National Park Service
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Natural Resource Stewardship and Science

Northeast Coastal and Barrier Network Coastal Topographic Change Monitoring

2011-2012 Annual Data Summary Report for Gateway National Recreation Area

Natural Resource Data Series NPS/NCBN/NRDS—2015/994



ON THE COVER
Severe erosion of beach, dune, and coastal road associated with Hurricane Irene, Fort Tilden, Jamaica Bay Unit, Gateway National Recreation Area, September 26, 2011.
Photograph by Dr. Norbert P. Psuty

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Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Executive Summary

This Annual Report on dune/beach profile changes in Gateway National Recreation Area establishes a second year of profiles development, Spring 2011 to Spring 2012. Although too early to identify trends of change, the data do provide a series of dimensions regarding linear distances of profile features and cross-sectional areas of beach and dune features on the profiles. Synthesis Appendices list the dimensions of each of the seasonal surveys and the differences among the seasonal surveys. Detailed analyses will await the Trend Report.

Acknowledgments

Many people participated in the collection of the field surveys, processing of the data sets, and in the development of this report. Early members of the Rutgers survey and data processing team included Billy Hudacek, Jake McDermott, John Gagnon, and Dan Soda. Tony Luscombe of the Jamaica Bay Unit of Gateway also assisted in the field at Breezy Point.

This project is supported by the Inventory and Monitoring Program of the Northeast Barrier Network of the National Park Service, Sara Stevens, Director. It is carried out under Cooperative Agreement H4503090700, Task Agreement P11AT40626.

Introduction

The National Park Service is committed to creating and maintaining a data base on coastal evolution within the parks composing the Northeast Coastal and Barrier Network (Stevens, et al. 2005). As described in the document on 'vital signs' (Allen 2000), information on shoreline position change and on coastal topographical change (dune/beach profiles) are among the most important and most beneficial data sets to support basic knowledge of the vectors of change at the coast, and they are fundamental to the establishment of resource management decisions in the coastal parks. And, as established in the foundation document on monitoring coastal morphological changes in Psuty et al. (2010b), there are specific protocols to be followed in tracking shoreline position changes as well as dune/beach profile changes in the coastal parks to assure quality control and comparability in the data set.

This is an Annual Report on the changes to dune/beach profiles in the coastal units in Gateway National Recreation Area. The collection of the profiles and their representation in this report follows the protocol on two-dimensional changes established in Psuty, et al (2012). They were applied throughout Gateway in a consistent manner starting in the spring of 2010. They have been consistently monitored The surveys conducted in the spring 2011, fall 20101 and spring 2012 form the basis of this second annual report.

The goal of the annual report is to document the collection of profile data and to describe the short-term variation that has occurred. The changes in the profile configuration are generally descriptive of the seasonal contrasts (lower energetics in the summer period versus higher energetics in the winter period) that support accumulation during summer and erosion during the winter. However, there are many other variables that affect the gains and losses of sediment and the changes to the profiles. Therefore, the short-term annual report is but one step in the understanding of the conditions that characterize the coastal components of the Gateway units and is meant to establish a continuum of comparable information for subsequent characterizations and analyses. Discussions and analyses of vectors of profile change and likely associations will be the theme of the longer-term (5 years) Trend Reports.

Site and Situation

The portion of Gateway National Recreation Area (GATE) covered in this report is composed of two coastal areas exposed to the ocean processes (Sandy Hook and Breezy Point), and four other areas shielded to various degrees from the direct exposure to ocean conditions (Great Kills, Miller Field, Fort Wadsworth, and Plumb Beach) (Figure 1). They each respond to the relative intensity of the energetics associated with their position and to the sediment supply reaching their position, as described in Psuty et al. (2010a). Within each of the areas, a series of monuments were installed (Fig. 2) that establish control points from where the survey lines are run. The profiles are surveyed with geodetic quality GPS equipment along predetermined azimuths from the monument (Fig. 3) and repeated at seasonal intervals.

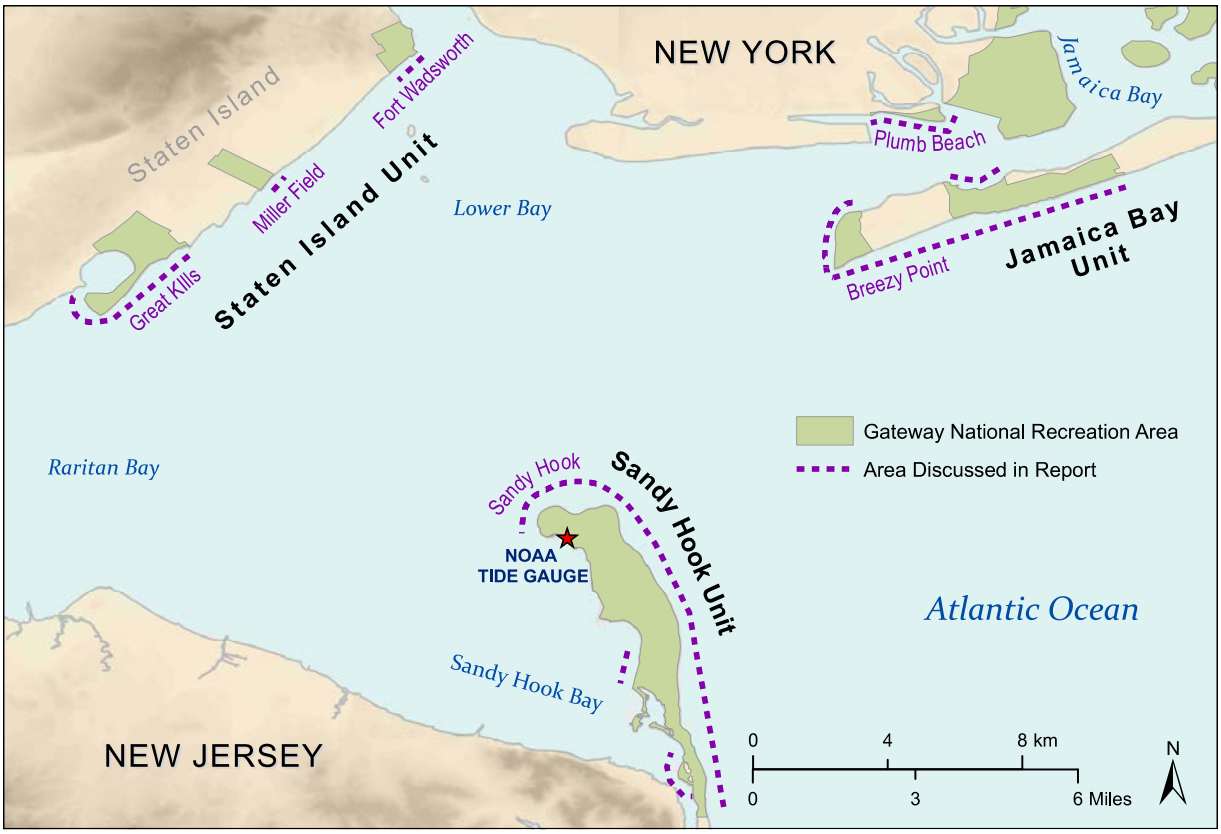


Figure 1. Location of coastal areas in Gateway NRA monitored with the dune/beach profile protocol.



Figure 2. Team installing PVC monument for 2D profile line. PVC (1.5 m length) at far left, coring at location of monument at right. Geodetic GPS unit for position determination in back.



Figure 3. Collecting 2D dune/beach profile with geodetic GPS equipment.

Timing of Dune/Beach Profile Surveys

The surveys are conducted during spring tide conditions to expose as much of the beach profile as possible and to facilitate the collection of the profile to at least the NAVD88 datum position (near mean sea level). On the basis of the protocol, the surveys occur at the end of the winter stormy period and at the end of the summer calm period, recording the seasonal variation of the dune/beach geomorphological system. As depicted in Figures 4 and 5, the surveys in the several units of GATE conform fairly well to the intended contrast of storminess. The first of the surveys was after a series of winter storms and was succeeded by a relatively stormless summer period, Hurricane Irene occurred in August, leading to the fall survey. Following the fall surveys, a succession of storms ensued until just about the spring 2012 surveys. Thus, the seasonal contrasts in storminess are generally consistent with the objectives of monitoring the changes in the dune/beach profiles associated with contrasts in energetics at the shoreline.

		Low Tide	
Season / Park	**Date of survey**	**Height* (m)**	**Time**
Spring 2011			
Sandy Hook	5 May 2011	0.139	03:00 PM
Great Kills	21 Apr 2011	-0.030	04:18 PM
Miller Field	21 Apr 2011	-0.030	04:18 PM
Fort Wadsworth	21 Apr 2011	-0.030	04:18 PM
Plumb Beach	15 Apr 2011	-0.087	11:12 AM
Breezy Point	26 May 2011	0.362	08:42 AM
Fall 2011			
Sandy Hook	9 Nov 2011	1.233	01:36 AM
Great Kills	26 Oct 2011	1.379	11:48 PM
Miller Field	26 Oct 2011	1.379	11:48 PM
Fort Wadsworth	26 Oct 2011	1.379	11:48 PM
Plumb Beach	25 Oct 2011	1.233	01:36 AM
Breezy Point	6 Nov 2011	0.305	11:00 AM
Spring 2012			
Sandy Hook	22 Mar 2012	1.295	01:06 PM
Great Kills	21 Mar 2012	-0.213	01:18 PM
Miller Field	21 Mar 2012	-0.213	01:18 PM
Fort Wadsworth	21 Mar 2012	-0.213	01:18 PM
Plumb Beach	4 Apr 2012	1.340	10:42 AM
Breezy Point			

*Tide elevation values are referenced to Mean Low Water (MLLW)

Figure 4. Survey dates and tidal position in the park areas.

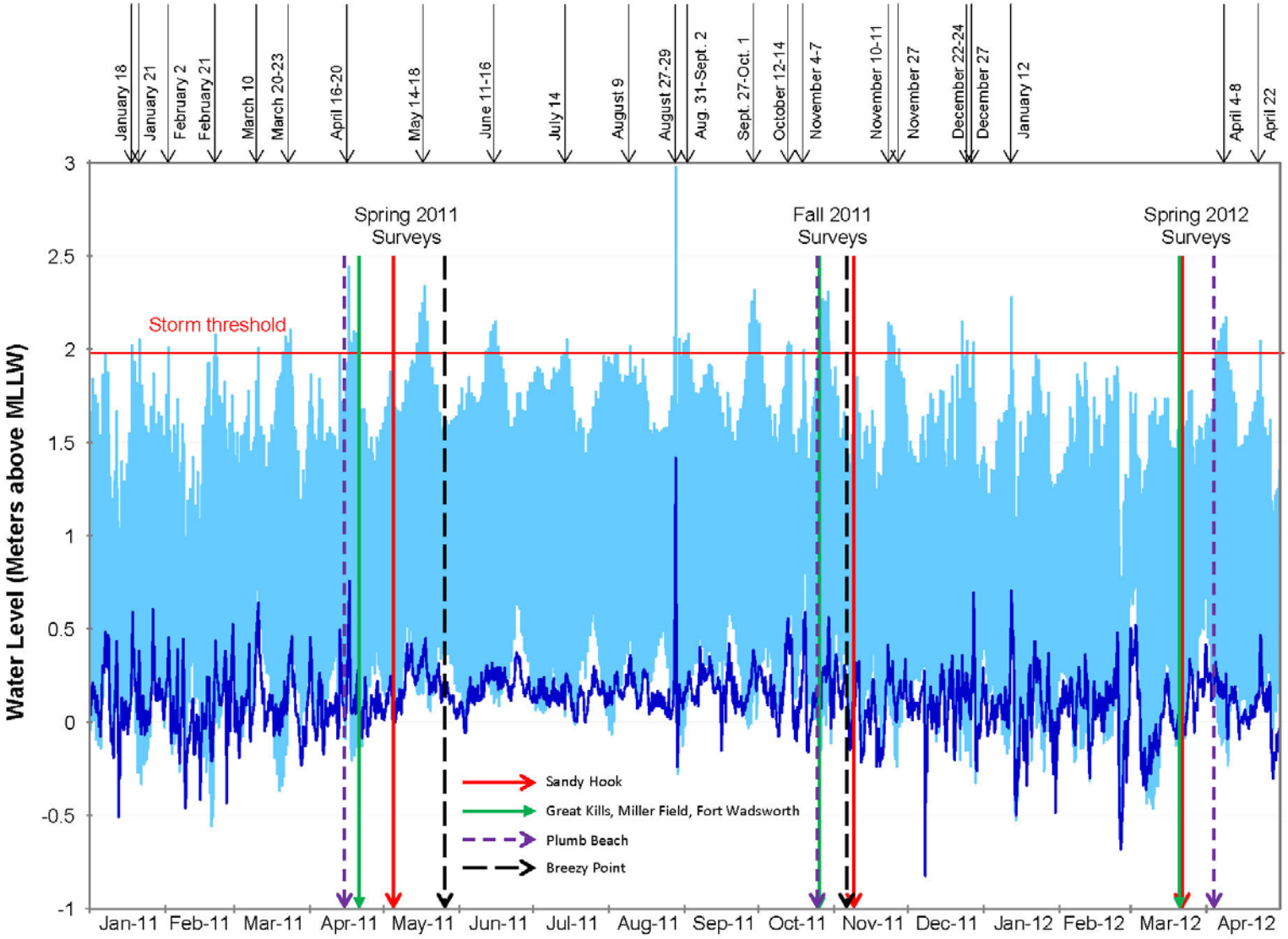


Figure 5. Water level variation and survey dates in the several parts of GATE during seasons. Dark blue line is a measure of surge (difference of actual water level compared to predicted). Water level is derived from the Sandy Hook tide gauge (web site).

Defining Water Level

In 2003, the National Ocean Service (NOS) changed the basis for referencing water levels at the tidal gauges by switching to the 1983-2001 tidal epoch. This 19-year period incorporates all of the water level variations caused by the cyclic planetary attraction of the earth, moon, and sun and establishes a new reference base for such measures as Mean Sea Level, Mean Low Water, Mean Higher High Water, etc. All of the predicted measures of water level are now related to this tidal epoch and all of the predicted elevations will be related to the Mean Lower Low Water derived from this period. All of the water level elevations in Figure 6 are depicted relative to MLLW as the 0.0 datum relative to the 1983-2001 tidal epoch. However, the absolute elevation of MLLW has changed because the world's oceans are rising and encroaching on the adjacent shores. The absolute elevations of the stationary features, such as the tide gauges, the roads, the Park infrastructure, etc. are affected by this global sea-level rise.

The dune/beach profiles are surveyed and recorded relative to a fixed datum, the North American Vertical Datum of 1988 (NAVD88). At the present time, NAVD88 and mean sea level are at similar elevations and the dune/beach topography has a similar relationship to these two elevations. However, as sea level rises through time, the topography will adjust and differeences will increase. Referencing a constant elevation and position with a fixed monument will permit the monitoring of spatial and elevational evolution as the profile responds to changes in sediment supply and increased water level.

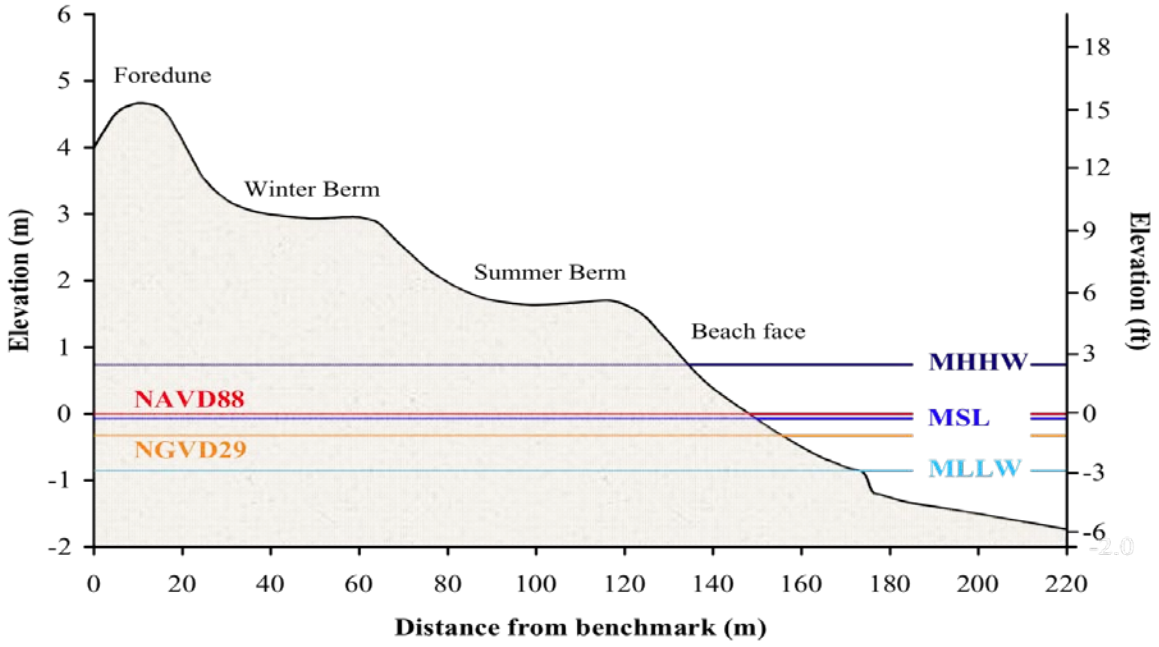


Figure 6. Relationship of 1983-2001 tidal epoch water levels to the North American Vertical Datum of 1988, to the 1929 National Geodetic Vertical Datum, and to a representative beach profile at Sandy Hook. All values are portrayed relative to NAVD88. Other terms are: MLLW = mean lower low water; NGVD29 = National Geodetic Vertical Datum of 1929; MSL = mean sea level; and MHHW = mean higher high water.

A comparison of the mean water elevation measured in the new tidal epoch and the mean water elevation in the previous tidal epoch indicates that the Sandy Hook tide gauge has undergone a relative sea-level rise of 7.92 cm (0.26 ft) in the interim. This relative sea-level rise includes the depression of the land as well as the increase of the water in the ocean. Together, these values constitute the relative increase of the water surface at the coast.

The tide gauge data shown in Figure 6 are themselves unaffected by the change in tidal epoch. They are portraying the water level elevations relative to the mean lower low water condition, and that is a statistical datum for the 19-year time span. But, the mean lower low water elevation (MLLW) has changed compared to a stationary level, such as NGVD29 as well as NAVD88. The increase in sea level is causing a slow but continuous change in the position of the beach profile as it elevates and shifts inland to maintain its topographical features that are, in turn, related to water level. Additionally, all of the permanent facilities in the coastal portions of GATE are increasingly exposed to storm surge and flooding because of the higher water surface upon which storms are developing.

Results of Monitoring Efforts

The short-term changes depicted in one year of monitoring are not indicative of the trends of the changes, but they do depict the type of information that is derived from the surveys. The intent herein is to portray the elements of the dune/beach profiles and to present some of the numerical data that can be derived. This presentation is a simple catalog of the dimensional changes described as possible outcomes in the Protocol document (Psuty et al. 2012). It is not meant to be all-inclusive. Further, only some of the spatial results are presented, as examples, because of the limitations of one year of data. Each profile site of the GATE topographical monitoring program is presented to depict its location and the seasonal changes at each of the sites. Dimensions of change are incorporated on each of the Profile figures and in summary tables in Appendix A and Appendix B.

Sandy Hook

Sixteen monuments have been established along the ocean and bay shoreline of Sandy Hook (Fig. 7). They may be tied to some pre-existing item, such as a concrete pad, or they may be tied to a newly-installed PVC pipe filled with concrete. The location, description, coordinates of the Sandy Hook monuments are detailed in a booklet prepared for this purpose (Psuty, et al., 2010g).

The monuments at SH4 and SH14 had to be re-located because of considerable erosion associated with Hurricane Irene in August 2011. That displacement is shown on the profiles for those two locations, and the changes are recorded in the Sandy Hook Survey Monument Booklet. All of the measures of dimensional changes are adjusted to reflect the cross-sections related to the new monument location. Also, Profiles SH9.1 and SH9.2 lack a Spring 2012 survey because of dredging in the navigation channel adjacent to the northern terminus of Sandy Hook and the closure of that portion of Sandy Hook for safety concerns. It is anticipated that the survey lines will be re-occupied following dredging of the navigation channel.



Figure 7. Location of 16 monuments and their accompanying azimuths on Sandy Hook used in running the 2D beach/dune profiles.

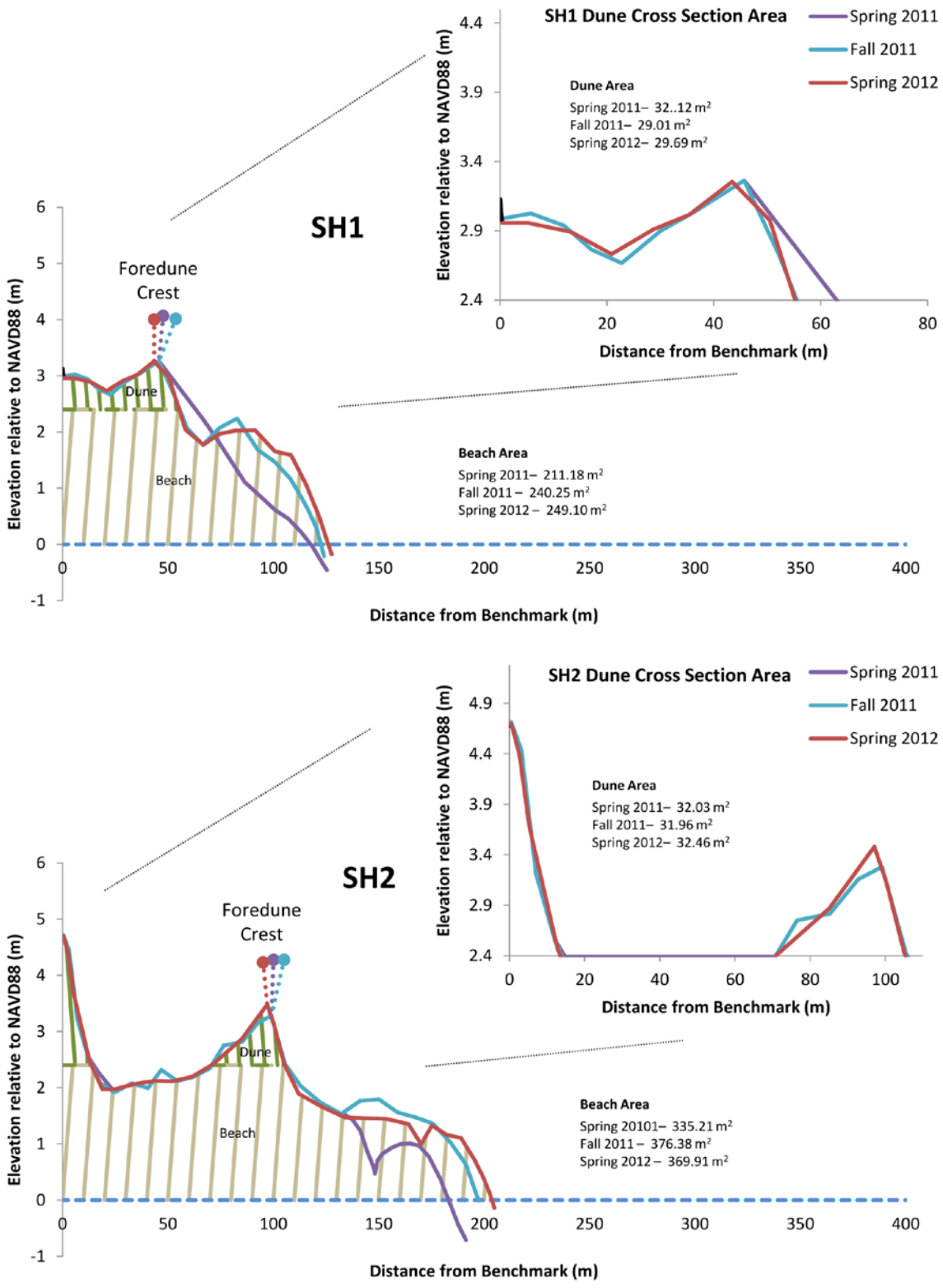


Figure 8. Profiles SH1 and SH2, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

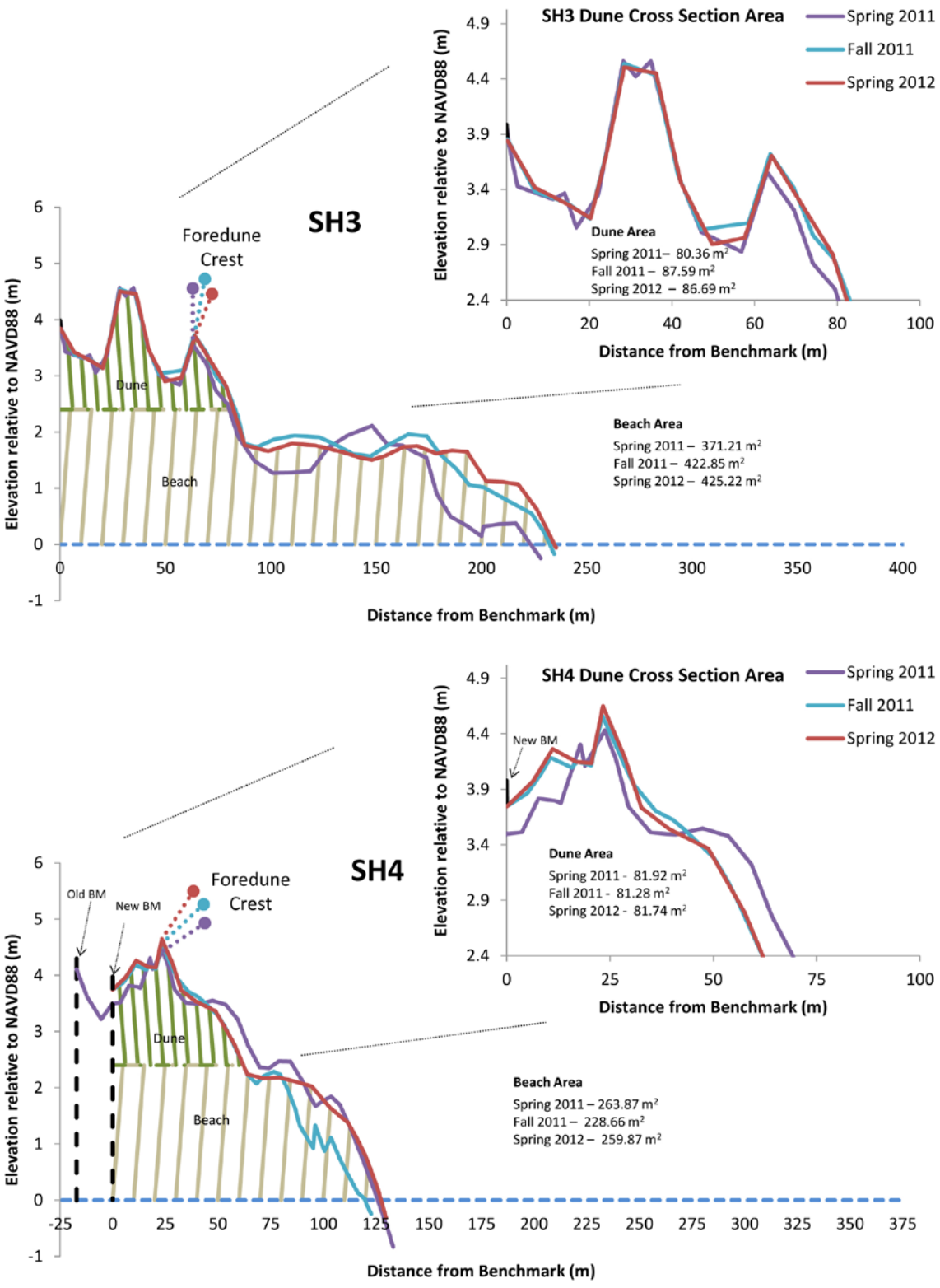


Figure 9. Profiles SH3 and SH4, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

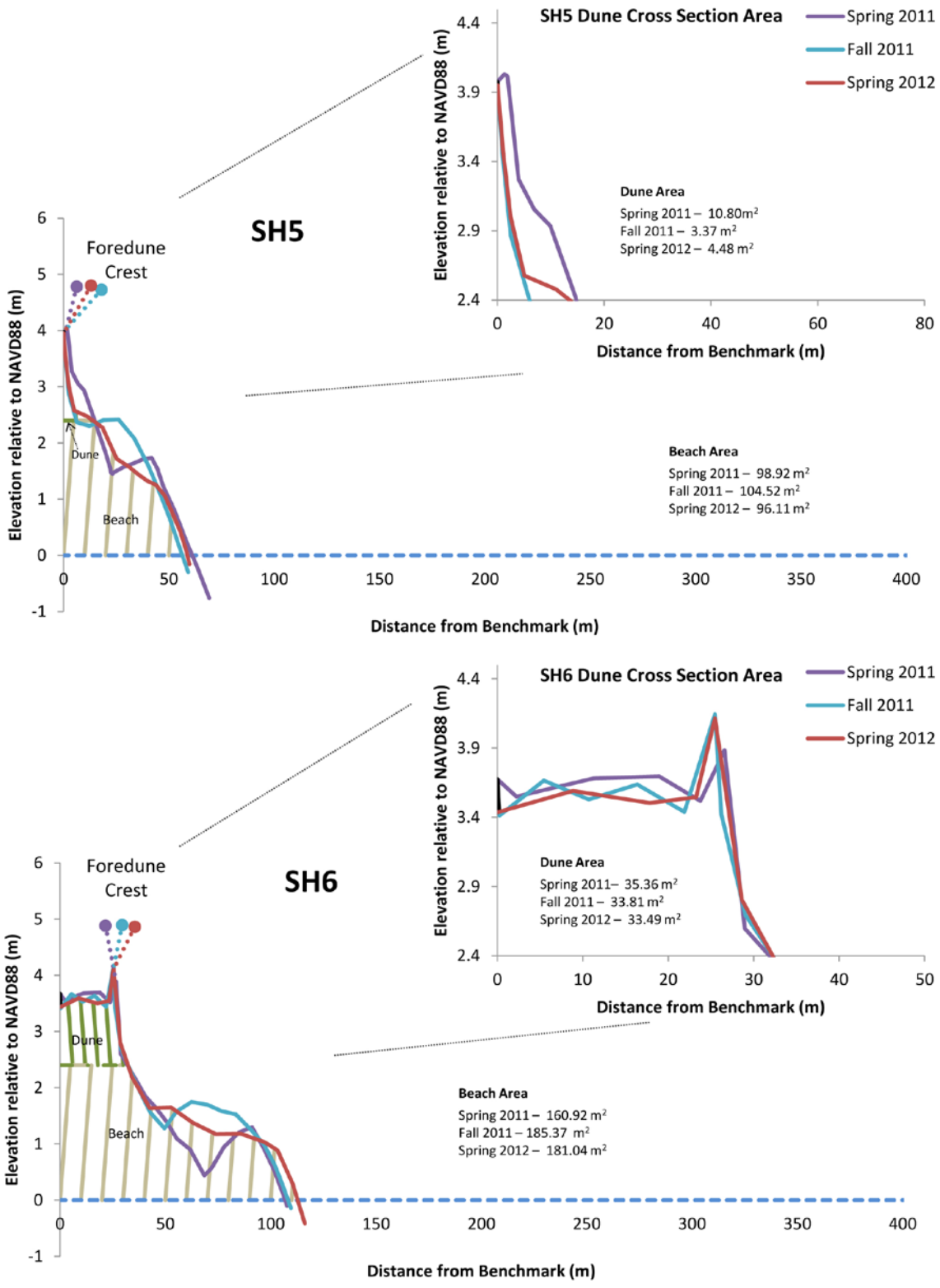


Figure 10. Profiles SH5 and SH6, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

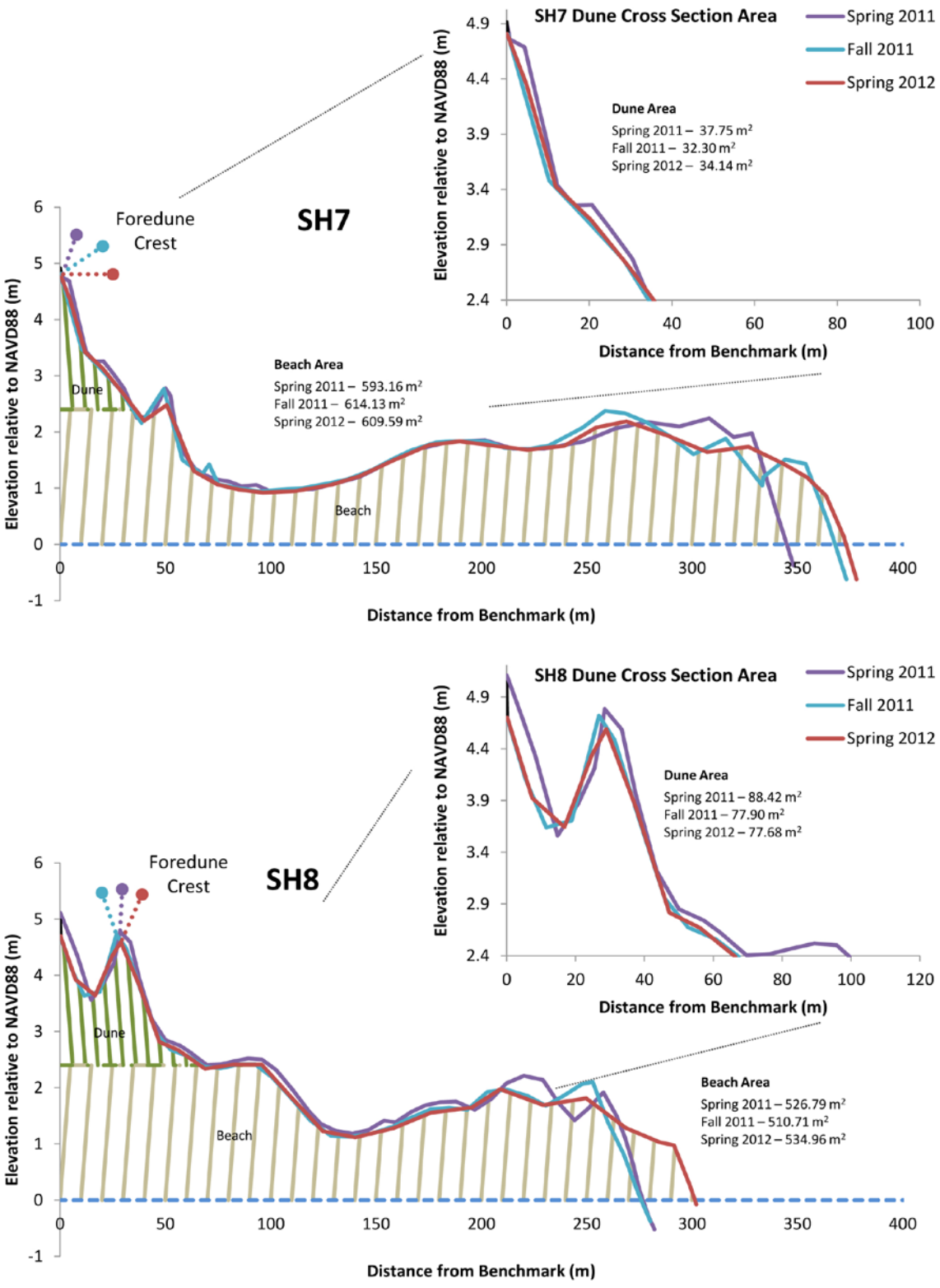


Figure 11. Profiles SH7 and SH8, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

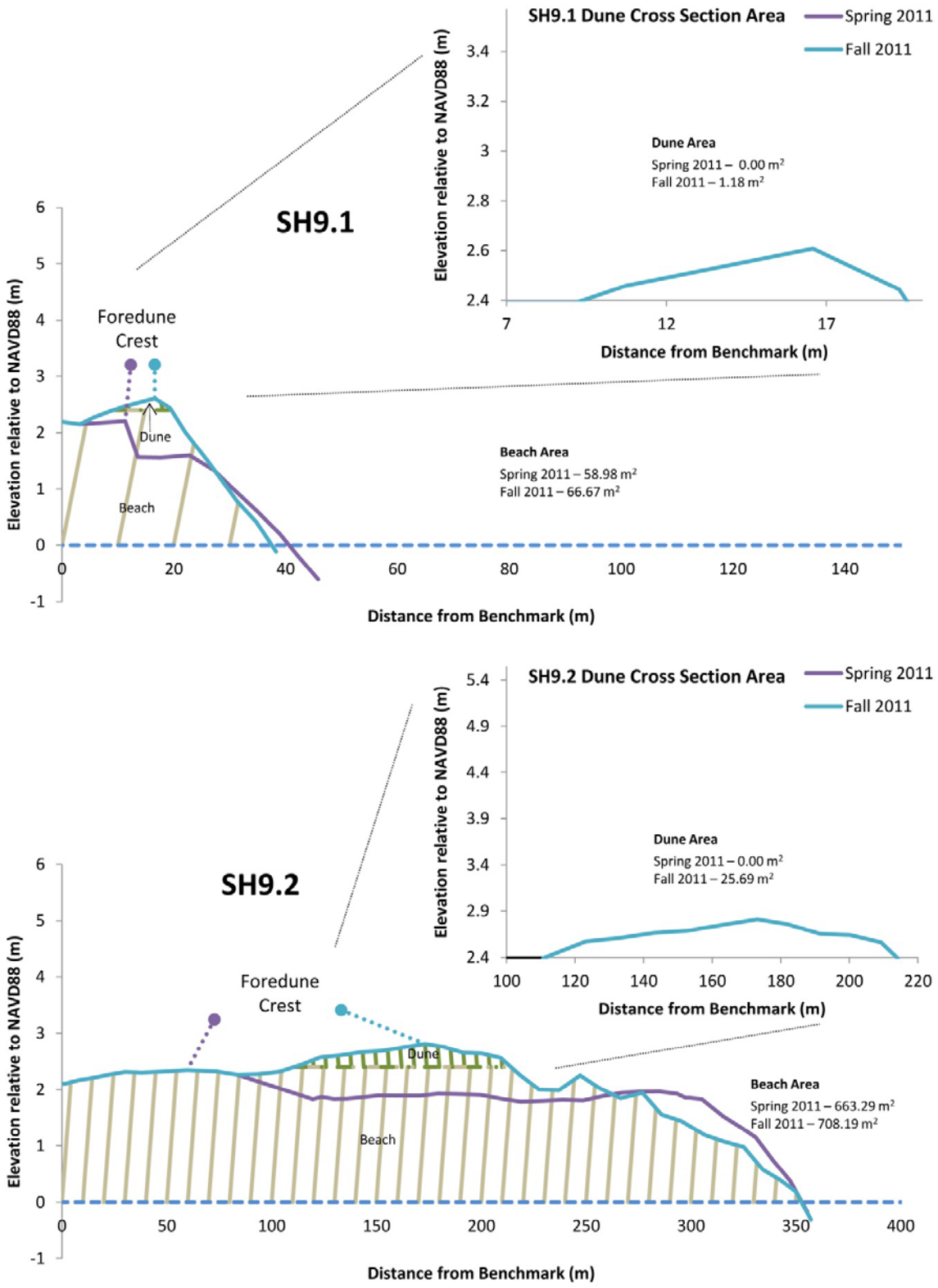


Figure 12. Profiles SH9.1 and SH9.2, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

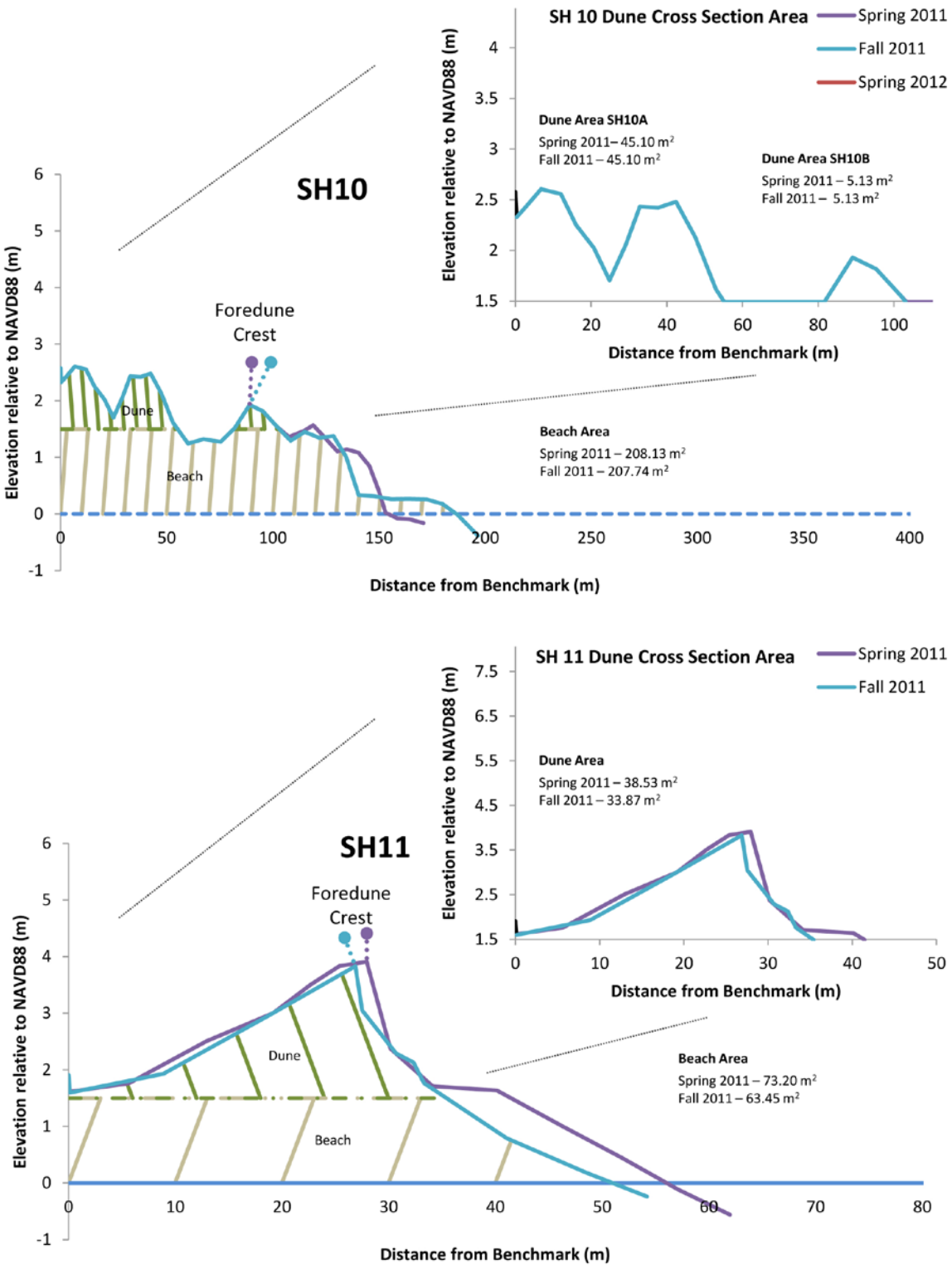


Figure 13. Profiles SH10 and SH11, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

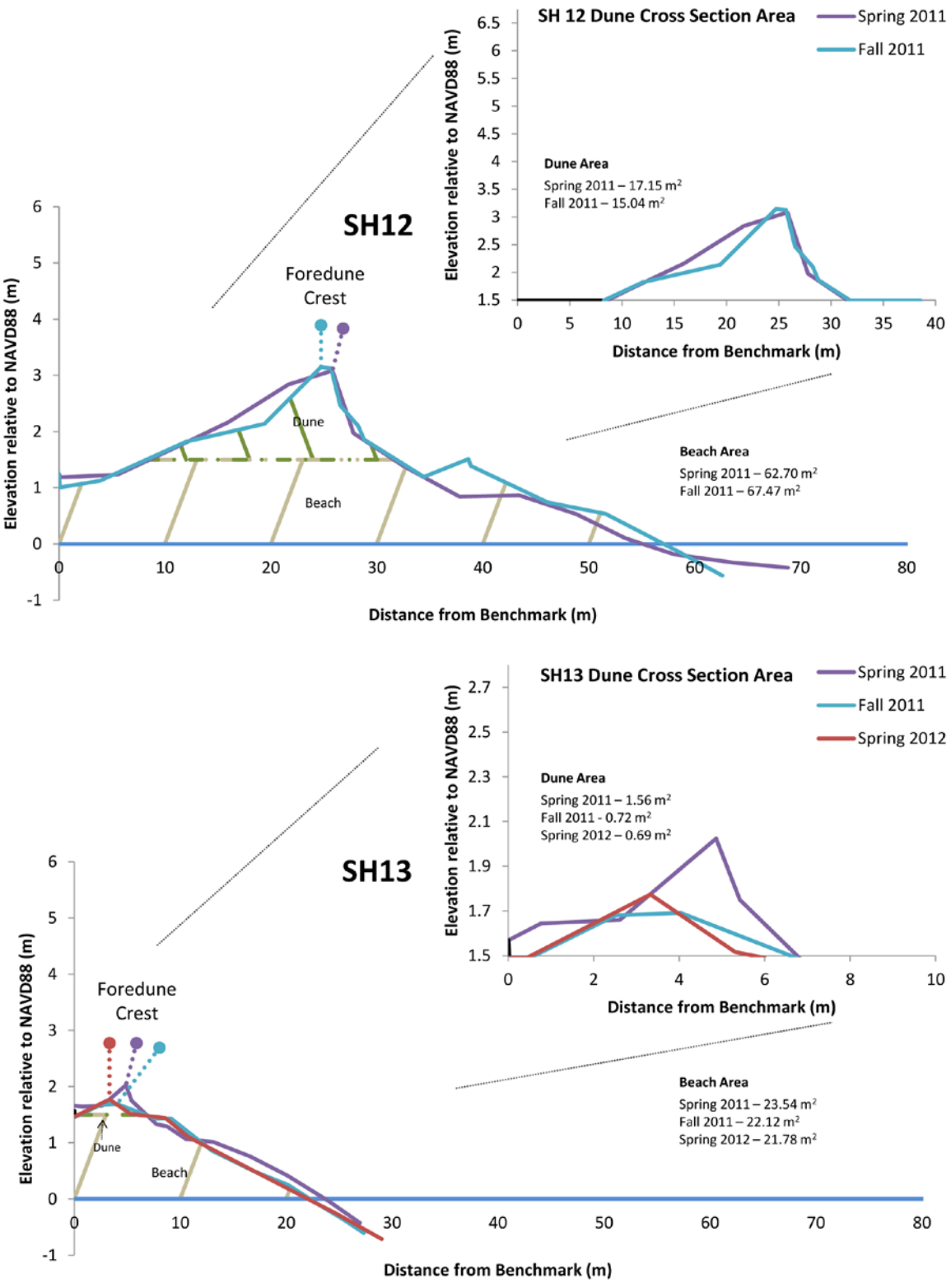


Figure 14. Profiles SH12 and SH13, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

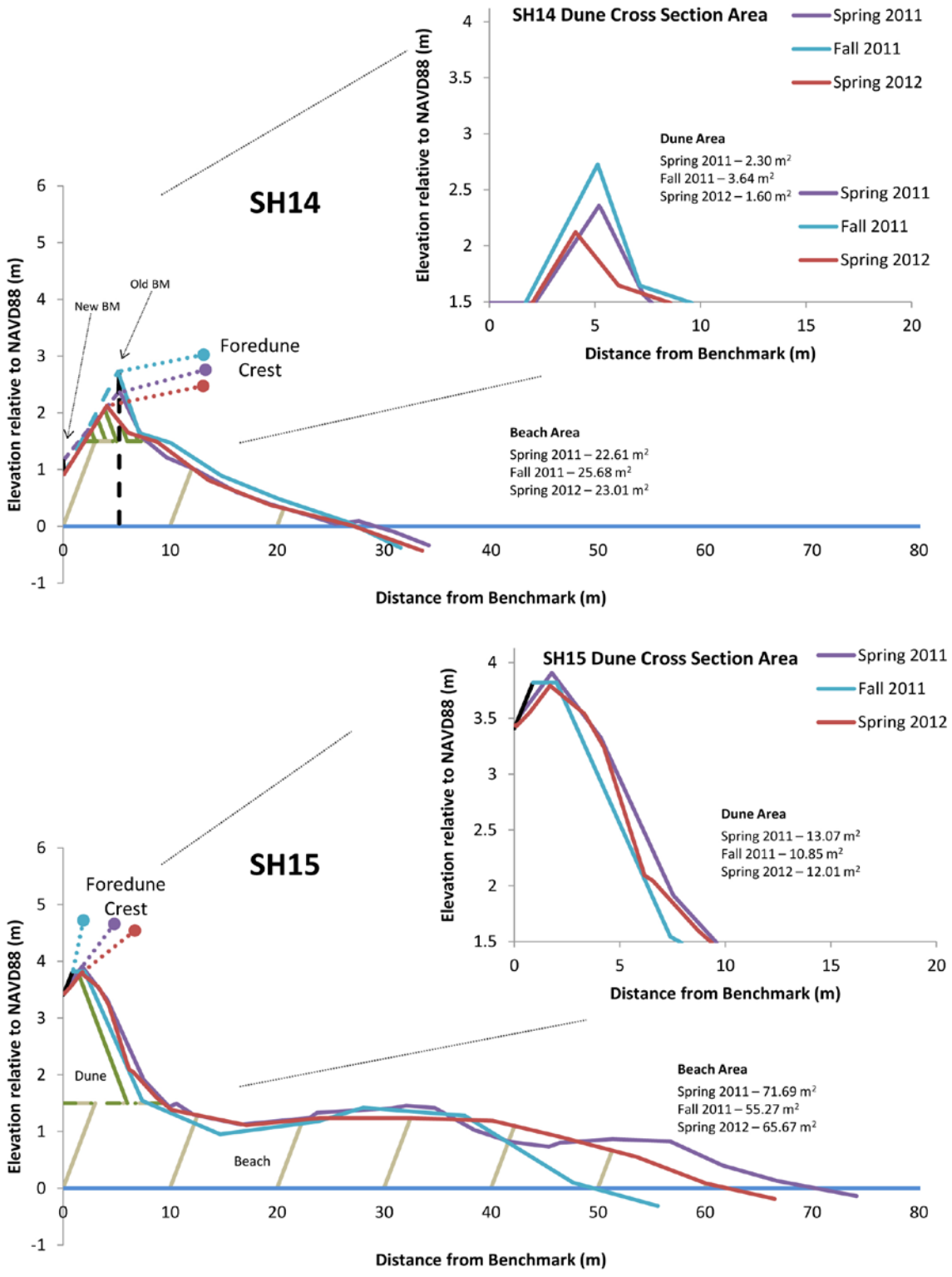


Figure 15. Profiles SH14 and SH15, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

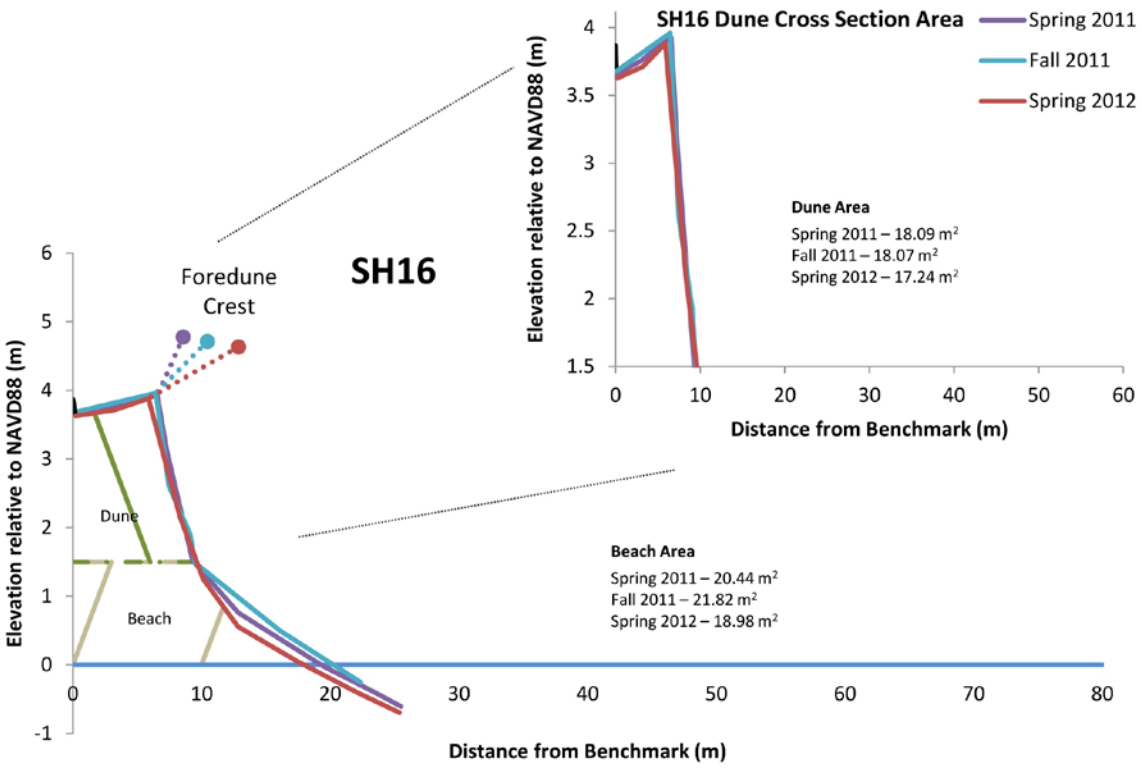


Figure 16. Profile SH16, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

Breezy Point

Eleven monuments have been established along the ocean and bay shoreline of Breezy Point (Fig. 17). They may be tied to some pre-existing item, such as a concrete pad, or they may be tied to a newly-installed PVC pipe filled with concrete. The location, description, coordinates of the Breezy Point monuments are detailed in a booklet prepared for this purpose (Psuty, et al., 2010c).



Figure 17. Location of 11 monuments and their accompanying azimuths (red lines) on Breezy Point used in running the 2D beach/dune profiles.

Problem

The Breezy Point Spring 2012 survey data set is missing. The survey was run and the Field Data Form has no mention of any difficulty in collecting the data. Attempts to find the data are ongoing. The file may have been mislabeled or may have been erased. It may have been misplaced in the cleaning of the files. All of the figures lack any input from the Spring 2012 survey period.

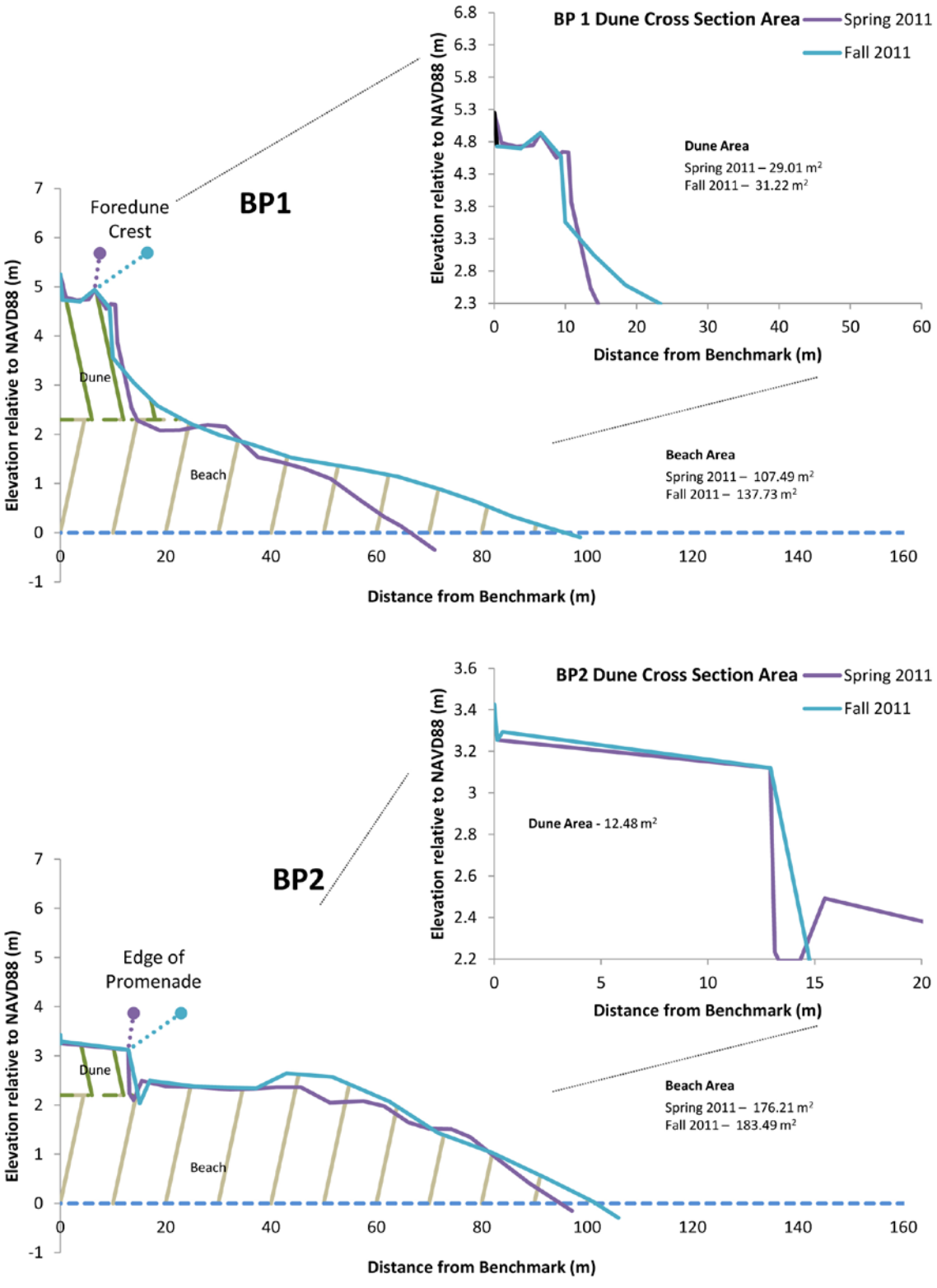


Figure 18. Profiles BP1 and BP2, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

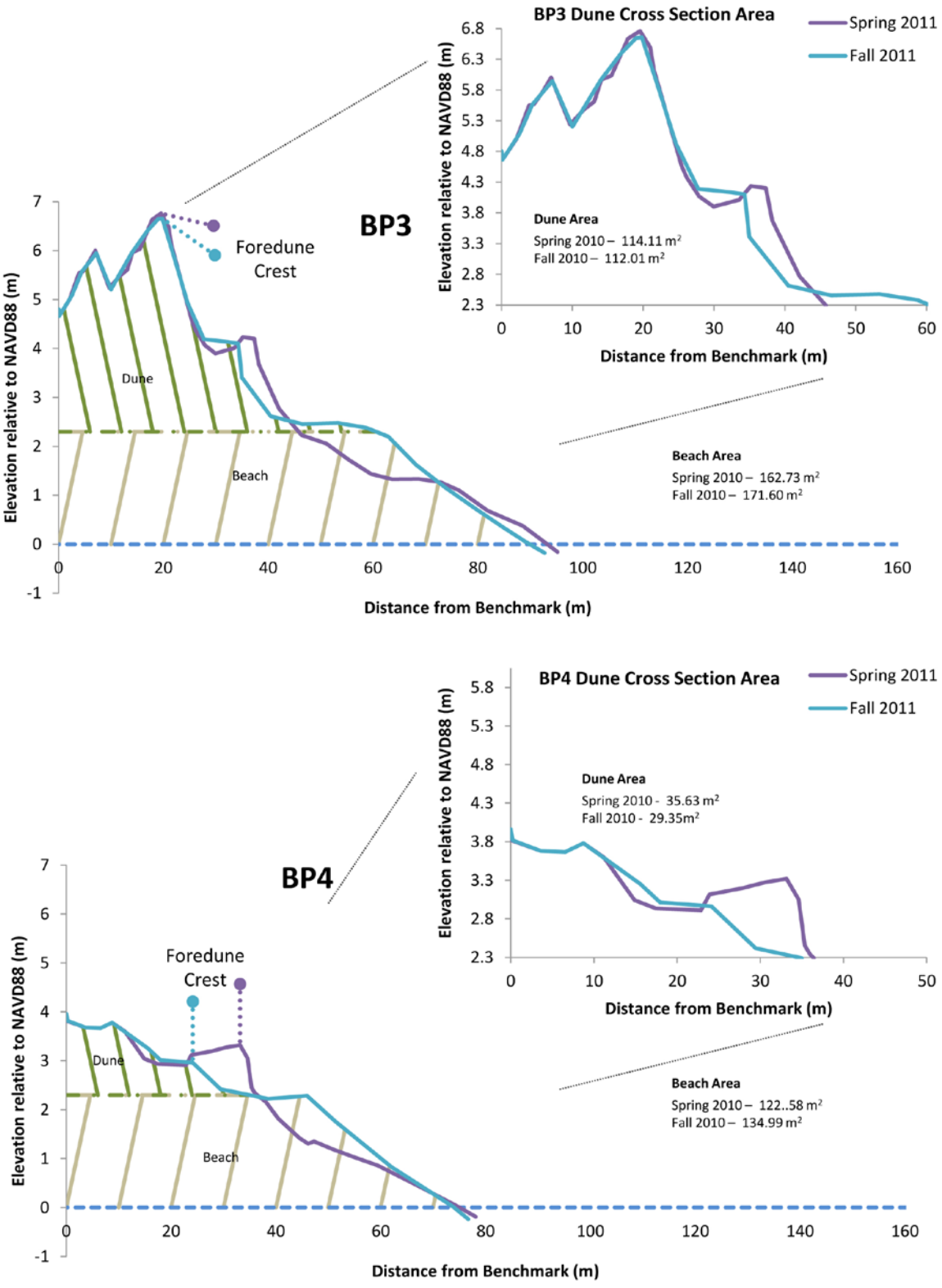


Figure 19. Profiles BP3 and BP4, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

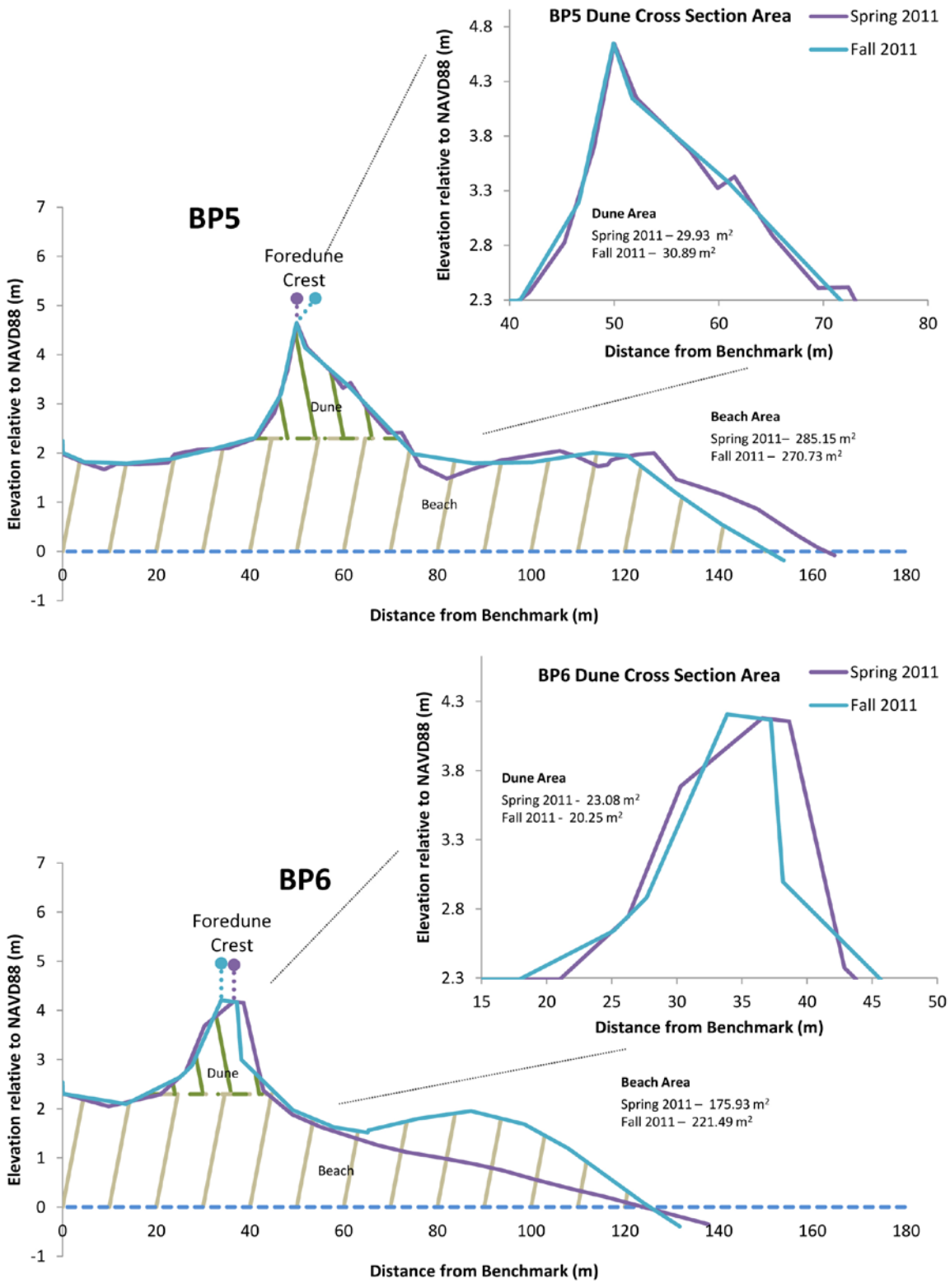


Figure 20. Profiles BP5 and BP6, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

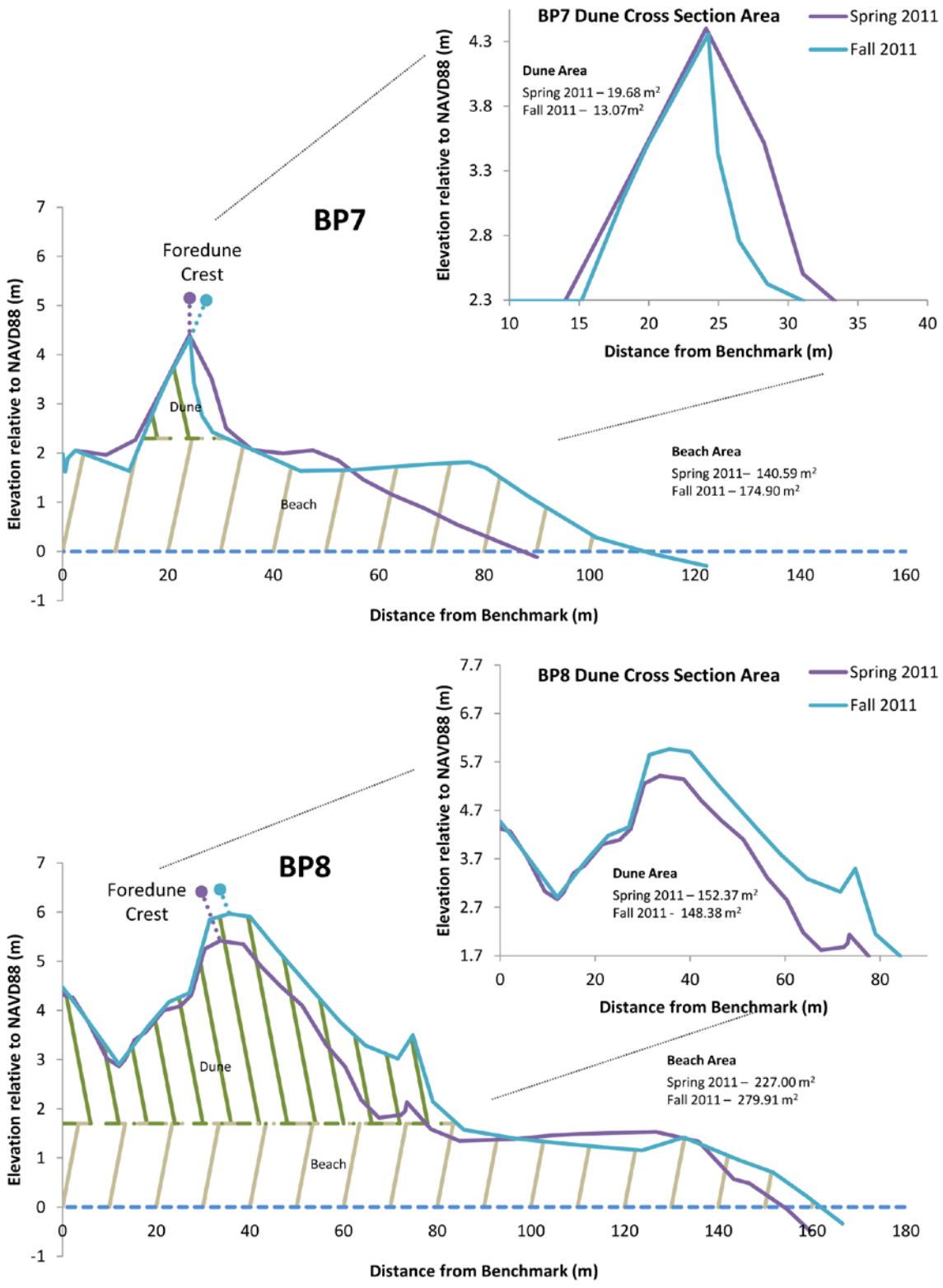


Figure 21. Profiles BP7 and BP8, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

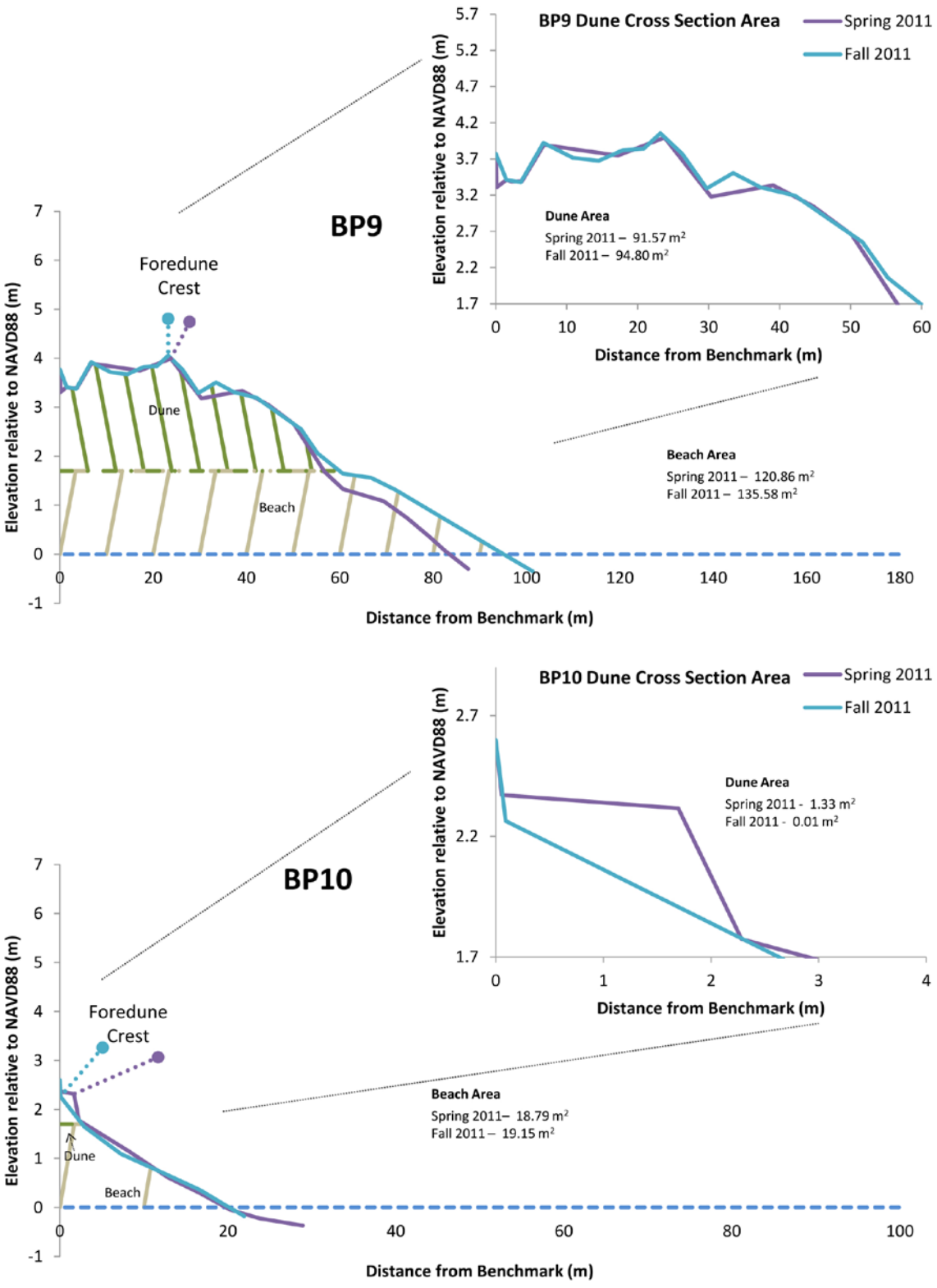


Figure 22. Profiles BP9 and BP10, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

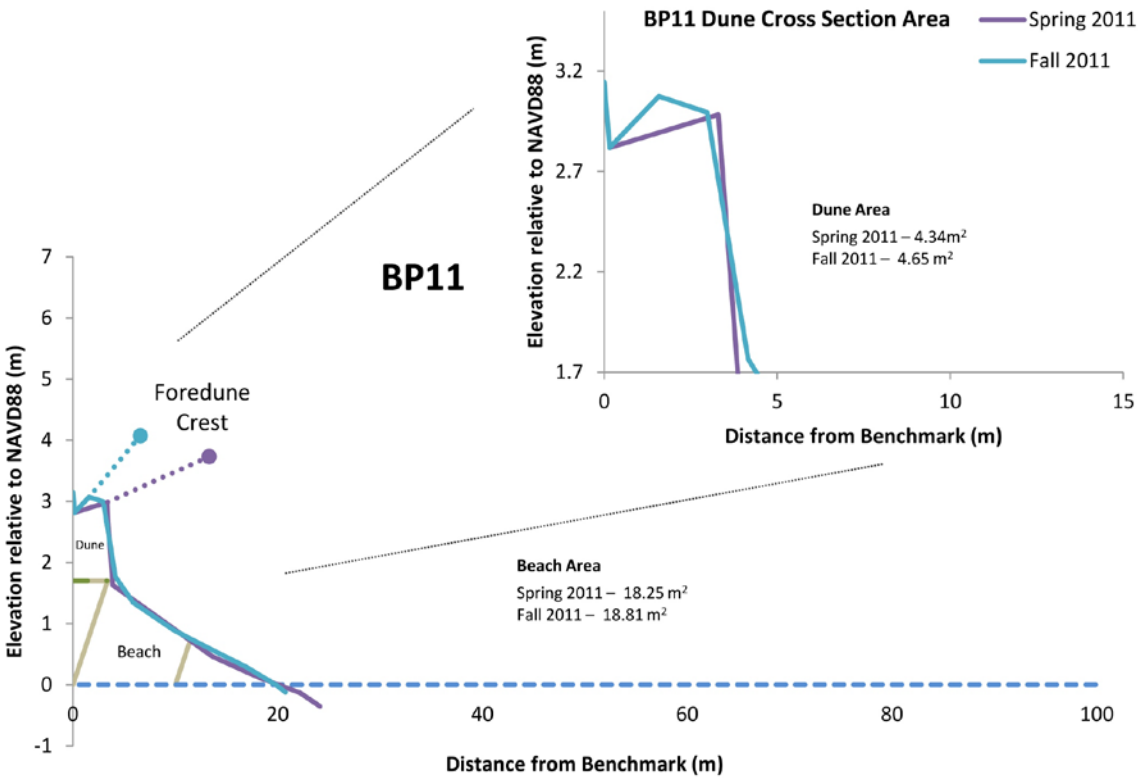


Figure 23. Profile BP11, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

Plumb Beach

Five monuments have been established along the ocean-facing shoreline of Plumb Beach (Fig. 24). They may be tied to some pre-existing item, such as a concrete curb, or they may be tied to a newly-installed PVC pipe filled with concrete. The location, description, coordinates of the Plumb Beach monuments are detailed in a booklet prepared for this purpose (Psuty, et al., 2010f).

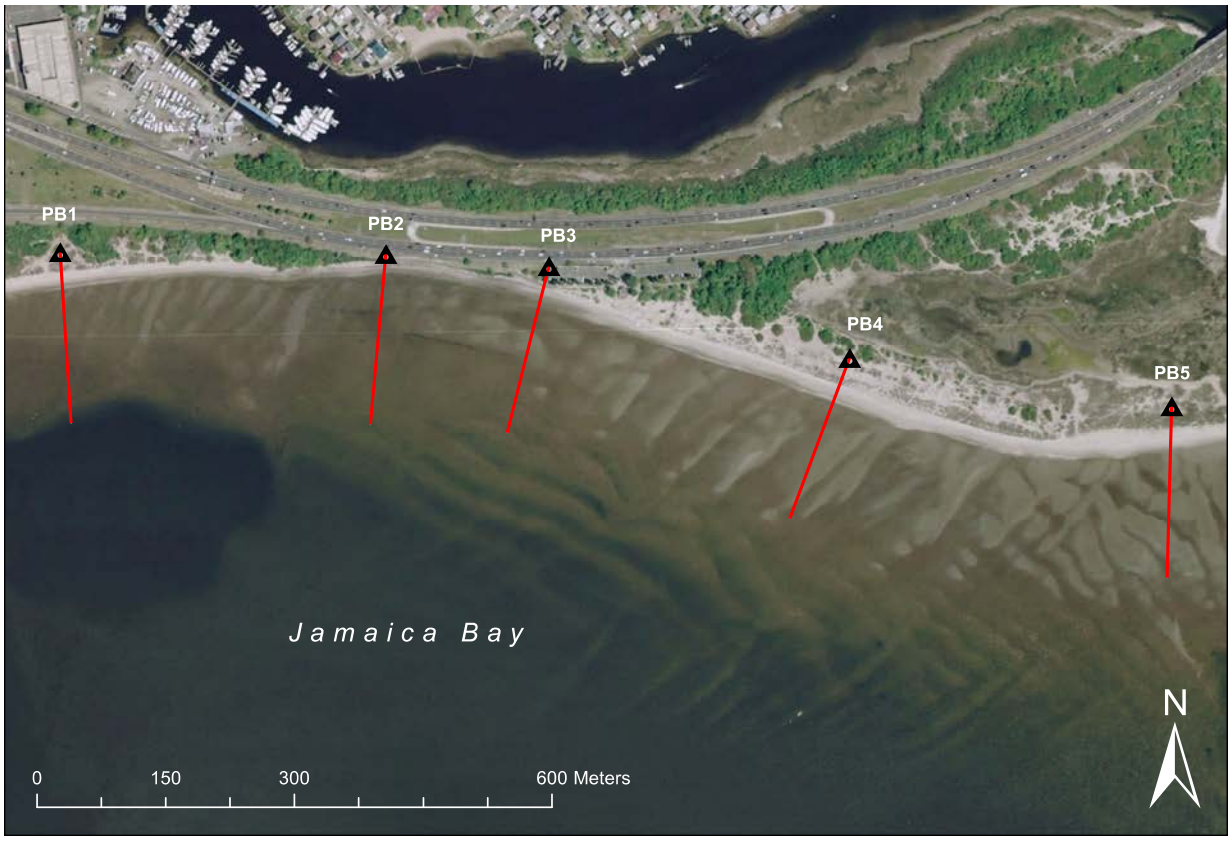


Figure 24. Location of five monuments and their accompanying azimuths (red lines) at Plumb Beach used in running the 2D beach/dune profiles.

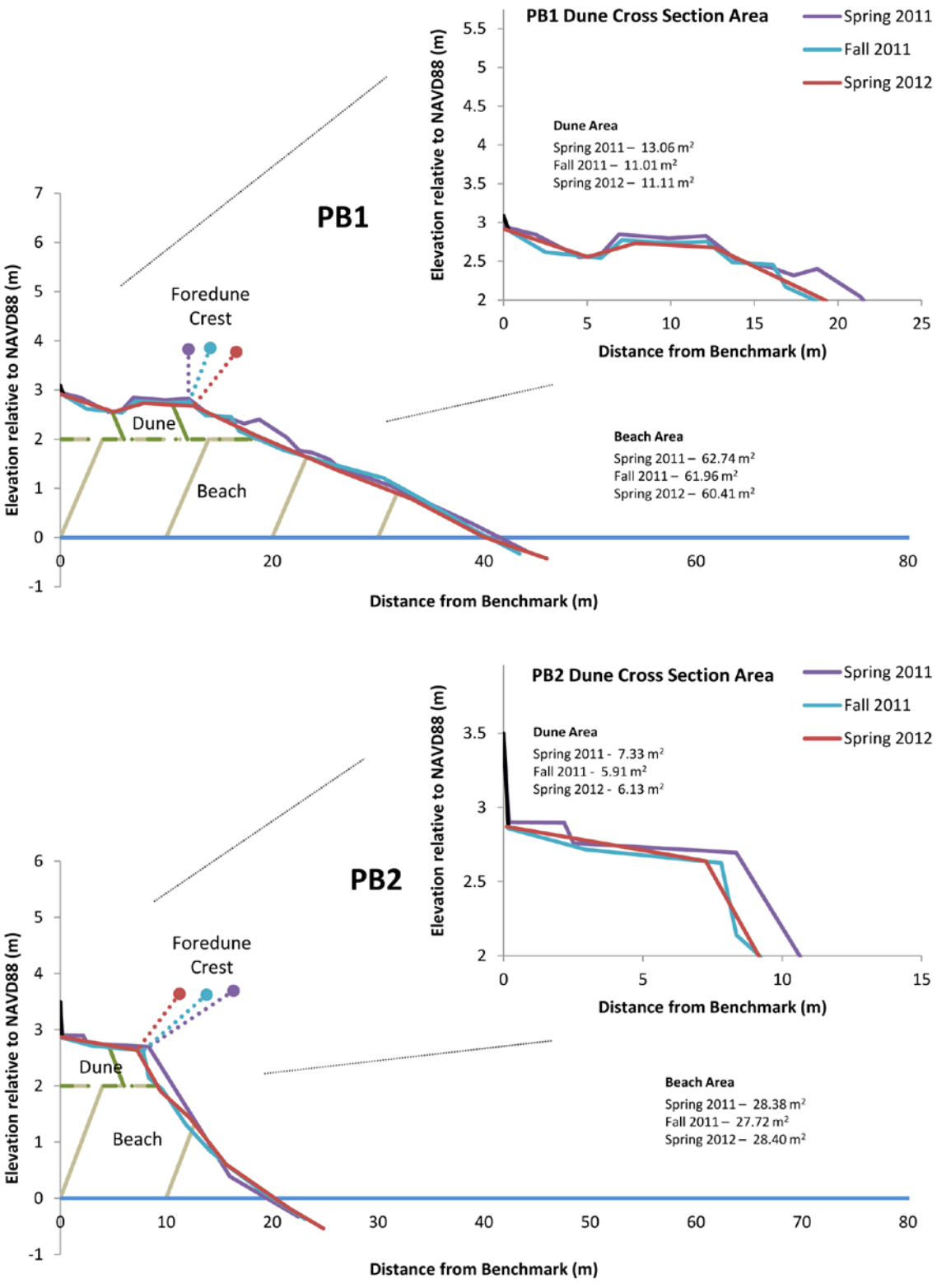
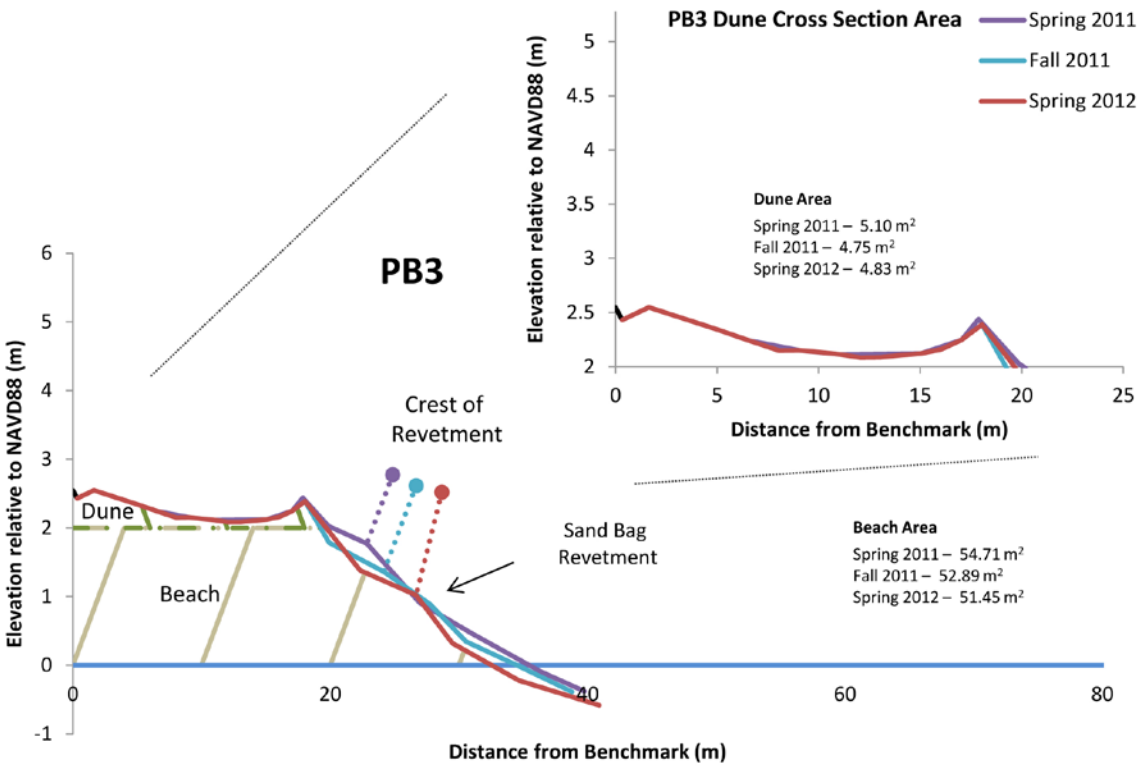


Figure 25. Profiles PB1 and PB2, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.



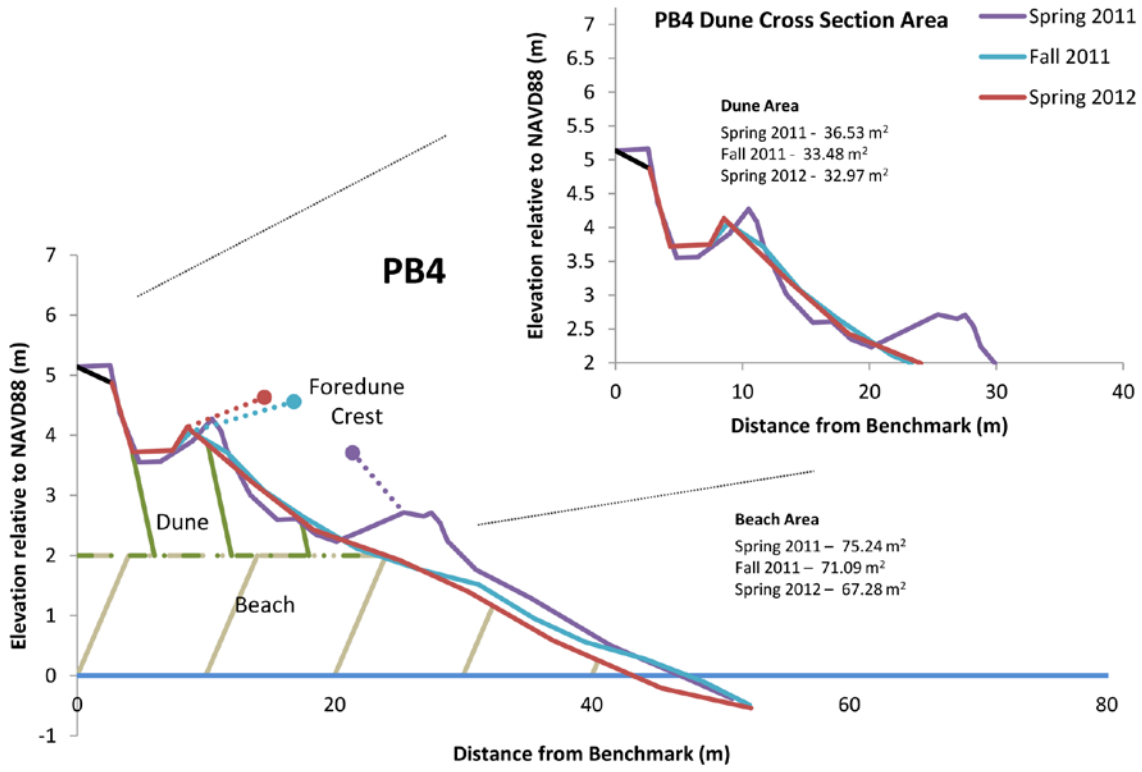


Figure 26. Profiles PB3 and PB4, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

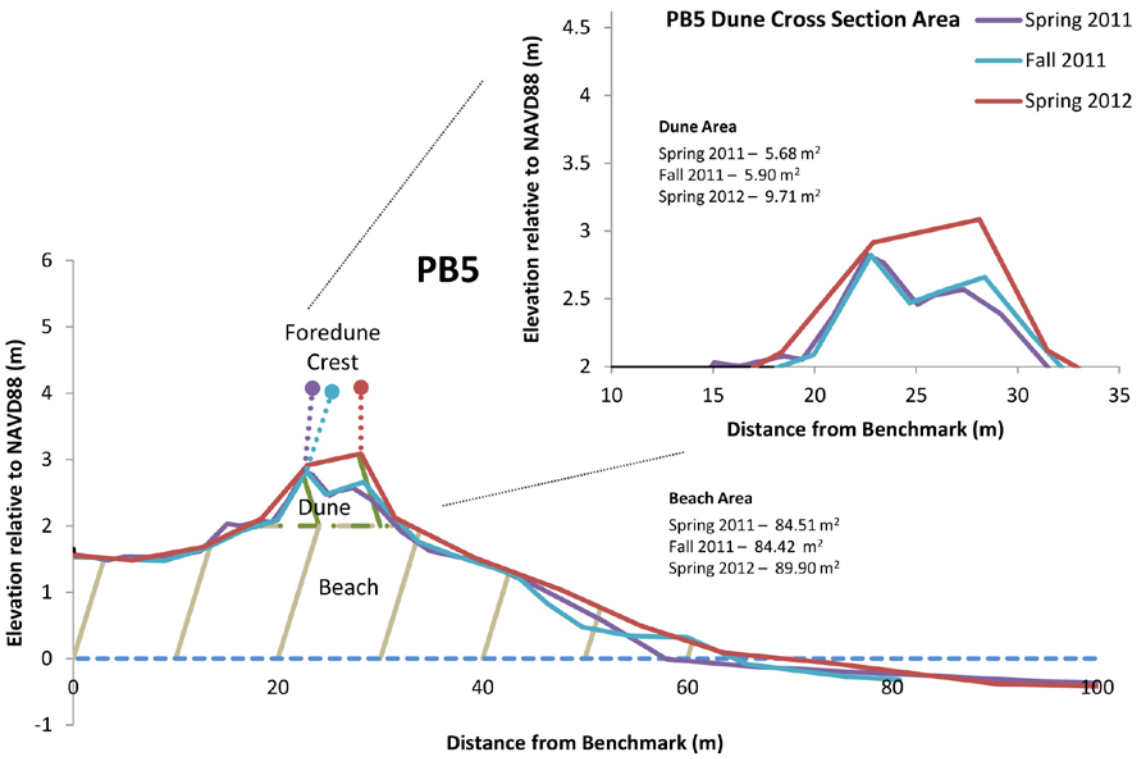


Figure 27. Profile PB5, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

Great Kills

Nine monuments have been established along the ocean-facing shoreline of Great Kills (Fig. 28). They may be tied to some pre-existing item, such as a concrete curb, or they may be tied to a newly-installed PVC pipe filled with concrete. The location, description, coordinates of the Great Kills monuments are detailed in a booklet prepared for this purpose (Psuty, et al., 2010d). There is a data gap at Profiles GK7 and GK8 caused by poor radio reception and subsequent failure of the equipment to receive and process a signal. GK7 is missing the Spring 2011 and Fall 2011 surveys, GK8 is missing the Spring 2011 survey.



Figure 28. Location of nine monuments and their accompanying azimuths at Great Kills used in running the 2D beach/dune profiles.

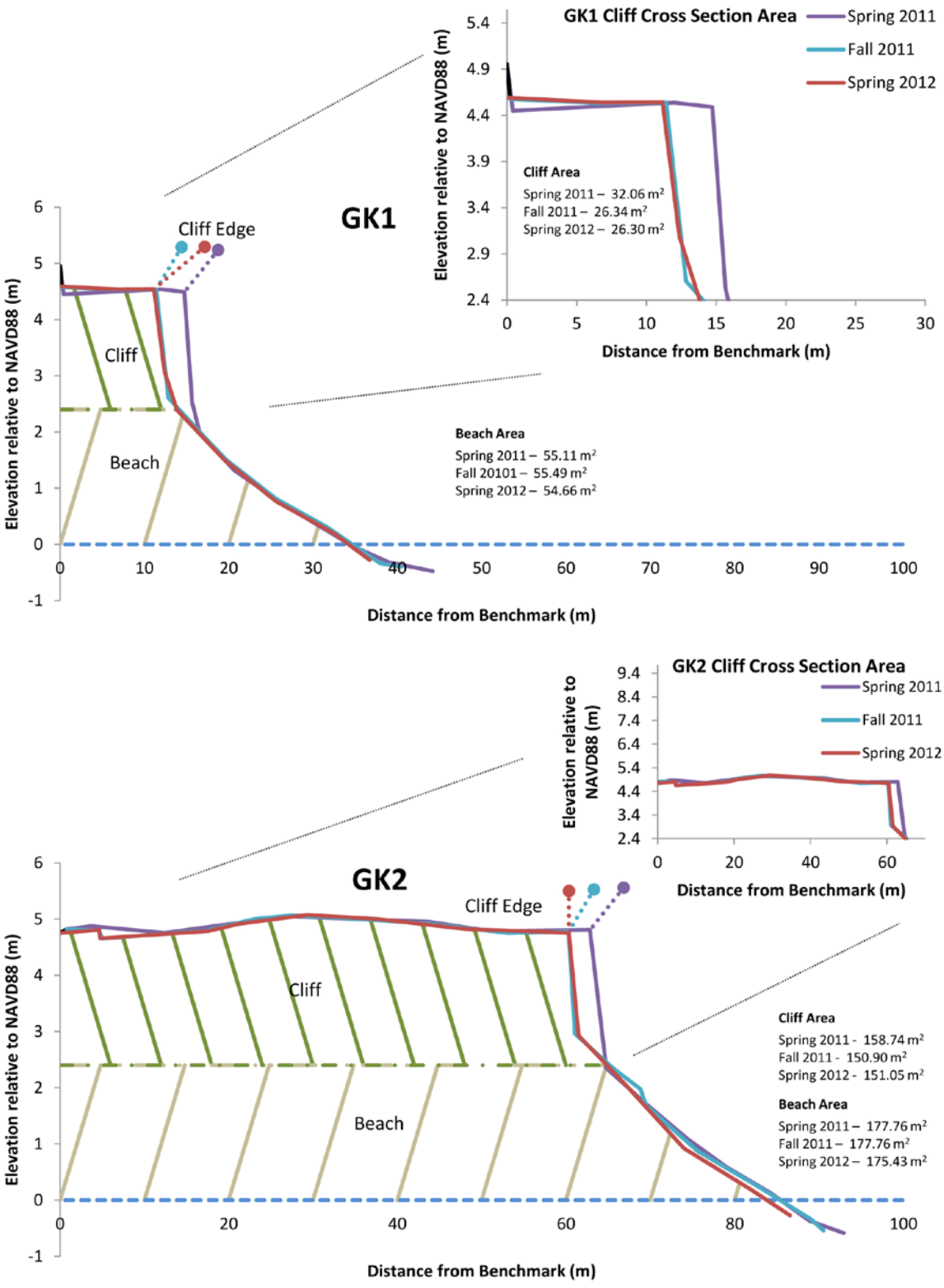


Figure 29. Profiles GK1 and GK2, features are labeled, cross-sectional area is calculated for beach and dune for each of the two spring surveys.

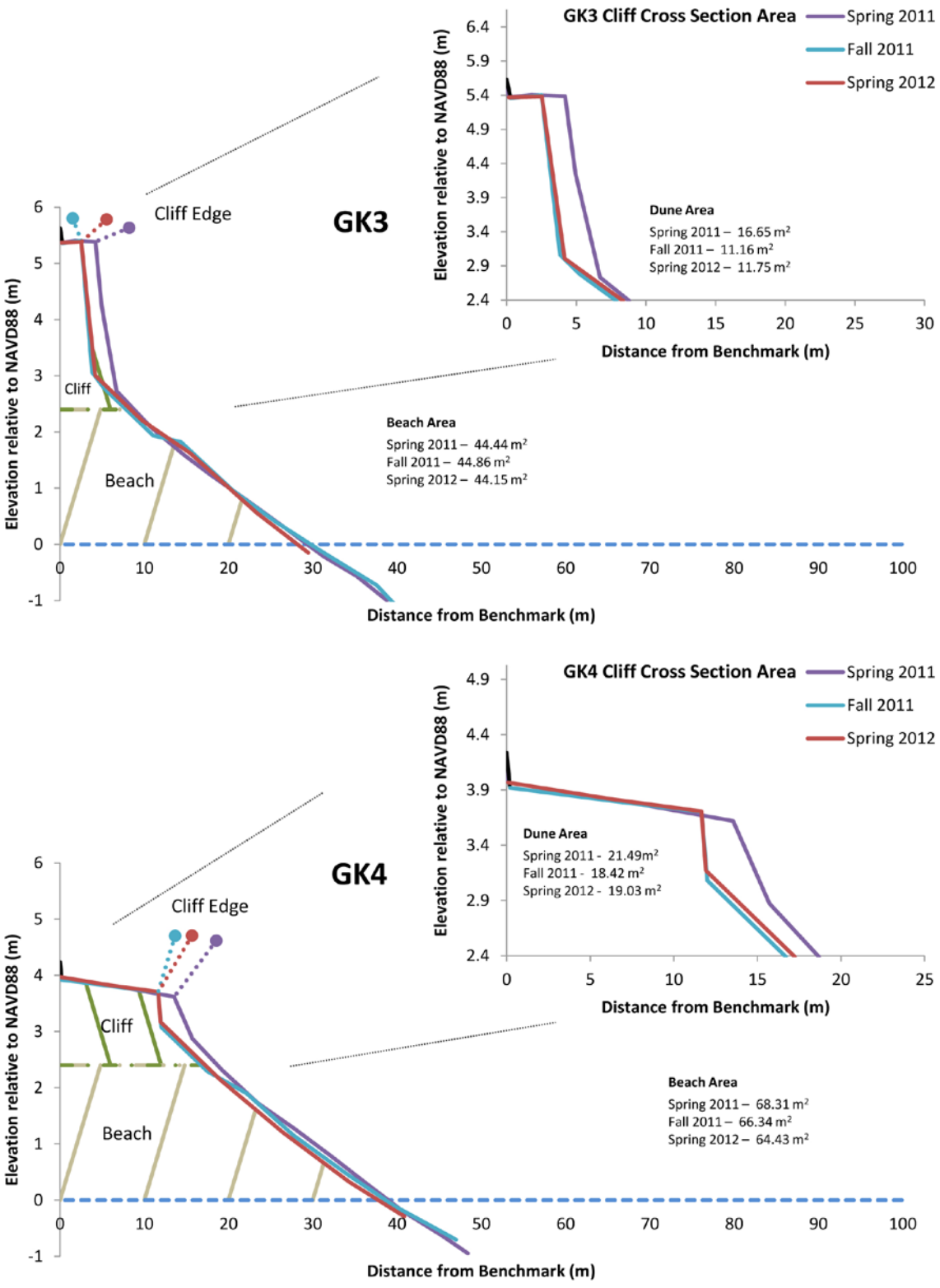


Figure 30. Profiles GK3 and GK4, features are labeled, cross-sectional area is calculated for beach and dune for each of the two spring surveys.

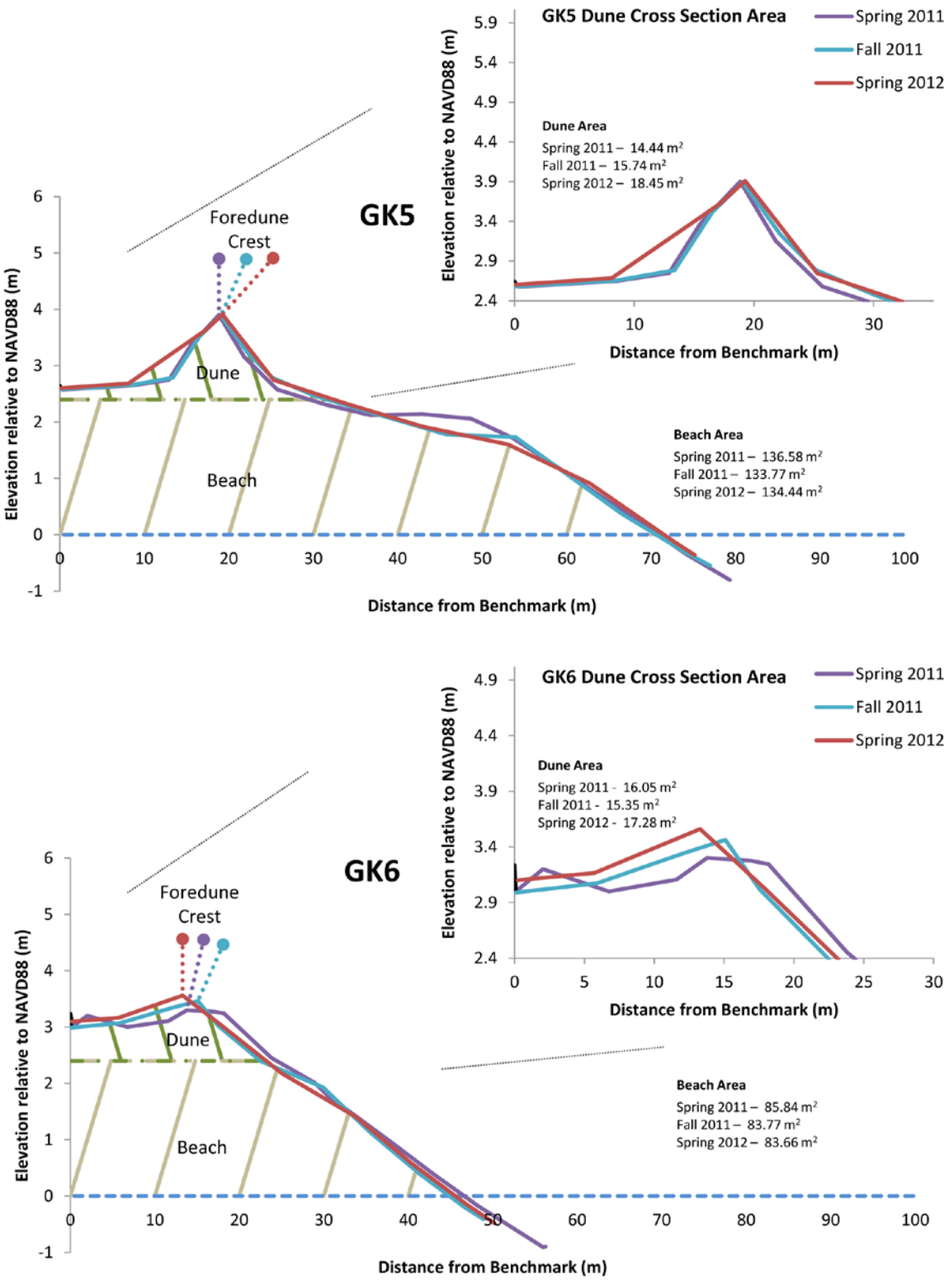


Figure 31. Profiles GK5 and GK6, features are labeled, cross-sectional area is calculated for beach and dune for each of the two spring surveys.

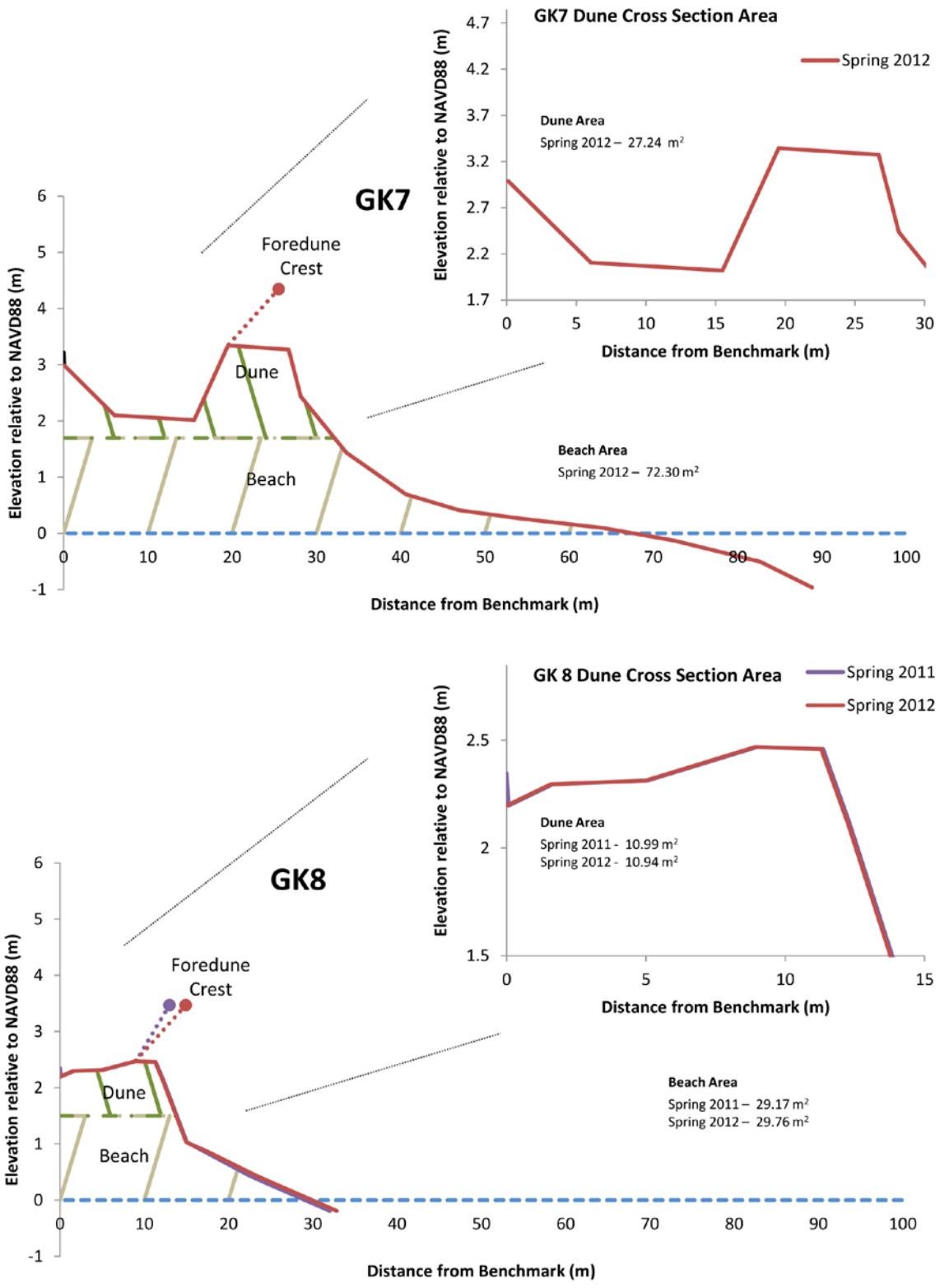


Figure 32. Profiles GK7 and GK8, features are labeled, cross-sectional area is calculated for beach and dune for each of the two spring surveys.

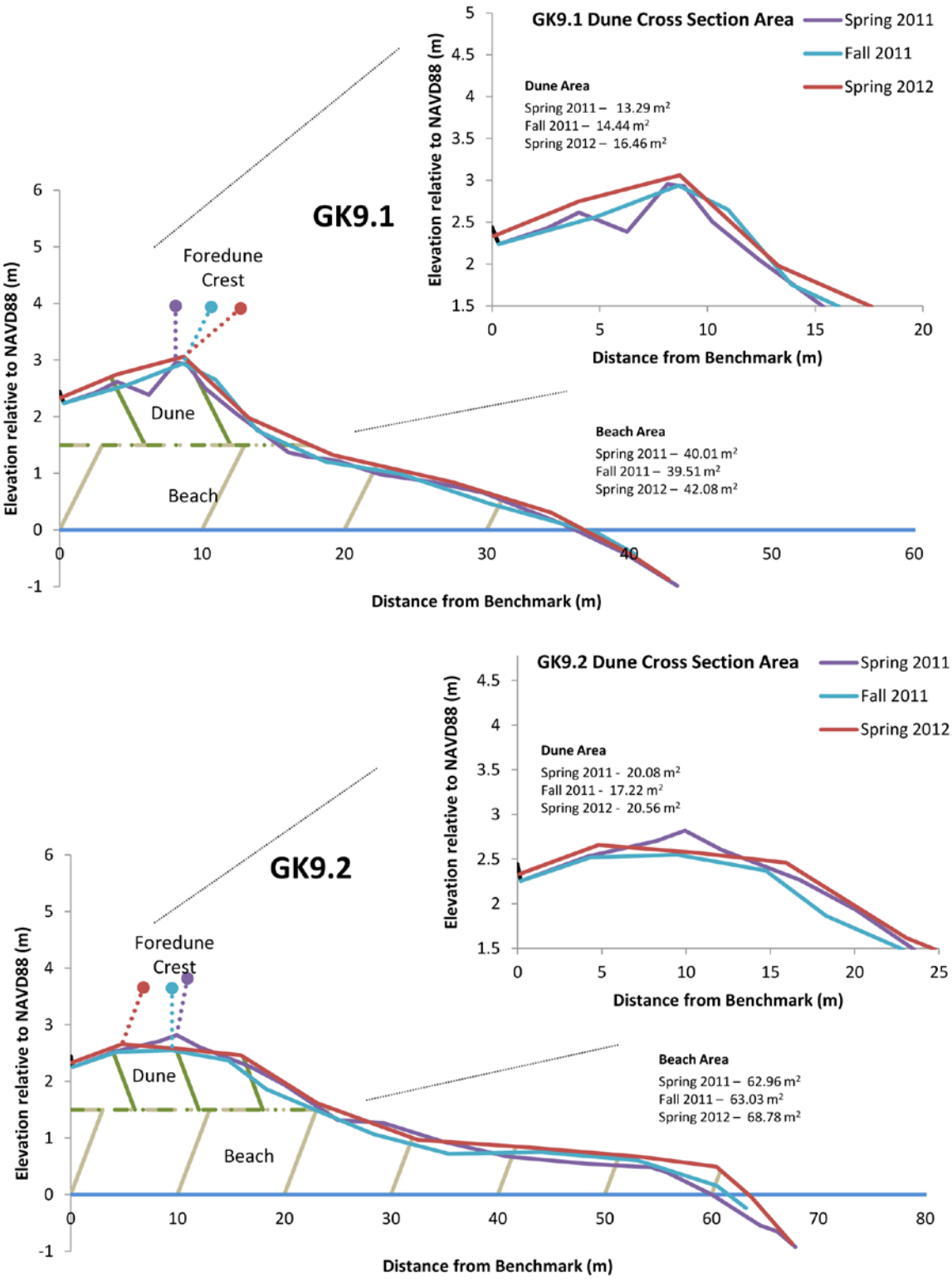


Figure 33. Profile GK9 and GK9.2, features are labeled, cross-sectional area is calculated for beach and dune for each of the two spring surveys.

Miller Field

Two monuments have been established along the ocean-facing of shoreline of Miller Field (Fig.34). They may be tied to some pre-existing item, such as a concrete step, or they may be tied to a newly-installed PVC pipe filled with concrete. The location, description, coordinates of the Miller Field monuments are detailed in a booklet prepared for this purpose (Psuty, et al., 2010e).



Figure 34. Location of two monuments and their accompanying azimuths at Miller Field used in running the 2D beach/dune profiles.

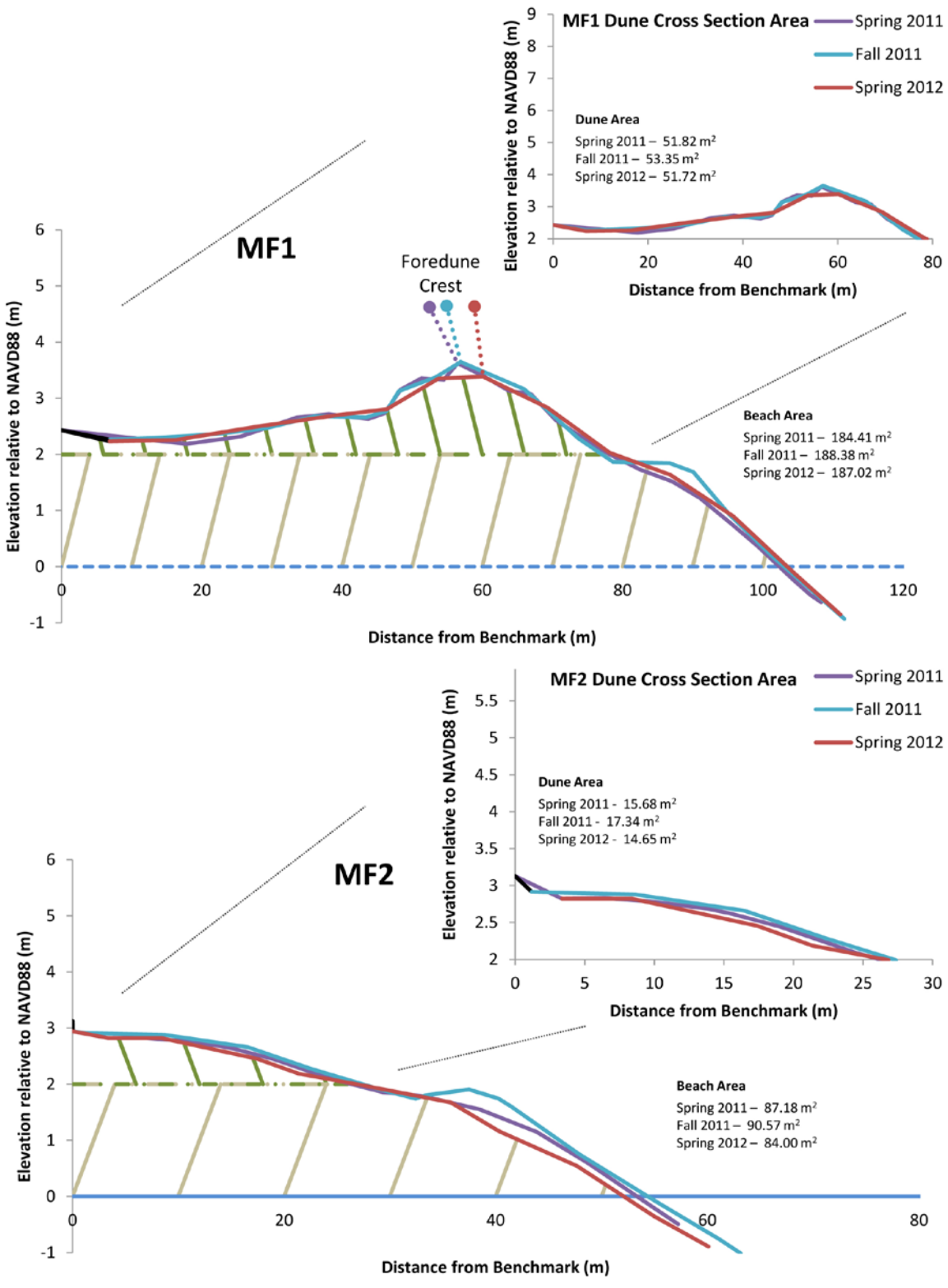


Figure 35. Profiles MF1 and MF2, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

Ft. Wadsworth

Three monuments have been established along the ocean-facing shoreline of Ft. Wadsworth (Fig. 36). They may be tied to some pre-existing item, such as a concrete pad, or they may be tied to a newly-installed PVC pipe filled with concrete. The location, description, coordinates of the Ft. Wadsworth monuments are detailed in a booklet prepared for this purpose (Psuty, et al., 2010e).



Figure 36. Location of 3 monuments and their accompanying azimuths at Fort Wadsworth used in running the 2D beach/dune profiles.

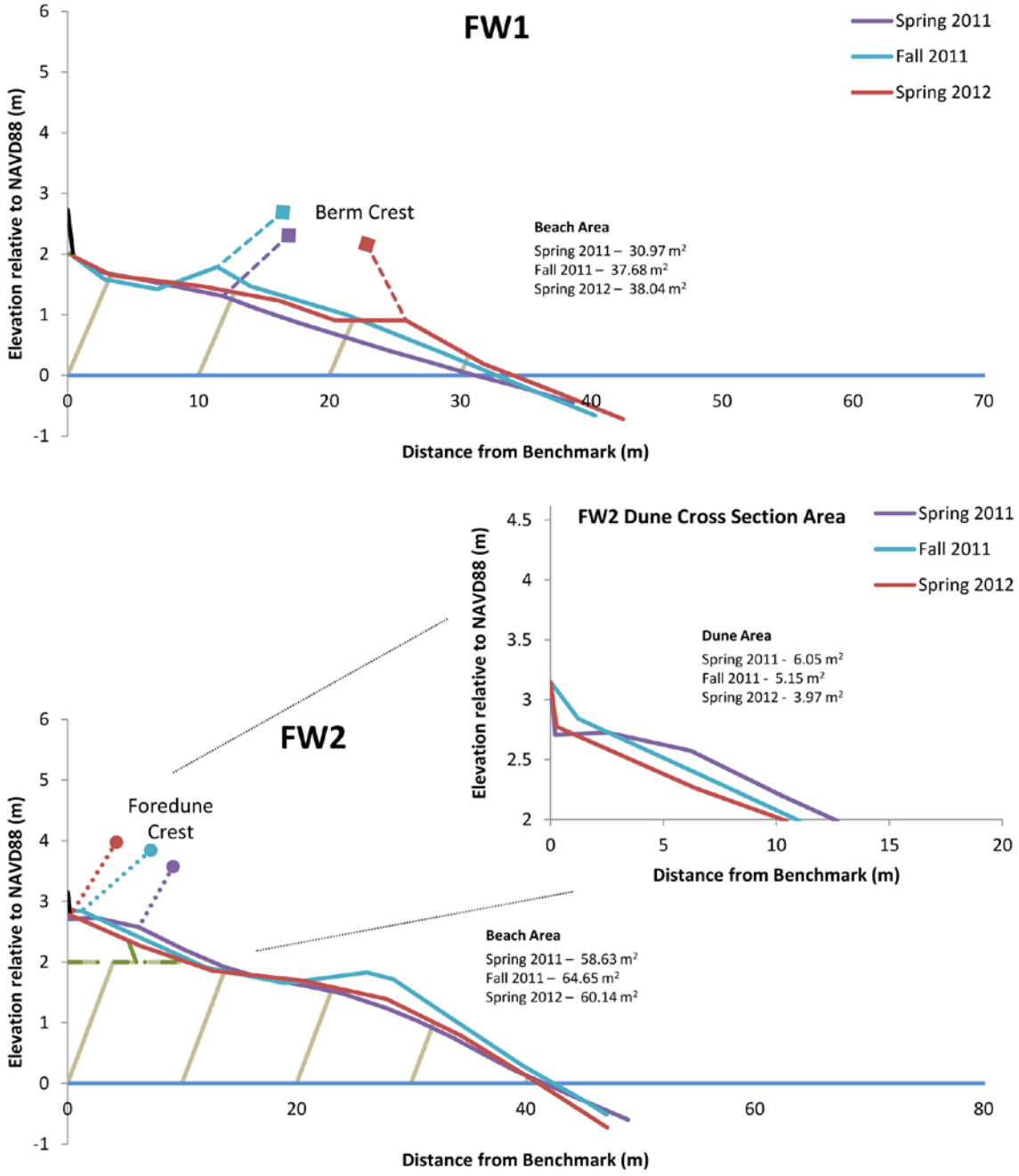


Figure 37. Profiles FW1 and FW2, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

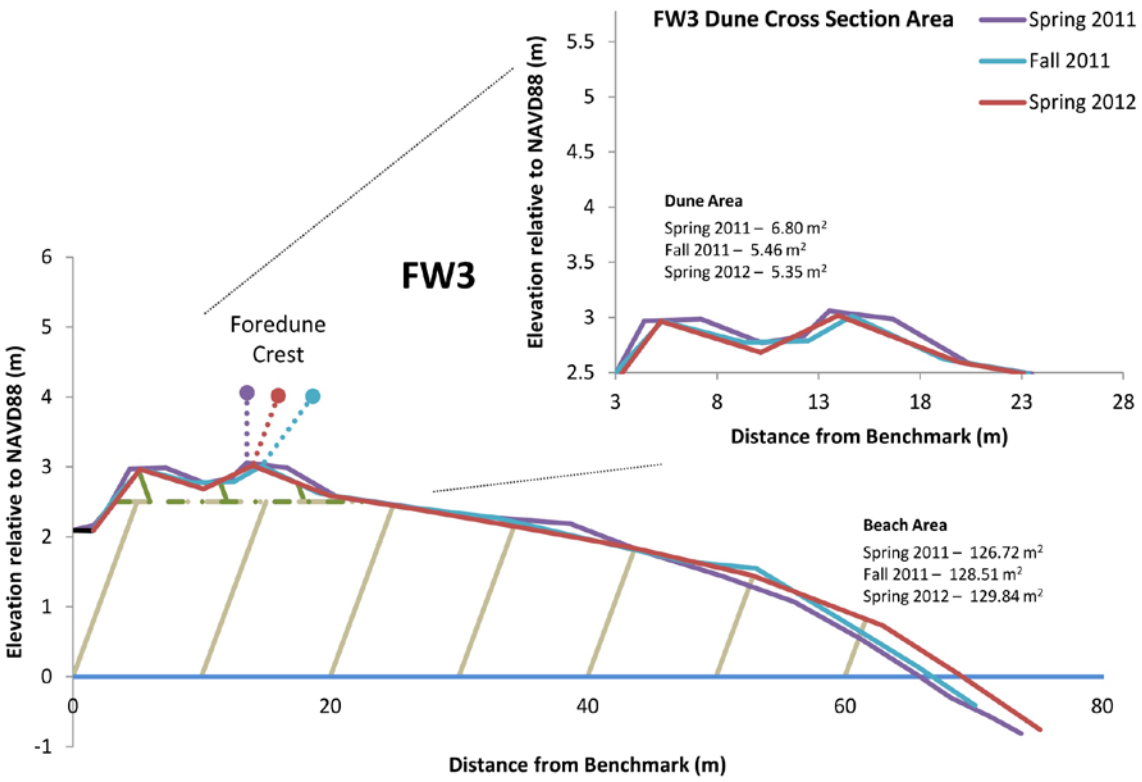


Figure 38. Profile FW3, features are labeled, cross-sectional area is calculated for beach and dune for each of the three seasonal surveys.

Spatial Association

The spatial association of the data sets portrays the modifications of the profiles in the alongshore direction, relating the dimensions of change to the conditions of sediment availability and sediment budget, and to the variety of exposures to the ambient energetics. The results of changes in distance to NAVD88, cross-section area, distance to foredune crest, and elevation of foredune crest are depicted as examples of the type of comparative measures available from the profile surveys. Many other descriptors are capable of being derived from the profiles. The dimension presented is change of the measured variable, either by season, or as the net annual change.

Sandy Hook

At Sandy Hook, the downdrift effect of beach nourishment outside of the Park and the changing exposure to the incident energies are represented by a general increase of area to the beach from south to north (Fig. 39), until reaching the northern extent of Sandy Hook. Then the changes are driven by relative exposure to the dominant winds and waves on the bayside. This is but one example of the type of information that is incorporated in the topographical data sets. A more complete presentation and interpretation will be part of the trend report.

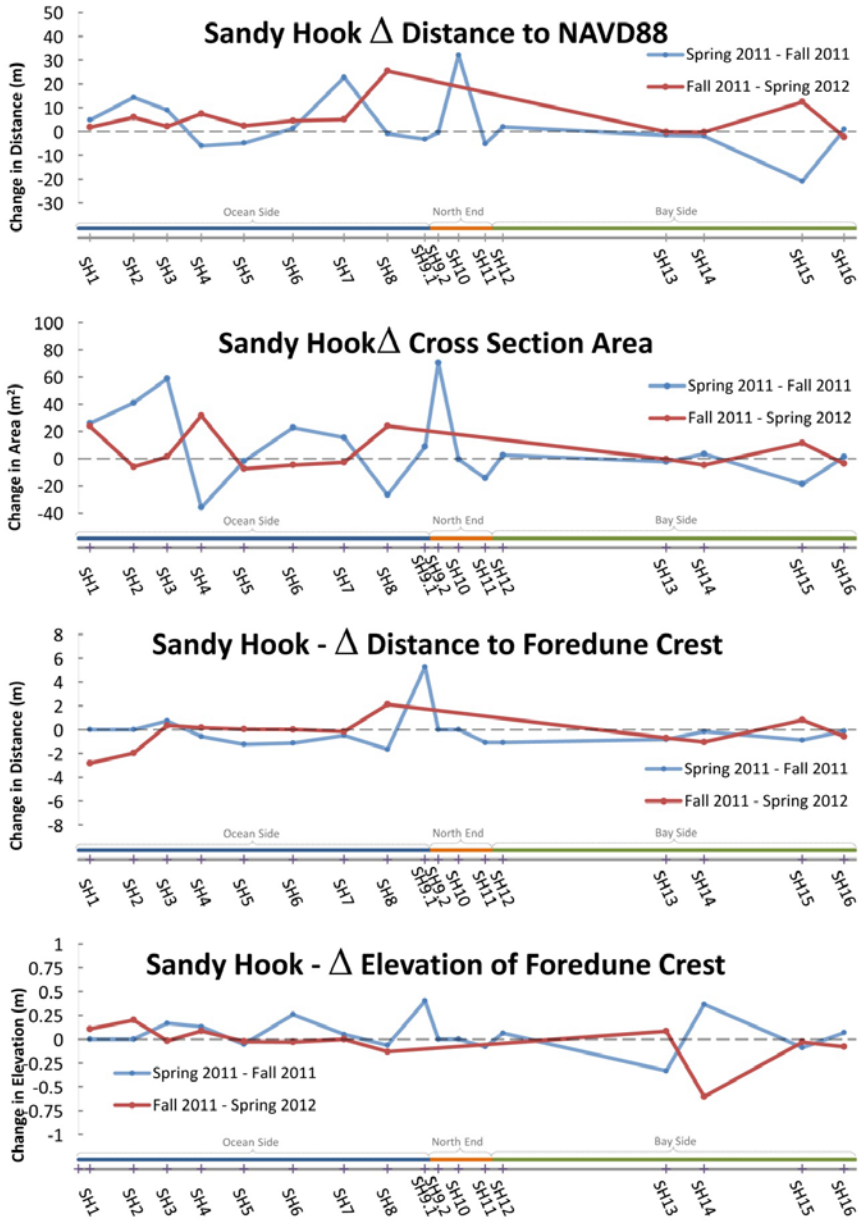


Figure 39. Alongshore dimensions of selected topographical variables at Sandy Hook, Spring 2011 – Fall 2012 and Fall 2011 – Spring 2012, incorporating dune/beach profile sites along the ocean side, inlet, and bay side situations.

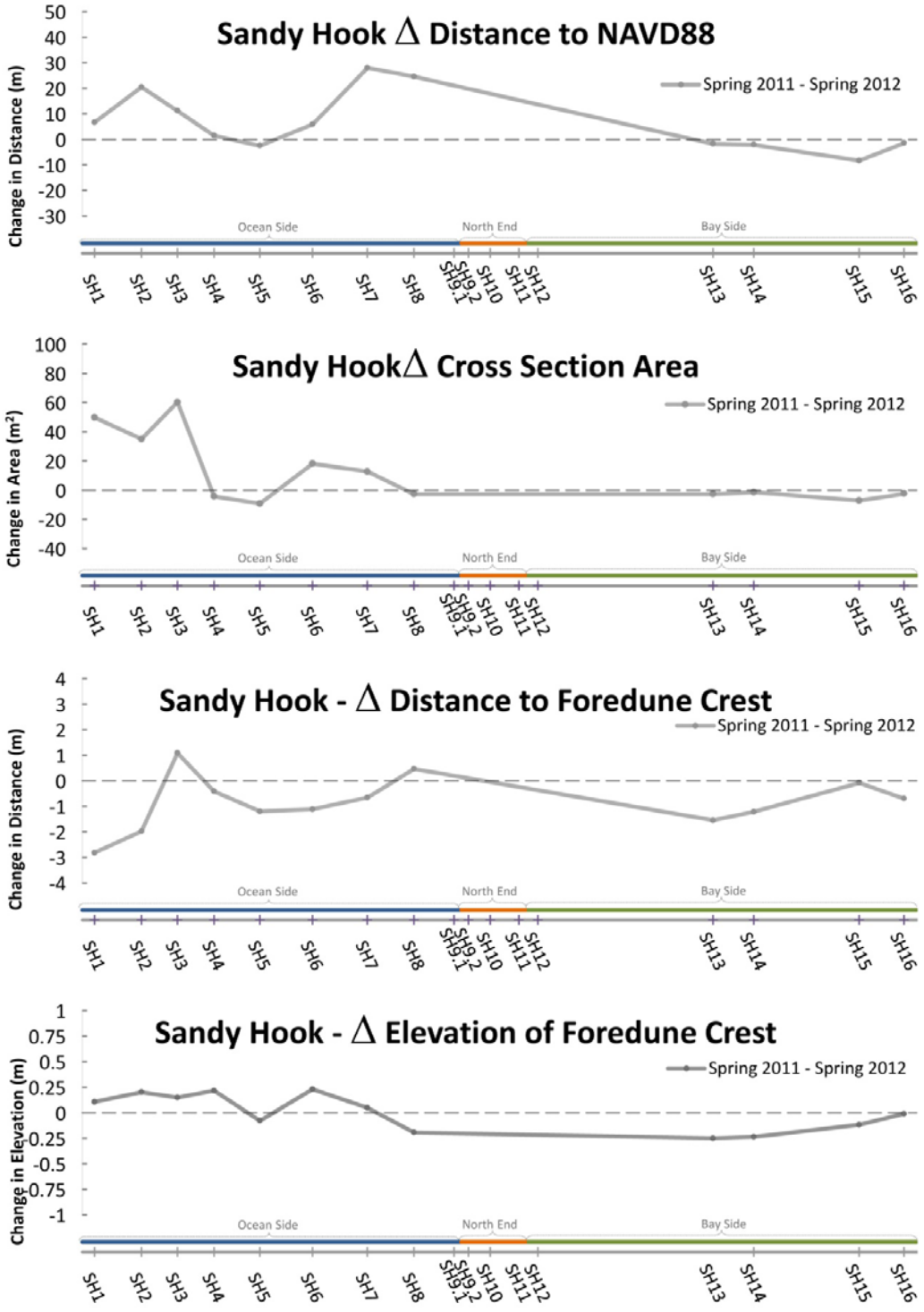


Figure 40. Alongshore dimensions of selected topographical variables at Sandy Hook, Spring 2011 – Spring 2012, incorporating dune/beach profile sites along the ocean side, inlet, and bay side situations.

Breezy Point

The spatial association extends from the eastern margin, in Riis Park (BP1), continues through Fort Tilden, Breezy Point, beyond the jetty at Rockaway Inlet, and to the bayside as far as Roxbury Cove (BP11).

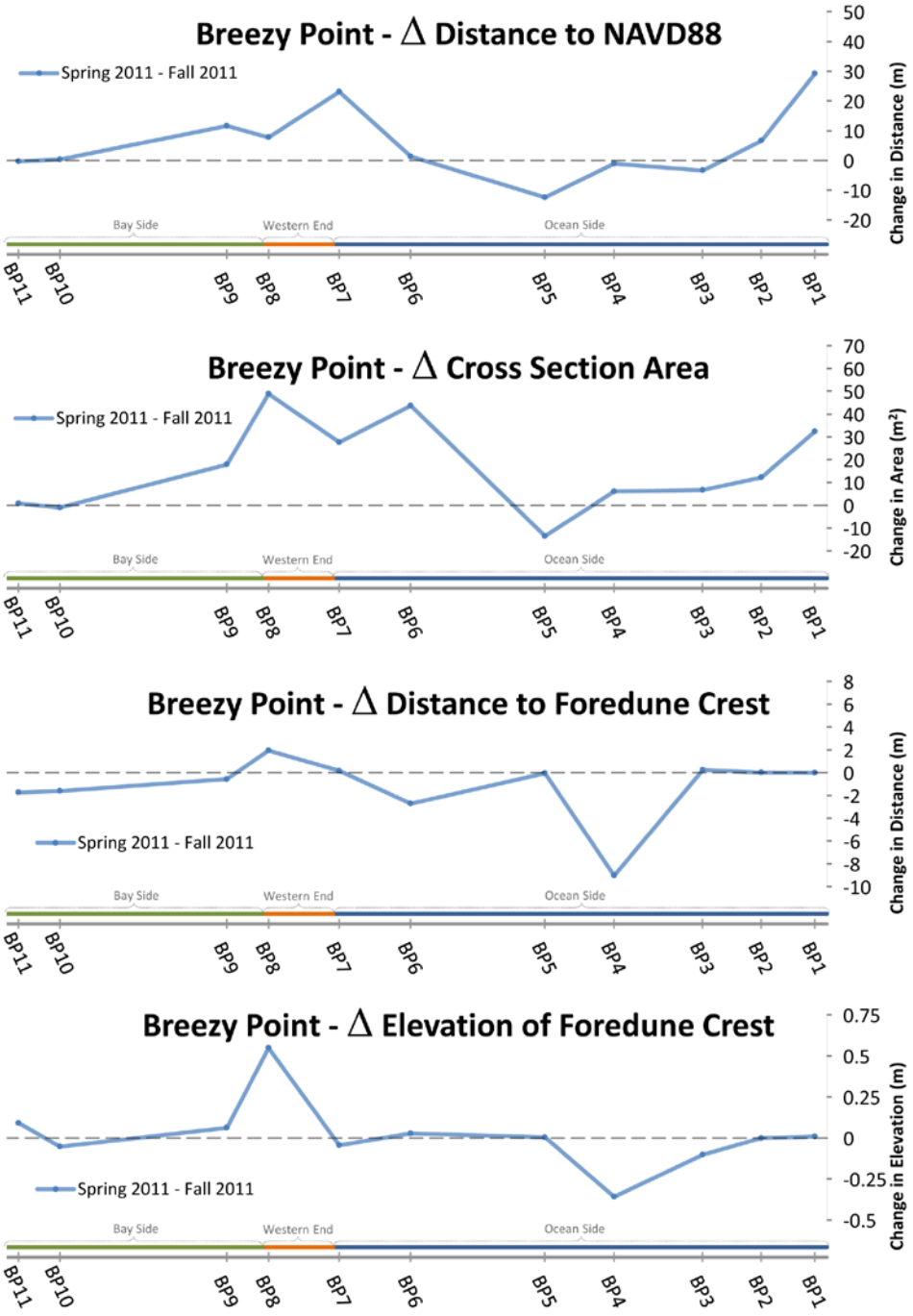


Figure 41. Alongshore dimensions of selected topographical variables at Breezy Point, Spring 2011 –Fall 2011, incorporating dune/beach profile sites along the ocean side, inlet, and bay side situations.

Plumb Beach

The alongshore dimension of coastal features extends from the western margin near the jetty (PB1) to the accreting spit at the eastern margin (BP5).

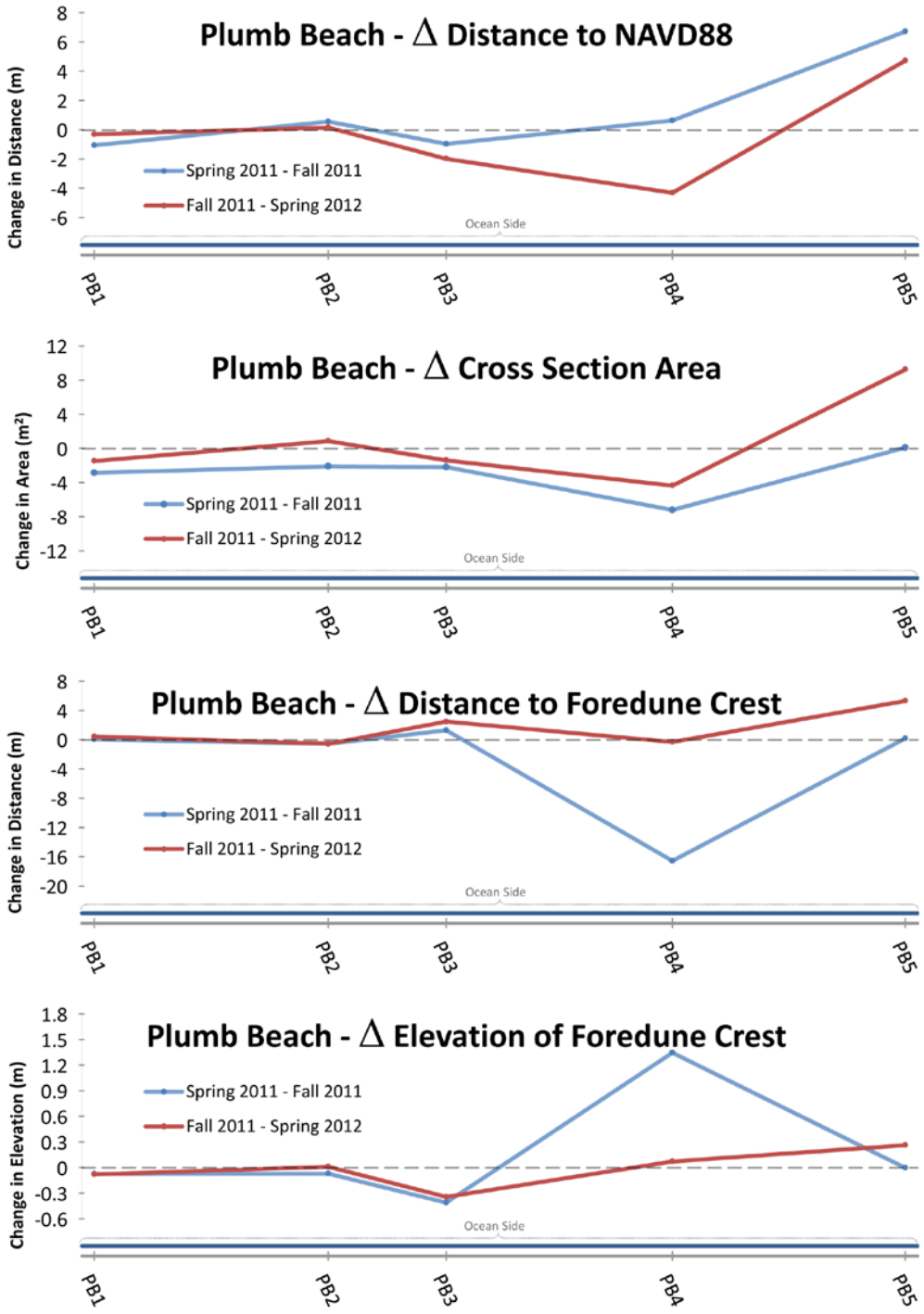


Figure 42. Alongshore dimensions of selected topographical variables at Breezy Point, Spring 2011 –Fall 2011, and Fall 2011 – Spring 2012.

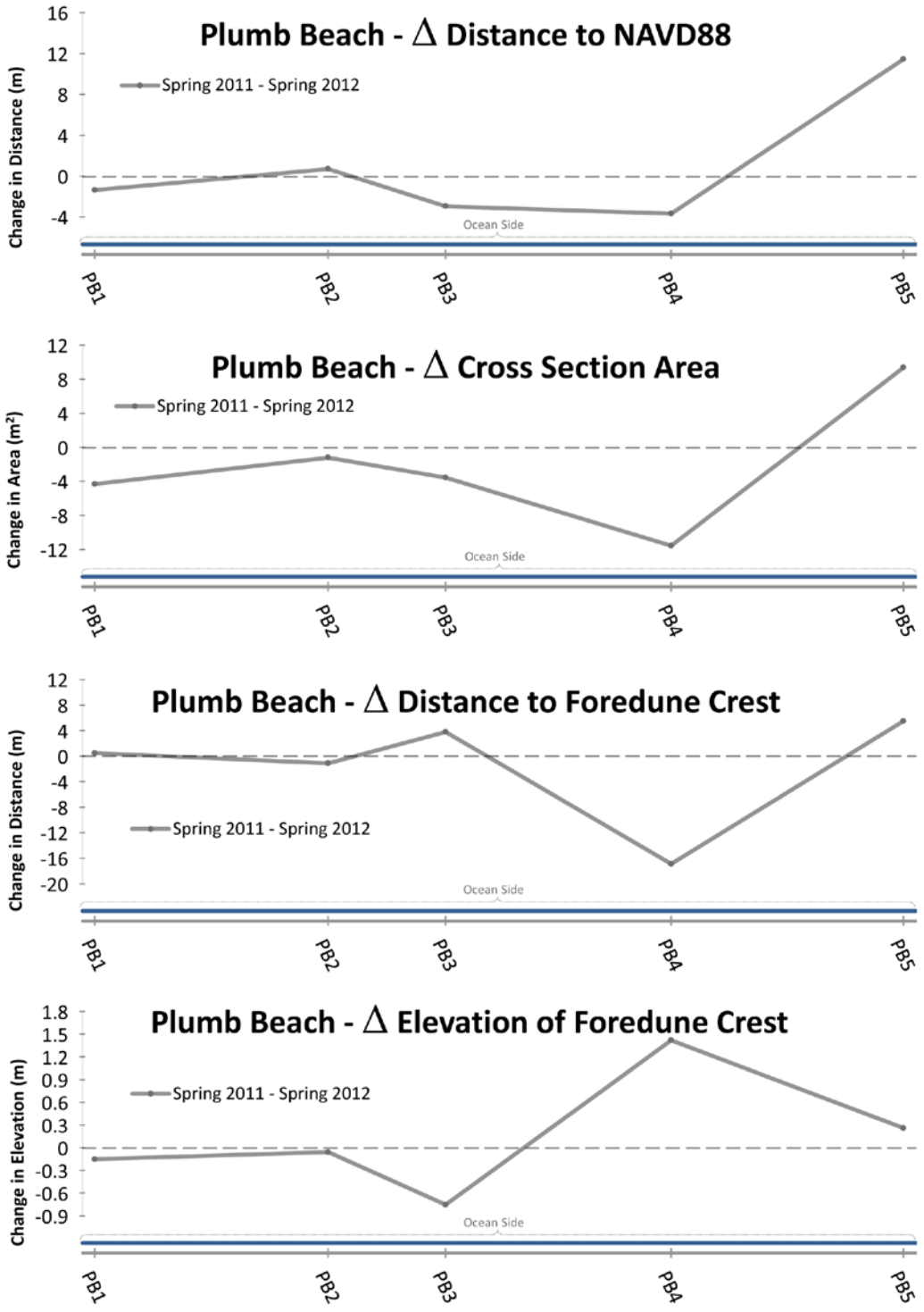


Figure 43. Alongshore dimensions of selected topographical variables at Breezy Point, Spring 2011 – Spring 2012.

Great Kills

The spatial association extends from the eastern margin (GK1) and continues through the jetty at Crookes Point. It includes sites along the inlet margin and into the Great Kills Marina (GK9.2).

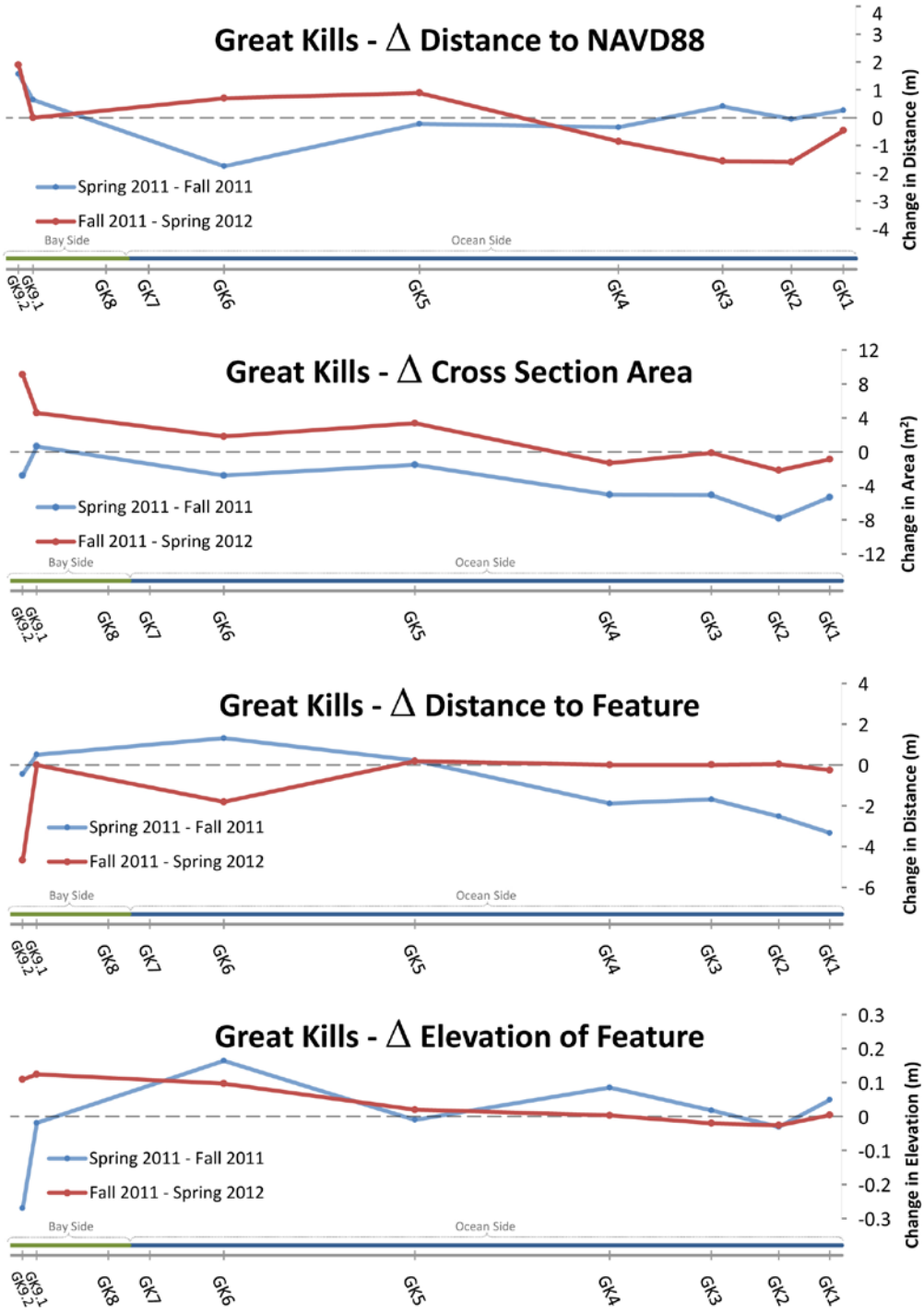


Figure 44. Alongshore dimensions of selected topographical variables at Great Kills, Spring 2011 – Fall 2011 and Fall 2011 - Spring 2012.

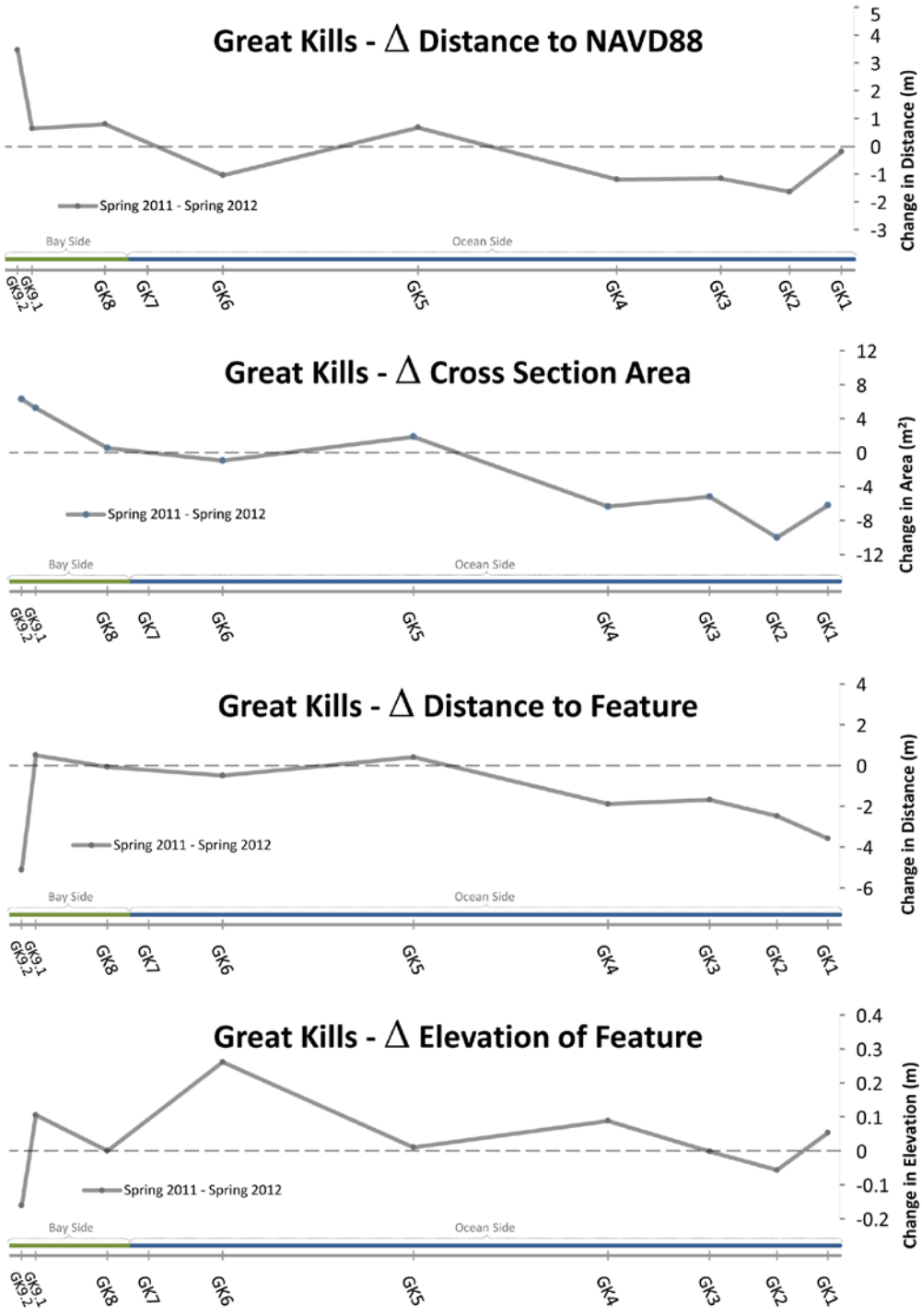


Figure 45. Alongshore dimensions of selected topographical variables at Great Kills, Spring 2011 - Spring 2012.

Miller Field

The two Miller Field profiles represent the conditions between a groin to the northeast (MF1) and a groin to the southwest (MF2) of the ocean-facing shoreline. There is a major restriction of sediment input/output because of the boundary conditions within the groin field and the result is an oscillation of the topography between the two alongshore margins of the groin compartment.

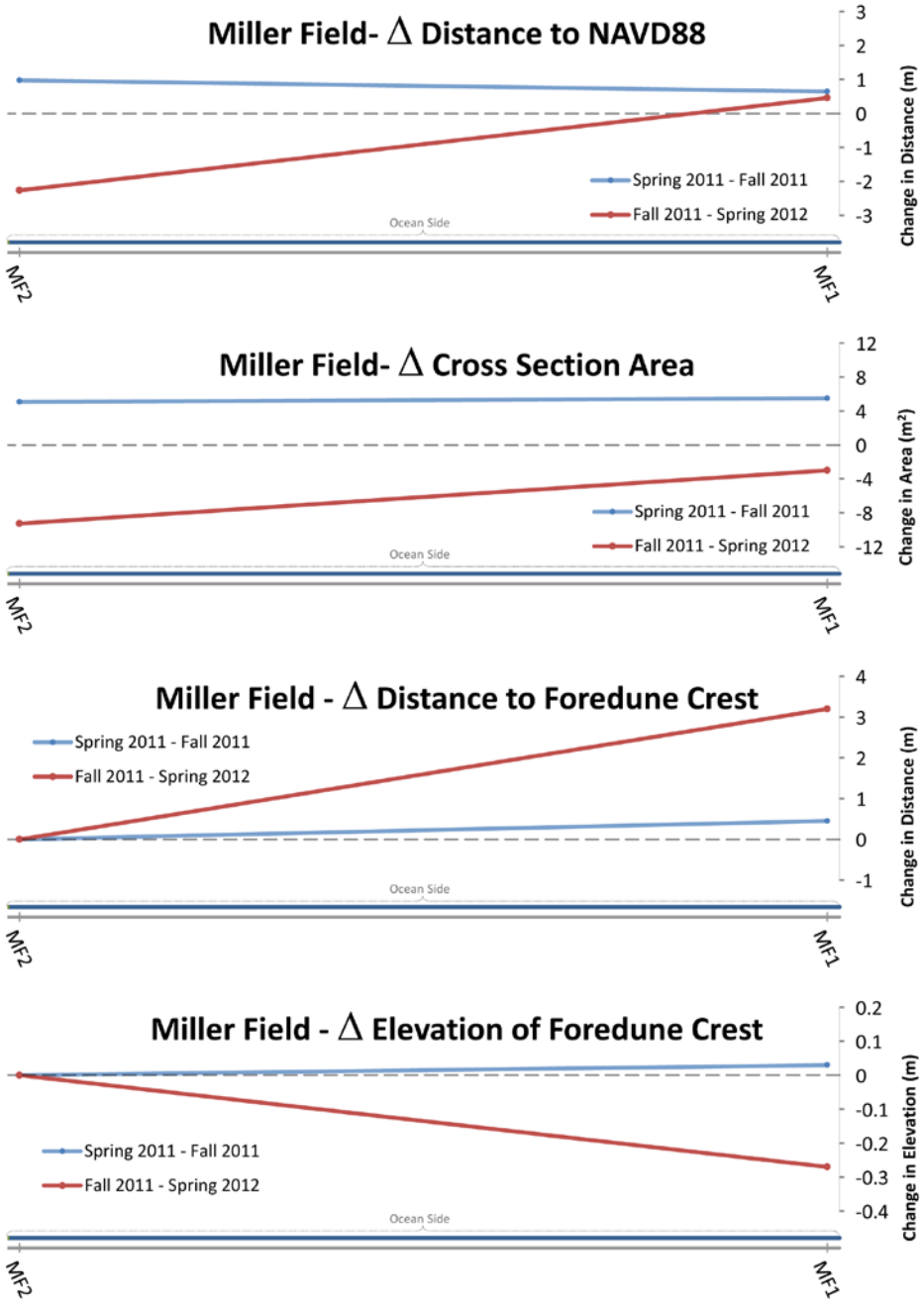


Figure 46. Alongshore dimensions of selected topographical variables at Miller Field, Spring 2011 –Fall 2011, and Fall 2011 – Spring 2012.

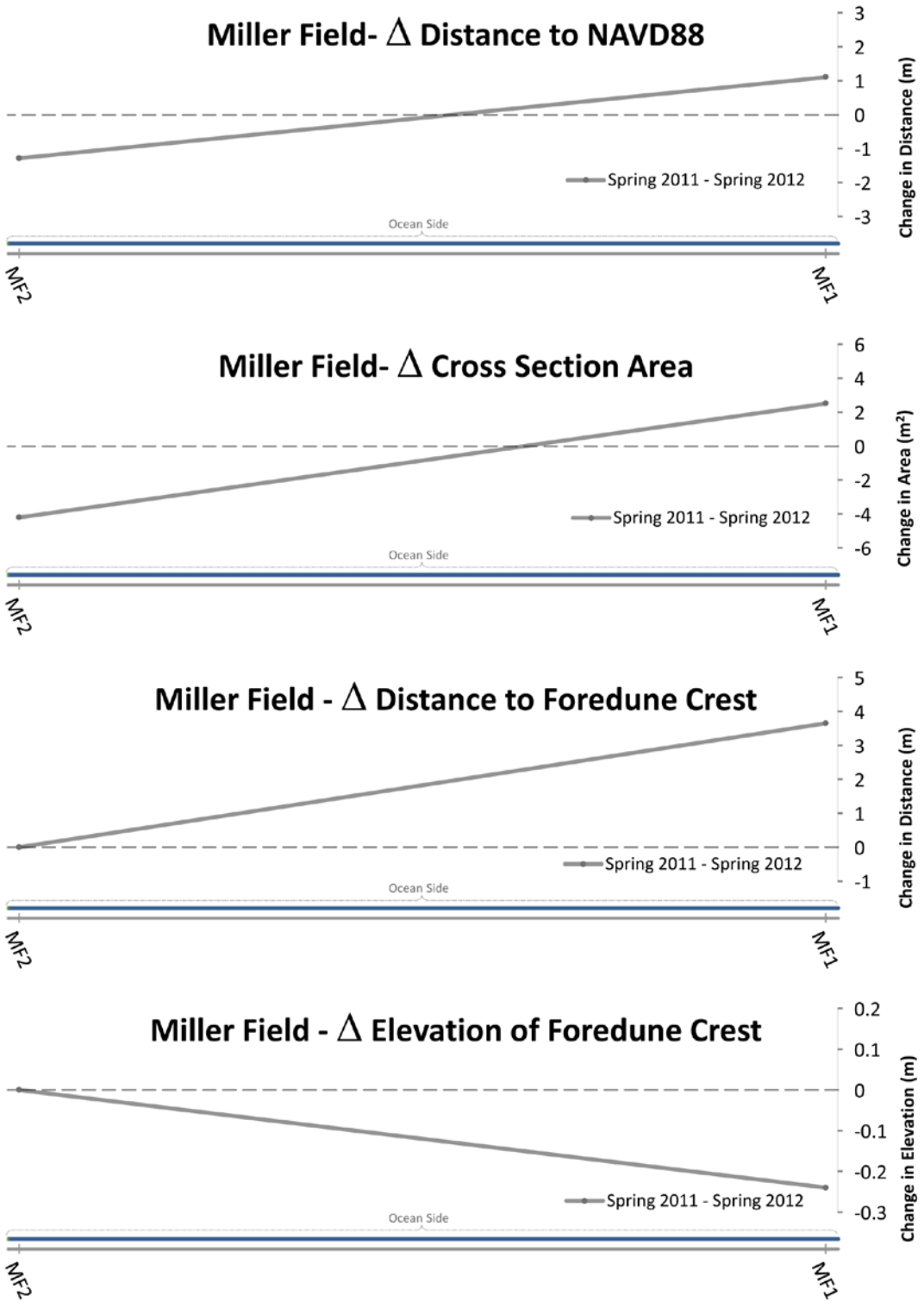


Figure 47. Alongshore dimensions of selected topographical variables at Miller Field, Spring 2011 – Spring 2012.

Fort Wadsworth

The ocean=facing shoreline at Fort Wadsworth is constrained by a groin to the west (FW3) and a terminal groin/jetty to the east (FW1). There is little sediment input to this section of the shoreline and the geomorphological features tend to depict gains and losses related to the alteration of alongshore transport conditions.

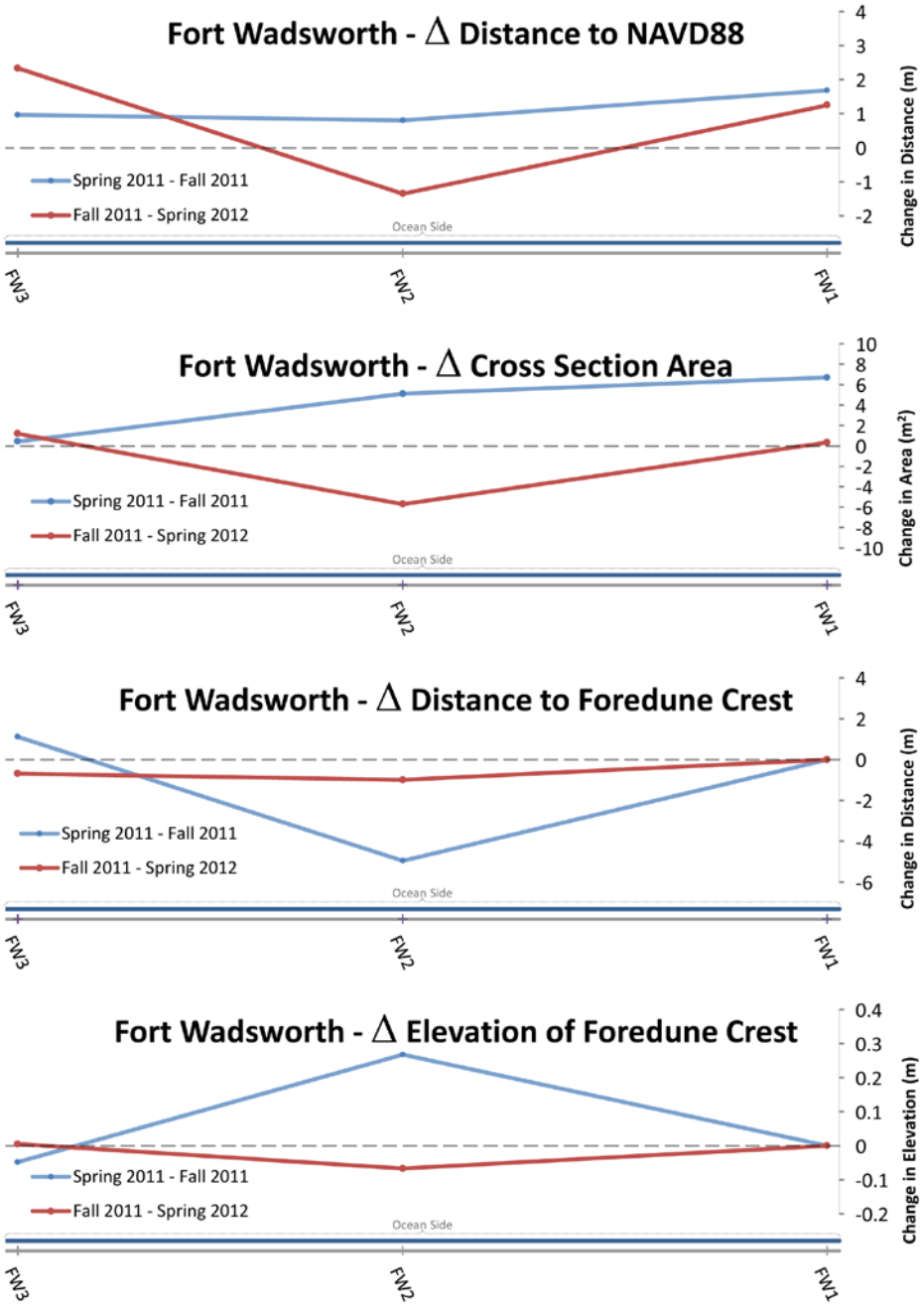


Figure 48. Alongshore dimensions of selected topographical variables at Miller Field, Spring 2011 –Fall 2011, and Fall 2011 – Spring 2012.

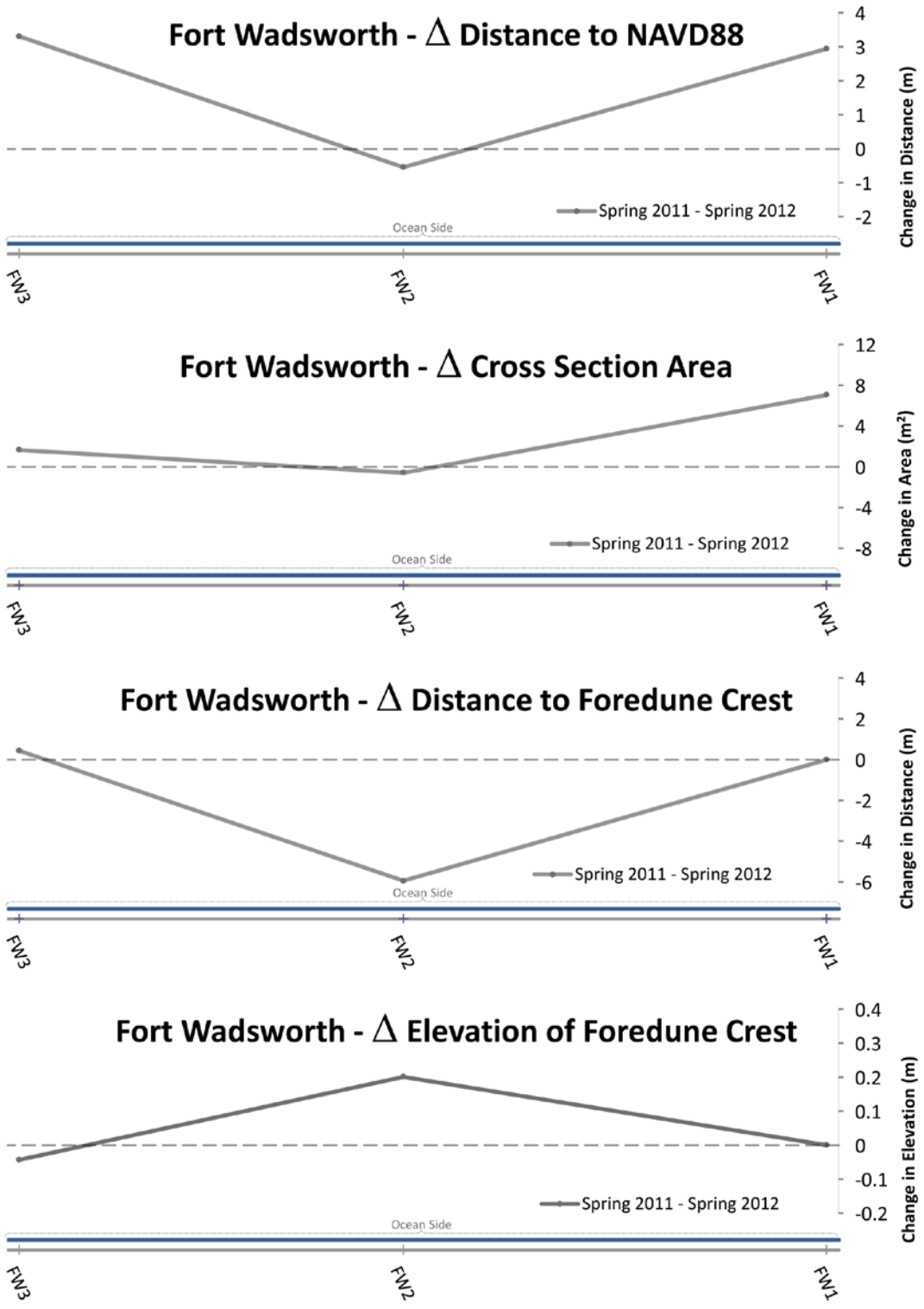


Figure 49. Alongshore dimensions of selected topographical variables at Fort Wadsworth, Spring 2011 – Spring 2012.

Conclusions

A wealth of information is available from the seasonal topographical surveys conducted throughout the coastal areas of GATE. The changes are seen in the individual profiles and in the comparison of profiles within the several parts of GATE. More detailed analyses will be conducted in the Trend Report that will cover five years of data collection.

All of the profile data and the derived measures of change are compiled in a database for GATE and are deposited with the Data Manager of the Northeast Coastal and Barrier Network.

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Appendix A: Dimensions of Distance and Area, GATE Profiles

- Spring 2011
- Fall 2011
- Spring 2012

Spring 2011

Sandy Hook				Survey Date 5/5/2011		Low Tide 3:20 AM			Height 0.139
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
SH1	117.78	45.69	-	3.26	-	243.31	211.18	32.12	-
SH2	183.18	99.09	-	3.28	-	367.25	335.21	32.03	-
SH3	223.49	63.03	-	3.56	-	451.58	371.21	80.36	-
+SH4	**125.82**	**23.73**	**-**	**4.43**	**-**	**345.79**	**263.87**	**81.92**	-
SH5	61.14	1.24	-	4.03	-	109.72	98.92	10.80	-
SH6	106.88	26.59	-	3.88	-	196.28	160.92	35.36	-
SH7	345.11	0.76	-	4.76	-	630.91	593.16	37.75	-
SH8	276.75	28.48	-	4.78	-	615.21	526.79	88.42	-
SH9.1	40.65	11.30	-	2.20	-	58.98	58.98	0.00	-
SH9.2	353.01	59.67	-	2.35	-	663.29	663.29	0.00	-
SH10	154.27	89.10	-	1.93	-	253.23	208.13	45.10	-
SH11	56.06	27.95	-	3.91	-	111.73	73.20	38.53	-
SH12	55.10	25.82	-	3.08	-	79.85	62.70	17.15	-
SH13	23.70	4.87	-	2.02	-	25.10	23.54	1.56	-
+SH14	**29.24**	**5.30**	**-**	**2.36**	**-**	**25.85**	**25.85**	**2.30**	-
SH15	70.32	1.78	-	3.91	-	84.76	71.69	13.07	-
SH16	19.27	6.56	-	3.89	-	38.53	20.44	18.09	-

Breezy Point				Survey Date 5/26/2011		Low Tide 8:42 AM			Height 0.362
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
BP1	66.45	6.52	-	4.93	-	136.50	107.49	29.01	-
BP2	94.94	12.92	-	3.12	-	188.69	176.21	12.48	-
BP3	93.21	19.56	-	6.76	-	276.84	162.73	114.11	-
BP4	75.04	33.15	-	3.32	-	158.21	122.58	35.63	-
BP5	162.96	50.00	-	4.64	-	315.08	285.15	29.93	-
BP6	124.03	36.58	-	4.18	-	198.01	174.93	23.08	-
BP7	87.38	24.11	-	4.40	-	160.26	140.59	19.68	-
BP8	154.05	33.66	-	5.42	-	379.37	227.00	152.37	-
BP9	83.47	23.77	-	3.99	-	212.43	120.86	91.57	-
BP10	19.79	1.70	-	2.32	-	20.11	18.79	1.33	-
BP11	20.08	3.30	-	2.98	-	22.59	18.25	4.34	-

Plumb Beach				Survey Date 4/15/2011		Low Tide 11:12 AM			Height -0.087
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
PB1	41.47	12.10	-	2.83	-	75.81	62.74	13.06	-
PB2	19.52	8.35	-	2.69	-	35.71	28.38	7.33	-
PB3	35.47	22.85	-	1.77	-	59.81	54.71	5.10	-
PB4	46.84	25.39	-	2.71	-	111.77	75.24	36.53	-
PB5	57.82	22.58	-	2.82	-	90.20	84.51	5.68	-

Great Kills				Survey Date 4/21/2011		Low Tide 4:18 PM			Height -0.03
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
GK1	34.41	-	14.74	-	4.49	87.17	55.11	-	32.06
GK2	85.44	-	62.83	-	4.81	336.49	177.76	-	158.74
GK3	29.35	-	4.20	-	5.39	61.09	44.44	-	16.65
GK4	38.96	-	13.54	-	3.62	89.81	68.31	-	21.49
GK5	70.82	18.84	-	3.90	-	151.02	136.58	14.44	-
GK6	46.64	13.79	-	3.30	-	101.89	85.84	16.05	-
GK7	-	-	-	-	-	-	-	-	-
GK8	29.11	8.98	-	2.47	-	40.16	29.17	10.99	-
GK9.1	36.22	8.15	-	2.96	-	53.30	40.01	13.29	-
GK9.2	60.01	9.93	-	2.82	-	83.05	62.96	20.08	-

Miller Field				Survey Date 4/21/2011		Low Tide 4:18 PM			Height -0.03
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
MF1	102.38	56.48	-	3.62	-	236.23	184.41	51.82	-
MF2	53.36	-	-	-	-	102.85	87.18	15.68	-

Fort Wadsworth				Surevy Date 4/21/2011		Low Tide 4:18 PM			Height -0.03
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
FW1	31.11	-	-	-	-	30.97	30.97	-	-
FW2	41.65	6.21	-	2.57	-	64.68	58.63	6.05	-
FW3	65.83	13.52	-	3.06	-	133.53	126.72	6.80	-

* Tide elevation values are referenced to Mean Lower Low Water (MLLW)

Spring 2011									
Sandy Hook				Survey Date 5/5/2011		Low Tide 3:20 AM		Height 0.139	
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
SH4	141.94	39.85	-	4.43	-	402.75	302.56	100.18	-
SH14	23.99	0.06	-	2.36	-	16.60	15.55	1.05	-

This supplement provides measurements related to the adjusted position of the monuments (SH4 and SH14) and their new starting position.

Fall 2011

Sandy Hook				Survey Date 11/9/2011		Low Tide 5:35 AM			Height 1.233
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
SH1	122.67	45.69	-	3.26	-	269.25	240.25	29.01	-
SH2	197.64	99.09	-	3.28	-	408.35	376.38	31.96	-
SH3	232.54	63.76	-	3.72	-	510.45	422.85	87.59	-
SH4	119.86	23.15	-	4.56	-	309.94	228.66	81.28	-
SH5	56.36	0.00	-	3.98	-	107.89	104.52	3.37	-
SH6	108.26	25.47	-	4.14	-	219.19	185.37	33.81	-
SH7	368.01	0.27	-	4.81	-	646.43	614.13	32.30	-
SH8	275.91	26.83	-	4.72	-	588.61	510.71	77.90	-
SH9.1	37.55	16.58	-	2.61	-	67.85	66.67	1.18	-
SH9.2	352.74	59.67	-	2.35	-	733.88	708.19	25.69	-
SH10	186.47	89.10	-	1.93	-	252.84	207.74	45.10	-
SH11	50.99	26.87	-	3.83	-	97.32	63.45	33.87	-
SH12	57.10	24.73	-	3.15	-	82.51	67.47	15.04	-
SH13	22.22	4.04	-	1.69	-	22.84	22.12	0.72	-
SH14	27.42	5.13	-	2.73	-	29.32	25.68	3.64	-
SH15	49.56	0.89	-	3.82	-	66.12	55.27	10.85	-
SH16	20.24	6.44	-	3.96	-	39.89	21.82	18.07	-

Breezy Point				Survey Date 11/6/2011		Low Tide 11:00 AM			Height 0.305
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
BP1	95.74	6.51	-	4.94	-	168.95	137.73	31.22	-
BP2	101.66	12.93	-	3.12	-	200.97	188.49	12.48	-
BP3	89.93	19.80	-	6.66	-	283.61	171.60	112.01	-
BP4	74.06	24.12	-	2.96	-	164.34	134.99	29.35	-
BP5	150.58	49.94	-	4.65	-	301.62	270.73	30.89	-
BP6	125.42	33.87	-	4.21	-	241.74	221.49	20.25	-
BP7	110.53	24.27	-	4.36	-	187.97	174.90	13.07	-
BP8	161.90	35.62	-	5.96	-	428.29	279.91	148.38	-
BP9	95.15	23.20	-	4.06	-	230.38	135.58	94.80	-
BP10	20.19	0.09	-	2.26	-	19.16	19.15	0.01	-
BP11	19.84	1.58	-	3.07	-	23.47	18.81	4.65	-

Plumb Beach				Survey Date 10/25/2011		Low Tide 1:36 AM			Height 1.233
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
PB1	40.43	12.16	-	2.75	-	72.97	61.96	11.01	-
PB2	20.09	7.81	-	2.63	-	33.64	27.72	5.91	-
PB3	34.52	24.17	-	1.36	-	57.64	52.89	4.75	-
PB4	47.49	8.84	-	4.06	-	104.57	71.09	33.48	-
PB5	64.56	22.78	-	2.82	-	90.32	84.42	5.90	-

Great Kills				Survey Date 10/26/2011		Low Tide 23:48			Height 1.379
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
GK1	34.68	-	11.40	-	4.54	81.83	55.49	-	26.34
GK2	85.39	-	60.31	-	4.78	328.66	177.76	-	150.90
GK3	29.76	-	2.51	-	5.40	56.02	44.86	-	11.16
GK4	38.63	-	11.65	-	3.70	84.77	66.34	-	18.42
GK5	70.60	19.07	-	3.89	-	149.51	133.77	15.74	-
GK6	44.90	15.10	-	3.46	-	99.11	83.77	15.35	-
GK7	-	-	-	-	-	-	-	-	-
GK8	-	-	-	-	-	-	-	-	-
GK9.1	36.87	8.65	-	2.94	-	53.94	39.51	14.44	-
GK9.2	61.59	9.48	-	2.55	-	80.25	63.03	17.22	-

Miller Field				Survey Date 10/26/2011		Low Tide 11:48 PM			Height 1.379
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
MF1	103.03	56.93	-	3.65	-	241.73	188.38	53.35	-
MF2	54.40	-	-	-	-	107.92	90.57	17.34	-

Fort Wadsworth				Survey Date 10/26/2011		Low Tide 11:48 PM			Height 1.379
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
FW1	32.80	-	-	-	-	37.68	37.68	-	-
FW2	42.46	1.25	-	2.84	-	69.79	64.65	5.15	-
FW3	66.80	14.64	-	3.01	-	133.97	128.51	5.46	-

* Tide elevation values are referenced to Mean Lower Low Water (MLLW)

Spring 2012

Sandy Hook				Survey Date 3/22/2012		Low Tide 1:06 PM			Height 1.295
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
SH1	126.13	43.46	-	3.25	-	278.78	249.10	29.69	-
SH2	203.72	97.12	-	3.48	-	402.37	369.91	32.46	-
SH3	234.77	64.12	-	3.71	-	511.92	425.22	86.69	-
SH4	127.41	23.32	-	4.65	-	341.61	259.87	81.74	-
SH5	58.78	0.04	-	3.95	-	100.59	96.11	4.48	-
SH6	112.85	25.48	-	4.12	-	214.53	181.04	33.49	-
SH7	373.19	0.10	-	4.81	-	643.72	609.59	34.14	-
SH8	301.42	28.95	-	4.59	-	612.64	534.96	77.68	-
SH9.1	-	-	-	-	-	-	-	-	-
SH9.2	-	-	-	-	-	-	-	-	-
SH10	-	-	-	-	-	-	-	-	-
SH11	-	-	-	-	-	-	-	-	-
SH12	-	-	-	-	-	-	-	-	-
SH13	22.05	3.33	-	1.77	-	22.47	21.78	0.69	-
SH14	27.21	4.08	-	2.12	-	24.61	23.01	1.60	-
SH15	62.09	1.70	-	3.79	-	77.68	65.67	12.01	-
SH16	17.96	5.87	-	3.88	-	36.22	18.98	17.24	-

Breezy Point				Survey Date		Low Tide			Height
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
BP1	-	-	-	-	-	-	-	-	-
BP2	-	-	-	-	-	-	-	-	-
BP3	-	-	-	-	-	-	-	-	-
BP4	-	-	-	-	-	-	-	-	-
BP5	-	-	-	-	-	-	-	-	-
BP6	-	-	-	-	-	-	-	-	-
BP7	-	-	-	-	-	-	-	-	-
BP8	-	-	-	-	-	-	-	-	-
BP9	-	-	-	-	-	-	-	-	-
BP10	-	-	-	-	-	-	-	-	-
BP11	-	-	-	-	-	-	-	-	-

Plumb Beach				Survey Date 4/4/2012		Low Tide 10:42 AM			Height 1.34
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
PB1	40.14	12.61	-	2.68	-	71.52	60.41	11.11	-
PB2	20.26	7.26	-	2.64	-	34.53	28.40	6.13	-
PB3	32.56	26.67	-	1.02	-	56.28	51.45	4.83	-
PB4	43.20	8.55	-	4.13	-	100.24	67.28	32.97	-
PB5	69.30	28.11	-	3.09	-	99.60	89.90	9.71	-

Great Kills				Survey Date 3/21/2012		Low Tide 1:18 PM			Height -0.213
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
GK1	34.22	-	11.15	-	4.54	80.96	54.66	-	26.30
GK2	83.81	-	60.35	-	4.75	326.48	175.43	-	151.05
GK3	28.20	-	2.52	-	5.38	55.89	44.15	-	11.75
GK4	37.78	-	11.66	-	3.71	83.45	64.43	-	19.03
GK5	71.50	19.25		3.91	-	152.89	134.44	18.45	-
GK6	45.60	13.29		3.56	-	100.94	83.66	17.28	-
GK7	67.64	19.53		3.35	-	99.54	72.30	27.24	-
GK8	29.91	8.91		2.47	-	40.70	29.76	10.94	-
GK9.1	36.87	8.65		3.06	-	58.54	42.08	16.46	-
GK9.2	63.48	4.81		2.66	-	89.34	68.78	20.56	-

Miller Field				Survey Date 3/21/2012		Low Tide 1:18 PM			Height -0.213
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
MF1	103.49	60.13	-	3.38	-	238.74	187.02	51.72	-
MF2	52.10	-	-	-	-	98.65	84.00	14.65	-

Fort Wadsworth				Survey Date 3/21/2012		Low Tide 1:18 PM			Height -0.213
ID	Distance (m)			Elevation (m)		Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
FW1	34.06	-	-		-	38.04	38.04	-	-
FW2	41.12	0.26	-	2.78	-	64.10	60.14	3.97	-
FW3	69.14	13.96	-	3.02	-	135.19	129.84	5.35	-

* Tide elevation values are referenced to Mean Lower Low Water (MLLW)

Appendix B: Dimensions of Change, GATE Profiles

- Spring 2011 – Fall 2011
- Fall 2011 – Spring 2012
- Spring 2011 – Spring 2012

Spring 2011 - Fall 2011

Sandy Hook

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
SH1	4.89	0.00	-	0.00	-	25.95	29.07	-3.12	-
SH2	14.46	0.00	-	0.00	-	41.10	41.17	-0.07	-
SH3	9.05	0.73	-	0.17	-	58.87	51.64	7.23	-
SH4	-5.96	-0.58	-	0.13	-	-35.84	-35.21	-0.63	-
SH5	-4.78	-1.24	-	-0.05	-	-1.82	5.60	-7.43	-
SH6	1.38	-1.13	-	0.26	-	22.91	24.45	-1.54	-
SH7	22.90	-0.49	-	0.05	-	15.52	20.97	-5.44	-
SH8	-0.84	-1.65	-	-0.06	-	-26.60	-16.08	-10.52	-
SH9.1	-3.10	5.28	-	0.40	-	8.87	7.69	1.18	-
SH9.2	-0.27	0.00	-	0.00	-	70.60	44.91	25.69	-
SH10	32.20	0.00	-	0.00	-	-0.39	-0.39	0.00	-
SH11	-5.07	-1.08	-	-0.08	-	-14.41	-9.75	-4.66	-
SH12	2.00	-1.09	-	0.06	-	2.65	4.77	-2.11	-
SH13	-1.48	-0.83	-	-0.33	-	-2.25	-1.42	-0.83	-
SH14	-1.82	-0.17	-	0.37	-	3.47	-0.17	1.34	-
SH15	-20.76	-0.89	-	-0.09	-	-18.65	-16.42	-2.23	-
SH16	0.96	-0.12	-	0.07	-	1.36	1.38	-0.02	-

Breezy Point

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
BP1	29.29	0.00	-	0.01	-	32.44	30.24	2.21	-
BP2	6.71	0.01	-	0.00	-	12.28	12.28	-	-
BP3	-3.29	0.24	-	-0.10	-	6.77	8.87	-2.10	-
BP4	-0.98	-9.03	-	-0.36	-	6.13	12.41	-6.28	-
BP5	-12.38	-0.05	-	0.00	-	-13.46	-14.42	0.96	-
BP6	1.39	-2.71	-	0.03	-	43.73	46.56	-2.83	-
BP7	23.15	0.16	-	-0.04	-	27.71	34.31	-6.61	-
BP8	7.85	1.95	-	0.55	-	48.93	52.92	-3.99	-
BP9	11.68	-0.57	-	0.06	-	17.95	14.72	3.23	-
BP10	0.40	-1.60	-	-0.05	-	-0.95	0.36	-1.32	-
BP11	-0.24	-1.72	-	0.09	-	0.88	0.56	0.31	-

Plumb Beach

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
PB1	-1.05	0.05	-	-0.07	-	-2.84	-0.78	-2.06	-
PB2	0.57	-0.54	-	-0.07	-	-2.07	-0.66	-1.41	-
PB3	-0.95	1.32	-	-0.41	-	-2.17	-1.82	-0.35	-
PB4	0.65	-16.56	-	1.35	-	-7.20	-4.15	-3.05	-
PB5	6.74	0.20	-	0.00	-	0.12	-0.09	0.21	-

Great Kills

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
GK1	0.27	-	-3.33	-	0.05	-5.34	0.38	-	-5.72
GK2	-0.04	-	-2.52	-	-0.03	-7.84	0.00	-	-7.84
GK3	0.41	-	-1.69	-	0.02	-5.07	0.41	-	-5.49
GK4	-0.34	-	-1.89	-	0.09	-5.04	-1.97	-	-3.07
GK5	-0.22	0.22	-	-0.01	-	-1.52	-2.81	1.30	-
GK6	-1.74	1.31	-	0.16	-	-2.78	-2.08	-0.70	-
GK7	-	-	-	-	-	-	-	-	-
GK8	-	-	-	-	-	-	-	-	-
GK9.1	0.65	0.50	-	-0.02	-	0.65	-0.50	1.15	-
GK9.2	1.57	-0.44	-	-0.27	-	-2.80	0.07	-2.87	-

Miller Field

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
MF1	0.66	0.44	-	0.02	-	5.51	3.97	1.54	-
MF2	1.04	-	-	-	-	5.07	3.40	1.67	-

Fort Wadsworth

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
FW1	1.69	-	-	-	-	6.71	6.71	-	-
FW2	0.81	-4.95	-	0.27	-	5.12	6.02	-0.90	-
FW3	0.97	1.12	-	-0.05	-	0.45	1.79	-1.34	-

Fall 2011 - Spring 2012

Sandy Hook

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
SH1	3.46	-2.23	-	-0.01	-	9.53	8.85	0.68	-
SH2	6.07	-1.97	-	0.20	-	-5.98	-6.48	0.50	-
SH3	2.23	0.35	-	-0.02	-	1.47	2.37	-0.90	-
SH4	7.54	0.17	-	0.09	-	31.67	31.21	0.45	-
SH5	2.42	0.04	-	-0.02	-	-7.30	-8.41	1.11	-
SH6	4.59	0.01	-	-0.03	-	-4.66	-4.33	-0.33	-
SH7	5.18	-0.16	-	0.00	-	-2.71	-4.54	1.83	-
SH8	25.50	2.12	-	-0.13	-	24.03	24.24	-0.21	-
SH9.1	-	-	-	-	-	-	-	-	-
SH9.2	-	-	-	-	-	-	-	-	-
SH10	-	-	-	-	-	-	-	-	-
SH11	-	-	-	-	-	-	-	-	-
SH12	-	-	-	-	-	-	-	-	-
SH13	-0.17	-0.71	-	0.08	-	-0.37	-0.34	-0.03	-
SH14	-0.20	-1.05	-	-0.60	-	-4.71	-2.67	-2.04	-
SH15	12.53	0.81	-	-0.03	-	11.56	10.40	1.16	-
SH16	-2.27	-0.58	-	-0.08	-	-3.67	-2.83	-0.83	-

Breezy Point

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
BP1	-	-	-	-	-	-	-	-	-
BP2	-	-	-	-	-	-	-	-	-
BP3	-	-	-	-	-	-	-	-	-
BP4	-	-	-	-	-	-	-	-	-
BP5	-	-	-	-	-	-	-	-	-
BP6	-	-	-	-	-	-	-	-	-
BP7	-	-	-	-	-	-	-	-	-
BP8	-	-	-	-	-	-	-	-	-
BP9	-	-	-	-	-	-	-	-	-
BP10	-	-	-	-	-	-	-	-	-
BP11	-	-	-	-	-	-	-	-	-

Plumb Beach

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
PB1	-0.29	0.45	-	-0.08	-	-1.45	-1.55	0.10	-
PB2	0.17	-0.55	-	0.01	-	0.89	0.68	0.22	
PB3	-1.97	2.50	-	-0.34	-	-1.36	-1.45	0.09	
PB4	-4.29	-0.29	-	0.07	-	-4.33	-3.82	-0.51	-
PB5	4.74	5.33	-	0.26	-	9.29	5.48	3.81	-

Great Kills

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
GK1	-0.46	-	-0.25	-	0.00	-0.87	-0.84	-	-0.03
GK2	-1.59	-	0.04	-	-0.03	-2.18	-2.33	-	0.15
GK3	-1.56	-	0.01	-	-0.02	-0.12	-0.71	-	0.59
GK4	-0.85	-	0.01	-	0.00	-1.31	-1.92	-	0.60
GK5	0.90	0.18	-	0.02	-	3.38	0.67	2.71	-
GK6	0.70	-1.81	-	0.10	-	1.82	-0.11	1.93	-
GK7	-	-	-	-	-	-	-	-	-
GK8	-	-	-	-	-	-	-	-	-
GK9.1	0.00	0.00	-	0.12	-	4.60	2.57	2.02	-
GK9.2	1.90	-4.67	-	0.11	-	9.09	5.75	3.34	-

Miller Field

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
MF1	0.46	3.20	-	-0.26	-	-2.99	-1.36	-1.63	-
MF2	-2.30	-	-	-	-	-9.27	-6.57	-2.69	-

Fort Wadsworth

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
FW1	1.26	-	-	-	-	0.35	0.35	-	-
FW2	-1.35	-0.99	-	-0.07	-	-5.69	-4.51	-1.18	-
FW3	2.34	-0.69	-	0.00	-	1.22	1.33	-0.12	-

Spring 2011 - Spring 2012

Sandy Hook

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
SH1	8.35	-2.23	-	-0.01	-	35.48	37.91	-2.44	-
SH2	20.53	-1.97	-	0.20	-	35.12	34.69	0.43	-
SH3	11.28	1.09	-	0.15	-	60.34	54.01	6.33	-
SH4	1.59	-0.41	-	0.22	-	-4.18	-4.00	-0.18	-
SH5	-2.36	-1.20	-	-0.08	-	-9.13	-2.81	-6.32	-
SH6	5.97	-1.12	-	0.23	-	18.25	20.12	-1.87	-
SH7	28.07	-0.66	-	0.05	-	12.81	16.42	-3.61	-
SH8	24.66	0.47	-	-0.19	-	-2.57	8.16	-10.73	-
SH9.1	-	-	-	-	-	-	-	-	-
SH9.2	-	-	-	-	-	-	-	-	-
SH10	-	-	-	-	-	-	-	-	-
SH11	-	-	-	-	-	-	-	-	-
SH12	-	-	-	-	-	-	-	-	-
SH13	-1.65	-1.54	-	-0.25	-	-2.62	-1.76	-0.86	-
SH14	-2.02	-1.21	-	-0.24	-	-1.24	-2.84	-0.70	-
SH15	-8.23	-0.08	-	-0.12	-	-7.08	-6.02	-1.06	-
SH16	-1.31	-0.70	-	-0.01	-	-2.31	-1.46	-0.86	-

Breezy Point

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
BP1	-	-	-	-	-	-	-	-	-
BP2	-	-	-	-	-	-	-	-	-
BP3	-	-	-	-	-	-	-	-	-
BP4	-	-	-	-	-	-	-	-	-
BP5	-	-	-	-	-	-	-	-	-
BP6	-	-	-	-	-	-	-	-	-
BP7	-	-	-	-	-	-	-	-	-
BP8	-	-	-	-	-	-	-	-	-
BP9	-	-	-	-	-	-	-	-	-
BP10	-	-	-	-	-	-	-	-	-
BP11	-	-	-	-	-	-	-	-	-

Plumb Beach

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
PB1	-1.34	0.51	-	-0.15	-	-4.28	-2.33	-1.95	-
PB2	0.74	-1.09	-	-0.06	-	-1.17	0.02	-1.20	-
PB3	-2.92	3.82	-	-0.75	-	-3.53	-3.26	-0.26	-
PB4	-3.65	-16.85	-	1.42	-	-11.53	-7.97	-3.56	-
PB5	11.48	5.53	-	0.26	-	9.41	5.39	4.02	-

Great Kills

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
GK1	-0.19	-	-3.59	-	0.05	-6.21	-0.46	-	-5.75
GK2	-1.63	-	-2.48	-	-0.06	-10.01	-2.32	-	-7.69
GK3	-1.15	-	-1.68	-	0.00	-5.20	-0.30	-	-4.90
GK4	-1.19	-	-1.89	-	0.09	-6.35	-3.89	-	-2.47
GK5	0.68	0.41	-	0.01	-	1.86	-2.14	4.00	-
GK6	-1.04	-0.50	-	0.26	-	-0.96	-2.19	1.23	-
GK7	-	-	-	-	-	-	-	-	-
GK8	0.80	-0.07	-	0.00	-	0.54	0.59	-0.05	-
GK9.1	0.65	0.50	-	0.11	-	5.24	2.07	3.17	-
GK9.2	3.47	-5.12	-	-0.16	-	6.29	5.82	0.48	-

Miller Field

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
MF1	1.12	3.64	-	-0.24	-	2.51	2.61	-0.10	-
MF2	-1.26	-	-	-	-	-4.20	-3.18	-1.02	-

Fort Wadsworth

ID	Δ Distance (m)			Δ Elevation (m)		Δ Cross Section Area (m^2)			
	NAVD88	Dune Crest	Cliff Edge	Dune Crest	Cliff Edge	Total	Beach	Dune	Cliff
FW1	2.95	-	-	-	-	7.06	7.06	-	-
FW2	-0.54	-5.95	-	0.20	-	-0.57	1.51	-2.08	-
FW3	3.31	0.43	-	-0.04	-	1.66	3.12	-1.45	-

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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