Executive Summary

In March 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. April 2009 to March 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 March 2010 survey data with previous surveys taken in April 2009 (spring to spring comparison) and October 2009 (most recent periodic survey comparison) in the Ocean View Beach area between Willoughby Spit and Little Creek Inlet.

Comparison	Parameter	Quantity
April 2009 vs. March 2010 Comparison	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	-20.83 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	-205,557 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	- cy/yr
October 2009 vs. March 2010 Comparison	Average Shoreline Change at MHW (+0.98 ft NAVD88)	-6.03 ft
	Cumulative Volume Change Above 0 ft NAVD88	-156,858 cy
	Cumulative Volume Change Above -15 ft NAVD88	-140,565 cy

The average shoreline change rate for the entire shoreline at MHW between the April 2009 and March 2010 surveys was -20.83 ft/yr. The cumulative volume change above 0 ft NAVD88 was approximately -205,557 cy/yr, between the April 2009 and March 2010 surveys, indicating an overall volumetric loss in the dune and subaerial beach over the past year. 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 the majority of losses over the year occurred in the October 2009 to March 2010 period. Due to a discrepancy in hydrographic survey data between the previous and current surveyors, the offshore portions of the profiles were not examined from April 2009 to March 2010 to determine if the trend of offshore accretion seen in previous reports has continued. While the October 2009 to March 2010 survey shows significant volumetric losses above -15 ft NAVD88 these are less than the losses above 0 ft NAVD88 indicating that some of the sediment lost from the beach and subaerial beach berm from the storm was captured in the nearshore region.

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. The Willoughby Spit region is the only region that has shown accretion at MHW in the most recent survey period, although there was still a volumetric loss of sediment in the system. The 800 block region has shown similar patterns of MHW and volume changes in this area due to the presence of the tombolos that have formed behind the two easternmost breakwaters, interrupting

littoral drift to the immediately adjacent area to the west. The region seems to recover towards the middle of the breakwater field with worsening erosion at the western end of the breakwater field. The West Ocean View region still remains fairly stable with some slight erosion, especially in the eastern portion of the region. This could be the result of the end effect of the Central Ocean View breakwaters. The Central Ocean View Breakwaters region appears to be fairly stable with some highly localized erosion/accretion patterns based on breakwater location. Like the eastern portion of the West Ocean View region, the western portion of this region is possibly seeing a slight end effect from the breakwater field. The Central Ocean View region continues to be fairly stable. For this monitoring period, the Central Ocean View region has most likely seen some benefit of material placed at East Ocean View due to natural littoral drift, lessening the downdrift impact of the breakwater field. Finally, the East Ocean View area shows a volumetric loss 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 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
East Ocean View Nourishment vs.March 2010 Comparison	-49.61 ft	-10.93 cy/ft	-57,038 cy
Central Ocean View Nourishment vs. March 2010 Comparison	-29.48 ft	-12.78 cy/ft	-240,436 cy

The 57,000 cy volumetric loss above 0 ft NAVD88 from the East Ocean View project is approximately 50% of the original amount placed in this dune and subaerial beach area while the 240,000 cy loss above 0 ft NAVD88 in the Central Ocean View project area is approximately 75% of the original amount placed above 0 ft NAVD88. Due to recent 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.

Table of Contents

Executive Summary i

1.0 Objective 1

2.0 Data Sources 1

3.0 Methods 4

4.0 Discussion of Periodic Surveying Evaluation 5

4.1. Differences in Relative Surveys 5

4.2. General Shoreline Trends 5

4.3. Regional Shoreline Trends 8

4.3.1. Willoughby Spit 8

4.3.2. 800 Block Breakwaters 8

4.3.3. West Ocean View 9

4.3.4. Central Ocean View Breakwaters 10

4.3.5. Central Ocean View 10

4.3.6. East Ocean View 11

4.4. East Ocean View Beach Nourishment Project (2009) 16

4.5. Central Ocean View Dune Restoration Project (2005) 20

5.0 Summary 24

Appendix A VIMS Aerial Photography and Digitized Shoreline

Appendix B Survey Profile Comparison Plots

Appendix C Tabulated Shoreline and Volume Change Data

List of Figures

Figure 1. Survey Baseline and Transects 3
Figure 2. Shoreline Change Rate (ft/yr) At Mean High Water (+0.98 ft NAVD88) for April 2009 to March 2010 12
Figure 3. Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr) for April 2009 to March 2010 13
Figure 4. Shoreline Change (ft) At Mean High Water (+0.98 ft NAVD88) for October 2009 to March 2010 14
Figure 5. Volume Change Above 0 ft NAVD88 (cy/ft) and -15 ft NAVD88 for October 2009 to March 2010 15
Figure 6. Net Volume Change Since the East Ocean View Nourishment Project (March 2009) 18
Figure 7. Shoreline Position Difference (ft) at MHW Between Pre-Fill and March 2010 Shorelines for East Ocean View 19
Figure 8. Net Volume Change Since the Willoughby Spit to Central Ocean View Dune Restoration Project (March 2005) 22
Figure 9. Shoreline Position Difference (ft) at MHW Between Pre-Fill and March 2010 Shorelines for Central Ocean View 23

List of Tables

Table 1. Regional Shoreline and Volume Change Statistics (April 2009 – March 2010 Comparison) 6
Table 2. Regional Shoreline and Volume Change Statistics (October 2009 – March 2010 Comparison) 6
Table 3. Regional Shoreline and Volume Change Statistics from the November 2009 Nor'easter (Late October 2009 Survey to Late November 2009 Survey Comparison) 7
Table 4. Average Shoreline and Volume Change Rates for Willoughby Spit 8
Table 5. Average Shoreline and Volume Change Rates for 800 Block Breakwaters 9
Table 6. Average Shoreline and Volume Change Rates for West Ocean View 9
Table 7. Average Shoreline and Volume Change Rates for Central Ocean View Breakwaters 10
Table 8. Average Shoreline and Volume Change Rates for Central Ocean View 10
Table 9. Average Shoreline and Volume Change Rates for East Ocean View 11
Table 10. Overall Shoreline and Volume Change Statistics – East Ocean View Nourishment Project (Post-Fill – March 2010 Comparison) 16
Table 11. Regional and Overall Shoreline and Volume Change Statistics for Central Ocean View Nourishment Project (Post-Fill – March 2010 Comparison) 20

1.0 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 and March 2010. This report documents the data sources, methods, and results of a periodic surveying evaluation performed to compare the March 2010 survey data with previous surveys taken in April 2009 (spring to spring comparison) and October 2009 (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 (March 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 March 2010.

2.0 Data Sources

Most recently, Geodynamics conducted a survey of Ocean View Beach in March 2010. The baseline and transects established for the September 2005 survey were used for the most recent survey. **Figure 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. Previous survey data collected by McKim & Creed in April 2009 were also used for comparisons in this study.

As noted, the Fall 2009 and Spring 2010 survey utilized a different surveying company than was used on the previous surveys. There is a notable offset in the hydrographic portion of the shoreline data between the most recent Fall 2009 and Spring 2010 surveys by Geodynamics and the Spring 2009 survey by McKim & Creed that may be attributed to several factors that affect hydrographic survey data. Each surveyor may use different types of equipment, and have different methods for handling sound velocity, both of which can affect the survey data elevations. Additionally, the distance of the vessel from the base station, or GPS interference from the nearby military bases, can impact the accuracy of the data. Due to this observed discrepancy, the hydrographic portions of the current Spring 2010 survey and the previous Spring 2009 survey data were not compared in this report; however, the Spring 2010 and Fall 2009 are compared. Comparison of the hydrographic data from all periods will resume in the Fall 2010 report as the survey data in the fall will be collected by Geodynamics.

Also, in March 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 March 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 1. Survey Baseline and Transects

3.0 Methods

Survey comparisons and respective analysis were performed using a combination of Autodesk Civil 3D 2007 (Civil 3D), Autodesk Land Development Desktop 2007 (LDD), Microsoft Excel (Excel), Surfer and Beach Morphology Analysis Package (BMAP). Civil 3D and LDD are AutoCAD based programs which allow 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. April 2009 to March 2010 (Entire Shoreline)
2. October 2009 to March 2010 (Entire Shoreline)
3. March 2009 (East Ocean View post-fill) to March 2010 (Sta 329+63-Sta 383+58)
4. June 2003 (East Ocean View pre-fill) to March 2010 (Sta 329+63-Sta 383+58)
5. March 2005 (Central Ocean View post-fill) to March 2010 (Sta 15+00-Sta 195+63)
6. December 2004-February 2005 (Central Ocean View pre-fill) to March 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. In previous reports, 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; however, due to the discrepancies between the two surveyors' methods, calculations above -15 ft NAVD88 are only provided for the comparison of October 2009 to March 2010. 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.

4.0 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**.

4.1. Differences in Relative Surveys

Differences in the surveys taken as part of the ongoing program of periodic surveying of the Ocean View shoreline (April 2009, October 2009 and March 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 3.0.

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 Civil3D 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.

4.2. 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 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 April 2009 to March 2010 comparison are presented in **Table 1**. A summary of the resulting statistics for the October 2009 to March 2010 comparison are presented in **Table 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 (for the two most recent surveys) in order to better understand onshore and offshore processes.

Table 1. Regional Shoreline and Volume Change Statistics (April 2009 – March 2010 Comparison)

Region	Average Shoreline Change	Average Volume Change Rate Above 0 ft NAVD88	Cumulative Volume Change Rate Above 0 ft NAVD88
	(ft/yr)	(cy/ft/yr)	(cy/yr)
Willoughby Spit (0+00 to 45+00)	-14.07	-4.04	-17,528
800 Block Breakwaters (45+25 to 87+62)	-16.40	-5.72	-26,150
West Ocean View (93+41 to 163+49)	-9.95	-5.15	-38,943
Central Ocean View Breakwaters (169+63 to 195+63)	-8.91	-3.52	-13,799
Central Ocean View (206+86 to 323+09)	-16.02	-5.70	-66,954
East Ocean View (329+63 to 383+58)	-61.87	-7.47	-42,182
OVERALL	Weighted Avg (ft/yr)	Weighted Avg (cy/ft/yr)	Total (cy/yr)
	-20.83	-5.47	-205,557

Table 2. Regional Shoreline and Volume Change Statistics (October 2009 – March 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
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit (0+00 to 45+00)	2.23	-4.32	-19,748	-7.77	-35,935
800 Block Breakwaters (45+25 to 87+62)	-0.17	-4.49	-20,200	-5.19	-22,568
West Ocean View (93+41 to 163+49)	-2.56	-4.20	-29,811	-4.20	-26,574
Central Ocean View Breakwaters (169+63 to 195+63)	1.85	-2.26	-9,375	-1.89	-8,477
Central Ocean View (206+86 to 323+09)	-2.05	-4.98	-59,527	-1.05	-8,816
East Ocean View (329+63 to 383+58)	-35.31	-3.37	-18,197	-6.83	-38,195
OVERALL	Weighted Avg (ft)	Weighted Avg (cy/ft)	Total (cy)	Weighted Avg (cy/ft)	Total (cy)
	-6.03	-4.20	-156,858	-3.89	-140,565

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**.

According to **Table 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 that 60-foot change in shoreline in the East Ocean View as well as the impact of the November 2009 nor'easter as shown in **Table 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 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 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
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit West (WS0+00 to WS3+67)	15.62	1.86	307	8.48	1,358
Willoughby Spit (0+00 to 45+00)	4.86	-5.97	-27,163	-3.42	-16,443
800 Block Breakwaters (45+25 to 87+62)	13.17	-4.57	-21,633	-0.29	-1,661
West Ocean View (93+41 to 163+49)	1.07	-3.27	-26,417	-0.30	-1,628
Central Ocean View Breakwaters (169+63 to 195+63)	7.67	-1.58	-6,531	2.94	8,877
Central Ocean View (206+86 to 323+09)	10.28	-5.48	-66,936	0.76	12,643
East Ocean View (329+63 to 383+58)	-12.59	-3.67	-21,018	0.53	3,001
OVERALL	Weighted Avg (ft)	Weighted Avg (cy/ft)	Total (cy)	Weighted Avg (cy/ft)	Total (cy)
	4.62	-4.31	-169,391	0.17	6,148

The most recent period of comparison, from the October 2009 survey to the March 2010 survey, is shown in **Table 2**. Overall there is erosion at the MHW line, though there are regions of accretion in Willoughby Spit and the Central Ocean View Breakwaters. There were significant volumetric losses 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. While the region above -15 ft NAVD88 experienced overall losses, it appears that this region captured some of the sediment from the subaerial beach berm. Although there is an overall loss of sediment from the subaerial beach berm, as shown in the cumulative volume change above 0 ft NAVD88, there has been some accretion (recovery) of sediment since the nor'easter with a smaller loss of quantity seen in comparisons of **Table 2** and **Table 3**.

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.

4.3. Regional Shoreline Trends

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

4.3.1. 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 April 2009 and March 2010 for the Willoughby Spit region along with average shoreline and volume change quantities between October 2009 and March 2010 are presented in **Table 4**.

Table 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
April 2009 vs. March 2010 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Willoughby Spit (0+00 to 45+00)	-14.07	-4.04	-17,528	-	-
October 2009 vs. March 2010 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Willoughby Spit (0+00 to 45+00)	2.23	-4.32	-19,748	-7.77	-35,935

Table 4 indicates that during the time between the two spring surveys (April 2009 and March 2010), this region experienced an average shoreline recession rate of -14.07 ft/yr at MHW with volumetric losses of sediment above 0 ft NAVD88 of approximately 17,500 cy. Examination of the profile plots in **Appendix B** and **Figure 3** show that the majority of erosion in this section occurred with the loss of the dune system on the eastern half. The areas updrift of the groins retained more sediment than those profiles immediately downdrift of the groins in this region; however the losses occurred on all profiles. The area closest to the terminal groin and breakwaters did not suffer as much volumetric erosion. This is due to the natural direction of littoral drift and sediment movement from east to west, causing accretion in the direction of the spit.

4.3.2. 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 April 2009 and March 2010 for the 800 Block Breakwater region along with average shoreline and volume change quantities between October 2009 and March 2010 are presented in **Table 5**.

Table 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
April 2009 vs. March 2010 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
800 Block Breakwaters (45+25 to 87+62)	-16.40	-5.72	-26,150	-	-
October 2009 vs. March 2010 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
800 Block Breakwaters (45+25 to 87+62)	-0.17	-4.49	-20,200	-5.19	-22,568

The comparison between profiles in the 800 Block Breakwater region indicates erosion at MHW with volumetric decreases above 0 ft NAVD88 over the past year from April 2009 to March 2010 and over the past six months from October 2009 to March 2010. The majority of the volume change in the previous six months occurred above 0 ft NAVD88 and may be attributed to the significant losses observed on the subaerial beach berm due to the November 2009 nor'easter. **Figure 3** through **Figure 5** show varying accretion and erosion throughout the region. Notable points include accretion at Station 73+62 and erosion at Station 77+62. Upon inspection of aerial photography, Sta 73+62 runs through the center of the second easternmost breakwater which, along with the easternmost breakwater, had formed tombolos as of the October 2007 periodic survey. Tombolo formation has interrupted sediment transport to the west, causing accretion at this transect. Differing from previous surveys, Sta 77+62, the transect through the center of the easternmost breakwater, has shown erosion from the previous surveys which appears to have been captured in the tombolo to the west. The system seems to recover westward of these transects.

4.3.3. 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 April 2009 and March 2010 for the West Ocean View region along with average shoreline and volume change quantities between October 2009 and March 2010 are presented in **Table 6**.

Table 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
April 2009 vs. March 2010 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
West Ocean View (93+41 to 163+49)	-9.95	-5.15	-38,943	-	-
October 2009 vs. March 2010 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
West Ocean View (93+41 to 163+49)	-2.56	-4.20	-29,811	-4.20	-26,574

The survey comparisons showed recession of the MHW shoreline as well as overall volumetric erosion above 0 ft NAVD88 and -15 ft NAVD88. The October 2009 to March 2010 volume losses are slightly less than the volume losses on the year, indicating some accretion in the system during the previous six months. **Figure 2** through **Figure 5** shows that the region is slightly erosional along the shoreline. 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 are updrift of timber groins and realized the greatest impacts from the storm.

4.3.4. 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 April 2009 and March 2010 for the Central Ocean View Breakwaters region along with average shoreline and volume change quantities between October 2009 and March 2010 are presented in **Table 7**.

Table 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
April 2009 vs. March 2010 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Central Ocean View Breakwaters (169+63 to 195+63)	-8.91	-3.52	-13,799	-	-
October 2009 vs. March 2010 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Central Ocean View Breakwaters (169+63 to 195+63)	1.85	-2.26	-9,375	-1.89	-8,477

In the Central Ocean View Breakwaters region the MHW position receded over the previous year and resulted in negative volumetric changes above 0 ft NAVD88. The six month period from October 2009 to March 2010 revealed a slight accretion at the MHW line but still an overall volumetric loss above 0 ft NAVD88. Based on the lower volumetric loss above -15 ft NAVD88, some of the sediment from the subaerial beach appears to have been captured in the offshore region. **Figure 2** through **Figure 5** show varying levels of erosion across the region with some slight accretion at some locations. Accretion appears to occur more on the west side of the breakwaters and in between at Stations 185+63 and 189+63, with higher erosion just east of the breakwater field. The level of erosion is on the same order as the erosion along the entire Ocean View shoreline.

4.3.5. 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 April 2009 and March 2010 for the Central Ocean View region along with average shoreline and volume change quantities between October 2009 and March 2010 are presented in **Table 8**.

Table 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
April 2009 vs. March 2010 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
Central Ocean View (206+86 to 323+09)	-16.02	-5.70	-66,954	-	-
October 2009 vs. March 2010 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
Central Ocean View (206+86 to 323+09)	-2.05	-4.98	-59,527	-1.05	-8,816

As shown in **Table 8**, Central Ocean View has experienced shoreline erosion at MHW over the past year with significant losses above 0 ft NAVD88. Some recovery of the subaerial beach berm has occurred since the October 2009 survey; however, there were losses offshore below the -15-foot depth. While in the past this has been a very stable region, the Central Ocean View region is unprotected and therefore more vulnerable to erosion. This was seen with the more than 66,000 cy loss of sediment above 0 ft NAVD88 that occurred during the November 2009 nor'easter as shown in **Table 3**. Erosive action appears to have occurred more on the western side of this section from April 2009 to March 2010; however, changes in the MHW shoreline were slight between the October 2009 and March 2010 survey. This may be attributed to the nourishment project in the East Ocean View section to the west of Central Ocean View that was undergoing equilibrium changes and providing an influx of sediment to the Central Ocean View region from spreading losses over the last year.

4.3.6. 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 April 2009 and March 2010 for the East Ocean View region along with average shoreline and volume change quantities between October 2009 and March 2010 are presented in **Table 9**.

Table 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
April 2009 vs. March 2010 Comparison					
	(ft/yr)	(cy/ft/yr)	(cy/yr)	(cy/ft/yr)	(cy/yr)
East Ocean View (329+63 to 383+58)	-61.87	-7.47	-42,182	-	-
October 2009 vs. March 2010 Comparison					
	(ft)	(cy/ft)	(cy)	(cy/ft)	(cy)
East Ocean View (329+63 to 383+58)	-35.31	-3.37	-18,197	-6.83	-38,195

As expected, the period following the nourishment has resulted in a negative MHW shoreline change and loss of material above the 0 ft NAVD88 as the profile equilibrates and fines are transported offshore. Some of this material was likely captured offshore near the breakwaters and some was likely transported westward due to the direction of the natural littoral drift. End effects of the ten easternmost breakwaters previously caused erosion to the western portion of East Ocean View (Bay Oaks hotspot). The five recently constructed breakwaters were designed to help alleviate these end effects and create a more uniform shoreline response. As evidenced in **Figure 2** through **Figure 5**, 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. There were more significant losses in this region above -15 ft NAVD88 than 0 ft NAVD88 due to impacts from the November 2009 nor'easter. The most severe volume loss occurred west of the breakwater field and at the very eastern portion of the breakwater field where tombolos had previously formed.

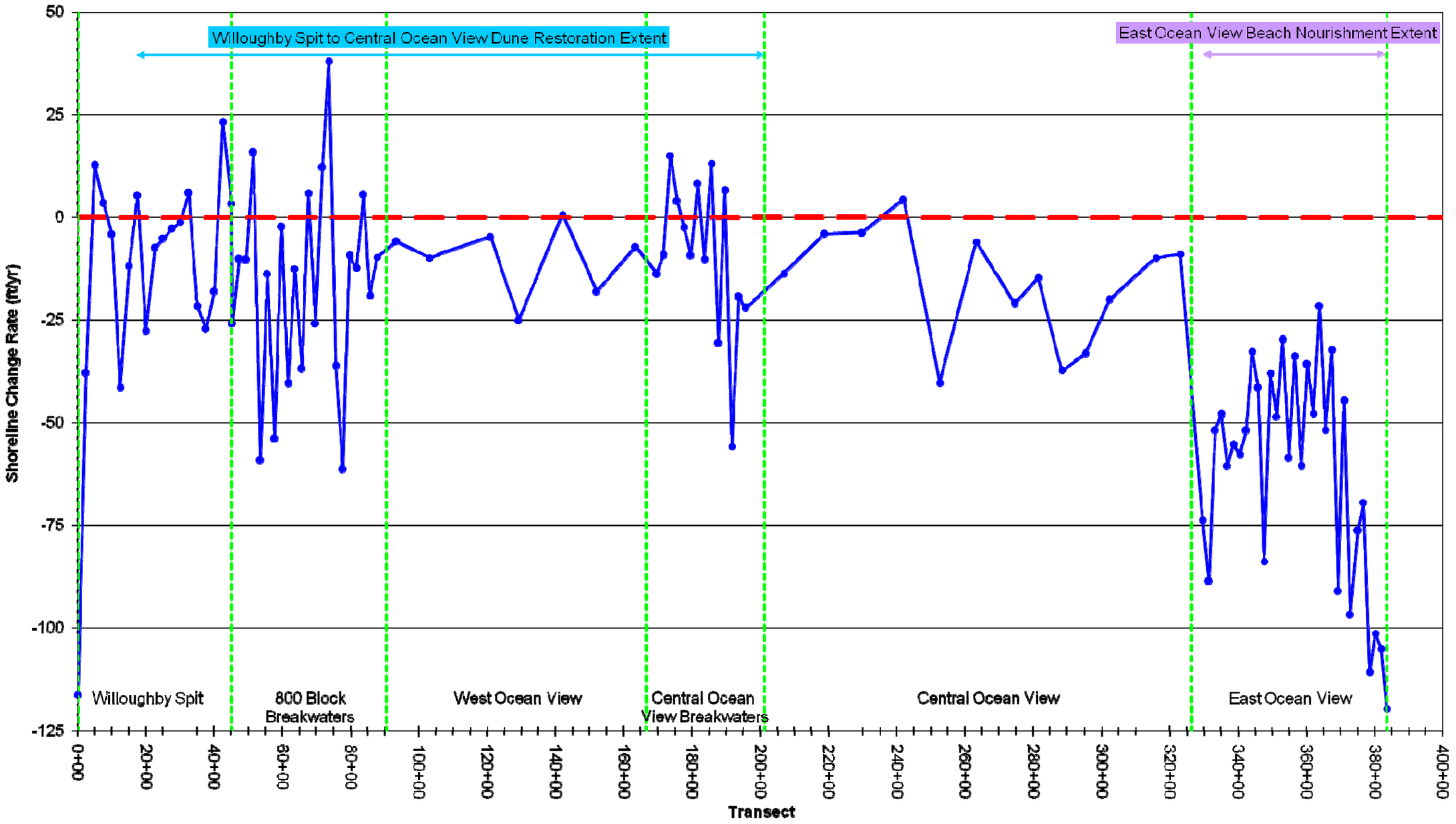


Figure 2. Shoreline Change Rate (ft/yr) At Mean High Water (+0.98 ft NAVD88) for April 2009 to March 2010

(Note: Positive=Accretion, Negative=Erosion)

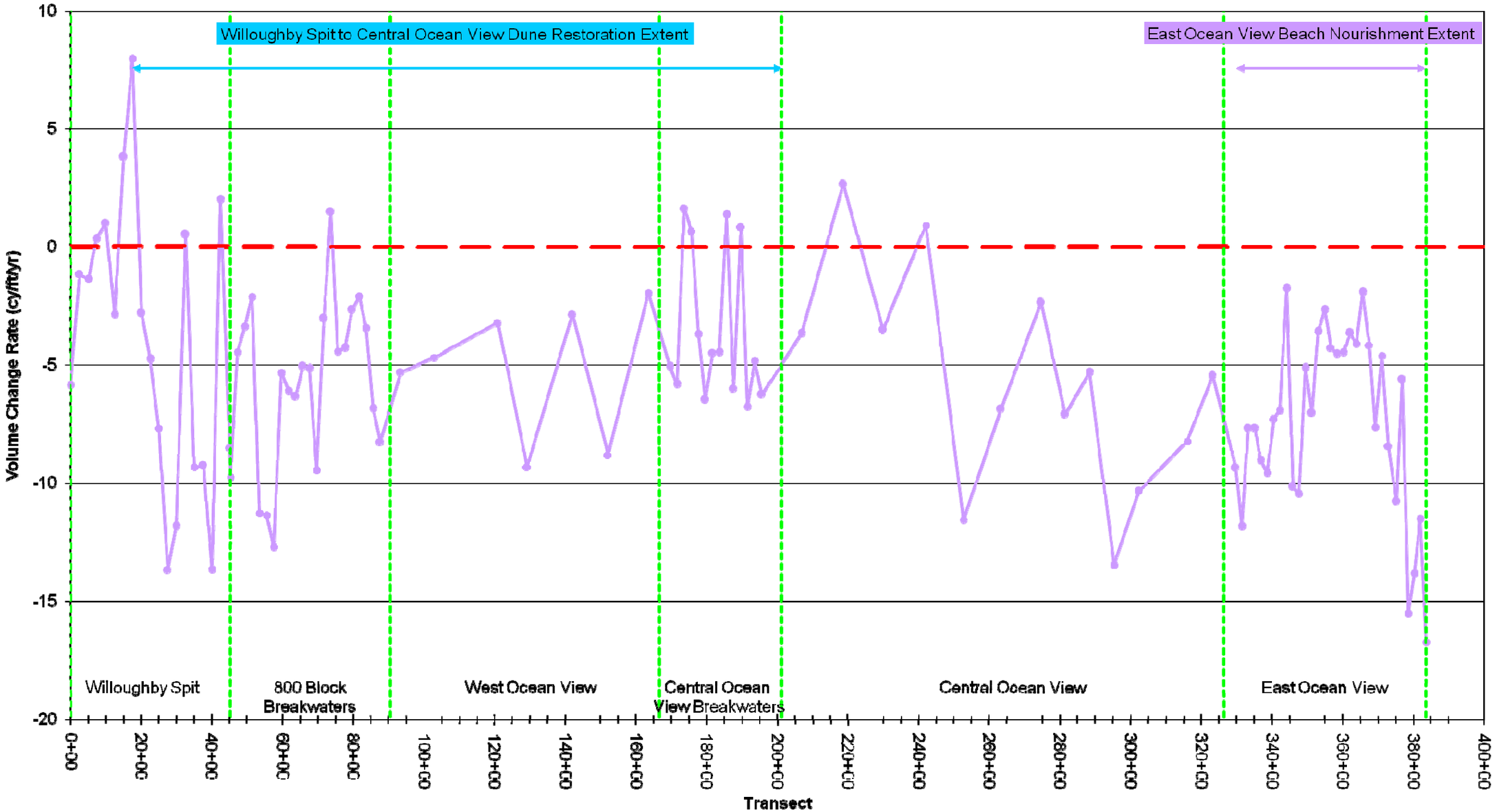


Figure 3. Volume Change Rate Above 0 ft NAVD88 (cy/ft/yr) for April 2009 to March 2010
(Note: Positive=Volume Gain, Negative=Volume Loss)

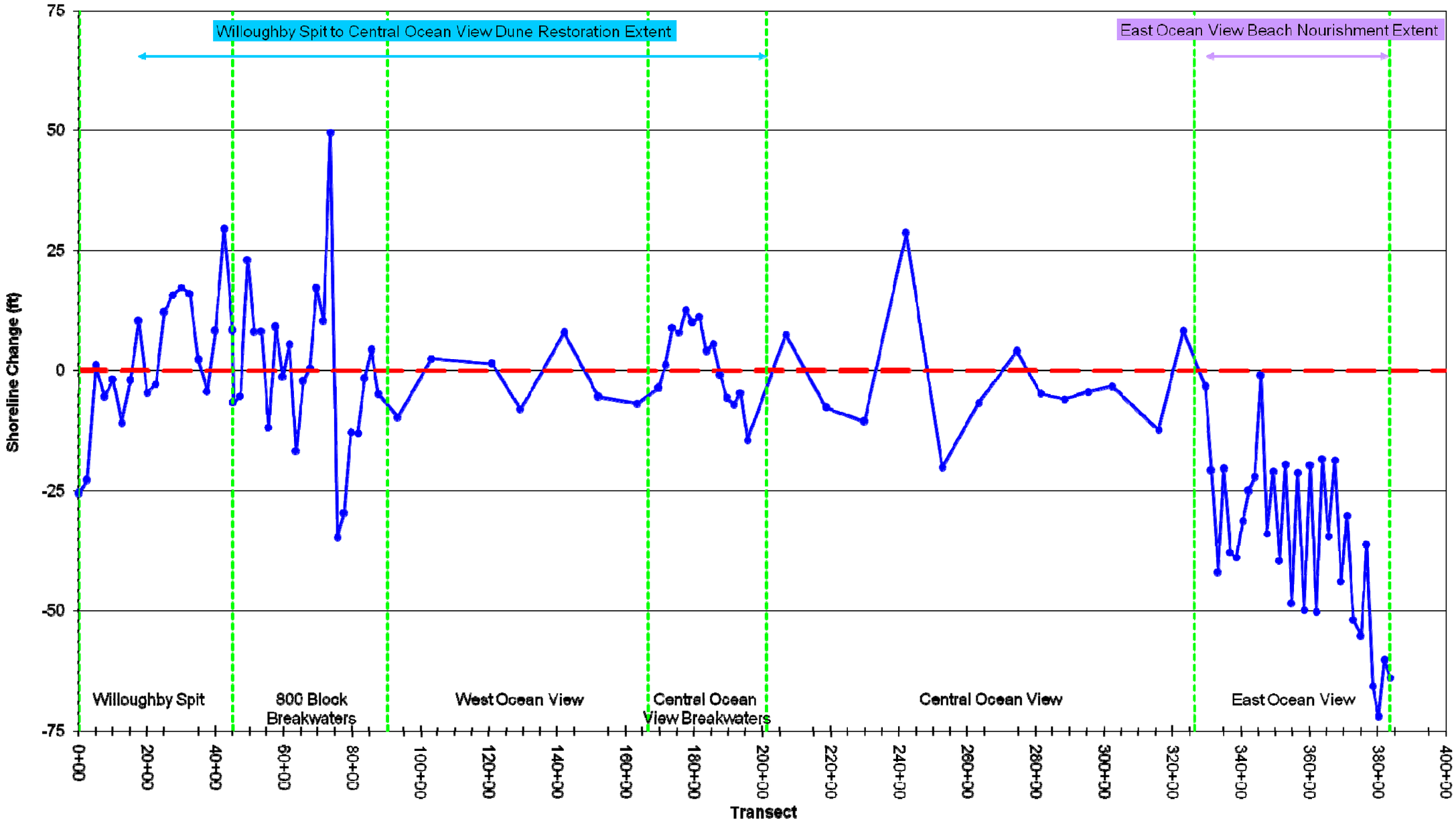


Figure 4. Shoreline Change (ft) At Mean High Water (+0.98 ft NAVD88) for October 2009 to March 2010
(Note: Positive=Accretion, Negative=Erosion)

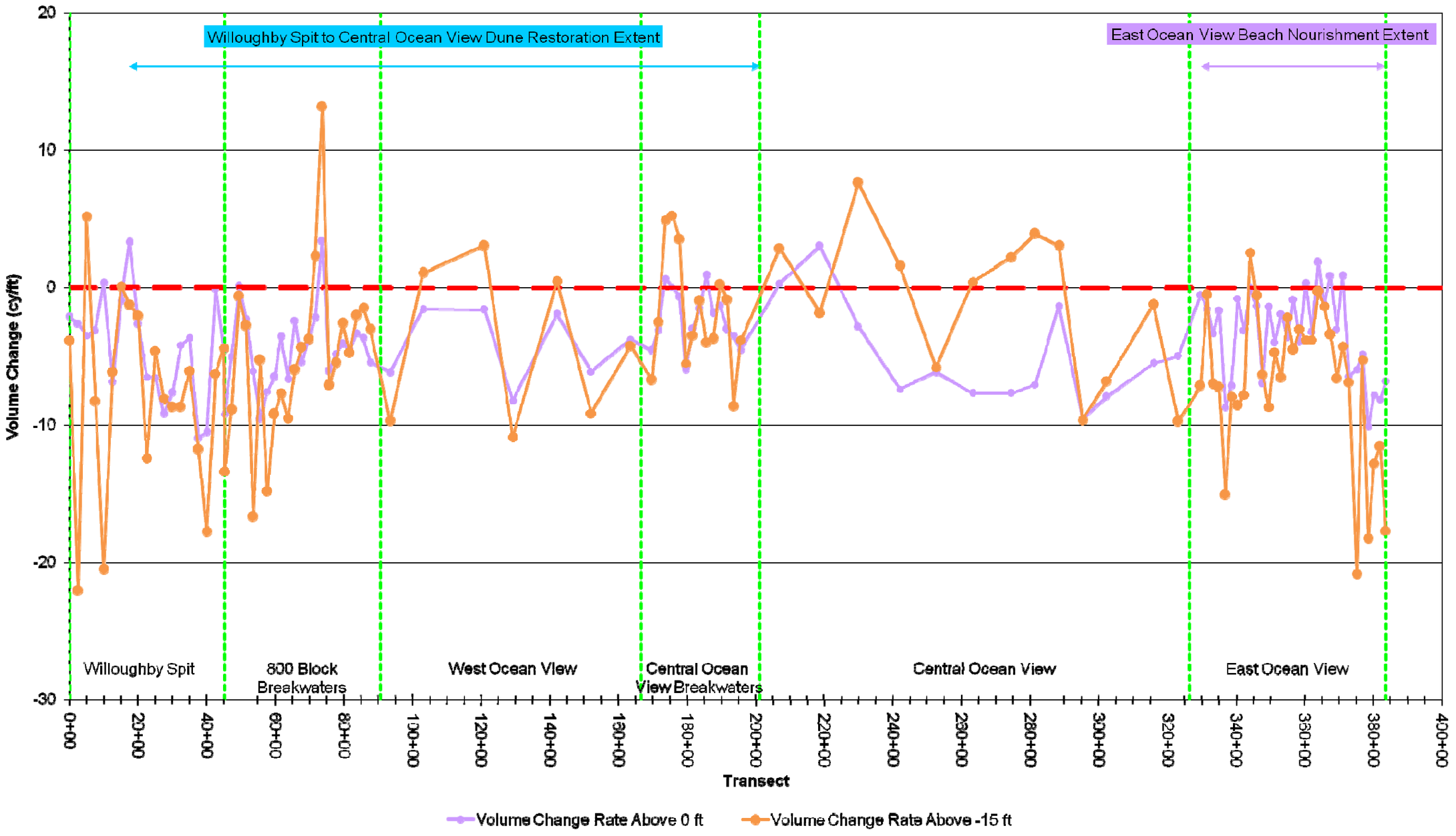


Figure 5. Volume Change Above 0 ft NAVD88 (cy/ft) and -15 ft NAVD88 for October 2009 to March 2010
(Note: Positive=Volume Gain, Negative=Volume Loss)

4.4. 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 March 2010, was compared to the post-fill survey taken in March 2009. **Table 10** presents the shoreline and volume change statistics comparing the two surveys.

Table 10. Overall Shoreline and Volume Change Statistics – East Ocean View Nourishment Project (Post-Fill – March 2010 Comparison)

Region		Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88
East Ocean View (329+63 to 383+58)	Rate per Year	-48.16 ft/yr	-10.61 cy/ft/yr	-55,370 cy/yr
	Total	-49.61 ft	-10.93 cy/ft	-57,038 cy

Results indicate that the East Ocean View shoreline has begun to equilibrate with losses at MHW. Roughly 57,000 cy of material has been lost above 0 ft NAVD88, or approximately 50% 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 half of the total volume loss for this area as shown in **Table 10**. As previously mentioned, the November 2009 nor'easter greatly impacted this region causing accelerated erosion rates. Over the course of the next few surveys, these rates should decrease as profile equilibration is achieved and post-storm recovery occurs. **Figure 6** shows areas of volume gain and volume loss between the post-fill survey and the March 2010 survey. As can be seen 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 March 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 7** 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 portions of the shoreline closest to the original pre-fill position occur at Sta 354+83 and Sta 331+43. Sta 354+83 is immediately east of the newly constructed breakwaters and Sta 331+43 is immediately downdrift of the recently constructed breakwaters and is affected by end effect erosion. It will be important to monitor these portions of shoreline as stabilization from the nourishment and breakwater construction continues.

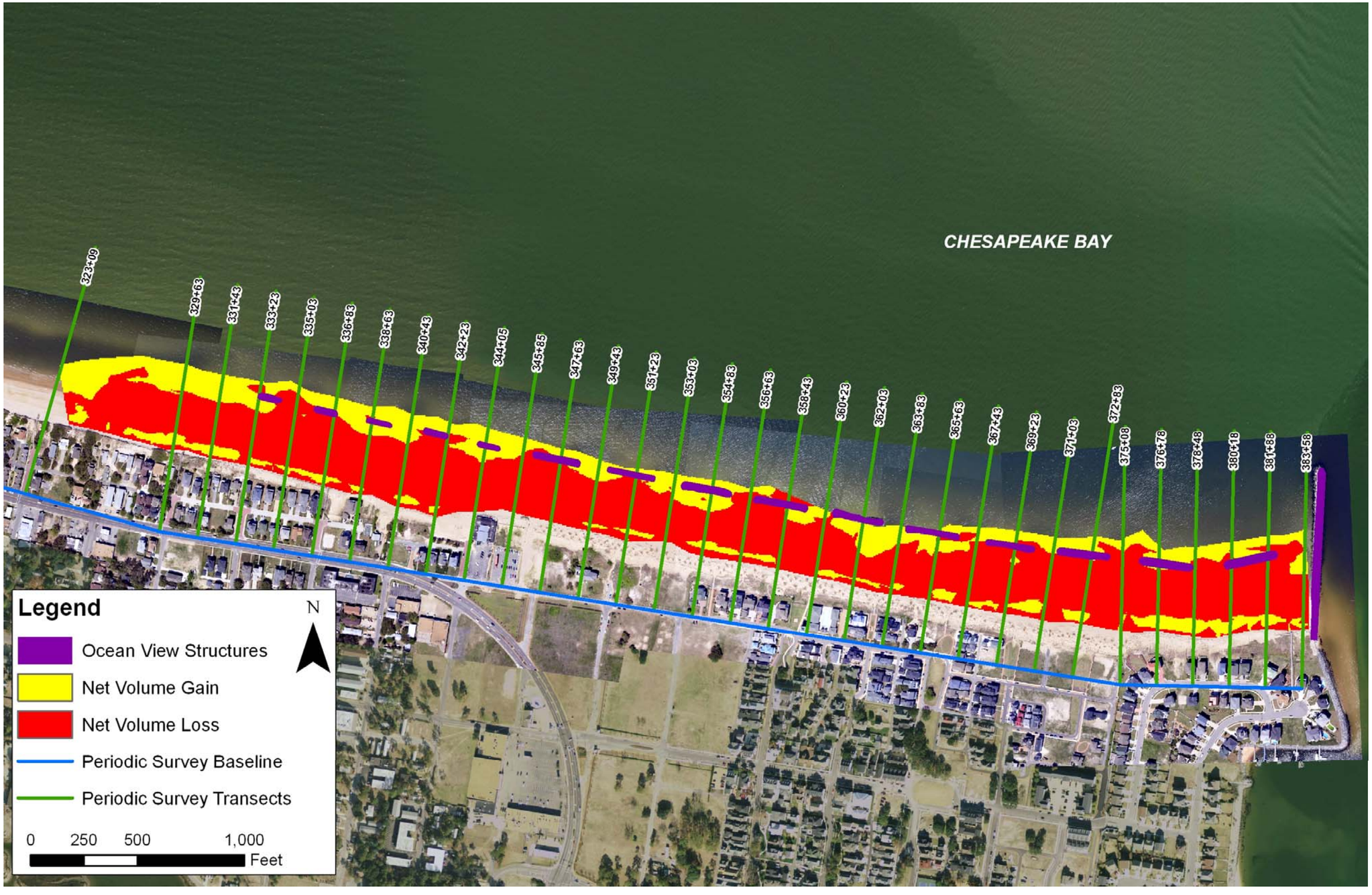


Figure 6. Net Volume Change Since the East Ocean View Nourishment Project (March 2009)

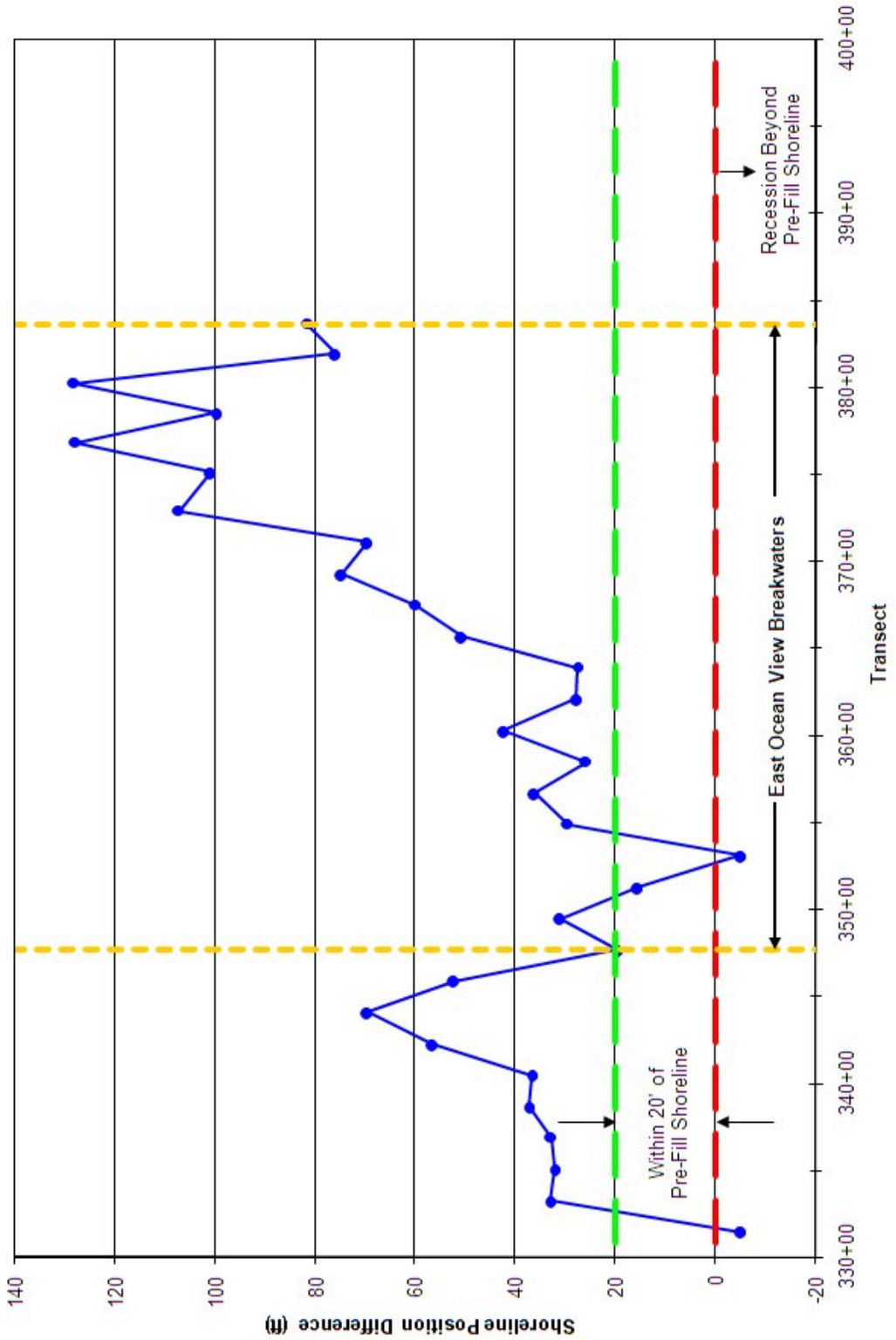


Figure 7. Shoreline Position Difference (ft) at MHW Between Pre-Fill and March 2010 Shorelines for East Ocean View

4.5. Central Ocean View Dune Restoration Project (2005)

The most recent periodic survey, taken in March 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 11** presents the shoreline and volume change statistics comparing the two surveys.

Table 11. Regional and Overall Shoreline and Volume Change Statistics for Central Ocean View Nourishment Project (Post-Fill – March 2010 Comparison)

Region		Average Shoreline Change	Average Volume Change Above 0 ft NAVD88	Cumulative Volume Change Above 0 ft NAVD88
Willoughby Spit	Rate per Year	-4.72 ft/yr	-2.91 cy/ft/yr	-8,871 cy/yr
(0+00 to 45+00)	Total	-23.81 ft	-14.70 cy/ft	-44,770 cy
800 Block Breakwaters	Rate per Year	-7.24 ft/yr	-2.18 cy/ft/yr	-9,453 cy/yr
(45+25 to 87+62)	Total	-36.53 ft	-11.01 cy/ft	-47,707 cy
West Ocean View	Rate per Year	-6.91 ft/yr	-3.23 cy/ft/yr	-25,246 cy/yr
(93+41 to 163+49)	Total	-34.89 ft	-16.28 cy/ft	-127,405 cy
Central Ocean View Breakwaters	Rate per Year	-2.68 ft/yr	-1.13 cy/ft/yr	-4,073 cy/yr
(169+63 to 195+63)	Total	-13.53 ft	-5.72 cy/ft	-20,553 cy
OVERALL		Weighted Avg	Weighted Avg	Total
	Rate per Year	-5.84 ft/yr	-2.53 cy/ft/yr	-47,643 cy/yr
	Total	-29.48 ft	-12.78 cy/ft	-240,436 cy

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 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 240,500 cy of material has been lost above 0 ft NAVD88, or approximately 75% of the 320,700 cy originally placed above 0 ft NAVD88. Approximately half, 120,000 cy, of this material was lost since the Fall 2009 survey as a result of the November 2009 nor'easter. The storm impacts to the dunes and subaerial beach berm in this region were severe. **Figure 8** supports the calculated statistics by showing more losses than gains to the dunes and subaerial beach. 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 March 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 is 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 9** shows the MHW shoreline position difference between the pre-fill and March 2010 shorelines. As can be seen, the March 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. While the City is currently conducting a couple of projects to restore a portion of the dunes in certain areas, targeted nourishment projects should be planned for these areas in the near future.

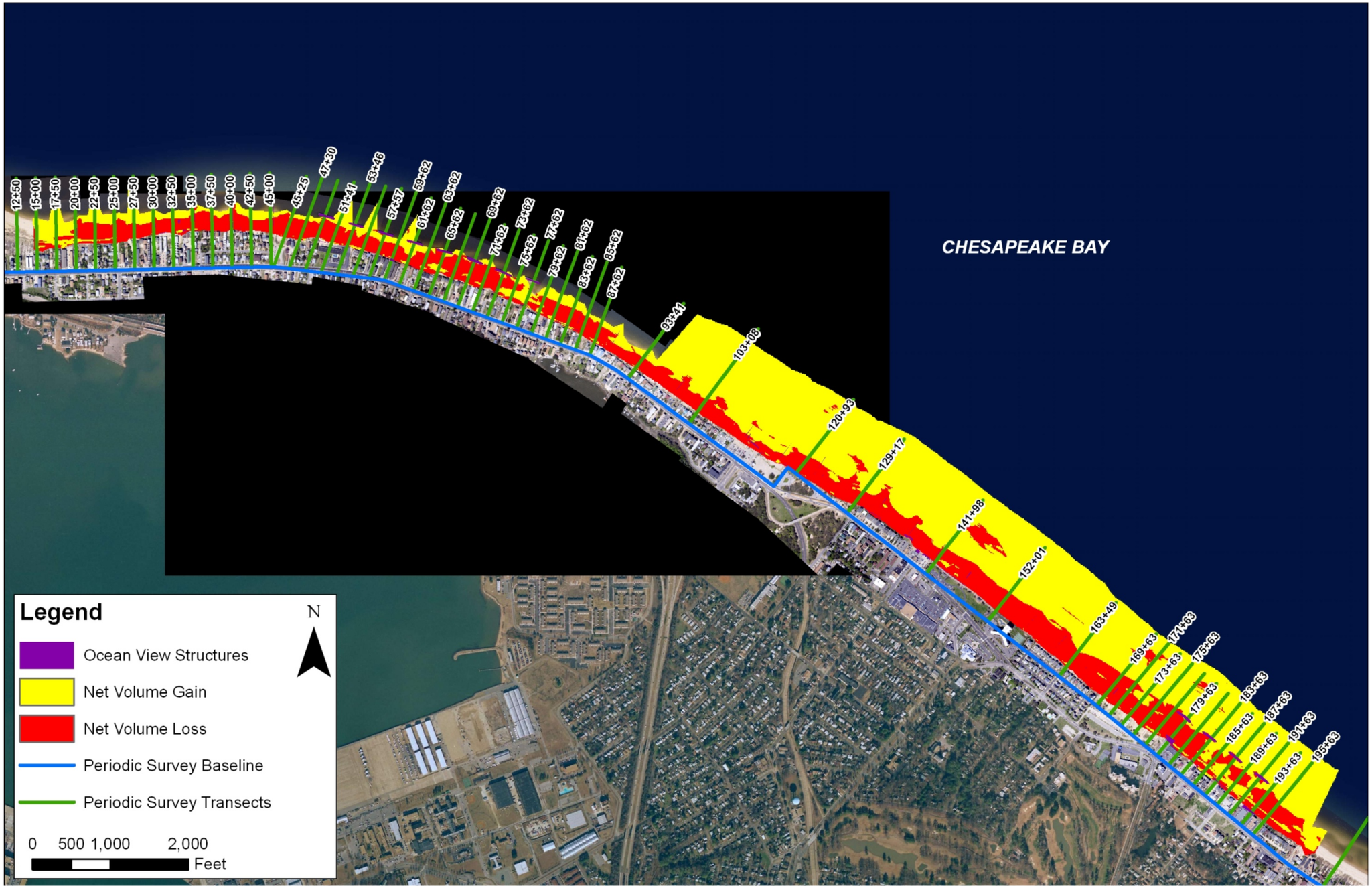


Figure 8. Net Volume Change Since the Willoughby Spit to Central Ocean View Dune Restoration Project (March 2005)

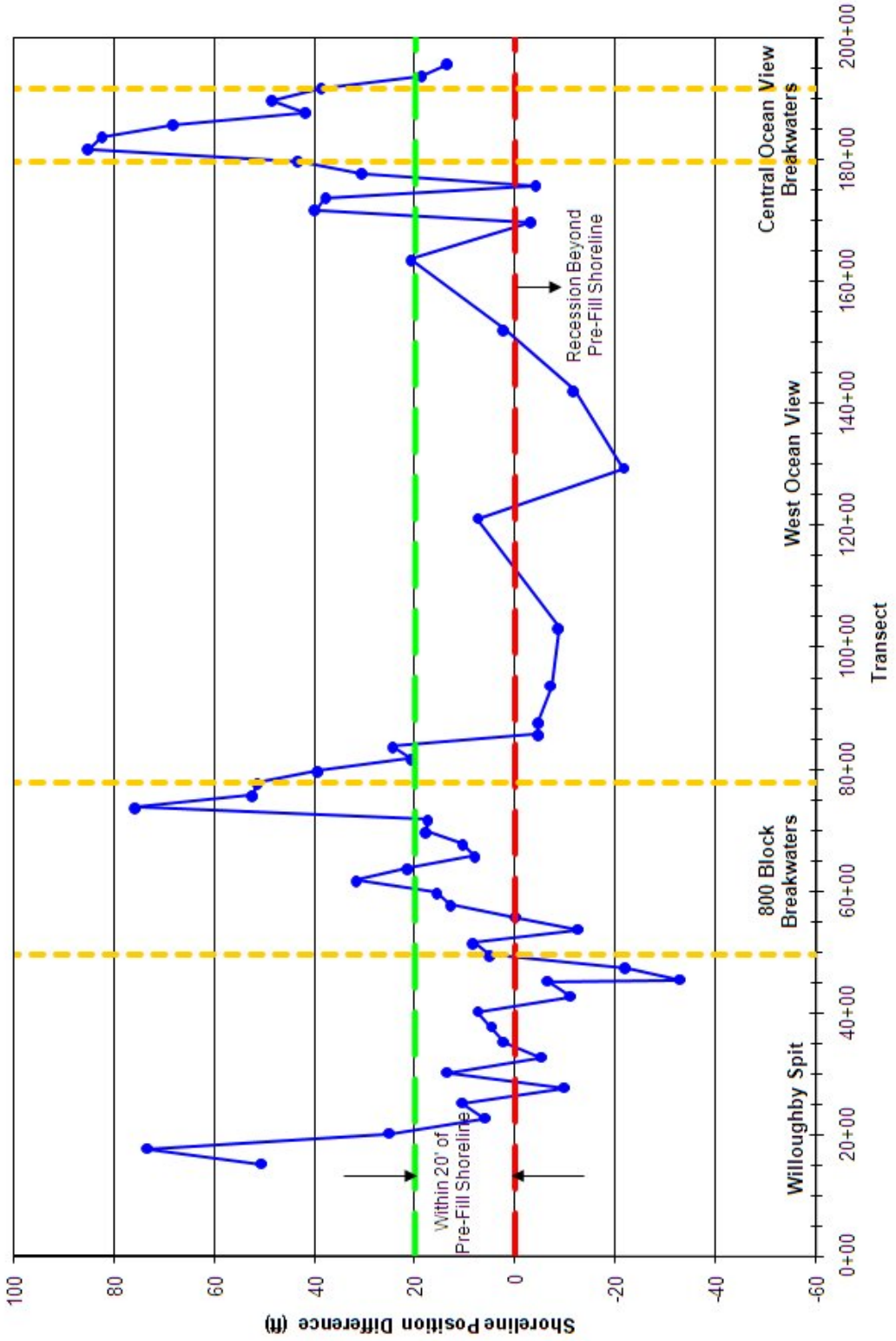


Figure 9. Shoreline Position Difference (ft) at MHW Between Pre-Fill and March 2010 Shorelines for Central Ocean View

5.0 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 March 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 March 2010 survey was compared with both the April 2009 and October 2009 surveys. The surveys were used to compute shoreline change at MHW and volume change above 0 ft NAVD88. In addition, the most recent survey in March 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 April 2009 and March 2010 surveys and the October 2009 and March 2010 surveys.

Comparison	Parameter	Quantity
April 2009 vs. March 2010 Comparison	Average Shoreline Change Rate at MHW (+0.98 ft NAVD88)	-20.83 ft/yr
	Cumulative Volume Change Rate Above 0 ft NAVD88	-205,557 cy/yr
	Cumulative Volume Change Rate Above -15 ft NAVD88	- cy/yr
October 2009 vs. March 2010 Comparison	Average Shoreline Change at MHW (+0.98 ft NAVD88)	-6.03 ft
	Cumulative Volume Change Above 0 ft NAVD88	-156,858 cy
	Cumulative Volume Change Above -15 ft NAVD88	-140,565 cy

The average shoreline change rate for the entire shoreline at MHW between the April 2009 and March 2010 surveys was -20.83 ft/yr. The cumulative volume change above 0 ft NAVD88 was approximately -205,557 cy/yr, between the April 2009 and March 2010 surveys, indicating an overall volumetric loss in the dune and subaerial beach over the past year. 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 the majority of losses over the year occurred in the October 2009 to March 2010 period. Due to the discrepancy in hydrographic survey data between the previous and current surveyors, the offshore portions of the profiles were not examined from April 2009 to March 2010 to determine if the trend of offshore accretion seen in previous reports has continued. While the October 2009 to March 2010 survey shows significant volumetric losses above -15 ft NAVD88, these are less than the losses above 0 ft NAVD88 indicating that some of the sediment lost from the beach and subaerial beach berm from the storm was captured in the nearshore region. 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 is the only region that has shown an increase in MHW in the most recent survey period; although, there was still a volumetric loss of sediment in the system.

800 Block Breakwaters

The 800 block region has shown a decrease in MHW position and volume losses above 0 ft NAVD88. There is accretion at the eastern portion of this region due to the presence of the tombolos that have formed behind the two easternmost breakwaters. These tombolos have interrupted littoral drift and resulted in erosion of the immediately adjacent area to the west. The region seems to recover towards the middle of the breakwater field with worsening erosion at the western end of the breakwater field. This region should benefit from the reworking of the existing beach.

West Ocean View

The West Ocean View region still remains fairly stable with some slight erosion, especially in the eastern portion of the region. This could be the result of the end effect of the Central Ocean View breakwaters.

Central Ocean View Breakwaters

The Central Ocean View Breakwaters region appears to be fairly stable with some highly localized erosion/accretion patterns based on breakwater location. Like the eastern portion of the West Ocean View region, the western portion of this region is possibly seeing a slight end effect from the breakwater field. Focused nourishments may be required here in the future.

Central Ocean View

Central Ocean View has experienced shoreline erosion at MHW over the past year with significant losses above 0 ft NAVD88 mainly attributable to the November 2009 nor'easter. While in the past this has been a very stable region, the Central Ocean View region is unprotected and therefore more vulnerable to erosion. Erosive action appears to have occurred more on the western side of this section from April 2009 to March 2010; however, changes in the MHW shoreline were slight between the October 2009 and March 2010 survey. This may be attributed to the nourishment project in the East Ocean View section to the west of Central Ocean View that was undergoing equilibrium changes and providing an influx of sediment to the Central Ocean View region from spreading losses over the last year.

East Ocean View

The East Ocean View area shows a volumetric loss 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
East Ocean View Nourishment vs.March 2010 Comparison	-49.61 ft	-10.93 cy/ft	-57,038 cy
Central Ocean View Nourishment vs. March 2010 Comparison	-29.48 ft	-12.78 cy/ft	-240,436 cy

Approximately 57,000 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 50% of the original amount of fill placed above the 0 ft contour. The Willoughby Spit to Central Ocean View region has lost approximately 240,500 cy of material from the dune system and/or subaerial beach since the project completion in March 2005, roughly half of which was lost as a result of the November 2009 nor'easter. This is approximately 75% of the total material placed above 0 ft NAVD88 during the dune restoration and a large loss of storm protection.

As another measure of the protection being supplied by the East Ocean View and Central Ocean View nourishment projects, the pre-fill and March 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 and west 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. Since the project is nearing the end of the anticipated design life, and has been impacted by storm activity, targeted nourishment should be planned for these areas in the near future. The City is constructing a dune restoration project at the time of this report which will place approximately 37,000 cy from approximately 13th View Street to 8th View Street to provide some storm protection to the areas most critically eroded by the November 2009 nor'easter. While this project will increase the storm protection in this area, additional nourishment, in this area and others, may still be necessary to provide sufficient storm protection.

This is the tenth periodic survey report completed to date, and ninth 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. April 2009 to March 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 survey, 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

Legend

- Digitized Shoreline (April 11, 2010)
- Survey Transects
- Survey Baseline

Shoreline Aerial Photo Date: April 2010

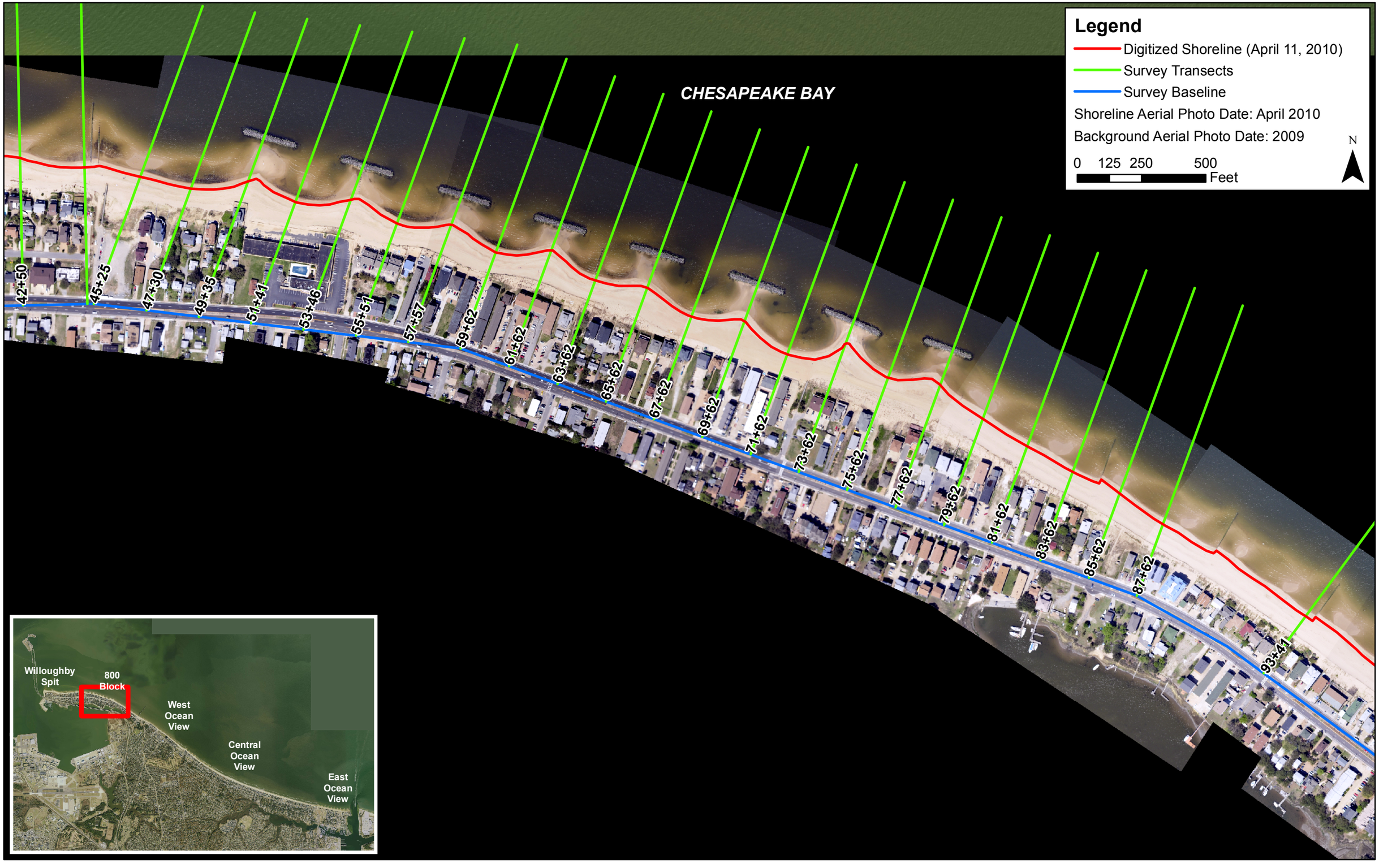
Background Aerial Photo Date: 2009

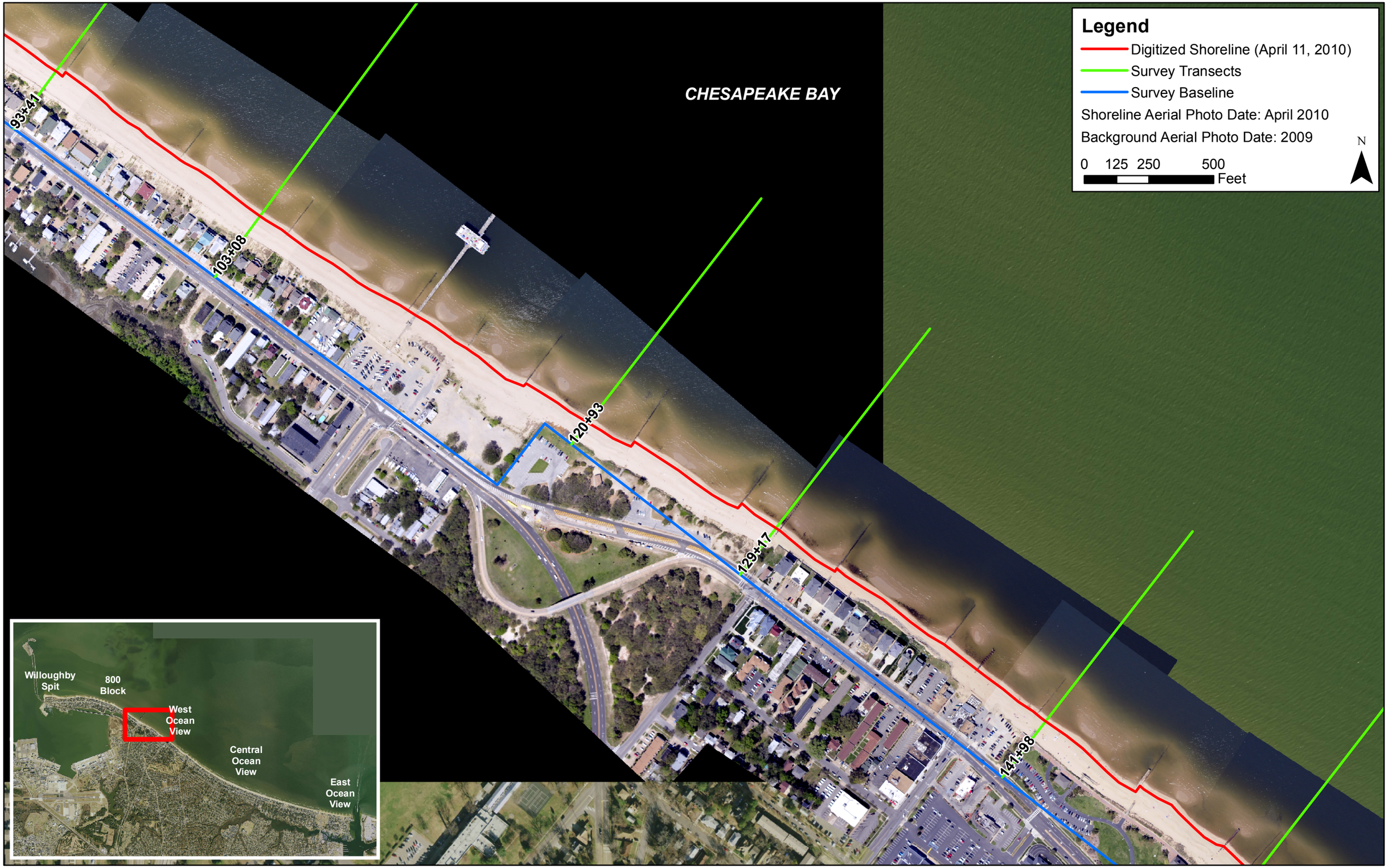
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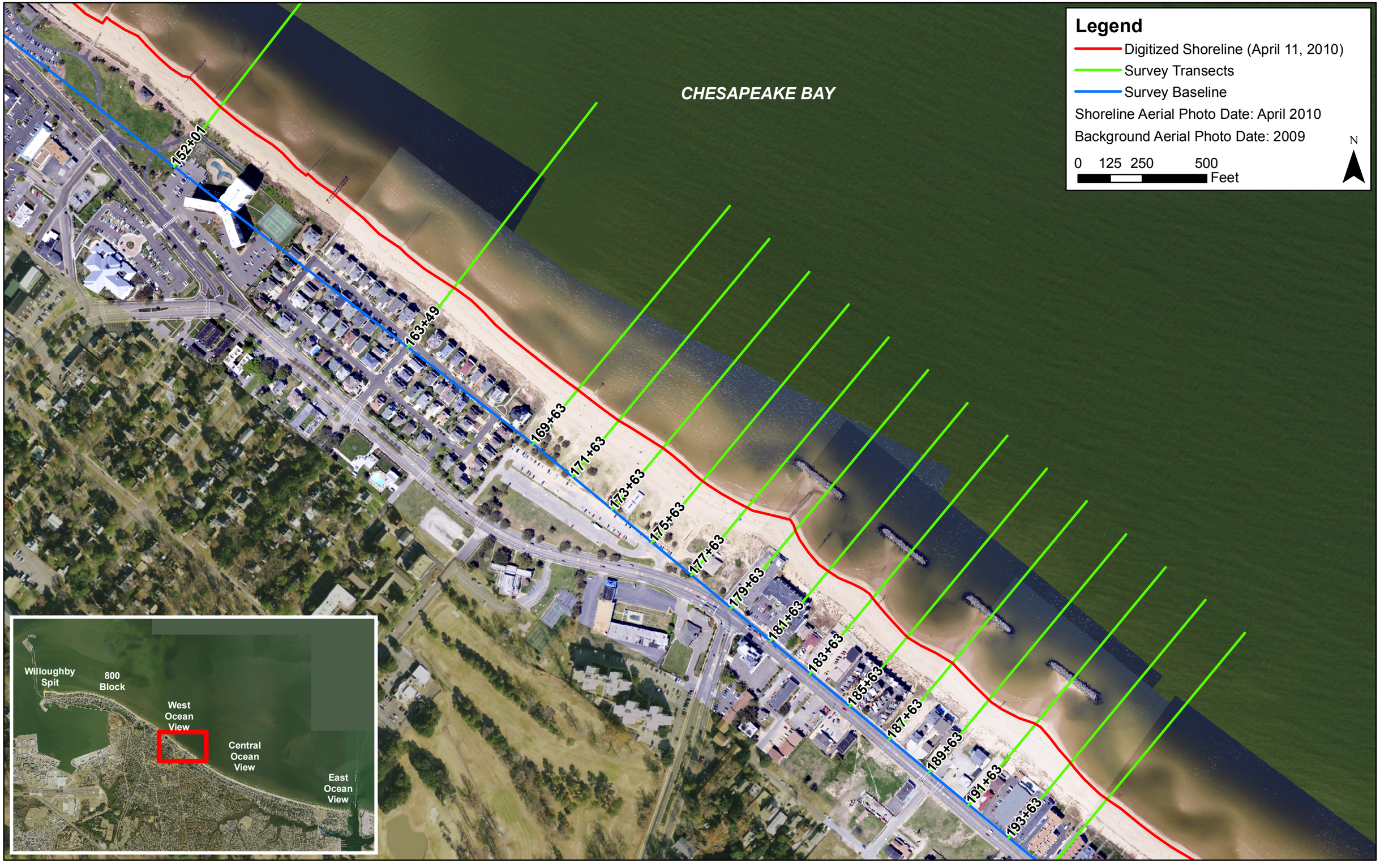
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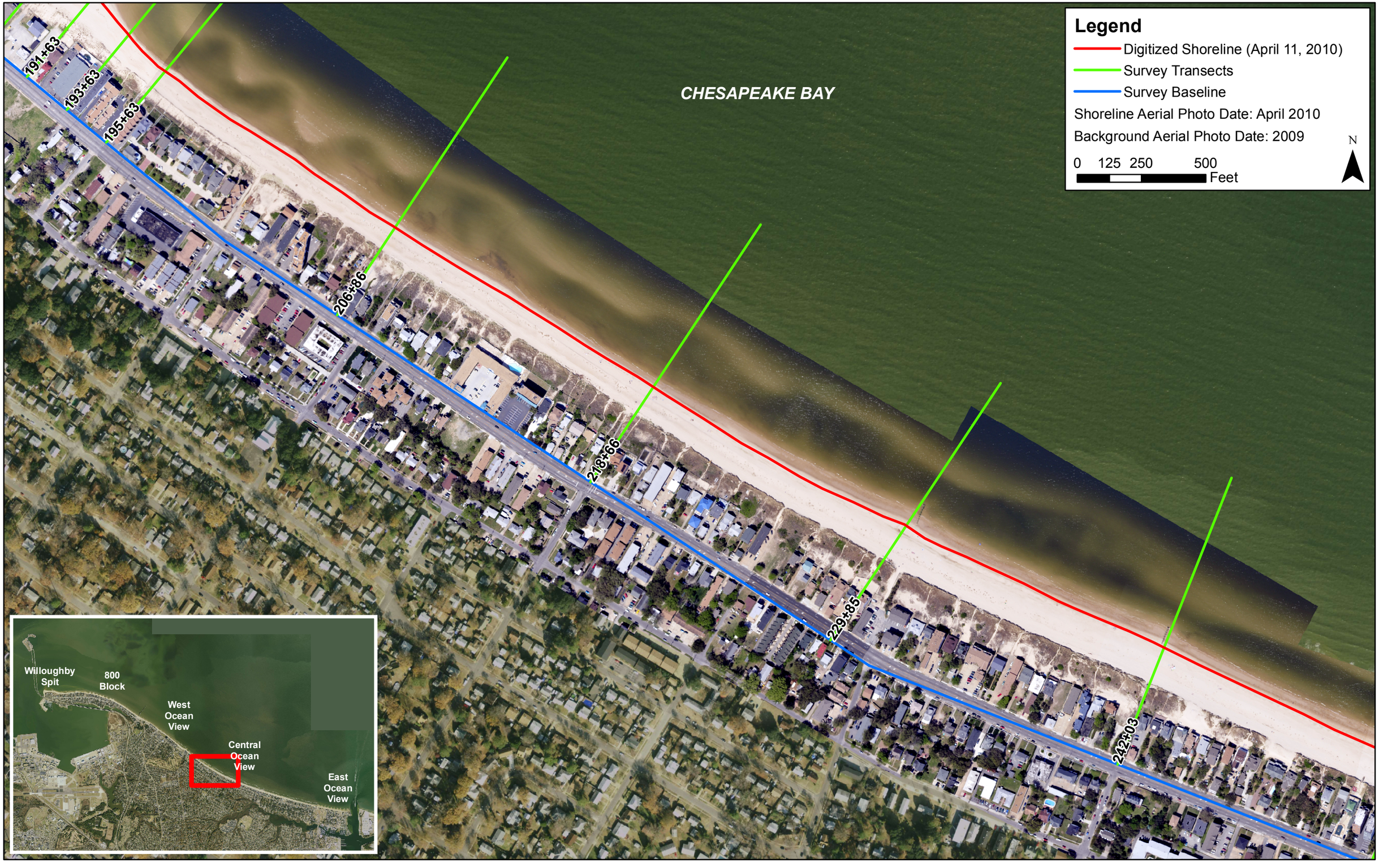
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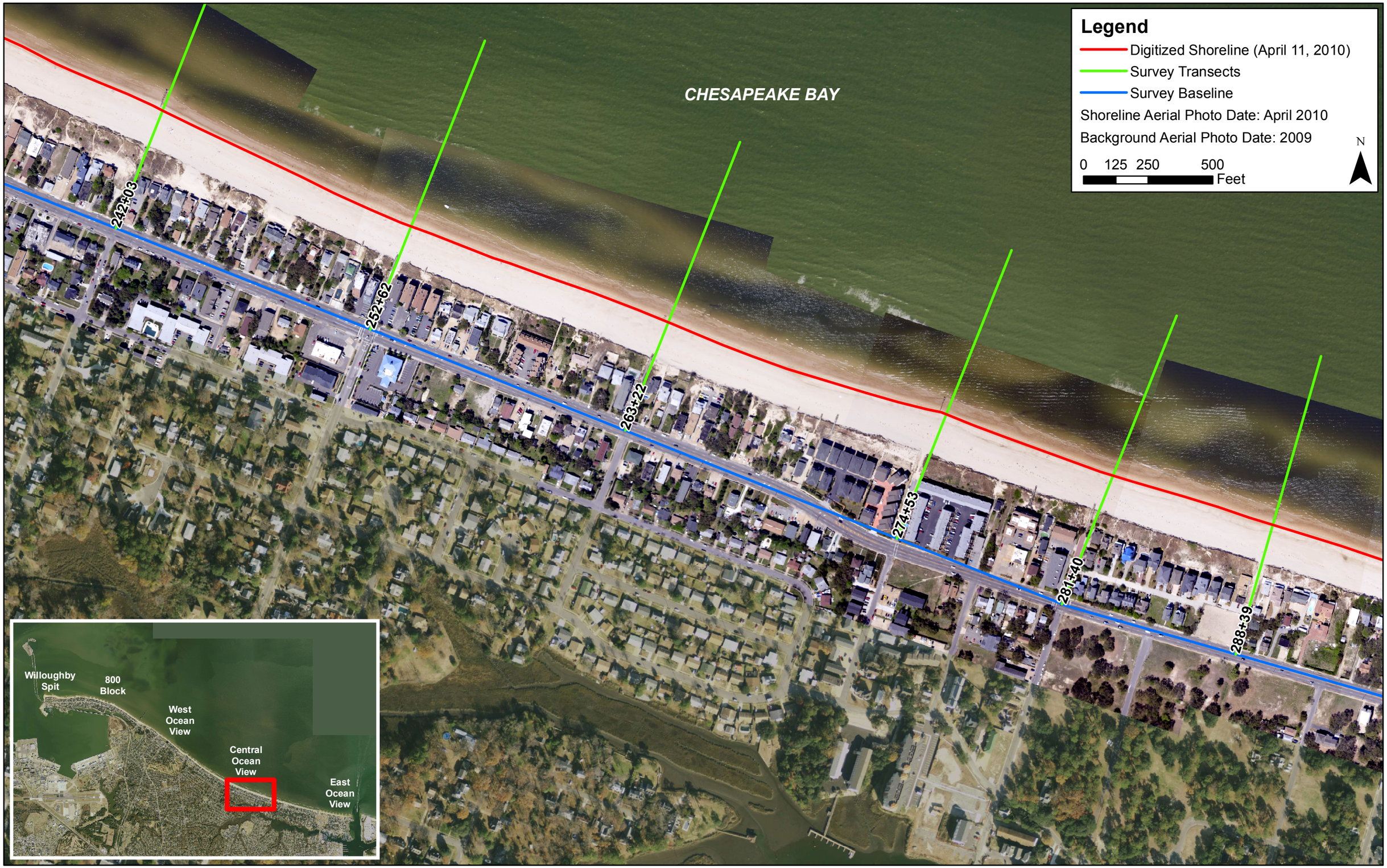


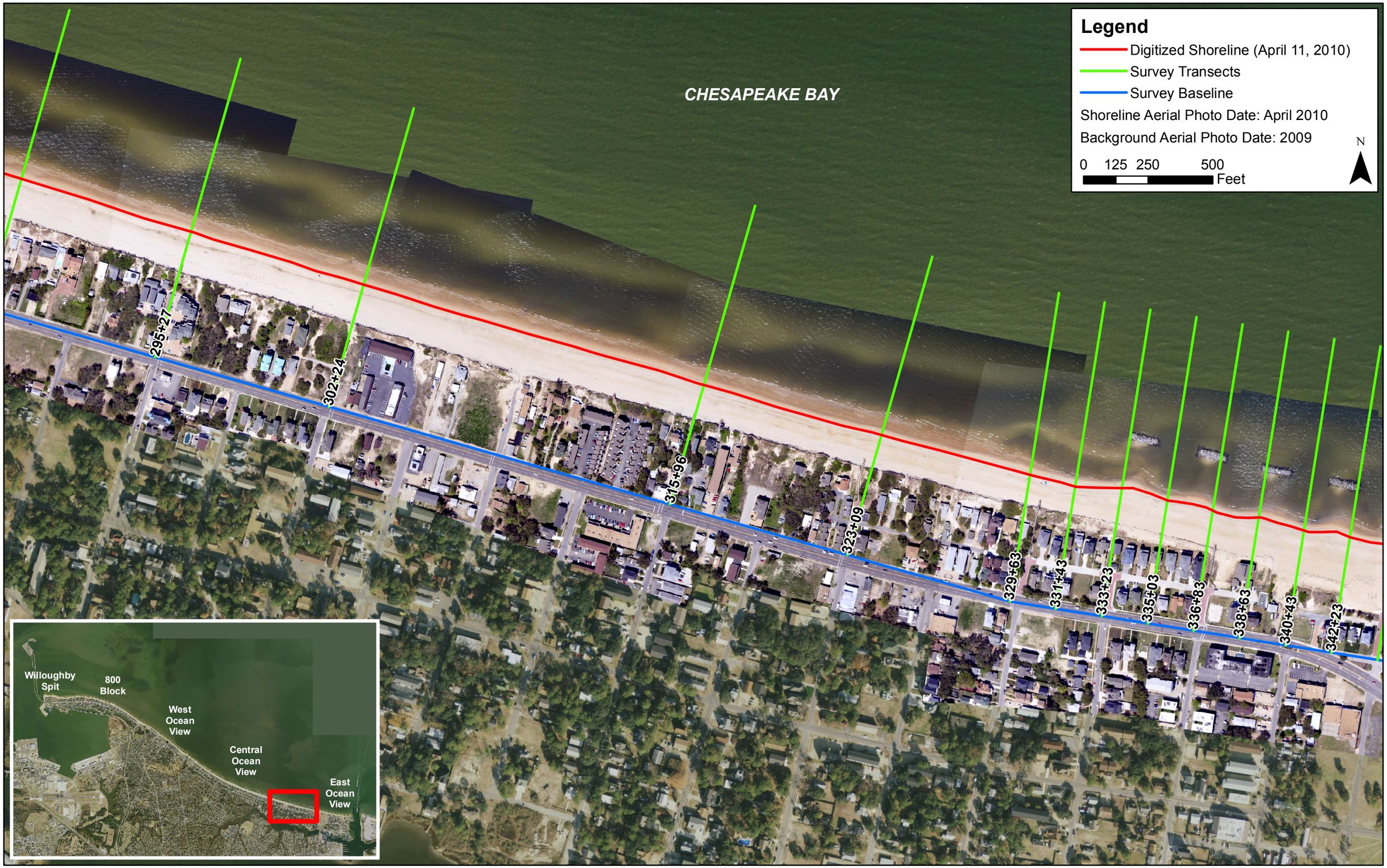

CHESAPEAKE BAY
Legend
Digitized Shoreline (April 11, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2010
Background Aerial Photo Date: 2009
0 125 250 500
Feet
N
42+50
45+25
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51+41
53+46
55+51
57+57
59+62
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63+62
65+62
67+62
69+62
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73+62
75+62
77+62
79+62
81+62
83+62
85+62
87+62
93+41
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
93+41
103+08
120+93
129+17
141+98
Legend
Digitized Shoreline (April 11, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2010
Background Aerial Photo Date: 2009
N
0 125 250 500
Feet
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
Legend
Digitized Shoreline (April 11, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2010
Background Aerial Photo Date: 2009
N
0 125 250 500
Feet
152+01
163+49
169+63
171+63
173+63
175+63
177+63
179+63
181+63
183+63
185+63
187+63
189+63
191+63
193+63
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
191+63
193+63
195+63
206+86
218+66
229+85
242+03
Legend
Digitized Shoreline (April 11, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2010
Background Aerial Photo Date: 2009
N
0 125 250 500
Feet
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
Legend
Digitized Shoreline (April 11, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2010
Background Aerial Photo Date: 2009
N
0 125 250 500
Feet
242+03
252+62
263+22
274+53
281+40
288+39
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View


CHESAPEAKE BAY
Legend
Digitized Shoreline (April 11, 2010)
Survey Transects
Survey Baseline
Shoreline Aerial Photo Date: April 2010
Background Aerial Photo Date: 2009
N
0 125 250 500
Feet
295+27
302+24
315+96
323+09
329+63
331+43
333+23
335+03
336+83
338+63
340+43
342+23
Willoughby Spit
800 Block
West Ocean View
Central Ocean View
East Ocean View

CHESAPEAKE BAY

Legend

- Digitized Shoreline (April 11, 2010)
- Survey Transects
- Survey Baseline

Shoreline Aerial Photo Date: April 2010

Background Aerial Photo Date: 2009

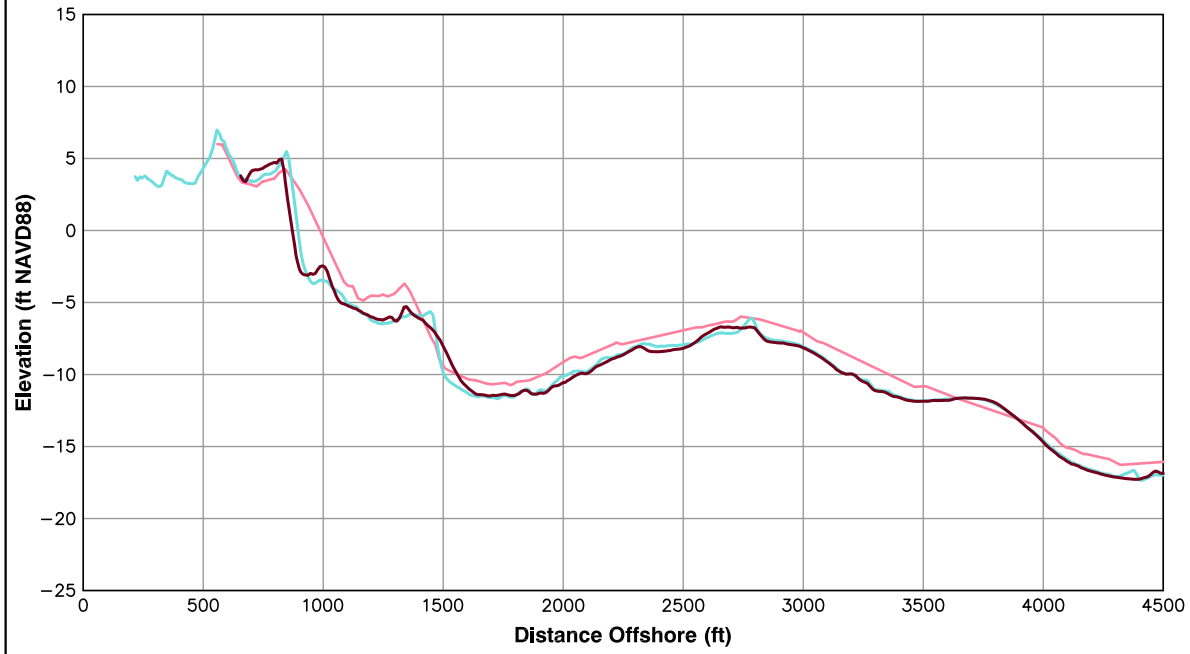
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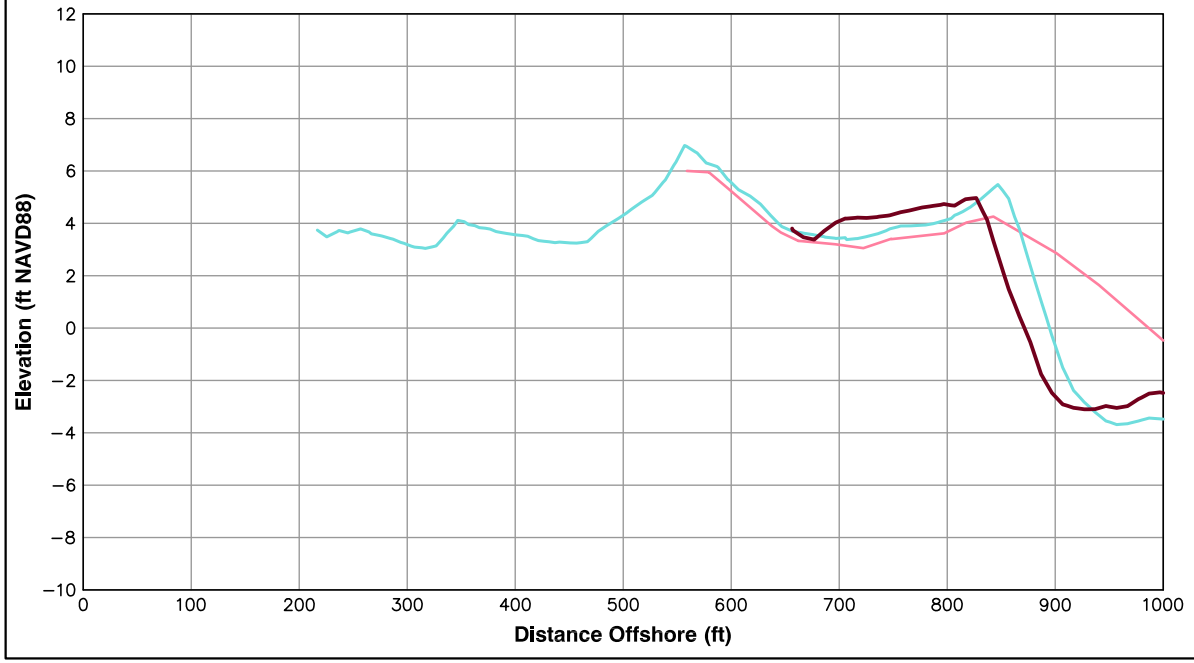
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340+43
342+23
344+05
345+85
347+63
349+43
351+23
353+03
354+83
356+63
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360+23
362+03
363+83
365+63
367+43
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375+08
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380+18
381+88
383+58



Appendix B: Survey Comparison Plots

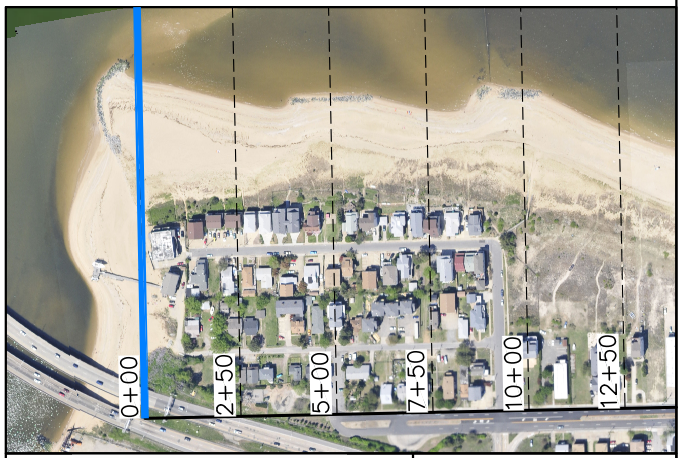




Survey Transect 0+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-106.28 ft/yr	-25.53 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.85 cy/ft
Volume Change Above 0 ft NAVD88	-5.81 cy/ft/yr	-2.15 cy/ft

LEGEND:
- 2010 MAR
- 2009 OCT
- 2009 APR

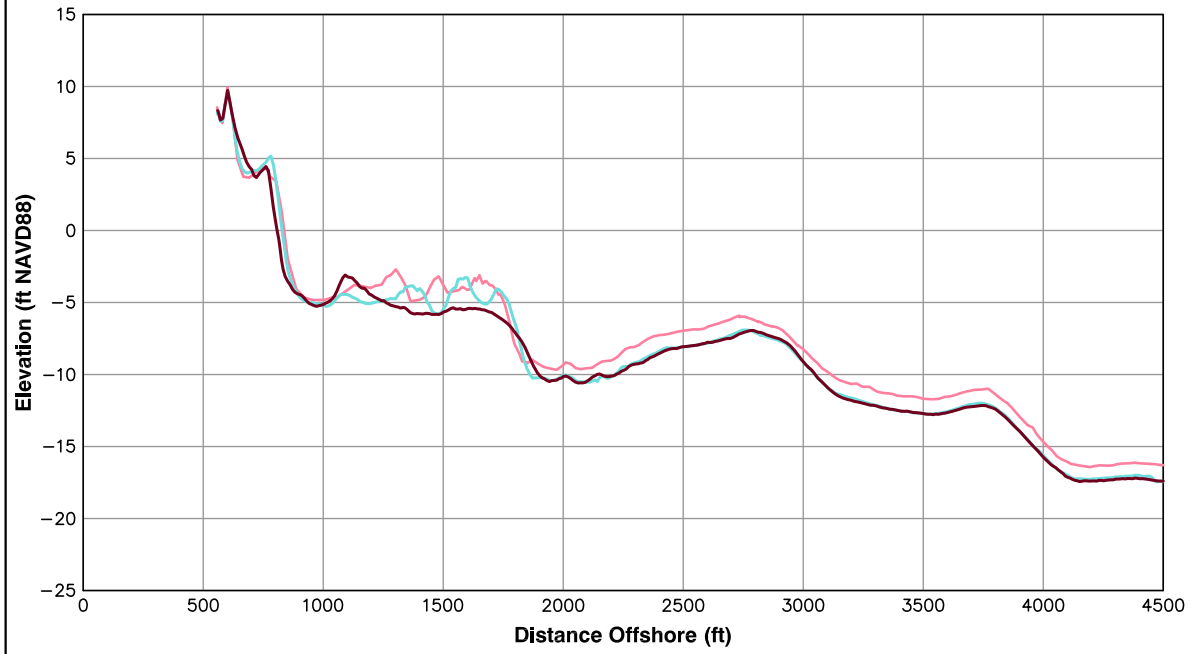
Notes:
1. Stationing From West To East At Varying Intervals.
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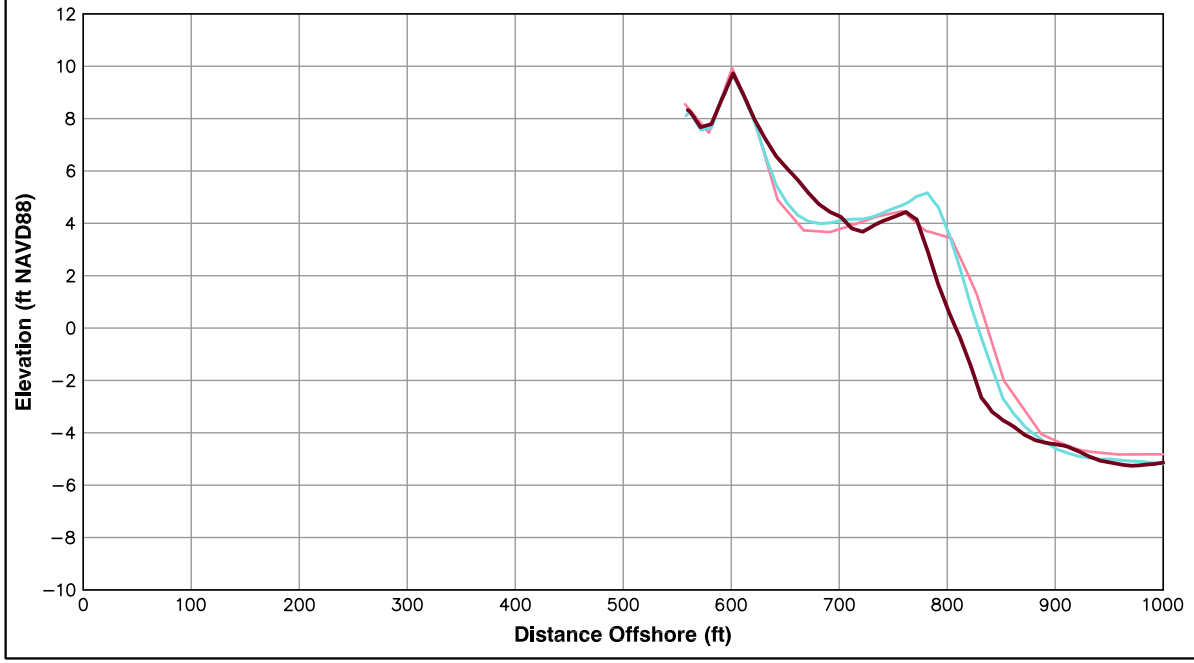


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 0+00	Pg 1 of 106	SPRING 2010

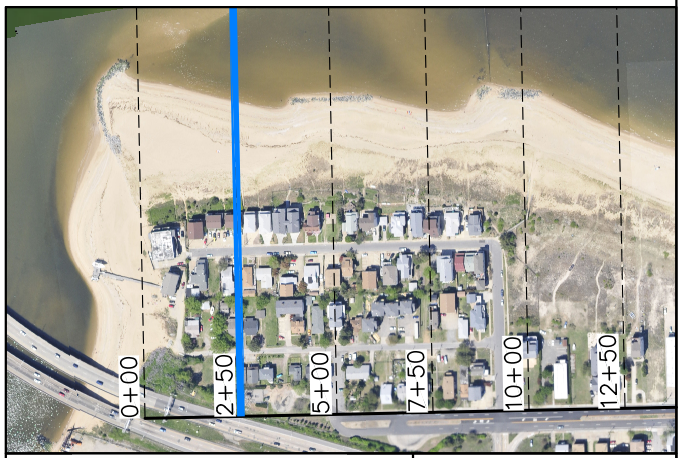




Survey Transect 2+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-34.54 ft/yr	-22.86 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-22.05 cy/ft
Volume Change Above 0 ft NAVD88	-1.15 cy/ft/yr	-2.64 cy/ft

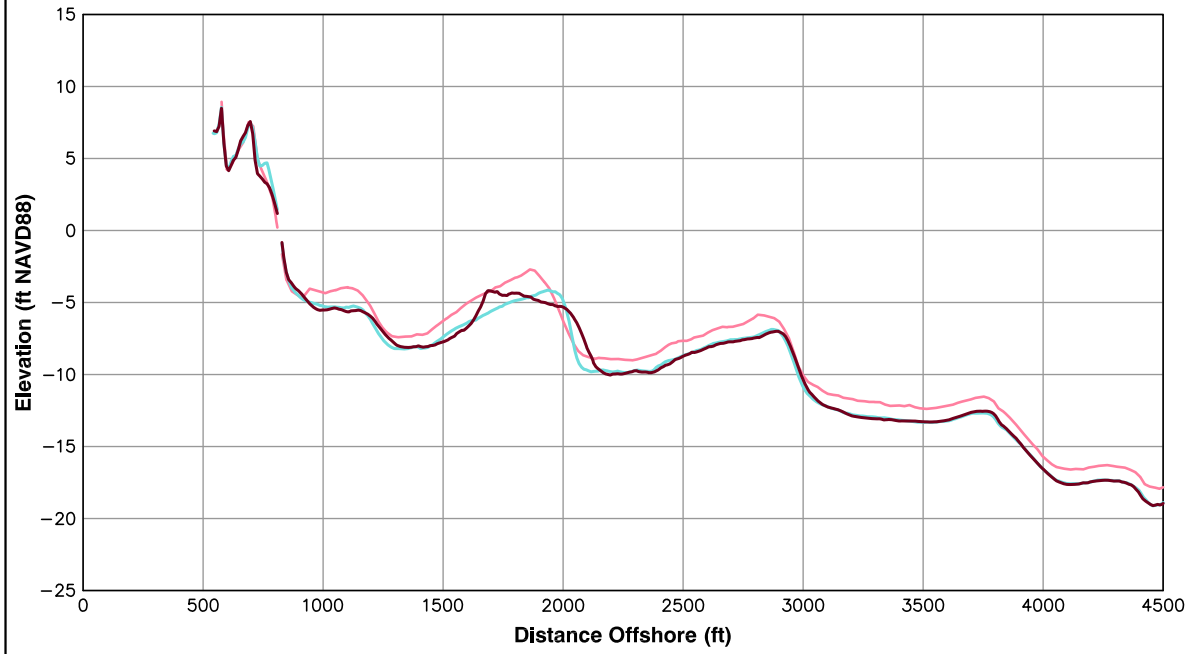
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- 2009 OCT
- 2009 APR

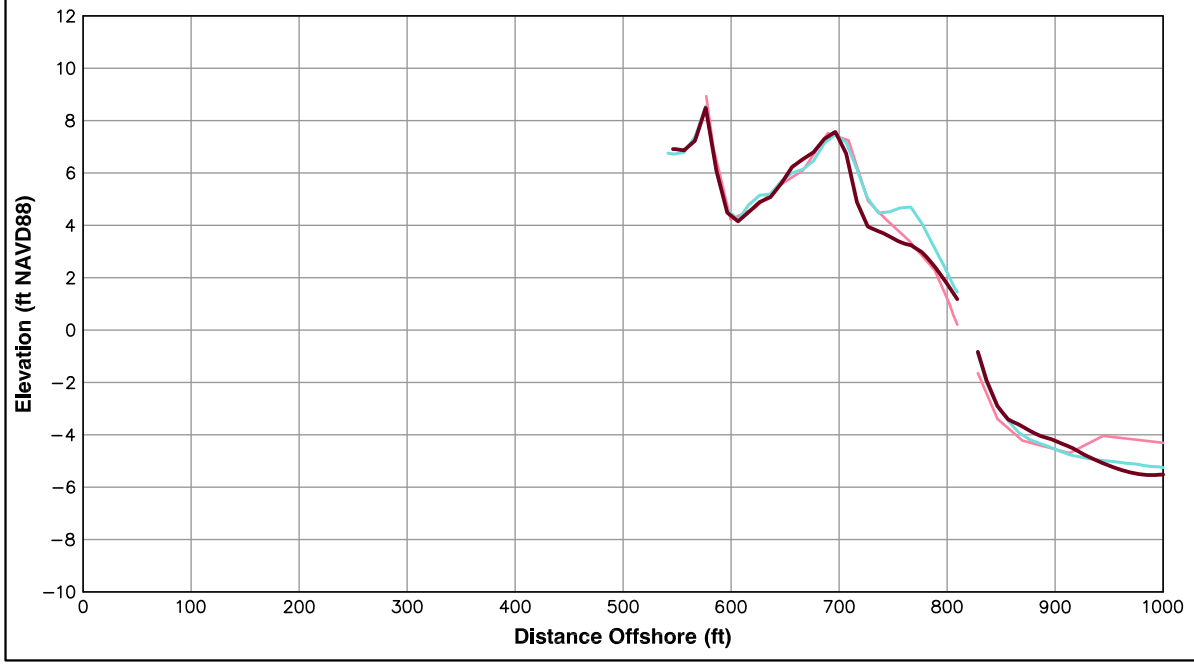
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

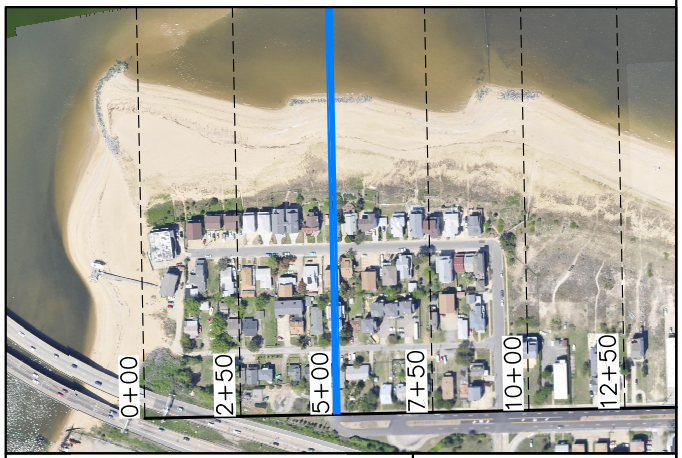




Survey Transect 5+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	11.63 ft/yr	1.00 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	5.16 cy/ft
Volume Change Above 0 ft NAVD88	-1.34 cy/ft/yr	-3.47 cy/ft

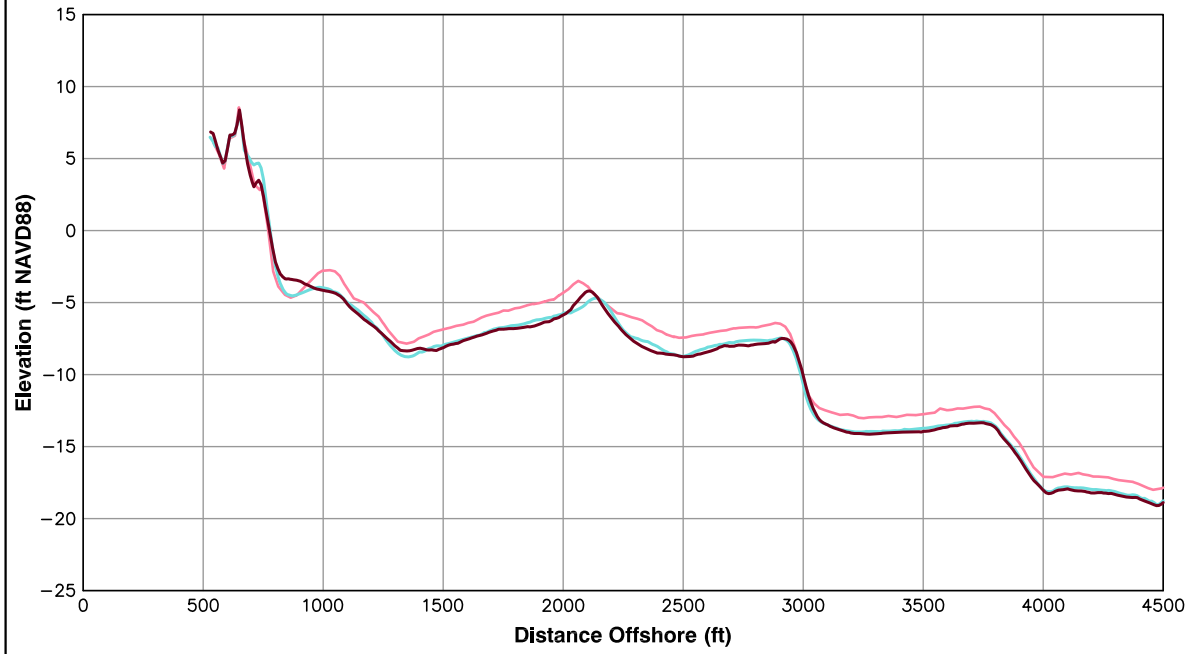
LEGEND:
- 2010 MAR
- 2009 OCT
- 2009 APR

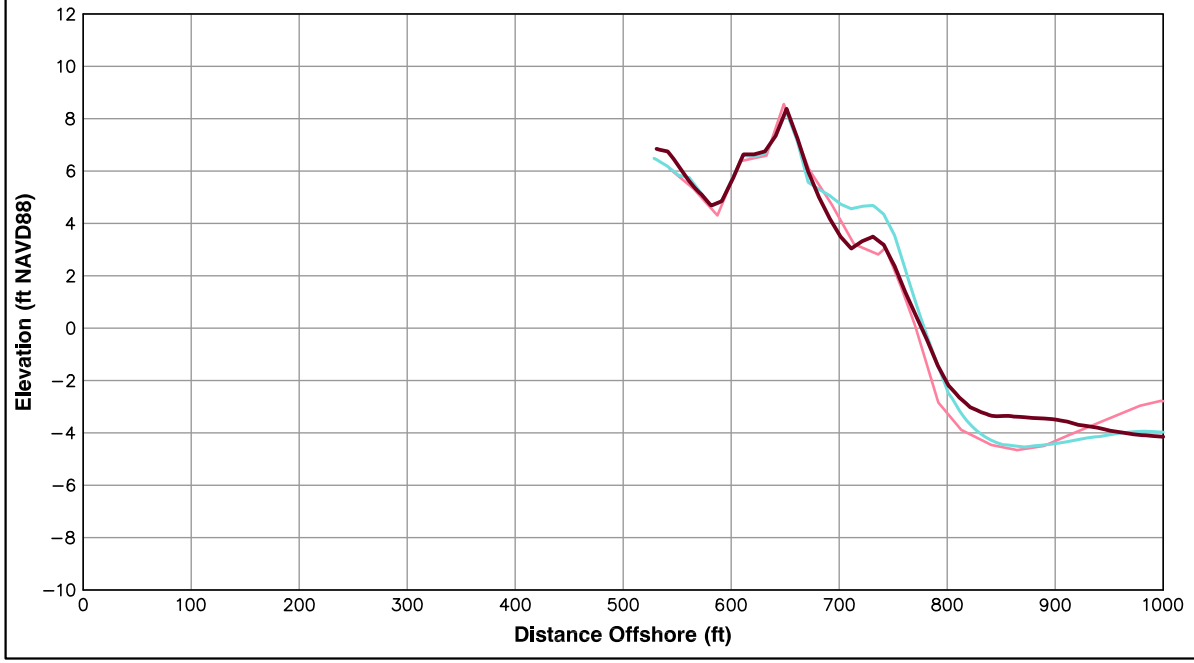
Notes:
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City of Norfolk

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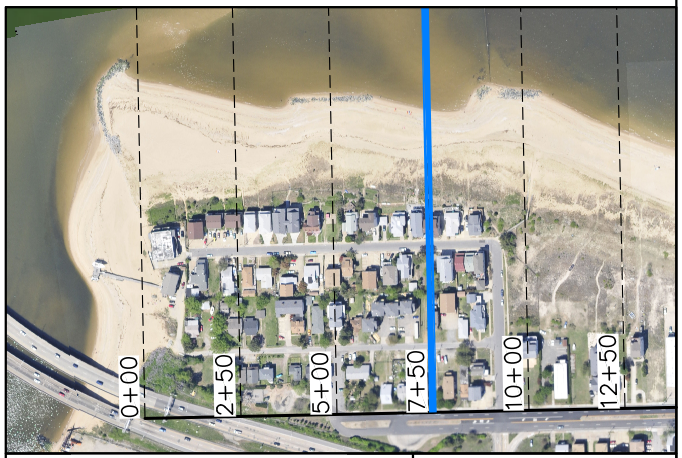




Survey Transect 7+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	3.28 ft/yr	-5.33 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-8.25 cy/ft
Volume Change Above 0 ft NAVD88	0.37 cy/ft/yr	-3.10 cy/ft

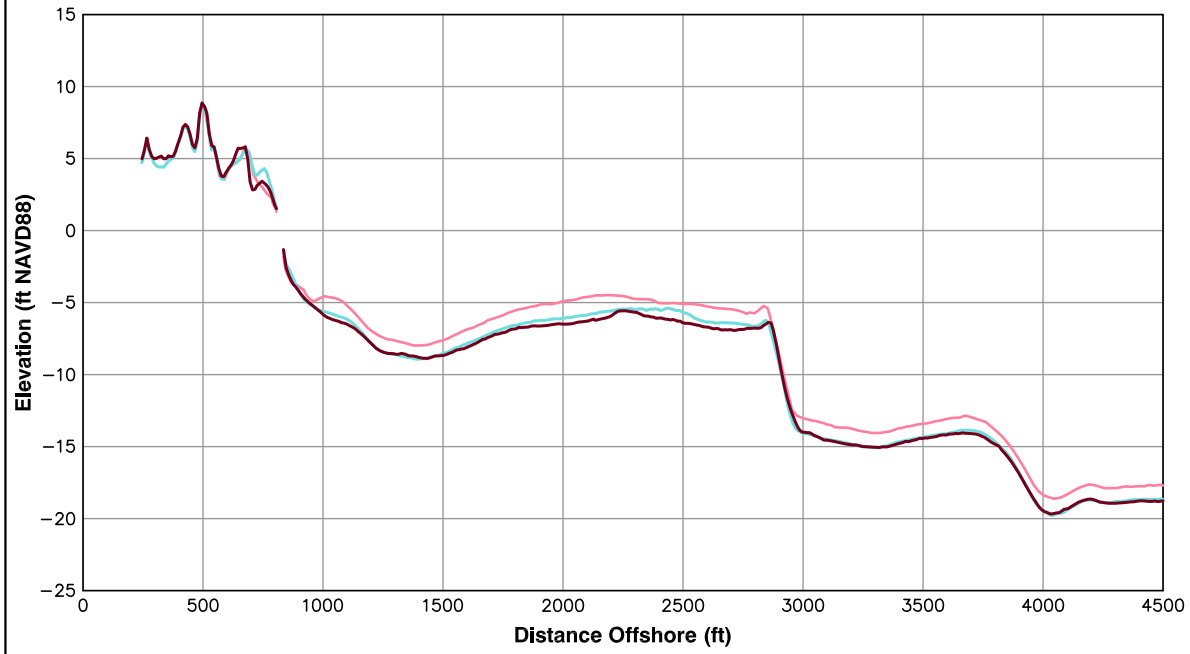
LEGEND:
- 2010 MAR
- 2009 OCT
- 2009 APR

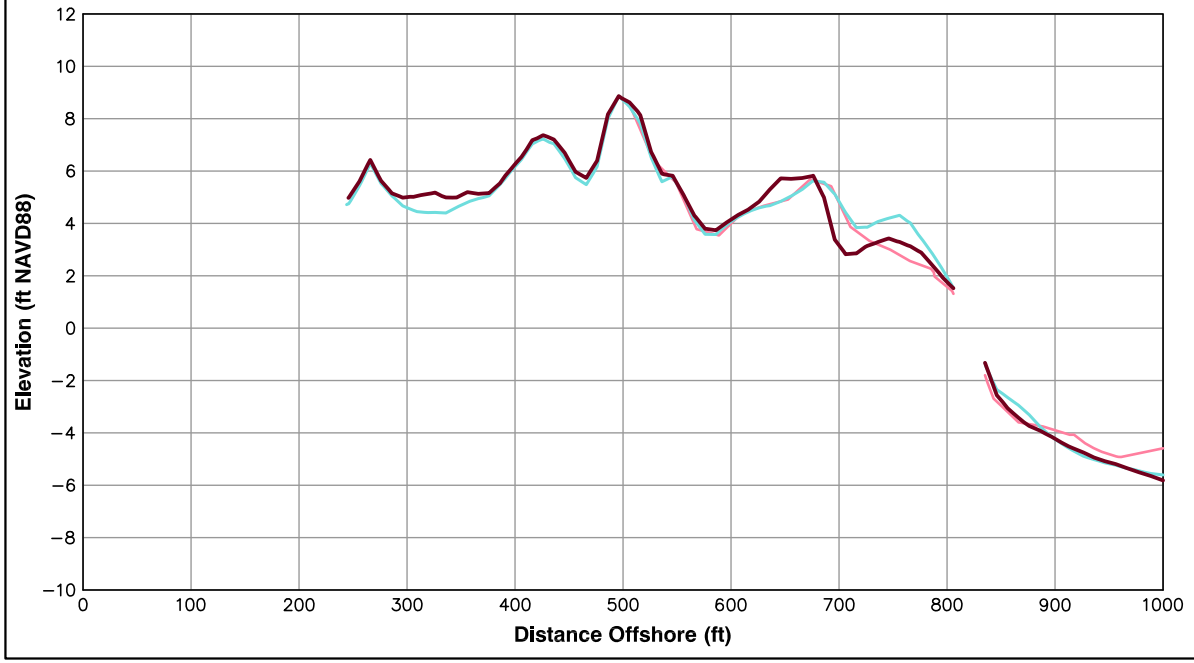
Notes:
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3. All Survey Elevations In Feet Referenced to NAVD88.
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City of Norfolk

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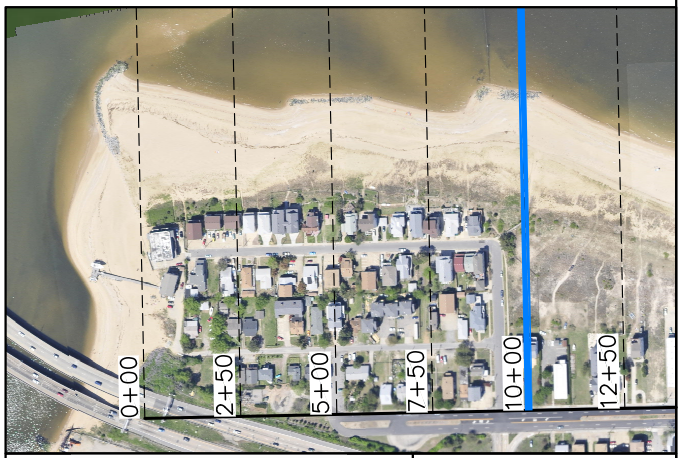




Survey Transect 10+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-3.76 ft/yr	-1.76 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-20.54 cy/ft
Volume Change Above 0 ft NAVD88	0.99 cy/ft/yr	0.31 cy/ft

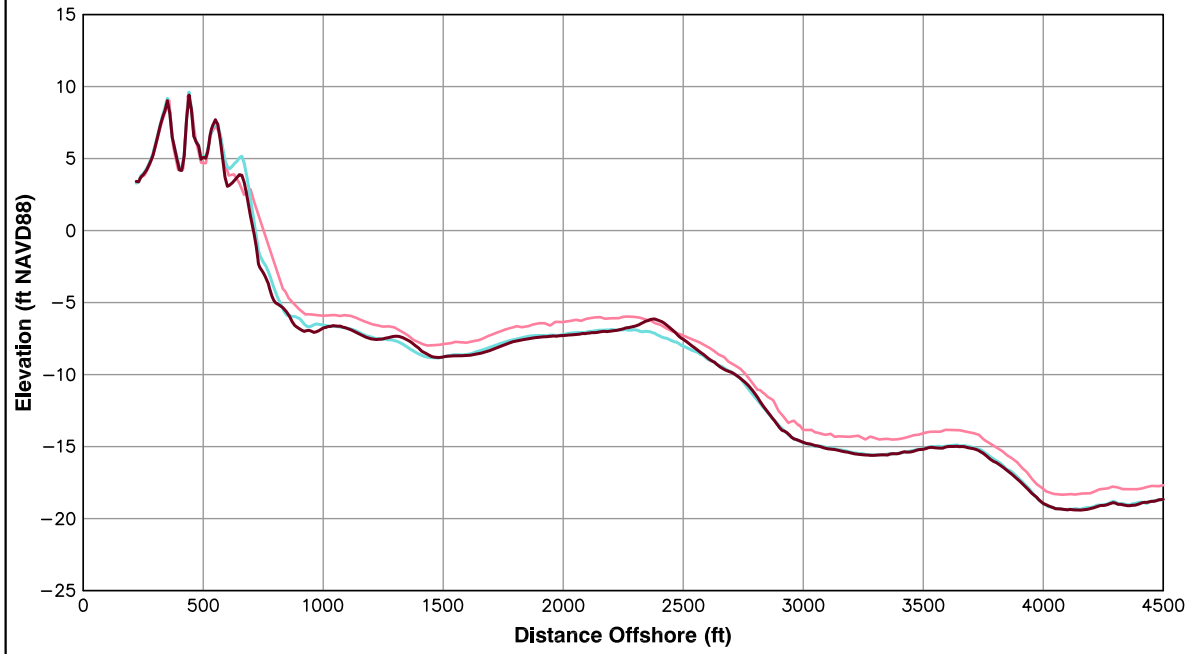
LEGEND:
- 2010 MAR
- 2009 OCT
- 2009 APR

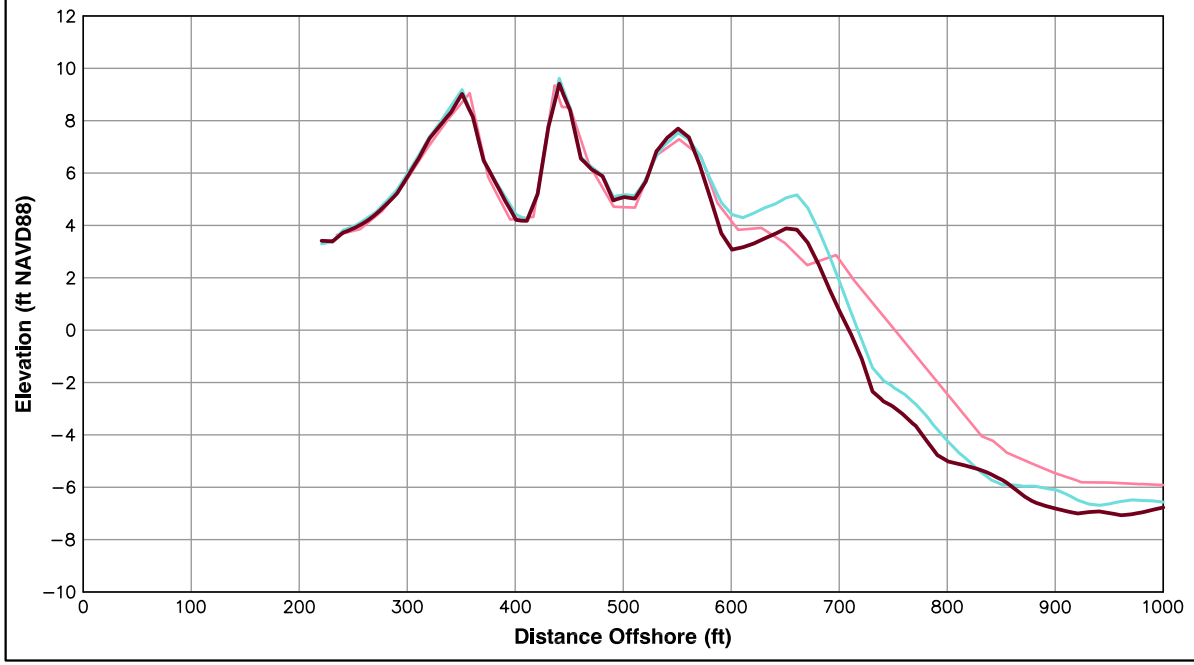
Notes:
1. Stationing From West To East At Varying Intervals.
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

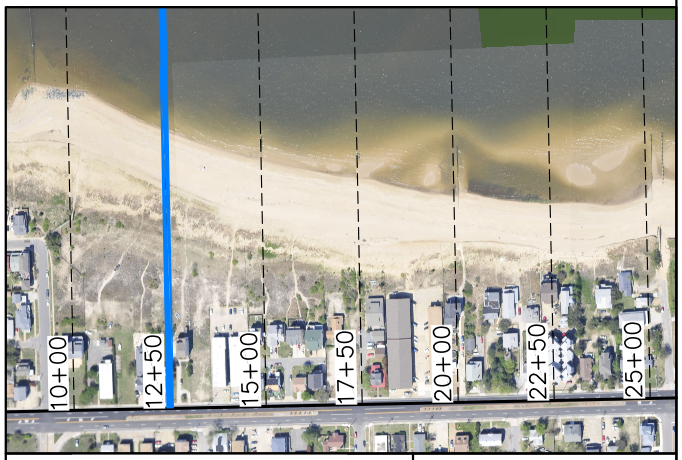




Survey Transect 12+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-37.87 ft/yr	-10.75 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.12 cy/ft
Volume Change Above 0 ft NAVD88	-2.84 cy/ft/yr	-6.89 cy/ft

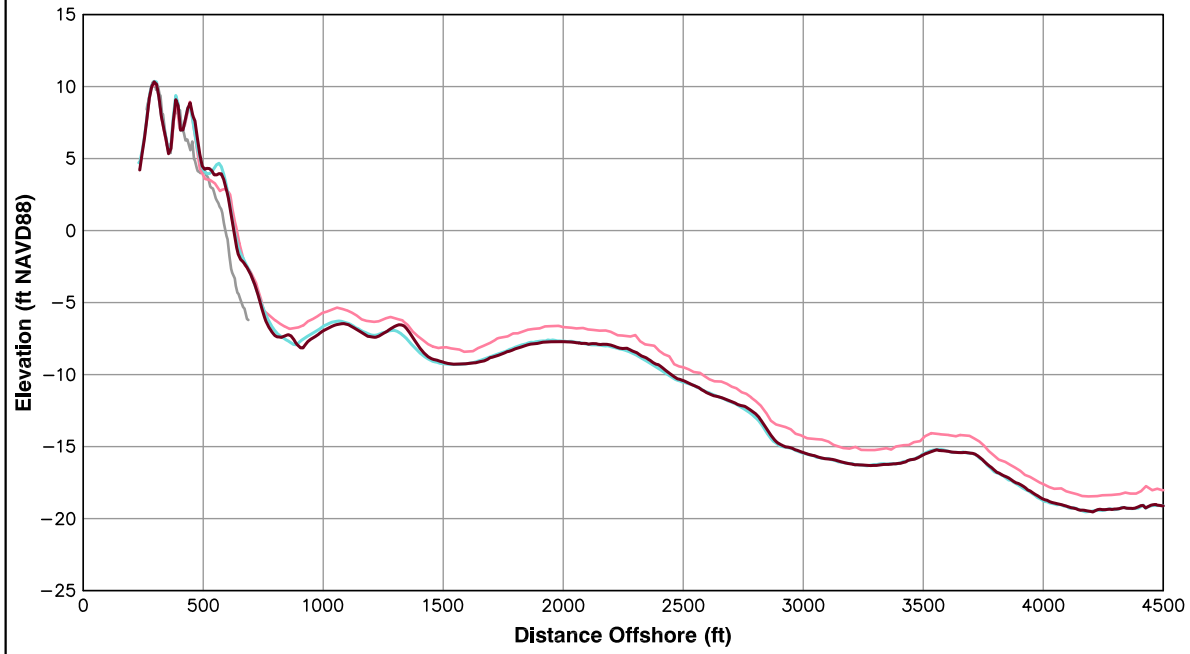
LEGEND:
- 2010 MAR
- 2009 OCT
- 2009 APR

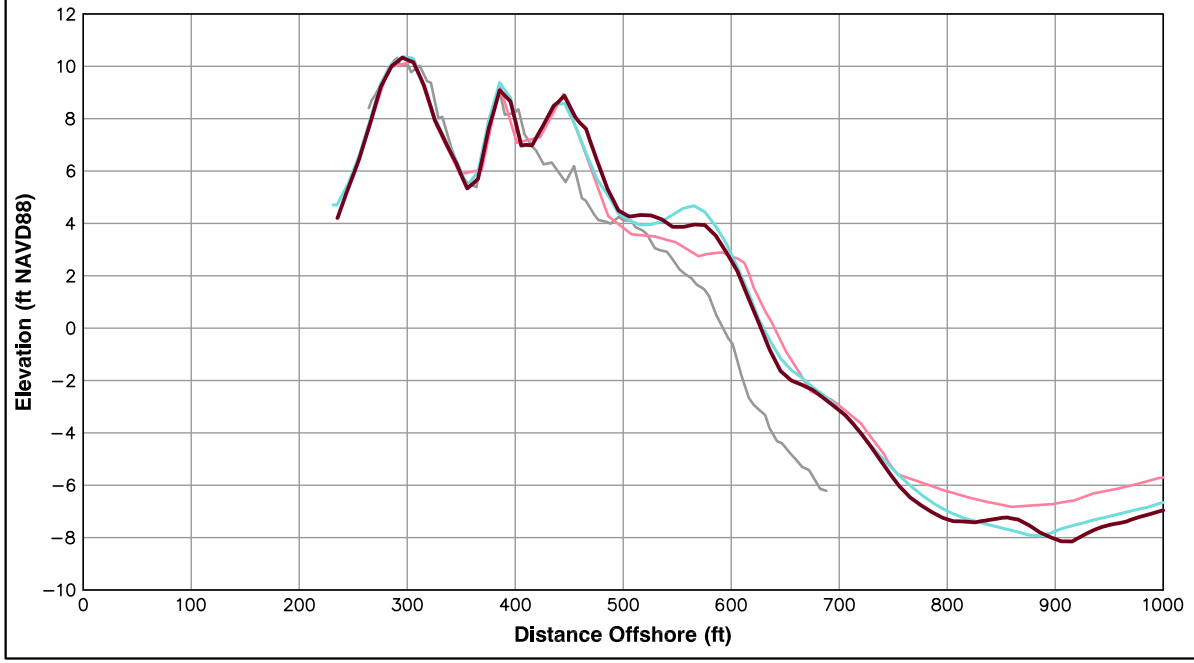
Notes:
1. Stationing From West To East At Varying Intervals.
2. Sections Are Viewed Toward Decreasing Stationing.
3. All Survey Elevations In Feet Referenced to NAVD88.
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

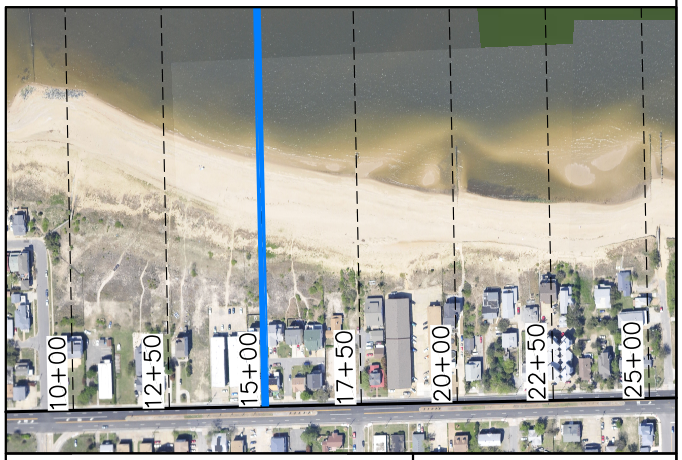




Survey Transect 15+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-10.81 ft/yr	-1.89 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	0.07 cy/ft
Volume Change Above 0 ft NAVD88	3.81 cy/ft/yr	-0.95 cy/ft

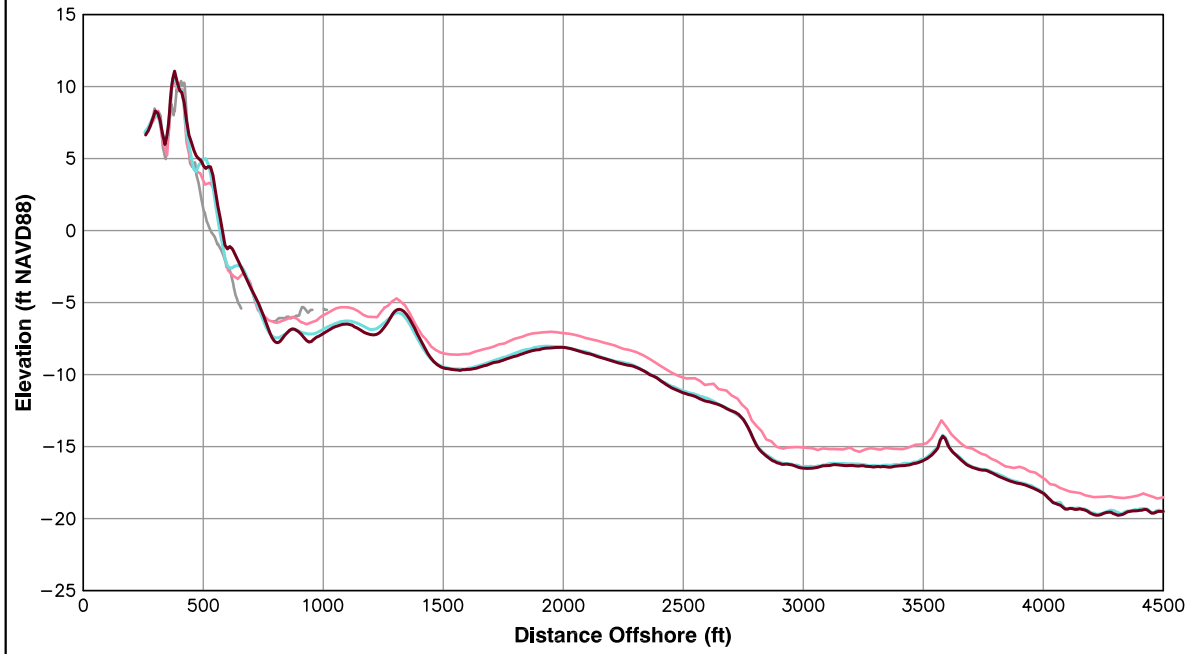
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- 2010 MAR
- 2009 OCT
- 2009 APR
- POST-FILL

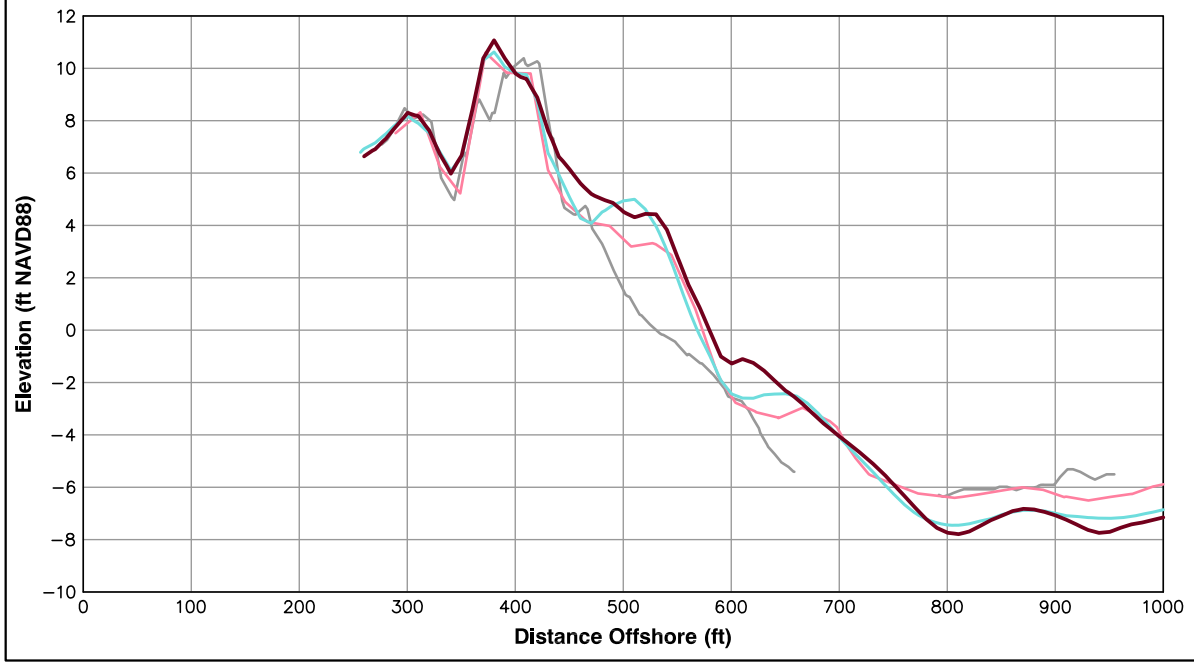
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

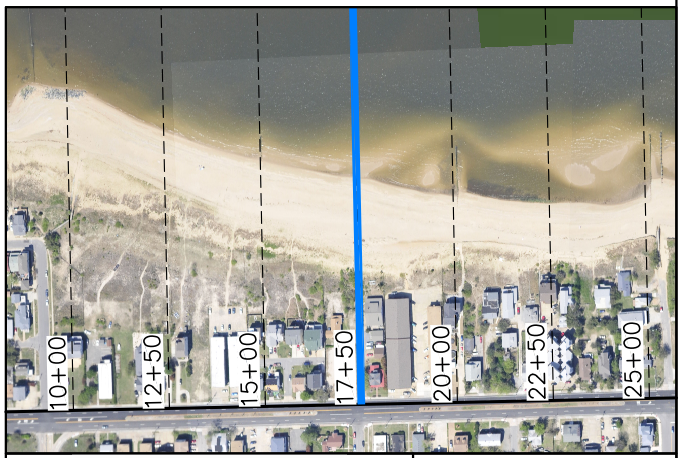




Survey Transect 17+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	4.97 ft/yr	10.34 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-1.24 cy/ft
Volume Change Above 0 ft NAVD88	8.00 cy/ft/yr	3.28 cy/ft

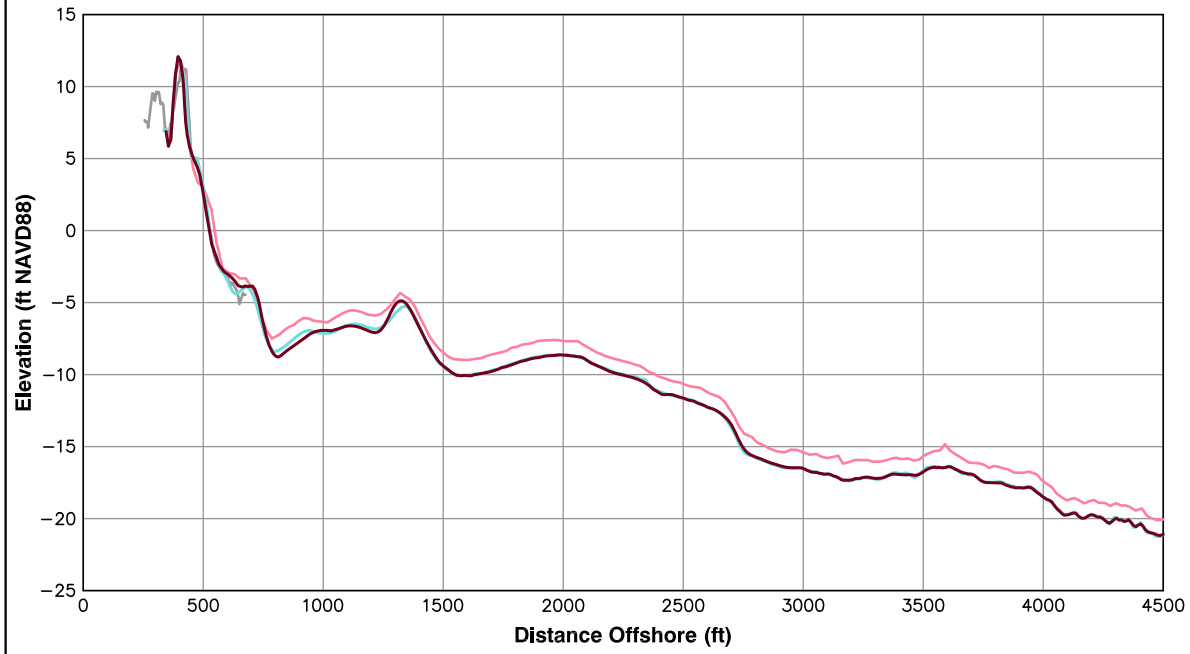
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- 2009 OCT
- 2009 APR
- POST-FILL

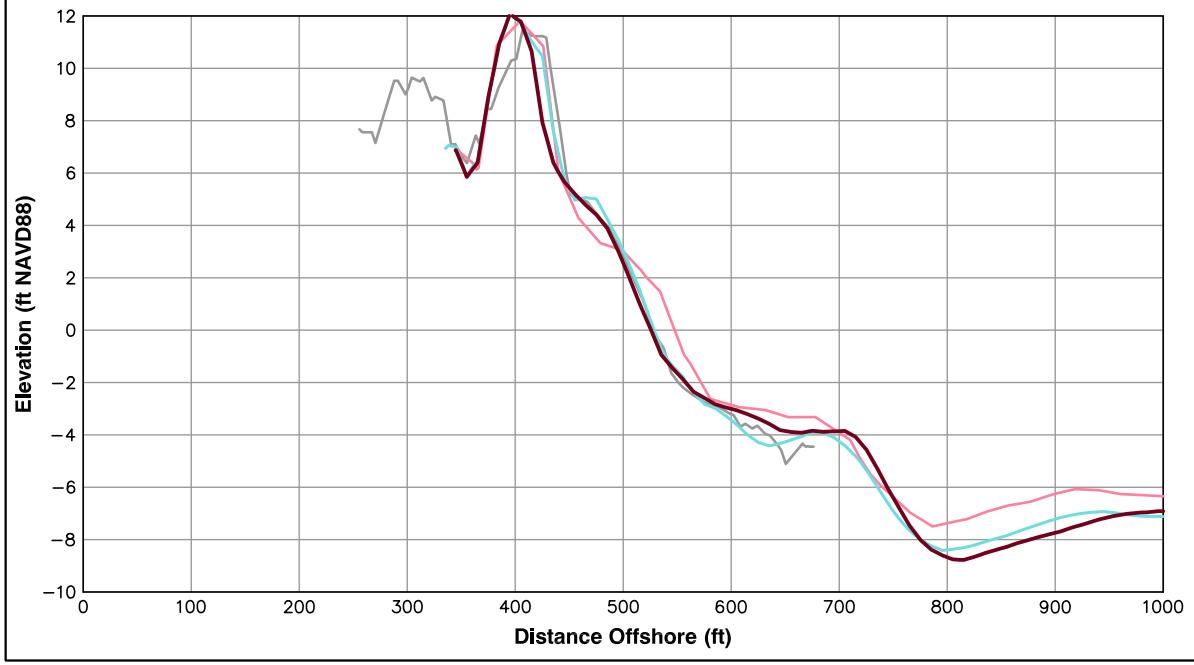
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

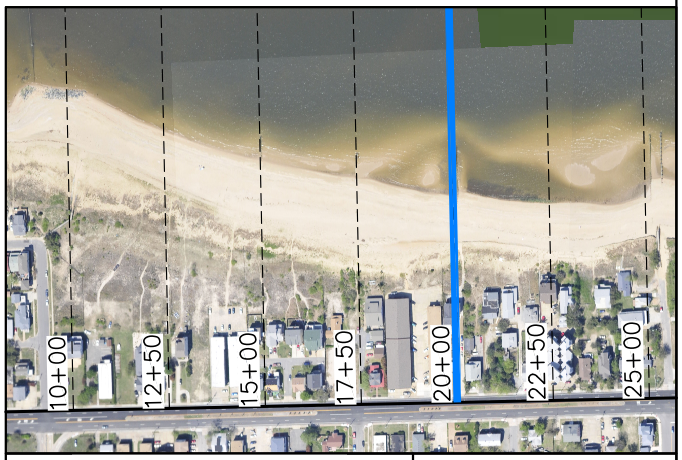




Survey Transect 20+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-25.20 ft/yr	-4.52 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-2.08 cy/ft
Volume Change Above 0 ft NAVD88	-2.80 cy/ft/yr	-2.62 cy/ft

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

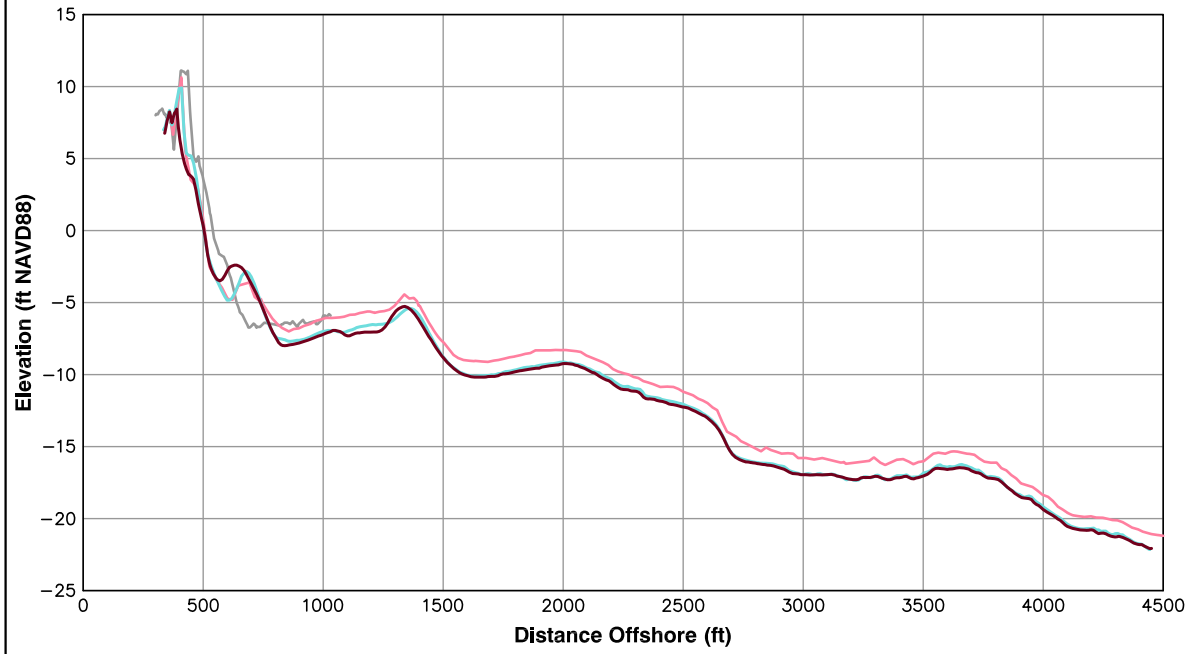
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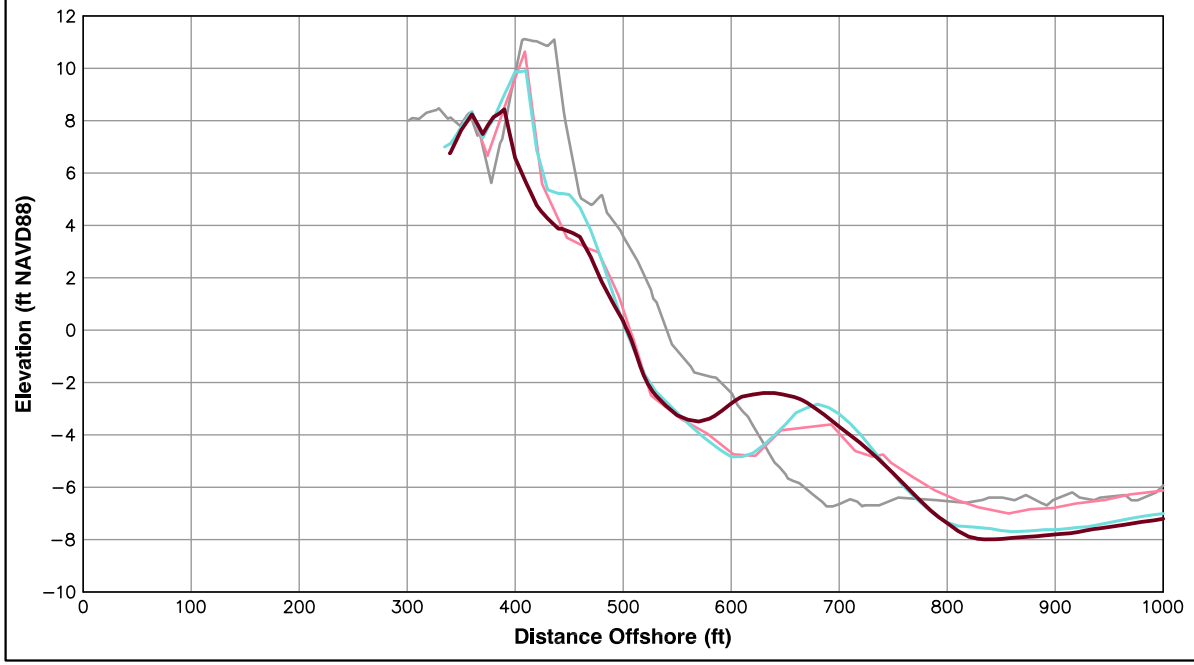


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 20+00	Pg 9 of 106	SPRING 2010

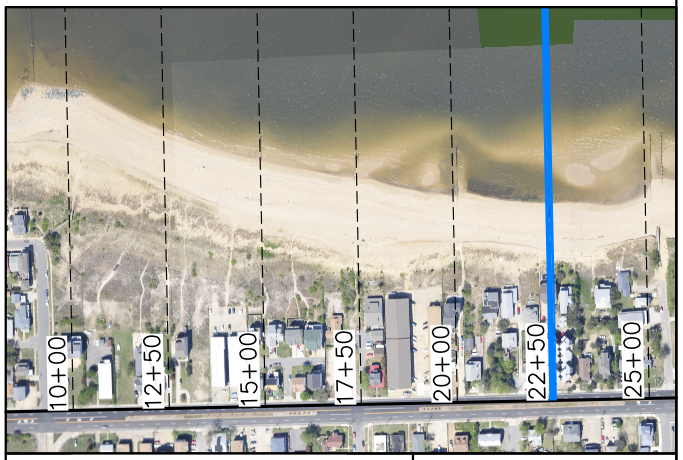




Survey Transect 22+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-6.88 ft/yr	-2.66 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-12.38 cy/ft
Volume Change Above 0 ft NAVD88	-4.75 cy/ft/yr	-6.50 cy/ft

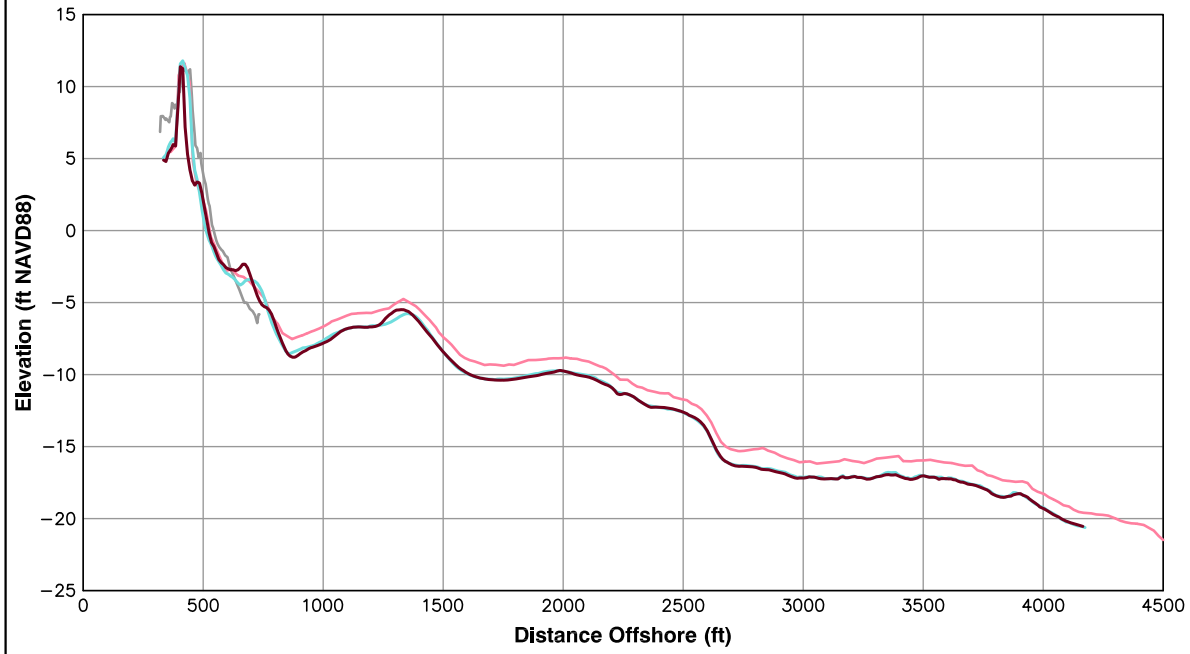
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- 2009 OCT
- 2009 APR
- POST-FILL

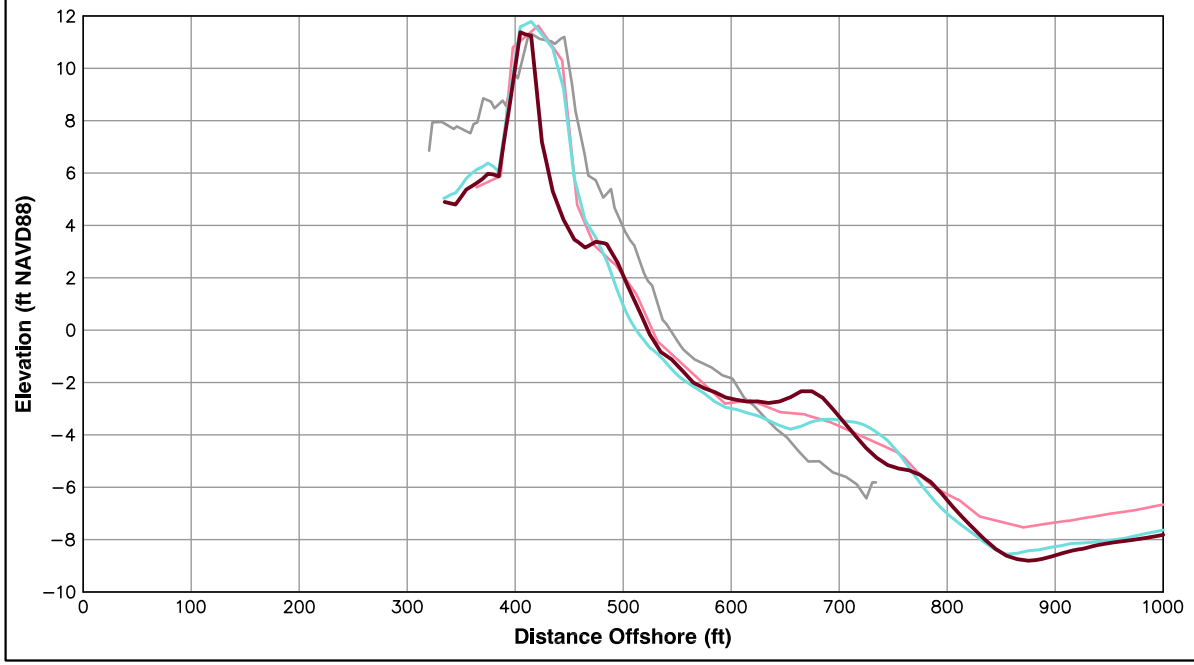
Notes:
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3. All Survey Elevations In Feet Referenced to NAVD88.
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City of Norfolk

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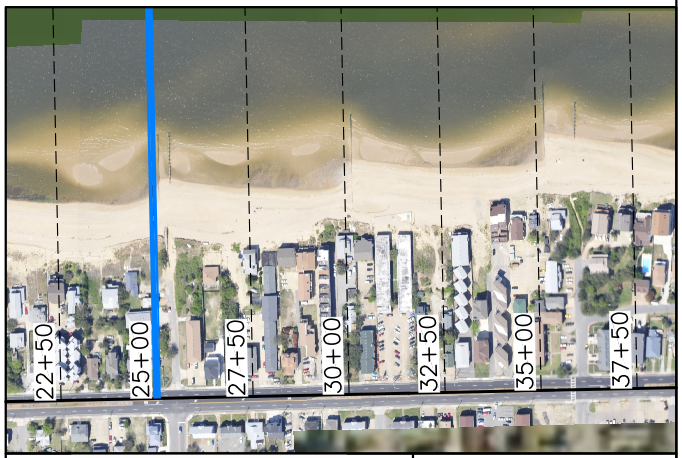




Survey Transect 25+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-4.76 ft/yr	12.28 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-4.58 cy/ft
Volume Change Above 0 ft NAVD88	-7.65 cy/ft/yr	-6.54 cy/ft

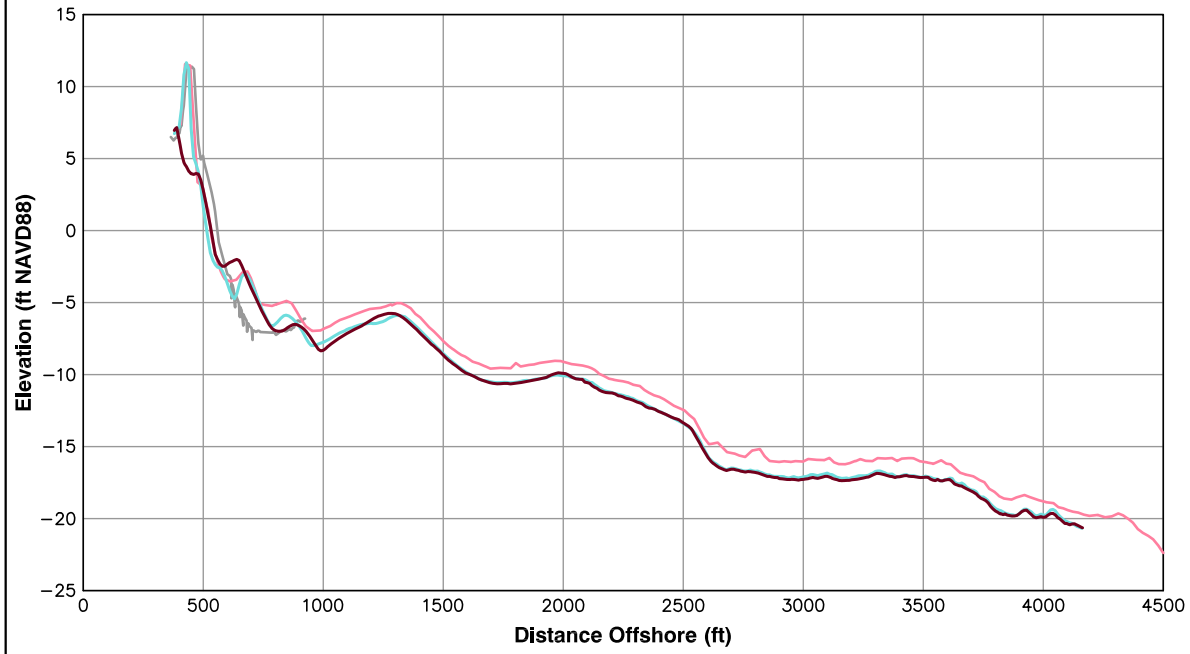
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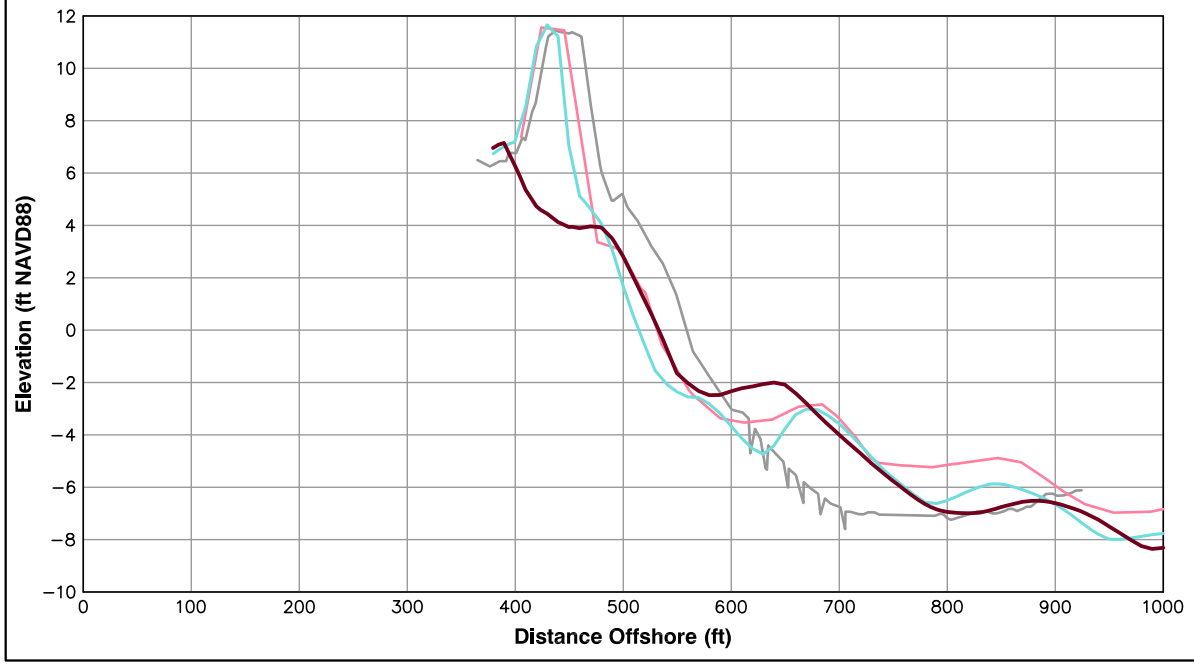
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

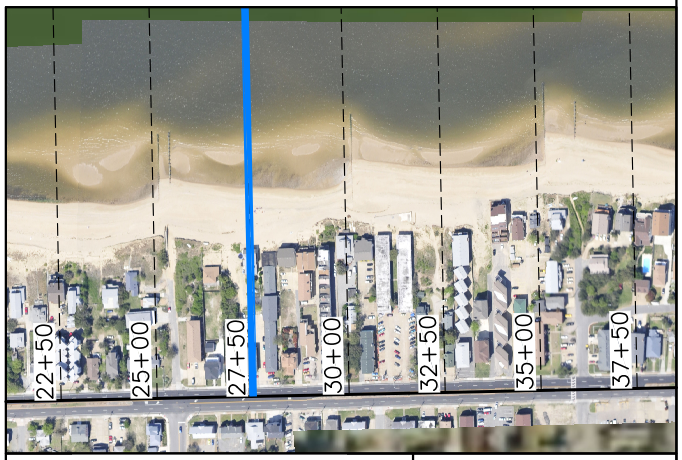




Survey Transect 27+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-2.50 ft/yr	15.87 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-8.10 cy/ft
Volume Change Above 0 ft NAVD88	-13.67 cy/ft/yr	-9.21 cy/ft

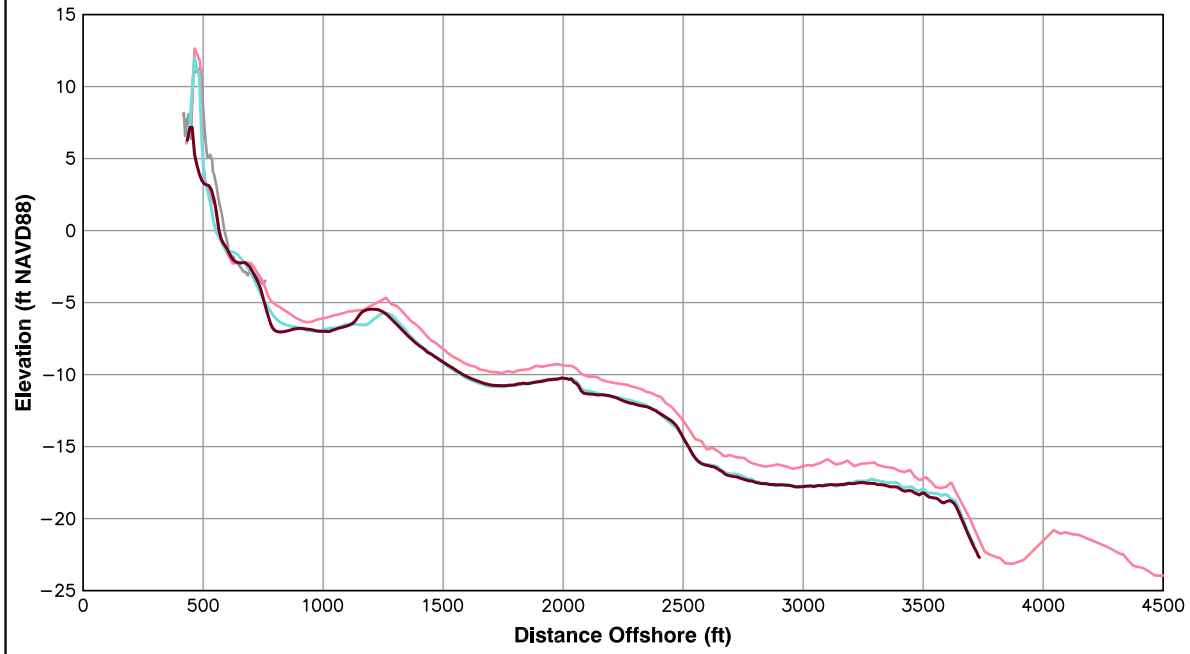
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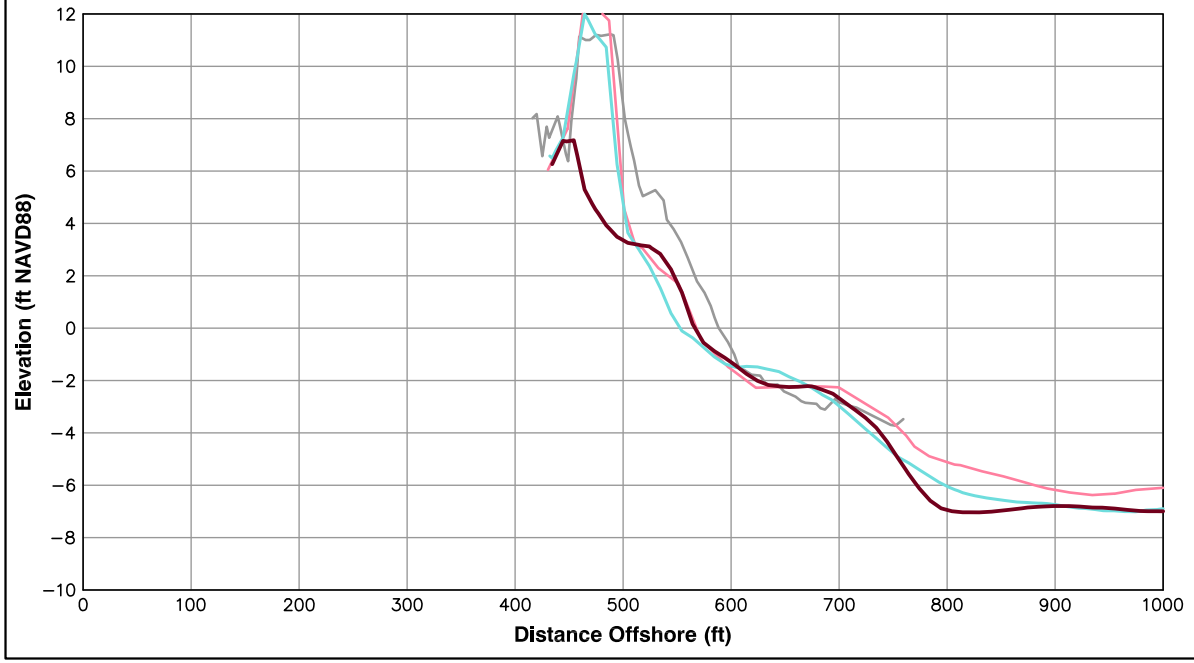
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

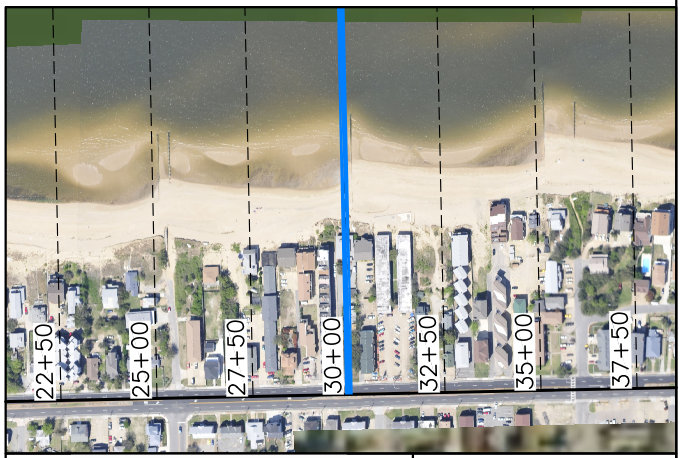




Survey Transect 30+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-1.00 ft/yr	17.45 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-8.68 cy/ft
Volume Change Above 0 ft NAVD88	-11.82 cy/ft/yr	-7.67 cy/ft

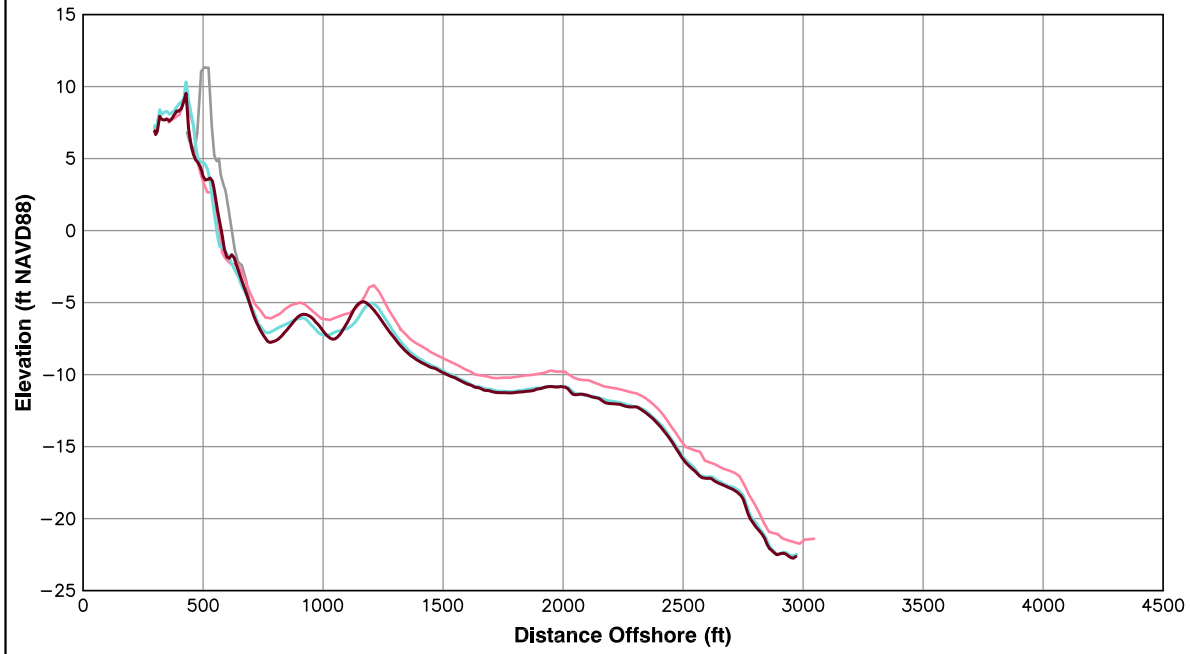
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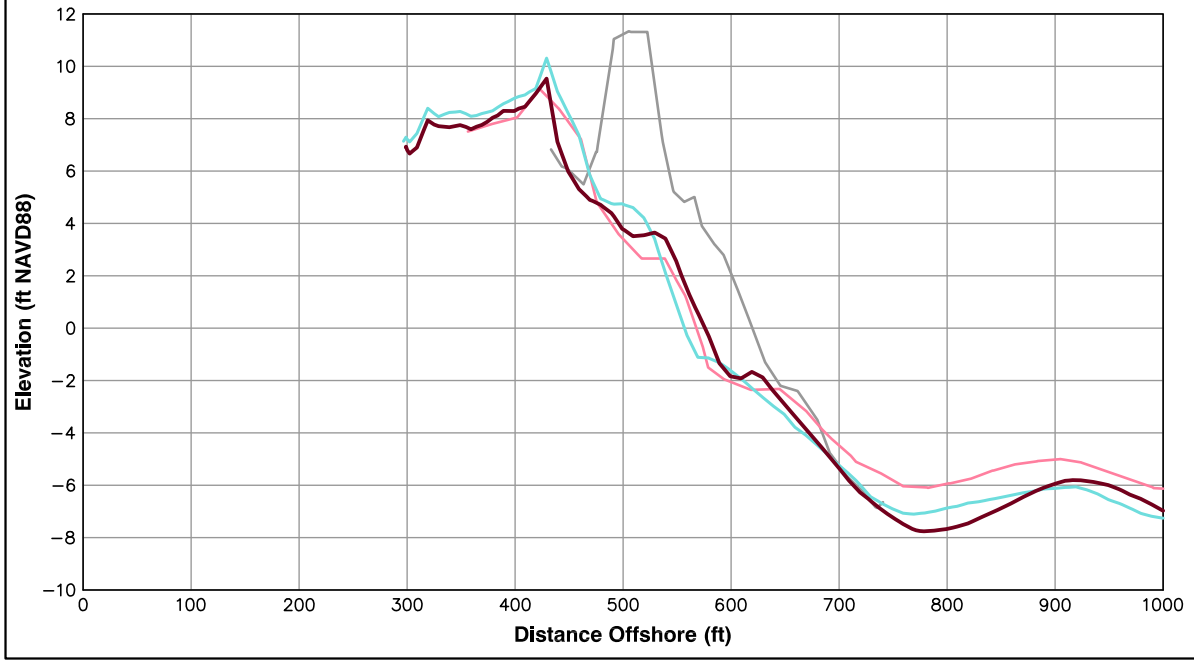
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

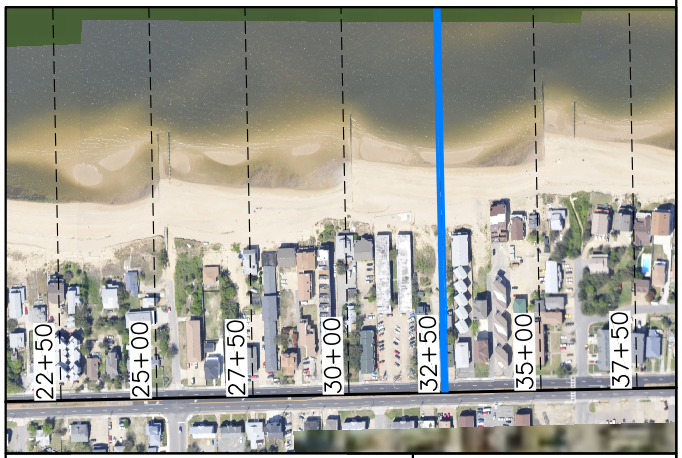




Survey Transect 32+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	5.50 ft/yr	16.18 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-8.66 cy/ft
Volume Change Above 0 ft NAVD88	0.52 cy/ft/yr	-4.16 cy/ft

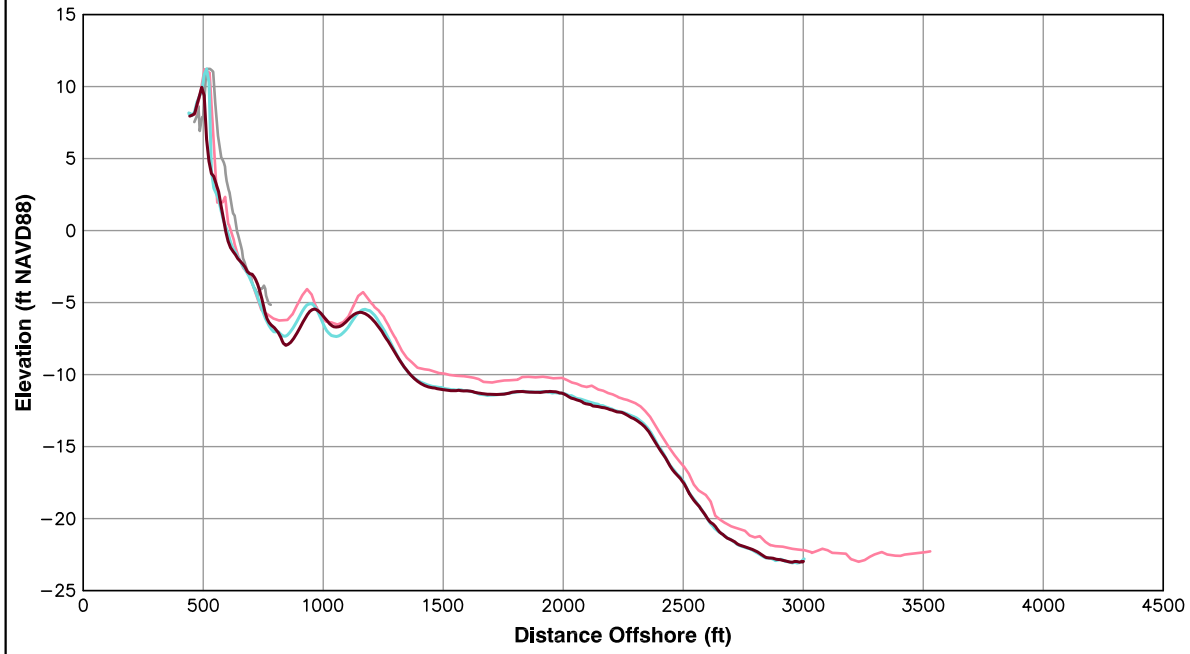
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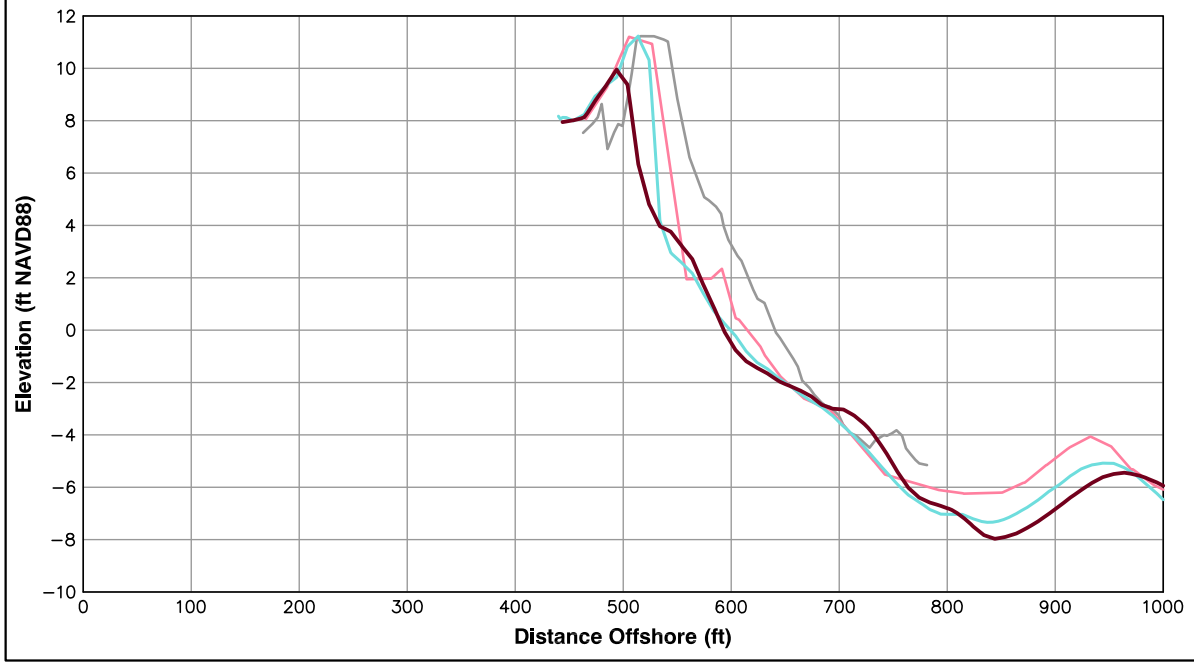
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

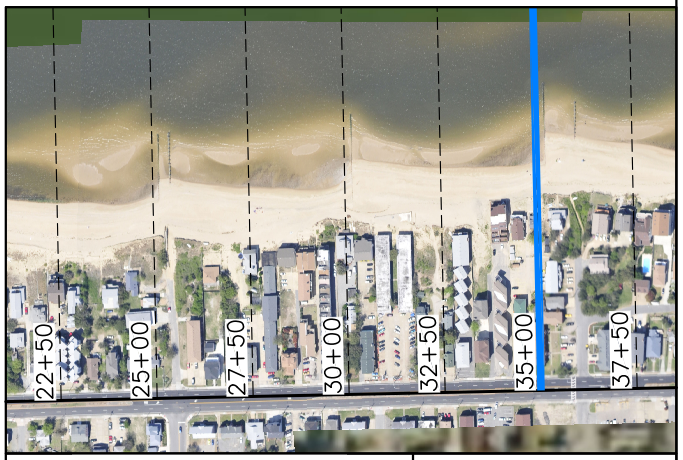




Survey Transect 35+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-19.61 ft/yr	2.39 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.10 cy/ft
Volume Change Above 0 ft NAVD88	-9.31 cy/ft/yr	-3.68 cy/ft

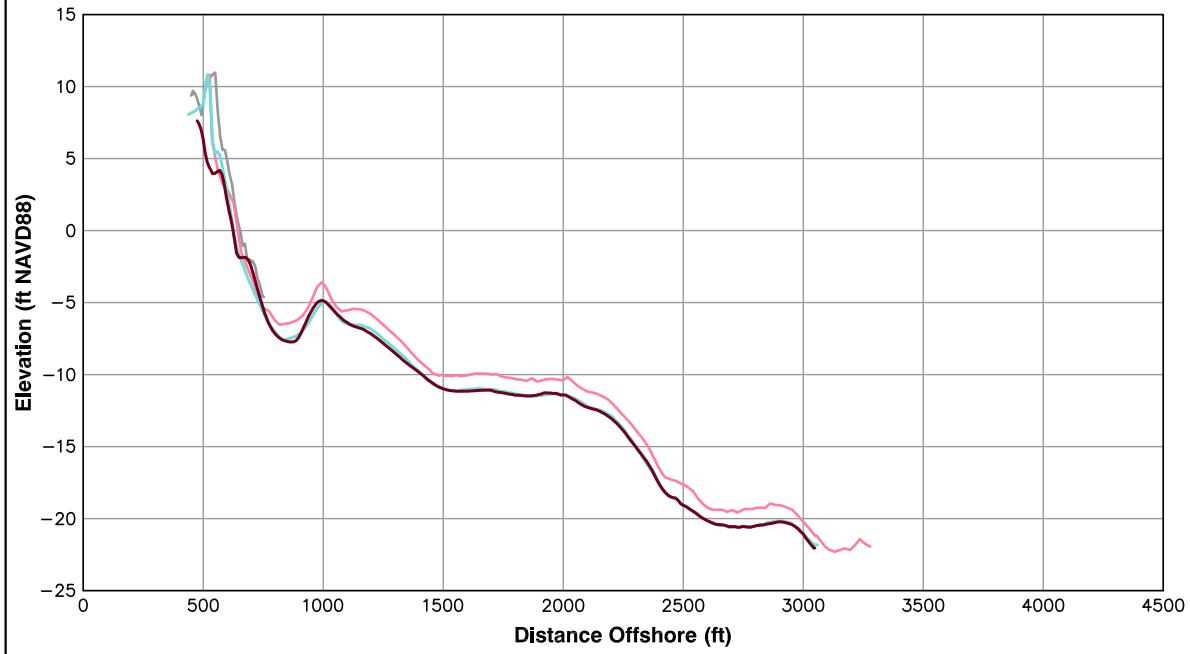
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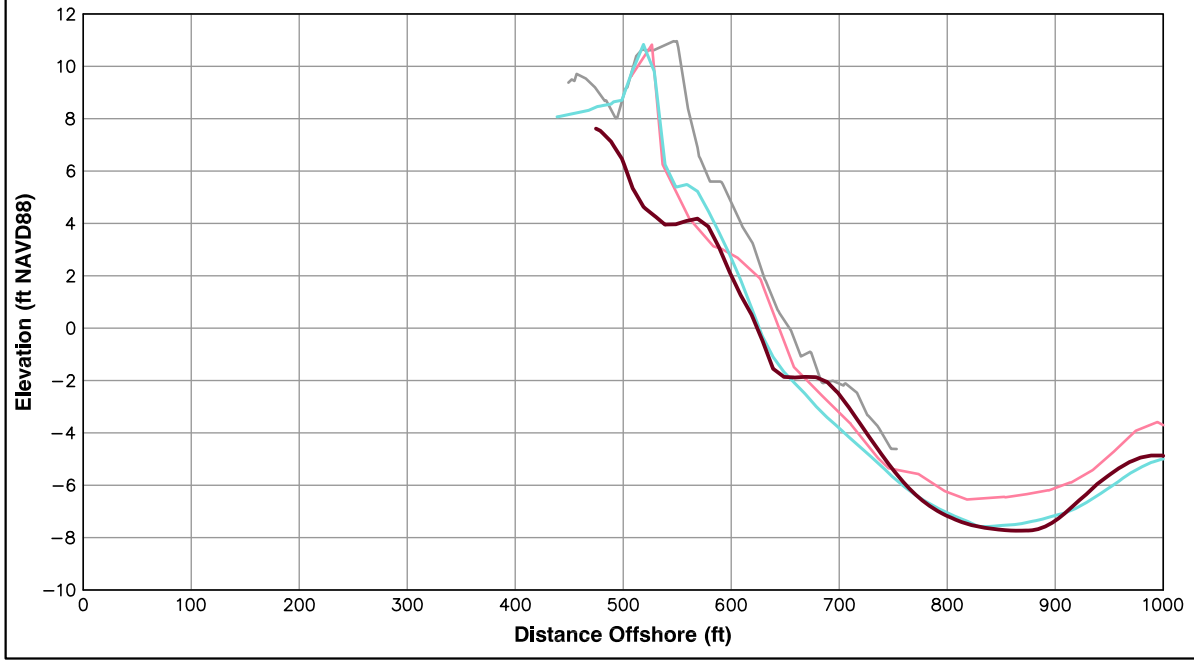
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 37+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-24.80 ft/yr	-4.33 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-11.80 cy/ft
Volume Change Above 0 ft NAVD88	-9.24 cy/ft/yr	-10.96 cy/ft

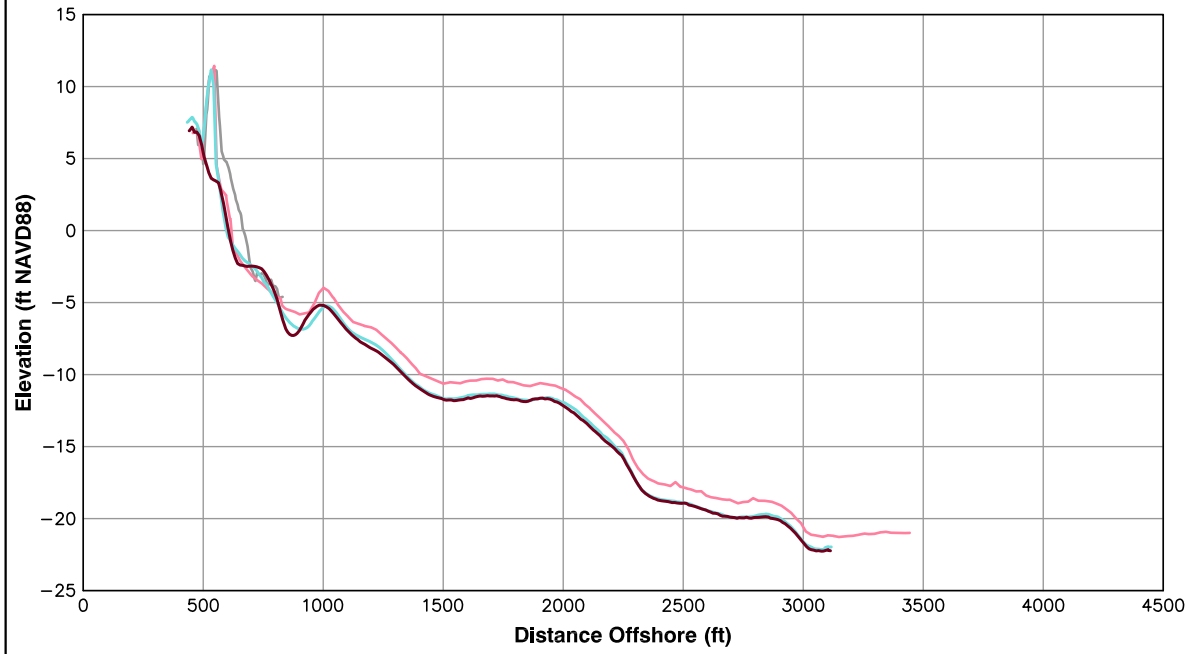
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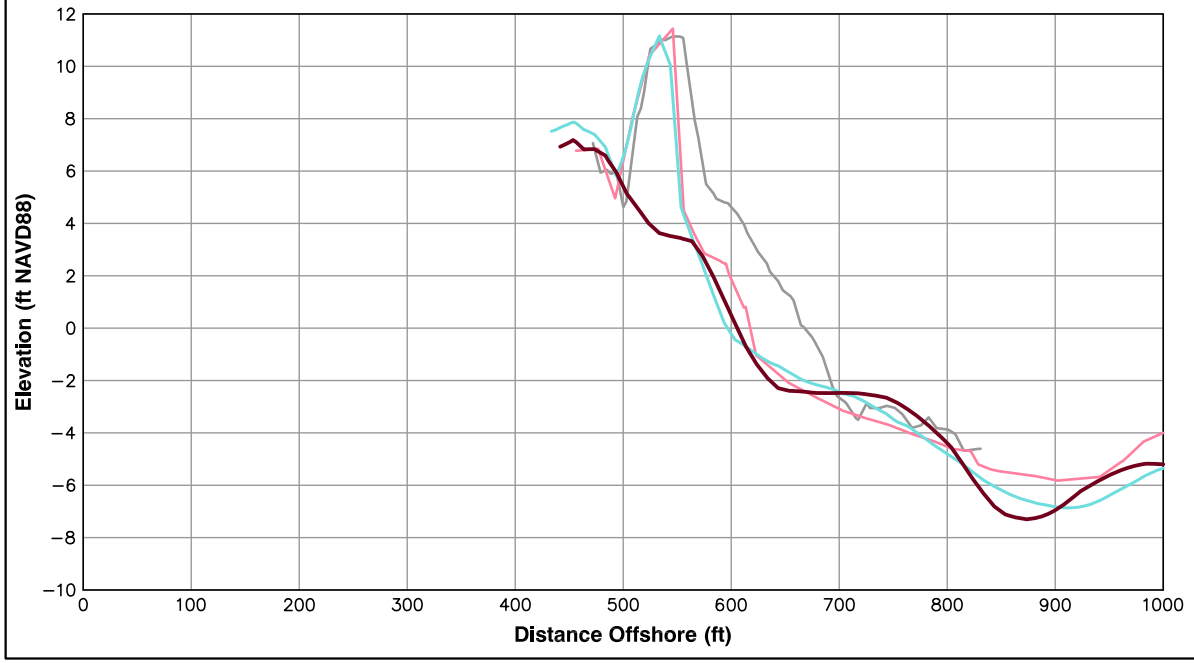
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 40+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-16.48 ft/yr	8.35 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-17.80 cy/ft
Volume Change Above 0 ft NAVD88	-13.66 cy/ft/yr	-10.56 cy/ft

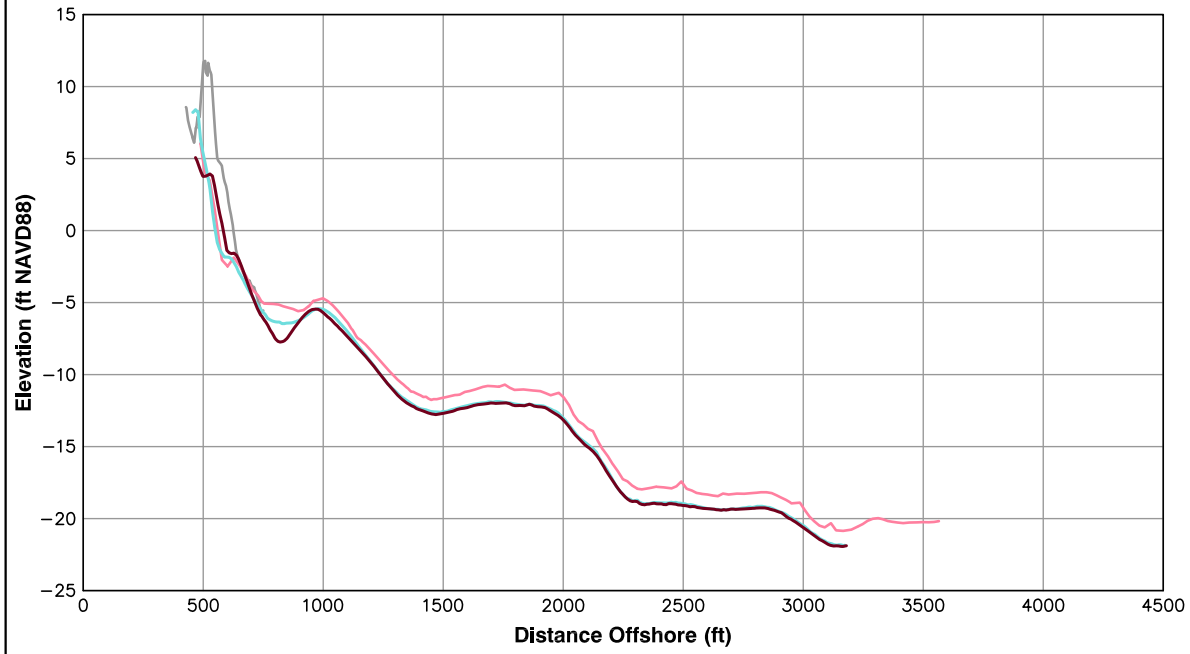
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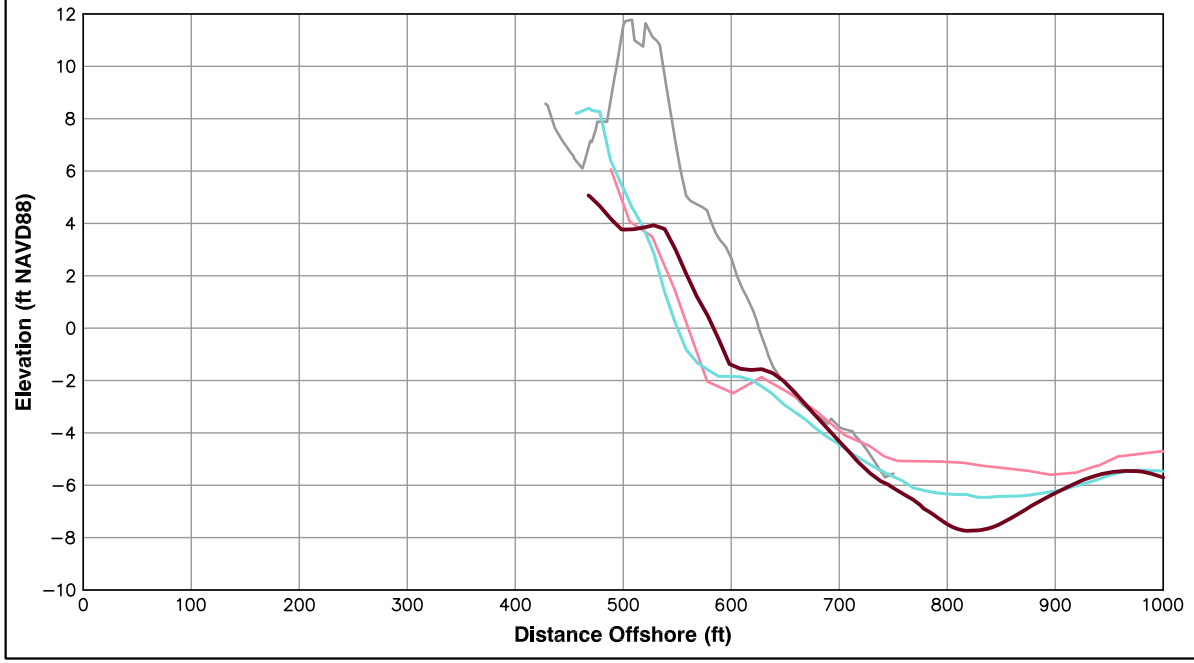
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

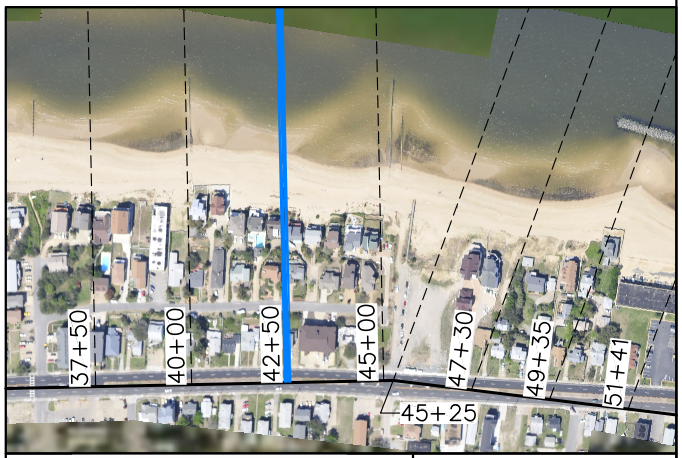




Survey Transect 42+50	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	21.32 ft/yr	29.65 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.25 cy/ft
Volume Change Above 0 ft NAVD88	1.99 cy/ft/yr	-0.07 cy/ft

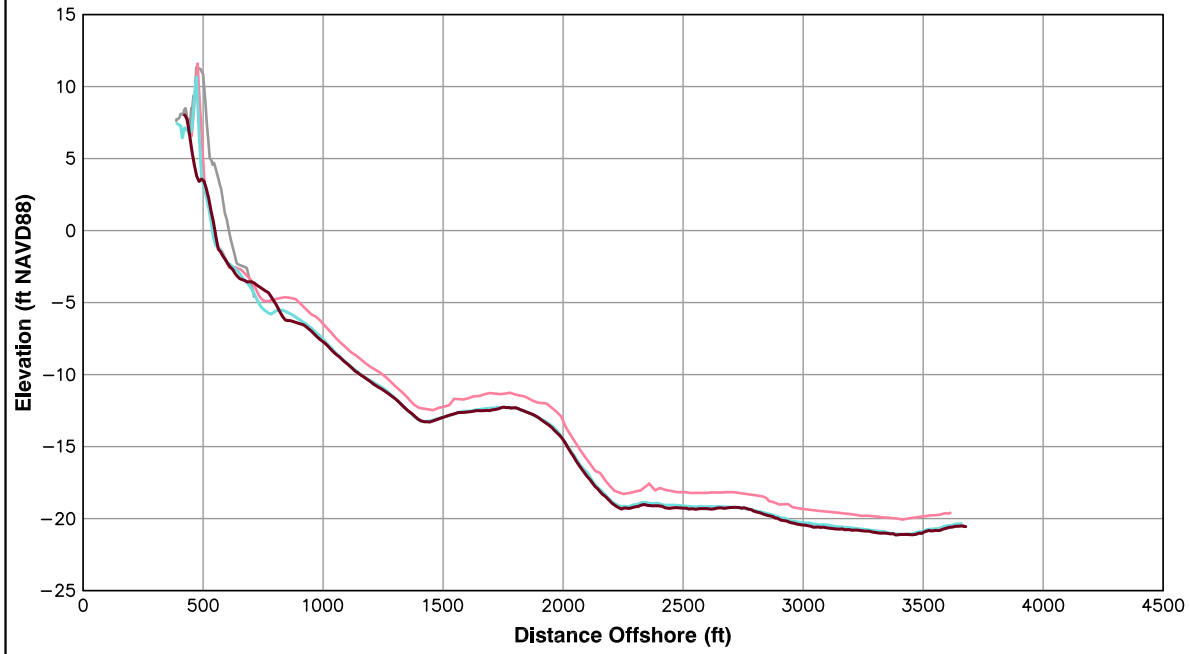
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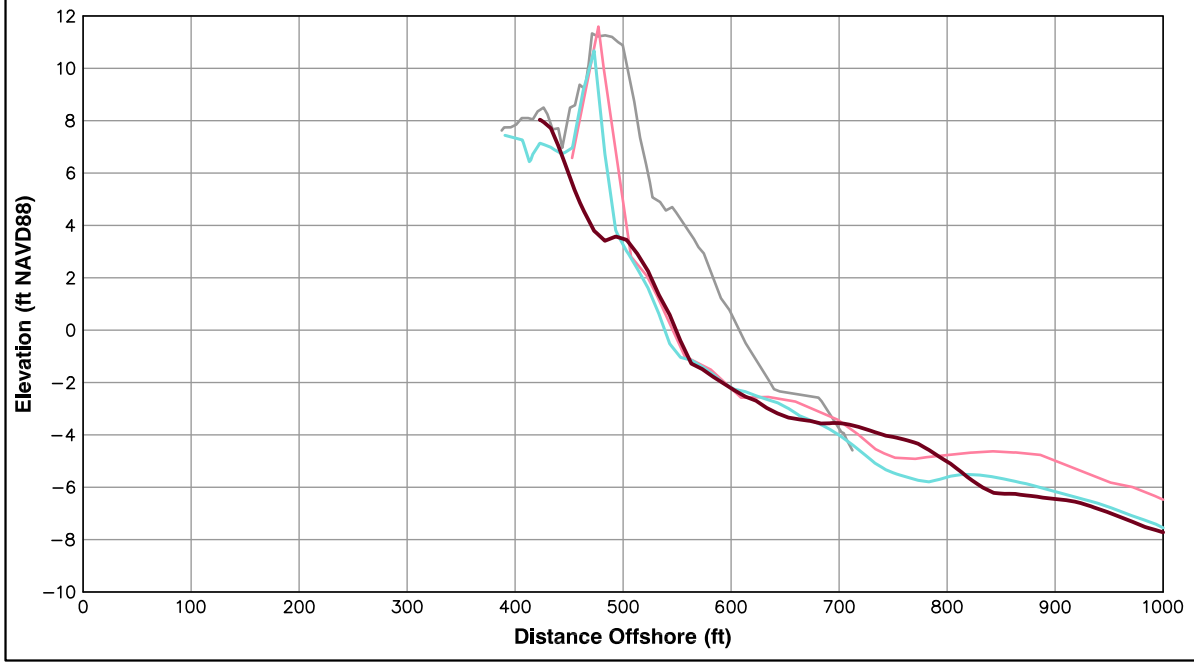
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

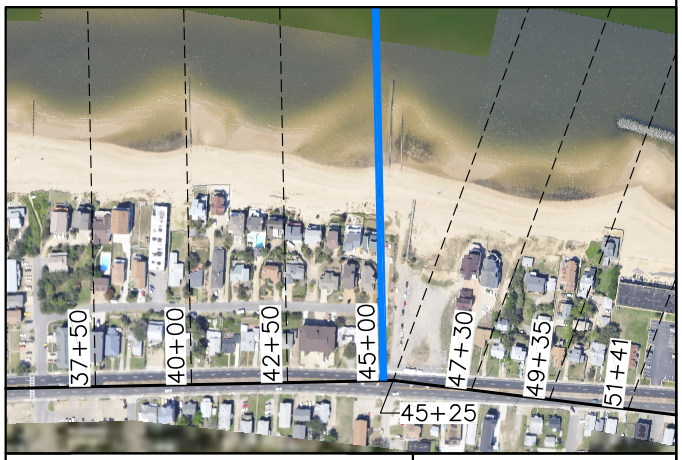




Survey Transect 45+00	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	3.17 ft/yr	8.50 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-4.39 cy/ft
Volume Change Above 0 ft NAVD88	-8.49 cy/ft/yr	-4.53 cy/ft

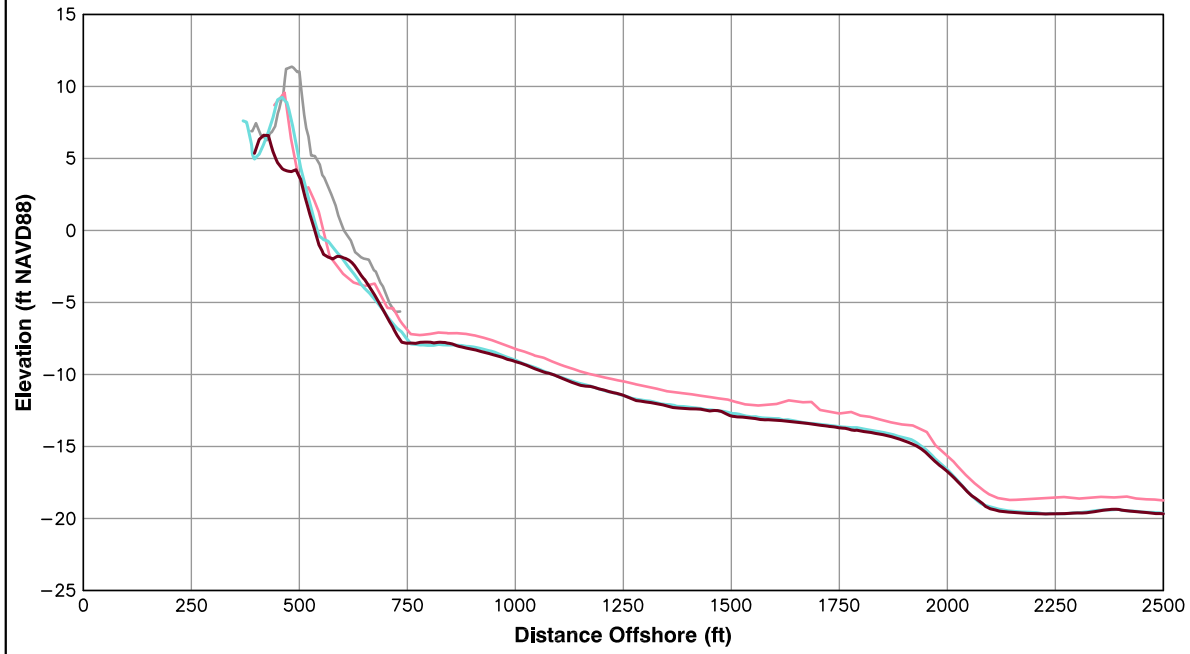
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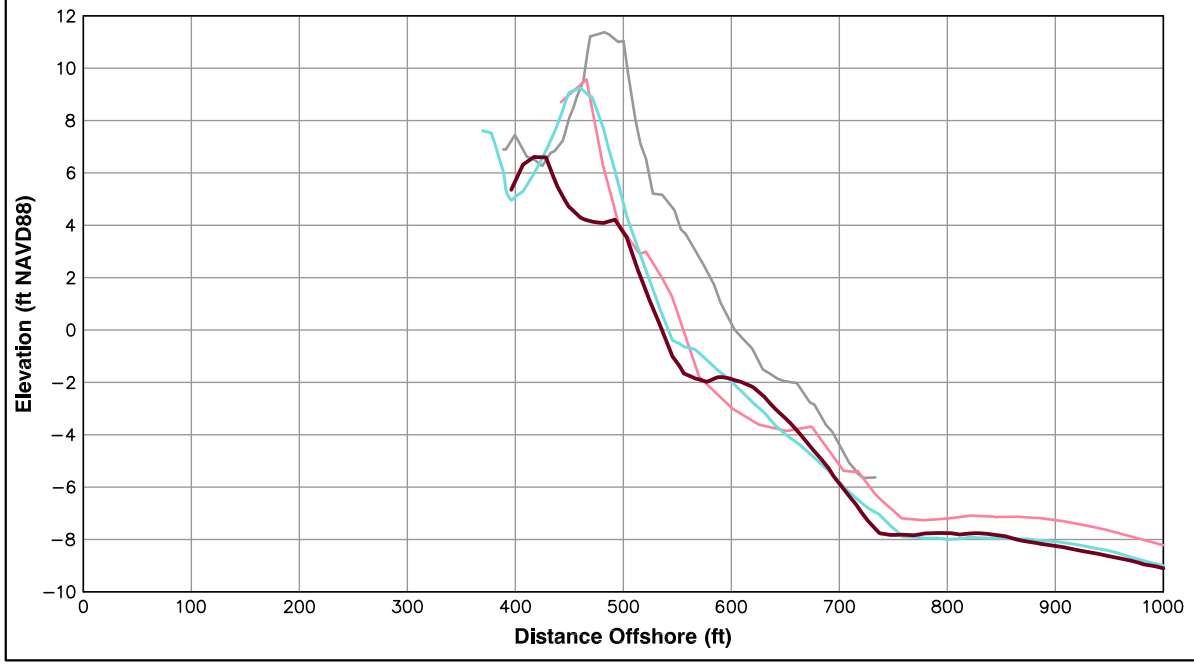
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

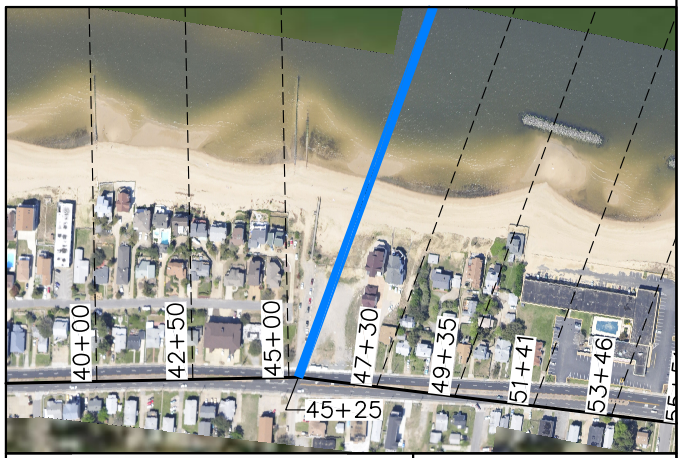




Survey Transect 45+25	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-23.71 ft/yr	-6.58 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-13.36 cy/ft
Volume Change Above 0 ft NAVD88	-9.77 cy/ft/yr	-9.19 cy/ft

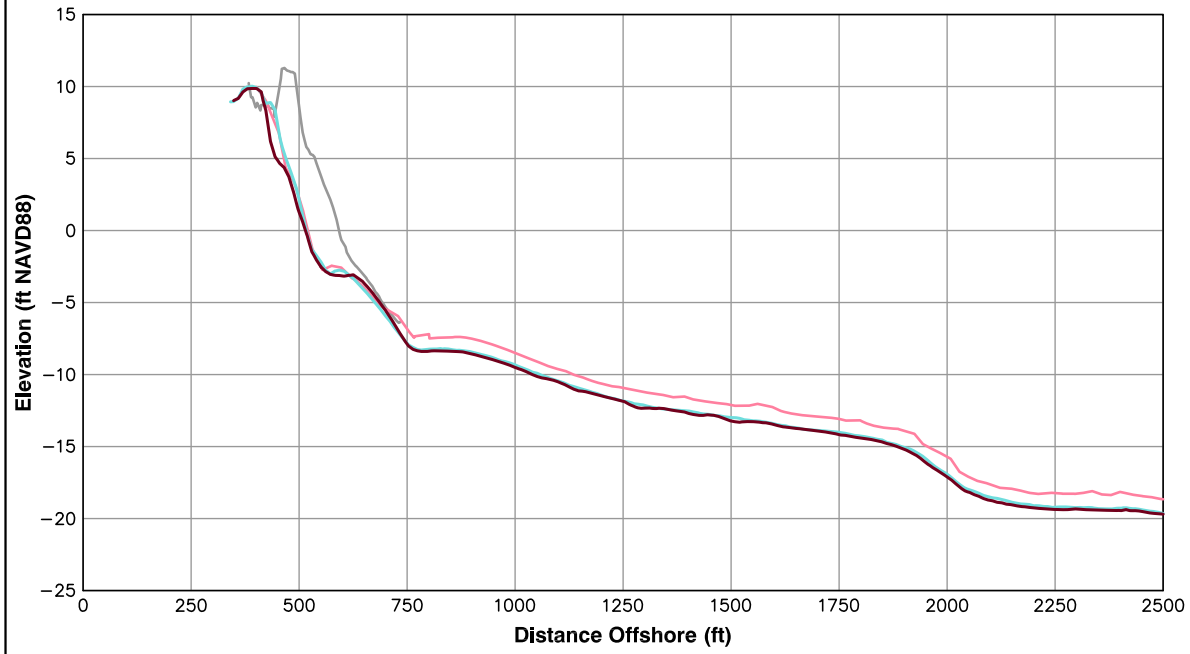
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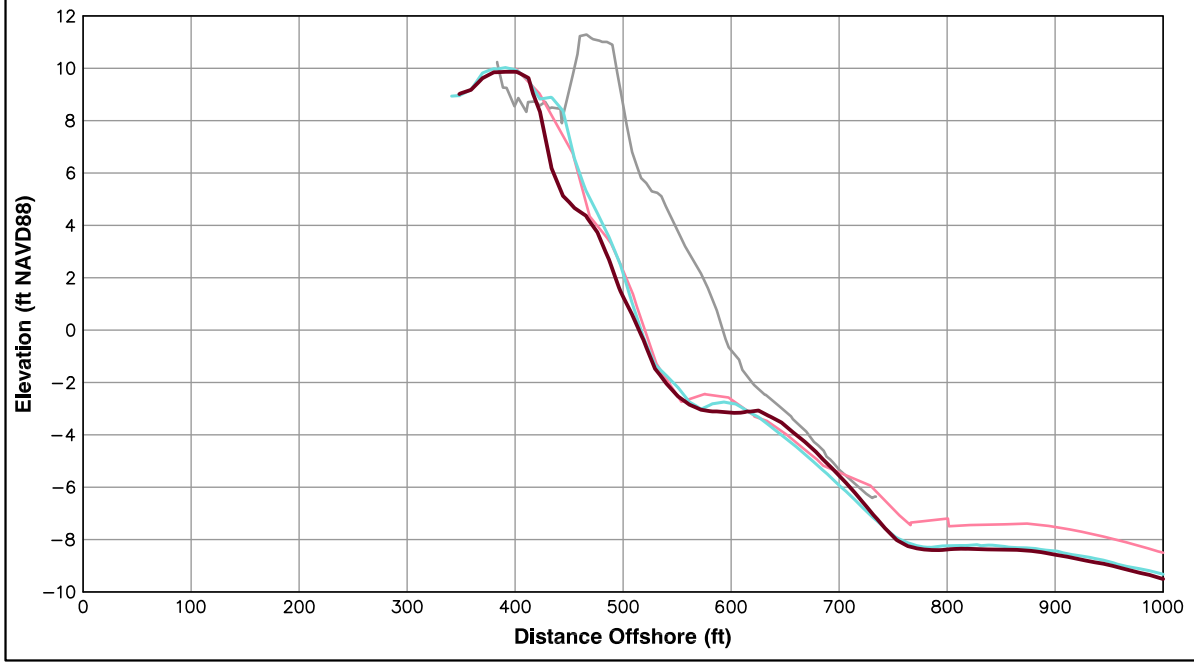
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

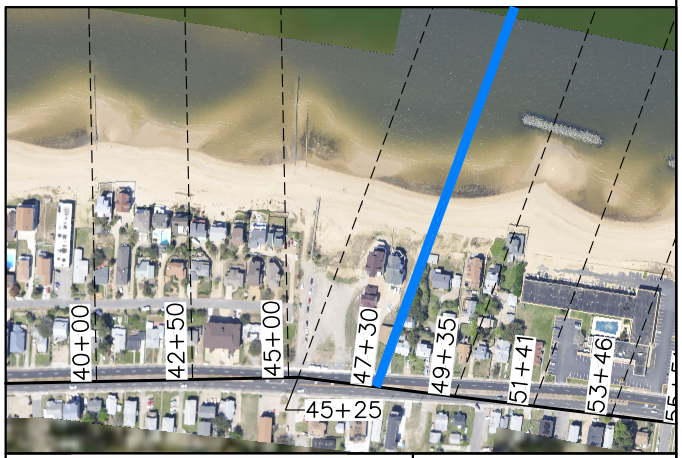




Survey Transect 47+30	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-9.30 ft/yr	-5.20 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-8.85 cy/ft
Volume Change Above 0 ft NAVD88	-4.45 cy/ft/yr	-5.06 cy/ft

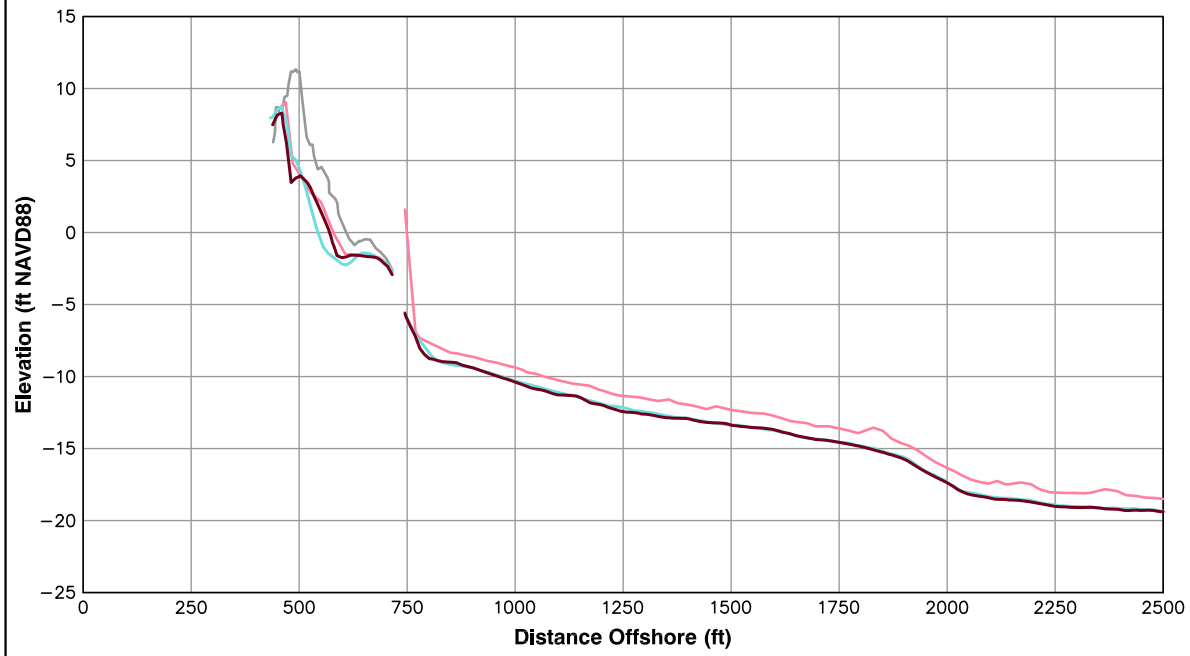
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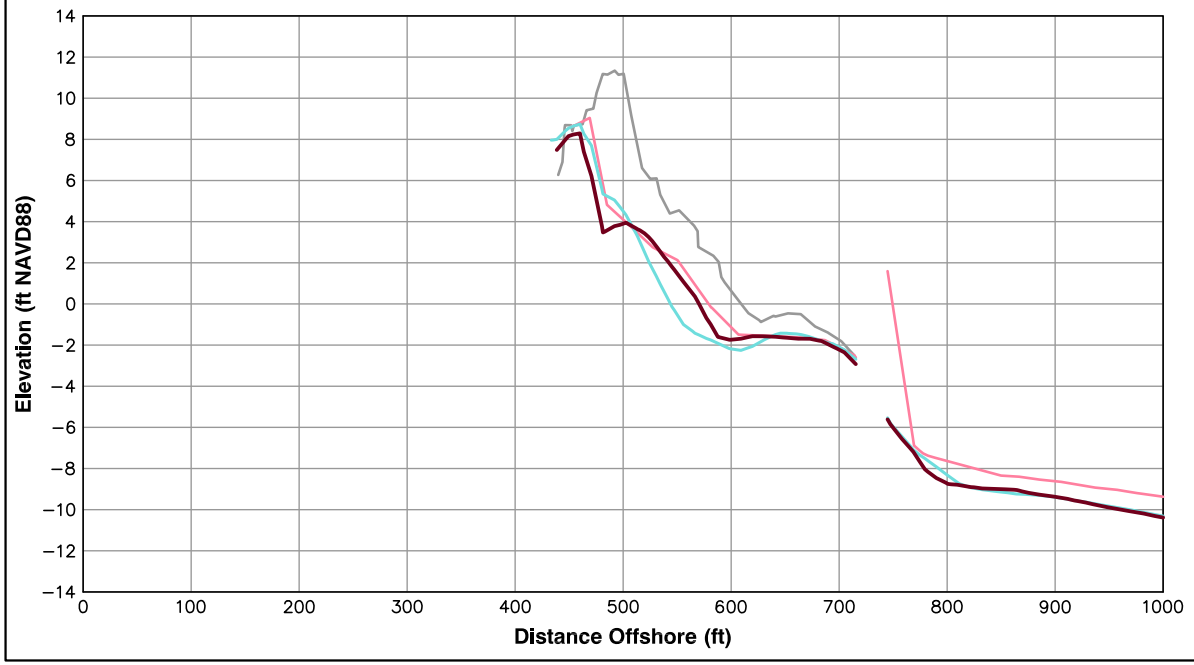
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

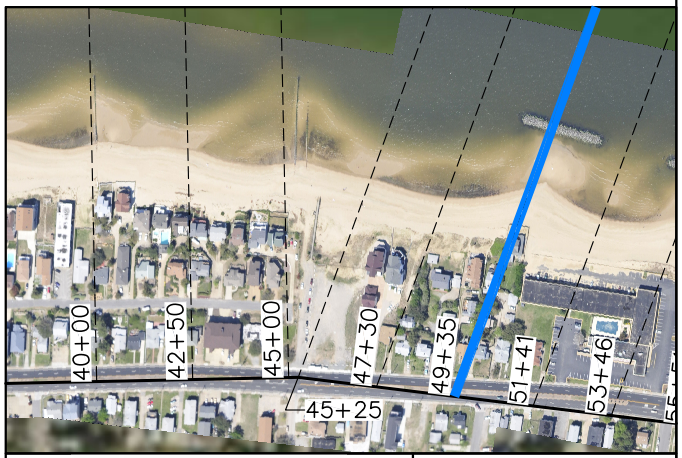




Survey Transect 49+35	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-9.48 ft/yr	23.07 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-0.67 cy/ft
Volume Change Above 0 ft NAVD88	-3.37 cy/ft/yr	0.08 cy/ft

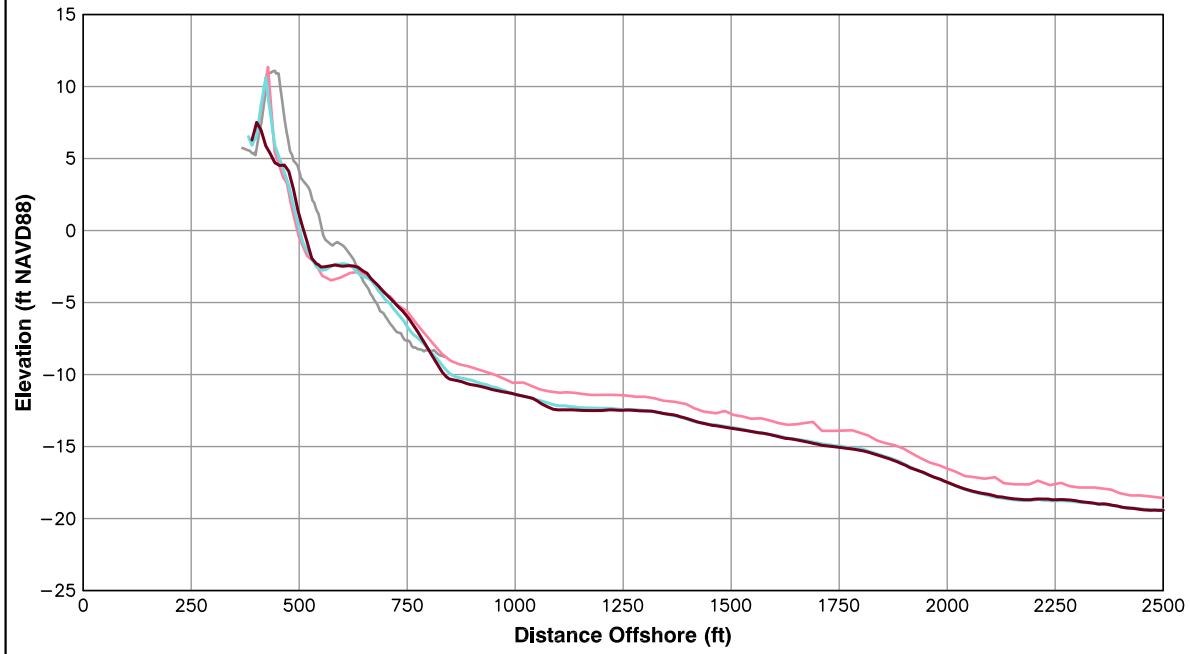
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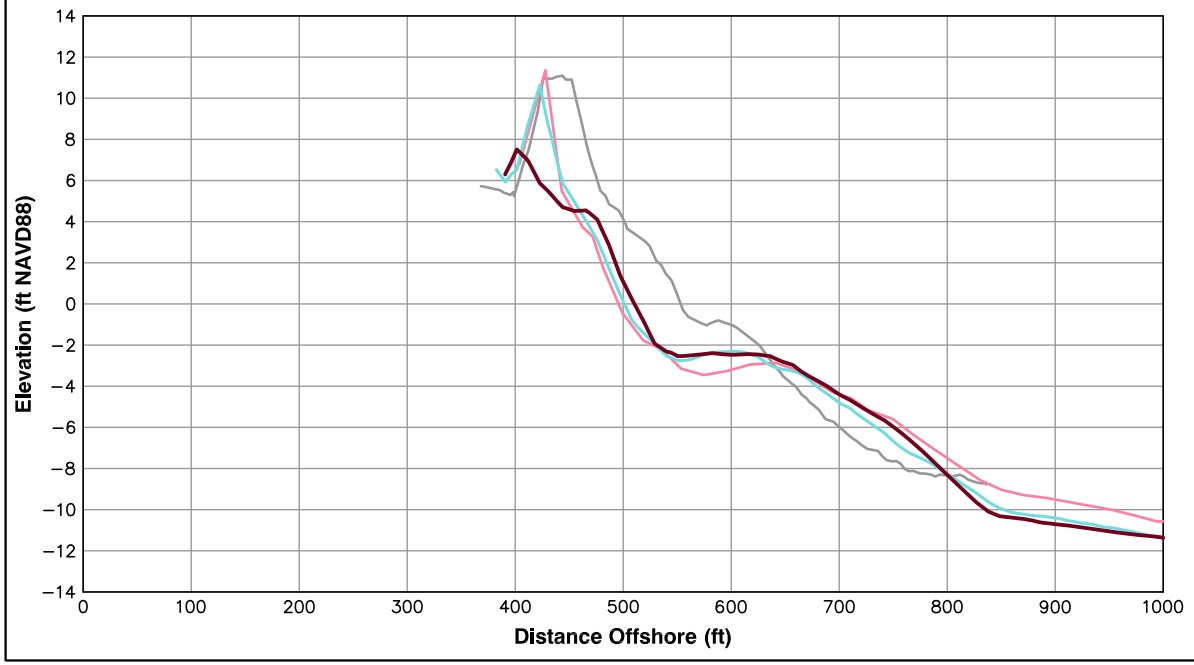
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 51+41	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	14.48 ft/yr	8.08 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-2.80 cy/ft
Volume Change Above 0 ft NAVD88	-2.11 cy/ft/yr	-2.33 cy/ft

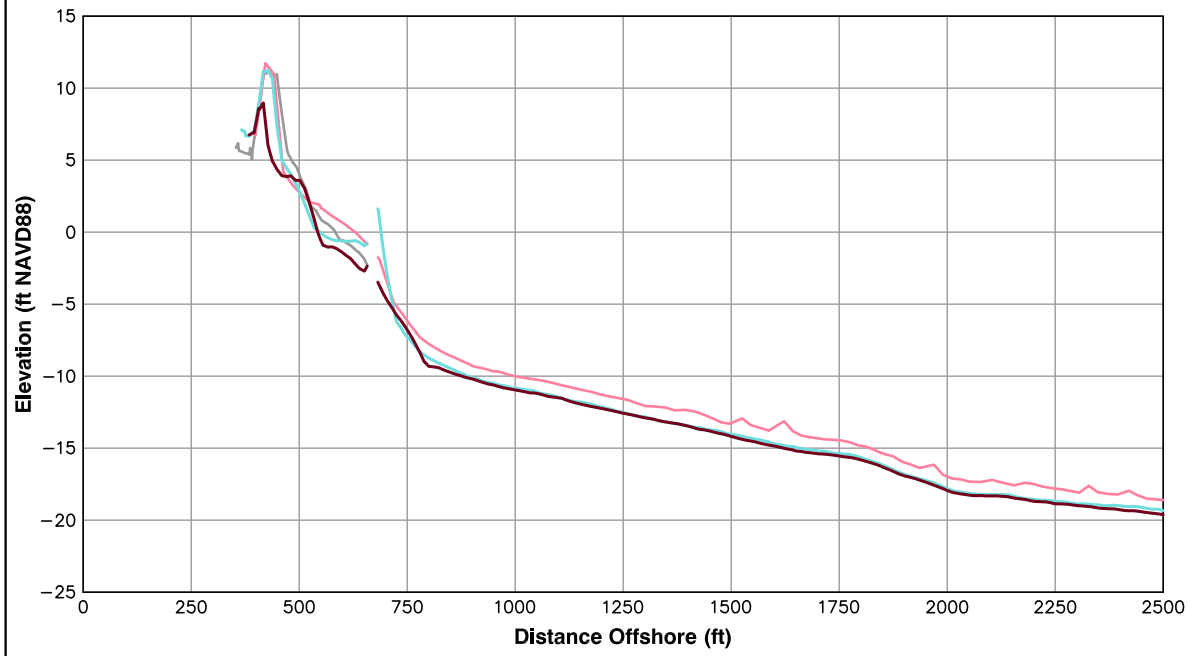
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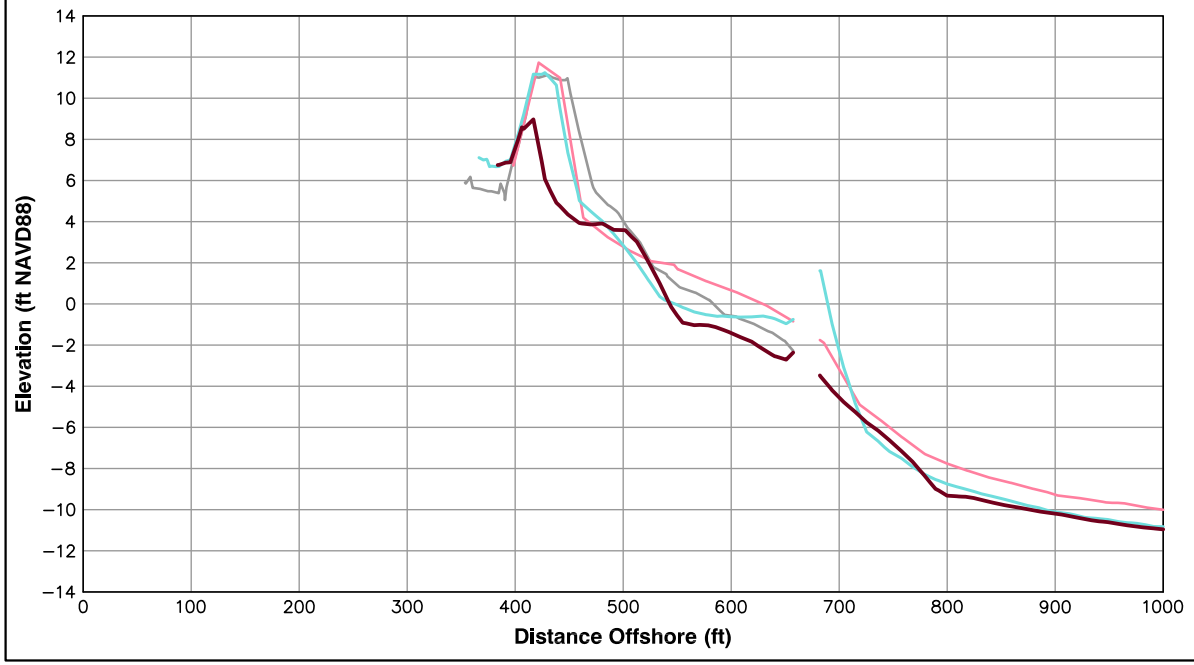
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 53+46	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-54.05 ft/yr	8.27 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-16.67 cy/ft
Volume Change Above 0 ft NAVD88	-11.25 cy/ft/yr	-6.06 cy/ft

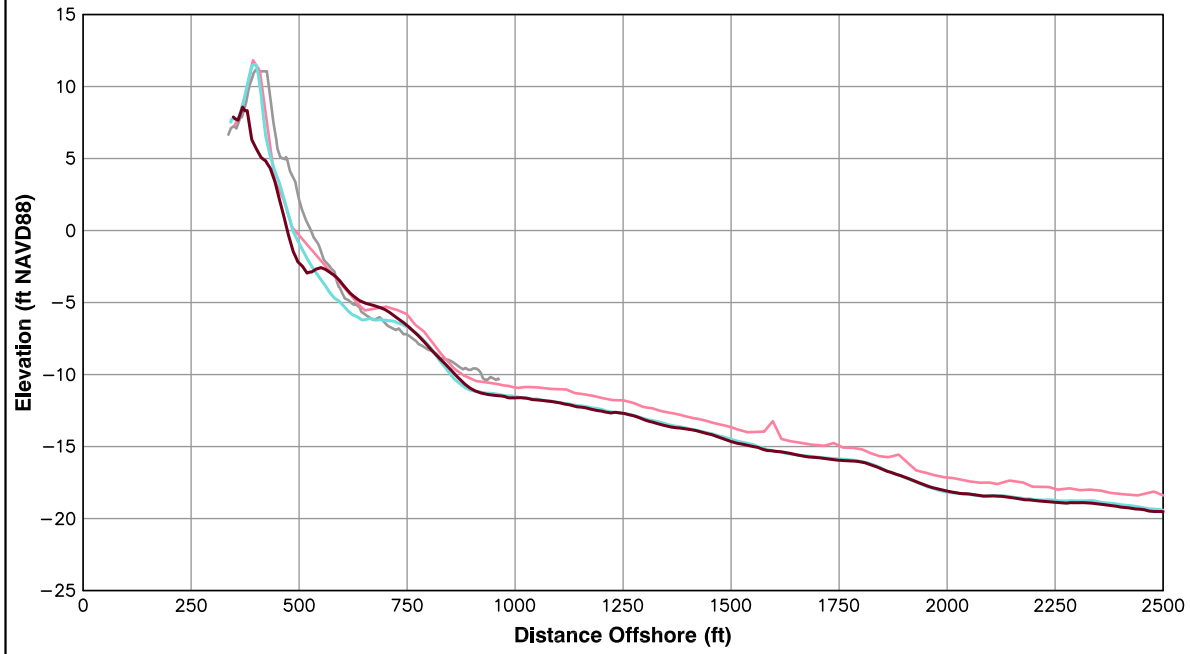
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- 2009 APR
- POST-FILL

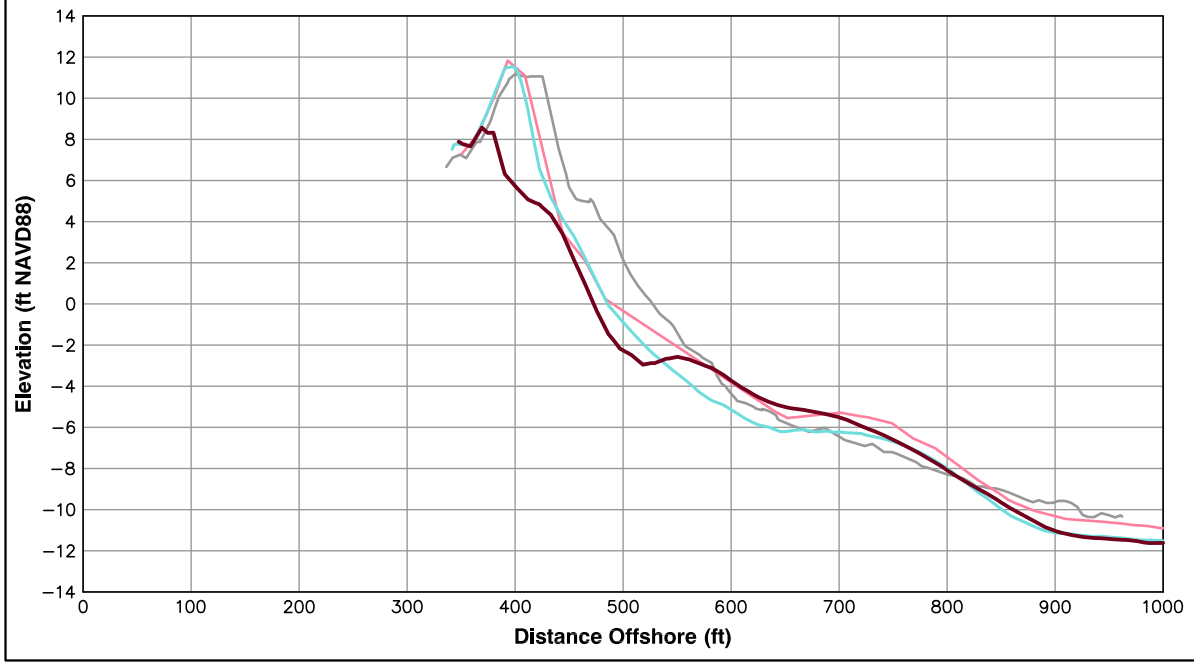
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 55+51	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-12.51 ft/yr	-11.73 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-5.31 cy/ft
Volume Change Above 0 ft NAVD88	-11.34 cy/ft/yr	-9.56 cy/ft

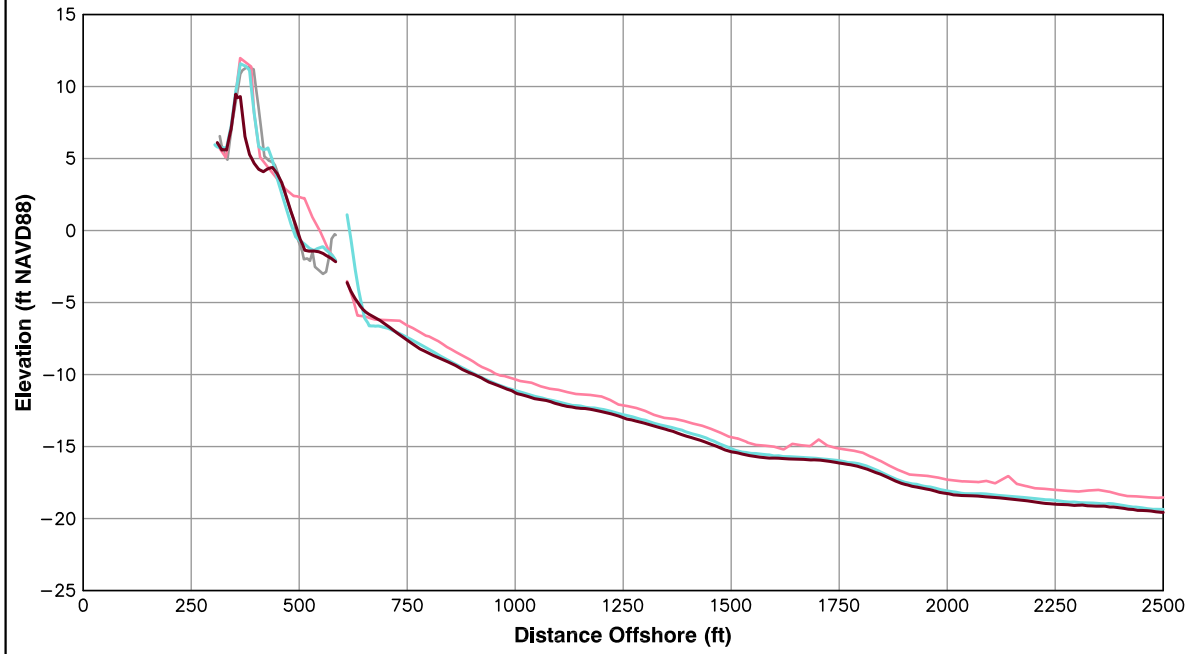
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- 2009 APR
- POST-FILL

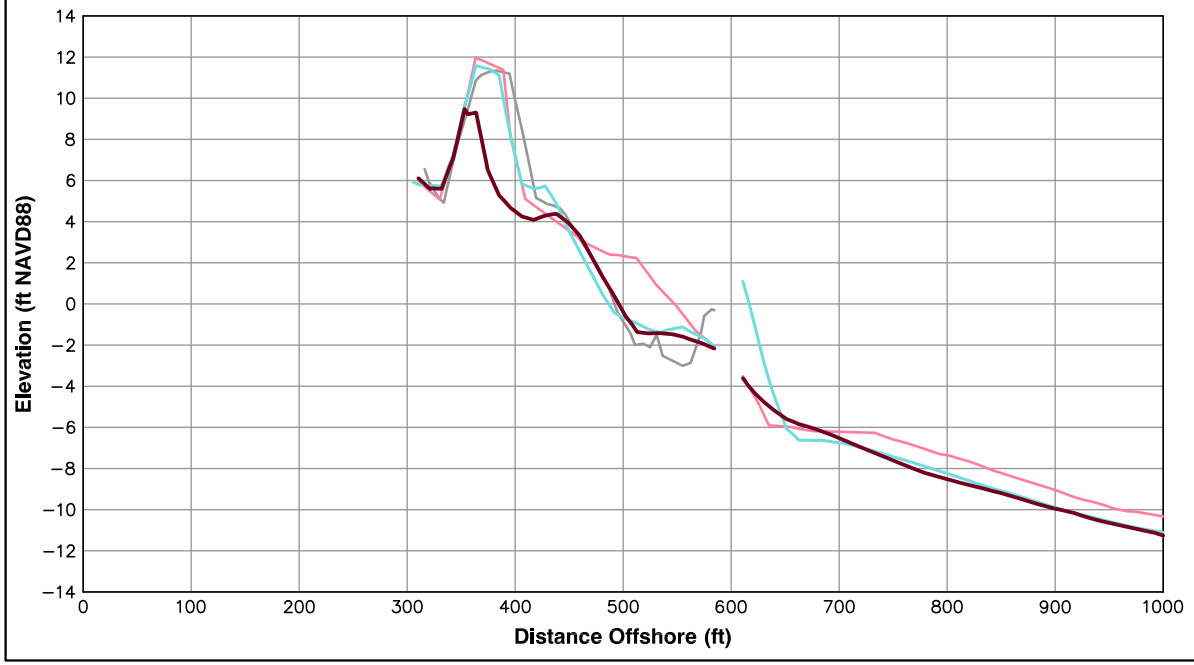
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 57+57	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-49.20 ft/yr	9.13 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-14.83 cy/ft
Volume Change Above 0 ft NAVD88	-12.72 cy/ft/yr	-7.55 cy/ft

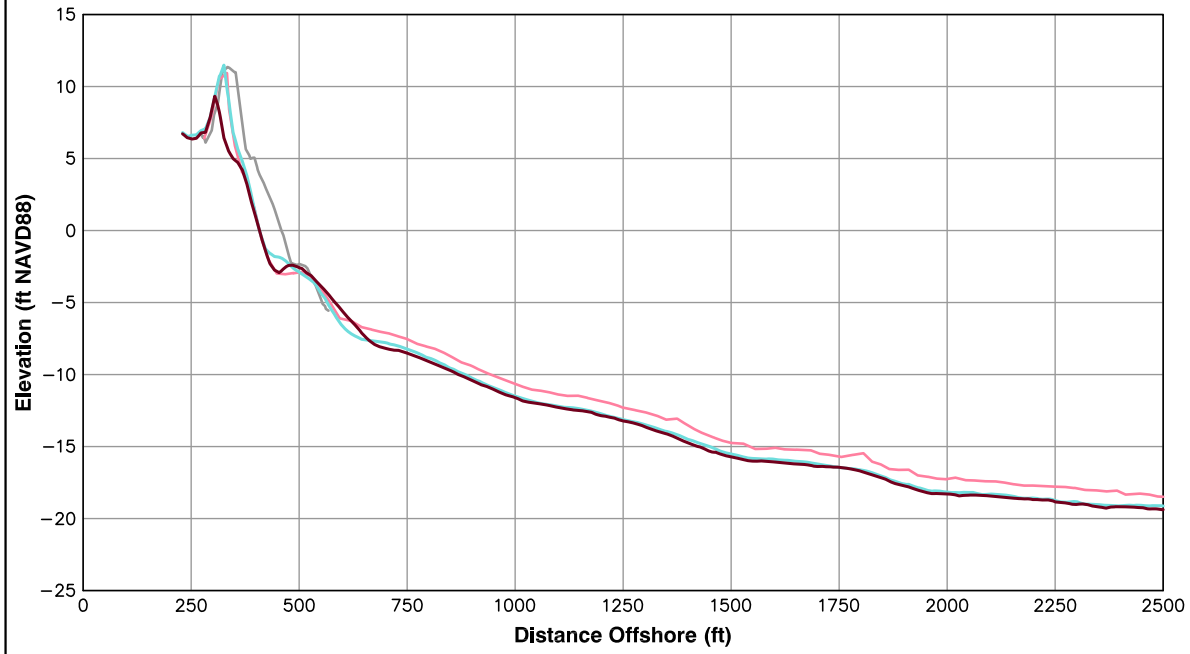
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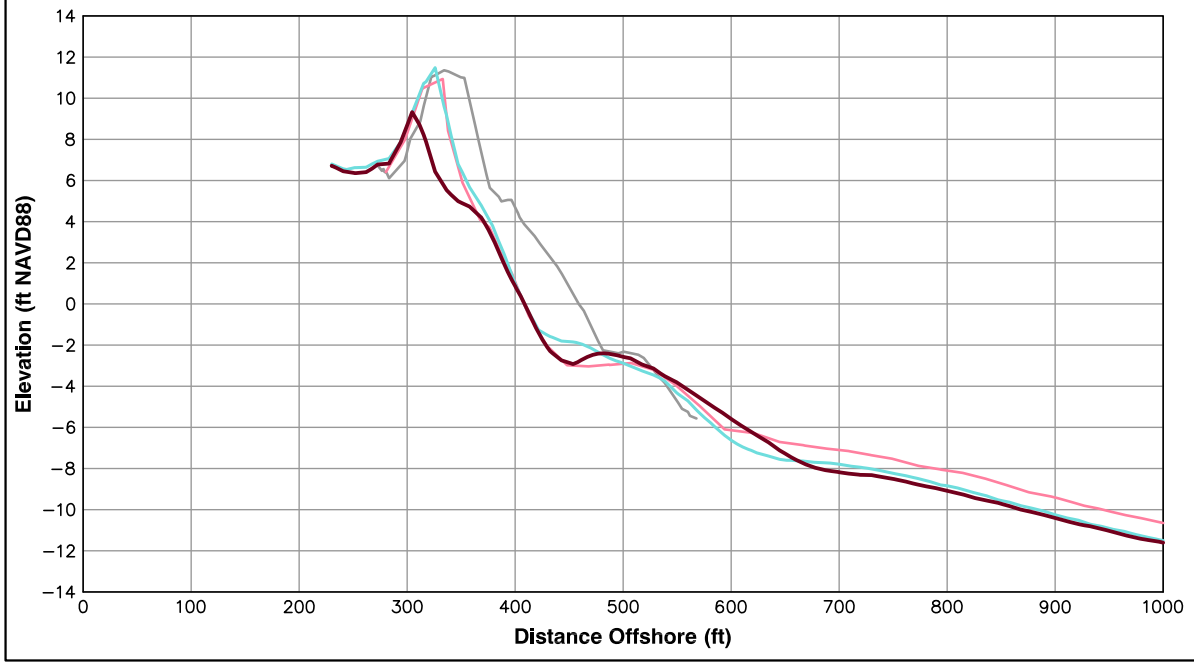
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 59+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-2.00 ft/yr	-1.21 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-9.20 cy/ft
Volume Change Above 0 ft NAVD88	-5.31 cy/ft/yr	-6.51 cy/ft

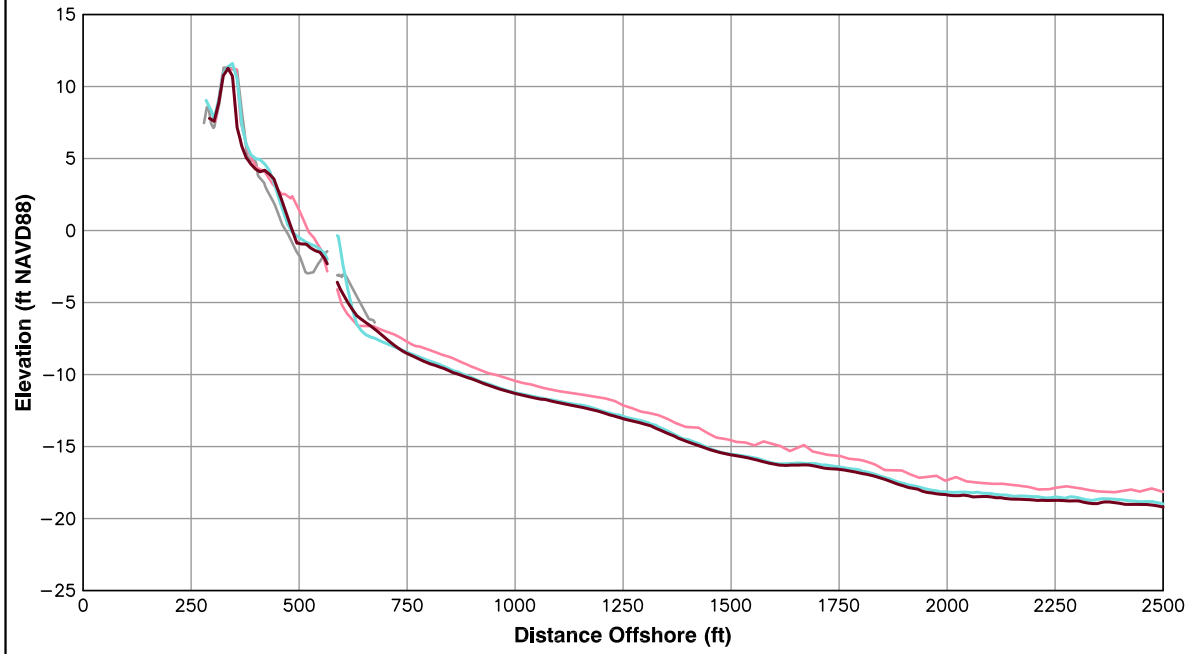
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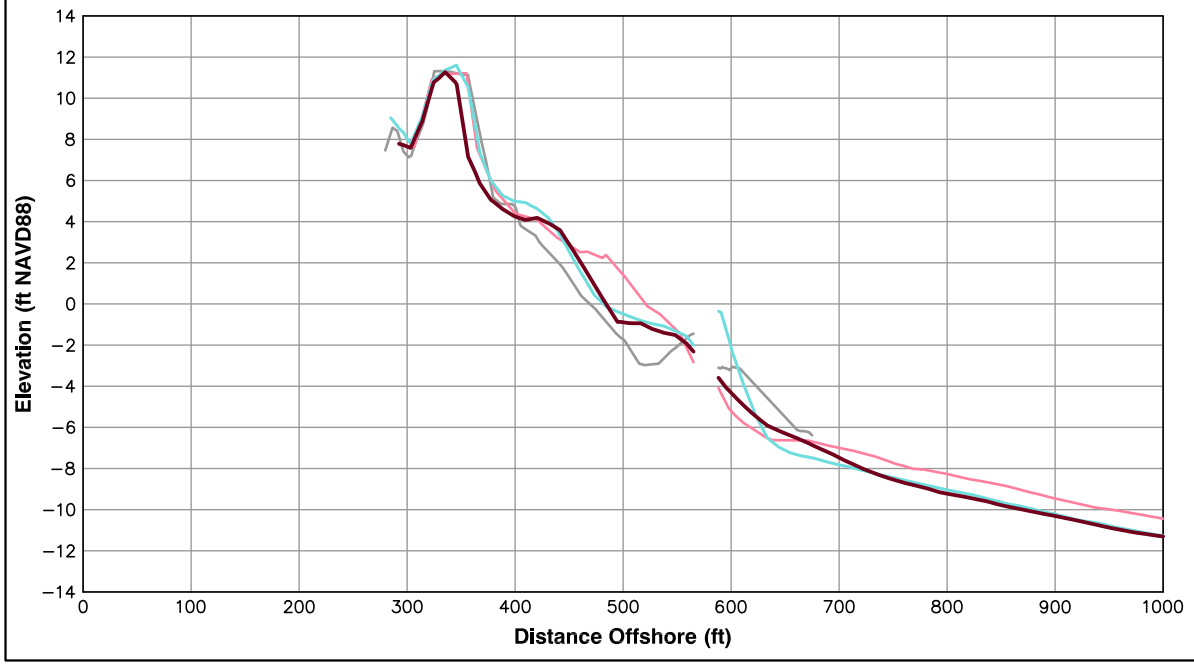
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 61+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-37.05 ft/yr	5.43 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-7.73 cy/ft
Volume Change Above 0 ft NAVD88	-6.06 cy/ft/yr	-3.60 cy/ft

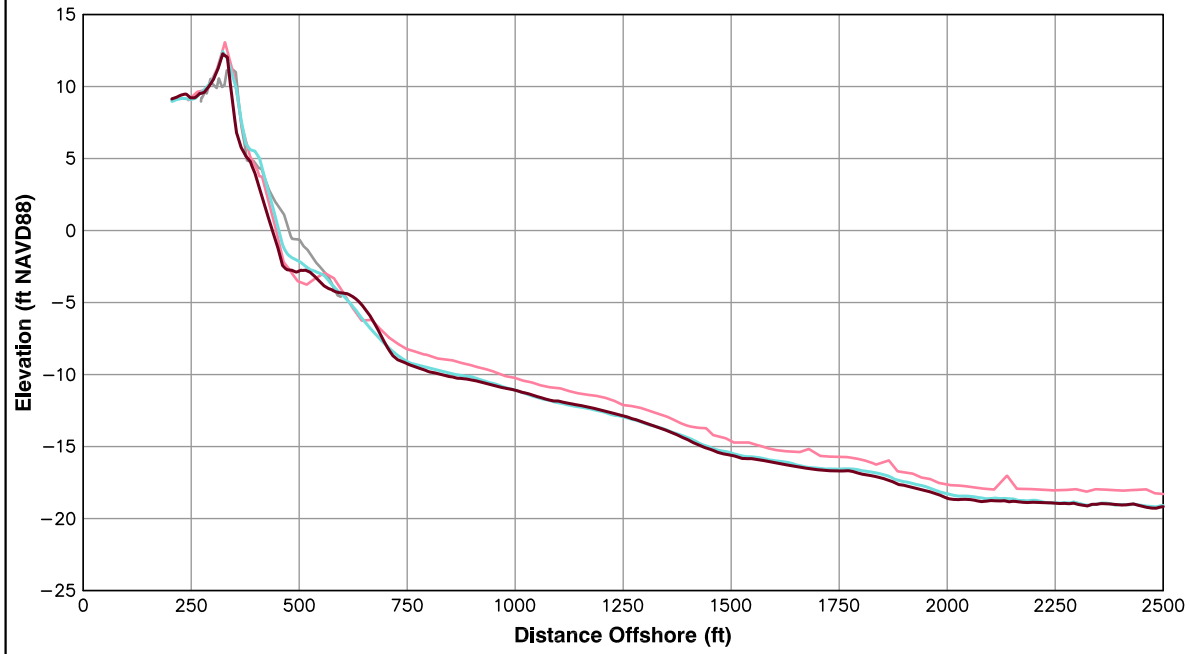
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- 2009 APR
- POST-FILL

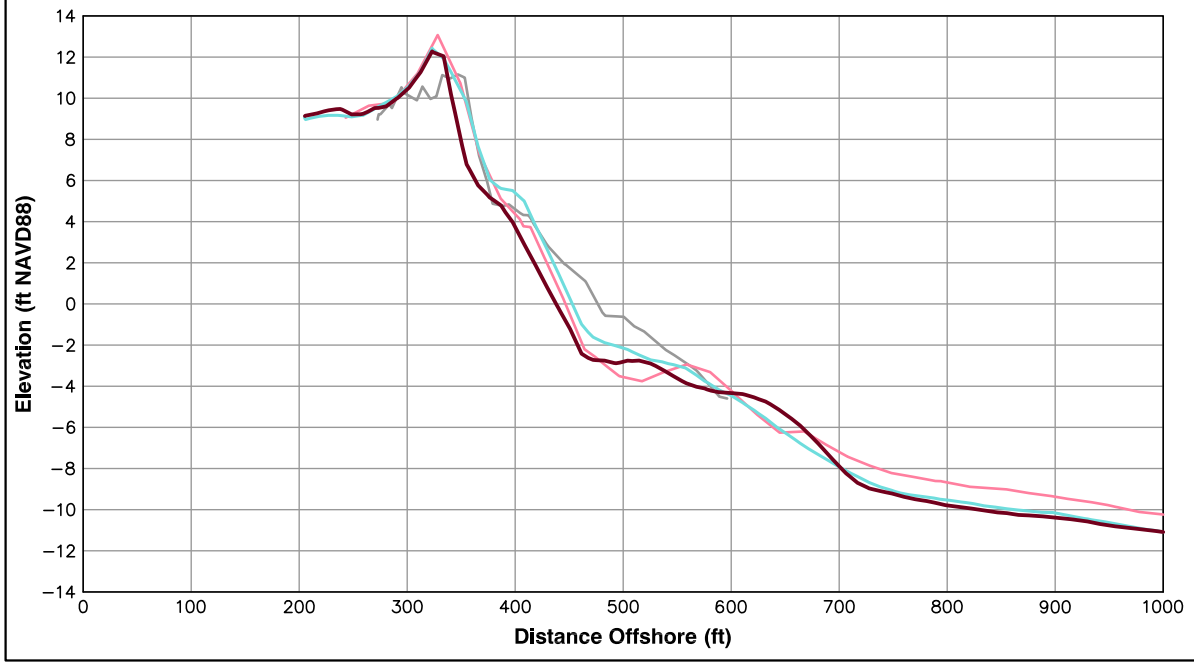
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 63+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-11.36 ft/yr	-16.61 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-9.52 cy/ft
Volume Change Above 0 ft NAVD88	-6.33 cy/ft/yr	-6.63 cy/ft

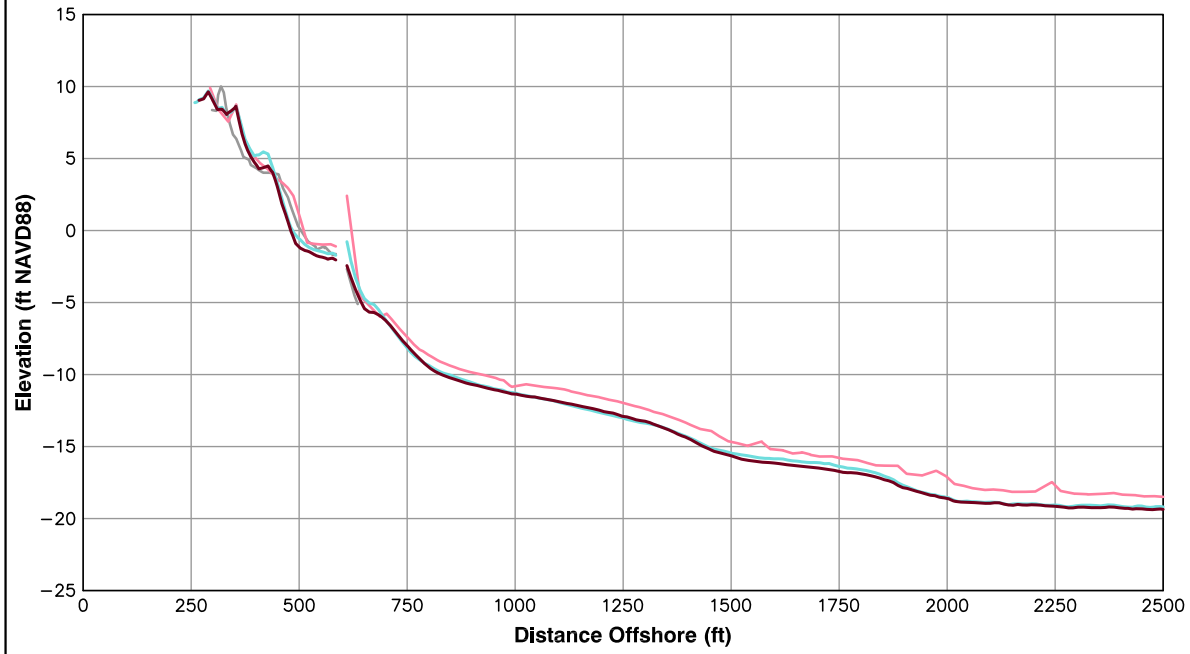
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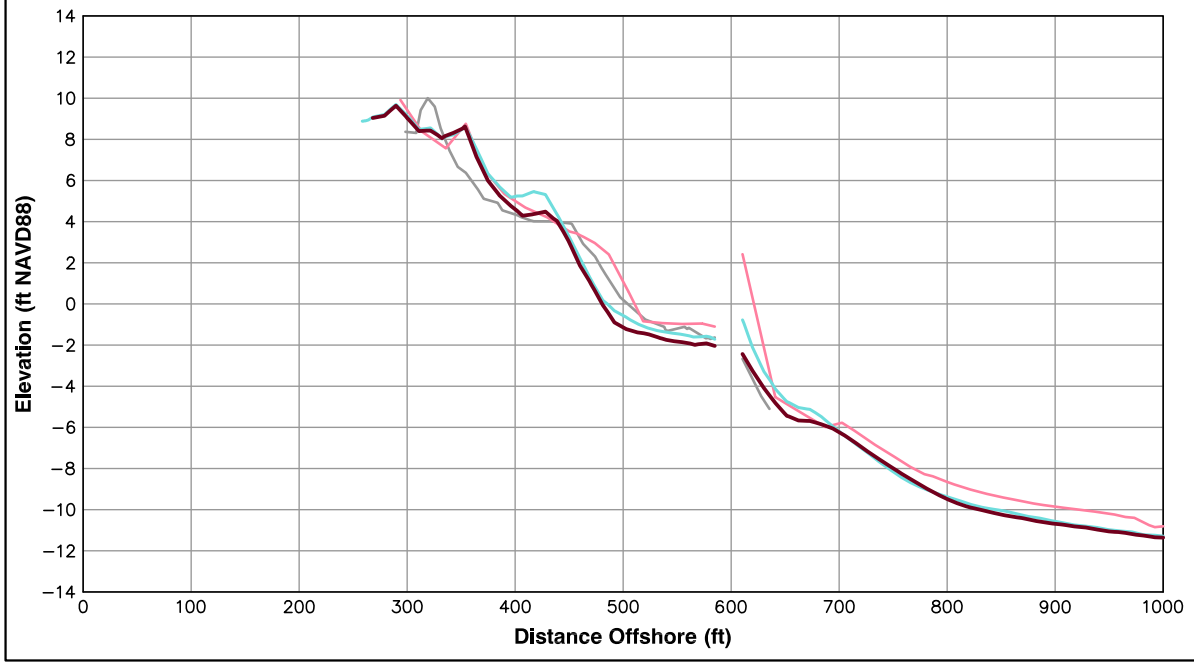
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 65+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-33.79 ft/yr	-2.16 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.01 cy/ft
Volume Change Above 0 ft NAVD88	-5.05 cy/ft/yr	-2.40 cy/ft

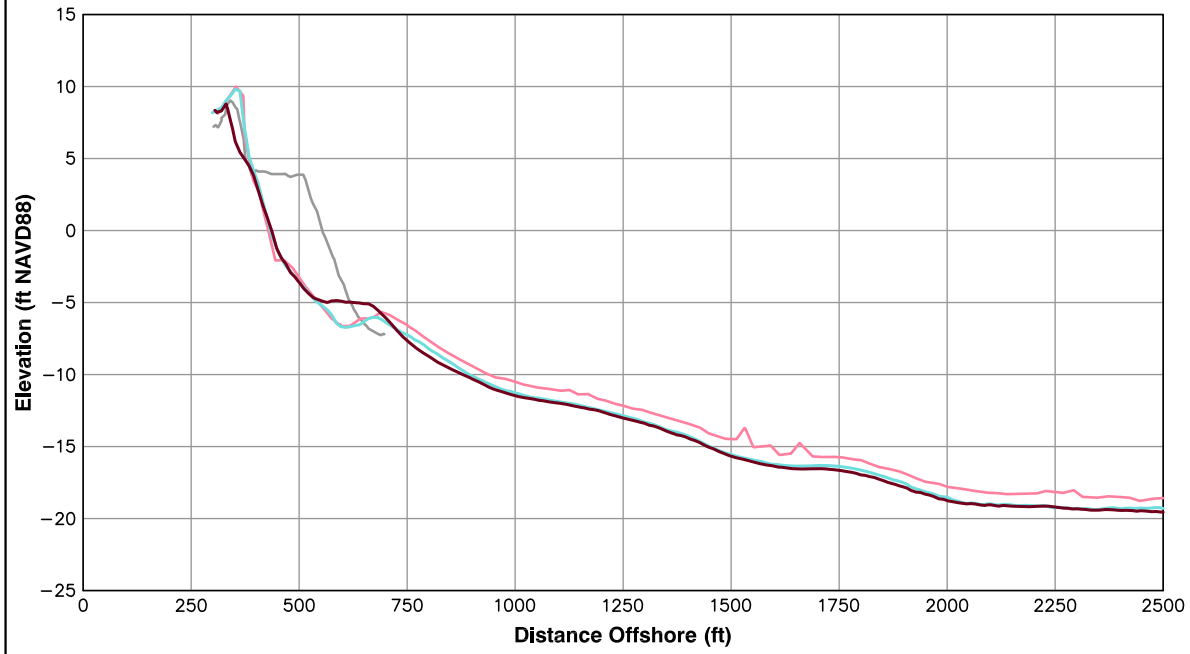
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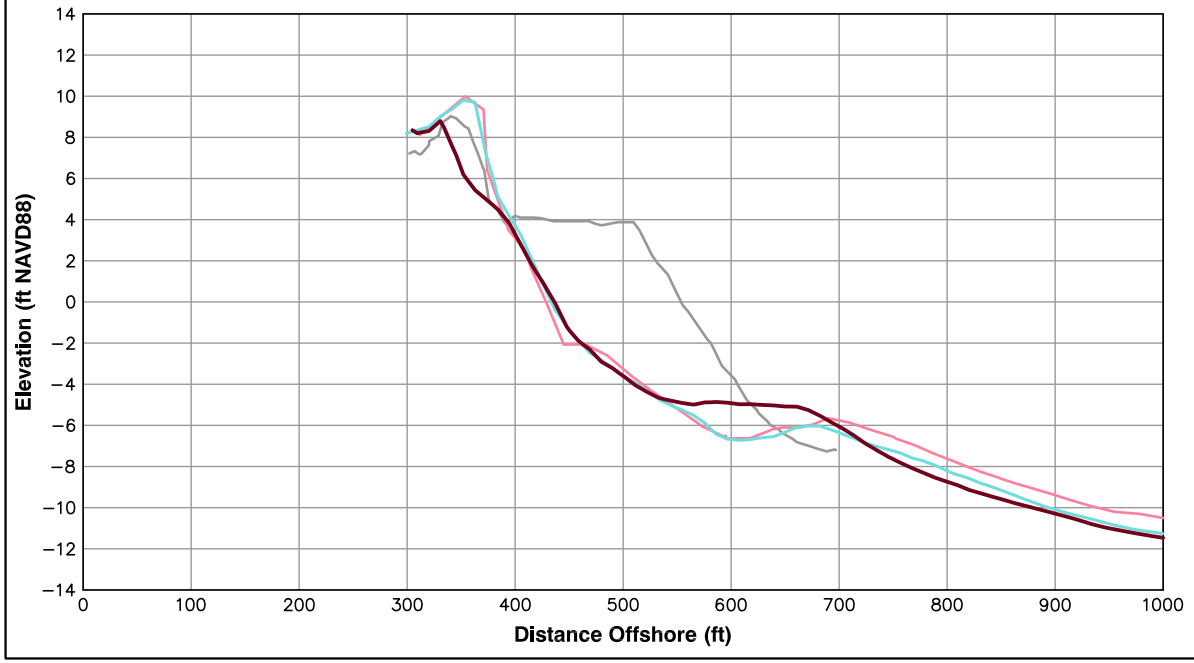
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

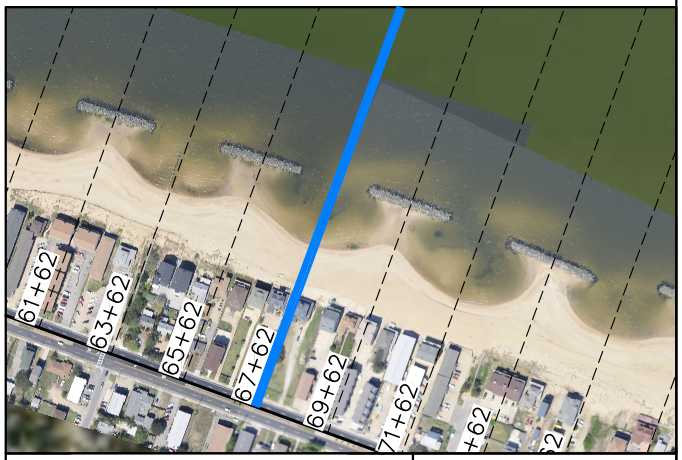




Survey Transect 67+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	5.39 ft/yr	0.52 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-4.38 cy/ft
Volume Change Above 0 ft NAVD88	-5.13 cy/ft/yr	-5.43 cy/ft

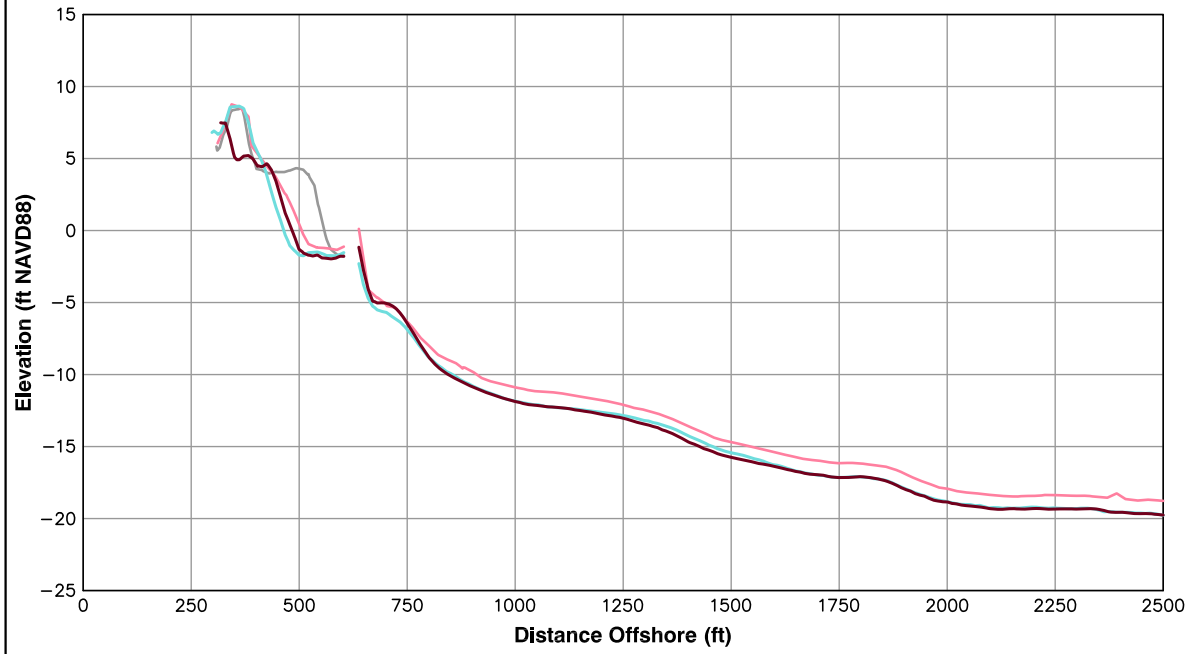
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- POST-FILL

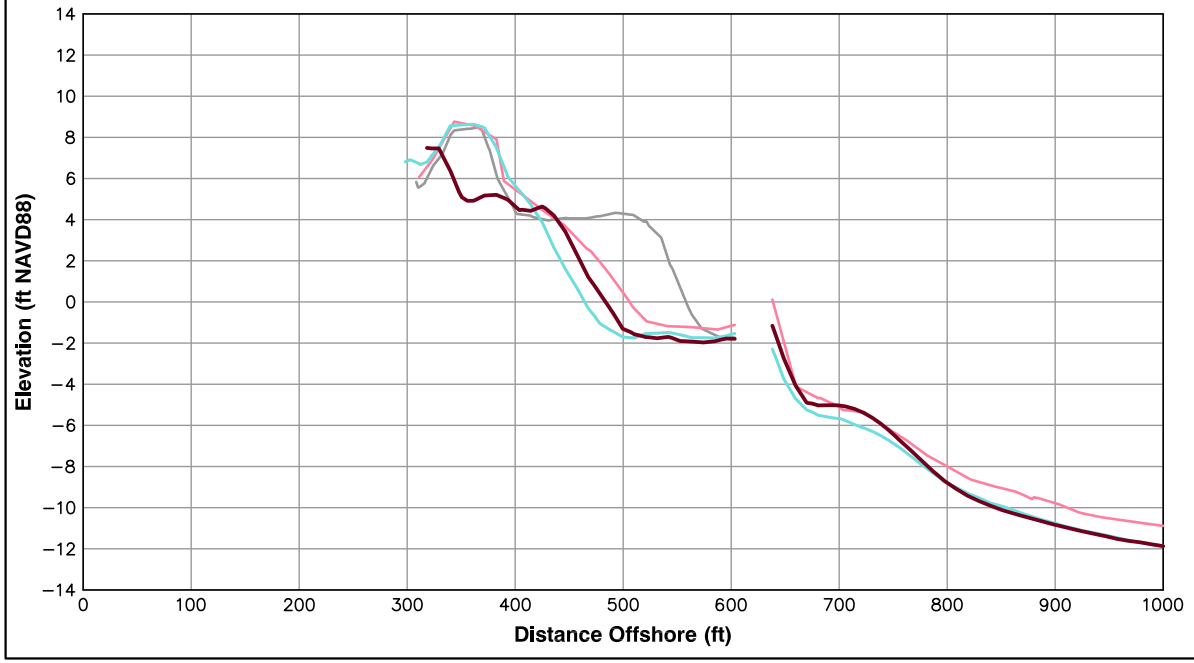
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

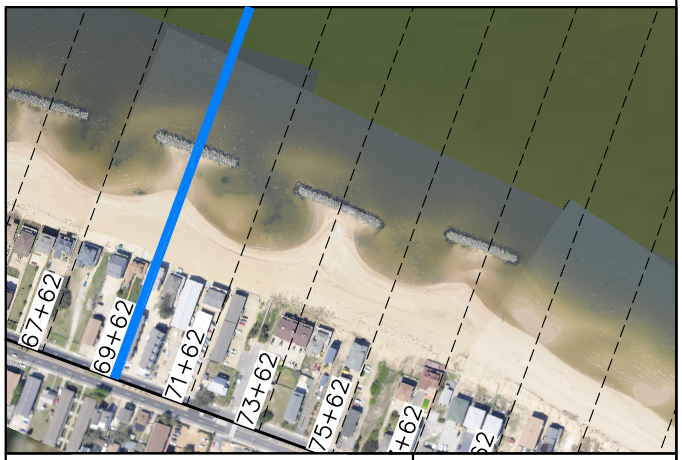




Survey Transect 69+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-23.67 ft/yr	17.16 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.77 cy/ft
Volume Change Above 0 ft NAVD88	-9.45 cy/ft/yr	-3.84 cy/ft

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

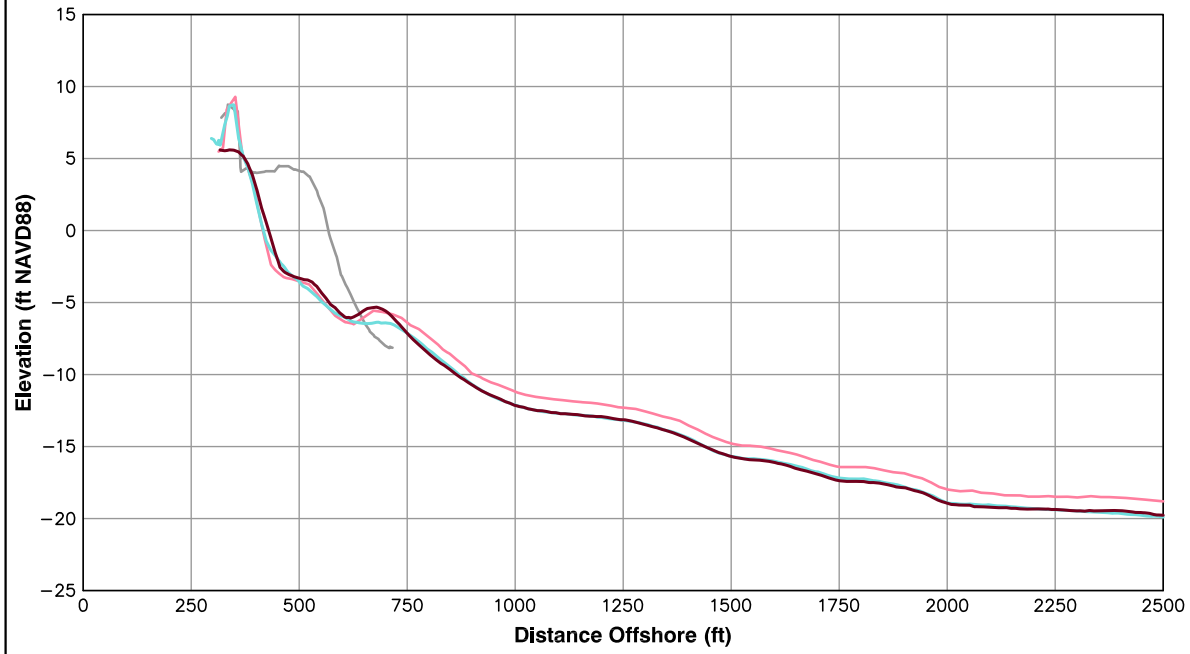
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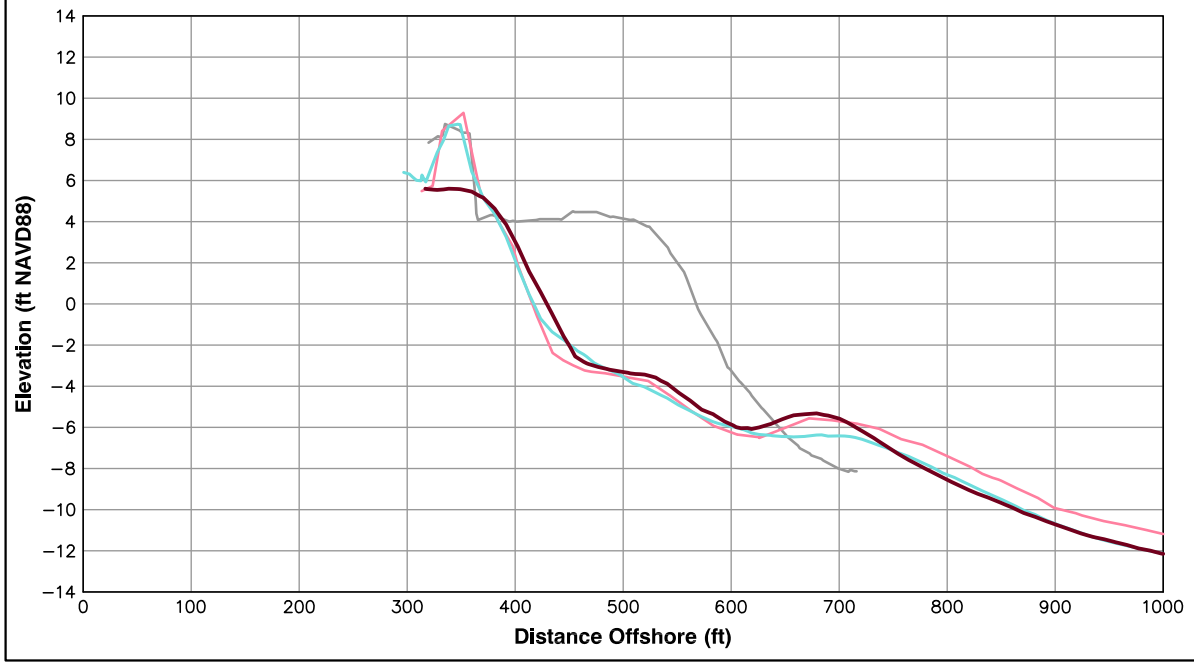


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 69+62	Pg 32 of 106	SPRING 2010





Survey Transect 71+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	11.25 ft/yr	10.41 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	2.29 cy/ft
Volume Change Above 0 ft NAVD88	-3.02 cy/ft/yr	-2.20 cy/ft

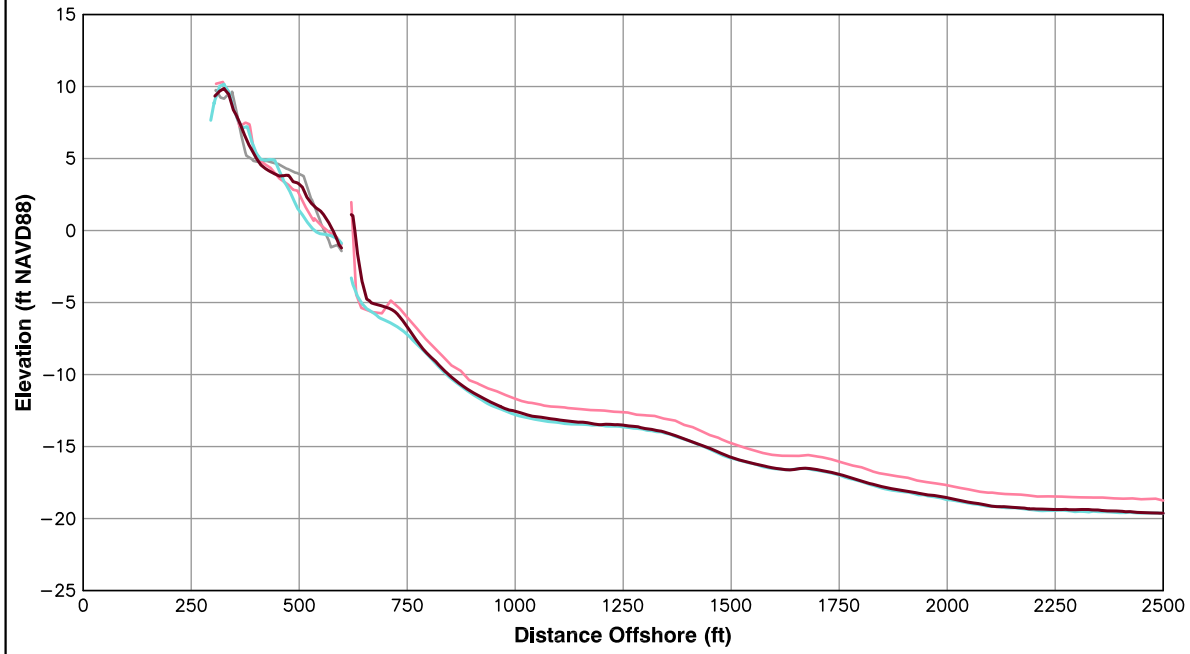
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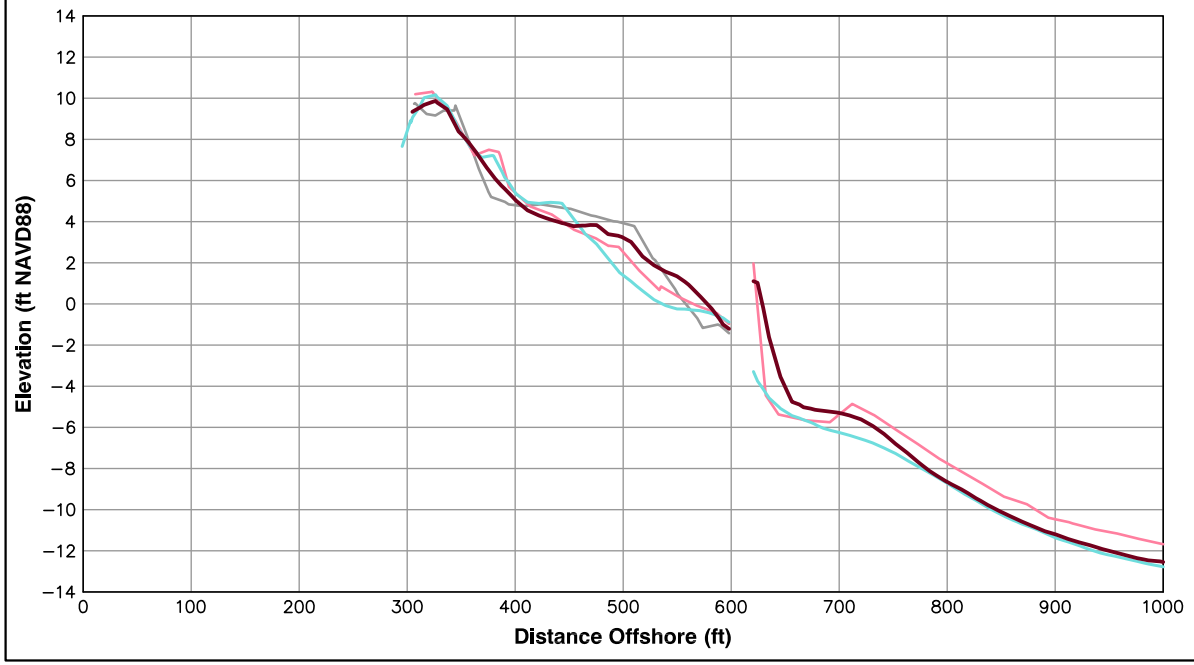
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

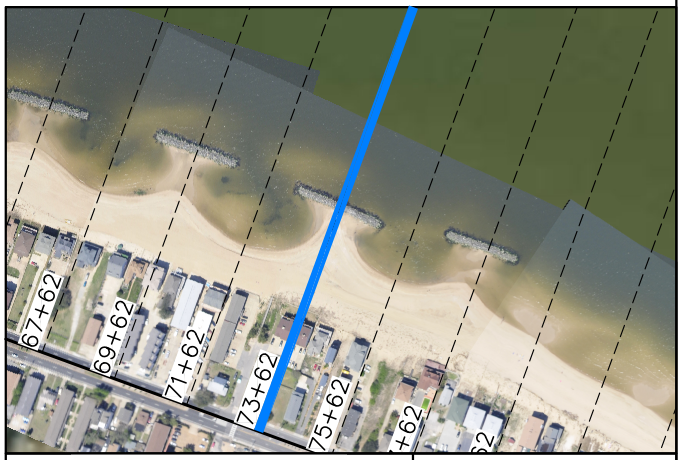




Survey Transect 73+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	34.93 ft/yr	49.54 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	13.20 cy/ft
Volume Change Above 0 ft NAVD88	1.51 cy/ft/yr	3.33 cy/ft

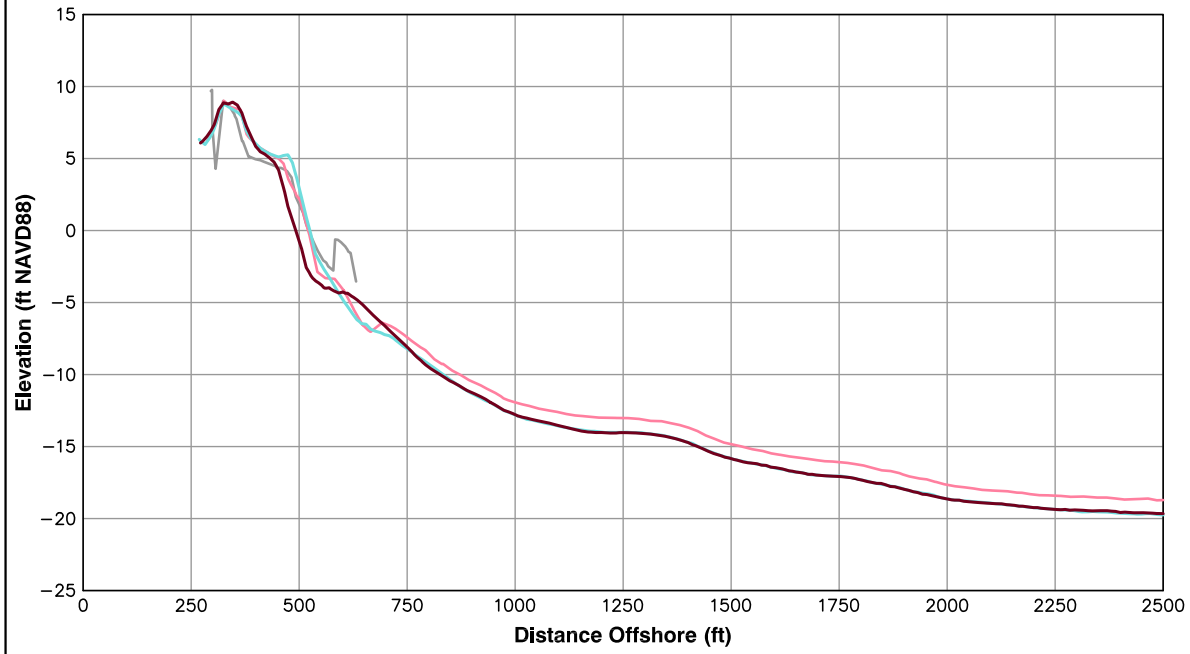
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- 2009 APR
- POST-FILL

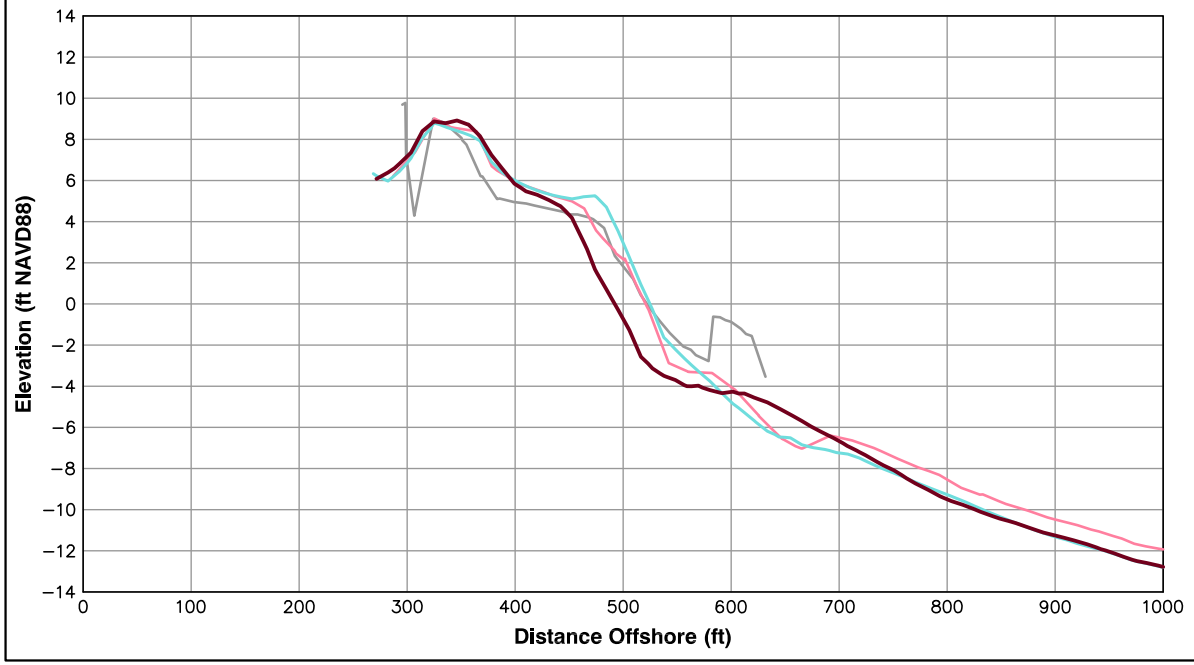
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 75+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-32.99 ft/yr	-34.65 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.10 cy/ft
Volume Change Above 0 ft NAVD88	-4.43 cy/ft/yr	-6.10 cy/ft

LEGEND:
- 2010 MAR
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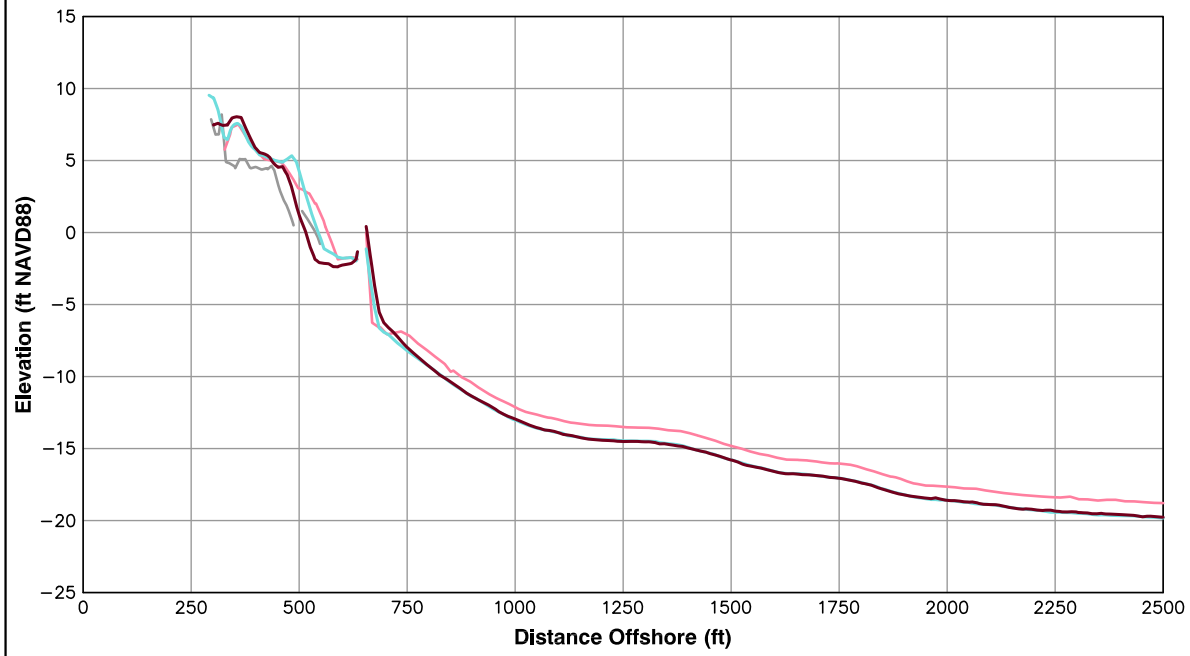
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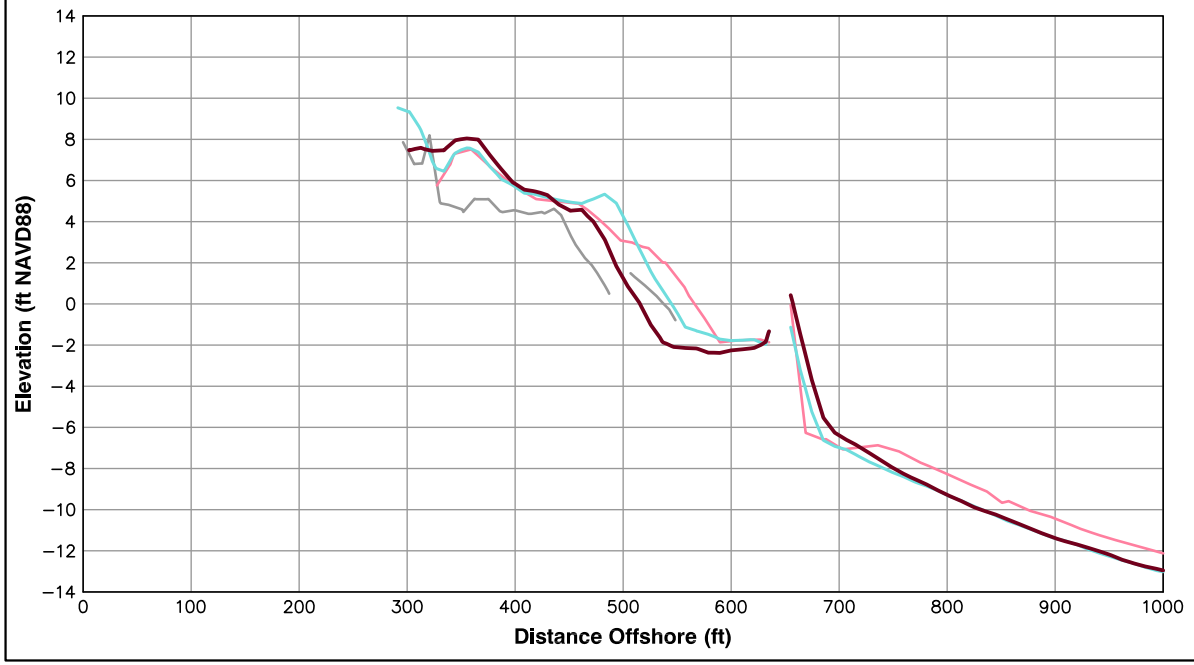


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 75+62	Pg 35 of 106	SPRING 2010





Survey Transect 77+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-56.17 ft/yr	-29.59 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-5.50 cy/ft
Volume Change Above 0 ft NAVD88	-4.27 cy/ft/yr	-4.78 cy/ft

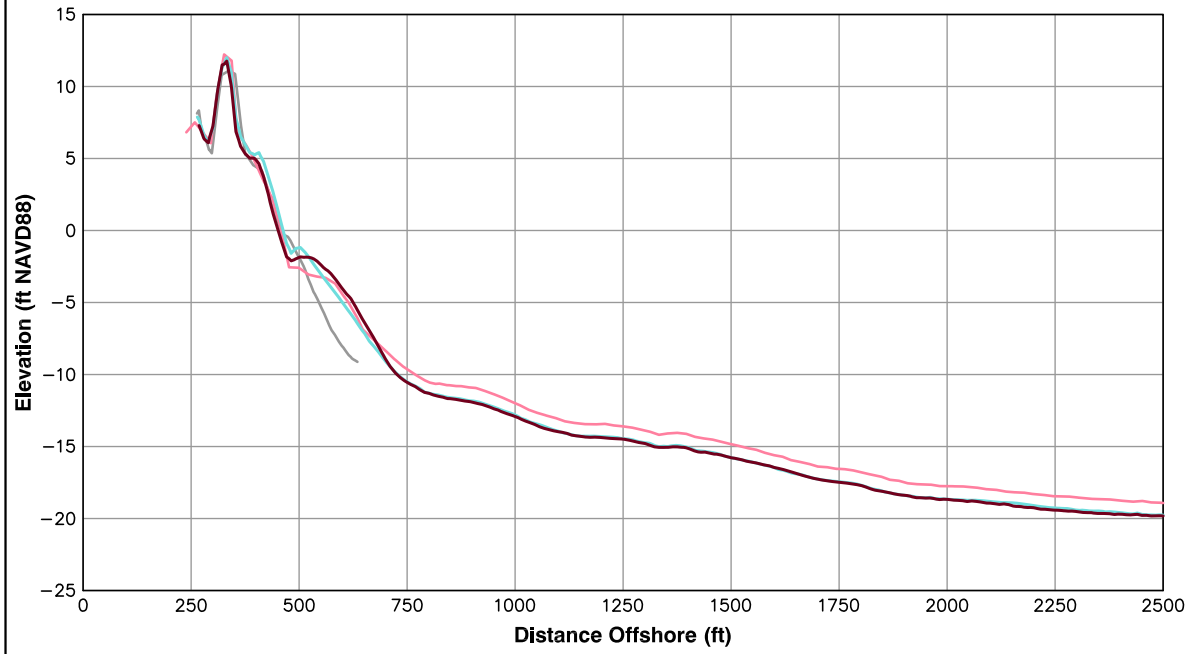
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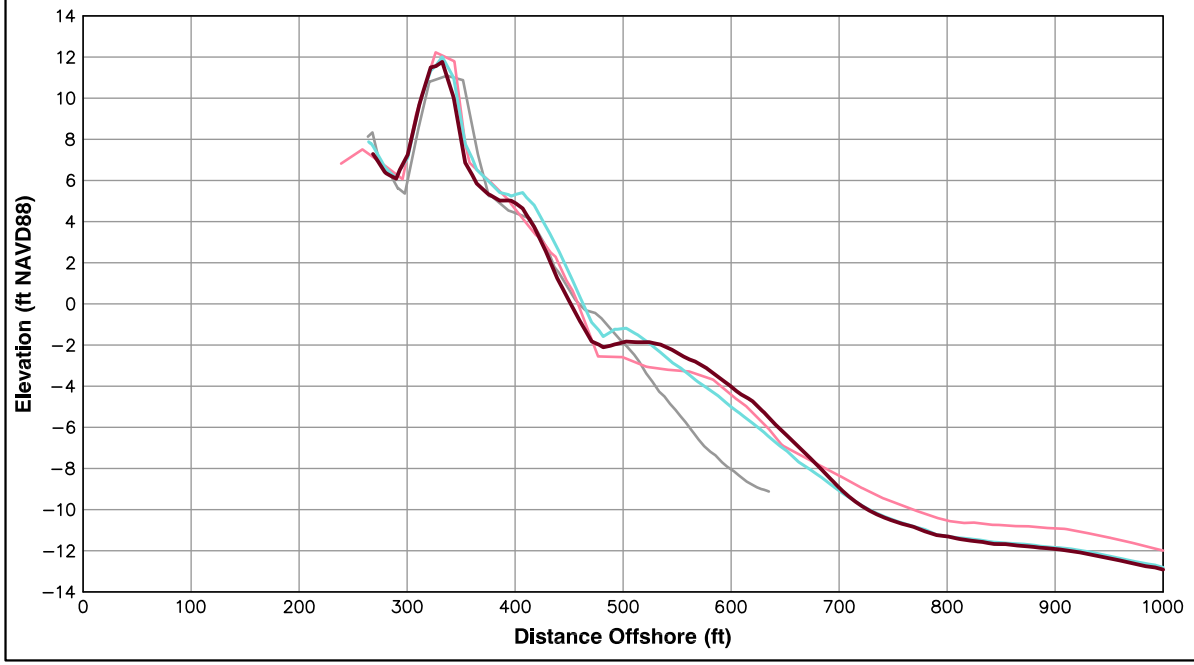
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 79+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-8.44 ft/yr	-12.85 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-2.62 cy/ft
Volume Change Above 0 ft NAVD88	-2.65 cy/ft/yr	-4.09 cy/ft

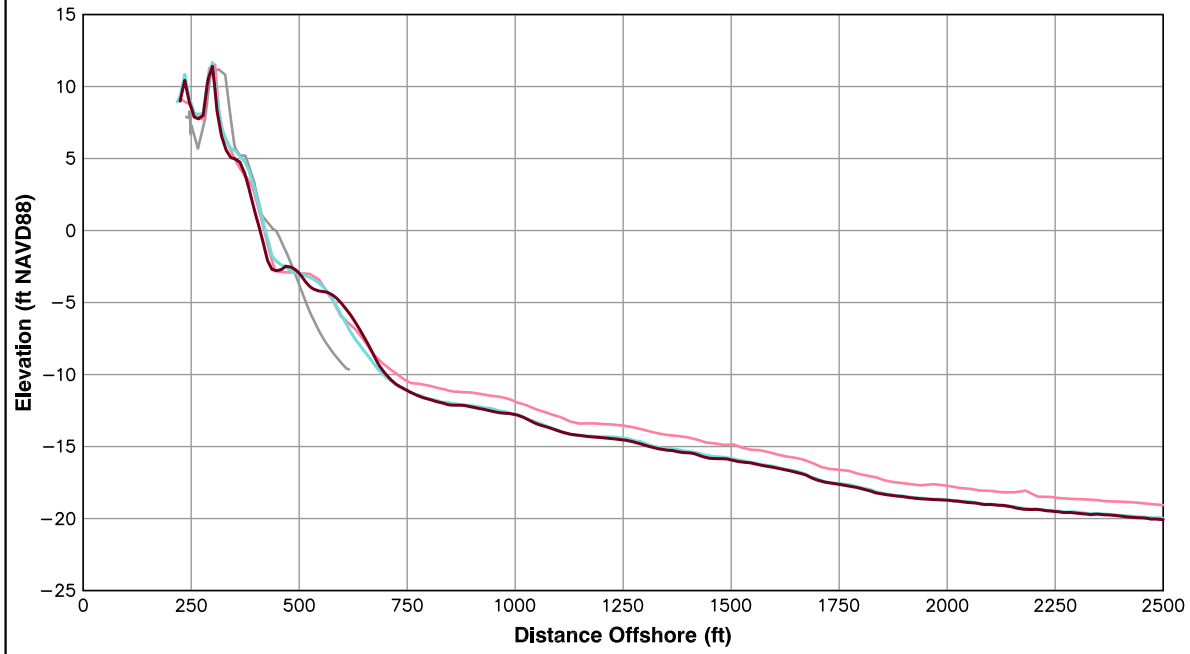
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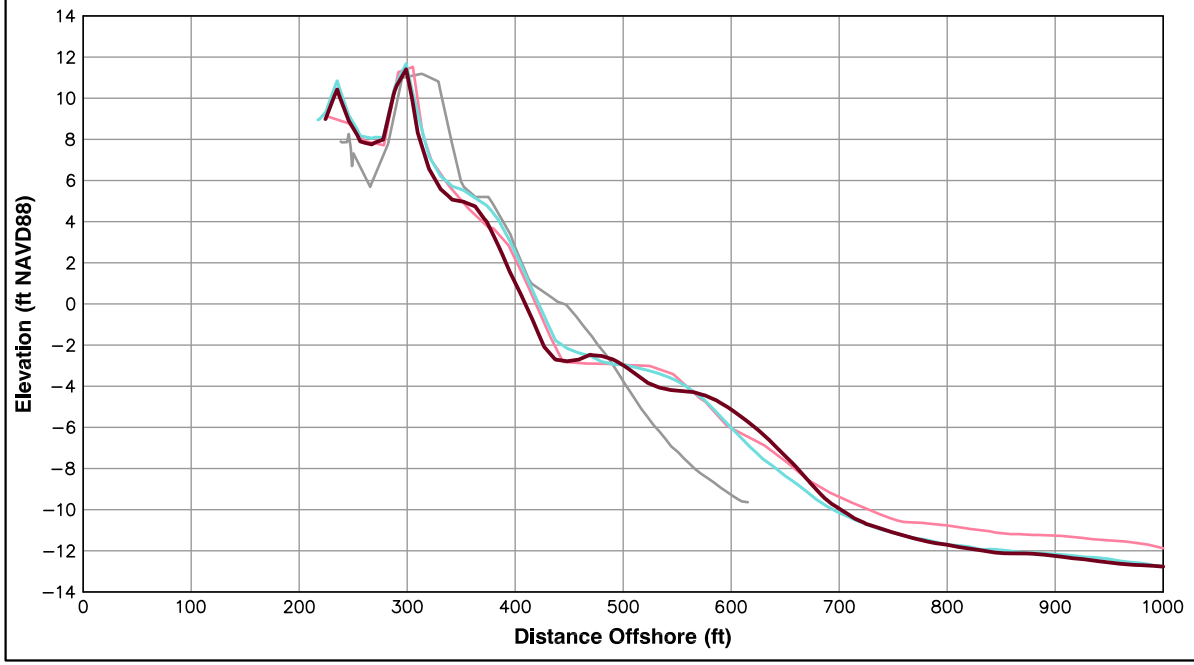
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 81+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-11.31 ft/yr	-12.90 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-4.75 cy/ft
Volume Change Above 0 ft NAVD88	-2.10 cy/ft/yr	-4.46 cy/ft

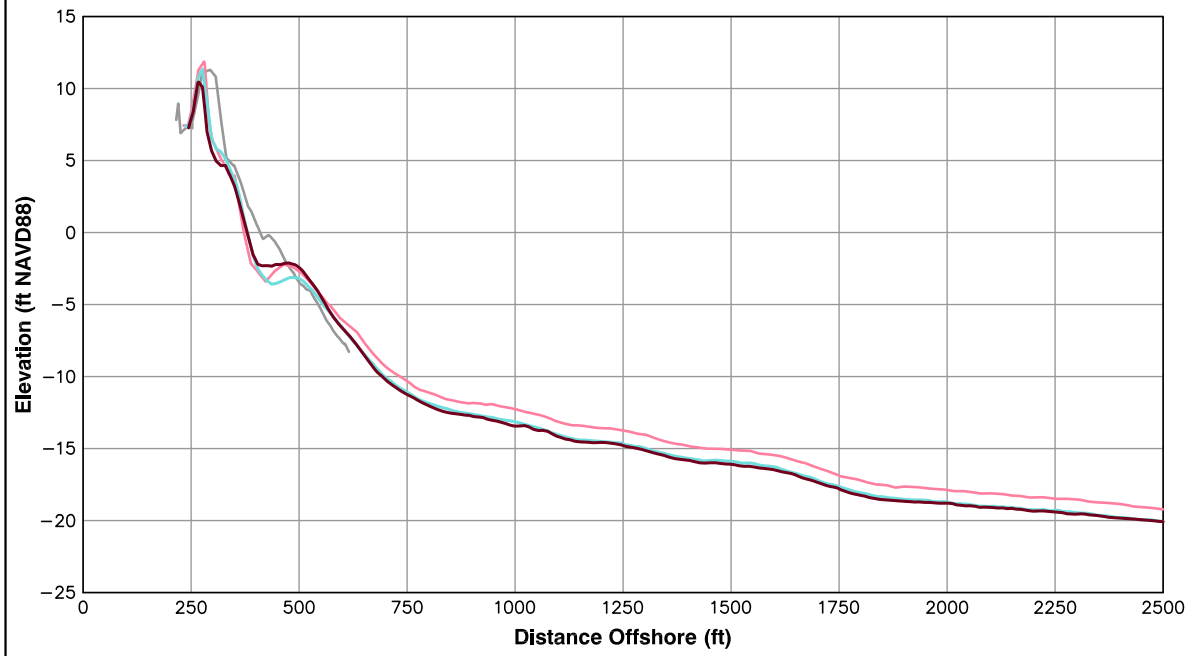
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- 2009 APR
- POST-FILL

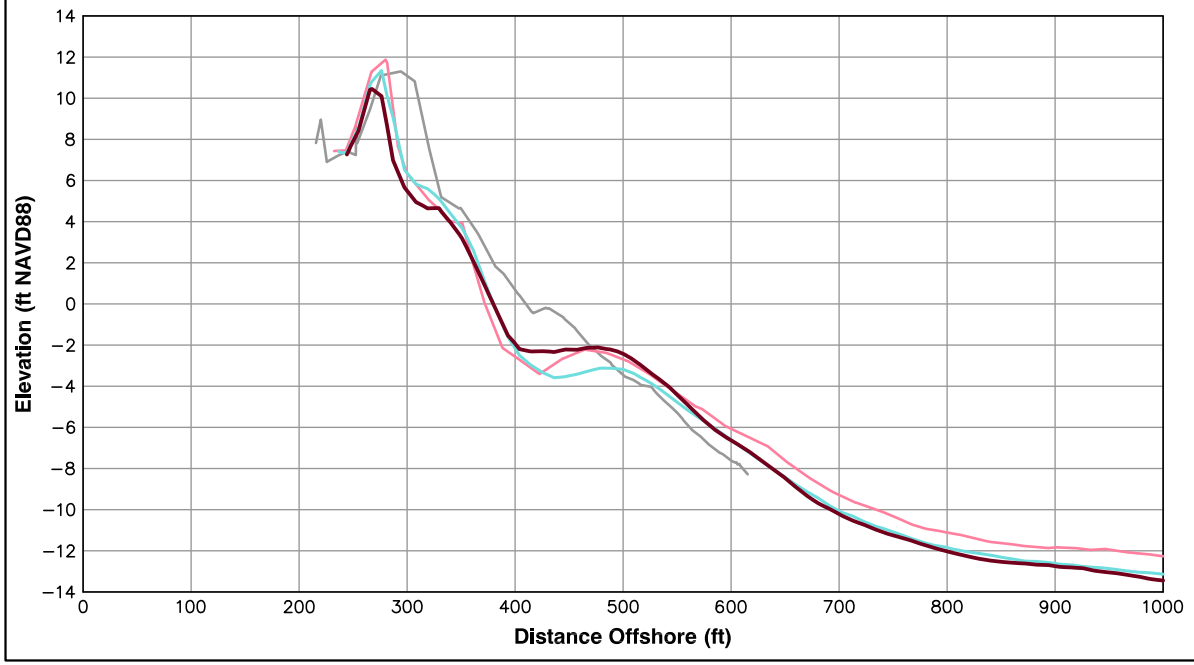
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 83+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	5.07 ft/yr	-1.48 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-2.06 cy/ft
Volume Change Above 0 ft NAVD88	-3.43 cy/ft/yr	-3.33 cy/ft

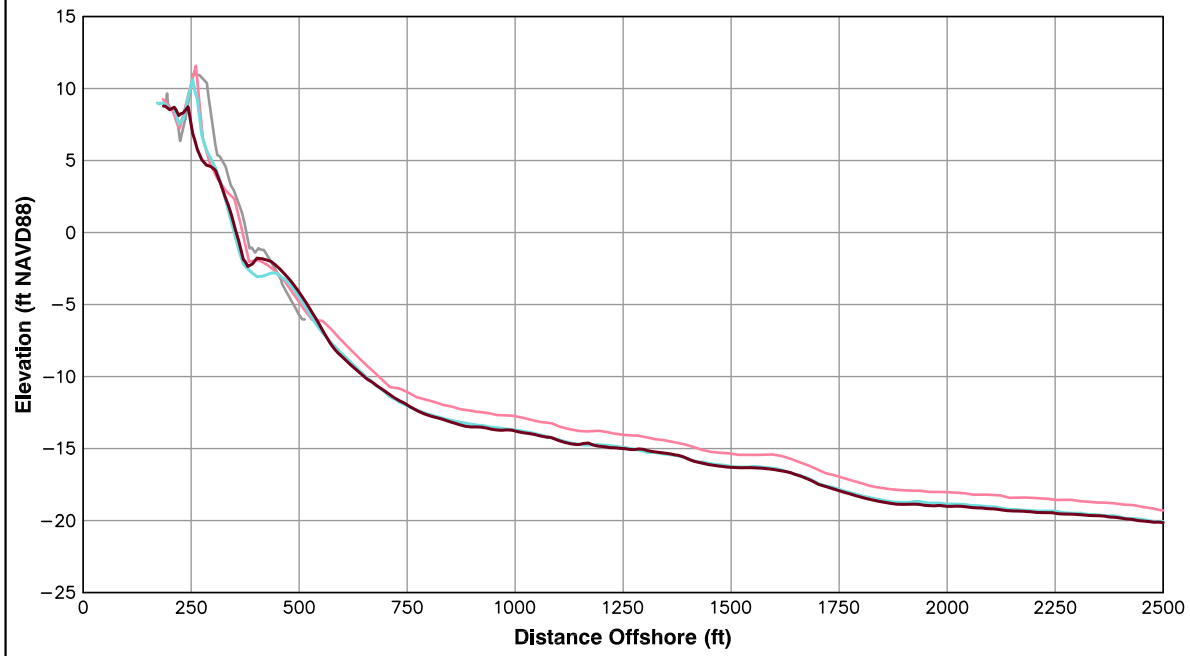
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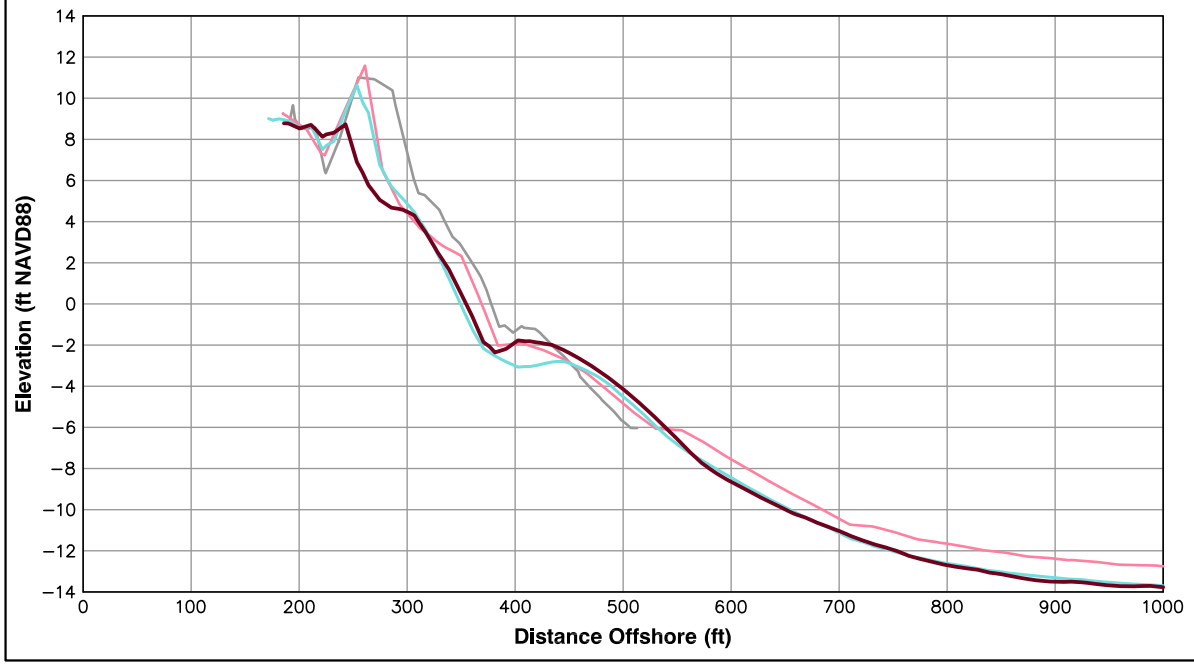
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 85+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-17.32 ft/yr	4.34 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-1.46 cy/ft
Volume Change Above 0 ft NAVD88	-6.83 cy/ft/yr	-3.72 cy/ft

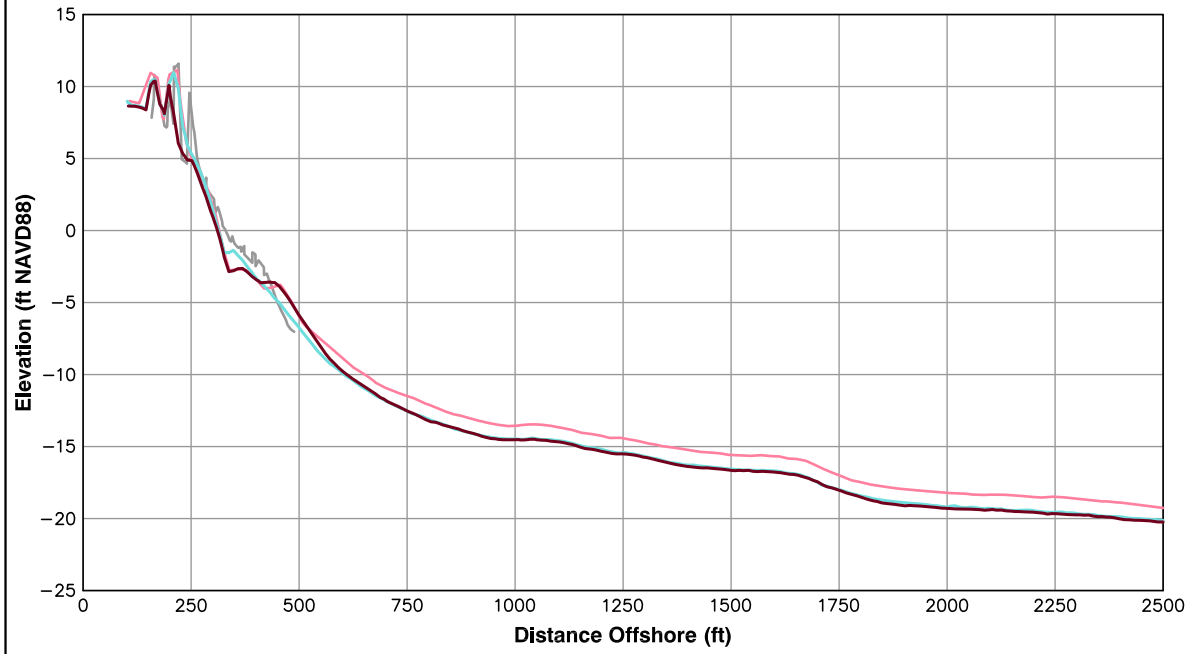
LEGEND:
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- 2009 OCT
- 2009 APR
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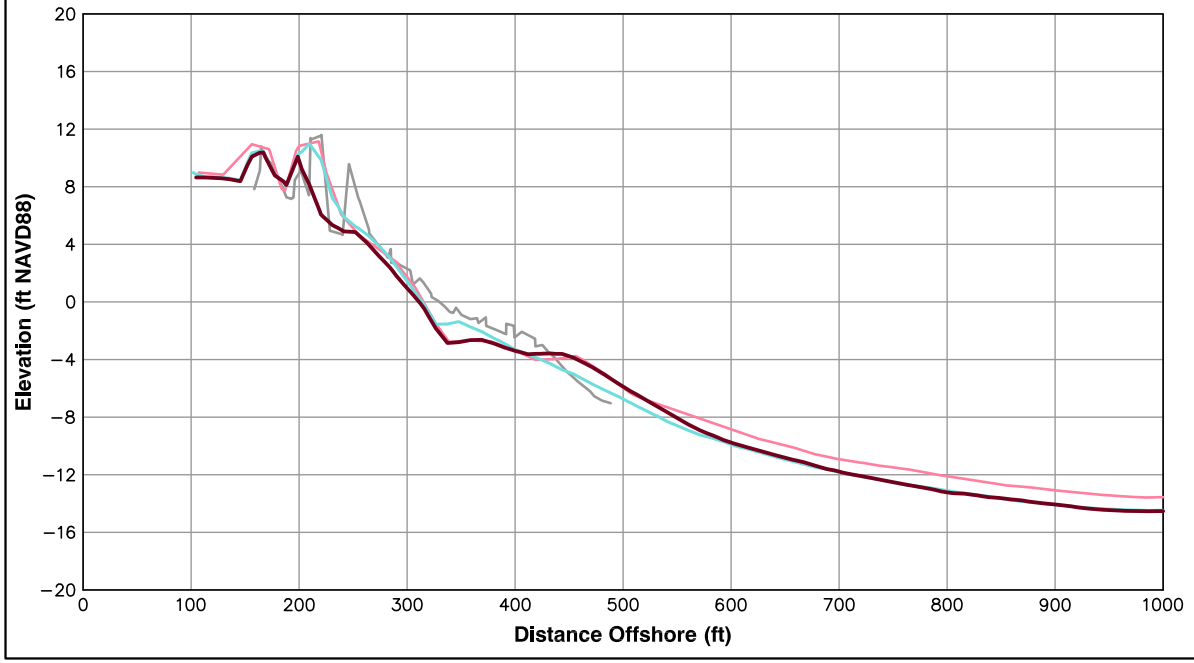
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 87+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-8.84 ft/yr	-4.77 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.08 cy/ft
Volume Change Above 0 ft NAVD88	-8.24 cy/ft/yr	-5.42 cy/ft

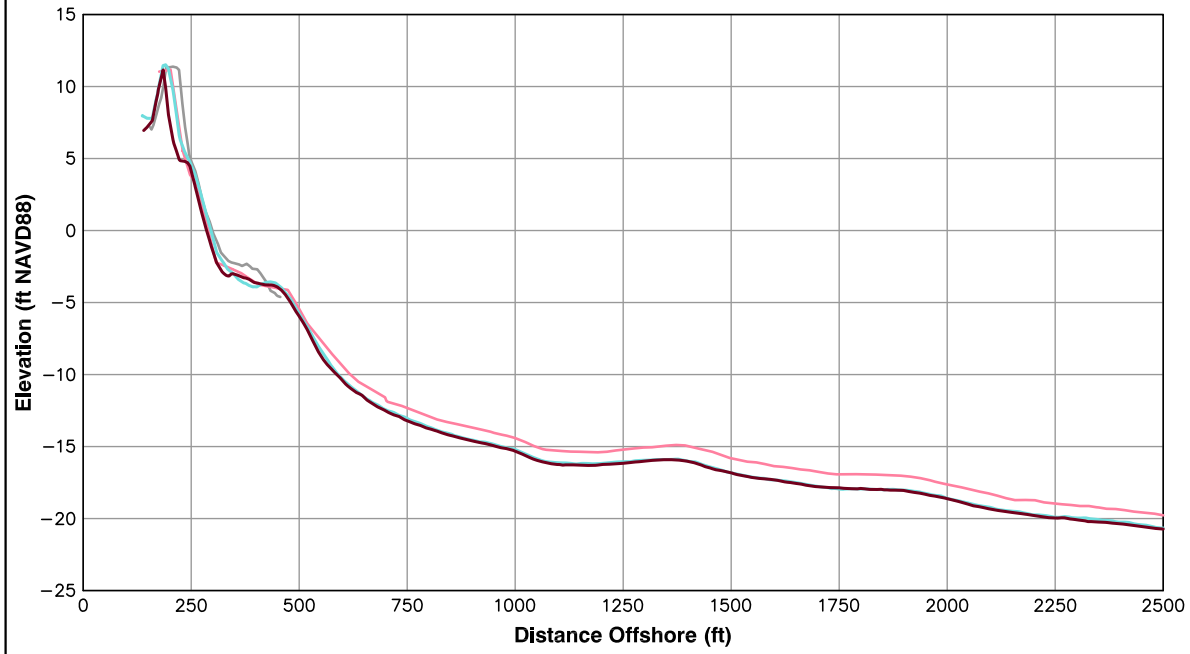
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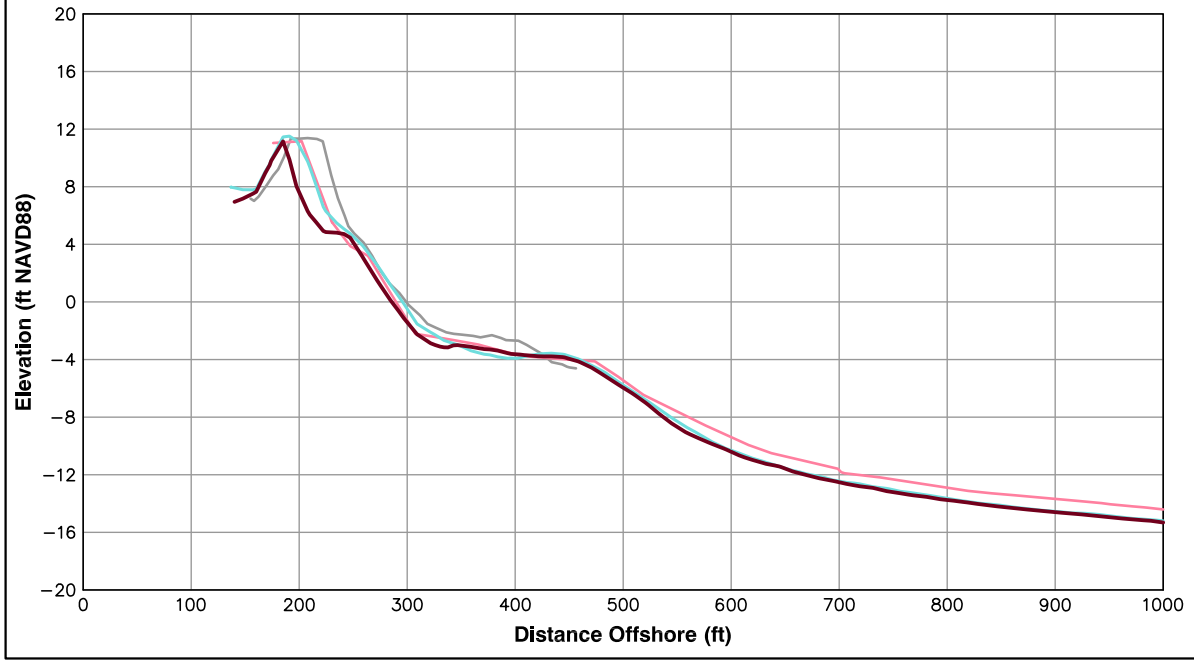
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

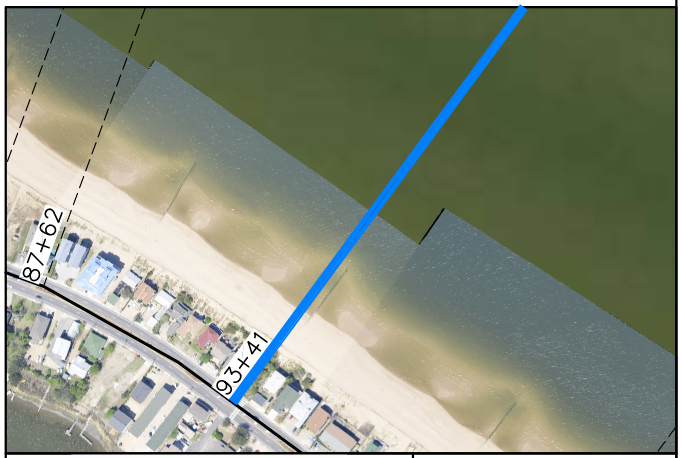




Survey Transect 93+41	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-5.29 ft/yr	-9.70 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-9.71 cy/ft
Volume Change Above 0 ft NAVD88	-5.30 cy/ft/yr	-6.17 cy/ft

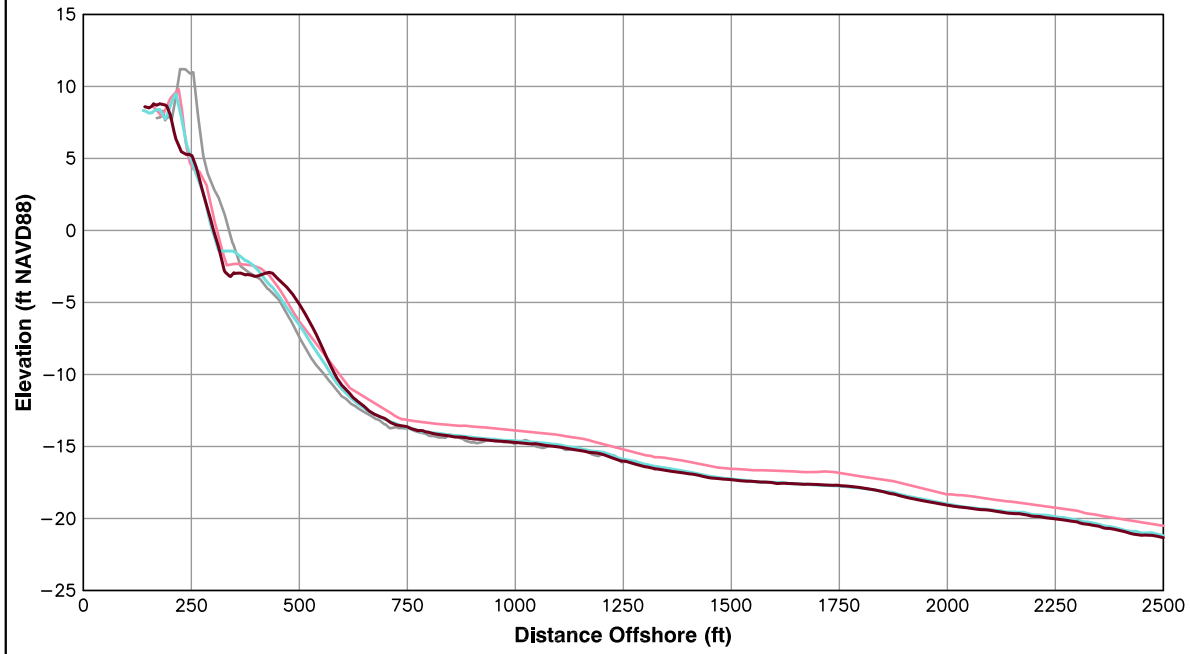
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- 2009 APR
- POST-FILL

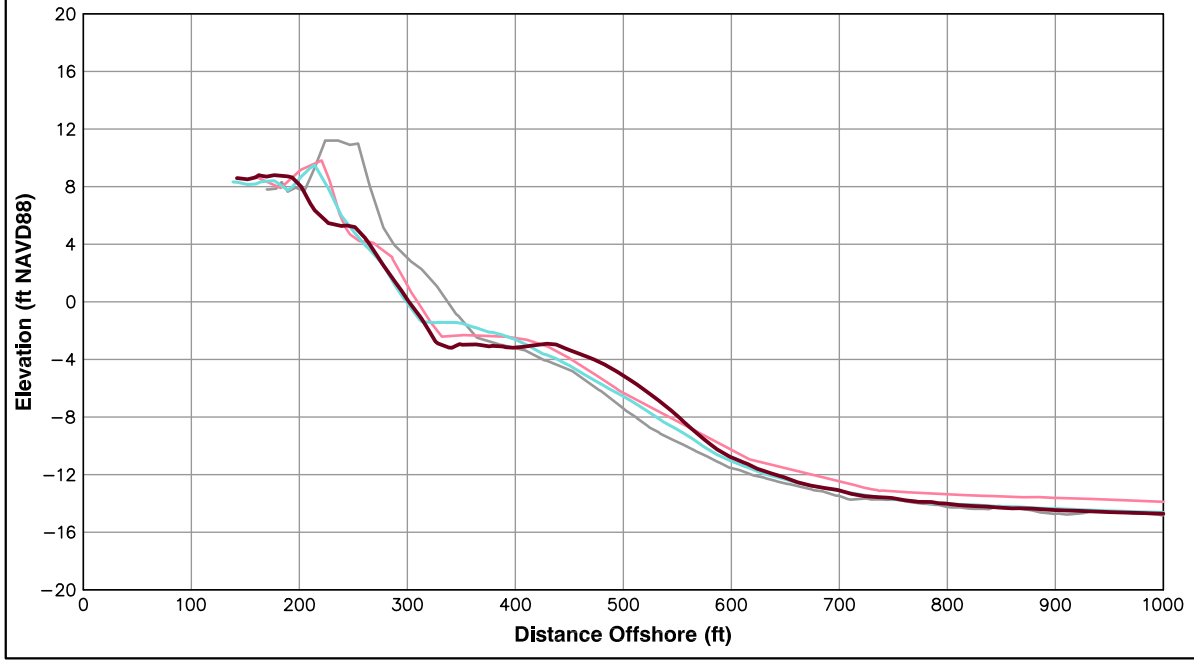
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 103+08	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-8.93 ft/yr	2.54 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	1.05 cy/ft
Volume Change Above 0 ft NAVD88	-4.67 cy/ft/yr	-1.57 cy/ft

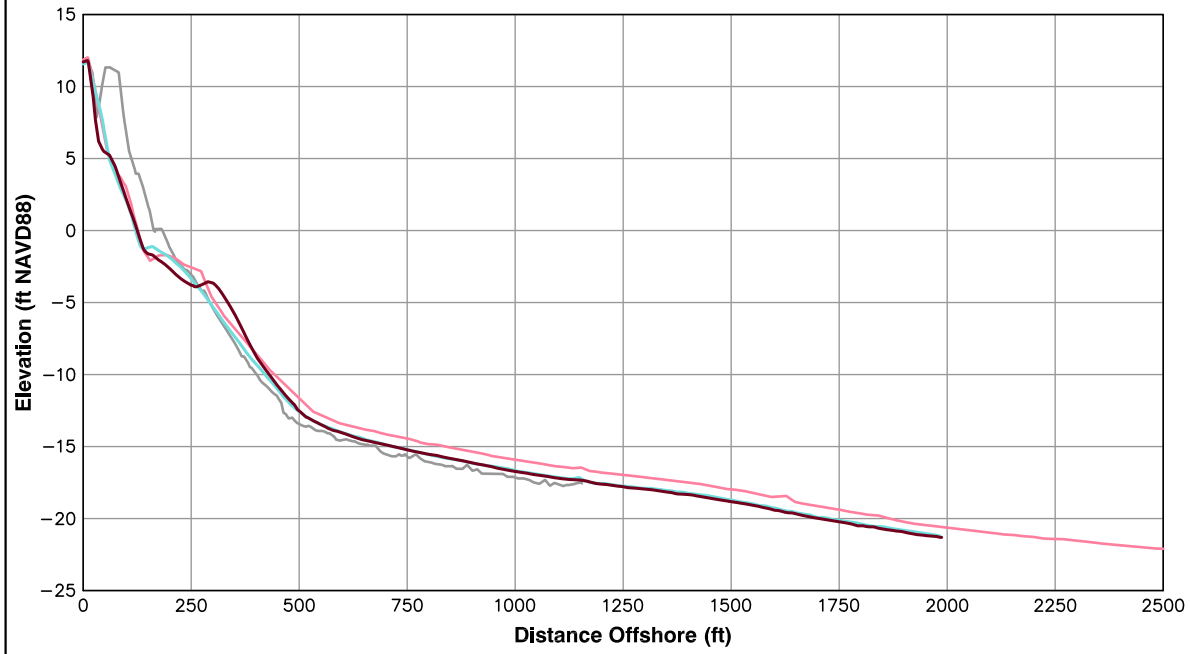
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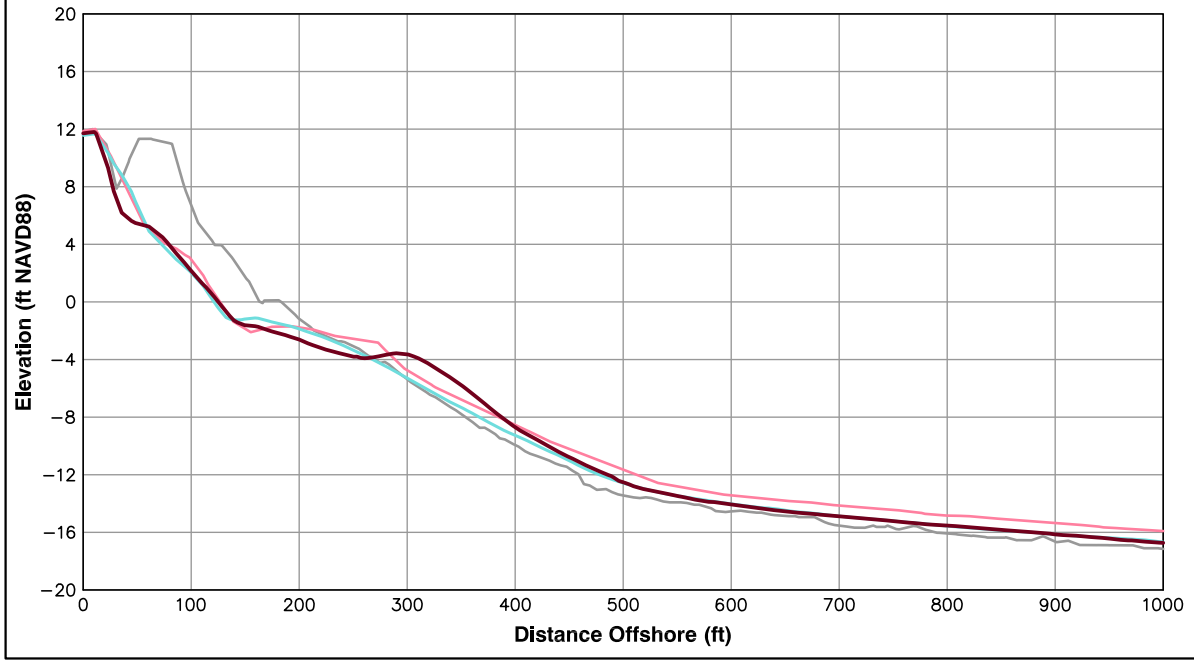
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

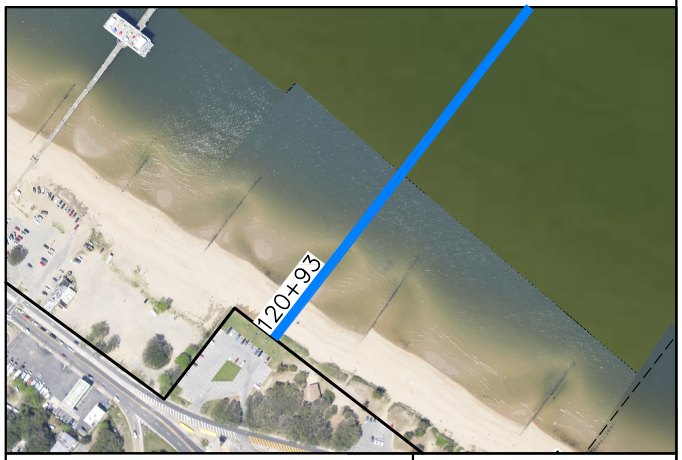




Survey Transect 120+93	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-4.26 ft/yr	1.55 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	3.02 cy/ft
Volume Change Above 0 ft NAVD88	-3.23 cy/ft/yr	-1.60 cy/ft

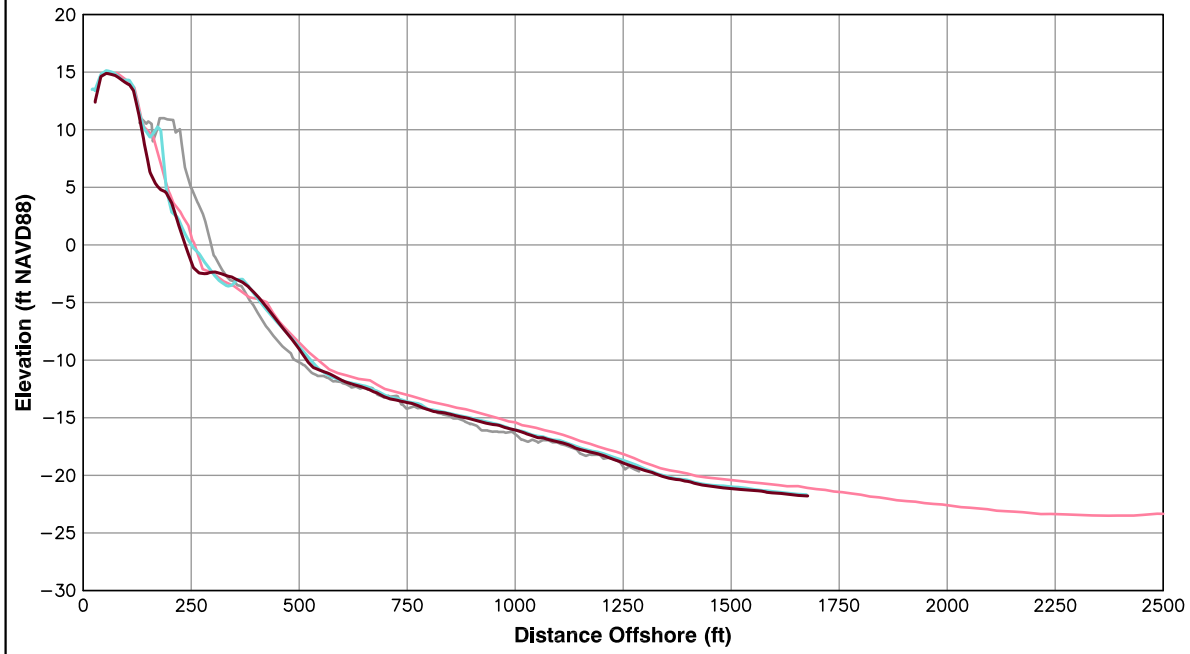
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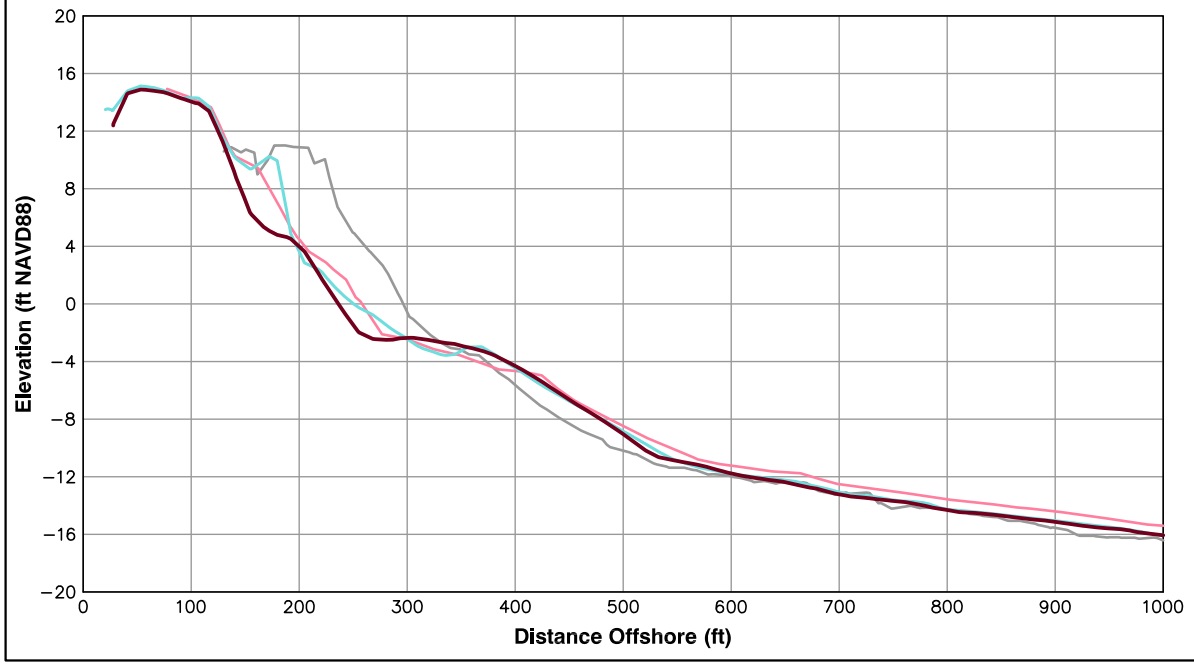
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 129+17	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-22.87 ft/yr	-8.04 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-10.84 cy/ft
Volume Change Above 0 ft NAVD88	-9.30 cy/ft/yr	-8.21 cy/ft

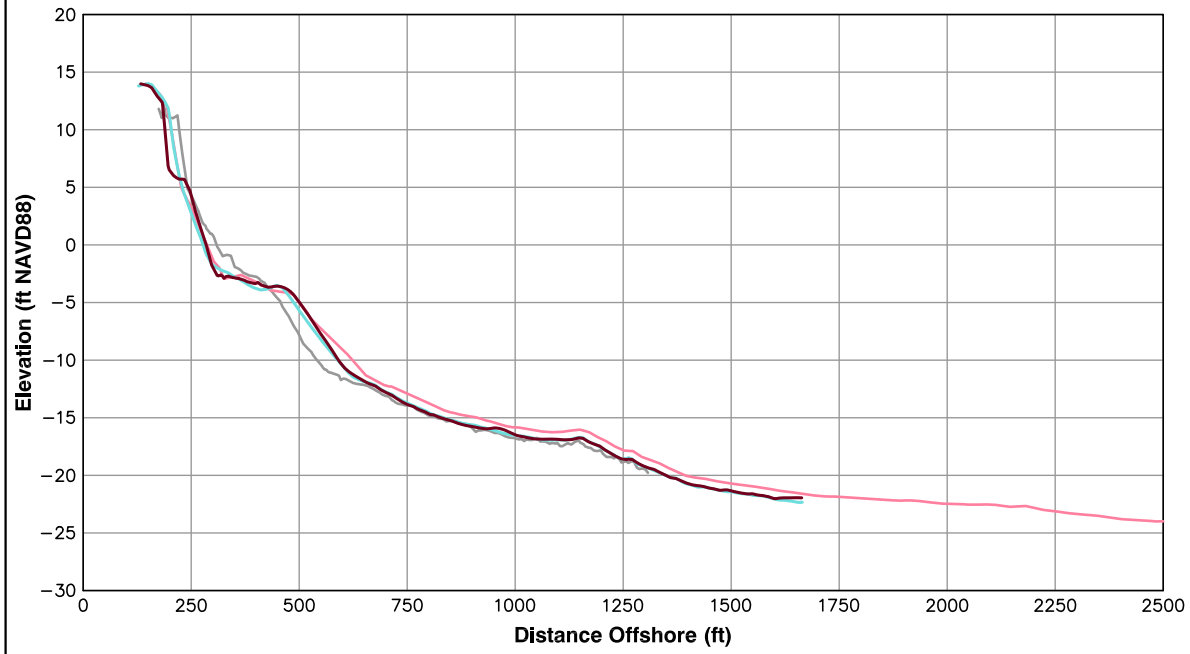
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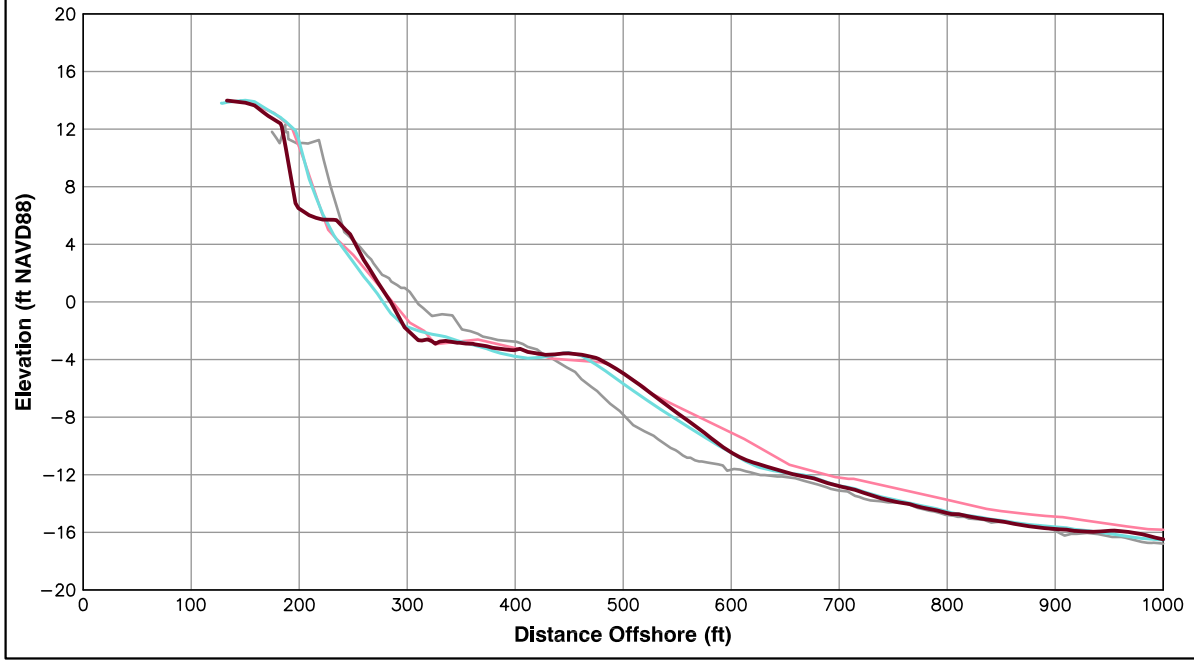
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 141+98	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	0.70 ft/yr	7.93 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	0.45 cy/ft
Volume Change Above 0 ft NAVD88	-2.83 cy/ft/yr	-1.96 cy/ft

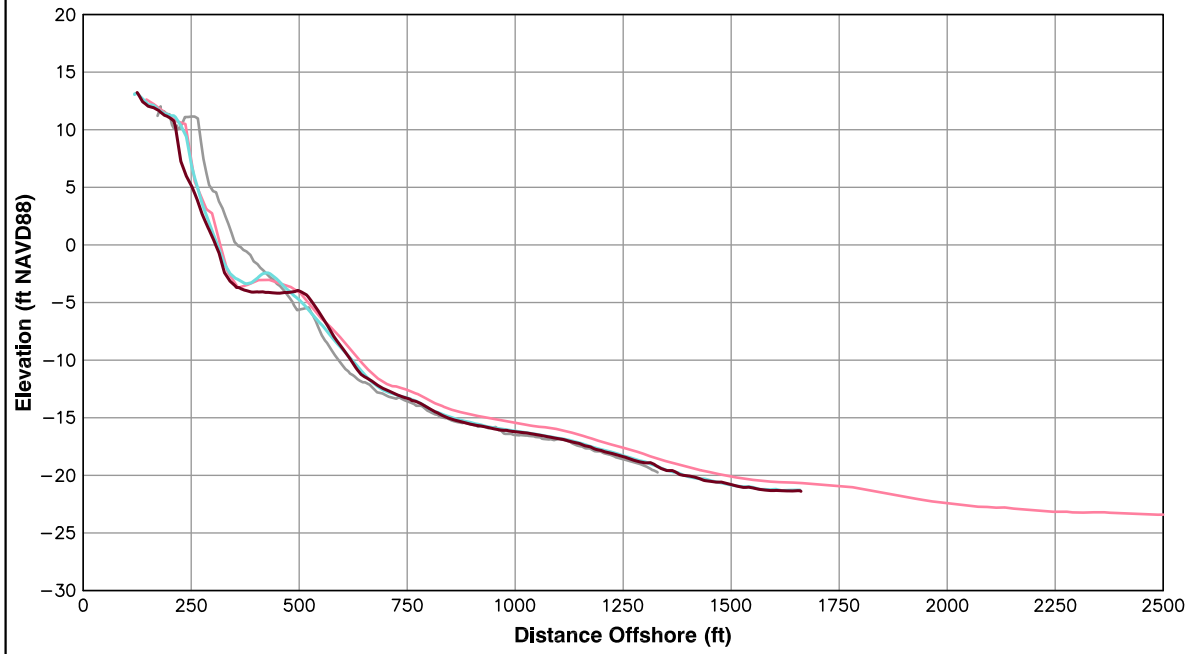
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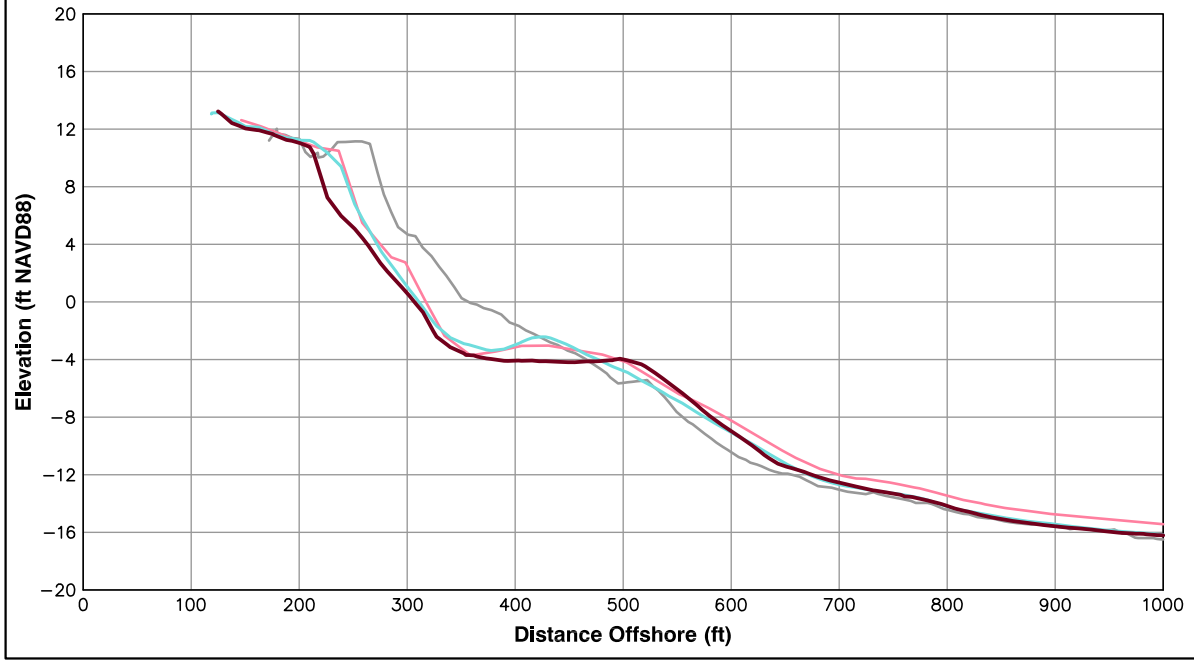
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 152+01	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-16.52 ft/yr	-5.40 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-9.13 cy/ft
Volume Change Above 0 ft NAVD88	-8.80 cy/ft/yr	-6.11 cy/ft

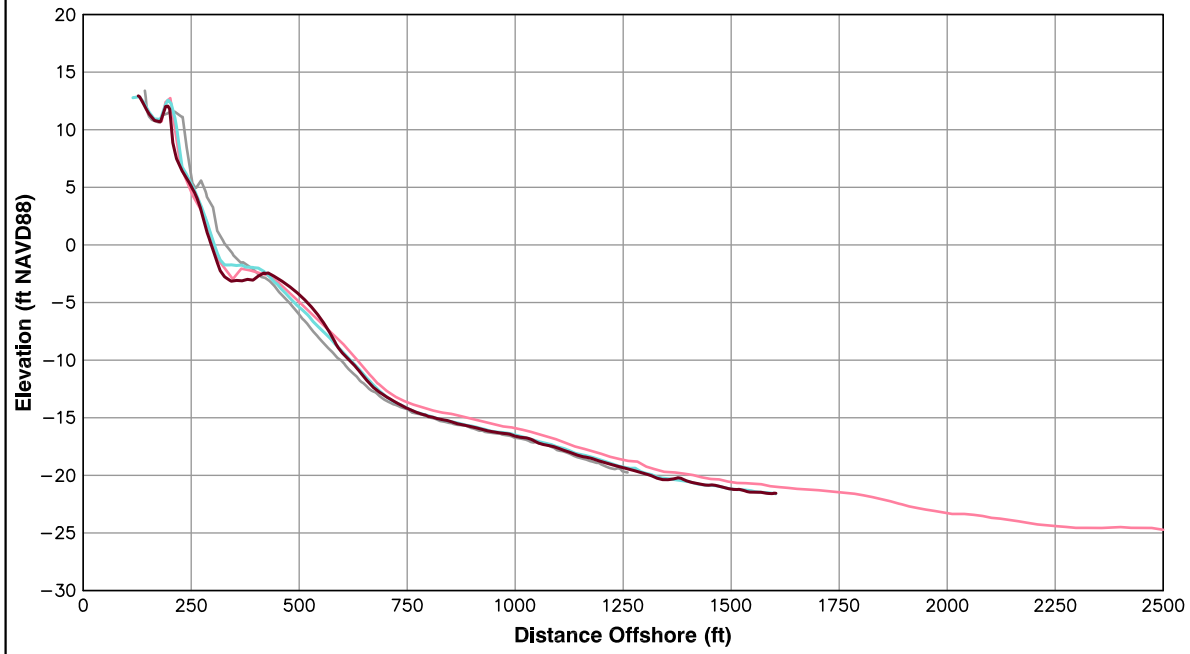
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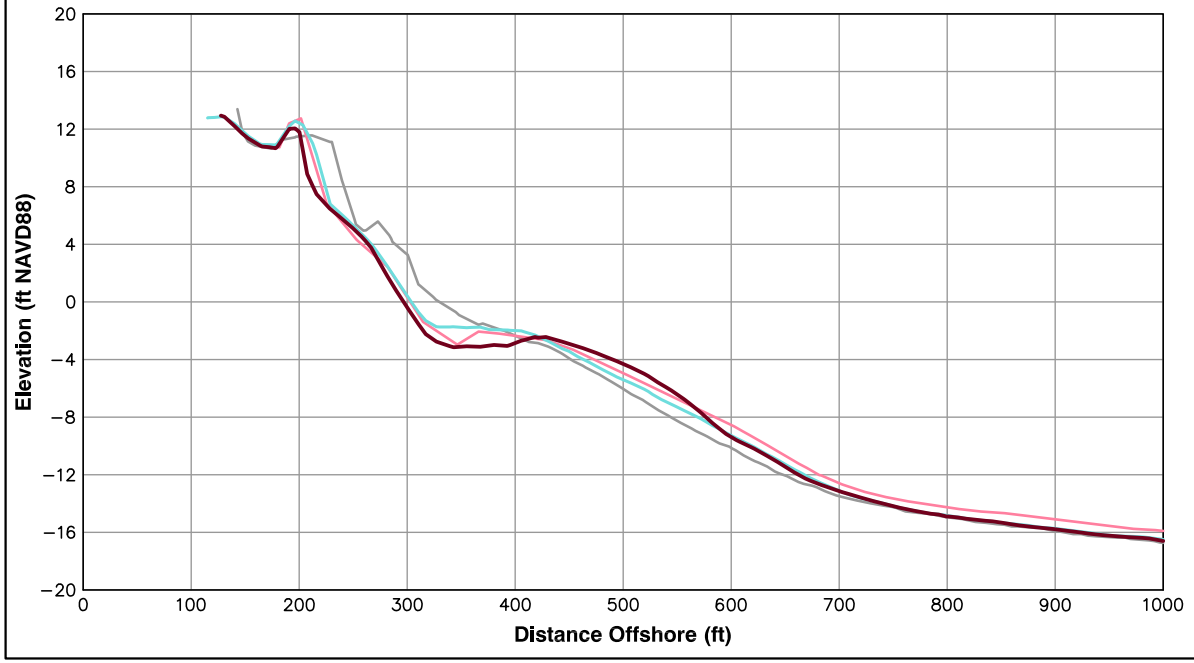
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 163+49	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-6.56 ft/yr	-6.81 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-4.26 cy/ft
Volume Change Above 0 ft NAVD88	-1.95 cy/ft/yr	-3.79 cy/ft

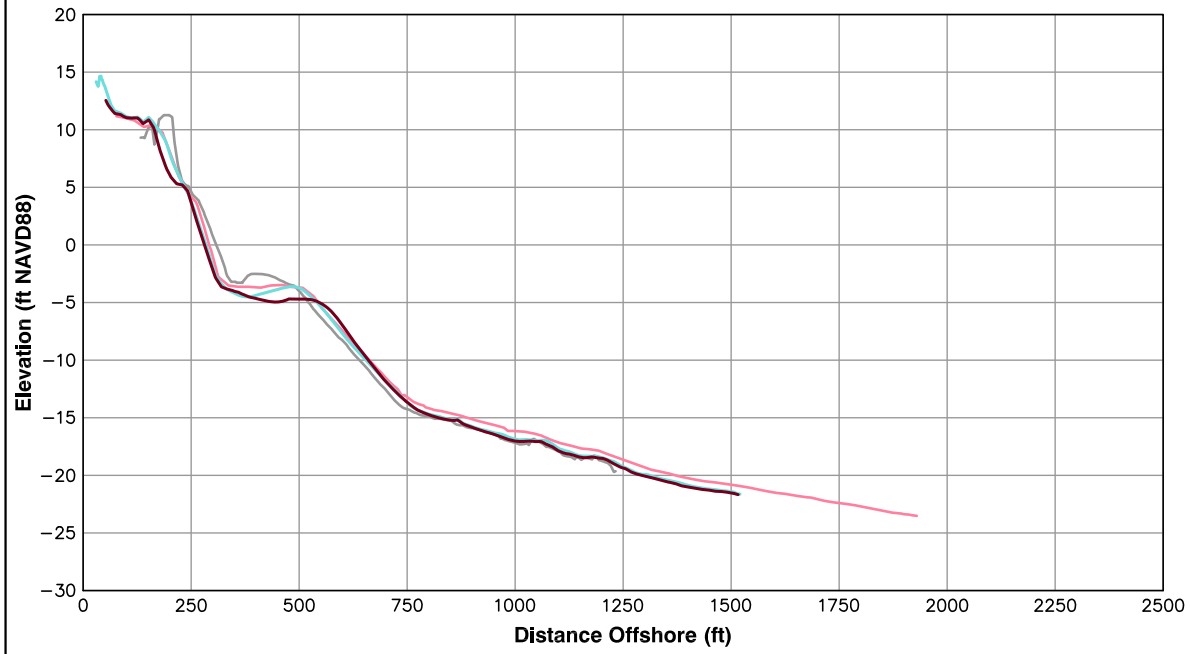
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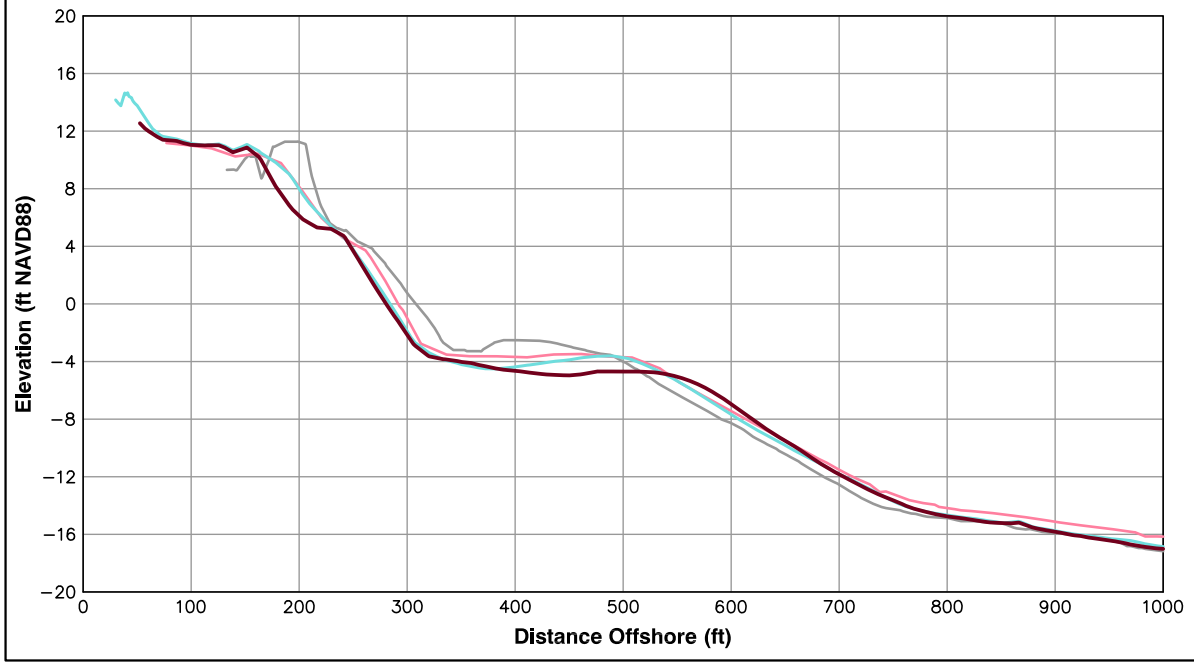
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

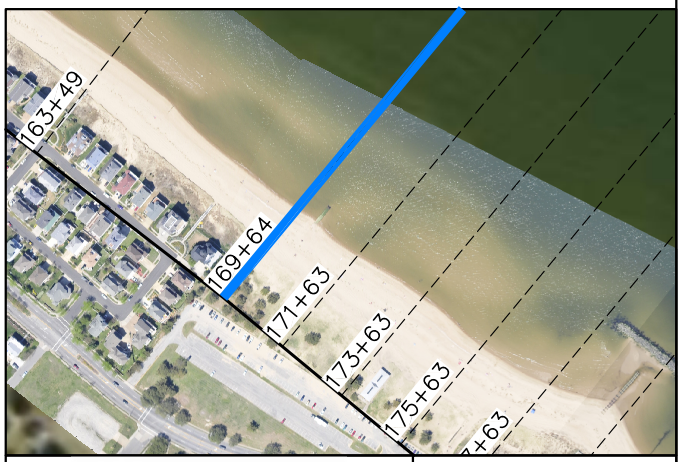




Survey Transect 169+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-12.48 ft/yr	-3.53 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.74 cy/ft
Volume Change Above 0 ft NAVD88	-5.06 cy/ft/yr	-4.61 cy/ft

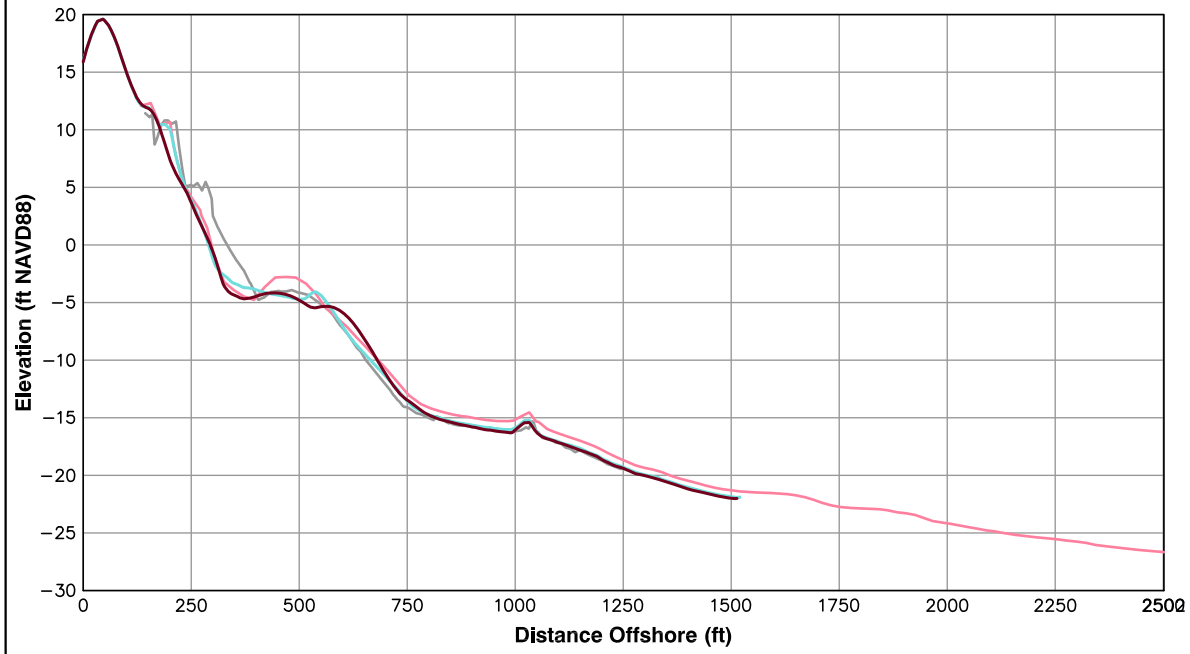
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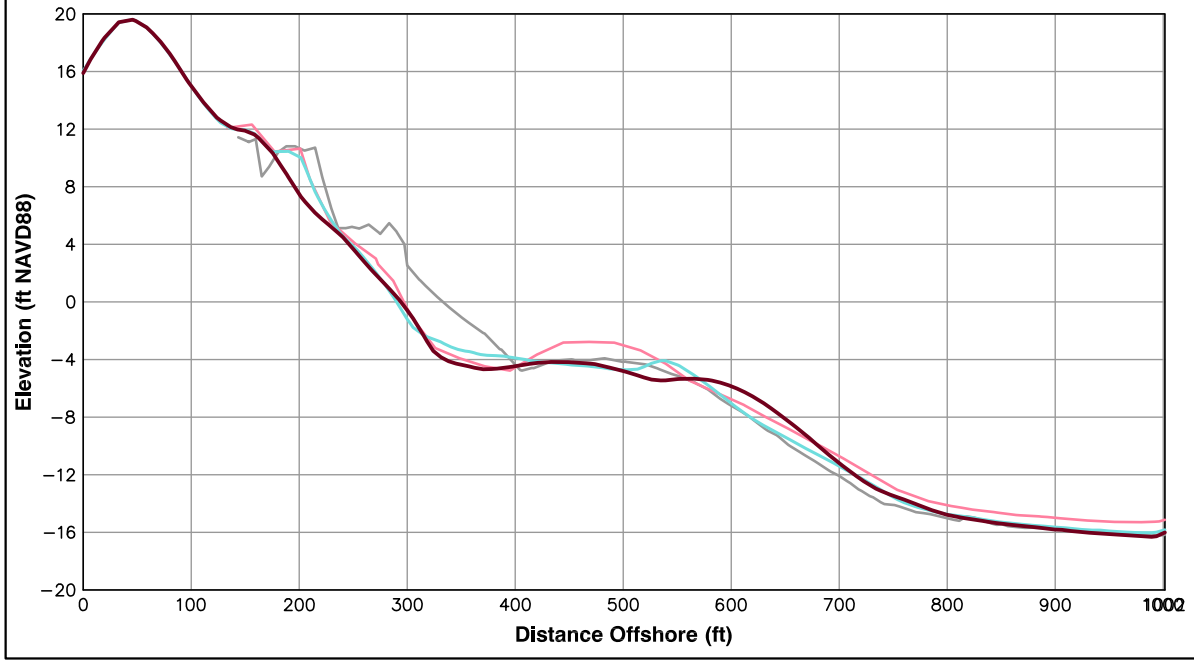
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

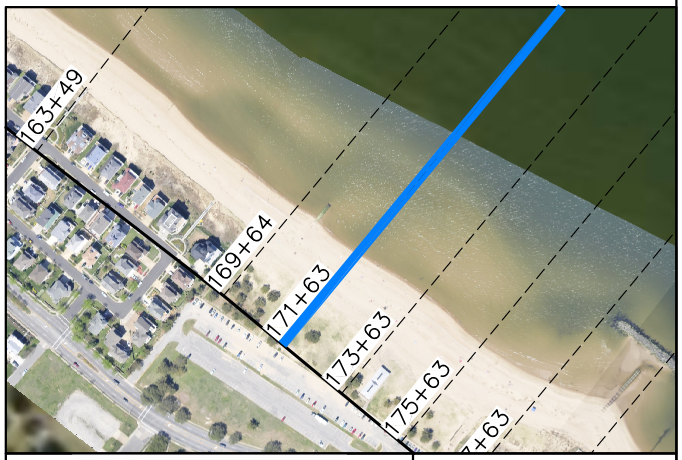




Survey Transect 171+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-8.46 ft/yr	1.17 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-2.55 cy/ft
Volume Change Above 0 ft NAVD88	-5.81 cy/ft/yr	-3.09 cy/ft

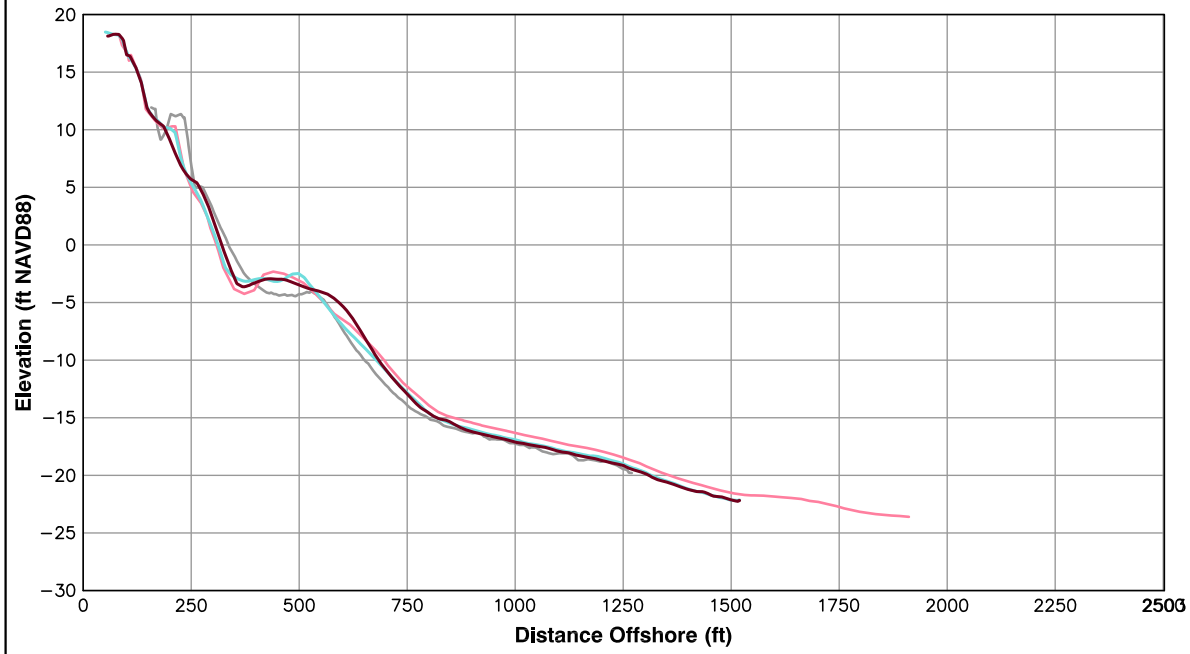
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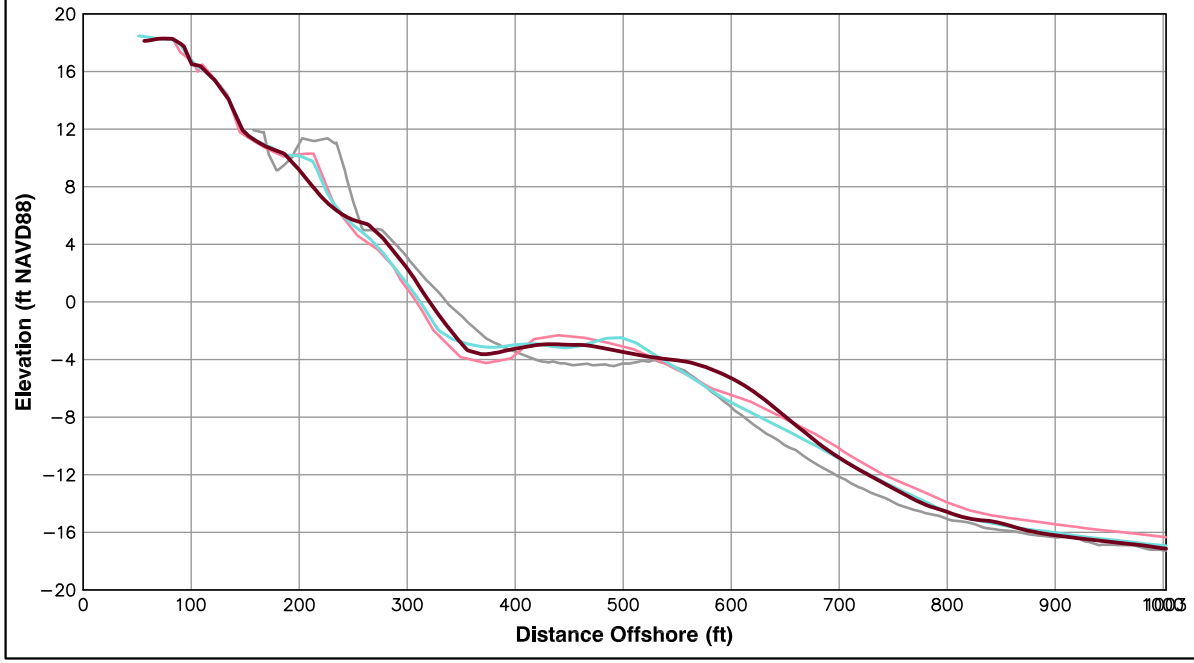
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City of Norfolk

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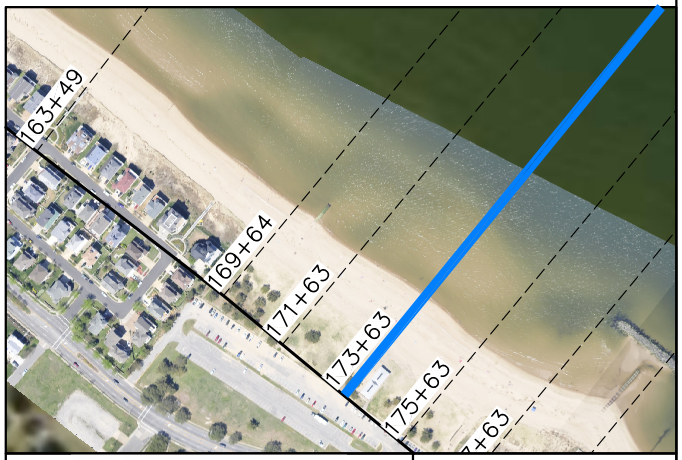




Survey Transect 173+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	13.85 ft/yr	9.12 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	4.93 cy/ft
Volume Change Above 0 ft NAVD88	1.63 cy/ft/yr	0.61 cy/ft

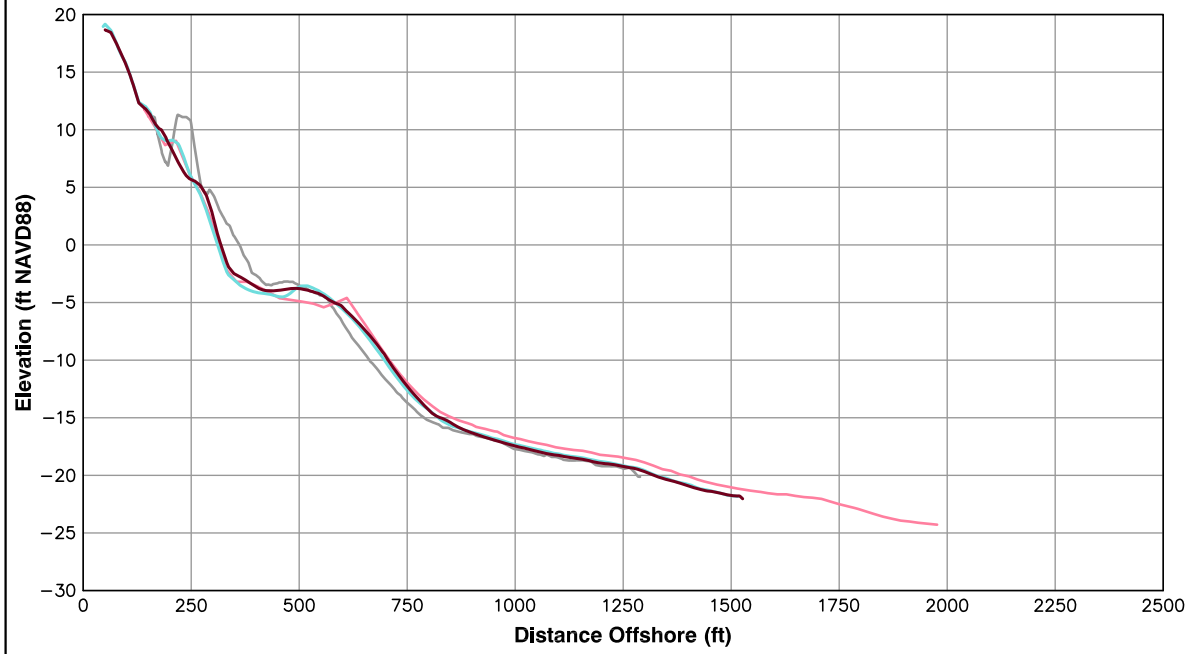
LEGEND:
- 2010 MAR
- 2009 OCT
- 2009 APR
- POST-FILL

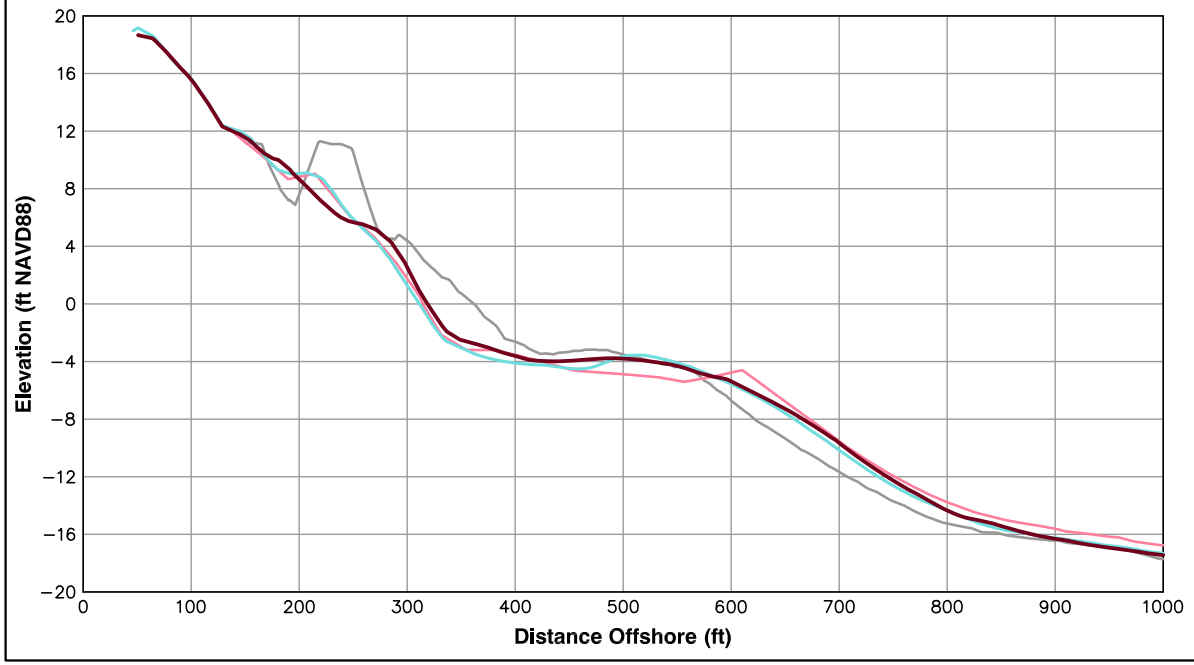
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

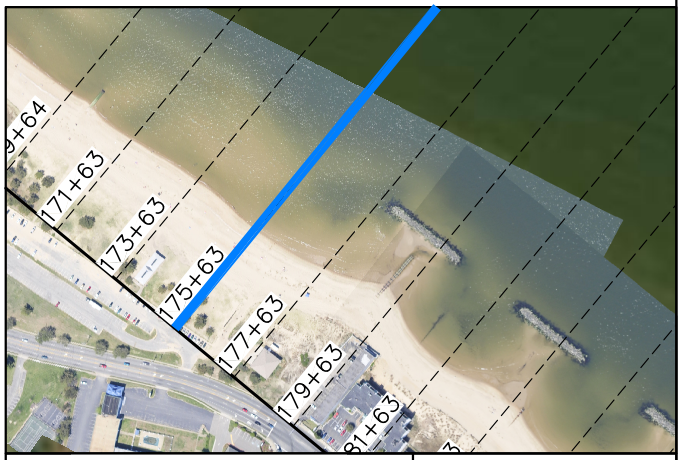




Survey Transect 175+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	3.74 ft/yr	7.98 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	5.26 cy/ft
Volume Change Above 0 ft NAVD88	0.66 cy/ft/yr	0.06 cy/ft

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

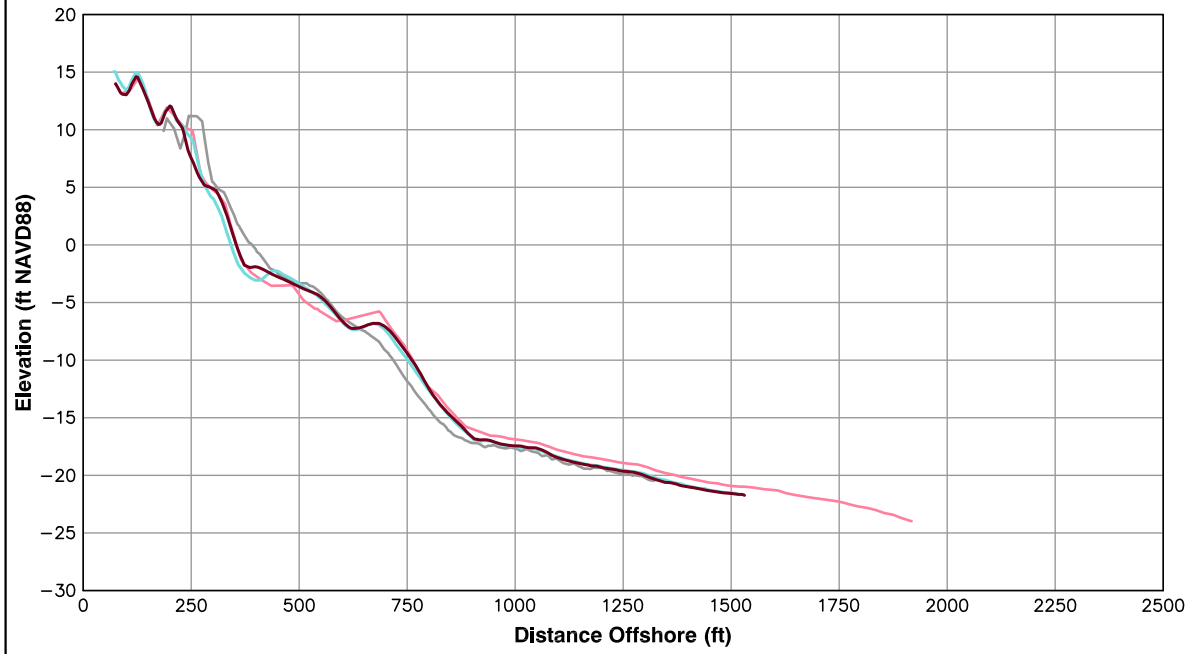
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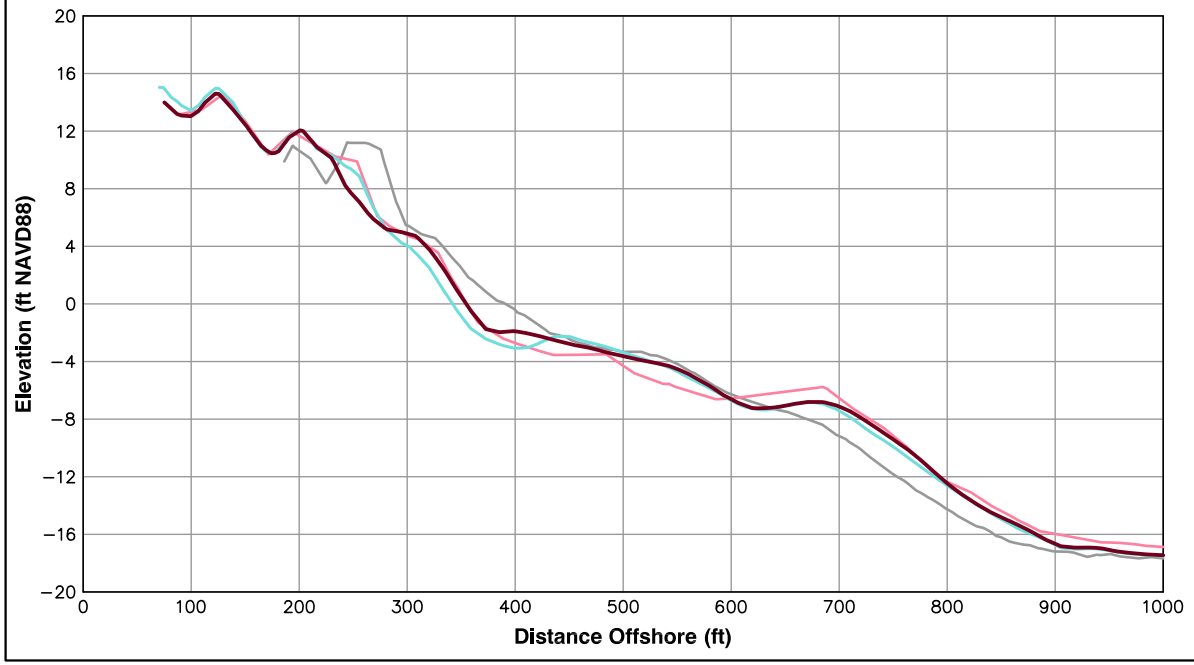


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 175+63	Pg 52 of 106	SPRING 2010

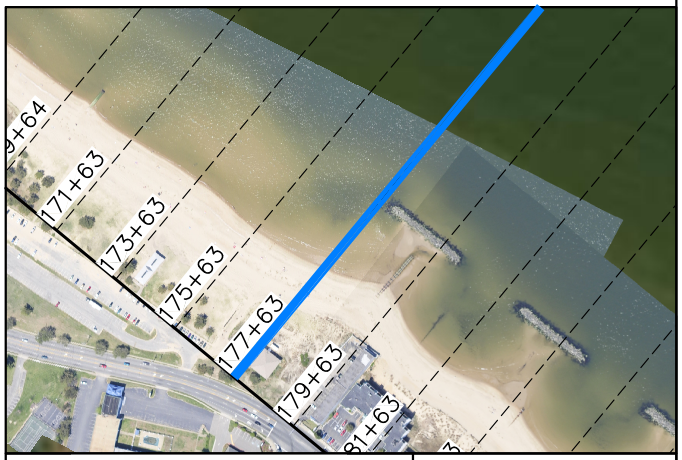




Survey Transect 177+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-2.10 ft/yr	12.49 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	3.55 cy/ft
Volume Change Above 0 ft NAVD88	-3.67 cy/ft/yr	-0.63 cy/ft

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

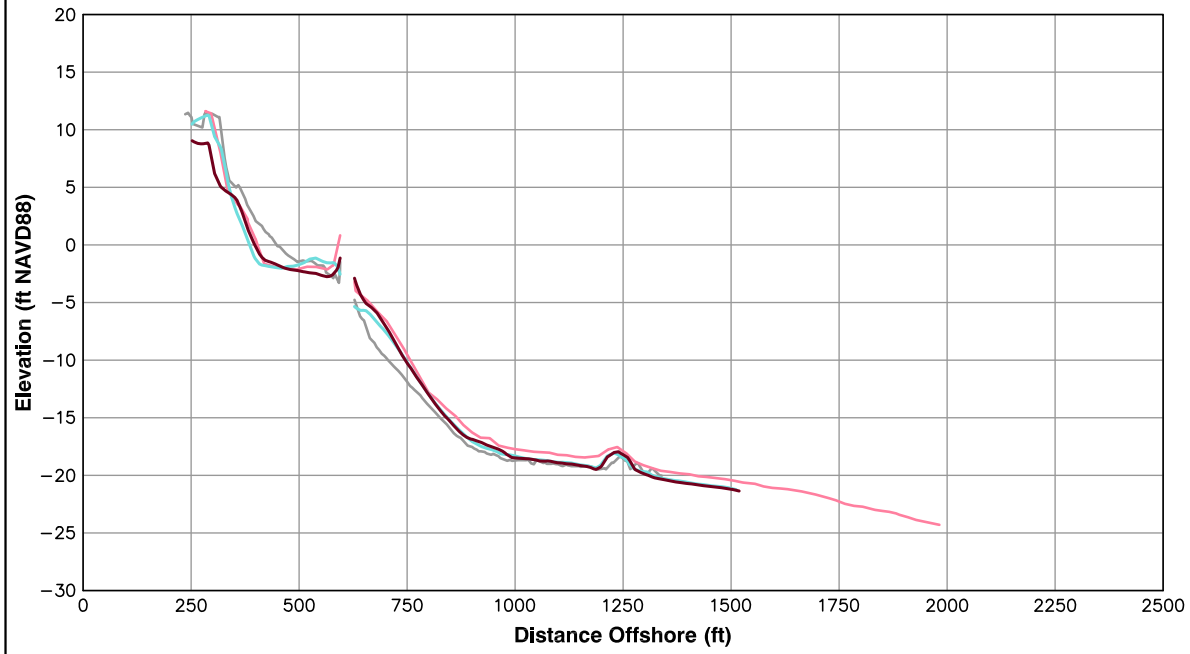
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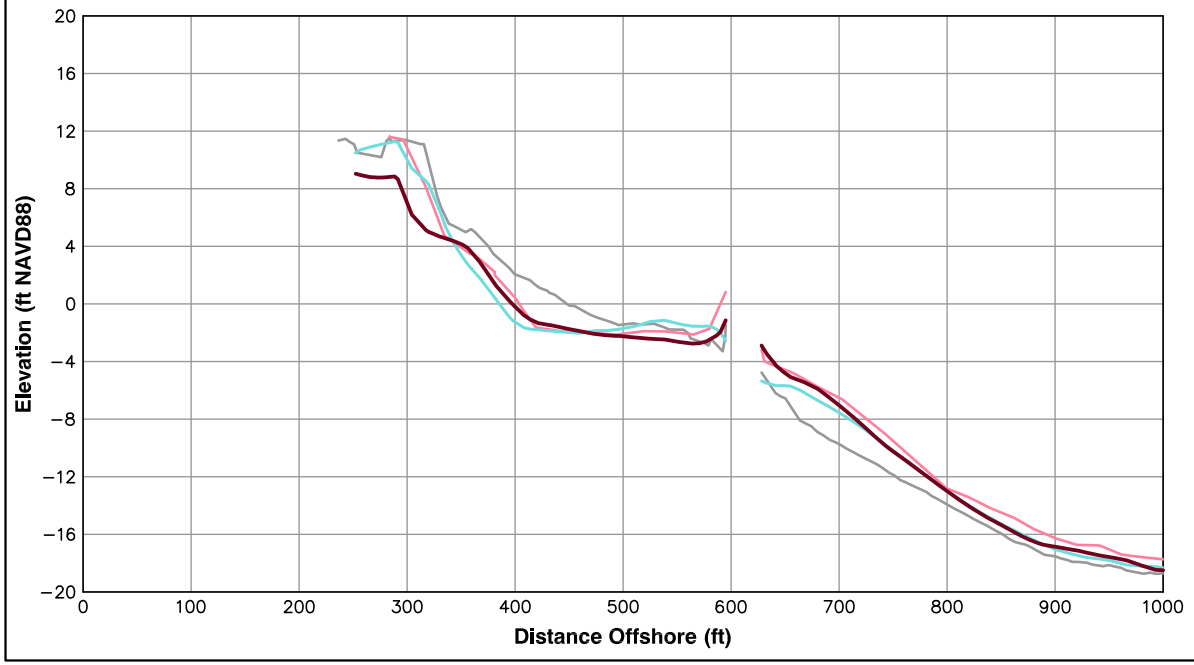


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 177+63	Pg 53 of 106	SPRING 2010

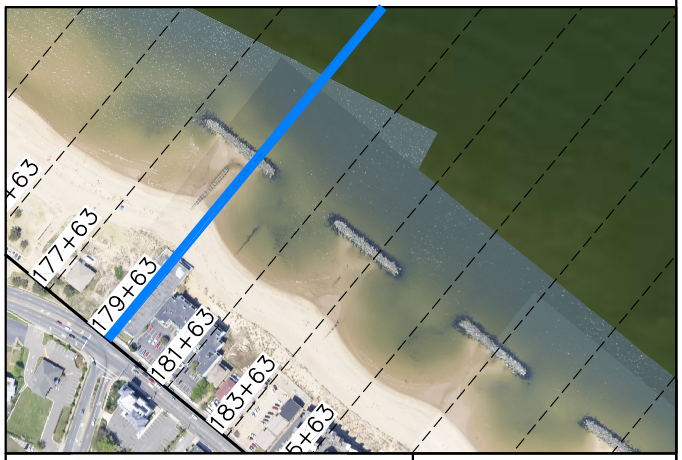




Survey Transect 179+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-8.39 ft/yr	10.14 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-5.55 cy/ft
Volume Change Above 0 ft NAVD88	-6.47 cy/ft/yr	-6.00 cy/ft

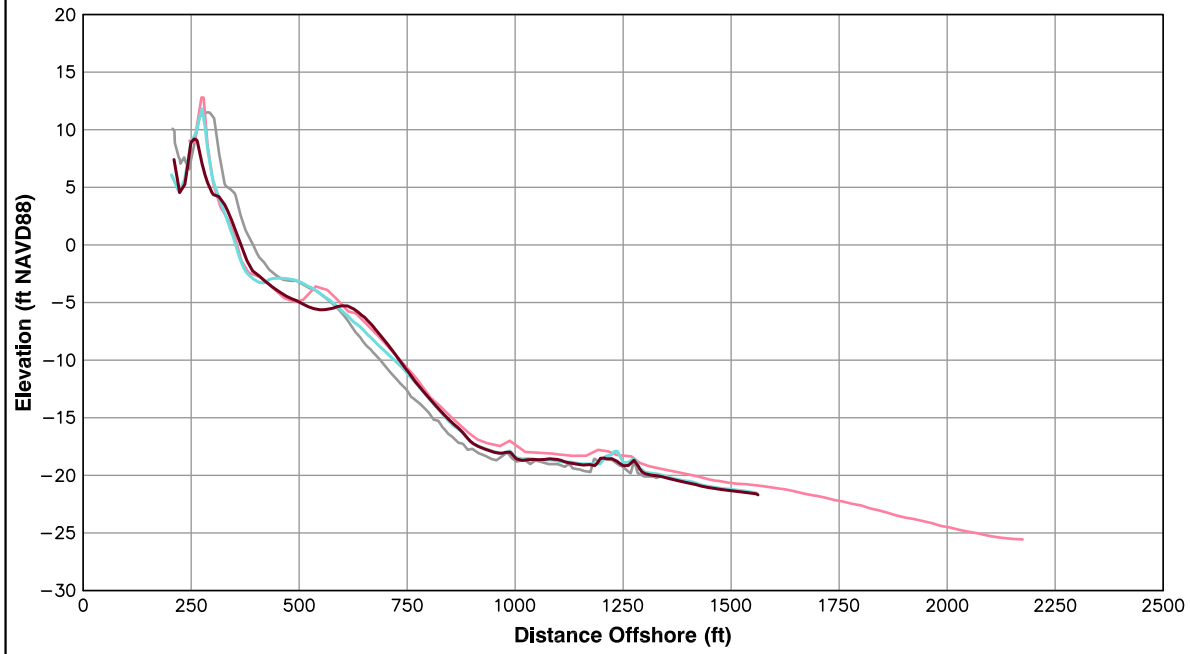
LEGEND:
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- 2009 OCT
- 2009 APR
- POST-FILL

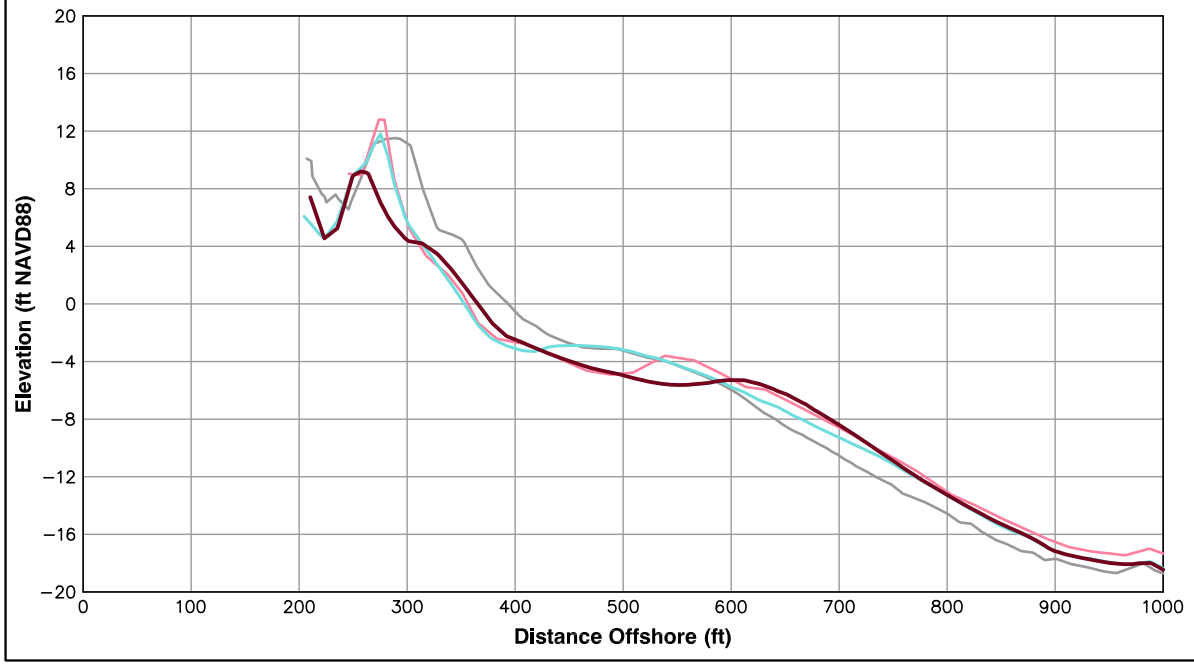
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

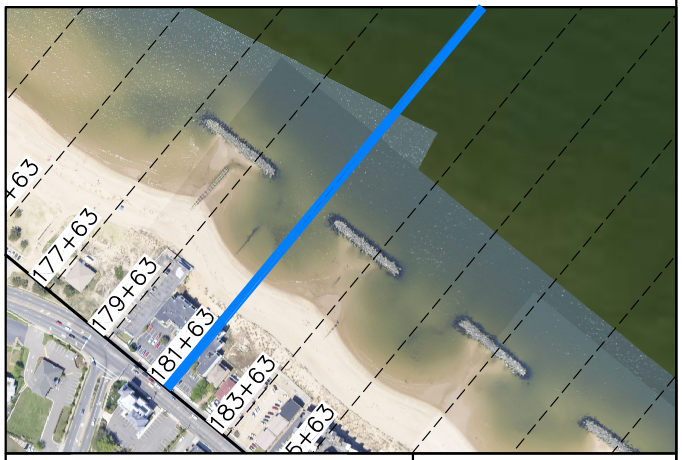




Survey Transect 181+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	7.53 ft/yr	11.19 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.46 cy/ft
Volume Change Above 0 ft NAVD88	-4.48 cy/ft/yr	-2.97 cy/ft

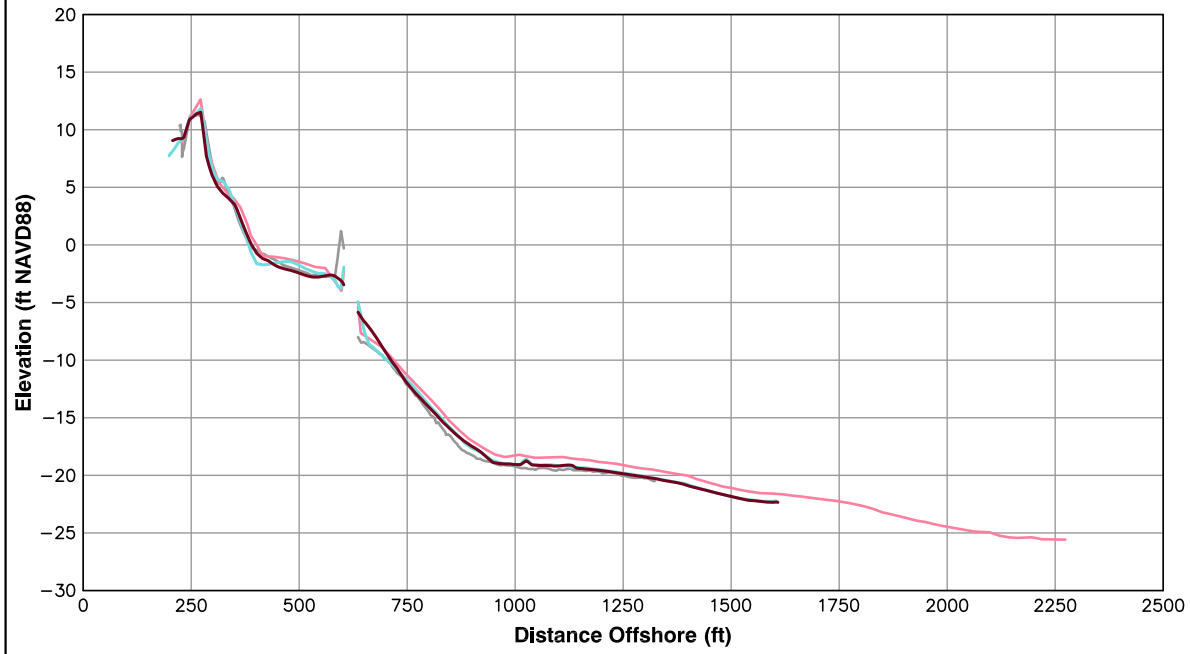
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- 2009 OCT
- 2009 APR
- POST-FILL

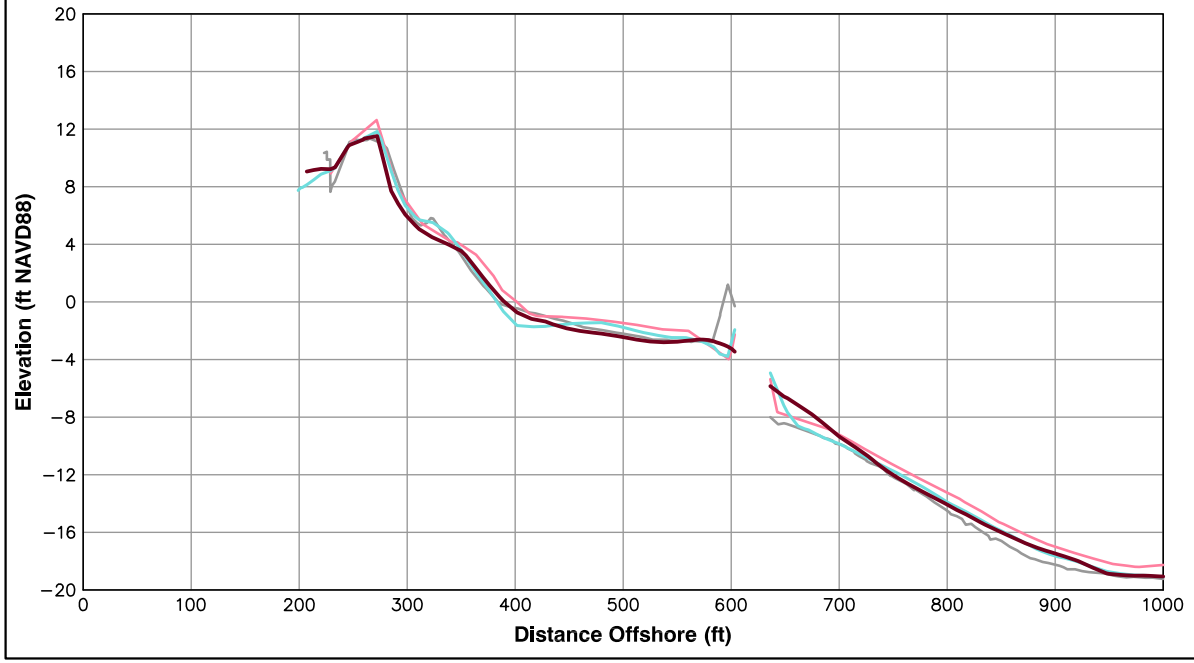
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 183+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-9.22 ft/yr	4.09 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-0.97 cy/ft
Volume Change Above 0 ft NAVD88	-4.46 cy/ft/yr	-1.55 cy/ft

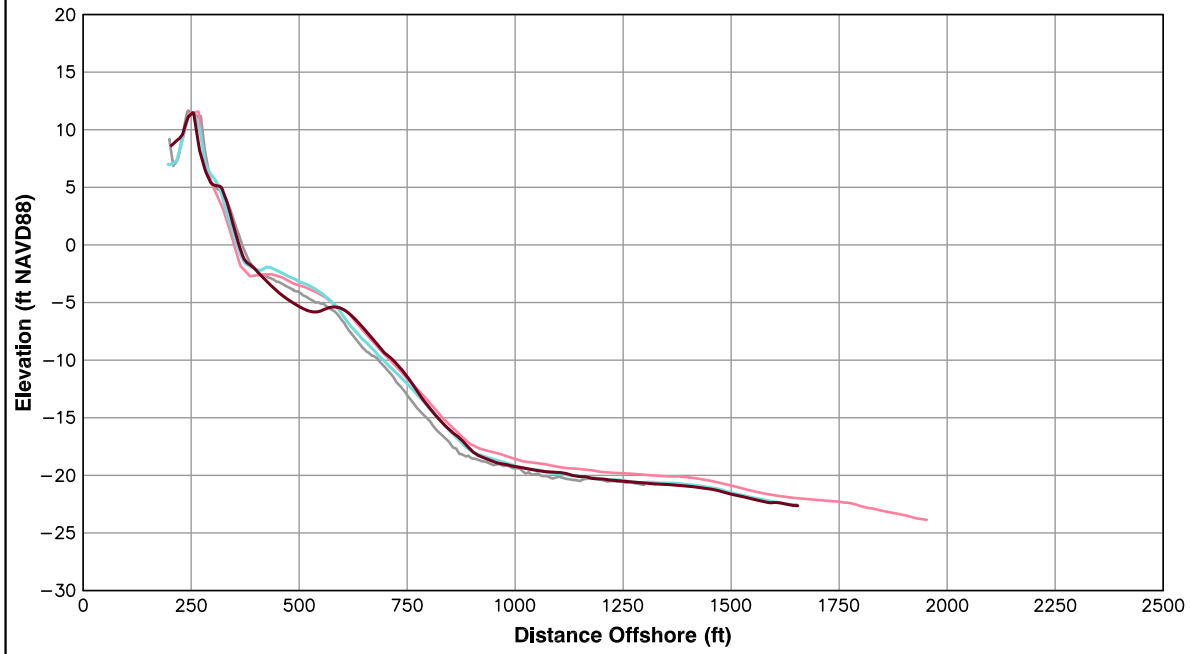
LEGEND:
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- 2009 OCT
- 2009 APR
- POST-FILL

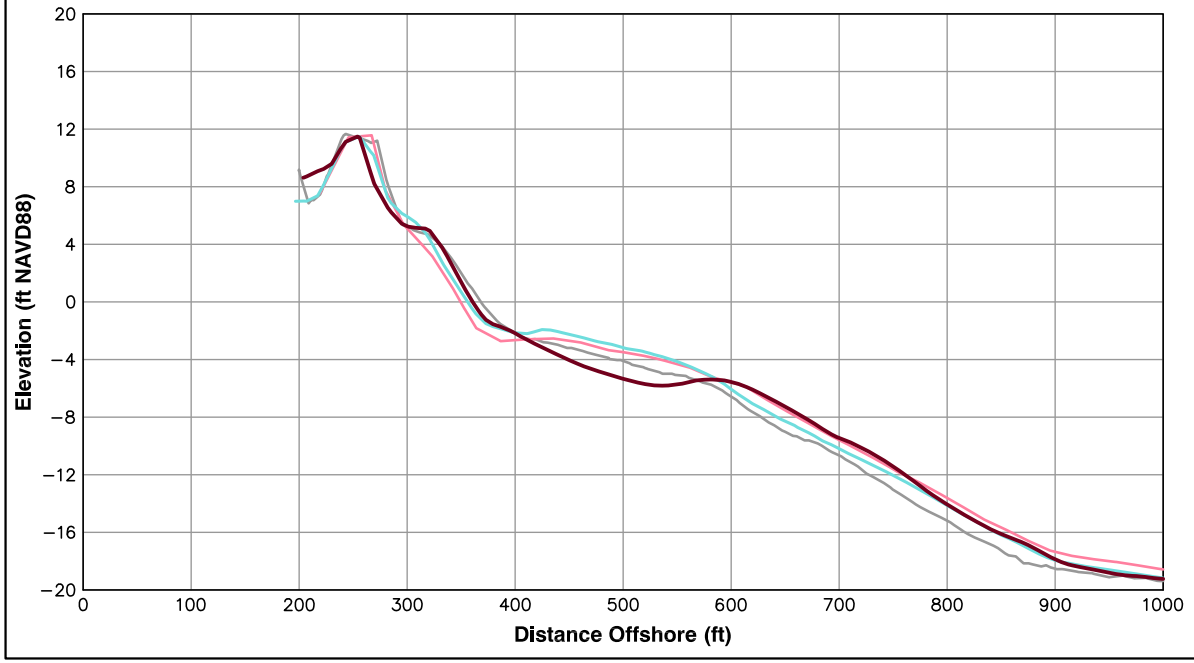
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

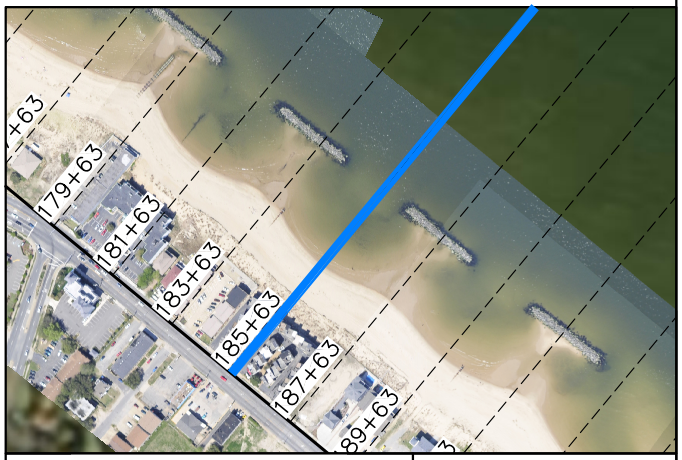




Survey Transect 185+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	12.14 ft/yr	5.63 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.98 cy/ft
Volume Change Above 0 ft NAVD88	1.38 cy/ft/yr	0.86 cy/ft

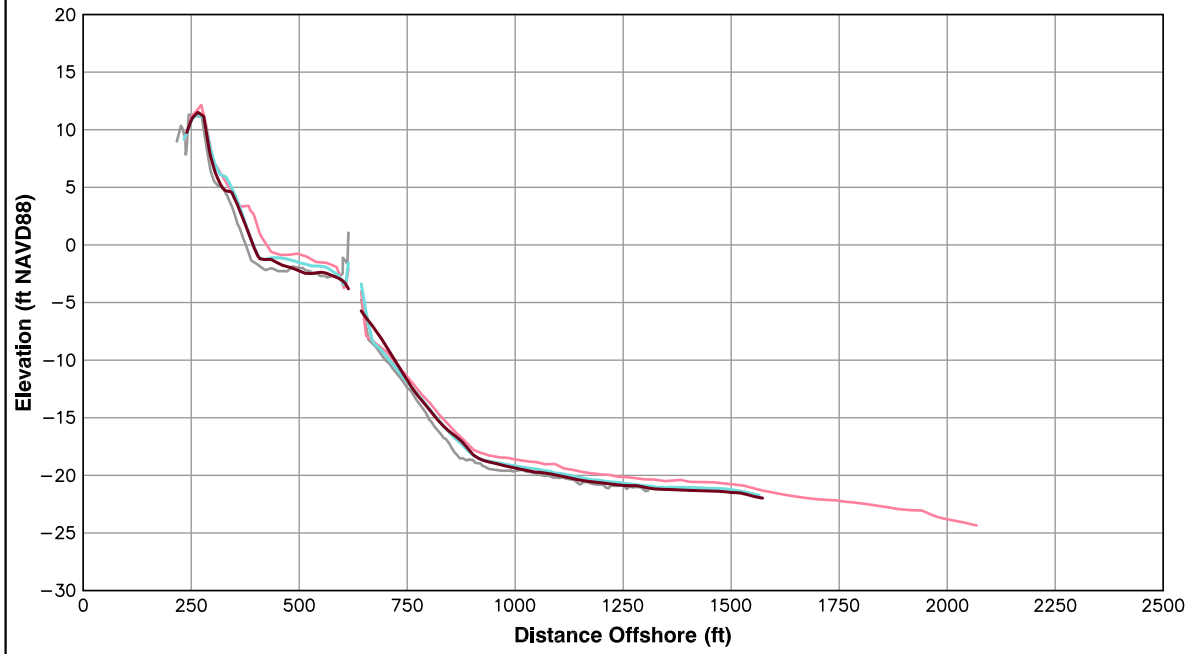
LEGEND:
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- 2009 OCT
- 2009 APR
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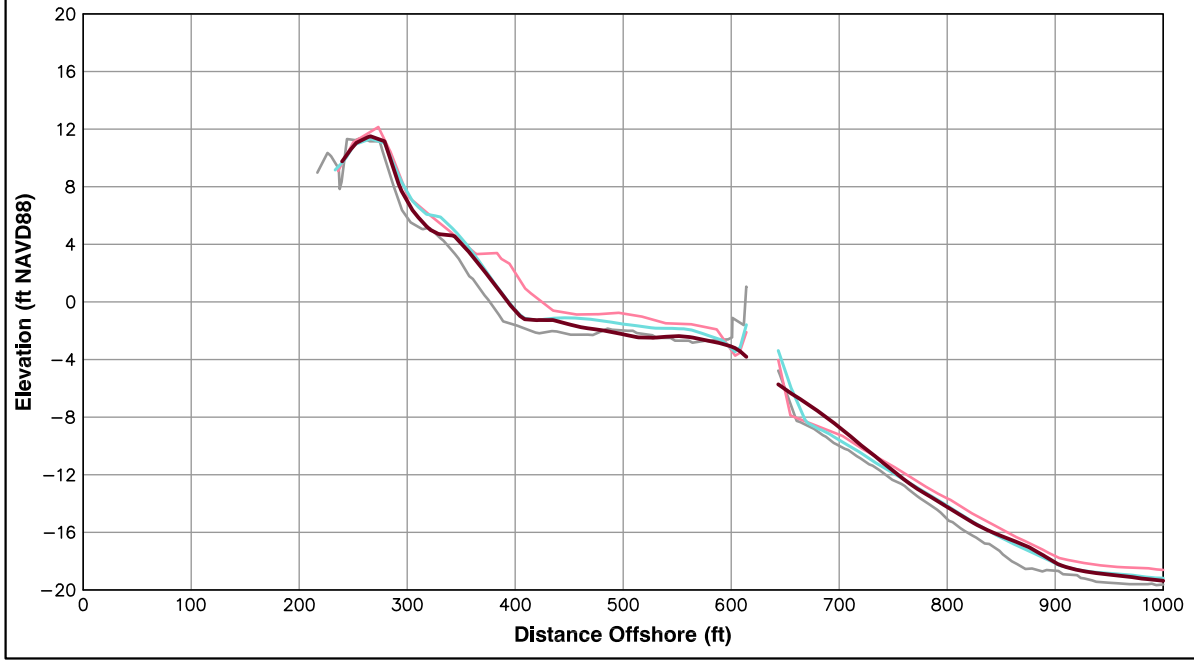
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

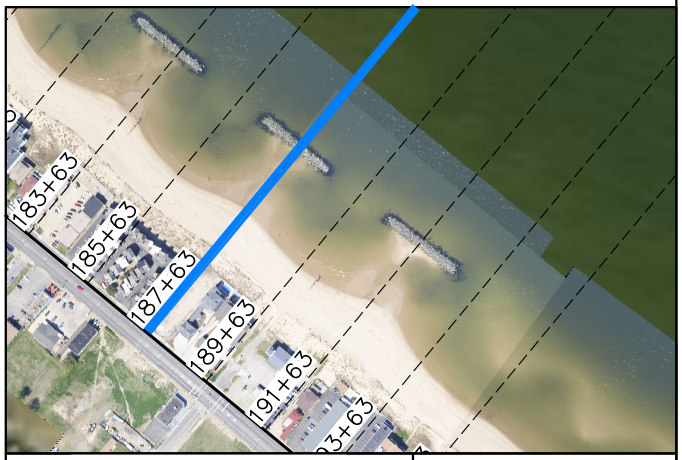




Survey Transect 187+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-27.92 ft/yr	-0.80 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.73 cy/ft
Volume Change Above 0 ft NAVD88	-5.99 cy/ft/yr	-1.87 cy/ft

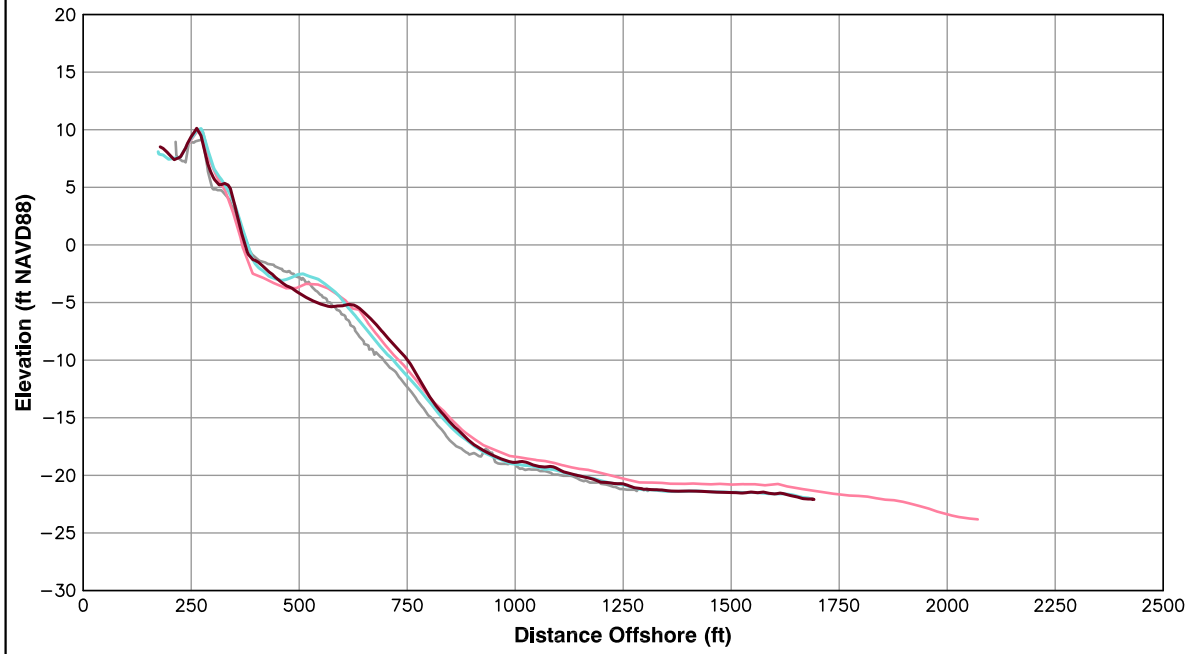
LEGEND:
- 2010 MAR
- 2009 OCT
- 2009 APR
- POST-FILL

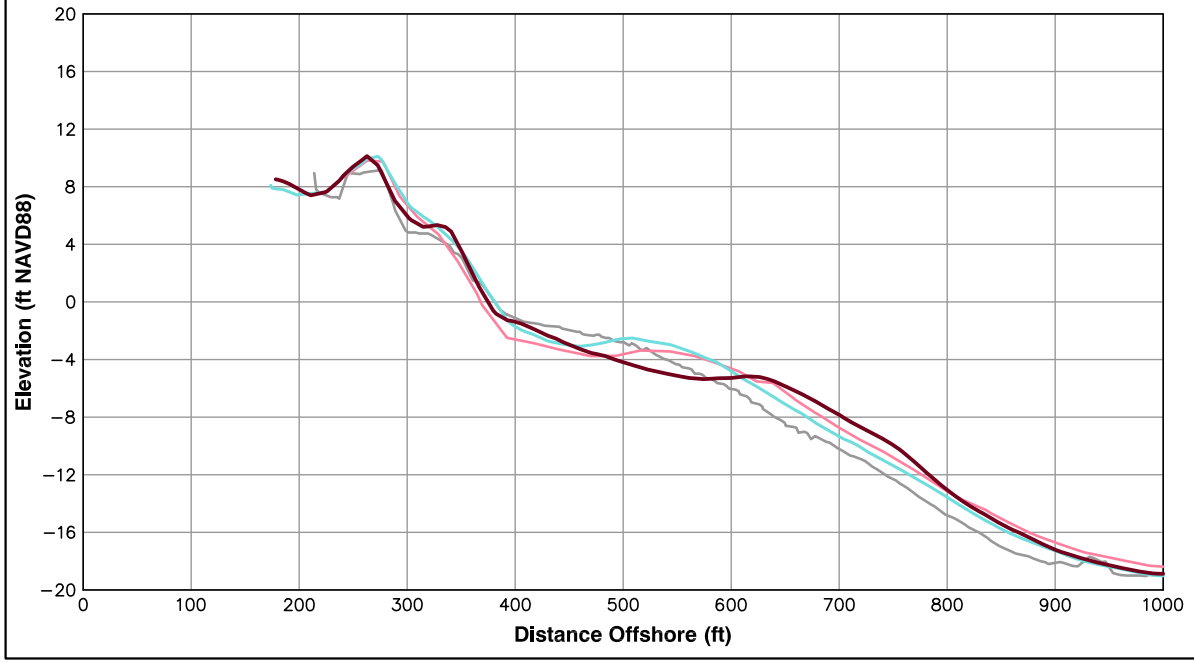
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

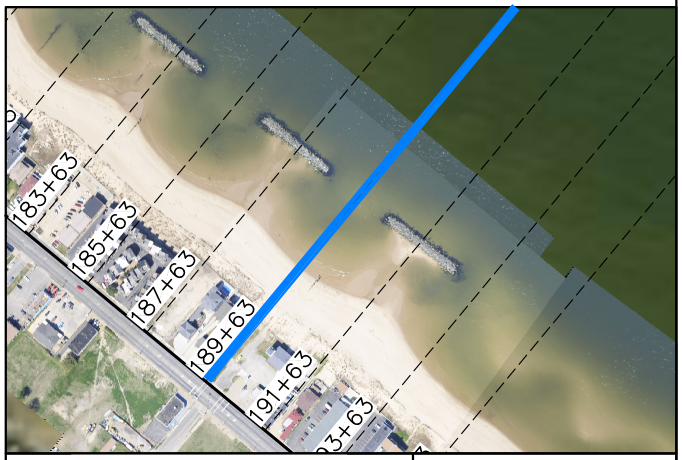




Survey Transect 189+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	6.15 ft/yr	-5.62 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	0.25 cy/ft
Volume Change Above 0 ft NAVD88	0.83 cy/ft/yr	-1.36 cy/ft

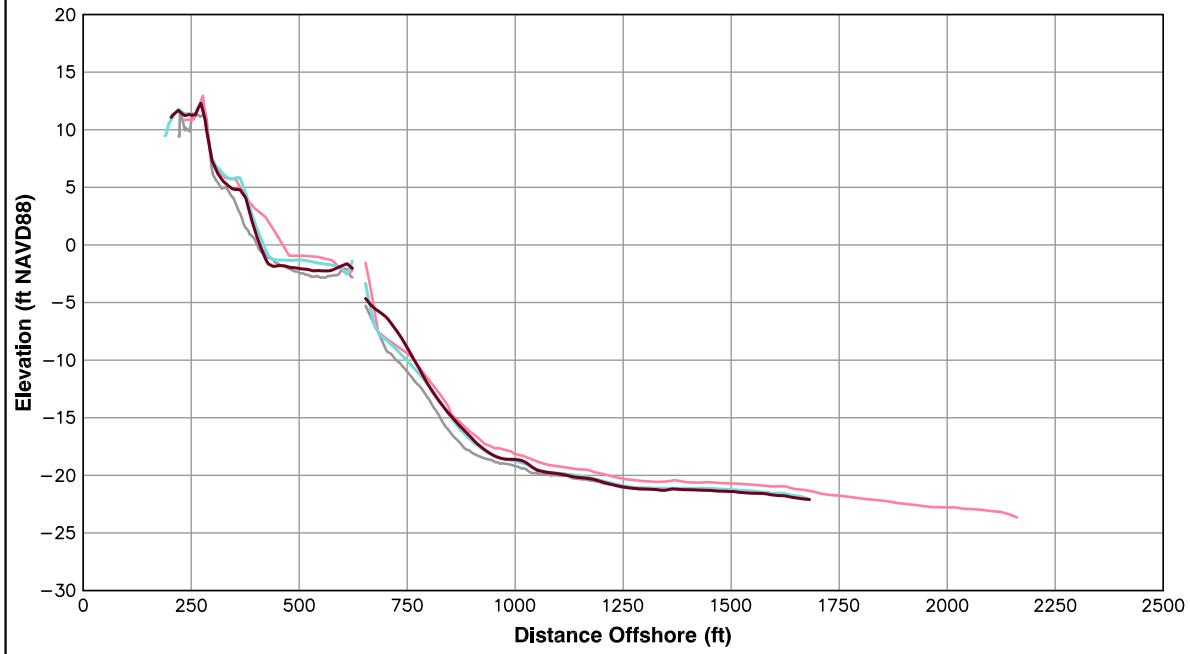
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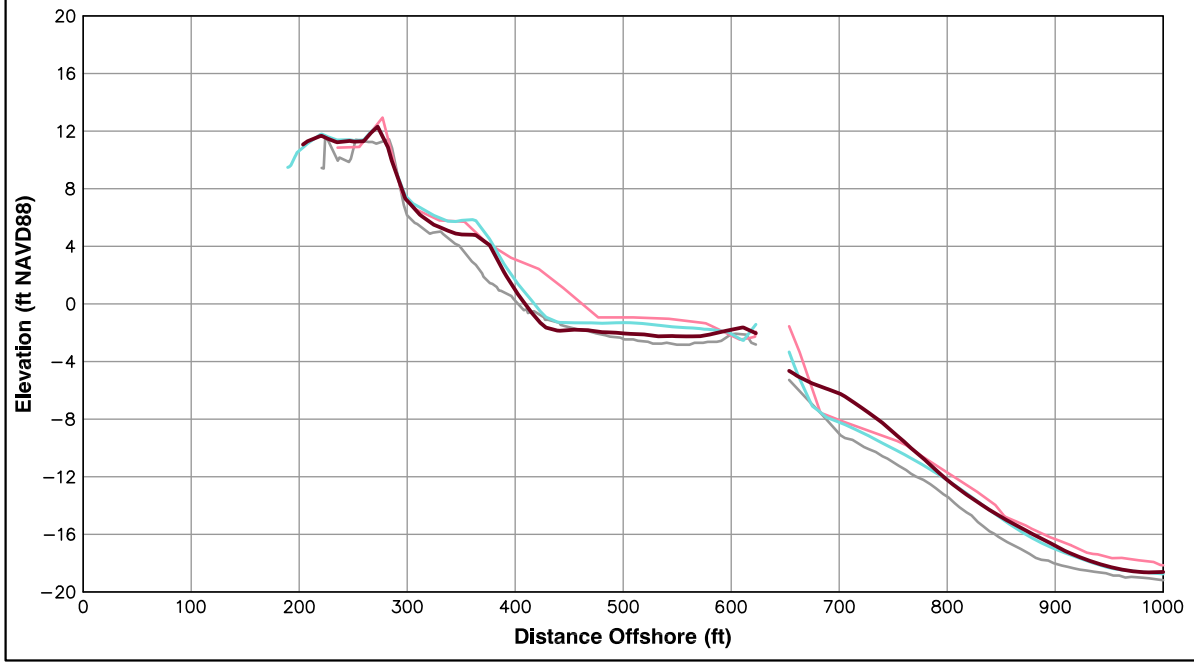
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

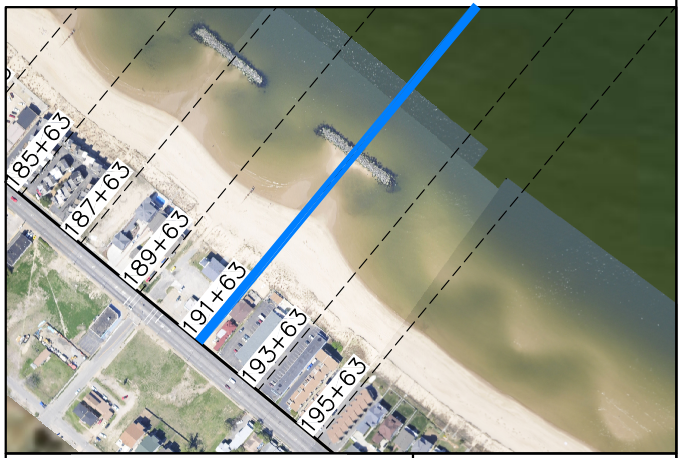




Survey Transect 191+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-50.96 ft/yr	-7.05 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-0.87 cy/ft
Volume Change Above 0 ft NAVD88	-6.78 cy/ft/yr	-3.04 cy/ft

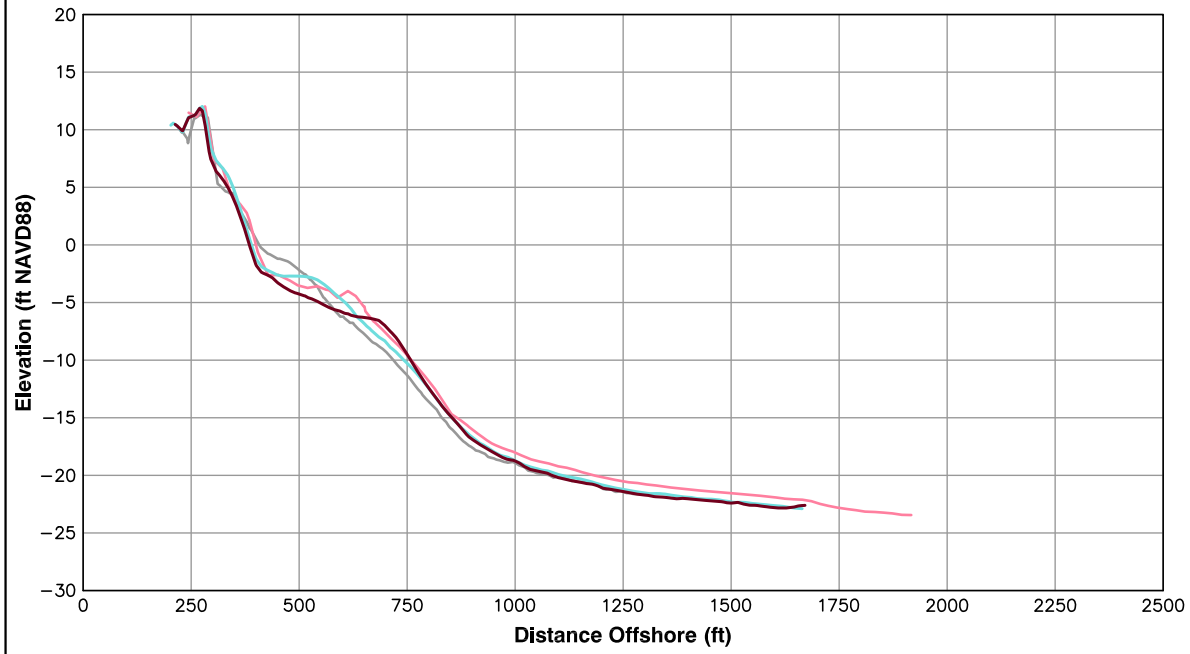
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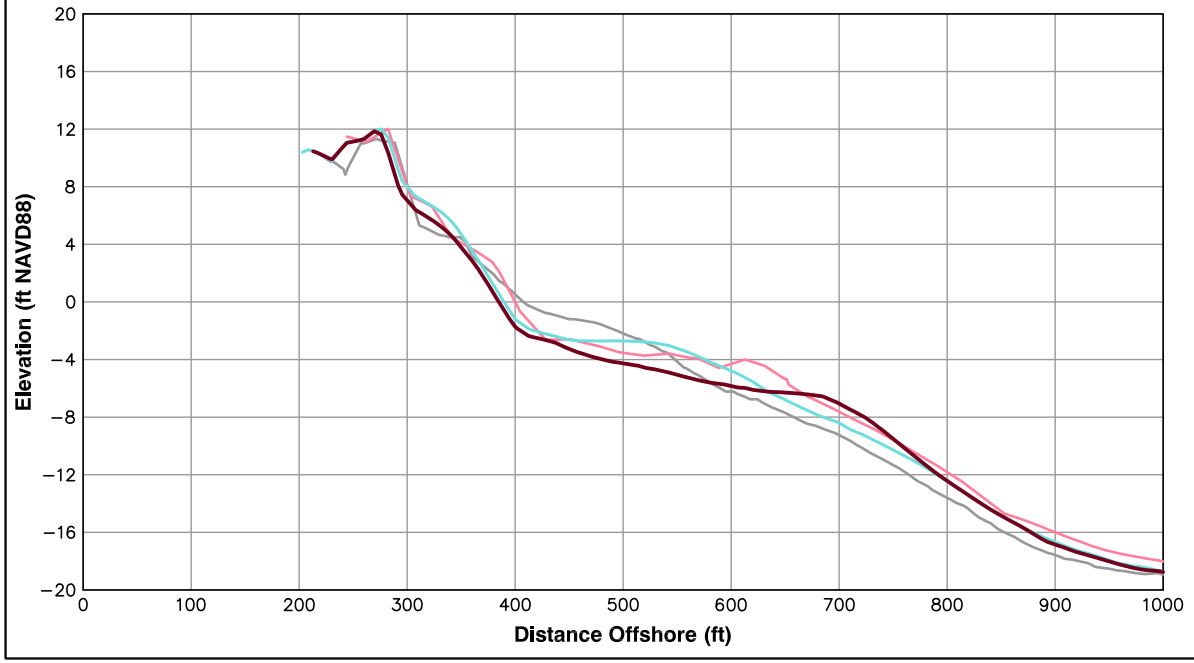
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 193+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-17.72 ft/yr	-4.63 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-8.62 cy/ft
Volume Change Above 0 ft NAVD88	-4.86 cy/ft/yr	-3.54 cy/ft

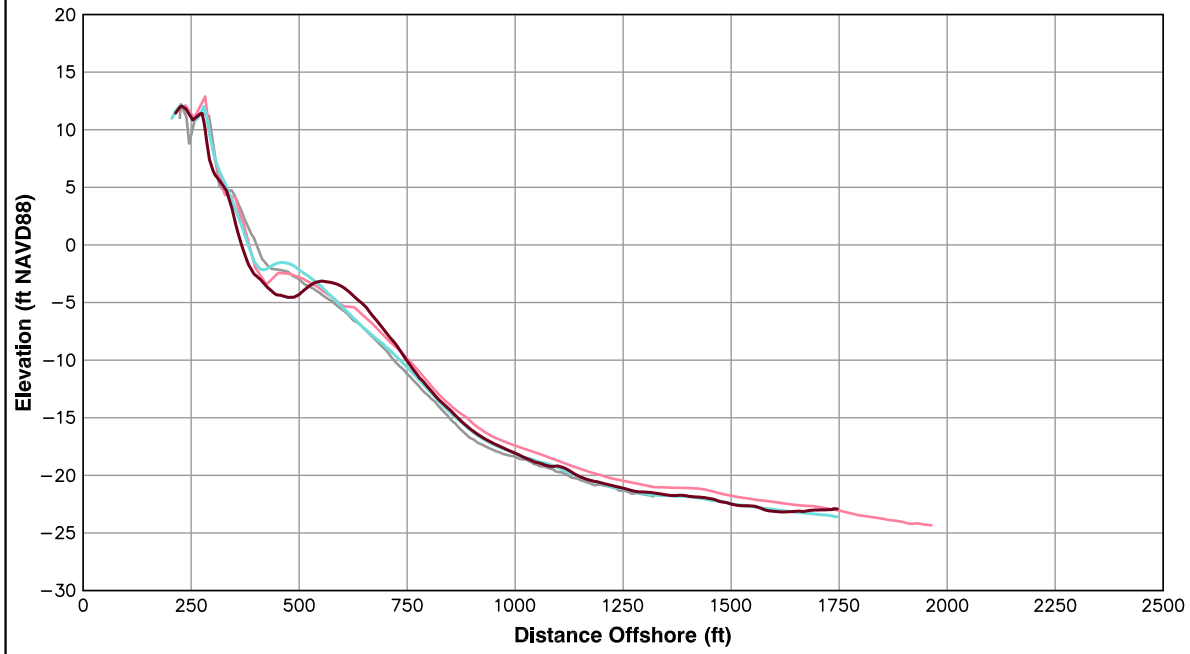
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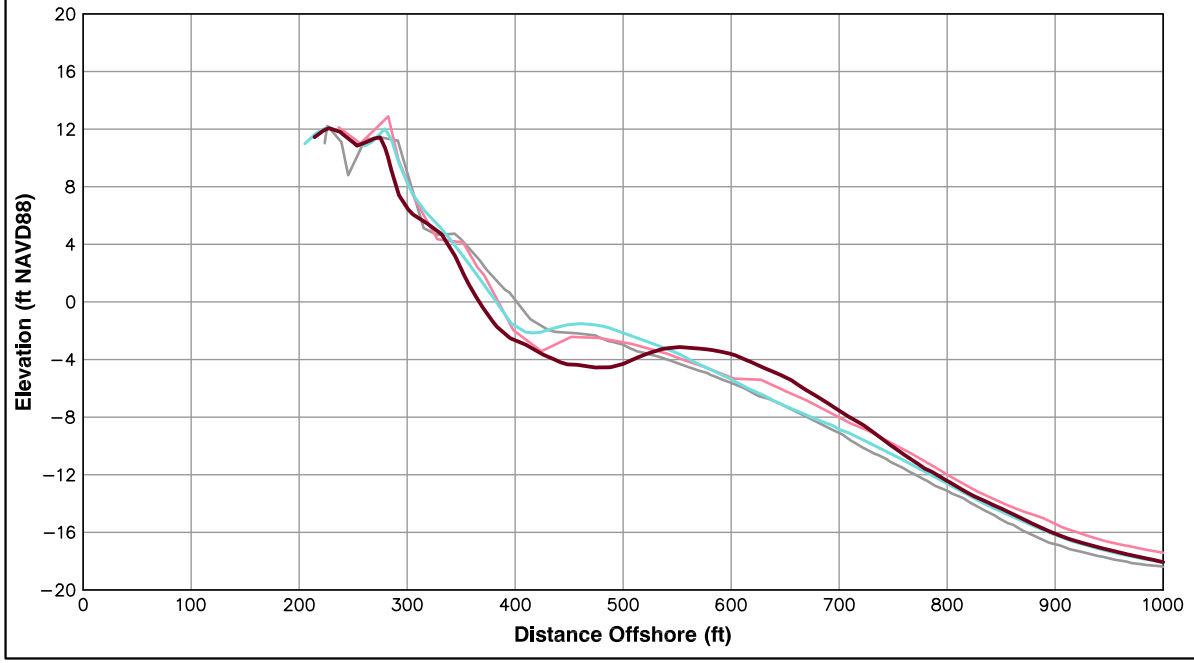
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 195+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-20.27 ft/yr	-14.36 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.91 cy/ft
Volume Change Above 0 ft NAVD88	-6.25 cy/ft/yr	-4.53 cy/ft

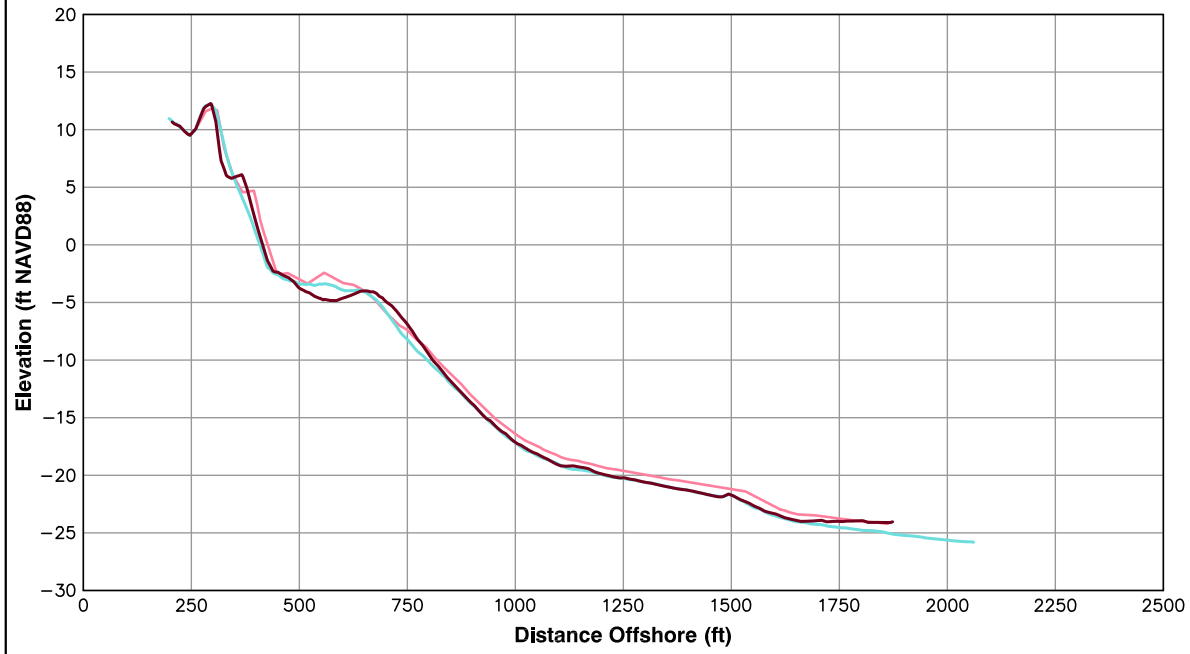
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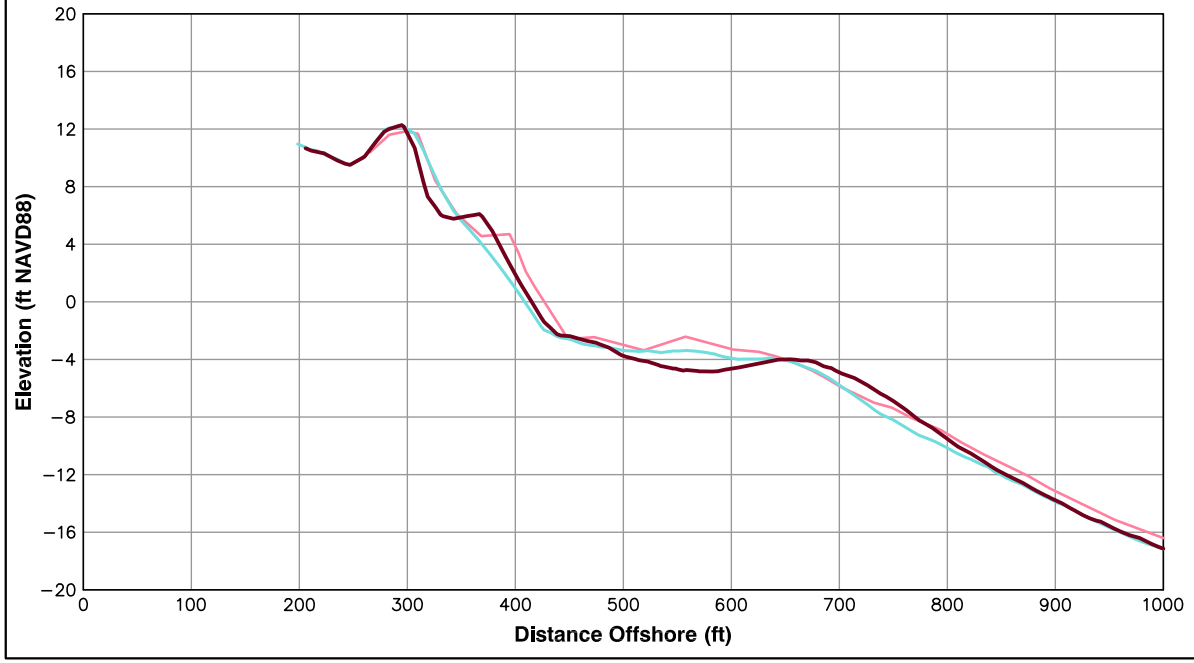
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 206+86	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-12.49 ft/yr	7.48 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	2.85 cy/ft
Volume Change Above 0 ft NAVD88	-3.66 cy/ft/yr	0.30 cy/ft

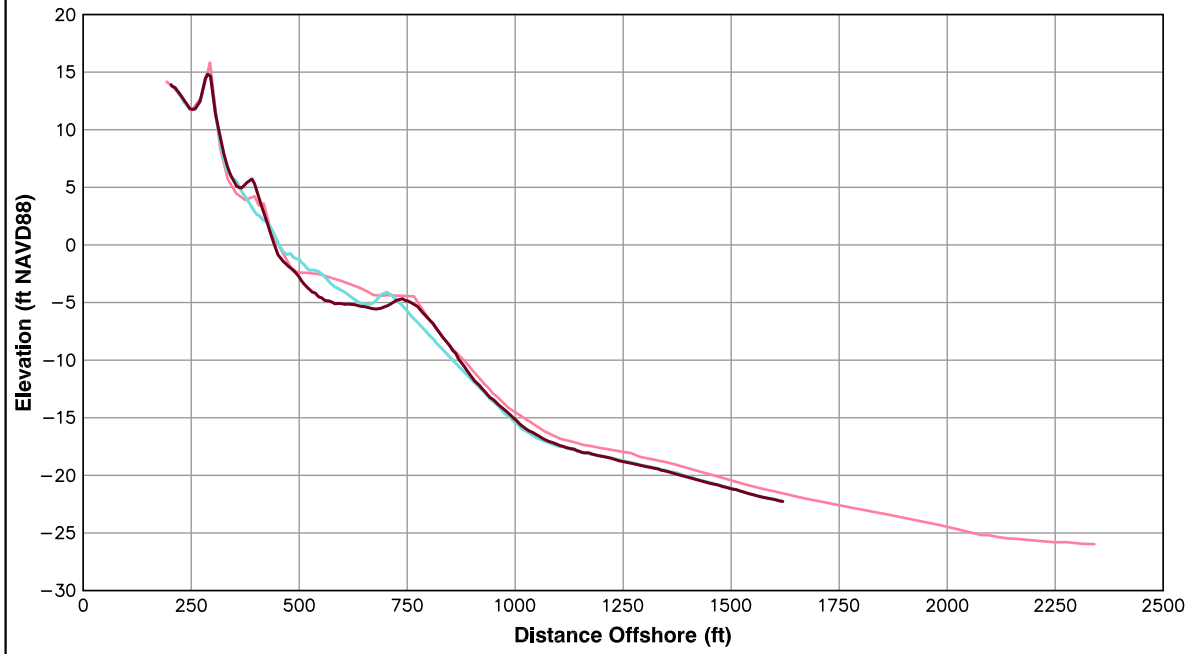
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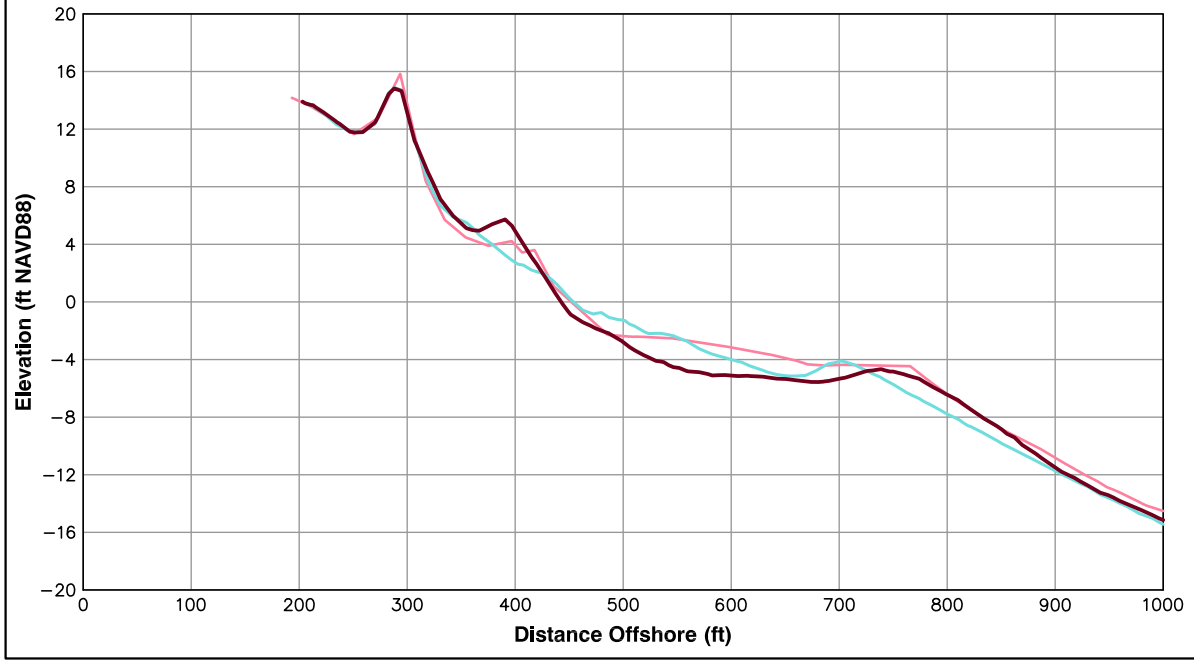
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 218+66	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-3.61 ft/yr	-7.61 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-1.85 cy/ft
Volume Change Above 0 ft NAVD88	2.67 cy/ft/yr	3.02 cy/ft

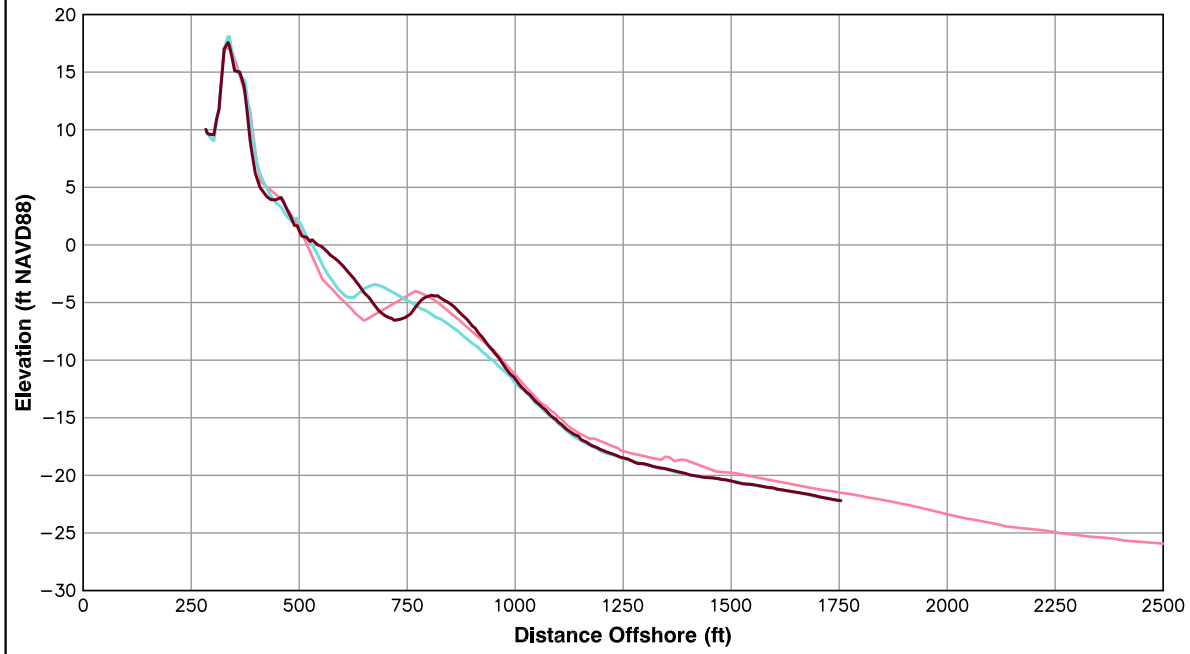
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- 2010 MAR
- 2009 OCT
- 2009 APR

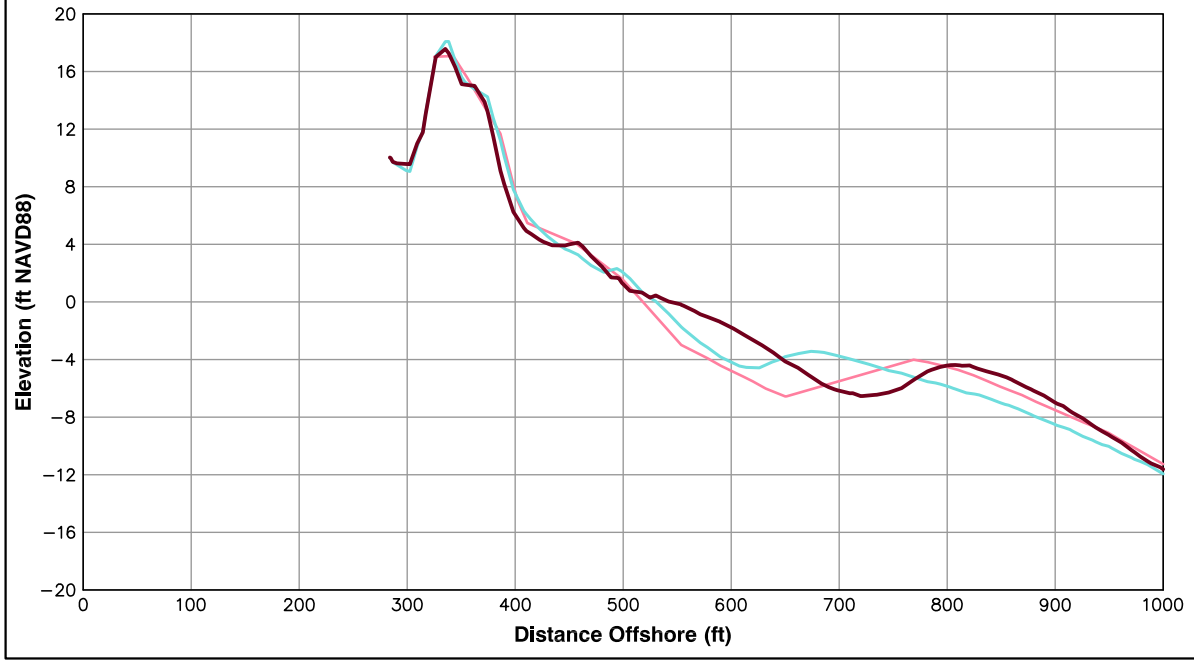
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

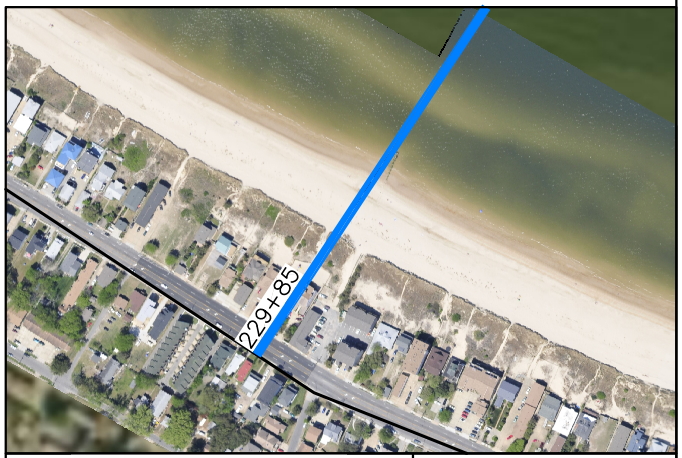




Survey Transect 229+85	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-3.41 ft/yr	-10.59 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	7.60 cy/ft
Volume Change Above 0 ft NAVD88	-3.49 cy/ft/yr	-2.81 cy/ft

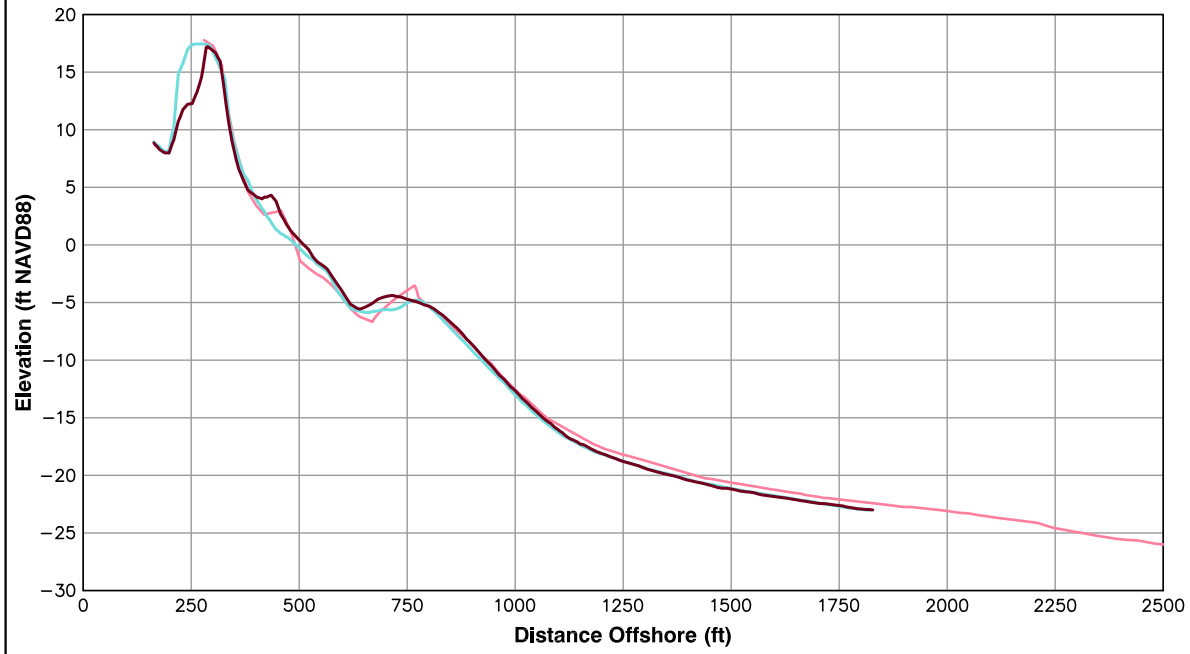
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- 2009 APR

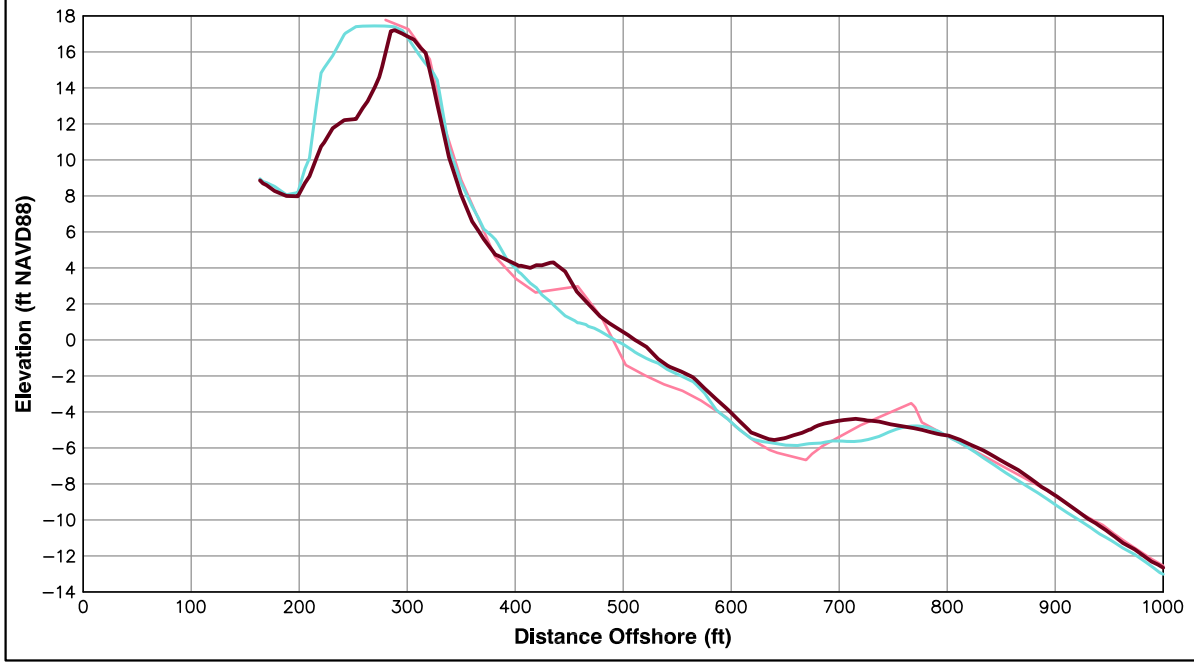
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 242+03	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	3.98 ft/yr	28.78 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	1.56 cy/ft
Volume Change Above 0 ft NAVD88	0.92 cy/ft/yr	-7.37 cy/ft

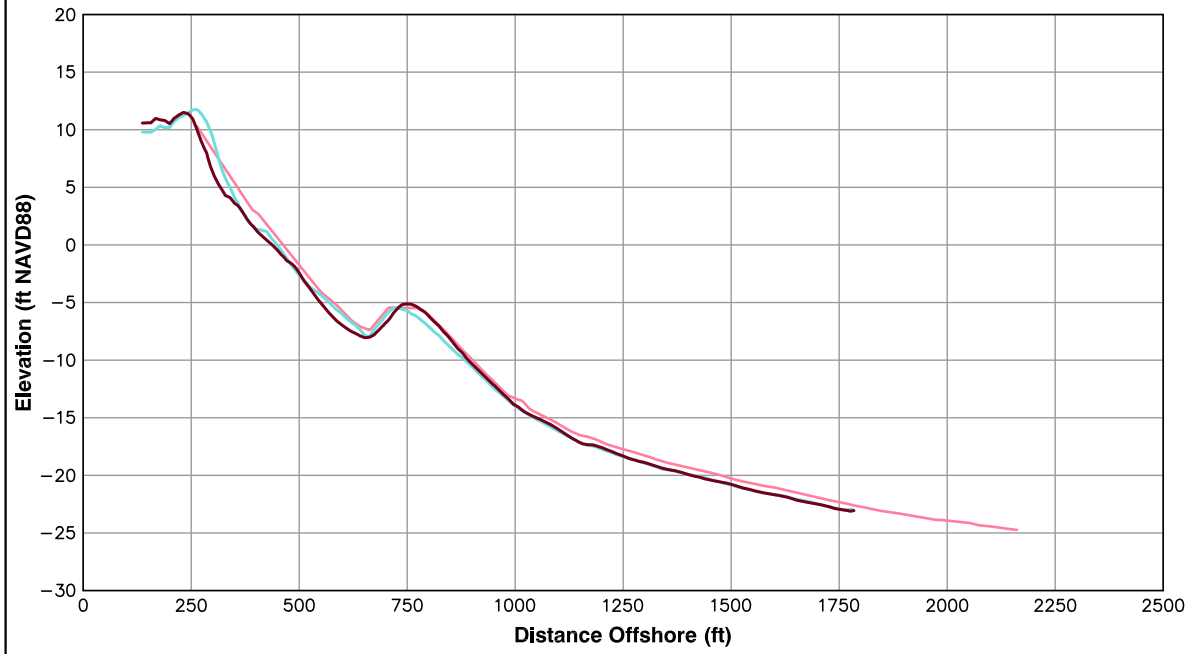
LEGEND:
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- 2009 APR

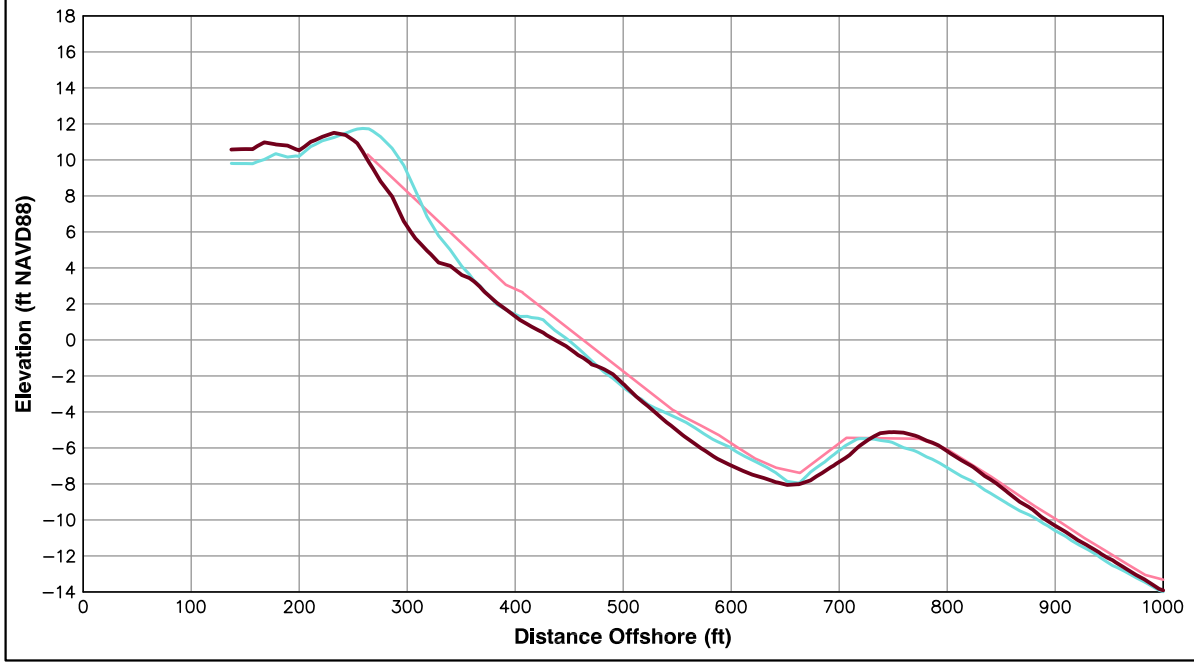
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 252+62	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-36.87 ft/yr	-20.16 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-5.85 cy/ft
Volume Change Above 0 ft NAVD88	-11.57 cy/ft/yr	-6.16 cy/ft

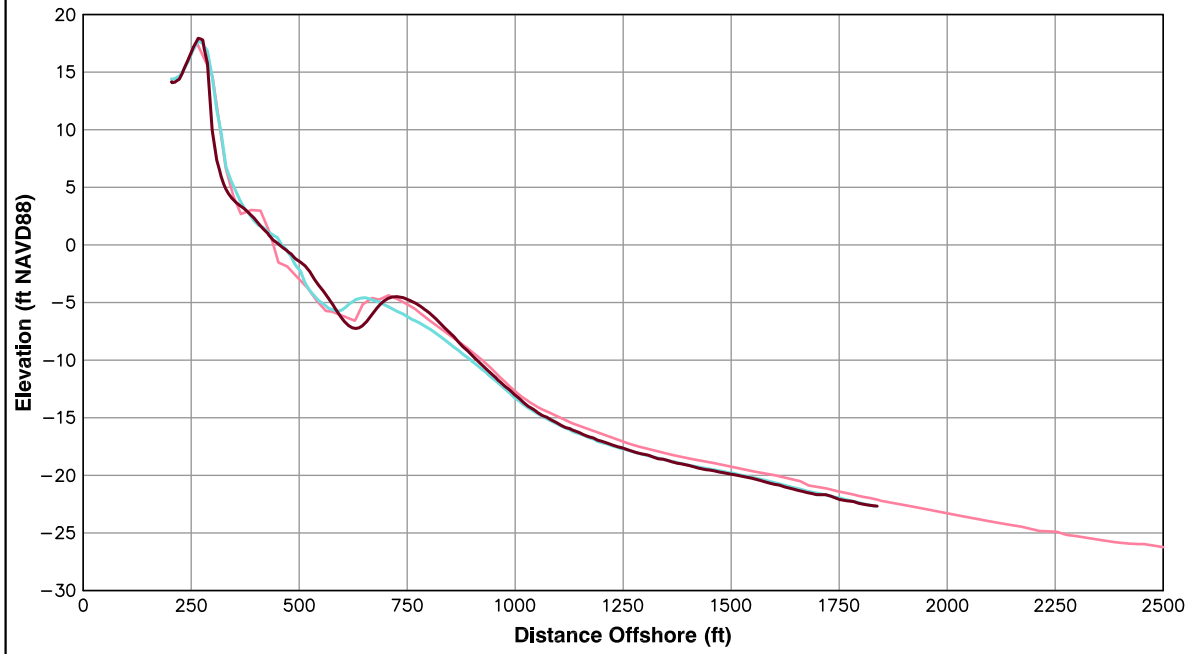
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- 2009 APR

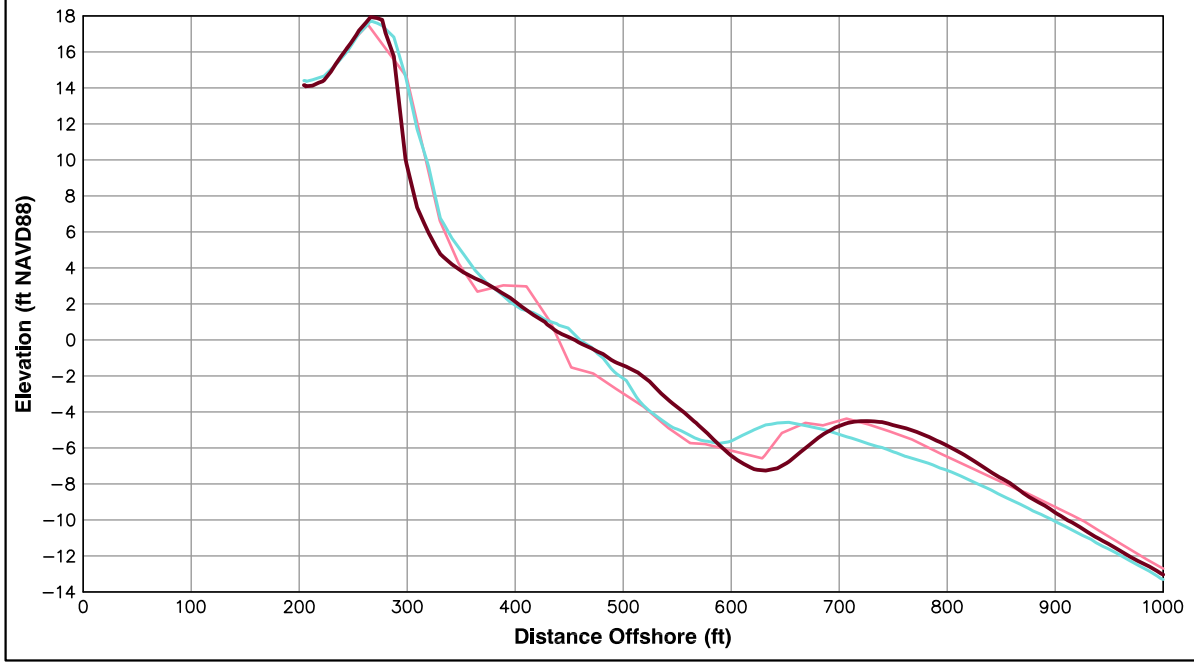
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 263+22	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-5.39 ft/yr	-6.61 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	0.44 cy/ft
Volume Change Above 0 ft NAVD88	-6.86 cy/ft/yr	-7.67 cy/ft

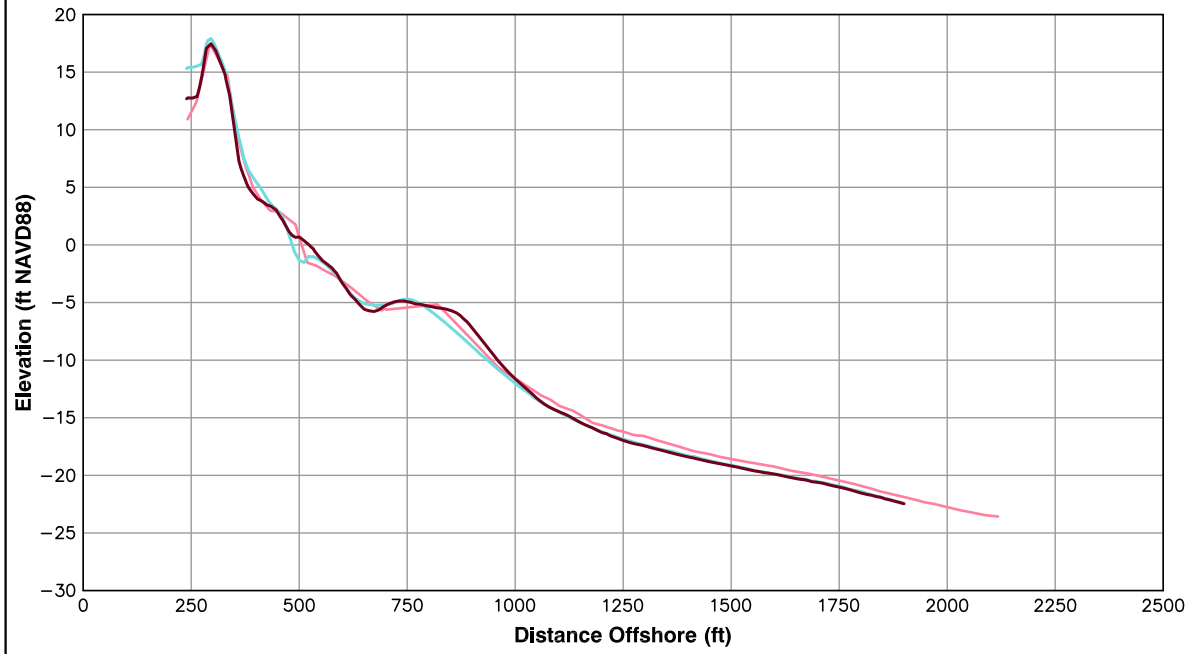
LEGEND:
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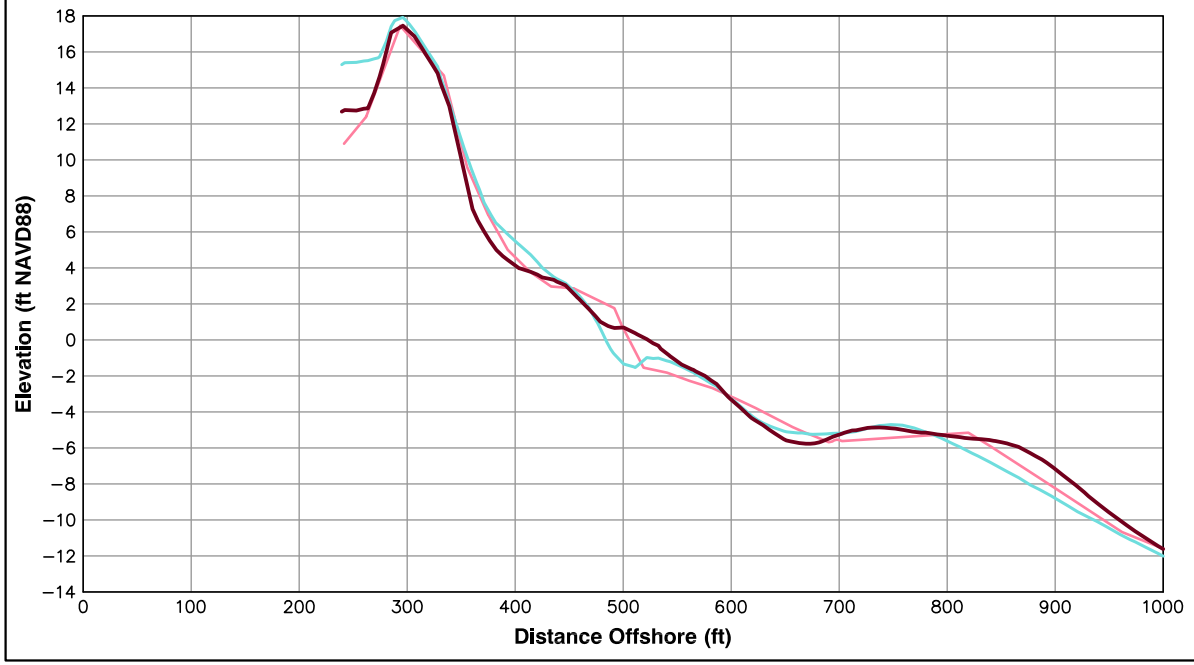
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

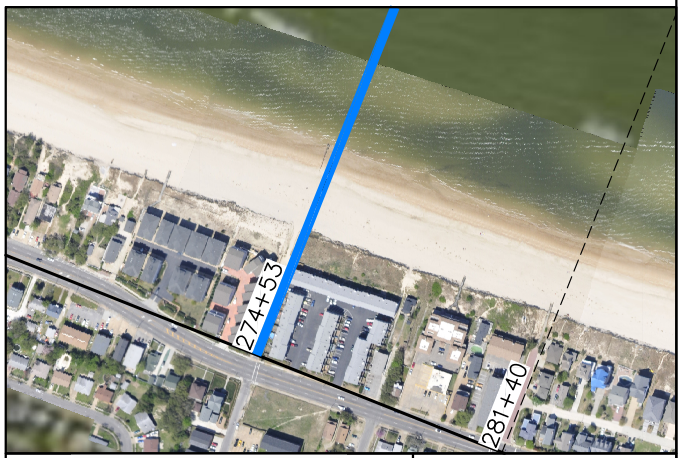




Survey Transect 274+53	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-19.29 ft/yr	4.07 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	2.19 cy/ft
Volume Change Above 0 ft NAVD88	-2.35 cy/ft/yr	-7.67 cy/ft

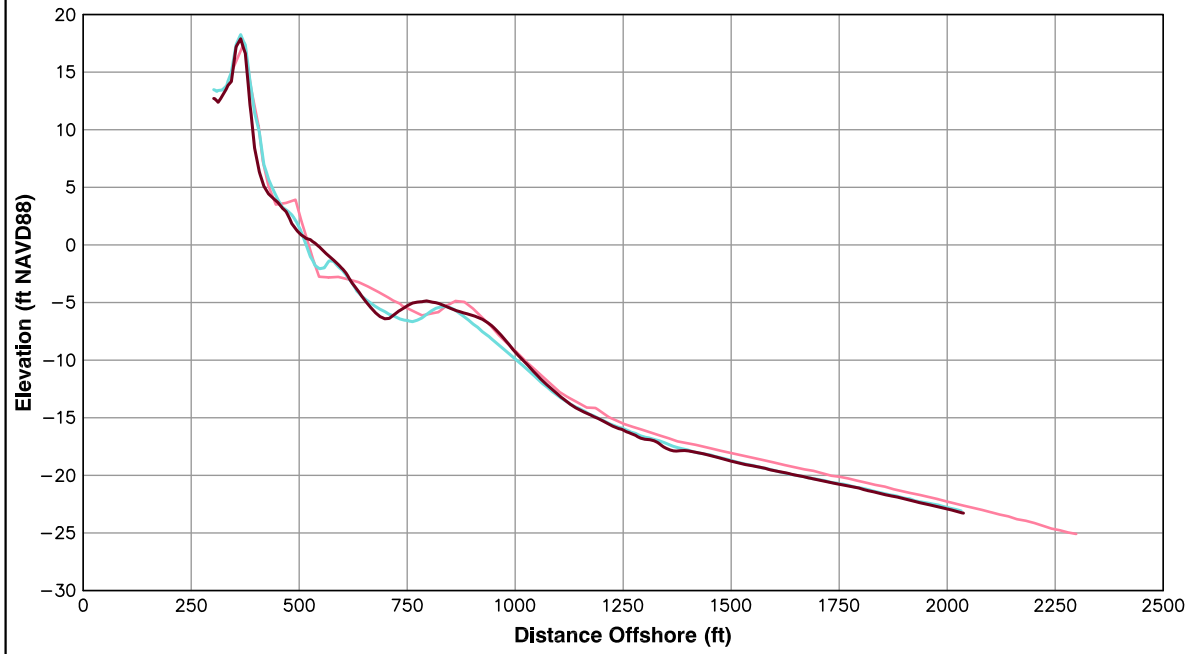
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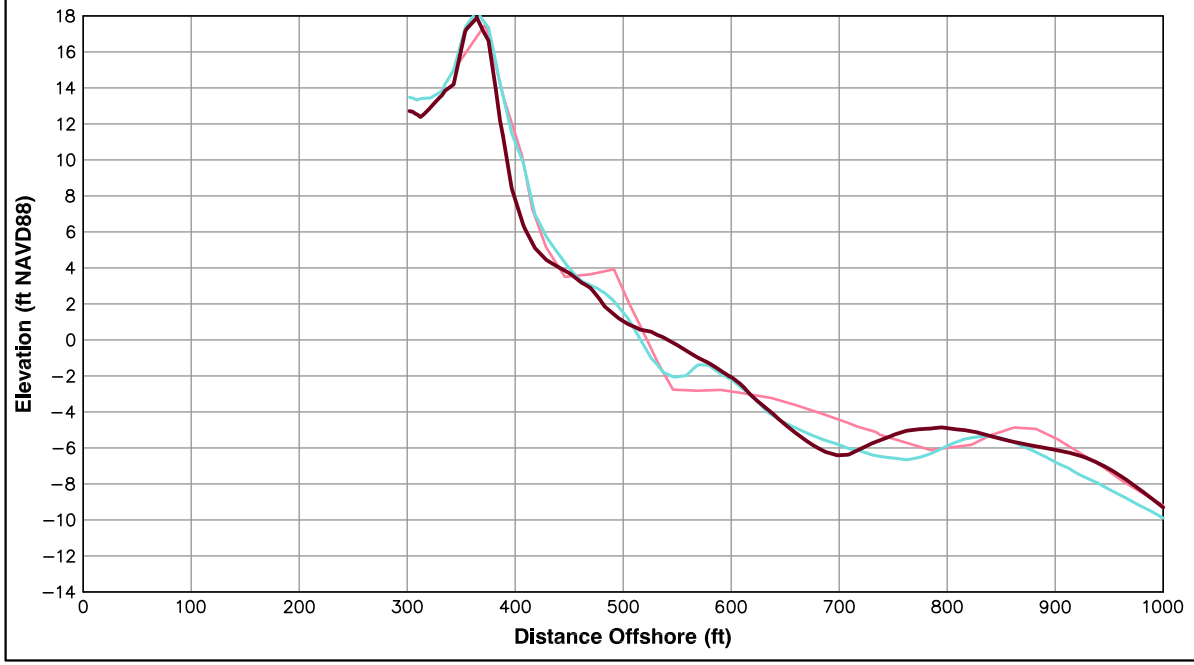
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 281+40	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-13.52 ft/yr	-4.74 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	3.90 cy/ft
Volume Change Above 0 ft NAVD88	-7.09 cy/ft/yr	-7.04 cy/ft

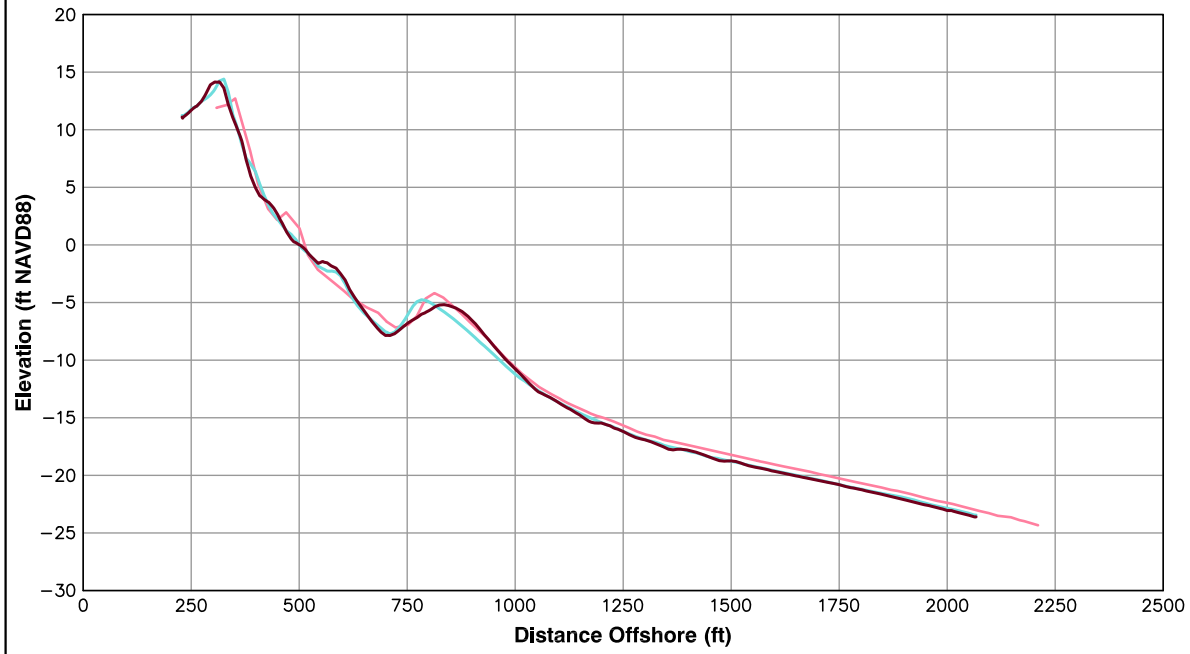
LEGEND:
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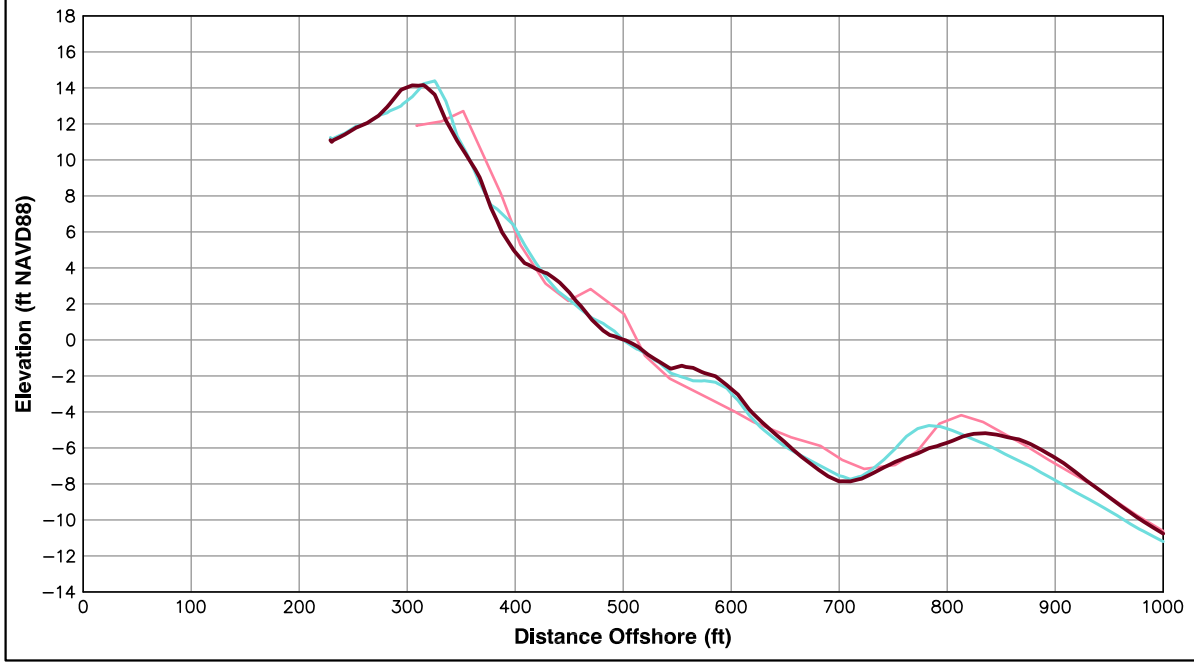
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 288+39	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-34.10 ft/yr	-5.83 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	3.00 cy/ft
Volume Change Above 0 ft NAVD88	-5.30 cy/ft/yr	-1.34 cy/ft

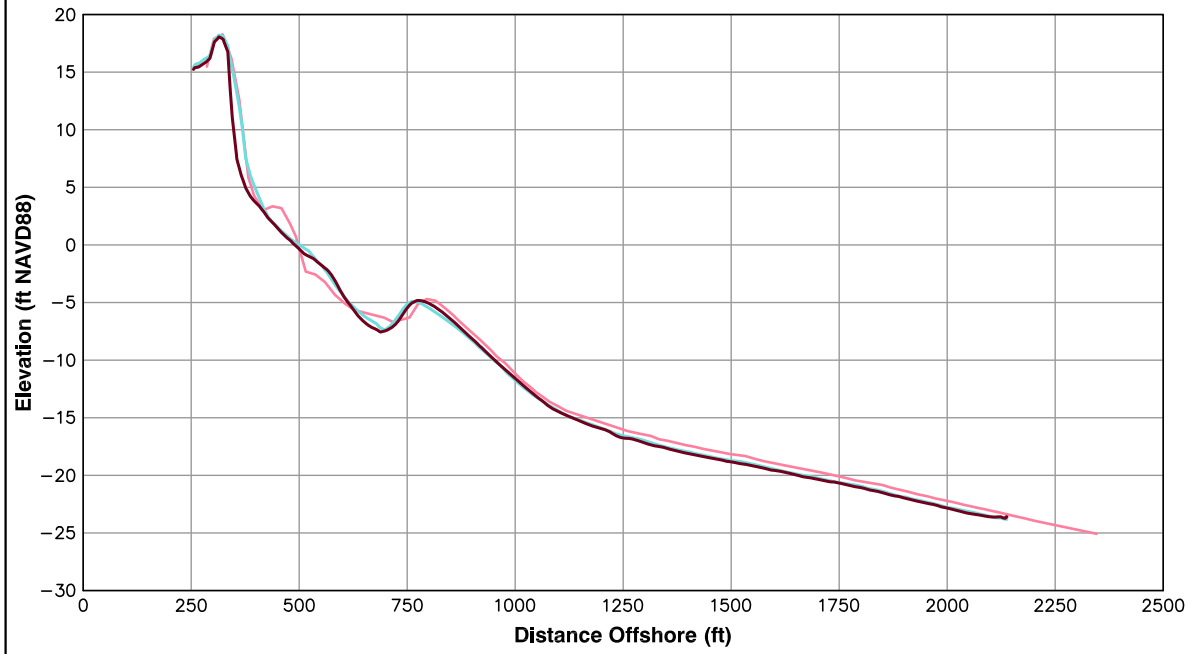
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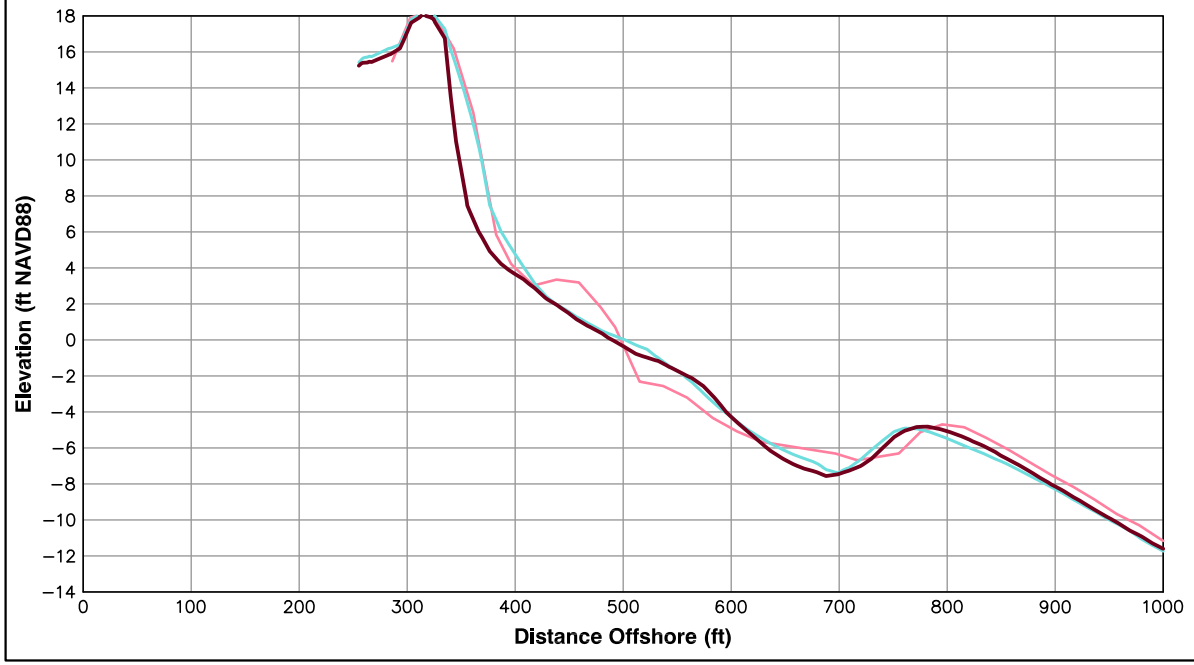
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 295+27	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-30.35 ft/yr	-4.40 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-9.65 cy/ft
Volume Change Above 0 ft NAVD88	-13.46 cy/ft/yr	-9.52 cy/ft

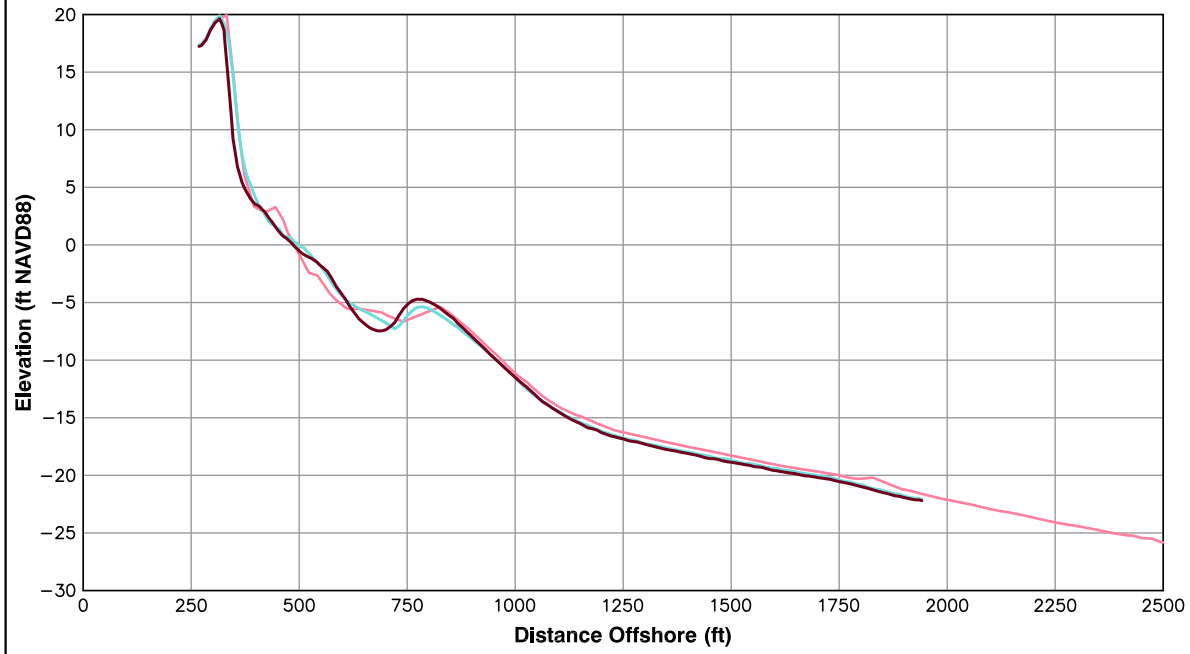
LEGEND:
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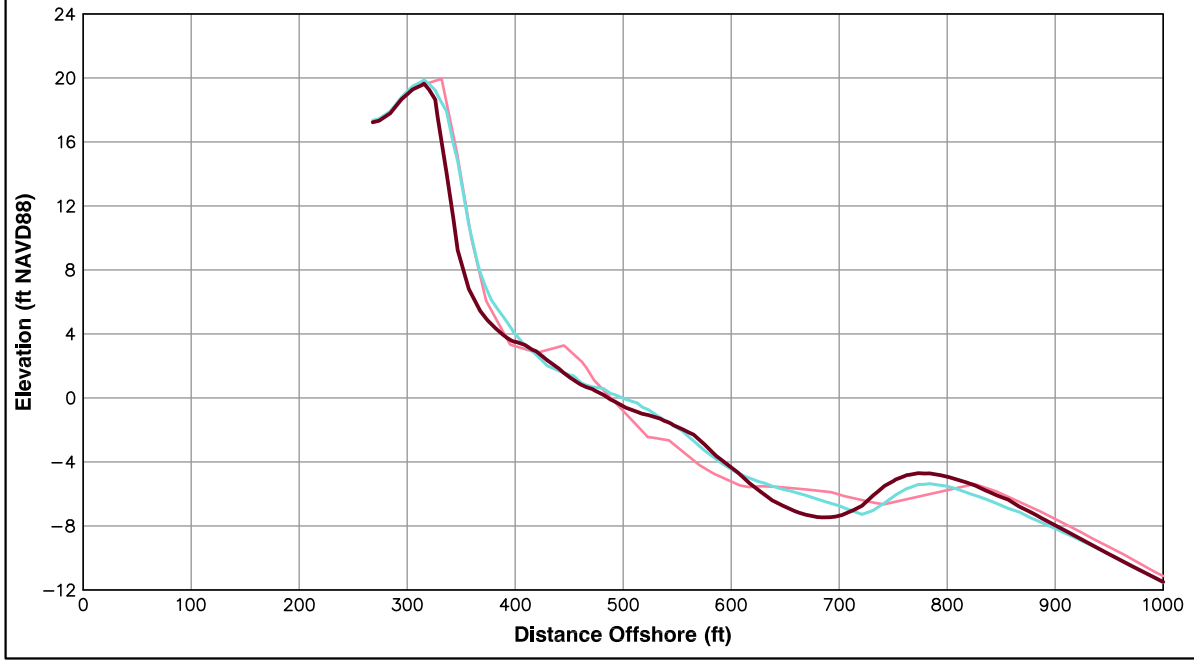
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 302+24	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-18.43 ft/yr	-3.17 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.82 cy/ft
Volume Change Above 0 ft NAVD88	-10.32 cy/ft/yr	-7.96 cy/ft

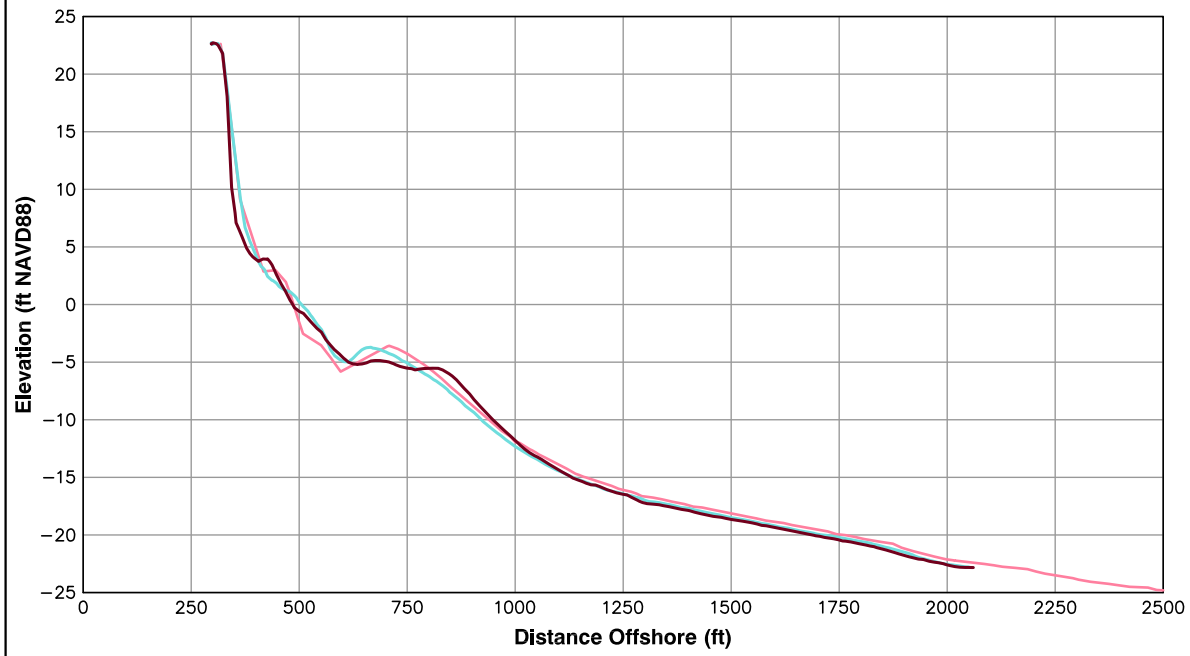
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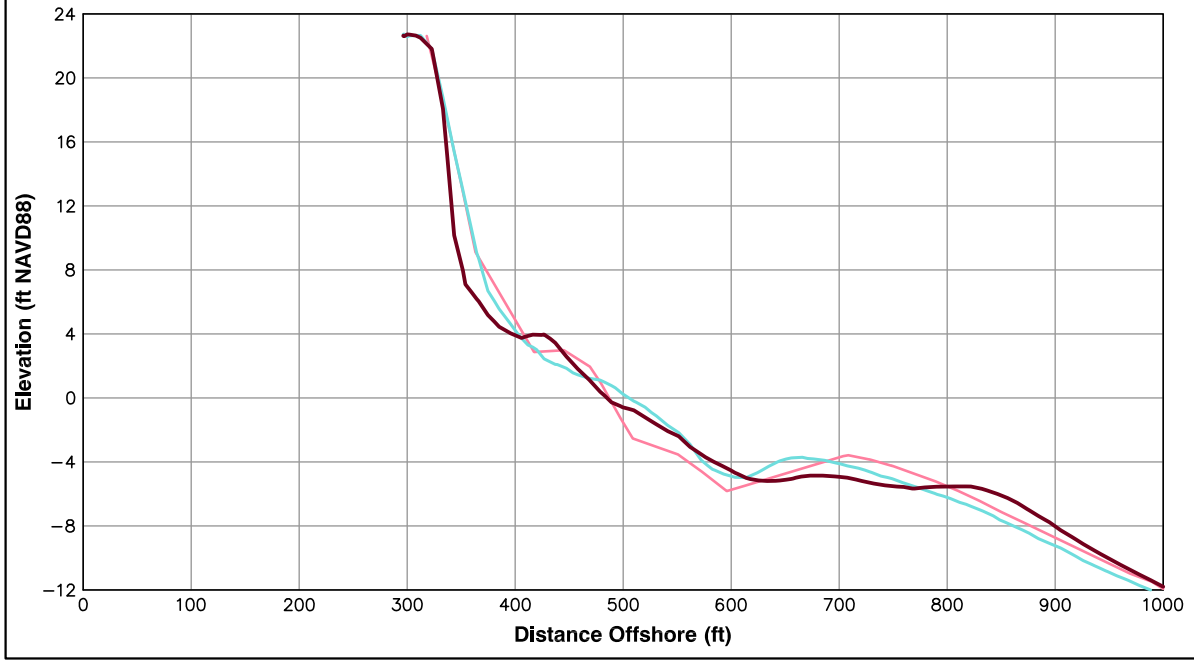
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 315+96	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-8.93 ft/yr	-12.27 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-1.22 cy/ft
Volume Change Above 0 ft NAVD88	-8.22 cy/ft/yr	-5.48 cy/ft

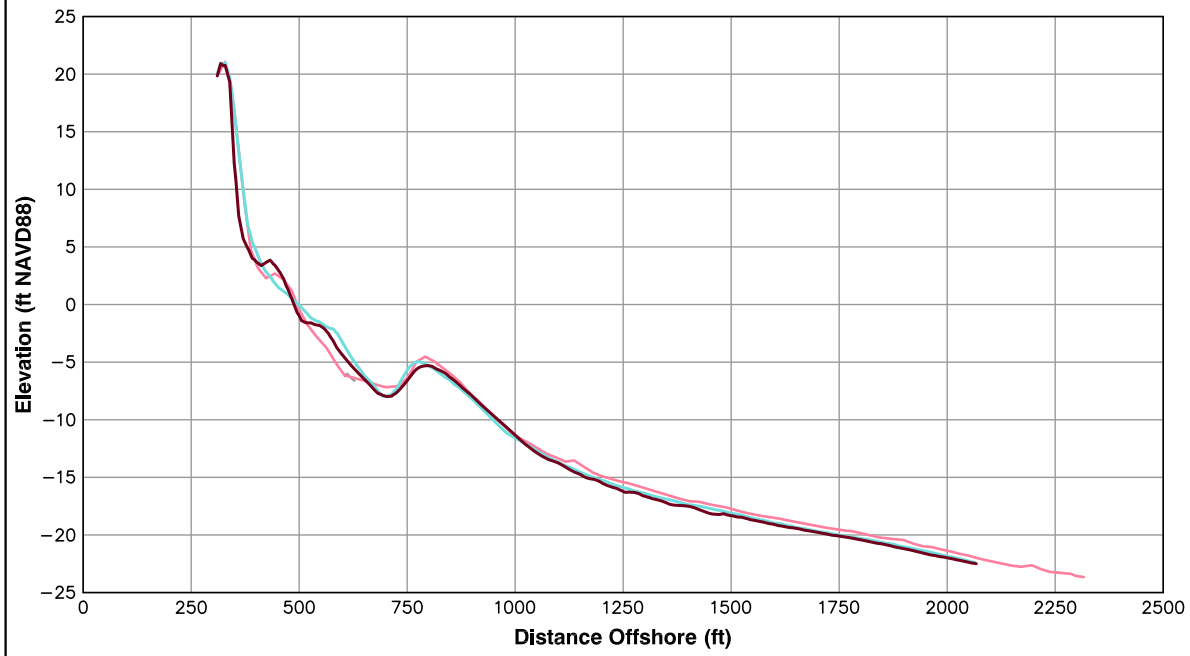
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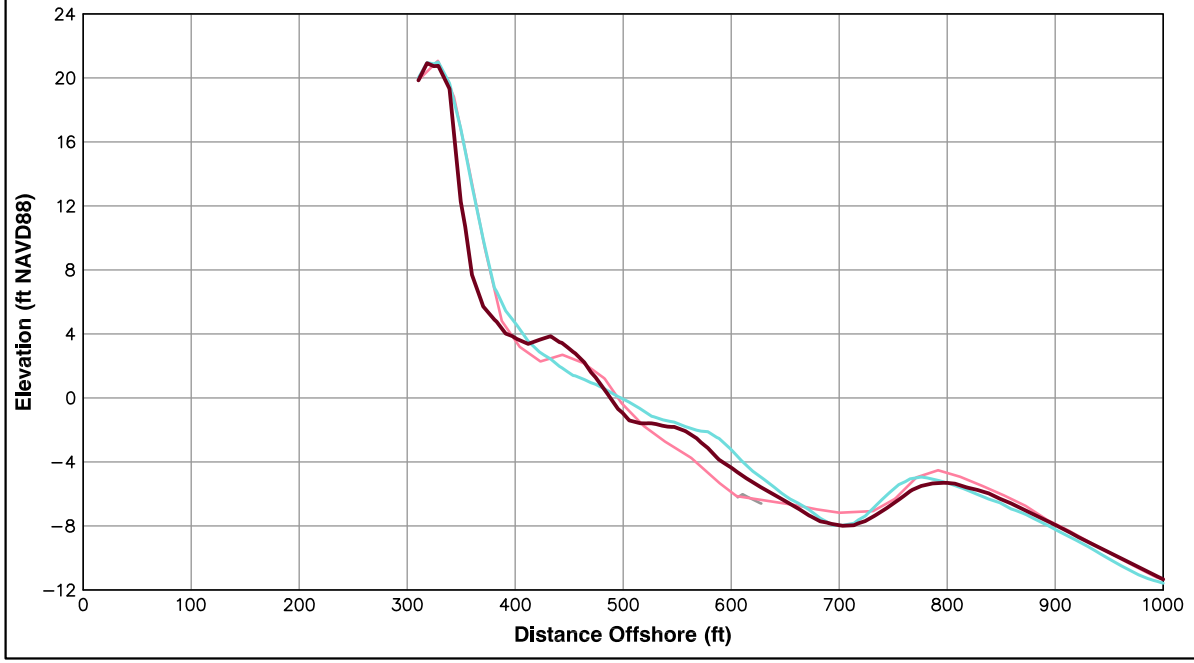
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 323+09	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-8.13 ft/yr	8.45 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-9.75 cy/ft
Volume Change Above 0 ft NAVD88	-5.44 cy/ft/yr	-4.97 cy/ft

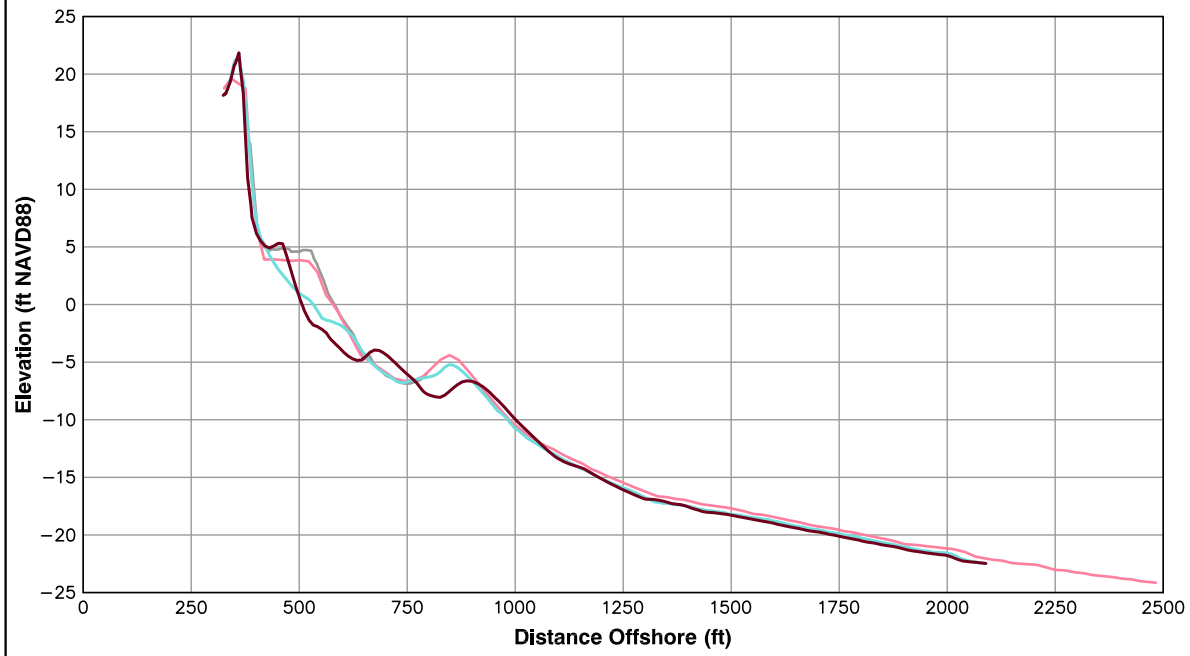
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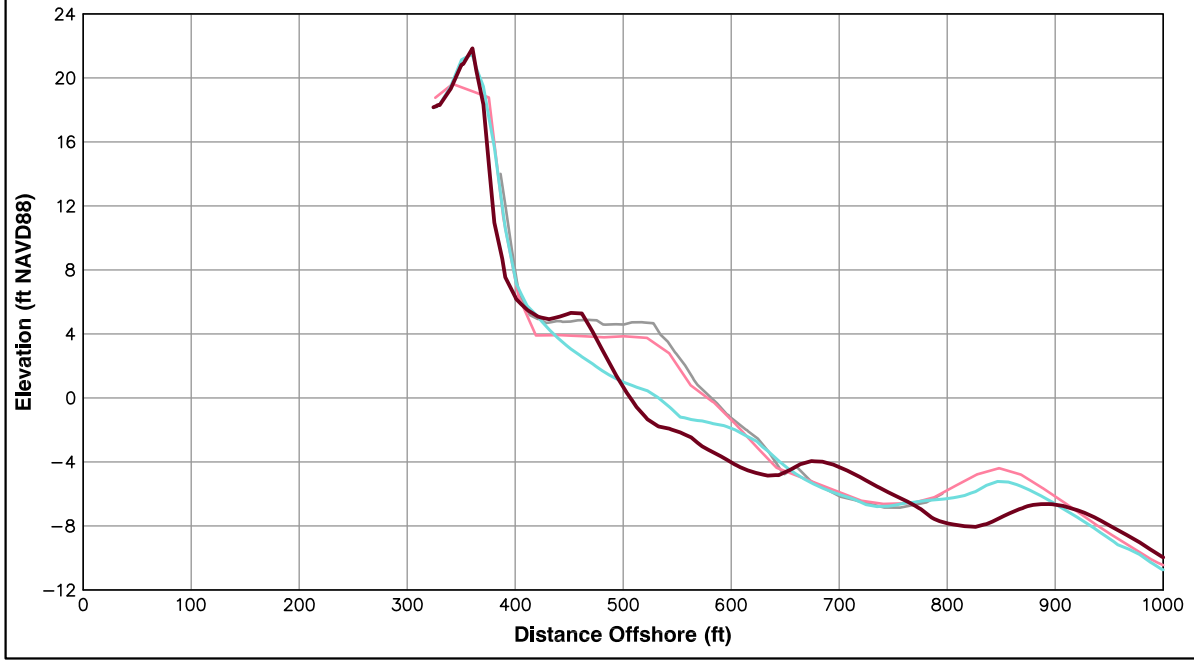
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 329+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-67.47 ft/yr	-3.26 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-7.16 cy/ft
Volume Change Above 0 ft NAVD88	-9.33 cy/ft/yr	-0.49 cy/ft

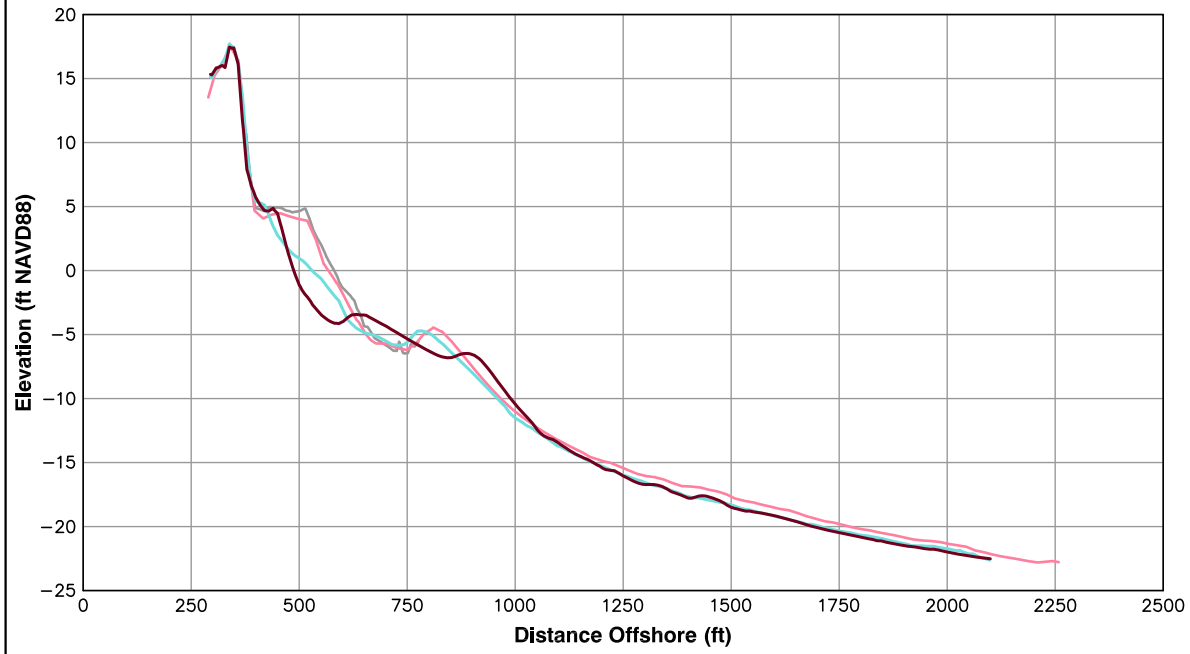
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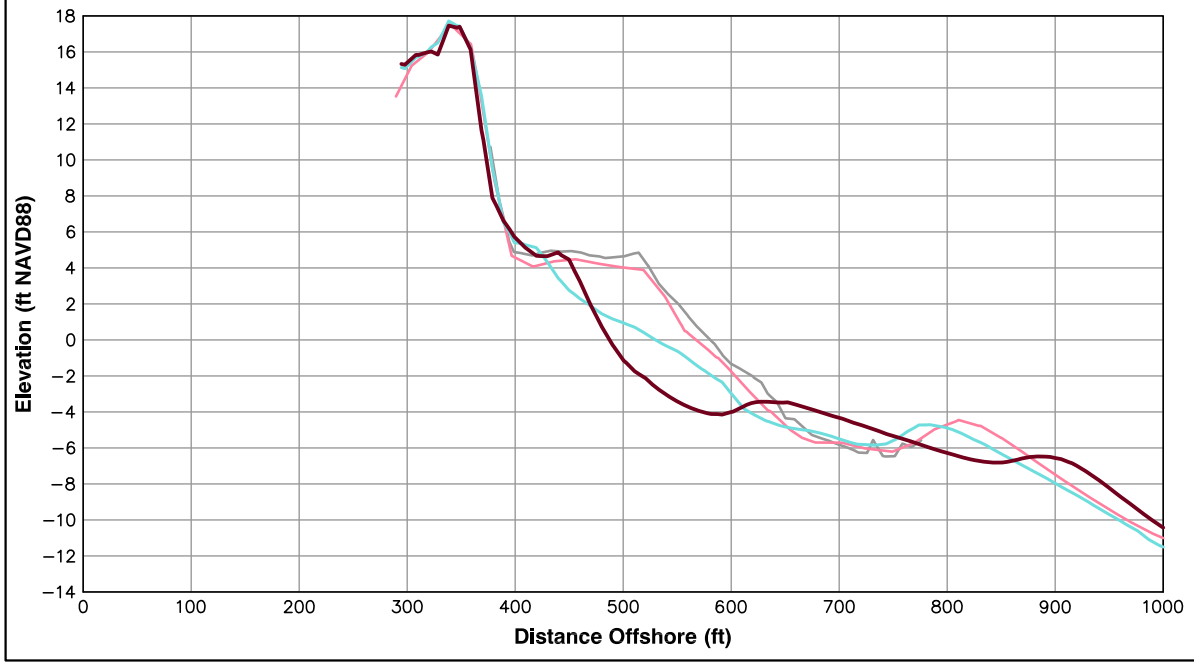
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 331+43	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-81.03 ft/yr	-20.64 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-0.51 cy/ft
Volume Change Above 0 ft NAVD88	-11.81 cy/ft/yr	-1.52 cy/ft

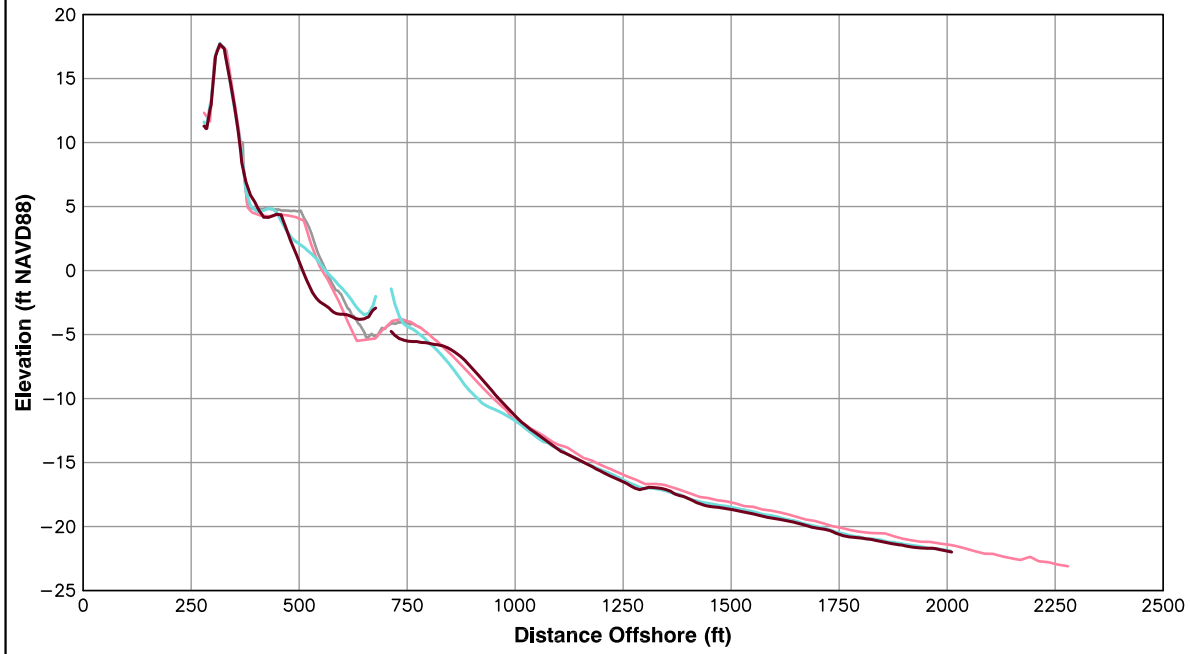
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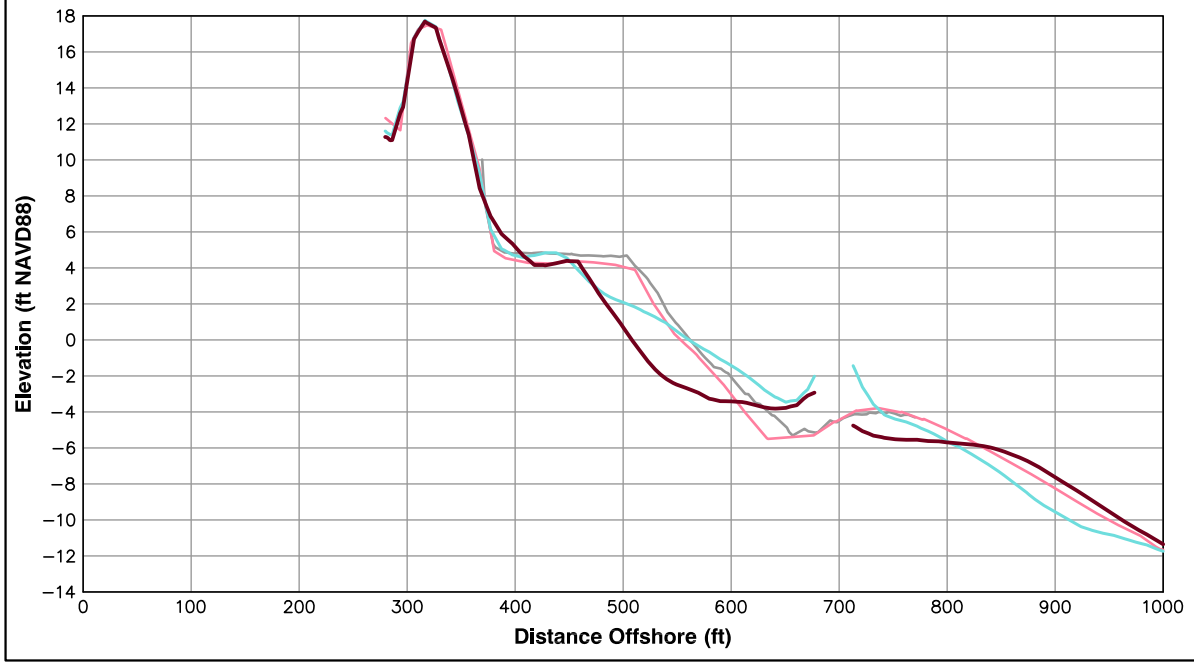
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 333+23	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-47.37 ft/yr	-42.00 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-7.03 cy/ft
Volume Change Above 0 ft NAVD88	-7.65 cy/ft/yr	-3.36 cy/ft

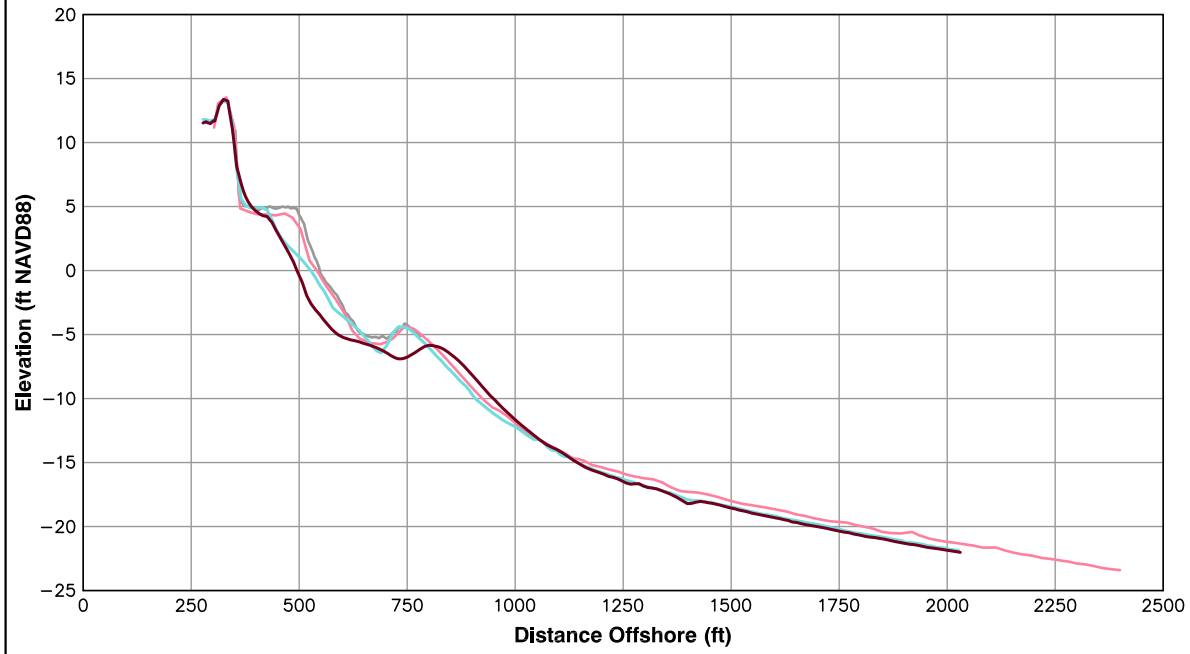
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- 2009 APR
- POST-FILL

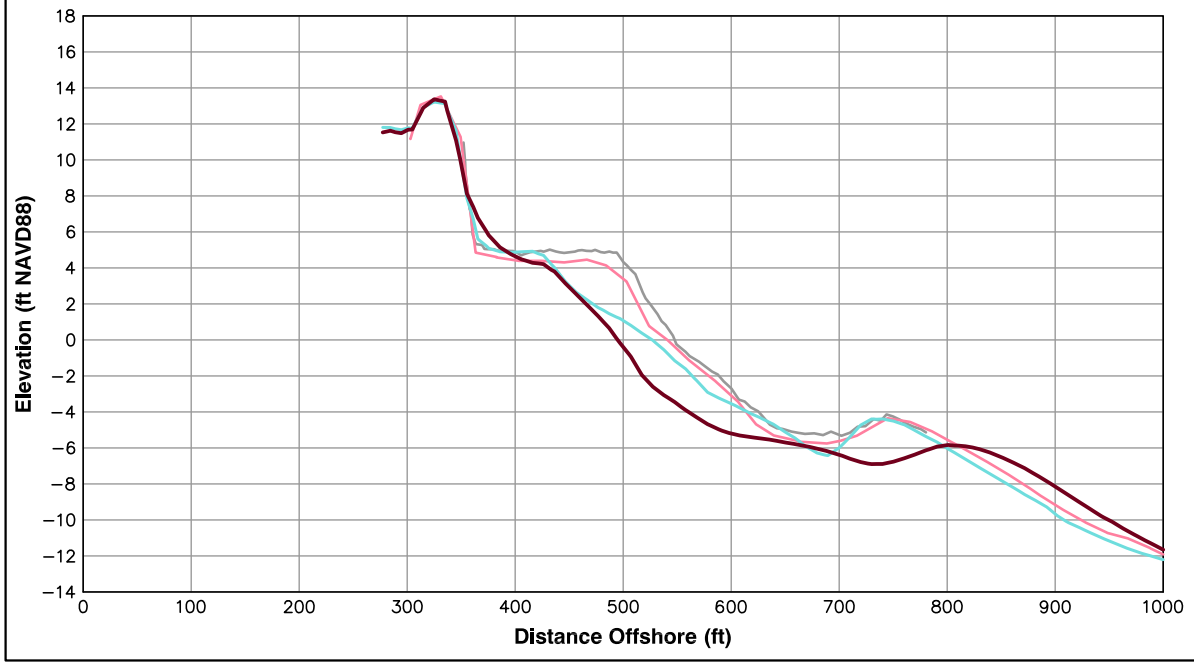
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 335+03	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-43.89 ft/yr	-20.47 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-7.26 cy/ft
Volume Change Above 0 ft NAVD88	-7.66 cy/ft/yr	-1.68 cy/ft

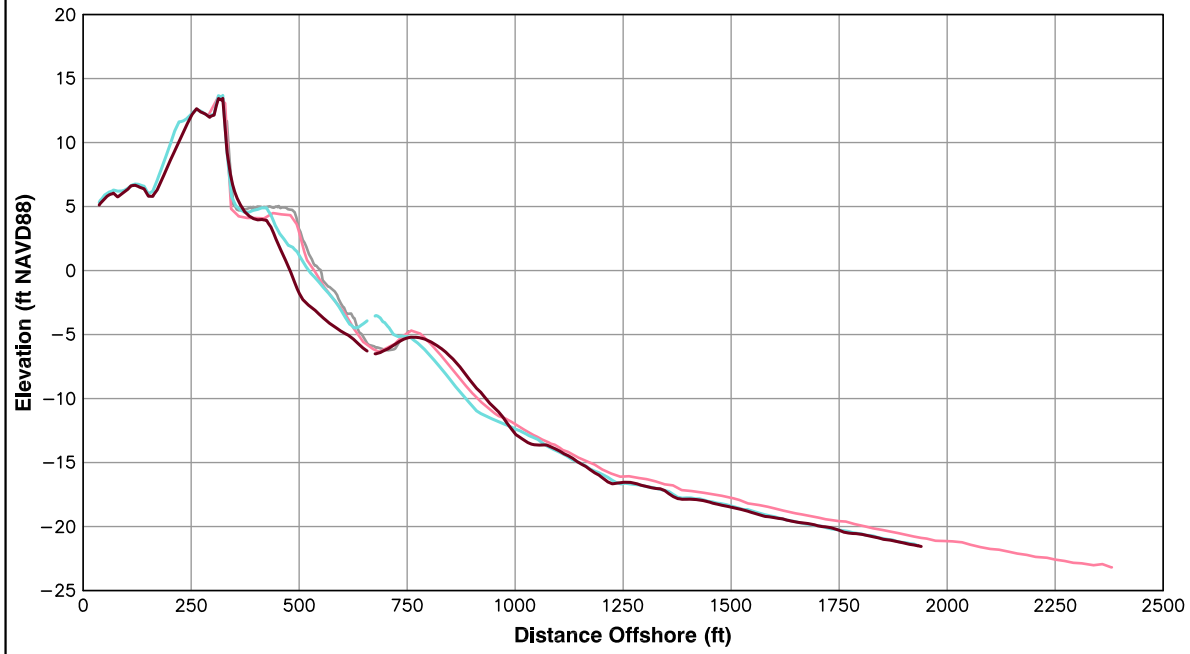
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- 2009 OCT
- 2009 APR
- POST-FILL

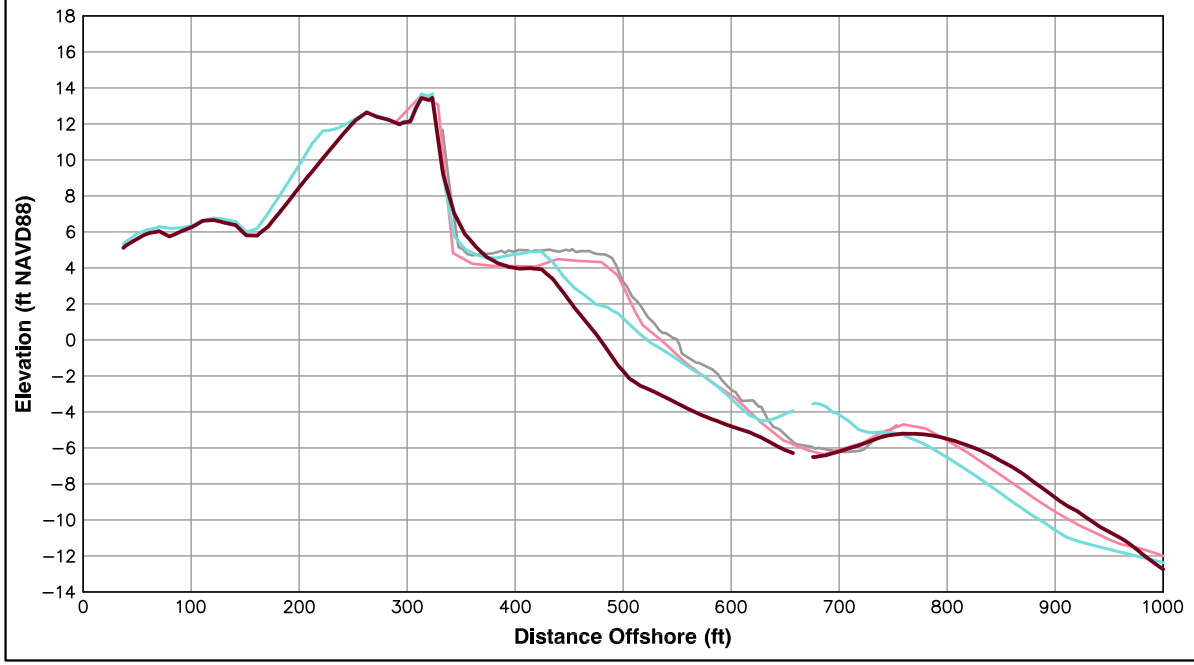
Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 336+83	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-55.33 ft/yr	-37.73 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-15.10 cy/ft
Volume Change Above 0 ft NAVD88	-9.03 cy/ft/yr	-8.75 cy/ft

LEGEND:
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- 2009 OCT
- 2009 APR
- POST-FILL

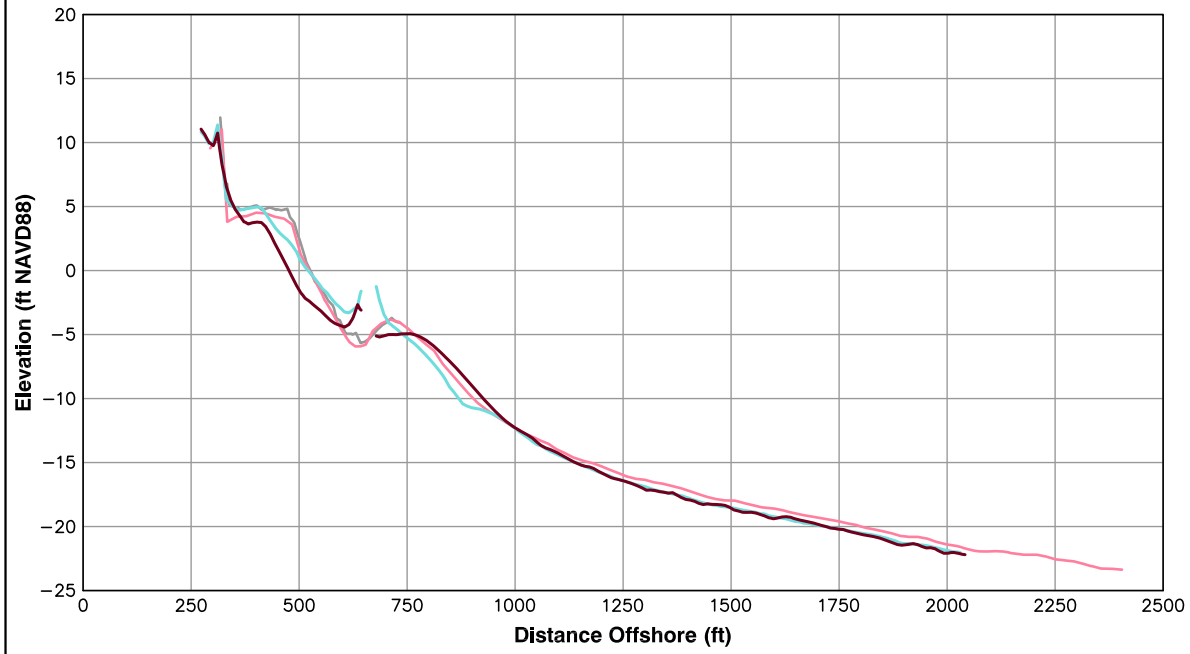
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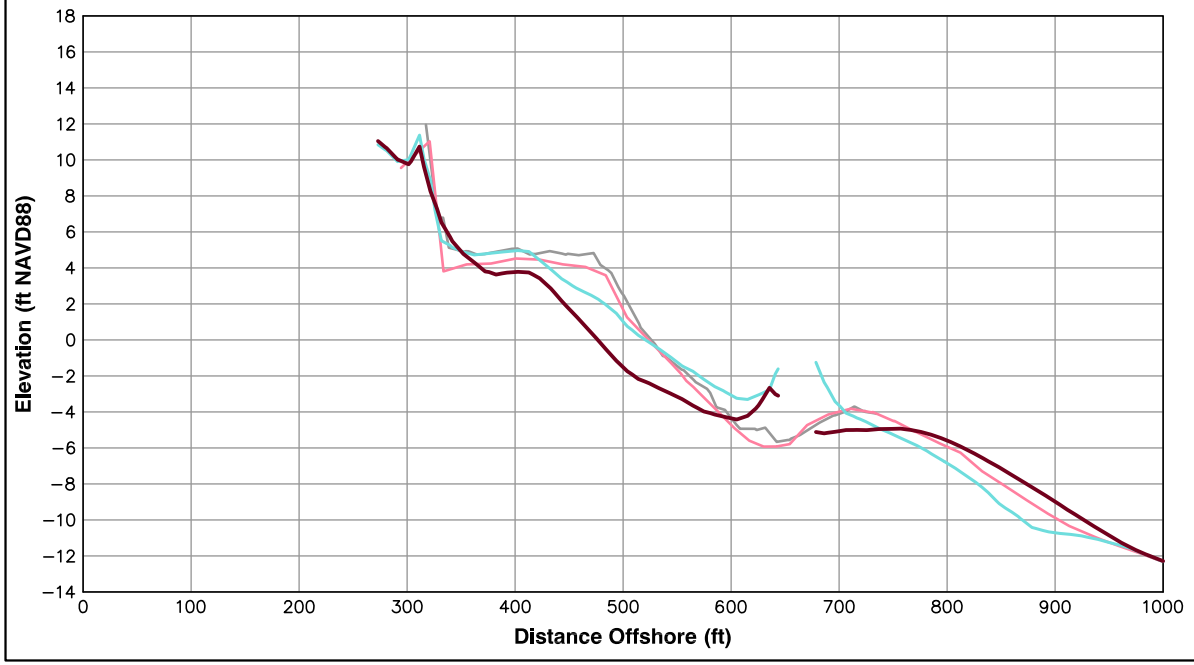


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 336+83	Pg 80 of 106	SPRING 2010





Survey Transect 338+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-50.59 ft/yr	-38.81 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-7.93 cy/ft
Volume Change Above 0 ft NAVD88	-9.55 cy/ft/yr	-7.16 cy/ft

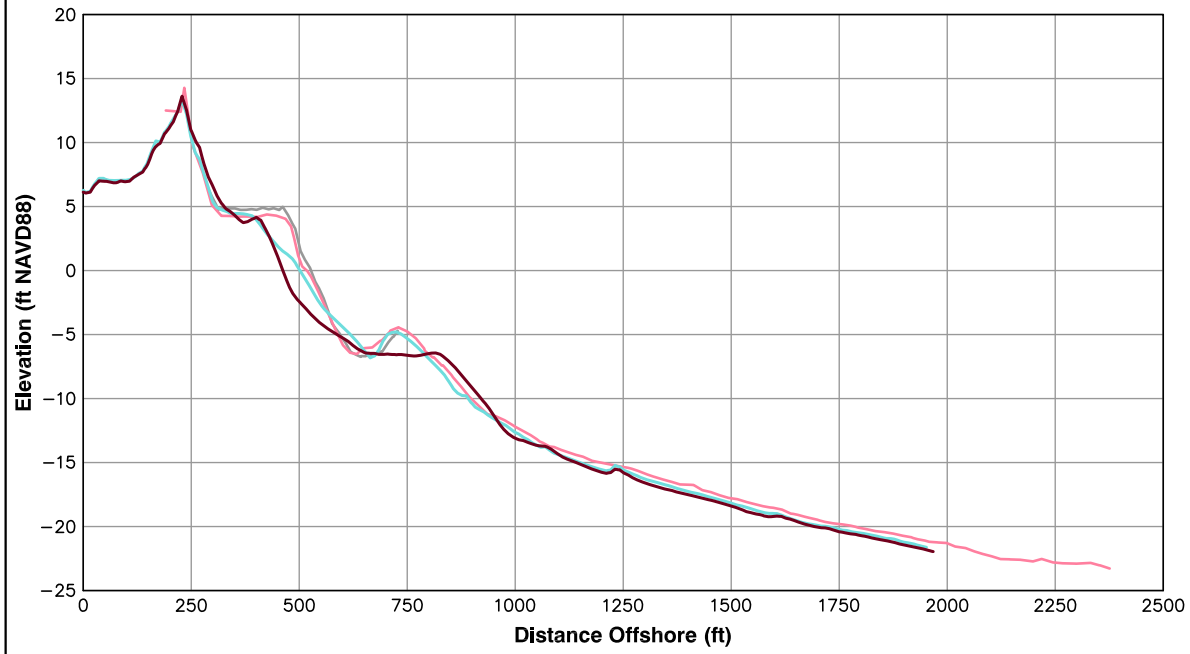
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- 2010 MAR
- 2009 OCT
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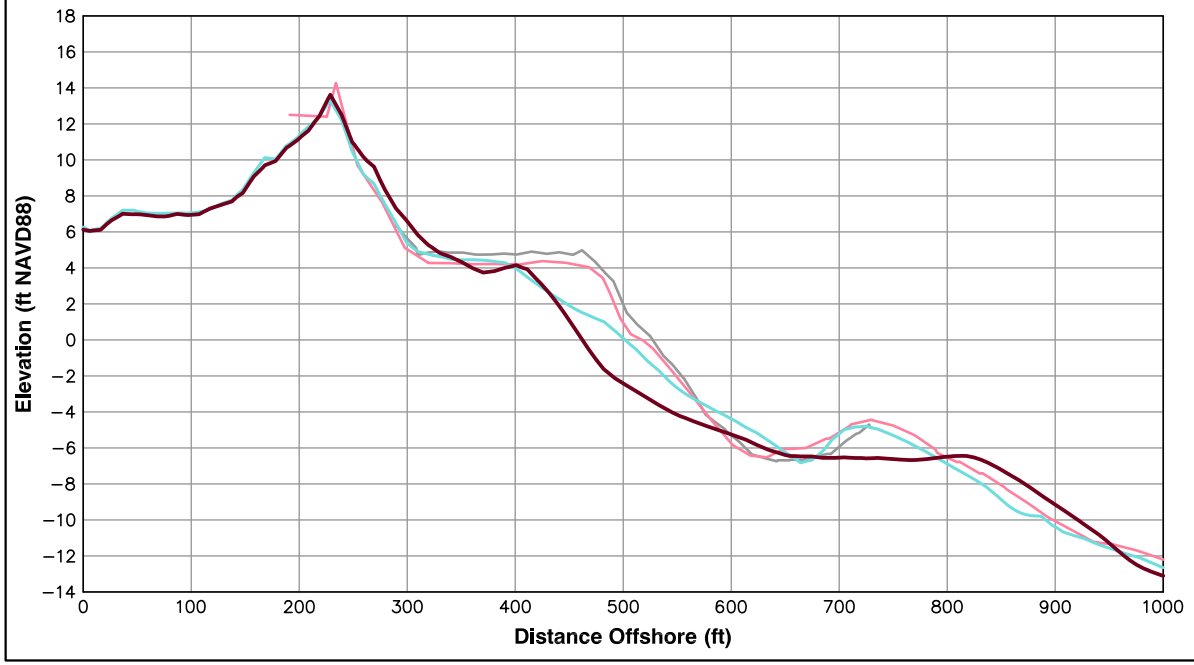
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 340+43	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-52.79 ft/yr	-31.35 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-8.56 cy/ft
Volume Change Above 0 ft NAVD88	-7.27 cy/ft/yr	-0.78 cy/ft

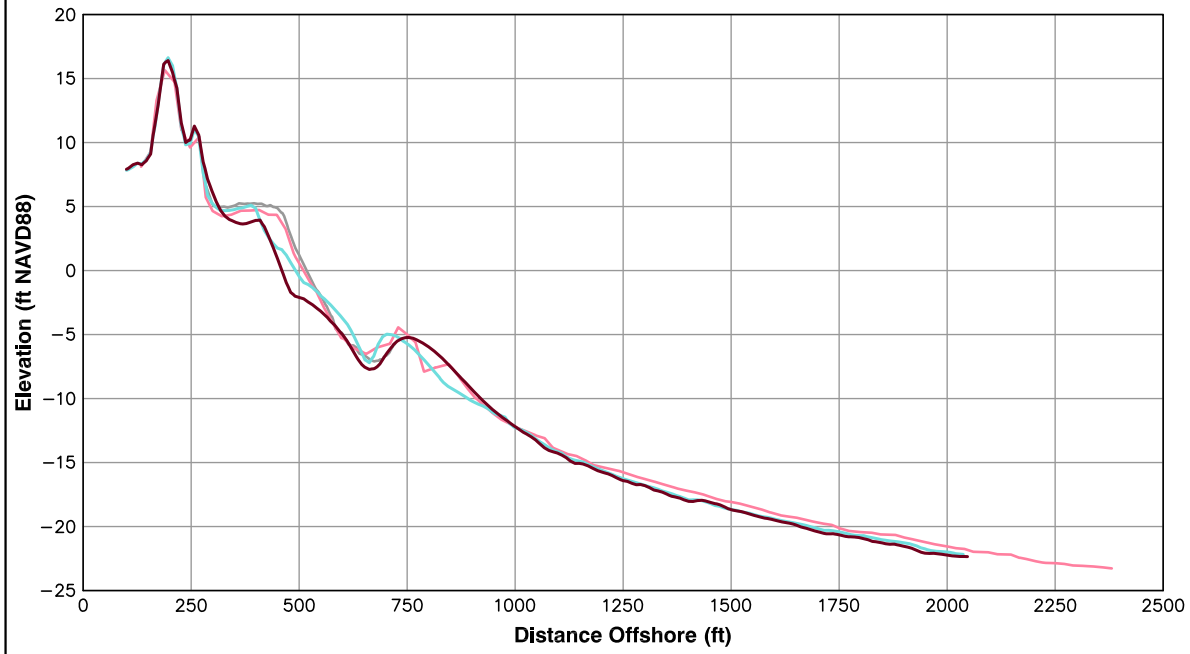
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- POST-FILL

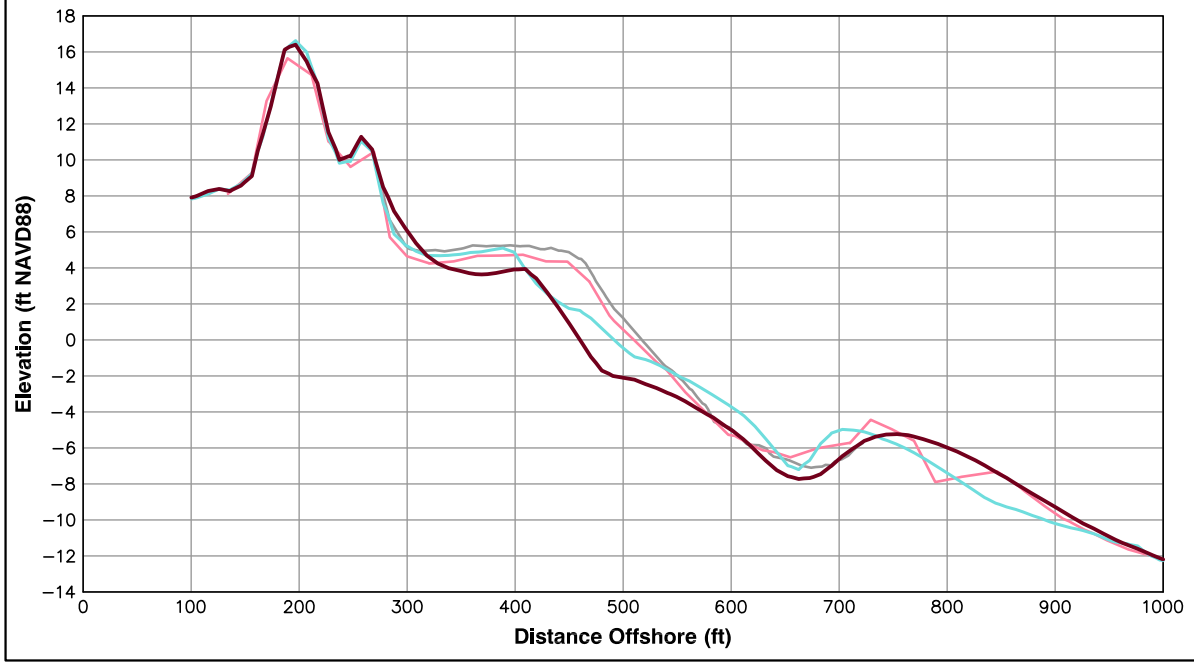
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 342+23	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-47.61 ft/yr	-24.92 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-7.78 cy/ft
Volume Change Above 0 ft NAVD88	-6.90 cy/ft/yr	-3.11 cy/ft

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

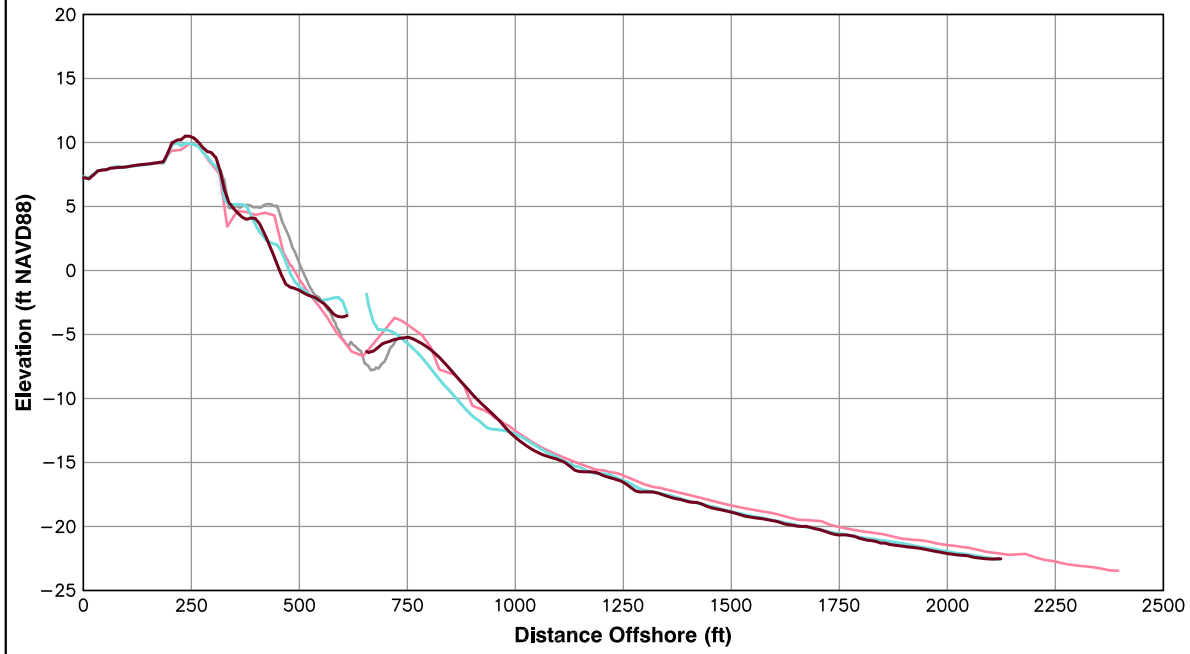
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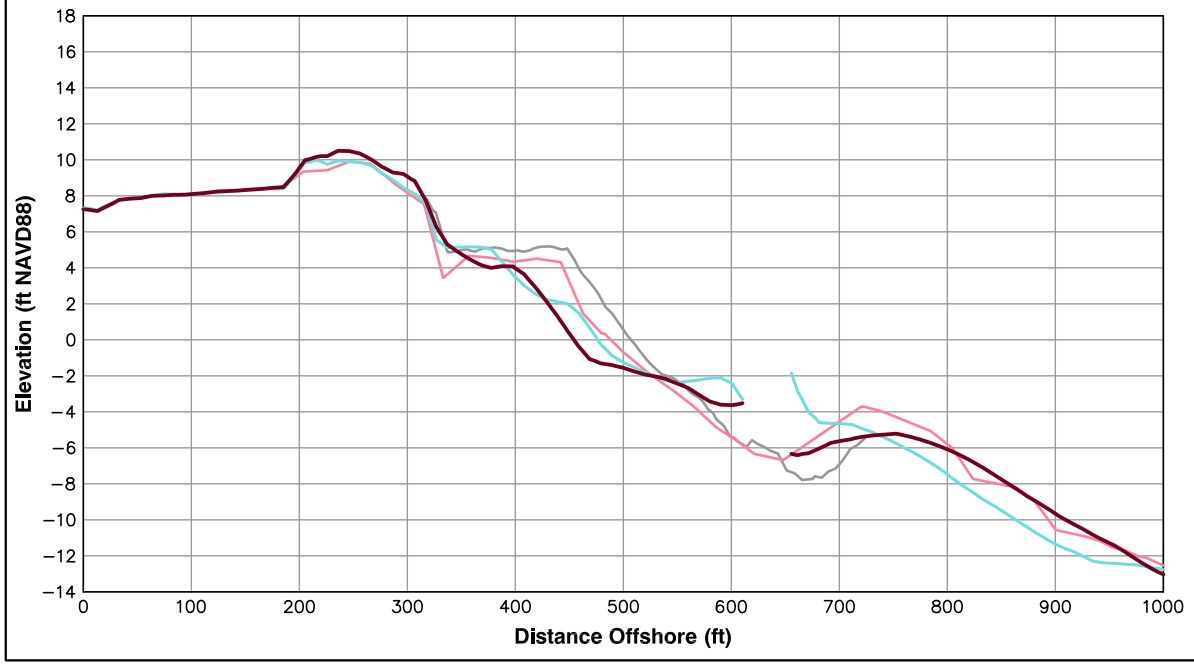


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 342+23	Pg 83 of 106	SPRING 2010





Survey Transect 344+05	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-29.89 ft/yr	-22.18 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	2.57 cy/ft
Volume Change Above 0 ft NAVD88	-1.72 cy/ft/yr	-0.06 cy/ft

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

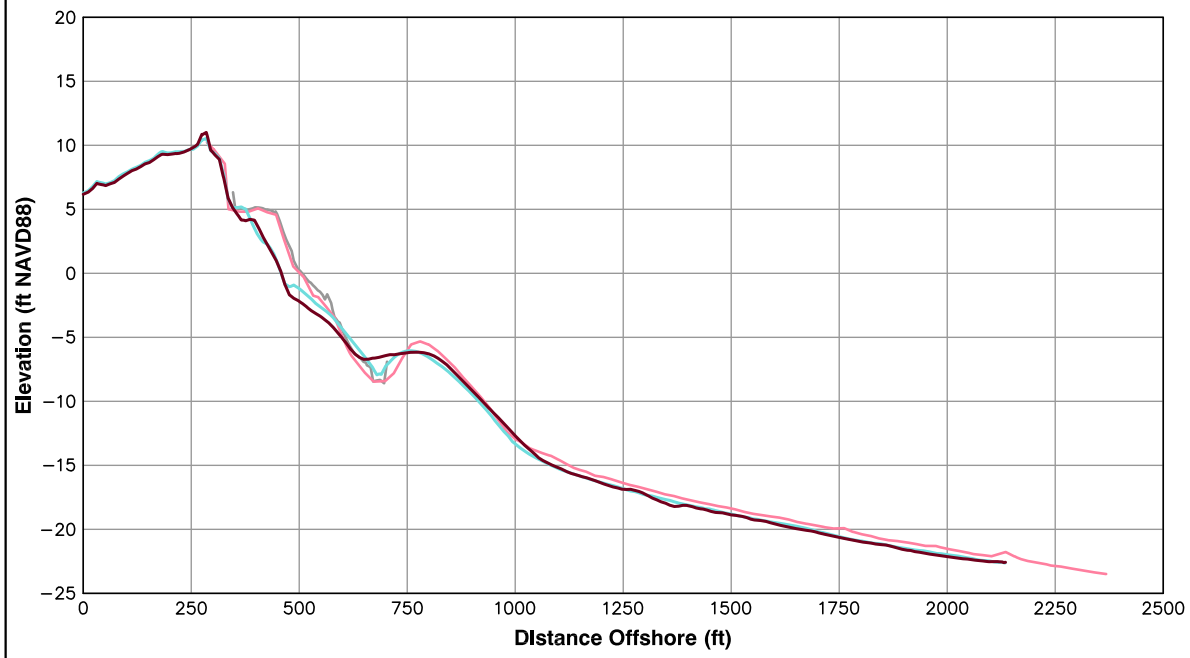
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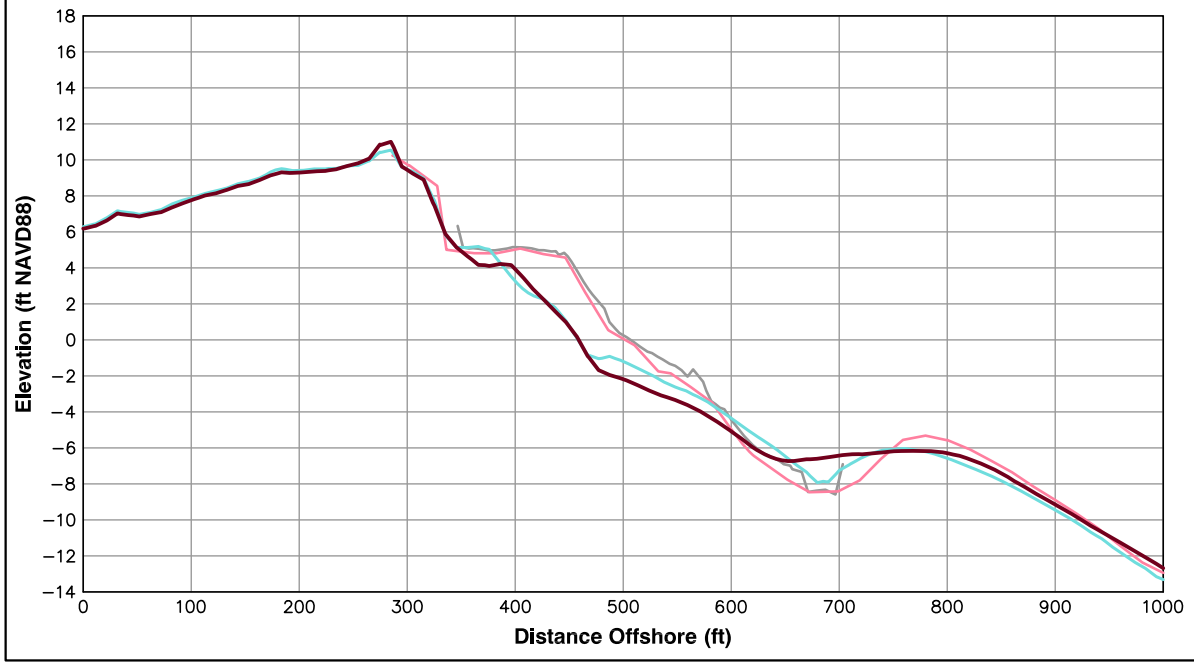


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 344+05	Pg 84 of 106	SPRING 2010





Survey Transect 345+85	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-37.91 ft/yr	-0.78 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-0.55 cy/ft
Volume Change Above 0 ft NAVD88	-10.15 cy/ft/yr	-1.27 cy/ft

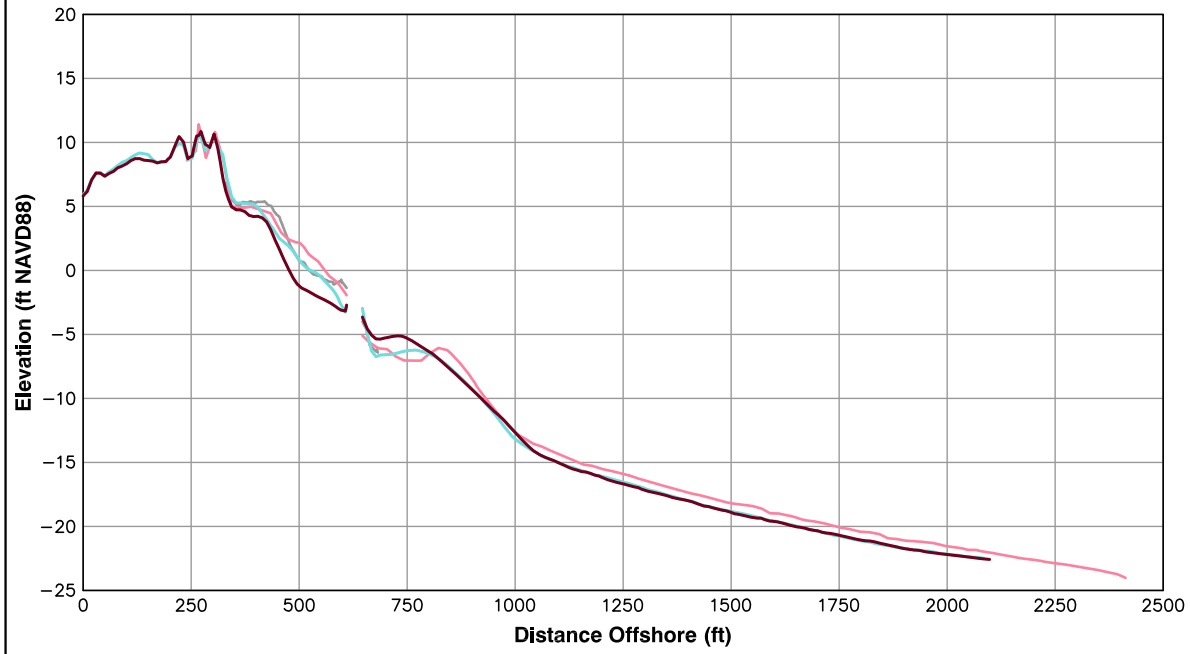
LEGEND:
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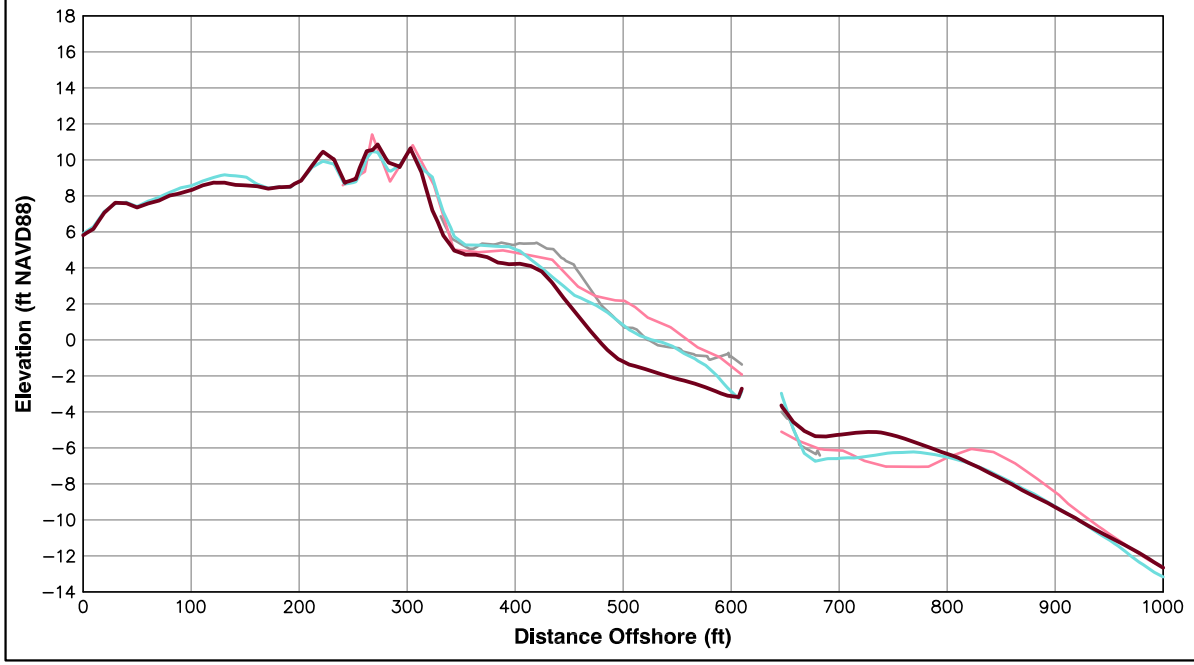
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 347+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-76.61 ft/yr	-33.85 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.34 cy/ft
Volume Change Above 0 ft NAVD88	-10.45 cy/ft/yr	-6.95 cy/ft

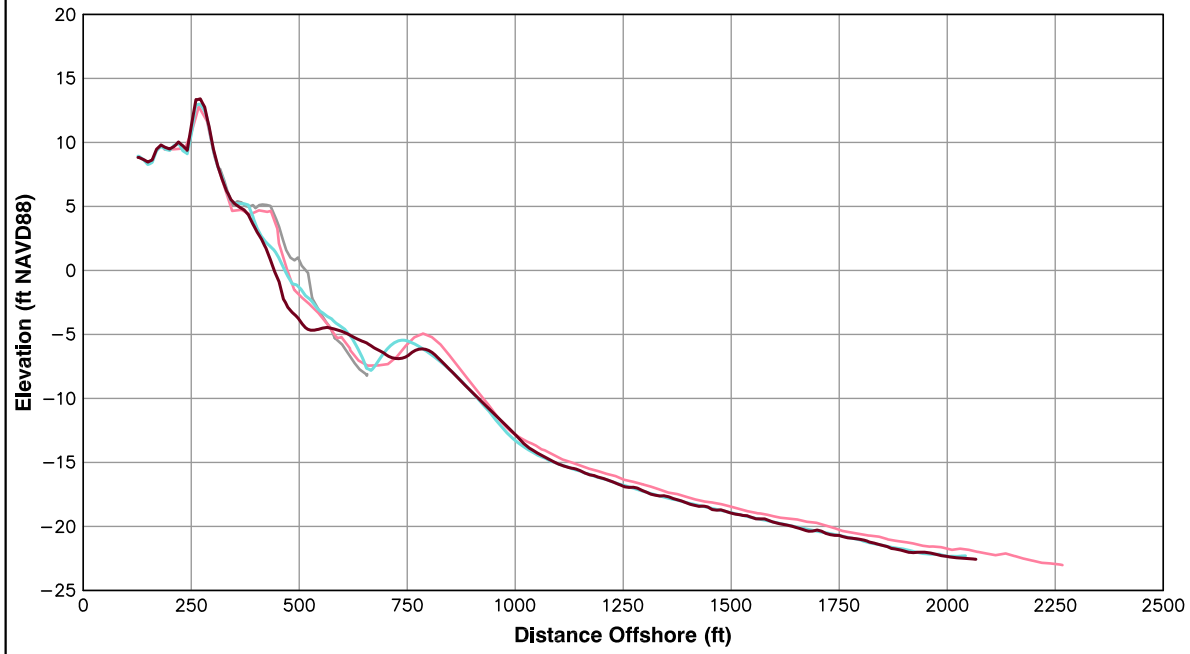
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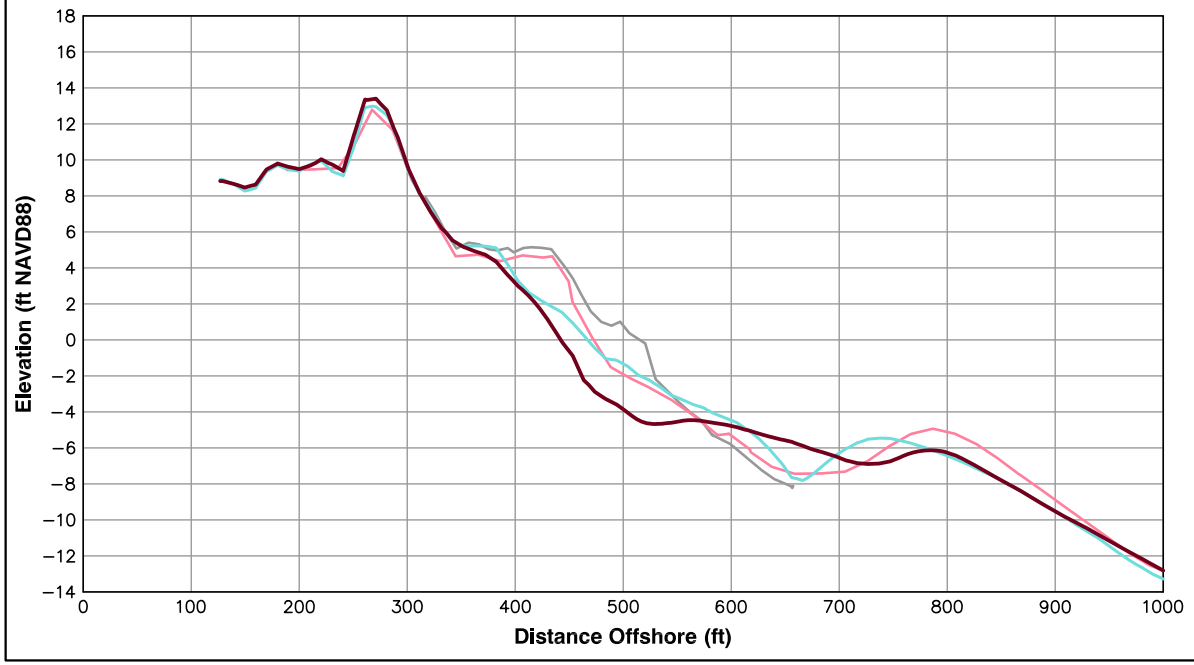
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 349+43	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-34.79 ft/yr	-20.91 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-8.67 cy/ft
Volume Change Above 0 ft NAVD88	-5.11 cy/ft/yr	-1.32 cy/ft

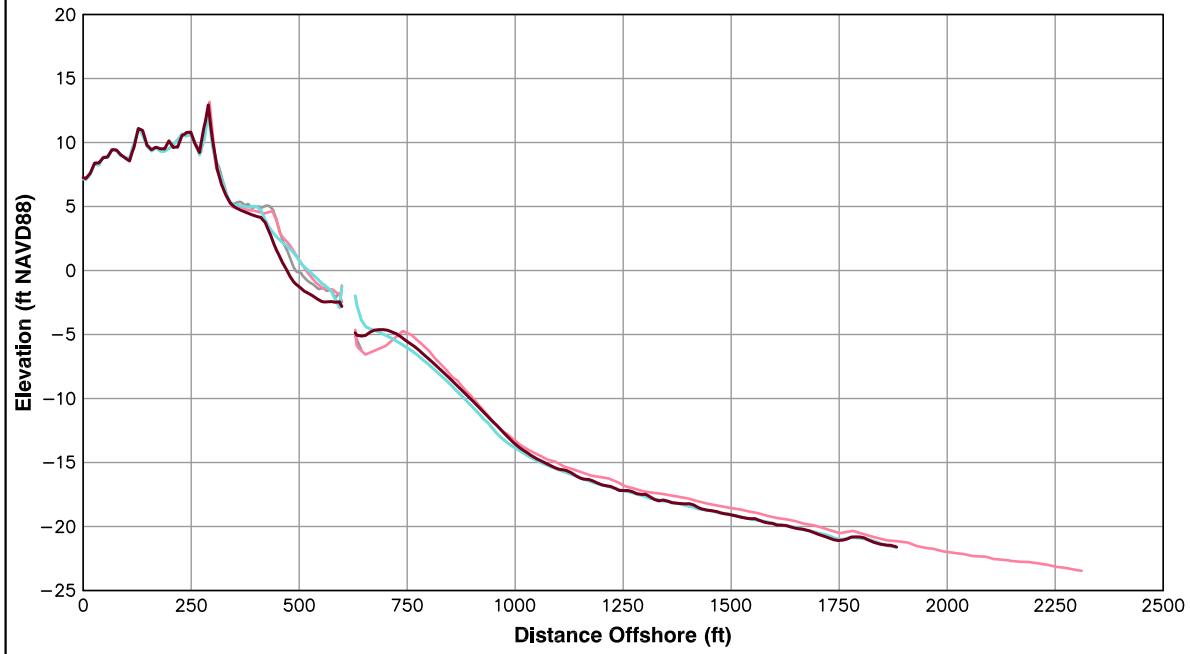
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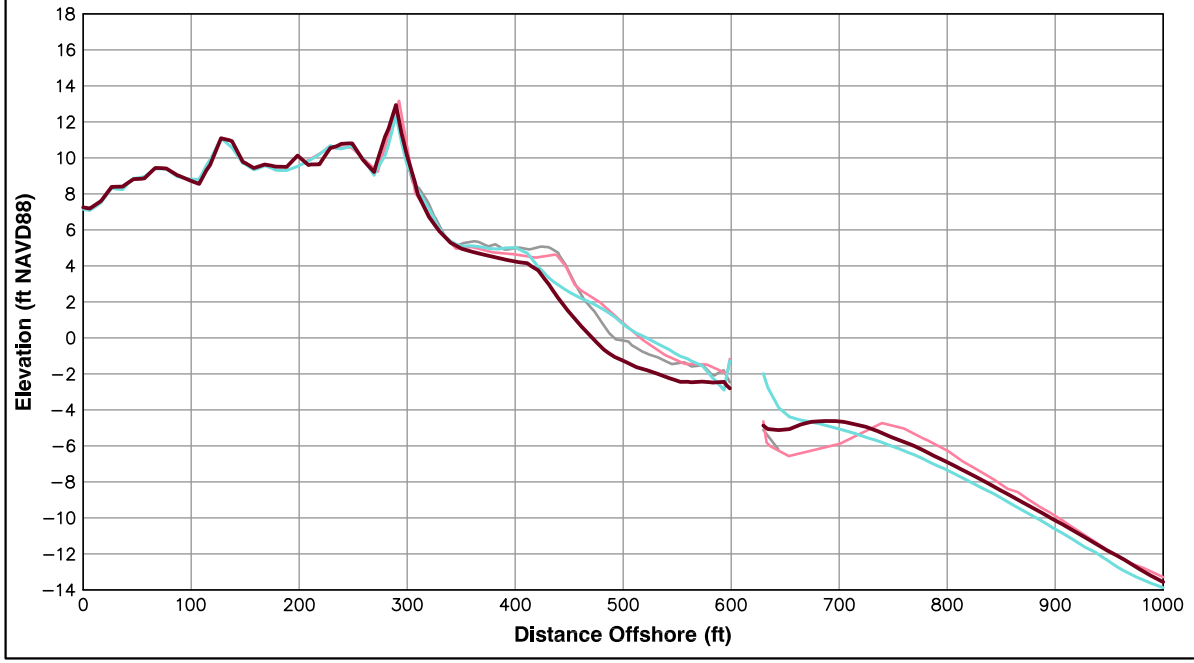
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

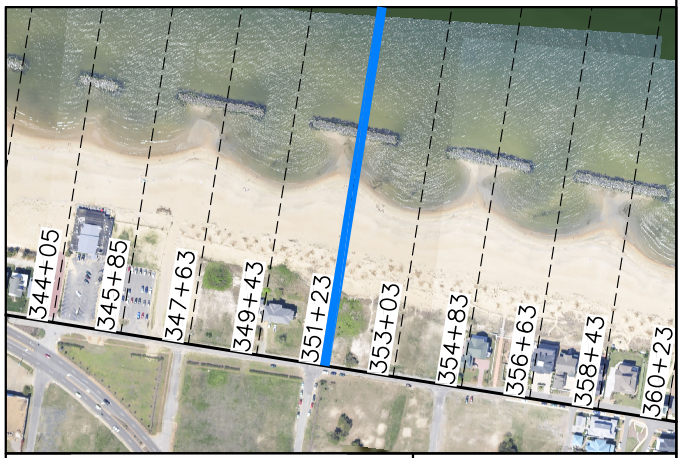




Survey Transect 351+23	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-44.50 ft/yr	-39.45 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-4.67 cy/ft
Volume Change Above 0 ft NAVD88	-7.03 cy/ft/yr	-4.00 cy/ft

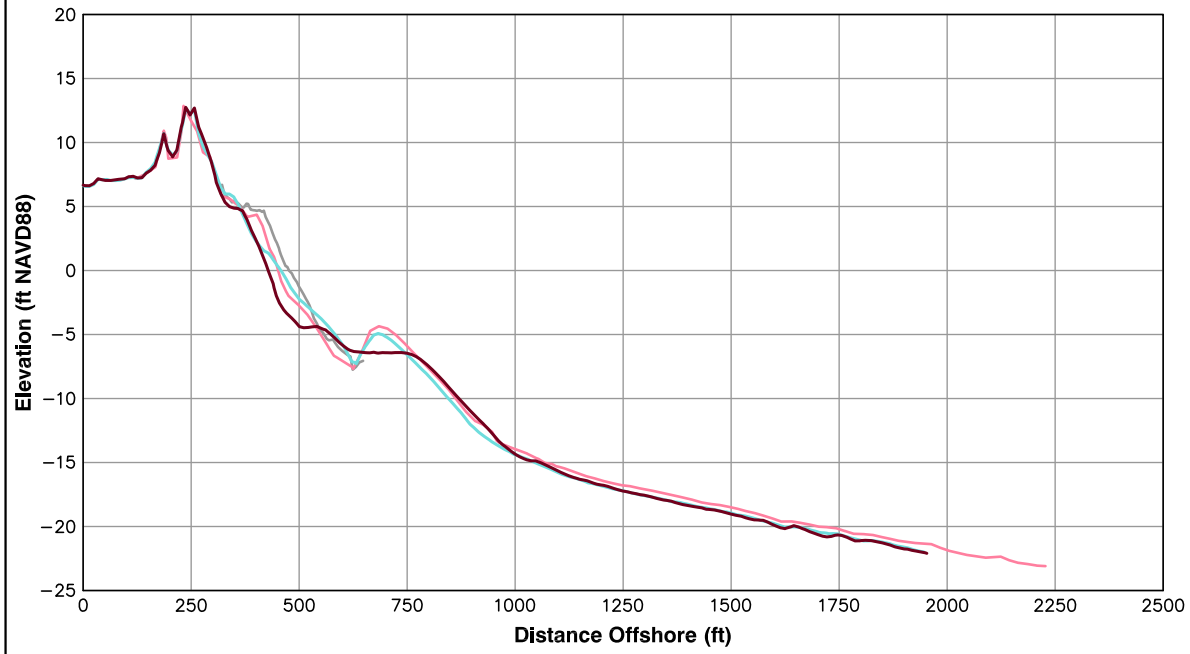
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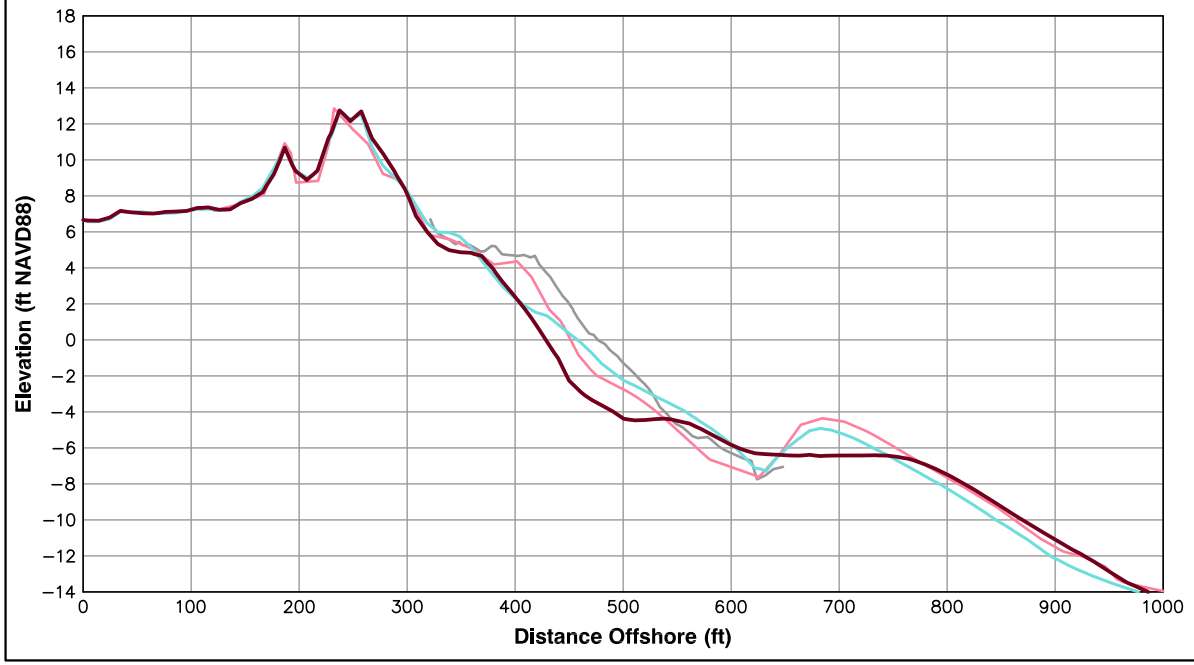
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 353+03	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-27.27 ft/yr	-19.48 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.54 cy/ft
Volume Change Above 0 ft NAVD88	-3.58 cy/ft/yr	-1.88 cy/ft

LEGEND:
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- 2009 APR
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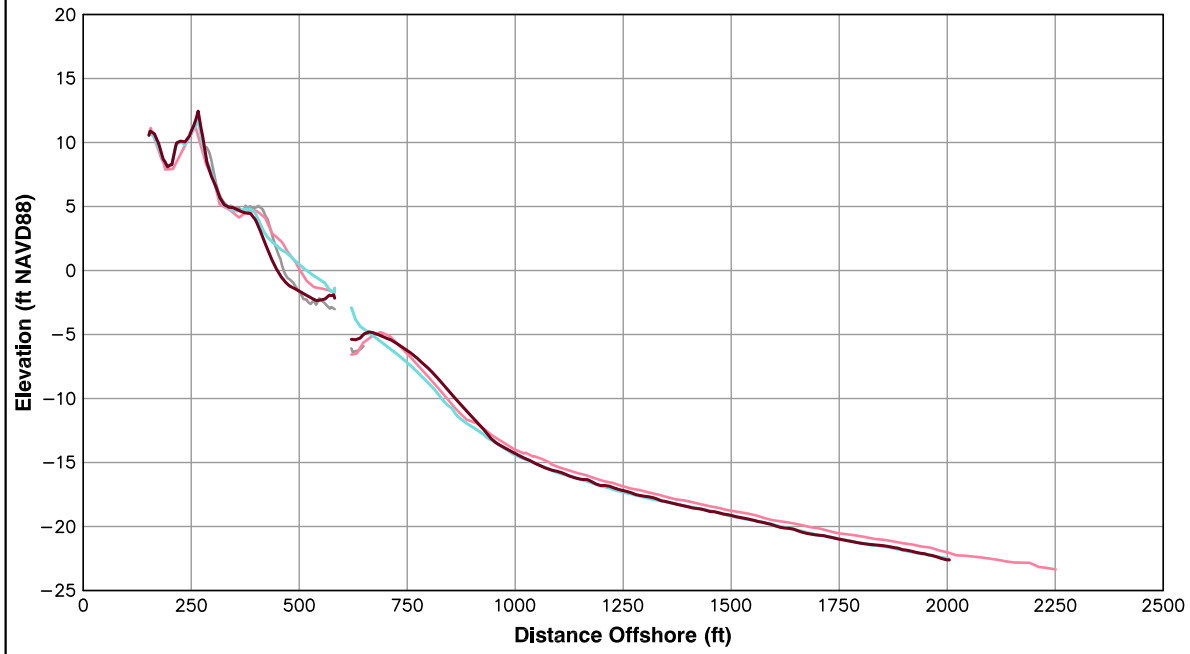
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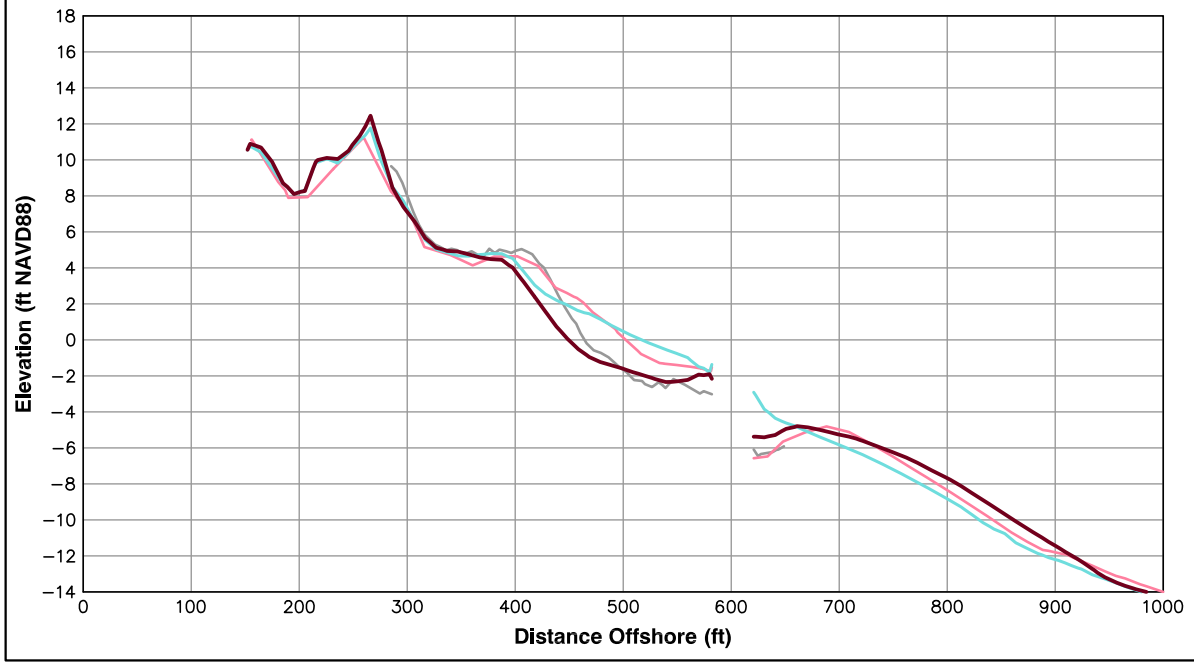


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 353+03	Pg 89 of 106	SPRING 2010





Survey Transect 354+83	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-53.52 ft/yr	-48.46 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-2.19 cy/ft
Volume Change Above 0 ft NAVD88	-2.65 cy/ft/yr	-3.61 cy/ft

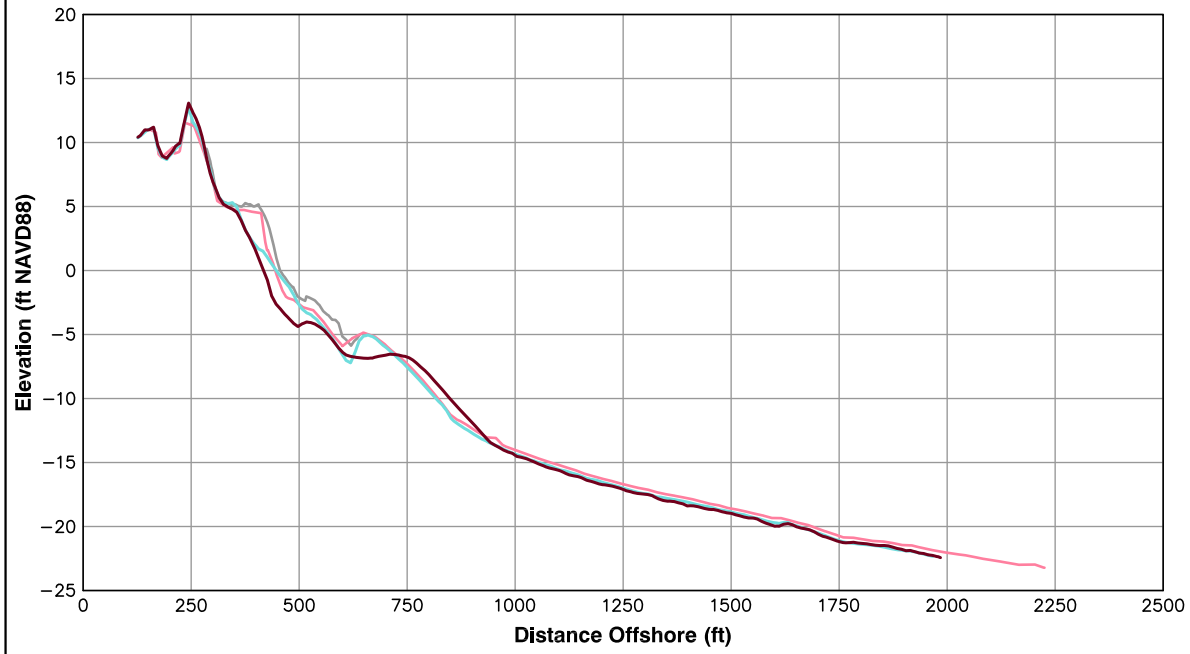
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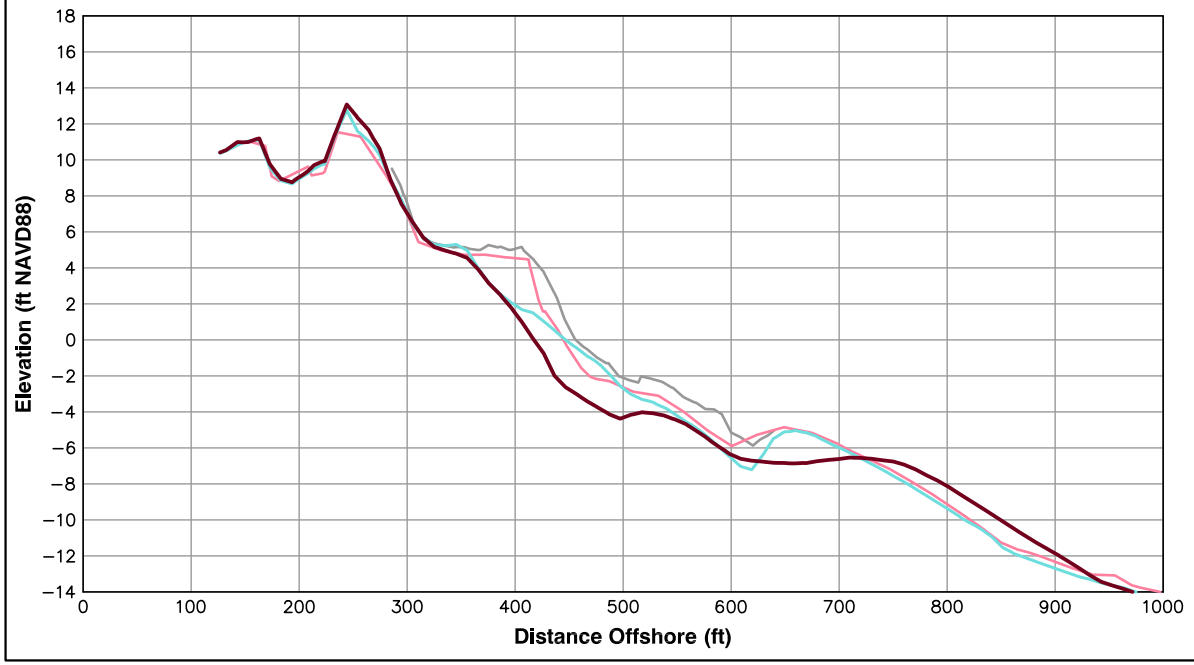
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 356+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-30.90 ft/yr	-21.18 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-4.52 cy/ft
Volume Change Above 0 ft NAVD88	-4.26 cy/ft/yr	-0.89 cy/ft

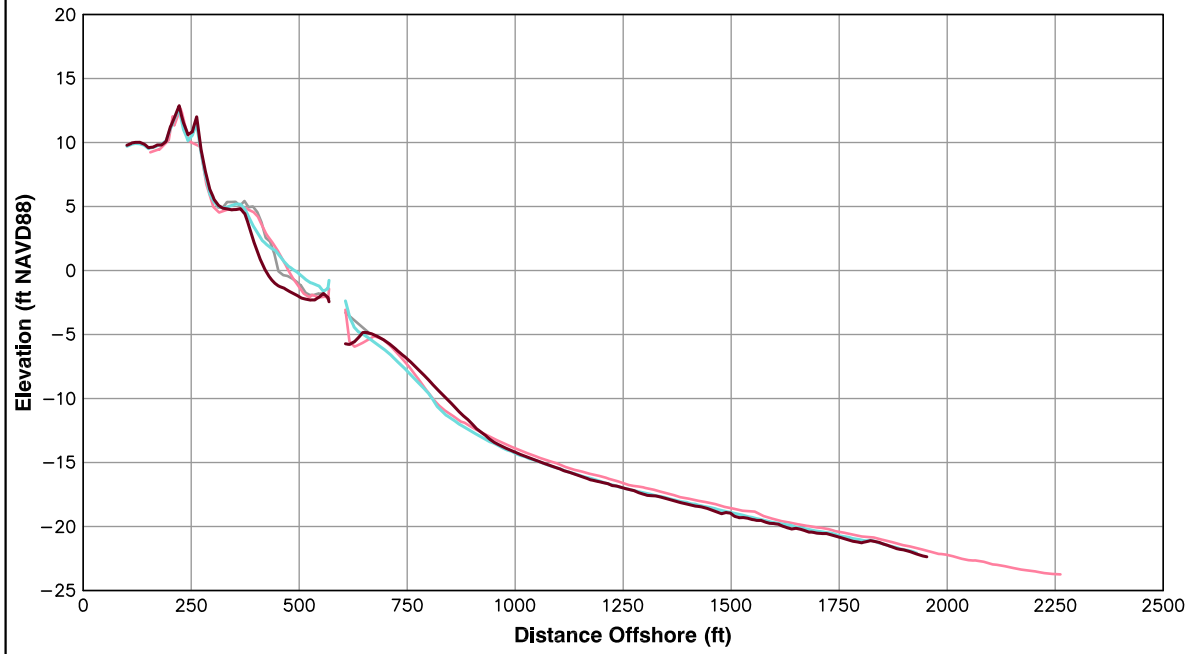
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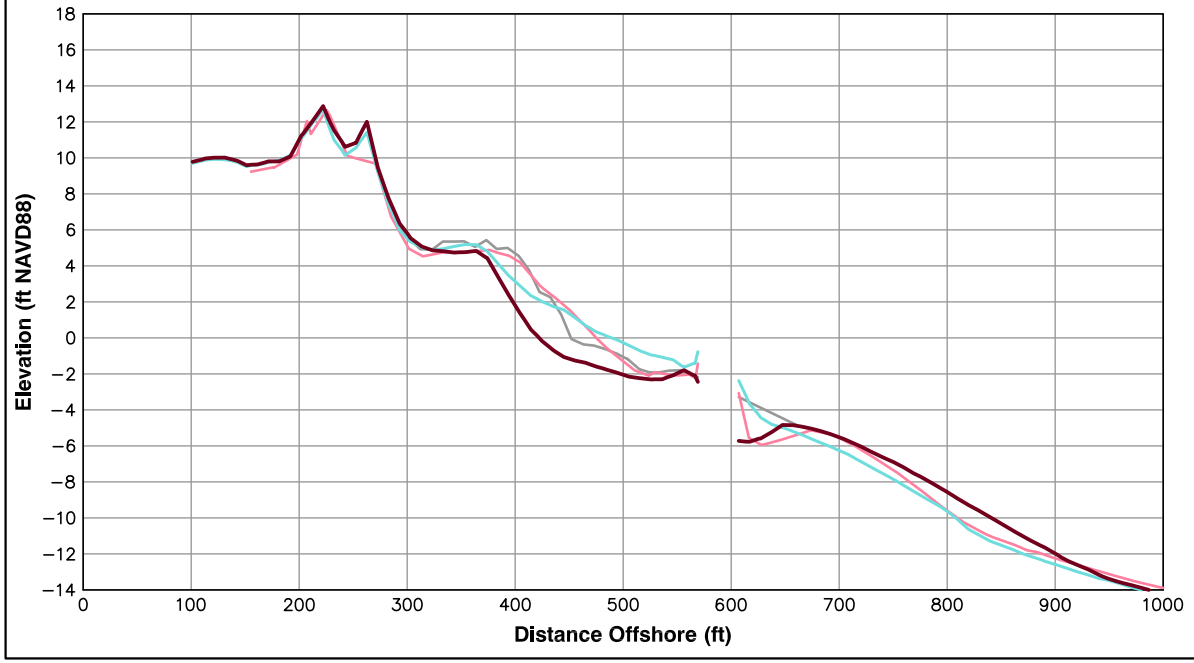
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 358+43	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-55.43 ft/yr	-49.73 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.00 cy/ft
Volume Change Above 0 ft NAVD88	-4.52 cy/ft/yr	-3.94 cy/ft

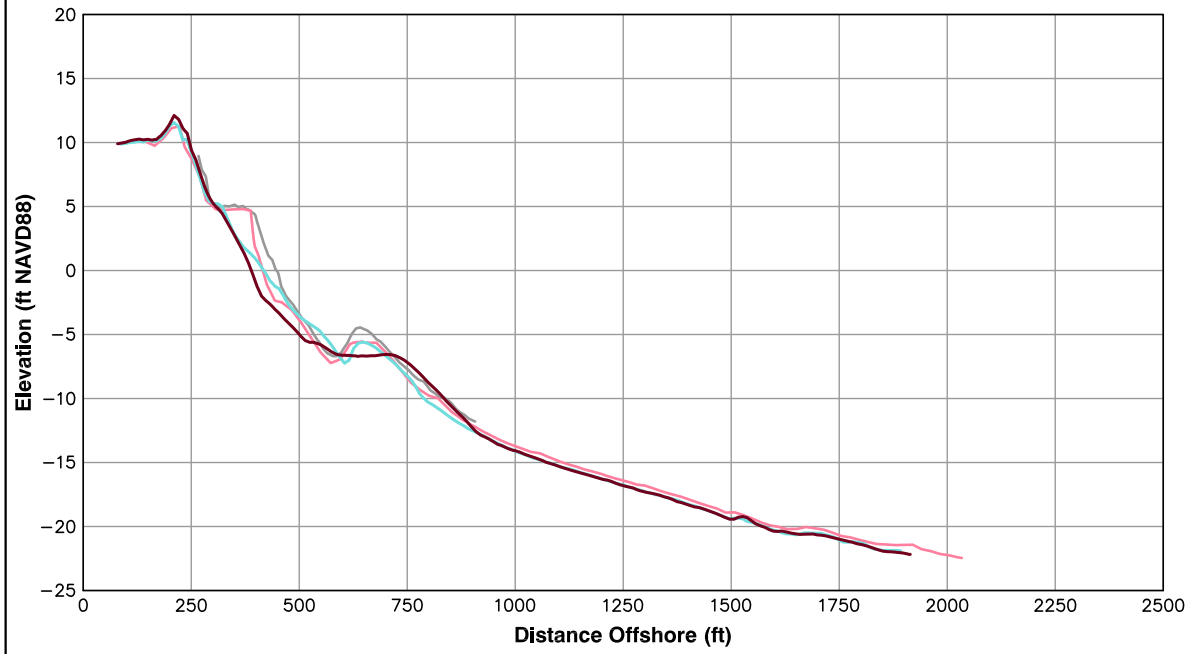
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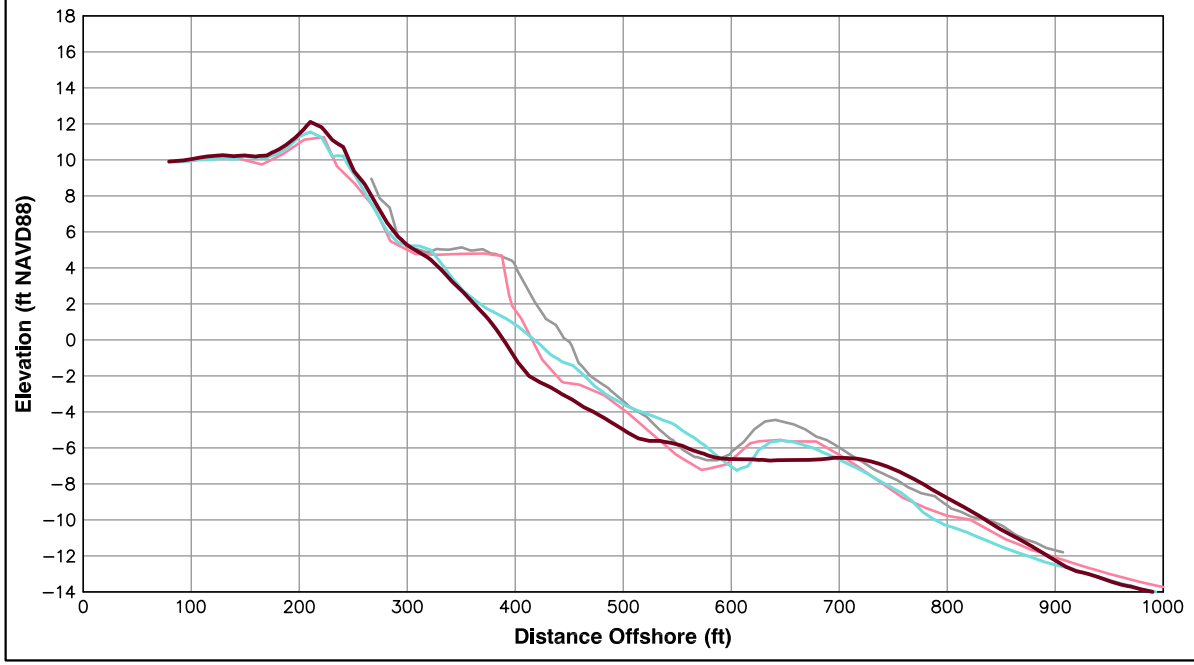
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 360+23	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-32.82 ft/yr	-19.56 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.79 cy/ft
Volume Change Above 0 ft NAVD88	-4.46 cy/ft/yr	0.27 cy/ft

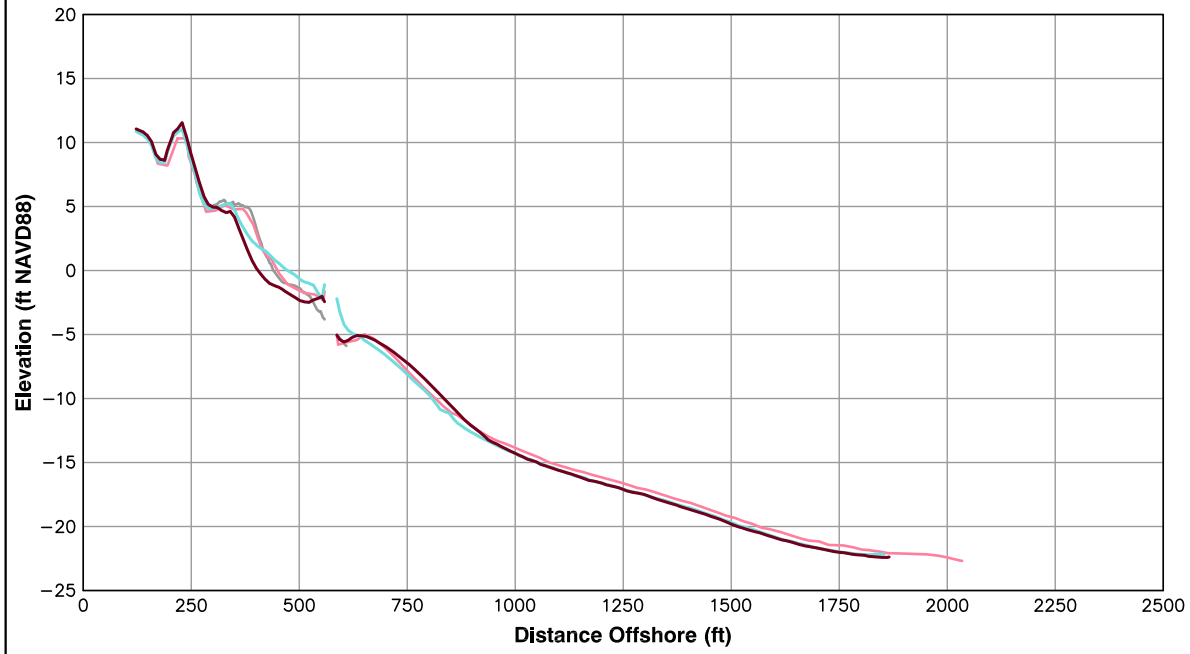
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- 2009 APR
- POST-FILL

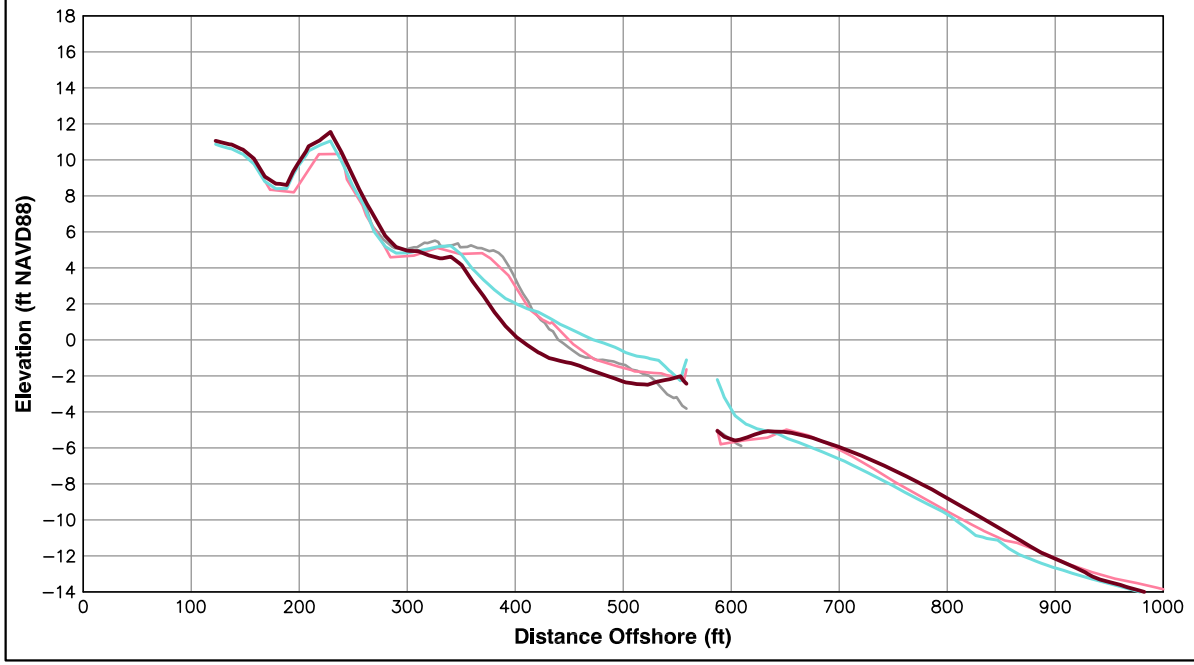
Notes:
1. Stationing From West To East At Varying Intervals.
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 362+03	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-43.79 ft/yr	-50.20 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.79 cy/ft
Volume Change Above 0 ft NAVD88	-3.63 cy/ft/yr	-3.19 cy/ft

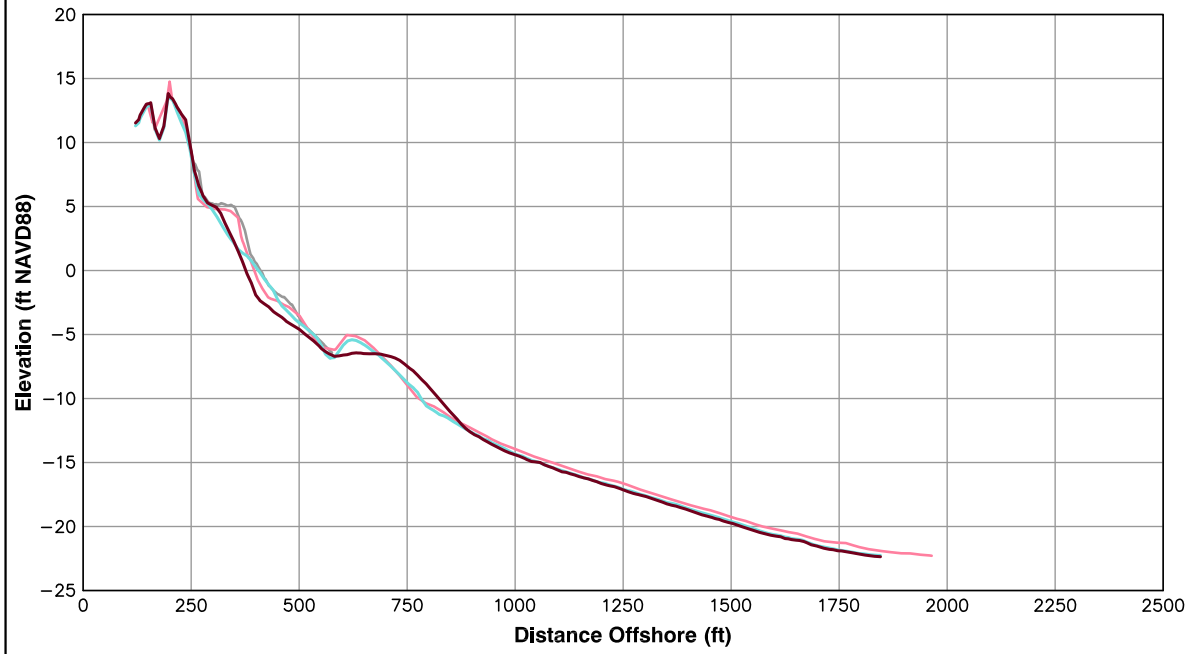
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- POST-FILL

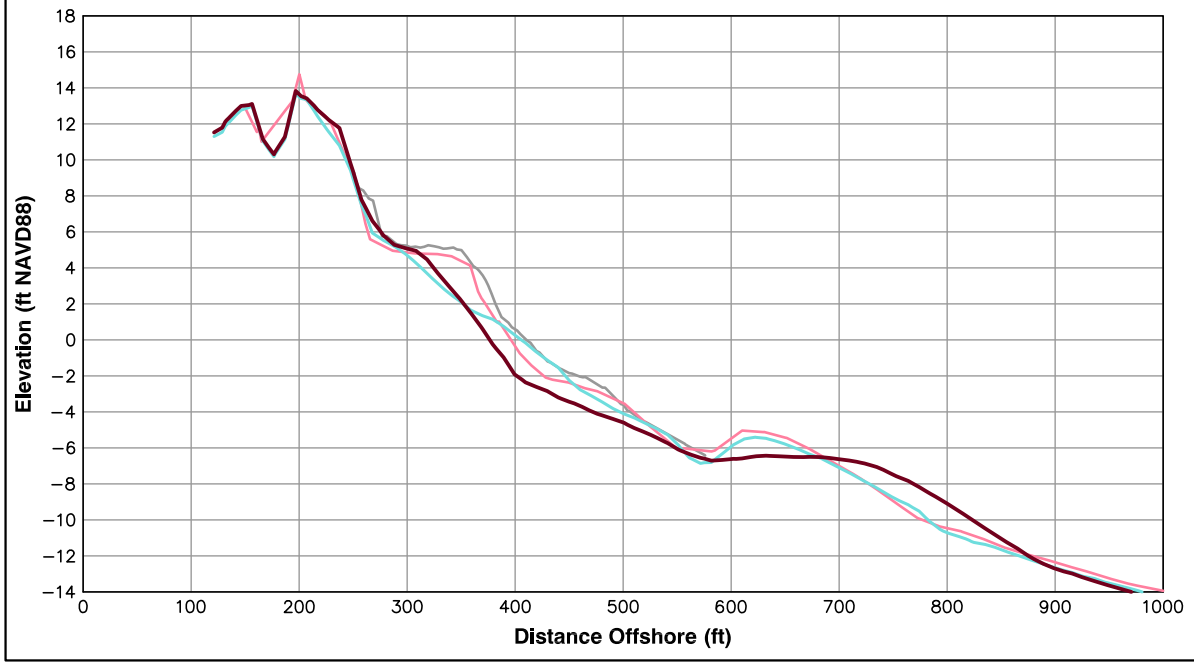
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 363+83	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-19.61 ft/yr	-18.25 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-0.29 cy/ft
Volume Change Above 0 ft NAVD88	-4.10 cy/ft/yr	1.85 cy/ft

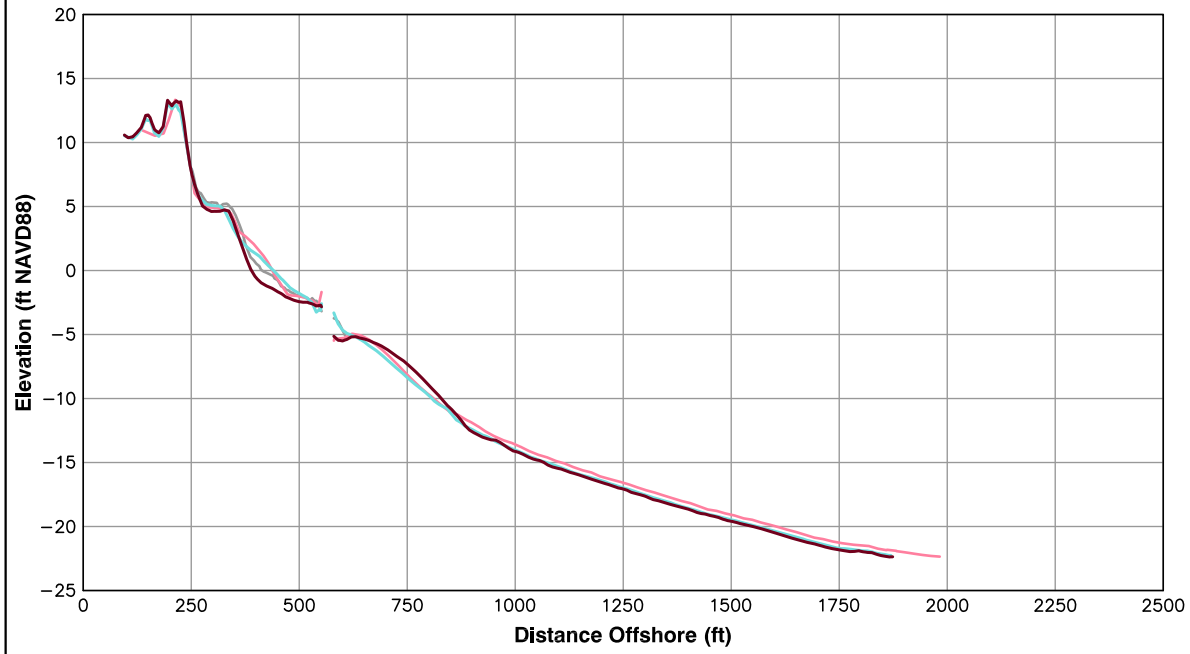
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- POST-FILL

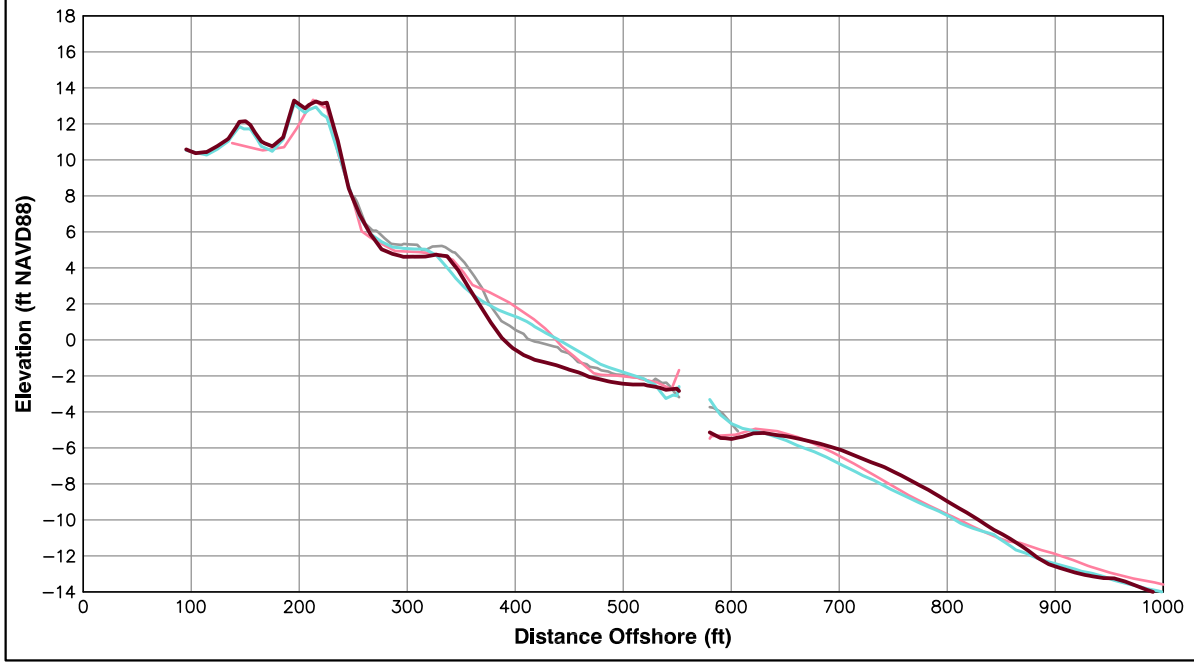
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 365+63	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-47.45 ft/yr	-34.35 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-1.32 cy/ft
Volume Change Above 0 ft NAVD88	-1.90 cy/ft/yr	-1.22 cy/ft

LEGEND:
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- 2009 OCT
- 2009 APR
- POST-FILL

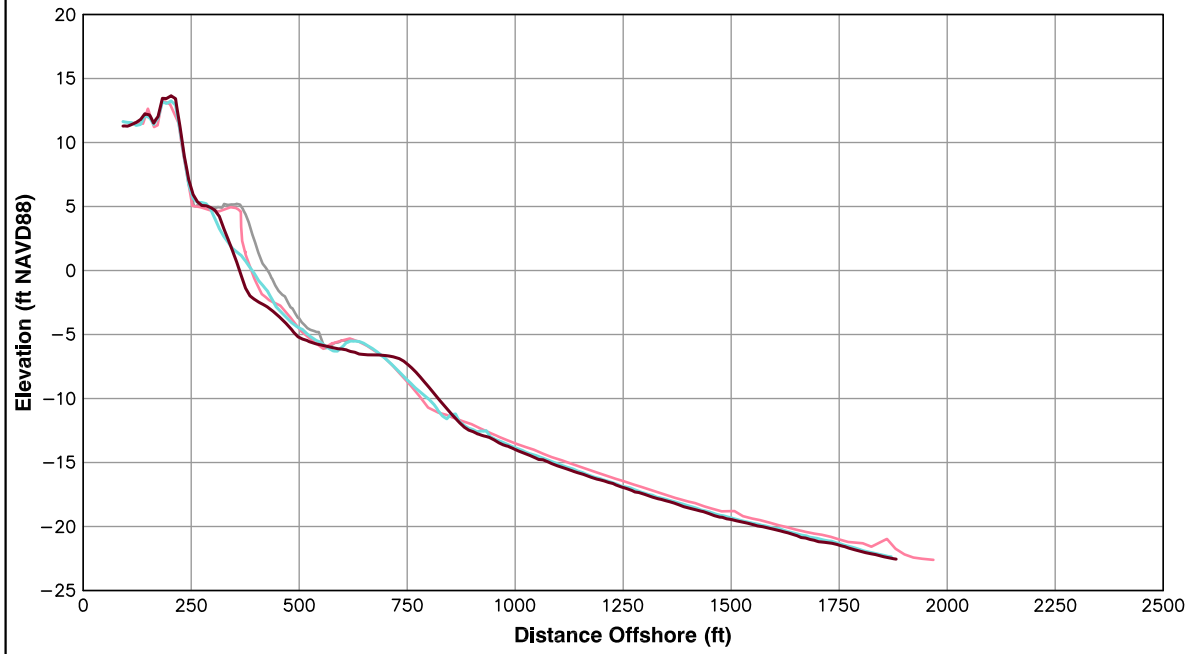
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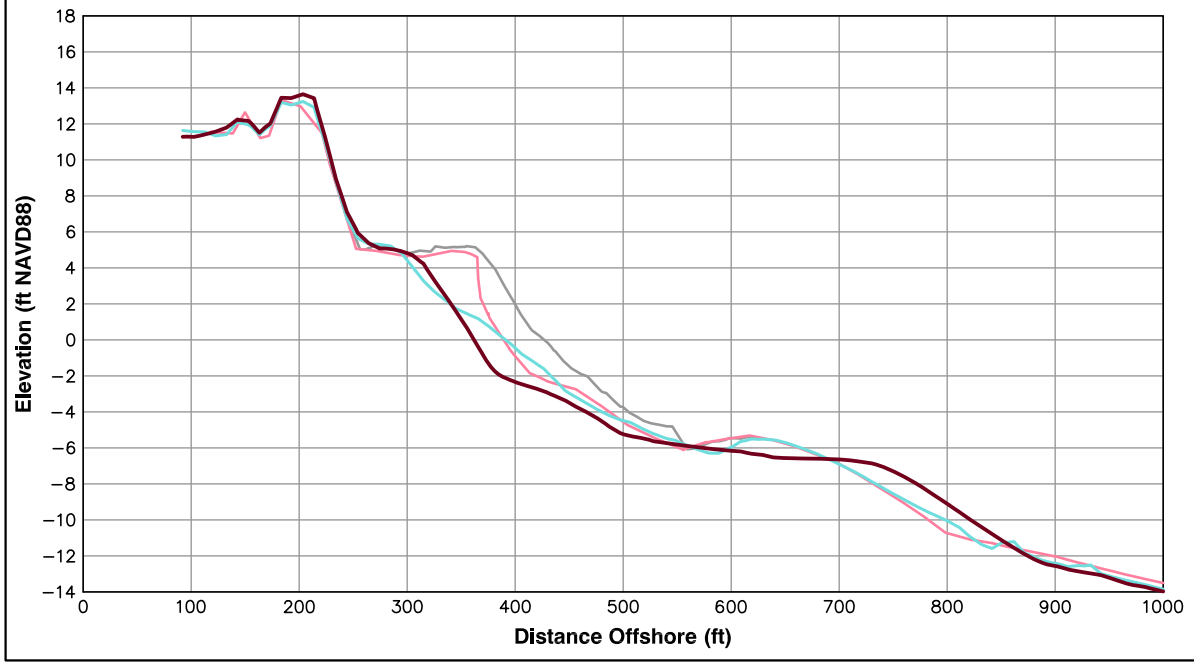


City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 365+63	Pg 96 of 106	SPRING 2010





Survey Transect 367+43	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-29.50 ft/yr	-18.48 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-3.39 cy/ft
Volume Change Above 0 ft NAVD88	-4.15 cy/ft/yr	0.86 cy/ft

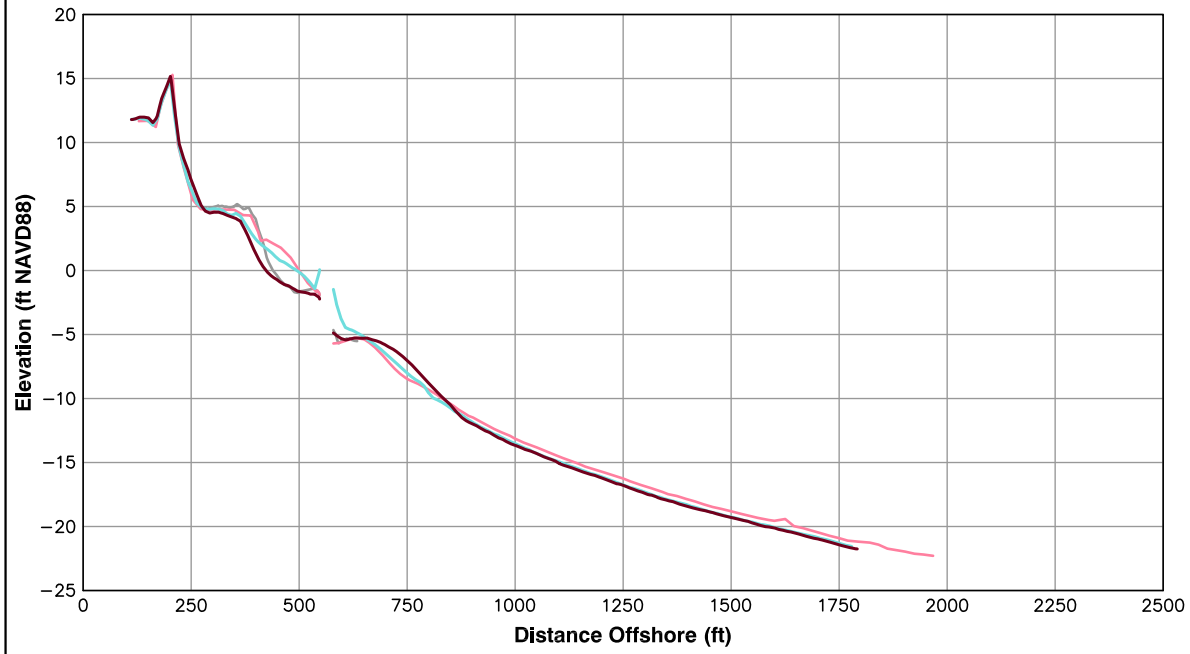
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- 2009 APR
- POST-FILL

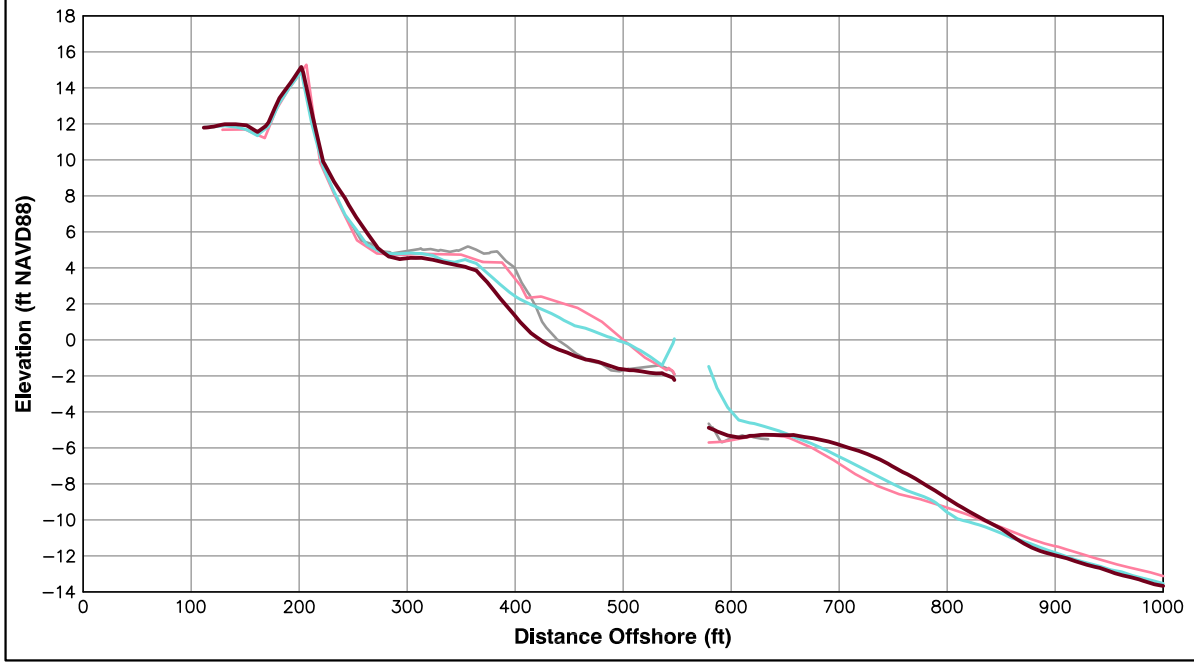
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 369+23	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-83.08 ft/yr	-43.91 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.60 cy/ft
Volume Change Above 0 ft NAVD88	-7.60 cy/ft/yr	-3.01 cy/ft

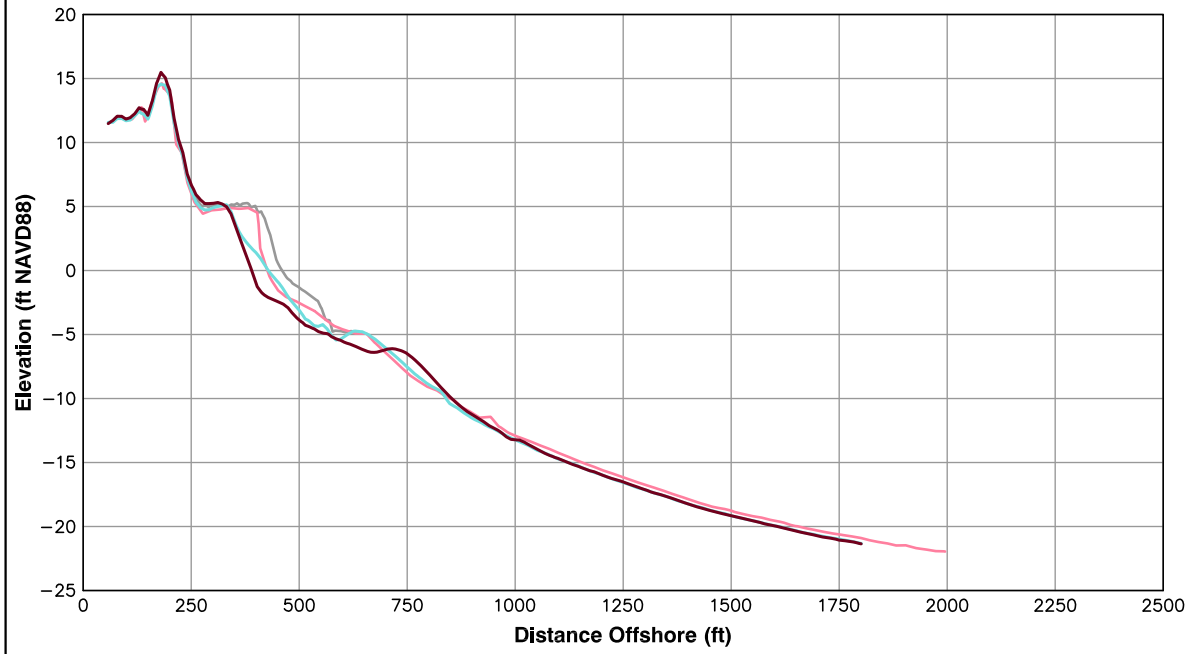
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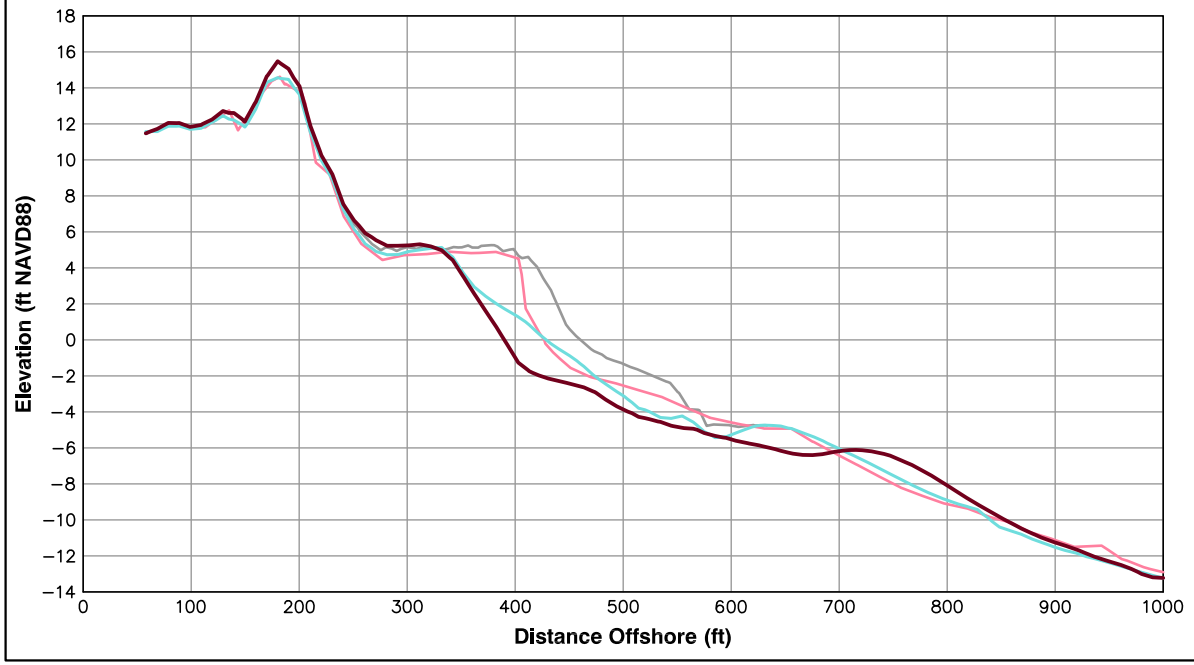
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 371+03	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-40.74 ft/yr	-30.11 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-4.27 cy/ft
Volume Change Above 0 ft NAVD88	-4.59 cy/ft/yr	0.82 cy/ft

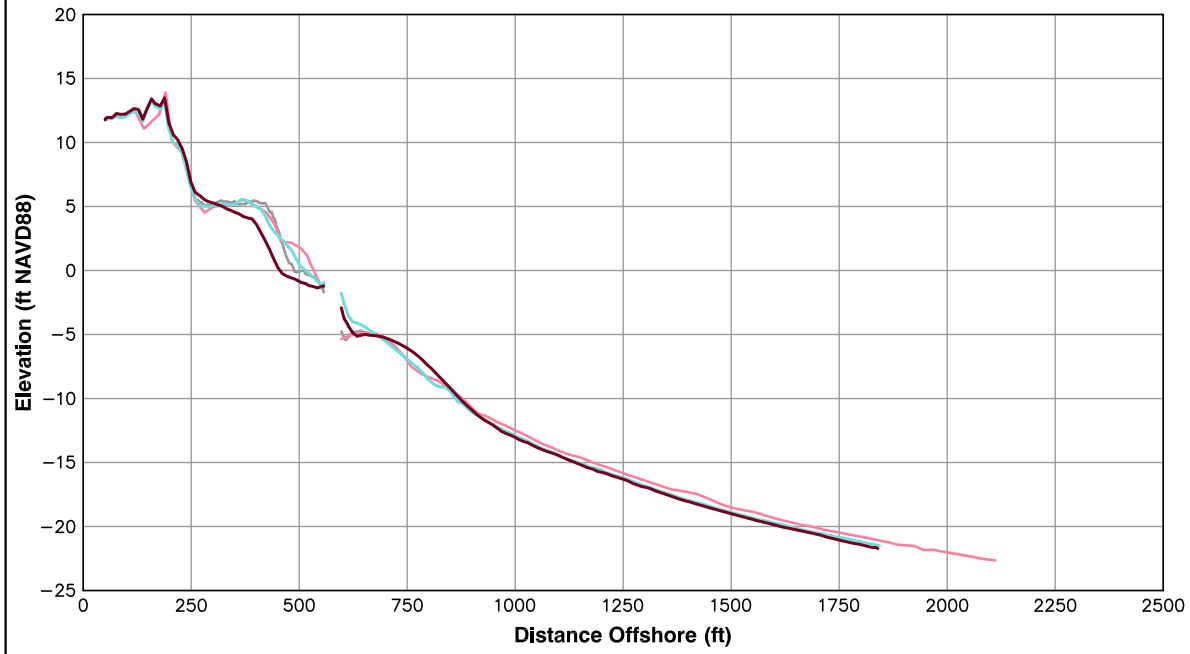
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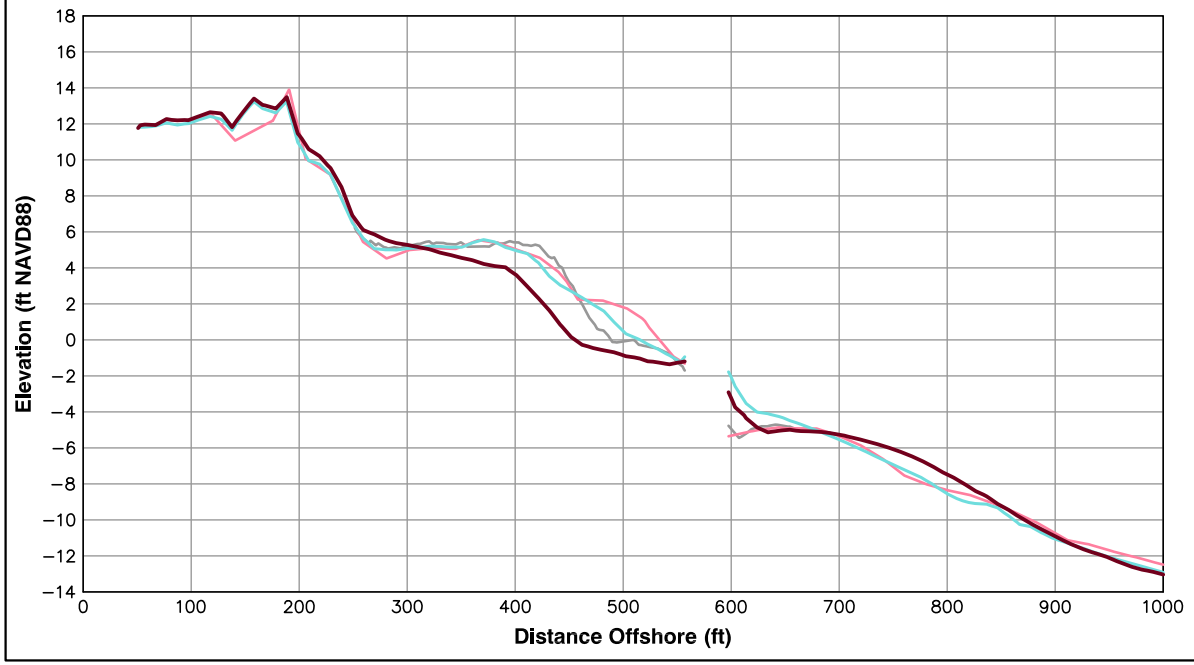
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

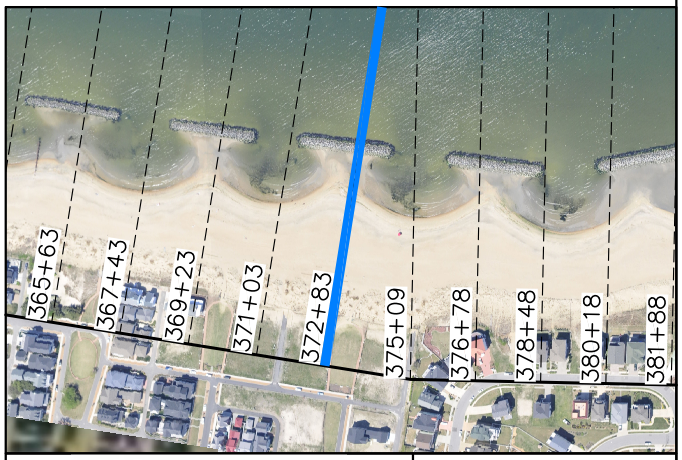




Survey Transect 372+83	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-88.36 ft/yr	-51.71 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-6.86 cy/ft
Volume Change Above 0 ft NAVD88	-8.41 cy/ft/yr	-6.45 cy/ft

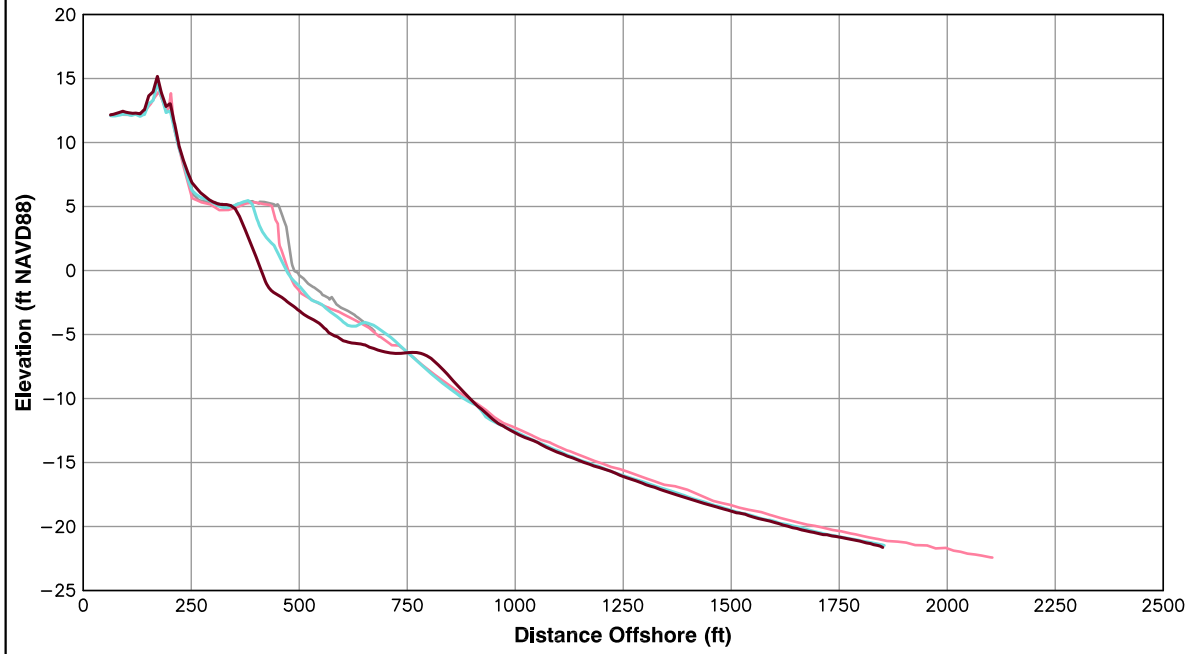
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- POST-FILL

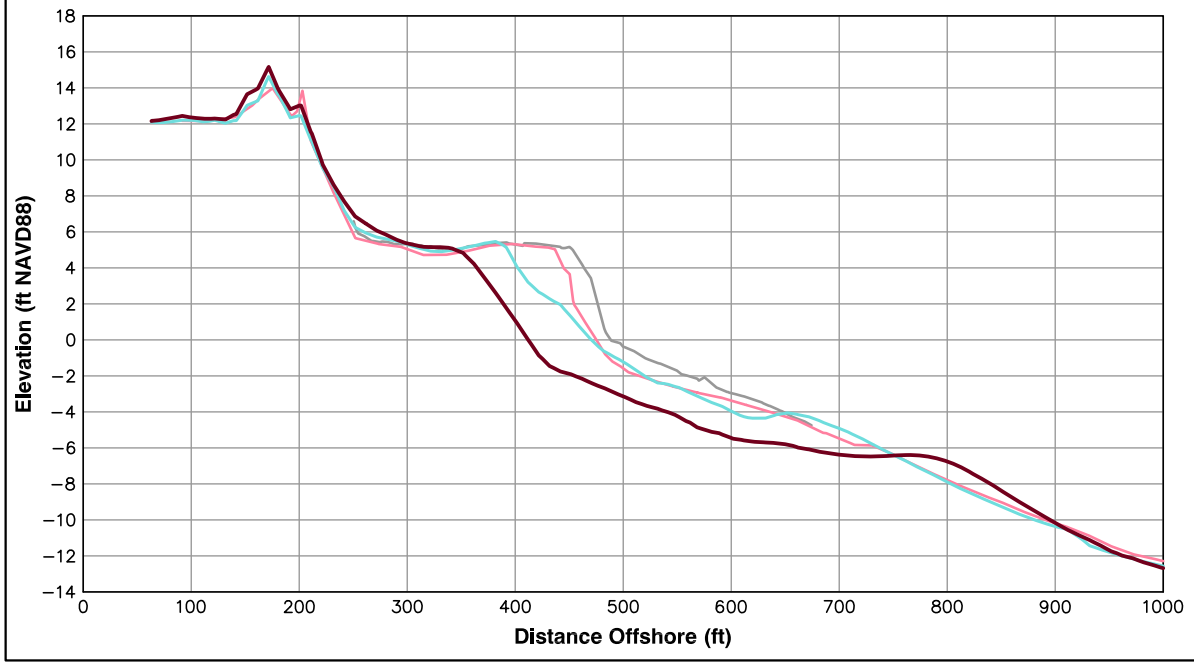
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

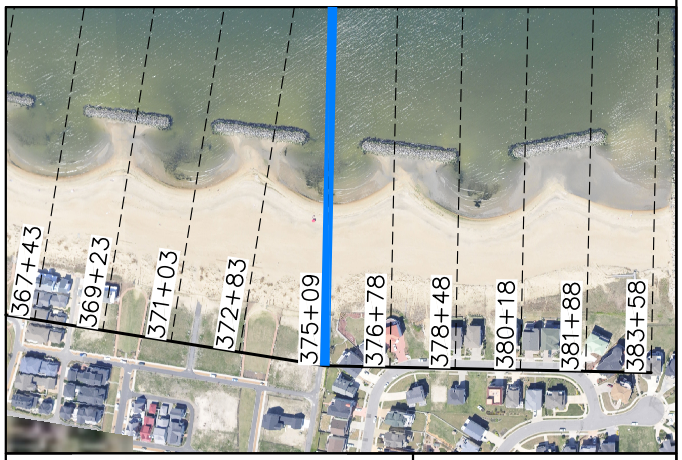




Survey Transect 375+08	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-69.57 ft/yr	-55.04 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-20.85 cy/ft
Volume Change Above 0 ft NAVD88	-10.77 cy/ft/yr	-5.93 cy/ft

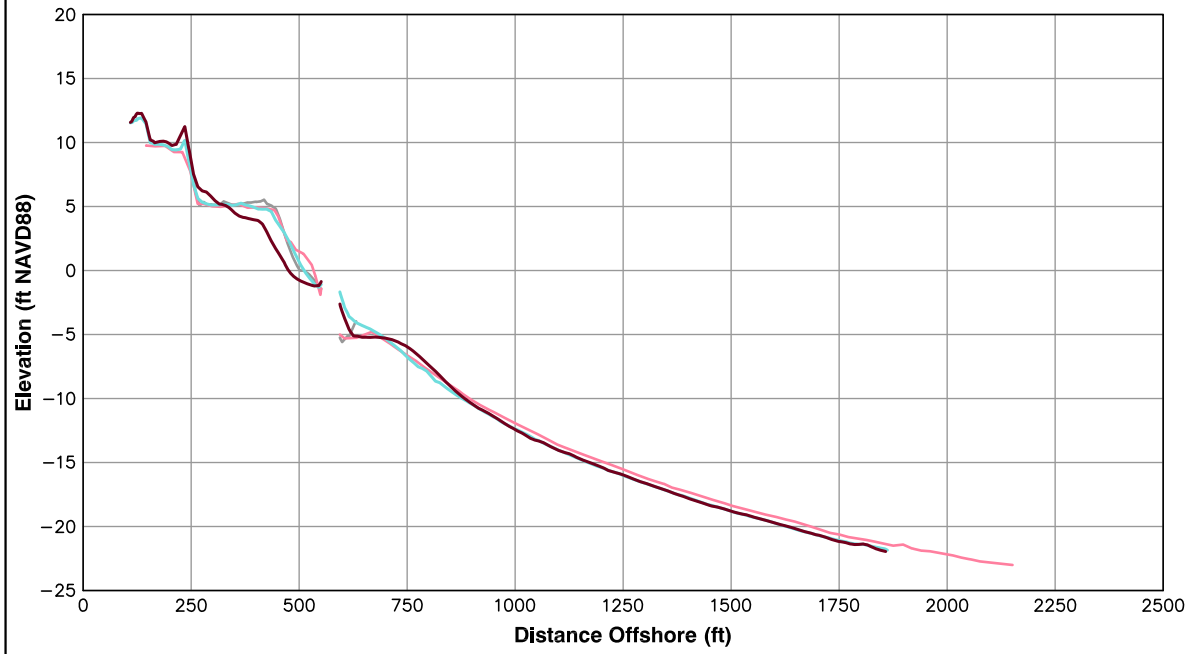
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- POST-FILL

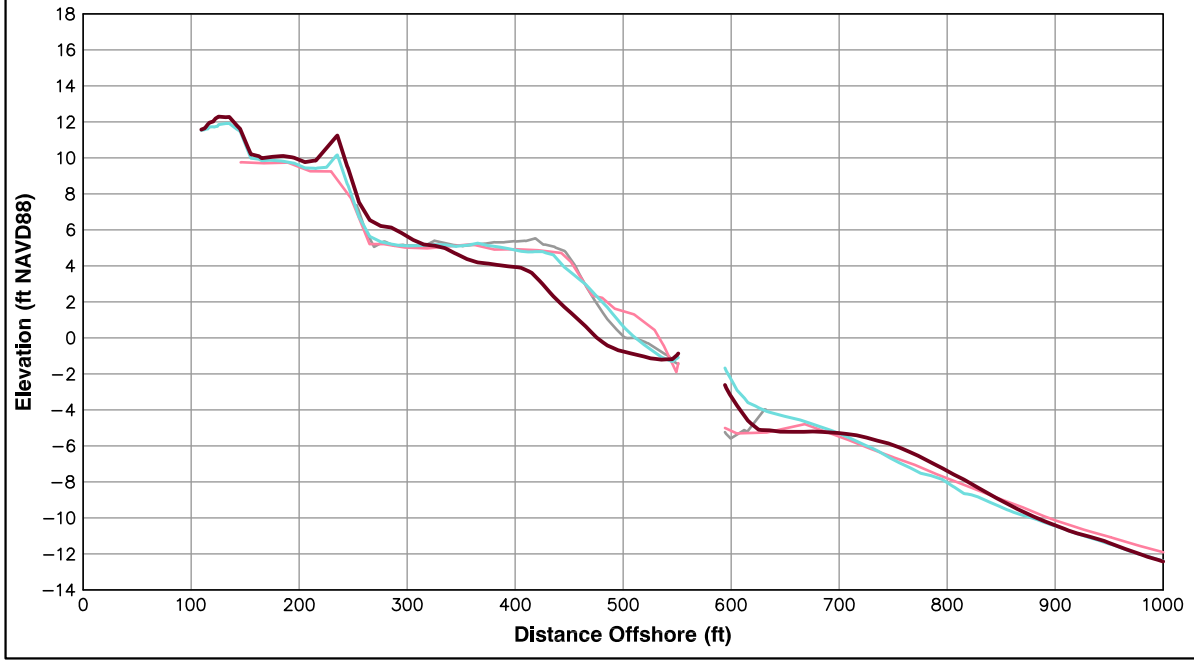
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

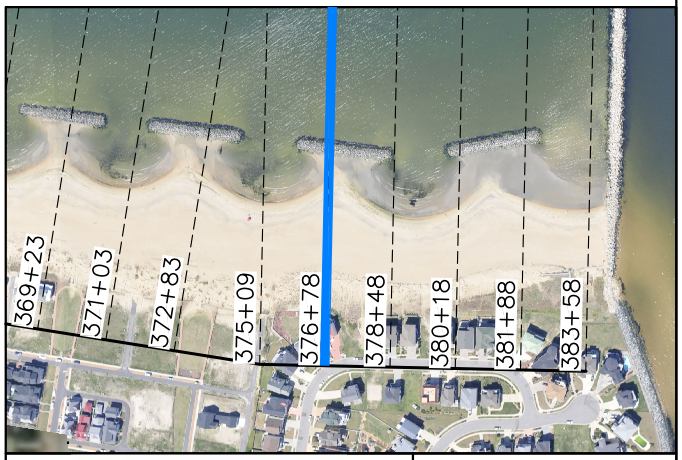




Survey Transect 376+78	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-63.50 ft/yr	-36.17 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-5.23 cy/ft
Volume Change Above 0 ft NAVD88	-5.59 cy/ft/yr	-4.81 cy/ft

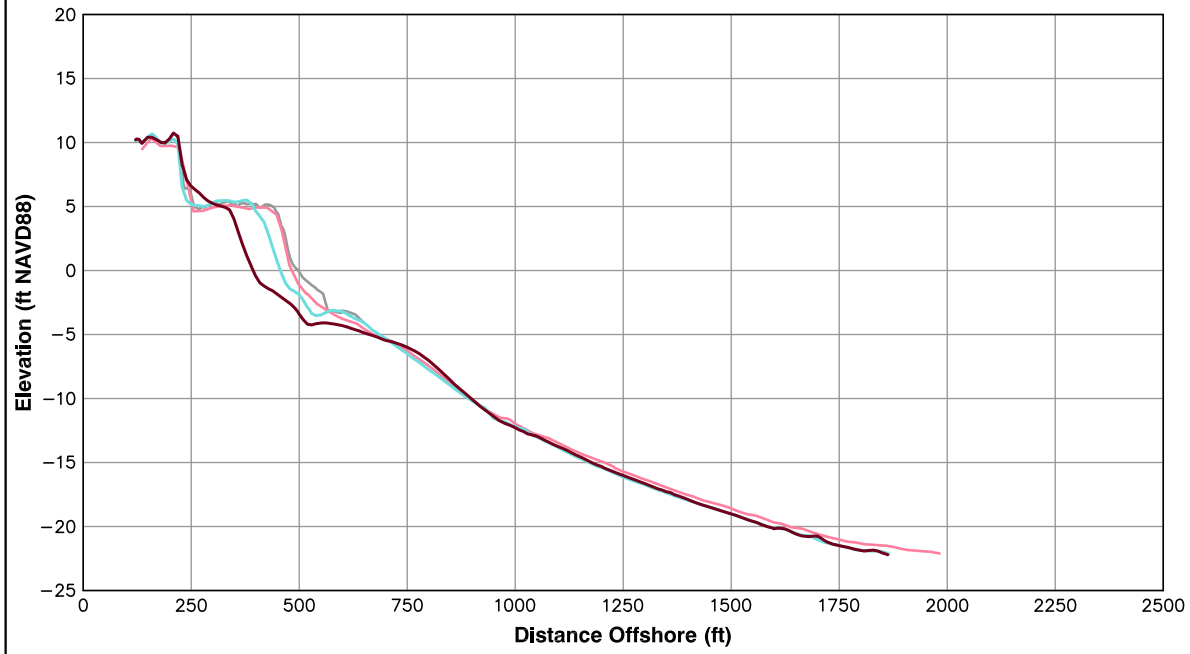
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- POST-FILL

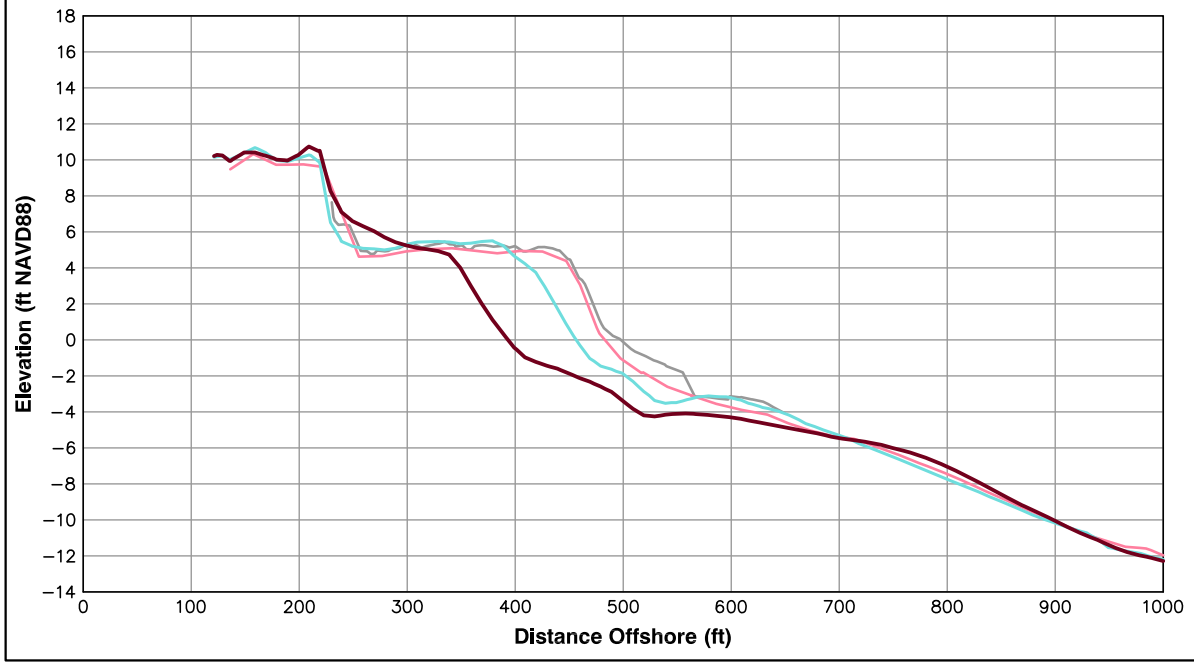
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 378+48	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-101.42 ft/yr	-65.60 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-18.26 cy/ft
Volume Change Above 0 ft NAVD88	-15.49 cy/ft/yr	-10.14 cy/ft

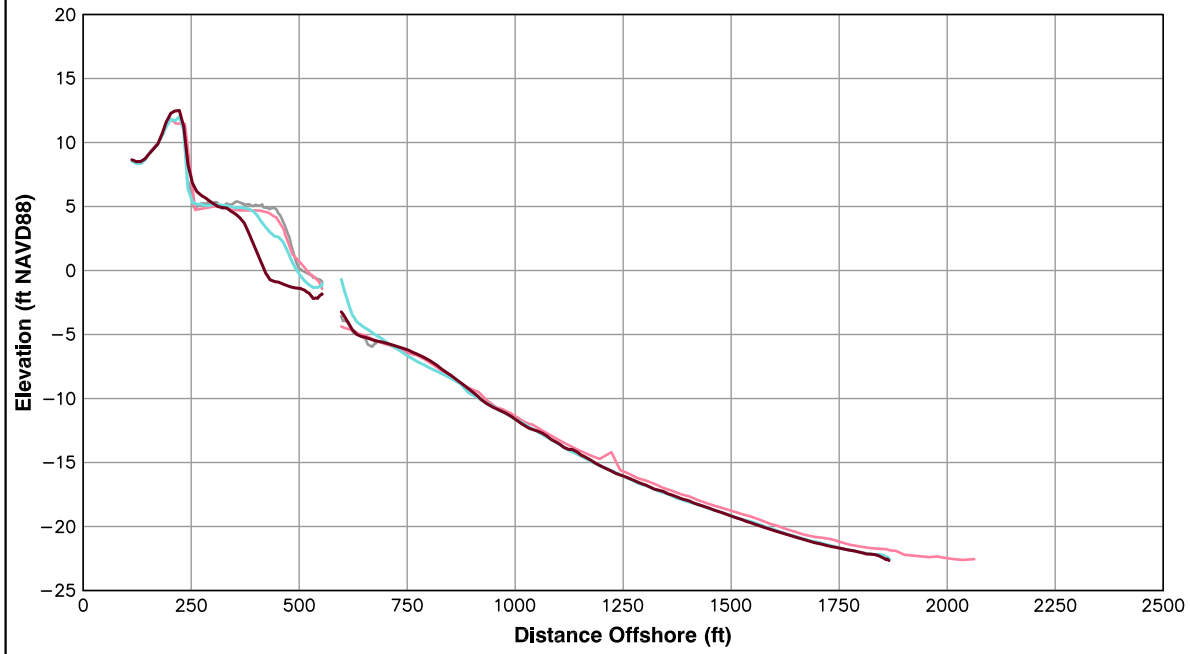
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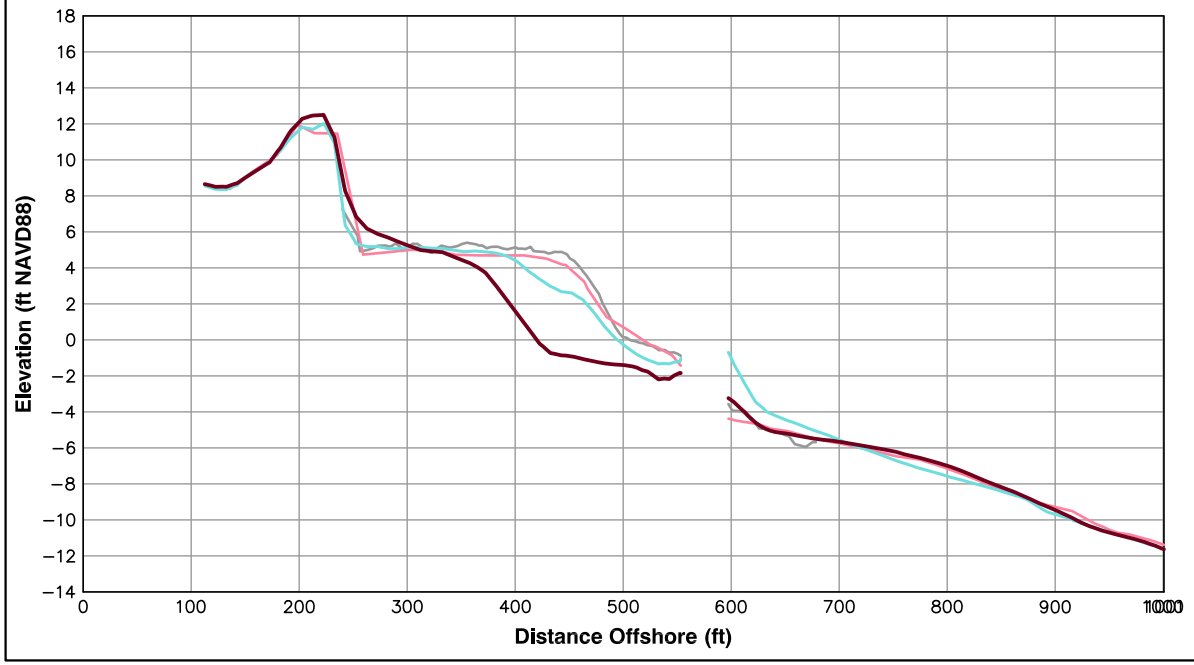
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

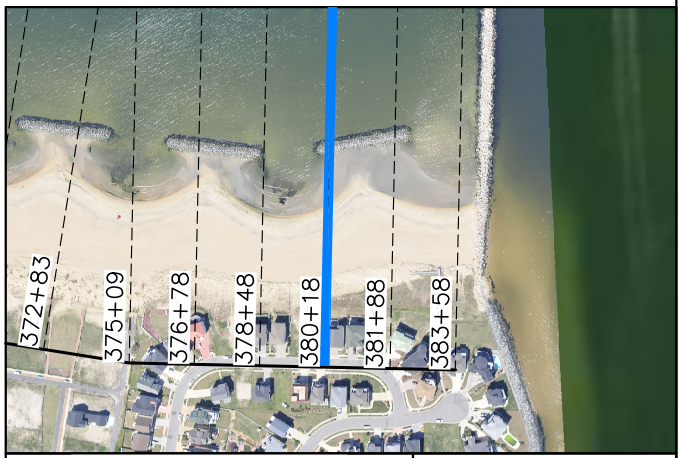




Survey Transect 380+18	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-92.65 ft/yr	-72.05 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-12.83 cy/ft
Volume Change Above 0 ft NAVD88	-13.84 cy/ft/yr	-7.80 cy/ft

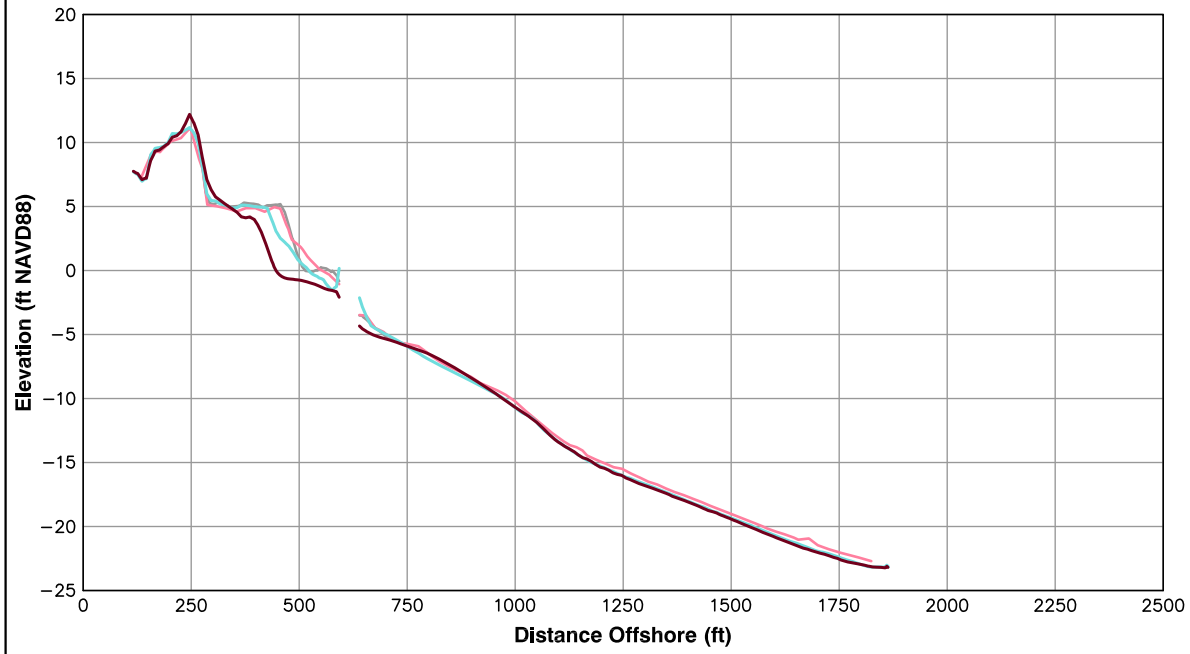
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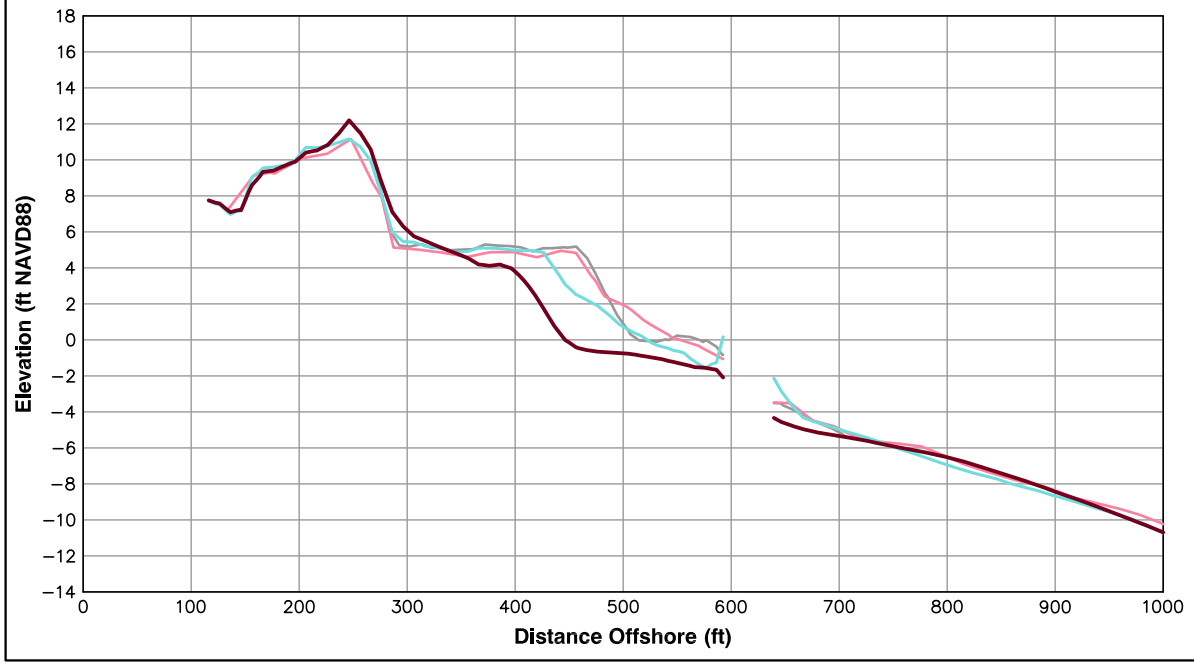
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 381+88	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-96.09 ft/yr	-60.18 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-11.50 cy/ft
Volume Change Above 0 ft NAVD88	-11.51 cy/ft/yr	-8.11 cy/ft

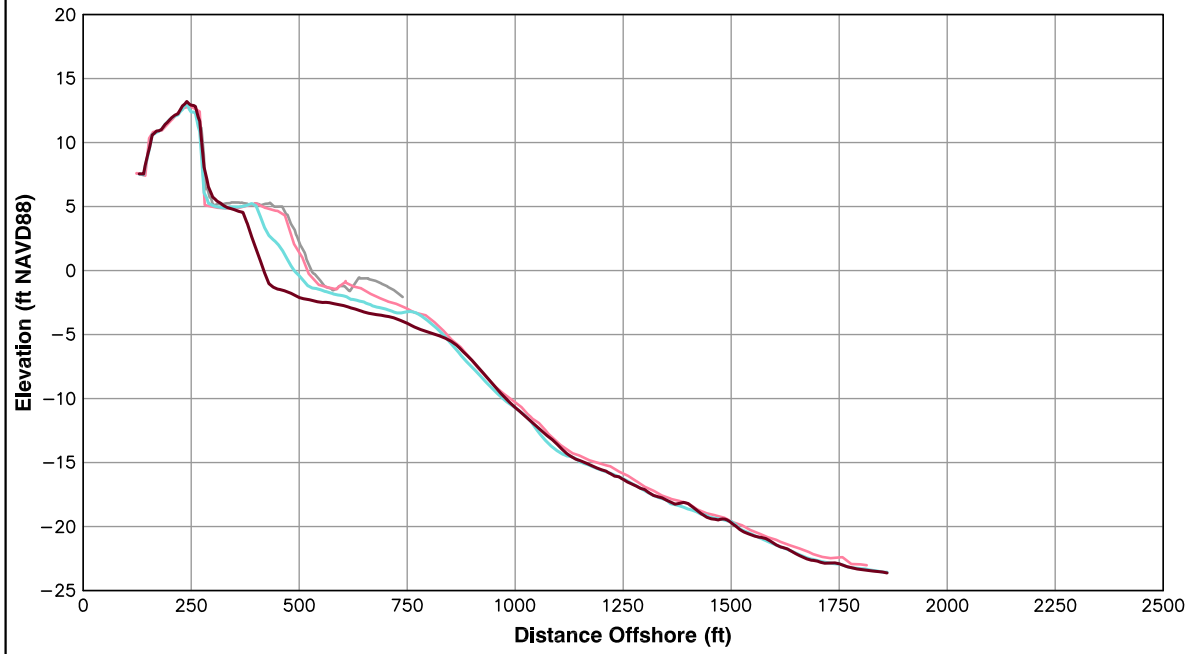
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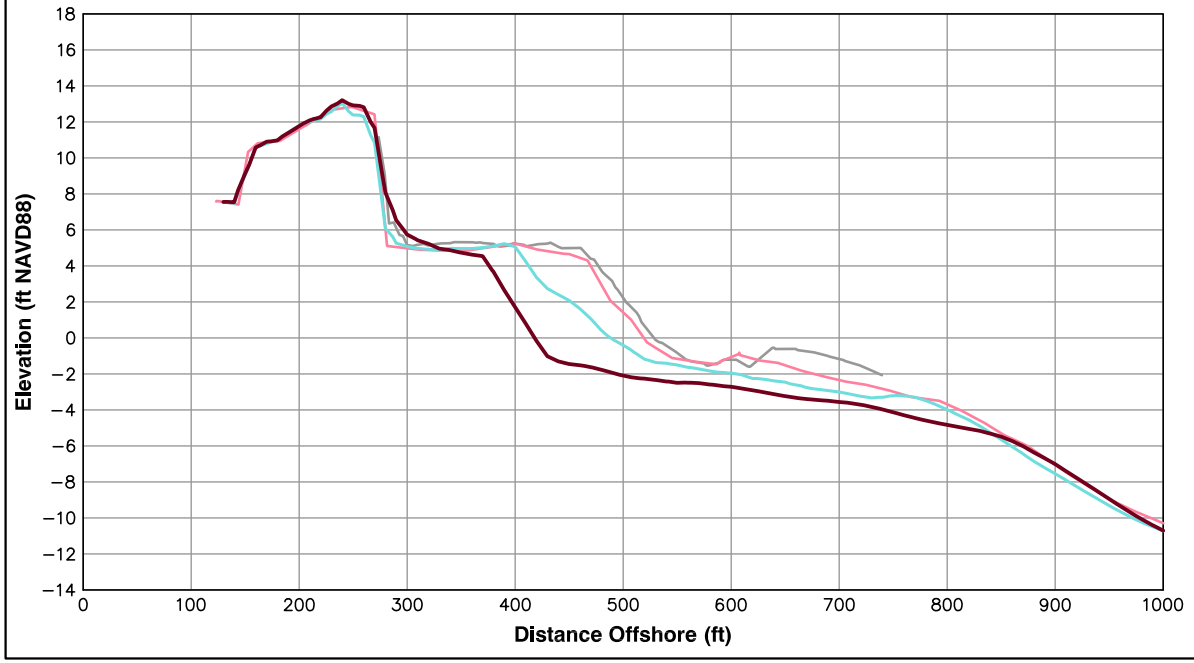
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS





Survey Transect 383+58	March 2010 - April 2009	March 2010 - October 2009
Shoreline Change at MHW (0.98 ft NAVD88)	-109.49 ft/yr	-63.83 ft
Volume Change Above -15 ft NAVD88	- cy/ft/yr	-17.67 cy/ft
Volume Change Above 0 ft NAVD88	-16.71 cy/ft/yr	-6.78 cy/ft

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

Notes:
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City of Norfolk

OCEAN VIEW PERIODIC SURVEYING DATA & ANALYSIS

ST 383+58	Pg 106 of 106	SPRING 2010

Appendix C: Summary of Shoreline Change and Volume Change Tables

Table C-1. Summary of Shoreline Change and Volume Change (April 2009 to March 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 May 1, 2009 to March 31, 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 NAVD 88 (cy/ft/yr)
0+00	5/1/2009	3/31/2010	-116.15	-5.81	-
2+50	5/1/2009	3/31/2010	-37.75	-1.15	-
5+00	5/1/2009	3/31/2010	12.71	-1.34	-
7+50	5/1/2009	3/31/2010	3.59	0.37	-
10+00	5/1/2009	3/31/2010	-4.11	0.99	-
12+50	5/1/2009	3/31/2010	-41.39	-2.84	-
15+00	5/1/2009	3/31/2010	-11.81	3.81	-
17+50	5/1/2009	3/31/2010	5.43	8.00	-
20+00	5/1/2009	3/31/2010	-27.54	-2.80	-
22+50	5/1/2009	3/31/2010	-7.52	-4.75	-
25+00	5/1/2009	3/31/2010	-5.20	-7.65	-
27+50	5/1/2009	3/31/2010	-2.73	-13.67	-
30+00	5/1/2009	3/31/2010	-1.09	-11.82	-
32+50	5/1/2009	3/31/2010	6.01	0.52	-
35+00	5/1/2009	3/31/2010	-21.43	-9.31	-
37+50	5/1/2009	3/31/2010	-27.10	-9.24	-
40+00	5/1/2009	3/31/2010	-18.00	-13.66	-
42+50	5/1/2009	3/31/2010	23.30	1.99	-
45+00	5/1/2009	3/31/2010	3.46	-8.49	-
45+25	5/1/2009	3/31/2010	-25.91	-9.77	-
47+30	5/1/2009	3/31/2010	-10.17	-4.45	-
49+35	5/1/2009	3/31/2010	-10.36	-3.37	-
51+41	5/1/2009	3/31/2010	15.83	-2.11	-
53+46	5/1/2009	3/31/2010	-59.07	-11.25	-
55+51	5/1/2009	3/31/2010	-13.67	-11.34	-
57+57	5/1/2009	3/31/2010	-53.77	-12.72	-
59+62	5/1/2009	3/31/2010	-2.18	-5.31	-
61+62	5/1/2009	3/31/2010	-40.49	-6.06	-
63+62	5/1/2009	3/31/2010	-12.41	-6.33	-
65+62	5/1/2009	3/31/2010	-36.92	-5.05	-
67+62	5/1/2009	3/31/2010	5.89	-5.13	-
69+62	5/1/2009	3/31/2010	-25.87	-9.45	-
71+62	5/1/2009	3/31/2010	12.30	-3.02	-
73+62	5/1/2009	3/31/2010	38.17	1.51	-
75+62	5/1/2009	3/31/2010	-36.06	-4.43	-
77+62	5/1/2009	3/31/2010	-61.38	-4.27	-
79+62	5/1/2009	3/31/2010	-9.23	-2.65	-
81+62	5/1/2009	3/31/2010	-12.36	-2.10	-
83+62	5/1/2009	3/31/2010	5.54	-3.43	-
85+62	5/1/2009	3/31/2010	-18.93	-6.83	-
87+62	5/1/2009	3/31/2010	-9.66	-8.24	-

Table C-1. Summary of Shoreline Change and Volume Change (April 2009 to March 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 May 1, 2009 to March 31, 2010.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD 88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
93+41	5/1/2009	3/31/2010	-5.78	-5.30	-
103+08	5/1/2009	3/31/2010	-9.76	-4.67	-
120+93	5/1/2009	3/31/2010	-4.66	-3.23	-
129+17	5/1/2009	3/31/2010	-25.00	-9.30	-
141+98	5/1/2009	3/31/2010	0.76	-2.83	-
152+01	5/1/2009	3/31/2010	-18.05	-8.80	-
163+49	5/1/2009	3/31/2010	-7.17	-1.95	-
169+63	5/1/2009	3/31/2010	-13.64	-5.06	-
171+63	5/1/2009	3/31/2010	-9.24	-5.81	-
173+63	5/1/2009	3/31/2010	15.14	1.63	-
175+63	5/1/2009	3/31/2010	4.09	0.66	-
177+63	5/1/2009	3/31/2010	-2.30	-3.67	-
179+63	5/1/2009	3/31/2010	-9.17	-6.47	-
181+63	5/1/2009	3/31/2010	8.22	-4.48	-
183+63	5/1/2009	3/31/2010	-10.07	-4.46	-
185+63	5/1/2009	3/31/2010	13.27	1.38	-
187+63	5/1/2009	3/31/2010	-30.51	-5.99	-
189+63	5/1/2009	3/31/2010	6.72	0.83	-
191+63	5/1/2009	3/31/2010	-55.69	-6.78	-
193+63	5/1/2009	3/31/2010	-19.36	-4.86	-
195+63	5/1/2009	3/31/2010	-22.15	-6.25	-
206+86	5/1/2009	3/31/2010	-13.64	-3.66	-
218+66	5/1/2009	3/31/2010	-3.94	2.67	-
229+85	5/1/2009	3/31/2010	-3.72	-3.49	-
242+03	5/1/2009	3/31/2010	4.35	0.92	-
252+62	5/1/2009	3/31/2010	-40.29	-11.57	-
263+22	5/1/2009	3/31/2010	-5.89	-6.86	-
274+53	5/1/2009	3/31/2010	-21.08	-2.35	-
281+40	5/1/2009	3/31/2010	-14.78	-7.09	-
288+39	5/1/2009	3/31/2010	-37.27	-5.30	-
295+27	5/1/2009	3/31/2010	-33.17	-13.46	-
302+24	5/1/2009	3/31/2010	-20.14	-10.32	-
315+96	5/1/2009	3/31/2010	-9.76	-8.22	-
323+09	5/1/2009	3/31/2010	-8.88	-5.44	-
329+63	5/1/2009	3/31/2010	-73.73	-9.33	-
331+43	5/1/2009	3/31/2010	-88.55	-11.81	-
333+23	5/1/2009	3/31/2010	-51.76	-7.65	-
335+03	5/1/2009	3/31/2010	-47.96	-7.66	-
336+83	5/1/2009	3/31/2010	-60.46	-9.03	-
338+63	5/1/2009	3/31/2010	-55.28	-9.55	-
340+43	5/1/2009	3/31/2010	-57.69	-7.27	-
342+23	5/1/2009	3/31/2010	-52.03	-6.90	-

Table C-1. Summary of Shoreline Change and Volume Change (April 2009 to March 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 May 1, 2009 to March 31, 2010.

Transect Number (Station)	Old Survey Date	New Survey Date	Shoreline Change Rate at MHW (ft/yr)	Volume Change Rate Above 0 ft NAVD 88 (cy/ft/yr)	Volume Change Rate Above -15 ft NAVD88 (cy/ft/yr)
344+05	5/1/2009	3/31/2010	-32.67	-1.72	-
345+85	5/1/2009	3/31/2010	-41.43	-10.15	-
347+63	5/1/2009	3/31/2010	-83.72	-10.45	-
349+43	5/1/2009	3/31/2010	-38.01	-5.11	-
351+23	5/1/2009	3/31/2010	-48.63	-7.03	-
353+03	5/1/2009	3/31/2010	-29.80	-3.58	-
354+83	5/1/2009	3/31/2010	-58.49	-2.65	-
356+63	5/1/2009	3/31/2010	-33.77	-4.26	-
358+43	5/1/2009	3/31/2010	-60.58	-4.52	-
360+23	5/1/2009	3/31/2010	-35.87	-4.46	-
362+03	5/1/2009	3/31/2010	-47.85	-3.63	-
363+83	5/1/2009	3/31/2010	-21.42	-4.10	-
365+63	5/1/2009	3/31/2010	-51.85	-1.90	-
367+43	5/1/2009	3/31/2010	-32.23	-4.15	-
369+23	5/1/2009	3/31/2010	-90.79	-7.60	-
371+03	5/1/2009	3/31/2010	-44.53	-4.59	-
372+83	5/1/2009	3/31/2010	-96.57	-8.41	-
375+08	5/1/2009	3/31/2010	-76.03	-10.77	-
376+78	5/1/2009	3/31/2010	-69.39	-5.59	-
378+48	5/1/2009	3/31/2010	-110.83	-15.49	-
380+18	5/1/2009	3/31/2010	-101.25	-13.84	-
381+88	5/1/2009	3/31/2010	-105.01	-11.51	-
383+58	5/1/2009	3/31/2010	-119.65	-16.71	-

Table C-2. Summary of Shoreline Change and Volume Change (October 2009 to March 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 November 6, 2009 to March 31, 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 NAVD 88 (cy/ft)
0+00	11/6/2009	3/31/2010	-25.53	-2.15	-3.85
2+50	11/6/2009	3/31/2010	-22.86	-2.64	-22.05
5+00	11/6/2009	3/31/2010	1.00	-3.47	5.16
7+50	11/6/2009	3/31/2010	-5.33	-3.10	-8.25
10+00	11/6/2009	3/31/2010	-1.76	0.31	-20.54
12+50	11/6/2009	3/31/2010	-10.75	-6.89	-6.12
15+00	11/6/2009	3/31/2010	-1.89	-0.95	0.07
17+50	11/6/2009	3/31/2010	10.34	3.28	-1.24
20+00	11/6/2009	3/31/2010	-4.52	-2.62	-2.08
22+50	11/6/2009	3/31/2010	-2.66	-6.50	-12.38
25+00	11/6/2009	3/31/2010	12.28	-6.54	-4.58
27+50	11/6/2009	3/31/2010	15.87	-9.21	-8.10
30+00	11/6/2009	3/31/2010	17.45	-7.67	-8.68
32+50	11/6/2009	3/31/2010	16.18	-4.16	-8.66
35+00	11/6/2009	3/31/2010	2.39	-3.68	-6.10
37+50	11/6/2009	3/31/2010	-4.33	-10.96	-11.80
40+00	11/6/2009	3/31/2010	8.35	-10.56	-17.80
42+50	11/6/2009	3/31/2010	29.65	-0.07	-6.25
45+00	11/6/2009	3/31/2010	8.50	-4.53	-4.39
45+25	11/6/2009	3/31/2010	-6.58	-9.19	-13.36
47+30	11/6/2009	3/31/2010	-5.20	-5.06	-8.85
49+35	11/6/2009	3/31/2010	23.07	0.08	-0.67
51+41	11/6/2009	3/31/2010	8.08	-2.33	-2.80
53+46	11/6/2009	3/31/2010	8.27	-6.06	-16.67
55+51	11/6/2009	3/31/2010	-11.73	-9.56	-5.31
57+57	11/6/2009	3/31/2010	9.13	-7.55	-14.83
59+62	11/6/2009	3/31/2010	-1.21	-6.51	-9.20
61+62	11/6/2009	3/31/2010	5.43	-3.60	-7.73
63+62	11/6/2009	3/31/2010	-16.61	-6.63	-9.52
65+62	11/6/2009	3/31/2010	-2.16	-2.40	-6.01
67+62	11/6/2009	3/31/2010	0.52	-5.43	-4.38
69+62	11/6/2009	3/31/2010	17.16	-3.84	-3.77
71+62	11/6/2009	3/31/2010	10.41	-2.20	2.29
73+62	11/6/2009	3/31/2010	49.54	3.33	13.20
75+62	11/6/2009	3/31/2010	-34.65	-6.10	-7.12
77+62	11/6/2009	3/31/2010	-29.59	-4.78	-5.50
79+62	11/6/2009	3/31/2010	-12.85	-4.09	-2.62
81+62	11/6/2009	3/31/2010	-12.90	-4.46	-4.75
83+62	11/6/2009	3/31/2010	-1.48	-3.33	-2.06
85+62	11/6/2009	3/31/2010	4.34	-3.72	-1.46
87+62	11/6/2009	3/31/2010	-4.77	-5.42	-3.08

Table C-2. Summary of Shoreline Change and Volume Change (October 2009 to March 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 November 6, 2009 to March 31, 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 NAVD 88 (cy/ft)
93+41	11/6/2009	3/31/2010	-9.70	-6.17	-9.71
103+08	11/6/2009	3/31/2010	2.54	-1.57	1.05
120+93	11/6/2009	3/31/2010	1.55	-1.60	3.02
129+17	11/6/2009	3/31/2010	-8.04	-8.21	-10.84
141+98	11/6/2009	3/31/2010	7.93	-1.96	0.45
152+01	11/6/2009	3/31/2010	-5.40	-6.11	-9.13
163+49	11/6/2009	3/31/2010	-6.81	-3.79	-4.26
169+63	11/6/2009	3/31/2010	-3.53	-4.61	-6.74
171+63	11/6/2009	3/31/2010	1.17	-3.09	-2.55
173+63	11/6/2009	3/31/2010	9.12	0.61	4.93
175+63	11/6/2009	3/31/2010	7.98	0.06	5.26
177+63	11/6/2009	3/31/2010	12.49	-0.63	3.55
179+63	11/6/2009	3/31/2010	10.14	-6.00	-5.55
181+63	11/6/2009	3/31/2010	11.19	-2.97	-3.46
183+63	11/6/2009	3/31/2010	4.09	-1.55	-0.97
185+63	11/6/2009	3/31/2010	5.63	0.86	-3.98
187+63	11/6/2009	3/31/2010	-0.80	-1.87	-3.73
189+63	11/6/2009	3/31/2010	-5.62	-1.36	0.25
191+63	11/6/2009	3/31/2010	-7.05	-3.04	-0.87
193+63	11/6/2009	3/31/2010	-4.63	-3.54	-8.62
195+63	11/6/2009	3/31/2010	-14.36	-4.53	-3.91
206+86	11/6/2009	3/31/2010	7.48	0.30	2.85
218+66	11/6/2009	3/31/2010	-7.61	3.02	-1.85
229+85	11/6/2009	3/31/2010	-10.59	-2.81	7.60
242+03	11/6/2009	3/31/2010	28.78	-7.37	1.56
252+62	11/6/2009	3/31/2010	-20.16	-6.16	-5.85
263+22	11/6/2009	3/31/2010	-6.61	-7.67	0.44
274+53	11/6/2009	3/31/2010	4.07	-7.67	2.19
281+40	11/6/2009	3/31/2010	-4.74	-7.04	3.90
288+39	11/6/2009	3/31/2010	-5.83	-1.34	3.00
295+27	11/6/2009	3/31/2010	-4.40	-9.52	-9.65
302+24	11/6/2009	3/31/2010	-3.17	-7.96	-6.82
315+96	11/6/2009	3/31/2010	-12.27	-5.48	-1.22
323+09	11/6/2009	3/31/2010	8.45	-4.97	-9.75
329+63	11/6/2009	3/31/2010	-3.26	-0.49	-7.16
331+43	11/6/2009	3/31/2010	-20.64	-1.52	-0.51
333+23	11/6/2009	3/31/2010	-42.00	-3.36	-7.03
335+03	11/6/2009	3/31/2010	-20.47	-1.68	-7.26
336+83	11/6/2009	3/31/2010	-37.73	-8.75	-15.10
338+63	11/6/2009	3/31/2010	-38.81	-7.16	-7.93
340+43	11/6/2009	3/31/2010	-31.35	-0.78	-8.56

Table C-2. Summary of Shoreline Change and Volume Change (October 2009 to March 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 November 6, 2009 to March 31, 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 NAVD 88 (cy/ft)
342+23	11/6/2009	3/31/2010	-24.92	-3.11	-7.78
344+05	11/6/2009	3/31/2010	-22.18	-0.06	2.57
345+85	11/6/2009	3/31/2010	-0.78	-1.27	-0.55
347+63	11/6/2009	3/31/2010	-33.85	-6.95	-6.34
349+43	11/6/2009	3/31/2010	-20.91	-1.32	-8.67
351+23	11/6/2009	3/31/2010	-39.45	-4.00	-4.67
353+03	11/6/2009	3/31/2010	-19.48	-1.88	-6.54
354+83	11/6/2009	3/31/2010	-48.46	-3.61	-2.19
356+63	11/6/2009	3/31/2010	-21.18	-0.89	-4.52
358+43	11/6/2009	3/31/2010	-49.73	-3.94	-3.00
360+23	11/6/2009	3/31/2010	-19.56	0.27	-3.79
362+03	11/6/2009	3/31/2010	-50.20	-3.19	-3.79
363+83	11/6/2009	3/31/2010	-18.25	1.85	-0.29
365+63	11/6/2009	3/31/2010	-34.35	-1.22	-1.32
367+43	11/6/2009	3/31/2010	-18.48	0.86	-3.39
369+23	11/6/2009	3/31/2010	-43.91	-3.01	-6.60
371+03	11/6/2009	3/31/2010	-30.11	0.82	-4.27
372+83	11/6/2009	3/31/2010	-51.71	-6.45	-6.86
375+08	11/6/2009	3/31/2010	-55.04	-5.93	-20.85
376+78	11/6/2009	3/31/2010	-36.17	-4.81	-5.23
378+48	11/6/2009	3/31/2010	-65.60	-10.14	-18.26
380+18	11/6/2009	3/31/2010	-72.05	-7.80	-12.83
381+88	11/6/2009	3/31/2010	-60.18	-8.11	-11.50
383+58	11/6/2009	3/31/2010	-63.83	-6.78	-17.67

Table C-3. Summary of Shoreline Change and Volume Change from East Ocean View Nourishment (March 2009 to March 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 March 31, 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 NAVD 88 (cy/ft/yr)
329+63	3/20/2009	3/31/2010	-67.13	-	-
331+43	3/20/2009	3/31/2010	-84.25	-13.67	-
333+23	3/20/2009	3/31/2010	-50.20	-8.95	-
335+03	3/20/2009	3/31/2010	-53.03	-10.81	-
336+83	3/20/2009	3/31/2010	-59.93	-12.43	-
338+63	3/20/2009	3/31/2010	-50.78	-12.91	-
340+43	3/20/2009	3/31/2010	-58.08	-11.93	-
342+23	3/20/2009	3/31/2010	-52.41	-12.64	-
344+05	3/20/2009	3/31/2010	-50.89	-11.29	-
345+85	3/20/2009	3/31/2010	-39.20	-10.22	-
347+63	3/20/2009	3/31/2010	-32.22	-8.51	-
349+43	3/20/2009	3/31/2010	-4.78	-10.65	-
351+23	3/20/2009	3/31/2010	-21.86	-6.23	-
353+03	3/20/2009	3/31/2010	-41.77	-8.75	-
354+83	3/20/2009	3/31/2010	-19.56	-5.47	-
356+63	3/20/2009	3/31/2010	-39.63	-10.00	-
358+43	3/20/2009	3/31/2010	-34.84	-6.59	-
360+23	3/20/2009	3/31/2010	-54.58	-11.84	-
362+03	3/20/2009	3/31/2010	-37.29	-7.75	-
363+83	3/20/2009	3/31/2010	-27.19	-6.93	-
365+63	3/20/2009	3/31/2010	-11.54	-3.77	-
367+43	3/20/2009	3/31/2010	-56.69	-10.82	-
369+23	3/20/2009	3/31/2010	-19.84	-5.81	-
371+03	3/20/2009	3/31/2010	-64.57	-12.35	-
372+83	3/20/2009	3/31/2010	-31.02	-8.89	-
375+08	3/20/2009	3/31/2010	-77.46	-16.33	-
376+78	3/20/2009	3/31/2010	-26.35	-7.86	-
378+48	3/20/2009	3/31/2010	-95.53	-17.45	-
380+18	3/20/2009	3/31/2010	-80.09	-15.02	-
381+88	3/20/2009	3/31/2010	-63.18	-12.70	-
383+58	3/20/2009	3/31/2010	-105.99	-19.65	-

Table C-4. Summary of Shoreline Change and Volume Change from Central Ocean View Nourishment (March 2005 to March 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 March 31, 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 NAVD 88 (cy/ft/yr)
15+00	3/15/2005	3/31/2010	7.11	2.44	-
17+50	3/15/2005	3/31/2010	11.79	2.74	-
20+00	3/15/2005	3/31/2010	-0.83	-0.47	-
22+50	3/15/2005	3/31/2010	-8.00	-3.59	-
25+00	3/15/2005	3/31/2010	-3.97	-3.78	-
27+50	3/15/2005	3/31/2010	-5.98	-4.14	-
30+00	3/15/2005	3/31/2010	-4.37	-3.48	-
32+50	3/15/2005	3/31/2010	-9.08	-4.49	-
35+00	3/15/2005	3/31/2010	-9.65	-3.40	-
37+50	3/15/2005	3/31/2010	-5.47	-4.66	-
40+00	3/15/2005	3/31/2010	-12.63	-4.68	-
42+50	3/15/2005	3/31/2010	-9.01	-5.07	-
45+00	3/15/2005	3/31/2010	-11.26	-5.28	-
45+25	3/15/2005	3/31/2010	-12.88	-5.51	-
47+30	3/15/2005	3/31/2010	-16.04	-5.55	-
49+35	3/15/2005	3/31/2010	-7.48	-3.89	-
51+41	3/15/2005	3/31/2010	-8.93	-3.16	-
53+46	3/15/2005	3/31/2010	-2.90	-2.21	-
55+51	3/15/2005	3/31/2010	-9.54	-3.91	-
57+57	3/15/2005	3/31/2010	0.03	-1.89	-
59+62	3/15/2005	3/31/2010	-9.80	-3.41	-
61+62	3/15/2005	3/31/2010	3.70	0.03	-
63+62	3/15/2005	3/31/2010	-7.64	-1.13	-
65+62	3/15/2005	3/31/2010	-3.79	-0.03	-
67+62	3/15/2005	3/31/2010	-23.65	-3.74	-
69+62	3/15/2005	3/31/2010	-15.81	-3.15	-
71+62	3/15/2005	3/31/2010	-28.01	-4.96	-
73+62	3/15/2005	3/31/2010	2.94	-0.18	-
75+62	3/15/2005	3/31/2010	-5.92	0.17	-
77+62	3/15/2005	3/31/2010	4.15	2.16	-
79+62	3/15/2005	3/31/2010	-0.99	-0.26	-
81+62	3/15/2005	3/31/2010	-2.97	-1.32	-
83+62	3/15/2005	3/31/2010	-4.92	-2.22	-
85+62	3/15/2005	3/31/2010	-5.09	-2.75	-
87+62	3/15/2005	3/31/2010	-3.72	-1.09	-
93+41	3/15/2005	3/31/2010	-2.19	-1.70	-
103+08	3/15/2005	3/31/2010	-7.08	-3.13	-
120+93	3/15/2005	3/31/2010	-8.46	-4.25	-
129+17	3/15/2005	3/31/2010	-12.31	-5.73	-
141+98	3/15/2005	3/31/2010	-3.58	-1.62	-
152+01	3/15/2005	3/31/2010	-9.64	-4.01	-

Table C-4. Summary of Shoreline Change and Volume Change from Central Ocean View Nourishment (March 2005 to March 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 March 31, 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 NAVD 88 (cy/ft/yr)
163+49	3/15/2005	3/31/2010	-5.14	-2.13	-
169+63	3/15/2005	3/31/2010	-5.14	-1.96	-
171+63	3/15/2005	3/31/2010	-0.77	-2.42	-
173+63	3/15/2005	3/31/2010	-2.58	-1.60	-
175+63	3/15/2005	3/31/2010	-7.02	-2.24	-
177+63	3/15/2005	3/31/2010	-4.94	-1.85	-
179+63	3/15/2005	3/31/2010	-8.30	-3.03	-
181+63	3/15/2005	3/31/2010	-4.84	-3.54	-
183+63	3/15/2005	3/31/2010	1.15	-0.30	-
185+63	3/15/2005	3/31/2010	-1.28	-0.34	-
187+63	3/15/2005	3/31/2010	3.29	0.84	-
189+63	3/15/2005	3/31/2010	-0.92	0.62	-
191+63	3/15/2005	3/31/2010	3.05	1.22	-
193+63	3/15/2005	3/31/2010	-3.28	-0.18	-
195+63	3/15/2005	3/31/2010	-5.94	-1.07	-