



Town of Hilton Head Island, SC

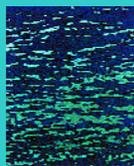
2016 Annual Beach Monitoring Report

Submitted to:

Town of
Hilton Head Island, SC

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July
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Town of Hilton Head Island, SC
2016 Annual Beach Monitoring Report:

July 2017

EXECUTIVE SUMMARY

This report summarizes beach conditions and changes along the sand shoreline of Hilton Head Island, South Carolina for the period April 2015 to February 2016. The results herein are related principally to the post-project performance of the 2006/07 Island-wide Beach Renourishment Project and the 2011/12 Port Royal Shoreline Restoration and Stabilization Project, but also provide information related to the condition of the island's sand shoreline as of the time of an February 2016 beach survey in anticipation of future need for nourishment.

The report includes:

- (1) a summary of current beach condition, beach change rates, and potential need for renourishment based on both,
- (2) a summary of shoreline and beach changes that occurred along the sand beaches of Hilton Head Island between April 2015 and February 2016,
- (3) a summary of beach conditions as of February 2016 compared to the immediate post-2006/07 project conditions,
- (4) a summary of beach conditions as of February 2016 compared, where appropriate, to the immediate post-2011/12 project conditions,
- (5) a summary of shoreline position as of February 2016 compared to a previously defined Recommended Minimum Beach Condition (RMBC) (Olsen Associates, Inc., 2004), and
- (6) a discussion of particular areas of the island shoreline where changes are occurring that are either historically atypical or otherwise in need of attention in anticipation of the upcoming island-wide renourishment.

Current Beach Conditions (February 2016). Five areas of the island have been identified to have relatively narrow beach widths. For the purposes of this evaluation, beach width is defined as the distance from the Town's Beachline to the February 2016 MHW shoreline. The benchmark for narrow here is a distance of 200 ft or less, which, while not a defined management distance, is used in this evaluation so that a comparative assessment of relative shoreline conditions can be performed. The areas where the beach is narrow, as of February 2016, are generally the same as those reported over the last three monitoring reports and include (1) an area of the Calibogue Sound shoreline between the Lands End groin and South Beach, (2) the Atlantic Ocean shoreline of

southern and central Sea Pines, (3) North Forest Beach, (4) Singleton Beach, and (5) a small portion of the Port Royal Sound shoreline at Ocean Point. This last area still has a narrow beach as of this survey despite completion of the Ocean Point Interim Sand Fill project (P/N 2013-00695-1W) in May 2014.

Three regional areas of the island shoreline have been identified to have high shoreline recession and beach volume erosion rates. For this evaluation, shoreline change rates greater than 5 ft/yr and beach volume loss rates greater than 2 cy/ft/yr are considered to be “high” and potentially problematic from a project performance perspective. Areas with high erosion rates include (1) a limited reach of shoreline at the north end of South Beach, (2) the reach of shoreline generally between Coligny Circle (HHI-13) and The Folly, and (3) the majority of the Port Royal Plantation shoreline, including the Heel shoreline.

Areas of the Island of particular concern are those areas where narrow beach conditions exist and erosion/recession rates are high. Combining these criteria, there are four main segments of the island shorefront that are considered to be important components of the upcoming renourishment project:

- South Beach and northward thereof – very high MHW shoreline retreat and beach volume loss rates exist between HHI-01C and HHI-04.
- North Forest Beach – narrow beach conditions exist between about HHI-13.5 and HHI-15.5, and erosion/recession rates are very high.
- Singleton Beach – slightly narrow beach conditions exist between HHI-23 and HHI-24, and erosion/recession rates are moderately high.
- Port Royal Sound shoreline at Ocean Point – High erosion/recession rates persist despite interim fill placement in 2014.

April 2015 to February 2016. Between April 2015 and February 2016, the MHW shoreline was generally stable, with -2.1 ft of average (un-weighted) shoreline retreat along the entire shoreline. However, changes in local beach width during the ten-month period were highly variable due in particular to evolving features on the northern and southern ends of the island as well as some isolated areas along the Atlantic shorefront.

Between April 2015 and February 2016, the total monitored area along all segments lost a net -73,700 cy (-0.9 cy/ft)¹. Generally speaking, the Atlantic shorefront of the island was accretional during this ten-month period, while the shoreline segments along *Calibogue Sound* and *Port Royal Sound* were erosion in the net. Volume change

¹ Unless stated otherwise, the volume changes in this report were computed from the seaward edge of the most seaward dune feature evident in the beach profile data to the apparent location of beach profile “closure.”

across the island was generally mild with only a few areas of significant erosion. These highly erosional areas are (1) most of the South Beach shoreline, (2) The Heel shoreline adjacent to and immediately south of the terminal groin, and (3) a portion of the Port Royal Plantation shoreline fronting Ocean Point. Otherwise, changes in local beach volume during the monitoring period are highly variable.

March 2007 to February 2016. Along the entire length of the island, the MHW shoreline advanced by an average of +20.0 ft (+2.2 ft/yr) over the nine-year inter-survey period. Changes in local beach width during the nine-year *monitoring* period were highly variable due primarily to highly localized dynamic areas at the northern and southern ends of the island and the effects of the 2011/12 beach fill project at The “Heel” of the island. Profile equilibration and alongshore spreading of fill material were secondary effects compared to the significant shoreline changes observed on the South Beach shoreline and at the Heel.

Between March 2007 and February 2016, comparison of beach profiles surveys suggests that the island’s entire sand shoreline gained +1,129,800 cy. This average net gain is skewed significantly by the gain of 1,170,000 cy of sand from *The Folly* to HHI-29F. This segment of shoreline includes both the portion of beach renourished as part of the 2011/12 PRS Shoreline Restoration and Stabilization Project Performance as well as adjacent areas of shoreline that have subsequently benefitted from the alongshore diffusion of fill sand. This quantity reflects significant shoreline sand losses between March 2007 and December 2011, the 2011/12 placement of more than 1,100,000 (between HHI-27 and HHI-29C) cy of sand between December 2011 and January 2012, and the onshore propagation of a sand wave resulting from the attachment of a portion of Joiner Bank to the Heel shoreline. Excluding this 1.1 Mcy sand placement, as well as the placement of approximately 20,000 cy at Ocean Point, the island shoreline has actually accreted by about 9,800 cy of sand over this entire period. This total includes significant losses along the Central Island shoreline and significant related gains along the South Island segment shoreline. However, there has also been substantial accretion of sand along the South Beach shoreline that has been caused by the onshore movement of an ebb tidal sand lobe.

February 2016 Shoreline Position Relative to RMBC. As of February 2016, the average MHW (+3.7 ft NGVD) shoreline position was +156.1 ft seaward of the RMBC shoreline position. The February 2016 position was seaward of the RMBC shoreline position (where there is a defined RMBC) for all but two transects over the entire island. The position of the February 2016 shoreline relative to the RMBC is highly variable due to the effects of beach nourishment and natural shoreline dynamics at the terminal ends of the island.

2011/12 PRS Shoreline Restoration and Stabilization Project Performance. The recent recession that has occurred at The “Heel” was expected to occur as part of post-construction fill equilibration (cross-shore and alongshore) and predicted project performance losses. The recent erosion has been limited to areas mostly within about 1,000 ft north and south of the terminal groin. Beyond about 1,000 ft north and south of the terminal groin, the shoreline has been generally stable since construction of the 2011/12 project. This stability is expected to be related to the sand losses along the shoreline immediately adjacent to the terminal groin.

Within the 2011/12 project limits (HHI-27 to HHI-29C), the beach has lost about -201,600 cy of sand since the post-construction survey (April 2012), with most of this loss occurring during the 2012/13 (-44,500 cy) and 2013/14 (-56,800 cy) winter inter-survey periods. This loss has resulted in moderate accretion to the Port Royal Plantation shoreline and significant accretion to the unfilled portion of the North Island shoreline. All of this sand is scheduled to be replaced during the upcoming 2016 island-wide beach renourishment project. The portion of the Port Royal Plantation segment that is outside of the project limits (*The Folly* to HHI-27) has gained +187,700 cy of sand since the post-construction survey (April 2012). While the project area has lost sand since completion of the project, the three segments in its vicinity (North Island, The Heel, and Port Royal Plantation) have actually experienced a slight gain of +2,200 cy of sand since the post-construction survey.

**Town of Hilton Head Island, SC
2016 Annual Beach Monitoring Report**

July 2017

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Town of Hilton Head Island, SC
Annual Beach Monitoring Report: April 2015 – February 2016
July 2017

1.0 INTRODUCTION

This report summarizes beach conditions and changes along the sand shoreline of Hilton Head Island, South Carolina for the period April 2015 to February 2016. The results herein are related principally to the post-project performance of the 2006/07 Island-wide Beach Renourishment Project and the 2011/12 Port Royal Shoreline Restoration and Stabilization Project, but also provide information related to the condition of the island’s sand shoreline as of the time of an February 2016, which is actually the pre-construction survey for the 2016 Hilton Head Island Beach Renourishment Project completed later in the year.

The report includes (1) a summary of current beach condition, beach change rates, and potential need for renourishment based on both, (2) a summary of shoreline and beach changes that occurred along the sand beaches of Hilton Head Island between April 2015 and February 2016, (3) a summary of beach conditions as of February 2016 compared to the immediate post-2006/07 project conditions, (4) a summary of beach conditions as of February 2016 compared, where appropriate, to the immediate post-2011/12 project conditions, and (5) a summary of shoreline position as of February 2016 compared to a previously defined Recommended Minimum Beach Condition (RMBC) (Olsen Associates, Inc., 2004). The RMBC was established as a basis to evaluate the condition of the island’s beaches relative to an assumed “minimum” width that the Town might want to consider. The minimum condition used herein is generally based upon the April 1997 island-wide beach position and condition. The beach survey conducted in April 1997 represents beach conditions that existed immediately prior to the construction of the 1997 Beach Renourishment Project. The defined RMBC was never formally adopted by the Town. In this instance, it is simply used as a basis for discussion of conditions as they relate to a historical condition.

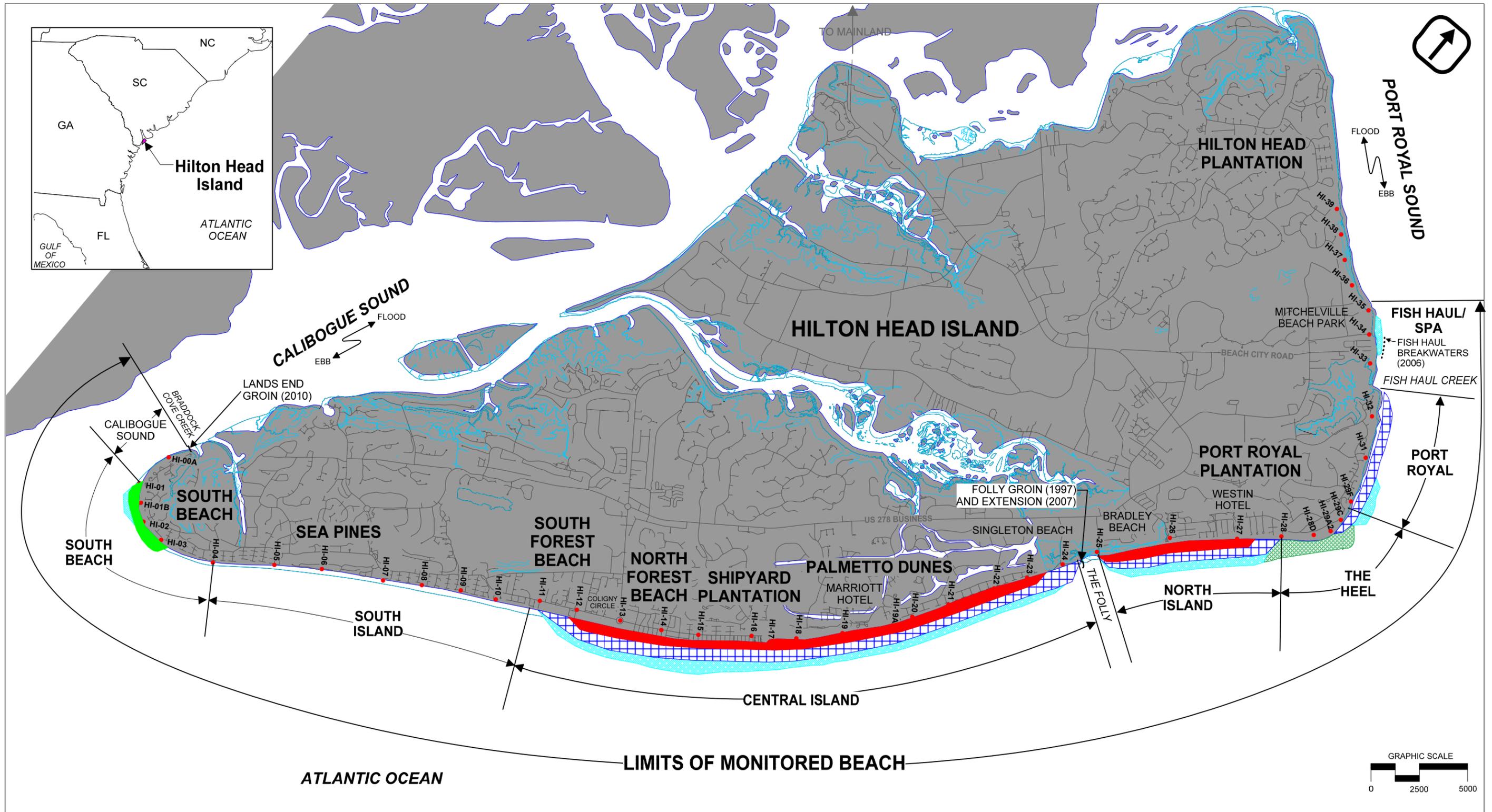
1.1. Background

The Town of Hilton Head Island has committed to a long-term beach management program that includes the preservation and enhancement of the island's sandy shorefront. The program is founded on shoreline restoration and maintenance with initial nourishment and subsequent scheduled periodic renourishment along portions of the island's Atlantic Ocean and sound shorelines. The program was initiated in 1990 with the construction of the 1990 Beach Restoration Project.

Since 1990, there have been five other sand placement projects constructed by the Town of Hilton Head Island as part of their island-wide beach management program. The projects have included renourishment and expanded restoration of areas of the island's sand shoreline. Some of these projects have had multiple components that address problems along discrete areas. The five projects include two large-renourishment projects, one in 1997 and the other in 2006/07, and three localized restoration projects, one in 1999, 2011/12 and 2013. In sum, approximately 10.3 million cy of sand were placed (pay and non-pay) along more than 11 miles of the island's shoreline between 1990 and 2013. The details of each of these sand placement projects are presented below. The approximate location and extent of each of these projects is depicted in **Figure 1.1**.

1.2. Brief Summary of Renourishment History

1990 Beach Nourishment Project. The Hilton Head Island 1990 beach restoration project was the initial comprehensive beach restoration project sponsored by the Town of Hilton Head Island. The project design called for the placement of approximately 2 million cy (pay volume) of sand from about the Westin Hotel (to the north) to just south of Coligny Circle (to the south). Including the tapers at both ends, the total project length was 35,000 ft (6.6 miles). Two offshore borrow sites were used for fill material. They were (1) the shoals seaward of Joiner Bank (at the island's north end) and (2) the landwardmost section of Gaskin Banks (about 2.5 miles offshore of the island's central shoreline). The 1990 project was constructed primarily during the summer months between May and August. The estimated total placed volume, pay and non-pay yardage, above the -10 ft NGVD contour was approximately 2,338,000 cy (Olsen Associates, Inc., 1992).



NOTE: BEACH FILL NOT TO SCALE.

Figure 1.1: Location and extent of past projects.

1997 Beach Renourishment Project. In 1997, the shoreline reaches restored in 1990 were renourished and new beach restoration work was performed along the Port Royal Sound shoreline (**Figure 1.1**). The latter was a new element of work and included the relocation of a tidal channel away from the shoreline and the placement of beach fill. In all, the 1997 Hilton Head Island Beach Renourishment Project consisted of three major elements (refer to **Figure 1.1**): (1) sand renourishment of approximately 38,000 ft of Atlantic Ocean shoreline (principally the same shoreline originally restored in 1990), (2) relocation of a tidal channel within Port Royal Sound, and (3) sand placement along some 8,500 ft of Port Royal Sound shoreline. The tidal channel relocation and Port Royal Sound beach fill portions of the project were both necessary to provide comprehensive restoration of that shoreline. The entire project was constructed between May and November, 1997.

The 1997 Hilton Head Island Beach Restoration Project included the placement of roughly 2,961,700 cy of sand (pay and non-pay) along approximately two-thirds of the island's Atlantic Ocean shorefront from about 1,700 ft north of the Westin Hotel, southward to Alder Lane at South Forest Beach, about 38,000 ft or 7.2 miles of shoreline. Similar to the 1990 project, a no-fill section approximately 1,400 ft in length was located at the Folly. This no-fill area, which divided the project into two segments, was about 600 ft smaller than that for the 1990 project due to the construction of a small sand-retention structure (i.e., rock groin) along the south side of The Folly. This new groin allowed beach fill material to be placed closer to The Folly at that location (Olsen Associates, Inc., 1999).

The Port Royal shoreline channel relocation work required the excavation of about 315,000 cy of sand from the new channel area. Following completion of the channel relocation, the Port Royal Plantation shoreline received as beach fill approximately 421,300 cy (pay and non-pay) of beach fill along about 8,500 ft of soundfront shoreline.

Two offshore borrow sites were used in the 1997 project. These were the same general areas used for the 1990 project. These areas are located seaward of Joiner Bank (at the island's north end) and on the landwardmost section of Gaskin Banks (about 2.5 miles offshore of the island's central shoreline).

1999 Emergency Beach Fill. A relatively small emergency beach fill project had been constructed by the Town along a localized segment of shoreline at the south end of the island (i.e., South Beach) in 1999. The South Beach beach fill project was constructed in January 1999 in response to chronic erosion on the southern terminus of Hilton Head Island adjacent to Calibogue Sound. This project placed about 290,200 cy along about 3,400-ft of shoreline in The Sea Pines Resort. The borrow area for the project was selected to be portions of the Barrett Shoals borrow site also identified for the Daufuskie Island beach nourishment project. The site lies just off the southern shoreline of Hilton Head Island in the Calibogue Sound ebb shoal

complex. The South Beach project was constructed between January 1999 and February 1999 (Olsen Associates, Inc., 2000).

2006/2007 Beach Renourishment Project. The 2006/07 Hilton Head Island Beach Renourishment Project renourished portions of the previously constructed 1990, 1997, and 1999 (i.e., South Beach) project segments that required sand fill at that time.

The 2006/07 project provided for the placement of beach-quality sand along about 8.4 miles of the island's sandy shoreline. The fill was placed along five distinct shoreline segments. Two of the project segments were along the Atlantic shorefront and covered roughly two-thirds of that portion of the island's sand shoreline from about 900 ft north of the Westin Hotel (HHI-28) southward to Alder Lane at South Forest Beach (HHI-11). This is generally the same segment of shoreline restored in 1990 and renourished in 1997. Including the tapers at both ends of the project, the final beach fill length along the Atlantic shorefront is about 38,700 ft (7.3 miles). The two segments are divided by the Folly, a small tidal creek on the north central area of the island's shorefront. Project permits required a no-fill area, approximately 1,300 ft in length, to reduce the potential for excessive shoaling of the creek mouth by beach fill migration (Olsen Associates, Inc., 2008).

The three other shoreline segments nourished as part of the 2006/07 project included approximately 2,000 ft of shorefront along South Beach, 2,700 ft of shoreline along the Port Royal Sound shorefront in Port Royal Plantation, and a 2,200-foot stretch of Port Royal Sound shoreline north of Fish Haul Creek.

As had been typical with the two past large nourishment projects on the island, no fill was placed along about 1,300 ft of shoreline between HHI-24 and HHI-25. This area includes the small tidal creek "the Folly" that is purposefully not filled to ensure that it remains open to tidal flows between the Atlantic Ocean and inland marsh.

The 2006/07 Hilton Head Island Beach Renourishment Project design called for the placement of approximately 2,725,000 cy of sand (pay and non-pay volume) along about 45,500 ft (8.4 miles) of shoreline at Hilton Head Island, SC. This included approximately 2,408,000 cy along the Atlantic Ocean shorefront, 158,100 cy along the Port Royal Sound shoreline, 57,300 cy along the South Beach shoreline, and 101,400 cy along the Fish Haul/Spa shoreline.

In addition to beach fill construction at Fish Haul, the project included six small rubble mound (rock) breakwaters. The breakwaters were sited immediately seaward of the constructed beach, but detached from the shoreline and beach fill.

Sand for the project was dredged from two offshore borrow sites; Joiner and Barrett Shoals. Dredging and beach fill construction began 17 September 2006 and concluded on 10 February 2007.

2011/12 Port Royal Sound Shoreline Restoration and Stabilization Project. The purpose of the project was to restore a localized area of highly erosional beach with sand fill from an offshore borrow site and stabilize the area with a low-crested, “leaky” groin (terminal groin). The project included sufficient sand volume to minimize potential downdrift effects of the permeable groin and meet typical annual sand transport volume demands expected for the period between project completion and future sand placement activities.

The project is located at the northeastern end of Hilton Head Island, SC at the intersection of the Atlantic Ocean and Port Royal Sound shorelines. The project included (1) the placement of approximately 1.1 million cy of beach compatible sand along approximately 5,700 ft of Atlantic Ocean shoreline between Barnacle Road (just north of The Westin Resort) and the southern area of the “sand spit” at the northeast tip of the island as configured at the time of construction and (2) the construction of a low-crested, “leaky” groin (terminal groin) at the northern terminus of the island’s Atlantic Ocean shorefront and within the limits of the beach fill (Olsen Associates, Inc., 2012). The project area is located between Atlantic Ocean and Port Royal Sound shorelines that have been nourished in the past. The project included fill placement throughout the Designated Critical Habitat area for Piping Plovers (Unit SC-15). The area for this project had not been previously nourished.

Beach quality sand fill for this project was dredged from a portion of a large linear ebb tidal shoal feature located on the eastern side of the Port Royal Sound ebb tidal shoal platform. Dredging and beach fill construction began 21 December 2011 and concluded on 23 January 2012. Rock work began on 9 January 2012 and concluded on 4 April 2012.

1.3. Survey Control

The Town of Hilton Head Island's beach monitoring program is founded on the use of established survey transects located at permanent reference monuments along the island's shoreline. This system of permanent monuments is considered the Town's beach monitoring baseline. The monuments are generally referenced to standard horizontal and vertical control systems and datums. The horizontal datum used is the South Carolina State Plane coordinate system which is relative to the North American Datum of 1983 (NAD83) in International Ft. The vertical datum used for the purposes of beach monitoring and beach fill construction control is the National Geodetic Vertical Datum of 1929 (NGVD29). **Table 1.3** lists the elevations of various fixed vertical and tidal datums in the vicinity of Hilton Head Island as reported by the National Geodetic Survey (NGS).

For the purposes of beach monitoring, 63 *primary* stations (or monuments) exist as permanent points of reference. Thirty two of these monuments -- whole numbers 01 through 32 -- were established in 1985 and have been surveyed at least twice a year since 1986. Thirteen intermediate monuments (e.g. 01A) were established prior to the 1997 renourishment project in order to obtain greater detail of beach change and conditions in specific areas of the shoreline, particularly along South Beach and the "Heel." Seven monuments -- whole numbers 33 through 39 -- were established prior to the 2006/07 renourishment project and included an area along the Fish Haul/Spa shoreline. The last eleven monuments were established prior to the 2011/12 renourishment project in order to obtain greater detail of beach change around the "Heel." The addition of these monuments necessitated renaming the preexisting intermediate monuments between HHI-29 and HHI-30. The primary monument locations and transect azimuths, reflecting those that have been renamed as well as listing their previous name, are tabulated in **Table 1.4**. In addition to the seven primary stations developed prior to the 2006/07 project, 14 intermediate stations were developed along the nourished Fish Haul shoreline. Three of these stations -- FH03, FH09, and FH14 -- are located concurrently with primary stations -- HI33, HI34, and HI35, respectively -- for 72 unique monuments established for surveying and control purposes.

Table 1.3: Tidal datums for various tidal stations around Hilton Head Island (NGS).
All elevations are in feet and relative to NGVD29.

NGS Station ID	8670870	8669338	8669691	8669167	8670870	8669133
NGS Station Name	Fort Pulaski	Broad Creek	Daufuskie Landing	Port Royal Pltn.	Bloody Point	Skull Creek South
Mean Higher-High Water (MHHW)	4.41	5.17	4.33	4.38	4.19	4.42
Mean High Water (MHW)*	4.04	4.23	3.96	3.62	3.82	4.02
NAVD88	0.96	0.93	0.92	0.92	0.92	0.93
Mean Sea Level (MSL)	0.73	0.64	0.71	0.65	0.57	0.69
Mean Tide Level (MTL)	0.58	0.49	0.45	0.57	0.44	0.38
NGVD29	0.00	0.00	0.00	0.00	0.00	0.00
Mean Low Water (MLW)	-2.88	-3.25	-3.06	-2.48	-2.95	-3.25
Mean Lower-Low Water (MLLW)	-3.09	-3.49	-3.27	-2.70	-3.15	-3.48

* For analysis purposes, an elevation of 3.72ft NGVD29 was used for the MHWL.

Table 1.4: Beach profile monument control tabulation for Hilton Head Island, SC.

Profile	Previous Name	Origin Position		Monument Elevation (ft-ngvd)	Grid Azimuth (decimal degrees)
		Easting (int'l ft-nad83)	Northing (int'l ft-nad83)		
00A		2053523.60	103983.70	10.48	295
00B		2053190.39	102502.80	8.01	285
1		2053231.01	101978.22	7.18	220
01A		2053666.83	101547.19	12.04	225
01B		2053931.54	101249.03	11.82	225
01C		2054195.15	100955.96	11.84	225
2		2054668.53	100583.28	7.52	211
02A		2055275.56	100247.48	10.58	195
3		2055976.59	100453.63	9.65	165
4		2058787.45	101275.94	14.03	144
5		2061313.53	103237.37	11.60	141
6		2063338.71	104656.00	12.30	156
7		2066151.05	106248.32	12.85	145
8		2067846.91	107356.24	8.20	148
9		2069572.96	108446.80	8.94	152.5
10		2071262.52	109254.86	10.52	153
11		2073064.30	110670.20	9.15	153
12		2074836.47	111546.74	10.83	155
13		2076918.58	112572.43	9.34	155
14		2078868.88	113563.74	11.83	146.5
15		2080499.60	114609.83	11.31	145
16		2082651.10	116344.18	13.85	137
17		2083575.84	116652.94	13.33	137
18		2084511.86	117737.05	13.04	136
19		2086172.66	119485.60	14.22	130
19A		2087909.66	121508.31	14.36	123
20		2088404.37	122463.58	16.16	123
21		2089438.57	124159.46	15.75	123
22		2090711.29	126319.72	9.87	121
23		2091677.85	127841.36	13.42	121
24		2092641.55	129560.77	12.70	125
25		2093587.85	131202.85	12.74	120
26		2096023.07	134189.96	13.05	132

Table 1.4 (cont): Beach profile monument control tabulation for Hilton Head Island, SC.

Profile	Previous Name	Origin Position		Monument Elevation (ft-ngvd)	Grid Azimuth (decimal degrees)
		Easting (int'l ft-nad83)	Northing (int'l ft-nad83)		
27		2098728.45	136397.45	10.65	136
27A	27-1	2099287.31	136921.71	-	139
27B	27-2	2099846.17	137445.97	-	139
28		2100405.02	137970.22	9.38	144
28A	28-1	2100900.50	138425.84	-	133.8
28B	28-2	2101148.23	138653.65	-	133.8
28C	28-3	2101395.97	138881.47	-	131.8
28D	28-4	2101643.71	139109.28	-	133.8
29		2101891.45	139337.09	6.71	125.5
29A1	29A-1	2102188.01	139824.52	-	116.8
29A2	29A-2	2102188.01	139824.52	-	93.1
29A3	29A	2102188.01	139824.52	11.01	74
29B	29A-3	2102205.46	140216.95	-	76.8
29C	29B	2102222.92	140609.39	13.13	75.5
29D	29B-1	2102157.97	140890.03	-	79.5
29E	29B-2	2102093.03	141170.65	-	79.5
29F	29C	2102011.40	141674.40	-	76
30		2101833.25	142293.16	10.50	71
30A		2101515.28	143189.49	11.91	69
31		2101140.70	143905.22	14.88	66
31A		2100853.46	144537.38	14.57	61
31B		2100372.62	145414.18	16.29	63
32		2100009.99	145759.00	8.40	63
33		2098175.33	147796.83	-	48
34		2097176.10	148915.56	-	48
35		2096343.42	149847.83	-	48
36		2094851.56	150291.90	-	48
37		2093720.65	151058.37	-	48
38		2092727.42	151947.81	-	48
39		2091710.11	152815.75	-	48

1.4. Physical Monitoring Program

The Town of Hilton Head Island has been monitoring continually the physical condition of the island's sandy shorelines since 1986. Presently, the program includes semi-annual beach profile surveys at up to 72 individual beach profile transects and annual reports of findings. Data collected along the beach monitoring transects are used to track shoreline and beach volume changes as well as beach renourishment performance.

In addition to the island-wide beach monitoring program, the 2006 Fish Haul/Spa shoreline improvements permit required a project specific monitoring plan following completion of that segment that included a greater frequency of surveys in the first two years following construction. Although the permit related monitoring for the Fish Haul/Spa project is now complete, the Town of Hilton Head Island has incorporated the Fish Haul/Spa monitoring baseline into the semi-annual island-wide monitoring program. The intermediate survey lines along the Fish Haul/Spa project shoreline are only surveyed to wading depth.

1.5. Hurricane Joaquin

During this inter-survey period, Hilton Head Island was impacted, between September 29 and October 7, 2015, by Hurricane Joaquin. Despite tracking far to the east of the island, moisture from the powerful category 4 Hurricane Joaquin fed a non-tropical low pressure system that stalled over the southeast United States resulting in elevated tides, waves, significant rains and substantial coastal flooding. Flooding from this storm was so catastrophic that portions of Interstate 95 were closed for nearly two weeks and significant portions of South Carolina were declared disaster areas by the Federal government. Impacts to the beach were such that, island-wide the shoreline lost approximately -142,020 cy (-1.7 cy/ft) from above the MHW shoreline and -177,250 cy (-2.1 cy/ft) from the entire beach system. More details on this storm and its impacts can be found in the "Post-Storm Design Survey Memorandum of Findings" submitted to the Town in December 2015 (OAI, 2015).

2.0 BEACH CONDITION SUMMARY

2.1 Organization of Monitoring Results

The following sections are organized to present shoreline and beach volume conditions for the entire monitored shoreline of Hilton Head Island in their current state and for three inter-comparisons of beach conditions. The first section explores the current beach condition, beach change rates, and potential need for renourishment based on both. The next two sections are comparisons that explore the change in shoreline and beach conditions over the most recent one-year inter-survey monitoring period (April 2015 to February 2016) and over the period since construction of the 2006/07 Beach Renourishment Project, respectively. The fourth section presents the shoreline position relative to a previously defined Recommended Minimum Beach Condition (RMBC) (Olsen Associates, Inc., 2004). As noted previously, the RMBC is only used as a baseline of comparison in this report and has not been formally adopted by the Town of Hilton Head Island as a definitive beach management measure. The fifth section compares the change in shoreline and beach conditions within the limits and since the construction of the 2011/12 Port Royal Sound Shoreline Restoration and Stabilization Project, while the final section discusses problem areas along the island shoreline that have been identified for further analysis.

To simplify analysis, the shoreline is sub-divided into segments. Shoreline segments are defined using natural boundaries where appropriate (e.g. Braddock Cove Creek, The Folly, Fish Haul Creek) and other designations commonly-used to identify beach areas. Additionally, to simplify presentation of results, the island is divided into two regions as delineated by The Folly. Herein, two regions, consisting of seven distinct shoreline segments, will be discussed:

- South of The Folly
 - Calibogue Sound Shoreline (Braddock Creek to HHI-01),
 - South Beach Shoreline (HHI-01 to HHI-04),
 - South Island (Atlantic) Shoreline (HHI-04 to Alder Lane),
 - Central Island (Atlantic) Shoreline (Alder Lane to *The Folly*),

- North of The Folly
 - North Island (Atlantic) Shoreline (*The Folly* to HHI-28),
 - The Heel Shoreline (HHI-28 to HHI-29E)
 - Port Royal Plantation Shoreline (HHI-29E to *Fish Haul Creek*), and
 - Inner Port Royal Sound Shoreline (*Fish Haul Creek* to HHI-39).

2.2 Current Beach Condition (February 2016)

Figure 2.1 presents, and **Table 2.1** lists, the beach width (from the Town's Beachline² to the February 2016 mean high water shoreline), rate of MHW shoreline change (ft/yr), and rate of beach volume change (cy/ft/yr) along the Hilton Head Island shoreline from Lands End groin to Fish Haul Creek. Also included is the distance from the Beachline to the Parcel Boundary. The Parcel Boundary is the seawardmost property boundary line adjacent to the beach, which is, in most cases, the seawardmost extent of private property. The figure also highlights problem areas along the shoreline where the beach is narrow or erosion rates are high. The shoreline and volume change rate assessment considered changes that occurred to the island's beaches between April 2007 (post-2006/07 project) and February 2016. Fill placement as part of the 2016 project was planned to address areas where the combined effect of narrow beach width, both existing and projected two-year conditions, and high shoreline change rates were expected to lead to problematic beach conditions prior to the end of the planned project life (i.e., 7-10 years following construction).

Five areas of the island have been identified to have relatively narrow beach widths. For the purposes of this evaluation, beach width is defined as the distance from the Town's Beachline to the February 2016 MHW shoreline. The benchmark for narrow here is a distance of 200 ft or less, which, while not a defined management distance, is used in this evaluation so that a comparative assessment of relative shoreline conditions can be performed. The areas where the beach is narrow, as of February 2016, are generally the same as those reported over the last three monitoring reports and include (1) an area of the Calibogue Sound shoreline between the Lands End groin and South Beach, (2) the Atlantic Ocean shoreline of southern and central Sea Pines, (3) North Forest Beach, (4) Singleton Beach, and (5) a small portion of the Port Royal Sound shoreline at Ocean Point. This last area still has a narrow beach as of this survey despite completion of the Ocean Point Interim Sand Fill project (P/N 2013-00695-1W) in May 2014.

Three regional areas of the island shoreline have been identified to have high shoreline recession and beach volume erosion rates. For this evaluation, shoreline change rates greater than 5 ft/yr and beach volume loss rates greater than 2 cy/ft/yr are considered to be "high" and potentially problematic from a project performance perspective. Areas with high erosion rates include (1) a limited reach of shoreline at the north end of South Beach, (2) the reach of shoreline generally between Coligny Circle (HHI-13) and The Folly, and (3) the majority of the Port Royal Plantation shoreline, including the Heel shoreline.

² The Town's Beachfront Line is a local regulatory line adopted by the Town in December 2006 and is defined as having the same location as the 1999 OCRM Baseline.

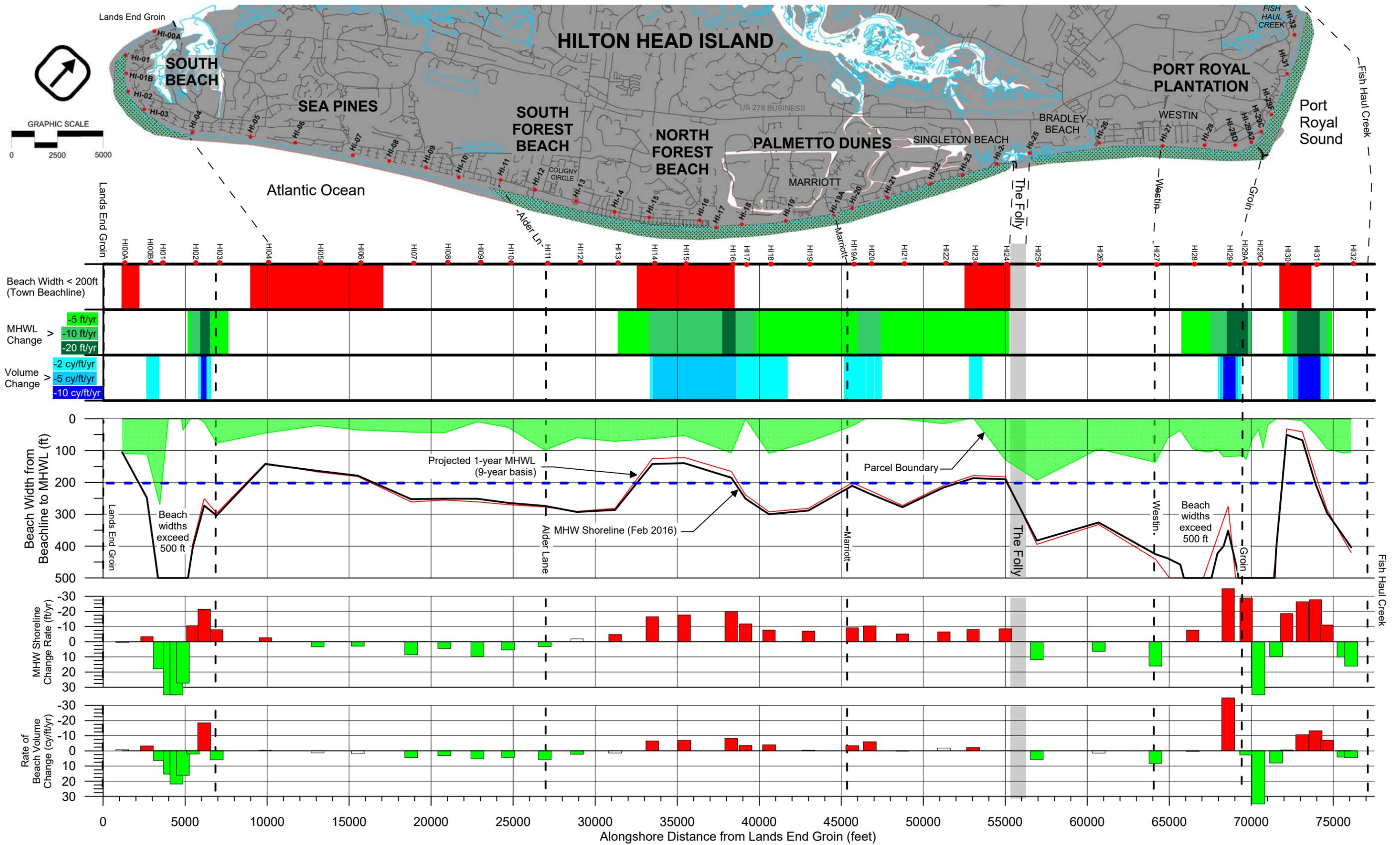


Figure 2.1: Beach width, rate of MHW shoreline change, and rate of beach volume change along the Hilton Head Island shoreline. Change rates are based on the period between March 2007 to February 2016.

Table 2.1: Hilton Head Island Beach Width and Shoreline Change Rates.

Segment	Monument	Alongshore Distance from Lands End (ft)	Beach Width from Beachfront Line (ft)				MHW Shoreline Change Rate (ft/yr)		Volume Change Rate (cy/ft/yr) Mar 07 to Feb 16
			Feb-2016	Projected +1yr		to Parcel Boundary	April 2015 to February 2016	March 2007 to February 2016	
				1-year rate	9-year rate				
Caliboque Sound	HI-00A	1,165	105	102	106	109	-2.7	0.6	-0.8
	HI-00B	2,669	249	240	245	112	-8.2	-3.3	-3.3
	HI-01	3,459	539	517	557	269	-21.2	17.9	6.4
		3,459	297	287	302	163	-10.7	5.0	0.7
South Beach	HI-01	3,459	539	517	557	269	-21.2	17.9	6.4
	HI-01A	4,073	759	747	809	-50	-12.1	49.5	15.3
	HI-01B	4,472	717	634	759	-138	-83.2	42.2	21.9
	HI-01C	4,866	599	496	626	35	-102.9	27.3	16.2
	HI-02	5,469	403	373	392	-10	-30.4	-10.6	2.0
	HI-02A	6,163	273	256	251	11	-17.1	-21.5	-18.5
	HI-03	6,921	304	291	296	77	-13.5	-7.9	5.8
	HI-04	9,990	142	133	140	45	-9.5	-2.6	-0.4
		6,431	467	431	479	30	-36.2	11.8	6.1
South Island	HI-04	9,990	142	133	140	45	-9.5	-2.6	-0.4
	HI-05	13,081	164	186	167	22	22.4	3.4	1.3
	HI-06	15,527	179	182	182	35	3.1	2.9	1.8
	HI-07	18,780	253	282	261	42	29.4	8.7	4.5
	HI-08	20,805	251	309	256	44	58.4	4.5	3.1
	HI-09	22,820	252	267	261	10	15.7	9.7	5.2
	HI-10	24,685	264	299	270	27	34.8	5.4	4.3
	HI-11	26,927	274	298	277	99	24.1	3.4	5.8
		17,037	222	245	227	40	22.3	4.4	3.2
Central Island	HI-11	26,927	274	298	277	99	24.1	3.4	5.8
	HI-12	28,891	293	309	291	59	16.6	-1.9	2.2
	HI-13	31,212	286	311	282	71	24.6	-4.7	1.4
	HI-14	33,483	142	142	126	63	-0.3	-16.5	-6.6
	HI-15	35,431	139	142	122	53	3.0	-17.7	-7.0
	HI-16	38,297	185	187	165	108	1.7	-19.8	-8.3
	HI-17	39,164	251	269	239	1	18.1	-11.8	-3.6
	HI-18	40,596	300	304	292	109	4.0	-7.7	-4.0
	HI-19	43,004	288	303	281	73	14.7	-6.9	-0.5
	HI-19A	45,673	211	222	201	23	11.2	-9.2	-3.4
	HI-20	46,743	236	266	225	-8	30.4	-10.4	-6.0
	HI-21	48,731	278	307	273	1	28.9	-5.1	0.2
	HI-22	51,256	216	187	209	16	-28.7	-6.5	-1.9
	HI-23	53,042	186	193	178	-3	6.6	-8.1	-2.2
HI-24	54,999	190	150	182	128	-40.7	-8.4	0.0	
		28,823	232	239	223	53	7.6	-8.7	-2.3
North Island	HI-25	56,925	383	460	394	193	77.4	11.9	5.8
	HI-26	60,697	326	296	332	95	-29.7	6.3	1.4
	HI-27	64,155	425	413	441	137	-11.6	16.0	8.3
	HI-27A	64,912	439	424		60	-14.6		
	HI-27B	65,669	458	435		36	-22.5		
	HI-28	66,426	603	577	596	94	-26.9	-7.6	0.4
			10,426	439	434	441	102	-4.6	6.6
The Heel	HI-28	66,426	603	577	596	94	-26.9		
	HI-28A	67,189	577	532		105	-45.6		
	HI-28B	67,557	502	452		103	-50.2		
	HI-28C	67,934	423	361		95	-61.6		
	HI-28D	68,311	400	322		119	-78.1		
	HI-29	68,588	352	268	275	119	-83.9	-76.5	-42.1
	HI-29A1	69,184	484	391		117	-93.5		
	HI-29A2	69,495	743	612		115	-131.4		
	HI-29A3	69,685	849	884	820	128	34.6	-28.8	2.8
	HI-29B	70,030	799	842		68	43.0		
	HI-29C	70,429	862	880	909	33	18.1	46.8	35.8
	HI-29D	70,716	970	1,011		92	41.8		
	HI-29E	71,004	944	899		20	-45.2		
		4,578	655	618	650	93	-36.8	-19.5	-1.2
Port Royal Plantation	HI-29E	71,004	944	899		20	-45.2		
	HI-29F	71,514	410	422	420	0	11.6	9.7	8.0
	HI-30	72,159	51	34	32	1	-17.0	-18.6	-0.6
	HI-30A	73,109	67	21	41	6	-46.9	-26.4	-10.7
	HI-31	73,916	205	166	177	48	-39.3	-27.7	-13.3
	HI-31A	74,613	295	176	284	93	-118.7	-11.0	-7.1
	HI-31B	75,624	369	383	379	108	13.8	10.1	4.0
	HI-32	76,086	404	417	420	104	12.5	16.1	4.5
		6,432	343	314	251	48	-28.7	-6.8	-2.2
Lands End Groin to Fish Haul Creek	Average		390	377	327	66	-12.6	-1.4	0.8
	Minimum		51	21	32	-138	-131.4	-76.5	-42.1
	Maximum		970	1,011	909	269	77.4	49.5	35.8

Of particular interest is the coincidental occurrence of narrow beach conditions and high erosion rates. It is anticipated that beach width along areas with high erosion rates will continued to narrow. Sand placement will be required in the future along those areas where the effects of the shoreline retreat and beach volume losses are expected to reduce beach width to problematic levels prior to the end of the anticipated project life. As depicted in **Figure 2.1**, the island shoreline is expected to retreat at varying rates over time. Without intervention in the form of a renourishment project, it is expected that beach widths along the Central Island shoreline at North Forest Beach will narrow to just over 100 ft wide in 2017. This would likely include encroachment into the vegetated dune areas fronting upland development. The Ocean Point Interim Sand Fill project along the Port Royal Sound shoreline, has temporarily stabilized the highly erosional beach at Ocean Point and delayed the effect of erosion to the adjacent upland properties. However, this project was implemented as an emergency measure to act in the interim until the next island-wide beach renourishment. As such, additional fill is needed at this location as part of the proposed 2016 renourishment. If recently-observed trends continue, threats to upland infrastructure are not expected over the next 12 to 18 months.

Overall, narrow beach width conditions and the patterns of shoreline and beach volume change are generally consistent with historical conditions, with only a few exceptions. That is, there are narrow beach conditions consistent with historically erosional areas in southern Sea Pines, North Forest Beach, Singleton Beach, and Port Royal Plantation. Higher erosion rates exist at an isolated area in the vicinity of South Beach, most of the central portion of the island, and in Port Royal Plantation. The area of shoreline between *The Folly* and *The Heel*, however, which has historically been narrow and erosional, is wide compared to historical conditions and has been generally stable to accretional since 2006. It is believed that the change in shoreline change conditions along this reach of shoreline is due to the beneficial effects of sand losses from the adjacent shoreline to the north (i.e. *The Heel*). This effect is anticipated to continue throughout the planned design life of the next island-wide renourishment project.

Figure 2.2 displays the history of change in beach sand volume along the entire Hilton Head Island shoreline relative to the February 1990 pre-project condition. The figure presents total beach volume changes within the project limits measured to profile change “closure.” Volume changes are tracked from the February 1990 pre-construction conditions until the current, February 2016, conditions and include the initial beach restoration in 1990, the renourishment in 1997, the 1999 Emergency beach fill at South Beach, the most recent renourishment in 2006/07, and the 2011/12 Port Royal Sound Shoreline Restoration project. The figure shows that as of February 2016 approximately +8.3 Mcy of sand are located within project limits compared to the February 1990 pre-project condition. Note that the inclusion of volumetric changes in this figure do not include the Calibogue Sound shoreline until April 1997 or the Inner Port Royal Sound shoreline until April 2006.

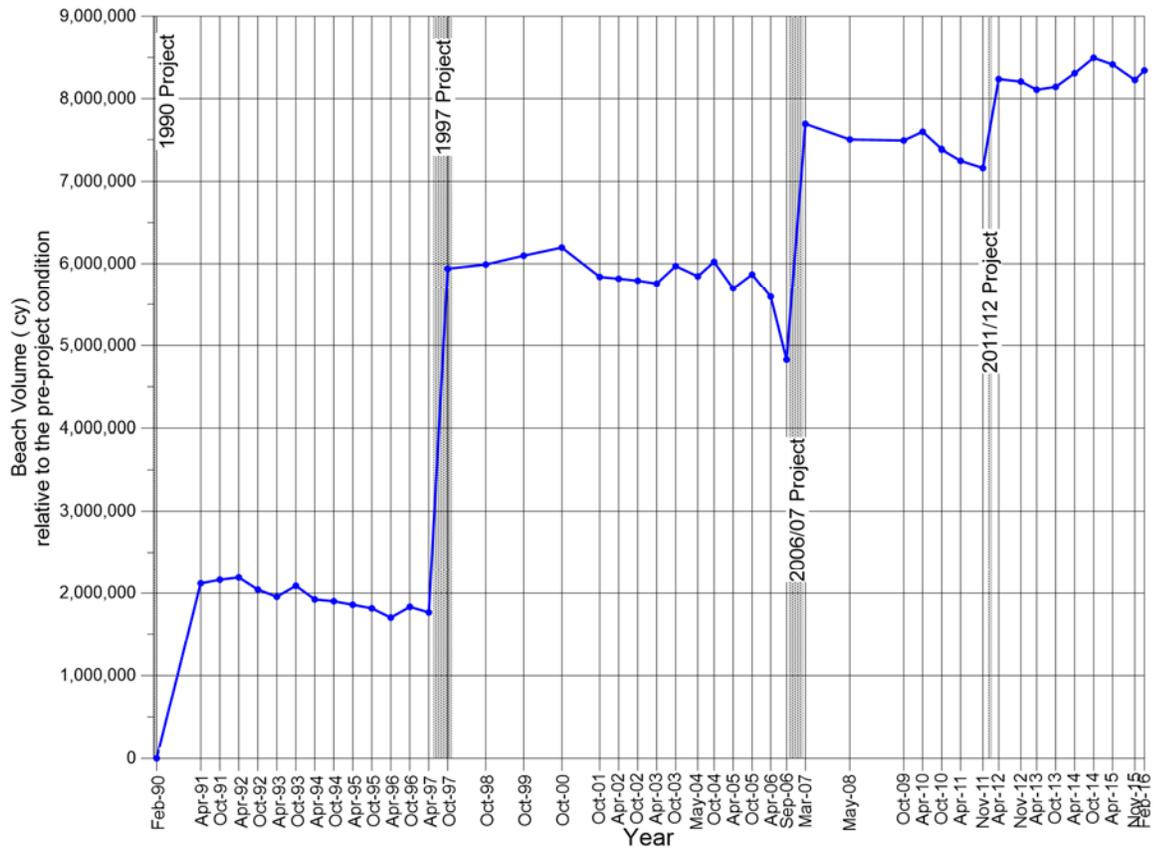


Figure 2.2: Hilton Head Island beach sand volume change over time.

2.3 One-Year Monitoring Period Beach Changes (April 2015 to February 2016)

2.3.1 Shoreline Change

Figure 2.3 depicts the change of the Mean High Water (MHW) shoreline (+3.7ft NGVD29 elevation) located between Braddock Cove Creek on Calibogue Sound and The Folly on the Atlantic Ocean for the period from February 2015 to April 2016. **Figure 2.4** depicts the change of the MHW shoreline located between the Folly and HHI-39, fronting Hilton Head Plantation on Port Royal Sound, for the same time period. Shoreline position changes at each monument are listed below in **Table 2.2**, with average shoreline position changes for each beach segment as well as the whole island.

Between April 2015 and February 2016, the MHW shoreline was generally stable, with -2.1 ft of average (un-weighted) shoreline retreat along the entire shoreline. However, changes in local beach width during the ten-month period were highly variable due in particular to evolving features on the northern and southern ends of the island as well as some isolated areas along the Atlantic shorefront.

The Calibogue Sound (HHI-00A to HHI-01) shoreline experienced an average MHW recession of -9.0 ft over the ten-month inter-survey period. All three transects experienced MHW shoreline retreat during this period, with a maximum recession of -17.8 ft at HHI-01. The South Beach (HHI-01 to HHI-04) shoreline experienced retreat of the MHW shoreline of -30.4 ft over the same period. Again, all transects within this segment were recessional, though the degree of retreat was highly variable, ranging from -86.2 ft at HHI-01C to -7.9 ft at HHI-04. It appears that the migration of a large sand wave from the Atlantic Ocean shoreline observed over the past several intersurvey periods has abated for the time being. This phenomenon will likely resume to some extent within several years after the construction of the next renourishment project, as sand transport to the South Island segment increases.

During this same ten-month period, the South Island segment, from HHI-04 to Alder Lane (at approximately HHI-11), experienced average MHW shoreline advance of +18.7 ft. This segment was generally accretional over this time period, with only HHI-04 experiencing shoreline retreat. MHW shoreline changes ranged from an advance of +48.9 ft at HHI-08 to retreat of -7.9 ft at HHI-04. The long beach cusps that defined changes to this segment over the past several years appear to have been smoothed out, likely due to a “resetting” of the beach system by the impacts of Hurricane Joaquin in October 2015.

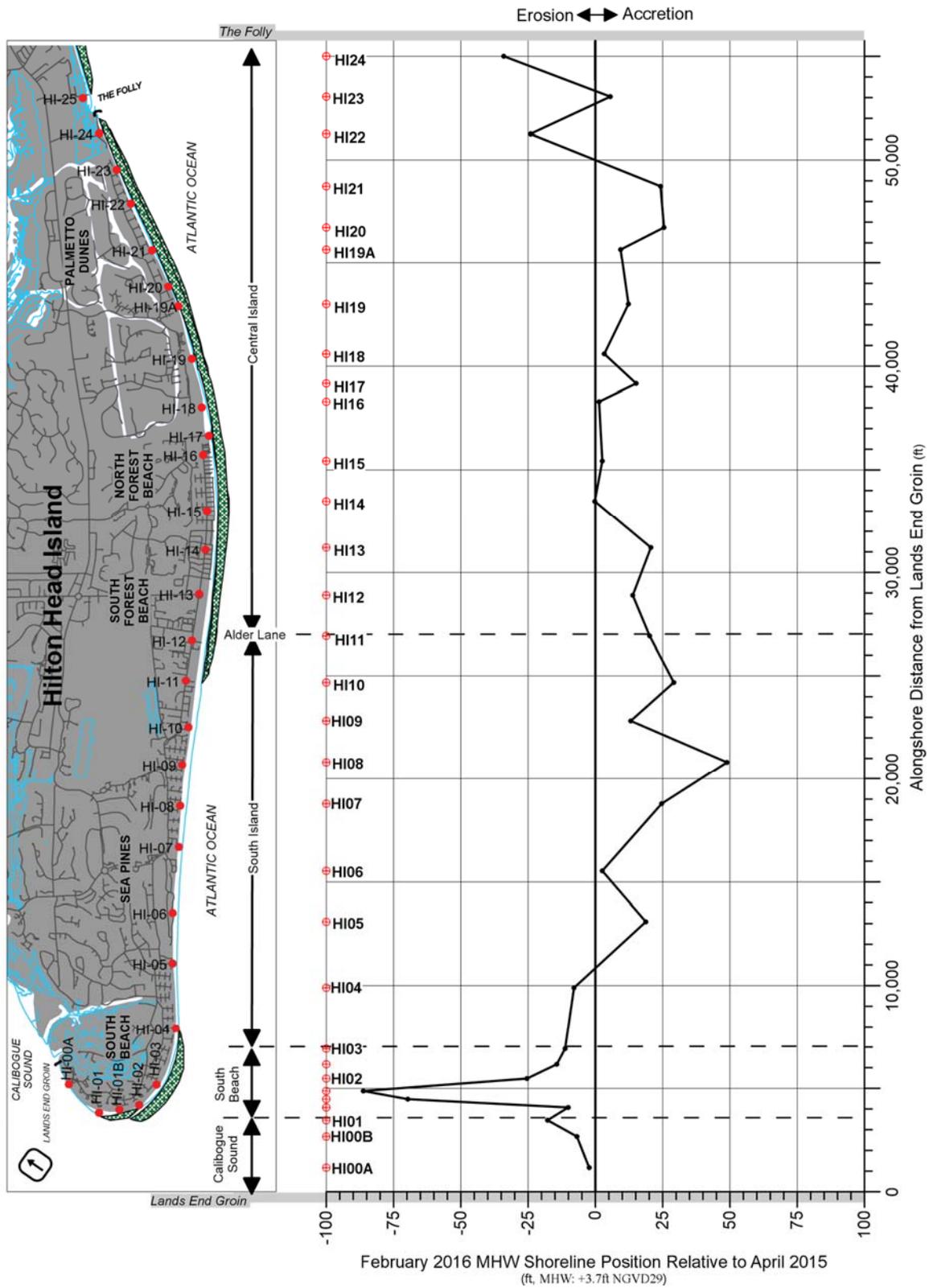


Figure 2.3: Mean high water shoreline (MHWL, +3.7 ft NGVD29) changes along Hilton Head Island between April 2015 and February 2016.

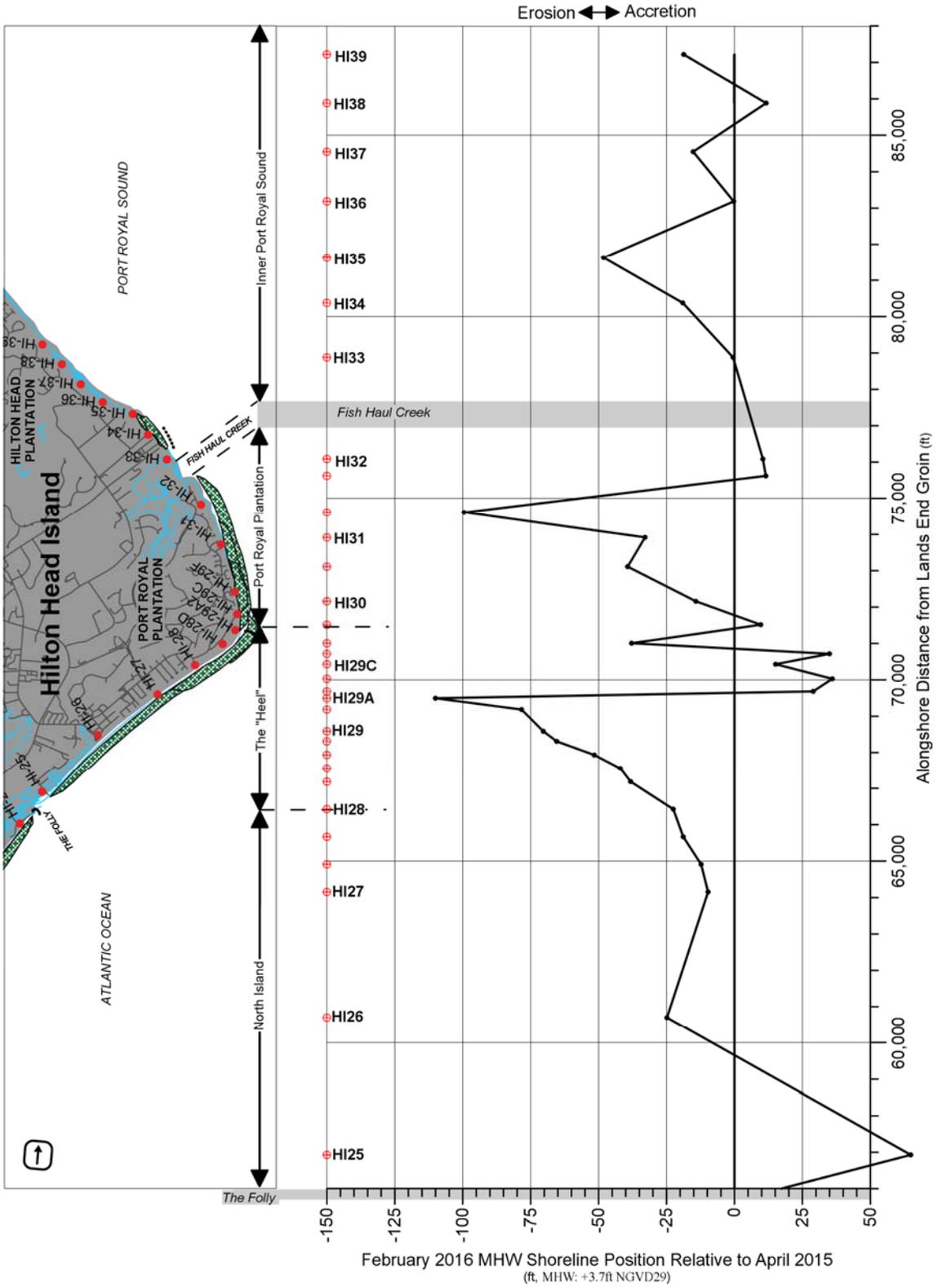


Figure 2.4: Mean high water shoreline (MHWL, +3.7 ft NGVD29) changes along Hilton Head Island between April 2015 and February 2016.

Table 2.2: Hilton Head Island MHWL Change Summary (April 2015 to February 2016).

Seg	Mon	Alongshore Distance (ft) from Lands End	Shoreline Position (ft) at MHW (+3.7 ft, NGVD)		
			Apr-15	Feb-16	Change
Braddock Cove Creek					
Calibogue Sound	HI-00A	1,165	52.4	50.1	-2.3
	HI-00B	2,669	223.3	216.4	-6.9
	HI-01	3,459	492.6	474.9	-17.8
		3,459			-9.0
South Beach	HI-01	3,459	492.6	474.9	-17.8
	HI-01A	4,073	799.3	789.2	-10.1
	HI-01B	4,472	807.7	737.9	-69.7
	HI-01C	4,866	685.5	599.3	-86.2
	HI-02	5,469	427.0	401.6	-25.5
	HI-02A	6,163	182.2	167.9	-14.4
	HI-03	6,921	458.7	447.4	-11.3
	HI-04	9,890	229.5	221.5	-7.9
		6,431			-30.4
South Island	HI-04	9,890	229.5	221.5	-7.9
	HI-05	13,081	303.1	321.8	+18.8
	HI-06	15,527	406.4	409.0	+2.6
	HI-07	18,780	348.6	373.3	+24.7
	HI-08	20,805	437.3	486.2	+48.9
	HI-09	22,820	628.5	641.7	+13.2
	HI-10	24,685	555.8	585.0	+29.2
	HI-11	26,927	989.7	1,009.8	+20.2
		17,037			+18.7
Central Island	HI-11	26,927	989.7	1,009.8	+20.2
	HI-12	28,891	976.6	990.4	+13.9
	HI-13	31,212	839.5	860.1	+20.7
	HI-14	33,483	650.7	650.5	-.2
	HI-15	35,431	634.3	636.9	+2.5
	HI-16	38,297	665.4	666.8	+1.4
	HI-17	39,164	308.5	323.6	+15.1
	HI-18	40,596	476.1	479.4	+3.3
	HI-19	43,004	342.8	355.1	+12.3
	HI-19A	45,673	182.3	191.6	+9.4
	HI-20	46,743	279.0	304.5	+25.5
	HI-21	48,731	320.4	344.6	+24.2
	HI-22	51,256	331.0	306.9	-24.1
HI-23	53,042	245.7	251.3	+5.6	
HI-24	54,999	364.4	330.3	-34.1	
		28,823			+6.4
The Folly					
The Folly					
North Island	HI-25	56,925	640.7	705.6	+64.8
	HI-26	60,697	716.0	691.2	-24.9
	HI-27	64,155	490.3	480.5	-9.7
	HI-27A	64,912	524.2	511.9	-12.3
	HI-27B	65,669	604.7	585.8	-18.8
	HI-28	66,426	698.2	675.7	-22.5
		10,426			-3.9
The Heel	HI-28	66,426	698.2	675.7	-22.5
	HI-28A	67,189	770.3	732.1	-38.2
	HI-28B	67,557	748.8	706.8	-42.0
	HI-28C	67,934	696.9	645.3	-51.6
	HI-28D	68,311	636.3	570.9	-65.4
	HI-29	68,588	525.9	455.5	-70.3
	HI-29A1	69,184	577.7	499.4	-78.4
	HI-29A2	69,495	868.3	758.3	-110.1
	HI-29A3	69,685	837.7	866.6	+29.0
	HI-29B	70,030	854.0	890.0	+36.0
HI-29C	70,429	909.1	924.2	+15.1	
HI-29D	70,716	965.9	1,000.9	+35.0	
HI-29E	71,004	1,065.3	1,027.4	-37.9	
		4,578			-30.9
Port Royal Plantation	HI-29E	71,004	1,065.3	1,027.4	-37.9
	HI-29F	71,514	413.2	422.9	+9.7
	HI-30	72,159	126.0	111.8	-14.2
	HI-30A	73,109	122.2	82.9	-39.3
	HI-31	73,916	280.5	247.6	-32.9
	HI-31A	74,613	460.6	361.2	-99.5
	HI-31B	75,624	404.7	416.2	+11.6
	HI-32	76,086	552.9	563.4	+10.5
		6,432			-24.0
Fish Haul Creek					
Inner Port Royal Sound	HI-33	78,877	91.7	91.2	-.5
	HI-34	80,377	176.3	157.3	-19.0
	HI-35	81,627	117.4	69.3	-48.2
	HI-36	83,183	467.5	467.2	-.3
	HI-37	84,550	321.4	306.2	-15.2
	HI-38	85,883	249.8	261.4	+11.6
	HI-39	87,220	191.2	172.5	-18.7
		9,458			-12.9
					-2.1
		86,645			-2.1

The shoreline along the Central Island segment, from Alder Lane to *The Folly*, experienced an average shoreline advance of +6.4 ft, with moderate variability from transect to transect. This segment of shoreline was fairly stable, but exhibited a modest trend of erosion to the north transitioning to stability and advance toward the south. Recession occurred at only three of the fifteen transects, but two of these were among the highest absolute changes observed alongshore. Shoreline changes ranged from retreat of -34.1 ft at HHI-24 to advance of +25.5 ft at HHI-20.

The North Island shoreline, from *The Folly* to HHI-28, retreated by -3.9 ft, on average. Five of the six transects experienced moderate erosion, while HHI-25 – directly adjacent to *The Folly* – experienced very high advance (+64.8 ft). This trend may be indicative of the continued loss of sand from the Port Royal Shoreline Restoration and Stabilization Project and its resultant deposition further south. However, the greatest erosion observed during this time period (-24.9 ft) occurred at HHI-26, immediately adjacent to HHI-25 and outside the limits of the 2011/12 project.

The Heel (between approximately HHI-28 and HHI-29E) MHW shoreline receded by -30.9 ft, on average. This segment was filled as part of the 2011/12 project and, as expected, experienced recession of the MHW shoreline due to the spreading of fill material from the center of the project to adjacent shorelines. Erosion was most marked to the south of the terminal groin, from HHI-29A2 south. This area saw an average shoreline retreat of nearly -60 ft, with a max of -110.1 at HHI-29A2. However, the area to the north of the terminal groin mostly experienced shoreline advance, averaging +15.4 ft from HHI-29A3 to HHI-29E. Within this area, only HHI-29E experienced shoreline recession. The maximum advance within the segment was +36.0 ft at HHI-29B. A large sand wave continues to propagate to the north, forming a large sand spit that fronts HHI-29E and further north (see **Figure B.09** in **Appendix B**). The sand wave is the product of the attachment of a portion of Joiner Bank to the Heel shoreline.

The Port Royal Plantation shoreline, from HHI-29E to Fish Haul Creek (just past HHI-32), retreated by an average of -24.0 ft during this period. The Ocean Point portion of this segment continues to experience elevated levels of erosion following construction of the Ocean Point Interim Sand Fill project. The focal point of the erosion appears to have continued its northward shift, with the greatest shoreline recession of -99.5 ft occurring at HHI-31A. However, erosion was still significant across the rest of the Ocean Point shoreline. Changes along this segment continue to be characterized by the presence of the sand wave propagating off The Heel shoreline. The large sand spit moving across this area served both to shelter the shoreline and cut off sand transport to it.

Along the Inner Port Royal Sound segment of the island, from Fish Haul Creek to HHI-39, the MHW shoreline retreated by -12.9 ft on average. Six of seven transects in this segment

experienced recession during this time, with the greatest (-48.2 ft) occurring at HHI-35, located at the west end of the 2006/07 project limits and lacking the protection of the breakwater field. The only transect to experience shoreline advance (+11.6 ft) was HHI-38, well west of the project footprint along a portion of the island shoreline that has not been actively managed. The eastern portion of this segment is also impacted by the presence of a large sand wave propagating westward from the Port Royal Plantation shoreline (see **Figure B.07** in **Appendix B**).

2.2.2 Beach Volume Change

Figure 2.5 displays the computed beach volume changes along the shoreline between Braddock Cove Creek on Calibogue Sound and The Folly on the Atlantic Ocean for the period between April 2015 and February 2016. **Figure 2.6** depicts the volume change for the shoreline located between The Folly and HHI-39, fronting Hilton Head Plantation on Port Royal Sound, for the same time period. The top portion of the figures displays the local beach volume density change in cubic yards per foot of shoreline (cy/ft) as represented at each monitoring profile. The bottom portion of the figure shows the cumulative beach volume change in cy summed along the shoreline from Braddock Cove Creek (HI-00A) to The Folly and The Folly to Fish Haul Creek (HI-32), respectively. Beach volume changes are listed below in **Table 2.3** for each beach segment along the monitored shoreline.

Between April 2015 and February 2016, the total monitored area along all segments lost a net -73,700 cy (-0.9 cy/ft)³. Generally speaking, the Atlantic shorefront of the island was accretional during this ten-month period, while the shoreline segments along *Calibogue Sound* and *Port Royal Sound* were erosion in the net. Volume change across the island was generally mild with only a few areas of significant erosion. These highly erosional areas are (1) most of the South Beach shoreline, (2) The Heel shoreline adjacent to and immediately south of the terminal groin, and (3) a portion of the Port Royal Plantation shoreline fronting Ocean Point. Otherwise, changes in local beach volume during the monitoring period are highly variable.

Along the Calibogue Sound (HHI-00A to HHI-01) shoreline, the beach was moderately erosional, losing -12,500 cy (-5.4 cy/ft) of sand, mostly due to significant erosion (-19.7 cy/ft) at HHI-01. Along the South Beach (HHI-01 to HHI-04) shoreline, the beach was very erosional, losing -130,400 cy (-20.3 cy/ft) of sand over the ten-month period. The South Beach shoreline eroded at every transect except HHI-04, where accretion was minimal (+1.3 cy/ft). The greatest erosion (-50.8 cy/ft) occurred at HHI-01C. Above the MHW contour, losses totaled -24,600 cy (-3.8 cy/ft), indicating that most of the loss occurred along the lower profile.

³ Unless stated otherwise, the volume changes in this report were computed from the seaward edge of the most seaward dune feature evident in the beach profile data to the apparent location of beach profile “closure.”

Along the island's Atlantic Ocean shorefront, the South Island segment, from HHI-04 to Alder Lane (at approximately HHI-11), accreted by +85,400 cy (+5.0 cy/ft), with all eight transects experiencing accretion. Gains range from a maximum of +11.9 cy/ft at HHI-11 to a minimum of +1.3 cy/ft at HHI-04. This gain is likely the result both of losses from the Central Island shoreline as well as onshore migration of sand from beyond the typical "toe" of the beach.

The beach along the Central Island segment, from Alder Lane to *The Folly*, gained about +118,100 cy (+4.1 cy/ft). Changes along this shoreline segment were highly variable, ranging from a gain of +17.3 cy/ft at HHI-13 to a loss of -4.8 cy/ft at HHI-22. Above the MHW contour, however, this segment was actually erosional, with a total loss of -21,900 cy (-0.8 cy/ft). These losses, which are captured on the lower profile, are likely the result of impacts from Hurricane Joaquin.

The North Island shoreline, from *The Folly* to HHI-28, gained +14,400 cy (+1.4 cy/ft) of sand over the ten-month inter-survey period. Changes alongshore were variable, with three transects experiencing erosion and three transects experiencing accretion. Of interest is that, while HHI-25 saw a significant advance of the MHW shoreline, the volume gain at this transect (+5.5 cy/ft) was not correspondingly high. This may be due to gains on the upper beach being the result of the onshore transport of sand from the lower profile. This is evidenced by the significant accretion observed at this transect (+12.3 cy/ft) above the 0.0 ft NGVD29 contour.

The Heel shoreline, from HHI-28 to HHI-29E, lost a total of -76,400 cy (-16.7 cy/ft) of sand across the entire profile. As with recession of the MHW shoreline, this segment, which was filled as part of the 2011/12 project, experienced significant erosion in the vicinity of the terminal groin and south thereof. From HHI-28D to HHI-29A3, erosion averaged nearly -40 cy/ft, with the greatest erosion (-68.6 cy/ft) occurring at HHI-29A2, at the middle of the terminal groin. To the north of the terminal groin, a maximum gain of +8.8 cy/ft occurred at HHI-29C.

The Port Royal Plantation shoreline, from HHI-29E to *Fish Haul Creek*, experienced erosion of -63,100 cy (-9.8 cy/ft) during this same period. The most significant erosion occurred along the Ocean Point shoreline, with a maximum loss of -36.0 cy/ft at HHI-31A. As with MHW shoreline change, the erosional hotspot along the Ocean Point shoreline has gradually shifted north over time.

Along the Inner Port Royal Sound segment of the island, from *Fish Haul Creek* to HHI-39, a loss of -9,200 cy (-1.0 cy/ft) was measured over the ten-month monitoring period. Five of seven transects in this segment experienced erosion, with changes ranging from erosion of -5.3 cy/ft at HHI-35 to accretion of +3.5 cy/ft at HHI-38.

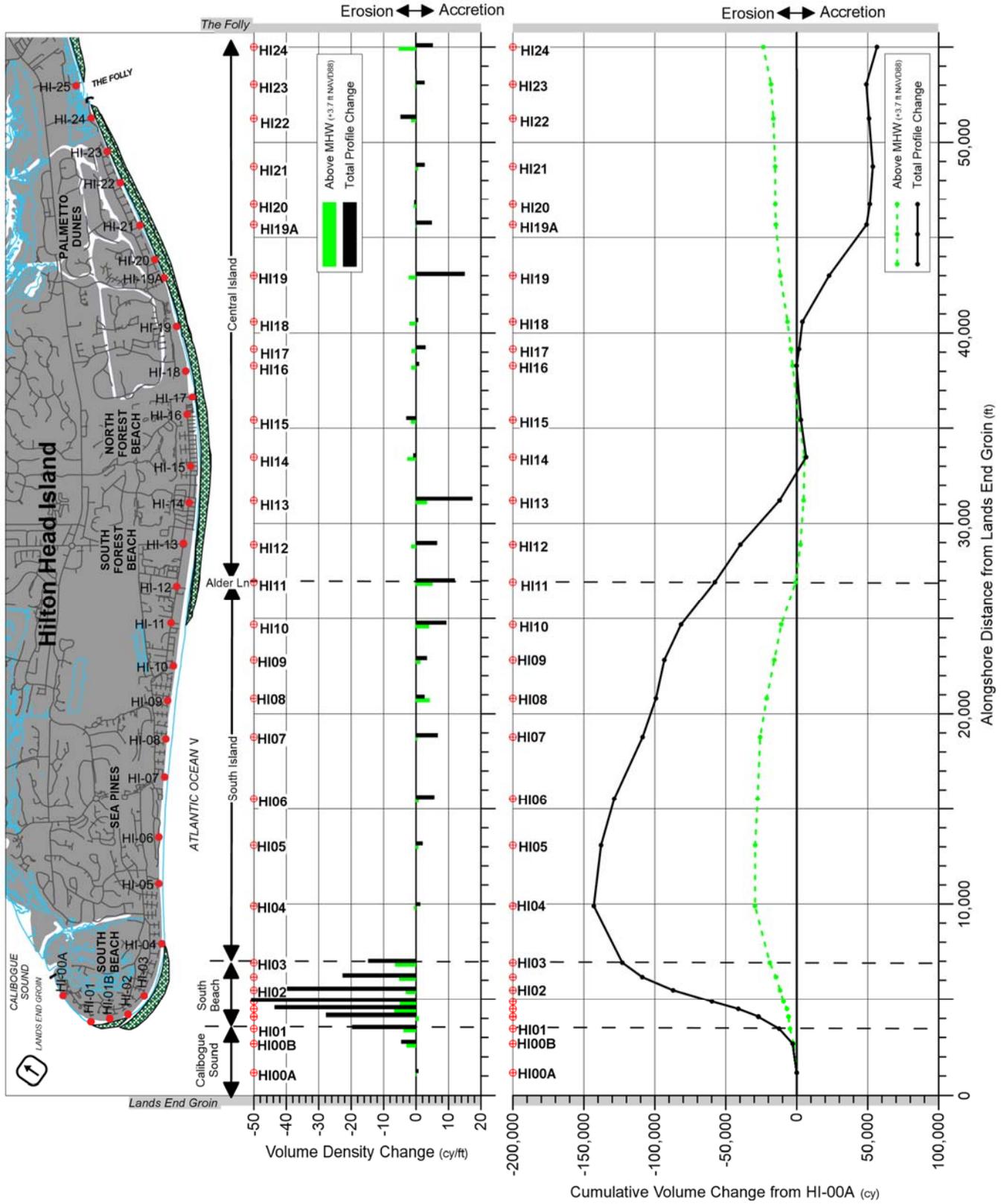


Figure 2.5: Beach volume changes on Hilton Head Island, SC between April 2015 and February 2016.

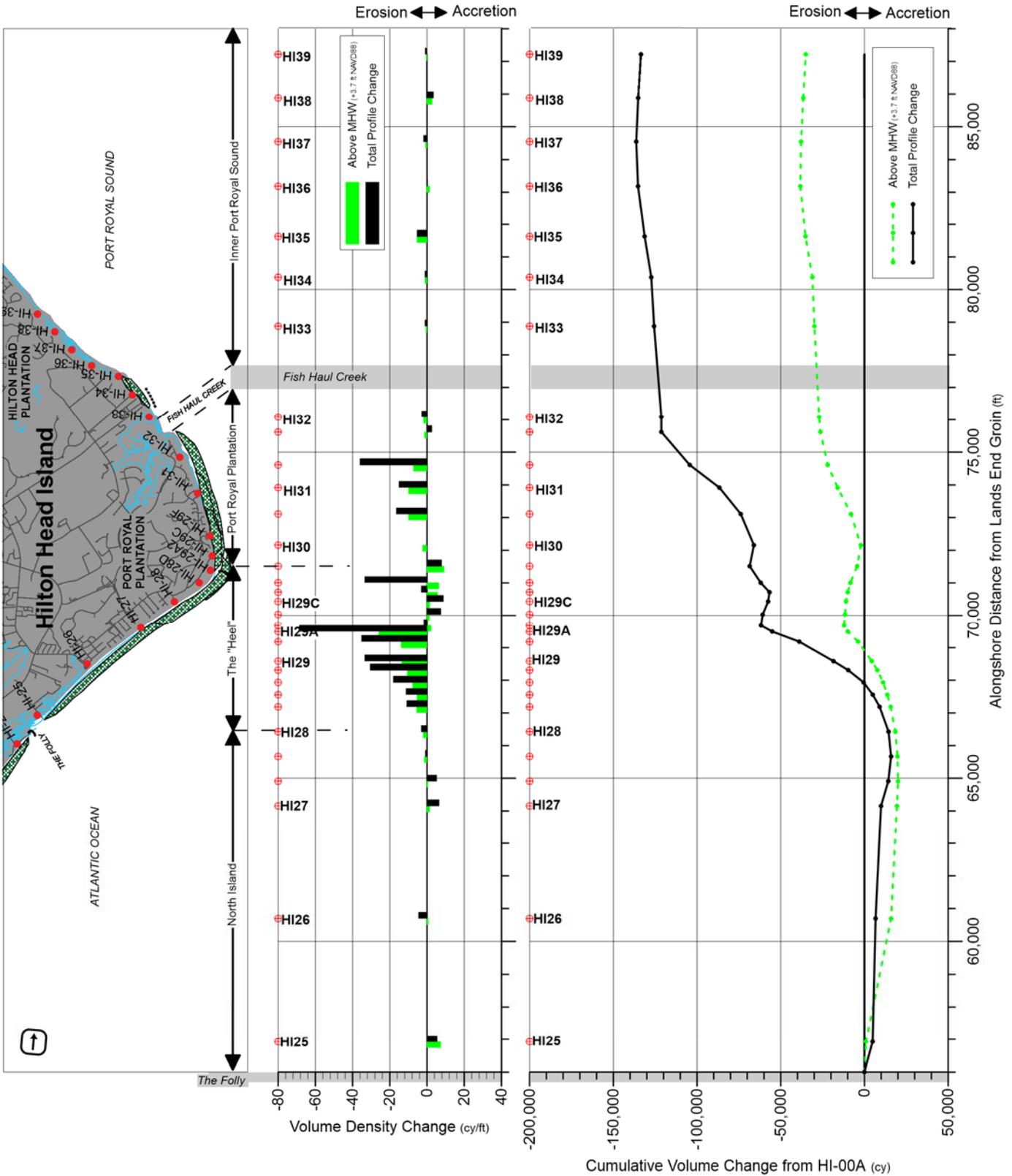


Figure 2.6: Beach volume changes on Hilton Head Island, SC between April 2015 and February 2016.

Table 2.3: Hilton Head Island Beach Volume Change Summary (April 2015 to February 2016).

April 2015 to February 2016	Monument Range	Reach Length (ft)	Average Volume Change (cy/ft)			Volume Change (cy)			
			Above +3.7'	Above 0.0'	Total Profile	Above +3.7'	Above 0.0'	Total Profile	
Whole Island	Calibogue Sound	HI00A to HI00B	1,505	-1.4	-1.8	-1.9	-2,200	-2,700	-2,900
		HI00B to HI01	790	-3.4	-5.4	-12.1	-2,700	-4,300	-9,600
		Subtotal	2,295	-2.1	-3.1	-5.4	-4,900	-7,000	-12,500
	South Beach	HI01 to HI01A	614	-1.5	-3.4	-23.7	-900	-2,100	-14,500
		HI01A to HI01B	399	-3.0	-8.9	-35.6	-1,200	-3,500	-14,200
		HI01B to HI01C	394	-5.9	-17.9	-47.2	-2,300	-7,100	-18,600
		HI01C to HI02	603	-4.1	-13.4	-45.3	-2,500	-8,100	-27,300
		HI02 to HI02A	694	-4.2	-8.1	-31.2	-2,900	-5,700	-21,600
		HI02A to HI03	759	-5.8	-8.0	-18.7	-4,400	-6,000	-14,200
		HI03 to HI04	2,969	-3.5	-5.4	-6.7	-10,400	-16,000	-20,000
	Subtotal	6,431	-3.8	-7.5	-20.3	-24,600	-48,500	-130,400	
	South Island	HI04 to HI05	3,191	0.0	-1.1	1.6	100	-3,600	5,100
		HI05 to HI06	2,446	0.7	0.2	3.8	1,800	400	9,300
		HI06 to HI07	3,253	0.6	1.6	6.1	1,800	5,300	20,000
		HI07 to HI08	2,024	2.2	2.3	4.6	4,500	4,600	9,400
		HI08 to HI09	2,015	2.7	2.3	3.0	5,500	4,500	6,000
		HI09 to HI10	1,865	2.6	4.6	6.3	4,900	8,700	11,800
		HI10 to HI11	2,242	4.5	6.9	10.6	10,100	15,400	23,800
	Subtotal	17,037	1.7	2.1	5.0	28,700	35,300	85,400	
	Central Island	HI11 to HI12	1,964	1.8	1.1	9.2	3,500	2,200	18,000
		HI12 to HI13	2,321	0.9	-2.0	11.9	2,100	-4,600	27,600
		HI13 to HI14	2,271	0.3	-0.9	8.3	800	-2,100	18,700
		HI14 to HI15	1,948	-2.1	-2.5	-1.9	-4,100	-4,800	-3,700
		HI15 to HI16	2,866	-1.5	-1.9	-1.1	-4,300	-5,500	-3,000
		HI16 to HI17	867	-1.4	-1.1	1.9	-1,200	-1,000	1,600
		HI17 to HI18	1,432	-1.7	-2.2	1.7	-2,400	-3,200	2,500
		HI18 to HI19	2,408	-2.1	-4.1	7.8	-5,100	-9,800	18,700
		HI19 to HI19A	2,669	-1.1	-2.5	9.9	-3,000	-6,600	26,400
		HI19A to HI20	1,070	-0.4	-1.4	2.1	-400	-1,500	2,300
		HI20 to HI21	1,988	-0.1	-1.3	1.1	-200	-2,600	2,100
HI21 to HI22		2,526	-0.5	-1.2	-1.1	-1,200	-3,100	-2,700	
HI22 to HI23		1,786	-0.9	0.0	-1.1	-1,600	-100	-1,900	
HI23 to HI24		1,957	-2.8	-0.4	3.9	-5,500	-800	7,500	
HI24 to Folly	750	1.0	4.9	5.3	700	3,700	4,000		
Subtotal	28,823	-0.8	-1.4	4.1	-21,900	-39,800	118,100		
North Island	Folly to HI25	925	1.0	4.9	5.3	900	4,600	4,900	
	HI25 to HI26	3,772	4.0	4.8	0.5	15,000	18,100	1,700	
	HI26 to HI27	3,458	1.0	-0.8	1.0	3,500	-2,600	3,300	
	HI27 to HI27A	757	0.9	0.8	5.8	700	600	4,400	
	HI27A to HI27B	757	-0.5	-1.2	2.1	-300	-900	1,600	
	HI27B to HI28	757	-1.7	-3.1	-2.0	-1,300	-2,300	-1,500	
Subtotal	10,426	1.8	1.7	1.4	18,500	17,500	14,400		

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Table 2.3 (con't): Hilton Head Island Beach Volume Change Summary (April 2013 to April 2014).

Continued from previous page									
April 2015 to February 2016	Monument Range	Reach Length (ft)	Average Volume Change (cy/ft)			Volume Change (cy)			
			Above +3.7'	Above 0.0'	Total Profile	Above +3.7'	Above 0.0'	Total Profile	
Whole Island	Calibogue Sound Subtotal	2,295	-2.1	-3.1	-5.4	-4,900	-7,000	-12,500	
	South Beach Subtotal	6,431	-3.8	-7.5	-20.3	-24,600	-48,500	-130,400	
	South Island Subtotal	17,037	1.7	2.1	5.0	28,700	35,300	85,400	
	Central Island Subtotal	28,823	-0.8	-1.4	4.1	-21,900	-39,800	118,100	
	North Island Subtotal	10,426	1.8	1.7	1.4	18,500	17,500	14,400	
	The Heel	HI28 to HI28A	763	-3.7	-6.0	-7.0	-2,900	-4,600	-5,300
		HI28A to HI28B	368	-5.4	-8.9	-11.1	-2,000	-3,300	-4,100
		HI28B to HI28C	377	-6.5	-11.1	-14.6	-2,500	-4,200	-5,500
		HI28C to HI28D	377	-9.1	-15.5	-24.3	-3,400	-5,800	-9,100
		HI28D to HI29	277	-12.0	-19.4	-32.0	-3,300	-5,400	-8,900
		HI29 to HI29A1	596	-13.7	-21.1	-34.3	-8,100	-12,600	-20,500
		HI29A1 to HI29A2	311	-19.8	-23.3	-51.9	-6,200	-7,300	-16,100
		HI29A2 to HI29A3	190	-11.8	-7.1	-35.2	-2,200	-1,400	-6,700
		HI29A3 to HI29B	345	1.7	13.0	2.9	600	4,500	1,000
		HI29B to HI29C	398	1.3	14.3	8.1	500	5,700	3,200
	HI29C to HI29D	288	3.5	17.2	2.9	1,000	4,900	800	
	HI29D to HI29E	288	6.0	7.3	-18.2	1,700	2,100	-5,200	
	Subtotal	4,578	-5.9	-6.0	-16.7	-26,800	-27,400	-76,400	
	Port Royal Plantation	HI29E to HI29F	510	7.8	7.2	-12.8	4,000	3,700	-6,500
		HI29F to HI30	645	3.4	9.0	3.9	2,200	5,800	2,500
		HI30 to HI30A	950	-6.2	-7.8	-8.3	-5,800	-7,400	-7,900
		HI30A to HI31	807	-9.9	-13.0	-15.8	-8,000	-10,500	-12,700
		HI31 to HI31A	697	-8.6	-18.0	-25.5	-6,000	-12,500	-17,800
		HI31A to HI31B	1,011	-4.3	-11.5	-16.7	-4,300	-11,700	-16,900
		HI31B to HI32	462	-1.6	0.2	-0.1	-700	100	0
		HI32 to FHC	1,350	-1.8	0.3	-2.8	-2,500	400	-3,800
	Subtotal	6,432	-3.3	-5.0	-9.8	-21,100	-32,100	-63,100	
	Inner Port Royal Sound	FHC to HI33	1,115	-0.6	-1.1	-1.1	-700	-1,300	-1,300
HI33 to HI34		1,500	-0.9	-1.1	-1.1	-1,300	-1,700	-1,700	
HI34 to HI35		1,250	-3.2	-4.4	-3.2	-4,000	-5,500	-4,000	
HI35 to HI36		1,557	-2.0	-3.3	-2.5	-3,100	-5,200	-3,900	
HI36 to HI37		1,366	0.3	-0.4	-0.8	400	-500	-1,100	
HI37 to HI38		1,333	1.0	0.8	0.8	1,300	1,100	1,100	
HI38 to HI39		1,337	1.2	0.5	1.3	1,600	700	1,700	
Subtotal	9,458	-0.6	-1.3	-1.0	-5,800	-12,400	-9,200		
TOTAL	85,480	-0.7	-1.3	-0.9	-57,900	-114,400	-73,700		

2.3 Post-Construction Period Beach Changes (March 2007 to February 2016)

2.3.1 Shoreline Change

Figure 2.7 depicts the change of the Mean High Water (MHW) shoreline (+3.7 ft NGVD29) along the Calibogue Sound, South Beach, South Island, and Central Island shorelines since completion of the 2006/07 Hilton Head Island Beach Renourishment Project (i.e., March 2007 to February 2016). **Figure 2.8** depicts the change of the MHW shoreline along the North Island, Port Royal Plantation, and Inner Port Royal Sound shorelines for the same time period. Shoreline position changes at each monument are listed in **Table 2.4**, with average shoreline position changes for each beach segment as well as the whole island.

Along the entire length of the island, the MHW shoreline advanced by an average of +20.0 ft (+2.2 ft/yr) over the nine-year inter-survey period. Changes in local beach width during the nine-year *monitoring* period were highly variable due primarily to highly localized dynamic areas at the northern and southern ends of the island and the effects of the 2011/12 beach fill project at The “Heel” of the island. Profile equilibration and alongshore spreading of fill material were secondary effects compared to the significant shoreline changes observed on the South Beach shoreline and at the Heel.

The Calibogue Sound (HI-00A to HHI-01) shoreline and the South Beach (HHI-01 to HHI-04) shoreline experienced significant advance of the MHW shoreline over the nine-year post-construction monitoring period. The Calibogue Sound shoreline advanced by +45.0 ft (+5.0 ft/yr), nearly entirely the result of advance at HHI-01 of +159.3 ft (+17.9 ft/yr). The western portion of South Beach has seen significant shoreline advance, with gains as high as +441.5 ft (+49.5 ft/yr) at HHI-01A. From HHI-01A to HHI-01C, the shoreline has advanced by an average of +353.8 ft (+39.7 ft/yr). The rest of the South Beach shoreline was erosion to varying degrees, with a maximum retreat of -191.6 ft (-21.5 ft/yr) at HHI-02A. Over this period, the entire South Beach segment advanced by +105.1 ft (+11.8 ft/yr).

Along the island’s Atlantic shorefront, the South Island segment, from HHI-04 to Alder Lane in South Forest Beach (at approximately HHI-11), experienced MHW shoreline advance of +39.3 ft (+4.4 ft/yr). This segment of the shoreline was generally stable to accretional, with some variability alongshore. Changes in this segment ranged from advance of +86.6 ft (+9.7 ft/yr) at HHI-09 to retreat of -23.4 ft (-2.6 ft/yr) at HHI-04.

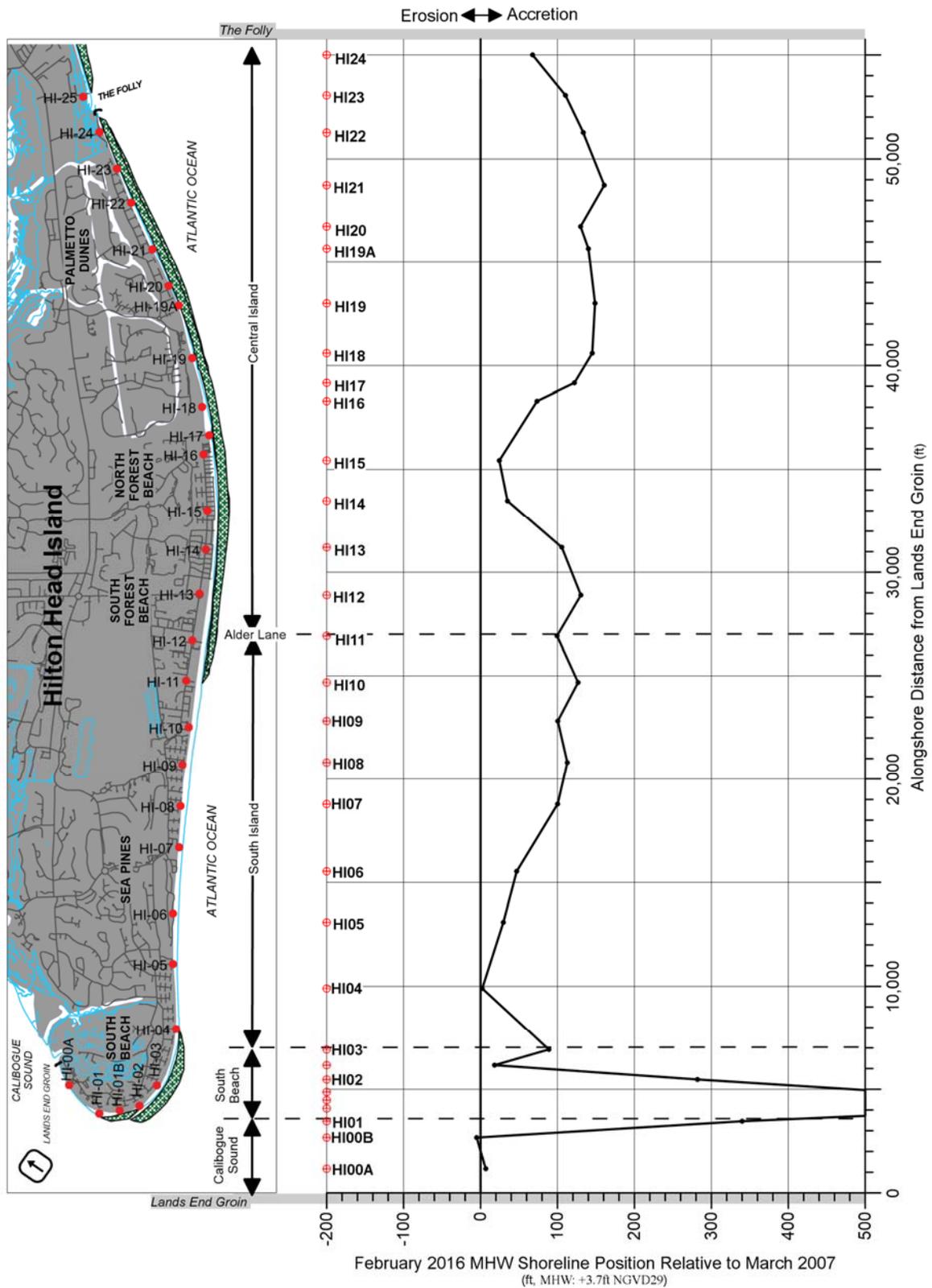


Figure 2.7: Mean high water shoreline (MHWL, +3.7 ft NGVD29) changes along Hilton Head Island between the 2006/07 Hilton Head Beach Renourishment post-construction survey in March 2007 and February 2016.

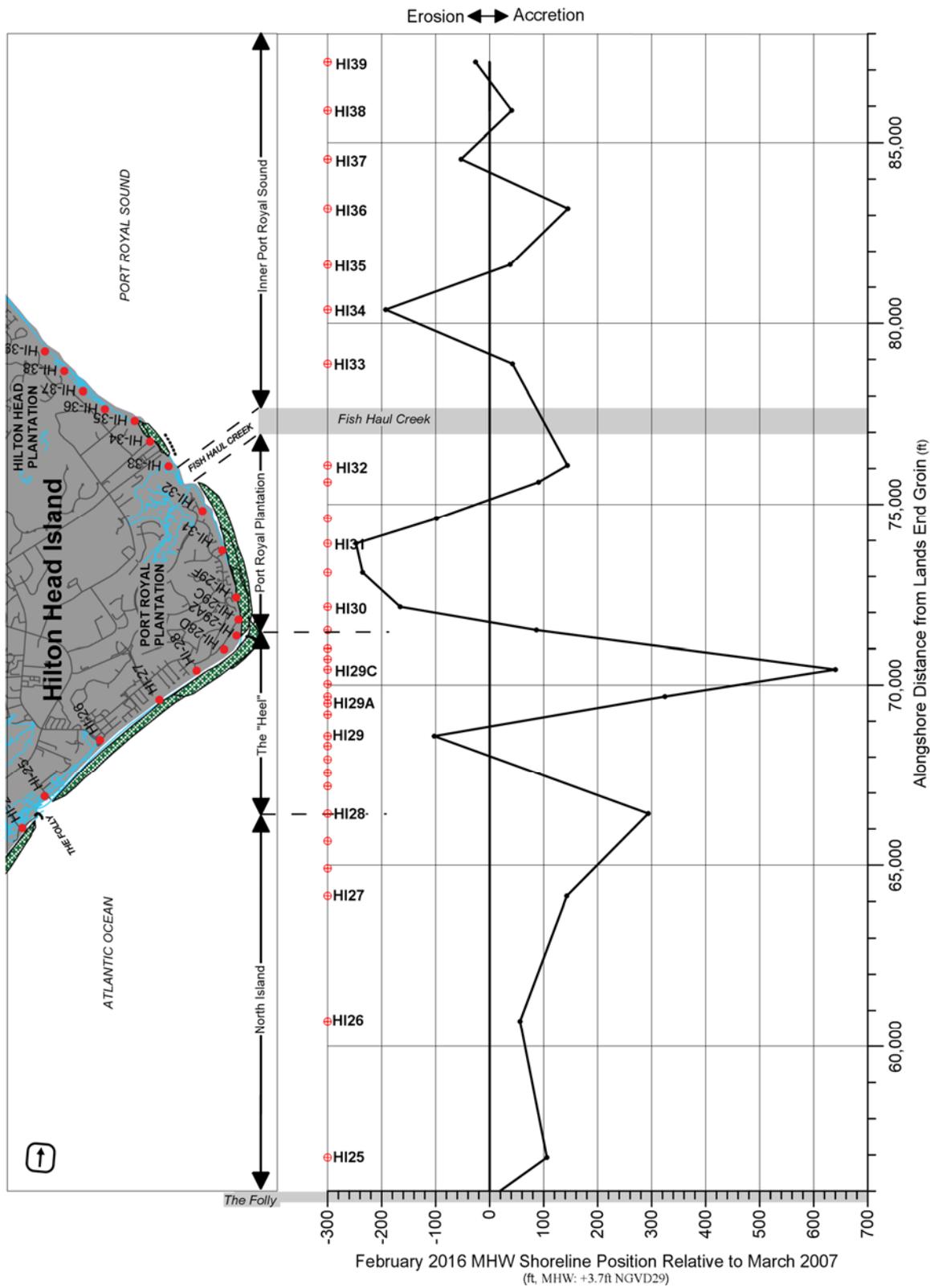


Figure 2.8: Mean high water shoreline (MHWL, +3.7 ft NGVD29) changes along Hilton Head Island between the 2006/07 Hilton Head Beach Renourishment post-construction survey in March 2007 and February 2016.

Table 2.4: Hilton Head Island MHWL Change Summary (March 2007 to February 2016).

Seg	Mon	Alongshore Distance (ft) from Lands End	Shoreline Position (ft) at MHW (+3.7 ft, NGVD)			
			Mar-07	Feb-16	Change	
Braddock Cove Creek						
Calibogue Sound	HI-00A	1,165	44.9	50.1	+5.3	
	HI-00B	2,669	246.0	216.4	-29.6	
	HI-01	3,459	315.5	474.9	+159.3	
		3,459			+45.0	
South Beach	HI-01	3,459	315.5	474.9	+159.3	
	HI-01A	4,073	347.8	789.2	+441.5	
	HI-01B	4,472	361.1	737.9	+376.8	
	HI-01C	4,866	356.0	599.3	+243.3	
	HI-02	5,469	496.0	401.6	-94.5	
	HI-02A	6,163	359.5	167.9	-191.6	
	HI-03	6,921	518.1	447.4	-70.8	
	HI-04	9,890	244.9	221.5	-23.4	
		6,431			+105.1	
South Island	HI-04	9,890	244.9	221.5	-23.4	
	HI-05	13,081	291.7	321.8	+30.2	
	HI-06	15,527	383.0	409.0	+26.0	
	HI-07	18,780	296.0	373.3	+77.3	
	HI-08	20,805	446.4	486.2	+39.9	
	HI-09	22,820	555.1	641.7	+86.6	
	HI-10	24,685	536.8	585.0	+48.2	
	HI-11	26,927	979.9	1,009.8	+30.0	
			17,037			+39.3
	Central Island	HI-11	26,927	979.9	1,009.8	+30.0
		HI-12	28,891	1,007.1	990.4	-16.7
HI-13		31,212	902.1	860.1	-41.9	
HI-14		33,483	797.6	650.5	-147.1	
HI-15		35,431	794.4	636.9	-157.6	
HI-16		38,297	843.5	666.8	-176.7	
HI-17		39,164	428.7	323.6	-105.1	
HI-18		40,596	547.9	479.4	-68.5	
HI-19		43,004	416.6	355.1	-61.5	
HI-19A		45,673	273.7	191.6	-82.0	
HI-20		46,743	397.2	304.5	-92.7	
HI-21		48,731	390.3	344.6	-45.7	
HI-22		51,256	365.0	306.9	-58.0	
HI-23		53,042	323.4	251.3	-72.1	
HI-24	54,999	405.3	330.3	-75.0		
		28,823			-78.0	
The Folly						
Seg	Mon	Alongshore Distance (ft) from Lands End	Shoreline Position (ft) at MHW (+3.7 ft, NGVD)			
			Mar-07	Feb-16	Change	
The Folly						
North Island	HI-25	56,925	599.5	705.6	+106.1	
	HI-26	60,697	634.9	691.2	+56.2	
	HI-27	64,155	337.7	480.5	+142.8	
	HI-27A	64,912		511.9		
	HI-27B	65,669		585.8		
	HI-28	66,426	382.1	675.7	+293.6	
			10,426			+149.7
The Heel	HI-28	66,426	382.1	675.7	+293.6	
	HI-28A	67,189		732.1		
	HI-28B	67,557		706.8		
	HI-28C	67,934		645.3		
	HI-28D	68,311		570.9		
	HI-29	68,588	558.1	455.5	-102.6	
	HI-29A1	69,184		499.4		
	HI-29A2	69,495		758.3		
	HI-29A3	69,685	542.0	866.6	+324.6	
	HI-29B	70,030		890.0		
	HI-29C	70,429	284.0	924.2	+640.2	
HI-29D	70,716		1,000.9			
HI-29E	71,004		1,027.4			
		4,578			+289.0	
Port Royal Plantation	HI-29E	71,004		1,027.4		
	HI-29F	71,514	336.4	422.9	+86.5	
	HI-30	72,159	277.5	111.8	-165.7	
	HI-30A	73,109	318.0	82.9	-235.2	
	HI-31	73,916	495.0	247.6	-247.5	
	HI-31A	74,613	459.5	361.2	-98.3	
	HI-31B	75,624	325.7	416.2	+90.5	
	HI-32	76,086	419.4	563.4	+144.0	
			6,432			-60.8
	Fish Haul Creek					
Inner Port Royal Sound	HI-33	78,877	48.8	91.2	+42.4	
	HI-34	80,377	349.9	157.3	-192.6	
	HI-35	81,627	31.2	69.3	+38.1	
	HI-36	83,183	322.4	467.2	+144.9	
	HI-37	84,550	359.1	306.2	-52.9	
	HI-38	85,883	220.5	261.4	+40.9	
	HI-39	87,220	198.6	172.5	-26.1	
			9,458			-8
			86,645			+20.0

The shoreline along the Central Island segment, from Alder Lane to The Folly, which includes South Forest Beach, North Forest Beach, and Palmetto Dunes, experienced an average shoreline retreat of -78.0 ft (-8.7 ft/yr), with all transects but HHI-11 experiencing some amount of shoreline retreat. Retreat was most significant in the area from HHI-14 to HHI-17 in the southern half of the segment (i.e., North Forest Beach), averaging -146.6 ft (-16.4 ft/yr), with a maximum retreat of -176.7 ft at HHI-16. HHI-11, at Alder Lane, saw advance of +30.0 ft (+3.4 ft/yr).

North of the Folly, the North Island (The Folly to HHI-28) MHW shoreline advanced by an average of +149.7 ft (+16.8 ft/yr) during this time period, in large part due to the 2011/12 beach fill project. All transects along this reach of shoreline saw advance during this period, ranging from +56.2 ft (+6.3 ft/yr) at HHI-26 to advance of +293.6 ft (+32.9 ft/yr) at HHI-28, within the limits of the 2011/12 beach fill project.

Though shoreline data from March 2007 is limited, The Heel MHW shoreline, between approximately HHI-28 and HHI-29E, experienced the most significant advance over this time period, with an average advance of +289.0 ft (+32.4 ft/yr). Illustrating the severity of erosion at The Heel that occurred between the 2006/07 project and the 2001/12 project is the MHW shoreline position at HHI-29, which is actually more than 100 ft landward of the March 2007 condition. From March 2007 to October 2011, just prior to construction of the 2011/12 project, the shoreline at HHI-29 retreated by -307 ft (-67 ft/yr). From April 2002, when this erosional trend began, to October 2011, the shoreline at HHI-29 retreated by -826 ft, or -87 ft/yr. The 2011/12 project advanced the shoreline at HHI-29 by 580 ft so, even with the construction of a sizeable beach nourishment, the shoreline was still landward of recent historical conditions. Further observation of the shoreline over a full 8- to 10-year renourishment interval will demonstrate how effective the terminal groin has been at reducing erosion and stabilizing the shoreline.

The Port Royal Plantation shoreline, from HHI-29E to Fish Haul Creek (HHI-32), retreated by an average of -60.8 ft (-6.8 ft/yr). The central portion of this shoreline fronting Ocean Point has been highly erosional over this time period, despite sand placement as part of the Ocean Point Interim Sand Fill project. From HHI-30 to HHI-31A, the shoreline has retreated by an average of -186.6 ft (-20.9 ft/yr). Conversely, the ends of this segment experienced significant advances of the shoreline over this same period, with a maximum advance of +144.0 ft (+16.1 ft/yr) observed at HHI-32. Part of this erosion and accretion dynamic can be attributed to the alongshore diffusion of sand placed during the 2006/07 beach fill, which renourished only a portion of this shoreline. Further erosion beyond that, particularly the evolving hotspot at Ocean Point, is principally related to the influence of the nearshore tidal channels and shoals fields.

Along the Inner Port Royal Sound segment of the island, from Fish Haul Creek to HHI-39, the MHW shoreline retreated by -0.8 ft (-0.1 ft/yr) on average. Changes to this segment of shoreline were highly varied, with a maximum shoreline retreat of -192.6 ft (-21.6 ft/yr) at HHI-34 – within the limits of the 2006/07 Fish Haul/Spa beach fill – and maximum shoreline advance of +144.9 ft (+16.2 ft/yr) at HHI-36. This significant advance is the result of the northward migration of the sand wave discussed in **Section 2.3.1**.

2.3.2 Beach Volume Change

Figure 2.9 displays the computed beach volume changes along the Calibogue Sound, South Beach, South Island, and Central Island shorelines since completion of the 2006/07 Hilton Head Island Beach Renourishment Project (March 2007 to February 2016). **Figure 2.10** depicts the computed beach volume changes along the North Island, Port Royal Plantation, and Inner Port Royal Sound shorelines for the same period. This period represents nine years of beach fill performance following completion of the 2006/07 project. The top portion of the figure displays the measured local beach volume density change (in cy/ft) at each monitoring profile and the bottom portion shows the cumulative beach volume change (in cy) summed along the shoreline from (1) the Lands End Groin at Braddock Cove Creek (about HHI-00A) to The Folly (HI-24) and (2) The Folly (HHI-25) to HHI-39. Beach volume changes are listed below in **Table 2.5** for each beach segment along the monitored shoreline of the island.

Between March 2007 and February 2016, comparison of beach profiles surveys suggests that the island's entire sand shoreline gained +1,129,800 cy. This average net gain is skewed significantly by the gain of 1,170,000 cy of sand from *The Folly* to HHI-29F. This segment of shoreline includes both the portion of beach renourished as part of the 2011/12 PRS Shoreline Restoration and Stabilization Project Performance as well as adjacent areas of shoreline that have subsequently benefitted from the alongshore diffusion of fill sand. This quantity reflects significant shoreline sand losses between March 2007 and December 2011, the 2011/12 placement of more than 1,100,000 (between HHI-27 and HHI-29C) cy of sand between December 2011 and January 2012, and the onshore propagation of a sand wave resulting from the attachment of a portion of Joiner Bank to the Heel shoreline. Excluding this 1.1 Mcy sand placement, as well as the placement of approximately 20,000 cy at Ocean Point, the island shoreline has actually accreted by about 9,800 cy of sand over this entire period. This total includes significant losses along the Central Island shoreline and significant related gains along the South Island segment shoreline. However, there has also been substantial accretion of sand along the South Beach shoreline that has been caused by the onshore movement of an ebb tidal sand lobe (see **Section 2.6**).

The Calibogue Sound (HHI-00A to HHI-01) shoreline was erosional on average, losing -16,800 cy (7.3 cy/ft) of sand. However, change was highly variable alongshore, ranging from loss of -29.3 cy/ft at HHI-00B to a gain of +56.7 cy/ft immediately adjacent at HHI-01. The South Beach (HHI-01 to HHI-04) shoreline, as discussed above, was highly accretional, on average, over the nine-year post-construction monitoring period, with a gain of +219,600 cy (+34.1 cy/ft). The western segment of South Beach, from HHI-01 to HHI-02, has experienced an average gain of +128.4 cy/ft over this time period. Immediately east of there, the shoreline from HHI-02 to HHI-03 was quite erosional, though still to a much smaller extent, with an average loss of -65.2 cy/ft. The remainder of the segment, from HHI-03 to HHI-04, was moderately accretional, likely due to transport of sediment from the north.

Along the island's Atlantic shorefront, the South Island segment, from HHI-04 to Alder Lane (at approximately HHI-11), gained +4621,700 cy. This is likely the effect of diffusion and normal alongshore transport from the 2006/07 beach fill to the area that did not receive fill. As can be seen in **Figure 2.9**, accretion above MHW and across the total profile occurred at all transects in this segment except HHI-04. Accretion was most significant at the north, immediately adjacent to the filled Central Atlantic segment, and generally decreased with distance south of HHI-11.

The beach along the Central Island segment, from Alder Lane to *The Folly*, lost about -595,600 cy with losses measured at 10 of 15 transects. The equivalent annual loss rate from this area is about -66,800 cy/yr. Losses between HHI-14 and HHI-20, where the most significant erosion was observed, averaged -43.9 cy/ft, with a maximum erosion of -74.0 at HHI-16. At the southern end of this segment, from HHI-11 to HHI-13, there was an accretion of 107,900 cy of sand during this time, with the beach around HHI-11 accounting for the greatest gain (+51.9 cy/ft).

The North Island shoreline, from *The Folly* (HHI-25) to HHI-28, gained +572,100 cy (+54.9 cy/ft) of sand over the nine-year post-construction monitoring period. The sand placed during, and lost to diffusion from, the Port Royal Sound Shoreline Restoration and Stabilization Project (i.e., 2011/12 beach fill, from HHI-27 to HHI-29C) accounts for most of this volume gain. Gains were measured at all transects within this segment over this period, with a maximum gain of +182.6 cy/ft at HHI-28.

The Heel shoreline, from HHI-28 to HHI-29E, gained a total of +485,200 cy (+106.0 cy/ft) of sand across the entire profile from March 2007 to February 2016. Over this time period, which includes the placement of sand from the 2011/12 project, the only area to experience loss is an isolated portion of the shoreline just south of the terminal groin, from HHI-28D to HHI-29A1. As with the MHW shoreline change, the greatest erosion occurred at HHI-29, where losses amounted to -97.3 cy/ft. Adjusting this loss by the 300 cy/ft of sand placed here as part of the 2011/12 project, losses at this transect since March 2007 have amounted to nearly -400 cy/ft. Adjusting for 2011/12 placement, only transects HHI-29B to HHI-29E have experienced accretion over this time. These transects have all benefitted both from the diffusion of placement fill as well as the sand wave moving onshore from Joiner Bank.

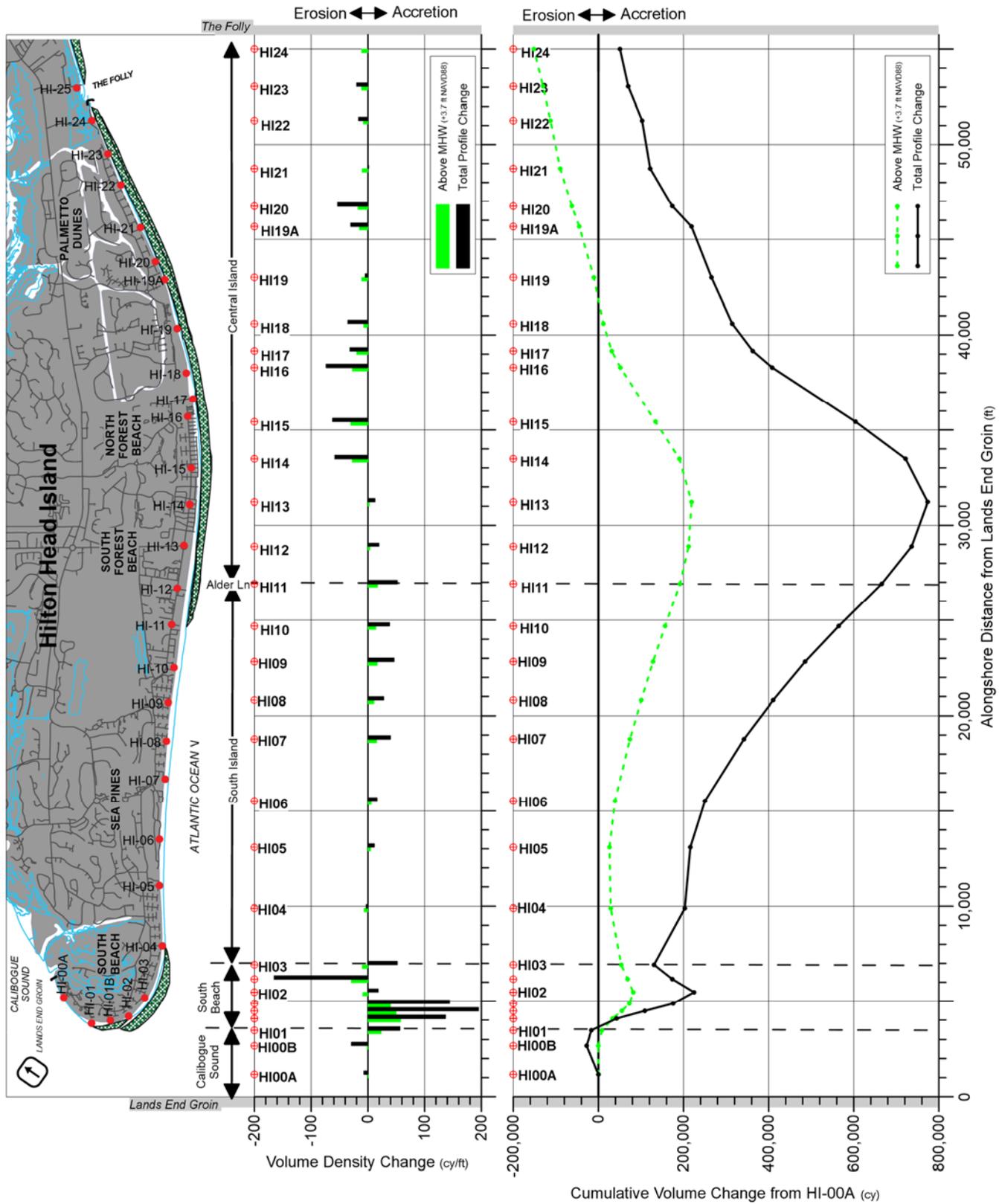


Figure 2.9: Beach volume changes on Hilton Head Island, SC between the 2006/2007 Hilton Head Beach Renourishment post-construction survey in March 2007 and February 2016.

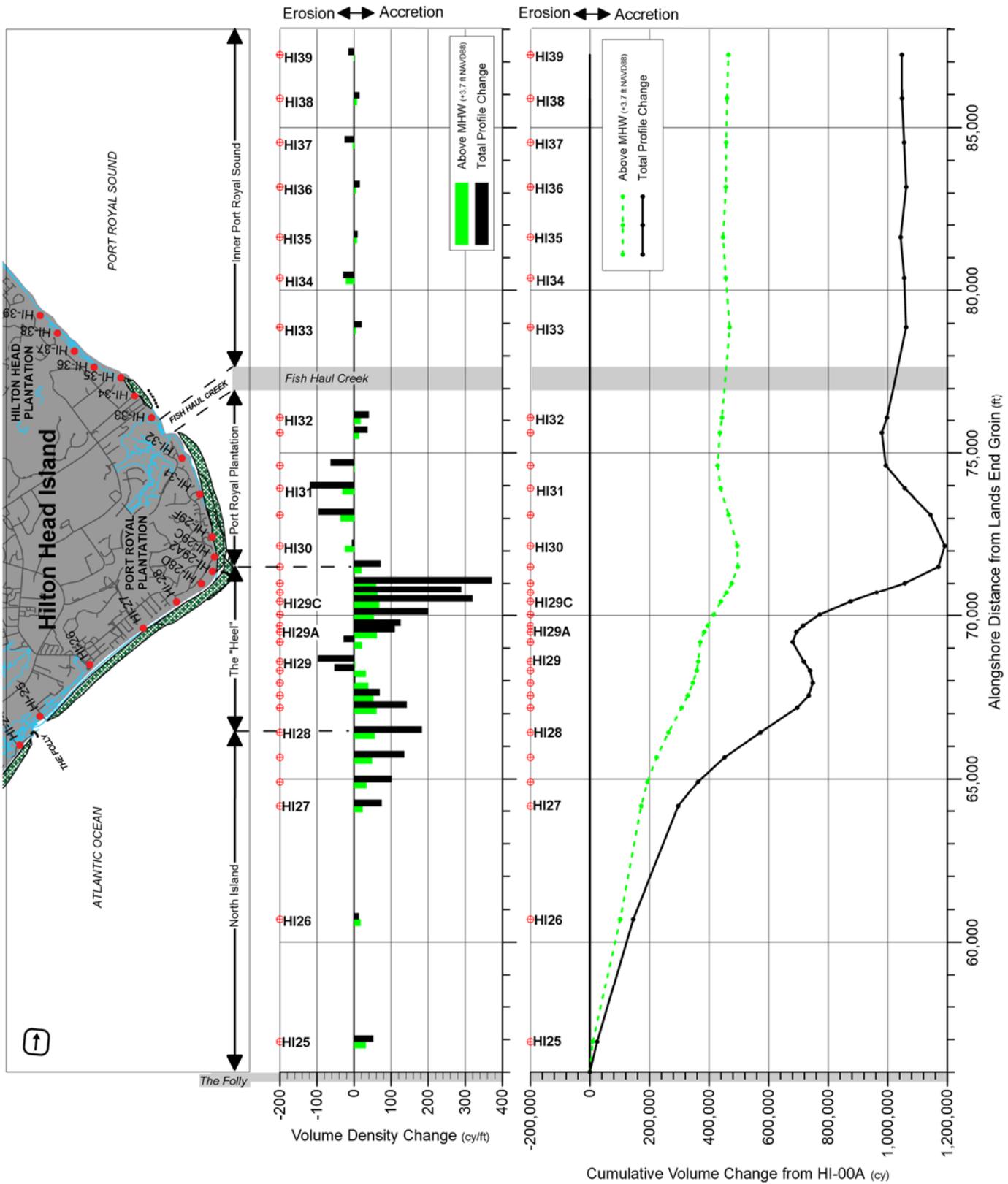


Figure 2.10: Beach volume changes on Hilton Head Island, SC between the 2006/2007 Hilton Head Beach Renourishment post-construction survey in March 2007 and February 2016.

Table 2.5⁴: Hilton Head Island Beach Volume Change Summary (March 2007 to February 2016).

March 2007 to February 2016	Monument Range	Reach Length (ft)	Average Volume Change (cy/ft)			Volume Change (cy)			
			Above +3.7'	Above 0.0'	Total Profile	Above +3.7'	Above 0.0'	Total Profile	
Whole Island	Calibogue Sound	HI00A to HI00B	1,505	-0.2	-1.9	-18.3	-300	-2,900	-27,600
		HI00B to HI01	790	11.0	21.3	13.7	8,700	16,900	10,800
		Subtotal	2,295	3.7	6.1	-7.3	8,400	14,000	-16,800
	South Beach	HI01 to HI01A	614	40.7	85.7	96.8	25,000	52,600	59,400
		HI01A to HI01B	399	53.8	109.9	166.0	21,500	43,800	66,200
		HI01B to HI01C	394	44.9	87.8	169.7	17,700	34,600	66,900
		HI01C to HI02	603	15.5	28.7	81.2	9,400	17,300	49,000
		HI02 to HI02A	694	-19.2	-37.8	-73.6	-13,300	-26,200	-51,100
		HI02A to HI03	759	-19.7	-35.2	-56.7	-14,900	-26,700	-43,000
		HI03 to HI04	2,969	-8.4	-11.9	24.3	-24,900	-35,300	72,200
		Subtotal	6,431	3.2	9.3	34.1	20,500	60,100	219,600
	South Island	HI04 to HI05	3,191	-0.9	1.6	4.1	-2,900	5,200	13,200
		HI05 to HI06	2,446	5.4	10.4	13.9	13,200	25,300	34,100
		HI06 to HI07	3,253	10.8	17.1	28.2	35,000	55,500	91,800
		HI07 to HI08	2,024	13.2	19.8	34.0	26,600	40,100	68,800
		HI08 to HI09	2,015	13.6	23.4	37.2	27,500	47,200	74,900
		HI09 to HI10	1,865	15.3	25.8	42.3	28,500	48,200	78,900
		HI10 to HI11	2,242	15.7	23.6	45.1	35,100	52,900	101,000
		Subtotal	17,037	9.6	16.1	27.2	163,000	274,400	462,700
	Central Island	HI11 to HI12	1,964	10.4	13.8	35.8	20,300	27,100	70,300
		HI12 to HI13	2,321	3.0	-0.5	16.2	7,000	-1,100	37,600
		HI13 to HI14	2,271	-12.6	-22.8	-22.9	-28,700	-51,700	-51,900
		HI14 to HI15	1,948	-29.0	-46.0	-60.4	-56,500	-89,600	-117,700
		HI15 to HI16	2,866	-28.7	-46.9	-68.2	-82,300	-134,300	-195,500
		HI16 to HI17	867	-23.5	-37.9	-53.0	-20,400	-32,900	-45,900
		HI17 to HI18	1,432	-13.6	-21.4	-33.7	-19,500	-30,600	-48,300
		HI18 to HI19	2,408	-9.2	-15.0	-20.1	-22,200	-36,100	-48,500
		HI19 to HI19A	2,669	-12.9	-21.0	-17.7	-34,500	-56,000	-47,200
HI19A to HI20		1,070	-16.2	-26.8	-42.1	-17,300	-28,700	-45,100	
HI20 to HI21		1,988	-13.8	-22.4	-26.1	-27,400	-44,600	-51,800	
HI21 to HI22		2,526	-9.1	-14.6	-7.5	-23,100	-36,800	-19,000	
HI22 to HI23		1,786	-9.6	-15.3	-18.3	-17,200	-27,300	-32,700	
HI23 to HI24	1,957	-11.1	-16.1	-9.9	-21,700	-31,400	-19,300		
HI24 to Folly	750	10.2	16.4	25.9	7,600	12,300	19,400		
	Subtotal	28,823	-11.7	-19.5	-20.7	-335,900	-561,700	-595,600	
North Island	Folly to HI25	925	10.2	16.4	25.9	9,400	15,100	23,900	
	HI25 to HI26	3,772	24.5	35.1	32.2	92,200	132,500	121,500	
	HI26 to HI27	3,458	20.3	31.9	43.5	70,200	110,300	150,500	
	HI27 to HI27A	757	28.1	48.6	87.7	21,300	36,800	66,400	
	HI27A to HI27B	757	40.9	69.4	118.3	31,000	52,500	89,500	
	HI27B to HI28	757	52.3	88.6	159.0	39,600	67,100	120,300	
	Subtotal	10,426	25.3	39.7	54.9	263,700	414,300	572,100	

Continued on next page

⁴ Intermediate profiles between HHI-27 and HHI-29F have only been surveyed since October 2010. In order to compute volume changes at these profile transects prior to that time, beach change measurements at the surrounding surveyed monuments have been interpolated. Values making use of this interpolation are displayed with red text.

**Table 2.5 (con't): Hilton Head Island Beach
Volume Change Summary (March 2007 to February 2016).**

Continued from previous page									
March 2007 to February 2016	Monument Range	Reach Length (ft)	Average Volume Change (cy/ft)			Volume Change (cy)			
			Above +3.7'	Above 0.0'	Total Profile	Above +3.7'	Above 0.0'	Total Profile	
Whole Island	Calibogue Sound								
	Subtotal	2,295	3.7	6.1	-7.3	8,400	14,000	-16,800	
	South Beach								
	Subtotal	6,431	3.2	9.3	34.1	20,500	60,100	219,600	
	South Island								
	Subtotal	17,037	9.6	16.1	27.2	163,000	274,400	462,700	
	Central Island								
	Subtotal	28,823	-11.7	-19.5	-20.7	-335,900	-561,700	-595,600	
	North Island								
	Subtotal	10,426	25.3	39.7	54.9	263,700	414,300	572,100	
	The Heel	HI28 to HI28A	763	58.1	100.8	162.0	44,300	76,900	123,600
		HI28A to HI28B	368	56.2	98.0	105.2	20,700	36,100	38,700
		HI28B to HI28C	377	45.1	78.0	35.9	17,000	29,400	13,500
		HI28C to HI28D	377	34.9	61.1	-24.9	13,100	23,000	-9,400
		HI28D to HI29	277	17.2	23.8	-74.9	4,800	6,600	-20,700
		HI29 to HI29A1	596	11.9	15.5	-62.6	7,100	9,200	-37,300
		HI29A1 to HI29A2	311	41.2	83.9	40.8	12,800	26,100	12,700
		HI29A2 to HI29A3	190	62.5	106.9	117.3	11,900	20,300	22,300
		HI29A3 to HI29B	345	58.5	91.7	162.3	20,200	31,600	56,000
		HI29B to HI29C	398	60.4	133.2	259.5	24,100	53,100	103,400
		HI29C to HI29D	288	65.6	148.9	304.0	18,900	42,800	87,500
	HI29D to HI29E	288	61.4	146.4	329.8	17,700	42,100	94,900	
	Subtotal	4,578	46.4	86.8	106.0	212,600	397,200	485,200	
	Port Royal Plantation	HI29E to HI29F	510	39.6	117.4	221.2	20,200	59,800	112,700
		HI29F to HI30	645	-2.4	12.9	32.9	-1,500	8,300	21,200
		HI30 to HI30A	950	-30.4	-58.7	-50.4	-28,900	-55,800	-47,900
		HI30A to HI31	807	-33.7	-69.7	-106.9	-27,200	-56,300	-86,300
		HI31 to HI31A	697	-14.6	-44.6	-90.9	-10,200	-31,100	-63,300
		HI31A to HI31B	1,011	7.6	2.1	-13.7	7,600	2,200	-13,800
		HI31B to HI32	462	15.4	31.1	37.8	7,100	14,400	17,500
		HI32 to FHC	1,350	17.3	36.8	39.7	23,400	49,600	53,600
	Subtotal	6,432	-1.5	-1.4	-1.0	-9,500	-8,900	-6,300	
Inner Port Royal Sound	FHC to HI33	1,115	4.6	8.8	20.6	5,100	9,800	22,900	
	HI33 to HI34	1,500	-8.7	-13.9	-4.1	-13,000	-20,800	-6,200	
	HI34 to HI35	1,250	-7.2	-13.1	-9.8	-9,100	-16,300	-12,200	
	HI35 to HI36	1,557	6.0	10.5	12.1	9,400	16,300	18,800	
	HI36 to HI37	1,366	0.9	2.4	-5.0	1,200	3,200	-6,800	
	HI37 to HI38	1,333	2.1	3.6	-5.2	2,800	4,800	-7,000	
	HI38 to HI39	1,337	3.2	6.4	-0.4	4,300	8,600	-600	
Subtotal	9,458	0.1	0.6	0.9	700	5,600	8,900		
TOTAL	85,480	3.8	7.0	13.2	323,500	595,000	1,129,800		

The Port Royal Plantation shoreline, HHI-29E to *Fish Haul Creek* (beyond HHI-32), saw very little change, on average, during this period, losing approximately -6,300 cy (-1.0 cy/ft) of sand. This small overall loss is made up of a large gain of sand from The Heel segment, significant losses along the Ocean Point erosional hotspot, and moderate accretion north of Ocean Point. Despite the placement of sand during the Ocean Point Interim Sand Fill project, the segment of shoreline from HHI-30 to HHI-31B eroded by -211,300 cy over this period.

Along the Inner Port Royal Sound segment of the island, from *Fish Haul Creek* to HHI-39, moderate accretion was measured, with +8,900 cy (+0.9 cy/ft) of beach sand gained over the nine-year post-construction monitoring period. Beach sand volume changes ranged from erosion of -28.8 cy/ft at HHI-34 to accretion of +20.6 cy/ft at HHI-33.

2.4 February 2016 Beach Condition relative to Recommended Minimum Beach Condition (RMBC)

Figure 2.11 depicts the September 2006 (pre-renourishment), March 2007 (post-renourishment), February 2016 position of the Mean High Water (MHW) shoreline (+3.7ft NGVD29) along the Calibogue Sound, South Beach, South Island, and Central Island shorelines relative to a Recommended Minimum Beach Condition (RMBC⁵). **Figure 2.12** depicts the position of the MHW shoreline relative to the RMBC along the North Island, The Heel, Port Royal Plantation, and Inner Port Royal Sound shorelines for the same surveys. The RMBC was defined in 2004 by Olsen Associates, Inc. and is generally based upon the pre-1997 beach fill shoreline position and beach condition. The figure gives a relative perspective of shoreline position and conditions along the island's entire sand shoreline. Shoreline position changes at each monument are listed below in **Table 2.6**, with average shoreline position changes for each beach segment as well as for the entire island.

As of February 2016, the average MHW (+3.7 ft NGVD) shoreline position was +156.1 ft seaward of the RMBC shoreline position. The February 2016 position was seaward of the RMBC shoreline position (where there is a defined RMBC) for all but two transects over the entire island. The position of the February 2016 shoreline relative to the RMBC is highly variable due to the effects of beach nourishment and natural shoreline dynamics at the terminal ends of the island.

The Calibogue Sound (HI-00A to HI-01) shoreline is well seaward (+114.0 ft) of the RMBC, on average, due entirely to the MHW shoreline position of HHI-01, which is +340.1 ft seaward of the RMBC. Otherwise, the remainder of this shoreline as of February 2016 is at about the location of the RMBC, which reflects the fact this shoreline segment has not been included in beach fill projects. This segment, contains one of the two transects where the February 2016 shoreline is landward of the RMBC shoreline, with a distance from RMBC to February 2016 MHW shoreline of -4.9 ft at HHI-00B. The South Beach (HI-01 to HI-04) shoreline is significantly seaward of the RMBC, on average, due to shoreline advance associated with natural sand transport to this area from the beach to the north as well as the nearshore shoal fields. The western and central portions of South Beach shoreline were significantly seaward of the RMBC as of February 2016. From HHI-01 to HHI-02, the 2016 MHW shoreline is an average of 511.5 ft seaward of that of the RMBC, with the most advanced being HHI-01A at +716.2 ft. For the entire South Beach shoreline the average distance between the RMBC and the February 2016 shoreline is +333.4 ft.

⁵ The RMBC was established as a basis to evaluate the condition of the island's beaches relative to an assumed "minimum" width that the Town might want to consider. The defined RMBC was never formally adopted by the Town. In this instance, it is simply used as a basis for discussion of conditions as they relate to a historical condition.

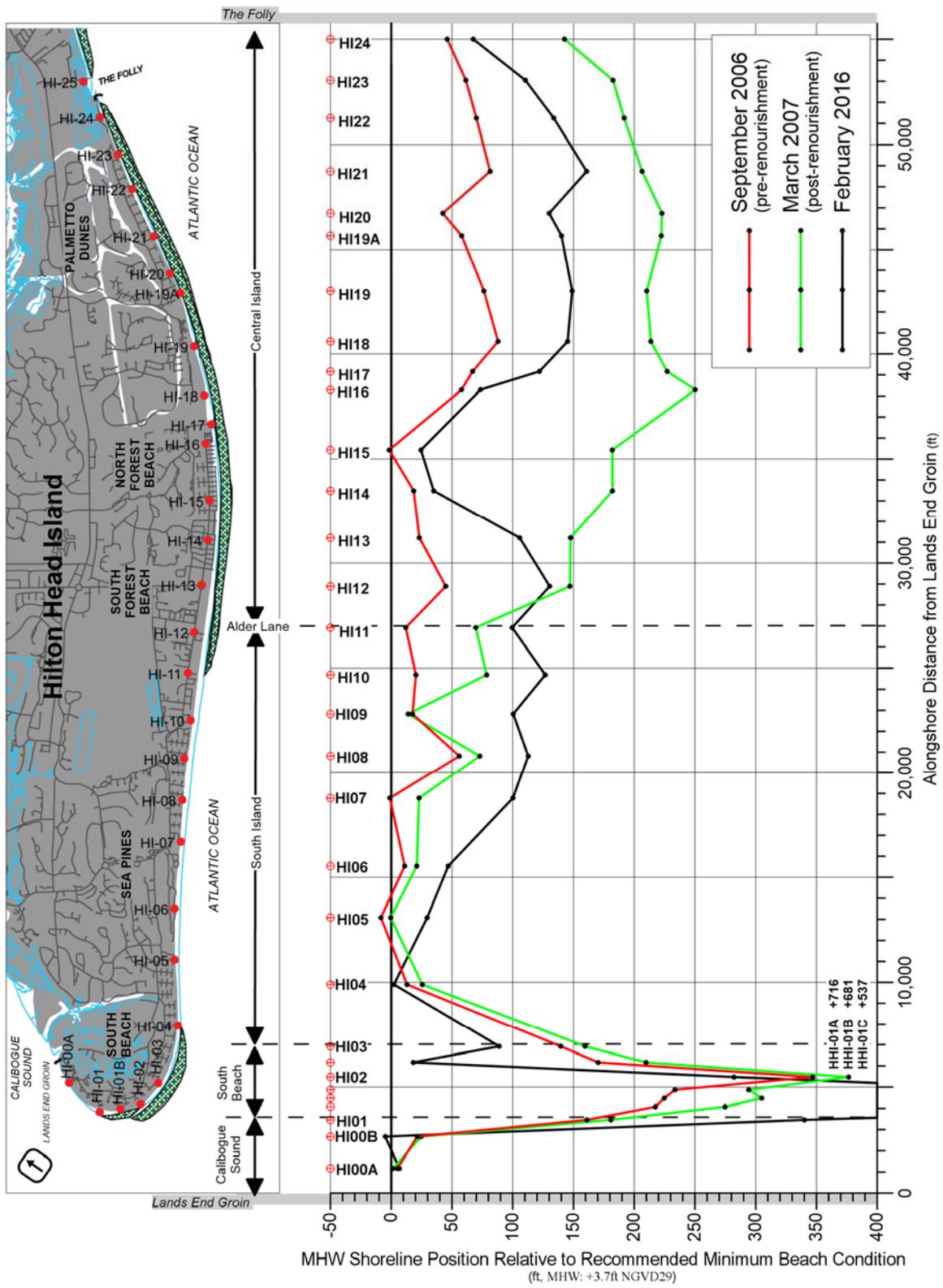


Figure 2.11: Mean High Water shoreline position along Hilton Head Island relative to the Recommended Minimum Beach Template.

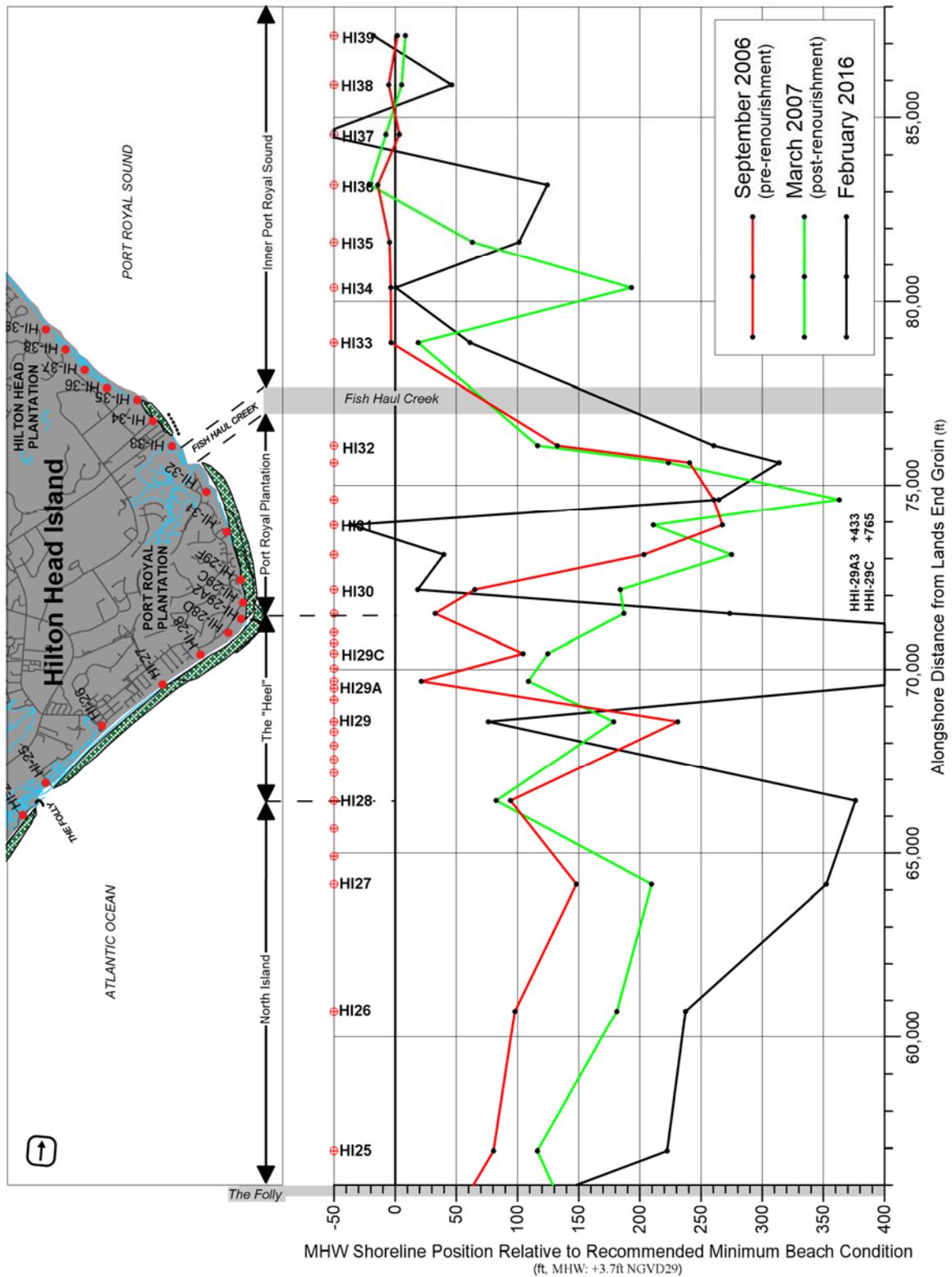


Figure 2.12: Mean High Water shoreline position along Hilton Head Island relative to the Recommended Minimum Beach Template.

Along the island's Atlantic shorefront, from HI-04 to Alder Lane in South Forest Beach (at approximately HI-11), the South Island segment MHW shoreline, on average, was +77.3 ft seaward of the RMBC as of February 2016. The location of the February 2016 MHW shoreline was seaward of the RMBC shoreline position at all transects within this segment, with distances varying from +2.3 ft at HI-04 to +126.8 ft at HI-10. As suggested earlier, this entire shoreline reach is generally stable to accretional with accretion generally increasing progressively toward the north.

The shoreline position in February 2016 along the Central Island segment (Alder Lane to *The Folly*) was consistently seaward of the RMBC, with the distance between the February 2016 and RMBC MHW shoreline varying considerably alongshore. The distance between the RMBC and the February 2016 MHW shoreline positions for this reach of shoreline averaged 108.5 ft and varied from +24.4 ft at HHI-15 to +160.9 ft at HHI-21.

Along the North Island shoreline, from *The Folly* to HI-28, the distance between the RMBC and the February 2016 MHW shoreline positions averaged +297.1 ft. Distances between the RMBC and February 2016 shoreline within this segment were all very high, and range from +222.3 ft at HHI-25 to +376.2 ft at HHI-28. These distances increase from south to north, reflecting the benefit accrued to the shoreline from the 2011/12 project sand placement and subsequent alongshore diffusion.

The MHW shoreline along the Heel, between approximately HI-28 and HI-29E, lies about +412.7 ft seaward of the RMBC, with a maximum distance from the RMBC to February 2016 MHW shoreline of +764.9 ft at HI-29C. It should be noted, however, that this average is composed of distances at only four transects, as the remainder of the monuments within this segment did not exist at the time that the RMBC was established.

The February 2016 MHW shoreline position along the Port Royal Plantation shoreline, from HHI-29E to *Fish Haul Creek*, was 162.0 ft seaward of the RMBC, on average. This segment contains the second of two transects along the entire island where the February 2016 shoreline is landward of the RMBC shoreline. Distances from the RMBC to February 2016 MHW shoreline reflect the erosional hotspot at Ocean Point discussed previously, with distances ranging from -36.5 ft at HHI-31 along Ocean Point to +313.9 ft at HHI-31B.

Along the Inner Port Royal Sound segment, from *Fish Haul Creek* to HI-39, the RMBC is established only for monuments HHI-33 through HHI-35, roughly the limits of the 2006/07 Fish Haul/Spa project shoreline. The RMBC for this segment is the pre-construction (September 2006) condition. Here, the February 2016 MHW shoreline position was +54.3 ft seaward of the RMBC, on average. The distance varies markedly from just +0.6 ft at HI-34 to +101.1 ft at HI-35.

Table 2.6: Hilton Head Island MHWL Change Summary (RMBC to February 2016).

Seg	Mon	Alongshore Distance (ft) from Lands End	Shoreline Position (ft) at MHW (+3.7 ft, NGVD)			
			RMBC*	Feb-16	Change	
Braddock Cove Creek						
Calibogue Sound	HI-00A	1,165	43.4	50.1	+6.8	
	HI-00B	2,669	221.3	216.4	-4.9	
	HI-01	3,459	134.8	474.9	+340.1	
		3,459			+114.0	
South Beach	HI-01	3,459	134.8	474.9	+340.1	
	HI-01A	4,073	73.0	789.2	+716.2	
	HI-01B	4,472	56.1	737.9	+681.9	
	HI-01C	4,866	61.8	599.3	+537.5	
	HI-02	5,469	119.5	401.6	+282.1	
	HI-02A	6,163	149.7	167.9	+18.1	
	HI-03	6,921	358.5	447.4	+88.8	
	HI-04	9,890	219.3	221.5	+2.3	
		6,431			+333.4	
South Island	HI-04	9,890	219.3	221.5	+2.3	
	HI-05	13,081	292.2	321.8	+29.6	
	HI-06	15,527	362.0	409.0	+47.0	
	HI-07	18,780	273.1	373.3	+100.2	
	HI-08	20,805	373.5	486.2	+112.7	
	HI-09	22,820	541.2	641.7	+100.5	
	HI-10	24,685	458.2	585.0	+126.8	
	HI-11	26,927	910.3	1,009.8	+99.5	
			17,037			+77.3
	Central Island	HI-11	26,927	910.3	1,009.8	+99.5
		HI-12	28,891	860.1	990.4	+130.4
HI-13		31,212	754.4	860.1	+105.7	
HI-14		33,483	615.6	650.5	+34.9	
HI-15		35,431	612.4	636.9	+24.4	
HI-16		38,297	593.3	666.8	+73.4	
HI-17		39,164	201.6	323.6	+122.0	
HI-18		40,596	334.2	479.4	+145.2	
HI-19		43,004	206.3	355.1	+148.9	
HI-19A		45,673	51.4	191.6	+140.2	
HI-20		46,743	174.4	304.5	+130.1	
HI-21		48,731	183.7	344.6	+160.9	
HI-22		51,256	173.2	306.9	+133.7	
HI-23		53,042	140.8	251.3	+110.4	
HI-24		54,999	262.8	330.3	+67.5	
		28,823			+108.5	
The Folly						
North Island	HI-25	56,925	483.3	705.6	+222.3	
	HI-26	60,697	453.8	691.2	+237.4	
	HI-27	64,155	128.1	480.5	+352.4	
	HI-27A	64,912		511.9		
	HI-27B	65,669		585.8		
	HI-28	66,426	299.5	675.7	+376.2	
			10,426			+297.1
The Heel	HI-28	66,426	299.5	675.7	+376.2	
	HI-28A	67,189		732.1		
	HI-28B	67,557		706.8		
	HI-28C	67,934		645.3		
	HI-28D	68,311		570.9		
	HI-29	68,588	379.5	455.5	+76.1	
	HI-29A1	69,184		499.4		
	HI-29A2	69,495		758.3		
	HI-29A3	69,685	433.2	866.6	+433.5	
	HI-29B	70,030		890.0		
HI-29C	70,429	159.3	924.2	+764.9		
HI-29D	70,716		1,000.9			
HI-29E	71,004		1,027.4			
		4,578			+412.7	
Port Royal Plantation	HI-29E	71,004		1,027.4		
	HI-29F	71,514	149.4	422.9	+273.5	
	HI-30	72,159	93.5	111.8	+18.4	
	HI-30A	73,109	43.2	82.9	+39.7	
	HI-31	73,916	284.0	247.6	-36.5	
	HI-31A	74,613	96.5	361.2	+264.6	
	HI-31B	75,624	102.3	416.2	+313.9	
	HI-32	76,086	303.1	563.4	+260.4	
		6,432			+162.0	
Fish Haul Creek						
Inner Port Royal Sound	HI-33	78,877	30.0	91.2	+61	
	HI-34	80,377	156.8	157.3	+6	
	HI-35	81,627	-31.9	69.3	+101.1	
	HI-36	83,183		467.2		
	HI-37	84,550		306.2		
	HI-38	85,883		261.4		
	HI-39	87,220		172.5		
		9,458			+54.3	
		86,645			+156.1	

2.5 2011/12 PRS Shoreline Restoration and Stabilization Project Performance

Figure 2.13 illustrates the shoreline progression over time at “The Heel”, both prior to and following completion of the 2011/12 project. This recent recession was expected to occur as part of post-construction fill equilibration (cross-shore and alongshore) and predicted project performance losses. As can be seen in the upper panel of **Figure 2.13**, the recent erosion has been limited to areas mostly within about 1,000 ft north and south of the terminal groin, with shoreline position to the north becoming largely stabilized over the last few years. Beyond about 1,000 ft of the terminal groin, the shoreline has been generally stable since construction of the 2011/12 project. This stability is expected to be related directly to the losses along the shoreline immediately adjacent to the terminal groin.

Table 2.7 lists the volume change that has occurred within the 2011/12 project limits as well as along the adjacent shoreline segments for each yearly intersurvey period since the pre-construction survey in November 2011. Within the project limits (HHI-27 to HHI-29C), the beach has lost about -201,600 cy of sand since the post-construction survey (April 2012), with most of this loss occurring during the 2012/13 (-44,500 cy) and 2013/14 (-56,800 cy) winter intersurvey periods. This loss has resulted in moderate accretion to the Port Royal Plantation shoreline and significant accretion to the unfilled portion of the North Island shoreline. The portion of the Port Royal Plantation segment that is outside of the project limits (*The Folly* to HHI-27) has gained +187,700 cy of sand since the post-construction survey (April 2012). While the project area has lost sand since completion of the project, the three segments in its vicinity (North Island, The Heel, and Port Royal Plantation) have actually experienced a slight gain of +2,200 cy of sand since the post-construction survey. This data is also depicted graphically in **Figure 2.14**, in which the cumulative volume, summed from *The Folly* to *Fish Haul Creek*, is presented over time relative to the pre-project condition.

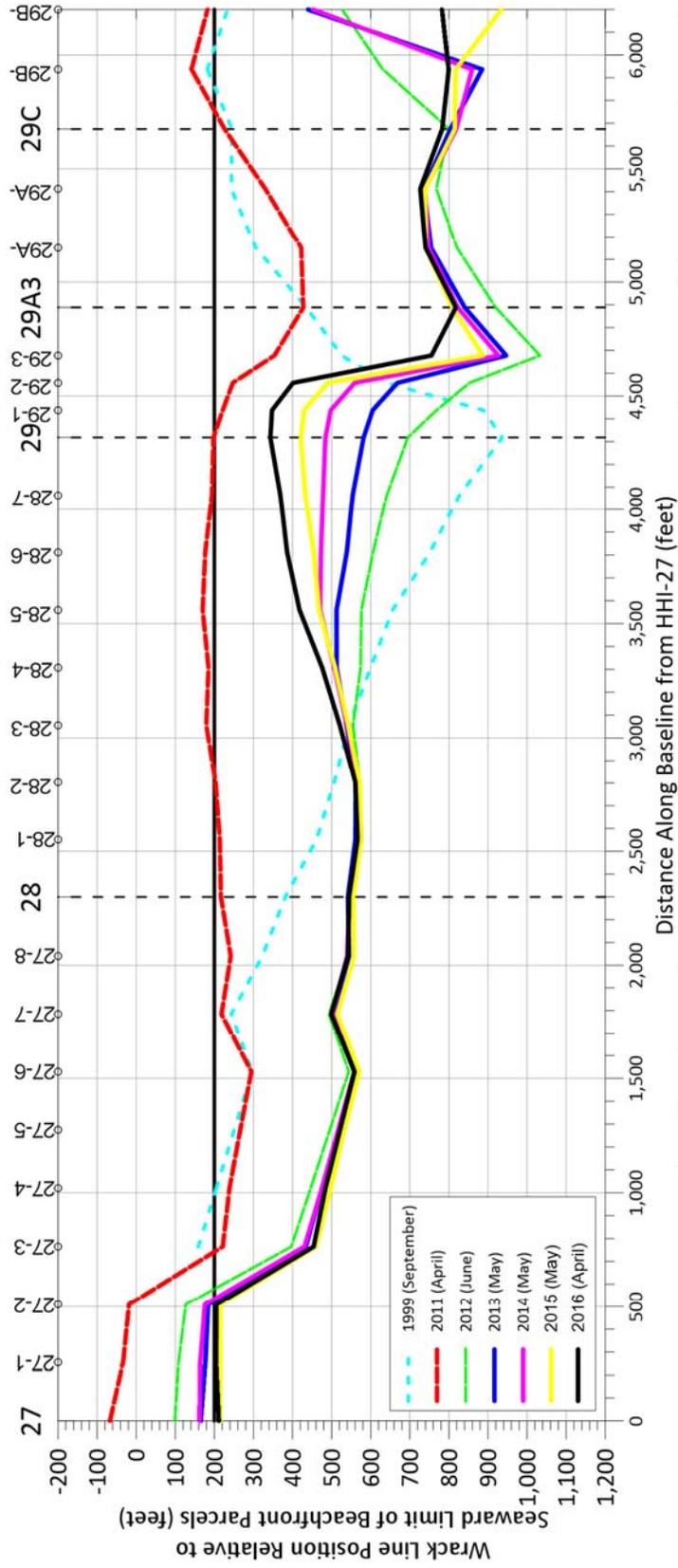
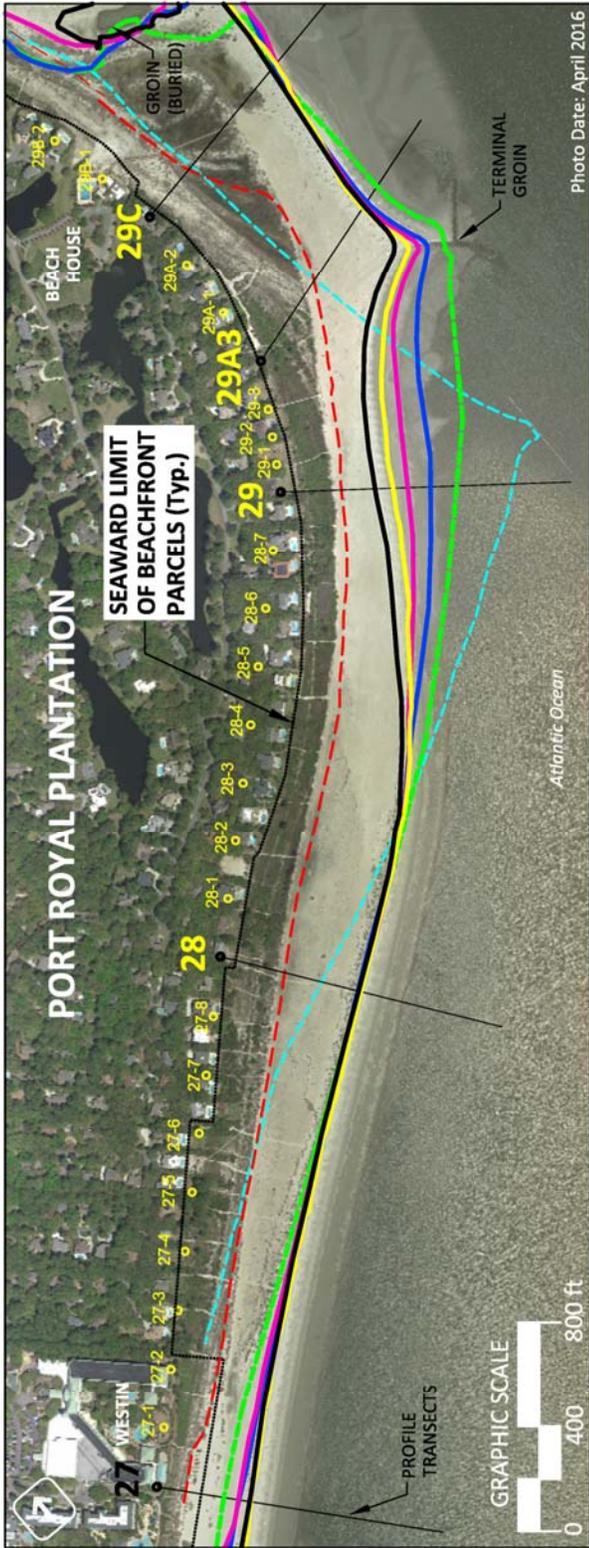


Figure 2.13: Shoreline change in the vicinity of the terminal groin constructed as part of the Port Royal Sound Shoreline Restoration and Stabilization Project on Hilton Head Island.

Table 2.7: Volume change since November 2011 (pre-construction survey) for the North Island and Port Royal Plantation shoreline segments, and the 2011/12 project area.

		Volume Change (cy)						
		Nov 2011 to April 2012	April 2012 to April 2013	April 2013 to April 2014	April 2014 to April 2015	April 2015 to Feb 2016	April 2012 to Feb 2016	
North Island	Folly to HI25	400	-6,400	2,900	15,500	4,900	16,900	
	HI25 to HI26	-1,100	-4,900	1,600	49,300	1,700	47,700	
	HI26 to HI27	1,400	61,800	25,000	33,000	3,300	123,100	
The "Heel"	2011/12 PRS Project Area	HI27 to HI27A	21,900	25,200	8,300	8,300	4,400	46,200
		HI27A to HI27B	76,400	13,000	5,000	4,500	1,600	24,100
		HI27B to HI28	134,100	1,700	3,500	4,700	-1,500	8,400
		HI28 to HI28A	172,200	-1,900	2,900	4,000	-5,300	-300
		HI28A to HI28B	84,200	-300	-2,200	400	-4,100	-6,200
		HI28B to HI28C	85,000	100	-9,600	-1,600	-5,500	-16,600
		HI28C to HI28D	90,700	-3,400	-15,900	-5,600	-9,100	-34,000
		HI28D to HI29	75,300	-10,900	-15,300	-6,600	-8,900	-41,700
		HI29 to HI29A1	184,400	-40,100	-35,700	-17,800	-20,500	-114,100
		HI29A1 to HI29A2	103,200	-14,700	-8,900	-9,000	-16,100	-48,700
		HI29A2 to HI29A3	55,300	-7,300	300	-2,500	-6,700	-16,200
		HI29A3 to HI29B	63,600	-10,700	1,300	-800	1,000	-9,200
		HI29B to HI29C	35,500	5,600	2,500	-4,600	3,200	6,700
			subtotal	1,181,800	-43,700	-63,800	-26,600	-67,500
Port Royal Plantation	HI29C to HI29D	12,300	17,000	3,900	-3,400	800	18,300	
	HI29D to HI29E	15,000	25,700	12,700	-1,800	-5,200	31,400	
	HI29E to HI29F	21,300	25,900	15,500	4,300	-6,500	39,200	
	HI29F to HI30	9,100	9,300	-1,200	600	2,500	11,200	
	HI30 to HI30A	1,600	4,100	7,100	-200	-7,900	3,100	
	HI30A to HI31	-7,600	-14,900	-4,400	-7,800	-12,700	-39,800	
	HI31 to HI31A	-1,300	-14,900	-12,500	-6,500	-17,800	-51,700	
	HI31A to HI31B	6,000	-4,500	-9,400	-1,200	-16,900	-32,000	
	HI31B to HI32	700	3,800	2,700	100	0	6,600	
	HI32 to FHC	-1,200	8,900	18,400	6,300	-3,800	29,800	
Total		1,238,400	67,200	-1,500	61,600	-125,100	2,200	

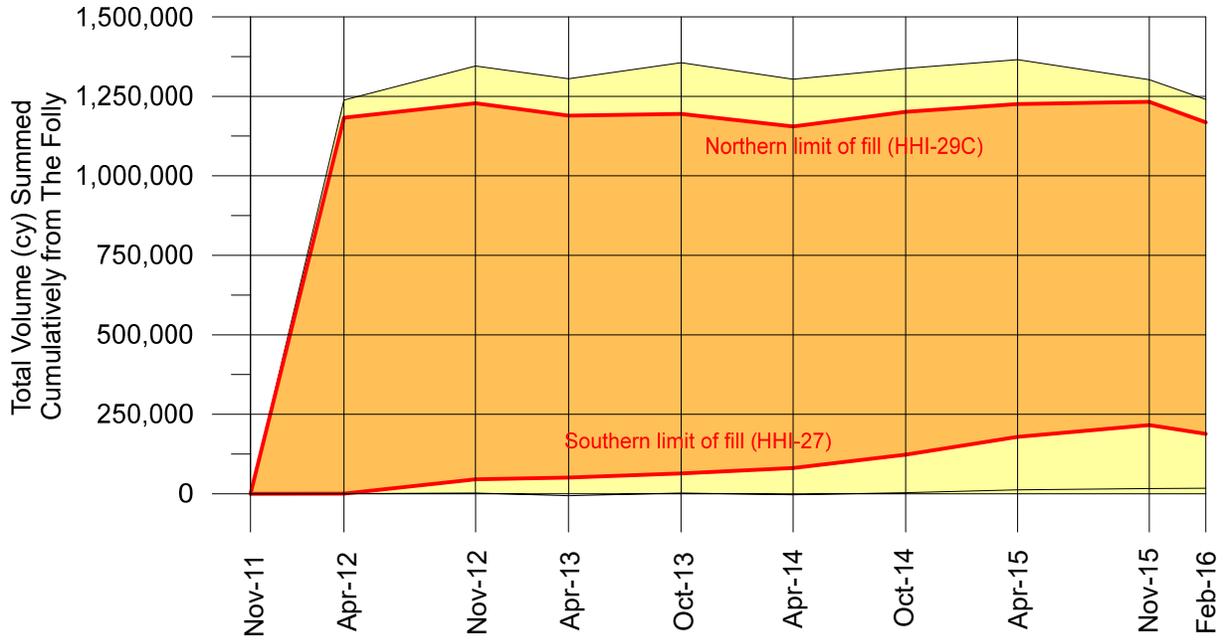


Figure 2.14: Cumulative volume change since November 2011 (pre-construction survey) for the North Island and Port Royal Plantation shoreline segments, and the 2011/12 project area. Volume is summed cumulatively from the Folly to Fish Haul Creek.

2.6 Detailed Discussion of Problem Areas

This section highlights areas of the island shoreline that are experiencing beach change that is either highly dynamic or not historically typical. As such, addressing these problem areas will require special consideration beyond that of a periodic renourishment.

2.6.1 *Lands End*

Figures 2.15 and **5.16** depict the shoreline in the vicinity of the Lands End groin on Calibogue Sound at Braddock Cove Creek over the period from December 2003 to April 2016. Photography is shown for eight conditions, (1) December 2003, (2) March 2007, (3) January 2009, prior to rehabilitation of the groin, (4) April 2010, immediately following groin rehabilitation, (5) May 2013, prior to the most recent Calibogue Sound dredging, (6) May 2014, following the most recent dredging, (7) May 2015, and (8) April 2016.

On comparison of the aerial photo series, the effect of the groin rehabilitation to the adjacent shoreline is apparent. After eroding from December 2003 to January 2009, to the moderate benefit of the shoreline to the north (right in the photo), the beach to the south (left in the photo) has advanced significantly and fairly consistently from April 2010 to April 2016. Since the groin rehabilitation, the shoreline to the north has eroded to the point of the recent exposure of the seawall immediately adjacent to the groin. The erosion that led to the wall exposure is associated, to some degree, with the groin improvement, but is likely more related to the recent SIDA dredging project in the entrance to Braddock Cove Creek, which was conducted from December 2013 to March 2014. Erosion has progressed through the beach that existed as of May 2013 resulting in worsening impacts to the marsh area north of the seawall. These impacts are likely exacerbated by the reflection of wave energy off the now-exposed seawall. Further exposure of the seawall, erosion of this sand spit, and destruction of marsh vegetation is expected to continue.

2.6.2 *South Beach*

As illustrated in **Figure 2.17**, the south end of the island has been highly dynamic since construction of the 2006/07 project. Past erosion along this segment of shoreline has been followed by the progression of a large sand wave around the tip of the island toward Calibogue Sound. This sand wave has resulted in significant shoreline accretion between HHI-01 and HHI-02, but its north to south movement along the shoreline is causing significant shoreline recession between HHI-02 and HHI-03, the area immediately north of the accretional area. Some areas of the shoreline between HHI-02 and HHI-04 have experienced recent shoreline recession rates of over -20 ft/yr and volume loss rates nearly -20 cy/ft/yr.



Figure 2.15: Aerial orthophotography depicting evolution of shoreline conditions around the Lands End groin on the Calibogue Sound shoreline of Hilton Head Island adjacent to Braddock Cove Creek.

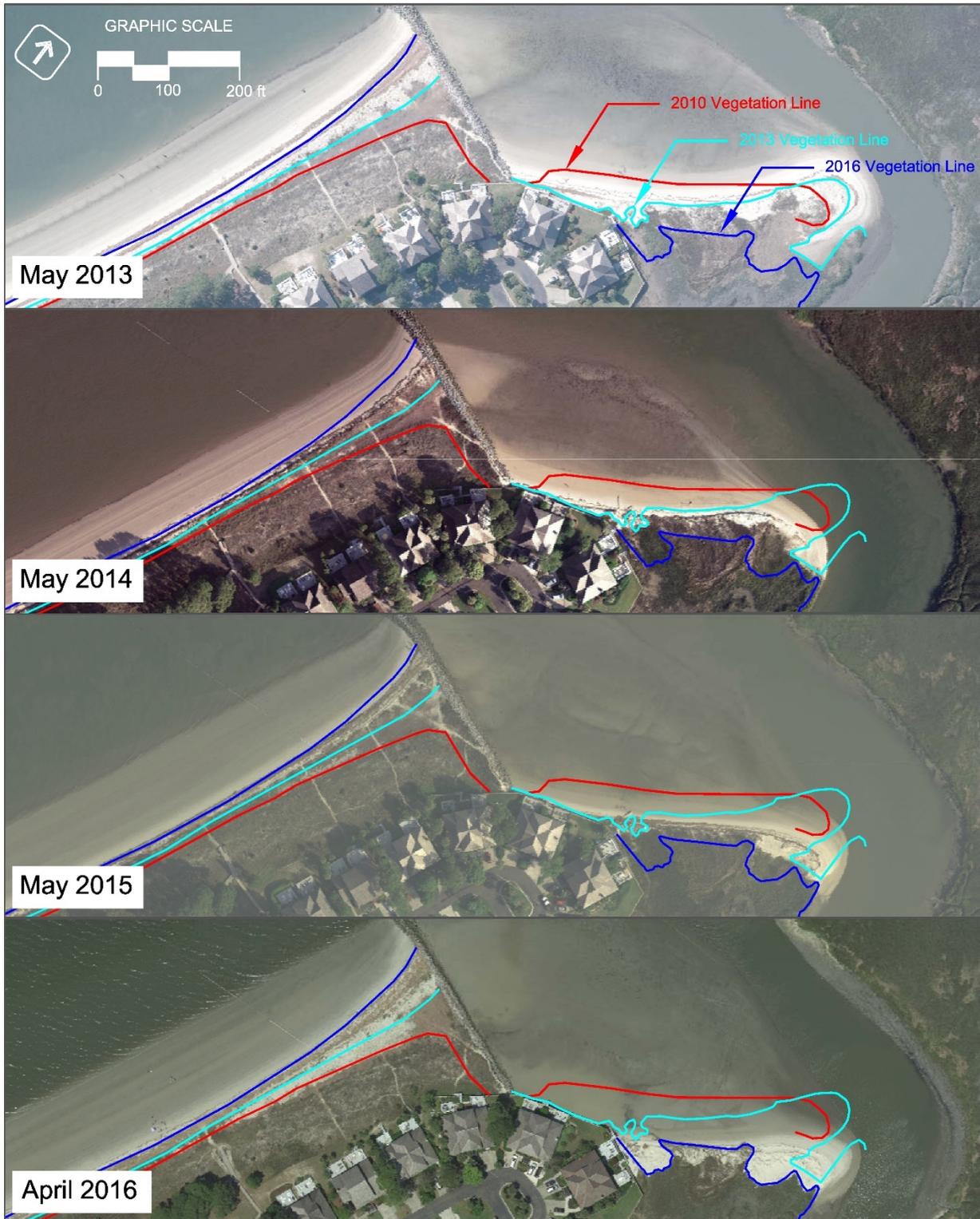


Figure 2.16: Aerial orthophotography depicting evolution of shoreline conditions around the Lands End groin on the Calibogue Sound shoreline of Hilton Head Island adjacent to Braddock Cove Creek.

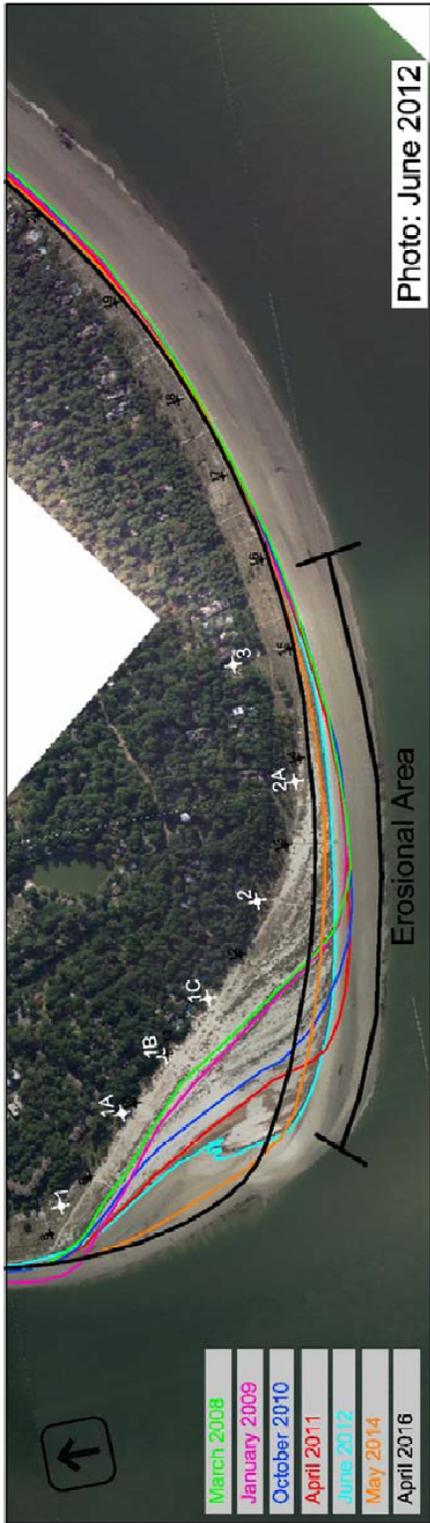
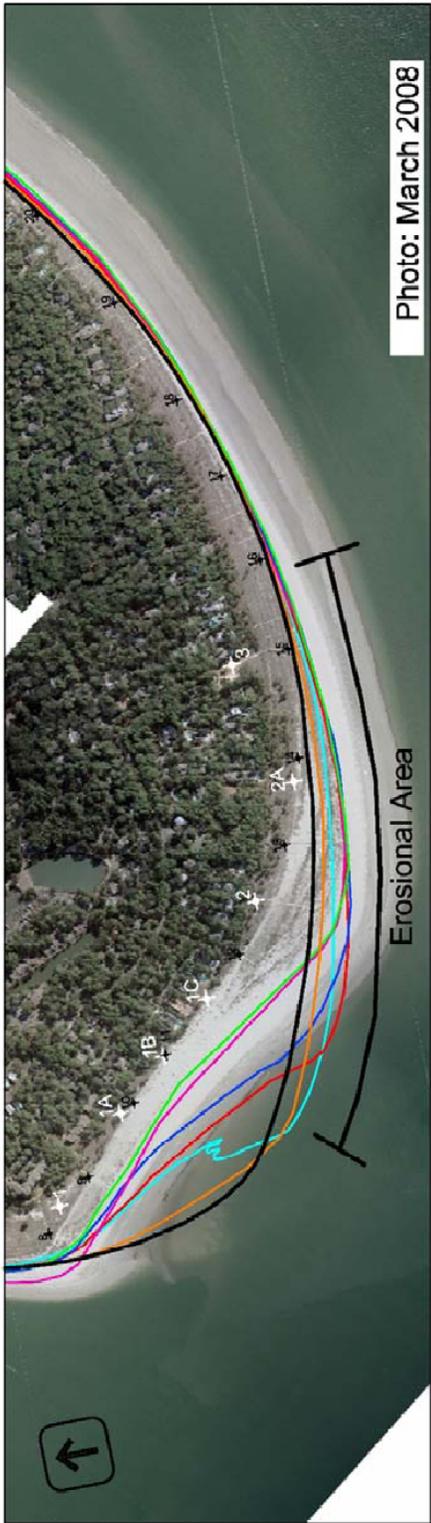


Figure 2.17: Shoreline change along the South Beach shoreline segment of Hilton Head Island.

2.6.3 The Heel

A portion of “The Heel” shoreline at the northern end of the island, that was restored in 2011/12, has experienced continued erosion since completion of the 2011/12 project, as illustrated in **Section 2.5**. Along The Heel shoreline nearest to the terminal groin (HHI-28 to HHI-29B), the volume of sand lost from the 2011/12 constructed project template is -287,000 cy as of February 2016.

2.6.4 Ocean Point

An area that has been of particular concern is the beach along Ocean Point on the Port Royal Sound shoreline. Since construction of the last island-wide renourishment in 2006/07, erosion at that area of the shoreline has outpaced the rest of the island. Accordingly, shoreline recession had progressed to the point that back berm and dune erosion had begun to threaten upland development. In response, the Town built an approximately 20,000 cy emergency beach fill along 1,800 ft of shoreline in April and May 2014. This project was designed to protect the upland from erosion on an interim basis until the construction of the next island-wide renourishment. As such, the volume of sand placed was much smaller than the anticipated long-term needs for this area. Renourishment of the Ocean Point shoreline will therefore be included in the 2016 renourishment as part of the Port Royal Sound project element.

2.6.5 Fish Haul

The Fish Haul/Spa segment of the Port Royal Sound shoreline has experienced significant change since the completion of breakwater construction and beach fill in early 2007. Over the past decade, the outlet of Fish Haul Creek has shifted to the north such that the channel runs just offshore of the breakwaters, effectively blocking sand transport to the northwest of the breakwaters. **Figure 2.22** illustrates the changes that have taken place since construction of the 2006/07 island-wide renourishment and the corresponding breakwater construction along this shoreline segment. The top panel shows conditions prior to construction (January 2005); the middle panel shows conditions immediately following construction (March 2007); and the bottom panel shows the conditions as of April 2016. Also shown overlaying the aerial images are lines representing the vegetation line as of the 2005 aerial and the wrack line as of the 2007 aerial. Both of these lines can be considered rough estimates of the approximate mean high water line at the time of photography.

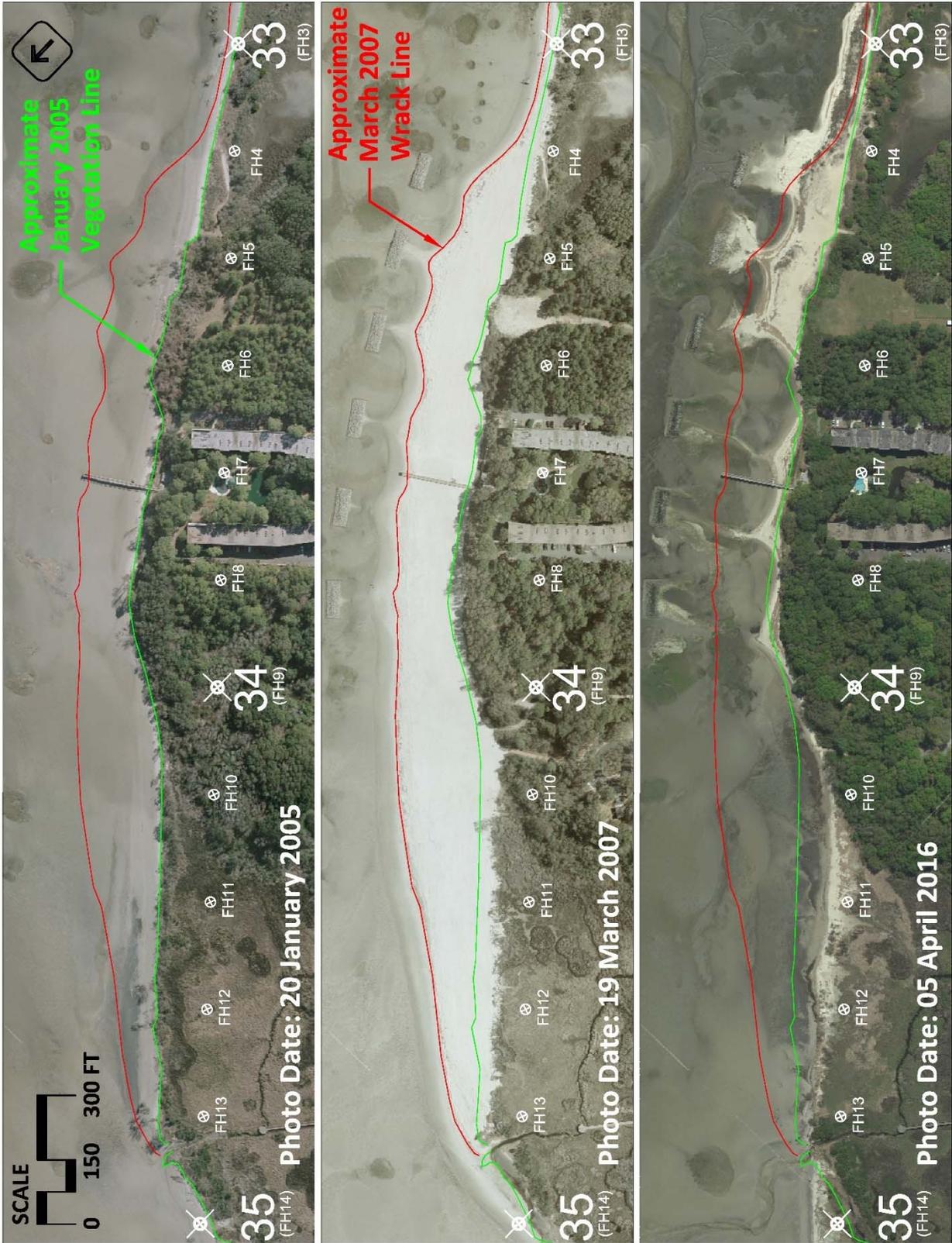


Figure 2.22: Shoreline change along the Fish Haul/Spa shore line segment of Hilton Head Island.

Construction of the breakwaters has resulted in significant vegetation growth in the lee of the structures, which has given a measure of stability to the shoreline fronted by the vegetation. However, there has also been a significant loss of beach sand since construction (comparing the middle and lower panel), particularly at the northern end of the project beyond the extent of the breakwaters. In fact, the shoreline in some areas – FH-09 to FH-13 – is landward of the 2005 vegetation line.

3.0 SUMMARY

Overall, narrowing beach width conditions and the measured patterns of shoreline and beach volume change are generally consistent with historical conditions, with only a few exceptions. That is, there are narrow beach conditions associated with historically erosional areas in southern Sea Pines, North Forest Beach, Singleton Beach, and Port Royal Plantation. Higher erosion rates exist at an isolated area in the vicinity of South Beach, most of the central portion of the island, and in Port Royal Plantation. The area of shoreline between *The Folly* and The Heel, however, which has historically been narrow and erosional, is wide compared to historical conditions. It is believed that the change in conditions along this reach of shoreline is due to the beneficial effects of sand losses from the 2011/12 project along the adjacent shoreline to the north. This effect is anticipated to continue throughout the planned design life of the next island-wide renourishment project (to be constructed in 2016).

The Port Royal Shoreline Restoration and Stabilization Project is performing as anticipated by reducing sand loss rates at The Heel and acting as a feeder for the shoreline to the Atlantic coast to the south. The Port Royal Sound shoreline to the northwest, however, has experienced significant benefit from the onshore movement of a portion of the remnants of Joiner Bank. Thus, the shoreline immediately adjacent to the structure on the north has lost relatively little sand since completion of the project in 2012. However, portions of the Port Royal Sound shoreline continue to be erosional, particularly at Ocean Point.

Areas of the Island of particular concern are those areas where narrow beach conditions exist and erosion/recession rates are high. Combining these criteria, there are four main segments of the island shorefront that are considered to be important components of the upcoming renourishment project:

- South Beach and northward thereof – very high MHW shoreline retreat and beach volume loss rates exist between HHI-01C and HHI-04.
- North Forest Beach – narrow beach conditions exist between about HHI-13.5 and HHI-15.5, and erosion/recession rates are very high.
- Singleton Beach – slightly narrow beach conditions exist between HHI-23 and HHI-24, and erosion/recession rates are moderately high.
- Port Royal Sound shoreline at Ocean Point – High erosion/recession rates persist despite interim fill placement in 2014.

4.0 REFERENCES

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- Olsen Associates, Inc. (2015). “*Town of Hilton Head Island, SC Hilton Head Island Post-Storm Design Survey: Hurricane Joaquin – Memorandum of Findings*,” Memorandum prepared for the Town of Hilton Head Island, SC. Olsen Associates, Inc., Jacksonville, FL, December 2015.

APPENDIX A HISTORICAL BEACH PROFILE PLOTS

The monitoring profile surveys conducted in April 2011, April 2013, April 2015, November 2015, and February 2016 were performed by Arc Surveying & Mapping, Inc. (Arc), of Jacksonville, FL. The monitoring profile survey conducted in March 2007 (post-construction) and May 2008 (fourteen-months post-construction) were performed by Hydrographic Information Services, (HIS) Inc., of Jacksonville, FL.

Figure A.1: Measured beach profiles at monument H100A0 – Hilton Head Island, South Carolina.

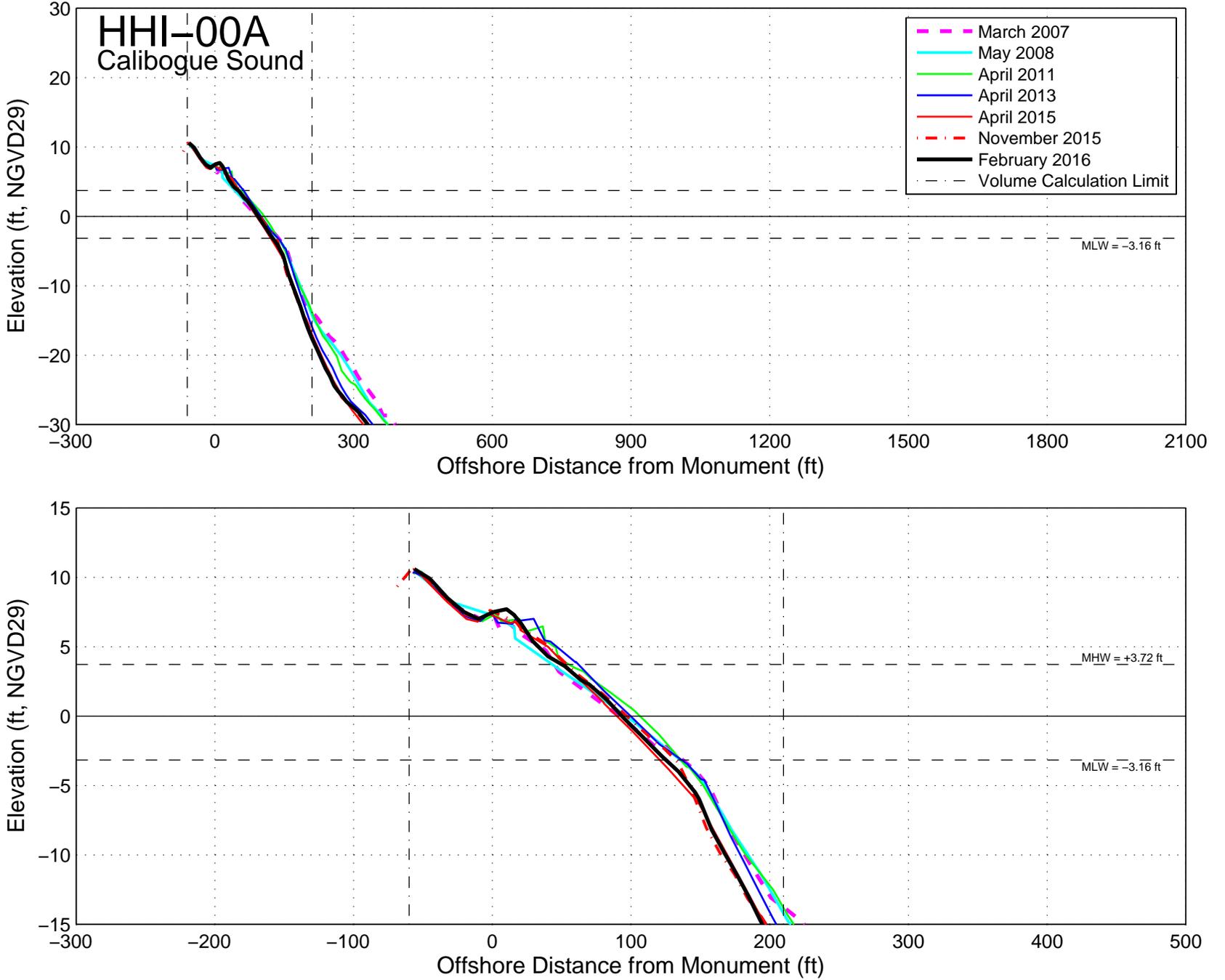


Figure A.2: Measured beach profiles at monument HHI00B0 – Hilton Head Island, South Carolina.

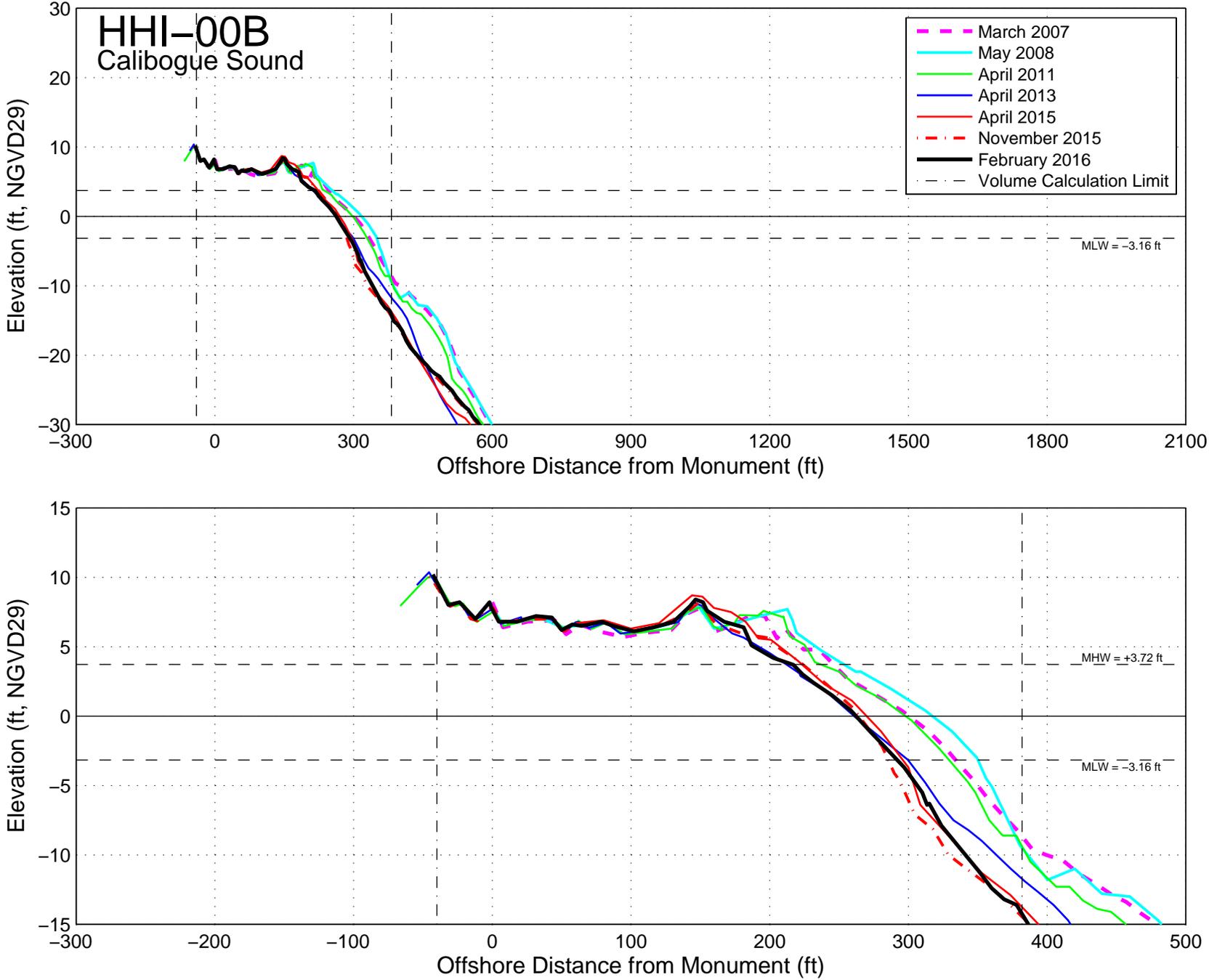


Figure A.3: Measured beach profiles at monument HHI0100 – Hilton Head Island, South Carolina.

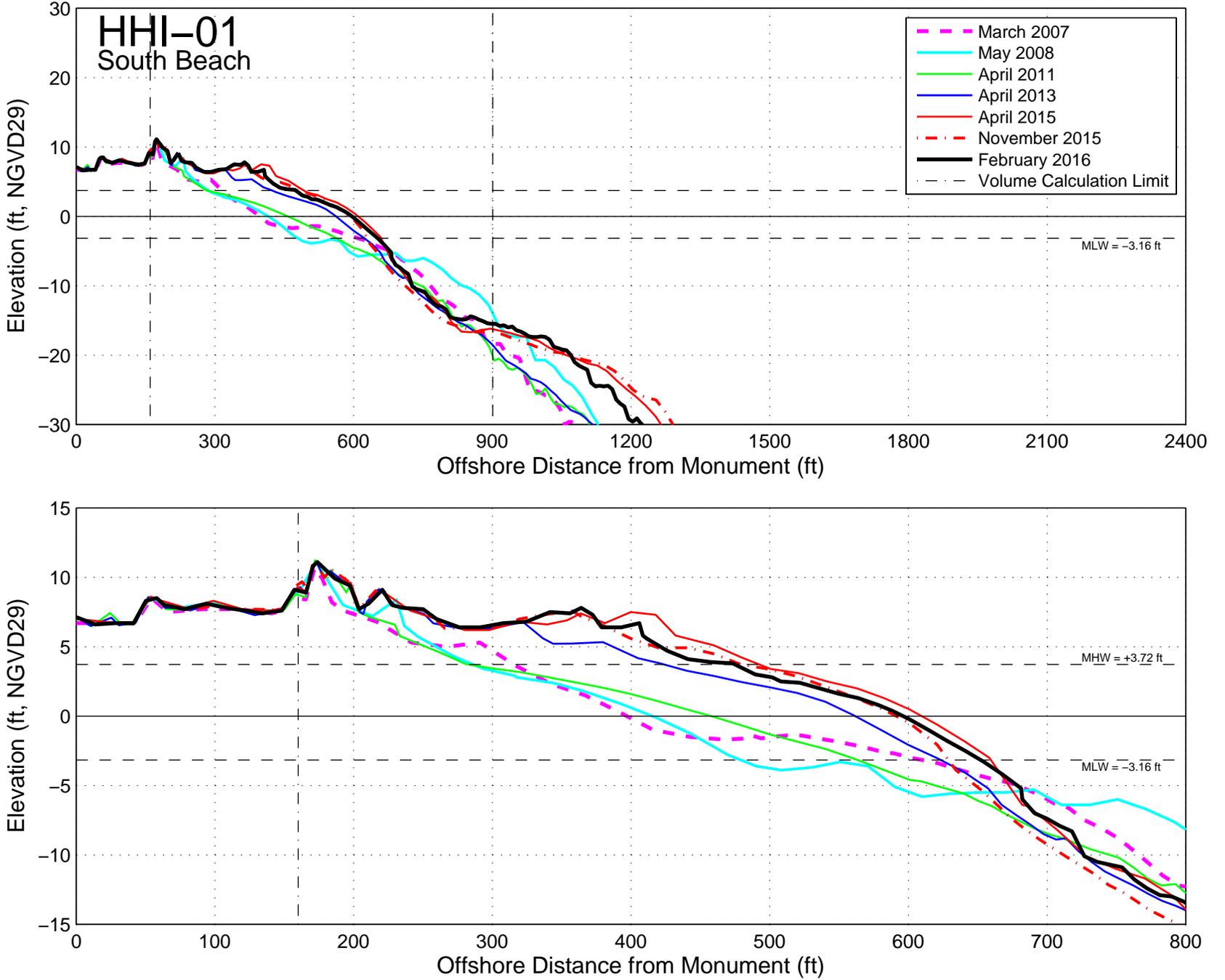


Figure A.4: Measured beach profiles at monument HHI01A0 – Hilton Head Island, South Carolina.

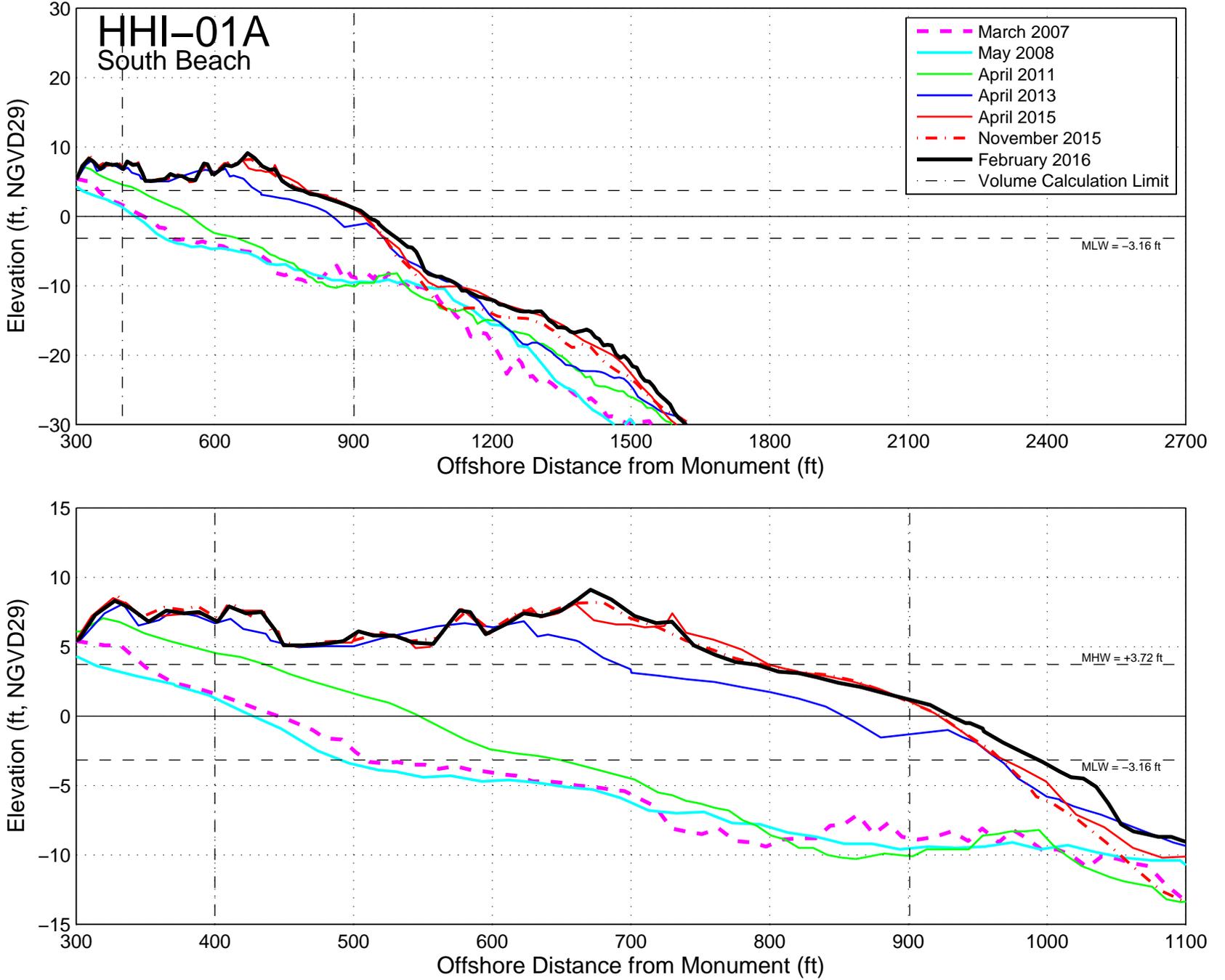


Figure A.5: Measured beach profiles at monument HHI01B0 – Hilton Head Island, South Carolina.

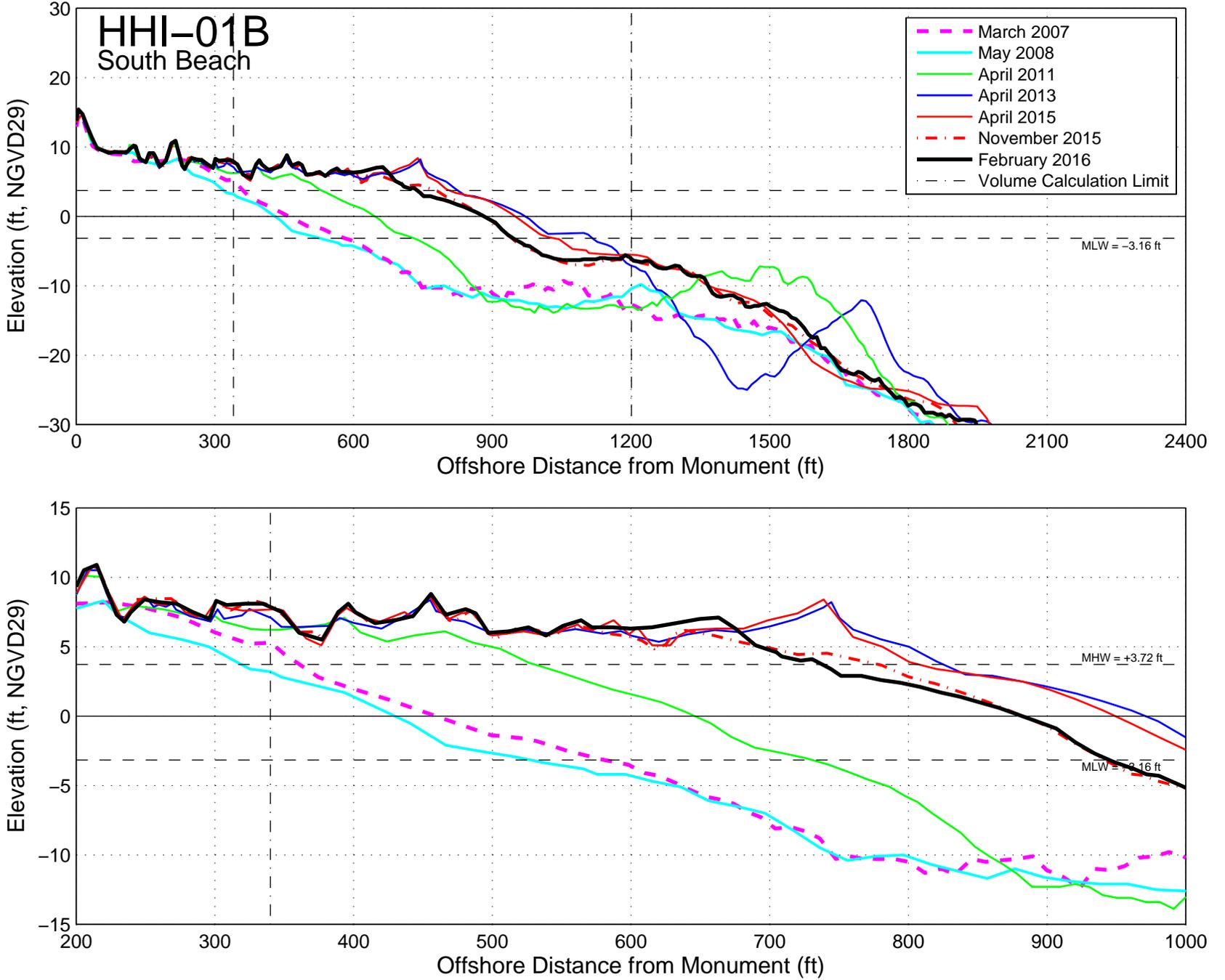


Figure A.6: Measured beach profiles at monument HHI01C0 – Hilton Head Island, South Carolina.

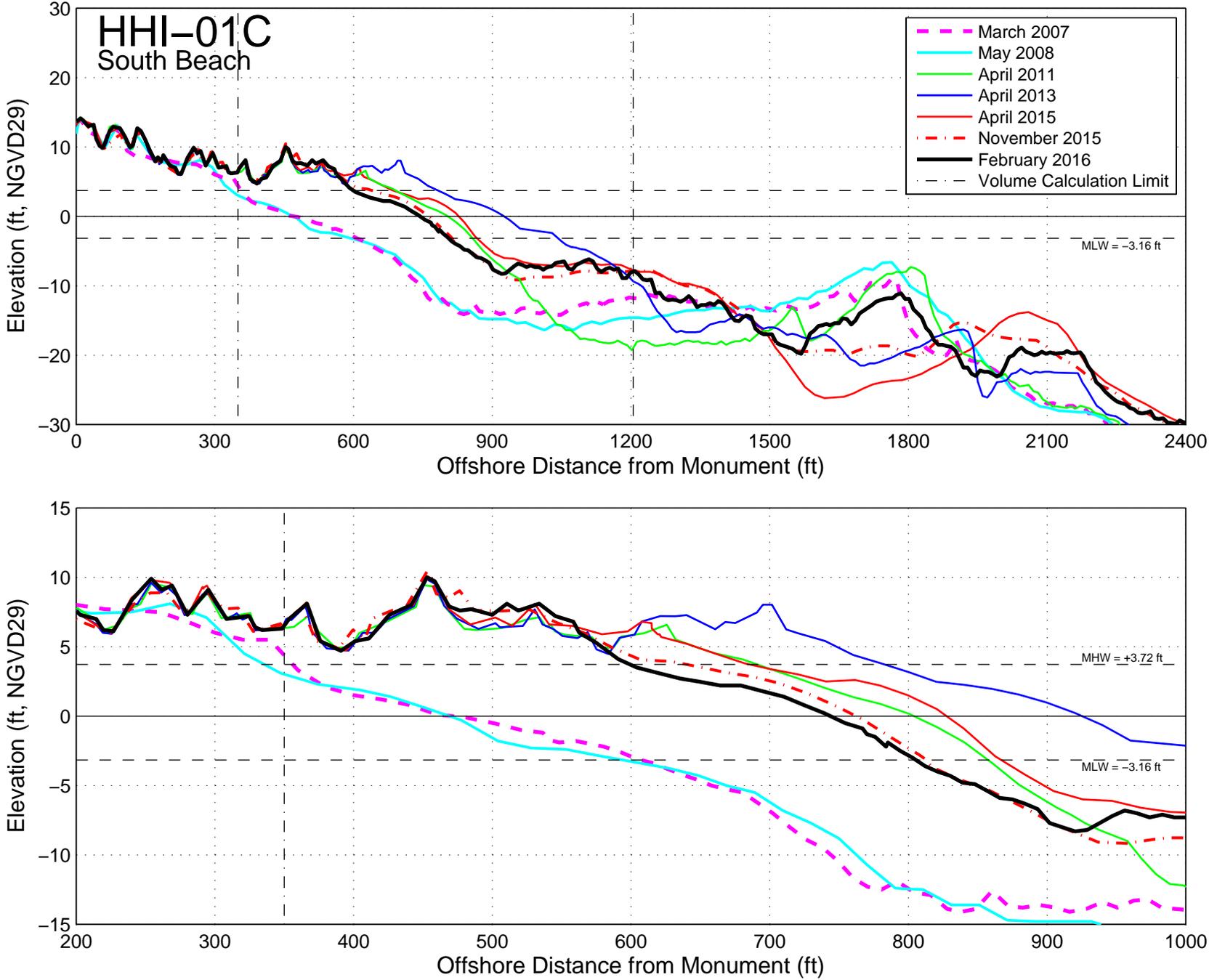


Figure A.7: Measured beach profiles at monument H10200 – Hilton Head Island, South Carolina.

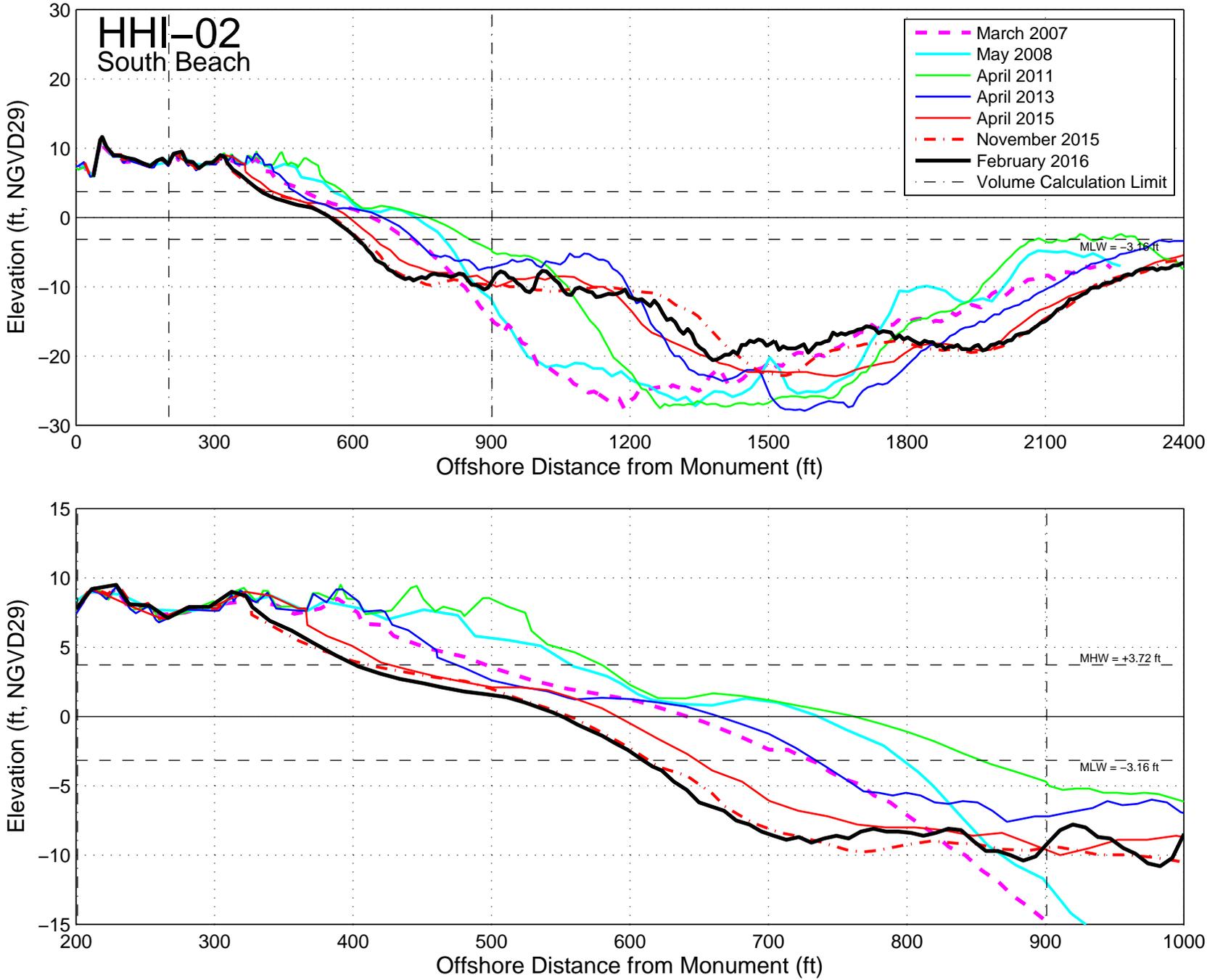


Figure A.8: Measured beach profiles at monument HHI02A0 – Hilton Head Island, South Carolina.

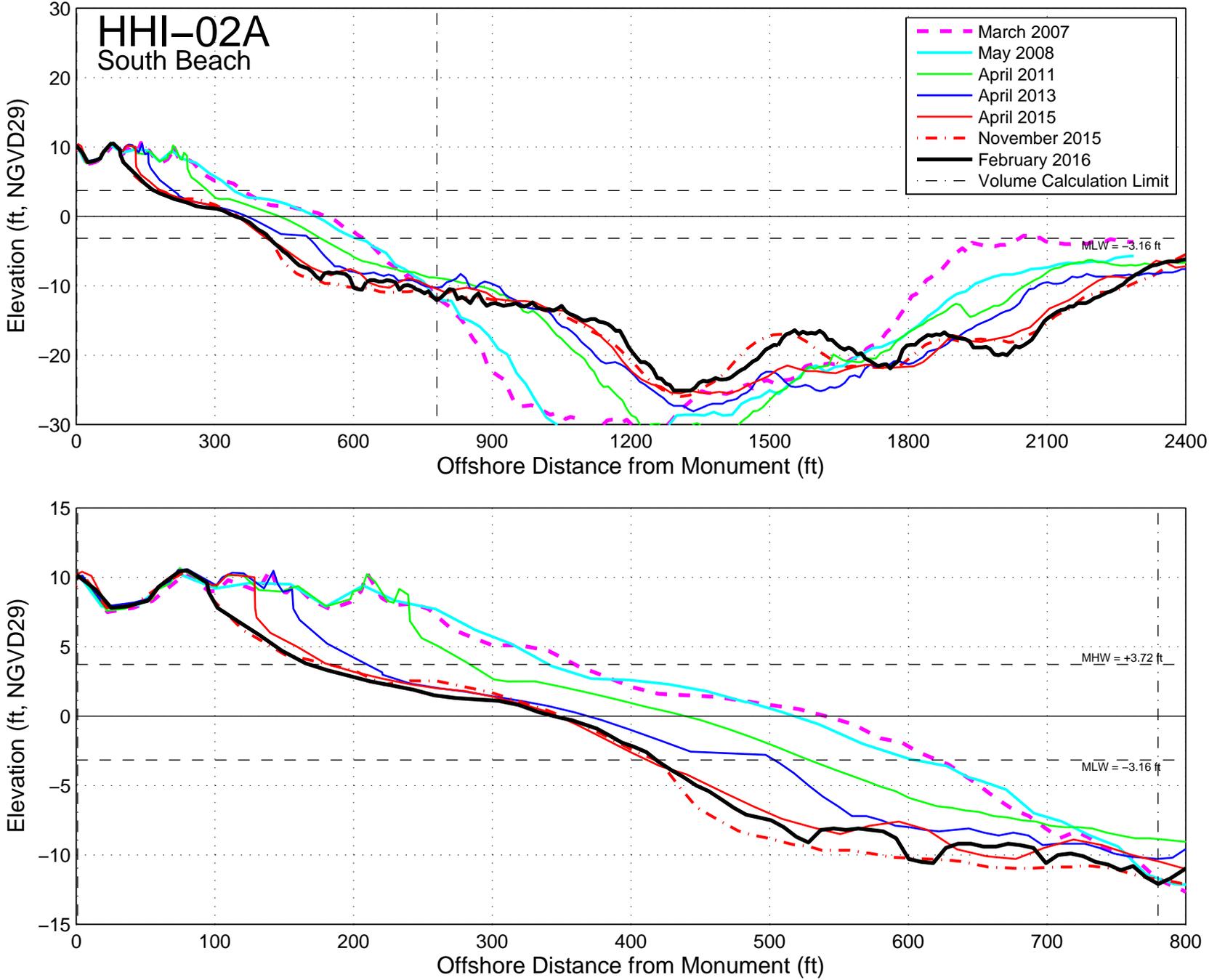


Figure A.9: Measured beach profiles at monument H10300 – Hilton Head Island, South Carolina.

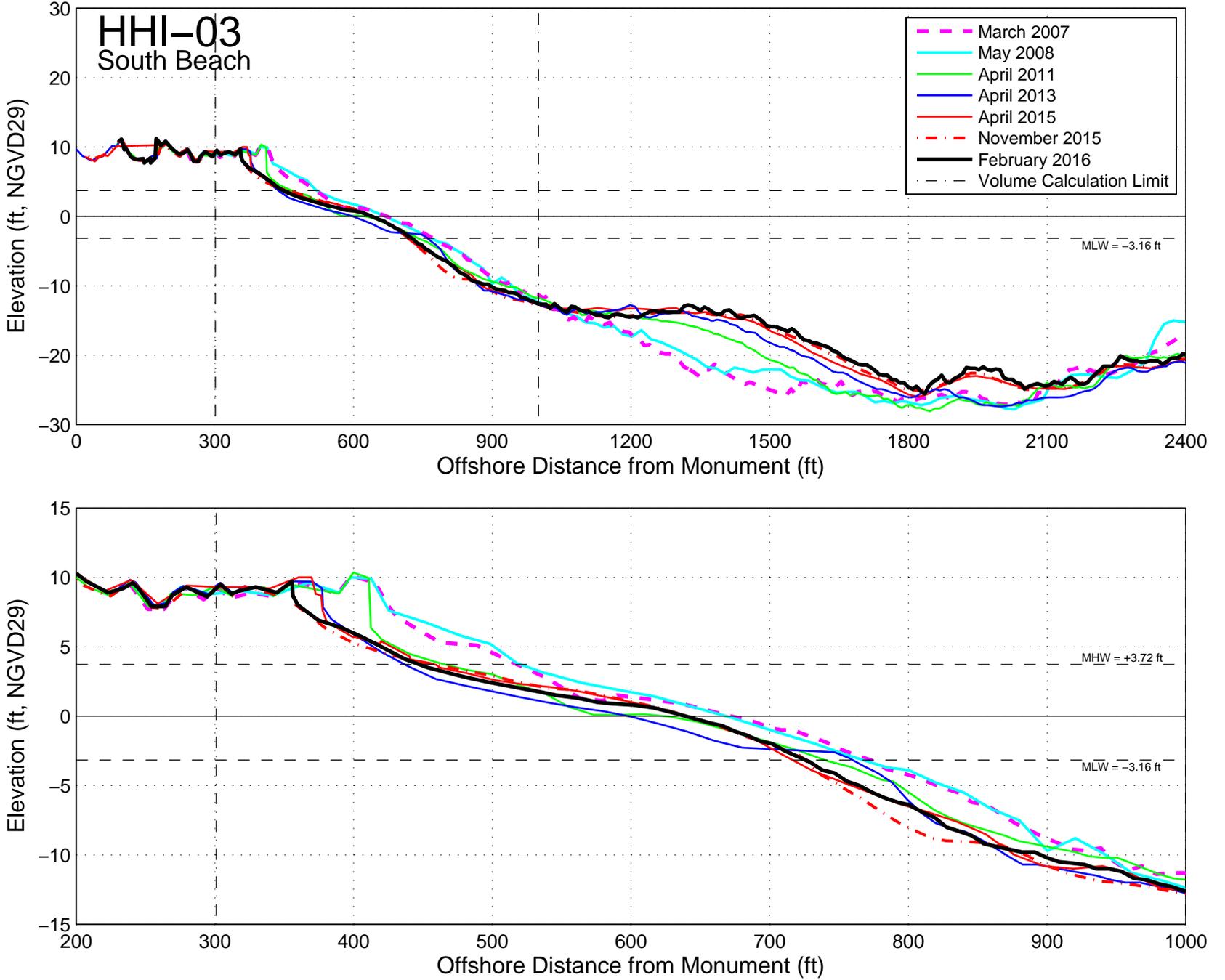


Figure A.10: Measured beach profiles at monument H10400 – Hilton Head Island, South Carolina.

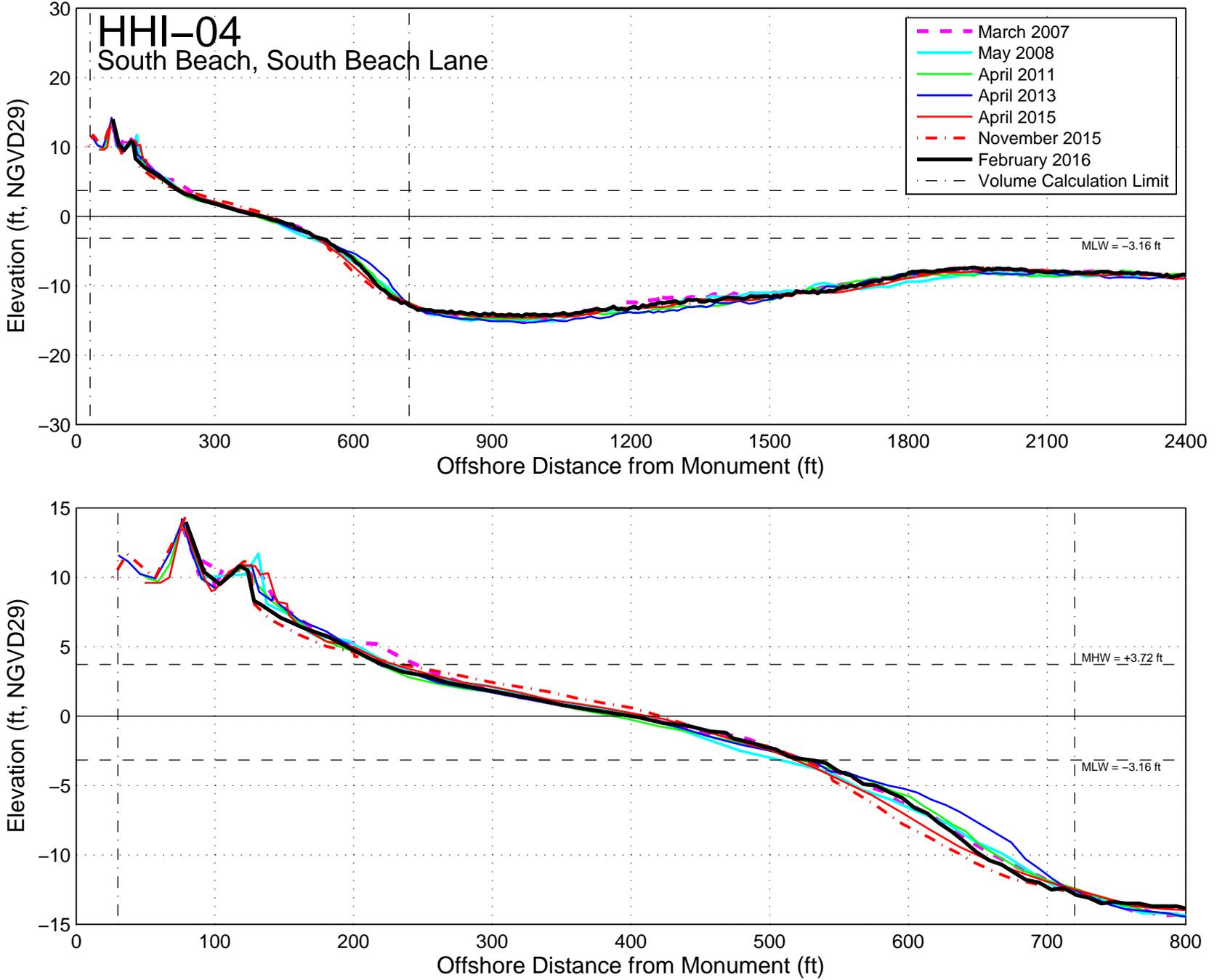


Figure A.11: Measured beach profiles at monument H10500 – Hilton Head Island, South Carolina.

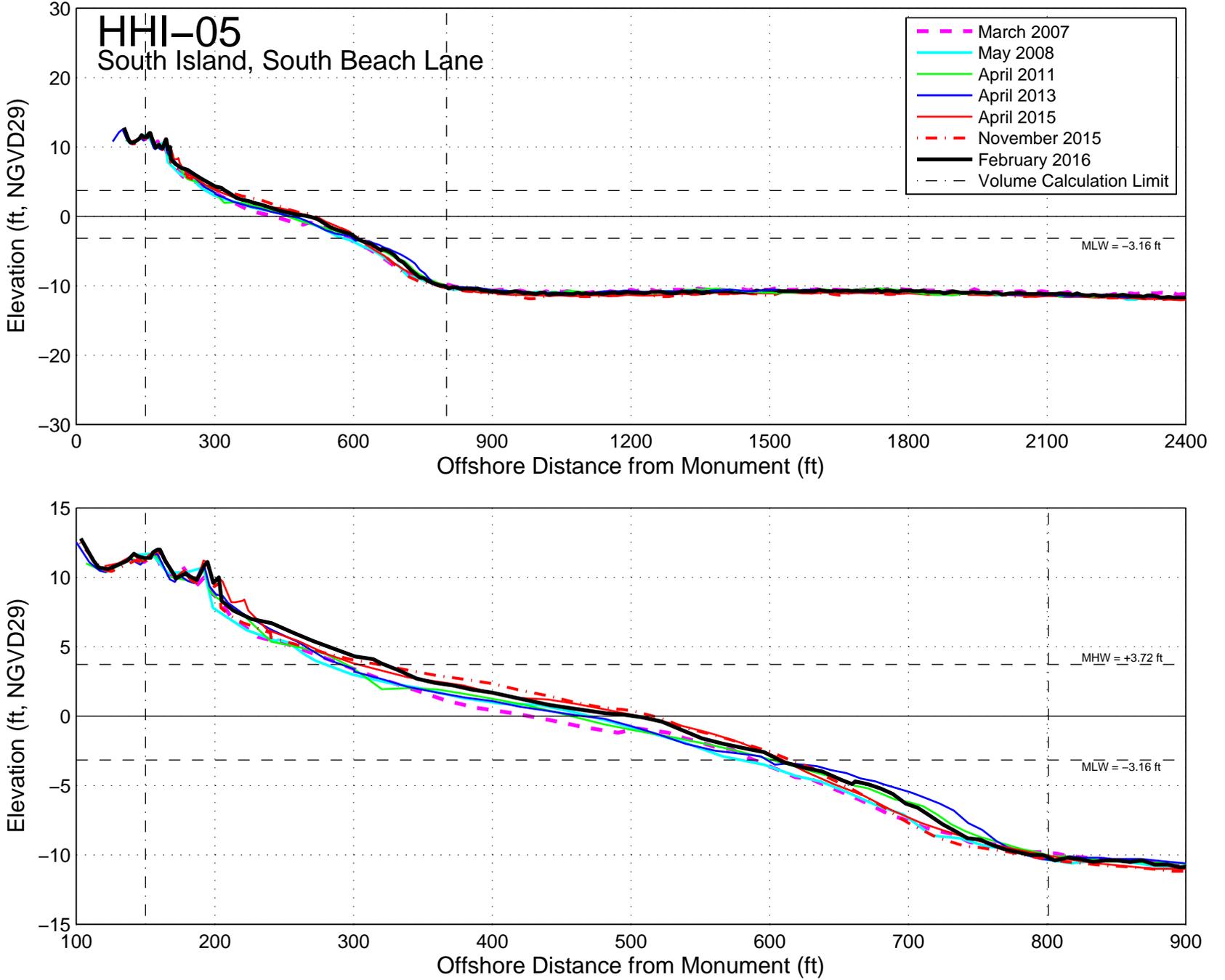


Figure A.12: Measured beach profiles at monument HHI0600 – Hilton Head Island, South Carolina.

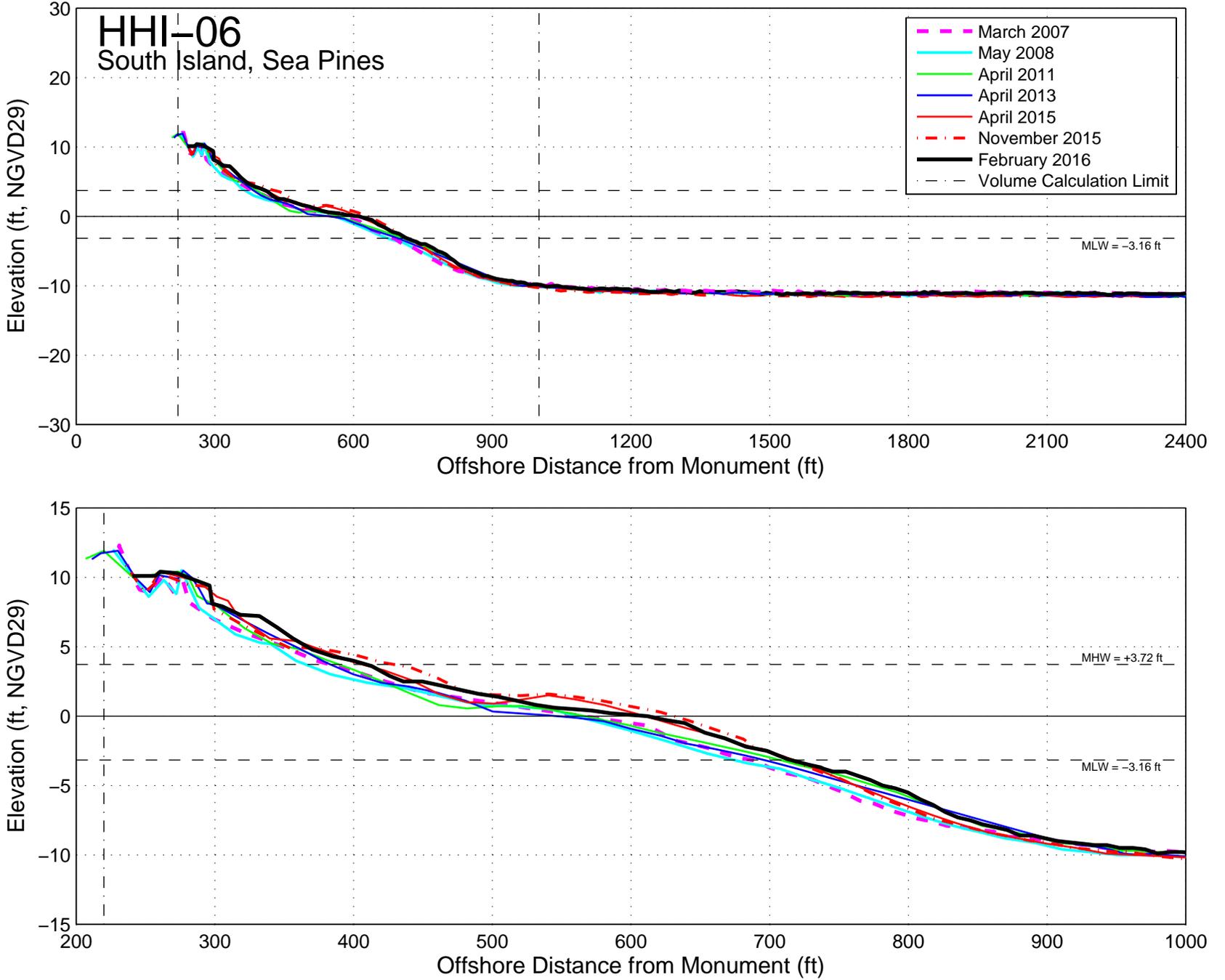


Figure A.13: Measured beach profiles at monument H10700 – Hilton Head Island, South Carolina.

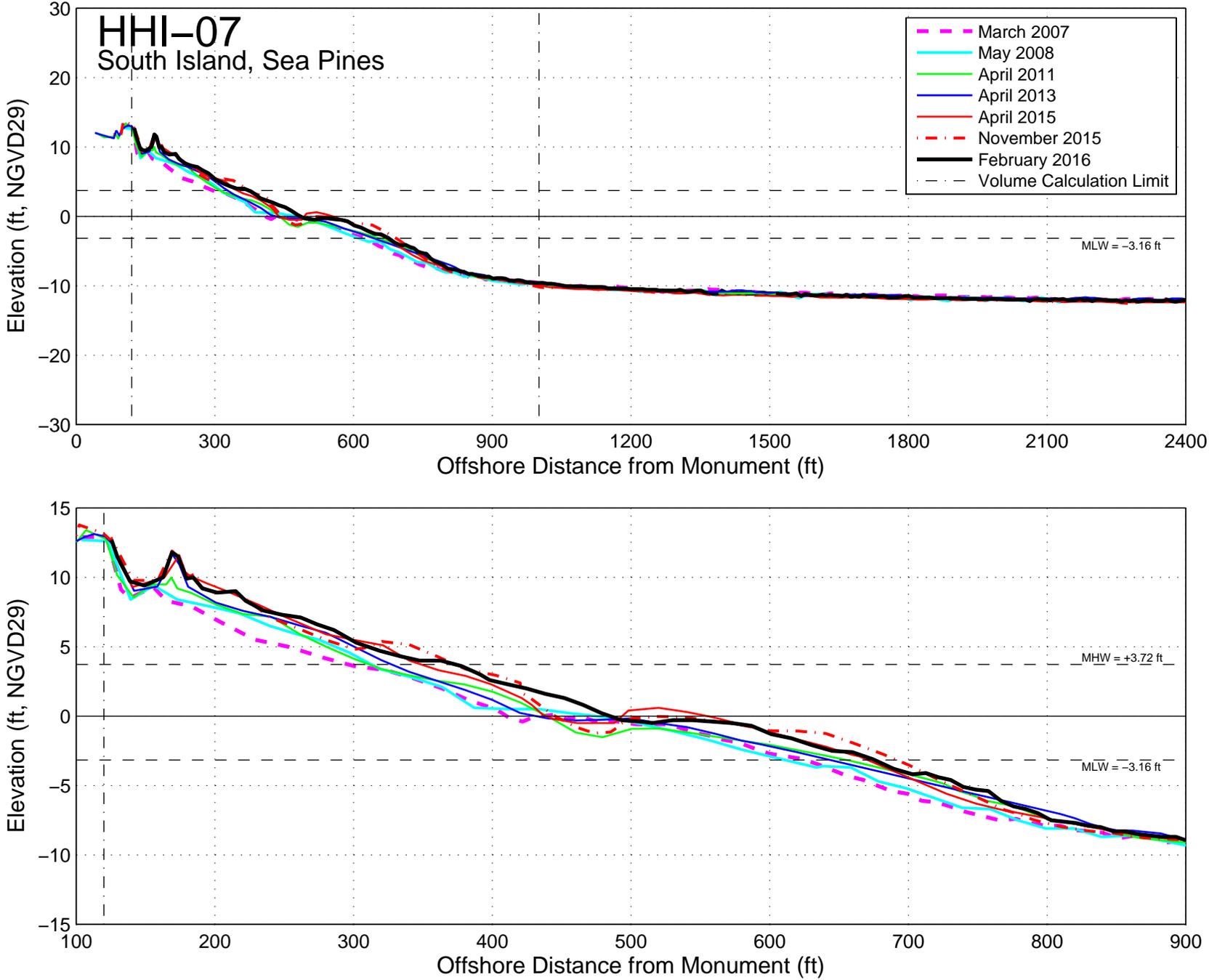


Figure A.14: Measured beach profiles at monument H10800 – Hilton Head Island, South Carolina.

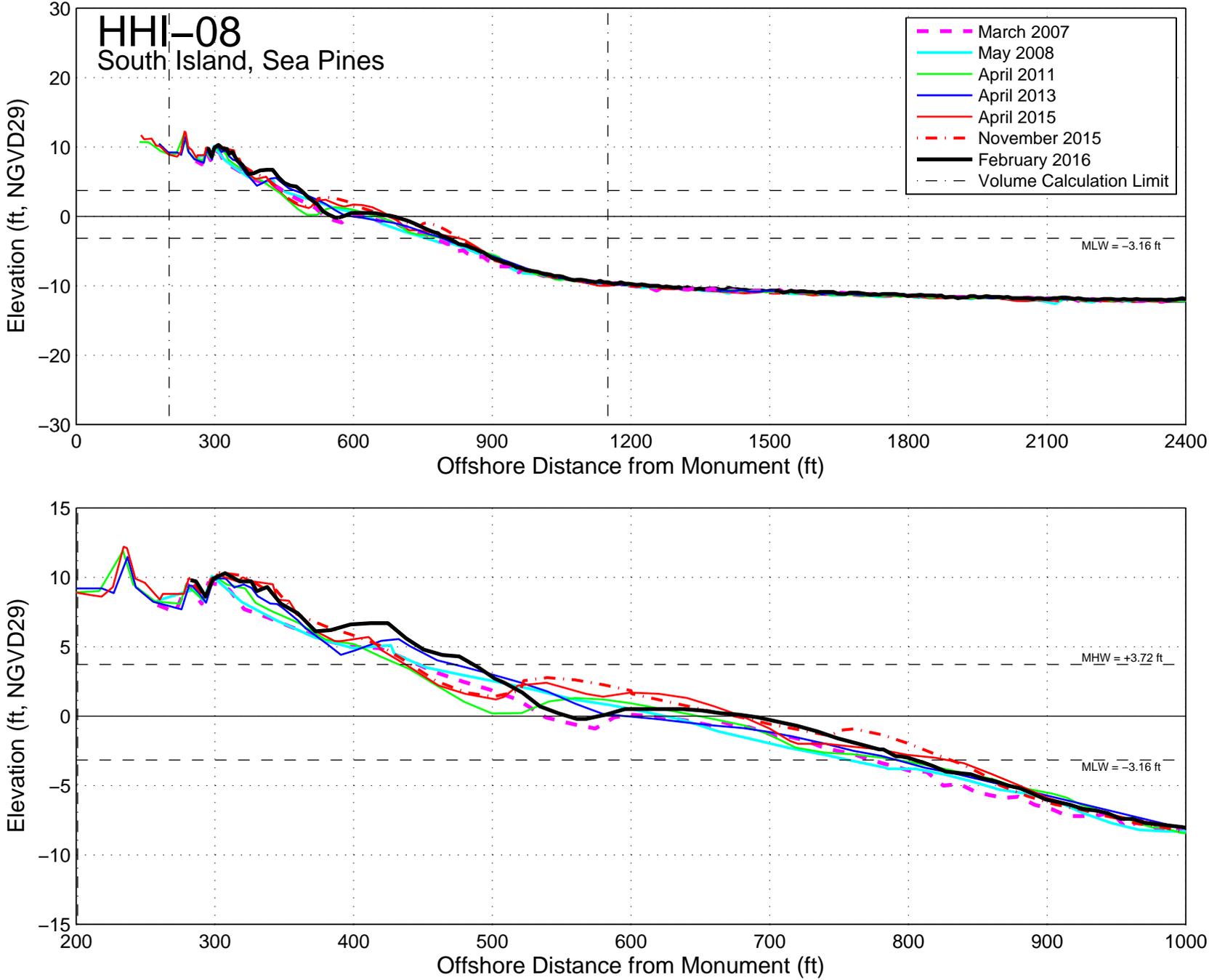


Figure A.15: Measured beach profiles at monument H10900 – Hilton Head Island, South Carolina.

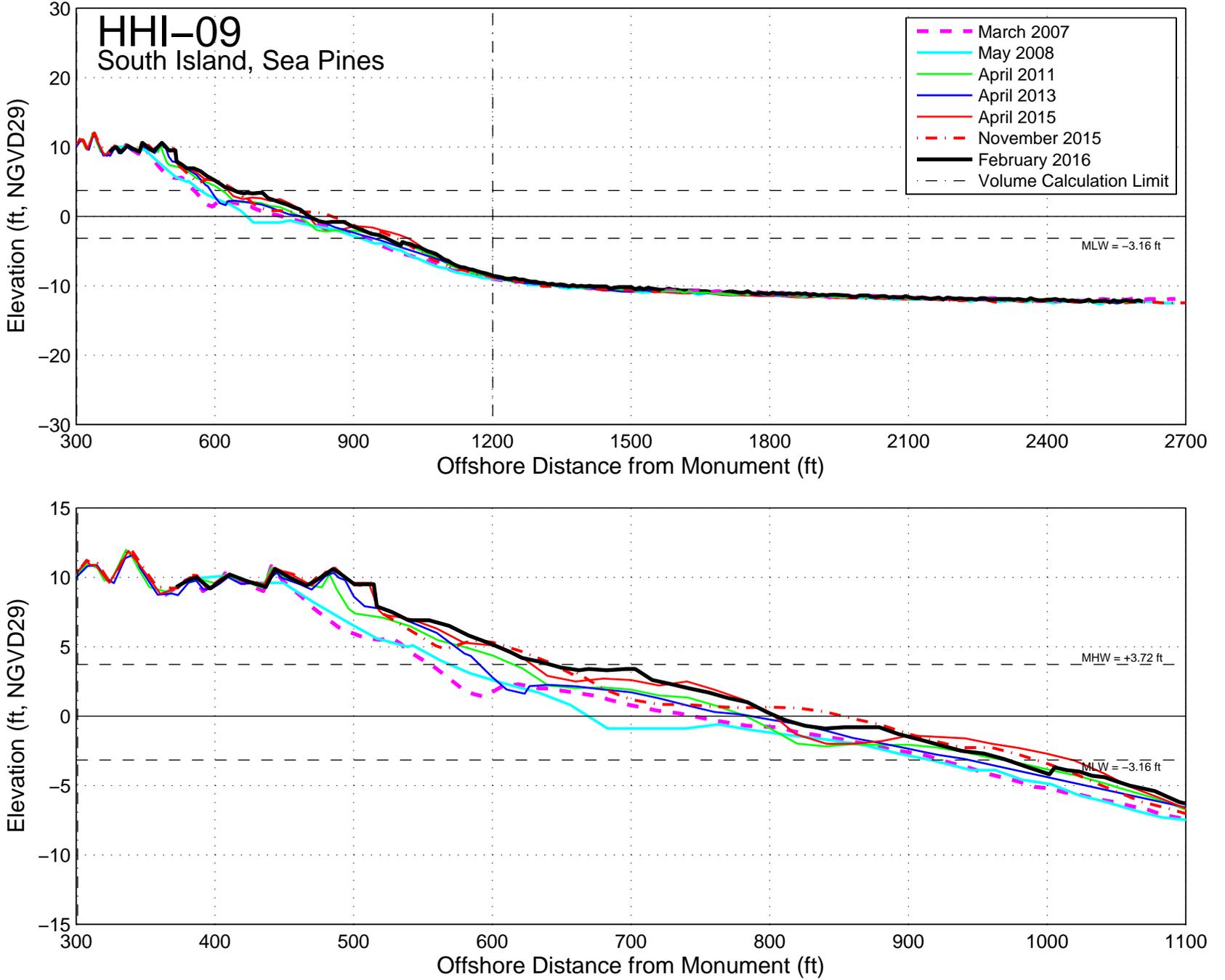


Figure A.16: Measured beach profiles at monument HHI1000 – Hilton Head Island, South Carolina.

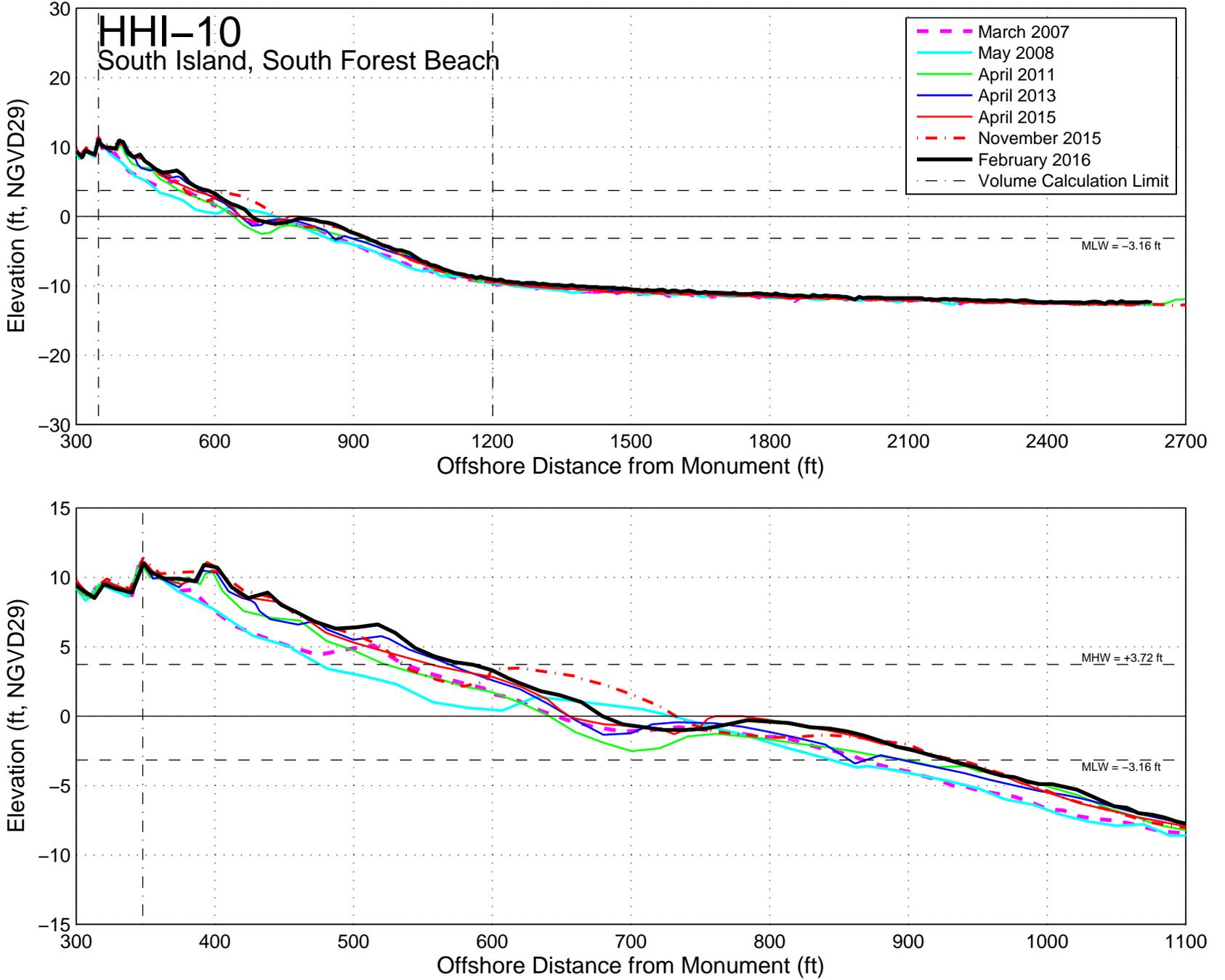


Figure A.17: Measured beach profiles at monument HHI1100 – Hilton Head Island, South Carolina.

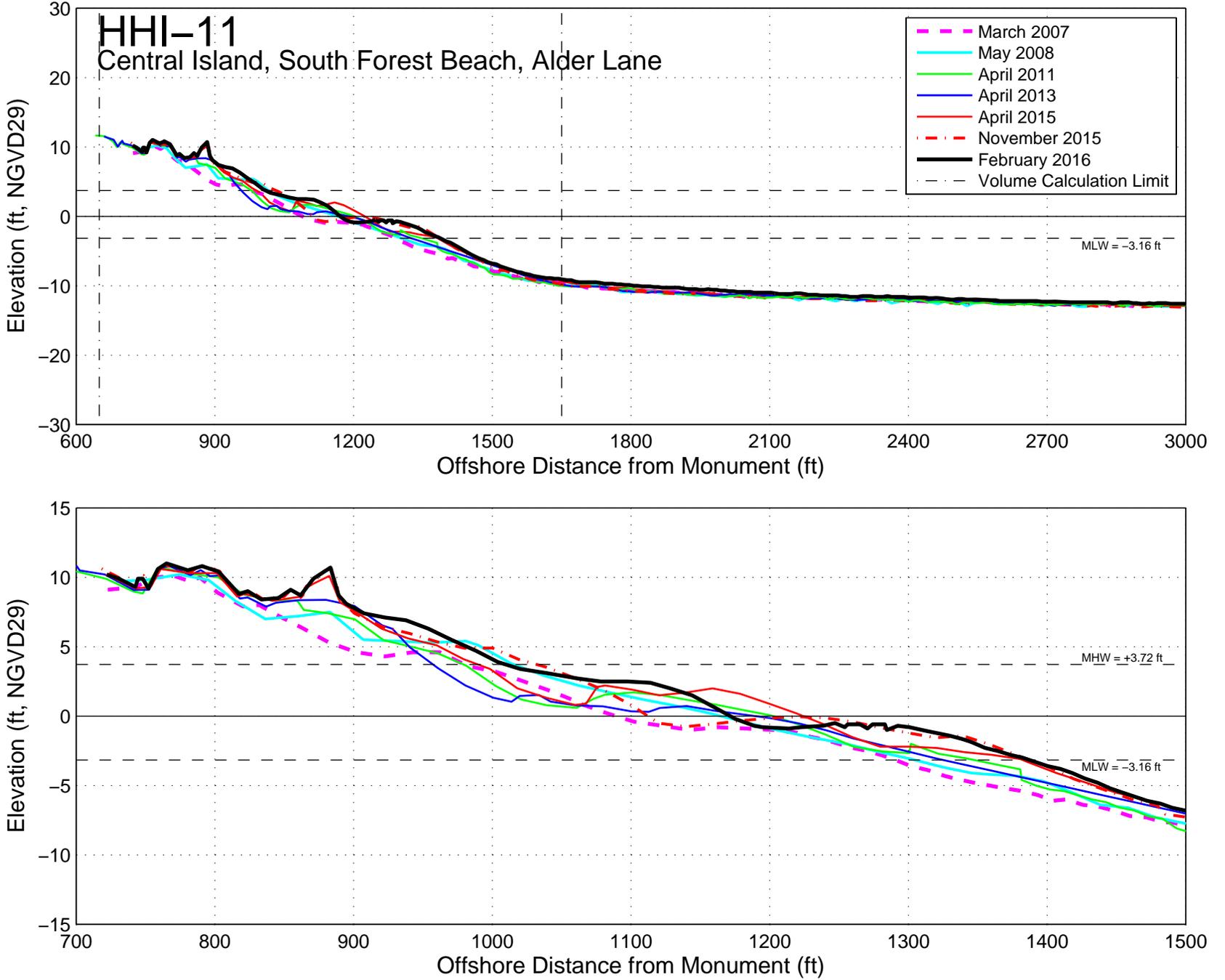


Figure A.18: Measured beach profiles at monument HHI1200 – Hilton Head Island, South Carolina.

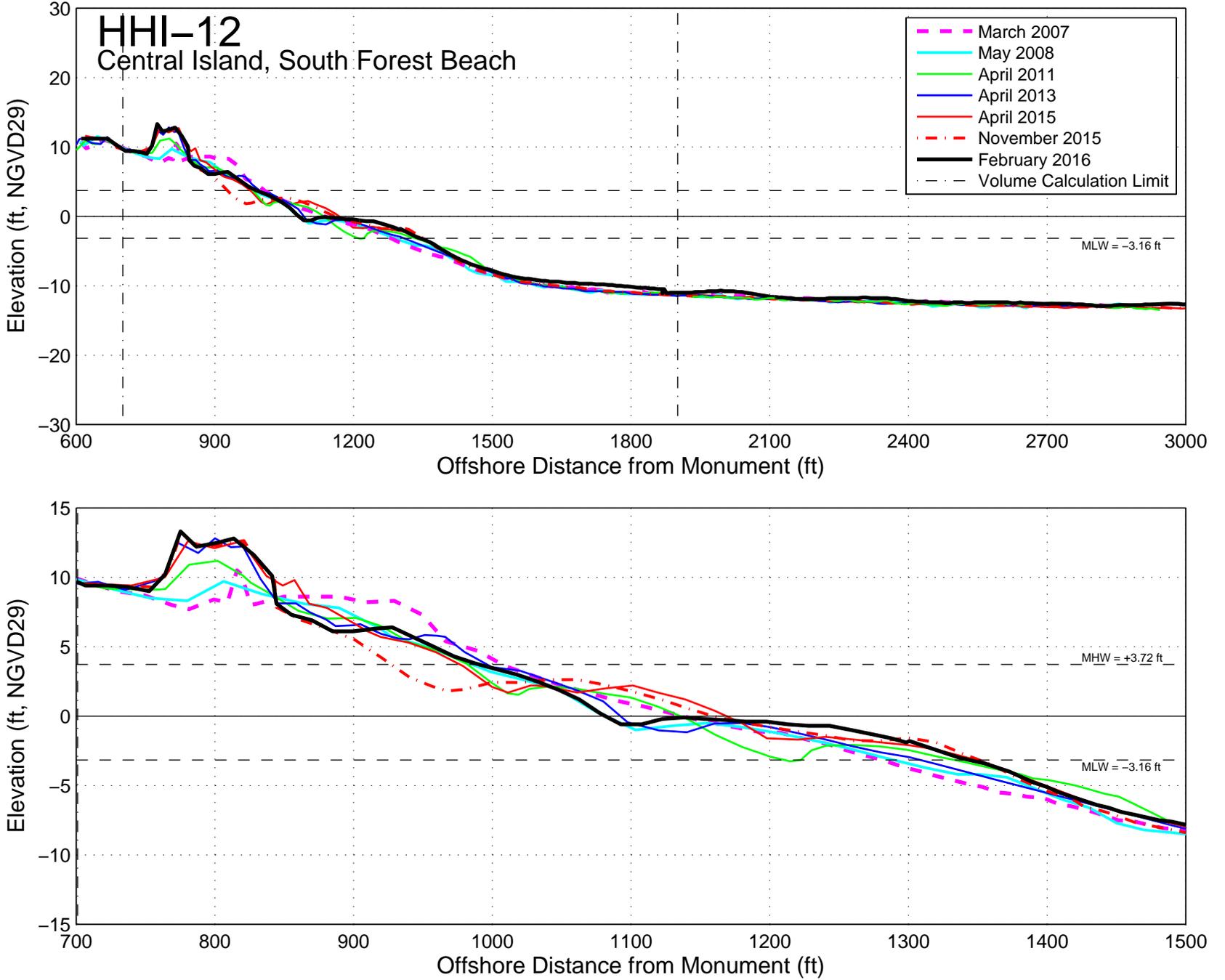


Figure A.19: Measured beach profiles at monument HHI1300 – Hilton Head Island, South Carolina.

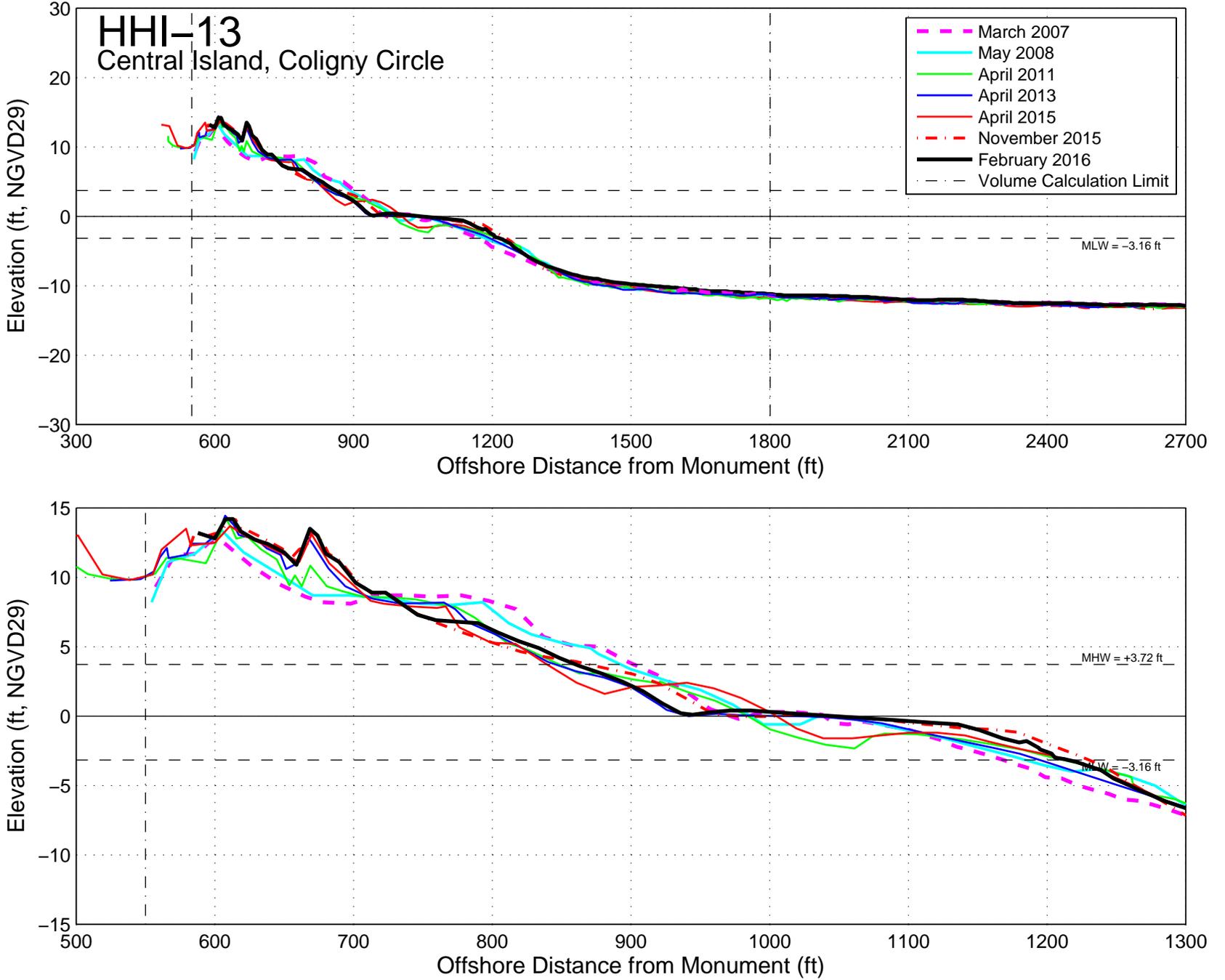


Figure A.20: Measured beach profiles at monument HHI 400 – Hilton Head Island, South Carolina.

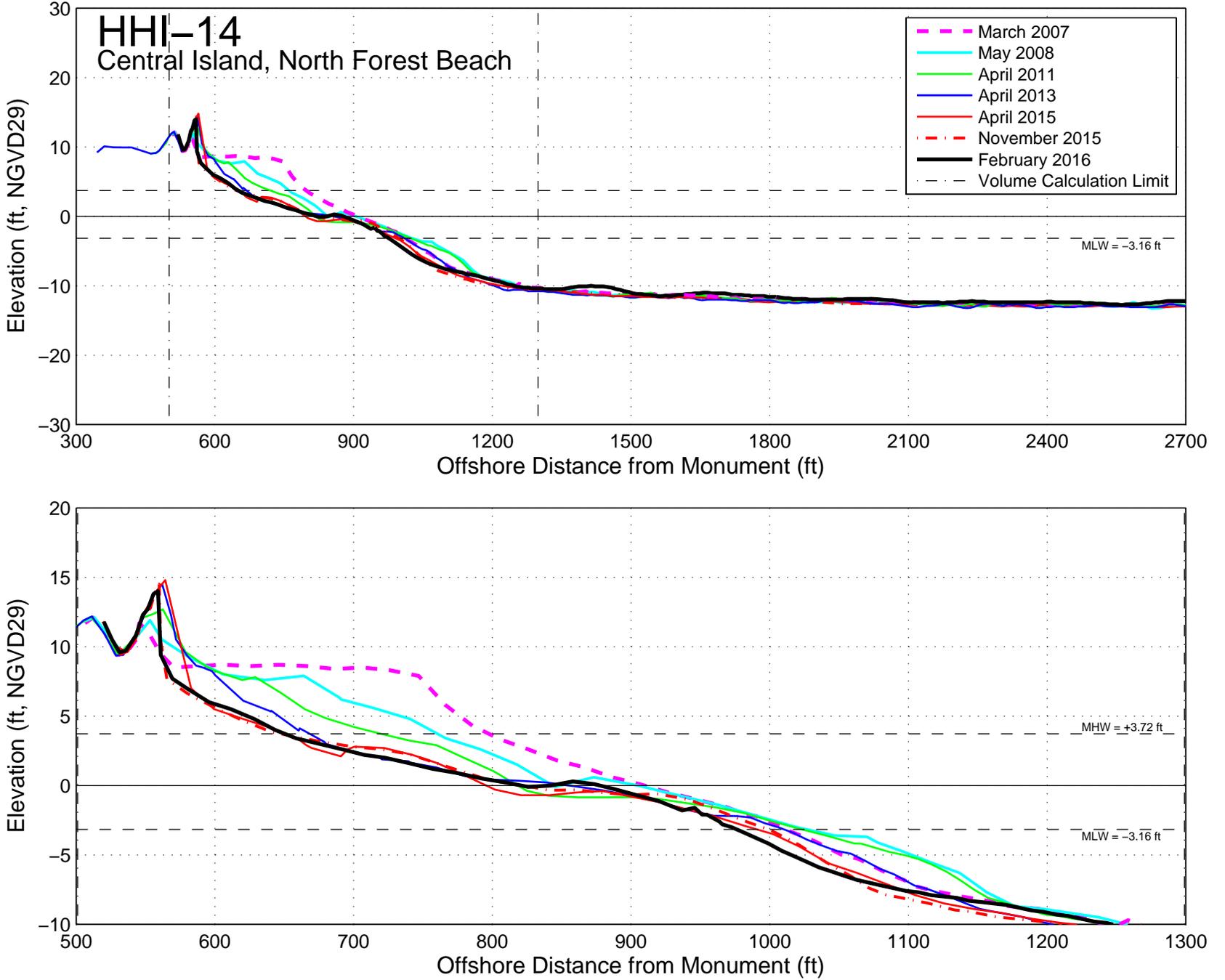


Figure A.21: Measured beach profiles at monument HHI1500 – Hilton Head Island, South Carolina.

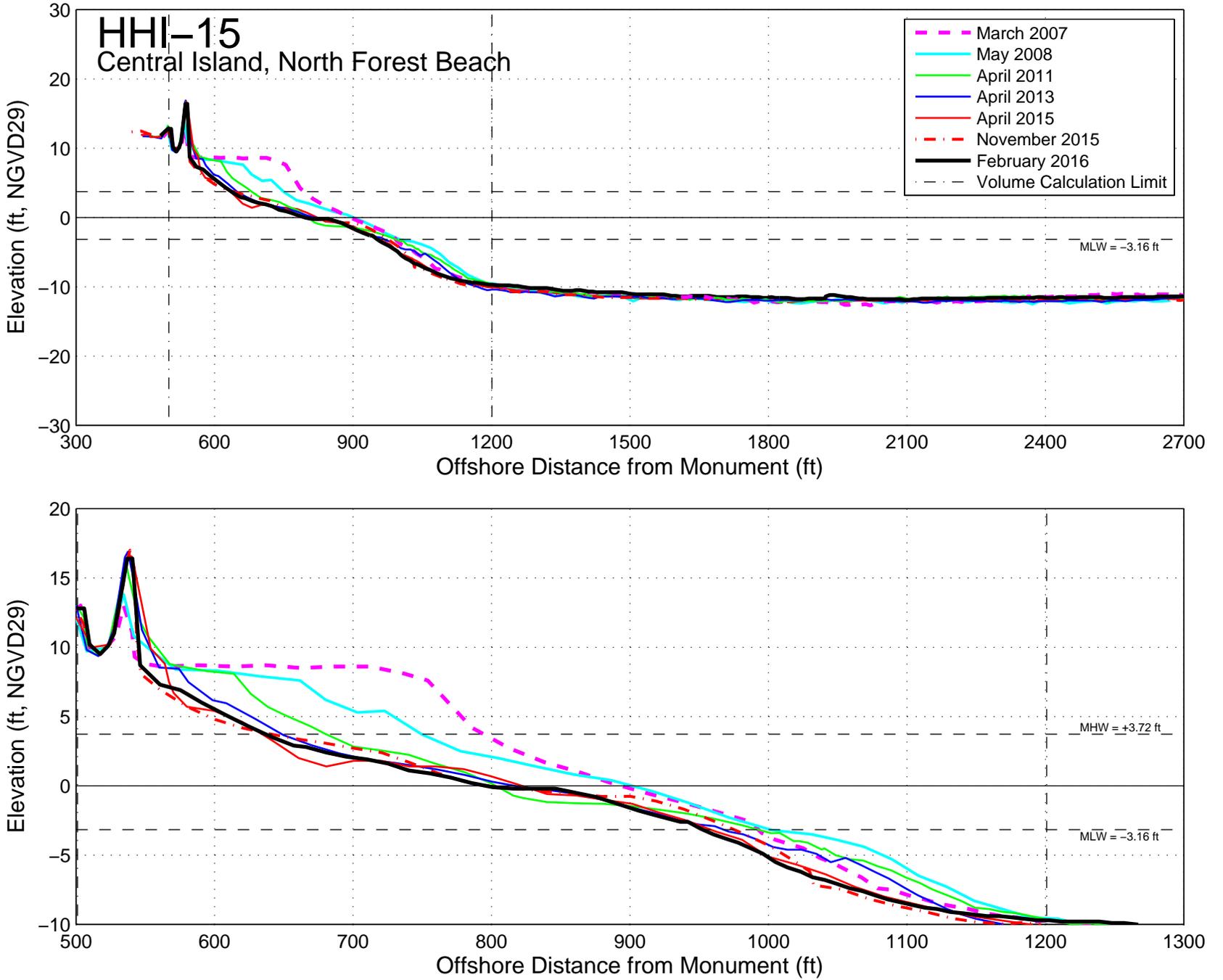


Figure A.22: Measured beach profiles at monument HHI 600 – Hilton Head Island, South Carolina.

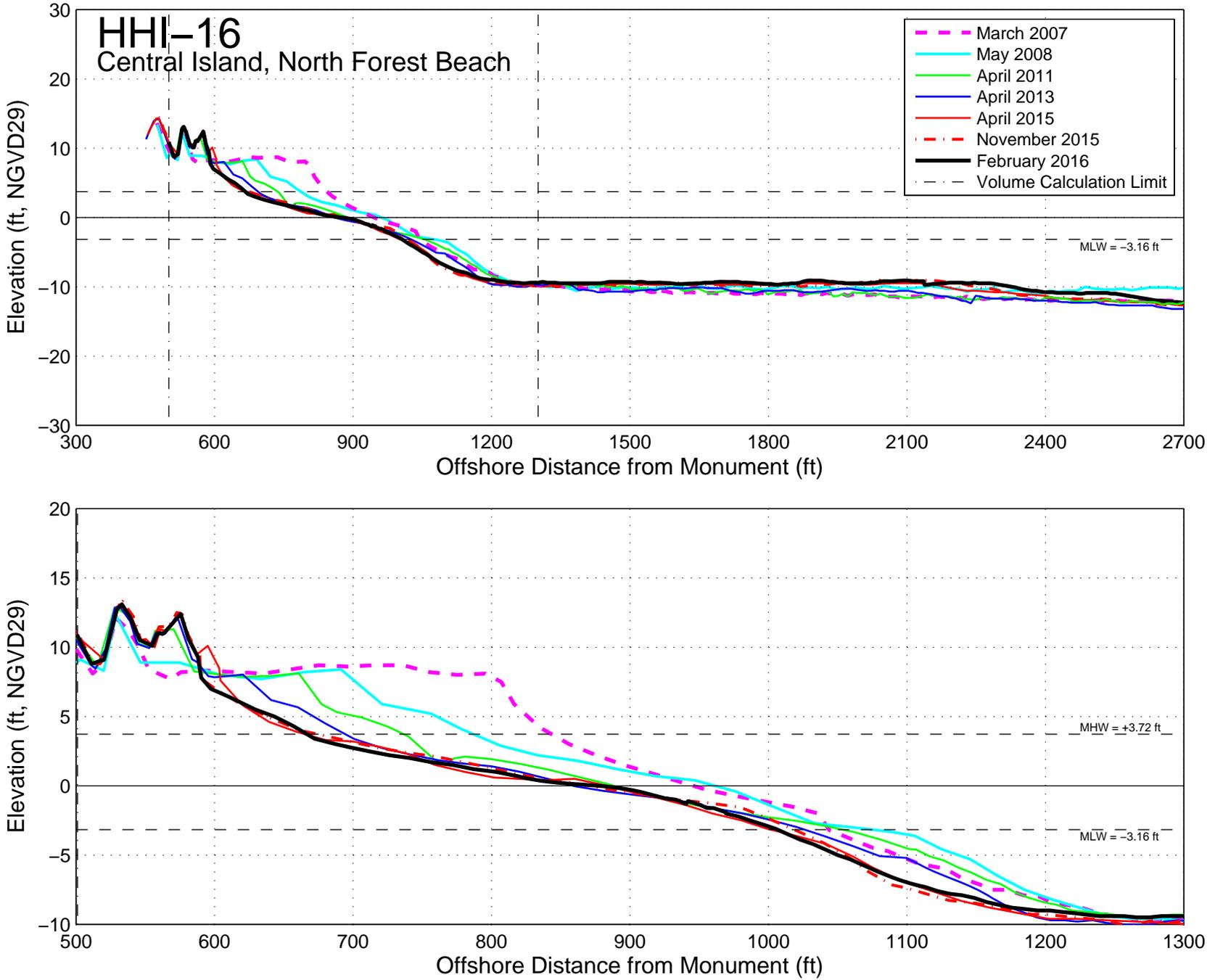


Figure A.23: Measured beach profiles at monument HHI1700 – Hilton Head Island, South Carolina.

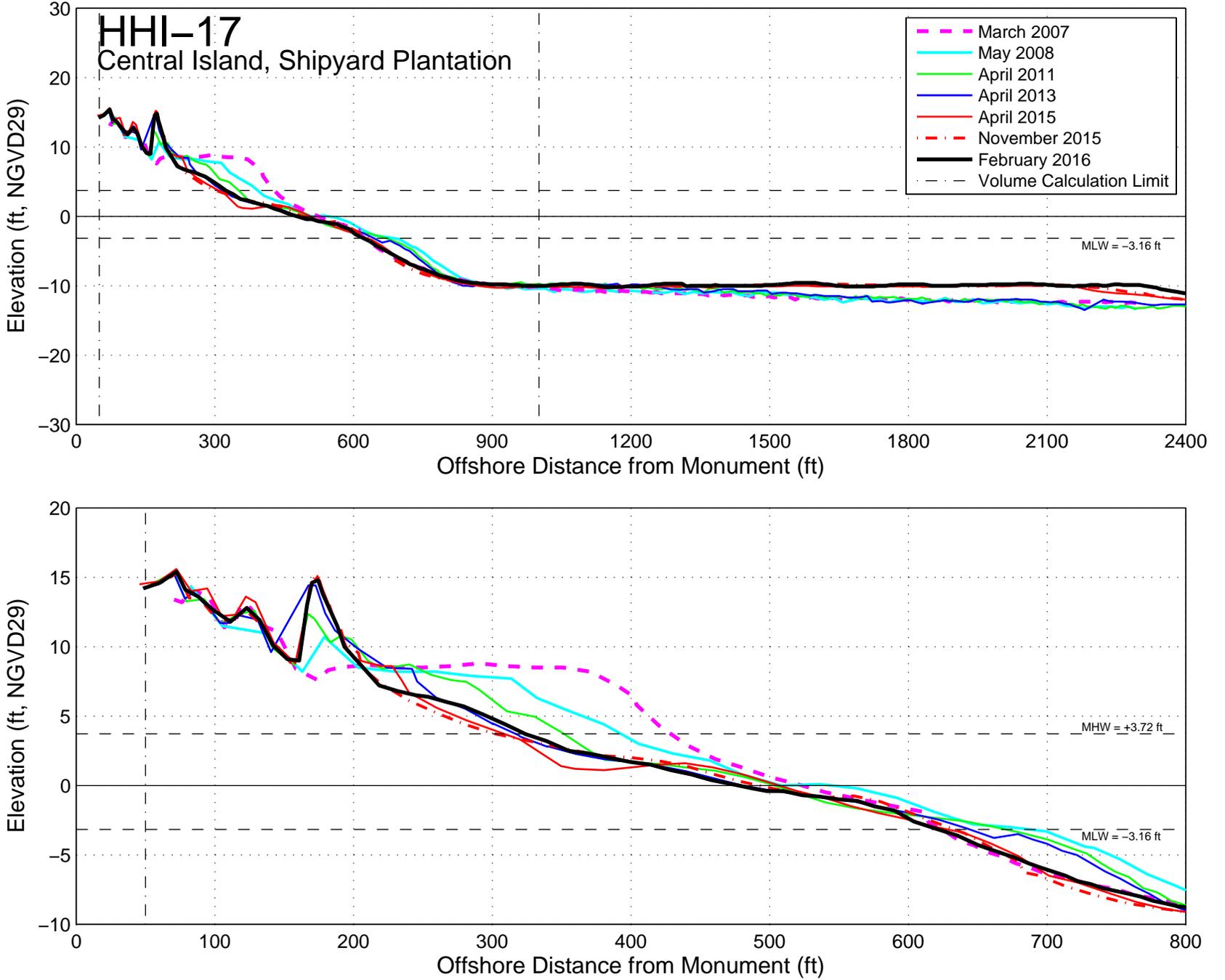


Figure A.24: Measured beach profiles at monument HHI 800 – Hilton Head Island, South Carolina.

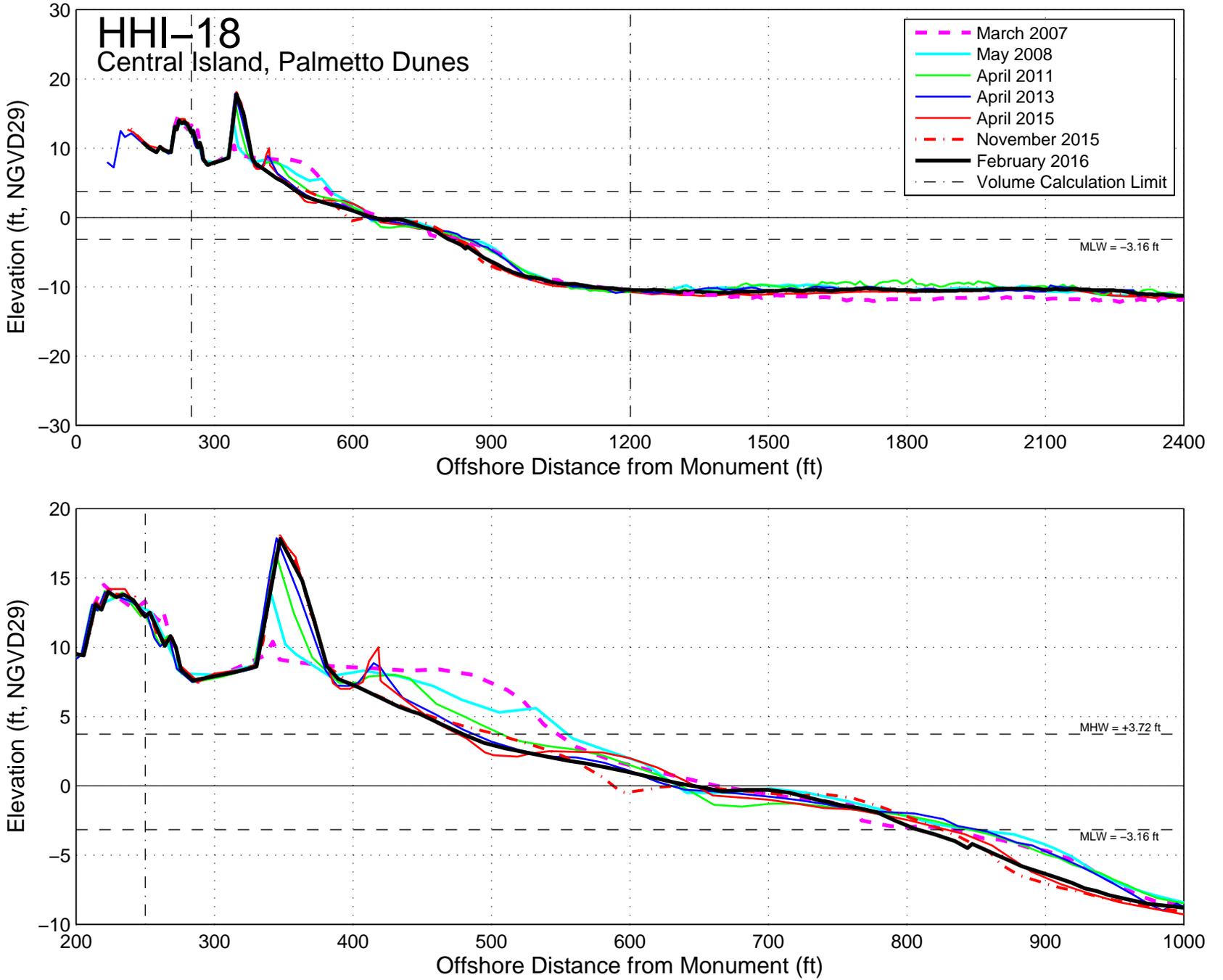


Figure A.25: Measured beach profiles at monument HHI1900 – Hilton Head Island, South Carolina.

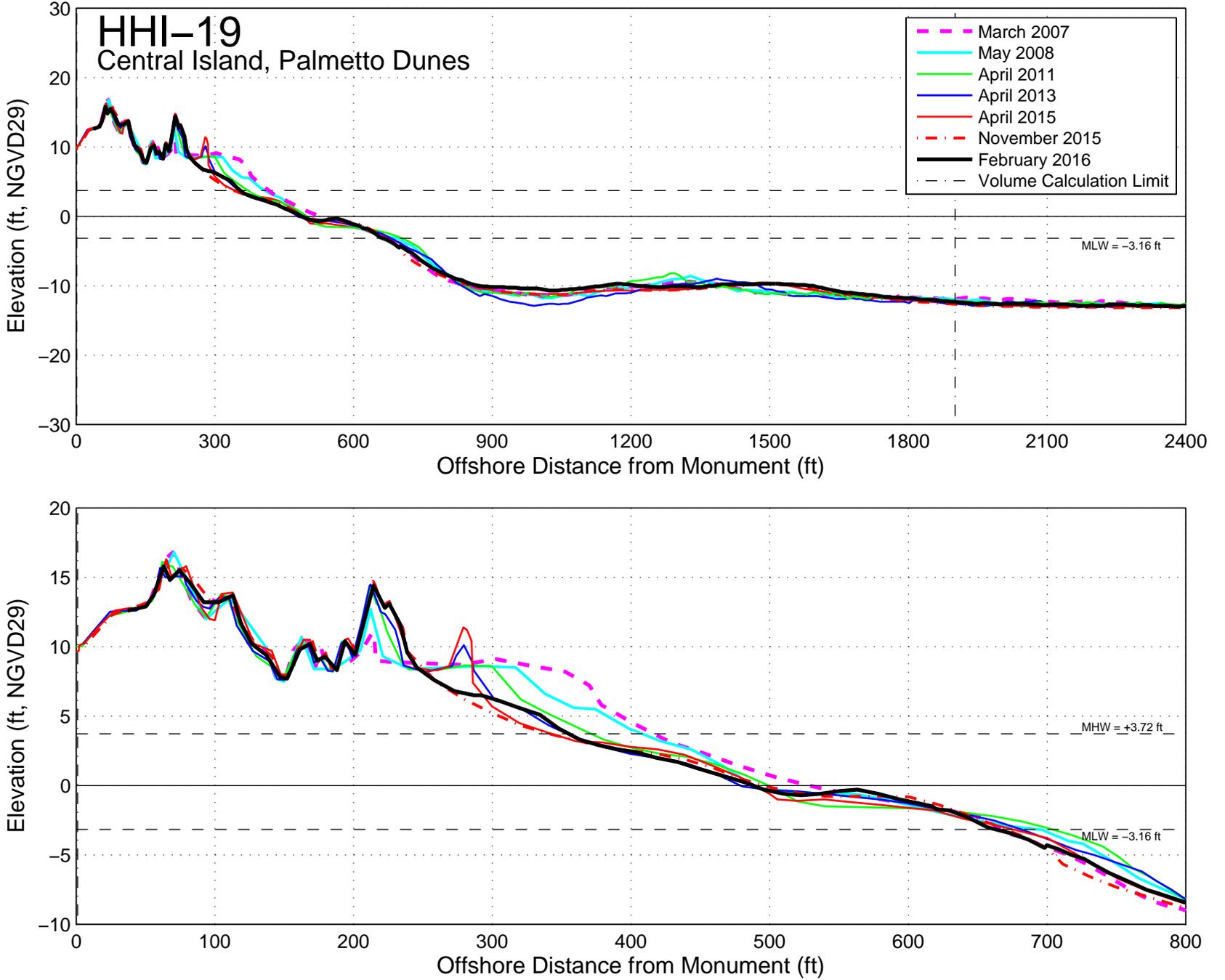


Figure A.26: Measured beach profiles at monument HHI19A0 – Hilton Head Island, South Carolina.

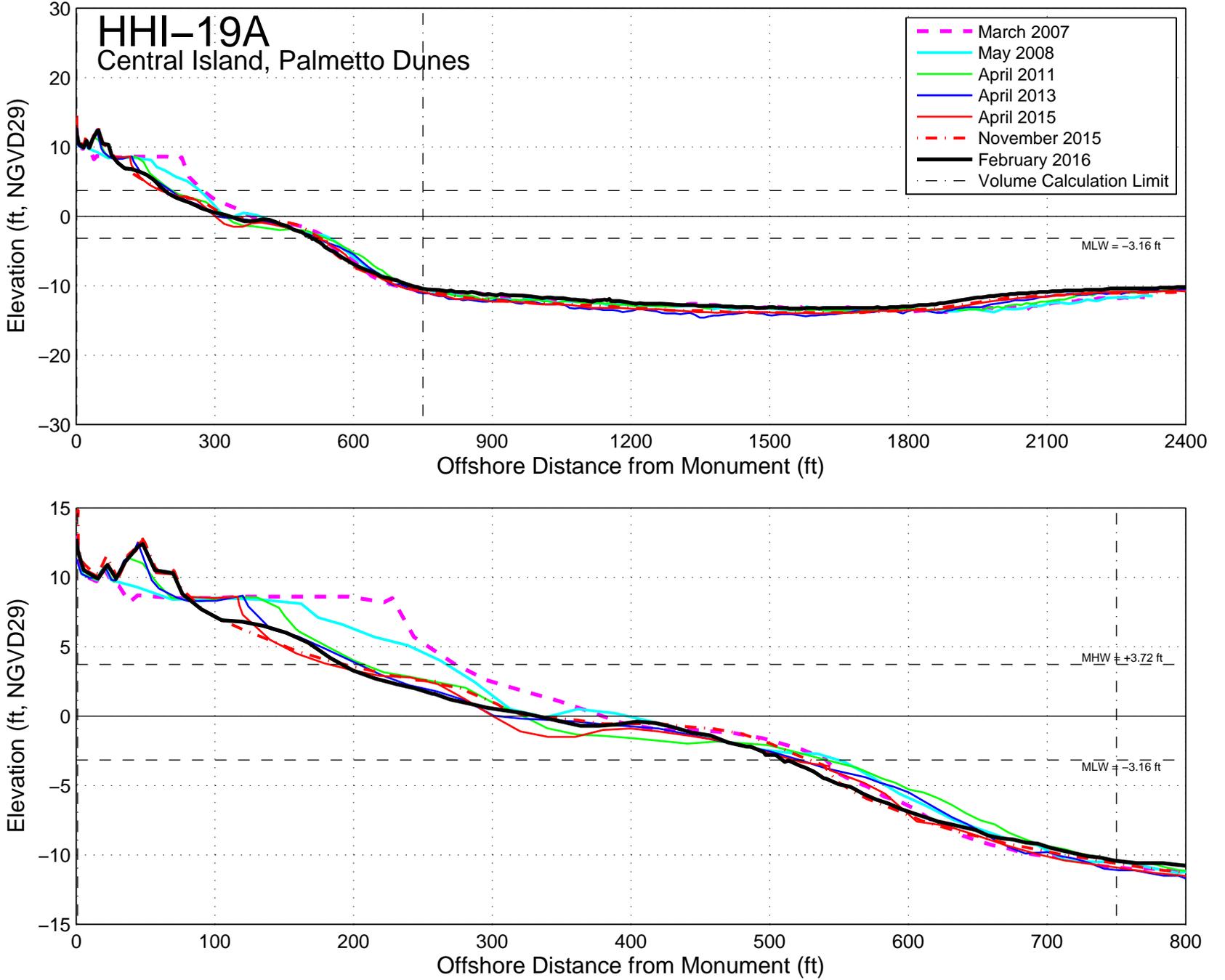


Figure A.27: Measured beach profiles at monument H12000 – Hilton Head Island, South Carolina.

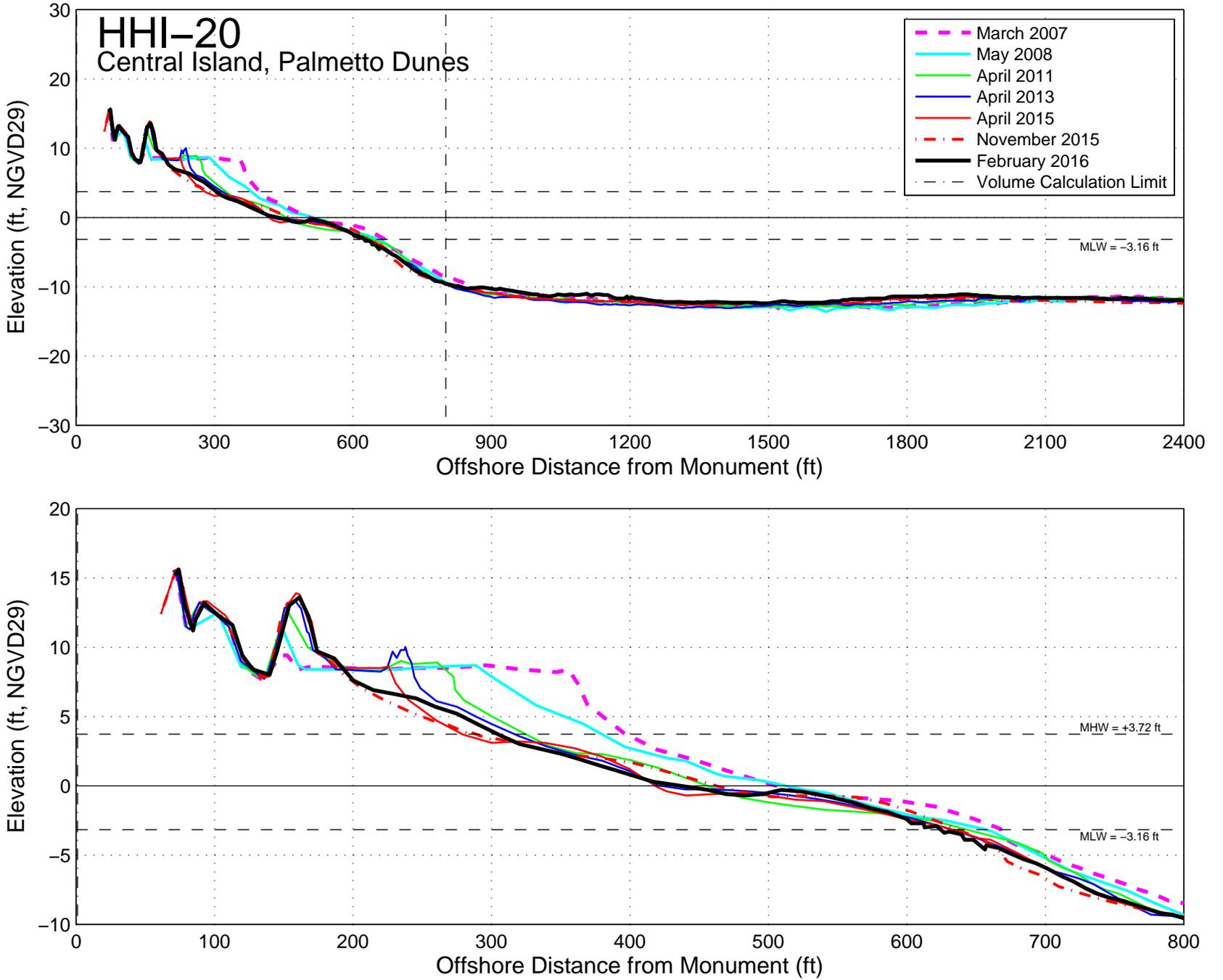


Figure A.28: Measured beach profiles at monument H12100 – Hilton Head Island, South Carolina.

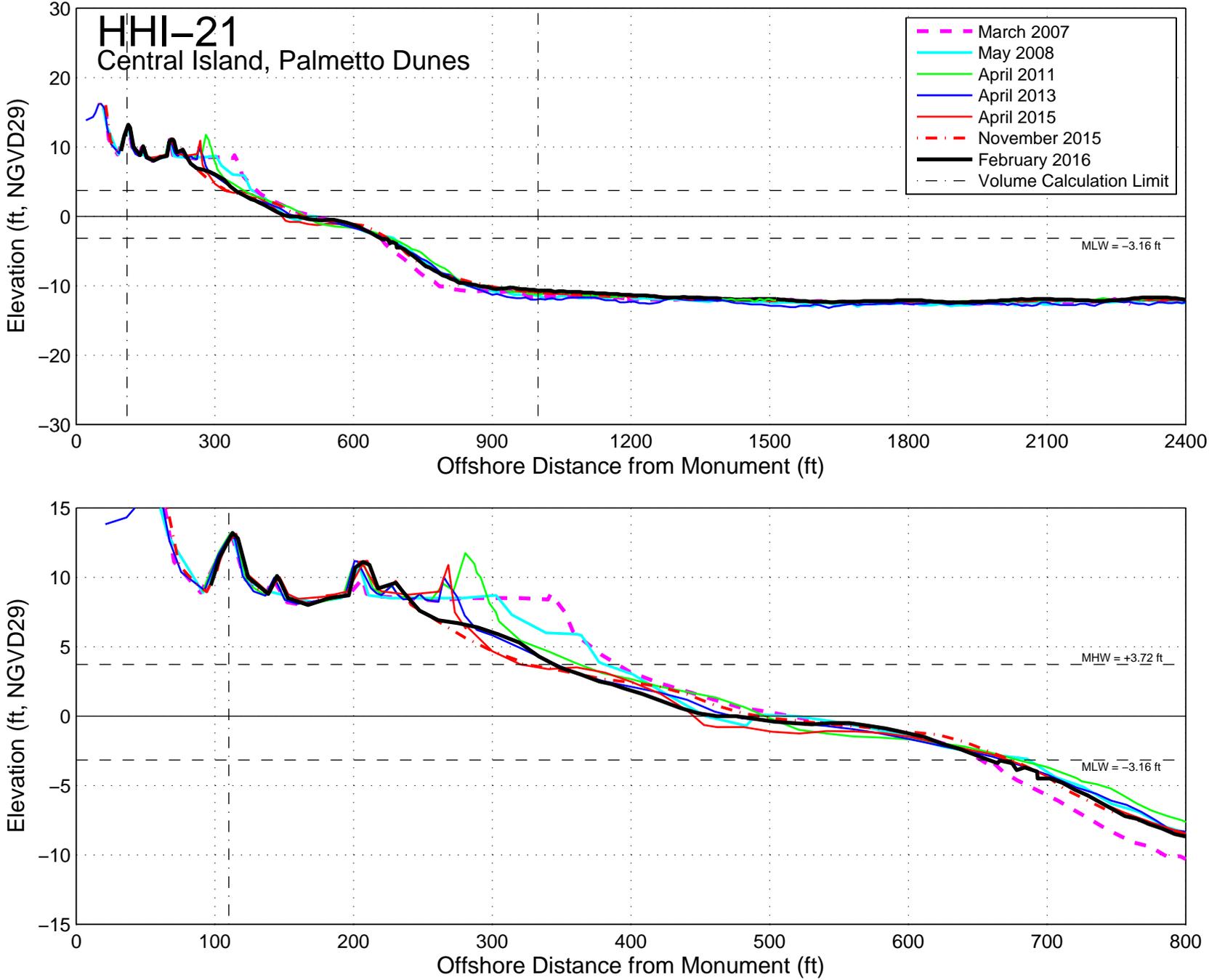


Figure A.29: Measured beach profiles at monument H12200 – Hilton Head Island, South Carolina.

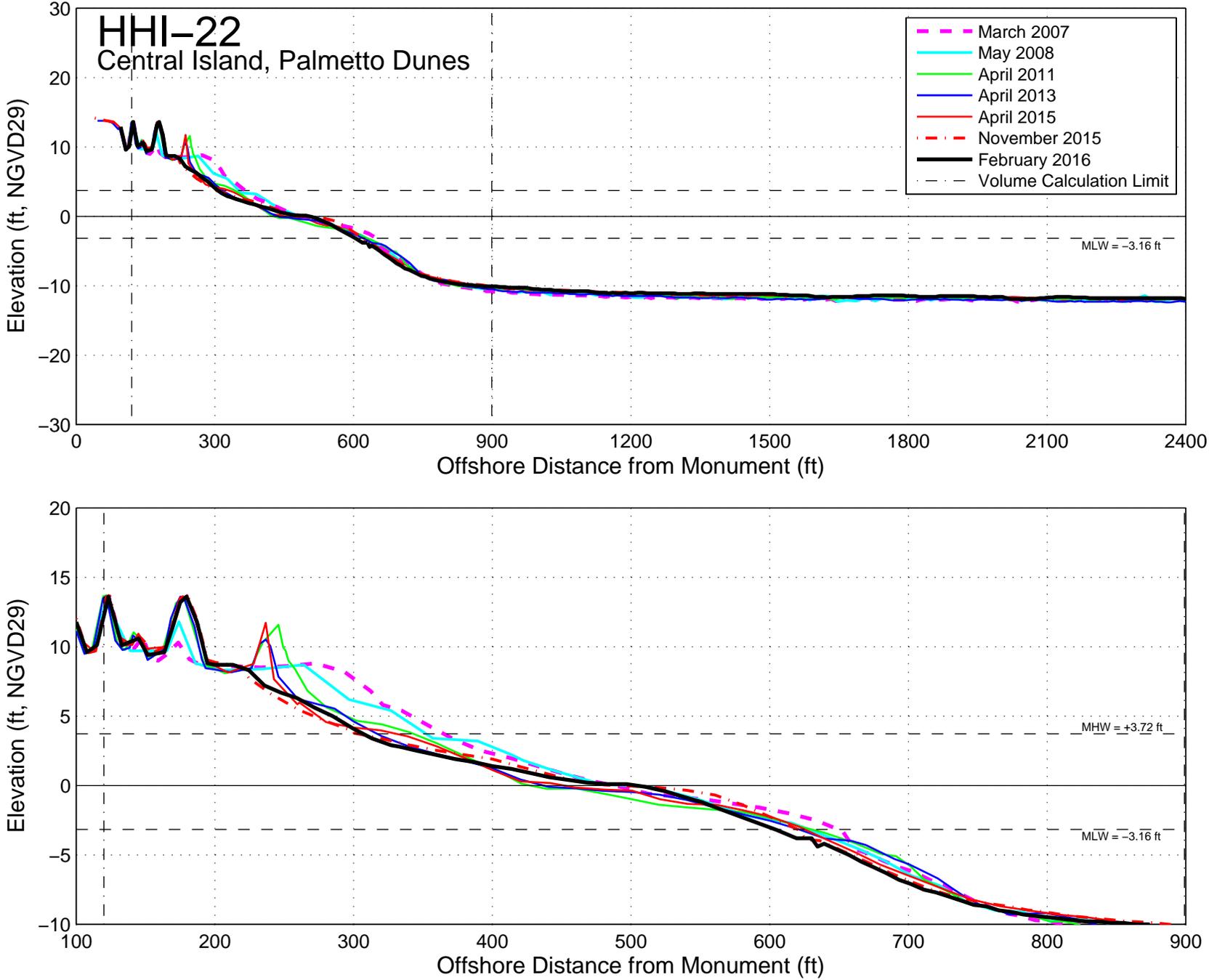


Figure A.30: Measured beach profiles at monument H12300 – Hilton Head Island, South Carolina.

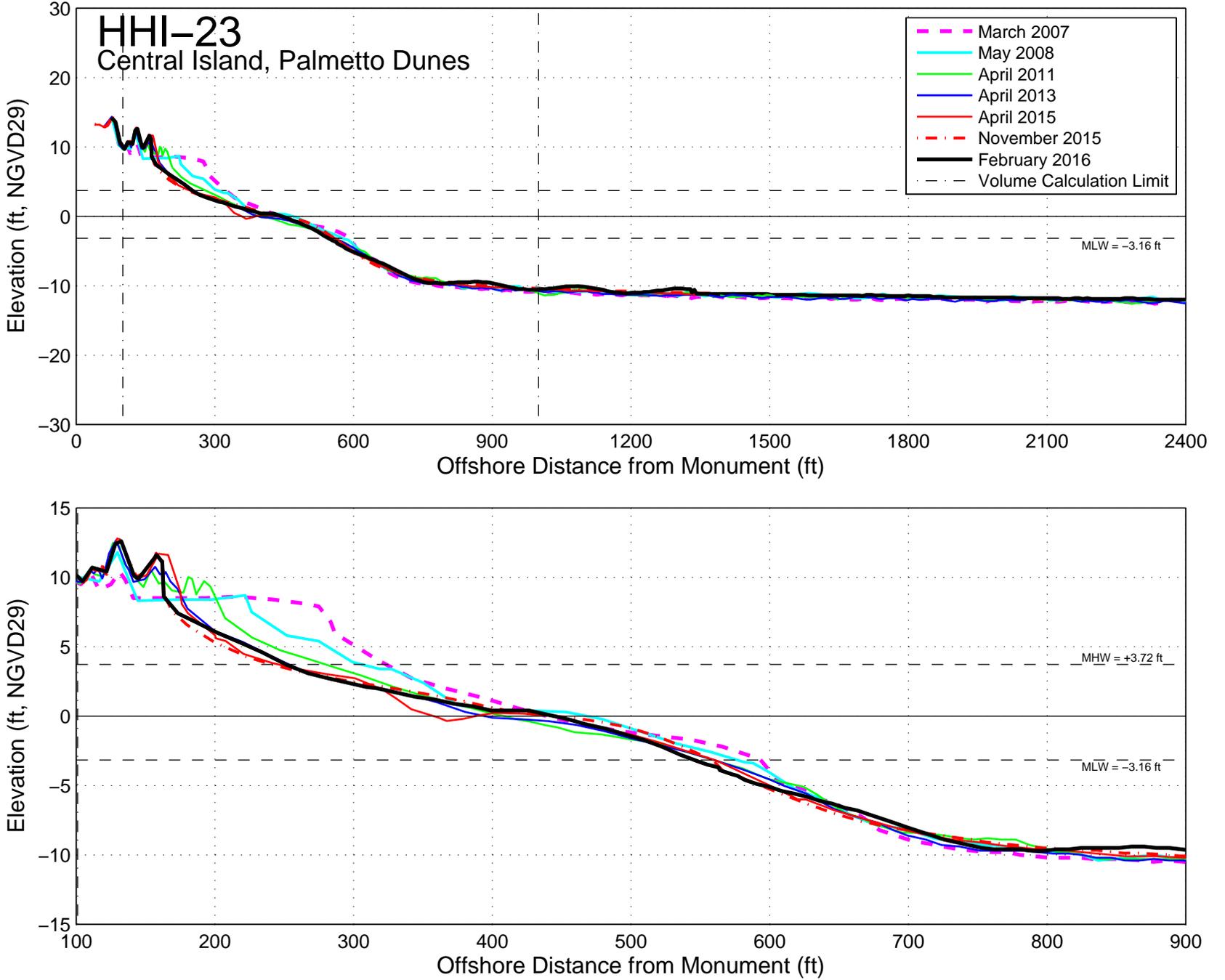


Figure A.31: Measured beach profiles at monument H12400 – Hilton Head Island, South Carolina.

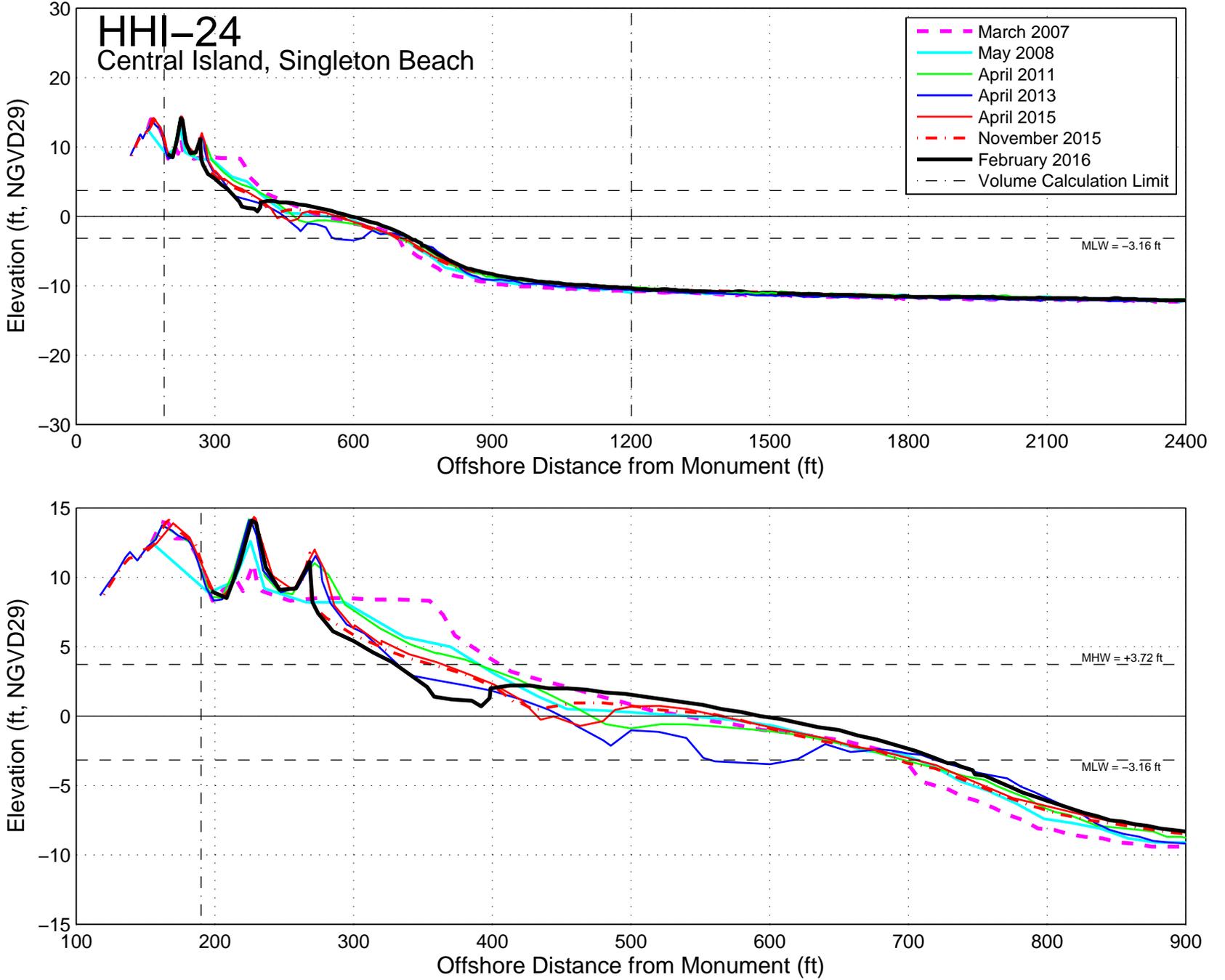


Figure A.32: Measured beach profiles at monument H12500 – Hilton Head Island, South Carolina.

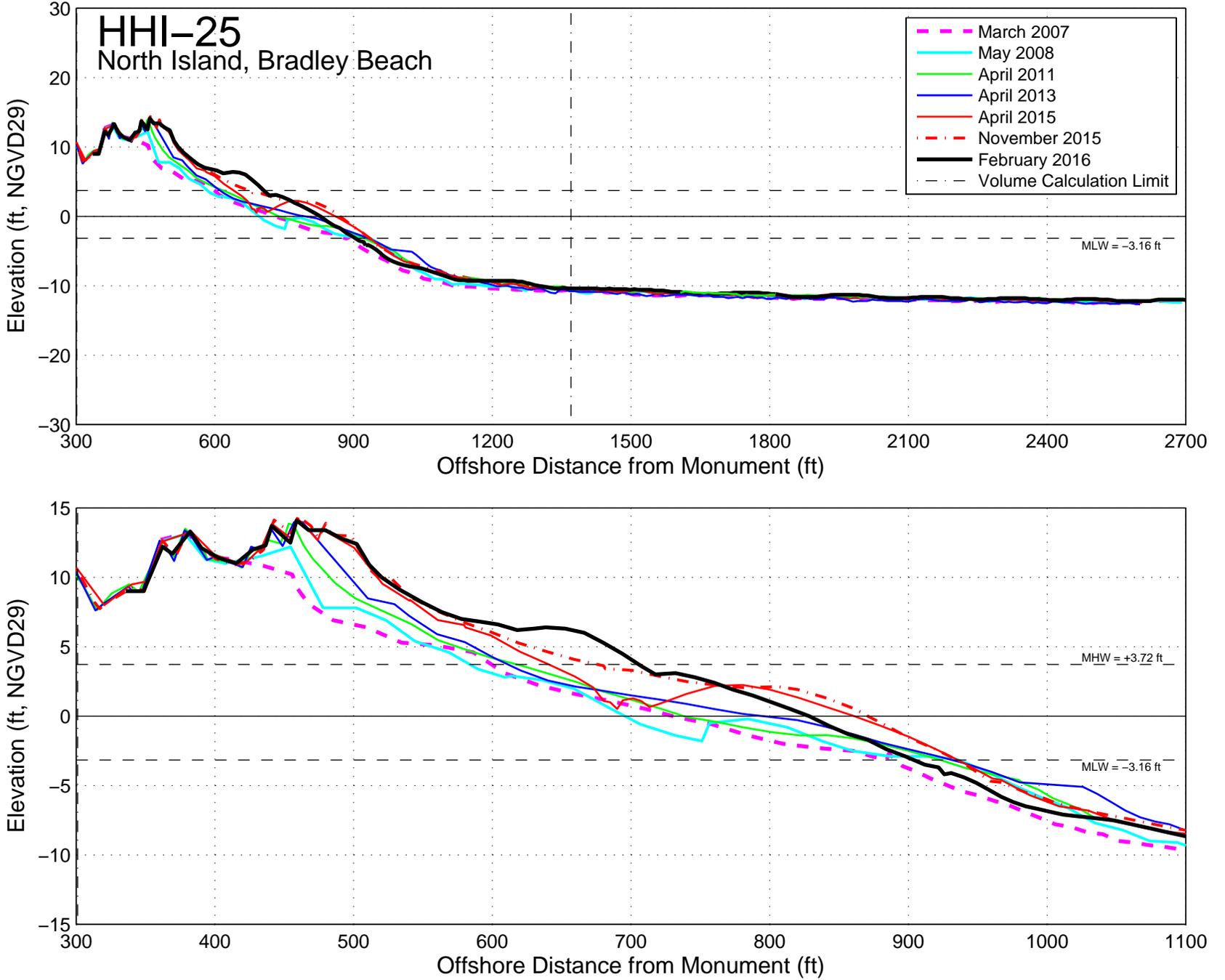


Figure A.33: Measured beach profiles at monument H12600 – Hilton Head Island, South Carolina.

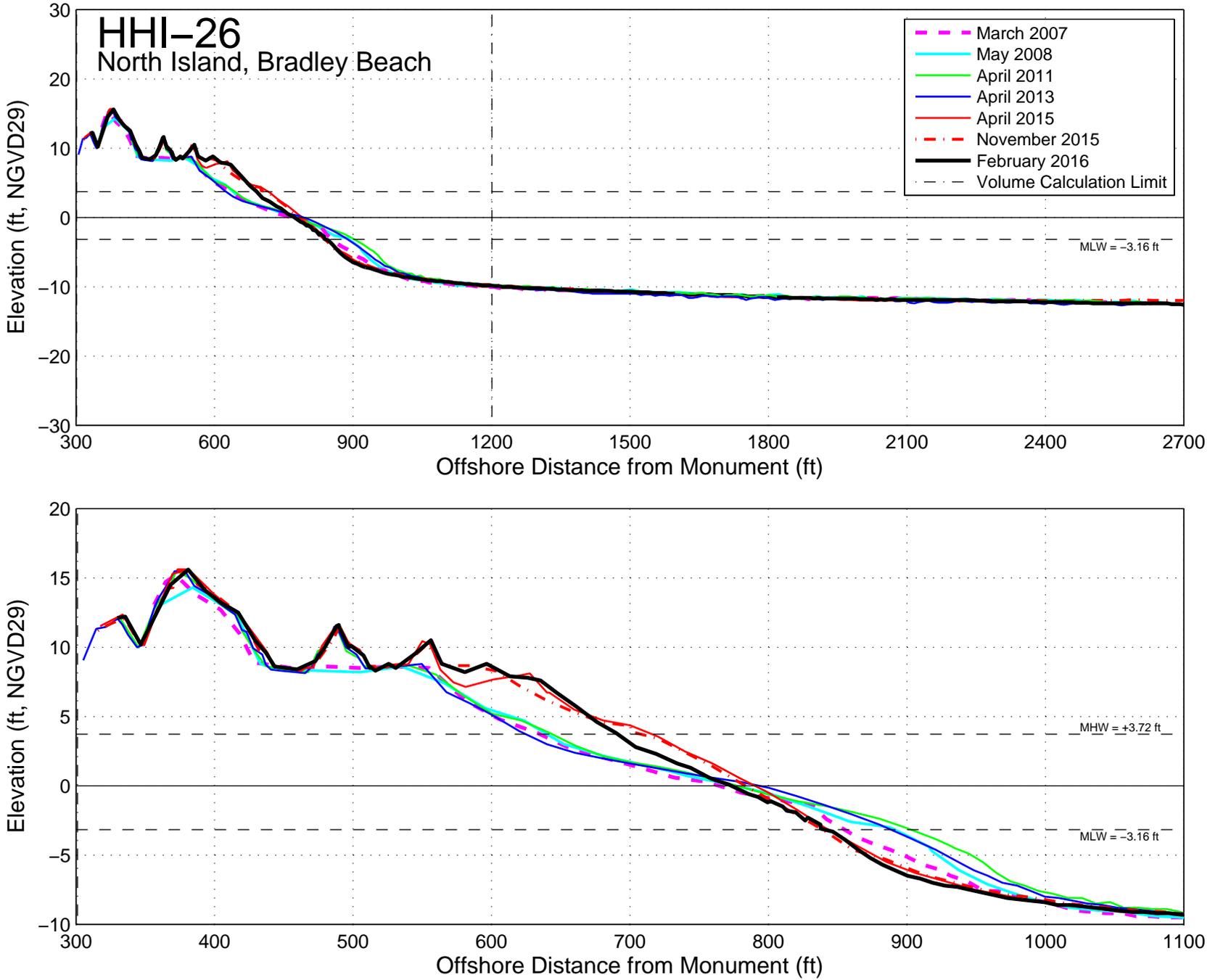


Figure A.34: Measured beach profiles at monument H12700 – Hilton Head Island, South Carolina.

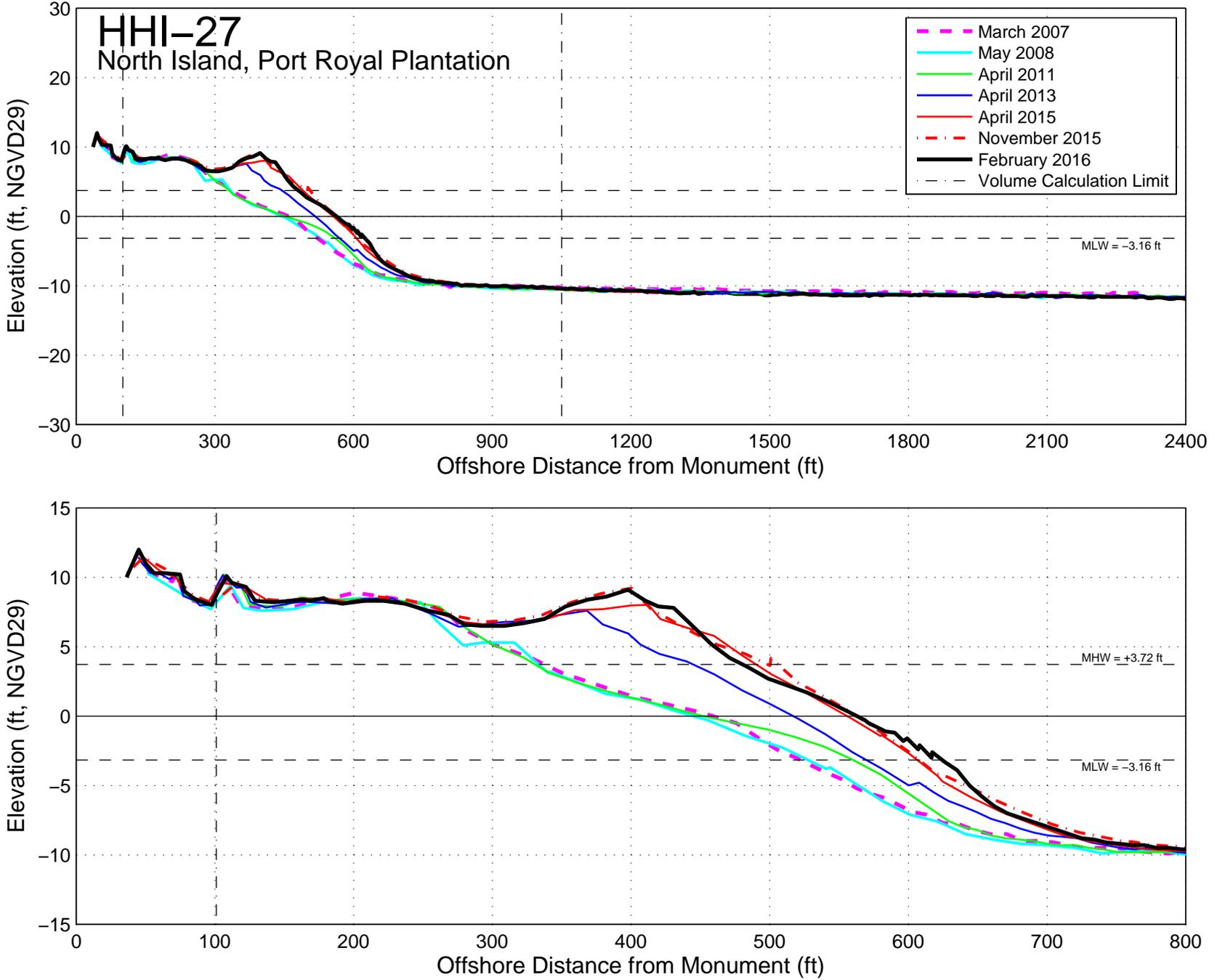


Figure A.35: Measured beach profiles at monument H127A0 – Hilton Head Island, South Carolina.

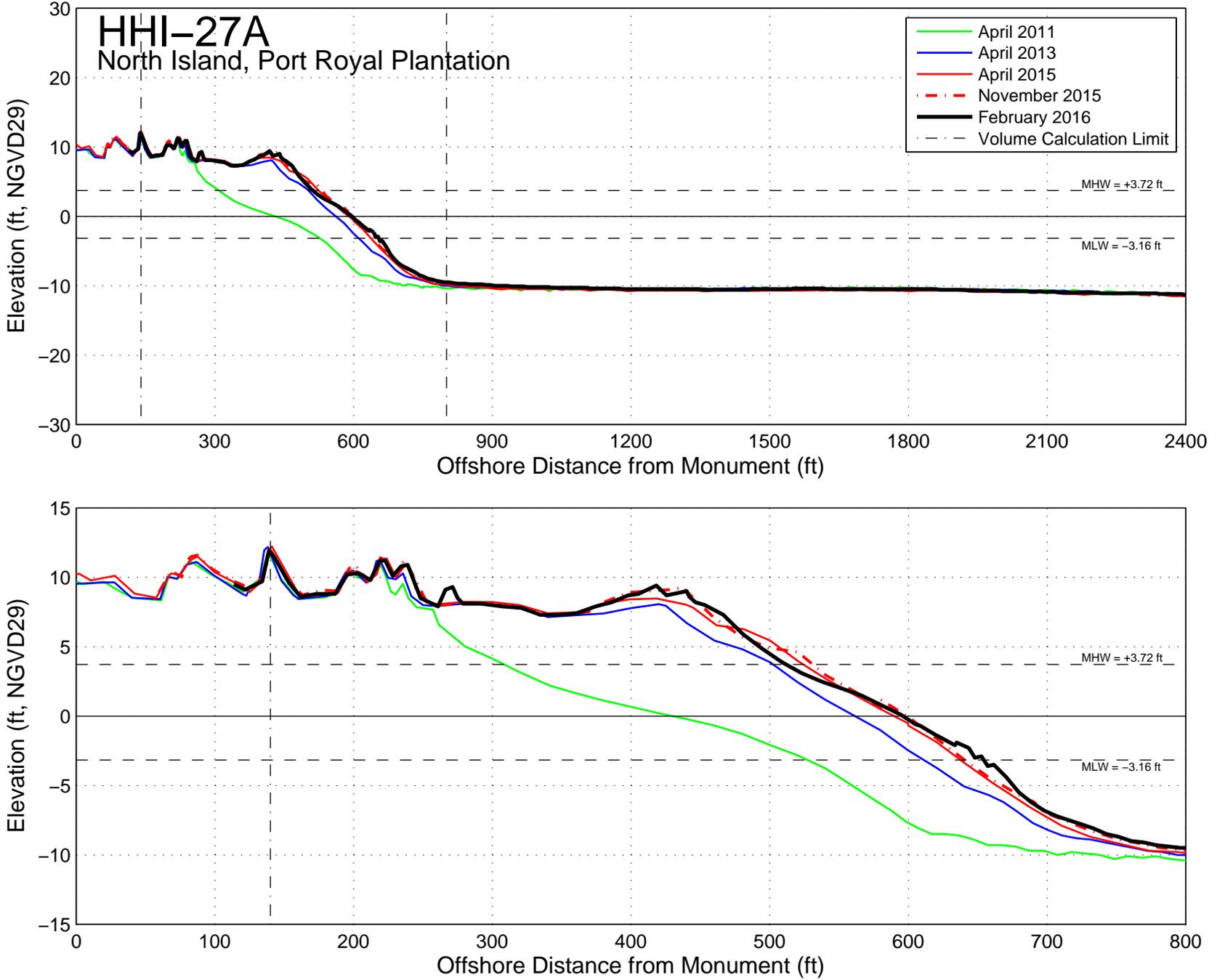


Figure A.36: Measured beach profiles at monument H127B0 – Hilton Head Island, South Carolina.

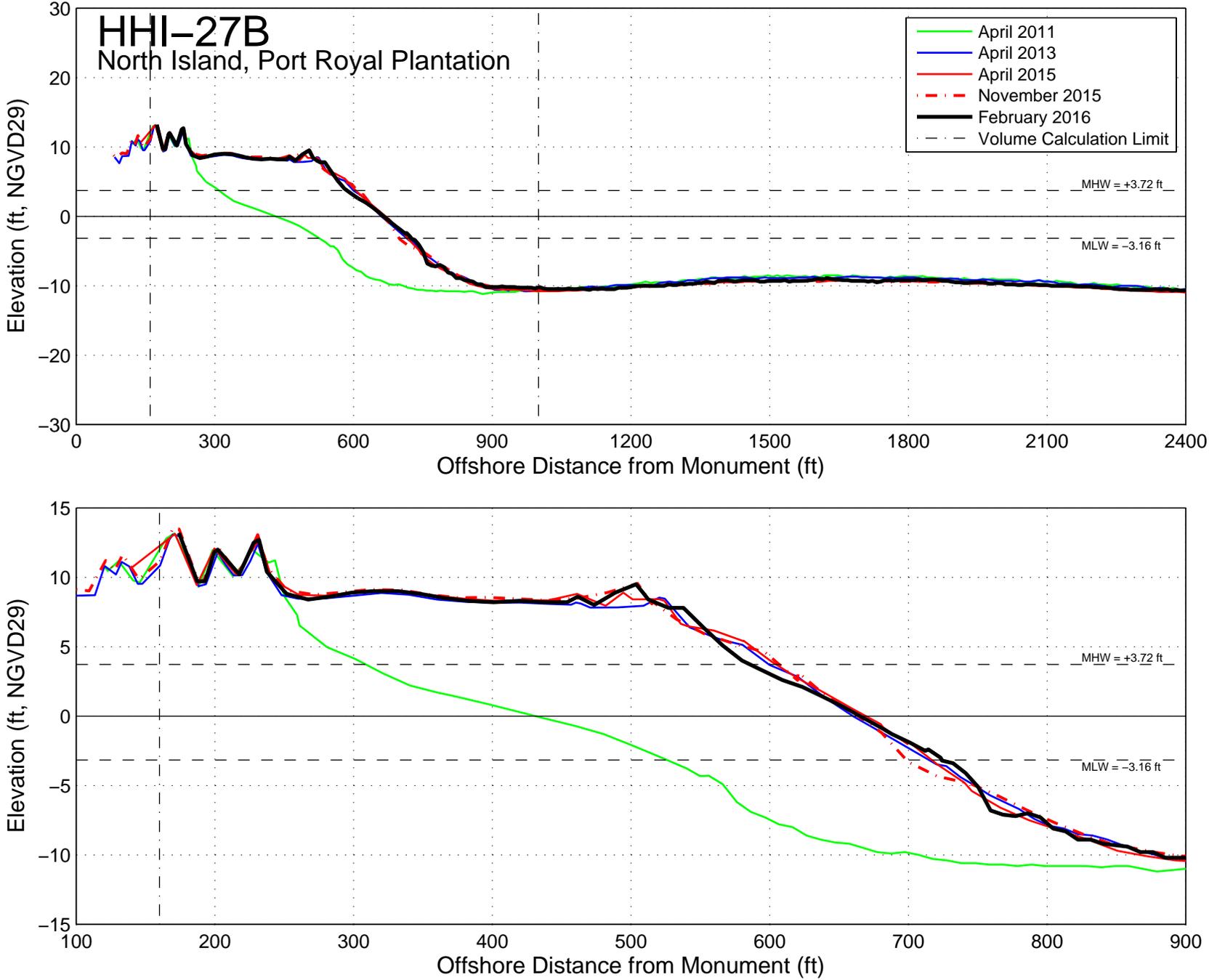


Figure A.37: Measured beach profiles at monument H12800 – Hilton Head Island, South Carolina.

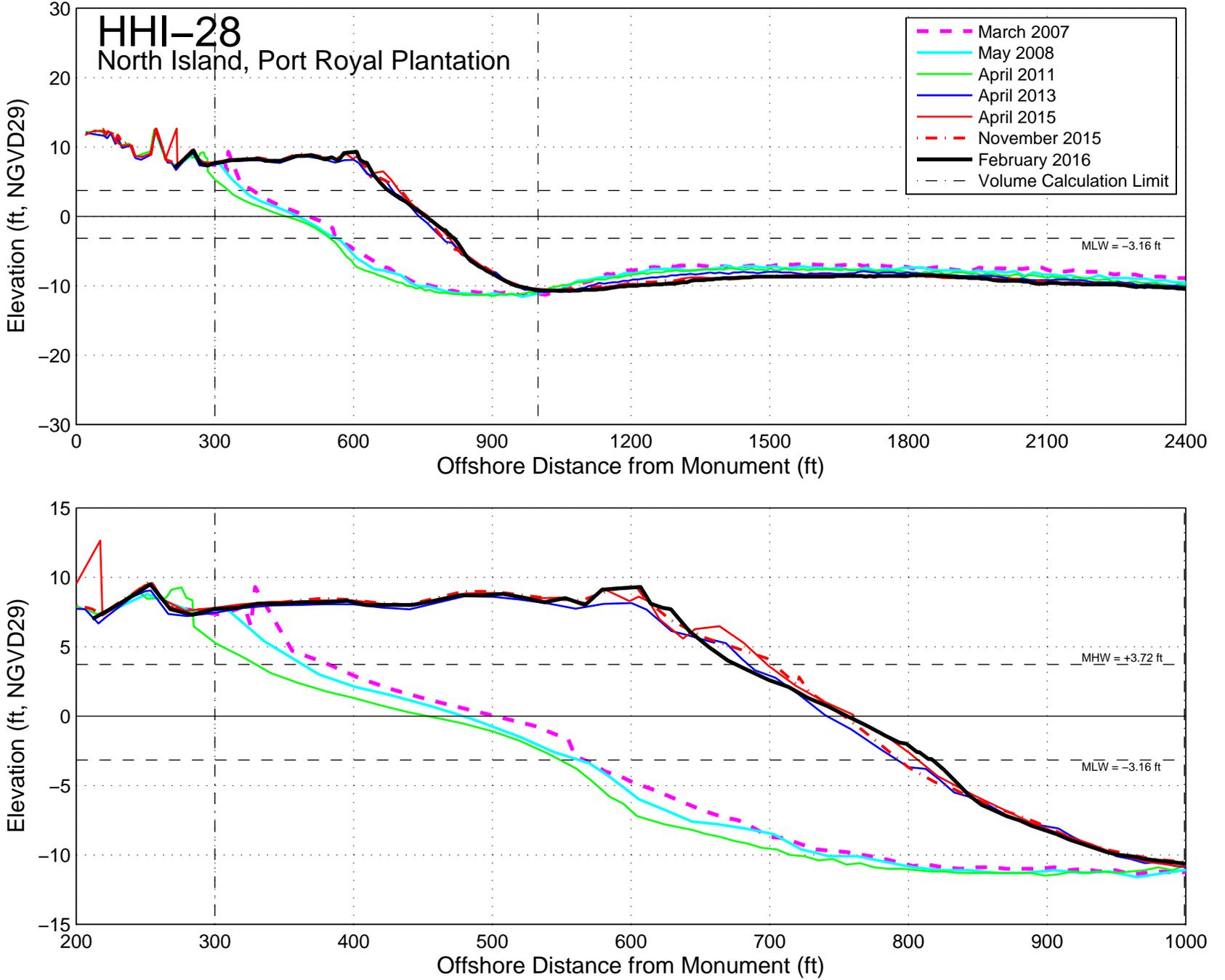


Figure A.38: Measured beach profiles at monument HHI28A0 – Hilton Head Island, South Carolina.

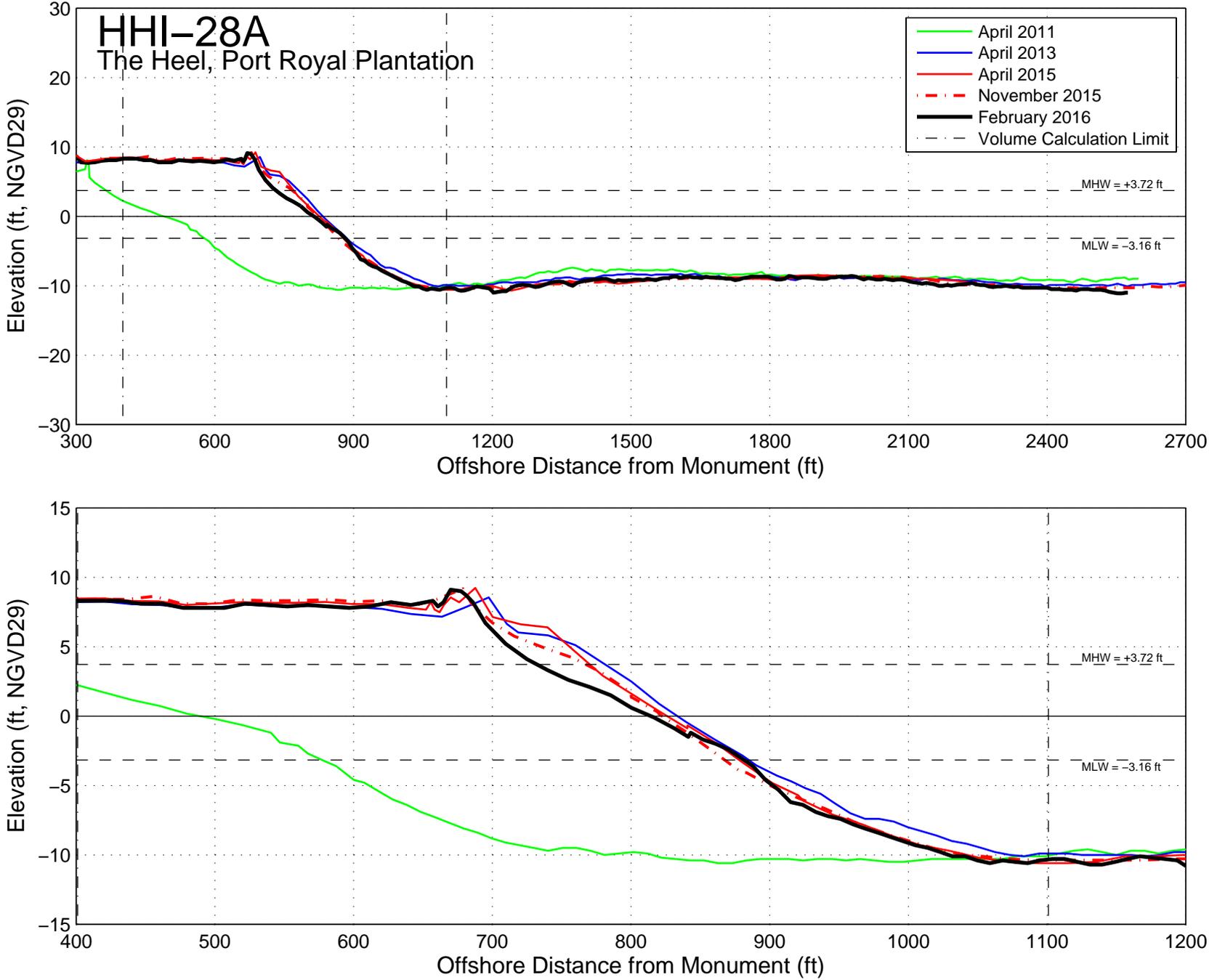


Figure A.39: Measured beach profiles at monument H128B0 – Hilton Head Island, South Carolina.

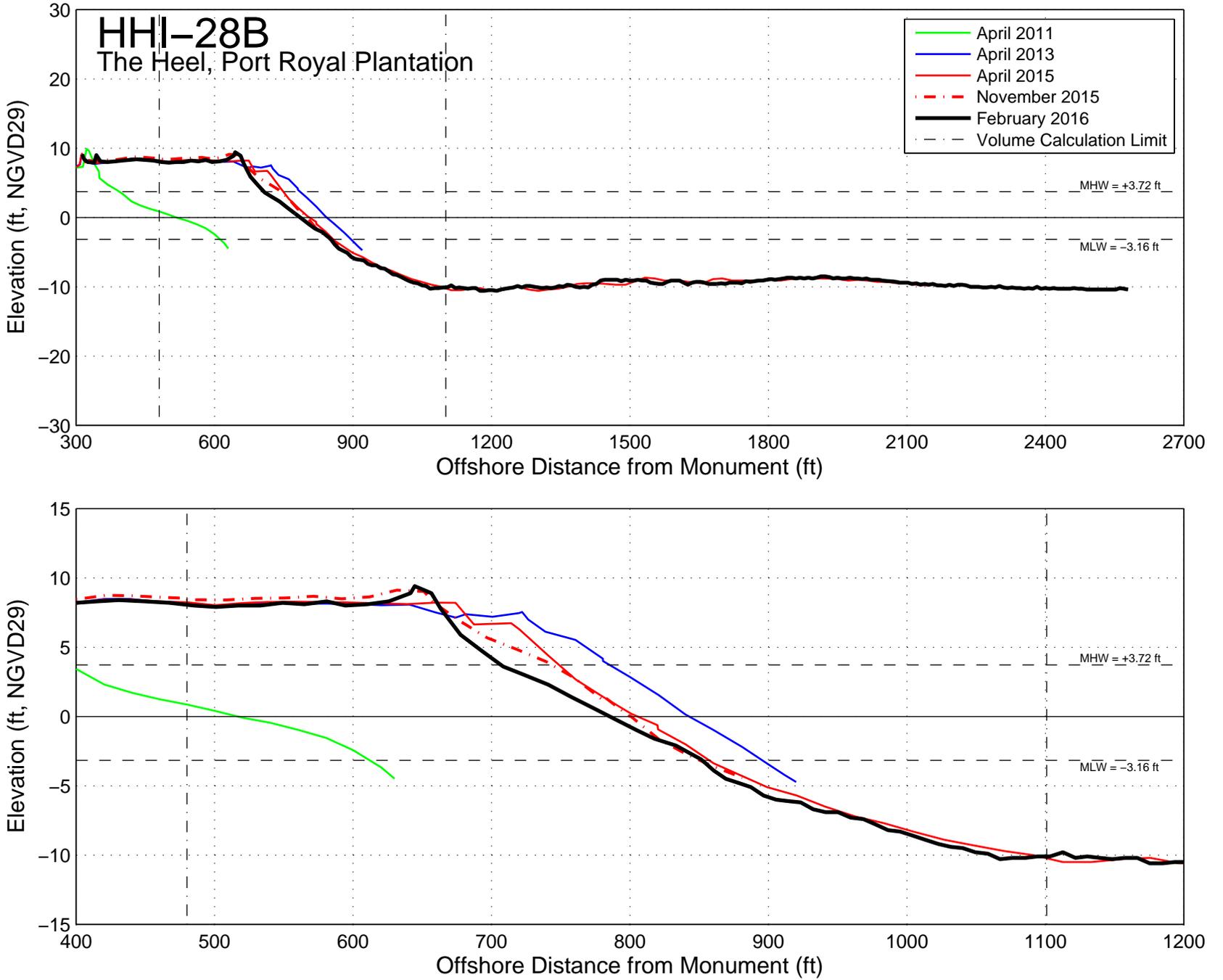


Figure A.40: Measured beach profiles at monument H128C0 – Hilton Head Island, South Carolina.

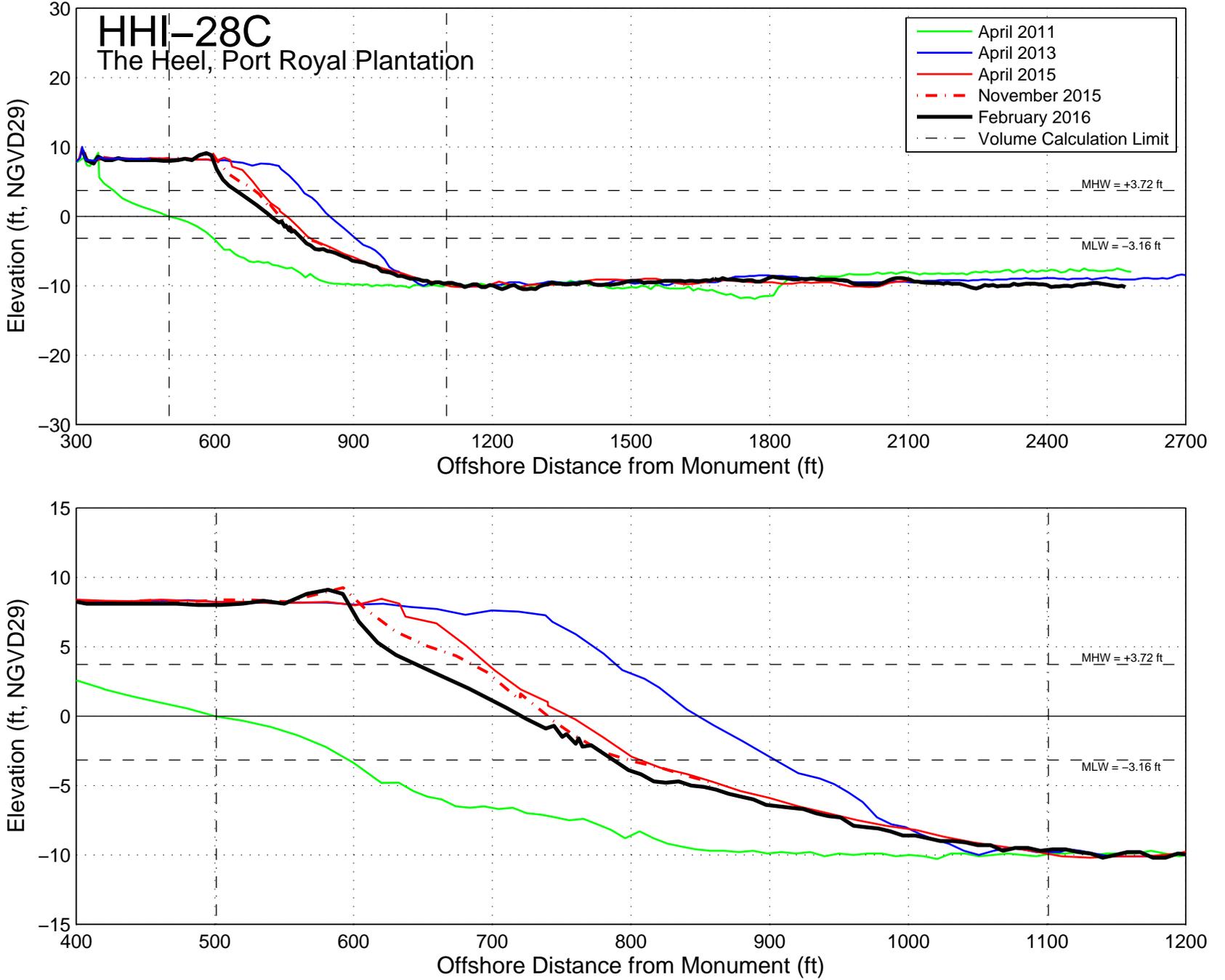


Figure A.41: Measured beach profiles at monument H128D0 – Hilton Head Island, South Carolina.

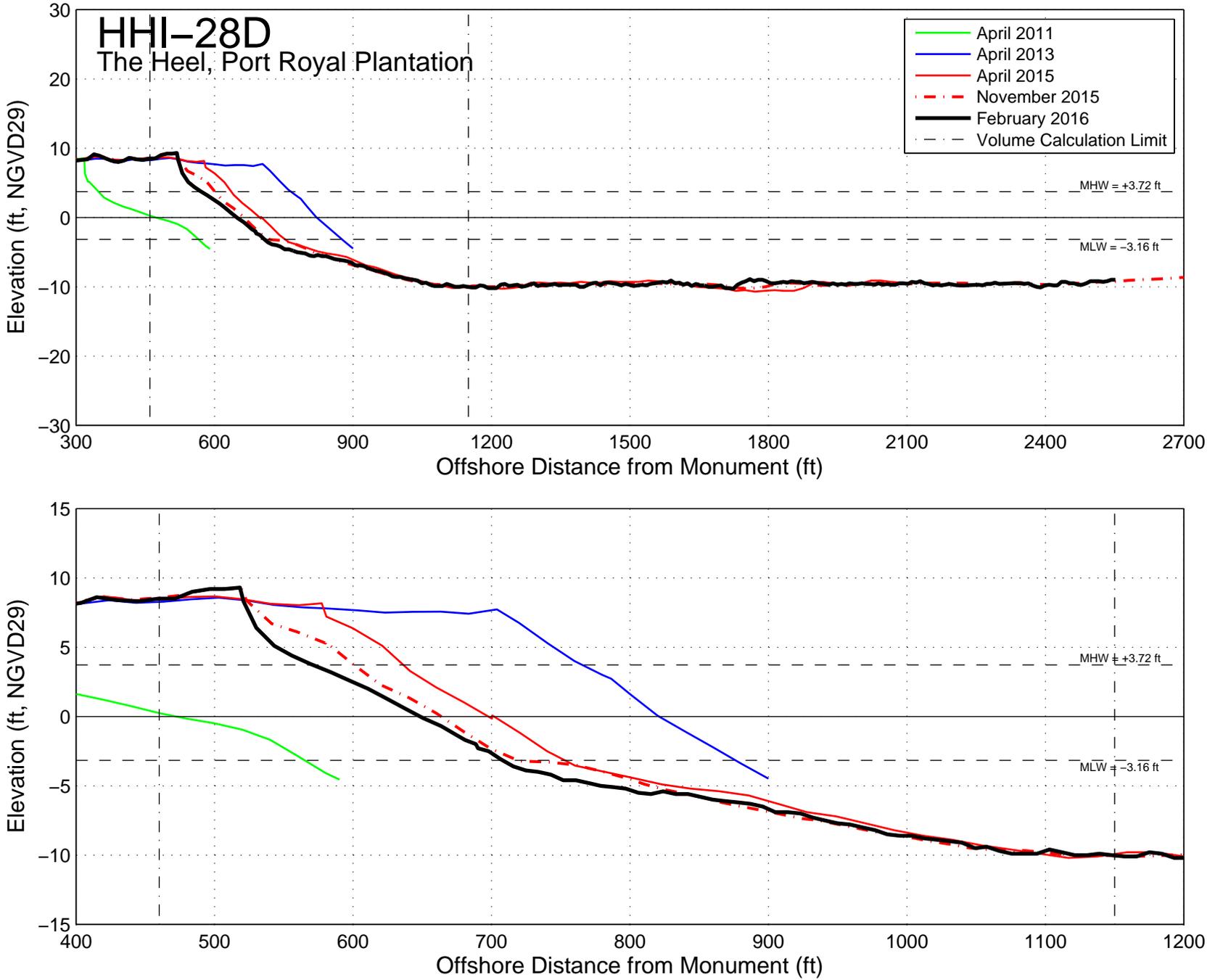


Figure A.42: Measured beach profiles at monument H12900 – Hilton Head Island, South Carolina.

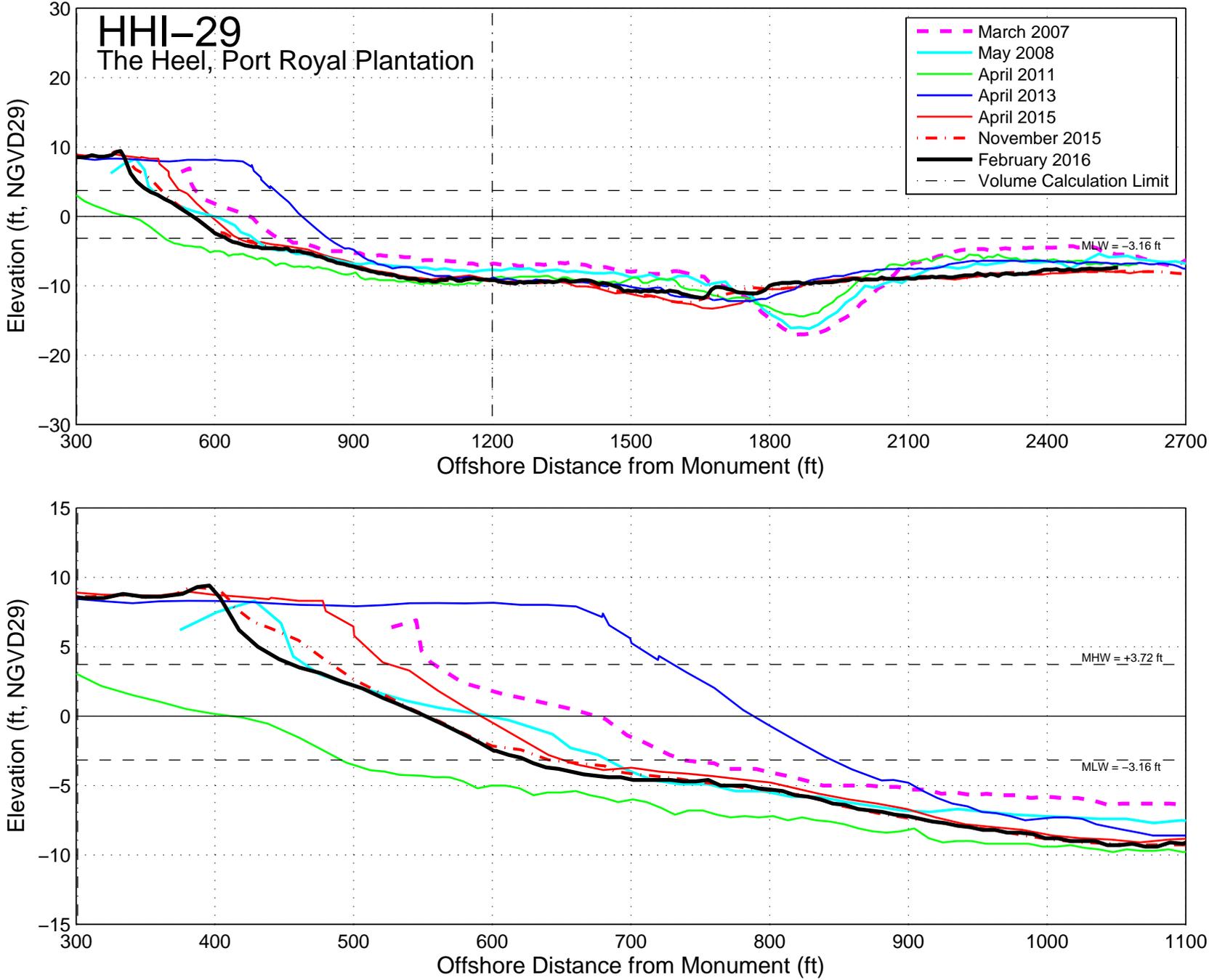


Figure A.43: Measured beach profiles at monument H129A1 – Hilton Head Island, South Carolina.

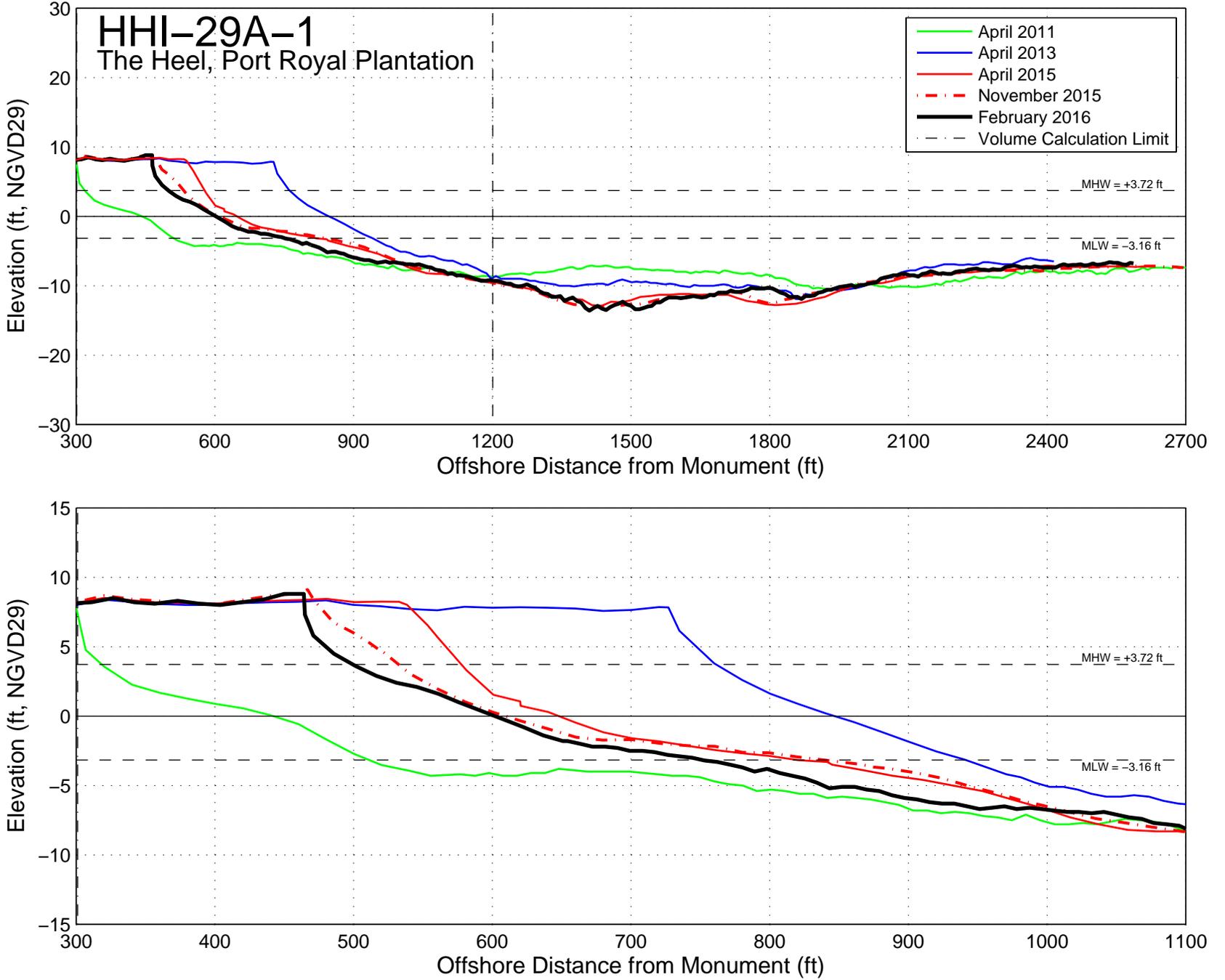


Figure A.44: Measured beach profiles at monument H129A2 – Hilton Head Island, South Carolina.

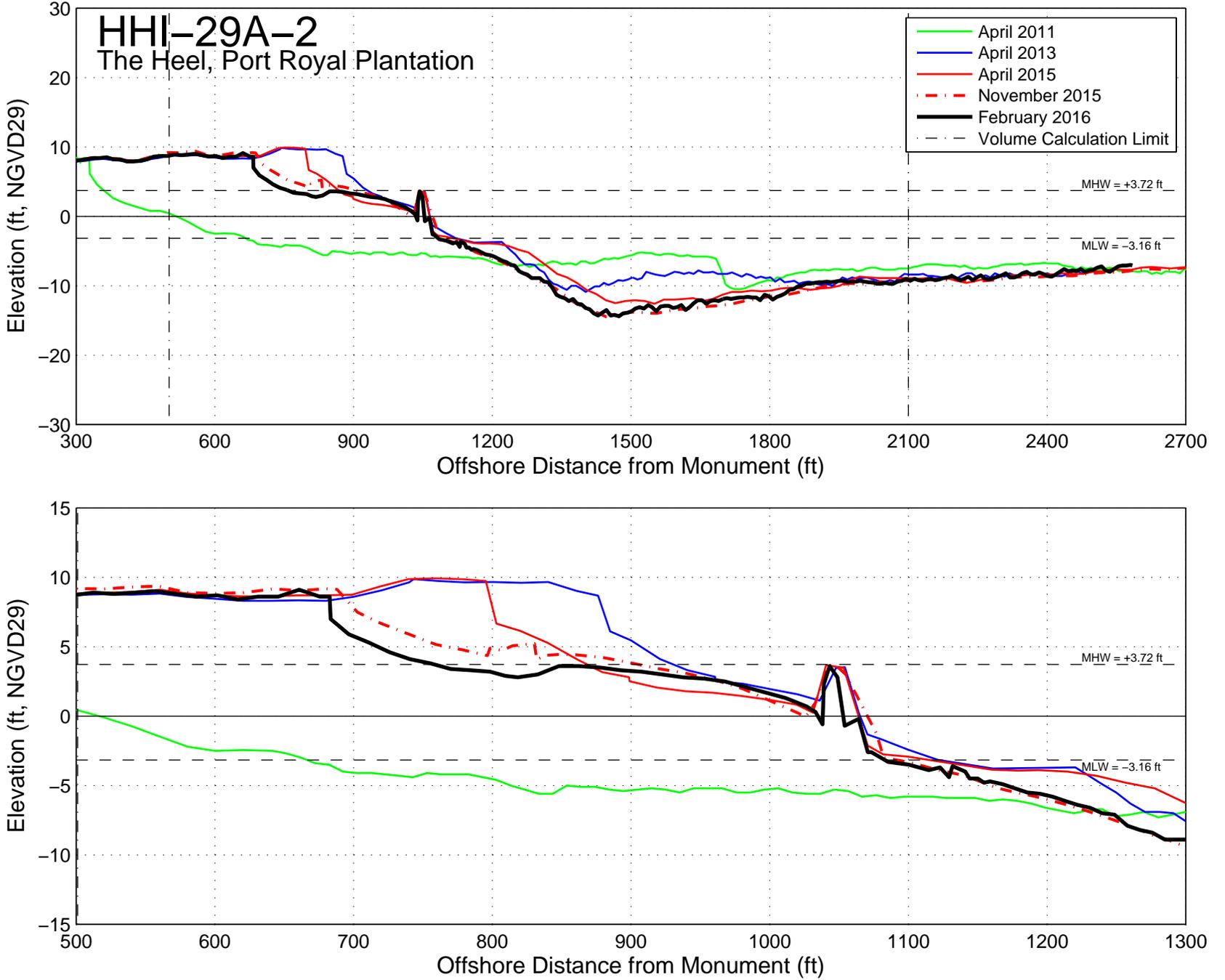


Figure A.45: Measured beach profiles at monument H129A3 – Hilton Head Island, South Carolina.

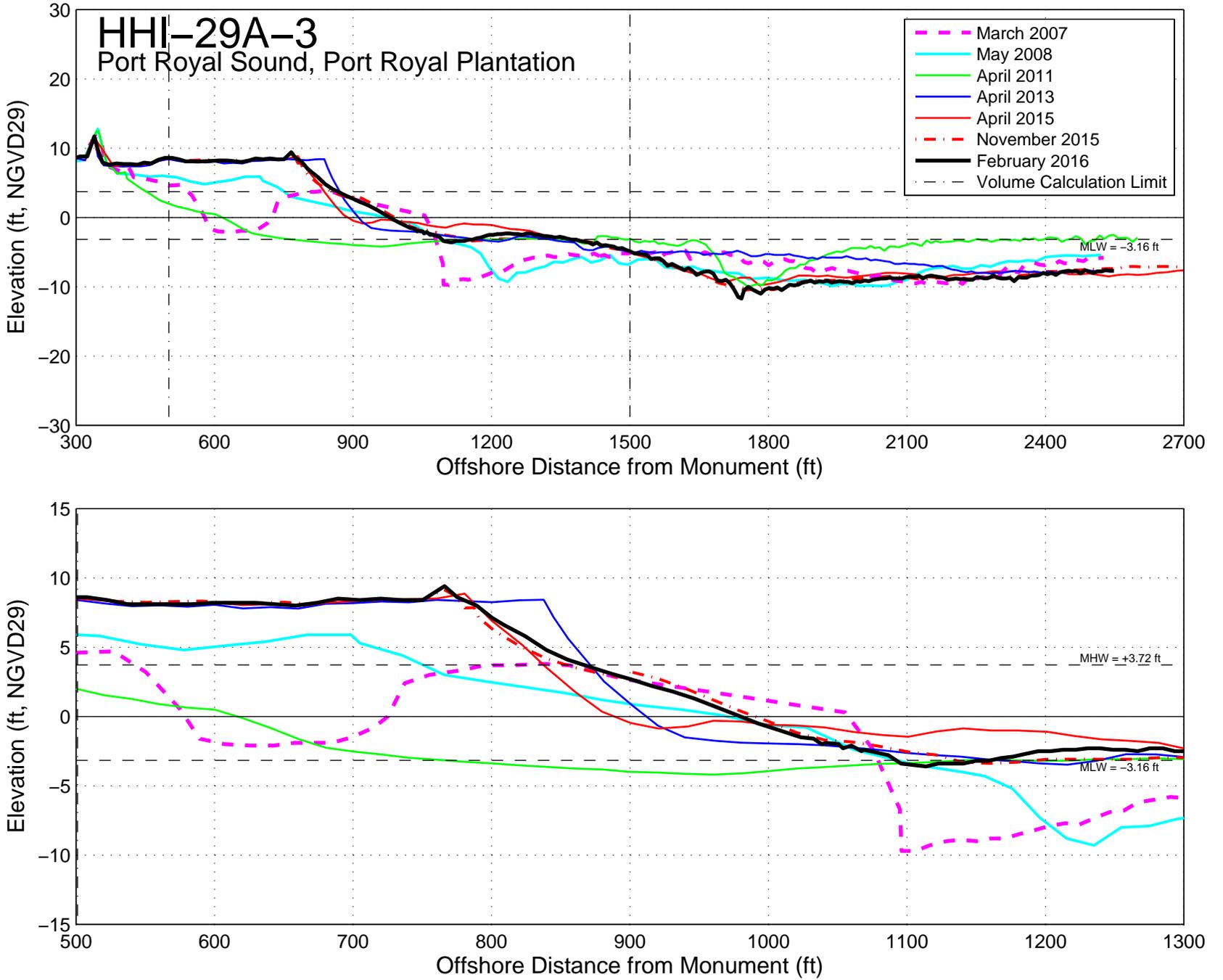


Figure A.46: Measured beach profiles at monument H129B0 – Hilton Head Island, South Carolina.

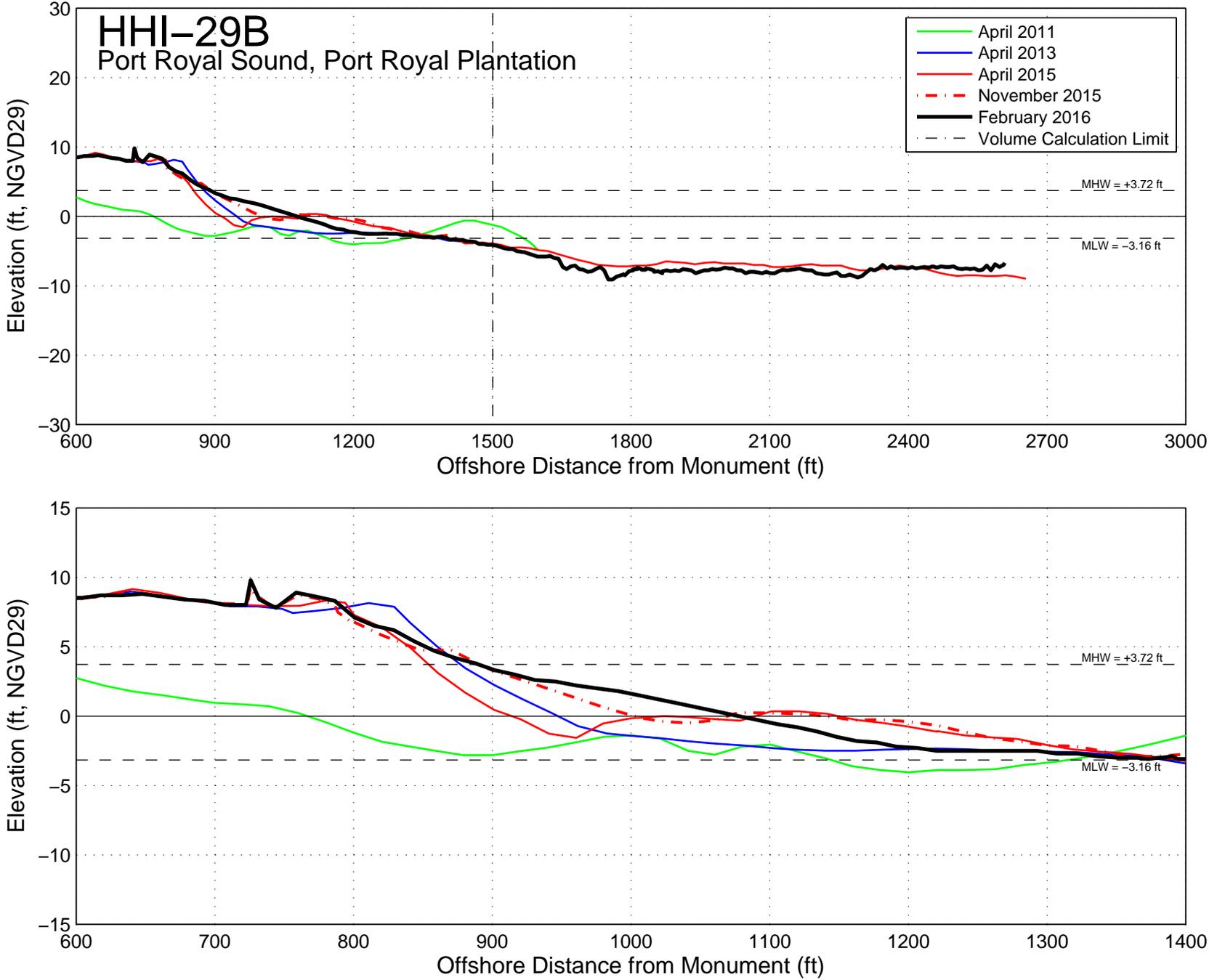


Figure A.47: Measured beach profiles at monument H129C0 – Hilton Head Island, South Carolina.

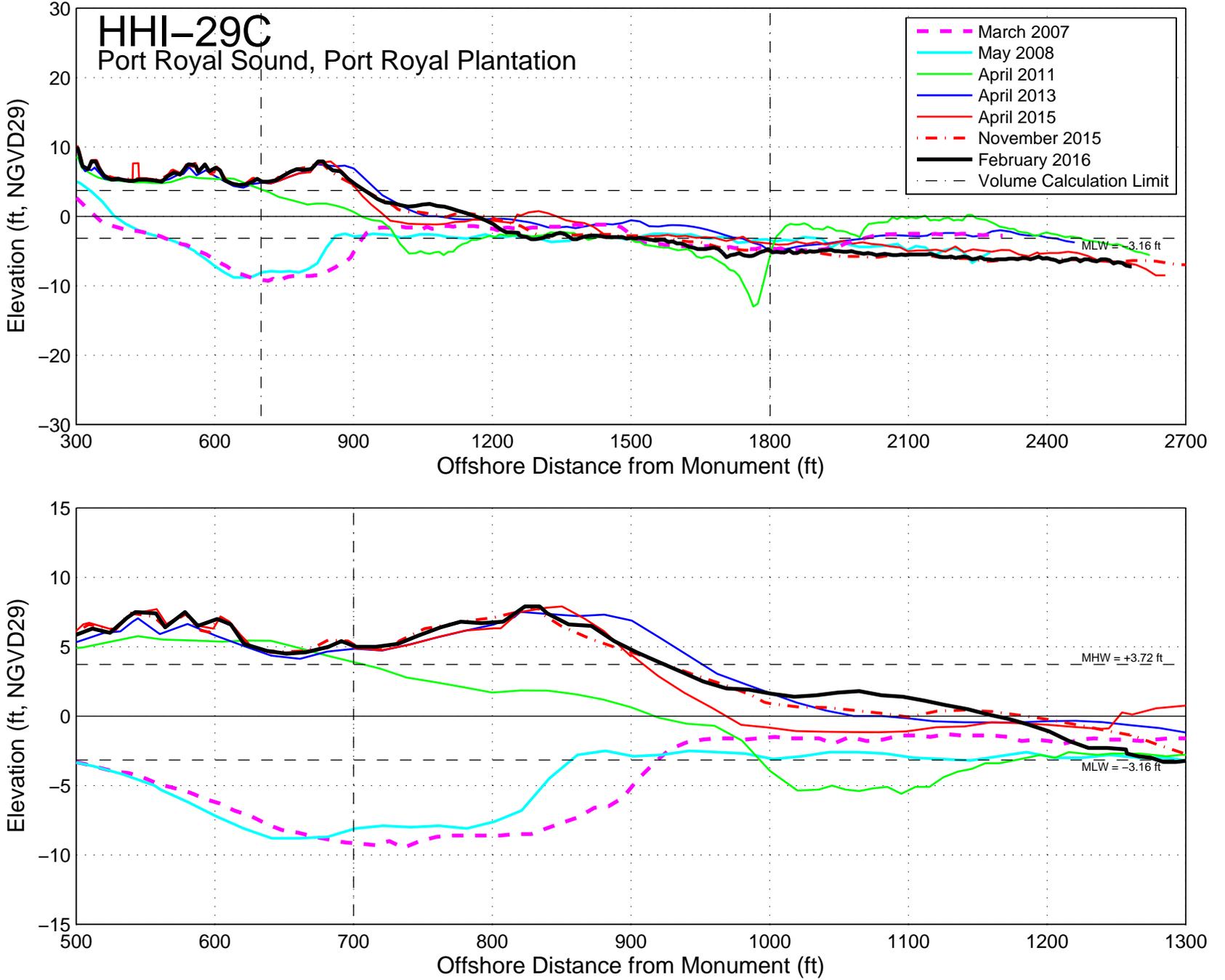


Figure A.48: Measured beach profiles at monument H129D0 – Hilton Head Island, South Carolina.

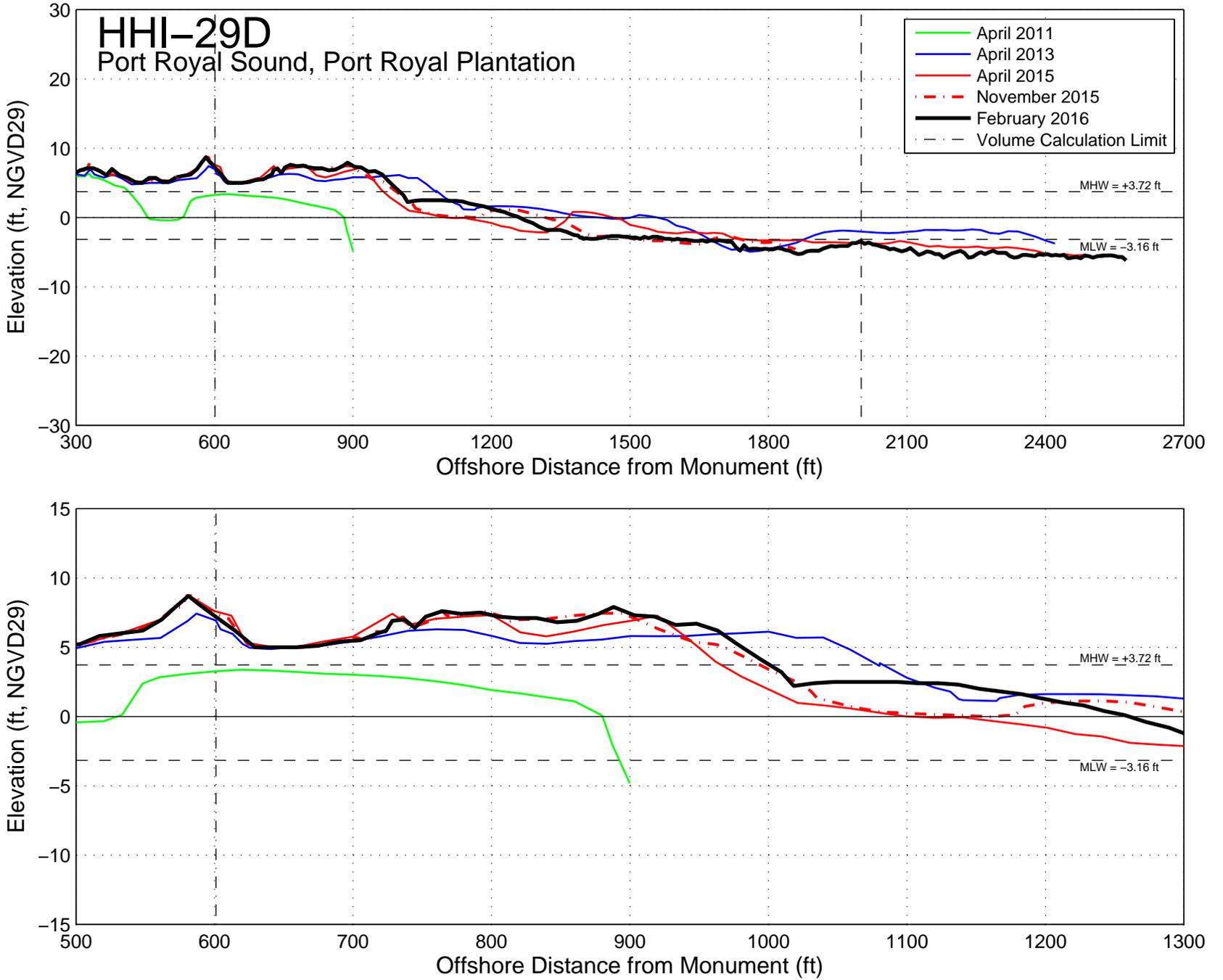


Figure A.49: Measured beach profiles at monument HHI29E0 – Hilton Head Island, South Carolina.

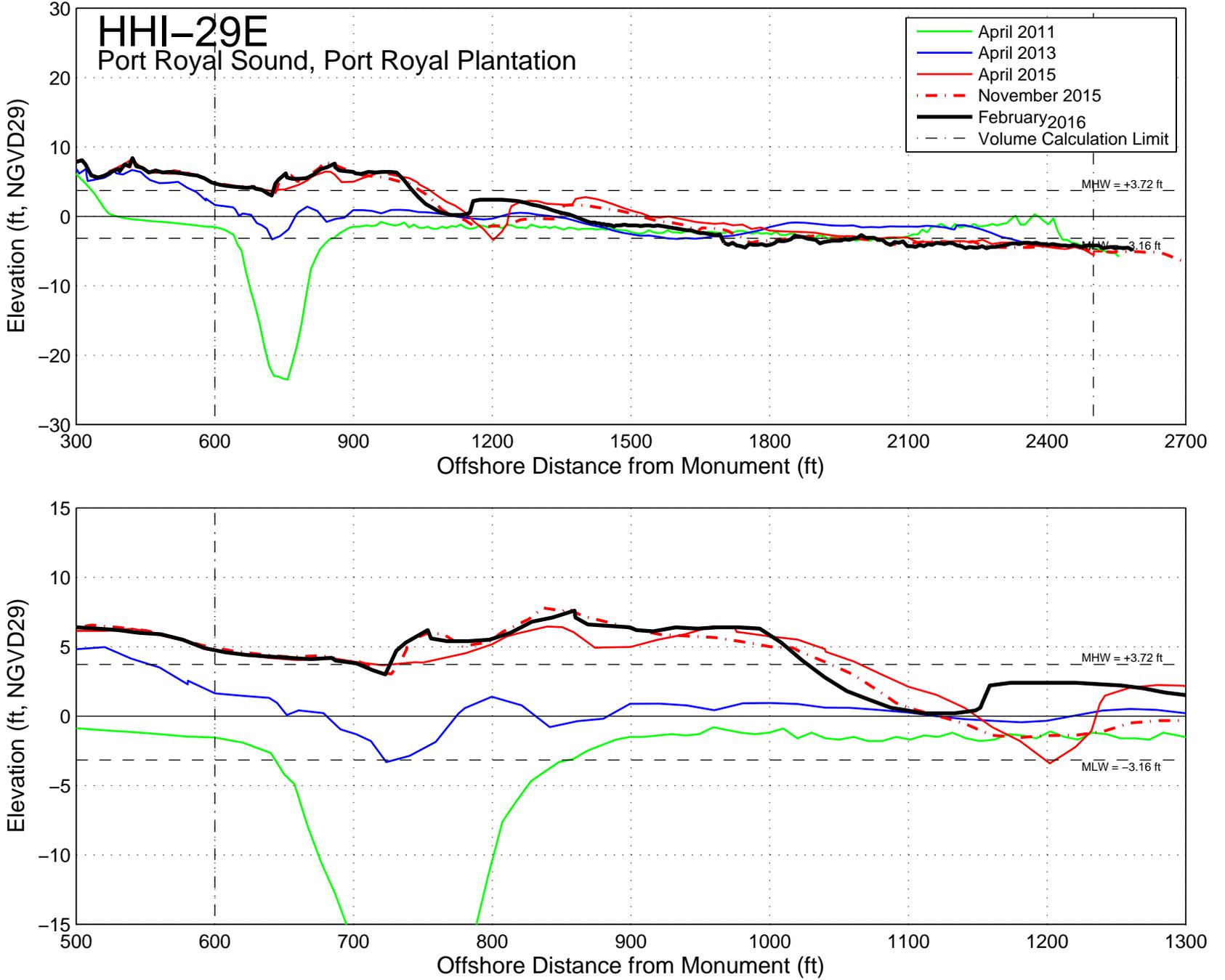


Figure A.50: Measured beach profiles at monument H129F0 – Hilton Head Island, South Carolina.

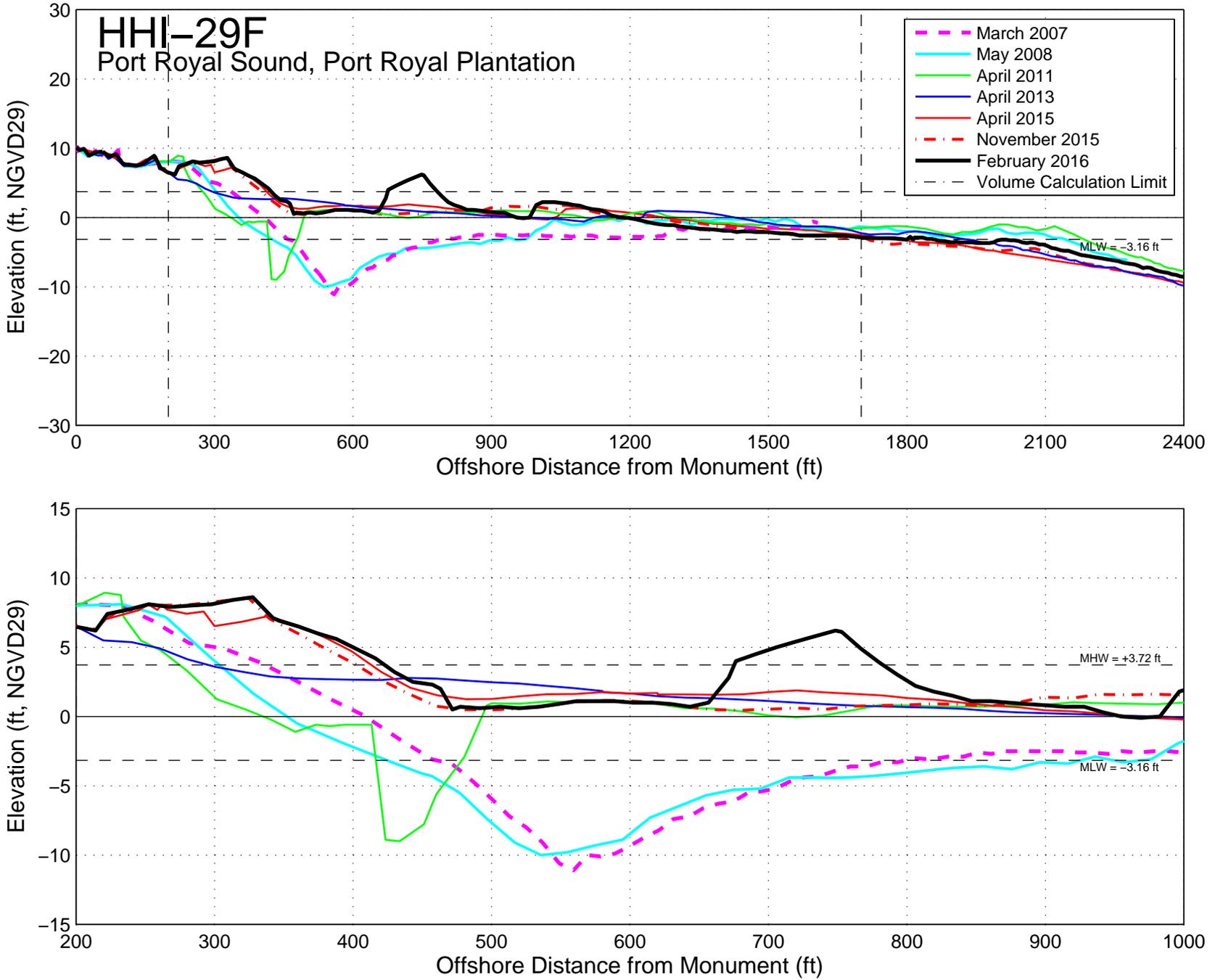


Figure A.51: Measured beach profiles at monument H13000 – Hilton Head Island, South Carolina.

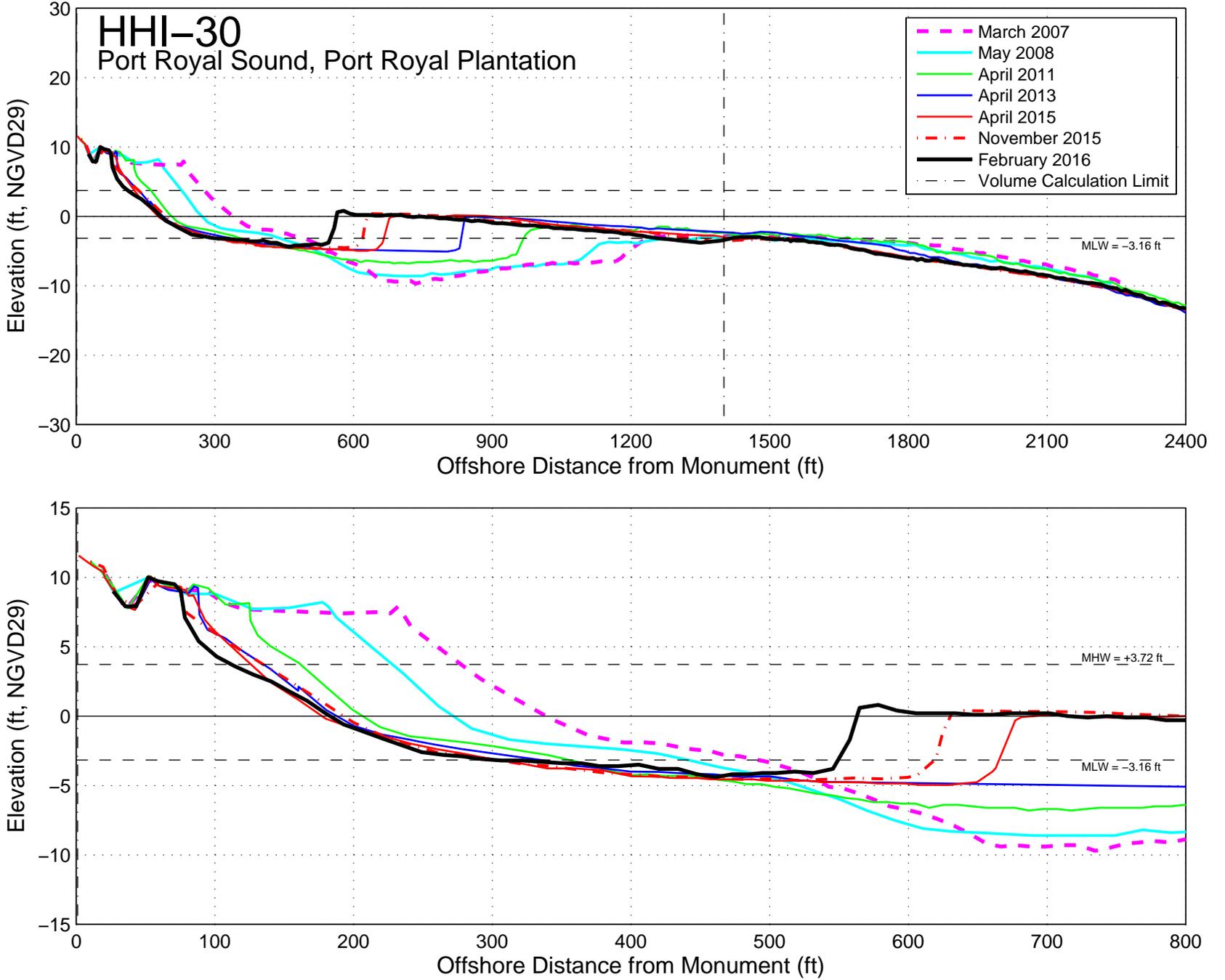


Figure A.52: Measured beach profiles at monument H130A0 – Hilton Head Island, South Carolina.

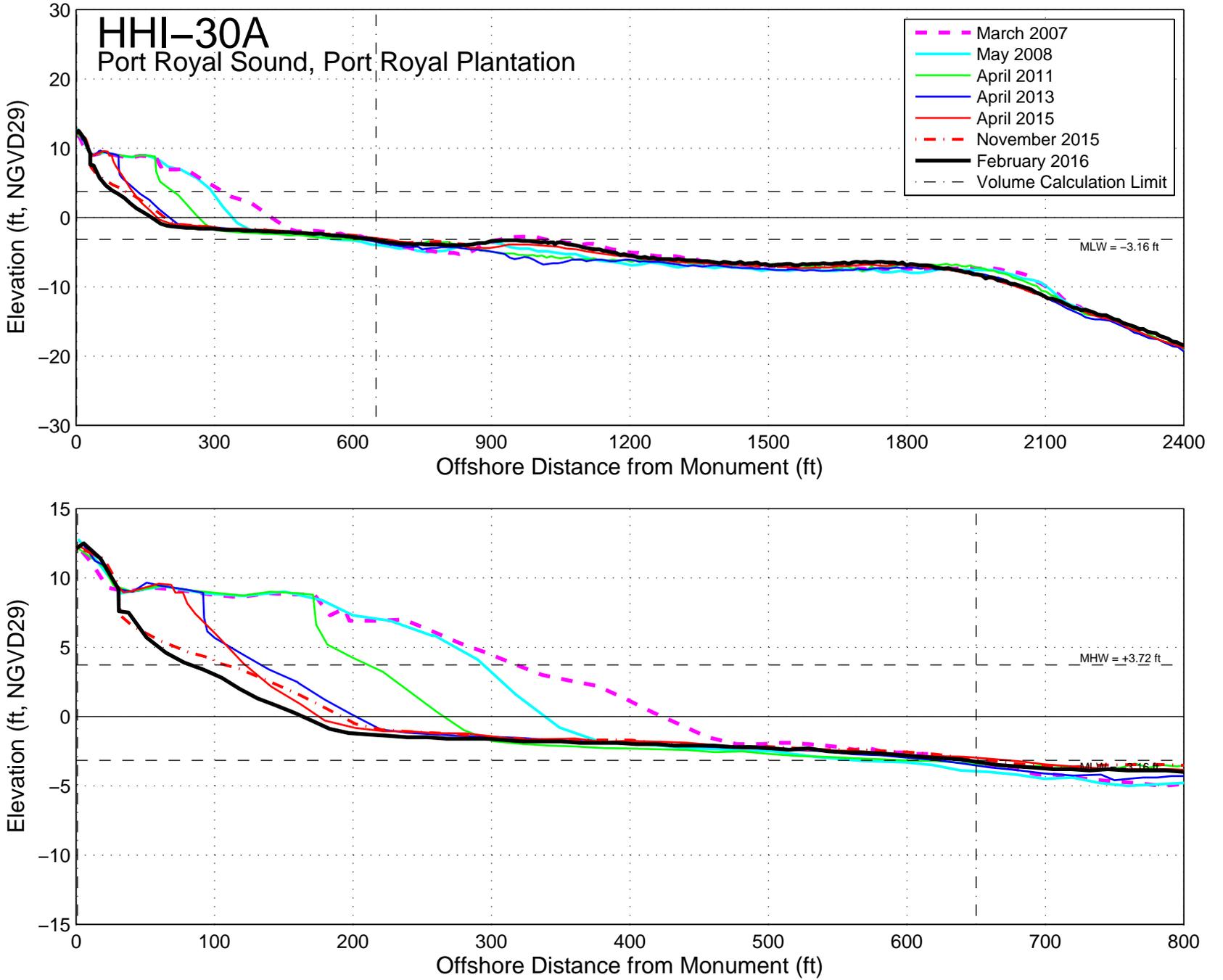


Figure A.53: Measured beach profiles at monument H13100 – Hilton Head Island, South Carolina.

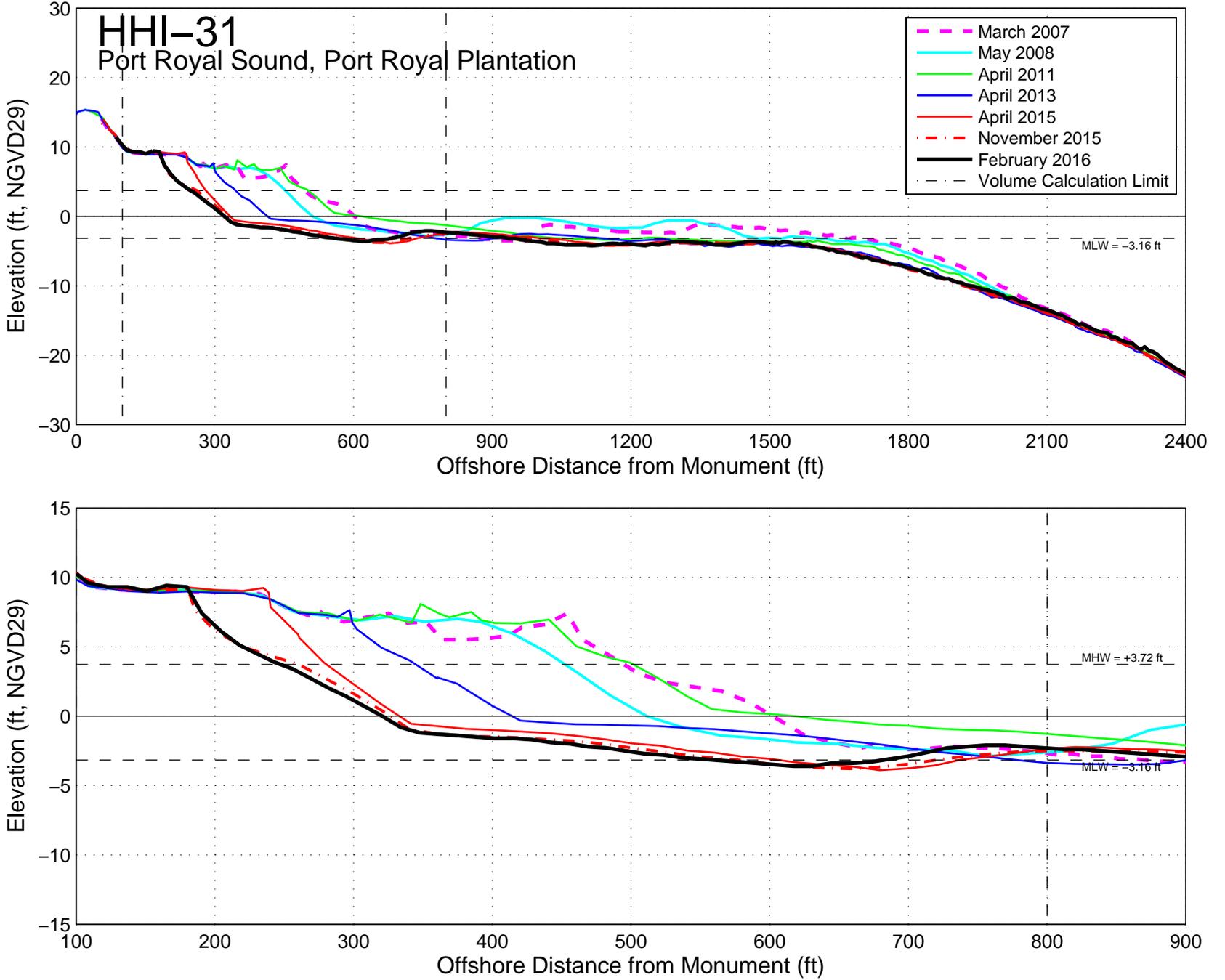


Figure A.54: Measured beach profiles at monument H131A0 – Hilton Head Island, South Carolina.

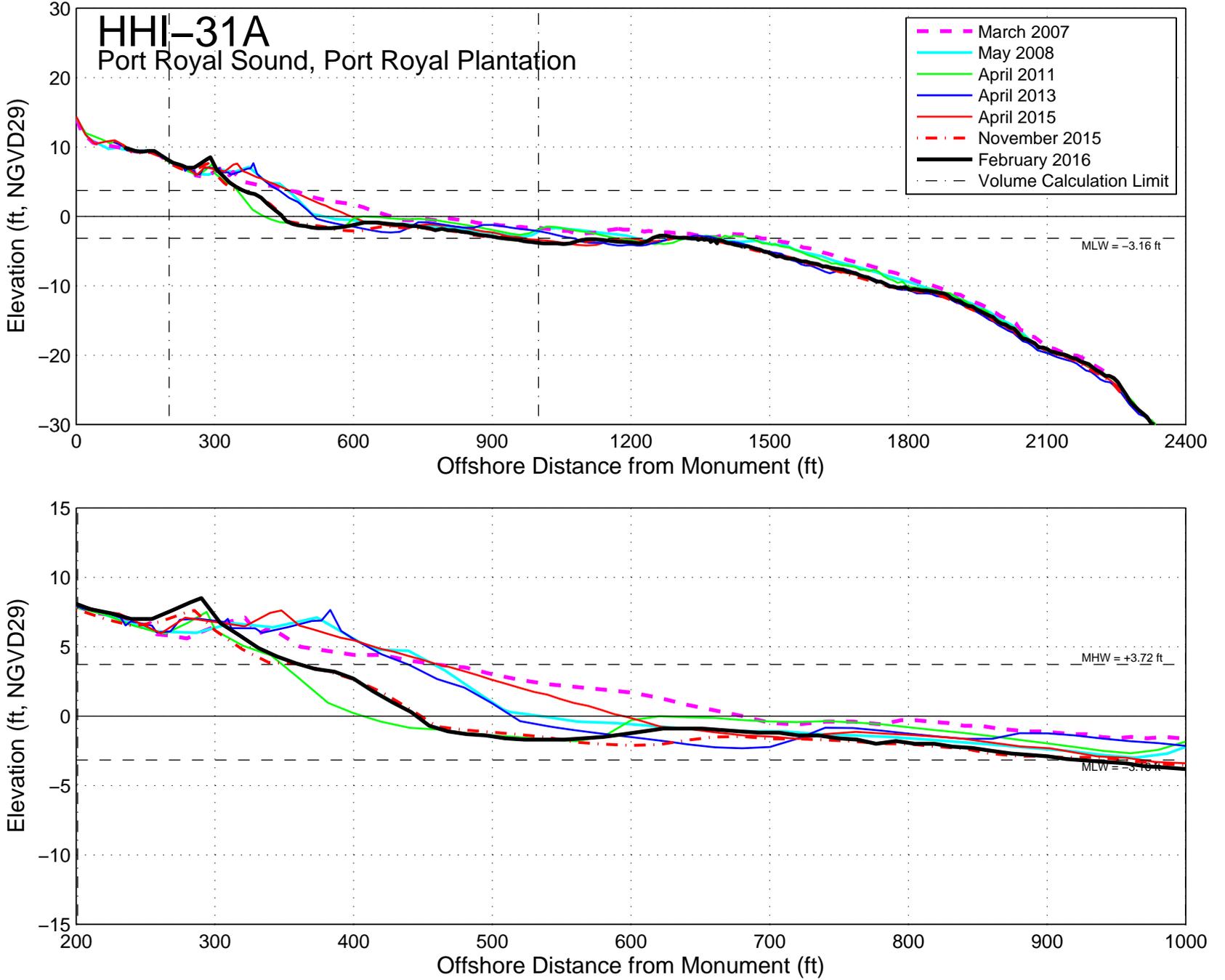


Figure A.55: Measured beach profiles at monument HHI31B0 – Hilton Head Island, South Carolina.

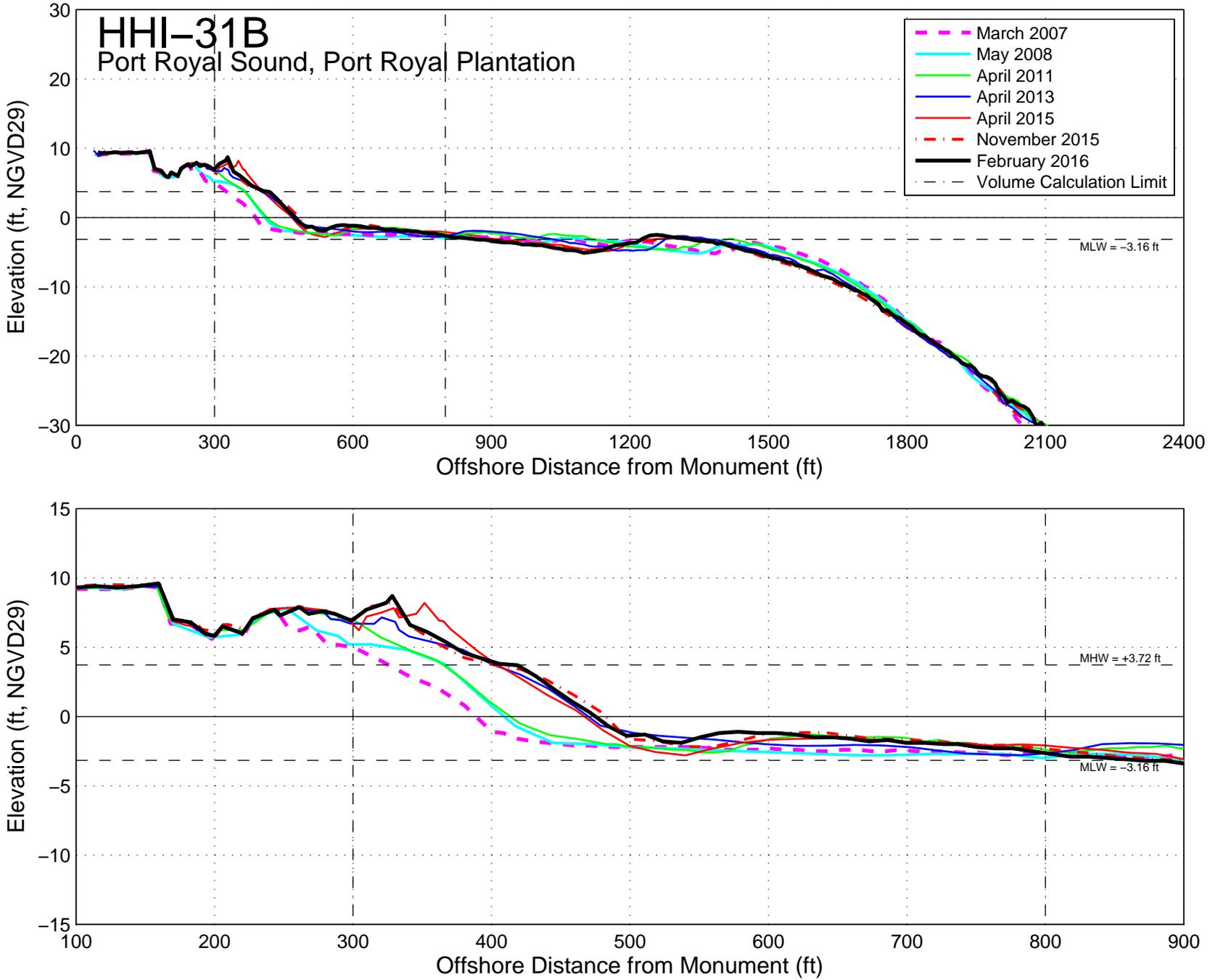


Figure A.56: Measured beach profiles at monument H13200 – Hilton Head Island, South Carolina.

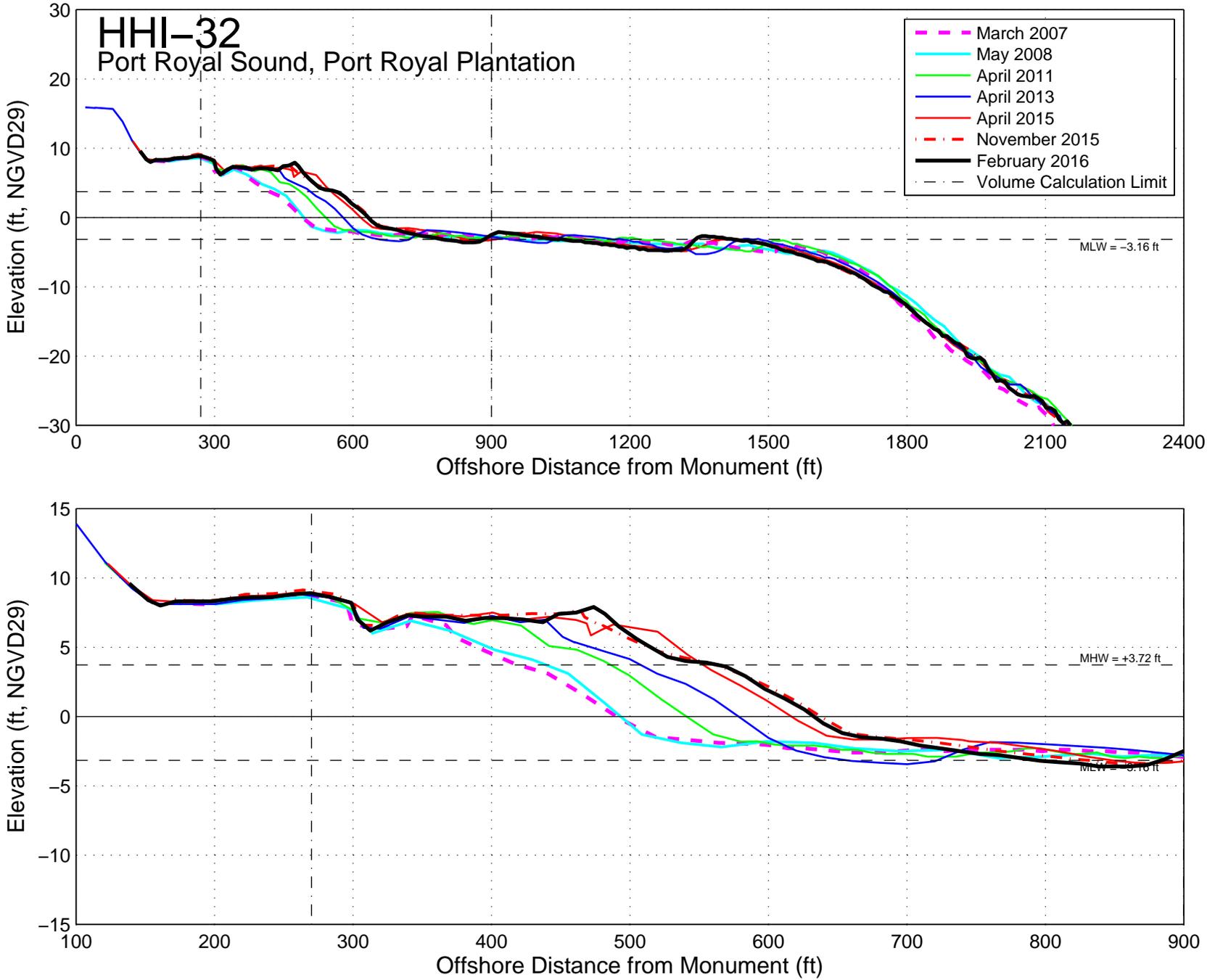


Figure A.57: Measured beach profiles at monument FH0100 – Hilton Head Island, South Carolina.

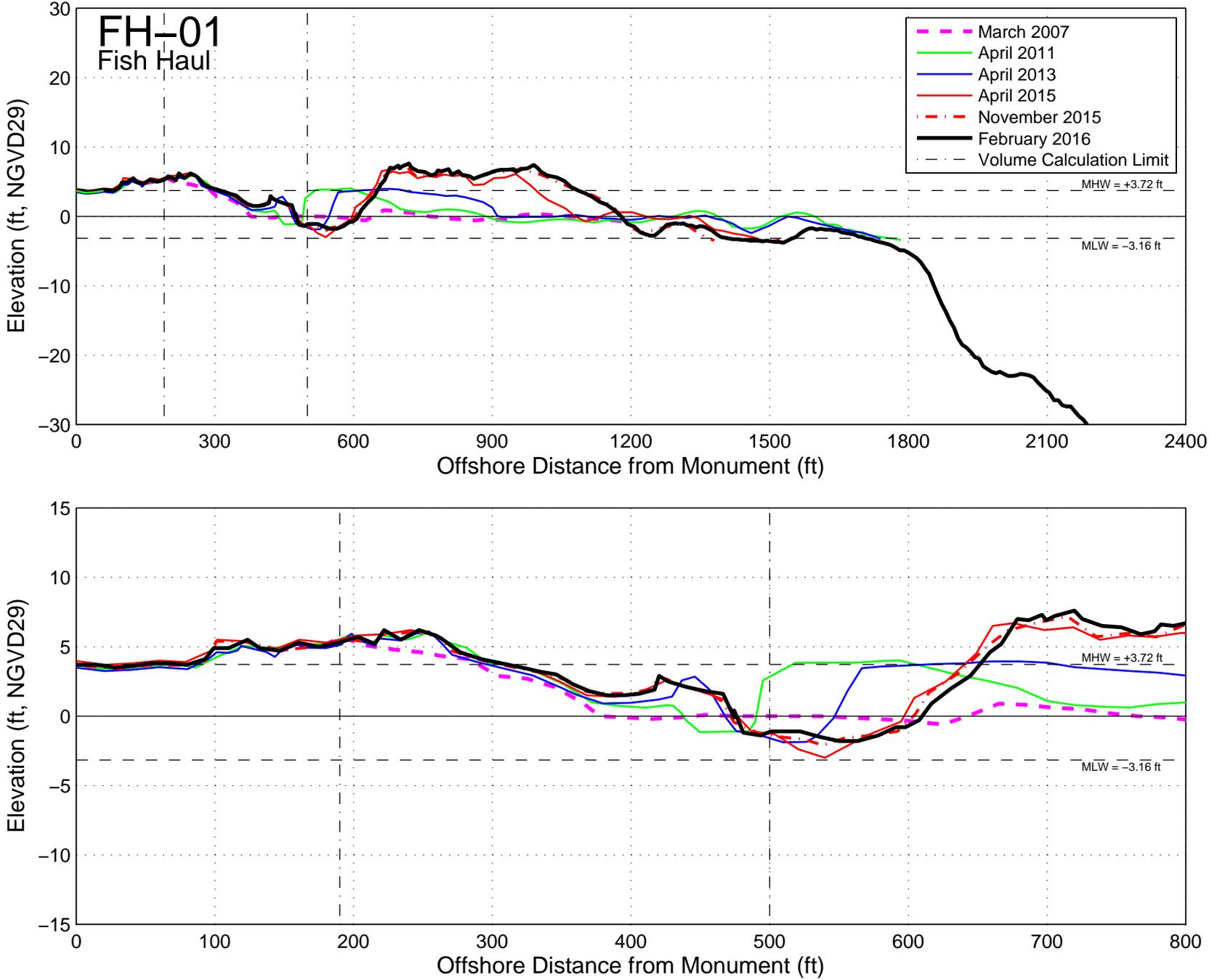


Figure A.58: Measured beach profiles at monument FH0200 – Hilton Head Island, South Carolina.

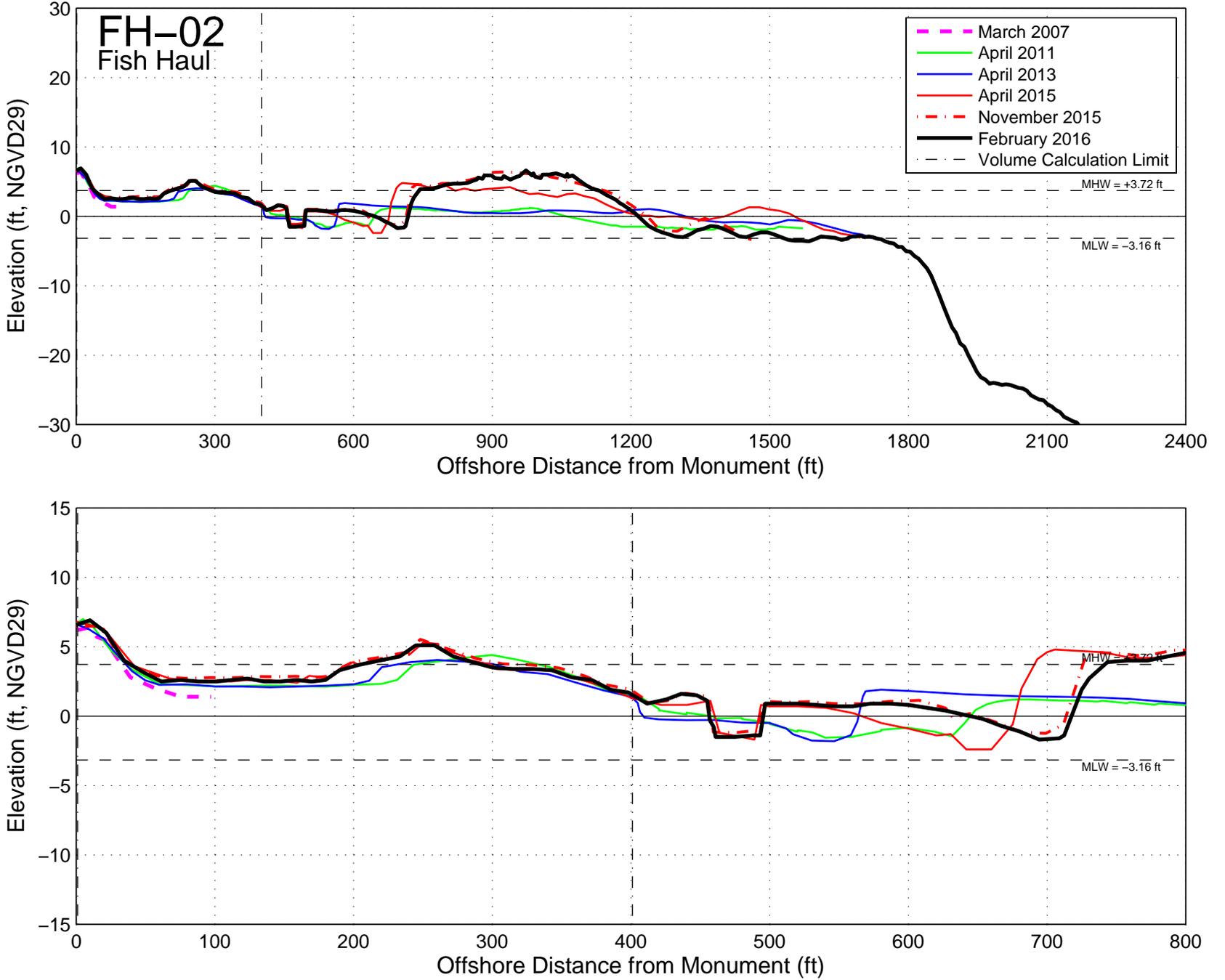


Figure A.59: Measured beach profiles at monument H13300 – Hilton Head Island, South Carolina.

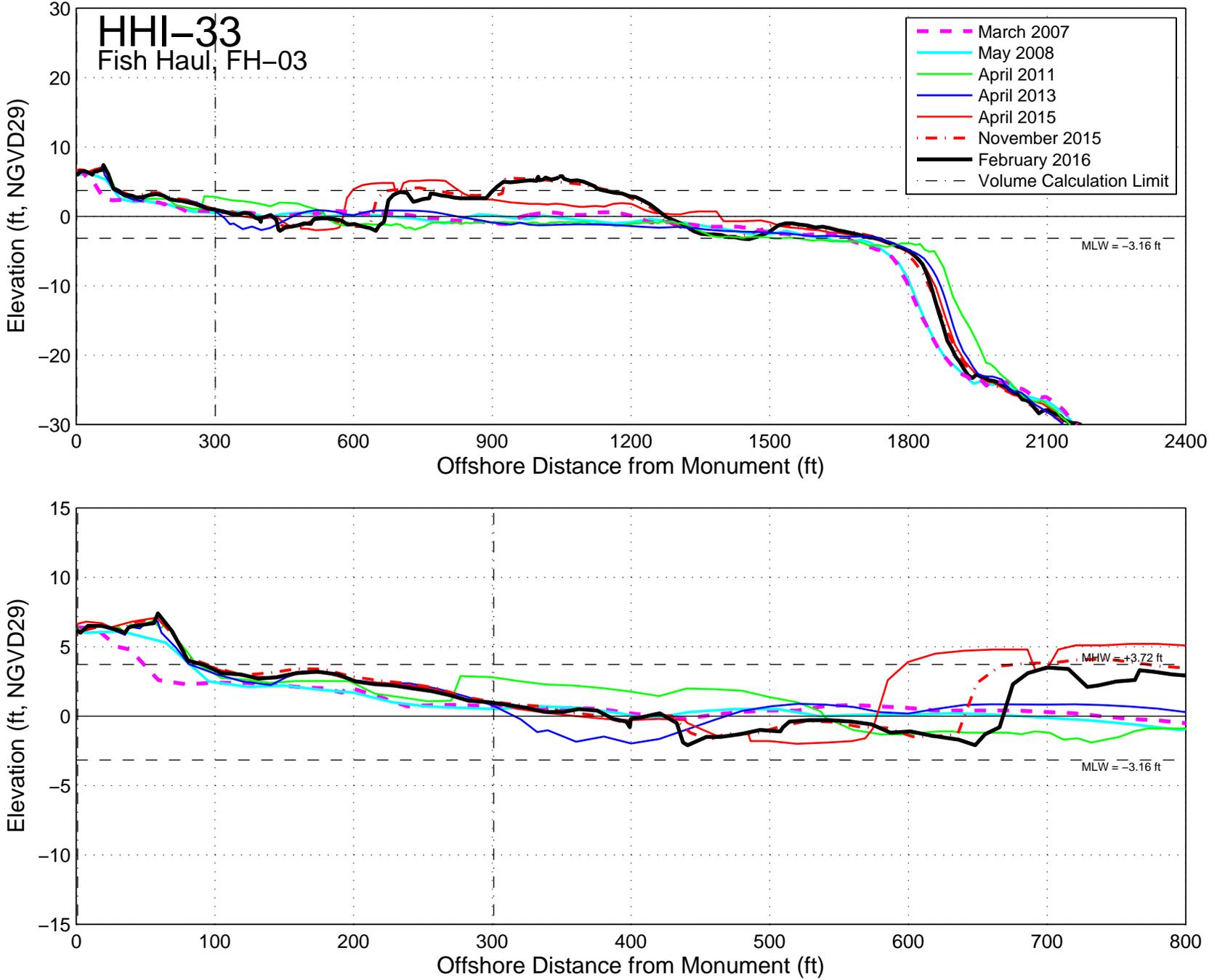


Figure A.60: Measured beach profiles at monument FH0400 – Hilton Head Island, South Carolina.

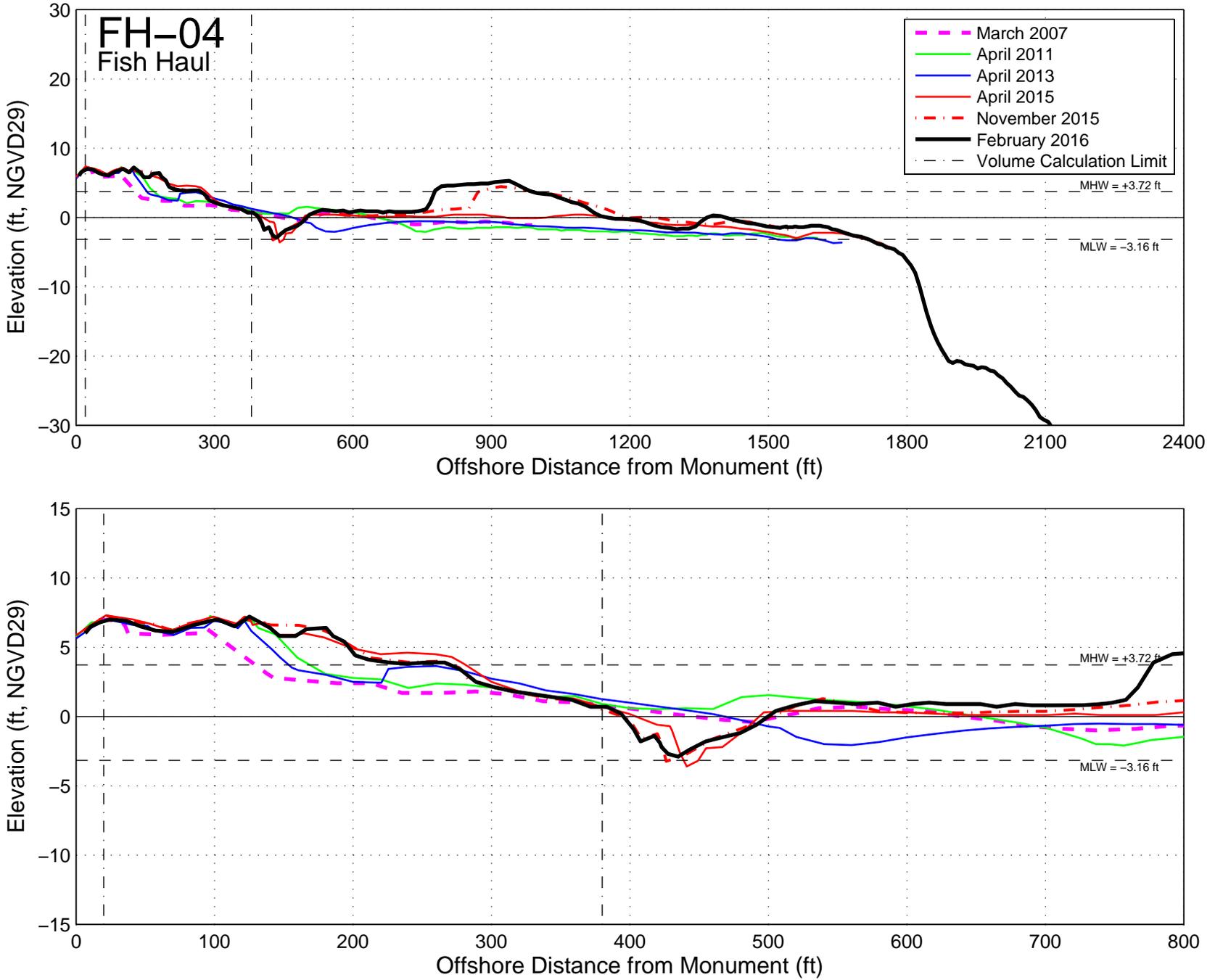


Figure A.61: Measured beach profiles at monument FH0500 – Hilton Head Island, South Carolina.

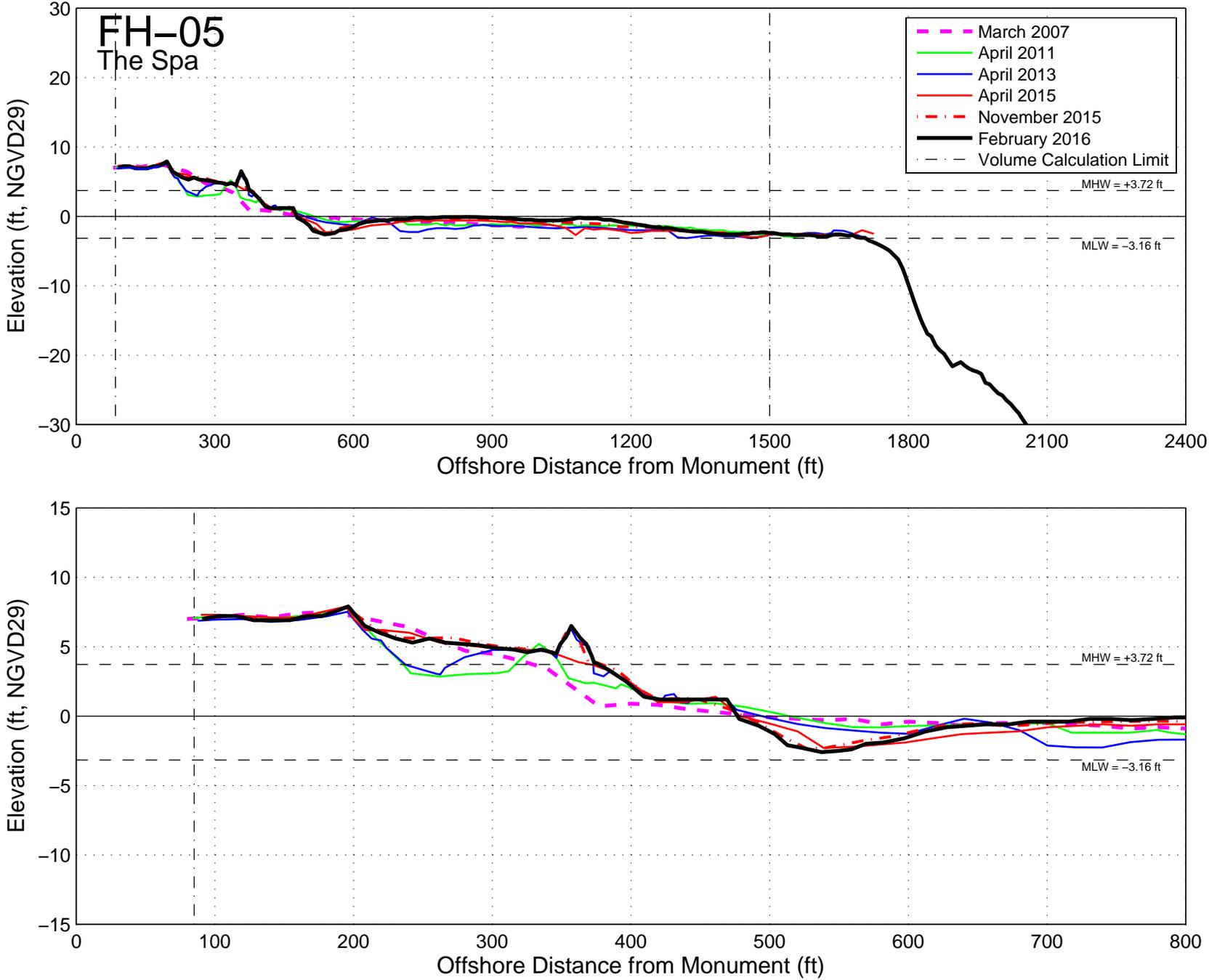


Figure A.62: Measured beach profiles at monument FH06000 – Hilton Head Island, South Carolina.

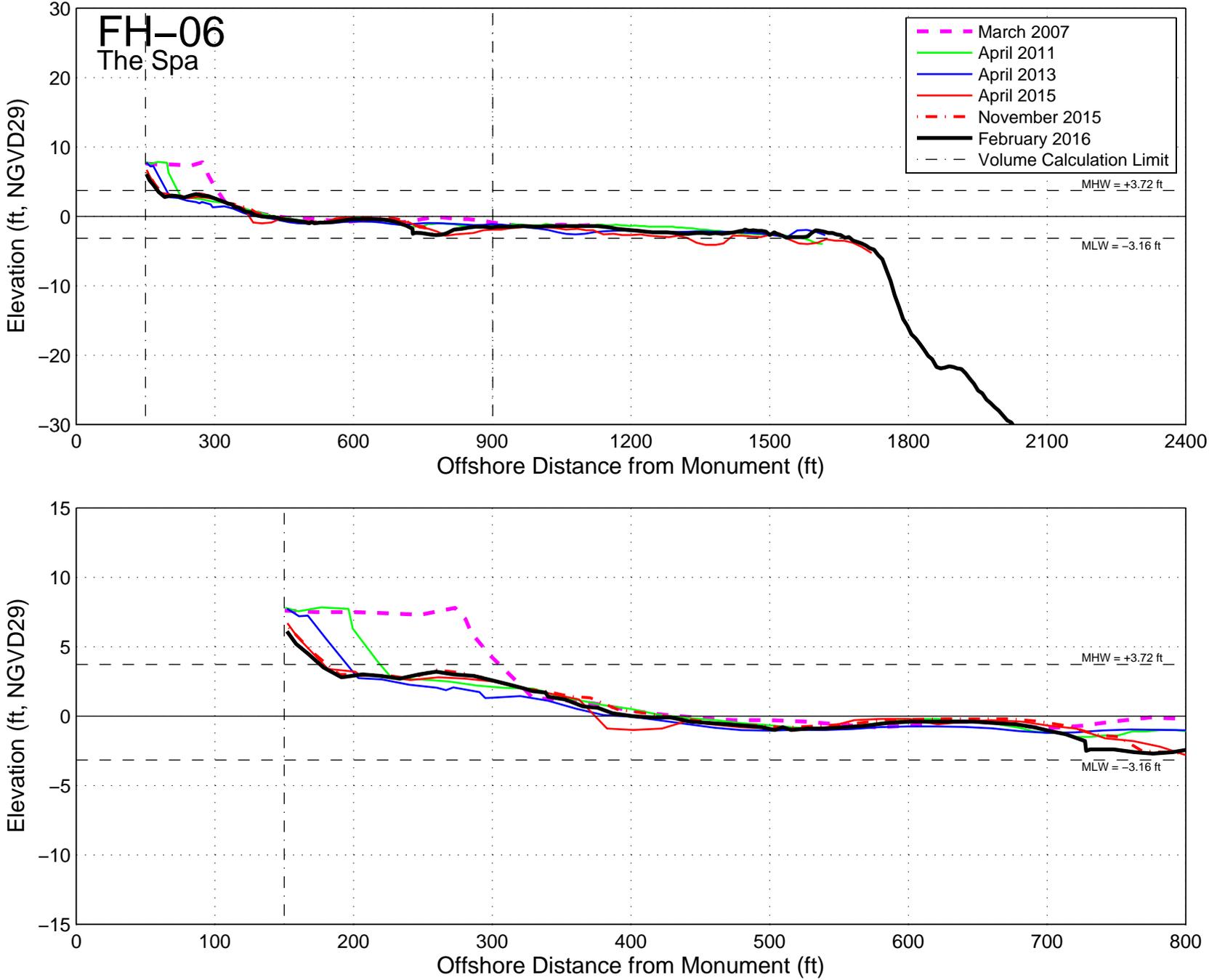


Figure A.63: Measured beach profiles at monument FH0700 – Hilton Head Island, South Carolina.

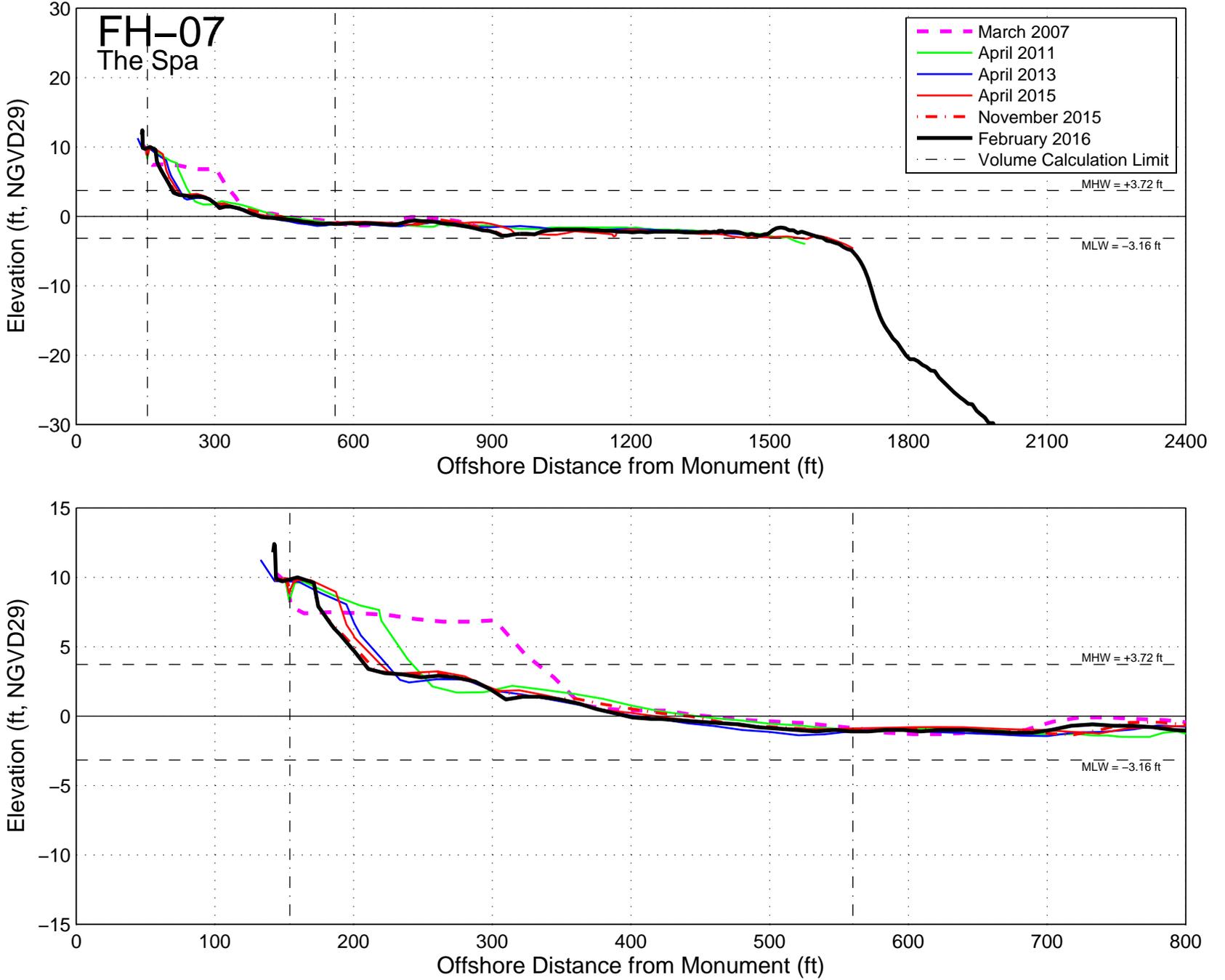


Figure A.64: Measured beach profiles at monument FH08000 – Hilton Head Island, South Carolina.

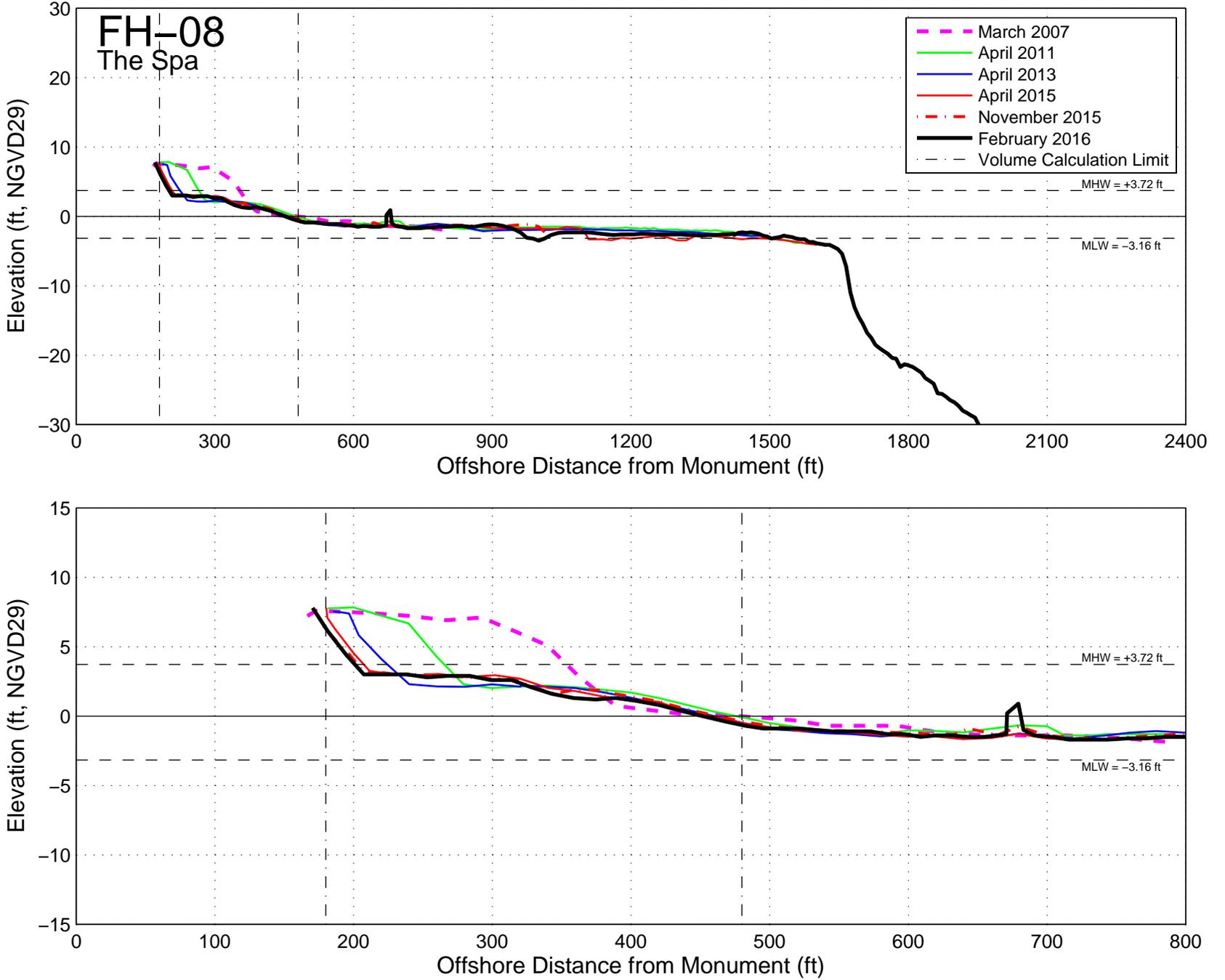


Figure A.65: Measured beach profiles at monument H13400 – Hilton Head Island, South Carolina.

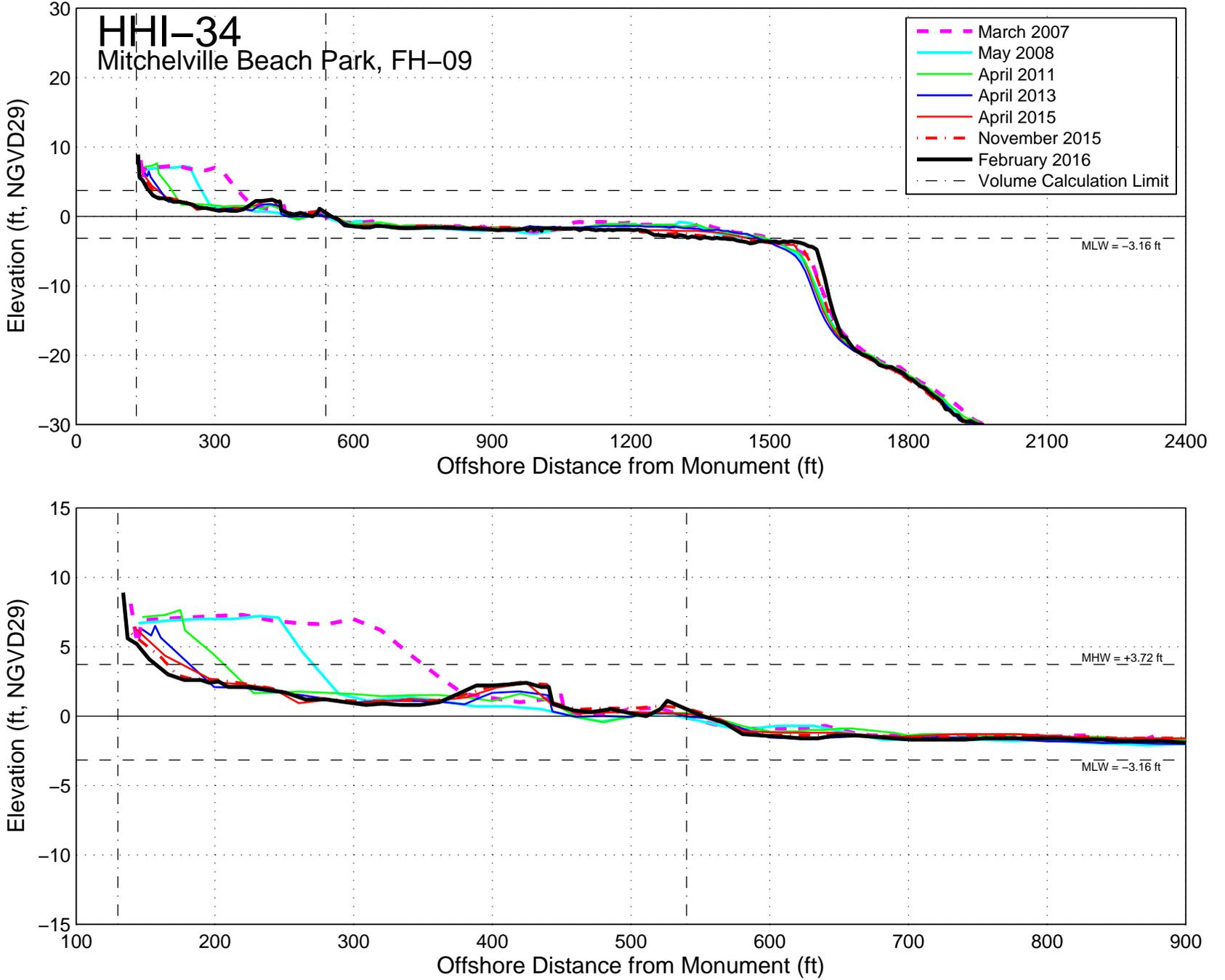


Figure A.66: Measured beach profiles at monument FH1000 – Hilton Head Island, South Carolina.

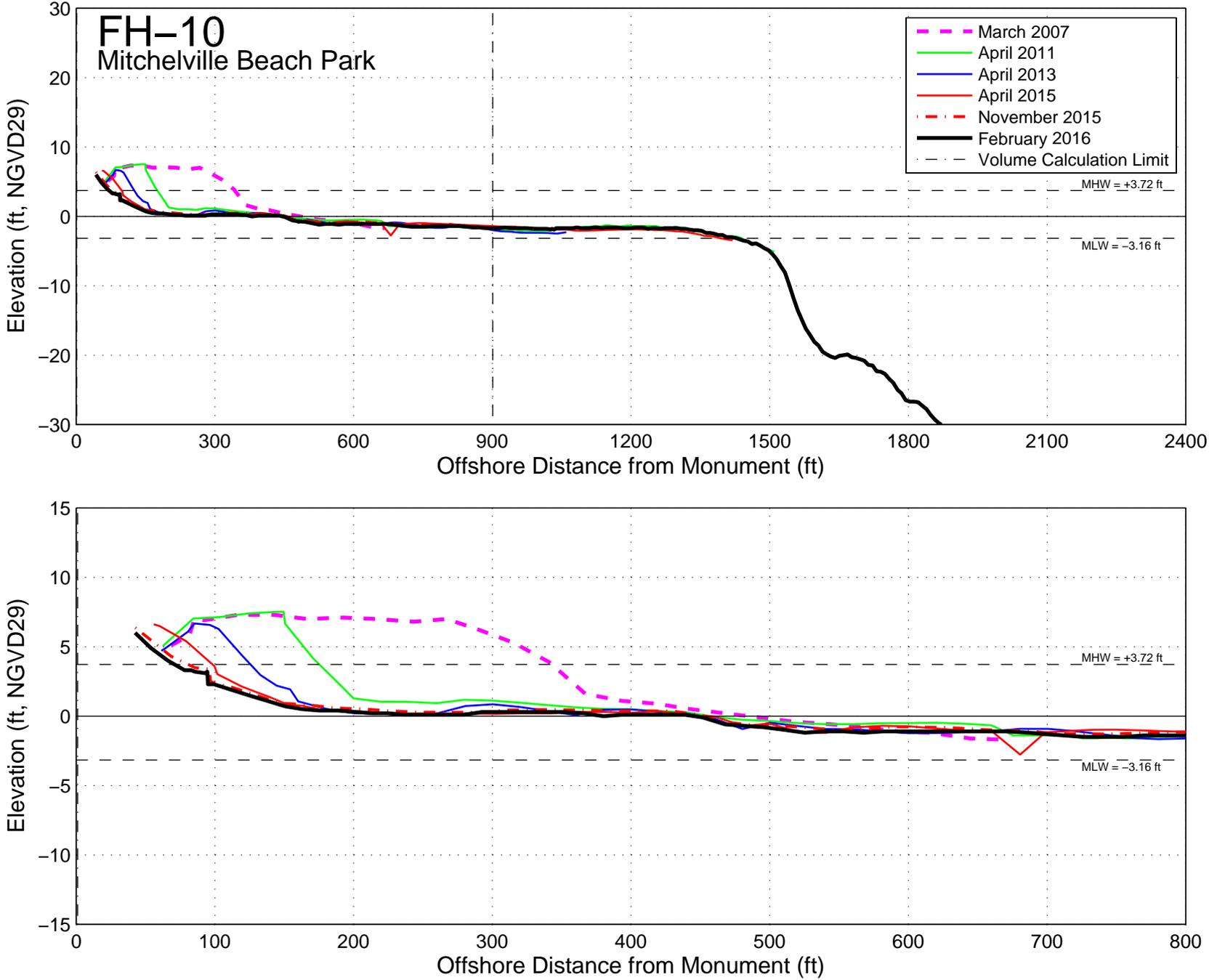


Figure A.67: Measured beach profiles at monument FH1100 – Hilton Head Island, South Carolina.

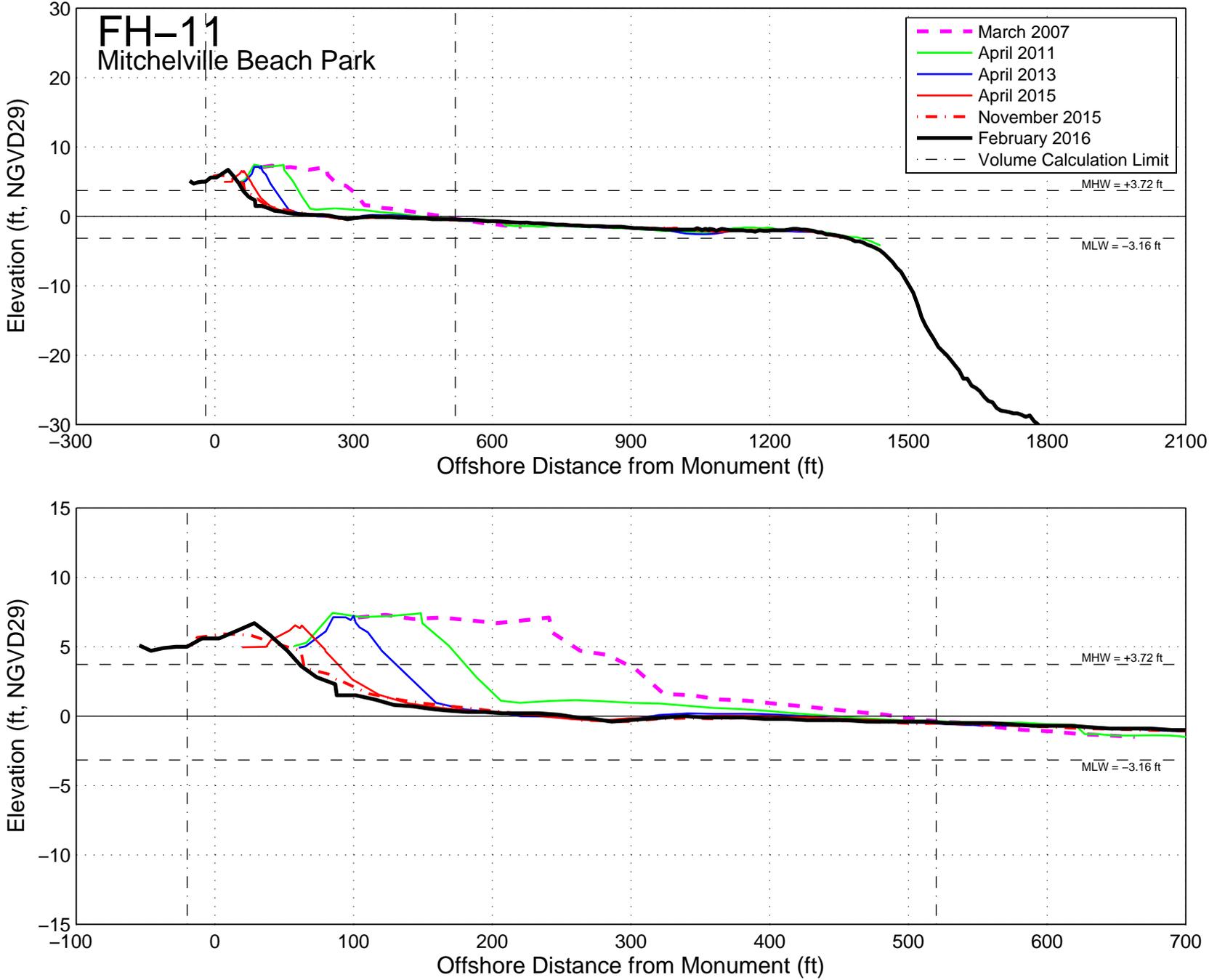


Figure A.68: Measured beach profiles at monument FH1200 – Hilton Head Island, South Carolina.

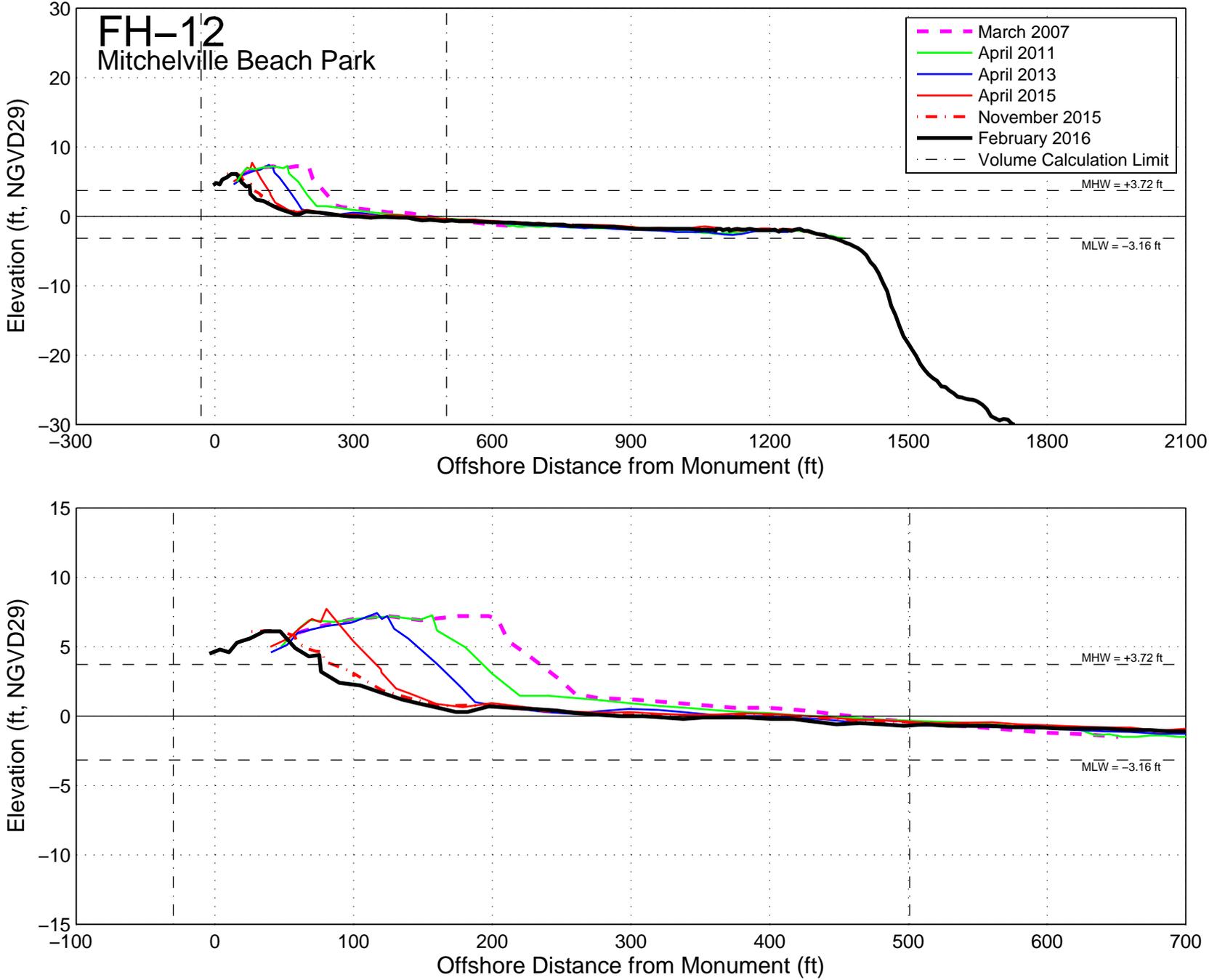


Figure A.69: Measured beach profiles at monument FH1300 – Hilton Head Island, South Carolina.

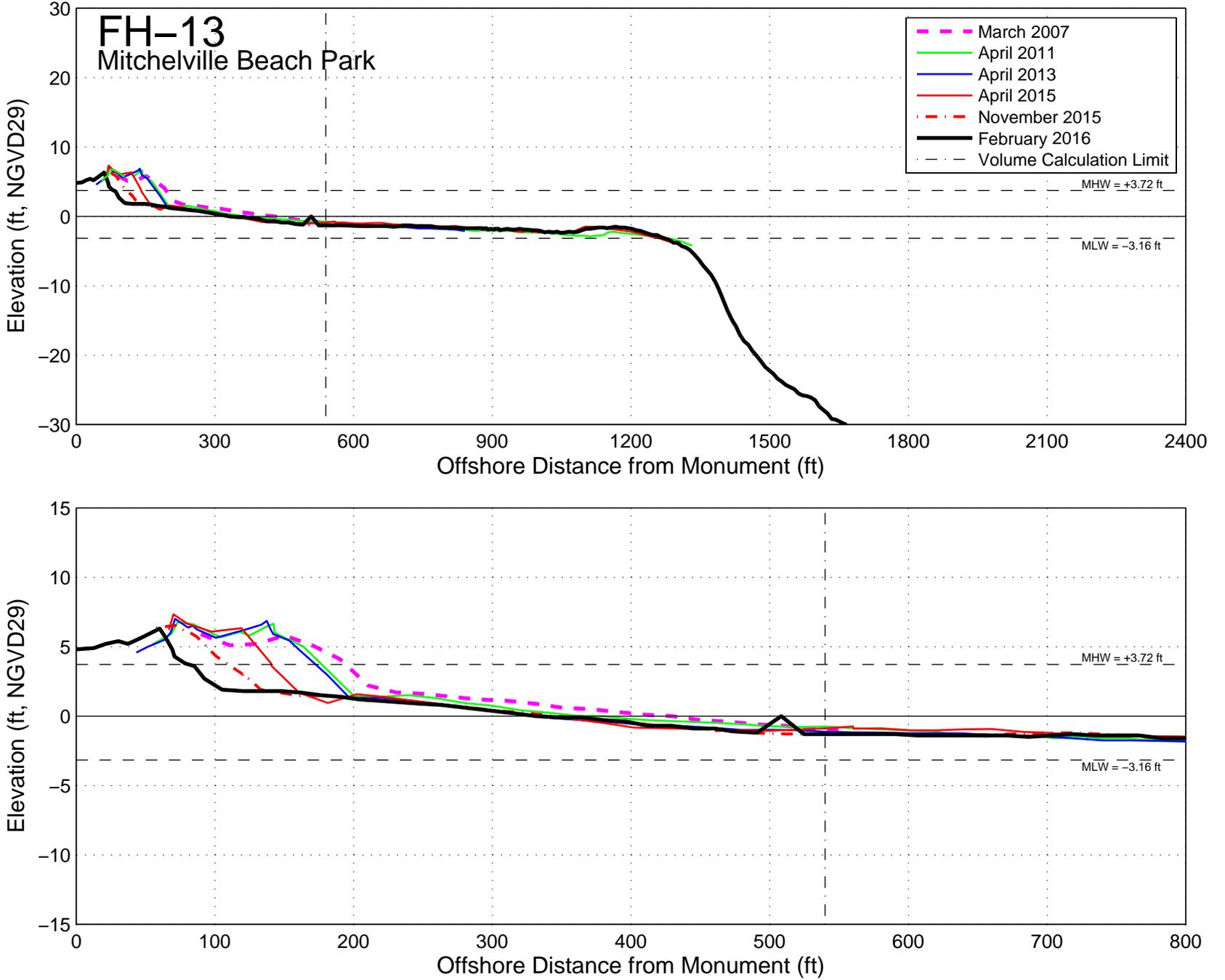


Figure A.70: Measured beach profiles at monument HHI3500 – Hilton Head Island, South Carolina.

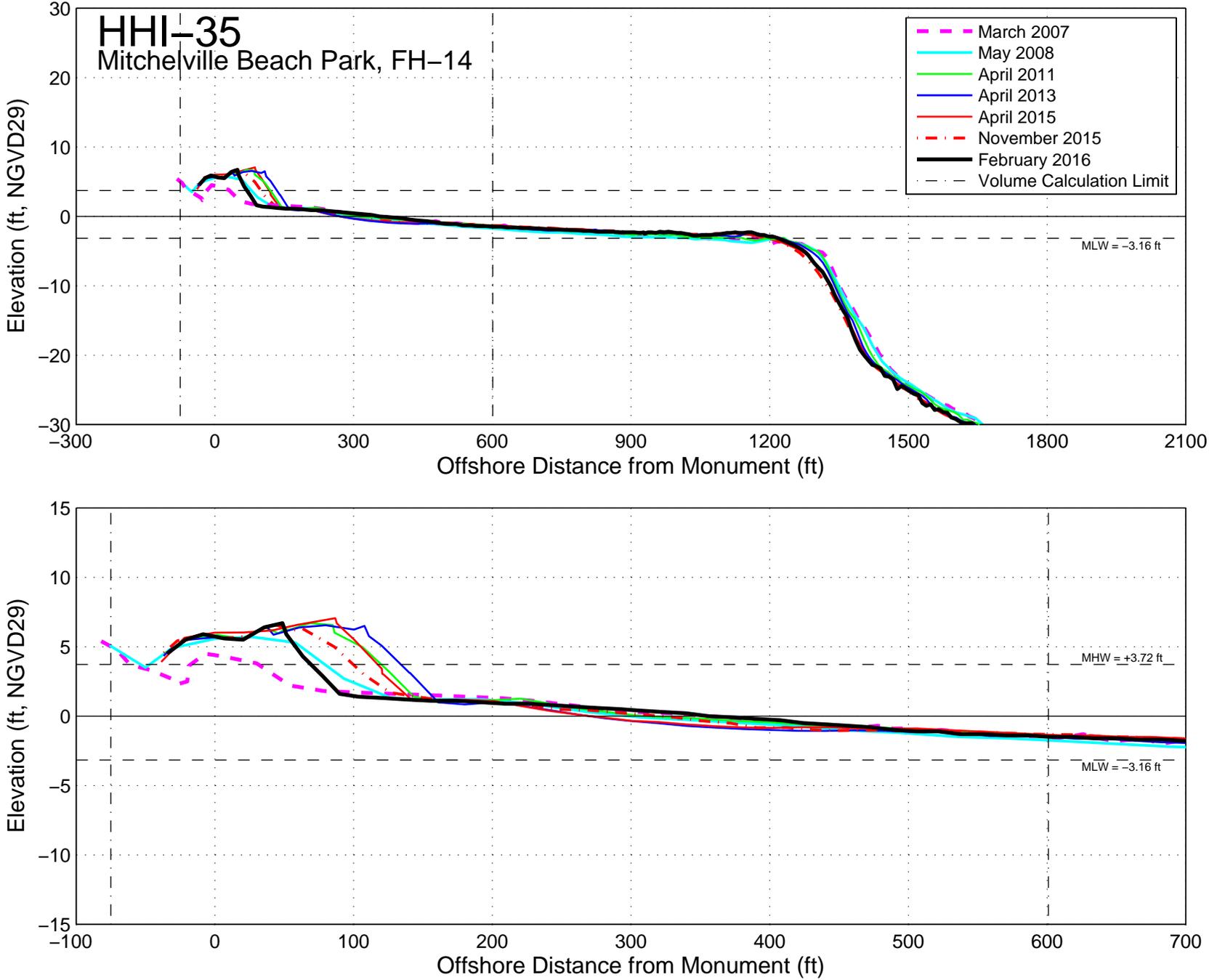


Figure A.71: Measured beach profiles at monument H13600 – Hilton Head Island, South Carolina.

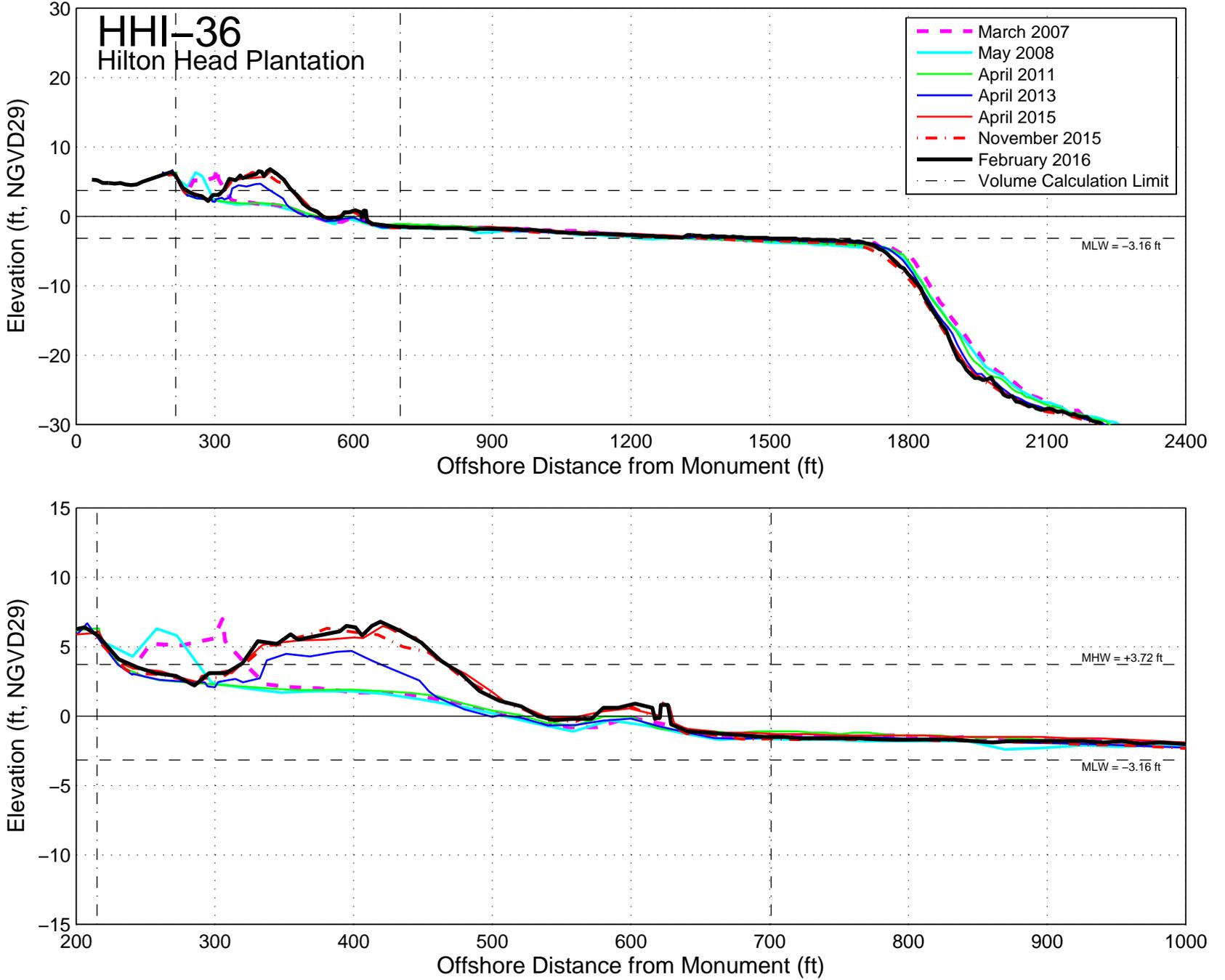


Figure A.72: Measured beach profiles at monument H13700 – Hilton Head Island, South Carolina.

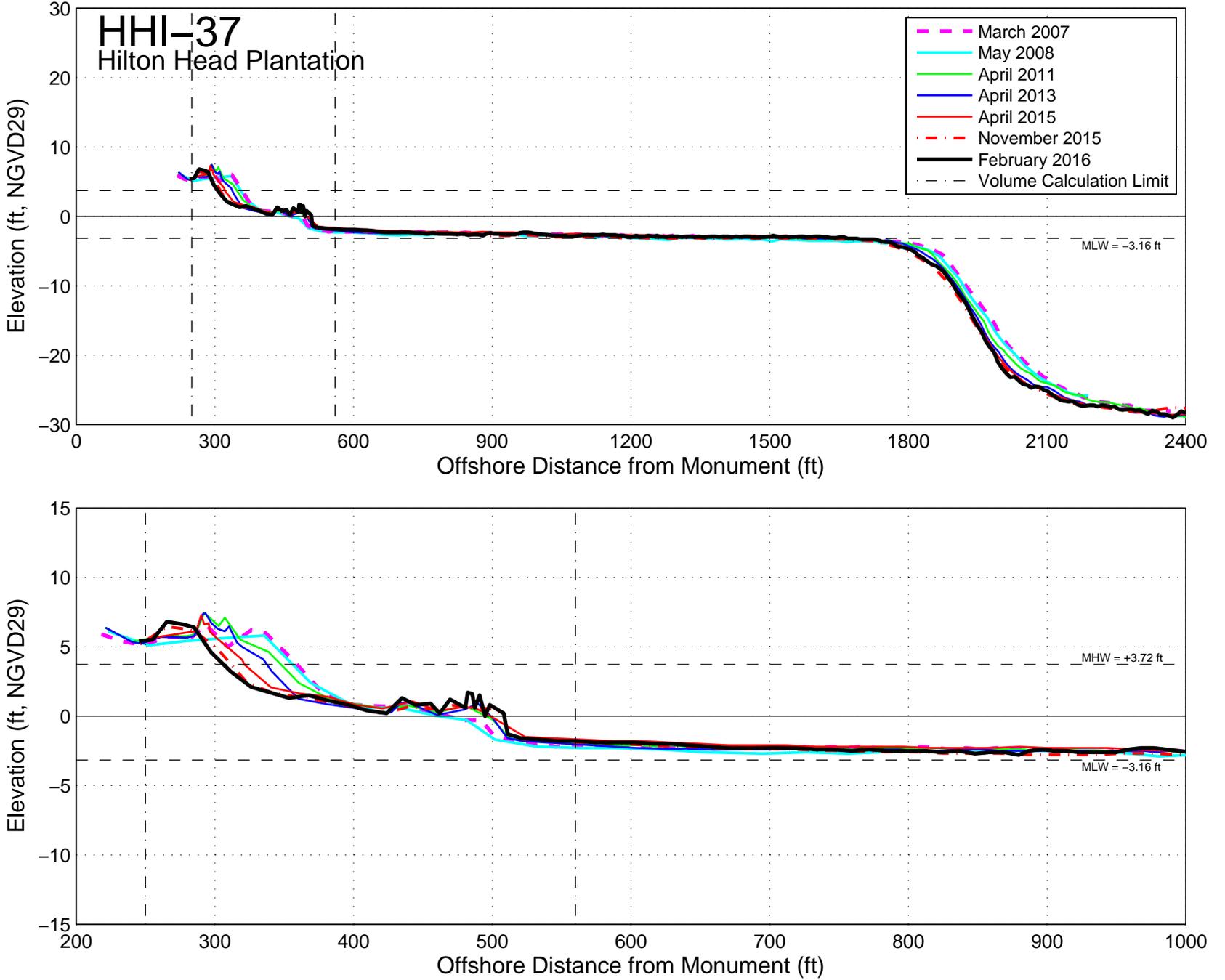


Figure A.73: Measured beach profiles at monument H13800 – Hilton Head Island, South Carolina.

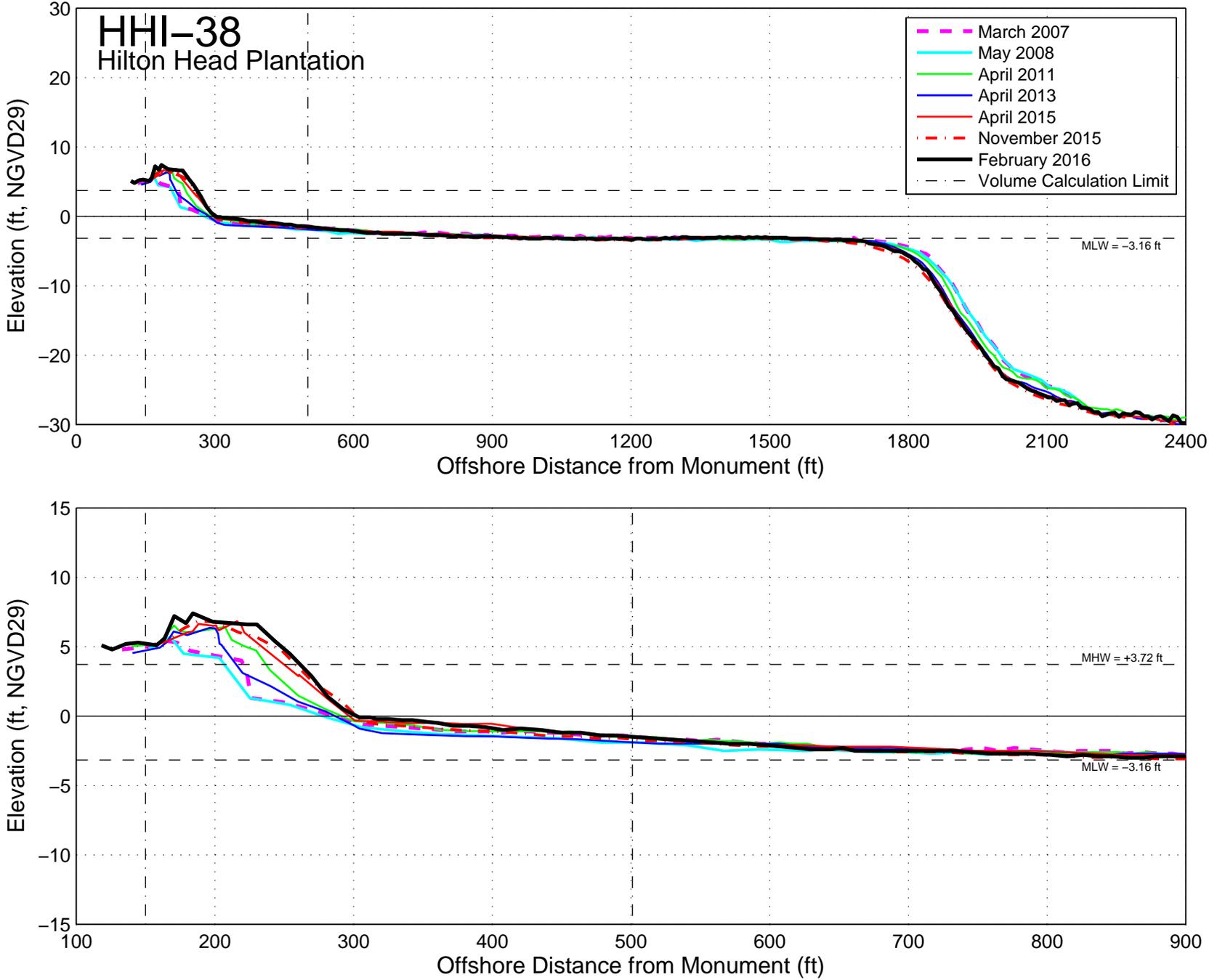
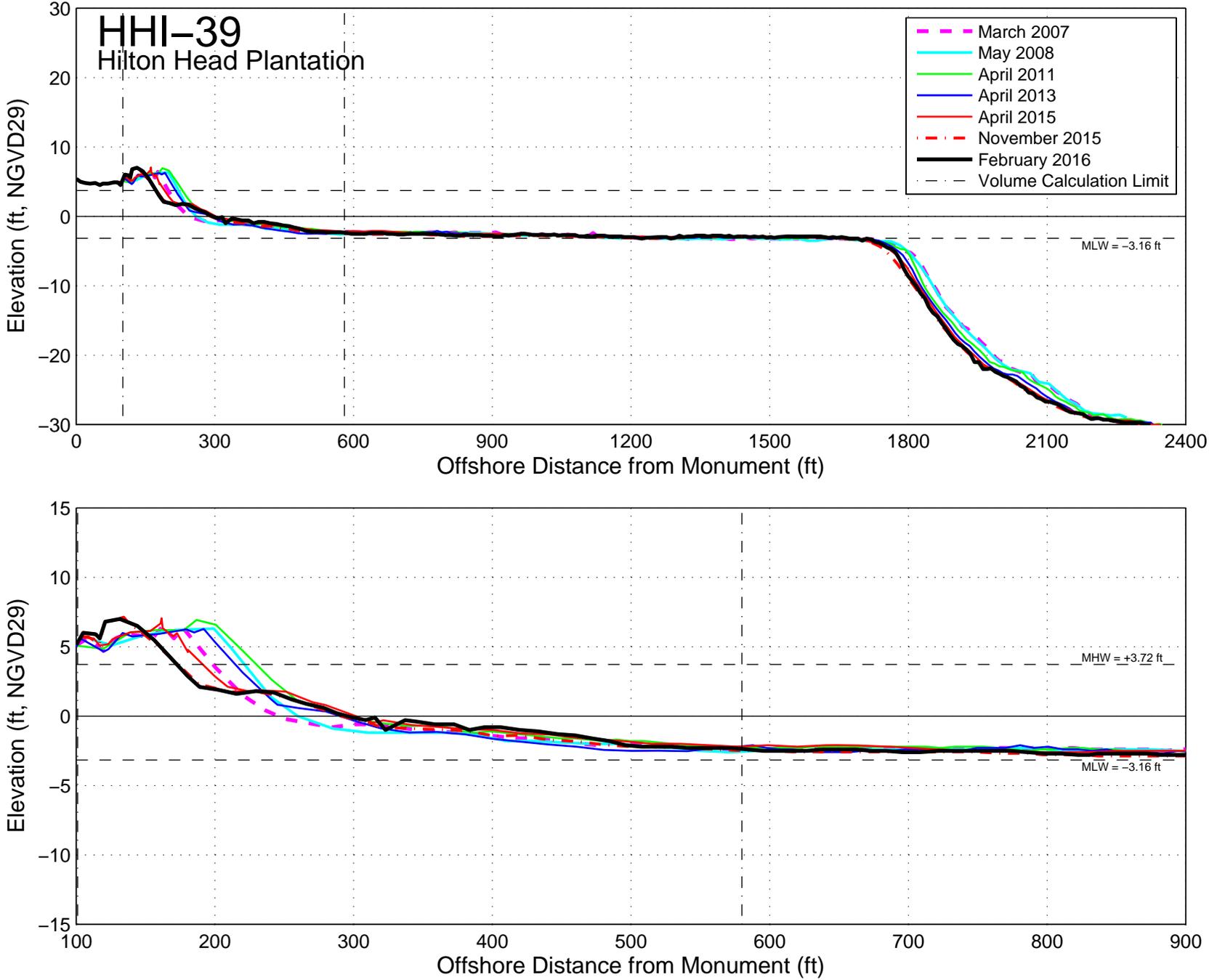


Figure A.74: Measured beach profiles at monument H13900 – Hilton Head Island, South Carolina.



APPENDIX B SHORELINE AERIALS – April 2016

Digital aerial photography was flown on 05 April 2016 by Kucera International, Inc., of Willoughby, OH

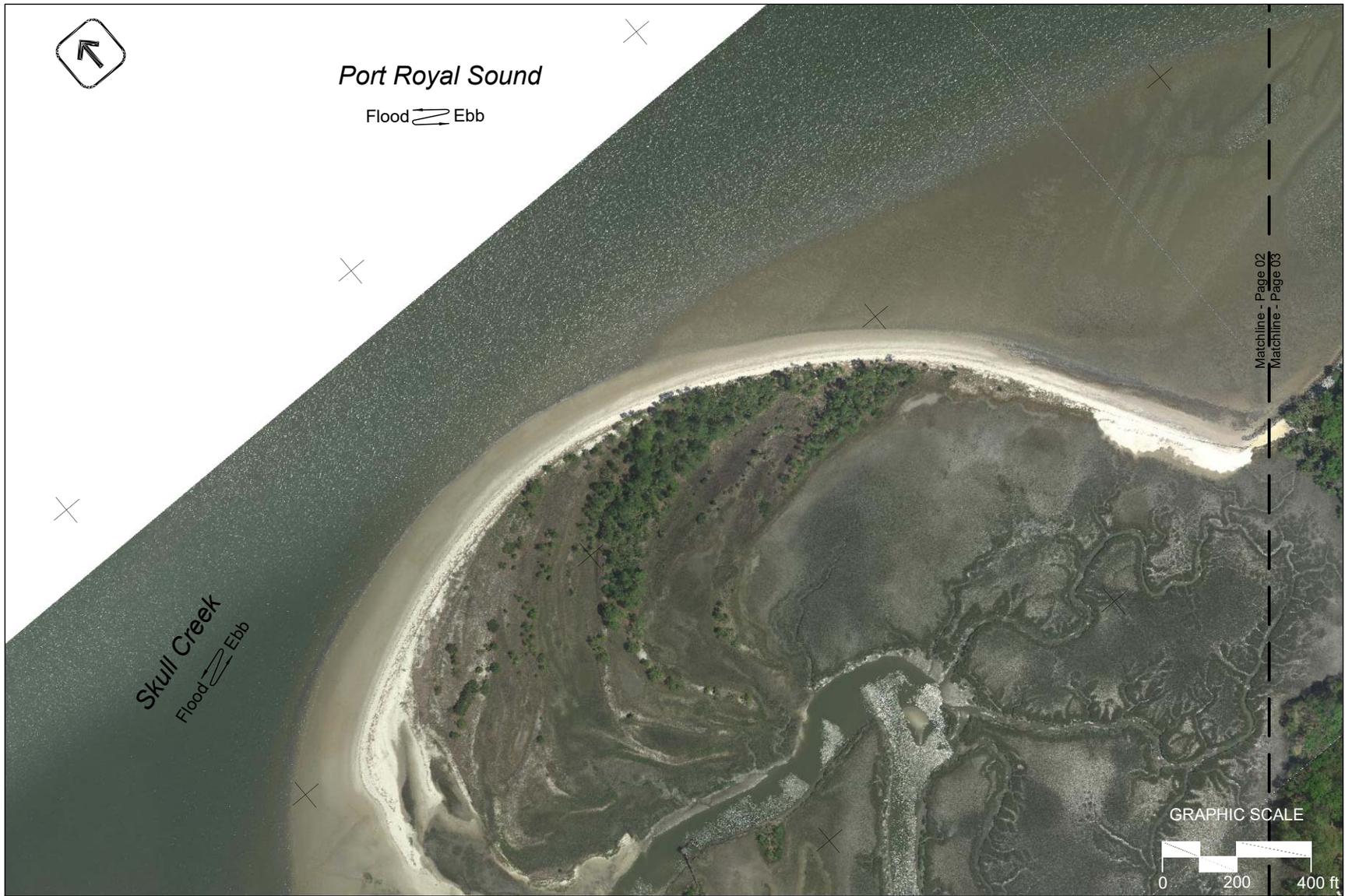


Figure B.01: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.02: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.03: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.05: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.06: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)

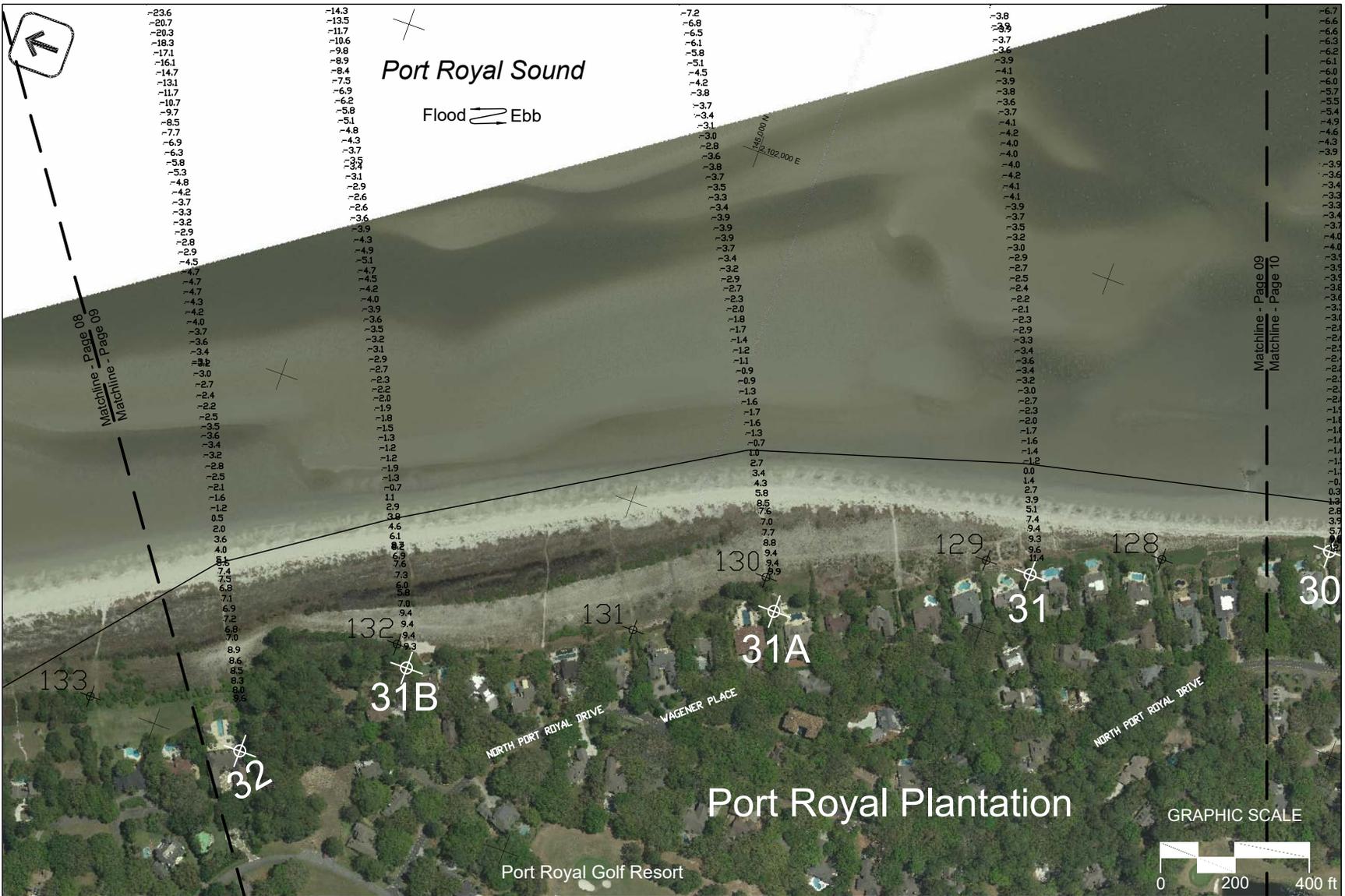


Figure B.08: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.09: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)

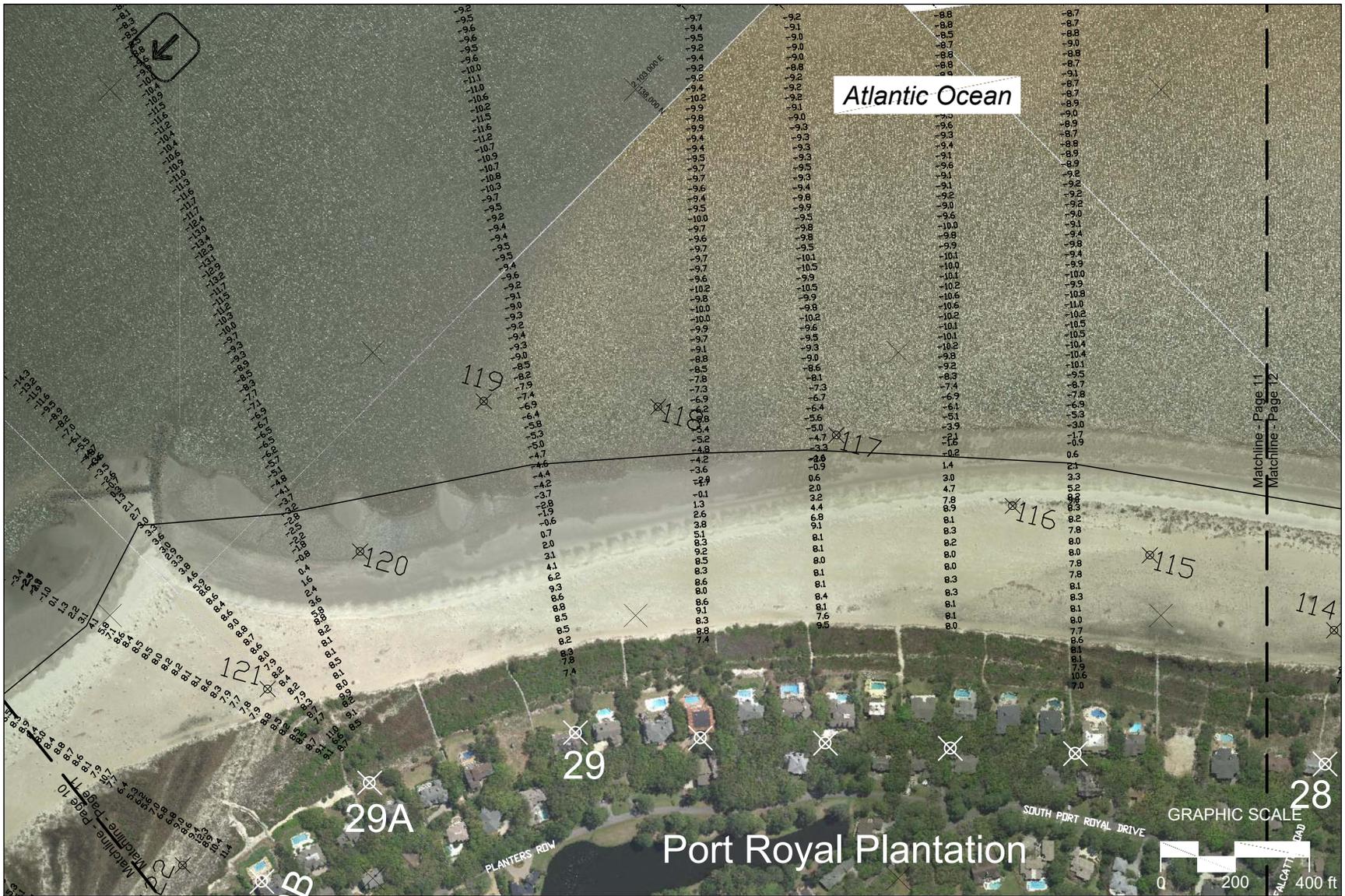


Figure B.10: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.11: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)

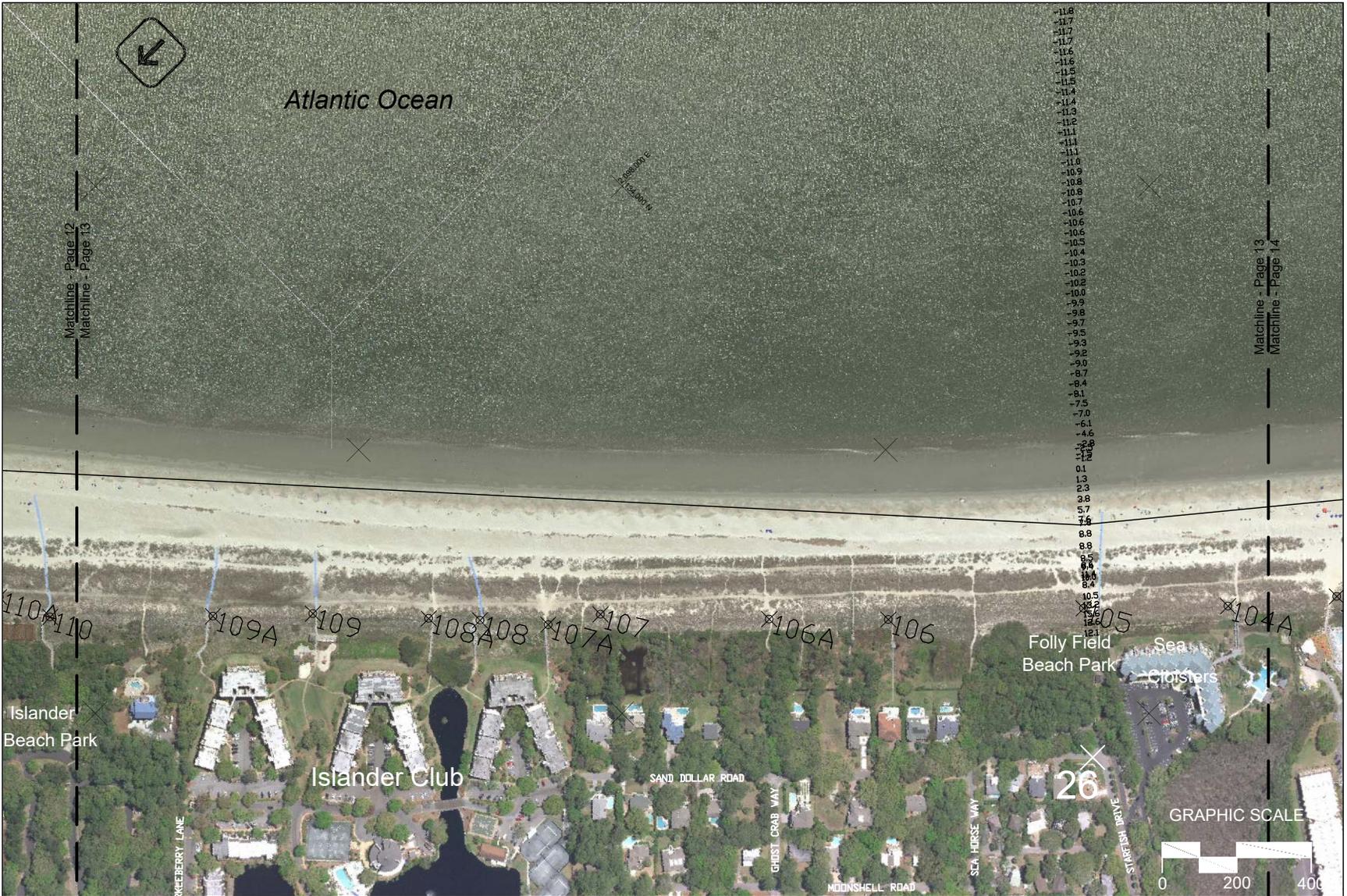


Figure B.12: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.13: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.14: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)

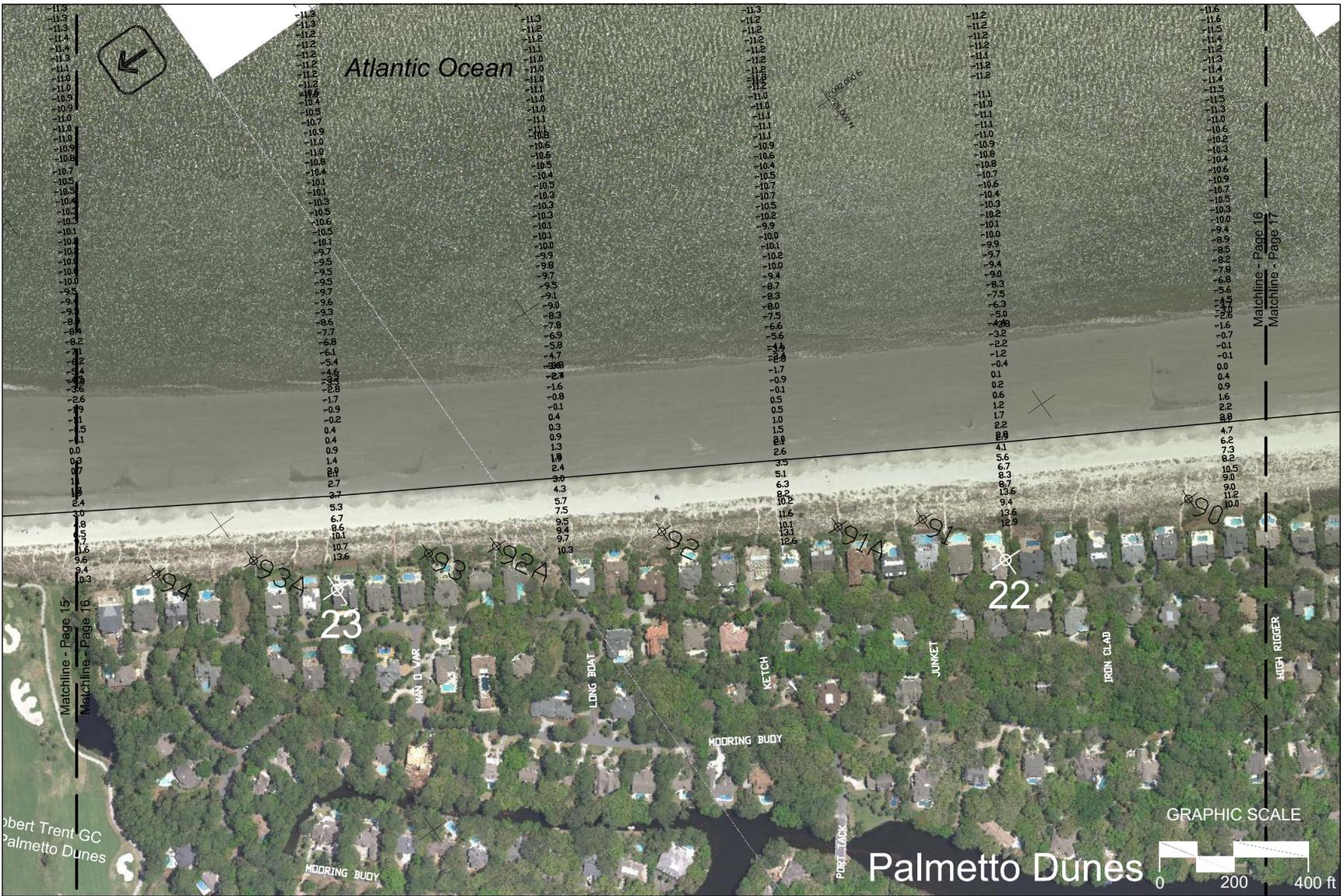


Figure B.15: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.16: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)

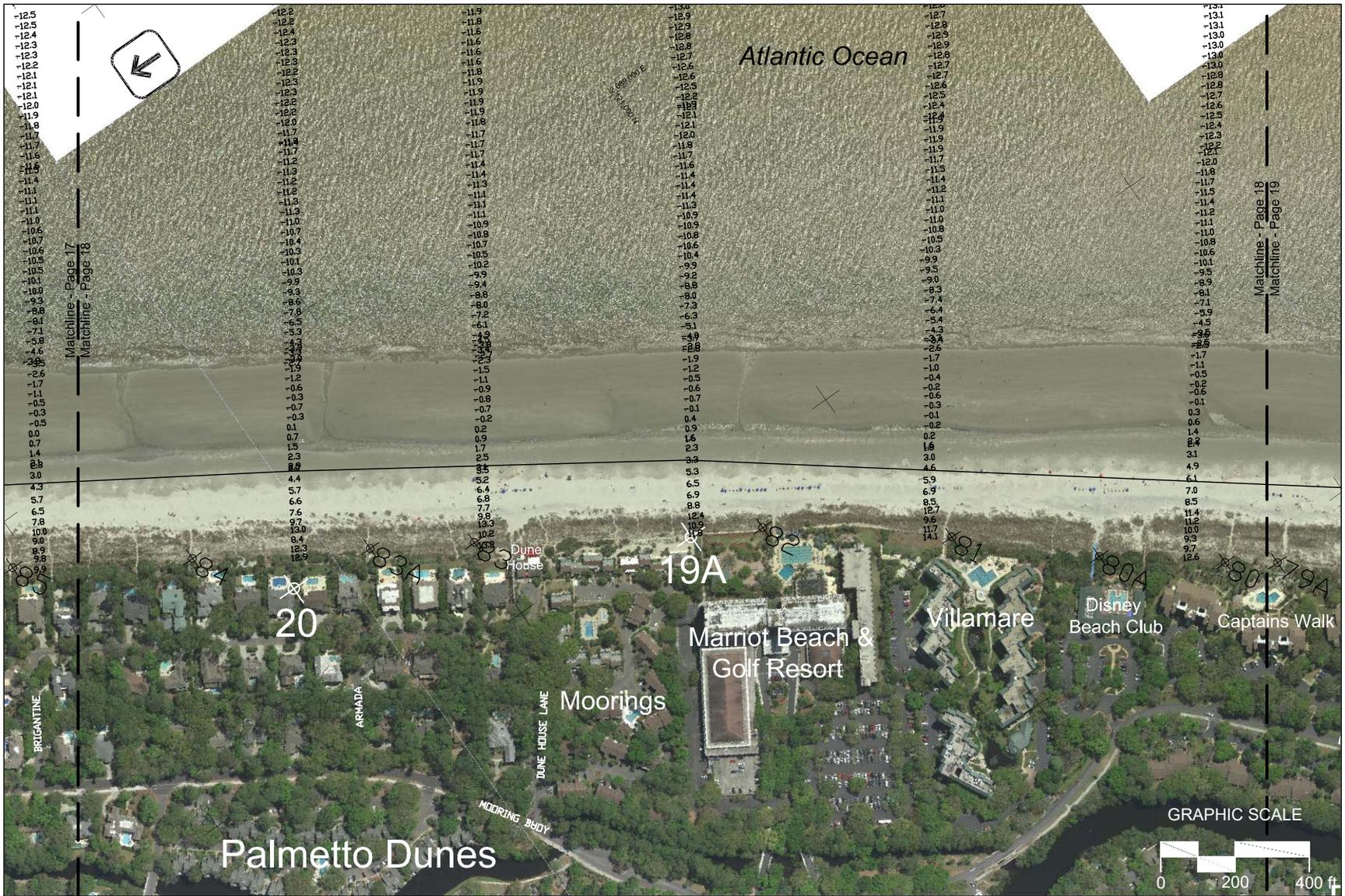


Figure B.17: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.18: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.19: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.20: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)

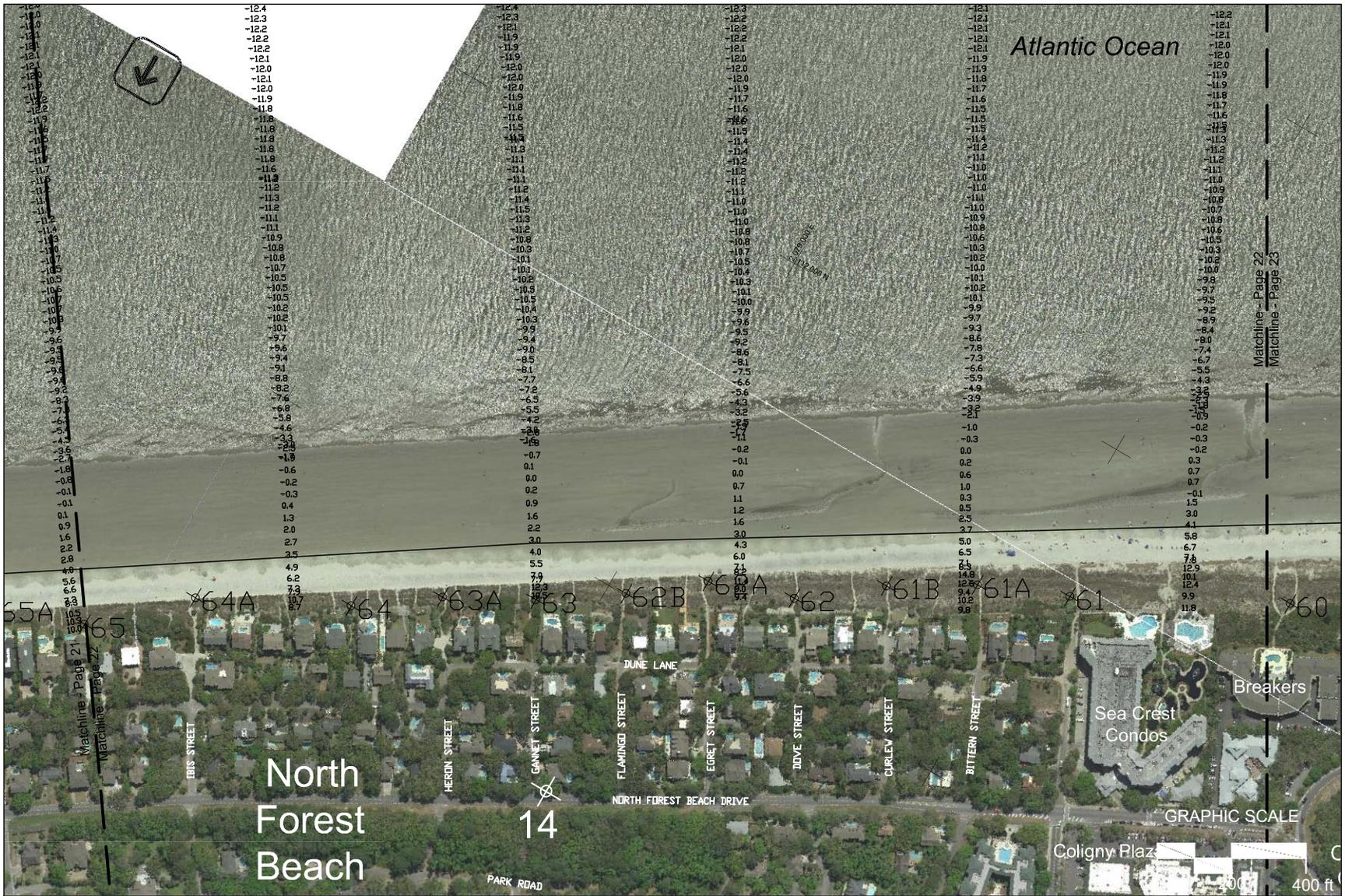


Figure B.21: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.22: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.23: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.25: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.26: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.28: Spring 2016 shoreline conditions along Hilton Head Island, SC.
 Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)



Figure B.29: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)

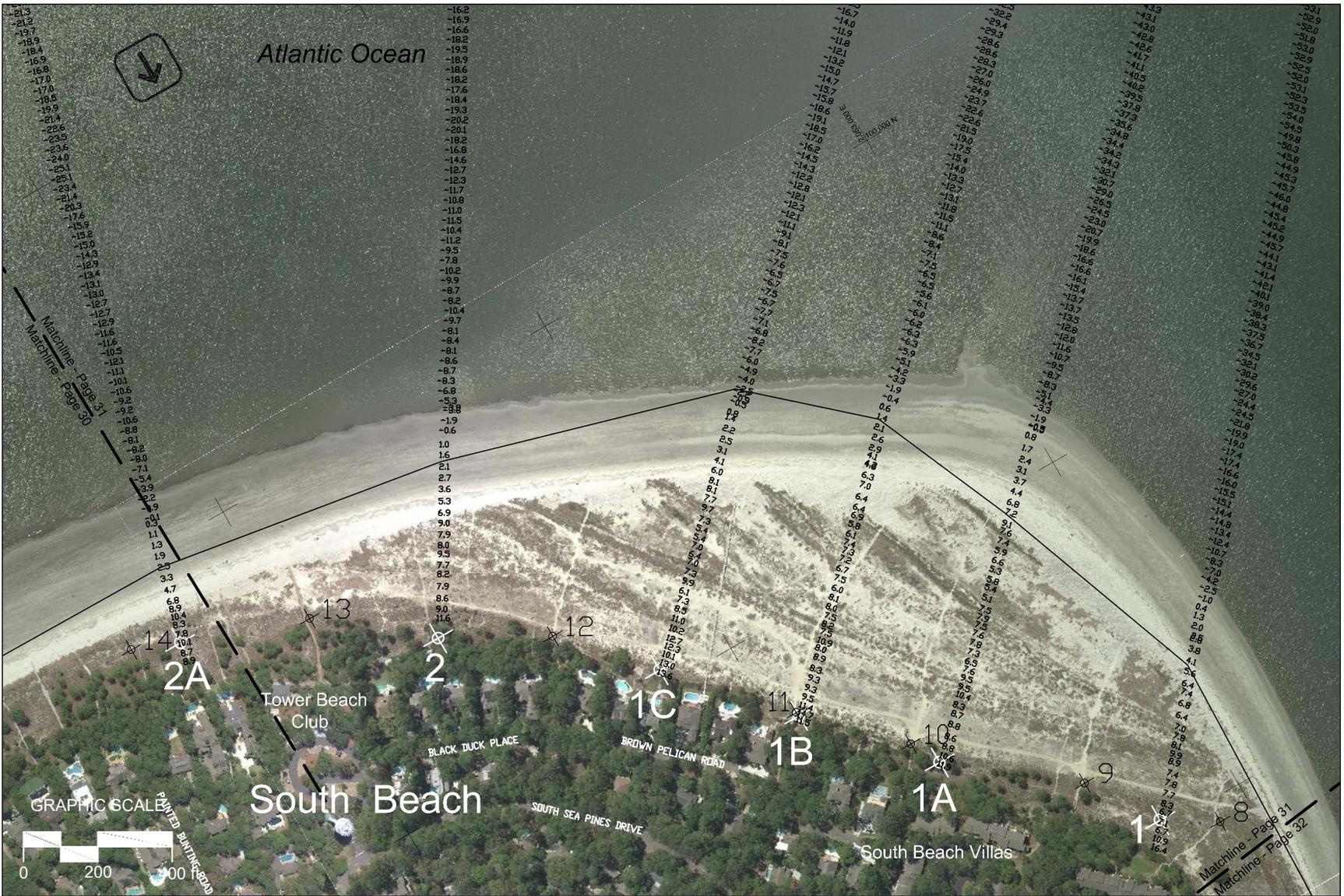


Figure B.30: Spring 2016 shoreline conditions along Hilton Head Island, SC.
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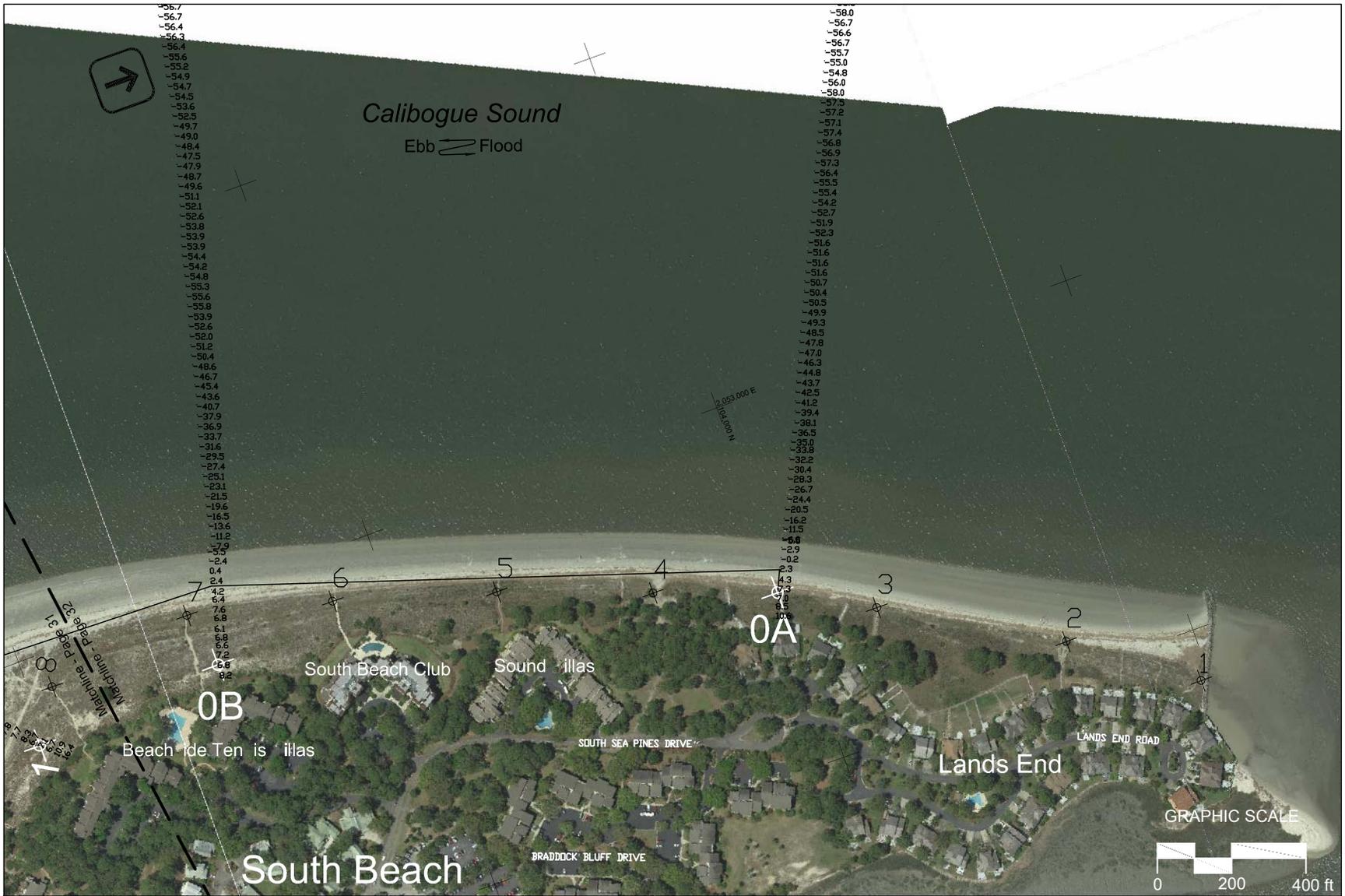


Figure B.31: Spring 2016 shoreline conditions along Hilton Head Island, SC.
Photo: April 5, 2016. Survey Elevations: February 2016 (ft, NGVD29)