Periodic Survey Evaluation: Ocean View Beach

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1. Executive Summary

In April 2013 Geodynamics, LLC conducted the sixteenth survey of the Ocean View shoreline. The study area extends from the western end of Willoughby Spit to the western edge of the Little Creek Inlet in East Ocean View. The periodic surveys are collected bi-annually in March/April and September/October to assess the condition of the shoreline and the state of existing shore protection projects. A baseline and transects were established with the first survey in September 2005 and have been used for each subsequent survey. Shoreline changes at Mean High Water (MHW) and volumetric changes above 0 feet NAVD88 and -15 feet NAVD88 are calculated at each transect. Differences in the region above 0 feet NAVD88 are indicative of changes to the dune and subaerial beach berm, while the differences above -15 feet NAVD88 indicate changes in the nearshore zone. Comparison of seasonal surveys (i.e. March 2012 to April 2013) eliminates seasonal variation of profiles in volumetric change analyses. Consecutive survey comparisons are useful to assess the direct impact of extreme events which may occur during the six month period between surveys. This report documents the data sources, methods, and results of a periodic surveying evaluation performed to compare the April 2013 survey data with previous surveys taken in March 2012 (spring to spring comparison) and September 2012 (most recent periodic survey comparison) in the Ocean View Beach area between Willoughby Spit and Little Creek Inlet.

Comparison	Parameter	Quantity
March 2012 vs. April 2013	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	-6.04 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	-1,011 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	58,646 cy/yr
September 2012 vs. April 2013	Average Shoreline Change at MHW (+0.98 ft NAVD88)	-4.76 ft
	Cumulative Volume Change Above 0 ft NAVD88	-3,416 cy
	Cumulative Volume Change Above -15 ft NAVD88	152,296 cy

The average shoreline change rate for the entire shoreline at MHW between the March 2012 and April 2013 surveys was -6.04 ft/yr, and the cumulative volume change above 0 feet NAVD88 was approximately -1,011 cy/yr. This indicates an overall volumetric loss in the dune and subaerial beach over the past year. The overall gain above -15 feet NAVD88 of 58,646 cy/yr indicates that while there were losses on the dune and subaerial beach, there was sediment gain across the nearshore system. The most recent period of comparison, from the September 2012 survey to the April 2013 survey depicts an overall loss at the MHW line and a significant sediment gain to the nearshore system above -15 feet NAVD88 of 152,296 cy. This indicates that all of this gain to the system occurred within the most recent survey cycle.

While the shoreline showed overall volume gains for the year, there was variability within the various regions. The changes within the Willoughby Spit region have been influenced by the Willoughby Spit Shoreline Improvement Project, which began construction in January 2013. The most significant gains over the year occurred adjacent to the terminal groin and the eastern section of Willoughby Spit due to a beach and dune nourishment. The source of this sand is adjacent to the terminal groin and from the vacant City land just east of the corner of Lea View Avenue and 15th View Street. This localized area experienced a significant recession of MHW which is accounted for in the sand removal for the improvement project. The Improvement project also included the construction of

seven additional nearshore breakwaters, which connect the Lea View breakwaters with the 800 block breakwaters.

In the 800 Block region, there has been a net loss of sediment above 0 feet NAVD88 and a net gain of sediment above -15 feet NAVD88. The previously attached tombolo at the easternmost breakwater has remained detached while a tombolo has formed at the adjacent breakwater. The relocation of the breakwater at this location, as part of the Willoughby Spit Shoreline Improvement Project, will serve to permanently resolve the tombolo issue and allow for more natural flow of sediment.

The patterns of sediment gains/losses in the West Ocean View region during the most recent period shows erosion being more severe offshore at the east end of the region. This area is closest to the Central Ocean View Breakwaters and is likely affected by these structures.

The Central Ocean View Breakwaters region showed losses in the MHW shoreline position; however, there were gains in sediment volume over the year. The smaller gains in volume above 0 feet NAVD88 in the most recent survey period, September 2012 to April 2013, indicate that the majority of the gains occurred during the winter season, which is likely due to quiescent weather.

Similar to the adjacent region, Central Ocean View has experienced losses at the MHW shoreline and volumetric gains in sediment over the past year. The majority of the volumetric gain occurred during the period from March 2012 to September 2012 and is likely due to post-Hurricane Irene recovery.

As expected, due to the direction of sediment movement, there were continued volume losses to the beach in the East Ocean View region between the March 2012 and April 2013 period. During the most recent period there were losses overall to the dune and subaerial beach; however, between 0 feet NAVD88 and -15 feet NAVD88 there were gains as compared to the overall year. The Bay Oaks breakwaters are performing well, trapping sediment and eliminating the hotspot at this location. The east end of the region, adjacent to the jetty, is more erosive than most areas west in this region due to the lack of a sediment source. The profiles have a fairly steady pattern of accretion on the profiles behind the breakwaters and erosion on the profiles between the breakwaters, showing the influence of the breakwaters on decreasing the wave heights and retaining sediment along the shore.

In addition to regional assessments, comparison of the April 2013 survey was made against post-fill surveys from the East Ocean View beach nourishment and Willoughby Spit to Central Ocean View dune restoration which took place in March 2009 and January-March 2005 respectively.

Comparison	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
East Ocean View Nourishment vs. April 2013 Comparison	-84.12 ft	-16.23 cy/ft	-84,296 cy	-28.63 cy/ft	-148,064 cy
Central Ocean View Nourishment vs. April 2013 Comparison	-29.34 ft	-11.59 cy/ft	-214,618 cy	-8.51 cy/ft	-151,779 cy

Since the East Ocean View Nourishment project in 2009, roughly 75% of the placed material above 0 feet NAVD88 has been lost. Since the Central Ocean View Nourishment project in 2005, roughly 67% of the placed material above 0 feet NAVD88 has been lost. The two design projects underway for the Willoughby Spit region and the West Ocean View region will replenish these areas and alleviate hotspots, while East Ocean View may need renourishment in the next 2-3 years.

2. Objective

The City of Norfolk, Virginia has maintained a program of periodic surveying of the Ocean View shoreline since 2005. The periodic surveying data collection dates are shown in Table 2-1. This report documents the data sources, methods, and results of a periodic surveying evaluation performed to compare the April 2013 survey data with previous surveys taken in March 2012 (spring to spring comparison) and September 2012 (most recent periodic survey comparison) in the Ocean View Beach area between Willoughby Spit and Little Creek Inlet. In addition, comparison of the most recent survey (April 2013) was made to pre-fill and post-fill surveys from the Central Ocean View beach nourishment project that took place in January-March 2005 and the most recent East Ocean View beach nourishment project which took place in March 2009.

Table 2-1: Surveyors and Collection Dates

Data Collection Date	Surveyor
September 2005	McKim & Creed
March 2006	McKim & Creed
October 2006	McKim & Creed
March 2007	McKim & Creed
October 2007	McKim & Creed
March 2008	McKim & Creed
October 2008	McKim & Creed
April 2009	McKim & Creed
October 2009	Geodynamics, LLC
March 2010	Geodynamics, LLC
October 2010	Geodynamics, LLC
April 2011	Geodynamics, LLC
October 2011	Geodynamics, LLC
March 2012	Geodynamics, LLC
September 2012	Geodynamics, LLC
April 2013	Geodynamics, LLC

3. Data Sources

Geodynamics, LLC, conducted the most recent survey of Ocean View Beach in April 2013. The baseline and transects established for the September 2005 survey were used for the most recent survey. Figure 3-1 shows the location of the baseline, transects and the stationing applied by Geodynamics for the surveying. As shown in Figure 3-1, transects were stationed from west to east along the Ocean View shoreline. The survey data were provided in xyz and shapefile formats allowing for compatibility with multiple programs.

Geodynamics noted that typical survey accuracy along the hydrographic portions of the profiles is approximately ±1 cm. This 'margin of error', if applied over the entire length of the hydrographic profiles can potentially result in significant volumetric differences, in particular on the shallow and long profiles near Willoughby Spit. Therefore, volumetric changes discussed herein are analyzed with regard to potential volumetric margins of error.

Also in April 2013, the Virginia Institute of Marine Science (VIMS) flew aerial photography of the Ocean View shoreline, georectified the images, and digitized a shoreline position from the images. The April 2013 aerial photos with the digitized shoreline positions from April 2013, September 2012, and March 2012 are presented in Appendix A. Since these photos cover a limited portion of area landward and seaward of the shoreline, a previous image (2009) is underlain, for presentation purposes.

Pre- and post-fill survey data from the East Ocean View beach nourishment, collected in June 2003 and March 2009, respectively, were used as baseline data for assessing the current state of that nourishment project. Similarly, pre- and post-fill survey data from the Willoughby Spit to Central Ocean View dune restoration were utilized; these surveys were collected in December 2004 – February 2005 and March 2005, respectively. Pre-fill and post-fill data were available in xyz format from previous studies of these projects by Moffatt & Nichol.

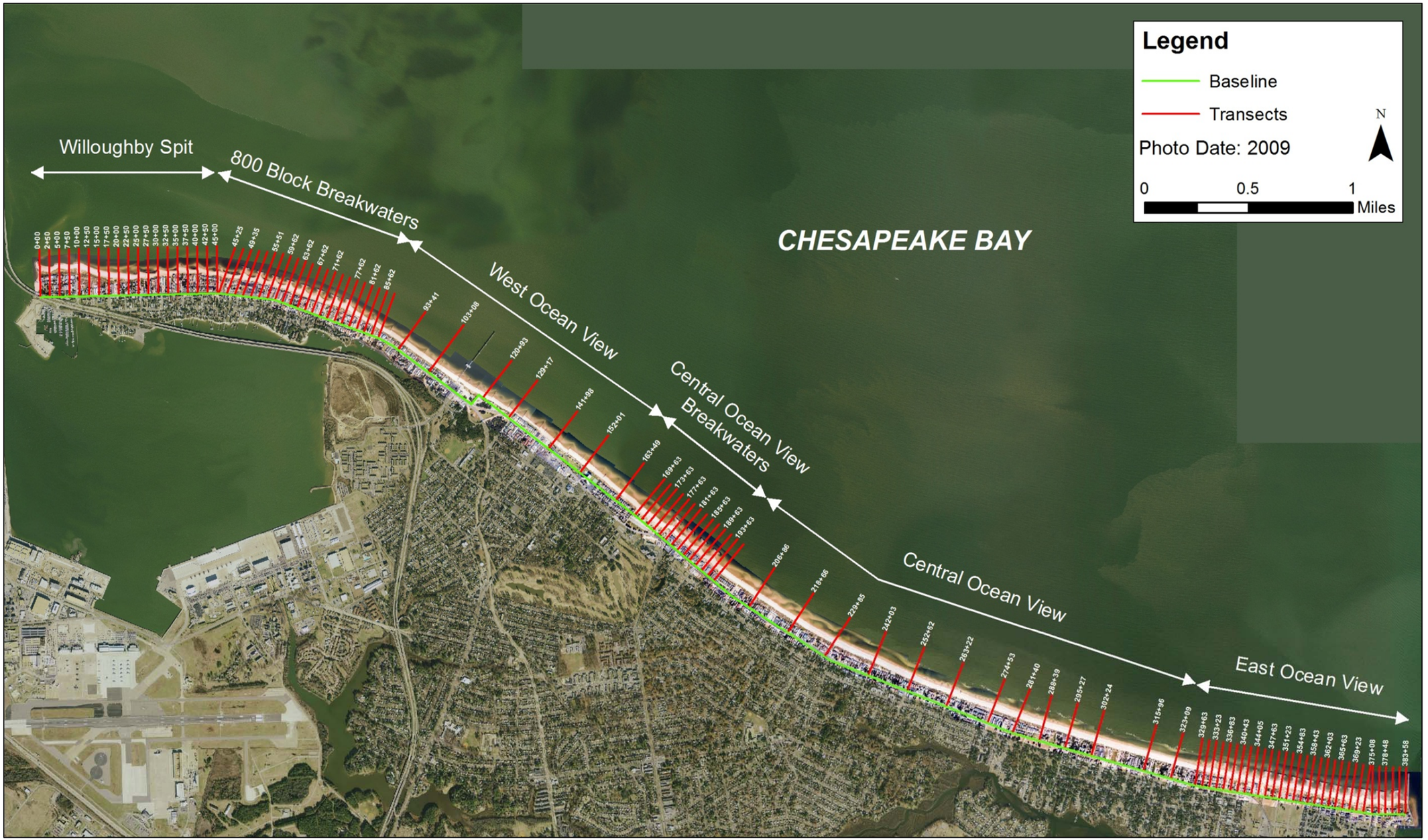


Figure 3-1: Survey Baseline and Transects

4. Methods

Survey comparisons and respective analysis were performed using a combination of Autodesk Civil 3D 2012 (Civil 3D), Microsoft Excel (Excel), Surfer and the USACE's Beach Morphology Analysis Package (BMAP). Civil 3D is an AutoCAD based program which allows the user to create and analyze Digital Terrain Models (DTMs). Surfer is a contouring and 3D surface mapping program utilized to create 3D surfaces for analysis. BMAP is a program developed by the USACE to analyze morphologic and dynamic properties of beach profiles.

All pertinent survey data were imported into Civil 3D in xyz format. The horizontal coordinate system used was Virginia South State Plane NAD 1983 (HARN), US Survey feet with a vertical datum of NAVD88. DTMs were created for each set of survey data, and a beach profile was extracted at each survey transect in station-elevation format. Individual profile plates showing the extracted profile at each transect for each date are presented in Appendix B. From the profiles, shoreline change and volumetric change were then calculated at each transect for the following time periods:

1. March 2012 to April 2013 (Entire Shoreline)
2. September 2012 to April 2013 (Entire Shoreline)
3. March 2009 (East Ocean View post-fill) to April 2013 (Sta 329+63 through Sta 383+58)
4. March 2005 (Central Ocean View post-fill) to April 2013 (Sta 15+00 through Sta 195+63)
5. December 2004-February 2005 (Central Ocean View pre-fill) to April 2013 (Sta 15+00 through Sta 195+63)
6. June 2003 (East Ocean View pre-fill) to April 2013 (Sta 329+63 through Sta 383+58)

First, the change in shoreline based on the profiles extracted from Civil 3D at mean high water (MHW) was calculated at each transect for each time period mentioned. MHW along Ocean View beaches is defined as +0.98 feet NAVD88 based on NOAA tidal benchmark at Sewells Point. The resulting value represents the shoreline change (feet) over the time period between surveys. The shoreline change rate (ft/yr) was then calculated by dividing by the amount of time between survey dates.

Representative volume changes were also calculated at each transect for all time periods. Volume changes were calculated for two different extents in order to better understand the processes occurring onshore and offshore of the Ocean View beach area. Calculations included volume change above -15 feet NAVD88 and volume change above 0 feet NAVD88. The results represent volume change per linear foot of shoreline (cy/ft) over the period of time between surveys. The volume change rate (cy/ft/yr) was then calculated by dividing by the amount of time between survey dates. In addition, the volume changes were converted to cumulative changes over the entire shoreline. This was done by applying the average end area method to the unit volume changes (cy/ft) and unit volume change rates (cy/ft/yr) computed at each transect and summing the total volume changes over

the entire shoreline. The resulting value indicated the total loss or gain of material (cy) between surveys based on the applicable profile extents.

Volume changes calculated for portions of the profiles above 0 feet NAVD88 are representative of changes in the amount of material in the dune system and on the subaerial beach. These areas are highly influenced by the performance of coastal structures and the impact of storm activity. Volume changes calculated for portions of the profiles above -15 feet NAVD88 allow for the tracking of sand movement offshore while reducing the amount of uncertainty associated with hydrographic data beyond this depth.

5. Discussion of Periodic Surveying Evaluation

This section discusses differences observed between the noted surveys, overall shoreline trends, regional shoreline trends and the East Ocean View and Central Ocean View nourishment projects. The computed shoreline changes and volume changes at each individual transect for the time periods covered are tabulated in Appendix C.

5.1. Differences in Survey Comparisons

Profile variations in the surveys taken as part of the ongoing program of periodic surveying of the Ocean View shoreline (March 2012, September 2012 and April 2013) were minimal in the topographic portion of the survey due to use of the same baseline and transects put in place for the initial survey in September 2005. Profile extents and alignment were virtually the same when comparing the survey data. The only discrepancy which impacted calculations was the vertical margin of error in the hydrographic portion of the survey as mentioned in Section 3.

The pre-fill and post-fill surveys taken for the East Ocean View and Central Ocean View nourishment projects did not use the same baseline and transects or cover the same extents as the periodic surveys. Therefore, the profiles extracted from the DTMs in Civil 3D at the periodic surveying transects are interpolations between the actual pre- and post-fill data points. In addition, the surveys did not extend as far offshore as the periodic surveys, limiting computations and the ability to track the offshore movement of sand.

5.2. Key Events During the Reporting Period

Beach processes are greatly influenced by natural and engineering processes. This section describes key events that happened during the reporting period which likely had an impact on the changes in shoreline position as well as profile volume gains and losses.

5.2.1. Storm Events

Understanding of the wave climate immediately offshore of the Norfolk shoreline is vital for the design, monitoring, and understanding of projects along the shoreline and the behavior of the beach. The data used were collected from the City's AWAC (Acoustic Wave and Current) gage, which was deployed in 2006 directly offshore of the Norfolk Shoreline in approximately 23 feet of water. The dates that the wave data were collected during this survey period were between March 13, 2012 and April 1, 2013.

A summary of the observed conditions during this deployment period yields the following general observations:

- The average significant wave height and peak period over the measurement period was approximately 1.3 feet and 5.3 seconds.
- The typical direction of the waves was from the northeast to southeast.

- The largest significant wave height observed during this deployment was approximately 7.0 feet with a corresponding peak period of approximately 6.6 seconds and mean direction of 351 degrees (March 6, 2013).

The data indicate that three events occurred during this period for which the significant wave height reached or exceeded 1.5 meters (4.9 feet). These events occurred on April 2, 2012, October 28, 2012 (Hurricane Sandy), and March 7, 2013. The significant wave height for the April 2, 2012 storm reached 1.6 meters (5.2 feet) with a maximum wave height of 2.3 meters (7.64 feet) as shown in Figure 5-1. The duration for this storm was 1 hour with significant wave heights greater than 1.5 meters. The significant wave height for the October 28, 2012 storm reached 2.1 meters (6.8 feet) with a maximum wave height of 4.0 meters (13.2 feet) as shown in Figure 5-2. The duration for this storm was 34 hours with significant wave heights greater than 1.5 meters. The significant wave height for the March 7, 2013 Storm reached 2.1 meters (7.0 feet) with a maximum wave height of 3.93 meters (12.9 feet) as shown in Figure 5-3. The duration for this storm was 6 hours with significant wave heights greater than 1.5 meters.

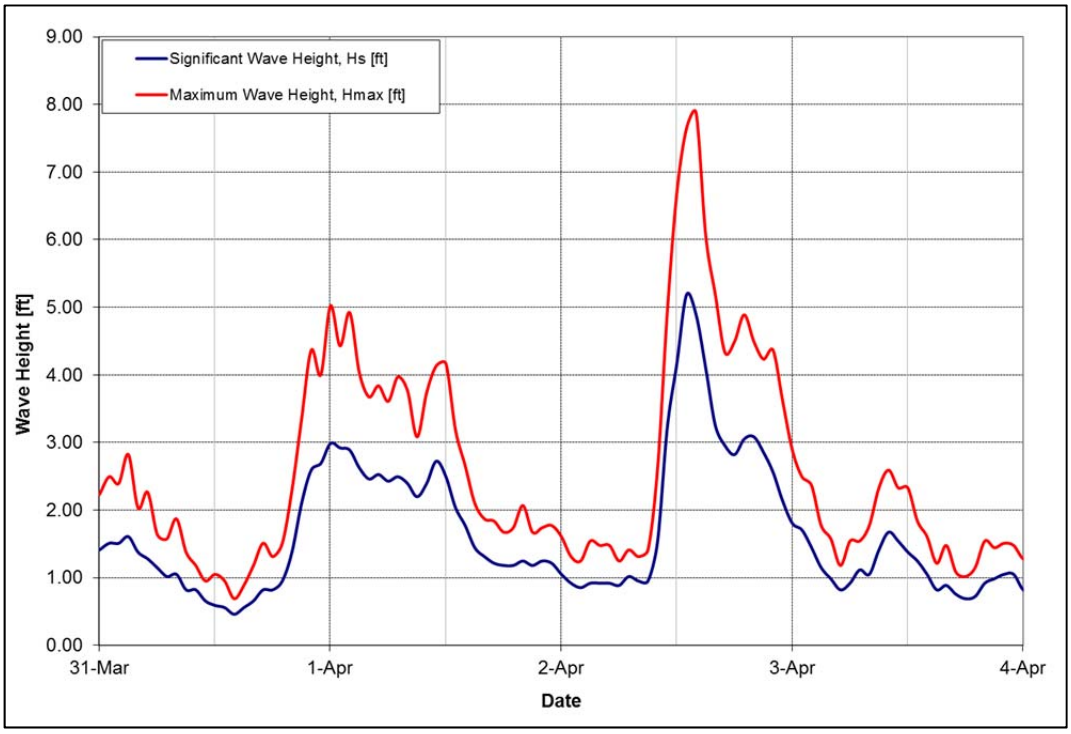


Figure 5-1: April 2, 2012 Storm

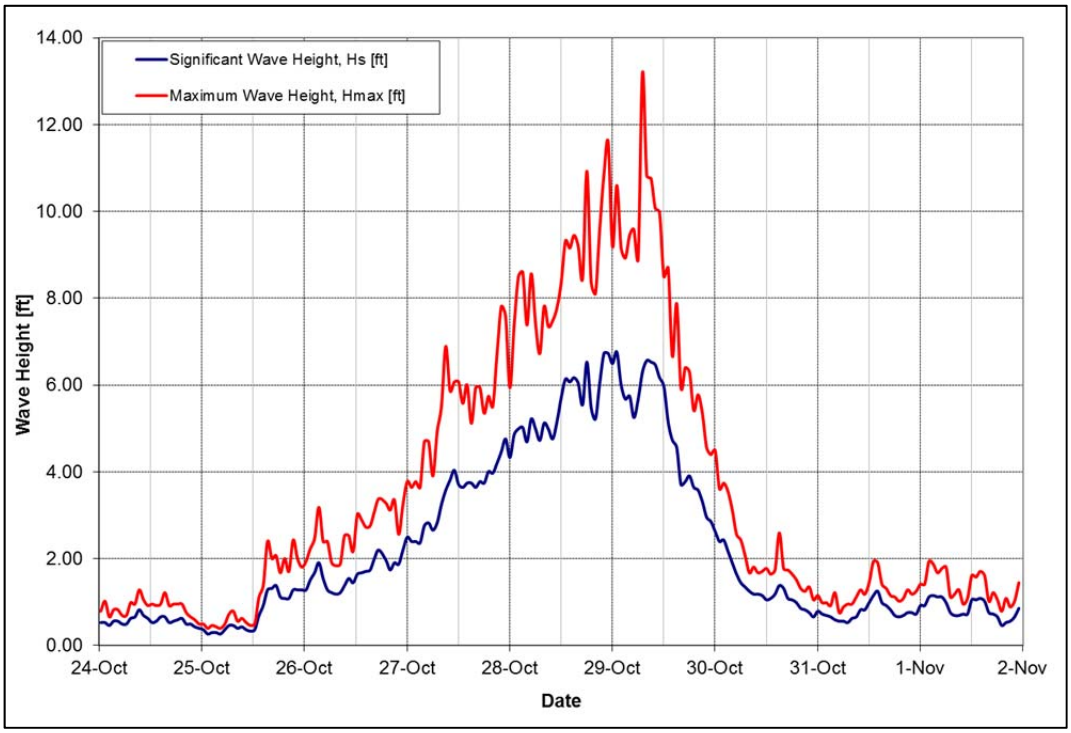


Figure 5-2: October 28, 2012 Storm (Hurricane Sandy)

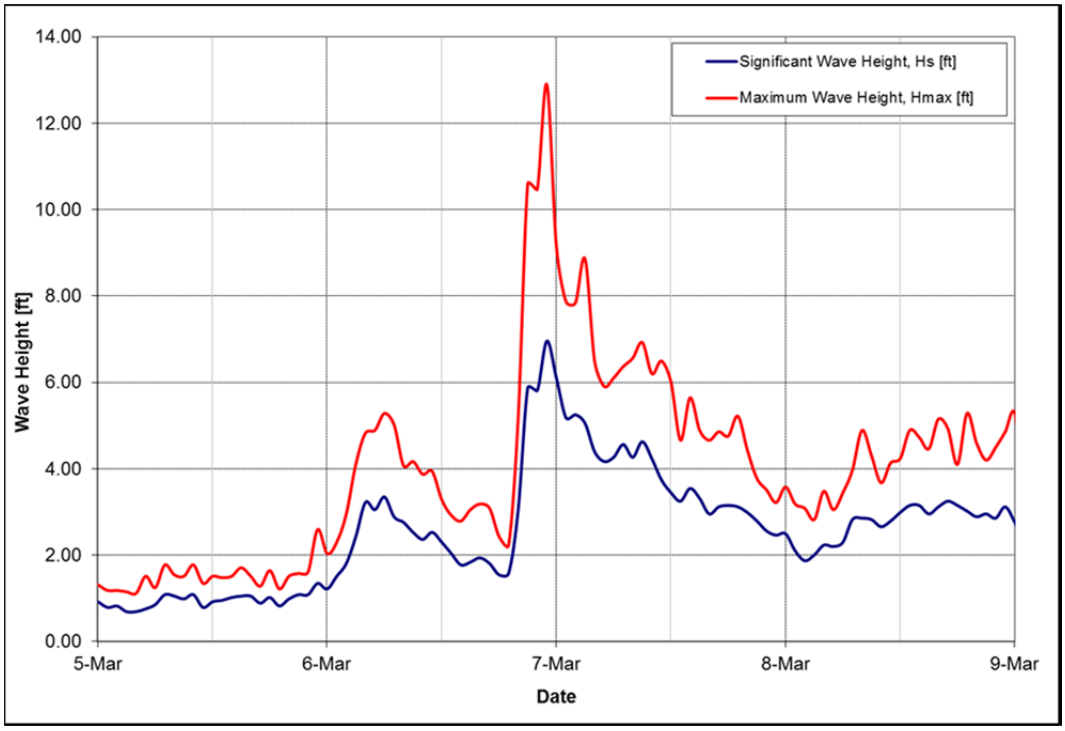


Figure 5-3: March 6, 2013 Storm

The hurricane season was fairly mild for this location with only one hurricane of interest. The nor'easter season was also fairly inactive with only two storms of significance and both storms had very short durations and mostly likely did not have much impact on the beach. A summary of wave statistics by month during this deployment is given in Table 5-1

Table 5-1: Monthly Wave Statistics Summary

Wave Statistic	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	No Data Dec 2012 – Jan 2013	Feb-13	Mar-13
Average Significant Wave Height, H_s (ft)	1.0	1.3	1.2	1.2	0.9	0.9	1.1	1.5	2.1		1.4	1.5
Average Wave Period, T_m (s)	2.5	2.4	2.7	2.4	2.3	2.4	2.6	2.7	2.9		2.7	2.7
Average Peak Wave Period, T_p (s)	4.8	4.6	5.3	4.8	5.5	5.4	6.6	5.7	4.6		4.8	5.3
Maximum Observed Significant Wave Height, H_s (ft)	3.9	5.2	3.4	4.0	3.1	3.7	3.3	6.8	4.9		4.3	7.0
Maximum Observed Wave Height, H_{max} (ft)	7.4	7.9	5.9	6.8	5.2	7.6	6.2	13.2	8.2		8.0	12.9

5.2.2. Engineering Activities

Within the most recent survey period (September 2012 to April 2013), the Willoughby Spit Shoreline Improvement Project began. This project includes removal of the existing groin field and will completely connect the 800 Block breakwater field with the existing Willoughby Spit breakwaters by adding seven new breakwaters. The new breakwaters are approximately 300 feet offshore and vary in length from 120 feet to 180 feet with two shorter ones (120 feet and 140 feet) located at the eastern end of the region to avoid impeding the sediment transport around the bend in the shoreline. The shoreline in front of the new breakwaters is being nourished with approximately 40,500 cy of material, some of which will be taken from the Willoughby Spit area. This nourishment project had not been completed as of the April 12, 2013 survey. In addition, approximately 7,900 cy of material will be utilized for a dune construction project in front of the houses on Lea View Avenue, providing extra protection since sediment from in front of those houses would be removed and used for nourishment. In conjunction with this project, one of the breakwaters at the 800 Block is being realigned to alleviate the issue of tombolo formation impacting sediment flow through the region. Figure 5-4 shows the location of the newly constructed breakwaters within Willoughby Spit as well as the realigned breakwater within the 800 Block Breakwaters region. A complete list of the historical engineering activities that have occurred in this region is shown in Appendix D.

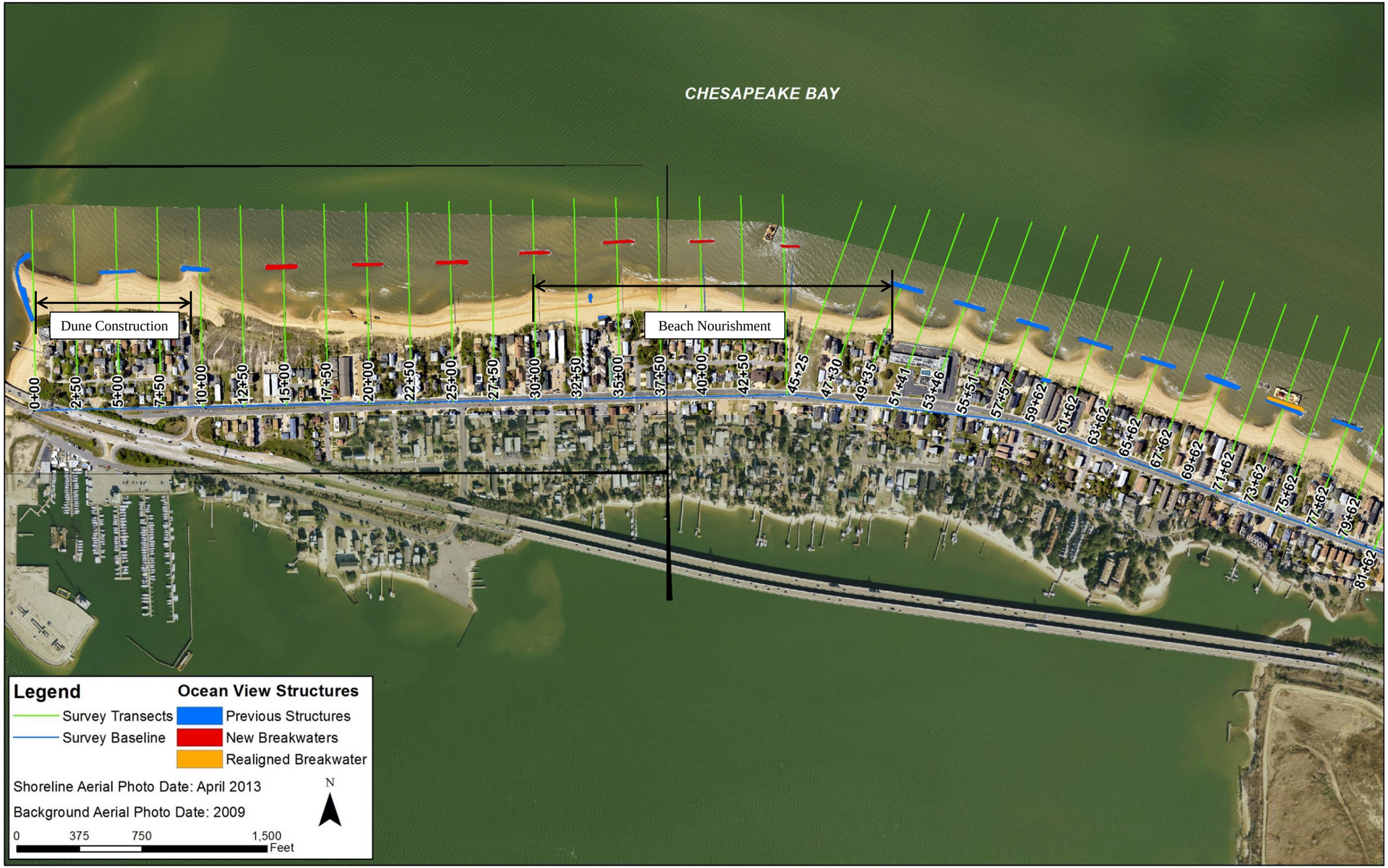


Figure 5-4: Ocean View Structures

5.3. General Shoreline Trends

Key statistics were calculated to describe the average shoreline and volume changes over the entire shoreline as well as for each region of the shoreline as defined in Figure 3-1. The computed statistics include average shoreline change, average volume change, and cumulative volume change (e.g. total volume of material lost or gained along a section of shoreline). A summary of the resulting statistics for the March 2012 to April 2013 comparison are presented in Table 5-2. A summary of the resulting statistics for the September 2012 to April 2013 comparison are presented in Table 5-3. Evaluation of the computed statistics took into account volume changes computed for portions of the profile above 0 feet NAVD88 and above -15 feet NAVD88 in order to better understand onshore and offshore processes.

According to Table 5-2, the Ocean View shoreline has experienced overall losses at MHW over the past year with a change rate of -6.04 feet per year. Most of this erosion occurred during the most recent survey period, as shown in Table 5-3. Hurricane Irene impacted the shoreline in August 2011 so recovery, and increases in sediment, would be expected in the months immediately following the storm. Once recovery occurred the shoreline appears to have suffered increased erosion. While the beach lost a minor amount of material above 0 feet NAVD88, there was an overall gain of material in the system with a change rate of 58,646 cy/yr with a majority of this occurring within the past six months.

While the overall trends over the past year show shoreline erosion and volumetric accretion of the system, patterns vary within each region of the shoreline as defined in Figure 3-1. The calculated statistics with respect to each region will be discussed in more detail in the following section.

Table 5-2: Regional Shoreline and Volume Change Statistics (March 2012 to April 2013)

Region	Average Shoreline Change Rate	Average Volume Change Rate Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Rate Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Willoughby Spit (0+00 to 45+00)	-0.28	1.09	3,777	7.14	30,204
800 Block Breakwaters (45+25 to 87+62)	-5.95	-1.37	-6,165	0.66	2,104
West Ocean View (93+41 to 163+49)	-6.20	-0.95	-6,398	-0.45	-4,062
Central Ocean View Breakwaters (169+63 to 195+63)	-0.64	1.45	5,161	2.64	8,069
Central Ocean View (206+86 to 323+09)	-6.75	1.15	13,341	3.15	37,152
East Ocean View (329+63 to 383+58)	-12.15	-1.78	-10,727	-2.56	-14,641
OVERALL	Weighted Average (ft/yr)	Weighted Average (cy/ft/yr)	Total (cy/yr)	Weighted Average (cy/ft/yr)	Total (cy/yr)
	-6.04	0.02	-1,011	1.71	58,646

Table 5-3: Regional Shoreline and Volume Change Statistics (September 2012 to April 2013)

Region	Average Shoreline Change	Average Volume Change Rate Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Rate Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit (0+00 to 45+00)	0.18	1.39	6,279	11.20	47,703
800 Block Breakwaters (45+25 to 87+62)	-1.80	-1.15	-5,246	3.31	13,986
West Ocean View (93+41 to 163+49)	-5.01	-0.68	-4,287	1.99	15,302
Central Ocean View Breakwaters (169+63 to 195+63)	-1.23	1.16	3,308	3.15	8,371
Central Ocean View (206+86 to 323+09)	-7.41	0.19	2,198	4.48	54,072
East Ocean View (329+63 to 383+58)	-7.03	-1.01	-5,667	1.90	12,863
OVERALL	Weighted Average (ft)	Weighted Average (cy/ft)	Total 鞀cy)	Weighted Average (cy/ft)	Total (cy)
	-4.76	-0.09	-3,416	4.13	152,296

5.4. Regional Shoreline Trends

Regional shoreline trends are discussed below for the defined regions between Willoughby Spit and Little Creek Inlet (see Figure 3-1). A summary of the information in Table 5-2 and Table 5-3 has been created for each region of study. Figure 5-5 through Figure 5-8, following the discussion of regional shoreline trends, present the shoreline and volume change at each transect within the defined regions.

5.4.1. Willoughby Spit

The Willoughby Spit region (Sta 0+00 to Sta 45+00) previously included two offshore breakwaters, timber groins and has historically been a stable and accreting region. Since January 2013, seven additional offshore breakwaters have been constructed and the timber groins are currently being removed as a part of the Willoughby Spit Shoreline Improvement Project. In addition, 48,400 cy of material has been placed in this region for beach nourishment and dune reconstruction. A summary of average shoreline and volume change rates for the Willoughby Spit region between March 2012 and April 2013 and between September 2012 and April 2013 are presented in Table 5-4.

Table 5-4: Average Shoreline and Volume Change Rates for Willoughby Spit

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
March 2012 vs. April 2013 Comparison					
Willoughby Spit (0+00 to 45+00)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-0.28	1.09	3,777	7.14	30,024
September 2012 vs. April 2013 Comparison					
Willoughby Spit (0+00 to 45+00)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	0.18	1.39	6,279	11.20	47,703

The information depicted in Table 5-4 shows the influence of the recent Willoughby Spit Shoreline Improvement Project on this region over the last year. For the year between the spring surveys (March 2012 and April 2013), this region experienced an average shoreline change rate of -0.28 ft/yr at MHW while showing an overall gain of sediment to the system. The shoreline at MHW as well as the volume change above 0 feet NAVD88 and -15 feet NAVD88 experienced a significant amount of erosion at 15th View Street because this was a borrow area for the nourishment project. The beach nourishment project placed 40,500 cy along the eastern end of this reach behind the new breakwaters from station 20+00 to 49+35. This region experienced a significant amount of accretion at MHW as well as volume change above 0 feet NAVD88 and 15 feet NAVD88 as shown in Figure 5-7 and Figure 5-8. This project is currently under construction and the easternmost section of this project was not complete at the time of the survey on April 12, 2013. The dune construction project place 7,900 cy directly adjacent to the terminal groin along Lea View Avenue. This dune placement of sand along with the natural westward sediment transport in this region caused the large increase in volume change above both 0 feet NAVD88 and -15 feet NAVD88. Over the entirety of this reach, the majority of sediment gain occurred between -15 feet NAVD88 and 0 feet NAVD88. The most significant gains over the year occurred adjacent to the terminal groin as shown in Figure 5-6. The only locations that showed losses were associated with the sand removal for the beach and dune nourishment projects.

5.4.2. 800 Block Breakwaters

The 800 Block Breakwaters region (Sta 45+25 to Sta 87+62) is characterized by a field of eight breakwaters. The easternmost breakwater was relocated in February 2006 along with removal of the pre-existing groin spur and toe extension. This new breakwater was built further offshore since the previous structural configuration caused the beach to fill out and impair natural sediment transport to the west. In conjunction with the Willoughby Spit Project, breakwater 7 (adjacent to the easternmost breakwater) is currently being relocated further offshore to enhance natural sediment transport in the region. A summary of average shoreline and volume change rates for the 800 Block Breakwaters region between March 2012 and April 2013 and between September 2012 and April 2013 are presented in Table 5-5.

Table 5-5: Average Shoreline and Volume Change Rates for 800 Block Breakwaters

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
March 2012 vs. April 2013 Comparison					
800 Block Breakwaters (45+25 to 87+62)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-5.95	-1.37	-6,165	0.66	2,104
September 2012 vs. April 2013 Comparison					
800 Block Breakwaters (45+25 to 87+62)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	-1.80	-1.15	-5,246	3.31	13,986

Overall, the shoreline change and the volume change above 0 feet NAVD88 have, on average, continued to erode within this reach over the past monitoring cycle. There has been an increase in volume above -15 feet NAVD88 over the past monitoring cycle. Since the sand removal in front of the easternmost breakwater in 2010, a tombolo has formed at the adjacent breakwater, impeding sediment flow to the west as shown in Figure 5-7. This breakwater is currently being realigned to prevent the tombolo from forming in the future.

5.4.3. West Ocean View

The West Ocean View area (Sta 93+41 to Sta 163+49), between the 800 Block and Central Ocean View breakwaters, is characterized by a series of timber groins. A summary of average shoreline and volume change rates for the West Ocean View region between March 2012 and April 2013 and between September 2012 and April 2013 are presented in Table 5-6.

Table 5-6: Average Shoreline and Volume Change Rates for West Ocean View

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
March 2012 vs. April 2013 Comparison					
West Ocean View (93+41 to 163+49)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-6.20	-0.95	-6,398	-0.45	-4,062
September 2012 vs. April 2013 Comparison					
West Ocean View (93+41 to 163+49)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	-5.01	-0.68	-4,287	1.99	15,302

The March 2012 to April 2013 survey comparison showed a retreat of the MHW shoreline position, with overall volume losses to the system. The majority of the retreat of the MHW shoreline occurred

between September 2012 and April 2013. During the same time period, the volume change above -15 feet NAVD88 started accreting, which occurred predominantly in the western section of this reach. The eastern section of this reach, adjacent to the Central Ocean View breakwaters, experienced localized erosion due to the effects caused by these structures. The West Ocean View shoreline improvement project, which includes the removal and rehabilitation of the timber groins and beach nourishment, commenced construction in June of 2013 and will be completed in the fall.

5.4.4. Central Ocean View Breakwaters

The Central Ocean View breakwater region covers the four offshore breakwaters at Central Ocean View and approximately 800 feet westward (Sta 169+63 to Sta 195+63). A summary of average shoreline and volume change rates for the Central Ocean View Breakwaters region between March 2012 and April 2013 and between September 2012 and April 2013 are presented in Table 5-7.

Table 5-7: Average Shoreline and Volume Change Rates for Central Ocean View Breakwaters

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
March 2012 vs. April 2013 Comparison					
Central Ocean View Breakwaters (169+63 to 195+63)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-0.64	1.45	5,161	2.64	8,069
September 2012 vs. April 2013 Comparison					
Central Ocean View Breakwaters (169+63 to 195+63)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	-1.23	1.16	3,308	3.15	8,371

The Central Ocean View Breakwaters region showed a retreat of the MHW shoreline position; however, there were gains in sediment volume above 0 feet NAVD88 and -15 feet NAVD88 over the year. The smaller gains in volume above 0 feet NAVD88 in the most recent survey period, September 2012 to April 2013, indicate that majority of the gains occurred during the winter season, which is likely due to the quiescent winter weather. The end effects of the breakwater field are apparent in the losses at MHW at Sta 175+63 and Sta 177+63 shown in Figure 5-5 and Figure 5-7 as well as sediment volume losses depicted in Figure 5-6 and Figure 5-8.

5.4.5. Central Ocean View

Central Ocean View (Sta 206+86 to Sta 323+09) is historically a stable region with slight accretion despite the absence of engineering interventions (e.g. beach fill or structures). A summary of average shoreline and volume change rates for the Central Ocean View region between March 2012 and April 2013 and between September 2012 and April 2013 are presented in Table 5-8.

Table 5-8: Average Shoreline and Volume Change Rates for Central Ocean View

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
March 2012 vs. April 2013 Comparison					
Central Ocean View (206+86 to 323+09)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-6.75	1.15	13,341	3.15	37,152
September 2012 vs. April 2013 Comparison					
Central Ocean View (206+86 to 323+09)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	-7.41	0.19	2,198	4.48	54,072

As shown in Table 5-8, Central Ocean View has experienced erosion at the MHW shoreline and volumetric gains in sediment above 0 feet NAVD88 and -15 feet NAVD88 over the past year. The majority of the volumetric gain above 0 feet NAVD88 occurred during the period from March 2012 to September 2012. This is likely due to sediment that was moved offshore during Hurricane Irene being pushed back onshore during the post-storm recovery. Assessment of Figure 5-6 and Figure 5-8 shows the majority of these gains occurred to the dune and subaerial beach berm above 0 feet NAVD88 which is in agreement with onshore movement of sediment.

5.4.6. East Ocean View

The East Ocean View region (Sta 329+63 to Sta 383+58) is characterized by 15 breakwaters of which the 5 westernmost were built in August of 2009. Prior to the breakwater construction, a beach renourishment project took place in March 2009, adding approximately 196,000 cy of material to the beach. A summary of average shoreline and volume change rates for the East Ocean View region between March 2012 and April 2013 and between September 2012 and April 2013 are presented in Table 5-9.

Table 5-9: Average Shoreline and Volume Change Rates for East Ocean View

Region	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
March 2012 vs. April 2013 Comparison					
East Ocean View (329+63 to 383+58)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-12.15	-1.78	-10,727	-2.56	-14,641
September 2012 vs. April 2013 Comparison					
East Ocean View (329+63 to 383+58)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	-7.03	-1.01	-5,667	1.90	12,863

As expected, due to sediment movement along the shoreline from east to west, there were continued volume losses to the beach in this this region between the March 2012 and April 2013 period. During the most recent survey period (September 2012 to April 2013), there were gains between -15 feet NAVD88 and 0 feet NAVD88. Figure 5-8 indicates the Bay Oaks breakwaters have been very successful at trapping sand that may be eroding from the beach and eliminating the previous hotspot. The east end of the region, adjacent to the jetty, is more erosive than most areas west in this region due to the lack of a sediment source and the littoral sediment movement in this region going from east to west. The region has a fairly steady pattern of accretion on the profiles behind the breakwaters and erosion on the profiles between the breakwaters. This indicates the influence of the breakwaters on decreasing the wave heights and retaining sediment along the shore.

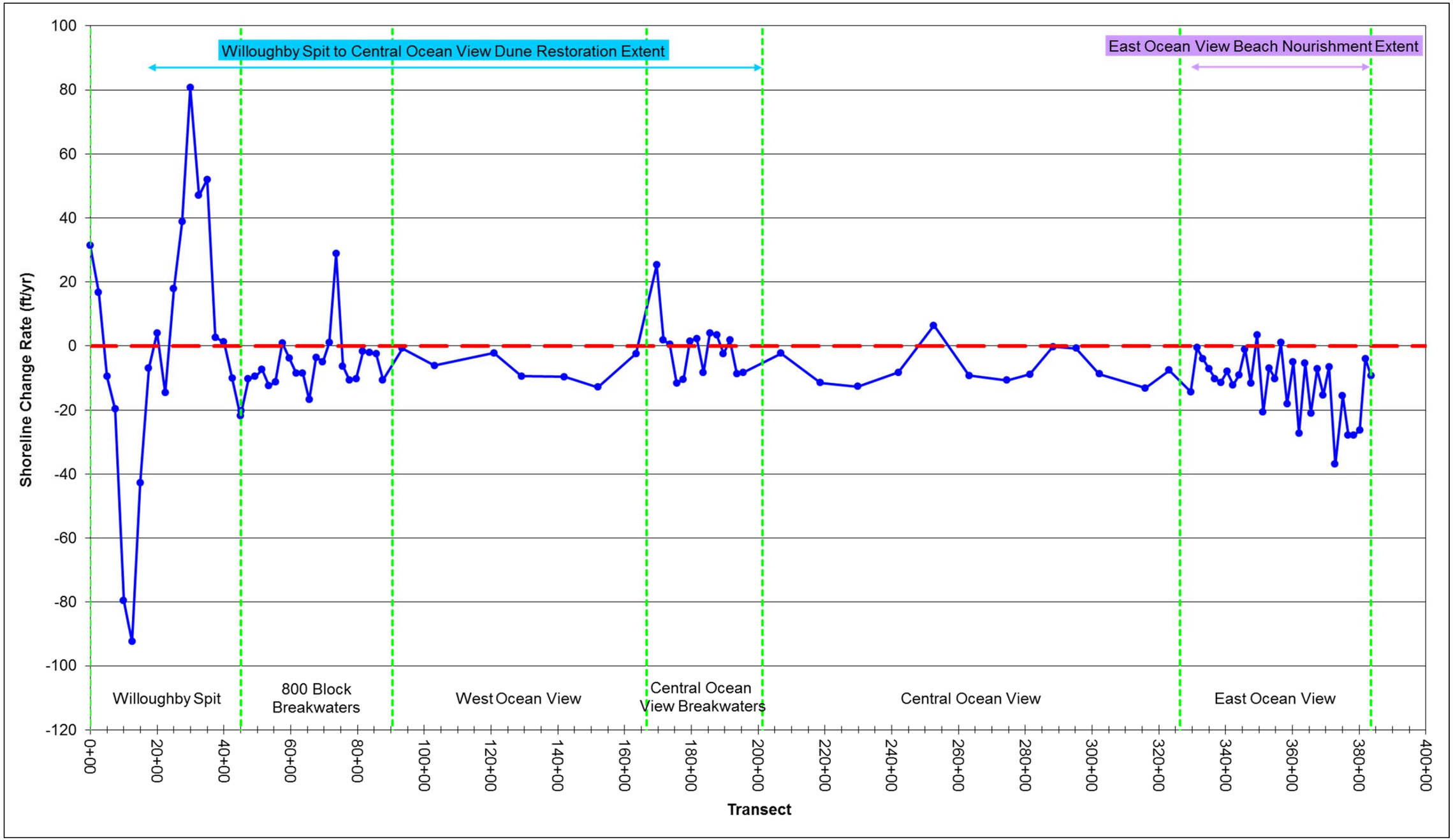


Figure 5-5: Shoreline Change Rate (ft/yr) at Mean High Water (+0.98 ft NAVD88) for March 2012 to April 2013 (Note: Positive = Accretion, Negative = Erosion)

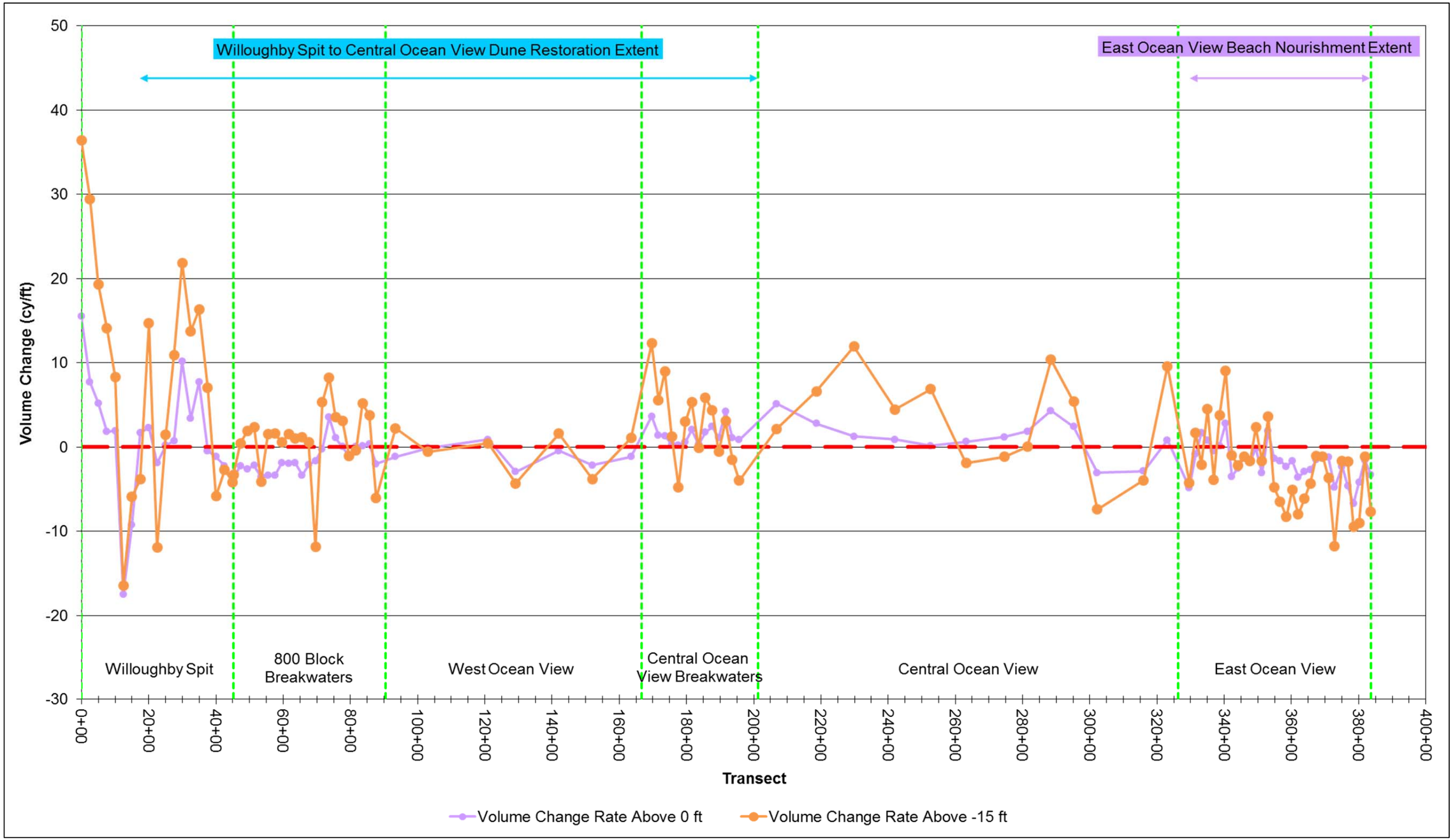


Figure 5-6: Volume Change Rate Above 0 ft NAVD88 (cy/ft) for March 2012 to April 2013 (Note: Positive = Accretion, Negative = Erosion)

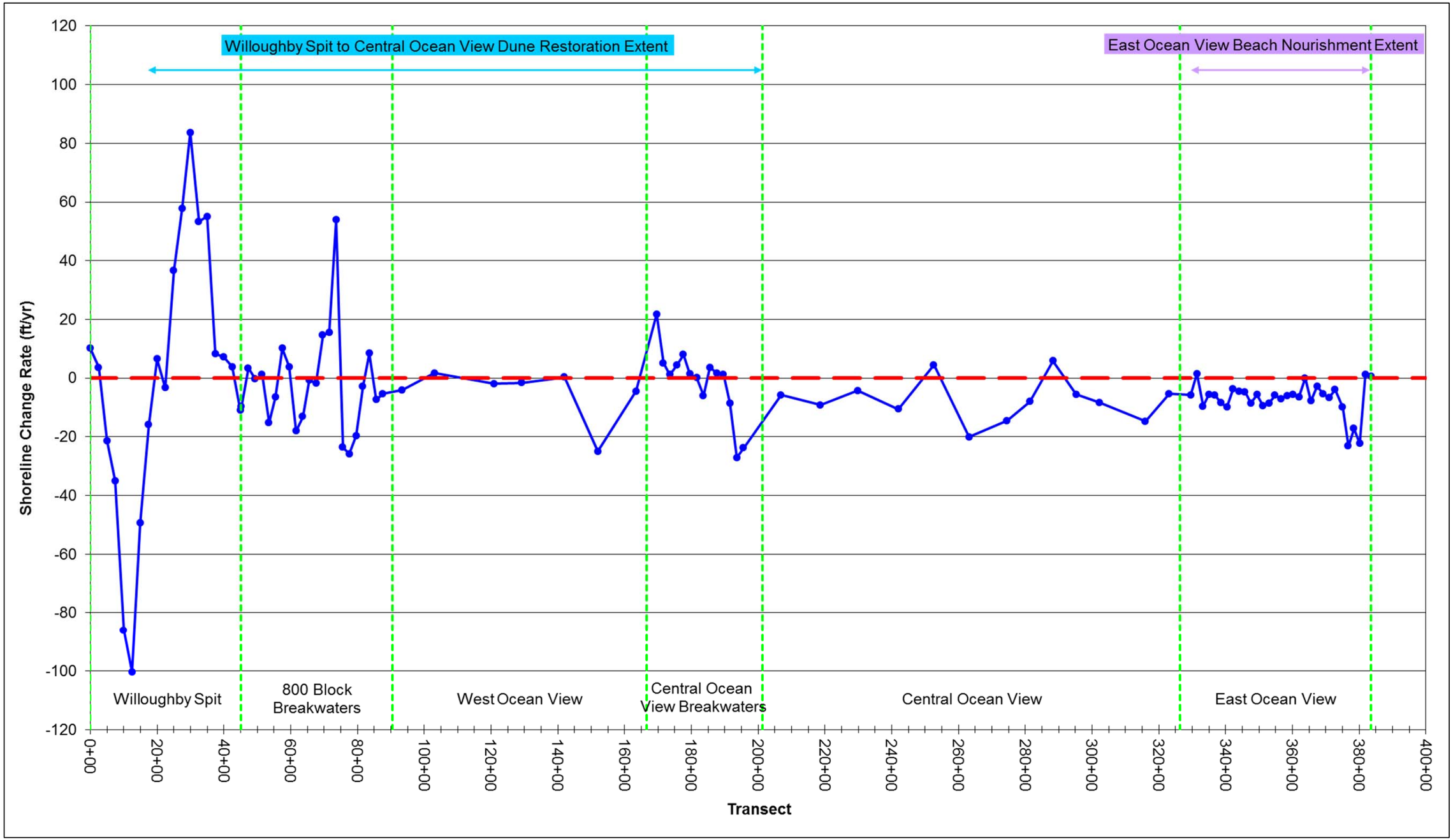


Figure 5-7: Shoreline Change (ft) at Mean High Water (+0.98 ft NAVD88) for September 2012 to April 2013 (Note: Positive = Accretion, Negative = Erosion)

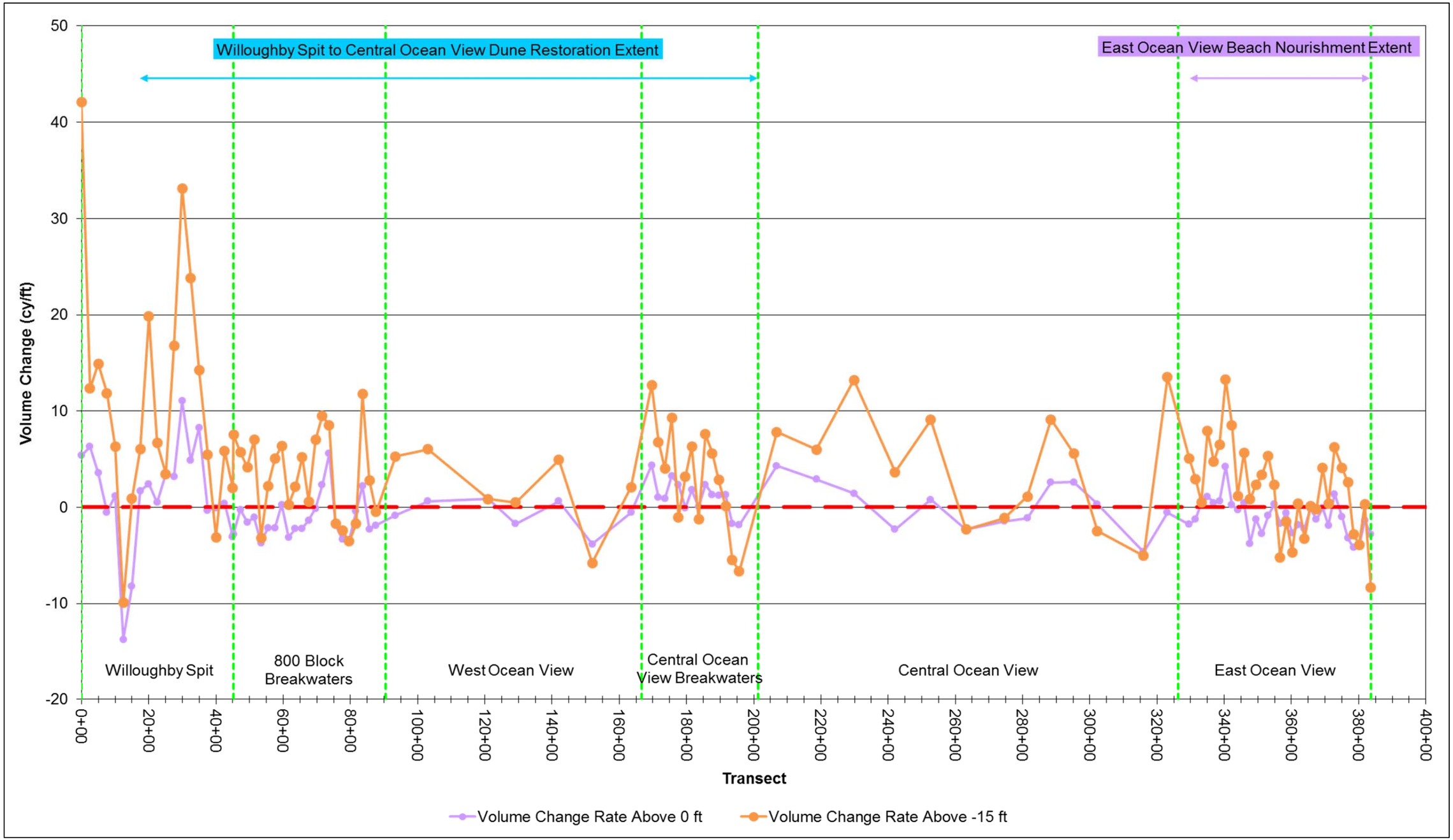


Figure 5-8: Volume Change Above 0 ft NAVD88 (cy/ft) and -15 ft NAVD88 for September 2012 to April 2013 (Note: Positive = Accretion, Negative = Erosion)

5.5. East Ocean View Beach Nourishment Project (2009)

An initial beach nourishment project took place along the East Ocean View shoreline in November 2003. Approximately 359,000 cy of material was placed on the beach between Sta 329+63 and Sta 383+58. More recently, the East Ocean View shoreline was renourished with approximately 196,000 cy of material in March 2009. The most recent periodic survey, taken in April 2013, was compared to the post-fill survey taken in March 2009. Table 5-10 presents the shoreline and volume change statistics comparing the two surveys.

Table 5-10: Overall Shoreline and Volume Change Statistics – East Ocean View Nourishment Project (March 2009 Post-Fill – April 2013 Comparison)

Region		Average Shoreline Change (ft)	Average Volume Change Above 0 ft NAVD88 (cy/ft)	Cumulative Volume Change Above 0 ft NAVD88 (cy)	Average Volume Change Above -15 ft NAVD88 (cy/ft)	Cumulative Volume Change Above -15 ft NAVD88 (cy)
East Ocean View (329+63 to 383+58)	Rate per Year	-20.83	-4.02	-20,874	-7.09	-36,664
	Total	-84.12	-16.23	-84,296	-28.63	-148,064

Results indicate that the East Ocean View shoreline has continued eroding with losses at MHW. Roughly 84,300 cy of material has been lost above 0 feet NAVD88, or approximately 75% of the 113,000 cy originally placed above 0 feet NAVD88. This loss of sediment is the result of the expected erosion due to design life of the nourishment project combined with storm activity. Previous experience from the 2003 nourishment project indicates that the design life of projects in this area is limited to 4-5 years due to storm impact and lack of sediment source to the east. Therefore, it is anticipated that renourishment will likely be needed within the next 1 to 2 years.

Figure 5-9 shows areas of elevation change between the post-fill survey and the April 2013 survey. As depicted in the figure, there has been erosion of the beach face and nearshore in-between the breakwaters with some of that sediment being trapped behind each of the breakwaters. The magnitude of the loss is much larger to the east, which is to be expected since this shoreline is cut off from a sediment source by the jetty. Some of the sediment eroded from the beach face and nearshore appears to be caught offshore in the vicinity of the Bay Oaks breakwaters. At station 329+63, there seems to be some slight end effects from the Bay Oaks breakwaters. These breakwaters have been very successful eliminating the previous hotspot and providing a transition into the Central Ocean View region. There has also been an increase in the dune area, which may partially be attributed to the annual dune planting project providing a mechanism for sand accumulation.

In addition, the April 2013 MHW shoreline was compared to the MHW shoreline from June 2003, before the first nourishment project in November 2003, as another way to measure the amount of protection being supplied by the March 2009 nourishment project. Areas where the current shoreline is within 20 feet of the June 2003 shoreline need to be targeted for nourishment. Figure 5-10 shows the MHW shoreline position difference between the June 2003 pre-fill and April 2013 shorelines. As can be seen, the 2009 nourishment project has provided ample protection along the East Ocean View shoreline in most cases. A portion of the shoreline has eroded past the original pre-fill position at two

locations. The first location is at Station 331+43 immediately downdrift of the Bay Oaks breakwaters. However, the shoreline in this location has remained in the same spot since the previous survey. The second location is at Stations 351+23 and 353+03, which have been consistently eroding over the past year. This location recessed beyond the position of the pre-fill shoreline within the most recent survey. It will be important to monitor this portion of shoreline for planning purposes of future nourishment projects.

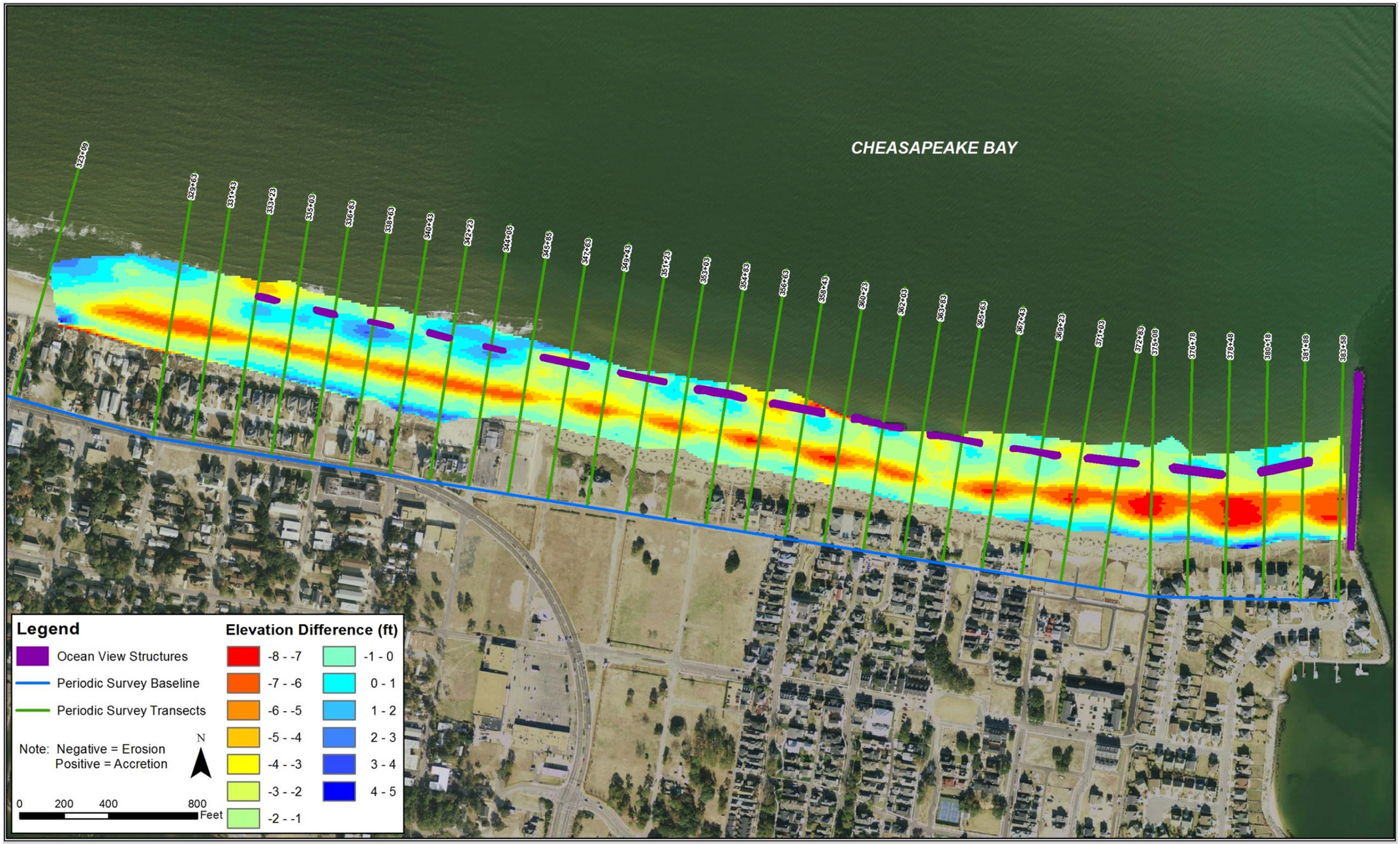


Figure 5-9: Net Volume Change Since the East Ocean View Nourishment Project (March 2009)

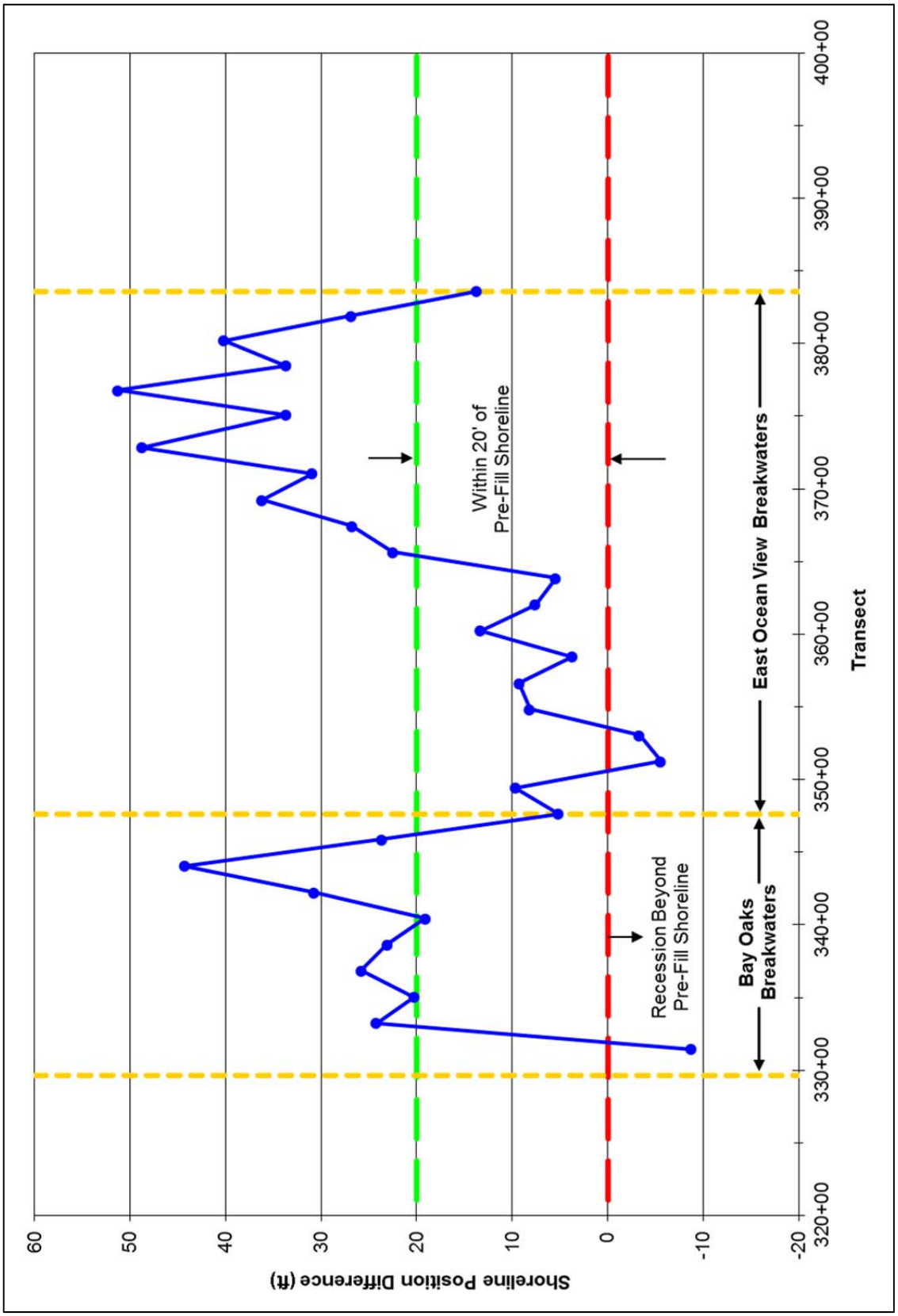


Figure 5-10: Shoreline Position Difference (ft) at MHW Between 2003 Pre-Fill and April 2013 Shorelines for East Ocean View

5.6. Central Ocean View Dune Restoration Project (2005)

The most recent periodic survey, taken in April 2013, was also compared to the post-fill survey taken in March 2005 after completion of the Willoughby Spit to Central Ocean View Dune Restoration project. A total of 504,300 cy of sand was placed from Sta 15+00 to Sta 195+63. Table 5-11 presents the shoreline and volume change statistics comparing the two surveys.

Table 5-11: Regional and Overall Shoreline and Volume Change Statistics for Central Ocean View Nourishment Project (March 2005 Post-Fill – April 2013 Comparison)

Region		Average Shoreline Change (ft)	Average Volume Change Above 0 ft NAVD88 (cy/ft)	Cumulative Volume Change Above 0 ft NAVD88 (cy)	Average Volume Change Above -15 ft NAVD88 (cy/ft)	Cumulative Volume Change Above -15 ft NAVD88 (cy)
Willoughby Spit (0+00 to 45+00)	Rate per Year	-0.82	-1.24	-3,663	-1.29	-3,691
	Total	-6.58	-10.00	-29,506	-10.40	-29,728
800 Block Breakwaters (45+25 to 87+62)	Rate per Year	-5.07	-1.24	-5,400	-1.77	-7,673
	Total	-40.85	-9.99	-43,496	-14.23	-61,808
West Ocean View (93+41 to 163+49)	Rate per Year	-5.01	-2.14	-16,543	-1.43	-10,523
	Total	-40.37	-17.22	-133,254	-11.54	-84,764
Central Ocean View Breakwaters (169+63 to 195+63)	Rate per Year	-1.33	-0.34	-1,038	0.91	3,044
	Total	-10.69	-2.75	-8,362	7.34	24,521
OVERALL	Weighted Average	Weighted Average	Total	Weighted Average	Total	Weighted Average
Rate per Year		-3.64	-1.44	-26,645	-1.06	-18,843
Total		-29.34	-11.59	-214,618	-8.51	-151,779

It is important to consider changes above the 0-foot contour since the project was primarily a dune restoration, placing the majority of sand above the intertidal zone. Table 5-11 shows that there has been significant loss of material in the dune system and subaerial beach above 0 feet NAVD88 since the project was completed. Roughly 214,600 cy of material has been lost above 0 feet NAVD88, or approximately 67% of the 320,700 cy originally placed above 0 feet NAVD88.

Figure 5-11 shows areas of elevation change between the post-fill survey and the April 2013 survey. As depicted in the figure, there has been erosion of the beach face and nearshore in-between the 800 Block breakwaters and the Central Ocean View breakwaters. These losses are less in the Central Ocean View breakwaters than in the 800 Block breakwaters. The losses due to the end effects from the 800 Block breakwaters can also be seen between stations 42+50 and 47+30. Between stations 129+17 and 141+98 there continues to be a hotspot due to the seawall at this location.

In addition, the April 2013 MHW shoreline was compared to the pre-fill MHW shoreline as another way to measure the amount of protection still being supplied by the January-March 2005 nourishment (dune restoration) project. The design life of the nourishment project was outlined in the M&N Willoughby Spit to Central Ocean View Dune Restoration Project Performance Analysis

from October 2004. The study anticipated a project design life of 5 to 6 years with no major storm activity and 2 to 3 years at hot spot areas if there were impacts to this reach of shoreline from storms. The nourishment project is in its eighth year and has been impacted by several storms since its construction, e.g. October 2006 and November 2009 nor'easters, and Hurricane Irene in August 2011. Areas where the current shoreline is within 20 feet of the pre-fill shoreline need to be targeted for nourishment. Figure 5-12 shows the MHW shoreline position difference between the pre-fill and April 2013 shorelines. As can be seen, the April 2013 Willoughby Spit to Central Ocean View MHW shoreline comes within 20 feet of the pre-fill shoreline in many locations and has even receded past the pre-fill shoreline at several locations. Areas of concern include the shoreline to the west of the 800 Block breakwater field as well as portions of the breakwater field itself which exist westward of the tombolo formation between stations 45+25 and 55+51. The breakwaters are most likely inhibiting the transport of sand to the western portion of the field and shoreline beyond. The MHW shoreline along the eastern section of the Willoughby Spit region between stations 35+00 and 45+00 has extended beyond 20 feet from the pre-fill shoreline. This section is along the eastern extent of the nourishment project, which was not complete at the time of this survey. This section of shoreline, during the previous survey period, eroded back to the pre-fill shoreline and will be improved once the nourishment project is complete. The rest of Willoughby Spit is in good condition due to the portion of the beach nourishment project that has been completed. The West Ocean View shoreline remains an area of concern with a majority of transects showing recession either beyond the pre-fill shoreline or within 20 feet of the pre-fill shoreline. The location of most concern is between stations 120+93 to 141+98 which has the largest recession beyond the pre-fill shoreline due to the timber bulkhead in this location. The shoreline suffered significant impacts from the November 2009 nor'easter which were further exacerbated by Hurricane Irene in August 2011. The West Ocean View Shoreline Improvement Project is currently under construction with the groin removal and rehabilitation underway and the beach nourishmentscheduled for Fall 2013 to alleviate erosion in this area. Targeted nourishment projects should continue to be planned for these areas in the future.

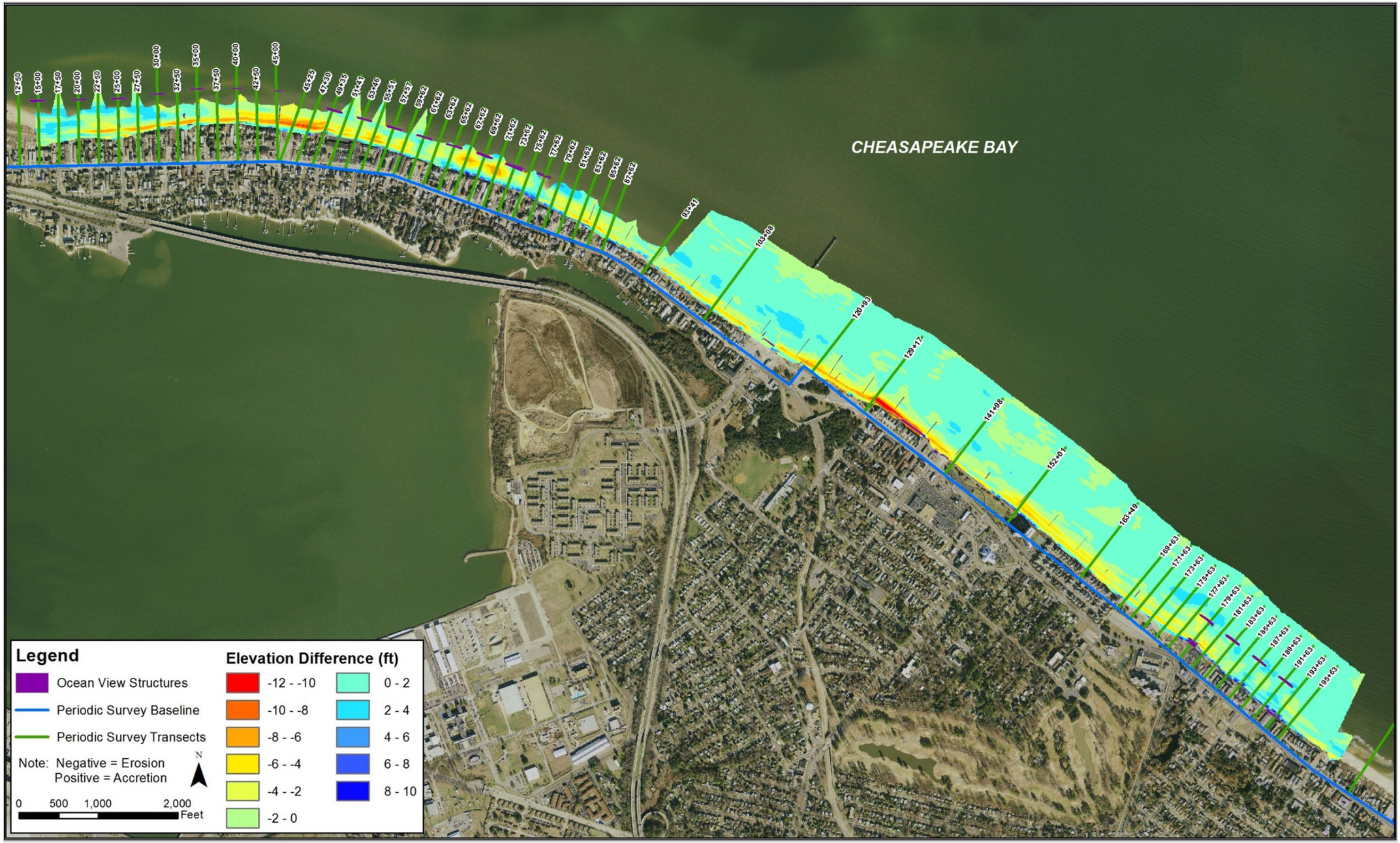


Figure 5-11: Net Volume Change Since the Willoughby Spit to Central Ocean View Dune Restoration Project (March 2005)

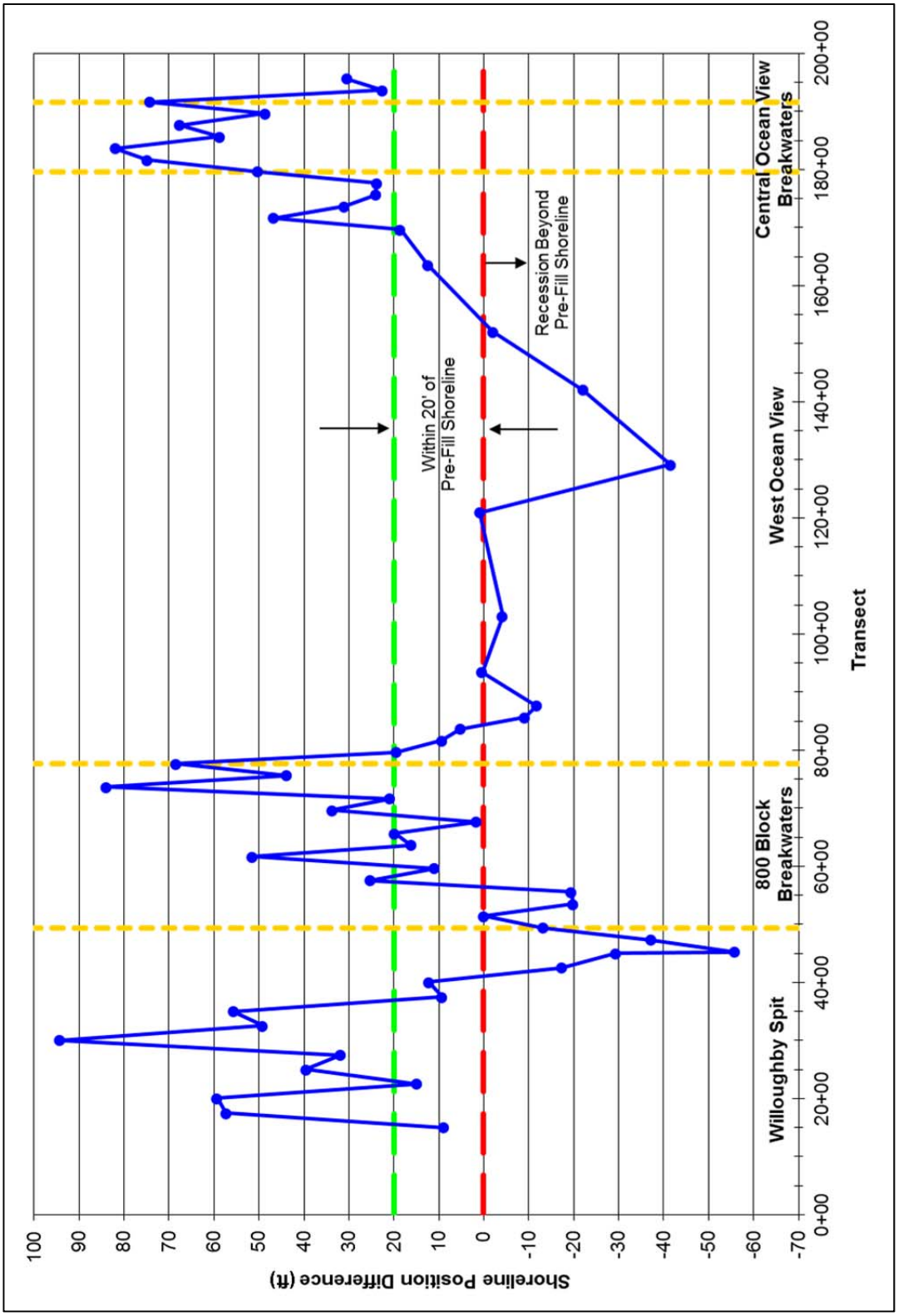


Figure 5-12: Shoreline Position Difference (ft) at MHW Between 2003 Pre-Fill and April 2013 Shorelines for Central Ocean View

6. Summary

Comprehensive periodic surveying of the entire Ocean View shoreline began with an initial survey in September 2005. The most recent survey was completed in April 2013. Subsequent surveys are planned to be conducted and evaluated every six months, in March/April and September/October. The beach and bathymetric surveys, performed by Geodynamics, utilized baseline and transect positions established in September 2005 which are used for all periodic surveys. For this periodic evaluation, the April 2013 survey was compared with both the September 2012 and March 2012 surveys. The surveys were used to compute shoreline change at MHW and volume change above 0 feet NAVD88 and above -15 feet NAVD88.

In addition, the most recent survey in April 2013 was compared to pre- and post-fill surveys taken after the East Ocean View beach nourishment and Willoughby Spit to Central Ocean View dune restoration projects in March 2009 and January-March 2005 respectively. This was done to quantify the amount of material loss since the projects were completed and condition of the shoreline with respect to pre-fill conditions.

Key statistics were computed for defined regions along Ocean View and the entire shoreline for the time period between both the March 2012 and April 2013 surveys and the September 2012 and April 2013 surveys.

Comparison	Parameter	Quantity
March 2012 vs. April 2013	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	-6.04 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	-1,011 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	58,646 cy/yr
September 2012 vs. April 2013	Average Shoreline Change at MHW (+0.98 ft NAVD88)	-4.76 ft
	Cumulative Volume Change Above 0 ft NAVD88	-3,416 cy
	Cumulative Volume Change Above -15 ft NAVD88	152,296 cy

The average shoreline change rate for the entire shoreline at MHW between the March 2012 and April 2013 surveys was -6.04 ft/yr. The cumulative volume change above 0 feet NAVD88 and -15 feet during this period was approximately -1,011 cy/yr and 58,646 cy/yr respectively. This indicates an overall volumetric loss in the dune, subaerial beach and subaqueous beach over the past year with an overall volumetric gain to the system. The most recent period of comparison, from the September 2012 survey to the April 2013 survey depicts losses at the MHW line overall with the majority of the gains in sediment for the year occurring during this time period. This can be attributed partially to the Willoughby Spit Shoreline Improvement Project and a period of quiescent weather.

Willoughby Spit

The Willoughby Spit region has been heavily influenced by the Willoughby Spit Shoreline Improvement Project which consists of seven new breakwaters, a beach nourishment project behind the easternmost four breakwaters, and a dune construction project adjacent to the terminal groin. The beach nourishment project was not complete at the time of the April survey. There are some notable gains in the eastern portion of the region, where the nourishment project is located, and adjacent to

the terminal groin, where the dune restoration occurred. There are also some losses in the area due to using material between stations 10+00 and 17+50 for nourishment.

800 Block Breakwaters

Overall, the shoreline change and the volume change above 0 feet NAVD88 continued to erode, and the volume change above -15 feet NAVD88 began to accrete over the past monitoring. A previous borrow area for a dune restoration project in 2010 was located landward of the easternmost breakwater and the removal of sediment allowed the tombolo that had formed at this breakwater to become detached. Hurricane Irene in August 2011 further decreased the salient formation. The tombolo that began to form during the previous survey period has continued to be an issue adjacent to this location. The realignment of this problematic breakwater began towards the end of this survey period. The realignment of this breakwater as part of the Willoughby Spit Shoreline Improvement Project is expected to permanently decrease the potential for formation of a tombolo at this location.

West Ocean View

The March 2012 to April 2013 survey comparison showed a slight erosion of the MHW shoreline, with overall losses to the system. Immediately updrift of the bulkhead and groin at the 200 Block of Ocean View the shoreline showed a loss of sediment which is characteristic of the effects of the armoring structures in the area. Also, updrift of the Central Ocean View breakwaters the shoreline showed losses which is indicative of the end effects caused by these structures. The most recent period shows erosion more severe offshore at the east end of the region. This area is closest to the Central Ocean View Breakwaters and is likely impacted by these structures.

Central Ocean View Breakwaters

The Central Ocean View Breakwaters region showed gains in the MHW shoreline position as well as gains in sediment volume above 0 feet NAVD88 and -15 feet NAVD88 over the year. The smaller volume increase above 0 feet NAVD88 in the most recent survey period, September 2012 to April 2013, indicate that the majority of the gains occurred during the winter season, which is likely due to recovery during the quiescent winter weather.

Central Ocean View

Typically a very stable region, Central Ocean View has experienced an increase at the MHW shoreline and volumetric gains in sediment above 0 feet NAVD88 and -15 feet NAVD88 over the past year. The majority of the volumetric gain occurred during the period from March 2012 to September 2012. This is likely due to sediment that was moved offshore during Hurricane Irene being pushed back onshore during the post-storm recovery.

East Ocean View

As expected, due to sediment movement along the shoreline from east to west, there were continued volume losses to the beach in this this region between the March 2012 and April 2013 period. During the most recent period there were losses overall to the dune and subaerial beach; however, between 0

feet NAVD88 and -15 feet NAVD88 there were gains as compared to the overall year. This is indicative of the Bay Oaks Breakwaters performing well, trapping sediment and eliminating the hotspot at this location. The east end of the region, adjacent to the jetty, is more erosive than most areas in the west of this region due to the lack of a sediment source and the littoral sediment movement in this region going from east to west. The profiles have a fairly steady pattern of accretion on the profiles behind the breakwaters and erosion on the profiles between the breakwaters showing the influence of the breakwaters on decreasing the wave heights and retaining sediment along the shore.

In addition to regional assessments, comparison of the October survey was made against post-fill surveys from the East Ocean View beach nourishment and Willoughby Spit to Central Ocean View dune restoration which took place in March 2009 and January-March 2005 respectively.

Comparison	Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88	Average Volume Change Above -15 ft NAVD88	Cumulative Volume Change Above -15 ft NAVD88
East Ocean View Nourishment vs. April 2013 Comparison	-84.12 ft	-16.23 cy/ft	-84,296 cy	-28.63 cy/ft	-148,064 cy
Central Ocean View Nourishment vs. April 2013 Comparison	-29.34 ft	-11.59 cy/ft	-214,618 cy	-8.51 cy/ft	-151,779 cy

The approximately 84,300 cy volumetric loss above 0 feet NAVD88 from the East Ocean View project is roughly 75% of the original amount placed in this dune and subaerial beach area while the approximately 214,600 cy loss above 0 feet NAVD88 in the Central Ocean View project area is roughly 67% of the original amount placed above 0 feet NAVD88. Due to storm impacts and background erosion that has occurred, as anticipated, over the projects' design life, there are areas in both of these shoreline regions that should be targeted for nourishment. The two design projects underway for the Willoughby Spit region and the West Ocean View region will help alleviate the concerns with these hot spots and provide additional protection in vulnerable areas; however, there are still other areas that may require nourishment to provide adequate storm protection. The East Ocean View project may also require a renourishment in the next 1 to 2 years.

As another measure of the protection being supplied by the East Ocean View and Central Ocean View nourishment projects, the projects' pre-fill and April 2013 MHW shoreline positions were compared. Areas where the current shoreline has receded beyond or eroded within 20 feet of the pre-fill shoreline may need to be targeted for immediate nourishment. Results of this analysis indicated that the East Ocean View nourishment project has provided ample shoreline protection for the majority of the shoreline with only slight end effects immediately west of the most recently constructed breakwaters; however, the November 2009 Nor'easter and Hurricane Irene have impacted the design life and renourishment of this area may be required in the next 2 to 3 years. The Willoughby Spit to Central Ocean View shoreline continues to have various problem spots. A portion of the shoreline in the Willoughby Spit groin field, the shoreline to the west of the 800 Block breakwaters, portions of the 800 Block region to the west of the easternmost breakwaters, and the shoreline between the 800 Block breakwaters and Central Ocean View breakwaters has eroded to within 20 ft of the pre-fill shoreline and even receded beyond the pre-fill shoreline in some locations.

This project had an anticipated design life of 5 to 6 years with no storm activity with hot spot areas anticipated to require nourishment after 2 to 3 years if storm activity impacted this region. The project is at the end of the anticipated design life and has been impacted by storm activity. While the emergency dune restoration project in 2010 restored a portion of the dunes in certain areas, there are still concerns about the hot spots in the area. Once construction is completed, the Willoughby Spit Shoreline Improvement Project and the West Ocean View Shoreline Improvement Project will help alleviate the concerns with these hot spots and provide additional protection in vulnerable areas.

This is the sixteenth periodic survey report completed to date, and fifteenth evaluation of a consistent survey period utilizing beach and bathymetric surveys. As noted, there are inevitable margins of error associated with the survey data that may reduce the accuracy of volumetric change analyses. Therefore, it is essential to thoroughly review the beach and bathymetric profiles using various analytical techniques and general engineering judgment to assure that results are not falsely interpreted. Comparison of seasonal surveys (i.e. March 2012 to April 2013) eliminates seasonal variation of profiles in volumetric change analyses. Consecutive survey comparisons are useful to assess the direct impact of extreme events which may occur during the six month period between surveys. Future periodic survey evaluations will continue to improve on analysis techniques so that the rich survey data sets are best utilized.

Appendix A: Aerial Photography and Digitized Shorelines

CHESAPEAKE BAY

0+00
2+50
5+00
7+50
10+00
12+50
15+00
17+50
20+00
22+50
25+00
27+50
30+00
32+50
35+00
37+50
40+00
42+50
45+00

Legend

- Digitized Shoreline (March 22, 2012)
- Digitized Shoreline (September 26, 2012)
- Digitized Shoreline (April 25, 2013)
- Survey Transects
- Survey Baseline

Shoreline Aerial Photo Date: April 2013

Background Aerial Photo Date: 2009

N

0 250 500 1,000 Feet

CHESAPEAKE BAY

45+25
47+30
49+35
51+41
53+46
55+51
57+57
59+62
61+62
63+62
65+62
67+62
69+62
71+62
73+62
75+62
77+62
79+62
81+62
83+62
85+62
87+62
93+41

Legend

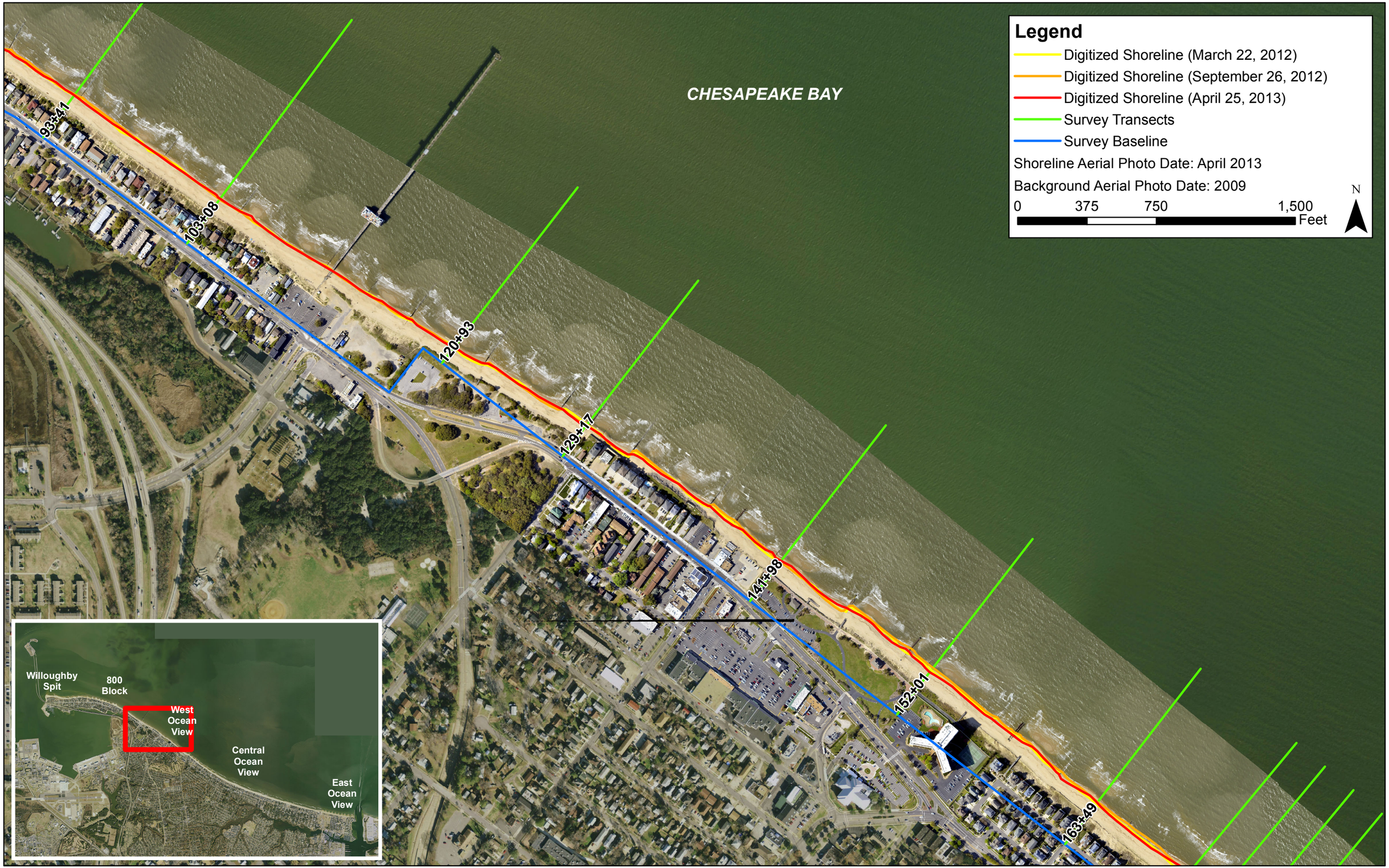
- Digitized Shoreline (March 22, 2012)
- Digitized Shoreline (September 26, 2012)
- Digitized Shoreline (April 25, 2013)
- Survey Transects
- Survey Baseline

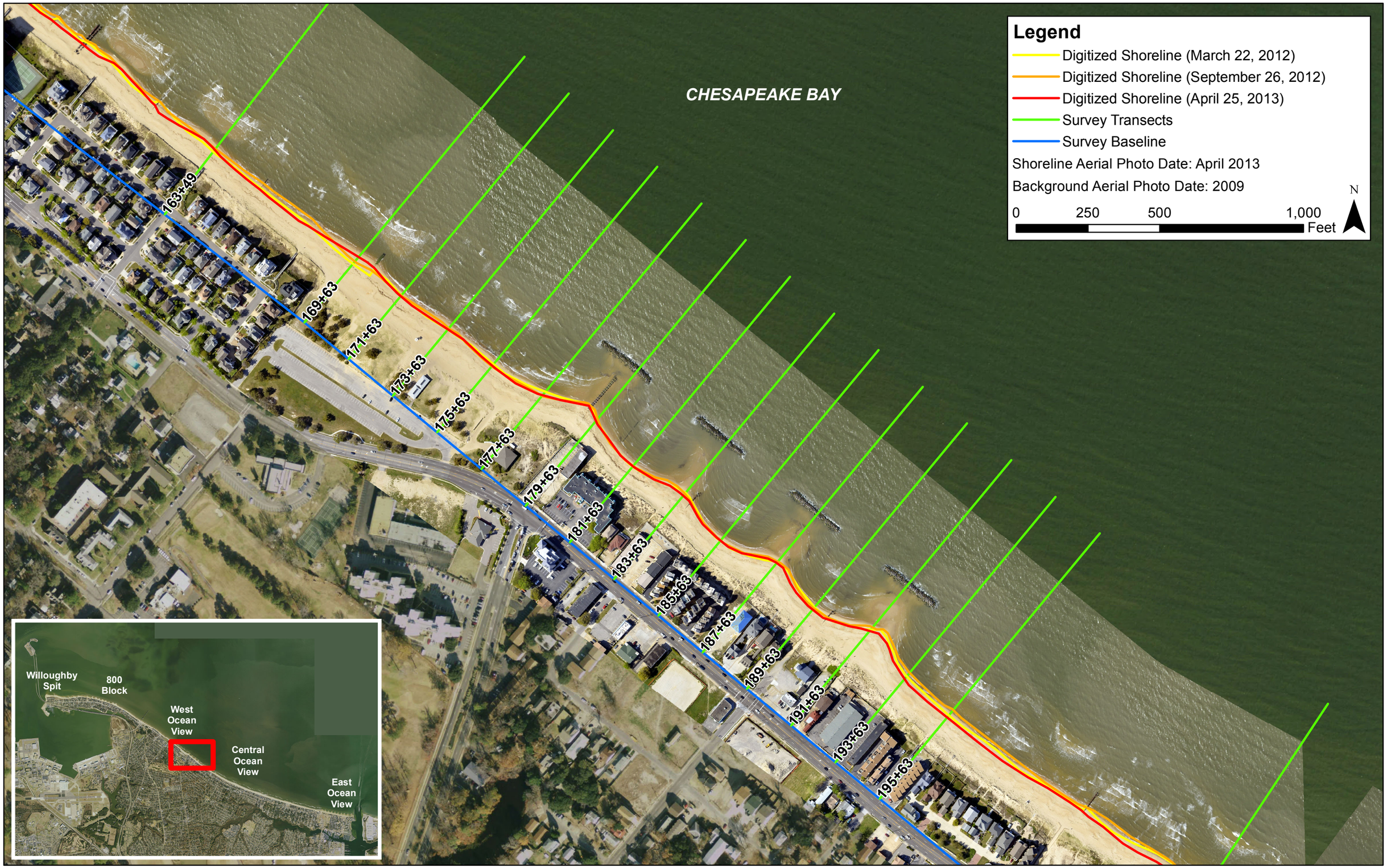
Shoreline Aerial Photo Date: April 2013

Background Aerial Photo Date: 2009

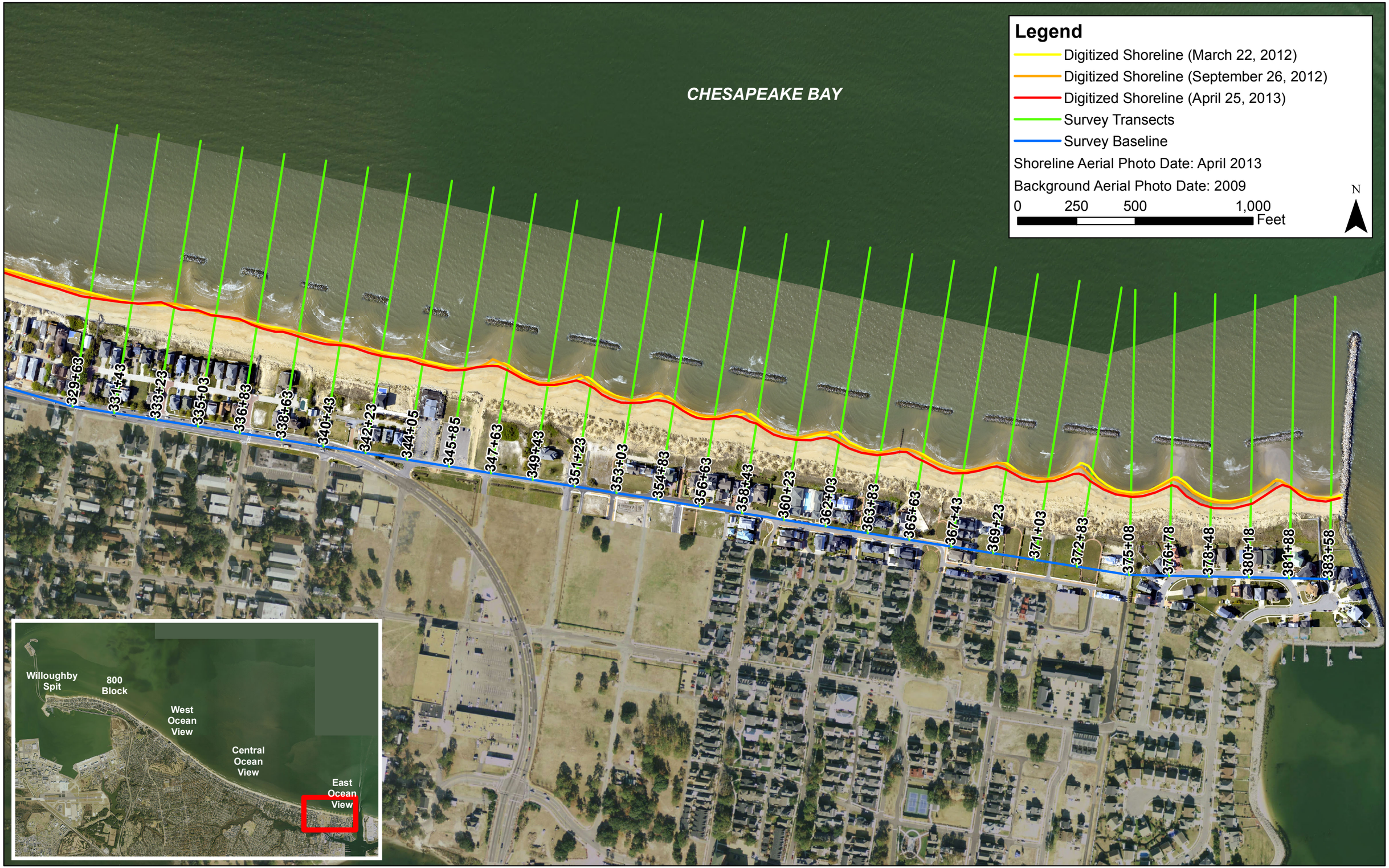
N

0 250 500 1,000 Feet

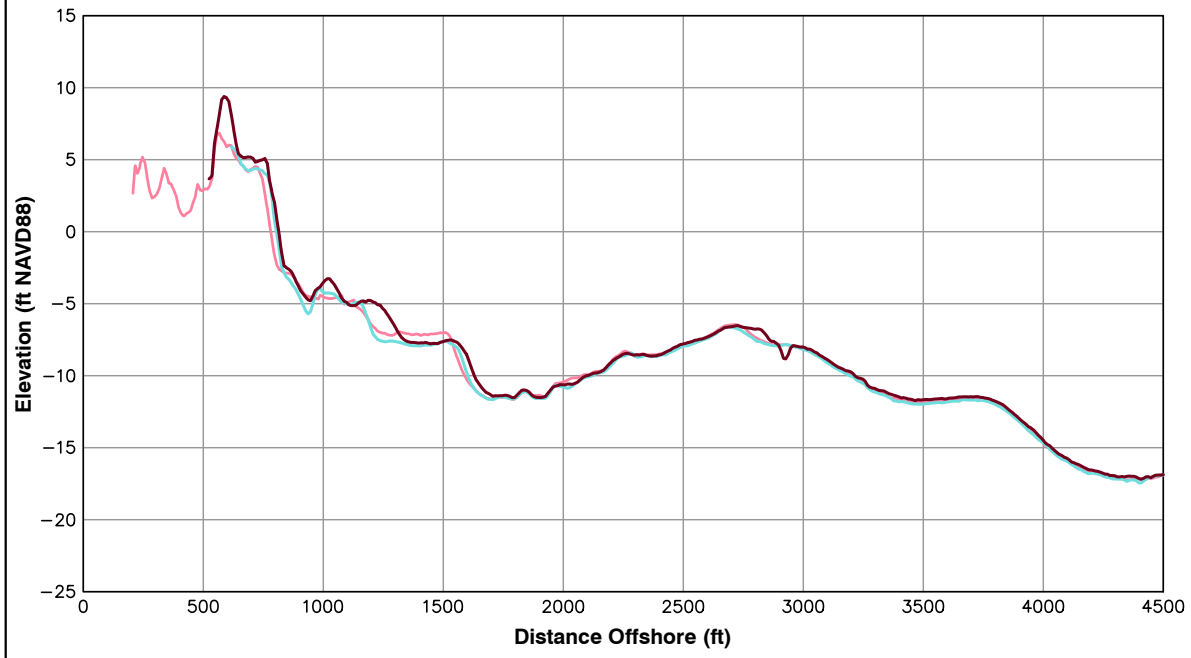

CHESAPEAKE BAY
93+41
103+08
120+93
129+17
141+98
152+01
163+49
Legend
Digitized Shoreline (March 22, 2012)
Digitized Shoreline (September 26, 2012)
Digitized Shoreline (April 25, 2013)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2013
Background Aerial Photo Date: 2009
0
375
750
1,500
Feet
N
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View

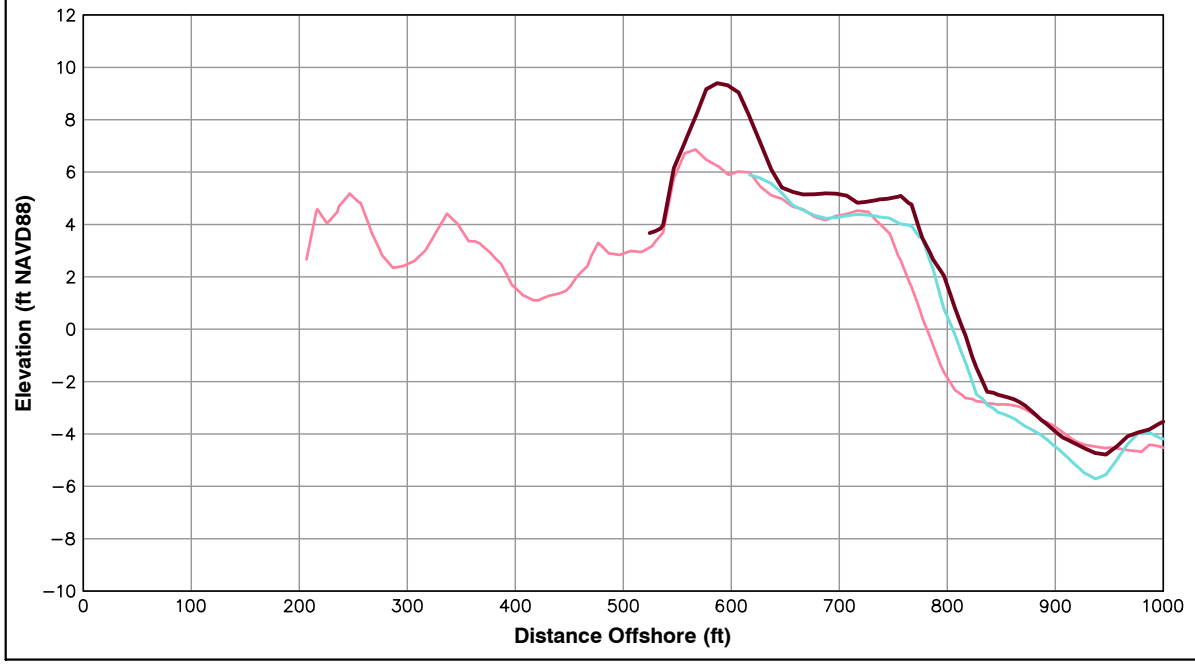

CHESAPEAKE BAY
Legend
Digitized Shoreline (March 22, 2012)
Digitized Shoreline (September 26, 2012)
Digitized Shoreline (April 25, 2013)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2013
Background Aerial Photo Date: 2009
N
0
250
500
1,000
Feet
163+49
169+63
171+63
173+63
175+63
177+63
179+63
181+63
183+63
185+63
187+63
189+63
191+63
193+63
195+63
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
206+86
218+66
229+85
242+03
252+62
263+22
274+53
281+40
288+39
295+27
302+24
315+96
323+09
329+63
331+43
Legend
Digitized Shoreline (March 22, 2012)
Digitized Shoreline (September 26, 2012)
Digitized Shoreline (April 25, 2013)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2013
Background Aerial Photo Date: 2009
0
500
1,000
2,000
Feet
N
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
Legend
Digitized Shoreline (March 22, 2012)
Digitized Shoreline (September 26, 2012)
Digitized Shoreline (April 25, 2013)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2013
Background Aerial Photo Date: 2009
0 250 500 1,000
Feet
N
329+63
331+43
333+23
335+03
336+83
338+63
340+43
342+23
344+05
345+85
347+63
349+43
351+23
353+03
354+83
356+63
358+43
360+23
362+03
363+83
365+63
367+43
369+23
371+03
372+83
375+08
376+78
378+48
380+18
381+88
383+58
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View

Appendix B: Survey Comparison Plots





Survey Transect 0+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	31.42 ft/yr	10.16 ft
Volume Change Above -15 ft NAVD88	34.52 cy/ft/yr	42.08 cy/ft
Volume Change Above 0 ft NAVD88	14.71 cy/ft/yr	5.38 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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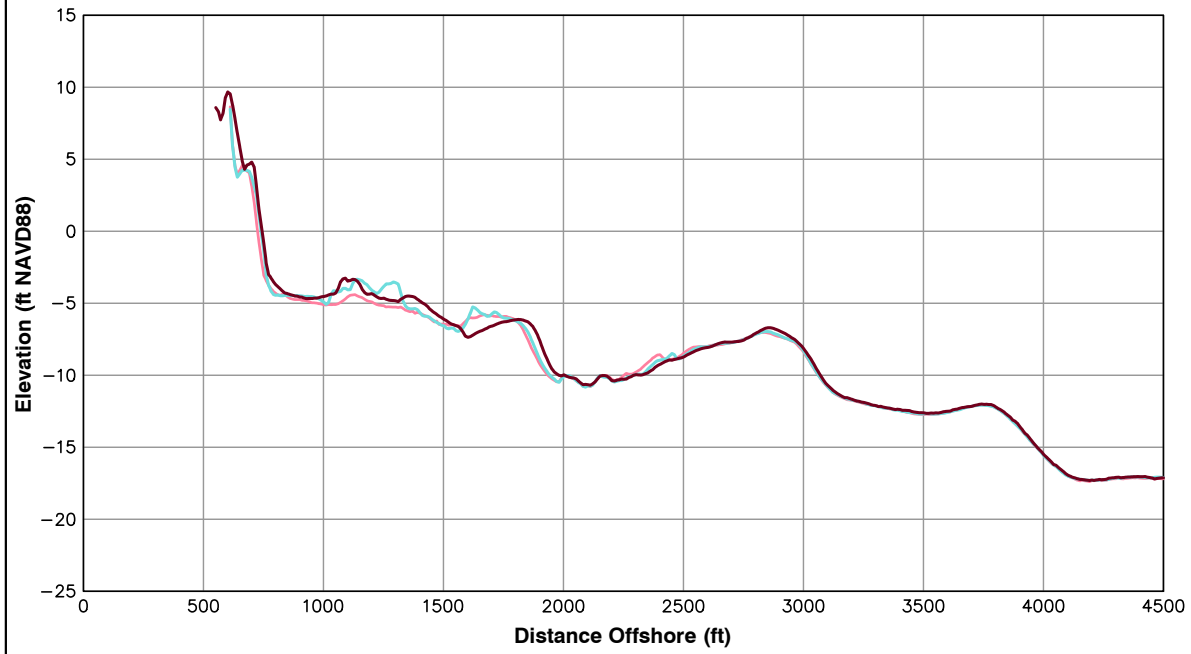
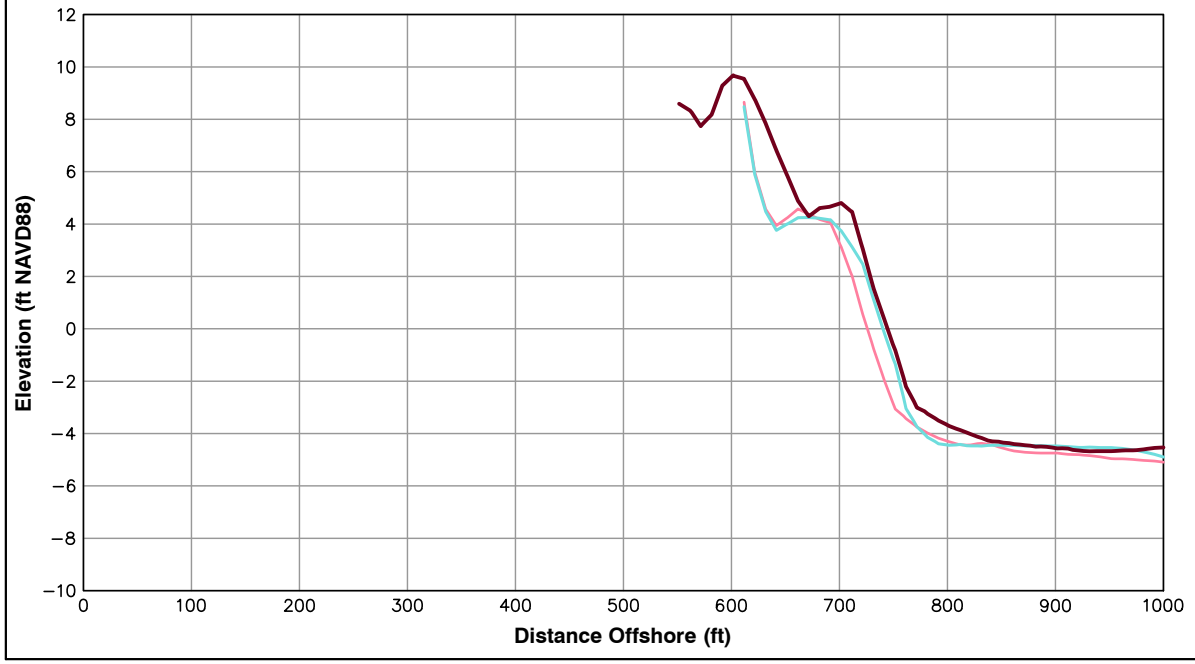
ST 0+00	Pg 1 of 106	Spring 2013





Survey Transect 2+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	16.71 ft/yr	3.63 ft
Volume Change Above -15 ft NAVD88	27.92 cy/ft/yr	12.35 cy/ft
Volume Change Above 0 ft NAVD88	7.30 cy/ft/yr	6.27 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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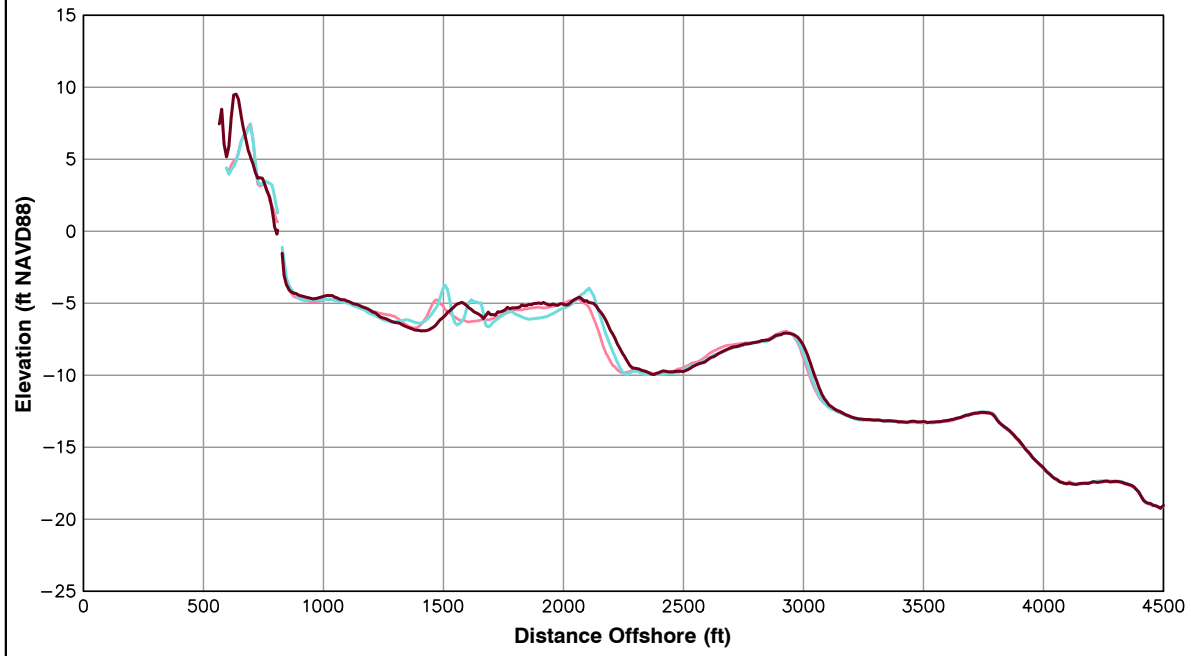
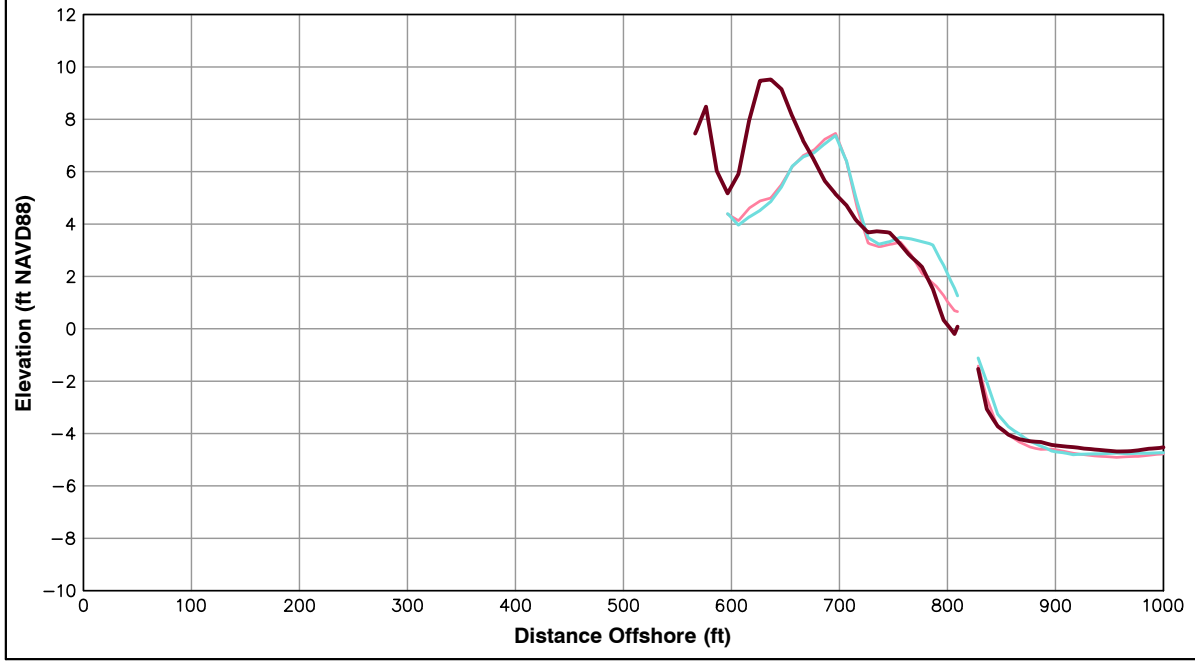
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 5+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-9.58 ft/yr	-21.34 ft
Volume Change Above -15 ft NAVD88	18.33 cy/ft/yr	14.90 cy/ft
Volume Change Above 0 ft NAVD88	4.93 cy/ft/yr	3.57 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
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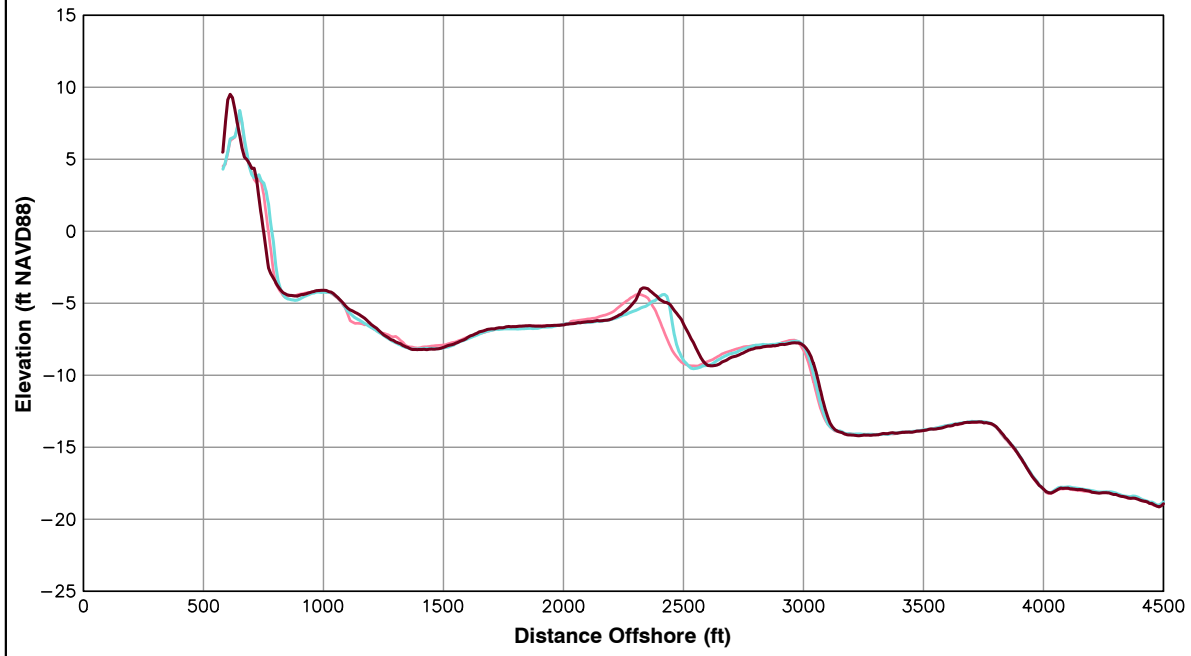
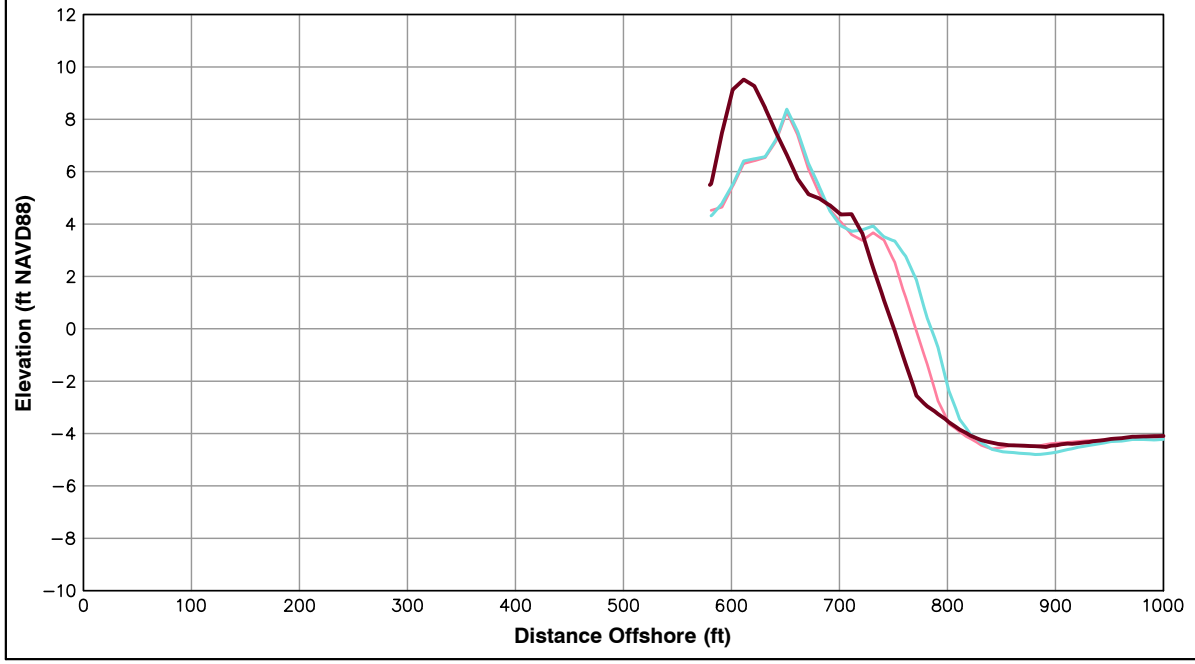
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 7+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-19.69 ft/yr	-35.04 ft
Volume Change Above -15 ft NAVD88	13.38 cy/ft/yr	11.86 cy/ft
Volume Change Above 0 ft NAVD88	1.75 cy/ft/yr	-0.51 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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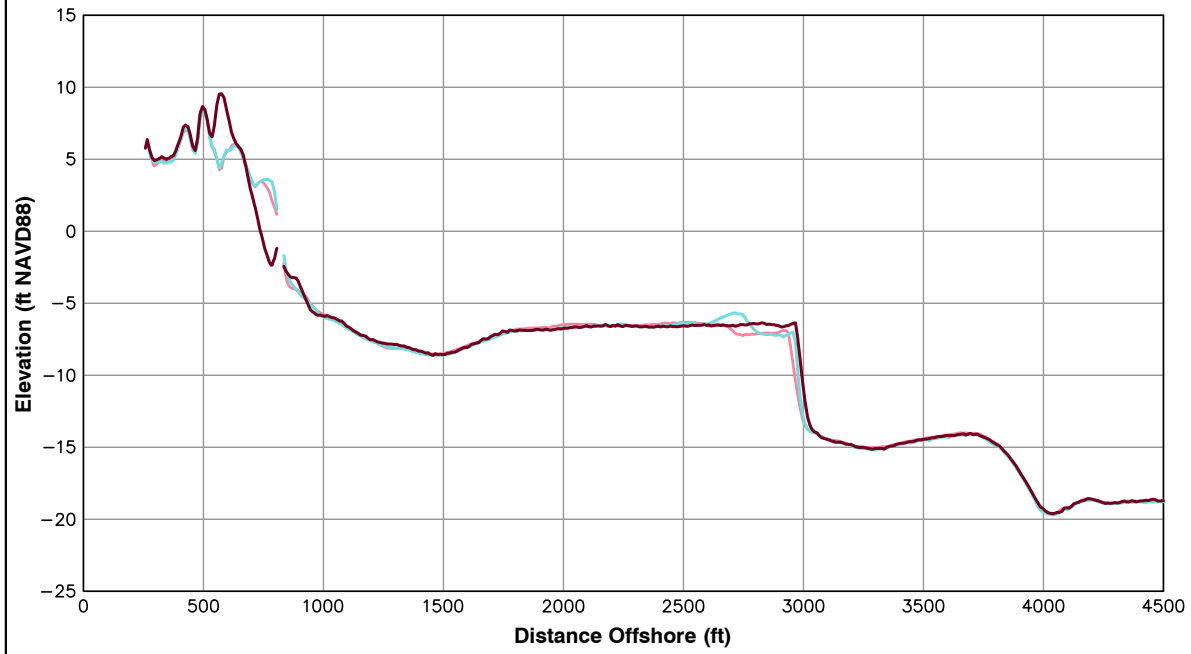
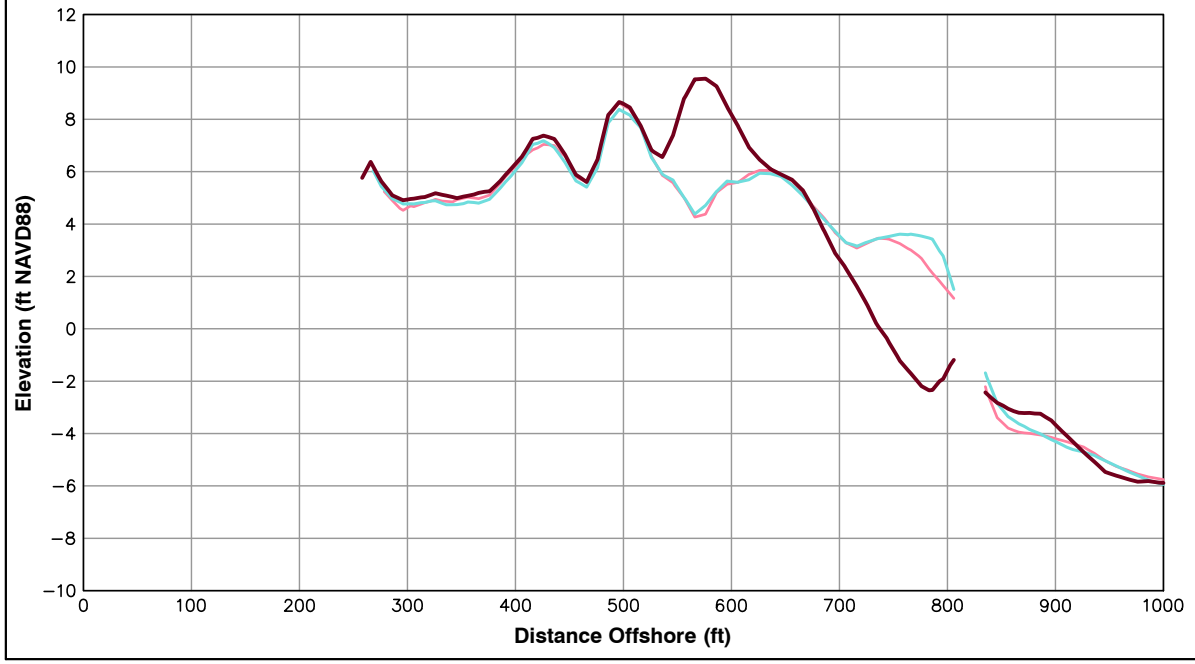
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





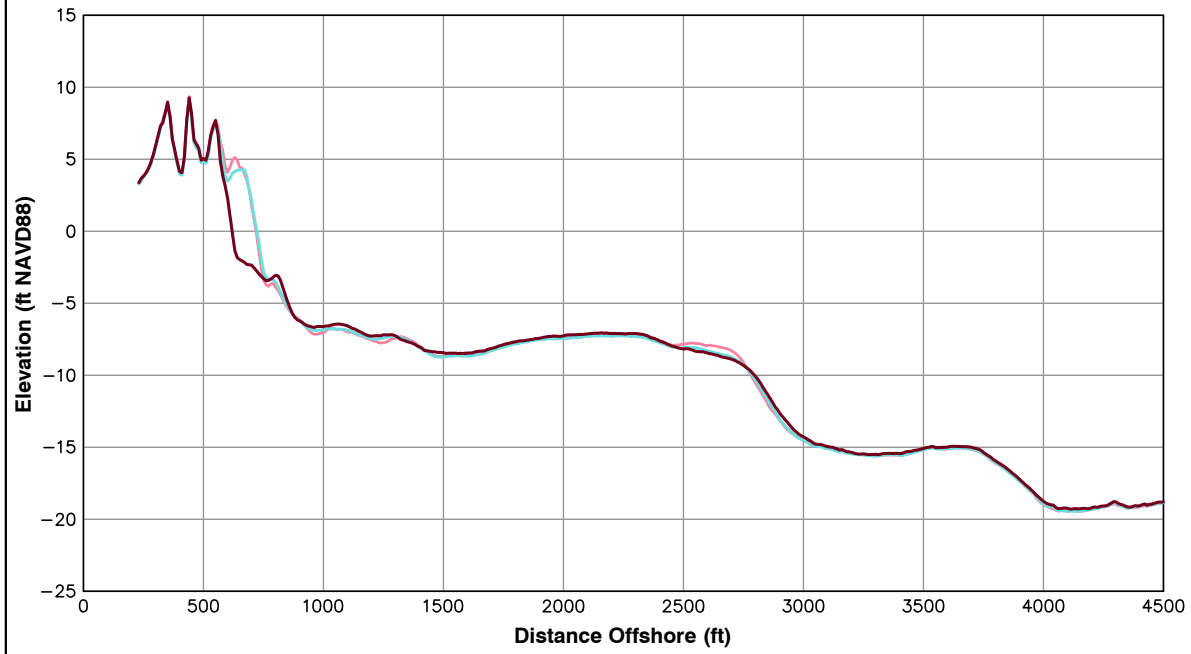
Survey Transect 10+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-79.64 ft/yr	-86.04 ft
Volume Change Above -15 ft NAVD88	7.92 cy/ft/yr	6.33 cy/ft
Volume Change Above 0 ft NAVD88	1.82 cy/ft/yr	1.18 cy/ft

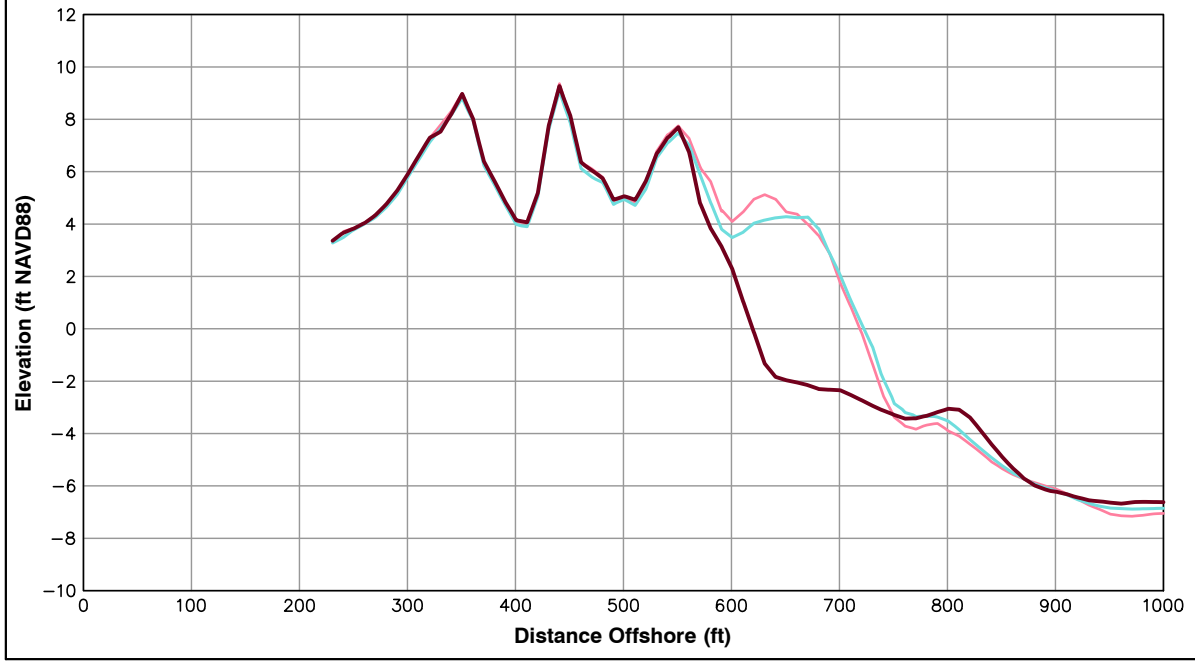
LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

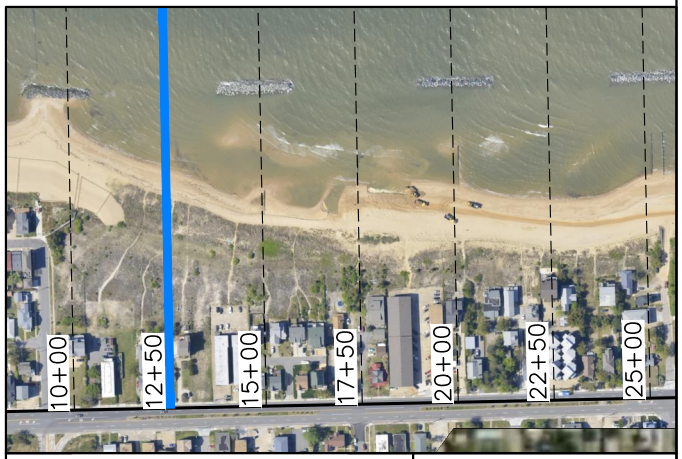




Survey Transect 12+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-92.52 ft/yr	-100.37 ft
Volume Change Above -15 ft NAVD88	-15.58 cy/ft/yr	-9.91 cy/ft
Volume Change Above 0 ft NAVD88	-16.58 cy/ft/yr	-13.78 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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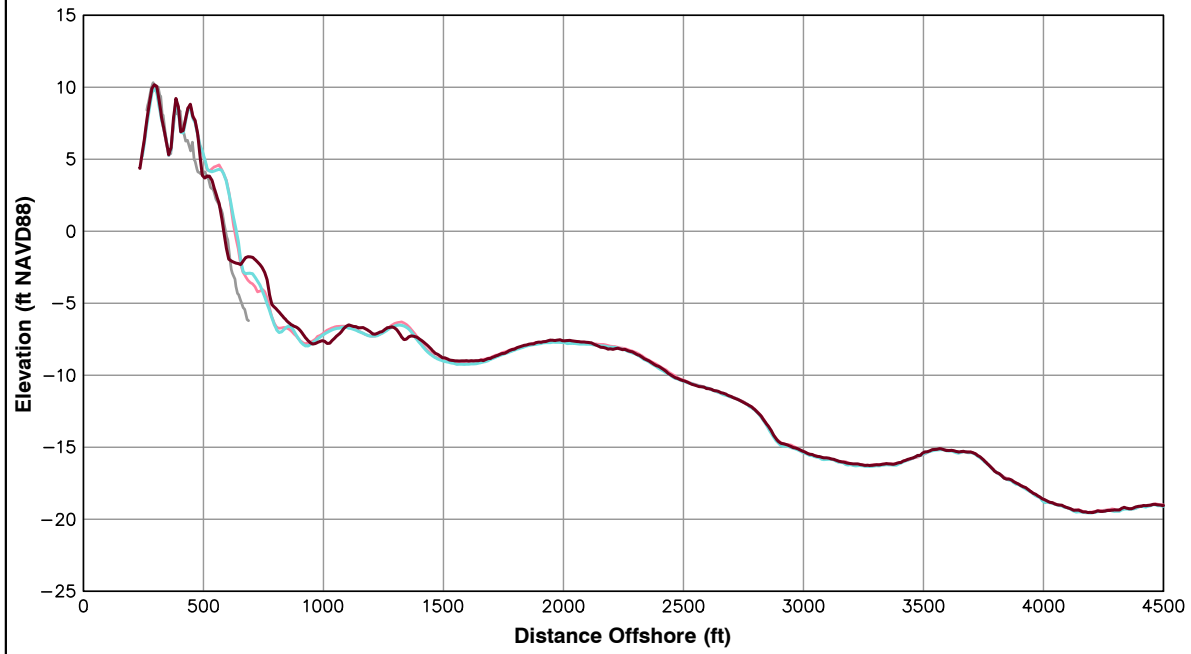
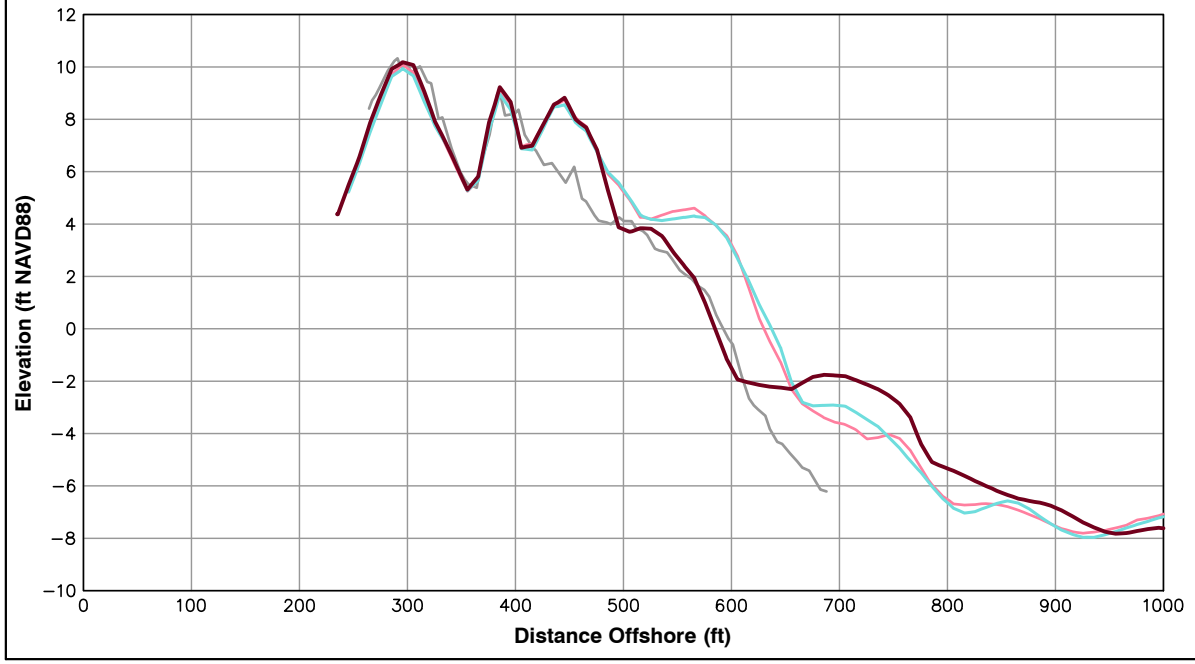
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

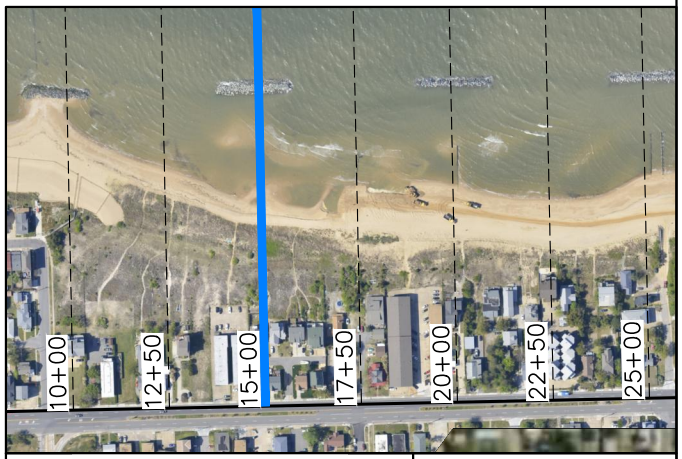




Survey Transect 15+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-42.80 ft/yr	-49.47 ft
Volume Change Above -15 ft NAVD88	-5.61 cy/ft/yr	0.93 cy/ft
Volume Change Above 0 ft NAVD88	-8.73 cy/ft/yr	-8.20 cy/ft

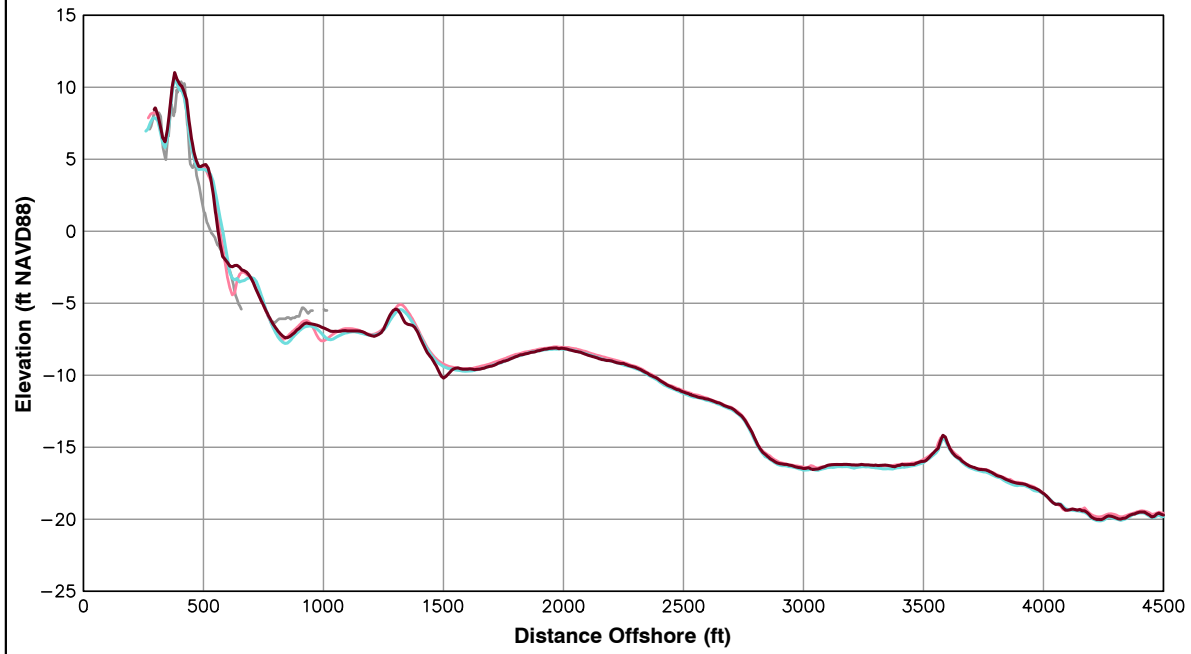
LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

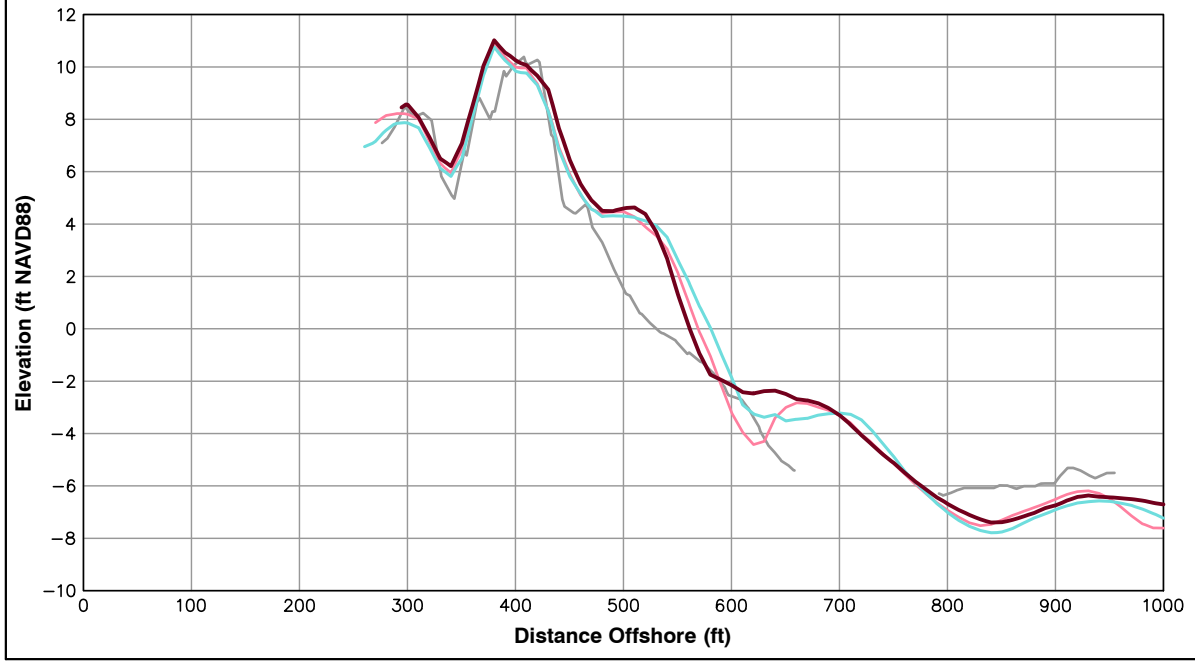
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 17+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-6.91 ft/yr	-15.81 ft
Volume Change Above -15 ft NAVD88	-3.64 cy/ft/yr	6.05 cy/ft
Volume Change Above 0 ft NAVD88	1.59 cy/ft/yr	1.71 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
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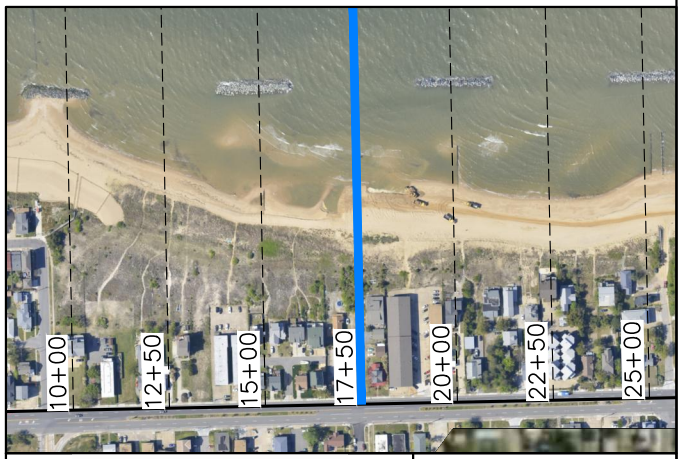
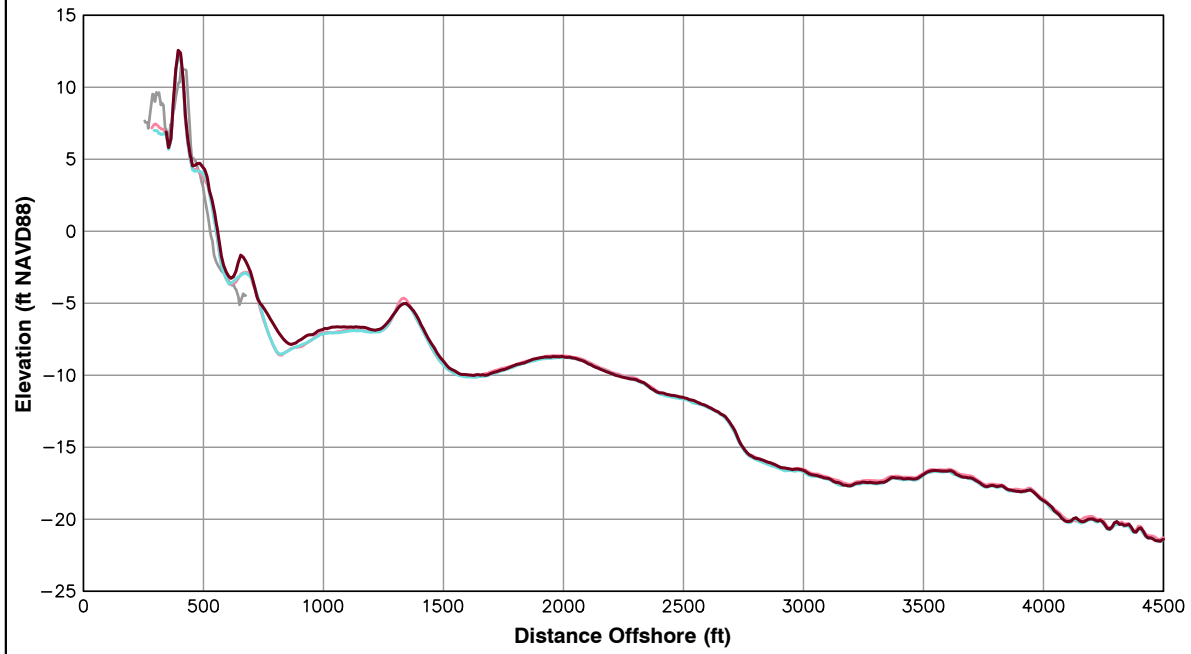
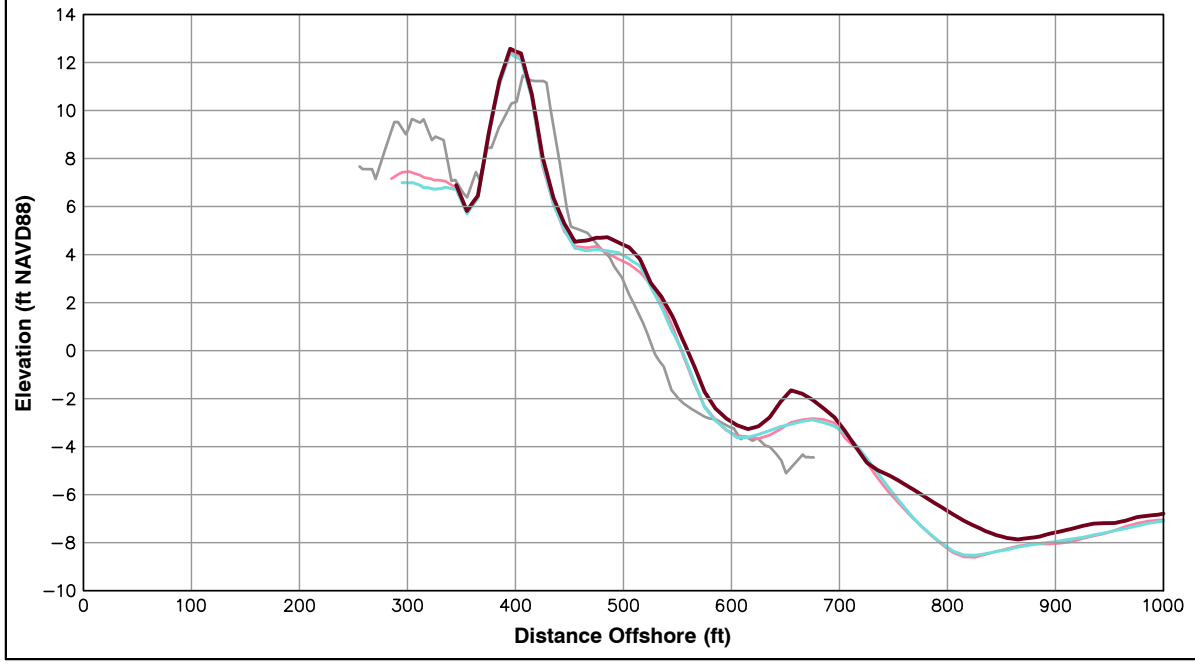


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 20+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	4.01 ft/yr	6.42 ft
Volume Change Above -15 ft NAVD88	13.92 cy/ft/yr	19.83 cy/ft
Volume Change Above 0 ft NAVD88	2.18 cy/ft/yr	2.42 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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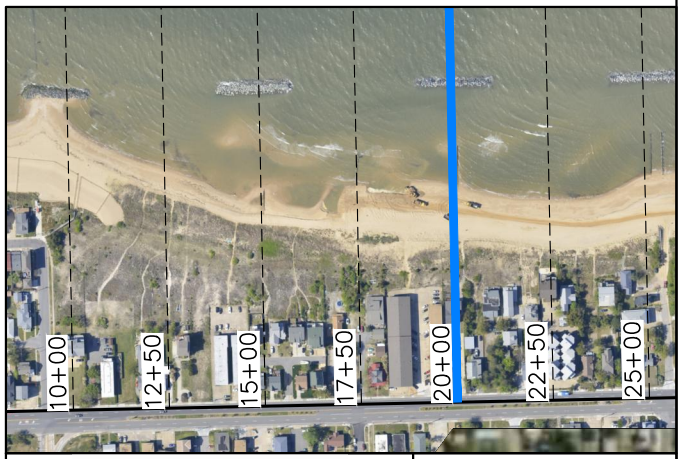
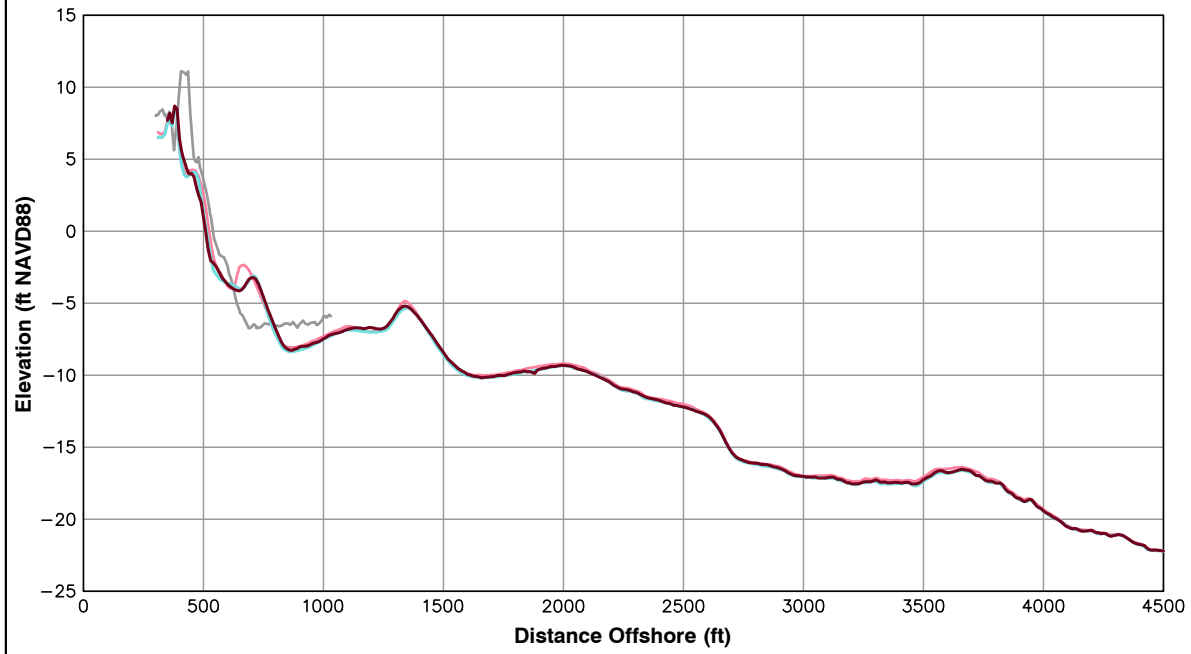
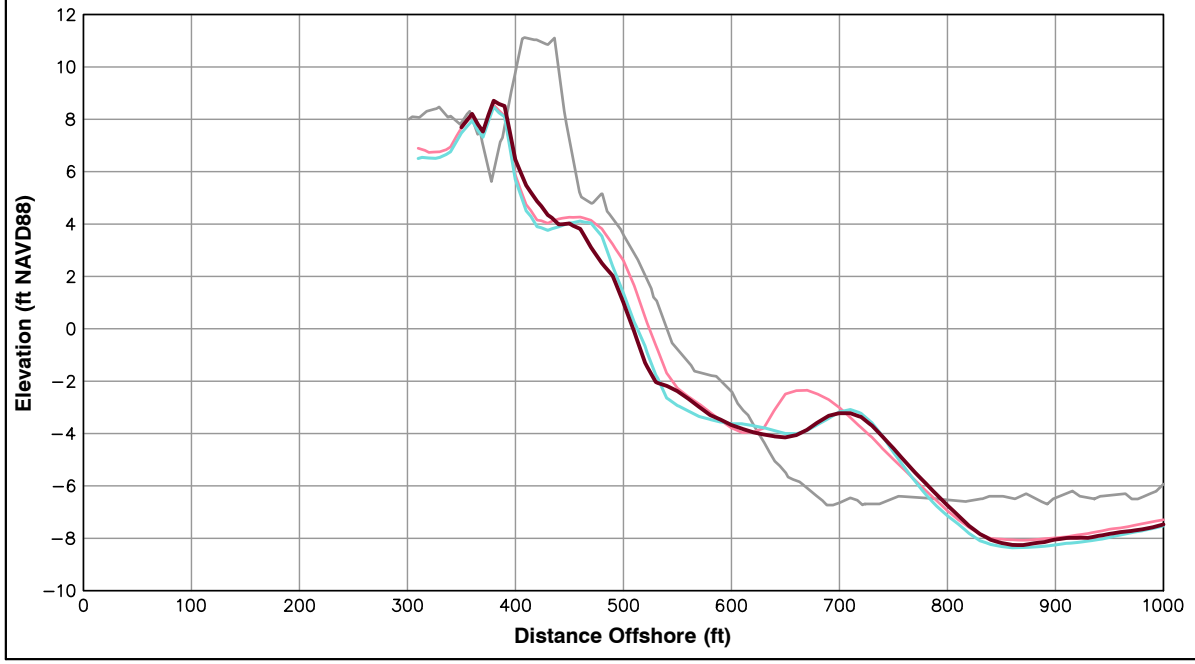
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

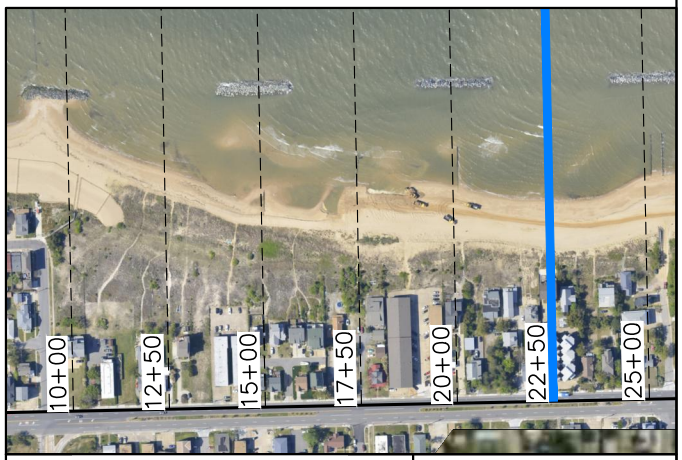




Survey Transect 22+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-14.67 ft/yr	-3.34 ft
Volume Change Above -15 ft NAVD88	-11.29 cy/ft/yr	6.68 cy/ft
Volume Change Above 0 ft NAVD88	-1.80 cy/ft/yr	0.51 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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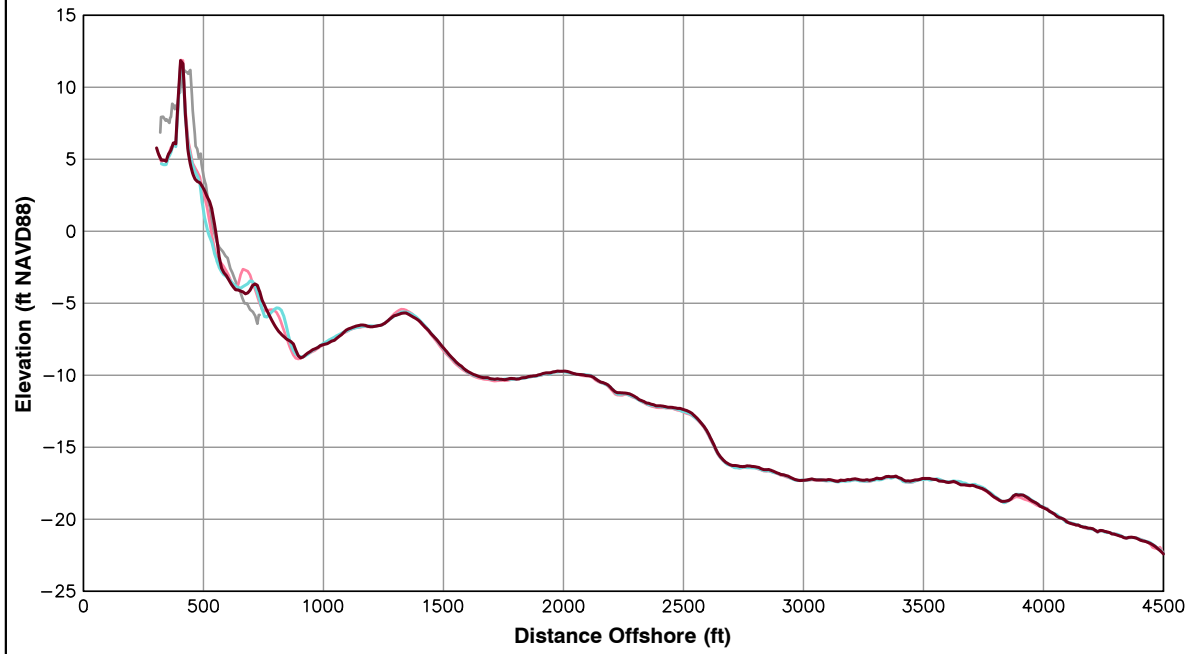
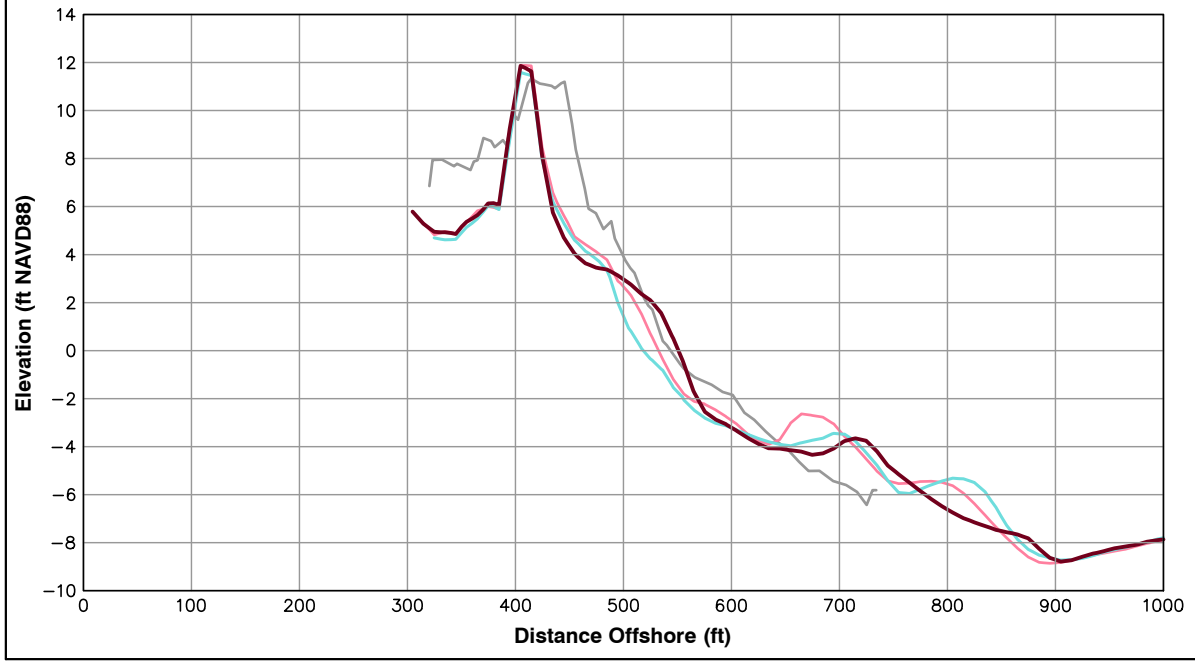
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 25+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	17.93 ft/yr	36.72 ft
Volume Change Above -15 ft NAVD88	1.42 cy/ft/yr	3.44 cy/ft
Volume Change Above 0 ft NAVD88	0.19 cy/ft/yr	3.48 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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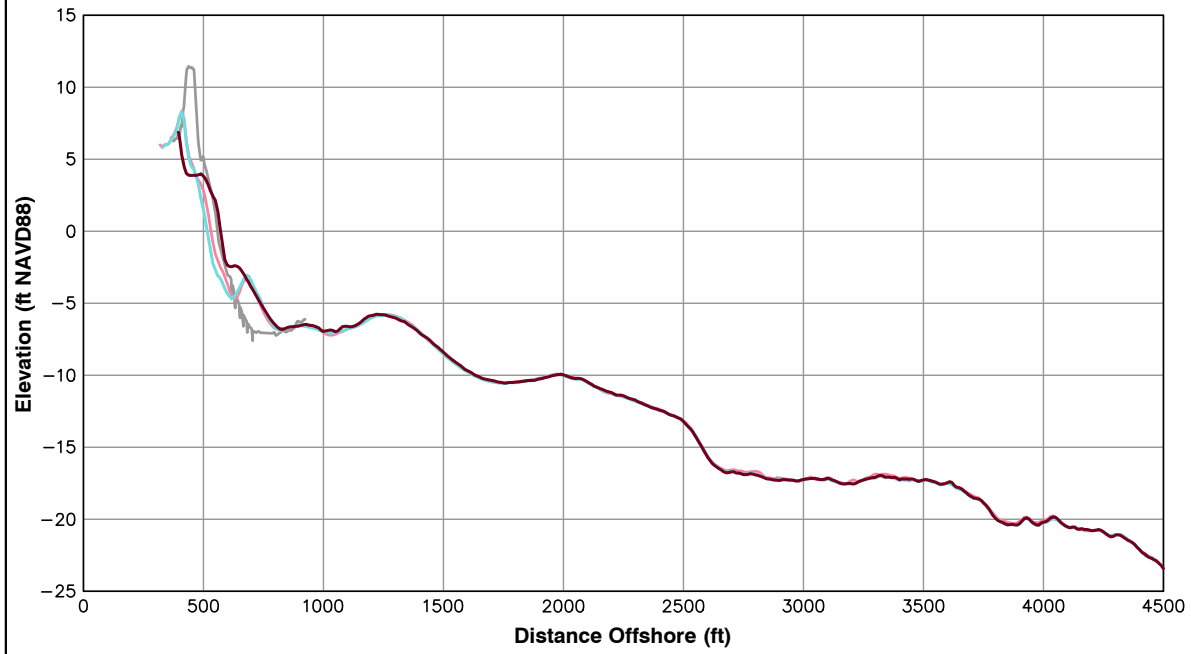
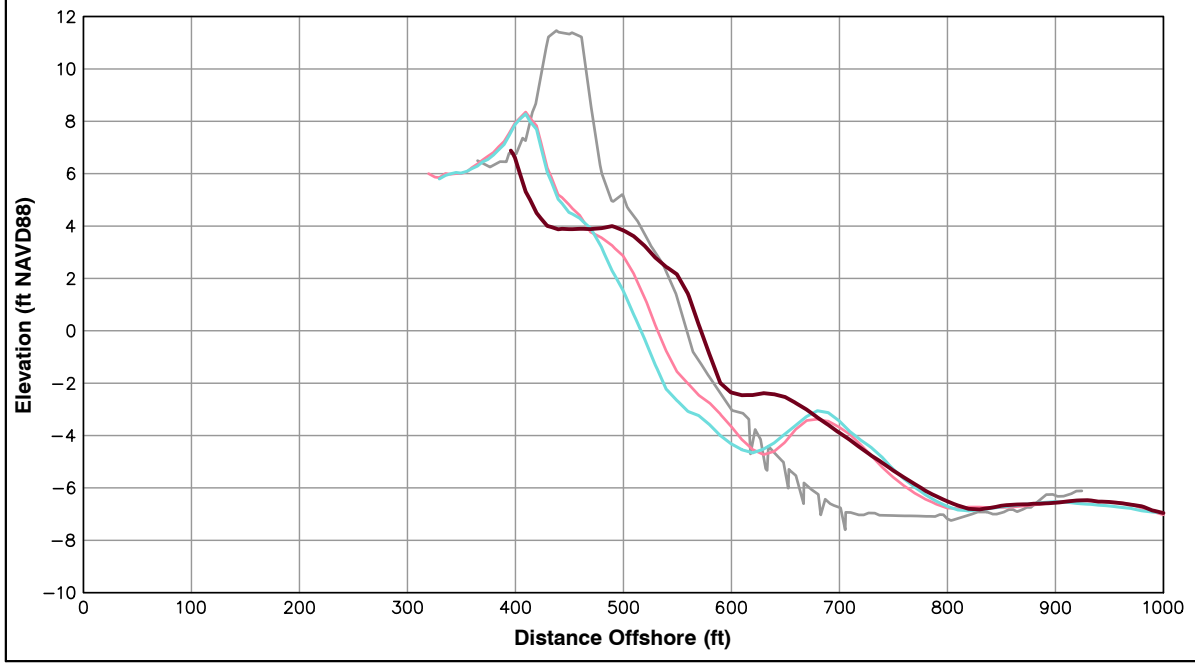
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 27+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	38.80 ft/yr	57.69 ft
Volume Change Above -15 ft NAVD88	10.37 cy/ft/yr	16.81 cy/ft
Volume Change Above 0 ft NAVD88	0.71 cy/ft/yr	3.19 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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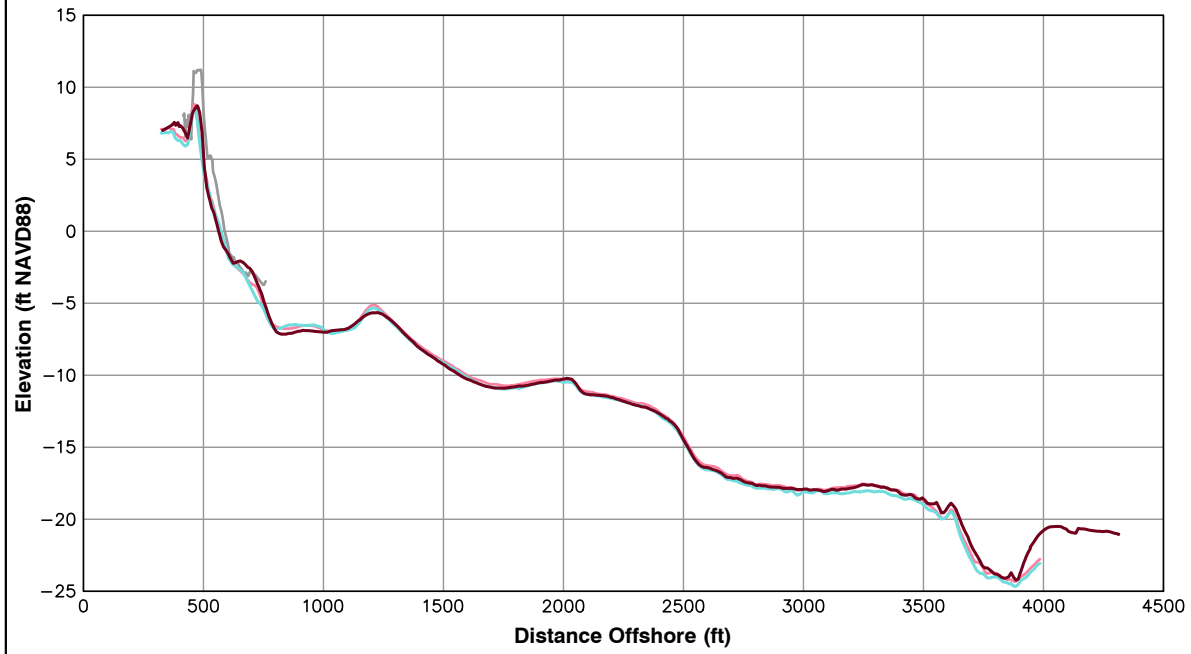
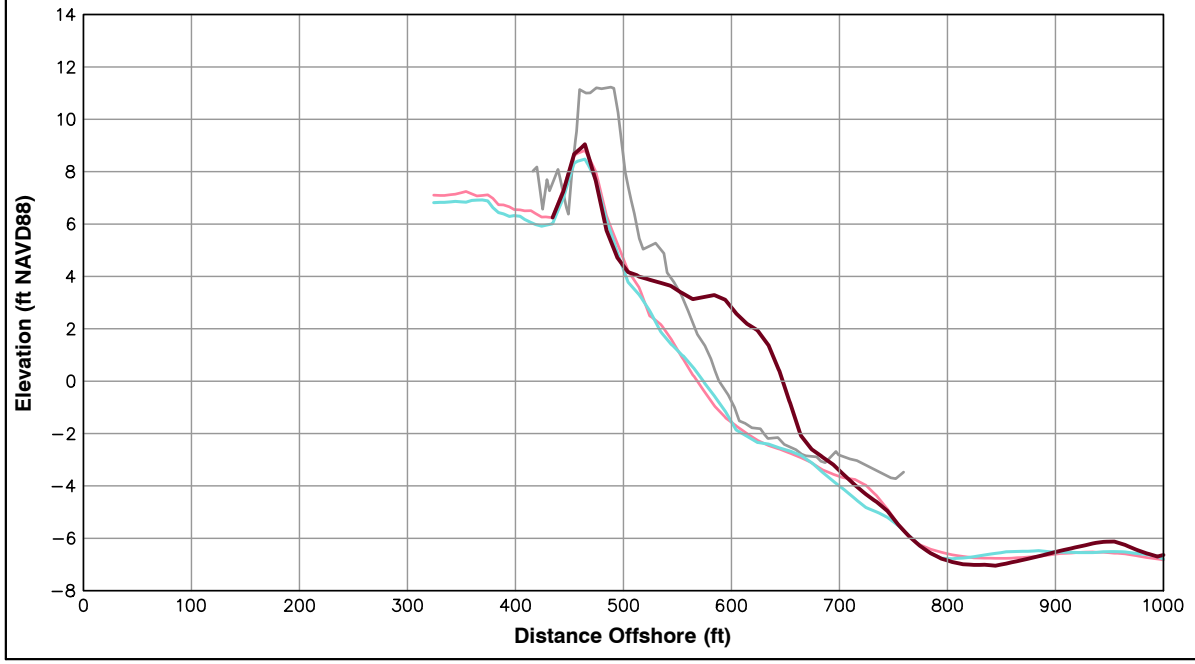
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 30+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	80.68 ft/yr	83.59 ft
Volume Change Above -15 ft NAVD88	20.73 cy/ft/yr	33.11 cy/ft
Volume Change Above 0 ft NAVD88	9.62 cy/ft/yr	11.05 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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3. All Survey Elevations In Feet Referenced to NAVD88.
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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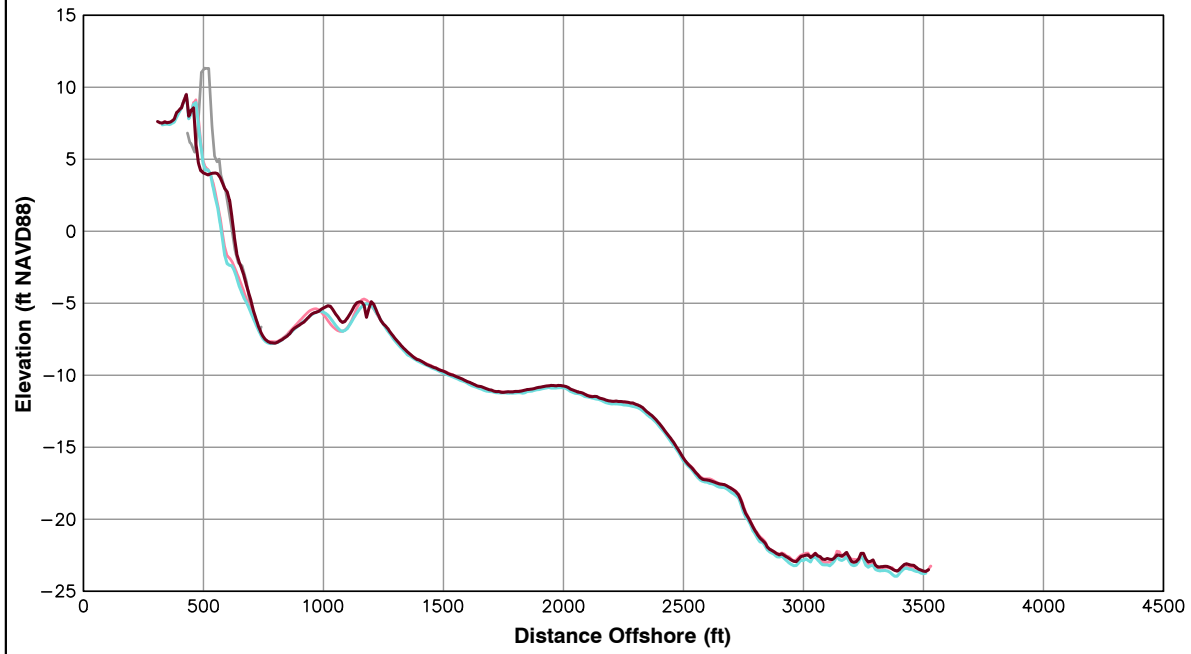
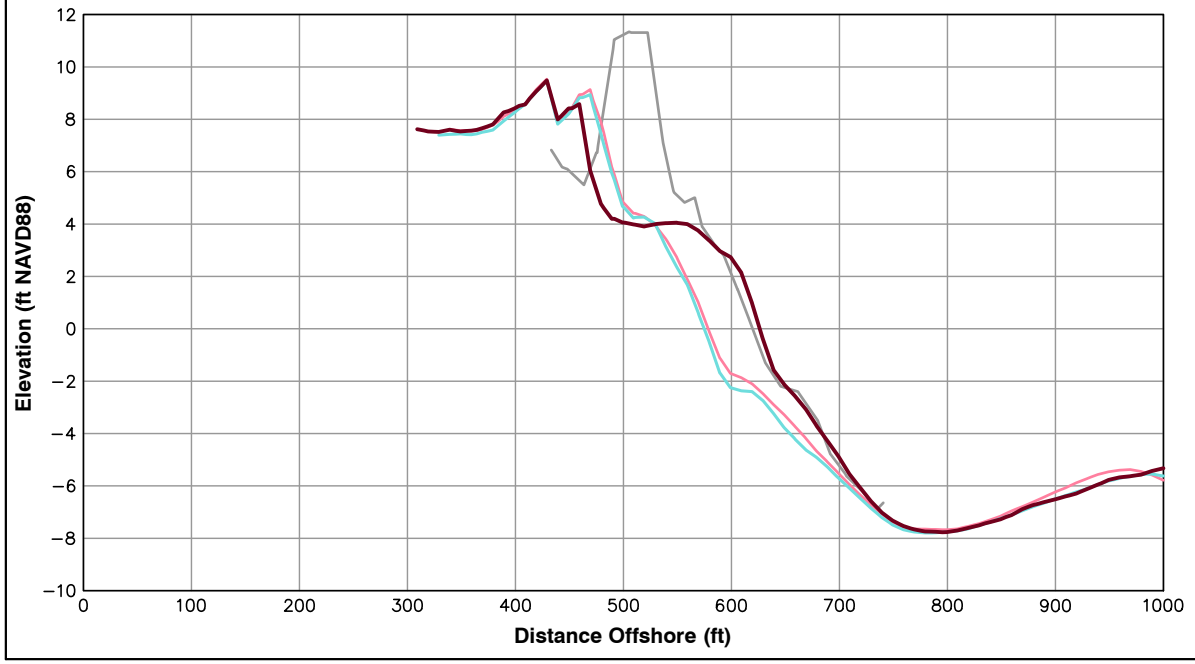
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 32+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	47.01 ft/yr	53.32 ft
Volume Change Above -15 ft NAVD88	13.05 cy/ft/yr	23.79 cy/ft
Volume Change Above 0 ft NAVD88	3.22 cy/ft/yr	4.87 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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3. All Survey Elevations In Feet Referenced to NAVD88.
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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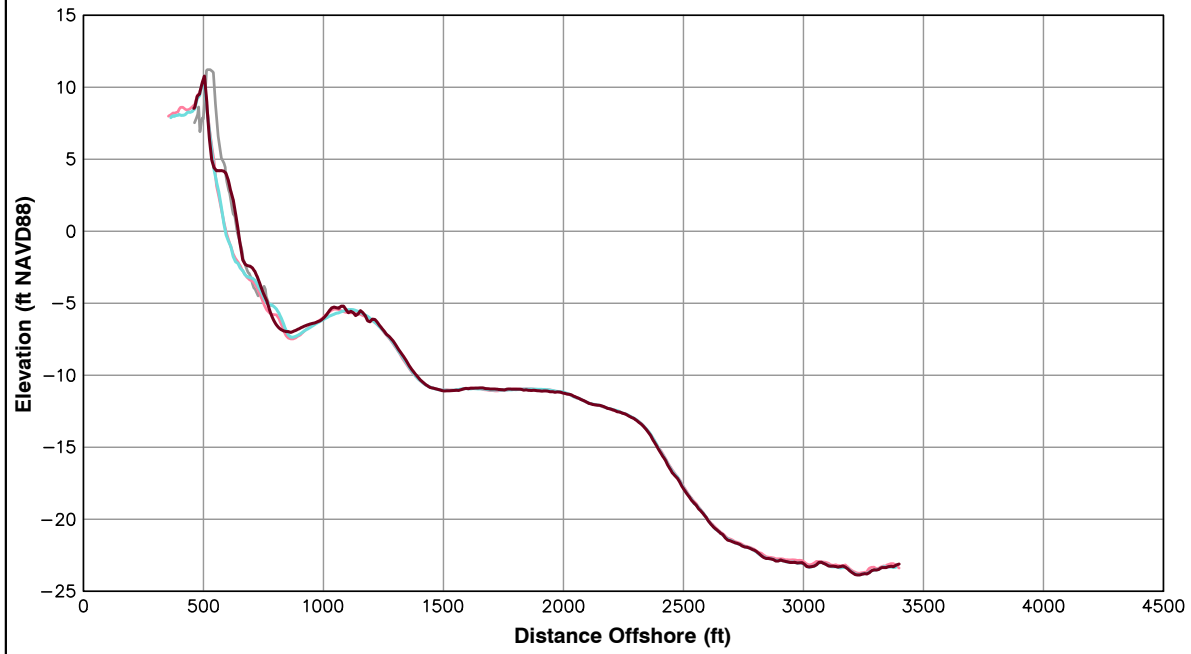
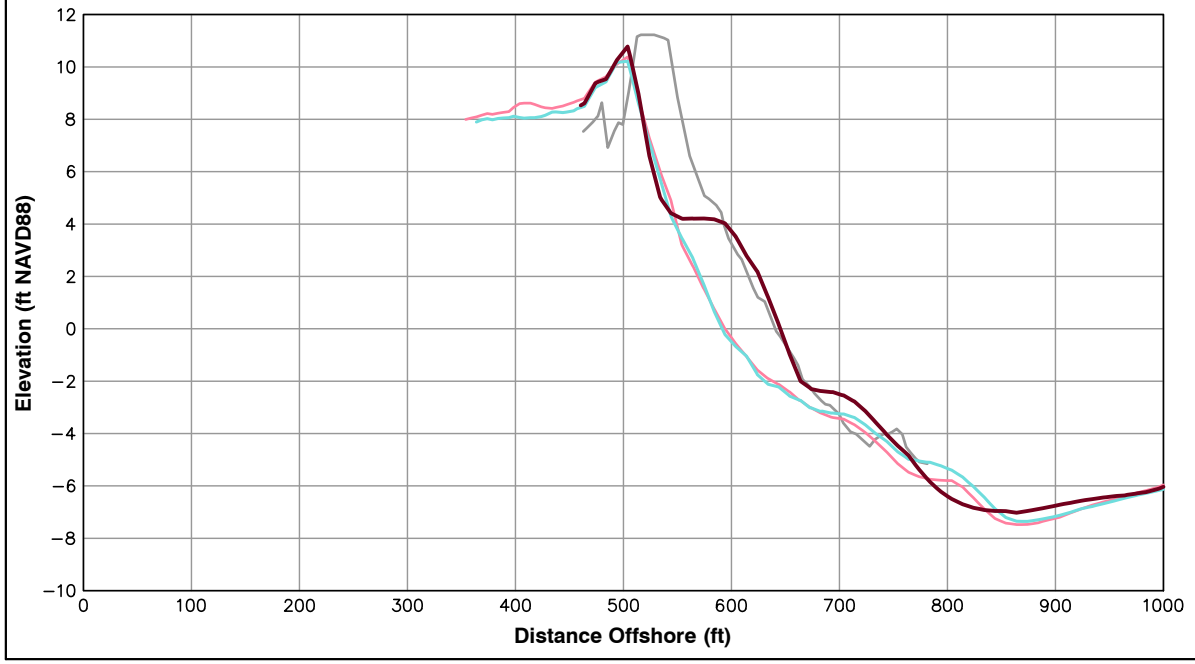
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 35+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	51.97 ft/yr	55.04 ft
Volume Change Above -15 ft NAVD88	15.48 cy/ft/yr	14.26 cy/ft
Volume Change Above 0 ft NAVD88	7.35 cy/ft/yr	8.28 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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3. All Survey Elevations In Feet Referenced to NAVD88.
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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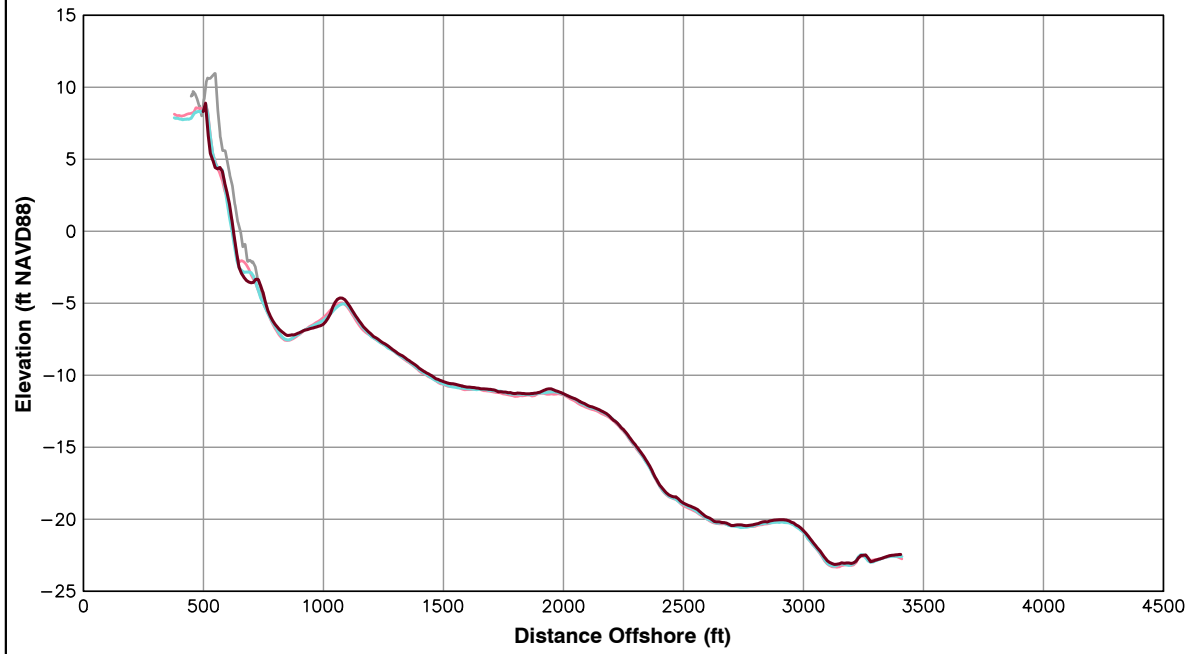
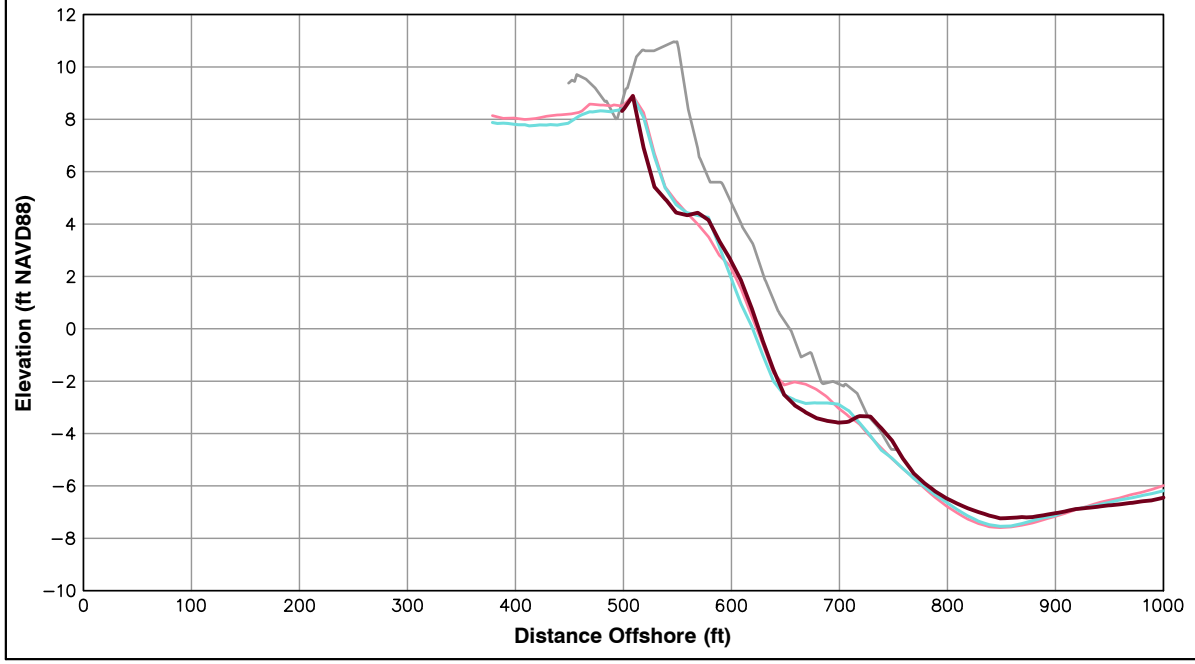
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 37+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	2.69 ft/yr	8.27 ft
Volume Change Above -15 ft NAVD88	6.68 cy/ft/yr	5.49 cy/ft
Volume Change Above 0 ft NAVD88	-0.43 cy/ft/yr	-0.30 cy/ft

LEGEND:

- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:

1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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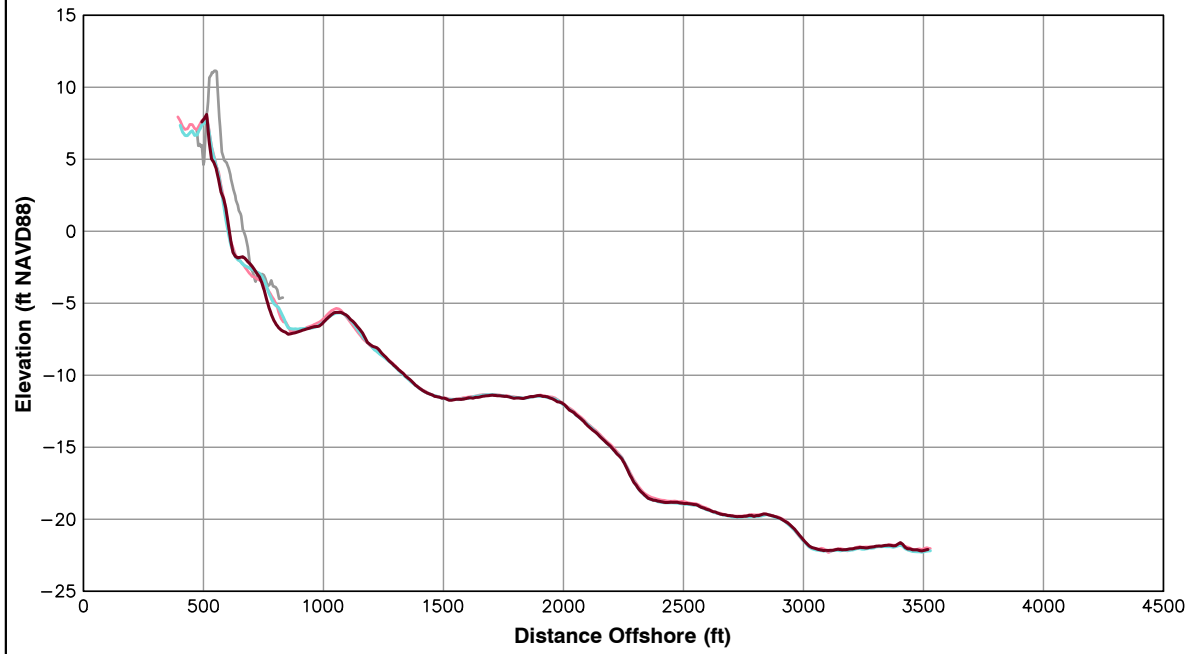
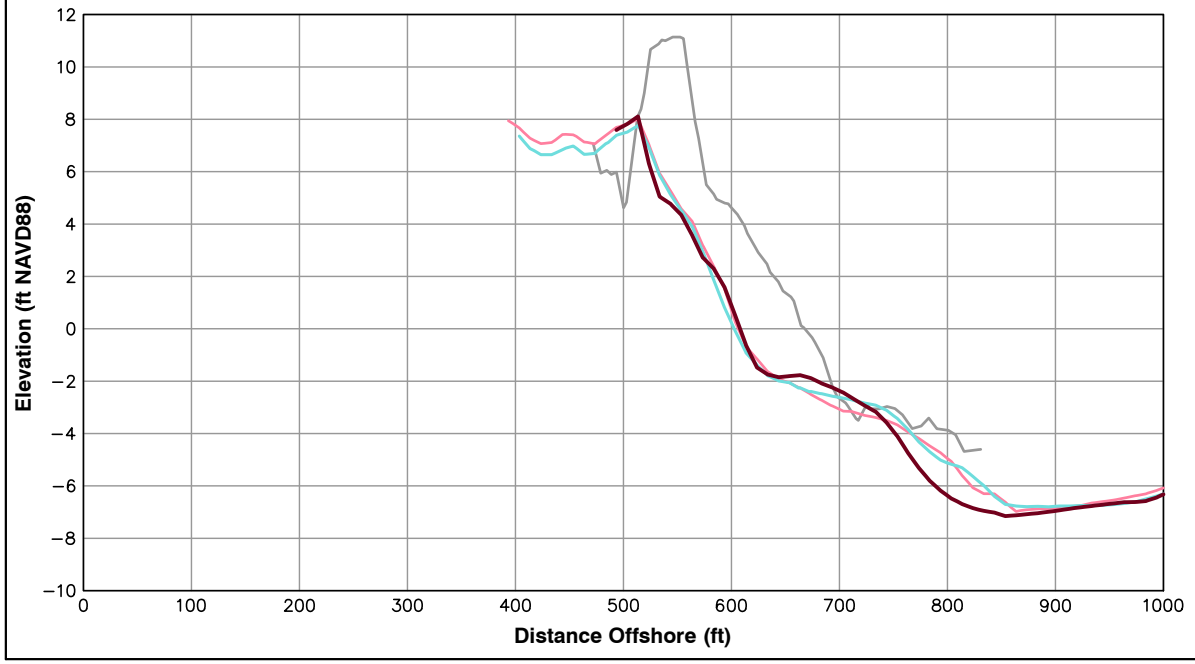
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 40+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	1.21 ft/yr	7.13 ft
Volume Change Above -15 ft NAVD88	-5.52 cy/ft/yr	-3.12 cy/ft
Volume Change Above 0 ft NAVD88	-1.10 cy/ft/yr	-0.06 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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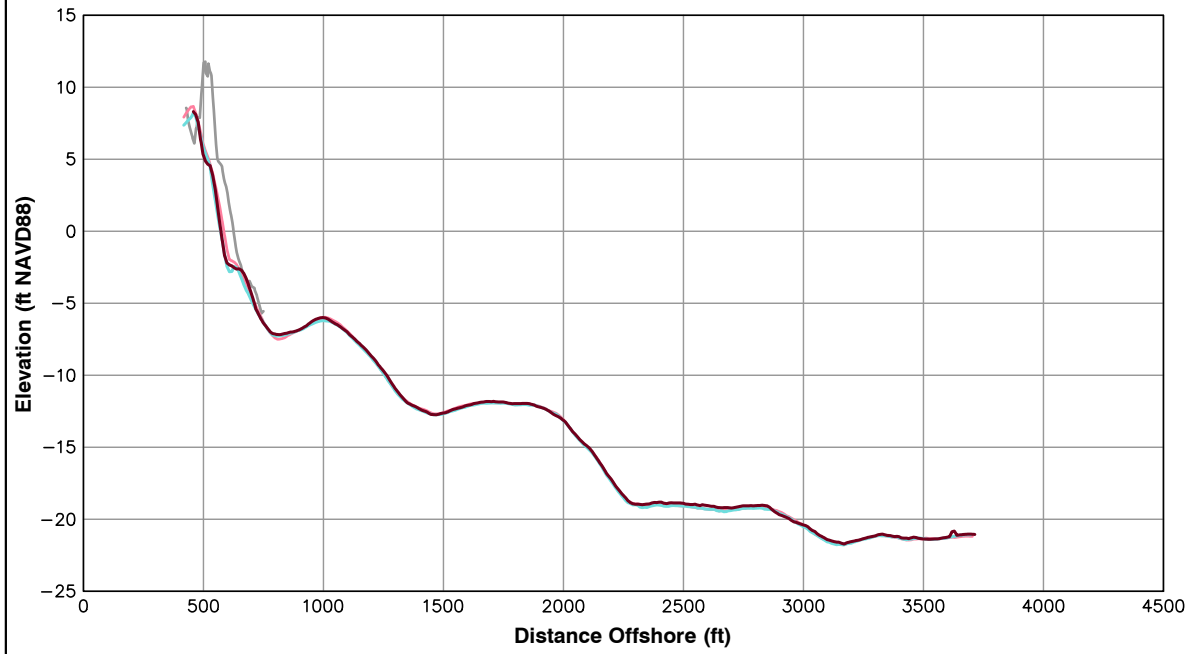
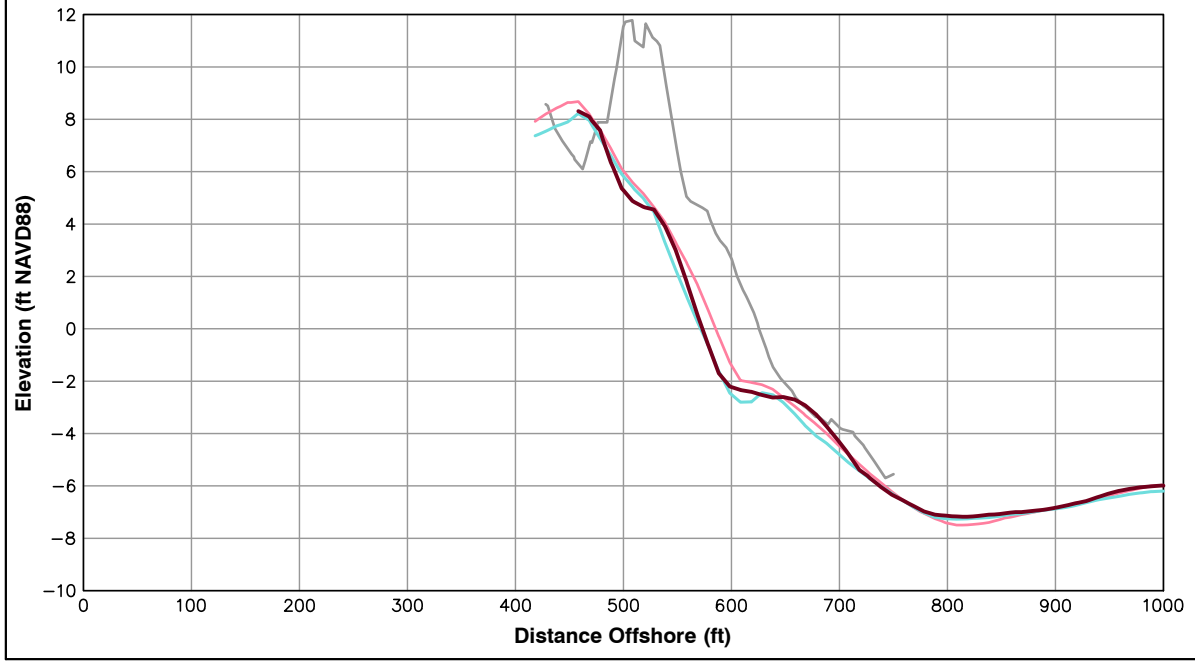
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





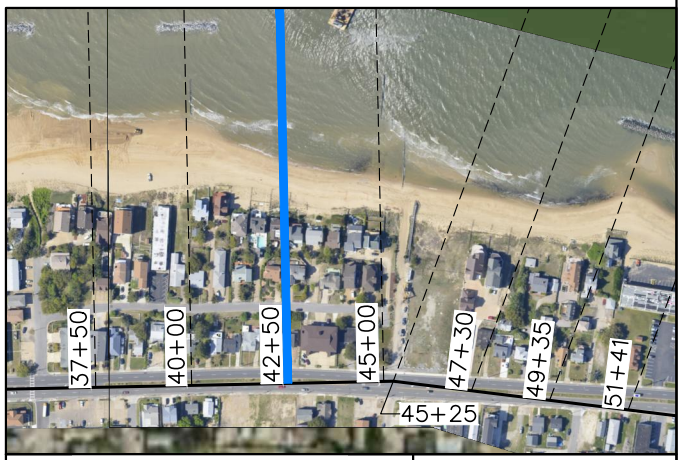
Survey Transect 42+50	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.12 ft/yr	3.81 ft
Volume Change Above -15 ft NAVD88	-2.58 cy/ft/yr	5.87 cy/ft
Volume Change Above 0 ft NAVD88	-2.09 cy/ft/yr	0.40 cy/ft

LEGEND:

- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:

1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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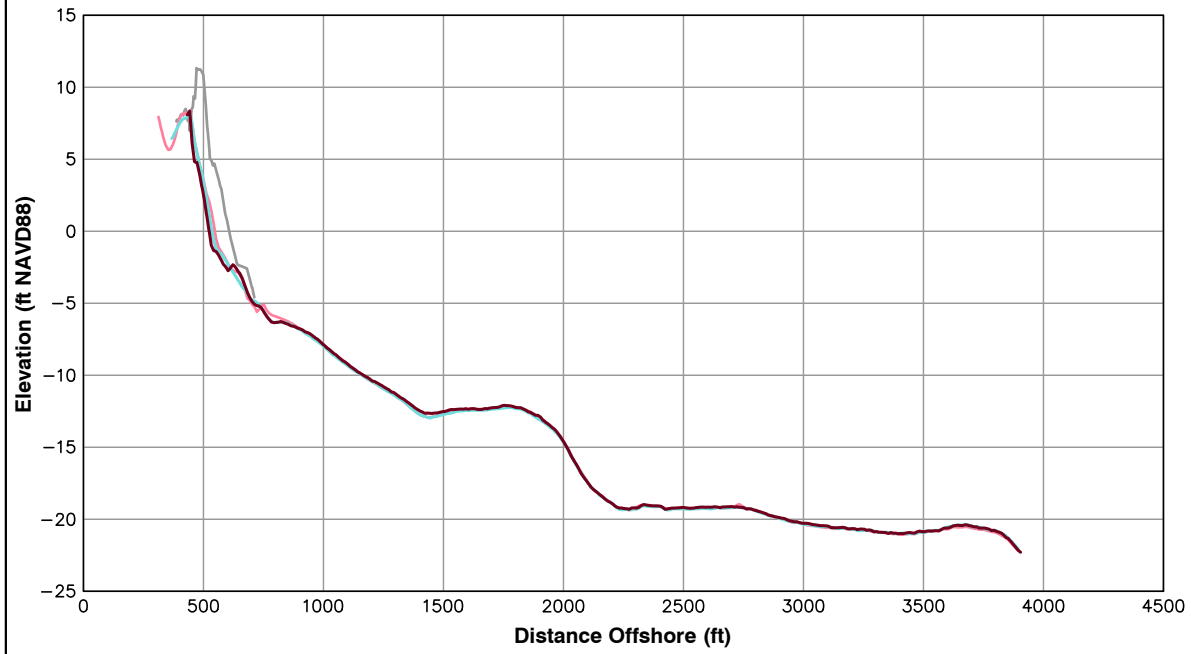
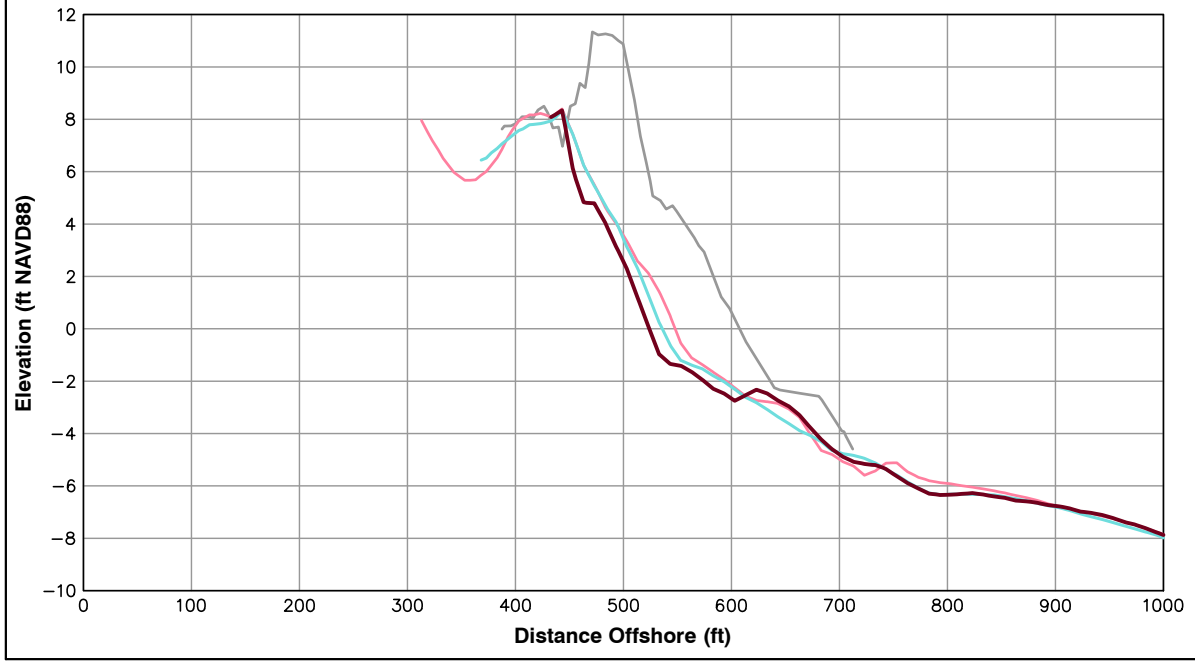
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 45+00	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-21.80 ft/yr	-10.98 ft
Volume Change Above -15 ft NAVD88	-3.93 cy/ft/yr	1.99 cy/ft
Volume Change Above 0 ft NAVD88	-3.96 cy/ft/yr	-3.06 cy/ft

LEGEND:

- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:

1. Stationing From West To East At Varying Intervals.
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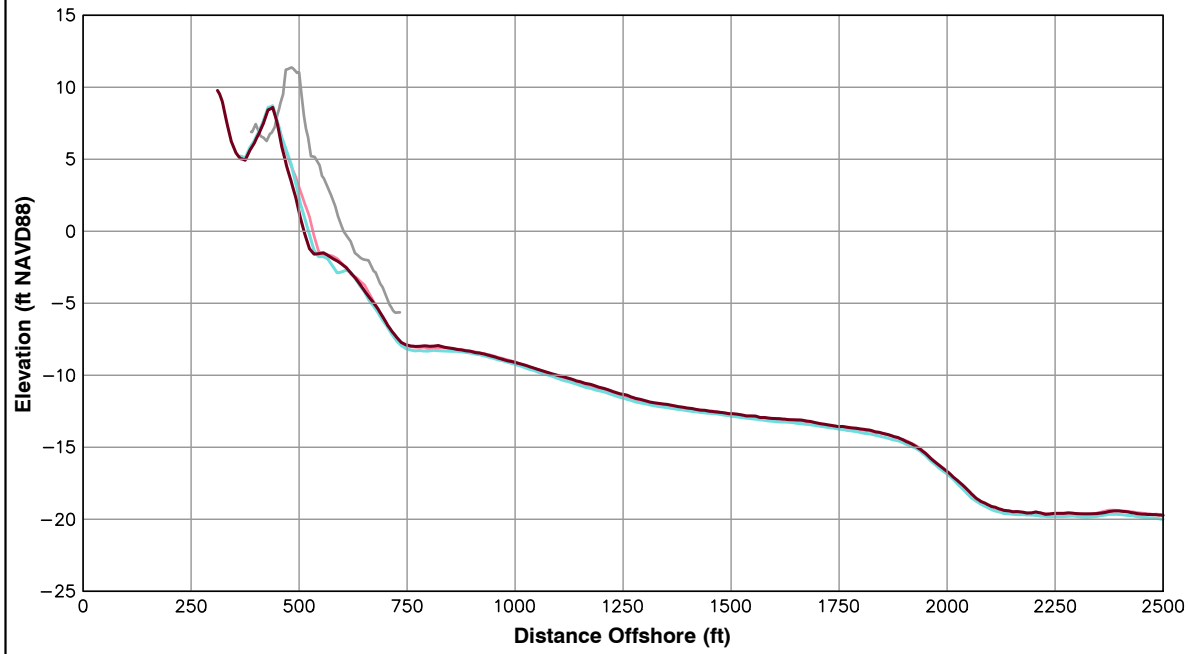
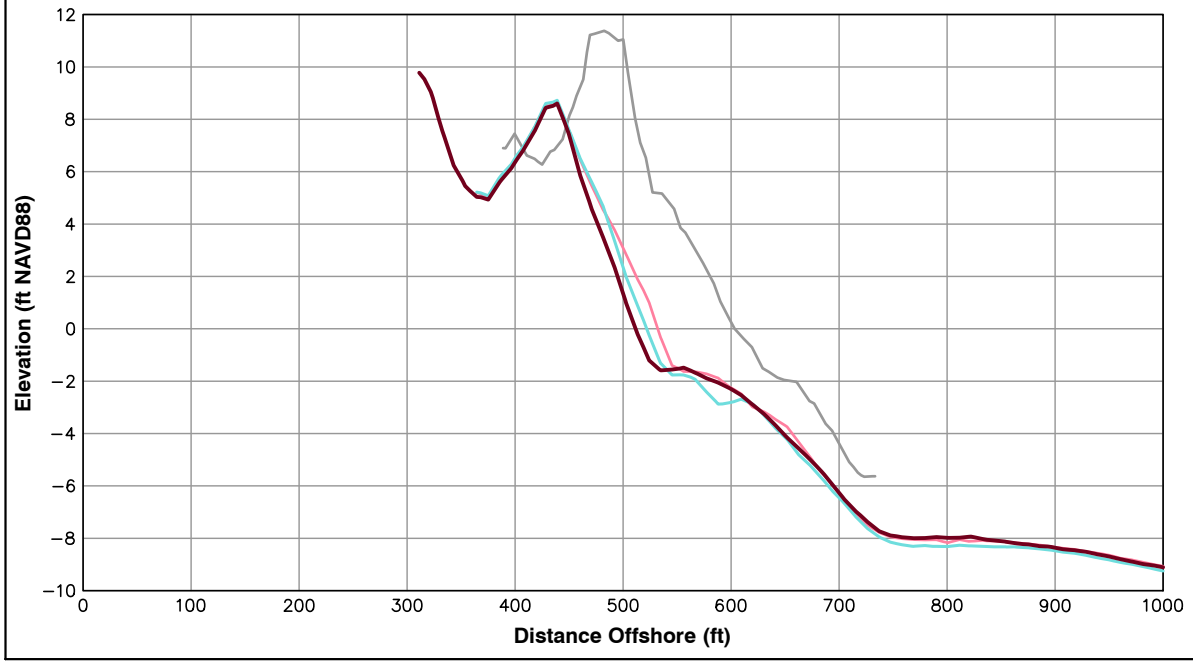
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 45+25	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-20.31 ft/yr	-9.63 ft
Volume Change Above -15 ft NAVD88	-3.08 cy/ft/yr	7.54 cy/ft
Volume Change Above 0 ft NAVD88	-3.52 cy/ft/yr	-2.79 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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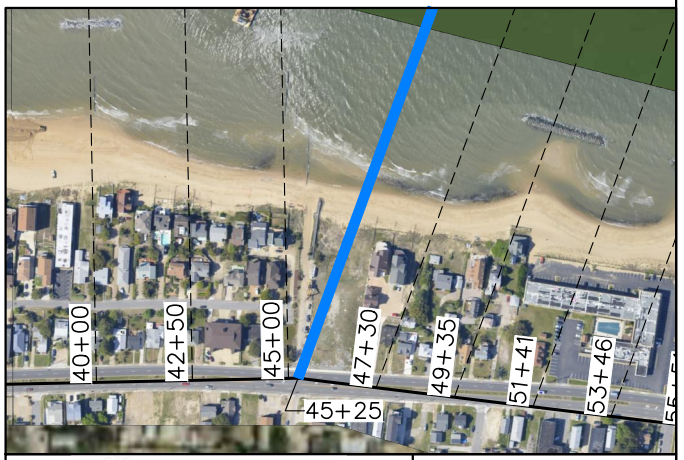

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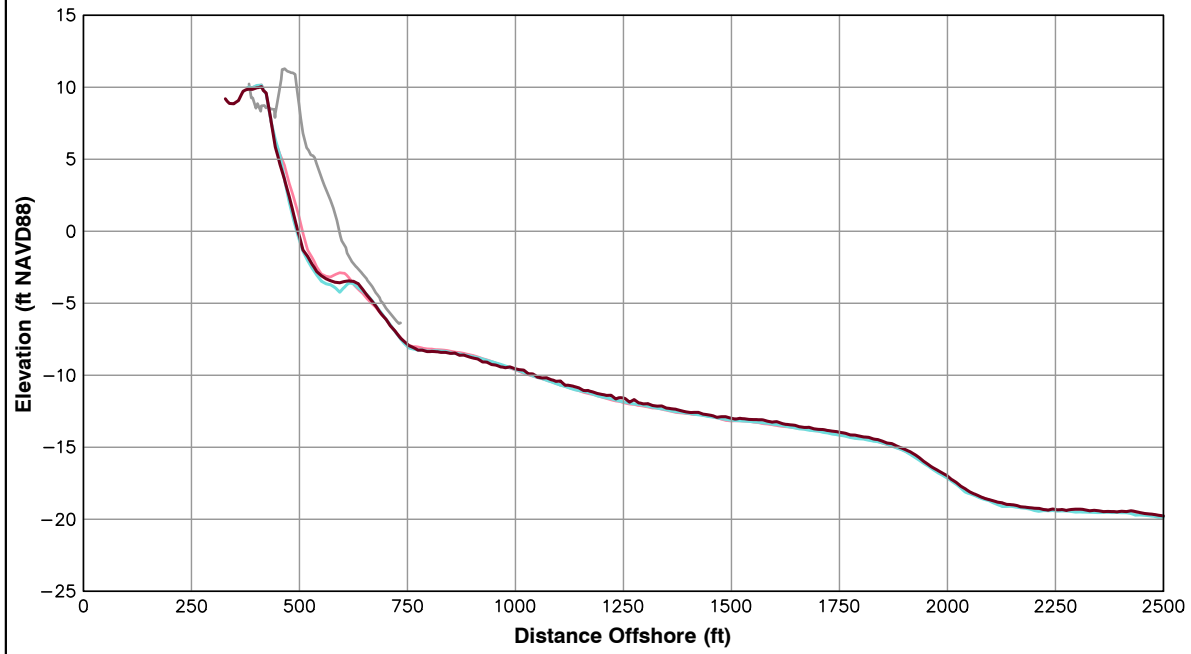

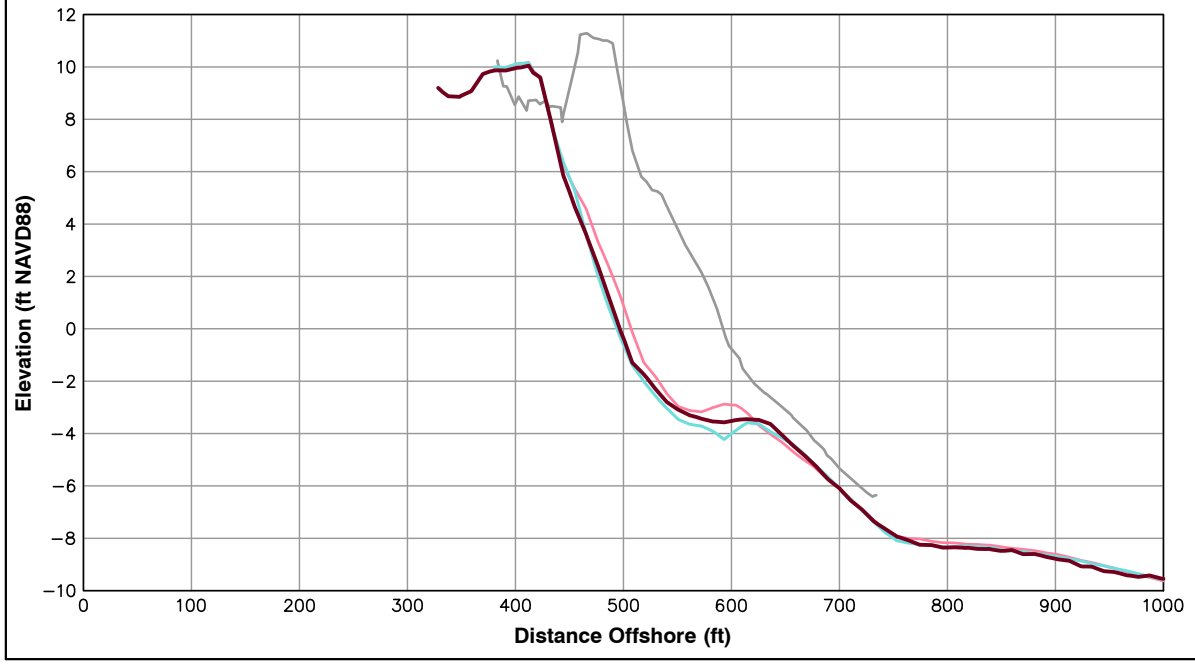

Survey Transect 47+30	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.34 ft/yr	3.36 ft
Volume Change Above -15 ft NAVD88	0.42 cy/ft/yr	5.72 cy/ft
Volume Change Above 0 ft NAVD88	-2.10 cy/ft/yr	-0.23 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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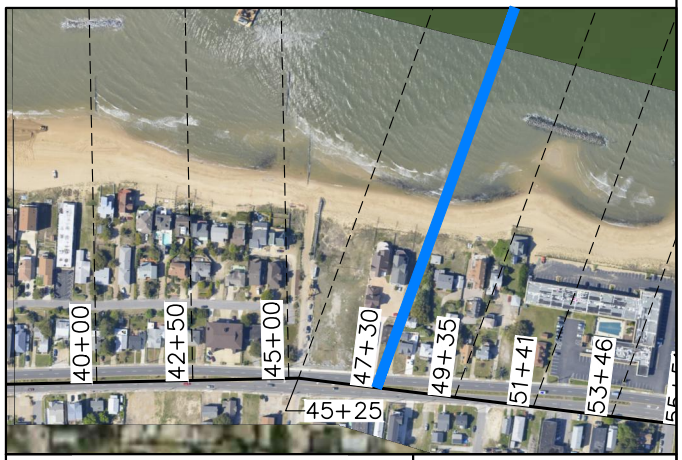
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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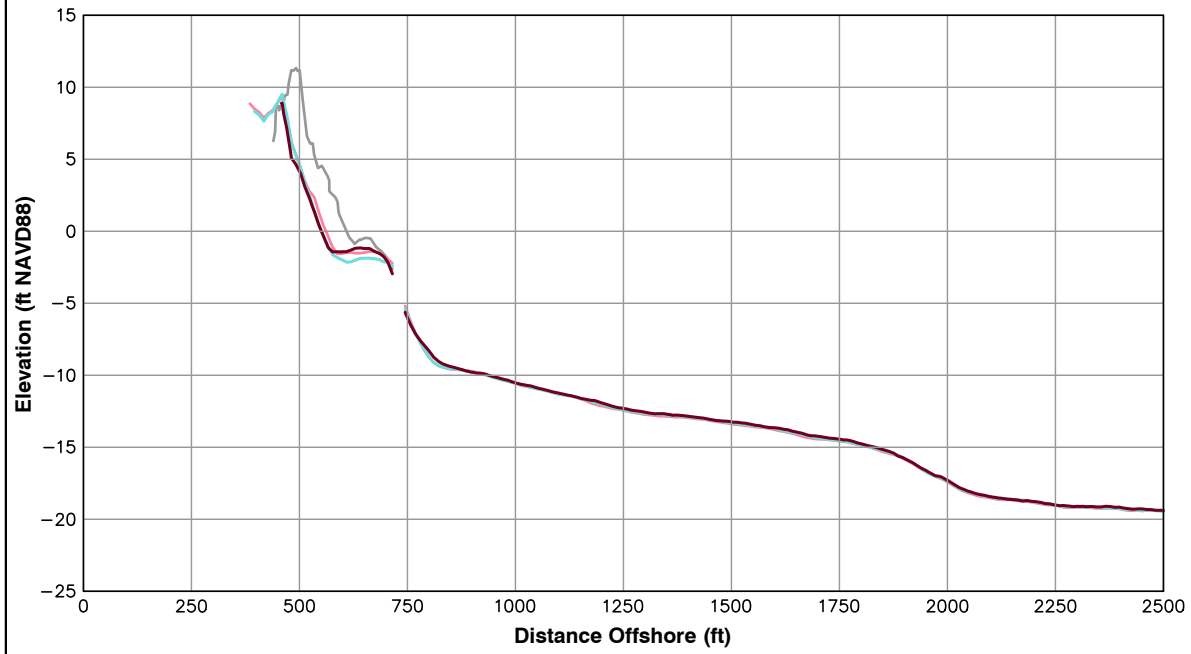

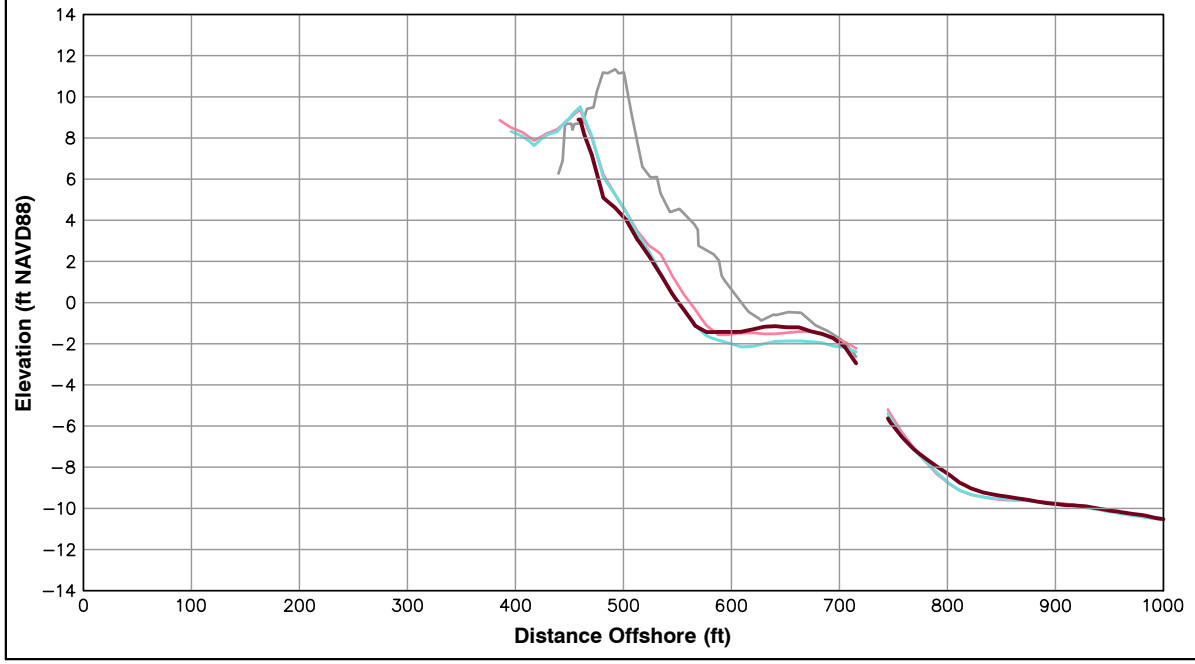

Survey Transect 49+35	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-9.58 ft/yr	-0.41 ft
Volume Change Above -15 ft NAVD88	1.81 cy/ft/yr	4.17 cy/ft
Volume Change Above 0 ft NAVD88	-2.45 cy/ft/yr	-1.55 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
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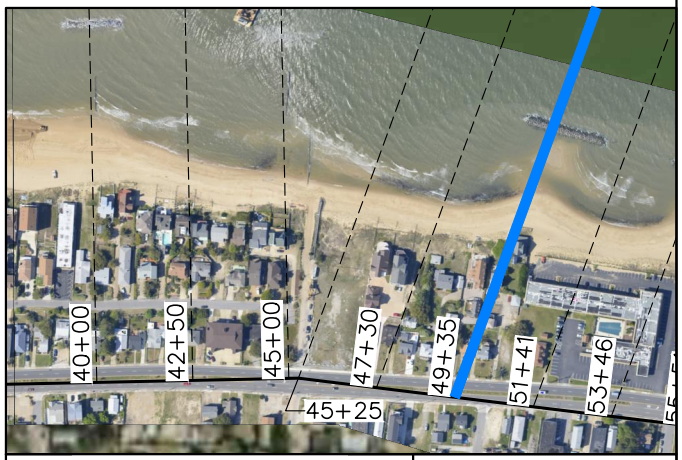
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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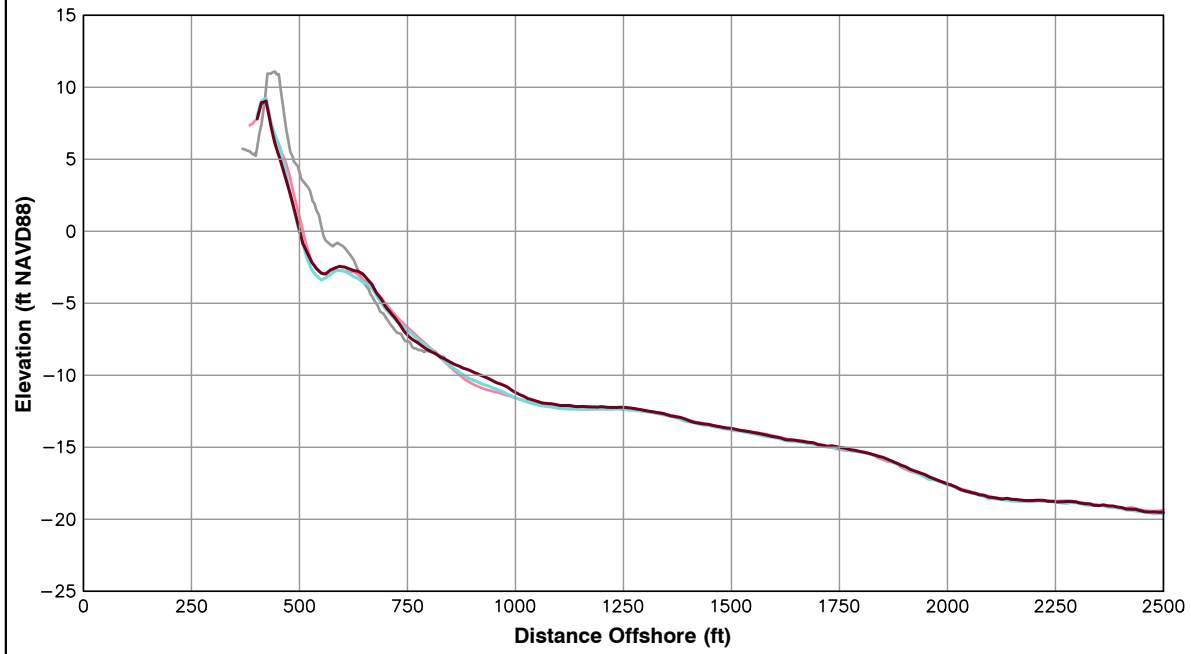
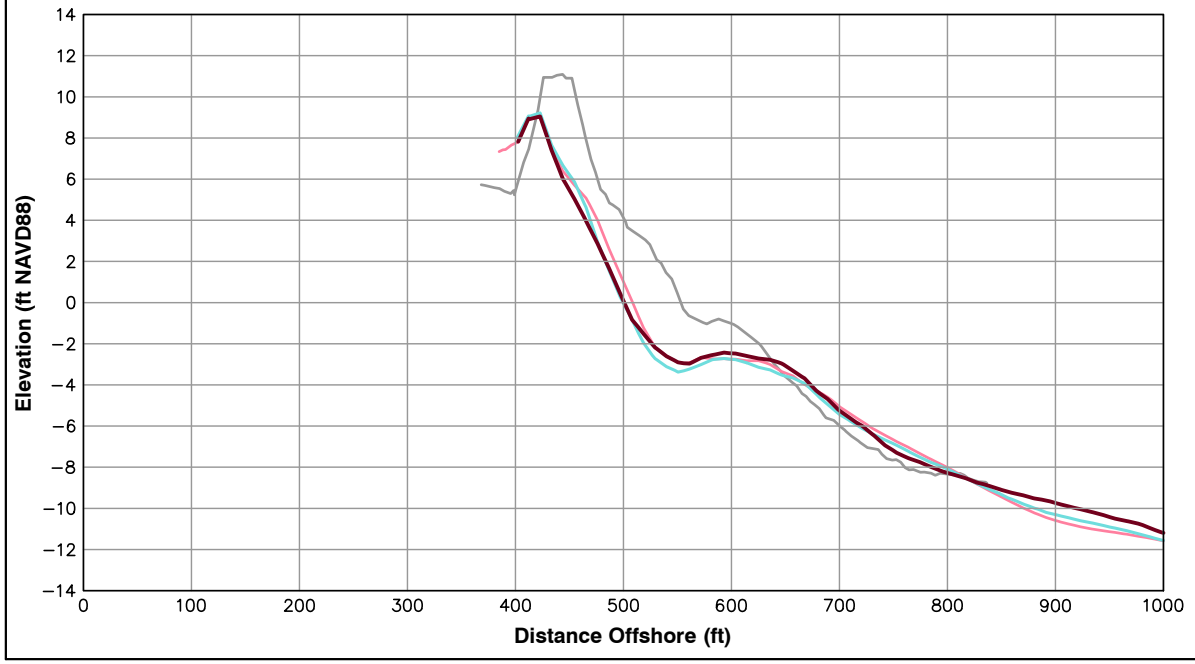
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 51+41	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-7.42 ft/yr	1.12 ft
Volume Change Above -15 ft NAVD88	2.28 cy/ft/yr	7.03 cy/ft
Volume Change Above 0 ft NAVD88	-2.05 cy/ft/yr	-1.06 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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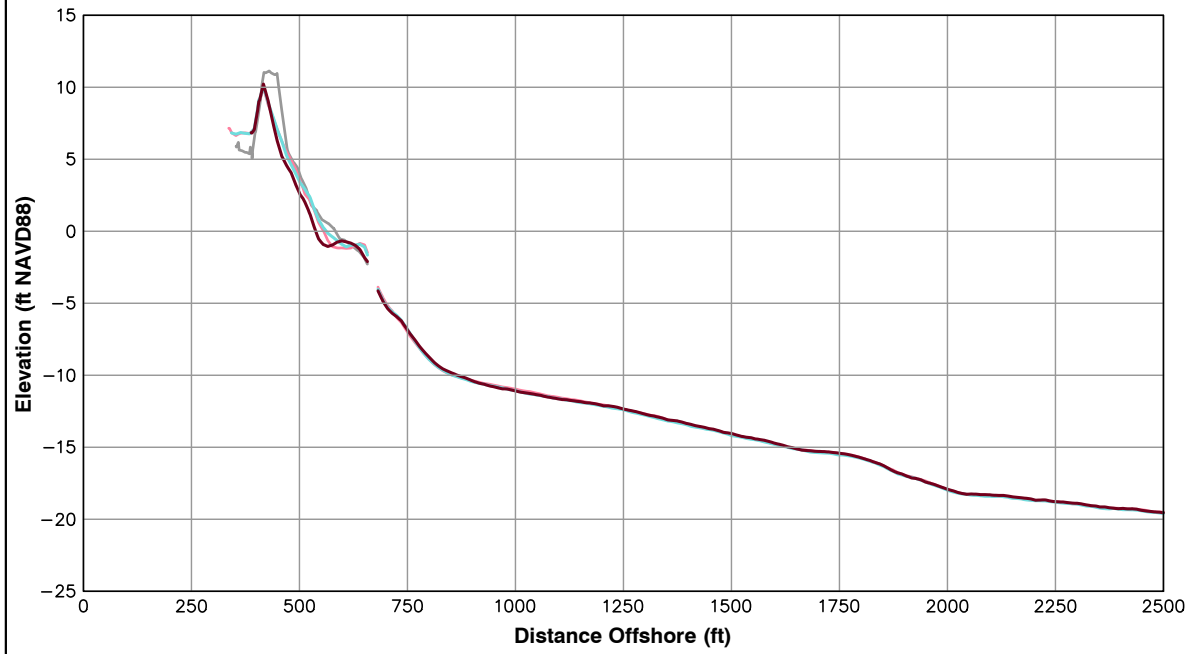
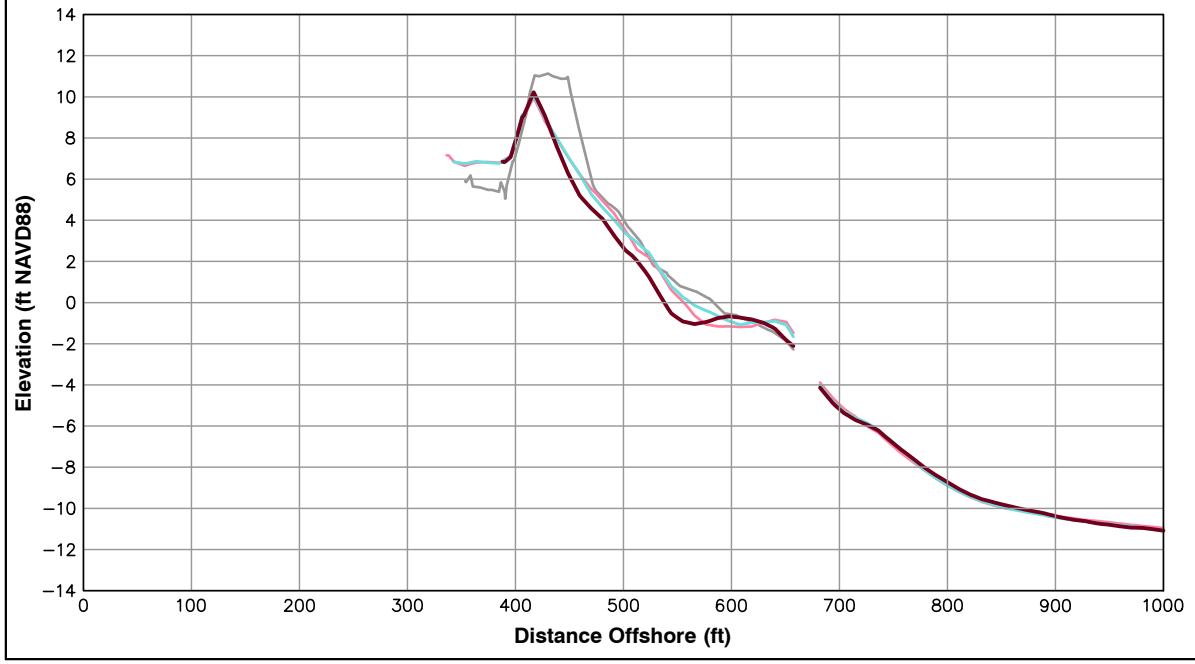
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 53+46	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-12.52 ft/yr	-15.17 ft
Volume Change Above -15 ft NAVD88	-3.85 cy/ft/yr	-3.16 cy/ft
Volume Change Above 0 ft NAVD88	-3.32 cy/ft/yr	-3.69 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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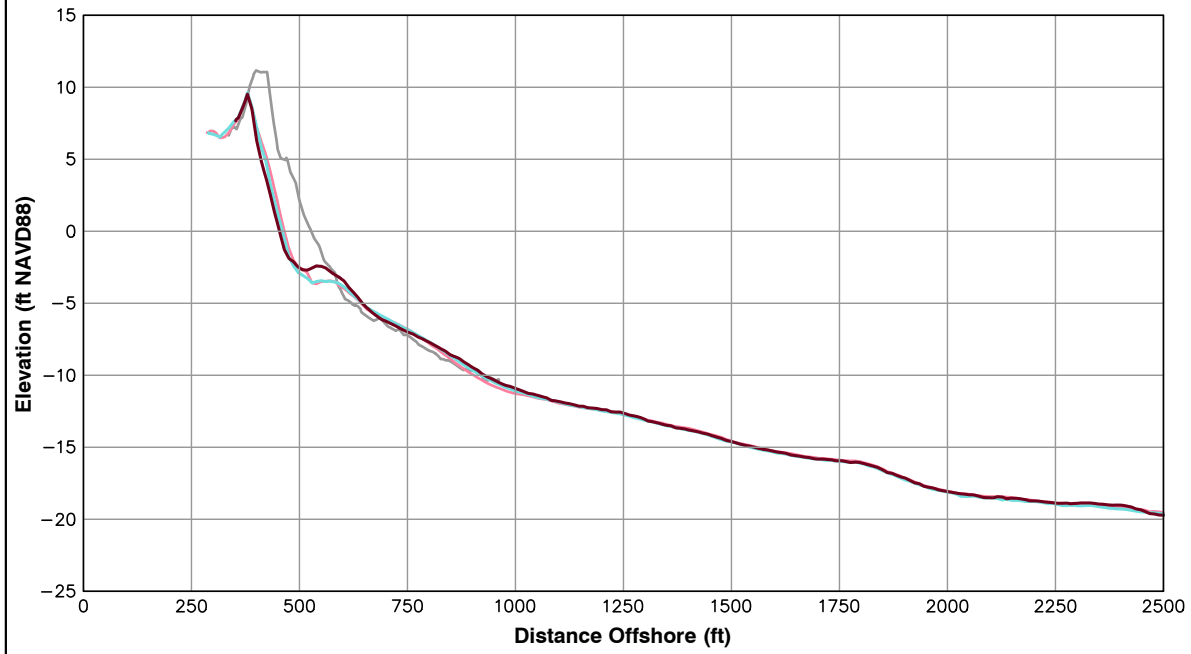
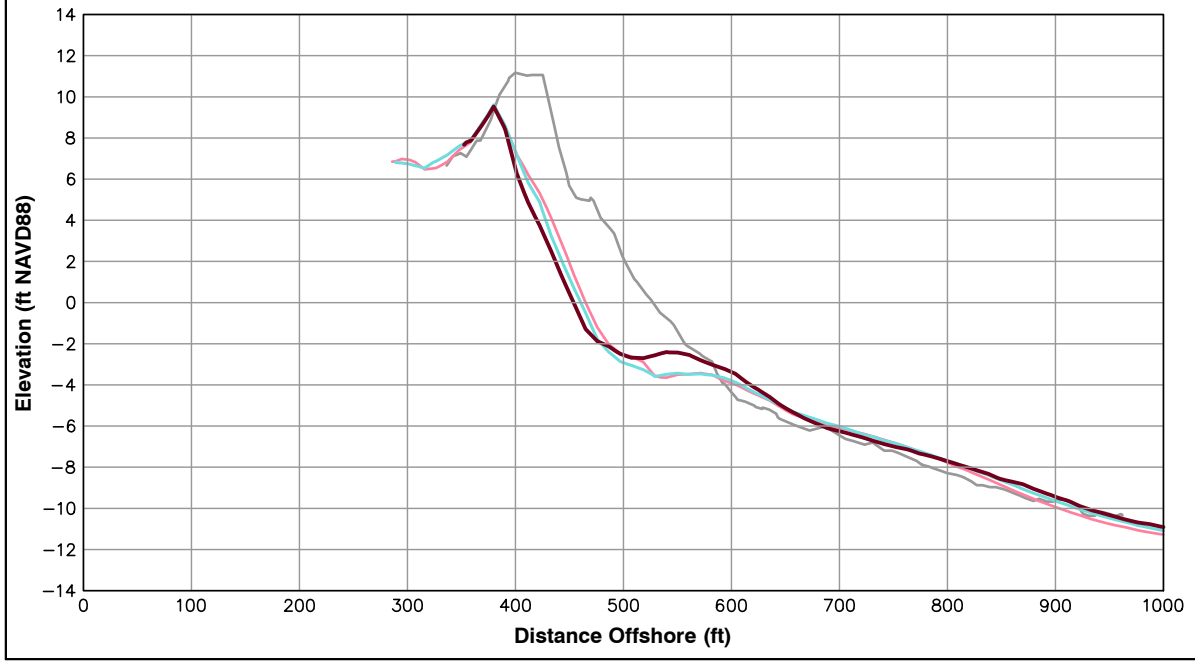
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 55+51	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-11.24 ft/yr	-6.52 ft
Volume Change Above -15 ft NAVD88	1.46 cy/ft/yr	2.20 cy/ft
Volume Change Above 0 ft NAVD88	-3.21 cy/ft/yr	-2.14 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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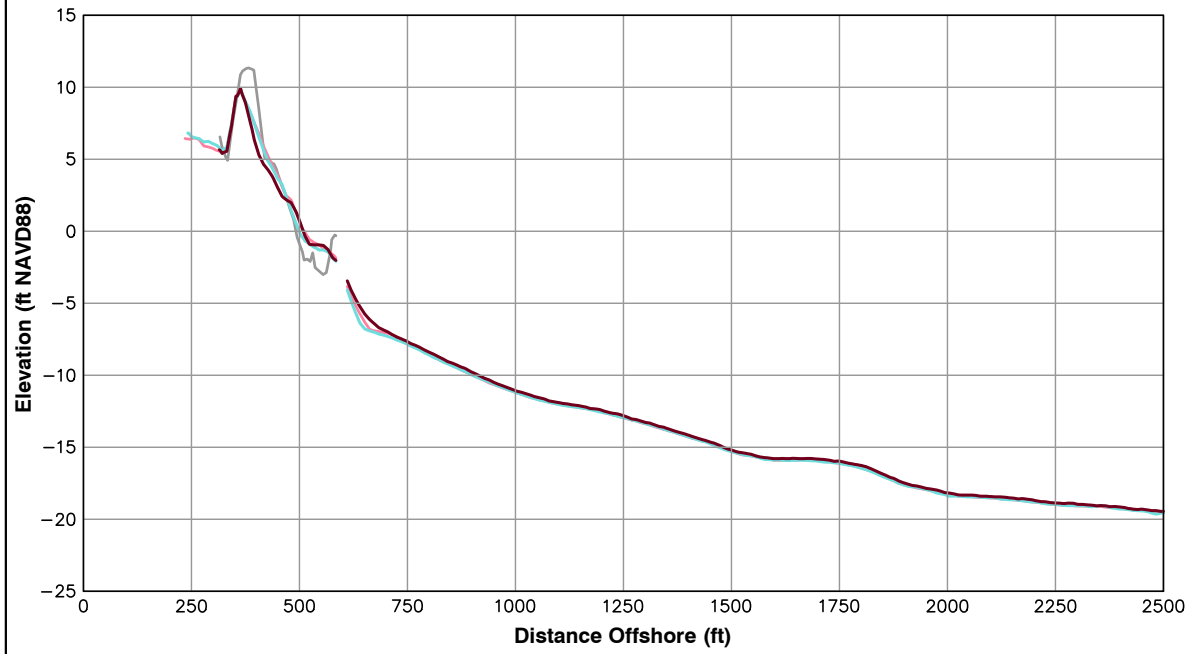
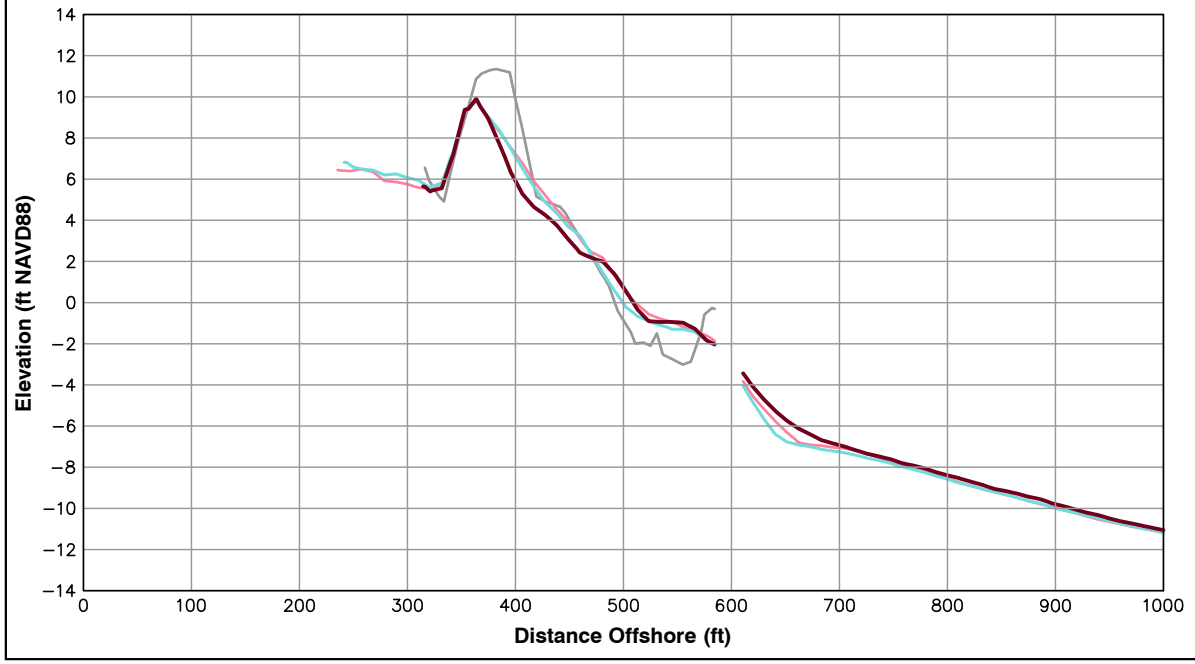
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 57+57	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	0.94 ft/yr	10.15 ft
Volume Change Above -15 ft NAVD88	1.55 cy/ft/yr	5.07 cy/ft
Volume Change Above 0 ft NAVD88	-3.19 cy/ft/yr	-2.17 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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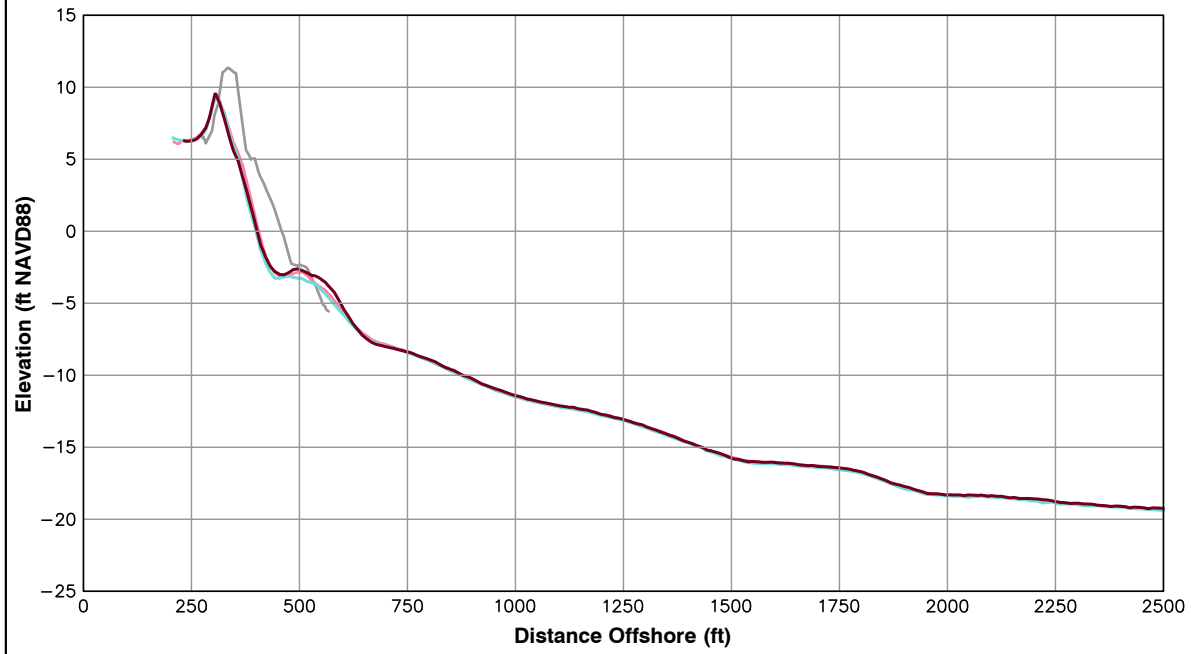
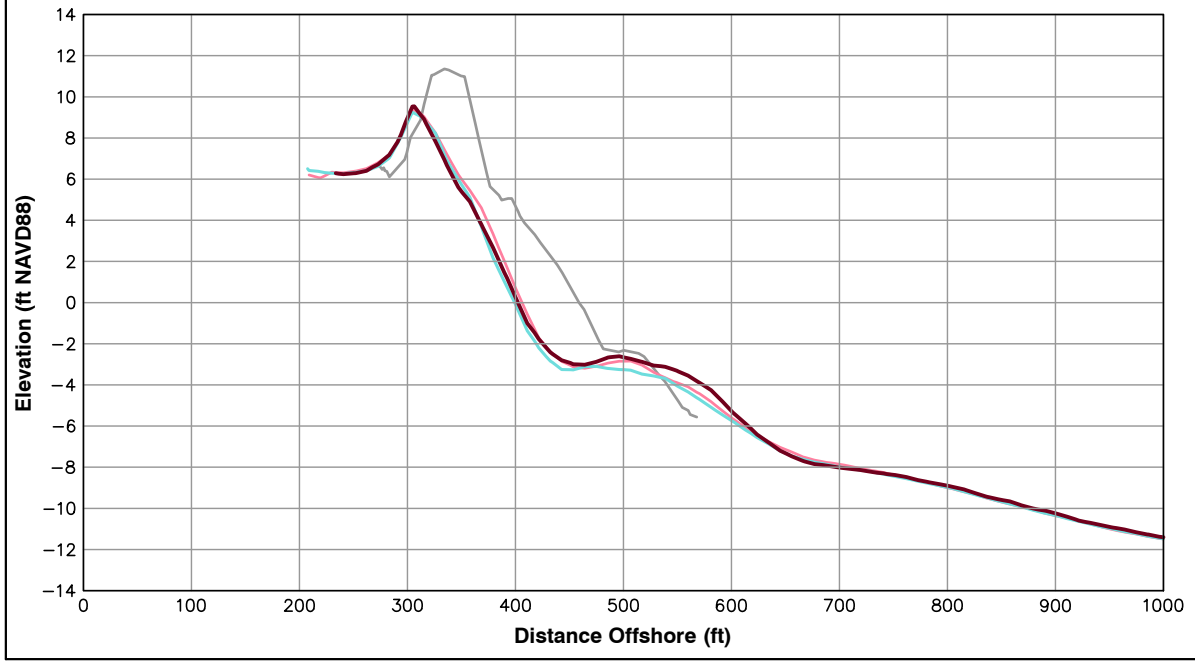
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 59+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-3.80 ft/yr	3.81 ft
Volume Change Above -15 ft NAVD88	0.54 cy/ft/yr	6.39 cy/ft
Volume Change Above 0 ft NAVD88	-1.78 cy/ft/yr	0.26 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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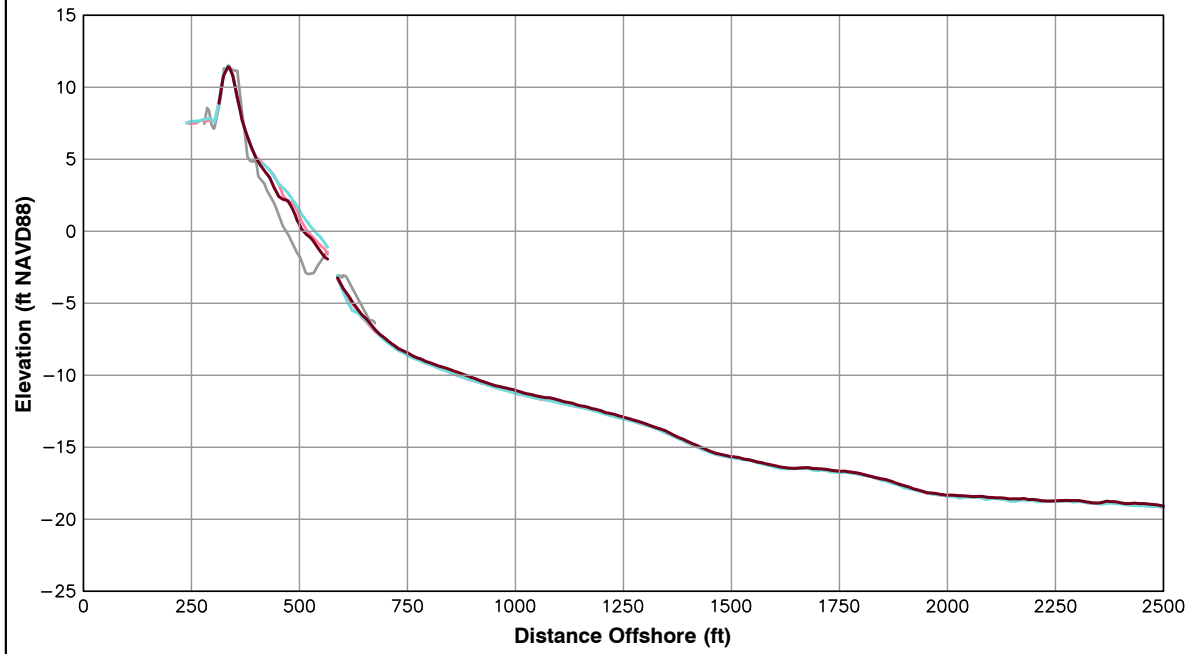
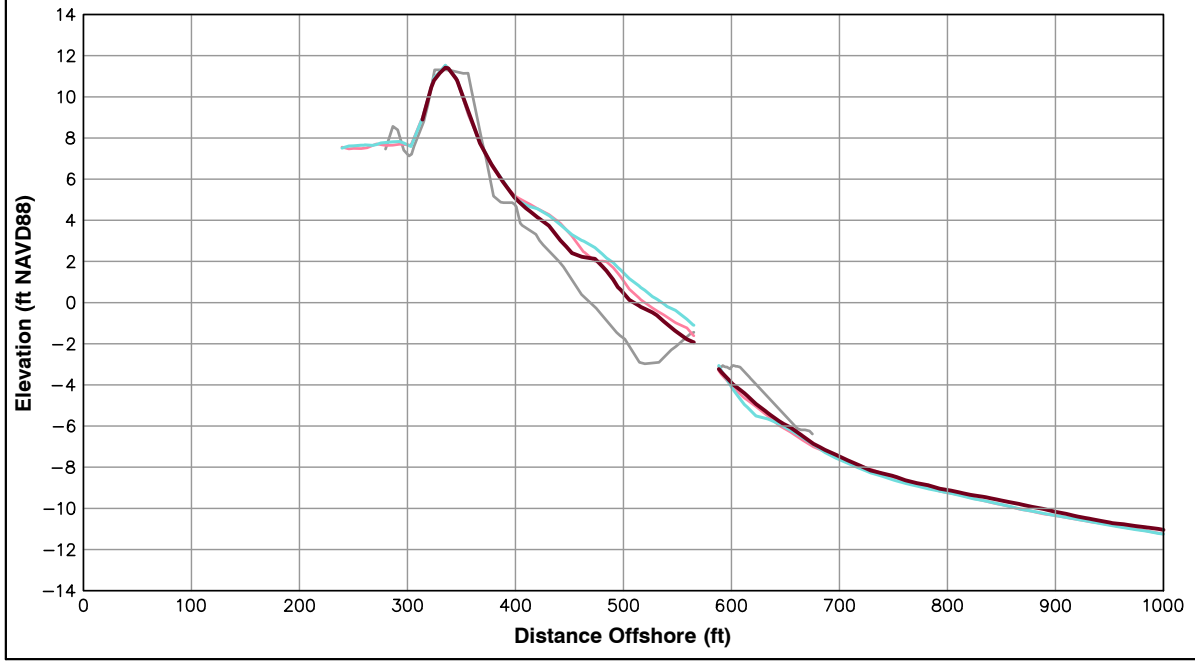
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 61+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-8.43 ft/yr	-18.03 ft
Volume Change Above -15 ft NAVD88	1.44 cy/ft/yr	0.26 cy/ft
Volume Change Above 0 ft NAVD88	-1.82 cy/ft/yr	-3.10 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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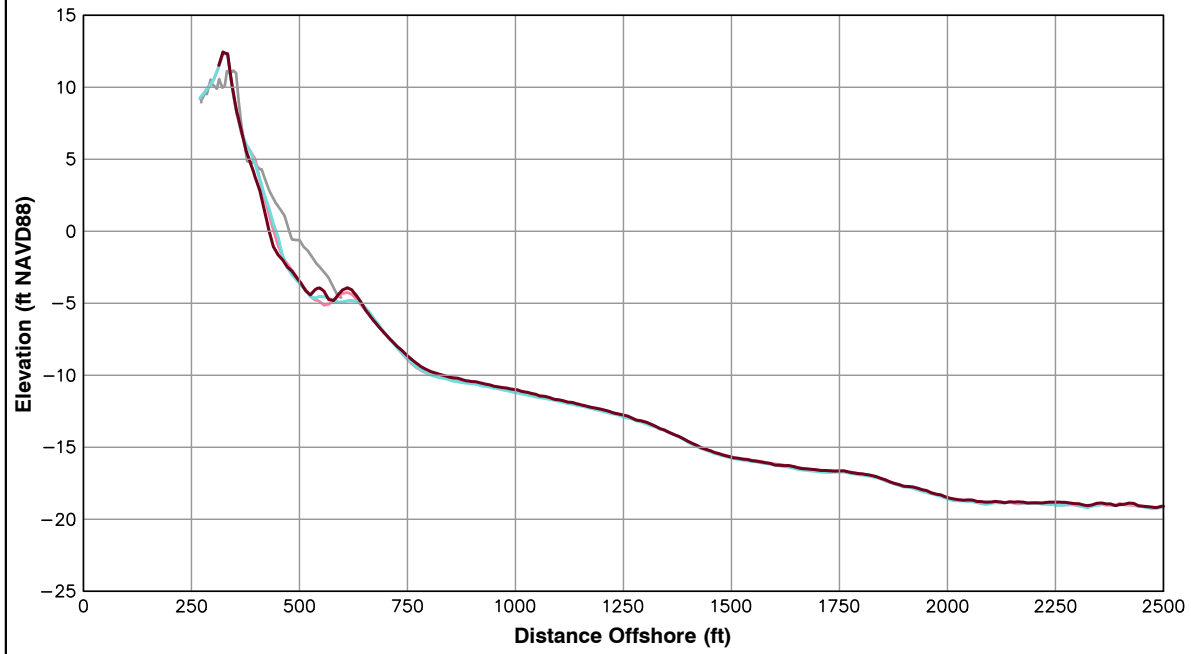
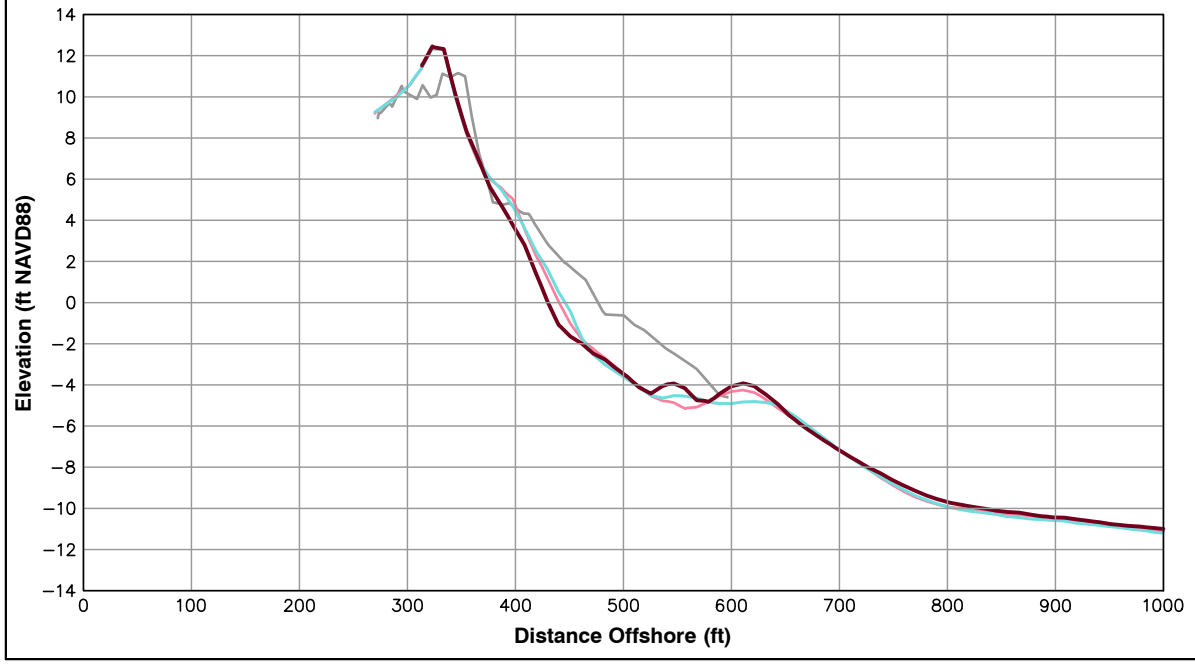
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 63+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-8.59 ft/yr	-13.16 ft
Volume Change Above -15 ft NAVD88	1.00 cy/ft/yr	2.11 cy/ft
Volume Change Above 0 ft NAVD88	-1.78 cy/ft/yr	-2.22 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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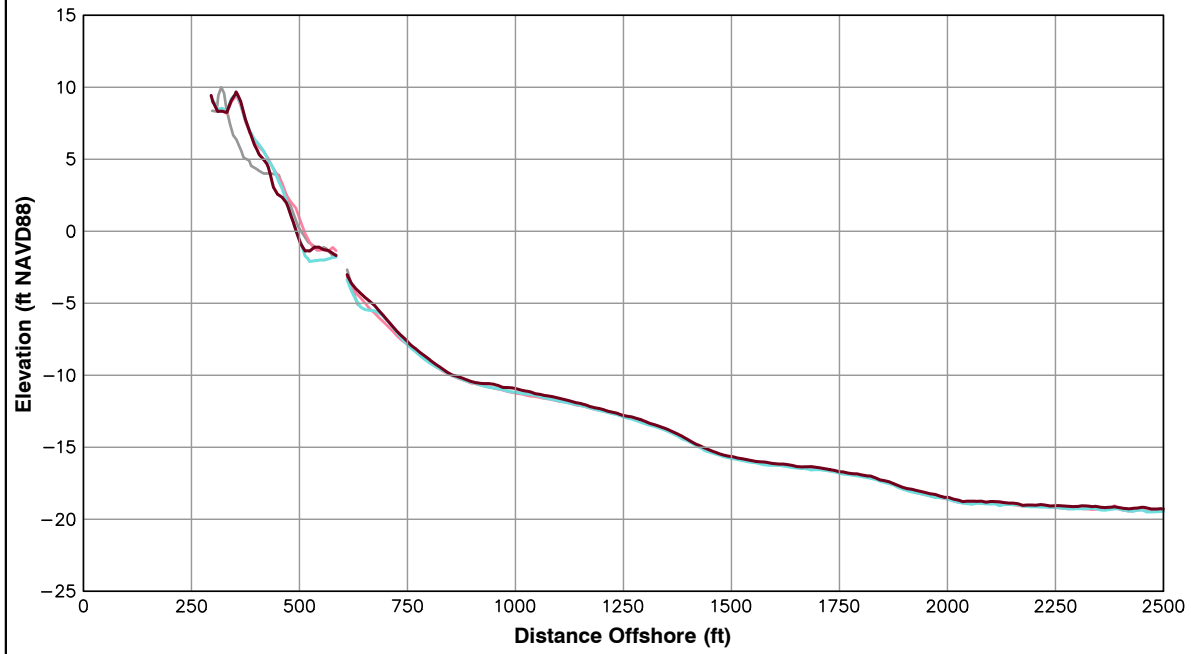
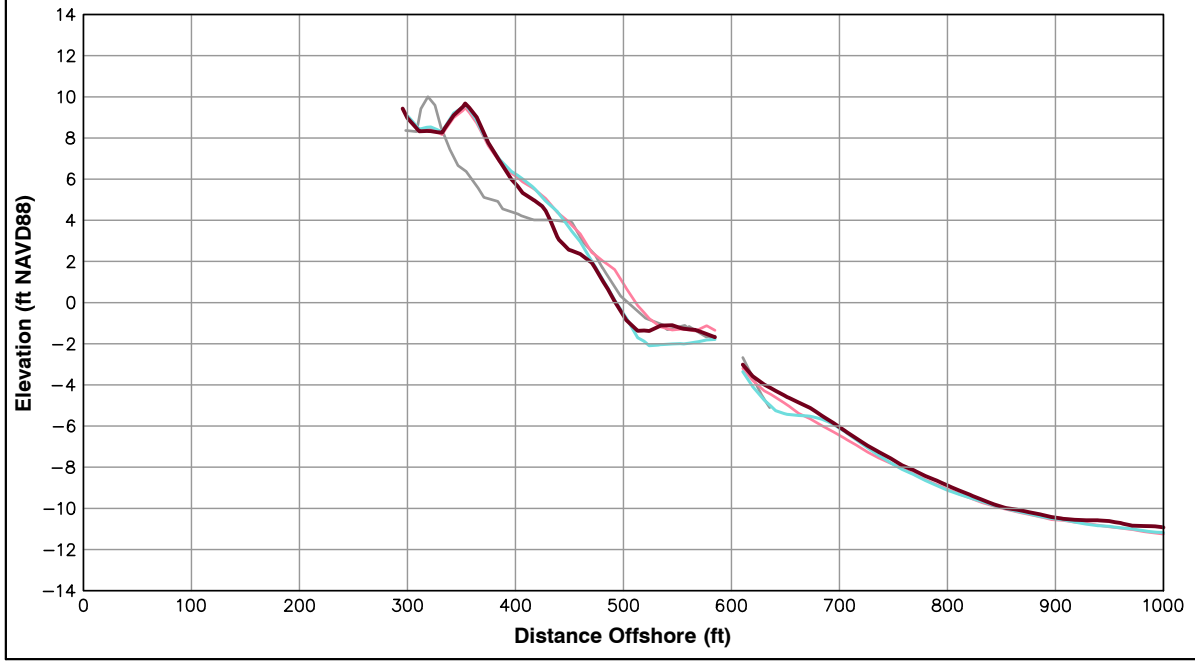
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 65+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-16.77 ft/yr	-0.81 ft
Volume Change Above -15 ft NAVD88	1.09 cy/ft/yr	5.22 cy/ft
Volume Change Above 0 ft NAVD88	-3.15 cy/ft/yr	-2.18 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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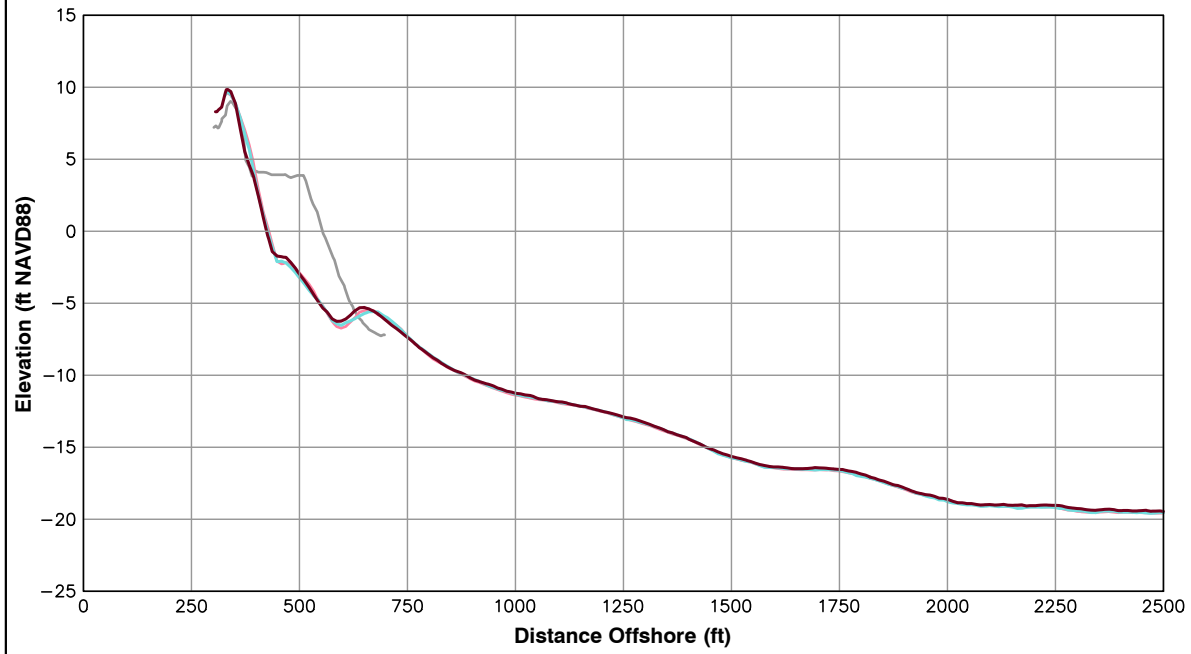
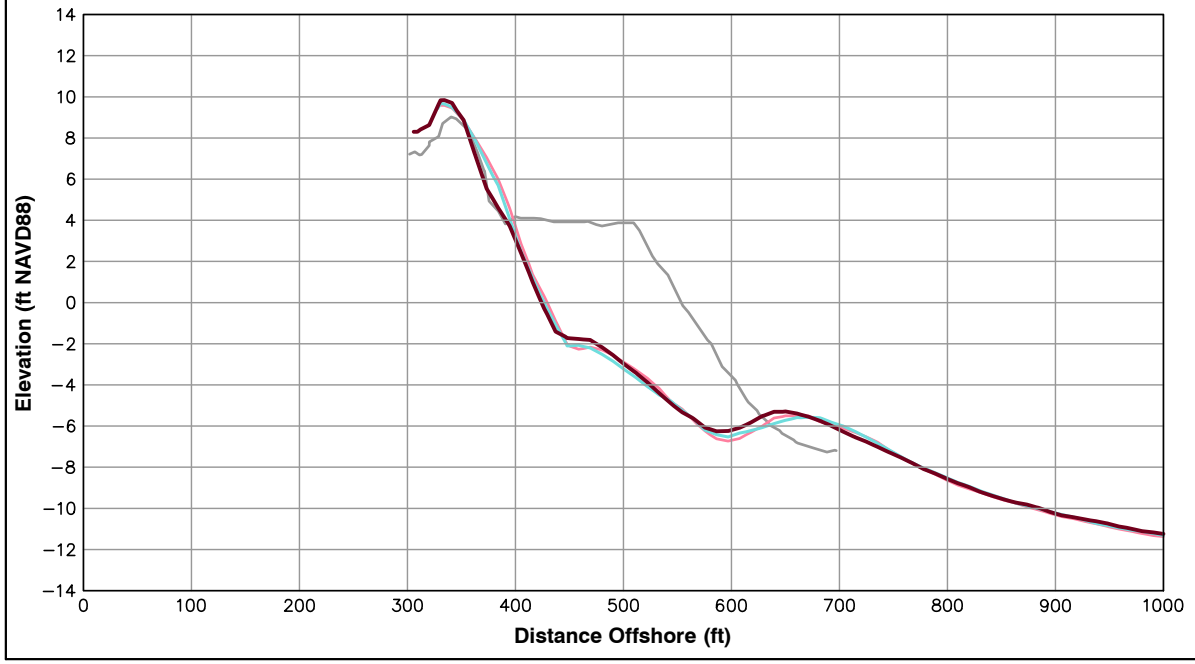
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 67+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-3.56 ft/yr	-1.74 ft
Volume Change Above -15 ft NAVD88	0.52 cy/ft/yr	0.60 cy/ft
Volume Change Above 0 ft NAVD88	-1.99 cy/ft/yr	-1.36 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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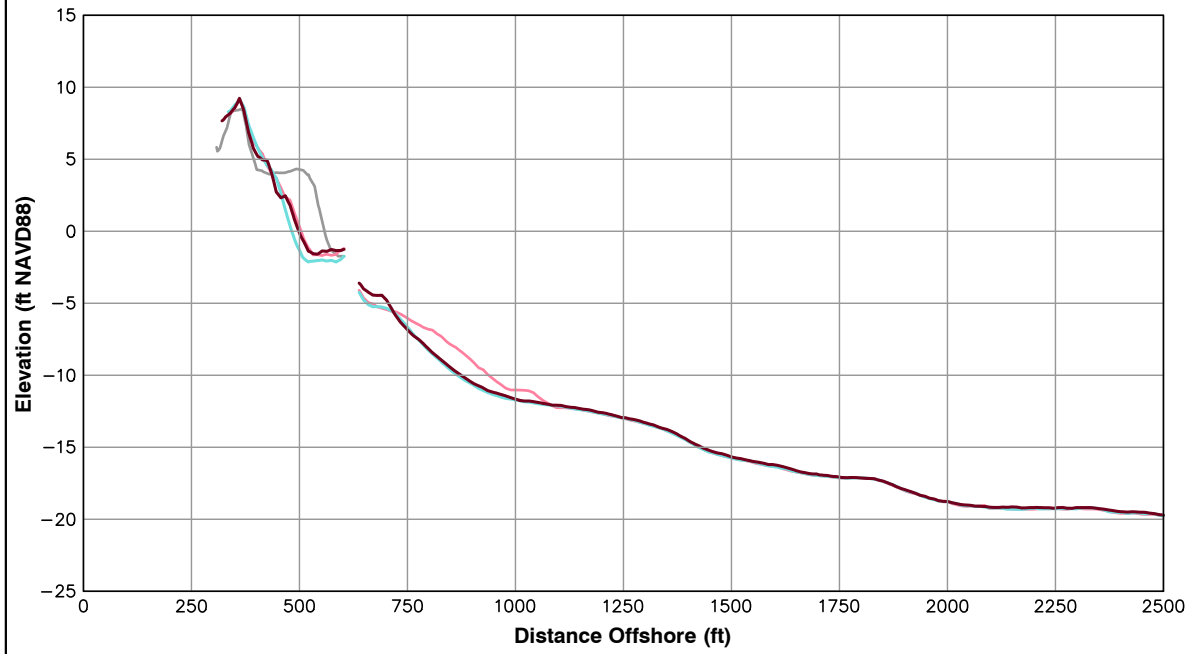
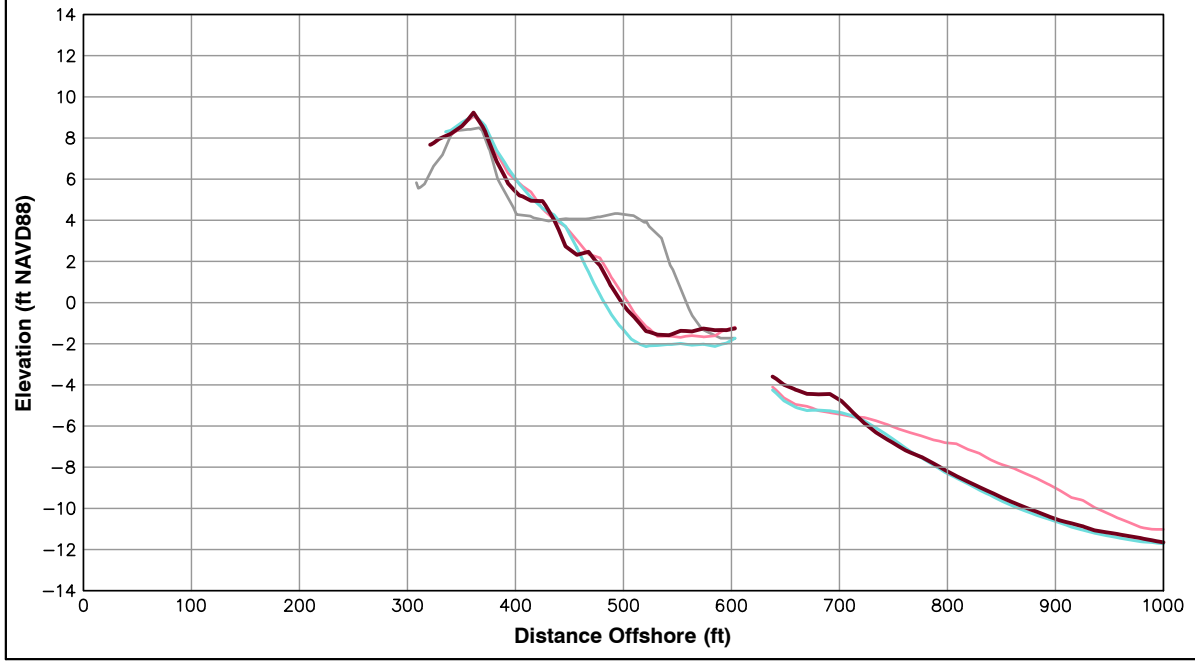
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 69+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-4.97 ft/yr	14.55 ft
Volume Change Above -15 ft NAVD88	-11.22 cy/ft/yr	7.01 cy/ft
Volume Change Above 0 ft NAVD88	-1.54 cy/ft/yr	-0.13 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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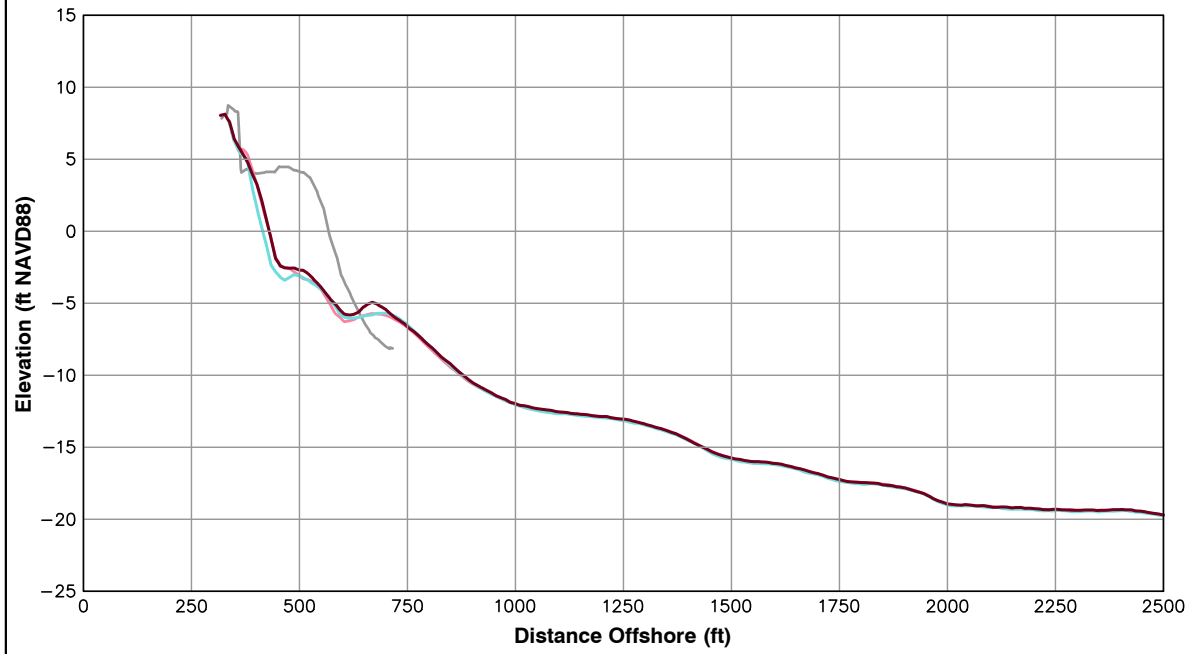
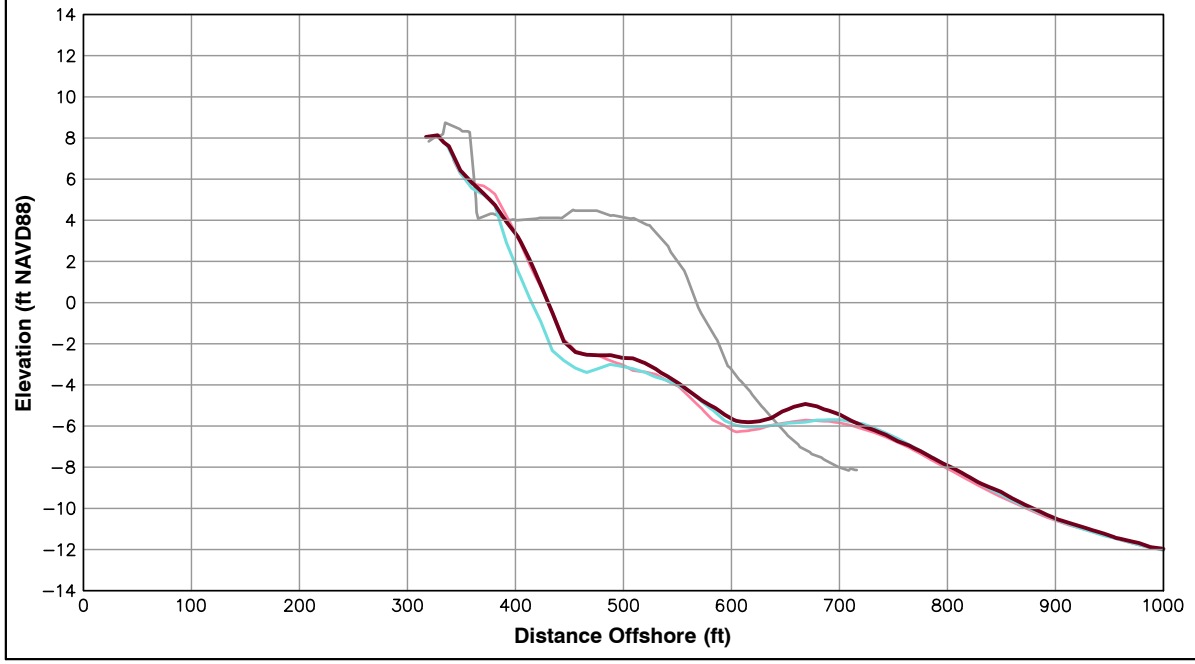
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 71+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	0.98 ft/yr	15.53 ft
Volume Change Above -15 ft NAVD88	5.06 cy/ft/yr	9.50 cy/ft
Volume Change Above 0 ft NAVD88	-0.22 cy/ft/yr	2.33 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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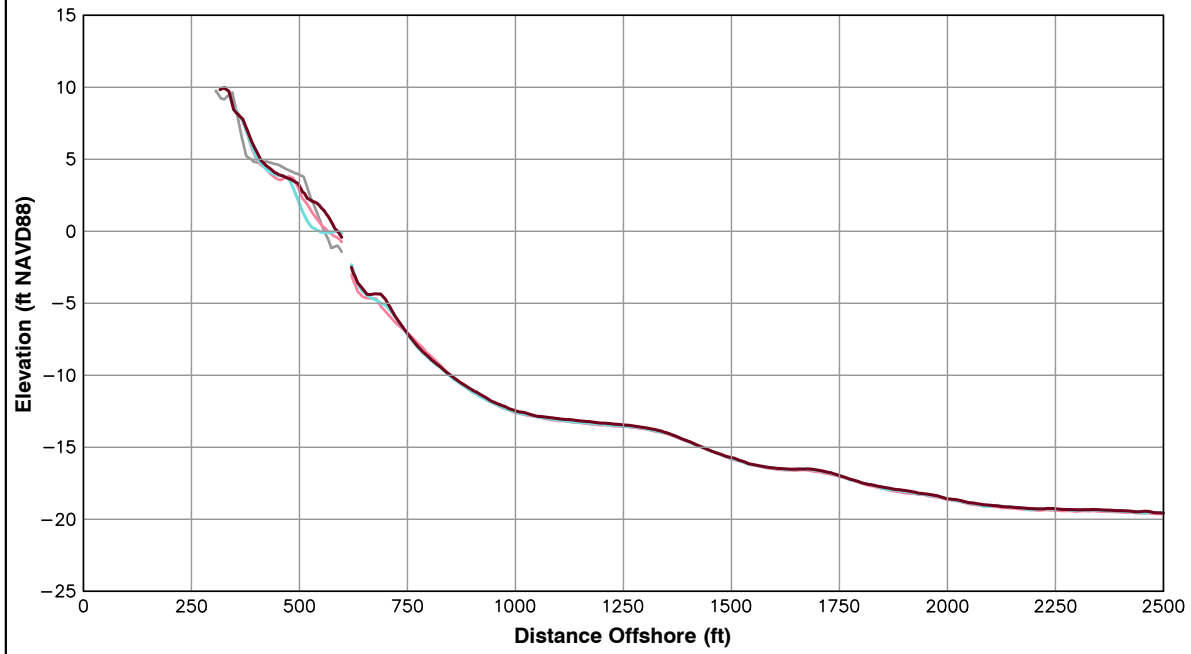
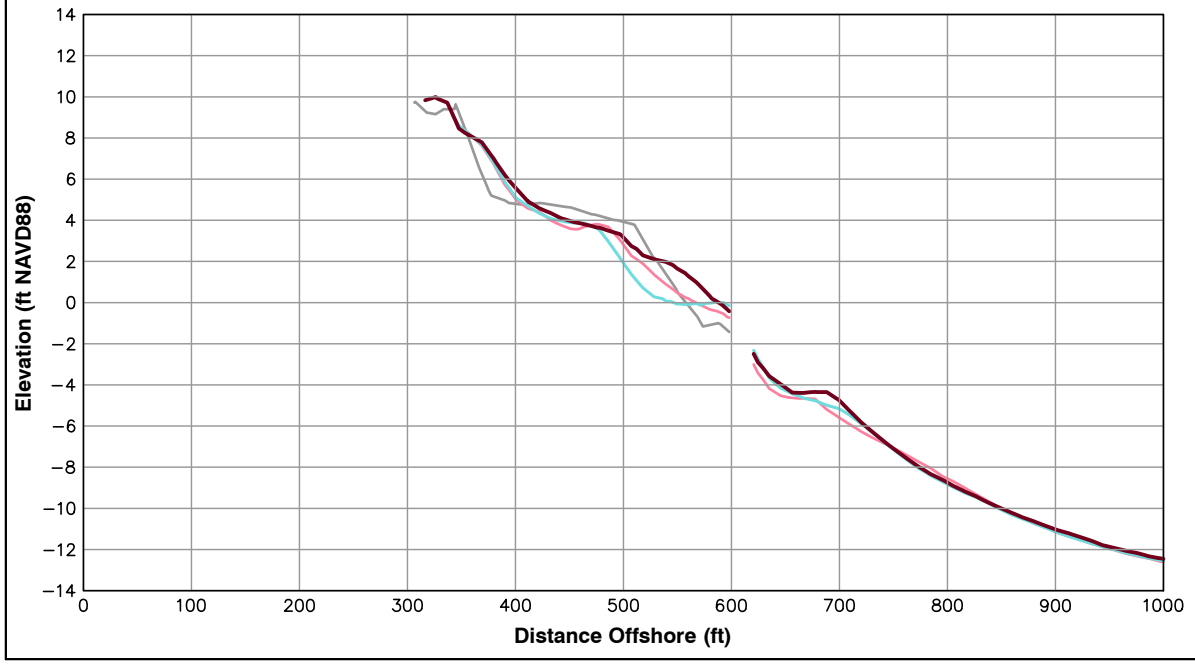
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 73+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	28.84 ft/yr	53.87 ft
Volume Change Above -15 ft NAVD88	7.83 cy/ft/yr	8.50 cy/ft
Volume Change Above 0 ft NAVD88	3.36 cy/ft/yr	5.57 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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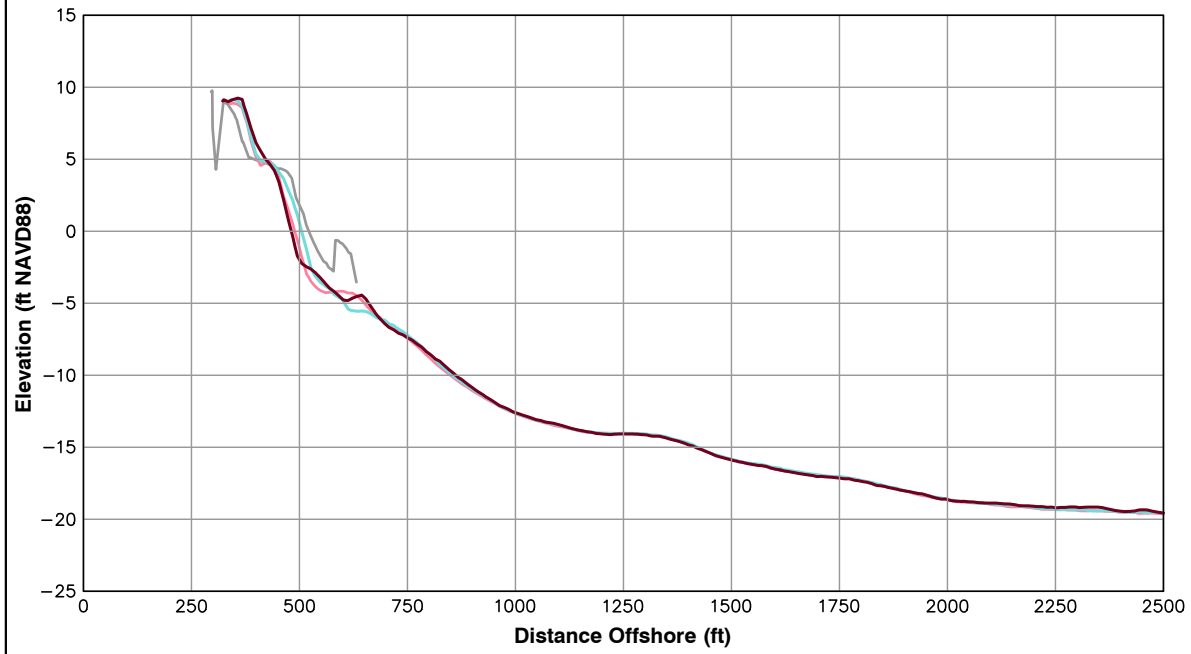
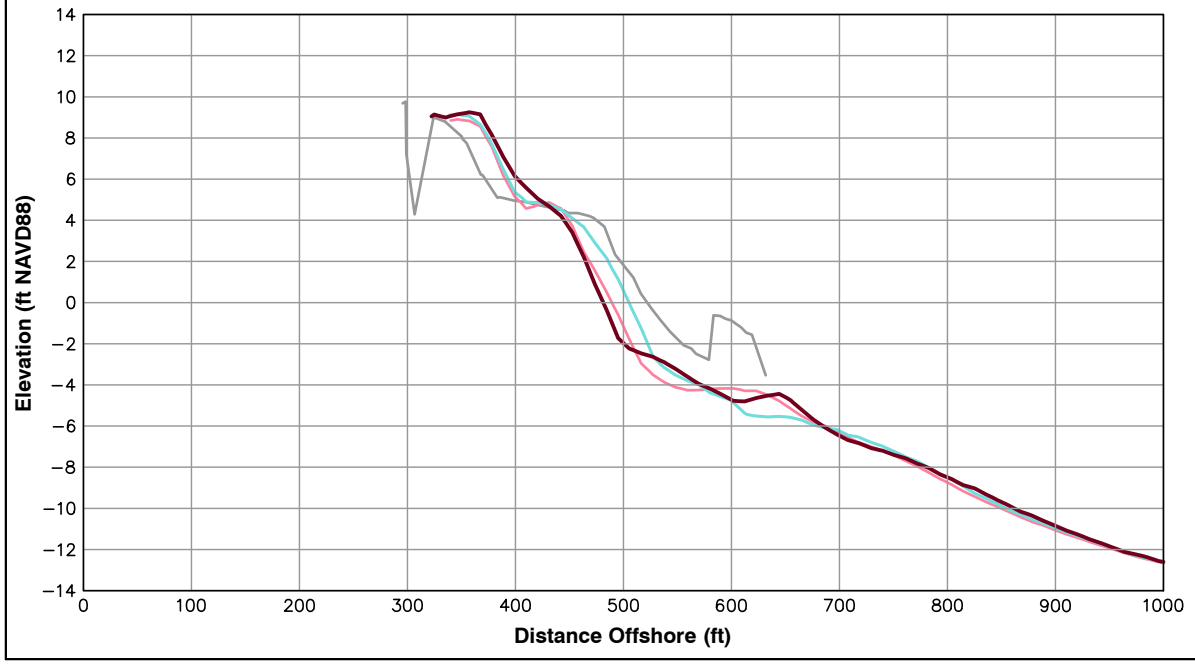
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 75+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-6.33 ft/yr	-23.61 ft
Volume Change Above -15 ft NAVD88	3.36 cy/ft/yr	-1.82 cy/ft
Volume Change Above 0 ft NAVD88	1.03 cy/ft/yr	-1.82 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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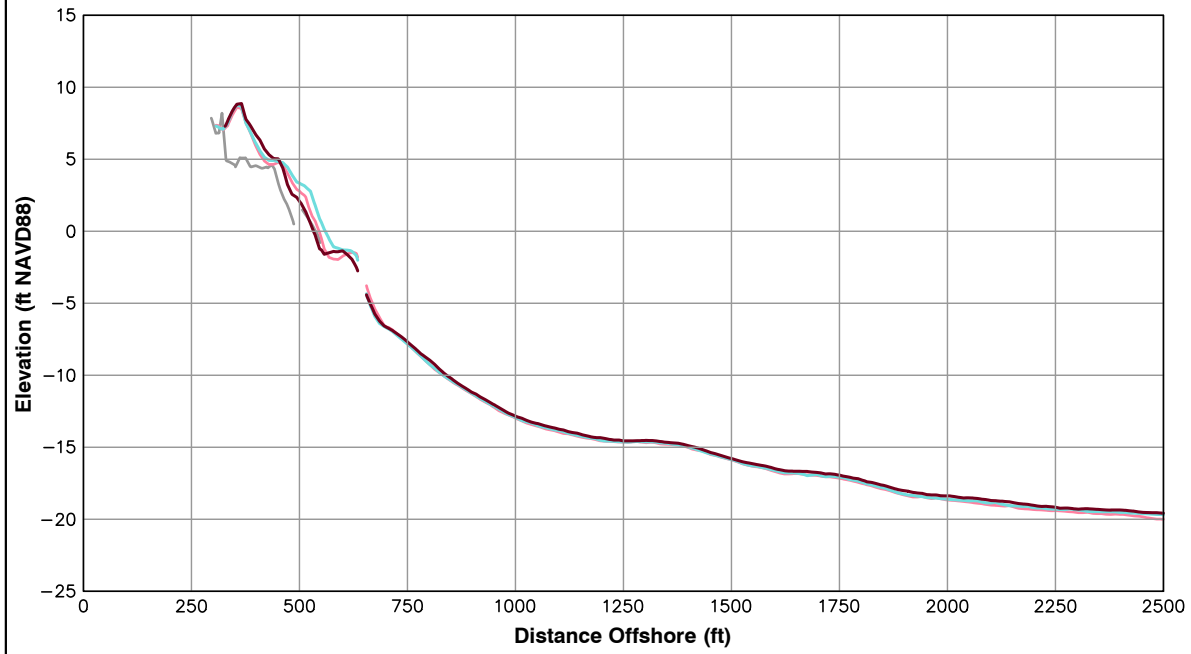
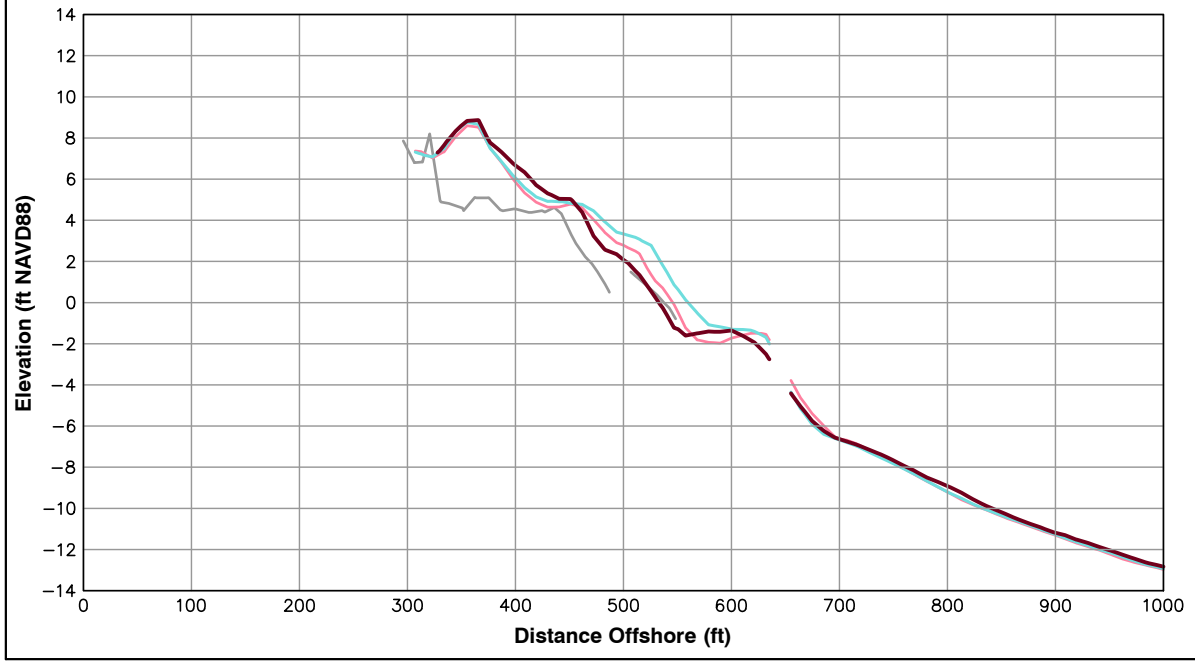
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 77+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.65 ft/yr	-25.91 ft
Volume Change Above -15 ft NAVD88	2.96 cy/ft/yr	-2.42 cy/ft
Volume Change Above 0 ft NAVD88	0.03 cy/ft/yr	-3.33 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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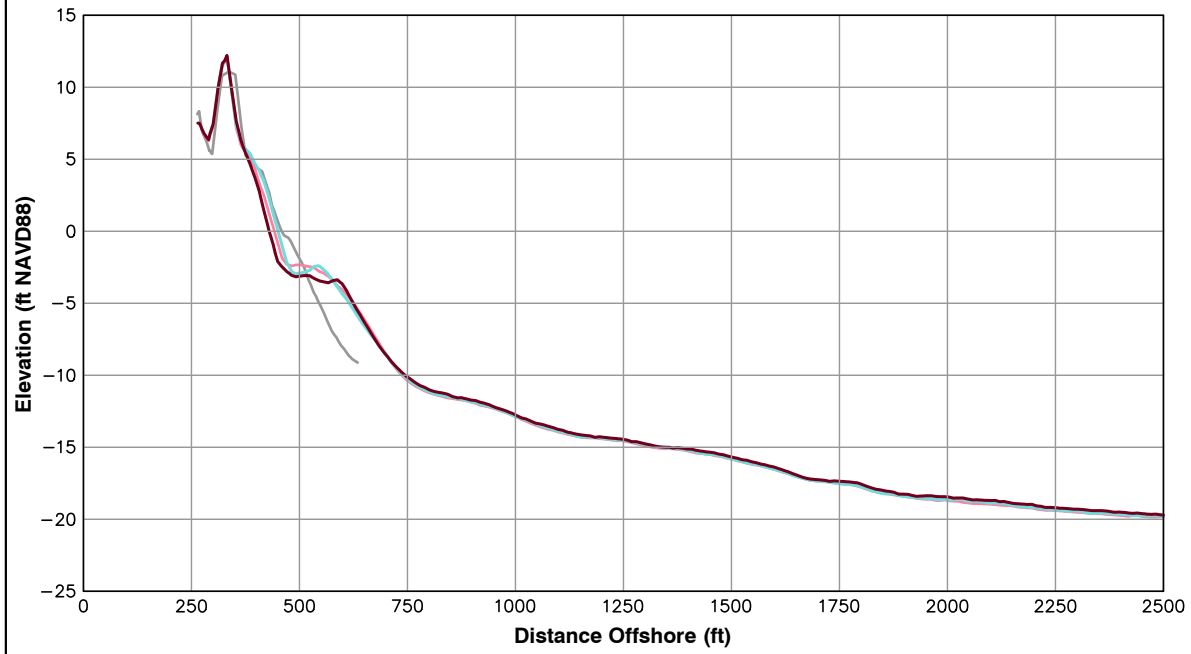
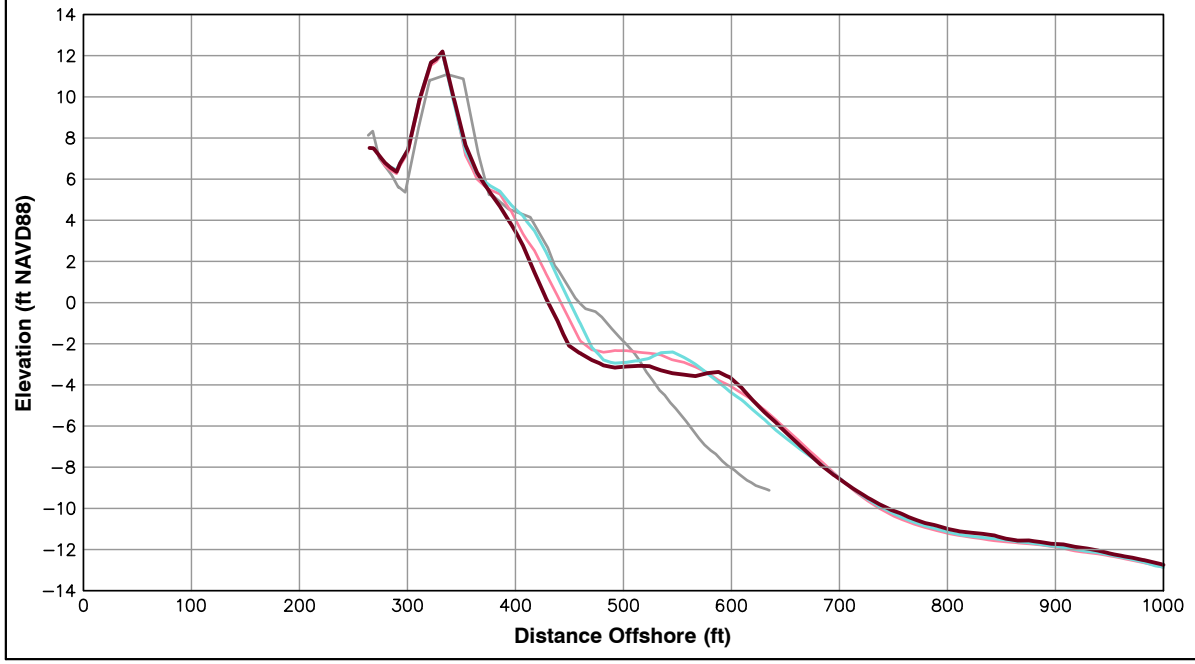
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 79+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.19 ft/yr	-19.72 ft
Volume Change Above -15 ft NAVD88	-1.03 cy/ft/yr	-3.53 cy/ft
Volume Change Above 0 ft NAVD88	-1.03 cy/ft/yr	-3.38 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

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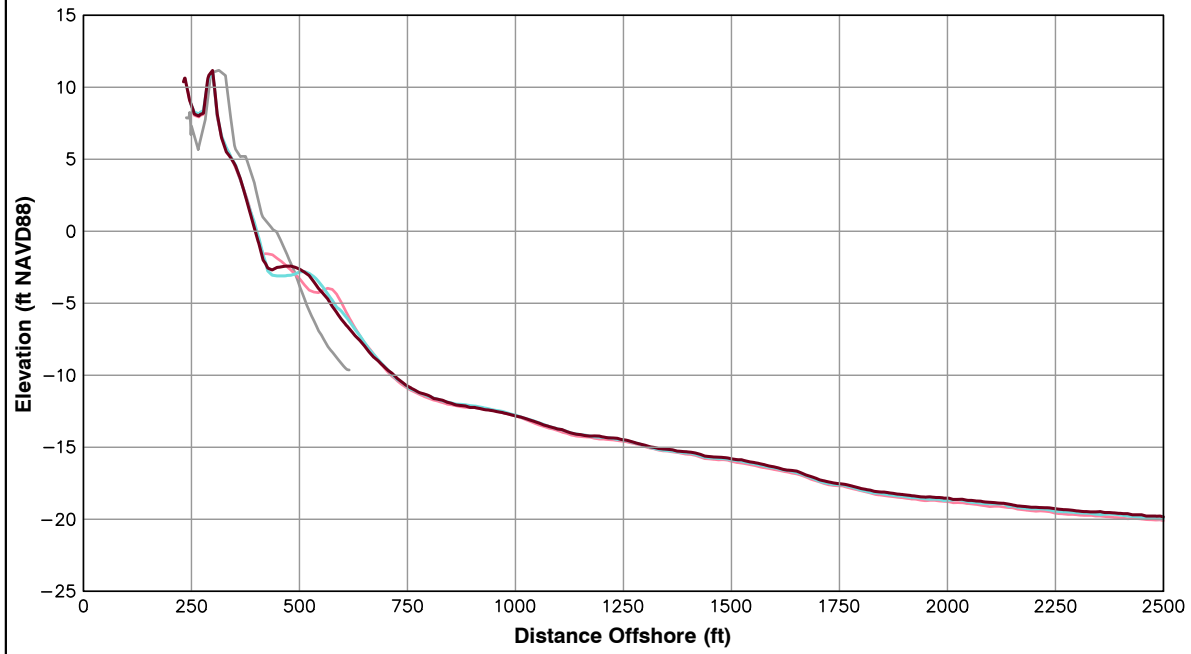
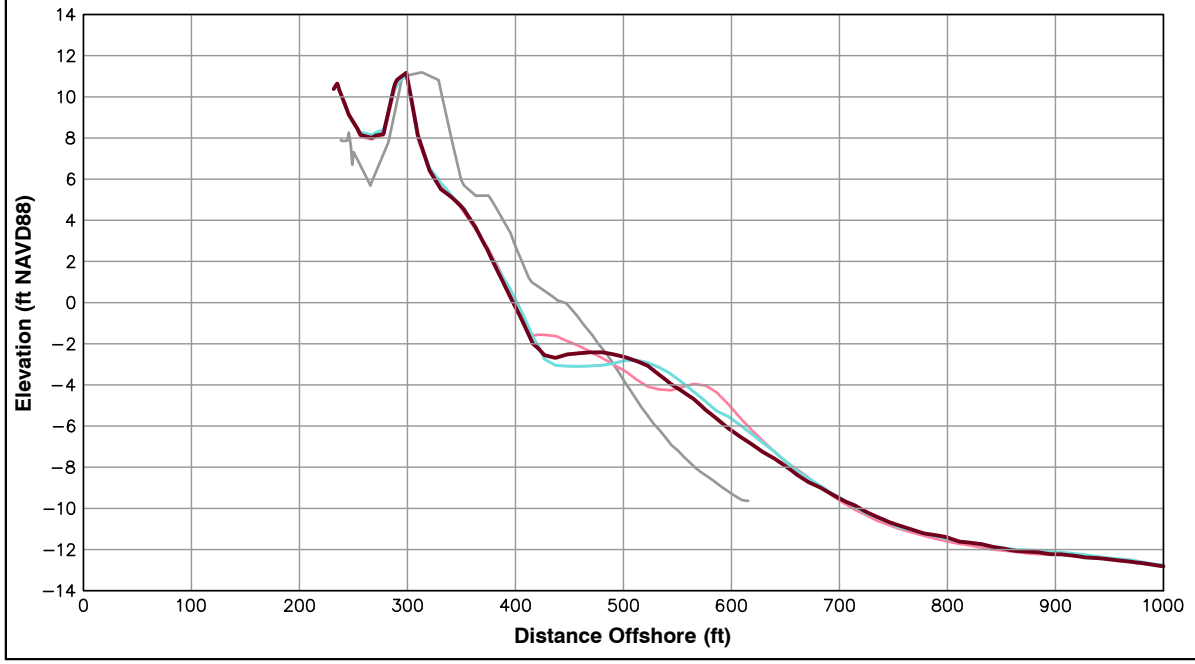
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 81+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-1.76 ft/yr	-2.78 ft
Volume Change Above -15 ft NAVD88	-0.36 cy/ft/yr	-1.70 cy/ft
Volume Change Above 0 ft NAVD88	0.09 cy/ft/yr	-0.42 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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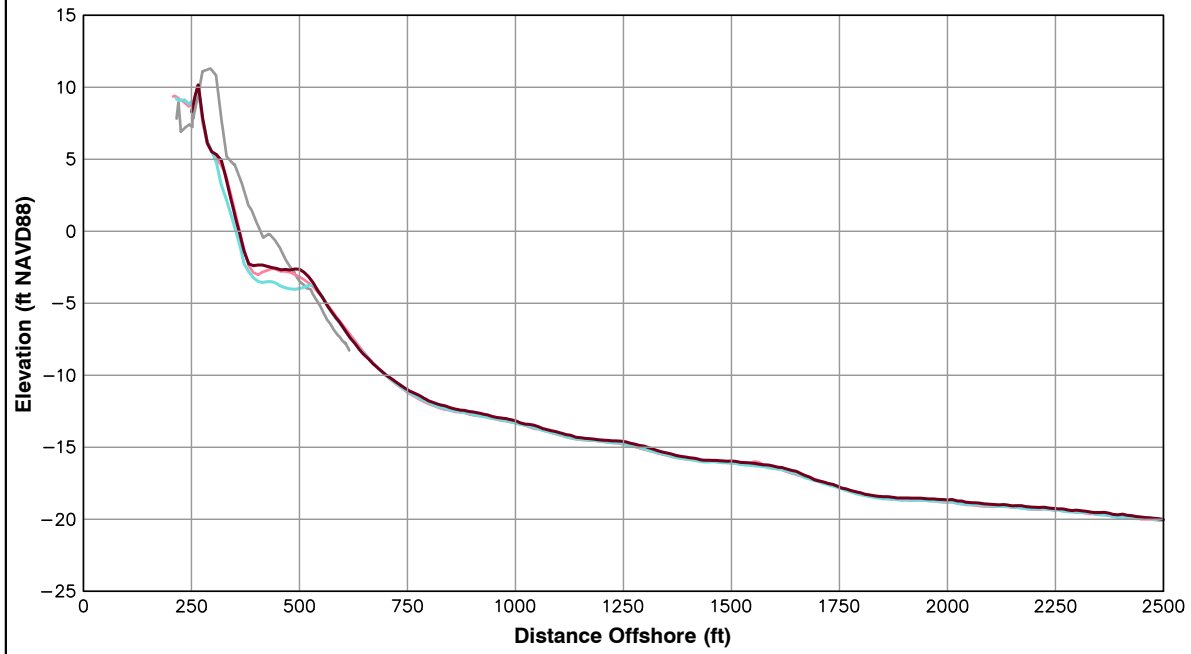
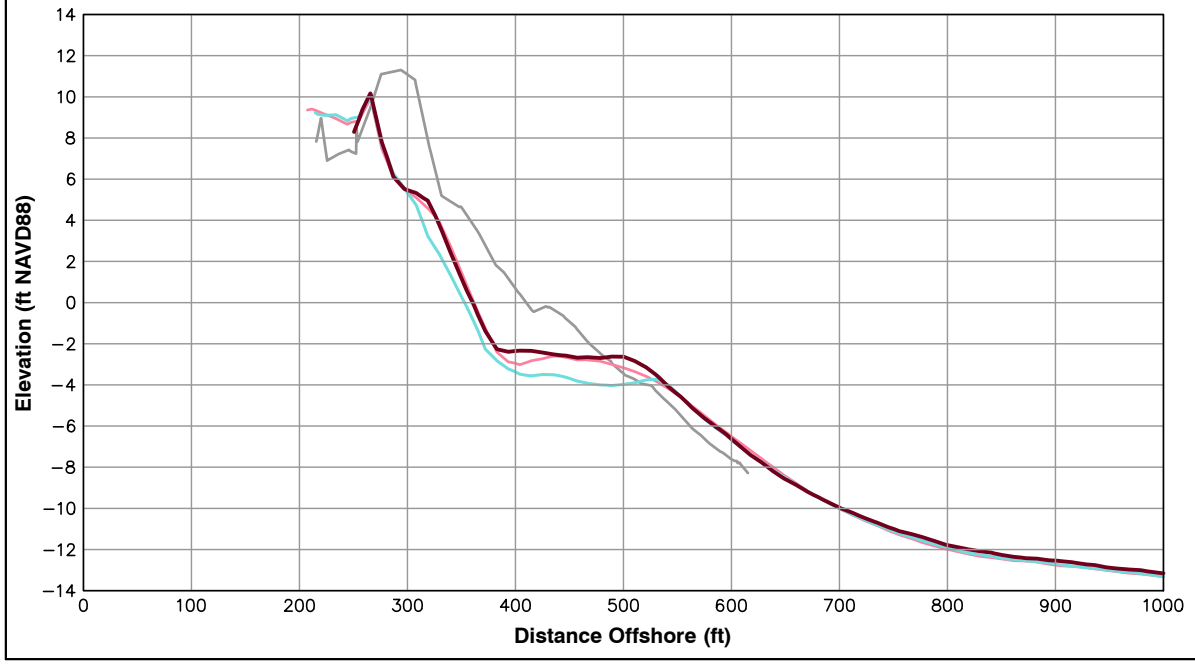
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





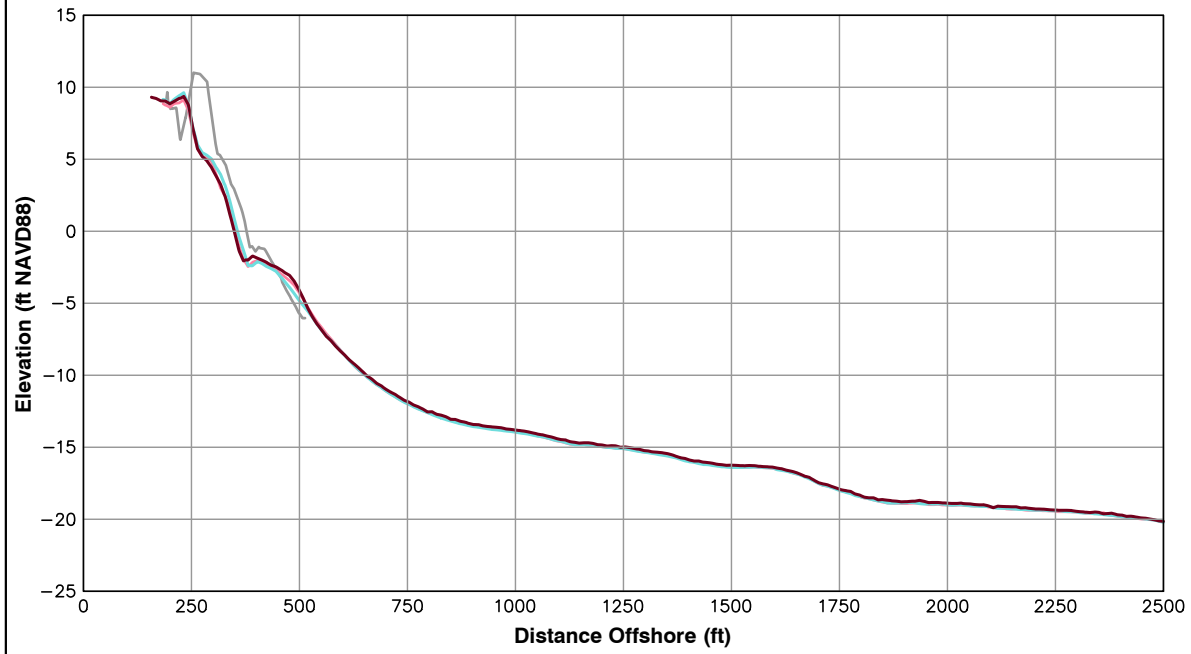
Survey Transect 83+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-2.10 ft/yr	8.36 ft
Volume Change Above -15 ft NAVD88	4.90 cy/ft/yr	11.80 cy/ft
Volume Change Above 0 ft NAVD88	0.14 cy/ft/yr	2.23 cy/ft

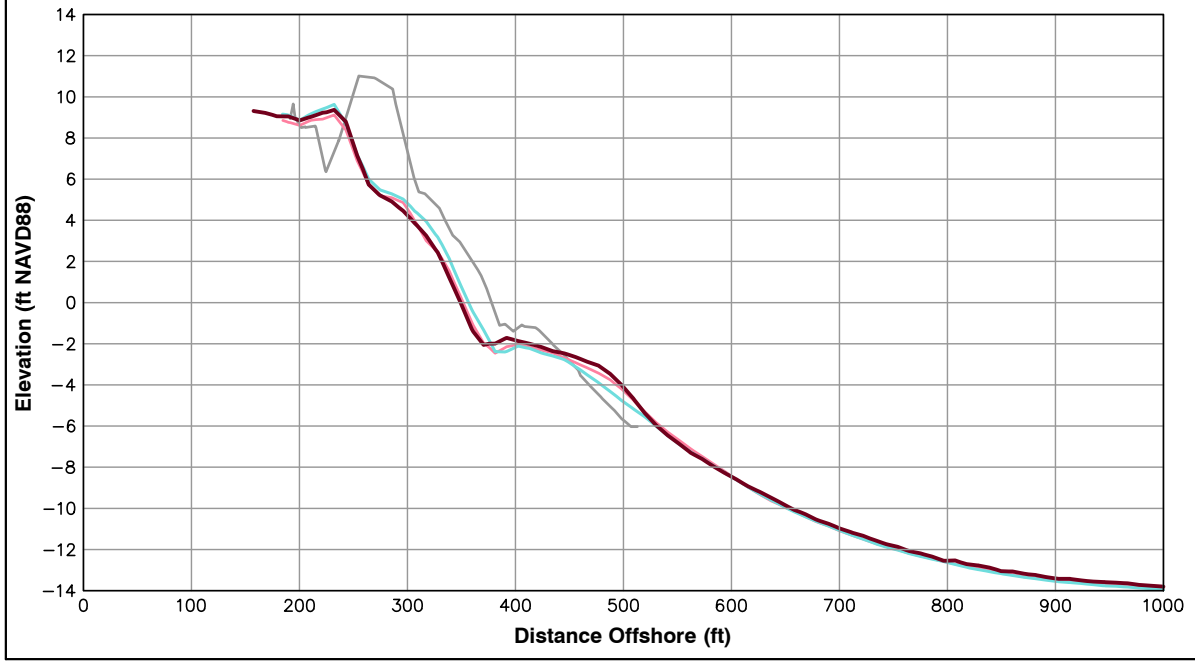
LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 85+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-2.46 ft/yr	-7.39 ft
Volume Change Above -15 ft NAVD88	3.60 cy/ft/yr	2.81 cy/ft
Volume Change Above 0 ft NAVD88	0.34 cy/ft/yr	-2.28 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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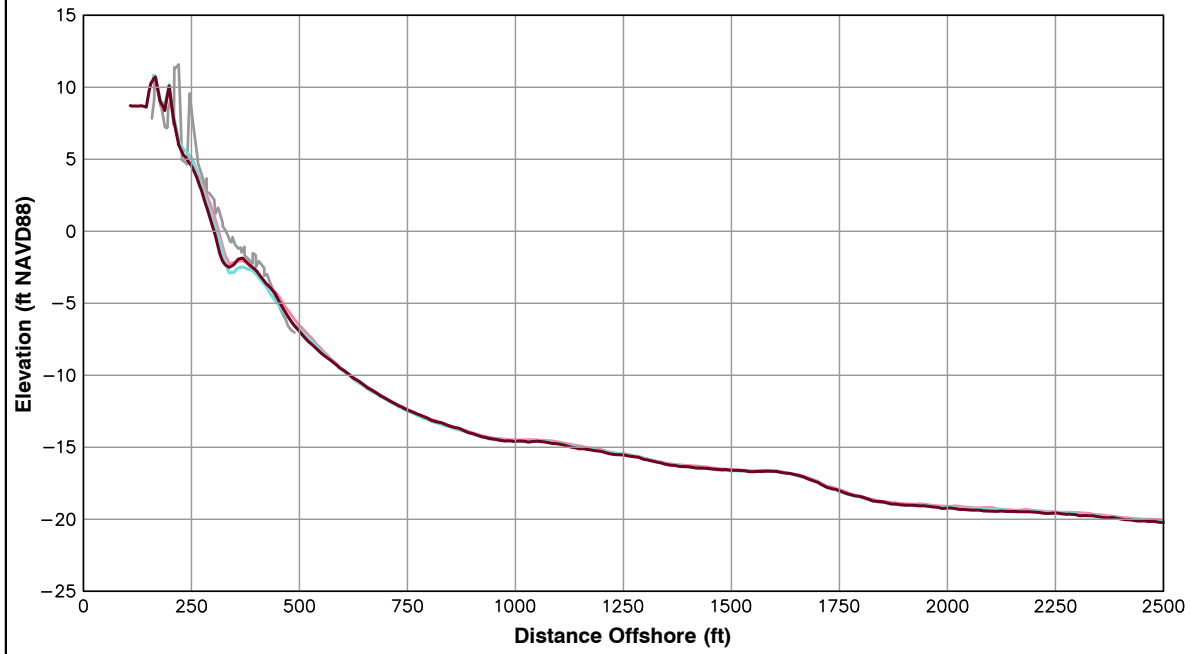
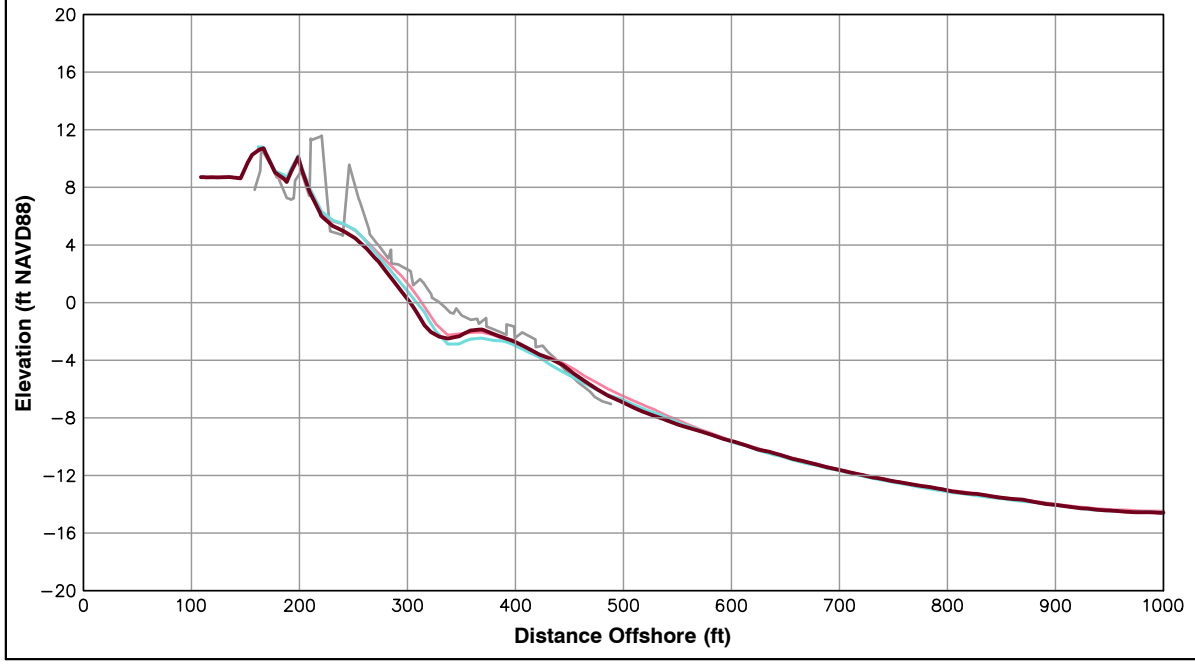
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 87+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.66 ft/yr	-5.38 ft
Volume Change Above -15 ft NAVD88	-5.75 cy/ft/yr	-0.47 cy/ft
Volume Change Above 0 ft NAVD88	-1.90 cy/ft/yr	-1.88 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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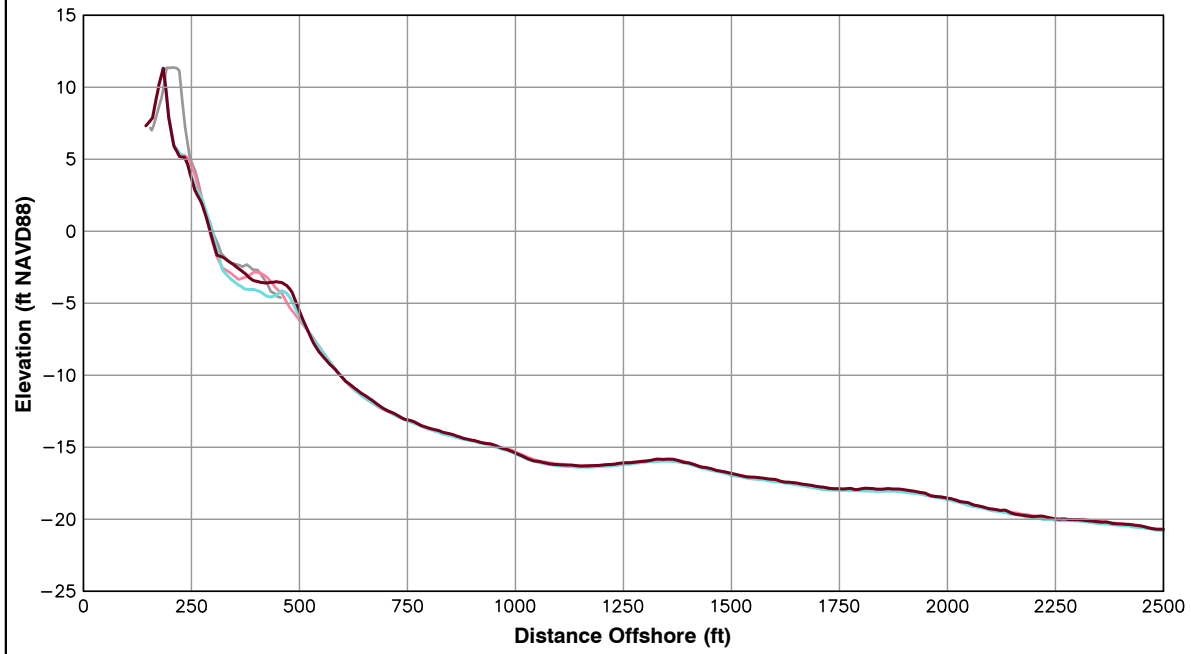
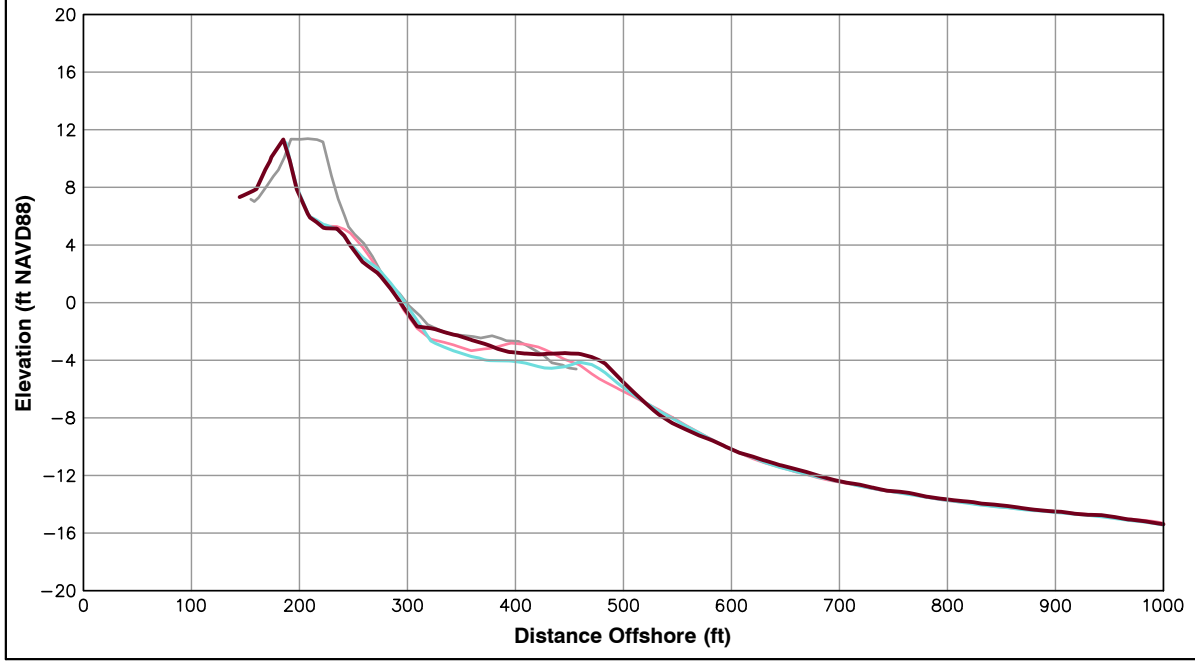
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 93+41	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-0.71 ft/yr	-4.07 ft
Volume Change Above -15 ft NAVD88	2.12 cy/ft/yr	5.29 cy/ft
Volume Change Above 0 ft NAVD88	-1.08 cy/ft/yr	-0.83 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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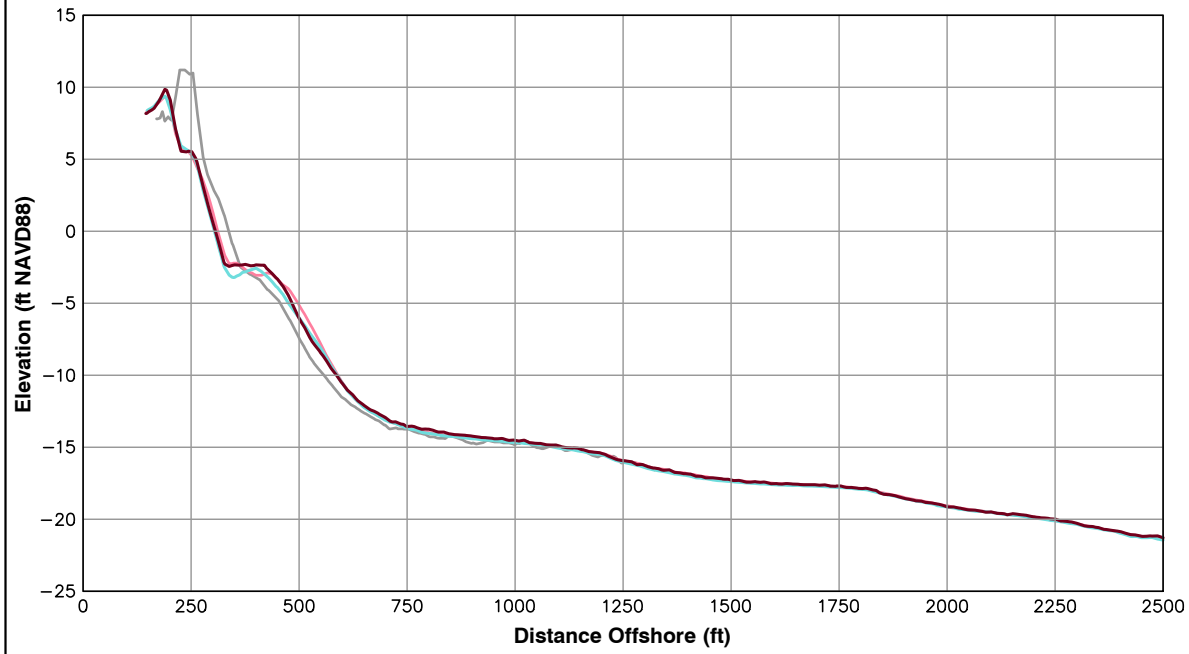
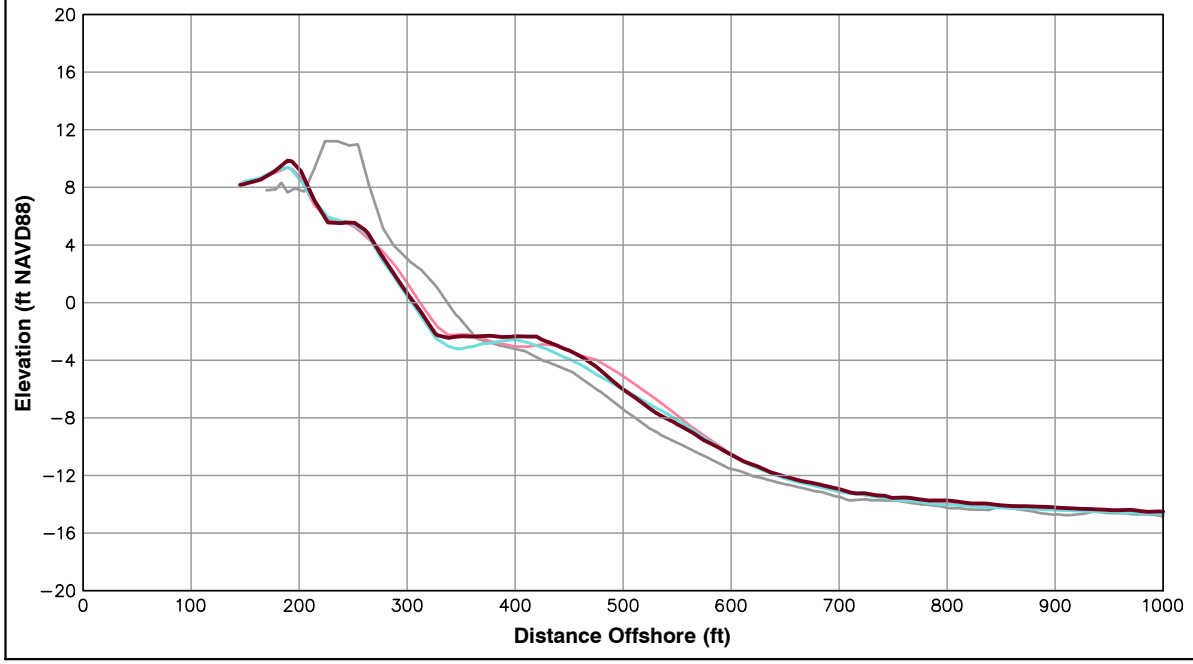
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 103+08	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-6.15 ft/yr	1.71 ft
Volume Change Above -15 ft NAVD88	-0.52 cy/ft/yr	6.03 cy/ft
Volume Change Above 0 ft NAVD88	-0.09 cy/ft/yr	0.62 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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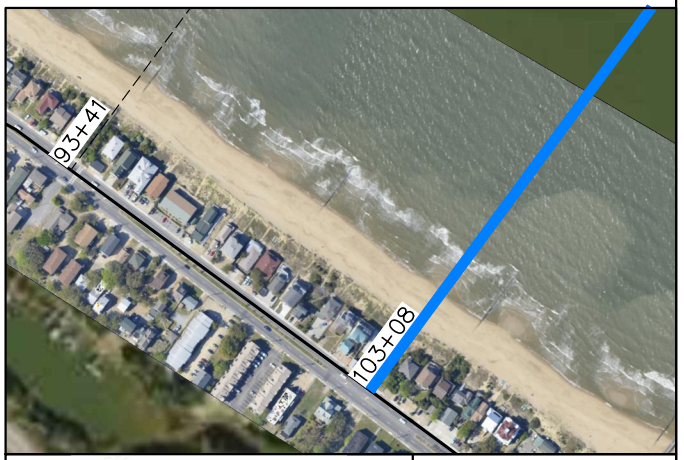

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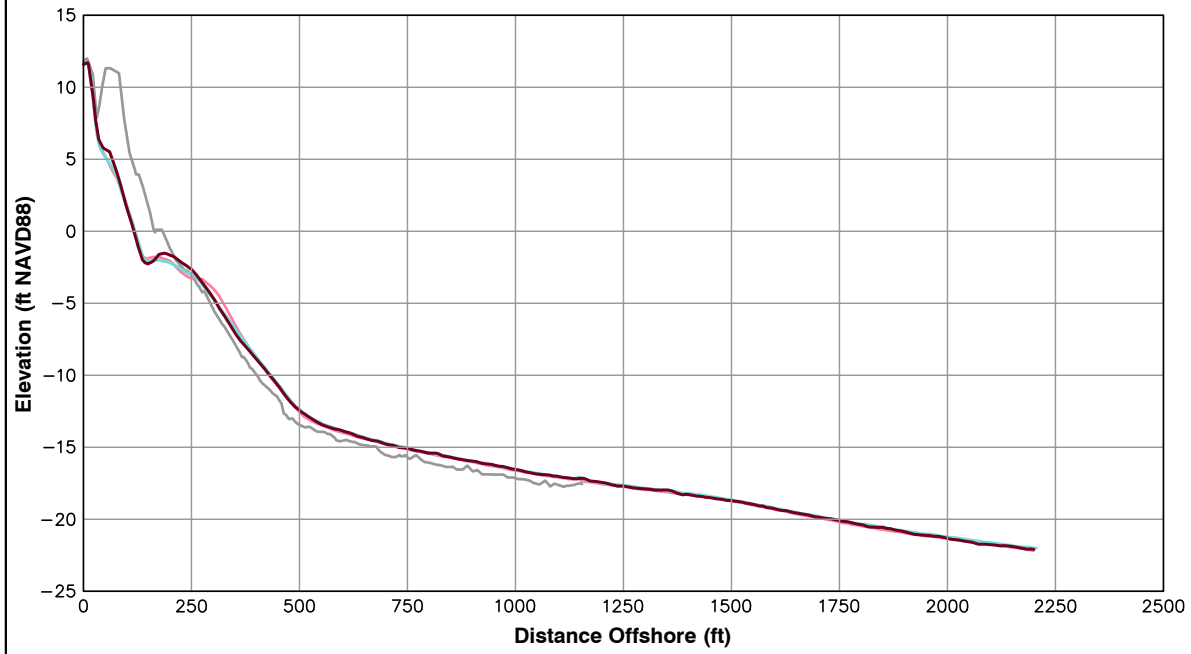
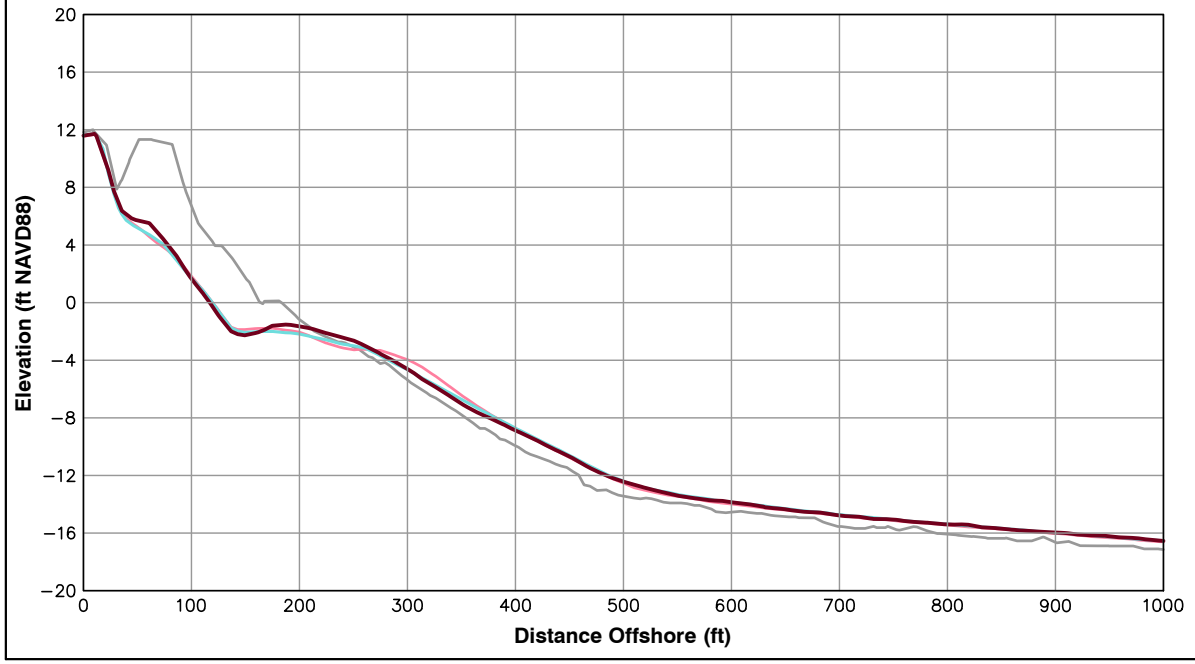
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 120+93	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-2.17 ft/yr	-1.92 ft
Volume Change Above -15 ft NAVD88	0.44 cy/ft/yr	0.86 cy/ft
Volume Change Above 0 ft NAVD88	0.85 cy/ft/yr	0.90 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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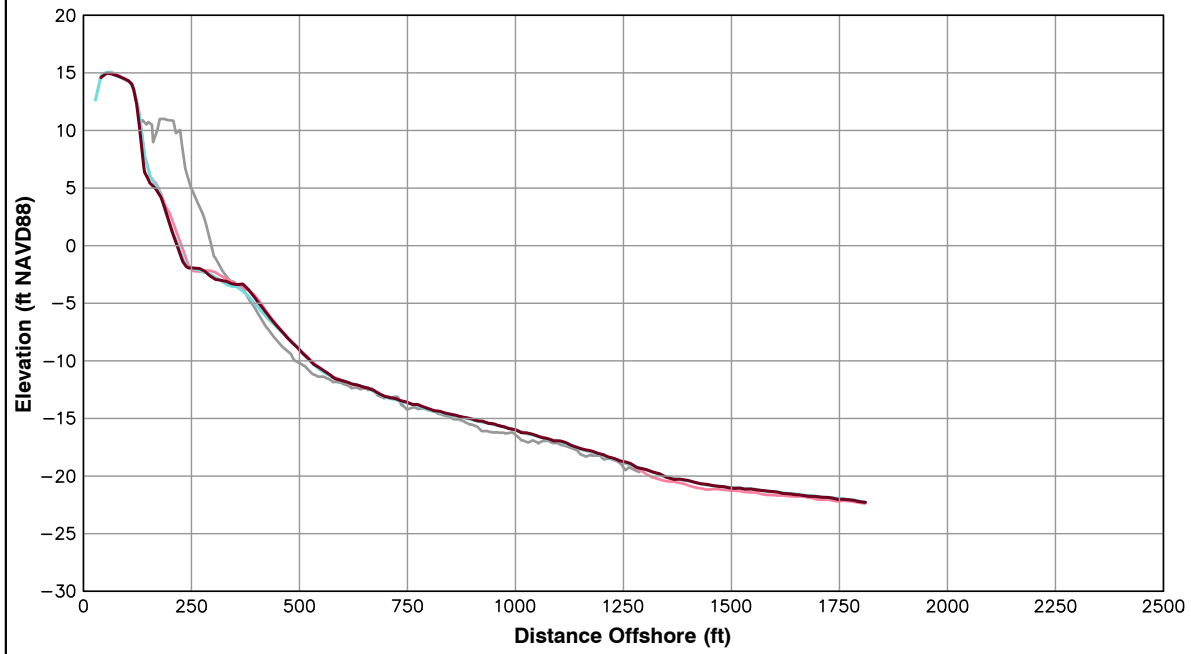
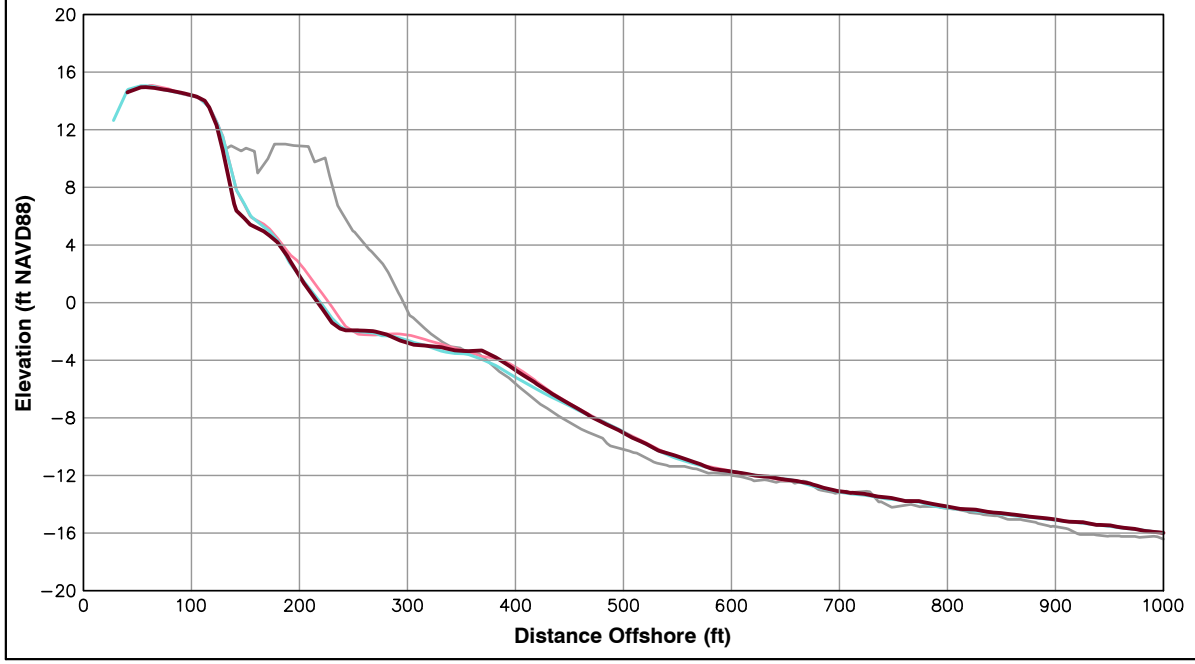
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 129+17	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-9.45 ft/yr	-1.63 ft
Volume Change Above -15 ft NAVD88	-4.09 cy/ft/yr	0.50 cy/ft
Volume Change Above 0 ft NAVD88	-2.78 cy/ft/yr	-1.72 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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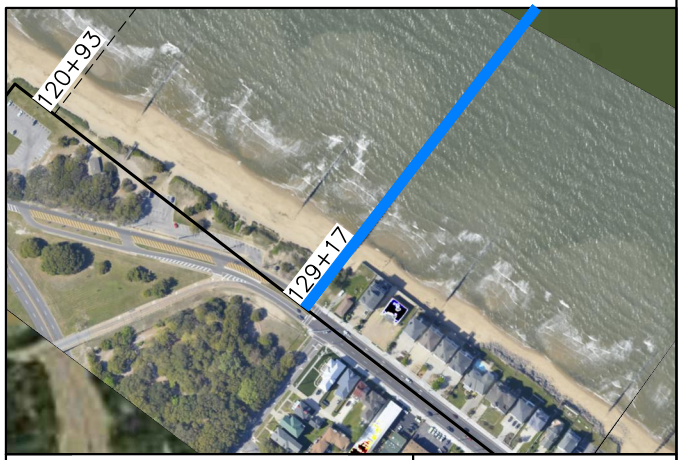

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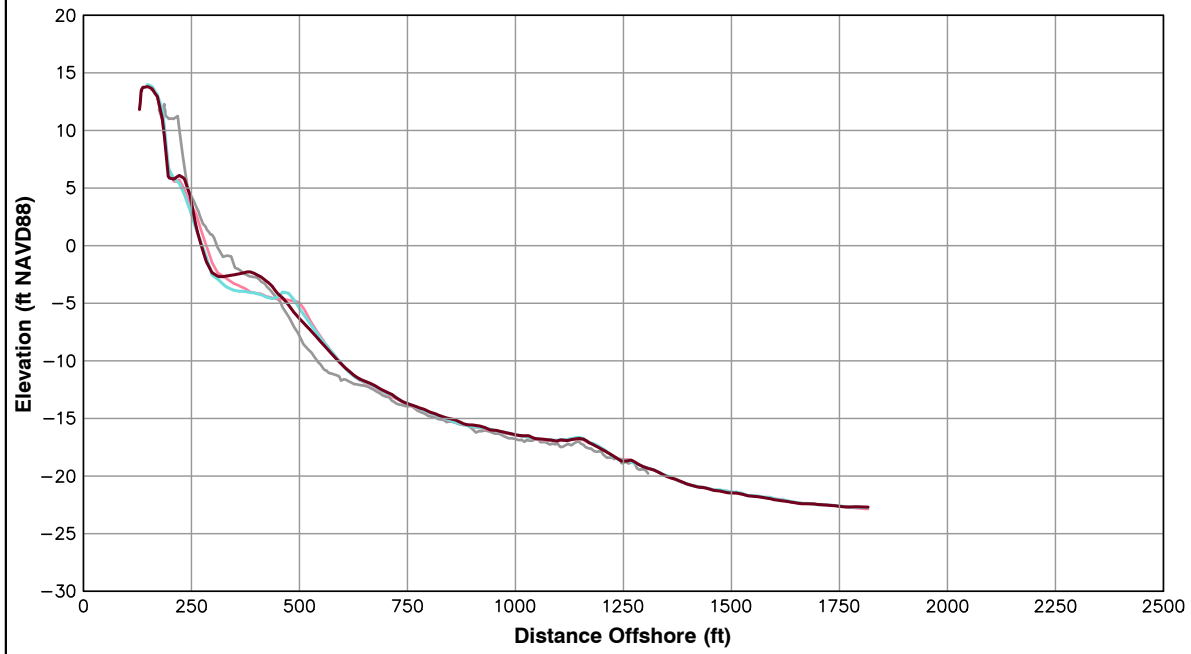
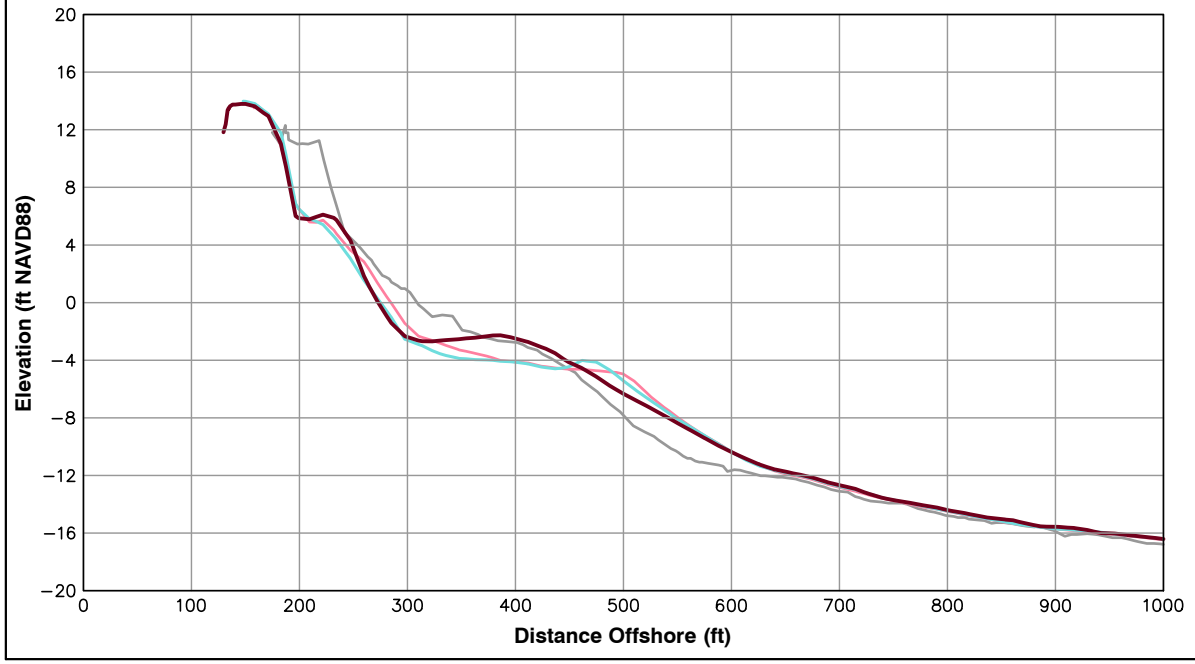
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 141+98	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-9.61 ft/yr	0.26 ft
Volume Change Above -15 ft NAVD88	1.51 cy/ft/yr	4.94 cy/ft
Volume Change Above 0 ft NAVD88	-0.41 cy/ft/yr	0.64 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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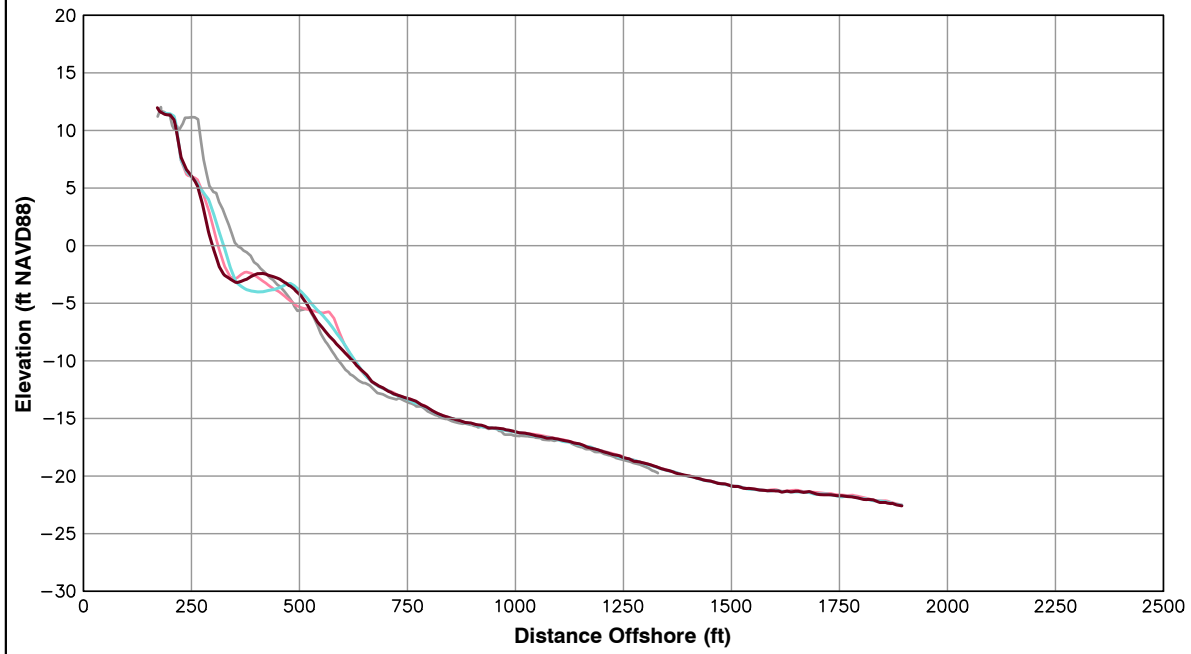
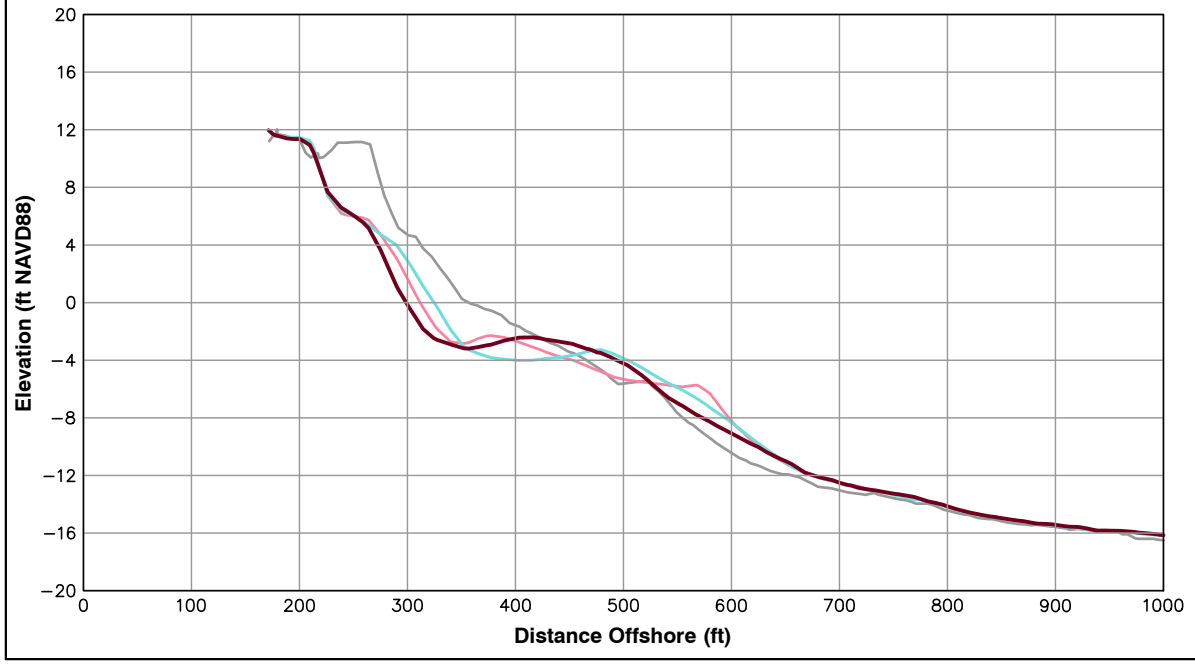
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 152+01	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-12.91 ft/yr	-24.98 ft
Volume Change Above -15 ft NAVD88	-3.60 cy/ft/yr	-5.79 cy/ft
Volume Change Above 0 ft NAVD88	-2.03 cy/ft/yr	-3.84 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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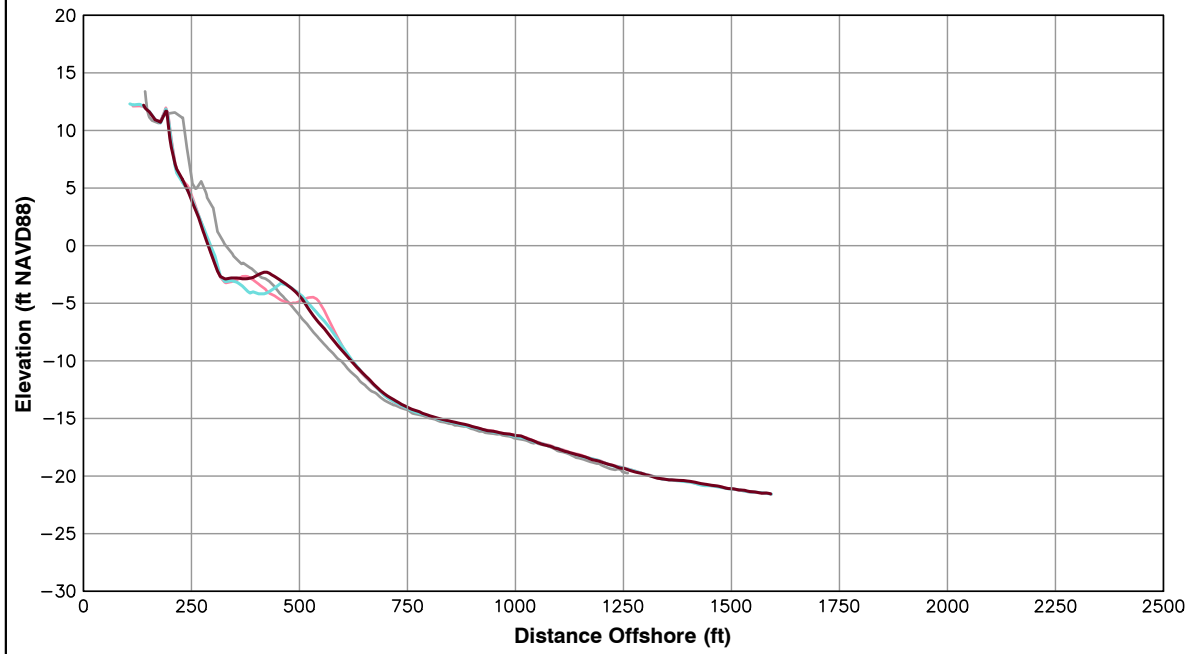
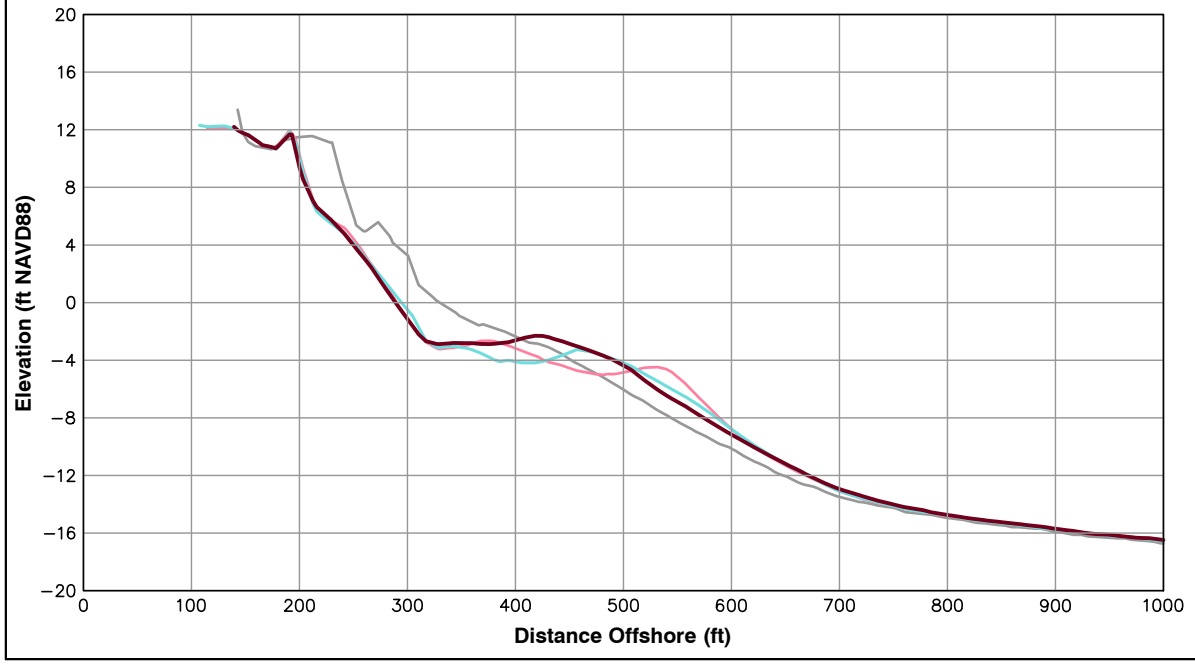
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 163+49	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-2.43 ft/yr	-4.47 ft
Volume Change Above -15 ft NAVD88	1.03 cy/ft/yr	2.10 cy/ft
Volume Change Above 0 ft NAVD88	-1.10 cy/ft/yr	-0.53 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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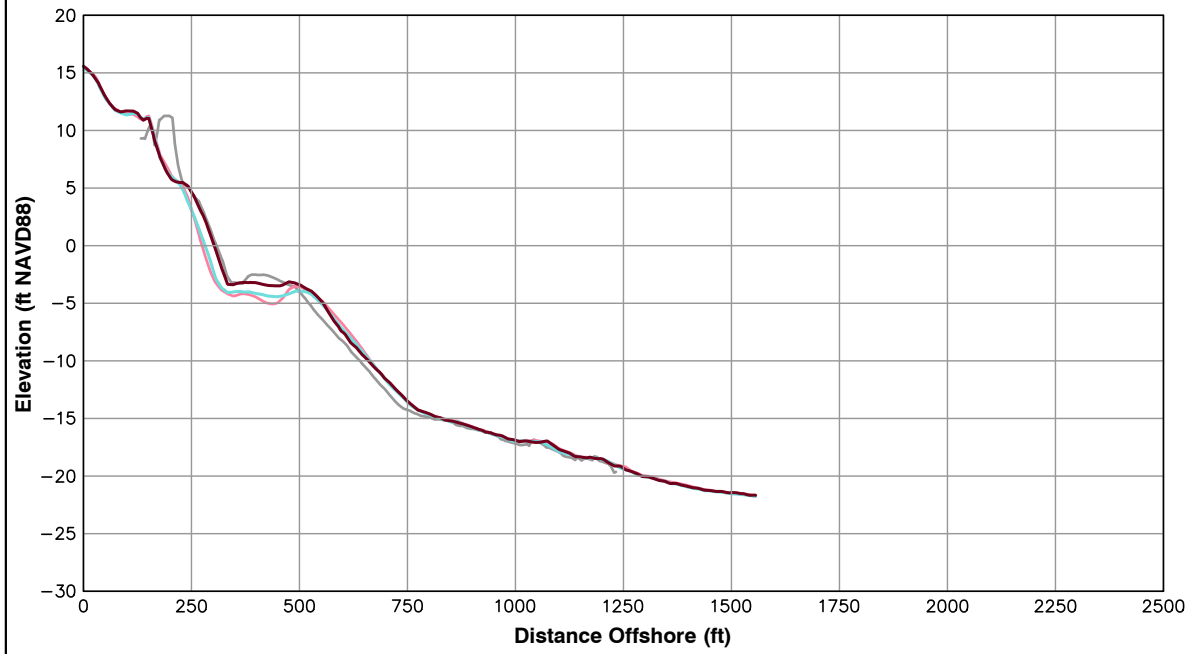
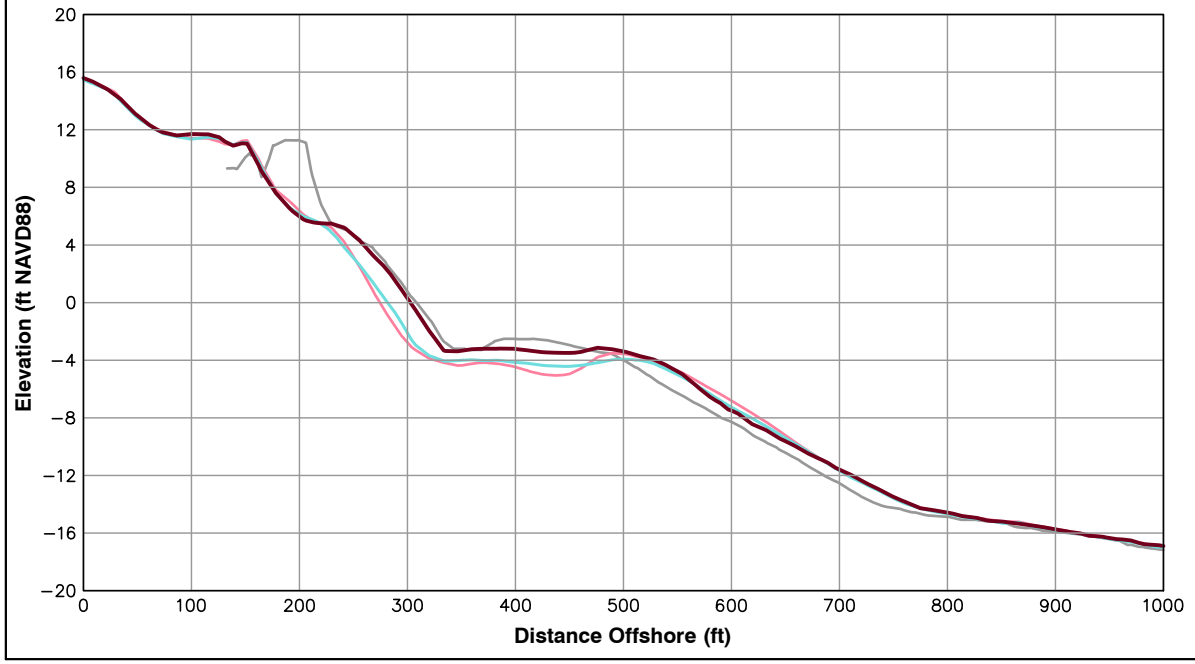
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 169+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	25.28 ft/yr	21.71 ft
Volume Change Above -15 ft NAVD88	11.66 cy/ft/yr	12.70 cy/ft
Volume Change Above 0 ft NAVD88	3.47 cy/ft/yr	4.36 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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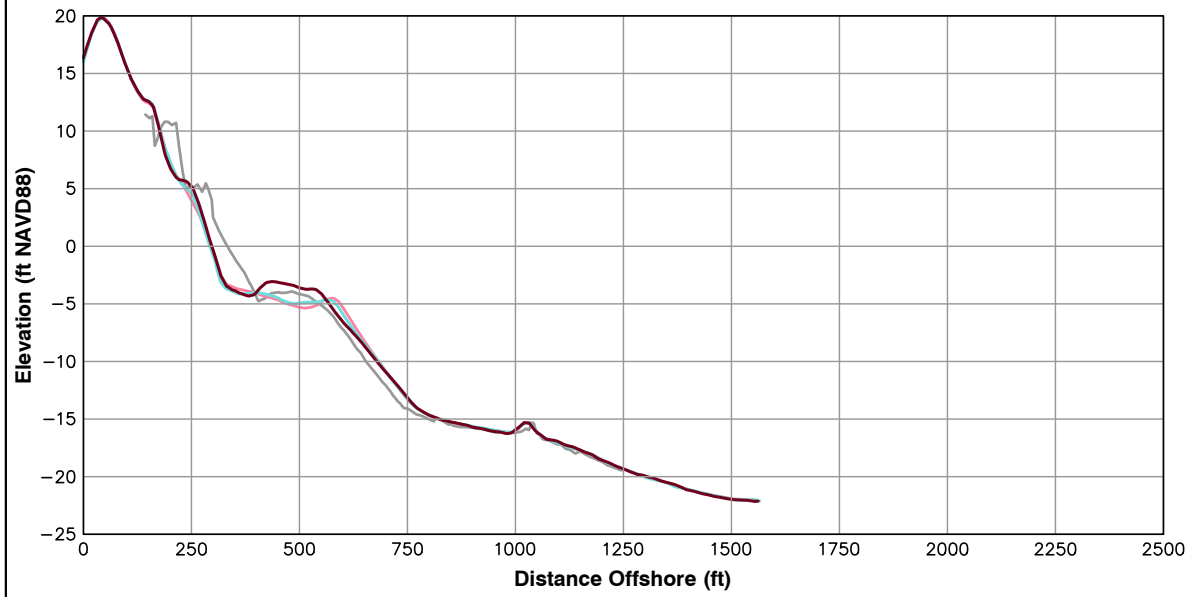
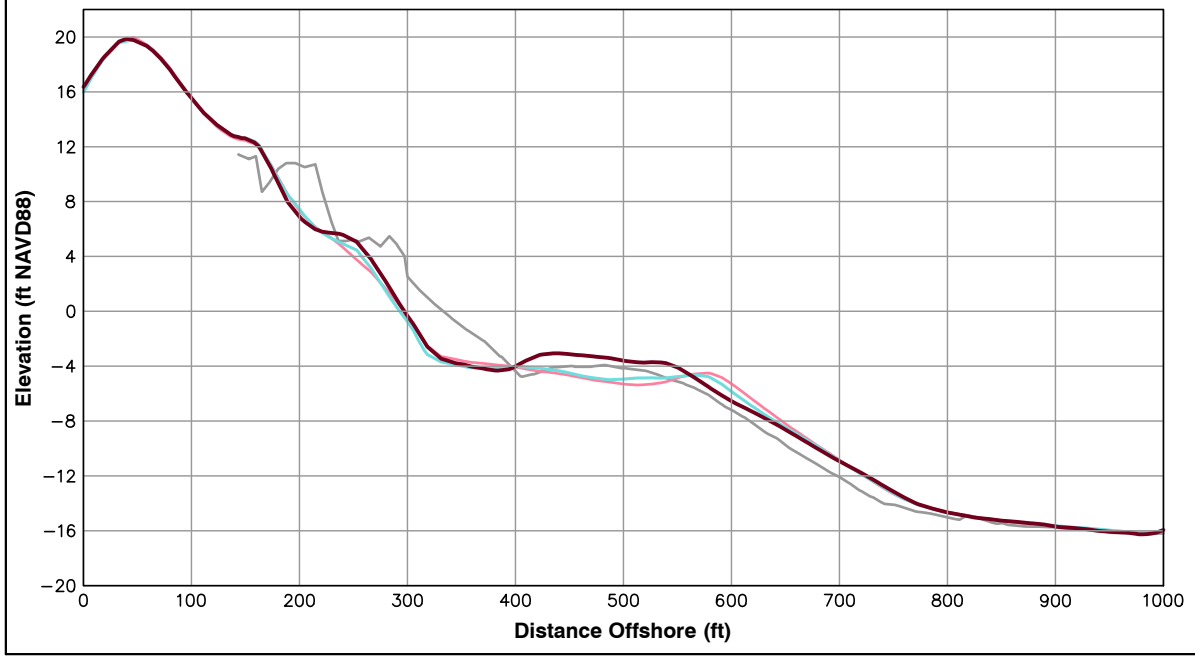
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 171+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	1.94 ft/yr	5.09 ft
Volume Change Above -15 ft NAVD88	5.27 cy/ft/yr	6.78 cy/ft
Volume Change Above 0 ft NAVD88	1.35 cy/ft/yr	1.03 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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City of Norfolk

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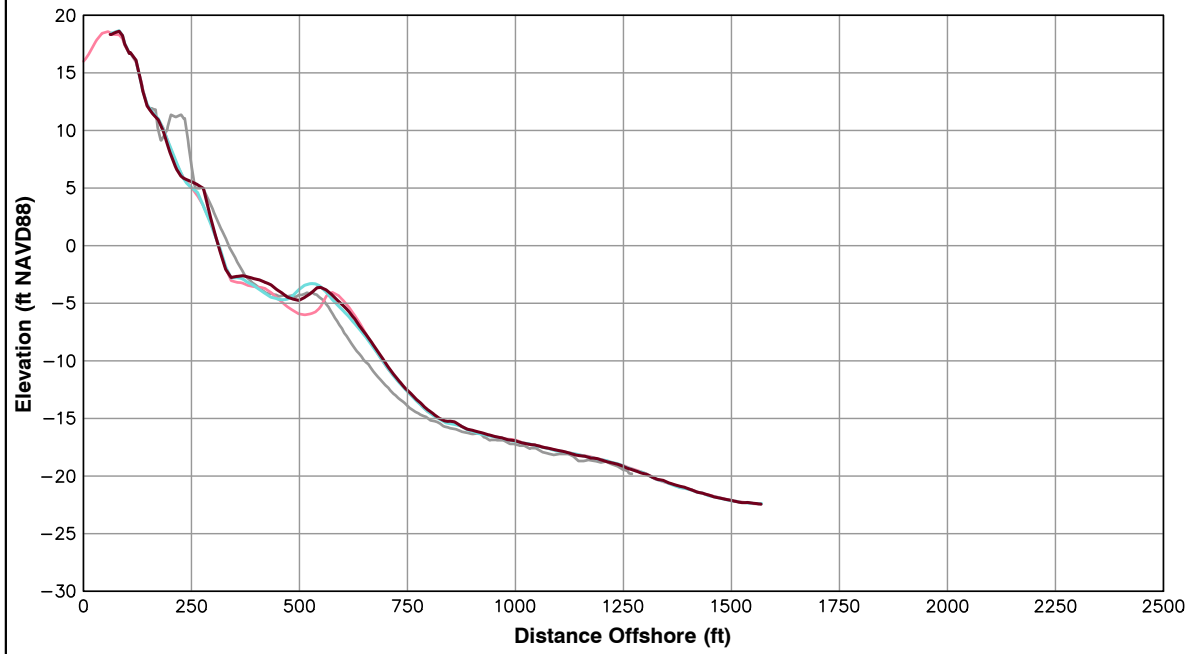

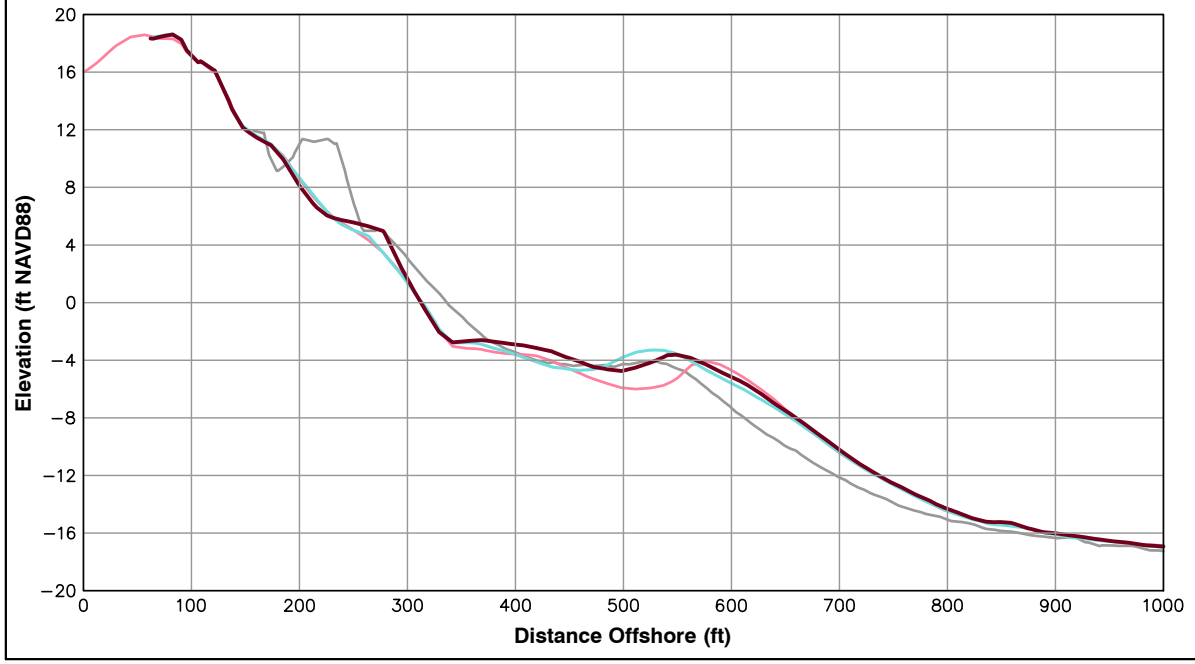

Survey Transect 173+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	0.47 ft/yr	1.19 ft
Volume Change Above -15 ft NAVD88	8.51 cy/ft/yr	4.06 cy/ft
Volume Change Above 0 ft NAVD88	1.29 cy/ft/yr	0.89 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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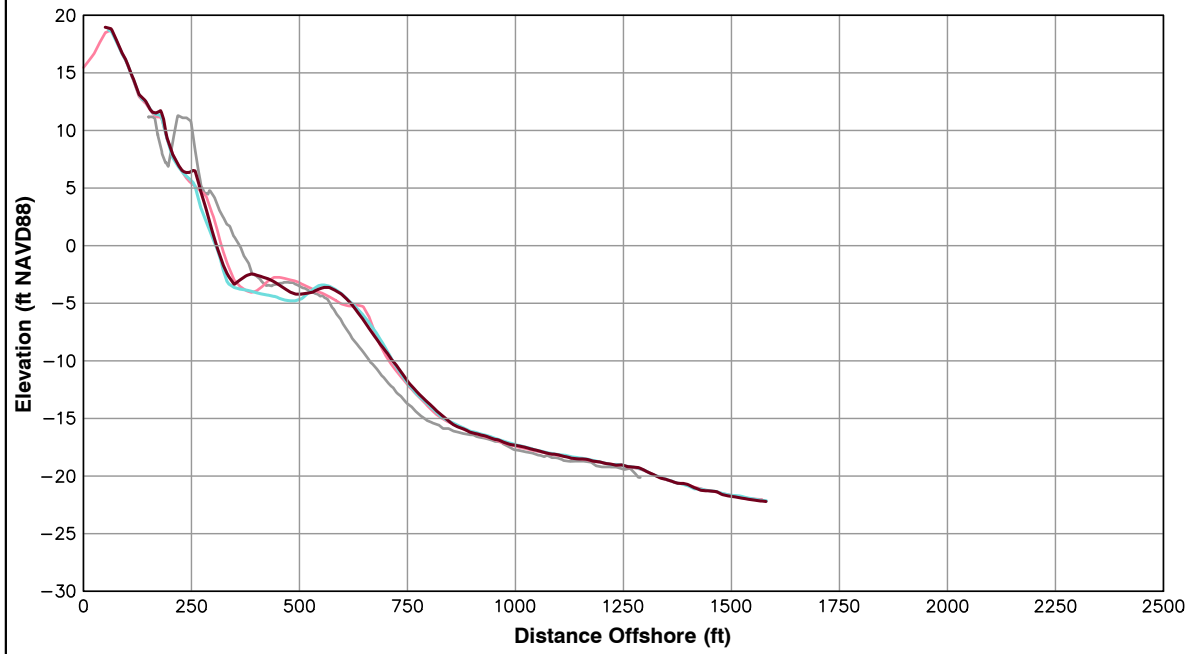
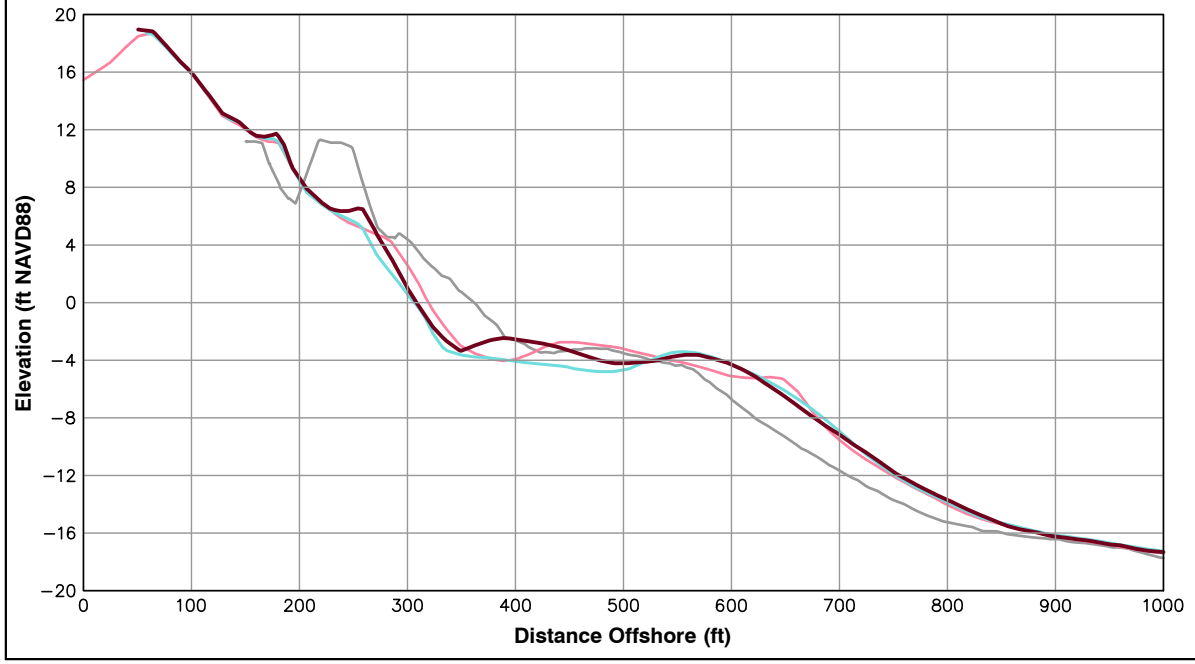
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 175+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-11.70 ft/yr	4.37 ft
Volume Change Above -15 ft NAVD88	1.22 cy/ft/yr	9.29 cy/ft
Volume Change Above 0 ft NAVD88	0.28 cy/ft/yr	3.25 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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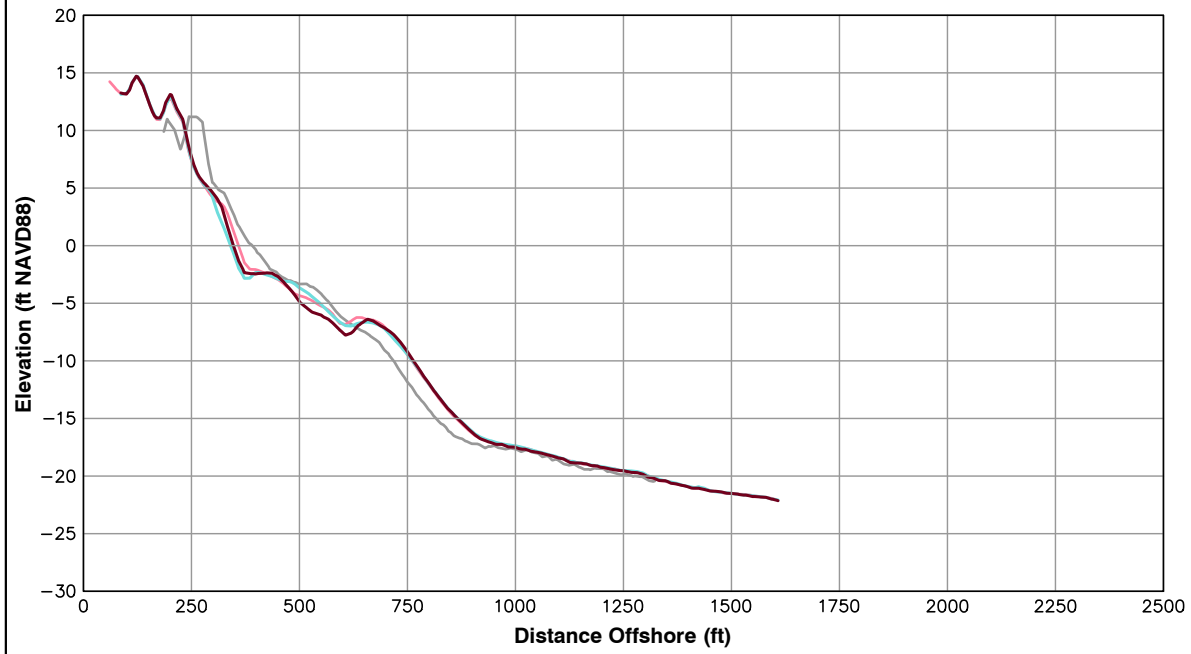
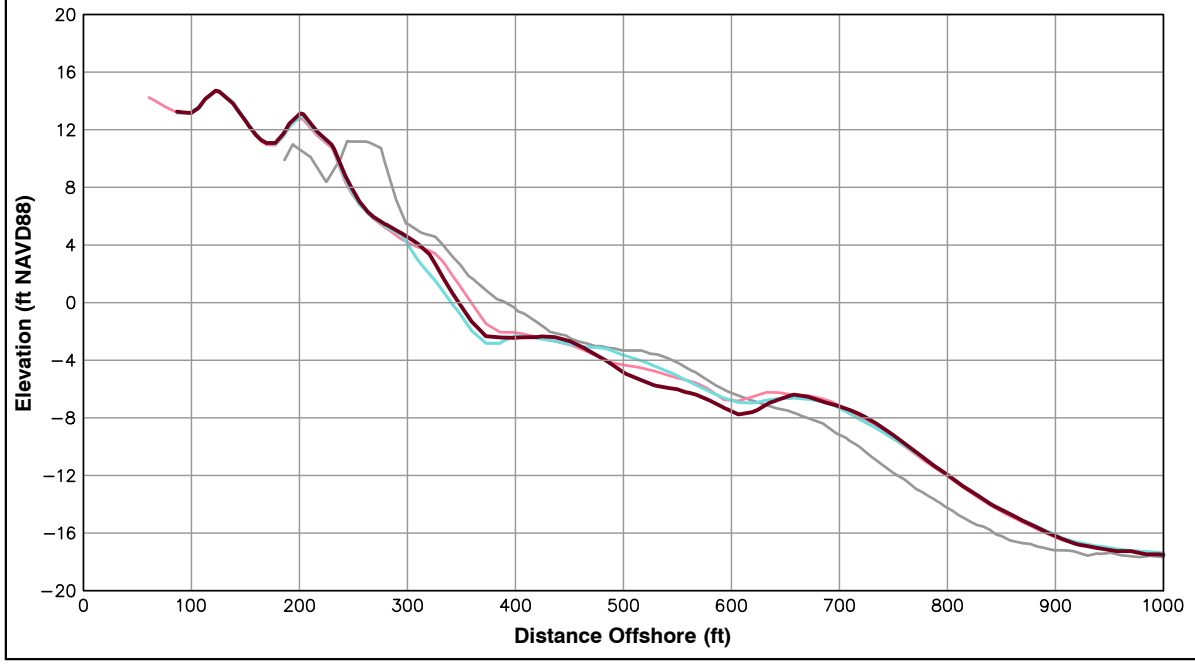
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





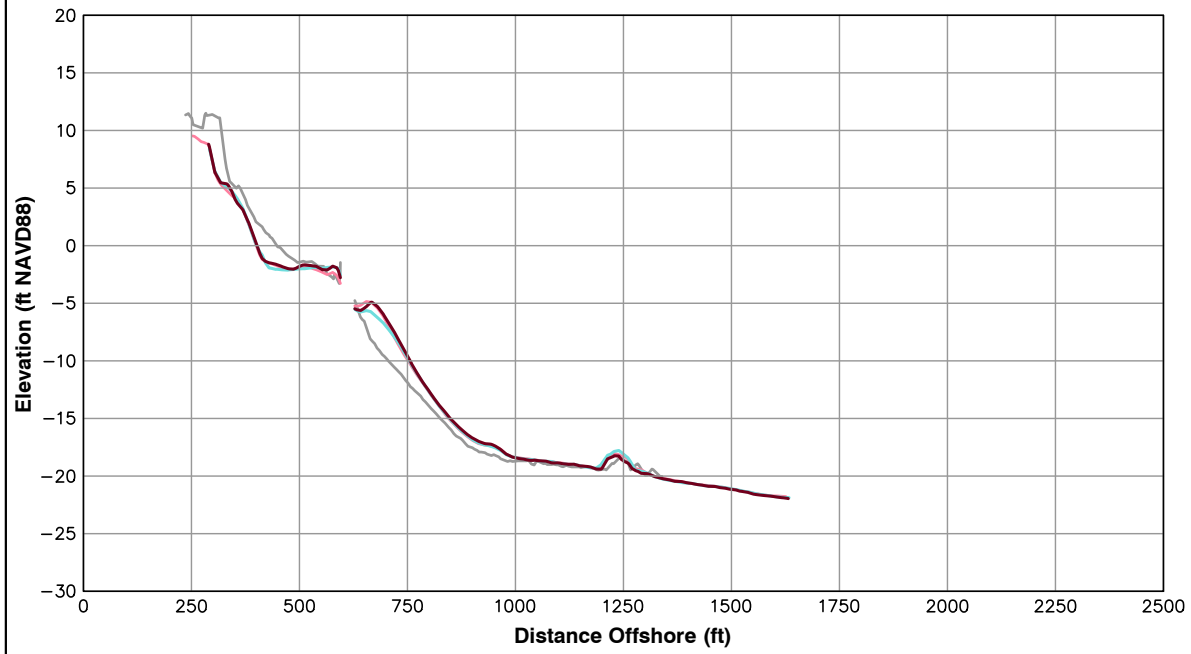
Survey Transect 177+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.45 ft/yr	8.02 ft
Volume Change Above -15 ft NAVD88	-4.49 cy/ft/yr	-1.03 cy/ft
Volume Change Above 0 ft NAVD88	0.20 cy/ft/yr	2.33 cy/ft

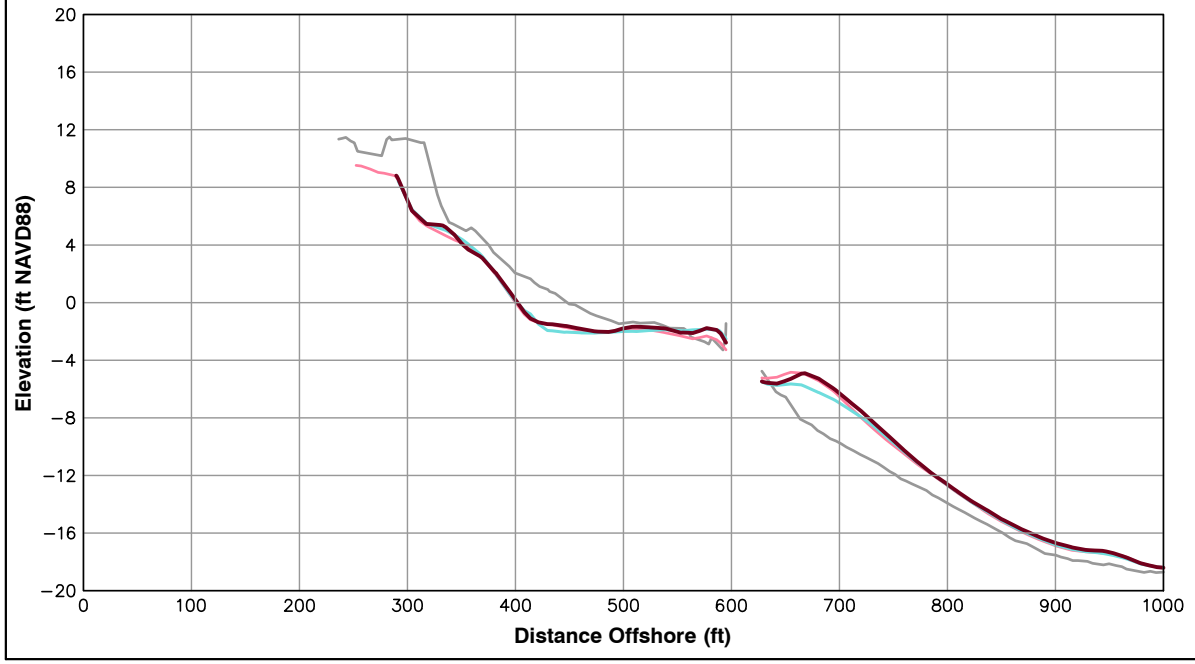
LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 179+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	1.54 ft/yr	1.33 ft
Volume Change Above -15 ft NAVD88	2.86 cy/ft/yr	3.21 cy/ft
Volume Change Above 0 ft NAVD88	0.58 cy/ft/yr	-0.06 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
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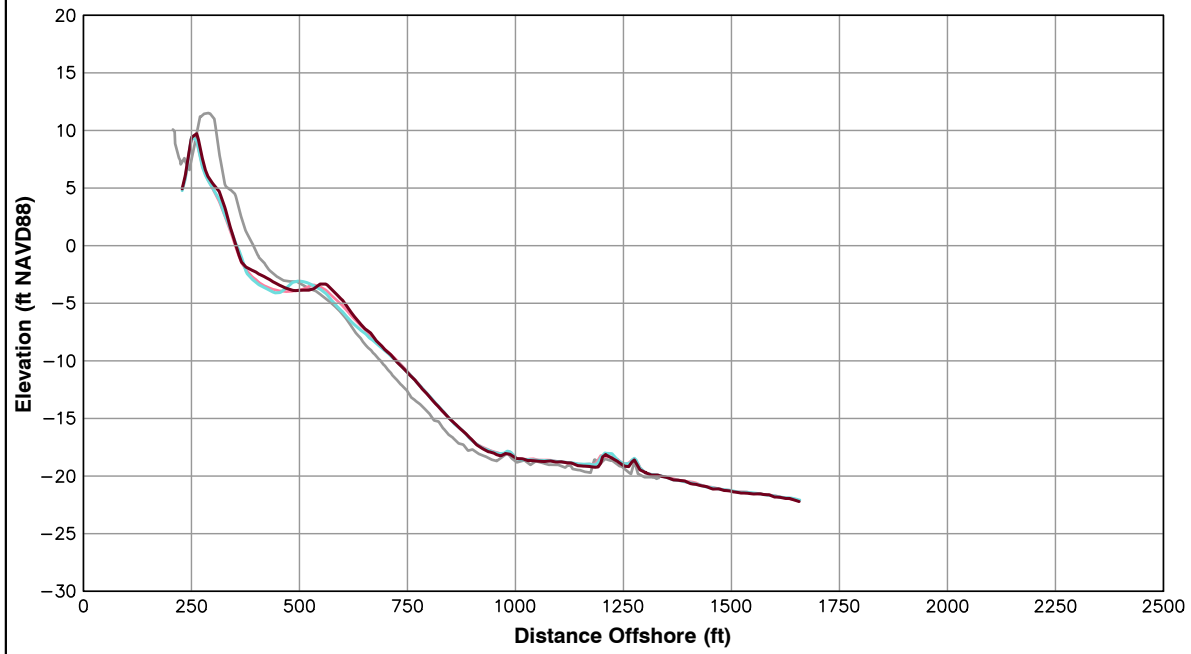
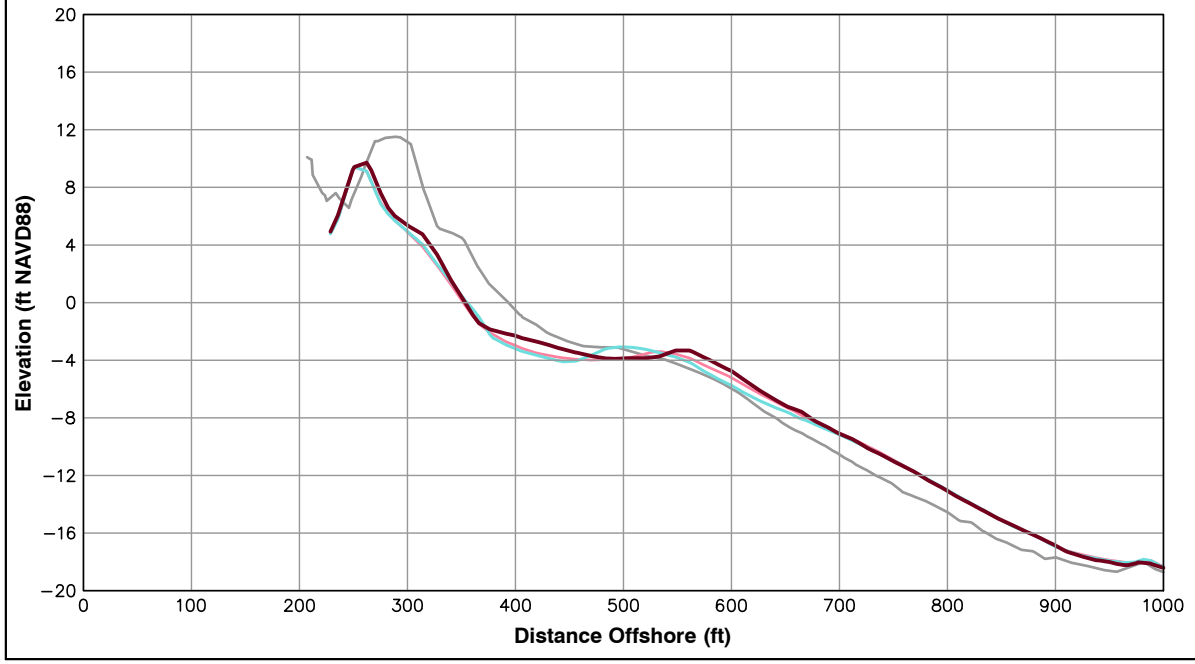
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 181+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	2.30 ft/yr	0.08 ft
Volume Change Above -15 ft NAVD88	5.05 cy/ft/yr	6.30 cy/ft
Volume Change Above 0 ft NAVD88	1.95 cy/ft/yr	1.79 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
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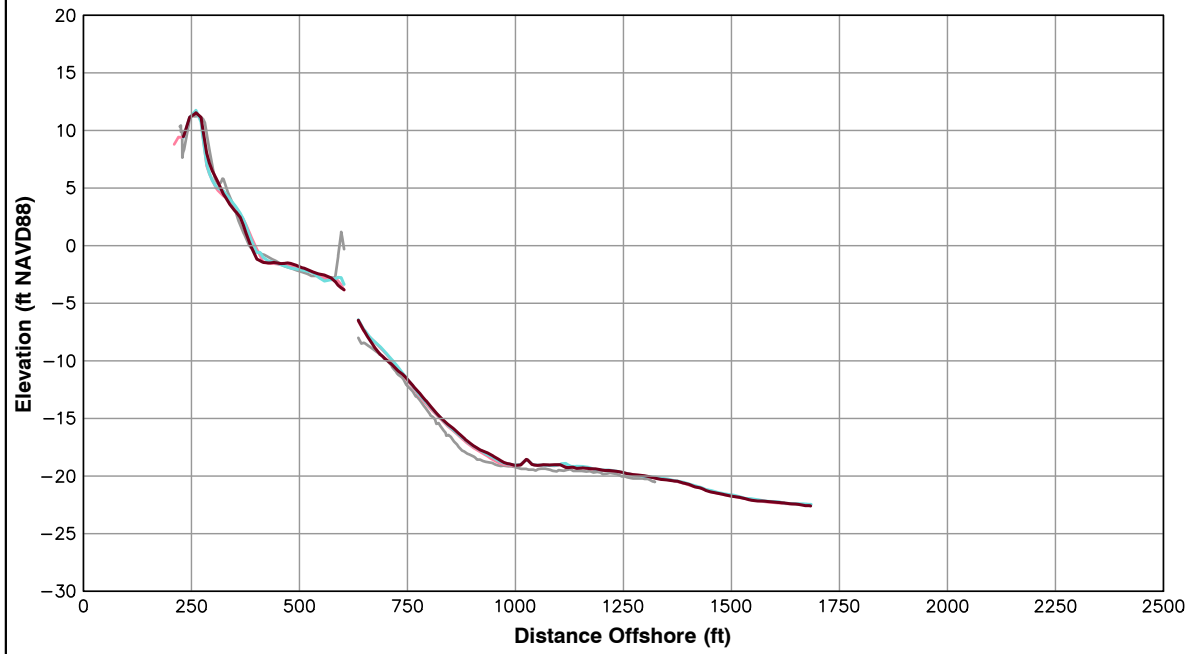
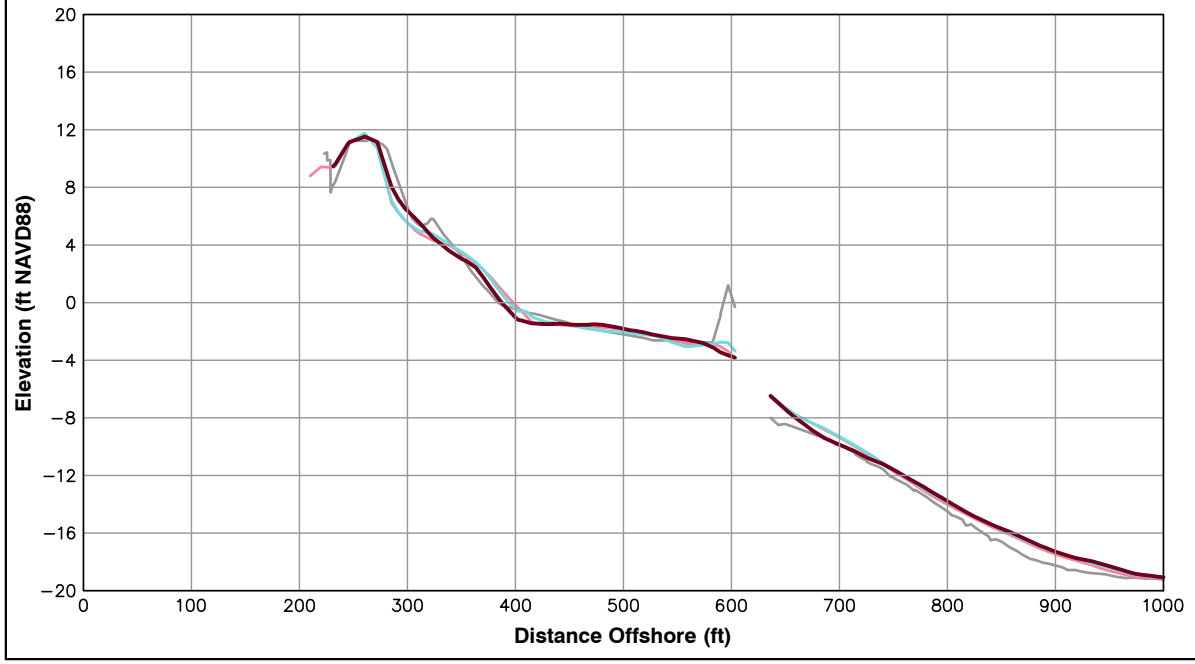
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 183+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-8.22 ft/yr	-6.05 ft
Volume Change Above -15 ft NAVD88	-0.10 cy/ft/yr	-1.24 cy/ft
Volume Change Above 0 ft NAVD88	0.34 cy/ft/yr	0.06 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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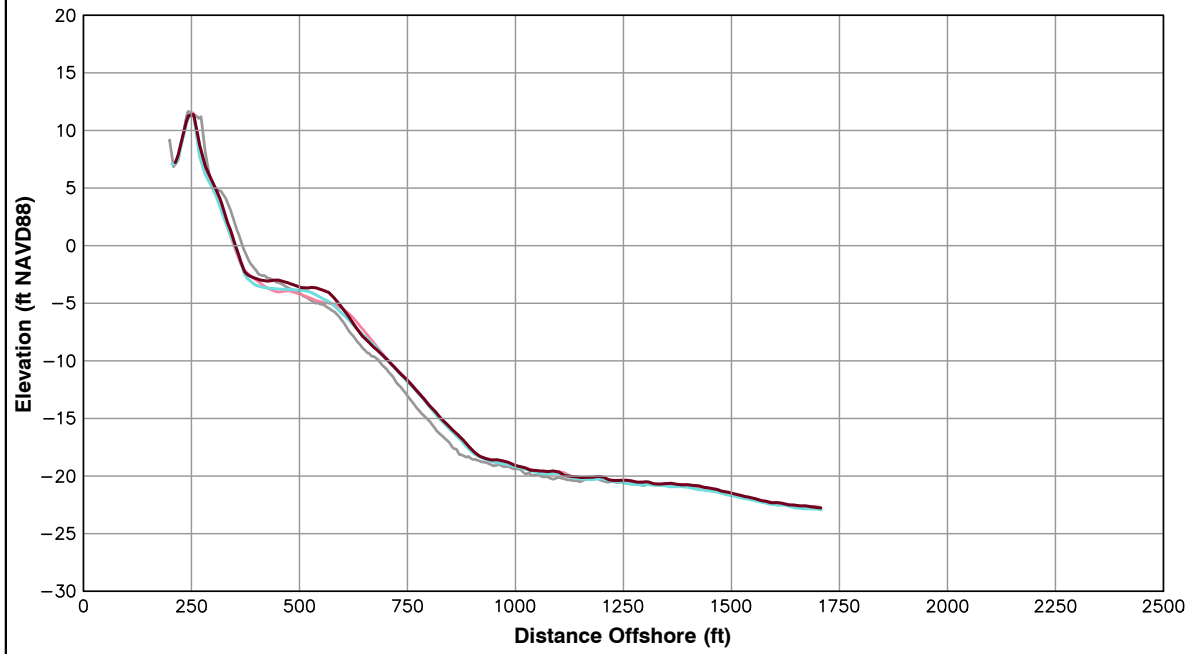
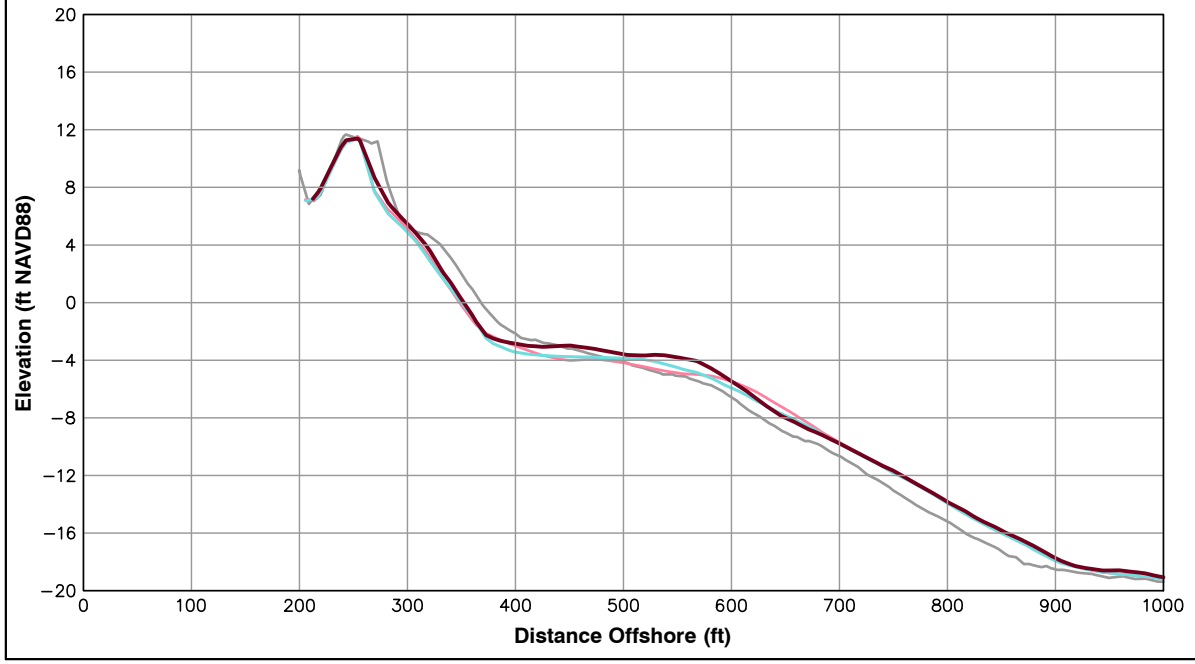
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 185+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	4.10 ft/yr	3.63 ft
Volume Change Above -15 ft NAVD88	5.55 cy/ft/yr	7.59 cy/ft
Volume Change Above 0 ft NAVD88	1.66 cy/ft/yr	2.36 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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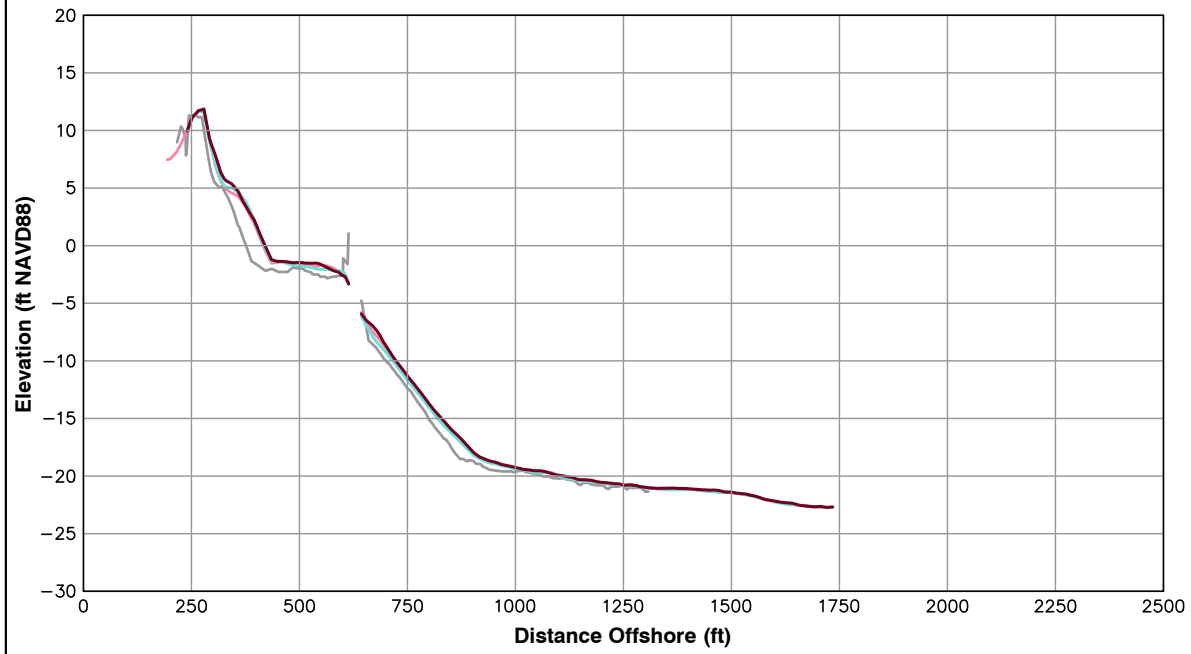
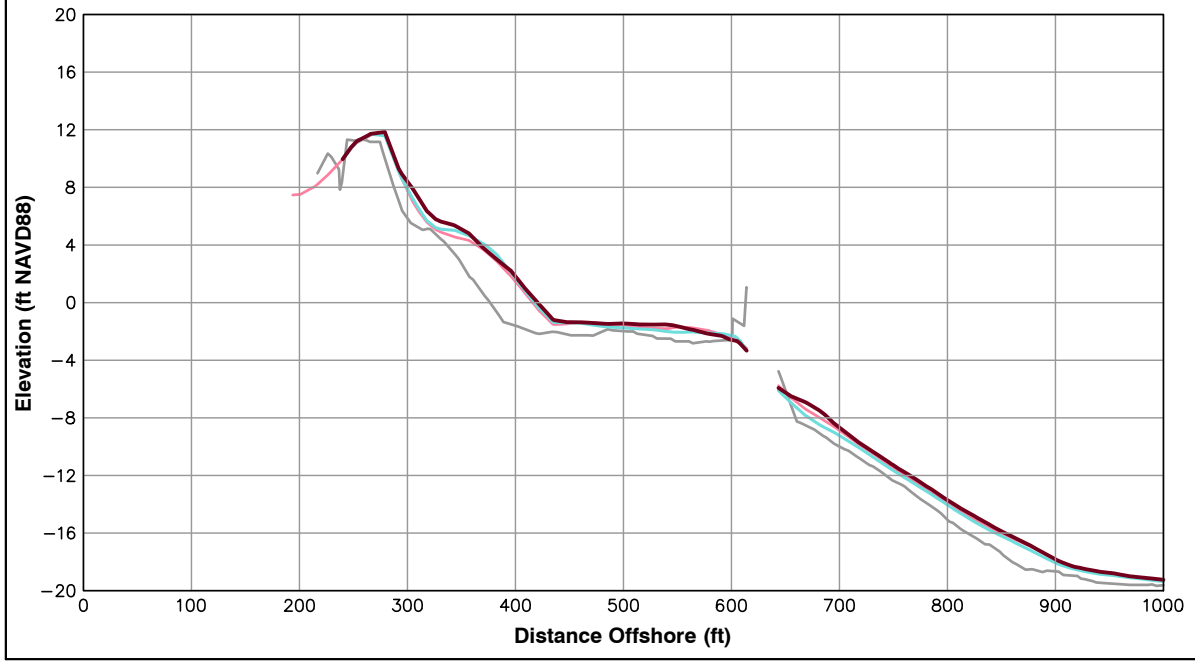
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 187+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	3.38 ft/yr	1.70 ft
Volume Change Above -15 ft NAVD88	4.17 cy/ft/yr	5.62 cy/ft
Volume Change Above 0 ft NAVD88	2.31 cy/ft/yr	1.31 cy/ft

LEGEND:

- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:

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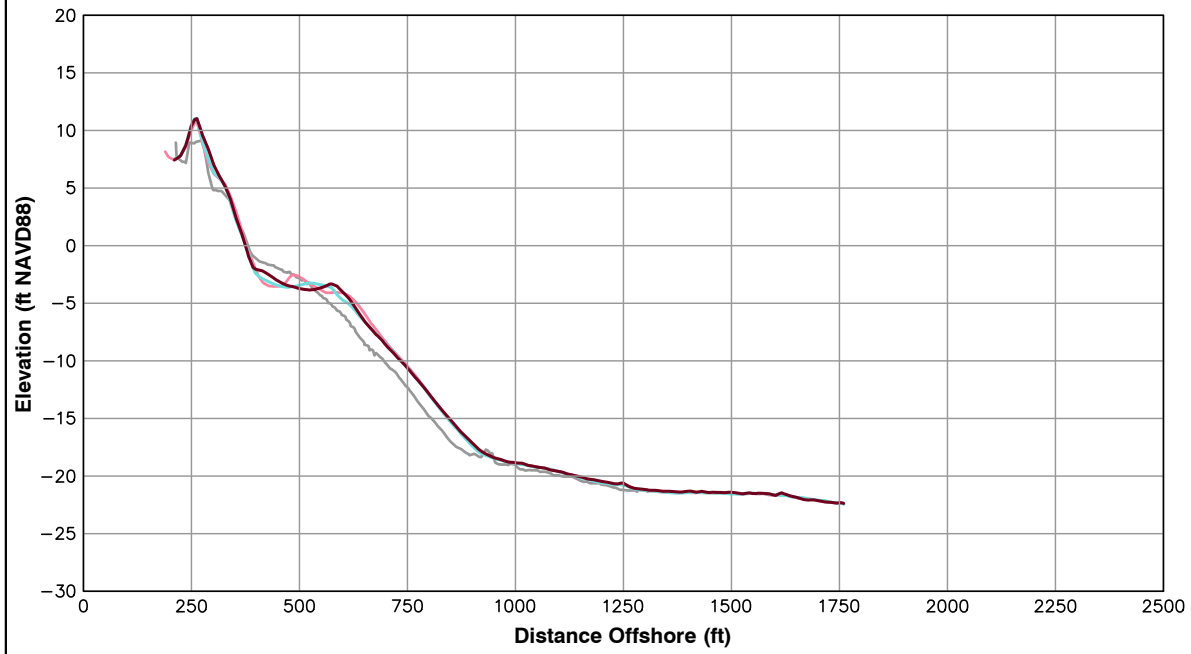
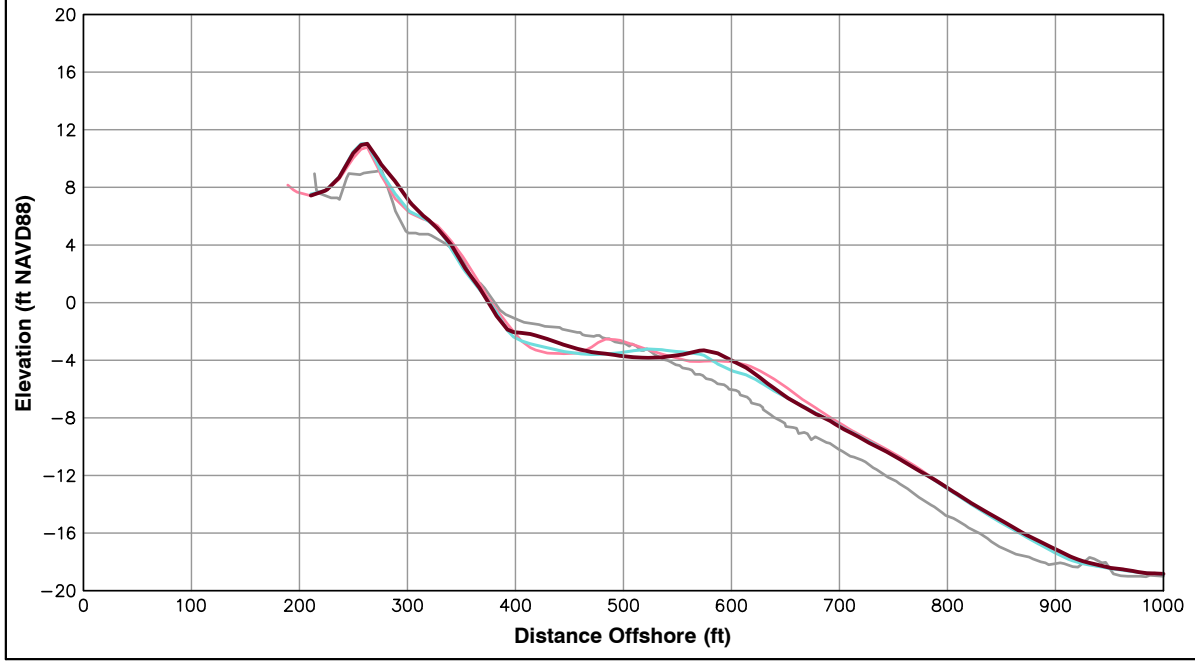
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 189+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-2.43 ft/yr	1.15 ft
Volume Change Above -15 ft NAVD88	-0.53 cy/ft/yr	2.85 cy/ft
Volume Change Above 0 ft NAVD88	1.02 cy/ft/yr	1.22 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

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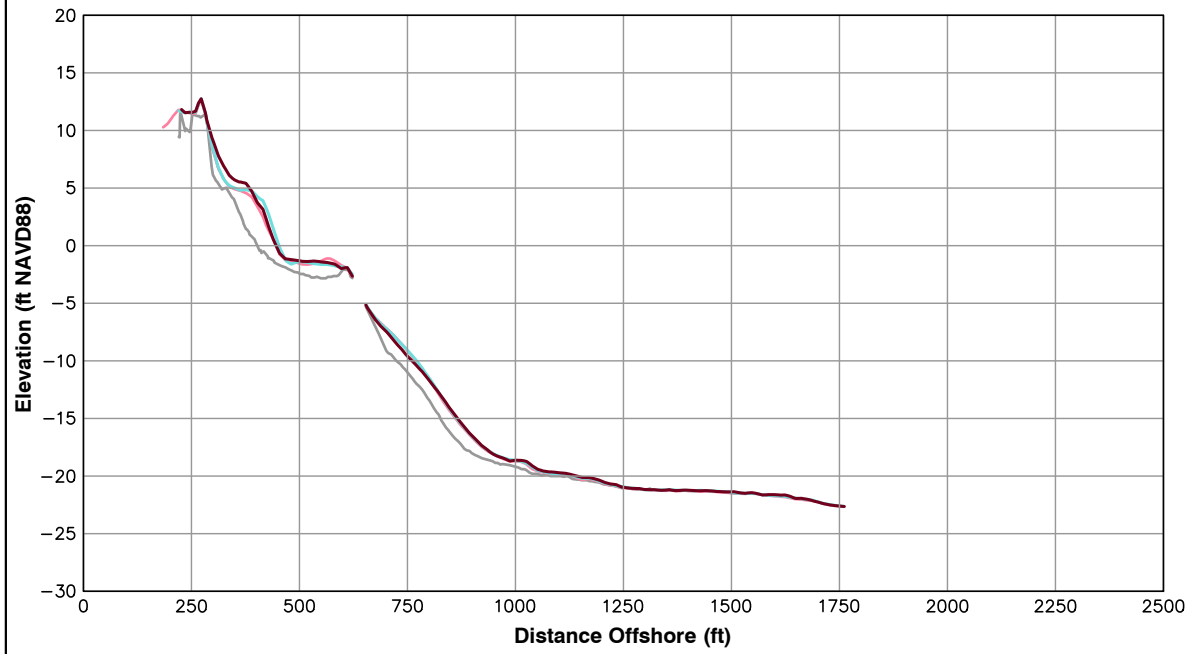
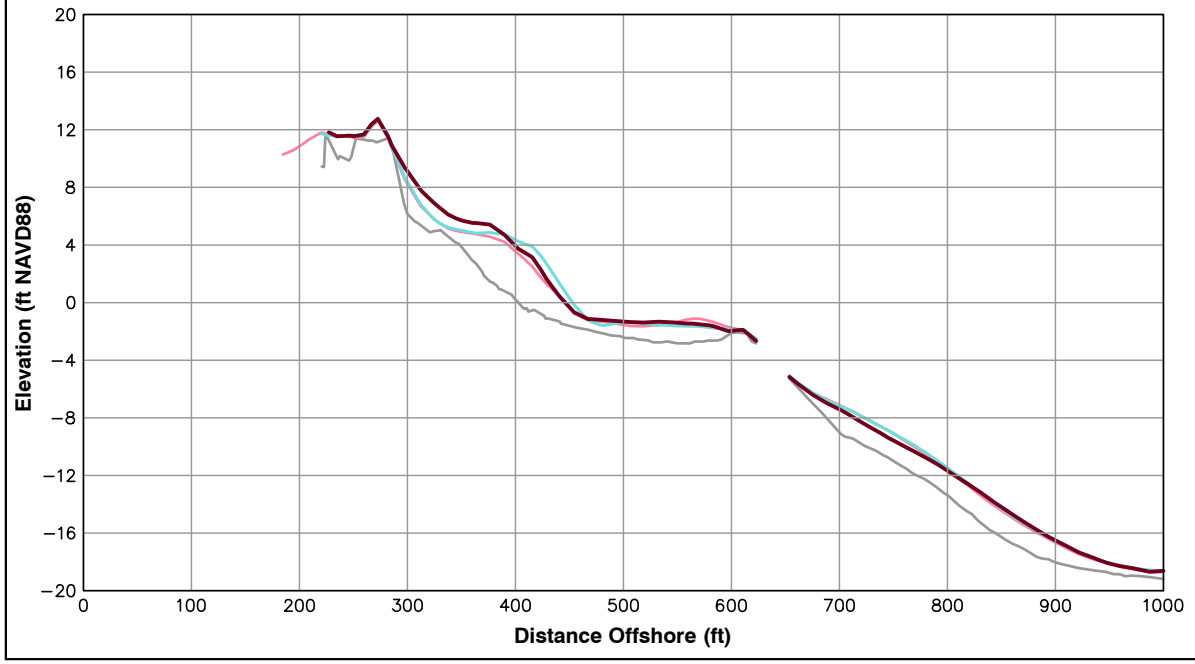
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 191+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	1.77 ft/yr	-8.57 ft
Volume Change Above -15 ft NAVD88	2.95 cy/ft/yr	0.11 cy/ft
Volume Change Above 0 ft NAVD88	4.03 cy/ft/yr	1.29 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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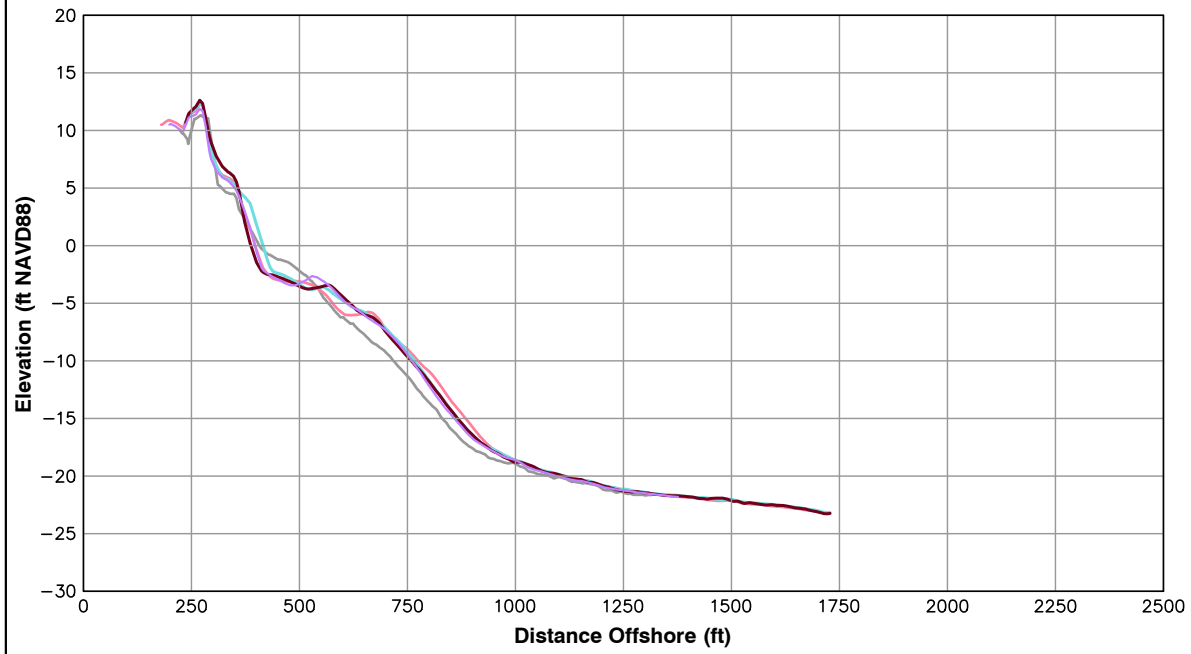
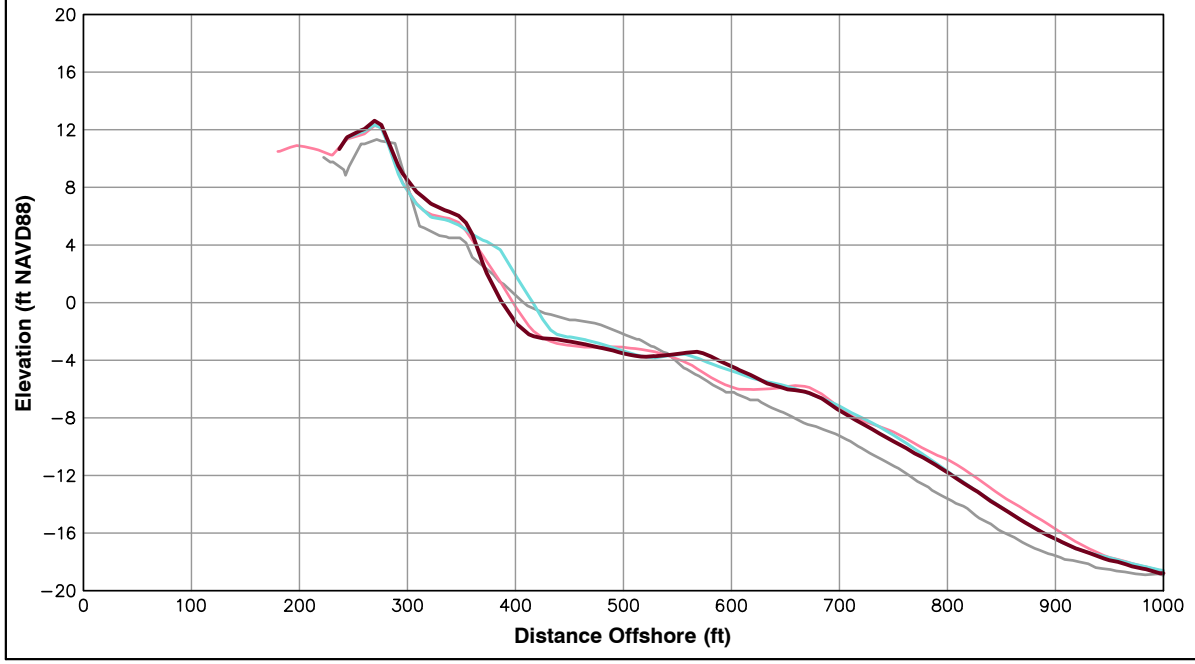
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 193+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-8.67 ft/yr	-27.11 ft
Volume Change Above -15 ft NAVD88	-1.39 cy/ft/yr	-5.48 cy/ft
Volume Change Above 0 ft NAVD88	1.08 cy/ft/yr	-1.70 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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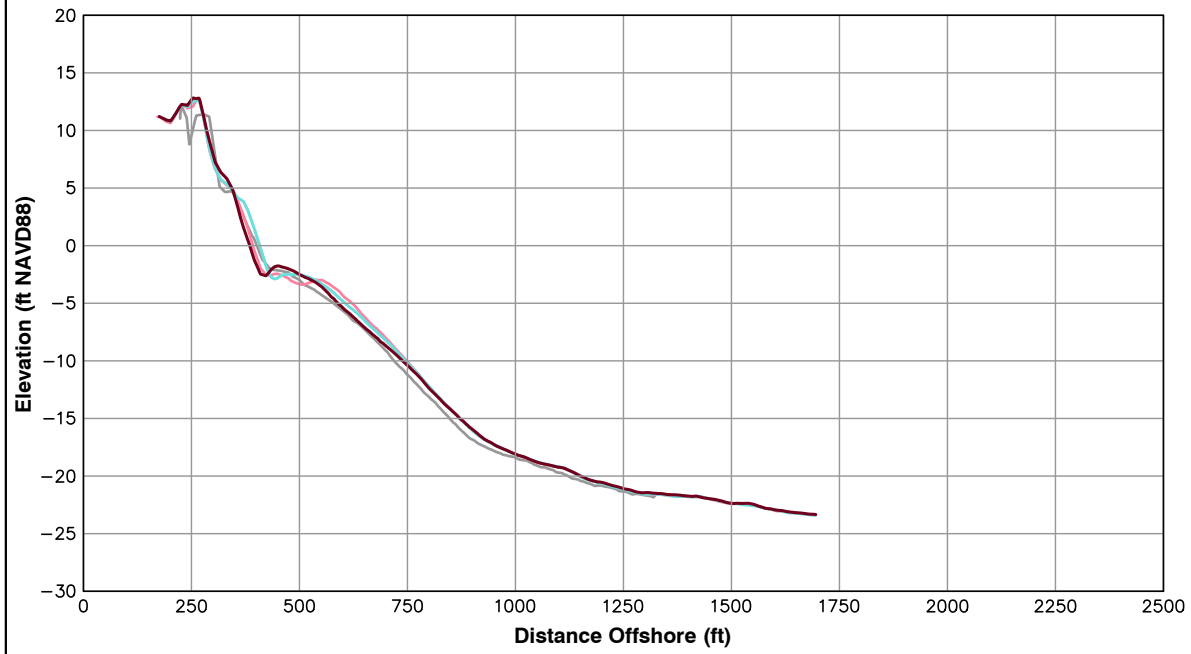
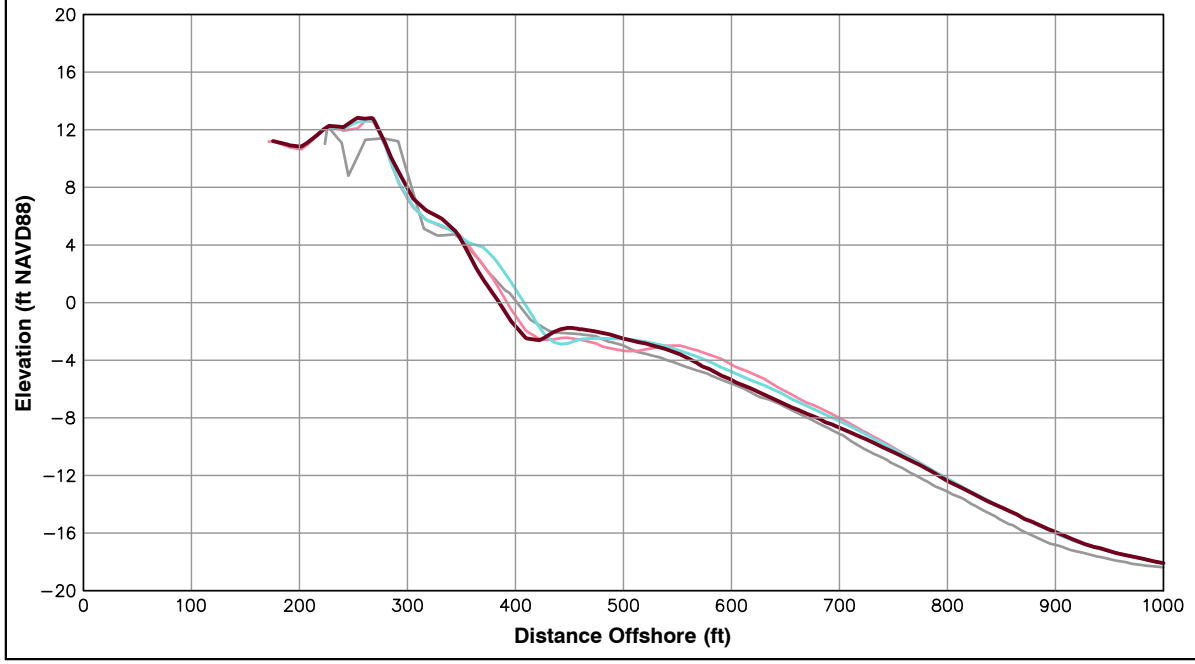
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 195+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-8.28 ft/yr	-23.78 ft
Volume Change Above -15 ft NAVD88	-3.76 cy/ft/yr	-6.67 cy/ft
Volume Change Above 0 ft NAVD88	0.80 cy/ft/yr	-1.84 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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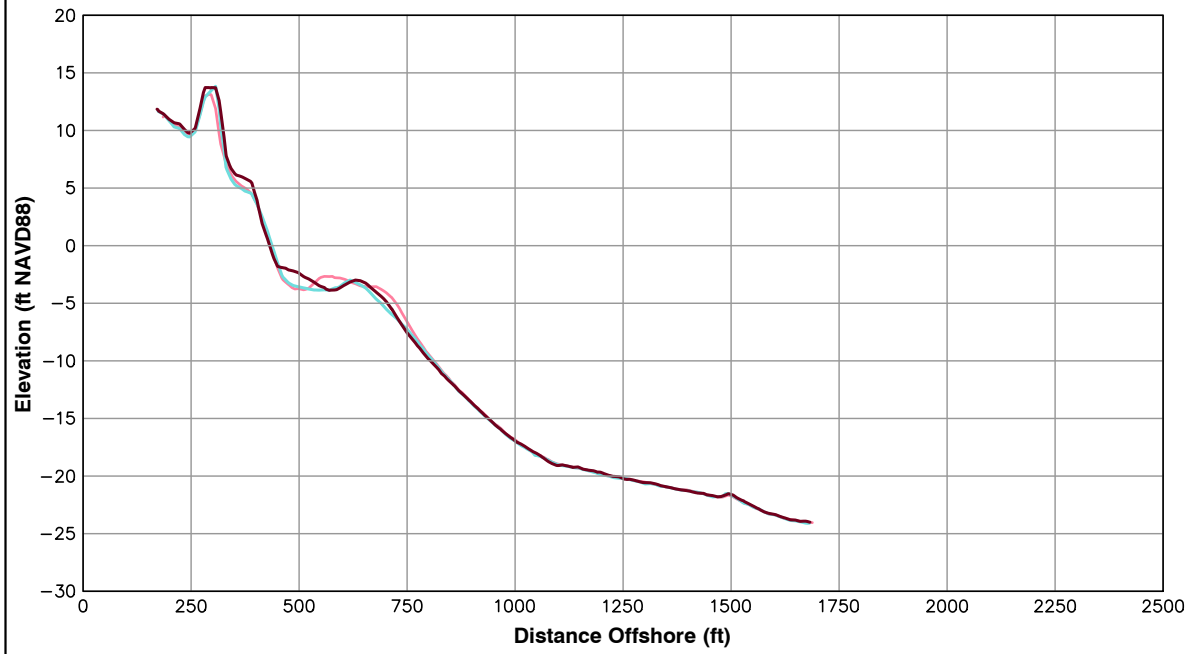
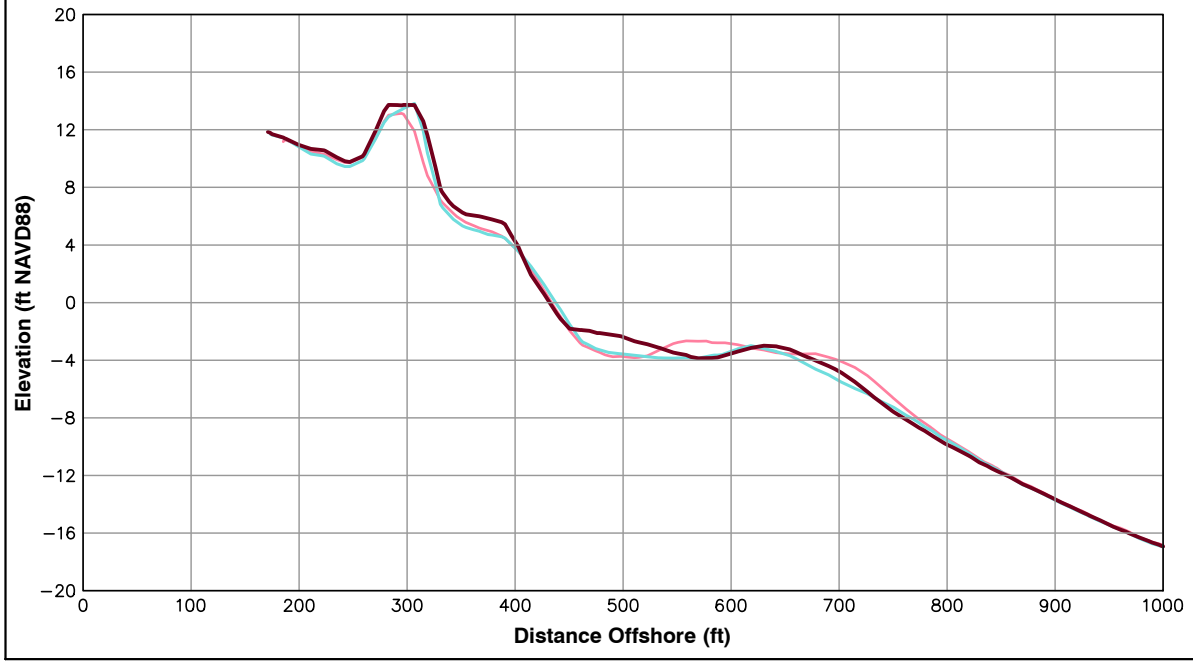
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 206+86	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-2.30 ft/yr	-5.81 ft
Volume Change Above -15 ft NAVD88	2.04 cy/ft/yr	7.82 cy/ft
Volume Change Above 0 ft NAVD88	4.86 cy/ft/yr	4.29 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
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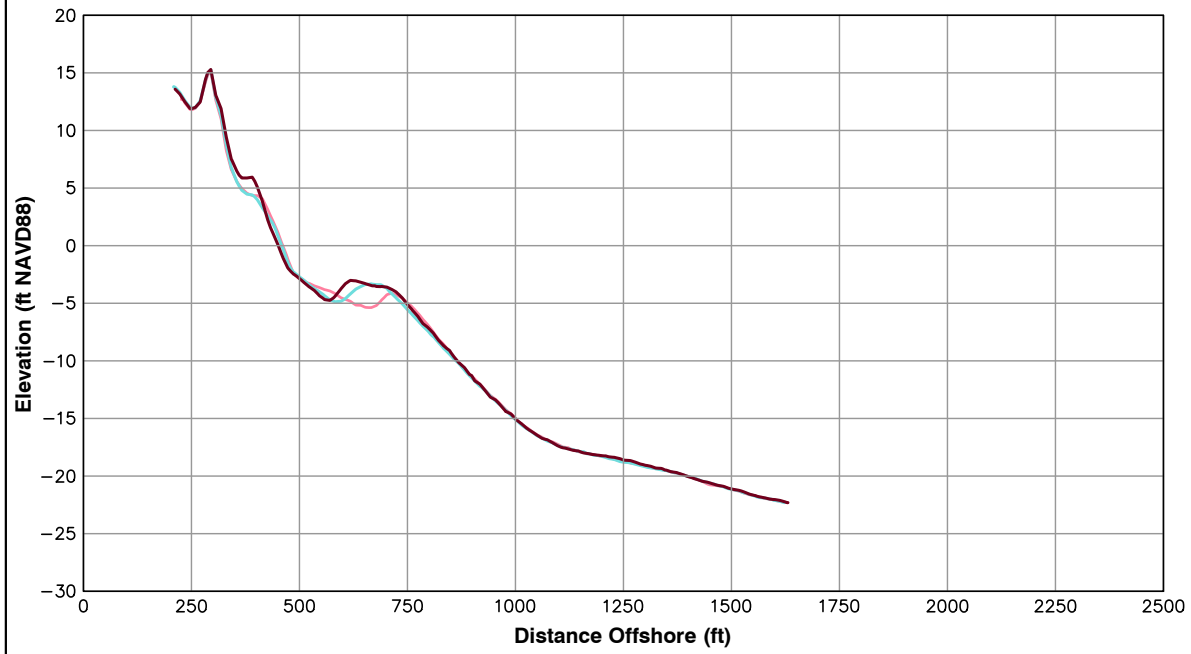
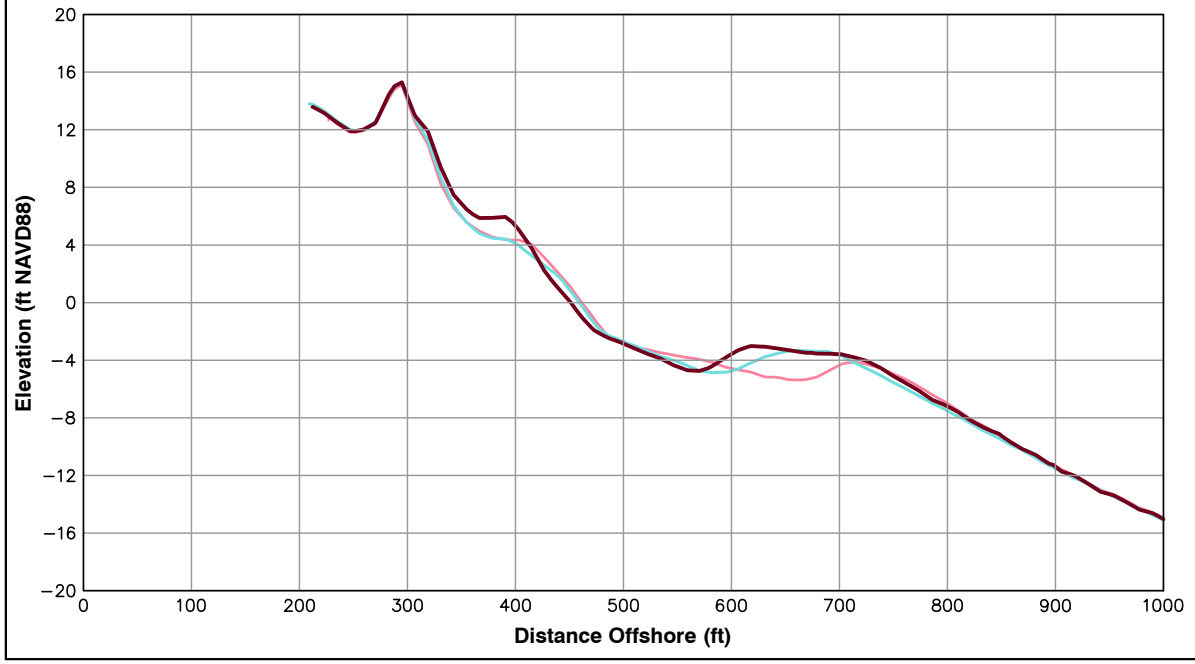
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 218+66	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-11.50 ft/yr	-9.25 ft
Volume Change Above -15 ft NAVD88	6.29 cy/ft/yr	6.01 cy/ft
Volume Change Above 0 ft NAVD88	2.65 cy/ft/yr	2.89 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
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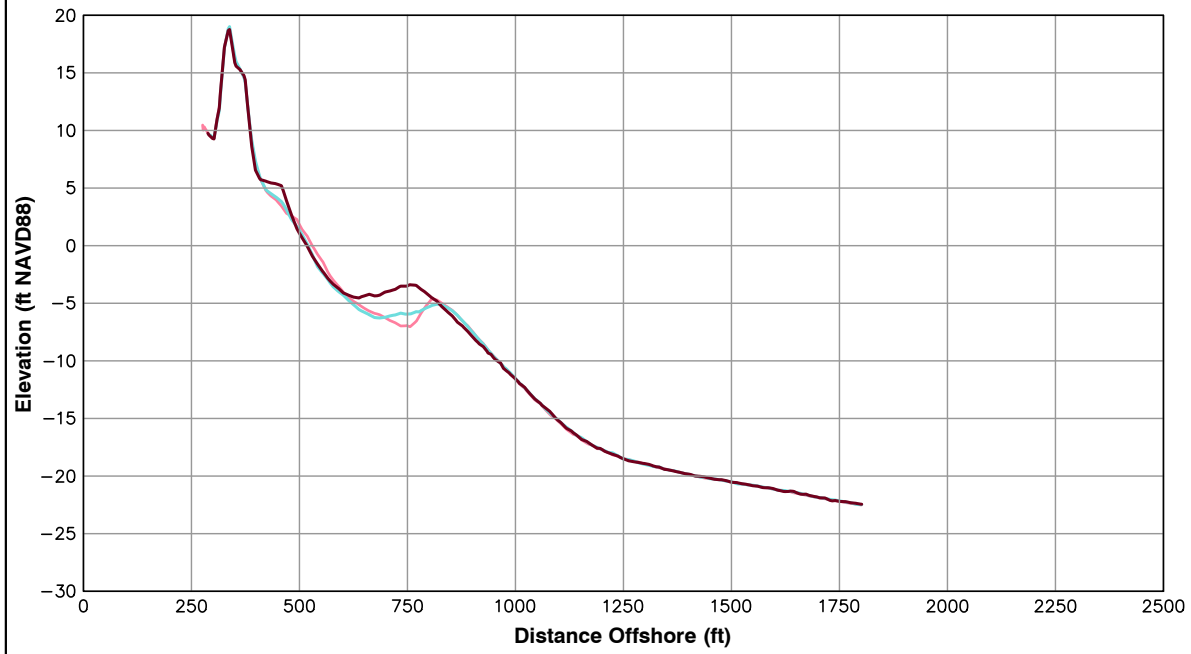
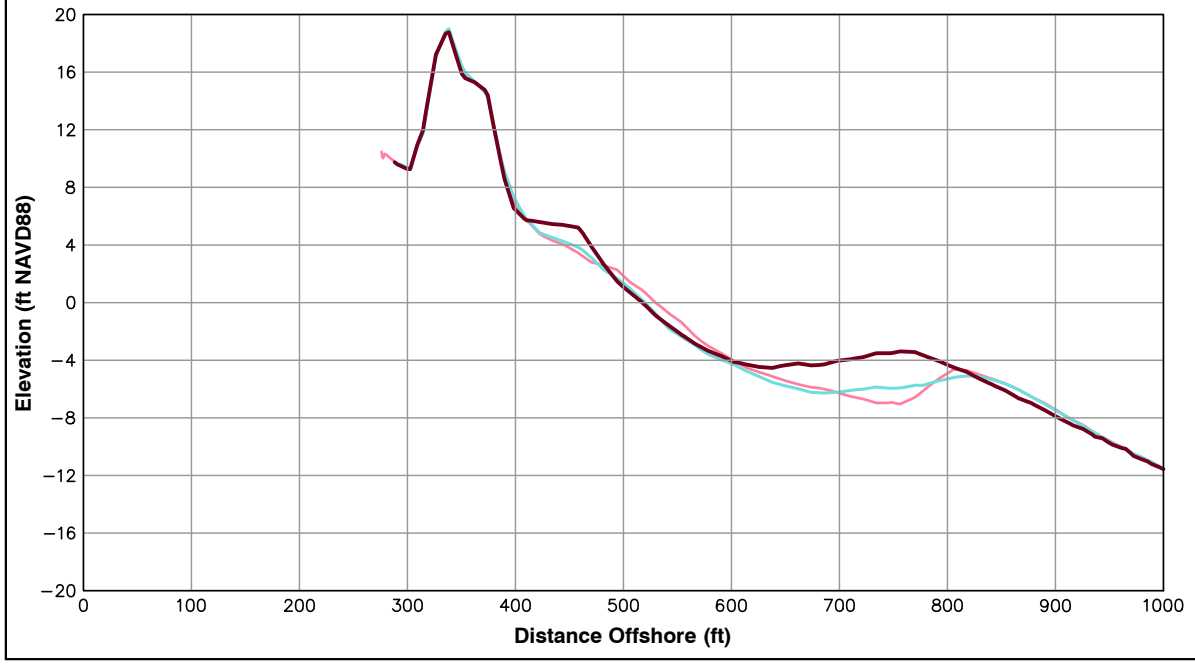
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 229+85	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-12.67 ft/yr	-4.31 ft
Volume Change Above -15 ft NAVD88	11.32 cy/ft/yr	13.23 cy/ft
Volume Change Above 0 ft NAVD88	1.21 cy/ft/yr	1.43 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
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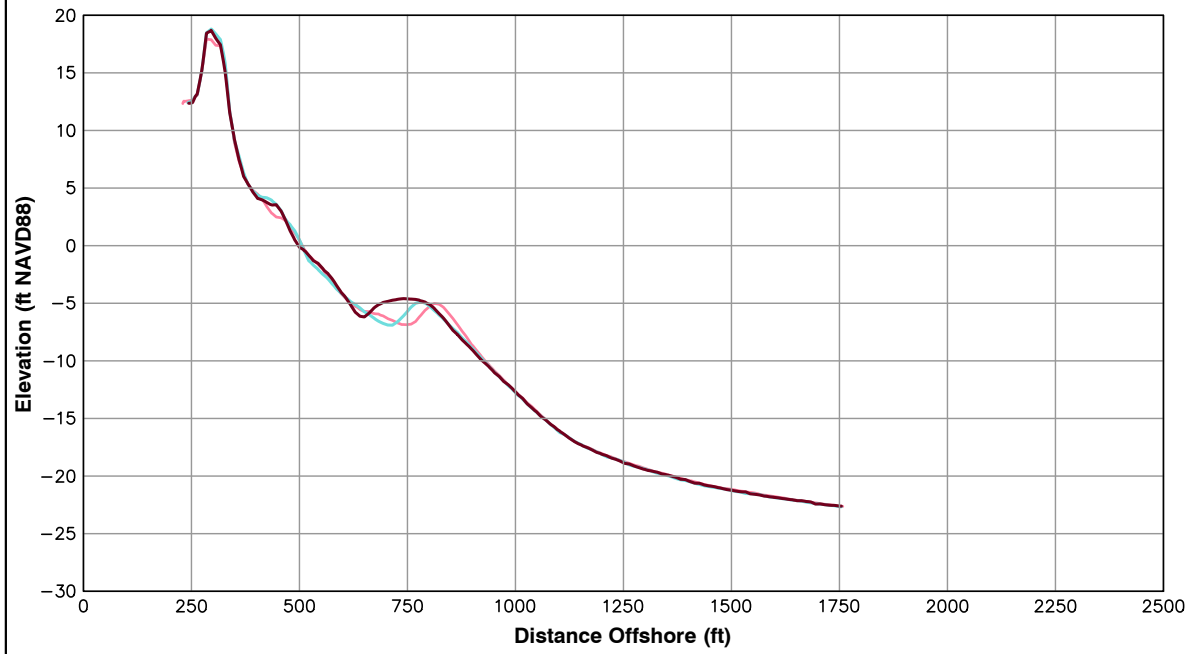
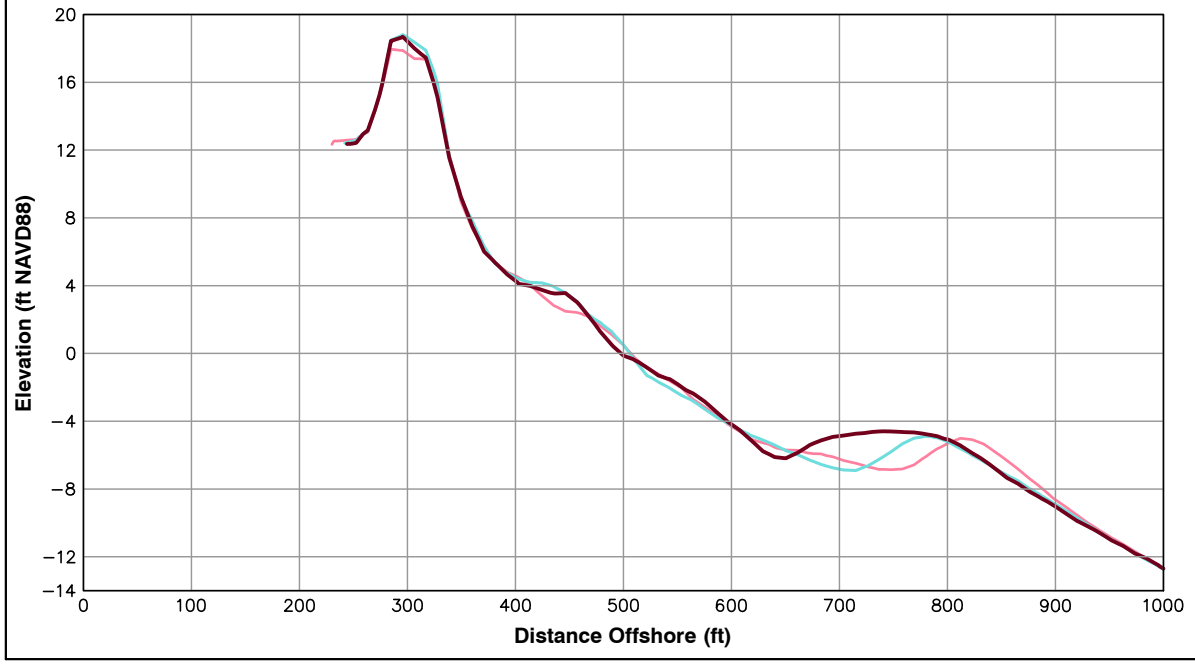
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 242+03	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-8.31 ft/yr	-10.56 ft
Volume Change Above -15 ft NAVD88	4.25 cy/ft/yr	3.65 cy/ft
Volume Change Above 0 ft NAVD88	0.87 cy/ft/yr	-2.29 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
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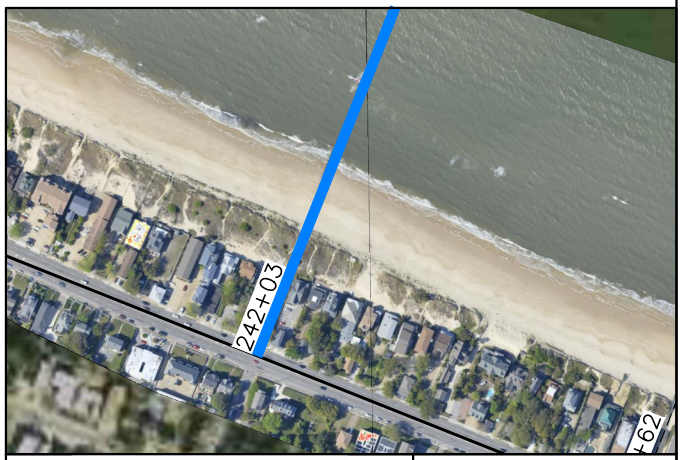
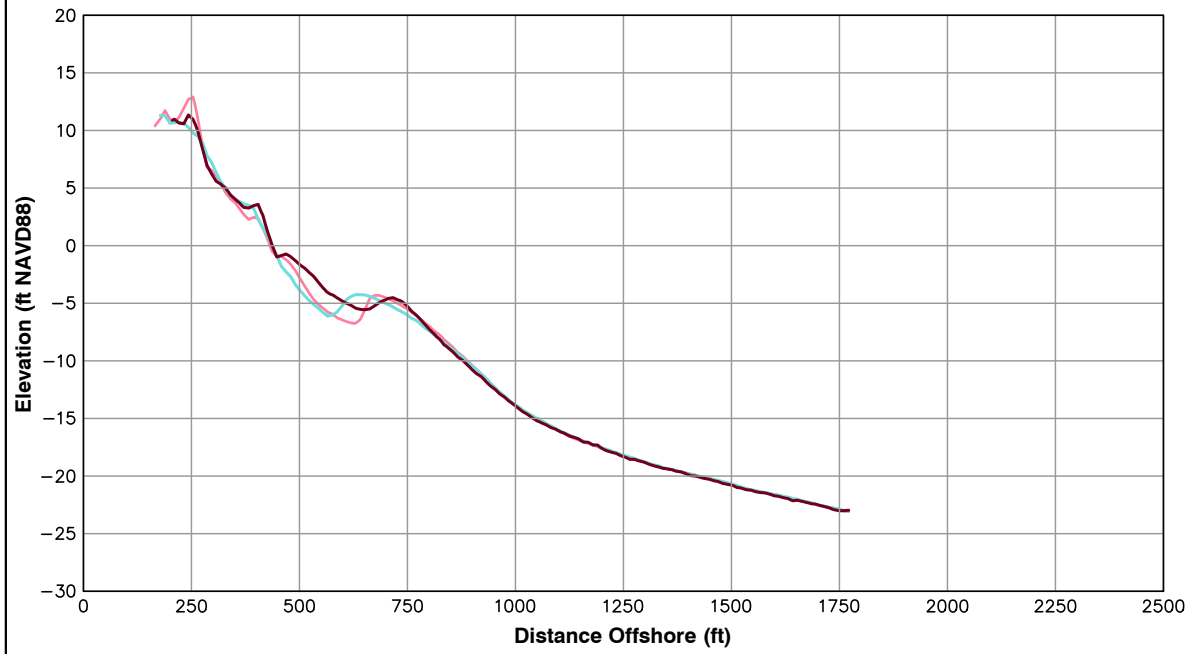
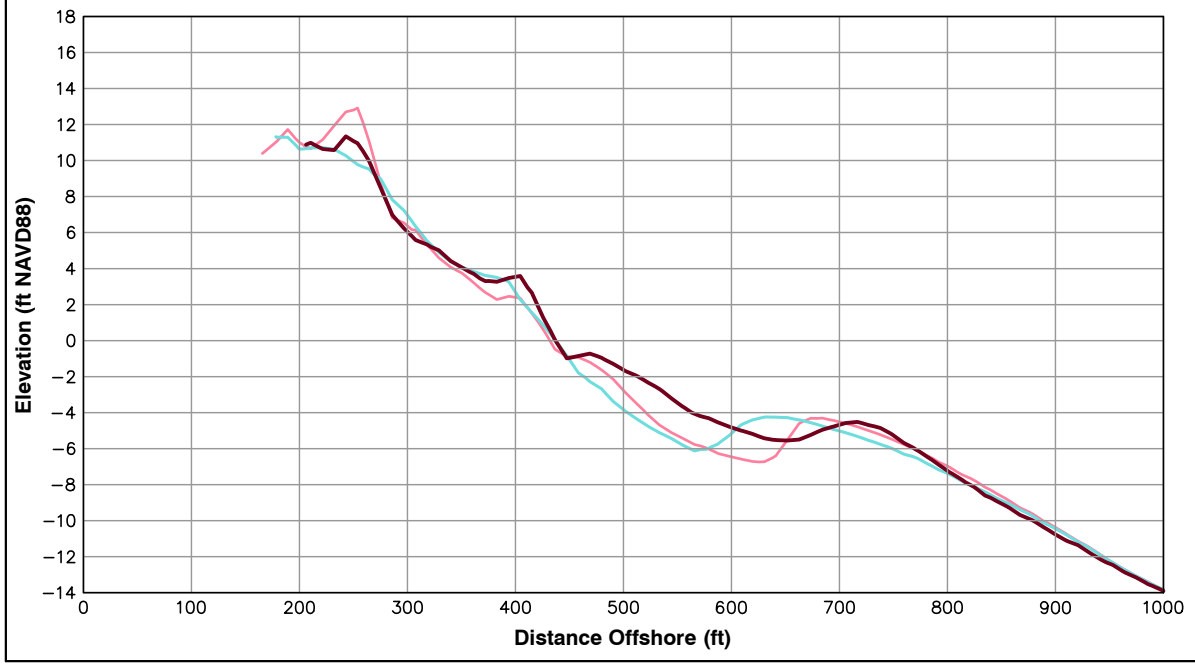


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 252+62	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	6.42 ft/yr	4.47 ft
Volume Change Above -15 ft NAVD88	6.54 cy/ft/yr	9.10 cy/ft
Volume Change Above 0 ft NAVD88	0.15 cy/ft/yr	0.78 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
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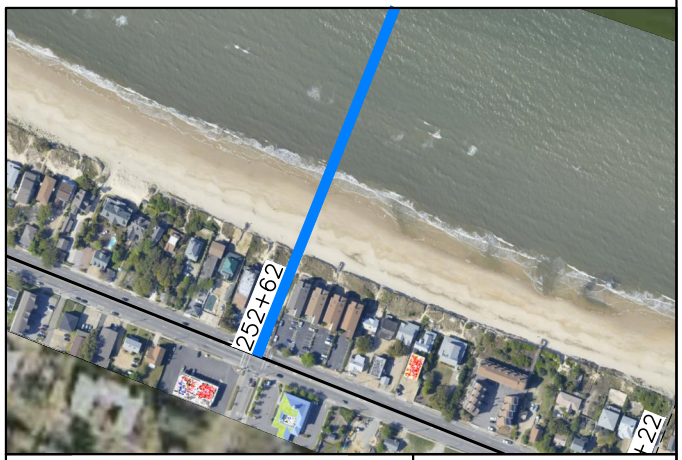
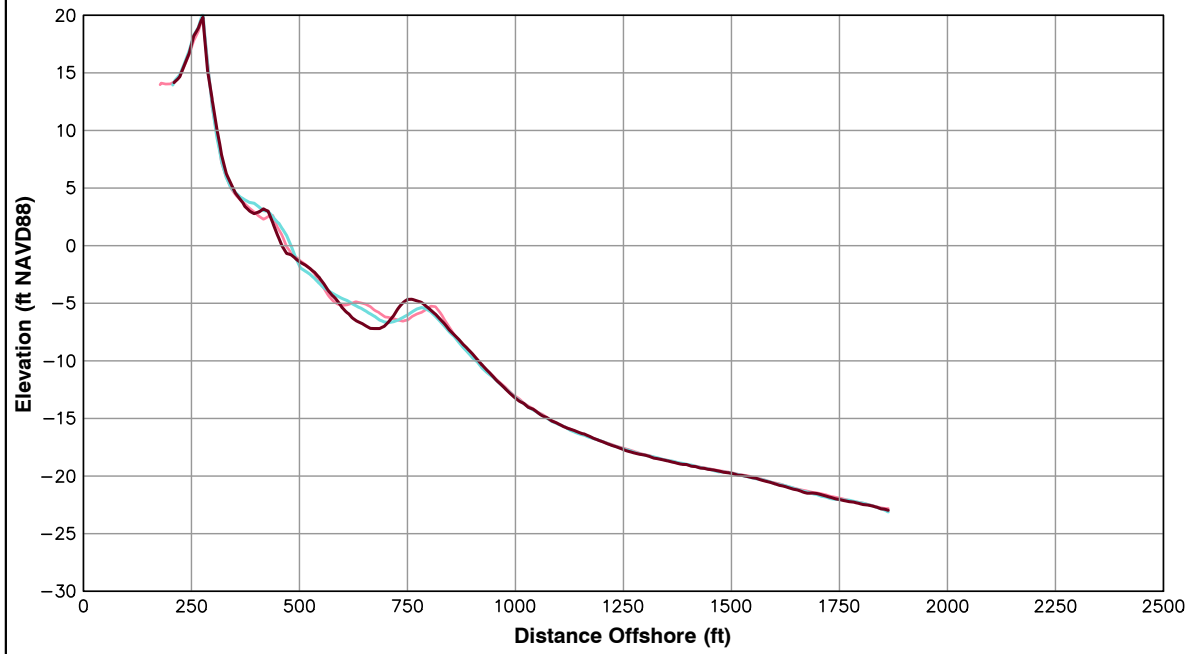
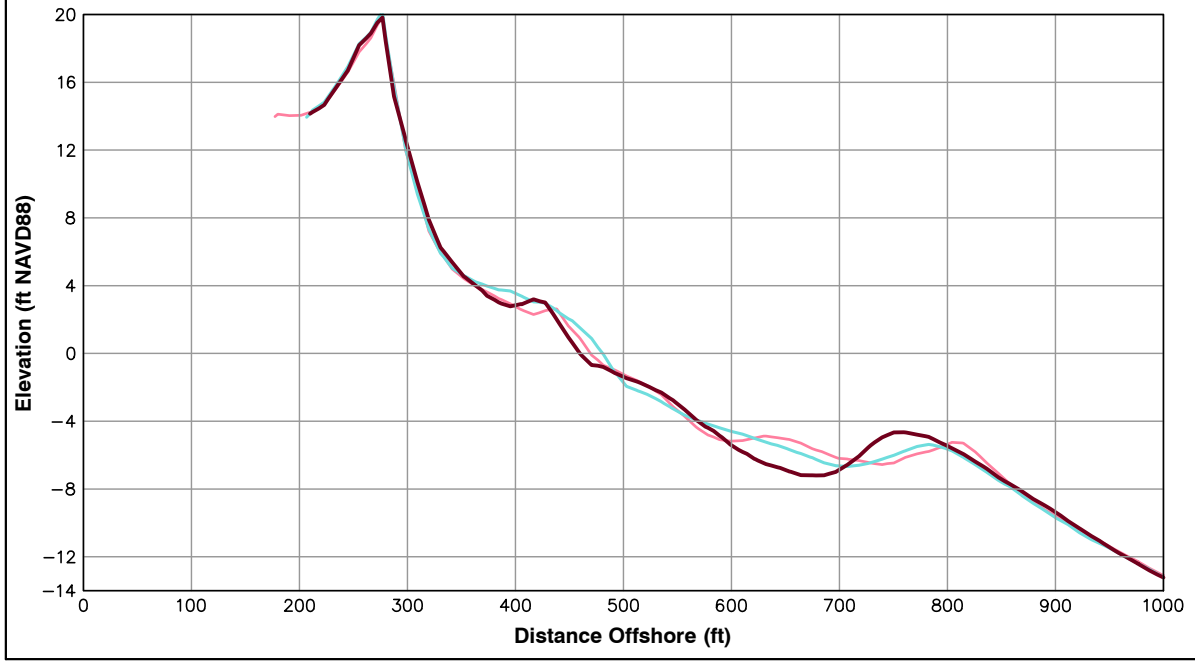


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

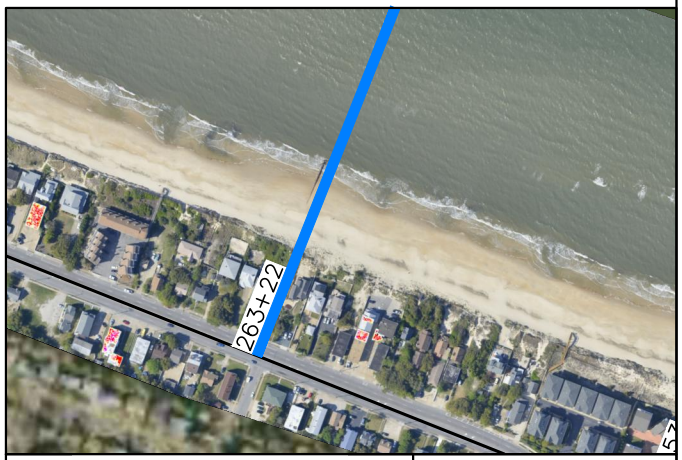




Survey Transect 263+22	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-9.28 ft/yr	-20.12 ft
Volume Change Above -15 ft NAVD88	-1.77 cy/ft/yr	-2.29 cy/ft
Volume Change Above 0 ft NAVD88	0.61 cy/ft/yr	-2.34 cy/ft

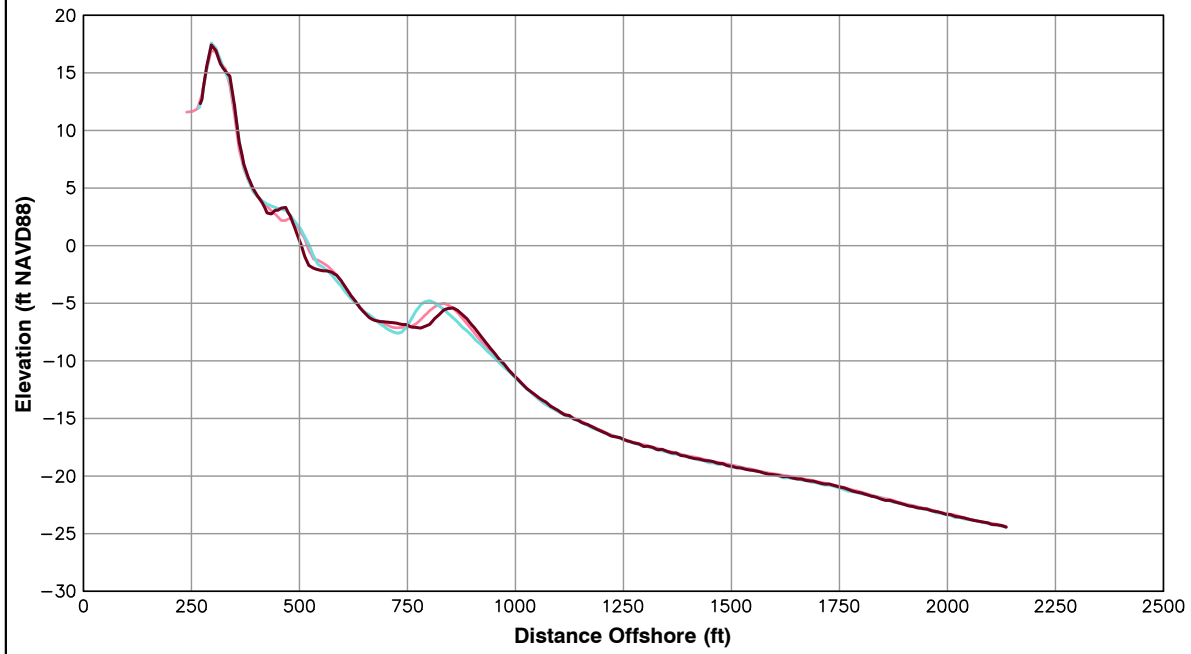
LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

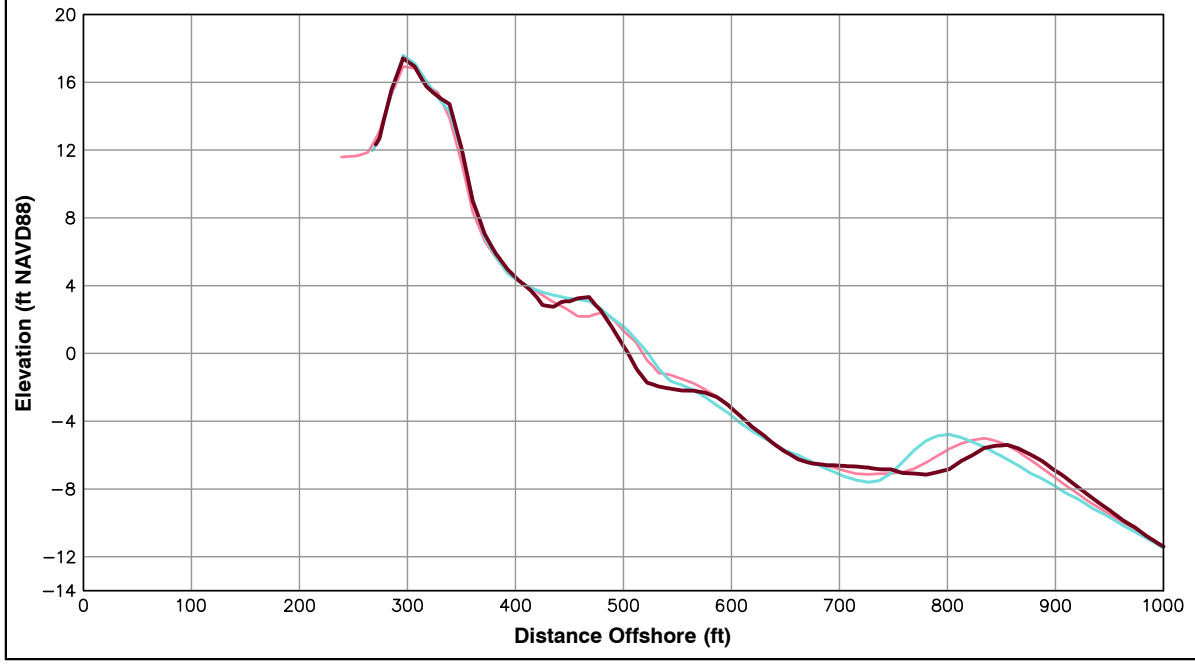
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 274+53	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.76 ft/yr	-14.50 ft
Volume Change Above -15 ft NAVD88	-1.07 cy/ft/yr	-1.13 cy/ft
Volume Change Above 0 ft NAVD88	1.14 cy/ft/yr	-1.46 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
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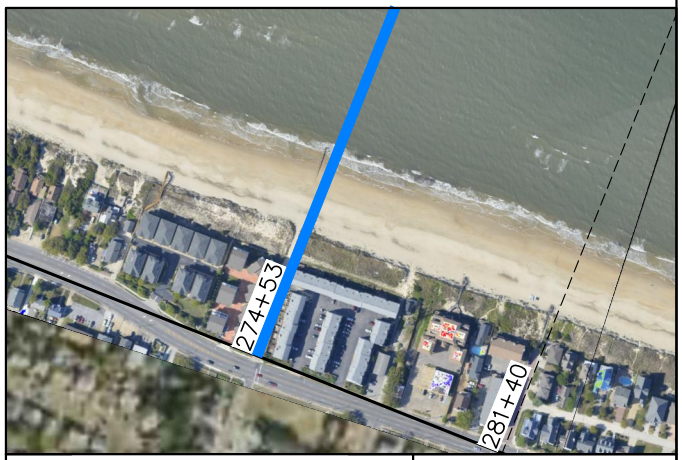
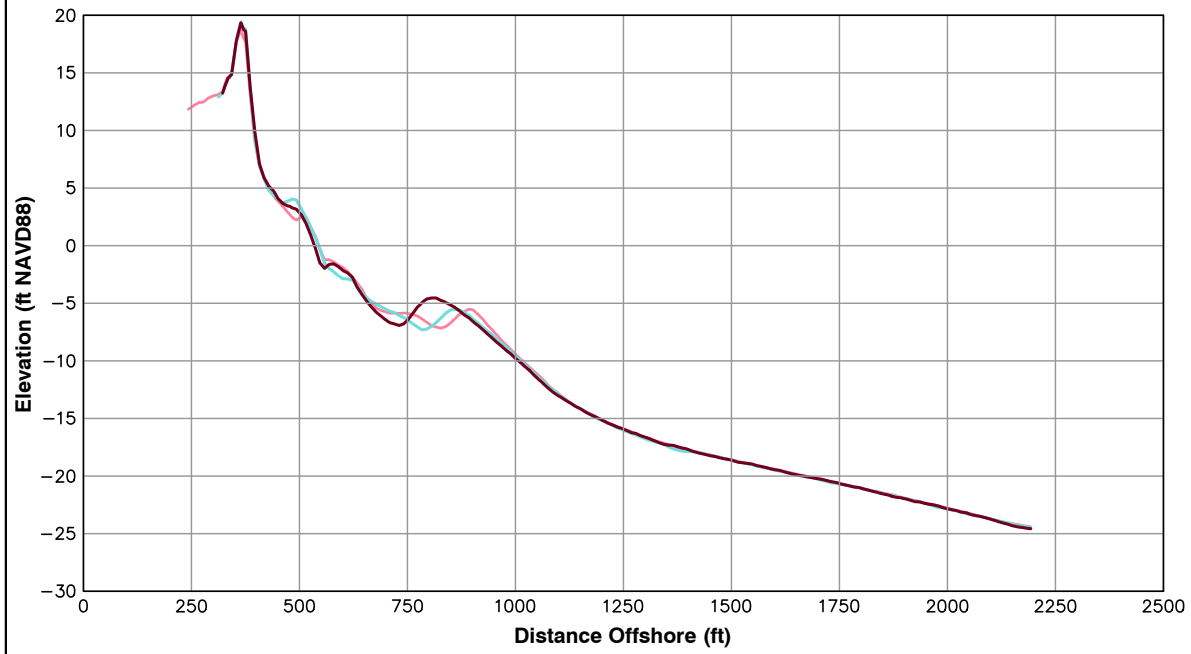
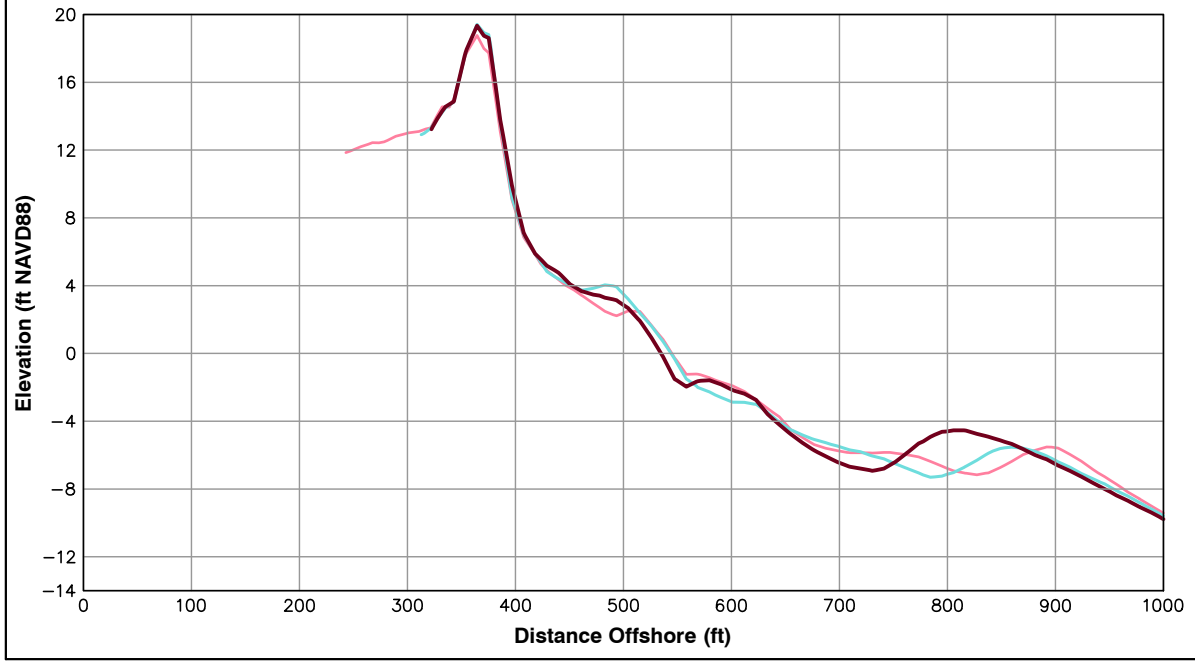


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

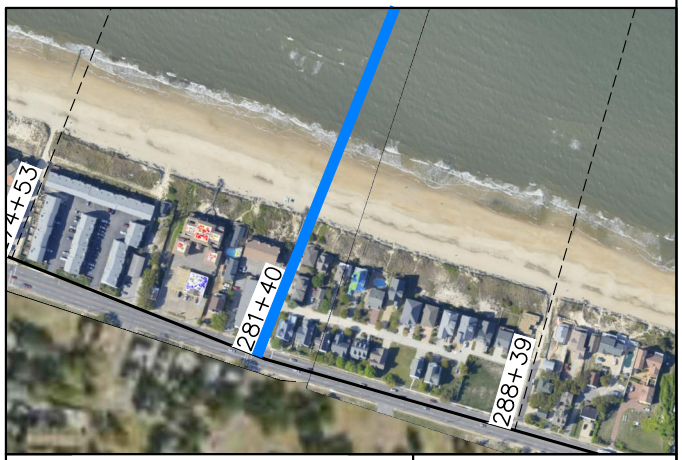




Survey Transect 281+40	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-8.83 ft/yr	-8.07 ft
Volume Change Above -15 ft NAVD88	0.05 cy/ft/yr	1.12 cy/ft
Volume Change Above 0 ft NAVD88	1.78 cy/ft/yr	-1.13 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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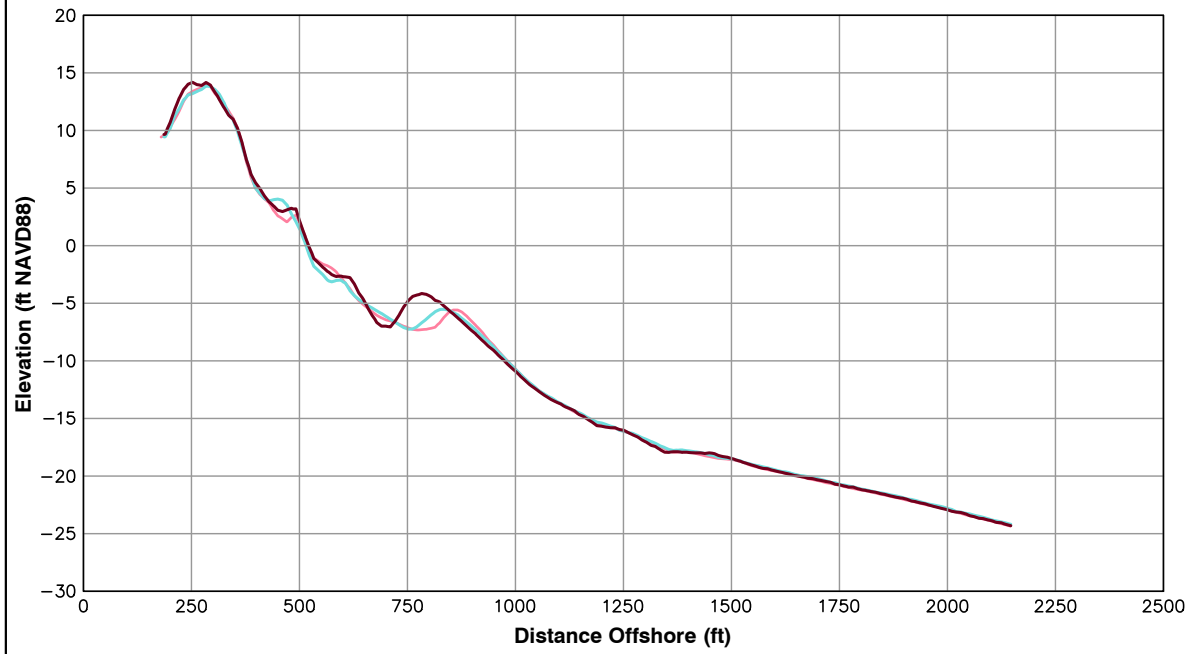
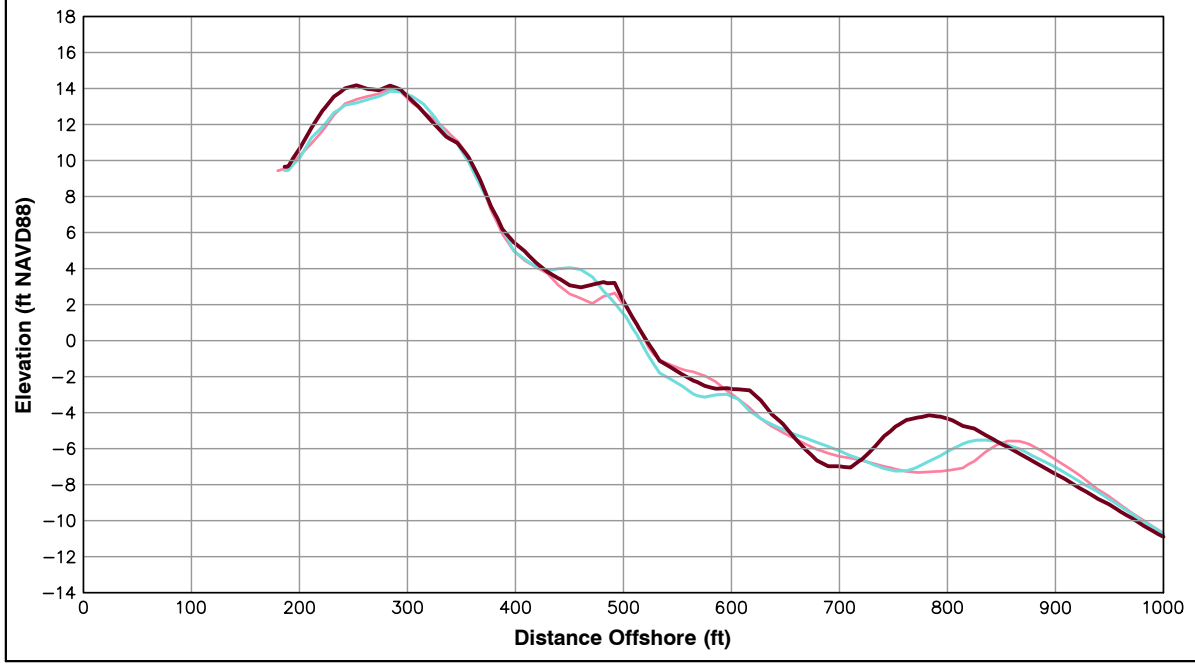
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 288+39	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-0.29 ft/yr	5.88 ft
Volume Change Above -15 ft NAVD88	9.85 cy/ft/yr	9.11 cy/ft
Volume Change Above 0 ft NAVD88	4.10 cy/ft/yr	2.58 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
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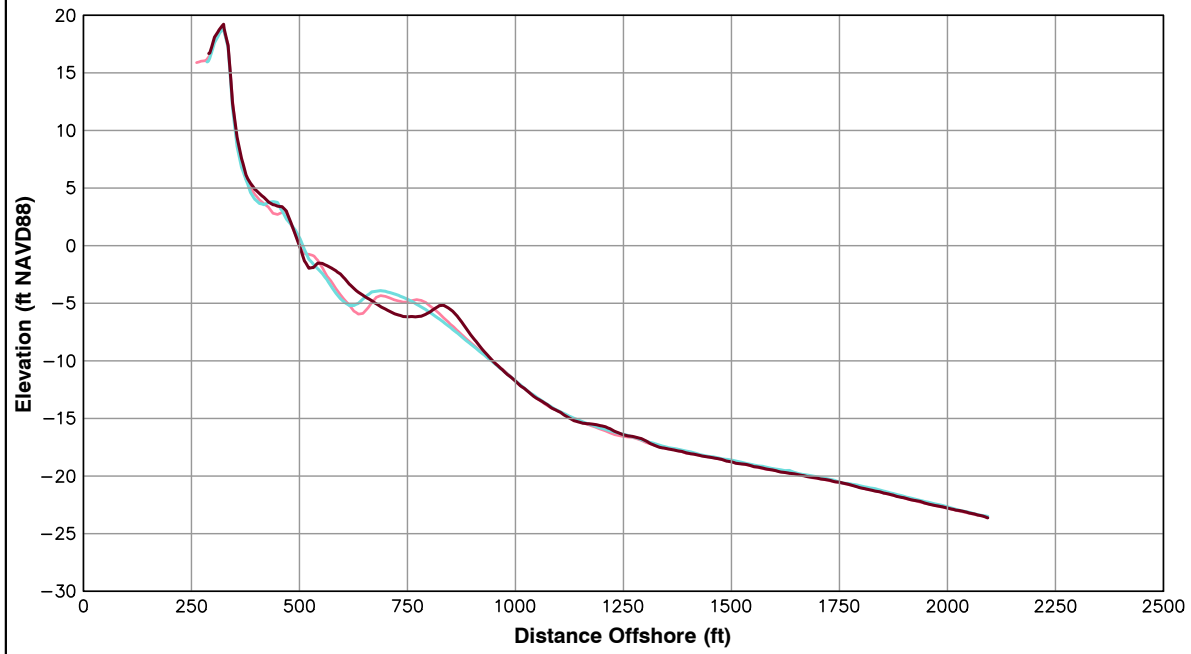
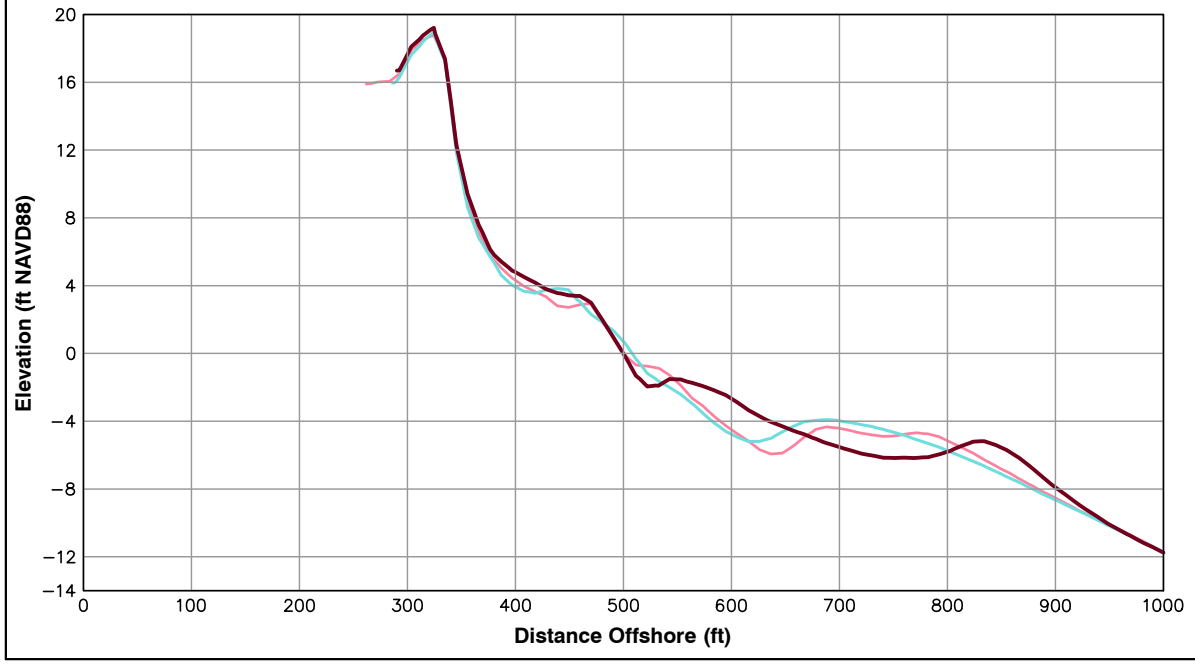
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 295+27	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-0.72 ft/yr	-5.63 ft
Volume Change Above -15 ft NAVD88	5.12 cy/ft/yr	5.61 cy/ft
Volume Change Above 0 ft NAVD88	2.31 cy/ft/yr	2.62 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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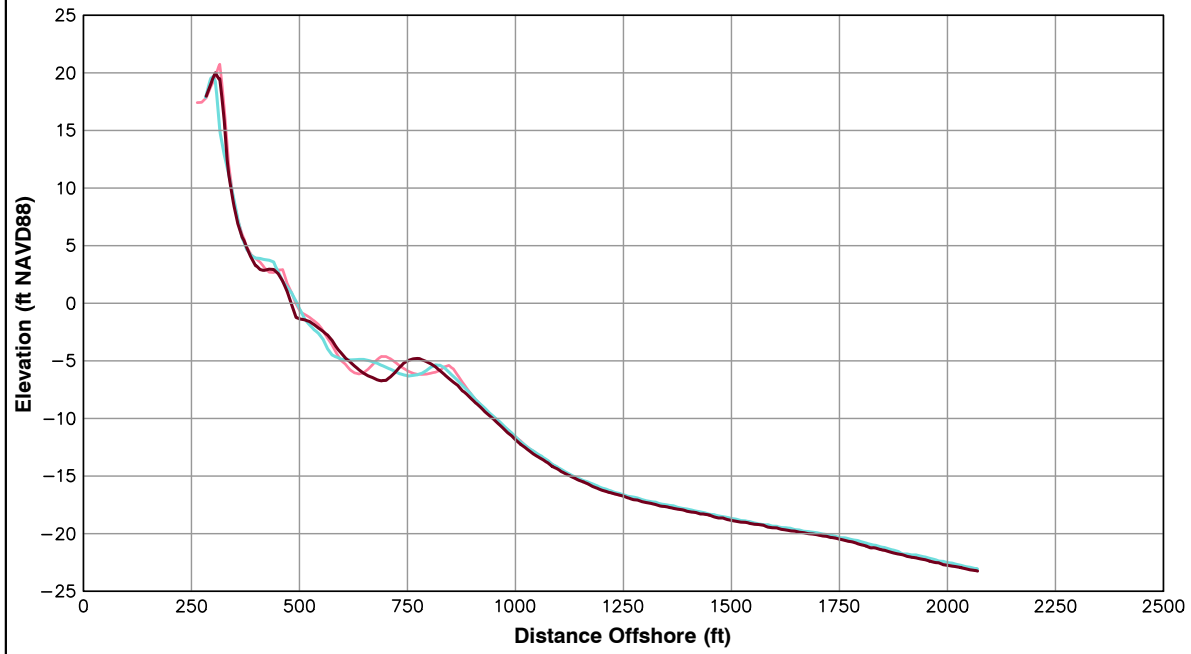
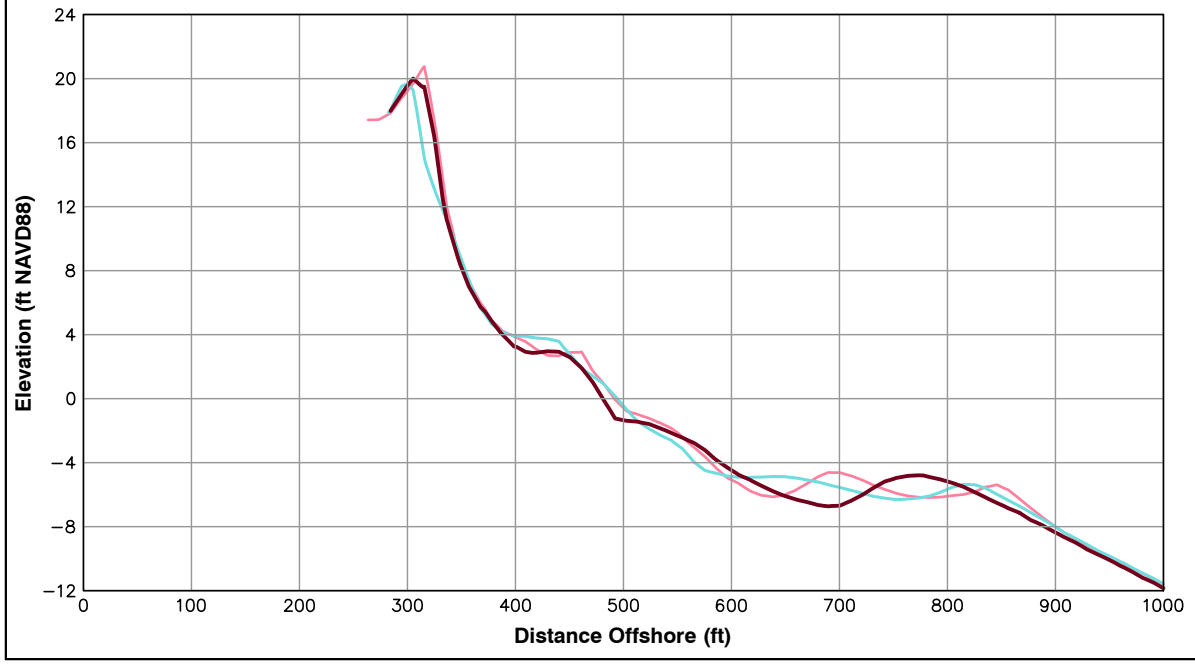
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 302+24	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-8.71 ft/yr	-8.36 ft
Volume Change Above -15 ft NAVD88	-7.02 cy/ft/yr	-2.46 cy/ft
Volume Change Above 0 ft NAVD88	-2.88 cy/ft/yr	0.33 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
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3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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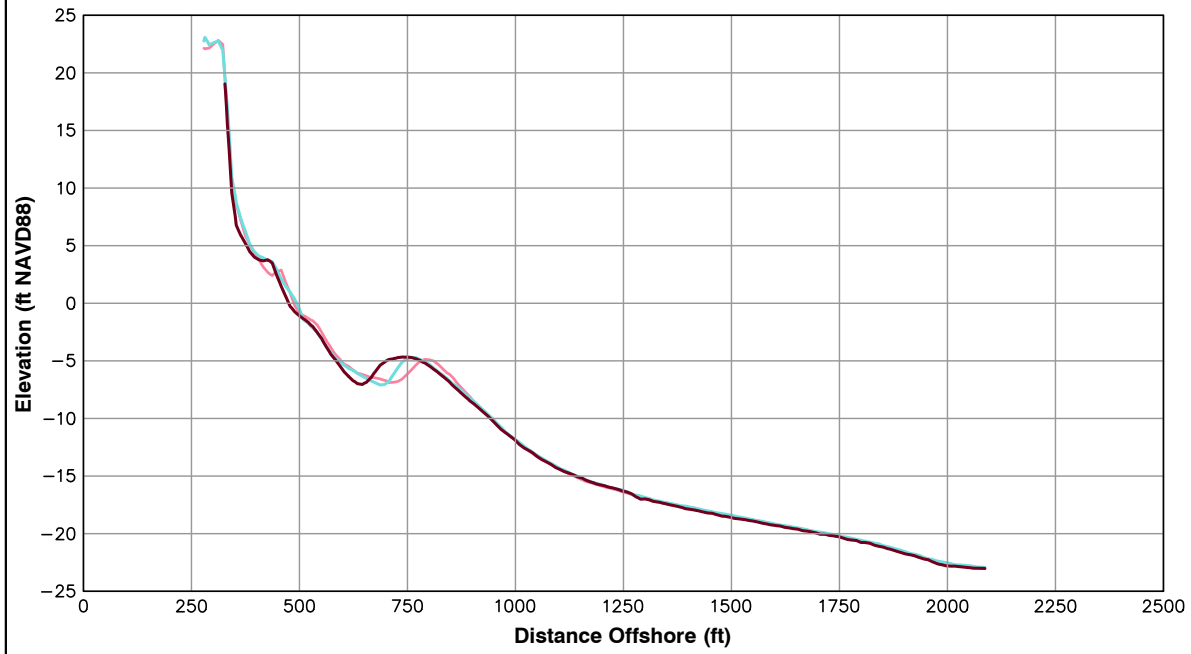
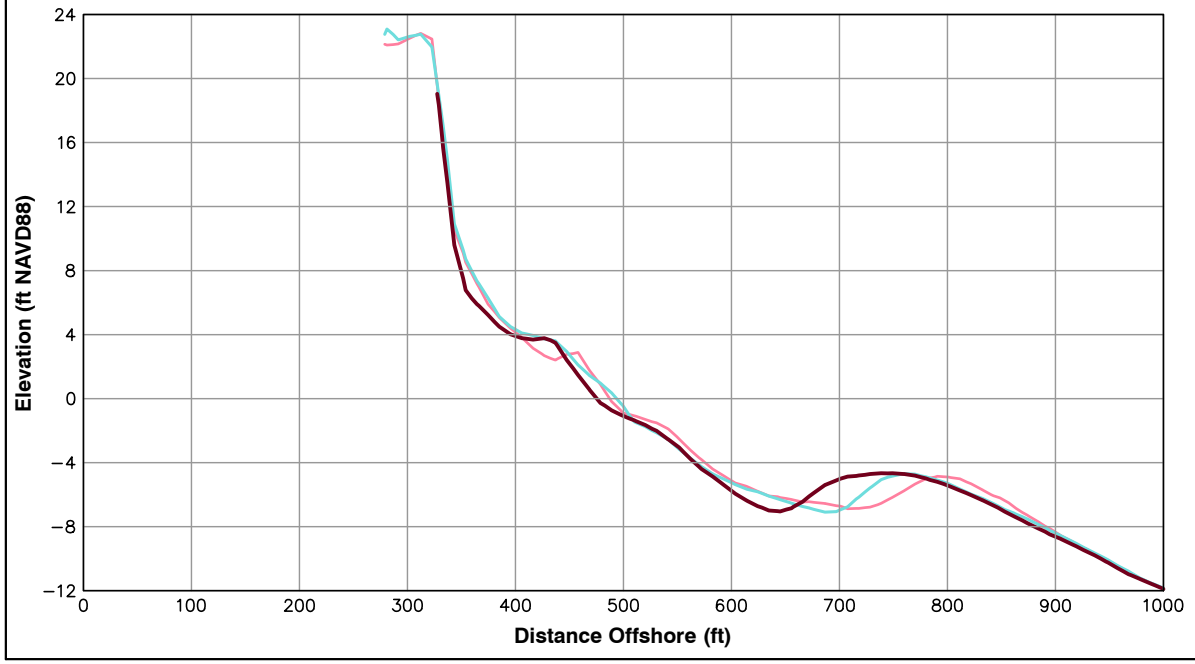
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 315+96	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-13.18 ft/yr	-14.78 ft
Volume Change Above -15 ft NAVD88	-3.74 cy/ft/yr	-5.02 cy/ft
Volume Change Above 0 ft NAVD88	-2.70 cy/ft/yr	-4.65 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
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5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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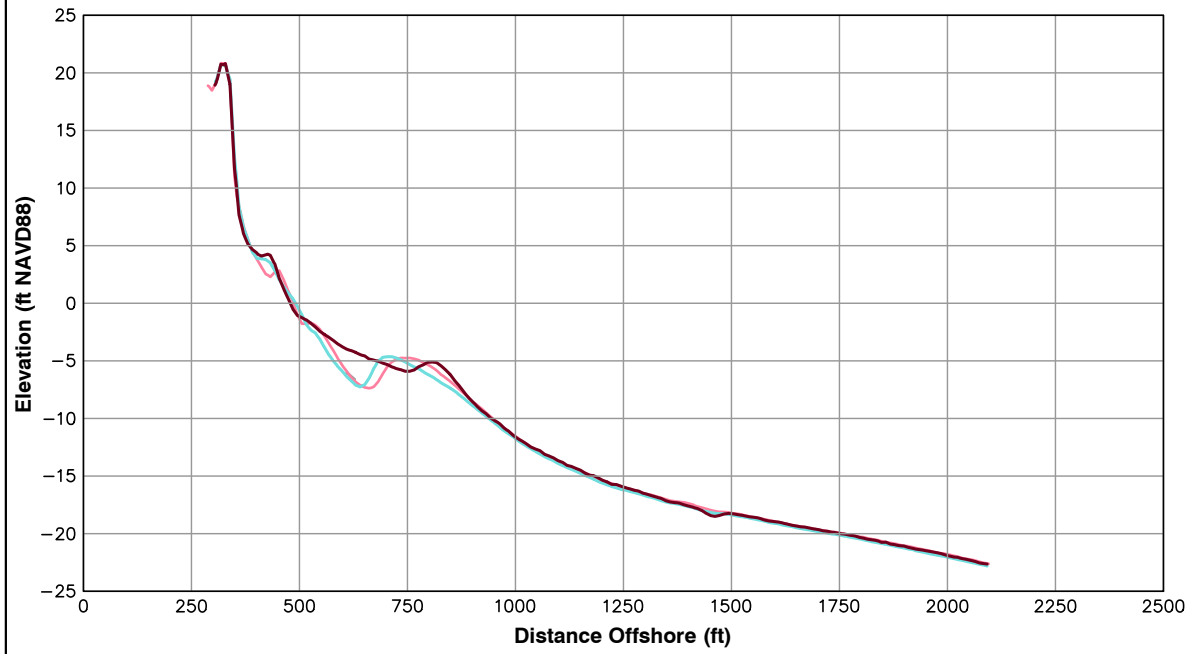
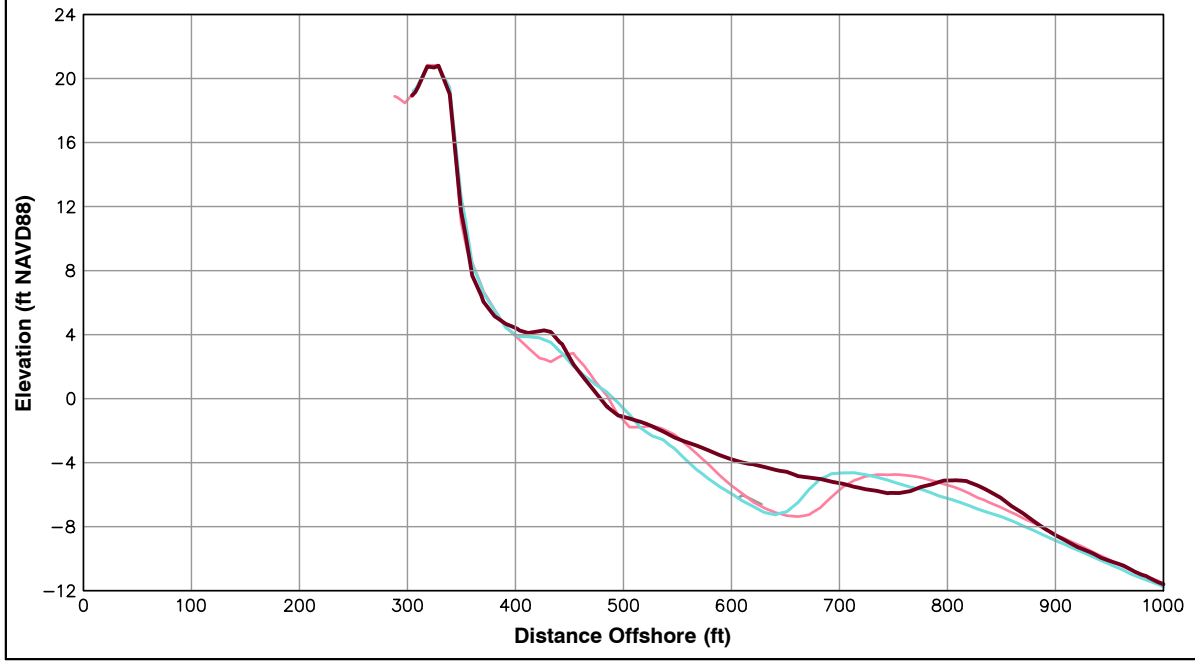
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 323+09	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-7.57 ft/yr	-5.35 ft
Volume Change Above -15 ft NAVD88	9.12 cy/ft/yr	13.50 cy/ft
Volume Change Above 0 ft NAVD88	0.80 cy/ft/yr	-0.56 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR

Notes:
1. Stationing From West To East At Varying Intervals.
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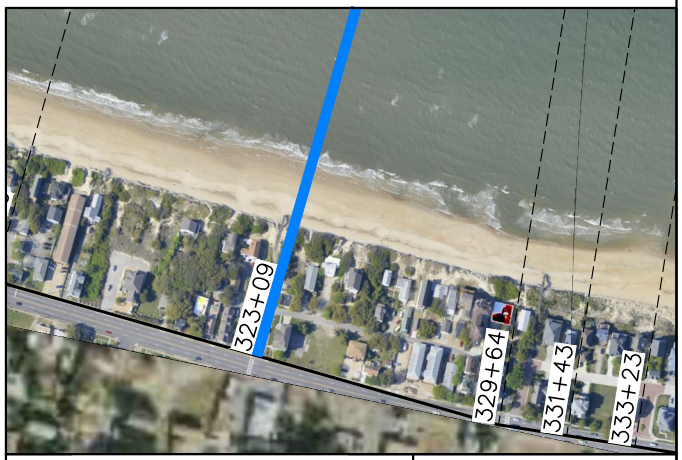
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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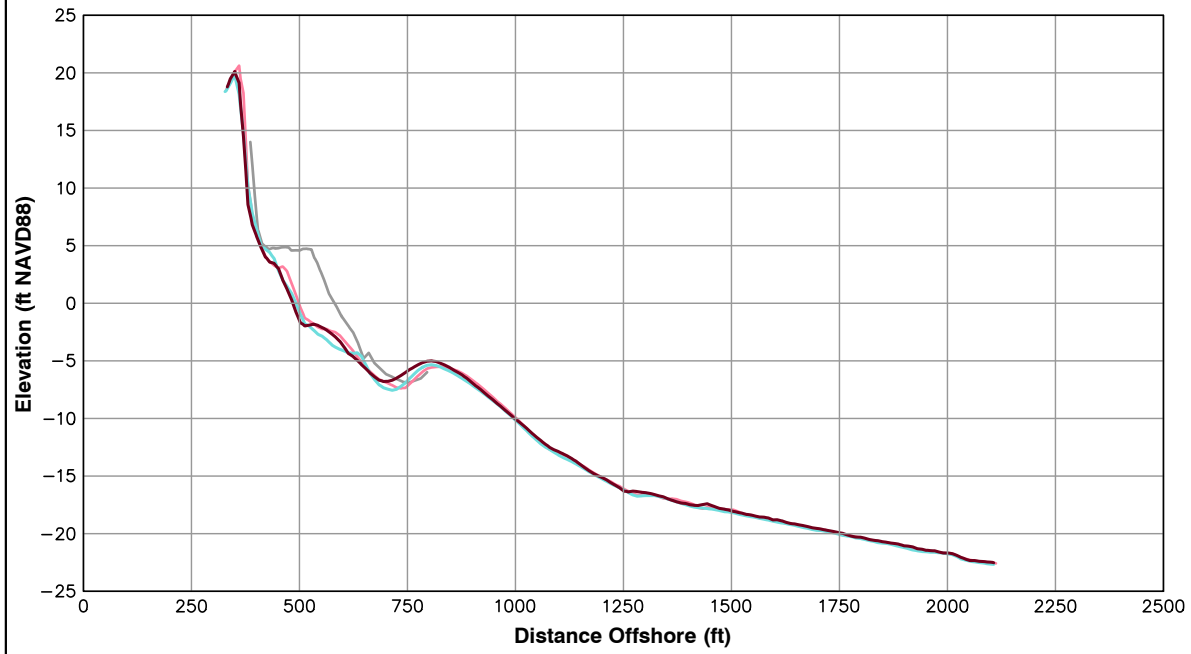
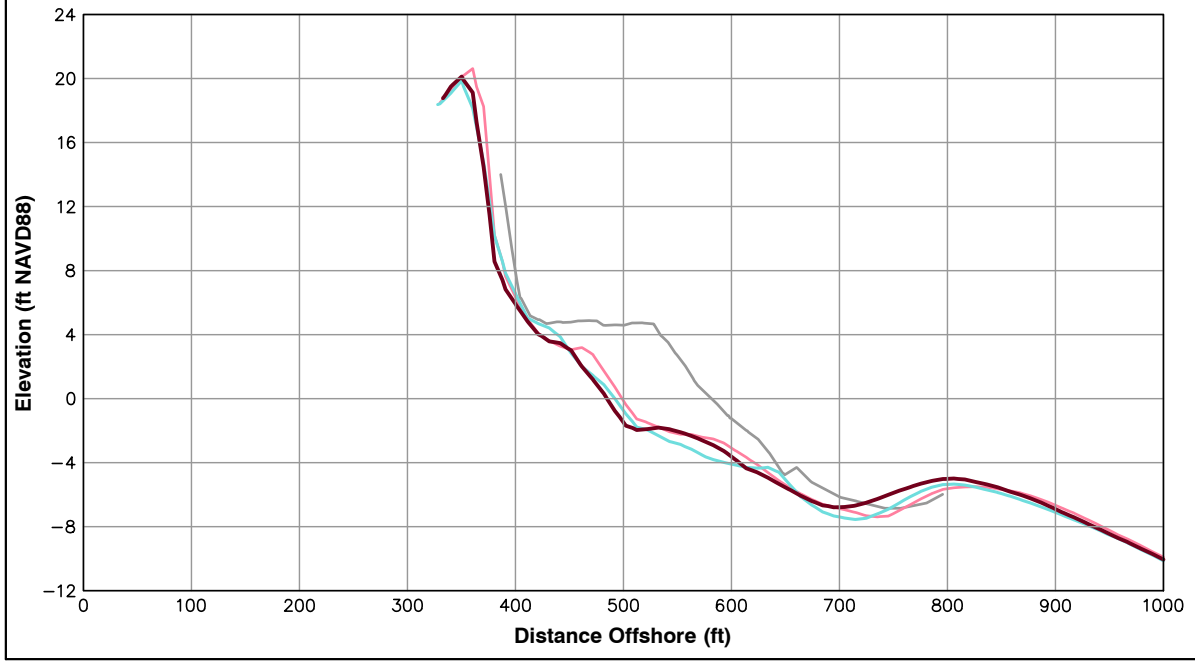
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





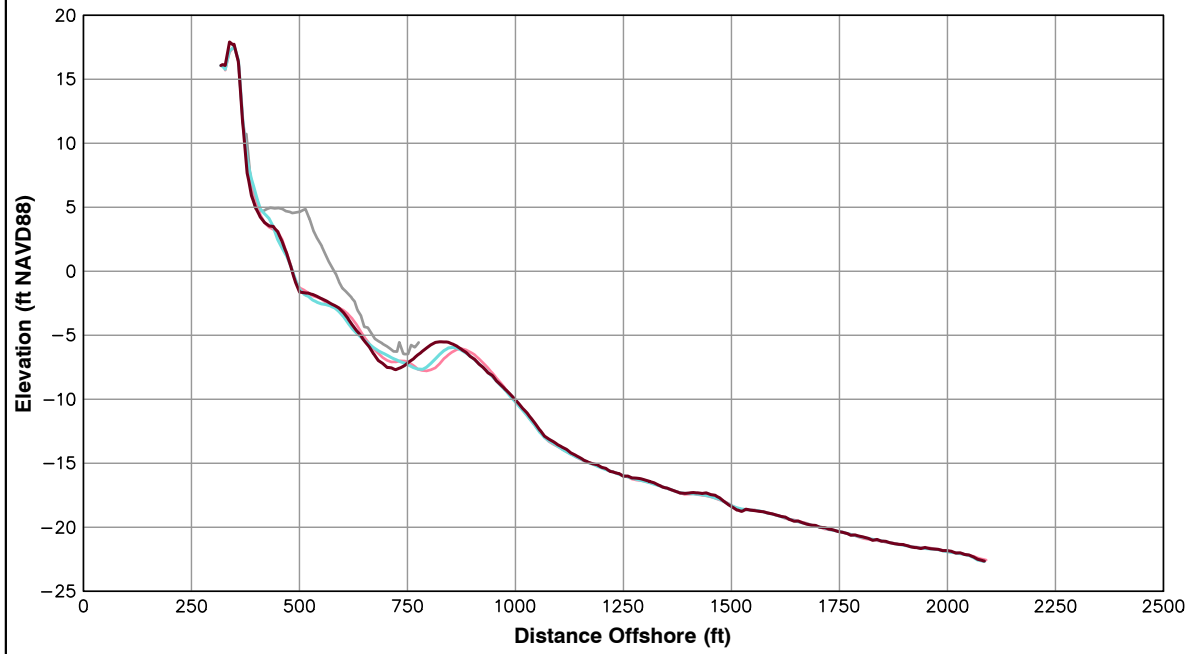
Survey Transect 329+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-14.38 ft/yr	-5.77 ft
Volume Change Above -15 ft NAVD88	-4.01 cy/ft/yr	5.05 cy/ft
Volume Change Above 0 ft NAVD88	-4.57 cy/ft/yr	-1.79 cy/ft

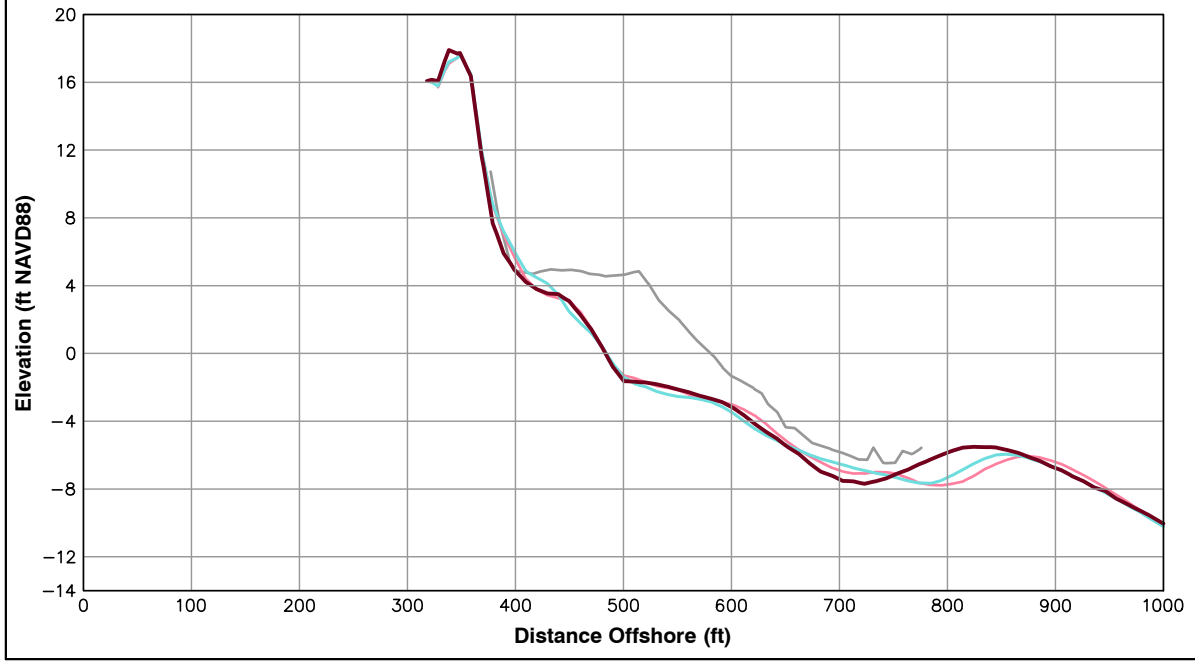
LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 331+43	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-0.51 ft/yr	1.43 ft
Volume Change Above -15 ft NAVD88	1.65 cy/ft/yr	2.92 cy/ft
Volume Change Above 0 ft NAVD88	-0.80 cy/ft/yr	-1.23 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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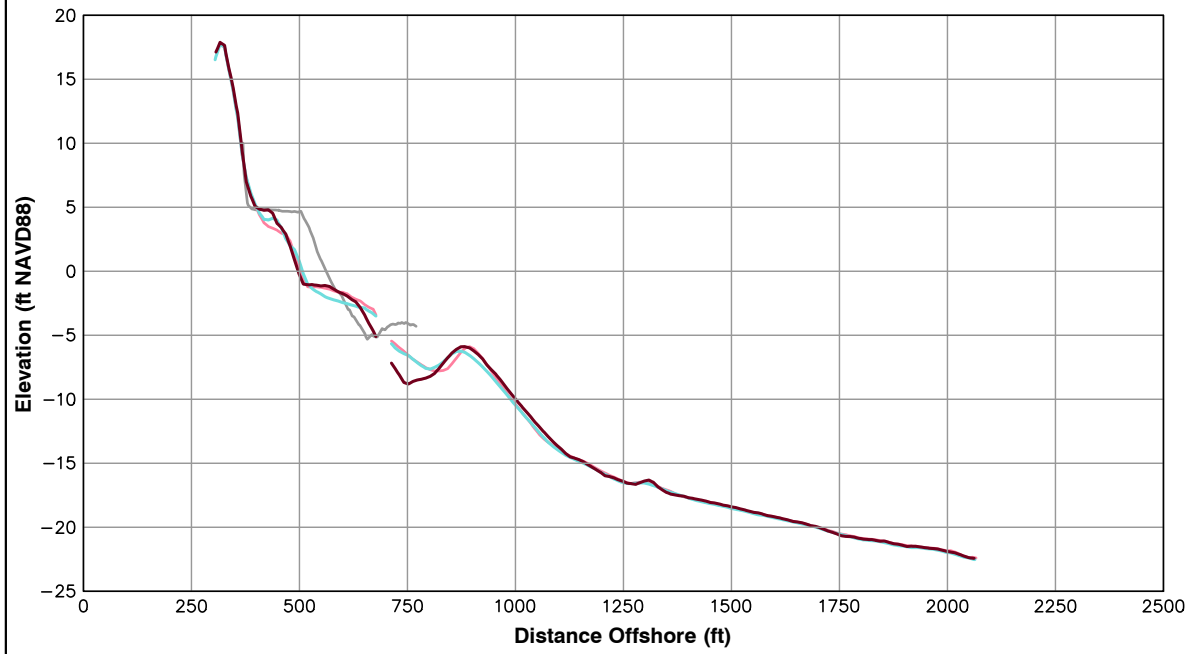
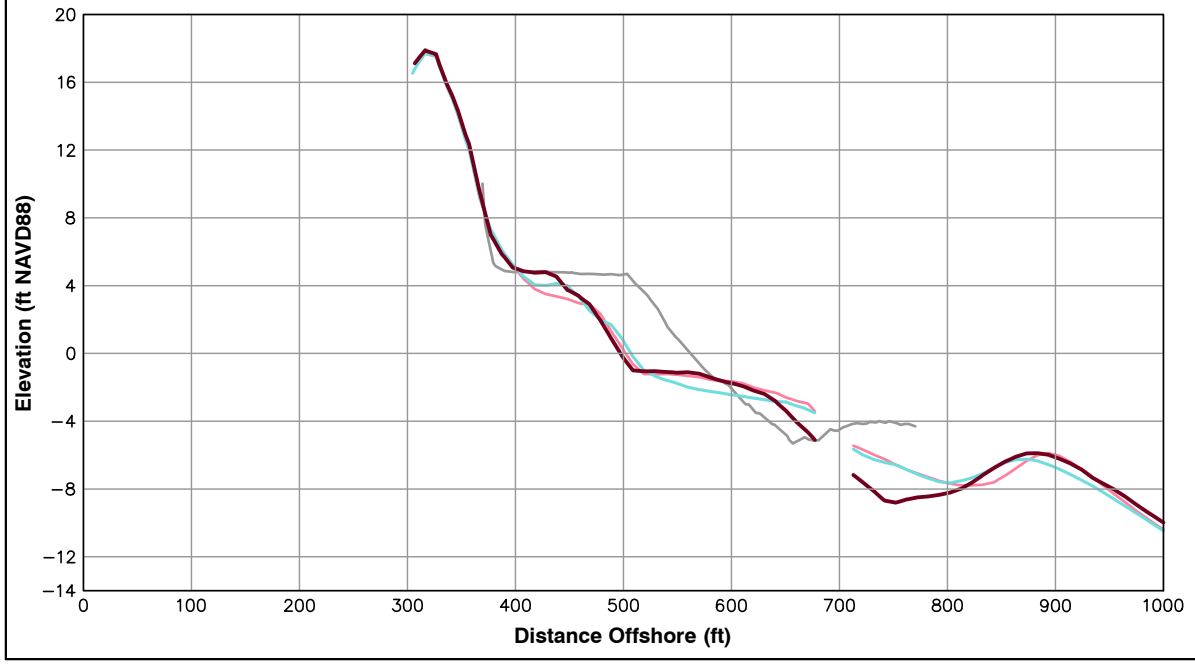
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 333+23	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-4.07 ft/yr	-9.63 ft
Volume Change Above -15 ft NAVD88	-2.01 cy/ft/yr	0.52 cy/ft
Volume Change Above 0 ft NAVD88	1.59 cy/ft/yr	0.51 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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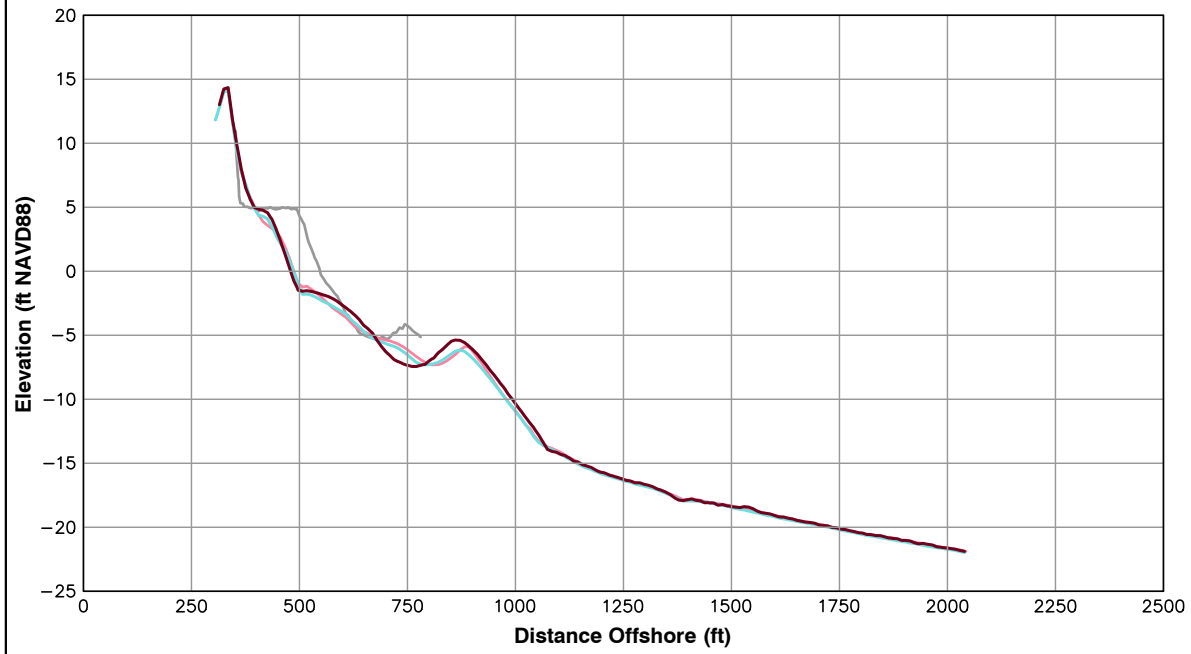
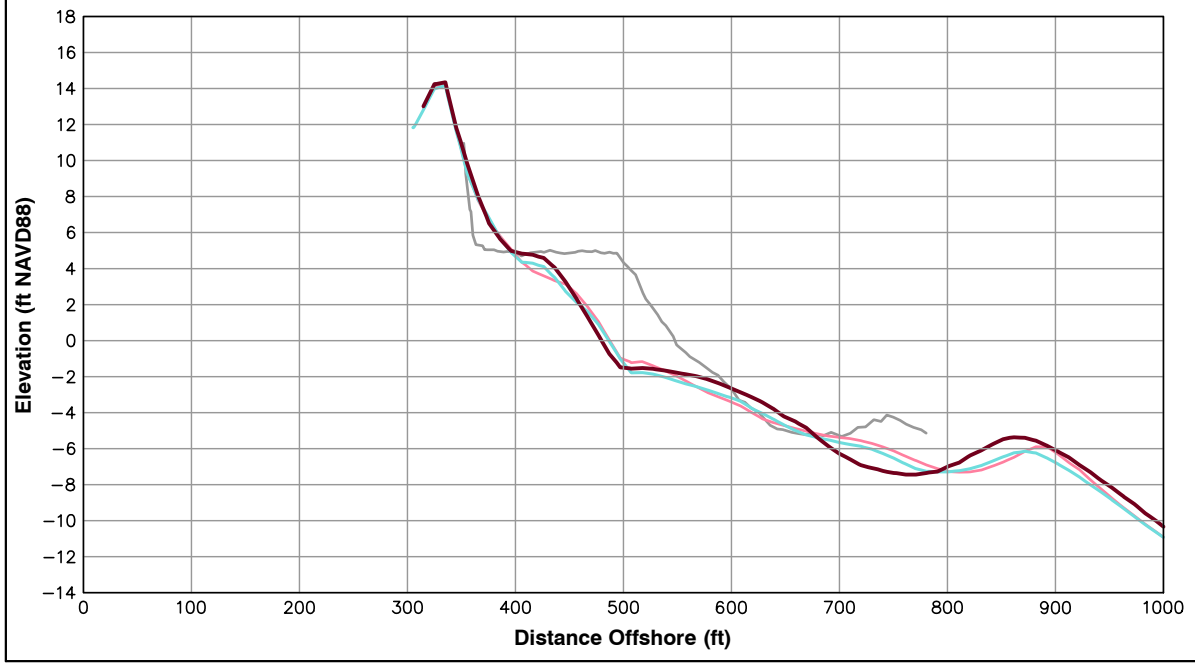
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 335+03	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-7.08 ft/yr	-5.60 ft
Volume Change Above -15 ft NAVD88	4.30 cy/ft/yr	7.90 cy/ft
Volume Change Above 0 ft NAVD88	0.79 cy/ft/yr	1.10 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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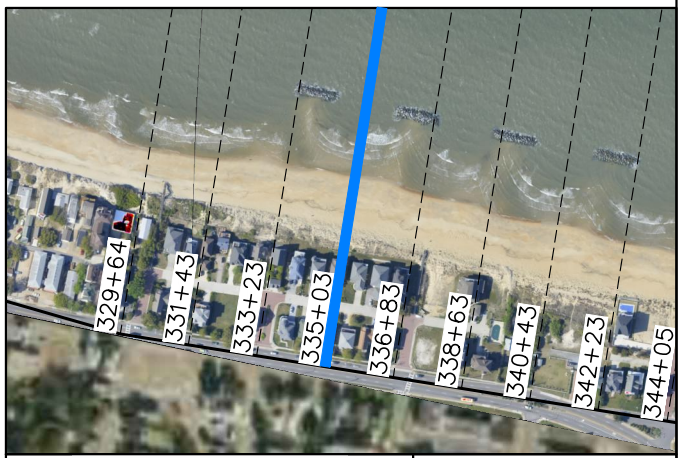

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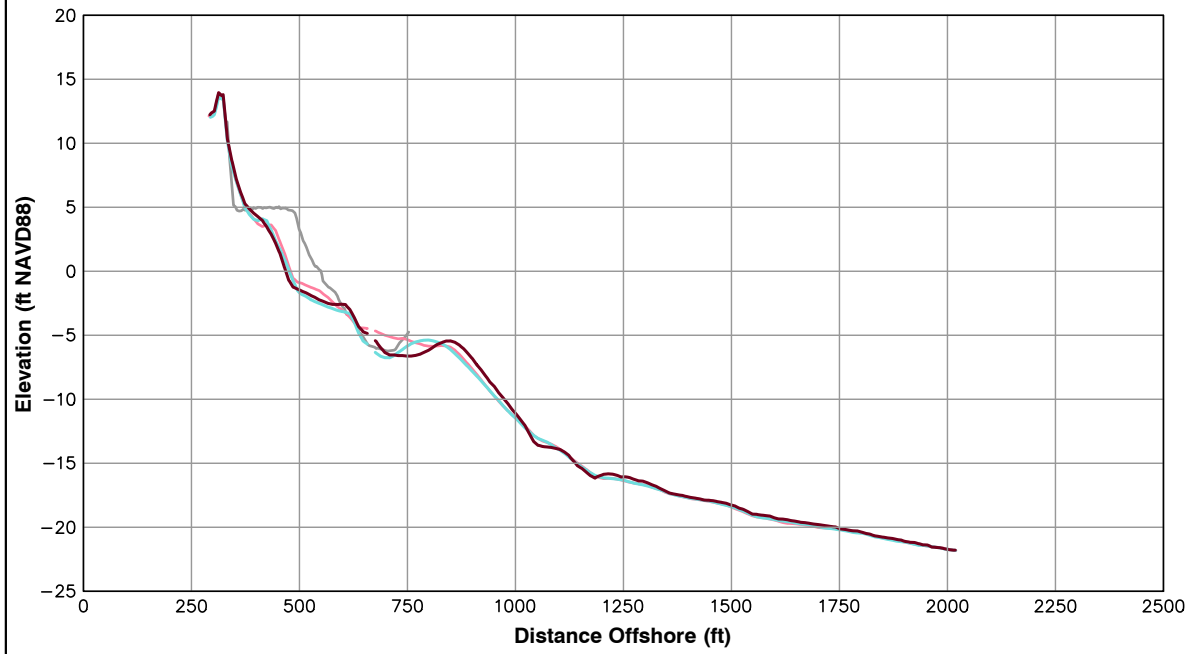
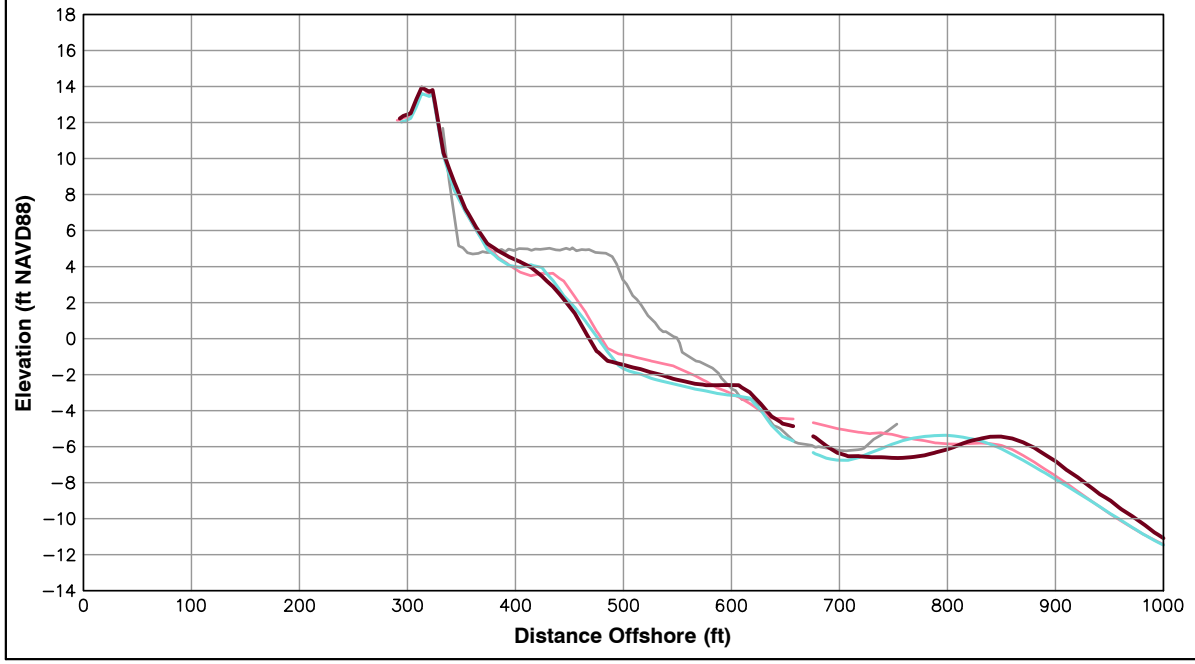
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 336+83	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.26 ft/yr	-5.77 ft
Volume Change Above -15 ft NAVD88	-3.66 cy/ft/yr	4.75 cy/ft
Volume Change Above 0 ft NAVD88	-0.43 cy/ft/yr	0.47 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

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1. Stationing From West To East At Varying Intervals.
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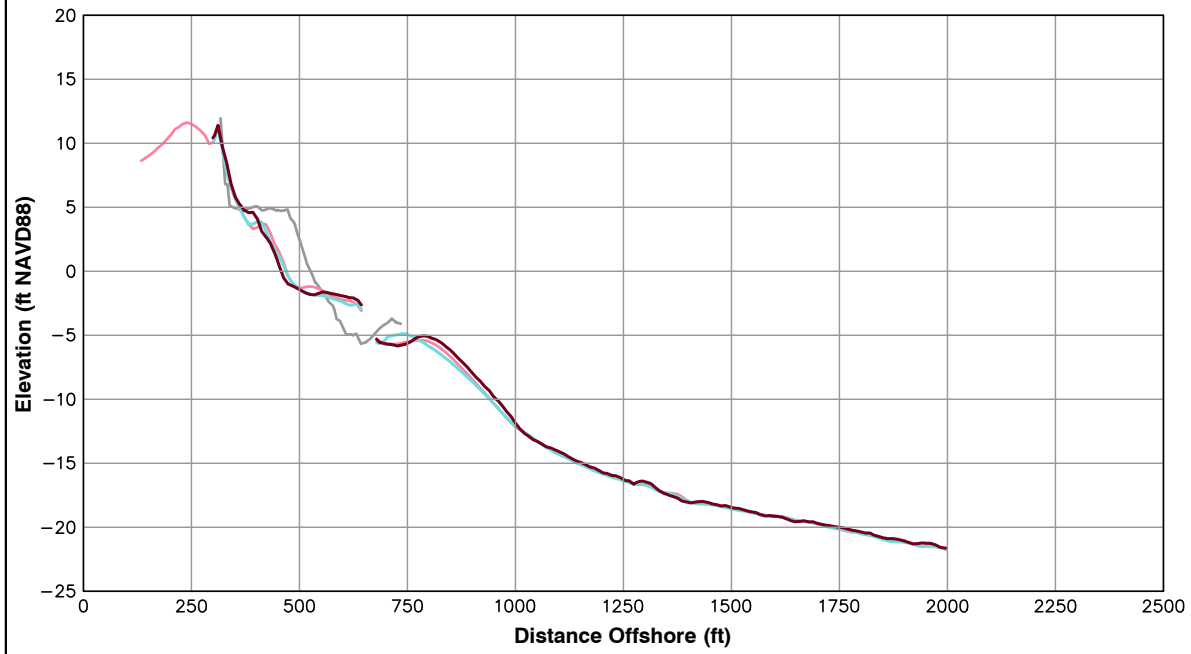
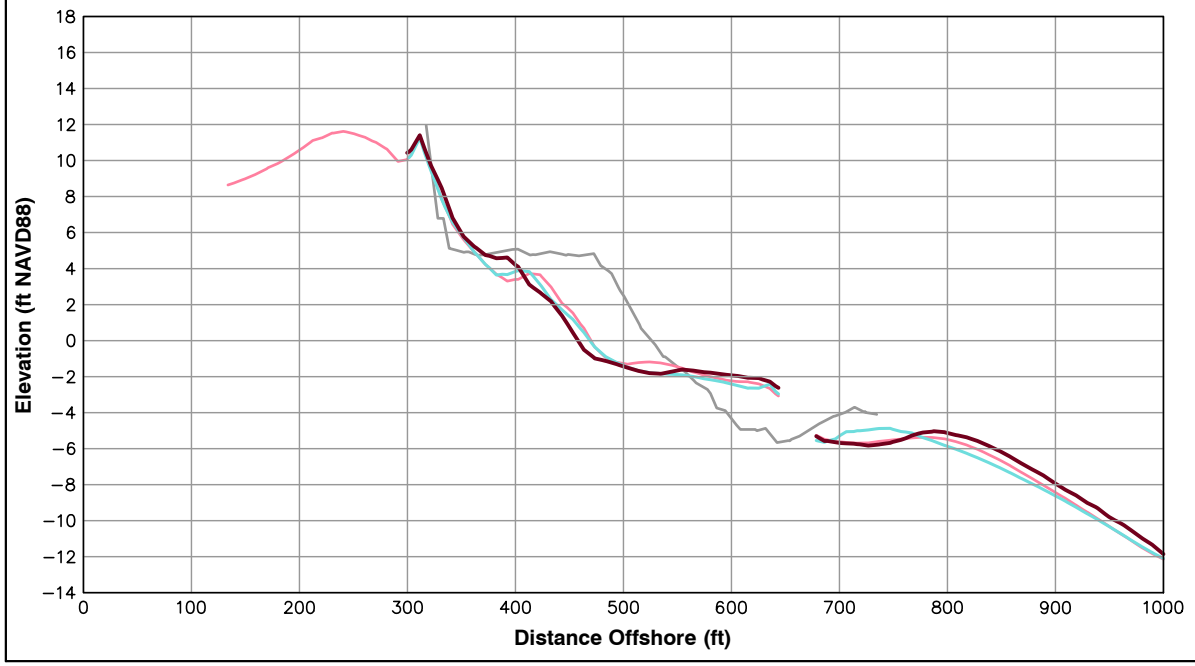
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 336+83	Pg 80 of 106	Spring 2013





Survey Transect 338+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-11.36 ft/yr	-8.43 ft
Volume Change Above -15 ft NAVD88	3.57 cy/ft/yr	6.52 cy/ft
Volume Change Above 0 ft NAVD88	0.13 cy/ft/yr	0.63 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

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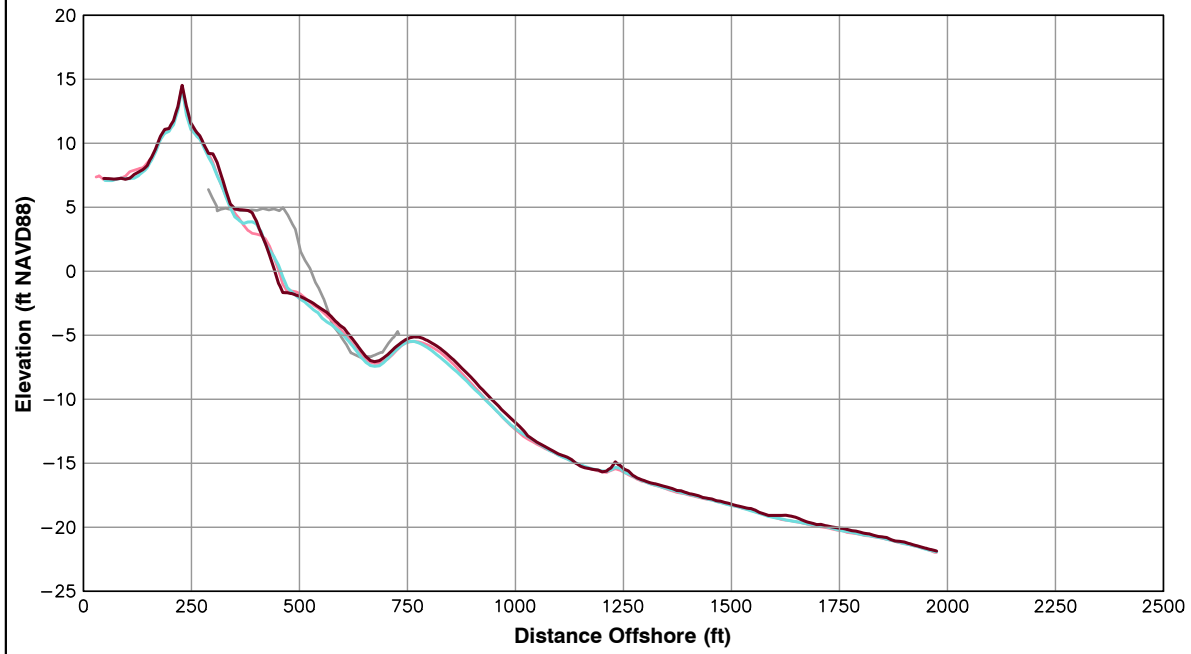
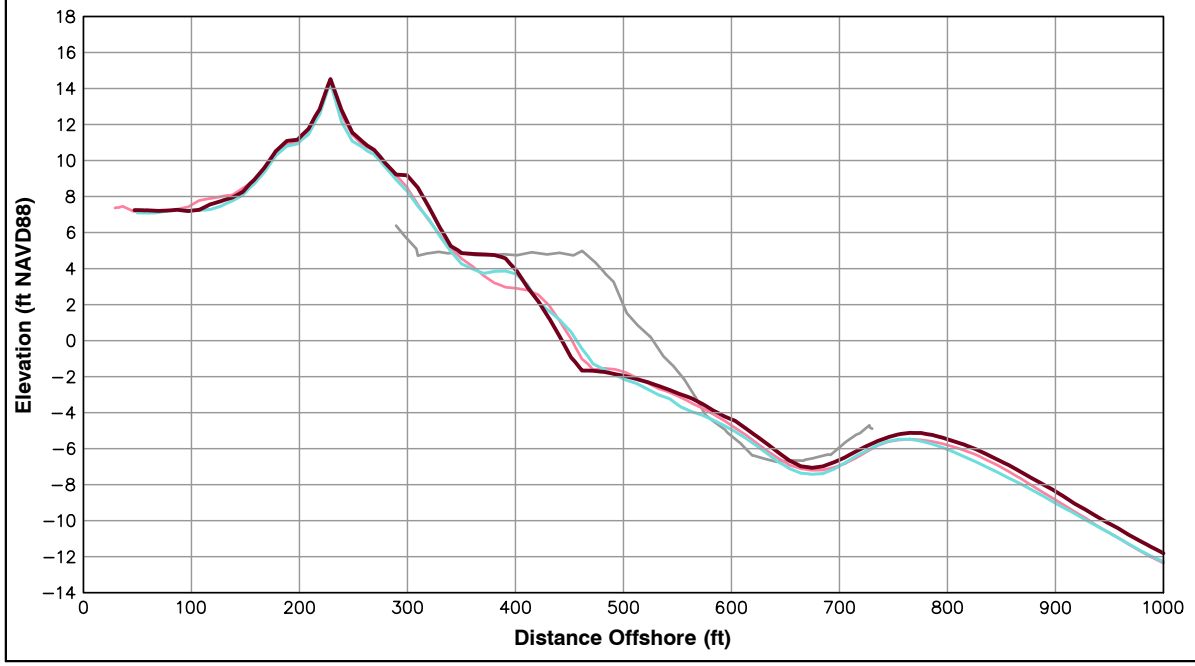
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





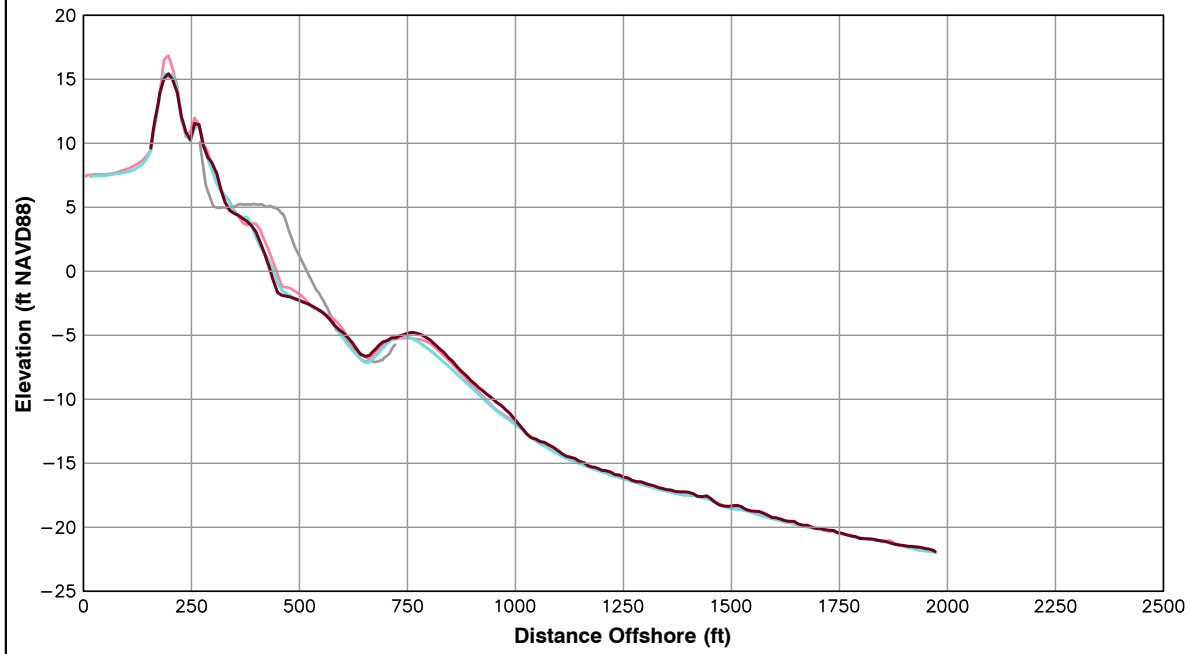
Survey Transect 340+43	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-7.96 ft/yr	-9.88 ft
Volume Change Above -15 ft NAVD88	8.57 cy/ft/yr	13.26 cy/ft
Volume Change Above 0 ft NAVD88	2.70 cy/ft/yr	4.23 cy/ft

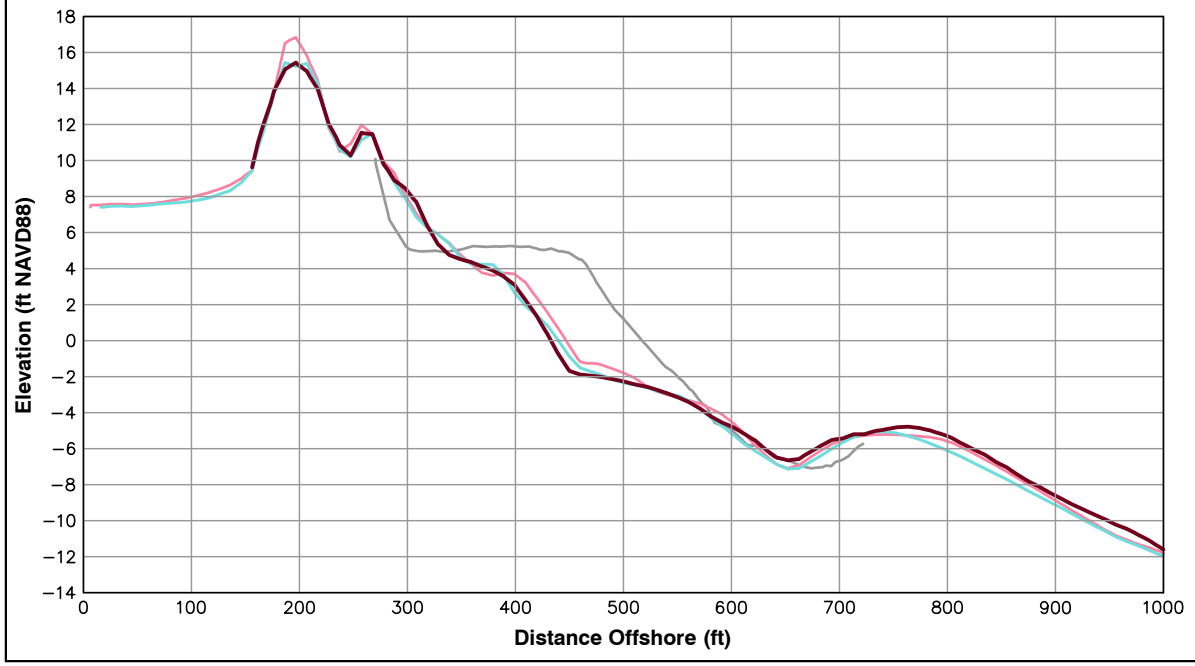
LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 342+23	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-12.18 ft/yr	-3.64 ft
Volume Change Above -15 ft NAVD88	-0.91 cy/ft/yr	8.52 cy/ft
Volume Change Above 0 ft NAVD88	-3.30 cy/ft/yr	0.23 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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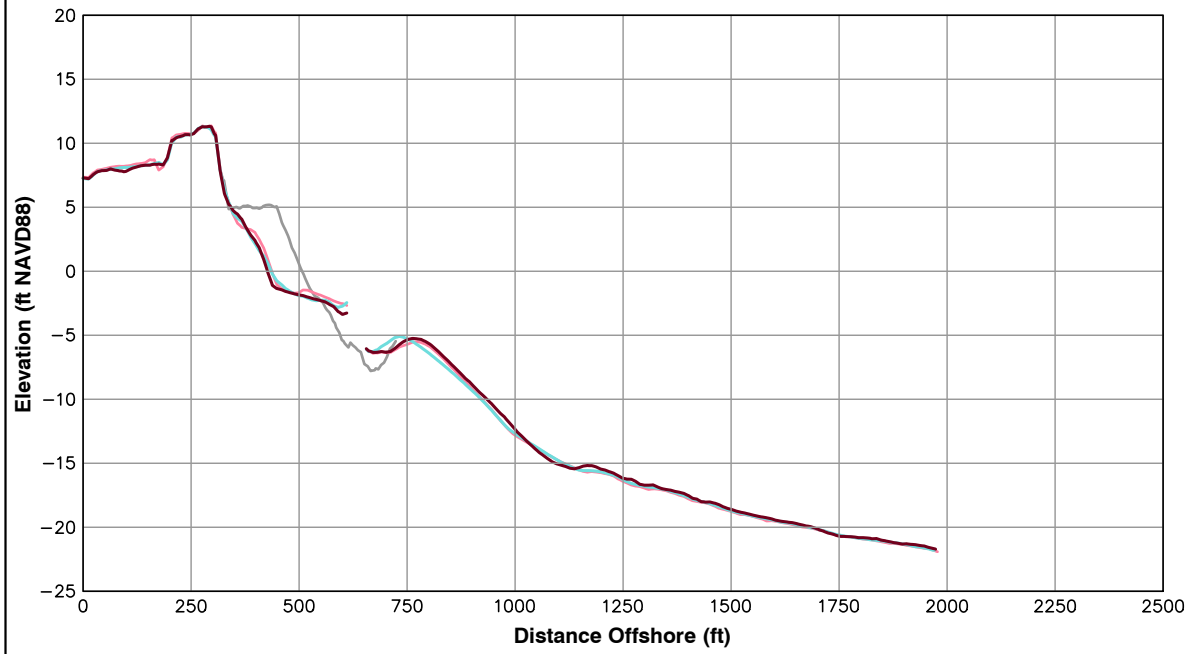
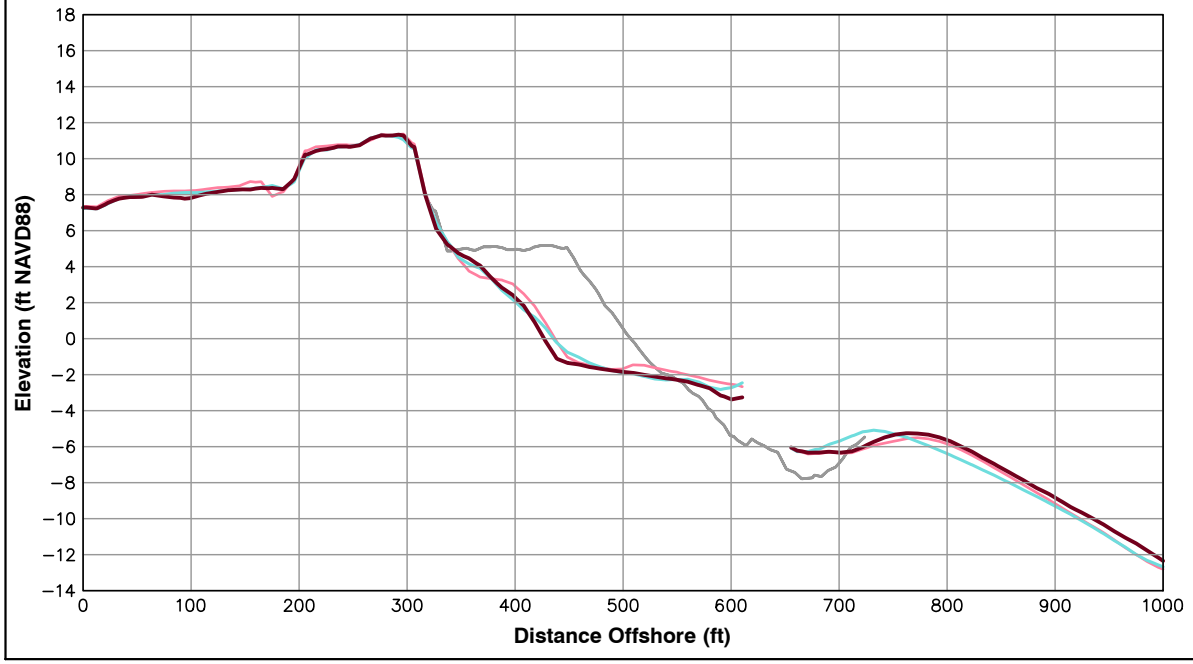
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 344+05	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-9.15 ft/yr	-4.52 ft
Volume Change Above -15 ft NAVD88	-2.03 cy/ft/yr	1.20 cy/ft
Volume Change Above 0 ft NAVD88	-2.38 cy/ft/yr	-0.25 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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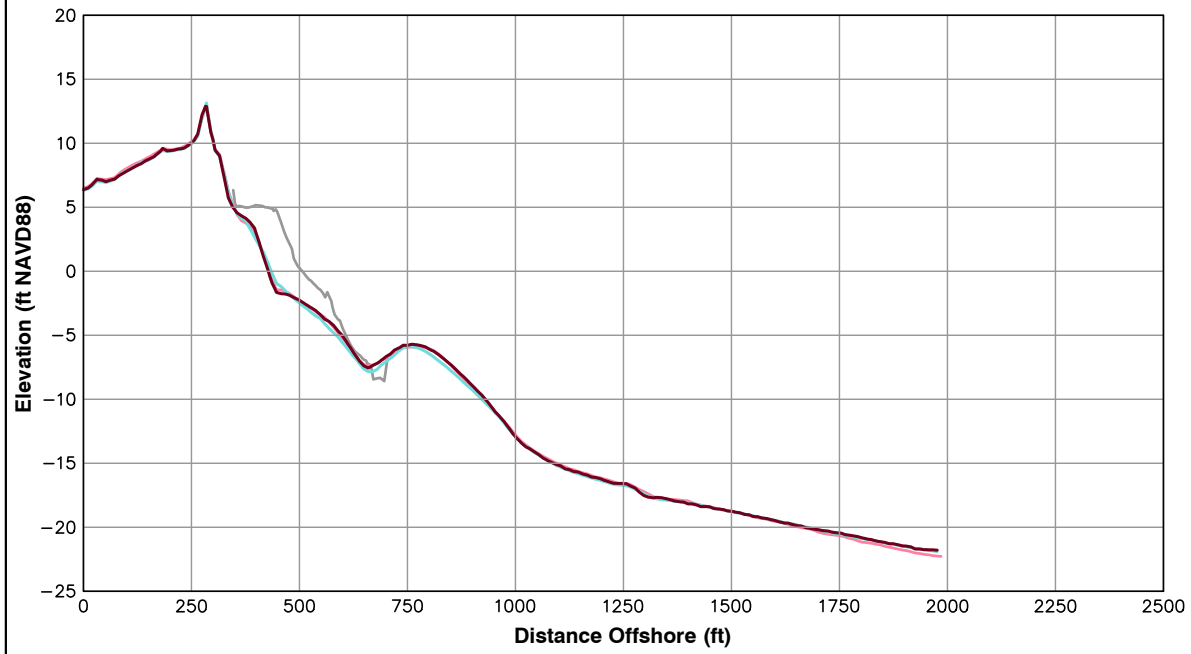
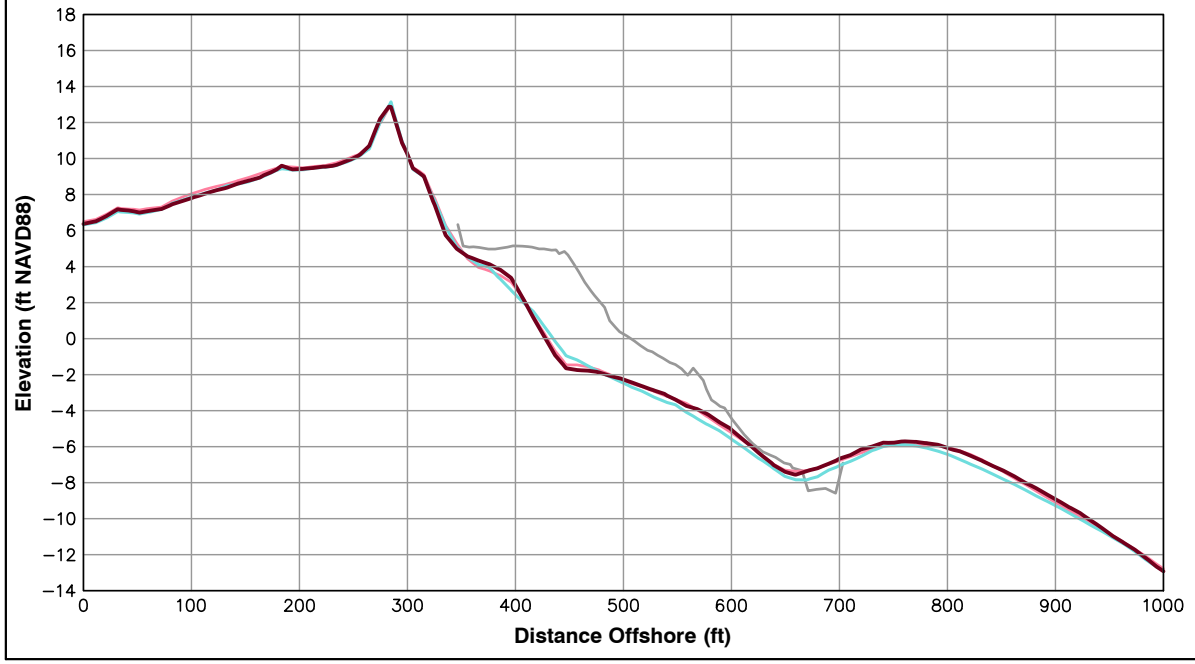
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 345+85	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-1.07 ft/yr	-4.71 ft
Volume Change Above -15 ft NAVD88	-1.06 cy/ft/yr	5.69 cy/ft
Volume Change Above 0 ft NAVD88	-1.19 cy/ft/yr	0.47 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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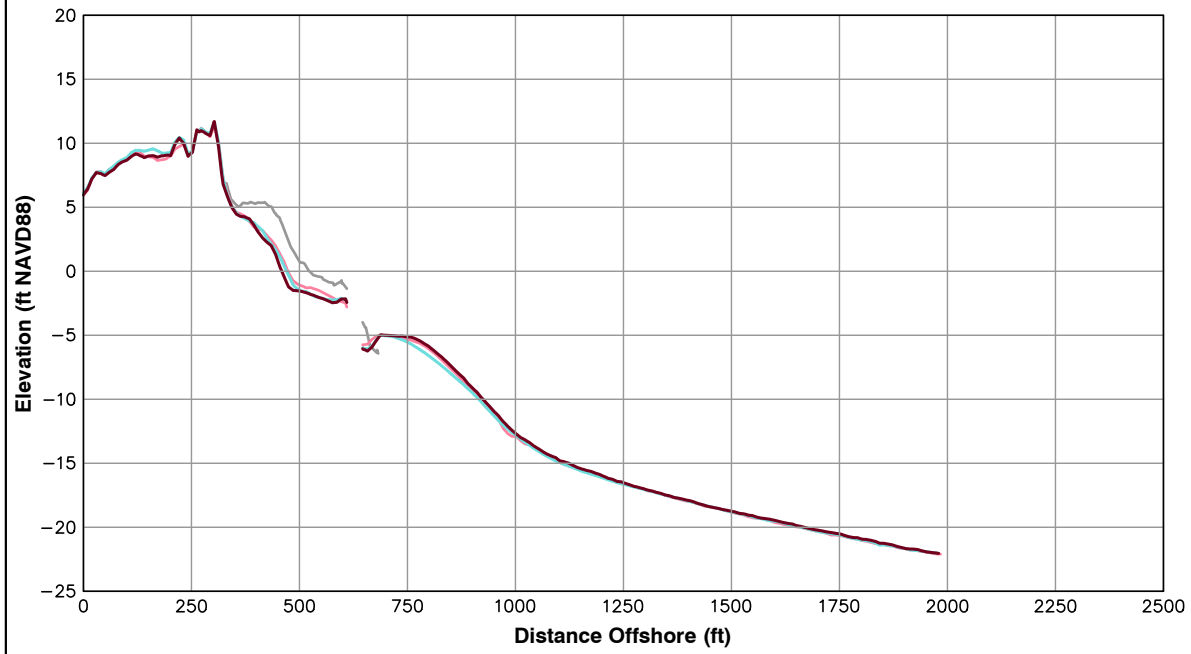
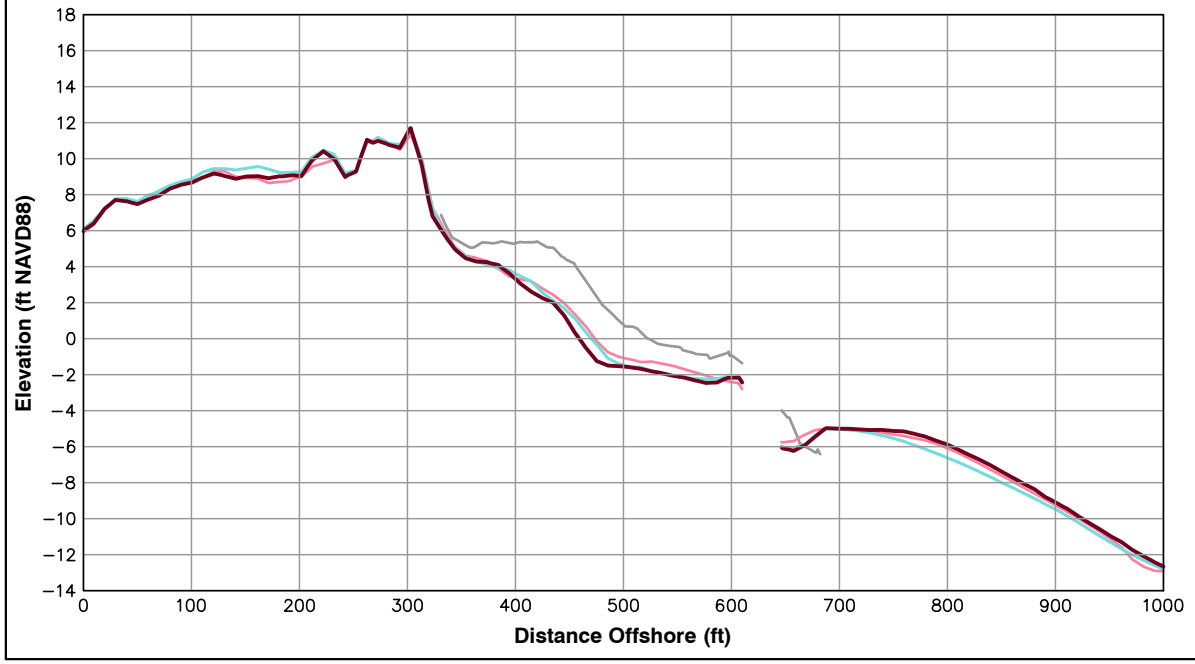
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 347+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-11.59 ft/yr	-8.53 ft
Volume Change Above -15 ft NAVD88	-1.59 cy/ft/yr	0.81 cy/ft
Volume Change Above 0 ft NAVD88	-1.70 cy/ft/yr	-3.76 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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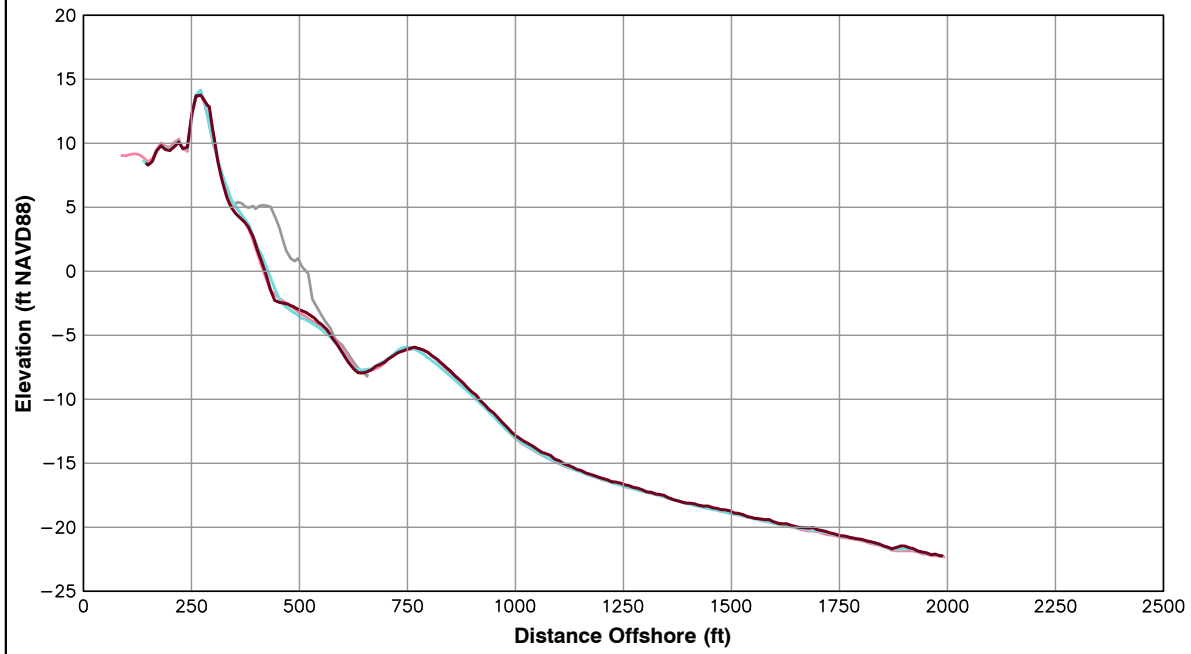
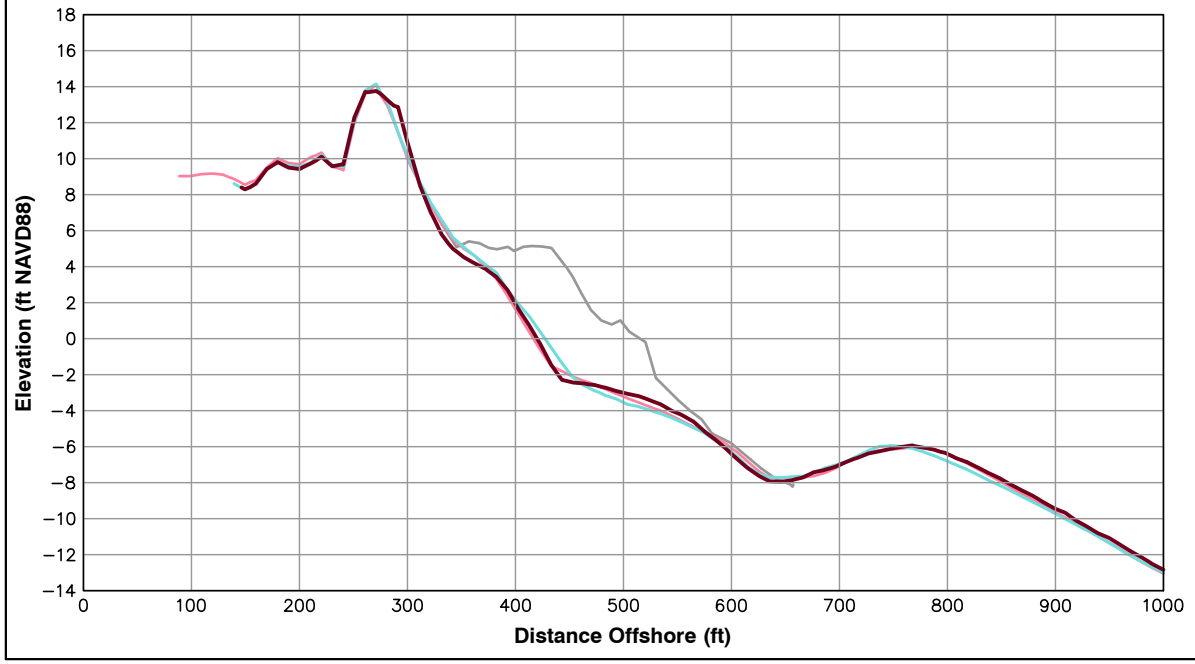
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 349+43	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	3.33 ft/yr	-5.68 ft
Volume Change Above -15 ft NAVD88	2.22 cy/ft/yr	2.37 cy/ft
Volume Change Above 0 ft NAVD88	-0.14 cy/ft/yr	-1.21 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

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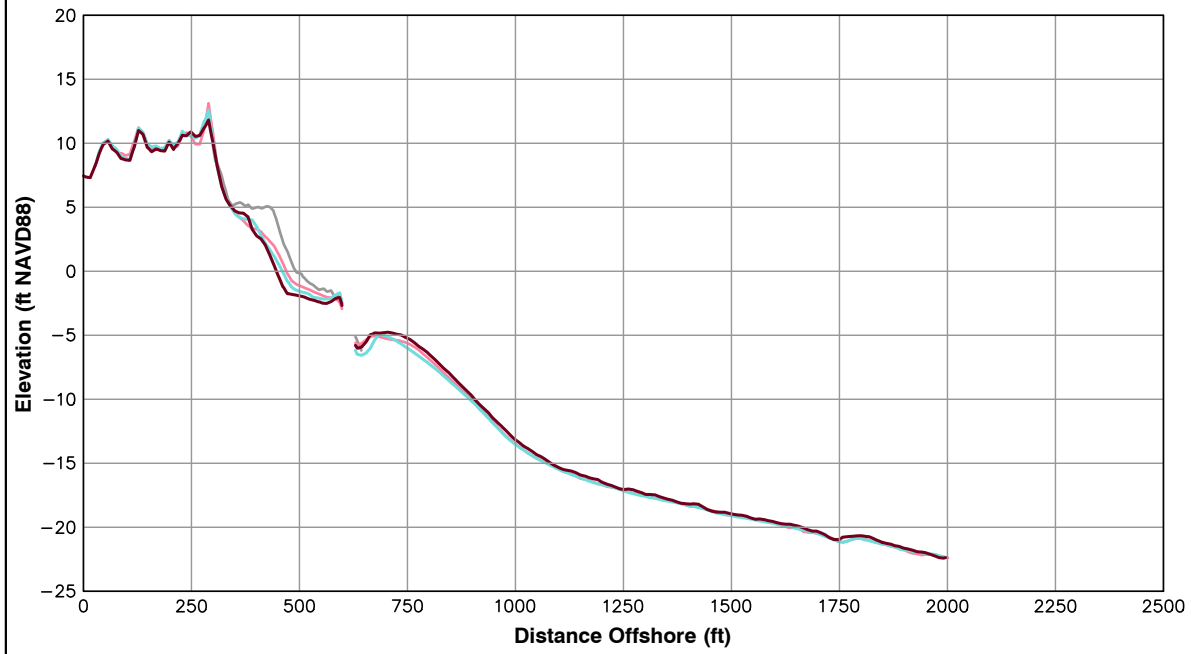
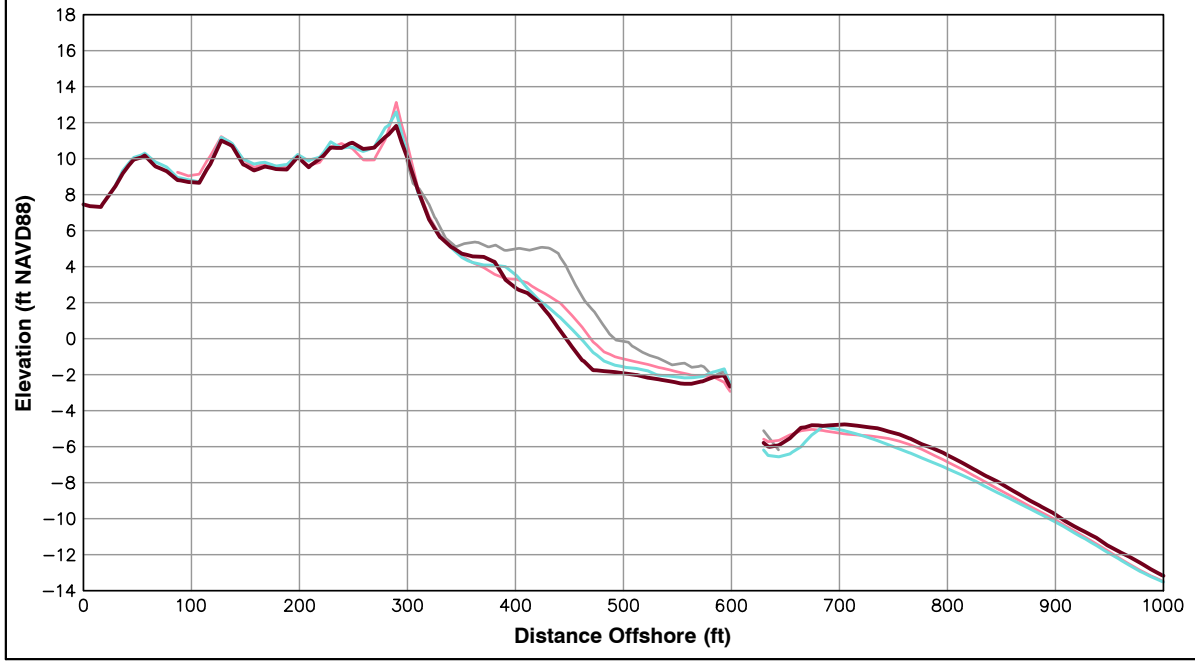
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 351+23	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-20.57 ft/yr	-9.57 ft
Volume Change Above -15 ft NAVD88	-1.56 cy/ft/yr	3.38 cy/ft
Volume Change Above 0 ft NAVD88	-2.91 cy/ft/yr	-2.71 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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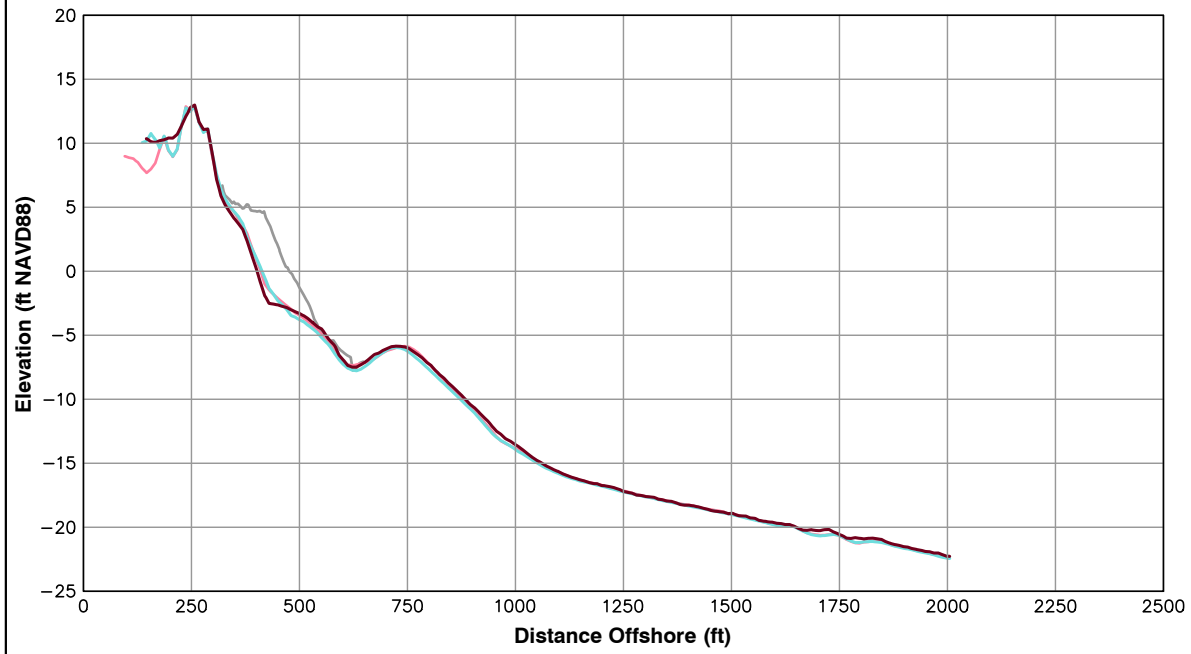
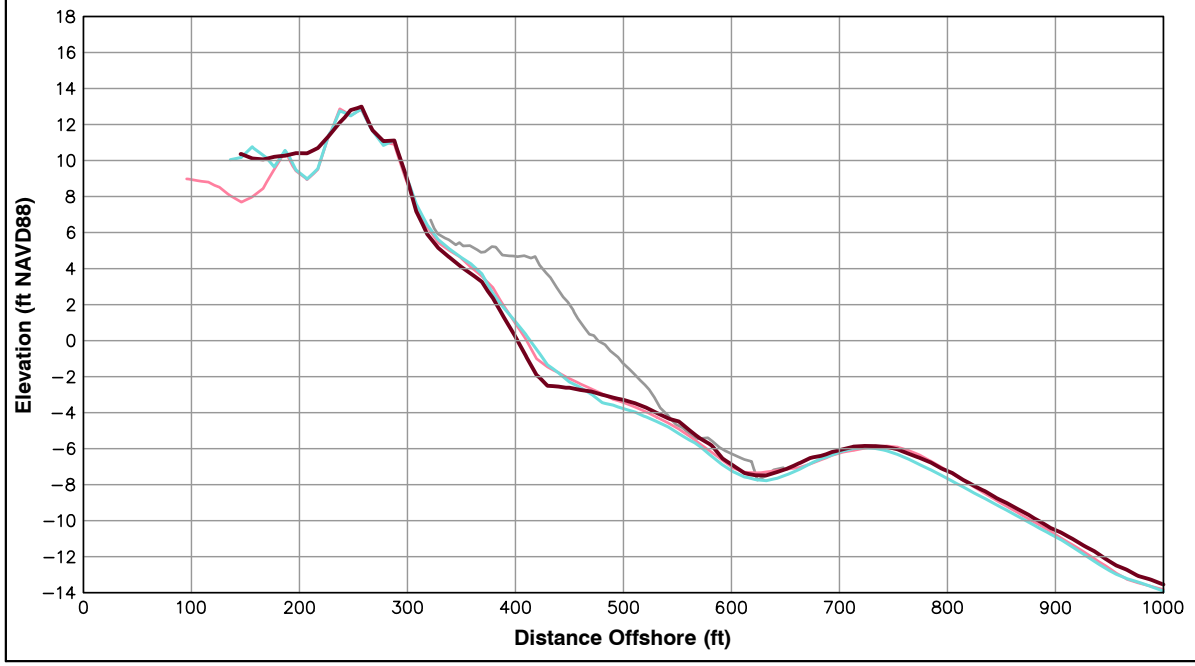
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 353+03	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-6.92 ft/yr	-8.58 ft
Volume Change Above -15 ft NAVD88	3.42 cy/ft/yr	5.34 cy/ft
Volume Change Above 0 ft NAVD88	1.82 cy/ft/yr	-0.85 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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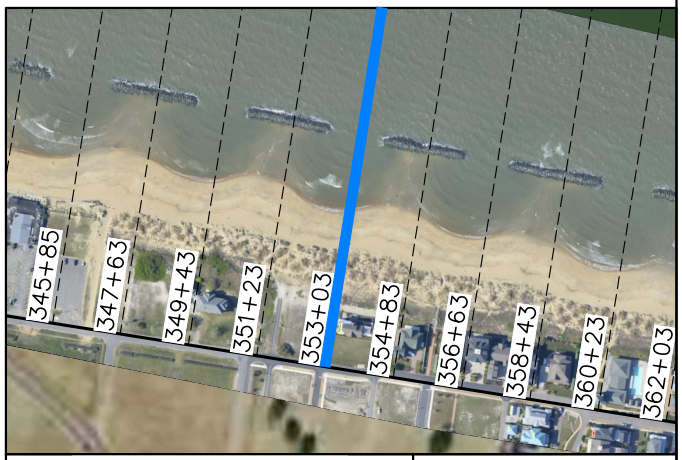

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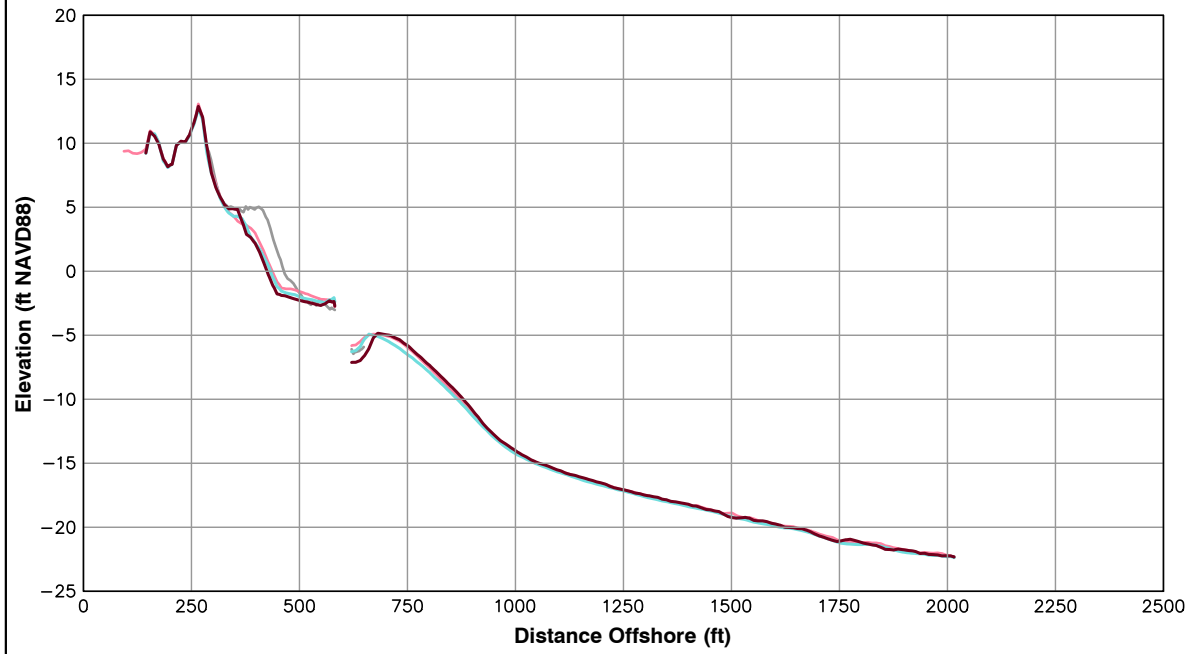
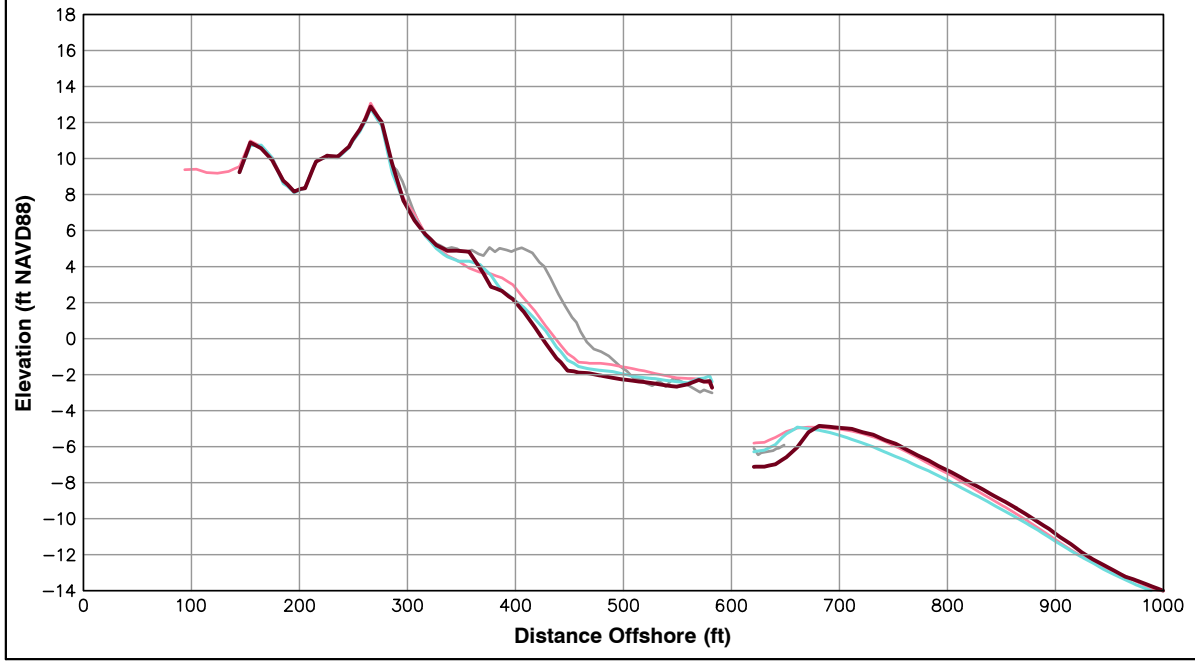
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 354+83	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-10.27 ft/yr	-5.89 ft
Volume Change Above -15 ft NAVD88	-4.50 cy/ft/yr	2.34 cy/ft
Volume Change Above 0 ft NAVD88	-1.27 cy/ft/yr	0.30 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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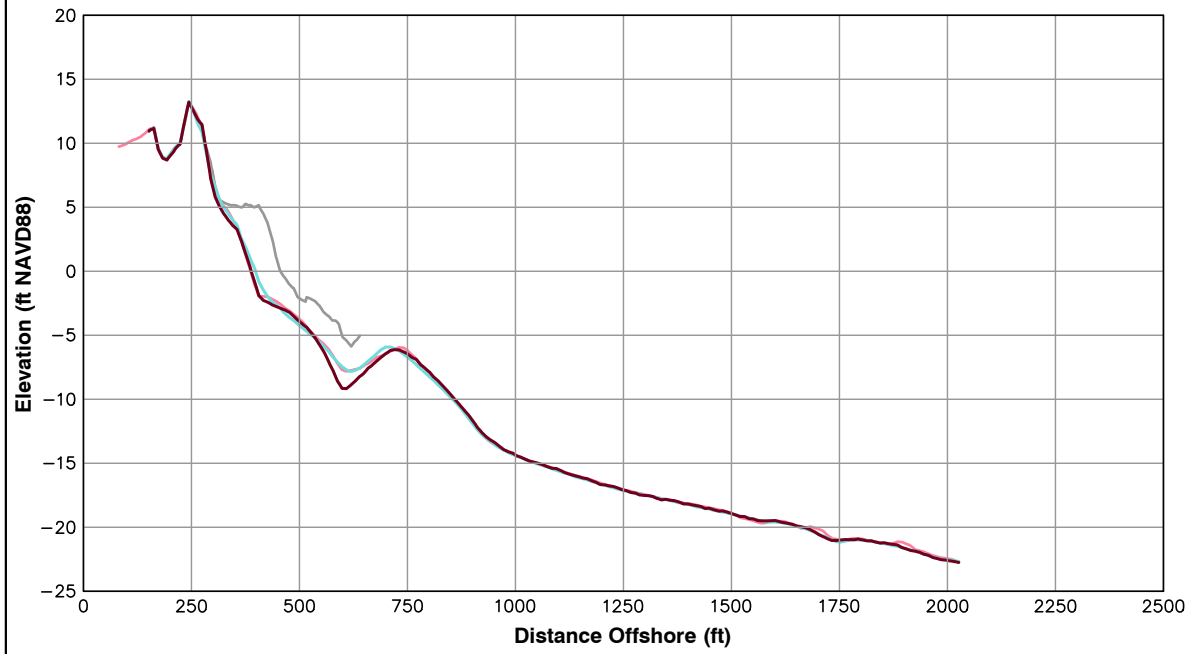
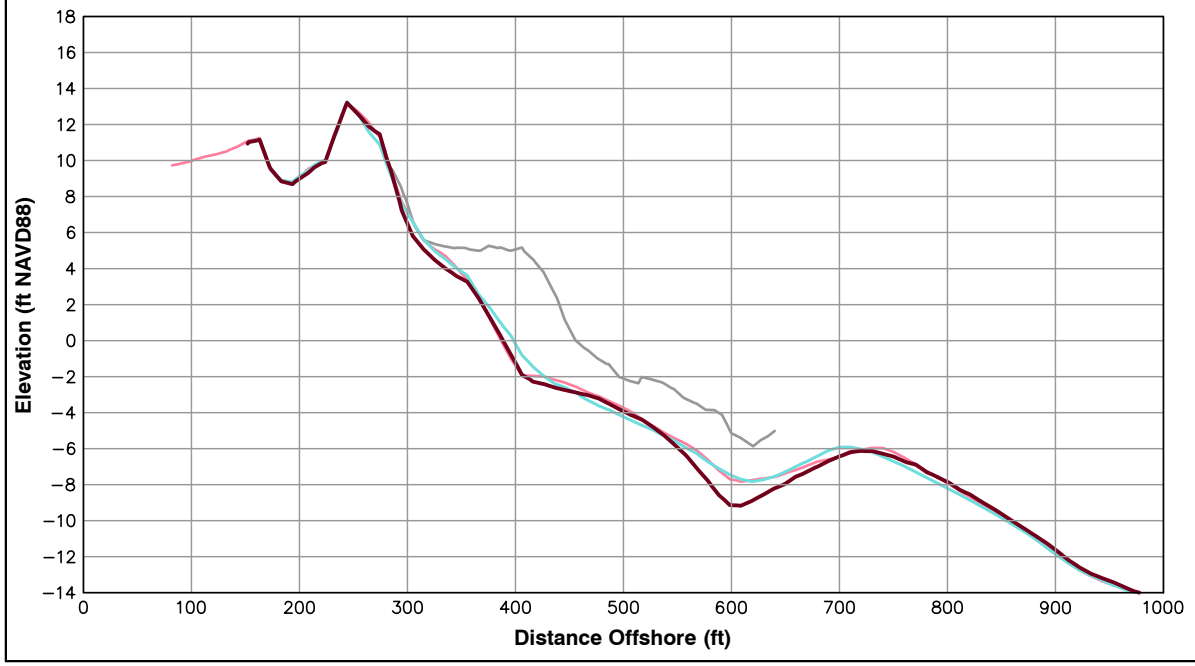
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 356+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	1.05 ft/yr	-7.12 ft
Volume Change Above -15 ft NAVD88	-6.12 cy/ft/yr	-5.20 cy/ft
Volume Change Above 0 ft NAVD88	-1.56 cy/ft/yr	-1.72 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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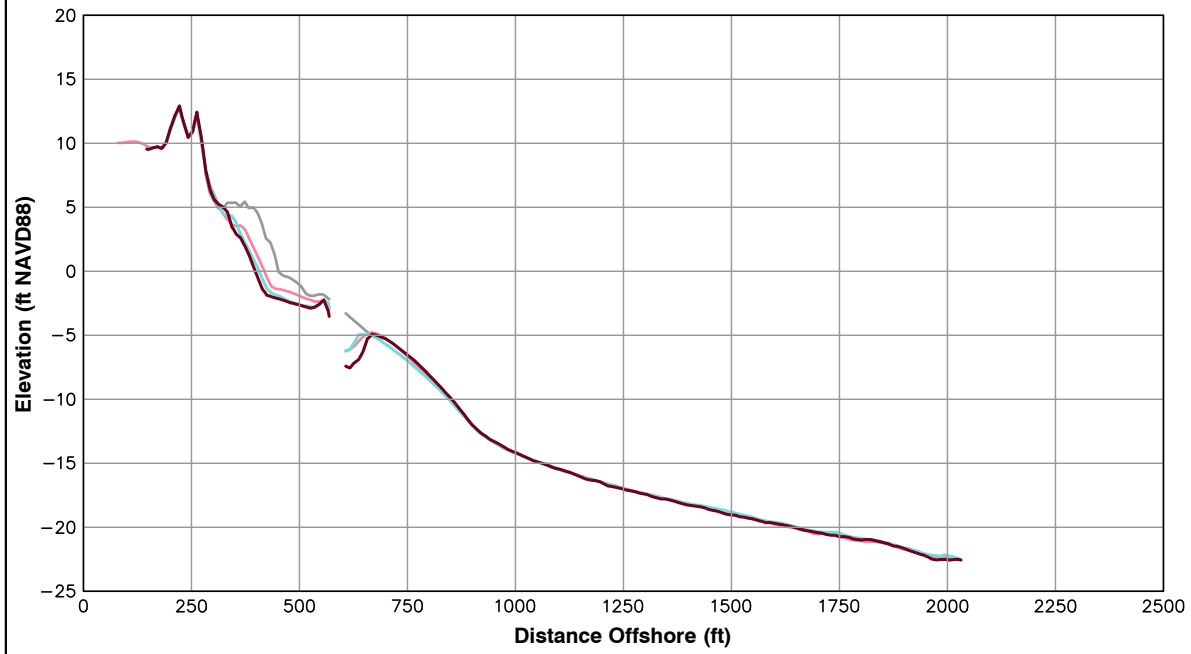
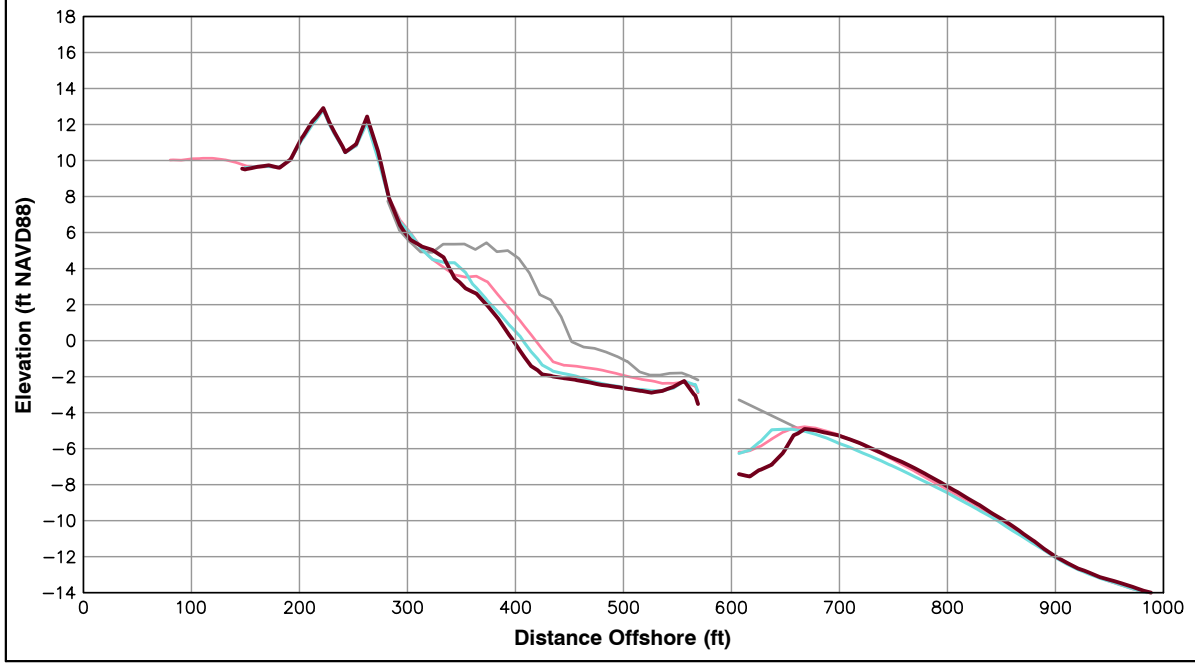
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 358+43	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-18.19 ft/yr	-6.02 ft
Volume Change Above -15 ft NAVD88	-7.86 cy/ft/yr	-1.47 cy/ft
Volume Change Above 0 ft NAVD88	-2.22 cy/ft/yr	-0.58 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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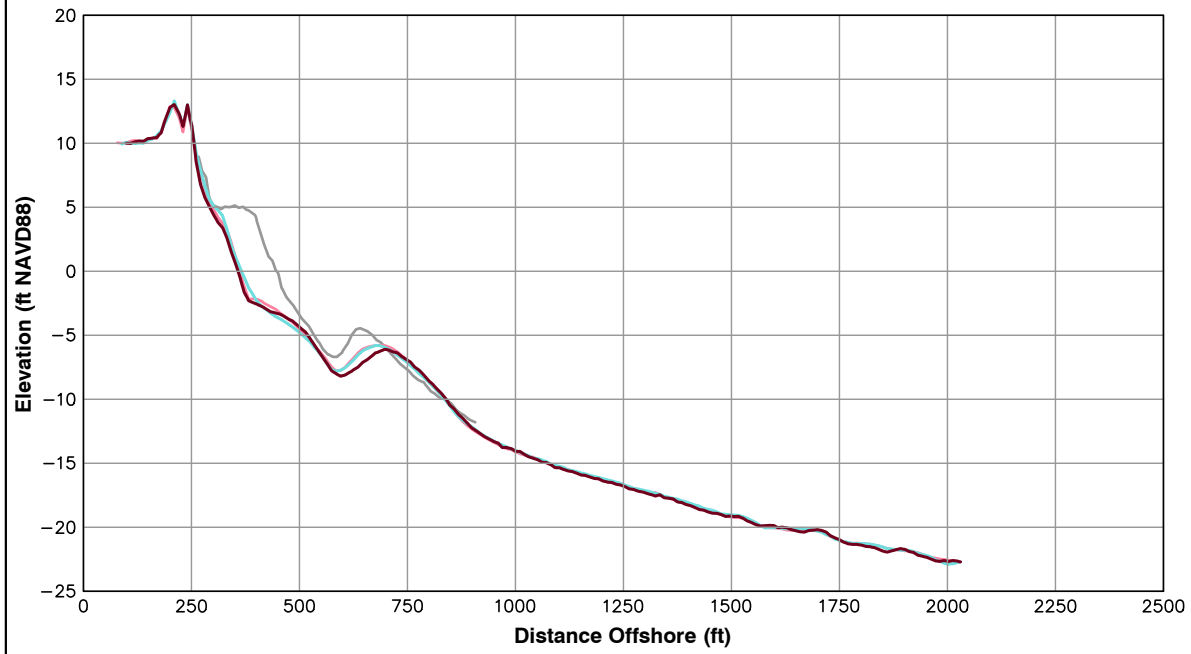
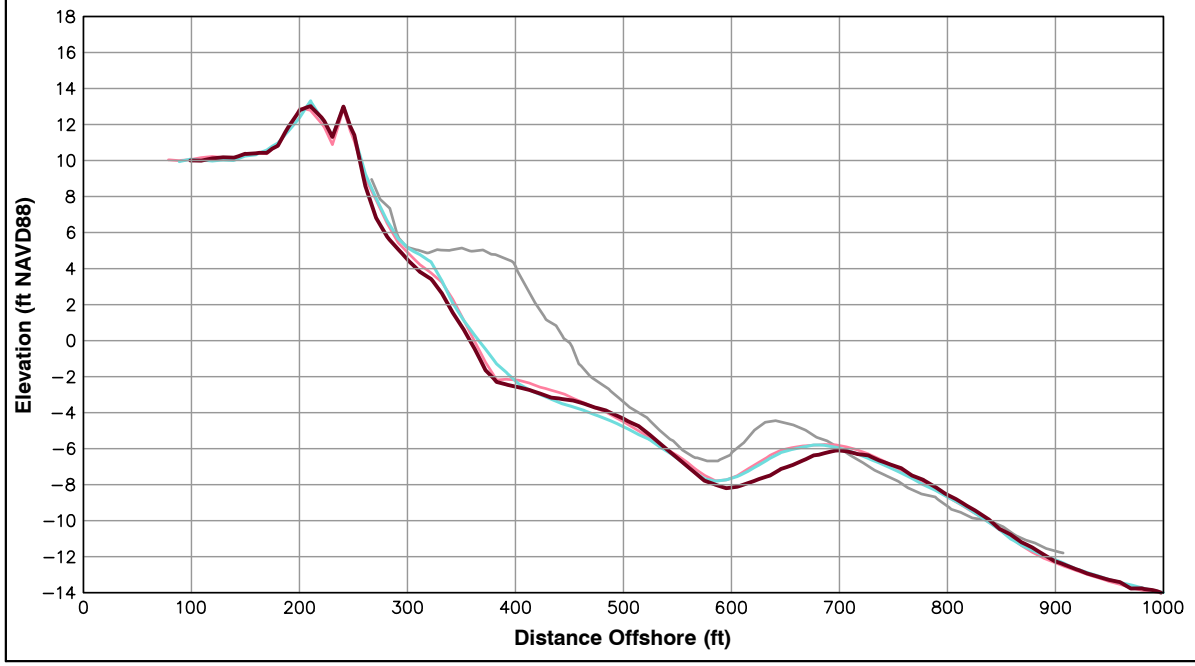
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 360+23	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-5.06 ft/yr	-5.74 ft
Volume Change Above -15 ft NAVD88	-4.80 cy/ft/yr	-4.66 cy/ft
Volume Change Above 0 ft NAVD88	-1.54 cy/ft/yr	-2.70 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
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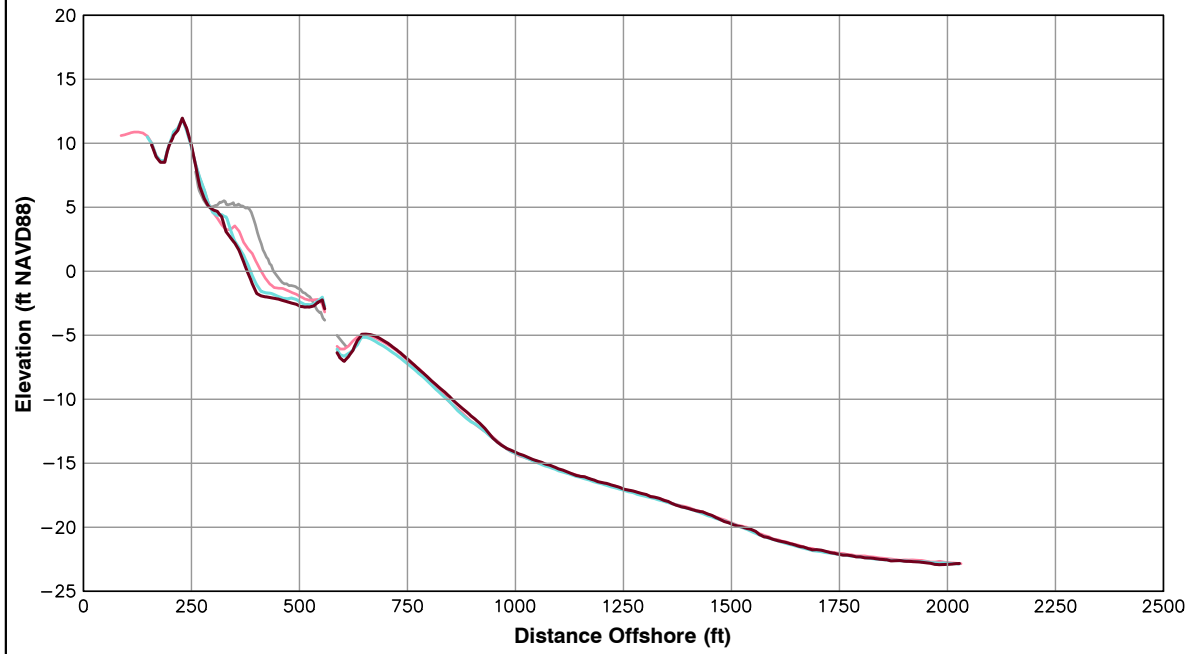
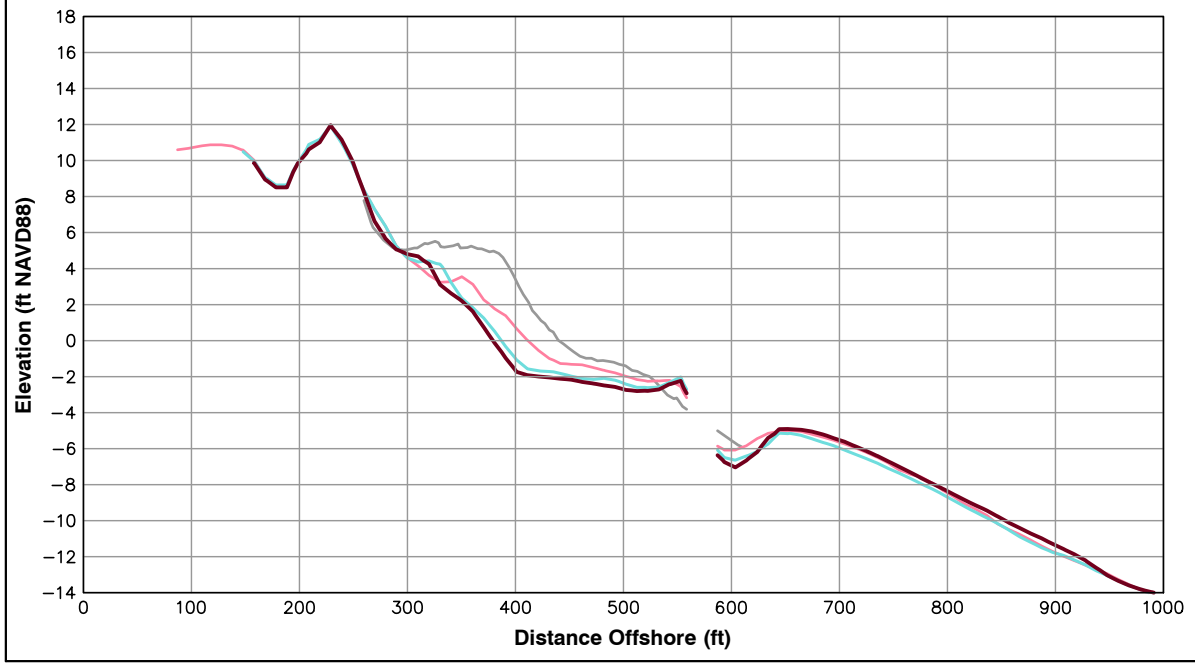
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 362+03	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-27.22 ft/yr	-6.40 ft
Volume Change Above -15 ft NAVD88	-7.58 cy/ft/yr	0.41 cy/ft
Volume Change Above 0 ft NAVD88	-3.38 cy/ft/yr	-1.84 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

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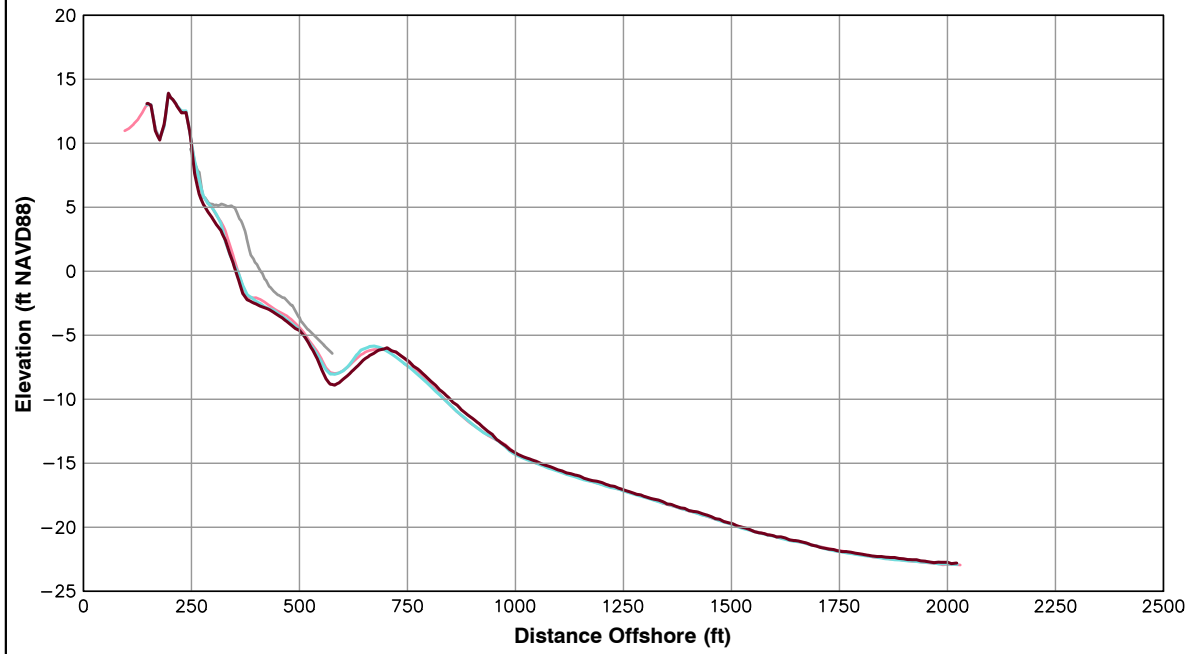

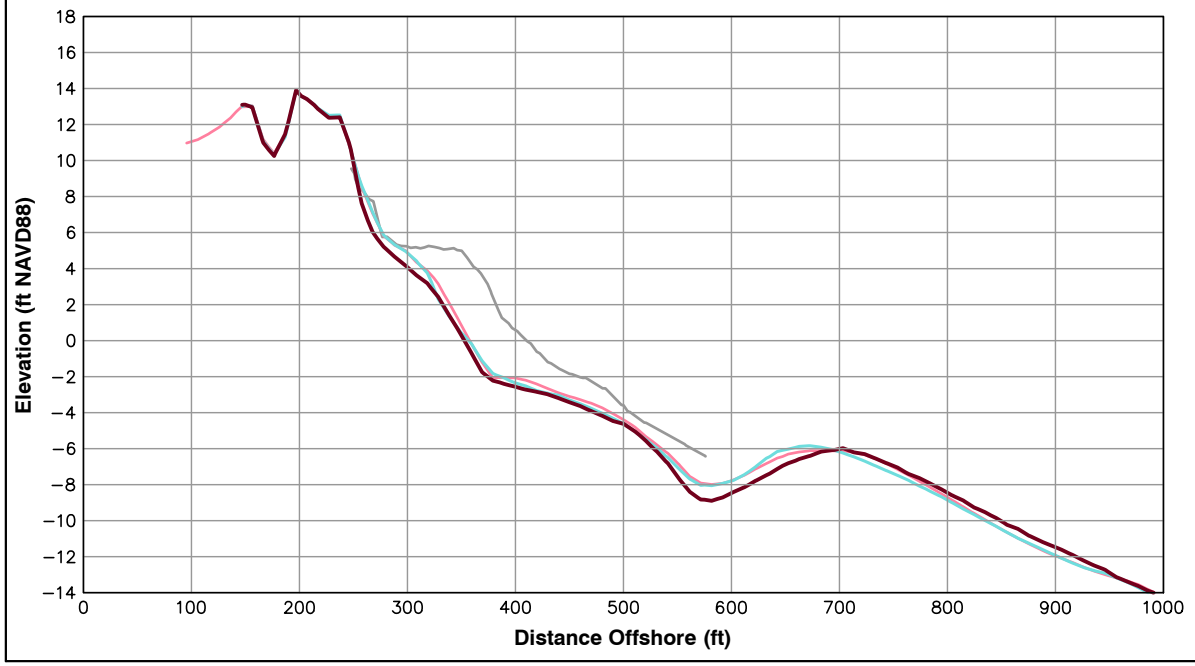

Survey Transect 363+83	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-5.47 ft/yr	-0.02 ft
Volume Change Above -15 ft NAVD88	-5.79 cy/ft/yr	-3.23 cy/ft
Volume Change Above 0 ft NAVD88	-2.77 cy/ft/yr	-2.18 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

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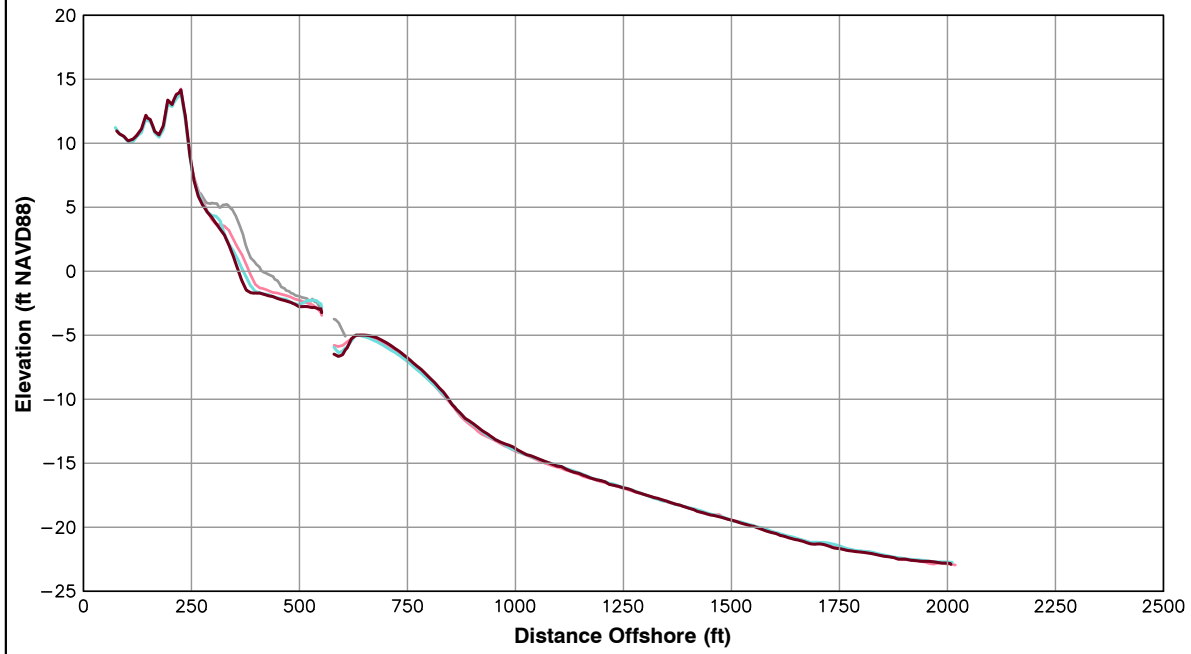

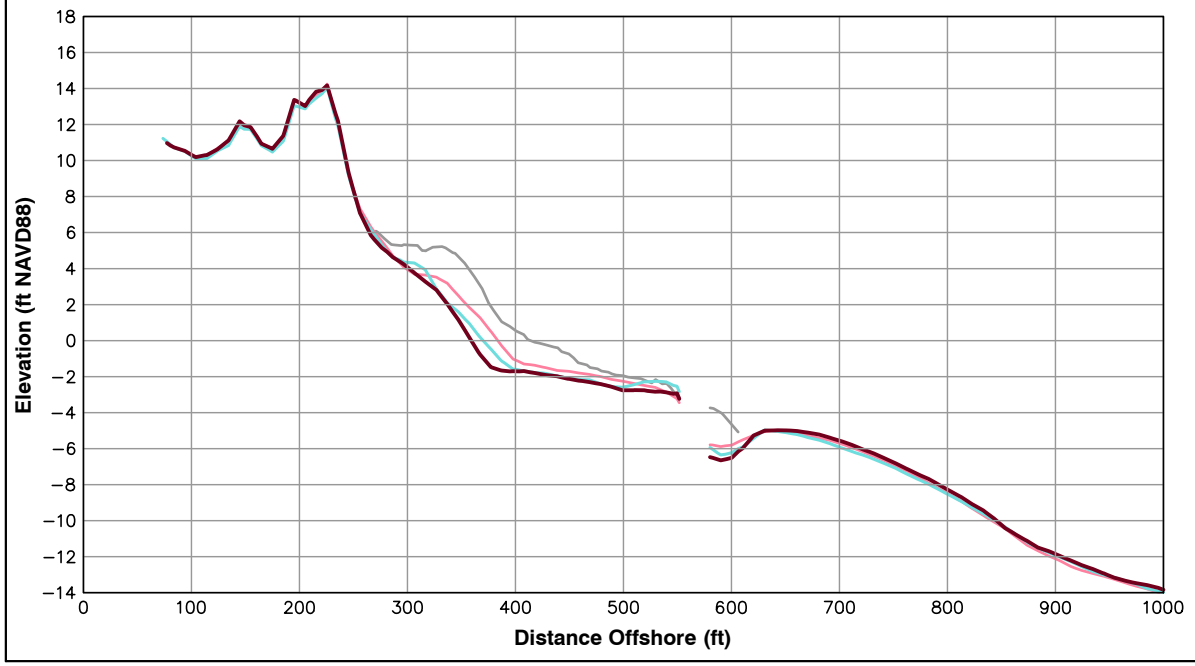

Survey Transect 365+63	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-20.95 ft/yr	-7.84 ft
Volume Change Above -15 ft NAVD88	-4.09 cy/ft/yr	0.11 cy/ft
Volume Change Above 0 ft NAVD88	-2.58 cy/ft/yr	-0.10 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

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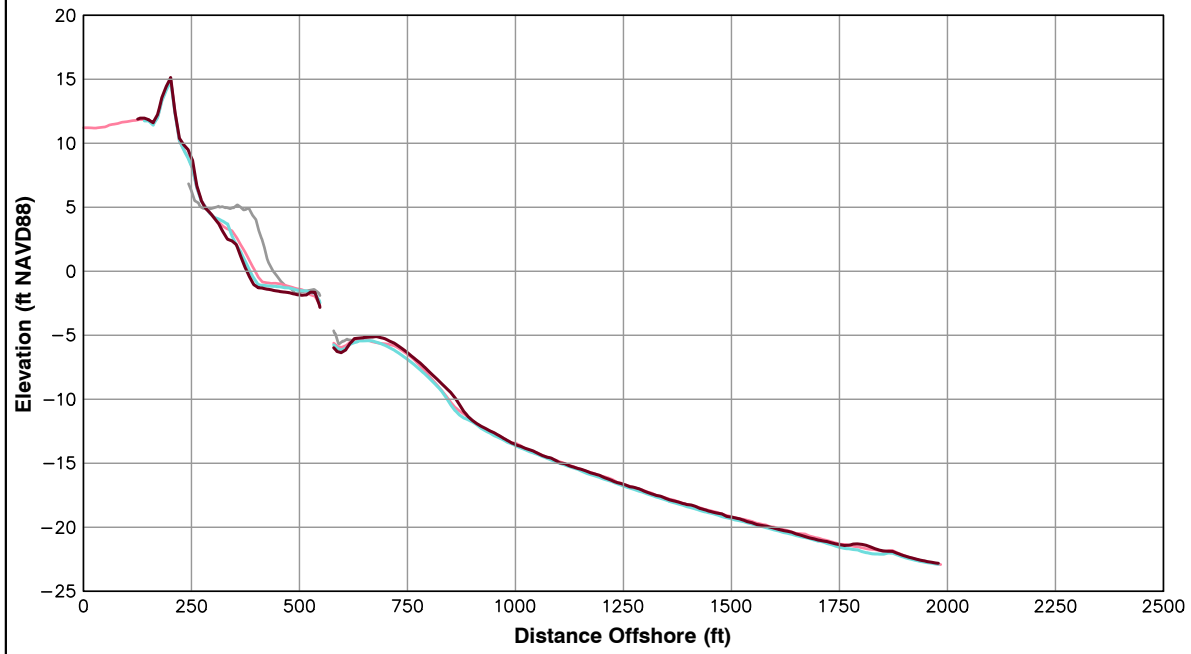

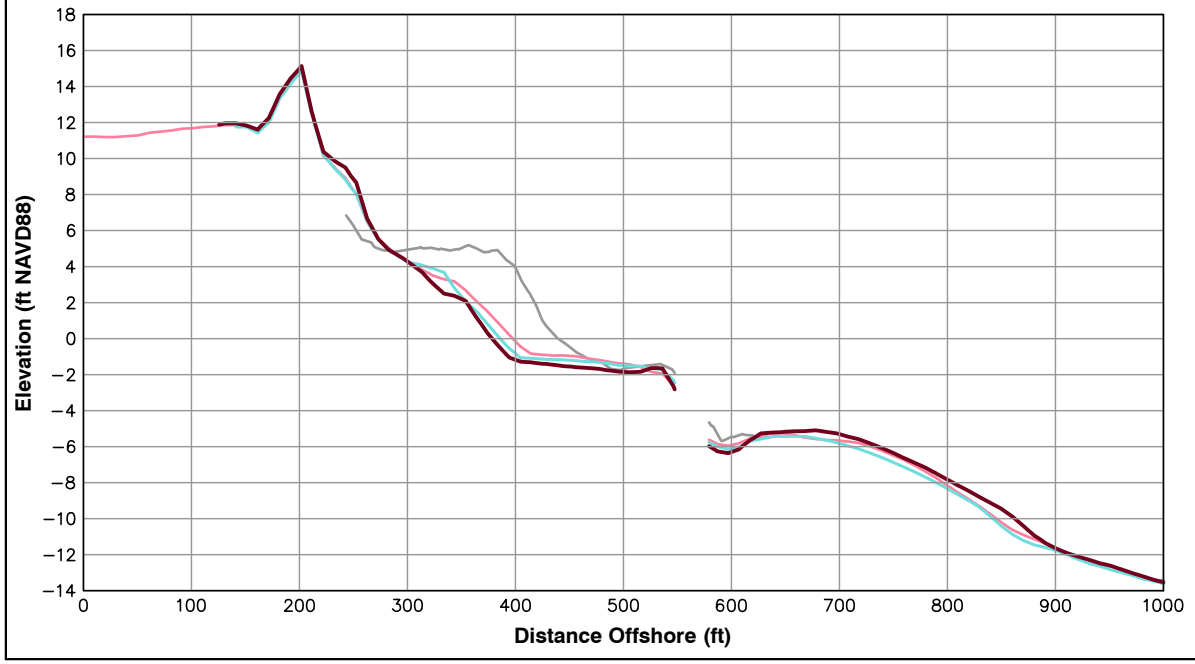

Survey Transect 369+23	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-15.28 ft/yr	-5.50 ft
Volume Change Above -15 ft NAVD88	-1.06 cy/ft/yr	4.07 cy/ft
Volume Change Above 0 ft NAVD88	-1.05 cy/ft/yr	-0.09 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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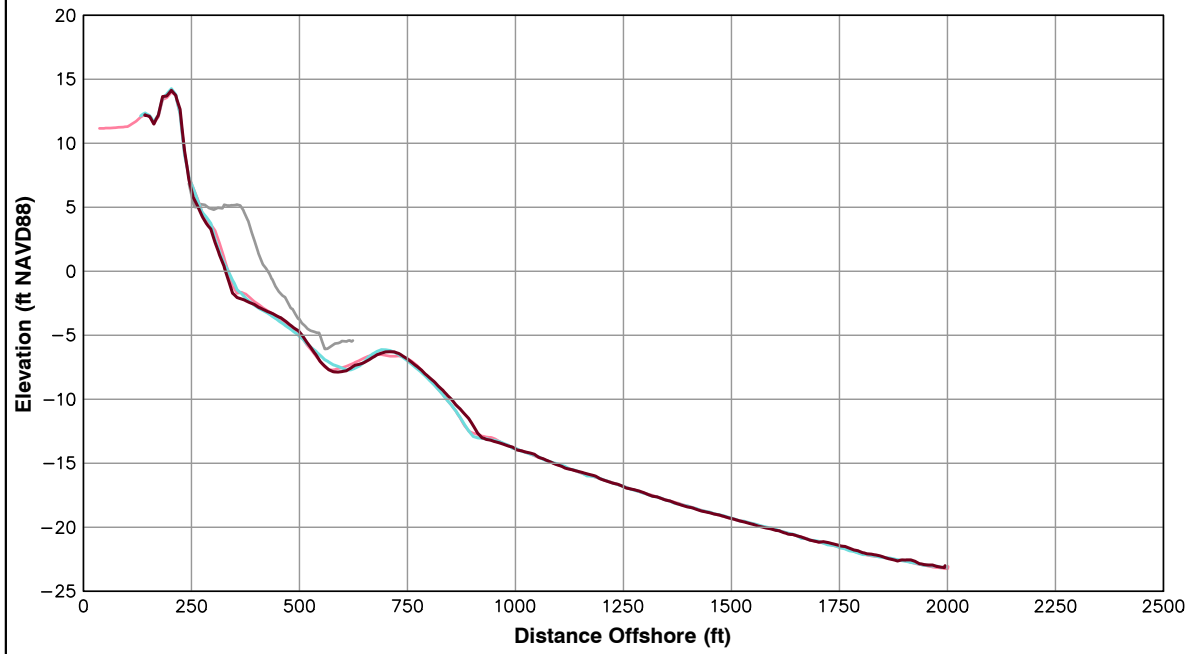
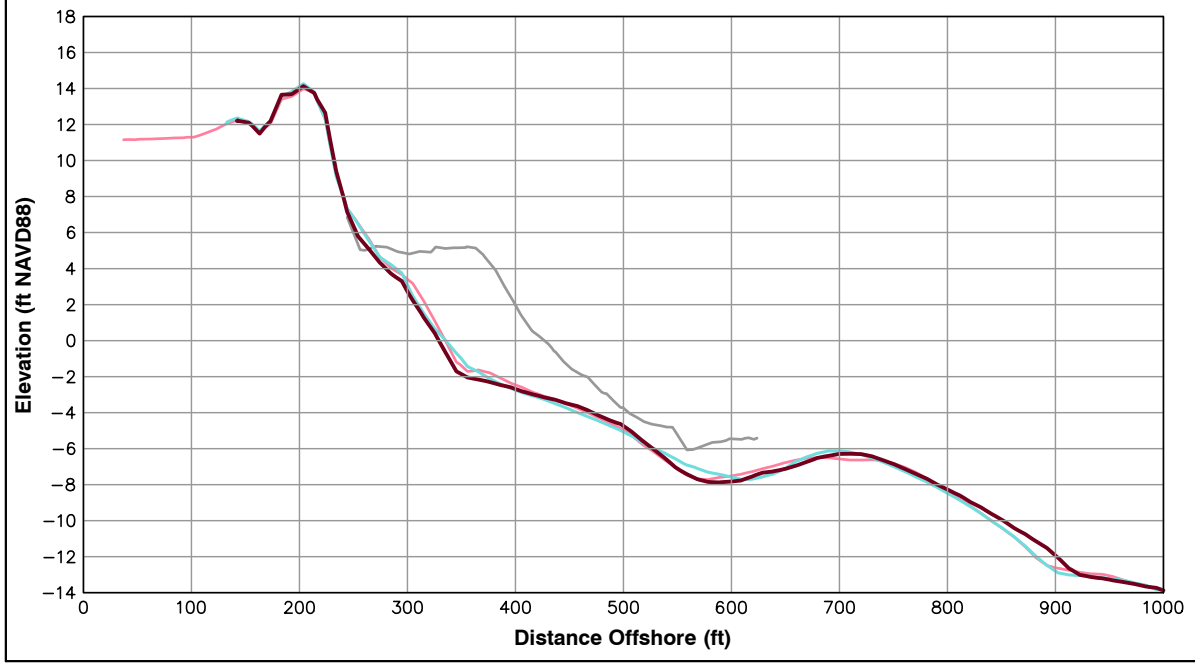
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 367+43	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-7.24 ft/yr	-2.77 ft
Volume Change Above -15 ft NAVD88	-0.99 cy/ft/yr	-0.18 cy/ft
Volume Change Above 0 ft NAVD88	-1.44 cy/ft/yr	-1.25 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
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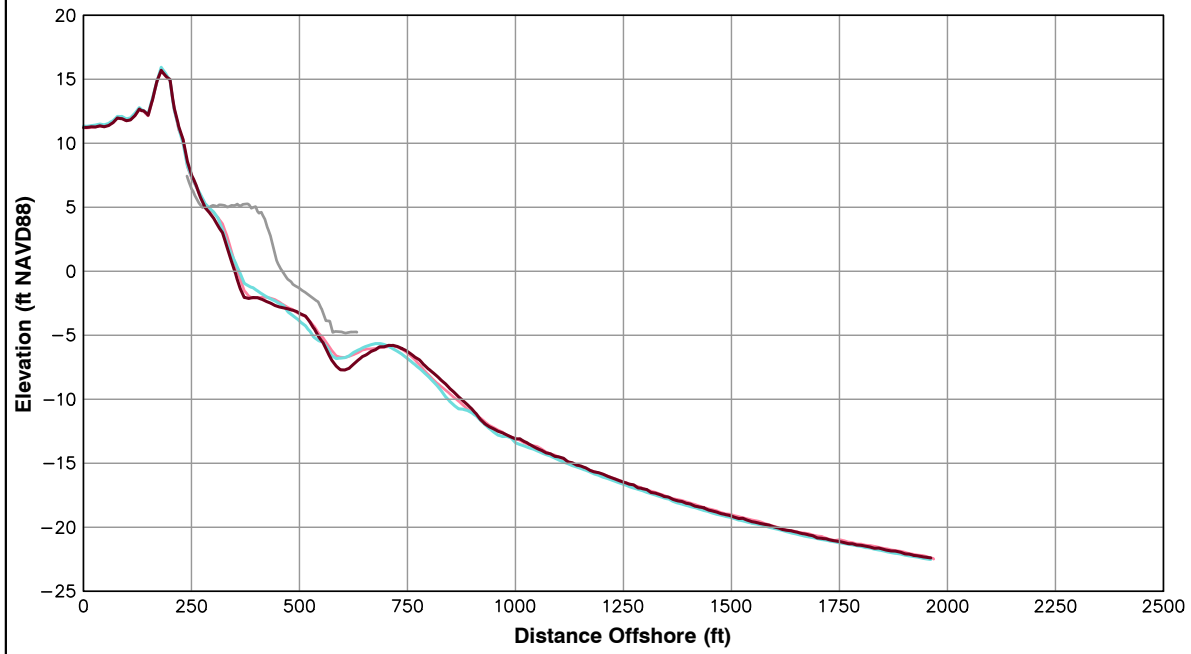
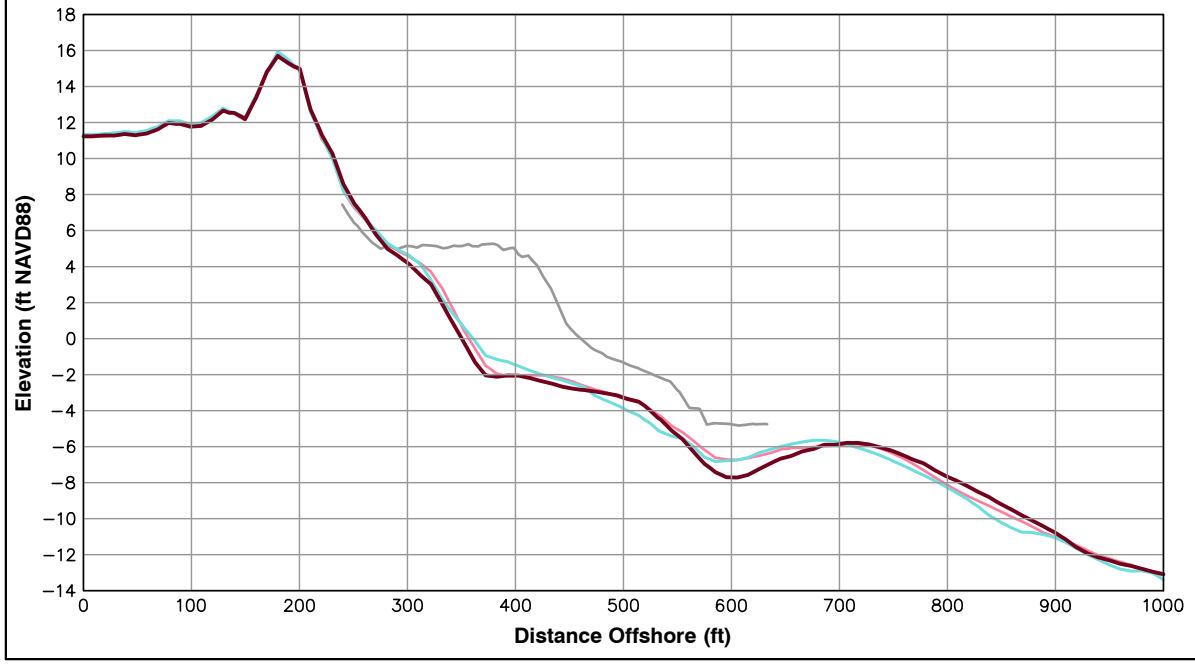
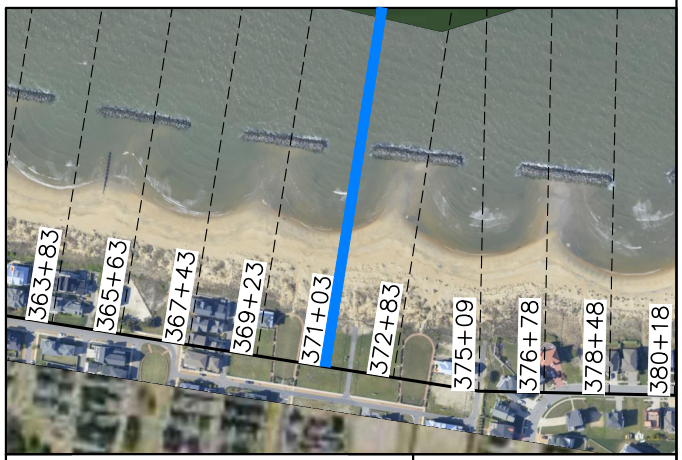




Survey Transect 371+03	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-6.49 ft/yr	-6.65 ft
Volume Change Above -15 ft NAVD88	-3.45 cy/ft/yr	0.36 cy/ft
Volume Change Above 0 ft NAVD88	-1.14 cy/ft/yr	-1.87 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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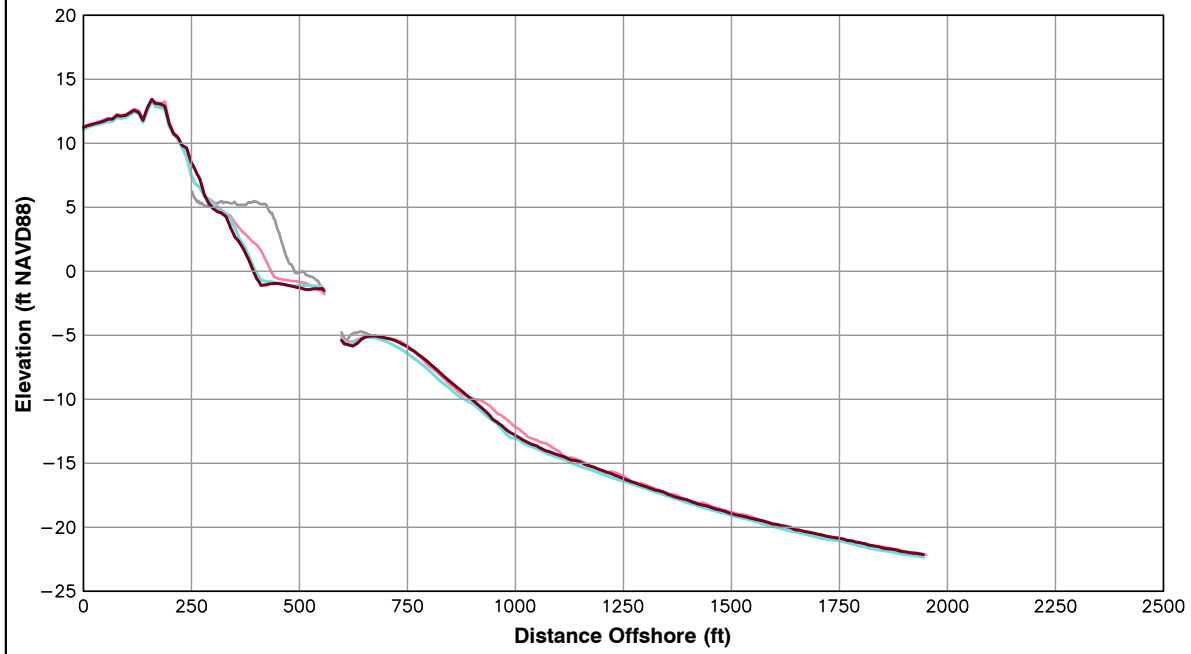
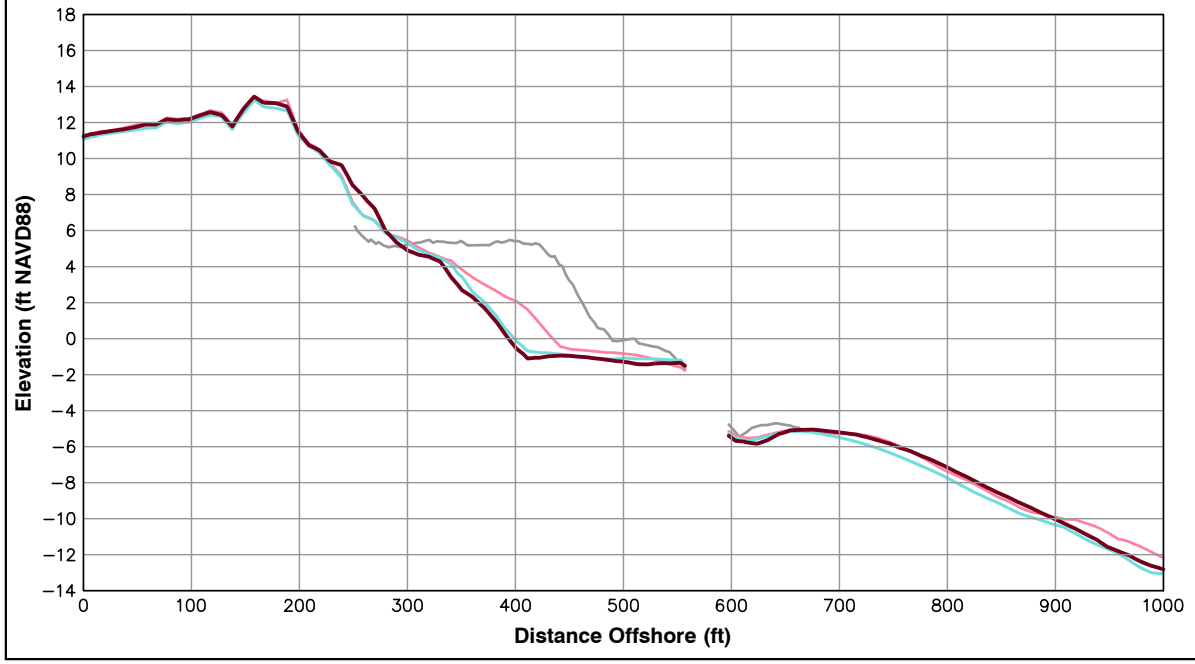
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 372+83	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-36.97 ft/yr	-4.00 ft
Volume Change Above -15 ft NAVD88	-11.13 cy/ft/yr	6.24 cy/ft
Volume Change Above 0 ft NAVD88	-4.53 cy/ft/yr	1.37 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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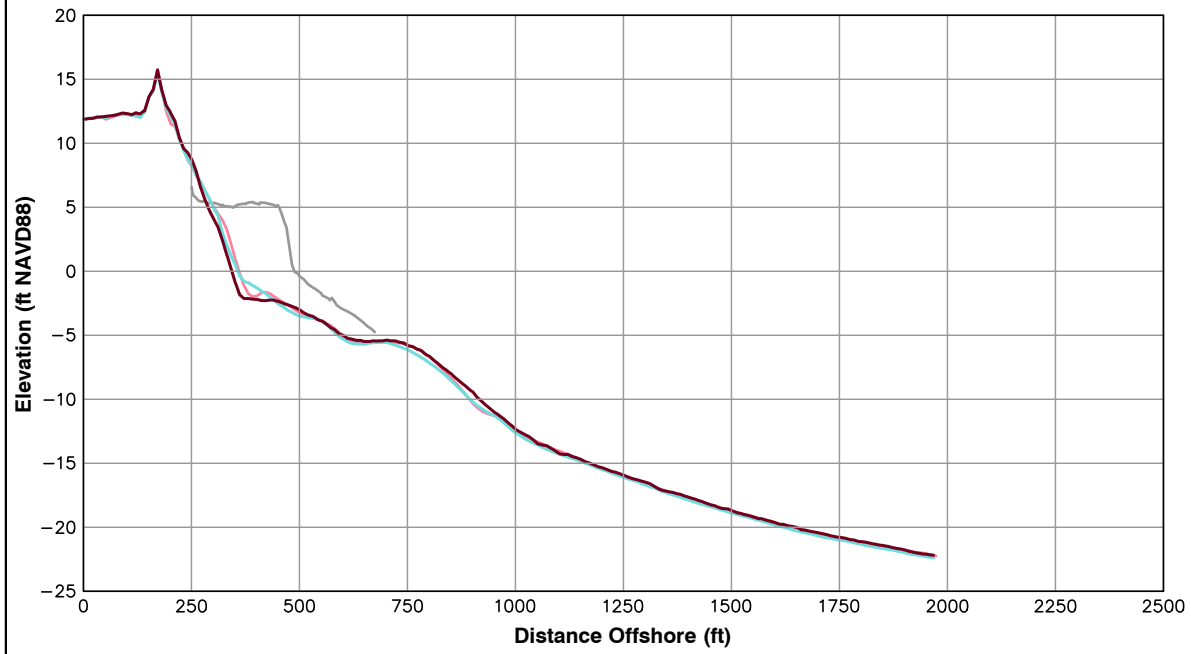

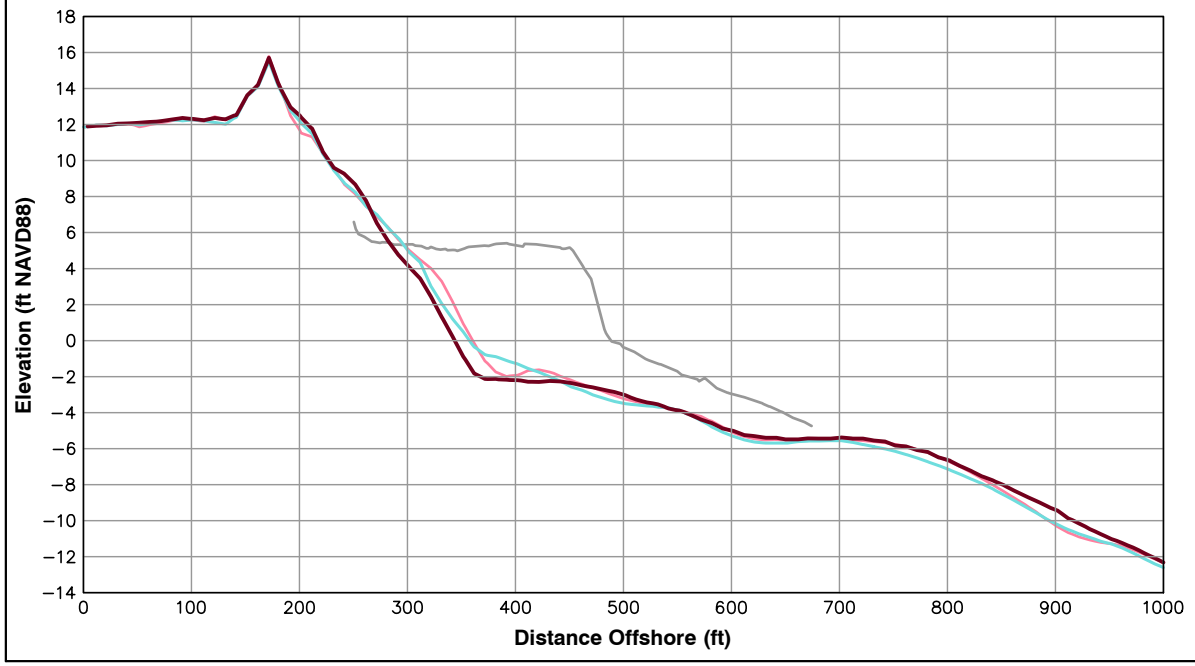

Survey Transect 375+08	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-15.63 ft/yr	-9.97 ft
Volume Change Above -15 ft NAVD88	-1.54 cy/ft/yr	4.13 cy/ft
Volume Change Above 0 ft NAVD88	-2.19 cy/ft/yr	-1.01 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
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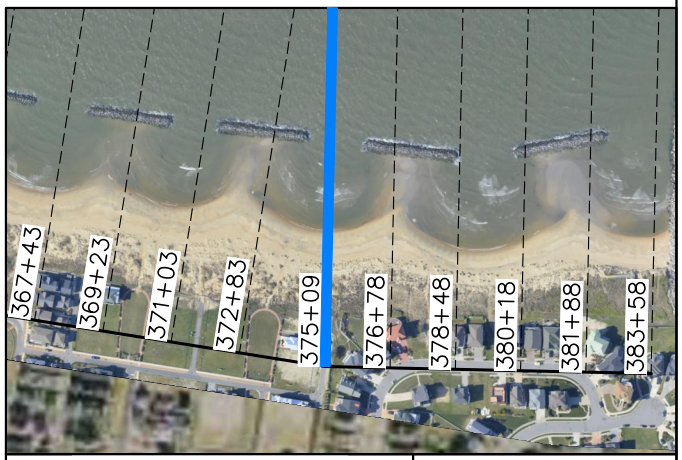
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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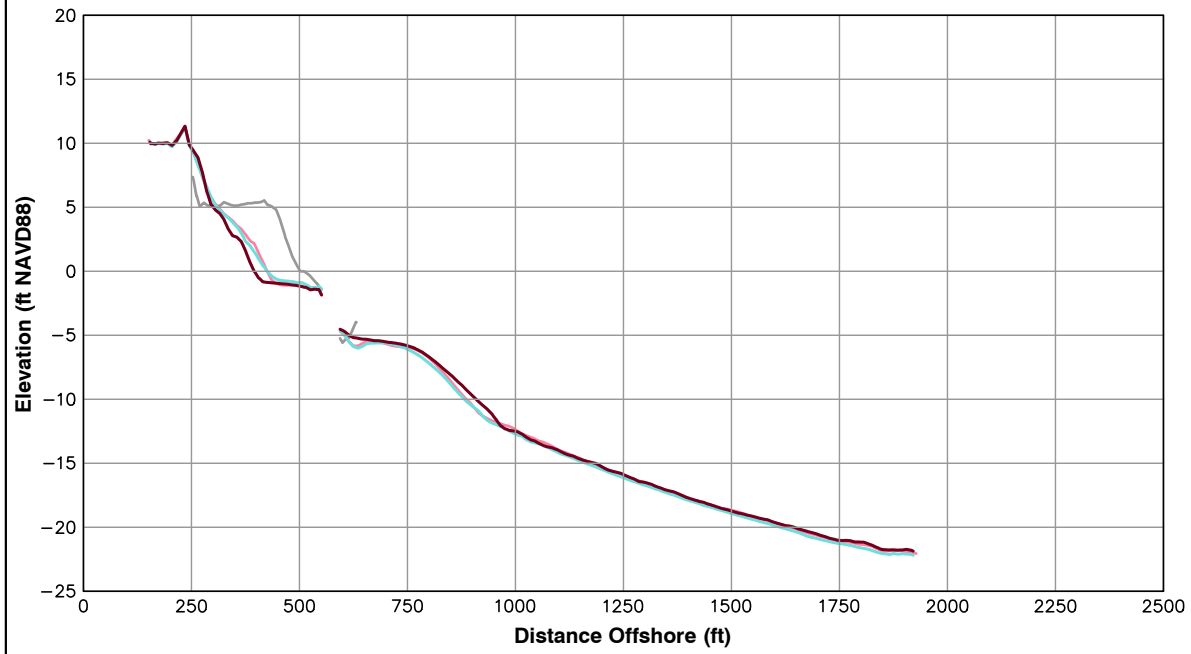
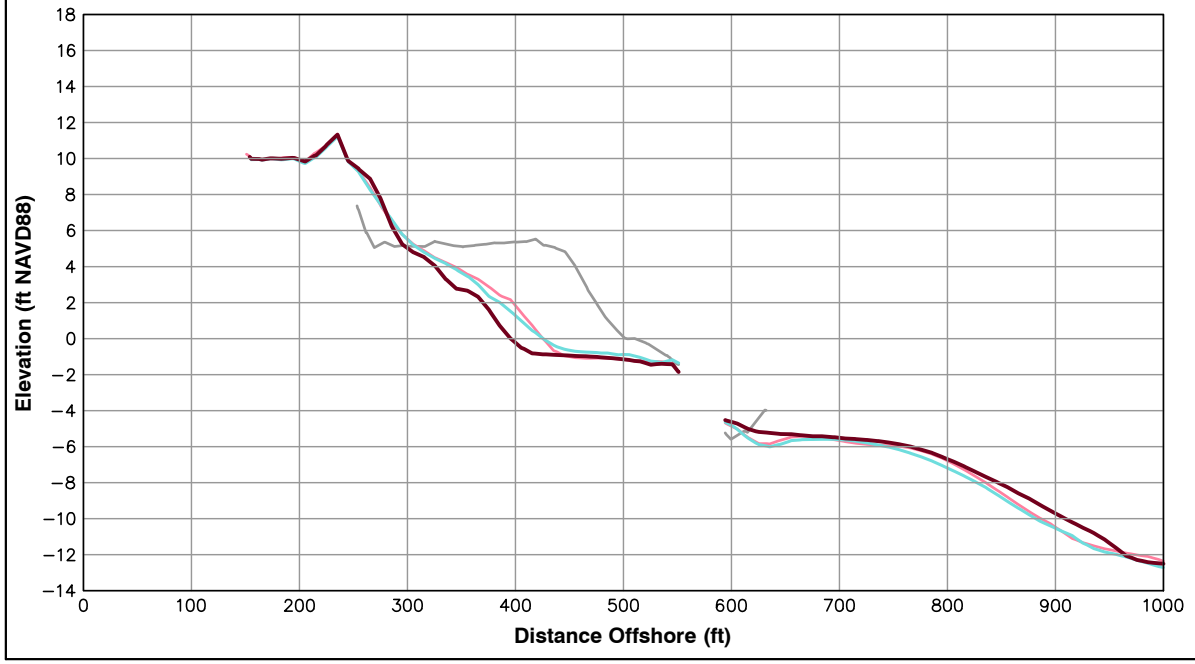
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 376+78	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-27.90 ft/yr	-23.16 ft
Volume Change Above -15 ft NAVD88	-1.63 cy/ft/yr	2.59 cy/ft
Volume Change Above 0 ft NAVD88	-4.40 cy/ft/yr	-3.21 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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3. All Survey Elevations In Feet Referenced to NAVD88.
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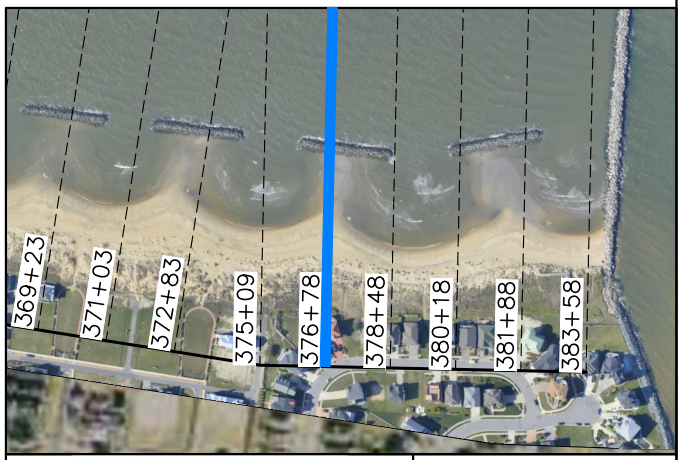
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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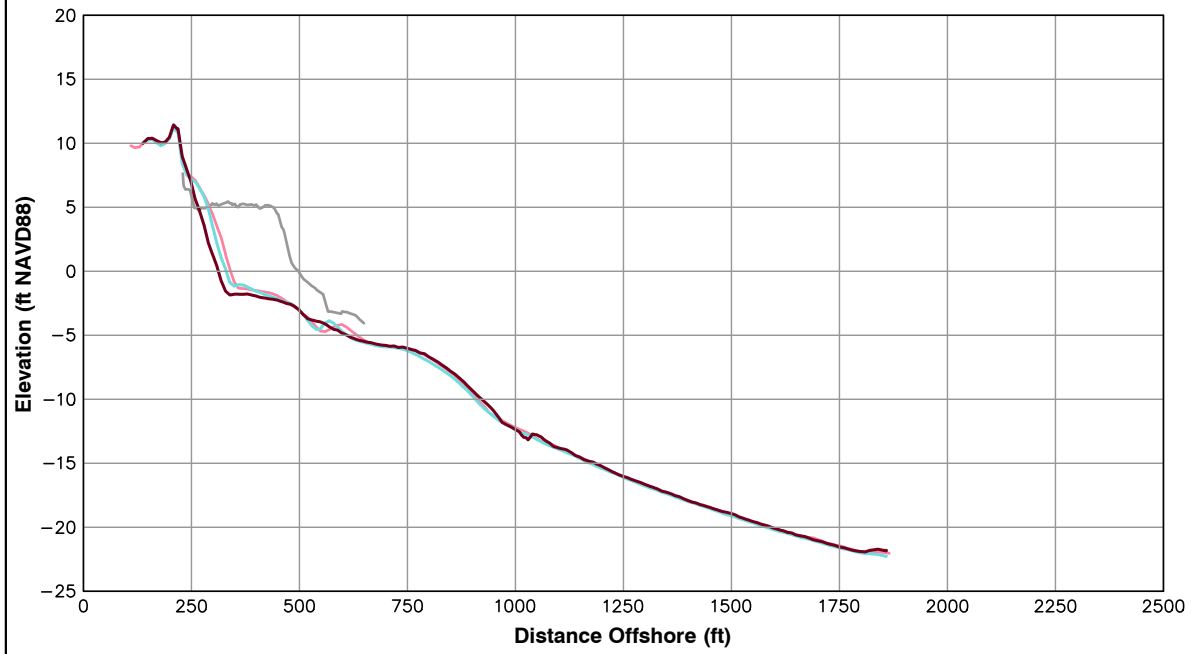
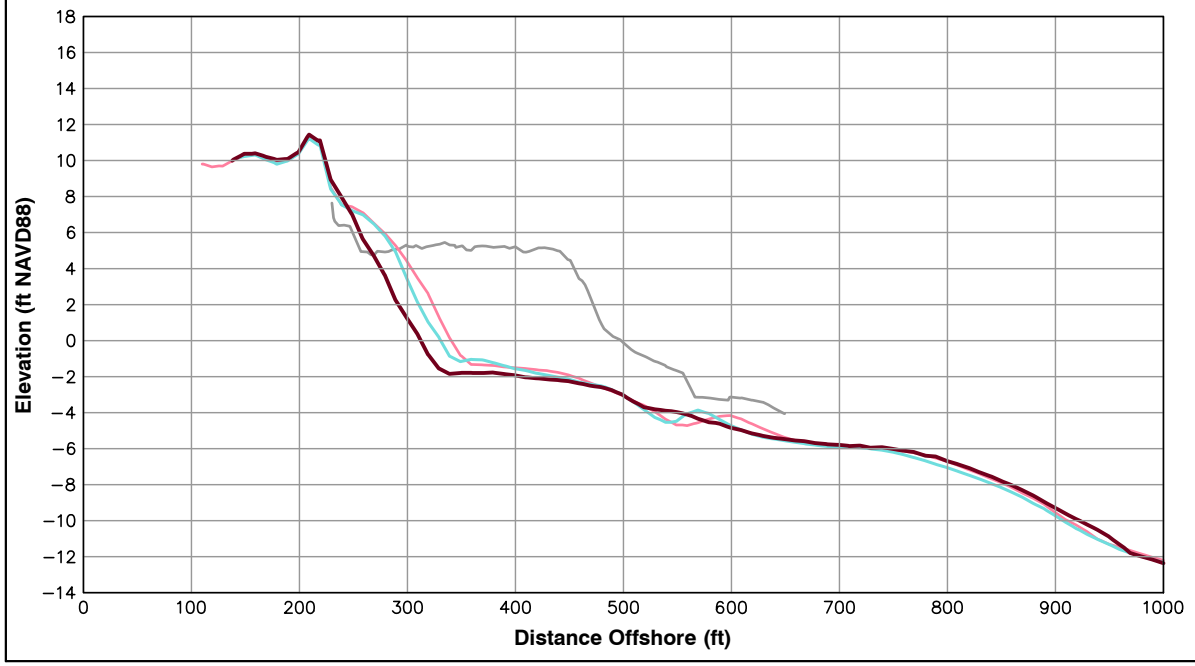
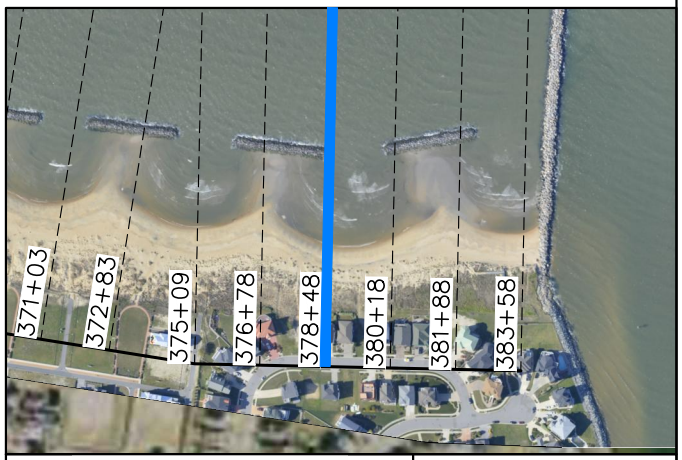




Survey Transect 378+48	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-27.90 ft/yr	-17.18 ft
Volume Change Above -15 ft NAVD88	-8.95 cy/ft/yr	-2.79 cy/ft
Volume Change Above 0 ft NAVD88	-6.38 cy/ft/yr	-4.19 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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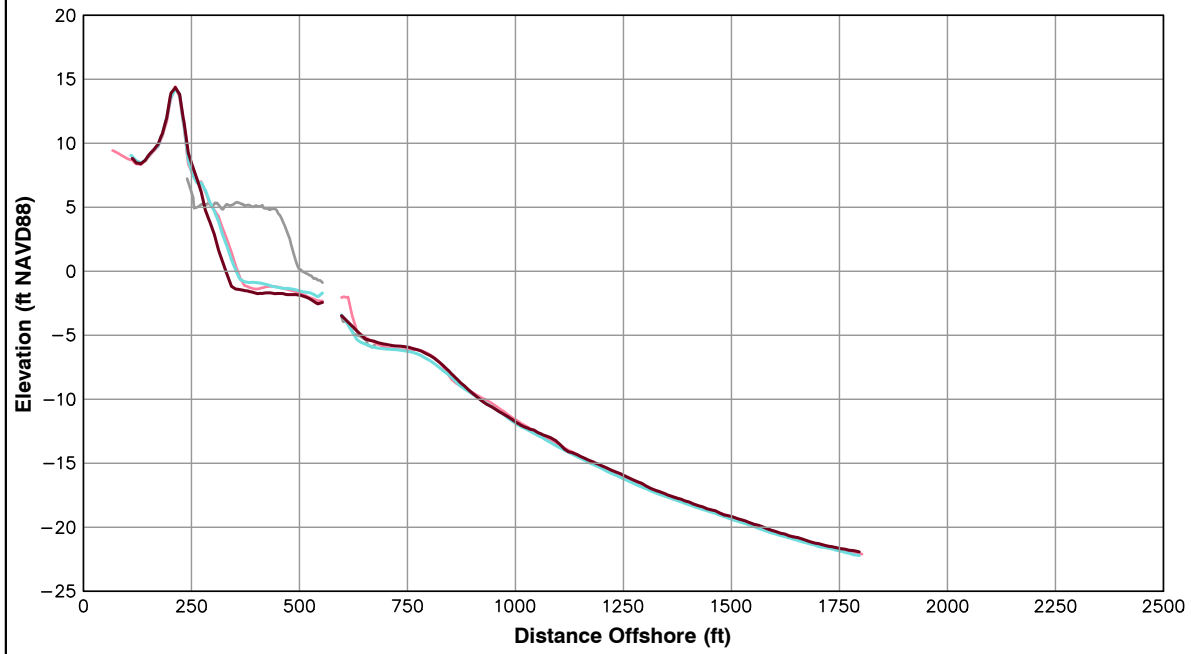
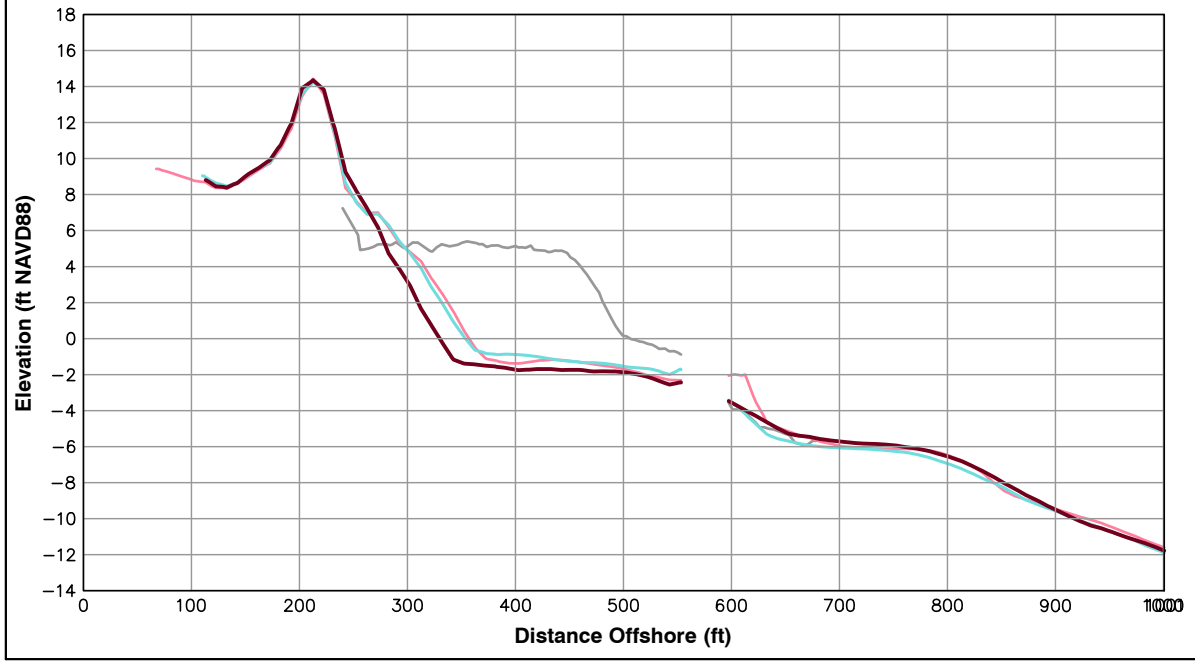
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

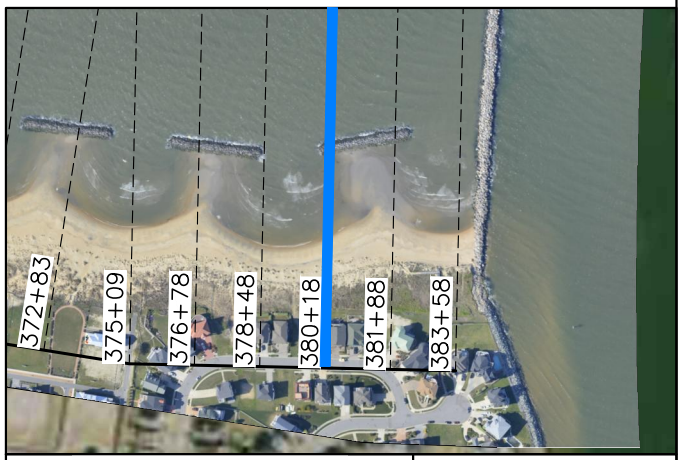




Survey Transect 380+18	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-26.29 ft/yr	-22.34 ft
Volume Change Above -15 ft NAVD88	-8.54 cy/ft/yr	-3.88 cy/ft
Volume Change Above 0 ft NAVD88	-3.95 cy/ft/yr	-4.01 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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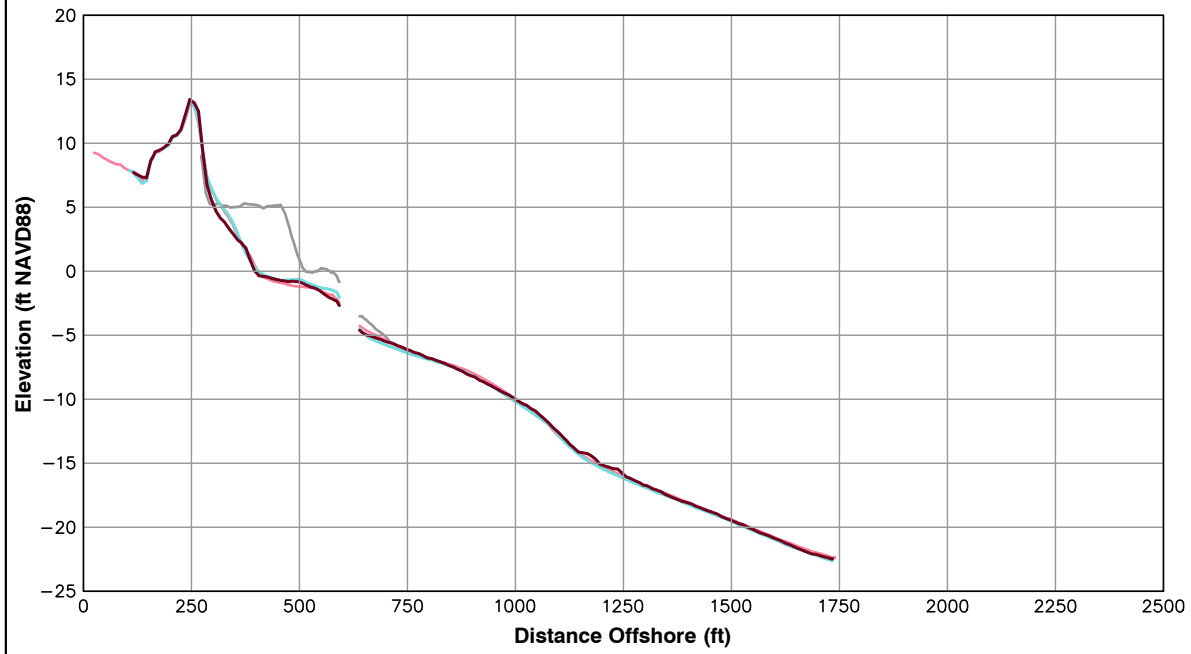
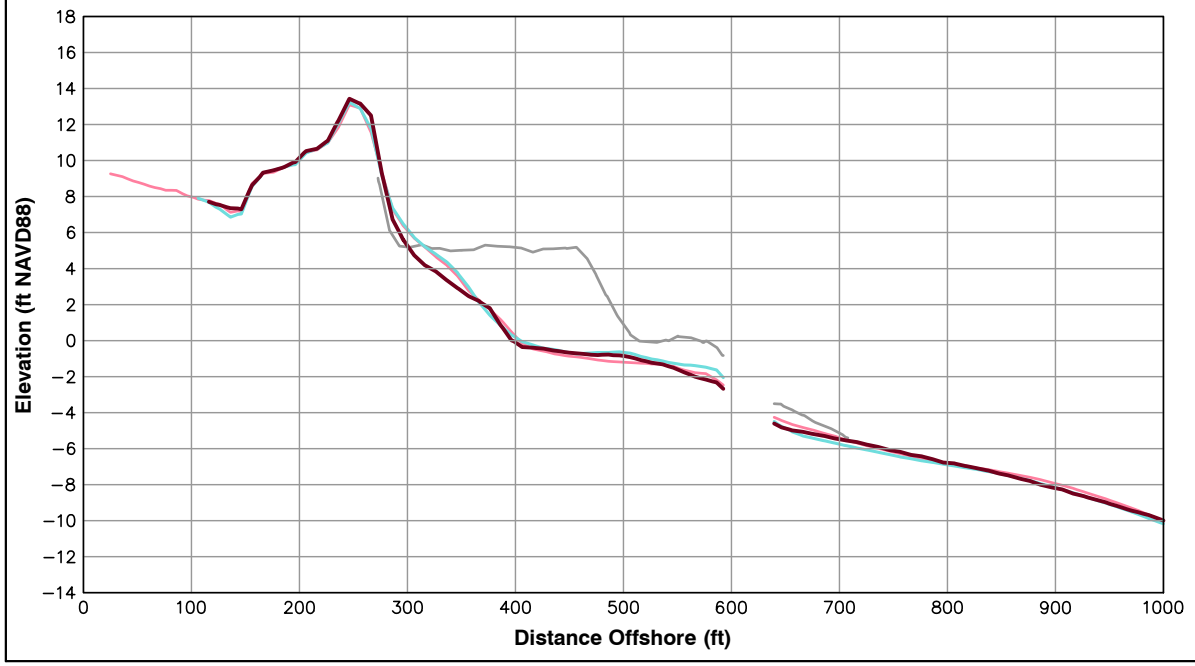
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

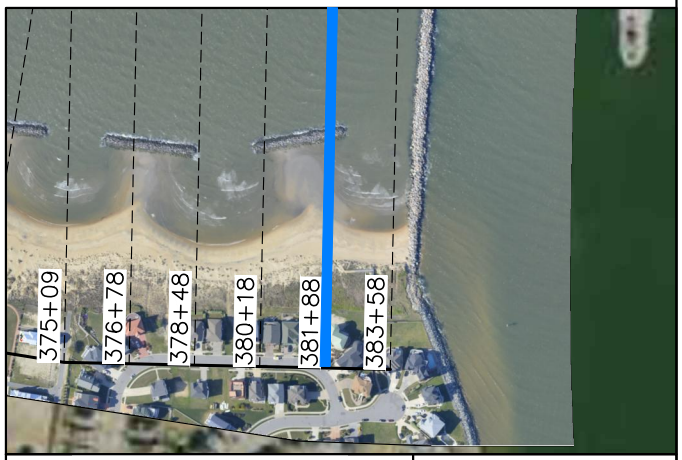




Survey Transect 381+88	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-3.95 ft/yr	1.12 ft
Volume Change Above -15 ft NAVD88	-1.07 cy/ft/yr	0.31 cy/ft
Volume Change Above 0 ft NAVD88	-1.47 cy/ft/yr	-1.39 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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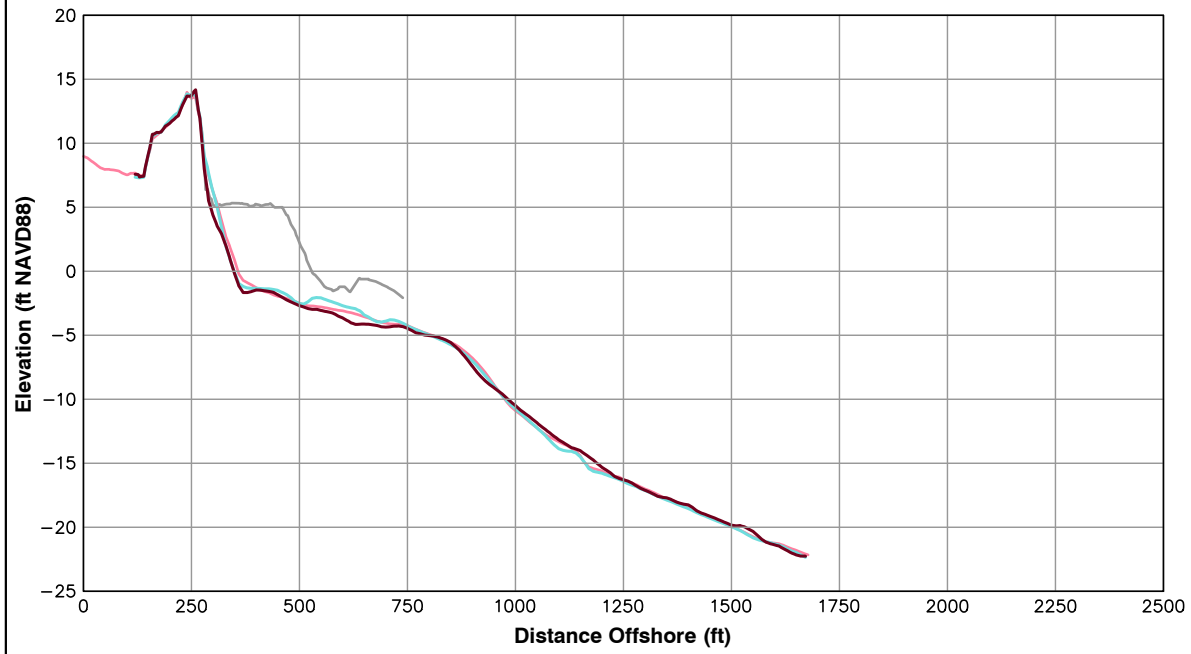
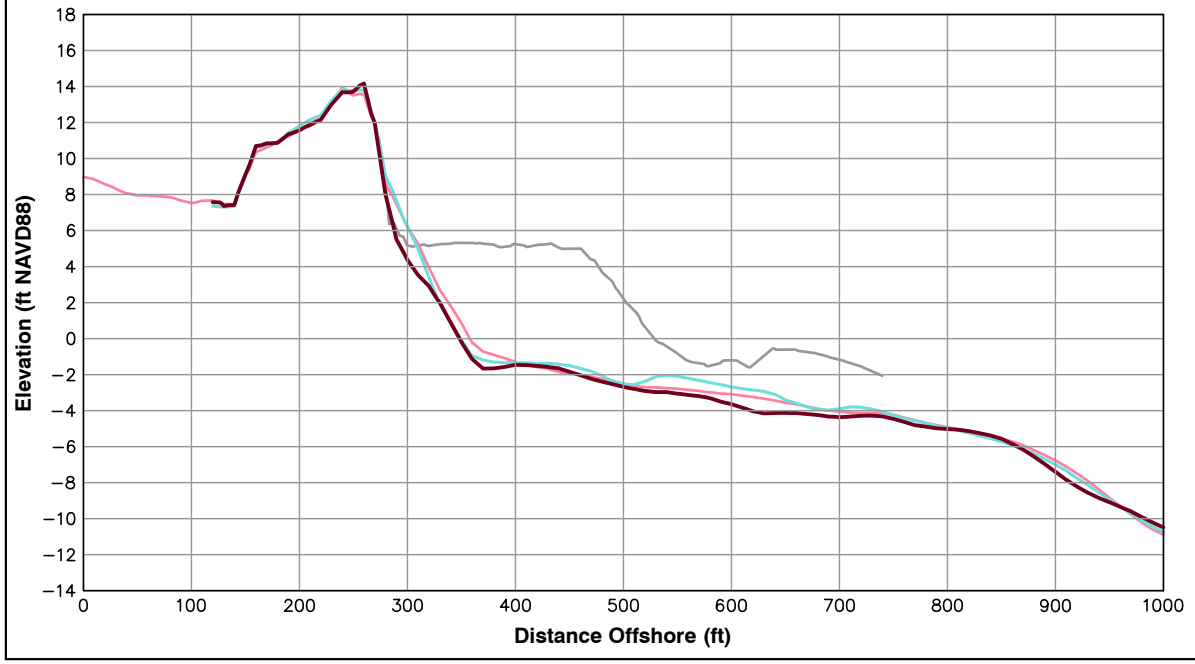
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 383+58	April 2013 - March 2012	April 2013 - September 2012
Shoreline Change at MHW (0.98 ft NAVD88)	-9.20 ft/yr	0.52 ft
Volume Change Above -15 ft NAVD88	-7.27 cy/ft/yr	-8.34 cy/ft
Volume Change Above 0 ft NAVD88	-3.08 cy/ft/yr	-2.77 cy/ft

LEGEND:
- 2013 APR
- 2012 SEP
- 2012 MAR
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To March 2012 and September 2012.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.

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Appendix C: Summary of Shoreline Change and Volume Change Tables

Table C-1. Summary of Shoreline Change and Volume Change (March 2012 to April 2013)

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from March 13, 2012 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
0+00	3/13/2012	4/2/2013	31.42	14.71	34.52
2+50	3/13/2012	4/2/2013	16.71	7.30	27.92
5+00	3/13/2012	4/2/2013	-9.58	4.93	18.33
7+50	3/13/2012	4/2/2013	-19.69	1.75	13.38
10+00	3/13/2012	4/2/2013	-79.64	1.82	7.92
12+50	3/13/2012	4/2/2013	-92.52	-16.58	-15.58
15+00	3/13/2012	4/2/2013	-42.80	-8.73	-5.61
17+50	3/13/2012	4/2/2013	-6.91	1.59	-3.64
20+00	3/13/2012	4/2/2013	4.01	2.18	13.92
22+50	3/13/2012	4/2/2013	-14.67	-1.80	-11.29
25+00	3/13/2012	4/2/2013	17.93	0.19	1.42
27+50	3/13/2012	4/2/2013	38.80	0.71	10.37
30+00	3/13/2012	4/2/2013	80.68	9.62	20.73
32+50	3/13/2012	4/2/2013	47.01	3.22	13.05
35+00	3/13/2012	4/2/2013	51.97	7.35	15.48
37+50	3/13/2012	4/2/2013	2.69	-0.43	6.68
40+00	3/13/2012	4/2/2013	1.21	-1.10	-5.52
42+50	3/13/2012	4/2/2013	-10.12	-2.09	-2.58
45+00	3/13/2012	4/2/2013	-21.80	-3.96	-3.93
45+25	3/13/2012	4/2/2013	-20.31	-3.52	-3.08
47+30	3/13/2012	4/2/2013	-10.34	-2.10	0.42
49+35	3/13/2012	4/2/2013	-9.58	-2.45	1.81
51+41	3/13/2012	4/2/2013	-7.42	-2.05	2.28
53+46	3/13/2012	4/2/2013	-12.52	-3.32	-3.85
55+51	3/13/2012	4/2/2013	-11.24	-3.21	1.46
57+57	3/13/2012	4/2/2013	0.94	-3.19	1.55
59+62	3/13/2012	4/2/2013	-3.80	-1.78	0.54
61+62	3/13/2012	4/2/2013	-8.43	-1.82	1.44
63+62	3/13/2012	4/2/2013	-8.59	-1.78	1.00
65+62	3/13/2012	4/2/2013	-16.77	-3.15	1.09
67+62	3/13/2012	4/2/2013	-3.56	-1.99	0.52
69+62	3/13/2012	4/2/2013	-4.97	-1.54	-11.22
71+62	3/13/2012	4/2/2013	0.98	-0.22	5.06
73+62	3/13/2012	4/2/2013	28.84	3.36	7.83
75+62	3/13/2012	4/2/2013	-6.33	1.03	3.36
77+62	3/13/2012	4/2/2013	-10.65	0.03	2.96
79+62	3/13/2012	4/2/2013	-10.19	-1.03	-1.03
81+62	3/13/2012	4/2/2013	-1.76	0.09	-0.36
83+62	3/13/2012	4/2/2013	-2.10	0.14	4.90
85+62	3/13/2012	4/2/2013	-2.46	0.34	3.60
87+62	3/13/2012	4/2/2013	-10.66	-1.90	-5.75

Table C-1. Summary of Shoreline Change and Volume Change (March 2012 to April 2013) Cont.

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from March 13, 2012 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
93+41	3/13/2012	4/2/2013	-0.71	-1.08	2.12
103+08	3/13/2012	4/2/2013	-6.15	-0.09	-0.52
120+93	3/13/2012	4/2/2013	-2.17	0.85	0.44
129+17	3/13/2012	4/2/2013	-9.45	-2.78	-4.09
141+98	3/13/2012	4/2/2013	-9.61	-0.41	1.51
152+01	3/13/2012	4/2/2013	-12.91	-2.03	-3.60
163+49	3/13/2012	4/2/2013	-2.43	-1.10	1.03
169+63	3/13/2012	4/2/2013	25.28	3.47	11.66
171+63	3/13/2012	4/2/2013	1.94	1.35	5.27
173+63	3/13/2012	4/2/2013	0.47	1.29	8.51
175+63	3/13/2012	4/2/2013	-11.70	0.28	1.22
177+63	3/13/2012	4/2/2013	-10.45	0.20	-4.49
179+63	3/13/2012	4/2/2013	1.54	0.58	2.86
181+63	3/13/2012	4/2/2013	2.30	1.95	5.05
183+63	3/13/2012	4/2/2013	-8.22	0.34	-0.10
185+63	3/13/2012	4/2/2013	4.10	1.66	5.55
187+63	3/13/2012	4/2/2013	3.38	2.31	4.17
189+63	3/13/2012	4/2/2013	-2.43	1.02	-0.53
191+63	3/13/2012	4/2/2013	1.77	4.03	2.95
193+63	3/13/2012	4/2/2013	-8.67	1.08	-1.39
195+63	3/13/2012	4/2/2013	-8.28	0.80	-3.76
206+86	3/13/2012	4/2/2013	-2.30	4.86	2.04
218+66	3/13/2012	4/2/2013	-11.50	2.65	6.29
229+85	3/13/2012	4/2/2013	-12.67	1.21	11.32
242+03	3/13/2012	4/2/2013	-8.31	0.87	4.25
252+62	3/13/2012	4/2/2013	6.42	0.15	6.54
263+22	3/13/2012	4/2/2013	-9.28	0.61	-1.77
274+53	3/13/2012	4/2/2013	-10.76	1.14	-1.07
281+40	3/13/2012	4/2/2013	-8.83	1.78	0.05
288+39	3/13/2012	4/2/2013	-0.29	4.10	9.85
295+27	3/13/2012	4/2/2013	-0.72	2.31	5.12
302+24	3/13/2012	4/2/2013	-8.71	-2.88	-7.02
315+96	3/13/2012	4/2/2013	-13.18	-2.70	-3.74
323+09	3/13/2012	4/2/2013	-7.57	0.80	9.12
329+63	3/13/2012	4/2/2013	-14.38	-4.57	-4.01
331+43	3/13/2012	4/2/2013	-0.51	-0.80	1.65
333+23	3/13/2012	4/2/2013	-4.07	1.59	-2.01
335+03	3/13/2012	4/2/2013	-7.08	0.79	4.30
336+83	3/13/2012	4/2/2013	-10.26	-0.43	-3.66
338+63	3/13/2012	4/2/2013	-11.36	0.13	3.57
340+43	3/13/2012	4/2/2013	-7.96	2.70	8.57
342+23	3/13/2012	4/2/2013	-12.18	-3.30	-0.91

Table C-1. Summary of Shoreline Change and Volume Change (March 2012 to April 2013) Cont.

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from March 13, 2012 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
344+05	3/13/2012	4/2/2013	-9.15	-2.38	-2.03
345+85	3/13/2012	4/2/2013	-1.07	-1.19	-1.06
347+63	3/13/2012	4/2/2013	-11.59	-1.70	-1.59
349+43	3/13/2012	4/2/2013	3.33	-0.14	2.22
351+23	3/13/2012	4/2/2013	-20.57	-2.91	-1.56
353+03	3/13/2012	4/2/2013	-6.92	1.82	3.42
354+83	3/13/2012	4/2/2013	-10.27	-1.27	-4.50
356+63	3/13/2012	4/2/2013	1.05	-1.56	-6.12
358+43	3/13/2012	4/2/2013	-18.19	-2.22	-7.86
360+23	3/13/2012	4/2/2013	-5.06	-1.54	-4.80
362+03	3/13/2012	4/2/2013	-27.22	-3.38	-7.58
363+83	3/13/2012	4/2/2013	-5.47	-2.77	-5.79
365+63	3/13/2012	4/2/2013	-20.95	-2.58	-4.09
367+43	3/13/2012	4/2/2013	-7.24	-1.44	-0.99
369+23	3/13/2012	4/2/2013	-15.28	-1.05	-1.06
371+03	3/13/2012	4/2/2013	-6.49	-1.14	-3.45
372+83	3/13/2012	4/2/2013	-36.97	-4.53	-11.13
375+08	3/13/2012	4/2/2013	-15.63	-2.19	-1.54
376+78	3/13/2012	4/2/2013	-27.90	-4.40	-1.63
378+48	3/13/2012	4/2/2013	-27.90	-6.38	-8.95
380+18	3/13/2012	4/2/2013	-26.29	-3.95	-8.54
381+88	3/13/2012	4/2/2013	-3.95	-1.47	-1.07
383+58	3/13/2012	4/2/2013	-9.20	-3.08	-7.27

Table C-2. Summary of Shoreline Change and Volume Change (September 2012 to April 2013)

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from September 26, 2012 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change at MHW (ft)	Volume Change Above 0 ft NAVD88 (cy/ft)	Volume Change Above -15 ft NAVD88 (cy/ft)
0+00	9/26/2012	4/2/2013	10.16	5.38	42.08
2+50	9/26/2012	4/2/2013	3.64	6.27	12.35
5+00	9/26/2012	4/2/2013	-21.34	3.57	14.90
7+50	9/26/2012	4/2/2013	-35.04	-0.51	11.86
10+00	9/26/2012	4/2/2013	-86.04	1.18	6.33
12+50	9/26/2012	4/2/2013	-100.37	-13.78	-9.91
15+00	9/26/2012	4/2/2013	-49.47	-8.20	0.93
17+50	9/26/2012	4/2/2013	-15.81	1.71	6.05
20+00	9/26/2012	4/2/2013	6.42	2.42	19.83
22+50	9/26/2012	4/2/2013	-3.34	0.51	6.68
25+00	9/26/2012	4/2/2013	36.72	3.48	3.44
27+50	9/26/2012	4/2/2013	57.69	3.19	16.81
30+00	9/26/2012	4/2/2013	83.59	11.05	33.11
32+50	9/26/2012	4/2/2013	53.32	4.87	23.79
35+00	9/26/2012	4/2/2013	55.04	8.28	14.26
37+50	9/26/2012	4/2/2013	8.28	-0.30	5.49
40+00	9/26/2012	4/2/2013	7.13	-0.06	-3.12
42+50	9/26/2012	4/2/2013	3.81	0.40	5.87
45+00	9/26/2012	4/2/2013	-10.98	-3.06	1.99
45+25	9/26/2012	4/2/2013	-9.63	-2.79	7.54
47+30	9/26/2012	4/2/2013	3.36	-0.23	5.72
49+35	9/26/2012	4/2/2013	-0.41	-1.55	4.17
51+41	9/26/2012	4/2/2013	1.12	-1.06	7.03
53+46	9/26/2012	4/2/2013	-15.17	-3.69	-3.16
55+51	9/26/2012	4/2/2013	-6.52	-2.14	2.20
57+57	9/26/2012	4/2/2013	10.15	-2.17	5.07
59+62	9/26/2012	4/2/2013	3.81	0.26	6.39
61+62	9/26/2012	4/2/2013	-18.03	-3.10	0.26
63+62	9/26/2012	4/2/2013	-13.16	-2.22	2.11
65+62	9/26/2012	4/2/2013	-0.82	-2.18	5.22
67+62	9/26/2012	4/2/2013	-1.74	-1.36	0.60
69+62	9/26/2012	4/2/2013	14.55	-0.13	7.01
71+62	9/26/2012	4/2/2013	15.53	2.33	9.50
73+62	9/26/2012	4/2/2013	53.87	5.57	8.50
75+62	9/26/2012	4/2/2013	-23.61	-1.82	-1.70
77+62	9/26/2012	4/2/2013	-25.91	-3.33	-2.42
79+62	9/26/2012	4/2/2013	-19.72	-3.38	-3.53
81+62	9/26/2012	4/2/2013	-2.78	-0.42	-1.70
83+62	9/26/2012	4/2/2013	8.36	2.23	11.80
85+62	9/26/2012	4/2/2013	-7.39	-2.28	2.81
87+62	9/26/2012	4/2/2013	-5.38	-1.88	-0.47

Table C-2. Summary of Shoreline Change and Volume Change (September 2012 to April 2013) Cont.

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from September 26, 2012 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change at MHW (ft)	Volume Change Above 0 ft NAVD88 (cy/ft)	Volume Change Above -15 ft NAVD88 (cy/ft)
93+41	9/26/2012	4/2/2013	-4.07	-0.83	5.29
103+08	9/26/2012	4/2/2013	1.71	0.62	6.03
120+93	9/26/2012	4/2/2013	-1.92	0.90	0.86
129+17	9/26/2012	4/2/2013	-1.63	-1.72	0.50
141+98	9/26/2012	4/2/2013	0.26	0.64	4.94
152+01	9/26/2012	4/2/2013	-24.98	-3.84	-5.79
163+49	9/26/2012	4/2/2013	-4.47	-0.53	2.10
169+63	9/26/2012	4/2/2013	21.71	4.36	12.70
171+63	9/26/2012	4/2/2013	5.09	1.03	6.78
173+63	9/26/2012	4/2/2013	1.19	0.89	4.06
175+63	9/26/2012	4/2/2013	4.37	3.25	9.29
177+63	9/26/2012	4/2/2013	8.02	2.33	-1.03
179+63	9/26/2012	4/2/2013	1.33	-0.06	3.21
181+63	9/26/2012	4/2/2013	0.08	1.79	6.30
183+63	9/26/2012	4/2/2013	-6.05	0.06	-1.24
185+63	9/26/2012	4/2/2013	3.63	2.36	7.59
187+63	9/26/2012	4/2/2013	1.70	1.31	5.62
189+63	9/26/2012	4/2/2013	1.15	1.22	2.85
191+63	9/26/2012	4/2/2013	-8.57	1.29	0.11
193+63	9/26/2012	4/2/2013	-27.11	-1.70	-5.48
195+63	9/26/2012	4/2/2013	-23.78	-1.84	-6.67
206+86	9/26/2012	4/2/2013	-5.81	4.29	7.82
218+66	9/26/2012	4/2/2013	-9.25	2.89	6.01
229+85	9/26/2012	4/2/2013	-4.31	1.43	13.23
242+03	9/26/2012	4/2/2013	-10.56	-2.29	3.65
252+62	9/26/2012	4/2/2013	4.47	0.78	9.10
263+22	9/26/2012	4/2/2013	-20.12	-2.34	-2.29
274+53	9/26/2012	4/2/2013	-14.50	-1.46	-1.13
281+40	9/26/2012	4/2/2013	-8.07	-1.13	1.12
288+39	9/26/2012	4/2/2013	5.88	2.58	9.11
295+27	9/26/2012	4/2/2013	-5.63	2.62	5.61
302+24	9/26/2012	4/2/2013	-8.36	0.33	-2.46
315+96	9/26/2012	4/2/2013	-14.78	-4.65	-5.02
323+09	9/26/2012	4/2/2013	-5.35	-0.56	13.50
329+63	9/26/2012	4/2/2013	-5.77	-1.79	5.05
331+43	9/26/2012	4/2/2013	1.43	-1.23	2.92
333+23	9/26/2012	4/2/2013	-9.63	0.51	0.52
335+03	9/26/2012	4/2/2013	-5.60	1.10	7.90
336+83	9/26/2012	4/2/2013	-5.77	0.47	4.75
338+63	9/26/2012	4/2/2013	-8.43	0.63	6.52
340+43	9/26/2012	4/2/2013	-9.88	4.23	13.26

Table C-2. Summary of Shoreline Change and Volume Change (September 2012 to April 2013) Cont.

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from September 26, 2012 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change at MHW (ft)	Volume Change Above 0 ft NAVD88 (cy/ft)	Volume Change Above -15 ft NAVD88 (cy/ft)
342+23	9/26/2012	4/2/2013	-3.64	0.23	8.52
344+05	9/26/2012	4/2/2013	-4.52	-0.25	1.20
345+85	9/26/2012	4/2/2013	-4.71	0.47	5.69
347+63	9/26/2012	4/2/2013	-8.53	-3.76	0.81
349+43	9/26/2012	4/2/2013	-5.68	-1.21	2.37
351+23	9/26/2012	4/2/2013	-9.57	-2.71	3.38
353+03	9/26/2012	4/2/2013	-8.58	-0.85	5.34
354+83	9/26/2012	4/2/2013	-5.89	0.30	2.34
356+63	9/26/2012	4/2/2013	-7.12	-1.72	-5.20
358+43	9/26/2012	4/2/2013	-6.02	-0.58	-1.47
360+23	9/26/2012	4/2/2013	-5.74	-2.70	-4.66
362+03	9/26/2012	4/2/2013	-6.40	-1.84	0.41
363+83	9/26/2012	4/2/2013	-0.02	-2.18	-3.23
365+63	9/26/2012	4/2/2013	-7.84	-0.10	0.11
367+43	9/26/2012	4/2/2013	-2.77	-1.25	-0.18
369+23	9/26/2012	4/2/2013	-5.50	-0.09	4.07
371+03	9/26/2012	4/2/2013	-6.65	-1.87	0.36
372+83	9/26/2012	4/2/2013	-4.00	1.37	6.24
375+08	9/26/2012	4/2/2013	-9.98	-1.01	4.13
376+78	9/26/2012	4/2/2013	-23.16	-3.21	2.59
378+48	9/26/2012	4/2/2013	-17.18	-4.19	-2.79
380+18	9/26/2012	4/2/2013	-22.34	-4.01	-3.88
381+88	9/26/2012	4/2/2013	1.12	-1.39	0.31
383+58	9/26/2012	4/2/2013	0.52	-2.77	-8.34

Table C-3. Summary of Shoreline Change and Volume Change from East Ocean View Nourishment (March 2009 to April 2013)

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from March 20, 2009 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
329+63	3/20/2009	4/2/2013	-22.83	-5.00	-
331+43	3/20/2009	4/2/2013	-22.42	-4.33	-
333+23	3/20/2009	4/2/2013	-15.00	-2.50	-
335+03	3/20/2009	4/2/2013	-16.48	-2.47	-
336+83	3/20/2009	4/2/2013	-17.05	-2.81	-
338+63	3/20/2009	4/2/2013	-16.48	-2.88	-
340+43	3/20/2009	4/2/2013	-19.18	-2.31	-
342+23	3/20/2009	4/2/2013	-19.79	-2.90	-
344+05	3/20/2009	4/2/2013	-19.27	-3.97	-
345+85	3/20/2009	4/2/2013	-17.09	-3.43	-
347+63	3/20/2009	4/2/2013	-11.83	-3.14	-
349+43	3/20/2009	4/2/2013	-17.44	-3.72	-
351+23	3/20/2009	4/2/2013	-10.83	-2.73	-
353+03	3/20/2009	4/2/2013	-16.91	-3.34	-
354+83	3/20/2009	4/2/2013	-10.28	-2.39	-
356+63	3/20/2009	4/2/2013	-16.79	-3.86	-
358+43	3/20/2009	4/2/2013	-14.38	-2.95	-
360+23	3/20/2009	4/2/2013	-21.13	-4.30	-
362+03	3/20/2009	4/2/2013	-14.54	-3.11	-
363+83	3/20/2009	4/2/2013	-12.44	-2.89	-
365+63	3/20/2009	4/2/2013	-9.94	-2.39	-
367+43	3/20/2009	4/2/2013	-22.66	-4.35	-
369+23	3/20/2009	4/2/2013	-14.63	-2.91	-
371+03	3/20/2009	4/2/2013	-26.04	-4.86	-
372+83	3/20/2009	4/2/2013	-22.39	-4.51	-
375+08	3/20/2009	4/2/2013	-36.17	-6.96	-
376+78	3/20/2009	4/2/2013	-25.71	-4.85	-
378+48	3/20/2009	4/2/2013	-43.72	-8.09	-
380+18	3/20/2009	4/2/2013	-42.22	-7.30	-
381+88	3/20/2009	4/2/2013	-28.28	-6.00	-
383+58	3/20/2009	4/2/2013	-43.84	-8.34	-

Table C-4. Summary of Shoreline Change and Volume Change from Central Ocean View Nourishment (March 2005 to April 2013)

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from March 15, 2005 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
15+00	3/15/2005	4/2/2013	-0.75	0.61	-
17+50	3/15/2005	4/2/2013	5.39	1.62	-
20+00	3/15/2005	4/2/2013	3.73	0.41	-
22+50	3/15/2005	4/2/2013	-3.92	-2.01	-
25+00	3/15/2005	4/2/2013	1.11	-1.97	-
27+50	3/15/2005	4/2/2013	1.44	-2.03	-
30+00	3/15/2005	4/2/2013	7.28	-0.37	-
32+50	3/15/2005	4/2/2013	1.05	-1.49	-
35+00	3/15/2005	4/2/2013	0.59	-0.70	-
37+50	3/15/2005	4/2/2013	-2.89	-2.02	-
40+00	3/15/2005	4/2/2013	-7.34	-2.31	-
42+50	3/15/2005	4/2/2013	-6.42	-2.59	-
45+00	3/15/2005	4/2/2013	-9.90	-3.30	-
45+25	3/15/2005	4/2/2013	-10.92	-3.29	-
47+30	3/15/2005	4/2/2013	-11.93	-3.55	-
49+35	3/15/2005	4/2/2013	-6.96	-2.51	-
51+41	3/15/2005	4/2/2013	-6.65	-1.86	-
53+46	3/15/2005	4/2/2013	-2.72	-1.14	-
55+51	3/15/2005	4/2/2013	-8.37	-2.69	-
57+57	3/15/2005	4/2/2013	1.52	-0.78	-
59+62	3/15/2005	4/2/2013	-6.75	-2.00	-
61+62	3/15/2005	4/2/2013	4.74	0.59	-
63+62	3/15/2005	4/2/2013	-5.45	-0.62	-
65+62	3/15/2005	4/2/2013	-0.95	0.53	-
67+62	3/15/2005	4/2/2013	-15.95	-2.05	-
69+62	3/15/2005	4/2/2013	-7.92	-1.09	-
71+62	3/15/2005	4/2/2013	-17.16	-2.72	-
73+62	3/15/2005	4/2/2013	2.84	0.20	-
75+62	3/15/2005	4/2/2013	-4.77	-0.06	-
77+62	3/15/2005	4/2/2013	4.68	1.63	-
79+62	3/15/2005	4/2/2013	-3.09	-0.48	-
81+62	3/15/2005	4/2/2013	-3.31	-1.09	-
83+62	3/15/2005	4/2/2013	-5.50	-1.88	-
85+62	3/15/2005	4/2/2013	-3.76	-1.63	-
87+62	3/15/2005	4/2/2013	-3.21	-0.80	-
93+41	3/15/2005	4/2/2013	-0.45	-0.98	-
103+08	3/15/2005	4/2/2013	-3.89	-1.61	-
120+93	3/15/2005	4/2/2013	-6.14	-2.72	-
129+17	3/15/2005	4/2/2013	-10.19	-4.26	-
141+98	3/15/2005	4/2/2013	-3.55	-1.30	-
152+01	3/15/2005	4/2/2013	-6.58	-2.28	-

Table C-4. Summary of Shoreline Change and Volume Change from Central Ocean View Nourishment (March 2005 to March 2012) Cont.

NOTES:

1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.

2. MHW assumed at +0.98 ft-NAVD88.

3. Shoreline Change and Volume Change is calculated for the period between surveys from March 15, 2005 to April 2, 2013.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
163+49	3/15/2005	4/2/2013	-4.29	-1.82	-
169+63	3/15/2005	4/2/2013	-0.54	-0.87	-
171+63	3/15/2005	4/2/2013	-3.70	-1.19	-
173+63	3/15/2005	4/2/2013	-2.49	-1.28	-
175+63	3/15/2005	4/2/2013	-5.68	-1.37	-
177+63	3/15/2005	4/2/2013	-3.94	-1.06	-
179+63	3/15/2005	4/2/2013	-4.35	-1.41	-
181+63	3/15/2005	4/2/2013	-4.31	-1.86	-
183+63	3/15/2005	4/2/2013	0.63	-0.14	-
185+63	3/15/2005	4/2/2013	-1.98	-0.55	-
187+63	3/15/2005	4/2/2013	5.25	1.38	-
189+63	3/15/2005	4/2/2013	-0.57	0.66	-
191+63	3/15/2005	4/2/2013	6.30	2.06	-
193+63	3/15/2005	4/2/2013	-1.59	0.63	-
195+63	3/15/2005	4/2/2013	-1.61	0.21	-