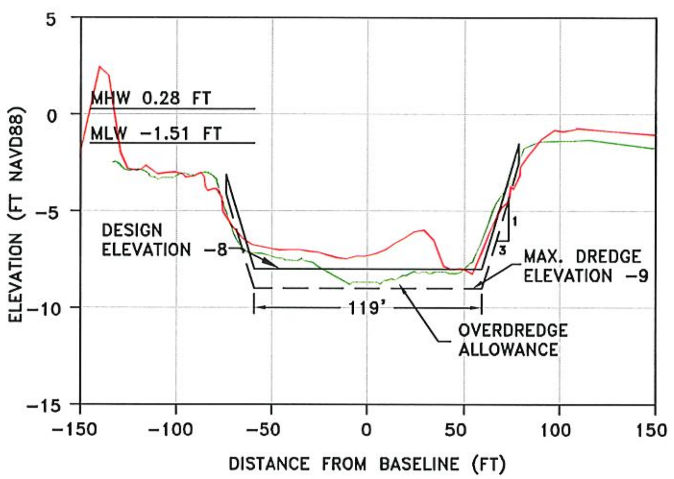
SHEET 5 OF
FILE NO.: 10058

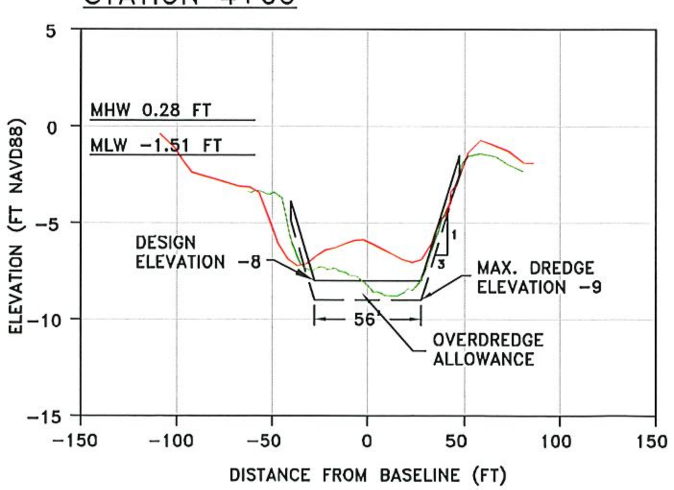
SUBAREA 6: ROOSEVELT CHANNEL

SCALE:
H: 1" = 100'
V: 1" = 10'









LEGEND

SURVEY CONDUCTED OCTOBER 19, 2010
SURVEY CONDUCTED AUGUST 25, 2009

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CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

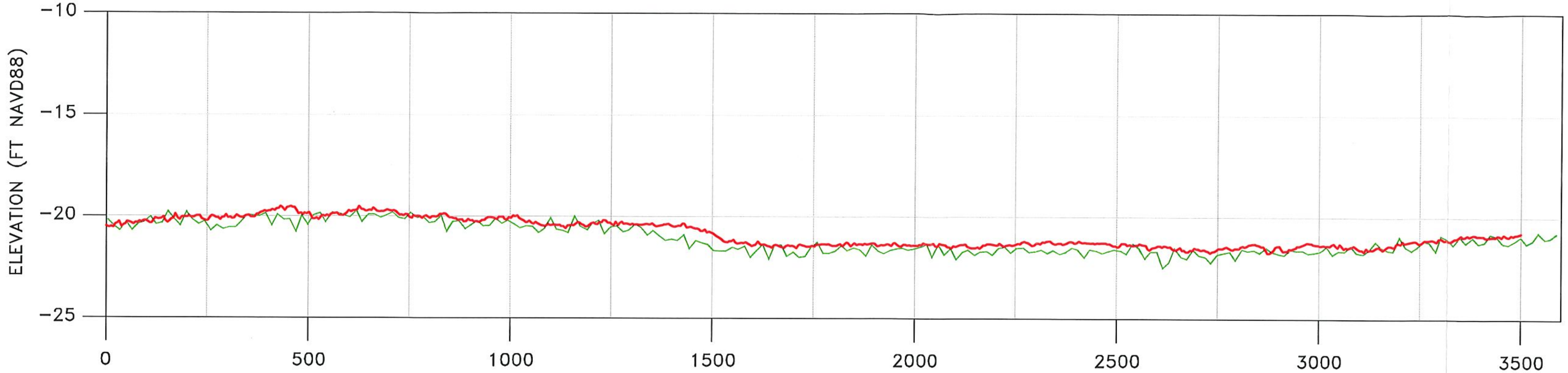
TITLE: BLIND PASS RESTORATION
ROOSEVELT CHANNEL
STA 0+50 TO 5+00

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058 XSEC POST CON APPENDIX 2
REF. NO. 10.058

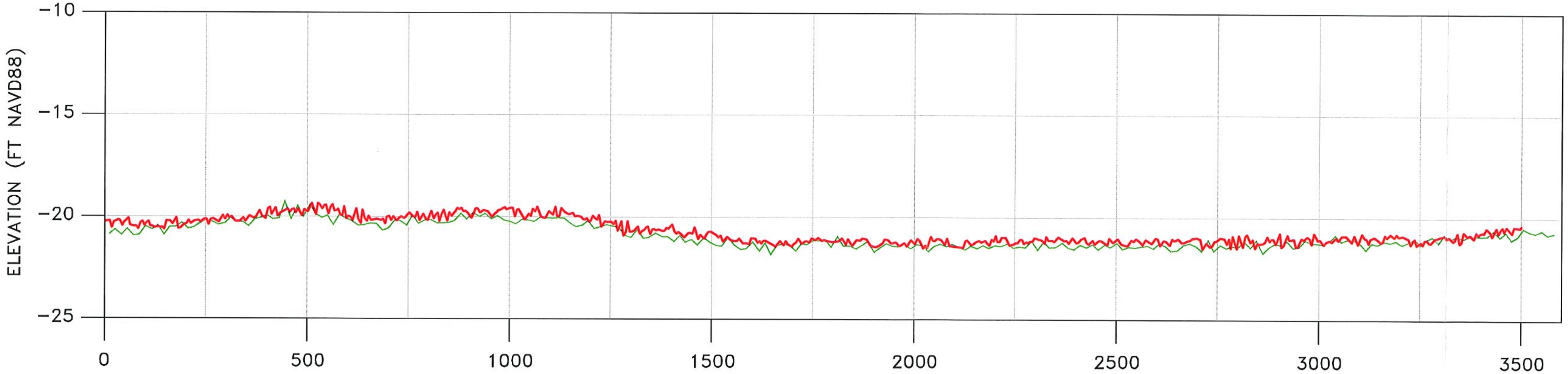
NO.	DATE	BY	REVISION DESCRIPTION

SHEET 6 OF
FILE NO.: 10058

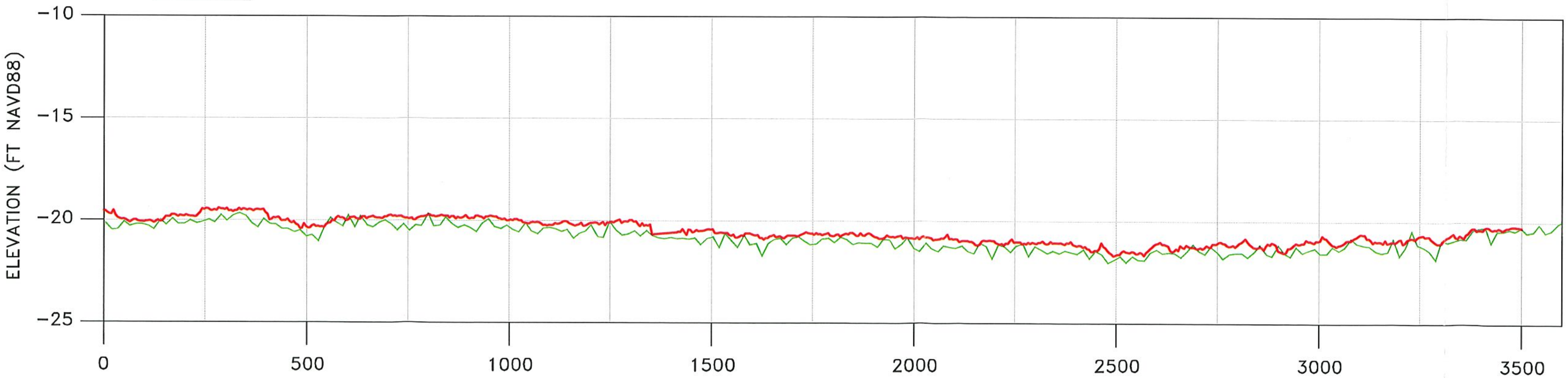
196+00



198+00



200+00



SCALE:
H: 1" = 300'
V: 1" = 6'

LEGEND

SURVEY 10/14/10

SURVEY 8/25/09

NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058 XSEC POST CON APPENDIX 2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION
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STA 196+00 TO 200+00

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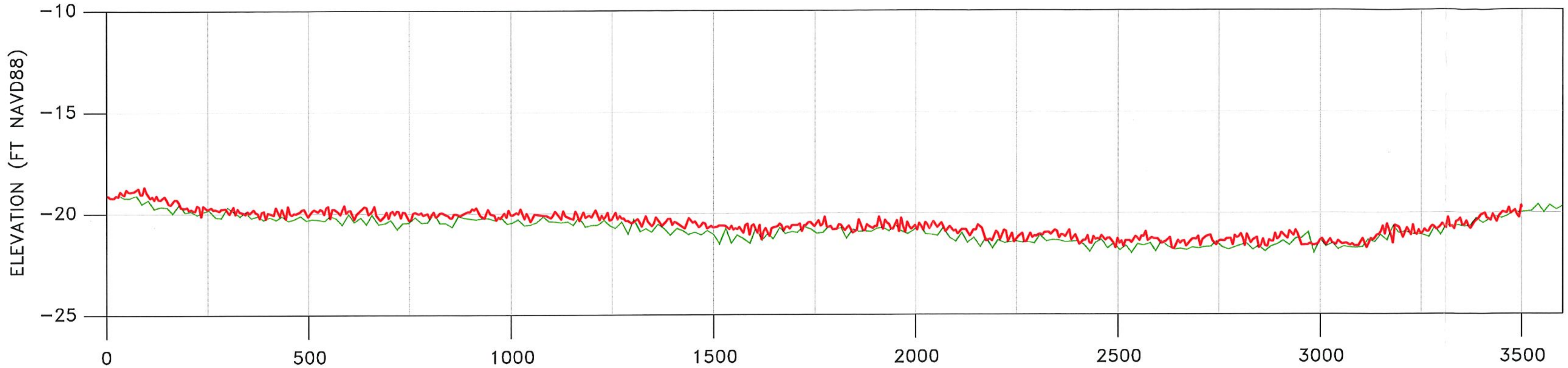
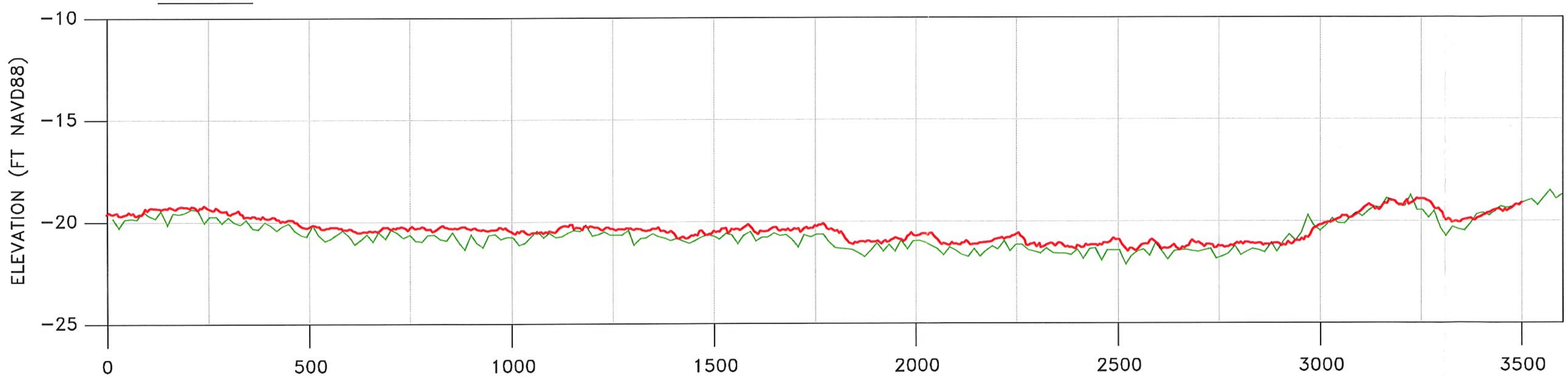
SHEET 7 OF
FILE NO.: 10058

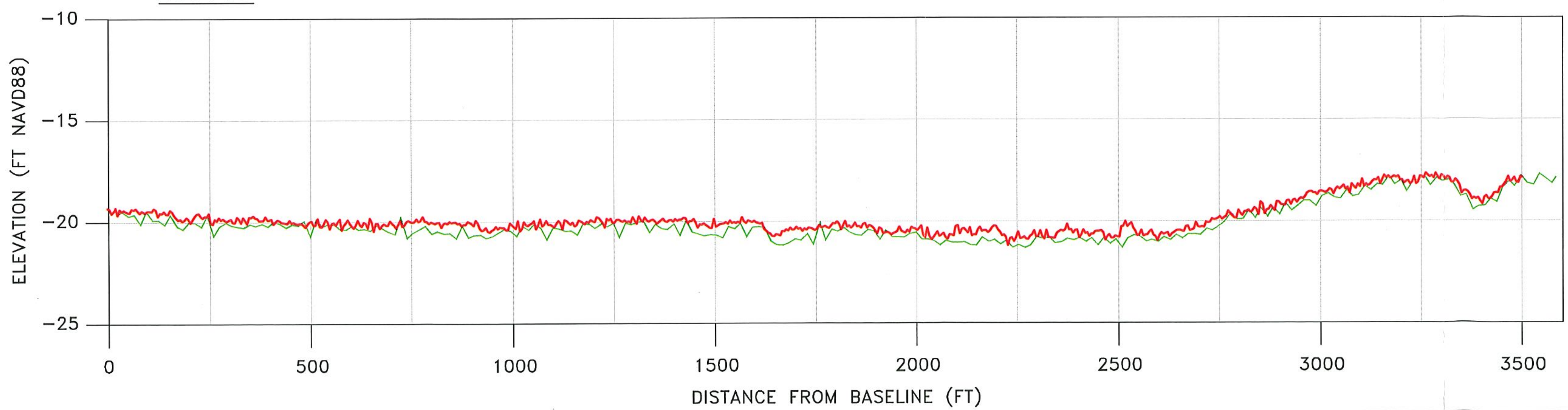
202+00



204+00



206+00



SCALE:
H: 1" = 300'
V: 1" = 6'

LEGEND

SURVEY 10/14/10

SURVEY 8/25/09

NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10
SCALE: AS NOTED
DRAWN: SDB
F.B.
CHECKED: MTP
PG.
SEC.
TWP.
RNG.
ACAD NO. 10058_XSEC POST CON_APPENDIX 2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION
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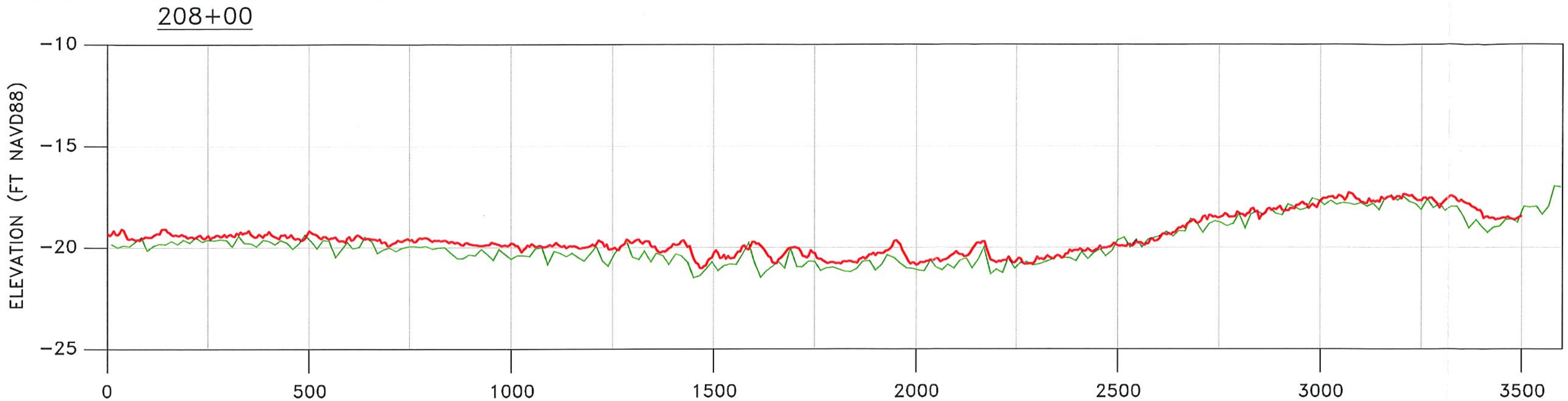
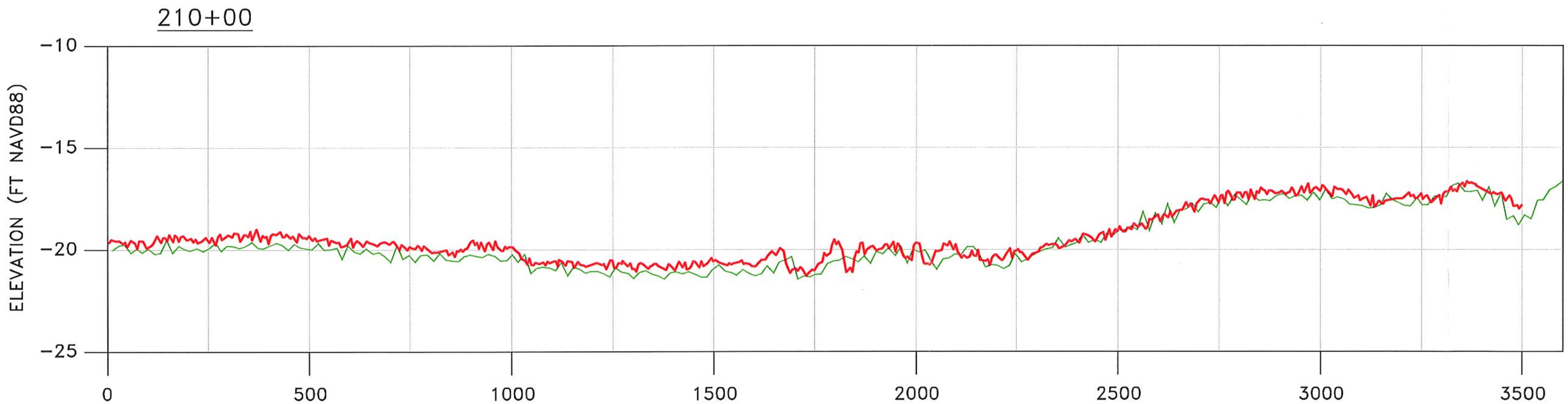
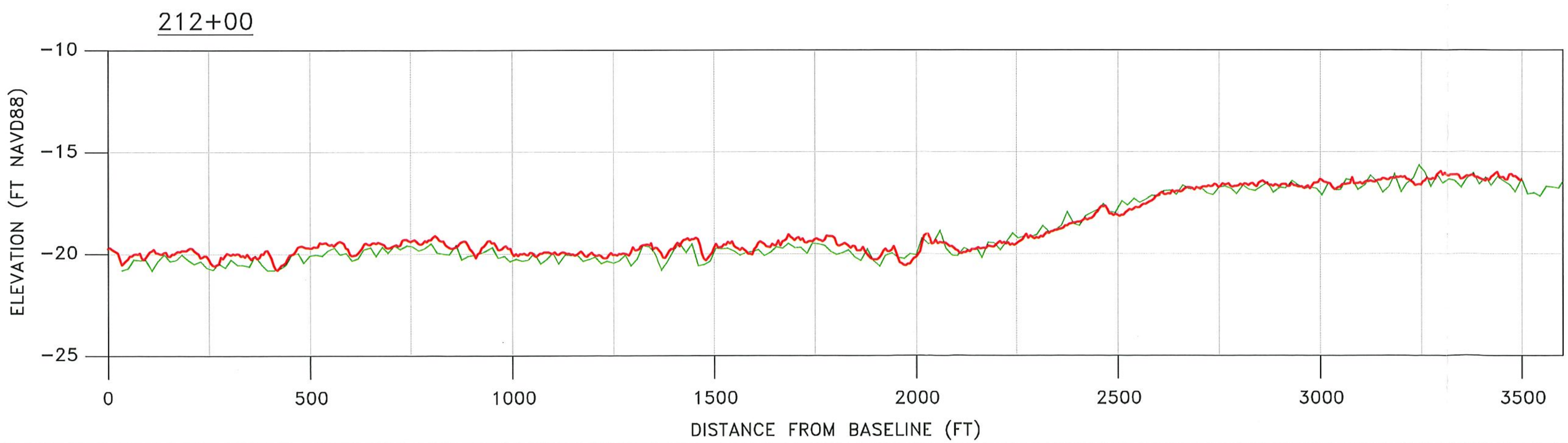
SHEET 8 OF
FILE NO.: 10058







SCALE:
H: 1" = 300'
V: 1" = 6'

LEGEND

SURVEY 10/14/10

SURVEY 8/25/09

NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058_XSEC POST CON_APPENDIX_2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION
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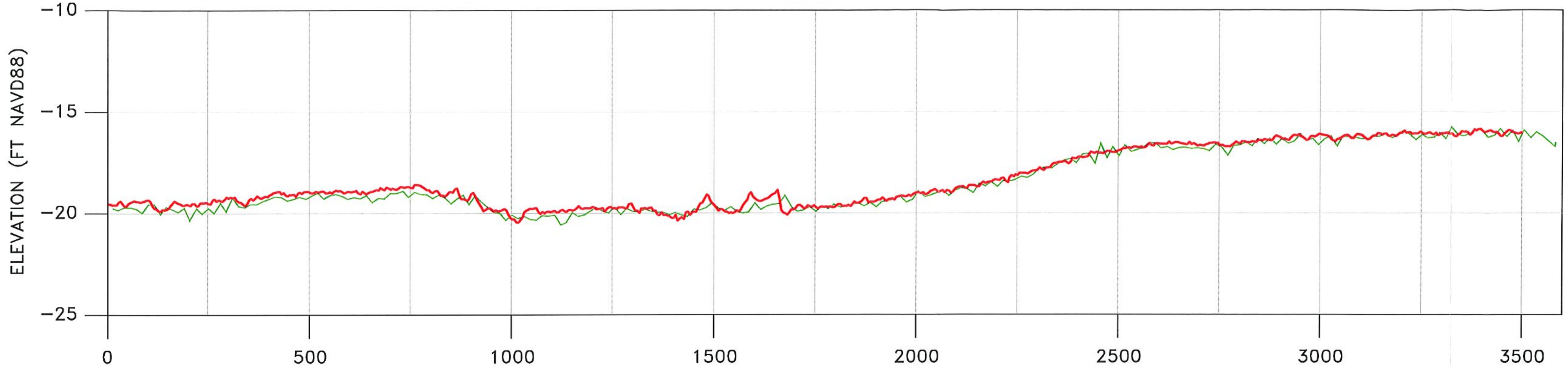
SHEET 9 OF
FILE NO.: 10058

214+00



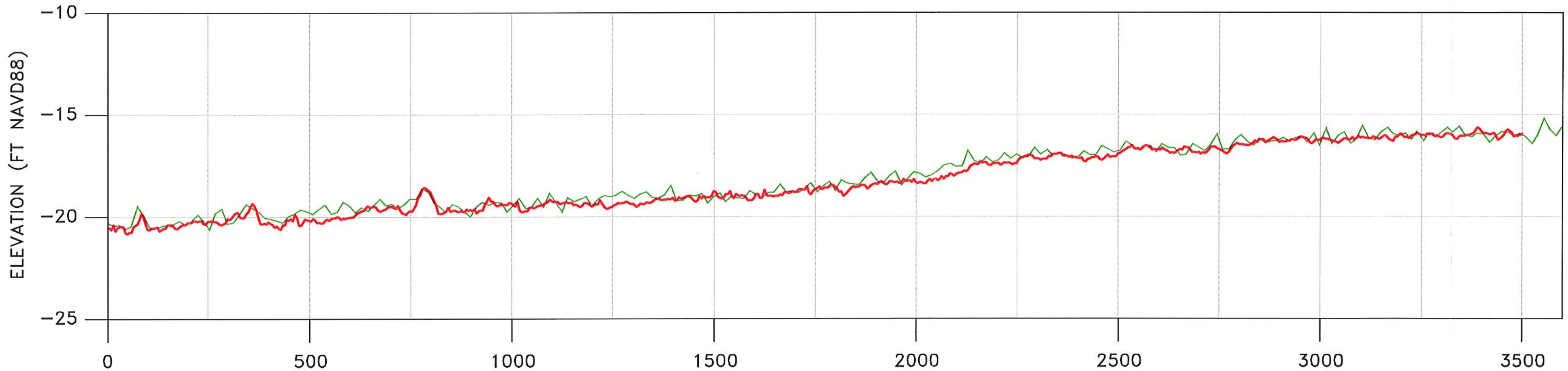
SCALE:
H: 1" = 300'
V: 1" = 6'

LEGEND

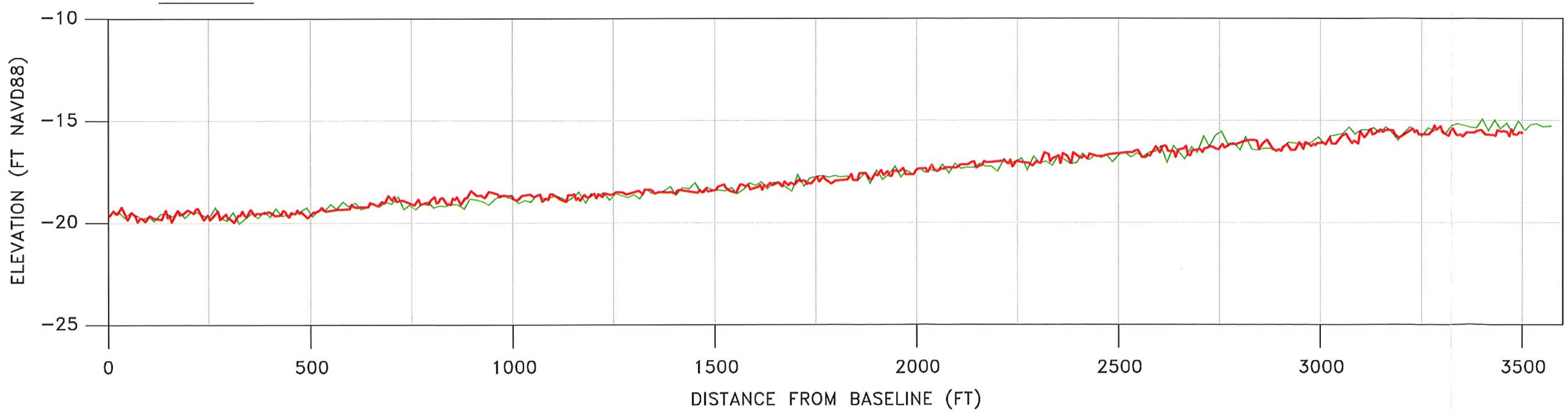
SURVEY 10/14/10

SURVEY 8/25/09

216+00



218+00



NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058 XSEC POST CON APPENDIX 2
REF. NO. 10.058

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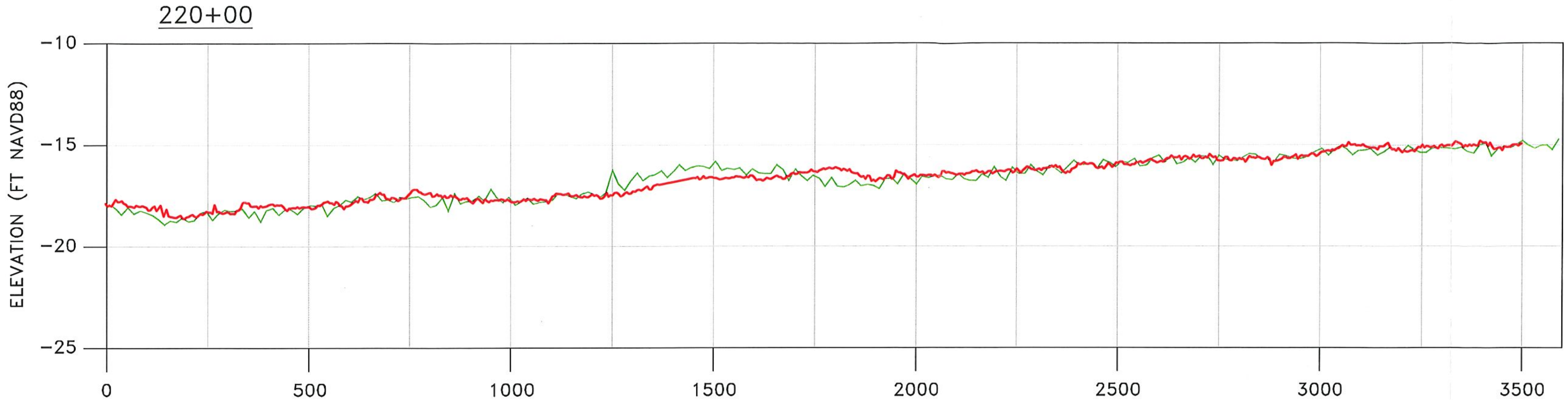
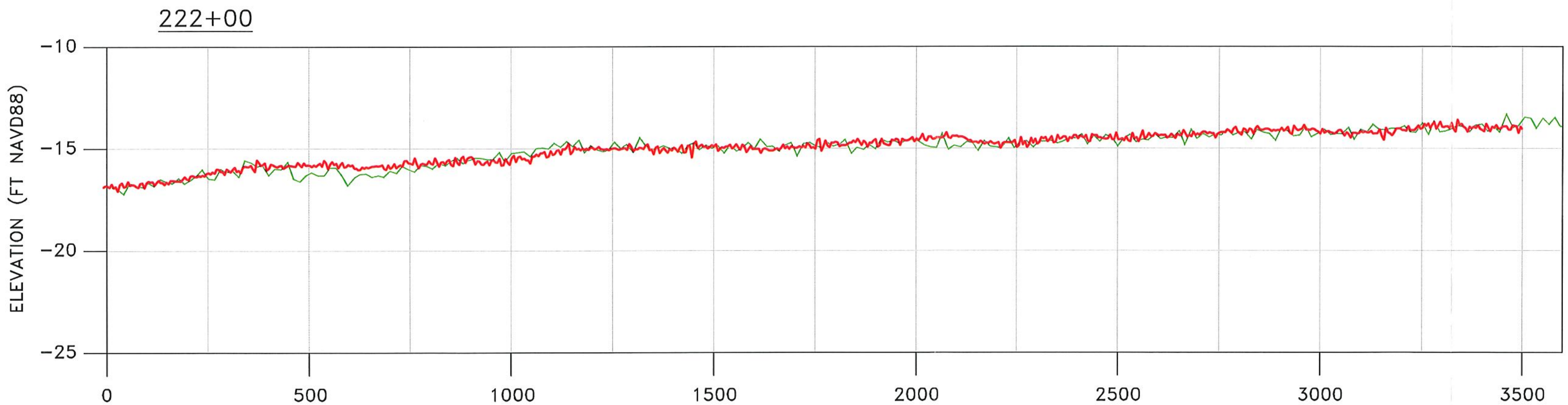
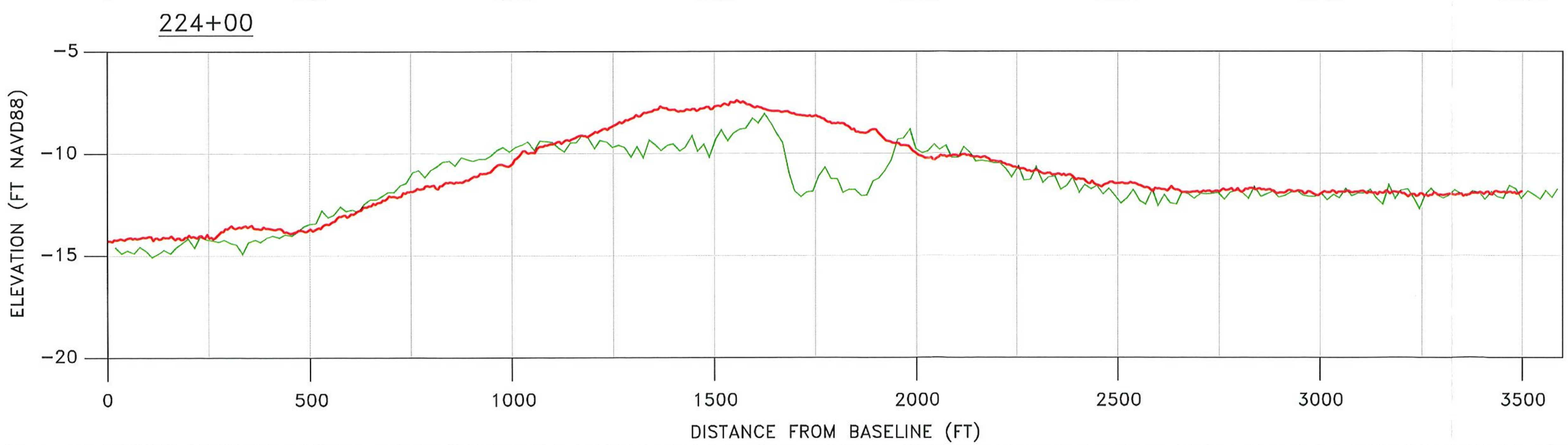
SHEET 10 OF
FILE NO.: 10058







SCALE:
H: 1" = 300'
V: 1" = 6'

LEGEND

SURVEY 10/14/10

SURVEY 8/25/09

NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
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ACAD NO. 10058_XSEC POST CON_APPENDIX 2
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CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

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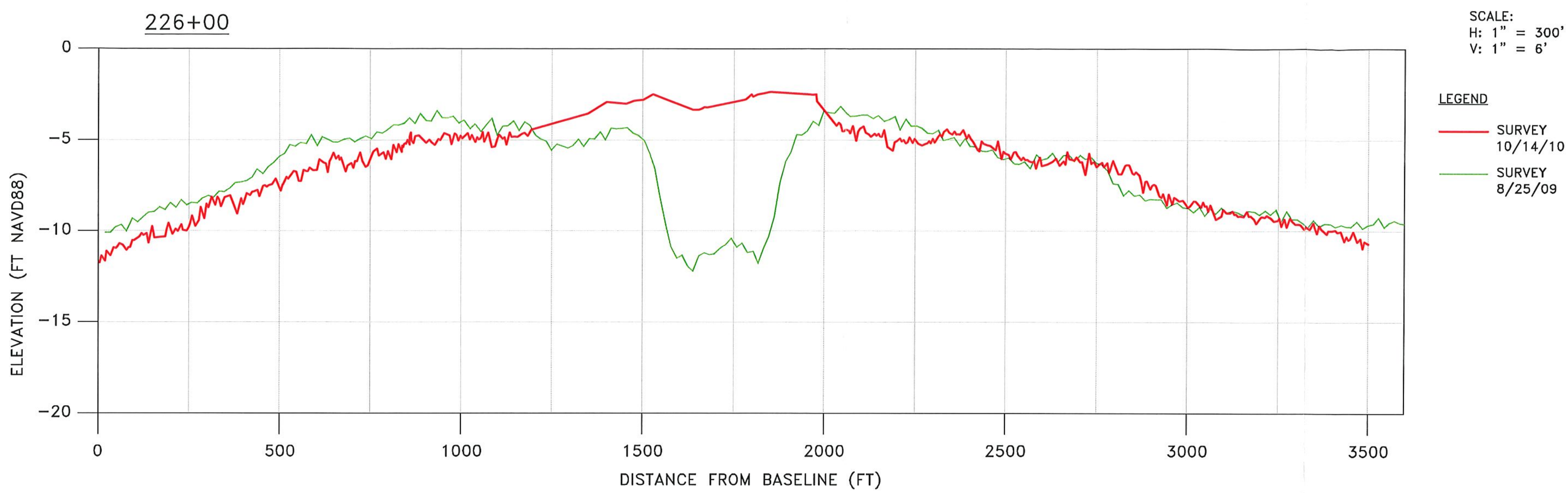
SHEET 11 OF
FILE NO.: 10058



NO.	DATE	BY	REVISION DESCRIPTION

DATE: 12/7/10 SCALE: AS NOTED
DRAWN: SDB F.B.
CHECKED: MTP PG.
SEC. TWP. RNG.
ACAD NO. 10058 XSEC POST CON APPENDIX 2
REF. NO. 10.058

CLIENT: LEE COUNTY BOARD OF COMMISSIONERS

TITLE: BLIND PASS RESTORATION
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STA 226+00 TO 228+00

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SHEET 12 OF
FILE NO.: 10058