Periodic Survey Evaluation: Ocean View Beach

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moffatt & nichol

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1. Executive Summary

In October 2010 Geodynamics, LLC conducted the tenth 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 ft NAVD88 and -15 ft NAVD88 are calculated at each transect. Differences in the region above 0 ft NAVD88 are indicative of changes to the dune and subaerial beach berm, while the differences above -15 ft NAVD88 indicate changes in the nearshore zone. Comparison of seasonal surveys (i.e. October 2009 to October 2010) 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 October 2010 survey data with previous surveys taken in October 2009 (fall to fall comparison) and March 2010 (most recent periodic survey comparison) in the Ocean View Beach area between Willoughby Spit and Little Creek Inlet.

Comparison	Parameter	Quantity
October 2009 vs. October 2010	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	-2.16 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	-54,049 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	-60,959 cy/yr
March 2010 vs. October 2010	Average Shoreline Change at MHW (+0.98 ft NAVD88)	3.71 ft
	Cumulative Volume Change Above 0 ft NAVD88	90,179 cy
	Cumulative Volume Change Above -15 ft NAVD88	70,240 cy

The average shoreline change rate for the entire shoreline at MHW between the October 2009 and October 2010 surveys was -2.16 ft/yr. The cumulative volume change above 0 ft NAVD88 was approximately -54,049 cy/yr, between the October 2009 and October 2010 surveys, indicating an overall volumetric loss in the dune and subaerial beach over the past year. An additional approximately 7,000 cy was lost in the region between 0 ft NAVD88 and -15 ft NAVD88 showing a loss the system as a whole. This loss can mostly be attributed to the East Ocean View nourishment project equilibrating and the November 2009 nor'easter. The impacts from the nor'easter are evident in that there was a gain in sediment during the period from March 2010 to October 2010 indicating recovery and that the majority of losses over the year occurred in the October 2009 to March 2010 period. Overall, the shoreline is erosive due to the impacts of the November 2009 nor'easter, and to some degree the equilibration of the East Ocean View nourishment project in March 2009.

While the impacts of the November 2009 nor'easter, and to some degree the equilibration of the East Ocean View nourishment project in March 2009, created an overall erosive shoreline, there were differences in the various regions. The Willoughby Spit region was able to utilize sediment from the terminal groin area to restore the dunes on the eastern portion of the region that were eroded by the nor'easter. Similar to Willoughby Spit, the 800 block region underwent a dune restoration utilizing sediment from the tombolos landward of the two easternmost breakwaters to restore some of the

storm protection lost during the nor'easter. The West Ocean View region, although typically stable, showed recession of the MHW shoreline as well as overall volumetric erosion. Recovery of this region has begun as the shoreline change and overall volume change across the profile in the most recent survey period were positive. The Central Ocean View Breakwaters region showed positive accretion at the MHW over the year, although the negative volume change above 0 ft NAVD88 is indicative of the sediment shifting from the dune and subaerial beach to the nearshore region. While this section was impacted by the storm, as with other regions of the shoreline, recovery of the system was apparent in the most recent survey period and is expected to continue in future surveys. Typically a very stable region, Central Ocean View has experienced some erosion of the dune and subaerial beach over the past year, with minimal losses above 0 ft NAVD88, due to the nor'easter. Overall, the system above -15 ft NAVD88 has shown a gain of sediment, which in most part can be attributed to losses from the beach nourishment in the East Ocean View region. Finally, the East Ocean View area shows a volumetric loss from the nor'easter and as the shoreline equilibrates from the large gain in material from nourishment, especially in the area behind the three easternmost breakwaters (which do not receive sediment from natural transport due to the jetties) and the area landward of the five recently constructed breakwaters (which was previously designated as an erosion hotspot). The recently constructed breakwaters appear to be alleviating the end effects from the previous breakwater field and creating a more uniform shoreline response.

In addition to regional assessments, comparison of the October 2010 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. October 2010 Comparison	-51.18 ft	-11.77 cy/ft	-61,204 cy	-18.13 cy/ft	-93,402 cy
Central Ocean View Nourishment vs. October 2010 Comparison	-26.13 ft	-9.95 cy/ft	-188,815 cy	-8.13 cy/ft	-150,157 cy

The 61,000 cy volumetric loss above 0 ft NAVD88 from the East Ocean View project is approximately 55% of the original amount placed in this dune and subaerial beach area while the 189,000 cy loss above 0 ft NAVD88 in the Central Ocean View project area is approximately 60% of the original amount placed above 0 ft NAVD88. Due to storm impacts and, in the case of the Central Ocean View project, anticipated project design life, there are areas in these shoreline regions that should be targeted for nourishment in the near future.

2. Objective

The City of Norfolk, Virginia has a program of periodic surveying of the Ocean View shoreline. The periodic surveying data were collected by McKim & Creed in September 2005, March 2006, October 2006, March 2007, October 2007, March 2008, October 2008, April 2009 and most recently by Geodynamics, LLC in October 2009, March 2010, and October 2010. This report documents the data sources, methods, and results of a periodic surveying evaluation performed to compare the October 2010 survey data with previous surveys taken in October 2009 (fall to fall comparison) and March 2010 (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 (October 2010) 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 East Ocean View beach nourishment project that was most recently renourished in March 2009. In November 2009, a nor'easter impacted the area and a post-storm survey was obtained. The impacts of this storm were assessed in the report entitled November 2009 Nor'easter Post-Storm Survey Evaluation: Ocean View Beach. Reference will be made to these impacts and changes that have occurred relative to the most recent survey in October 2010.

3. Data Sources

Most recently, Geodynamics conducted a survey of Ocean View Beach in October 2010. 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, transects were stationed from west to east along the Ocean View shoreline. The survey data were obtained 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 October 2010, the Virginia Institute of Marine Science (VIMS) flew aerial photography of the Ocean View shoreline, georectified these images, and digitized a shoreline position from the images. The October 2010 aerial photos with the digitized shoreline position 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.

In addition, pre-fill survey data from the East Ocean View beach nourishment, taken in June 2003, and the Willoughby Spit to Central Ocean View dune restoration, taken in December 2004-February 2005, were used. Post-fill surveys taken for the East Ocean View beach nourishment and Willoughby Spit to Central Ocean View dune restoration projects in March 2009 and March 2005 respectively were also used. 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 2010 (Civil 3D), Microsoft Excel (Excel), Surfer and 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 State Plane NAD 1983 (HARN), US Survey feet with a vertical datum of NAVD88 (ft). Digital Terrain Models (DTMs) were created for each set of survey data. From these surfaces, 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. October 2009 to October 2010 (Entire Shoreline)
2. March 2010 to October 2010 (Entire Shoreline)
3. March 2009 (East Ocean View post-fill) to October 2010 (Sta 329+63-Sta 383+58)
4. June 2003 (East Ocean View pre-fill) to October 2010 (Sta 329+63-Sta 383+58)
5. March 2005 (Central Ocean View post-fill) to October 2010 (Sta 15+00-Sta 195+63)
6. December 2004-February 2005 (Central Ocean View pre-fill) to October 2010 (Sta 15+00-Sta 195+63)

First, change in shoreline position at mean high water (MHW), which was defined as +0.98 ft NAVD88 (based on NOAA tidal benchmark at Sewells Point), was calculated at each transect for all time periods mentioned. The resulting value represents the shoreline change (ft) 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 ft NAVD88 and volume change above 0 ft NAVD88. As with the shoreline change, the results represent volume change (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 between surveys based on the applicable profile extents.

Volume changes calculated for portions of the profiles above 0 ft 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.

5. Discussion of Periodic Surveying Evaluation

This section will discuss differences observed in the relative 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 being covered are tabulated in Appendix C.

5.1. Differences in Relative Surveys

Differences in the surveys taken as part of the ongoing program of periodic surveying of the Ocean View shoreline (October 2009, March 2010, and October 2010) 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. 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 October 2009 to October 2010 comparison are presented in Table 5-1. A summary of the resulting statistics for the March 2010 to October 2010 comparison are presented in Table 5-2. Evaluation of the computed statistics took into account volume changes computed for portions of the profile above 0 ft NAVD88 and above -15 ft NAVD88 in order to better understand onshore and offshore processes.

These volumetric changes are influenced by the dune restorations that occurred between March and May 2010. The projects introduced additional sediment into the system from the area west of the terminal groin as well as shifted sediment east of the terminal groin from the nearshore region to the dune system.

Table 5-1: Regional Shoreline and Volume Change Statistics (October 2009 – October 2010 Comparison)

Region	Average Shoreline Change	Average Volume Change Rate Above 0 ft NAVD88	Cumulative Volume Change Rate Above 0 ft NAVD88	Average Volume Change Rate Above -15 ft NAVD88	Cumulative Volume Change Rate Above -15 ft NAVD88
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Willoughby Spit (0+00 to 45+00)	-6.65	-1.84	-6,943	-7.56	-31,212
800 Block Breakwater (45+25 to 87+62)	0.05	-0.48	-2,375	-3.15	-13,389
West Ocean View (93+41 to 163+49)	-2.25	-2.22	-16,625	-1.82	-12,245
Central Ocean View Breakwaters (169+63 to 195+63)	6.61	-0.79	-3,568	0.33	386
Central Ocean View (206+86 to 323+09)	10.61	-0.79	-6,751	1.92	30,460
East Ocean View (329+63 to 383+58)	-33.51	-3.49	-17,787	-6.53	-34,958
OVERALL	Weighted Average (ft/yr)	Weighted Average (cy/ft/yr)	Total (cy/yr)	Weighted Average (cy/ft/yr)	Total (cy/yr)
	-2.16	-1.57	-54,049	-1.94	-60,959

Table 5-2: Regional Shoreline and Volume Change Statistics (March 2010 – October 2010 Comparison)

Region	Average Shoreline Change	Average Volume Change Rate Above 0 ft NAVD88	Cumulative Volume Change Rate Above 0 ft NAVD88	Average Volume Change Rate Above -15 ft NAVD88	Cumulative Volume Change Rate Above -15 ft NAVD88
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit (0+00 to 45+00)	-9.81	2.21	11,885	-0.43	2,236
800 Block Breakwater (45+25 to 87+62)	0.23	4.01	17,636	1.86	8,276
West Ocean View (93+41 to 163+49)	0.38	1.79	11,779	2.21	13,212
Central Ocean View Breakwaters (169+63 to 195+63)	5.20	1.46	5,828	2.32	9,252
Central Ocean View (206+86 to 323+09)	13.35	3.54	44,439	2.51	33,386
East Ocean View (329+63 to 383+58)	-0.40	-0.47	-1,388	0.41	3,877
OVERALL	Weighted Average (ft)	Weighted Average (cy/ft)	Total (cy)	Weighted Average (cy/ft)	Total (cy)
	3.71	2.31	90,179	1.70	70,240

In mid-November 2009, a nor'easter impacted the mid-Atlantic region. The affects of this storm are apparent in the significant changes in the onshore and offshore regions throughout Ocean View. As depicted in the profile comparison figures in Appendix B (note: nor'easter profiles are not included), the dune system along most of this shoreline was severely impacted with resulting losses in the dune and subaerial beach berm. A post-storm survey was conducted two weeks after the storm and the shoreline and volume changes between this survey and the October 2009 survey, two weeks before the storm, are shown in Table 3 for comparison purposes.

According to Table 5-1, the Ocean View shoreline has experienced overall erosion at MHW over the past year. This can be attributed in part to the East Ocean View nourishment project, which took place in March 2009, shifting towards a state of equilibrium as shown by the more than 30-foot change in shoreline in the East Ocean View as well as the impact of the November 2009 nor'easter as shown in Table 5-3. The recent East Ocean View project placed approximately 196,000 cy of material on the beach in the East Ocean View region, approximately 113,000 cy of which was placed above 0 ft NAVD88. This nourishment equilibration and storm also affected the overall shoreline trends, and the volume change over the past year above 0 ft NAVD88 was negative.

Table 5-3: Regional Shoreline and Volume Change Statistics from the November 2009 Nor'easter (Late October 2009 Survey to Late November 2009 Survey Comparison)

Region	Average Shoreline Change	Average Volume Change Rate Above 0 ft NAVD88	Cumulative Volume Change Rate Above 0 ft NAVD88	Average Volume Change Rate Above -15 ft NAVD88	Cumulative Volume Change Rate Above -15 ft NAVD88
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit (0+00 to 45+00)	15.62	1.86	307	8.48	1,358
800 Block Breakwater (45+25 to 87+62)	4.86	-5.97	-27,163	-3.42	-16,443
West Ocean View (93+41 to 163+49)	13.17	-4.57	-21,633	-0.29	-1,661
Central Ocean View Breakwaters (169+63 to 195+63)	1.07	-3.27	-26,417	-0.30	-1,628
Central Ocean View (206+86 to 323+09)	7.67	-1.58	-6,531	2.94	8,877
East Ocean View (329+63 to 383+58)	10.28	-5.48	-66,936	0.76	12,643
OVERALL	Weighted Average (ft)	Weighted Average (cy/ft)	Total (cy)	Weighted Average (cy/ft)	Total (cy)
	4.62	-4.31	-169,391	0.17	6,148

The most recent period of comparison, from the March 2010 survey to the October 2010 survey (shown in Table 5-2) depicts an overall accretion at the MHW line, though there are regions of erosion in Willoughby Spit and East Ocean View. There were significant volumetric gains above 0 ft NAVD88, as compared to the year-long period, indicating the impact of the November 2009 nor'easter on the sediment in the system. The region above -15 ft NAVD88 experienced a positive gain in volume, though not nearly as much as that observed above 0 ft NAVD88. This may be attributed to the two-phase dune restoration project that was completed between March and May and

some natural recovery processes after the storm. This project placed approximately 30,000 cy of sediment, borrowed from the subaerial and nearshore zone around the terminal groin and the 800 Block two easternmost breakwaters, on portions of the shoreline between Sta 27+50 and Sta 71+62. While this retains the sediment in the system, it does impact the amount of sediment in the system between -15 ft NAVD88 and 0 ft NAVD88.

While the overall trends over the past year are erosional due to the nourishment project equilibrating and the November 2009 nor'easter, patterns vary within each region of the shoreline as defined in Figure 1. The calculated statistics with respect to each region will be discussed in more detail in the following section.

5.3. 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 5-1 and Table 5-2 has been created for each region of study. Figure 5-1 through Figure 5-4, following the discussion of regional shoreline trends, present the shoreline and volume change at each transect within the defined regions.

5.3.1. Willoughby Spit

The Willoughby Spit region (Sta 0+00 to Sta 45+00) includes two offshore breakwaters, timber groins and has historically been a stable and accreting region. A summary of average shoreline and volume change rates between October 2009 and October 2010 for the Willoughby Spit region along with average shoreline and volume change quantities between March 2010 and October 2010 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
October 2009 vs. October 2010 Comparison					
Willoughby Spit (0+00 to 45+00)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-6.65	-1.84	-6,943	-7.56	-31,212
March 2010 vs. October 2010 Comparison					
Willoughby Spit (0+00 to 45+00)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	-9.81	2.21	11,885	-0.43	2,236

The information depicted in Table 5-4 depicts the influence of the nor'easter and dune restoration project on this region over the last year. For the year between the fall surveys (October 2009 and October 2010), this region experienced an average shoreline recession rate of 6.65 ft/yr at MHW with volumetric losses of sediment above 0 ft NAVD88 of approximately 6,943 cy. Examination of the profile plots in Appendix B and Figure 5-2 show that this is due in most part to shifting sediments from the nor'easter and significant erosion of the dune on the eastern portion of this region. The overall addition of sediment to the system in this region from natural recovery processes following the storm, and the dune restoration, is observed in the sediment volume gain during the March to

October time period. As depicted in Figure 5-4, excavation of the area near the terminal groin on this western end of this region allowed for a negative average volume change above -15 ft NAVD88 while simultaneously allowing for the positive cumulative volume change by keeping the sediment in this region with the dune restoration on the eastern portion of the region.

5.3.2. 800 Block Breakwaters

The 800 Block Breakwaters region (Sta 45+25 to Sta 87+62) is characterized by a field of 8 breakwaters. The easternmost breakwater was built 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. A summary of average shoreline and volume change rates between October 2009 and October 2010 for the 800 Block Breakwater region along with average shoreline and volume change quantities between March 2010 and October 2010 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
October 2009 vs. October 2010 Comparison					
800 Block Breakwaters (45+25 to 87+62)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	0.05	-0.48	-2,375	-3.15	-13,389
March 2010 vs. October 2010 Comparison					
800 Block Breakwaters (45+25 to 87+62)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	0.23	4.01	17,636	1.86	8,276

As with the Willoughby Spit region, the influences of the nor'easter and dune restoration on this area are apparent in the annual and seasonal changes. Although there was an overall loss of volume to the system attributed in most part to the nor'easter, as depicted in the fall to fall comparison, there were significant gains in the portions of shoreline above 0 ft NAVD88 from the spring to fall comparison due to the dune restoration and the natural recovery process following the storm. While the system was not restored to the pre-storm level, as shown in the profiles in Appendix B, there is significantly more dune protection compared to the spring survey. Figure 5-4 depicts the decrease in sediment on the eastern portion of this region and the increase in sediment on the western portion of this region during the most recent survey period due to excavation and placement of the dune restoration project.

5.3.3. 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 between October 2009 and October 2010 for the West Ocean View region along with average shoreline and volume change quantities between March 2010 and October 2010 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
October 2009 vs. October 2010 Comparison					
West Ocean View (93+41 to 163+49)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-2.25	-2.22	-16,625	-1.82	-12,245
March 2010 vs. October 2010 Comparison					
West Ocean View (93+41 to 163+49)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	0.38	1.79	11,779	2.21	13,212

The October 2009 to October 2010 survey comparison showed recession of the MHW shoreline as well as overall volumetric erosion above 0 ft NAVD88 and -15 ft NAVD88 which can be mostly attributed to the nor'easter. From Figure 5-2, it is apparent that the erosion is worse at the eastern portion of the region, especially at Sta 129+17 and Sta 152+01, which realized the greatest impacts from the storm. The recovery of the profiles since the storm is apparent in the March 2010 to October 2010 comparison as the shoreline change and the overall volume change across the profile is positive.

5.3.4. 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 between October 2009 and October 2010 for the Central Ocean View Breakwaters region along with average shoreline and volume change quantities between March 2010 and October 2010 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
October 2009 vs. October 2010 Comparison					
Central Ocean View Breakwaters (169+63 to 195+63)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	6.61	-0.79	-3,568	0.33	386
March 2010 vs. October 2010 Comparison					
Central Ocean View Breakwaters (169+63 to 195+63)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	5.20	1.46	5,828	2.32	9,252

In the Central Ocean View Breakwaters region the MHW position accreted over the previous year, although the negative volume change above 0 ft NAVD88 is indicative of the sediment shifting from the dune and subaerial beach to the nearshore region. This sediment movement was typical of the impact of the nor'easter and resulted in positive gains in the region between 0 ft NAVD88 and -15 ft NAVD88. Figure 5-2 through Figure 5-5 show varying levels of erosion and accretion across the region. The greatest level of accretion from the spring to fall survey period appears to occur at the

ends of this section and is indicative of the region recovering from the storm as can be seen in the profile changes in Appendix B.

5.3.5. 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 between October 2009 and October 2010 for the Central Ocean View region along with average shoreline and volume change quantities between March 2010 and October 2010 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
October 2009 vs. October 2010 Comparison					
Central Ocean View (206+86 to 323+09)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	10.61	-0.79	-6,751	1.92	30,460
March 2010 vs. October 2010 Comparison					
Central Ocean View (206+86 to 323+09)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	13.35	3.54	44,439	2.51	33,386

As shown in Table 5-8, Central Ocean View has experienced some erosion of the dune and subaerial beach over the past year with minimal losses above 0 ft NAVD88. Overall, the system above -15 ft NAVD88 has shown a gain of sediment, which in most part can be attributed to losses from the beach nourishment in the East Ocean View region, and also from the impacts of the nor'easter and post-storm recovery.

5.3.6. 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 between October 2009 and October 2010 for the East Ocean View region along with average shoreline and volume change quantities between March 2010 and October 2010 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
October 2009 vs. October 2010 Comparison					
East Ocean View (329+63 to 383+58)	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
	-33.51	-3.49	-17,787	-6.53	-34,958
March 2010 vs. October 2010 Comparison					
East Ocean View (329+63 to 383+58)	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
	-0.40	-0.47	-1,388	0.41	3,877

As expected, due to the post-nourishment profile equilibration and the impacts of the nor'easter, there were significant volume losses to this region between the October 2009 and October 2010 period. The dune system remained intact over the majority of the region; however, the berm was eroded as shown in Appendix B. The sediment from this region appears to have moved west, in the direction of littoral drift, and been captured in the Central Ocean View region. The easternmost portion of this region, where tomobolos had previously formed, appears to have suffered the most erosion over the year long period. Changes from the spring to fall comparison have a fairly steady pattern of accretion on the profiles landward of the breakwaters and erosion on the profiles between the breakwaters. This shows the influence of the breakwaters on decreasing the wave heights and retaining sediment along the shore. Gains in sediment volume during this period are also indicative of the natural recovery processes following the storm.

End effects of the ten easternmost breakwaters previously caused erosion to the western portion of East Ocean View (Bay Oaks hotspot). The five breakwaters constructed in 2009 were designed to help alleviate these end effects and create a more uniform shoreline response. As evidenced in Figure 5-1 through Figure 5-4, the erosion hotspot, which was apparent at the western end of the breakwater field in previous reports, has been adequately filled with new material and the newly constructed breakwaters have performed as expected, decreasing the end effects of the breakwater field on the shoreline.

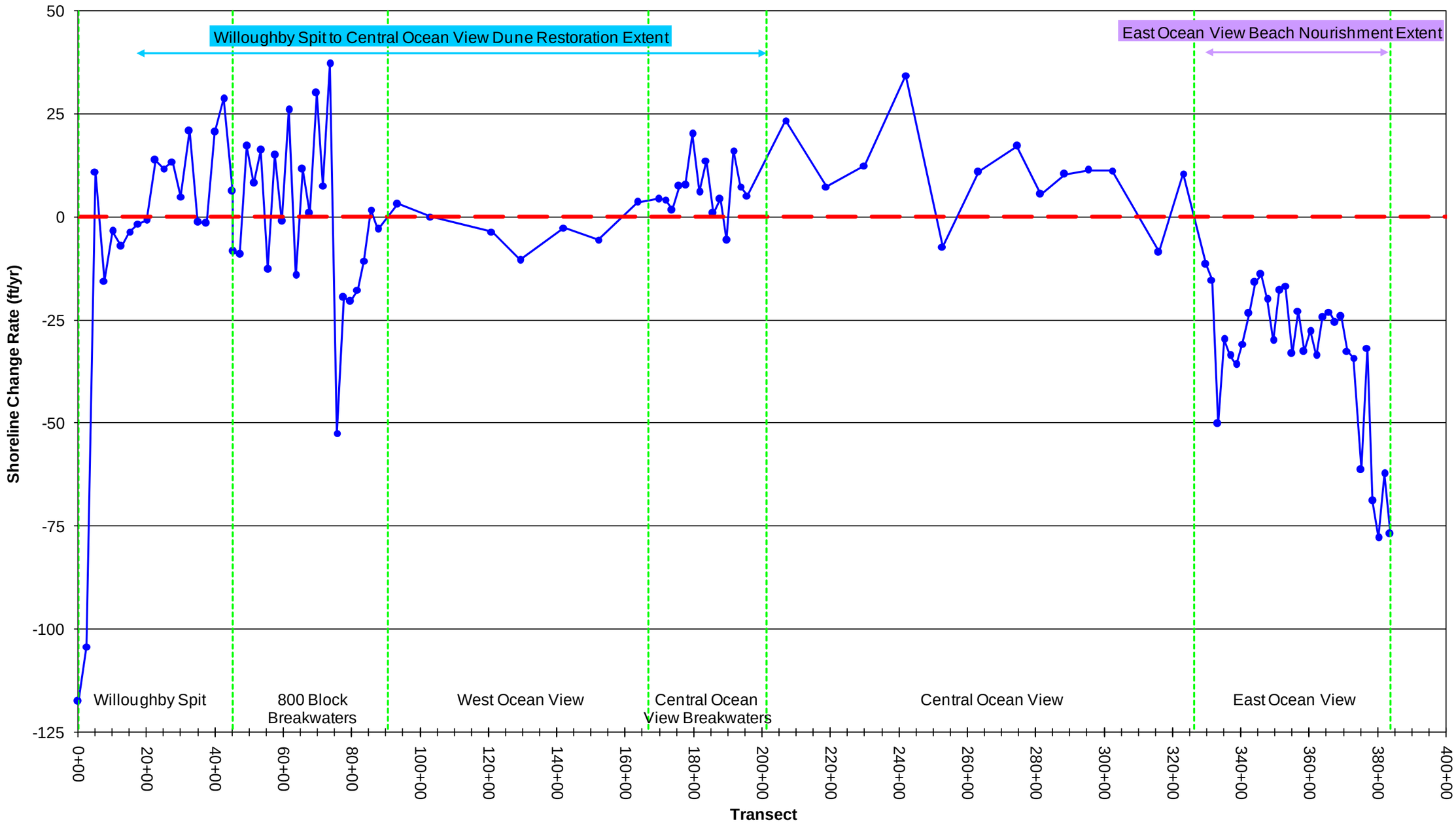


Figure 5-1: Shoreline Change Rate (ft/yr) at Mean High Water (+0.98 ft NAVD88) for October 2009 to October 2010 (Note: Positive = Accretion, Negative = Erosion)

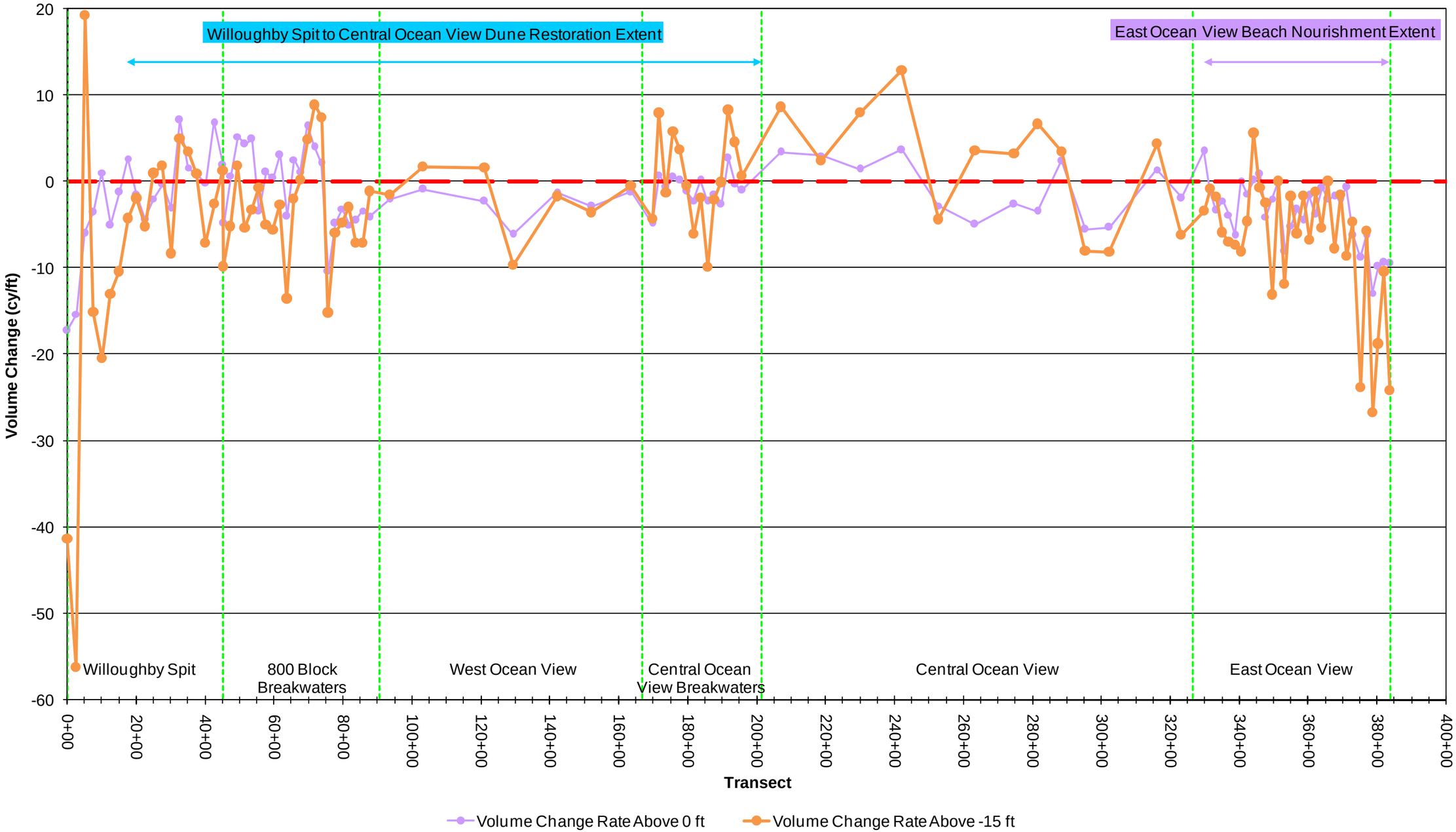


Figure 5-2: Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr) for October 2009 to October 2010 (Note: Positive = Accretion, Negative = Erosion)

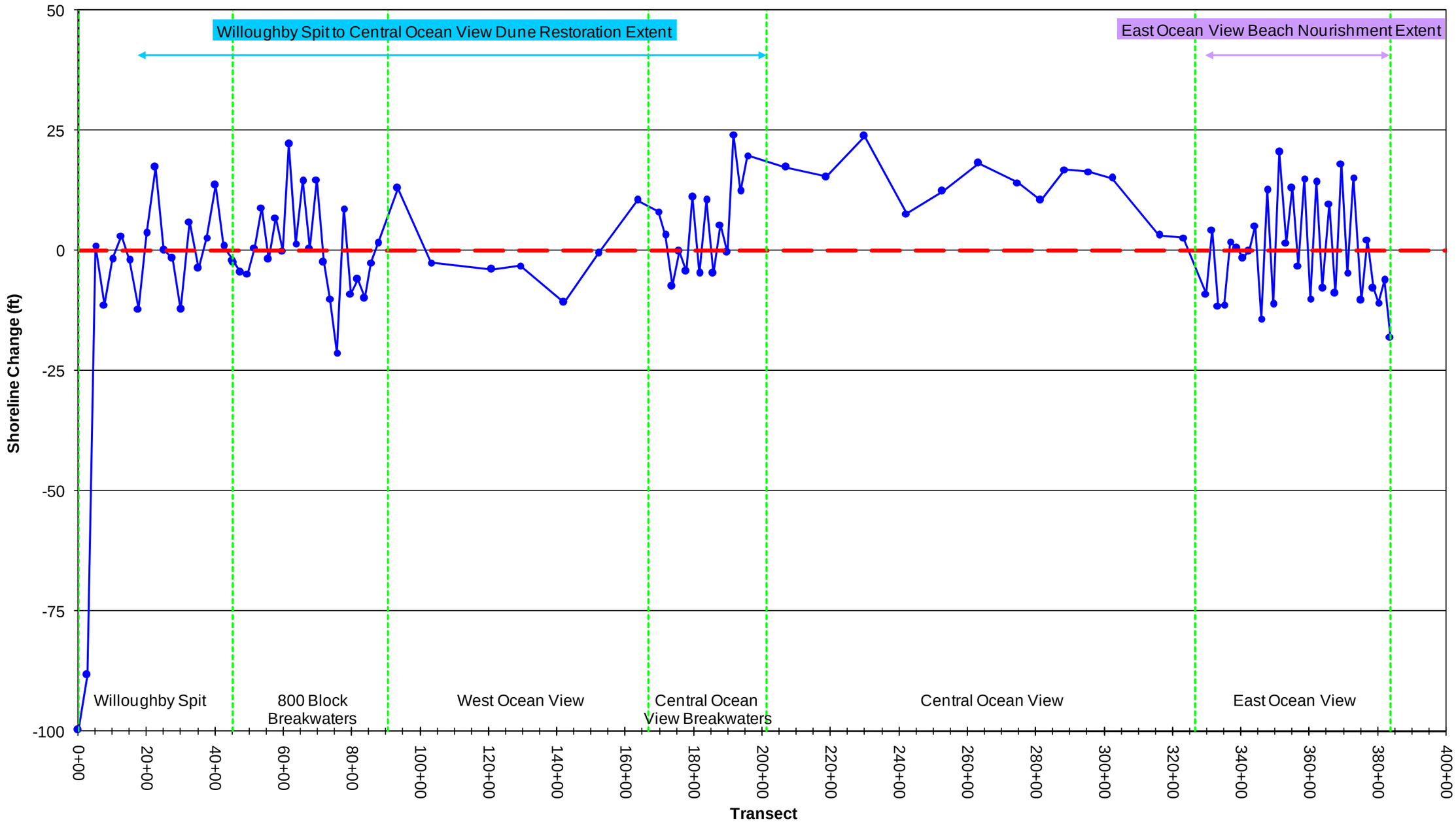


Figure 5-3: Shoreline Change (ft) at Mean High Water (+0.98 ft NAVD88) for March 2010 to October 2010 (Note: Positive = Accretion, Negative = Erosion)

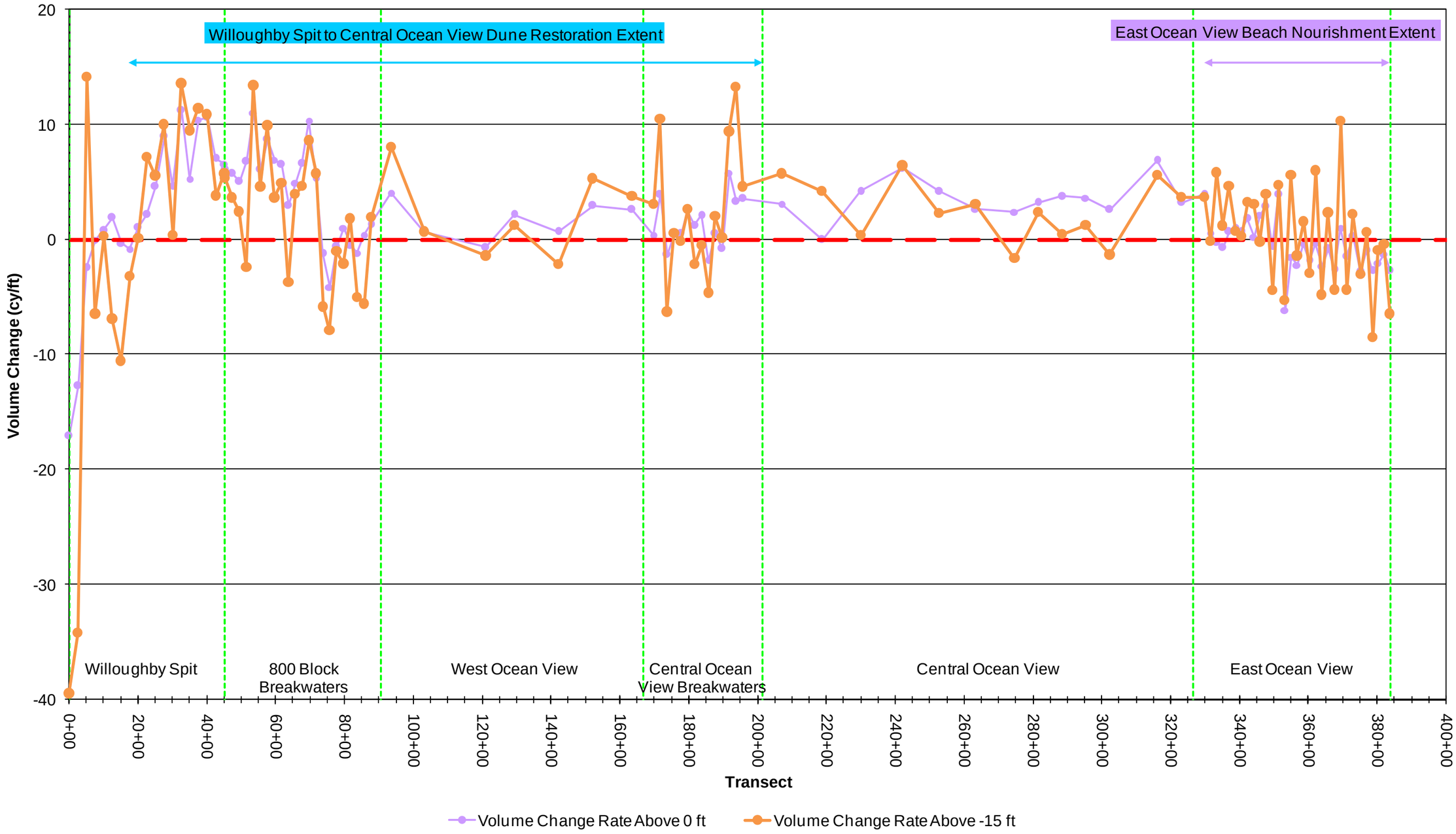


Figure 5-4: Volume Change Above 0 ft NAVD88 (cy/ft) and -15 ft NAVD88 for March 2010 to October 2010 (Note: Positive = Accretion, Negative = Erosion)

5.4. East Ocean View Beach Nourishment Project (2009)

Previously, a 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. Most 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 October 2010, 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 (Post-Fill – October 2010 Comparison)

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
East Ocean View (329+63 to 383+58)	Rate per Year	-31.94	-7.34	-38,187	-11.31	-58,277
	Total	-51.18	-11.77	-61,204	-18.13	-93,402

Results indicate that the East Ocean View shoreline has continued equilibrating with losses at MHW. Roughly 61,000 cy of material has been lost above 0 ft NAVD88, or approximately 55% of the 113,000 cy originally placed above 0 ft NAVD88. This loss is the result of the expected increased erosion over the short term due to profile equilibration of the recent nourishment project as well as the impacts from the November 2009 nor'easter. The East Ocean View Nourishment Project study prepared by M&N in June 2004 estimated the design life of the nourishment project to be on the order of 7 to 8 years with no major storm activity. In the instance of storm impacts along this reach of shoreline, the design life of the project was anticipated to be on the order of 4 to 5 years. Impacts from the November 2009 nor'easter have reduced the anticipated project design life to be more in line with the 4 to 5 year period as long as some recovery does take place between these events.

The volume loss above 0 ft NAVD88 in the first survey period following the nourishment project (April 2009 to October 2009), documented in the Fall 2009 Periodic Survey Report, was approximately 24,000 cy. This is approximately 40% of the total volume loss for this area as shown in Table 5-10. As previously mentioned, the November 2009 nor'easter greatly impacted this region causing accelerated erosion rates; however, there was only an additional 5% of material erosion from above 0 ft NAVD88 that occurred during this last survey period. This can be attributed to post-storm recovery and the profile approaching equilibrium. Figure 5-5 shows areas of volume gain and volume loss between the post-fill survey and the October 2010 survey. As depicted in the figure, there has been erosion of the beach face and nearshore, which is to be expected after a nourishment project as profiles equilibrate. It is notable that the eroded material from the beach face and nearshore appears to be caught offshore in the vicinity of the breakwaters.

In addition, the October 2010 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 may need to be targeted for nourishment. Figure 5-6

shows the MHW shoreline position difference between the pre-fill and March 2010 shorelines. As can be seen, the recent nourishment project has provided ample protection along the East Ocean View shoreline. The portion of the shoreline closest to the original pre-fill position occurs at Sta 331+43. Sta 331+43 is immediately downdrift of the recently constructed breakwaters and is affected by end effect erosion. It will be important to monitor this portion of shoreline as stabilization from the nourishment and breakwater construction continues.

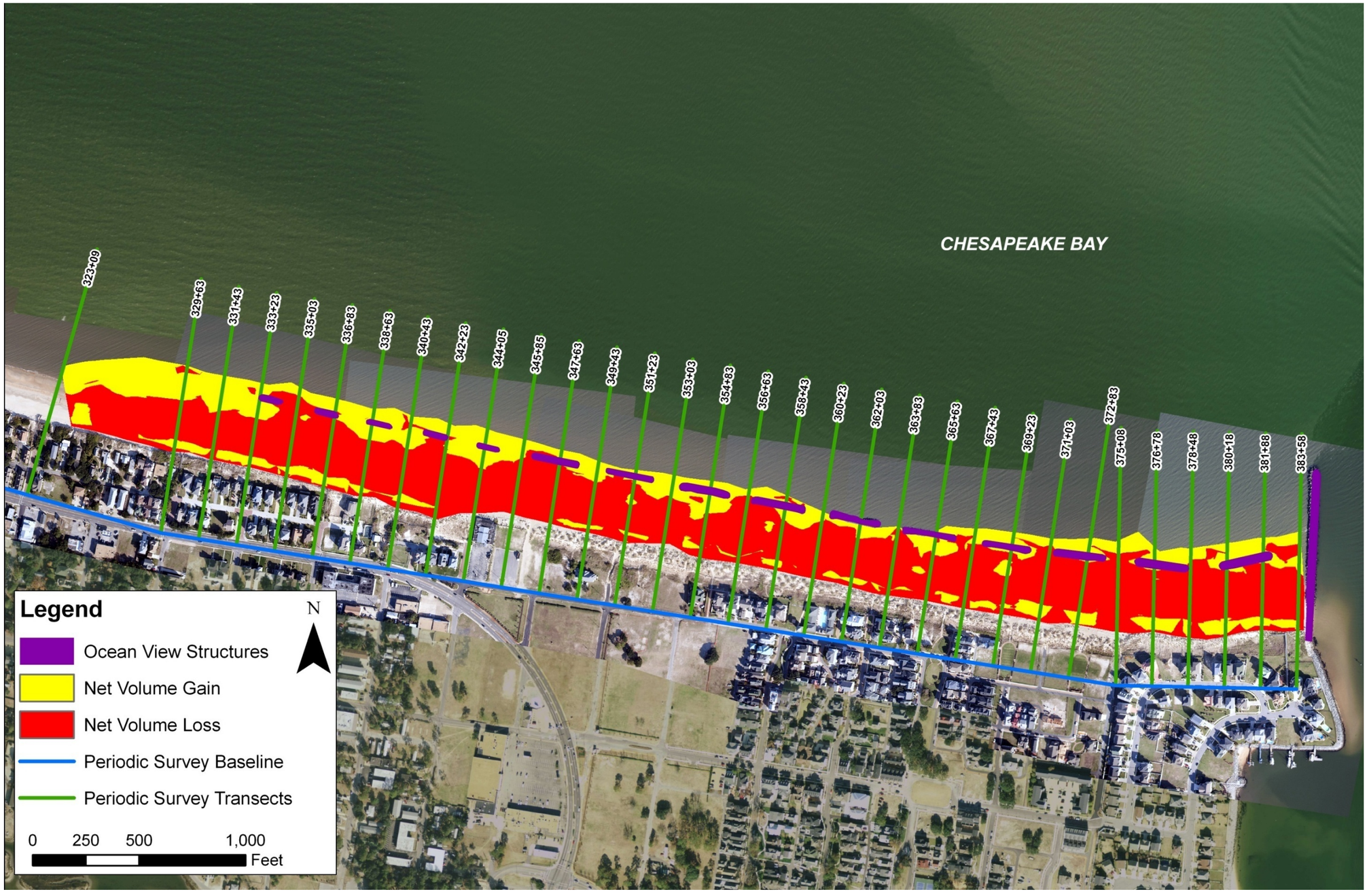


Figure 5-5: Net Volume Change Since the East Ocean View Nourishment Project (March 2009)

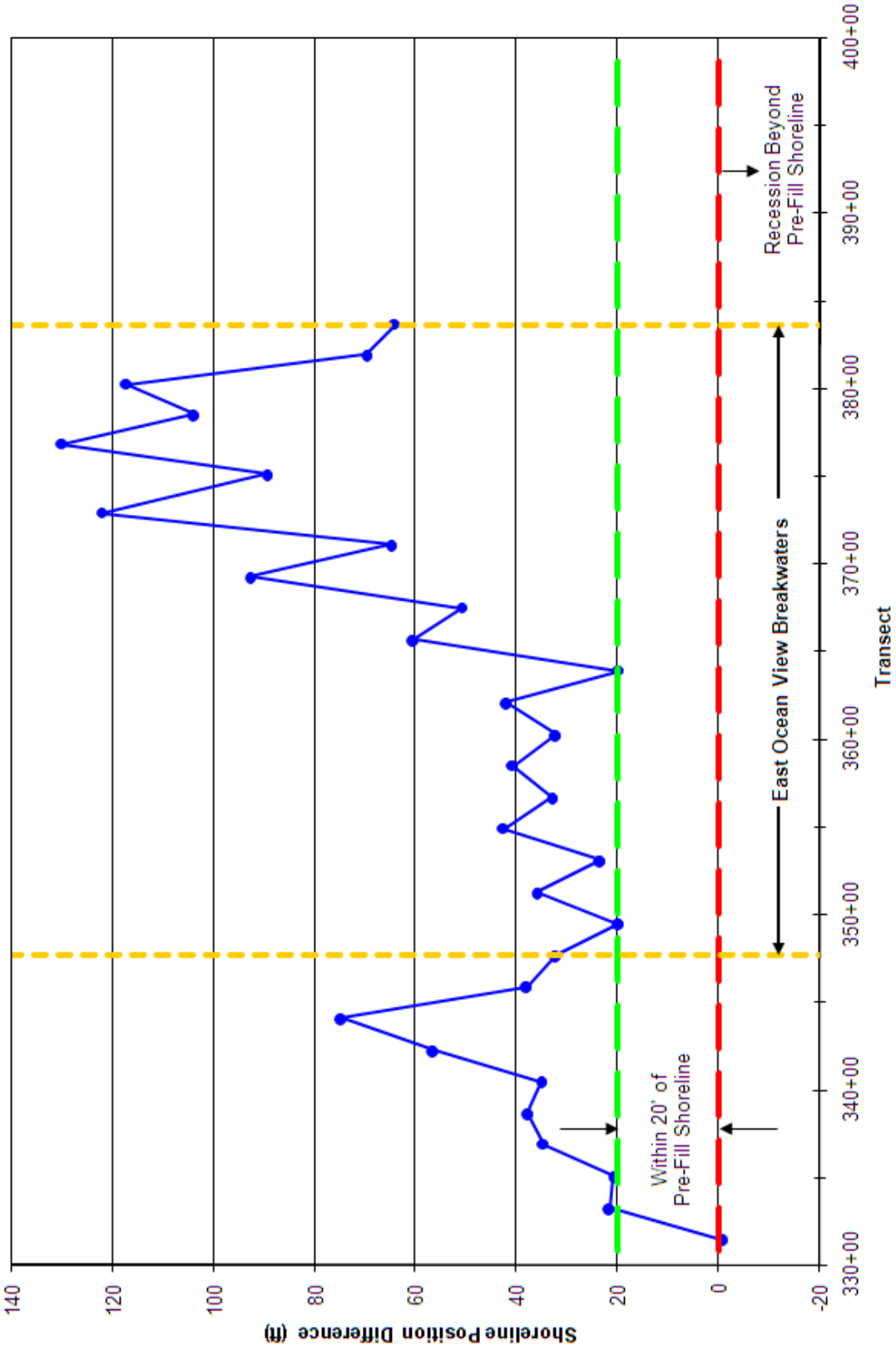


Figure 5-6: Shoreline Position Difference (ft) at MHW Between Pre-Fill and October 2010 Shorelines for East Ocean View

5.5. Central Ocean View Dune Restoration Project (2005)

The most recent periodic survey, taken in October 2010, 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 (Post-Fill – October 2010 Comparison)

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
Willoughby Spit (0+00 to 45+00)	Rate per Year	-4.09	-1.58	-4,750	-1.70	-5,014
	Total	-23.01	-8.87	-26,691	-9.53	-28,172
800 Block Breakwaters (45+25 to 87+62)	Rate per Year	-6.46	-1.26	-5,447	-2.15	-9,268
	Total	-36.30	-7.11	-30,609	-12.10	-52,081
West Ocean View (93+41 to 163+49)	Rate per Year	-5.06	-2.61	-20,757	-1.77	-13,645
	Total	-28.41	-14.65	-116,636	-9.95	-76,672
OVERALL	Weighted Average	Weighted Average	Total	Weighted Average	Total	Weighted Average
Rate per Year		-4.65	-1.77	-33,602	-1.45	-26,722
Total		-26.13	-9.95	-188,815	-8.13	-150,157

It is important to consider changes above the 0 ft contour since the project was primarily a dune restoration, placing the majority of sand above the water. Table 5-11 shows that there has been significant loss of material in the dune system and subaerial beach above 0 ft NAVD88 since the project was completed. Roughly 189,000 cy of material has been lost above 0 ft NAVD88, or approximately 60% of the 320,700 cy originally placed above 0 ft NAVD88. This area was significantly impacted by the nor'easter and suffered severe losses and although approximately 60% of the material from the dune and subaerial beach berm has been eroded, there was a gain in sediment since the spring survey. This gain in sediment is due not only to recovery of the system, but also to the dune restoration project that placed approximately 30,000 cy in this region between March and May 2010. Figure 5-7 supports the calculated statistics by showing more losses than gains to the dunes and subaerial beach and gains in the region where the emergency dune restoration took place earlier in the year. This dune/subaerial beach material is likely being transported offshore but remains within the system. Although the material likely remains within the system, storm protection is being lost as material is moved offshore from the dune and subaerial beach system.

In addition, the October 2010 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 sixth year and was impacted by several storms since its construction, e.g. October 2006 and November 2009 nor'easters. Areas where the current shoreline is within 20 feet of the pre-fill shoreline may need to be targeted for nourishment. Figure 5-8 shows the MHW shoreline position difference between the pre-fill and October 2010 shorelines. As can be seen, the October 2010 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. One area of concern is 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 at Sta 73+62 and Sta 61+62. The breakwaters are most likely inhibiting the transport of sand to the western portion of the field and shoreline beyond. Portions of the shoreline in the groin field of the Willoughby Spit region also appear to be retreating to the pre-fill shoreline position. The shoreline between the 800 Block breakwater field and the Central Ocean View breakwaters is also of concern as most transects either show recession beyond the pre-fill shoreline or shoreline positions within 20 feet of the pre-fill shoreline. The shoreline suffered significant impacts from the November 2009 nor'easter. While, the natural recovery process has begun, and the recent emergency dune restoration project in 2010 restored a portion of the dunes in certain areas, targeted nourishment projects should be planned for these areas in the near future.



Figure 5-7: Net Volume Change Since the Willoughby Spit to Central Ocean View Dune Restoration Project (March 2005)

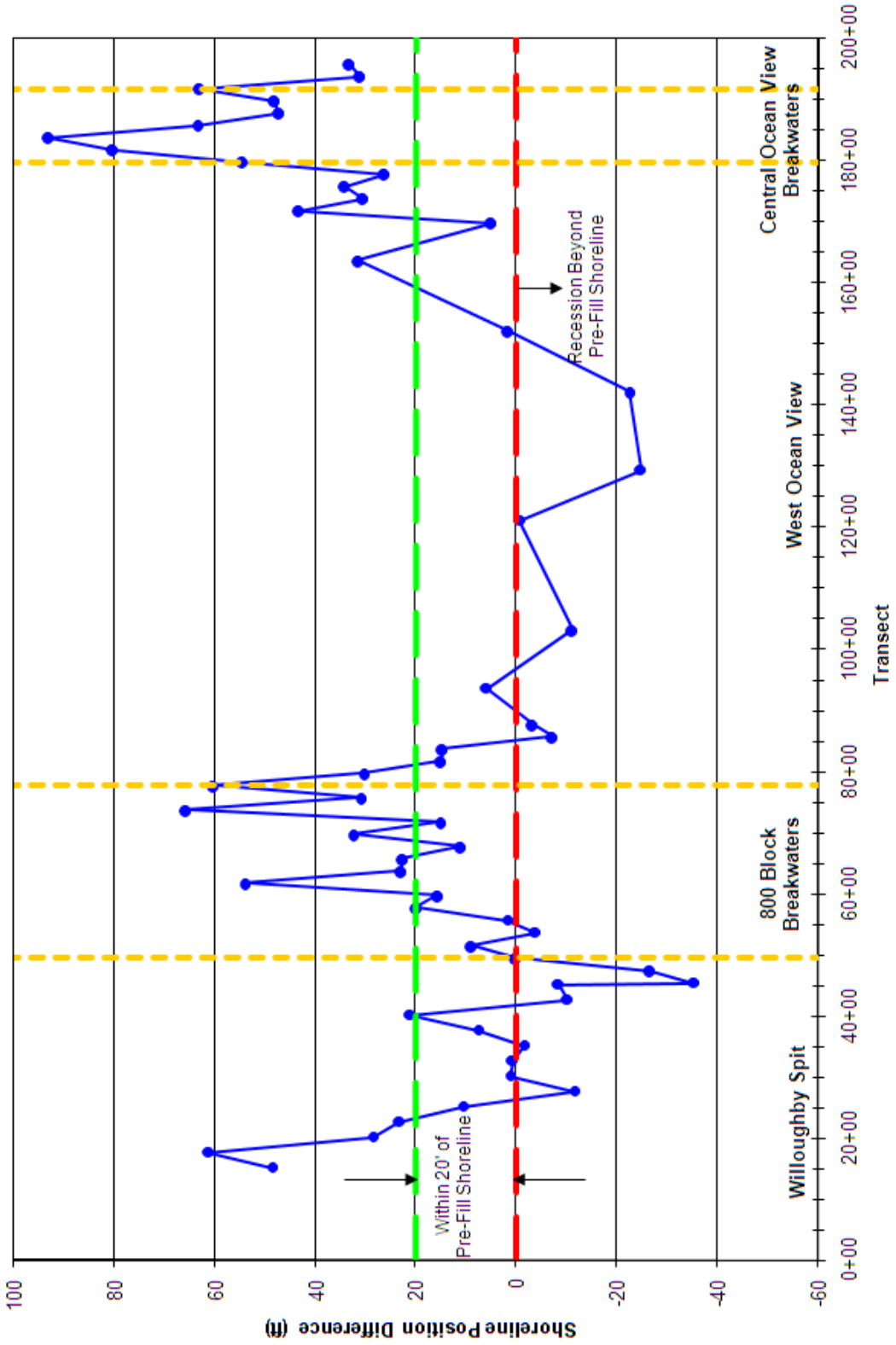


Figure 5-8: Shoreline Position Difference (ft) at MHW Between Pre-Fill and October 2010 Shorelines for Central Ocean View

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 October 2010. 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 will be used for all future periodic surveys. For this periodic evaluation, the October 2010 survey was compared with both the October 2009 and March 2010 surveys. The surveys were used to compute shoreline change at MHW and volume change above 0 ft NAVD88 and above -15 ft NAVD88. In addition, the most recent survey in October 2010 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 October 2009 and October 2010 surveys and the March 2010 and October 2010 surveys.

Comparison	Parameter	Quantity
October 2009 vs. October 2010	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	-2.16 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	-54,049 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	-60,959 cy/yr
March 2010 vs. October 2010	Average Shoreline Change at MHW (+0.98 ft NAVD88)	3.71 ft
	Cumulative Volume Change Above 0 ft NAVD88	90,179 cy
	Cumulative Volume Change Above -15 ft NAVD88	70,240 cy

The average shoreline change rate for the entire shoreline at MHW between the October 2009 and October 2010 surveys was -2.16 ft/yr. The cumulative volume change above 0 ft NAVD88 was approximately -54,049 cy/yr, between the October 2009 and October 2010 surveys, indicating an overall volumetric loss in the dune and subaerial beach over the past year. An additional approximately 7,000 cy was lost in the region between 0 ft NAVD88 and -15 ft NAVD88 showing a loss the system as a whole. This loss can mostly be attributed to the East Ocean View nourishment project equilibrating and the November 2009 nor'easter. The impacts from the nor'easter are evident in that there was a gain in sediment during the period from March 2010 to October 2010 indicating the occurrence of the natural recovery process following the significant losses from the nor'easter during the October 2009 to March 2010 period. Overall, the shoreline is erosive due to the impacts of the November 2009 nor'easter, and to some degree the equilibration of the East Ocean View nourishment project in March 2009.

Willoughby Spit

The Willoughby Spit region was influenced by the nor'easter and dune restoration project. The eastern portion of the shoreline was significantly impacted by the nor'easter with losses to the dune system; however, sediment from the terminal groin area was able to be utilized to assist in restoring

these dunes in the most recent survey period. While there was an overall loss for the period from October 2009 to October 2010 recovery started to occur in the March 2010 to October 2010 period.

800 Block Breakwaters

As with the Willoughby Spit region, the influences of the nor'easter and dune restoration on this area are apparent in the annual and seasonal changes. Although there was an overall loss of volume to the system attributed in most part to the nor'easter, as depicted in the fall to fall comparison, there were significant gains in the portions of shoreline above 0 ft NAVD88 from the spring to fall comparison due to the dune restoration.

West Ocean View

The West Ocean View region showed recession of the MHW shoreline as well as overall volumetric erosion above 0 ft NAVD88 and -15 ft NAVD88 over the year, which can be mostly attributed to the nor'easter. Recovery of this region has begun as the shoreline change and overall volume change across the profile in the most recent survey period were positive.

Central Ocean View Breakwaters

In the Central Ocean View Breakwaters region the MHW position accreted over the previous year, although the negative volume change above 0 ft NAVD88 is indicative of the sediment shifting from the dune and subaerial beach to the nearshore region. While this section was impacted by the storm, as with other regions, the shoreline recovery of the system was apparent in the most recent survey period and is expected to continue in future surveys.

Central Ocean View

Typically a very stable region, Central Ocean View has experienced some erosion of the dune and subaerial beach over the past year, with minimal losses above 0 ft NAVD88, due to the nor'easter. Overall, the system above -15 ft NAVD88 has shown a gain of sediment, which in most part can be attributed to losses from the beach nourishment in the East Ocean View region.

East Ocean View

The East Ocean View area shows a volumetric loss from the nor'easter and as the shoreline equilibrates from the large gain in material from nourishment, especially in the area behind the three easternmost breakwaters (which do not receive sediment from natural transport due to the jetties) and the area landward of the five recently constructed breakwaters (which was previously designated as an erosion hotspot). The recently constructed breakwaters appear to be alleviating the end effects from the previous breakwater field and creating a more uniform shoreline response.

In addition to regional assessments, comparison of the March 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. October 2010 Comparison	-51.18 ft	-11.77 cy/ft	-61,204 cy	-18.13 cy/ft	-93,402 cy
Central Ocean View Nourishment vs. October 2010 Comparison	-26.13 ft	-9.95 cy/ft	-188,815 cy	-8.13 cy/ft	-150,157 cy

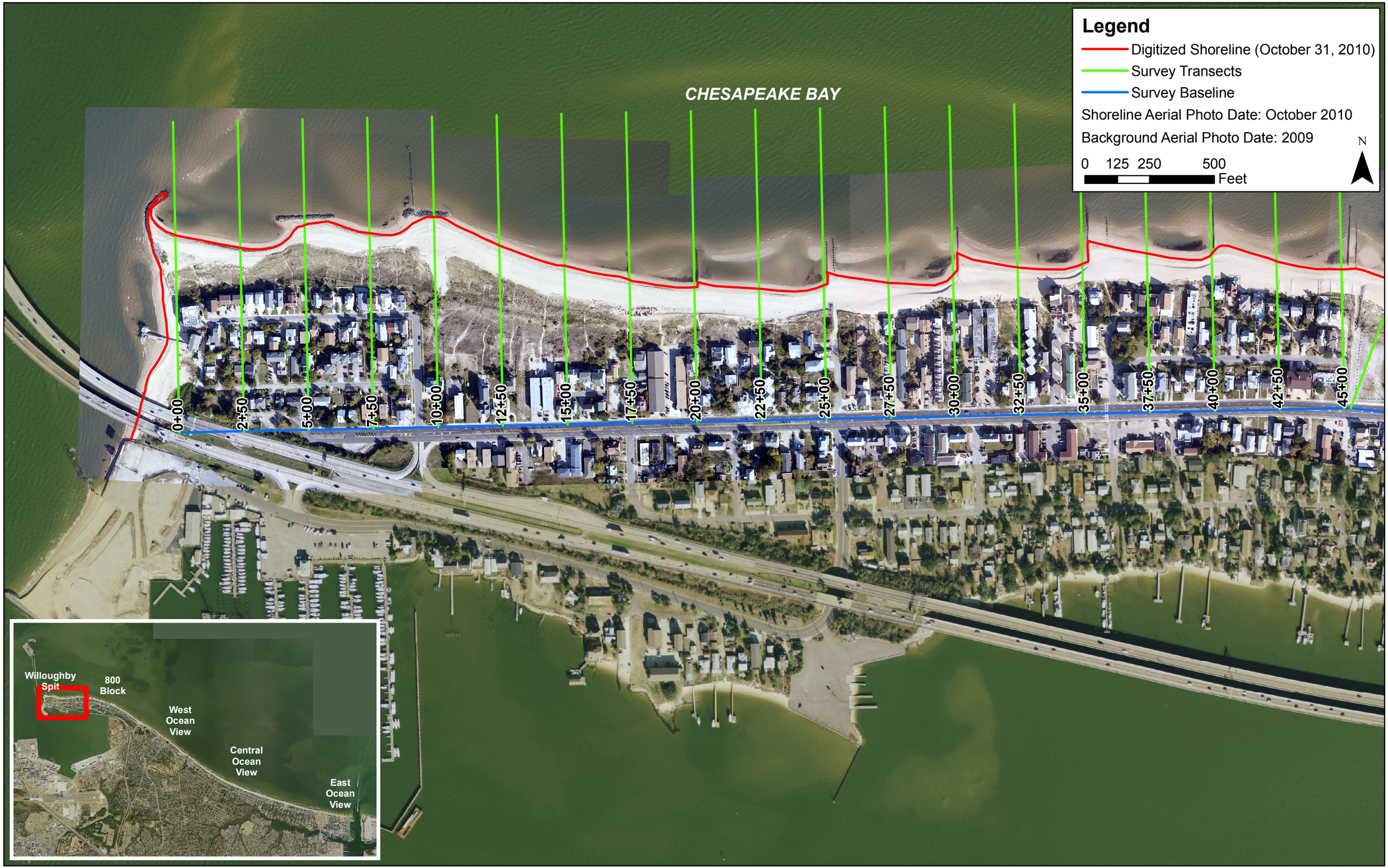
Approximately 61,000 cy of material has been lost in the East Ocean View area above 0 ft NAVD88 since the nourishment project which took place in March 2009. This is approximately 55% of the original amount of fill placed above the 0 ft contour. The Willoughby Spit to Central Ocean View region has lost approximately 189,000 cy of material above 0 ft NAVD88, or approximately 60% of the 320,700 cy originally placed above 0 ft NAVD88. This area was significantly impacted by the nor'easter and suffered severe losses. Although approximately 60% of the material from the dune and subaerial beach berm has been eroded, there was a gain in sediment since the spring survey. This gain in sediment is due not only to recovery of the system, but also to the dune restoration project that placed approximately 30,000 cy in this region between March and May 2010.

As another measure of the protection being supplied by the East Ocean View and Central Ocean View nourishment projects, the pre-fill and October 2010 MHW shoreline positions were compared. Areas where the current shoreline has receded beyond or eroded within 20 ft 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 east of the recently constructed breakwaters. 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 nearing the end of the anticipated design life and has been impacted by storm activity. While the recent emergency dune restoration project in 2010 restored a portion of the dunes in certain areas, targeted nourishment projects should be planned for these areas in the near future.

This is the eleventh periodic survey report completed to date, and tenth 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. October 2009 to October 2010) 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. The benefit of this comparison was evidenced with the assessment of the post-storm survey,

and subsequently the March 2010 and October 2010 surveys, to determine immediate and more long-term effects of storm events on the shoreline. 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
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Digitized Shoreline (October 31, 2010)
Survey Transects
Survey Baseline
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Background Aerial Photo Date: 2009
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Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
Legend
Digitized Shoreline (October 31, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: October 2010
Background Aerial Photo Date: 2009
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93+41
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
93+41
103+08
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Legend
Digitized Shoreline (October 31, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: October 2010
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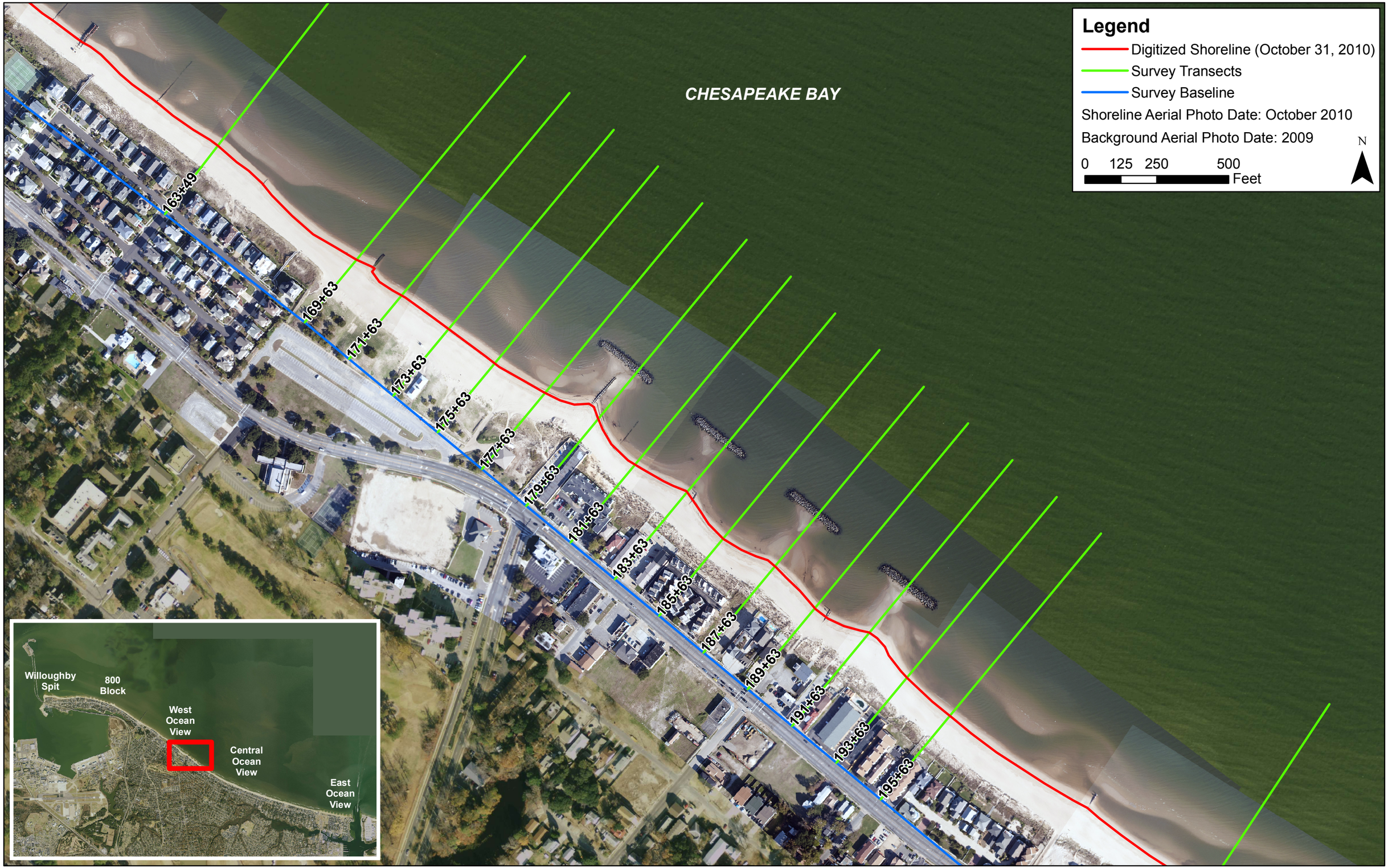
800 Block
West Ocean View
Central Ocean View
East Ocean View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Survey Baseline
Shoreline Aerial Photo Date: October 2010
Background Aerial Photo Date: 2009
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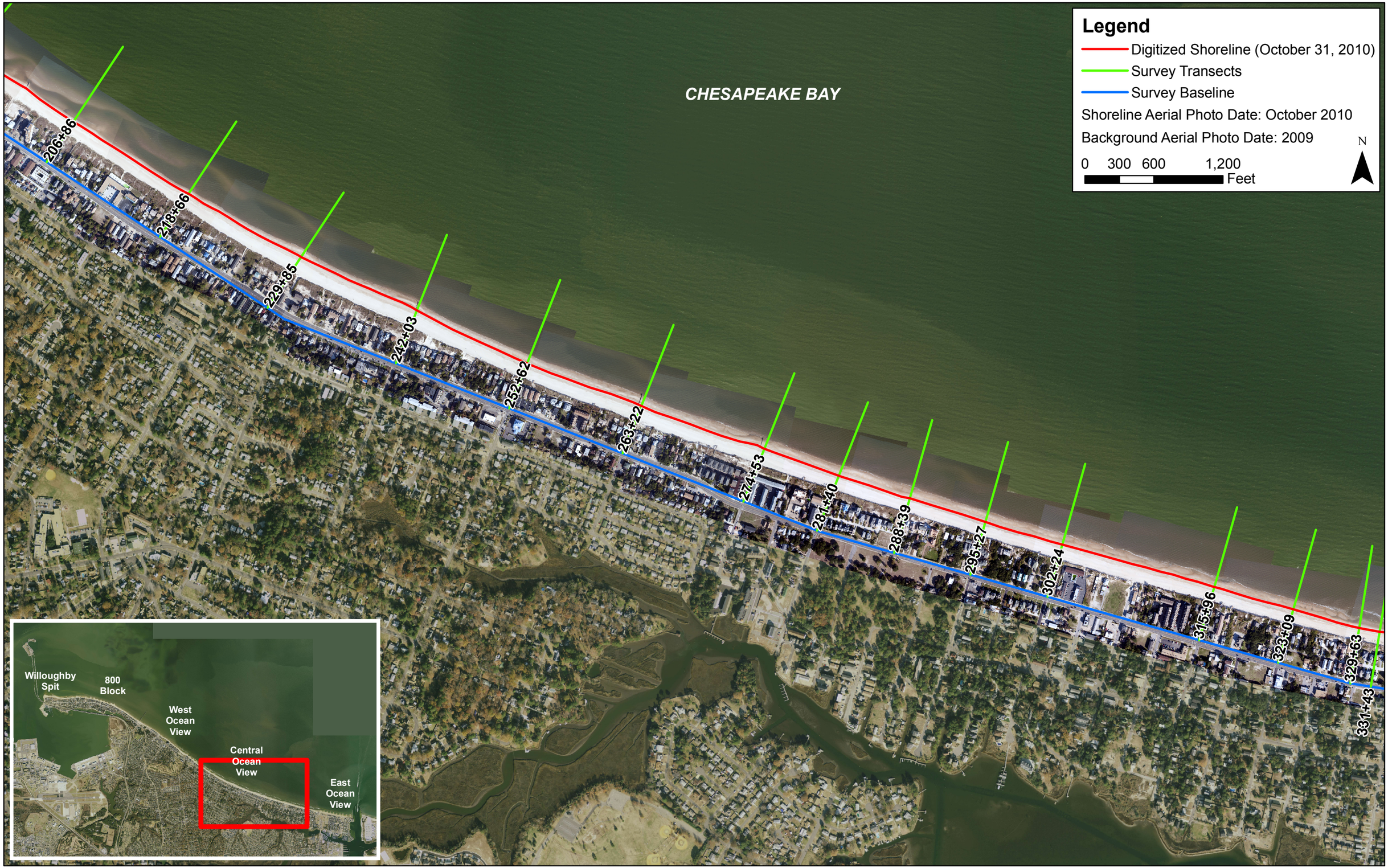
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View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Legend
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Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: October 2010
Background Aerial Photo Date: 2009
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Feet
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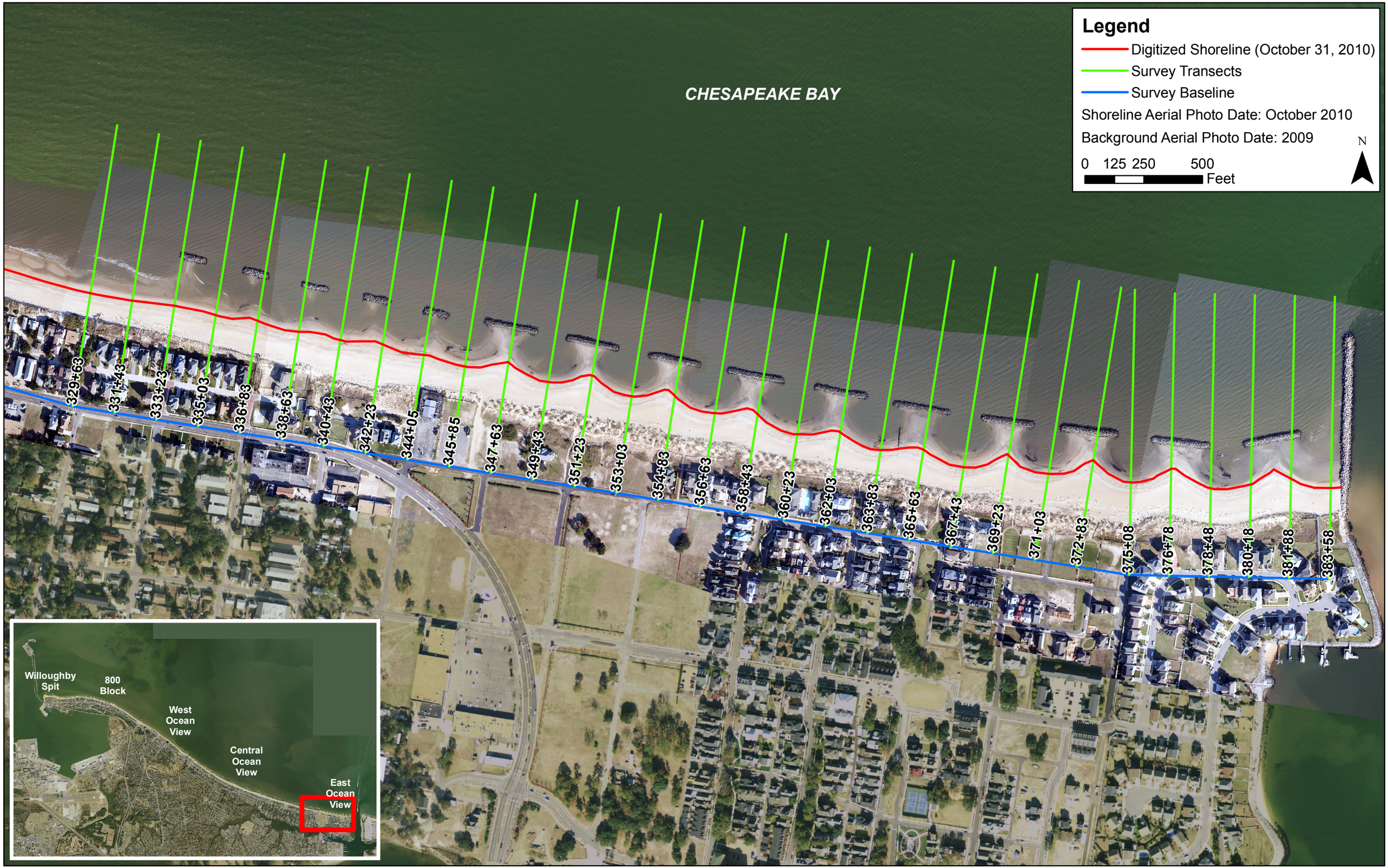
274+53
281+40
288+39
295+27
302+24
315+96
323+09
329+63
331+43
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
Legend
Digitized Shoreline (October 31, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: October 2010
Background Aerial Photo Date: 2009
N
0 125 250 500
Feet
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
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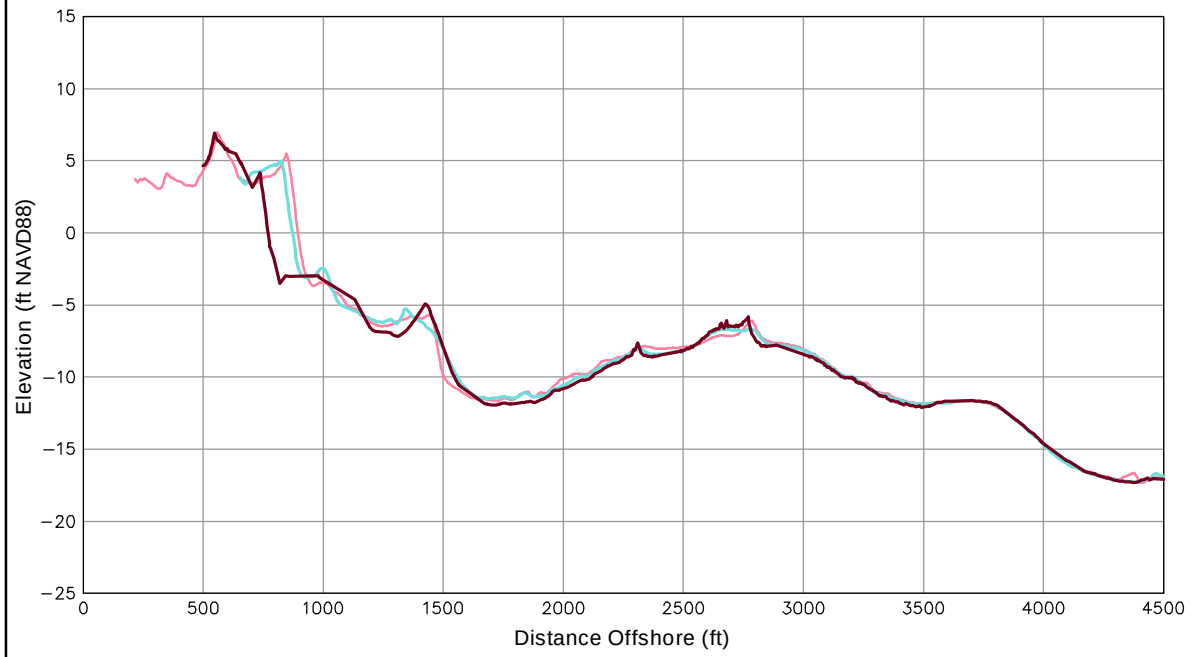
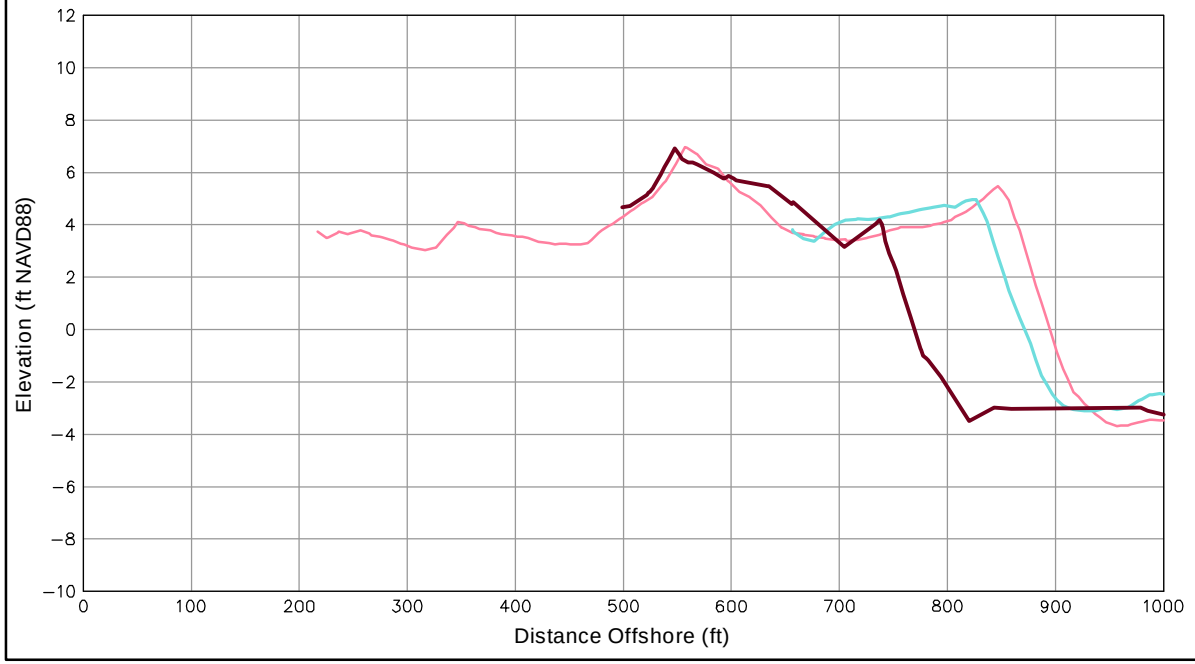
358+43
360+23
362+03
363+83
365+63
367+43
369+23
371+03
372+83
375+08
376+78
378+48
380+18
381+88
383+58
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View

Appendix B: Survey Comparison Plots





Survey Transect 0+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-117.51 ft/yr	-99.71 ft
Volume Change Above -15 ft NAVD88	-38.76 cy/ft/yr	-39.45 cy/ft
Volume Change Above 0 ft NAVD88	-16.14 cy/ft/yr	-17.05 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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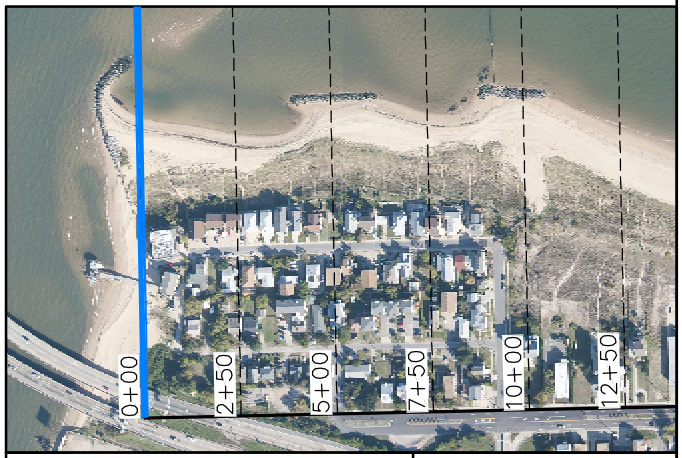
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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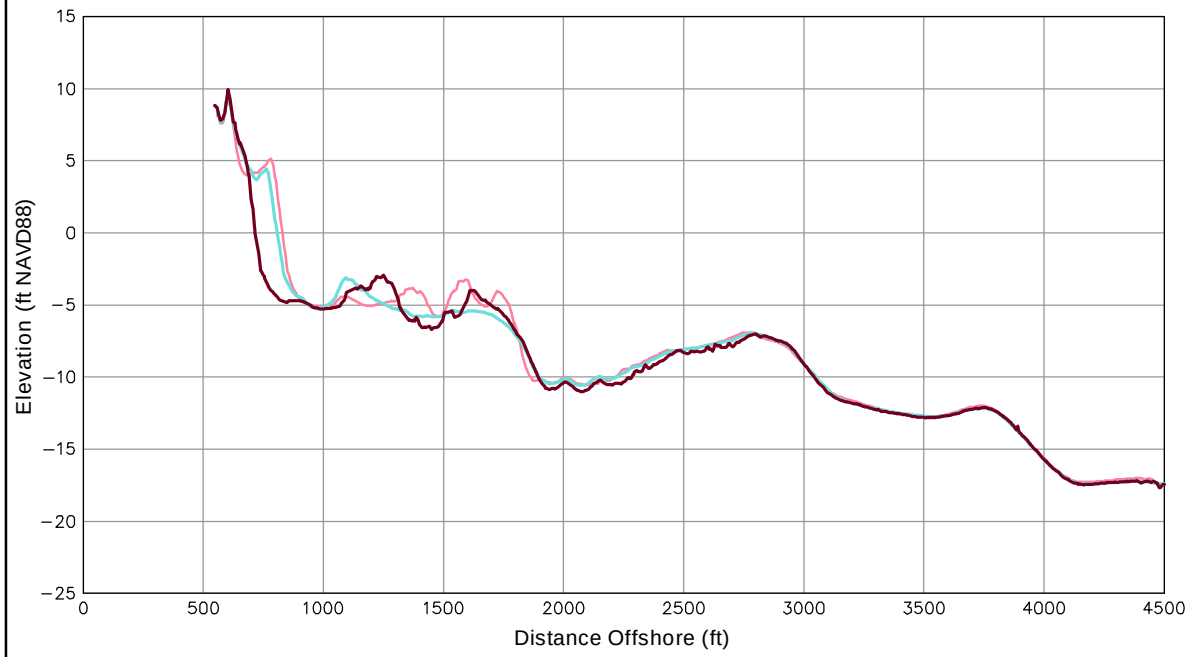
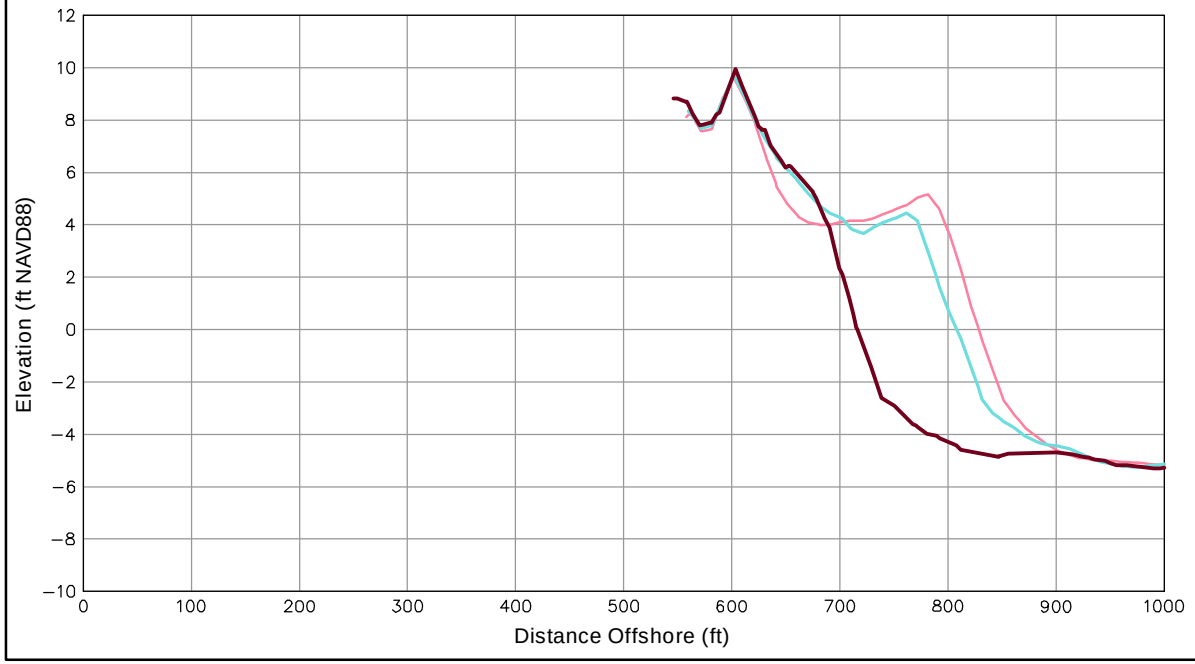
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 2+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-104.24 ft/yr	-88.23 ft
Volume Change Above -15 ft NAVD88	-52.74 cy/ft/yr	-34.19 cy/ft
Volume Change Above 0 ft NAVD88	-14.36 cy/ft/yr	-12.70 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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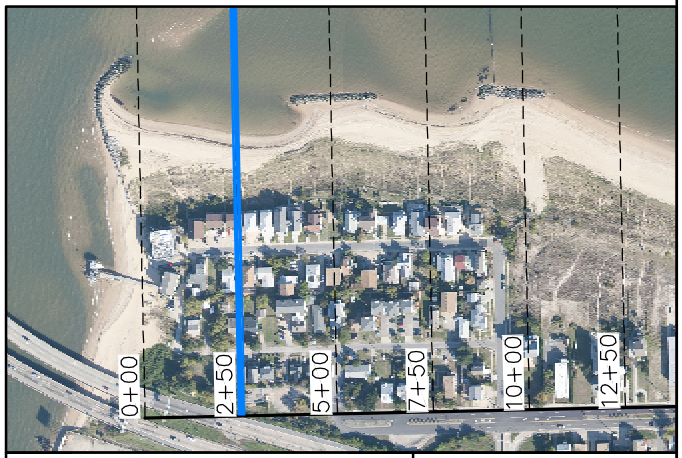

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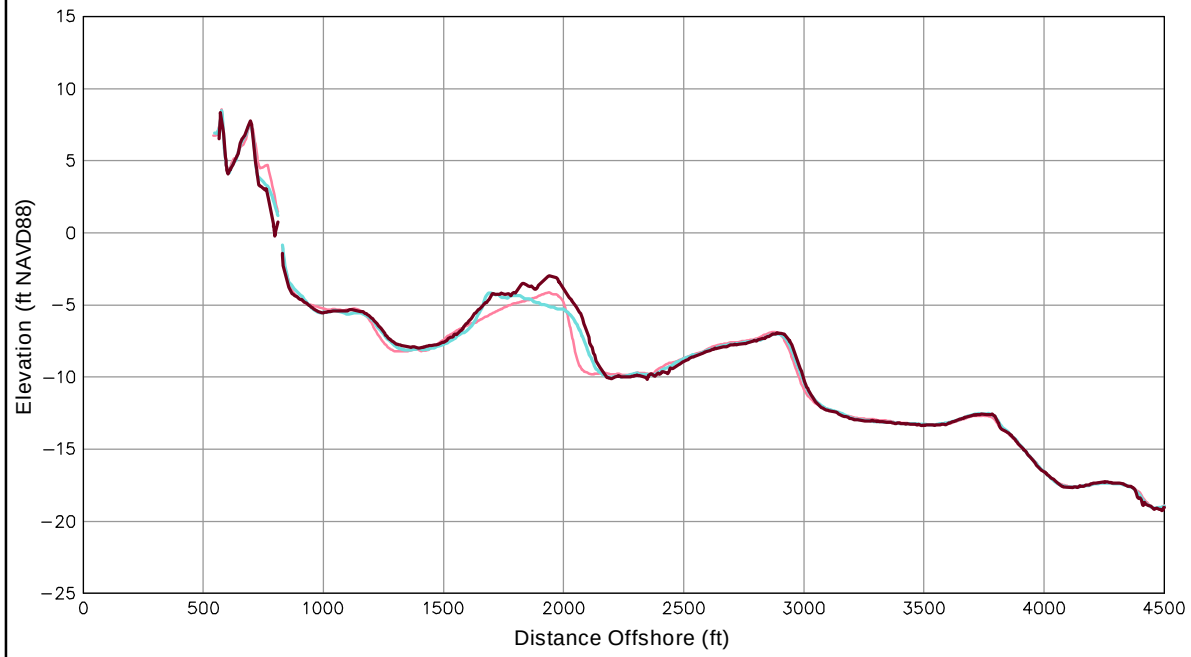
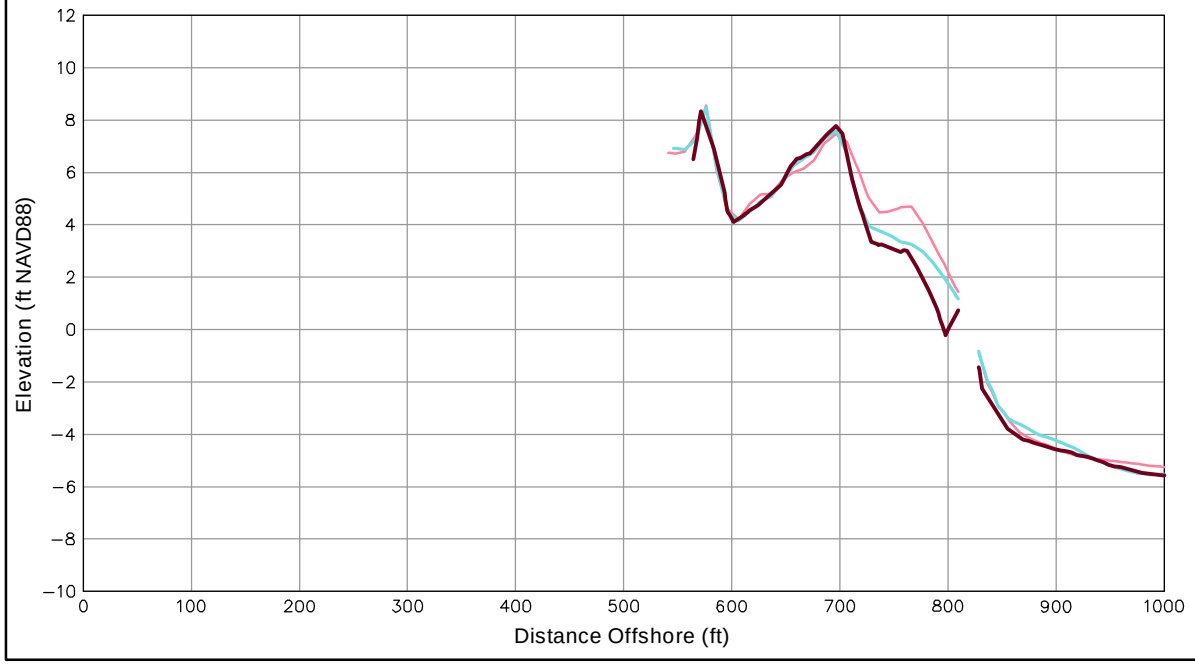
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 5+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	11.63 ft/yr	1.00 ft
Volume Change Above -15 ft NAVD88	18.07 cy/ft/yr	14.15 cy/ft
Volume Change Above 0 ft NAVD88	-5.58 cy/ft/yr	-2.42 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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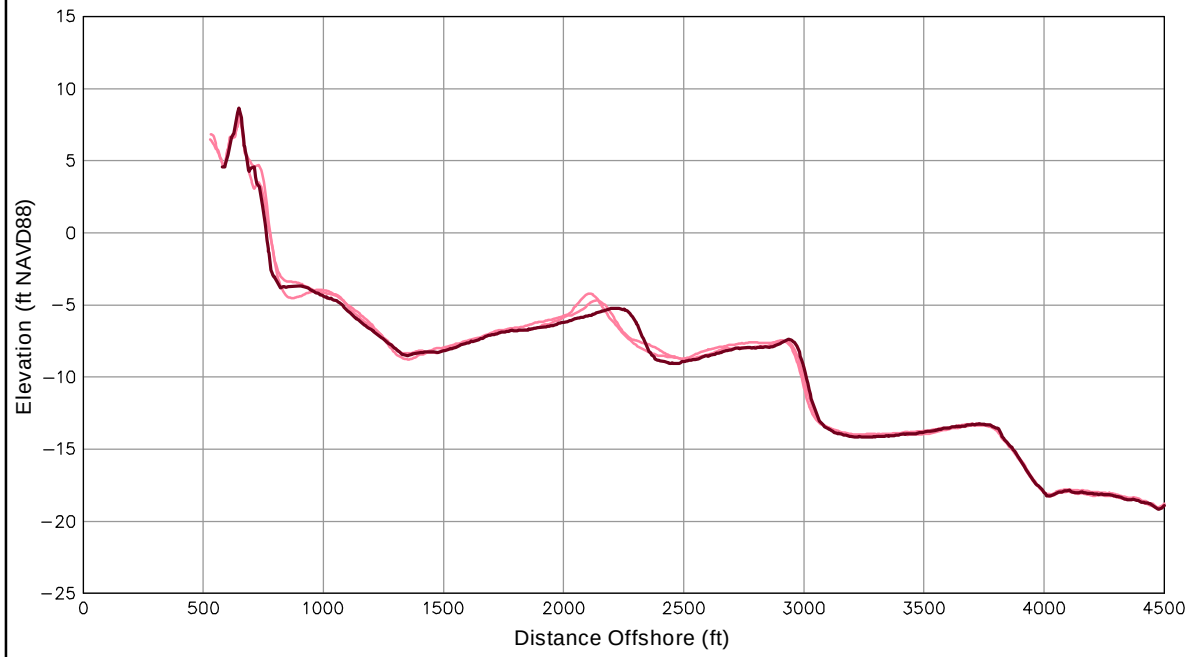

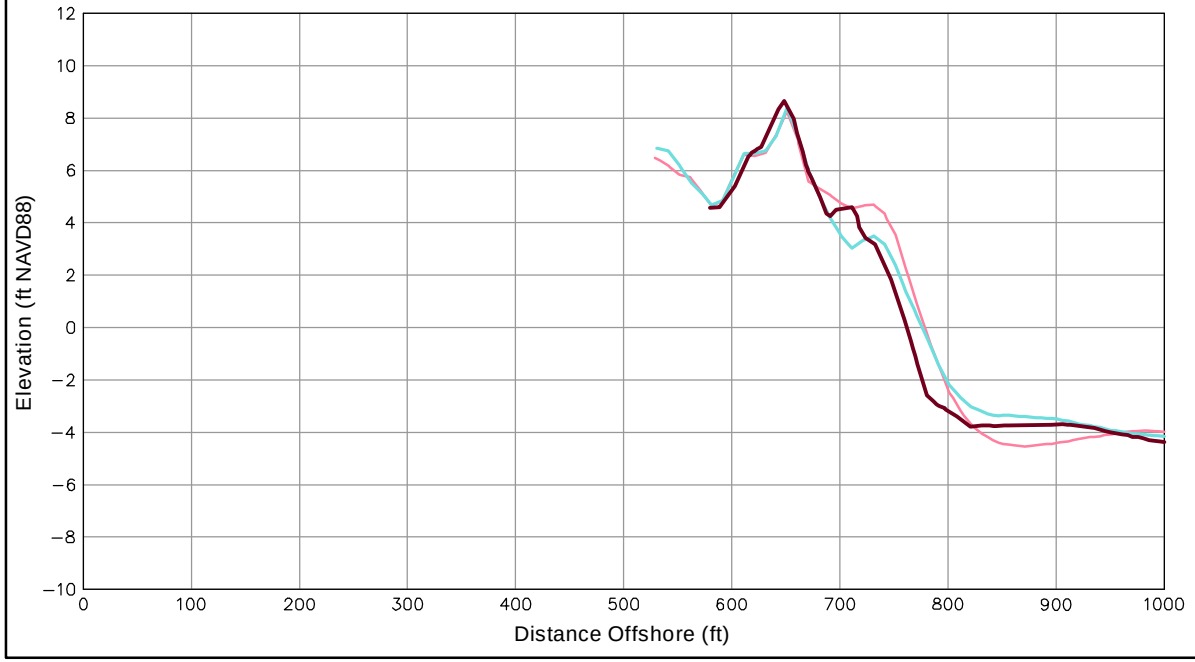

Survey Transect 7+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-15.59 ft/yr	-11.29 ft
Volume Change Above -15 ft NAVD88	-14.15 cy/ft/yr	-6.47 cy/ft
Volume Change Above 0 ft NAVD88	-3.29 cy/ft/yr	-0.05 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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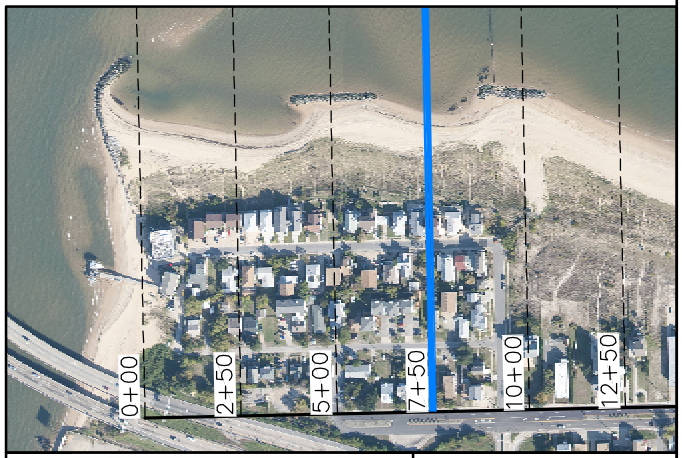

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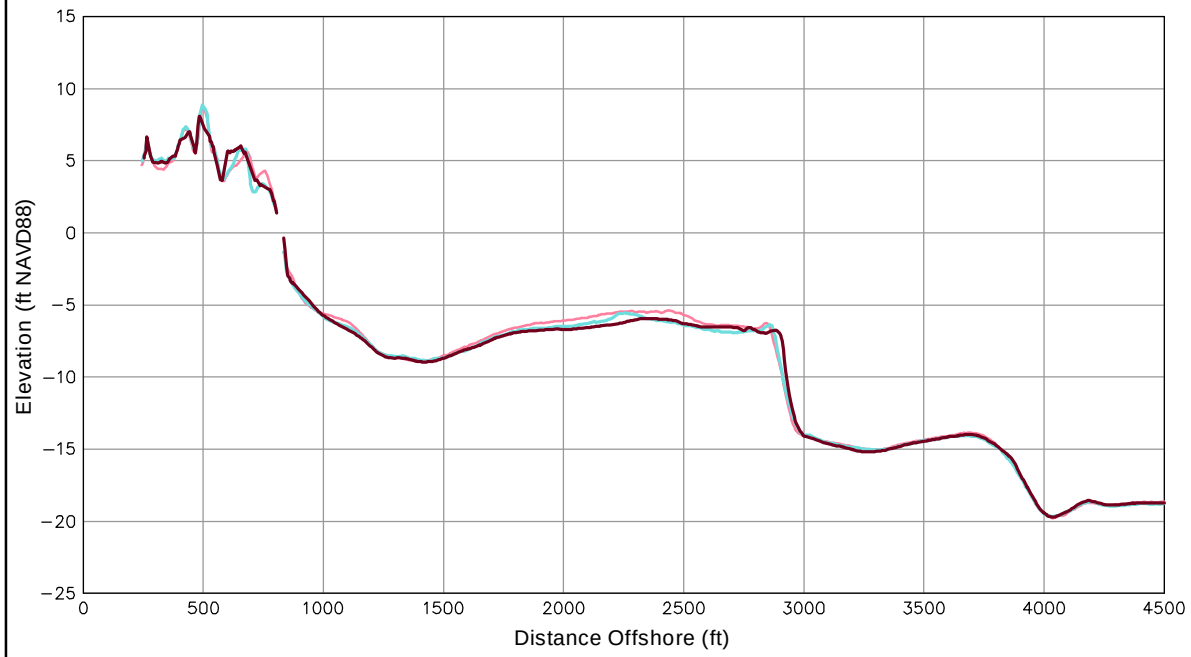

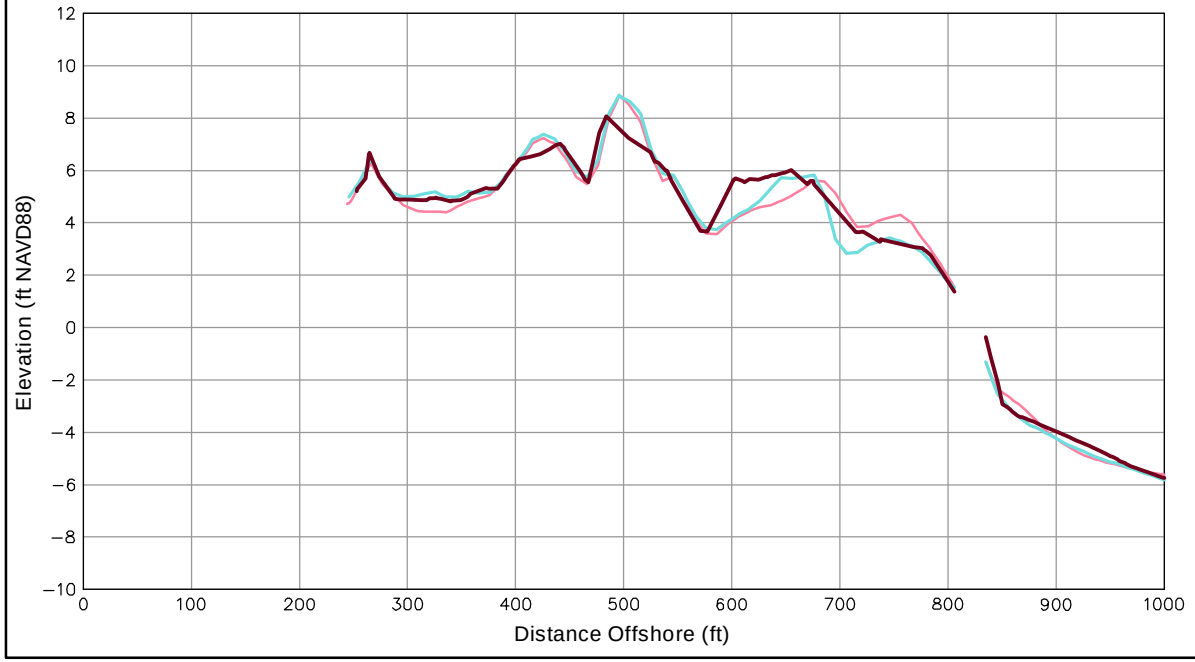

Survey Transect 10+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-3.76 ft/yr	-1.76 ft
Volume Change Above -15 ft NAVD88	-19.15 cy/ft/yr	0.30 cy/ft
Volume Change Above 0 ft NAVD88	0.99 cy/ft/yr	0.81 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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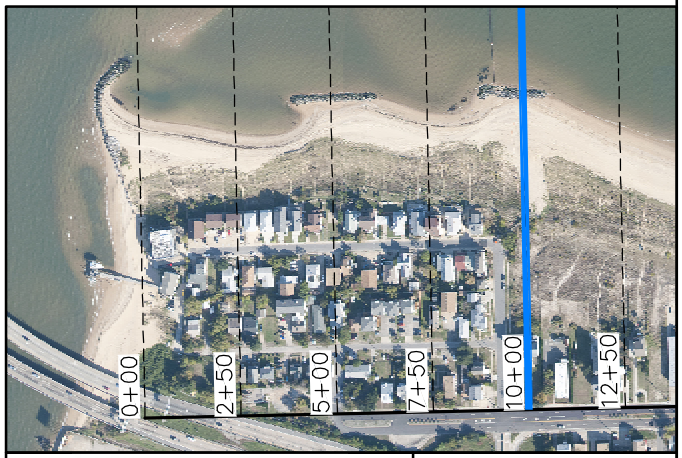

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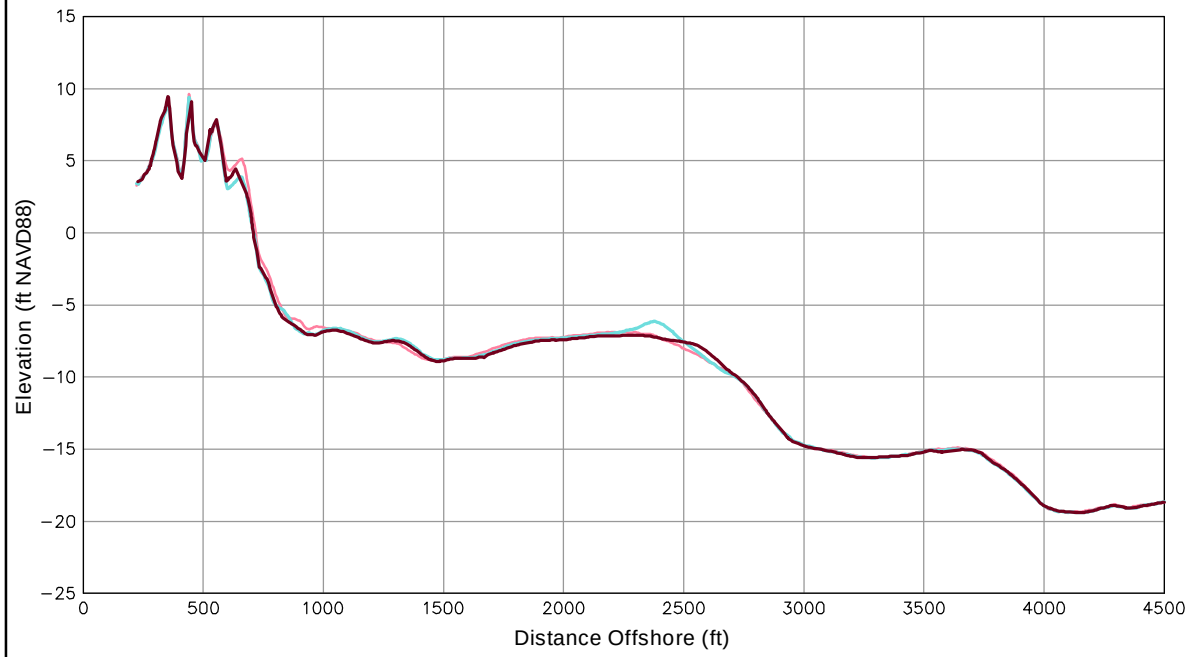
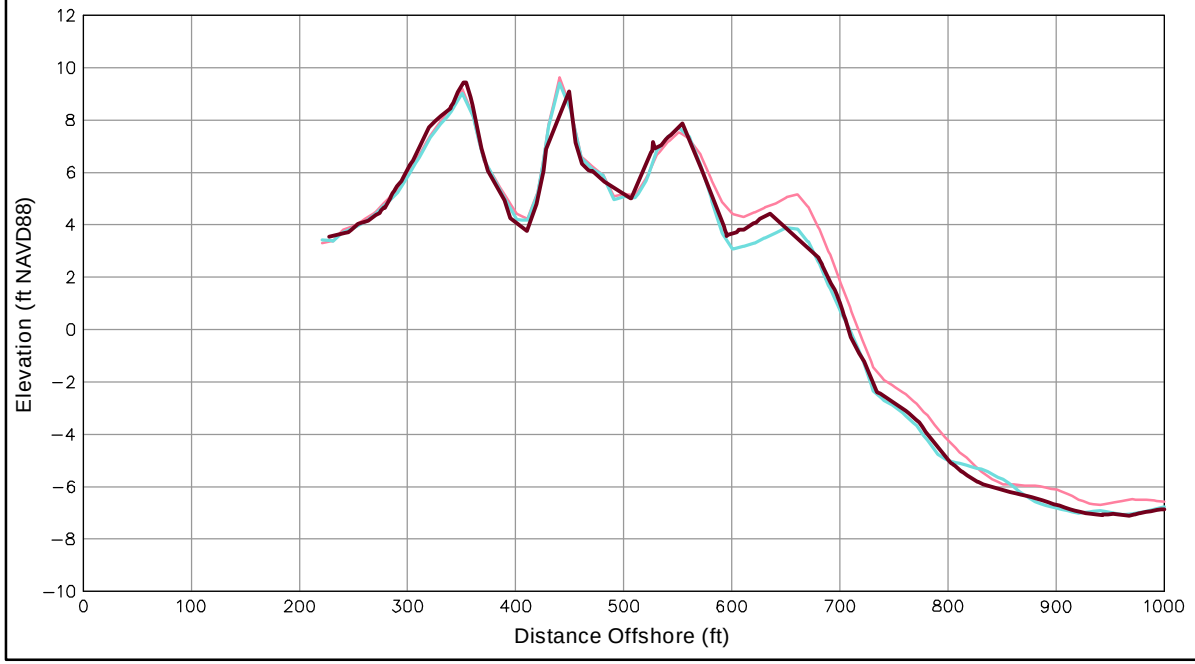
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 12+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-7.18 ft/yr	3.10 ft
Volume Change Above -15 ft NAVD88	-12.21 cy/ft/yr	-6.88 cy/ft
Volume Change Above 0 ft NAVD88	-4.70 cy/ft/yr	1.90 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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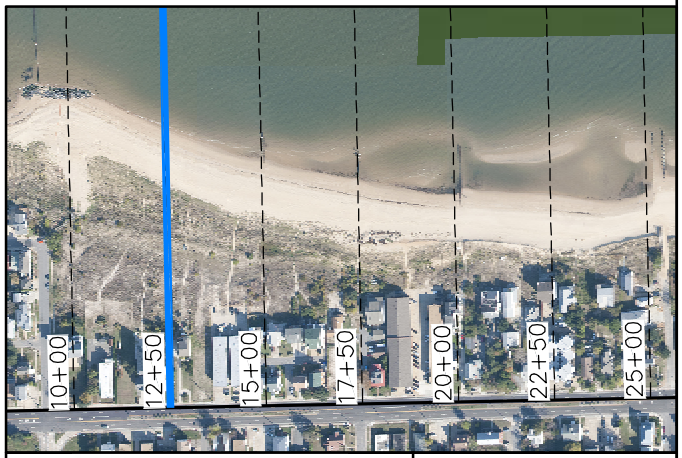
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



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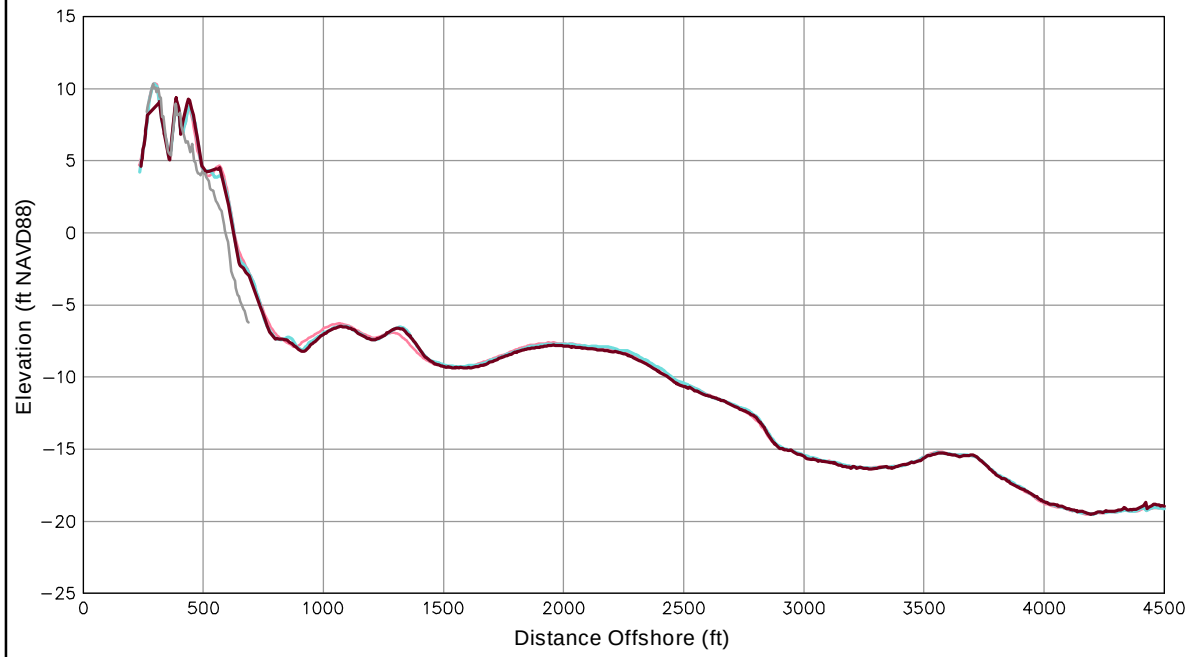
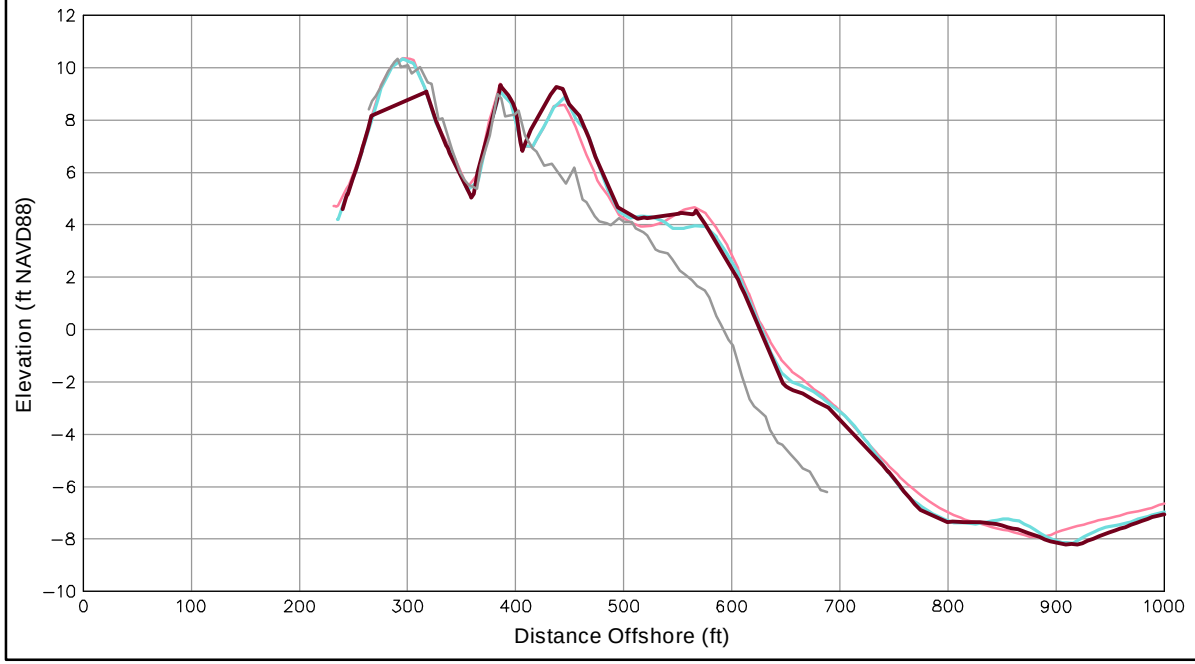
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 15+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-3.68 ft/yr	-2.03 ft
Volume Change Above -15 ft NAVD88	-9.76 cy/ft/yr	-10.54 cy/ft
Volume Change Above 0 ft NAVD88	-1.12 cy/ft/yr	-0.31 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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4. Survey Comparison Made To October 2009 and March 2010.
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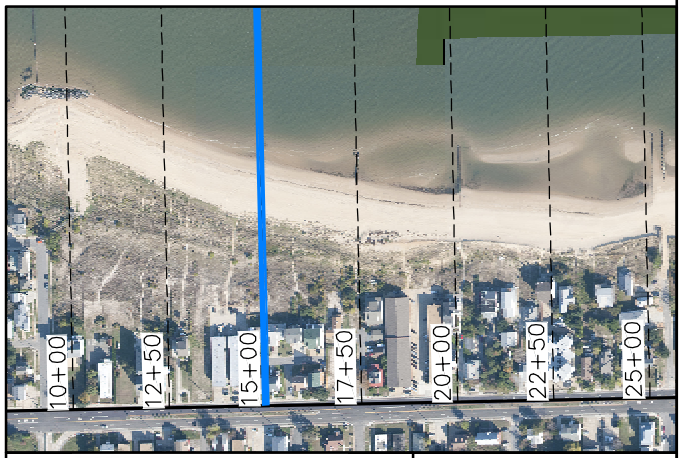

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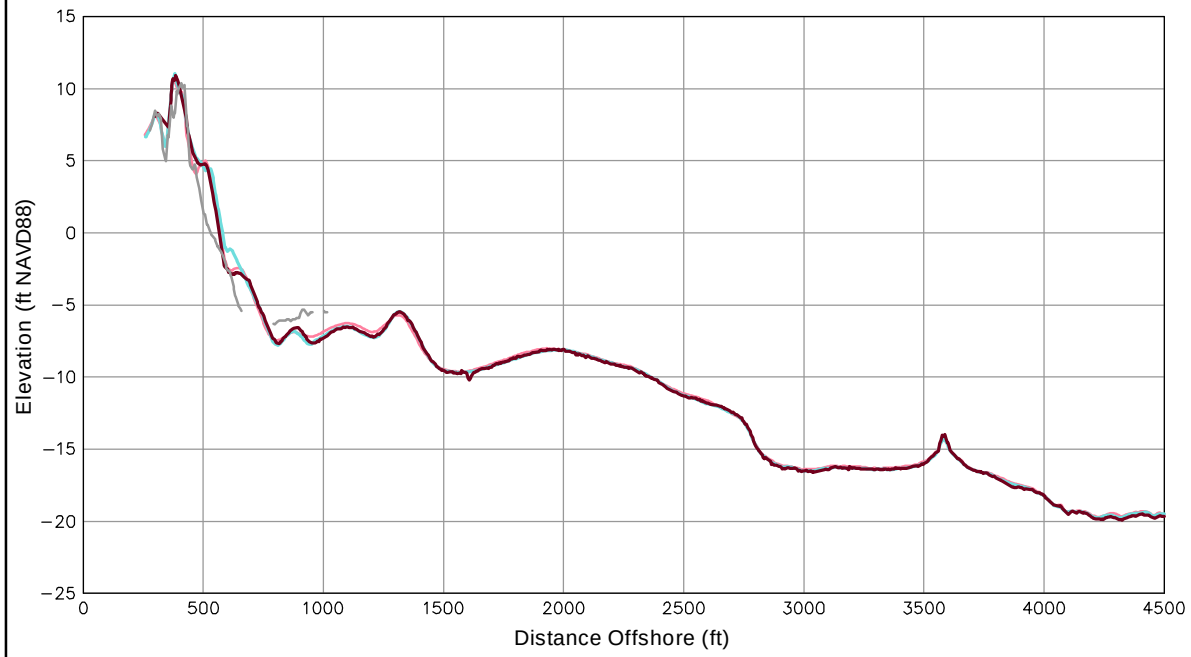
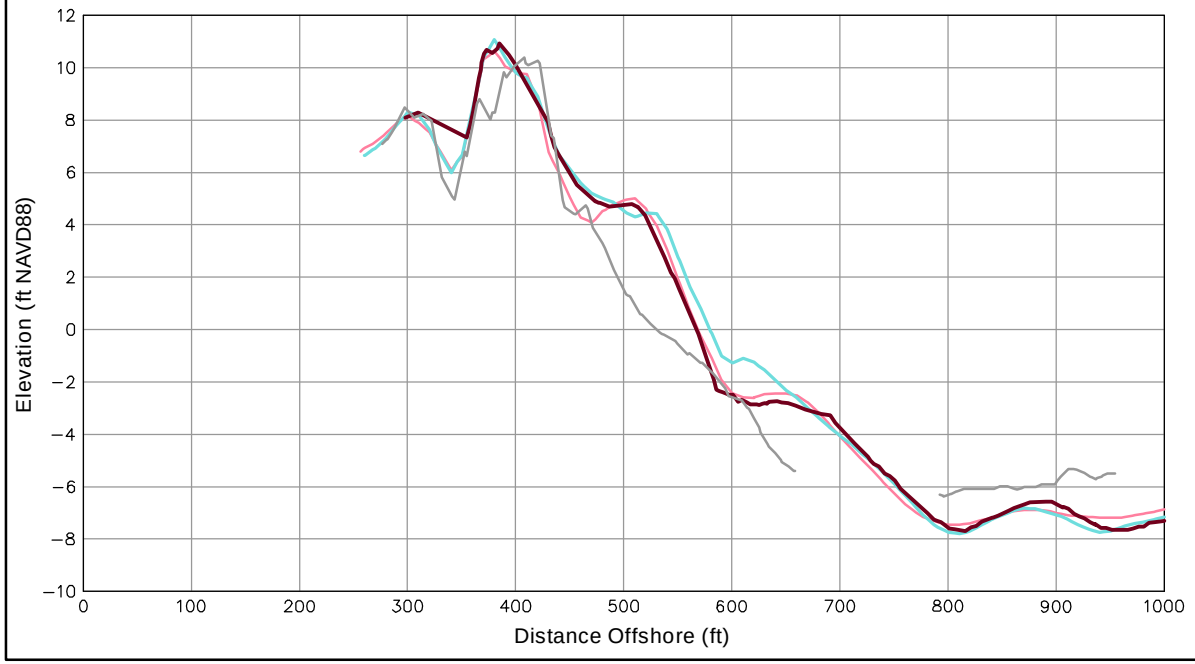
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 17+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-1.69 ft/yr	-12.15 ft
Volume Change Above -15 ft NAVD88	-3.97 cy/ft/yr	-3.22 cy/ft
Volume Change Above 0 ft NAVD88	2.51 cy/ft/yr	-0.83 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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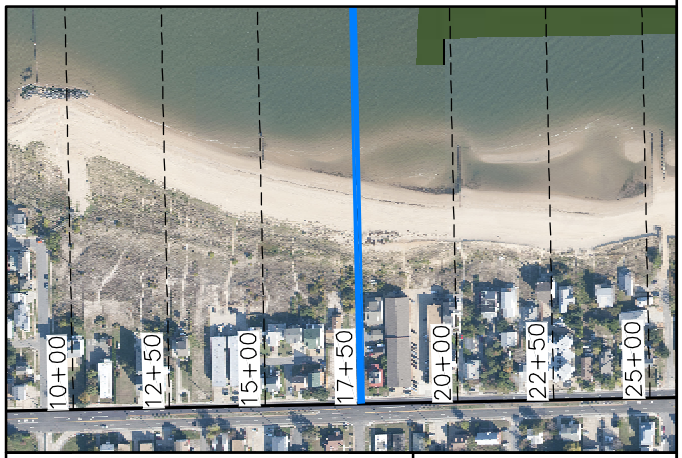

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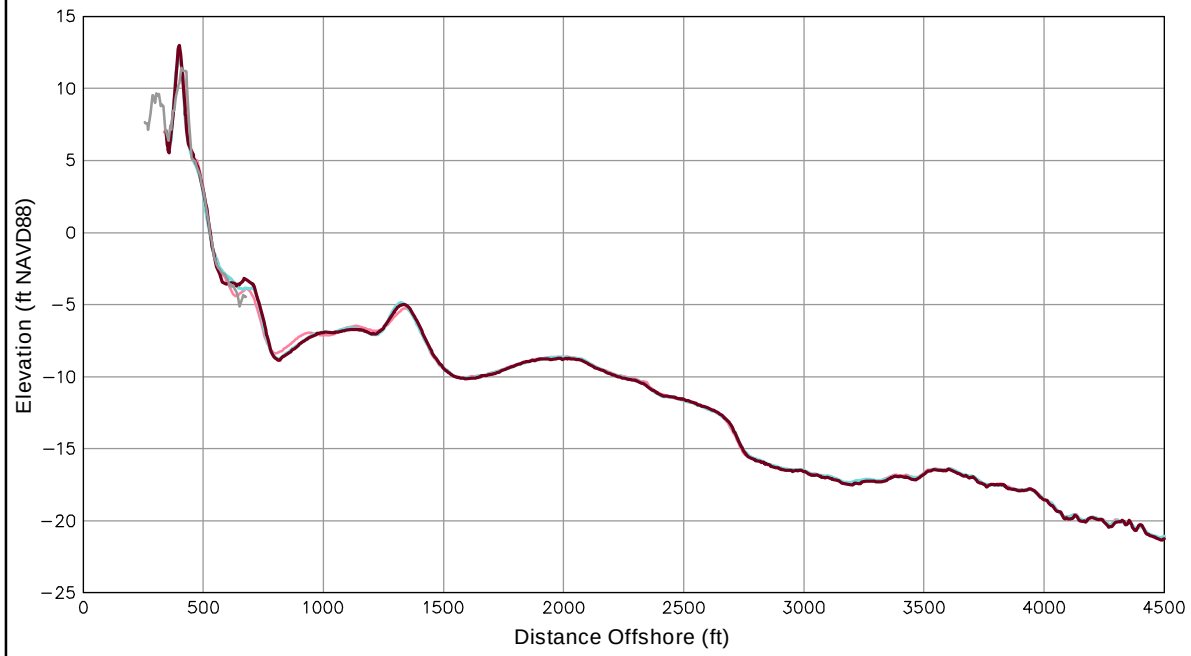
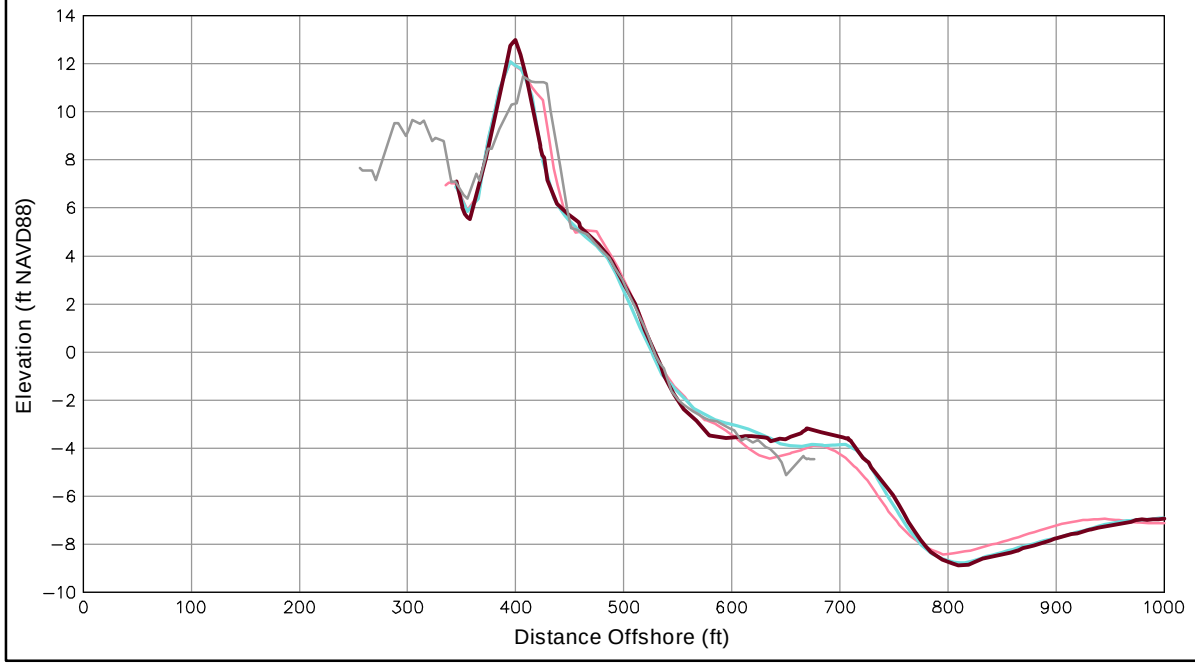
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 20+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-0.85 ft/yr	3.61 ft
Volume Change Above -15 ft NAVD88	-1.82 cy/ft/yr	0.14 cy/ft
Volume Change Above 0 ft NAVD88	-1.46 cy/ft/yr	1.07 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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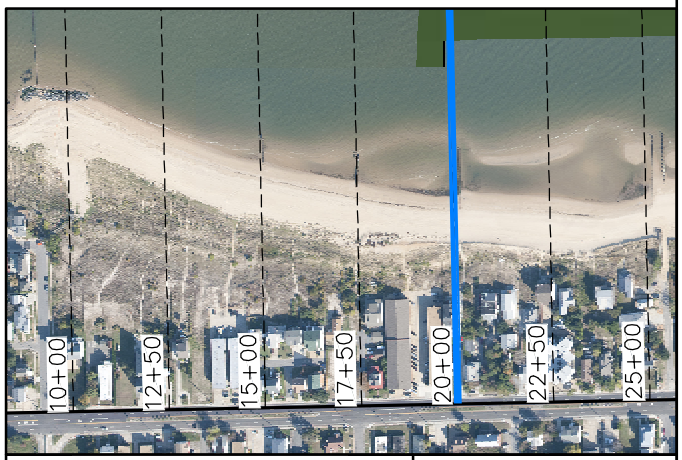

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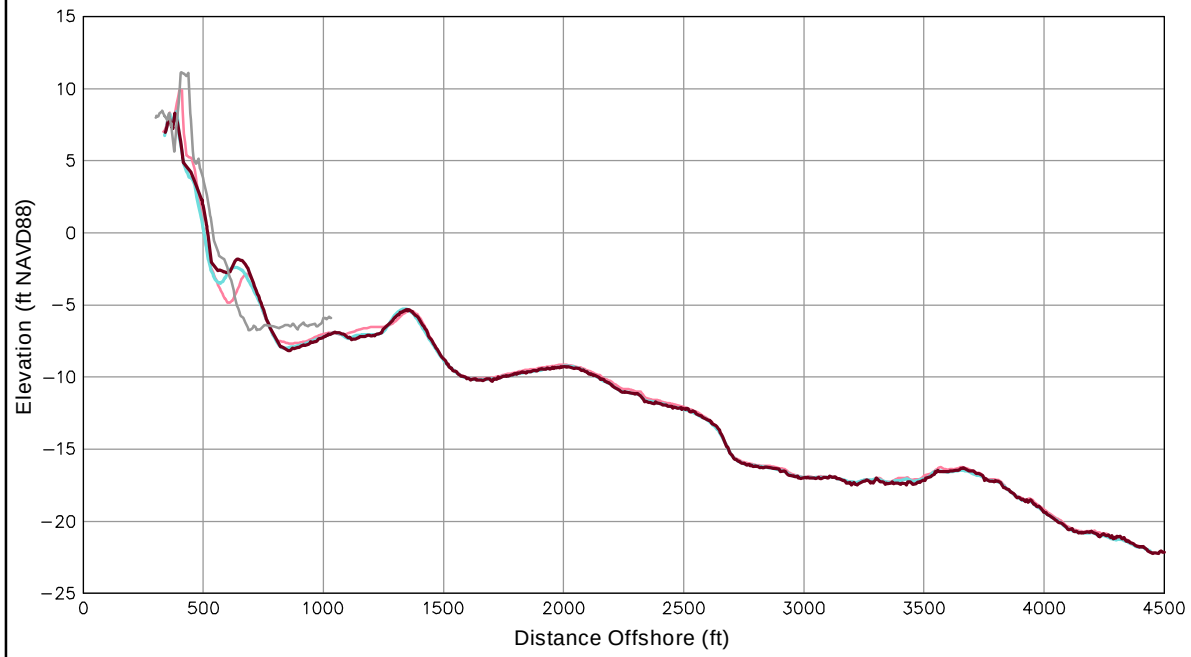
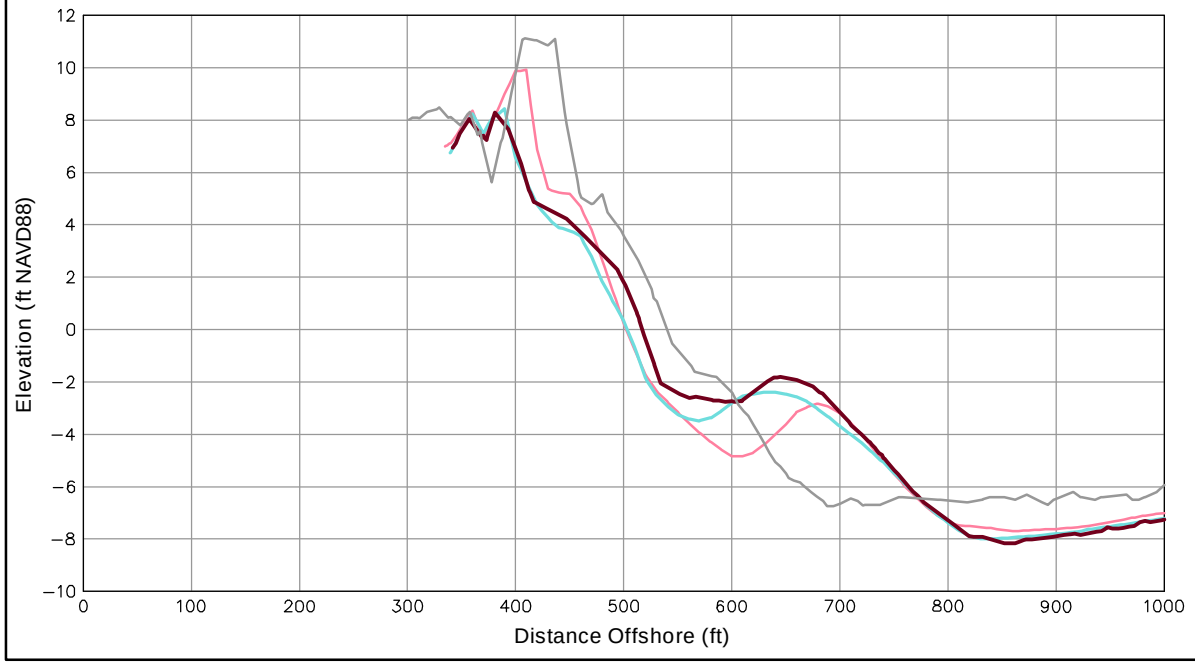
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 22+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	13.74 ft/yr	17.31 ft
Volume Change Above -15 ft NAVD88	-4.87 cy/ft/yr	7.16 cy/ft
Volume Change Above 0 ft NAVD88	-4.01 cy/ft/yr	2.19 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- 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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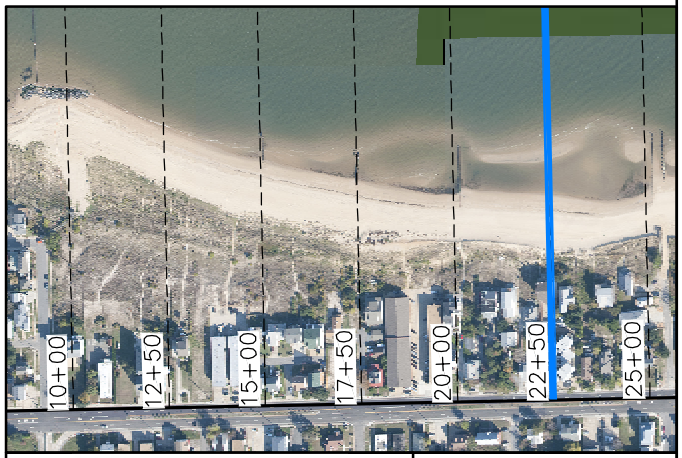

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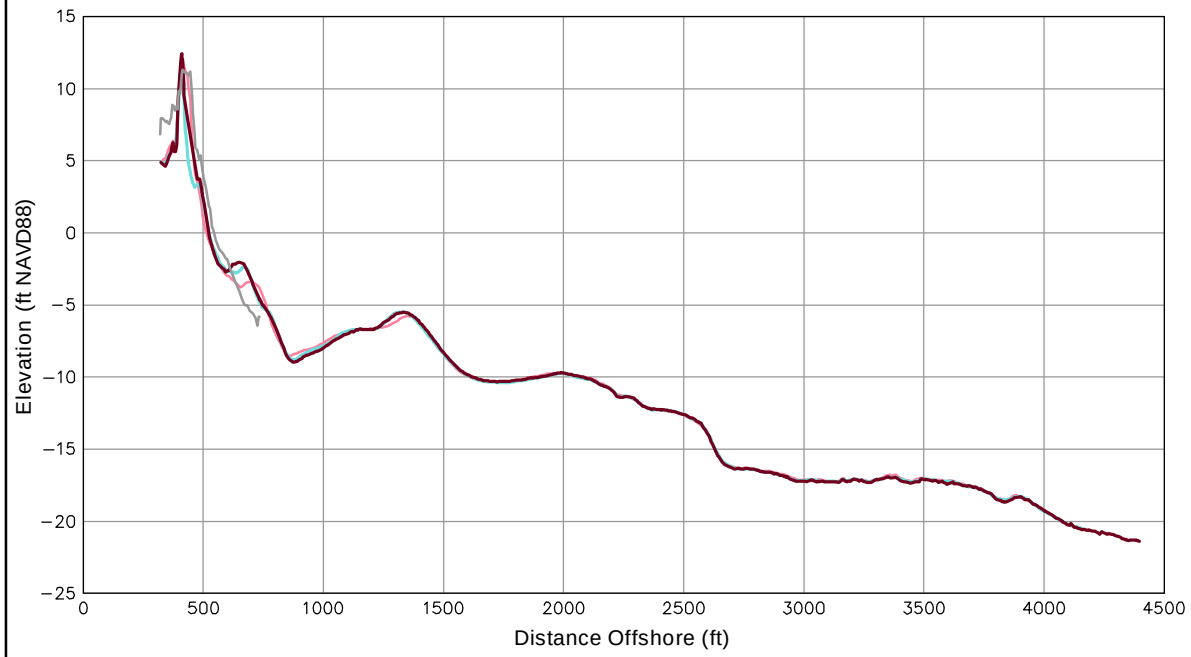
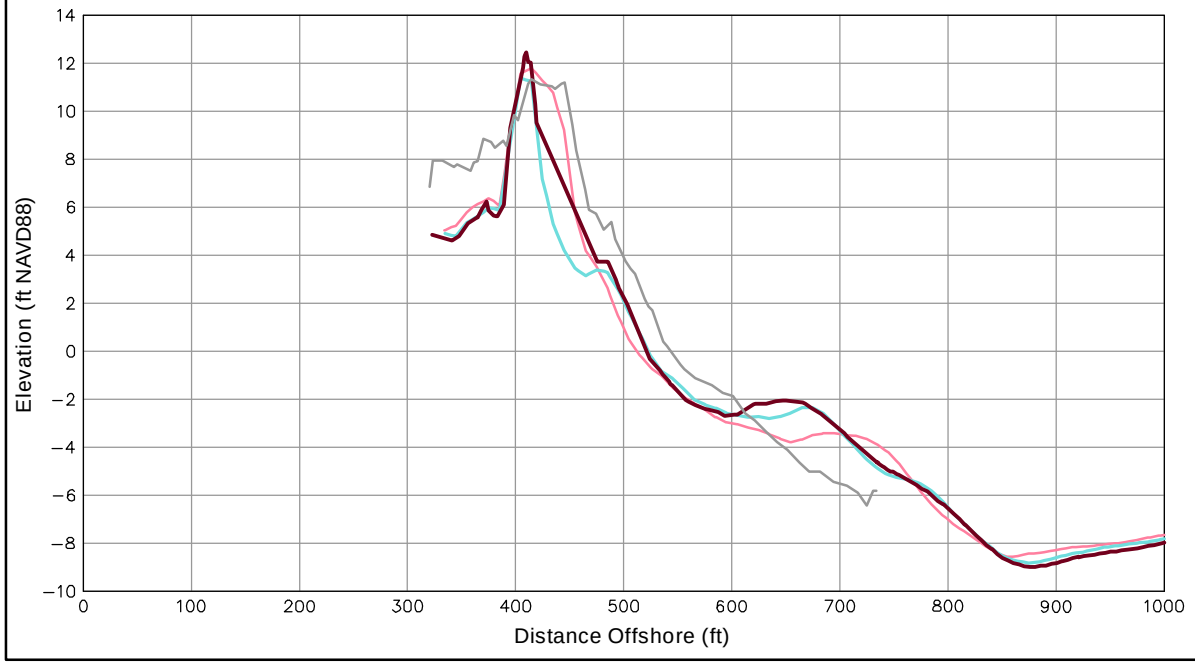
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 25+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	11.64 ft/yr	0.13 ft
Volume Change Above -15 ft NAVD88	0.91 cy/ft/yr	5.56 cy/ft
Volume Change Above 0 ft NAVD88	-1.84 cy/ft/yr	4.59 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- 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 October 2009 and March 2010.
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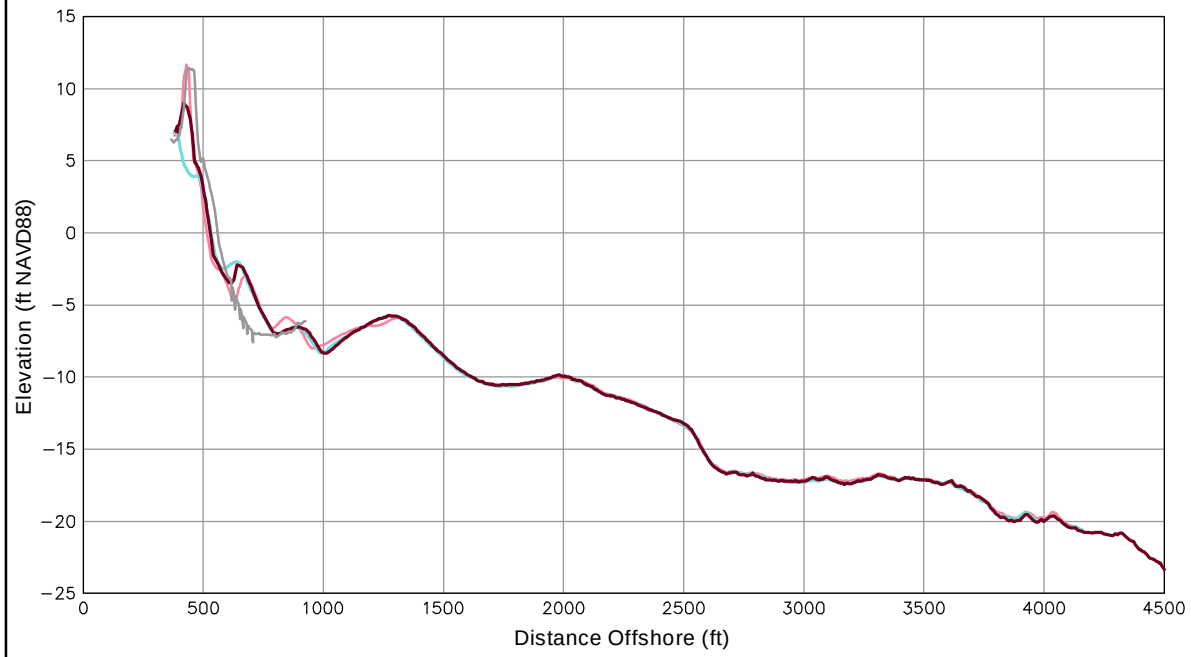
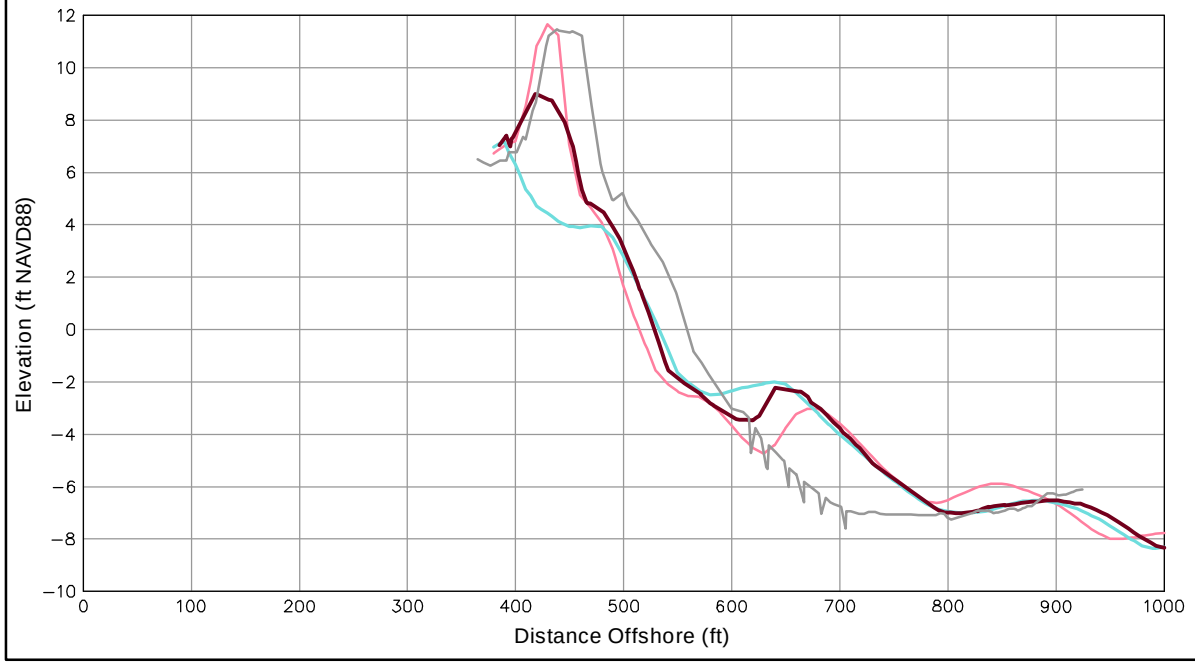
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

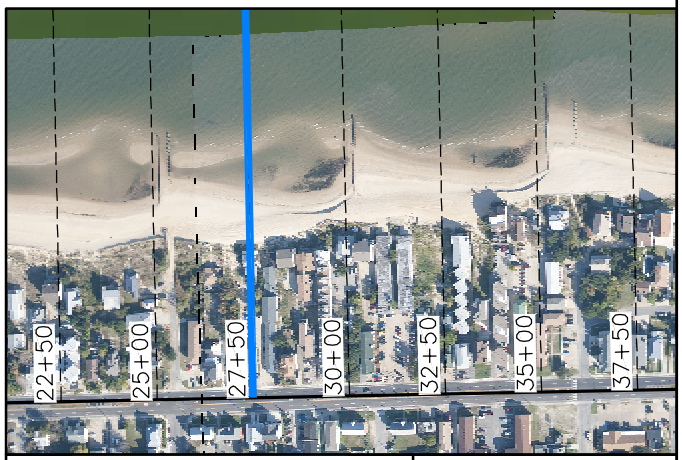




Survey Transect 27+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	13.37 ft/yr	-1.62 ft
Volume Change Above -15 ft NAVD88	1.73 cy/ft/yr	10.00 cy/ft
Volume Change Above 0 ft NAVD88	-0.27 cy/ft/yr	8.97 cy/ft

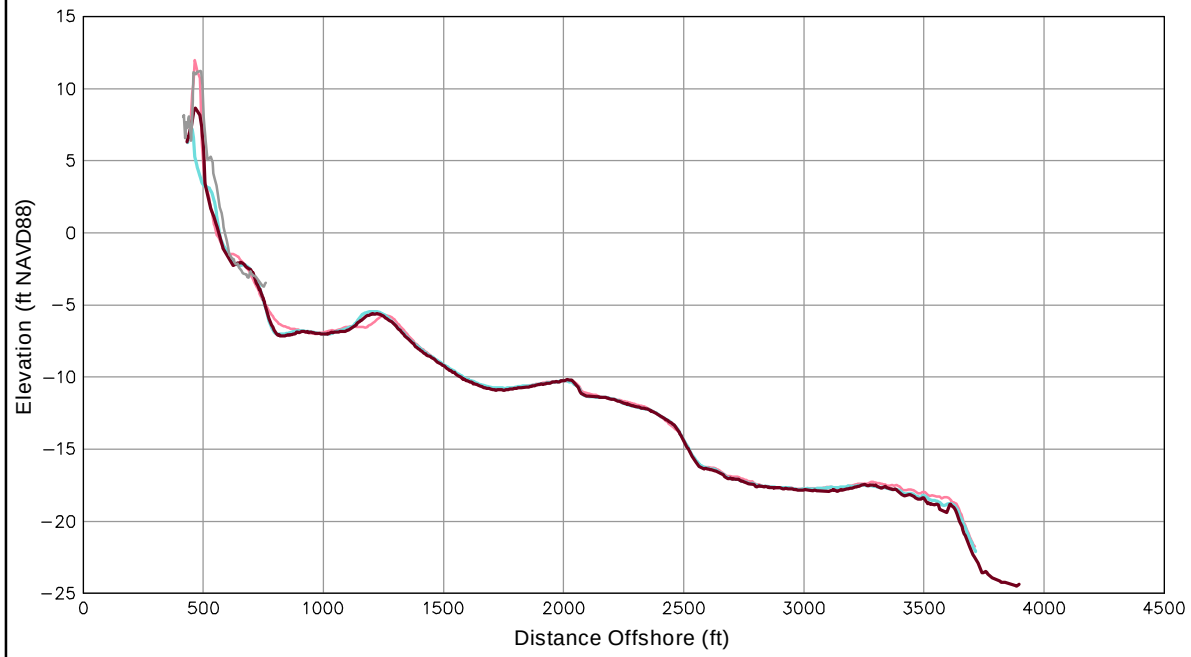
LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

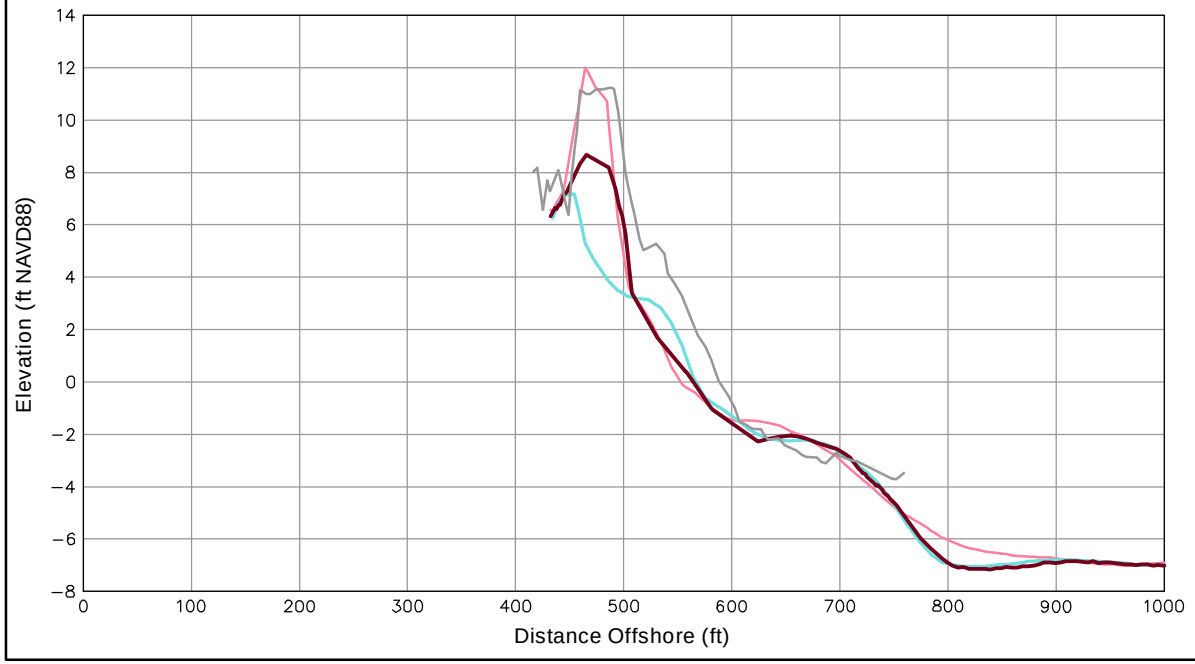
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To October 2009 and March 2010.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were 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 30+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	4.87 ft/yr	-12.26 ft
Volume Change Above -15 ft NAVD88	-7.80 cy/ft/yr	0.37 cy/ft
Volume Change Above 0 ft NAVD88	-2.86 cy/ft/yr	4.63 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
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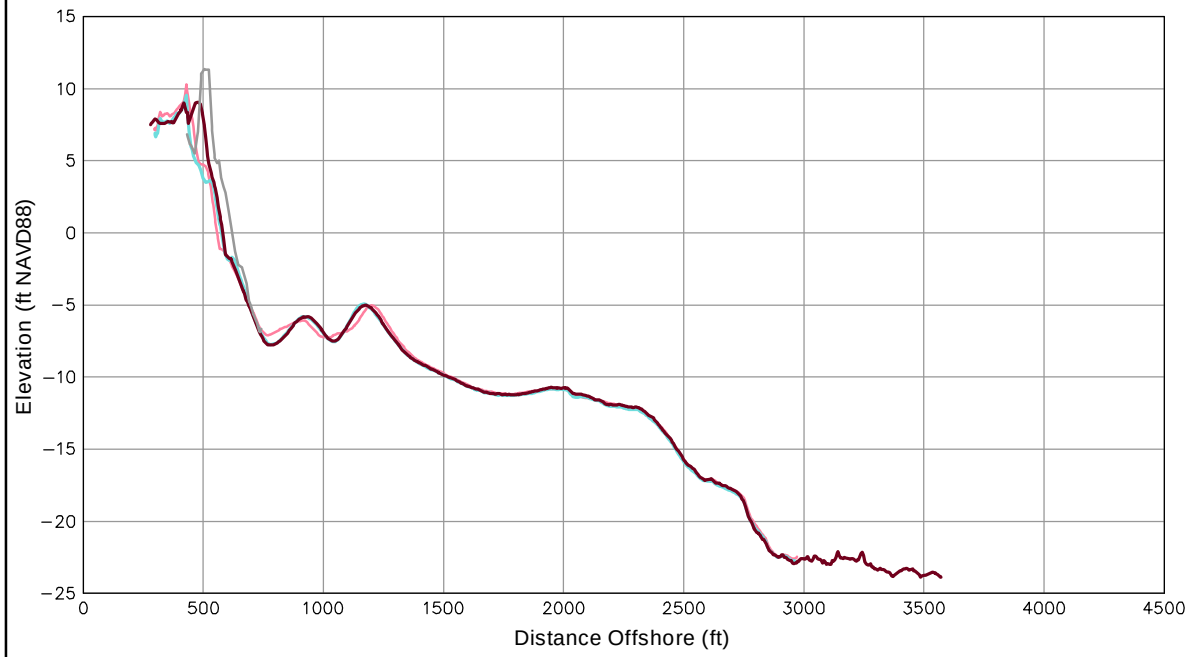
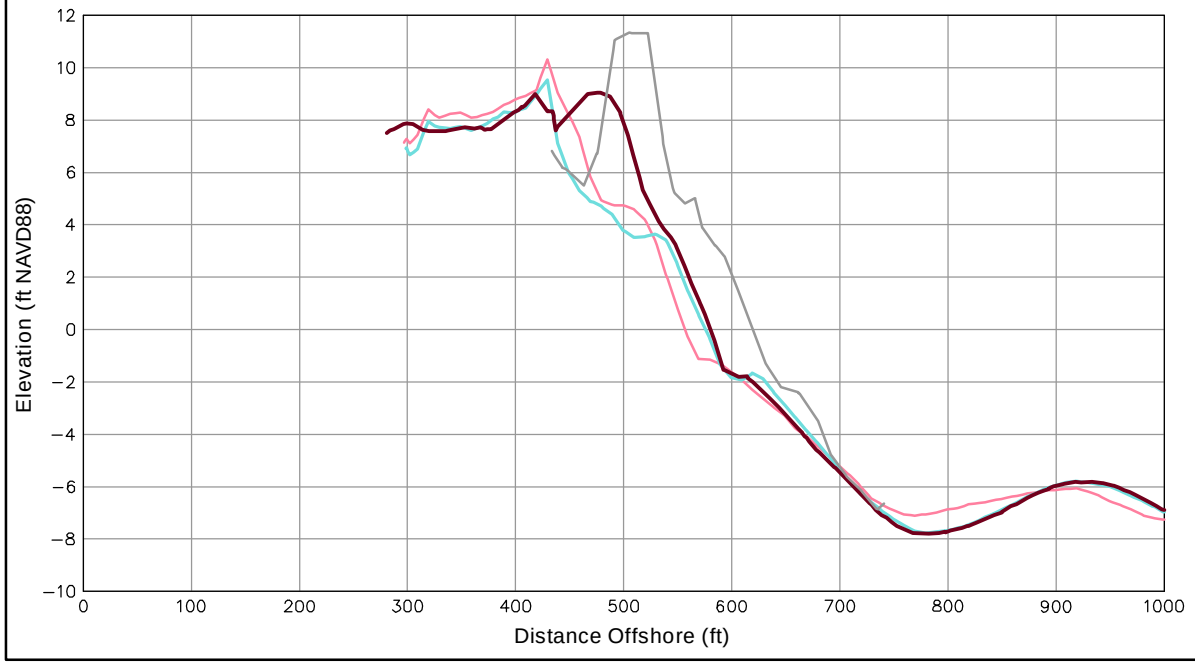
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 32+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	20.82 ft/yr	6.01 ft
Volume Change Above -15 ft NAVD88	4.66 cy/ft/yr	13.58 cy/ft
Volume Change Above 0 ft NAVD88	6.71 cy/ft/yr	11.26 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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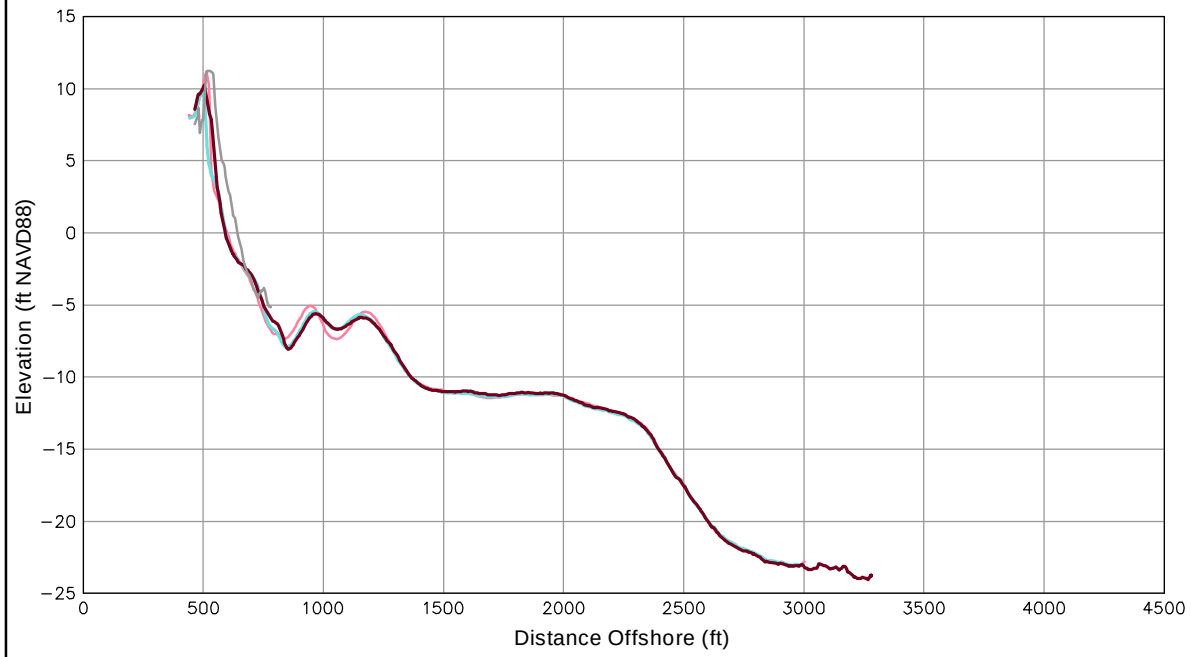
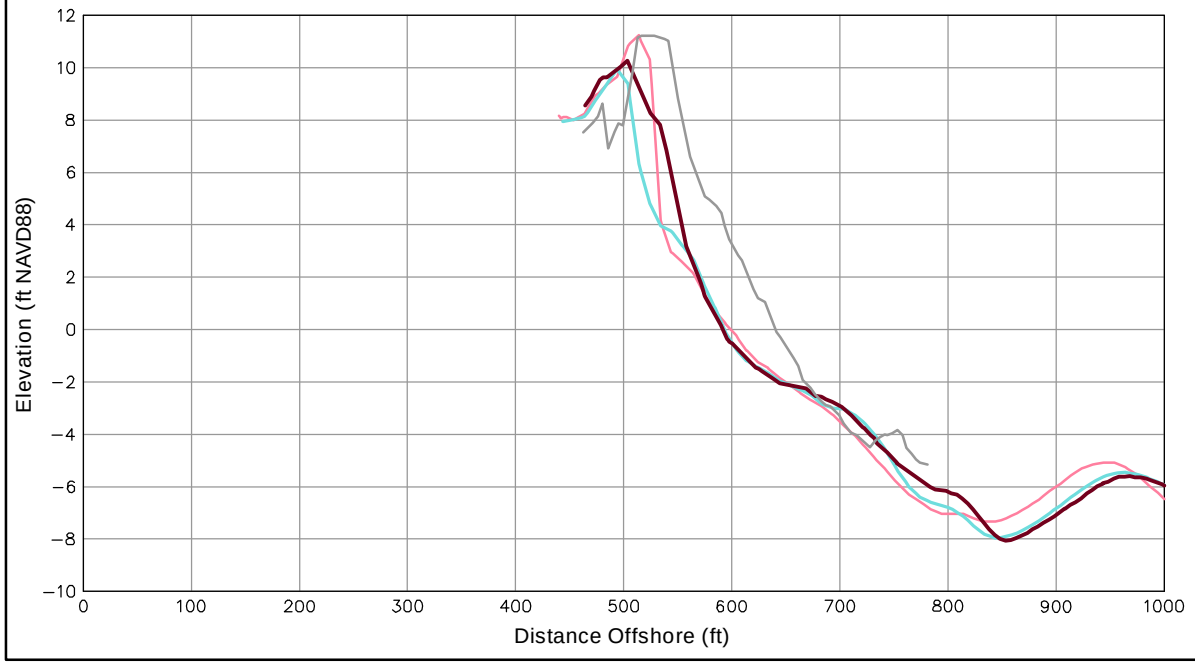
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 35+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-1.27 ft/yr	-3.75 ft
Volume Change Above -15 ft NAVD88	3.23 cy/ft/yr	9.49 cy/ft
Volume Change Above 0 ft NAVD88	1.55 cy/ft/yr	5.27 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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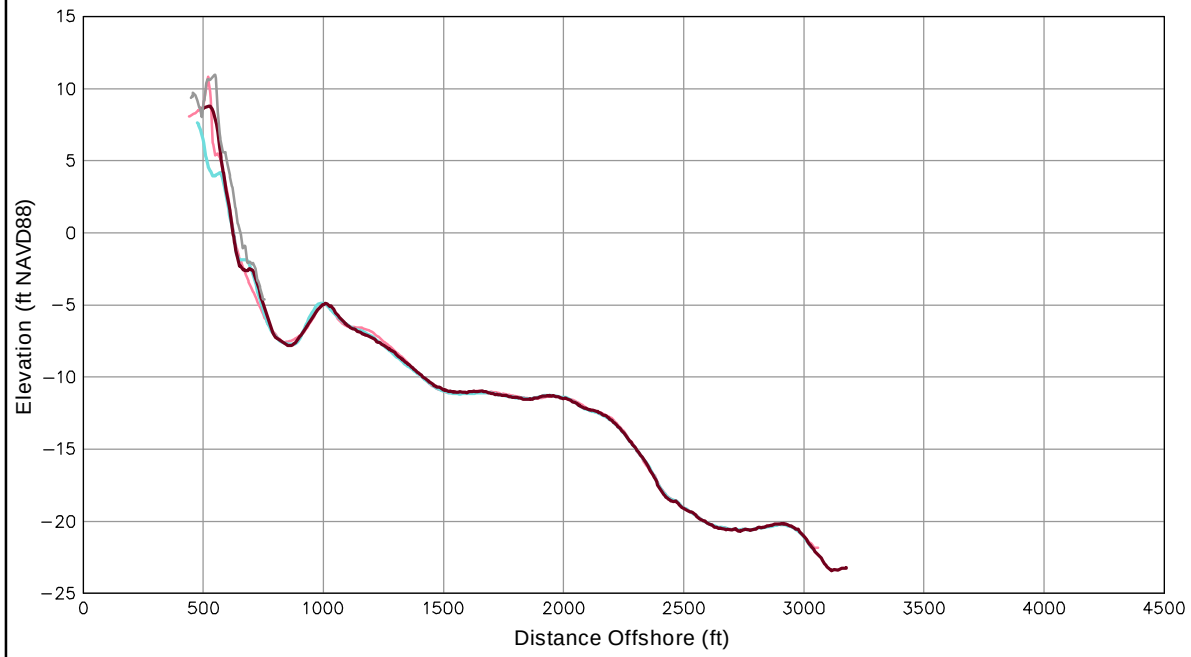
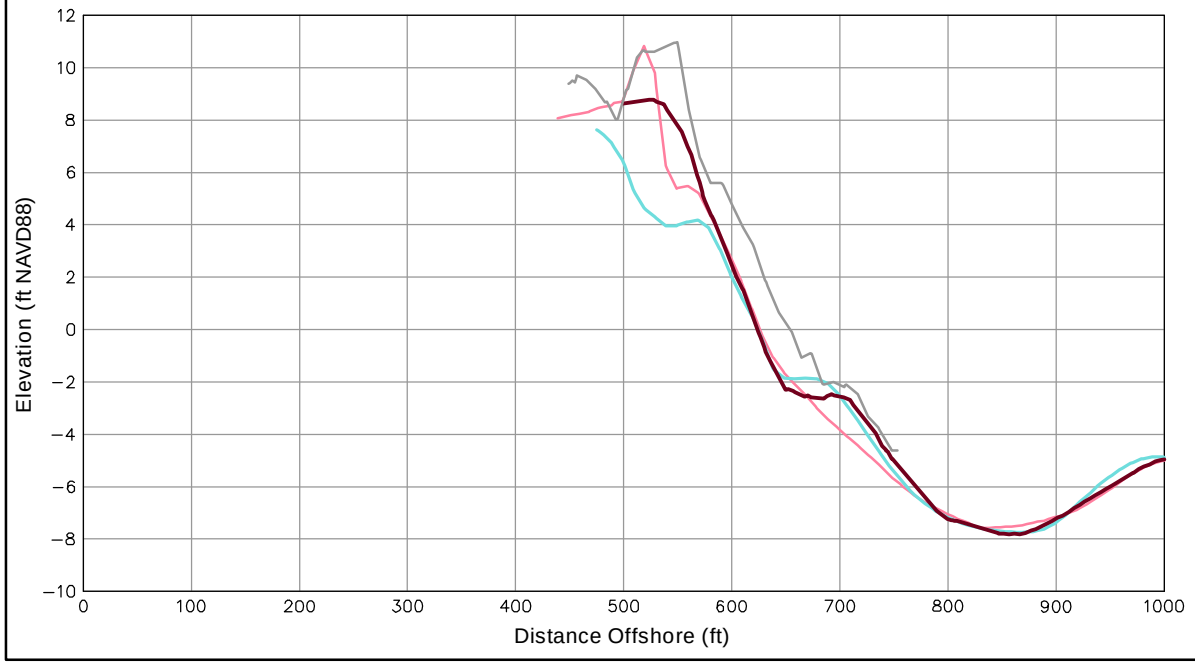
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 37+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-1.55 ft/yr	2.67 ft
Volume Change Above -15 ft NAVD88	0.84 cy/ft/yr	11.39 cy/ft
Volume Change Above 0 ft NAVD88	0.70 cy/ft/yr	10.40 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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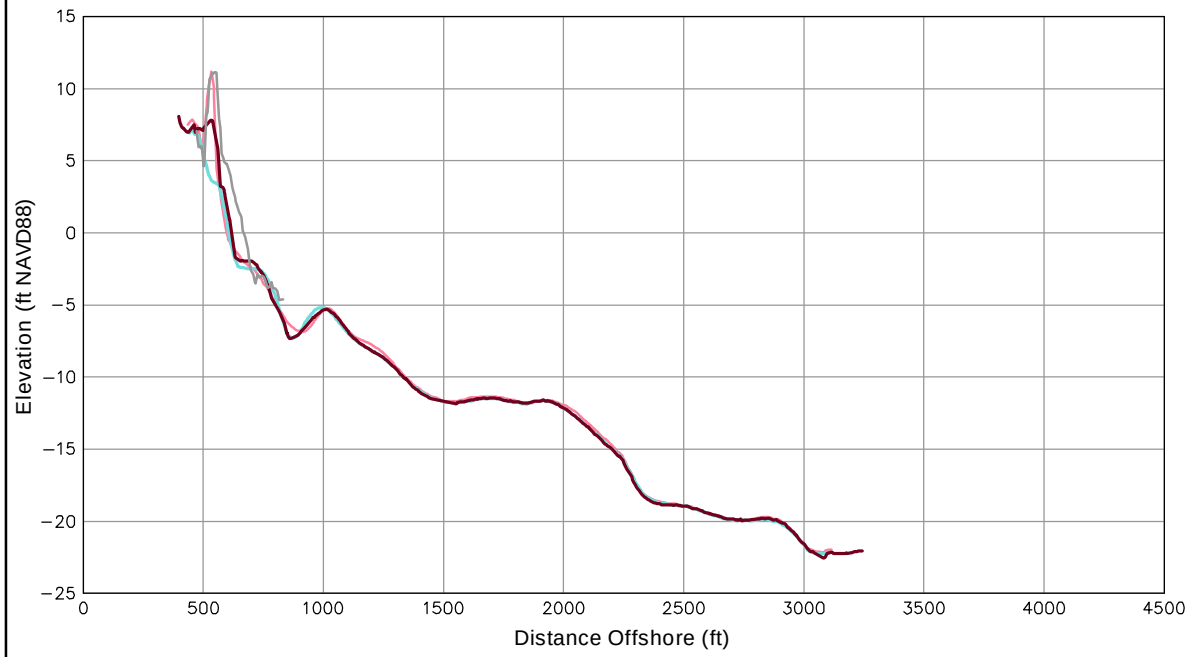
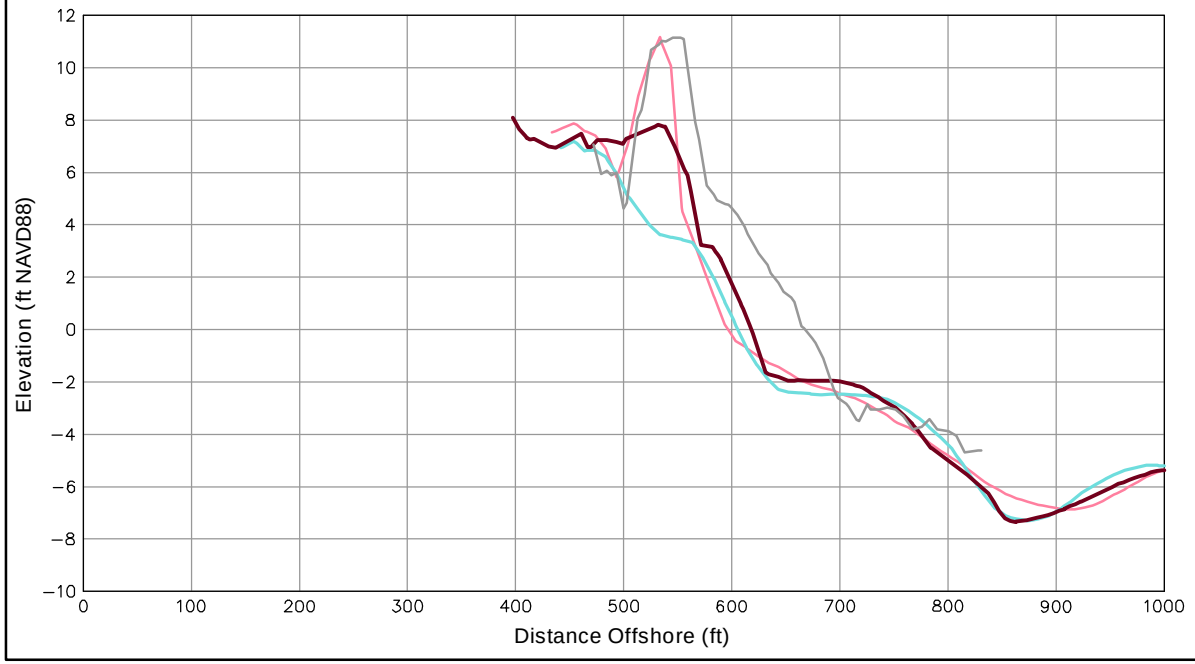
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 40+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	20.55 ft/yr	13.55 ft
Volume Change Above -15 ft NAVD88	-6.66 cy/ft/yr	10.87 cy/ft
Volume Change Above 0 ft NAVD88	-0.10 cy/ft/yr	10.63 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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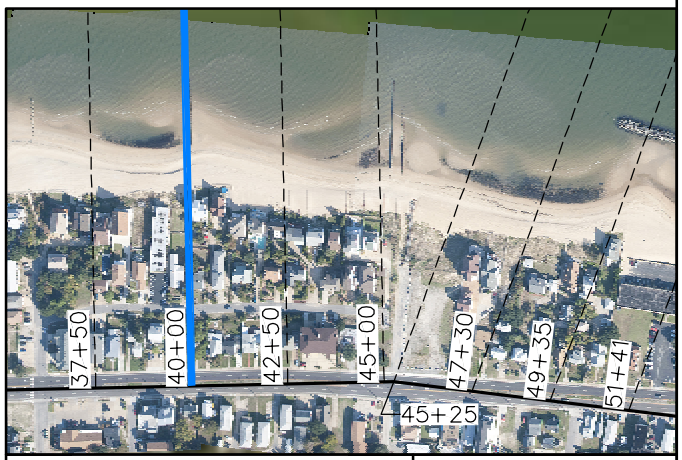

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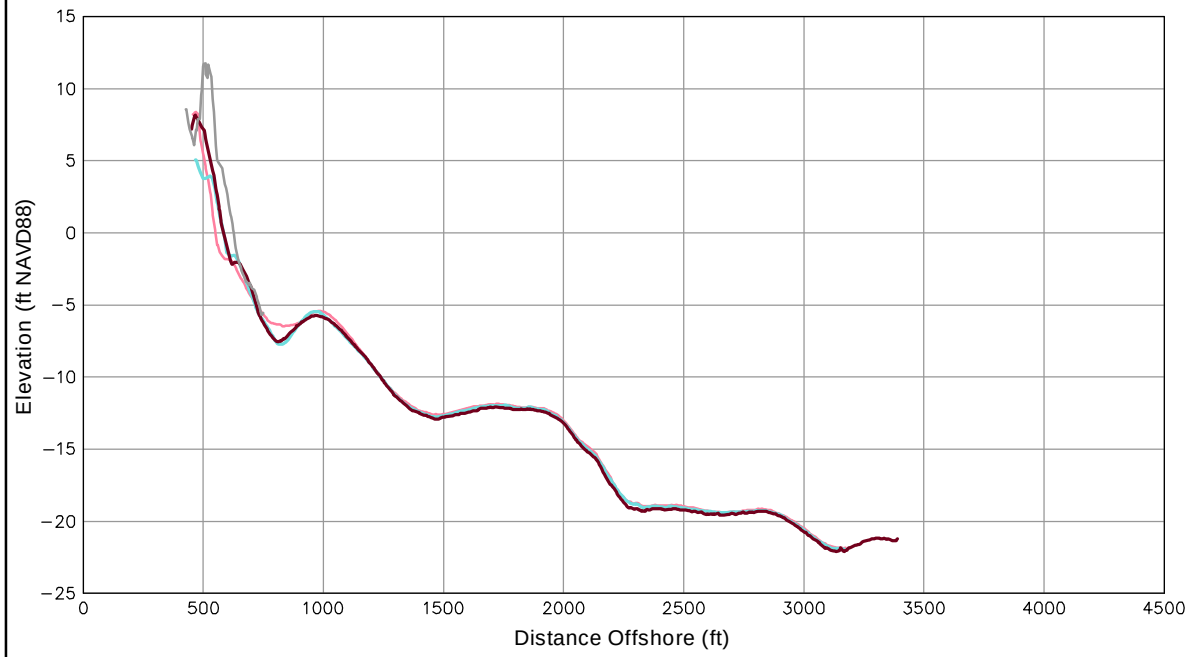

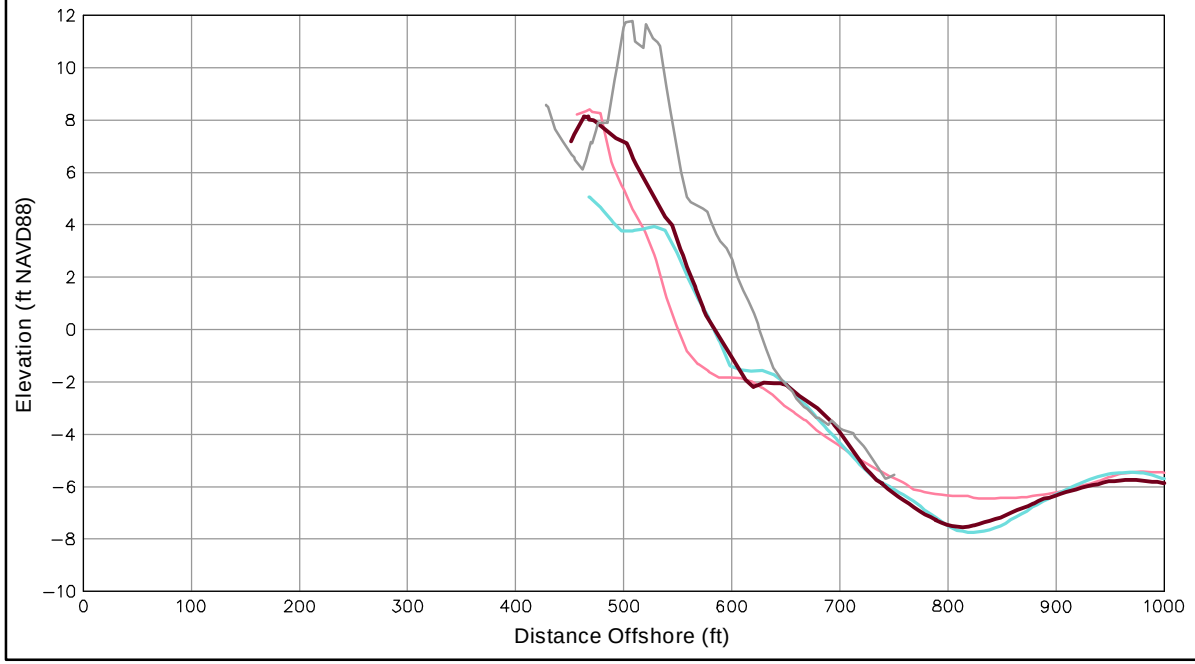

Survey Transect 42+50	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	28.62 ft/yr	0.85 ft
Volume Change Above -15 ft NAVD88	-2.42 cy/ft/yr	3.81 cy/ft
Volume Change Above 0 ft NAVD88	6.41 cy/ft/yr	7.05 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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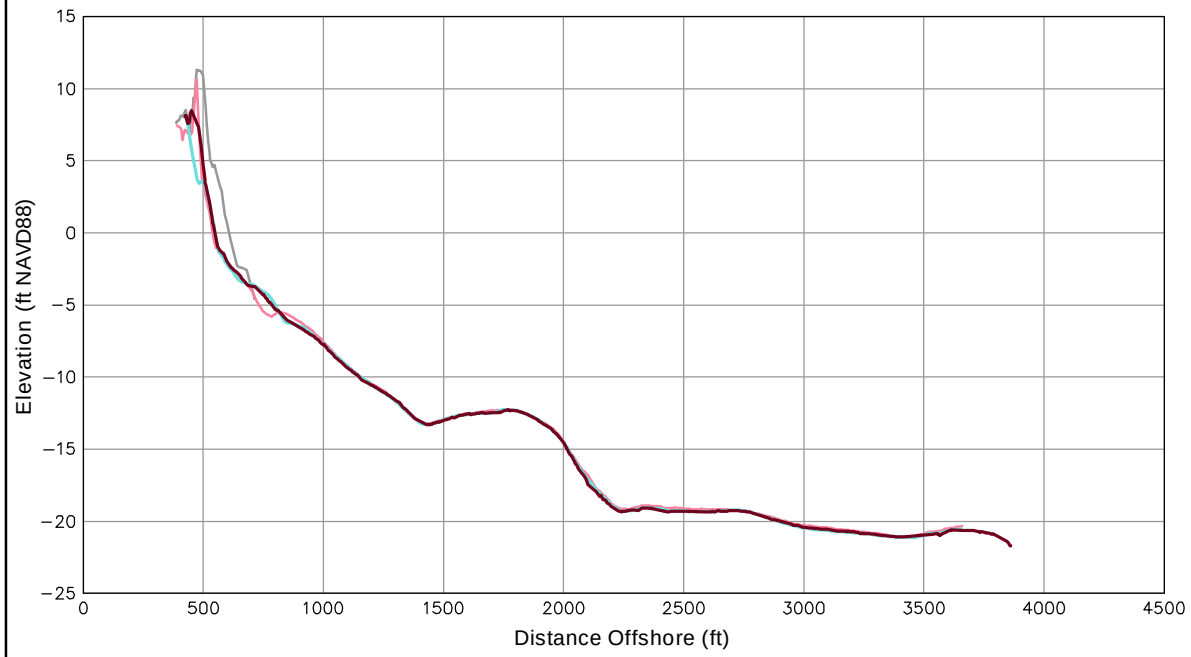
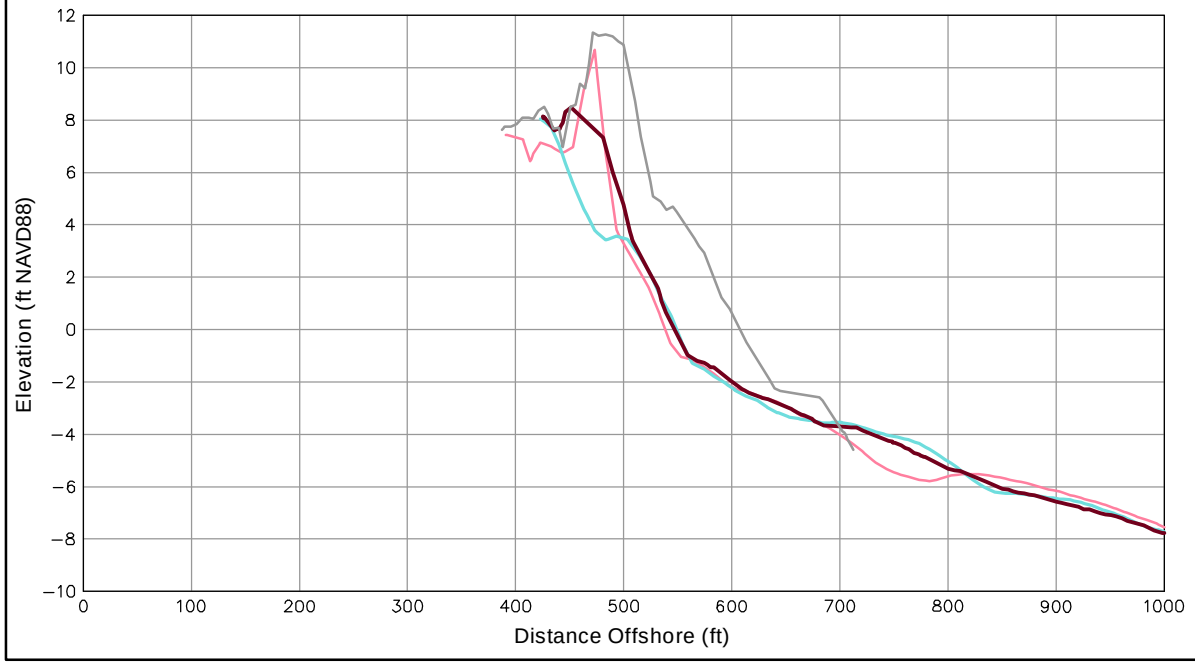
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 45+00	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	6.21 ft/yr	-1.88 ft
Volume Change Above -15 ft NAVD88	1.19 cy/ft/yr	5.73 cy/ft
Volume Change Above 0 ft NAVD88	1.84 cy/ft/yr	6.57 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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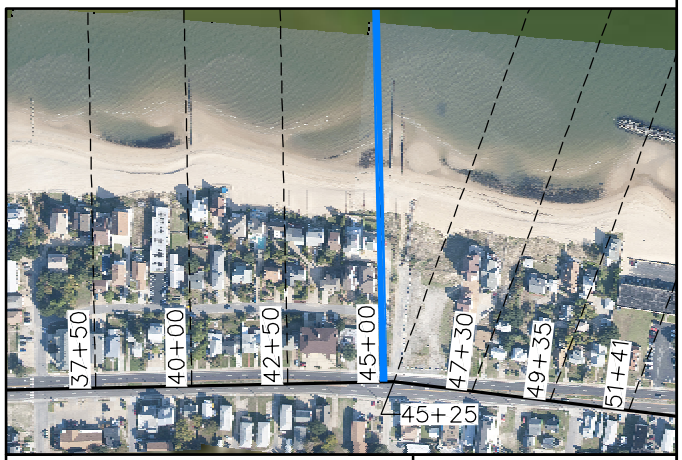

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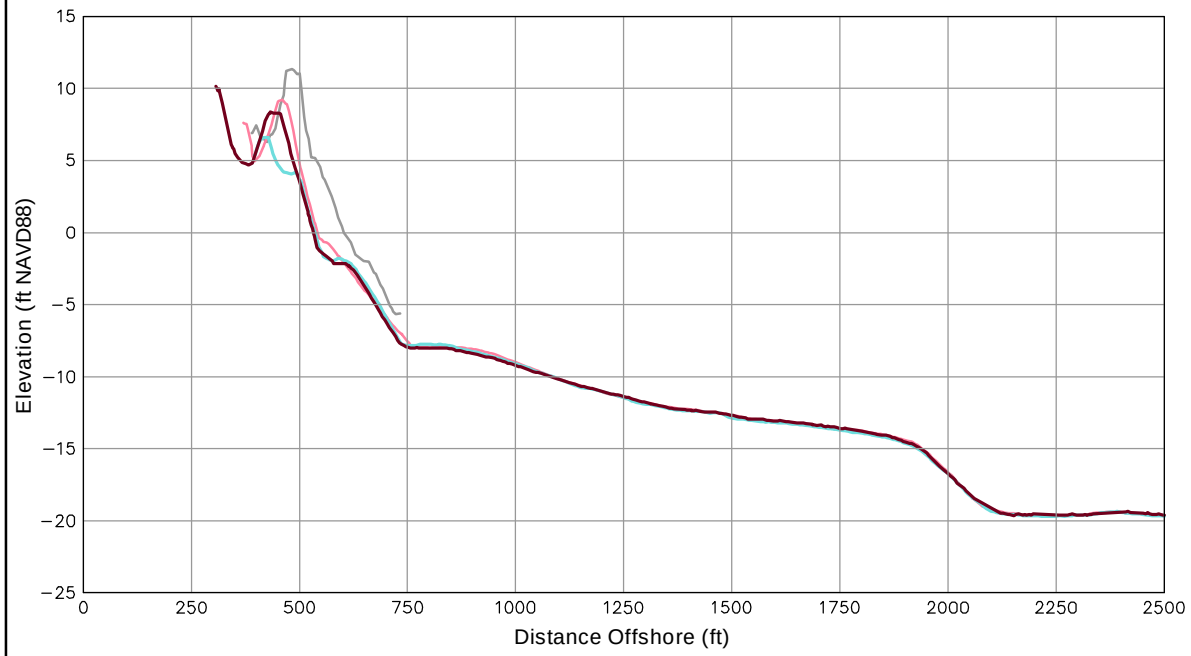
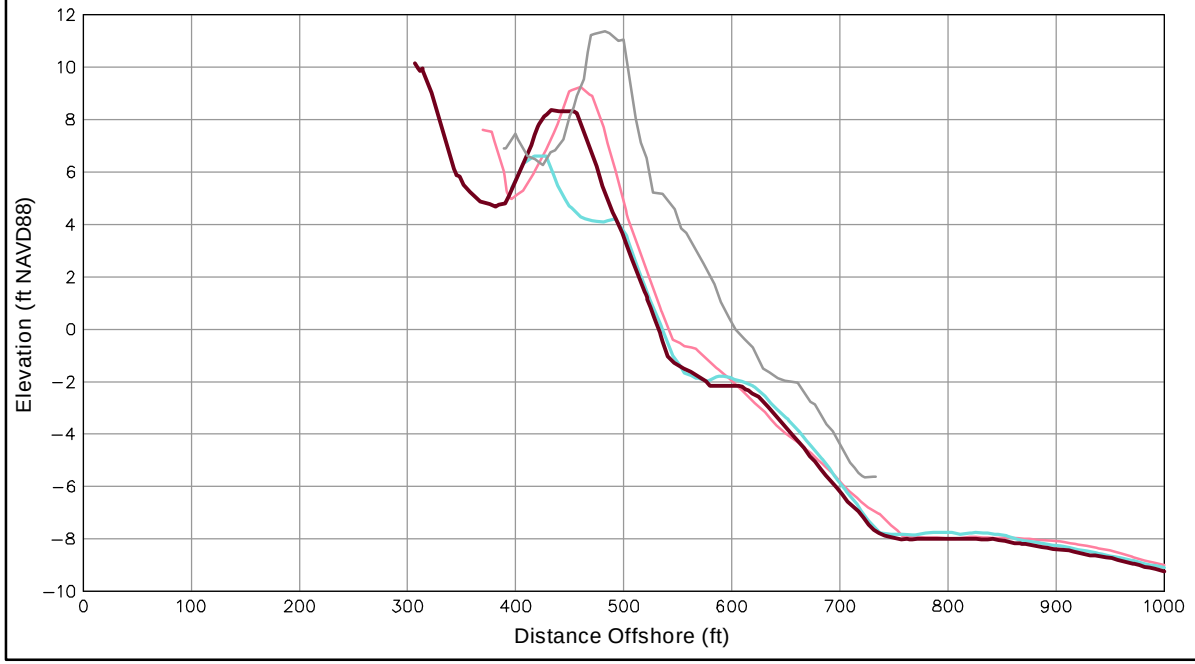
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 45+25	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-8.35 ft/yr	-2.32 ft
Volume Change Above -15 ft NAVD88	-9.20 cy/ft/yr	5.31 cy/ft
Volume Change Above 0 ft NAVD88	-4.54 cy/ft/yr	6.11 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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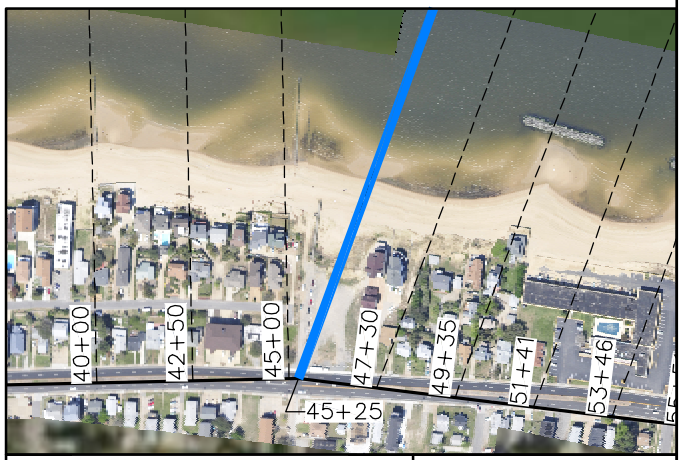

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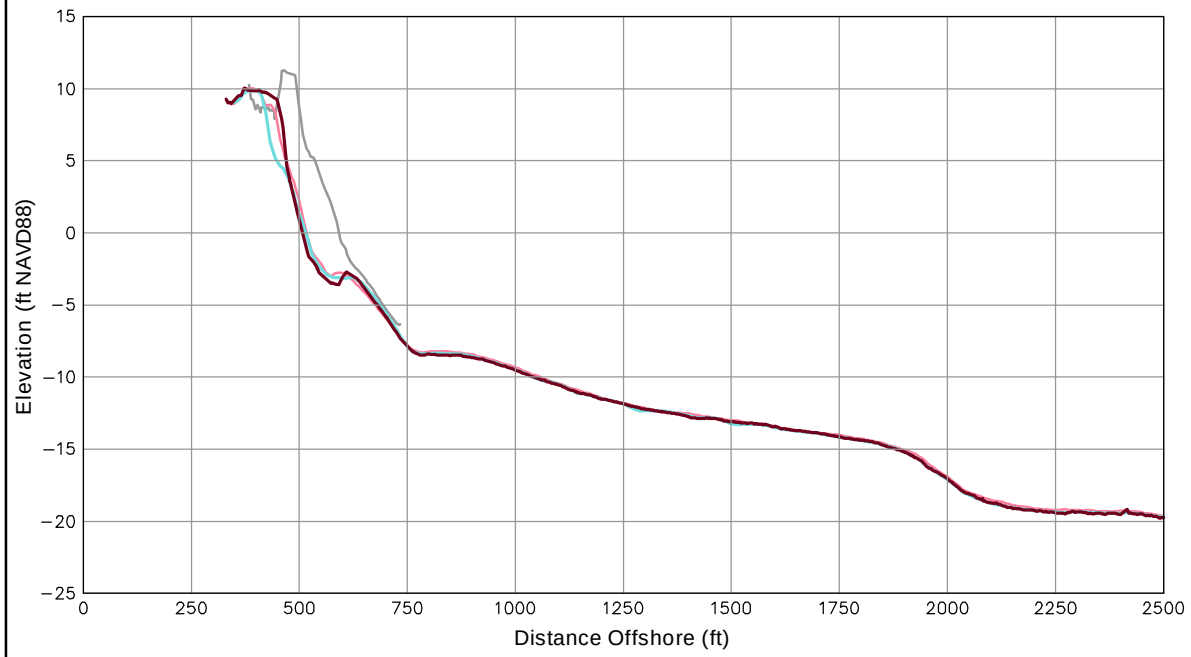
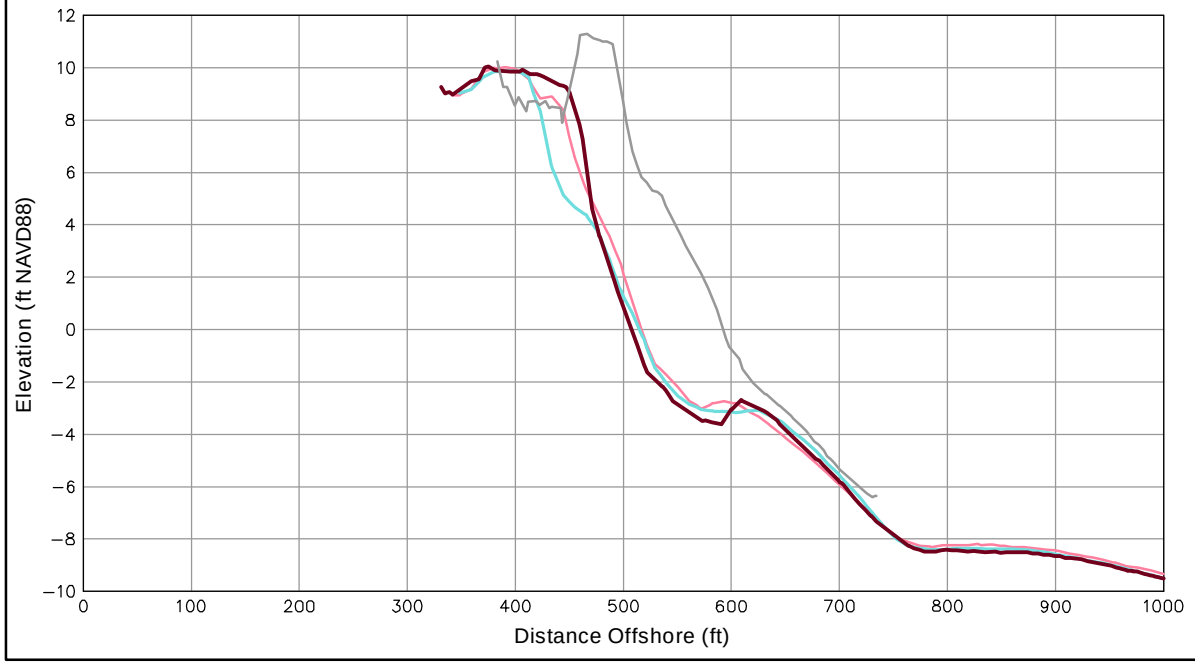
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 47+30	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-9.12 ft/yr	-4.52 ft
Volume Change Above -15 ft NAVD88	-4.85 cy/ft/yr	3.65 cy/ft
Volume Change Above 0 ft NAVD88	0.66 cy/ft/yr	5.73 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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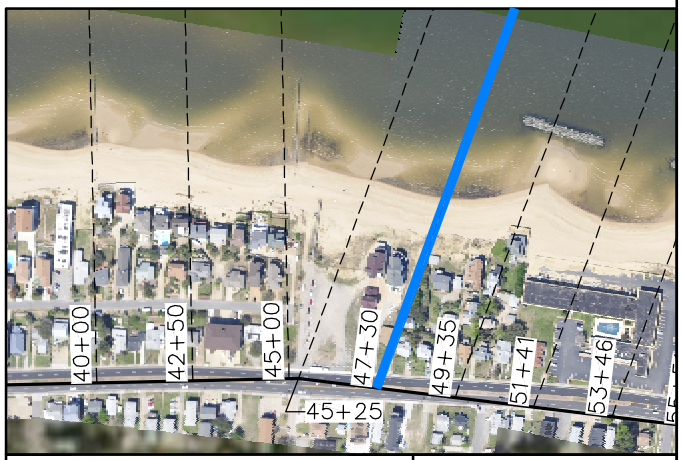

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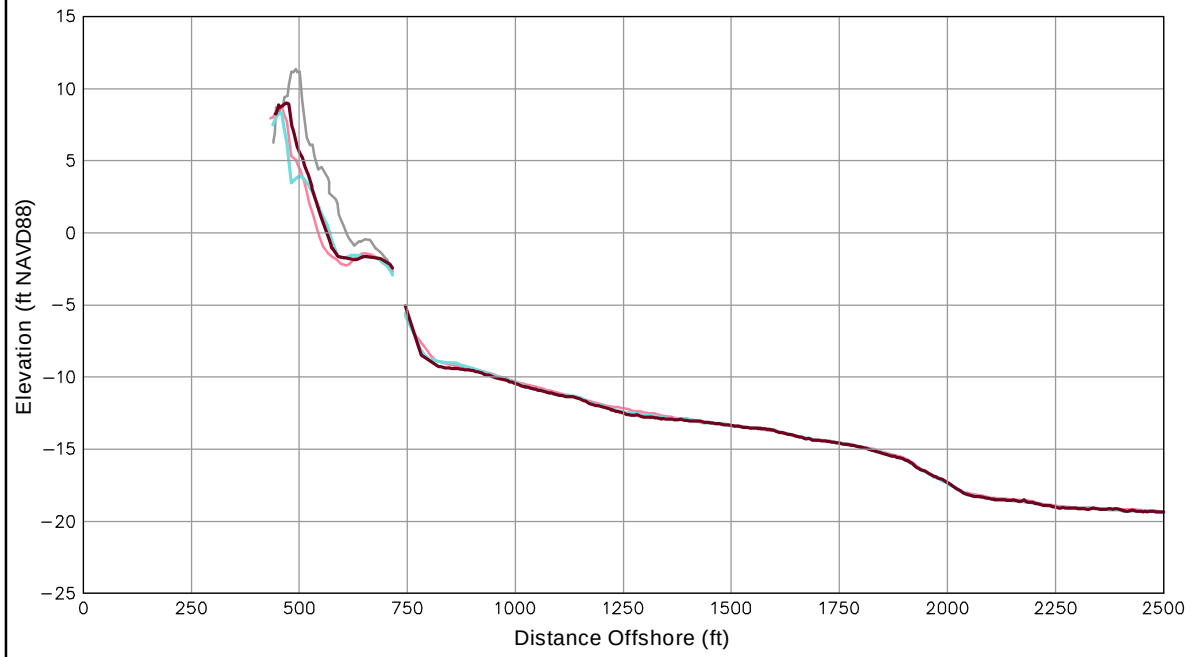
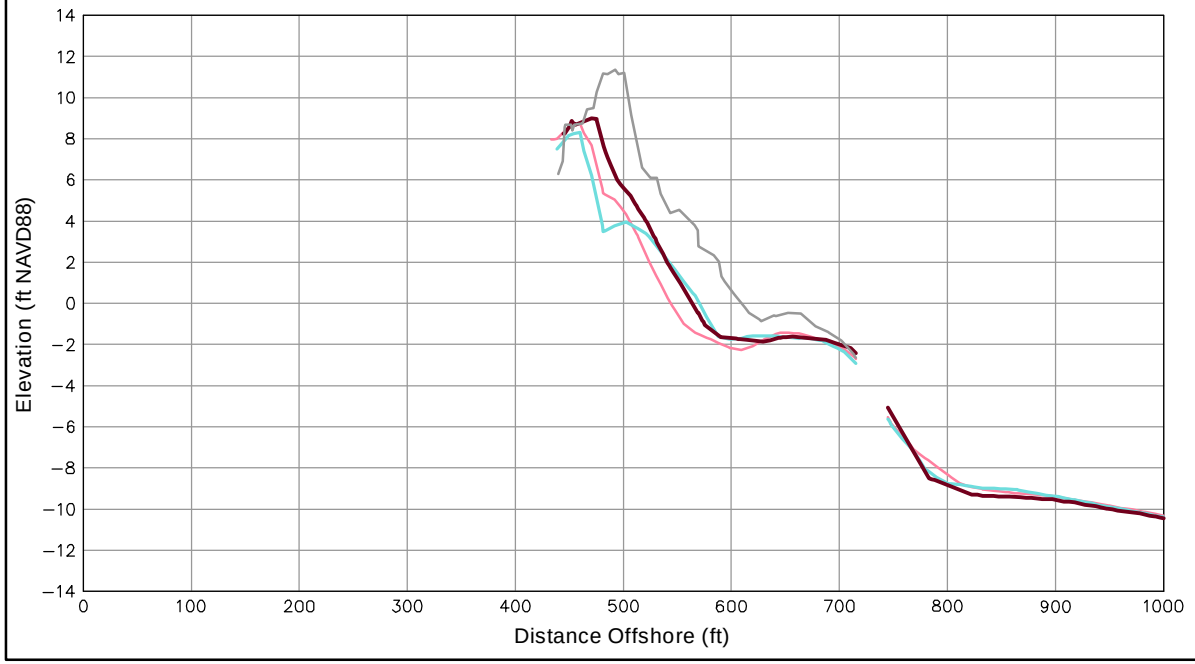
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 49+35	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	17.09 ft/yr	-4.85 ft
Volume Change Above -15 ft NAVD88	1.74 cy/ft/yr	2.41 cy/ft
Volume Change Above 0 ft NAVD88	4.91 cy/ft/yr	5.05 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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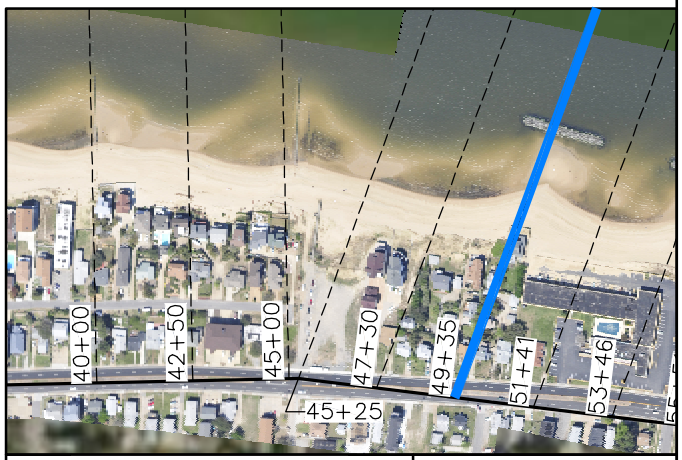

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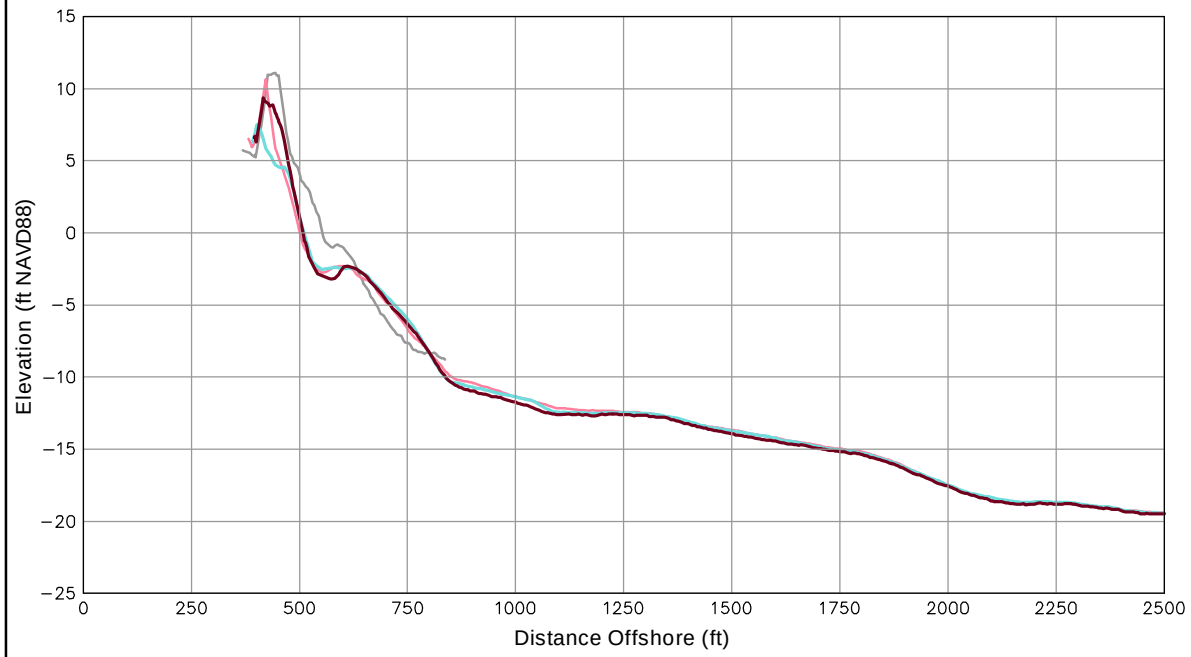
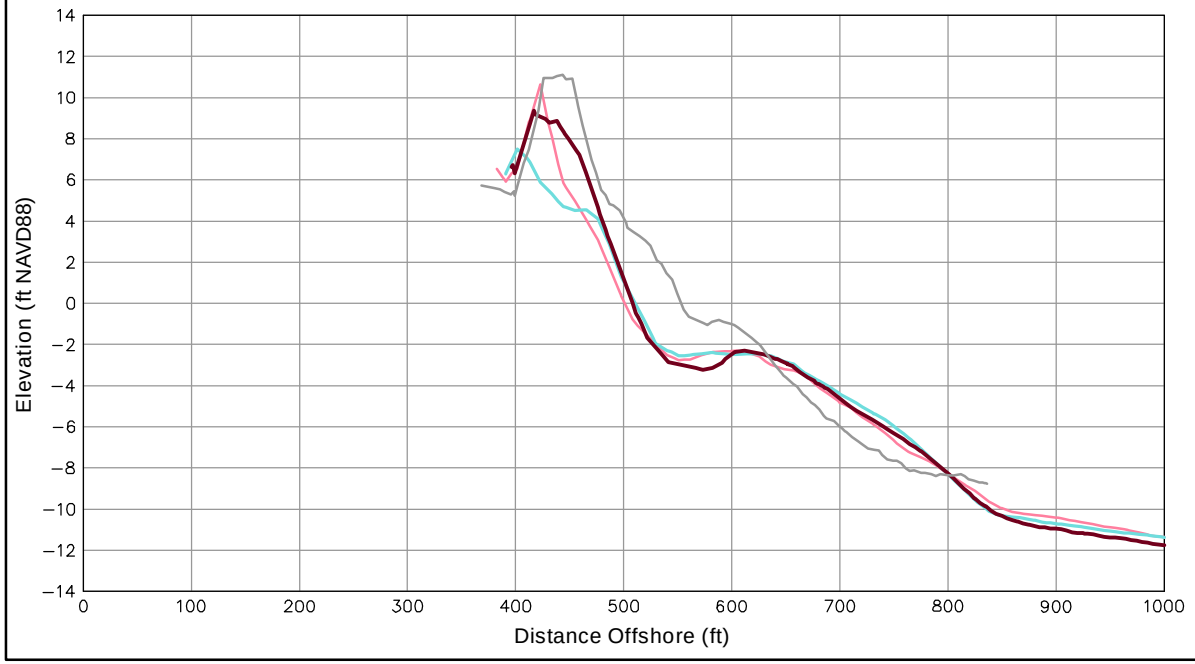
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 51+41	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	8.12 ft/yr	0.57 ft
Volume Change Above -15 ft NAVD88	-4.99 cy/ft/yr	-2.42 cy/ft
Volume Change Above 0 ft NAVD88	4.11 cy/ft/yr	6.81 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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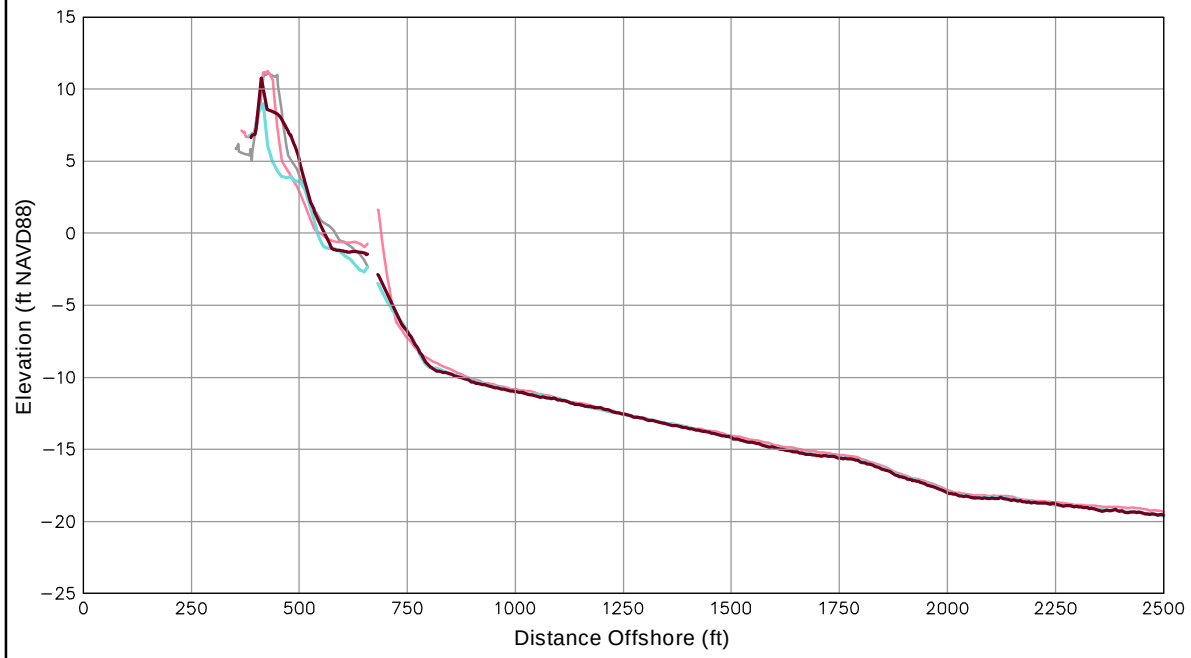

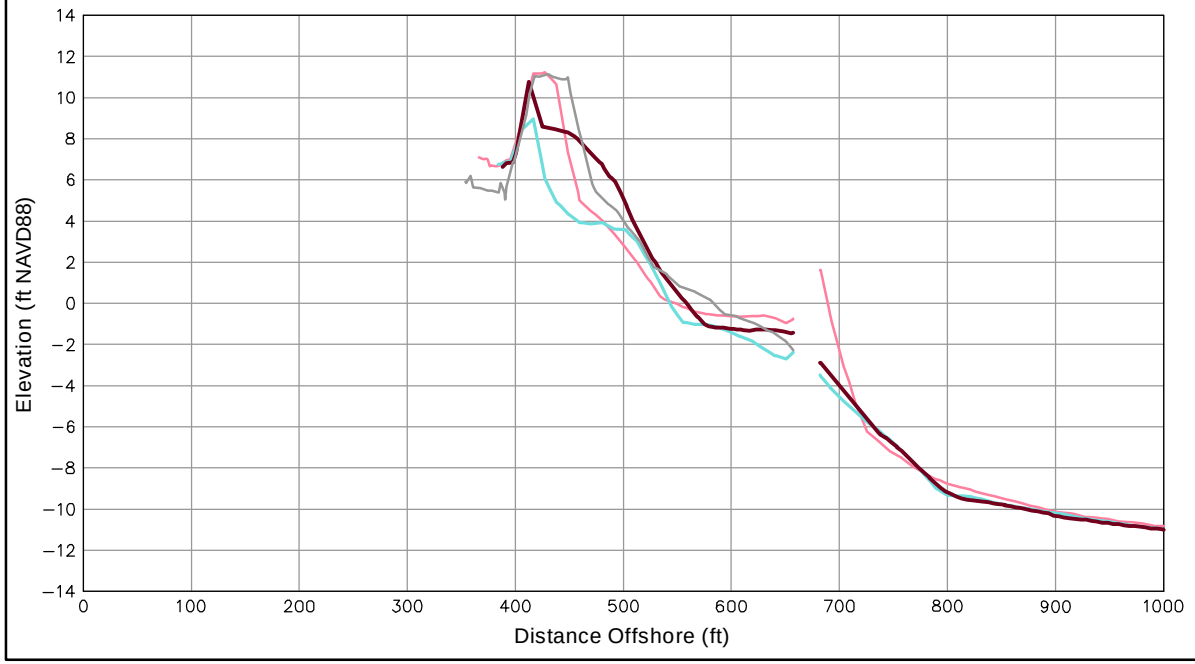

Survey Transect 53+46	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	16.11 ft/yr	8.90 ft
Volume Change Above -15 ft NAVD88	-3.09 cy/ft/yr	13.39 cy/ft
Volume Change Above 0 ft NAVD88	4.65 cy/ft/yr	11.02 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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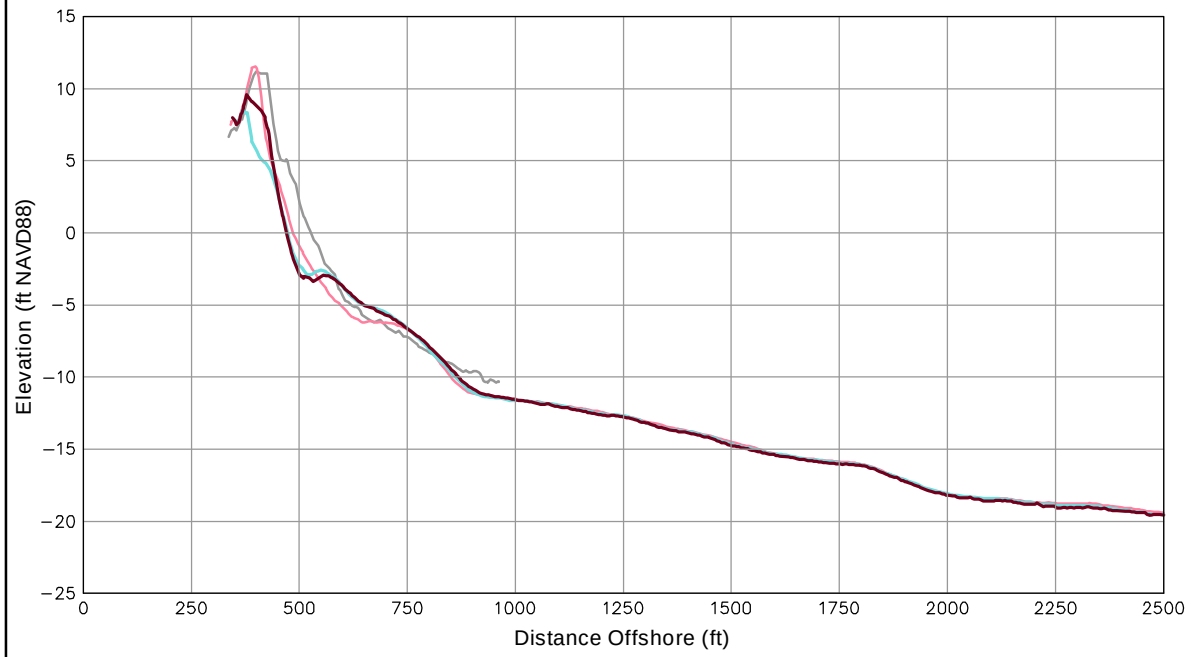

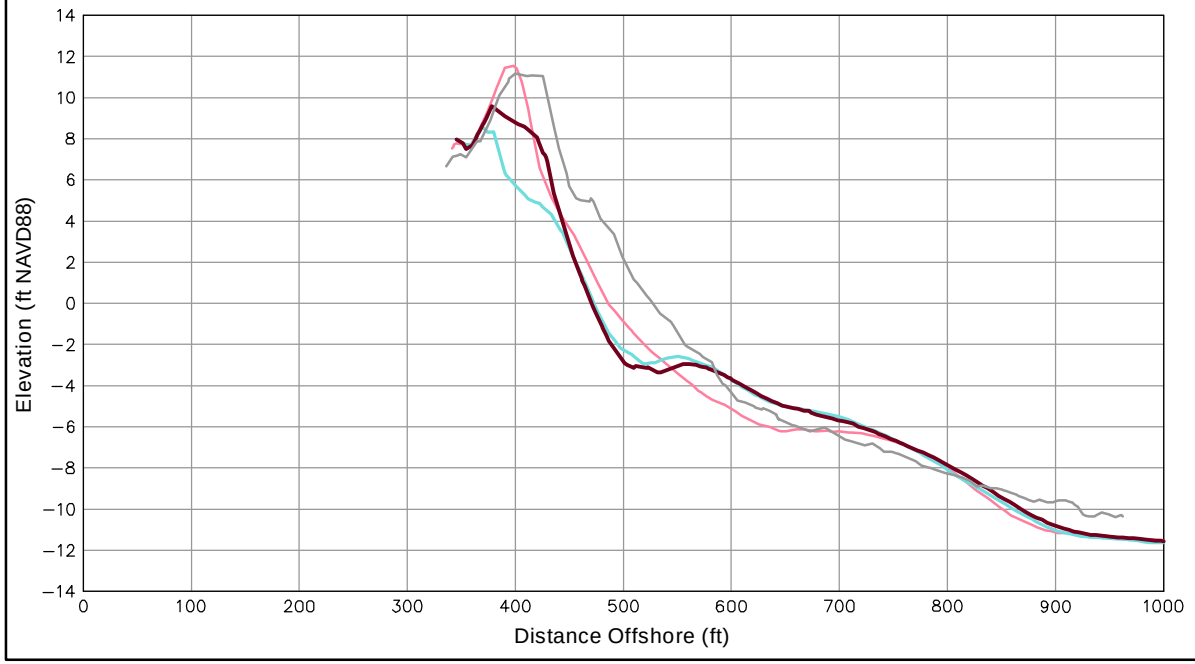

Survey Transect 55+51	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-12.70 ft/yr	-1.80 ft
Volume Change Above -15 ft NAVD88	-0.65 cy/ft/yr	4.60 cy/ft
Volume Change Above 0 ft NAVD88	-3.22 cy/ft/yr	6.12 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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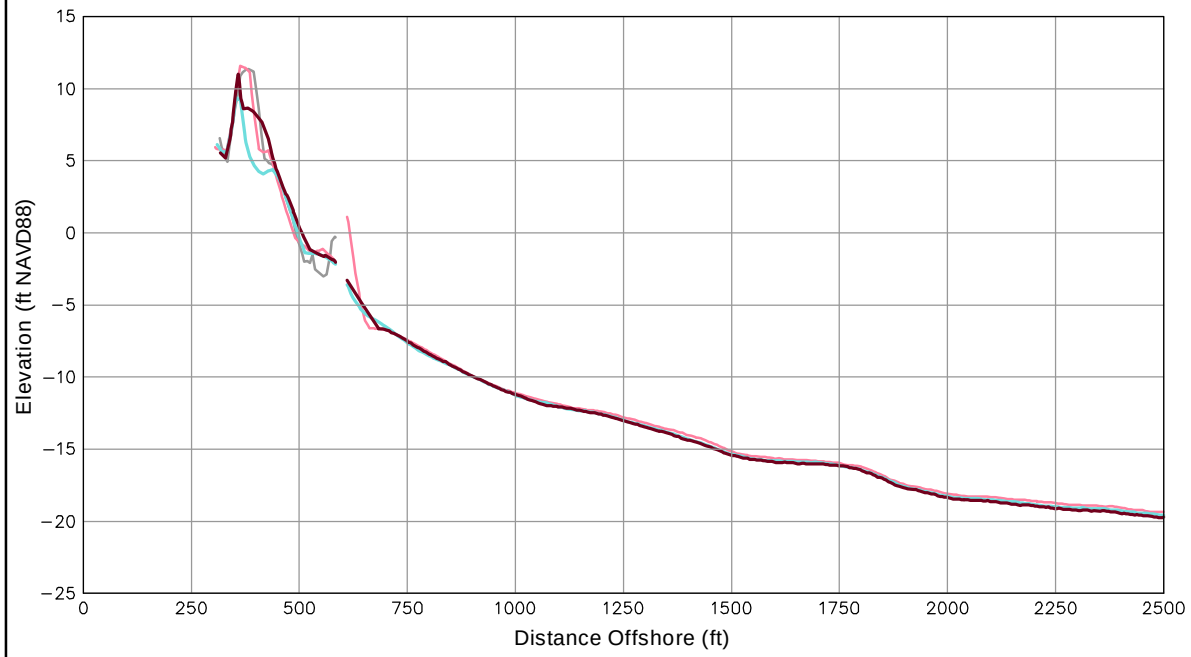
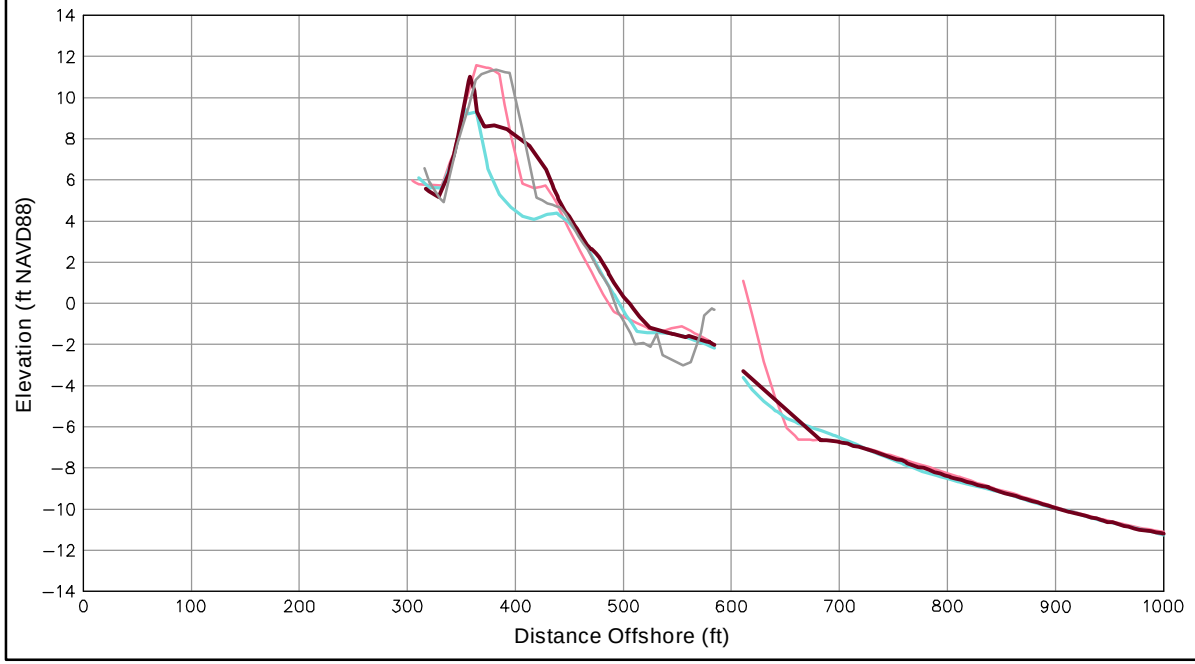
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 57+57	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	15.01 ft/yr	6.87 ft
Volume Change Above -15 ft NAVD88	-4.71 cy/ft/yr	9.92 cy/ft
Volume Change Above 0 ft NAVD88	1.03 cy/ft/yr	8.69 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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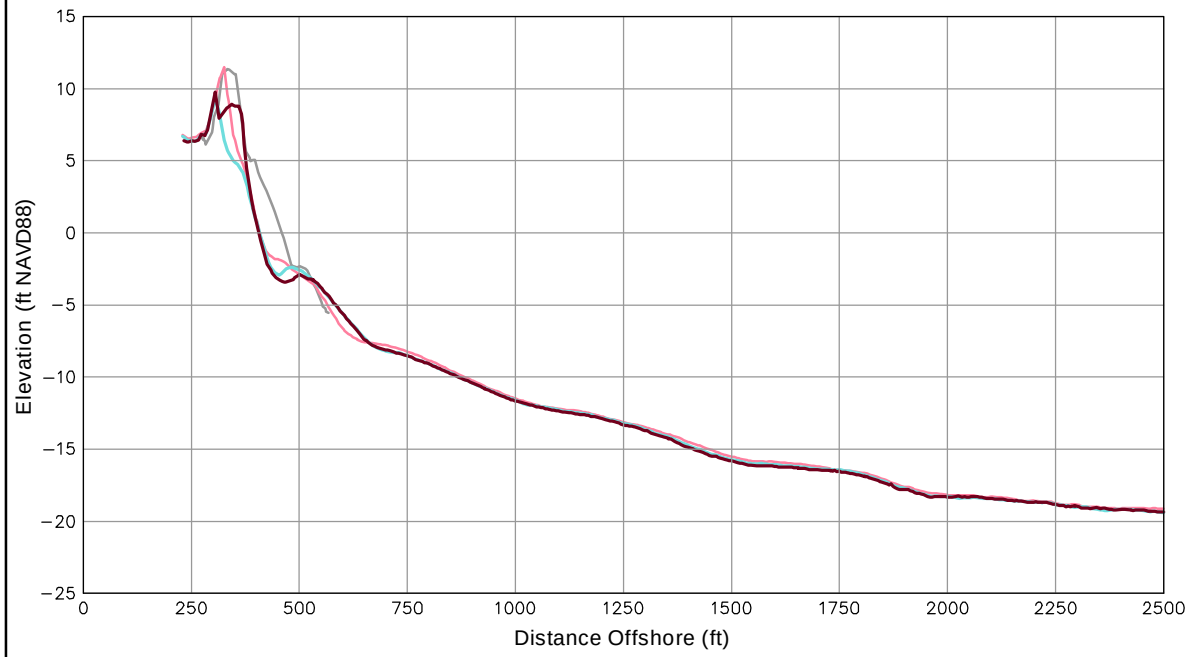
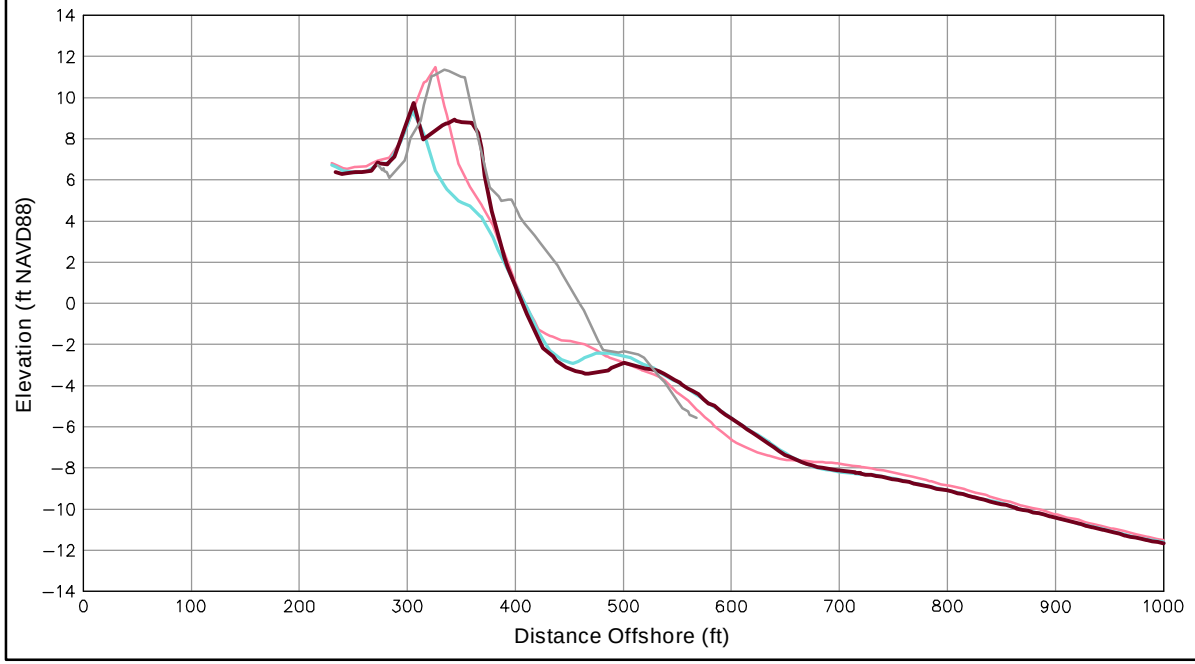
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 59+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-1.17 ft/yr	-0.03 ft
Volume Change Above -15 ft NAVD88	-5.21 cy/ft/yr	3.63 cy/ft
Volume Change Above 0 ft NAVD88	0.41 cy/ft/yr	6.94 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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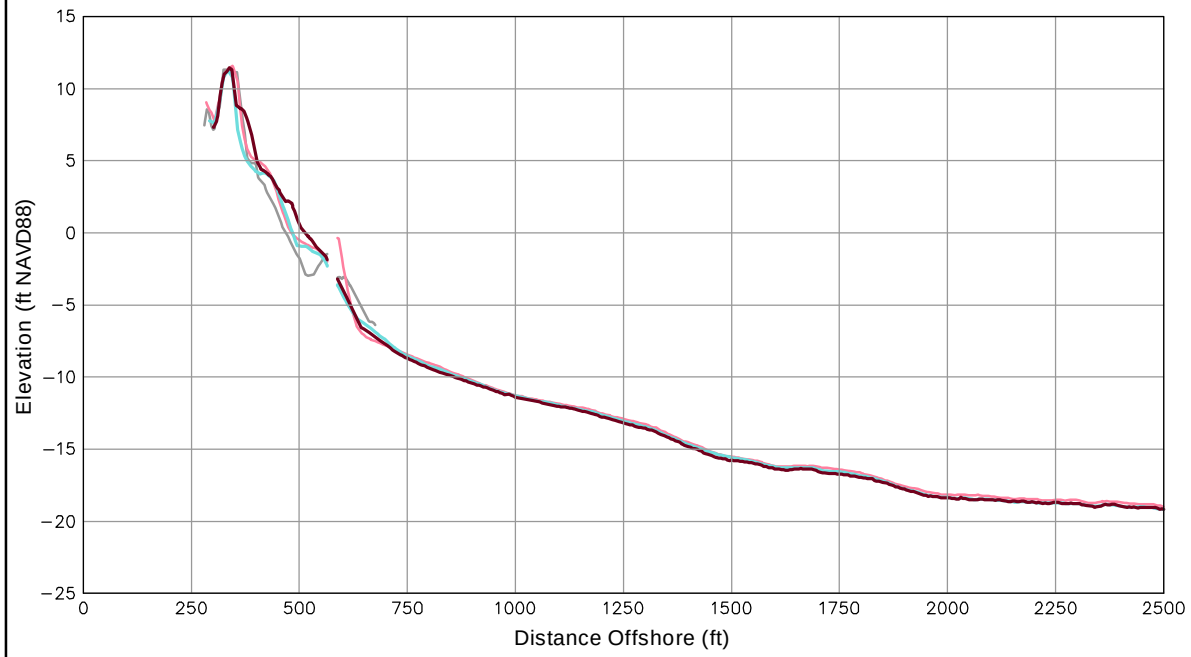

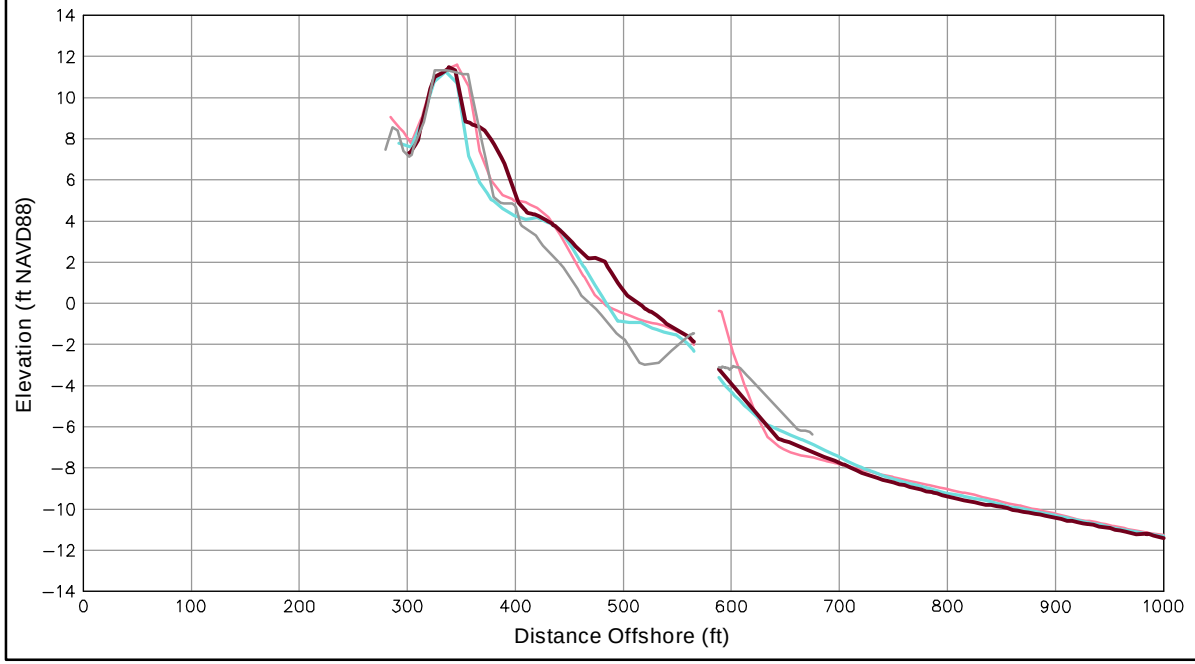

Survey Transect 61+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	25.87 ft/yr	22.14 ft
Volume Change Above -15 ft NAVD88	-2.49 cy/ft/yr	4.89 cy/ft
Volume Change Above 0 ft NAVD88	2.92 cy/ft/yr	6.52 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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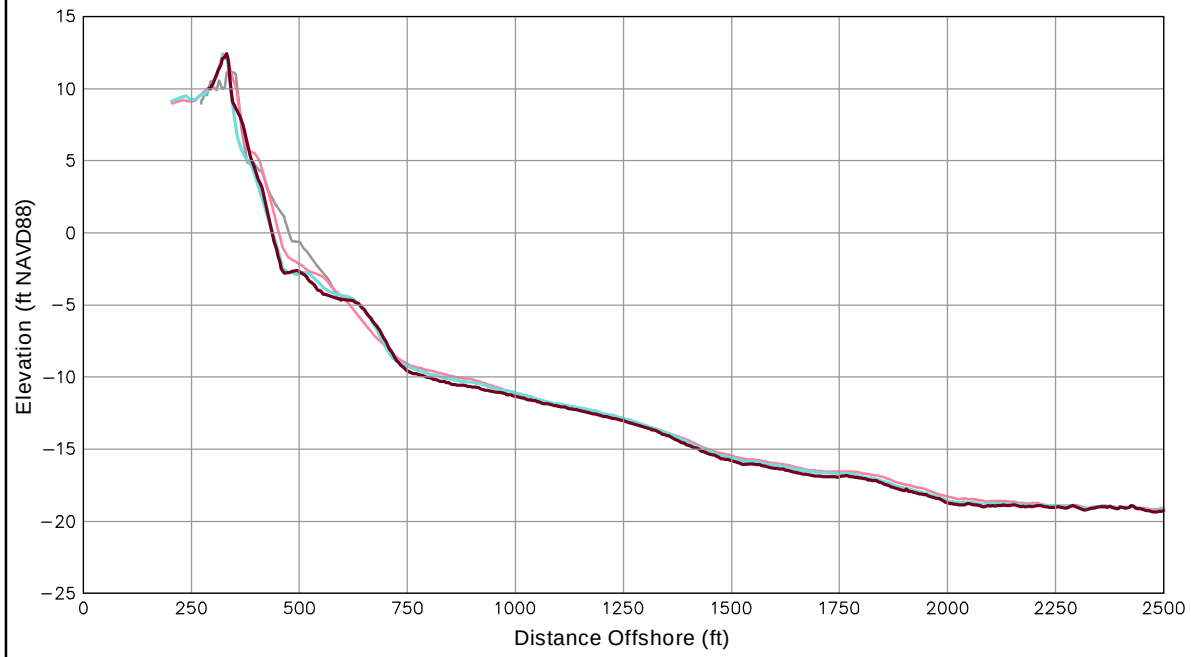

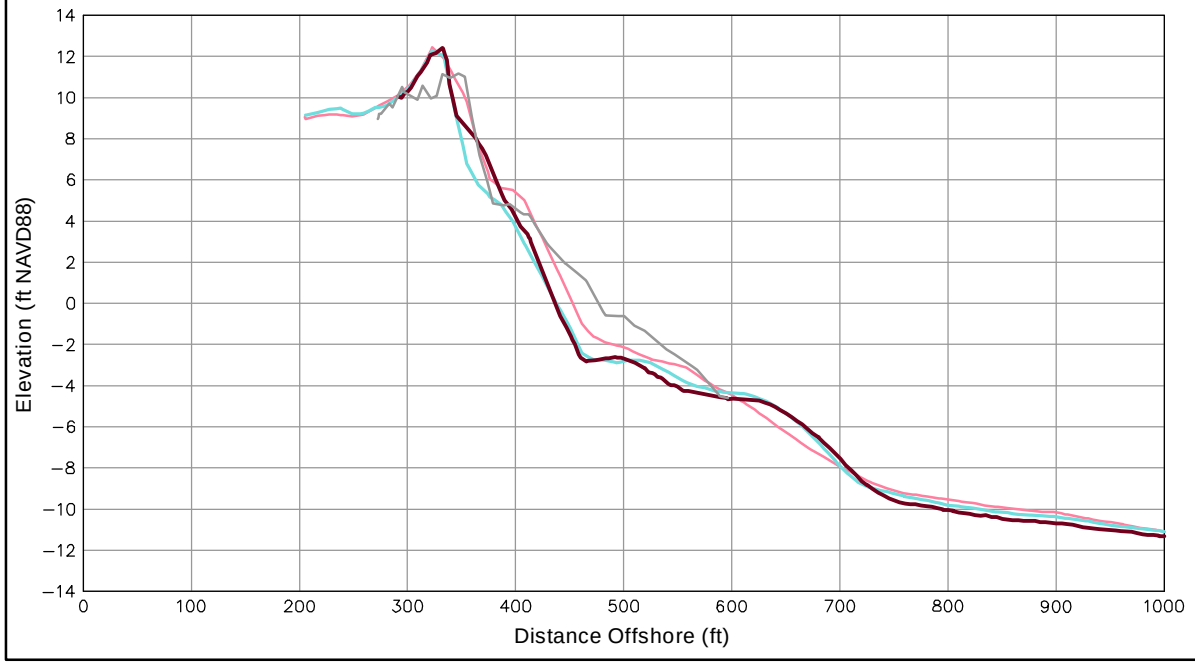

Survey Transect 63+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-14.23 ft/yr	1.44 ft
Volume Change Above -15 ft NAVD88	-12.70 cy/ft/yr	-3.70 cy/ft
Volume Change Above 0 ft NAVD88	-3.72 cy/ft/yr	2.98 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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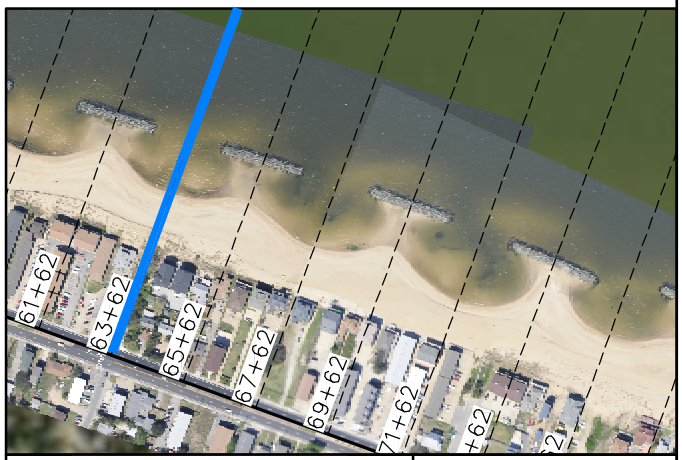

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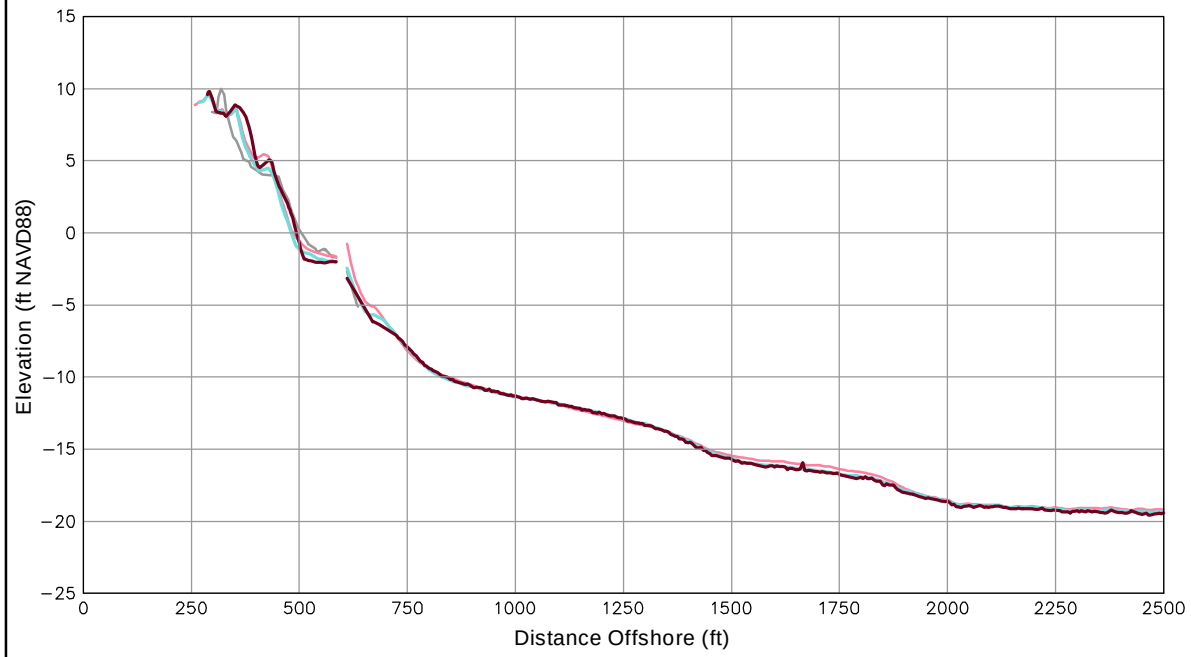

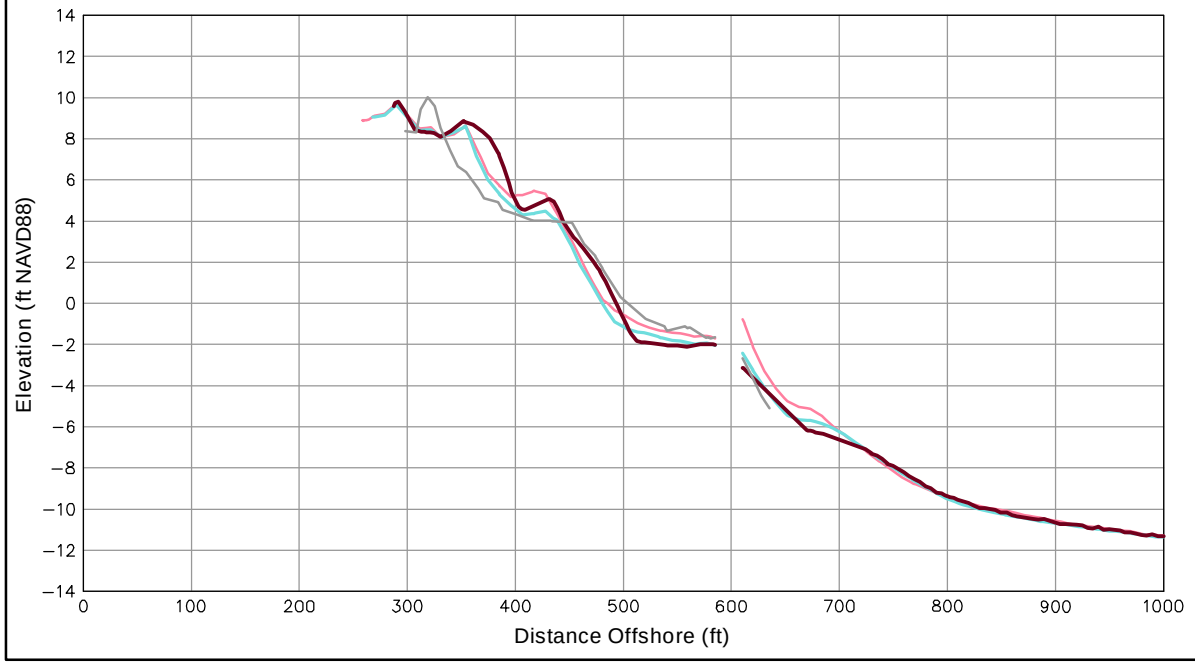

Survey Transect 65+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	11.56 ft/yr	14.48 ft
Volume Change Above -15 ft NAVD88	-1.89 cy/ft/yr	3.96 cy/ft
Volume Change Above 0 ft NAVD88	2.40 cy/ft/yr	4.93 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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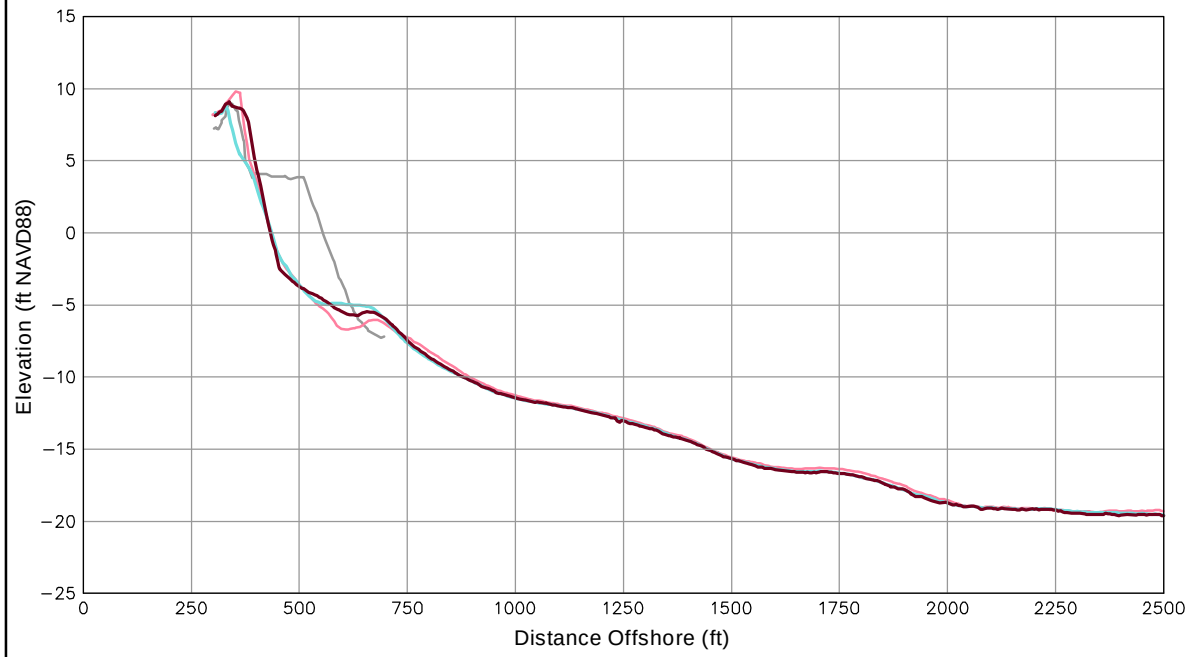
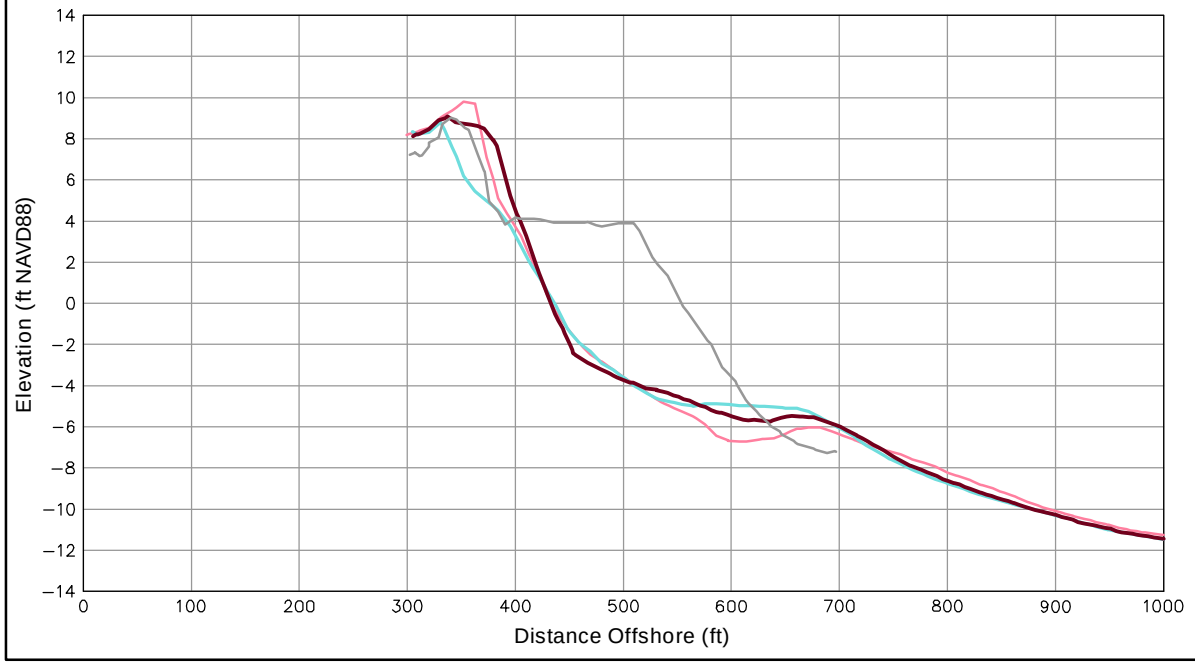
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 67+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	0.78 ft/yr	0.31 ft
Volume Change Above -15 ft NAVD88	0.24 cy/ft/yr	4.64 cy/ft
Volume Change Above 0 ft NAVD88	1.10 cy/ft/yr	6.61 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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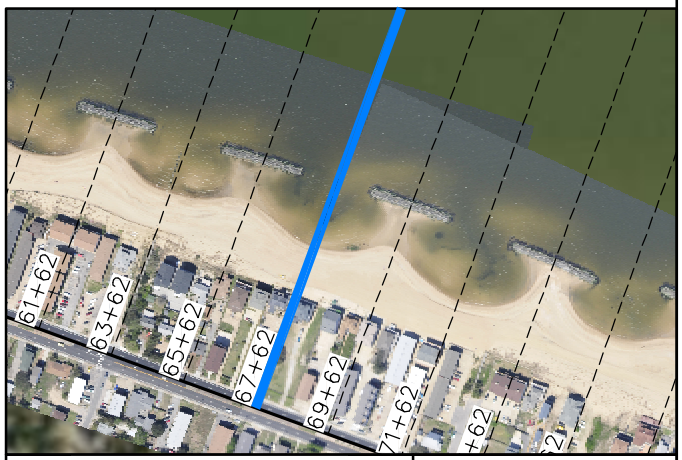

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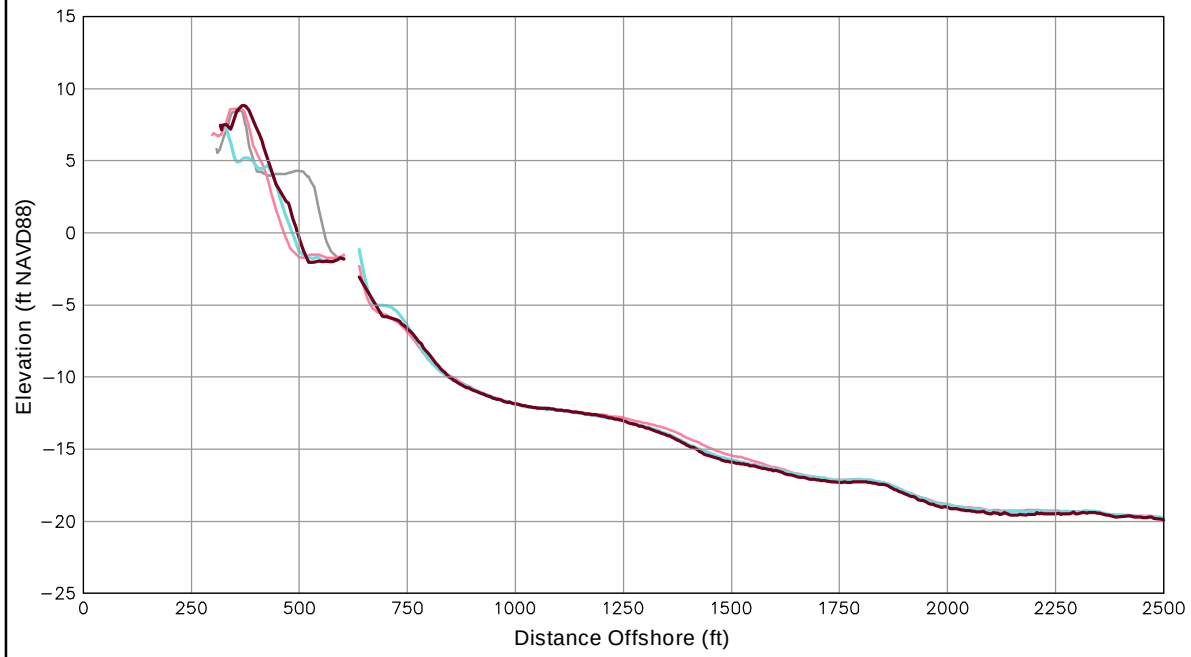
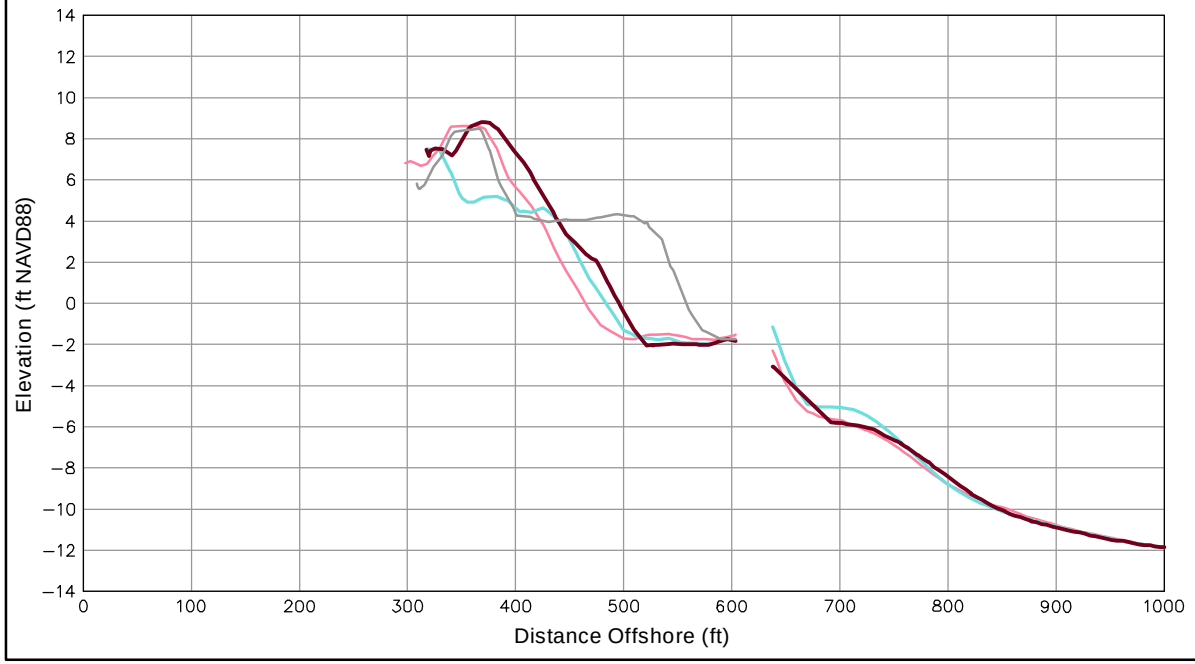
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 69+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	29.95 ft/yr	14.76 ft
Volume Change Above -15 ft NAVD88	4.55 cy/ft/yr	8.59 cy/ft
Volume Change Above 0 ft NAVD88	6.09 cy/ft/yr	10.31 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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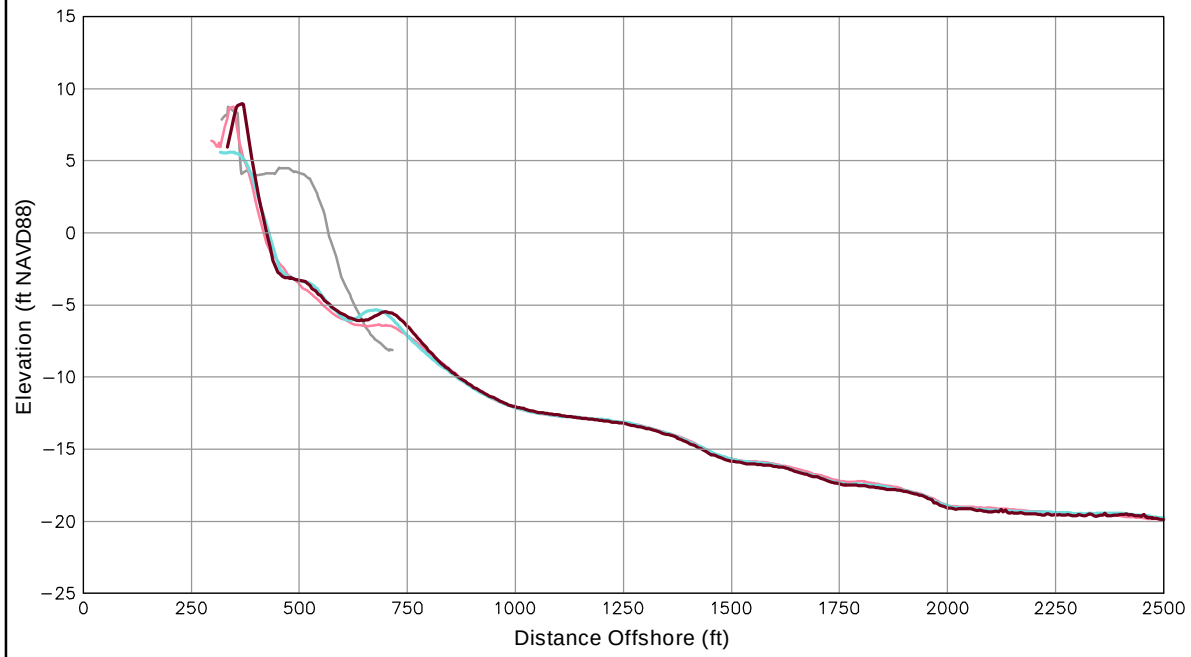
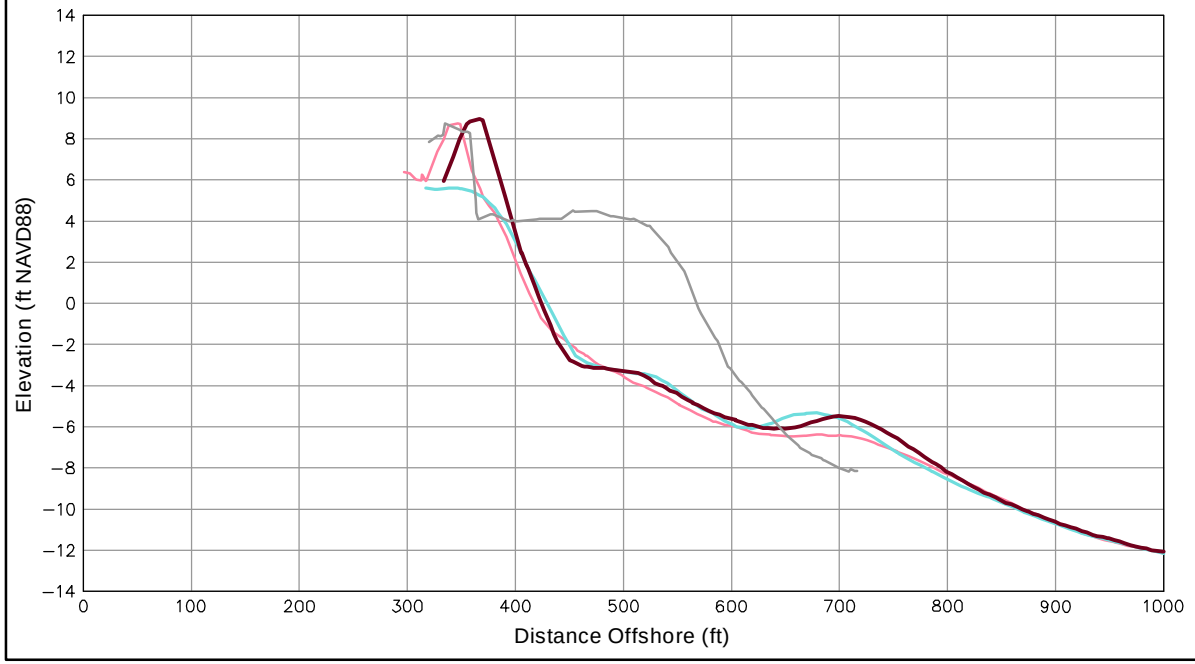
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 71+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	7.53 ft/yr	-2.39 ft
Volume Change Above -15 ft NAVD88	8.34 cy/ft/yr	5.73 cy/ft
Volume Change Above 0 ft NAVD88	3.80 cy/ft/yr	5.37 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
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- POST-FILL

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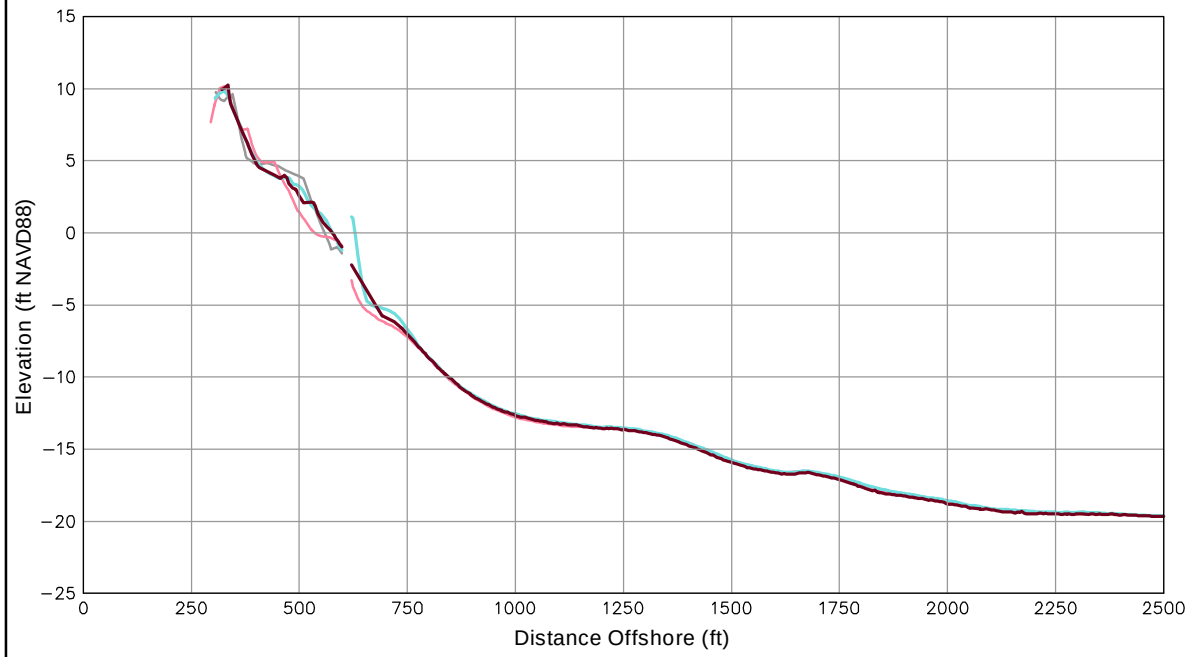
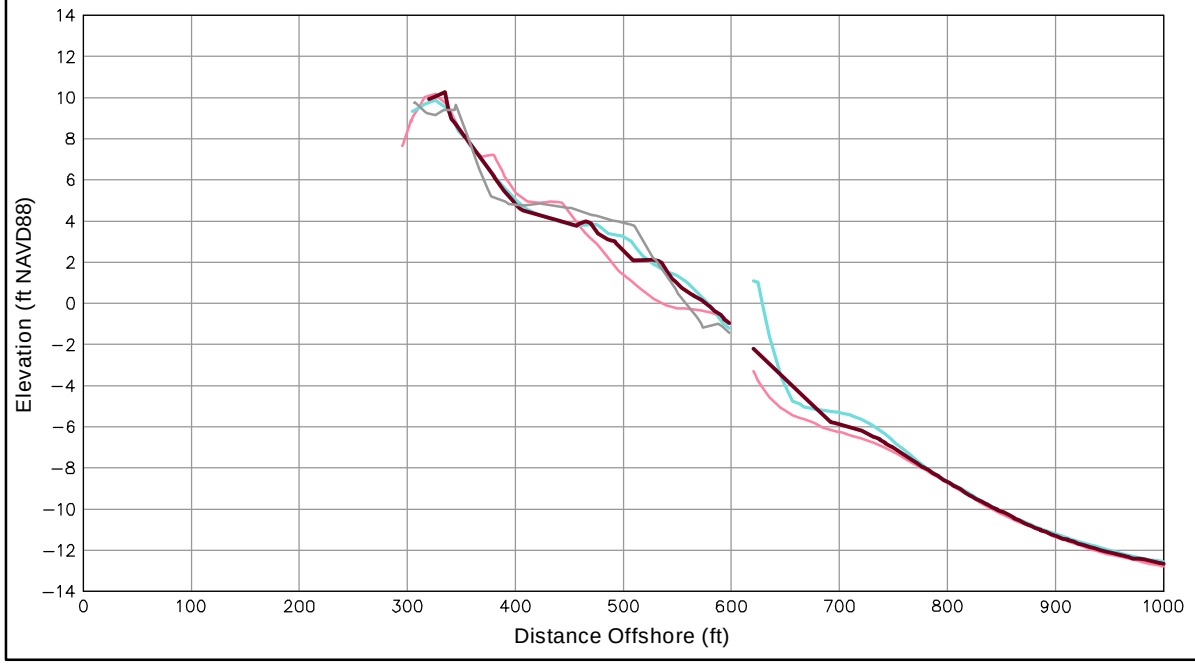
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 73+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	37.06 ft/yr	-10.03 ft
Volume Change Above -15 ft NAVD88	6.96 cy/ft/yr	-5.84 cy/ft
Volume Change Above 0 ft NAVD88	2.02 cy/ft/yr	-1.23 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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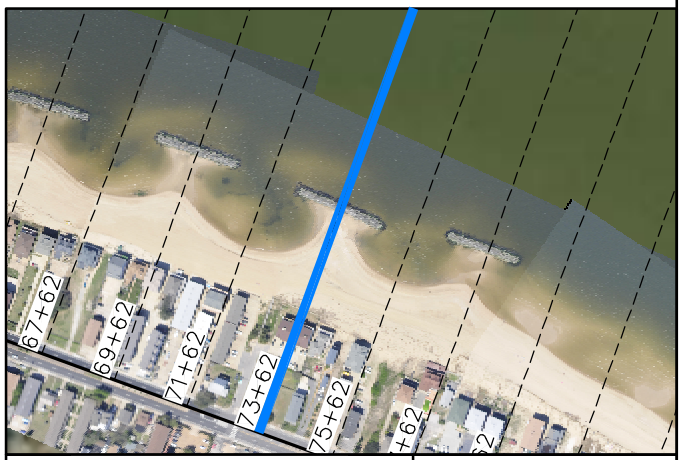
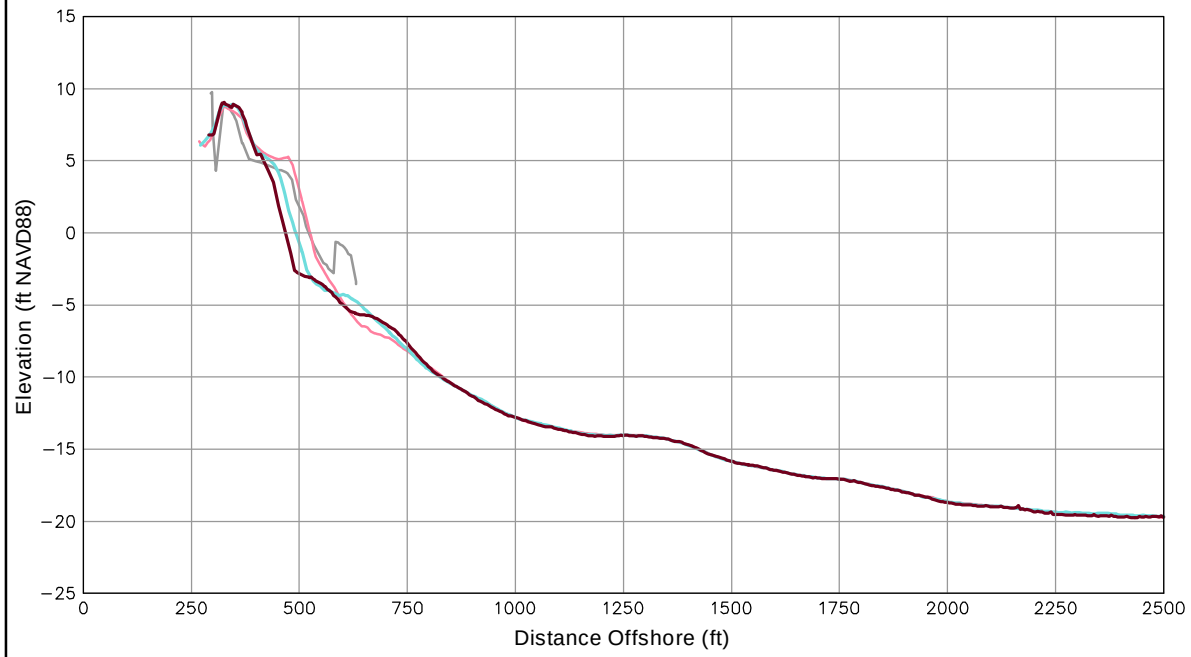
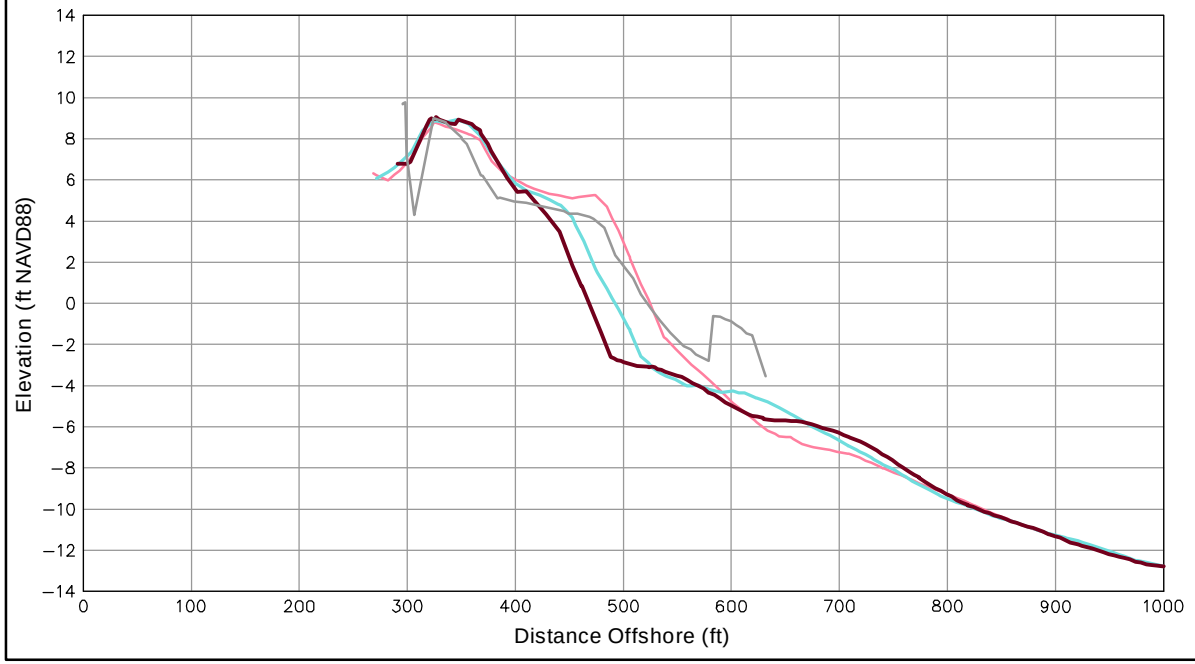


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 75+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-52.47 ft/yr	-21.27 ft
Volume Change Above -15 ft NAVD88	-14.24 cy/ft/yr	-4.12 cy/ft
Volume Change Above 0 ft NAVD88	-9.76 cy/ft/yr	-4.12 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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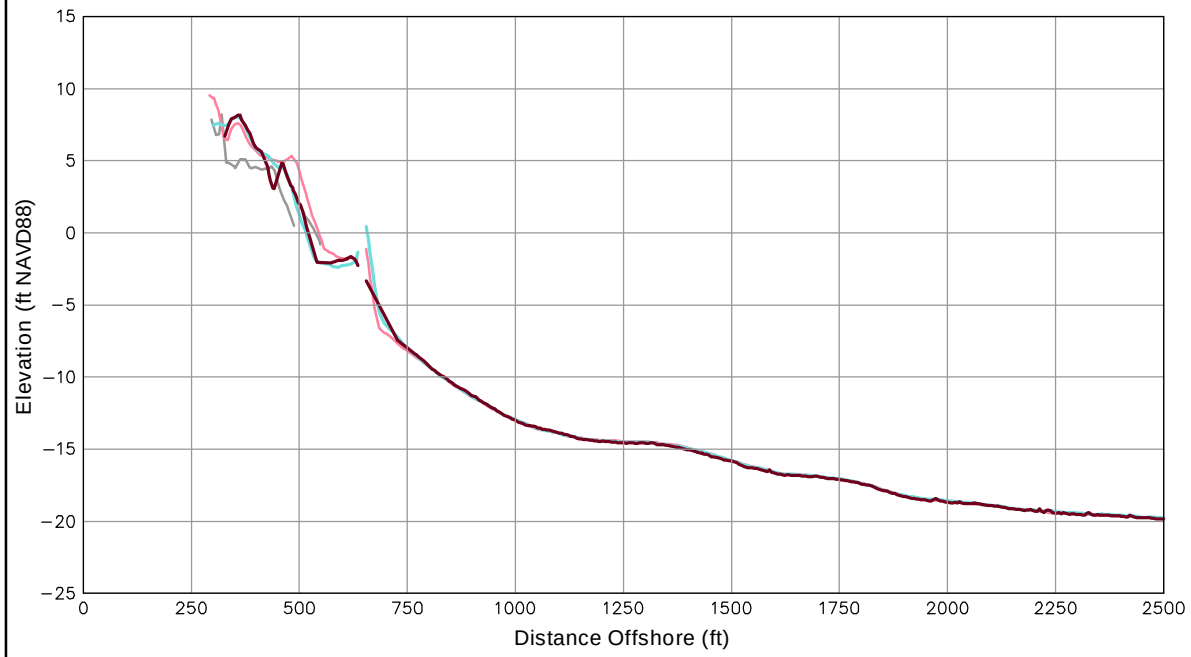
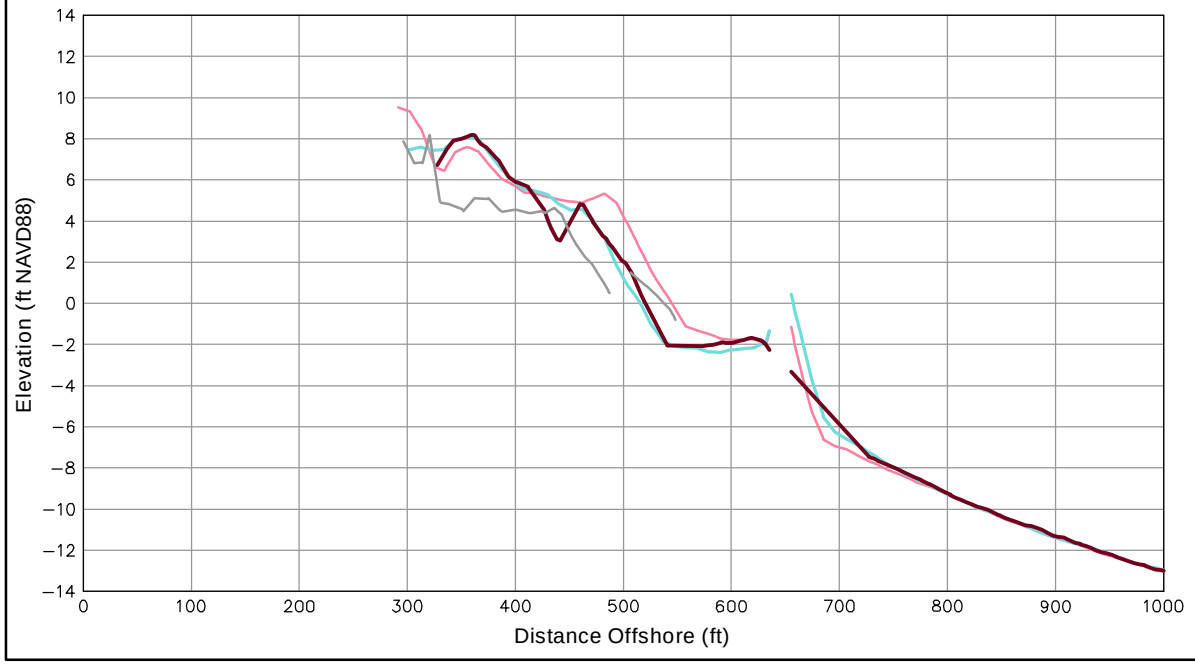
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 77+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-19.59 ft/yr	8.71 ft
Volume Change Above -15 ft NAVD88	-5.58 cy/ft/yr	-0.99 cy/ft
Volume Change Above 0 ft NAVD88	-4.54 cy/ft/yr	-0.60 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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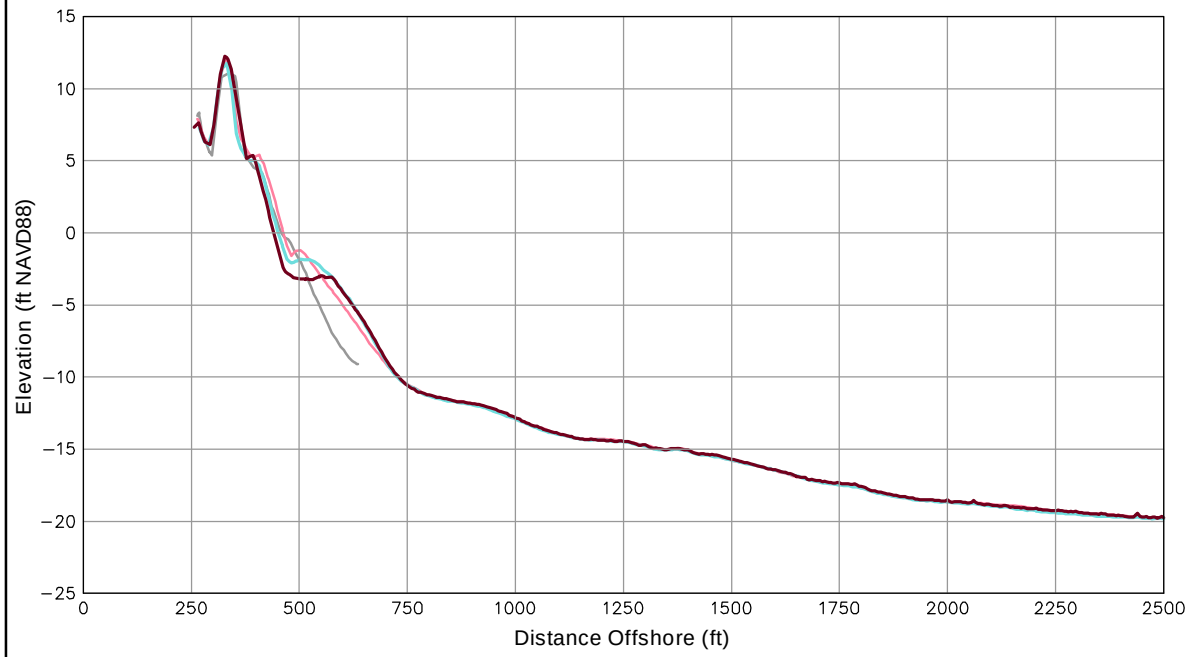

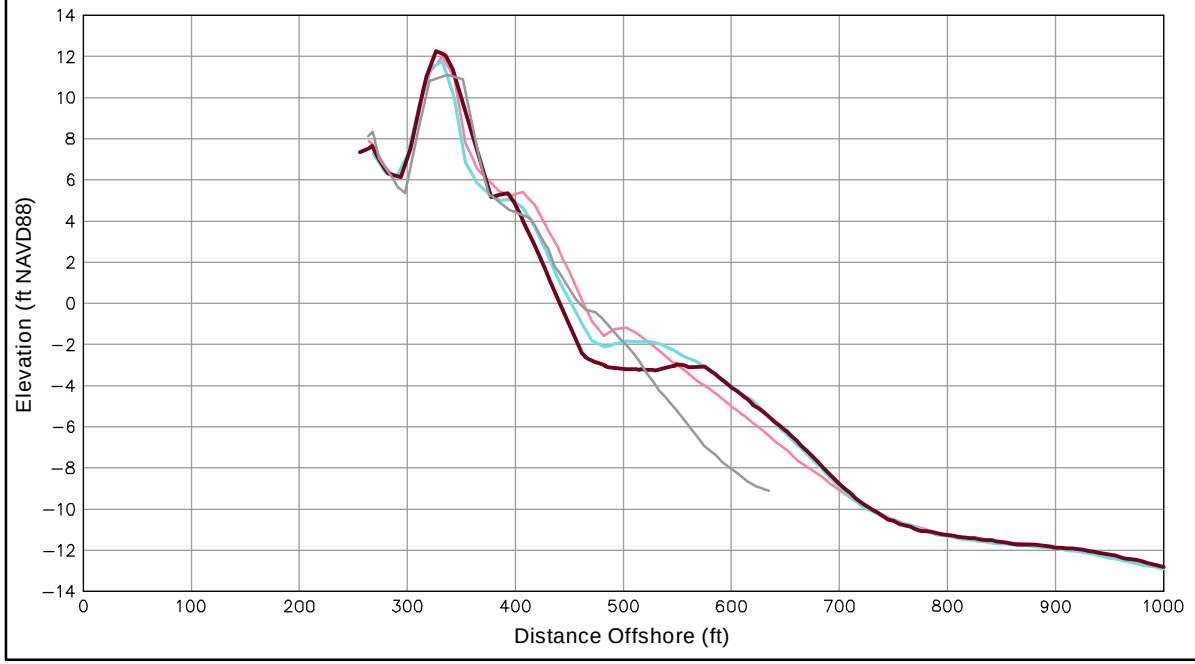

Survey Transect 79+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-20.47 ft/yr	-8.98 ft
Volume Change Above -15 ft NAVD88	-4.46 cy/ft/yr	-2.11 cy/ft
Volume Change Above 0 ft NAVD88	-2.92 cy/ft/yr	1.01 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
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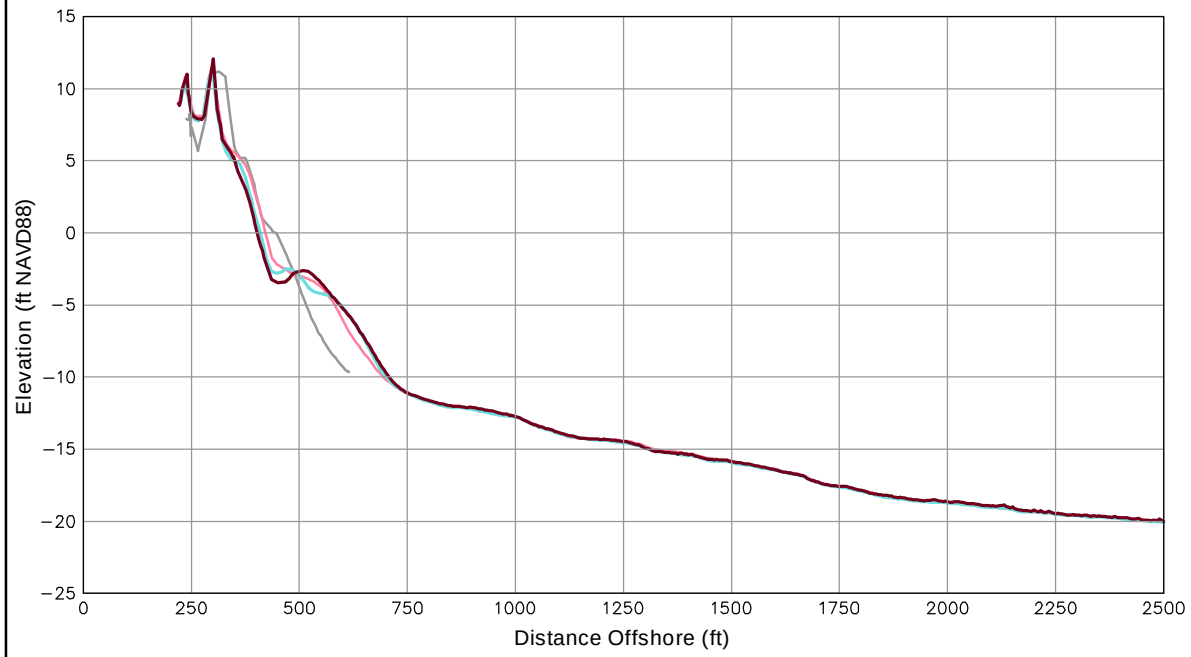

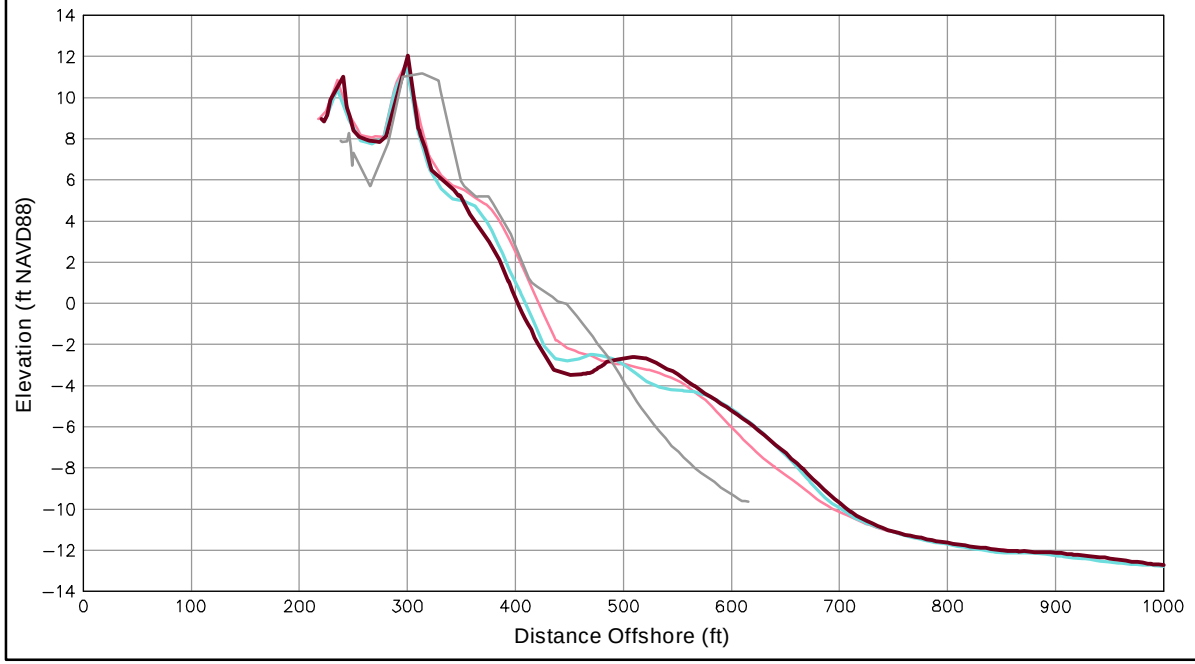

Survey Transect 81+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-17.75 ft/yr	-6.02 ft
Volume Change Above -15 ft NAVD88	-2.79 cy/ft/yr	1.82 cy/ft
Volume Change Above 0 ft NAVD88	-4.69 cy/ft/yr	-0.50 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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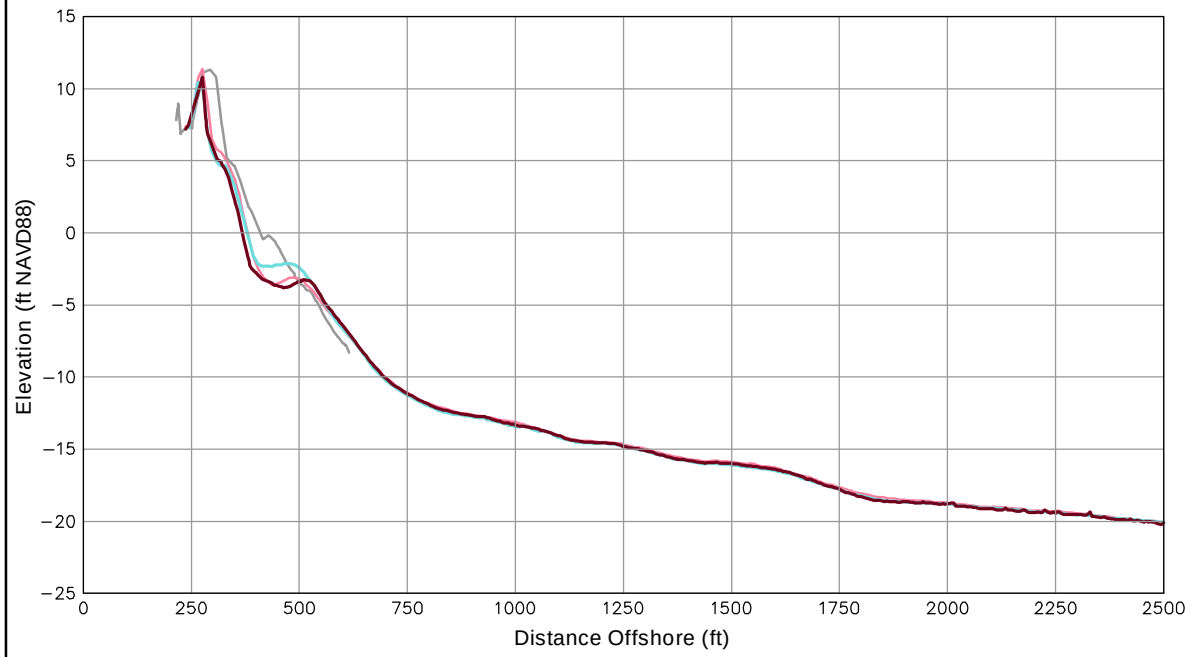

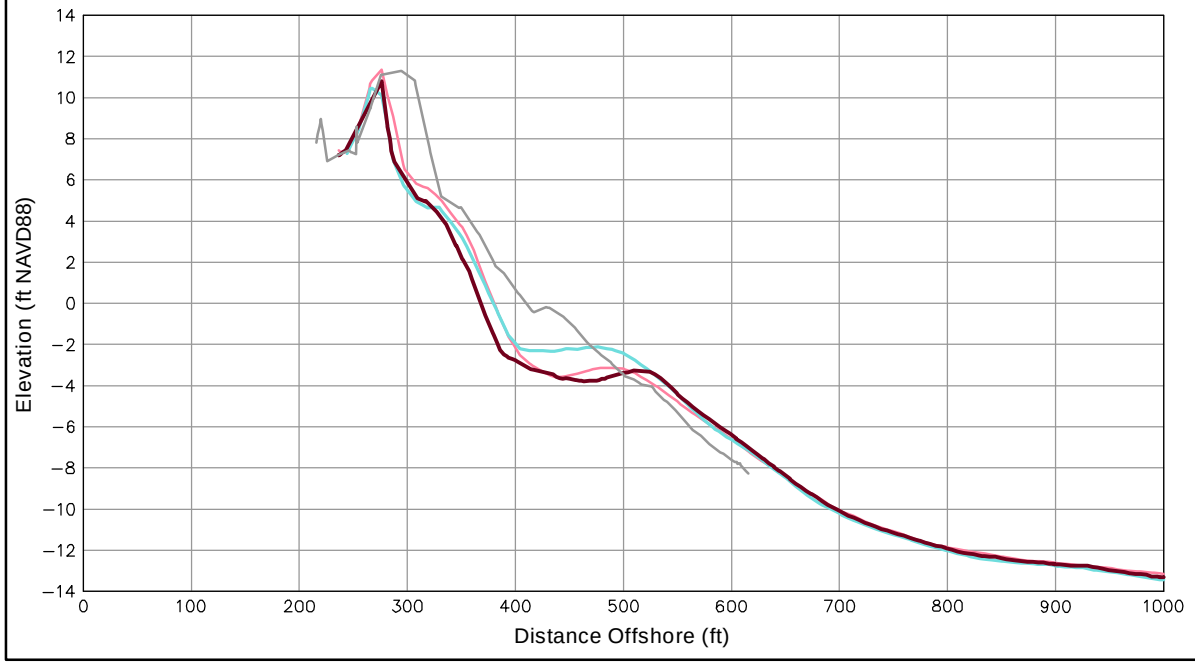

Survey Transect 83+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-10.66 ft/yr	-9.88 ft
Volume Change Above -15 ft NAVD88	-6.64 cy/ft/yr	-5.01 cy/ft
Volume Change Above 0 ft NAVD88	-4.22 cy/ft/yr	-1.16 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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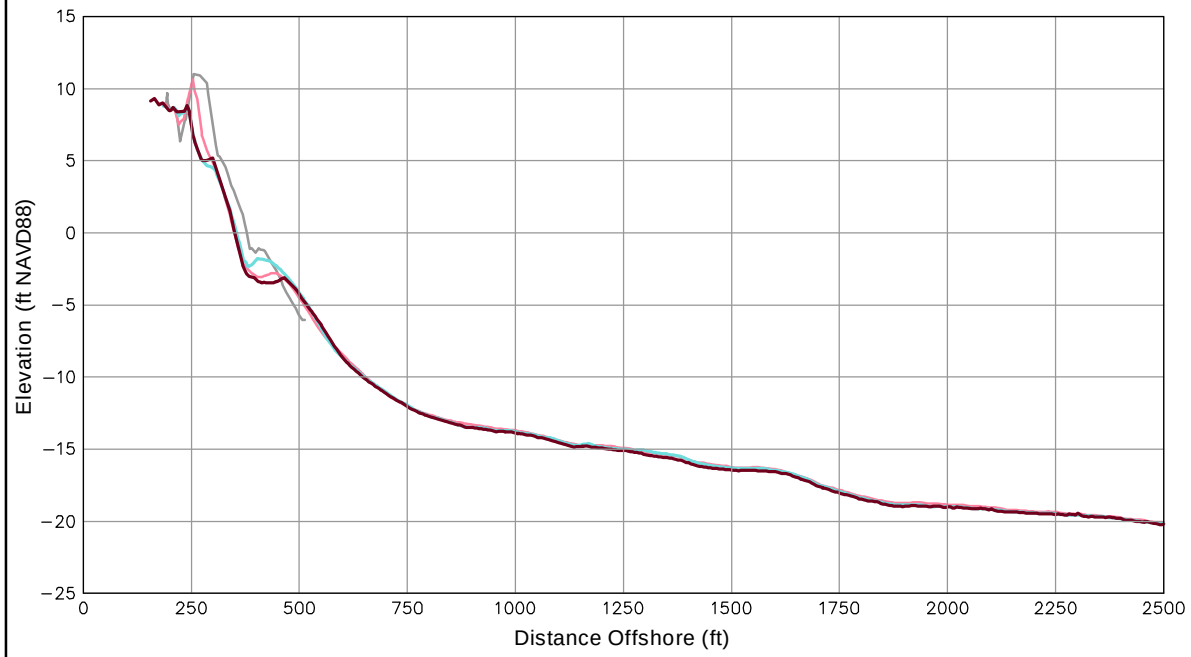
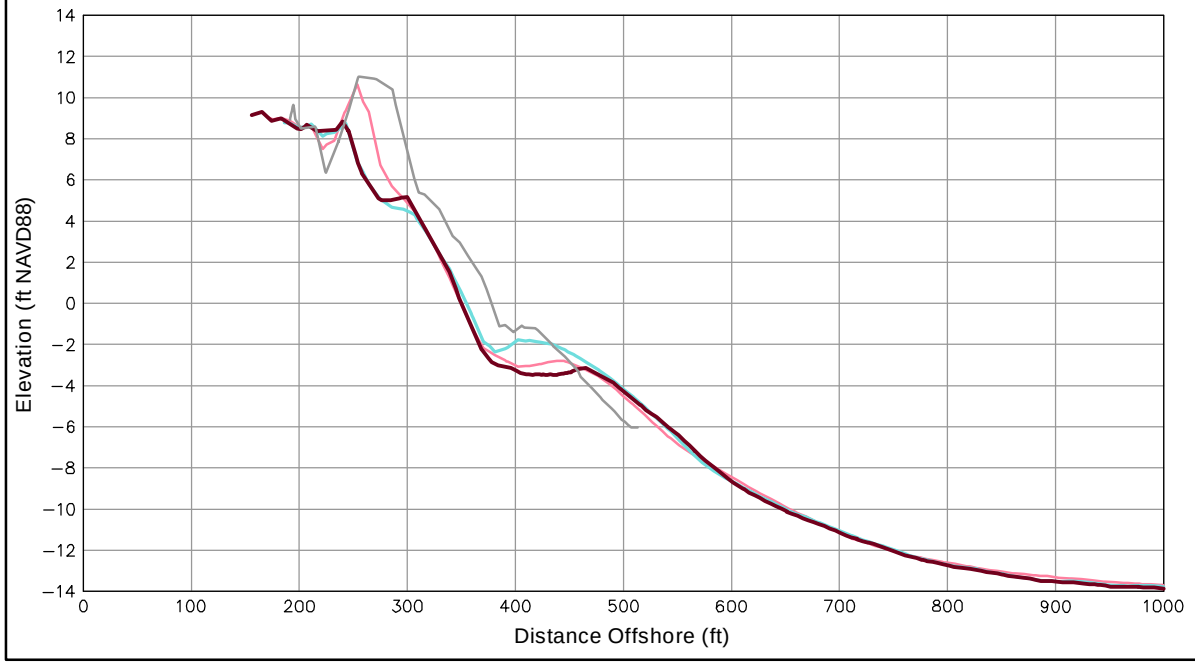
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 85+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	1.69 ft/yr	-2.53 ft
Volume Change Above -15 ft NAVD88	-6.65 cy/ft/yr	-5.60 cy/ft
Volume Change Above 0 ft NAVD88	-3.15 cy/ft/yr	0.38 cy/ft

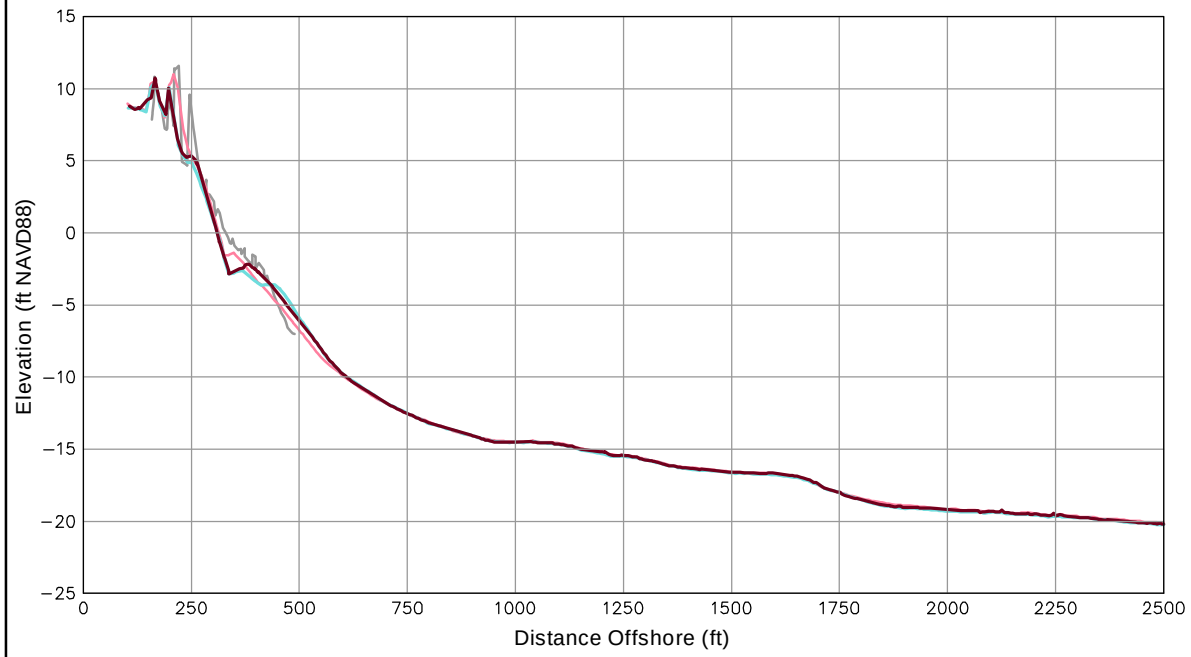
LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

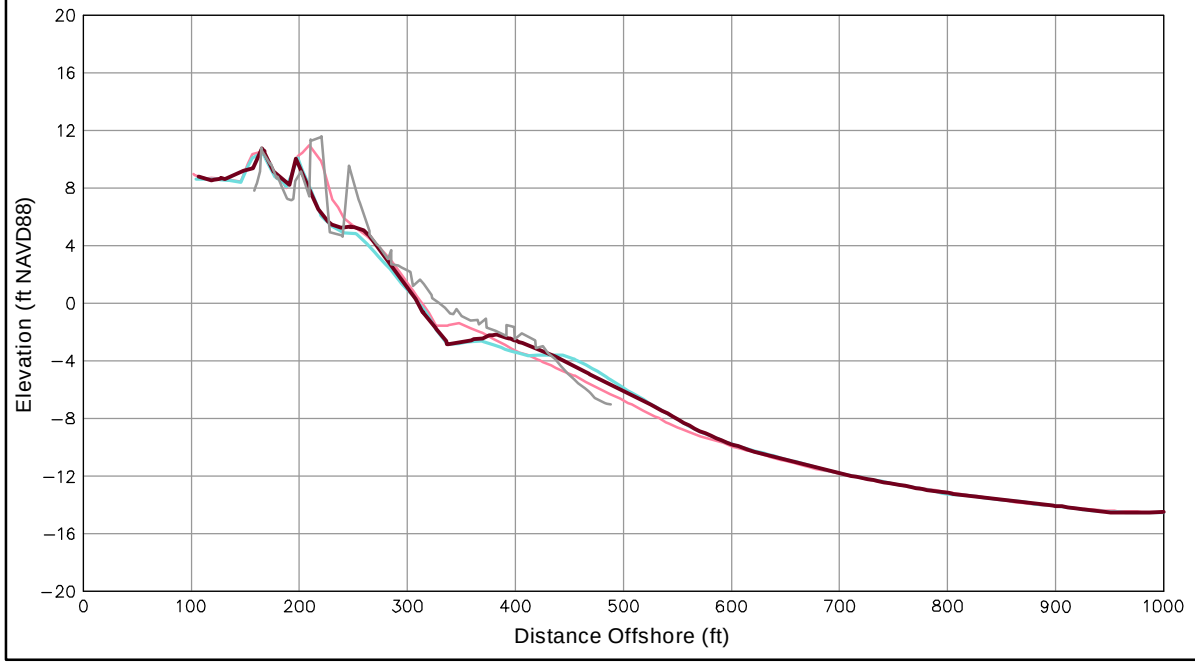
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To October 2009 and March 2010.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were 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	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-3.07 ft/yr	1.51 ft
Volume Change Above -15 ft NAVD88	-1.05 cy/ft/yr	1.94 cy/ft
Volume Change Above 0 ft NAVD88	-3.83 cy/ft/yr	1.32 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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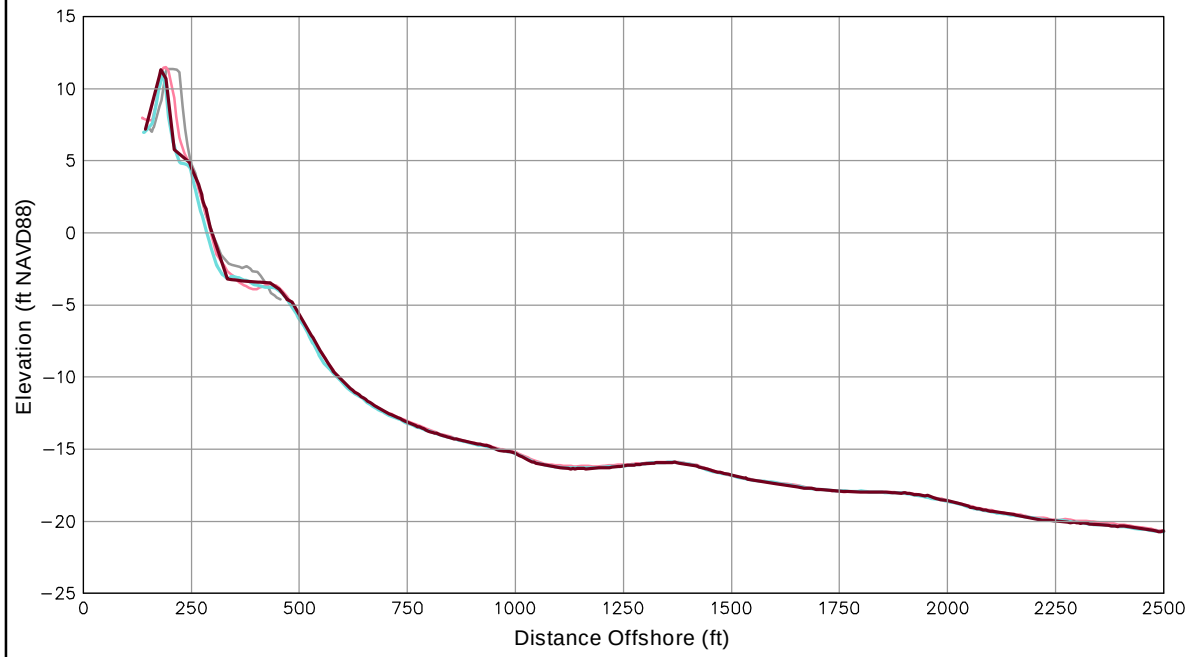
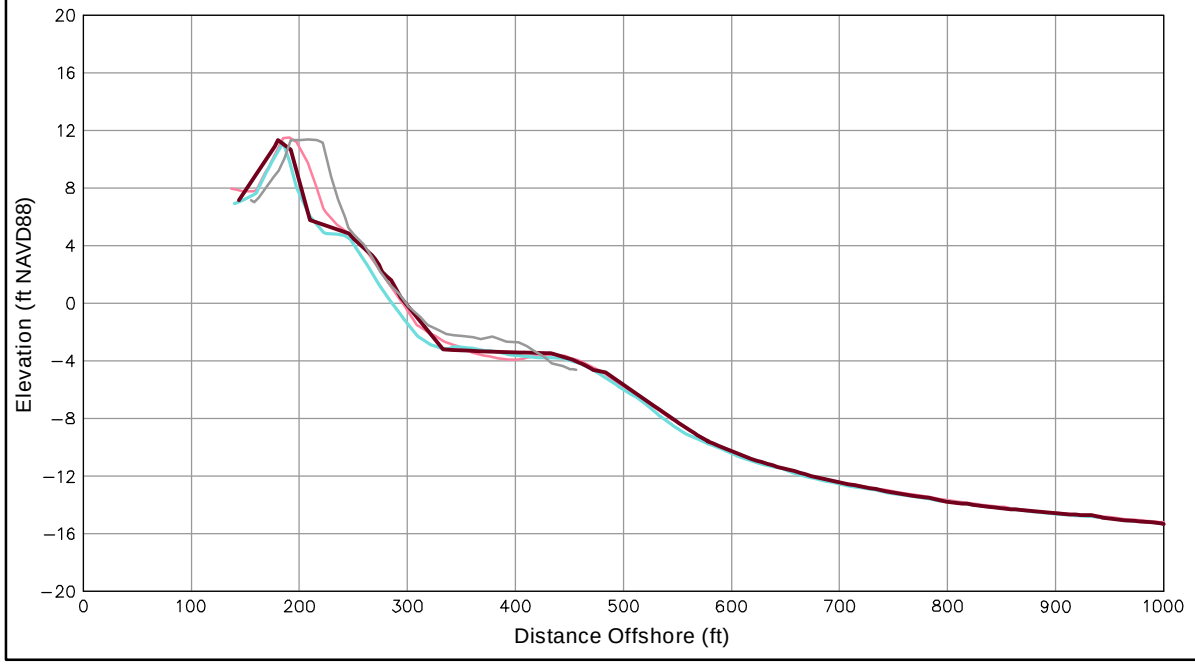
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 93+41	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	3.11 ft/yr	13.01 ft
Volume Change Above -15 ft NAVD88	-1.44 cy/ft/yr	8.05 cy/ft
Volume Change Above 0 ft NAVD88	-1.88 cy/ft/yr	4.04 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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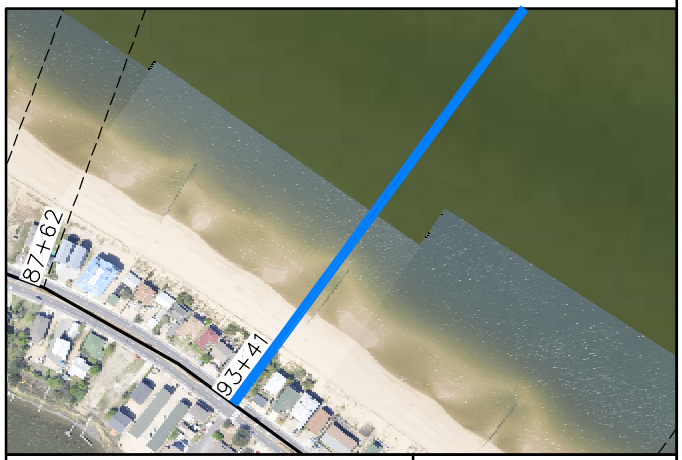

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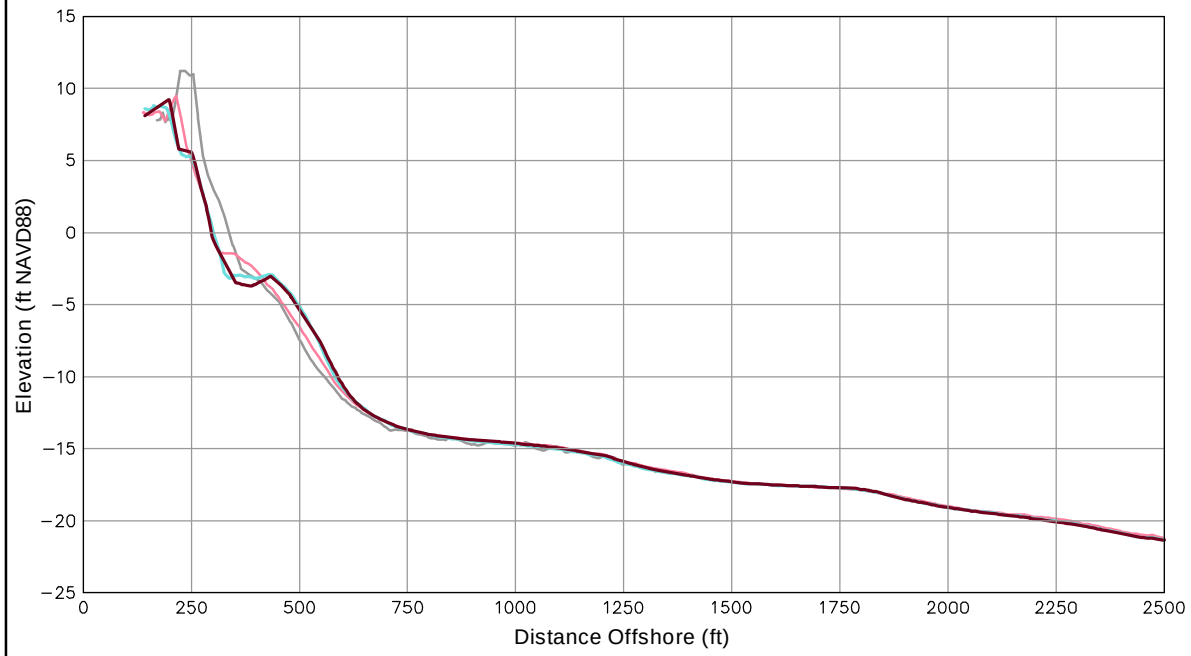
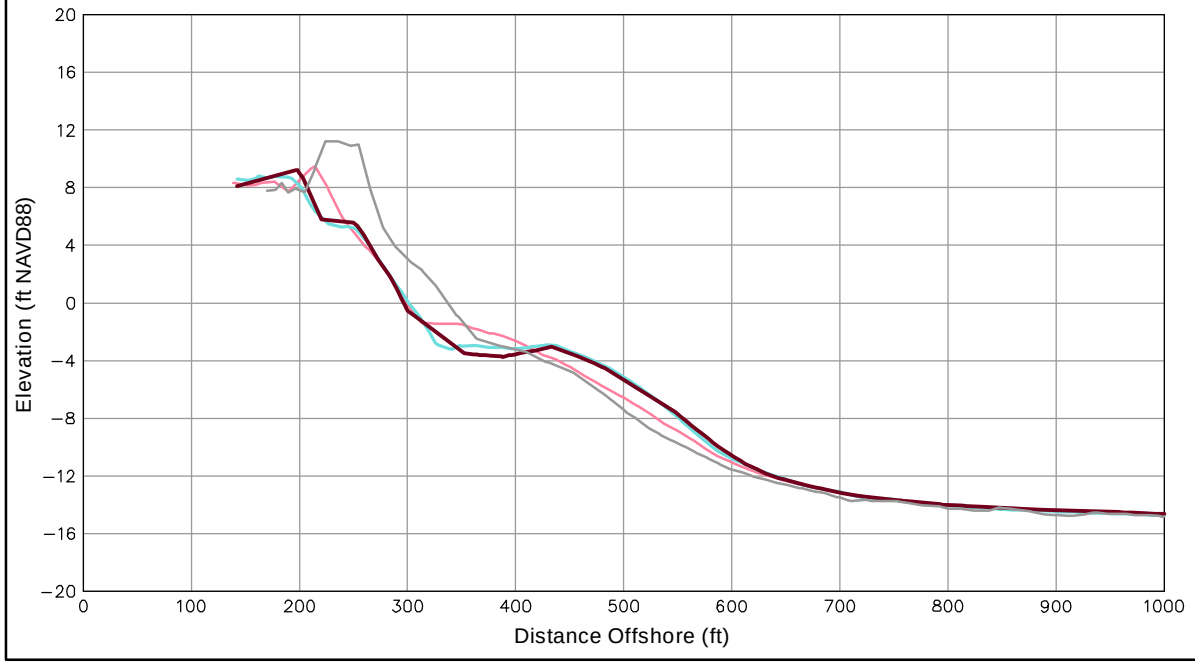
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 103+08	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	0.03 ft/yr	-2.51 ft
Volume Change Above -15 ft NAVD88	1.63 cy/ft/yr	0.69 cy/ft
Volume Change Above 0 ft NAVD88	-0.81 cy/ft/yr	0.71 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- 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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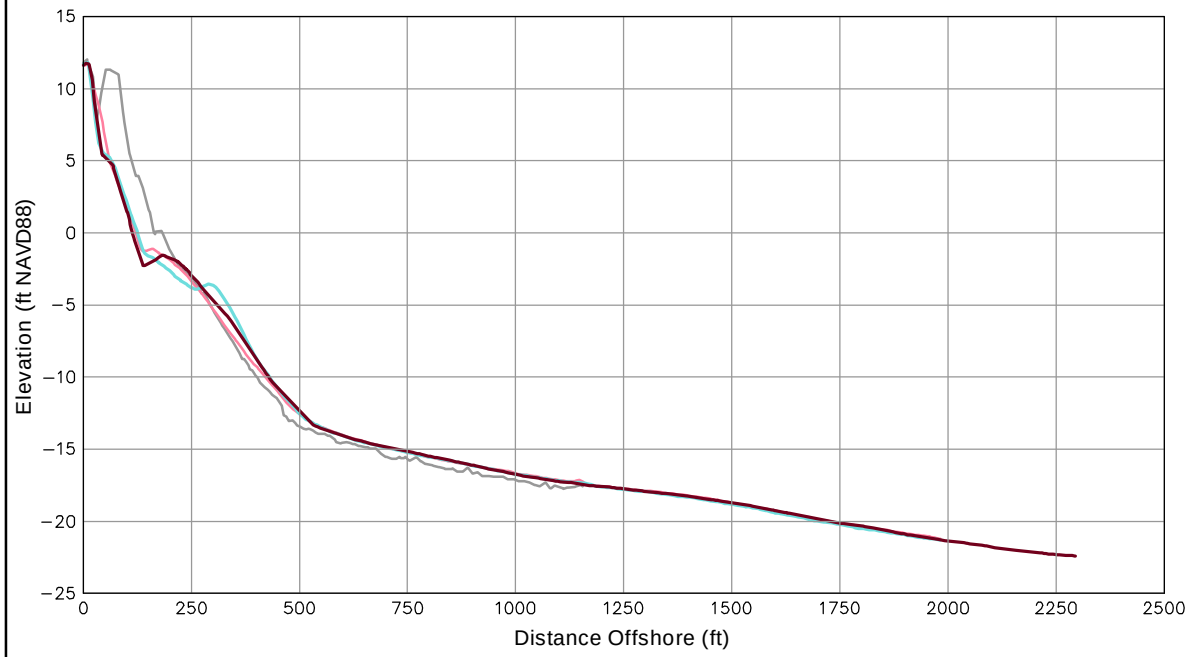
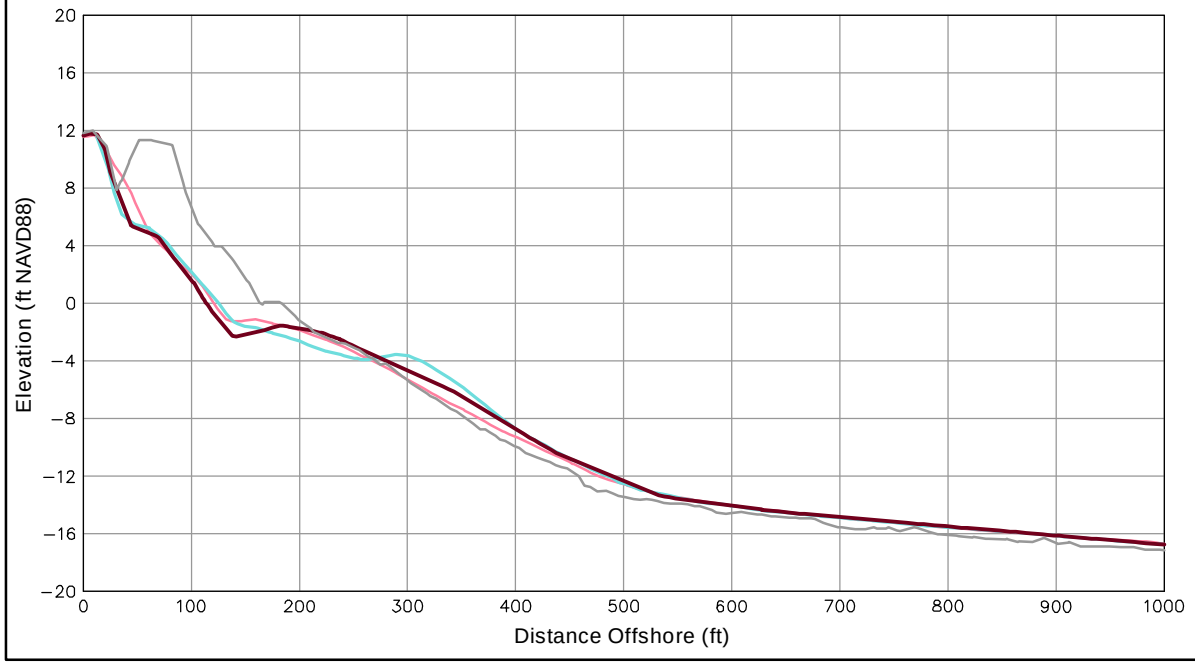
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 120+93	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-3.66 ft/yr	-3.90 ft
Volume Change Above -15 ft NAVD88	1.51 cy/ft/yr	-1.41 cy/ft
Volume Change Above 0 ft NAVD88	-2.13 cy/ft/yr	-0.67 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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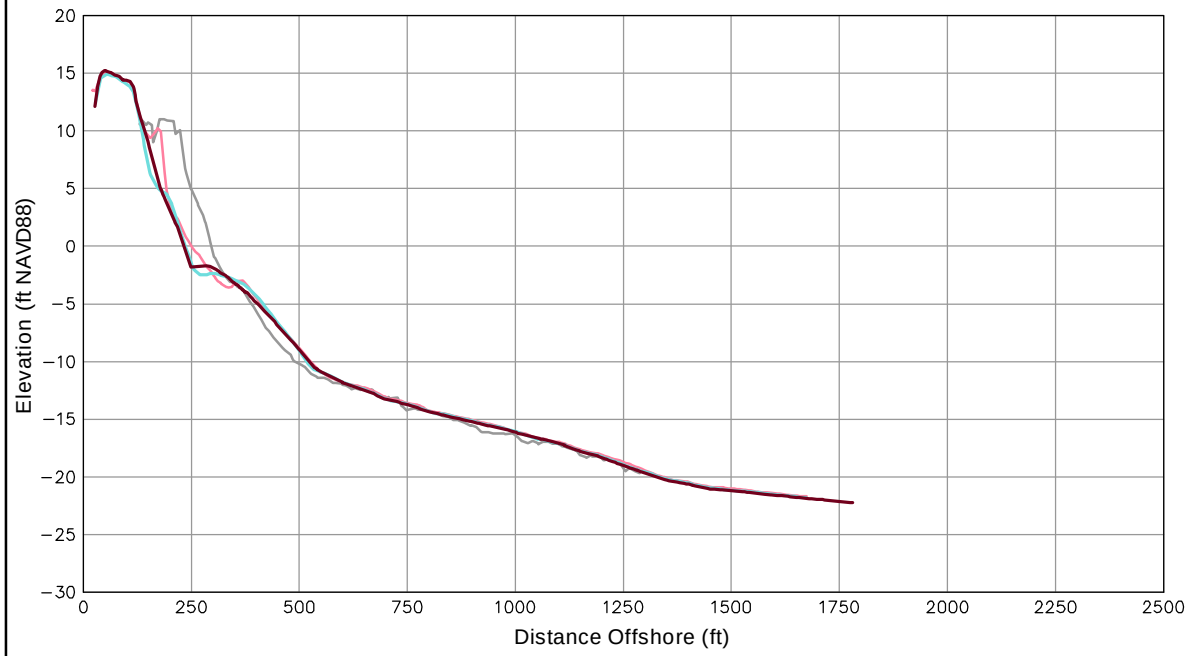
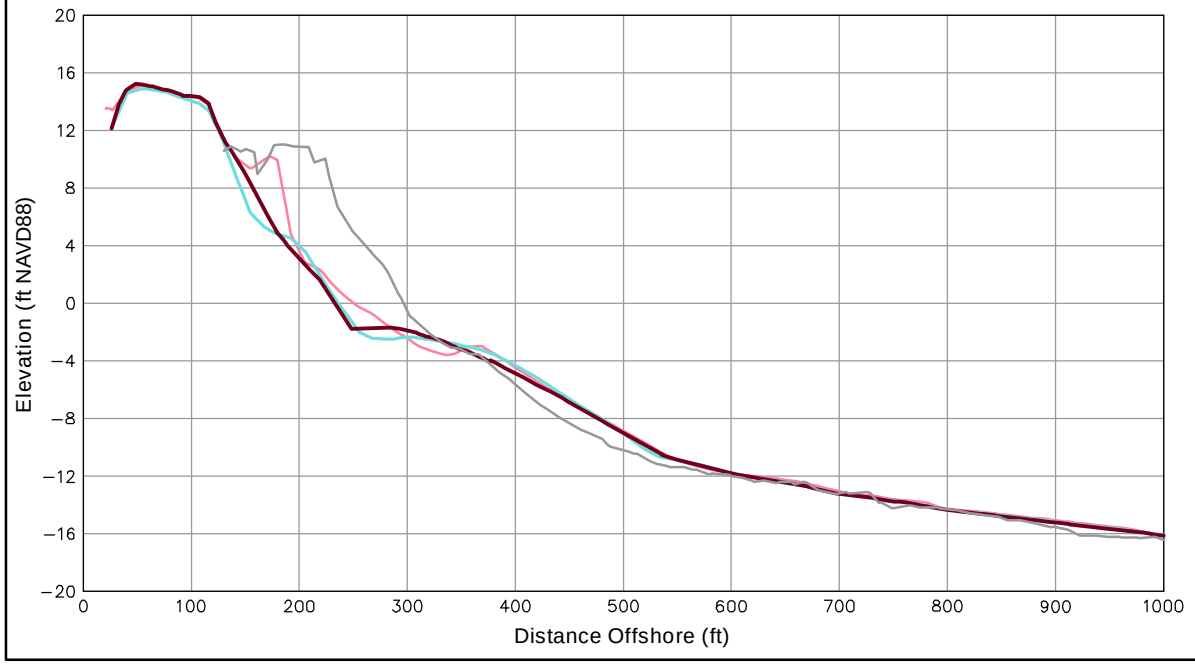
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 129+17	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-10.50 ft/yr	-3.16 ft
Volume Change Above -15 ft NAVD88	-9.07 cy/ft/yr	1.23 cy/ft
Volume Change Above 0 ft NAVD88	-5.70 cy/ft/yr	2.19 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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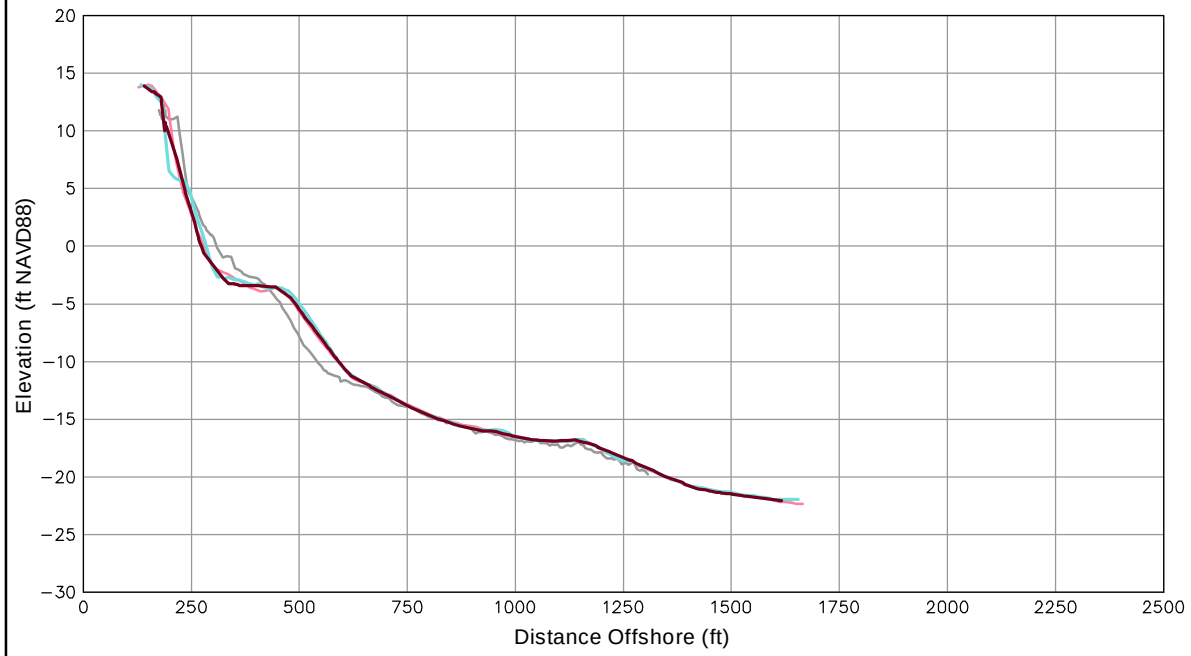
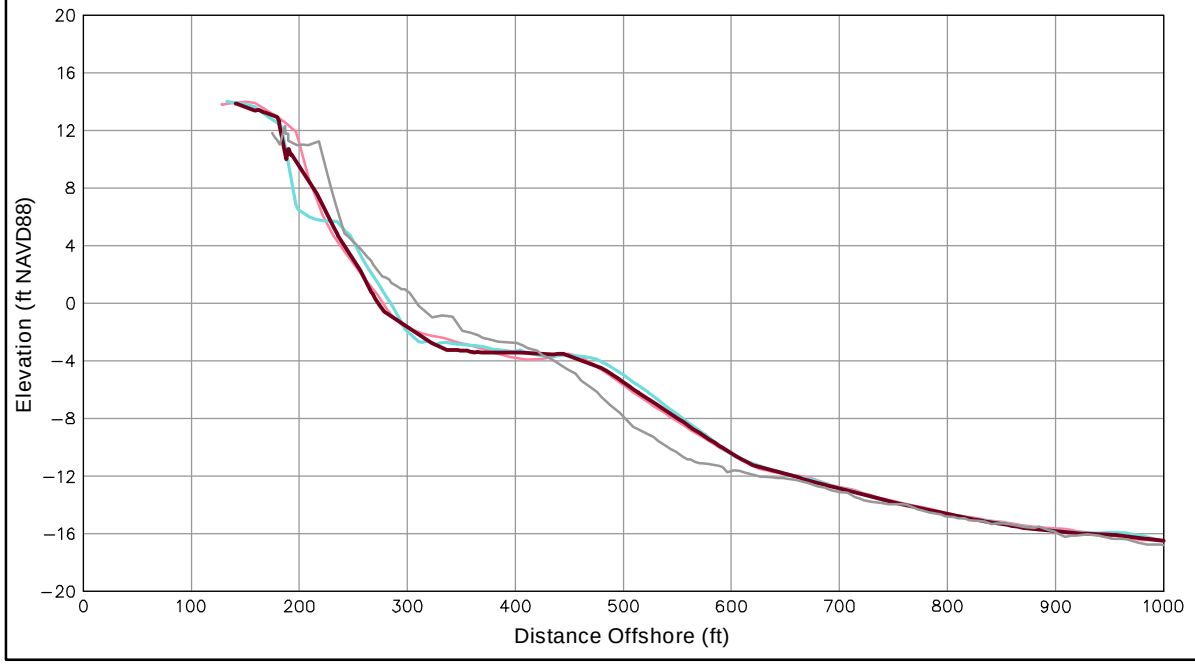
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 141+98	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-2.65 ft/yr	-10.76 ft
Volume Change Above -15 ft NAVD88	-1.58 cy/ft/yr	-2.12 cy/ft
Volume Change Above 0 ft NAVD88	-1.22 cy/ft/yr	0.67 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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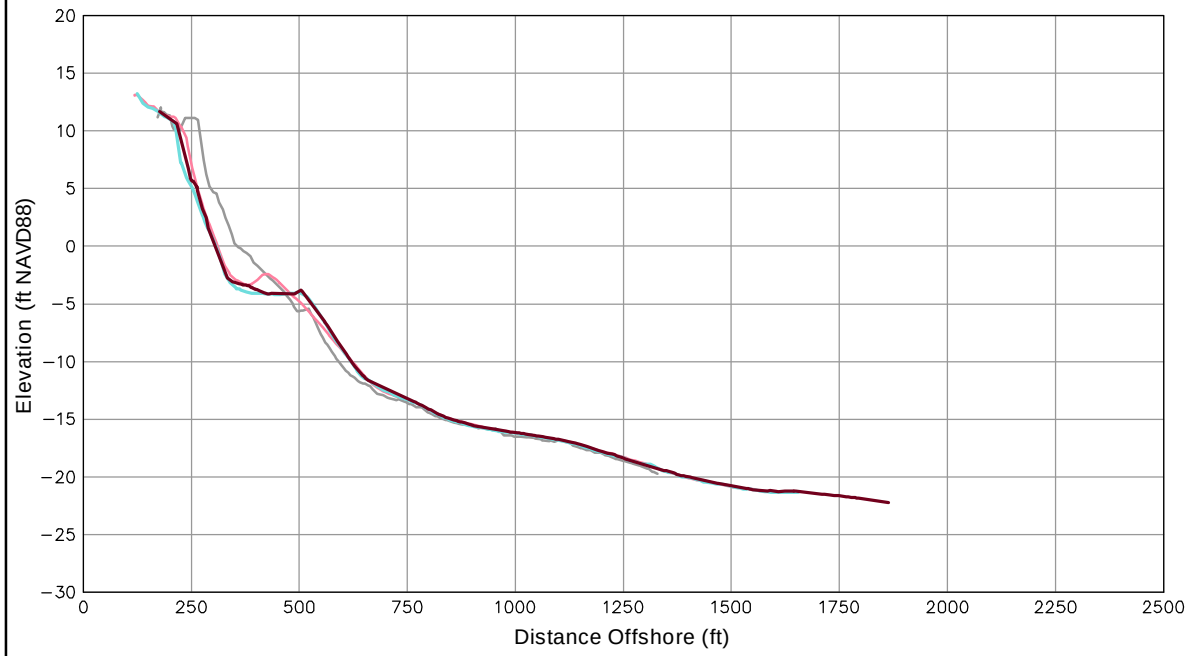
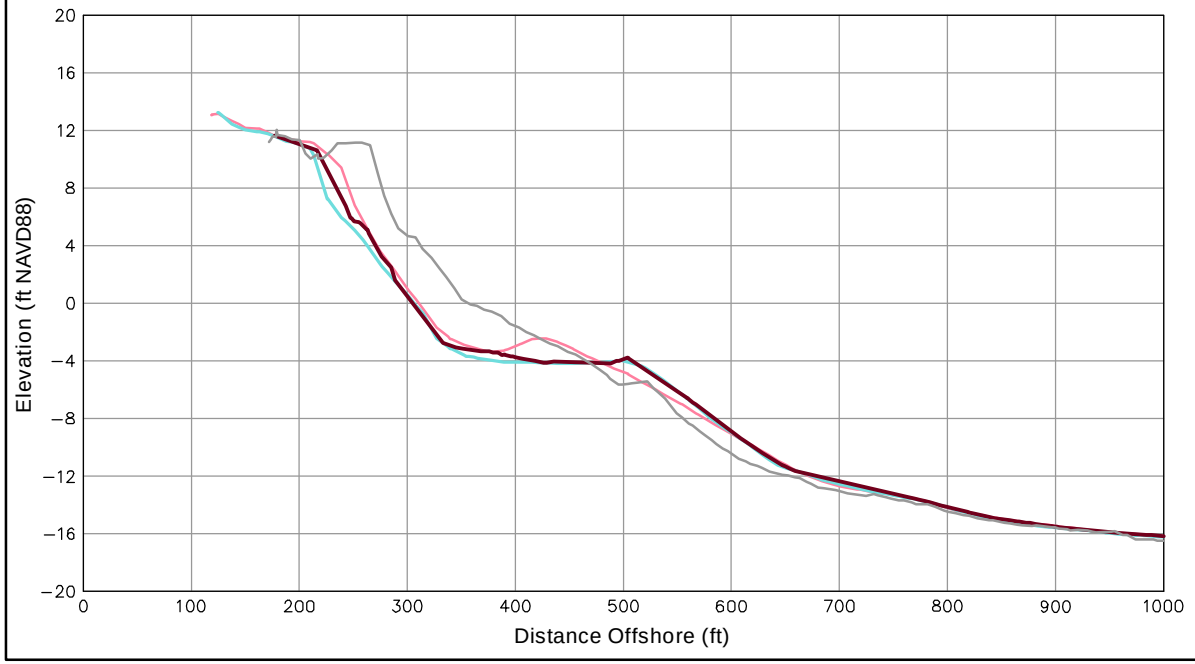
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 152+01	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-5.56 ft/yr	-0.53 ft
Volume Change Above -15 ft NAVD88	-3.34 cy/ft/yr	5.29 cy/ft
Volume Change Above 0 ft NAVD88	-2.70 cy/ft/yr	2.97 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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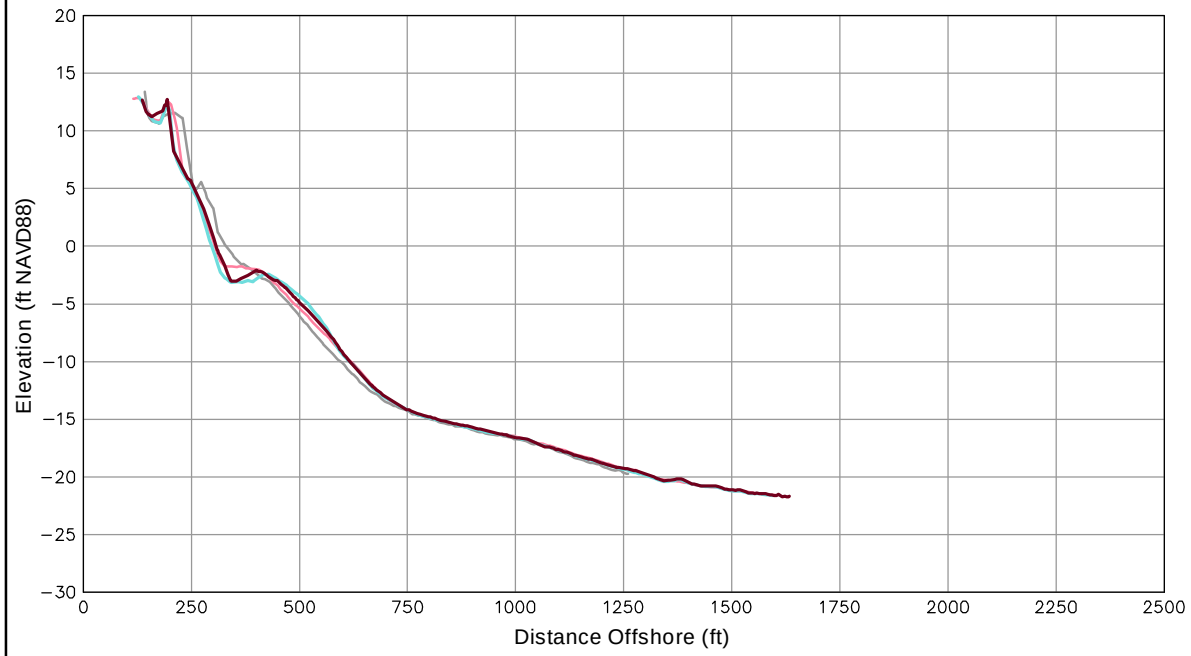
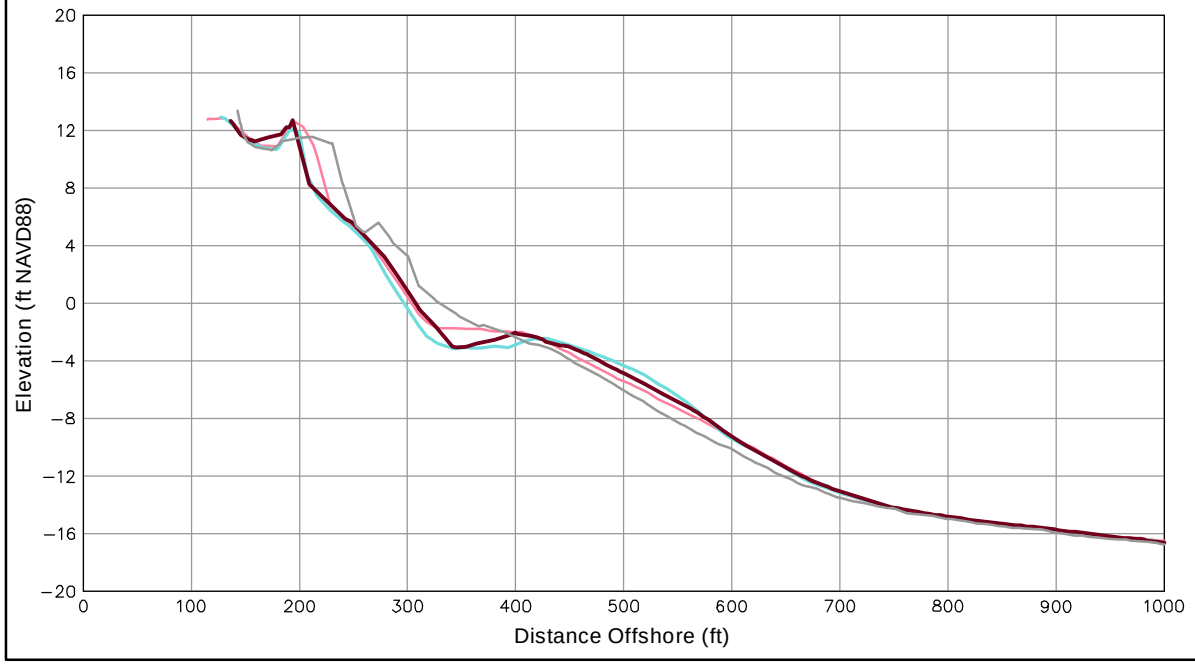
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 163+49	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	3.48 ft/yr	10.51 ft
Volume Change Above -15 ft NAVD88	-0.46 cy/ft/yr	3.78 cy/ft
Volume Change Above 0 ft NAVD88	-1.11 cy/ft/yr	2.61 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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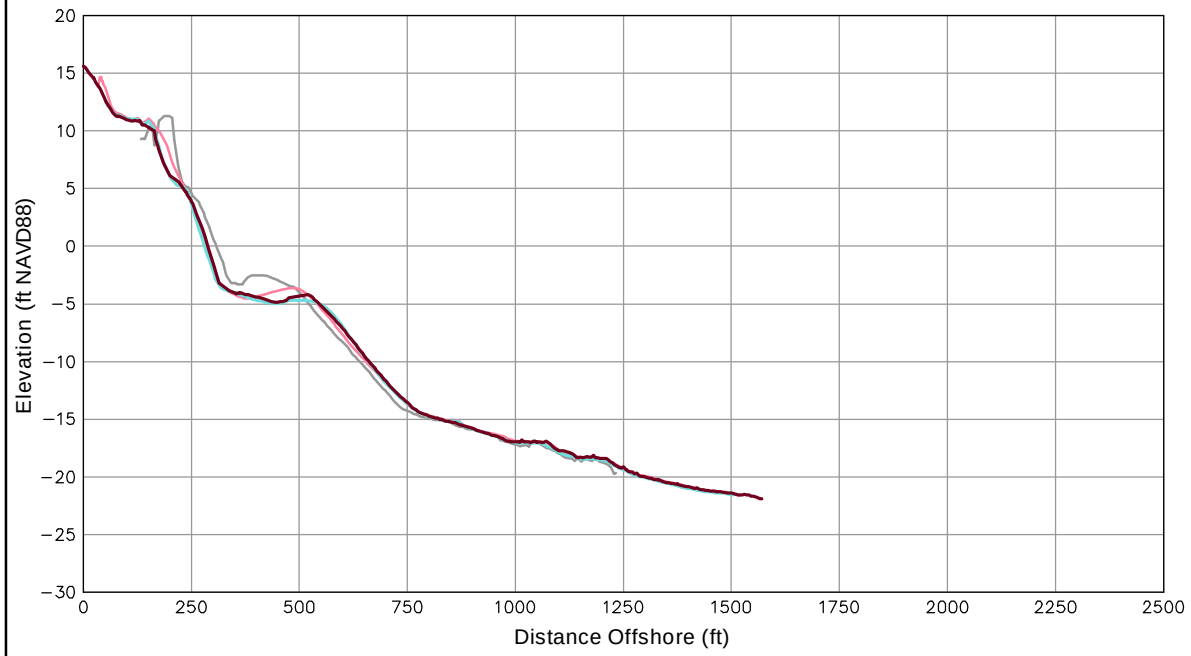
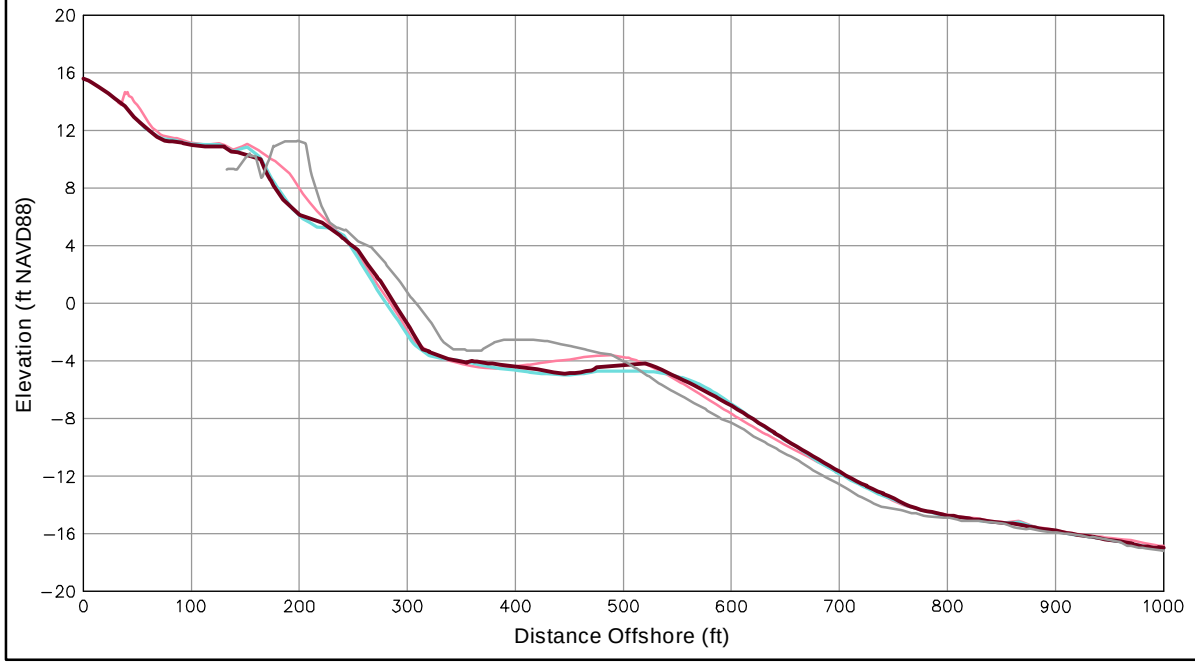
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 169+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	4.29 ft/yr	8.10 ft
Volume Change Above -15 ft NAVD88	-4.01 cy/ft/yr	3.06 cy/ft
Volume Change Above 0 ft NAVD88	-4.50 cy/ft/yr	0.40 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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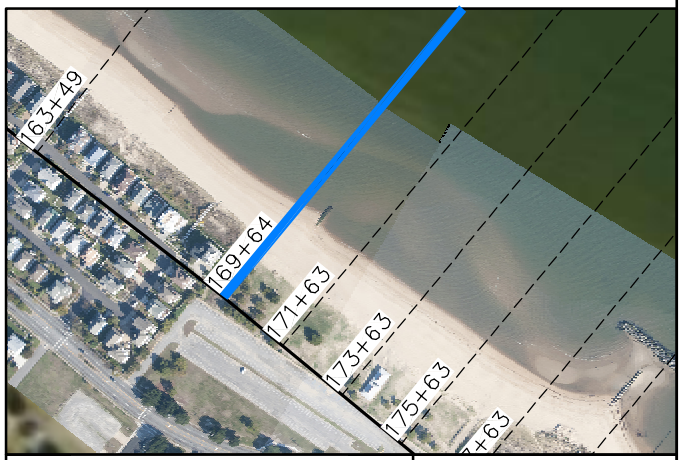

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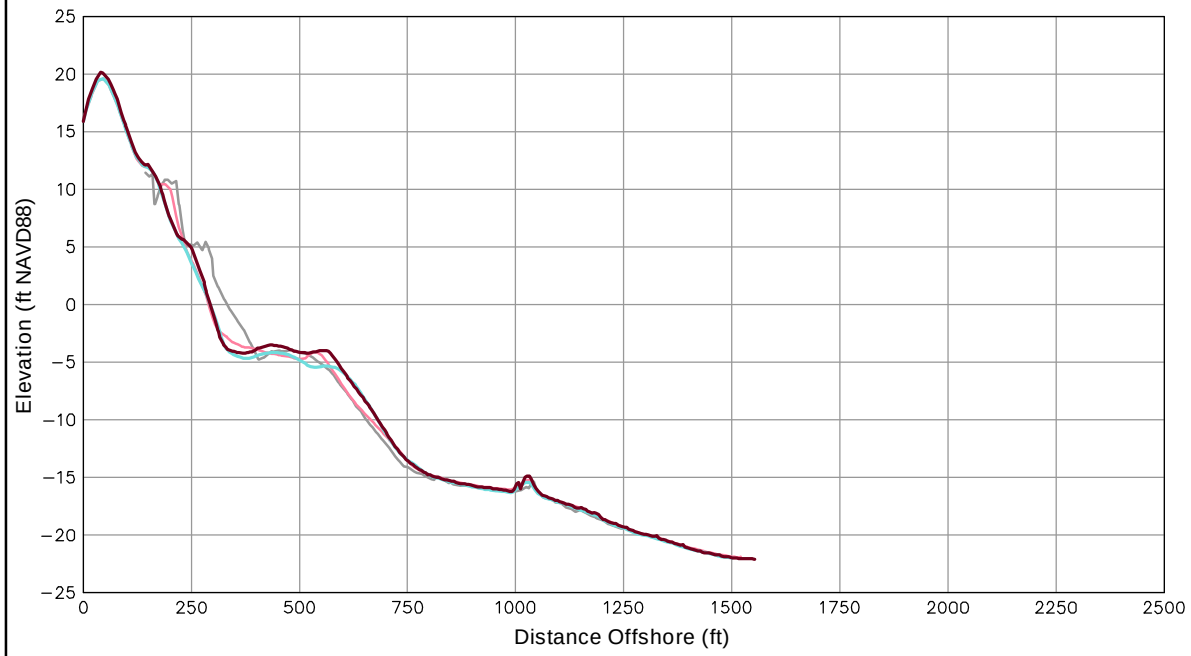

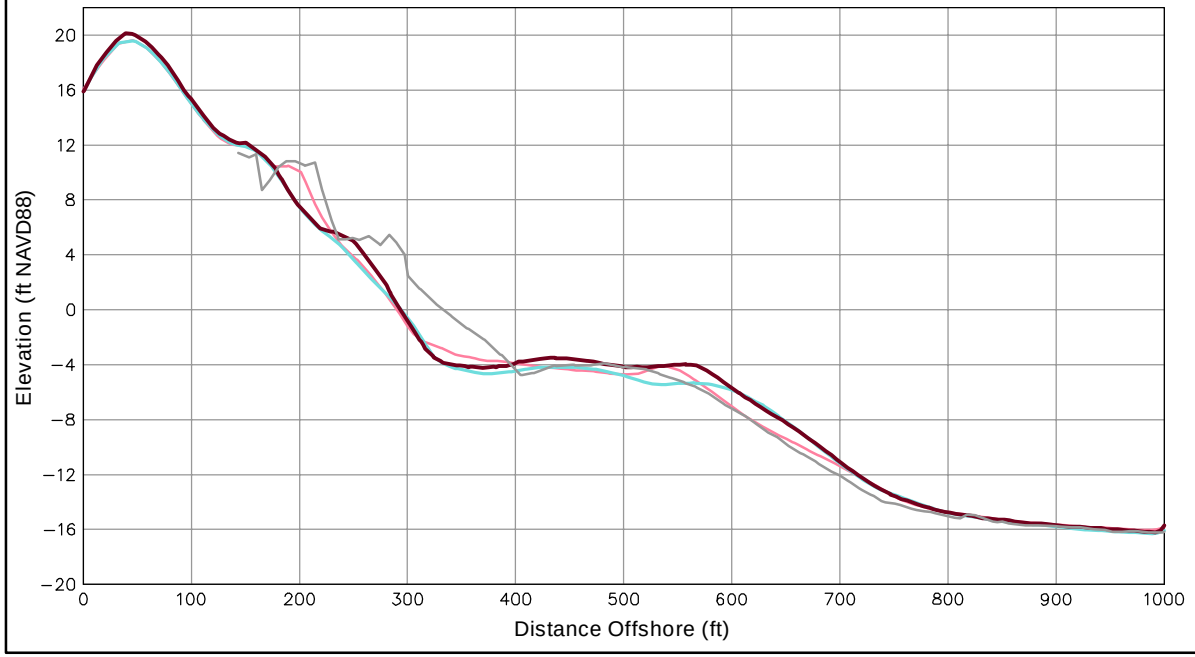

Survey Transect 171+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	4.13 ft/yr	3.23 ft
Volume Change Above -15 ft NAVD88	7.44 cy/ft/yr	10.48 cy/ft
Volume Change Above 0 ft NAVD88	0.79 cy/ft/yr	3.93 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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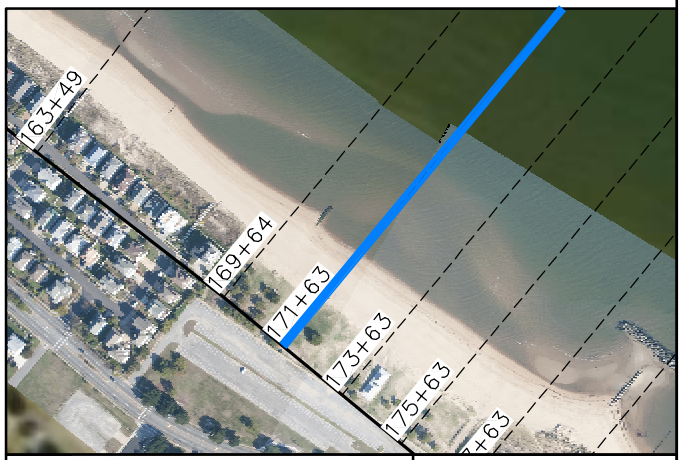

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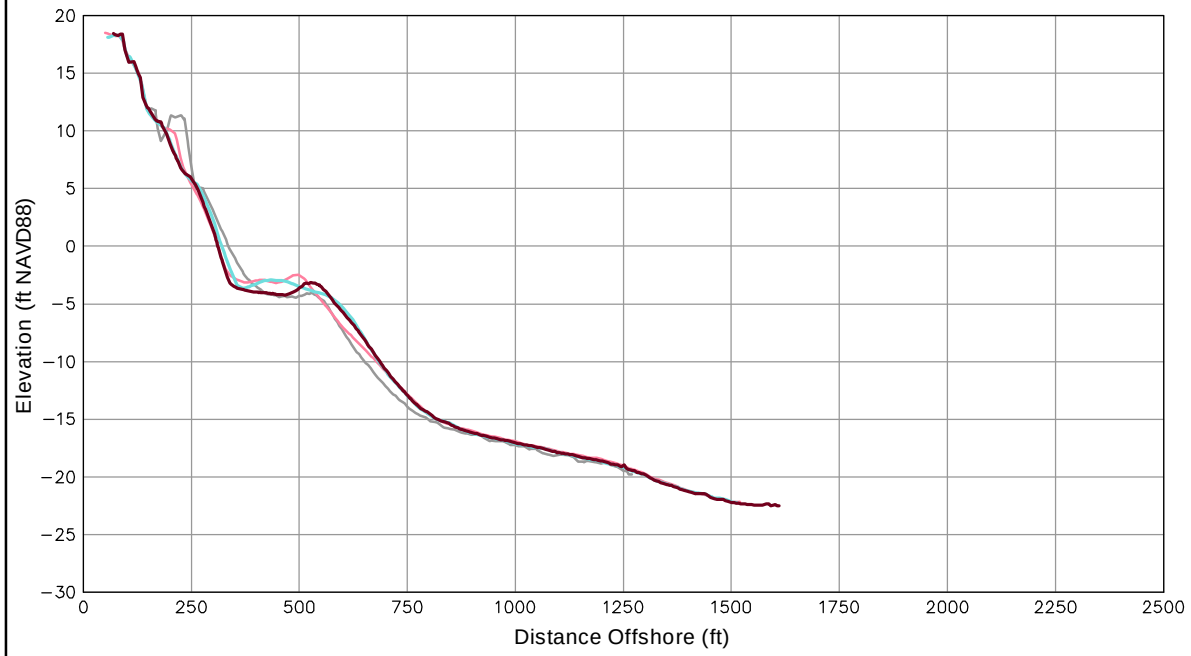

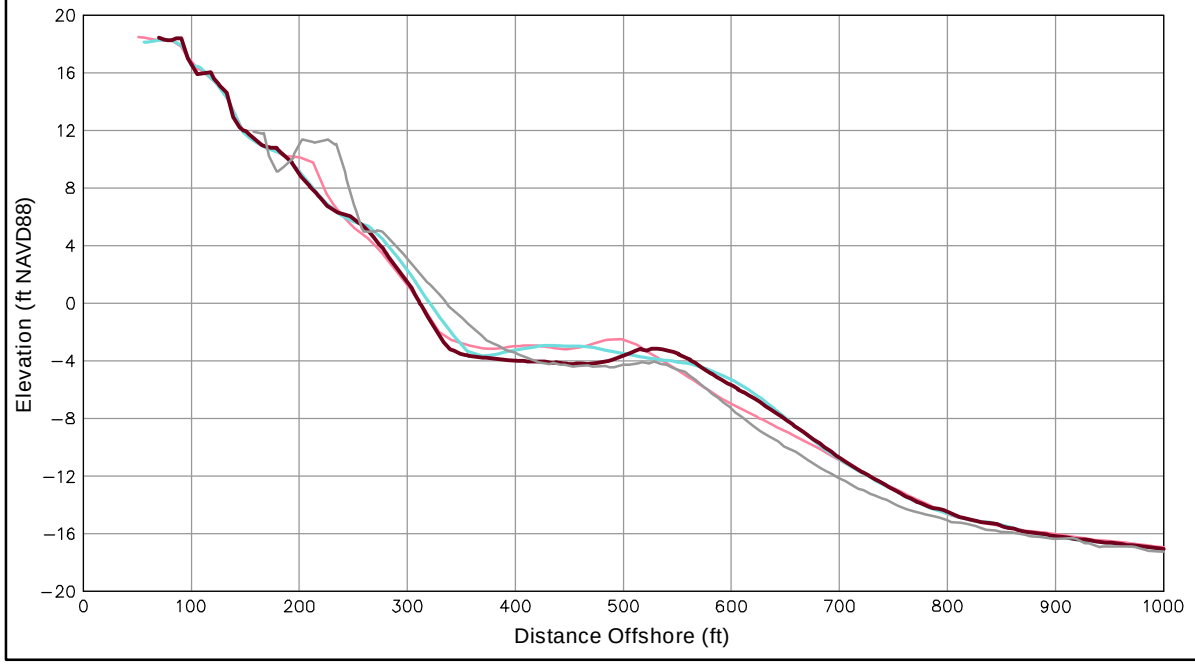

Survey Transect 173+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	1.63 ft/yr	-7.39 ft
Volume Change Above -15 ft NAVD88	-1.20 cy/ft/yr	-6.29 cy/ft
Volume Change Above 0 ft NAVD88	-0.58 cy/ft/yr	-1.31 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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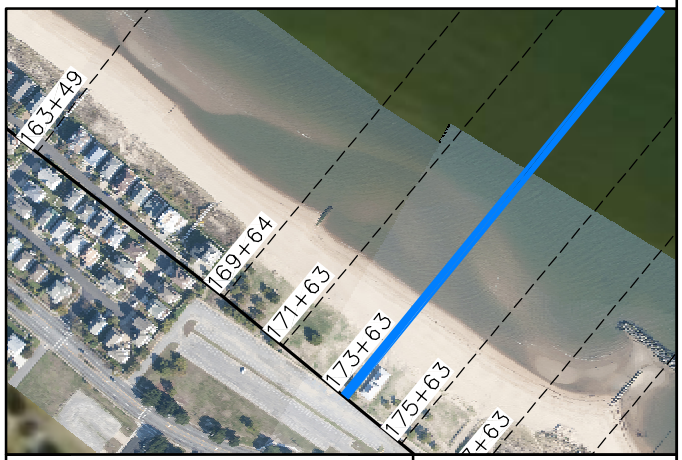

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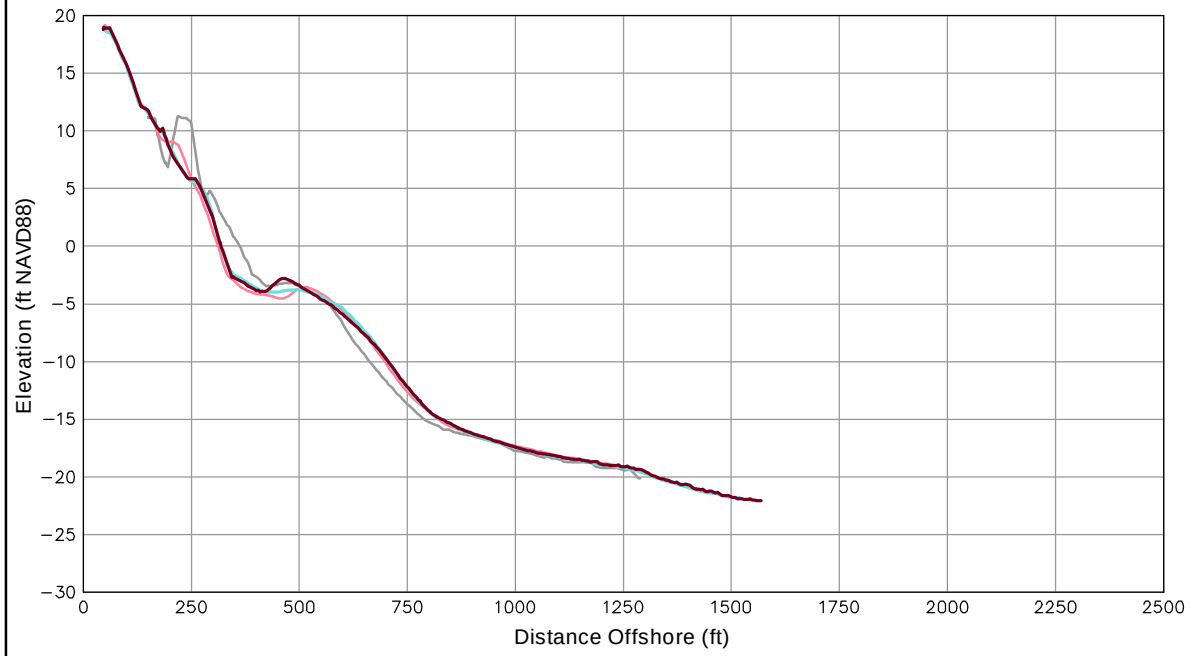

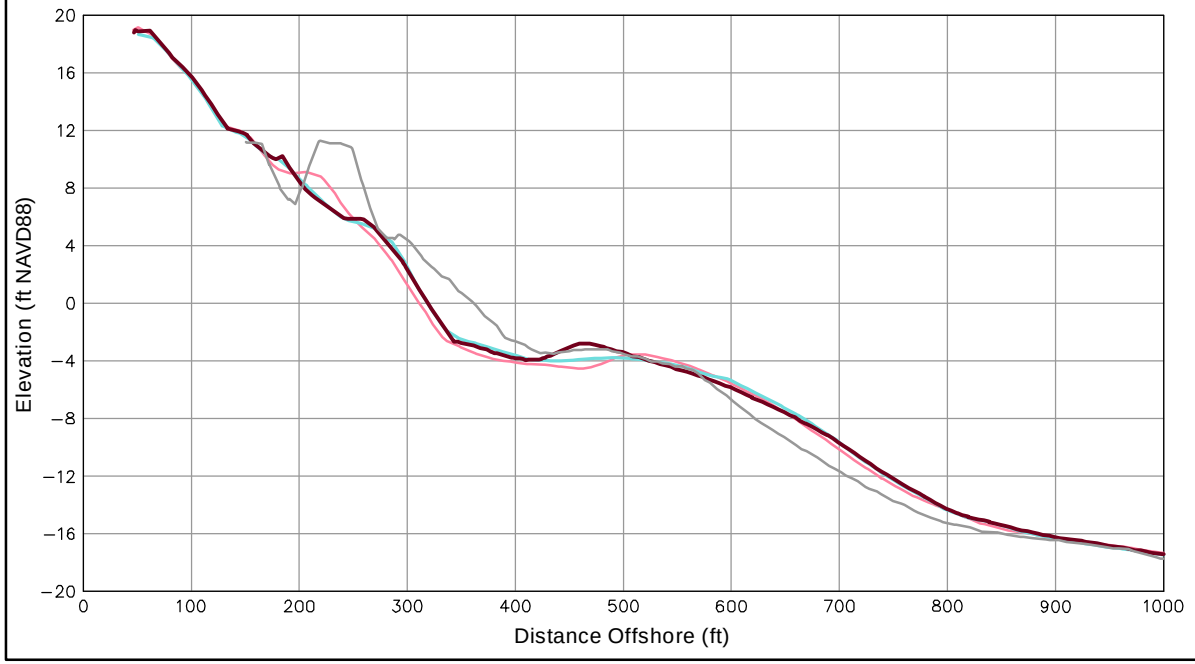

Survey Transect 175+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	7.35 ft/yr	-0.14 ft
Volume Change Above -15 ft NAVD88	5.45 cy/ft/yr	0.57 cy/ft
Volume Change Above 0 ft NAVD88	0.48 cy/ft/yr	0.48 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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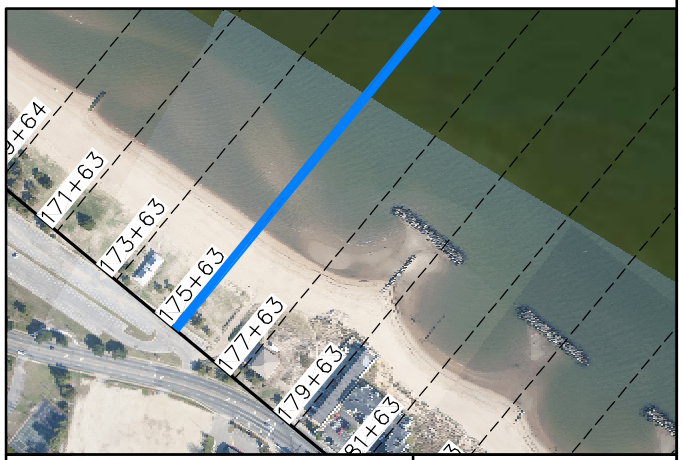

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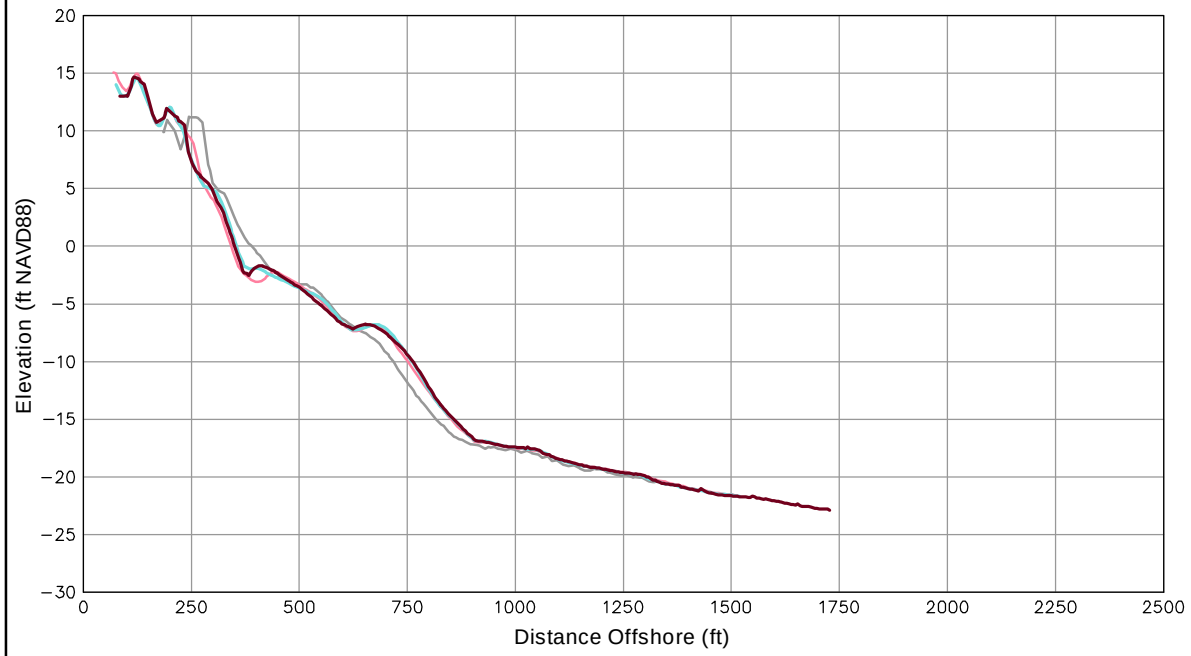
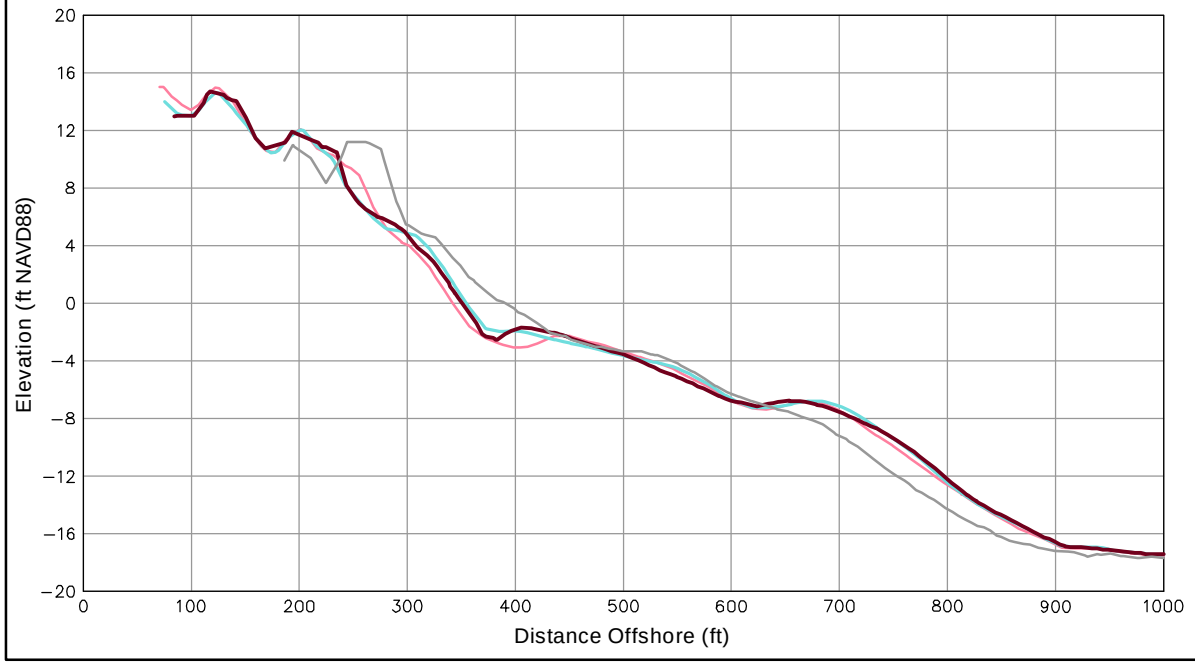
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 177+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	7.70 ft/yr	-4.28 ft
Volume Change Above -15 ft NAVD88	3.45 cy/ft/yr	-0.15 cy/ft
Volume Change Above 0 ft NAVD88	0.18 cy/ft/yr	0.53 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
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4. Survey Comparison Made To October 2009 and March 2010.
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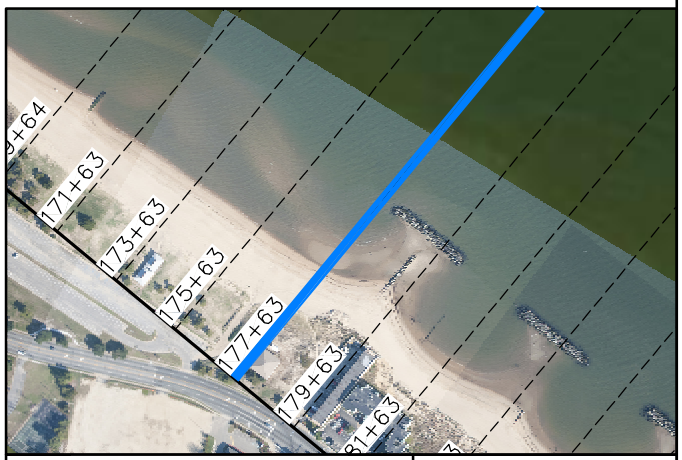
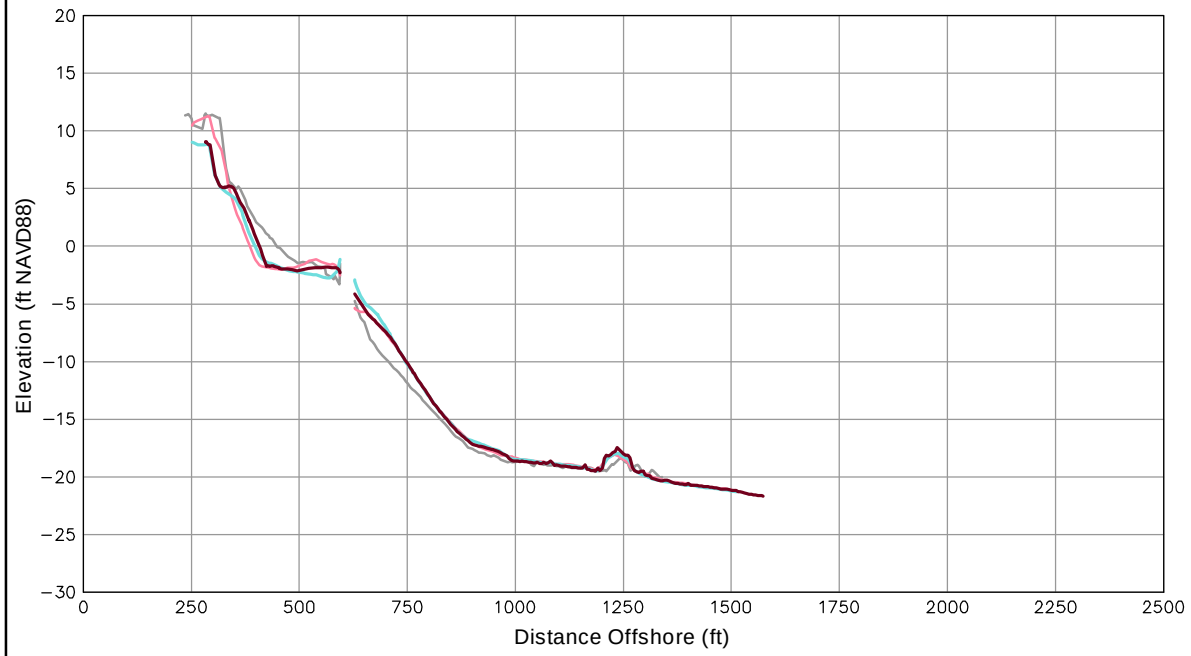
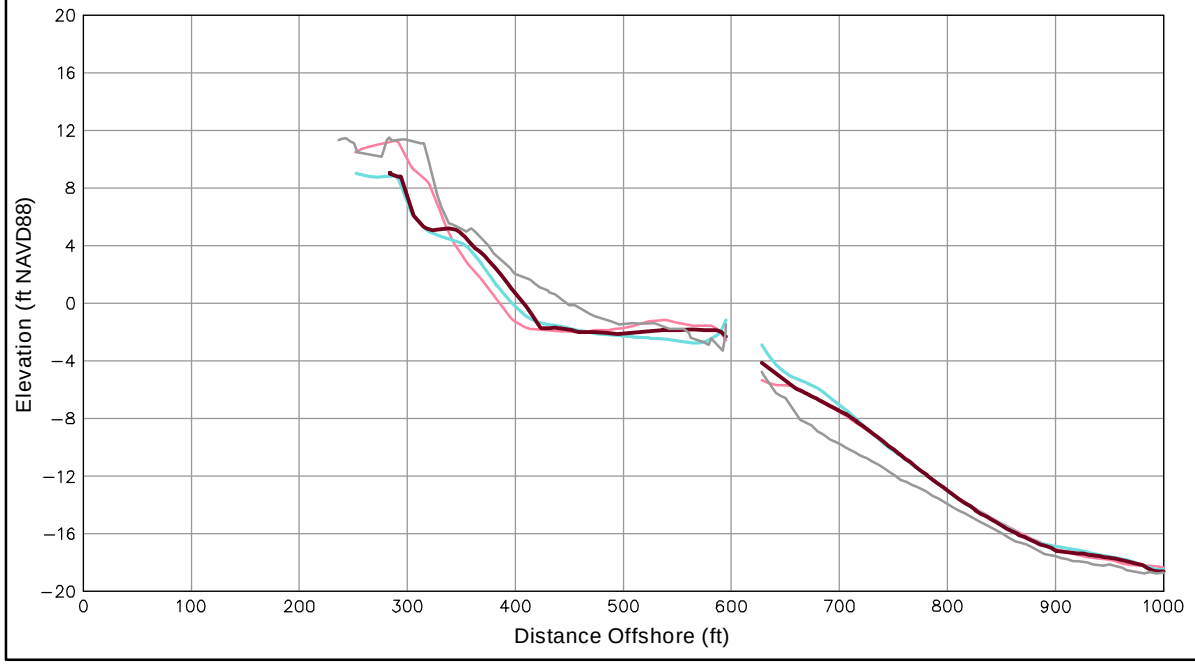


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 179+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	20.00 ft/yr	11.18 ft
Volume Change Above -15 ft NAVD88	-0.47 cy/ft/yr	2.65 cy/ft
Volume Change Above 0 ft NAVD88	-1.04 cy/ft/yr	2.50 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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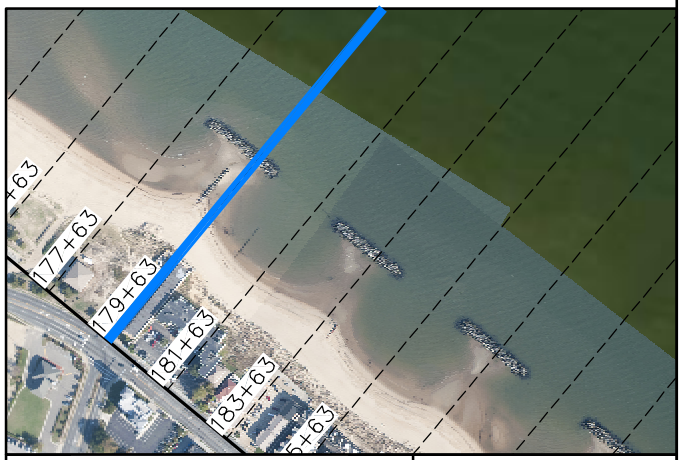
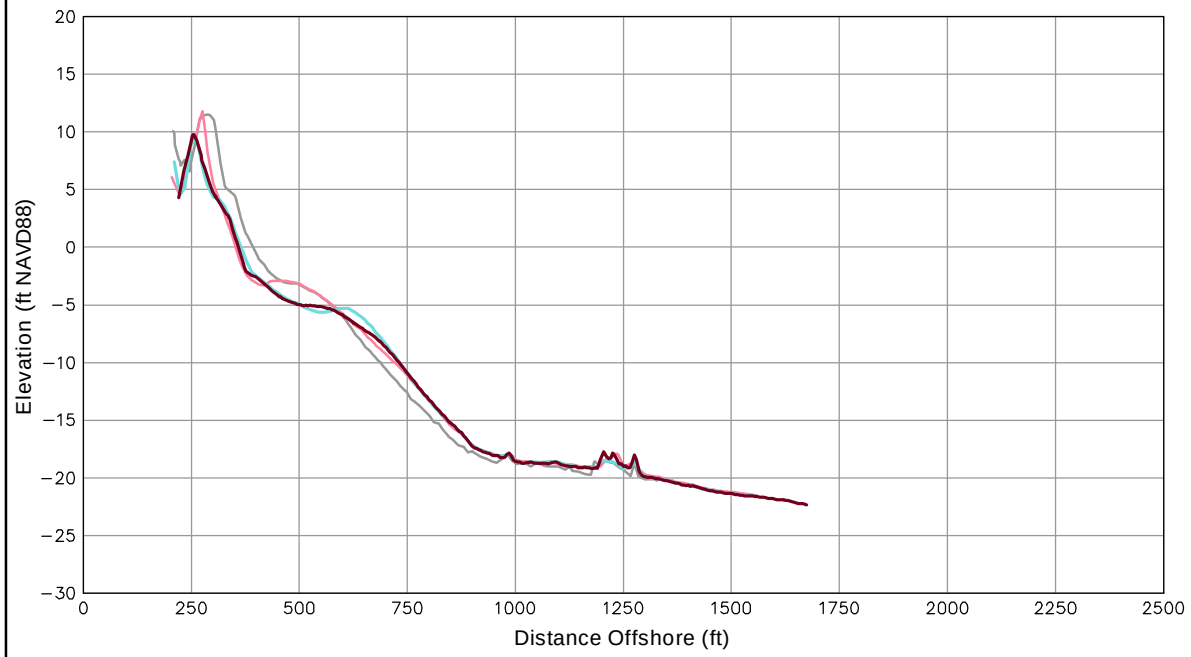
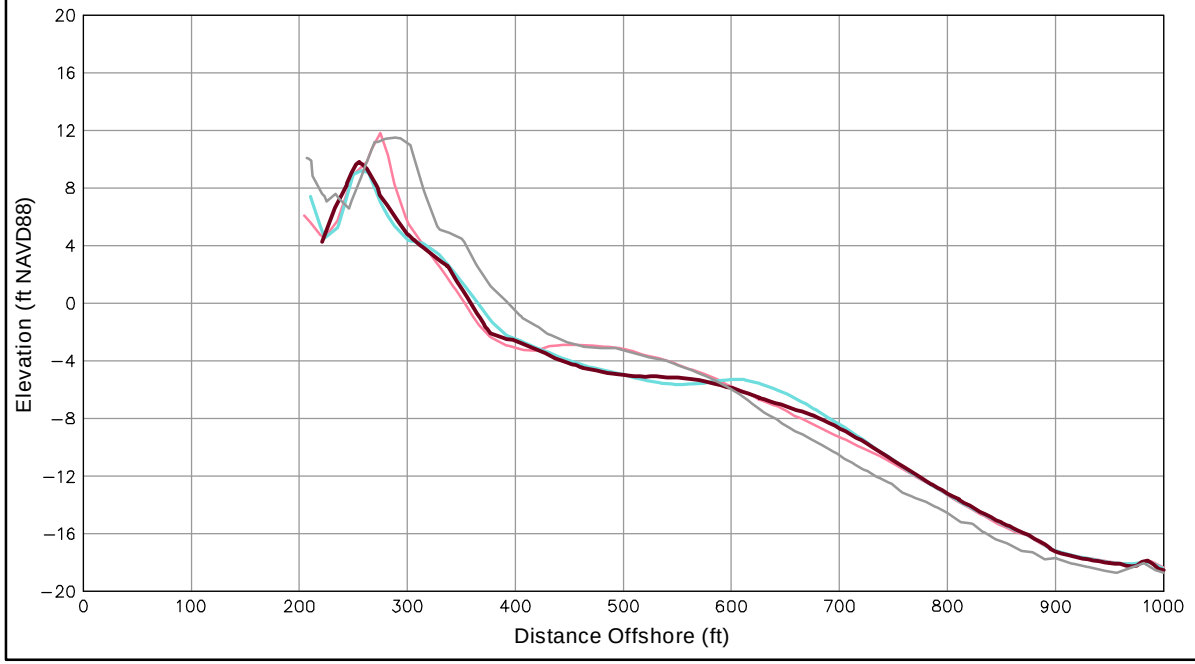


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 181+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	6.02 ft/yr	-4.77 ft
Volume Change Above -15 ft NAVD88	-5.69 cy/ft/yr	-2.15 cy/ft
Volume Change Above 0 ft NAVD88	-2.05 cy/ft/yr	1.24 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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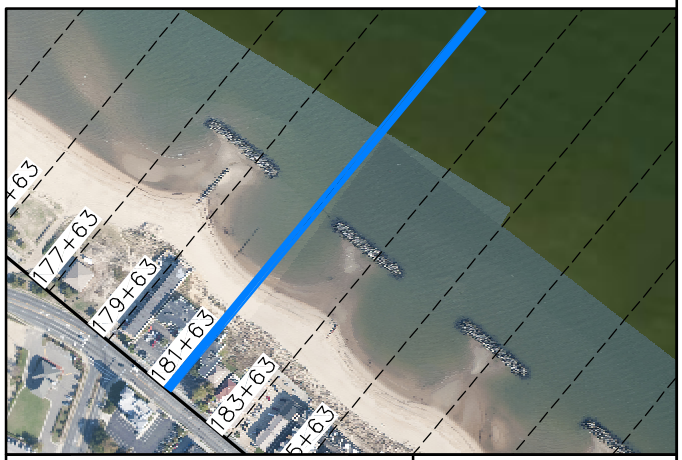
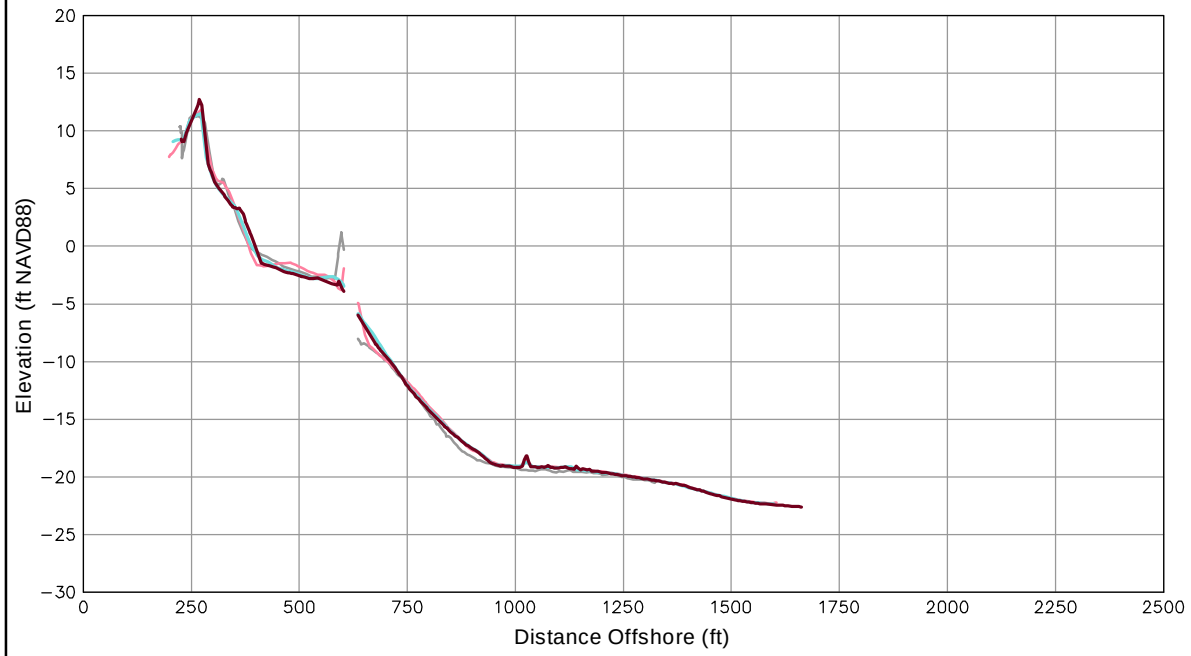
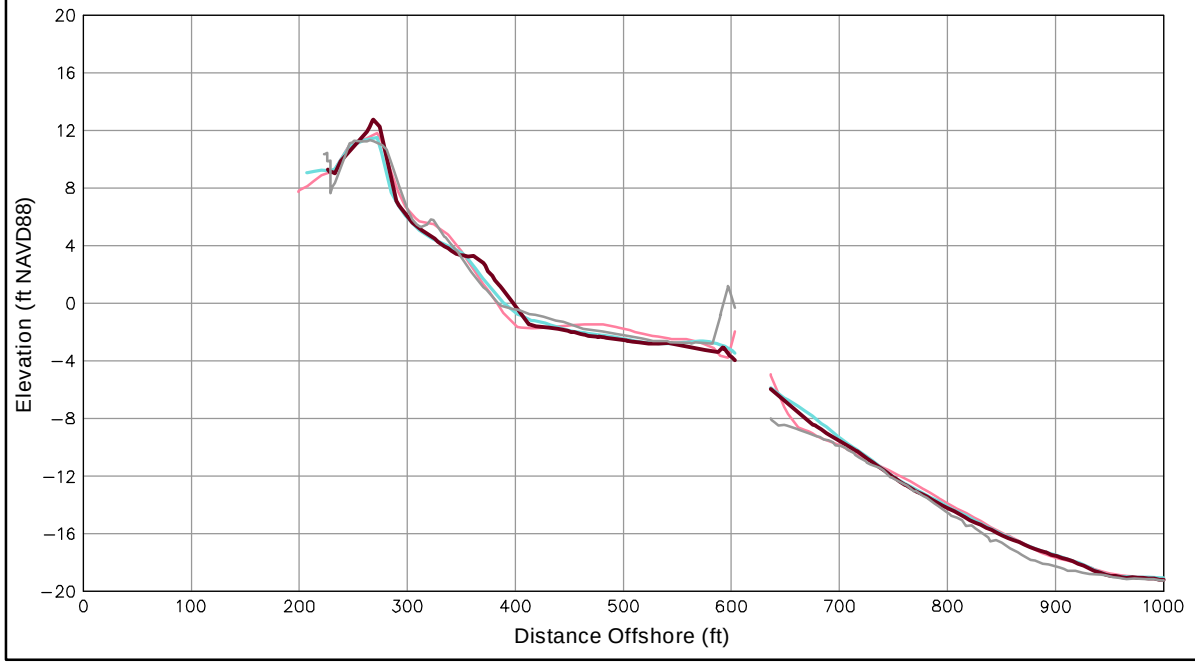


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 183+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	13.63 ft/yr	10.43 ft
Volume Change Above -15 ft NAVD88	-1.72 cy/ft/yr	-0.47 cy/ft
Volume Change Above 0 ft NAVD88	0.16 cy/ft/yr	2.11 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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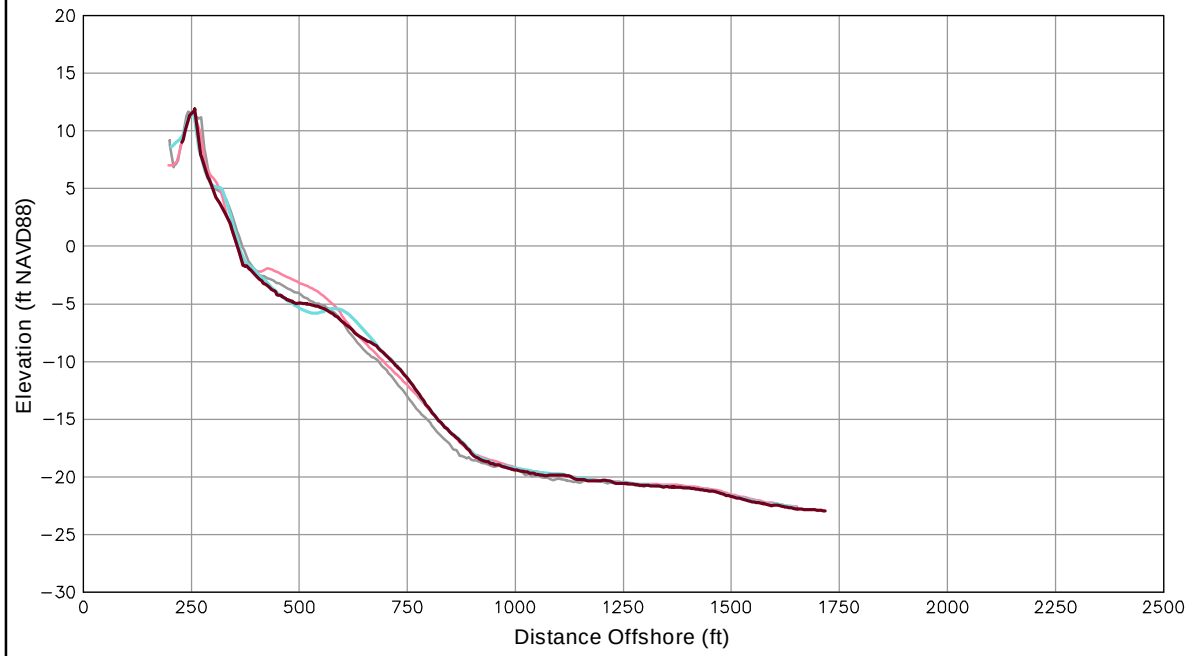
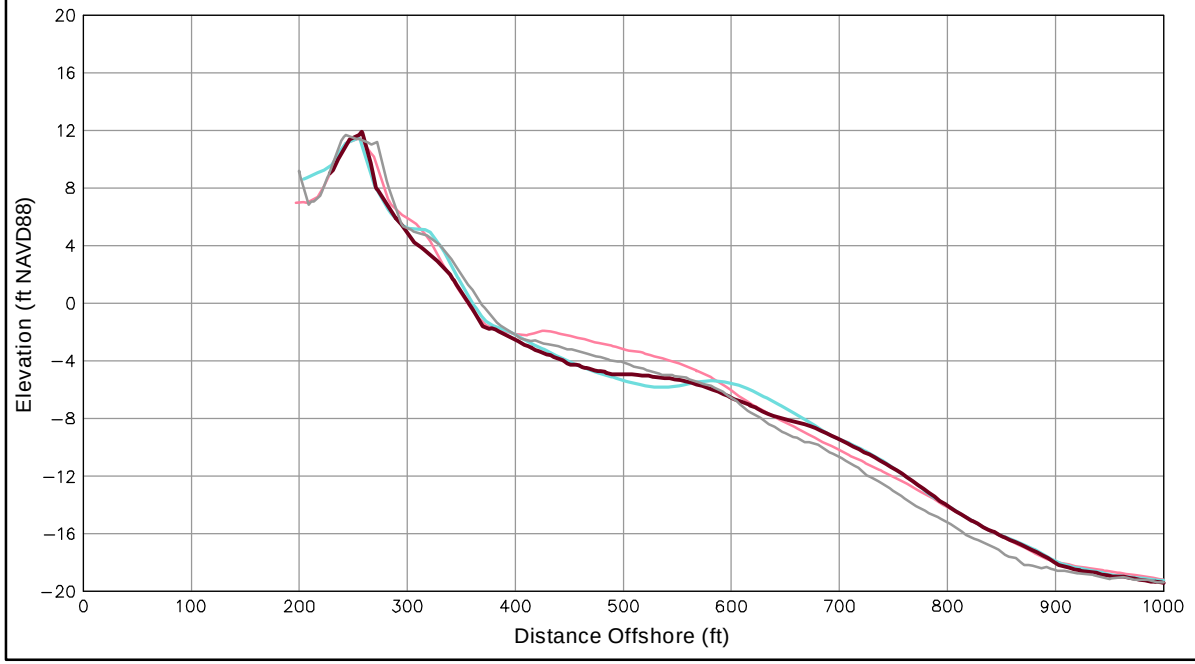
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 185+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	0.83 ft/yr	-4.75 ft
Volume Change Above -15 ft NAVD88	-9.30 cy/ft/yr	-4.64 cy/ft
Volume Change Above 0 ft NAVD88	-2.11 cy/ft/yr	-1.82 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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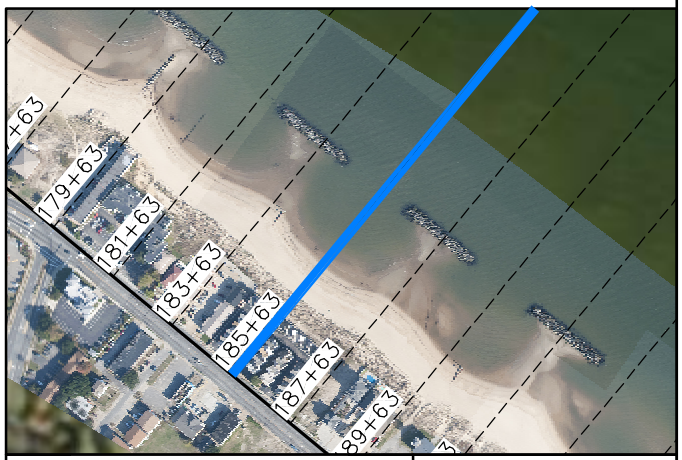

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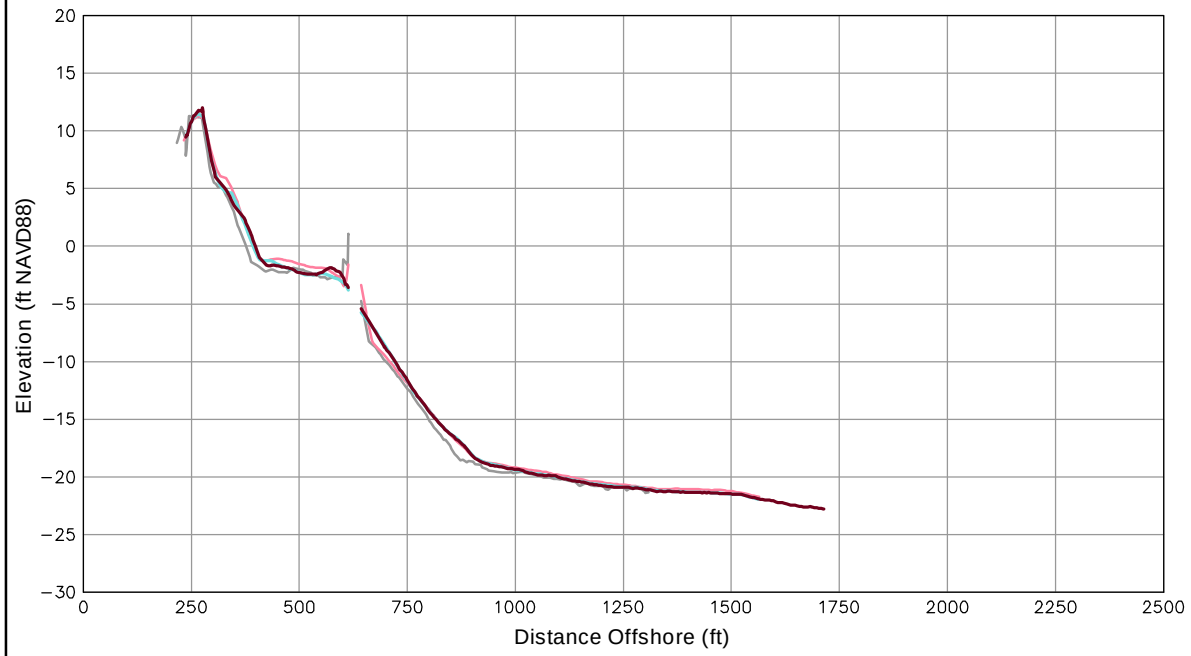
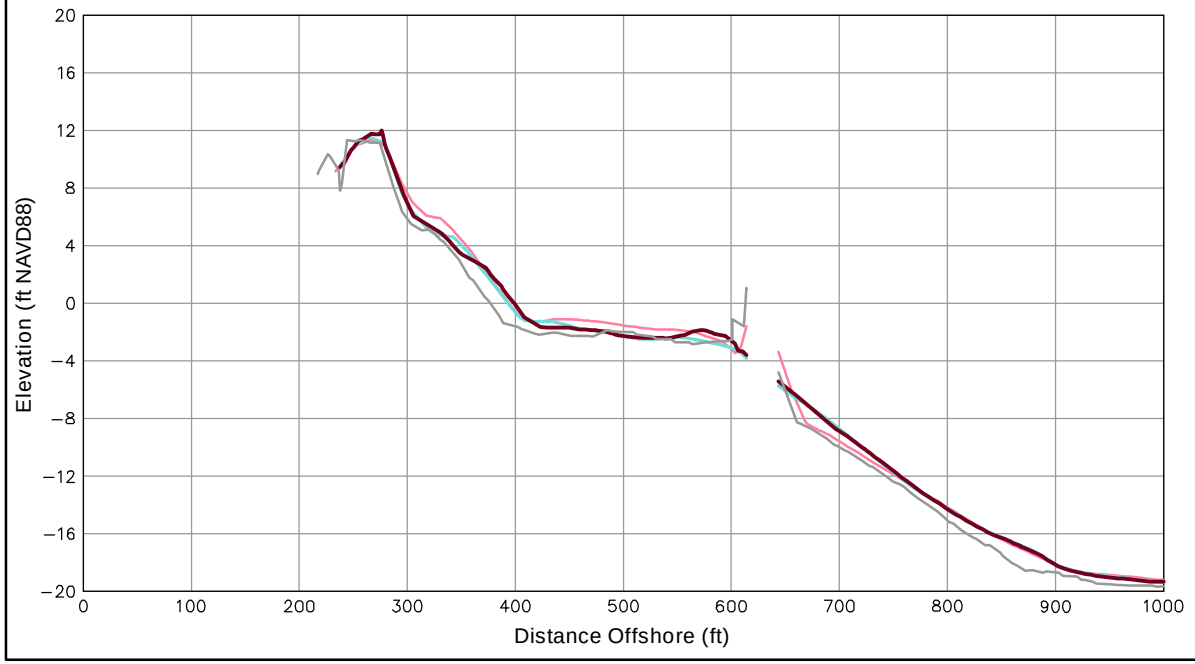
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 187+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	4.30 ft/yr	5.38 ft
Volume Change Above -15 ft NAVD88	-1.96 cy/ft/yr	2.01 cy/ft
Volume Change Above 0 ft NAVD88	-1.29 cy/ft/yr	0.50 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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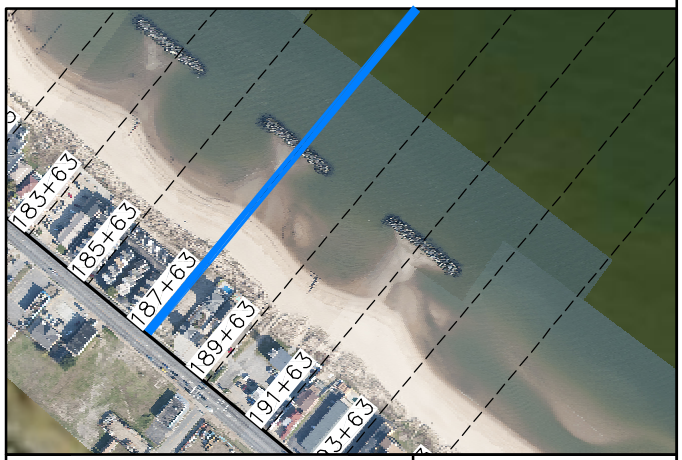

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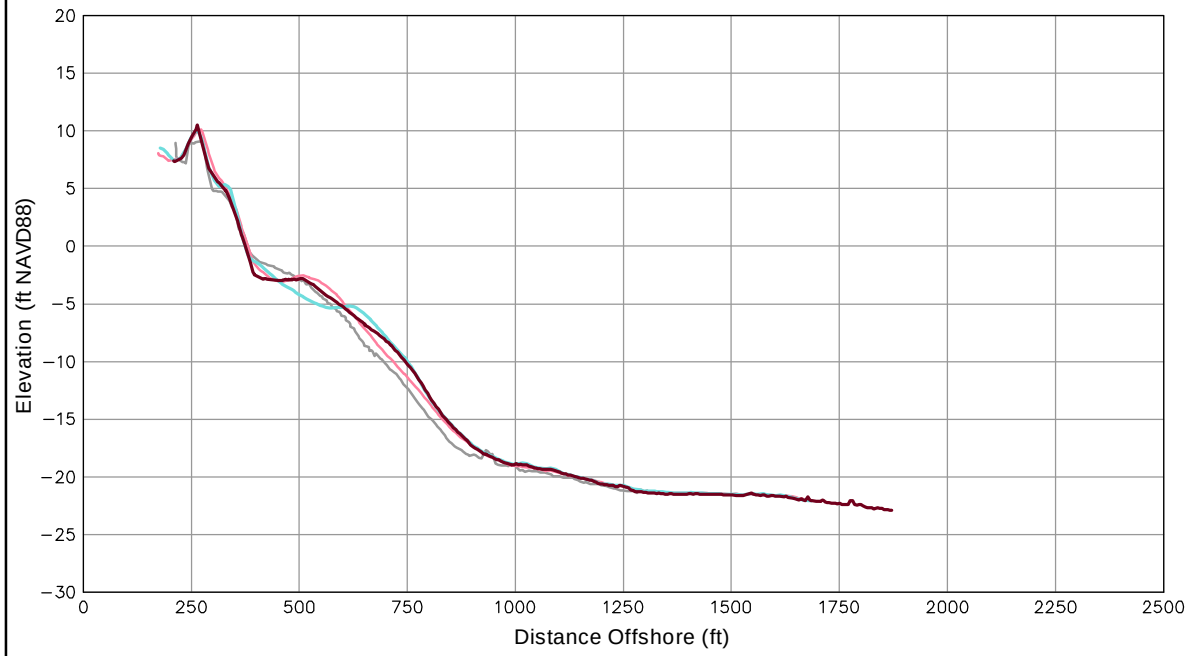

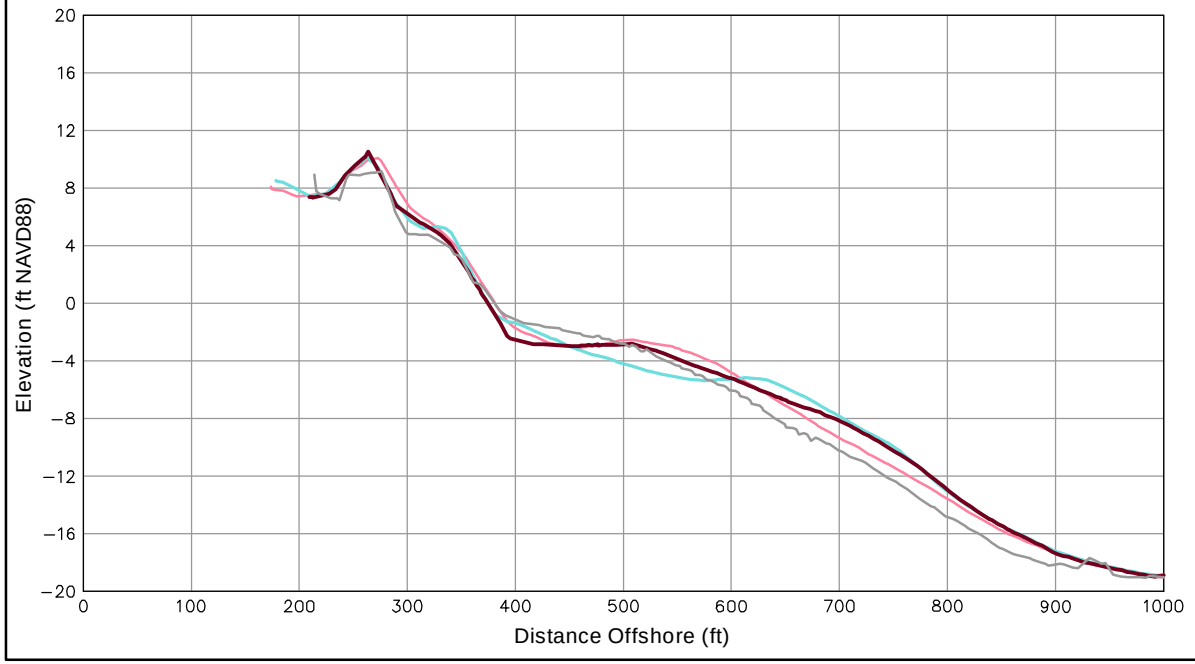

Survey Transect 189+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-5.64 ft/yr	-0.39 ft
Volume Change Above -15 ft NAVD88	-0.08 cy/ft/yr	0.16 cy/ft
Volume Change Above 0 ft NAVD88	-2.47 cy/ft/yr	-0.79 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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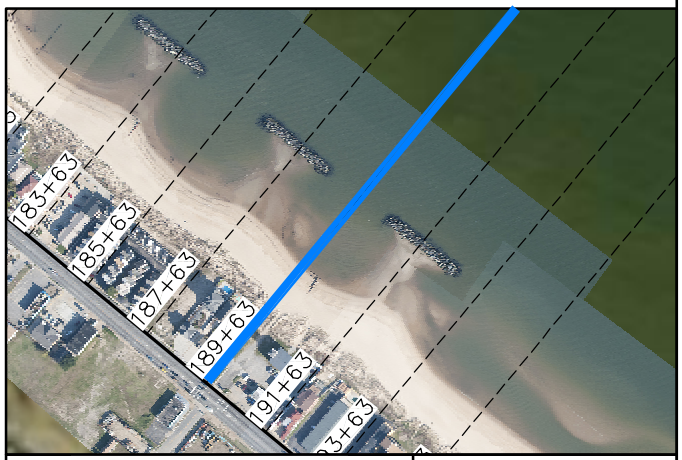
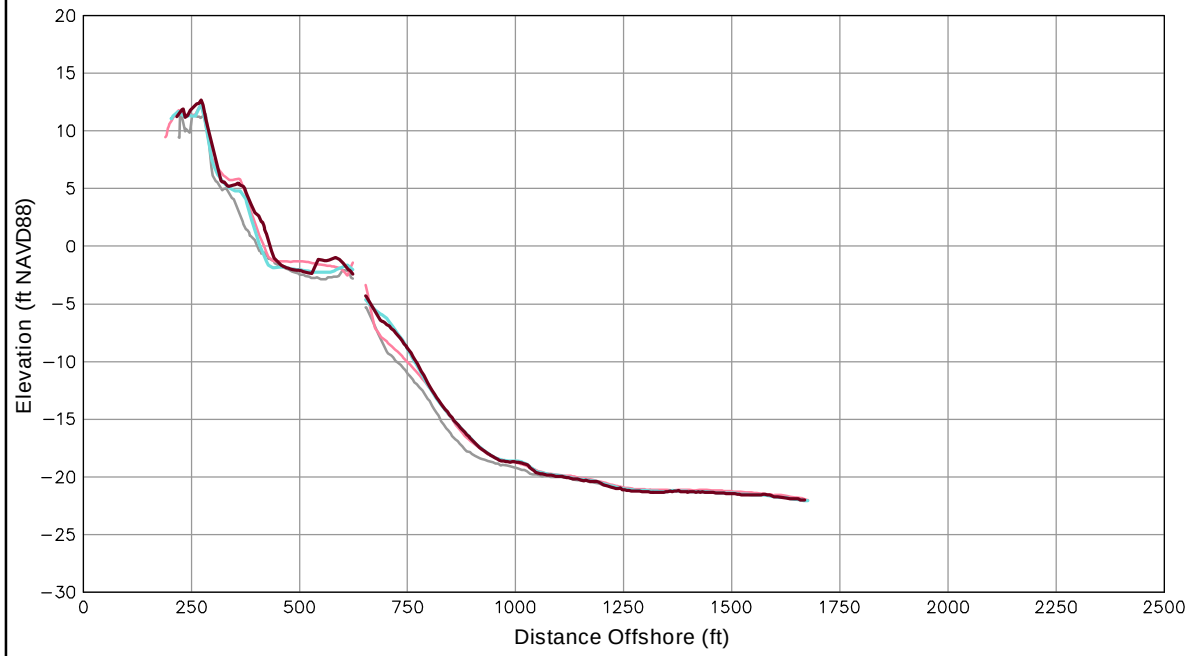
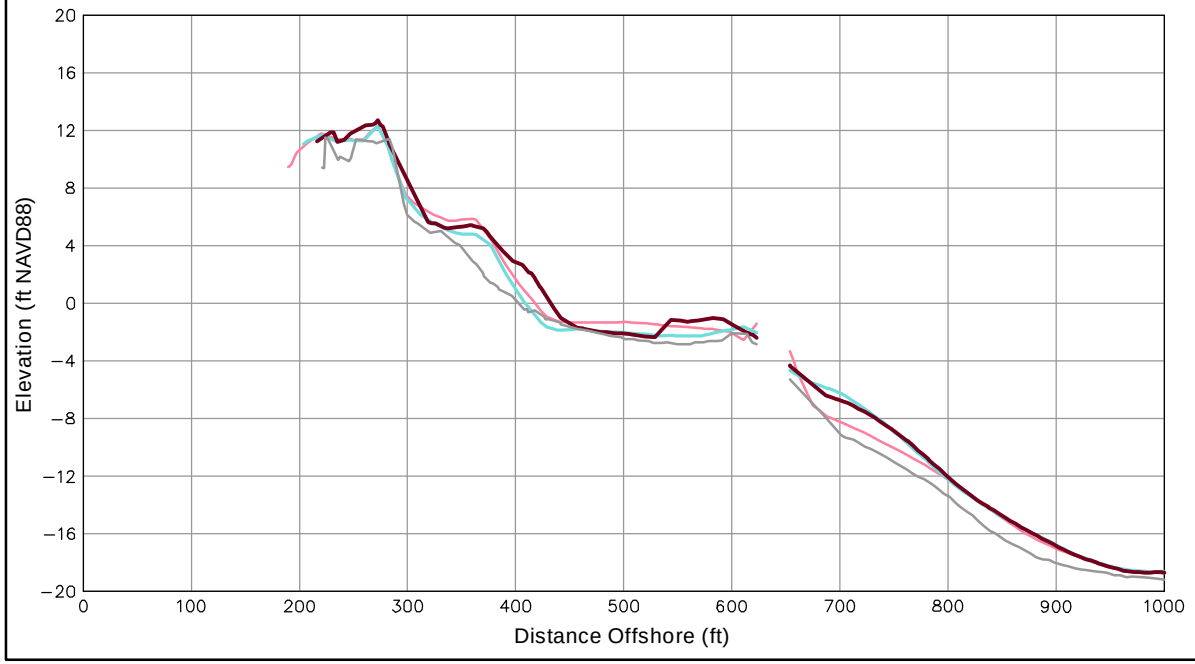


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 191+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	16.03 ft/yr	24.13 ft
Volume Change Above -15 ft NAVD88	7.79 cy/ft/yr	9.40 cy/ft
Volume Change Above 0 ft NAVD88	2.55 cy/ft/yr	5.80 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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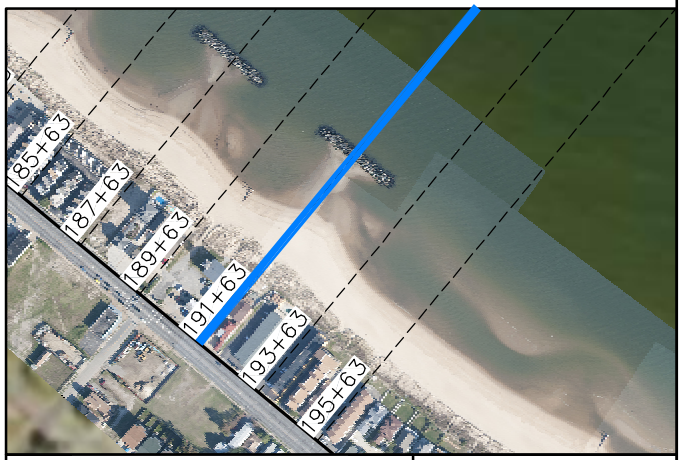
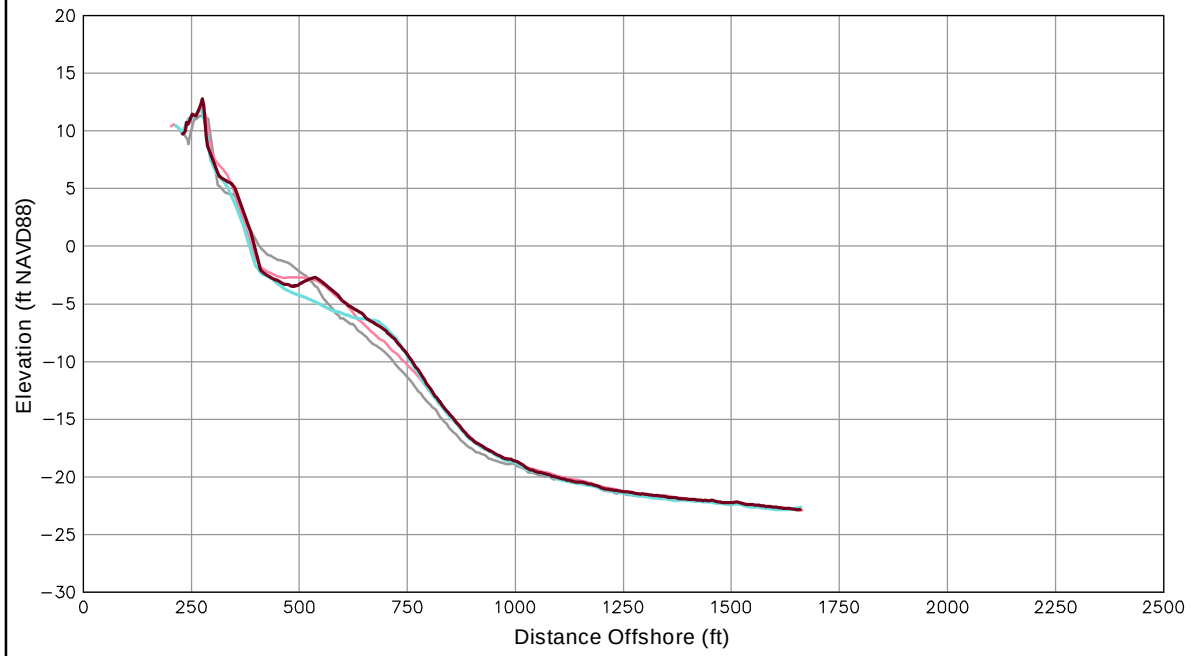
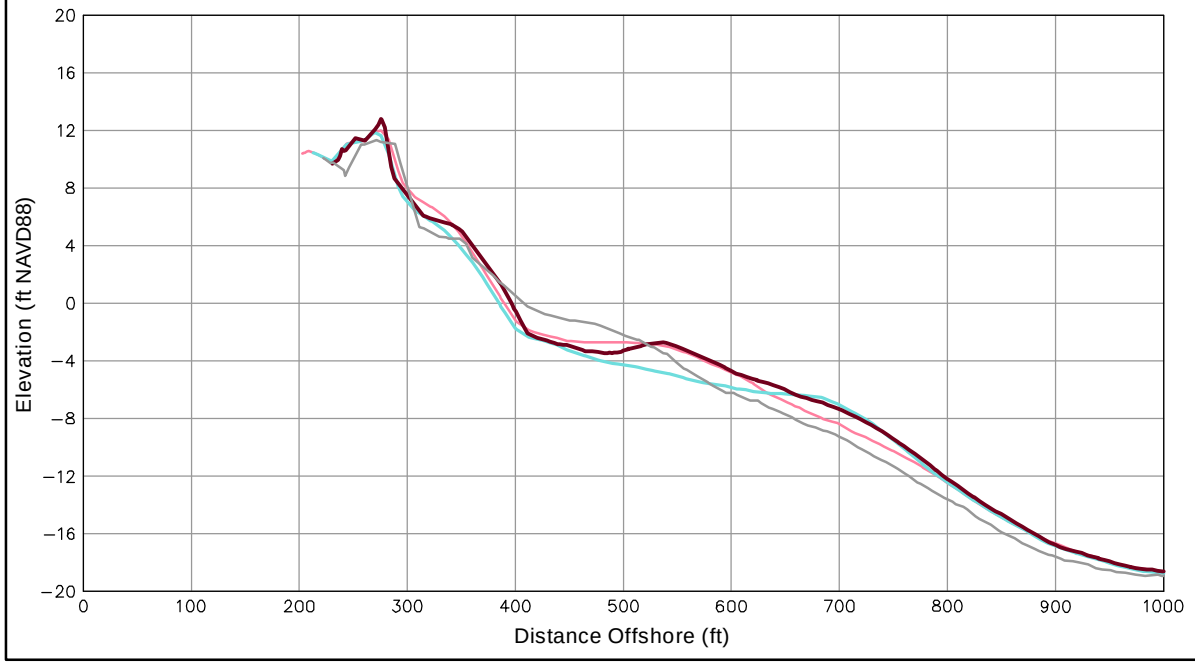


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 193+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	7.26 ft/yr	12.37 ft
Volume Change Above -15 ft NAVD88	4.31 cy/ft/yr	13.24 cy/ft
Volume Change Above 0 ft NAVD88	-0.25 cy/ft/yr	3.30 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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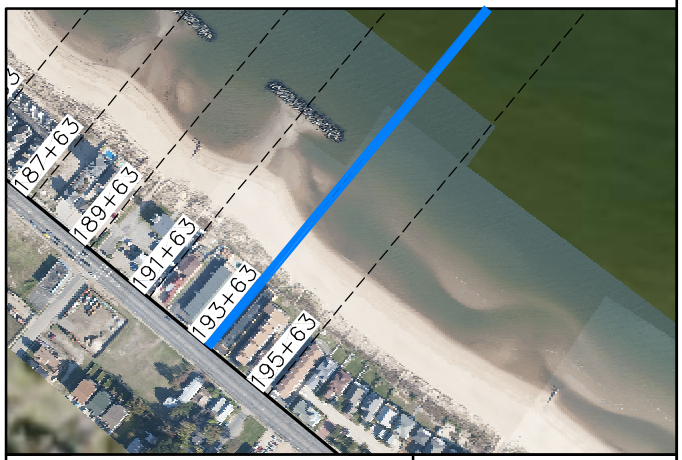
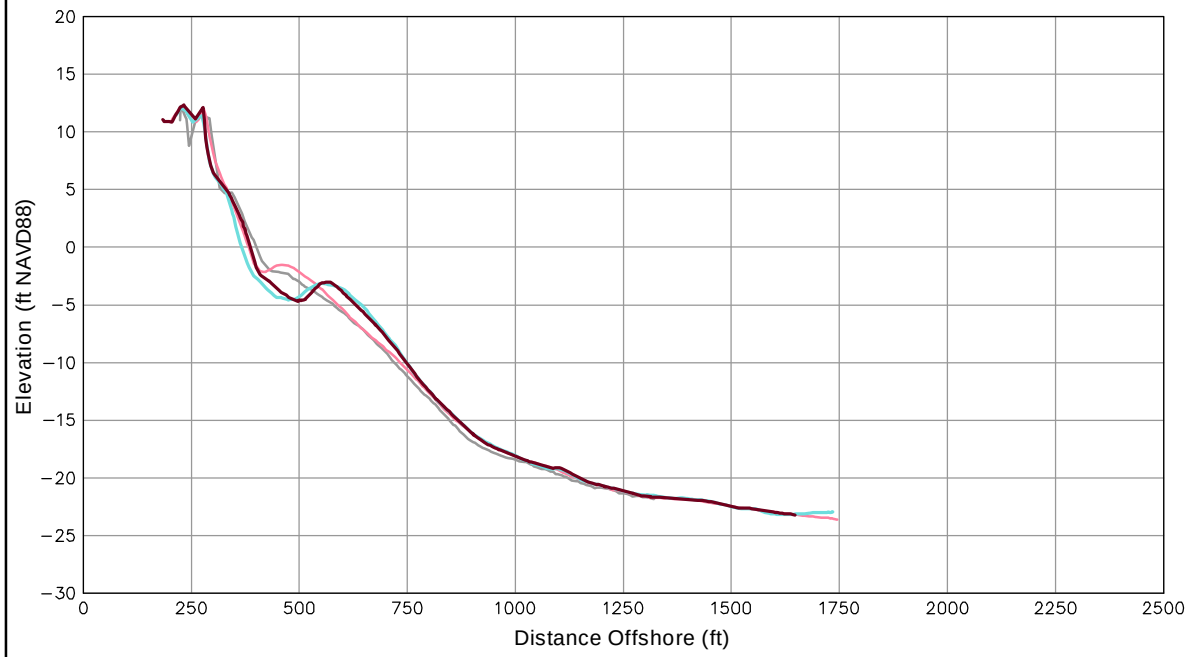
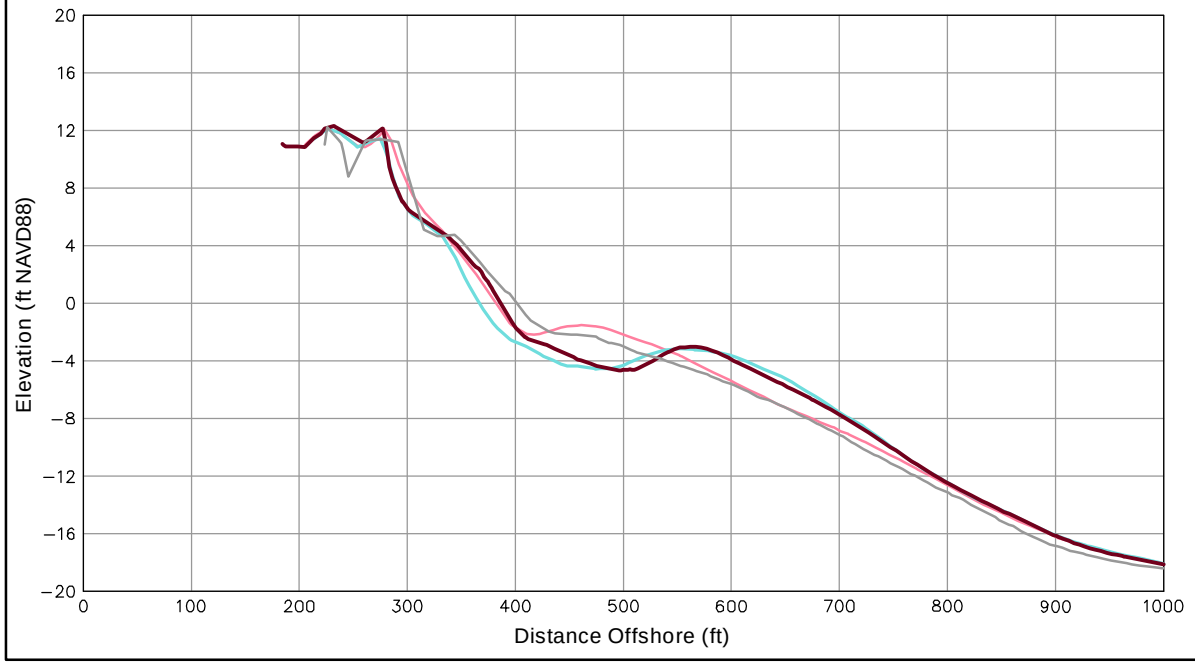


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 195+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	5.09 ft/yr	19.78 ft
Volume Change Above -15 ft NAVD88	0.62 cy/ft/yr	4.60 cy/ft
Volume Change Above 0 ft NAVD88	-0.92 cy/ft/yr	3.58 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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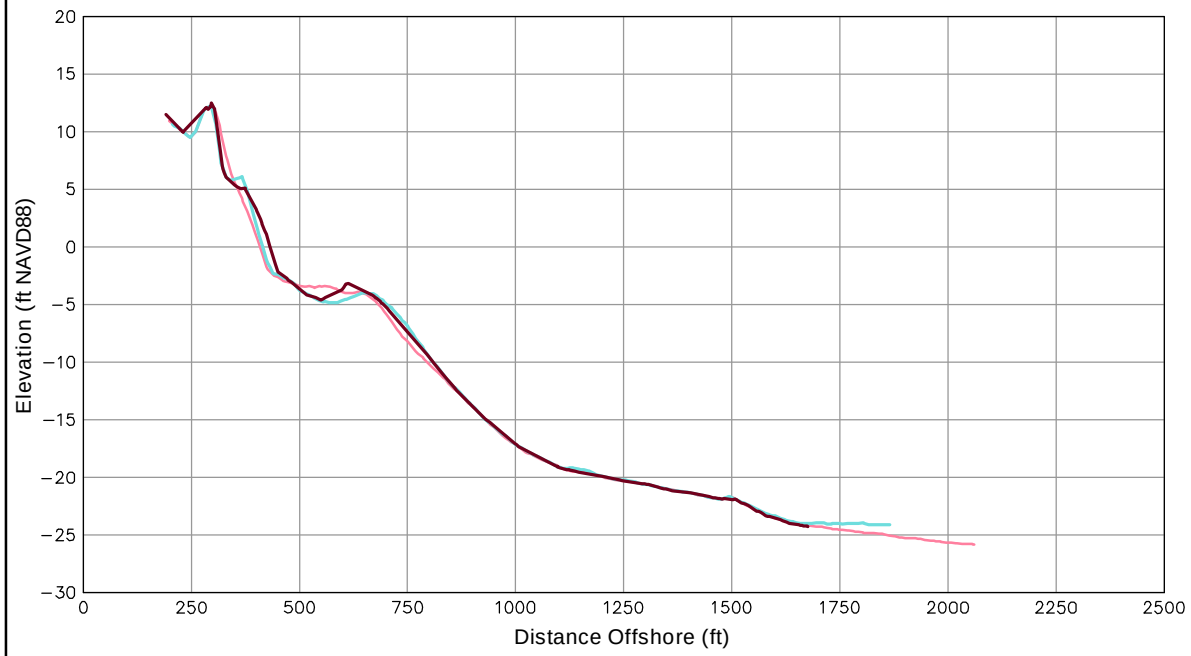
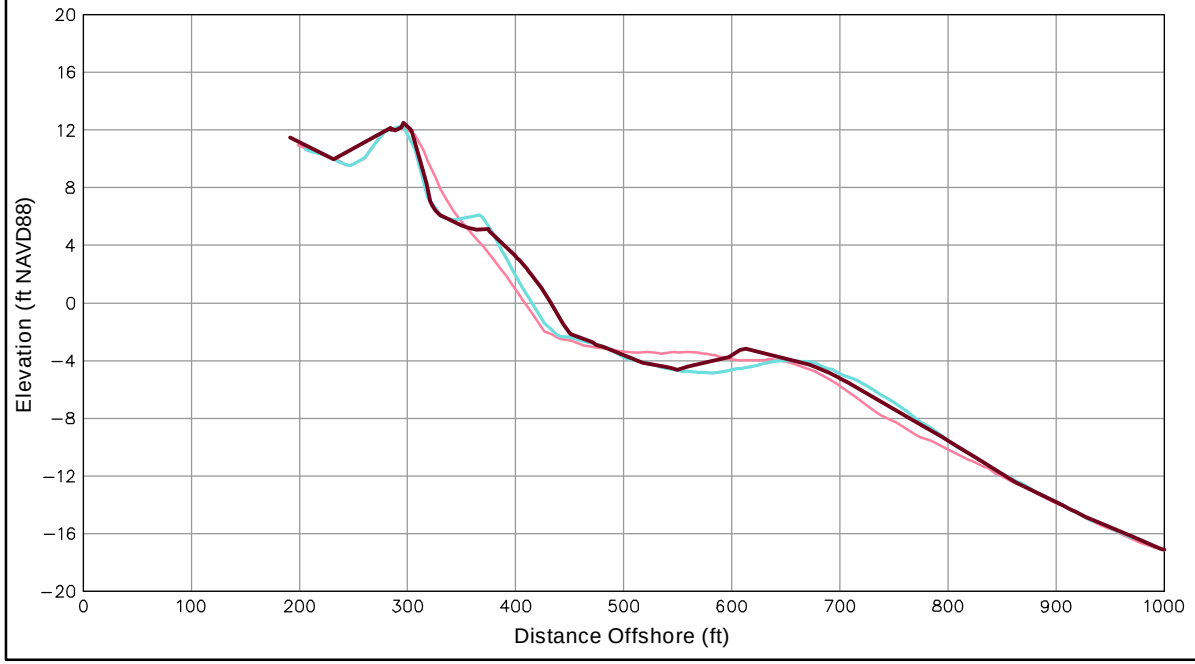
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 206+86	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	23.34 ft/yr	17.40 ft
Volume Change Above -15 ft NAVD88	8.12 cy/ft/yr	5.74 cy/ft
Volume Change Above 0 ft NAVD88	3.24 cy/ft/yr	3.09 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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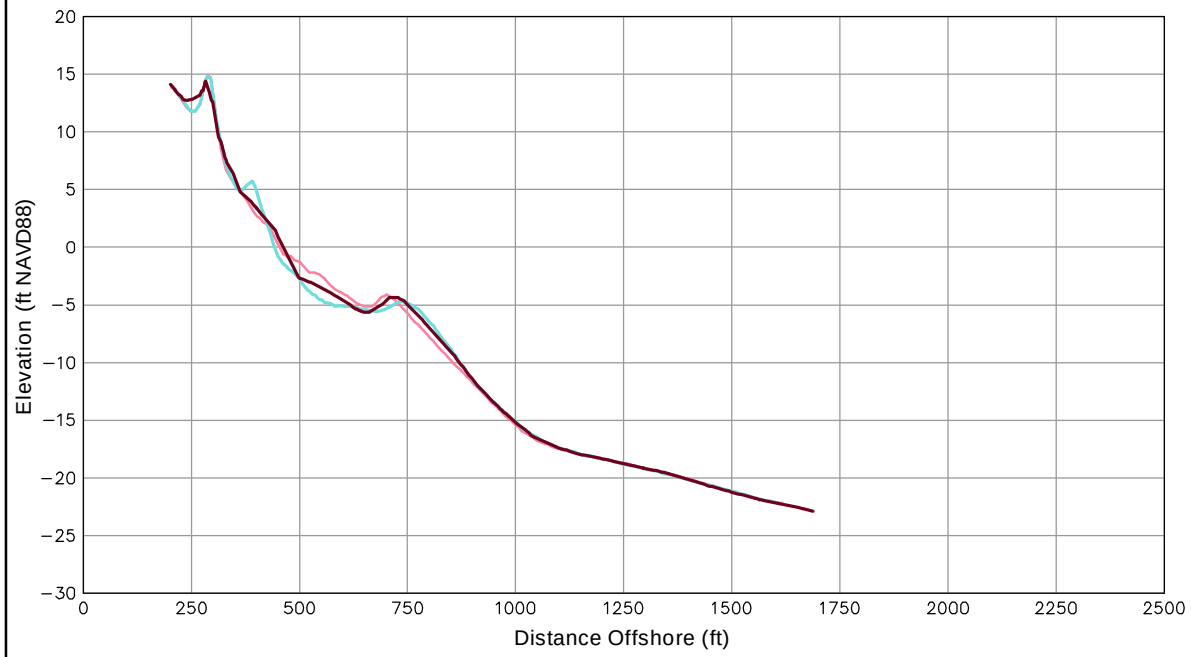

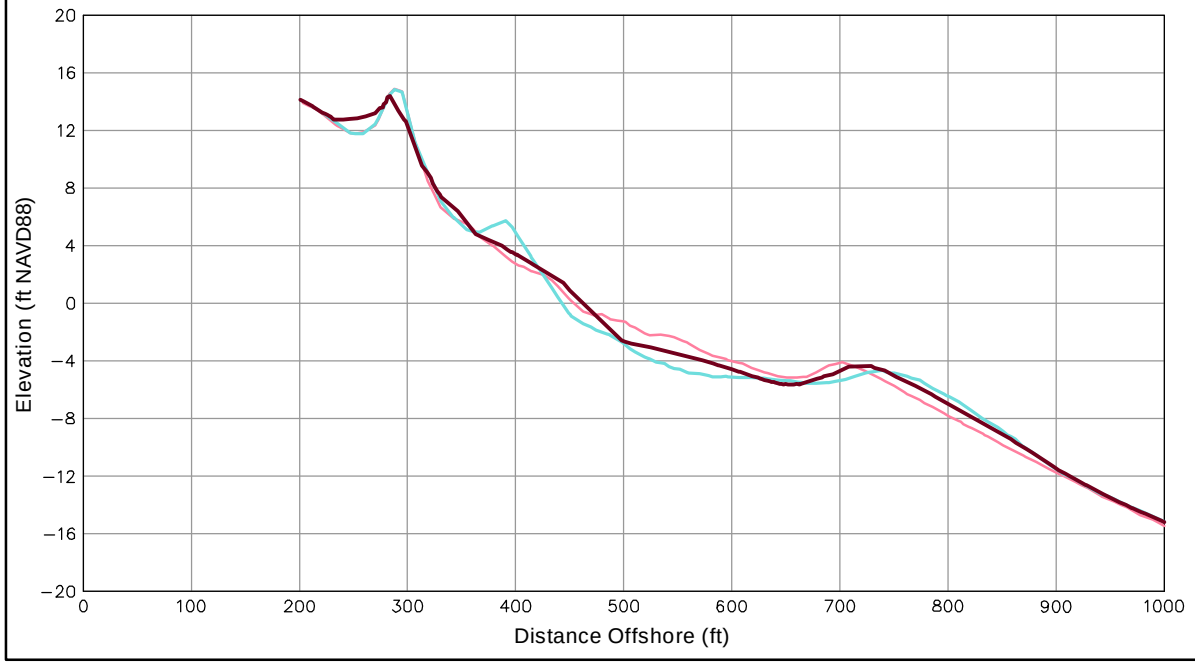

Survey Transect 218+66	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	7.26 ft/yr	15.35 ft
Volume Change Above -15 ft NAVD88	2.26 cy/ft/yr	4.22 cy/ft
Volume Change Above 0 ft NAVD88	2.85 cy/ft/yr	-0.02 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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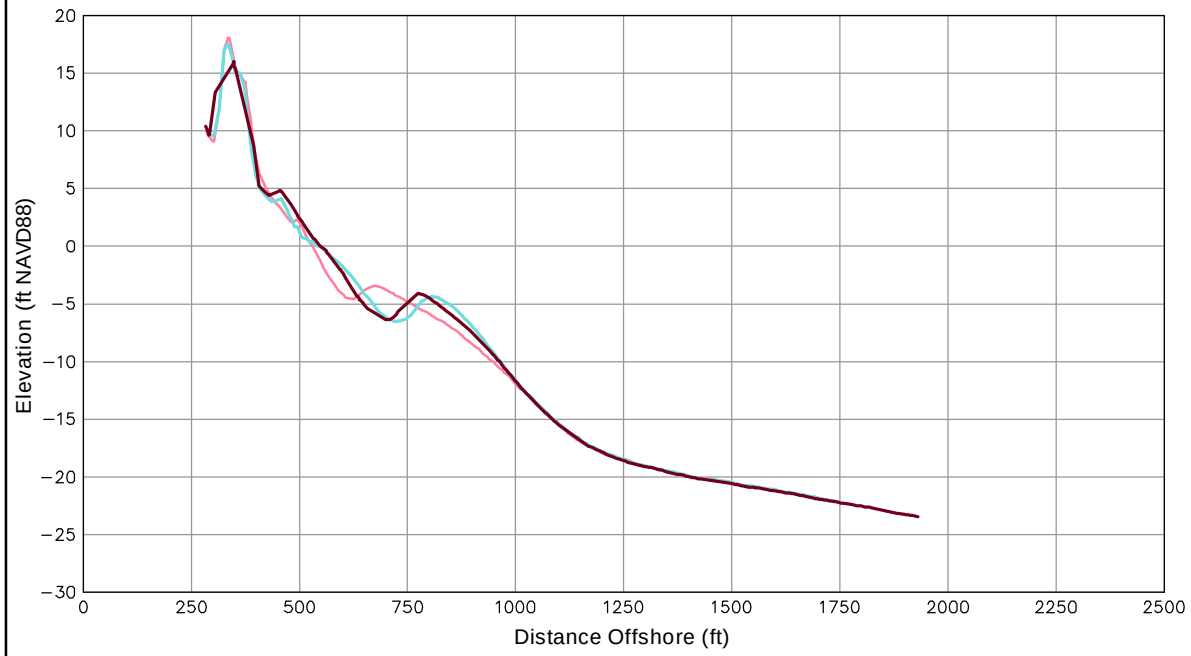

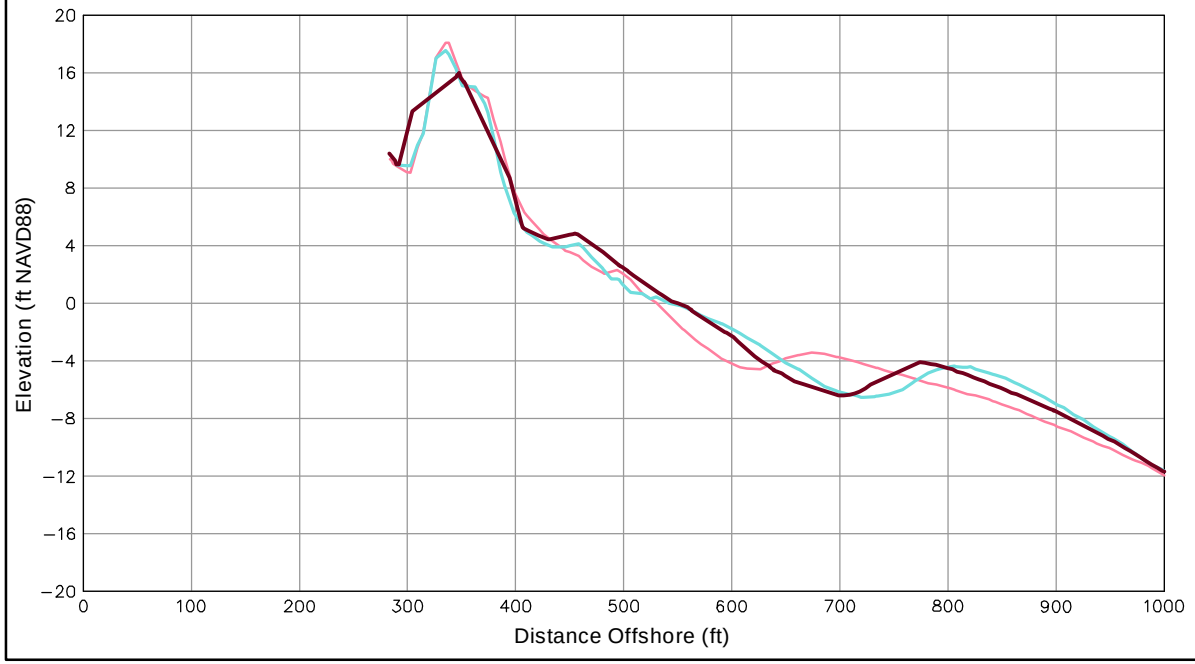

Survey Transect 229+85	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	12.36 ft/yr	23.77 ft
Volume Change Above -15 ft NAVD88	7.52 cy/ft/yr	0.37 cy/ft
Volume Change Above 0 ft NAVD88	1.35 cy/ft/yr	4.20 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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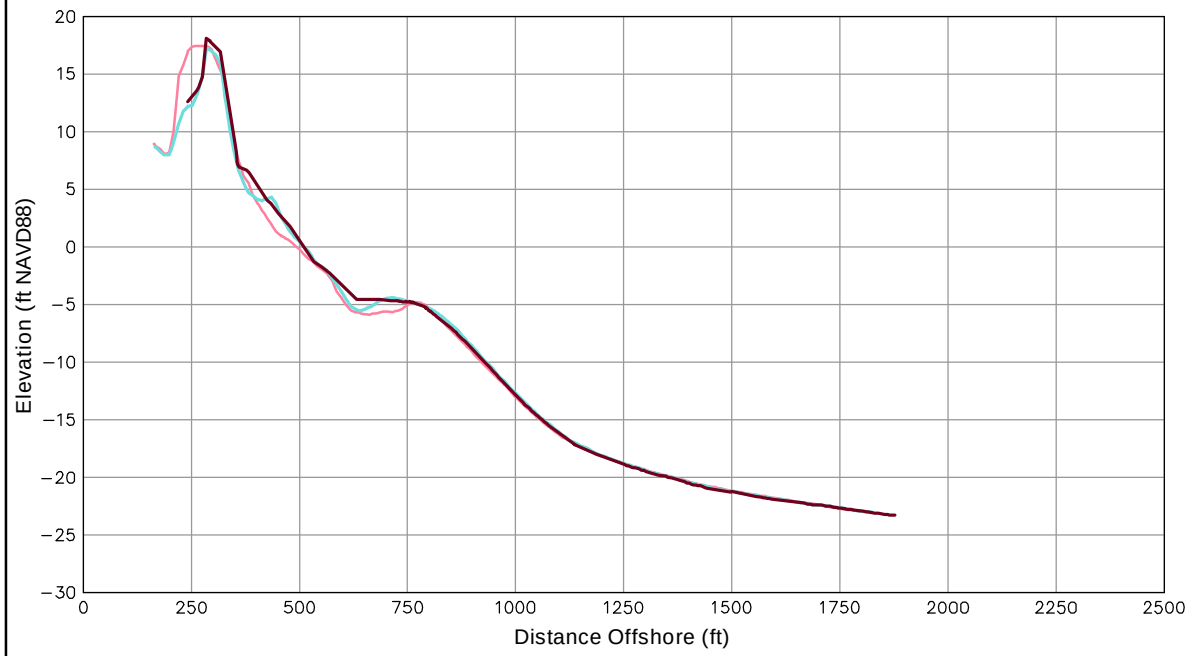
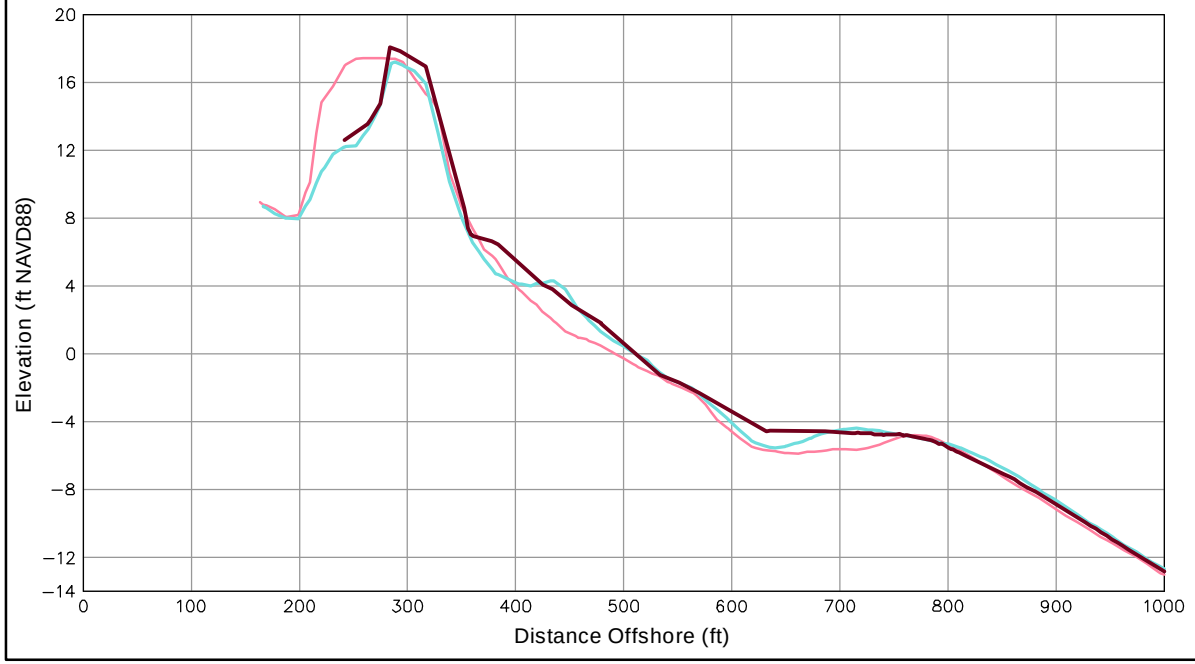




Survey Transect 242+03	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	34.23 ft/yr	7.70 ft
Volume Change Above -15 ft NAVD88	12.06 cy/ft/yr	6.44 cy/ft
Volume Change Above 0 ft NAVD88	3.47 cy/ft/yr	6.22 cy/ft

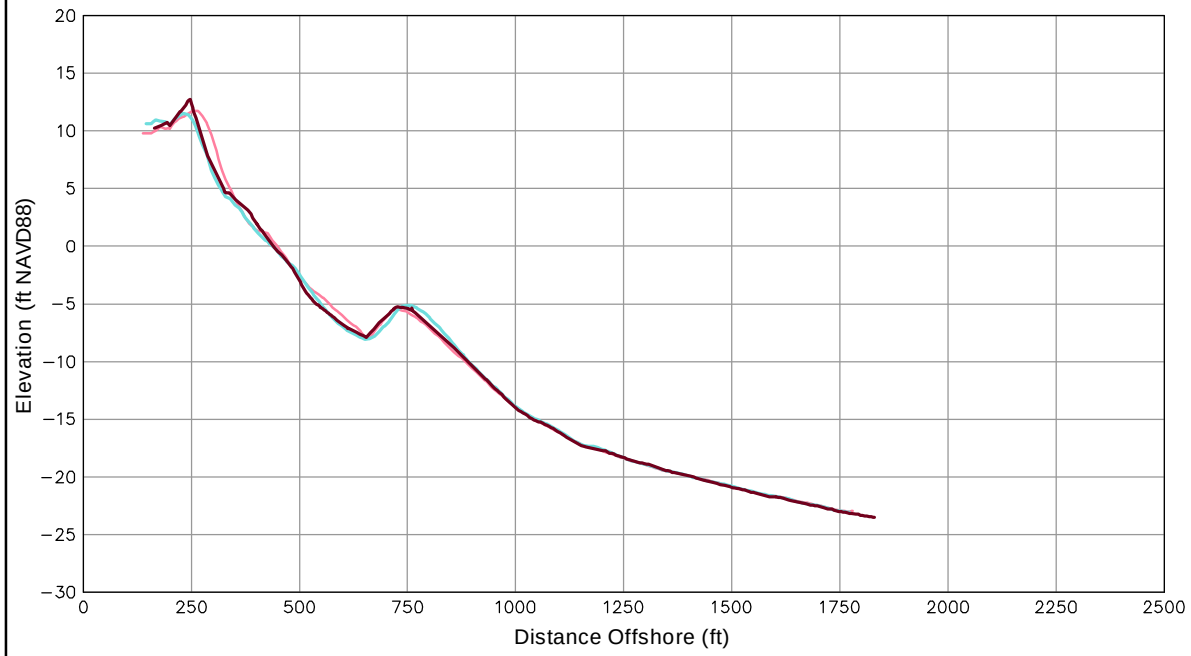
LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

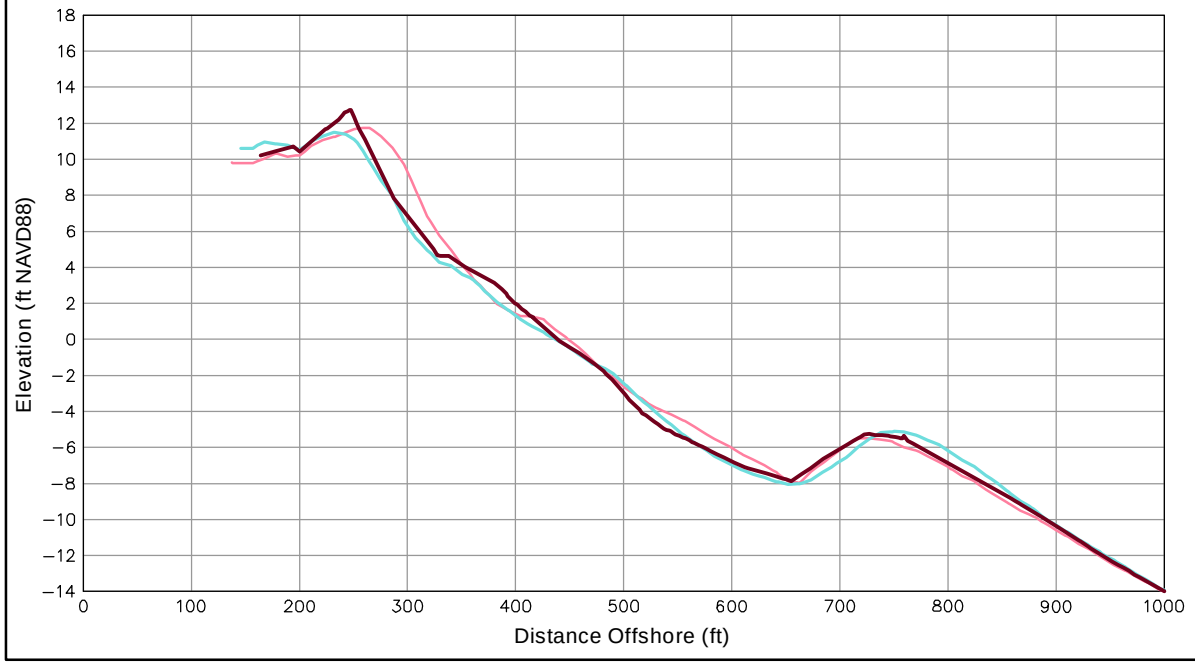
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To October 2009 and March 2010.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were 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 252+62	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-7.32 ft/yr	12.36 ft
Volume Change Above -15 ft NAVD88	-4.10 cy/ft/yr	2.30 cy/ft
Volume Change Above 0 ft NAVD88	-2.60 cy/ft/yr	4.20 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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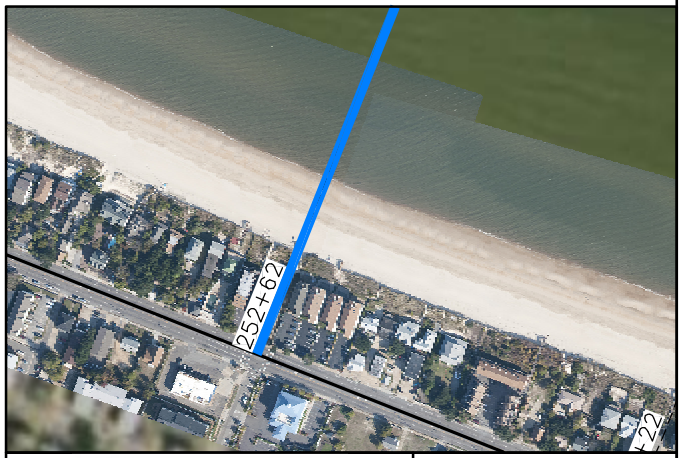

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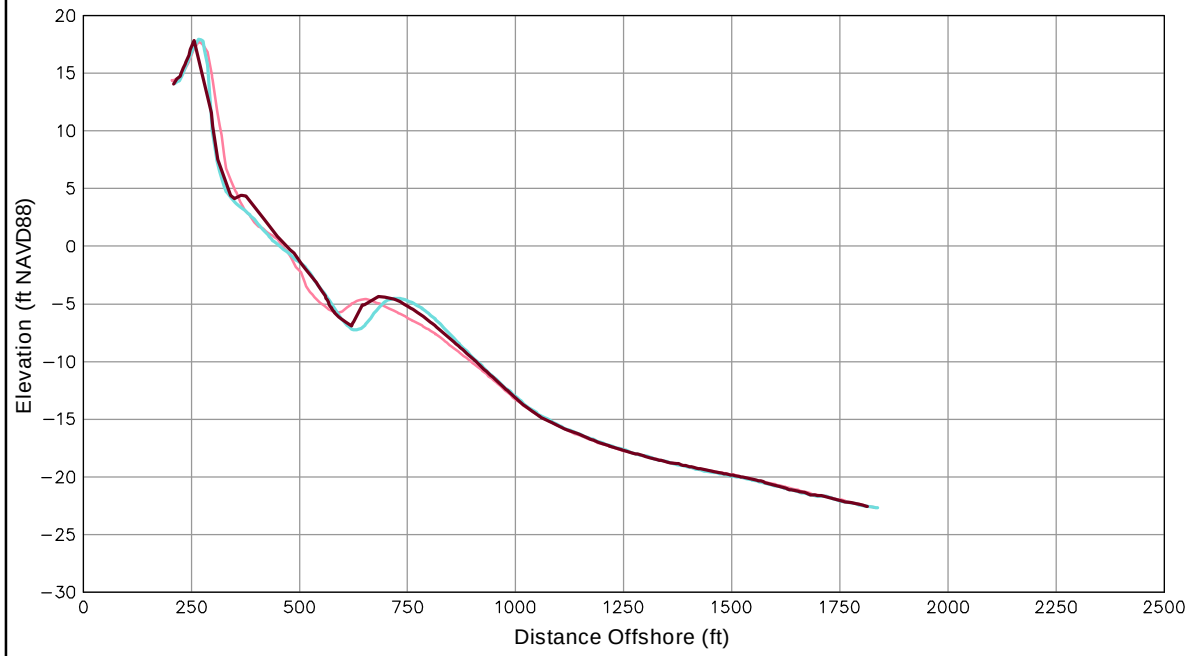

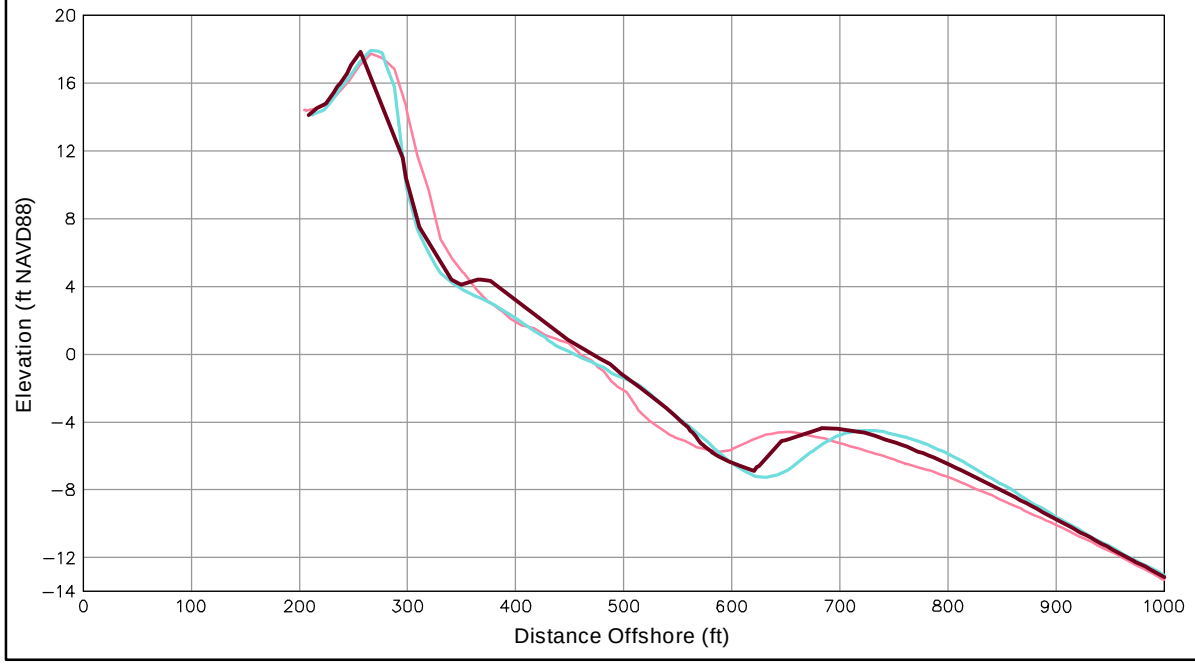

Survey Transect 263+22	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	10.89 ft/yr	18.23 ft
Volume Change Above -15 ft NAVD88	3.36 cy/ft/yr	3.09 cy/ft
Volume Change Above 0 ft NAVD88	-4.65 cy/ft/yr	2.66 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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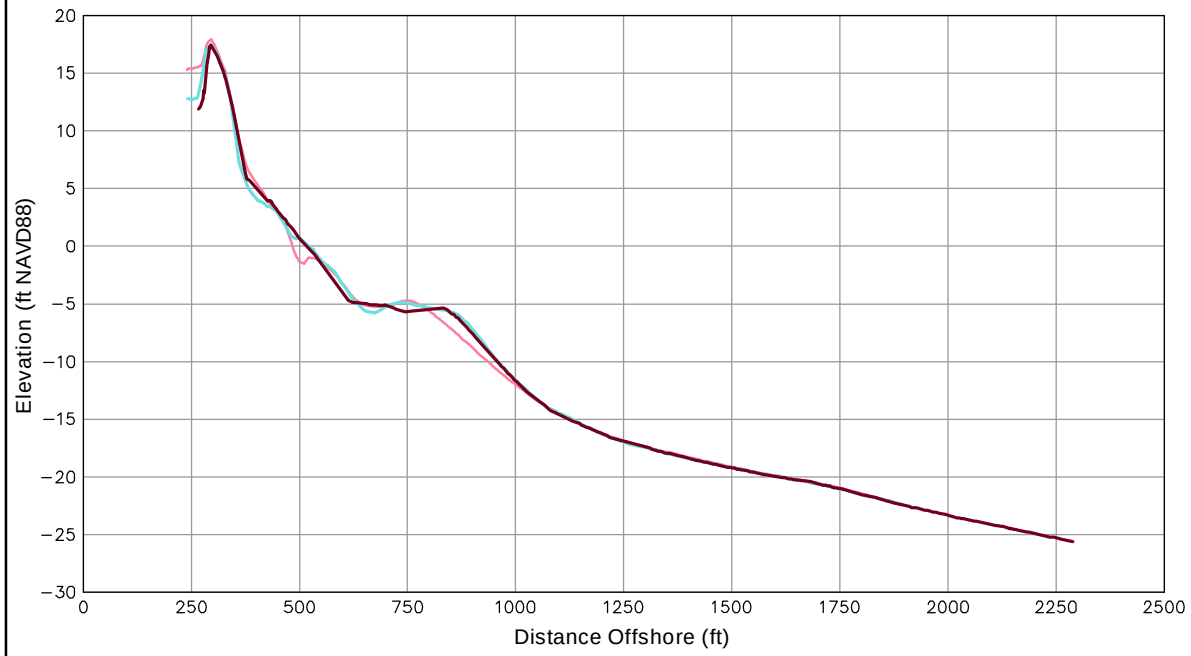
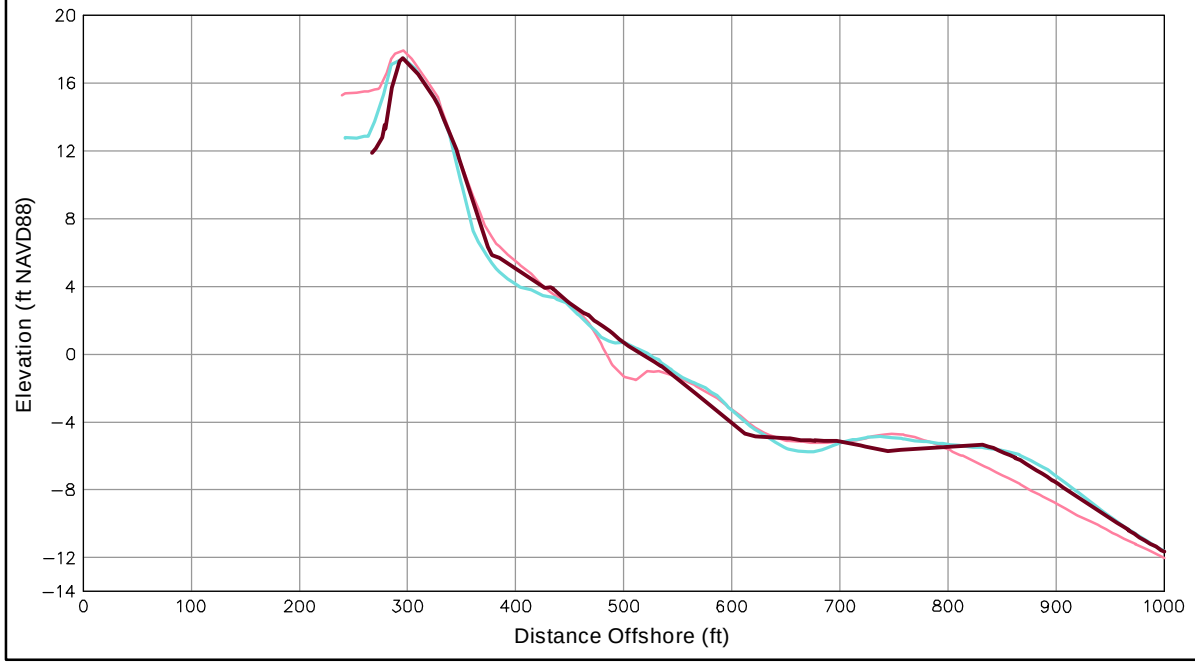
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 274+53	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	17.07 ft/yr	14.13 ft
Volume Change Above -15 ft NAVD88	3.07 cy/ft/yr	-1.63 cy/ft
Volume Change Above 0 ft NAVD88	-2.42 cy/ft/yr	2.38 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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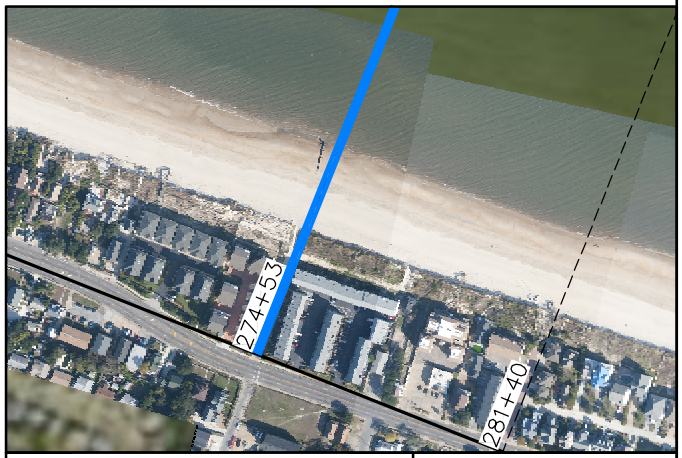

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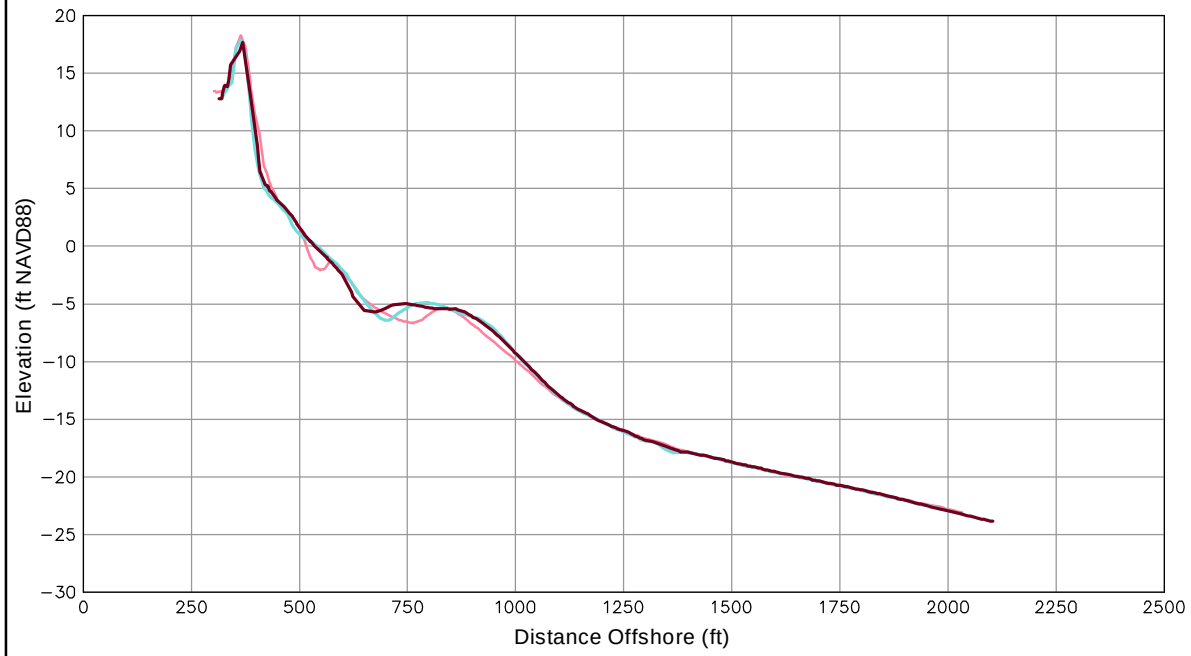

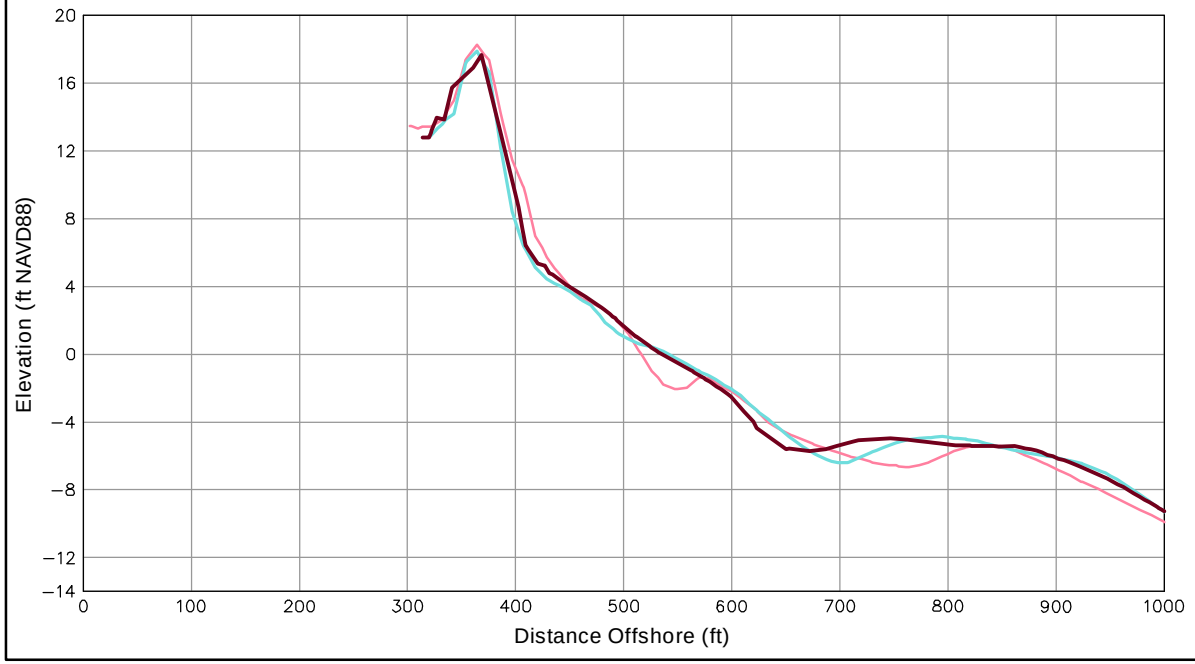

Survey Transect 281+40	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	5.42 ft/yr	10.52 ft
Volume Change Above -15 ft NAVD88	6.27 cy/ft/yr	2.38 cy/ft
Volume Change Above 0 ft NAVD88	-3.24 cy/ft/yr	3.20 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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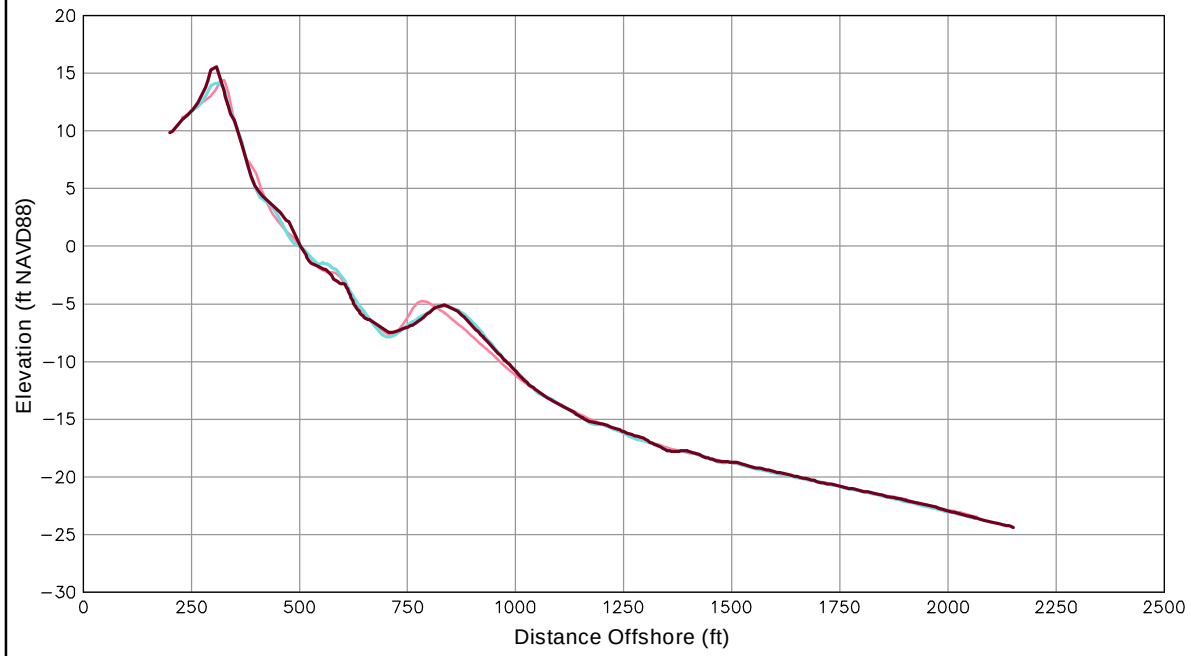

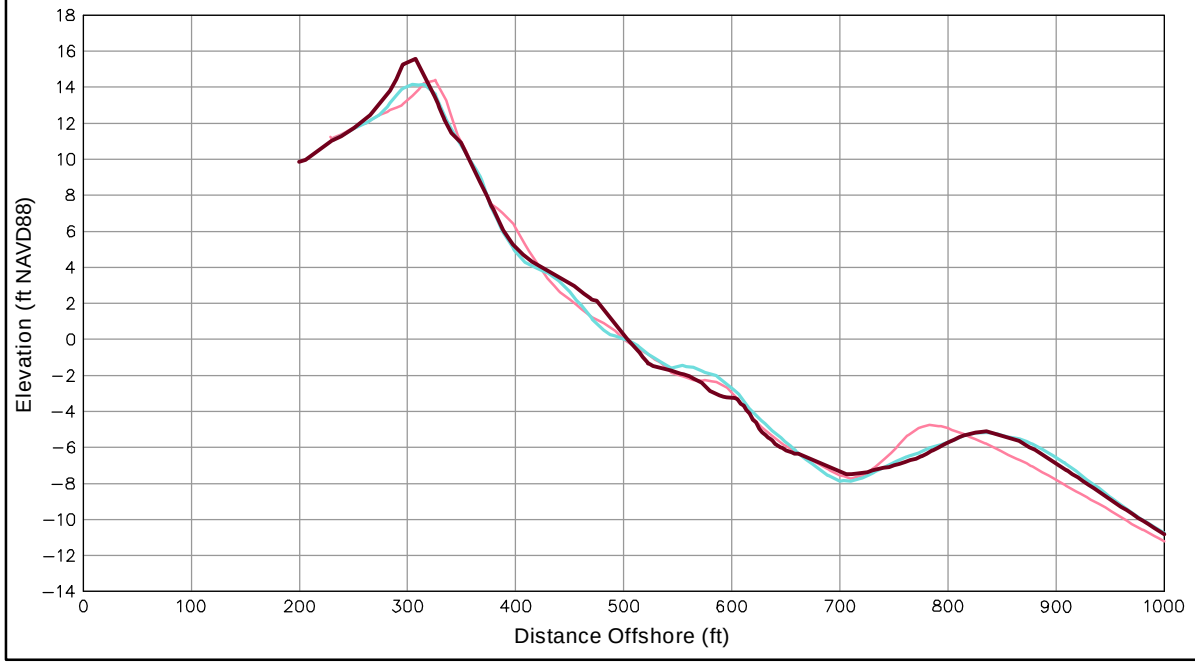

Survey Transect 288+39	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	10.34 ft/yr	16.84 ft
Volume Change Above -15 ft NAVD88	3.24 cy/ft/yr	0.45 cy/ft
Volume Change Above 0 ft NAVD88	2.28 cy/ft/yr	3.77 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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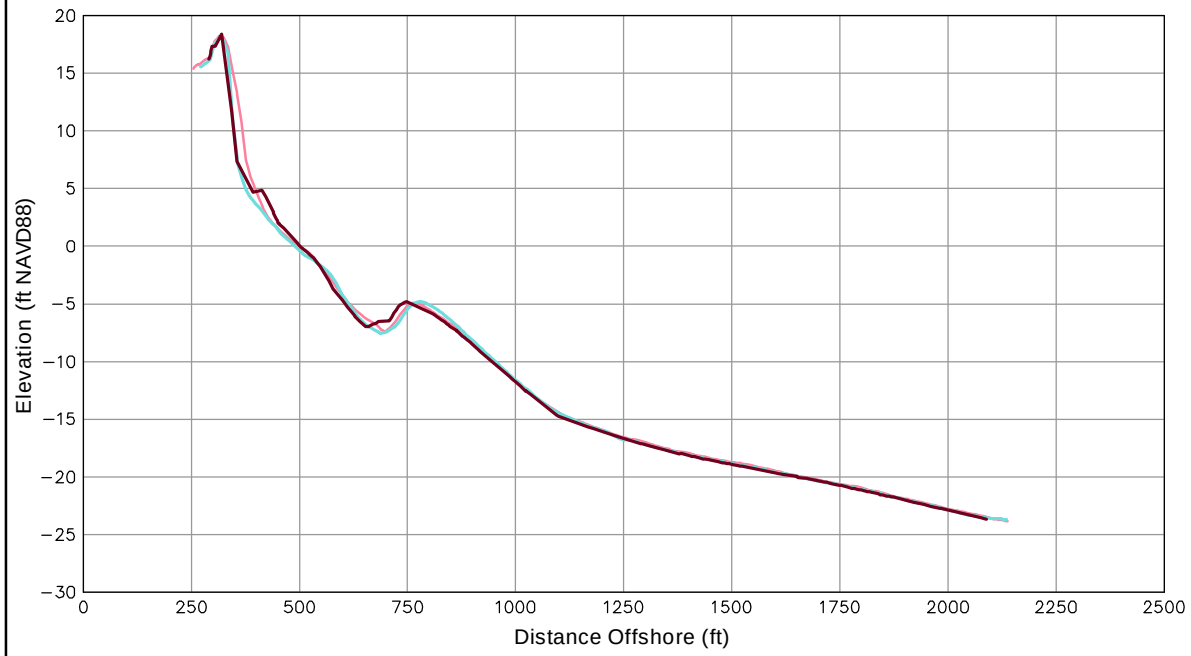
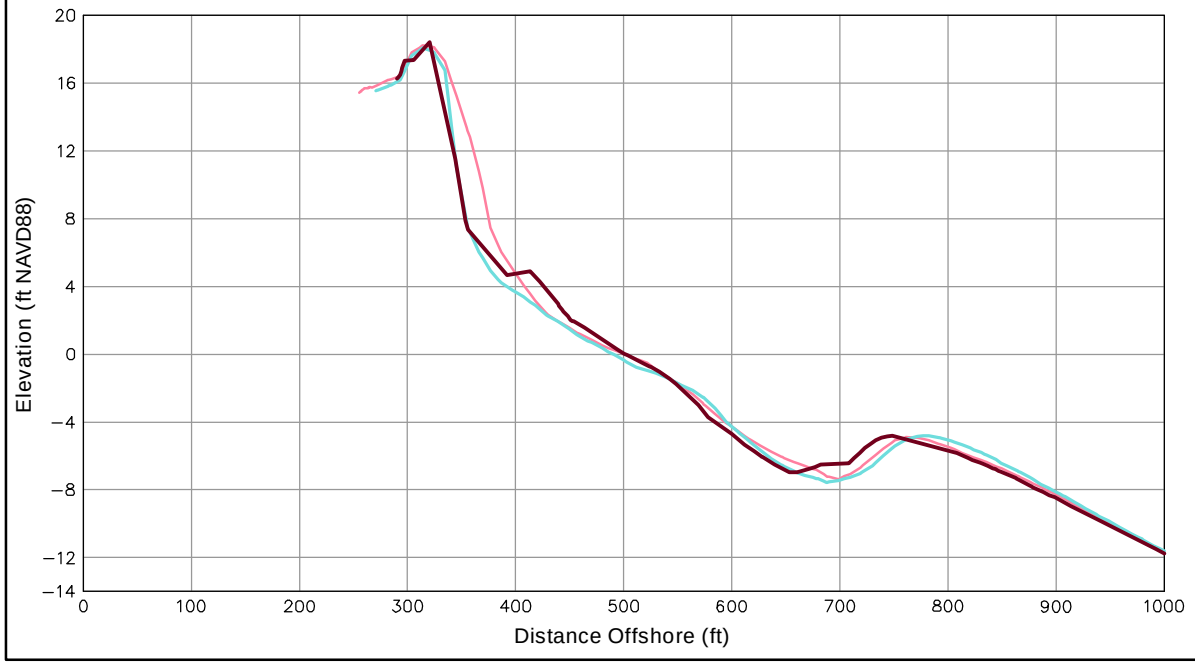
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 295+27	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	11.30 ft/yr	16.44 ft
Volume Change Above -15 ft NAVD88	-7.55 cy/ft/yr	1.23 cy/ft
Volume Change Above 0 ft NAVD88	-5.18 cy/ft/yr	3.61 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

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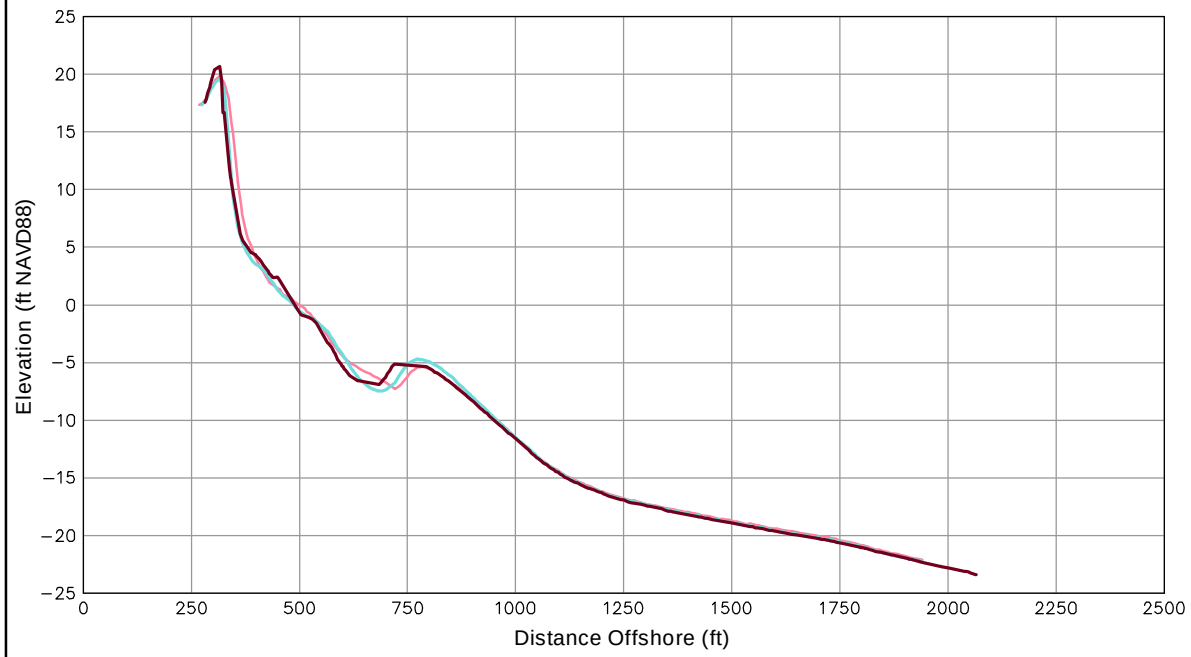

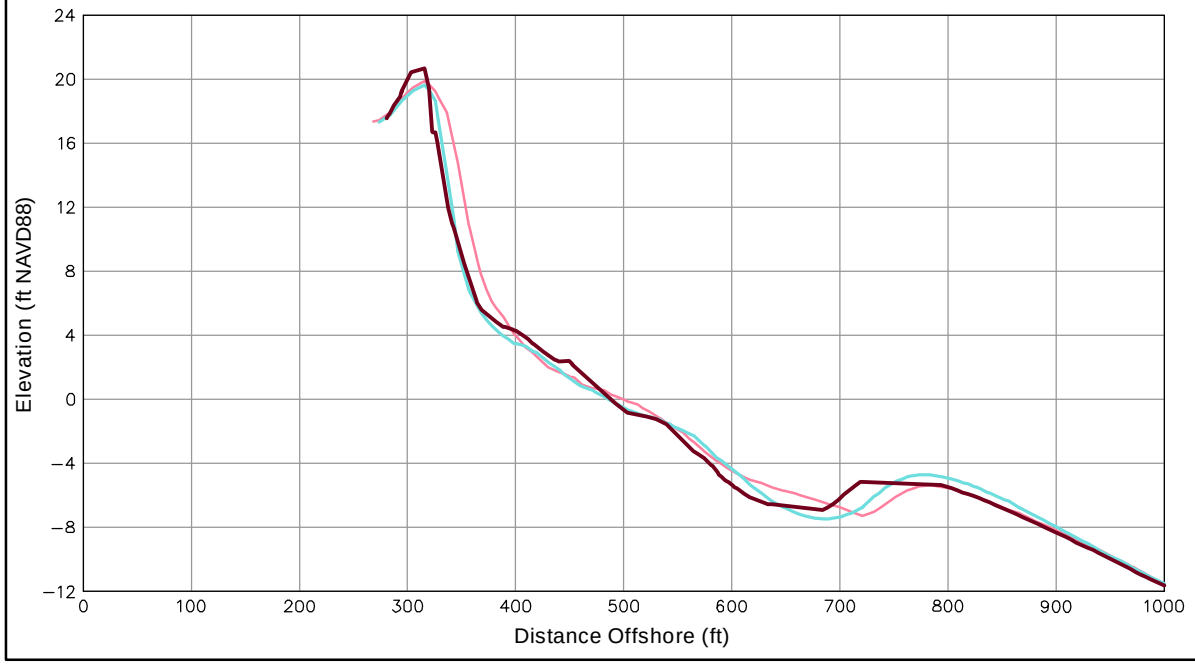

Survey Transect 302+24	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	11.16 ft/yr	15.06 ft
Volume Change Above -15 ft NAVD88	-7.60 cy/ft/yr	-1.34 cy/ft
Volume Change Above 0 ft NAVD88	-4.96 cy/ft/yr	2.61 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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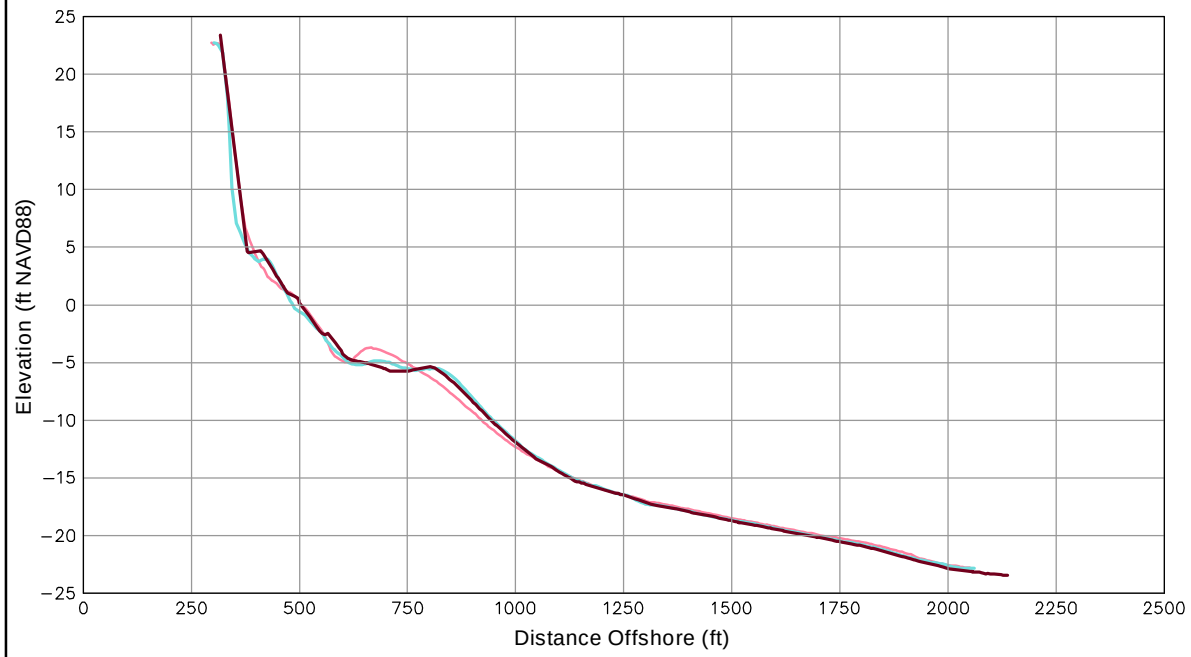
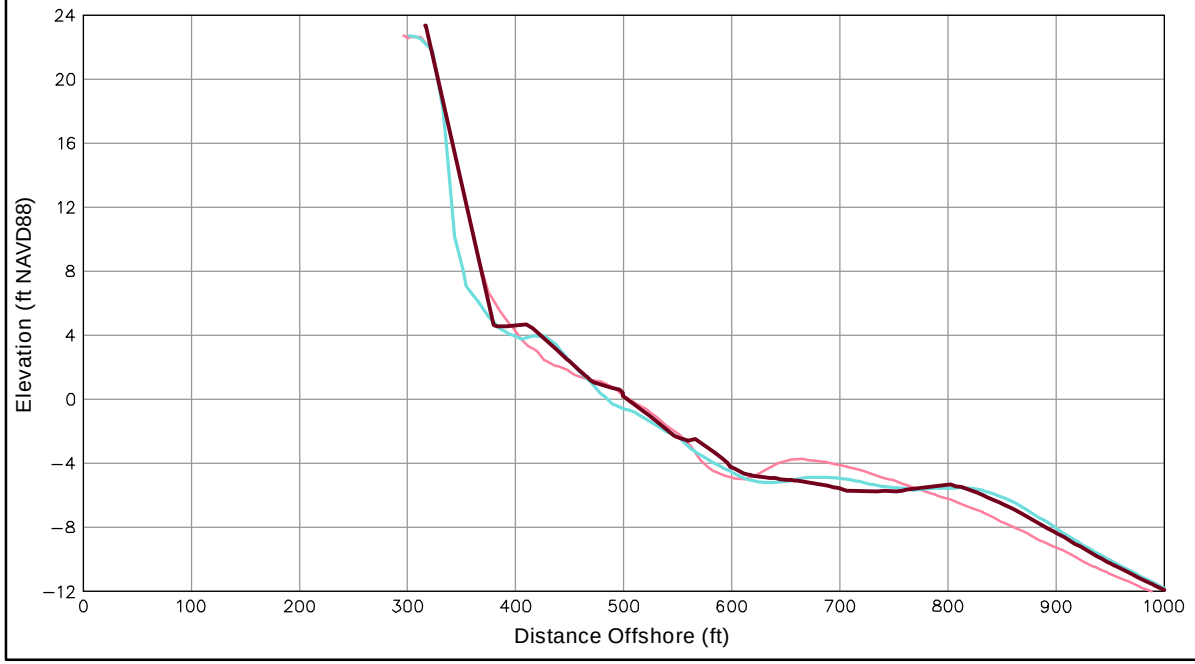
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 315+96	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-8.57 ft/yr	3.14 ft
Volume Change Above -15 ft NAVD88	4.15 cy/ft/yr	5.62 cy/ft
Volume Change Above 0 ft NAVD88	1.31 cy/ft/yr	6.86 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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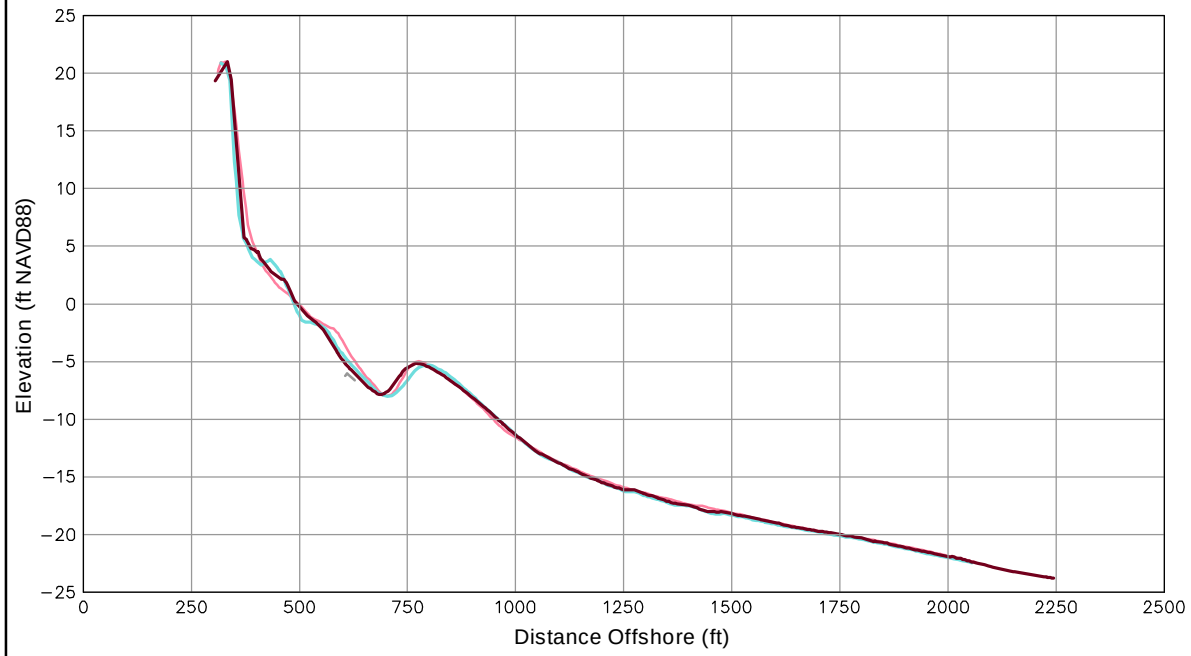
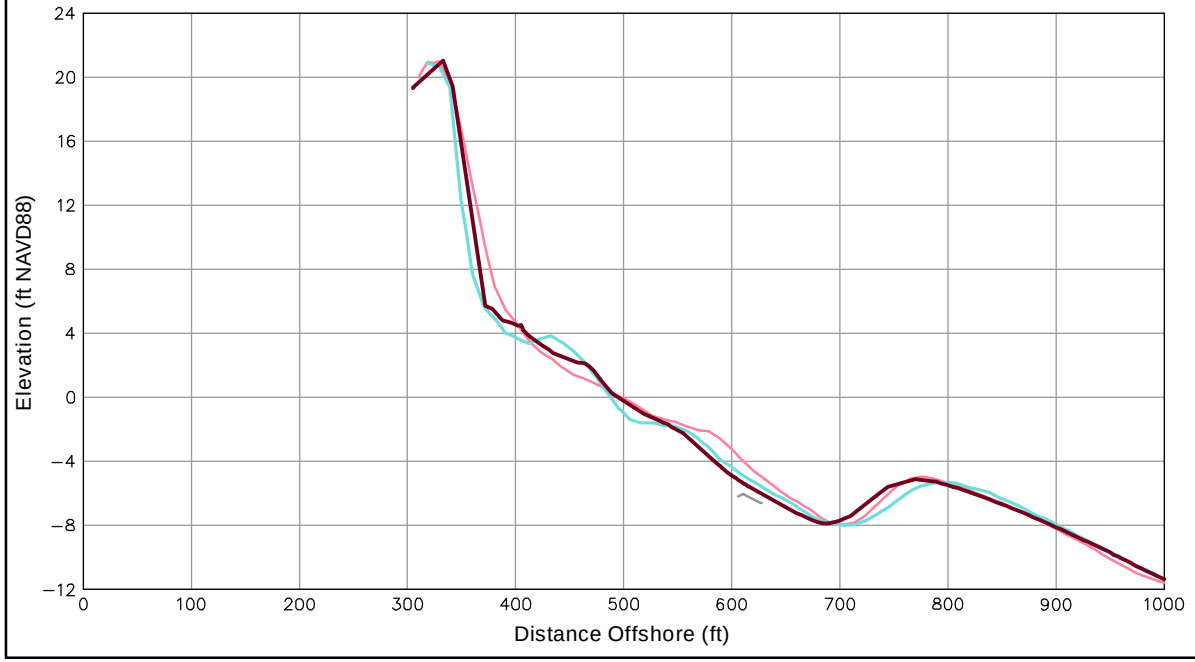
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 323+09	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	10.41 ft/yr	2.65 ft
Volume Change Above -15 ft NAVD88	-5.79 cy/ft/yr	3.70 cy/ft
Volume Change Above 0 ft NAVD88	-1.76 cy/ft/yr	3.22 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT

Notes:
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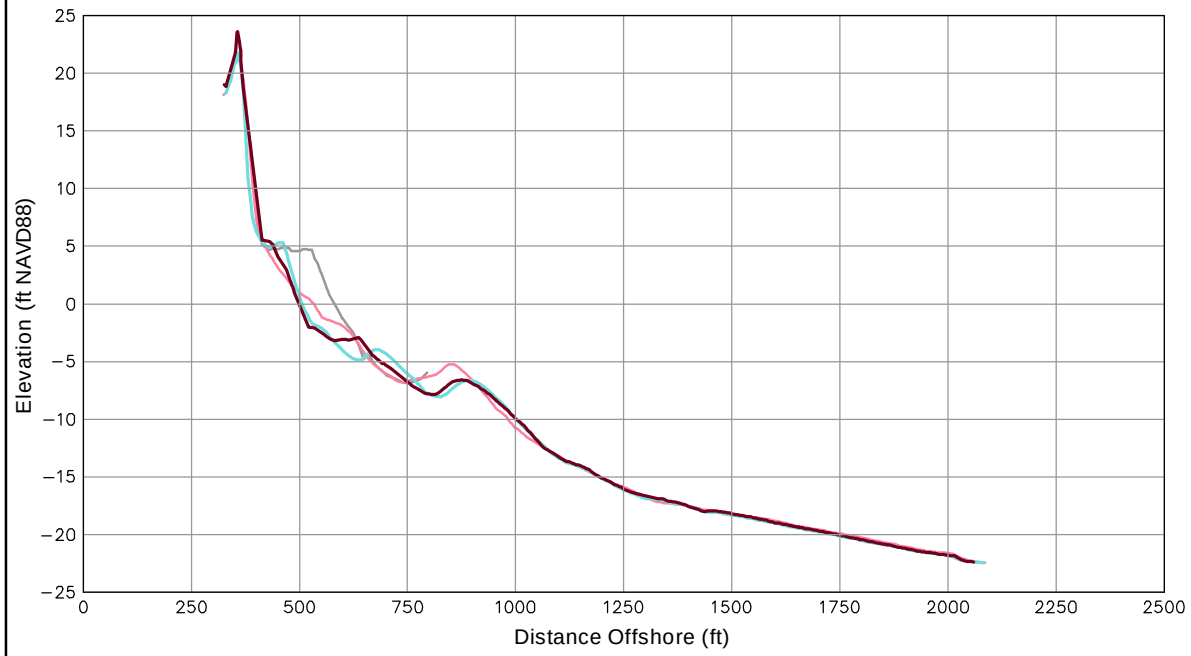
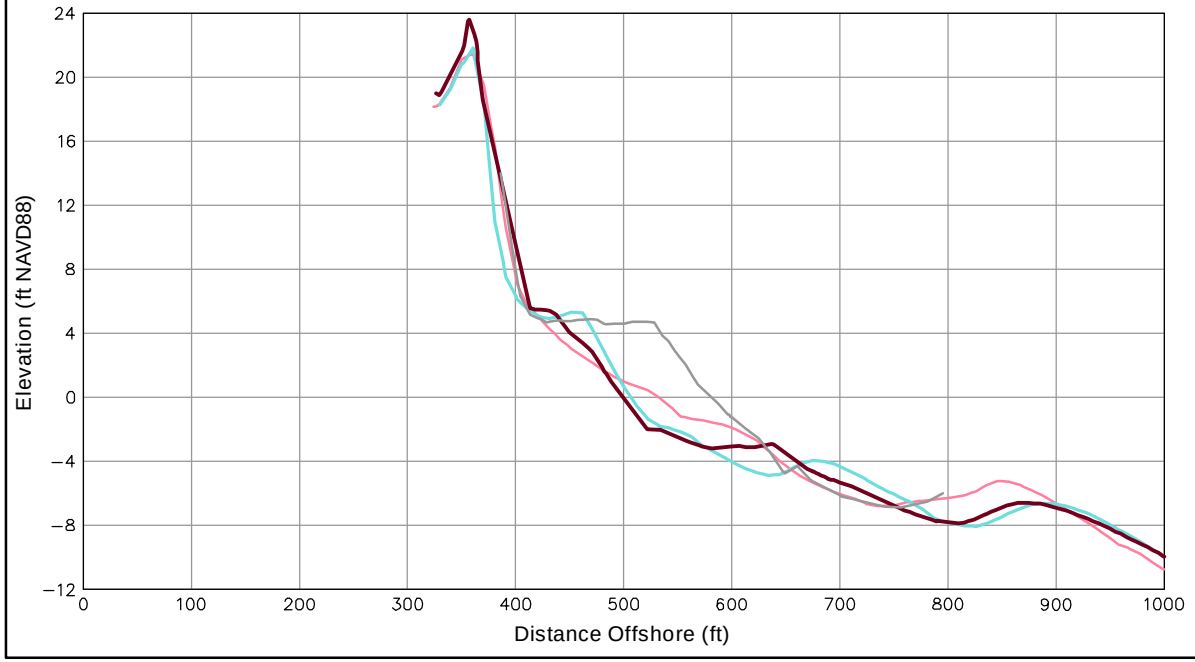
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 329+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-11.51 ft/yr	-9.01 ft
Volume Change Above -15 ft NAVD88	-3.18 cy/ft/yr	3.70 cy/ft
Volume Change Above 0 ft NAVD88	3.30 cy/ft/yr	3.94 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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City of Norfolk

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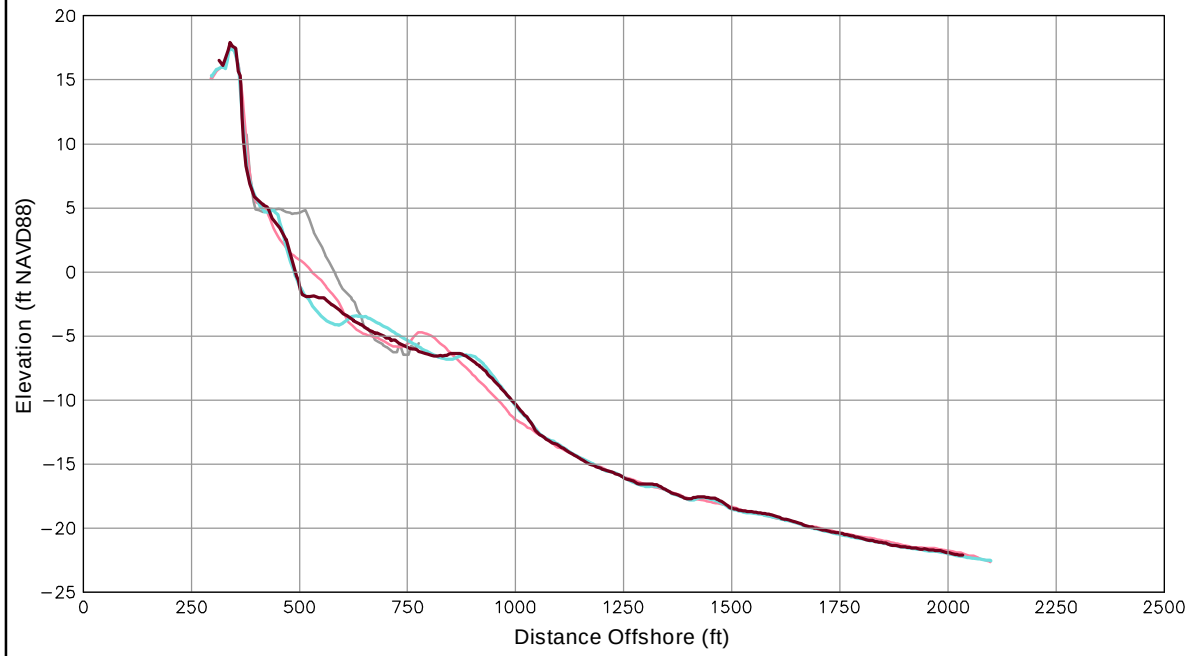

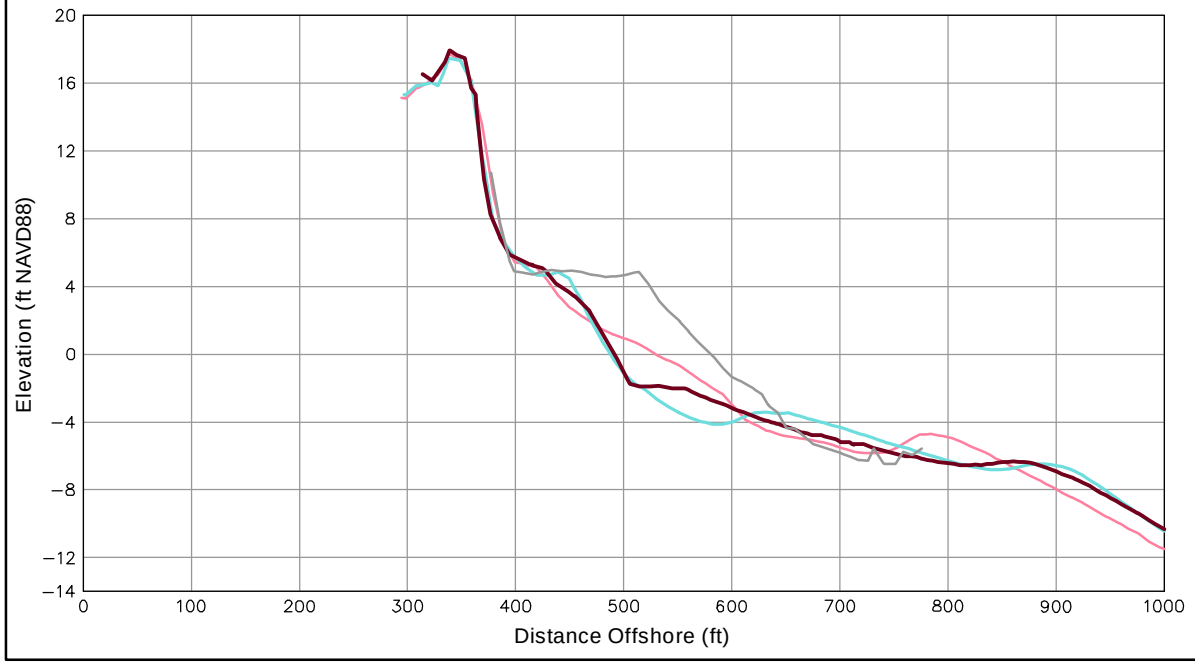

Survey Transect 331+43	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-15.30 ft/yr	4.34 ft
Volume Change Above -15 ft NAVD88	-0.74 cy/ft/yr	-0.17 cy/ft
Volume Change Above 0 ft NAVD88	-1.00 cy/ft/yr	0.57 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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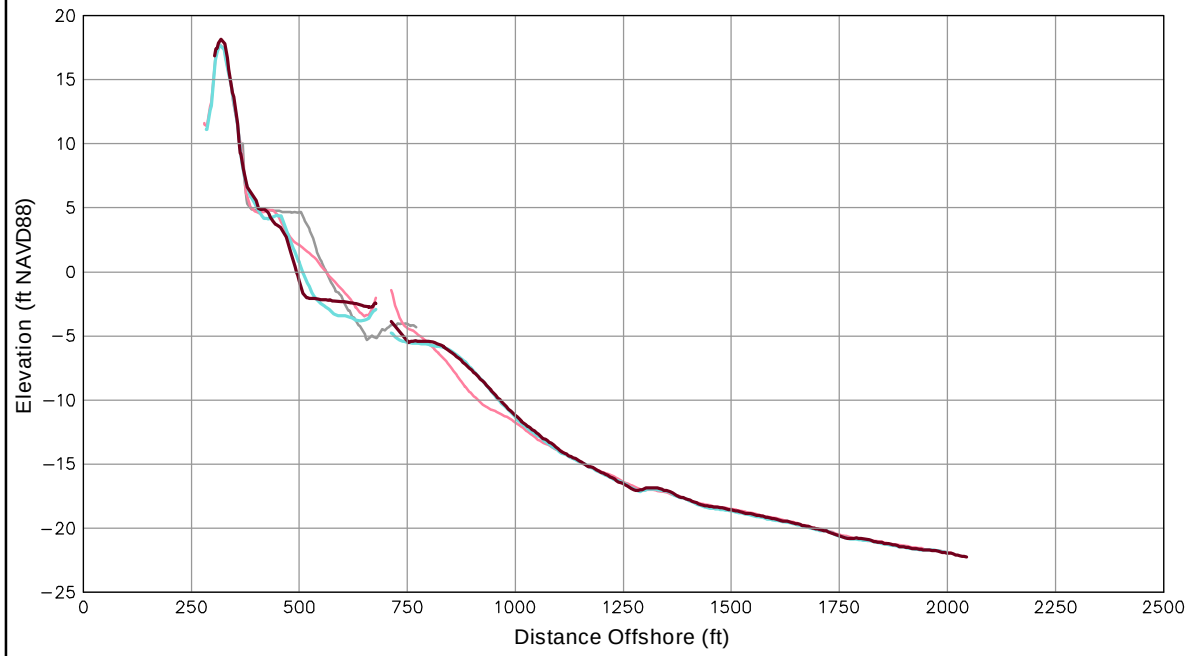

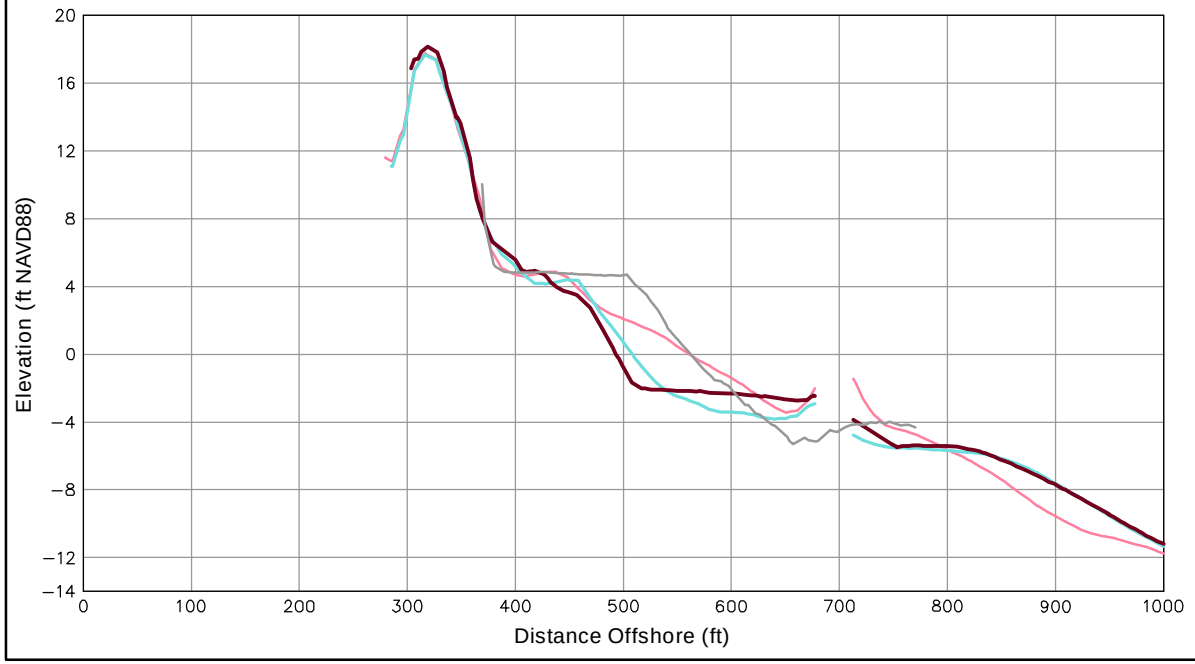

Survey Transect 333+23	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-50.17 ft/yr	-11.46 ft
Volume Change Above -15 ft NAVD88	-1.62 cy/ft/yr	5.83 cy/ft
Volume Change Above 0 ft NAVD88	-3.12 cy/ft/yr	-0.21 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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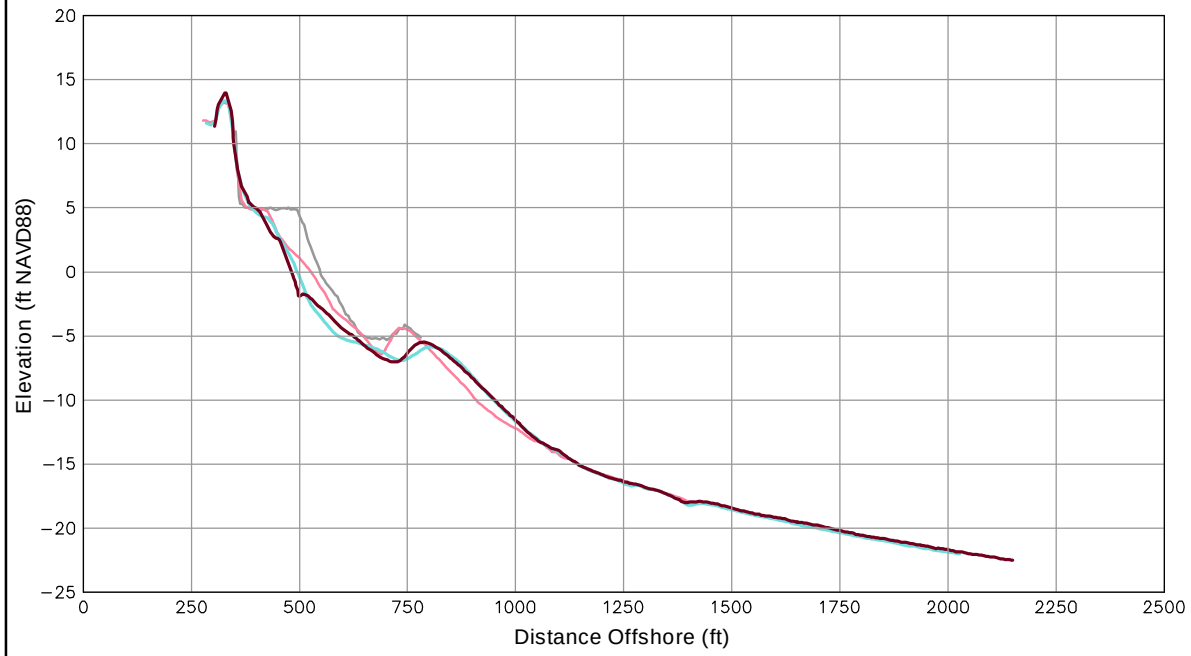

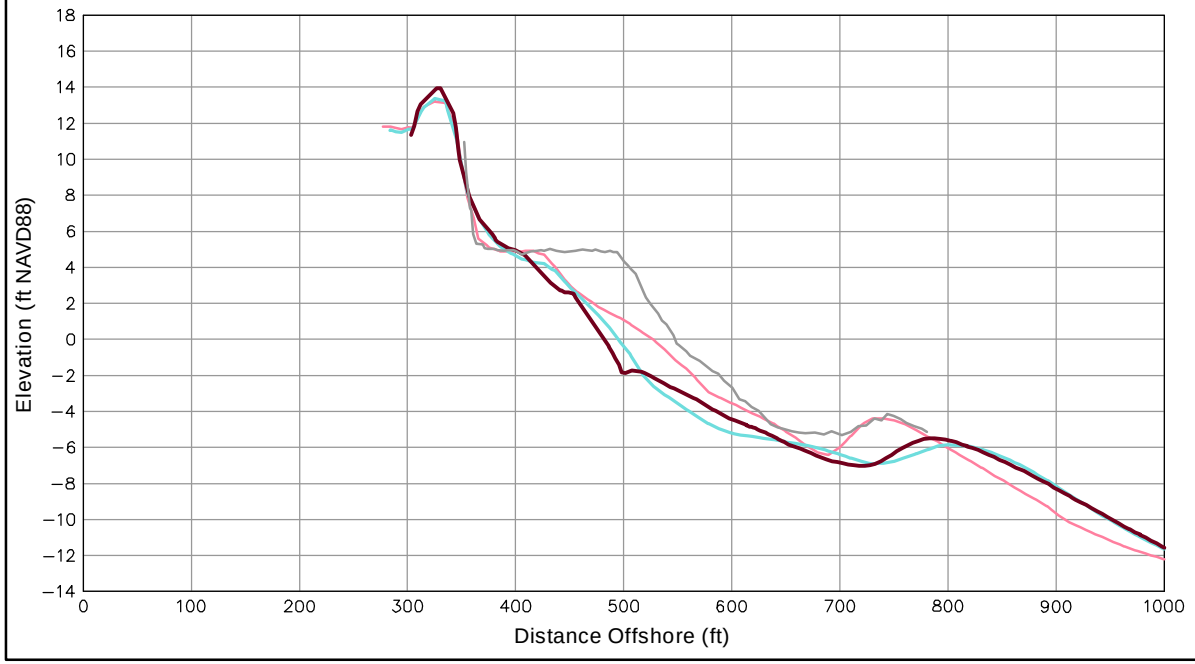

Survey Transect 335+03	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-29.77 ft/yr	-11.26 ft
Volume Change Above -15 ft NAVD88	-5.51 cy/ft/yr	1.22 cy/ft
Volume Change Above 0 ft NAVD88	-2.07 cy/ft/yr	-0.70 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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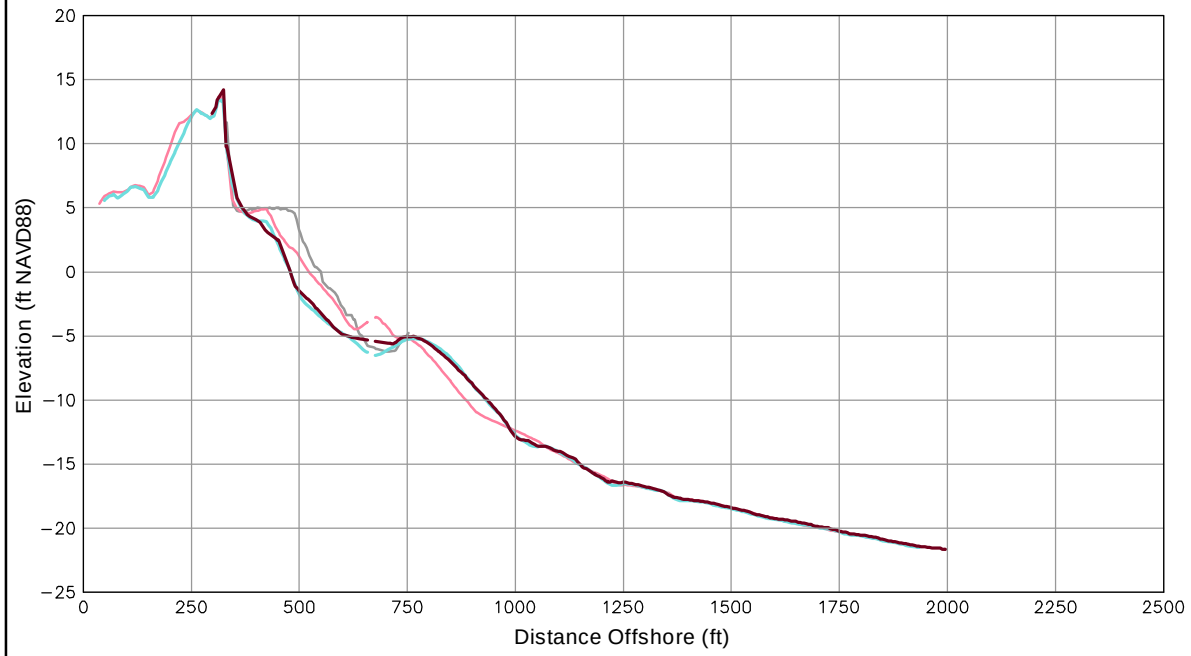

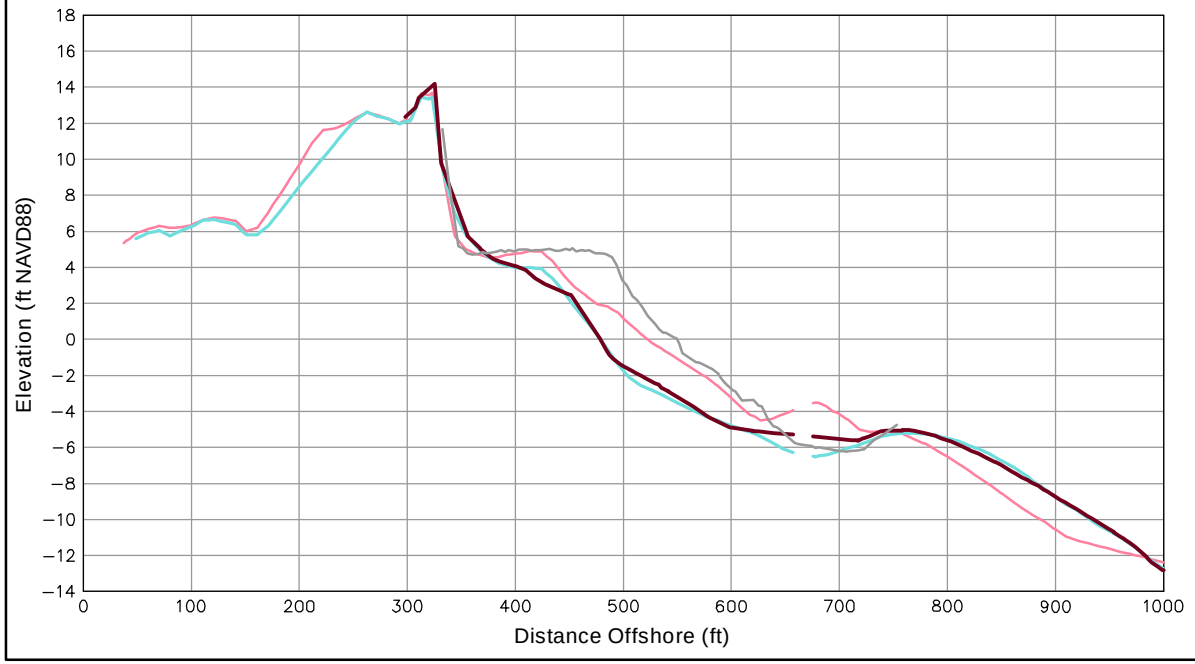

Survey Transect 336+83	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-33.67 ft/yr	1.84 ft
Volume Change Above -15 ft NAVD88	-6.54 cy/ft/yr	4.64 cy/ft
Volume Change Above 0 ft NAVD88	-3.60 cy/ft/yr	0.68 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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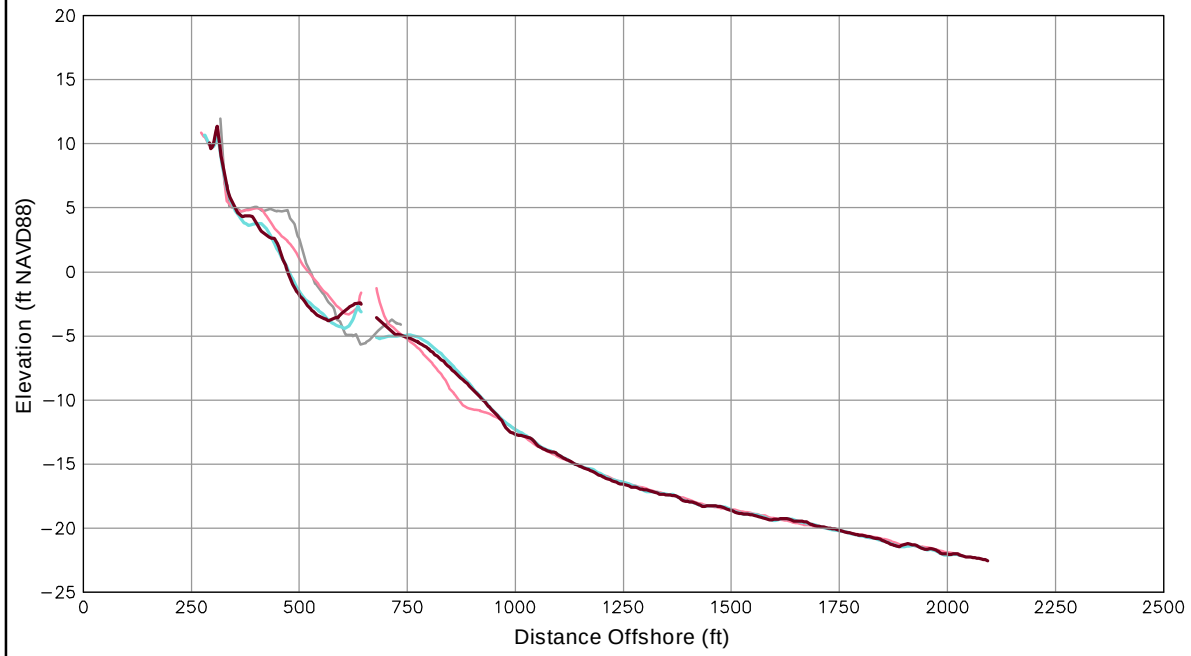
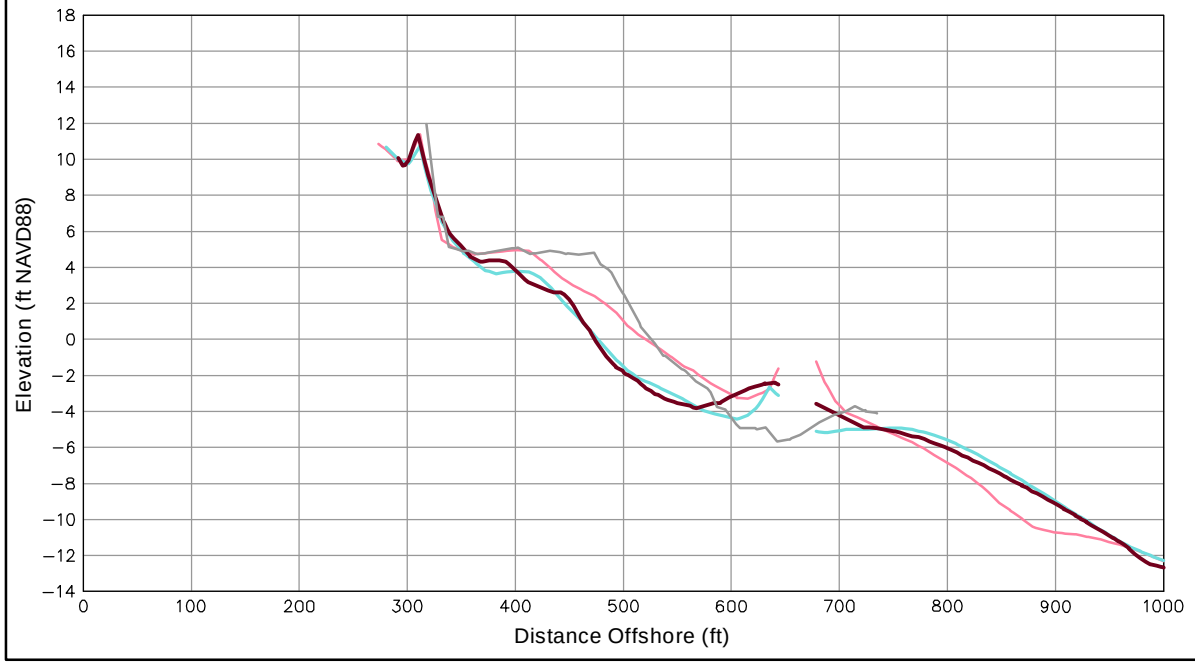
City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 338+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-35.91 ft/yr	0.54 ft
Volume Change Above -15 ft NAVD88	-6.87 cy/ft/yr	0.70 cy/ft
Volume Change Above 0 ft NAVD88	-5.79 cy/ft/yr	1.09 cy/ft

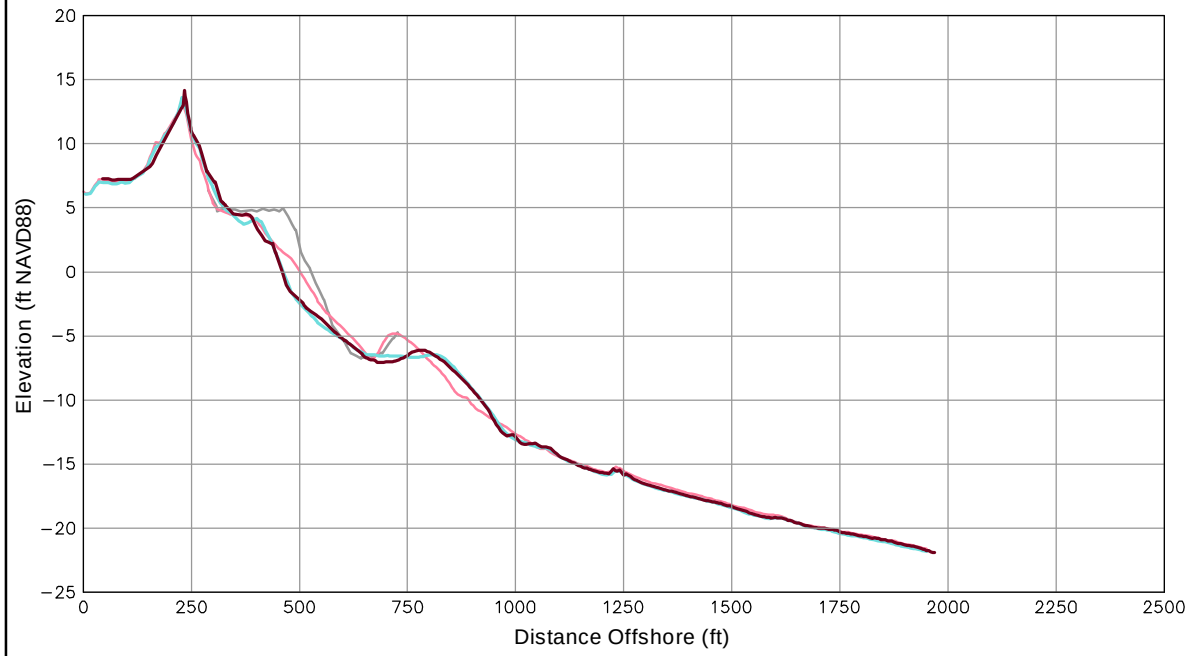
LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

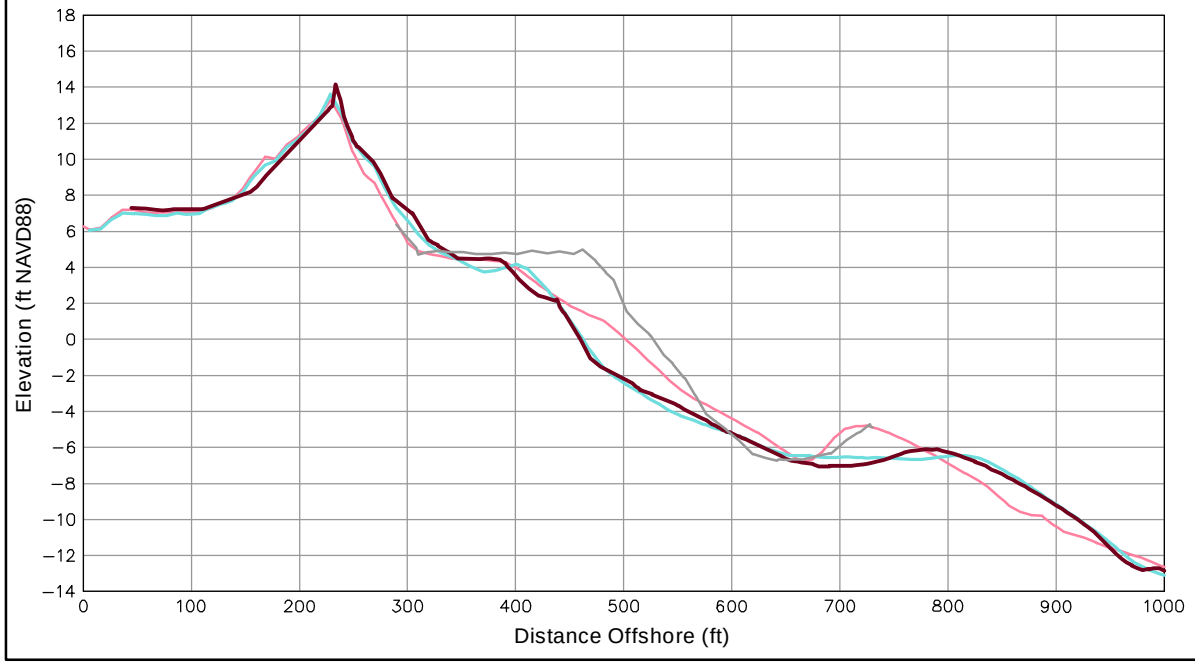
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To October 2009 and March 2010.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were 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 340+43	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-30.86 ft/yr	-1.54 ft
Volume Change Above -15 ft NAVD88	-7.59 cy/ft/yr	0.28 cy/ft
Volume Change Above 0 ft NAVD88	0.13 cy/ft/yr	0.73 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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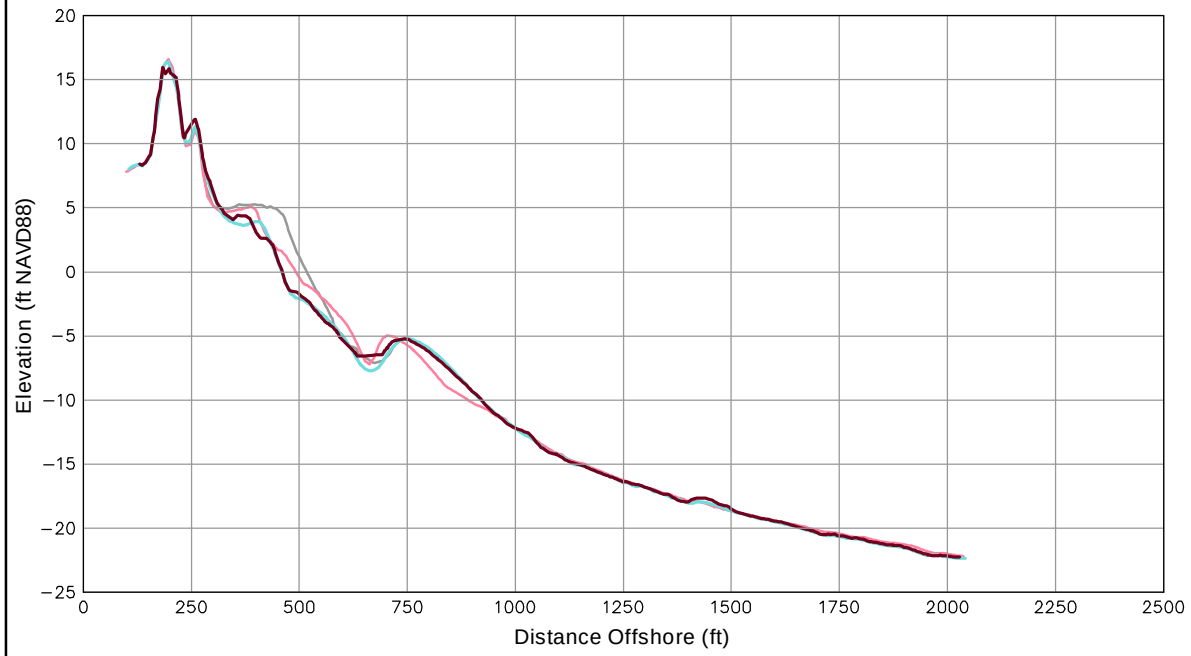
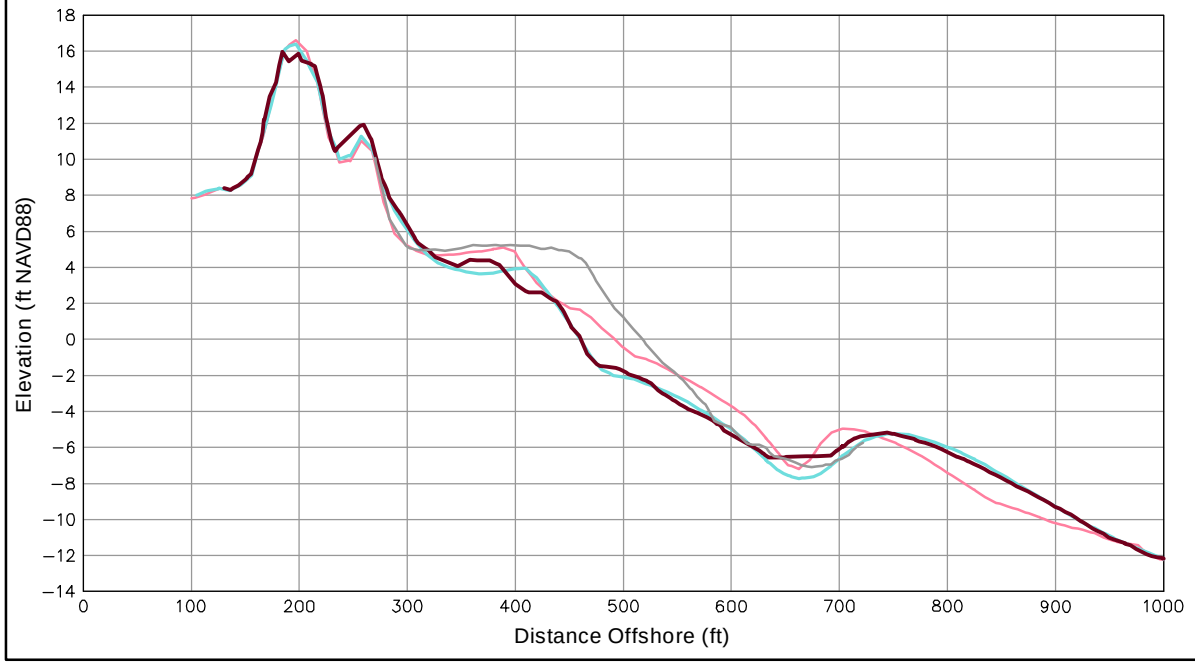
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 342+23	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-23.45 ft/yr	-0.08 ft
Volume Change Above -15 ft NAVD88	-4.33 cy/ft/yr	3.27 cy/ft
Volume Change Above 0 ft NAVD88	-1.31 cy/ft/yr	1.81 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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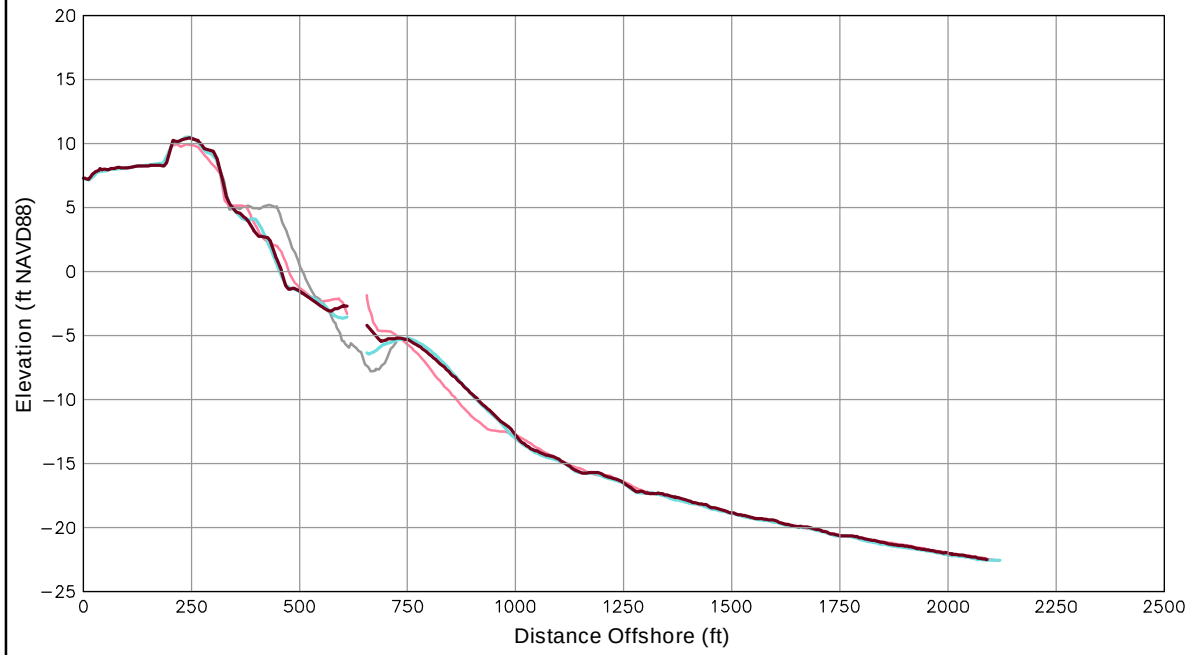
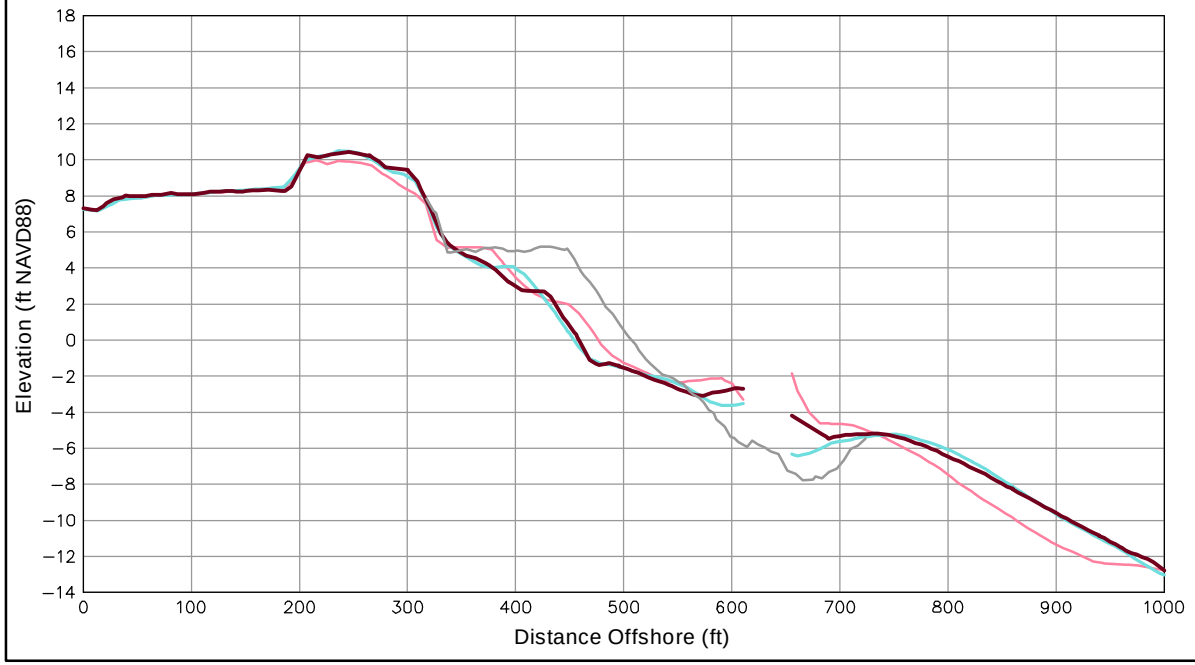
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 344+05	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-15.98 ft/yr	5.15 ft
Volume Change Above -15 ft NAVD88	5.28 cy/ft/yr	3.06 cy/ft
Volume Change Above 0 ft NAVD88	0.15 cy/ft/yr	0.22 cy/ft

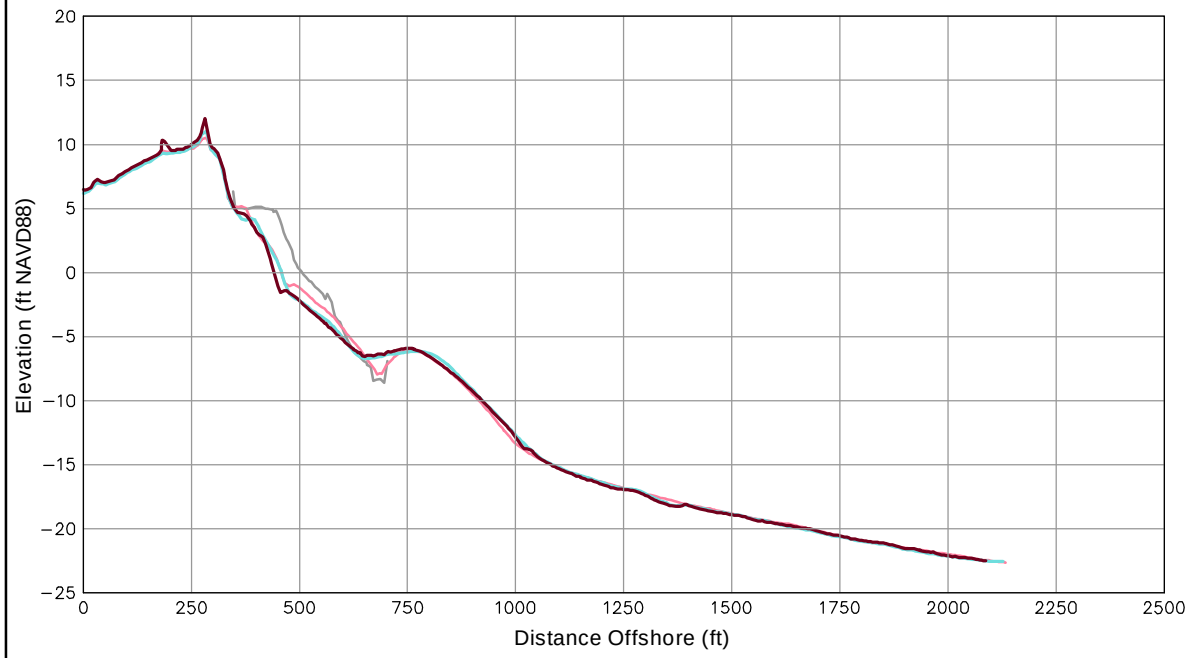
LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

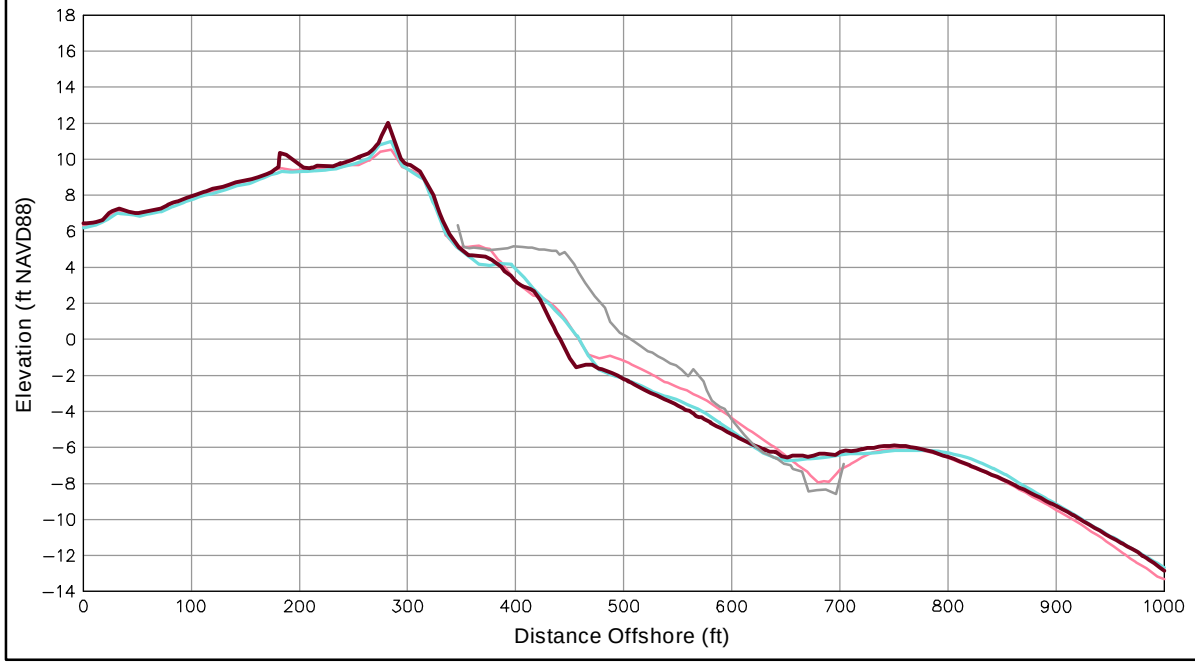
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To October 2009 and March 2010.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were 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 345+85	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-14.05 ft/yr	-14.19 ft
Volume Change Above -15 ft NAVD88	-0.70 cy/ft/yr	-0.19 cy/ft
Volume Change Above 0 ft NAVD88	0.82 cy/ft/yr	2.15 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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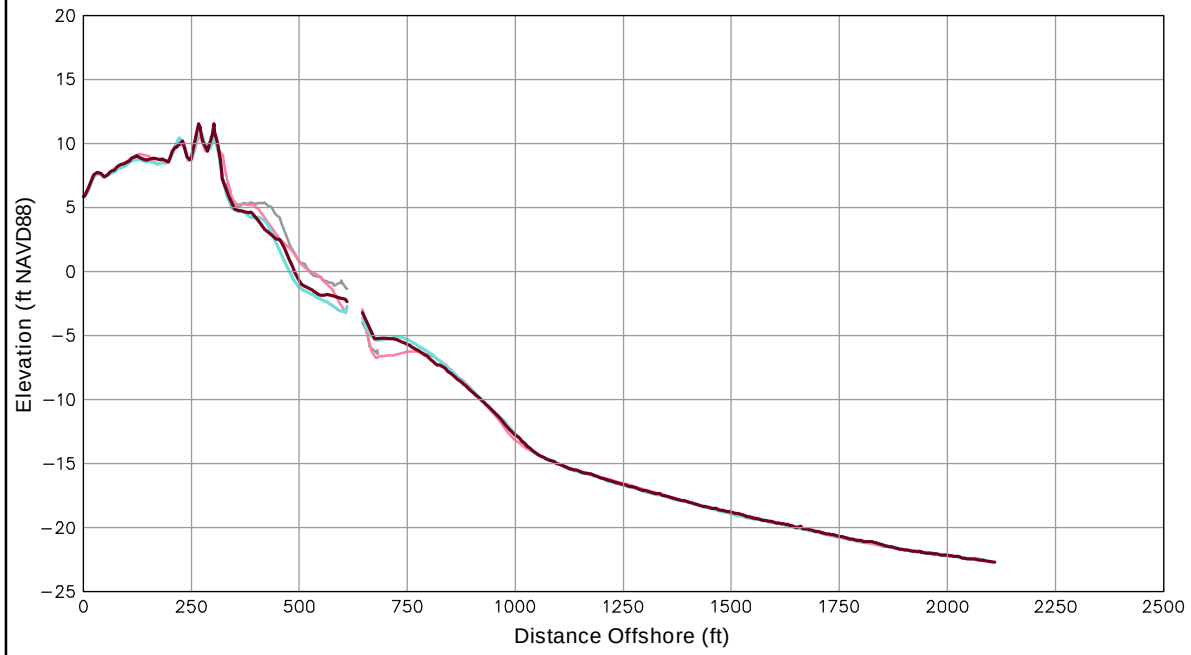
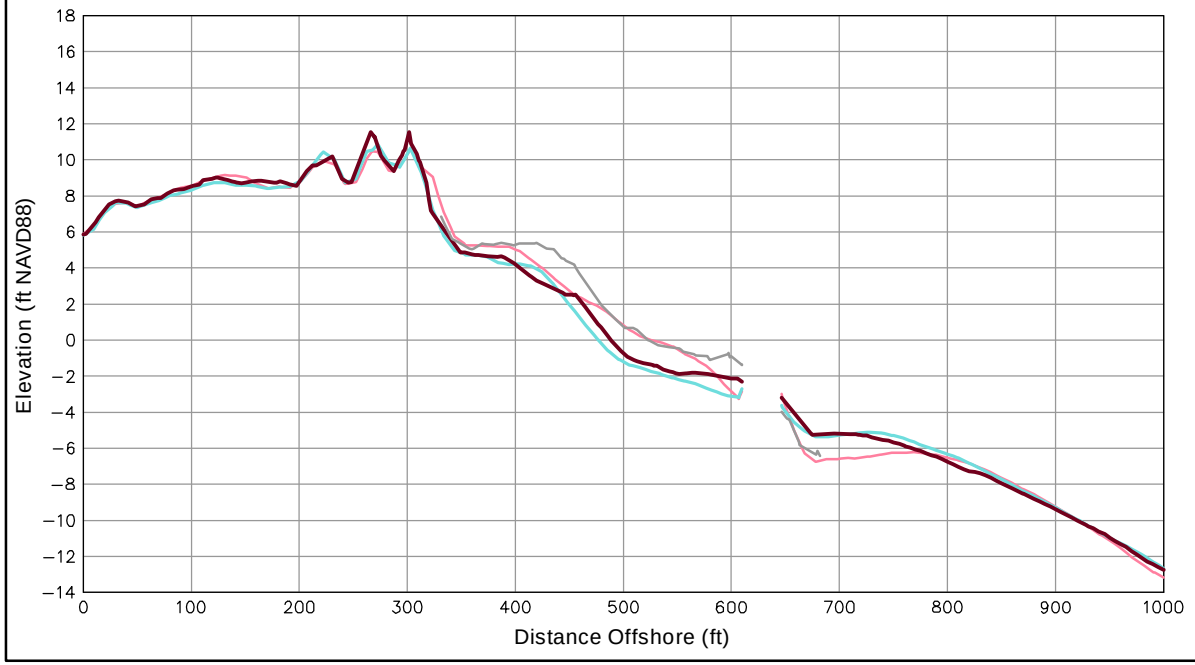
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 347+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-20.03 ft/yr	12.50 ft
Volume Change Above -15 ft NAVD88	-2.27 cy/ft/yr	3.92 cy/ft
Volume Change Above 0 ft NAVD88	-3.81 cy/ft/yr	2.89 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- 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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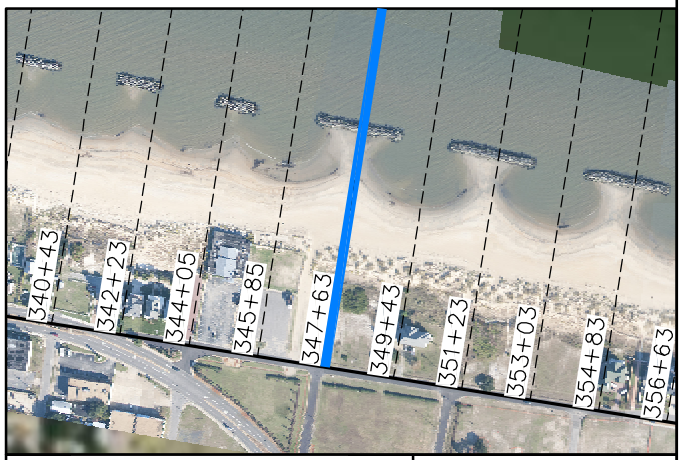

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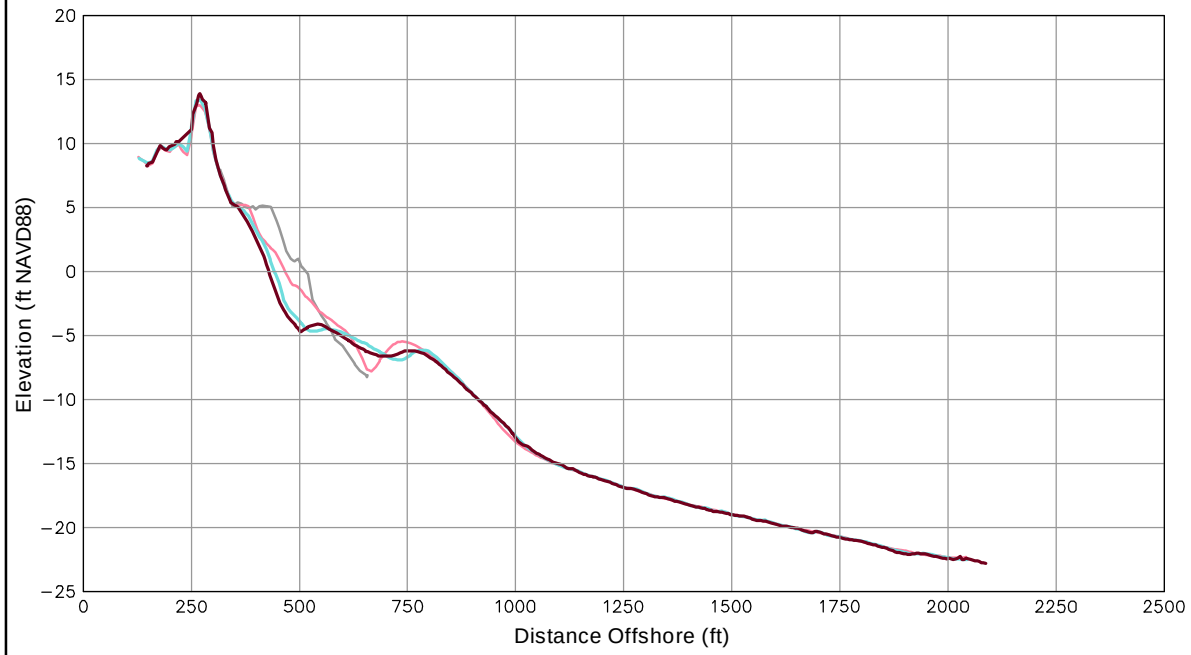
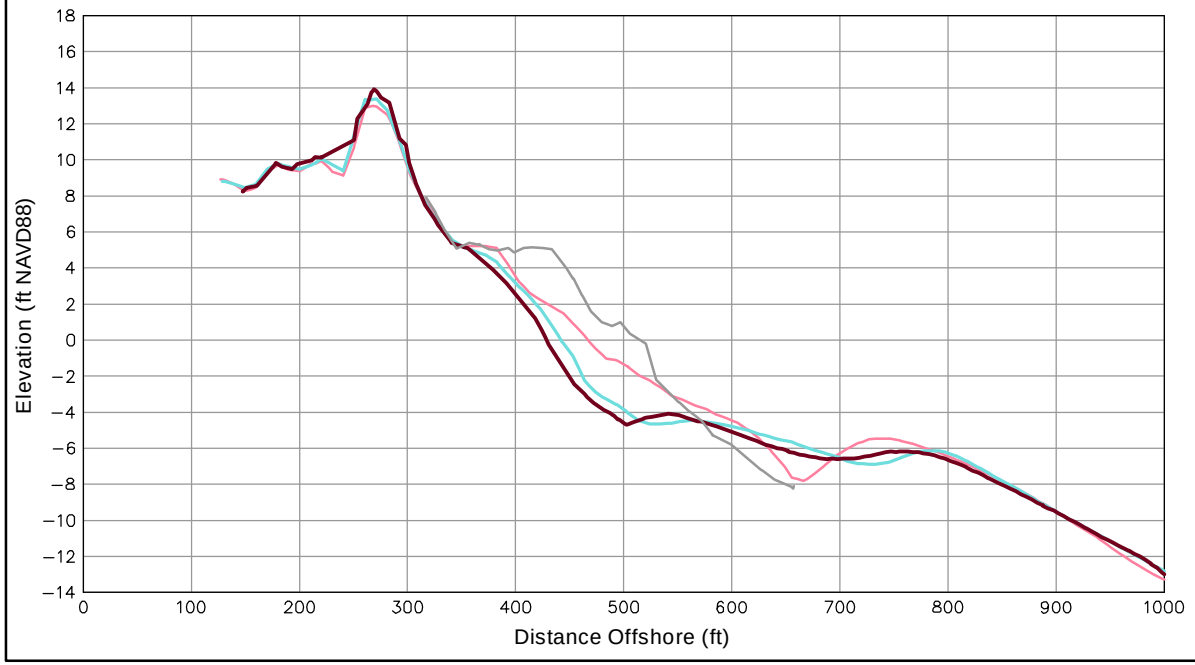
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 349+43	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-30.07 ft/yr	-11.14 ft
Volume Change Above -15 ft NAVD88	-12.27 cy/ft/yr	-4.41 cy/ft
Volume Change Above 0 ft NAVD88	-1.83 cy/ft/yr	-0.63 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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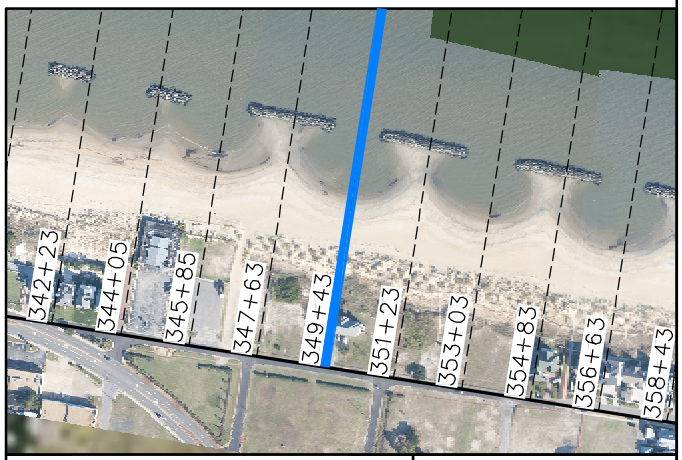
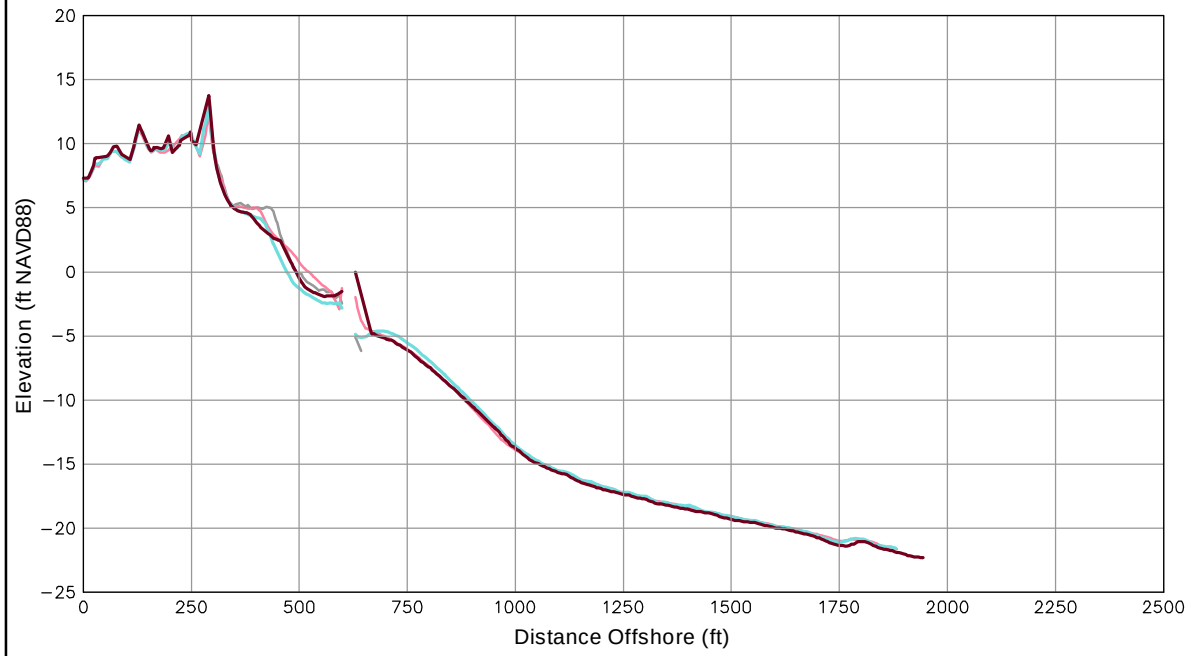
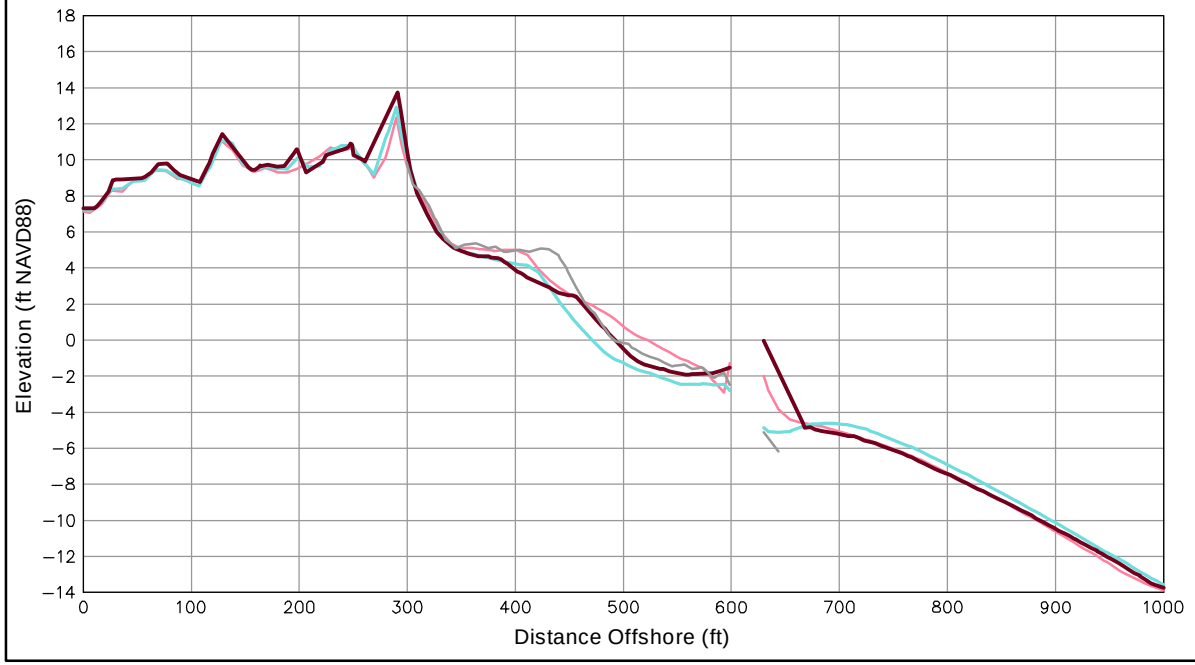


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 351+23	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-17.80 ft/yr	20.49 ft
Volume Change Above -15 ft NAVD88	0.06 cy/ft/yr	4.73 cy/ft
Volume Change Above 0 ft NAVD88	-0.09 cy/ft/yr	3.90 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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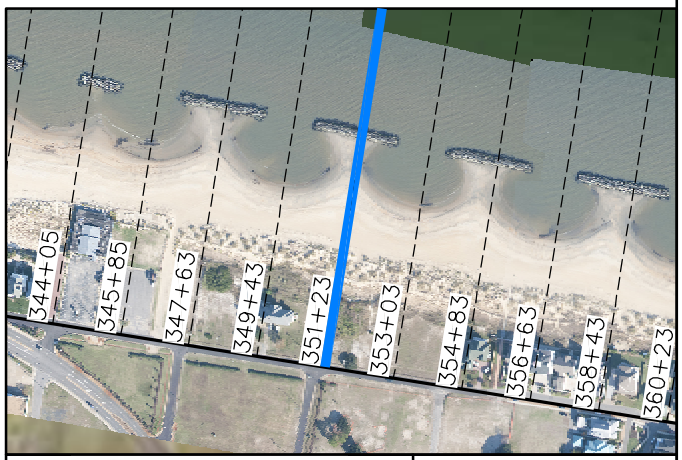
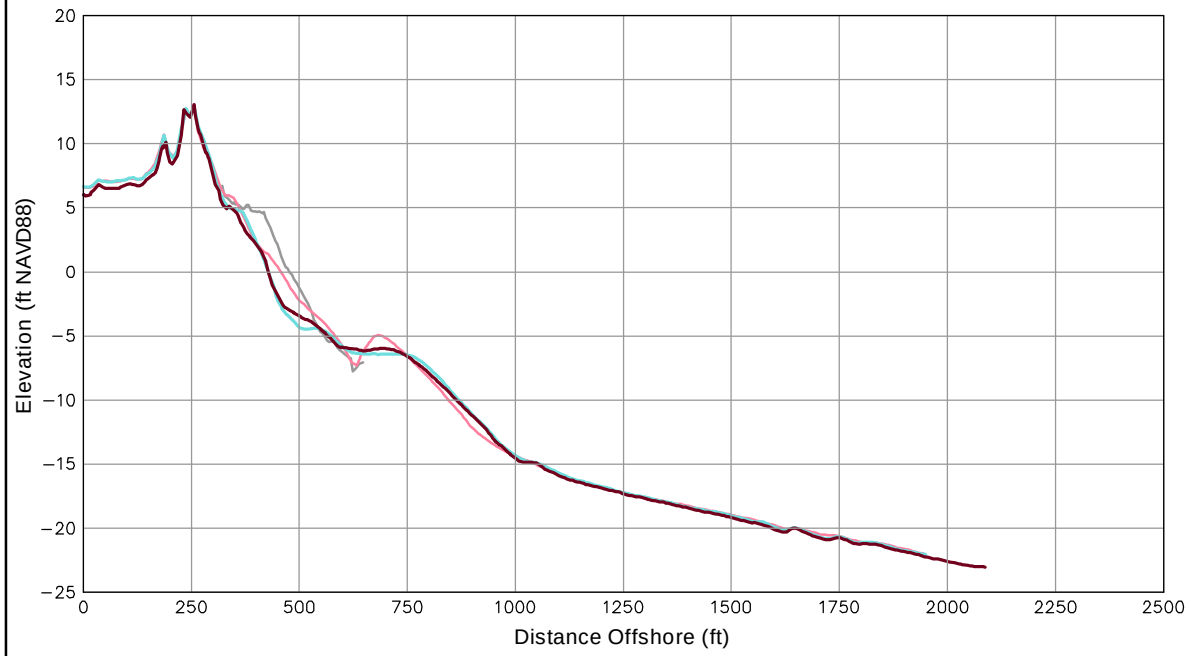
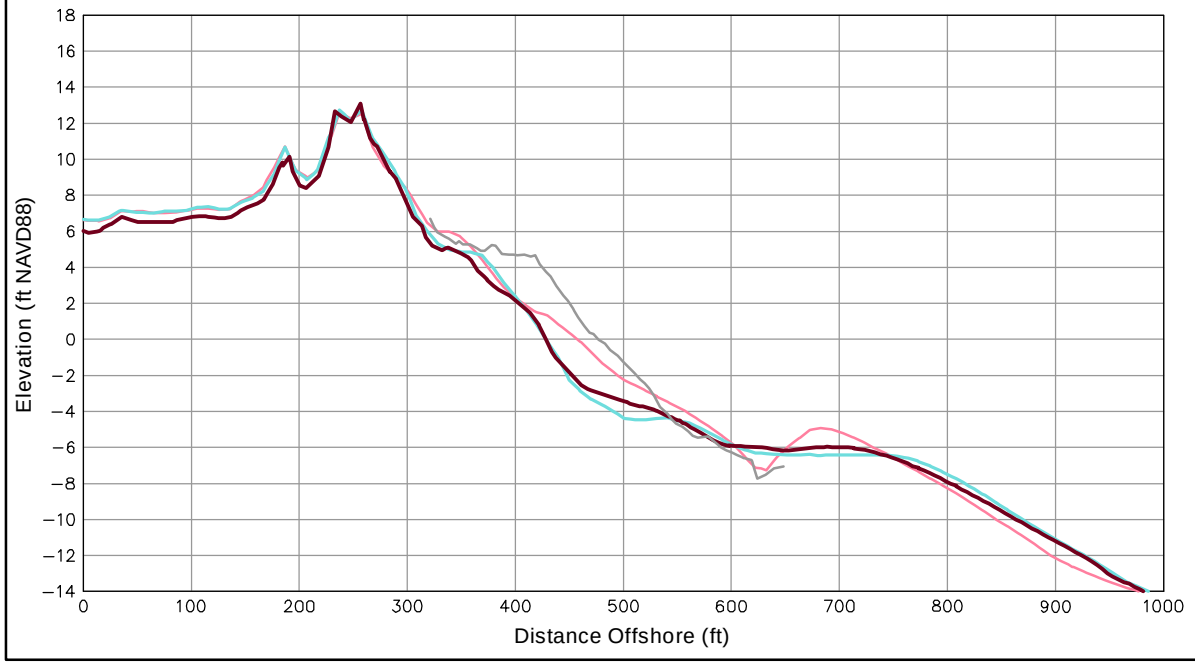


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 353+03	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-16.78 ft/yr	1.60 ft
Volume Change Above -15 ft NAVD88	-11.12 cy/ft/yr	-5.31 cy/ft
Volume Change Above 0 ft NAVD88	-7.54 cy/ft/yr	-6.15 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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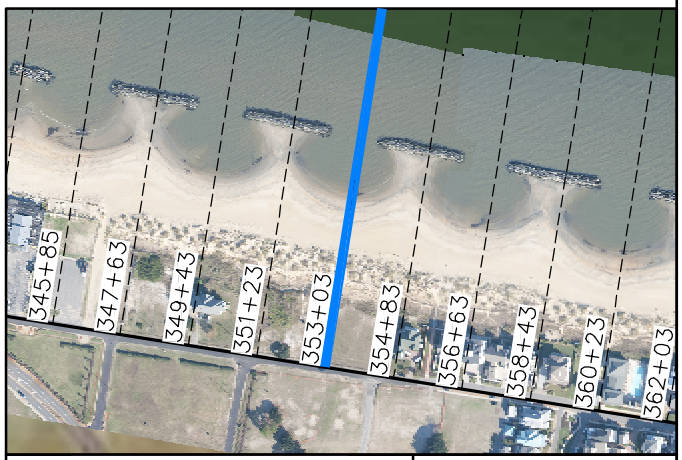

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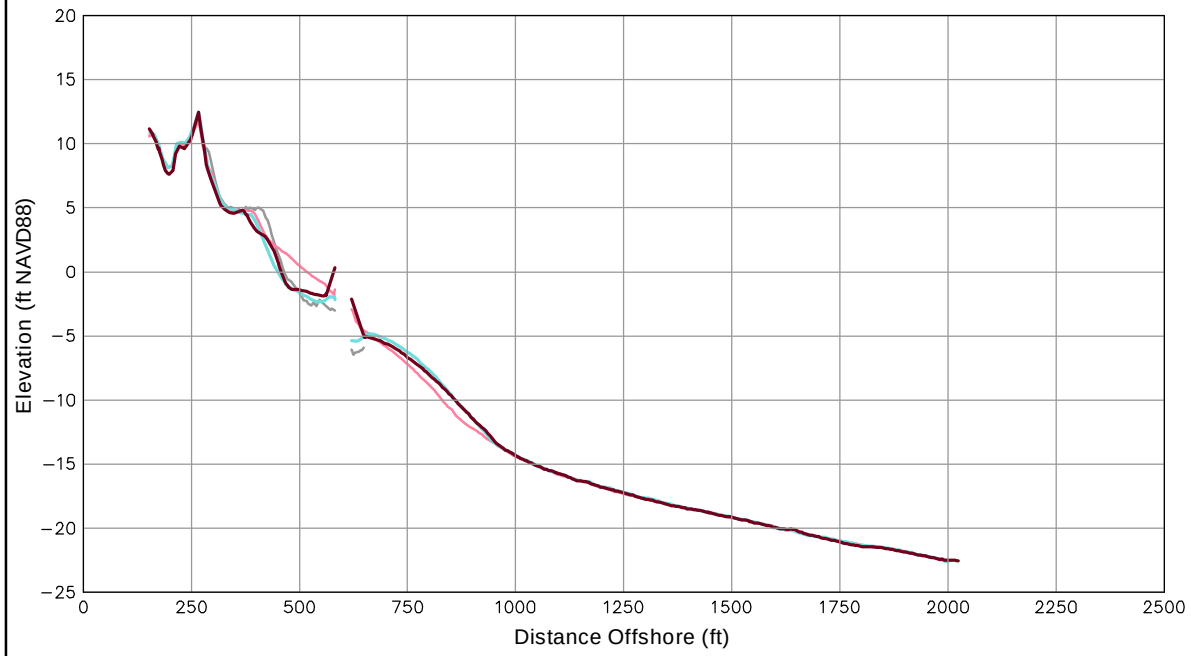
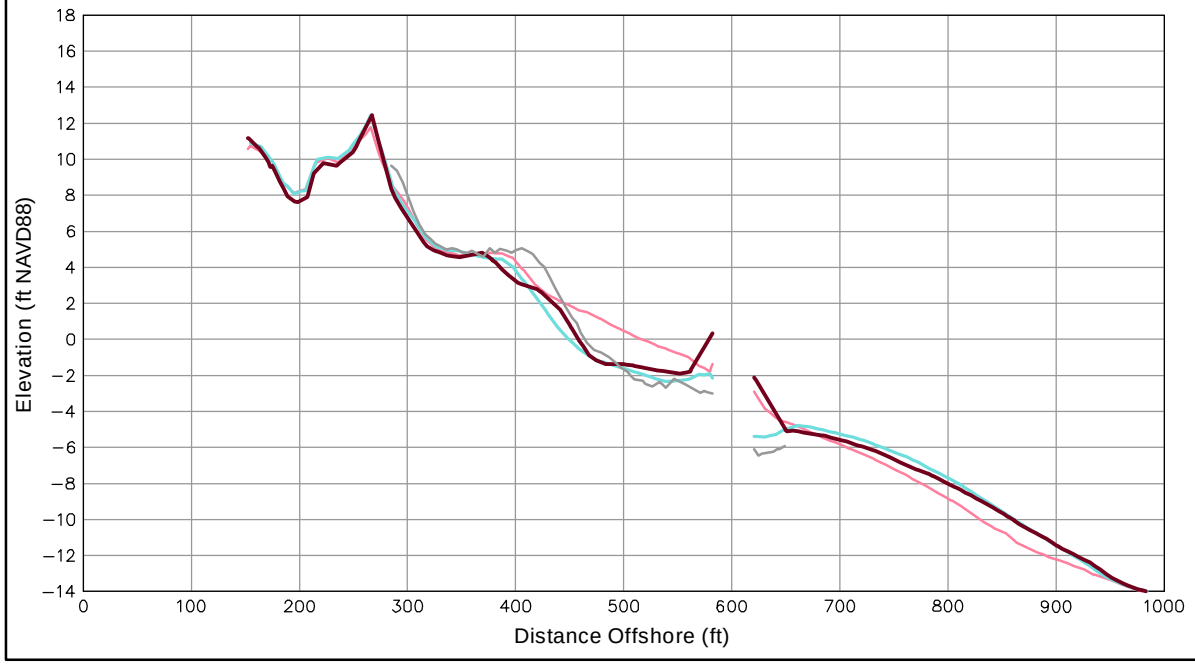
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 354+83	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-33.22 ft/yr	13.05 ft
Volume Change Above -15 ft NAVD88	-1.57 cy/ft/yr	5.60 cy/ft
Volume Change Above 0 ft NAVD88	-4.80 cy/ft/yr	-1.53 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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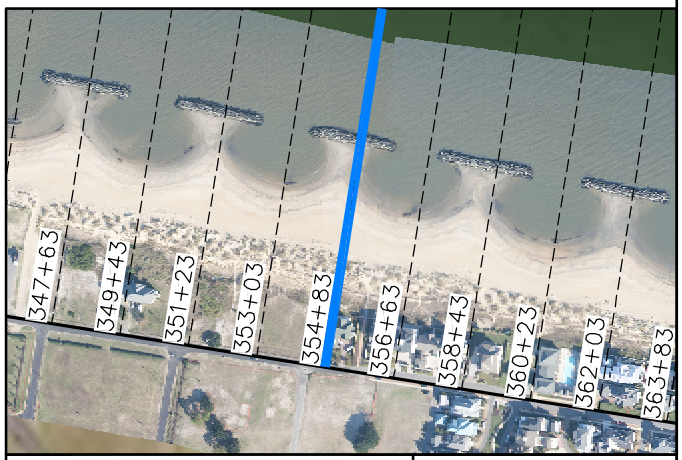
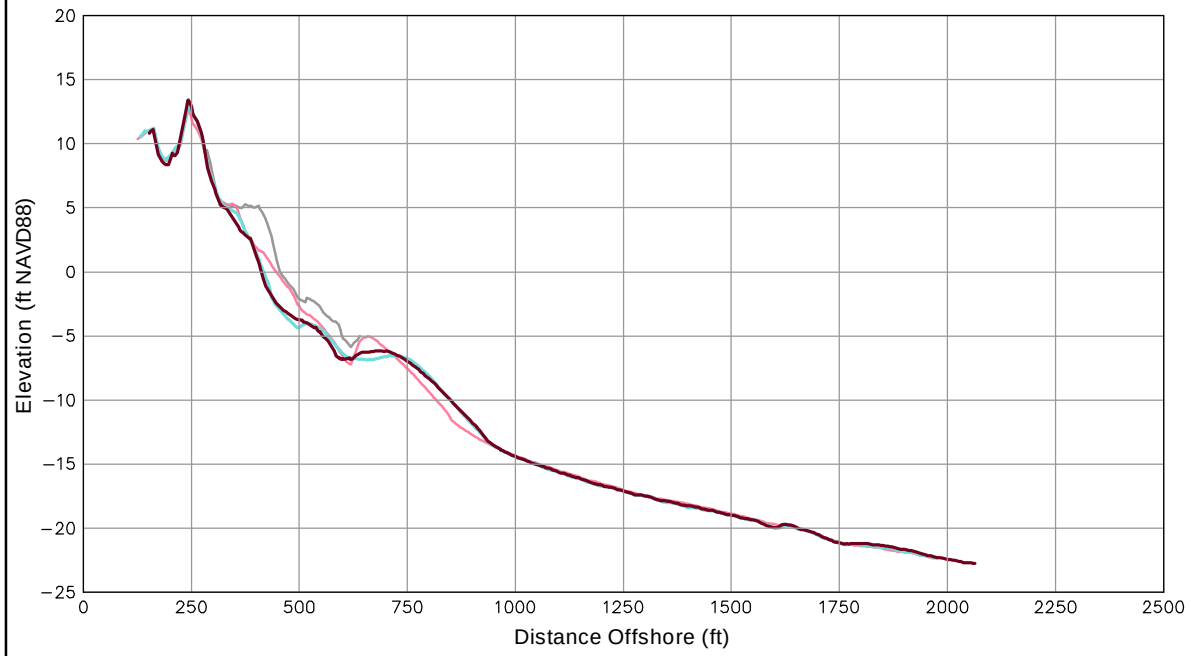
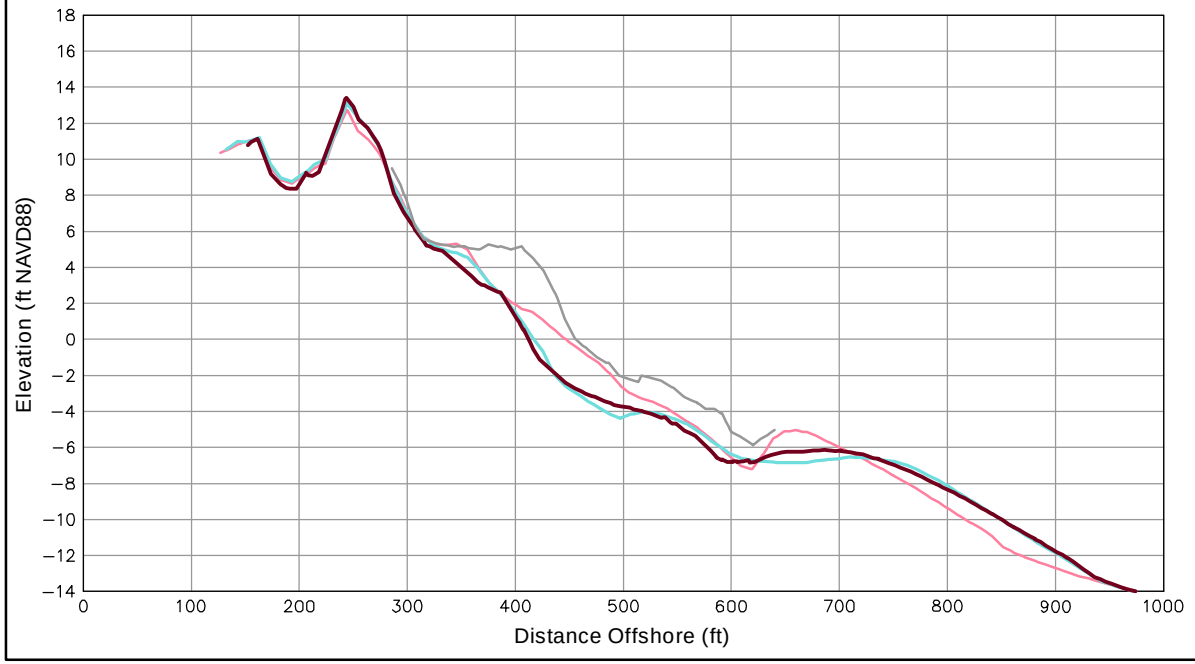


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 356+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-22.85 ft/yr	-3.17 ft
Volume Change Above -15 ft NAVD88	-5.62 cy/ft/yr	-1.40 cy/ft
Volume Change Above 0 ft NAVD88	-2.98 cy/ft/yr	-2.22 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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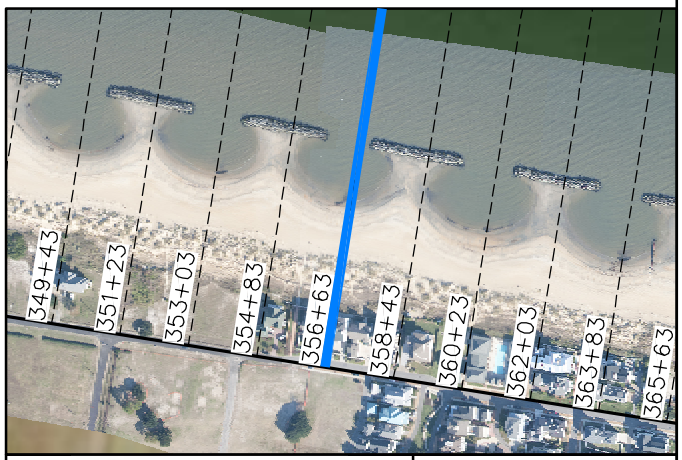

City of Norfolk

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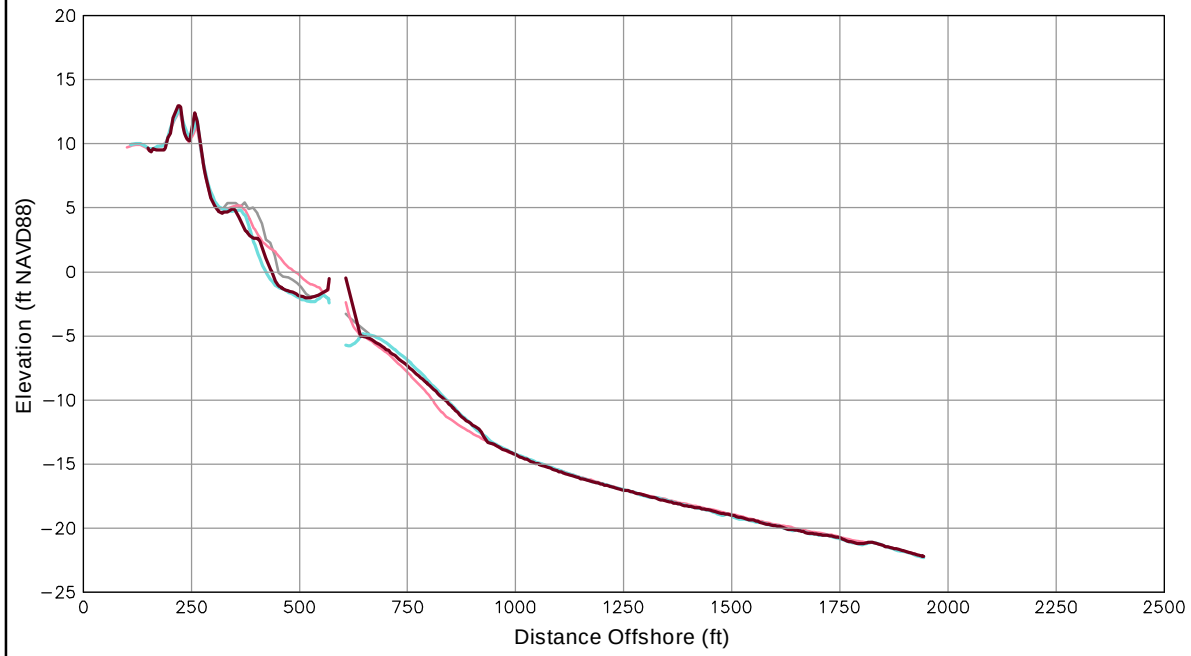

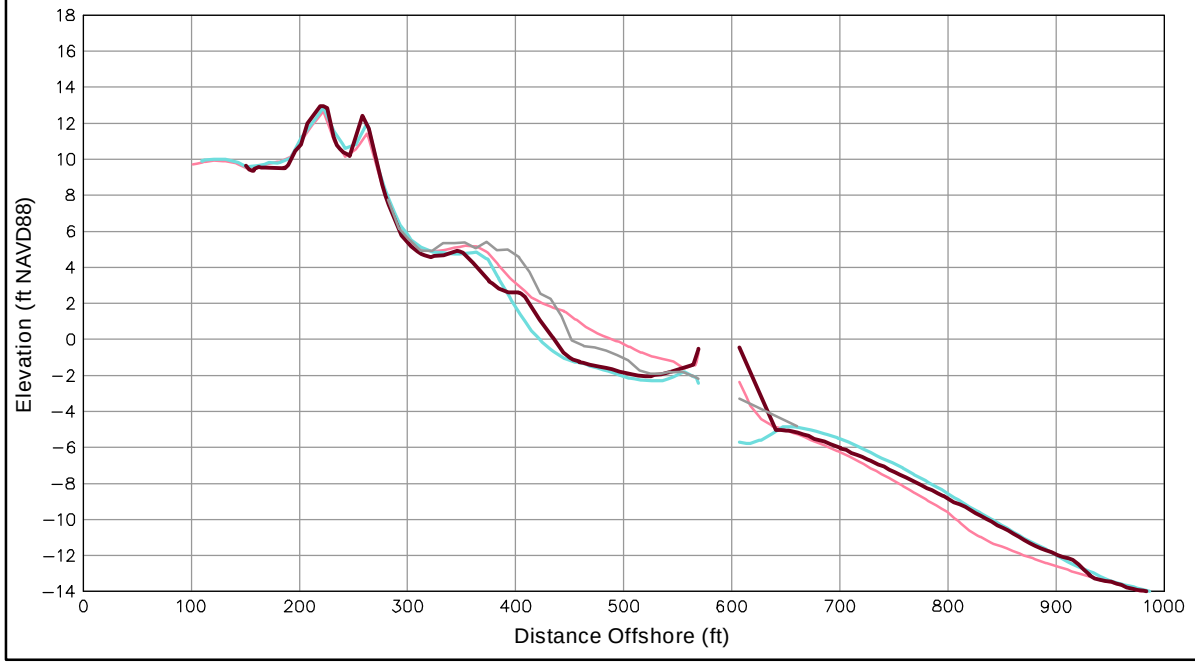

Survey Transect 358+43	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-32.62 ft/yr	14.96 ft
Volume Change Above -15 ft NAVD88	-1.53 cy/ft/yr	1.54 cy/ft
Volume Change Above 0 ft NAVD88	-4.22 cy/ft/yr	-0.39 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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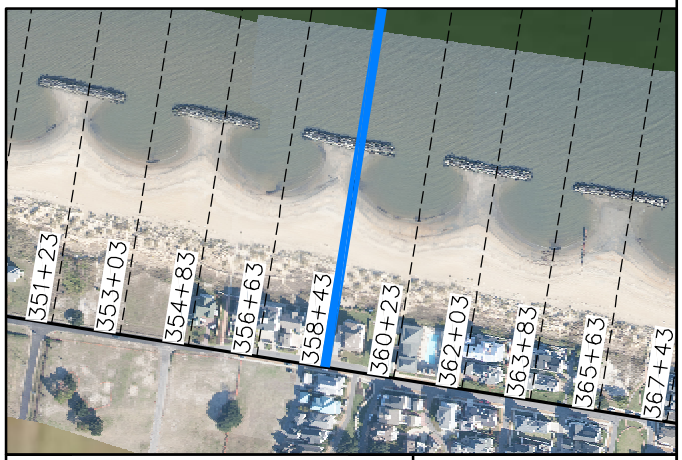
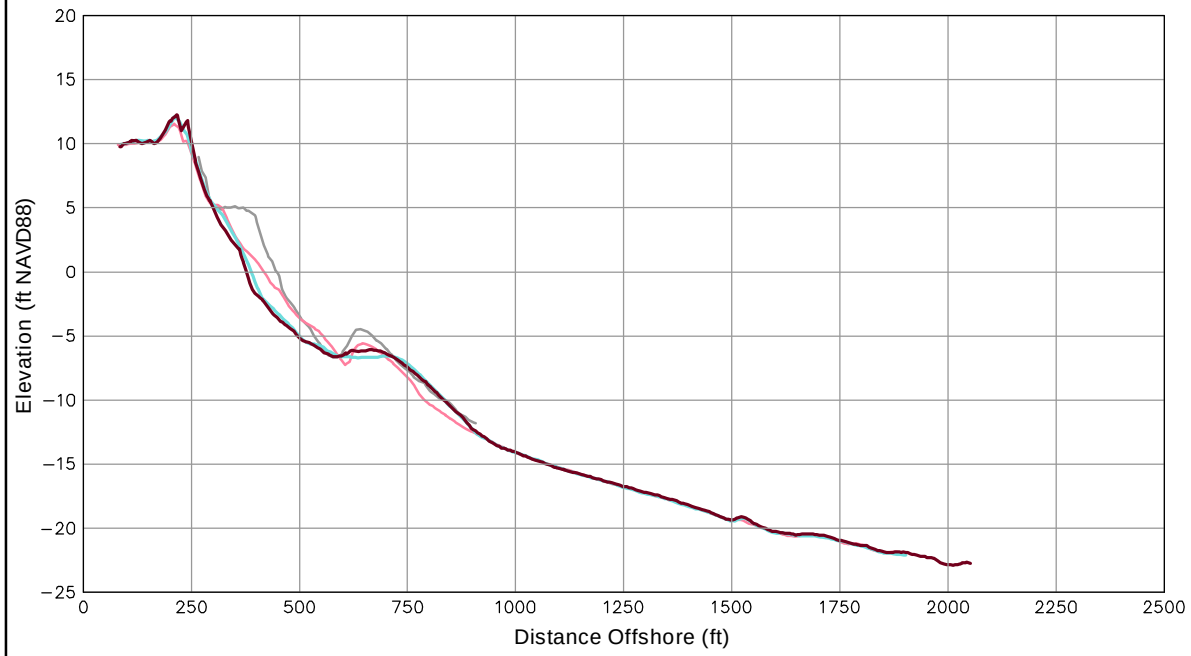
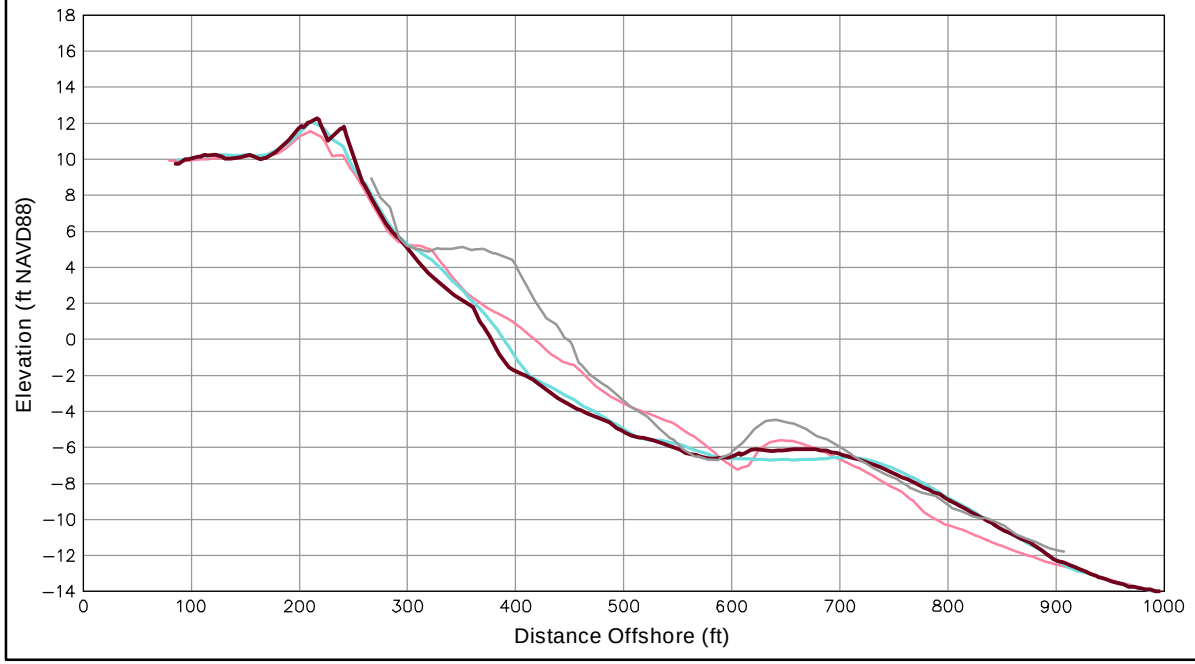


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 360+23	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-27.77 ft/yr	-10.04 ft
Volume Change Above -15 ft NAVD88	-6.30 cy/ft/yr	-2.90 cy/ft
Volume Change Above 0 ft NAVD88	-1.49 cy/ft/yr	-1.84 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
1. Stationing From West To East At Varying Intervals.
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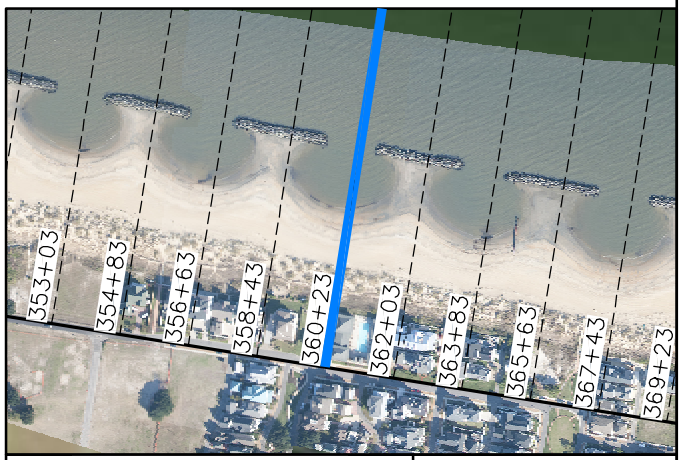
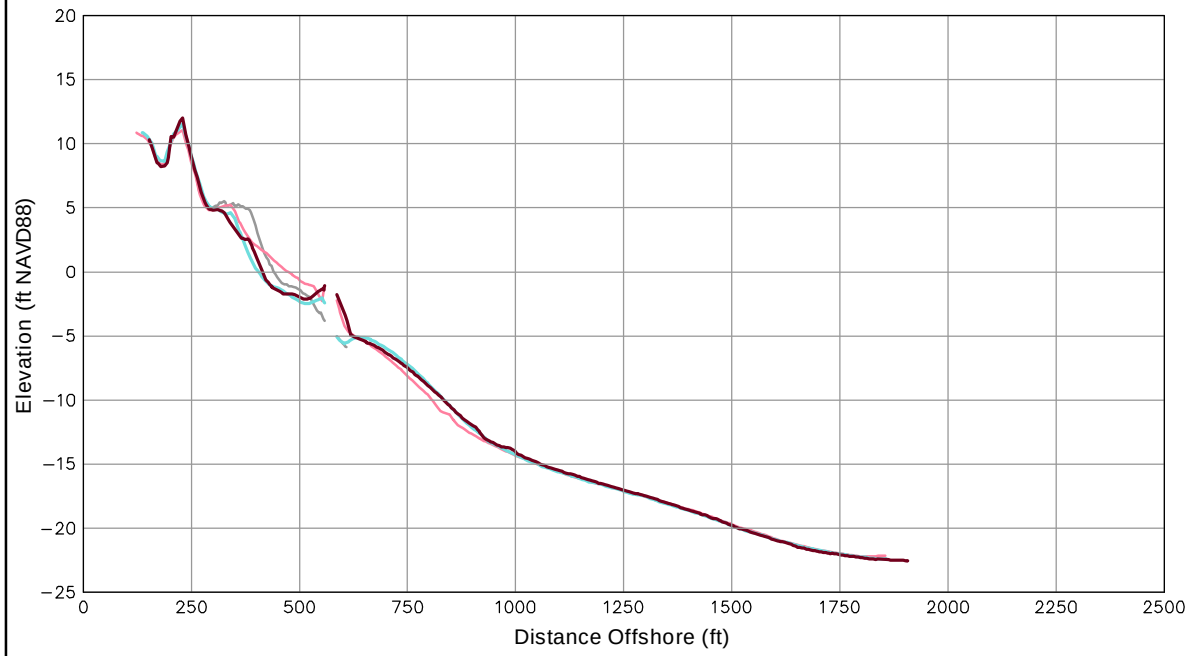
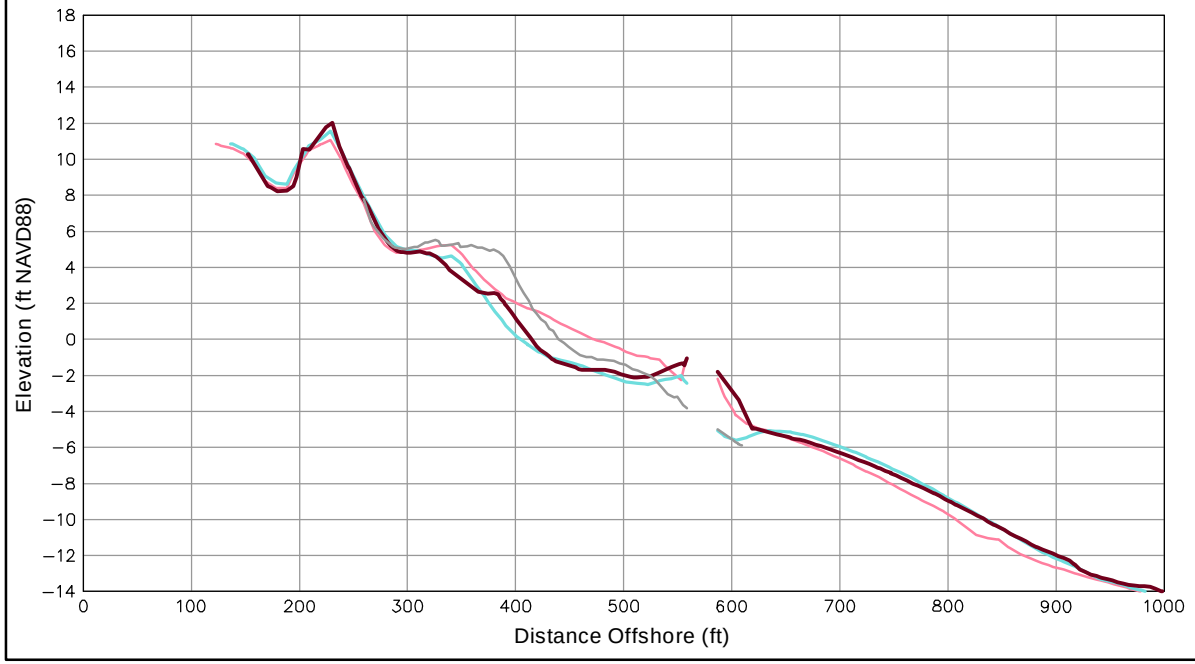
3. All Survey Elevations In Feet Referenced to NAVD88.
4. Survey Comparison Made To October 2009 and March 2010.
5. For Transects With Offshore Breakwaters, Volume Change Calculations Were Limited To The Portions Of The Profiles Both Landward And Seaward Of The Breakwater.



City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 362+03	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-33.69 ft/yr	14.29 ft
Volume Change Above -15 ft NAVD88	-1.12 cy/ft/yr	5.99 cy/ft
Volume Change Above 0 ft NAVD88	-3.55 cy/ft/yr	-0.33 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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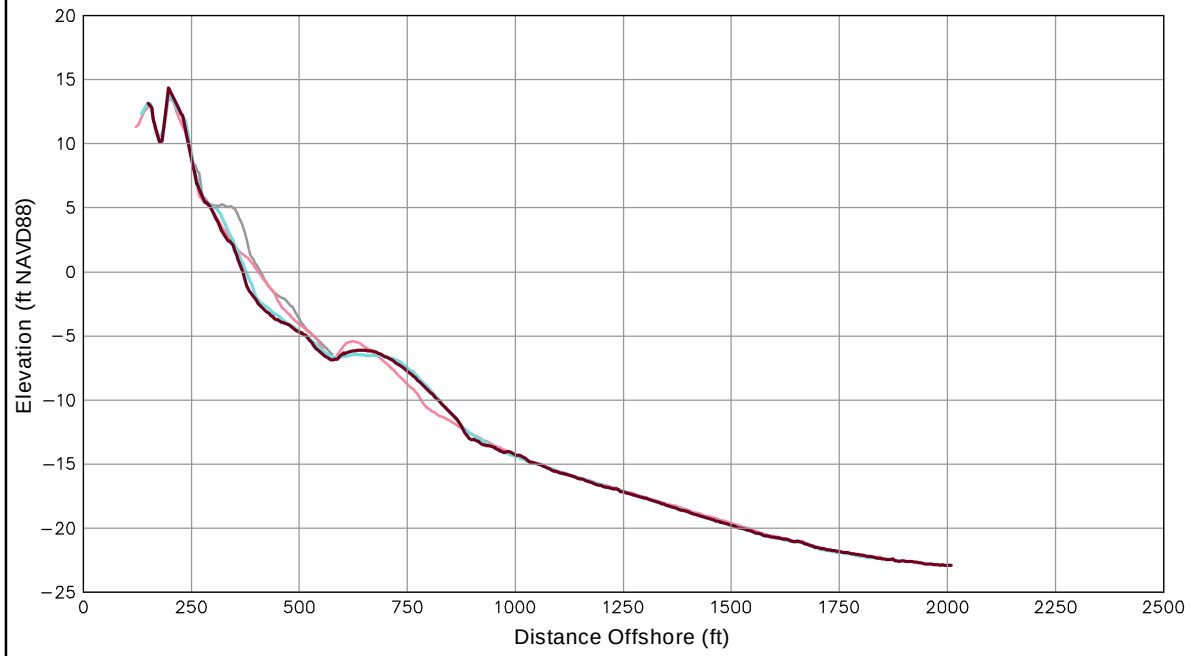
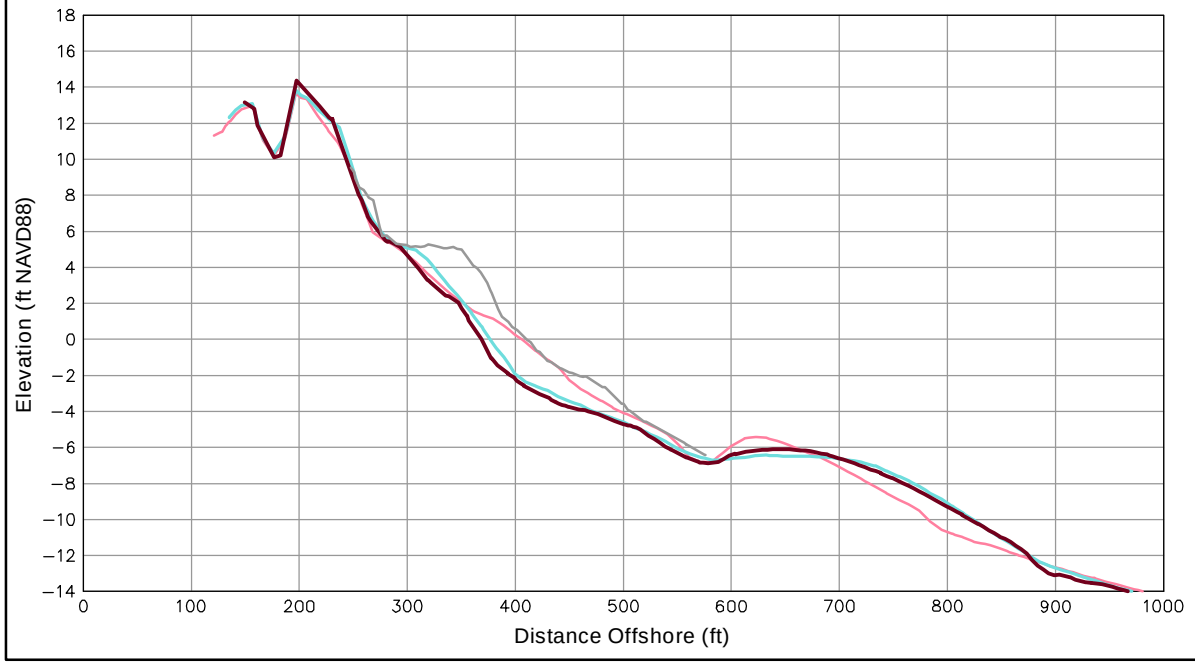
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 363+83	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-24.43 ft/yr	-7.78 ft
Volume Change Above -15 ft NAVD88	-5.00 cy/ft/yr	-4.80 cy/ft
Volume Change Above 0 ft NAVD88	-0.67 cy/ft/yr	-2.32 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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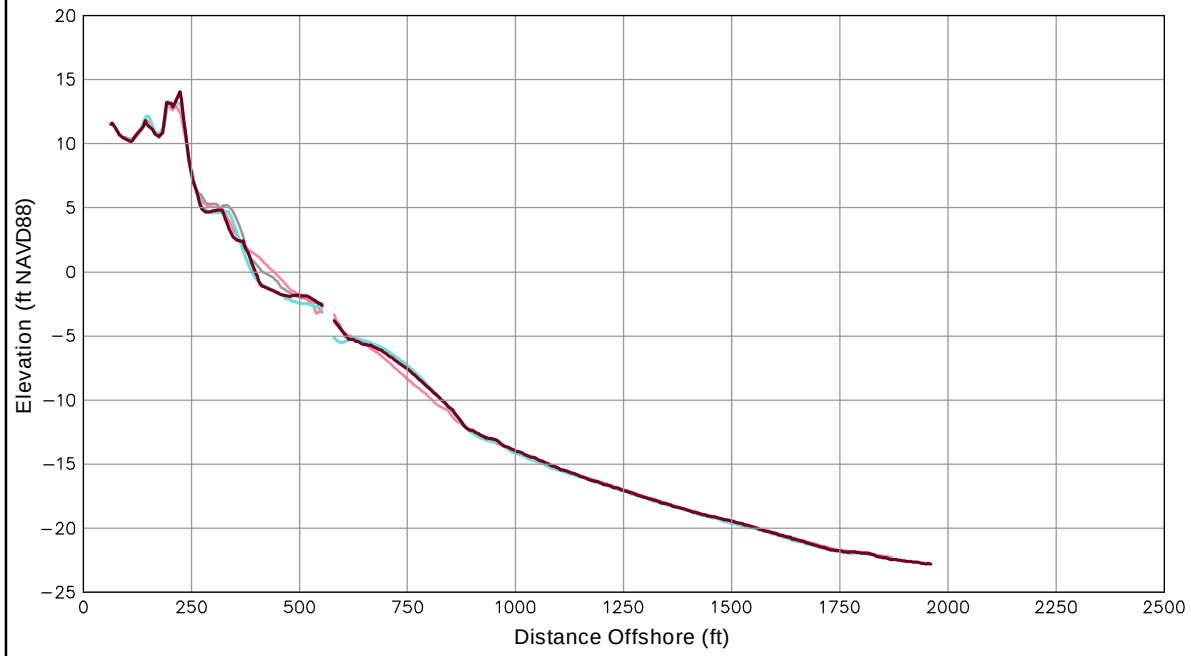
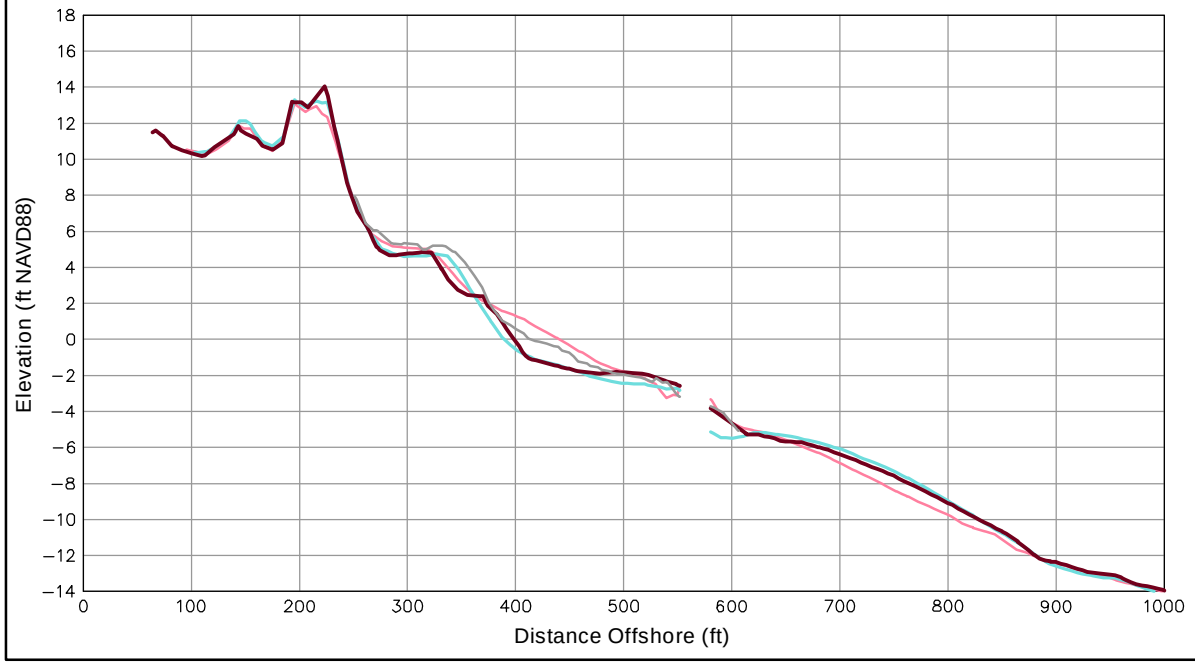
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 365+63	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-23.08 ft/yr	9.75 ft
Volume Change Above -15 ft NAVD88	0.05 cy/ft/yr	2.34 cy/ft
Volume Change Above 0 ft NAVD88	-1.90 cy/ft/yr	-0.77 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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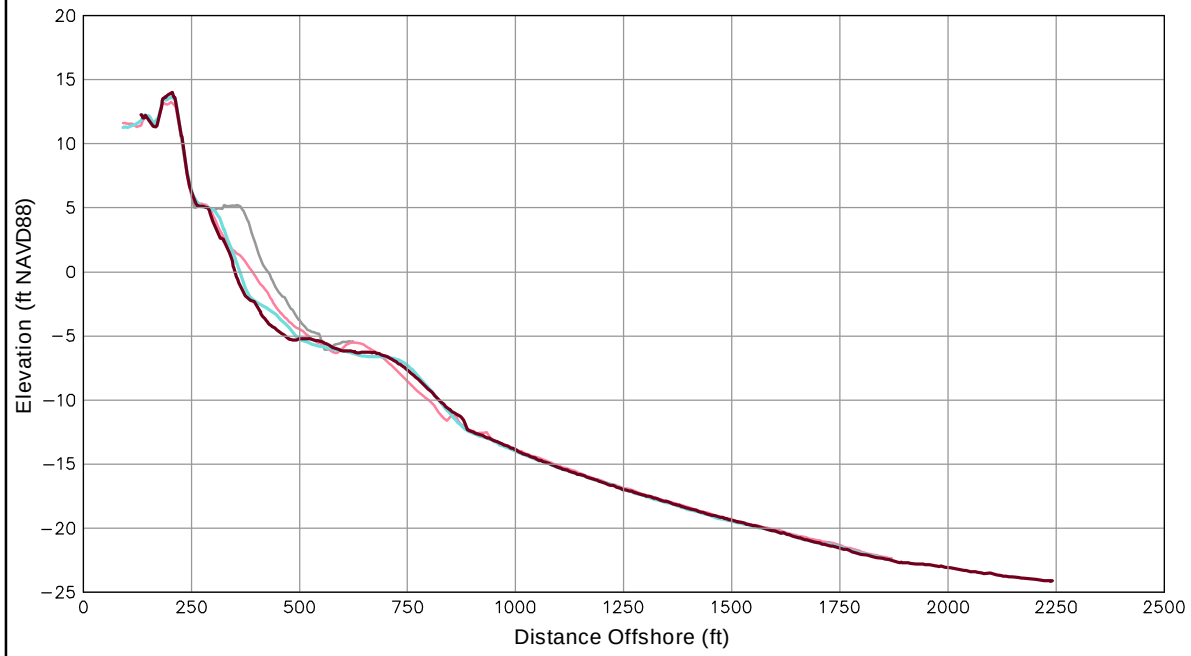
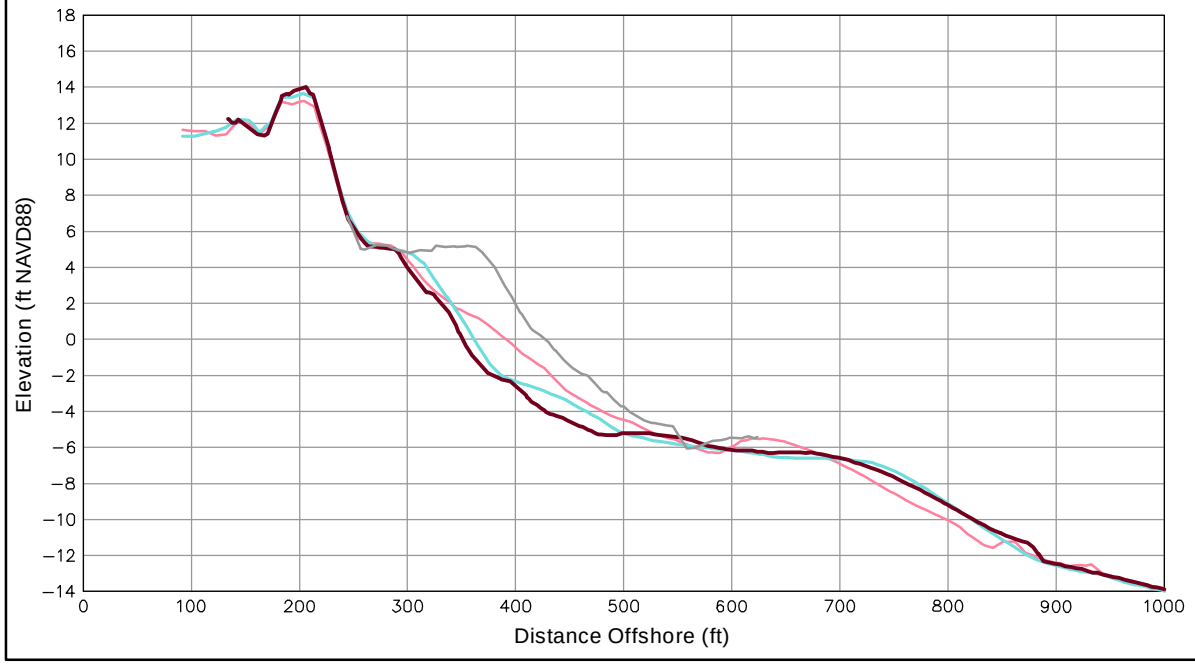
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 367+43	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-25.72 ft/yr	-8.93 ft
Volume Change Above -15 ft NAVD88	-7.24 cy/ft/yr	-4.38 cy/ft
Volume Change Above 0 ft NAVD88	-1.60 cy/ft/yr	-2.61 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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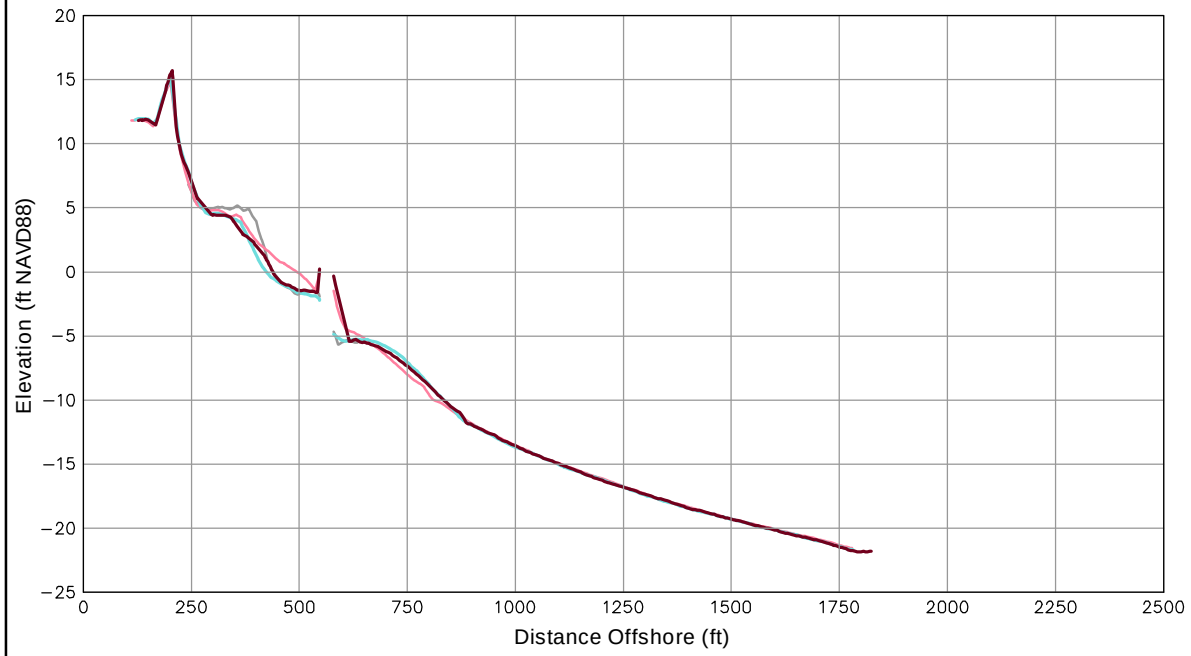
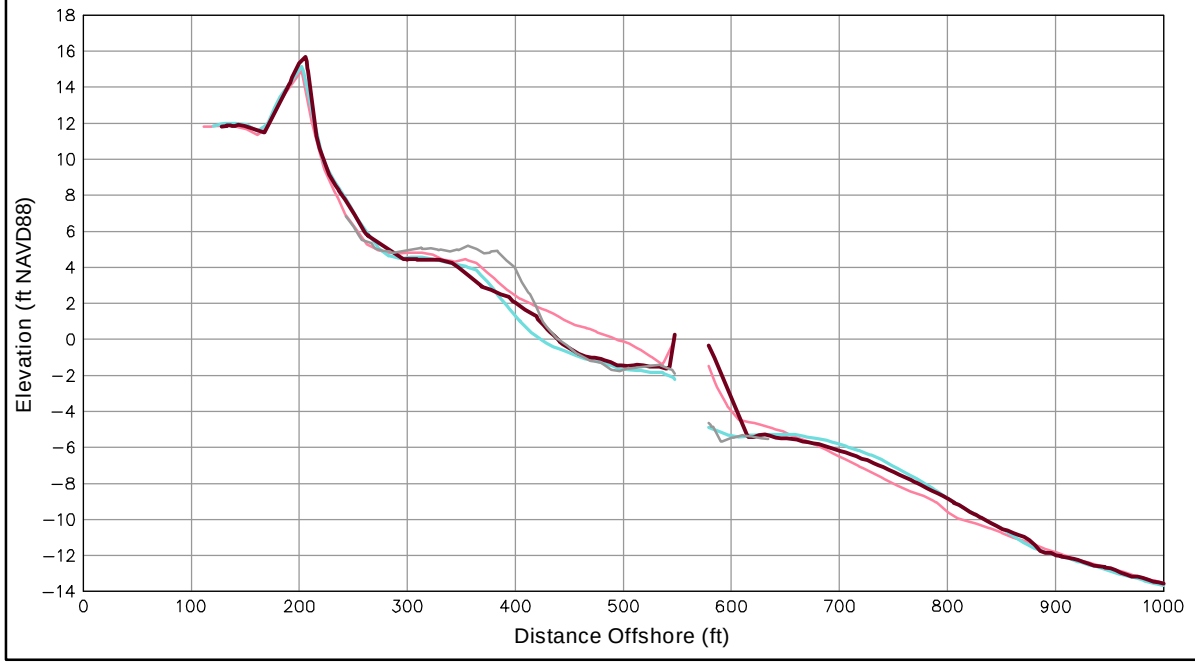
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 369+23	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-24.23 ft/yr	18.09 ft
Volume Change Above -15 ft NAVD88	-1.43 cy/ft/yr	10.33 cy/ft
Volume Change Above 0 ft NAVD88	-1.88 cy/ft/yr	1.01 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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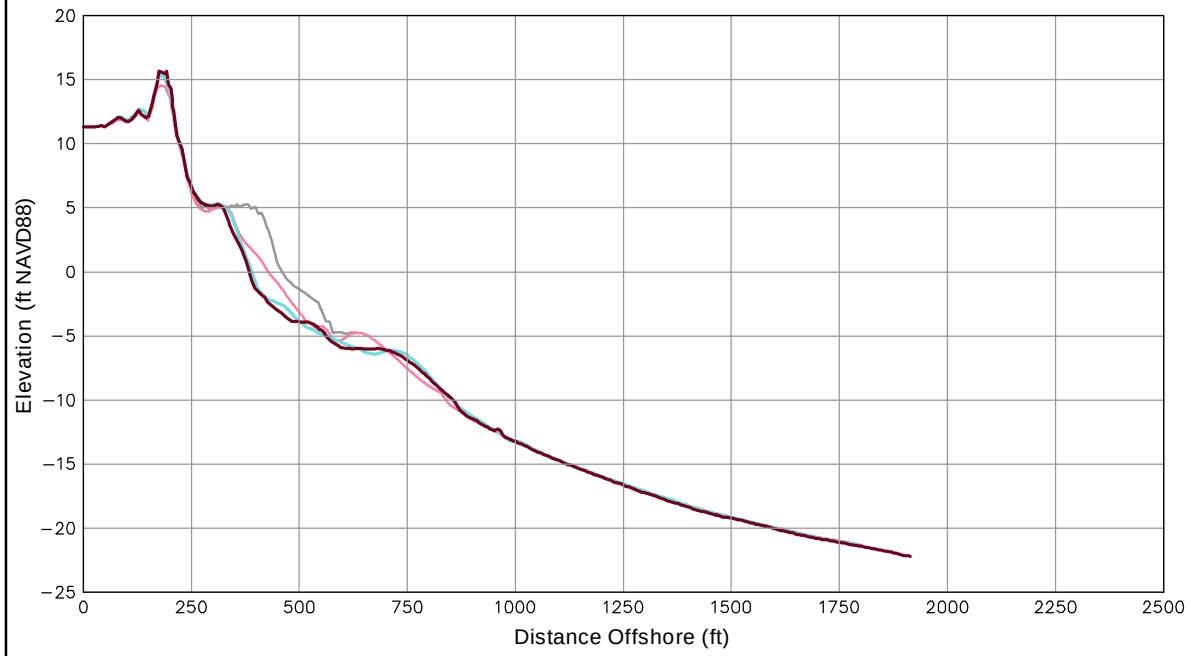
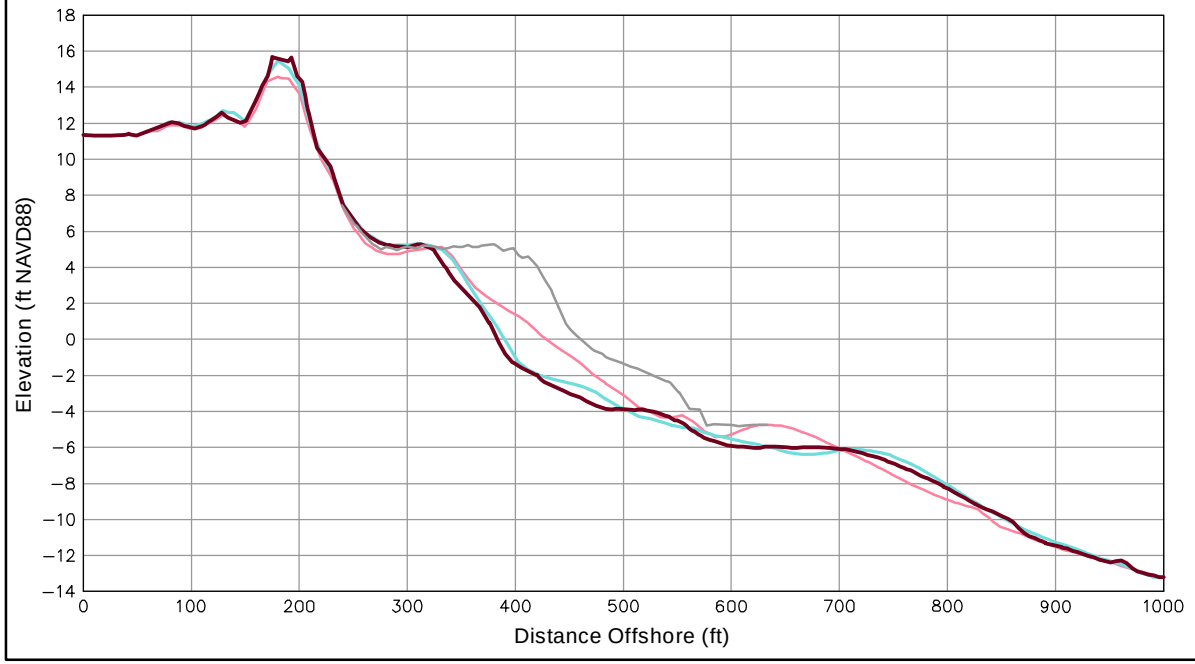
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 371+03	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-32.55 ft/yr	-4.59 ft
Volume Change Above -15 ft NAVD88	-8.10 cy/ft/yr	-4.37 cy/ft
Volume Change Above 0 ft NAVD88	-0.60 cy/ft/yr	-1.46 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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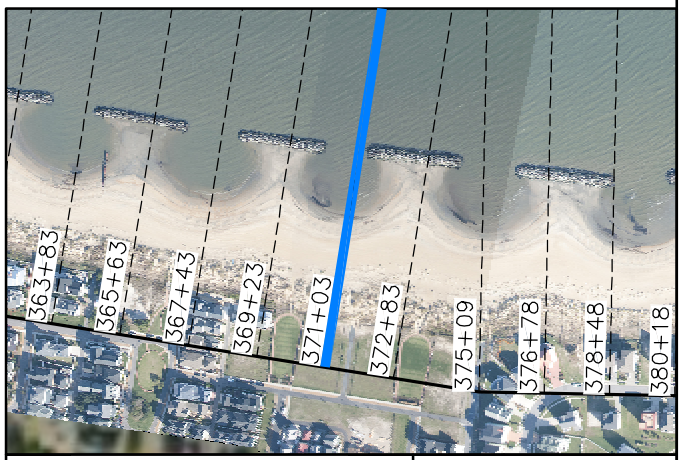

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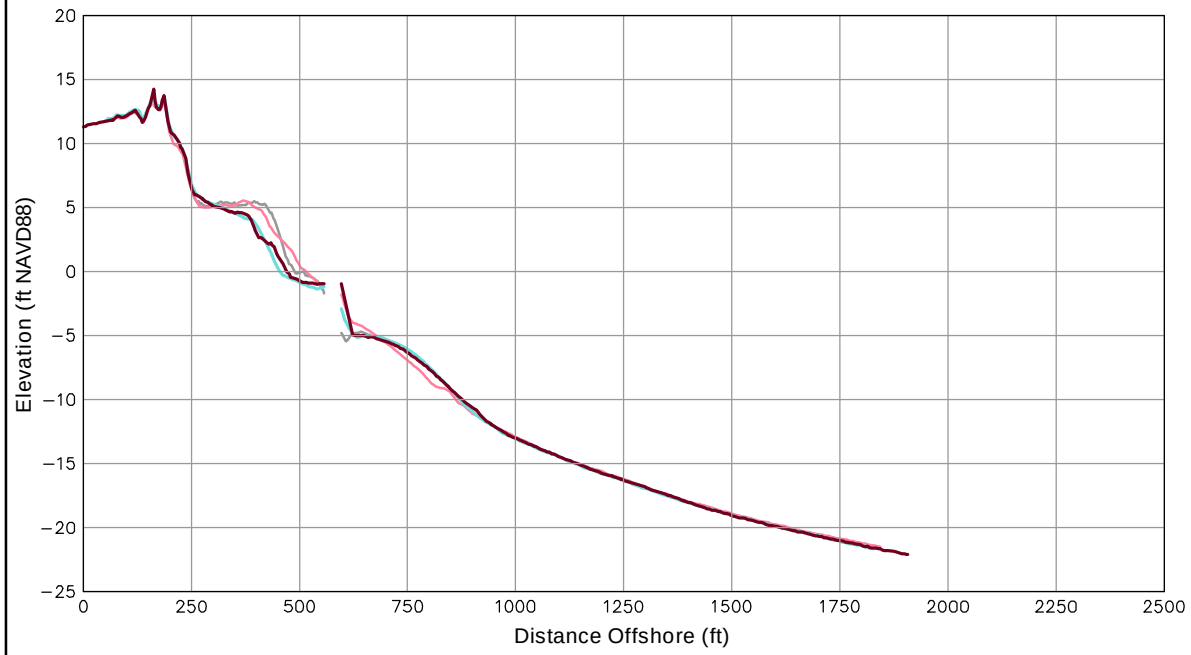
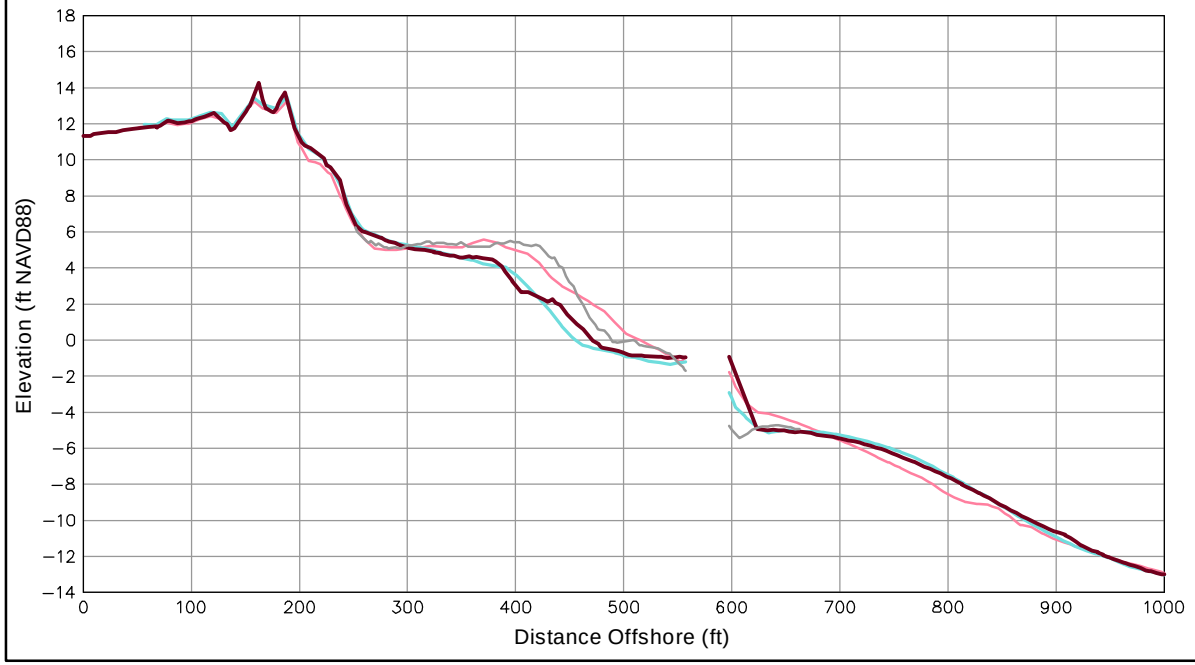
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 372+83	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-34.30 ft/yr	15.15 ft
Volume Change Above -15 ft NAVD88	-4.39 cy/ft/yr	2.21 cy/ft
Volume Change Above 0 ft NAVD88	-5.85 cy/ft/yr	0.24 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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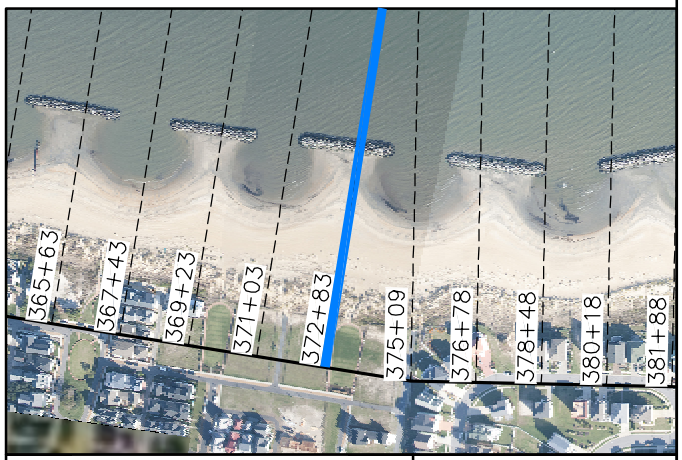

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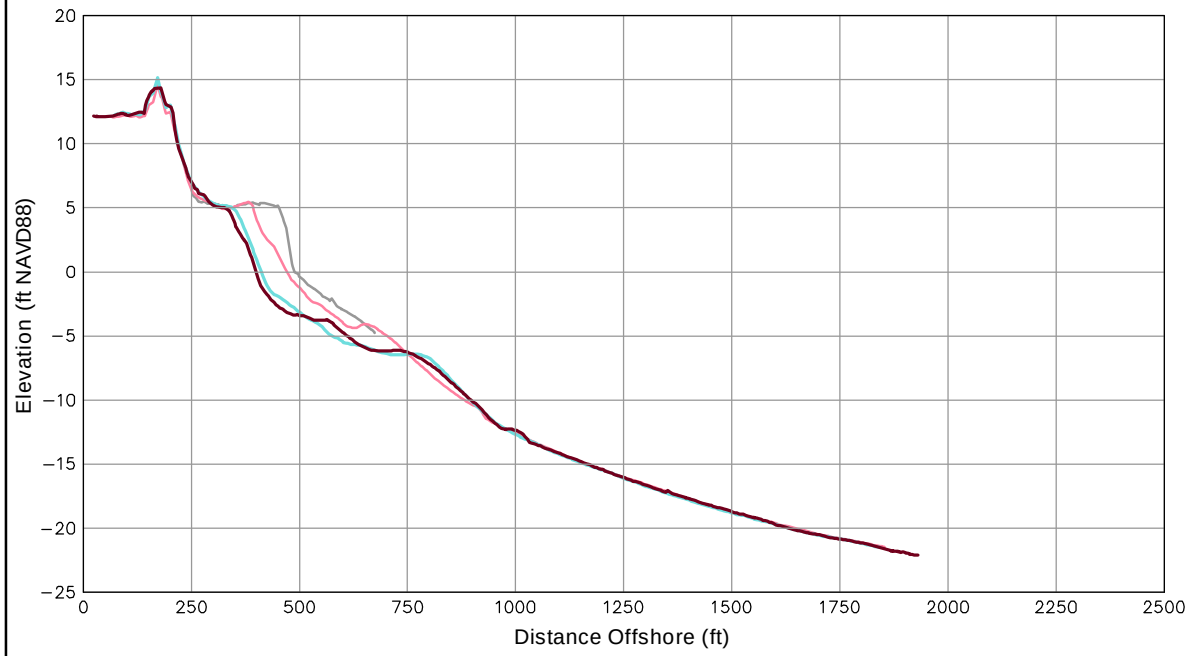
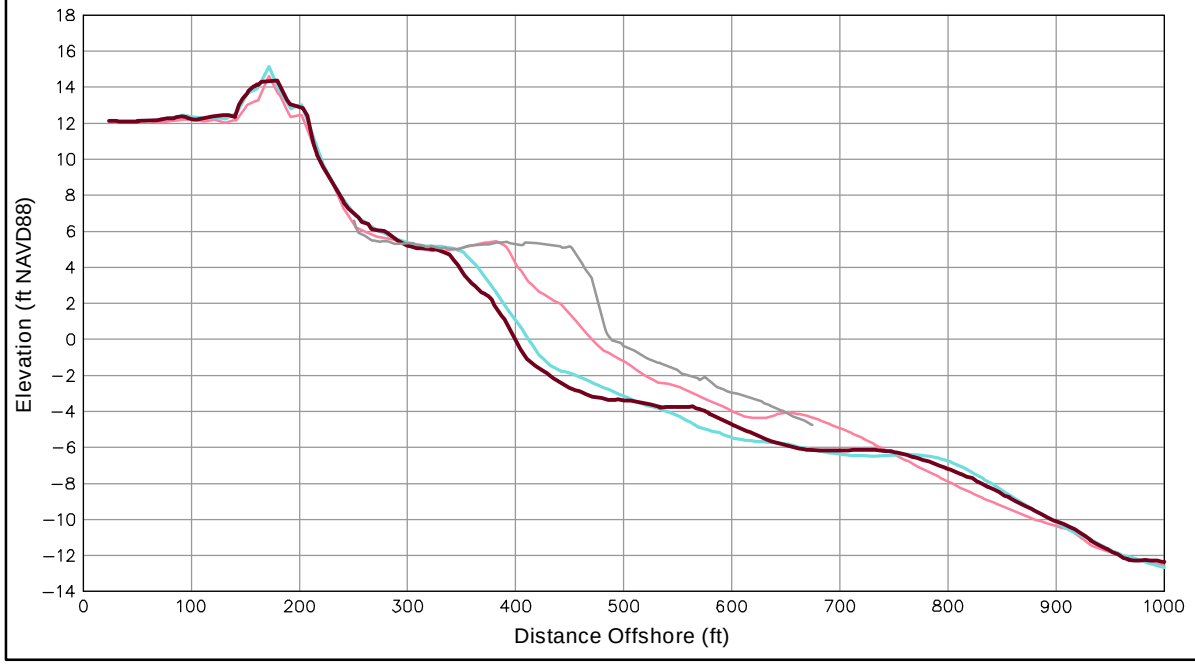
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 375+08	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-61.33 ft/yr	-10.32 ft
Volume Change Above -15 ft NAVD88	-22.38 cy/ft/yr	-2.99 cy/ft
Volume Change Above 0 ft NAVD88	-8.20 cy/ft/yr	-2.81 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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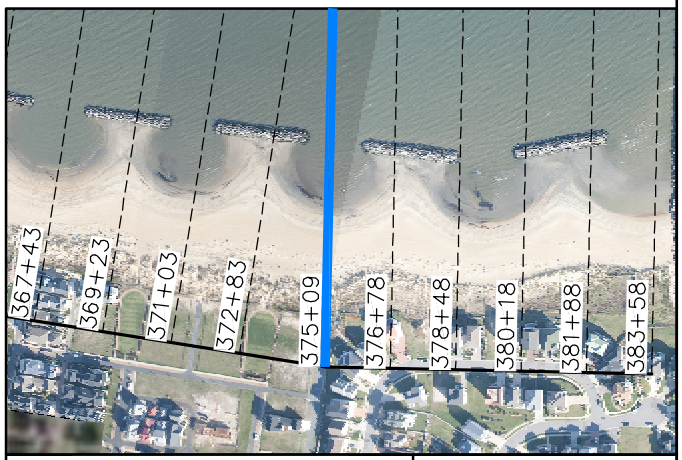

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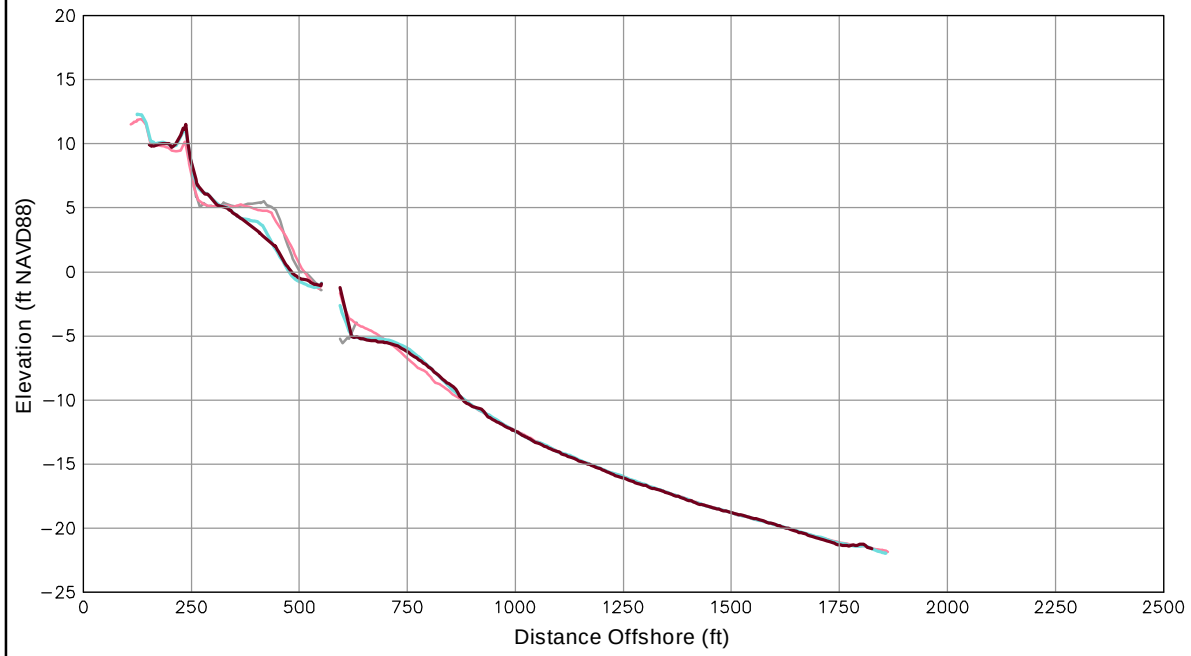
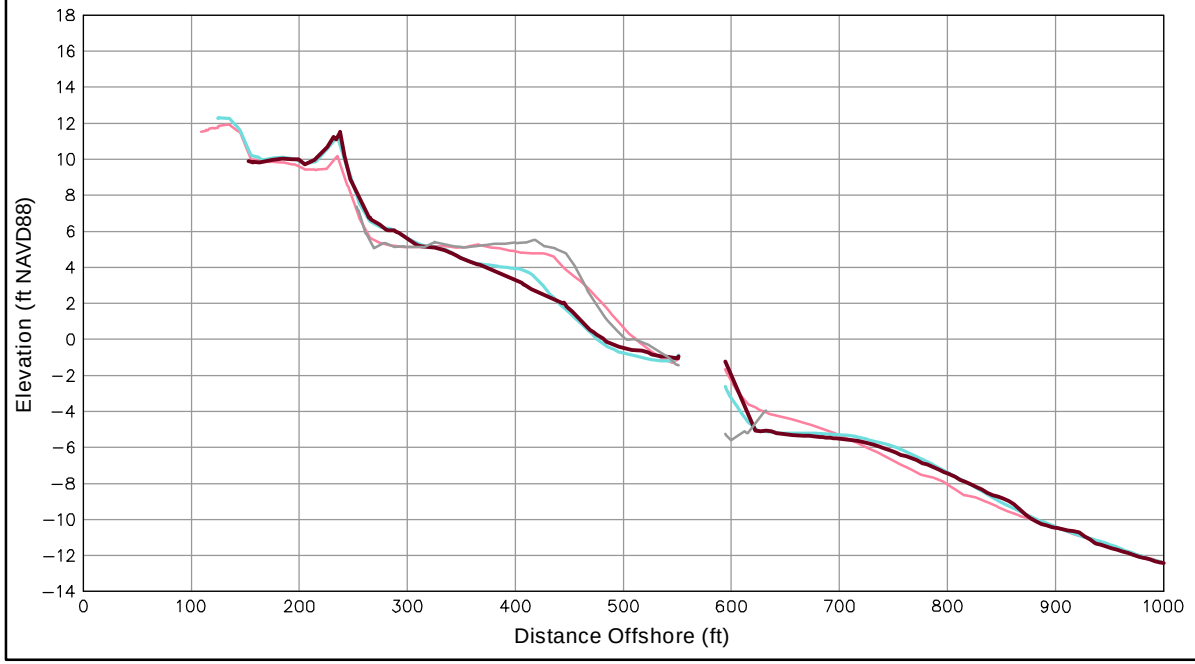
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 376+78	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-31.81 ft/yr	2.27 ft
Volume Change Above -15 ft NAVD88	-5.33 cy/ft/yr	0.61 cy/ft
Volume Change Above 0 ft NAVD88	-5.83 cy/ft/yr	-0.98 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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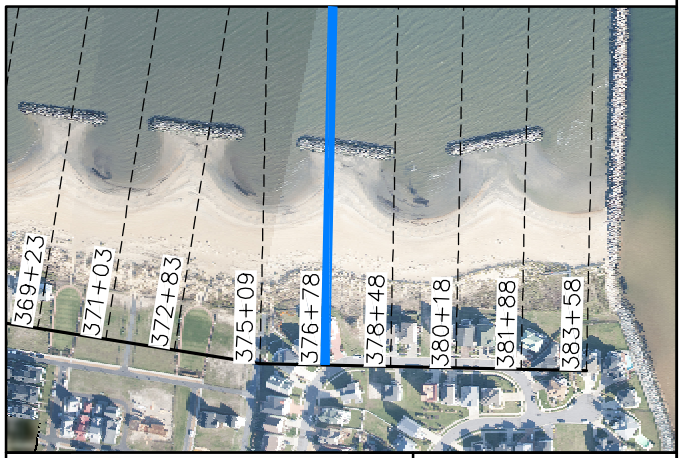

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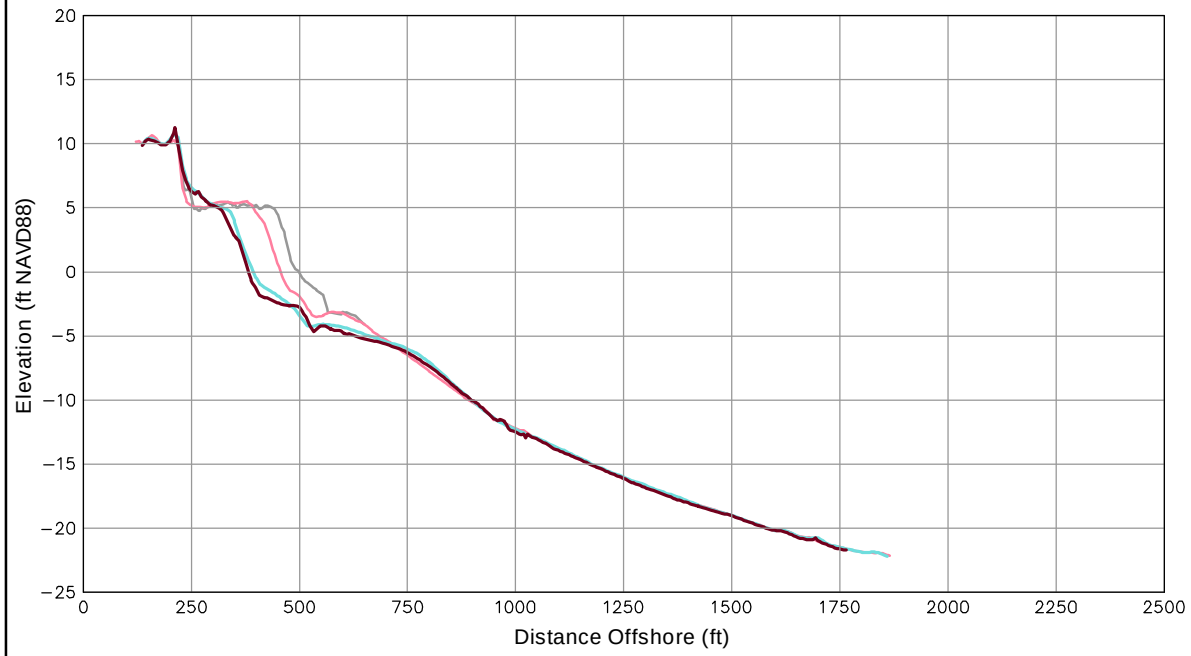
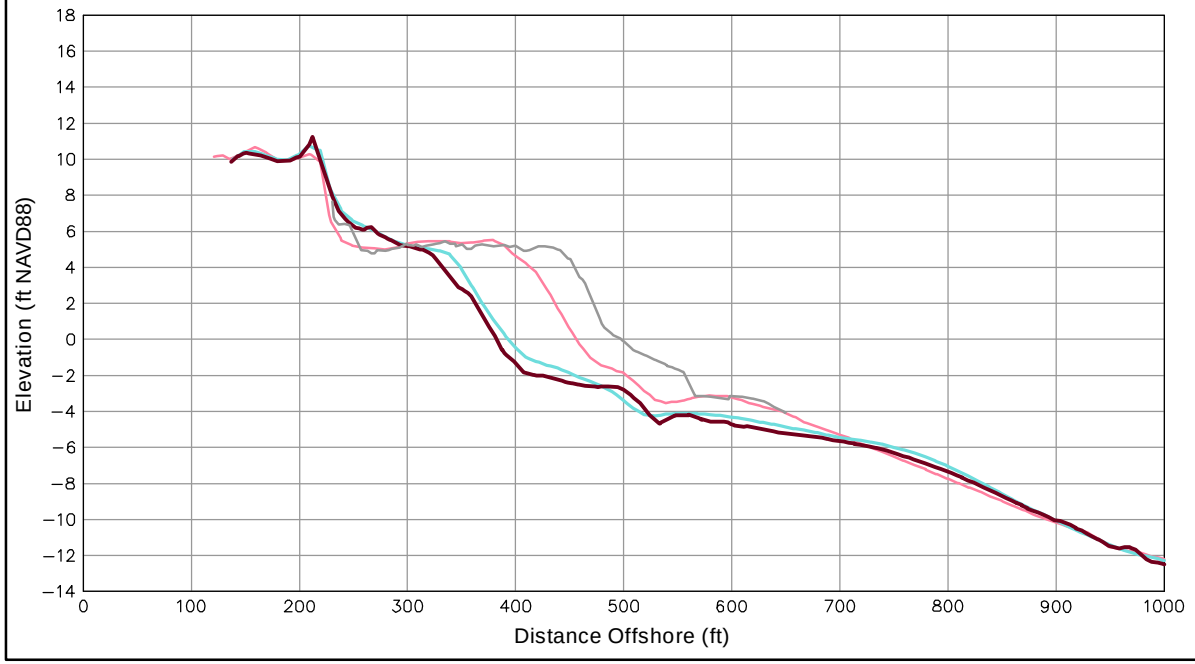
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 378+48	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-68.87 ft/yr	-7.80 ft
Volume Change Above -15 ft NAVD88	-25.10 cy/ft/yr	-8.48 cy/ft
Volume Change Above 0 ft NAVD88	-12.09 cy/ft/yr	-2.73 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

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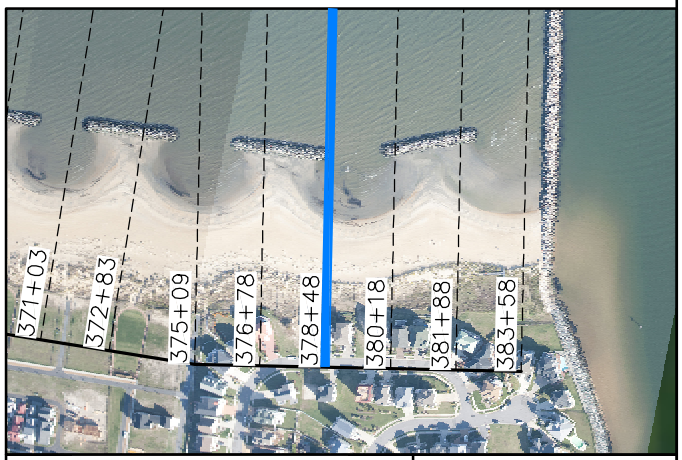

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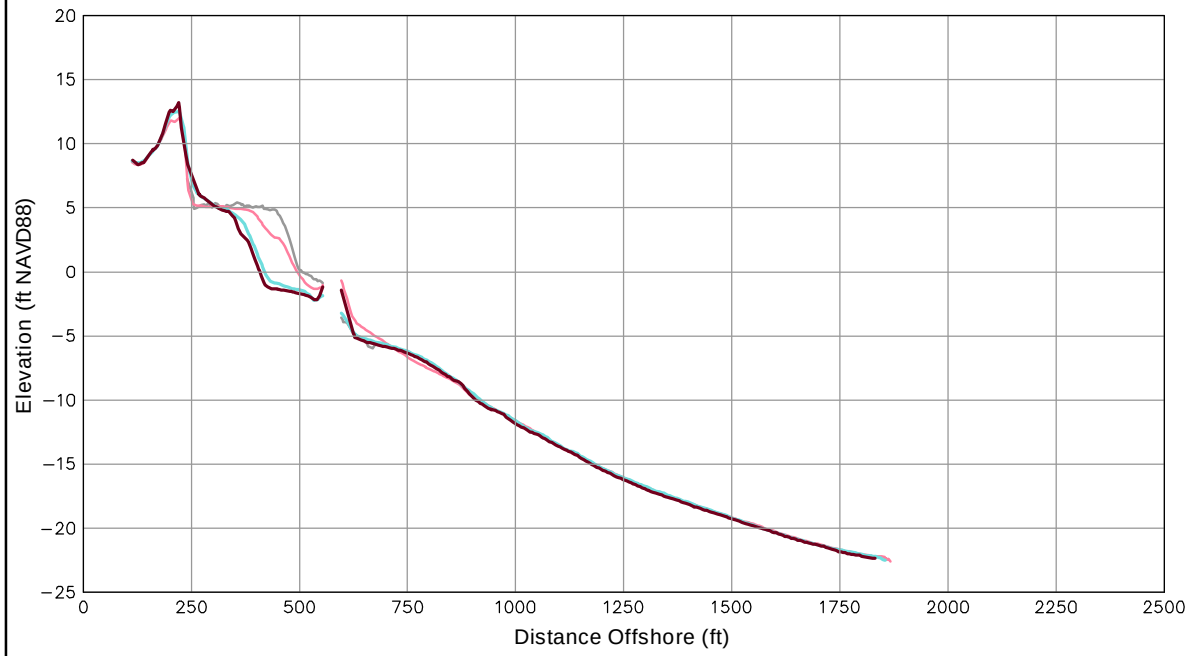

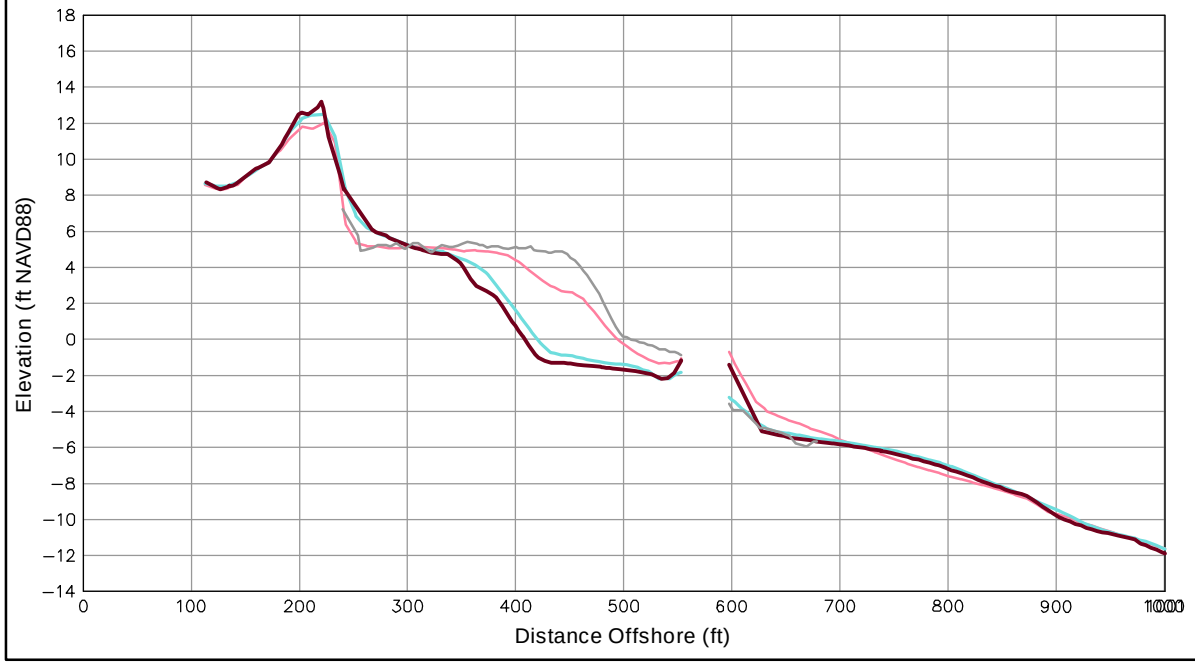

Survey Transect 380+18	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-77.83 ft/yr	-10.90 ft
Volume Change Above -15 ft NAVD88	-17.60 cy/ft/yr	-0.93 cy/ft
Volume Change Above 0 ft NAVD88	-9.23 cy/ft/yr	-2.03 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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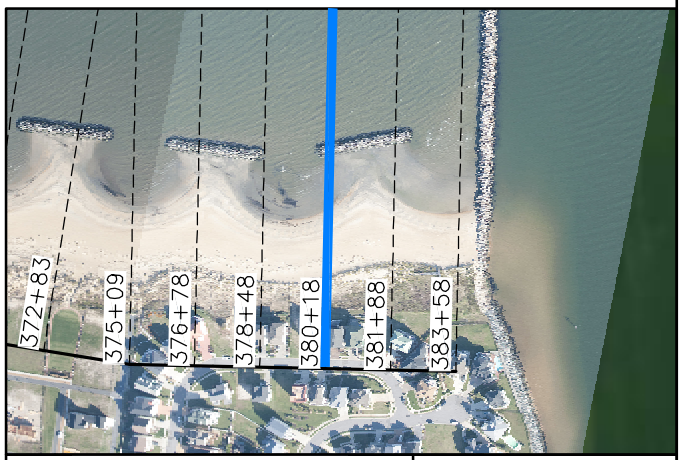

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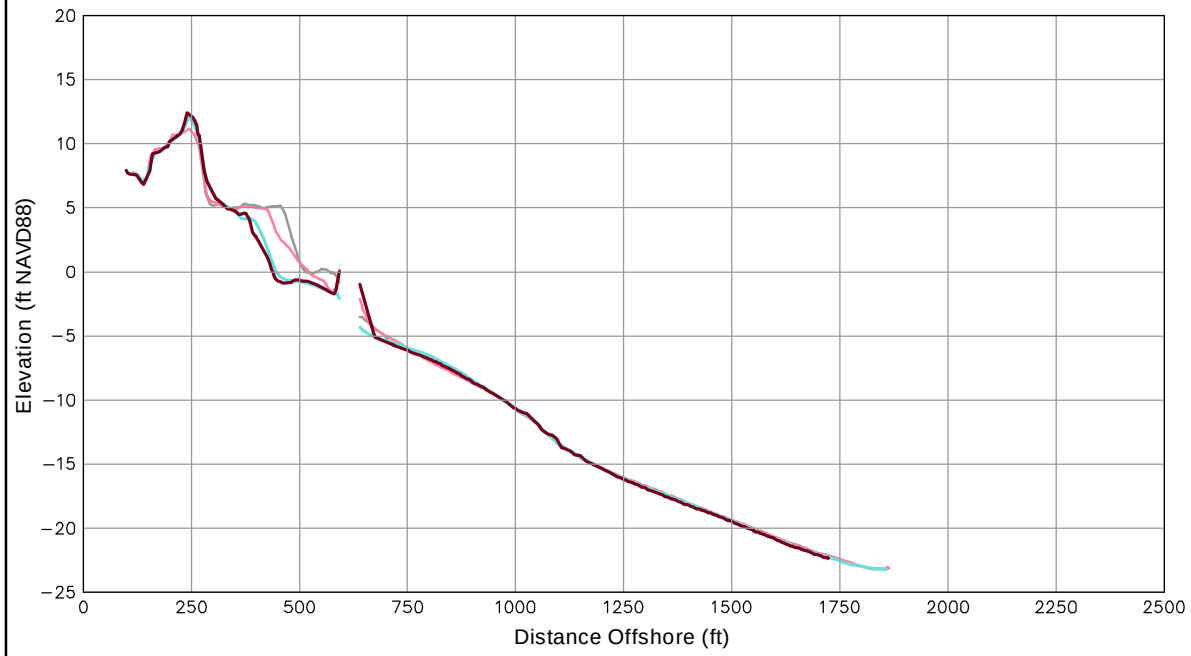
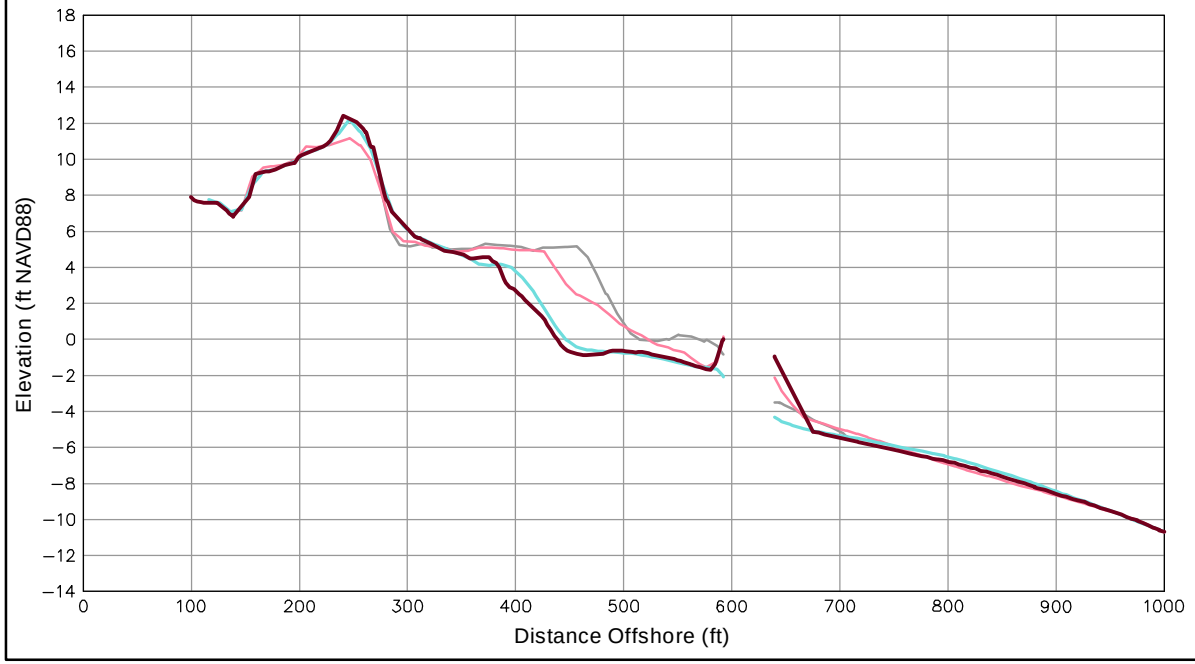
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 381+88	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-62.31 ft/yr	-6.23 ft
Volume Change Above -15 ft NAVD88	-9.76 cy/ft/yr	-0.42 cy/ft
Volume Change Above 0 ft NAVD88	-8.80 cy/ft/yr	-1.26 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- POST-FILL

Notes:
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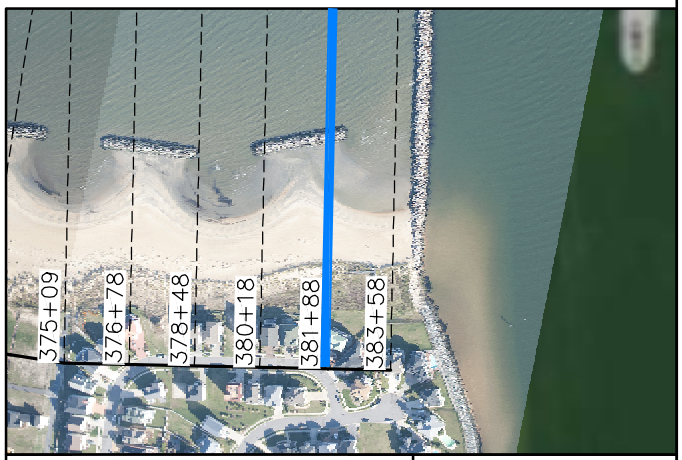

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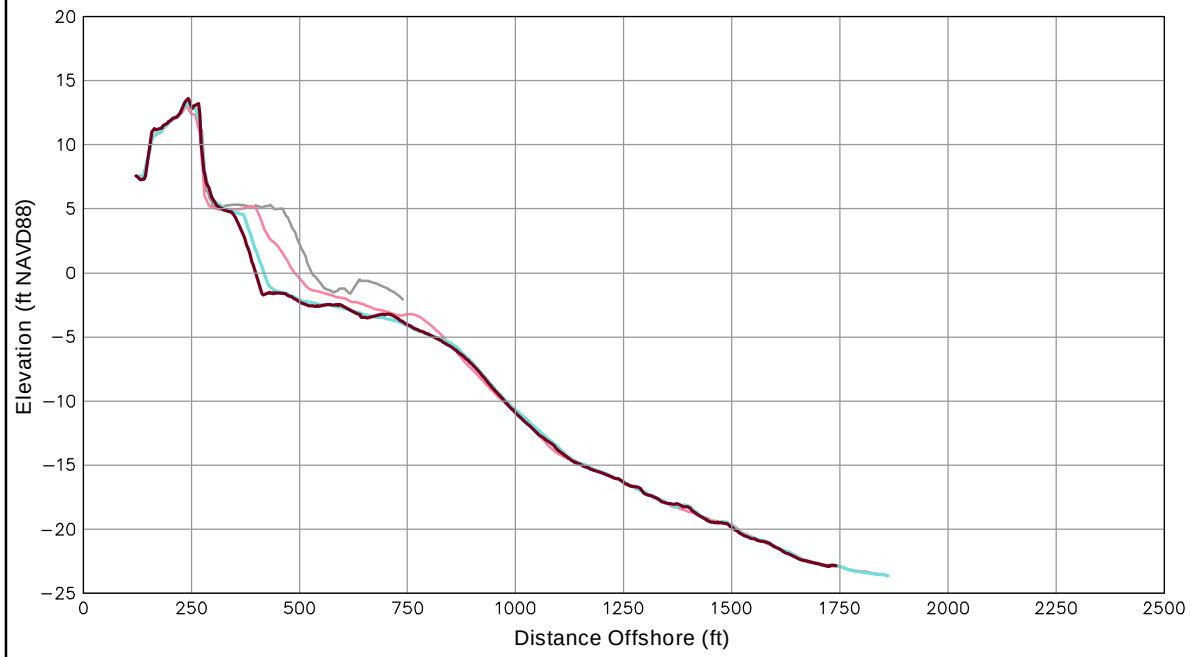
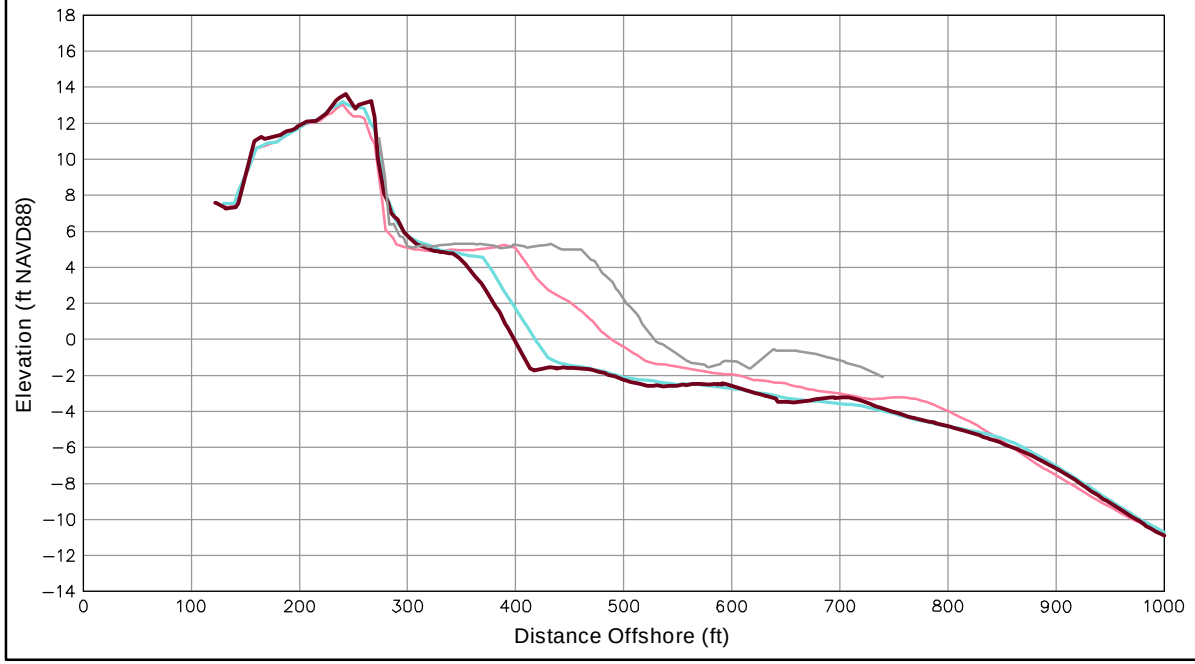
OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

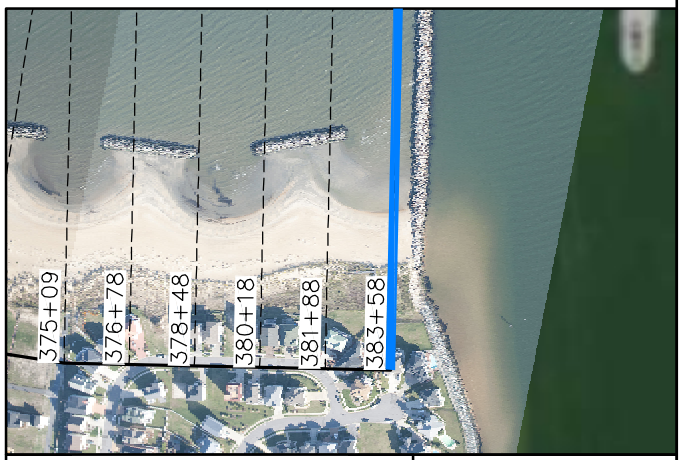




Survey Transect 383+58	October 2010 - October 2009	October 2010 - March 2010
Shoreline Change at MHW (0.98 ft NAVD88)	-76.97 ft/yr	-17.97 ft
Volume Change Above -15 ft NAVD88	-22.65 cy/ft/yr	-6.47 cy/ft
Volume Change Above 0 ft NAVD88	-8.90 cy/ft/yr	-2.71 cy/ft

LEGEND:
- 2010 OCT
- 2010 MAR
- 2009 OCT
- 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 October 2009 and March 2010.
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

Appendix C: Summary of Shoreline Change and Volume Change Tables

Table C-1. Summary of Shoreline Change and Volume Change (October 2009 to October 2010)

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 October 2, 2009 to October 26, 2010.

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	10/2/2009	10/26/2010	-117.51	-16.14	-38.76
2+50	10/2/2009	10/26/2010	-104.24	-14.36	-52.74
5+00	10/2/2009	10/26/2010	10.91	-5.58	18.07
7+50	10/2/2009	10/26/2010	-15.59	-3.29	-14.15
10+00	10/2/2009	10/26/2010	-3.53	0.99	-19.15
12+50	10/2/2009	10/26/2010	-7.18	-4.70	-12.21
15+00	10/2/2009	10/26/2010	-3.68	-1.12	-9.76
17+50	10/2/2009	10/26/2010	-1.69	2.51	-3.97
20+00	10/2/2009	10/26/2010	-0.85	-1.46	-1.82
22+50	10/2/2009	10/26/2010	13.74	-4.01	-4.87
25+00	10/2/2009	10/26/2010	11.64	-1.84	0.91
27+50	10/2/2009	10/26/2010	13.37	-0.27	1.73
30+00	10/2/2009	10/26/2010	4.87	-2.86	-7.80
32+50	10/2/2009	10/26/2010	20.82	6.71	4.66
35+00	10/2/2009	10/26/2010	-1.27	1.55	3.23
37+50	10/2/2009	10/26/2010	-1.55	0.70	0.84
40+00	10/2/2009	10/26/2010	20.55	-0.10	-6.66
42+50	10/2/2009	10/26/2010	28.62	6.41	-2.42
45+00	10/2/2009	10/26/2010	6.21	1.84	1.19
45+25	10/2/2009	10/26/2010	-8.35	-4.54	-9.20
47+30	10/2/2009	10/26/2010	-9.12	0.66	-4.85
49+35	10/2/2009	10/26/2010	17.09	4.91	1.74
51+41	10/2/2009	10/26/2010	8.12	4.11	-4.99
53+46	10/2/2009	10/26/2010	16.11	4.65	-3.09
55+51	10/2/2009	10/26/2010	-12.70	-3.22	-0.65
57+57	10/2/2009	10/26/2010	15.01	1.03	-4.71
59+62	10/2/2009	10/26/2010	-1.17	0.41	-5.21
61+62	10/2/2009	10/26/2010	25.87	2.92	-2.49
63+62	10/2/2009	10/26/2010	-14.23	-3.72	-12.70
65+62	10/2/2009	10/26/2010	11.56	2.40	-1.89
67+62	10/2/2009	10/26/2010	0.78	1.10	0.24
69+62	10/2/2009	10/26/2010	29.95	6.09	4.55
71+62	10/2/2009	10/26/2010	7.53	3.80	8.34
73+62	10/2/2009	10/26/2010	37.06	2.02	6.96
75+62	10/2/2009	10/26/2010	-52.47	-9.76	-14.24
77+62	10/2/2009	10/26/2010	-19.59	-4.54	-5.58
79+62	10/2/2009	10/26/2010	-20.47	-2.92	-4.46
81+62	10/2/2009	10/26/2010	-17.75	-4.69	-2.79
83+62	10/2/2009	10/26/2010	-10.66	-4.22	-6.64
85+62	10/2/2009	10/26/2010	1.69	-3.15	-6.65
87+62	10/2/2009	10/26/2010	-3.07	-3.83	-1.05

Table C-1. Summary of Shoreline Change and Volume Change (October 2009 to October 2010) 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 October 2, 2009 to October 26, 2010.

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	10/2/2009	10/26/2010	3.11	-1.88	-1.44
103+08	10/2/2009	10/26/2010	0.03	-0.81	1.63
120+93	10/2/2009	10/26/2010	-3.66	-2.13	1.51
129+17	10/2/2009	10/26/2010	-10.50	-5.70	-9.07
141+98	10/2/2009	10/26/2010	-2.65	-1.22	-1.58
152+01	10/2/2009	10/26/2010	-5.56	-2.70	-3.34
163+49	10/2/2009	10/26/2010	3.48	-1.11	-0.46
169+63	10/2/2009	10/26/2010	4.29	-4.50	-4.01
171+63	10/2/2009	10/26/2010	4.13	0.79	7.44
173+63	10/2/2009	10/26/2010	1.63	-0.58	-1.20
175+63	10/2/2009	10/26/2010	7.35	0.48	5.45
177+63	10/2/2009	10/26/2010	7.70	0.18	3.45
179+63	10/2/2009	10/26/2010	20.00	-1.04	-0.47
181+63	10/2/2009	10/26/2010	6.02	-2.05	-5.69
183+63	10/2/2009	10/26/2010	13.63	0.16	-1.72
185+63	10/2/2009	10/26/2010	0.83	-2.11	-9.30
187+63	10/2/2009	10/26/2010	4.30	-1.29	-1.96
189+63	10/2/2009	10/26/2010	-5.64	-2.47	-0.08
191+63	10/2/2009	10/26/2010	16.03	2.55	7.79
193+63	10/2/2009	10/26/2010	7.26	-0.25	4.31
195+63	10/2/2009	10/26/2010	5.09	-0.92	0.62
206+86	10/2/2009	10/26/2010	23.34	3.24	8.12
218+66	10/2/2009	10/26/2010	7.26	2.85	2.26
229+85	10/2/2009	10/26/2010	12.36	1.35	7.52
242+03	10/2/2009	10/26/2010	34.23	3.47	12.06
252+62	10/2/2009	10/26/2010	-7.32	-2.60	-4.10
263+22	10/2/2009	10/26/2010	10.89	-4.65	3.36
274+53	10/2/2009	10/26/2010	17.07	-2.42	3.07
281+40	10/2/2009	10/26/2010	5.42	-3.24	6.27
288+39	10/2/2009	10/26/2010	10.34	2.28	3.24
295+27	10/2/2009	10/26/2010	11.30	-5.18	-7.55
302+24	10/2/2009	10/26/2010	11.16	-4.96	-7.60
315+96	10/2/2009	10/26/2010	-8.57	1.31	4.15
323+09	10/2/2009	10/26/2010	10.41	-1.76	-5.79
329+63	10/2/2009	10/26/2010	-11.51	3.30	-3.18
331+43	10/2/2009	10/26/2010	-15.30	-1.00	-0.74
333+23	10/2/2009	10/26/2010	-50.17	-3.12	-1.62
335+03	10/2/2009	10/26/2010	-29.77	-2.07	-5.51
336+83	10/2/2009	10/26/2010	-33.67	-3.60	-6.54
338+63	10/2/2009	10/26/2010	-35.91	-5.79	-6.87
340+43	10/2/2009	10/26/2010	-30.86	0.13	-7.59
342+23	10/2/2009	10/26/2010	-23.45	-1.31	-4.33

Table C-1. Summary of Shoreline Change and Volume Change (October 2009 to October 2010) 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 October 2, 2009 to October 26, 2010.

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	10/2/2009	10/26/2010	-15.98	0.15	5.28
345+85	10/2/2009	10/26/2010	-14.05	0.82	-0.70
347+63	10/2/2009	10/26/2010	-20.03	-3.81	-2.27
349+43	10/2/2009	10/26/2010	-30.07	-1.83	-12.27
351+23	10/2/2009	10/26/2010	-17.80	-0.09	0.06
353+03	10/2/2009	10/26/2010	-16.78	-7.54	-11.12
354+83	10/2/2009	10/26/2010	-33.22	-4.80	-1.57
356+63	10/2/2009	10/26/2010	-22.85	-2.98	-5.62
358+43	10/2/2009	10/26/2010	-32.62	-4.22	-1.53
360+23	10/2/2009	10/26/2010	-27.77	-1.49	-6.30
362+03	10/2/2009	10/26/2010	-33.69	-3.55	-1.12
363+83	10/2/2009	10/26/2010	-24.43	-0.67	-5.00
365+63	10/2/2009	10/26/2010	-23.08	-1.90	0.05
367+43	10/2/2009	10/26/2010	-25.72	-1.60	-7.24
369+23	10/2/2009	10/26/2010	-24.23	-1.88	-1.43
371+03	10/2/2009	10/26/2010	-32.55	-0.60	-8.10
372+83	10/2/2009	10/26/2010	-34.30	-5.85	-4.39
375+08	10/2/2009	10/26/2010	-61.33	-8.20	-22.38
376+78	10/2/2009	10/26/2010	-31.81	-5.83	-5.33
378+48	10/2/2009	10/26/2010	-68.87	-12.09	-25.10
380+18	10/2/2009	10/26/2010	-77.83	-9.23	-17.60
381+88	10/2/2009	10/26/2010	-62.31	-8.80	-9.76
383+58	10/2/2009	10/26/2010	-76.97	-8.90	-22.65

Table C-2. Summary of Shoreline Change and Volume Change (March 2010 to October 2010)

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 31, 2010 to October 26, 2010.

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	3/31/2010	10/26/2010	-99.71	-17.05	-39.45
2+50	3/31/2010	10/26/2010	-88.23	-12.70	-34.19
5+00	3/31/2010	10/26/2010	1.00	-2.42	14.15
7+50	3/31/2010	10/26/2010	-11.29	-0.05	-6.47
10+00	3/31/2010	10/26/2010	-1.76	0.81	0.30
12+50	3/31/2010	10/26/2010	3.10	1.90	-6.88
15+00	3/31/2010	10/26/2010	-2.03	-0.31	-10.54
17+50	3/31/2010	10/26/2010	-12.15	-0.83	-3.22
20+00	3/31/2010	10/26/2010	3.61	1.07	0.14
22+50	3/31/2010	10/26/2010	17.31	2.19	7.16
25+00	3/31/2010	10/26/2010	0.13	4.59	5.56
27+50	3/31/2010	10/26/2010	-1.62	8.97	10.00
30+00	3/31/2010	10/26/2010	-12.26	4.63	0.37
32+50	3/31/2010	10/26/2010	6.01	11.26	13.58
35+00	3/31/2010	10/26/2010	-3.75	5.27	9.49
37+50	3/31/2010	10/26/2010	2.67	10.40	11.39
40+00	3/31/2010	10/26/2010	13.55	10.63	10.87
42+50	3/31/2010	10/26/2010	0.85	7.05	3.81
45+00	3/31/2010	10/26/2010	-1.88	6.57	5.73
45+25	3/31/2010	10/26/2010	-2.32	6.11	5.31
47+30	3/31/2010	10/26/2010	-4.52	5.73	3.65
49+35	3/31/2010	10/26/2010	-4.85	5.05	2.41
51+41	3/31/2010	10/26/2010	0.57	6.81	-2.42
53+46	3/31/2010	10/26/2010	8.90	11.02	13.39
55+51	3/31/2010	10/26/2010	-1.80	6.12	4.60
57+57	3/31/2010	10/26/2010	6.87	8.69	9.92
59+62	3/31/2010	10/26/2010	-0.03	6.94	3.63
61+62	3/31/2010	10/26/2010	22.14	6.52	4.89
63+62	3/31/2010	10/26/2010	1.44	2.98	-3.70
65+62	3/31/2010	10/26/2010	14.48	4.93	3.96
67+62	3/31/2010	10/26/2010	0.31	6.61	4.64
69+62	3/31/2010	10/26/2010	14.76	10.31	8.59
71+62	3/31/2010	10/26/2010	-2.39	5.37	5.73
73+62	3/31/2010	10/26/2010	-10.03	-1.23	-5.84
75+62	3/31/2010	10/26/2010	-21.27	-4.12	-7.88
77+62	3/31/2010	10/26/2010	8.71	-0.60	-0.99
79+62	3/31/2010	10/26/2010	-8.98	1.01	-2.11
81+62	3/31/2010	10/26/2010	-6.02	-0.50	1.82
83+62	3/31/2010	10/26/2010	-9.88	-1.16	-5.01
85+62	3/31/2010	10/26/2010	-2.53	0.38	-5.60
87+62	3/31/2010	10/26/2010	1.51	1.32	1.94

Table C-2. Summary of Shoreline Change and Volume Change (March 2010 to October 2010) 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 31, 2010 to October 26, 2010.

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	3/31/2010	10/26/2010	13.01	4.04	8.05
103+08	3/31/2010	10/26/2010	-2.51	0.71	0.69
120+93	3/31/2010	10/26/2010	-3.90	-0.67	-1.41
129+17	3/31/2010	10/26/2010	-3.16	2.19	1.23
141+98	3/31/2010	10/26/2010	-10.76	0.67	-2.12
152+01	3/31/2010	10/26/2010	-0.53	2.97	5.29
163+49	3/31/2010	10/26/2010	10.51	2.61	3.78
169+63	3/31/2010	10/26/2010	8.10	0.40	3.06
171+63	3/31/2010	10/26/2010	3.23	3.93	10.48
173+63	3/31/2010	10/26/2010	-7.39	-1.31	-6.29
175+63	3/31/2010	10/26/2010	-0.14	0.48	0.57
177+63	3/31/2010	10/26/2010	-4.28	0.53	-0.15
179+63	3/31/2010	10/26/2010	11.18	2.50	2.65
181+63	3/31/2010	10/26/2010	-4.77	1.24	-2.15
183+63	3/31/2010	10/26/2010	10.43	2.11	-0.47
185+63	3/31/2010	10/26/2010	-4.75	-1.82	-4.64
187+63	3/31/2010	10/26/2010	5.38	0.50	2.01
189+63	3/31/2010	10/26/2010	-0.39	-0.79	0.16
191+63	3/31/2010	10/26/2010	24.13	5.80	9.40
193+63	3/31/2010	10/26/2010	12.37	3.30	13.24
195+63	3/31/2010	10/26/2010	19.78	3.58	4.60
206+86	3/31/2010	10/26/2010	17.40	3.09	5.74
218+66	3/31/2010	10/26/2010	15.35	-0.02	4.22
229+85	3/31/2010	10/26/2010	23.77	4.20	0.37
242+03	3/31/2010	10/26/2010	7.70	6.22	6.44
252+62	3/31/2010	10/26/2010	12.36	4.20	2.30
263+22	3/31/2010	10/26/2010	18.23	2.66	3.09
274+53	3/31/2010	10/26/2010	14.13	2.38	-1.63
281+40	3/31/2010	10/26/2010	10.52	3.20	2.38
288+39	3/31/2010	10/26/2010	16.84	3.77	0.45
295+27	3/31/2010	10/26/2010	16.44	3.61	1.23
302+24	3/31/2010	10/26/2010	15.06	2.61	-1.34
315+96	3/31/2010	10/26/2010	3.14	6.86	5.62
323+09	3/31/2010	10/26/2010	2.65	3.22	3.70
329+63	3/31/2010	10/26/2010	-9.01	3.94	3.70
331+43	3/31/2010	10/26/2010	4.34	0.57	-0.17
333+23	3/31/2010	10/26/2010	-11.46	-0.21	5.83
335+03	3/31/2010	10/26/2010	-11.26	-0.70	1.22
336+83	3/31/2010	10/26/2010	1.84	0.68	4.64
338+63	3/31/2010	10/26/2010	0.54	1.09	0.70
340+43	3/31/2010	10/26/2010	-1.54	0.73	0.28

Table C-2. Summary of Shoreline Change and Volume Change (March 2010 to October 2010) 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 31, 2010 to October 26, 2010.

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	3/31/2010	10/26/2010	-0.08	1.81	3.27
344+05	3/31/2010	10/26/2010	5.15	0.22	3.06
345+85	3/31/2010	10/26/2010	-14.19	2.15	-0.19
347+63	3/31/2010	10/26/2010	12.50	2.89	3.92
349+43	3/31/2010	10/26/2010	-11.14	-0.63	-4.41
351+23	3/31/2010	10/26/2010	20.49	3.90	4.73
353+03	3/31/2010	10/26/2010	1.60	-6.15	-5.31
354+83	3/31/2010	10/26/2010	13.05	-1.53	5.60
356+63	3/31/2010	10/26/2010	-3.17	-2.22	-1.40
358+43	3/31/2010	10/26/2010	14.96	-0.39	1.54
360+23	3/31/2010	10/26/2010	-10.04	-1.84	-2.90
362+03	3/31/2010	10/26/2010	14.29	-0.33	5.99
363+83	3/31/2010	10/26/2010	-7.78	-2.32	-4.80
365+63	3/31/2010	10/26/2010	9.75	-0.77	2.34
367+43	3/31/2010	10/26/2010	-8.93	-2.61	-4.38
369+23	3/31/2010	10/26/2010	18.09	1.01	10.33
371+03	3/31/2010	10/26/2010	-4.59	-1.46	-4.37
372+83	3/31/2010	10/26/2010	15.15	0.24	2.21
375+08	3/31/2010	10/26/2010	-10.32	-2.81	-2.99
376+78	3/31/2010	10/26/2010	2.27	-0.98	0.61
378+48	3/31/2010	10/26/2010	-7.80	-2.73	-8.48
380+18	3/31/2010	10/26/2010	-10.90	-2.03	-0.93
381+88	3/31/2010	10/26/2010	-6.23	-1.26	-0.42
383+58	3/31/2010	10/26/2010	-17.97	-2.71	-6.47

Table C-3. Summary of Shoreline Change and Volume Change from East Ocean View Nourishment (March 2009 to October 2010)

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 October 26, 2010.

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	10/26/2010	-48.77	-7.77	-
331+43	3/20/2009	10/26/2010	-51.44	-8.78	-
333+23	3/20/2009	10/26/2010	-39.42	-6.51	-
335+03	3/20/2009	10/26/2010	-41.11	-7.76	-
336+83	3/20/2009	10/26/2010	-37.37	-7.90	-
338+63	3/20/2009	10/26/2010	-32.30	-7.77	-
340+43	3/20/2009	10/26/2010	-38.29	-7.36	-
342+23	3/20/2009	10/26/2010	-33.73	-7.78	-
344+05	3/20/2009	10/26/2010	-29.50	-7.36	-
345+85	3/20/2009	10/26/2010	-34.05	-7.37	-
347+63	3/20/2009	10/26/2010	-12.91	-4.81	-
349+43	3/20/2009	10/26/2010	-37.52	-8.15	-
351+23	3/20/2009	10/26/2010	-1.27	-3.22	-
353+03	3/20/2009	10/26/2010	-25.85	-6.43	-
354+83	3/20/2009	10/26/2010	-4.43	-3.55	-
356+63	3/20/2009	10/26/2010	-27.45	-7.44	-
358+43	3/20/2009	10/26/2010	-13.06	-4.31	-
360+23	3/20/2009	10/26/2010	-41.34	-9.08	-
362+03	3/20/2009	10/26/2010	-15.05	-4.85	-
363+83	3/20/2009	10/26/2010	-22.33	-5.89	-
365+63	3/20/2009	10/26/2010	-1.33	-2.66	-
367+43	3/20/2009	10/26/2010	-42.01	-8.50	-
369+23	3/20/2009	10/26/2010	-1.46	-3.12	-
371+03	3/20/2009	10/26/2010	-44.36	-8.99	-
372+83	3/20/2009	10/26/2010	-10.49	-5.23	-
375+08	3/20/2009	10/26/2010	-56.22	-12.17	-
376+78	3/20/2009	10/26/2010	-15.52	-5.63	-
378+48	3/20/2009	10/26/2010	-66.27	-12.73	-
380+18	3/20/2009	10/26/2010	-58.28	-10.89	-
381+88	3/20/2009	10/26/2010	-44.49	-9.19	-
383+58	3/20/2009	10/26/2010	-79.20	-14.85	-

Table C-4. Summary of Shoreline Change and Volume Change from Central Ocean View Nourishment (March 2005 to October 2010)

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 October 26, 2010.

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	10/26/2010	6.03	2.13	-
17+50	3/15/2005	10/26/2010	8.43	2.32	-
20+00	3/15/2005	10/26/2010	-0.11	-0.20	-
22+50	3/15/2005	10/26/2010	-4.10	-2.77	-
25+00	3/15/2005	10/26/2010	-3.54	-2.82	-
27+50	3/15/2005	10/26/2010	-5.66	-2.15	-
30+00	3/15/2005	10/26/2010	-6.10	-2.30	-
32+50	3/15/2005	10/26/2010	-7.09	-2.00	-
35+00	3/15/2005	10/26/2010	-9.33	-2.12	-
37+50	3/15/2005	10/26/2010	-4.44	-1.81	-
40+00	3/15/2005	10/26/2010	-8.93	-2.35	-
42+50	3/15/2005	10/26/2010	-7.94	-3.06	-
45+00	3/15/2005	10/26/2010	-10.45	-3.38	-
45+25	3/15/2005	10/26/2010	-11.98	-3.88	-
47+30	3/15/2005	10/26/2010	-15.21	-4.01	-
49+35	3/15/2005	10/26/2010	-7.58	-2.63	-
51+41	3/15/2005	10/26/2010	-7.92	-1.73	-
53+46	3/15/2005	10/26/2010	-1.02	-0.21	-
55+51	3/15/2005	10/26/2010	-8.89	-2.44	-
57+57	3/15/2005	10/26/2010	1.25	-0.14	-
59+62	3/15/2005	10/26/2010	-8.81	-1.81	-
61+62	3/15/2005	10/26/2010	7.26	1.21	-
63+62	3/15/2005	10/26/2010	-6.61	-0.51	-
65+62	3/15/2005	10/26/2010	-0.83	0.84	-
67+62	3/15/2005	10/26/2010	-21.18	-2.20	-
69+62	3/15/2005	10/26/2010	-11.57	-1.10	-
71+62	3/15/2005	10/26/2010	-25.58	-3.27	-
73+62	3/15/2005	10/26/2010	0.85	-0.35	-
75+62	3/15/2005	10/26/2010	-9.10	-0.58	-
77+62	3/15/2005	10/26/2010	5.28	1.68	-
79+62	3/15/2005	10/26/2010	-2.49	-0.05	-
81+62	3/15/2005	10/26/2010	-3.74	-1.29	-
83+62	3/15/2005	10/26/2010	-6.18	-2.19	-
85+62	3/15/2005	10/26/2010	-5.02	-2.40	-
87+62	3/15/2005	10/26/2010	-3.08	-0.78	-
93+41	3/15/2005	10/26/2010	0.35	-0.85	-
103+08	3/15/2005	10/26/2010	-6.80	-2.64	-
120+93	3/15/2005	10/26/2010	-0.69	-3.94	-
129+17	3/15/2005	10/26/2010	-11.62	-4.95	-
141+98	3/15/2005	10/26/2010	-5.13	-1.33	-
152+01	3/15/2005	10/26/2010	-8.75	-3.08	-

Table C-4. Summary of Shoreline Change and Volume Change from Central Ocean View Nourishment (March 2005 to October 2010) 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 October 26, 2010.

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	10/26/2010	-2.74	-1.46	-
169+63	3/15/2005	10/26/2010	-3.18	-1.65	-
171+63	3/15/2005	10/26/2010	-5.91	-1.76	-
173+63	3/15/2005	10/26/2010	-3.63	-1.70	-
175+63	3/15/2005	10/26/2010	-6.33	-2.05	-
177+63	3/15/2005	10/26/2010	-5.20	-1.70	-
179+63	3/15/2005	10/26/2010	-5.46	-1.93	-
181+63	3/15/2005	10/26/2010	-5.20	-2.74	-
183+63	3/15/2005	10/26/2010	2.89	0.13	-
185+63	3/15/2005	10/26/2010	-1.99	-0.85	-
187+63	3/15/2005	10/26/2010	3.92	0.84	-
189+63	3/15/2005	10/26/2010	-0.90	0.42	-
191+63	3/15/2005	10/26/2010	7.04	2.13	-
193+63	3/15/2005	10/26/2010	-0.74	0.42	-
195+63	3/15/2005	10/26/2010	-1.82	-0.33	-