

**LEE COUNTY, FLORIDA  
GASPARILLA ISLAND SEGMENT  
SHORE PROTECTION PROJECT**

**2013 BEACH RENOURISHMENT**

**POST CONSTRUCTION MONITORING REPORT**

**August 2014**



**US Army Corps  
of Engineers**  
Jacksonville District

**U.S. ARMY CORPS OF ENGINEERS  
JACKSONVILLE DISTRICT**

## Table of Contents

Introduction.....	3
Authority.....	4
Project History.....	6
Description of 2013 Project.....	7
Impacts of the 2012-2013 Hurricane Season.....	9
Project Monitoring.....	11
Profile Survey Analysis .....	13
Borrow Area Survey Analysis.....	18
Summary.....	21

## List of Figures

1. Project Map.....	4
2. Project Limits and Monument Location.....	5
3. 2013 Project Typical Profile and Beach Fill Template .....	8
4. Hurricane and tropical storm tracks – 2012.....	10
5. Hurricane and tropical storm tracks – 2013.....	10
6. Mean High Water Change.....	15
7. Volumetric Change.....	18
8. Pre-construction Borrow Area Depths .....	19
9. Post-construction Borrow Area Depths .....	20
10. Borrow Area Pre- Post- Construction bathmetry change.....	20

## List of Tables

1. Monitoring Surveys .....	11
2. Tidal Datums .....	12
3. MHW Changes .....	14
4. Volume Changes .....	17

## Appendices

### A. Beach Profiles

## Introduction

The Federally-authorized Lee County, Gasparilla Island Shore Protection Project (SPP) consists of beach renourishment along 2.8 miles of Gulf coastline, extending from the Lee County northern boundary to near Boca Grande Pass. The primary purpose of the project is to protect upland property from damages due to storm-induced erosion and flooding. Initial construction of the Lee County, Gasparilla Island (SPP) was completed in 2007. Recent completion of a Project Information Report for impacts sustained by Tropical Storm (T.S.) Debby resulted in a positive request for Flood Control and Coastal Emergencies (FCCE) and Construction General (CG) funds. This project was constructed during October through December of 2013.

The performance of the 2013 renourishment of the Lee County, Gasparilla Island shoreline is the subject of this monitoring report. This report was prepared under the provisions of Florida Department of Environmental Protection (DEP) Permit 0174403-001-JC, which requires annual beach profile monitoring of the beach renourishment project, and preparation of a monitoring report to present the results of each survey. This report will present the results of the post construction project monitoring following completion of the 2013 renourishment.

Figure 1 shows the Federal project fill limits, from R-11 to R-24 of the Lee County, Gasparilla Island Shore (SPP), with additional 1200 ft and 600 ft tapers, to the north and south of the fill limits, respectively, which connect the fill to the existing shoreline. The limits of the 2013 beach renourishment project are approximately from R-10.5 to R-24.5, which includes tapers on each end of the fill as shown on this Figure 2. The borrow area is located approximately 1 mile southwest of the southern end of Gasparilla Island, as shown in Figure 1.

The surveyed beach profiles used in this monitoring study are based on Department of Natural Resources (DNR), now renamed Florida Department of Environmental Protection (FDEP), monuments which are located along the length of the Lee County Gasparilla Island shoreline, in the positions shown in Figure 1. The Federal project extends from DNR monument R-11 (north) to R-24 (south). Note that the “DNR-” survey monument designation is typically shortened to “R-“ for convenience.



Figure 1. Lee County Gasparilla Island Shore Protection Project Map.

**Authority**

The Lee County, Florida, Beach Erosion Control Project was authorized under the provisions of Section 201 of the 1965 Flood Control Act by Senate Resolution dated December 17, 1970, and House Resolution dated December 15, 1970. The authorized project provides for Federal participation in beach erosion control measures for the gulf shoreline of Gasparilla Island, Captiva Island, and Estero Island in Lee County, Florida.



Figure 2. Limits of the 2013 renourishment construction project fill area depicted by elevation change and DNR survey monuments along Lee County Gasparilla Island Segment SPP.

## **Project History**

The Federally-authorized Lee County (SPP) consists of beach renourishment along shoreline of Gasparilla Island, Captiva Island, and Estero Island. The primary purpose of the project is to protect upland property from damages due to storm-induced erosion and inundation. Initial Construction was completed in 2007 under Section 206 authority by the local non-Federal sponsor-Lee County. The General Reevaluation Report (GRR) study was approved 2004 with an April 2008 Addendum. Completion of a Rehabilitation Effort for the Lee County Hurricane and Storm Damage Reduction Project Gasparilla Island Segment Project Information Report (PIR) (February 2013) for impacts sustained by Tropical Storm (T.S.) Debby (June 2012) resulted in a positive request for Flood Control and Coastal Emergencies (FCCE) and CG funds. The 2013 renourishment project volume includes the 79,250 cubic yards (cy) estimated to have been removed by T.S. Sandy plus an additional advanced nourishment volume of 338,000 cy.

The Gasparilla segment was in need of periodic nourishment after T.S. Debby, which was within the authorized 10 years of Federal participation. The non-Federal sponsor requested this work to be completed by the USACE under a cost-shared project partnership agreement, not under Section 206 of WRDA 1992 authority. The non-Federal sponsor also requested reevaluation of the project to extend federal participation from 10 years as approved in a 2004 Assistant Secretary of the Army (ASA) memo to 50 years as authorized by Section 934 of WRDA 1986, with the work to be performed by the USACE. The GRR approved in 2004 included an analysis for 50 years that determined the project was economically justified.

The Section 934 study is underway for the USACE to assume authority to construct the next renourishment of Gasparilla Segment. The USACE is conducting a Section 934 study to extend the project already authorized by Congress the additional 40 years to bring total project life to 50 years provided that the project dimensions design berm width and length of project) are not increased.

### Initial Construction

In 2004, the U.S. Army Corps of Engineers approved a General Reevaluation Report (GRR) for Gasparilla and Estero Islands. The recommended project for the two islands was later modified. The modified project provides for restoration of 2.8 miles of shoreline on Gasparilla Island (R-11toR-24). A terminal groin at the south end of the island adjacent to Boca Grande Pass was considered uneconomical and not recommended.

In January 2000, Lee County, under a cost-share agreement with the Florida Department of Environmental Protection (FDEP), initiated engineering design and permitting to construct the project on a reimbursement basis with the Federal government. The final design included a segmented breakwater located approximately 325 feet offshore of R-25; two T-head groins in the vicinity of R-26; and restoration from R-11 to R-24 using approximately 920,000 cubic yards of sand from an offshore borrow area. The initial construction of the restoration project

was completed in April of 2007 under Section 206 Authority by Lee County, the local non-Federal sponsor. The design template consists of a 20 ft berm at elevation of +5 feet MLW, a foreshore slope of 1V:15H transitioning to a nearshore slope of 1V:25H at MLW extending out to the intersection with the existing profile. The source of material for the 2013 construction of the Lee County, Gasparilla Island Segment project was the borrow area located approximately 1 mile offshore southwest of the southern end of Gasparilla Island. The structures were scheduled for construction in 2010, but have not been constructed. The project includes construction of 0.9 acres of artificial reef offshore of R-11 to mitigate for adverse impacts to nearshore hardbottom. The renourishment volume is projected to be 542,000 cubic yards (cy) every 7 years (2004) GRR.

The initial construction contract of the project was conducted between December 2006 and April 2007. This contract involved the placement of 1,073,000 cy, along 3.2 miles of shoreline from R-10.5 to R-26. This includes fill outside the limits of the Federal project (R-11 to R-24) from R-24 to R-26. The design intent was to extend the shoreline 20 ft from the 2000 position for a period of 7 years. This equates to an average fill density of 64 cubic yards per linear foot (cy/lf).

### **2013 Lee County Gasparilla SPP Renourishment**

The 2013 renourishment of the Lee County, Gasparilla Island Segment SPP was constructed in the Fall of 2013, and is the subject of this monitoring report. This renourishment was performed to repair damages to the Federal project resulting from T.S. Debby which impacted Florida in 23-27 June 2012. The PIR recommended 467,250 cy (31.6 cy/ft) of which 79,250 cy of material were required to repair damages and rebuild affected portions of the Lee County, Gasparilla SPP to its full construction template and the remainder being required volume for the first advanced nourishment fill. As shown in Figure 1, the project was to be constructed along 2.8 miles of the southern end of Gasparilla Island, from about R-10.5 to R-24.5, including tapers. The source of fill for the 2013 renourishment was the offshore borrow area located 1 mile southwest of the southern end of Gasparilla Island as shown in Figure 1.

Figure 3 shows a typical construction template as used in the 2013 renourishment. These fill templates are consistent with the templates used in the initial project construction and in subsequent renourishments. The Lee County SPP authorization requires the construction and maintenance of a specific design template in order to prevent damages due to storm-induced erosion along the project length. The construction cross-section includes the fill required to construct the design cross-section plus additional fill placed seaward of the design section for advanced nourishment. The construction template includes a 100-foot wide berm at +3.8 NAVD88 (which is equivalent to +5.0 ft NGVD and 2.55 ft MLW) elevation sloping to +3.0 ft NAVD88 (+4.2 ft NGVD, 1.75 MLW) and a foreshore slope of 1V:10H constructed from R-10.5 to R-24.5 (including tapers).

The final contract payment volume placed during the 2013 Lee County, Gasparilla Segment SPP renourishment was 457,834 cy. This volume of material was calculated based on acceptance section surveys, which are performed separately from the pre- and post- fill



monitoring surveys. Acceptance section surveys are taken over short reaches of shoreline as the project progresses. As such, they are taken shortly after each section of fill is completed and do not typically reflect substantial losses of material due to erosion or profile adjustment. The elapsed time between the pre- and post-construction FDEP profile surveys is typically much longer; in this case approximately 8 months (May 2013 to February 2014). This allows the project to equilibrate to some degree following fill placement. Also, since the entire length of the project is surveyed much more quickly for the FDEP datasets, these FDEP surveys give a better “snapshot” view of the project condition.

During the 2013 construction operation an adjustment to the fill template along Gasparilla Island was required. The contract volume was based on the May 2013 survey of Gasparilla Island Beach collected during plans and specifications phase (Spring of 2013), which yielded an estimated 480,000 cubic yards of material required for the construction template—this was the volume that was used in the construction contract solicitation and engineering plans and specifications. The Contractor’s preliminary pre-construction survey, Before Dredge survey #13-207 (13-207 BD), conducted in October 2013, of Gasparilla Island using 500-foot intervals yielded a substantially lower volume of 341,000 cy of material resulting in a potential 29% underrun of the contract volume.

In order to account for decrease in contract volume due to natural accretion and recovery of the beach, the contract plans were modified with an additional berm width of 30’ (from 100’ to 130’) from R-21 to R-19 (P61 to P52) and extended the berm width by 10’ from Sta 61+00 (R-15.5 or approx. P32) throughout the remainder of the fill template terminating at Sta 0+00 near R-10, along Gasparilla Island beach.

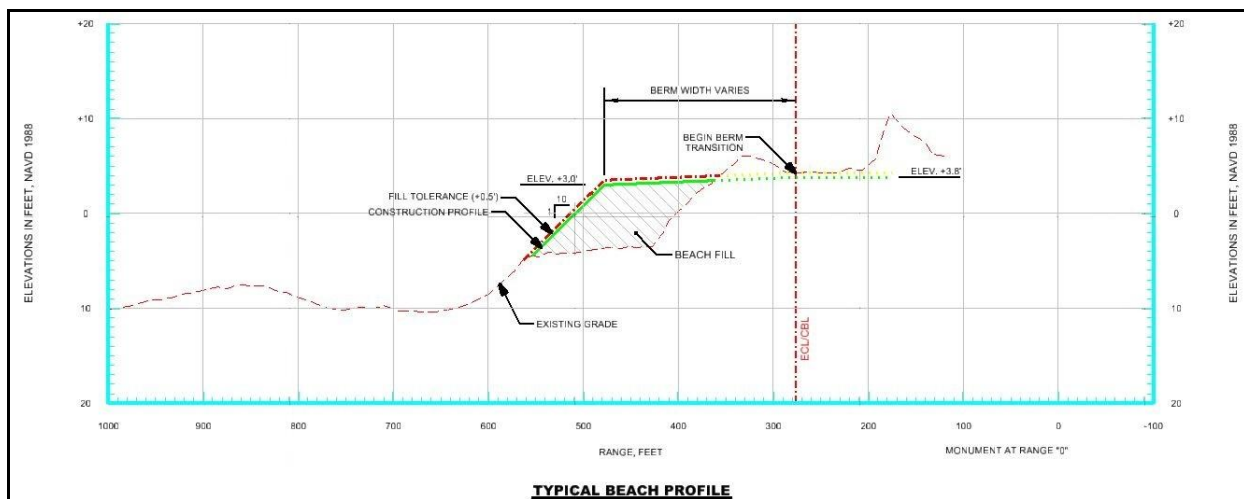


Figure 3. Typical profile and beach fill template.

Approximately 55,000 cy of additional material was added to the project by increasing the berm width. This increase in berm width is accounted for in the advanced nourishment volume since it is beyond the 20 foot berm design width. The modified contract volumes were thus 128,000 cy of design berm (less required due to natural accretion), and 338,000cy of advanced fill for a total volume of 466,000 cy. The total proposed advanced nourishment for this project with a 10-foot berm width adjustment is 338,000 cy, which is within the authorized project advanced nourishment volume of 421,227 cy.

### **Impacts of the 2012-2013 Hurricane Season**

The 2013 Lee County, Gasparilla Island Segment renourishment was performed to repair damages caused by T.S. Debby in 2012 and included advanced nourishment. Subsequent weather events in the project area were not significant and likely caused no more than normal background erosion. During the remainder of 2012, Hurricane Isaac and Hurricane Sandy were the only tropical events to occur in the region (Figure 4). Hurricane Sandy, while a significant event on the Atlantic coast, was not significant on the Gulf coast. Maximum sustained winds of 25 knots and waterlevels less than 1.0 ft above predicted tide were measured at Ft. Myers. Hurricane Issac was a tropical storm during most of its time in the Gulf of Mexico and did not become a Category 1 hurricane until just before landfall in Louisiana. Maximum sustained winds of 39 knots and a maximum storm surge of 2.3 ft were measured at Ft. Myers.

Between the pre- (May 2013) and post- (Feb 2014) construction surveys 3 tropical events of minor significance occurred in the project vicinity, T.S. Andrea, Tropical Depression Dorian, and T.S. Karen (Figure 5). T.S. Andrea, occurring during June 5-7 2013, had maximum sustained winds of 24 knots and waterlevels 1.3 ft above predicted tide measured at Ft Myers. Tropical Depression Dorian following a path along the Florida Atlantic coast, occurred during July 23–Aug 3 2013, and had maximum sustained winds of 17 knots and waterlevels 0.5 ft above predicted tide measured at Ft Myers.

T.S. Karen, occurring during Oct 3-6 2013, had maximum sustained winds of 25 knots, which lasted a few hours and waterlevels 1.3 ft above predicted tide for about a24 hour period, measured at Ft. Myers. No record of any significant extra-tropical events were found during the survey interval.

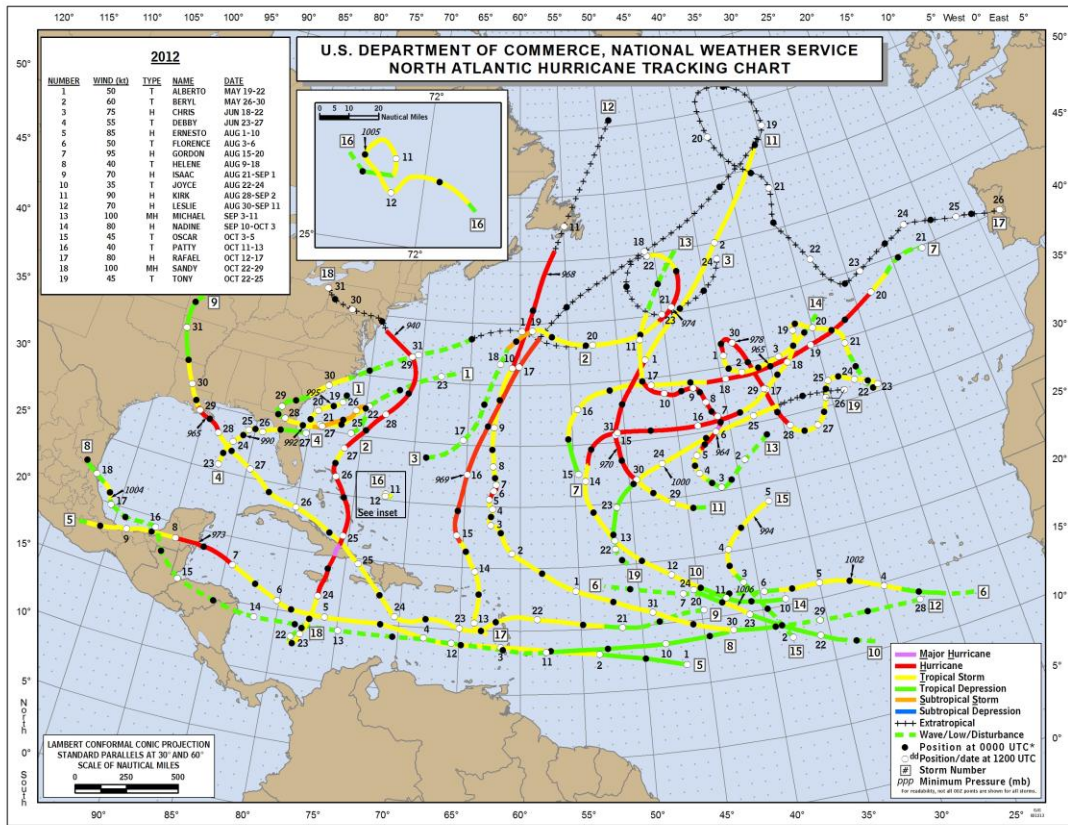


Figure 4. Hurricane and tropical storm tracks – 2012.

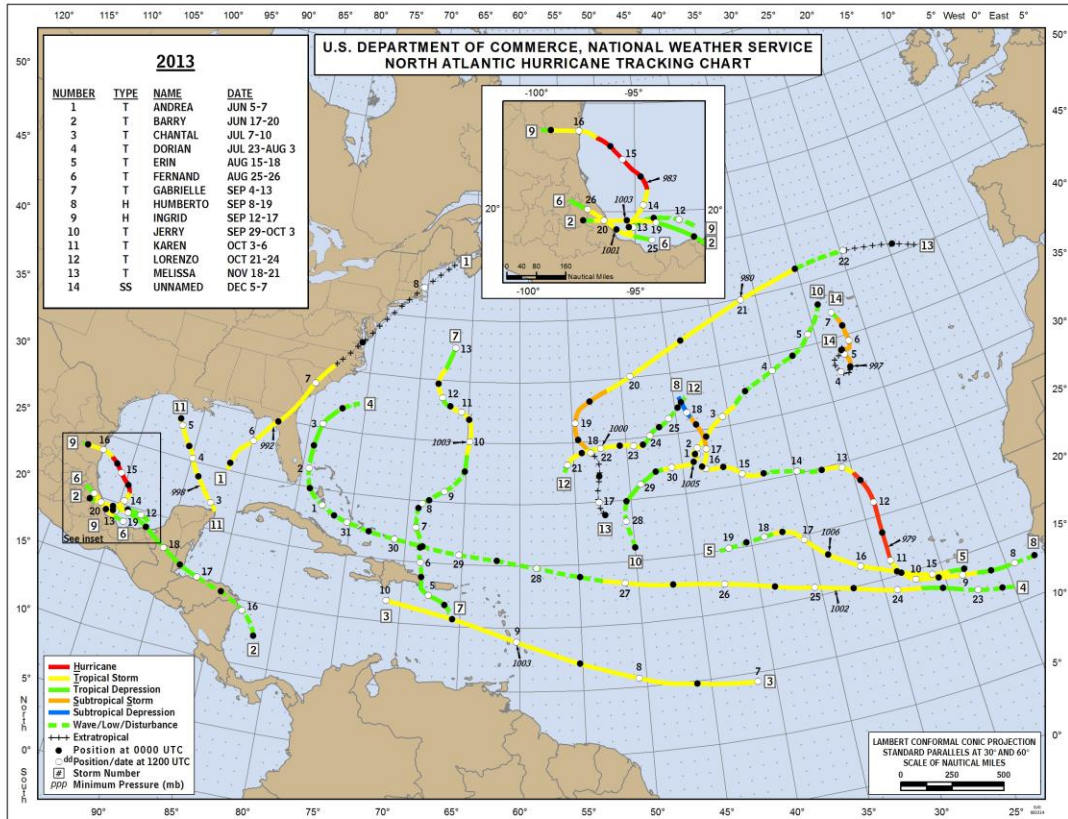


Figure 5. Hurricane and tropical storm tracks – 2013.

## Monitoring Surveys

The pre-construction monitoring survey and post-construction monitoring survey each consist of beach profiles surveyed along the Lee County Gasparilla Island Segment shoreline. The pre-construction survey (Post Sandy Survey 13-077) was conducted during 13 – 17 May 2013 and extends from R-10 (north) southward to R-26A (south) with profiles about every 500 feet at R-monuments and half monuments and profile lengths of 3000 feet. The pre-construction survey (Post Sandy Survey 13-077) also included the borrow area. The pre-/post- fill construction surveys were performed between 26 October and 13 December 2013. The pre-/post- fill construction pay volume survey (Survey 13-207) extends from R-10 (north) southward to R-24.5 (south) with profiles about every 100 feet (not specifically at R-monuments) and profile lengths of about 575 ft. A preliminary construction “before dredge” (13-207 BD) survey and an “after dredge” (13-207 AD) survey were also conducted as part of the construction contract. These surveys were about 500 ft apart (not specifically at R-monuments) with profile lengths of about 1000 ft. Construction of the beach fill began at the south end of the project with the survey team staying well ahead of the construction proceeding northward along the beach. Construction of the beach fill was completed on 13 December 2013, and the pre- /post- fill (pay volume) survey was performed during construction, between 26 October and 13 December 2013. The post-construction monitoring survey was conducted during 11-12 February 2014. The post-construction monitoring survey (Survey 14-039) extends from R-10 (north) southward to R-26A (south) with profiles at R-monuments about every 1000 feet and profile lengths of about 4000 ft. The post-construction borrow area survey (14-041) was conducted on 11 February 2014. A summary of the survey information is shown in Table 1. Datums for all surveys used in this report are in NAD83 (horizontal) and NAVD88 (vertical). All units of measurement are in feet.

Table 1. Monitoring Surveys

Survey	Date	Area	
		Shoreline	Borrow Area
Post Sandy Survey (Pre Construction) 13-077	13-17 May 2013	R10 – R26A	X
BD, Pre/Post Fill, AD 13-207	Oct to Dec 2013	R10 – R24.5	
Post Construction Survey 14-039	11-12 Feb 2014	R10 – R26A	
Post Construction Borrow Area Survey 14-041	11 Feb 2014		X

In order to evaluate the monitoring surveys with reference to a tidal datum such as Mean High Water (MHW), the geodetic datum North American Vertical Datum (NAVD88), which is the vertical datum of all the surveys, must be related to the tidal datum in the project area.

The nearest tidal datum in the project area is Port Boca Grande, Station No. 8725577 available from the NOAA. This gauge is located in Charlotte Harbor on the east side of Gasparilla Island just inside the Boca Grande Pass. Due to tidal compression, this gauge is

not representative of tide range that occurs on the Gulf side of Gasparilla Island where the project is located.

NOAA analysts (personal communication) recommended that the NOAA VDatum model should be applied to determine the relationship between NAVD88 and the tidal datums. A confirmation of the VDatum model application VDatum was run at the Venice (8725858) and Naples (8725110) gauges, the two closest gulf side gauges and at three gauges in Gasparilla Sound and Pine Island Sound, all of which have NAVD88 and NGVD29 published along with the tidal datums. This exercise was performed as a check on the VDatum model. All values checked within a tolerance 0.01 feet.

The VDatum model was then applied for three locations along the project, one at the northern end (R-10), the mid-point (R-17) and one at the southern (R-25). The VDatum model at R-17 shown in Table 2, are used for all conversion between NAVD88 and MHW for the survey analysis in this report.

Table 2. VDatum Tidal Datums

VDatum Values at R 17 (referenced to 0.00 MLLW, feet)	
Datum	Value (ft)
Mean High Water (MHW)	1.77
National American Vertical Datum of 1988(NAVD88)	1.69
Mean Sea Level (MSL)	1.12
Nation Geodetic Vertical Datum of 1929 (NGVD29)	0.54
Mean Low Water (MLW)	0.44
Mean Lower Low Water (MLLW)	0.00

## **Survey Analysis**

The pre-construction and post-construction monitoring surveys were analyzed utilizing the Coastal Engineering Design and Analysis System (CEDAS) Regional Morphology Analysis Package (RMAP) software package. Comparative profiles for each of the surveys were then extracted and plotted for each monument location. These profiles are shown in Figures A-1 through A- 18 in Appendix A- Beach Profiles.

This survey analysis consists of two components: a MHW position change analysis and a volumetric change analysis. For the mean high water position change analysis, the distances between MHW positions were measured from each plotted cross-section for each survey interval. The resulting shoreline position change values for pre-construction vs postconstruction interval are summarized in Table 3. Data from Table 3 were plotted graphically in Figure 7. More detailed views of shoreline responses at each profile can be seen in the plotted cross-sections in Figures A-1 through A-18. These cross-sections are referenced to North American Vertical Datum 1988 (NAVD88). Mean High Water is 0.08 feet above NAVD88 and Mean Low Water (MLW) is 1.25 feet below NAVD88.

In a similar manner, volumetric changes between pre-construction vs post-construction, post-construction surveys were calculated utilizing the CEDAS-RMAP software. Changes in beach fill volumes between adjacent profile lines were computed using the End-Area method for the pre-construction (13-077) and post-construction (14-039) monitoring profiles. Volumetric change computations include the area extending in the cross-shore direction from the seaward face of the dune line seaward to the approximate position of the 13-ft depth contour, a distance of about 1000 feet. The 13 ft was selected because that is the depth of closure in this area. Table 4 presents the total volumetric changes between profiles for the pre- vs post-construction survey interval, with all volumetric changes measured in cubic yards. The tabulated data from Table 4 are presented graphically in Figure 8.

### **Pre- vs Post-Construction MHW Changes**

As expected, analysis of pre-construction (May 2013) and post-construction (February 2014) surveys indicates a substantial shoreline advance along the length of the Federal project, which is a direct result of the placement of beach fill during this period. The changes in Mean High Water (MHW) position were measured from beach profiles at each DNR monument (shown in Figures A-1 through A-18), and these measured values are tabulated in Table 3. Figure 7 provides a graphical representation of the same data. The general trend toward shoreline advance during this period is obvious in the figure. Individual MHW changes vary from a minimum of +55.9 feet to a maximum shoreline advance of +157.5 feet. As shown in Table 3 the average MHW advance over the length of the surveyed area was +100.5 feet. Comparison of MHW profile extensions from the pre-/post- fill pay volume surveys (Survey 13-207) to the pre- /post- construction monitoring surveys (May 2013 to Feb 2014) generally confirms the updated construction template fill with the 30 foot extension from approximately R-19 to R-21; however, some differences occur that are due to overfill of the

template, equilibration, and profile changes, which occurred between the the pre-construction (May 2013) and the pre- fill survey (October 2013). MHW difference at R-23 indicate possible end losses. The construction template fill with the 10 foot extension from approximately R-15.5 to R-10.5 is evident at R-15; however, R-13 and R-14 pre- /post-construction monitoring MHW extensions are about 35 ft less than the pre-/post- fill pay volume survey MHW extensions, which may be due to profile changes that occurred between the the pre- construction (May 2013) and the pre- fill survey (October 2013) . The R-11 and R-12 pre- /post- construction monitoring MHW extensions are 14 to 28 ft less than the pre-/post- fill construction survey MHW extensions, which is likely due to end losses.

Table 3. Mean High Water Position Change

FDEP	May2013- Feb2014
Monument	MHW Change
10	35.0
11	72.1
12	86.5
13	95.0
14	105.5
15	106.0
16	87.8
17	95.3
18	106.2
19	141.1
20	147.0
21	157.5
22	133.0
23	83.7
24	55.9
AVG	100.5



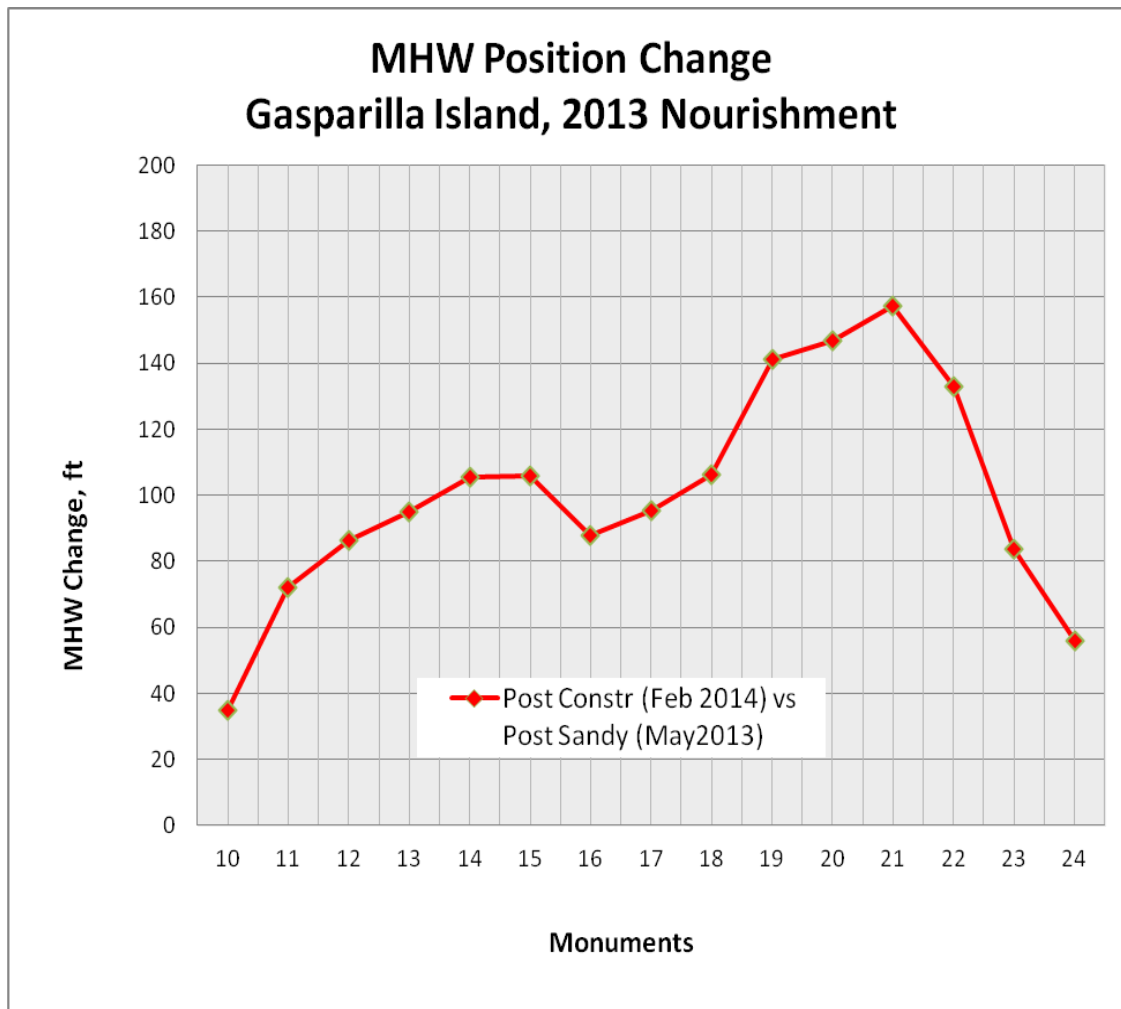


Figure 6. MHW position change.

### Pre- vs Post-Construction Volumetric Changes

Volumetric changes were measured directly from adjacent beach profile pairs in a manner similar to the methodology presented above for the MHW change analysis. Volumetric calculations extend from the seaward face of the dune to approximately the -13 ft (NAVD88) depth contour, corresponding to the zone of most active sediment transport. Table 4 shows the volumetric changes measured between adjacent beach profiles during the pre- to post-construction monitoring survey interval, and Figure 7 provides a graphical display of this data.

As was shown in the MHW analysis above, a strong trend toward shoreline advance/volumetric gain occurred during the pre-construction to post-construction monitoring period, a direct result of beach fill construction. Accretion was measured along the fill segment (R-10 to R-24.5). As was the case with the MHW changes, the effects of the beach fill placements can be seen in Table 4 and Figure 7. Similar to comparisons of MHW profile extensions



from the pre-/post- fill construction survey (Survey 13-207) to the pre- /post- construction monitoring surveys (May 2013 to Feb 2014) the volume change generally confirms the updated construction template fill with the 30 foot extension from approximately R-19 to R-21, and the 10 ft extension from R-15.5 to R-10, however some differences occur. The largest fill templates occur from R-19 to R-21 however the largest volume changes occur from R-15 to R-16. This may be in part due to some overfilling but is also likely due to profile changes between May 2013 and Oct 2013.

Table 4 shows the total volume increase from the dune/berm interface to a depth of -13 ft of 510,524 cy with an average fill volume density of 34 cy/ft. This includes 188,529 cy above MHW and 321,995 cy from MHW to a depth of -13 ft. The total volume is about 50,000 cy more than the pay volume of 457,434 which only includes the volume within the construction template tolerance. Also note that the net placement volume within the template tolerance based on surface differences between the before dredge (13-207 BD) and the after dredge (13-207 AD) surveys is 454,565 cy. Based on surface differences between the after dredge (13-207 AD) and post-construction monitoring (14-039) surveys, there is a net loss of 58,920 cy within the template tolerance. Based on surface differences between the pre-construction (13-077) and post-construction (14-039) monitoring surveys, there is a net loss of 150,737 cy from a depth of -13 ft to a depth of -20 ft. This is similar to the R-monument end area calculation shown in Table 4 of -175,388 cy for the pre-/ post- construction monitoring period.

Table 4. Volumetric Change – Post Construction (Feb 2014) vs Pre- Construction(May 2013).

<b>Gasparilla / 2013 Renourishment Volumetric Change (cy)</b>							
<b>Monument</b>	<b>Volume, (cy)  Above MHW</b>	<b>Unit Vol  (cy/lf)</b>	<b>Volume, (cy)  Below MHW to -13 ft</b>	<b>Unit Vol  (cy/lf)</b>	<b>Volume ( cy)  Volume Berm to -13ft</b>	<b>Unit Vol  (cy/lf)</b>	<b>Vol -13 to -20 ft (cy)</b>
R-10	8907	3.6	19356	9.4	28263	13.0	-2830
R-11	10509	9.5	20218	19.1	30728	28.6	-3874
R-12	11712	9.7	19184	17.7	30896	27.4	-3349
R-13	14565	13.5	25446	20.2	40011	33.7	-4284
R-14	15888	15.4	34924	30.2	50812	45.6	-6691
R-15	13370	14.5	33479	35.6	46849	50.1	-7260
R-16	11545	10.5	26736	27.0	38281	37.5	-5600
R-17	12808	11.7	25609	24.3	38417	35.9	-5969
R-18	17230	14.1	23437	27.2	40666	41.3	-15042
R-19	19803	20.4	22167	19.7	41970	40.1	-23464
R-20	19834	20.7	19584	26.3	39418	46.9	-30497
R-21	17177	20.5	18884	14.3	36060	34.8	-33009
R-22	9821	14.4	19236	24.0	29057	38.4	-21262
R-23	4227	7.3	10794	18.5	15021	25.8	-9552
R-24	1134	4.5	2941	11.6	4075	16.0	-2706
R-24.5		0		0		0	
<b>TOTAL(survey area)</b>	<b>188,529</b>	<b>12.67</b>	<b>321,995</b>	<b>21.67</b>	<b>510,524</b>	<b>34.34</b>	<b>-175,388</b>

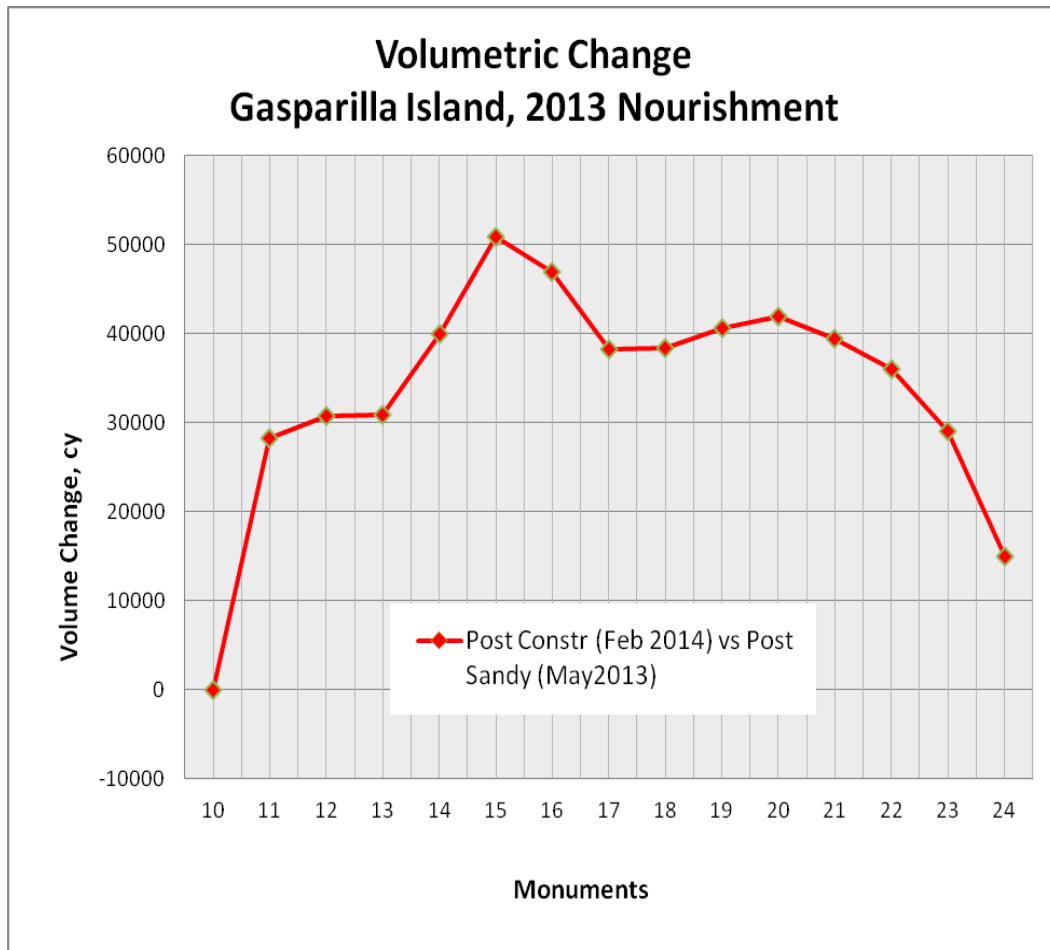


Figure 7. Volumetric Change Pre-Construction to Post-Construction From Dune to -13.0 NAVD88.

### Borrow Area Survey Analysis

The offshore borrow area for the 2013 Lee County, Gasparilla Island Segment SPP renourishment project is located approximately 1 mile southwest of the southern end of Gasparilla Island, in pre-dredging water depths of about -10 feet, NAVD88. The maximum permitted excavation limits in Cuts 1 through 4 used for this nourishment of the borrow area is -25.2 feet, NAVD88 (equivalent to -23.46 ft mllw and -24.0 ft NGVD). The dimensions of the permitted borrow area are approximately 1,200 feet (north-south) by 5,800 feet (east-west).

As specified in DEP Permit 0174403-001-JC, borrow area surveys were required for pre- and post- construction only. The pre- construction survey was conducted during 13-17 May 2013

(Survey 13-077 Post Sandy Survey). The post-construction borrow area survey was performed on 11 February 2014. The total net volume change measured within the limits of the permitted borrow area was -398,804 cubic yards. This is lower than the measured contract pay volume within the fill template on the beach (457,834 cy). The difference may represent some sediment movement into the borrow area. Also a volume difference of -86,704 cy was calculated for the borrow area access, Cut 1, which could be due to sediment movement out of Cut 1 and possibly into Cut 2.

Analysis of the pre- and post- project borrow area surveys indicates that the area was dredged relatively uniformly, and no areas were dredged beyond the permitted limits.

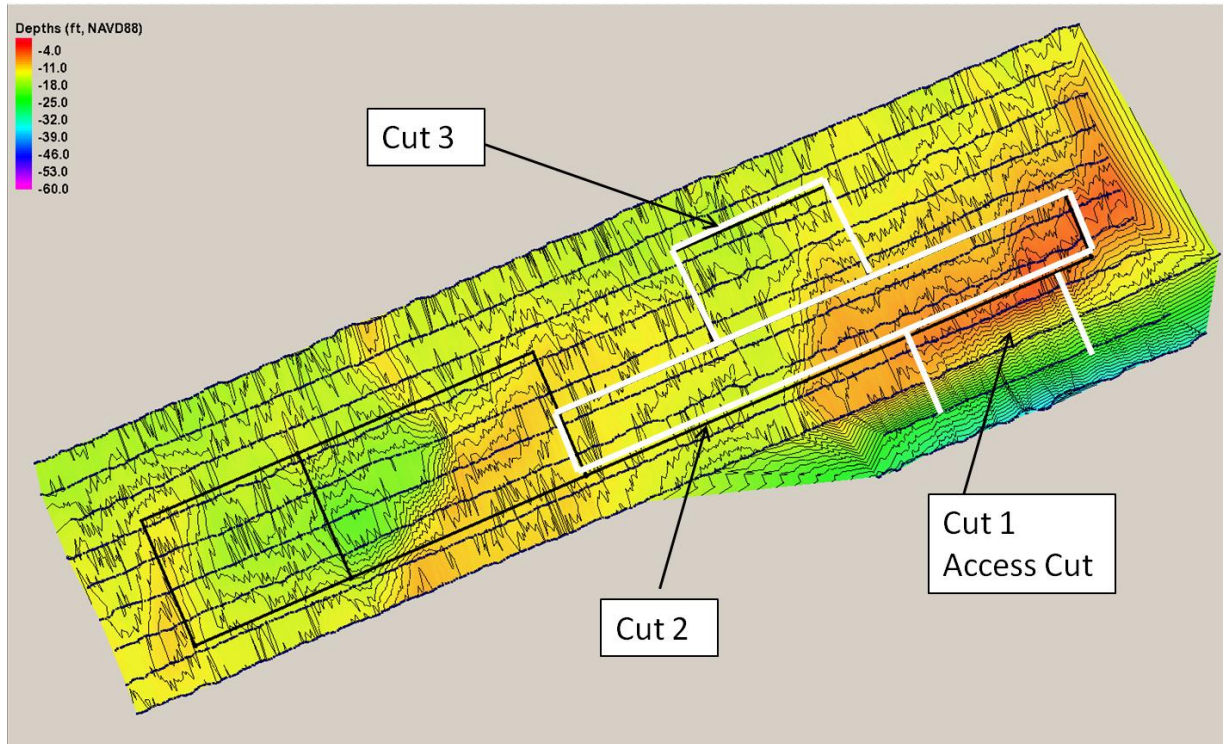


Figure 8. Pre-construction Borrow Area Depths (Survey 13-077 -11 -17 May 2013).

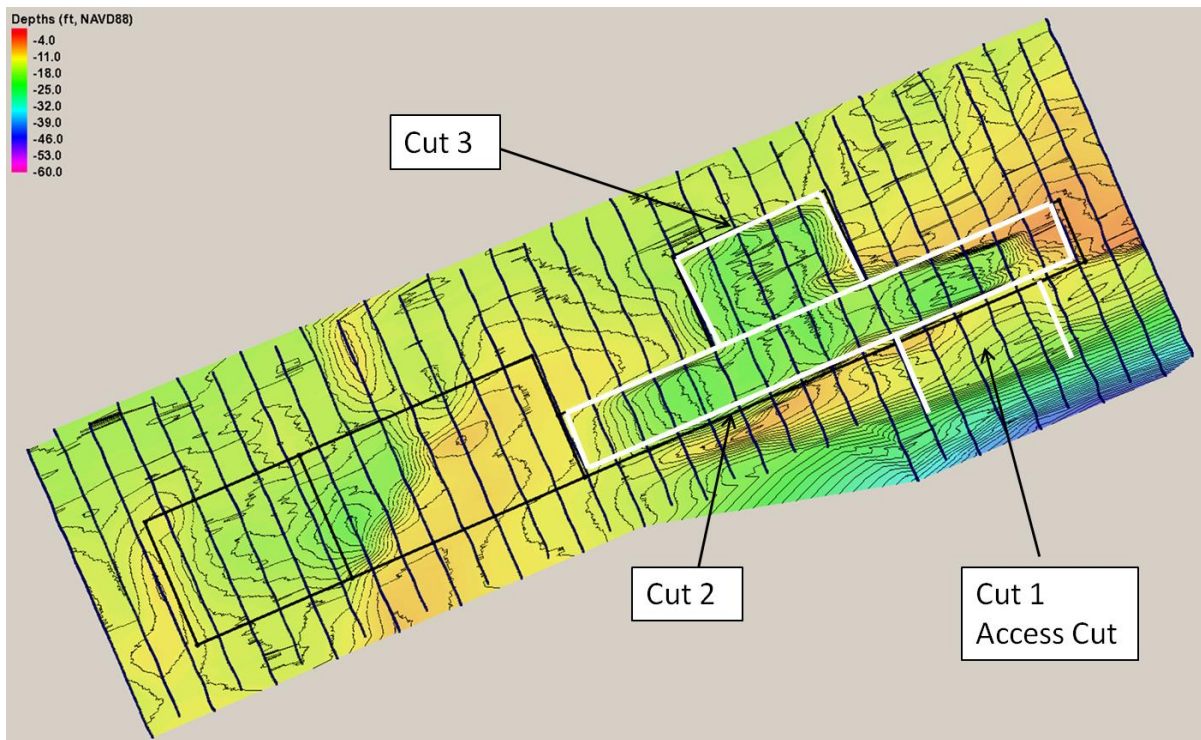


Figure 9. Post-construction Borrow Area Depths (Survey 14-041 -11Feb 2014).

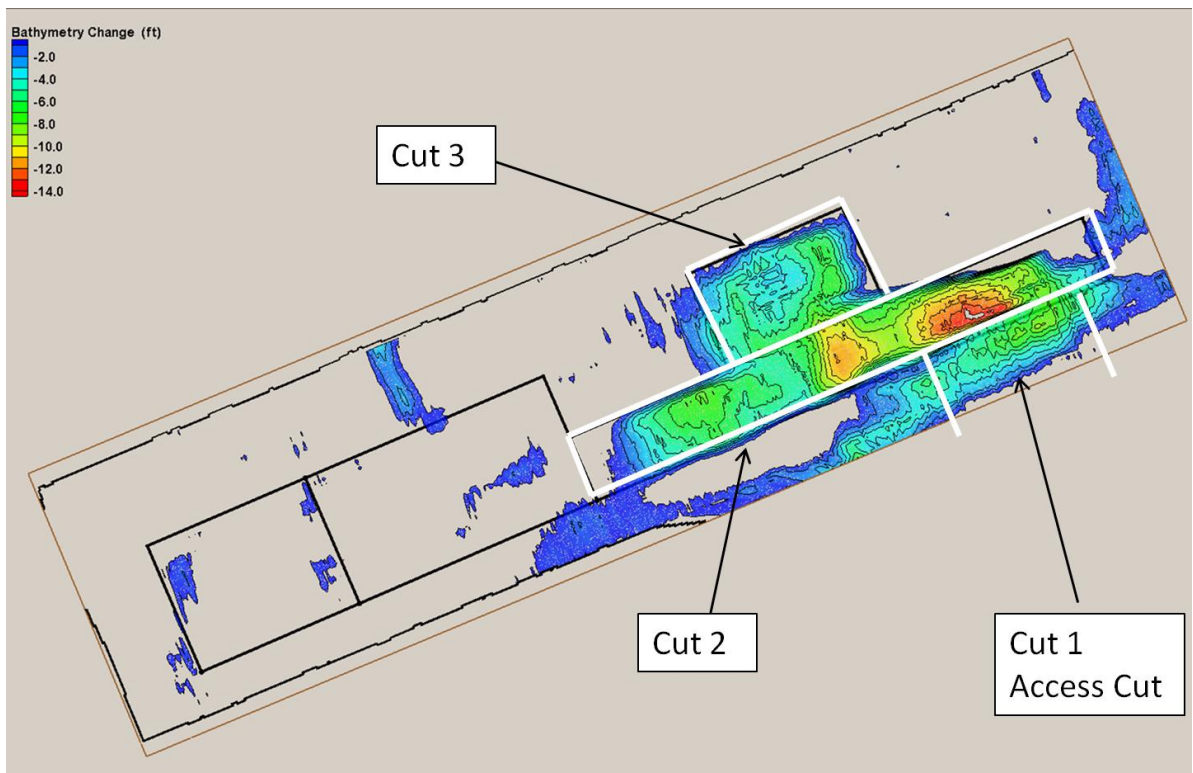


Figure 10. Borrow Area Pre- Post- Construction bathymetry change.

## Summary

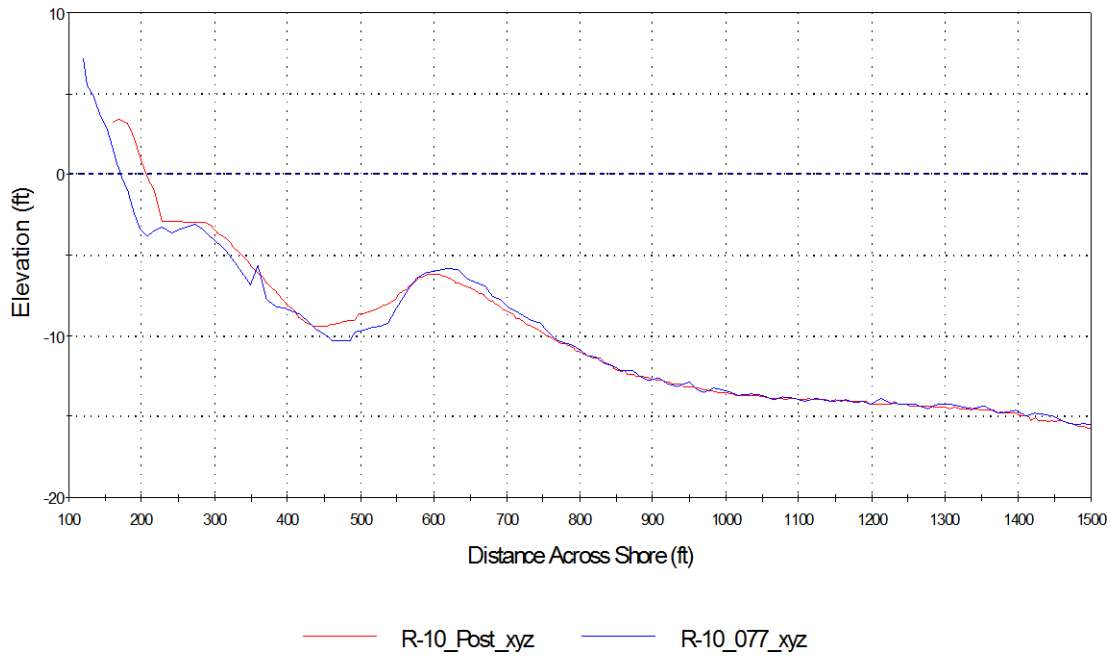
This report summarizes the history of the Lee County Gasparilla Island Segment (SPP) and provides details of the events during the construction of the 2013 renourishment. The pre-construction, post-construction beach profile surveys and borrow area surveys were evaluated in this report and the results are presented herein.

The average mhw advance throughout the fill area as a result of project construction was +100.5 feet. The contract (pay) volume was 457,434 cubic yards, based on acceptance-section surveys performed at the time of construction. Analysis of the pre- and post-construction monitoring surveys indicated a volume difference of +510,524 cubic yards along the fill area. The total volume is about 50,000 cy more than the pay volume of 457,434 which only includes the volume within the construction template tolerance. The difference between the two sets of volumes are due to overfill of the template, equilibration, and profile changes which occurred between the pre-construction (May 2013) and the pre-fill survey (October 2013). Based on surface differences between the after dredge (13-207 AD) and post-construction (14-039) surveys, there is a net loss of -58,920 cy within the template tolerance.

The total net volume change measured within the limits of the permitted borrow area was -398,804 cubic yards. This is lower than the measured contract pay volume within the fill template on the beach (457,834 cy). The difference includes material lost due to turbidity at both the borrow area and pumpout sites, and may represent some sediment movement into the borrow area. Also a volume difference of -86,704 cy was calculated for the borrow area access, Cut 1, which could be due to sediment movement out of Cut 1 and possibly into Cut 2.

## **Appendix A- BEACH PROFILES**

### R-10



### R-10

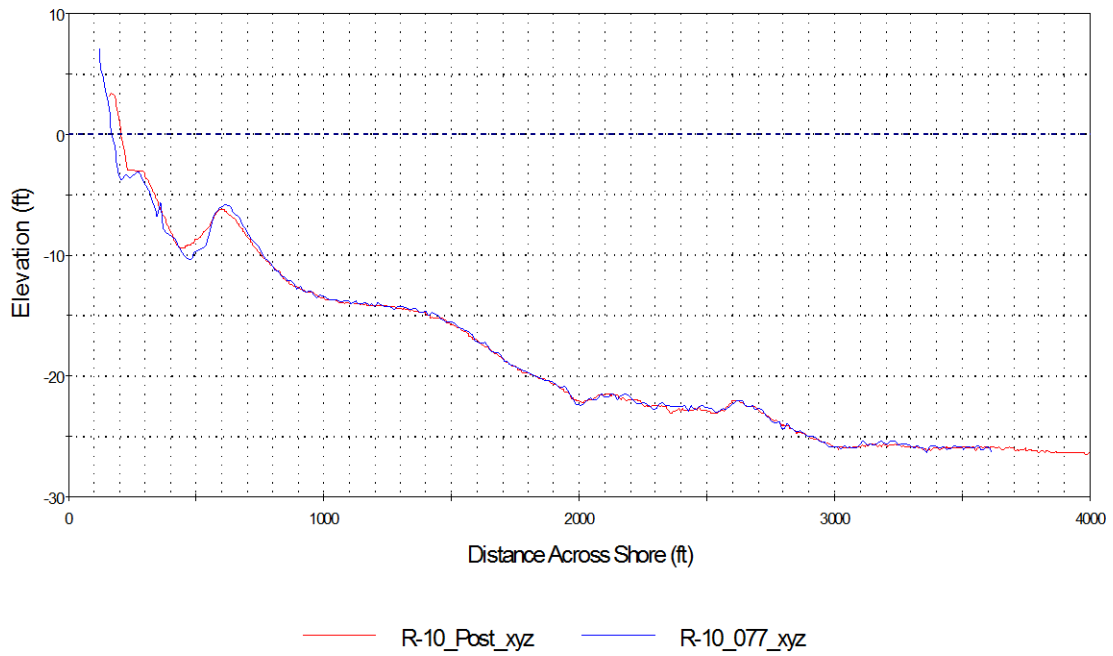
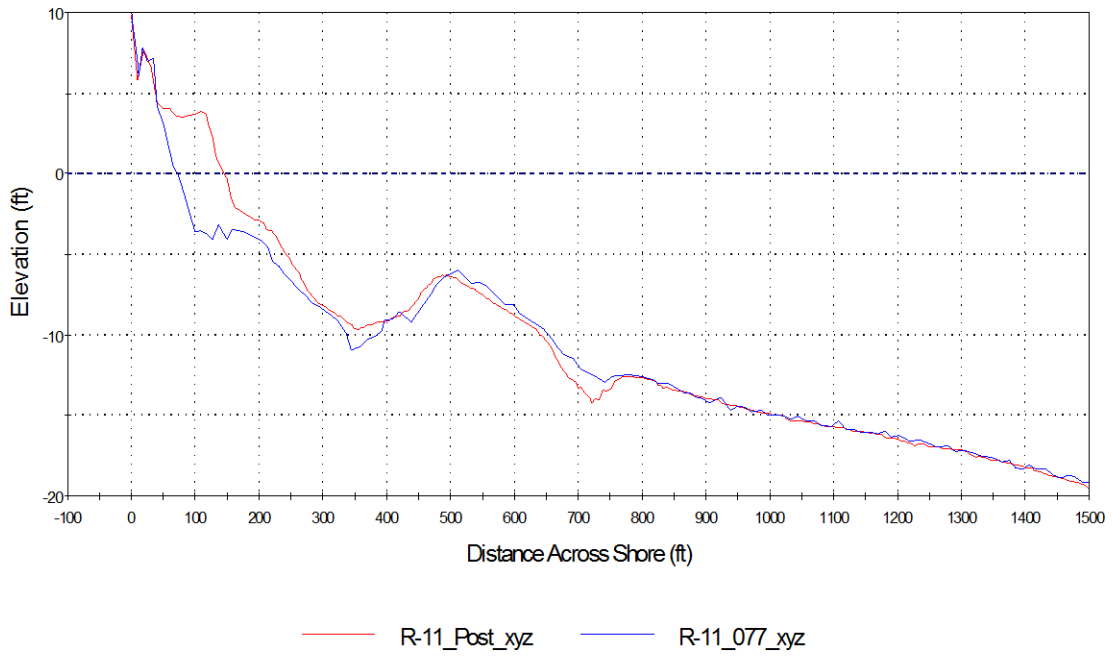


Figure A-1. Pre-/ post construction monitoring profiles at R-10.



R-11



R-11

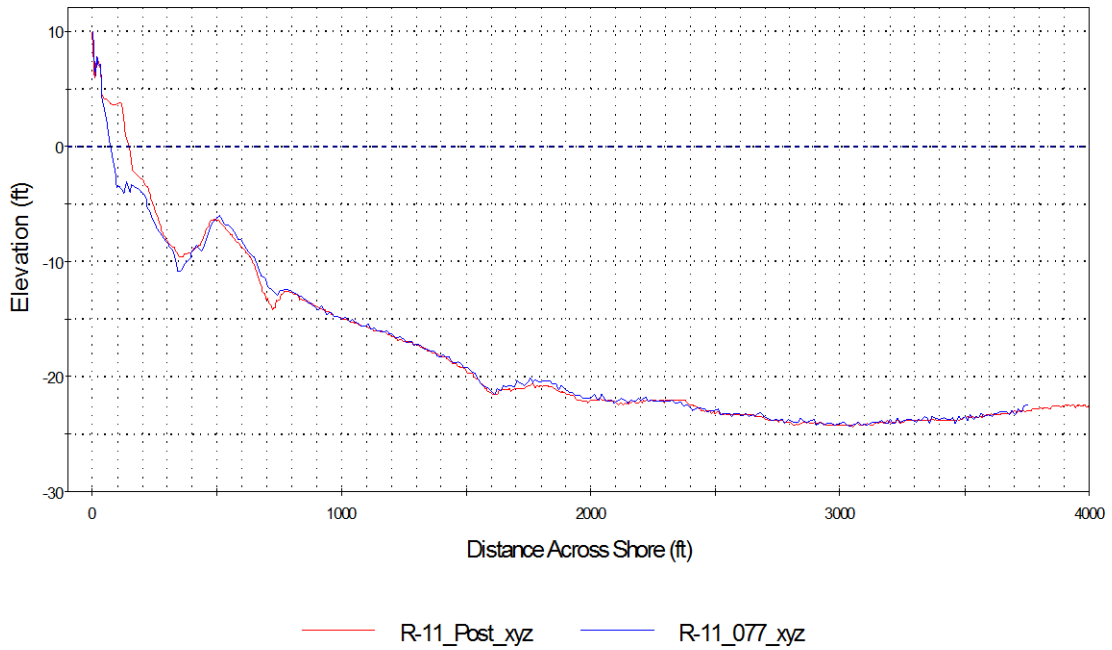
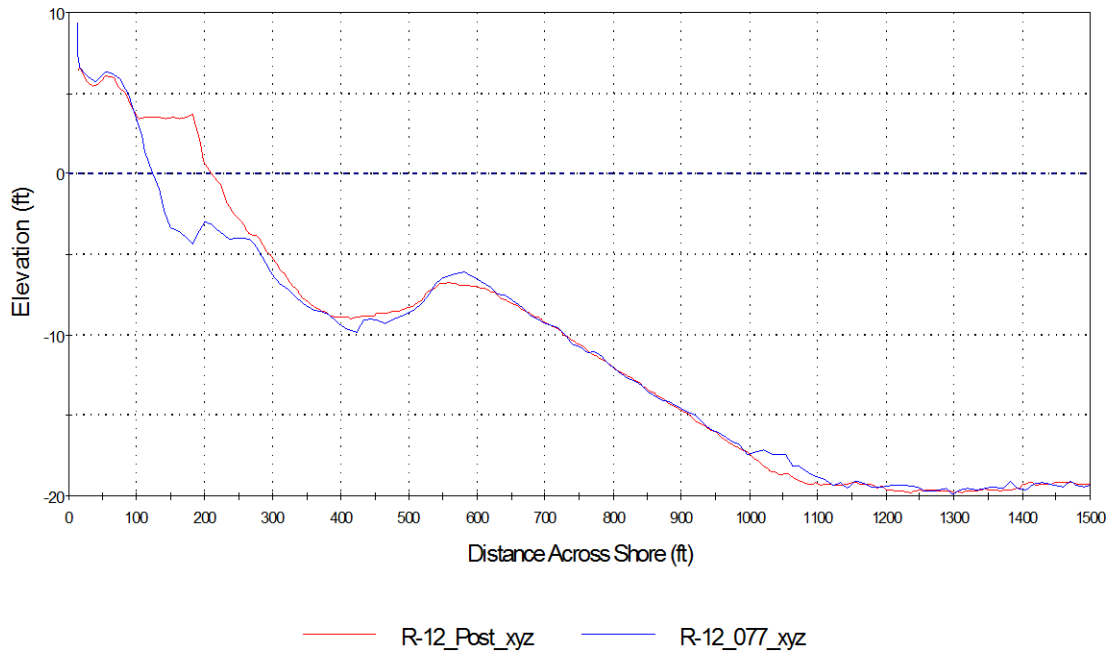


Figure A-2. Pre-/ post construction monitoring profiles at R-11.

R-12



R-12

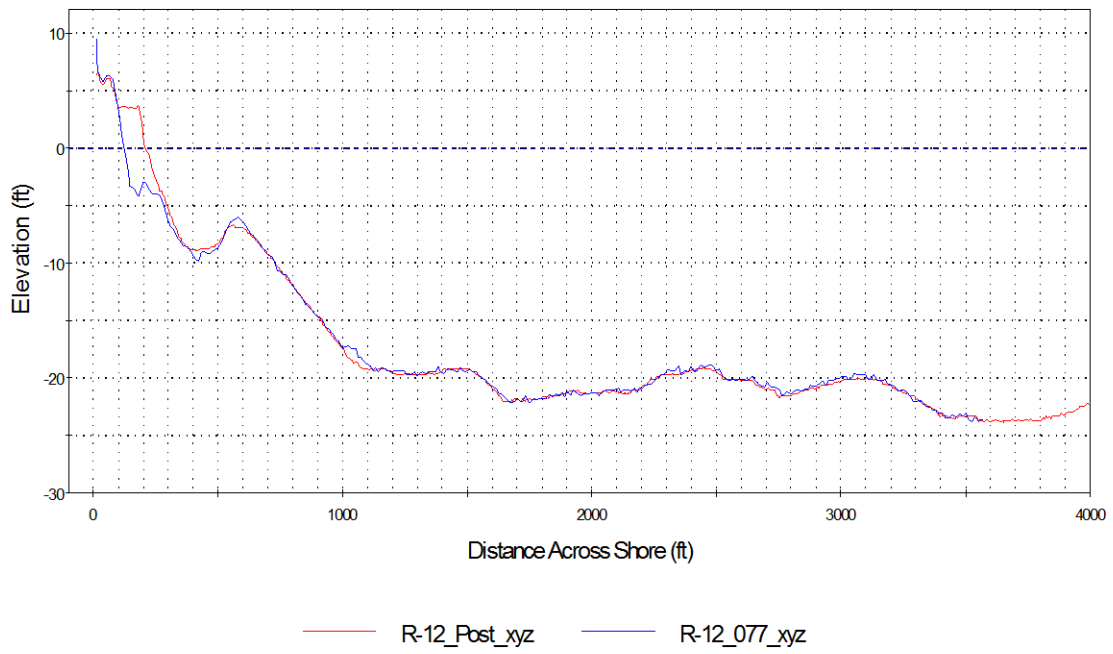
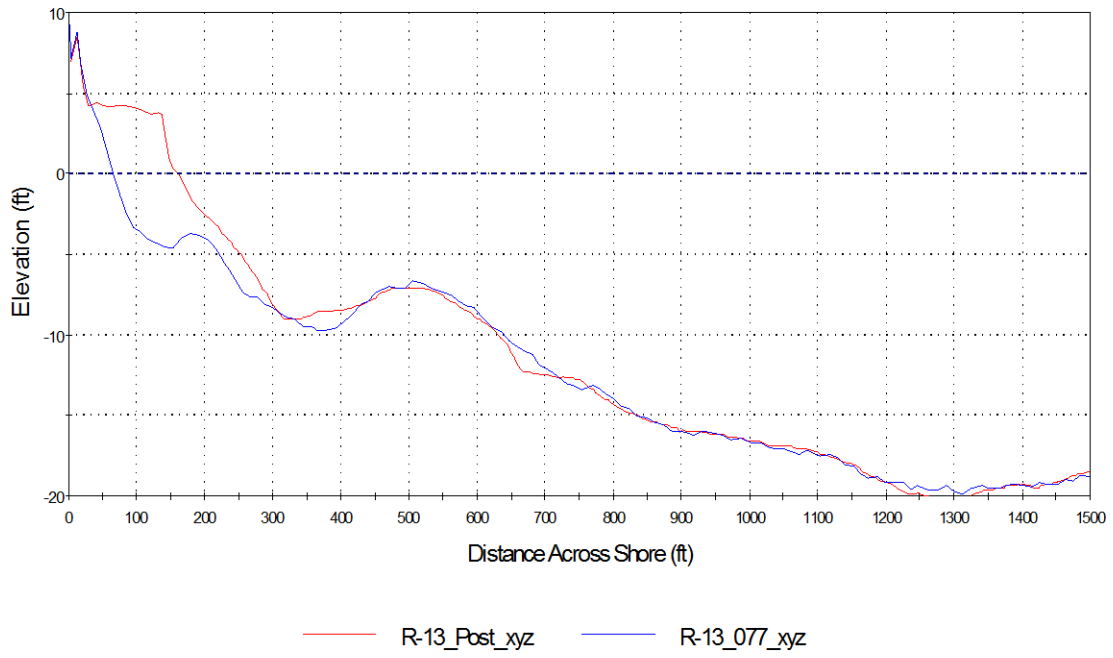


Figure A-3. Pre-/ post construction monitoring profiles at R-12.

R-13



R-13

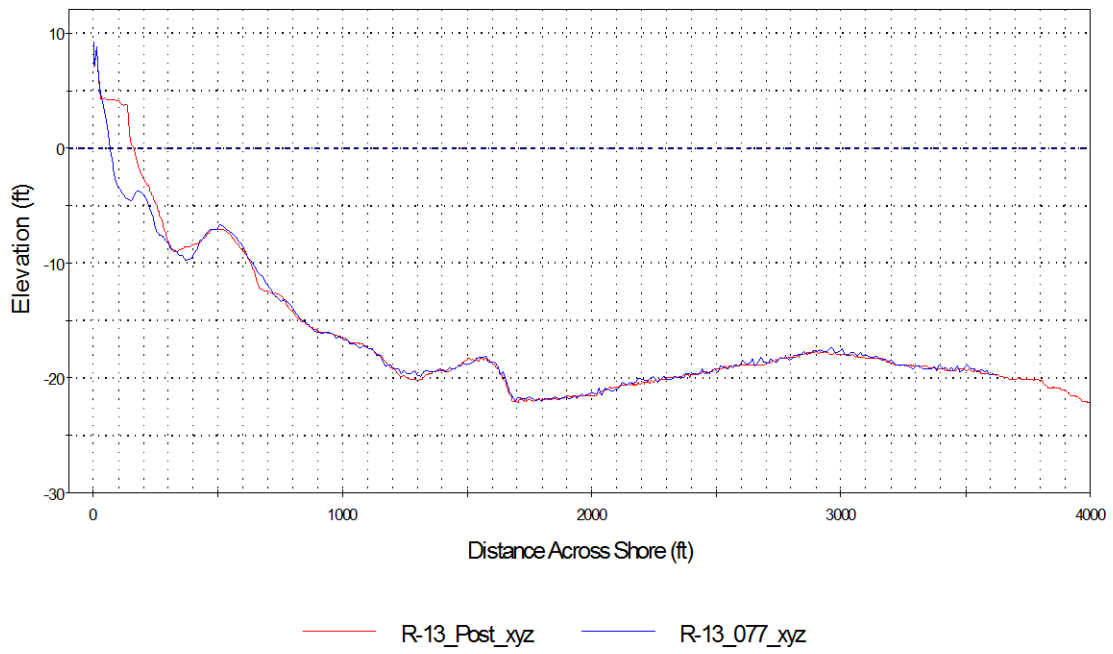


Figure A-4. Pre-/ post construction monitoring profiles at R-13.

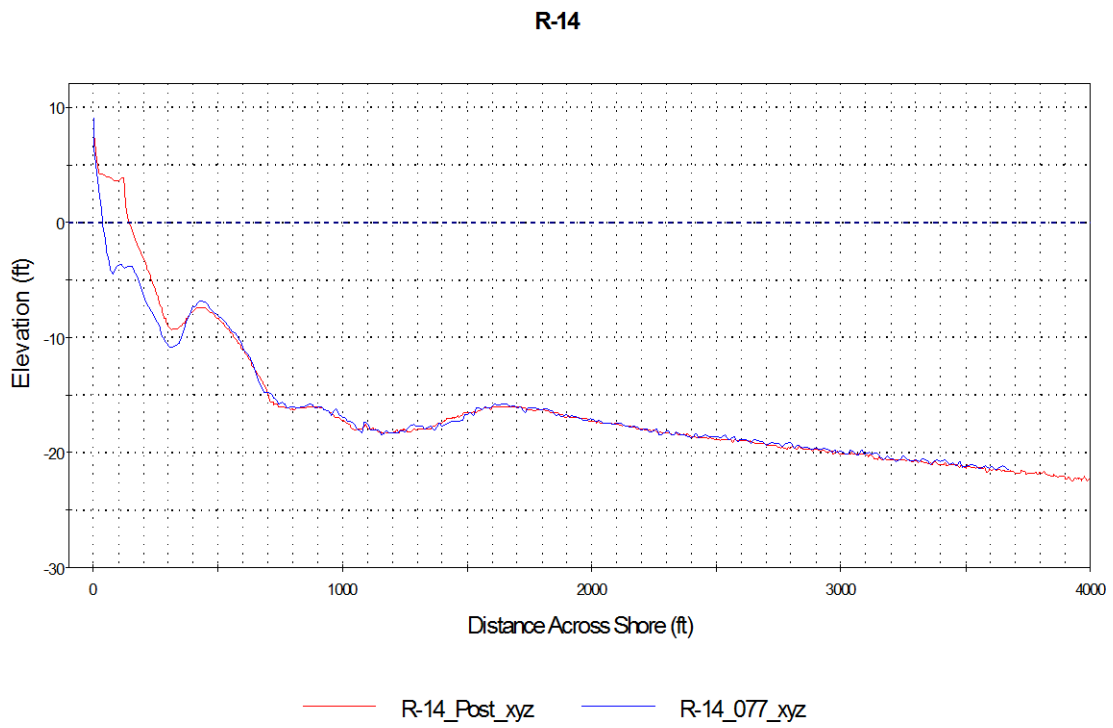
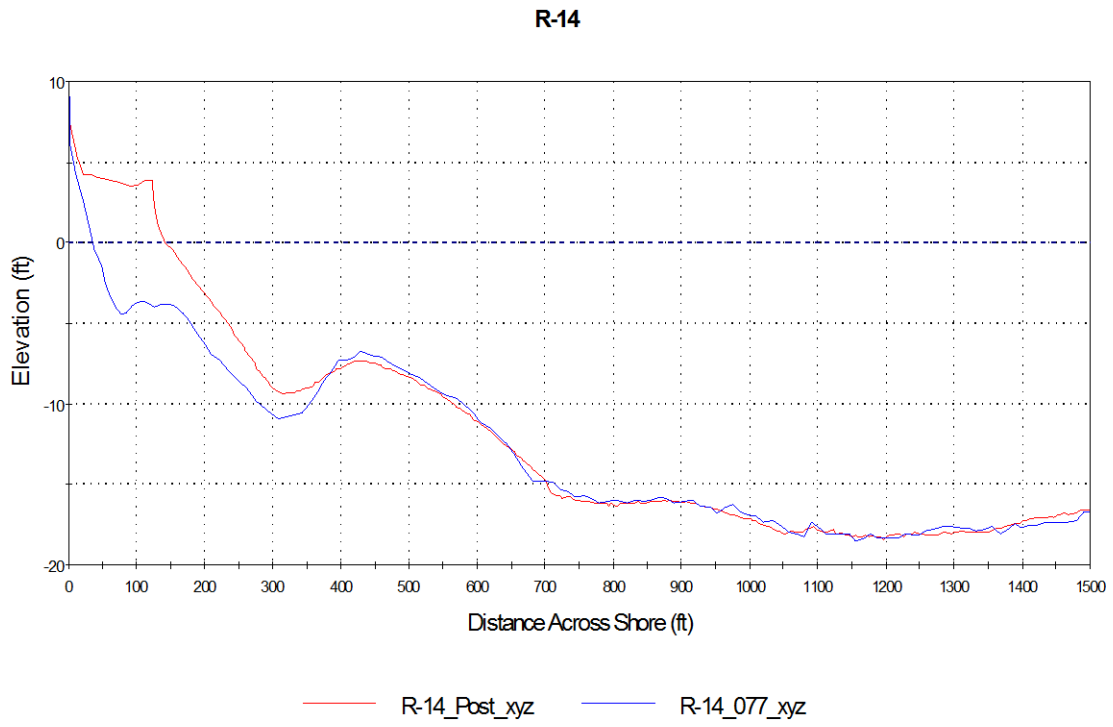
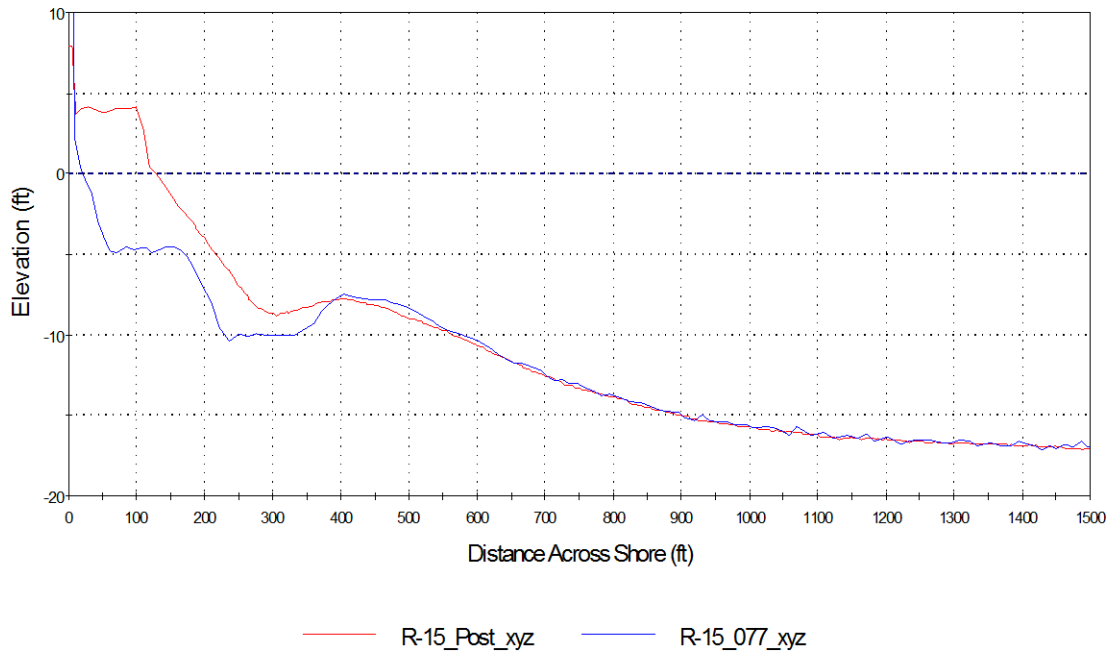


Figure A-5. Pre-/ post construction monitoring profiles at R-14.

R-15



R-15

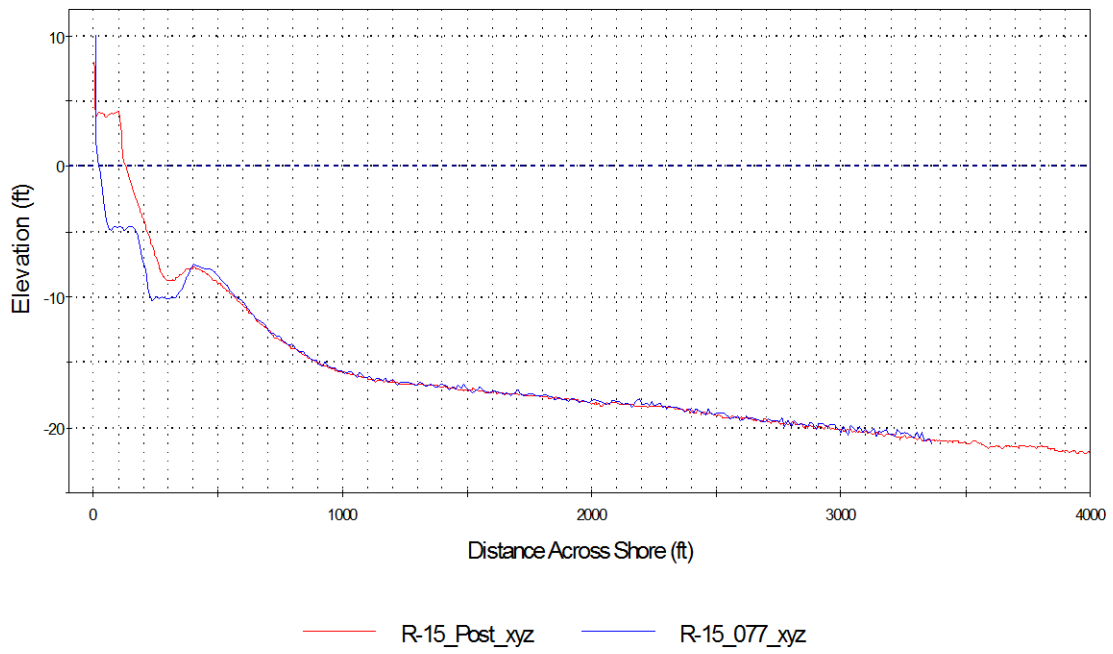


Figure A-6. Pre-/ post construction monitoring profiles at R-15.

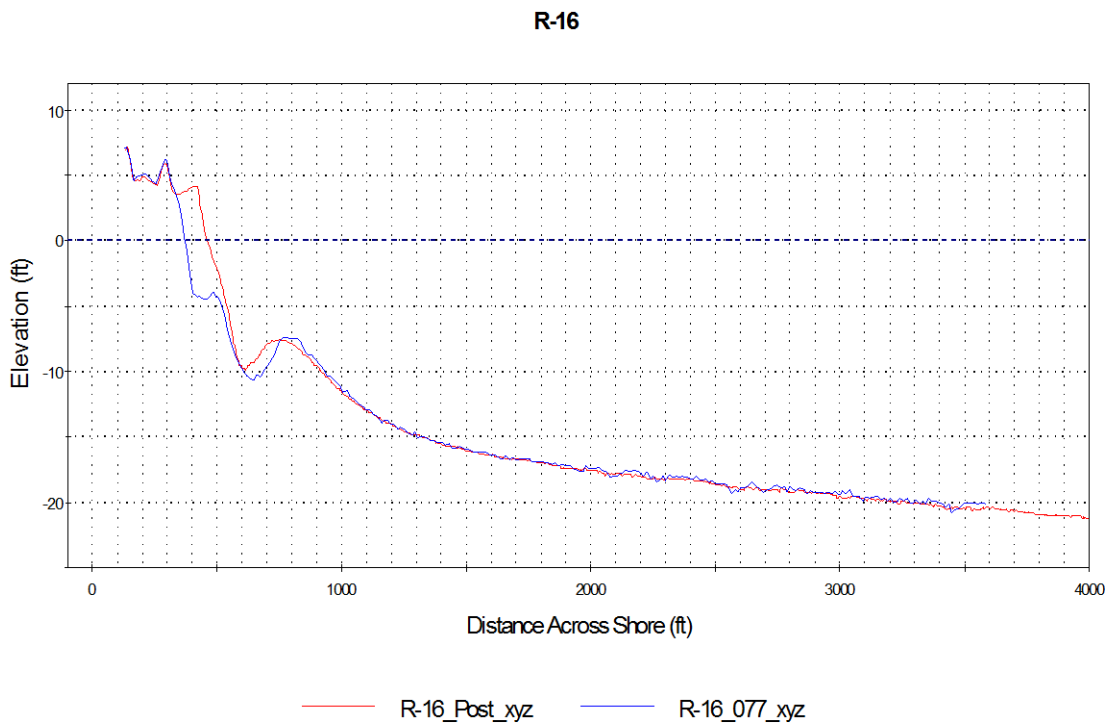
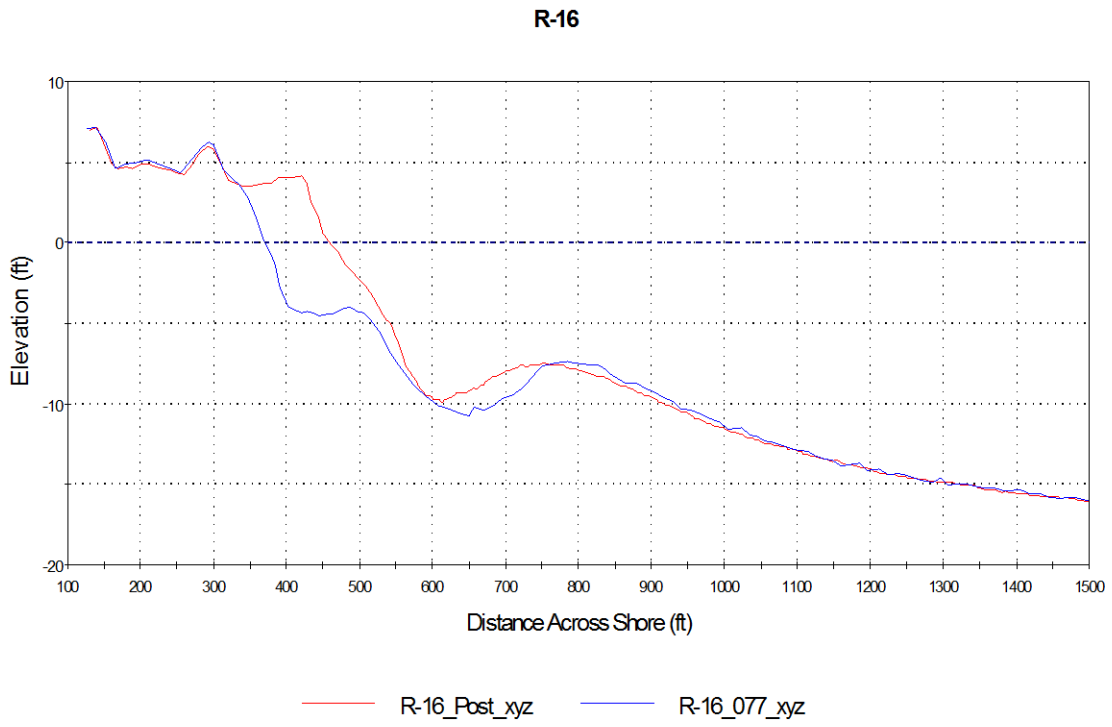


Figure A-7. Pre-/ post construction monitoring profiles at R-16.

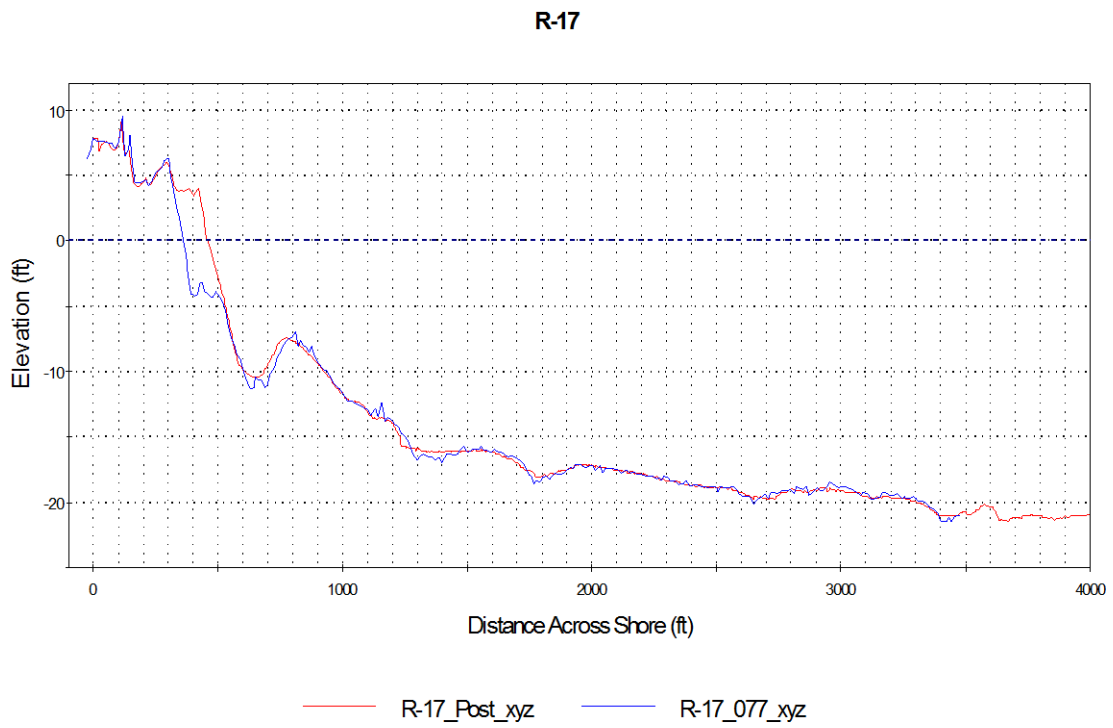
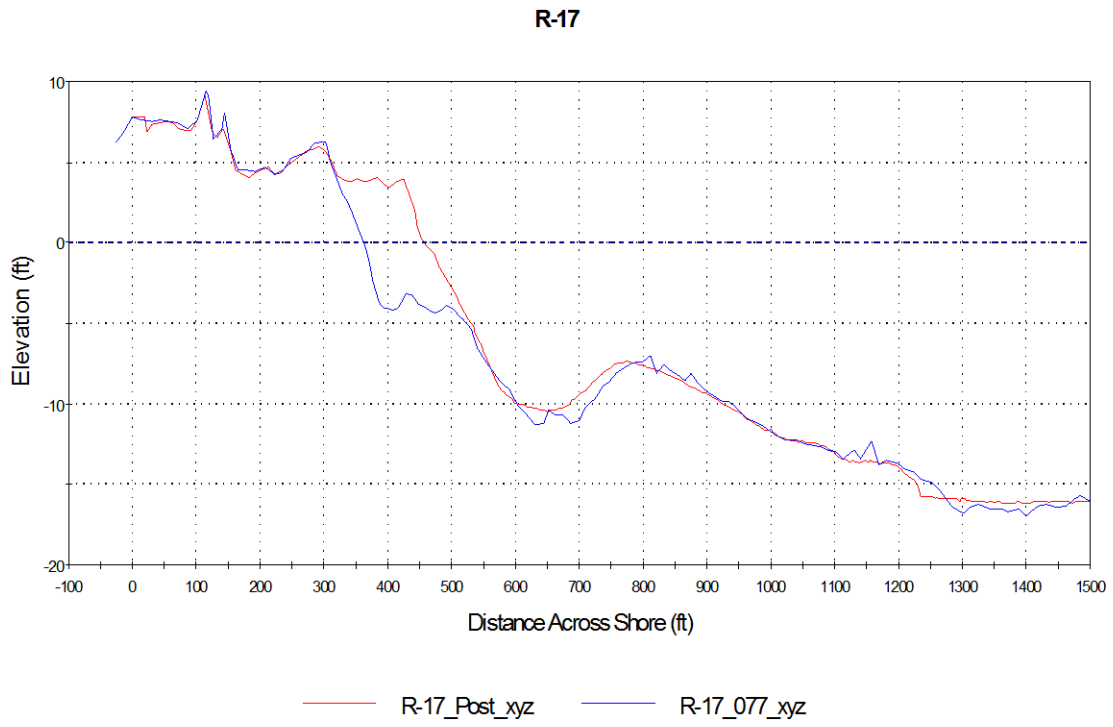


Figure A-8. Pre-/ post construction monitoring profiles at R-17.

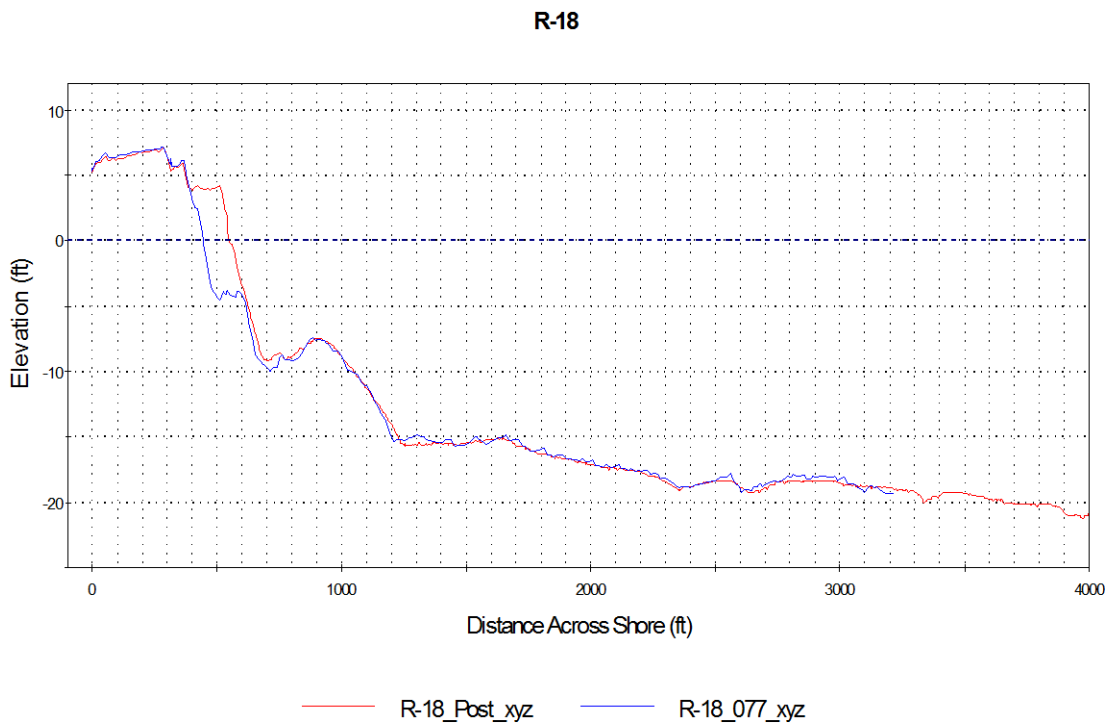
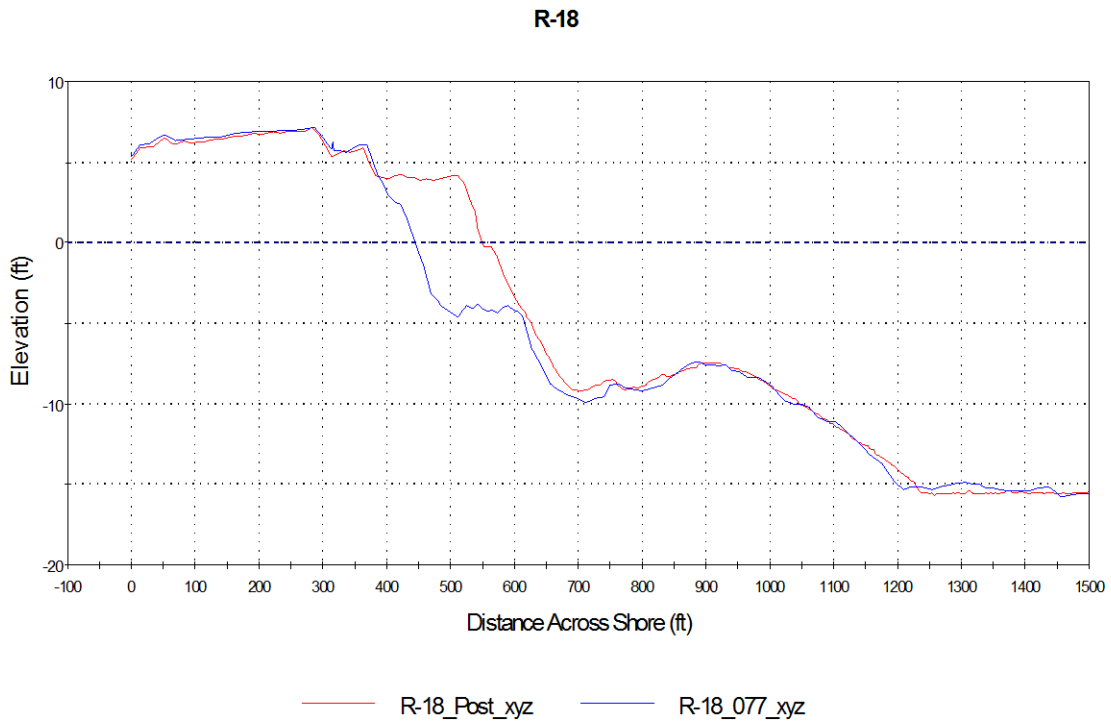


Figure A-9. Pre-/ post construction monitoring profiles at R-18.



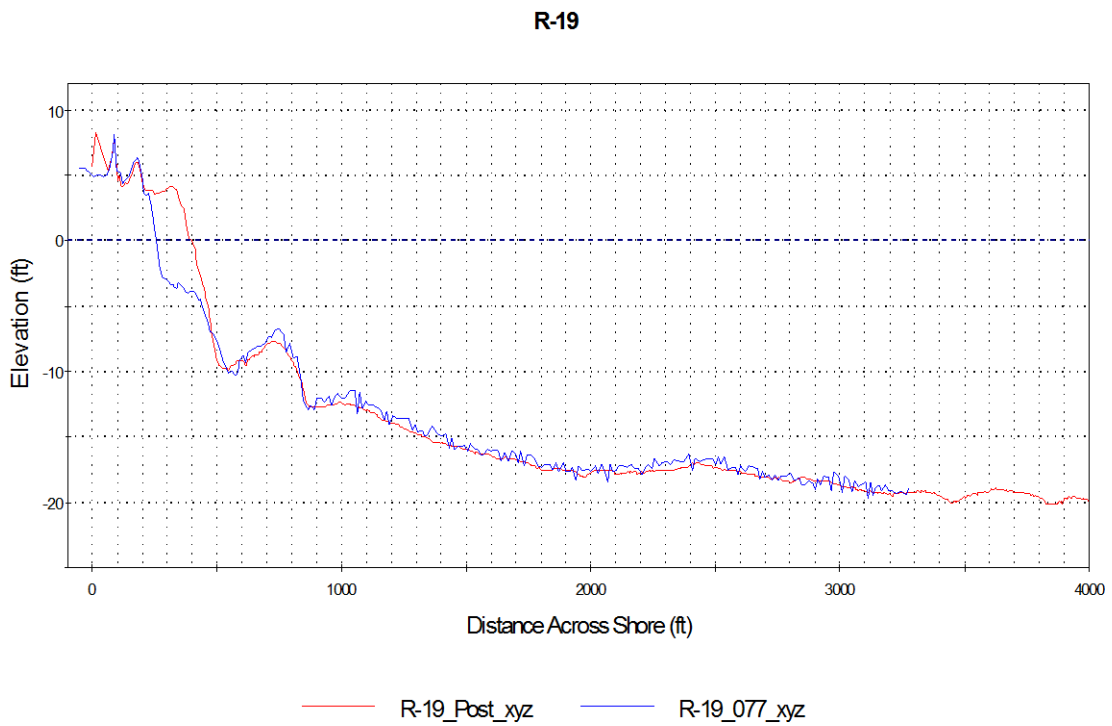
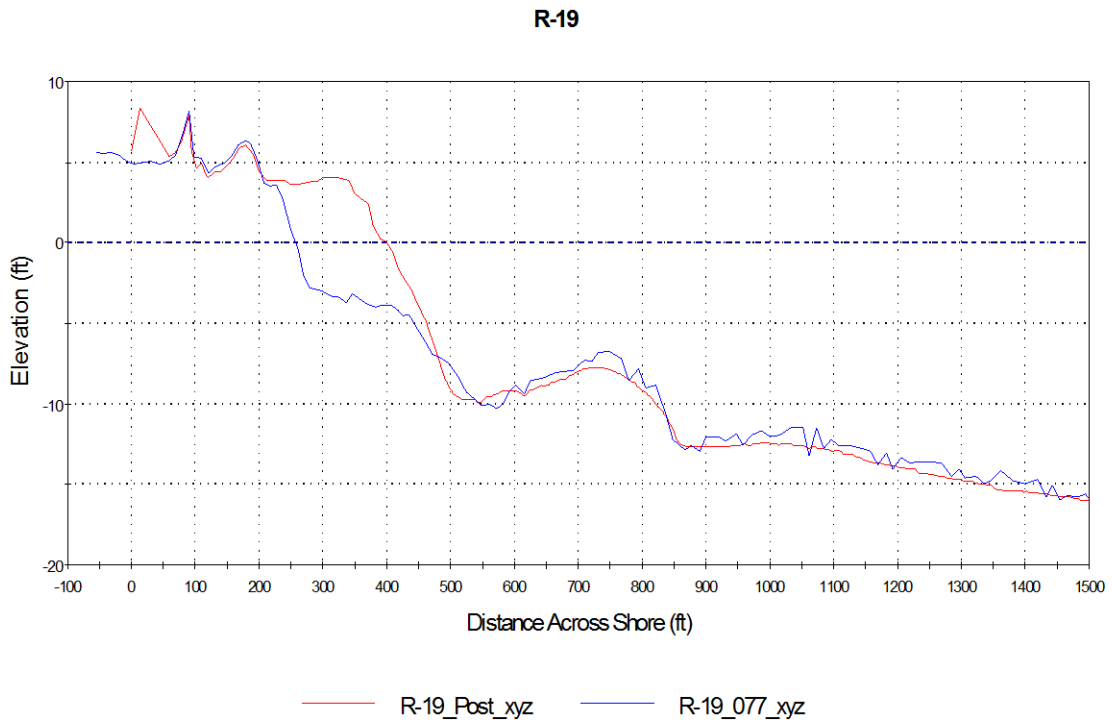


Figure A-10. Pre-/ post construction monitoring profiles at R-19.

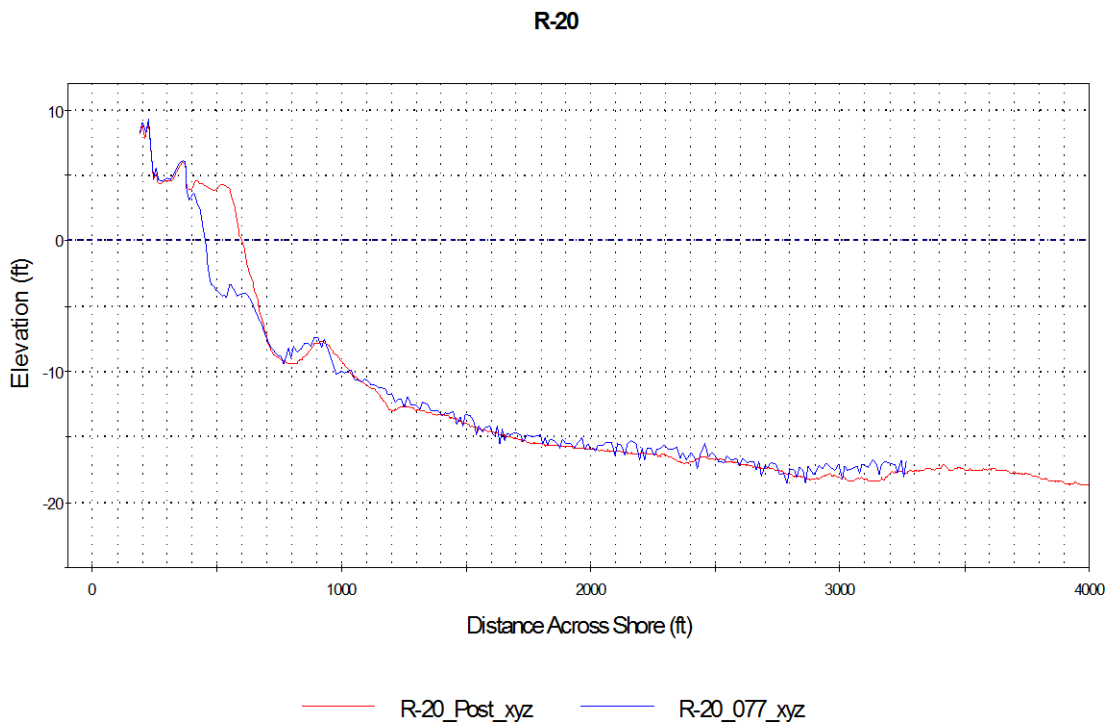
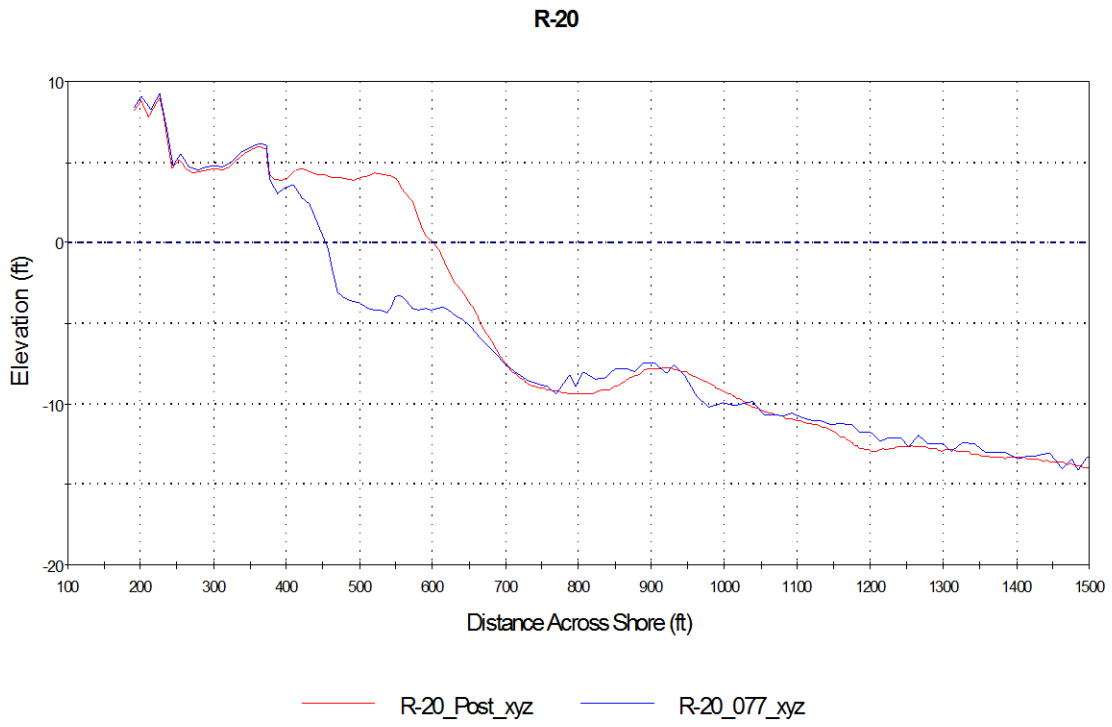


Figure A-11. Pre-/ post construction monitoring profiles at R-20.

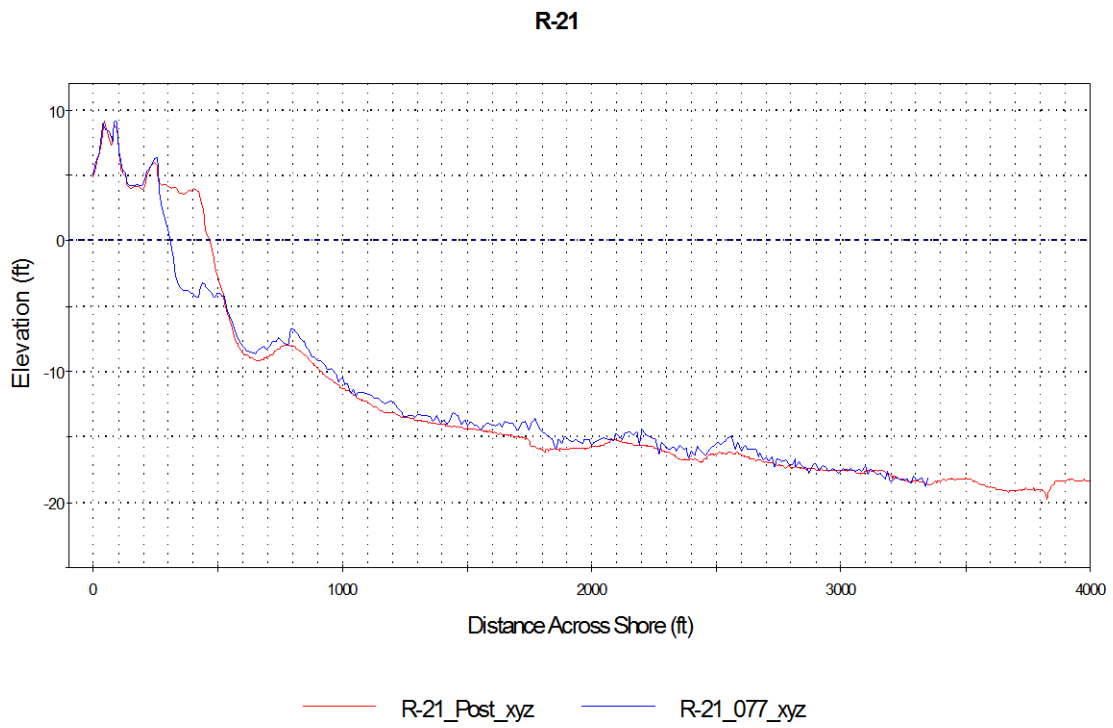
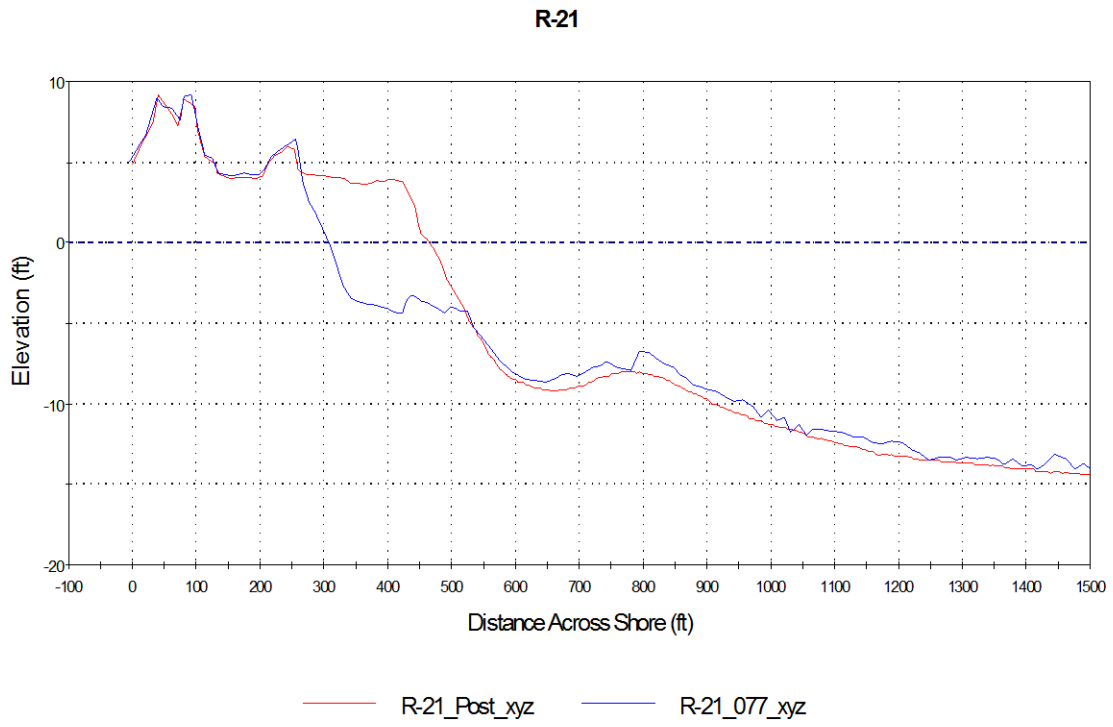


Figure A-12. Pre-/ post construction monitoring profiles at R-21.

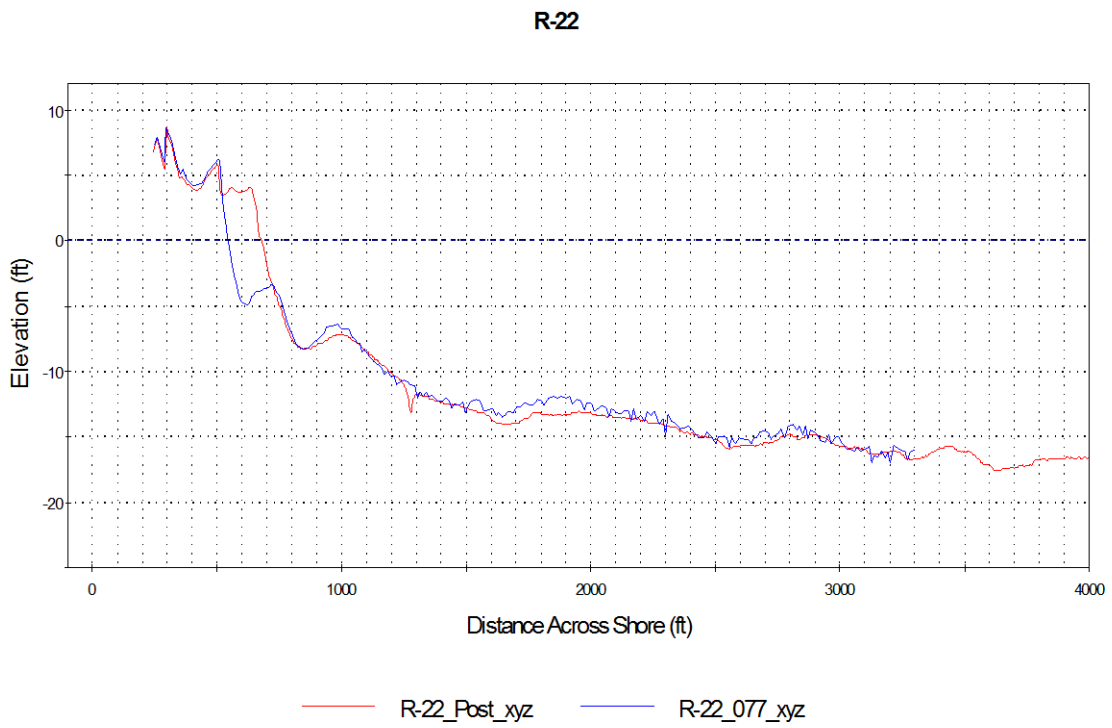
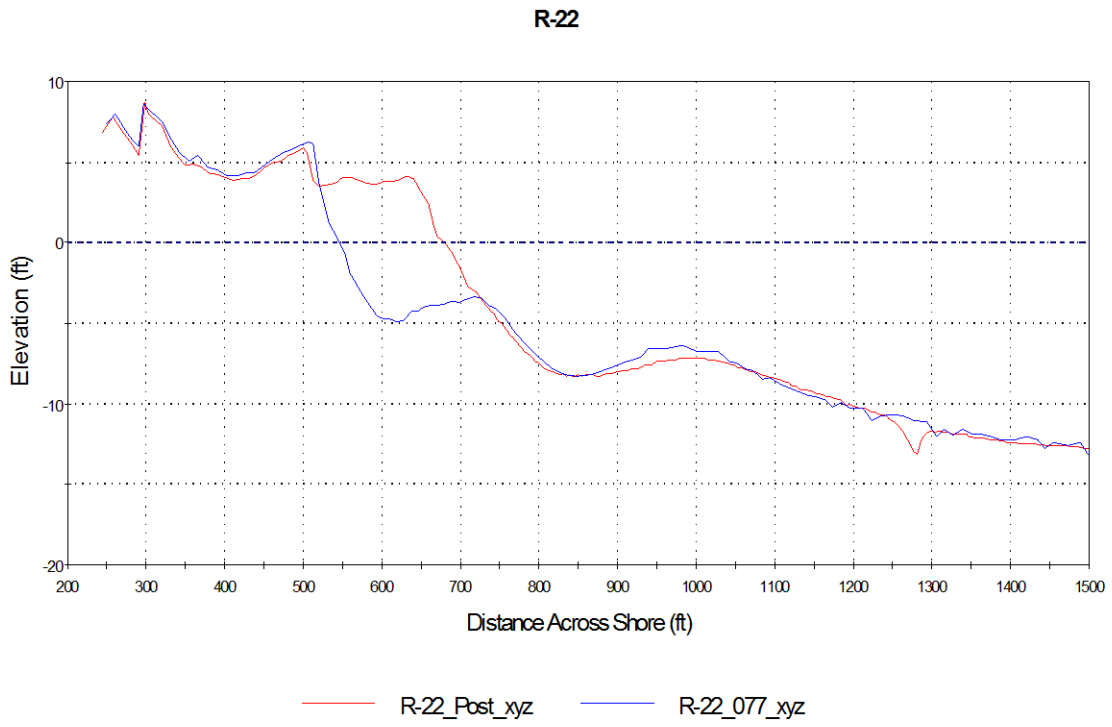


Figure A-13. Pre-/ post construction monitoring profiles at R-22.

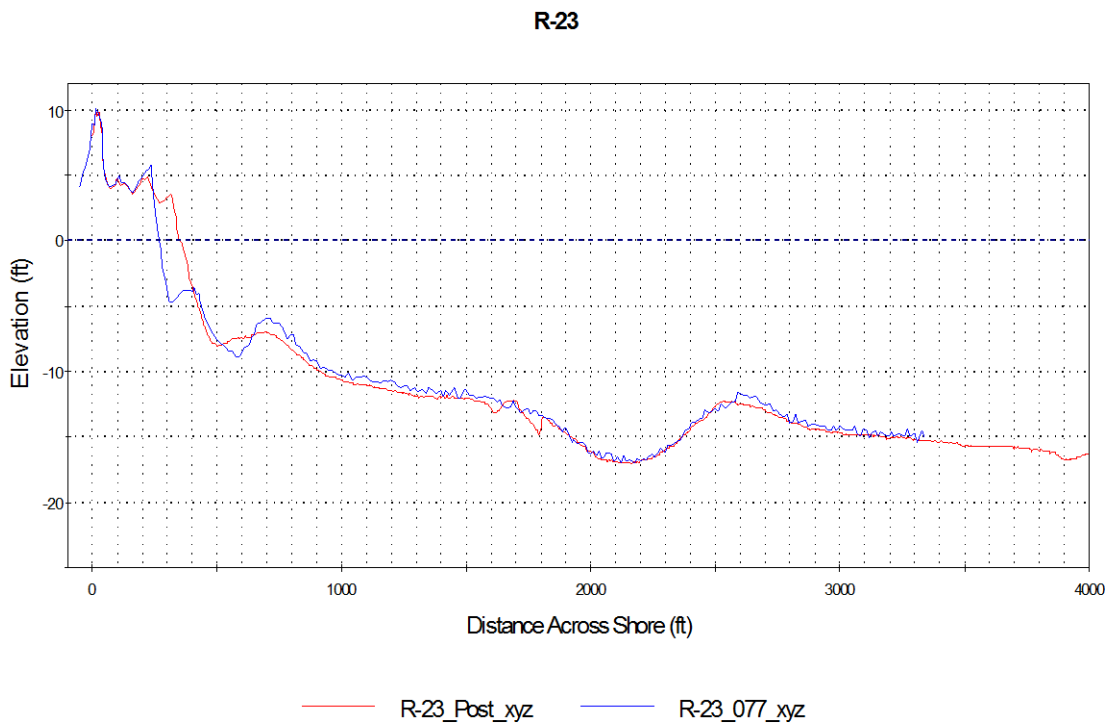
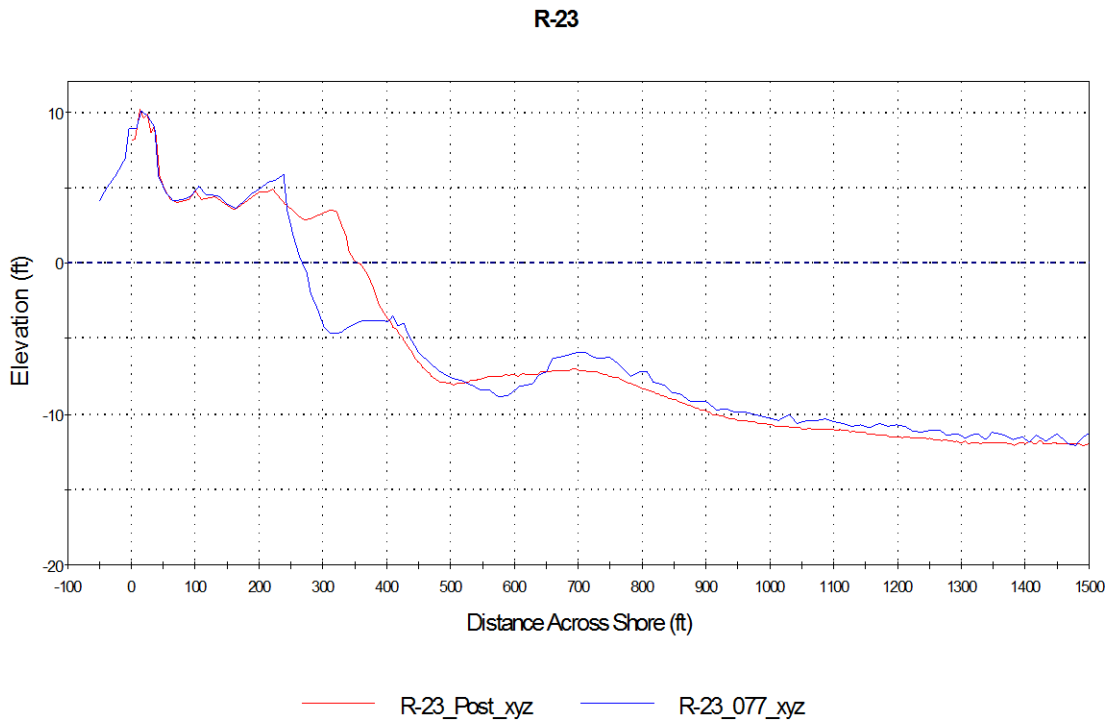


Figure A-14. Pre-/ post construction monitoring profiles at R-23.

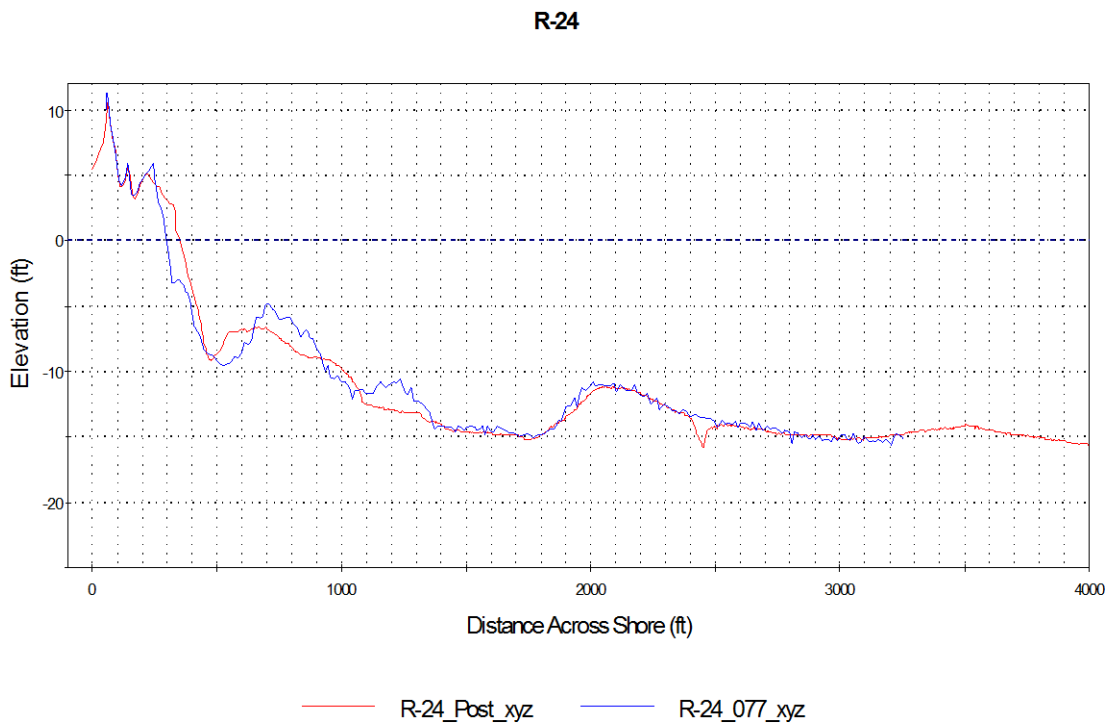
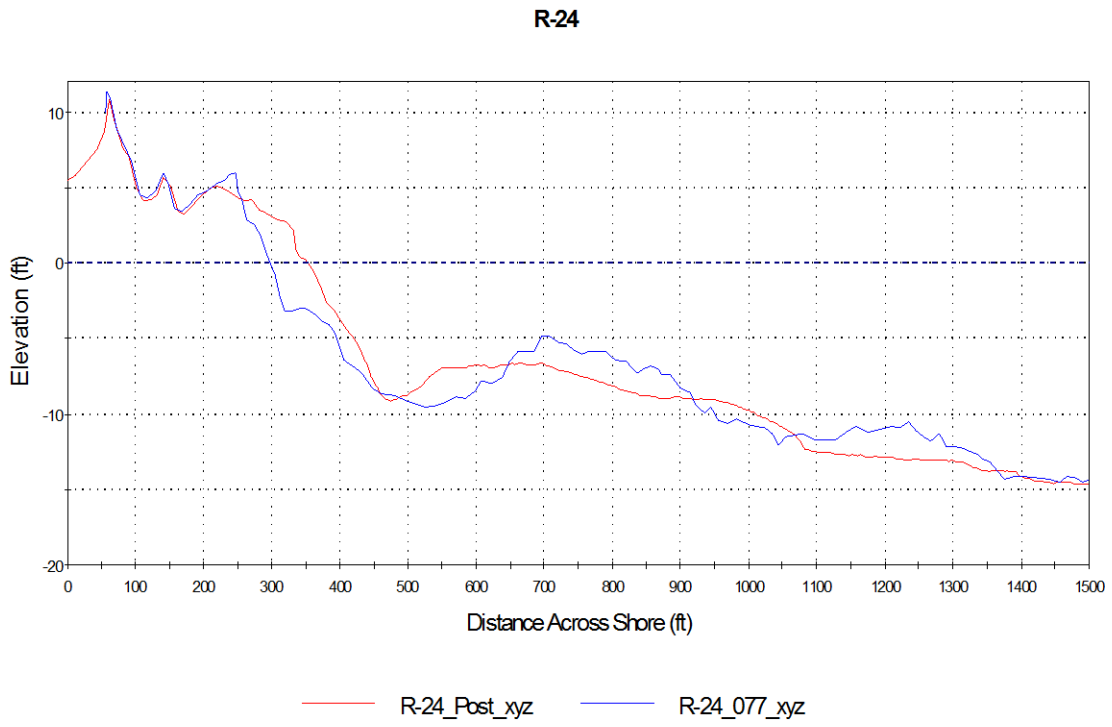
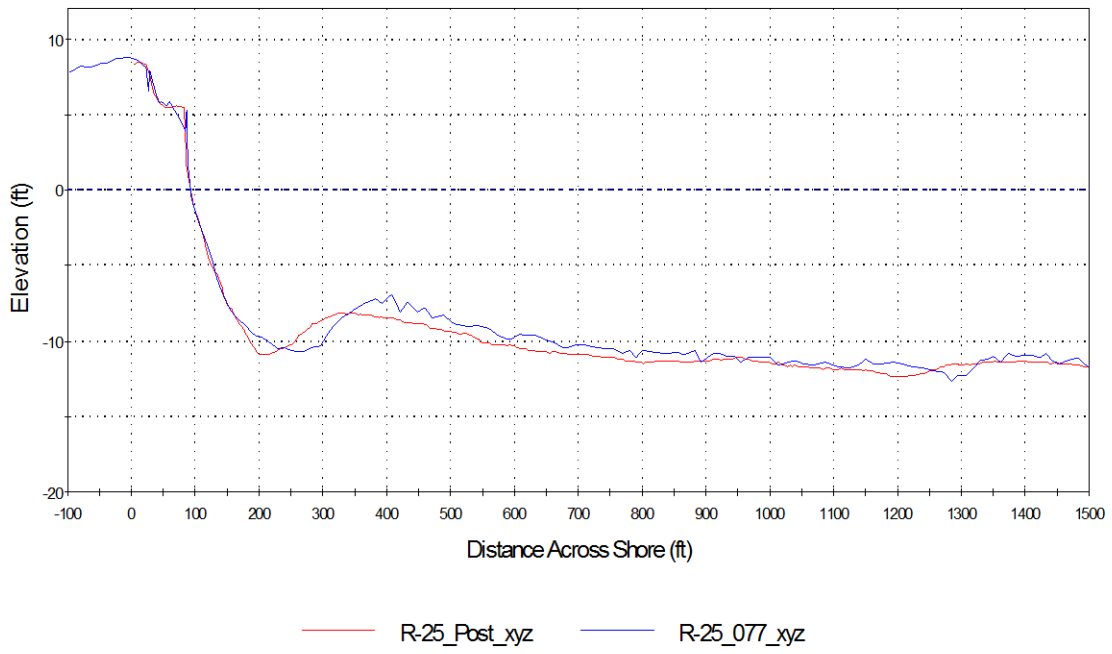


Figure A-15. Pre-/ post construction monitoring profiles at R-24.

R-25



R-25

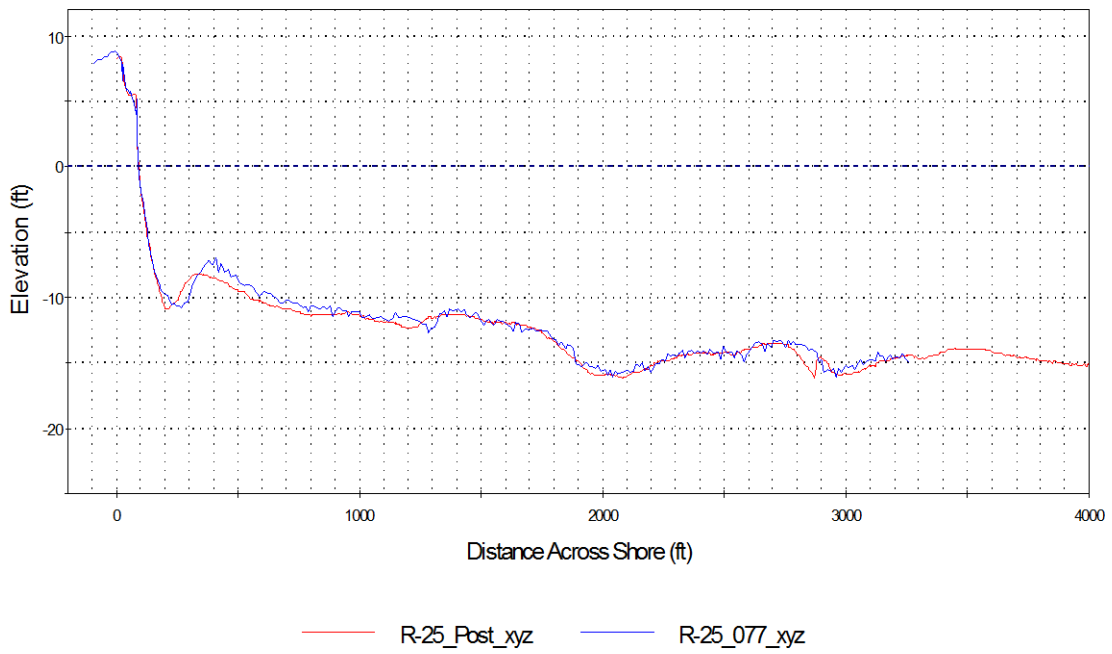
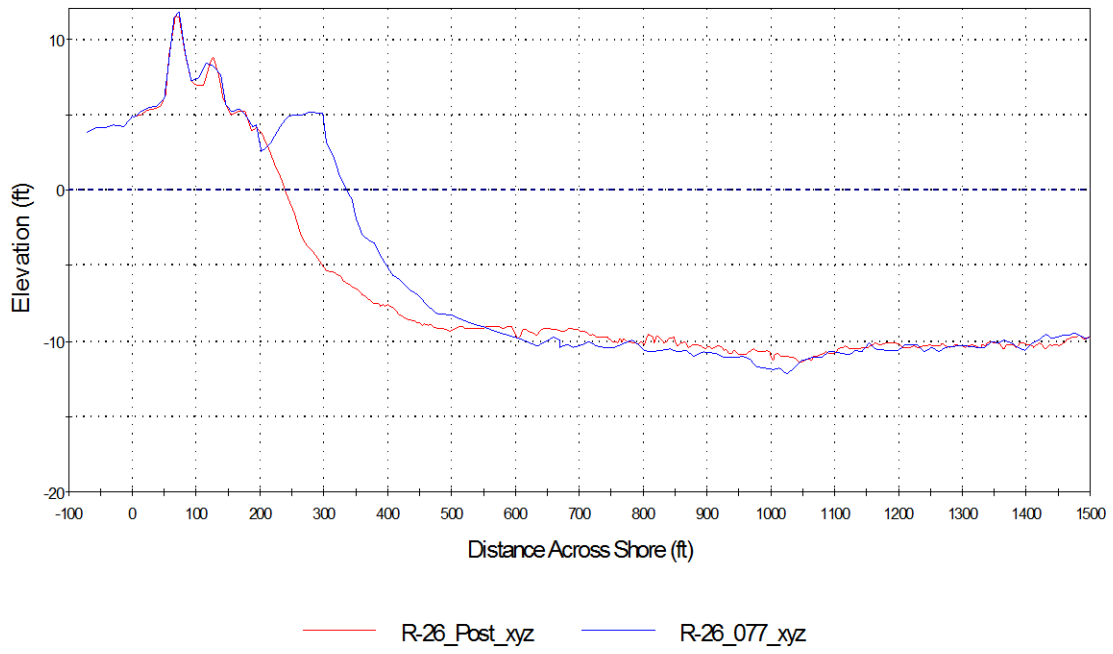


Figure A-16. Pre-/ post construction monitoring profiles at R-25.

R-26



R-26

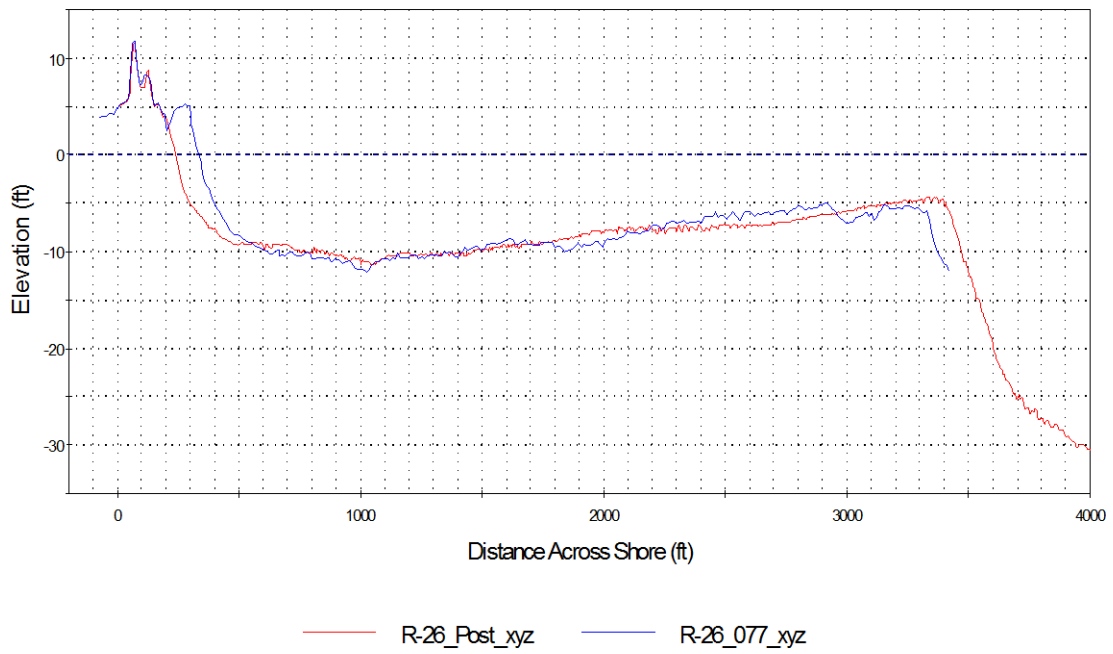


Figure A-17. Pre-/ post construction monitoring profiles at R-26.



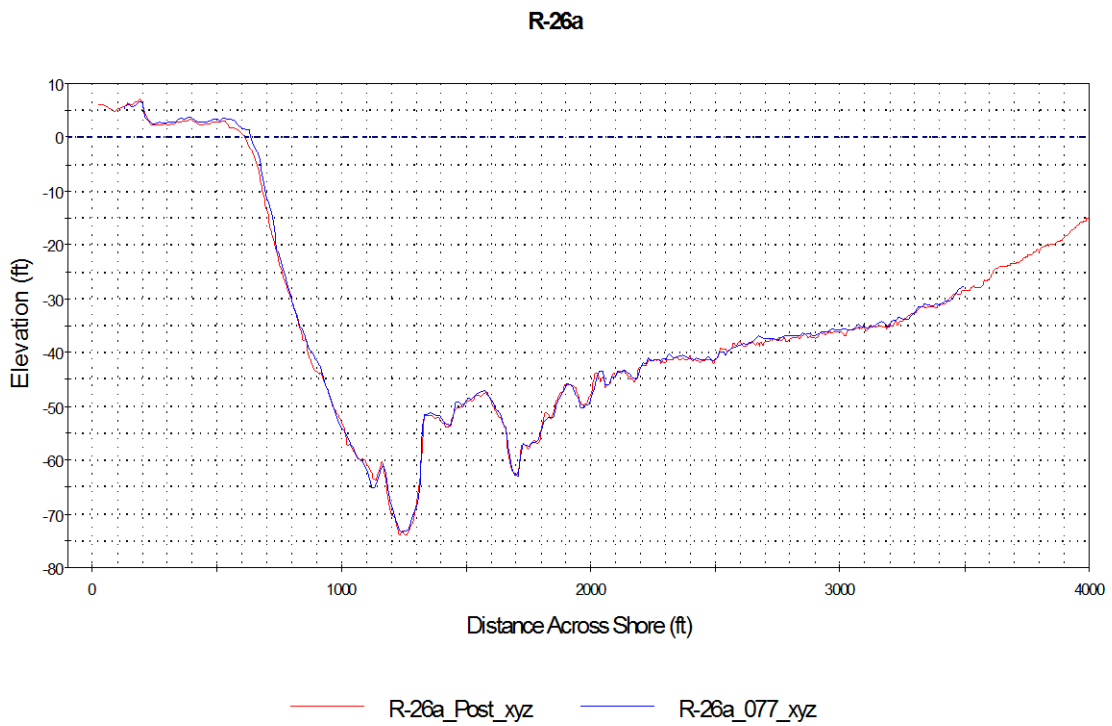
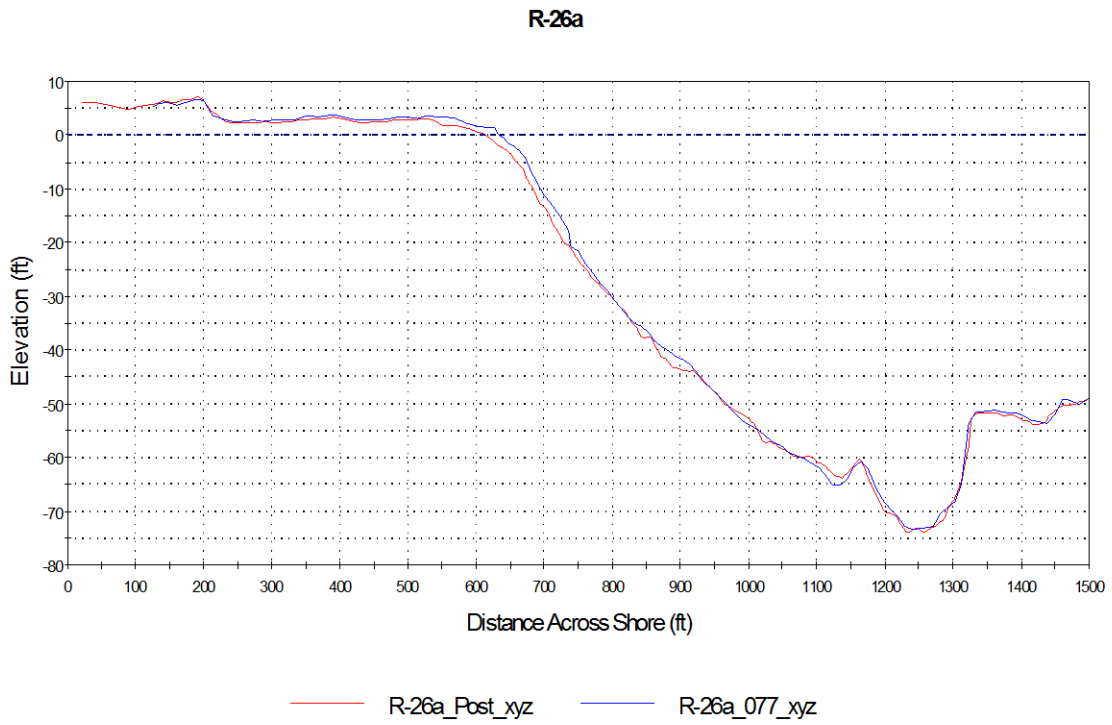


Figure A-18. Pre-/ post construction monitoring profiles at R-26a.