2008 BEACH RESTORATION PROJECT
ISLE OF PALMS SOUTH CAROLINA

Beach Monitoring Report — Year 2
March 2011

Prepared for:

City of Isle of Palms

2008 Isle of Palms Beach Restoration Project

YEAR 2 MONITORING REPORT

Prepared for:

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[2300YR2]

March 2011

COVER PHOTO: Oblique aerial images of the northeastern end of the Isle of Palms on 28 April 2010 (looking southwest). [Photos by S Traynum]

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EXECUTIVE SUMMARY

This report presents results of Year 2 beach and inlet monitoring following the 2008 beach restoration project at the Isle of Palms, which was accomplished in May-June 2008 under permit P/N 2007-02631-2IG. As part of the Operations, Monitoring, and Contingency Plan (CSE 2008a) for the project, annual surveys are being conducted to track the performance of the project, measure sand volumes remaining, and provide a condition survey of the beach, inlets, and shoals from Dewees Inlet to Breach Inlet. Year 2 monitoring involved condition surveys in March and September 2010 as well as collection of sediment samples in July 2010. These data are compared with pre-project and post-project conditions in the project area (north of 53rd Avenue). Data for remaining areas of the Isle of Palms and Breach Inlet are compared with earlier surveys by CSE and SCDHEC Office of Ocean and Coastal Resource Management (OCRM). The report includes:

- Shoreline history and summary of the 2008 beach restoration project.
- Description of the data collection and analysis methods.
- Monitoring results by section of shoreline using seven (7) reaches along the island.
- Nourishment volume remaining within the project limits.
- Identification of local erosion "hot spots."
- Discussion of findings.

The present report follows the Year 1 monitoring report (CSE 2009) and an interim report (CSE 2010) which focused on condition changes through March 2010 (Table A). The present report continues those analyses through the September 2010 beach condition. All surveys since March 2009 have used the same baseline (shore-parallel stationing system based on distance from the Breach Inlet bridge), established following the project to encompass the entire island. Cross-shore volume calculation limits and depth limits were adjusted profile-by-profile in an attempt to fully account for all measurable volume change occurring at a profile. This results in certain volumes slightly differing from previous reports. Where this occurred, previous profiles were recomputed using the new limits.

TABLE A. Important dates of events related to the 2008 beach nourishment project and subsequent monitoring.

Milestone	Date	Comment
Beach Condition Survey	Jul 2007	
Pre-Construction Survey	Mar 2008	
Project Construction	May-Jun 2008	934,000 cubic yards placed along 10,200 ft of shoreline
Monitoring Survey	Mar 2009	93 percent of nourishment volume remained within the fill placement
Monitoring Survey	Sep 2009	81 percent of nourishment volume remained within the fill placement
Year 1 Monitoring Report	Dec 2009	
Monitoring Survey	Mar 2010	73 percent of nourishment volume remained within the fill placement
Monitoring Survey	Sep 2010	72 percent of nourishment volume remained within the fill placement
Permit Application Submitted	Oct 2010	
Year 2 Monitoring Report	Mar 2011	

The 2008 beach restoration project obtained sand from deposits ~2.5 miles offshore and placed 933,895 cubic yards (cy) in three reaches between 53rd Avenue and Dewees Inlet. As of September 2010 (2.3 years after project completion), Reach A (53rd Avenue to Beach Club Villas) retained ~53.9 percent of the nourishment volume; Reach B (Mariners Walk Villas to the 18th fairway of Wild Dunes Links Course) retained ~78.1 percent of the nourishment volume; and Reach C (a 1,000-foot length of Dewees Inlet shoreline adjacent to the 17th hole and 18th tee of the Wild Dunes Links Course) retained ~116.7 percent of the nourishment volume (Fig A).

Collectively, the project areas retained ~72 percent of the nourishment fill as of September 2010. From September 2009 to March 2010, erosion was similar to trends observed from 2008 to 2009; however, by September 2010, much of the beach north of 53rd Avenue had stabilized or shown accretion. This was especially true in areas which had shown the most erosion since the project (Beachwood East and Ocean Club areas).

The 2010 surveys confirm that sand is continuing to enter the Isle of Palms littoral zone in the vicinity of the Wild Dunes Property Owners Beach House (situated between Beach Club Villas I and Beach Club Villas II) via a process called "shoal bypassing" (described herein). A broad, triangular, underwater platform containing ~4.3 million cubic yards accounts for some new sand added to the beach in 2010. Two shoal-bypassing events since completion of the nourishment project accounted for rapid nourishment losses in the vicinity of Seascape Villas and Ocean Club (Reach B) as well as a localized area fronting the Beachwood East area (Reach A). As mentioned previously, erosion in these areas had been rapid; however, since March 2010, erosion has slowed and the beach has stabilized. This is a result of sand spread-ing from the shoal attachment areas.

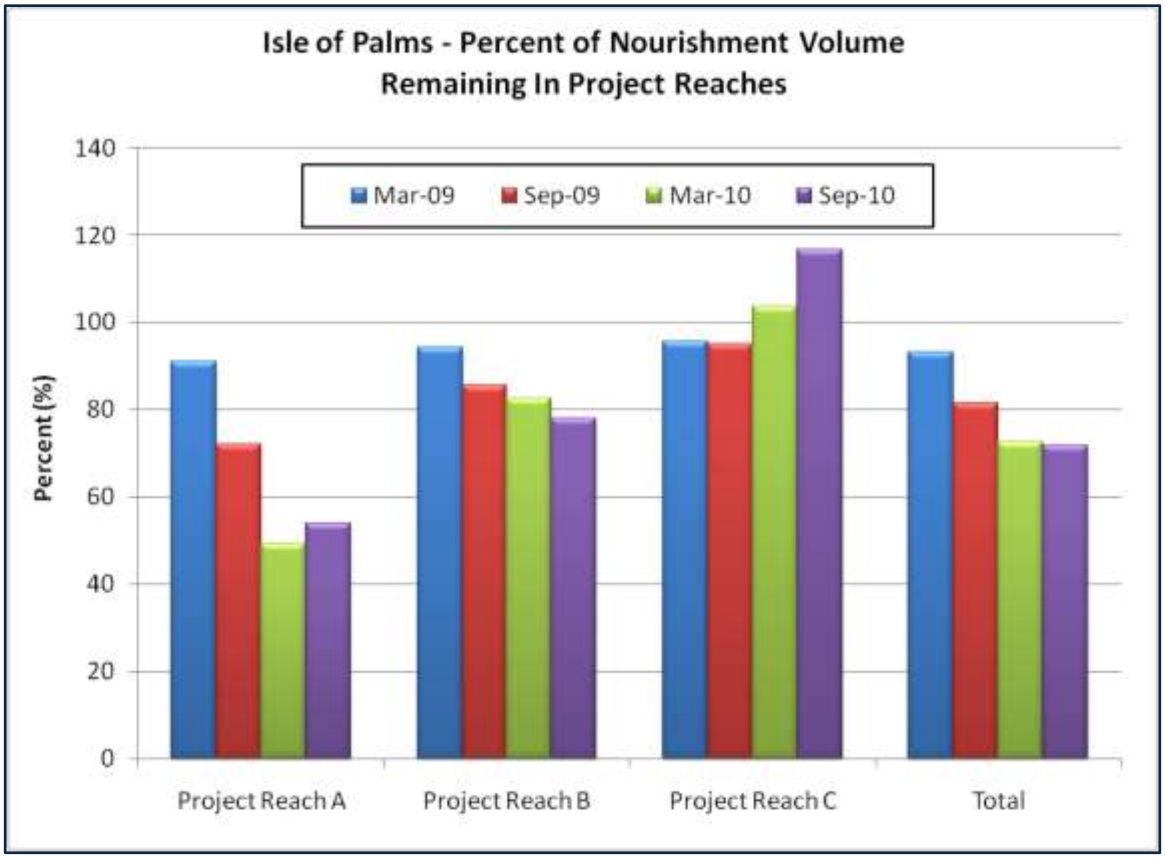

FIGURE A. Percent of nourishment volume remaining in project areas. Sand lost from nourishment areas has contributed to accretion in adjacent areas, including near the Wild Dunes Property Owners Beach House, the 18th fairway of the Links Course, and between the Citadel Beach House and 53rd Avenue.

The present surveys (2010) indicate that downcoast sections of the Isle of Palms from 53rd Avenue to Breach Inlet gained ~213,000 cubic yards (cy) [9.6 cubic yards per foot (cy/ft)] between September 2009 and September 2010. Minor erosion was observed from March to September 2009, thought to be caused by the recent shoal attachment interrupting longshore transport to downcoast areas. The recent accretion is greater than the long-term net change of 2.7 cubic yards per foot per year (cy/ft/yr). Areas north of 53rd Avenue lost ~126,700 cy from September 2009 to March 2010, though gained ~5,000 cy from March to September 2010.

Between March and September 2009, CSE observed erosion of the beach near Breach Inlet due to landward migration of a marginal flood channel. By September 2010, the channel had shifted further offshore, and the beach accreted. Of note in the more recent surveys is that Breach Inlet appears to be undergoing a channel avulsion, much like the one occurring at Dewees Inlet. A new channel oriented to the southeast is becoming more established. This likely will not have a significant impact to the Isle of Palms beach, but will certainly lead to continued accretion at Sullivan's Island.

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1.0 INTRODUCTION

This monitoring report is provided to the City of Isle of Palms by Coastal Science & Engineering (CSE) as part of a three-year agreement for beach monitoring following the 2008 Isle of Palms beach restoration project (P/N 2007-02631-2IG, CSE 2008b). This report details the third and fourth data collections after nourishment. It follows submission of the Year 1 monitoring report (CSE 2009) and the Year 2 interim monitoring report (CSE 2010). Discussions presented herein are based on comparisons of pre-project and post-project data with surveys performed in March and September of both 2009 and 2010. Additional data collection is planned for summer 2011.

The analyses presented in this report provide an updated condition of the beach ~26 months after the completion of the restoration project. There are several objectives of post-project beach monitoring, some of which are required by the conditions of the permits. This report provides beach profile volumes along the length of the Isle of Palms (IOP), including detailed volume changes in the project areas. It also addresses the current physical and environmental condition of the beach and offshore borrow areas impacted by the project, including sand grain size, beach slope, beach compaction, and borrow area infilling rates. Ground and aerial photography are included to identify features such as dunes, escarpments, sand texture and color, as well as to give a visual representation of the beach width to compare with previous and future surveys.

1.1 Setting

Isle of Palms is an ~7-mile long, southeast-facing, barrier island located ~8 miles east of Charleston, South Carolina. It is bounded by Dewees Inlet and Dewees Island to the northeast and Breach Inlet and Sullivan's Island to the southwest. A feature typical of the central South Carolina barrier islands is the "drumstick" shape produced by the interaction of waves and tides, and formation of prominent ebb-tidal deltas at the inlets. Seaward shoals of each delta produce wave refraction and variable longshore transport rates. This leads to a wider upcoast (northern) end and a relatively thin downcoast end (Breach Inlet end, Fig 1.1). The wider end of the island is influenced by shoal bypassing, a process whereby sand is periodically released from the inlet delta and moved onshore through wave action. This process occurs at somewhat regular intervals (average interval between events from 1941 to 1997 is 6.6 years, Gaudiano 1998) and contributes to the overall health of the island. However, it also can cause focused erosion in areas adjacent to the shoal attachment zone (Kana et al 1985).

FIGURE 1.1. Isle of Palms is a typical "drumstick" barrier island (after Hayes 1979), where the upcoast end is wider due to sediment accumulation through shoal-bypass events, and the downcoast end usually forms a growing recurve spit. Other examples of drumstick barrier islands along South Carolina are Bull Island, Kiawah Island, and Fripp Island. Zones of sediment transport reversal generally occur in the lee of delta shoals which are situated offshore. Upon shoal attachment to the beach, transport directions in the vicinity of the shoal switch, spreading sand away from the attachment point (see for example — Fig 1.2).

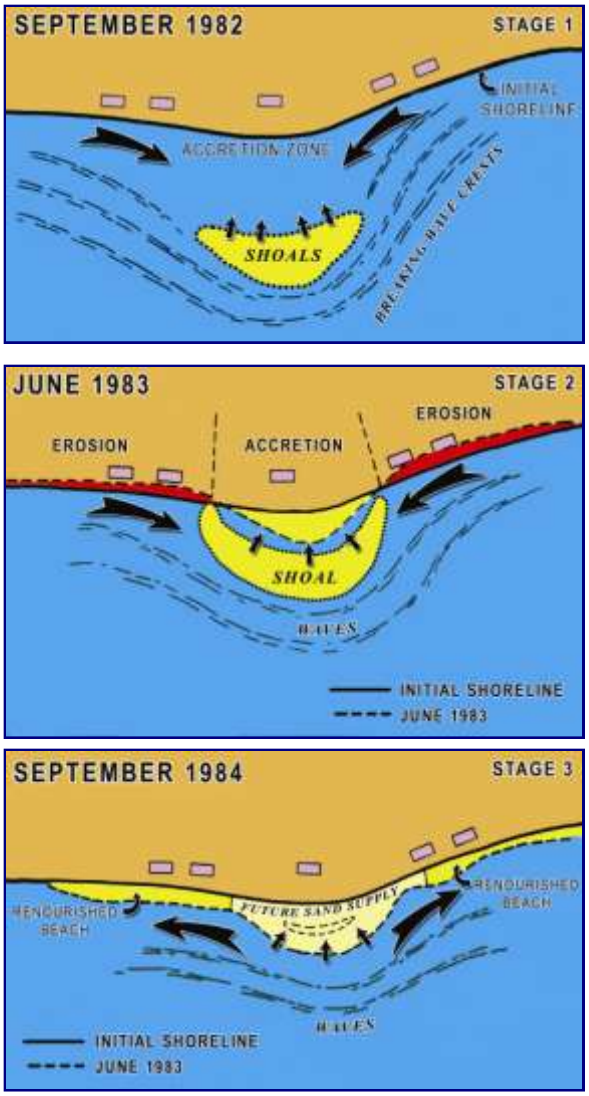

FIGURE 1.2.

[LEFT]
Schematic of the shoal-bypass cycle originally modeled from a bypass event at IOP. During Stages 1 and 2 of the cycle, accretion in the lee of the shoal is accompanied by erosion on either side of the attachment site. (After Kana et al 1985)

[RIGHT]
Shoal-bypass event at the northeastern end of IOP. The upper photo shows a shoal in Stage 1 of the bypass cycle in March 1996. The middle image, taken in 1997, shows that the shoal is beginning to attach to the beach and is in Stage 2 of the bypass cycle. The lower image (from December 1998) shows the shoal completely attached (Stage 3), and sand has spread to previously eroded areas.

The long-term accretion trend at the Isle of Palms is a direct result of shoal bypassing at Dewees Inlet. Numerous episodic events have deposited sand on the northeastern end of the island (Gaudiano 1998). The annual average sand gain from shoal-bypass events is ~100,000 cubic yards per year (cy/yr); however, ~120,000–130,000 cy/yr are typically lost to downcoast areas each year, leaving a net sand deficit of ~20,000–30,000 cy/yr at the northeastern end (CSE 2007a). A more detailed explanation of the coastal processes and erosion history of Isle of Palms is provided in CSE (2007a, 2009).

The shoal-bypassing event which led to the 2008 project appears to have begun around 2003. By 2004, some areas (eg – Port O'Call) experienced 150 ft of beach recession in one year (ATM 2006). In February 2007, exposed bars extended nearly one-half mile offshore around Beach Club Villas and the Wild Dunes Property Owners beach house (Fig 1.3). The southern part of the attaching shoal was already in Stage 3 with some sand moving south to nourish other parts of IOP; the northern side remained in Stage 2. As Figure 1.3 shows, all properties north of Beach Club Villas had lost their dry-sand beach by then. To protect buildings, property owners placed ~5-gallon-sized sand bags along the scarped dune. These bags were quickly destroyed or washed away, and property owners replaced them with large (1 cy) sand bags in front of buildings for protection. Erosion continued into 2008, eventually claiming half of the signature 18th hole of the Wild Dunes Links Course and leaving no dry beach (even at low tide) in front of several properties.

FIGURE 1.3.

[UPPER]

February 2007 oblique aerial image of the northeastern end of IOP showing the approaching shoal in Stage 2 of the bypass cycle.

Note loss of dry beach and various shore-protection measures from Mariners Walk Villas to the 18th fairway (red-outlined arrows – focused erosion).

[LOWER]

Small, 5-gallon-sized sand bags (left) and large 1 cy-sized sandbags (right) installed by property owners to temporarily offer protection to buildings.

Prior to the 2008 project, little to no beach was present at low tide near the Ocean Club condominiums.

Left image courtesy of Coastal Carolina University Beach Erosion Research and Monitoring Program.

1.2 The 2008 Isle of Palms Beach Restoration Project

The Wild Dunes Community Association retained CSE in May 2007 to develop an analysis of erosion and prepare a plan for long-term restoration of the beach. CSE (2007) determined that upward of 900,000 cy should be added along the northeastern end of IOP to restore the sand deficit and provide reserves that will accommodate future erosion events over an approximate ten-year period. Following a number of community meetings and discussions with City and State officials, the City of Isle of Palms elected to proceed with the final design and planning for the project.

The specific objectives of the 2008 beach restoration project were to:

- Restore the recreational beach along the northeastern erosion zone of IOP from 53rd Avenue to the terminal groin along Dewees Inlet, excluding areas with a sand surplus in the active sand-bypassing zone or which were likely to receive sand as a result of natural spreading to downcoast areas.
- Restore a protective beach seaward of buildings such that dune enhancement may be initiated by the applicant and individual property owners.
- Remove emergency sandbags placed by property owners, all of which were in violation of OCRM permits after approximately November 2007.
- Place nourishment volumes of variable section quantities to reduce the variability of beach width caused by inlet sand-bypassing processes.
- Provide a protective buffer between existing infrastructure and the ocean.
- Improve the overall aesthetics of the beach and enhance its recreational value.
- Restore habitat for nesting sea turtles.

Construction Contract

The City of Isle of Palms entered into a contract with Weeks Marine of Covington (LA) for placement of 780,000 cy of sand along 9,200 liner feet of beach. Two change orders increased the total volume to 847,400 cy over 10,200 ft of beach and added a fill section to the Dewees Inlet shoreline. The original bid was for $7,914,100, and the total cost after the change orders was $8,402,090. Weeks Marine selected Dirt Cheap Inc (Charleston SC) as subcontractor to remove sandbags installed by property owners. Weeks Marine was required to have U.S. Coast Guard certifications and licenses, a contractor's license to work in the state of South Carolina, and a business license in the City of Isle of Palms.

Project Construction

The restoration project was designed to add ~850,000 cy of sand to ~10,200 linear feet of beach (Fig 1.4). The fill was to be placed in three reaches. Reaches A and B were located along the oceanfront spanning from ~53rd Avenue to the 18th fairway of the Wild Dunes Links Course, separated by an accretion zone associated with the shoal-bypassing event. Reach C represented a portion of the Dewees Inlet shoreline. Roughly 2,600 linear feet of Reach A bordered publically accessible areas of the City. The remaining fill bordered the Wild Dunes community. Design fill volumes for full sections (excluding tapers) were 75 cy/ft in Reach A, 140 cy/ft to 180 cy/ft for Reach B, and 27 cy/ft in Reach C.

Pumping began in Reach B, along the most severely eroded area of Wild Dunes. Once Reach B was complete, Reach C along Dewees Inlet was filled, followed by Reach A between 53rd Avenue and Beach Club Villas. Borrow area A was used to fill the majority of Reach B. Borrow area C was used to fill the northern end of Reach B and all of Reach C. Borrow area B was the sediment source for Reach A. The design berm was set at an elevation of +6 ft NAVD, with the beach face sloping at 1 on 20 (1 on 12 in Reach C due to the naturally steeper shoreline along inlets). A storm berm (set at +8 ft NAVD) was incorporated in the design along the most severely eroded areas of Wild Dunes.

The final volume added to the beach calculated from Weeks Marine's surveys was 933,895 cy, which was ~10 percent greater than the design volume of 847,400 cy. The overage of 86,495 cy was not a pay quantity as stated in the contract; therefore, the City was only required to pay for the contract volume of 847,400.

FIGURE 1.4. Project map of the 2008 IOP restoration project. The project was designed to nourish sections of the beach and provide sufficient sand to offset losses associated with long-term erosion as well as an ongoing shoal-bypass event. Borrow areas were located 2-3 miles offshore. Area D was not dredged.

Post-Project Monitoring Requirements

Several monitoring requirements were outlined in the conditions of the permit and in the OMCP (CSE 2008a). Many of the requirements involved aspects of project construction and have already been completed. Monitoring efforts which extend beyond project construction will be addressed through work performed in the present monitoring contract (CSE Project 2300), as well as work that was included in the project contract (CSE Project 2277). Specific monitoring requirements which are ongoing are as follows:

- Borrow area bathymetric surveys including production of digital terrain models (DTMs) and calculation of infilling rates.
- Beach compaction measurements and escarpment monitoring prior to turtle nesting season.
- Sediment quality analysis of the fill with comparison to pre- and post-project conditions.
- Monitoring of beach slopes (profiles).
- Borrow area (offshore) and fill area (beach) benthic macrofauna surveys comparing pre- and post-project densities. (CSE Project 2277 data were provided in separate reports.)

The current compliance status regarding the above-listed requirements is outlined in later sections of this report.

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2.0 METHODS

Monitoring efforts for the 2010 report took place during several deployments to the Isle of Palms. CSE collected topographic and bathymetric data in March and September 2010. Sediment compaction measurements were also collected in February 2010. Beach sediment samples were collected in July 2010.

Changes in the volume of sand in the active beach zone were evaluated by obtaining topographic and bathymetric data along shore-perpendicular transects at established locations along the beach (herein referred to as the baseline, Fig 2.1). The baseline for the present report is modified from the project baseline (pre-2009) to encompass the entire island. Modifications were also made around turns in the baseline, which provide better detail and greater consistency in comparing beach volume changes. The present baseline spans from the center of the Breach Inlet bridge (Station 0+00) and continues to Cedar Creek spit at the northeastern end of the island (Station 376+00). The new baseline overlaps the baseline used in the project beginning at 53rd Avenue, which was the location of project station 0+00. That station is now station 222+00. Stationing relates to distance along the shore with the number before the "+" symbol representing 100 ft. Therefore, station 36+00 is 3,600 ft from station 0+00. The baseline is generally set landward of the present active beach to allow for future erosion/accretion.

Topographic data were collected via RTK-GPS (Trimble™ R8 GNSS), which provides position and elevation measurements at sub-centimeter accuracy. Beach profiles were obtained by collecting data at low tide along the dunes, berm, and active beach to low-tide wading depth. Over-water work was then performed at high tide to overlap the land-based work (Fig 2.2) and was collected with RTK-GPS coupled with an Odom HydroTrak™ precision echo sounder mounted on CSE's shallow-draft vessel, the *RV Congaree River*. Profiles were collected from the most landward accessible point in the dune system to a minimum of 1,500 ft from the baseline. Profiles in the project area extended up to 15,000 ft offshore to encompass the shoals associated with Dewees Inlet and to monitor changes in bathymetry in the vicinity of the nourishment borrow areas. Alongshore spacing of the profiles ranged from 200 ft to 1,000 ft with the more closely spaced profiles in the project area and along Breach Inlet. Comparative profiles from CSE's monitoring efforts are shown in Appendix A. The complexity of areas impacted by inlets requires more detailed analysis (closer profile spacing) to fully incorporate volume changes associated with shoal-bypassing events and inlet migration. Bathymetric data were collected in the borrow areas at 100-ft spacing for comparison to pre- and post-dredging DTMs.

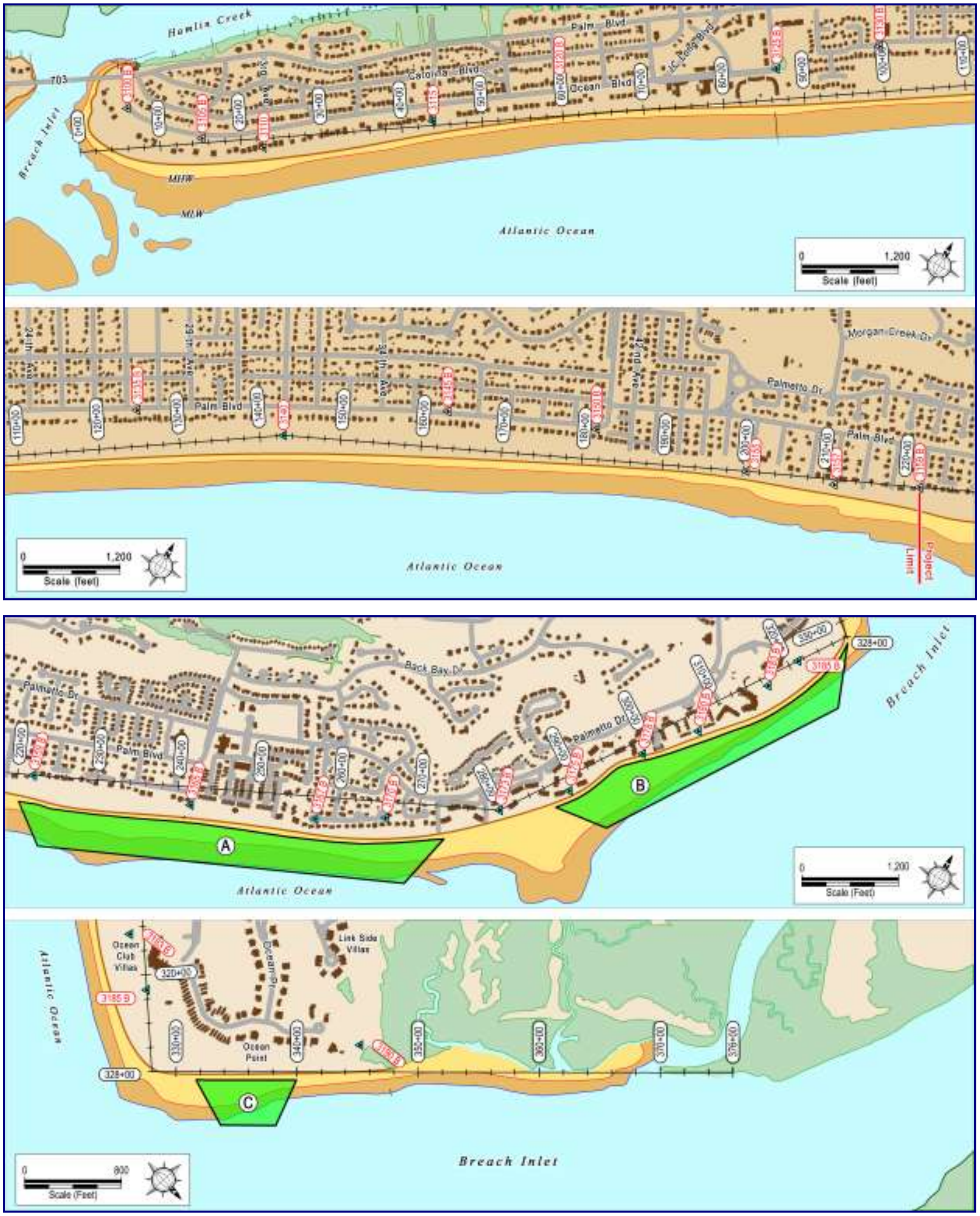


FIGURE 2.1 CSE established a monitoring baseline to encompass the length of IOP. The baseline between stations 222+00 and 376+00 corresponds to the baseline used in the 2008 project (project stations 0+00 through 174+00). Red labels indicate locations of OCRM survey monuments. CSE profile sections are oriented perpendicular to the baseline while OCRM profiles are perpendicular to the local beach azimuth. [CSE and OCRM azimuths are only significantly different at Breach Inlet.]

FIGURE 2.2. CSE beach monitoring methods include land-based data collection using Trimble™ RTK GPS from the backshore to low-tide wading depth and over-water work using RTK GPS linked to a precision echosounder aboard CSE's shallow draft boat (RV *Congaree River).*

To better understand regional sand volume changes, seven reaches were defined along IOP. By combining several profiles into a reach, it is easier to identify overall sediment gains and losses over large portions of the beach. In the project area, the reaches differ from reaches used during construction so as to encompass areas where no work was performed. [Some sections of this report may refer to volume changes within constructed project reaches and will be clearly indicated.] The reaches used for monitoring purposes are shown in Figure 2.3 and are defined as follows:

Reach 1	0+00 – OCRM 3115	Breach Inlet to 6th Avenue
Reach 2	OCRM 3115 – OCRM 3125	6th Avenue to Pier
Reach 3	OCRM 3125 – OCRM 3140	Pier to 31st Avenue
Reach 4	OCRM 3140 – 222+00	31st Avenue to 53rd Avenue
Reach 5	222+00 – 280+00	53rd Avenue to Property Owners Beach House
Reach 6	280+00 – 328+00	Property Owners Beach House to Dewees Inlet
Reach 7	330+00 – 370+00	Dewees Inlet Shoreline

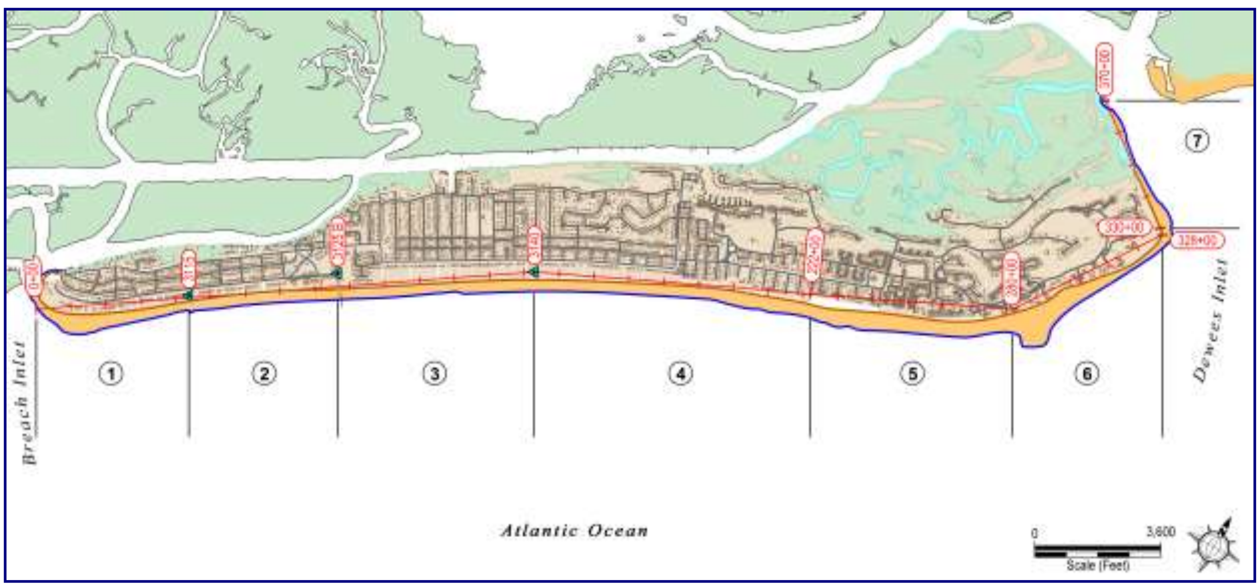


FIGURE 2.3. Location map of the reaches used in post-project monitoring at IOP. The 2008 beach restoration project occurred in subareas within Reaches 5, 6, and 7.

To determine changes in beach volume along IOP, survey data were entered into CSE's in-house custom software, Beach Profile Analysis System (BPAS), which converts 2-D profile data in x-y format to 3-D volumes. The software provides a quantitative and objective way of determining ideal minimum beach profiles and how the sand volume per unit length of shoreline compares with the desired condition. It also provides an accurate method of comparing historical profiles—as the volume method measures sand volumes in the active beach zone rather than extrapolating volumes based on single-contour shoreline position (ie – from aerial photography). Unit-volume calculations can distinguish the quantity of sediment in the dunes, on the dry beach, in the intertidal zone to wading depth, and in the remaining area offshore to the approximate limit of profile change. Figure 2.4 depicts the profile volume concept. The reference boundaries are site-specific, but ideally encompass the entire zone over which sand moves each year.

For the present survey, sand volume was calculated between the primary dune and between −9 ft and −18 ft NAVD. The lower calculation limit was site-specific, as profiles in the center of the island and along Dewees Inlet generally have deeper closure depths than areas in the unstable inlet/shoal zones. Comparative volumes and volume changes were computed using standard procedures (average-end-area method, in which the average of the area under the profiles computed at the ends of each cell is multiplied by the length of the cell to determine the cell's sand volume). Certain adjustments were made to account for changes in the baseline direction and for volumes at the turn in the baseline at Dewees Inlet.

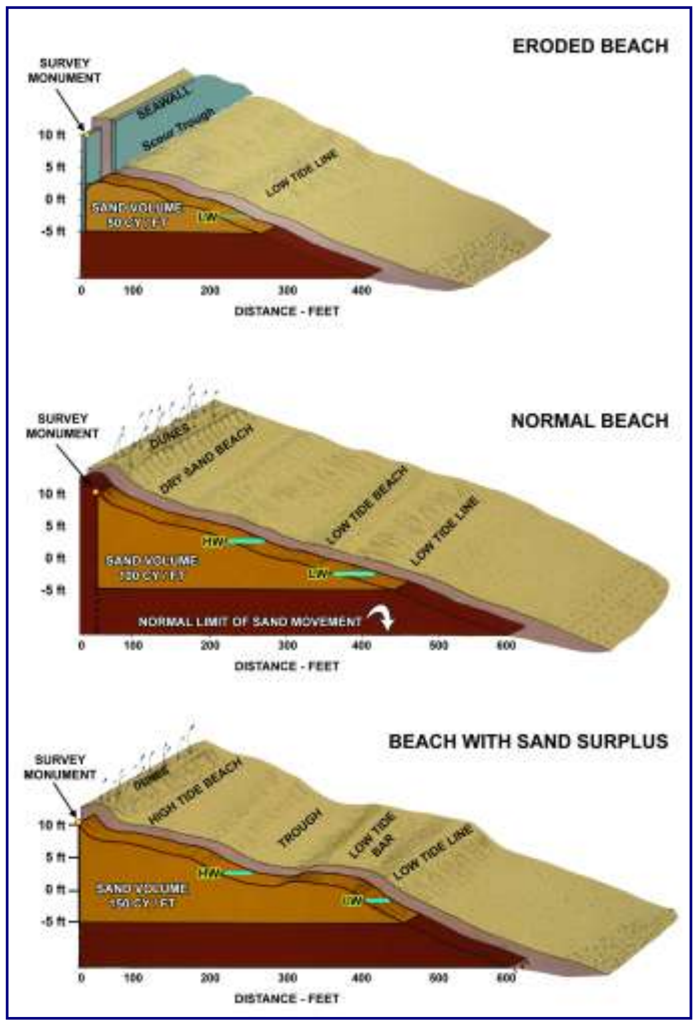


FIGURE 2.4. Calculation of unit-width profile volumes is a means of comparing the condition of one section of beach with another. Profile volumes are the amount of sand contained in a one-foot length of beach between specified elevations. [After Kana 1990]

Sand volumes for offshore areas were calculated from DTMs produced from MATLAB and AutoCAD® Civil 3D®. DTMs are digital 3D representations of the topography and bathymetry of an area and are useful for calculating changes in contour positions and calculating sediment volumes. Position data were entered into software as x-y-z coordinates and were processed to provide cross-section profiles and volumes. DTMs from the 2010 data collections were compared with earlier collections (pre- and post-project) to determine changes in shoal positions and volumes as well as infilling rates of the offshore borrow areas. Color contour maps were also produced from the DTMs.

Beach compaction measurements were performed in February 2010 in accordance with conditions of the permit. Triplicate measurements were made at depths of 6 inches, 12 inches, and 18 inches at the toe of the dune and middle of the berm every 500 ft in the project area. Several stations outside of the project area were sampled to provide a "native" compaction value. Results of the compaction measurements and subsequent communication with USFWS indicated that the project area **did** need to be tilled. Results of the compaction measurements and the accompanying letter were submitted to USFWS (Appendix B).

Sediment samples from the nourished beach were collected in July 2010. These samples were analyzed as outlined in the OMCP (CSE 2008a), using 0.25-phi intervals for grain-size analysis. Percent by weight of calcium carbonate was analyzed through dissolution with dilute HCl. At each sampling site, five samples (minimally) were collected—one each from the toe of dune, middle of berm, berm crest, mid beach face, and low-tide terrace. Sample transects were collected at 2,000-ft spacing throughout the project area, and additional samples were collected in adjacent unnourished areas for comparison. To provide island-wide sediment characteristics, four transects were included outside of the project area at ~1-mile intervals between Breach Inlet and 53rd Avenue.

Results of the borrow area survey, compaction measurements, and sediment density are given in Section 3.5.

3.0 RESULTS

3.1 Beach Condition in Monitoring Reaches

Results of the March and September 2010 data collections are presented in this section. Where applicable, profiles from these dates are compared to previous CSE profiles. Volume changes are discussed in detail beginning at the upcoast end of the island, along the Dewees Inlet shoreline, then progressing south toward Breach Inlet. Unit volumes for each station and reach are given in Figure 3.1, Table 3.1, and Table 3.2.

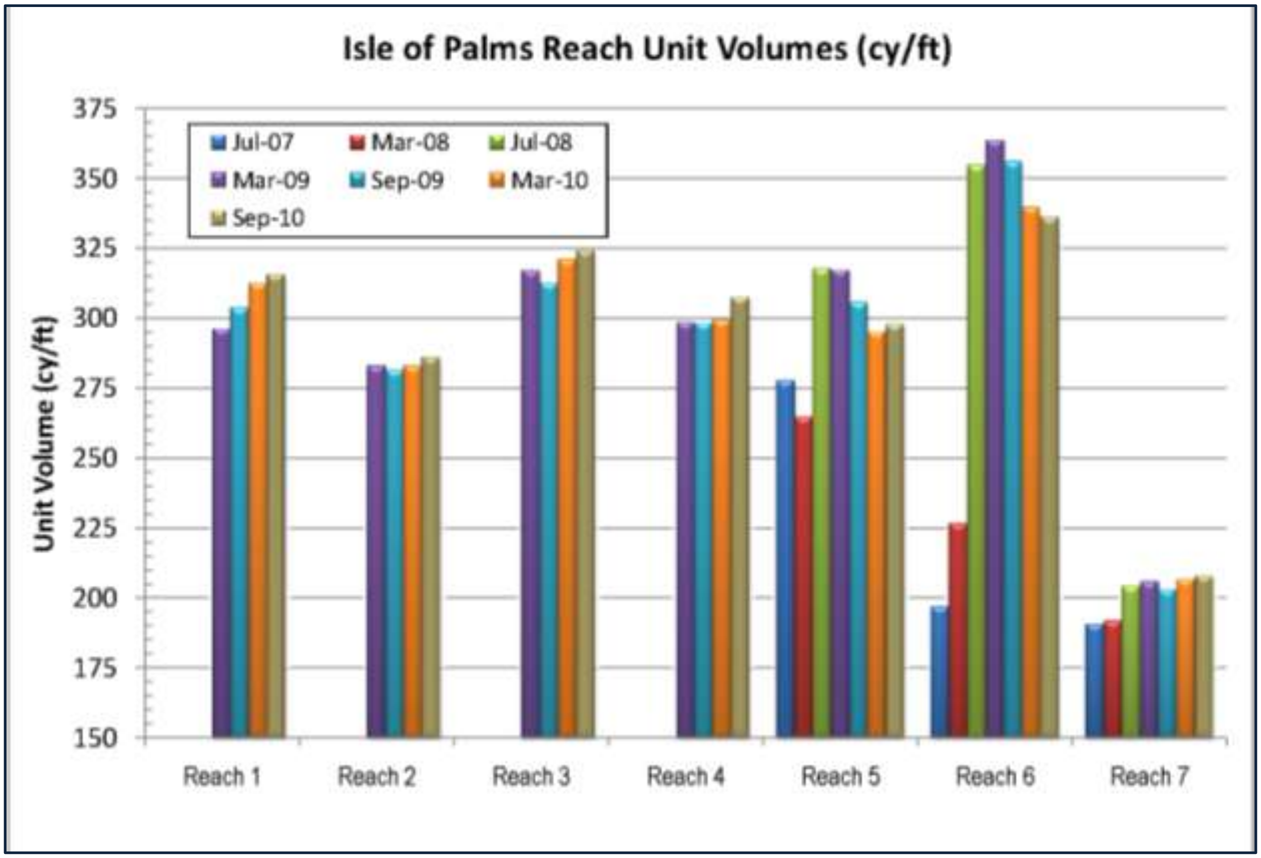


FIGURE 3.1. Average unit-width volumes for each monitoring reach at Isle of Palms. See Fig 2.3 for reach boundaries. Unit volumes were calculated from the primary dune to a profile-specific depth, generally between −9 ft and −13 ft NAVD for the beachfront. Nourishment occurred prior to the July 2008 data collection in Reaches 5, 6, and 7. Design-fill unit volumes for full sections were ~75 cy/ft in Reach 5, ~140-180 cy/ft in Reach 6, and ~27 cy/ft in Reach 7. See Fig 2.1 for beach nourishment locations.

TABLE 3.1. Profile unit-width volumes for each monitoring station at Isle of Palms. Nourishment occurred between stations 224 to 274 and stations 286 to 340 prior to the July 2008 data collection. Volumes are calculated between the approximate crest of the primary dune and the indicated "elevation lens" depth. Nourishment areas are highlighted in blue (project reach A), green, (project reach B), and yellow (project reach C). As additional surveys are completed, calculation limits may change to better encompass volume changes. This results in small differences in reported volumes between the present and earlier reports.

Reach	Line	Elevation Lens (ft NAVD)	Distance to Next (ft)	Unit Volume (cy/ft)					
				Mar-08	Jul-08	Mar-09	Sep-09	Mar-10	Sep-10
Reach 1	3100	-13	0			548.8	347.2	402.7	366.7
	3105	-11	0			406.3	523.4	519.6	530.1
	0	-10	400			351.5	272.5	374.1	331.0
	4	-10	400			275.8	244.5	281.8	279.4
	8	-10	400			271.8	289.1	273.6	277.5
	12	-10	400			387.8	424.3	403.7	422.3
	16	-10	400			350.0	389.4	367.0	382.6
	20	-10	270			271.7	317.3	316.4	317.4
	3110	-11	730			295.4	311.6	323.7	323.5
	30	-12	1000			275.9	276.9	293.2	300.9
	40	-12	390			261.2	261.3	268.3	272.4
Reach 2	3115	-12	610			294.4	288.1	299.6	293.0
	50	-12	1000			293.2	296.7	297.6	305.3
	60	-12	1000			265.6	269.5	274.4	274.7
	70	-12	1000			284.1	282.7	272.7	280.1
	80	-12	670			276.3	265.7	270.8	274.9
Reach 3	3125	-12	330			312.4	308.1	315.8	314.0
	90	-13	1000			300.9	292.5	306.4	302.0
	100	-13	1000			311.1	304.4	318.1	324.0
	110	-13	1000			307.2	306.8	319.1	316.5
	120	-13	500			330.4	323.6	325.6	336.6
	3135	-12	500			315.4	314.3	304.5	318.6
	130	-13	1000			298.9	294.1	302.6	300.9
	140	-13	290			371.1	367.3	377.4	383.5
Reach 4	3140	-12	710			296.0	292.4	297.5	305.4
	150	-13	1000			311.5	299.5	305.2	309.7
	160	-13	290			297.8	284.6	275.8	283.1
	3145	-12	710			268.2	263.7	243.2	249.2
	170	-13	1000			292.5	291.8	290.3	293.4
	180	-12	150			277.7	275.7	287.0	293.6
	3150	-12	850			289.6	295.3	303.2	314.1
	190	-12	1000			280.6	275.9	278.6	293.7
	200	-12	200			360.3	349.3	355.1	370.4
	202	-12	200		280.5	317.7	325.0	323.1	337.3
	204	-12	200		286.8	315.9	333.0	331.6	343.5
	206	-12	200		288.7	314.3	336.4	337.7	344.8
	208	-11	200		278.8	304.5	317.0	333.6	331.6
	210	-11	200		287.8	306.7	328.2	334.2	341.7
	212	-11	200		258.0	274.0	298.1	303.9	310.7
	214	-11	200		251.7	281.8	305.3	304.3	306.3
	216	-11	200		253.4	286.8	302.3	298.9	303.1
	218	-11	200		274.5	309.6	312.9	308.9	318.8
	220	-11	200		269.5	305.9	309.1	306.1	315.1
Reach 5	222	-10	200	252.0	261.0	292.6	295.7	295.6	305.9
	224	-10	200	221.5	233.5	269.0	273.0	269.1	271.3
	226	-10	200	217.6	225.3	274.0	286.8	276.0	276.8
	228	-10	200	222.6	252.1	292.2	299.8	275.3	288.4
	230	-10	200	233.0	284.4	306.3	307.4	298.8	304.6
	232	-10	200	241.6	284.5	303.9	304.6	301.4	299.6
	234	-10	200	245.9	320.5	335.1	327.9	321.9	319.7
	236	-10	200	214.2	295.1	317.1	300.6	301.7	297.7
	238	-10	200	204.8	294.6	318.1	299.6	303.7	297.9
	240	-10	200	184.4	277.6	307.6	285.8	288.9	283.3
	242	-10	200	182.6	273.6	304.3	283.8	283.5	282.3
	244	-10	200	189.8	283.1	313.0	297.7	289.6	290.0
	246	-10	200	181.8	271.0	286.4	271.4	263.5	264.5
	248	-10	200	188.7	272.2	280.5	267.2	255.5	258.1
	250	-10	200	188.5	282.2	278.3	261.2	253.7	254.2
	252	-10	200	197.9	291.9	275.9	265.5	253.3	253.2
Reach 5 (continued)	254	-10	200	197.5	298.1	270.3	267.1	247.5	242.3
	256	-10	200	212.3	313.2	276.2	273.8	248.0	240.7
	258	-10	200	201.7	297.6	256.8	252.6	219.5	214.6
	260	-10	200	229.1	305.9	270.5	256.9	215.3	216.8
	262	-10	200	283.5	346.2	340.9	297.5	283.5	276.0
	264	-10	200	289.4	349.3	340.9	300.6	270.5	267.1
	266	-10	200	303.7	374.3	328.9	303.3	242.1	264.1
	268	-10	200	292.7	338.1	272.0	266.2	236.3	250.1
	270	-10	200	365.0	394.5	314.9	312.5	291.7	309.0
	272	-10	200	363.2	377.0	326.0	307.7	287.1	308.2
	274	-10	200	341.5	344.6	300.7	289.8	297.7	307.6
	276	-10	200	461.8	459.1	427.9	399.1	439.8	433.3
	278	-10	400	463.2	415.2	384.9	371.7	450.2	436.7
Reach 6	280	-10	200	461.0	436.6	602.3	603.9	535.3	557.5
	282	-10	200	501.0	440.4	616.0	634.9	521.9	549.6
	284	-10	200	515.3	522.2	627.9	679.5	567.3	583.0
	286	-10	200	445.3	471.8	553.2	587.5	500.8	506.8
	288	-10	200	333.0	423.8	433.6	453.8	447.5	445.8
	290	-10	200	255.4	357.3	387.9	390.9	398.7	391.1
	292	-10	200	246.8	355.6	382.7	389.3	400.7	377.8
	294	-10	200	235.7	363.0	378.1	380.7	397.9	370.7
	296	-10	200	213.5	354.7	359.8	353.7	378.7	352.0
	298	-10	200	191.1	354.1	349.5	339.4	360.0	337.2
	300	-10	200	173.6	347.5	336.8	323.6	340.8	320.5
	302	-10	200	149.8	339.3	329.5	306.7	319.0	305.8
	304	-10	200	141.5	333.2	307.5	289.8	293.3	283.0
	306	-10	200	171.7	372.6	359.8	312.2	316.7	305.7
	308	-10	200	155.4	341.0	301.7	287.0	275.9	260.9
	310	-10	200	152.6	312.9	284.6	241.6	236.1	233.9
	312	-10	200	111.2	281.0	234.7	215.2	205.2	194.3
	314	-10	200	86.9	246.1	198.9	169.0	163.7	170.6
	316	-10	200	136.4	309.3	268.6	252.7	245.7	254.3
	318	-10	200	128.2	312.0	272.7	256.8	241.4	251.8
	320	-10	200	140.9	324.5	284.3	271.8	260.8	264.8
	322	-10	200	205.4	368.5	336.5	318.2	297.0	295.5
	324	-10	200	212.3	361.7	342.8	331.6	298.6	304.0
	326	-10	200	174.1	291.2	314.4	309.9	288.6	290.1
	328	-10	100	241.0	285.3	341.4	321.5	299.8	307.5
Reach 7	330	-18	200	228.2	262.4	281.7	297.0	329.3	348.6
	332	-18	200	286.9	333.6	340.5	344.8	367.4	384.7
	334	-18	200	252.6	295.8	324.2	328.5	338.6	347.3
	336	-18	200	232.8	284.0	281.2	291.3	298.3	300.7
	338	-18	200	214.7	261.2	247.8	240.3	240.1	245.2
	340	-18	200	204.6	244.6	223.2	216.1	209.4	212.5
	342	-18	200	227.6	246.4	239.2	232.7	226.1	226.1
	344	-18	200	201.1	209.5	208.3	205.0	196.9	196.4
	346	-18	200	198.4	198.1	201.8	197.7	190.0	189.3
	348	-15	200	150.9	147.2	150.7	149.0	141.8	136.2
	350	-15	200	170.1	169.7	170.7	167.5	167.2	165.5
	352	-15	200	159.8	160.4	155.2	153.3	155.4	157.3
	354	-15	200	170.1	171.1	168.1	165.0	167.0	171.8
	356	-15	200	186.5	185.6	183.1	177.9	183.7	185.1
	358	-15	200	175.3	171.9	173.1	163.8	173.4	174.5
	360	-15	200	177.2	172.0	174.4	164.2	179.7	175.7
	362	-15	200	173.3	167.4	173.1	164.5	172.4	174.9
	364	-15	200	146.2	141.2	137.5	139.7	136.3	145.2
	366	-13	200	137.4	131.6	146.1	138.9	135.0	131.2
	368	-13	200	168.9	174.2	183.7	178.5	187.0	177.0
	370	-13	0				176.0	202.5	178.8

TABLE 3.2. Isle of Palms reach volume analysis from March 2008 through September 2010. Nourishment occurred May-June 2008, prior to the July 2008 data collection. Volumes are calculated for each profile to a profile-specific depth, and then extrapolated to the next profile using the average-end-area method. The March 2008 data collection represents the prenourishment condition. As additional surveys are completed, calculation limits may change to better encompass volume changes. This results in small differences in reported volumes between the present and earlier reports.

			Total Volume (cy)						Average unit Volume (cy/ft)					
Reach	Limits	Length (ft)	Mar-08	Jul-08	Mar-09	Sep-09	Mar-10	Sep-10	Mar-08	Jul-08	Mar-09	Sep-09	Mar-10	Sep-10
Reach 1	0-3115	4,390	-	-	1,300,813	1,332,791	1,371,608	1,385,734	-	-	296.3	303.6	312.4	315.7
Reach 2	3115-3125	4,280	-	-	1,210,927	1,204,056	1,210,097	1,224,707	-	-	282.9	281.3	282.7	286.1
Reach 3	3125-3140	5,620	-	-	1,781,858	1,756,250	1,803,023	1,822,223	-	-	317.1	312.5	320.8	324.2
Reach 4	3140-222	7,910	-	-	2,360,592	2,358,731	2,367,650	2,432,166	-	-	298.4	298.2	299.3	307.5
Reach 5	222-280	6,000	1,587,593	1,905,827	1,902,750	1,833,722	1,770,696	1,787,429	264.6	317.6	317.1	305.6	295.1	297.9
Reach 6	280-328	4,900	1,109,721	1,737,374	1,780,813	1,743,807	1,664,741	1,647,127	226.5	354.6	363.4	355.9	339.7	336.1
Reach 7	330-370	4,000	766,568	816,758	822,893	810,992	826,350	832,090	191.6	204.2	205.7	202.7	206.6	208.0

			Net Change Since Previous						Unit Change Since Previous (cy/ft)					
Reach	Limits	Length (ft)	Mar-08	Jul-08	Mar-09	Sep-09	Mar-10	Sep-10	Mar-08	Jul-08	Mar-09	Sep-09	Mar-10	Sep-10
Reach 1	0-3115	4,390	-	-	-	31,978	38,817	14,126	-	-	-	7.3	8.8	3.2
Reach 2	3115-3125	4,280	-	-	-	-6,870	6,041	14,610	-	-	-	-1.6	1.4	3.4
Reach 3	3125-3140	5,620	-	-	-	-25,608	46,773	19,201	-	-	-	-4.6	8.3	3.4
Reach 4	3140-222	7,910	-	-	-	-1,861	8,919	64,516	-	-	-	-0.2	1.1	8.2
Reach 5	222-280	6,000	-78,699	318,233	-3,076	-69,028	-63,026	16,732	-13.1	53.0	-0.5	-11.5	-10.5	2.8
Reach 6	280-328	4,900	146,076	627,653	43,439	-37,006	-79,066	-17,614	29.8	128.1	8.9	-7.6	-16.1	-3.6
Reach 7	330-370	4,000	4,393	50,190	6,135	-11,901	15,358	5,740	1.1	12.5	1.5	-3.0	3.8	1.4

			Net Change Since Prenourishment (cy)						Unit Change Since Prenourishment (cy/ft)					
Reach	Limits	Length (ft)	Mar-08	Jul-08	Mar-09	Sep-09	Mar-10	Sep-10	Mar-08	Jul-08	Mar-09	Sep-09	Mar-10	Sep-10
Reach 1	0-3115	4,390	-	-	-	-	-	-	-	-	-	-	-	-
Reach 2	3115-3125	4,280	-	-	-	-	-	-	-	-	-	-	-	-
Reach 3	3125-3140	5,620	-	-	-	-	-	-	-	-	-	-	-	-
Reach 4	3140-222	7,910	-	-	-	-	-	-	-	-	-	-	-	-
Reach 5	222-280	6,000	-	318,233	315,157	246,129	183,103	199,835	-	53.0	52.5	41.0	30.5	33.3
Reach 6	280-328	4,900	-	627,653	671,092	634,086	555,020	537,406	-	128.1	137.0	129.4	113.3	109.7
Reach 7	330-370	4,000	-	50,190	56,325	44,424	59,782	65,521	-	12.5	14.1	11.1	14.9	16.4

Reach 7 (Dewees Inlet) Volume Changes

FIGURE 3.2.

[UPPER RIGHT]
Reach 7 in December 2007.

[LOWER RIGHT]
June 2008 near the end of the project.

[LOWER LEFT]
April 2010.

[Right images by TW Kana]
[Left image by S Traynum]

Dewees Inlet (Fig 3.2, previous page) generally receives less wave energy than the rest of the Isle of Palms due to the sheltering effects of the ebb-tidal delta associated with the inlet. Shorelines along stable inlets usually show less dynamic volume changes than ocean-facing beaches; however, over time, they can experience severe erosion due to several factors. One factor thought to contribute to localized erosion along the Dewees Inlet shoreline is wave focusing through breaks in the inlet delta (Kana and Dinnel 1980). Breaks between the outer shoals on the Dewees Island side of the channel allow larger waves or destabilizing diffracted waves to reach the IOP shoreline and cause localized erosion. A low profile groin was built in 1981 near the 17th tee of the Wild Dunes Links Course to trap sand moving into Dewees Inlet and slow erosion (Kana et al 1985). The monitoring reach (Fig 3.3) extends from the turn in the shoreline near the 18th tee to the end of Cedar Creek spit.

FIGURE 3.3. Station map of the Dewees Inlet area (Reach 7). Reach 7 spans from station 330+00 near the 18th tee to station 368+00 near Cedar Creek spit. The approximate limits of nourishment Reach C are identified by the yellow bar. The 1981 low profile groin is positioned near station 348+00. [March 2009 aerial image by Independent Mapping Consultants Inc]

Volume calculations from the 2010 monitoring efforts show that the nourished portion of Reach 7 (project Reach C) is gaining sand, while the rest of Reach 7 has eroded since March 2010 (Fig 3.4). Since September 2009, the southwest end of the reach from station 330+00 to 338+00 (from the ocean to the middle of the 17th fairway) shows the most accretion (Fig 3.5). Erosion was observed between stations 340+00 to 350+00 (mid 17th fairway to the groin), though most of the erosion occurred between September 2009 and March 2010. The rest of the reach, north of the groin, was generally accretional and again showed the most change between September 2009 and March 2010.

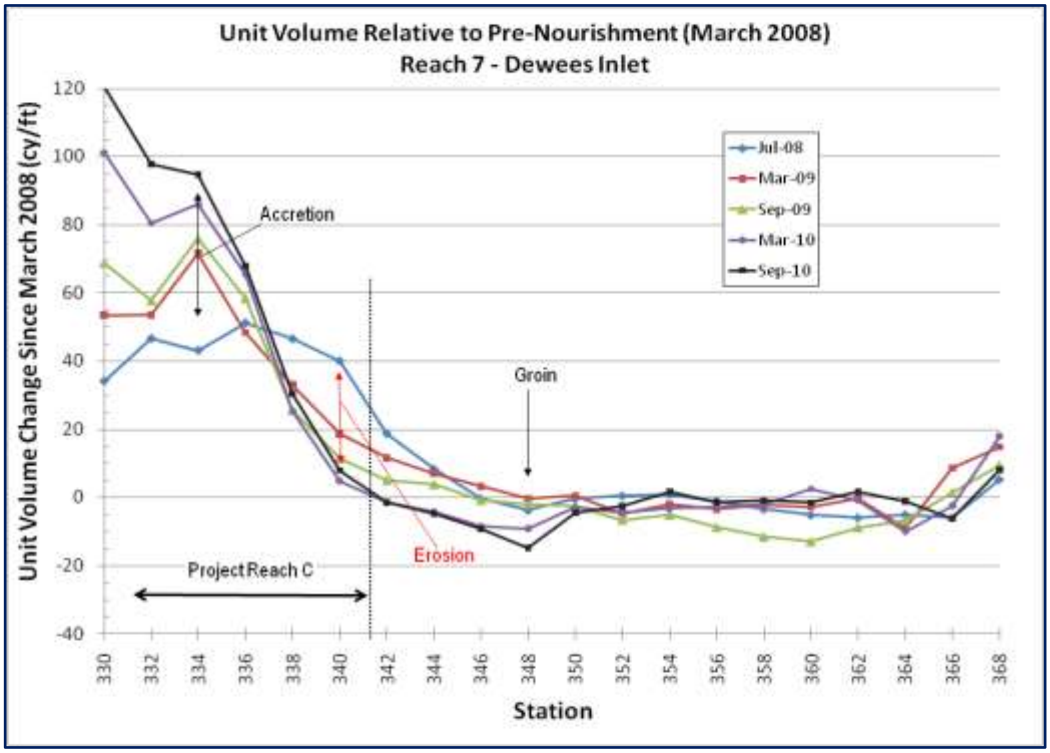


FIGURE 3.4. Unit volumes for stations in Dewees Inlet relative to the pre-nourishment condition of March 2008. Profiles in the southwestern portion of the reach (17th green – 18th tee) have accreted following the project, while the remaining stations have been stable or have eroded. Values greater than 0 cy/ft indicate the station retains more sand than the pre-nourishment condition, regardless of the trend from July 2008 to September 2009.

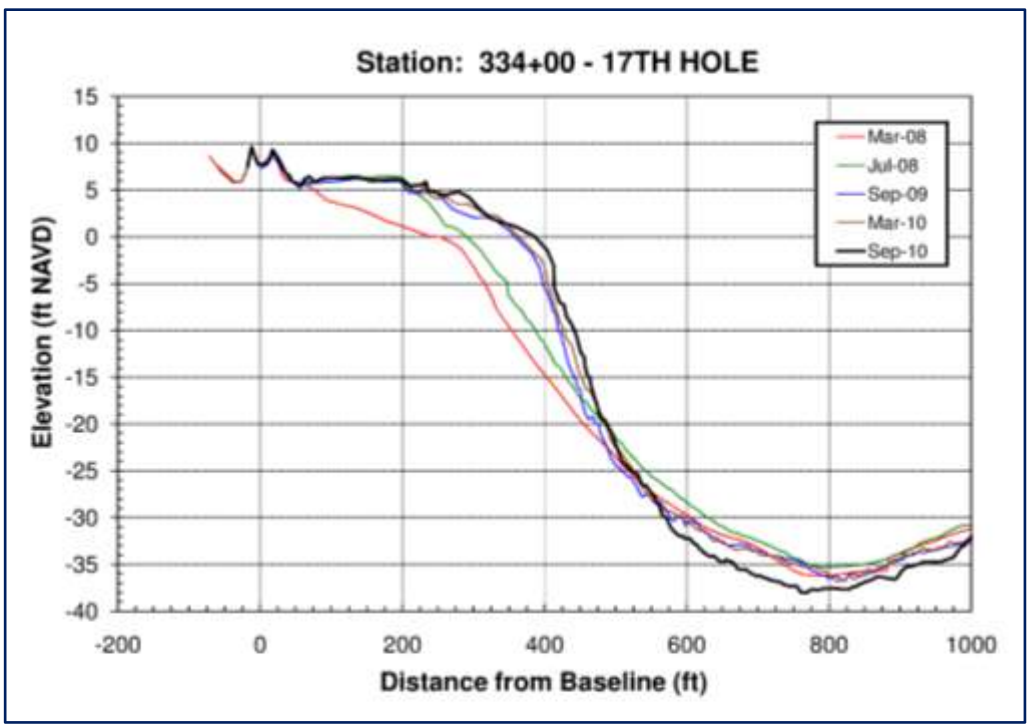


FIGURE 3.5. Profiles from station 334+00 (near the 17th green) in the Dewees Inlet project area. This profile currently contains 51.5 cy/ft more sand than immediately after the project. The new sand migrated from the oceanfront in the opposite direction to the normal play of golfers along the 18th fairway.

Reach 7 gained a total of ~15,400 cy between September 2009 and March 2010, and another ~5,700 cy between March and September 2010. This translates into an average annual gain of 5.3 cy/ft/yr over the past year. The reach currently contains ~65,500 cy more sand that was present in March 2008 (Fig 3.6). Stations 330+00 through 340+00 have gained ~71,700 cy over that time, while stations 342+00 through 370+00 have lost 6,200 cy. [Note: These results are based on profile volumes between the foredune and −13 ft to −18 ft NAVD. They do not include changes along the Dewees Inlet channel margin between −18 ft and −38 ft, the approximate inlet depth along the reach.]

FIGURE 3.6. View looking northwest in Reach 7 in the vicinity of the 17th green of the Wild Dunes Links Course in October 2007 (upper) and March 2010 (lower).

Reach 6 – Property Owners Beach House to Dewees Inlet

FIGURE 3.7. Reach 6 in December 2007 (upper left), June 2008 near the end of the project (upper right), and September 2009 (lower left) and April 2010 (lower right). [Upper images by TW Kana; lower left image by C Jones; lower right image by S Traynum]

Reach 6 (Fig 3.7, previous page) extends from the Wild Dunes Property Owners Beach House northeast ~4,900 ft to the 18th fairway, where the beach turns into Dewees Inlet (stations 280+00 to 328+00, Fig 3.8). This area has been highly impacted by shoal-bypassing events since the island's formation. Depending on the location and timing of bypass events, the shoreline can change hundreds of feet over a period of several months (Kana et al 1985, Gaudiano 1998). As was the case in 2007-2008, the shoreline may encroach on development in this reach when shoal-bypass events are prolonged. Previous studies have suggested that the background, long-term erosion for the northeastern end of IOP is between 15,000 cy/yr and 30,000 cy/yr, even though the estimated average volume of sand added by each shoal-bypass event is ~500,000 cy (CSE 2007a). This means that, while large fluctuations in the shoreline and severe local erosion may occur, the long-term erosion rate for the area is relatively low. Sand simply migrates from one area of the beach to another and is either transported back to Dewees Inlet or downcoast to IOP, eventually being replaced by offshore sand through another shoal-bypassing event.

FIGURE 3.8. Reach 6 spans from the Wild Dunes Property Owners Beach House (station 280+00) to the 18th fairway of the Wild Dunes Links Course (station 328+00). The approximate limits of nourishment Reach B are identified by the yellow bar. March 2009 aerial image by Independent Mapping Consultants Inc.

Prior to nourishment in June 2008, most of Reach 6 was severely eroded with profile volumes seaward of development well below an ideal condition. Property owners had sandbags piled against buildings for protection, and little or no dry beach was present (see Fig 1.3). The condition was beginning to improve just before the nourishment as the shoal attaching at the western end of the reach was in Stage 3 of the bypass cycle. Sand was moving from the shoal toward Dewees Inlet, but not quickly enough to restore the beach along most properties north of the Wild Dunes Property Owners Beach House.

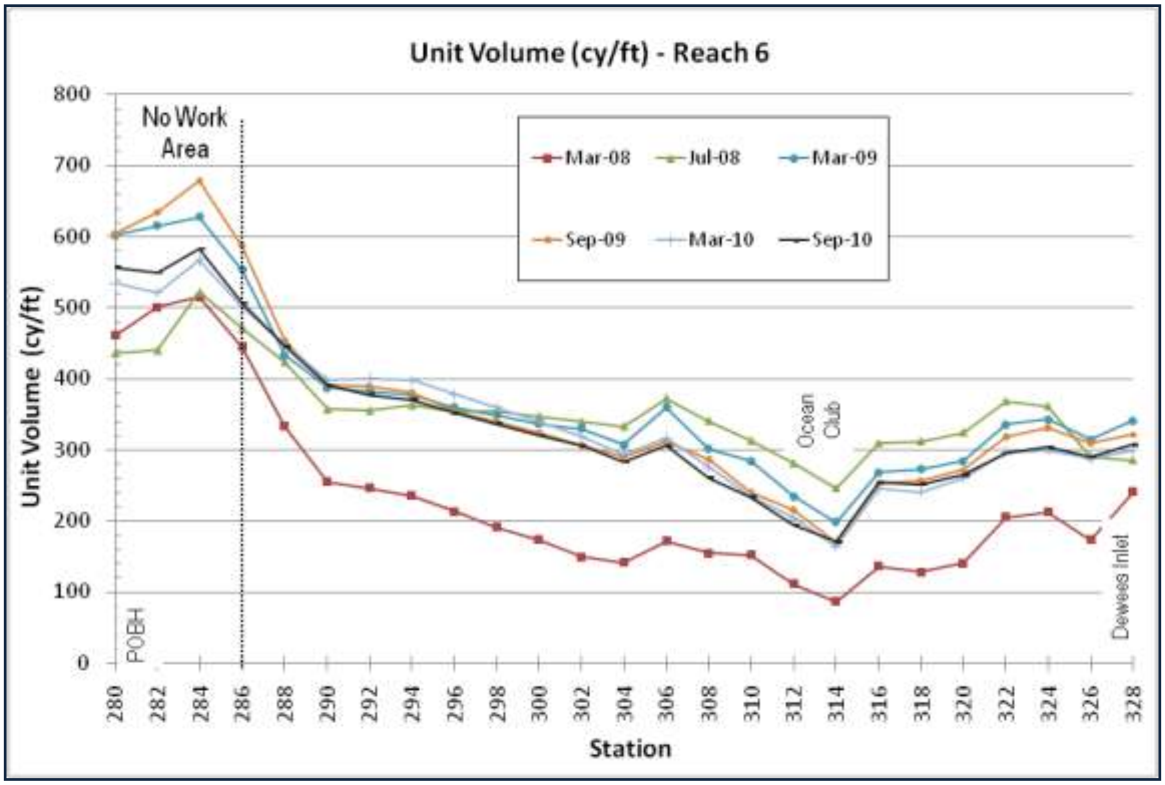
Additional sand was needed to supplement the natural sand transport condition. Between March and July 2008, ~628,000 cy of sand were added to the reach through nourishment and natural spreading of sand from the shoal (the design volume for this reach was 550,000 cy). Average profile unit volumes increased from 226 cy/ft to 355 cy/ft (calculated to −10 ft NAVD).

Since July 2008, the reach has shown accretion in the western portion and erosion in the central and eastern portions (Fig 3.9). Accretion in the western area of the reach is a result of the emergence and attachment of two shoals off the Wild Dunes Property Owners Beach House. The first shoal formed shortly after completion of the project, originating on the same "swash platform" which produced the "2006" shoal. Wave action moved sand from the seaward end of the shoal toward the beach, where it built on itself to produce a visible sandbar in the vicinity of the Wild Dunes Property Owners Beach House. The second shoal formed by April 2010 (cf – Fig 3.7), and attached around September 2010. The new shoal attached a few hundred feet to the north of the previous shoal. These changes are reflected in the profiles of Figure 3.10.

The unnourished portion of Reach 6 (between the Wild Dunes Property Owners Beach House and Mariners Walk) lost ~60,500 cy between September 2009 and March 2010, though was accretional between March and September 2010, gaining 11,500 cy. This area contains the most volume of sand per foot along Isle of Palms at over 550 cy/ft, measured to −10 ft NAVD.

Between September 2009 and March 2010, the area between Mariners Walk and Port O Call showed accretion, averaging 11.3 cy/ft. The remainder of the reach (between Port O Call and the 18th fairway eroded an average of 14.8 cy/ft. Between March 2010 and September 2010, the reach was relatively stable, with minor erosion from stations 288+00 through 306+00 (Beach Club Villas to Port O Call) averaging 5.0 cy/ft, and stability or minor accretion from Seascape to the north end of the reach. Overall, the reach lost ~79,000 cy (16.1 cy/ft) between September 2009 and March 2010, and ~17,600 cy (3.6 cy/ft) between March and September 2010.

Overall, Reach 6 contains ~537,400 cy (110.0 cy/ft) more sand than the pre-nourishment (March 2008) condition, and ~90,000 cy (18.4 cy/ft) less sand than the post-nourishment (July 2008) condition (Fig 3.11).



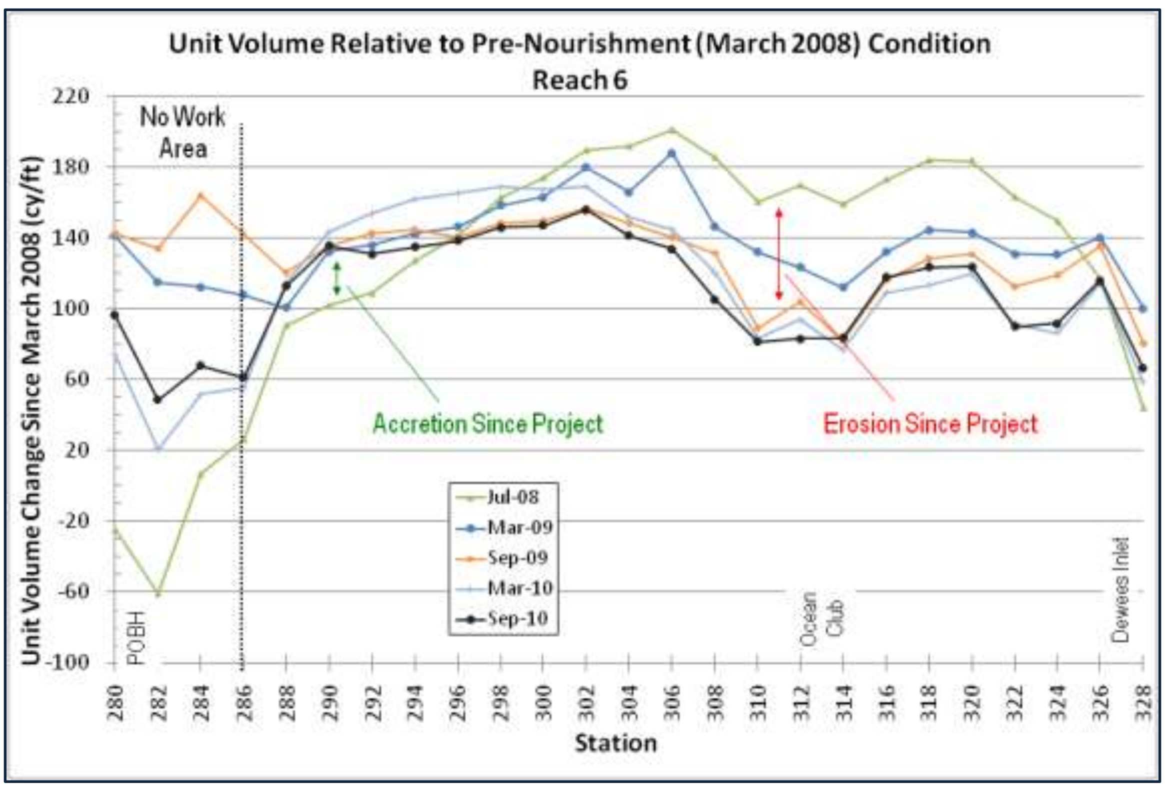
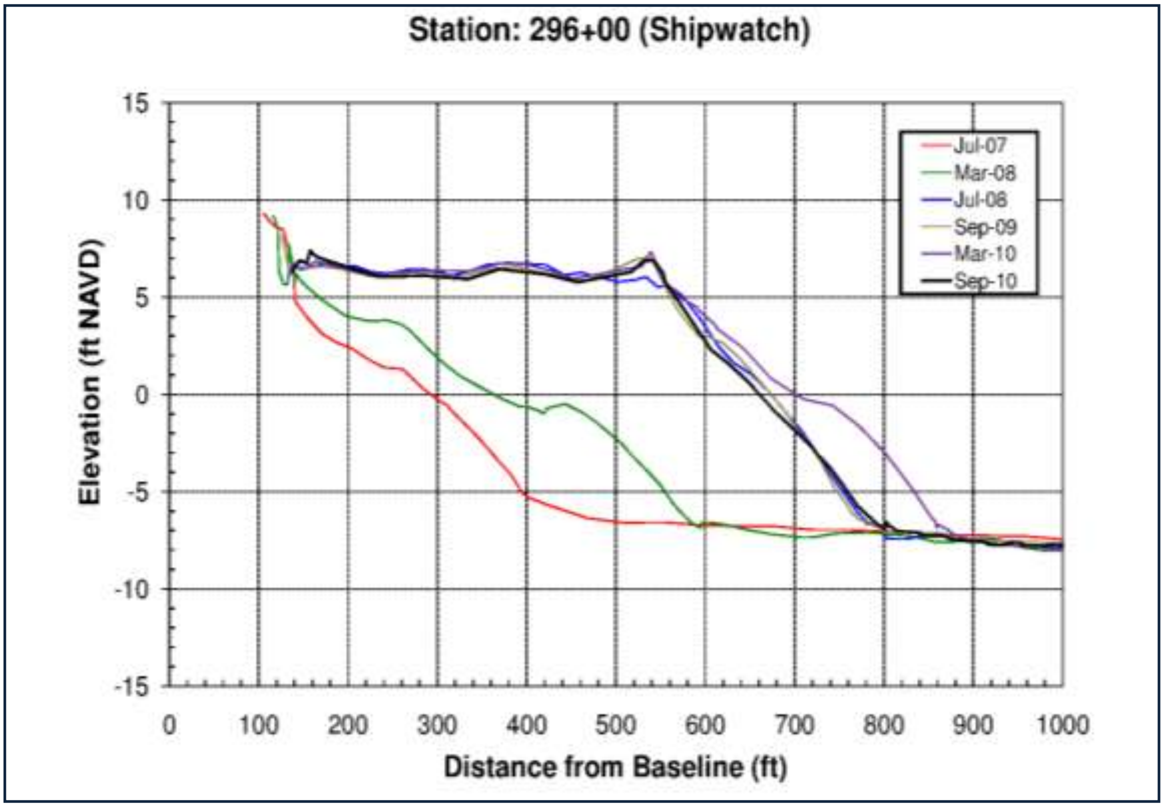


FIGURE 3.9. Profile unit-width volumes for stations in the Reach 6 (upper), and unit volumes compared to the pre-nourishment condition (lower). Erosion has dominated the northeastern portion of the reach, while accretion has occurred in the southwestern portion of the reach. The beach was much more stable from 2009 to 2010.



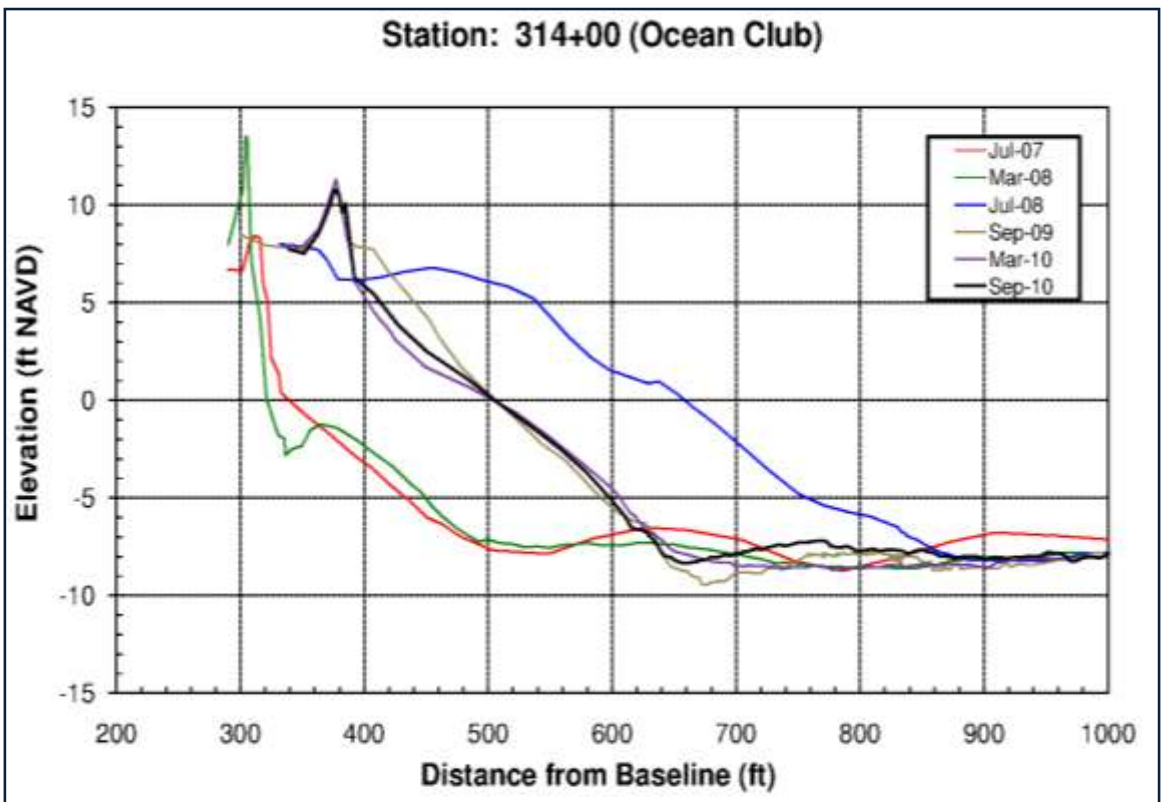


FIGURE 3.10. Profiles from stations in Reach 6. Station 296+00 has remained stable since July 2008, while station 314+00 has experienced significant erosion. Erosion at 314+00 (near the Ocean Club complex) slowed between September 2009 and March 2010, and the beach stabilized through September 2010.

FIGURE 3.11.

[UPPER] View south in December 2007 near Summer Dunes Lane prior to the project.

[MIDDLE LEFT] View north in December 2007 near Summer Dunes Lane prior to the project

[MIDDLE RIGHT] View north of the same area in June 2008 immediately following the project.

[LOWER] The same area in September 2010 looking south (left image) and west (right image).

[Photos by S. Traynum and Weeks Marine]

Reach 5 – 53rd Avenue to Property Owners Beach House

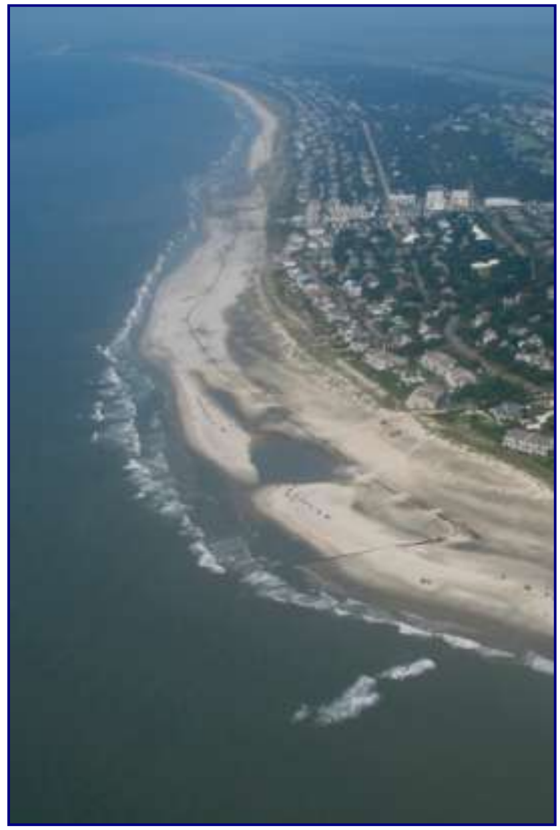


FIGURE 3.12.

[UPPER LEFT]
Reach 5 in December 2007.

[UPPER RIGHT]
June 2008 (during final completion of the project – note dredge pipeline on the beach).

[LOWER] April 2010

Upper images by TW Kana.
Lower image by S Traynum.

Reach 5 (Fig 3.12, previous page) spans ~6,000 ft between 53rd Avenue and the Wild Dunes Property Owners Beach House (Fig 3.13, stations 222+00 thru 280+00) and encompasses project Reach A. Like Reach 6, this area is greatly influenced by shoal-bypass events, especially at the northern end of the reach where the majority of shoals attach to the beach. Prior to the 2008 nourishment, an erosional arc had formed in the area of the Wild Dunes Grand Pavilion (Fig 3.14, station ~248+00). Erosional arcs are typical in areas adjacent to shoal attachment sites because of wave refraction and sediment transport reversals, which drive sand from these areas into the lee of the shoal during Stages 1 and 2 of the shoal-bypass cycle. Immediately prior to nourishment, the “2006” shoal had completely attached (Stage 3) at the northern end of the reach, and sand was beginning to spread into the eroded areas.

FIGURE 3.13. Reach 5 spans from 53rd Avenue (station 222+00) to the Wild Dunes POBH (station 280+00). The approximate limits of nourishment Reach A are identified by the green bar. [March 2009 aerial image by Independent Mapping Consultants Inc]

Reach 5 gained ~318,000 cy of sand between March and July 2008, which includes nourishment and natural accretion from the shoal attachment (cf – Table 3.2). The design volume was 270,000 cy, and CSE estimates ~340,000 cy of sand were added to the project area between March and July 2008. [Note the project reach limits differ from the monitoring reach, producing the difference in accretion numbers.] Design fill unit volumes were ~75 cy/ft throughout area A, decreasing in the taper sections. Dry beach width increased up to ~225 ft in this reach.

The northern portion of Reach 5 was highly erosional prior to the nourishment project, losing up to 45 cy/ft between July 2007 and March 2008. The rest of the reach was more stable, gaining sand at most stations. Erosion prior to the project was due to spreading of the “2006” shoal, which was attached to the beach in 2007 at the northern end of the reach. The bulge of sand created an unnatural shape in the shoreline until wave action worked this area into a straighter shoreline between 2007 and 2008.

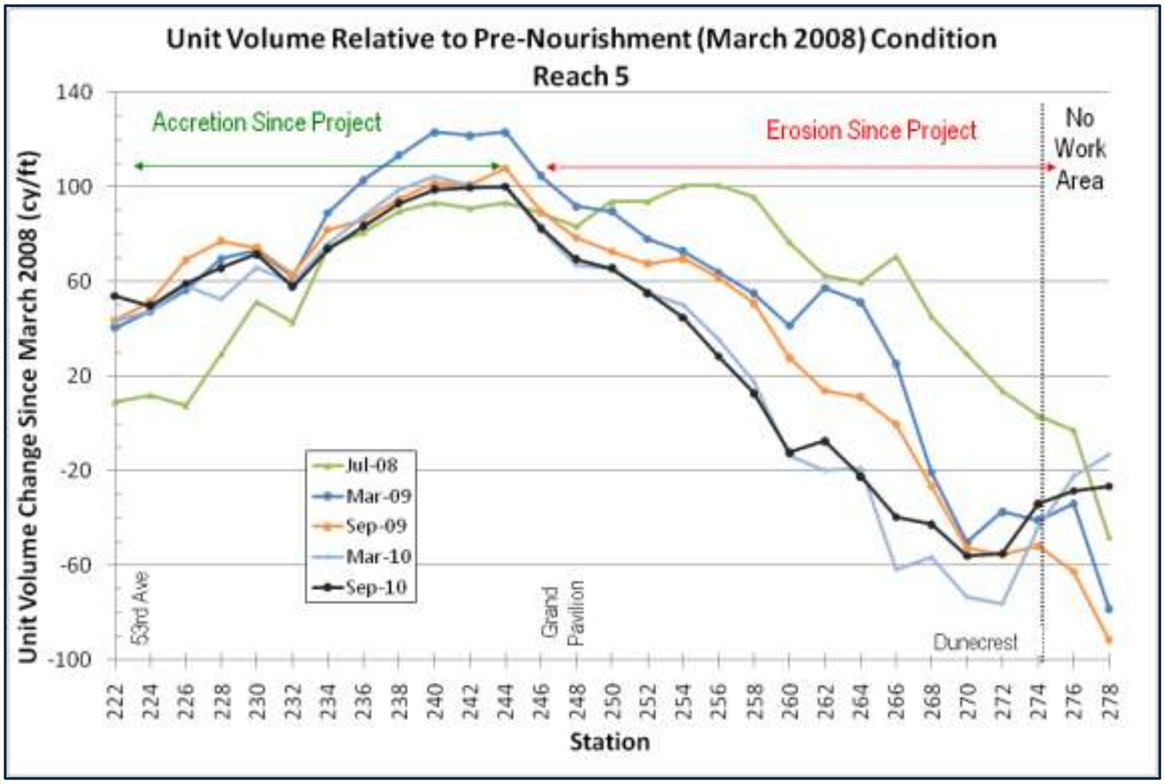
FIGURE 3.14. Reach 5 and Reach 6 in September 2007 (upper), March 2009 (middle) and April 2010 (lower). Note the erosional arc in the 2007 image adjacent to the Wild Dunes Grand Pavilion (left center of image). The "2008" shoal is visible in the middle image, and the "2010" shoal in the lower image.

Since project completion in June 2008, emergence of new shoals off the Wild Dunes Property Owners Beach House has caused the northern two-thirds of the reach to erode rapidly as sand from this area was deposited in the area directly behind the attaching shoal (in Reach 6). Erosion peaked by March 2010, with portions of the reach showing total losses of ~76 cy/ft relative to the March 2008 condition (Fig 3.15). Between March and September 2010, stations near Dunecrest Lane gained ~14-22 cy/ft. While these stations have shown significant erosion since 2008, they still retain similar overall unit volumes relative to the southern parts of the reach. Figure 3.15 (lower) shows total unit volumes for the reach, and the graph shows that the northern end of the reach contained a larger volume of sand in 2008 than did the southern end (due to the 2006 shoal). Additional shoal-bypass events in 2009 and 2010 have again added sand to the northernmost part of the reach, increasing total unit volumes and contributing to the accretion observed between March and September 2010.

Stations to the south of the Grand Pavilion (station 246+00) generally showed less erosion since September 2009, with stations between 55th and 57th Avenues losing an average of 3.5 cy/ft over the past year (Fig 3.16). Stations between 54th and 55th Avenues showed greater erosion, losing between 10.0 and 22.1 cy/ft. Since completion of the project (July 2008), the area between 53rd Avenue and the Grand Pavilion has averaged 15.1 cy/ft accretion, while the remaining portion of the reach has averaged 65.9 cy/ft erosion. Stations 260+00 through 274+00 (Beachwood East) currently retain less sand than the pre-nourishment condition (ie – all nourishment sand has been eroded from this area). Despite the erosion, it is important to note that the fill quantity in this area was generally small because it was essentially healthy prior to the project.

Despite recent erosion along the northern half of Reach 5, a dry beach area and growing dunes still exist because of the influx of sand associated with attaching shoals (Fig 3.17). At least 300 ft of beach/dunes exist between the high tide line and structures in the reach. The “2008” shoal was completely attached by September 2009, and sand had begun to spread from the shoal as evidenced by the reduced erosion rates. Another shoal forming and attaching in 2010 (“2010” shoal) at the south end of Reach 6 has accounted for accretion at the north end of Reach 5.

Overall, Reach 5 lost ~118,400 cy (19.7 cy/ft) of sand since July 2008 which includes a gain of 16,700 cy (2.8 cy/ft) between March and September 2010. Total erosion from September 2009 to September 2010 was ~46,300 cy (7.7 cy/ft). As noted previously, most of the erosion is accounted for in the northern half of the reach.



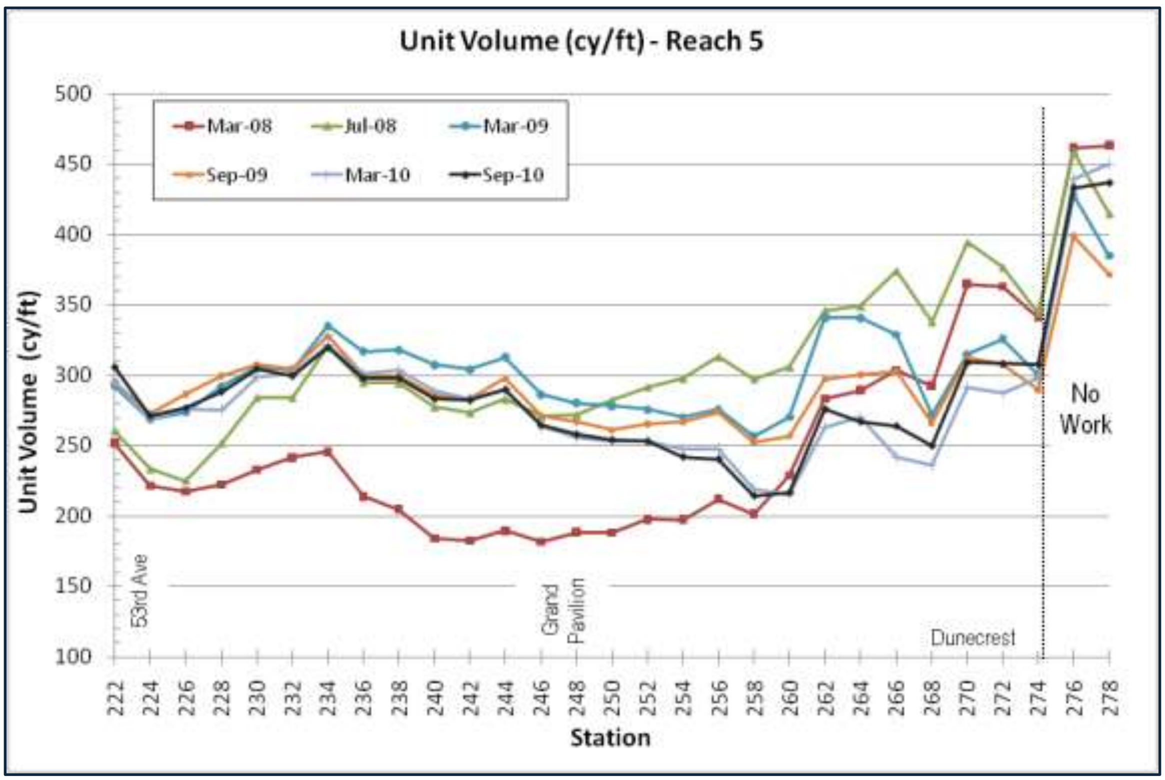
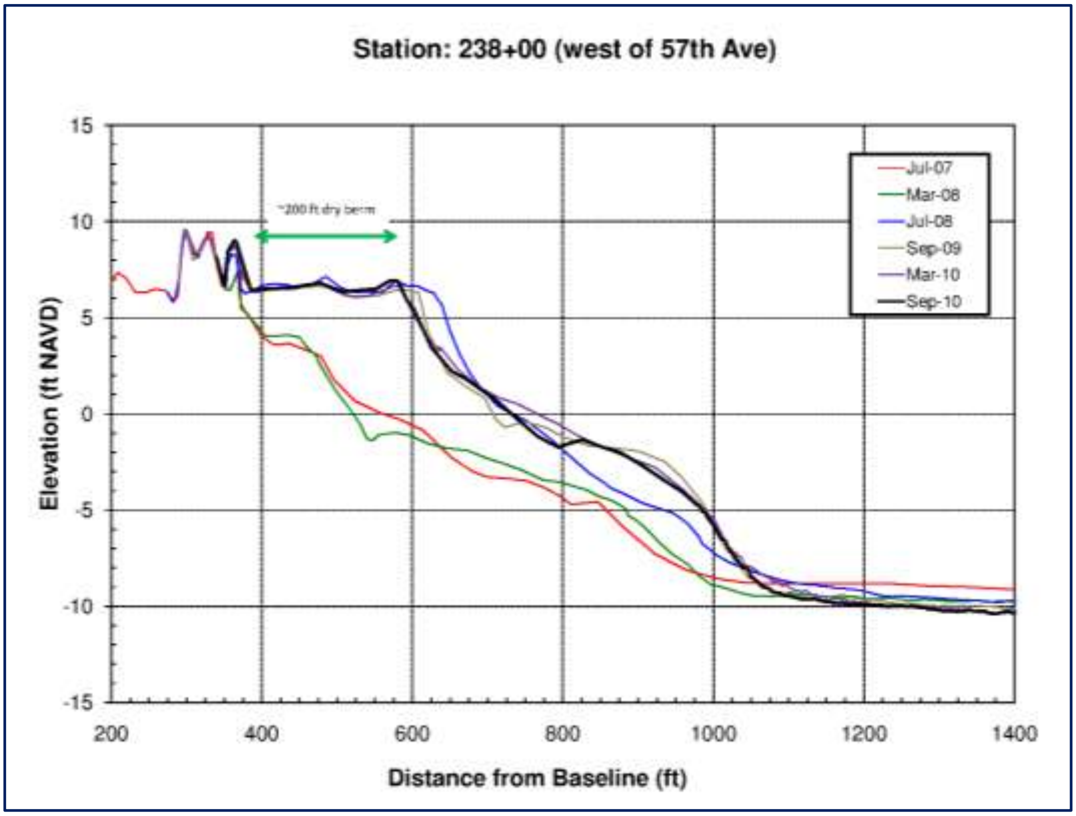


FIGURE 3.15. Profile unit-width volumes in Reach 5 (upper), and unit volume compared to the pre-nourishment condition of March 2008 (lower). Erosion in the northern part of the reach (stations 250-278) is associated with erosion of excess sand resulting from shoal attachment events in 2006, 2009, and 2010.



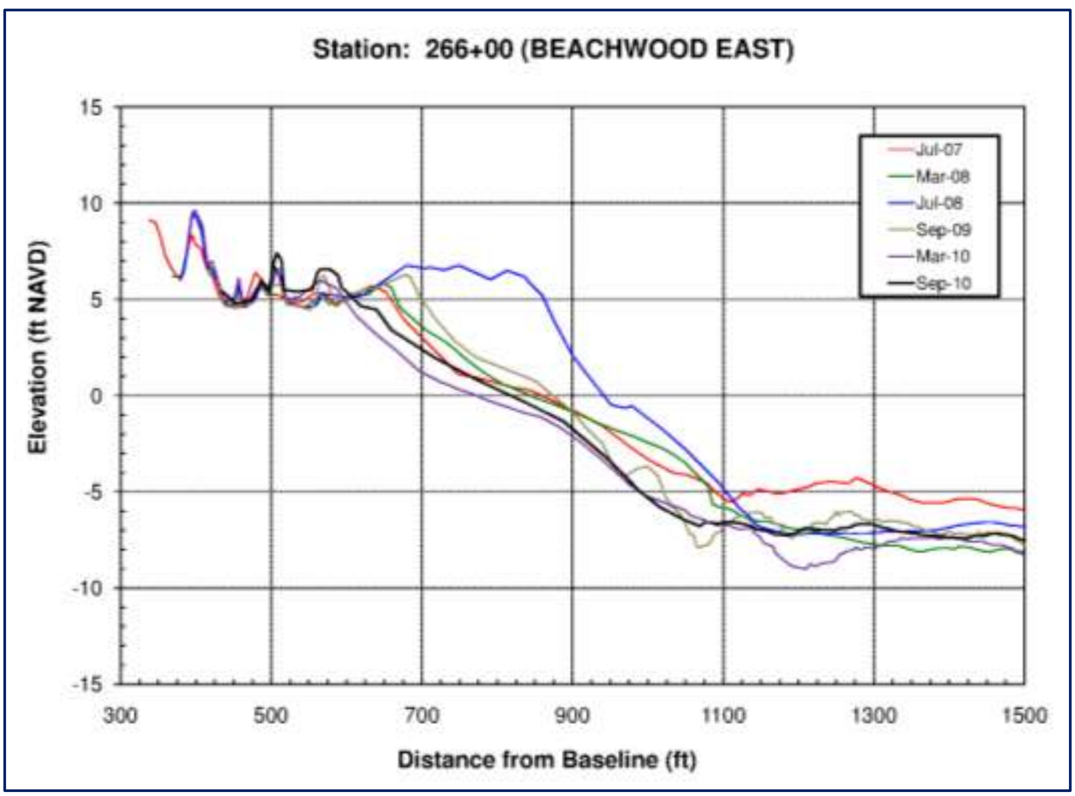


FIGURE 3.16. Profiles from station 238+00 (upper) and 266+00 (lower) in Reach 5. Station 238 has remained fairly stable while the Beachwood East area eroded rapidly between July 2008 and March 2010, then gained sand between March 2010 and September 2010. Despite the erosion, a wide dune field still offers protection for structures in this area.

FIGURE 3.17. View northeast from station 254+00 (adjacent to Seagrove Villas) prior to the project in October 2007 (upper) and views northeast (middle left) and southwest (middle right) in September 2009. View from station 248+00 (lower) looking landward in September 2010. An erosional arc associated with the 2006 shoal-bypass event had formed in this area prior to the project (see Fig 3.15). The dark-colored band of sediments in the upper photo are "heavy minerals" such as ilmenite which concentrate at the base of dunes along eroding shorelines. Light-colored sands are typically quartz and feldspar in this setting.

IOP Reaches 2–4 (6th Avenue to 53rd Avenue)

Reaches 2–4 represent the central portion of the island and have historically been stable to accretional over the past century. The reaches are considered to be outside of the direct influence of Dewees and Breach Inlets and are classified as "S" for standard erosion zones by SCDHEC-OCRM. Erosion/accretion signatures along "S" zones tend to be predictable over the long term. Short-term changes in sand volume are generally smaller in magnitude than in areas close to inlets (SCSGC 2001).

Together, Reaches 2–4 represent 17,810 ft of shoreline between 6th and 53rd Avenues (Fig 3.18). CSE established profile stations at 1,000-ft spacing as well as reoccupied monuments established by SCDHEC-OCRM, which have been surveyed generally every year since the early 1990s. CSE profiles were obtained in March and September of 2009 and 2010 as part of the present monitoring agreement between the City and CSE.

From March 2009 to September 2009, the three reaches lost ~34,000 cy of sand over the ~18,000 ft of shoreline represented. This translates to a unit volume change of 1.93 cy/ft (erosion), which is opposite the historical trend (SCSGC 2001). Between September 2009 and March 2010, these areas accreted ~61,700 cy (3.5 cy/ft); and between March and September 2010, Reaches 2–4 gained 98,300 cy (5.5 cy/ft). Total change (accretion) in Reaches 2–4 from September 2009 to September 2010 was ~160,000 cy (9.0 cy/ft). Unit volume changes from March 2009 to September 2010 are shown in Figure 3.19 for each profile. Detailed volume changes for each of the three reaches follows.

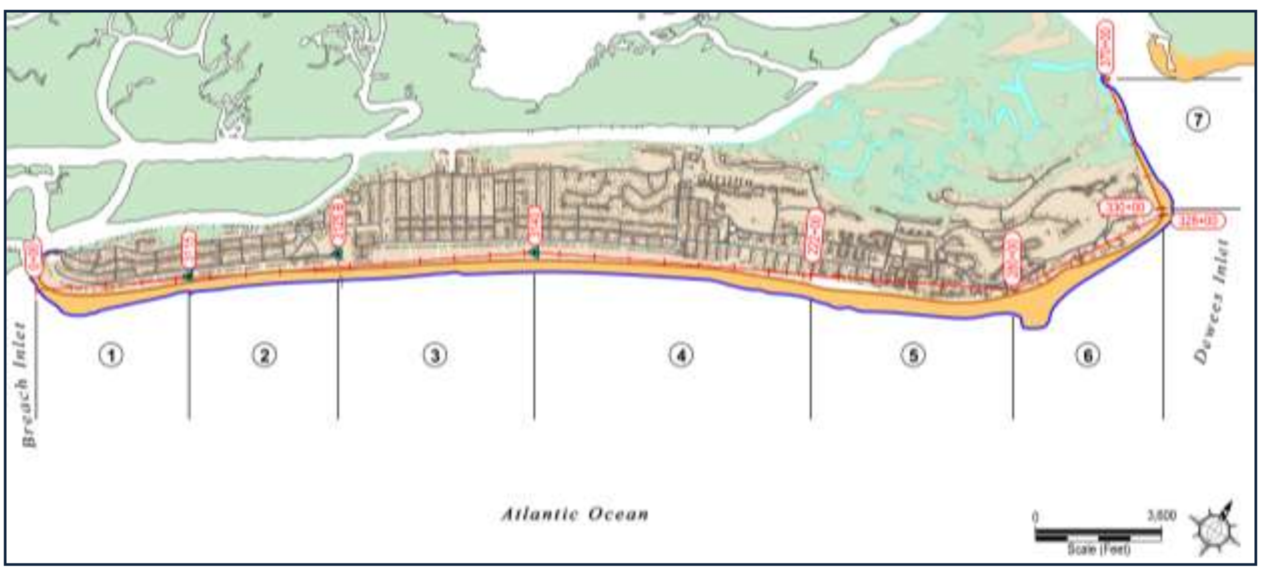


FIGURE 3.19. Monitoring reach boundaries.

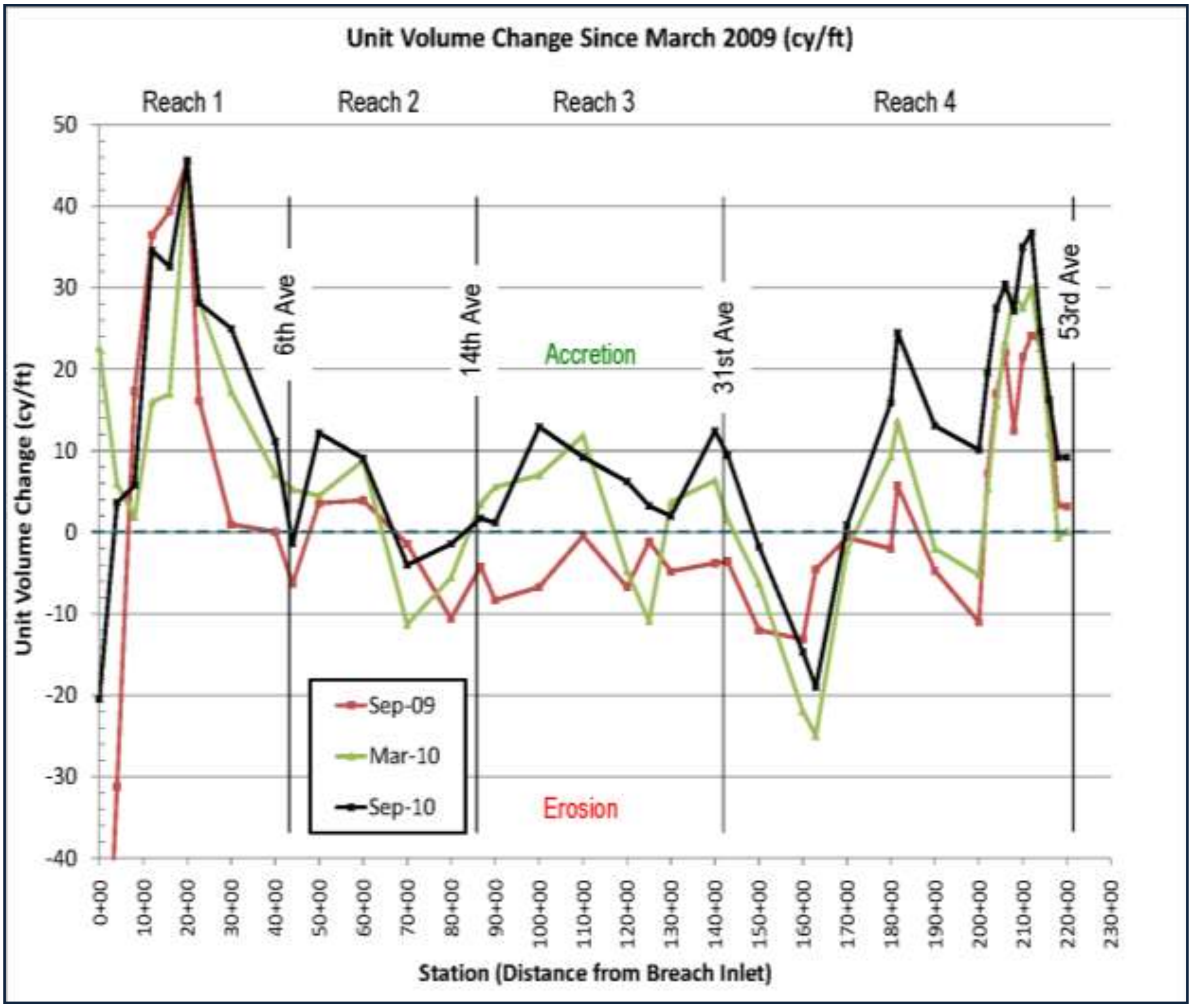


FIGURE 3.19. Profile unit-width volume change (cy/ft) between March 2009 and later dates for Reaches 1-4. CSE established and surveyed profiles spaced 1,000 ft apart in the Isle of Palms reaches and reoccupied monuments surveyed annually by SCDHEC-OCRM. Historically, these reaches have been accretional; however, between March and September 2009, most stations outside of the influence of the inlet or project were erosional. Since September 2009, most stations have shown accretion and are currently healthier than the March 2009 condition (ie – where the black line is greater than zero). Change is relative to the March 2009 condition.

Reach 4 – 31st Avenue to 53rd Avenue

Reach 4 spans 7,910 ft between 31st Avenue and 53rd Avenue (stations OCRM 3140 to CSE 222+00, Fig 3.20). It is immediately downdrift of the 2008 nourishment project and, therefore, should benefit from losses of nourishment sand from the project area. The reach lost ~1,800 cy (0.2 cy/ft) between March and September 2009, but has gained sand since then. Between September 2009 and September 2010, net erosion was observed at stations 160+00 and OCRM 3145 (1.6 cy/ft and 14.5 cy/ft loss, respectively) (Fig 3.21). Accretion was observed at all other stations (since September 2009), averaging 10.9 cy/ft. Highest accretion rates were observed between stations 180+00 and 204+00 (40th Avenue and the Citadel beach house), averaging 16.4 cy/ft. Overall the reach gained 8,900 cy (1.1 cy/ft) between September 2009 and March 2010, and 64,500 cy (8.2 cy/ft) between March and September 2010 for a total change over the past year of +73,400 cy (9.3 cy/ft).

Historical accretion along this reach (combined with sufficient setbacks for development) has led to a substantial dune system between most structures and the beach. As long as there is slow steady accretion, the foredune will continue to build wider and higher, offering more storm protecttion to property behind the dunes (Fig 3.22).

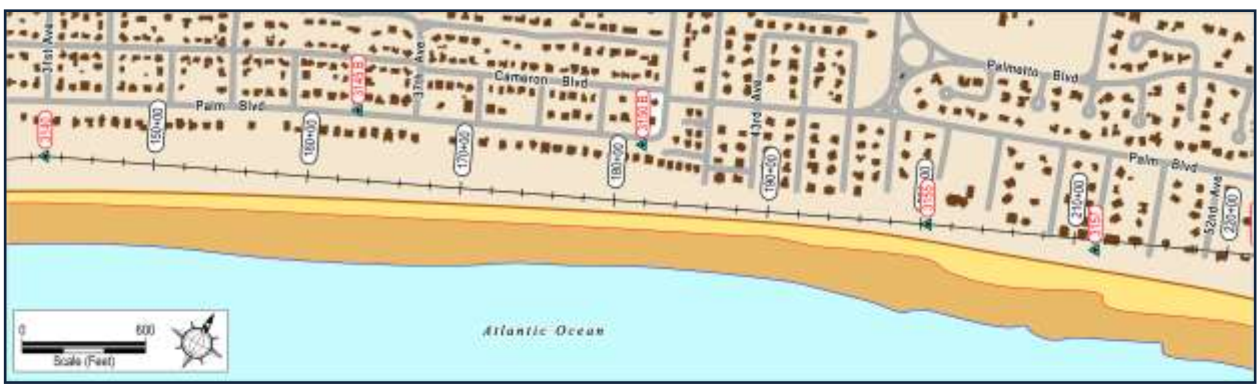
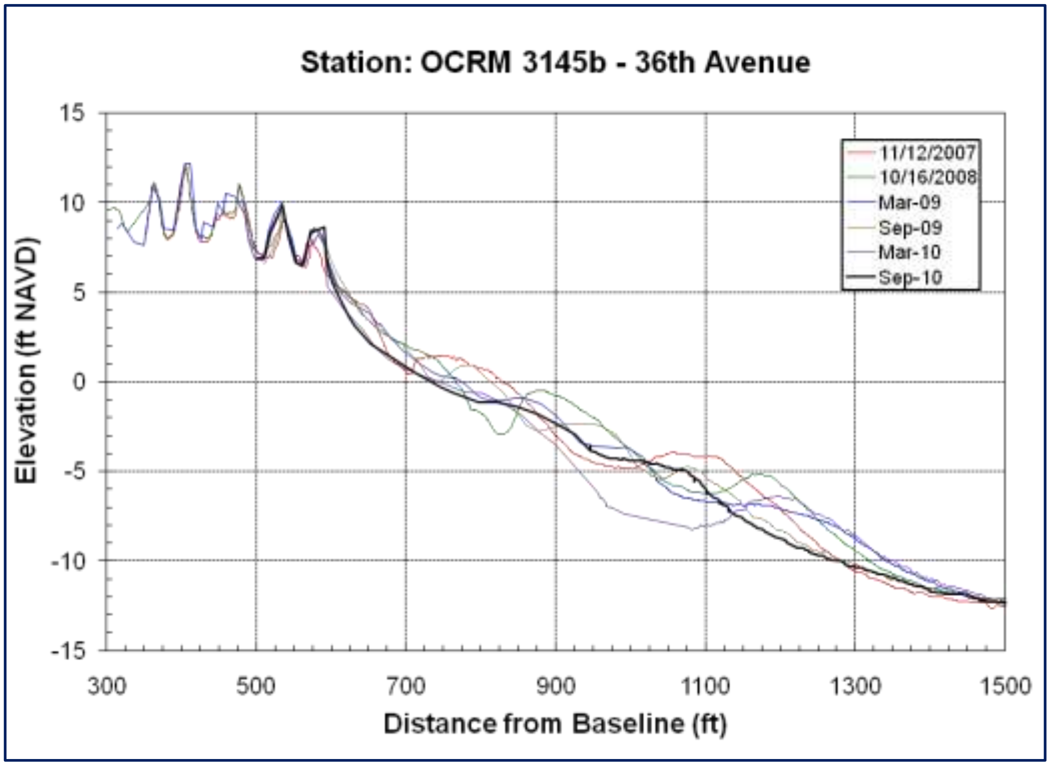


FIGURE 3.21. Reach 4 spans from stations OCRM 3140 (31st Avenue) to CSE 222+00 (53rd Avenue).



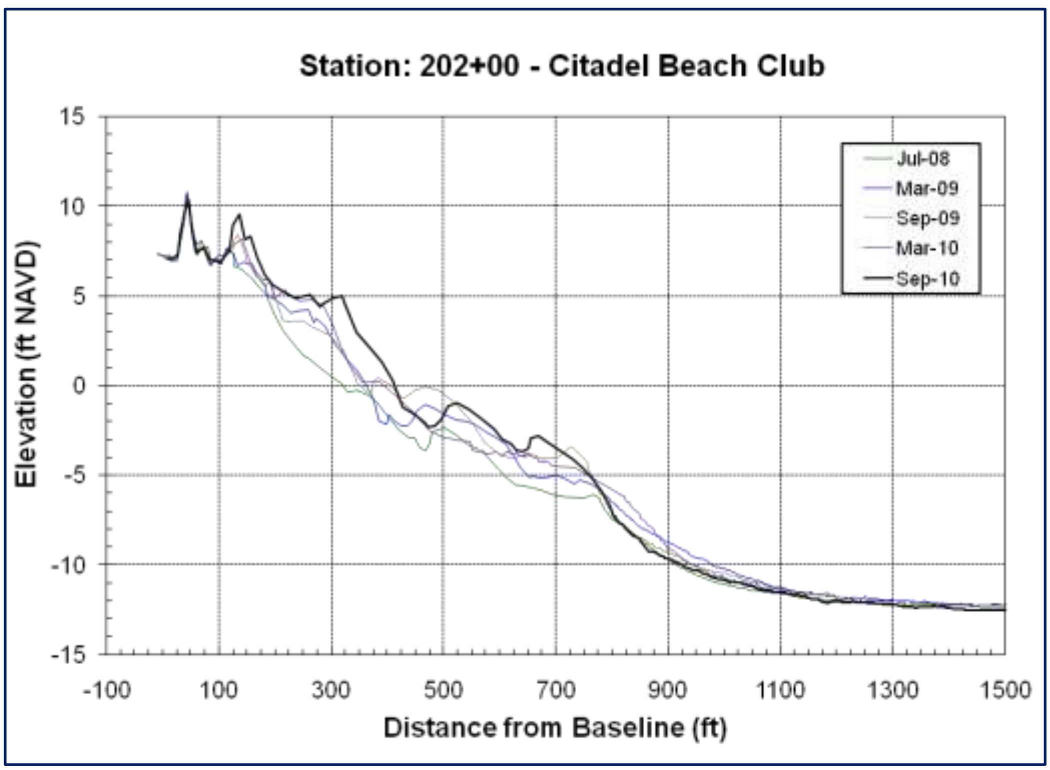


FIGURE 3.21. Profiles from OCRM station 3145 (upper) in Reach 4 showing net erosion since March 2009; however, this station accreted between March and September 2010. Profile 202+00, near the Citadel Beach House has accreted over 100 ft since the nourishment project in 2008.

FIGURE 3.22. Photos from station OCRM 3145 (near 36th Ave, upper two photos) and station 202+00 (near Citadel Beach House, lower two photos). [Photos by P McKee, September 2010]

Reach 3 – The Pier to 31st Avenue

Reach 3 spans the oceanfront between the pier and 31st Avenue (OCRM monuments 3125 to 3140, Fig 3.23). As previously mentioned, the long-term trend in this area is stable to accretional. Profiles from OCRM station 3135 (near 27th Avenue) show the beach in this area has gained ~40 ft in width at the +5-ft NAVD contour (Fig 3.24) over the past ten years. A similar trend is evident at OCRM station 3125 (14th Avenue) with dune growth and beach widening over the past ten years.

Reach 3 was the most erosional of the IOP reaches between March and September 2009, losing ~25,600 cy (4.6 cy/ft). Since September 2009, the reach has recovered, gaining 46,800 cy (8.3 cy/ft) from September 2009 to March 2010, and 19,200 cy (3.4 cy/ft) from March to September 2010. Total volume change in Reach 3 over the past year was ~66,000 cy (11.7 cy/ft).

All stations in the reach currently contain more sand than the March 2009 condition (Fig 3.24). Individual gains from September 2009 to September 2010 ranged from 4.4 cy/ft to 19.7 cy/ft. Four out of the eight stations in the reach showed minor erosion between March and September 2010; however, the average change for all stations in the reach was 3.3 cy/ft accretion during that period. These changes highlight the fact that short-term fluctuations in unit volume are typical, even in historically accreting beaches. Erosion at intermittent stations in this area is likely a result of the positions of the underwater bar around the time of the surveys. As bars migrate onshore/offshore and alongshore, unit volumes at any given station fluctuate rapidly. Averaging over the reach generally accounts for such effects.

Figure 3.25 shows the beach condition in September 2009.

FIGURE 3.23. Reach 3 spans from station OCRM 3125 (pier) to station OCRM 3140 (31st Avenue).

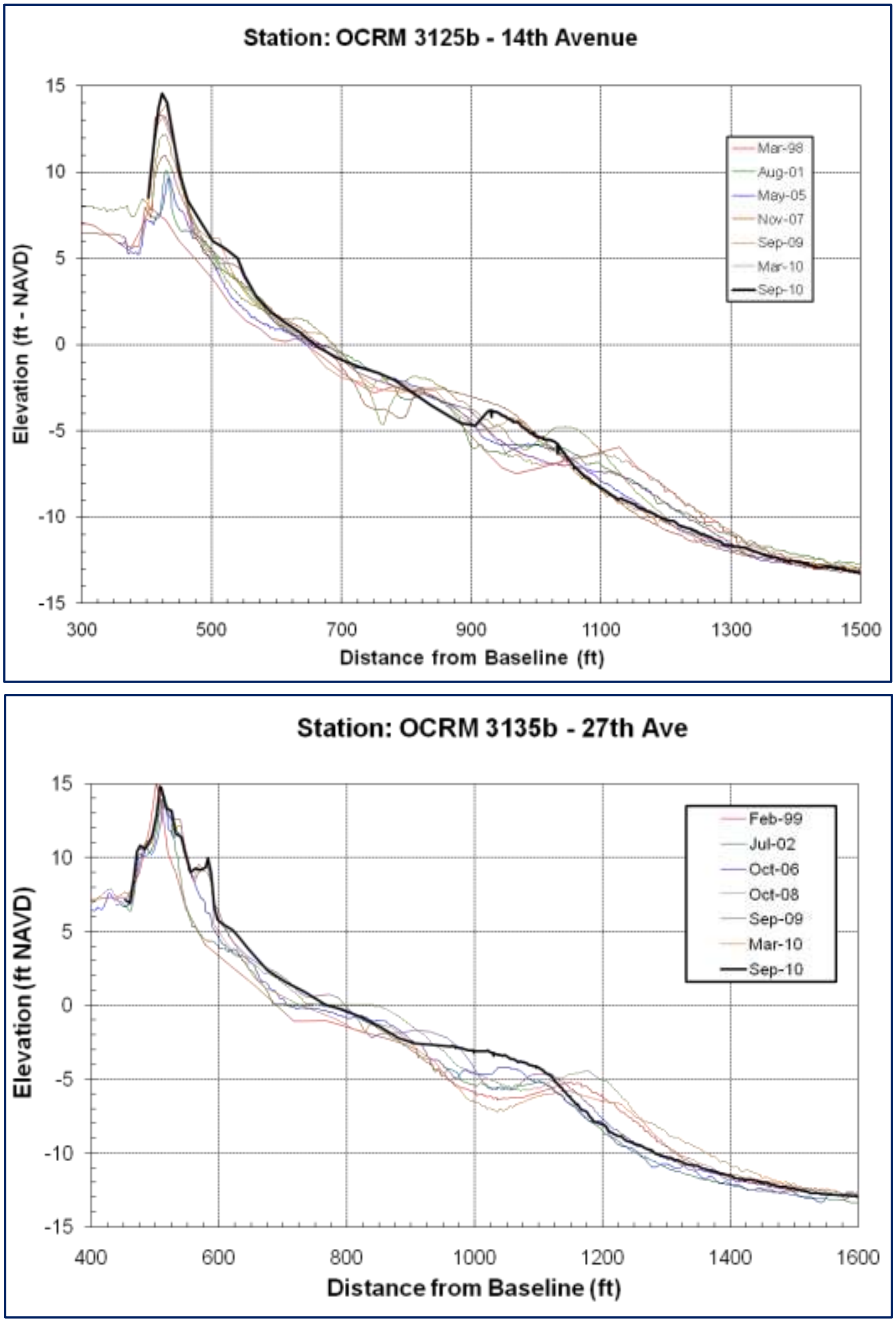


FIGURE 3.24. Profiles from OCRM station 3125 (upper) and OCRM station 3135 (lower), showing long-term accretion since 1999. Protective dunes reach to +15 ft NAVD in this area and have been building since 1998. [Profiles prior to March 2009 courtesy SCDHEC-OCRM.]

FIGURE 3.25. Views northeast (upper) of station OCRM 3125 (just north of the pier) and southwest (lower) of station OCRM 3135 near 27th Avenue.

Reach 2 – 6th Avenue to the Pier

Reach 2 spans 4,280 ft between 6th Avenue and the pier (OCRM monuments 3115–3125, Fig 3.26). All stations in this reach except statioin 70+00 showed net accretion since September 2009. The reach showed a net gain of ~20,700 cy (4.8 cy/ft) between September 2009 and September 2010. Reach 2 had lost 1.6 cy/ft from March to September 2009. OCRM station 3115 (6th Avenue) has been fairly stable since 2002 (Fig 3.27) as evidenced by the growth of dunes. As of September 2010, station 3115 contained ~5.9 cy/ft more sand than the July 2002 condition. A small scarp was present in September 2009 near station 60+00 (8th Avenue) but had healed by September 2010 (Fig 3.28).

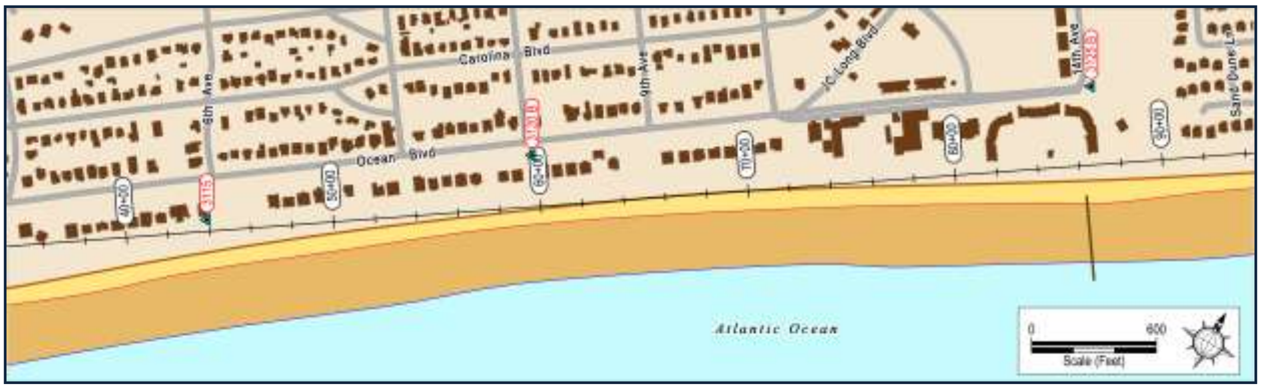


FIGURE 3.26. Reach 2 spans from OCRM 3115 (6th Avenue) to OCRM 3125 (pier).

Long-Term Trends in the Central Reaches (2-4)

CSE used profile data collected by the state of South Carolina to determine long-term volume change along the central portion of the Isle of Palms (between 6th Avenue and 41st Avenue). The state has collected profiles since the 1980s; however, only since 1998 have the profiles encompassed the entire beach profile to closure depth (ie – the depth at which measurable change in the bottom approaches zero). CSE has reoccupied OCRM monuments since March 2009 and combined those data with the state profiles to produce an approximate 12-year record of sand volumes.

Profile volumes from 1998 to 2010 are shown in Figure 3.29 for the OCRM stations in the IOP reaches (away from the influence of tidal inlets). The plots show generally increasing unit volumes at each station with the 2010 condition always showing greater volume than the 1998 condition. Two instances where erosion was present at the majority of stations occurred between 2001 and 2002, and between 2008 and 2009.

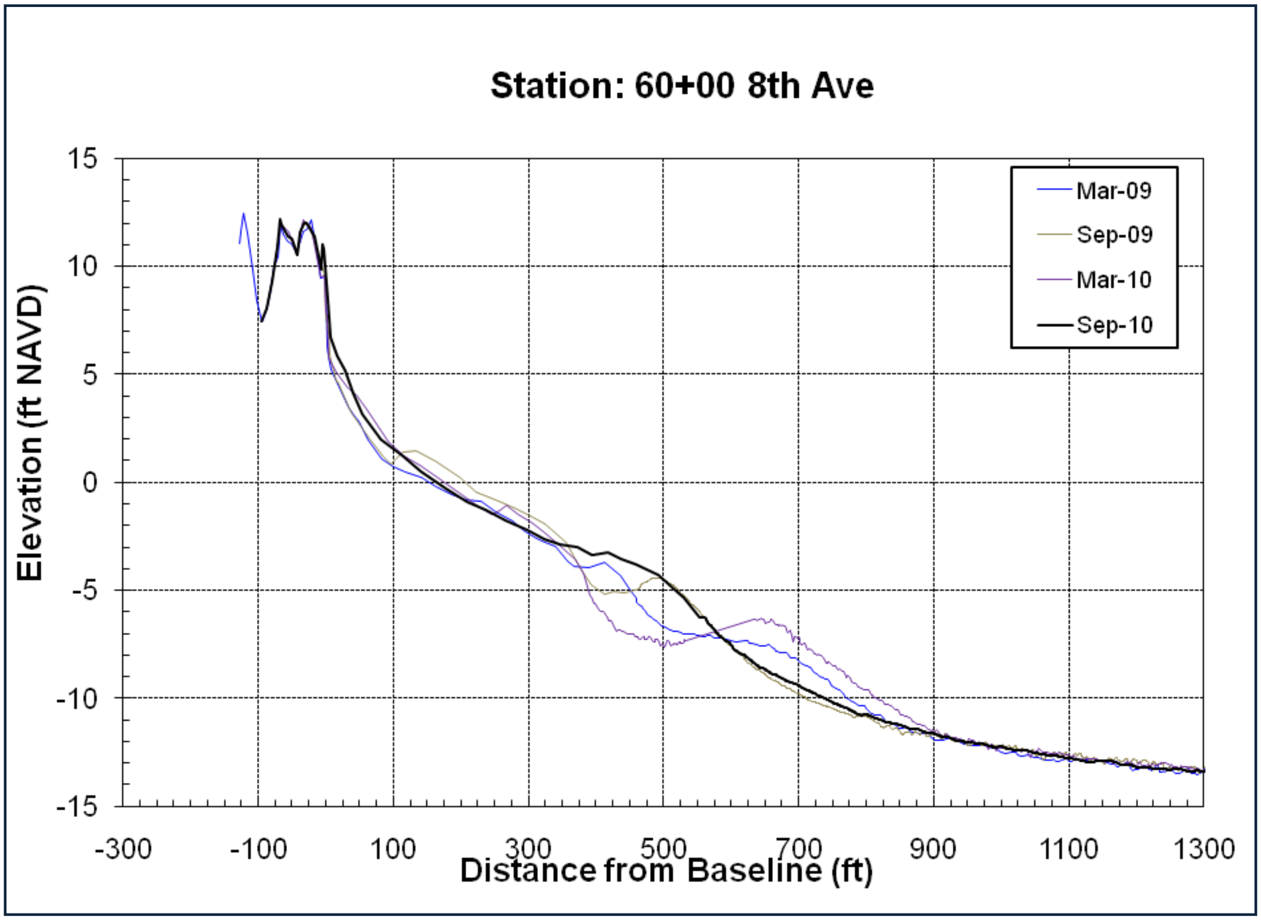


FIGURE 3.27. Profiles from station 60+00 (8th Avenue) in Reach 2. Note negligible change in elevation below −12 ft NAVD, the volume calculation limit.

Between August 2001 and July 2002, the stations lost an average of ~20 cy/ft; however, it should be noted that the offshore data from August 2001 is anomalously higher than other dates, suggesting that the data may contain an error. True volumes are likely less than those calculated for August 2001, which would reduce the erosion measured from these profiles between 2001 and 2002. CSE calculated the long-term accretion rate with and without the August 2001 data. **The 12-year trend for average unit volume change in the central reaches (2-4) is accretion at 2.9 cy/ft/yr (2.7 cy/ft/yr including the August 2001 data).** The average unit volume decreased by ~15 cy/ft between October 2008 and September 2009; however, it increased by ~8 cy/ft between September 2009 and September 2010.

FIGURE 3.28. September 2010 photos from (upper) station OCRM 3115 (6th Avenue) and (lower) station 80+00 (just south of the pier). Dune scarping was present along portions of this reach in 2009. By September 2010, natural accretion had healed the erosional escarpments.

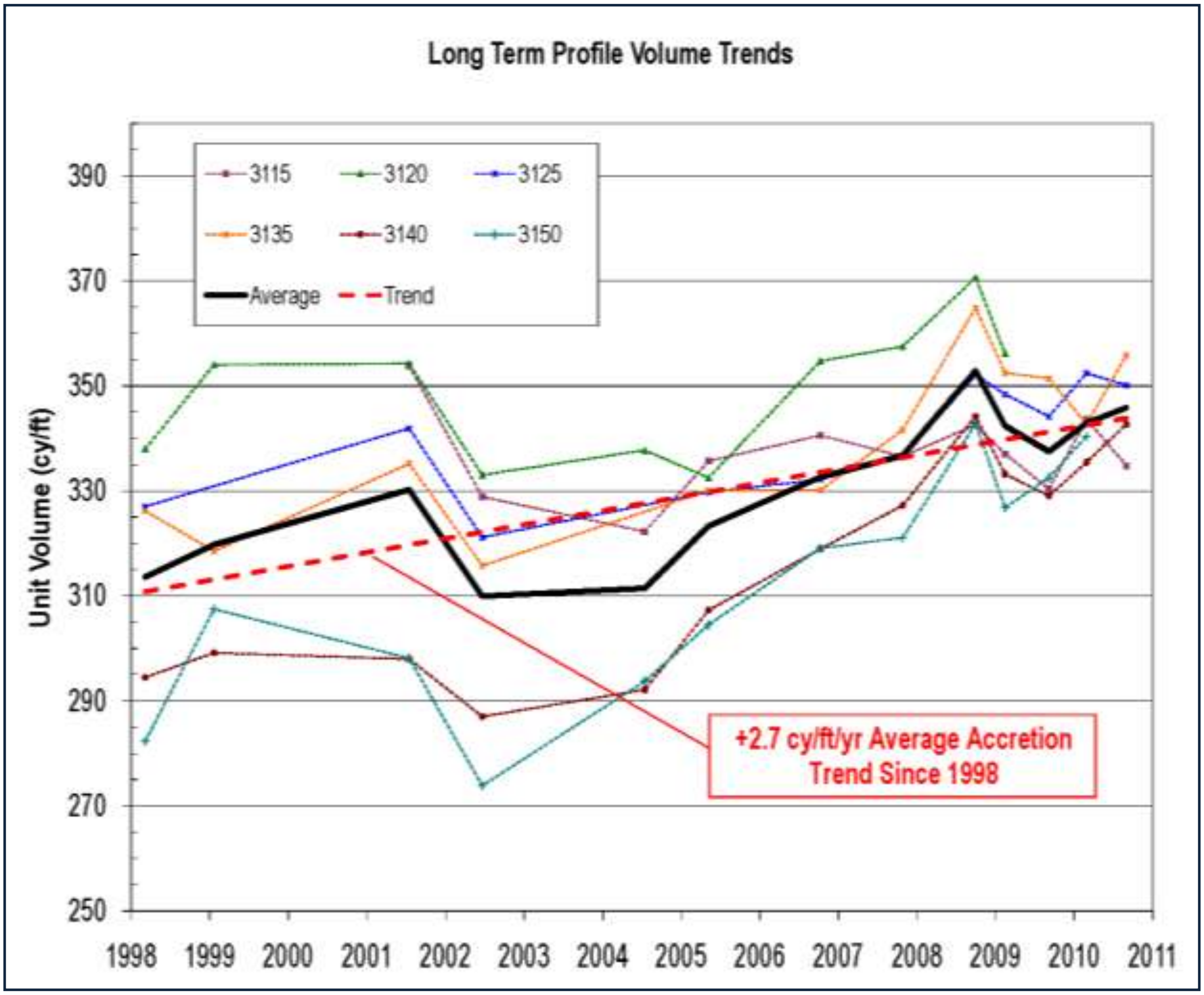


FIGURE 3.29. Long-term volume change in Reaches 2–4. Data obtained by the State were used to compute an ~12-year trend, showing an average annual accretion of ~2.7 cy/ft/yr between OCRM stations 3115 and 3150.

Reach 1 – Breach Inlet

Reach 1, between Breach Inlet and 6th Avenue (Fig 3.30), is classified as an unstabilized inlet erosion zone due to the dynamic nature of the shoals associated with the inlet delta. While labeled as unstable, the long-term trend for this reach is accretional with an estimated growth of ~8.9 ft/yr (linear beach width). The historical accretion trend in this reach is due to a plentiful sand supply from upcoast and sand trapping by the Breach Inlet ebb-tidal delta. Sand supply originates from shoal-bypass events at Dewees Inlet and longshore sand transport from north to south over the length of Isle of Palms. Excess sand is deposited along the southern spit of the island (Reach 1) and in the Breach Inlet ebb-tidal delta. Shoals of Breach Inlet form a protuberance in the shoreline, which backs sand up along the oceanfront much like a terminal groin traps sand. Changes in this area are related to bars from the inlet delta migrating onto the beach or marginal flood channels moving landward or seaward. Such natural processes lead to rapid changes in the beach volume compared to the central IOP reaches.

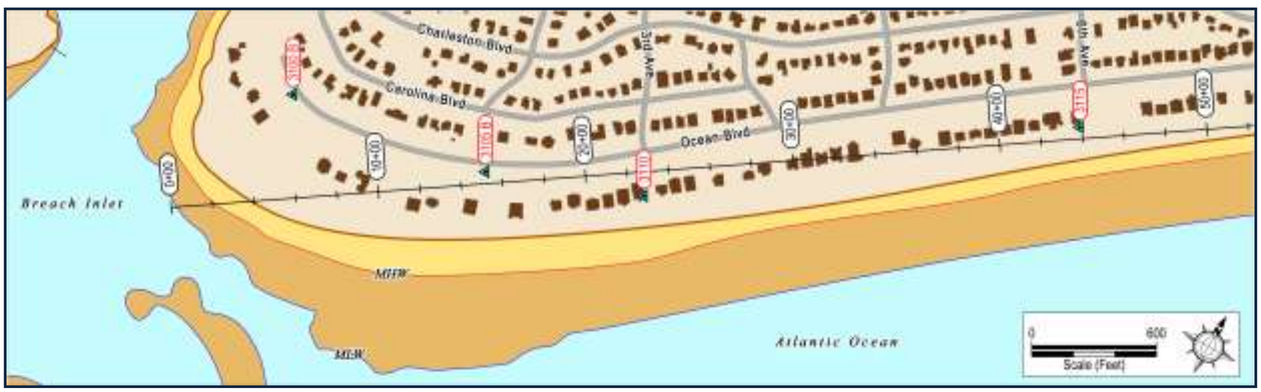


FIGURE 3.30. Reach 1 spans ~4,200 ft from Breach Inlet to OCRM station 3115 (6th Avenue).

Between March and September 2009, the two stations closest to Breach Inlet (0+00 and 4+00) were highly erosional, while the remaining stations in the reach showed accretion. Stations 8+00 through OCRM 3110 (3rd Avenue) each gained over 15 cy/ft, including gains over 35 cy/ft for stations 12+00 through 20+00. Stations 30+00 and 40+00 were more stable, only gaining 1.0 and 0.1 cy/ft (respectively).

Since September 2009, the reach has gained ~52,900 cy (12.1 cy/ft) of sand. Erosion averaging 6.7 cy/ft occurred between stations 8+00 and 16+00; however, stations to the north and south accreted an average of 11.8 cy/ft and 29.9 cy/ft (respectively). The marginal flood channel running north(east) along the beach at Breach Inlet moved landward between March and September 2009, causing significant reductions in beach volume at station 0+00 to station 8+00 (Fig 3.31). By September 2010, the channel had shifted seaward, nearly matching its position of March 2009. Fluctuations in the position of the marginal flood channel have a direct impact on the beach although changes are often temporary. The long-term trend around Breach Inlet is accretion, and this will continue as long sediment from northern Isle of Palms migrates downcoast.

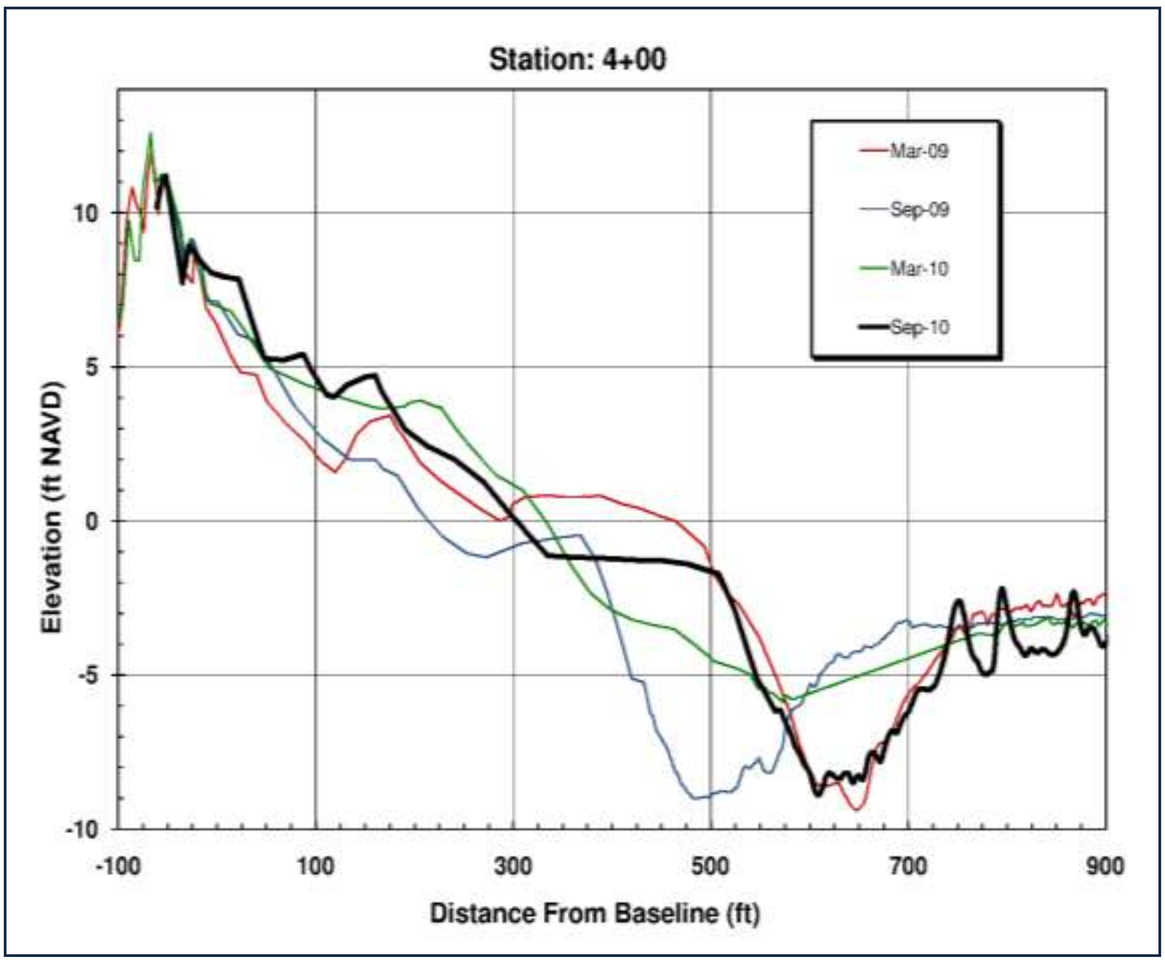


FIGURE 3.31. Profiles from station 4+00 near Breach Inlet. A marginal flood channel migrated landward between March and September 2009, but had returned to its March 2009 position as of September 2010.

Figure 3.32 shows color DTMs of the northeastern shoal of Breach Inlet. It is apparent from the models that the marginal flood channel migrated landward between March and September 2009, moving seaward since then. Prior to 2009, the main (ebb) inlet channel was oriented to the southwest in front of Sullivan's Island (not visible in the models) while a secondary ebb channel (E on Fig 3.32) was in the formative stage. The secondary ebb channel widened and deepened after March 2009, and its seaward end deflected slightly to the southeast. This may indicate a channel avulsion event at Breach Inlet with sand on the west side of the new channel being available to attach to Sullivan's Island in the near future (Fig 3.33).

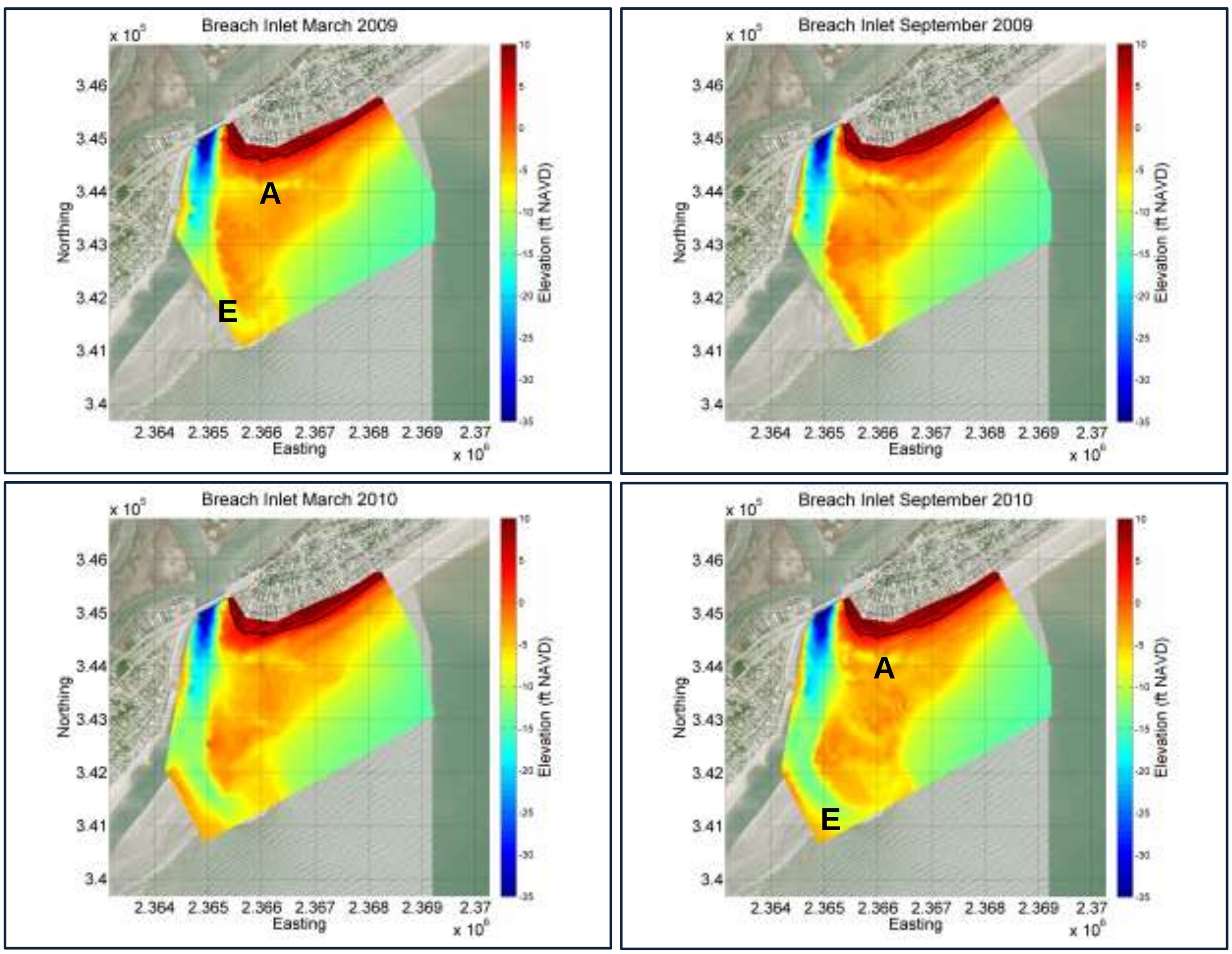


FIGURE 3.32. Color DTMs of Breach Inlet and neighboring IOP shoreline. Note the marginal flood channel (A) migrated closer to the beach between March and September 2009, but moved seaward again by September 2010. The secondary ebb channel (E) at the lower left edge of each image has become more defined since March 2009. A likely channel avulsion event is occurring where the main inlet channel realigns from a westward to a southerly orientation. The +5 ft NAVD contour is shown as the black line. This is the approximate location of the normal high-tide wave run-up limit.

FIGURE 3.33. Aerial image of Breach Inlet taken 28 April 2010 (SB Traynum). The secondary ebb channel (E) has become more developed since 2009, likely indicating a channel avulsion event. If this is the case, the linear sandbar (S) will likely migrate onshore and accrete along the Sullivan's Island oceanfront. A marginal flood channel (M) is visible adjacent to the southern end of Isle of Palms.

3.2 Shoal Bypassing

Between March and September 2009, a bypassing shoal ("2008" shoal) fully attached to the beach just north of the Wild Dunes Property Owners Beach House. It originated from the same platform of sand as the previous shoal-bypass event, which ultimately led to the need for the nourishment project. In March 2009, the "2008" shoal was separated from the beach by a narrow and relatively deep channel as seen in the 2009 aerial image (cf – Fig 3.14) and profile from station 282+00 (Fig 3.34). Using a DTM from the March 2009 monitoring data, CSE estimates ~330,000 cy of sand came ashore in the "2008" shoal. This shoal had completely attached by September 2009.

Another shoal emerged by April of 2010 (Fig 3.34). This shoal appeared smaller than the previous shoal and attached a few hundred feet to the north of the Wild Dunes Property Owners Beach House. The shoal emerged and attached quickly, and is estimated to contain less than 100,000 cy of sand. Net accretion was observed in the shoal attachment area (between stations 260+00 and 286+00) between March and September 2010, as the shoal attached to the beach. This resulted in some recovery of the most severely eroded portions of Reach 5 (near Dunecrest Lane). Recovery was also observed near the 18^{th} hole of the Wild Dunes Links Course as sand that had recently added (via the 2010 shoal attachment) to the southern portion of Reach 6 (between Mariners Walk and Summer Dunes Lane) eroded and was transported north. CSE anticipates that the shoreline in the shoal attachment area will erode over the next several months as attached sand spreads laterally.

The two shoals that emerged following the nourishment project built from a large platform of sand on the southern side of the Dewees Inlet delta. The platform, which slopes offshore in the vicinity of the Wild Dunes Property Owners Beach House, is estimated to contain over 4.3 million cubic yards of sand. This value includes only the portion of the delta downcoast of the inlet and excludes the offshore shoals to the east and north of the Dewees Inlet channel. It is likely that this platform will continue to be a source of sand for shoal-bypass events. Shoals are built as sand from the outer portions of the platform is transported landward by wave action. As more sand is added, the shoals build higher and, in turn, experience more breaking wave energy. Once shoals are emergent, they tend to migrate faster than submerged bars. Just as discrete waves can be observed moving toward the beach, discrete shoals produce episodic bypassing events every few years.

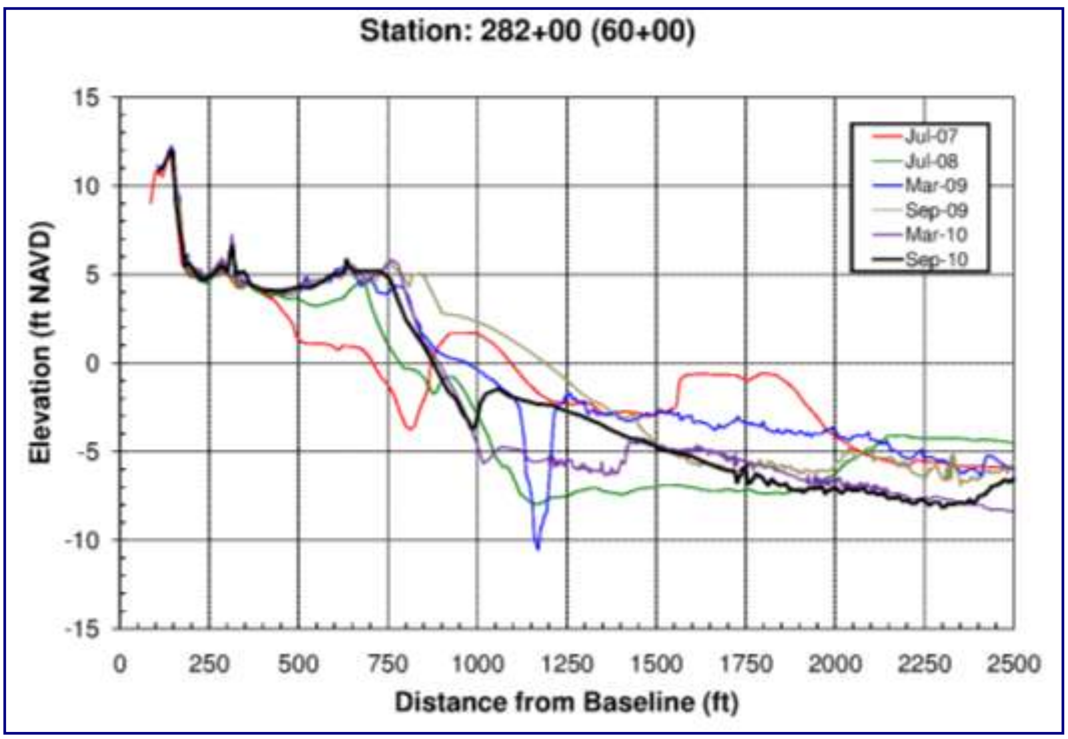


FIGURE 3.34. **[UPPER]** April 2010 aerial image of the northeast end of Isle of Palms. The shoal off the Wild Dunes POBH (red line at station 282+00) was ~300 ft from the shoreline at this time and was completely attached by September 2010. Section 1 indicates the location of the profile shown in Fig 3.39. **[LOWER]** Profiles from station 282+00 near the Wild Dunes POBH show the landward migration of shoals since 2007. Note the "2006" shoal (red line) attached to the shoreline with an ephemeral lagoon in July 2007 and completely welded to the beach in July 2008 (green line). The "2008" shoal almost attached in March 2009 (blue line) and attached in September 2009 (brown line). The newest shoal was much smaller than the previous two, and was ~300 ft from the beach in March 2010 (purple line) and essentially attached in September 2010 (black line). Note 0 ft NAVD is approximate mean sea level.

3.3 Dewees Inlet and Delta

Dewees Inlet's ebb-tidal delta is the sand source responsible for the historical accretion along the Isle of Palms. Since the 1950s, the seaward end of the main channel has been deflected to the south due to dominant wave forcing from the northeast driving sand to the southwest. The southerly deflection results in the large platform of sand in the nearshore of the northeastern end of the island (discussed in the previous section). The channel has generally been bounded by a large sand shoal on the northeast and southeast, separated by a secondary channel which ran parallel to the inlet (between Isle of Palms and Dewees Island). The cross-sectional area of the inlet (measured at station 362+00) is ~35,000 square feet (ft^2) (3,250 m^2) and shows long-term stability.

While the Dewees Inlet delta has remained in a fairly similar position since the 1950s, recent observations (since 2007) suggest large-scale changes are occurring. An event occurring in the 1940s shows features similar to present conditions within the inlet. The aerial photos from the 1940s and 1950's suggest there was a channel avulsion event which realigned the main ebb channel from a southwest to a southeast orientation. This allowed a significant quantity of sand to attach to the beach, creating a barrier beach/lagoon system in the process. Note the presence of the feature (arrow) in the 1949 image (Fig 3.35). The barrier beach was pushed onshore over the next decade, closing the lagoon and adding a large sand supply to the Isle of Palms beach. Aerial photos from the event are shown in Figure 3.35.

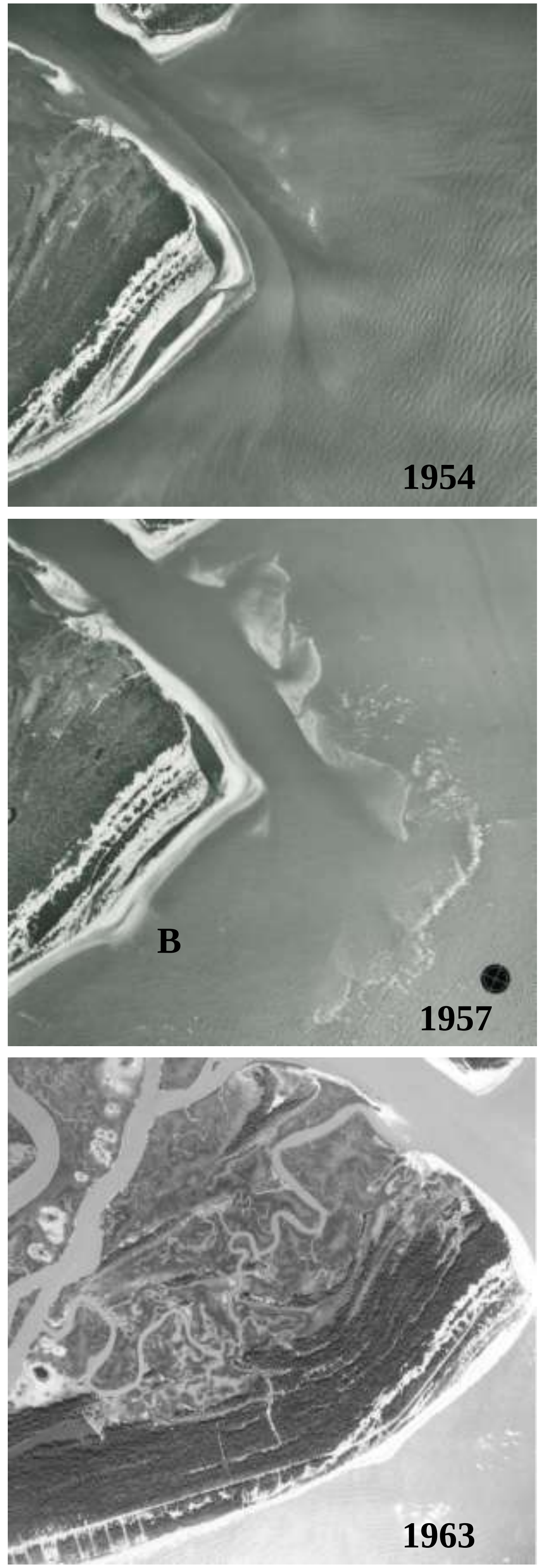
Perhaps the most significant observation from the sequence of photos in Figure 3.35 is that in 1944, the inlet channel (C) was oriented to the southeast. This differs from the southwest orientation of the outer channel observed in 1957 (and possibly 1954). Also of note in the 1944 image is the extensive, sparsely vegetated beach/dune area. Lack of dense shrub vegetation indicates that a broad section of the oceanfront accreted, likely within the previous 10–20 years. At some point prior to 1944, the active beach was positioned in the vicinity of the stable tree line but accreted rapidly, leaving the wide sparsely vegetated area that is visible in the 1944 photo.

By 1949, a large shoal had enveloped the northern end of the island. Isolated shoals (visible offshore in the 1944 image) merged and migrated onshore, creating the barrier beach/lagoon system at the northeastern end of Isle of Palms. A central flushing channel for the lagoon can be seen in the 1949 and 1954 images (Fig 3.35). While the orientation of the main inlet channel is difficult to determine from the 1949 and 1954 photos, the 1954 photo does show deflection of flows to the southwest, indicating the channel was probably oriented to the southwest at that time. It is clear by 1957 that the channel is deflected to the southwest. Between 1949 and 1957, the incipient lagoon narrowed as waves overwashed the barrier beach and drove sand into the lagoon.

FIGURE 3.35.

Sequence of vertical aerial photos of the northeastern end of Isle of Palms, showing a set of photos spanning 1949-1963. A large shoal-bypass event likely due to a channel avulsion impacted the island during this time period, creating a washover barrier and lagoon which eventually infilled and created new beach and dune habitat.

Photo sequence begins (left column from top) in 1944, 1949, and 1953, then continues (right column from top) in 1954, 1957, 1963. [Note that images are not at the same scale.]



The 1957 photo also shows the first signs of the typical shoal-bypass events which have occurred periodically since then (and have been described in this report), with a bulge in the shoreline (B) created by a recent shoal attachment. By 1963, the incipient lagoon had completely infilled, and the shoreline was shaped similarly to what exists today.

Monitoring efforts by CSE reveal that the ebb-tidal delta of Dewees Inlet has experienced significant changes since 2007. These changes suggest an event similar to the one which occurred in the 1940s–1950s is now in the beginning stages. Whether a similar large-scale event sufficient to produce a barrier beach like the one in 1949 occurs is uncertain. However, a channel avulsion at Dewees Inlet would free more than enough sediment on the downcoast side of the delta to produce a similar feature. This is why comprehensive surveys of the ebb-tidal delta are important. Figures 3.36 through 3.38 show DTMs of the inlet between July 2007 and September 2010 with features of interest labeled:

- **A**) Dewees Inlet 2007 main channel.
- **B**) The shoal platform and site of recent bypass events.
- **C**) Offshore shoal on the seaward limit of the Dewees Inlet main channel.
- **D**) Dewees Inlet 2010 main channel and its associated spillover lobe.

Changes in the ebb-tidal delta morphology are evident in the series of DTMs from 2007 to 2010. The most significant changes occurring since September 2009 were the emergence and onshore migration of a small incipient shoal between March and September 2010 (near the area indicated by B in upper Fig 3.38) and continued migration of the outer shoal (C in Fig 3.38) to the southwest. The outer shoal has essentially merged with the sand platform (B) extending from the beach in the vicinity of the Wild Dunes Property Owners Beach House. The outer shoal has been migrating at a rate of ~630 ft/yr to the southwest (Fig 3.39). CSE expects to see continued movement of the shoal to the southwest over the next year and then increased landward movement after the entirety of the shoal has merged with the sand platform (B).

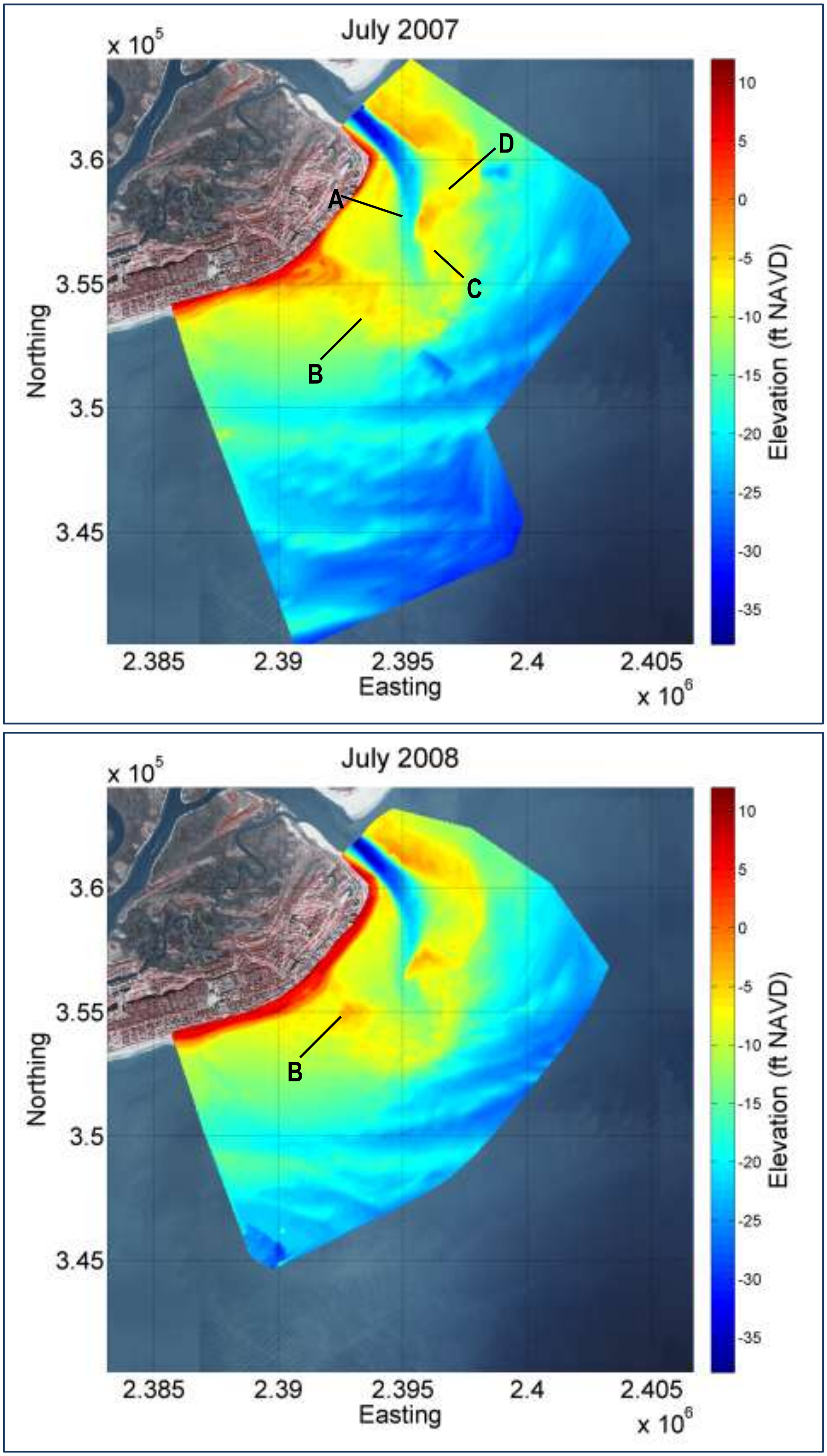


FIGURE 3.36. DTMs from July 2007 (upper) and July 2008 (lower) showing changes in the shoals of the Dewees Inlet ebb-tidal delta. Labels are described in the text.

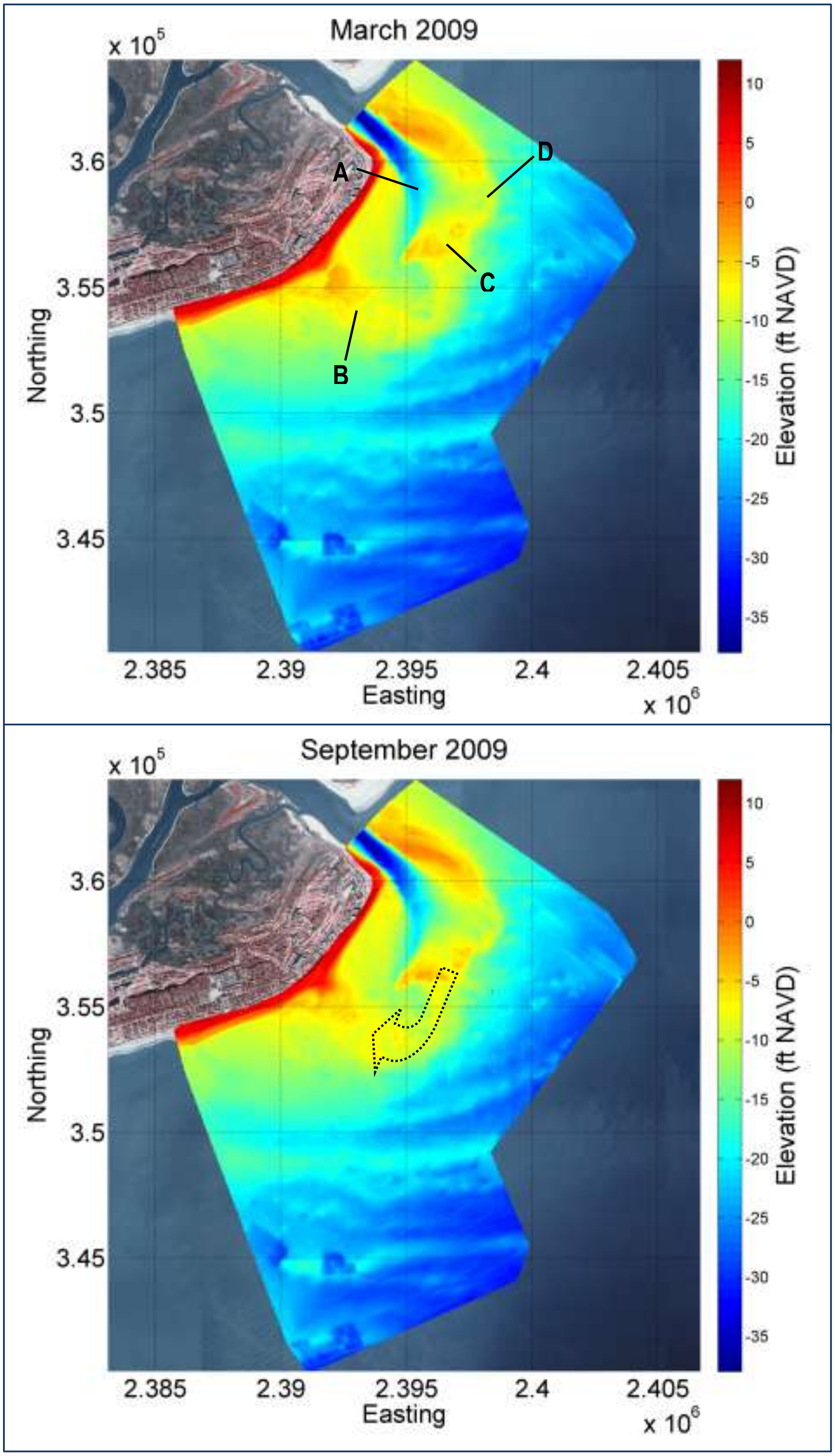
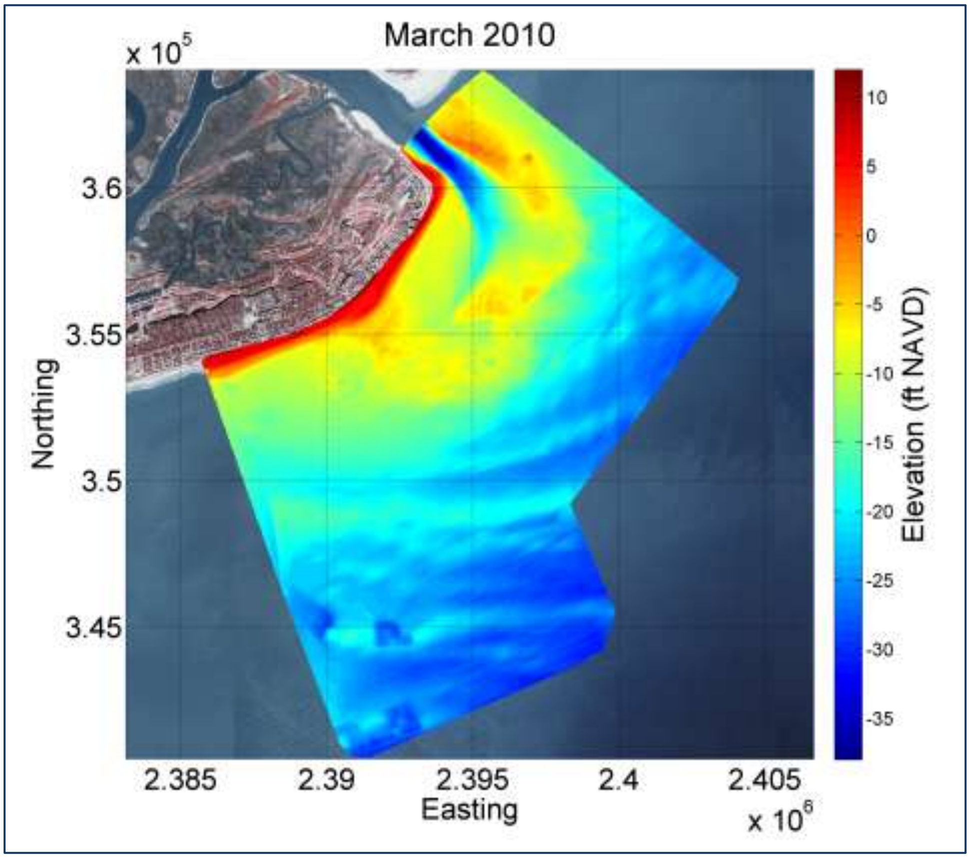


FIGURE 3.37. DTMs from March (upper) and September (lower) 2009 showing changes in the shoals of the Dewees Inlet ebb-tidal delta. Labels are described in the text. The general sand transport pathway is highlighted by the arrow. Borrow areas for the project are the small deep-blue patches at the lower corners of the DTMs.



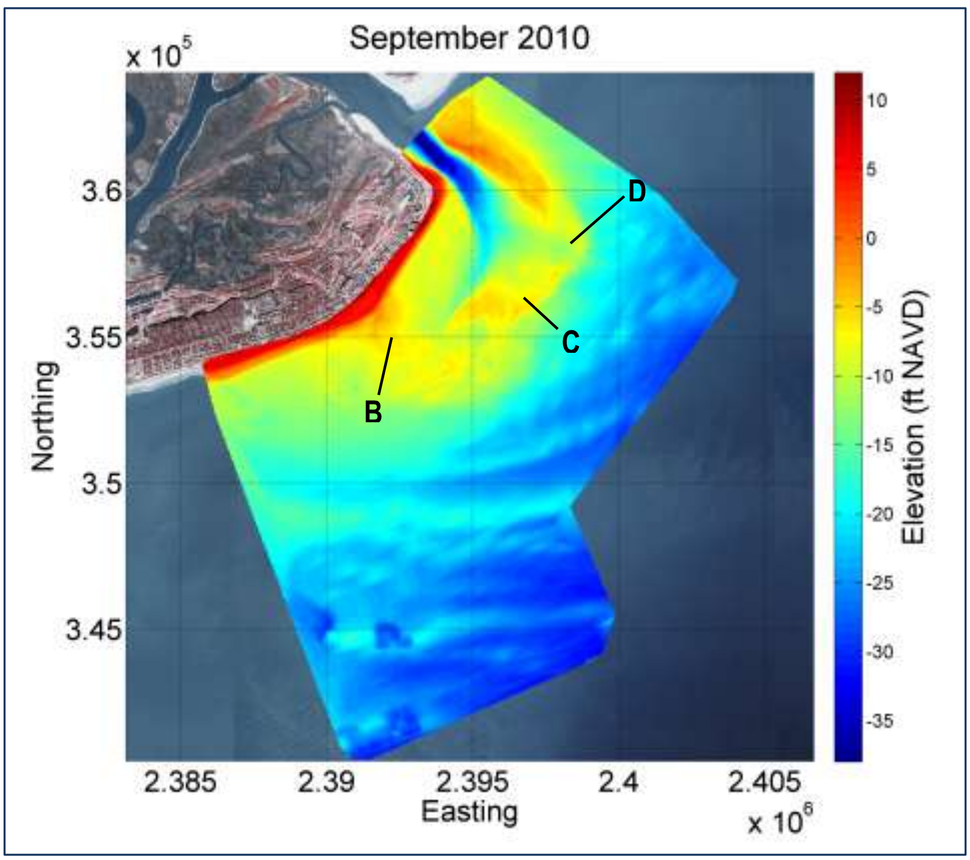


FIGURE 3.38. DTMs from March (upper) and September (lower) 2010 showing changes in the shoals of the Dewees Inlet ebb-tidal delta. By September 2010, the 2007 main channel essentially closed as the outer shoal (C) merged with the shoal platform (B). Borrow areas for the project are the small deep-blue patches at the lower corners of the DTMs.

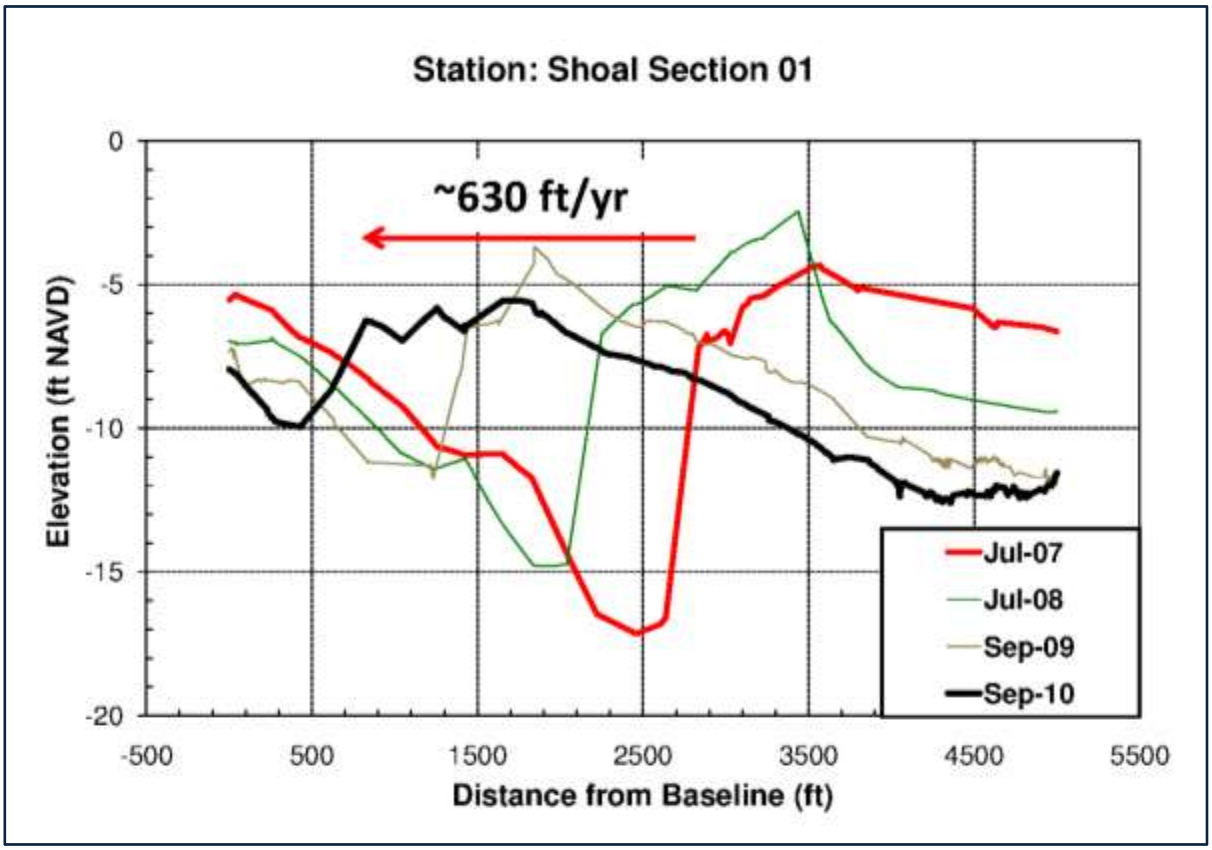


FIGURE 3.39. Cross-section through the outer portion of the 2007 Dewees Inlet main channel. The section runs generally parallel to the shore beginning offshore of the Wild Dunes Property Owners Beach House and extending to the northeast. The channel has decreased in width from over 2,000 ft to ~400 ft and has decreased in depth from ~17 ft to ~10 ft since July 2007. See Figure 3.34 for location of the transect.

DTMs produced by CSE show that in response to the narrowing of the main channel, a secondary channel of Dewees Inlet is widening and deepening to accommodate tidal flow. The secondary channel (D) is aligned with the inner portion of the inlet (between Isle of Palms and Dewees Island). In July 2007, the secondary channel was much shallower and less well defined than the main channel (−9 ft compared to −20 ft NAVD). Cross sections running perpendicular to the secondary channel show that it has become wider and deeper since 2007 (sections shown in Appendix C).

The DTMs also show that a new terminal lobe (outer crest of the ebb-tidal delta) is continuing to grow seaward of the secondary channel. This is an indication that ebb-tidal currents have increased through the secondary channel as the main channel has shoaled. Increased velocity is responsible for widening and deepening the secondary channel, and sand removed by this process is being deposited further offshore, forming the new terminal lobe. The lobe grew ~900 ft seaward between July 2007 and September 2009, and ~100-200 ft between September 2009 and September 2010. The terminus of the channel has also begun to shift to the south over the past year. CSE expects the new channel to rotate from southeast to southwest over the next few years.

The outer shoal (C) has elongated in the direction of movement, meaning that a significant quantity of sand lags behind the leading edge. At this point, it is unclear whether all of the sand in the outer shoal will first migrate southwest and merge with the sand platform, or if at some point, the sand will move landward closer to its current position (east of the platform). If the present channel avulsion event progresses similar to the event which occurred during the 1940s–1950s, sand will likely migrate onshore as a long, linear bar exposed throughout most of the tidal cycle. A lagoon may form between the existing beach and the offshore bar as it migrates onshore, persisting for several years if left unaltered.

CSE bases these assumptions of future changes on previous events at Isle of Palms, as well as on a similar event observed at Kiawah Island. CSE has worked intermittently at Kiawah Island since the 1970s, providing shoreline analysis and restoration plans to the Town. Kiawah Island has a similar shape as the Isle of Palms and is controlled by the same shoal-bypassing process which directs the shape of Isle of Palms. There, two large shoal-bypass events, containing an estimated total of 5 million cubic yards of sand migrated onshore, creating a barrier beach/ lagoon system spanning nearly 3 miles around the northeastern end of the island. At the eastern end of Kiawah Island, the quantity of sand was so large that the incipient beach formed dunes of sufficient height to prevent overtopping. This stopped the landward migration of the barrier berm, leaving the new beach ~1,500 ft seaward of the pre-existing beach and forming a mature marsh-filled lagoon between the new beach and the older shoreline (Fig 3.40).

FIGURE 3.40. Shoal-bypass events at Kiawah Island. The upper image from 1998 shows two shoals estimated to contain ~5 million cubic yards of sand. Shoal 1 was attached and had built a barrier beach ~1,500 ft seaward of the original shoreline. A marsh was forming in the created lagoon. The second shoal was attached at the north end, but still in Stage 2 of the bypass cycle at the south end. The lower image is the same area in April 2010. By this time the second shoal had completely attached and was in the process of forming a new outer beach. Marsh had developed throughout the lagoon, leaving a network of tidal creeks flushing the new system. [Source: CSE 2007, 2010]

Due to the ongoing channel avulsion at Dewees Inlet, several million cubic yards of sand may be released to the Isle of Palms over the next decade or so. As of September 2010, the leading edge of the offshore shoal was beginning to merge with the existing sand platform attached to the beach. It is likely that more of the offshore shoal will merge with the platform over the next year, then begin to migrate landward. Changes to the beach associated with such a large release of sand are uncertain, but may include significant areas of localized accretion and erosion, much like what was present prior to the 2008 beach restoration project. It is unclear whether sand would migrate ashore as a single large shoal (similar to the 1940s event at Isle of Palms and recent shoal-bypassing events at Kiawah Island – CSE 2005, 2007b, 2009), or whether there would be an increase in scale and frequency of typical shoal-bypass events which have impacted IOP in recent years. The uncertainty of rates and the rapidity of changes in the ebb-tidal delta, inlet channels, and shoal platform point to the importance of annual monitoring.

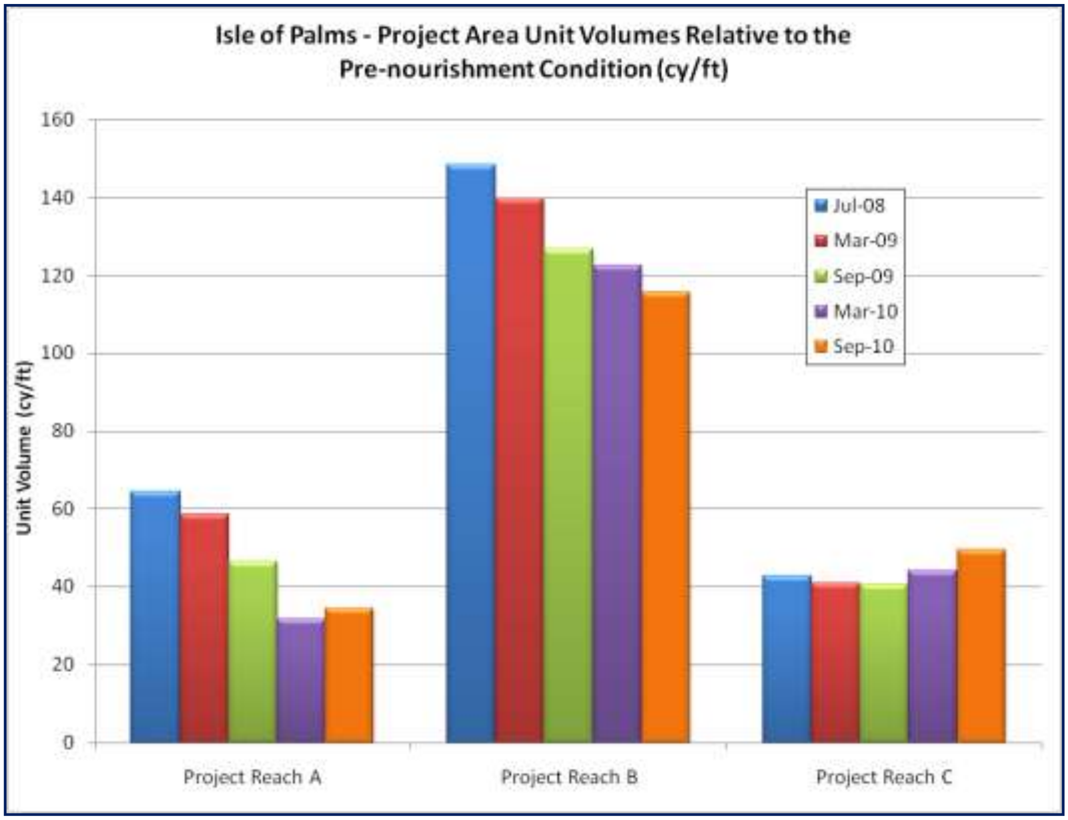
3.4 Project Area Volume Changes

Within the fill limits of the *Dewees Inlet* project area (nourishment Reach C, Fig 3.41), the beach gained sand since September 2009 at all stations except 340+00. Overall, the project reach gained ~9,250 cy (9.3 cy/ft) over the past year, leaving it with 116.7 percent of the nourishment volume remaining (Fig 3.42). As of September 2010, Reach C contained ~50,000 cy more sand than the pre-nourishment condition. Accretion between station 330 and station 338 (area of the 18th tee and fairway) is likely due to losses in Reach 6. The volume change trends along the 18th fairway of the Wild Dunes Links Course, which wraps around the northeastern point of the island, provide an indicator of net sand transport from the oceanfront to the inlet shoreline in this area, consistent with the findings of Kana and Dinnel (1980).

The length of beach within the project boundary (Reach B, between Shipwatch and the 18th fairway) presently retains 115.9 cy/ft more sand than the pre-nourishment condition (compared to 148.4 cy/ft immediately following nourishment). As of March 2010, 83 percent of the fill remained, while **78.1 percent remained as of September 2010**. Individual stations retain between 49.0 percent and 133.2 percent of the nourishment volume. [Calculation excludes the taper sections, which would bias the results.]

Within the 2008 project Reach A, ~154,700 cy of sand were lost between July 2008 and September 2010 (cf – Fig 3.41). The project area presently retains an average of 34.8 cy/ft more sand than the pre-nourishment condition compared to 64.6 cy/ft more sand immediately post-nourishment. In March 2009, 90.8 percent of the nourishment volume remained in the project area. This reduced to 72.0 percent in September 2009, 49.2 percent in March 2010, and then increased to 53.9 percent in September 2010 (see Fig 3.17). CSE expects sand to migrate from the shoal attachment site in Reach 6 to portions of Reach 5, though erosion may still be experienced due to continued straightening of the shoreline.

FIGURE 3.41. Reaches for the 2008 nourishment project. The graphic shows the project baseline with 0+00 located at 53rd Avenue (monitoring station 222+00).



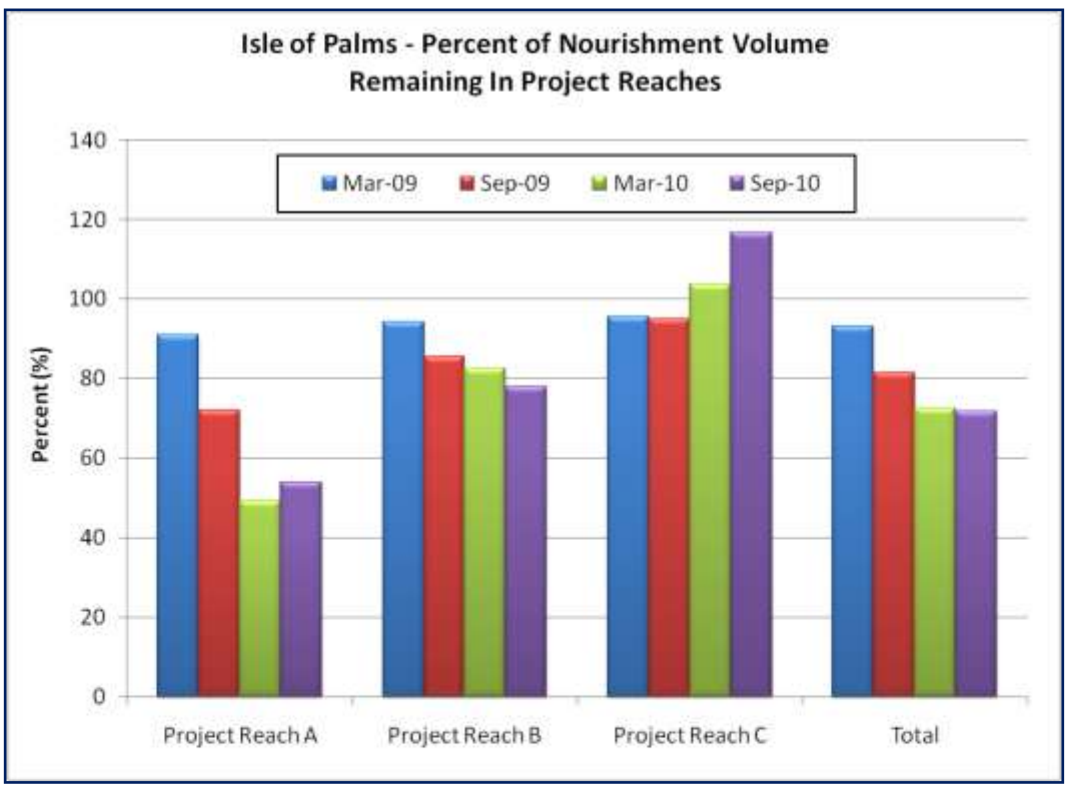


FIGURE 3.42. **[UPPER]** Project area unit volumes relative to the pre-nourishment (March 2008) condition, which is zero on these graphs. [Note that the project area limits differ from monitoring reach limits.] **[LOWER]** Percent of nourishment volume remaining in each project area.

3.5 Required Post-Project Monitoring

Borrow Areas

Three separate borrow areas were used in the 2008 nourishment (Fig 3.43). A fourth area (D) was available but was not used. The borrow areas were situated on offshore ridges and were limited to excavation depths of ~7 ft at the request of permitting agencies to avoid creation of deep holes. Elevation contours of the pre-nourishment condition are shown on Figure 3.43. Special conditions of the permit required topographic monitoring of the borrow areas for three years. Data were collected at 100-ft spacing throughout each of the borrow areas, extending beyond the limit of each area to account for changes near the boundaries.

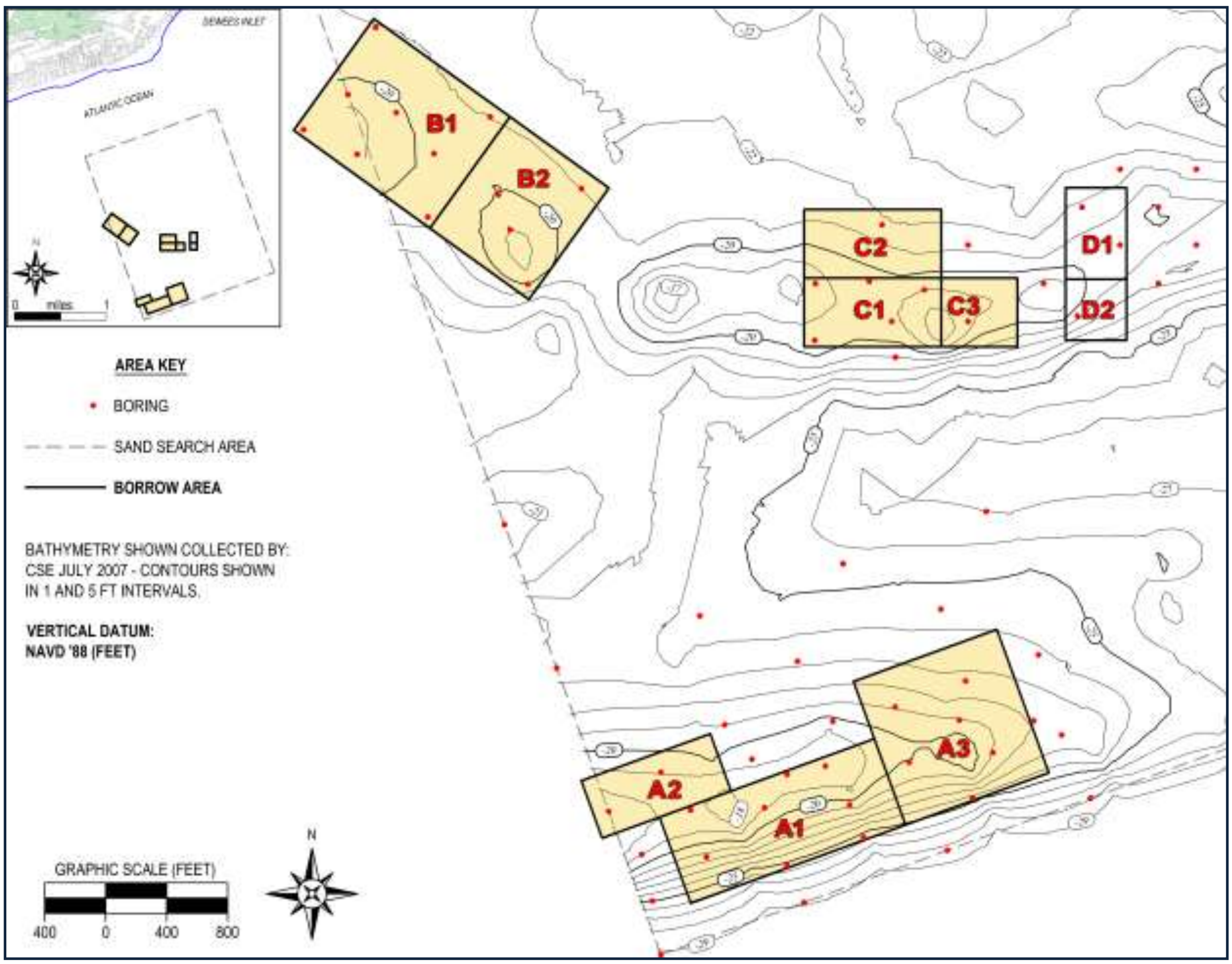


FIGURE 3.43. Locations of the borrow areas used in the 2008 nourishment project. ("D" areas were not used.) Contours show bathymetry in July 2007, prior to the project. The borrow areas were situated on topographic highs as recommended by resource agencies.

DTMs from July 2007 (before dredging), March 2009 (~8 months post-dredging) and September 2010 are shown in Figures 3.44–3.46. Profile sections for each borrow area are presented in Figure 3.46. Generally, deeper portions of each borrow area have infilled, while higher areas have eroded. Infilling is also occurring at the boundaries of the borrow areas where material from undredged areas is falling into the dredged area. Borrow area A shows a net change of 2,600 cy infill as of March 2010 and a net loss of 45,800 cy as of September 2010. A total of 508,000 cy was dredged from Borrow Area A.

The change from net gain to net loss between March and September 2010 is likely a result of small surveying errors computed over a large area (for borrow area A, 51.8 acres). A survey error of 0.5 ft results in volume changes of ~42,000 cy over this area. As depths increase, survey errors can be magnified due to changes in speed of sound of seawater, salinity, turbidity, and waves. Data from September 2010 appear to show generally lower elevations than in March 2010 and that results in a net loss of sand when computed over a large area. In general, infilling rates over a six-month time period are likely less than the overall potential survey error, which can make short-term changes difficult to determine. However, by computing longer term changes, survey errors are averaged out, and a better understanding of the total change is possible. CSE prefers to avoid adjusting data unless a clear pattern can be observed.

Borrow area B gained 95,800 cy between the post-dredge and March 2010 conditions, though showed only a gain of 51,000 cy as of September 2010. Total dredged volume in borrow area B was ~404,000 cy; therefore, ~24 percent of the dredge volume had been replaced by March 2010. Borrow area C infilled by 21,600 cy as of March 2010, and 1,400 cy September 2010, representing 8 percent and <1 percent (respectively) of the 258,200 cy dredge volume. Note that dredge volumes were calculated from before and after surveys of the borrow areas and not by volumes placed on the beach. In-place volumes are smaller than dredge volumes due to losses of fine material at the beach during pumping.

Sediment quality in the borrow areas is beyond the scope of the present report; however, it is addressed in biological monitoring reports prepared by CSA South Inc (CSA 2009). Generally, some fine material (mud) is accumulating in the dredged areas, likely inhibiting future use of each area for nourishment purposes. Sediment quality and topography will continue to change in the borrow areas, and future geotechnical studies would be needed prior to determining the potential suitability for re-use of any area.

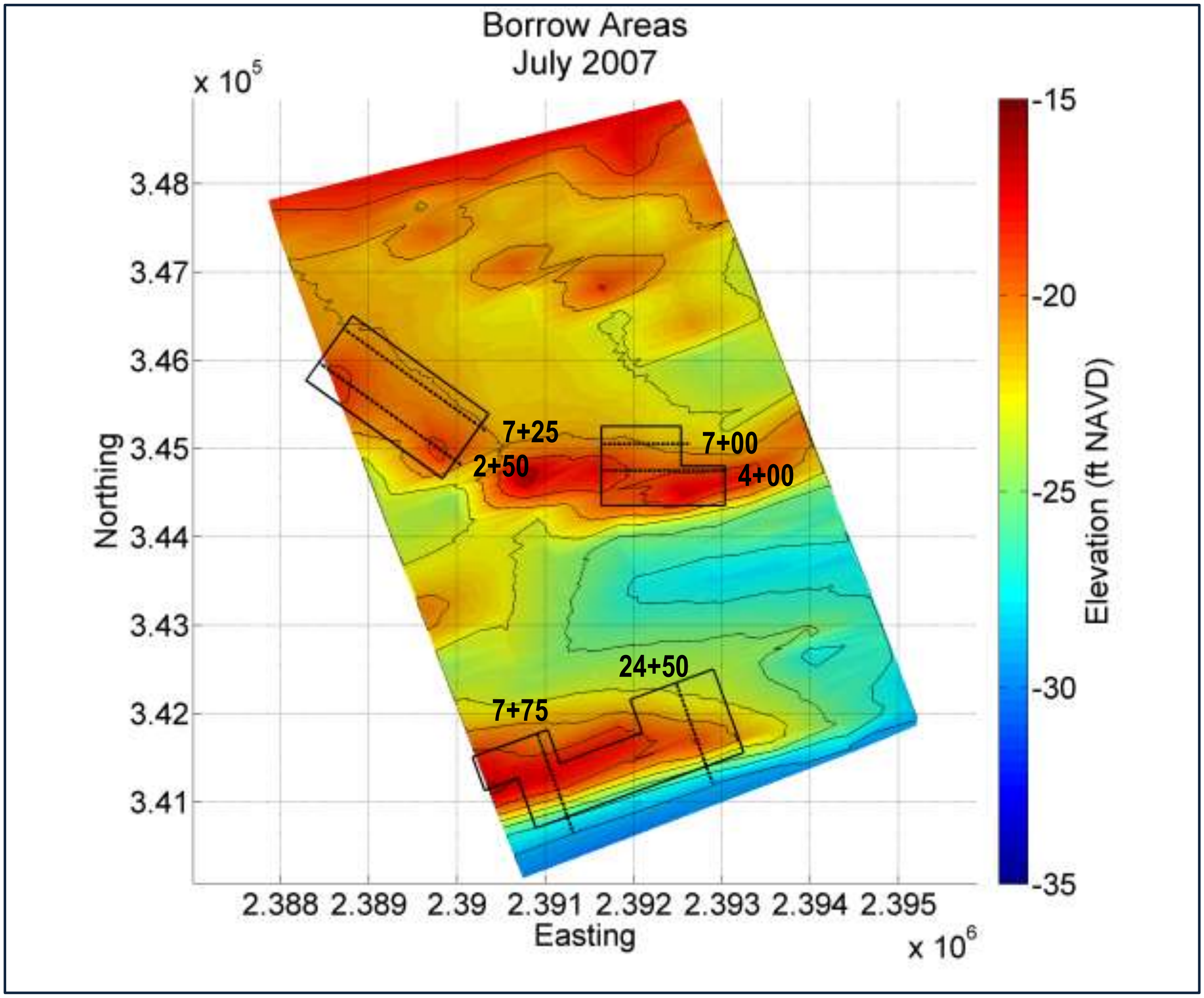


FIGURE 3.44. DTM models of borrow areas before nourishment in July 2007. [Dashed lines are the locations of sections in Figure 3.47.]

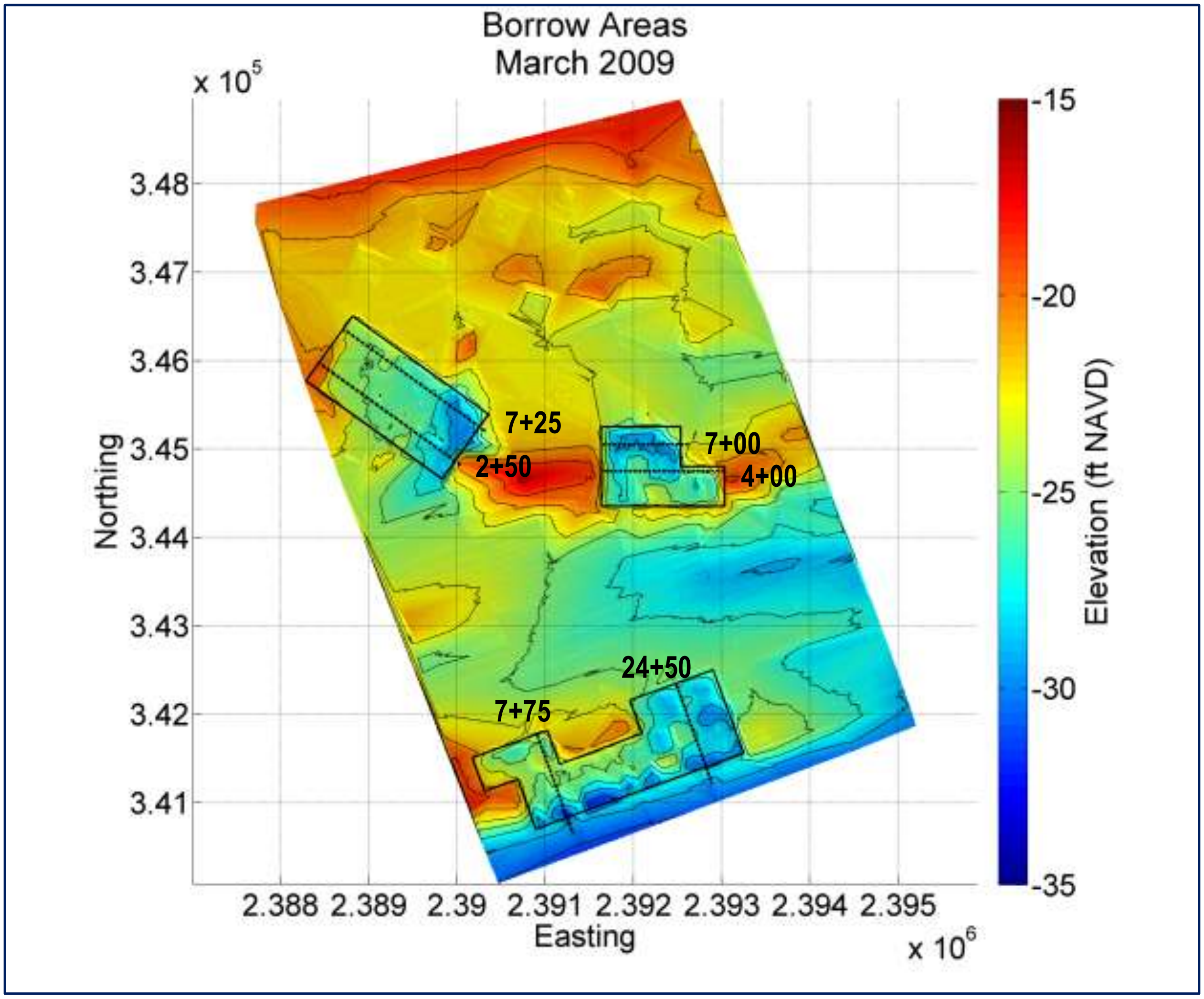


FIGURE 3.45. DTM models of borrow areas ~8 months after nourishment in March 2009 [Dashed lines are the locations of sections in Figure 3.47.]

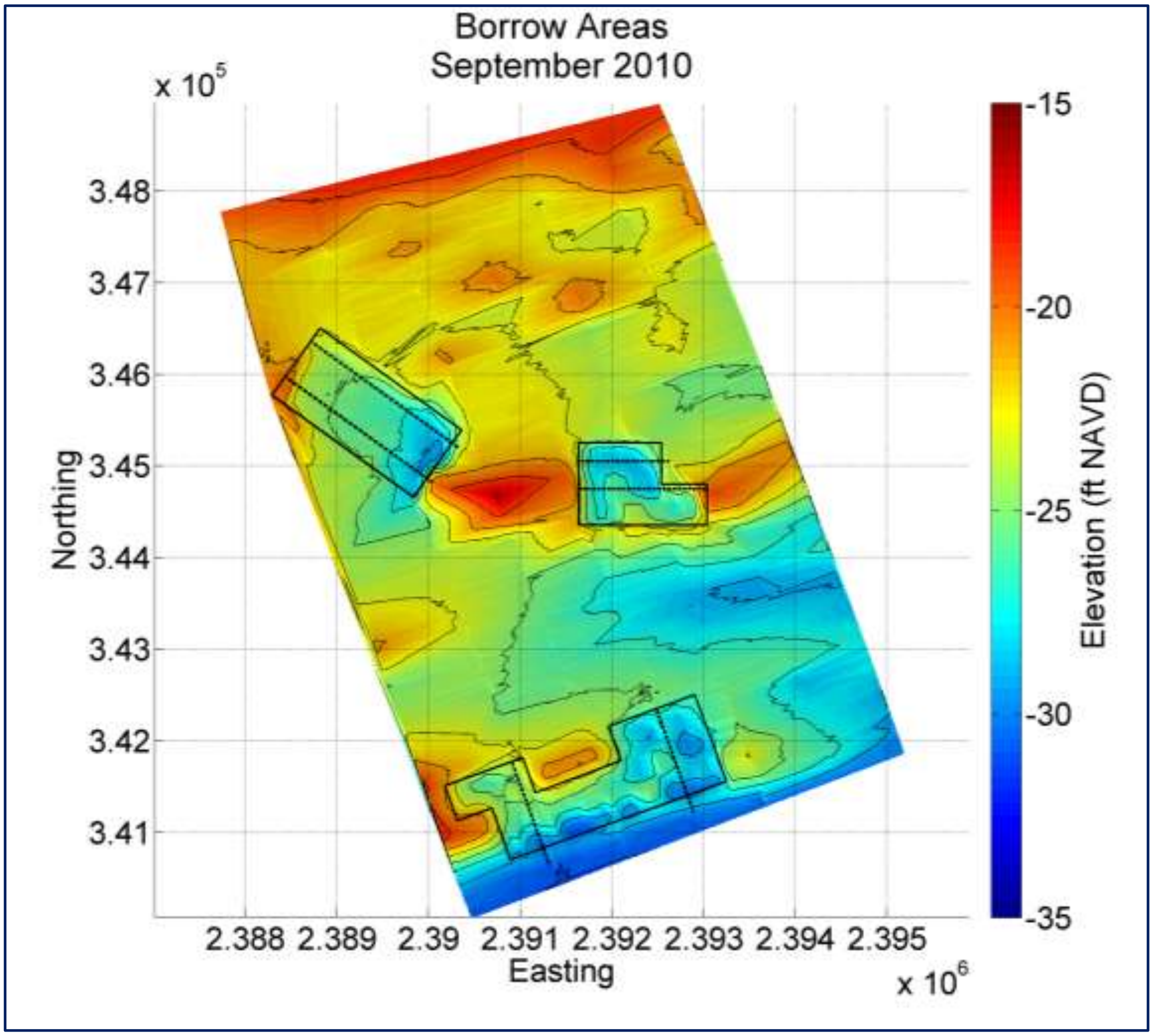


FIGURE 3.46. DTM models of borrow areas in September 2010, ~27 months after nourishment. [Dashed lines are the locations of sections in Figure 3.47.]

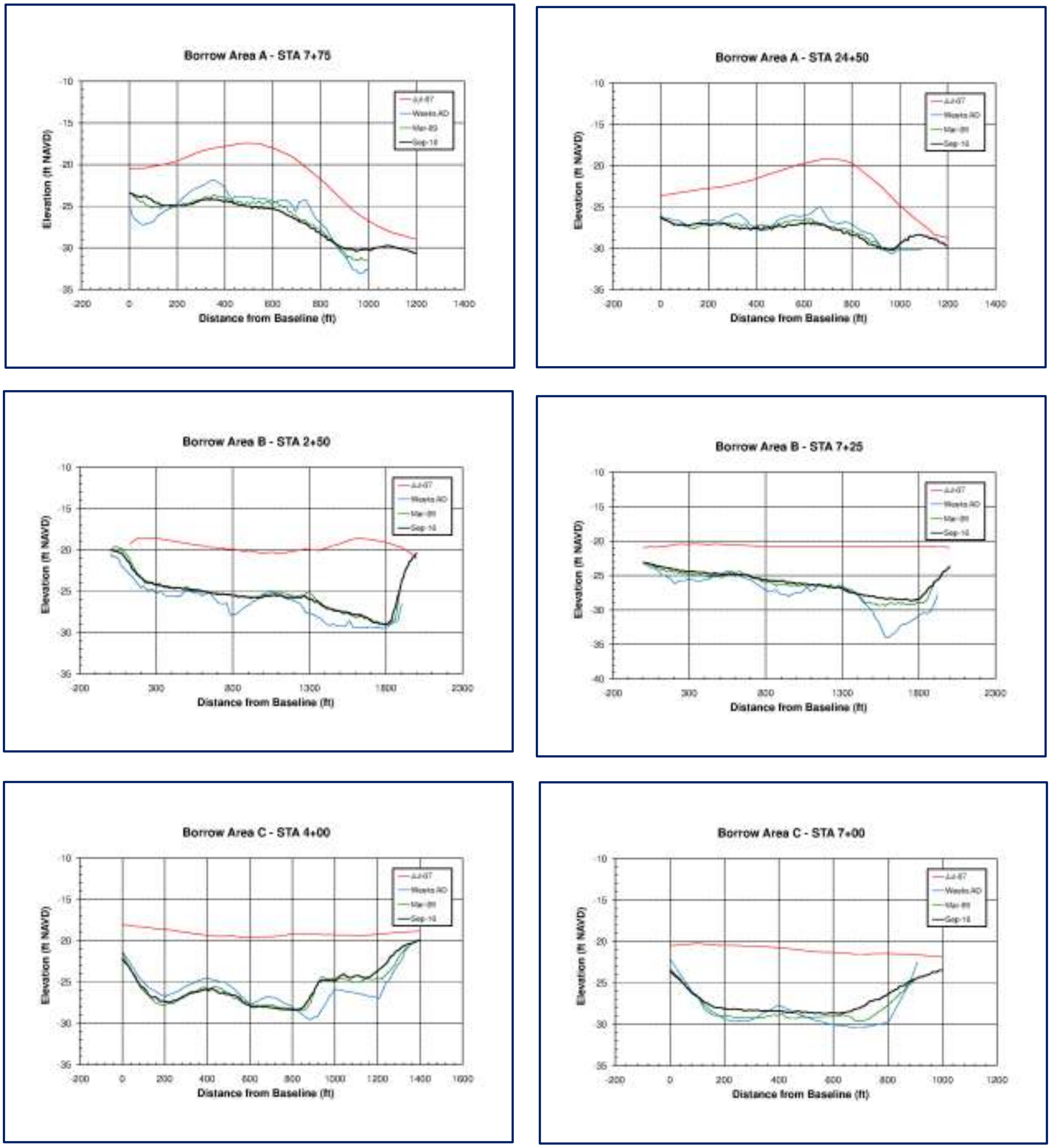


FIGURE 3.47. Profile sections of the three borrow areas used in the 2008 beach restoration project. Locations of profiles are shown in the DTMs of Figures 3.44 through 3.46. Note deeper portions have infilled, whereas some higher areas have eroded. Waves, currents, and gravity act to smooth the bathymetry which was left in an unnatural state after dredging. [AD = after dredging condition survey]

Sediment Quality

Part of the post-project monitoring efforts included collection and analysis of sediment samples over the length of the Isle of Palms. These analyses track changes in the quality of the nourishment sand as the fill continues to adjust and be reworked by waves. Samples were collected immediately post-project in July 2008 and in July 2009 and July 2010. The 2009 and 2010 samples also included stations in the central and southern portions of the island. Samples were collected at five locations in the cross-shore direction (see Section 2 – Methods). Grain-size distribution and descriptive statistics for each sample collected in 2010 are given in Appendix D.

Prior to nourishment, CSE collected native beach samples in the project area for compatibility analyses with nourishment sediments. These results showed a native grain size of 0.253 millimeter (mm) with 11.1 percent (by weight) calcium carbonate ($CaCO_3$). Following nourishment, mean grain size increased to 0.384 mm in the project area (compared to 0.181 mm outside of the project area, Table 3.4). Average mean grain size decreased to 0.287 mm between July 2008 and July 2009, and decreased to 0.265 mm by July 2010. Shell ($CaCO_3$) content increased to 25.2 percent following nourishment, but has since decreased to 13.2 percent in the project area.

TABLE 3.4. Sediment grain size and shell content for the post-project and 1-year and 2-year post-project sediment samples. Both grain size and shell content in the project area have decreased since July 2008, becoming closer to the pre-project values.

Isle of Palms Post Project Sediment Analysis		Jul-08		Jul-09		Jul-10	
		Mean (mm)	% $CaCO_3$	Mean (mm)	% $CaCO_3$	Mean (mm)	% $CaCO_3$
Dune	Non Project	0.164	4.2	0.195	3.0	0.190	3.0
	Project	0.455	24.5	0.269	7.4	0.235	8.0
Mid Berm	Non Project	0.170	2.7	0.213	3.8	0.189	3.4
	Project	0.482	31.1	0.359	24.4	0.307	18.6
Berm Crest	Non Project	0.175	2.8	0.210	5.1	0.191	3.2
	Project	0.408	29.4	0.268	8.4	0.268	13.6
Beach Face	Non Project	0.193	6.3	0.278	12.3	0.232	8.5
	Project	0.332	22.7	0.339	19.5	0.310	14.2
LTT	Non Project	0.201	10.4	0.231	11.5	0.182	8.5
	Project	0.246	18.1	0.198	9.6	0.205	11.5
Cross Shore Average	Non Project	0.181	5.3	0.225	7.1	0.197	5.3
	Project	0.384	25.2	0.287	13.9	0.265	13.2

In the project area, grain size was highest in the upper beach area (dune, mid berm, and berm crest) in July 2008 as wind-blown sand had not accumulated immediately after the project (Fig 3.48). Grain size decreased significantly in each of those areas by July 2009 and continued to decrease in the dune and mid berm through 2010. All portions of the beach profile show finer sand in 2010 than the post-nourishment condition. Finer sand in the upper beach is a result of accumulating wind-blown sediment, whereas finer sand along the beach face and low-tide terrace are a result of waves rearranging sediment to a natural distribution (and input of finer sand from shoal-bypass events). Coarser grain sizes are expected along the beach face, where wave energy is more focused for longer periods of time. The upper beach is expected to continue to become finer as more wind-blown sand accumulates, and high waves and tides deposit finer material on the upper beach.

The initial increase in grain size and shell content was expected as the fill material was slightly coarser and contained a higher percentage of shell than the native material. The coarser fill was placed to prolong the life of the nourishment, since larger grain sizes are more slowly eroded (Dean 2002). Sediment characteristics would be expected to eventually stabilize in the project area. However, recurring shoal-bypass events introduce new sand into the system and redistribute sediment along the beach. Thus, sediment texture at any given location will be influenced by shoal-bypassing events as well as the nourishment project.

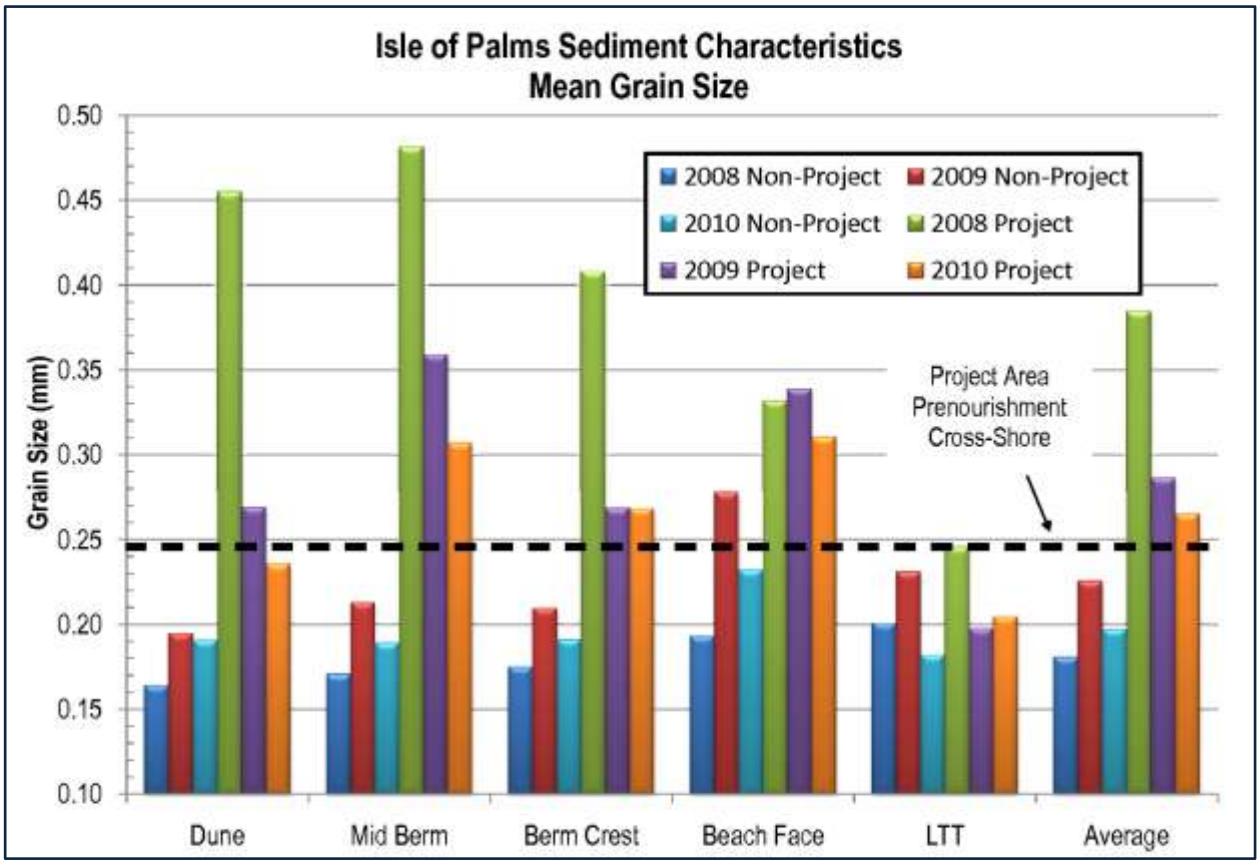


FIGURE 3.48. Cross-shore, grain-size distribution for Isle of Palms following the 2008 restoration project. Note how the upper beach became finer between 2008 and 2009. This is an expected trend associated with accumulation of wind-blown sand.

Figure 3.49 shows the distribution of grain sizes and shell content over the length of the Isle of Palms. It is apparent from the graph that grain size is coarser at the northeastern end and tends to become finer in the downcoast direction (toward Breach Inlet). Finer grain sizes are more easily eroded and transported by wave action, and it follows that finer material can travel farther than coarser material under similar wave energy. The northeastern end is the sediment source for the rest of the island; therefore, finer material is eroded from the northeastern end and moves downcoast. Over time, it produces an alongshore gradient of mean grain size.

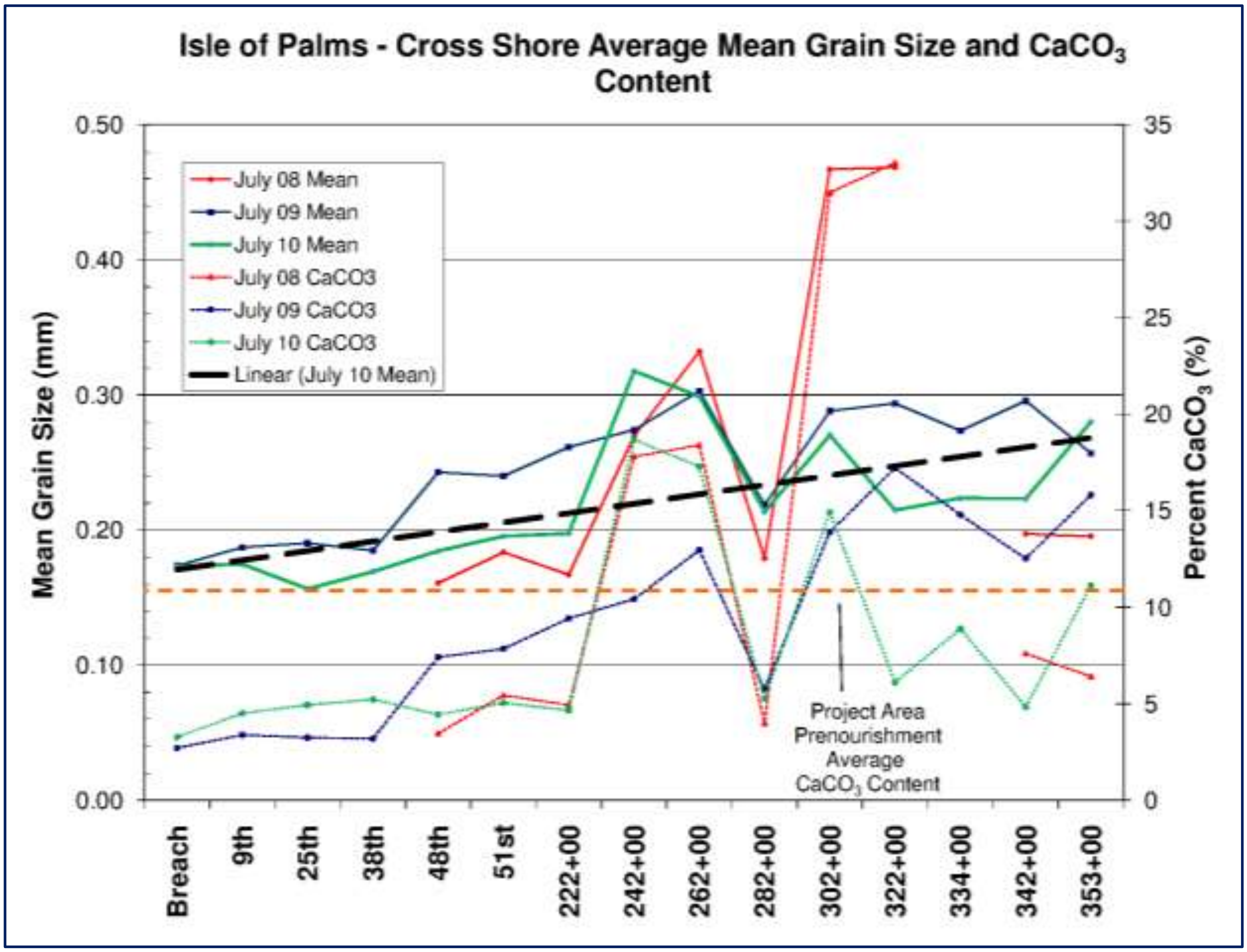


FIGURE 3.49. Alongshore distribution of average grain size (cross-shore average at each station). It is apparent from the graph that sediment becomes finer toward Breach Inlet. This is a function of nourishment sand being slightly coarser than the native sand supply as well as normal longshore transport of finer sand away from the northeastern end.

Compaction

The nourishment area was tilled in early July 2008, following completion of pumping. CSE measured sediment compaction in February 2010 at 500-ft intervals in the project area and surrounding areas (to establish a native value). Compaction measurements are provided in Appendix B. In portions of the project area, compaction values measured in 2010 were higher than the threshold set in the permit special conditions to trigger tilling. These areas were selectively tilled, avoiding vegetation and areas of active dune building. Results were sent to USFWS and SCDHEC-OCRM. Compaction measurements will be repeated in early 2011.

3.6 Sand Fencing/Dune Growth

Installation of sand fencing was included in the project design in areas lacking existing dunes or vegetation. Fencing was installed in May 2009 between Beach Club Villas and Ocean Club as well as along the Dewees Inlet shoreline. Fencing was installed in "v-shaped" sections spaced ~10 ft apart (Fig 3.50). Dune vegetation was also installed in a 15-ft-wide swath surrounding the fencing. Sand fencing aids in dune building by accumulating wind-blown sand. Vegetation also acts to block wind and accumulate sand. While vegetation would naturally spread to the nourished areas, which would then begin to build dunes, installation of the fencing and vegetation speeds the process. A desirable goal is to build a dune line along the back beach as high and wide as possible to provide storm protection to buildings. A secondary benefit is creation of habitat for beach organisms.

As of February 2011, the sand fencing had accumulated over 2 ft of sand in many areas. The fence is expected to continue to trap sand as long as the areas are fronted by an area of dry-sand beach and are not regularly impacted by overwash. It is very likely that natural vegetation and dune growth will occur in nourishment areas seaward of the fencing, where a large platform of dry berm is situated between the fencing and the normal high-tide limit.

In areas of the island already possessing dunes and/or vegetation (nourished and unnourished areas), natural dune building was evident in many of the profiles. Of particular interest is the area in front of the Wild Dunes Grand Pavilion, which has lower and narrower dunes than most other areas of the island. Profile 248 shows that the dune there has grown ~0.5 ft between March and September 2009, and almost 2 ft since March 2008—the pre-nourishment condition (Fig 3.51). Dune growth at this location may slow as sand fencing and vegetation located seaward of the current foredune becomes more established and intercepts sand moving across the dry beach. It is preferable to allow natural dune building at the most landward portion of the dry beach possible. This will allow formation of a larger dune in a more stable area. CSE would recommend future fencing location be evaluated prior to installation to encourage maximum dune growth at stable locations.

FIGURE 3.50. [LEFT] Sand fencing in Reach 5 in February 2011. Less sand has accumulated in this area than in Reach 6. **[RIGHT]** Sand fencing and vegetation in Reach 6 (near Port O Call) in February 2011, ~22 months after installation. Over 2 ft of sand has accumulated in a generally continuous dune.

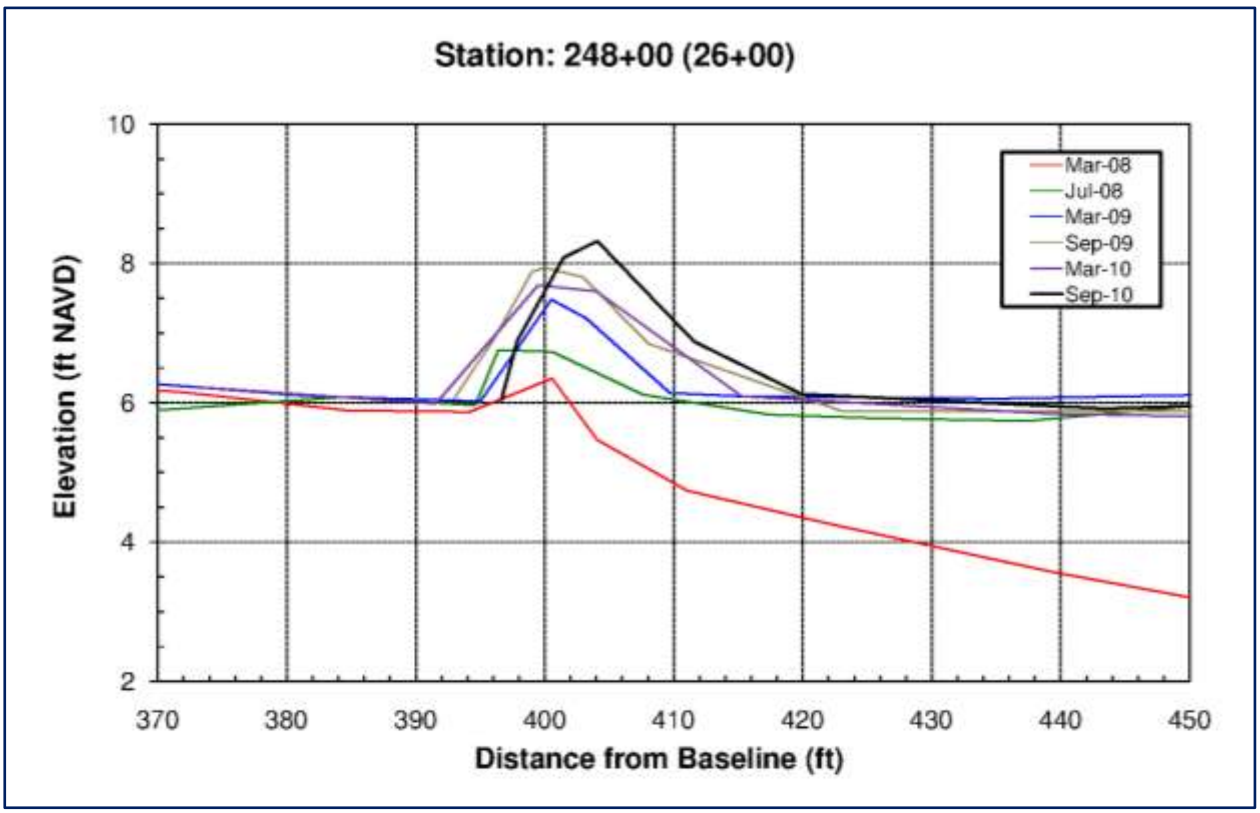


FIGURE 3.51. Evidence of dune growth at station 248+00 (adjacent to the Wild Dunes Grand Pavilion) following nourishment (May-June 2008). Elevation of the dune has increased ~2.5 ft naturally since the pre-project condition. Dune growth may slow in this area as the dune further seaward (at the sand fencing) becomes larger, intercepting more sand.

4.0 DISCUSSION AND RECOMMENDATIONS

Monitoring efforts conducted before and after the 2008 beach restoration project at the Isle of Palms show that the condition of the beach over the entire island is dependent on the release of sand from the Dewees Inlet ebb-tidal delta. Periodically, sand in the downcoast portion of the delta is worked by waves into an exposed shoal, which then migrates landward until and attaches to the beach. The shoal acts as a breakwater, causing the beach to build out in its lee. Sand accumulation in the lee of the shoal is produced through erosion of sand from adjacent areas. This process accounts for rapid shoreline changes, often measuring several hundred feet, while the shoal is migrating to the beach.

While offshore, the shoals interrupt normal sediment transport to downcoast areas, leaving the rest of the island deprived of sand. Once attached, sand spreads to eroded areas, and longshore transport is restored to the rest of the island. The extreme erosion and accretion associated with shoal-bypass events is temporary. In the long term, each event adds sand to the system and is responsible for the historical accretion observed over the length of the island.

CSE has obtained seven detailed topographic data sets since 2007, when the severely eroded condition of the beach at the northeastern end of the island led the community to begin looking for a solution to the erosion problem. These data offer a detailed description of the morphology of the Dewees Inlet delta and changes in the size and position of the delta shoals. Surveys of the inlet are the key prerequisite for prediction of future changes along the beach at the Isle of Palms.

Beach profiles, collected as part of the monitoring, detail volume changes in the 2008 project area before and after nourishment. They also provide analyses of the beach condition for the rest of the island, outside of the project area. The underlying theme suggested by the data is that while shoals are migrating onshore, erosion occurs in the adjacent areas, and sediment transport to downcoast areas is interrupted. Once attached, sand from the shoal restores eroded areas, and sediment transport is restored to downcoast areas.

Significant findings of the present report are highlighted below:

- Between September 2009 and March 2010, the area north of 53rd Avenue was moderately erosional, losing 126,700 cy (8.5 cy/ft). The area stabilized between March and September 2010, gaining ~5,000 cy (0.3 cy/ft).

- Areas which had lost the most sand following nourishment, such as Beachwood East and Ocean Club, were stable to accretional from March 2010 to September 2010.

- Two shoal-bypass events of moderate scale have occurred since completion of the 2008 beach restoration project. The "2009" shoal encompassed an estimated 300,000 cy whereas the "2010" shoal contained ~100,000 cy.

- The smaller shoal ("2010") fully attached by September 2010.

- No new emergent shoals were visible as of September 2010, however, the sand platform extending from the beach remains a dominant underwater feature. It is expected to provide an ongoing sand source for more shoal-bypassing events in the next several years.

- The outer shoal of the 2007 Dewees Inlet main channel has migrated ~630 ft/yr to the southwest, and is beginning to merge with the existing sand platform attached to the beach, essentially closing the old main channel. The outer shoal should continue to merge with the attached sand platform over the next year, and will likely begin migrating landward. It is clear that a channel avulsion event is occurring, and a large quantity of sand is in the process of migrating towards the beach. CSE expects to see changes in the beach associated with the avulsion event beginning within the next two years.

- It is presently unclear how the channel avulsion event compares to a similar event observed in the 1940s–1950s. It is possible that major morphological changes including formation of a barrier beach/lagoon system around the northeast end of the Isle of Palms may occur over the next decade as a new inlet channel matures.

- Breach Inlet appears to be undergoing a channel avulsion event as well, with a secondary ebb channel evolving to the southeast of the existing main channel by way of a break through the outer bar of the delta. This should have relatively little impact on the Isle of Palms, but illustrates the similarity in processes occurring at each island.

The present monitoring effort focused on changes in the shoals of Dewees Inlet and Breach Inlet. CSE's surveys involved closely spaced transects in these areas so that DTMs (contour maps) could be developed. Six detailed maps of Dewees Inlet (encompassing the period July 2007 to September 2010) confirm the changes described above.

Few inlets in the United States have been surveyed in such detail to document rates of change in the shoals and channels of ebb-tidal deltas. CSE surveys on the updrift side of Breach Inlet similarly provide clearer evidence of channel shifts that encroach on the Isle of Palms or that release sand bars for migration and attachment to the beach.

CSE's 2010 surveys confirm that:

- About 72 percent of the nourishment volume remains within the fill placement limits. Much of the "lost" volume is accounted for in the buildup downcoast.

- Within the project area, the general trend was erosion along the oceanfront between September 2009 and March 2010, and stability or accretion from March 2010 to September 2010. Only Reach 6 (northern half of the Wild Dunes area) was erosional from March 2010 to September 2010, losing ~3.6 cy/ft. That loss was concentrated at the southern end of the reach, which still maintains at or near the post-nourishment quantity.

- Areas south of 53rd Avenue gained ~213,000 cy (9.6 cy/ft) of sand between September 2009 and September 2010, which is higher than the average gain of 2.7 cy/ft between 1998 and 2010.

- Overall, the entire Isle of Palms beach gained 91,127 cy (2.5 cy/ft) of sand between September 2009 and September 2010.

Seascape, the Ocean Club, and the 18th fairway areas bear close monitoring because of the continuing changes in Dewees Inlet. Erosion losses in this area are primarily due to the post-nourishment shoal-bypass events, though since March 2010, the area has been stable. Sand eroded from the bulge off the Wild Dunes Property Owners Beach House is now migrating into the area at a rate which keeps pace with erosion losses. Another factor acting on the Ocean Club locality is enlargement of the secondary ebb channel of the inlet. The channel opens northeast of Ocean Club, thus exposing the shoreline to higher wave energy at present.

CSE believes that wave propagation through the secondary channel toward Ocean Club, the 18th hole, and nearby areas will change in relation to channel development and the evolution of the new outer bar. The combination of wave refraction around the shoal platform off the Wild Dunes Property Owners Beach House and wave diffraction through the secondary channel are the underlying reasons for irregular shoreline changes along Wild Dunes. Variations in wave energy and sediment transport inside the Dewees Inlet ebb-tidal delta are the root cause of the erosion and deposition patterns observed in this area of coast over the past 30 years. Any mitigation measures for dealing with short-term erosion events should seek to work in concert with the controlling wave and sediment-transport processes, recognizing that some of the natural controls dwarf all emergency beach restoration measures to date.

Status of Permit Compliance Measures

Borrow area surveys were completed in March and September of 2009 and 2010, and will be continued in 2011. Results are included in this report and will be submitted to US Army Corps of Engineers (USACE) and National Marine Fisheries Service (NMFS).

Beach compaction measurements were taken, and results were submitted to US Army Corps of Engineers and US Fish and Wildlife Service. The beach was tilled in selected areas per specifications of USFWS. Compaction measurements will be repeated prior to turtle nesting season in 2011 in accordance with permit conditions.

Beach and offshore benthic surveys were discontinued in 2009 at the suggestion of resource agencies. Results of all surveys to that point were submitted to agencies. The City has fulfilled its obligations regarding benthic surveying associated with the 2008 nourishment project.

Recommendations

CSE recommends that the City continue to pursue a permit application to transfer sand from the shoal-attachment area to eroded areas. As of this writing, regulatory agencies have received public comments and are in the process of compiling the comments for review by the City. All required application documents have been submitted to the appropriate agencies.

The City should continue monitoring efforts similar to what is presented in this document. As the channel-avulsion event progresses, consideration should be given to increased monitoring of certain affected areas. Quarterly or semi-annual monitoring of the upper and intertidal beach and/or the underwater profile may be warranted if conditions change rapidly along portions of the beach as a result of shoal attachment.

At the present time, CSE does not recommend remedial action (even if the permits were in hand) because the next cycle of shoal bypassing is not clear. Also, as of September 2010, the 100-ft trigger established in the permit application has not been met. CSE recommends close observation of the channel-avulsion event and the impact it has on the shoreline around Ocean Club and the 18th fairway.

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ACKNOWLEDGMENTS

This report is prepared under an agreement between the City of Isle of Palms (IOP) and CSE. It is the second of a series of annual reports following the 2008 beach restoration project at the north-eastern end of the island.

CSE thanks the IOP City Council (Mayor Dick Cronin), Linda Lovvorn Tucker (City Manager), and Emily Dziuban (Assistant to the Administrator) for their support and coordination of this project. We also thank the City's consulting coastal engineer, Christopher P Jones (PE), for his assistance, review of the report, and condition photographs.

SCDHEC – Office of Coastal Resource Management (c/o Bill Eiser) provided historical profiles collected by Coastal Carolina University, which were incorporated into CSE's island-wide analysis. We also thank officials and staff at SC Department of Natural Resources, US Army Corps of Engineers, and US Fish & Wildlife Service for their review and comments on certain compaction results and environmental reports prepared in connection with the project.

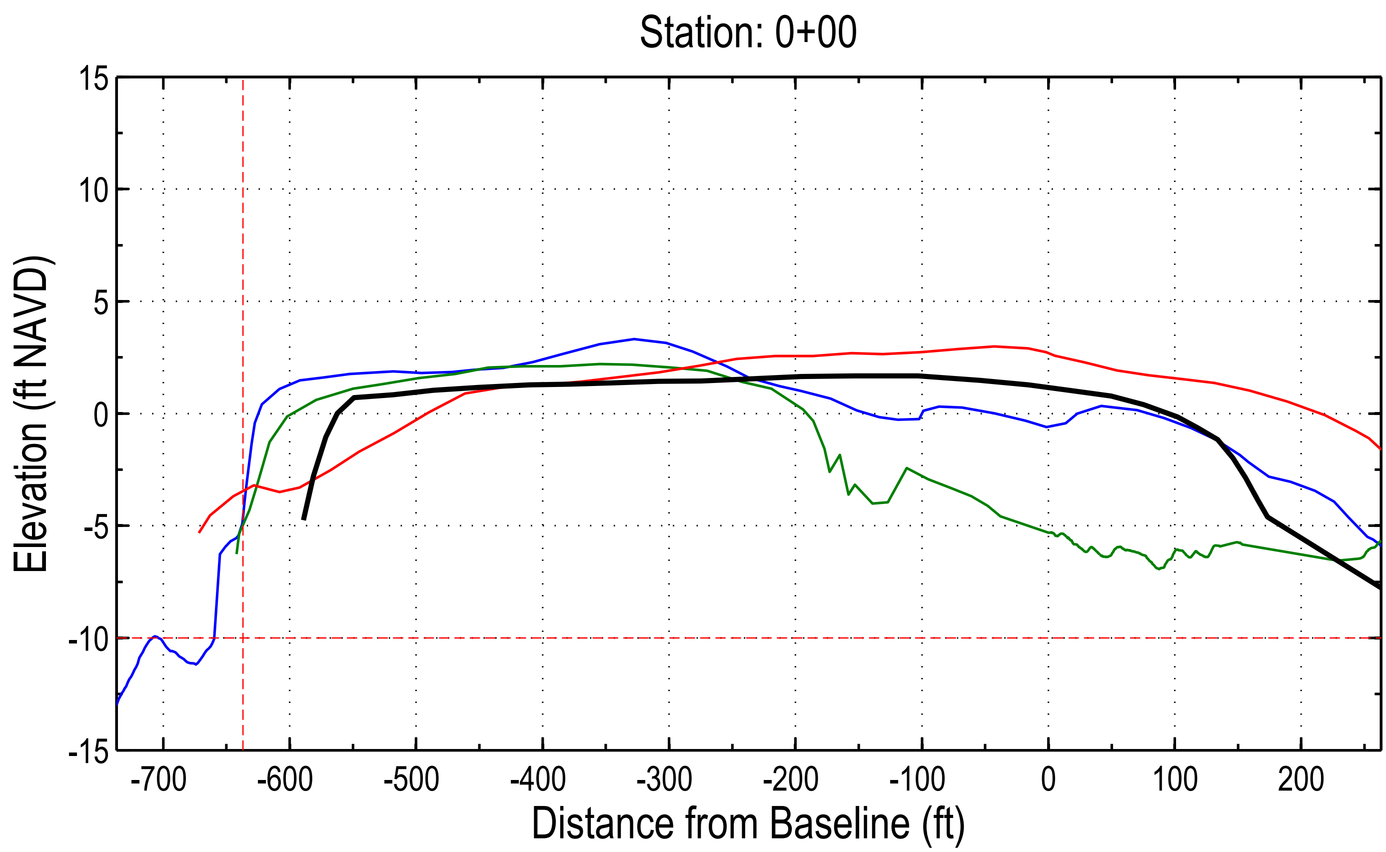
CSE's data collection and analyses were directed by Steven Traynum with assistance by Philip McKee, Trey Hair, and Tim Kana. Graphics were prepared by Trey Hair and Steven Traynum using AutoCAD® Civil 3D® and MATLAB® for digital terrain models. The report was written by Steven Traynum and Dr. Timothy Kana (SC PG 564) with production assistance by Diana Sangster and Trey Hair.

APPENDIX A

Representative Profiles

September 2010

[Isle of Palms – Year 2]



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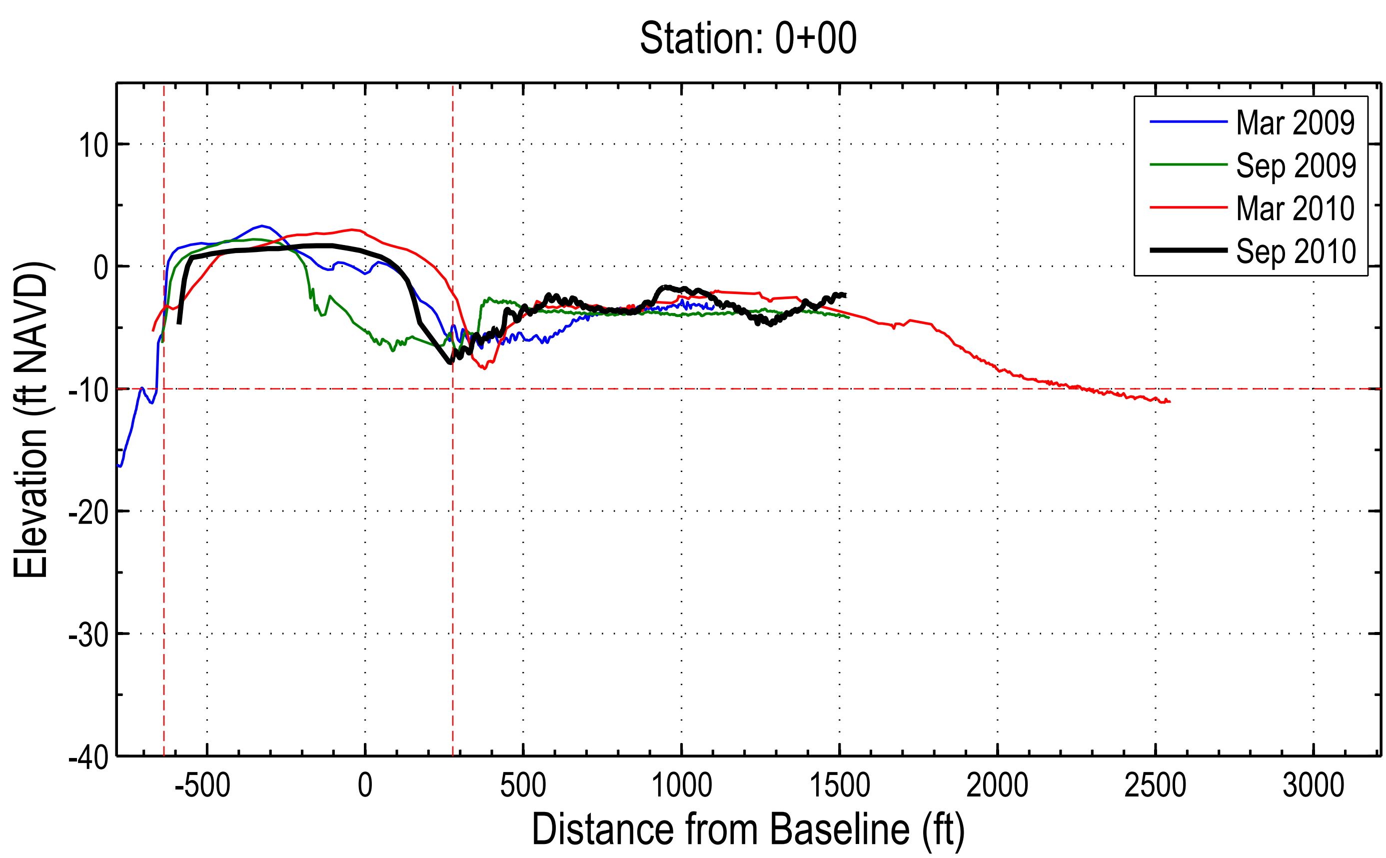

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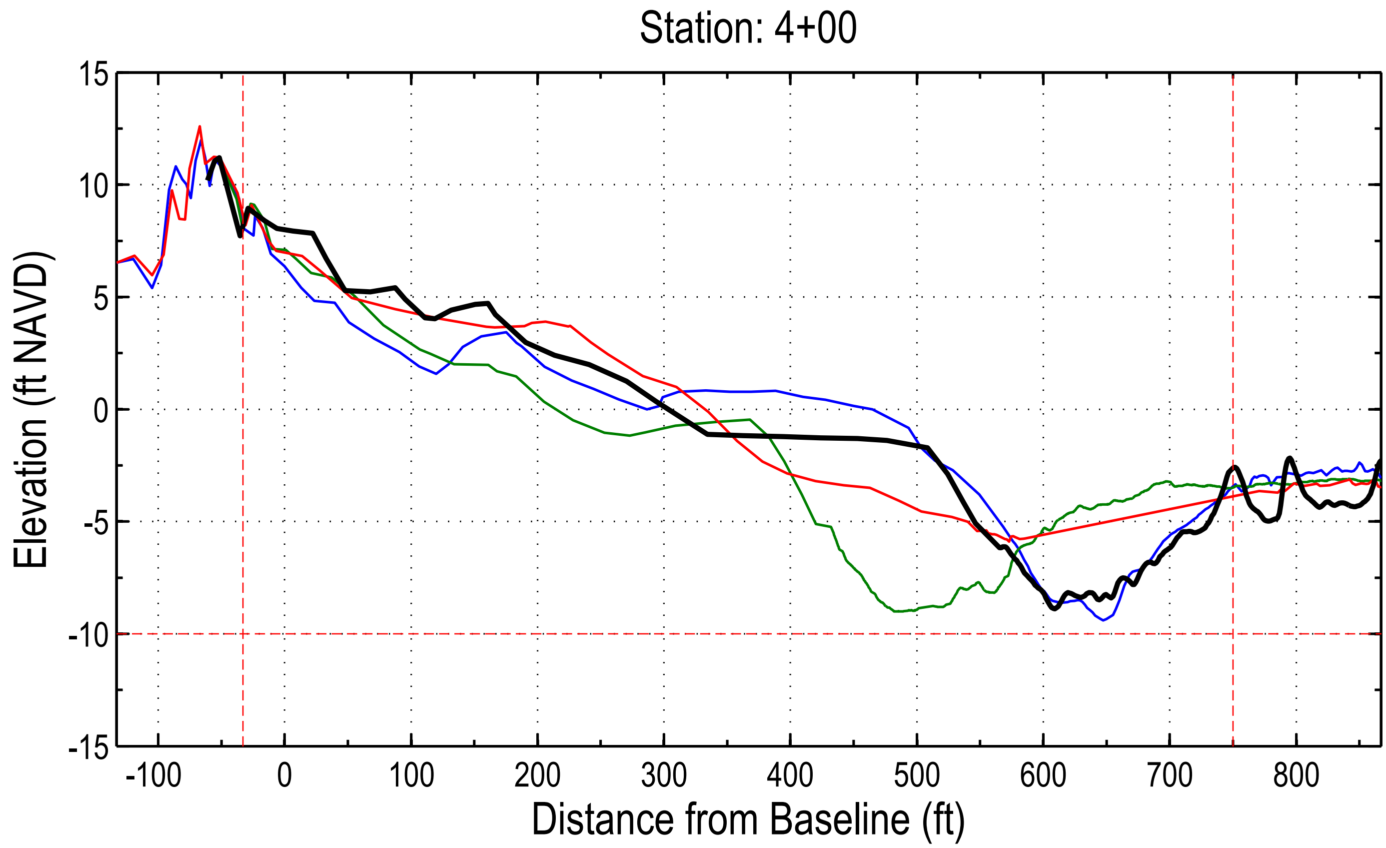

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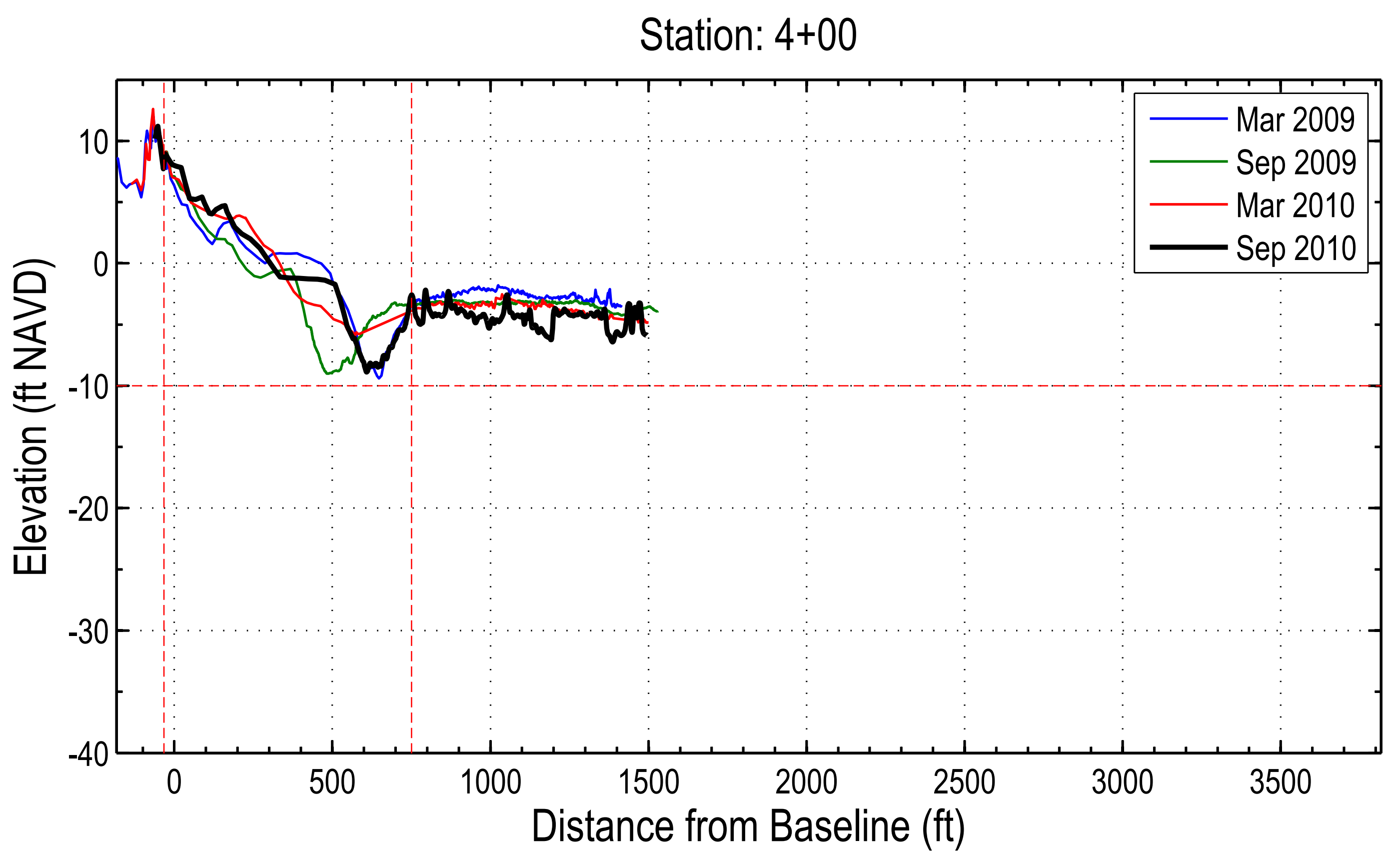

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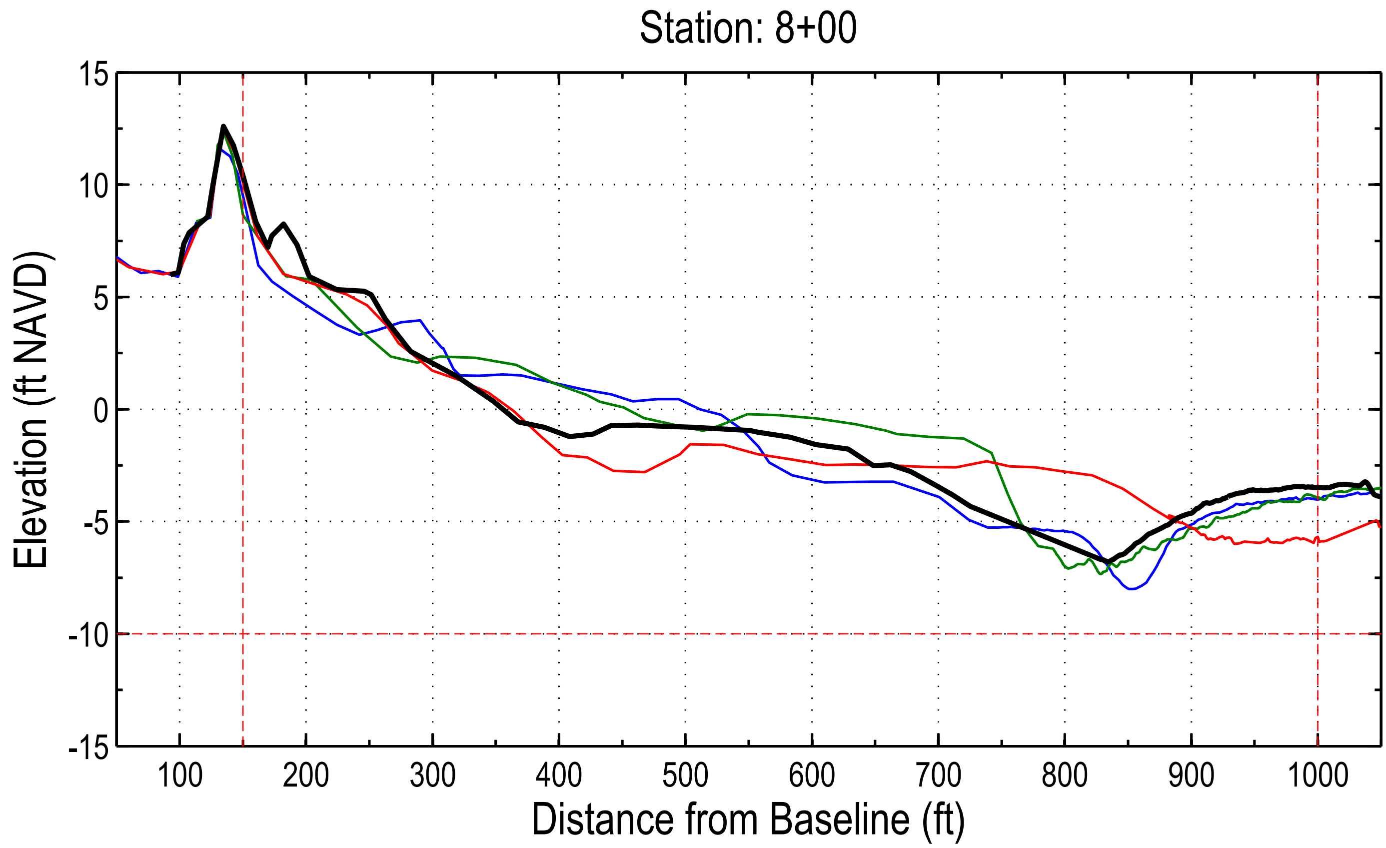
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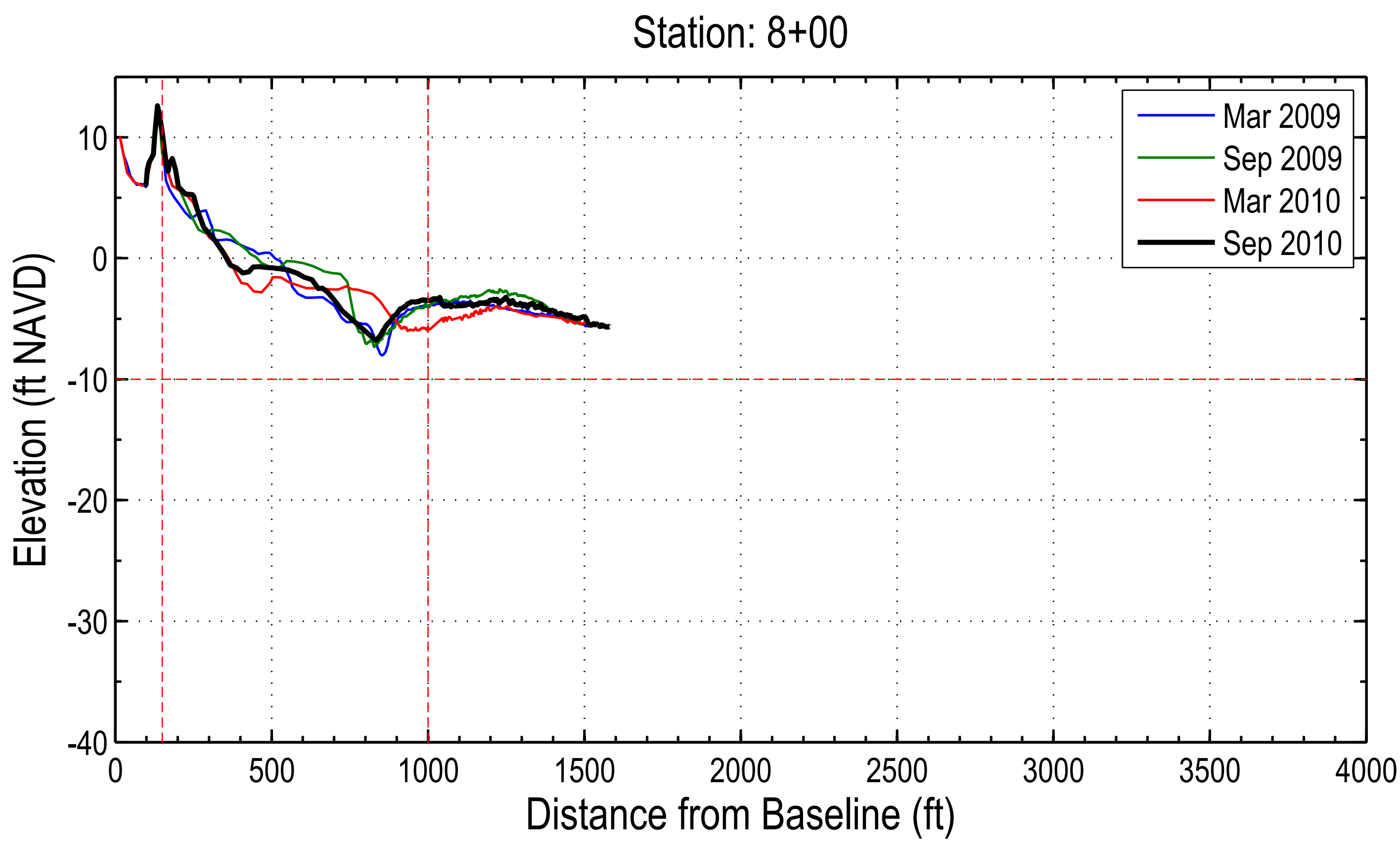
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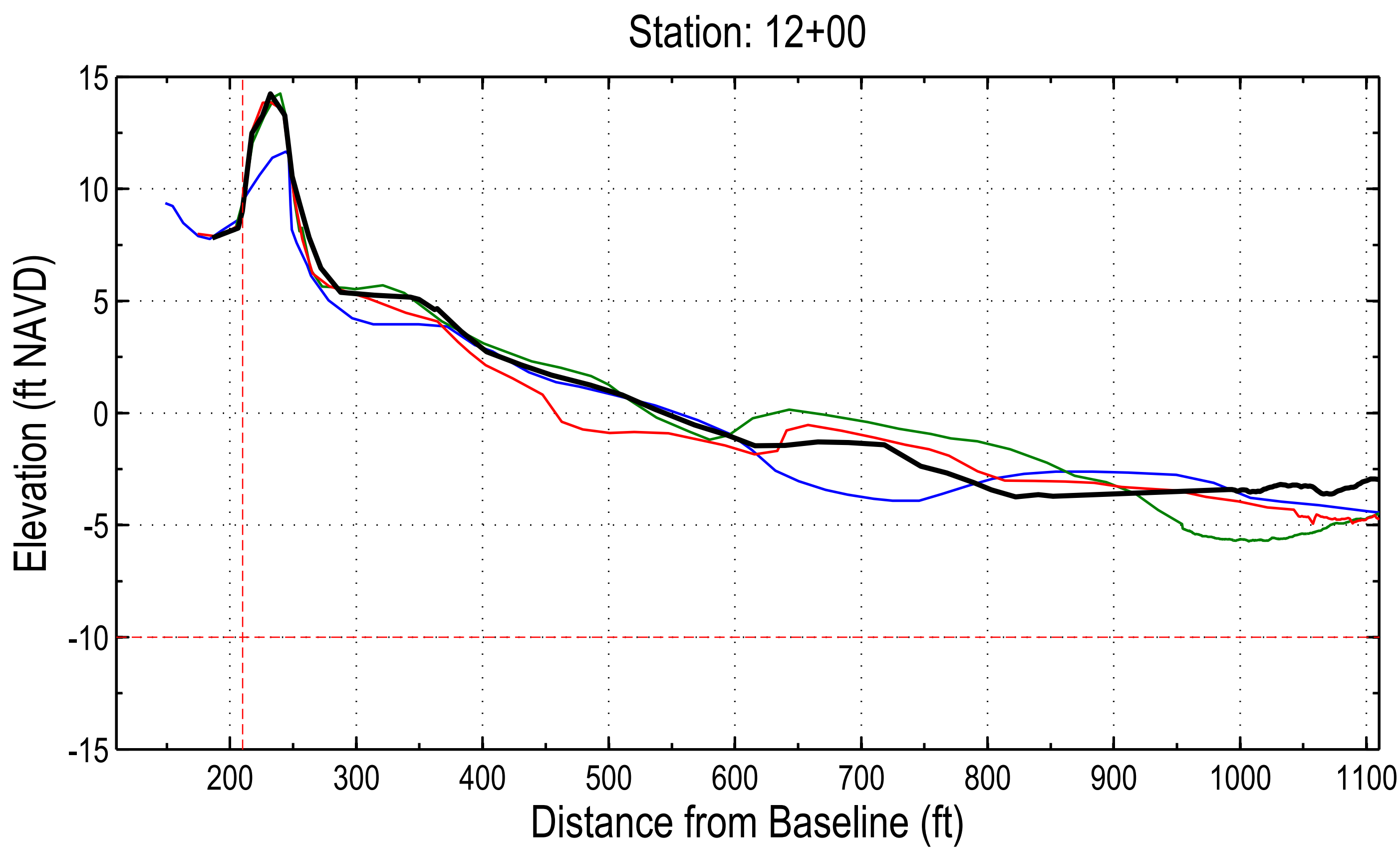
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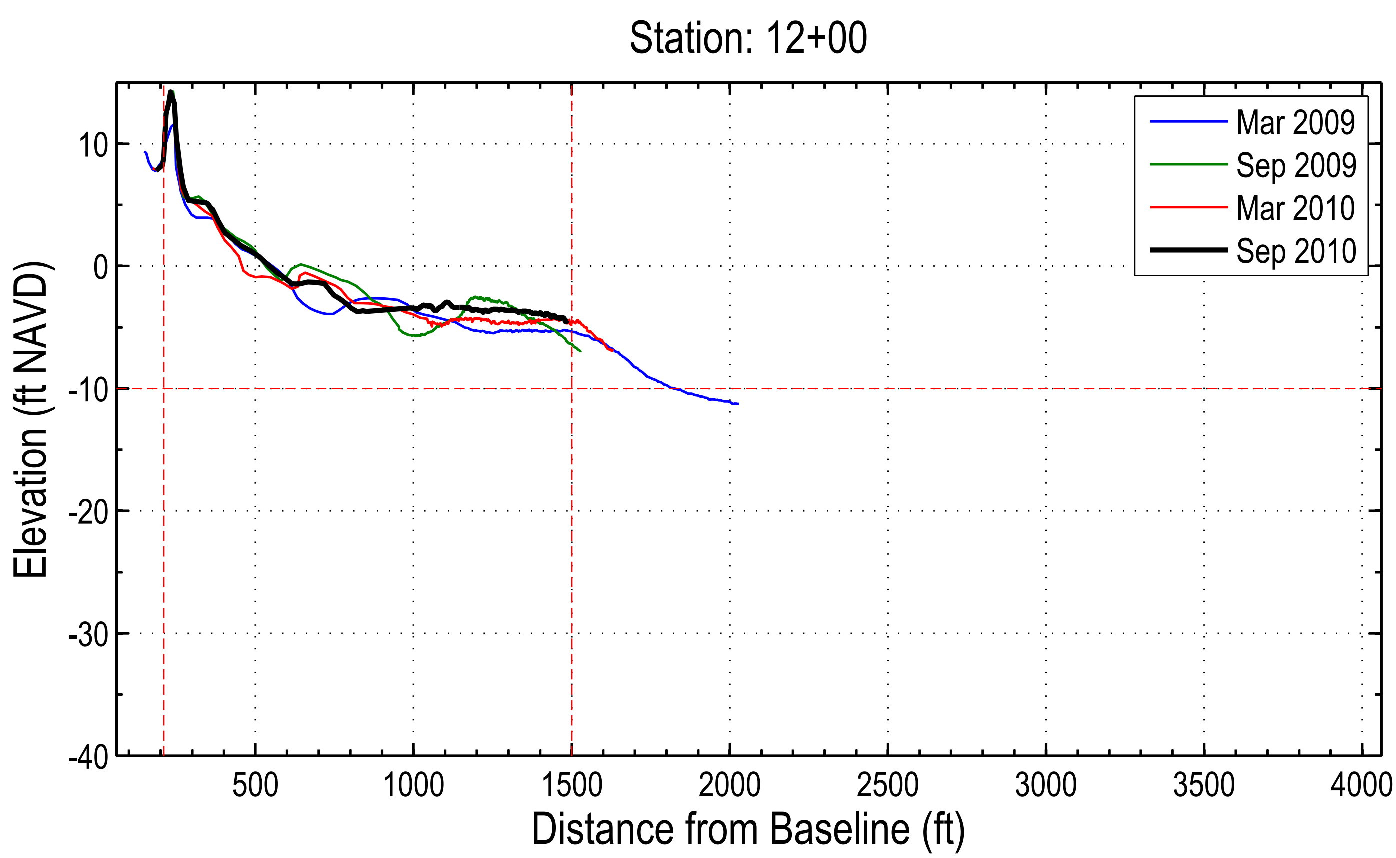
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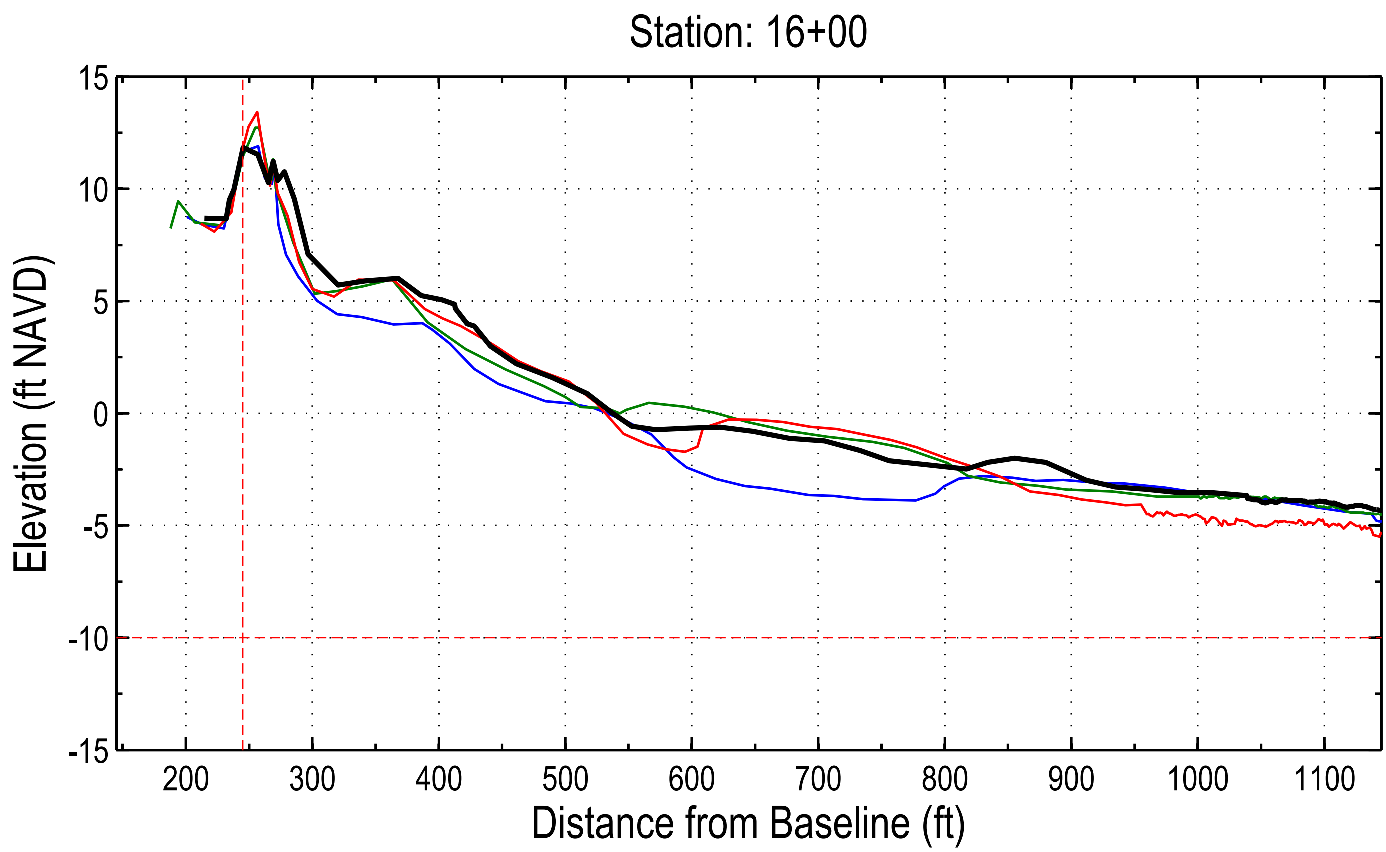
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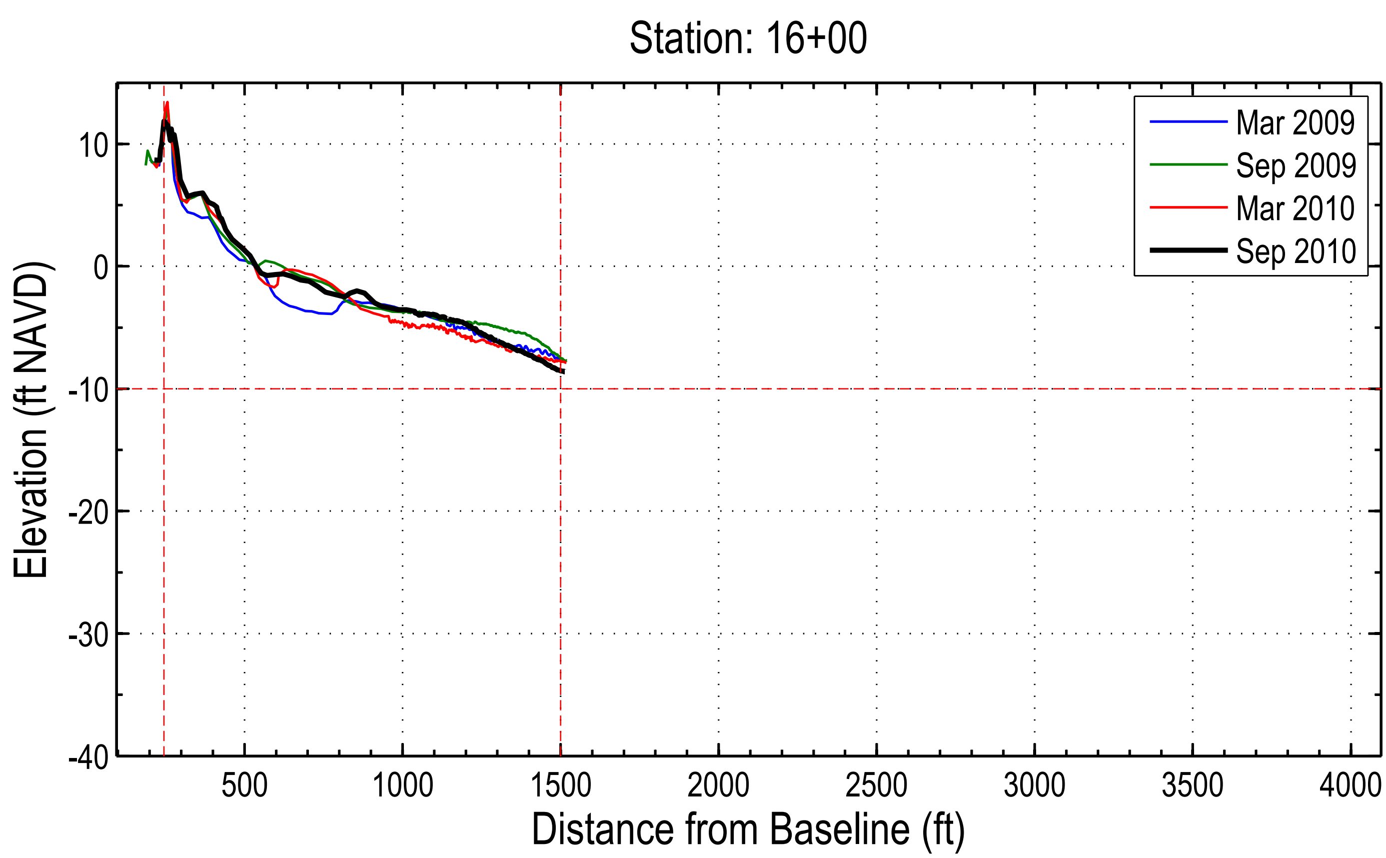
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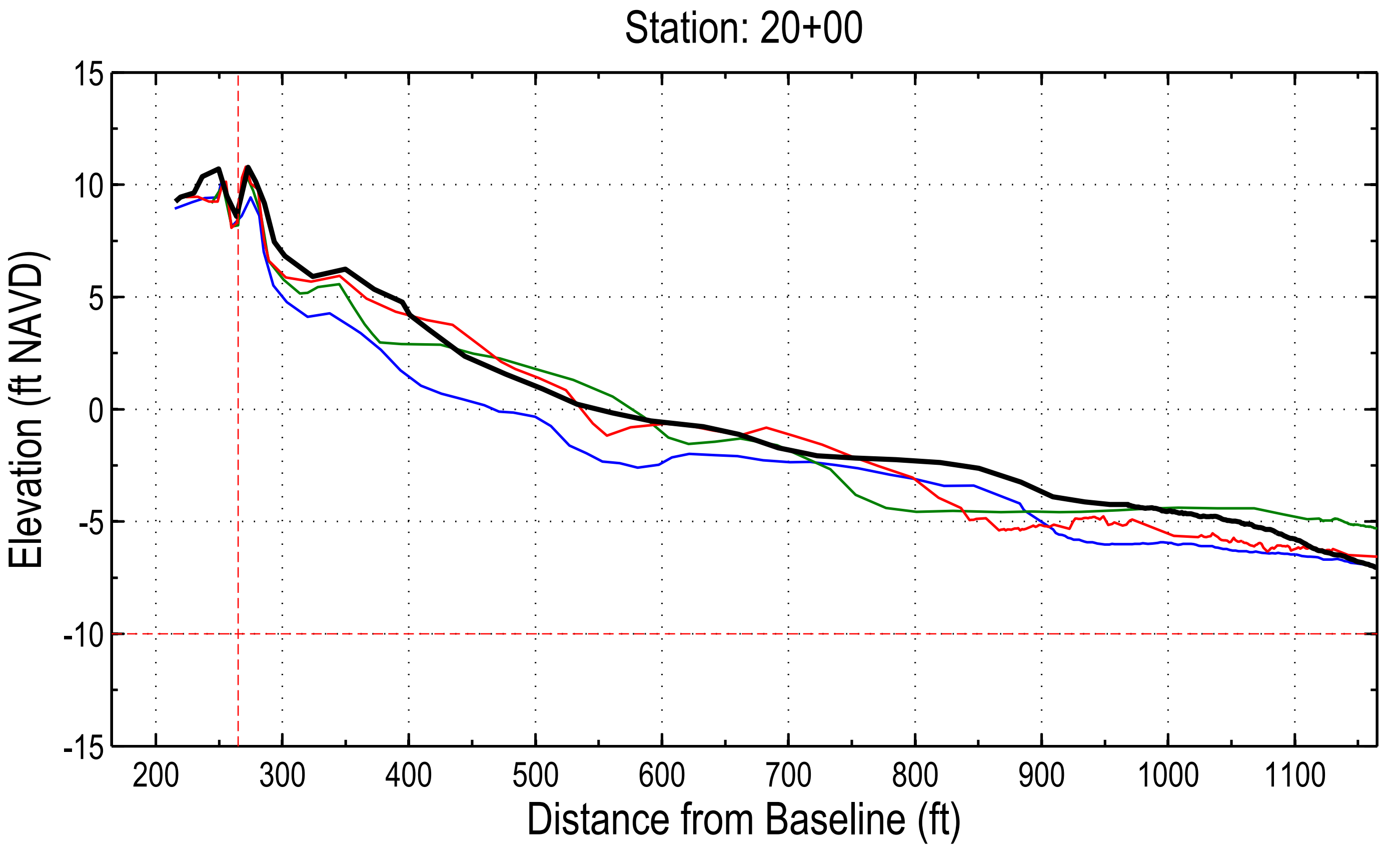
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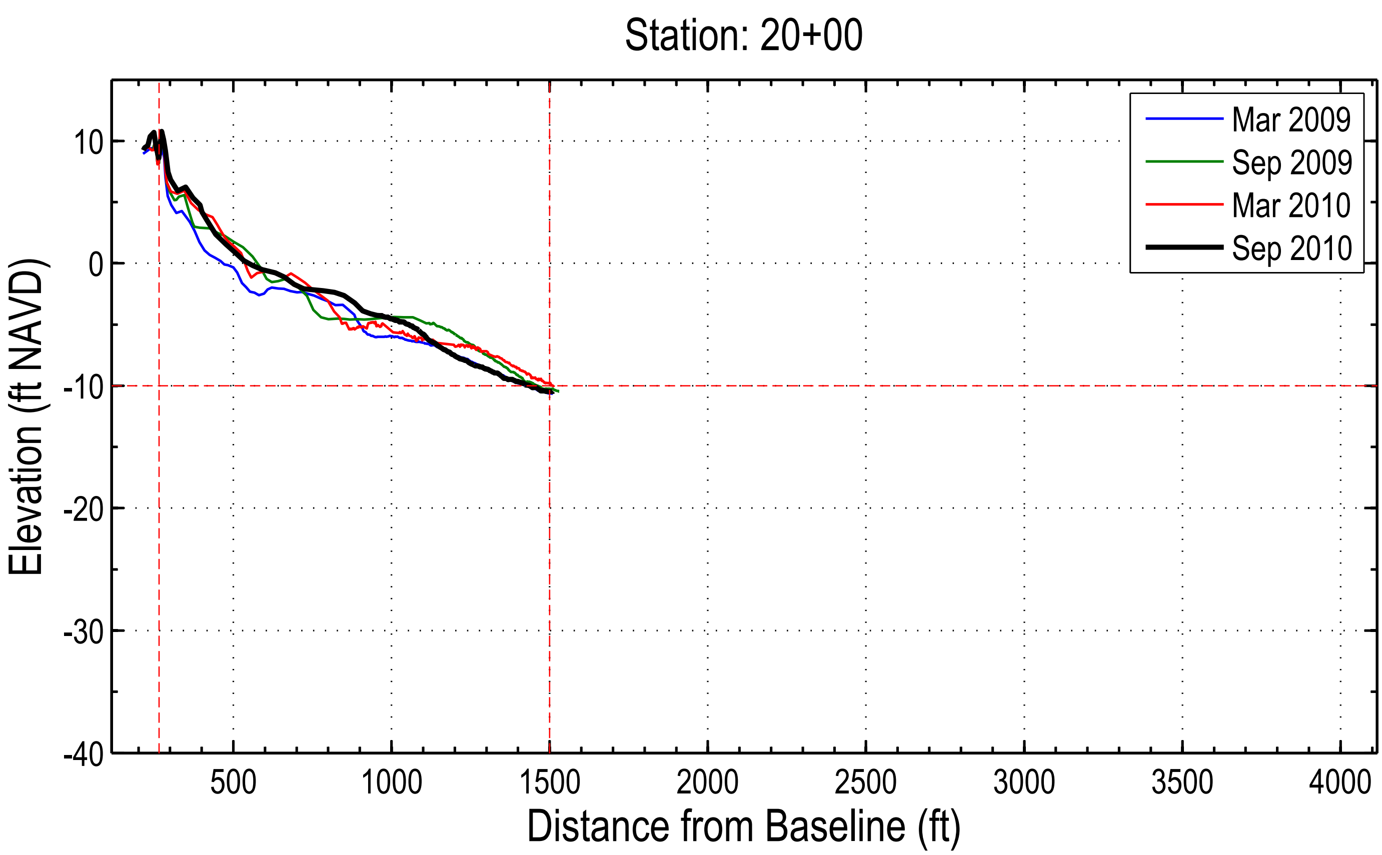
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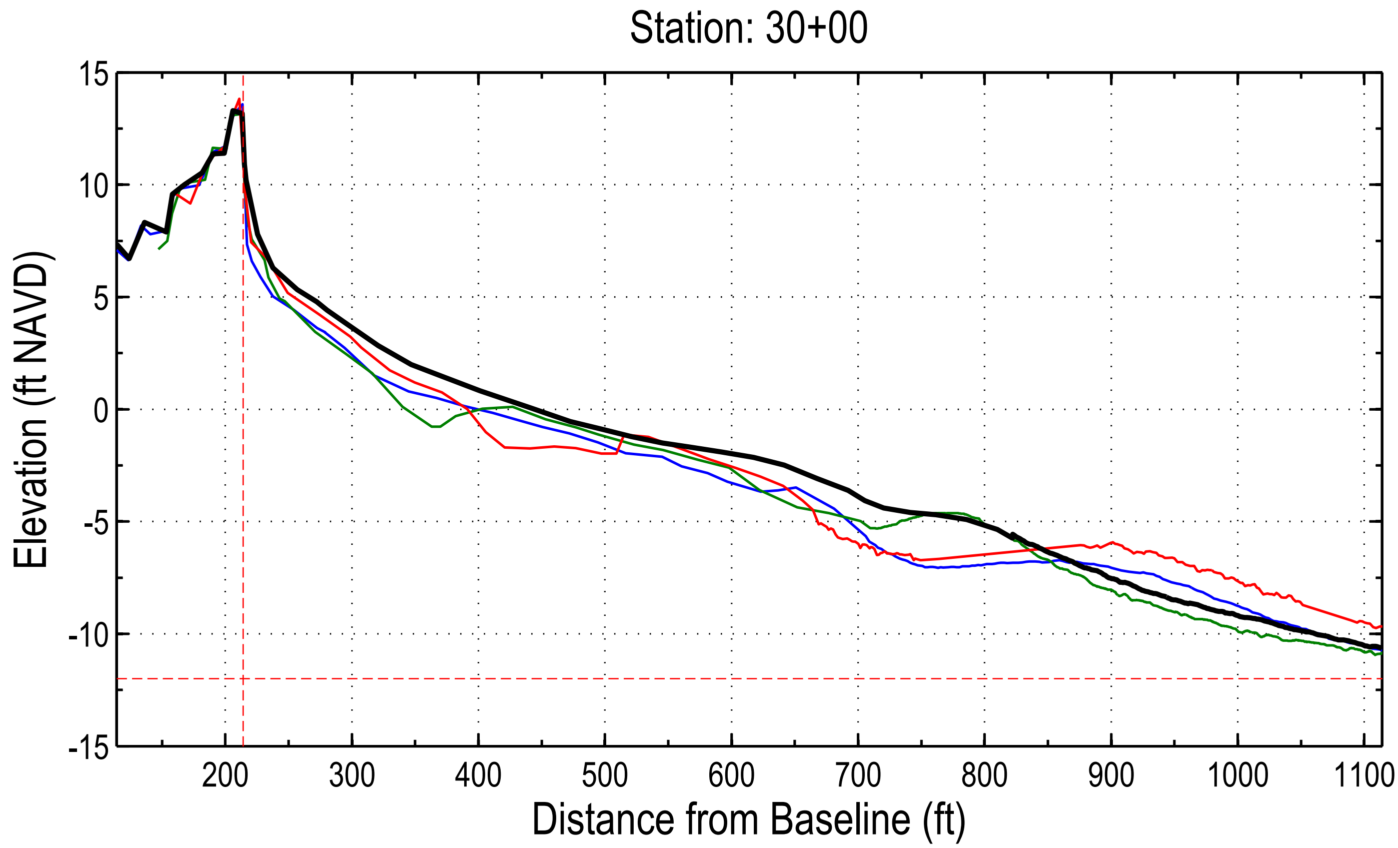
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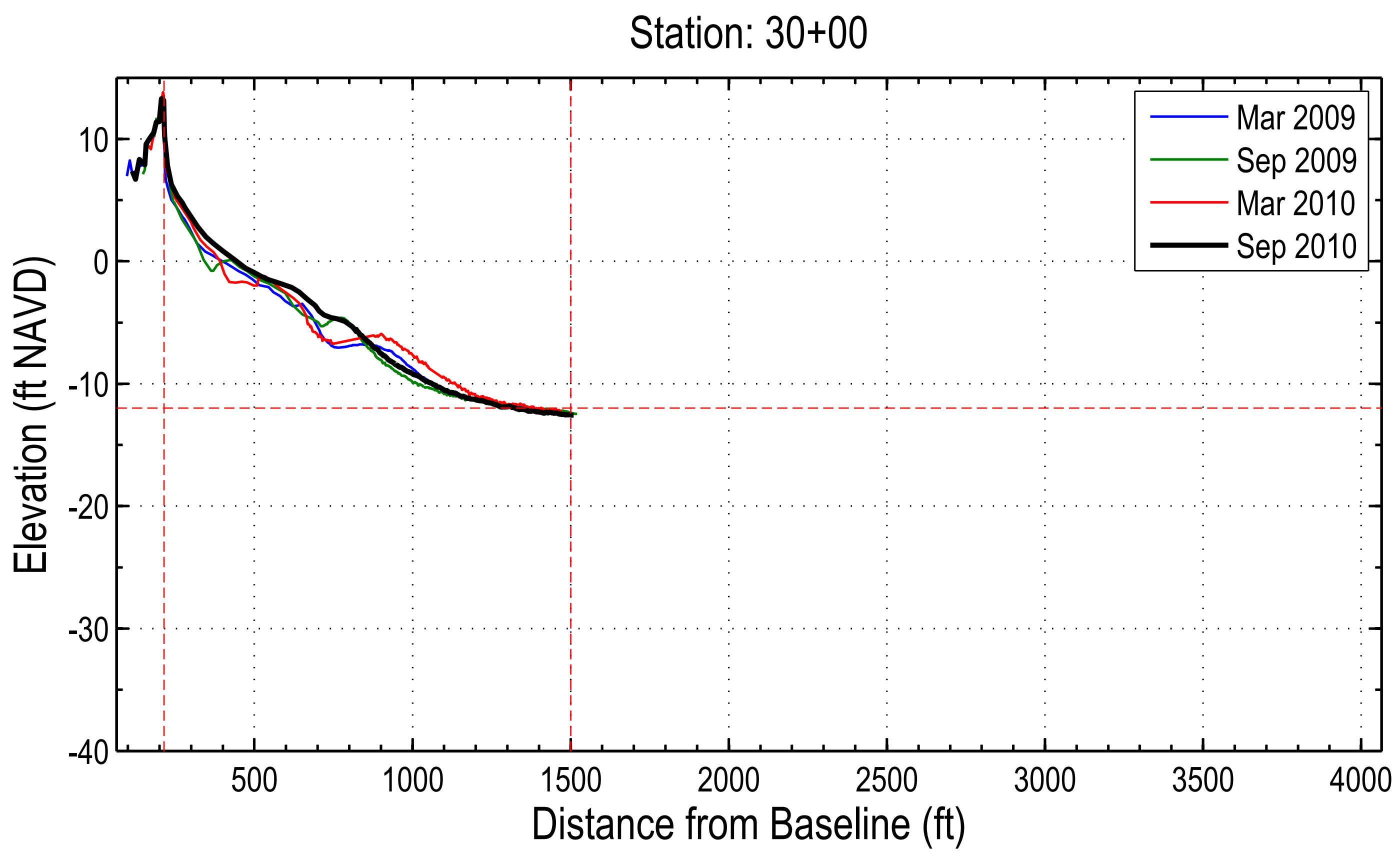
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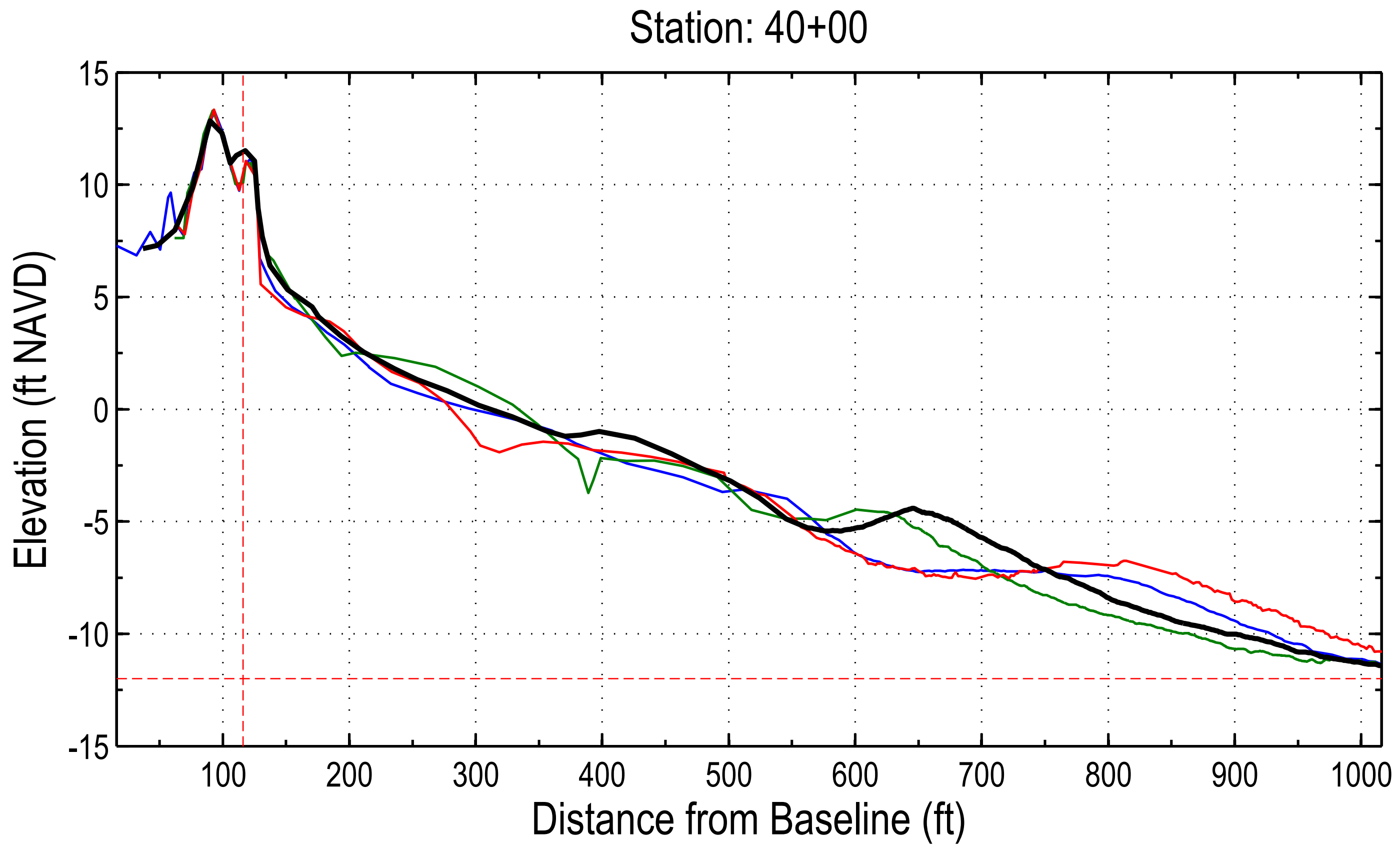

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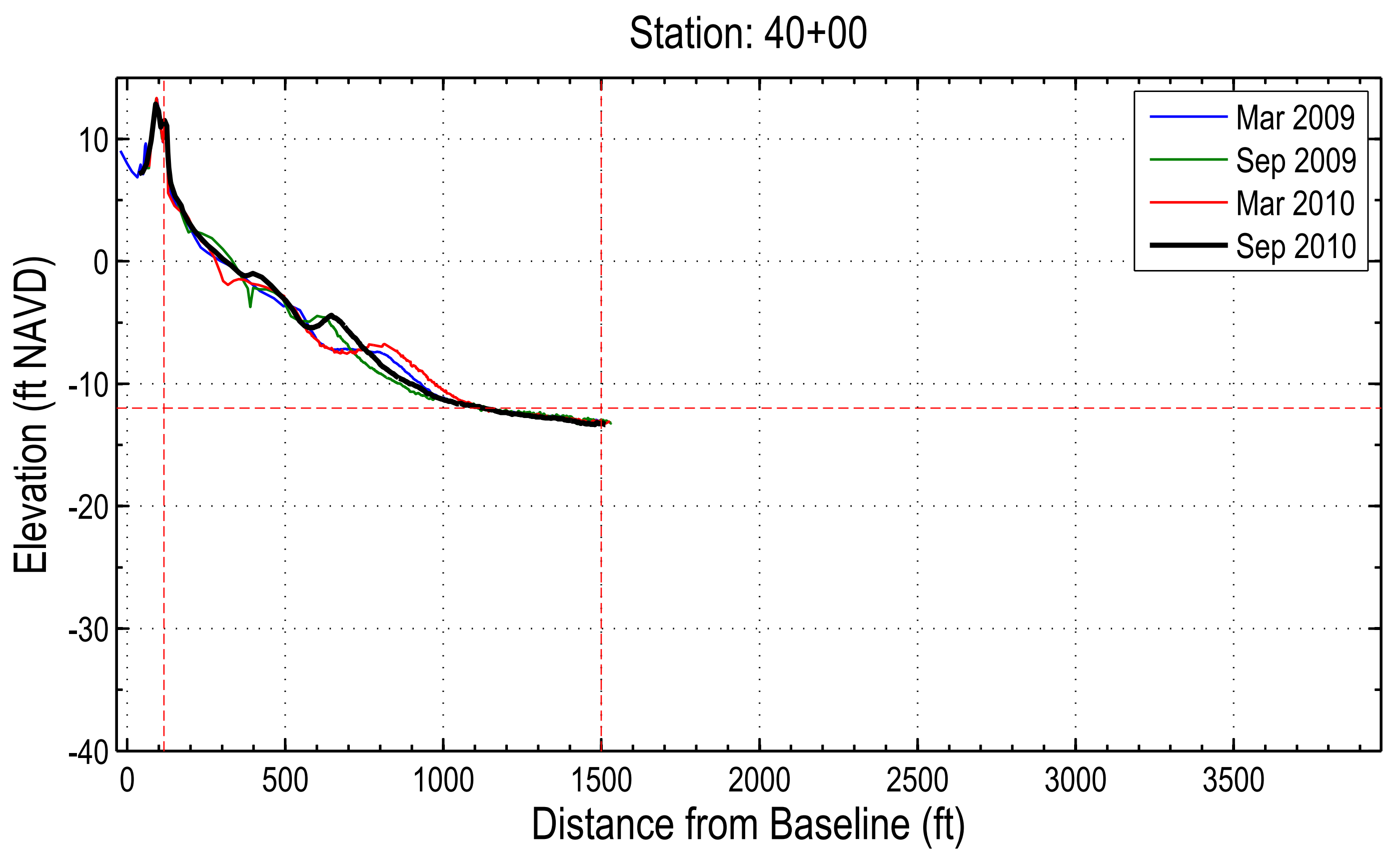

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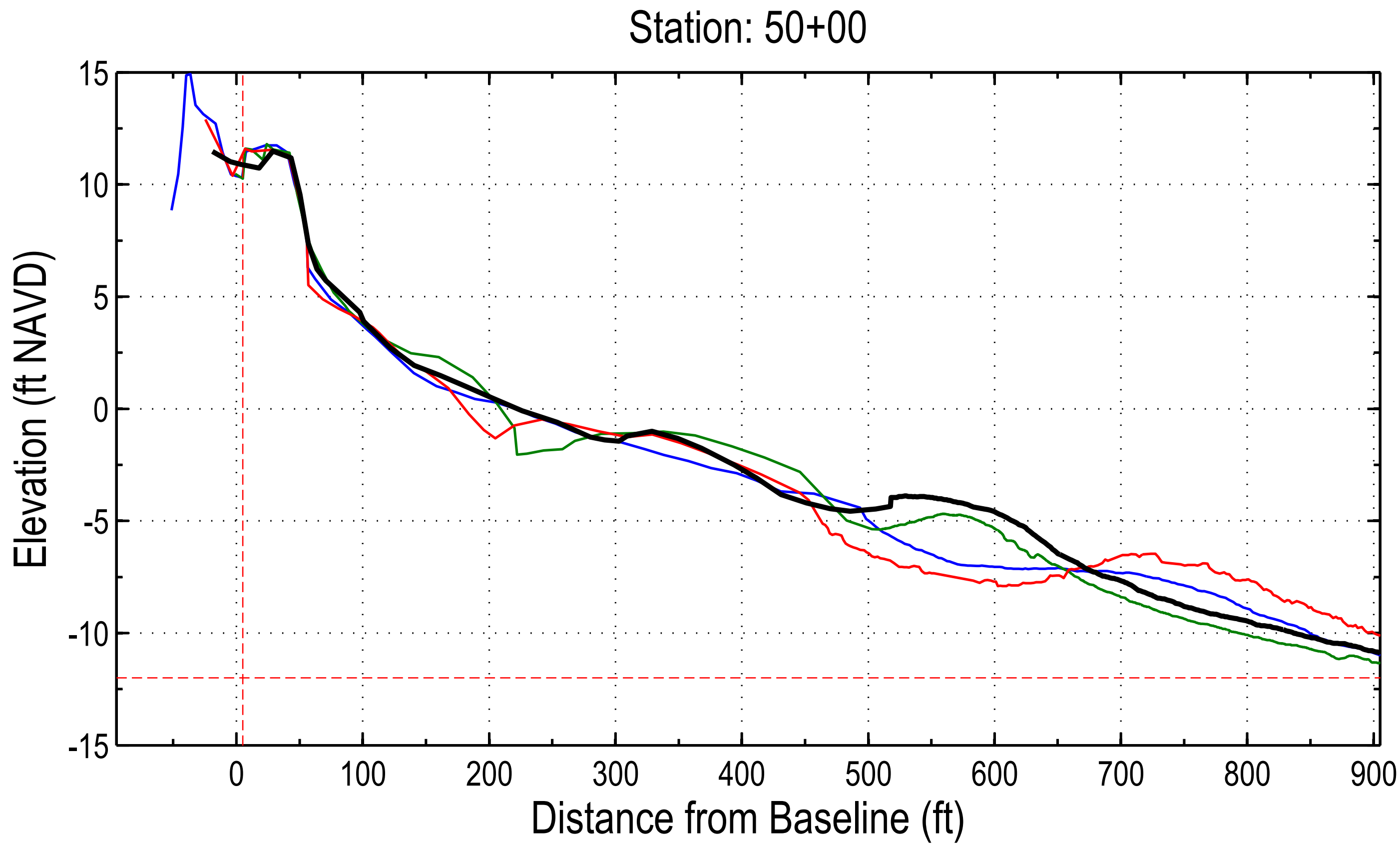

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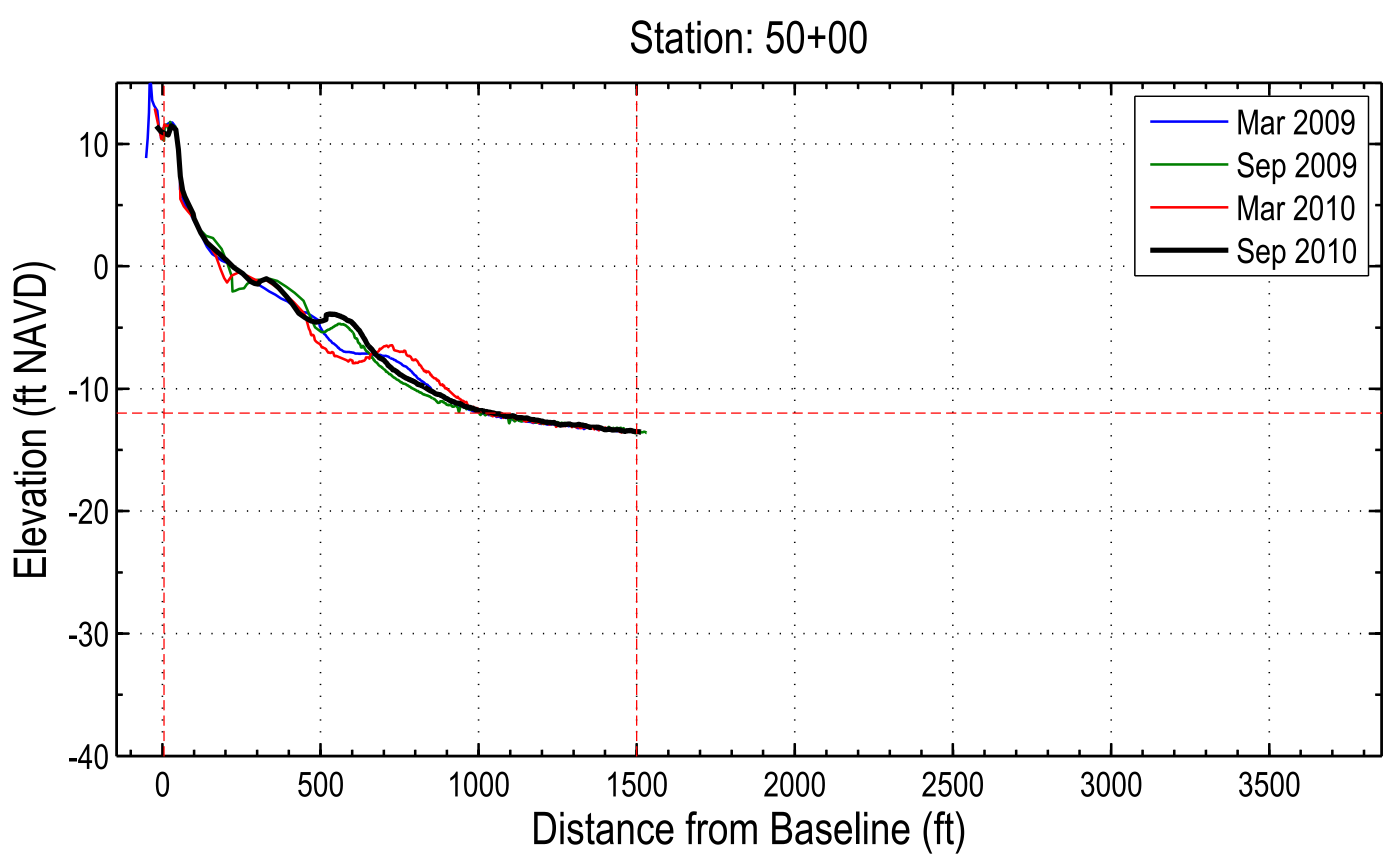

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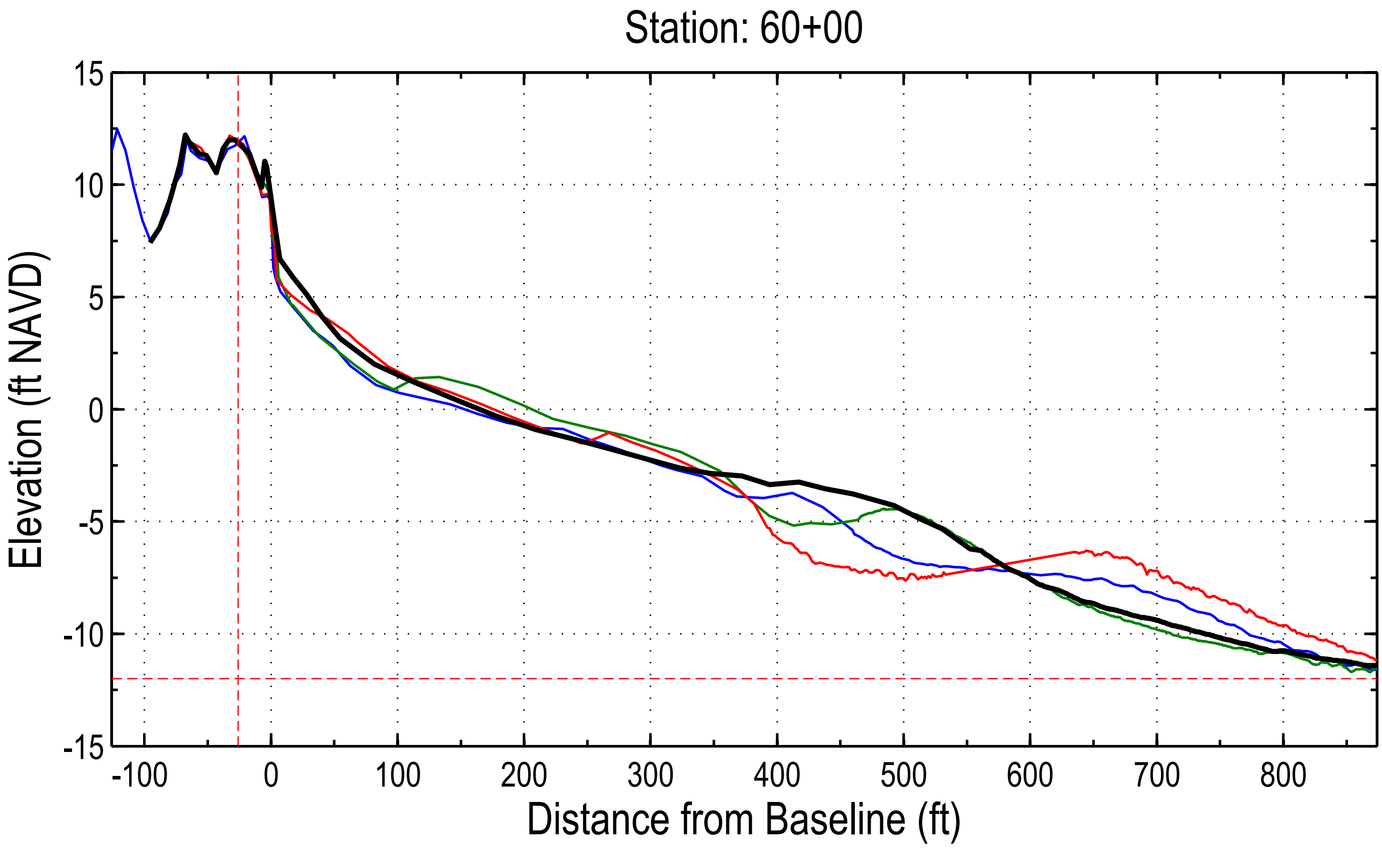
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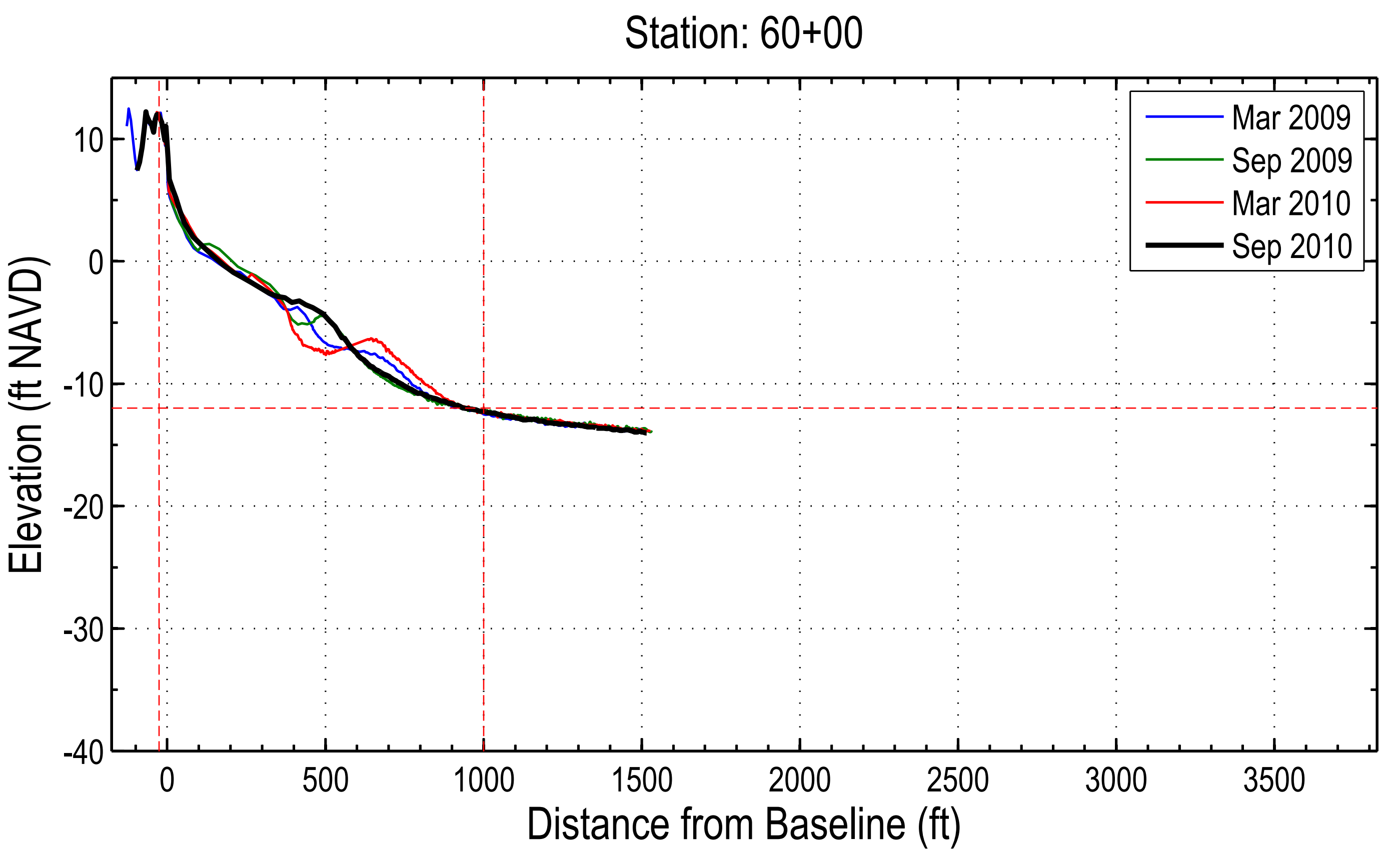
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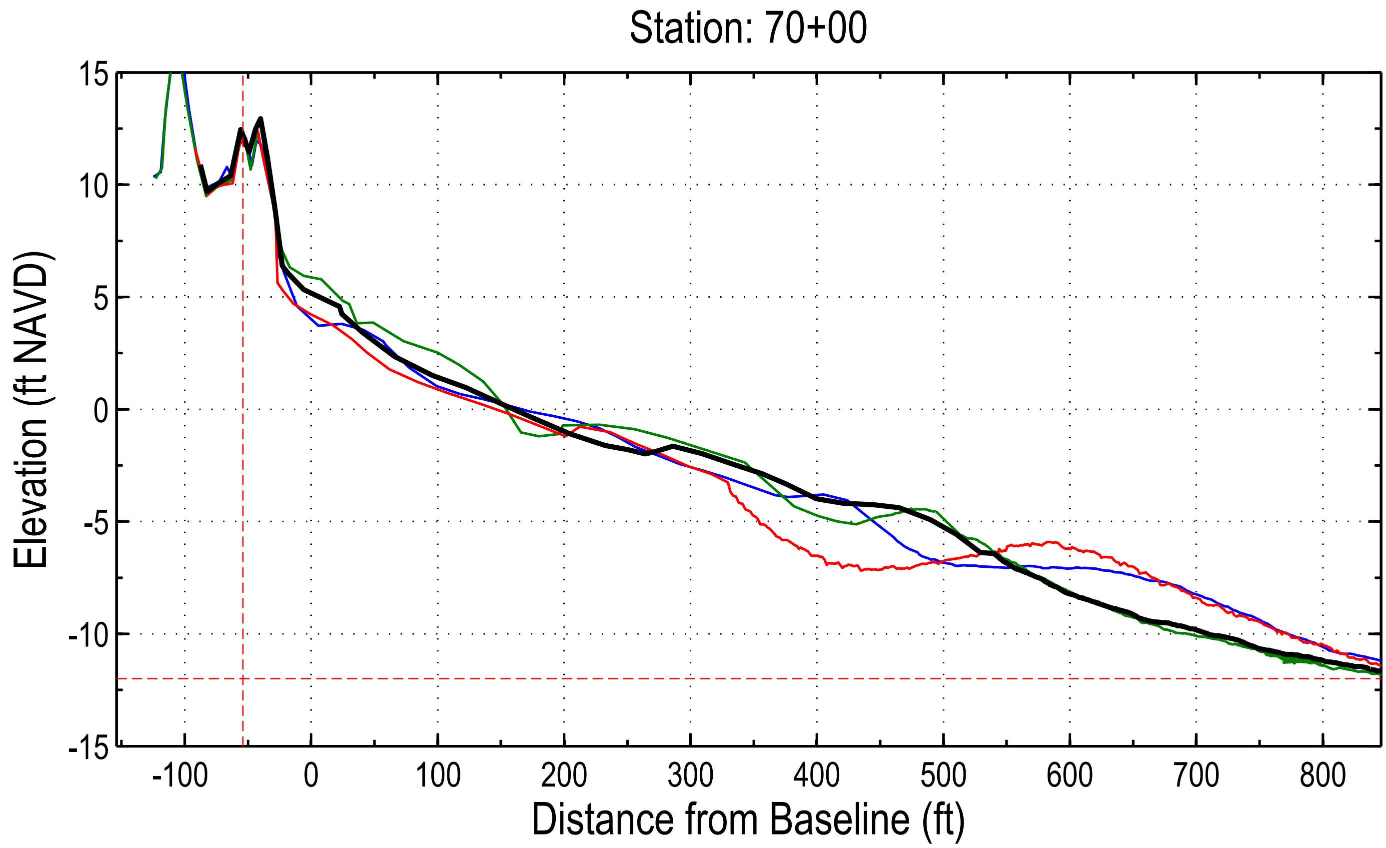
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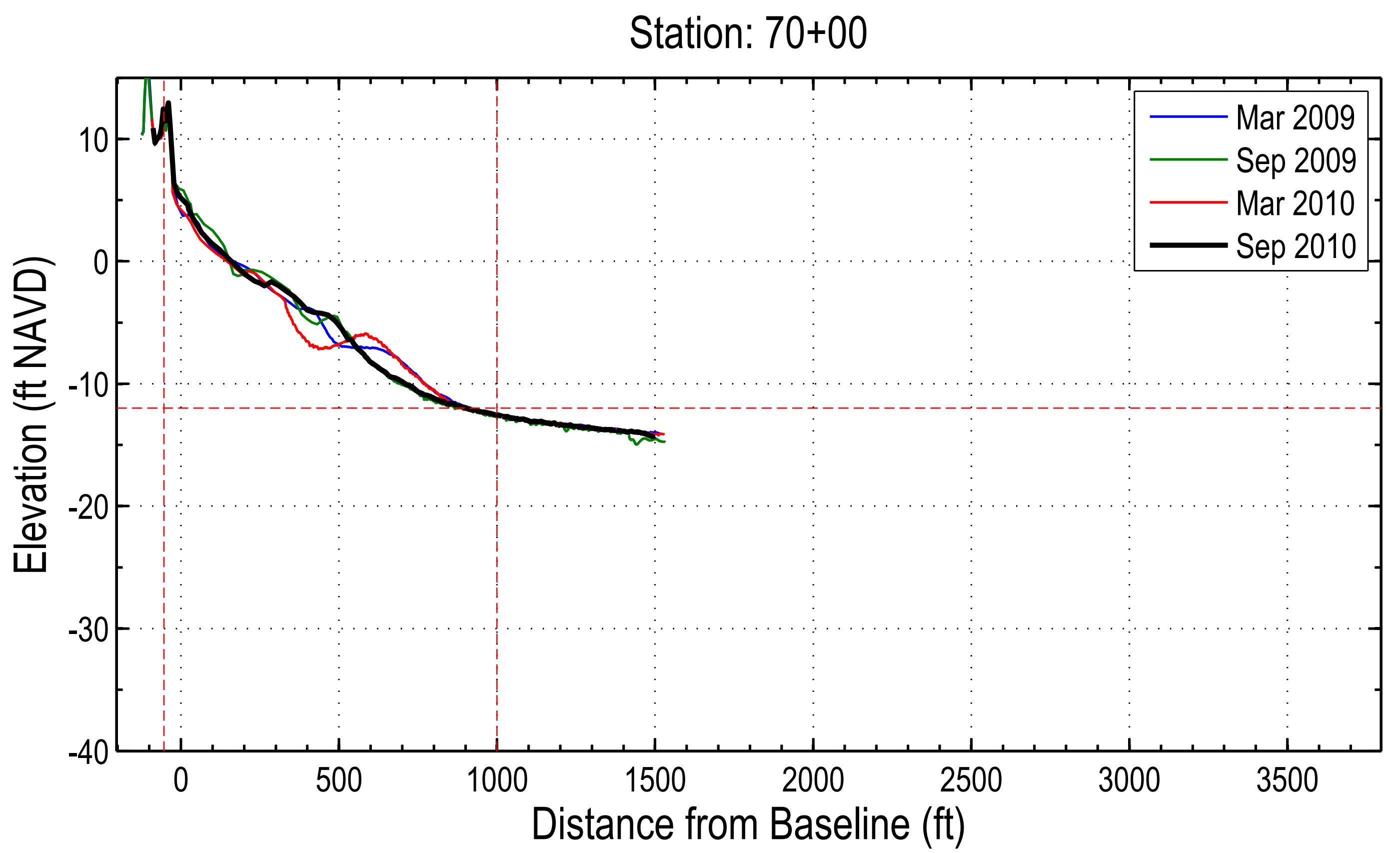
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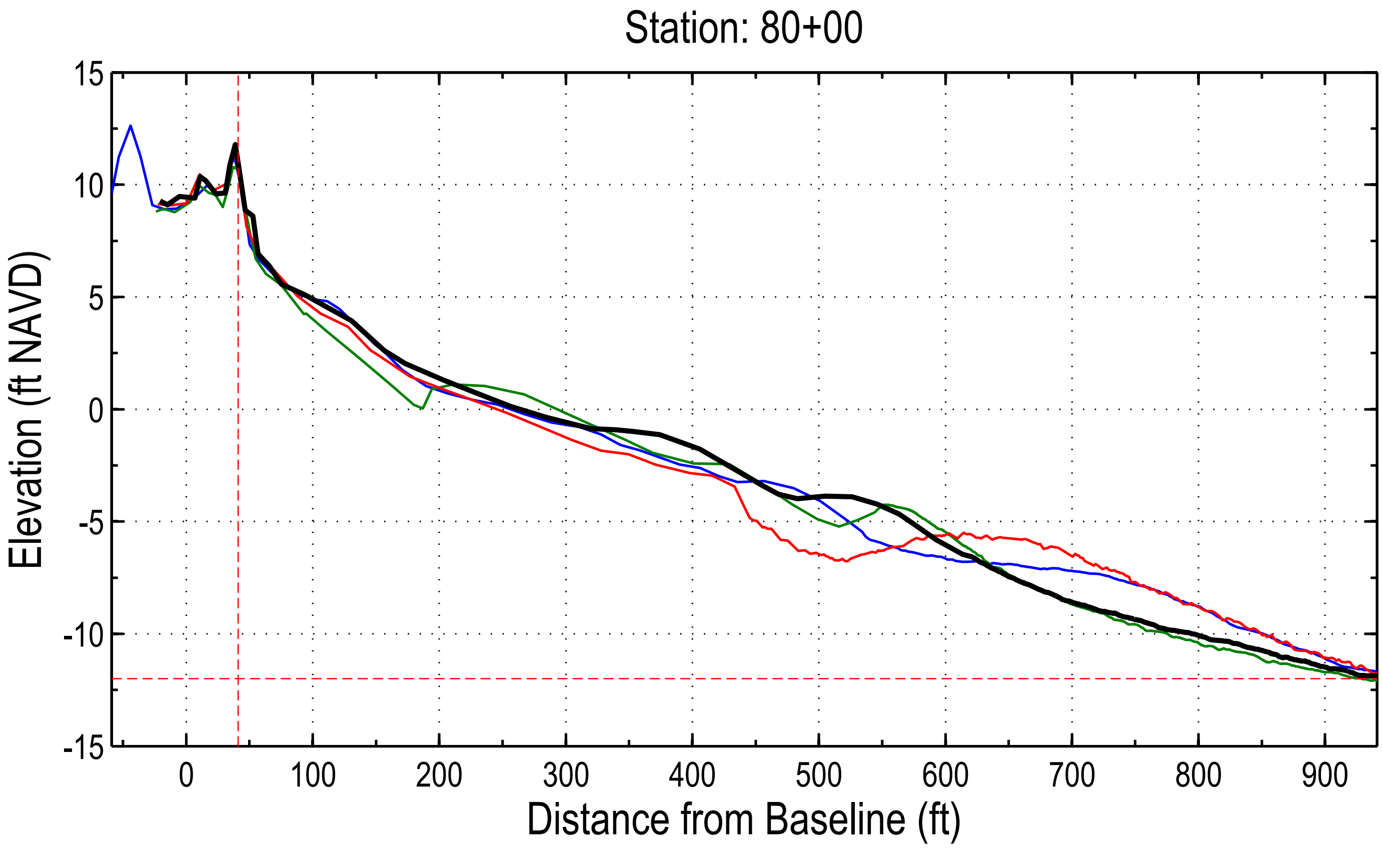
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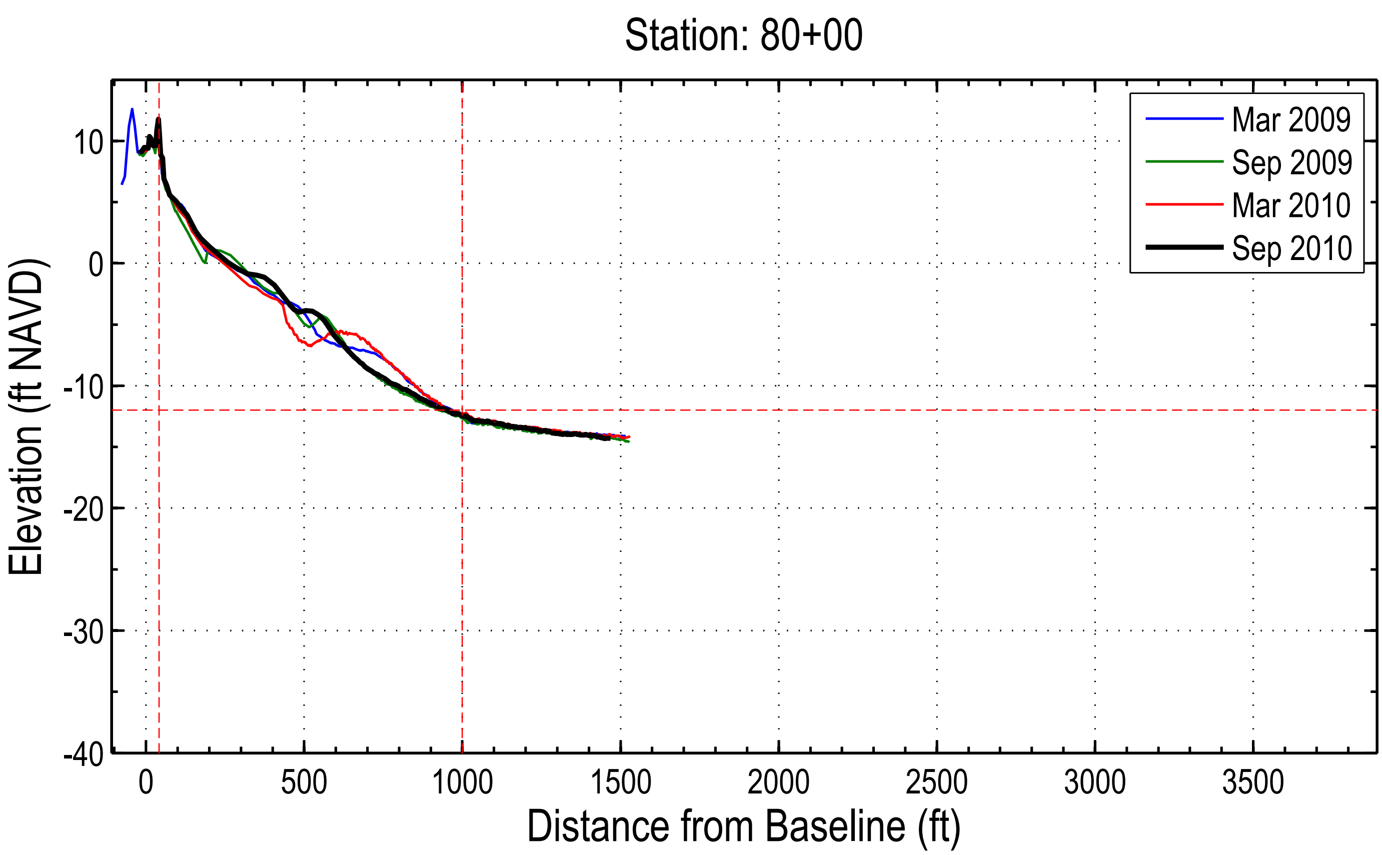
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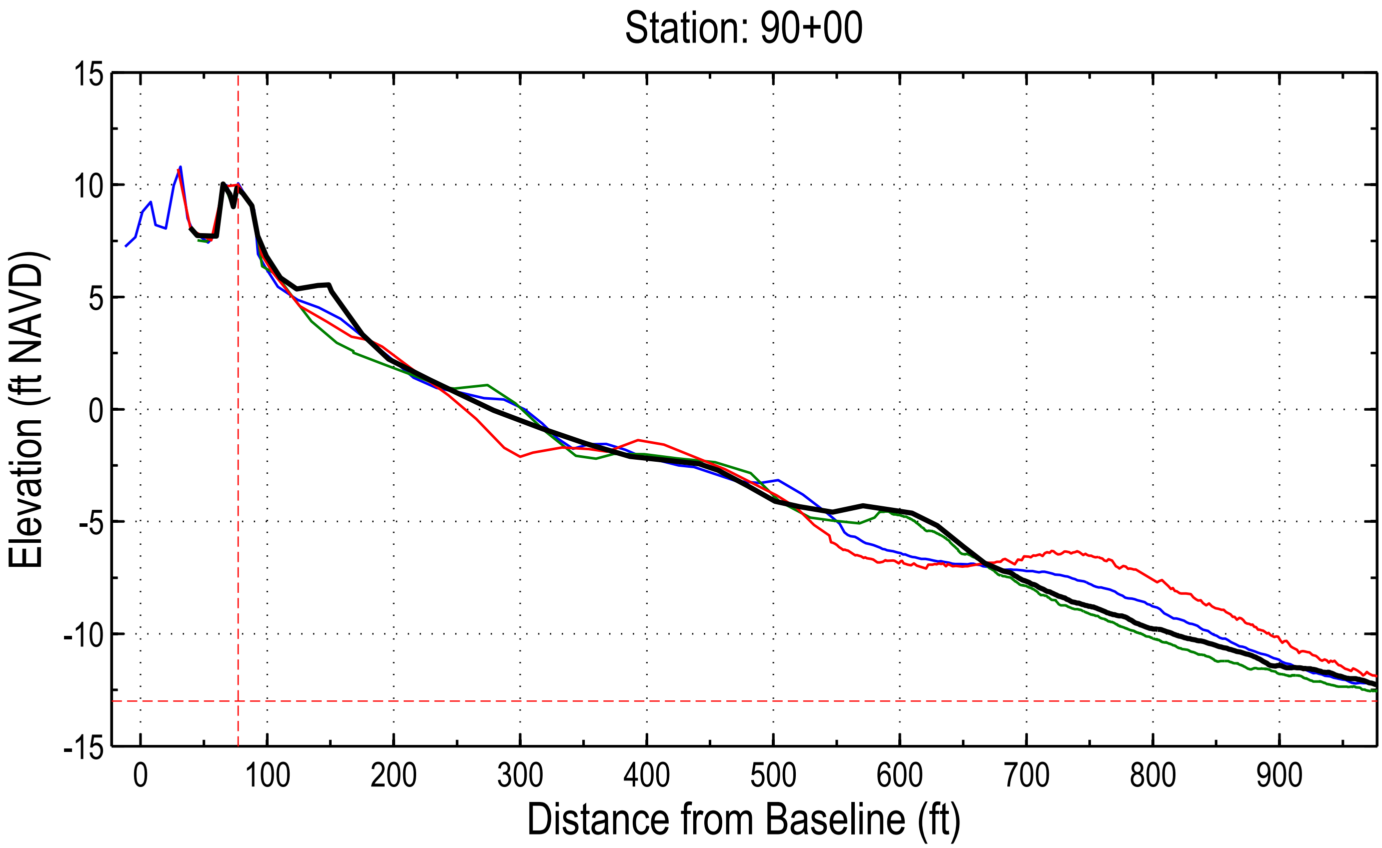

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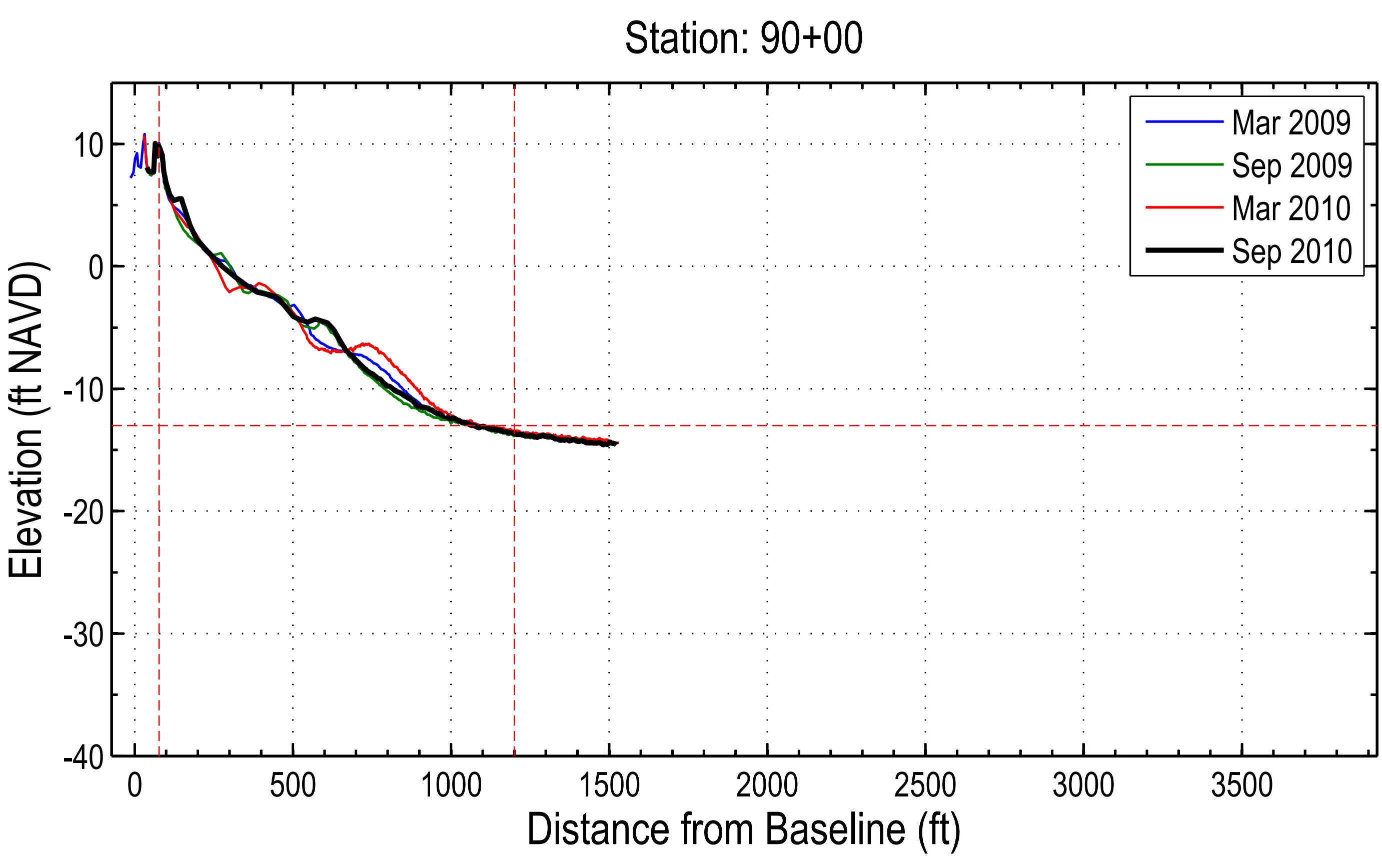

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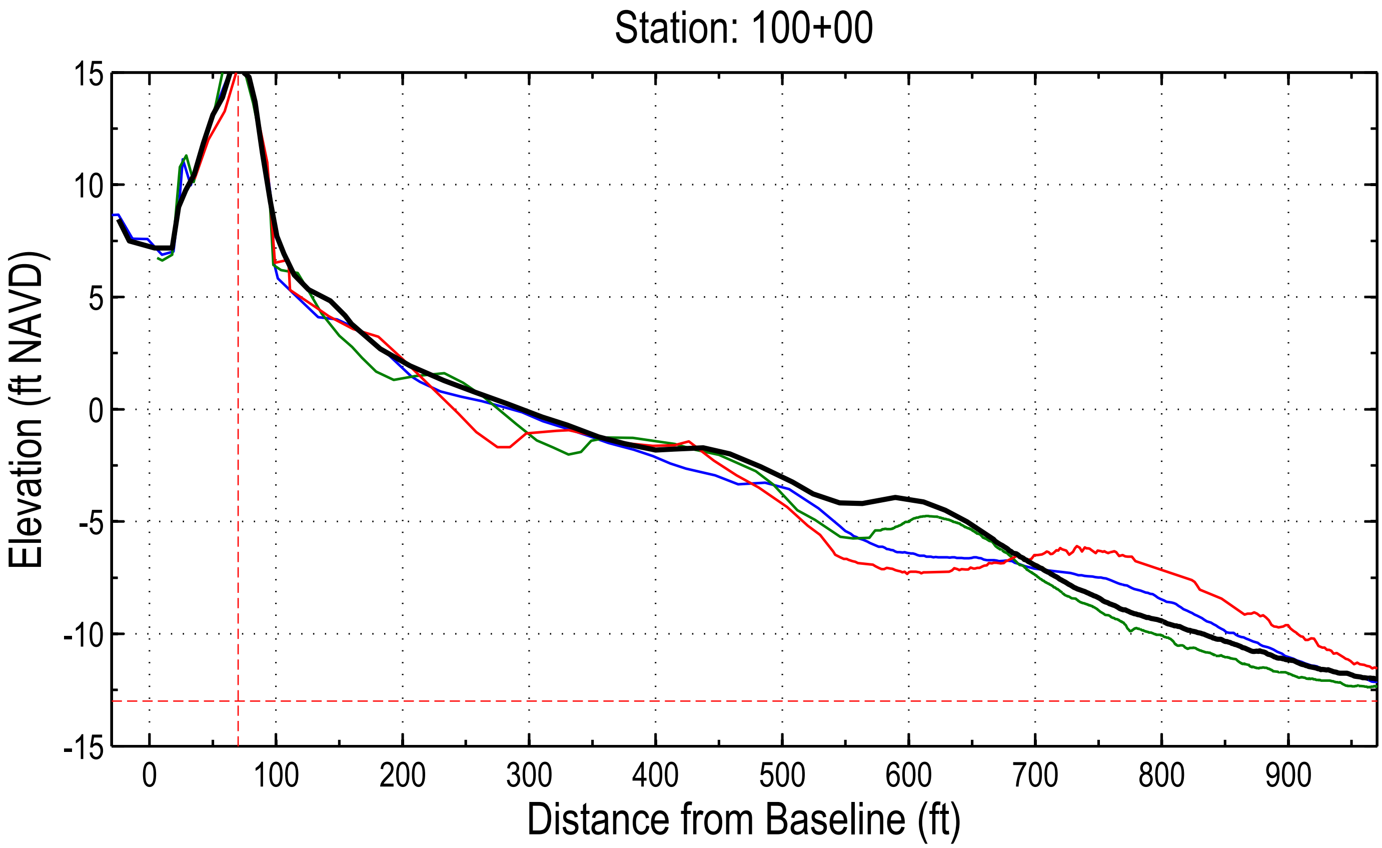

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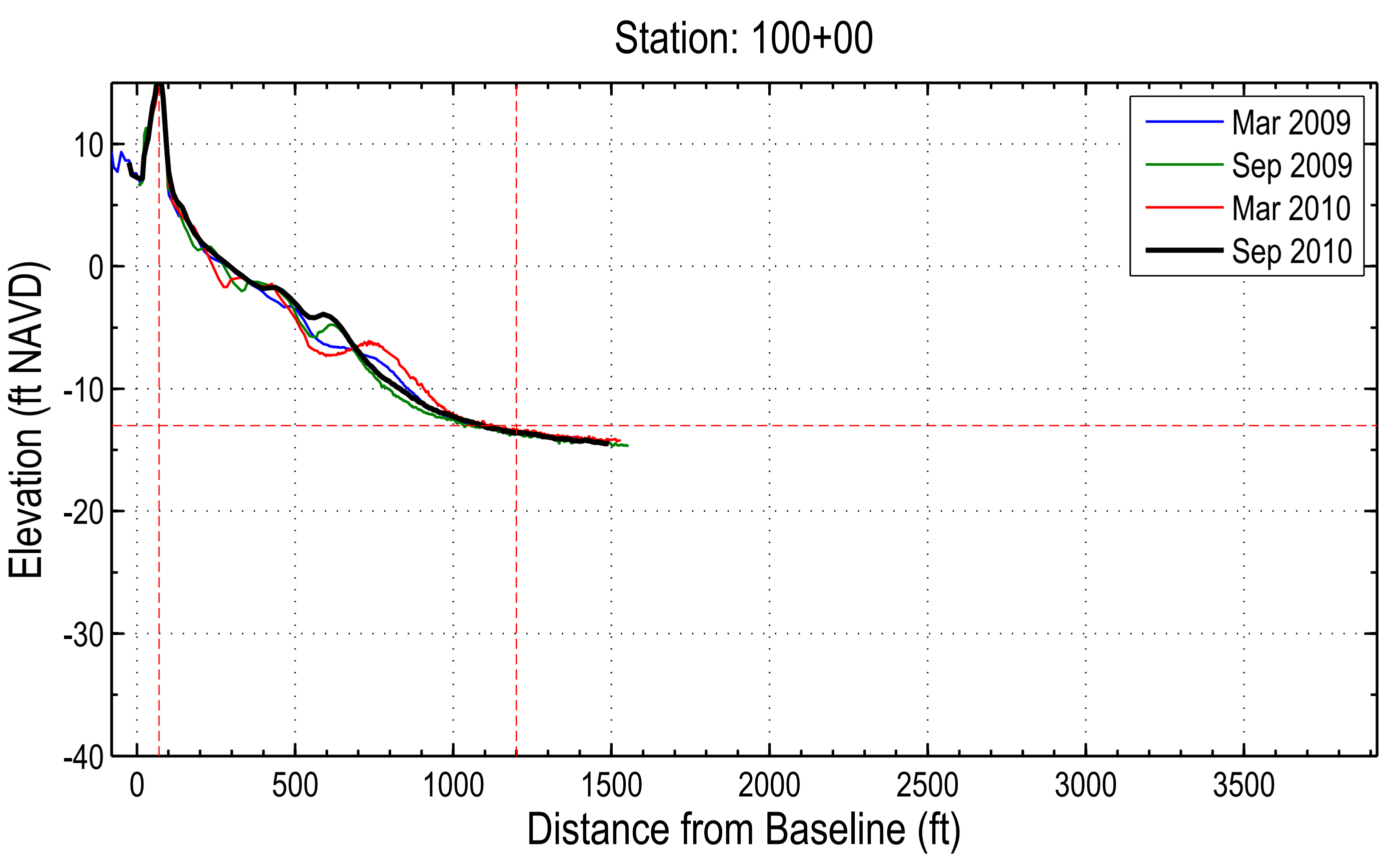

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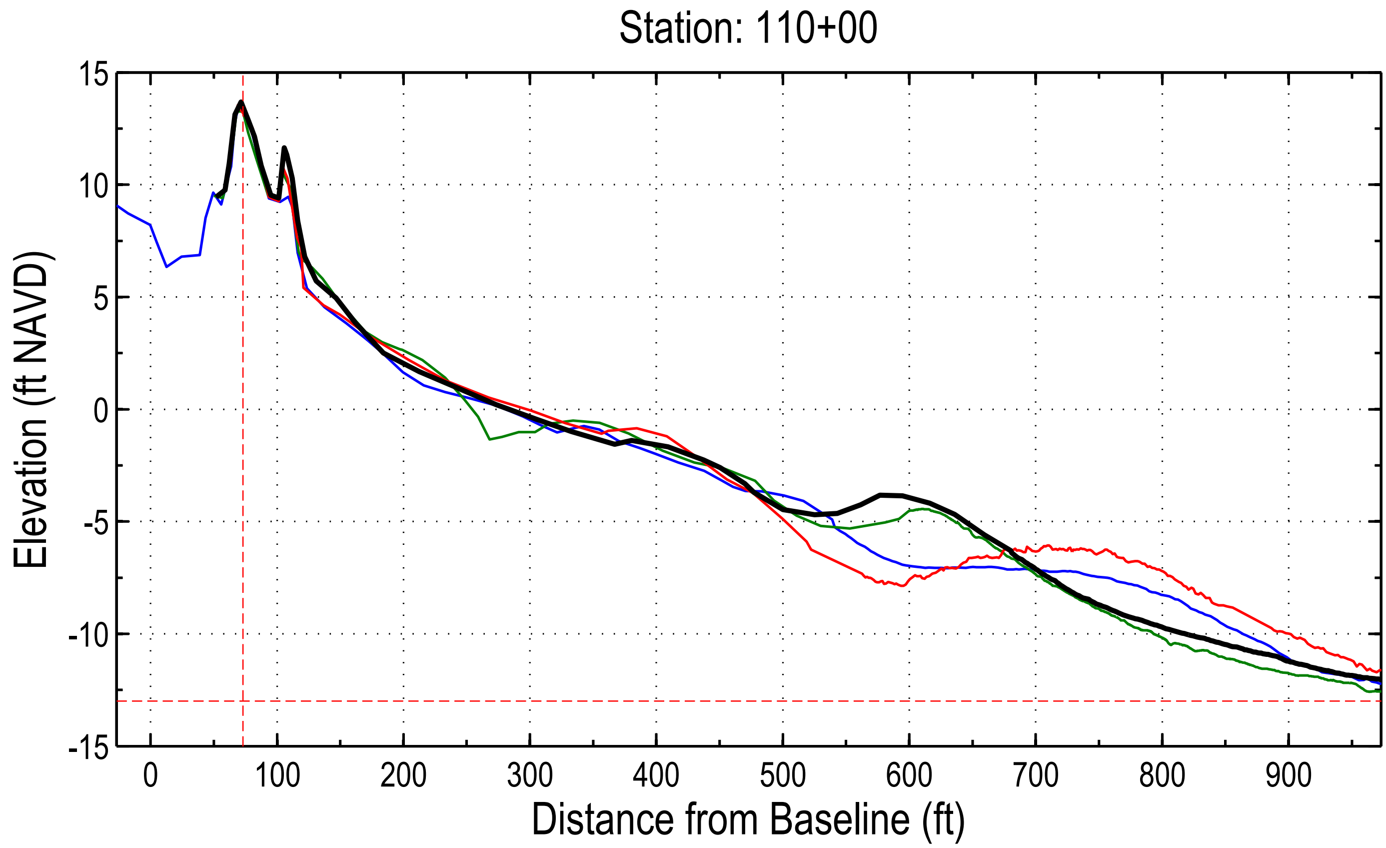
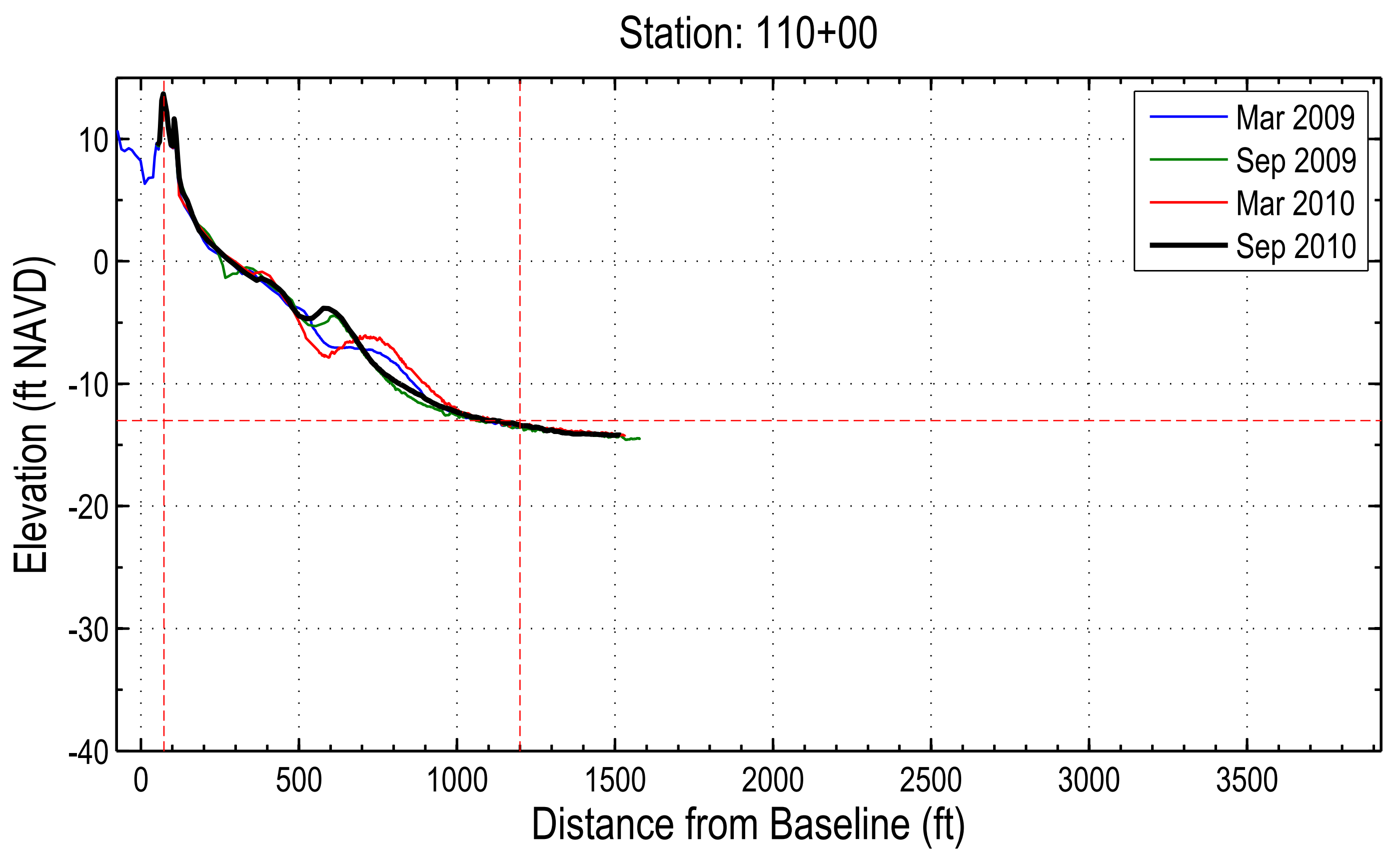
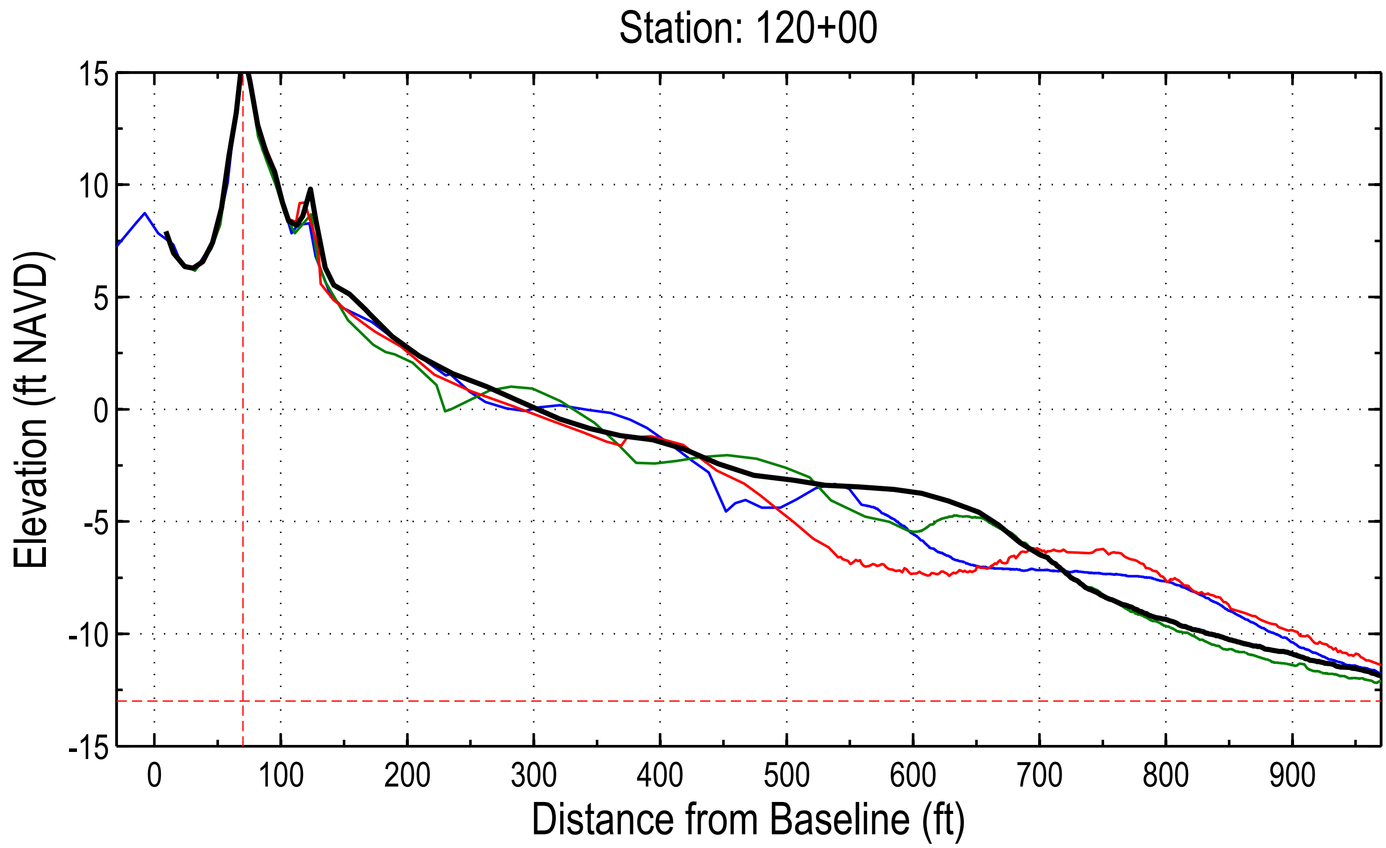
Mar 2010
Sep 2010



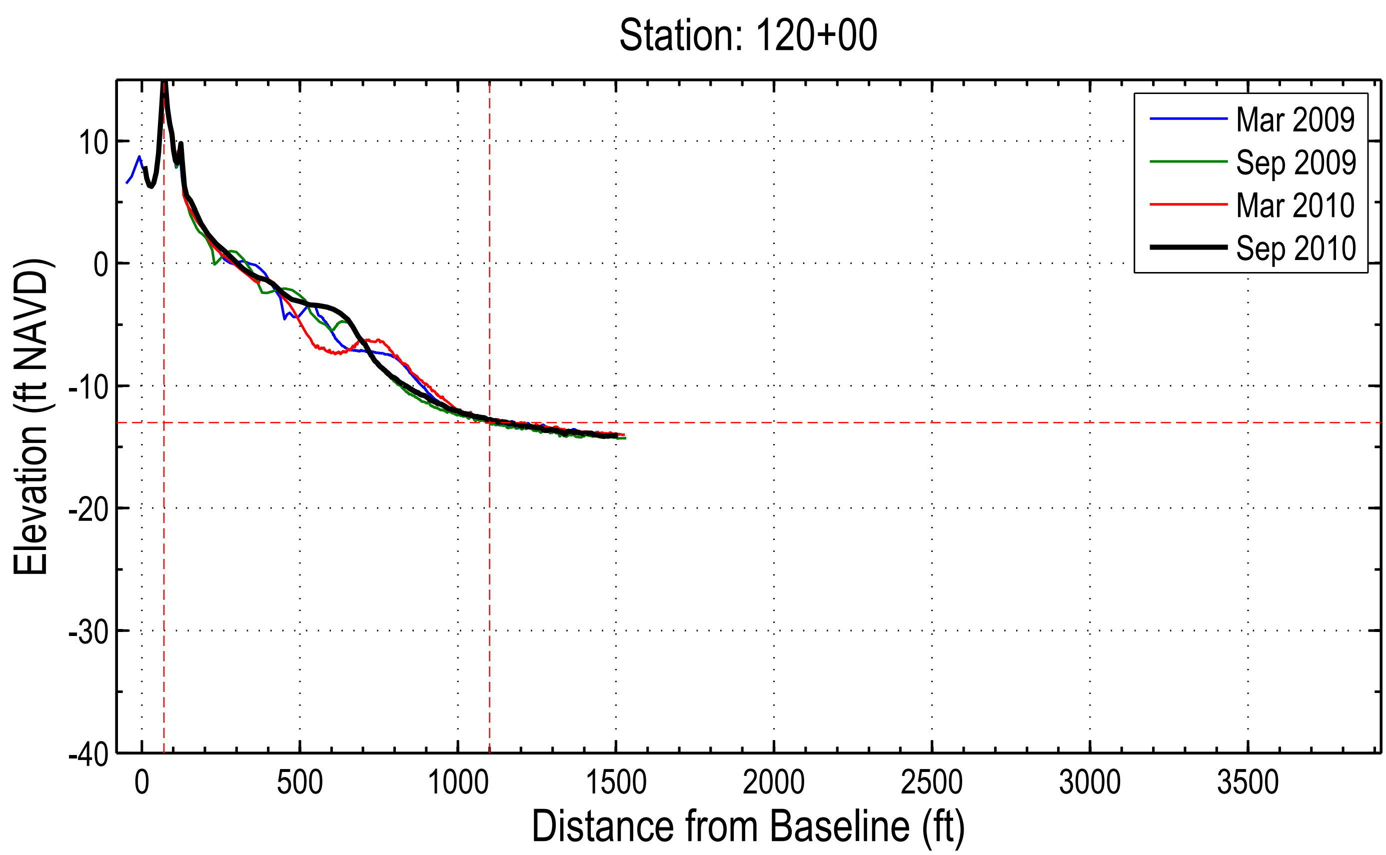
Station: 110+00
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900
Distance from Baseline (ft)



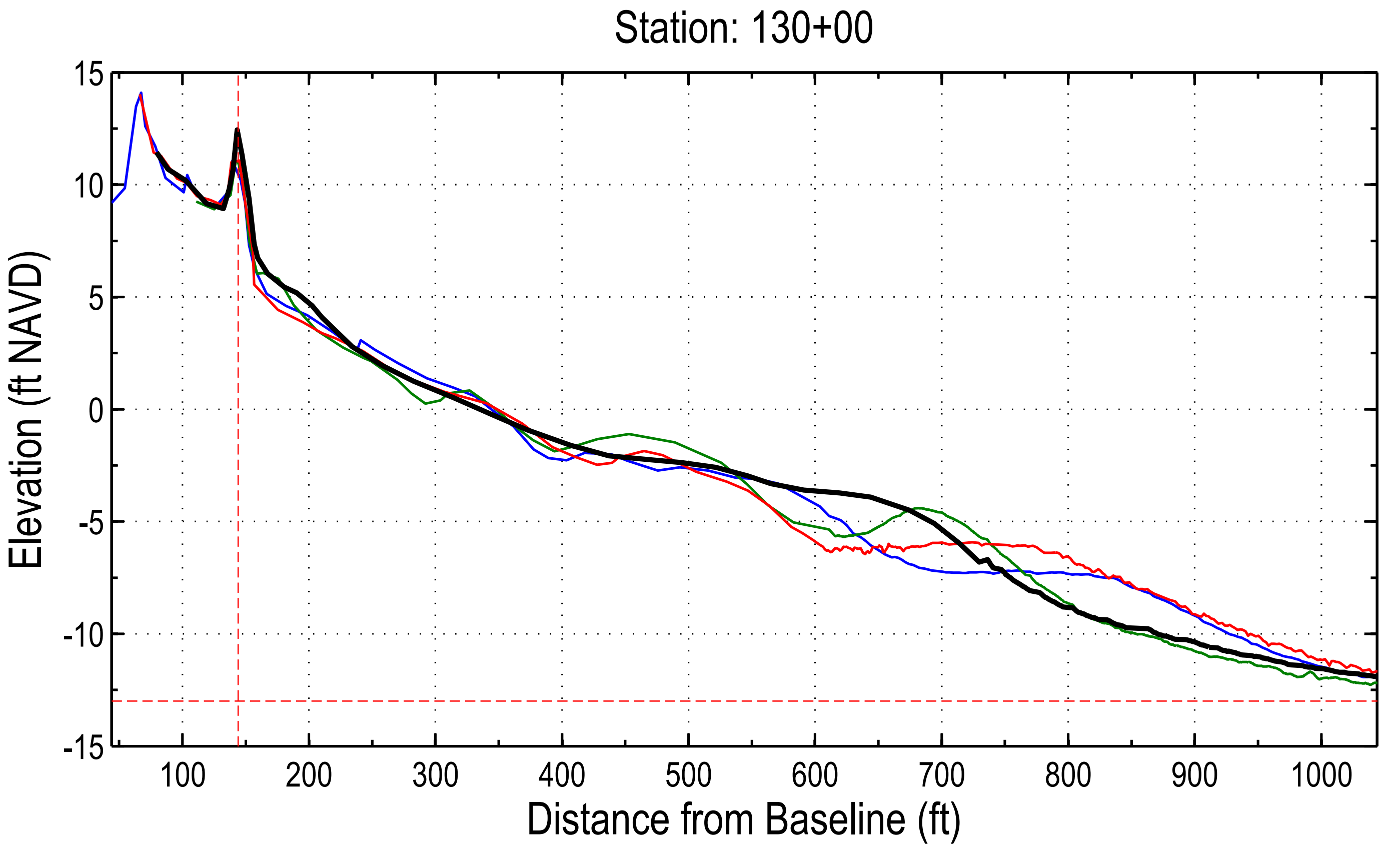
Station: 110+00
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010



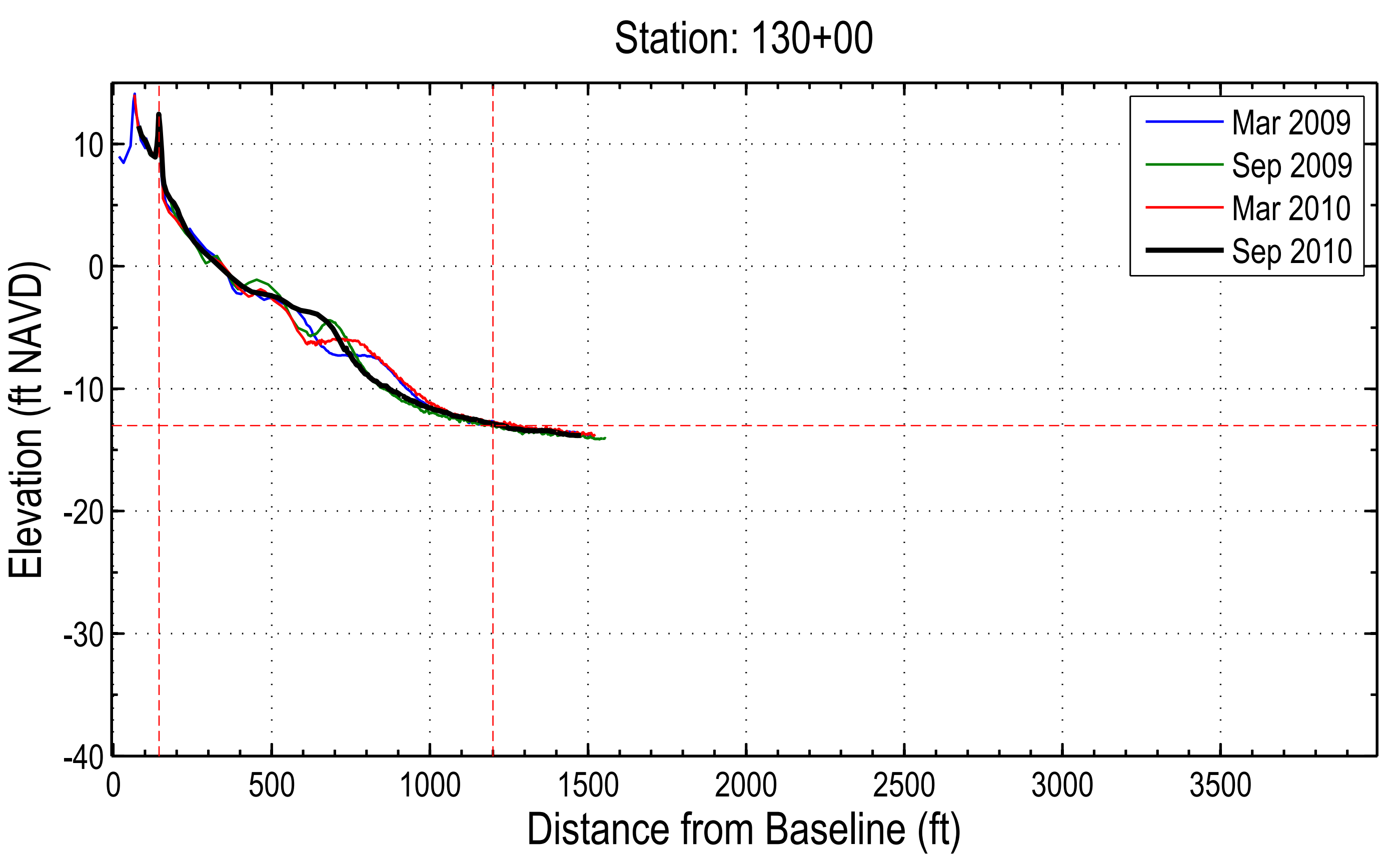
Station: 120+00
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900



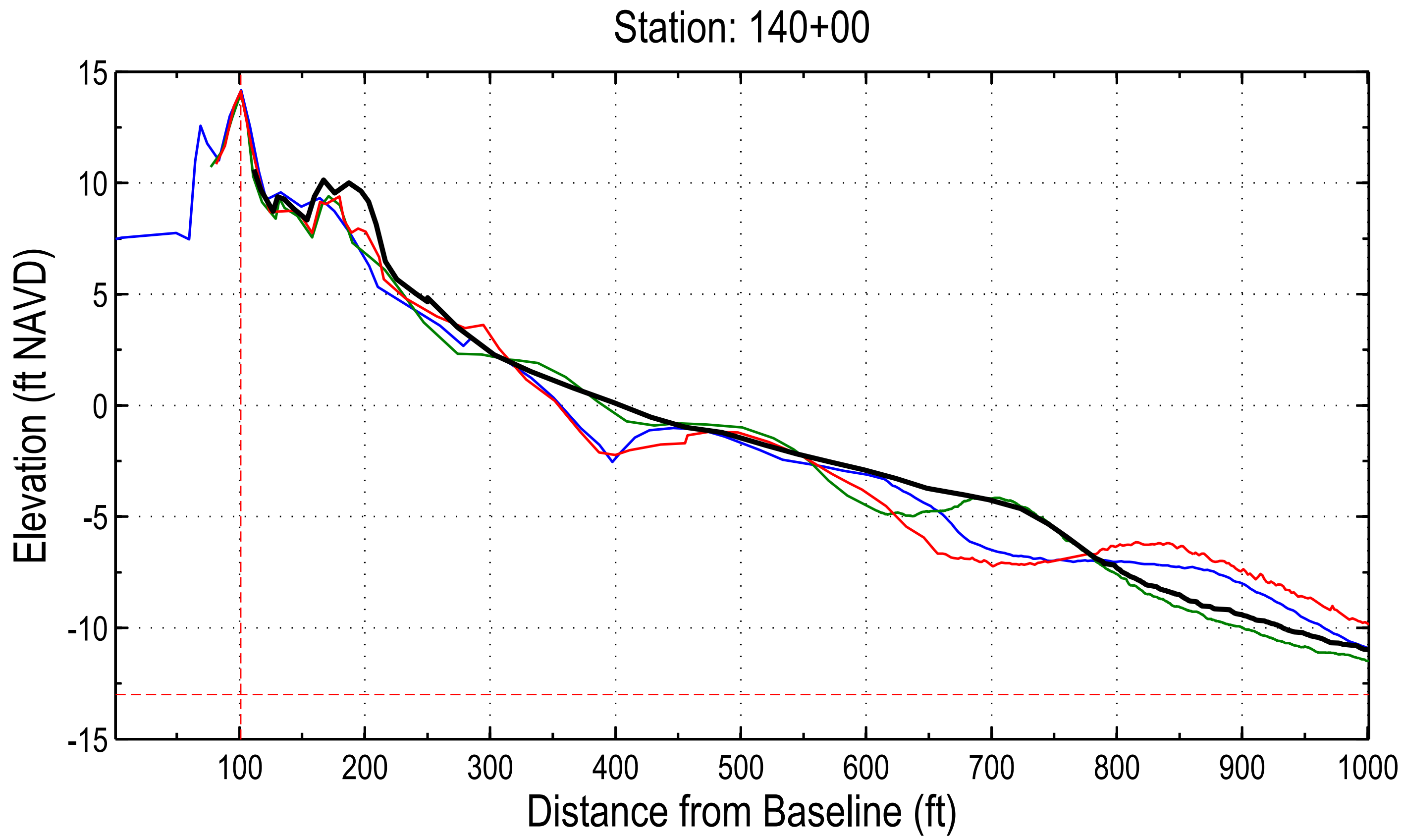
Station: 120+00
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Mar 2009
Sep 2009
Mar 2010
Sep 2010



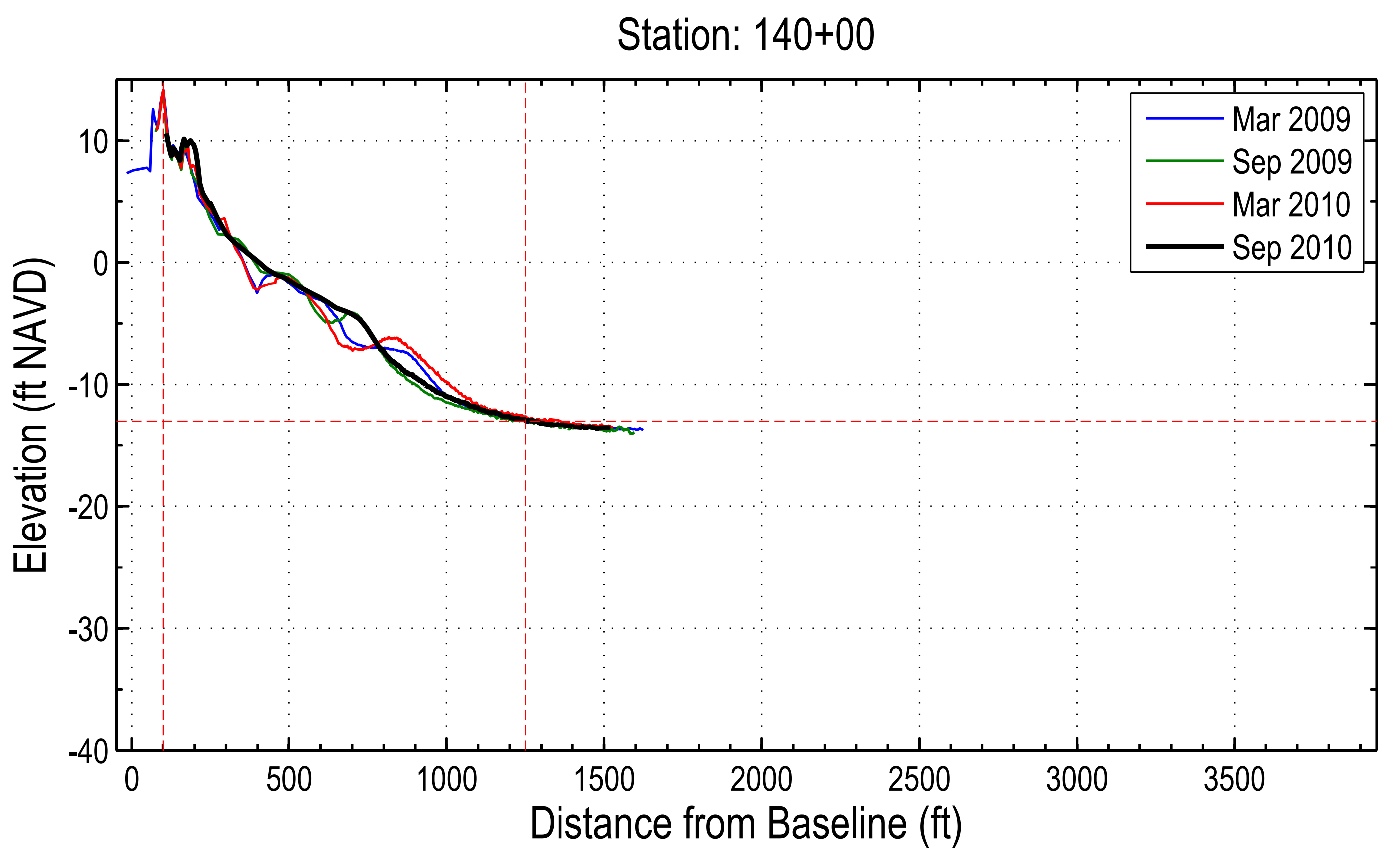
Station: 130+00
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000
Distance from Baseline (ft)



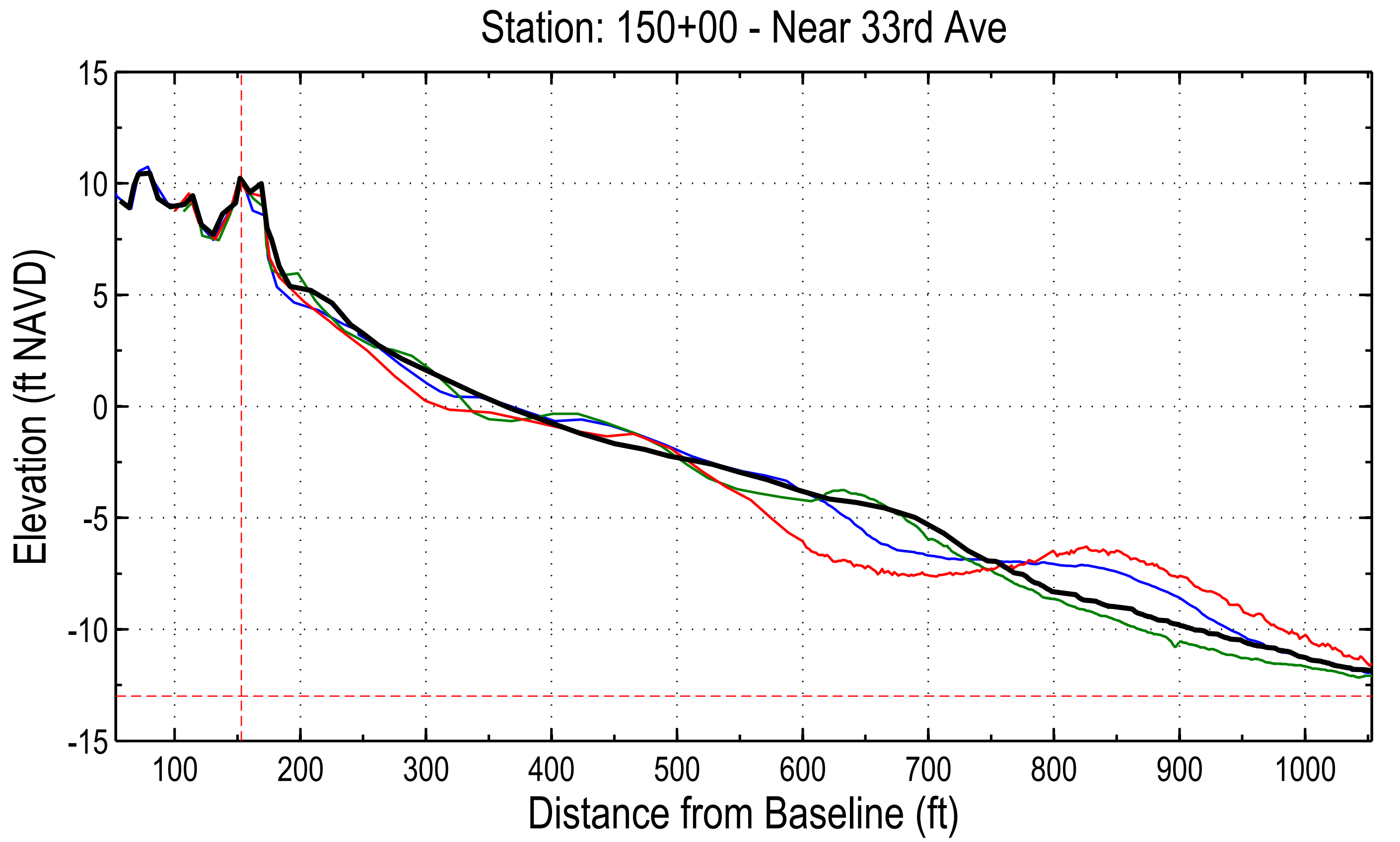
Station: 130+00
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010



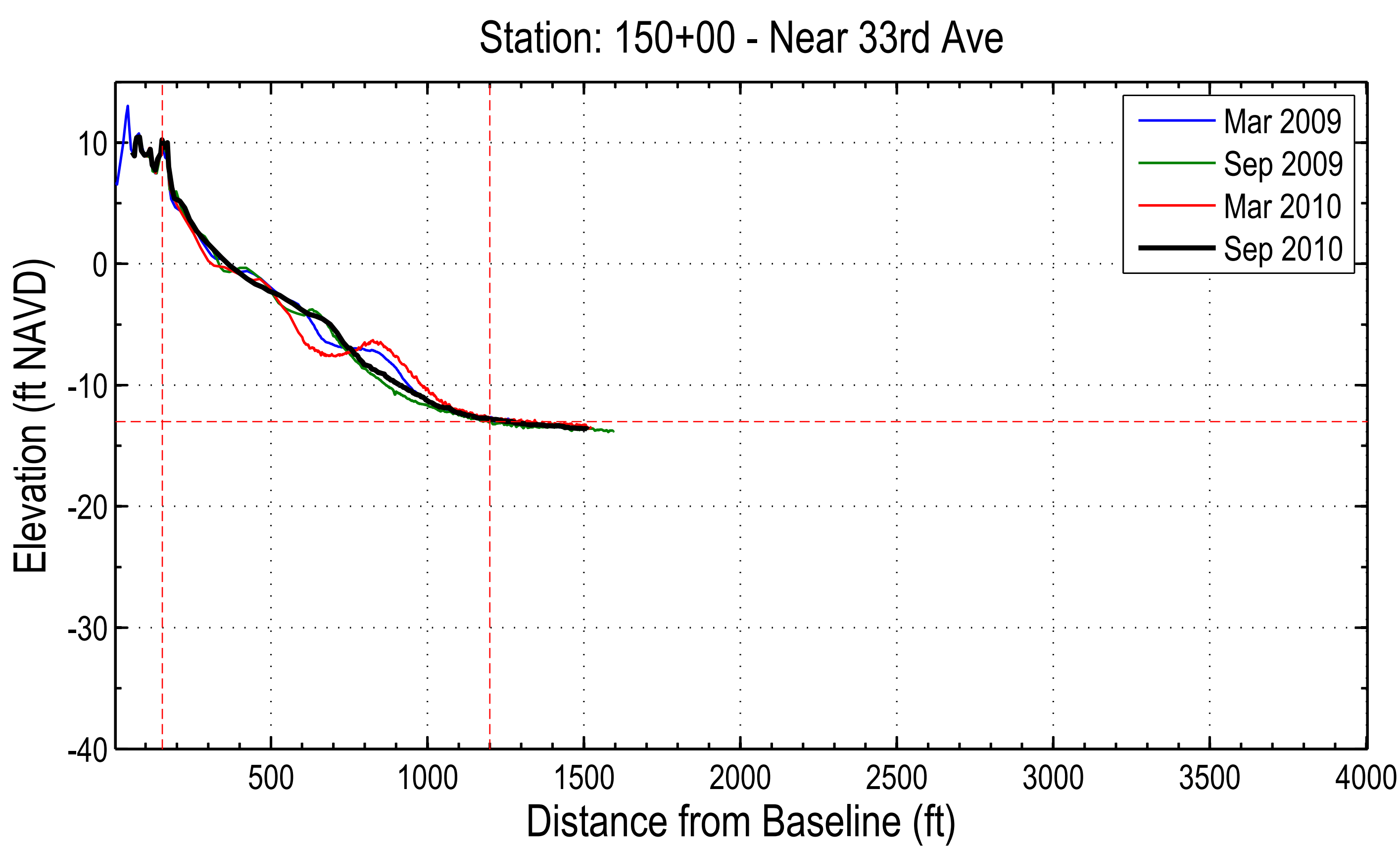
Station: 140+00
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



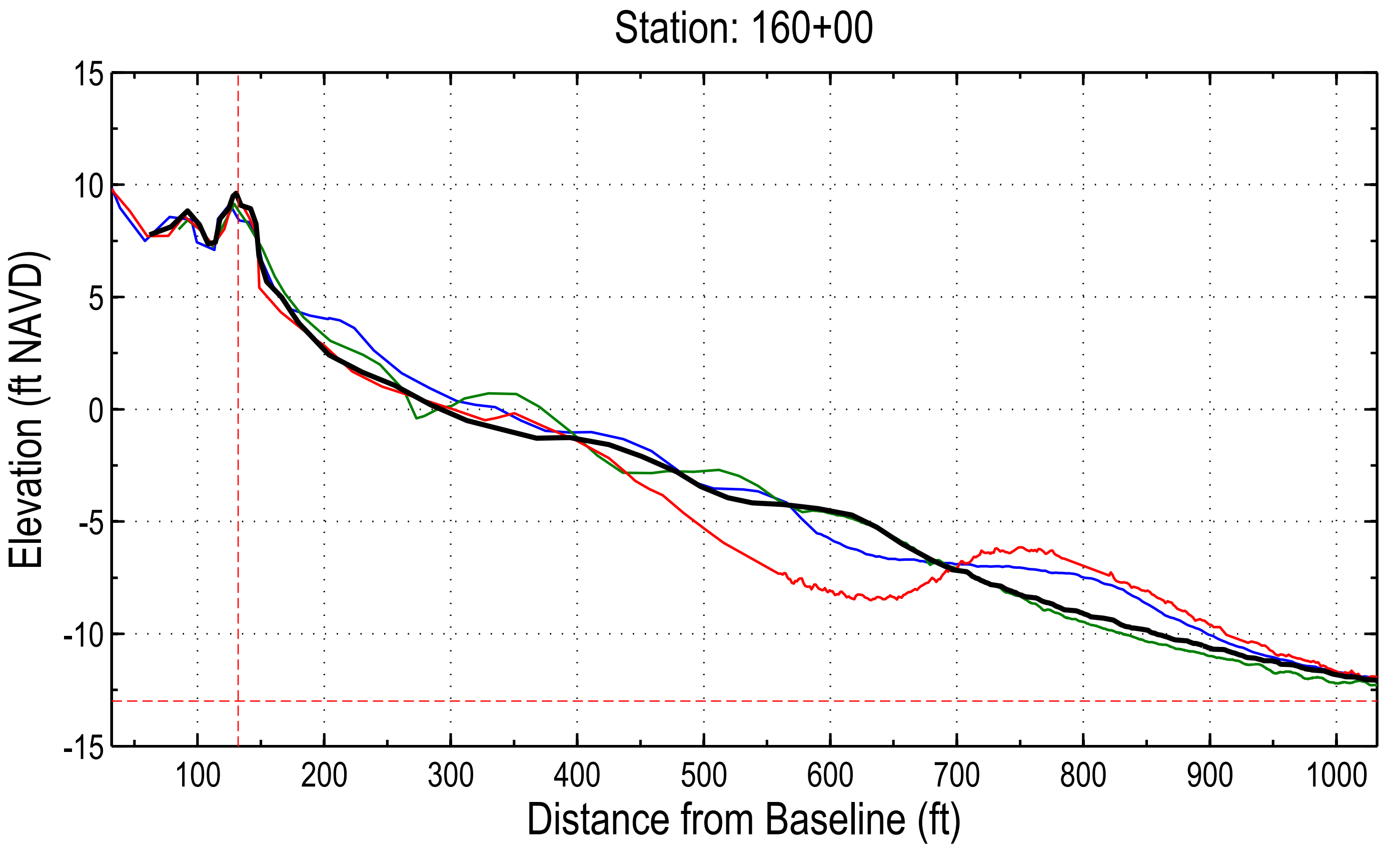
Station: 140+00
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Mar 2009
Sep 2009
Mar 2010
Sep 2010



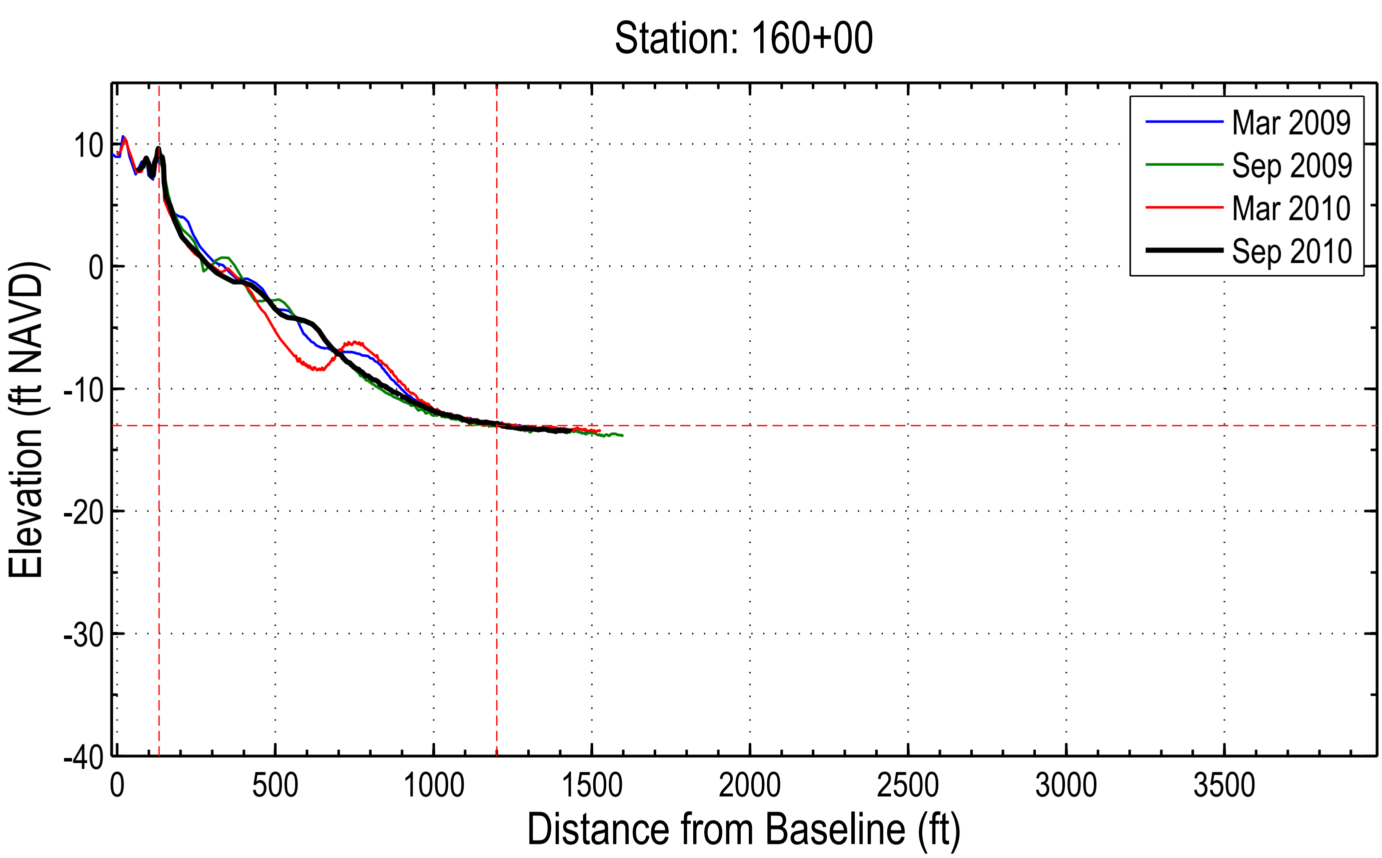
Station: 150+00 - Near 33rd Ave
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



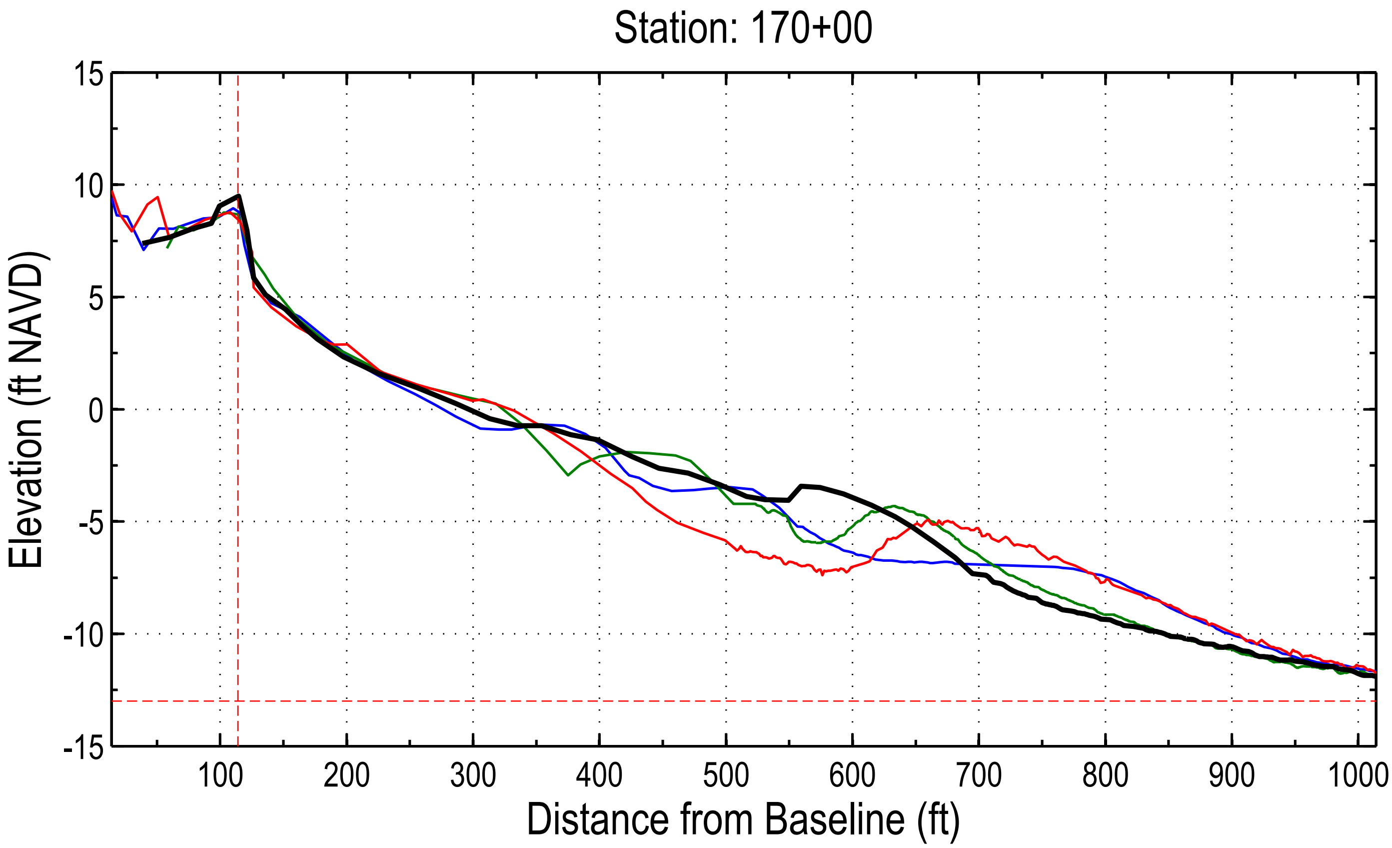
Station: 150+00 - Near 33rd Ave
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000



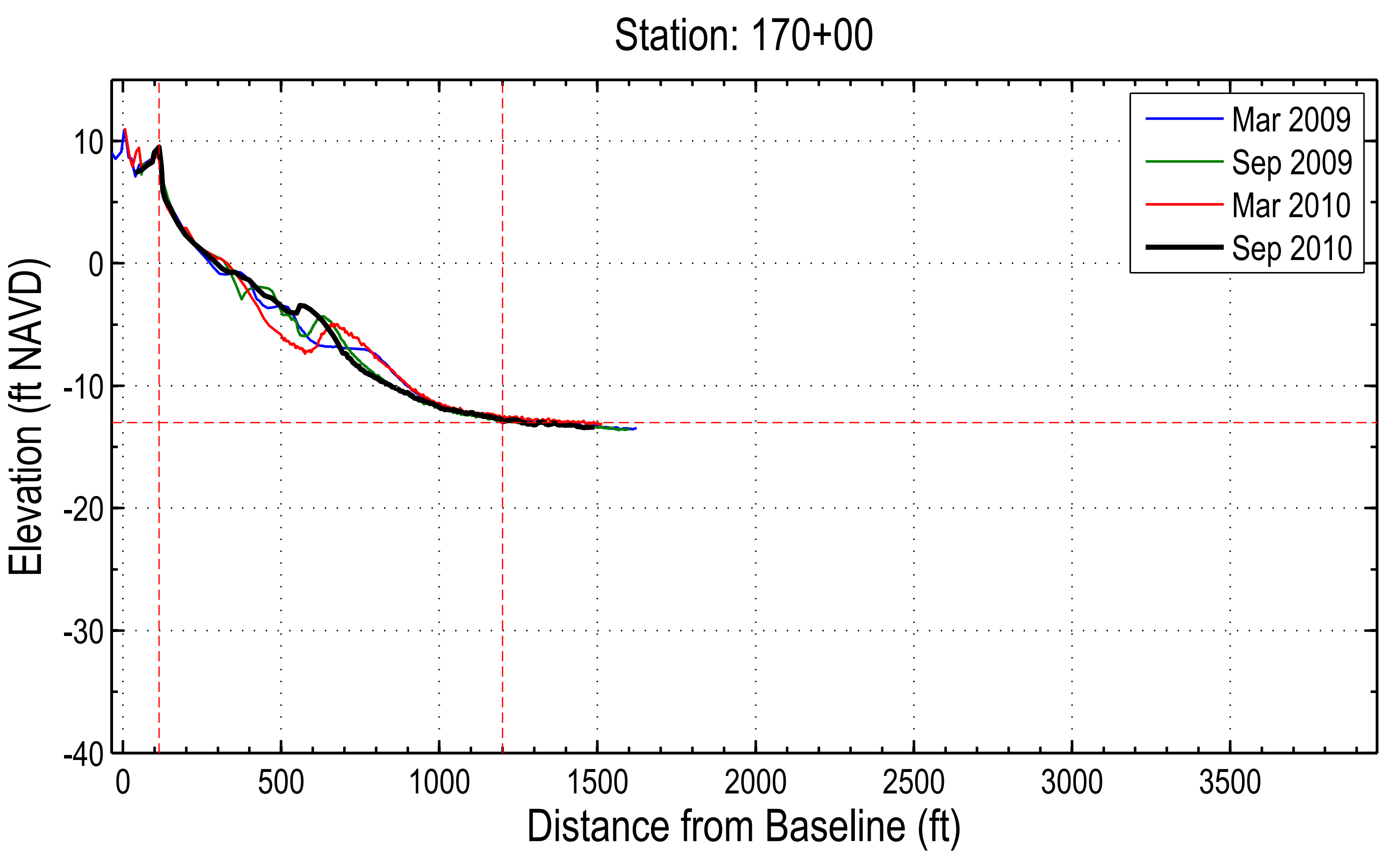
Station: 160+00
15
10
5
0
-5
-10
-15
Elevation (ft NAVD)
100
200
300
400
500
600
700
800
900
1000
Distance from Baseline (ft)



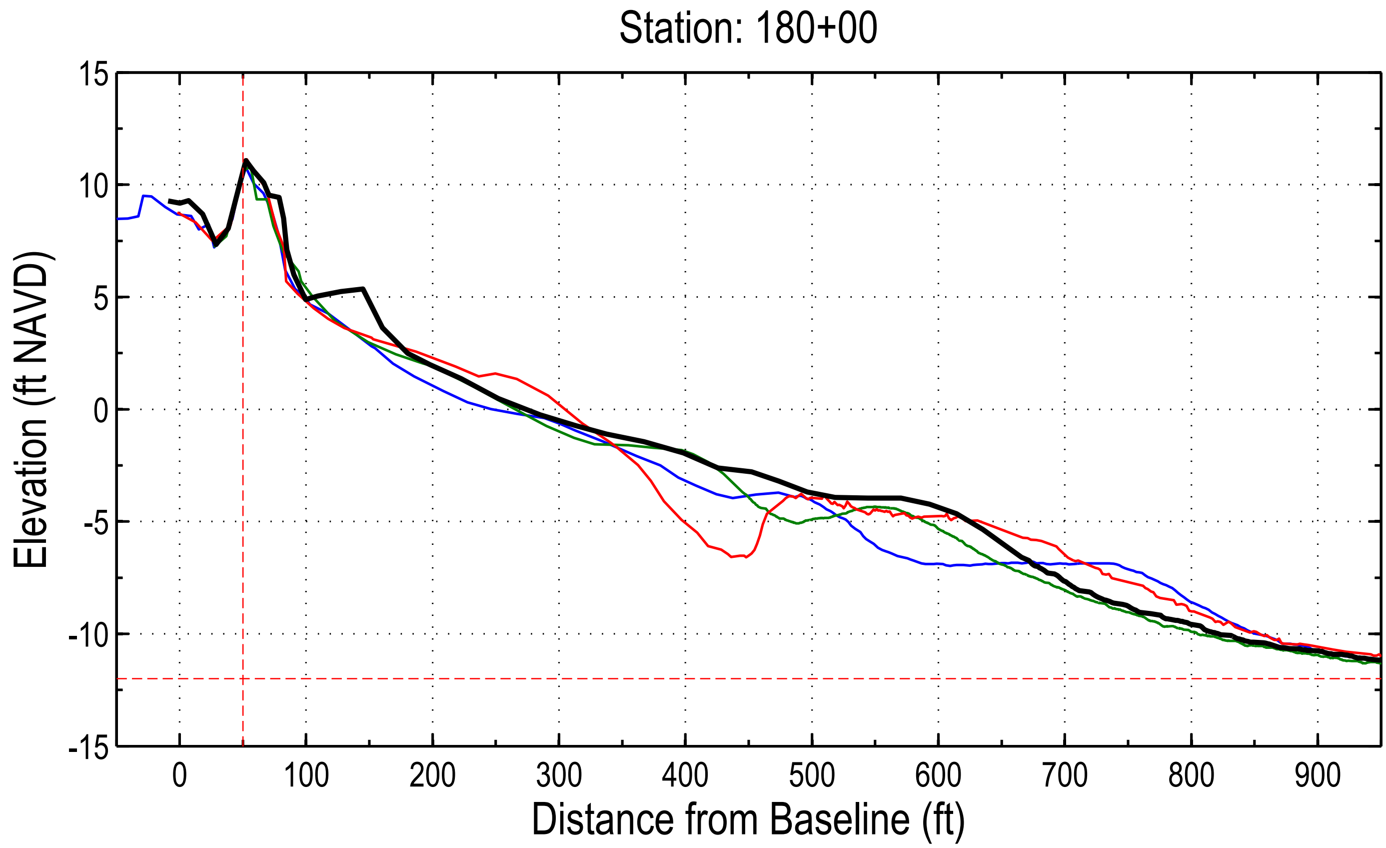
Station: 160+00
10
0
-10
-20
-30
-40
Elevation (ft NAVD)
0
500
1000
1500
2000
2500
3000
3500
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010

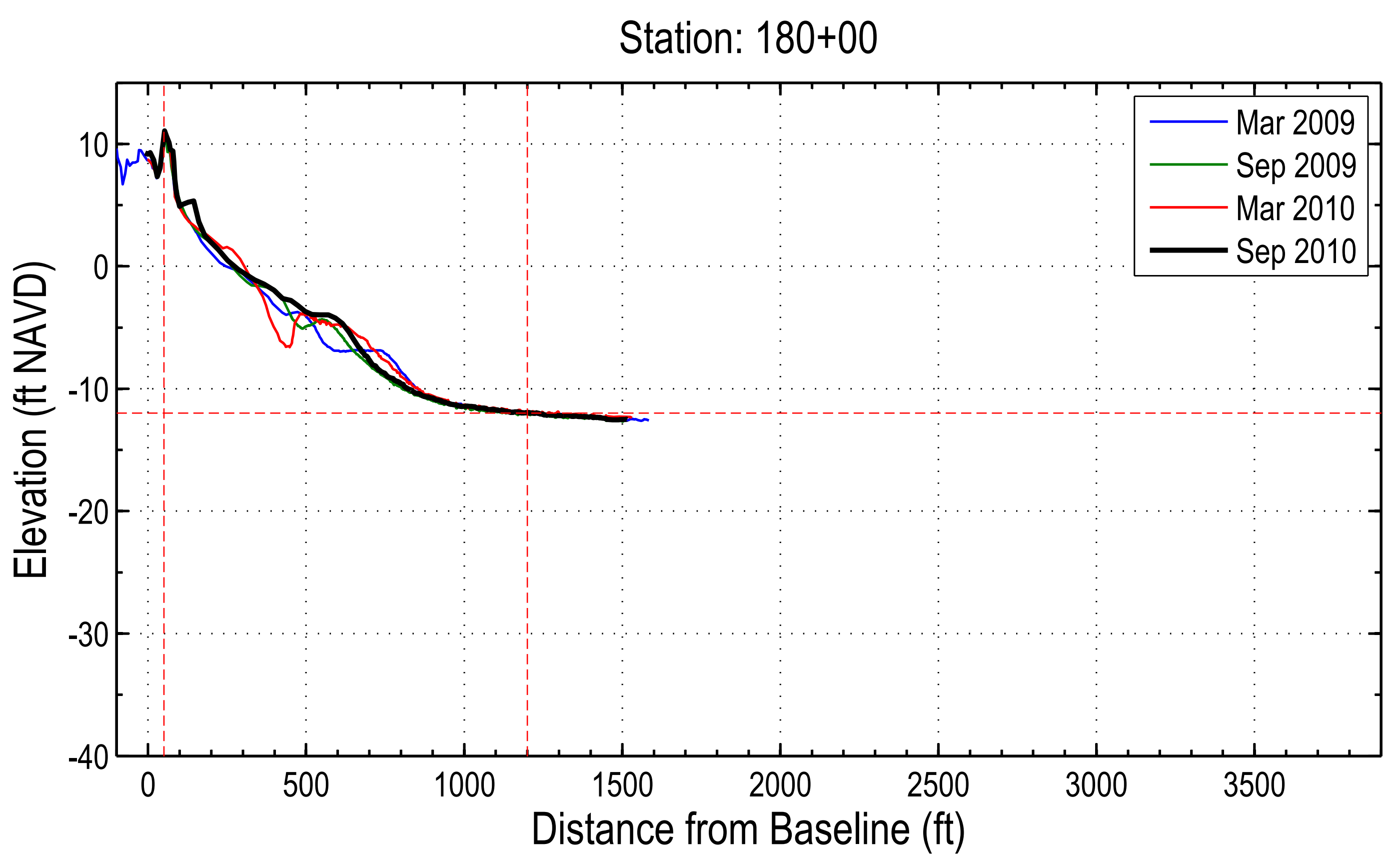


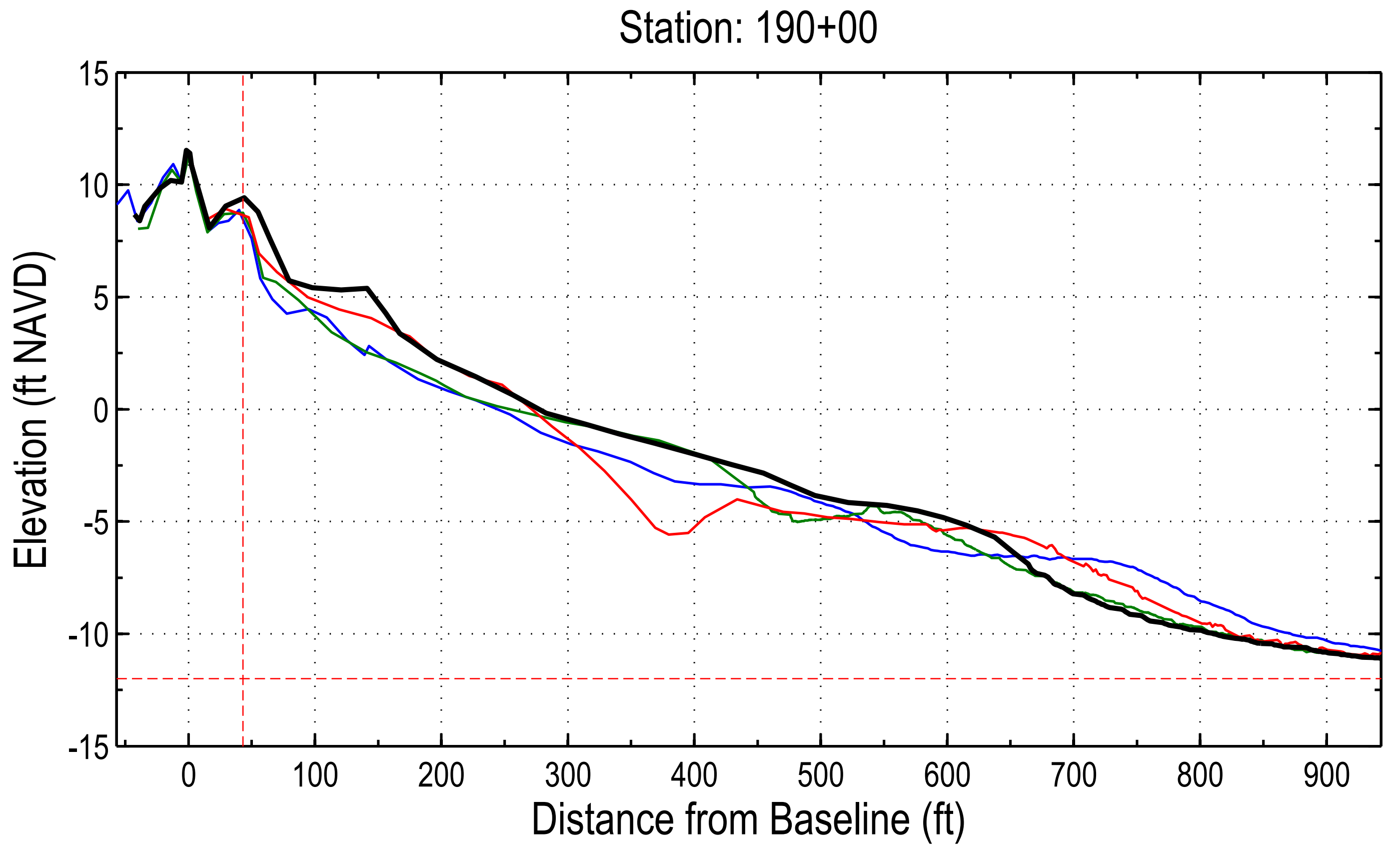
Station: 170+00
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



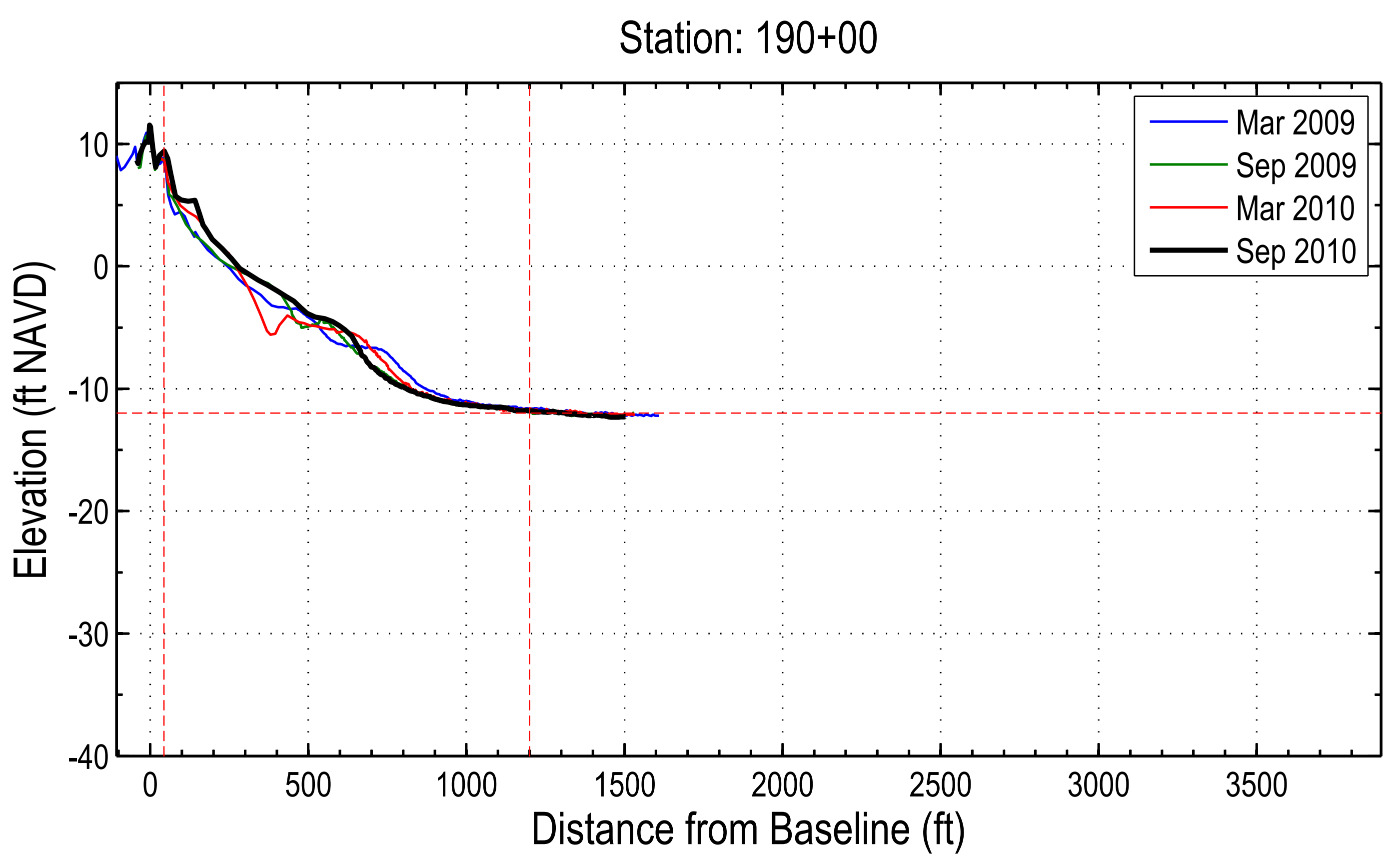
Station: 170+00
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500


Station: 180+00
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900

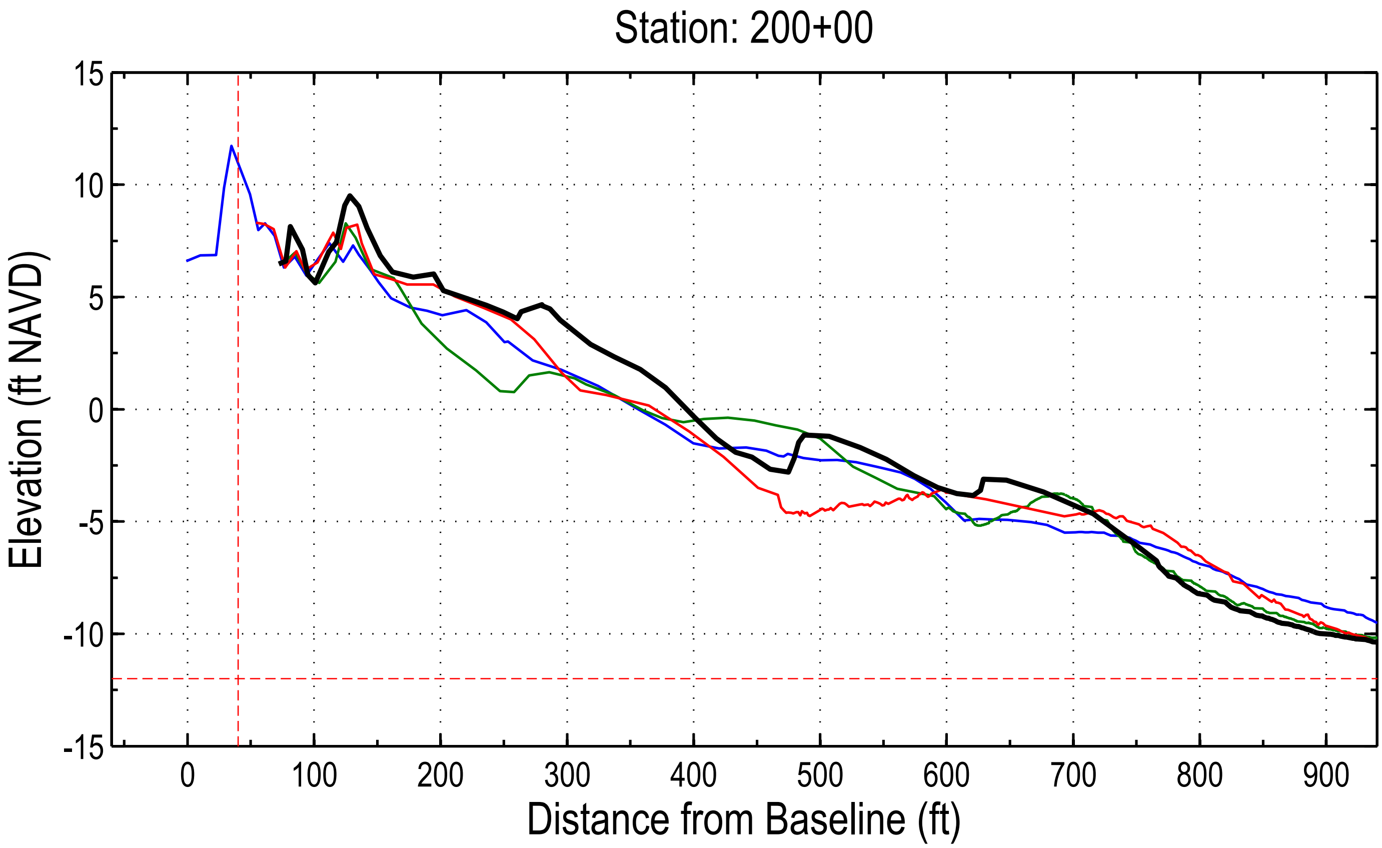

Station: 180+00
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Mar 2009
Sep 2009
Mar 2010
Sep 2010

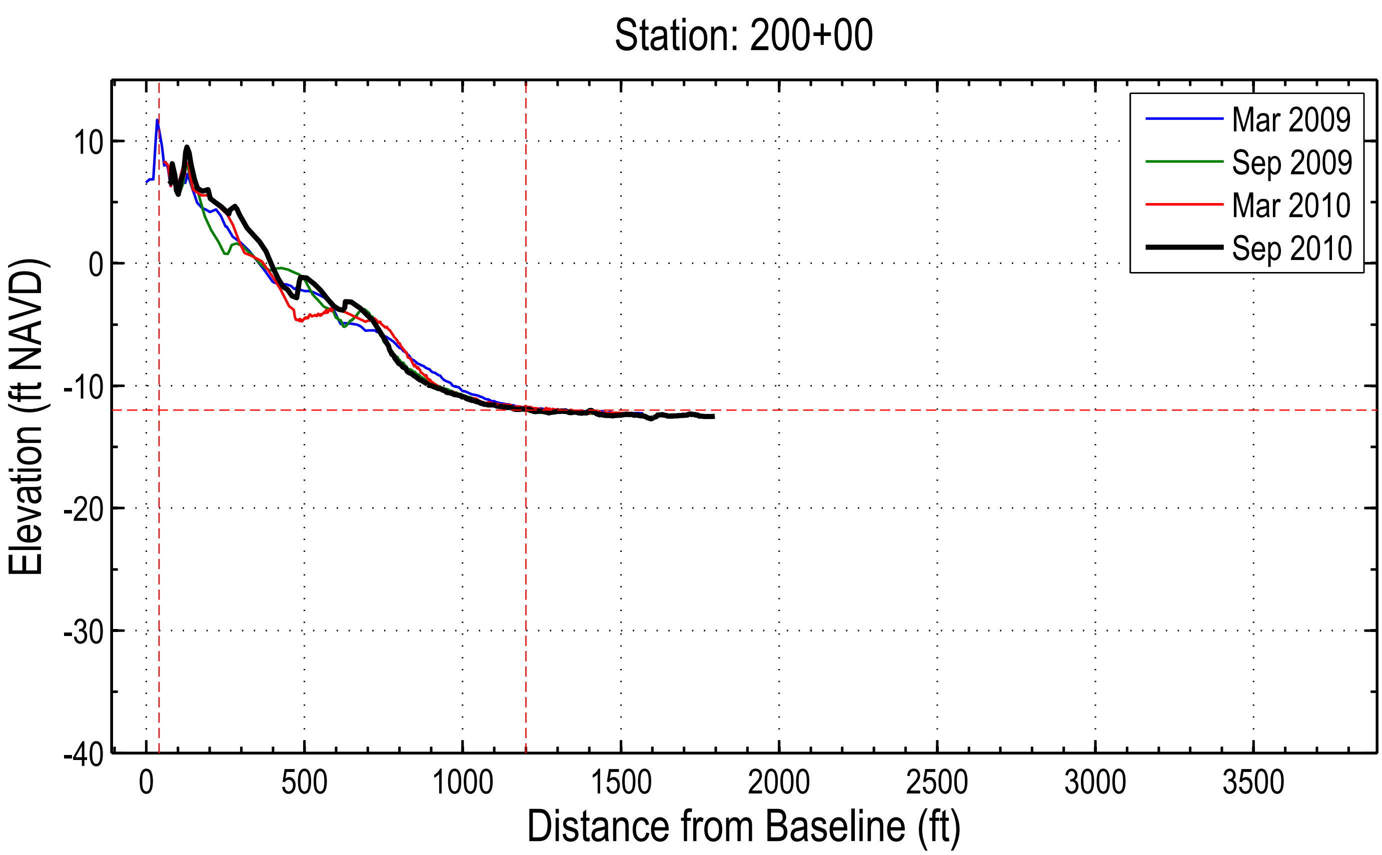


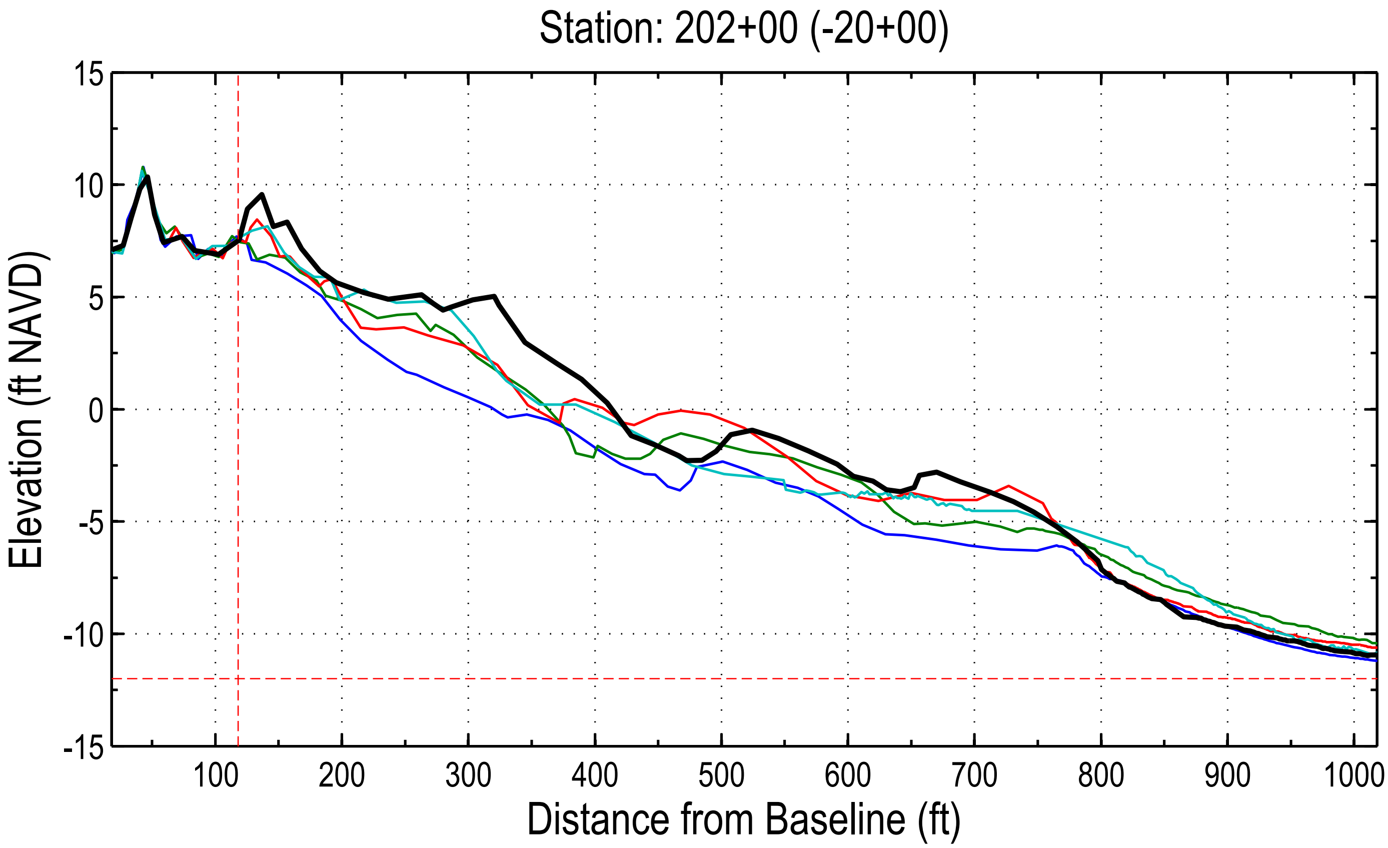
Station: 190+00
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900

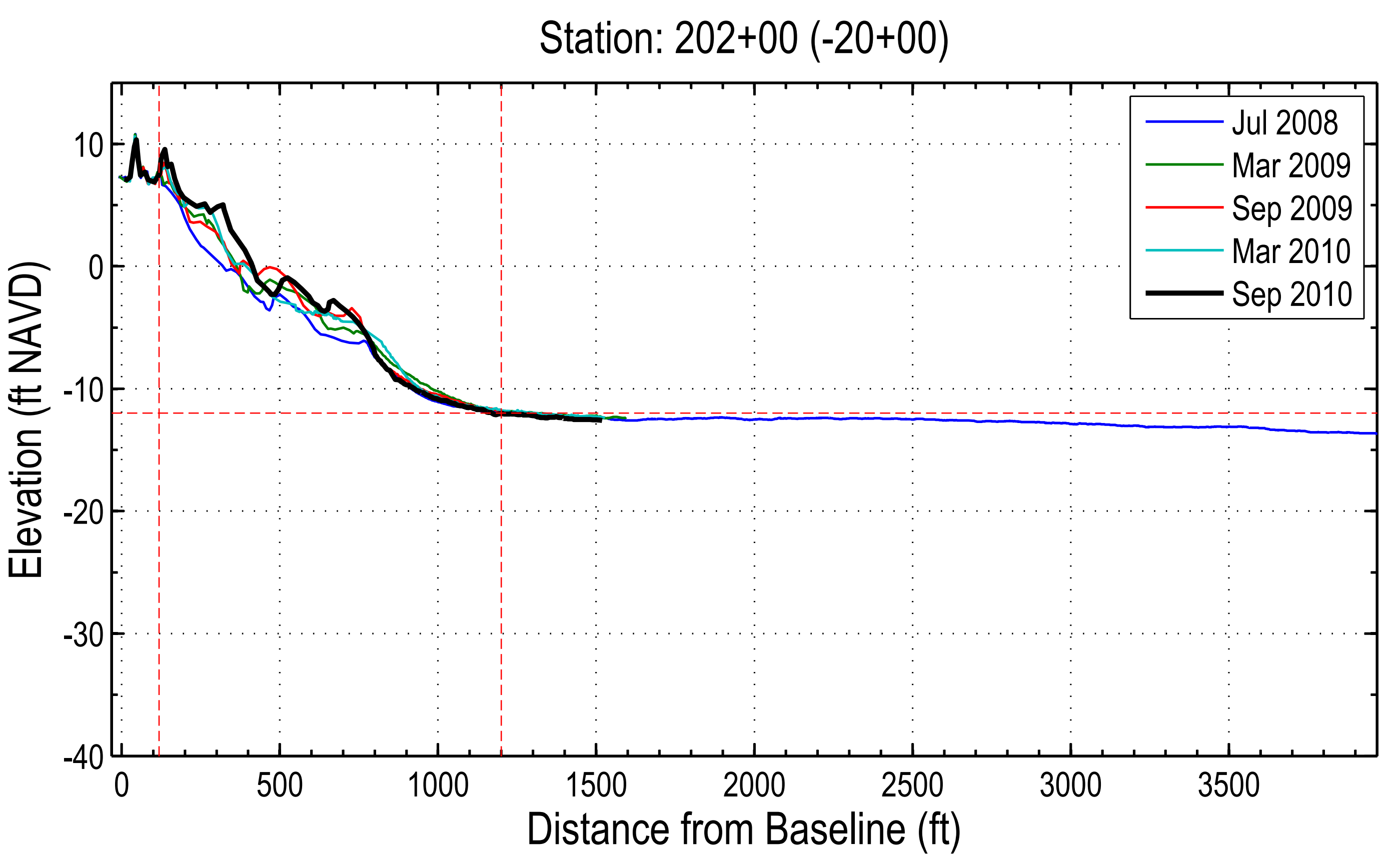


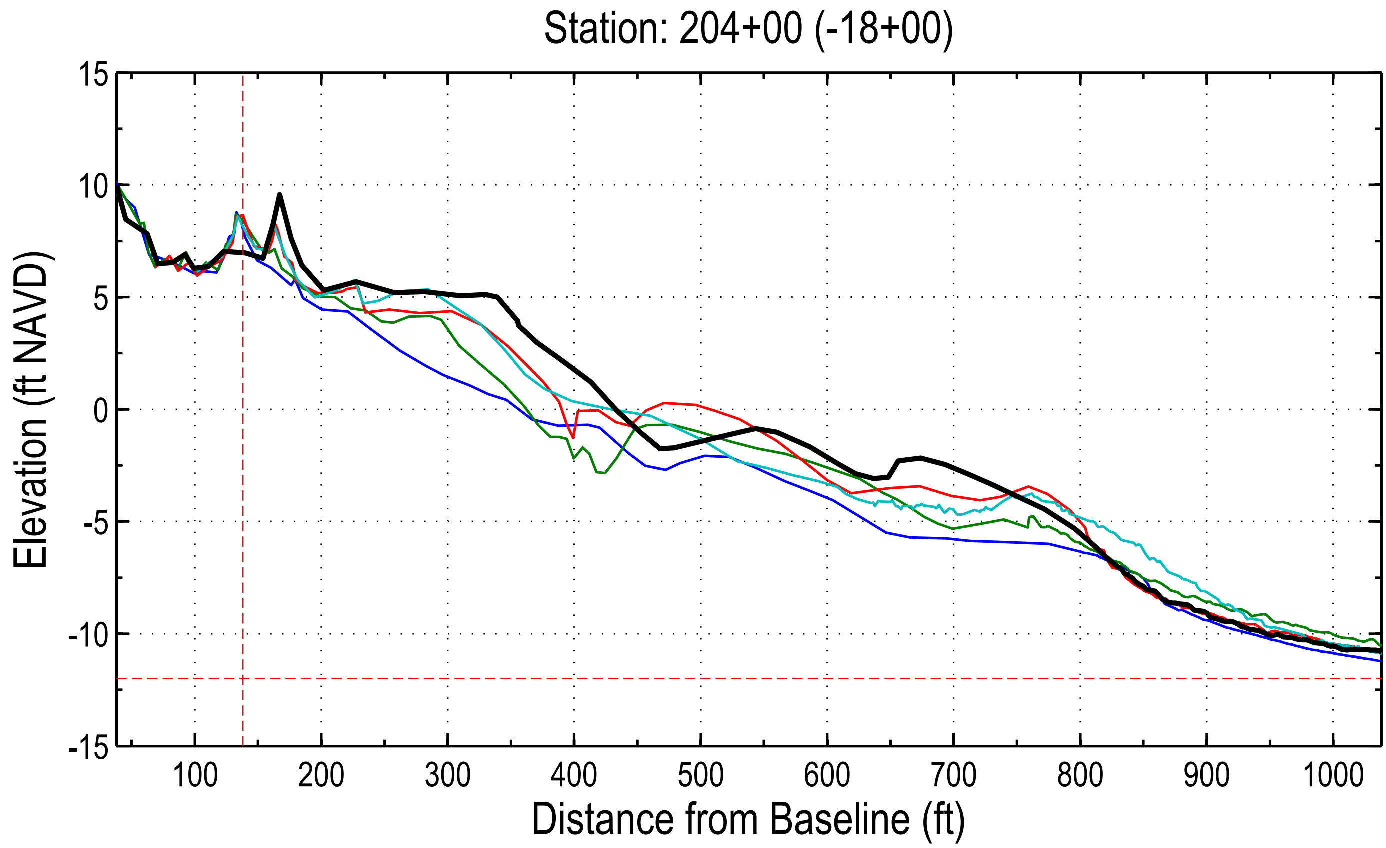
Station: 190+00
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Mar 2009
Sep 2009
Mar 2010
Sep 2010

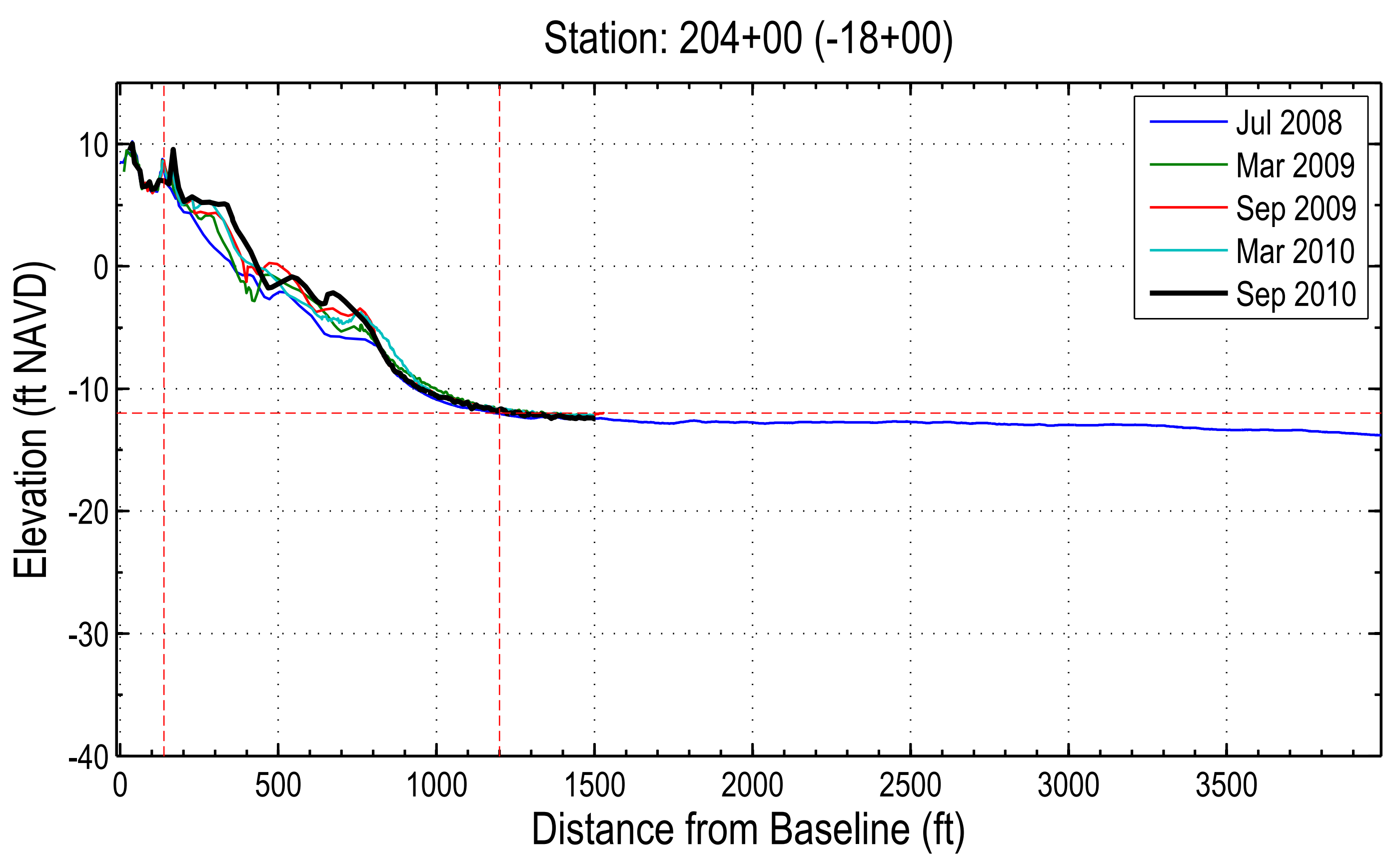

Station: 200+00
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900

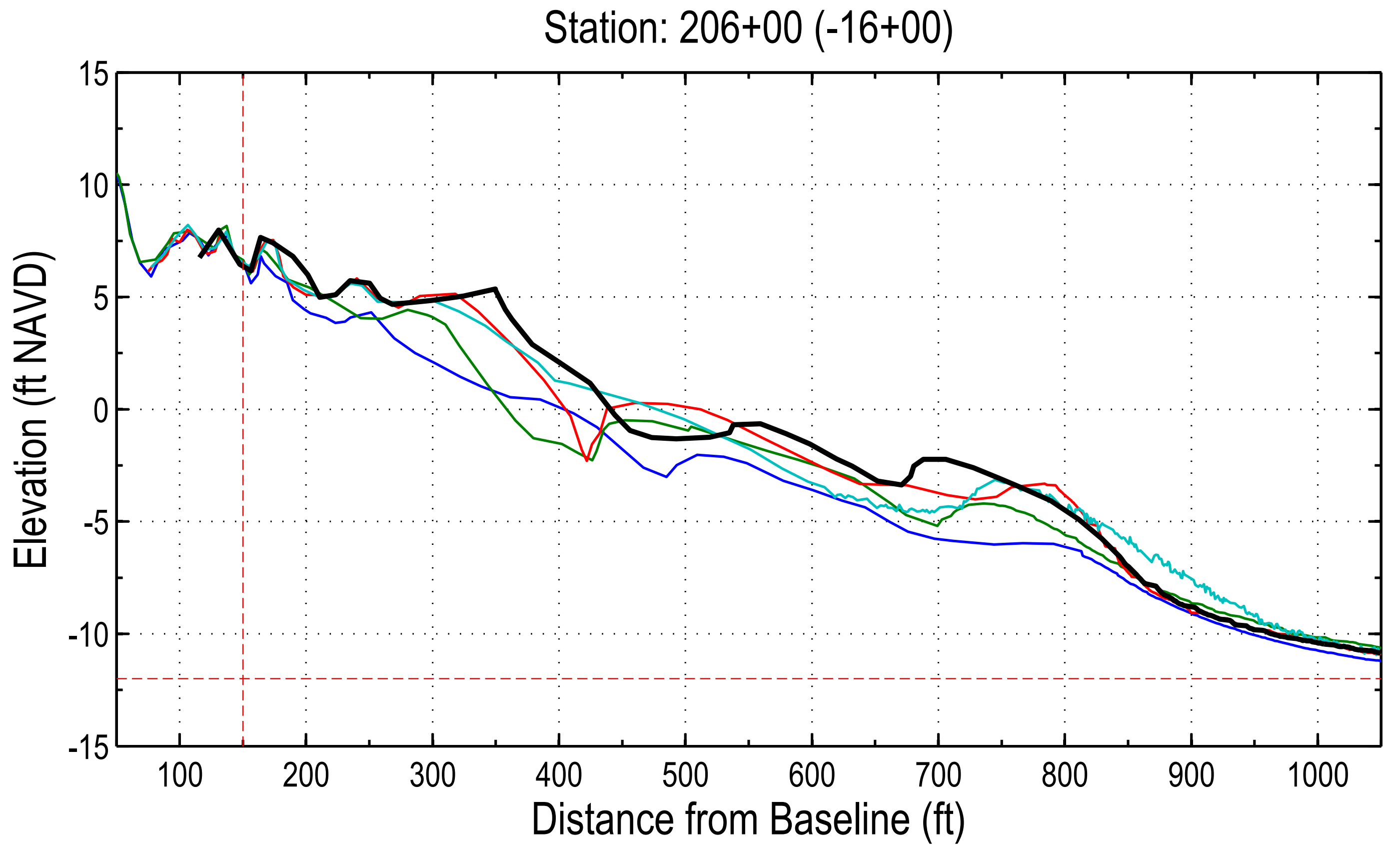

Station: 200+00
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500

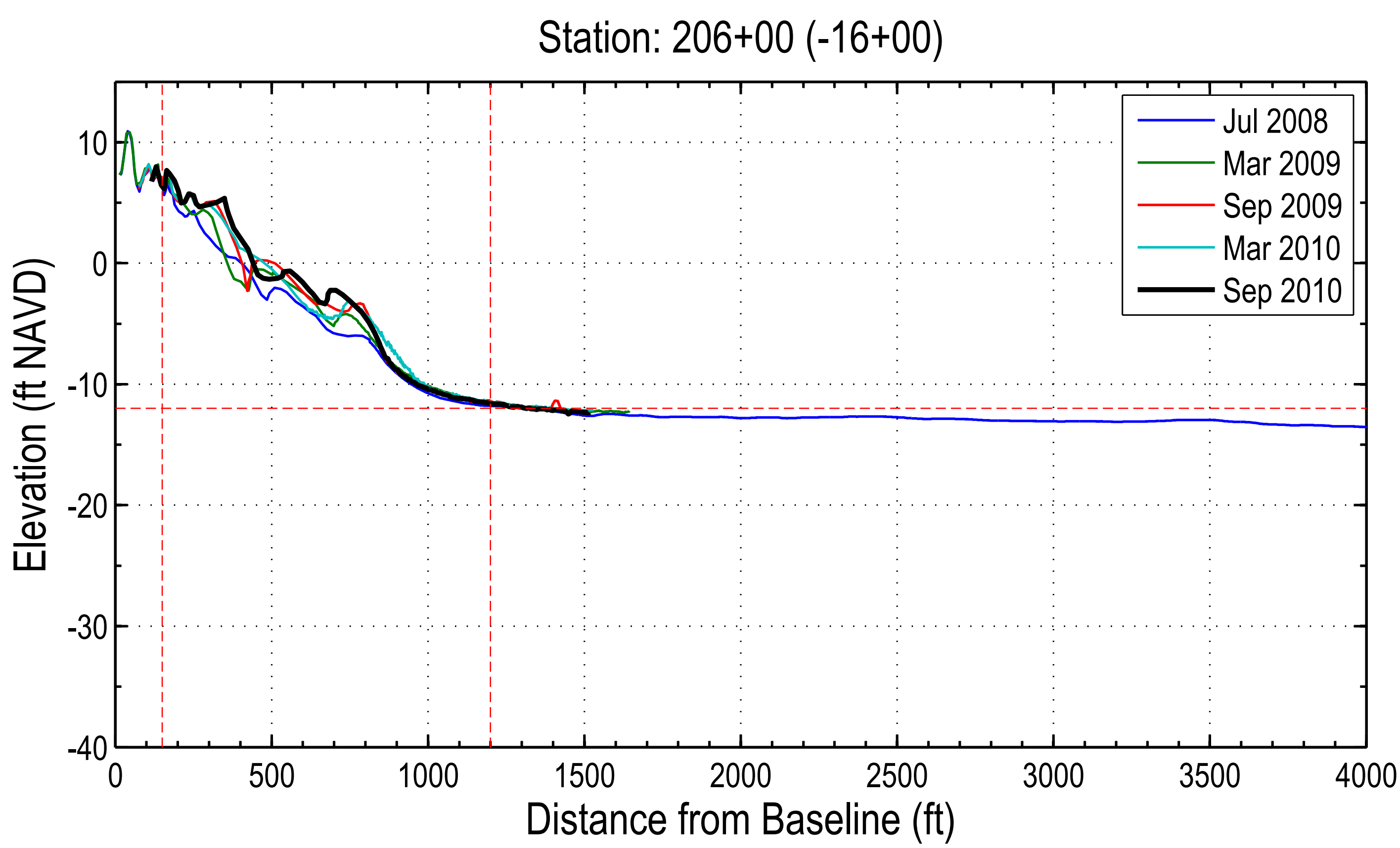

Station: 202+00 (-20+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000


Station: 202+00 (-20+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 204+00 (-18+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000


Station: 204+00 (-18+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 206+00 (-16+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000


Station: 206+00 (-16+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
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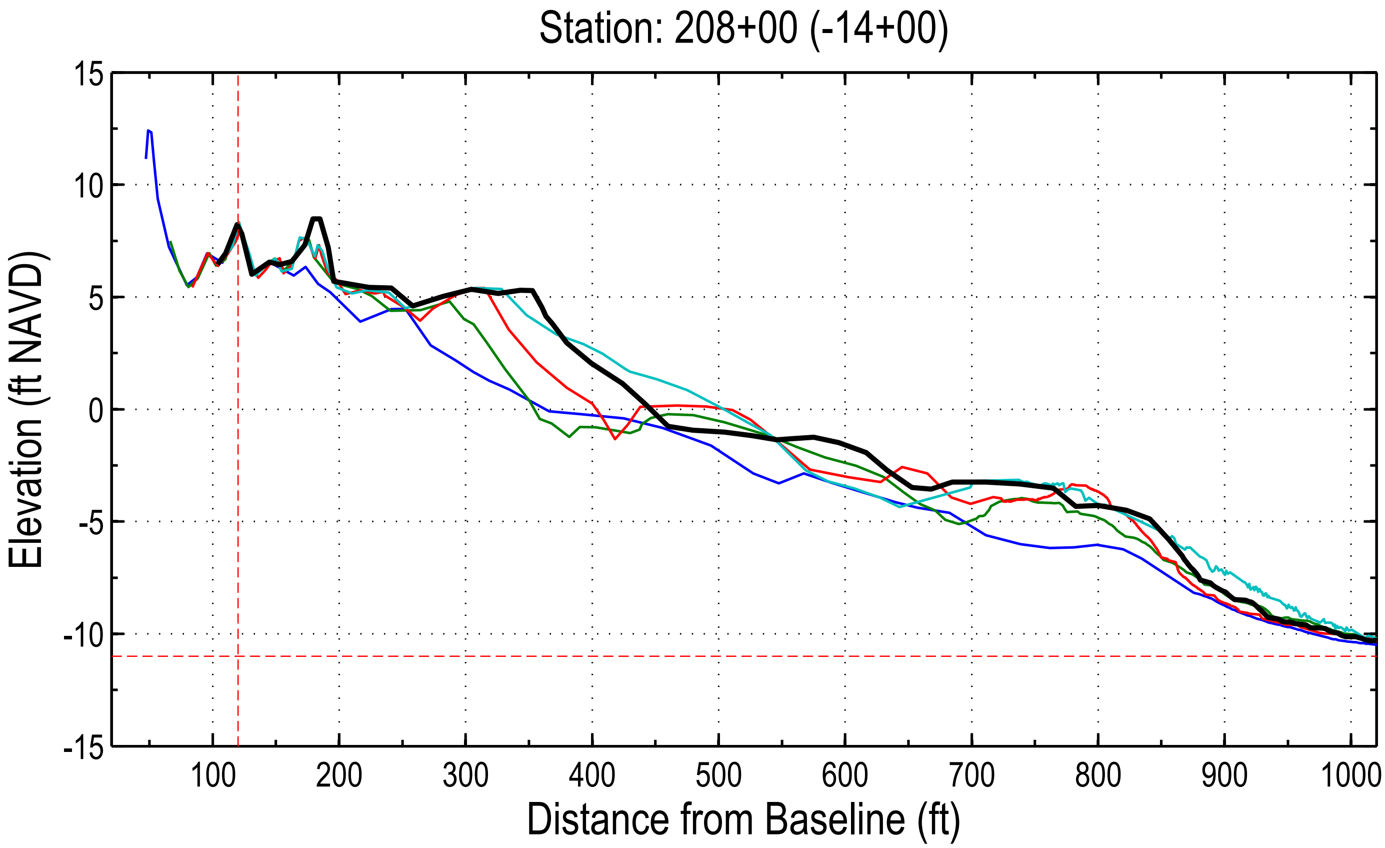
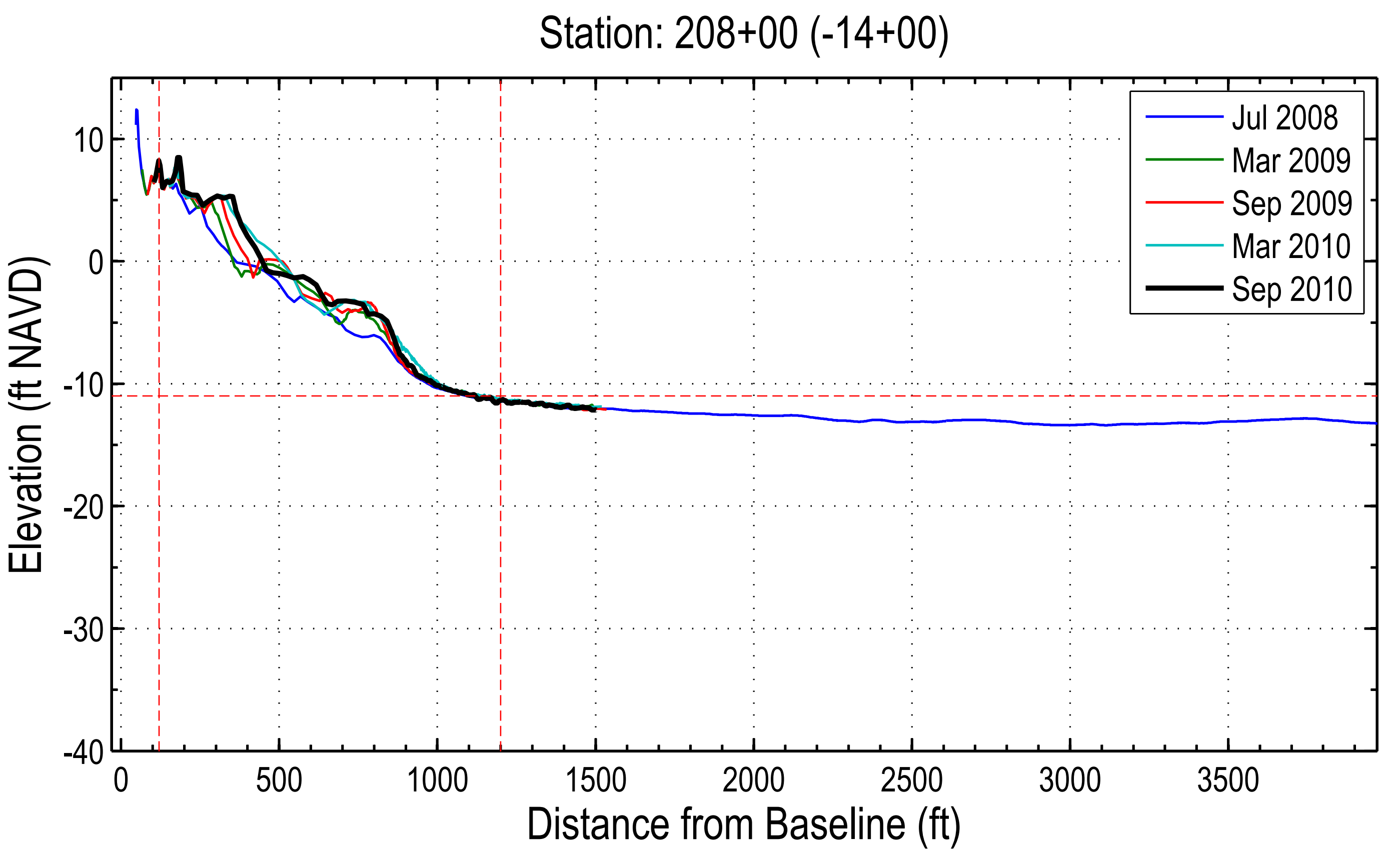
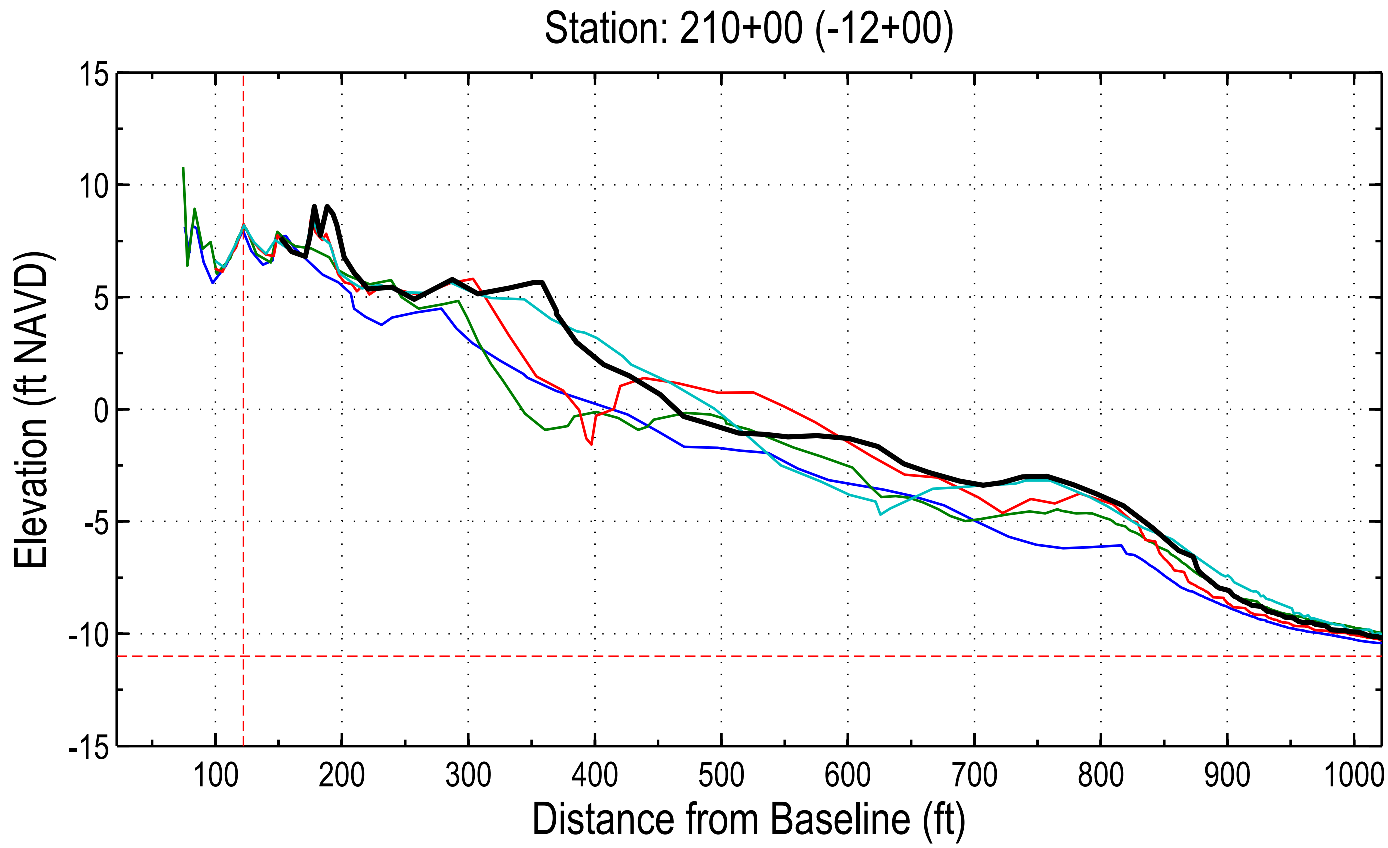
2000
2500
3000
3500
4000



Station: 208+00 (-14+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



Station: 208+00 (-14+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500


Station: 210+00 (-12+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
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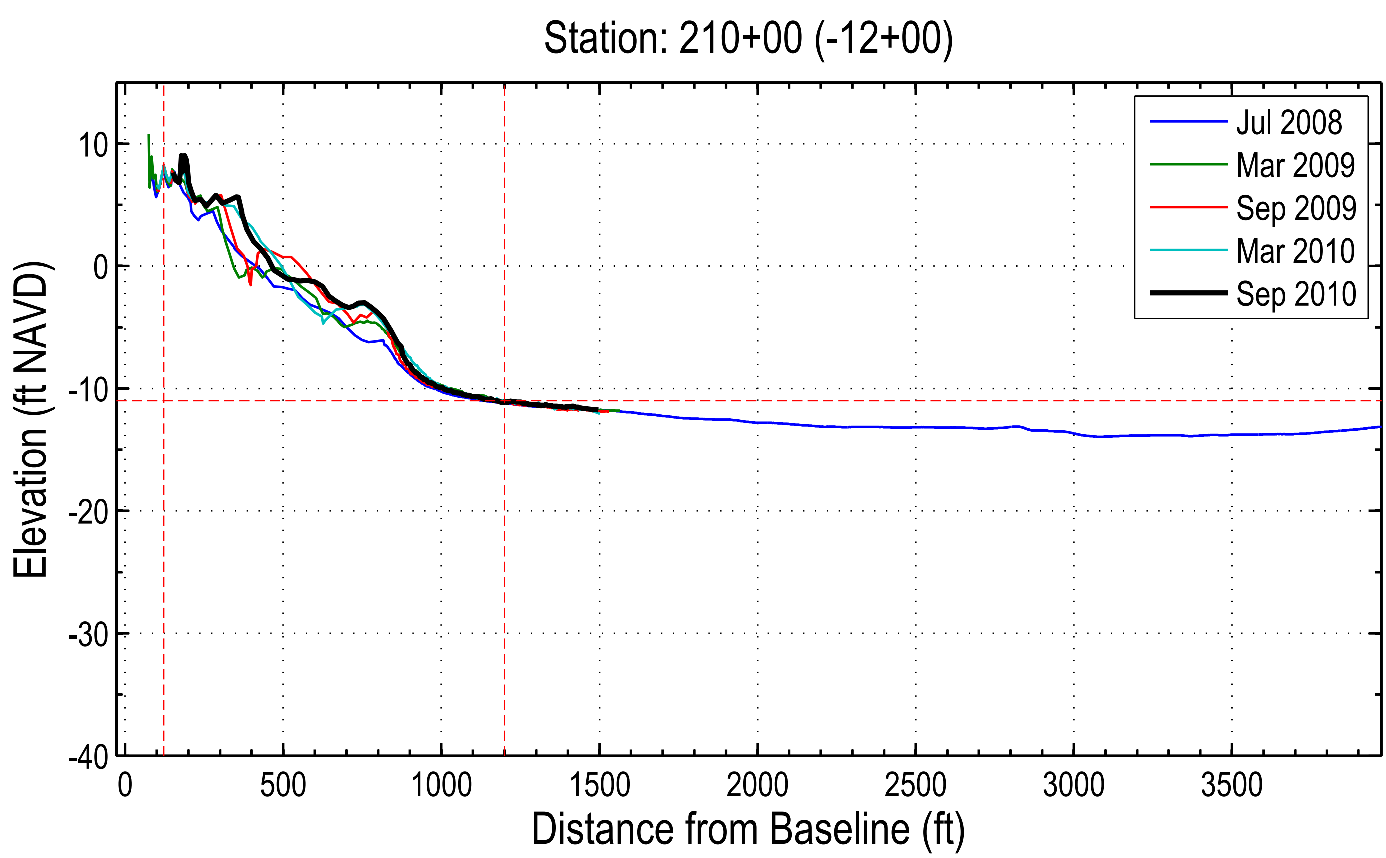
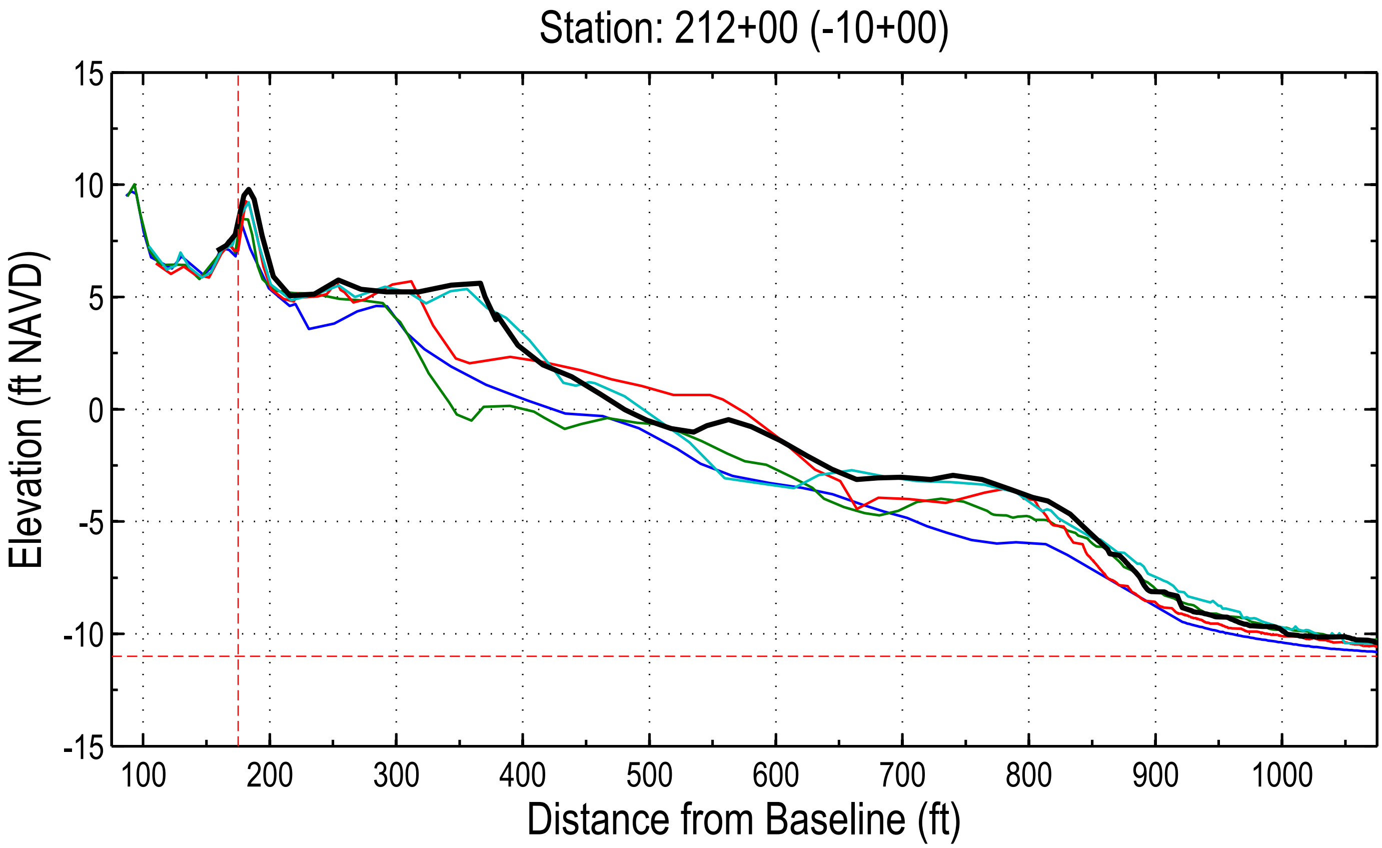
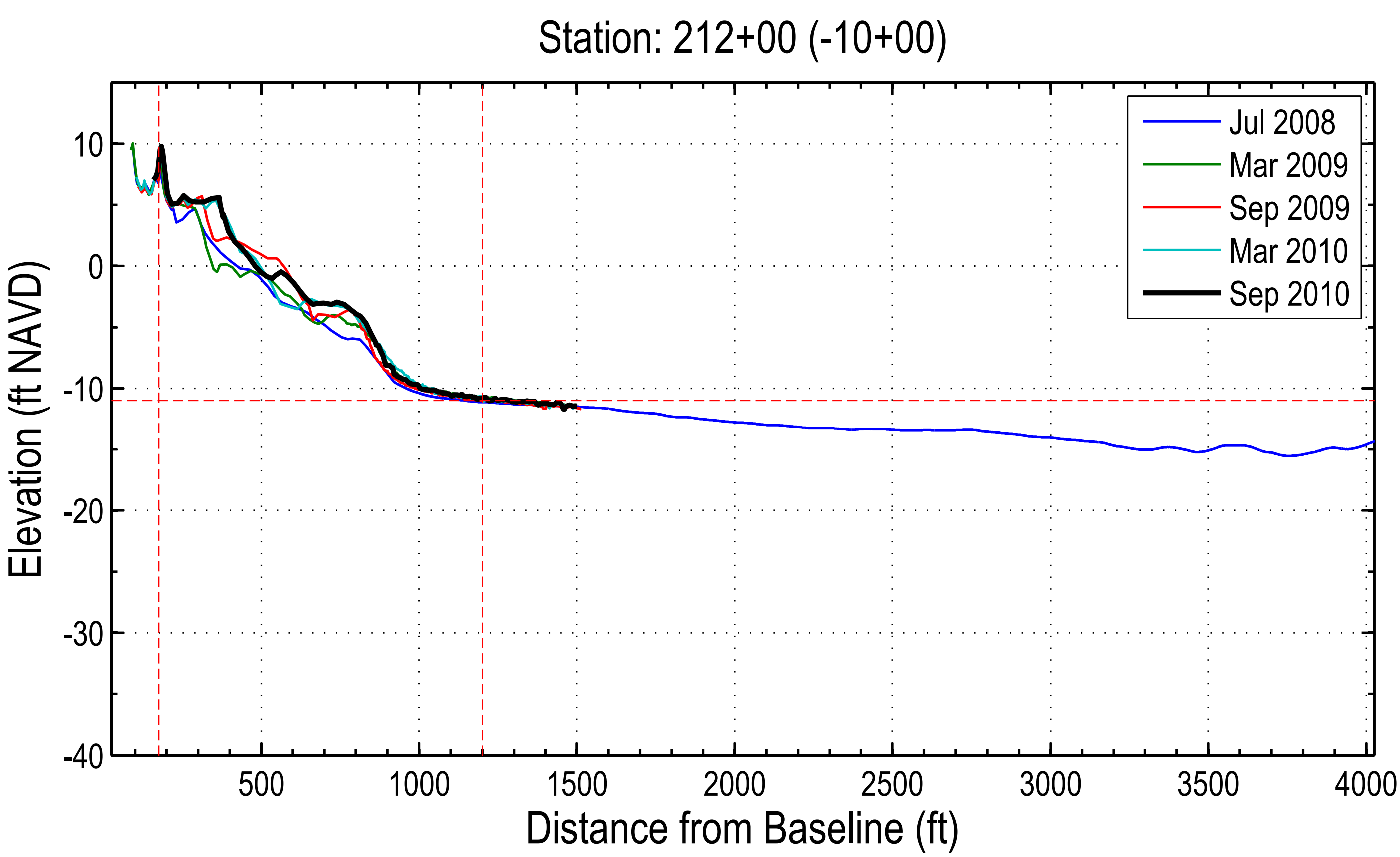
300
400
500
600
700
800
900
1000

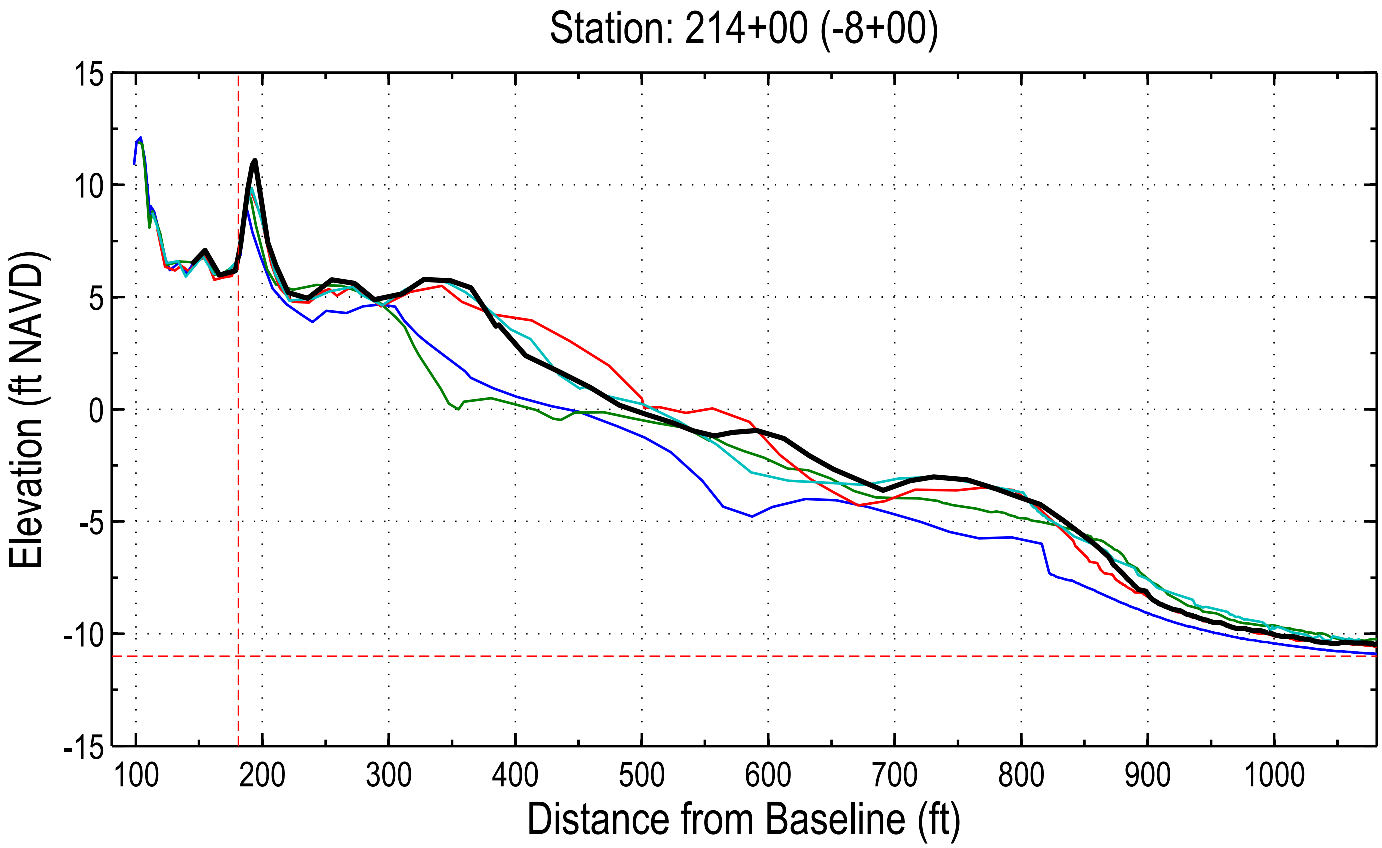

Station: 210+00 (-12+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

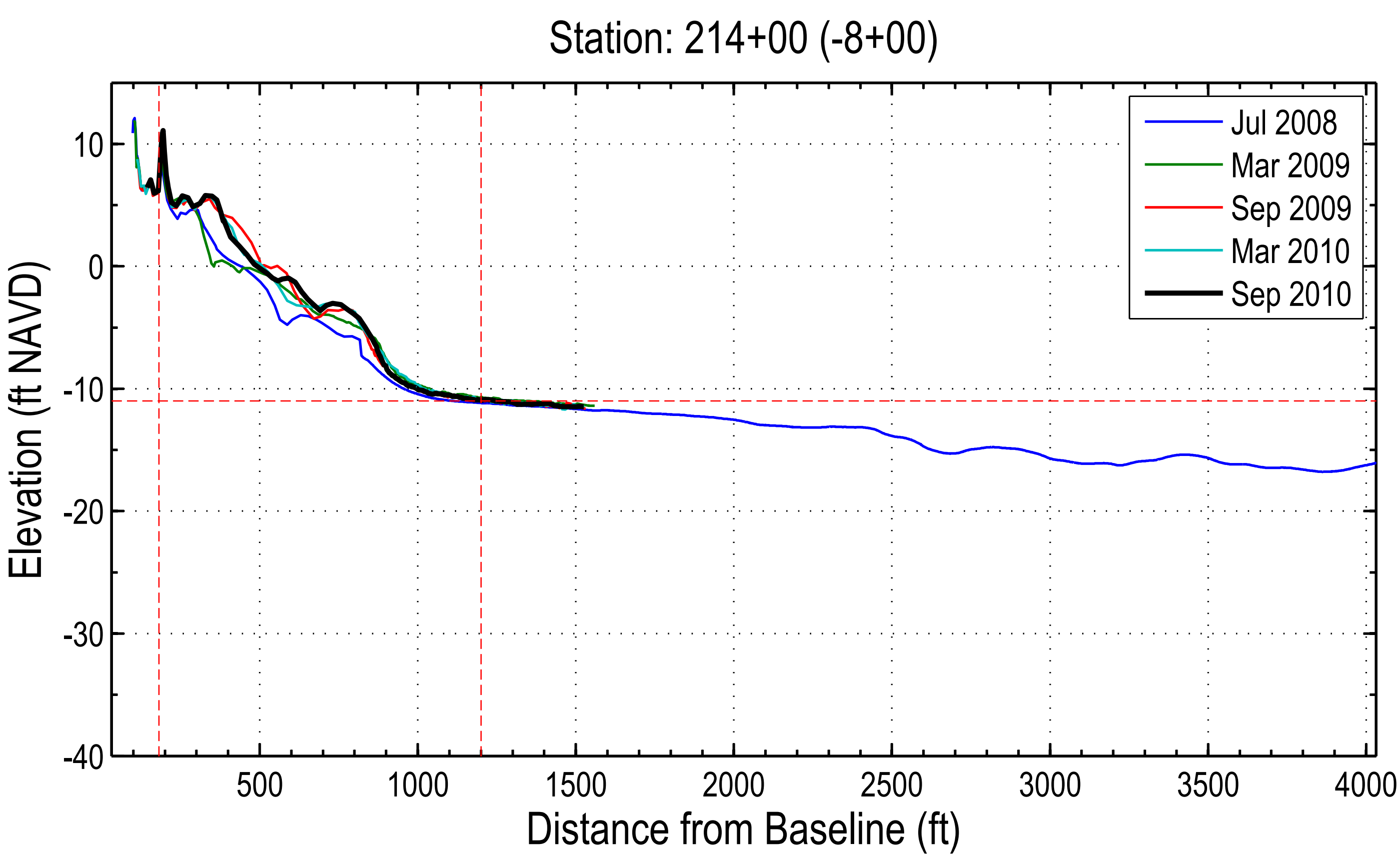


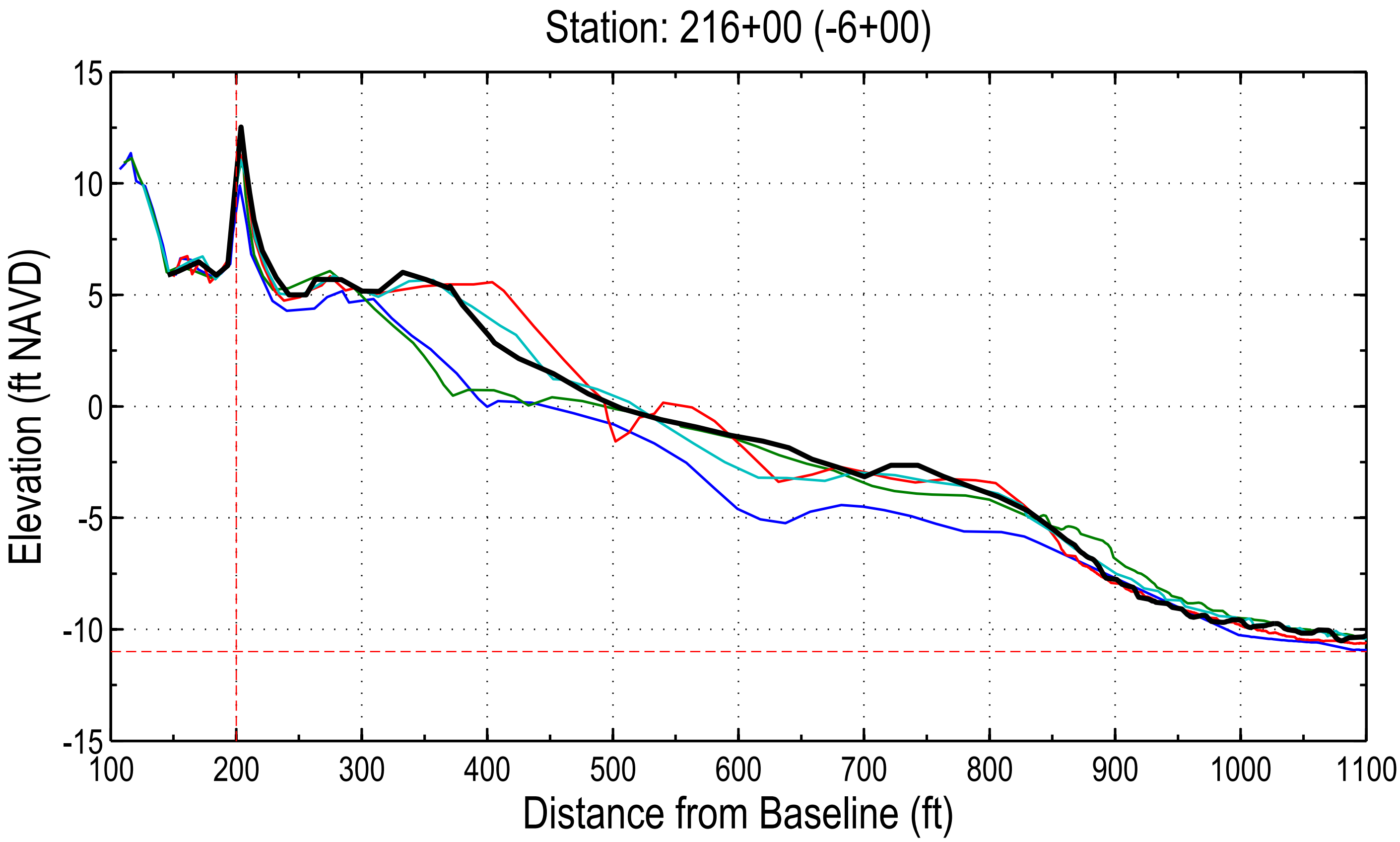
Station: 212+00 (-10+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



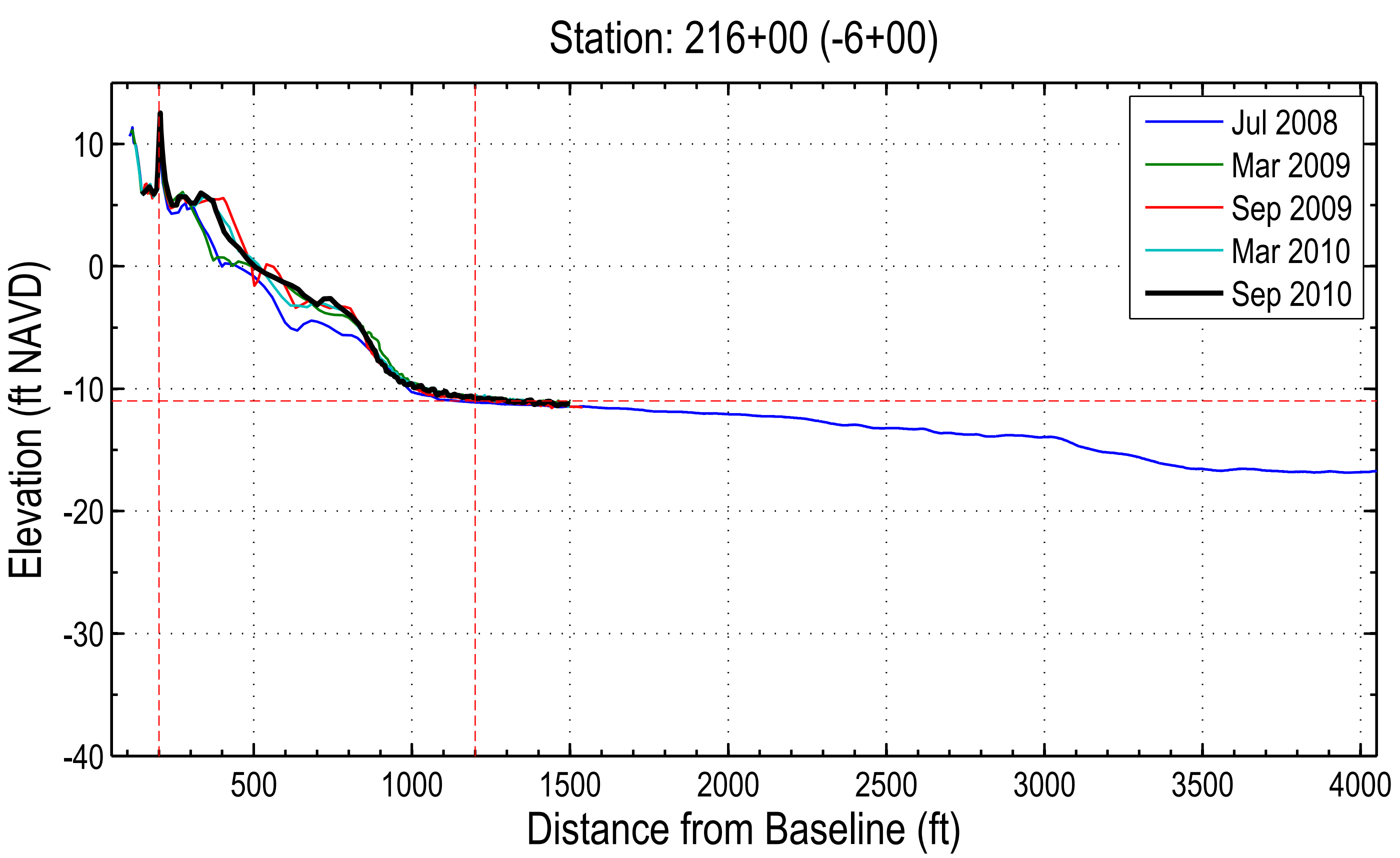
Station: 212+00 (-10+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 214+00 (-8+00)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000
Elevation (ft NAVD)
Distance from Baseline (ft)

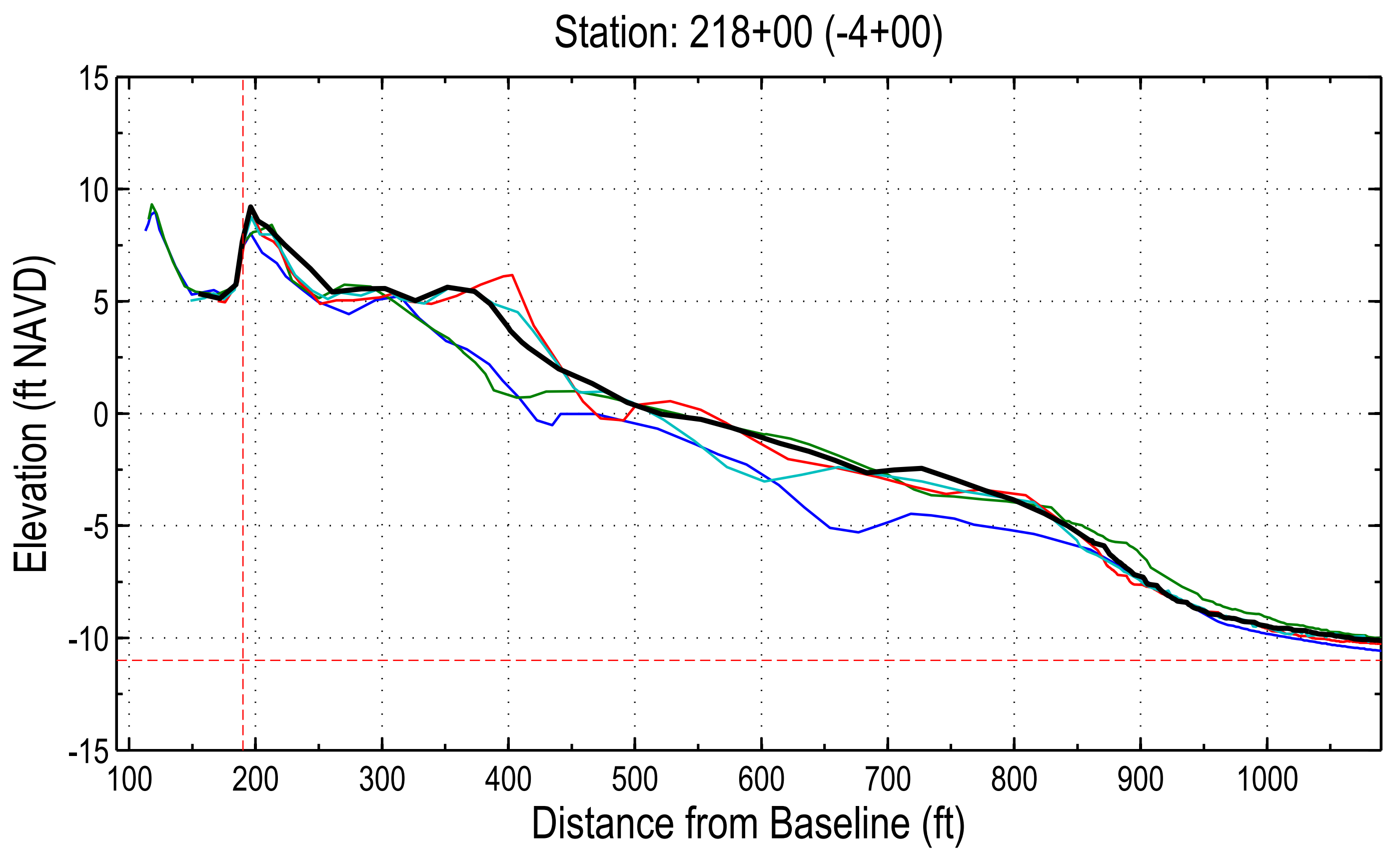

Station: 214+00 (-8+00)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



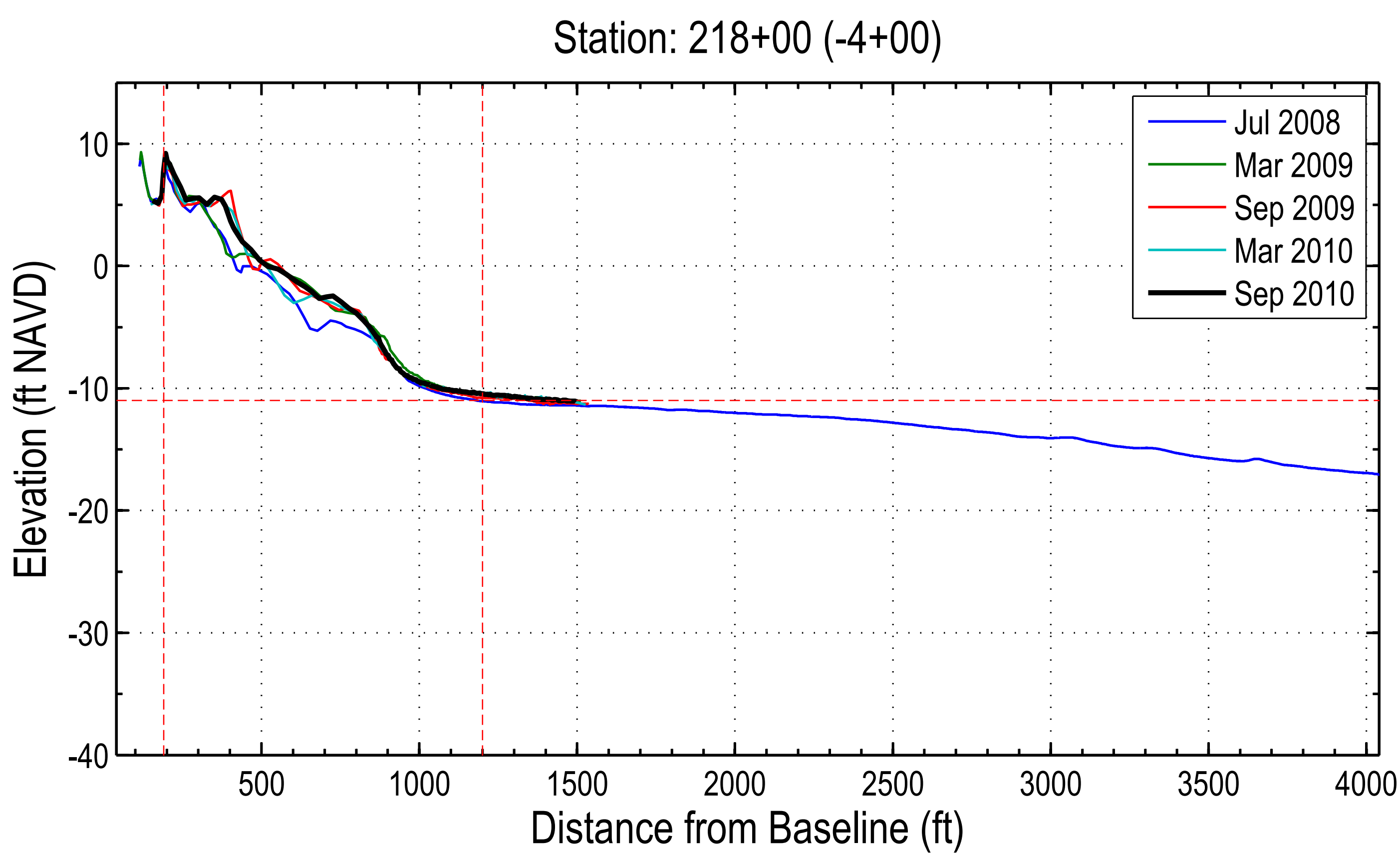
Station: 216+00 (-6+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000
1100



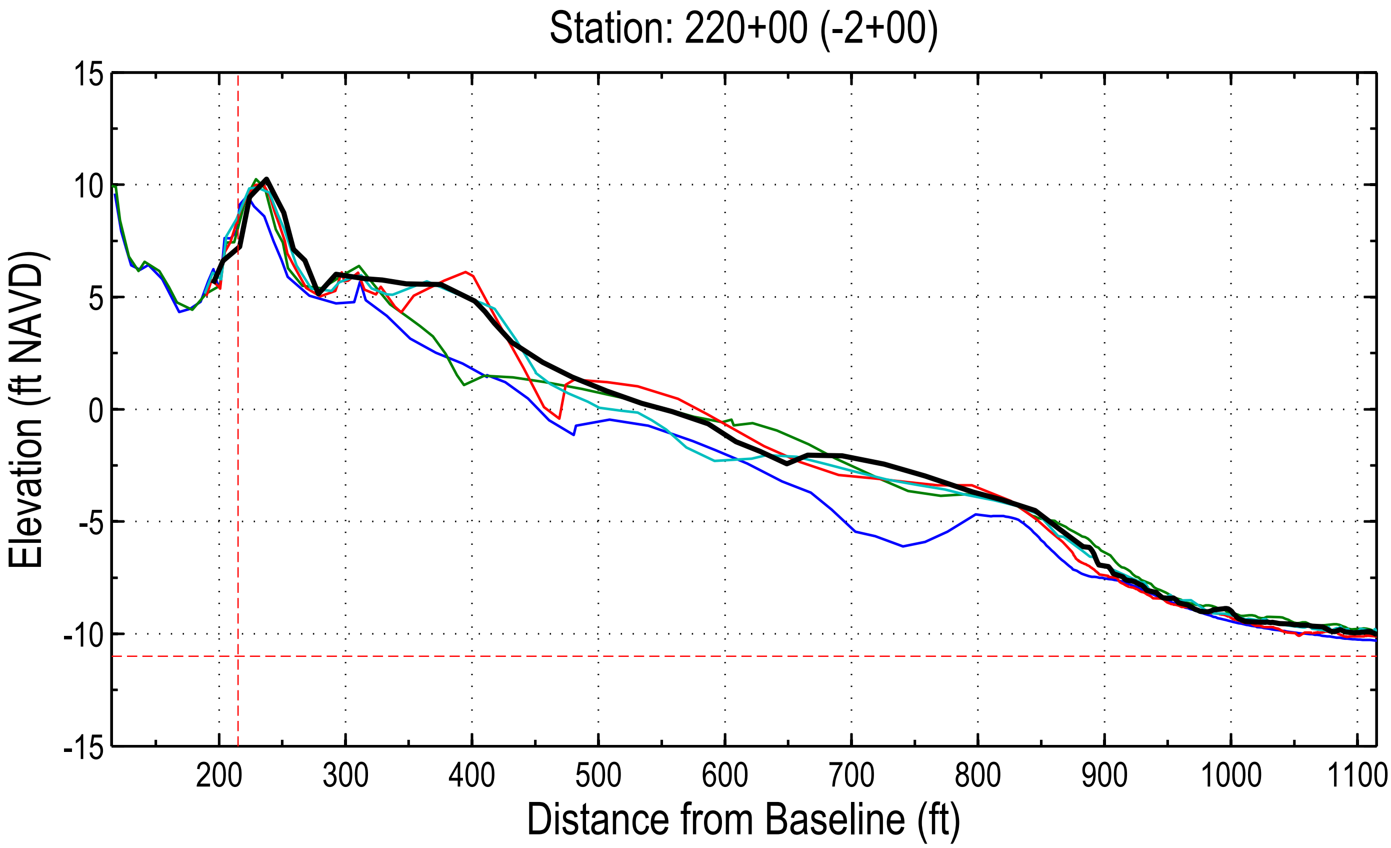
Station: 216+00 (-6+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000



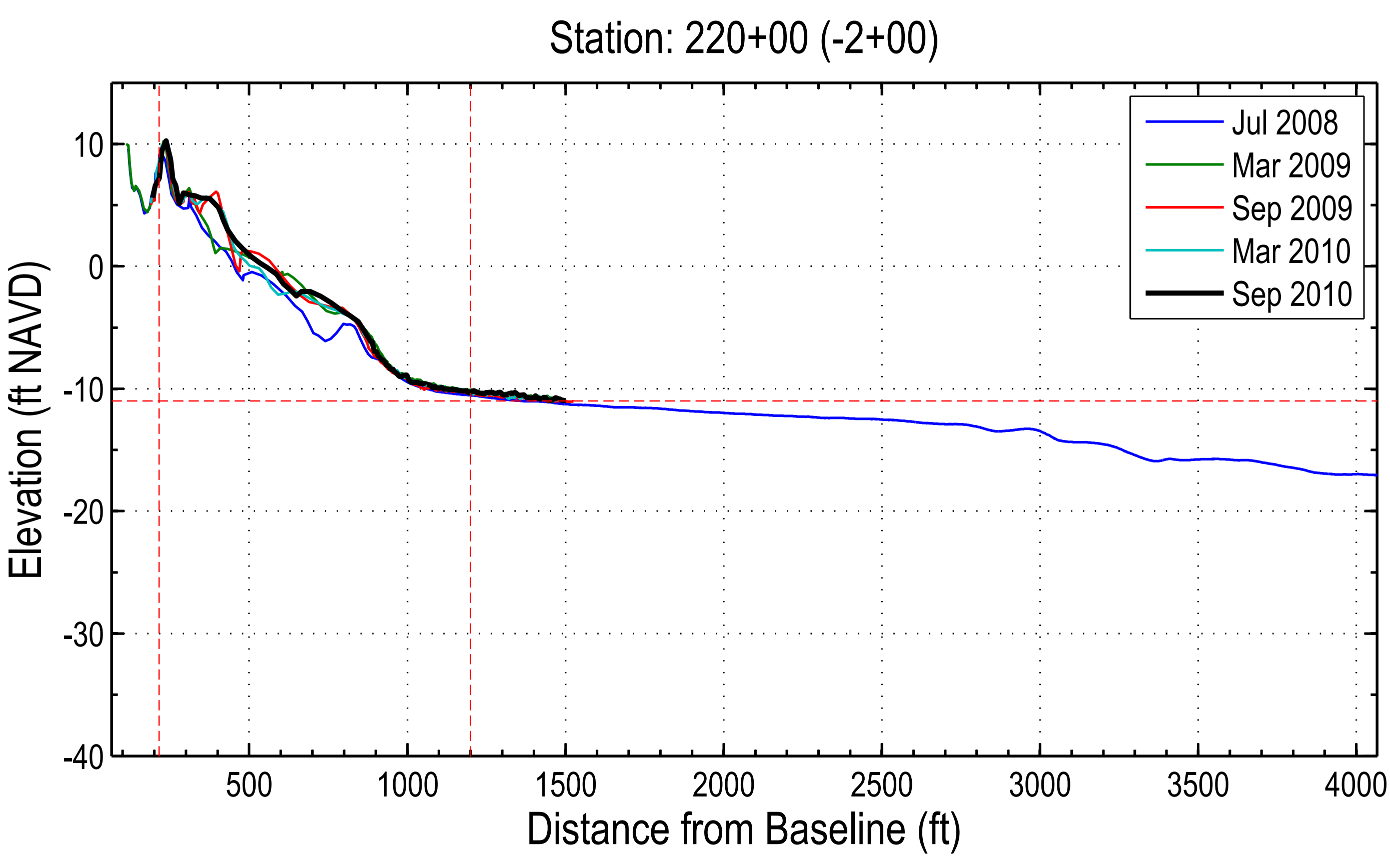
Station: 218+00 (-4+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



Station: 218+00 (-4+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000

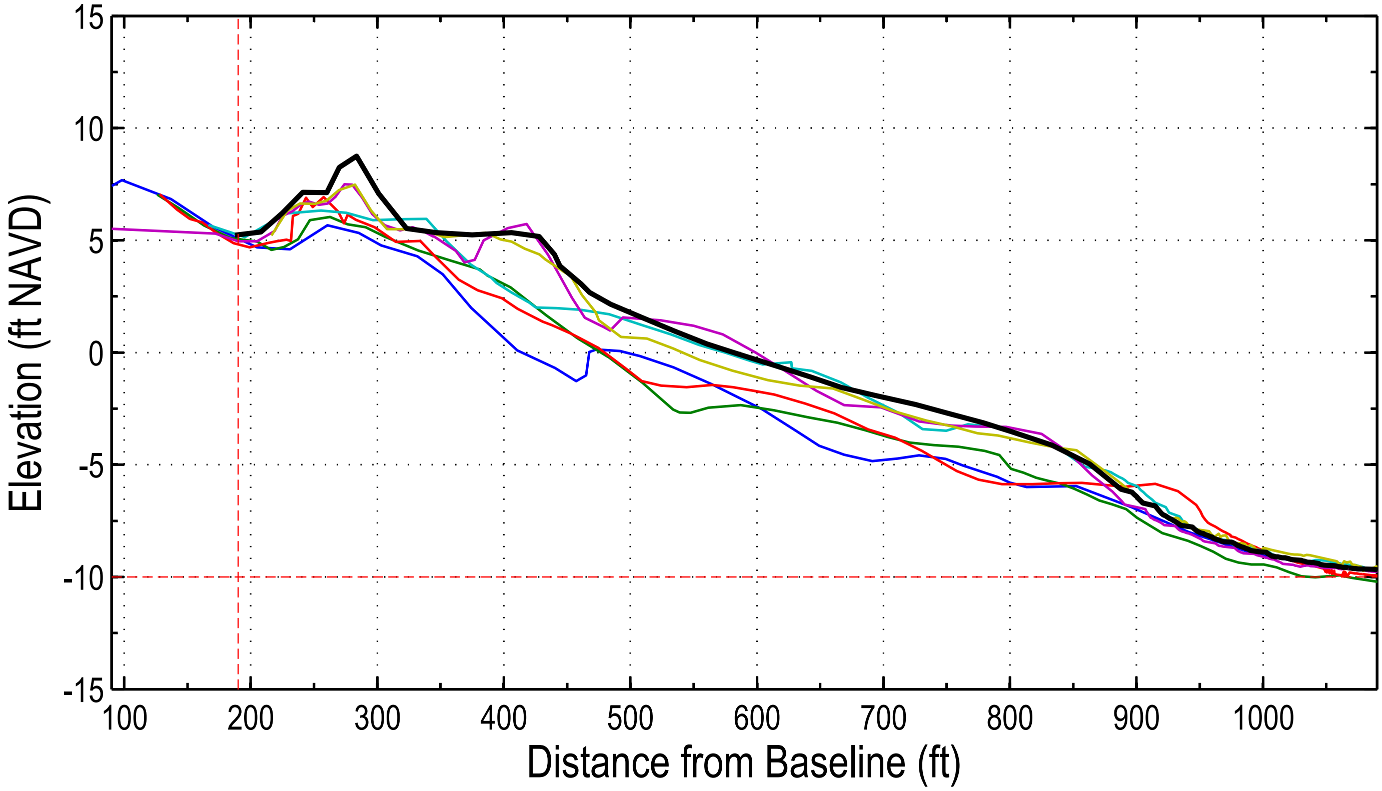


Station: 220+00 (-2+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100

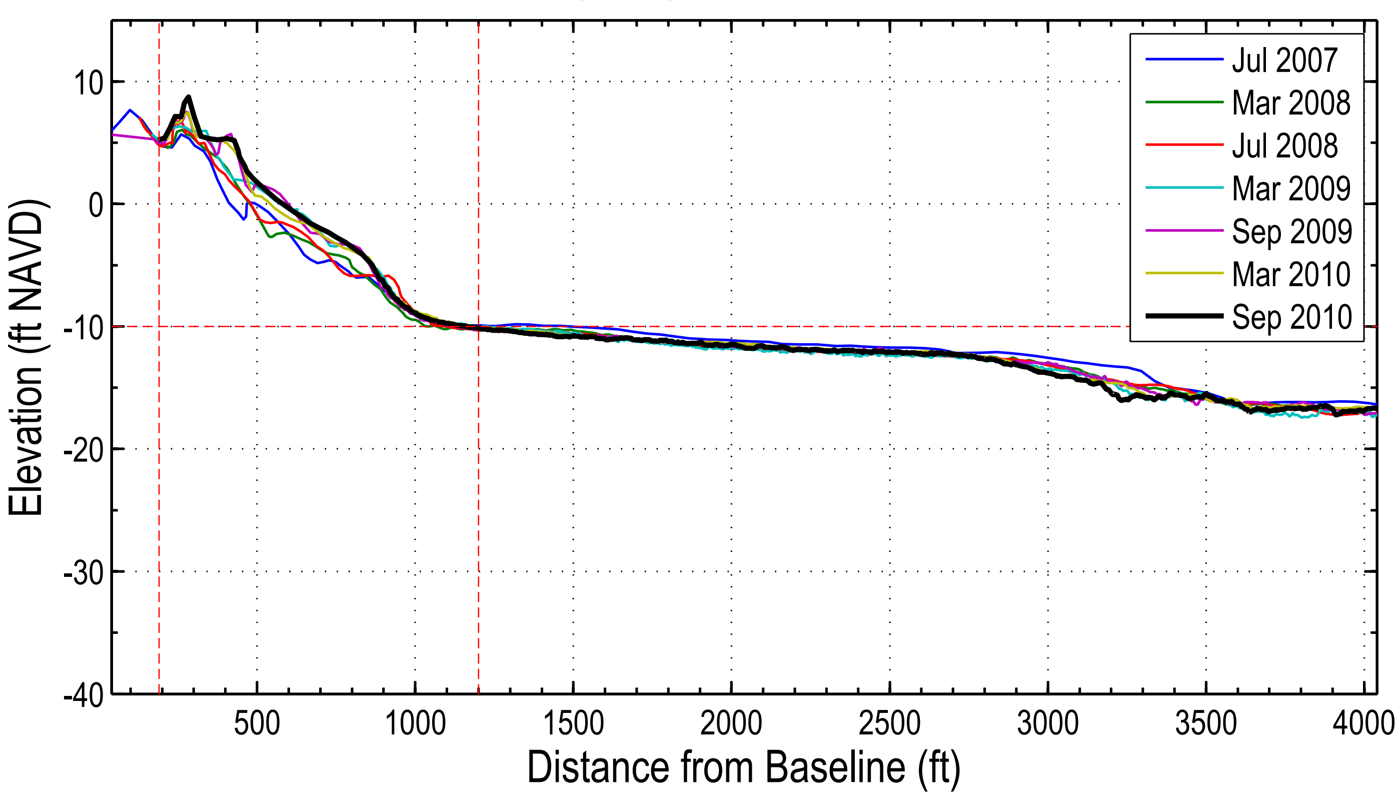


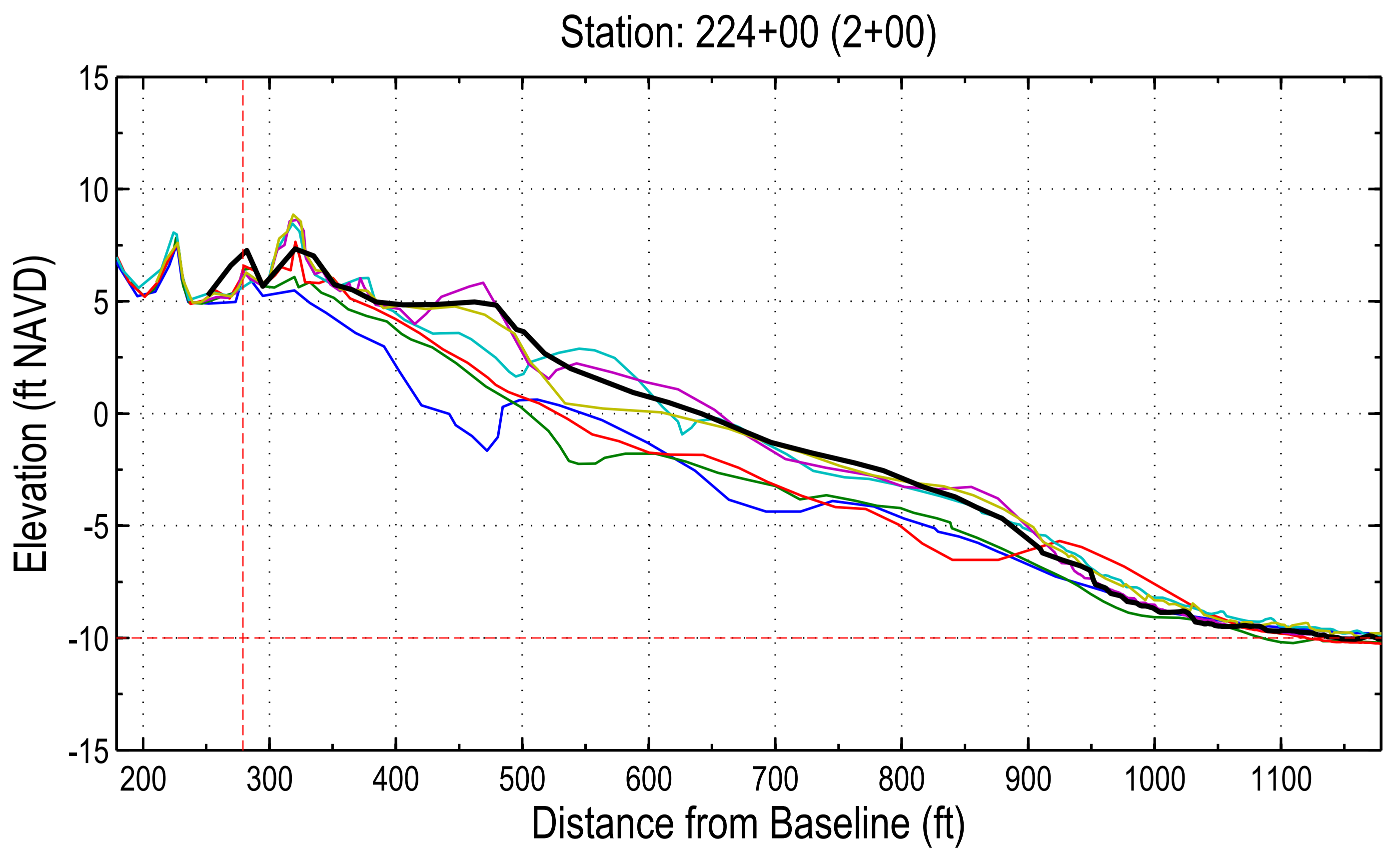
Station: 220+00 (-2+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000

Station: 222+00 (0+00) 53RD AVENUE - SCCC 3159

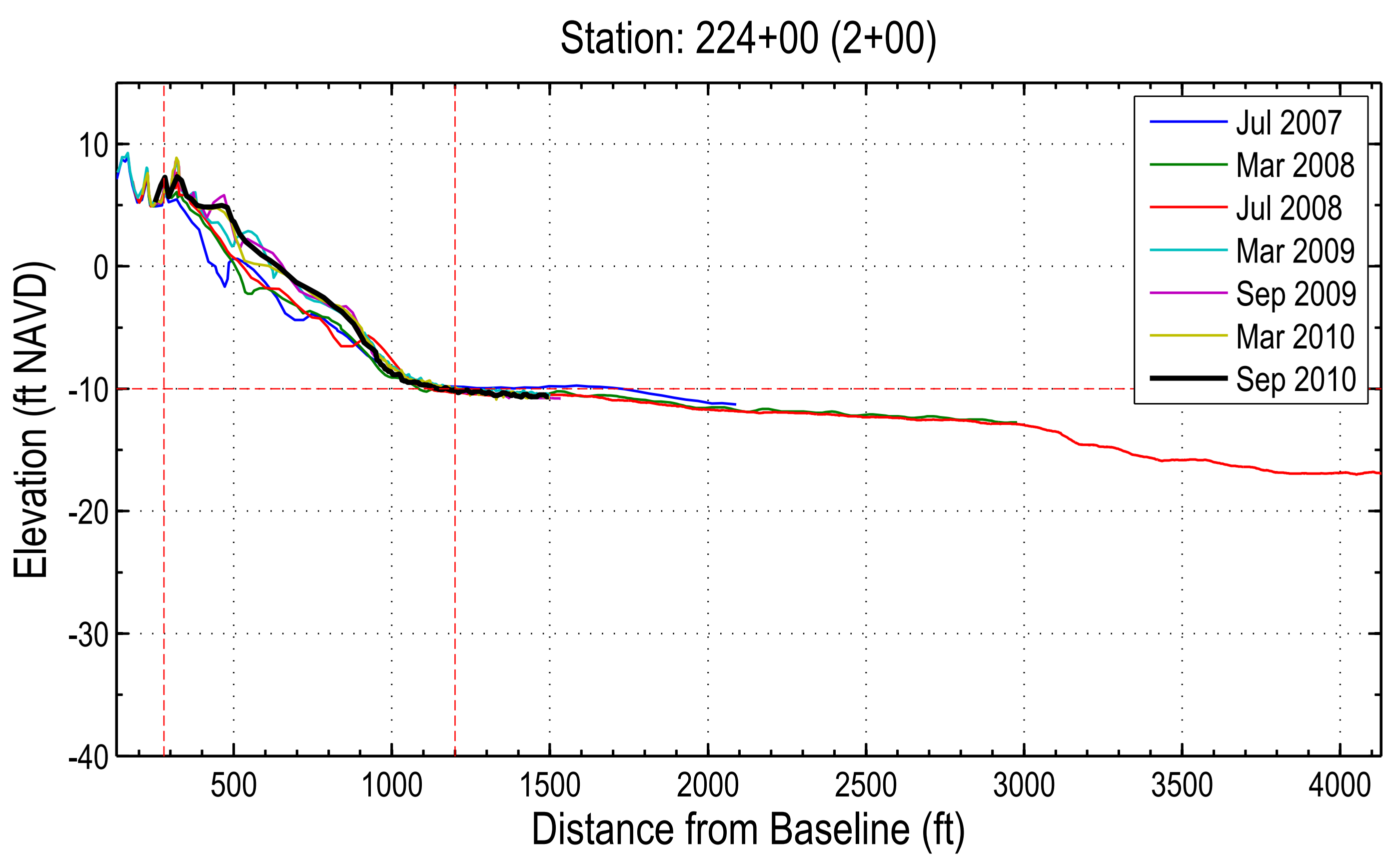


Station: 222+00 (0+00) 53RD AVENUE - SCCC 3159

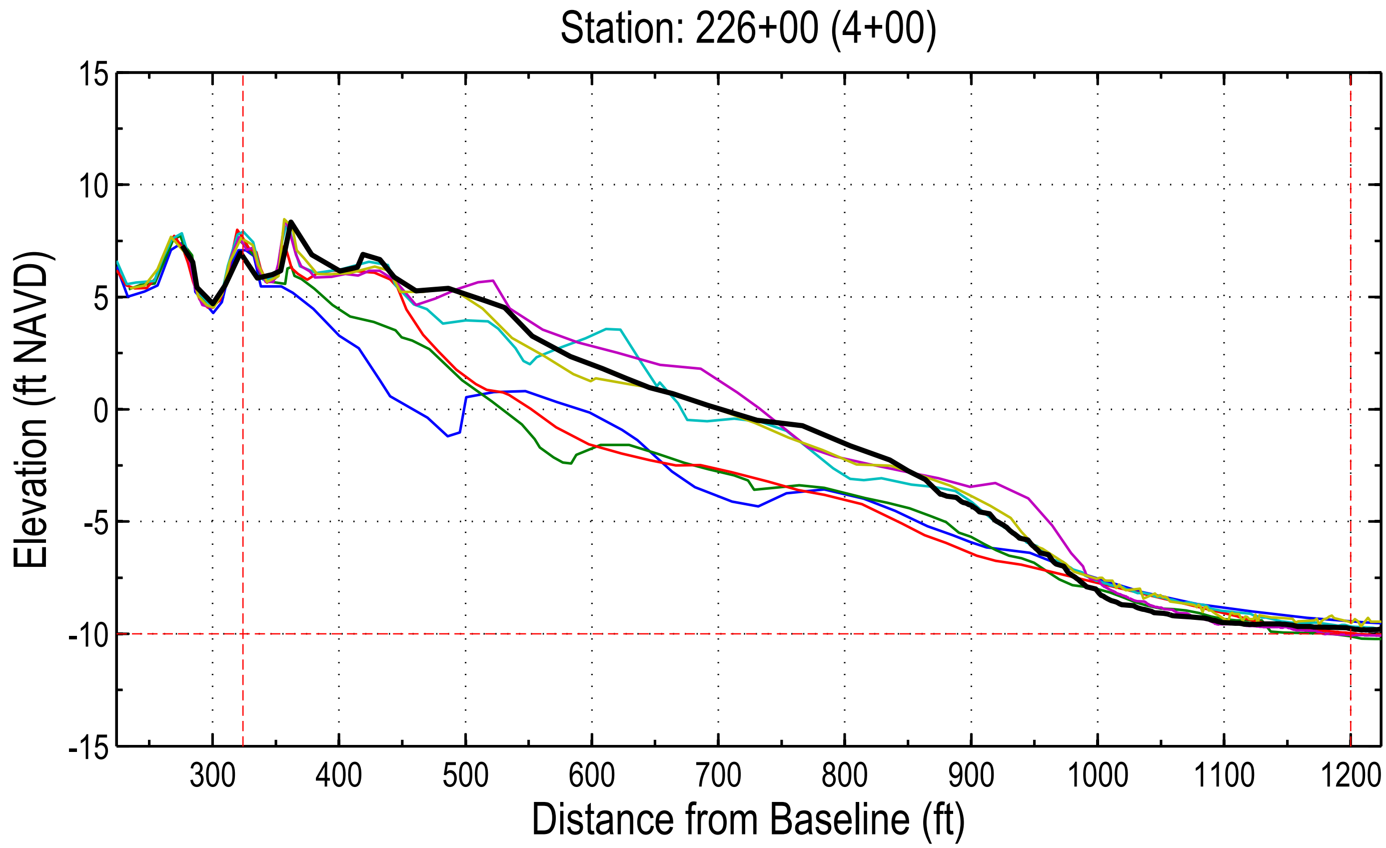


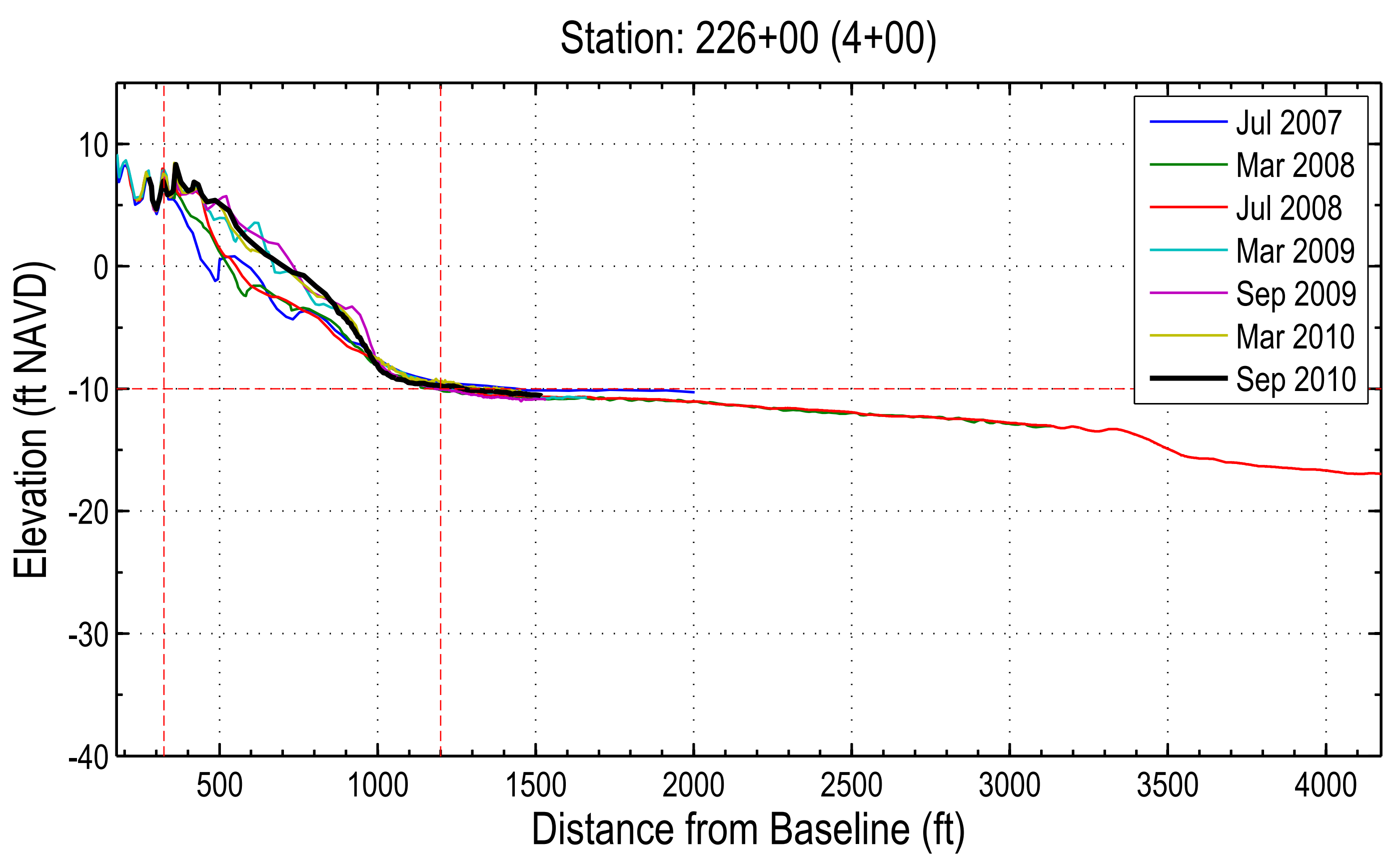


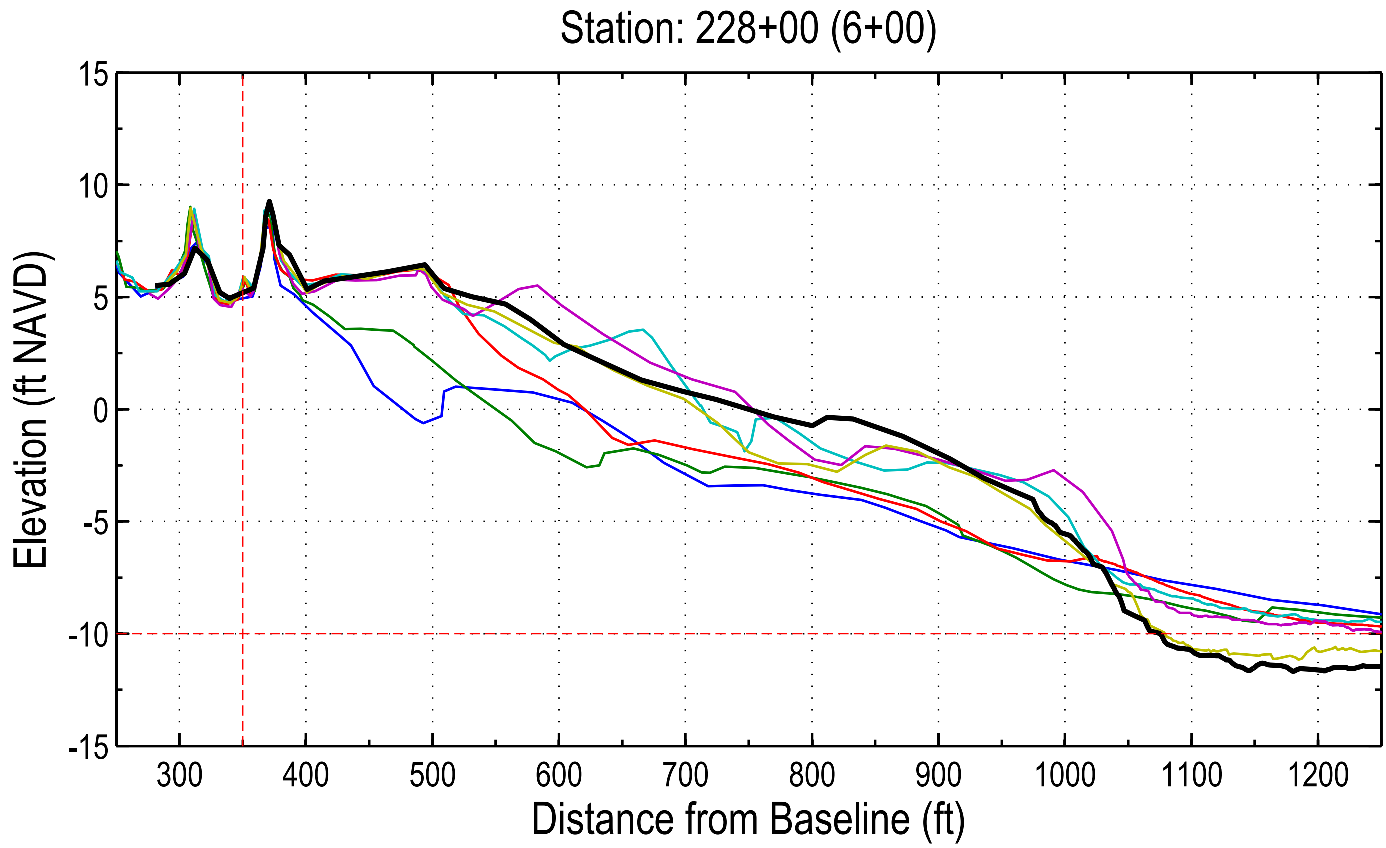
Station: 224+00 (2+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100



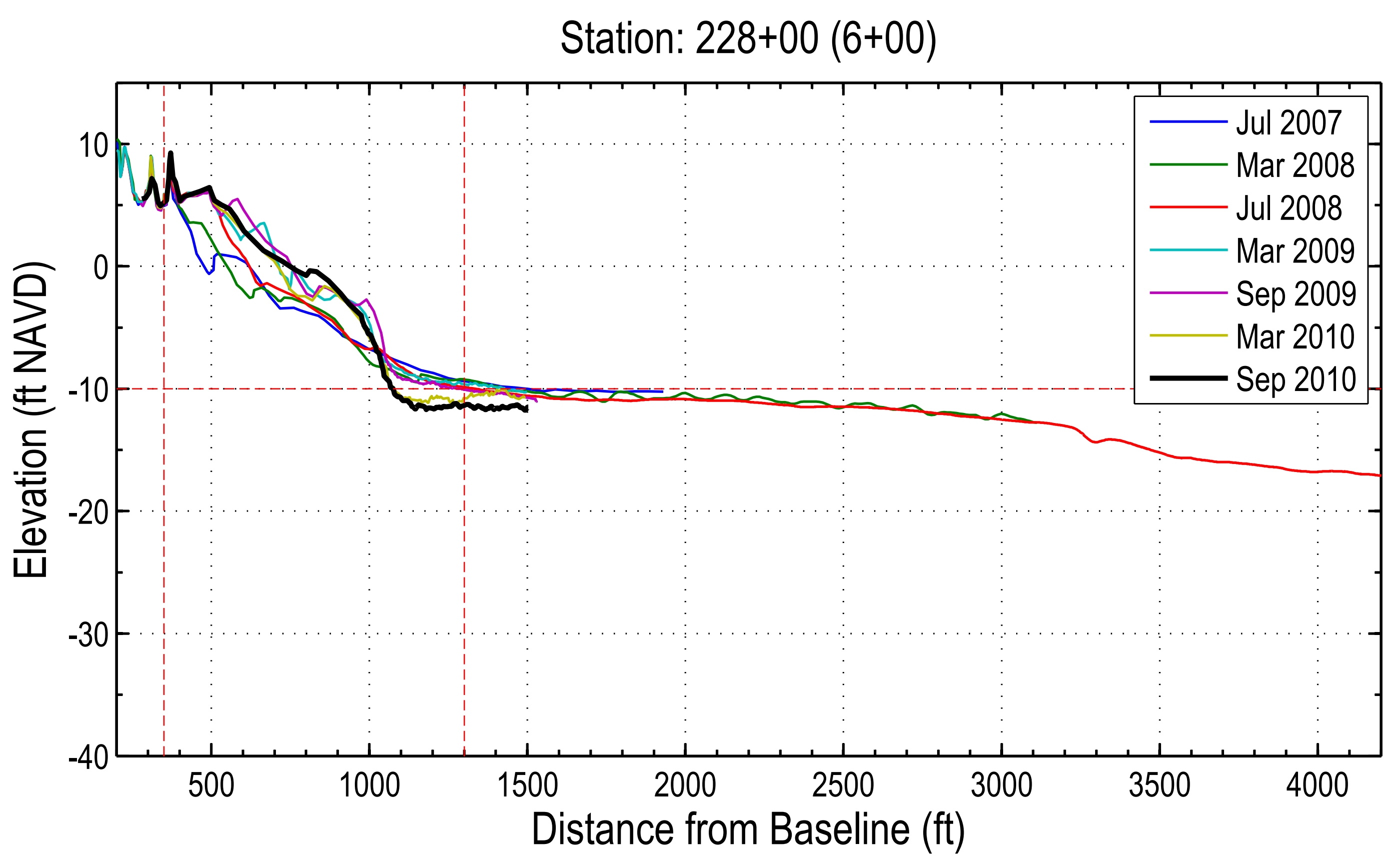
Station: 224+00 (2+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 226+00 (4+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200

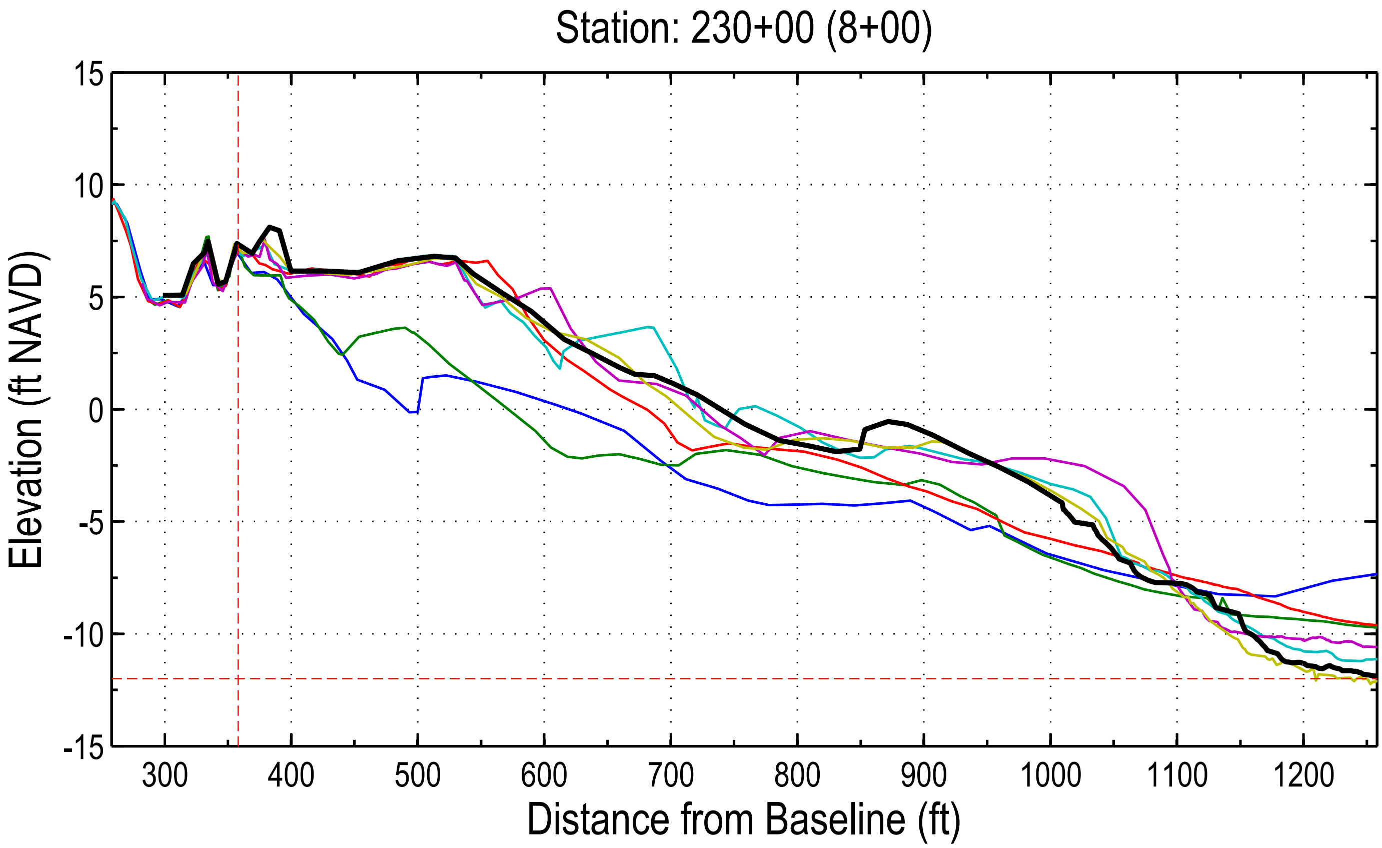

Station: 226+00 (4+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

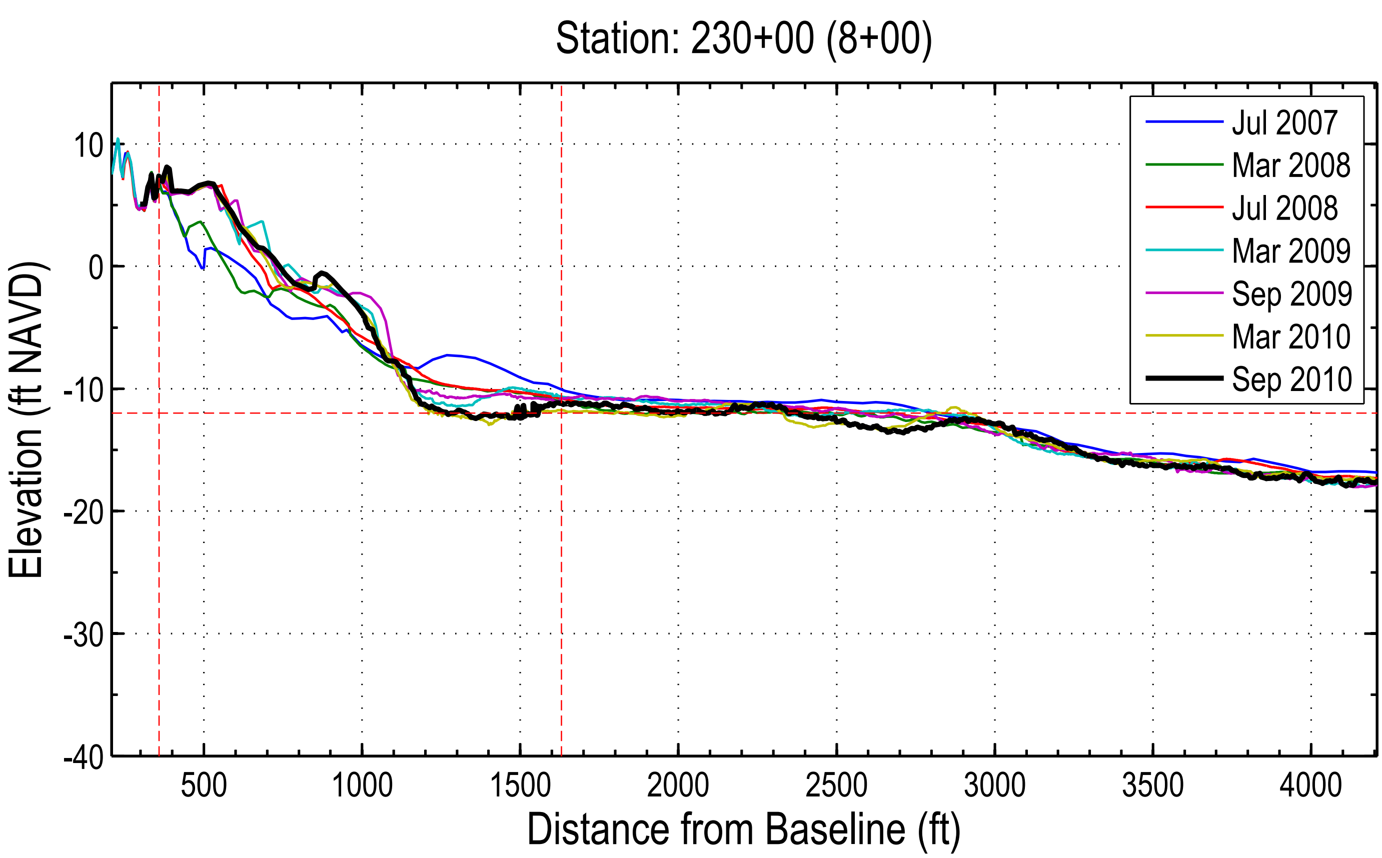


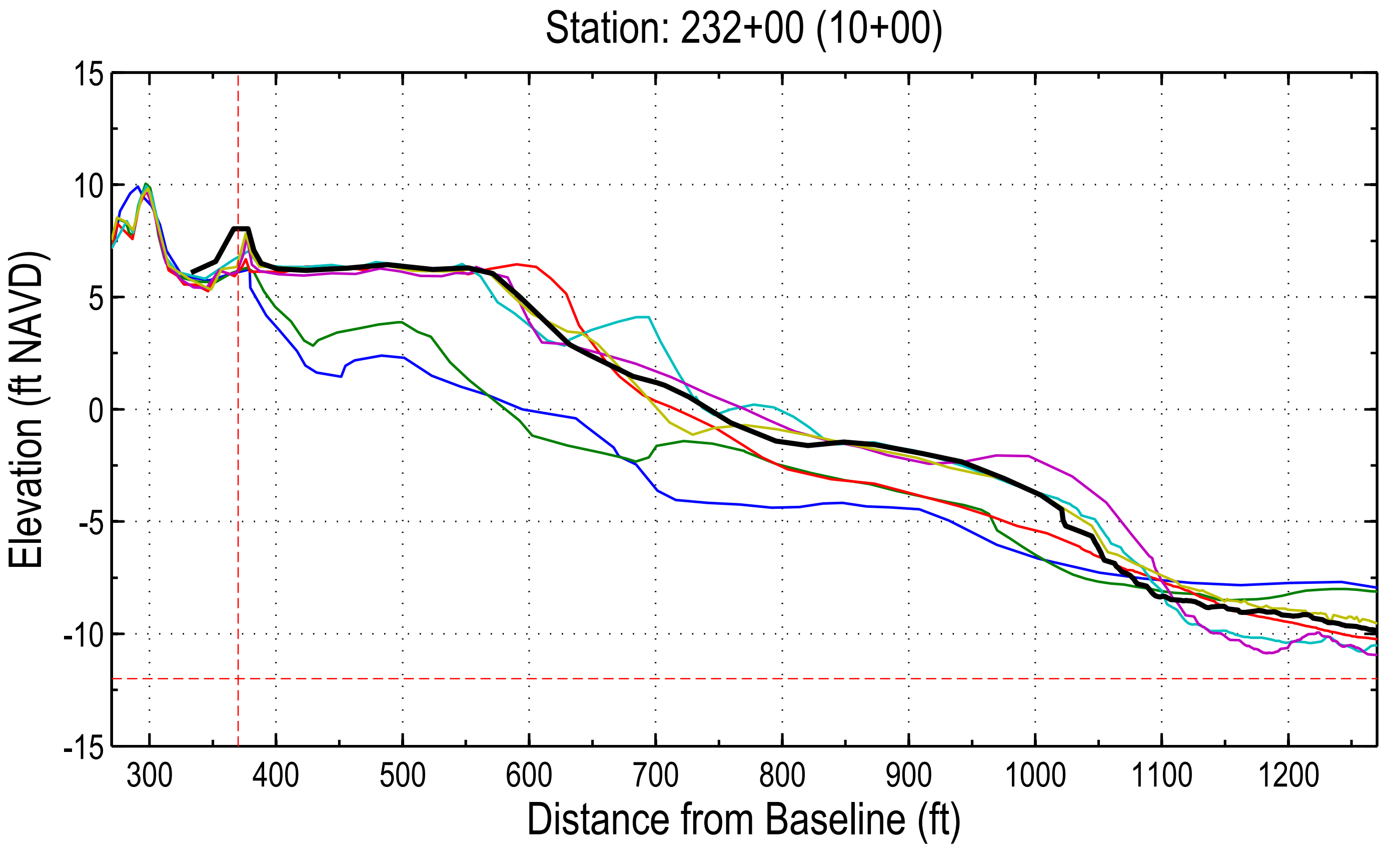
Station: 228+00 (6+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200

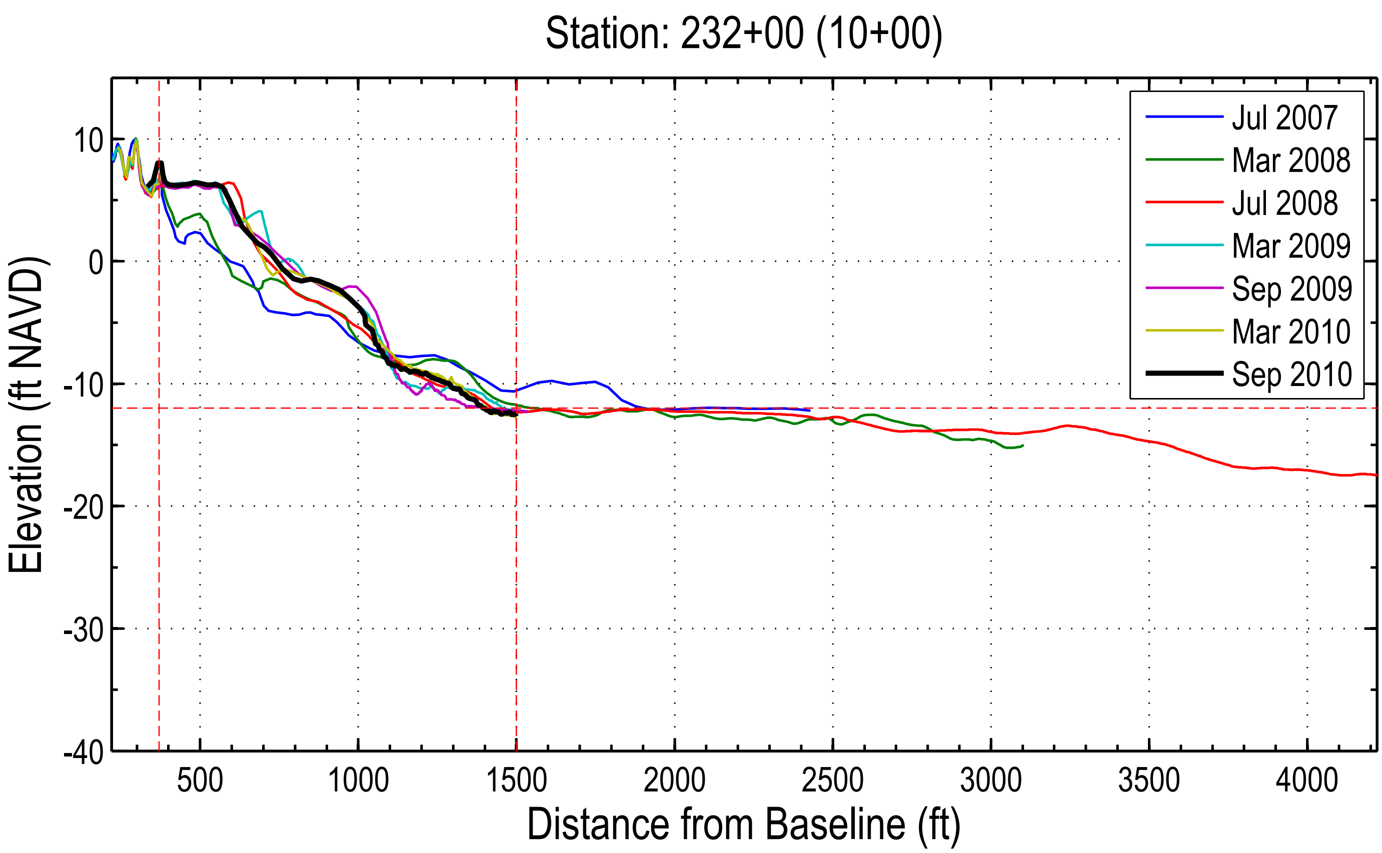


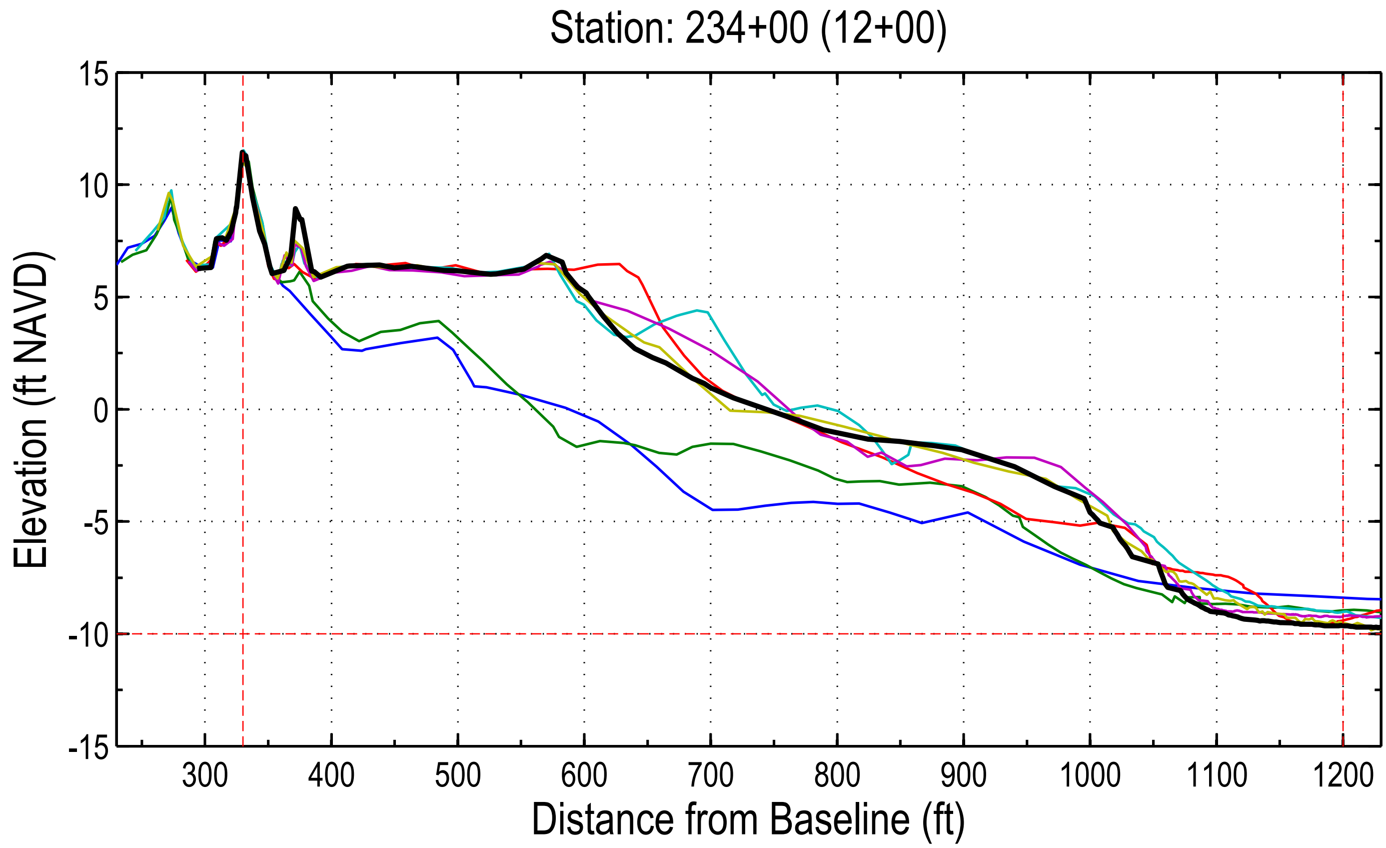
Station: 228+00 (6+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 230+00 (8+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200

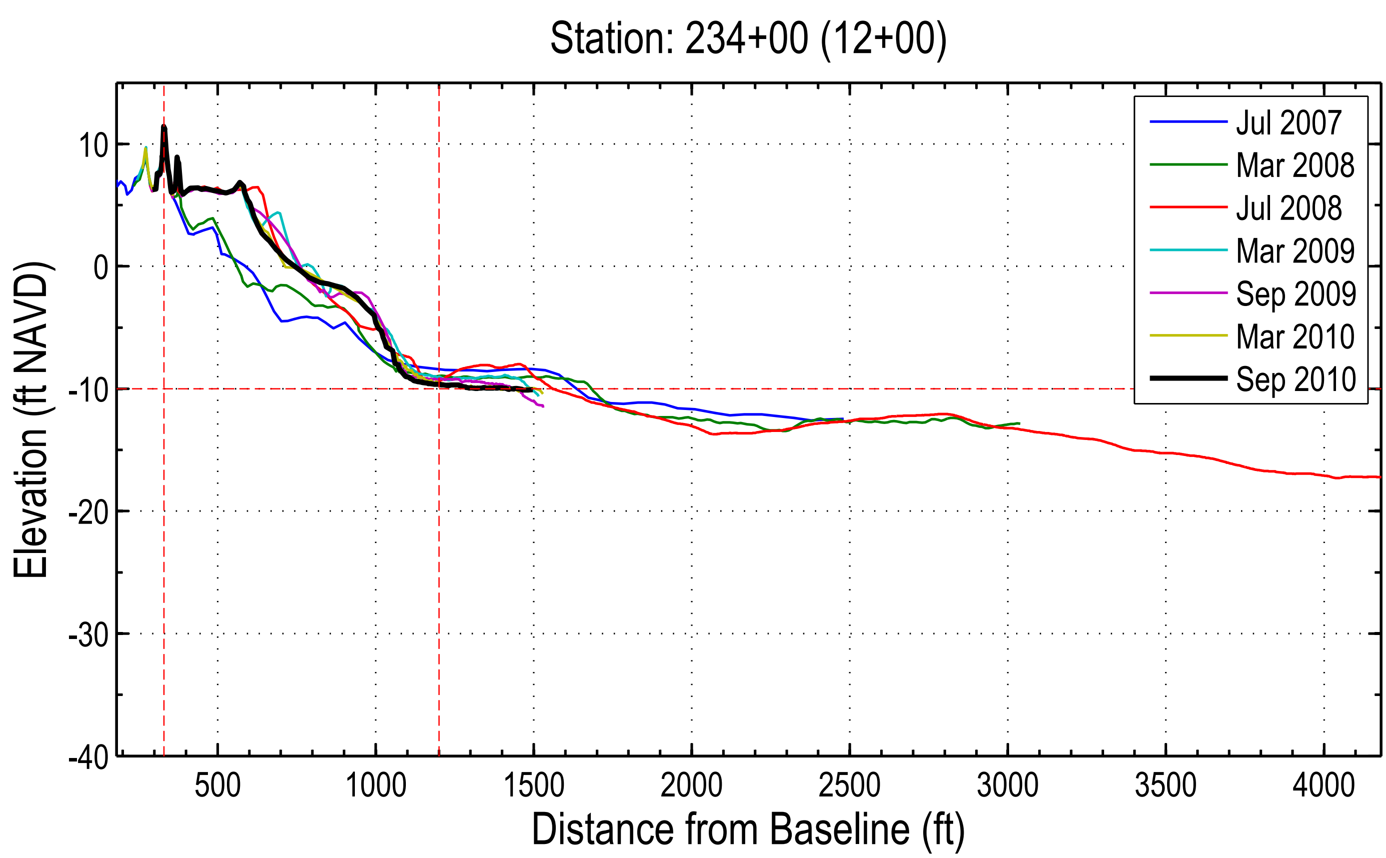

Station: 230+00 (8+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 232+00 (10+00)
15
10
5
0
-5
-10
-15
Elevation (ft NAVD)
300
400
500
600
700
800
900
1000
1100
1200
Distance from Baseline (ft)

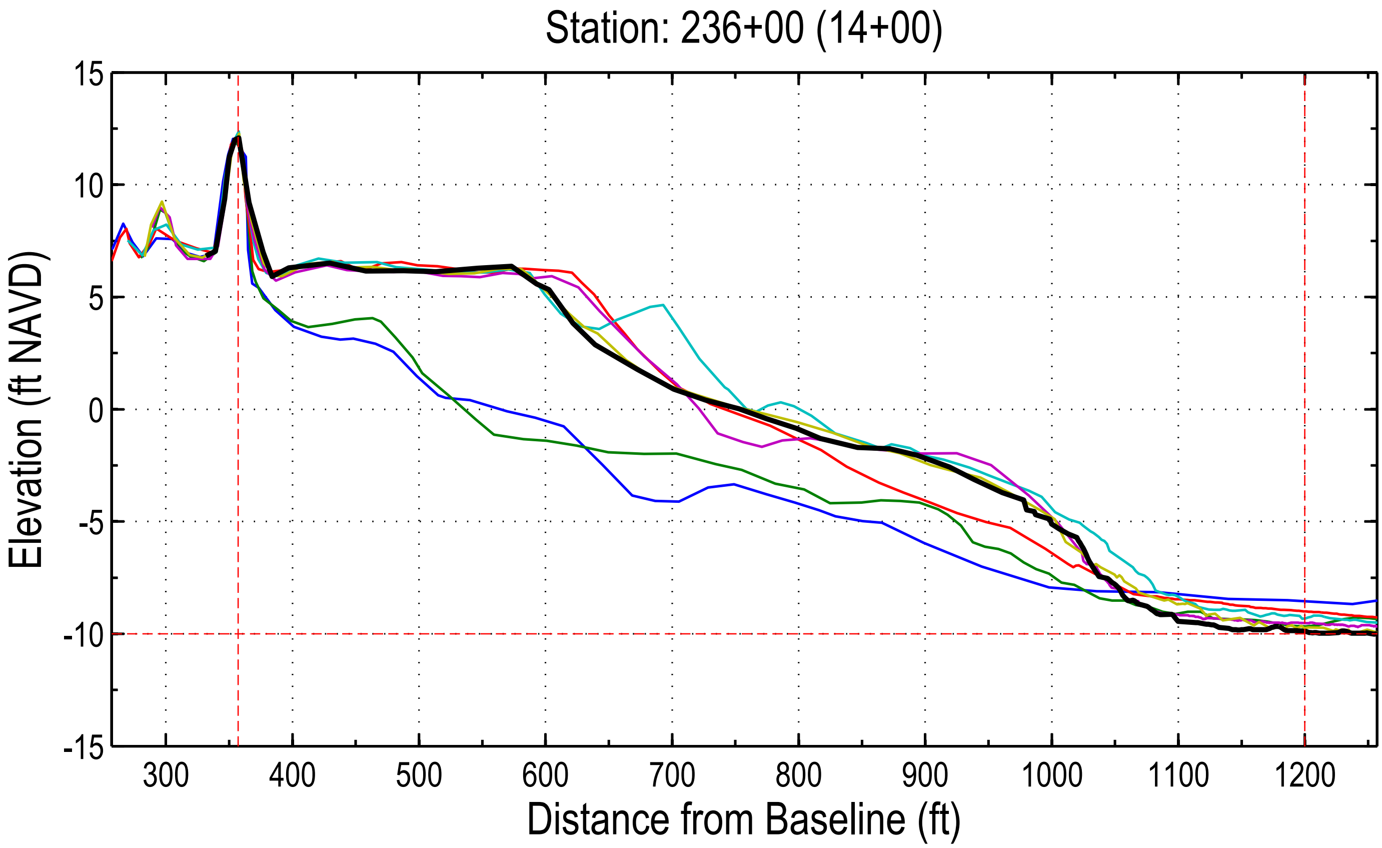

Station: 232+00 (10+00)
10
0
-10
-20
-30
-40
Elevation (ft NAVD)
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

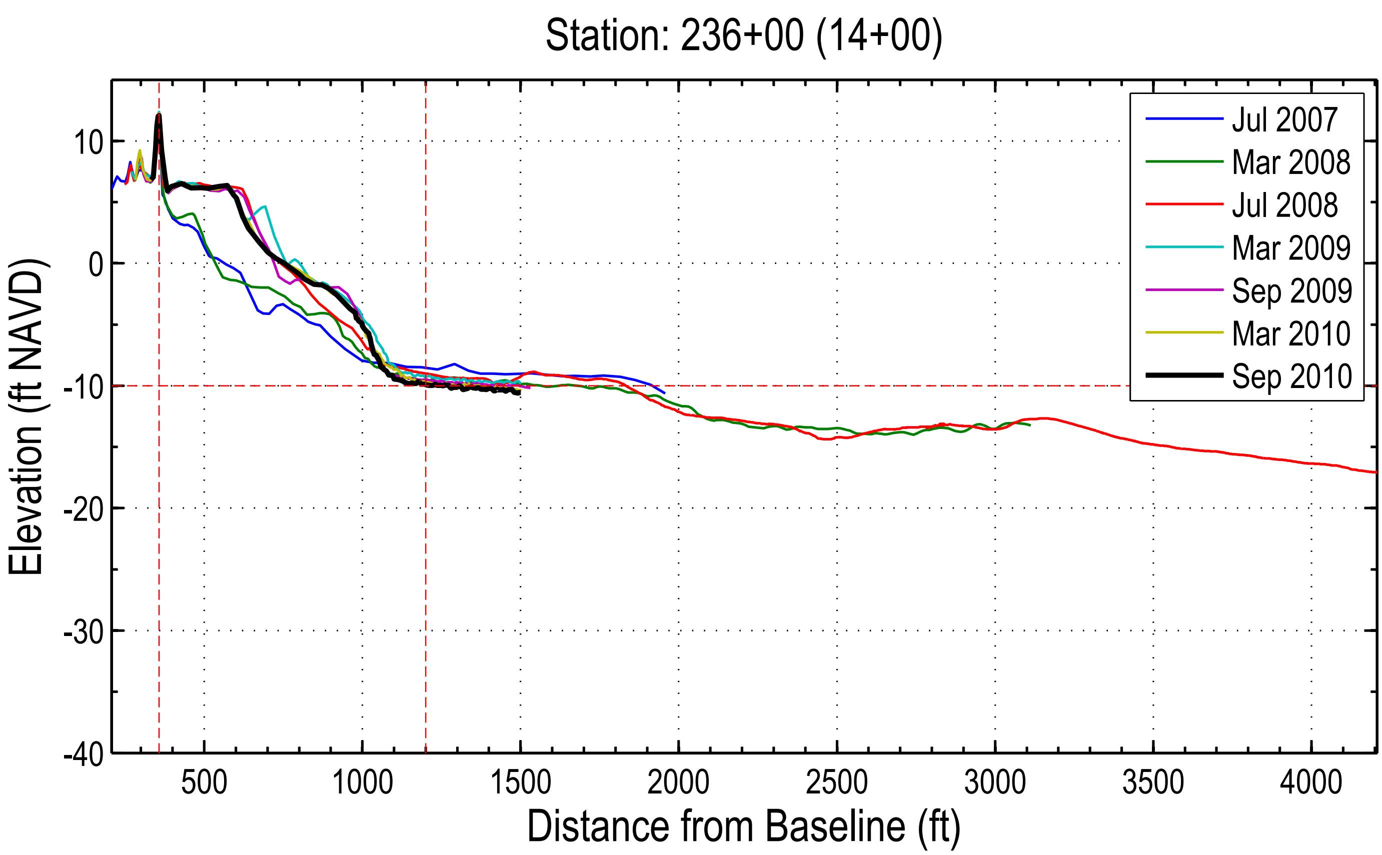


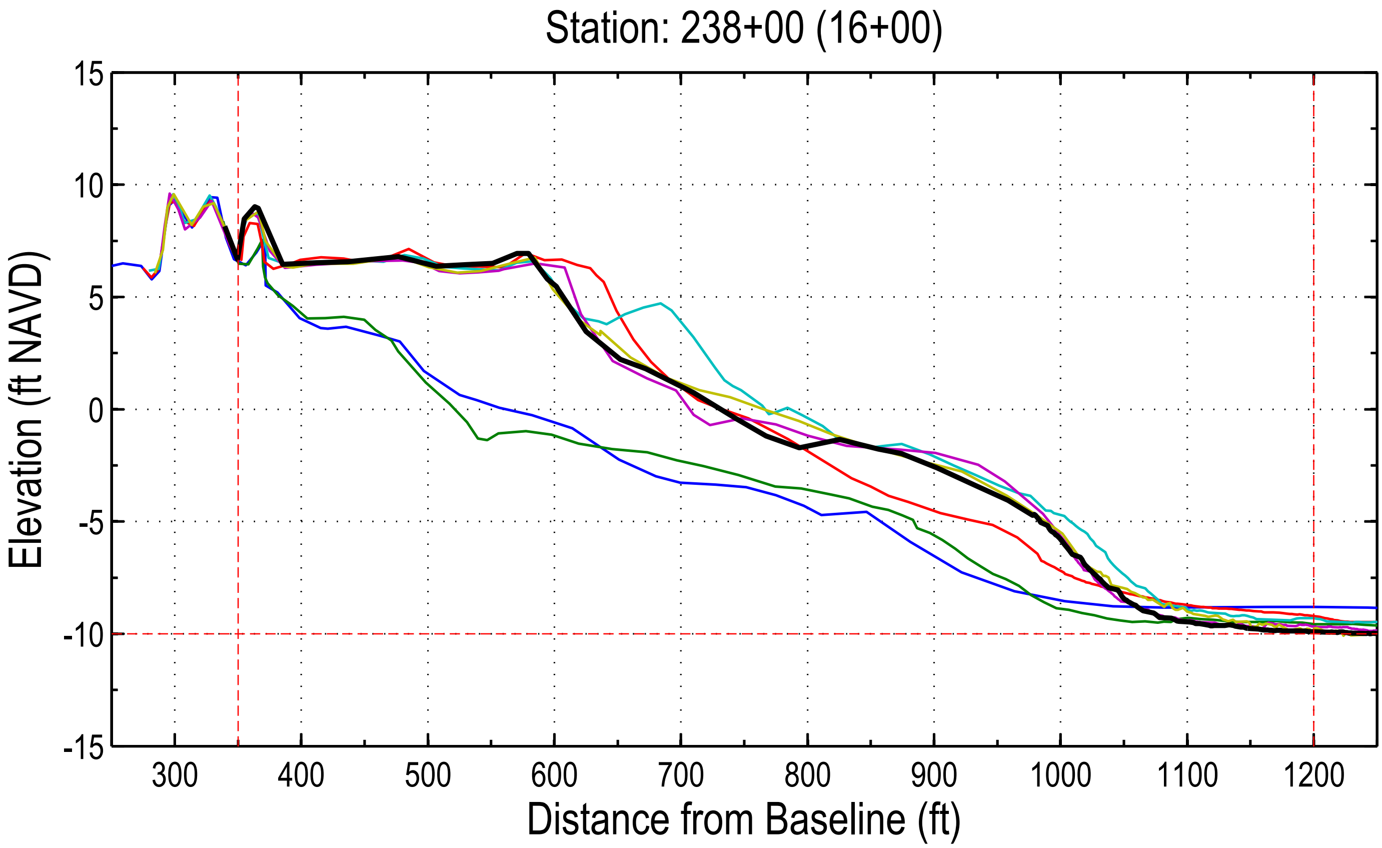
Station: 234+00 (12+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200



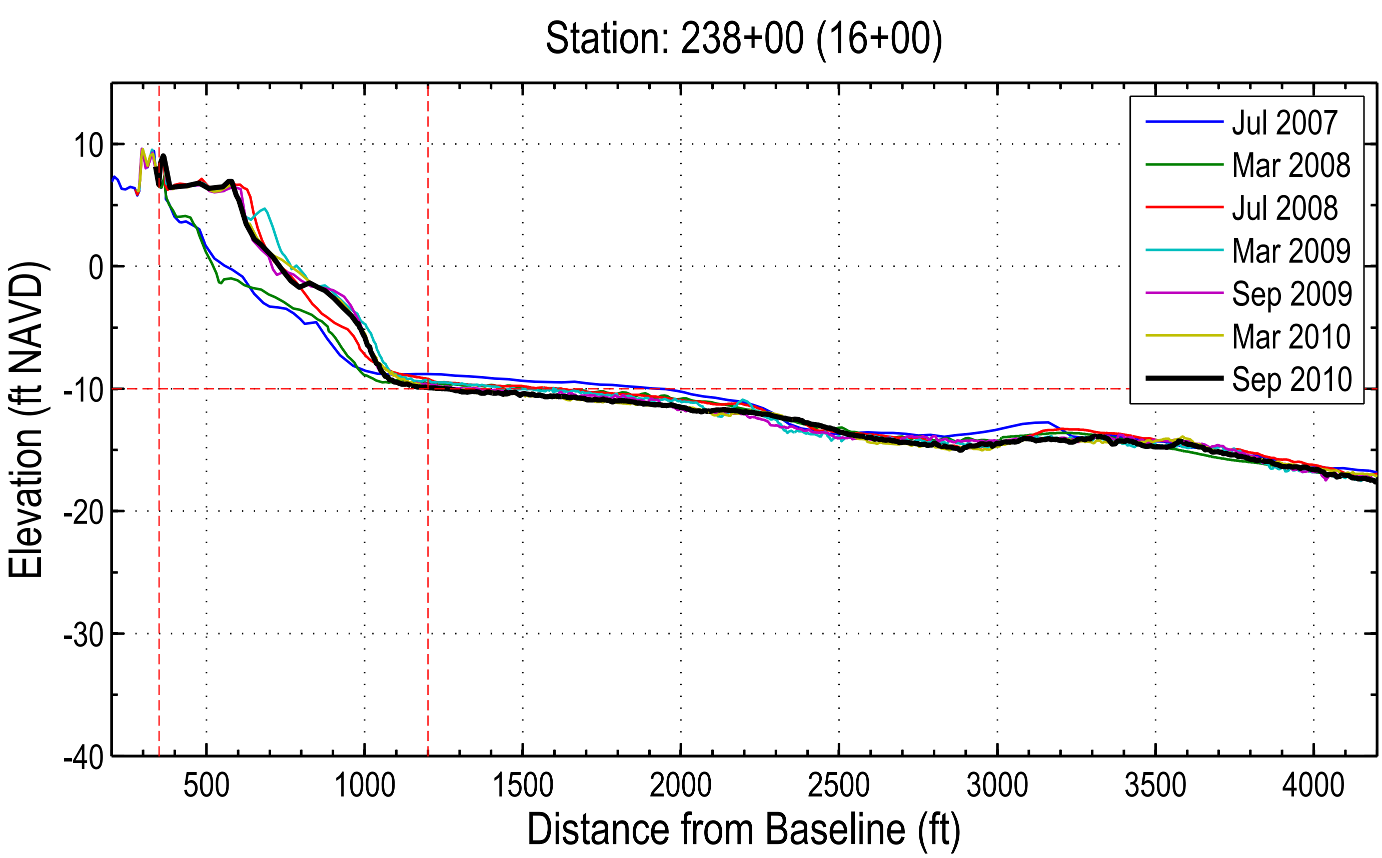
Station: 234+00 (12+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 236+00 (14+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200

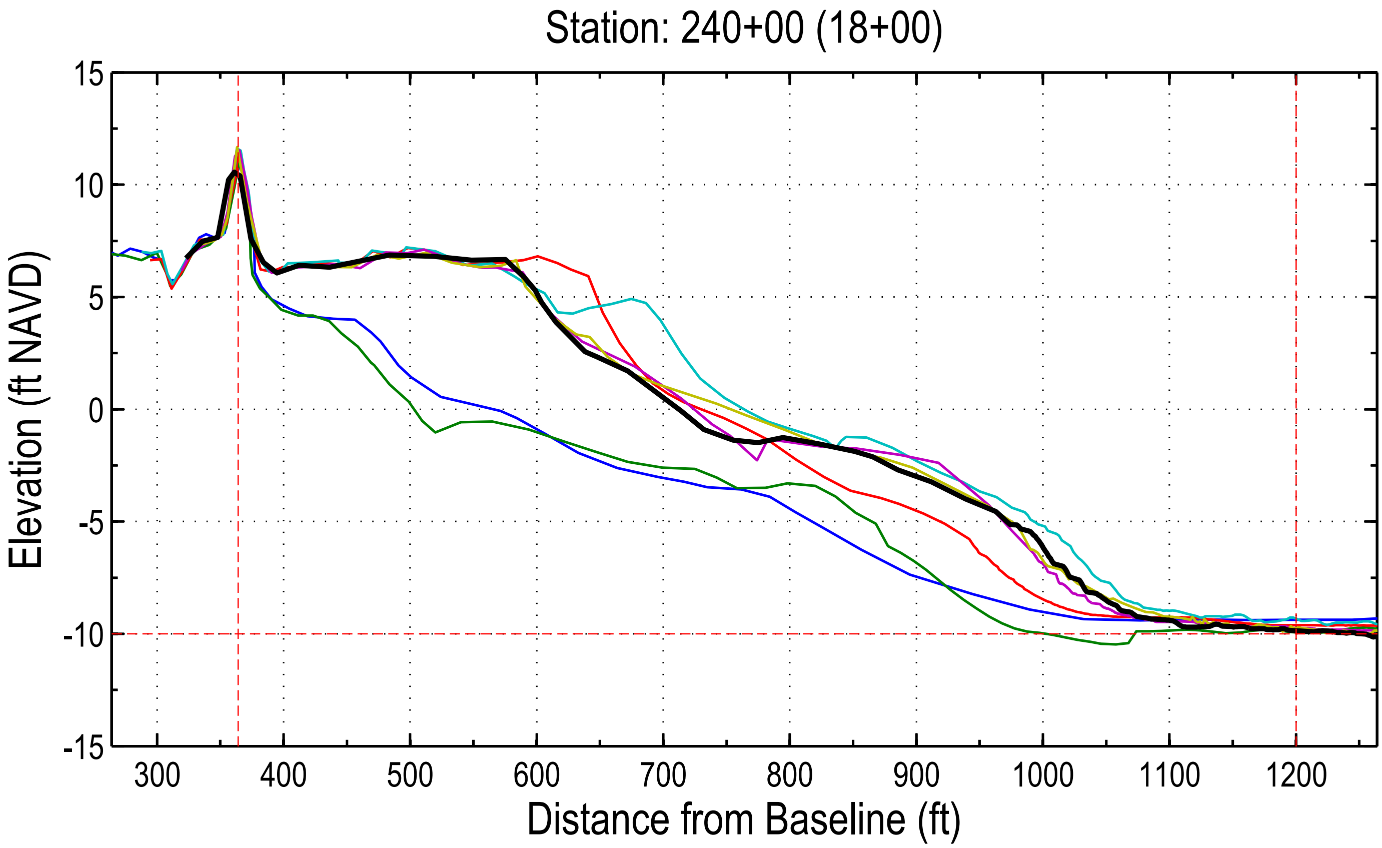

Station: 236+00 (14+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



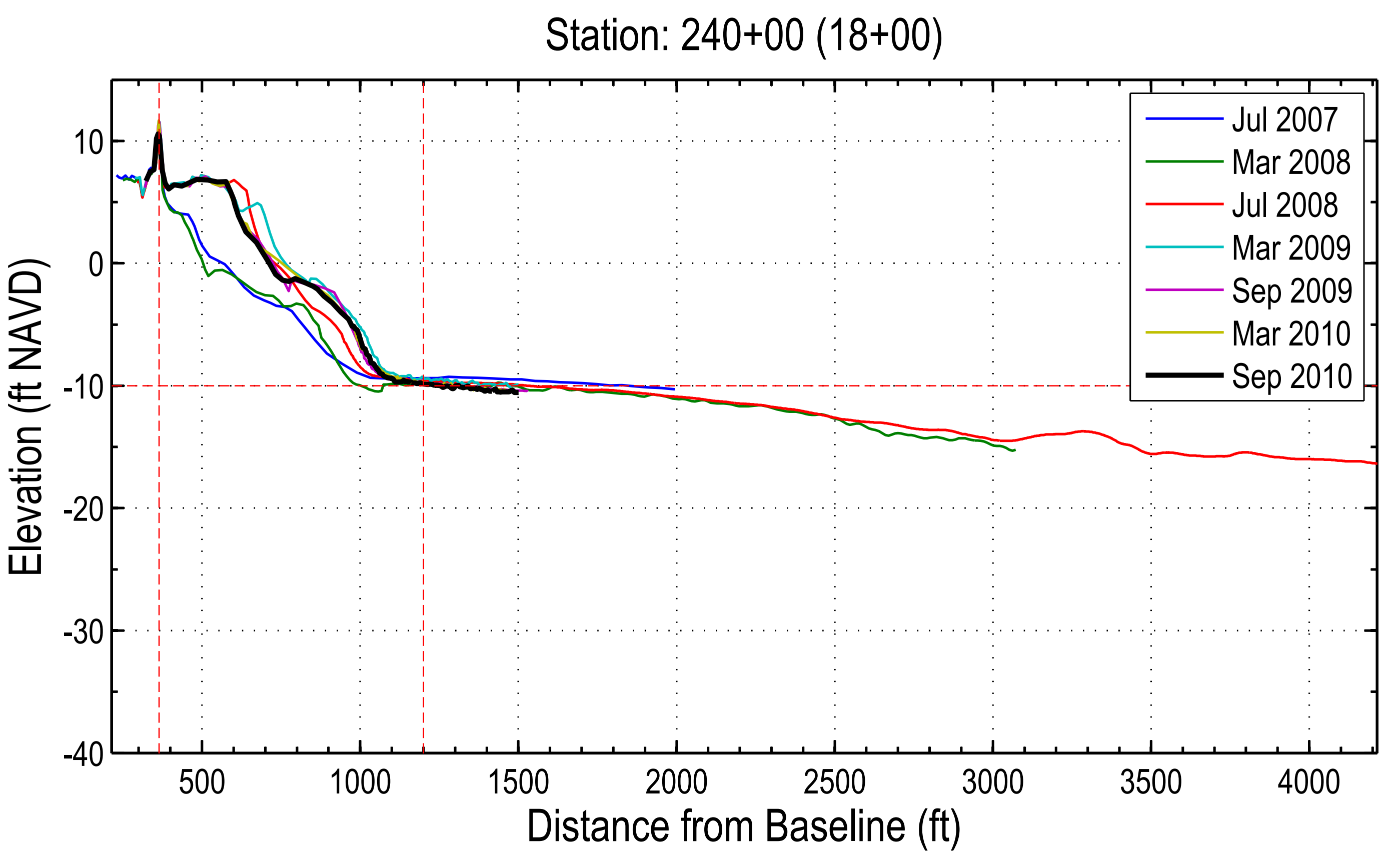
Station: 238+00 (16+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200



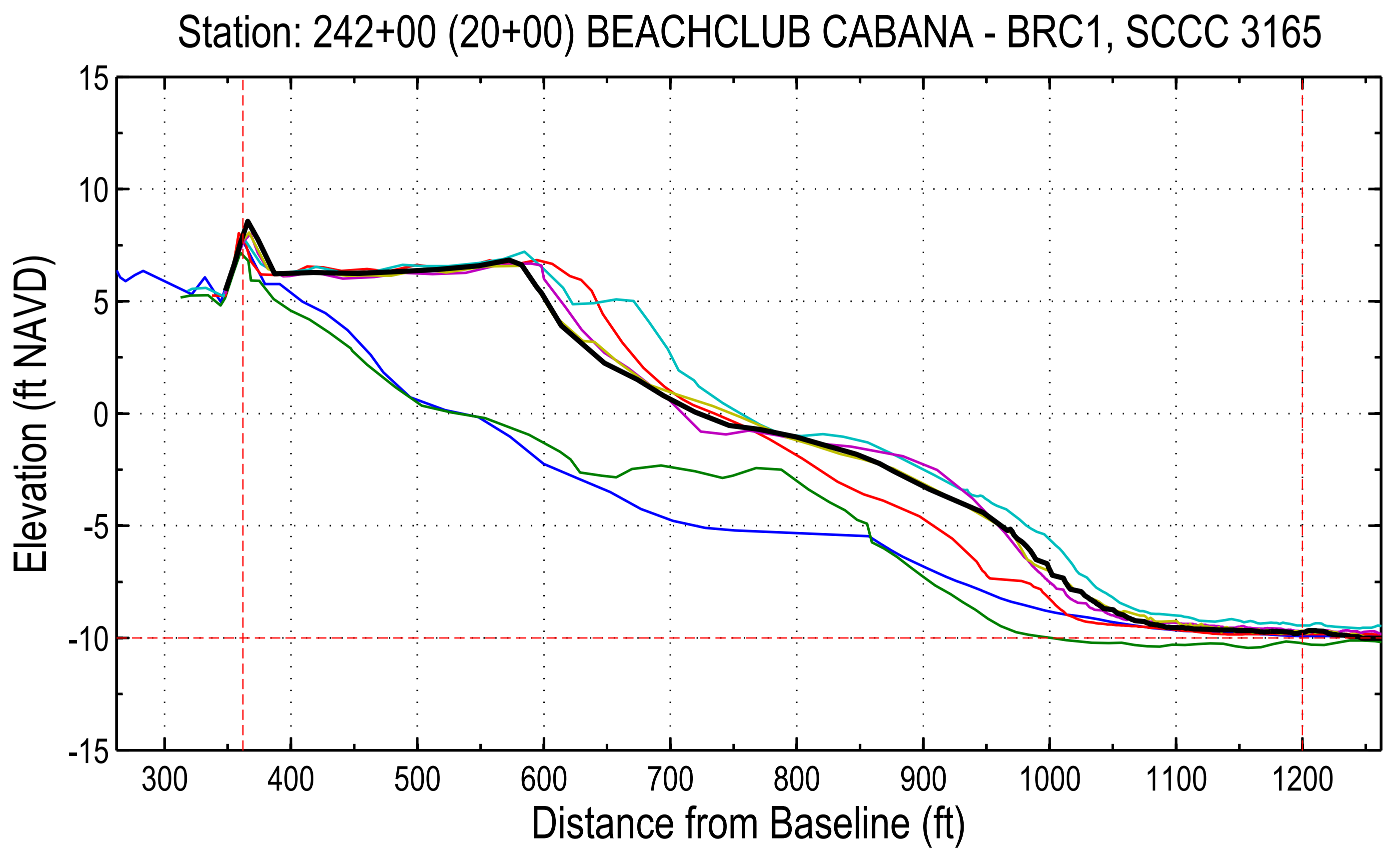
Station: 238+00 (16+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

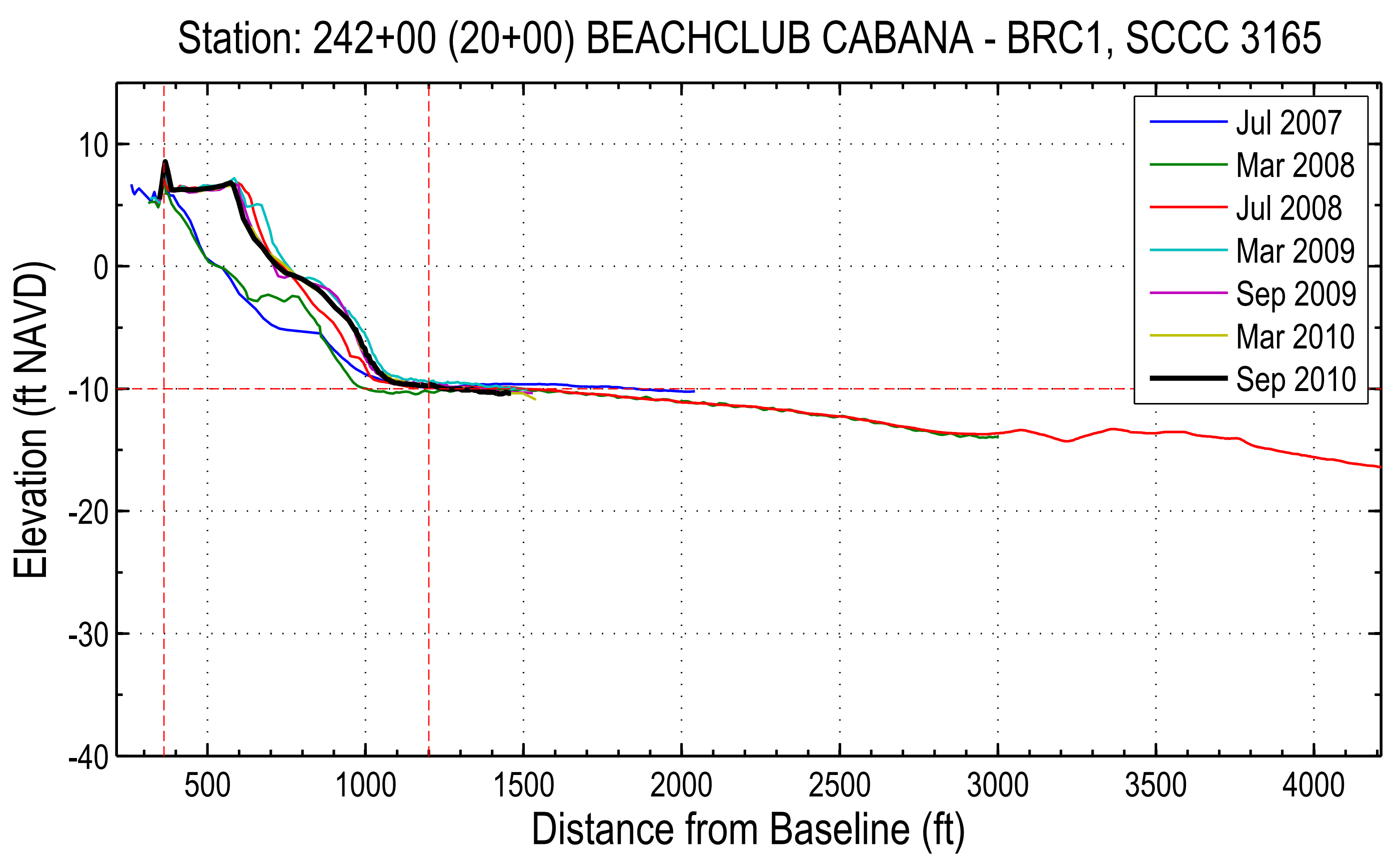


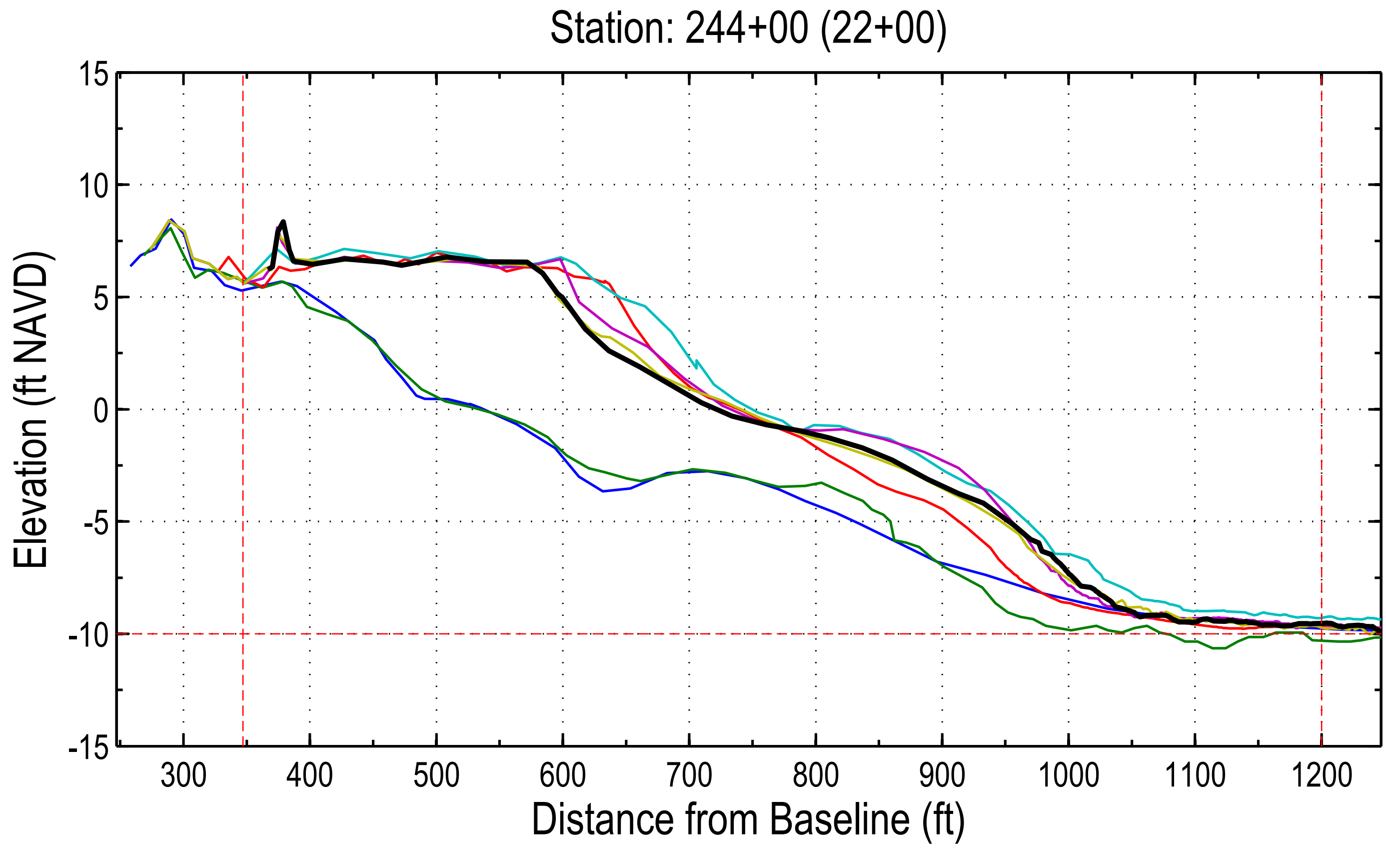
Station: 240+00 (18+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200



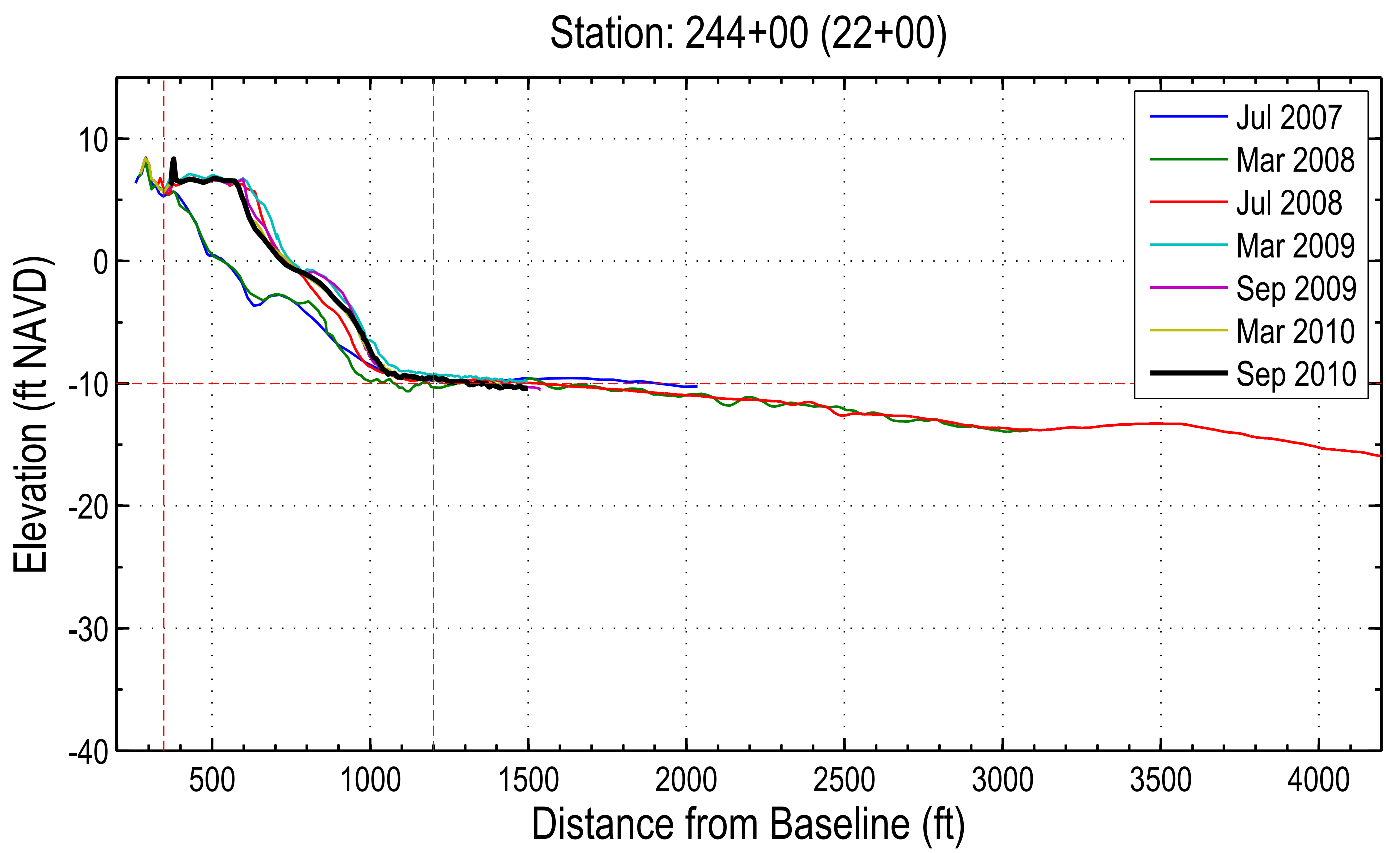
Station: 240+00 (18+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000


Station: 242+00 (20+00) BEACHCLUB CABANA - BRC1, SCCC 3165
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200

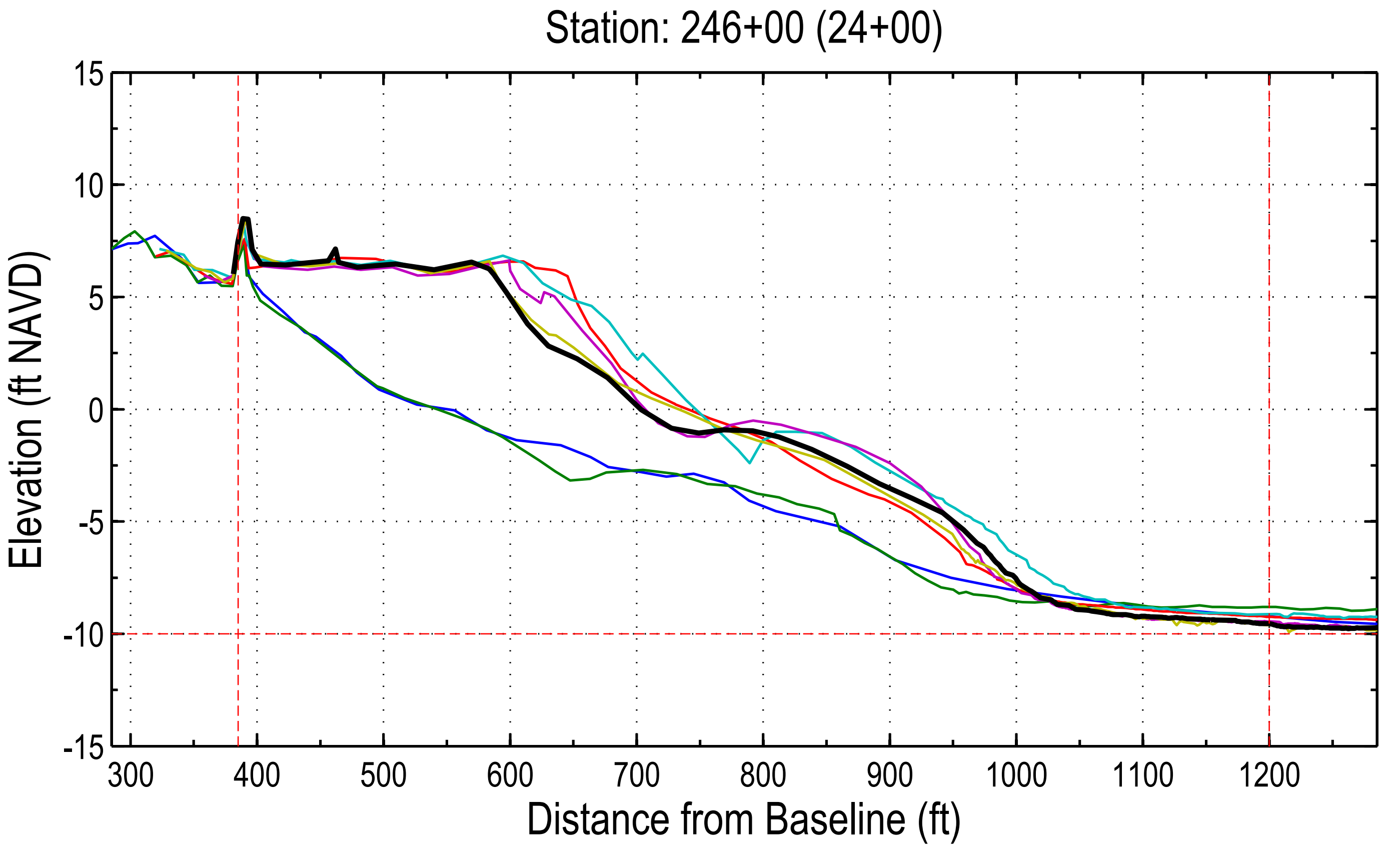

Station: 242+00 (20+00) BEACHCLUB CABANA - BRC1, SCCC 3165
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



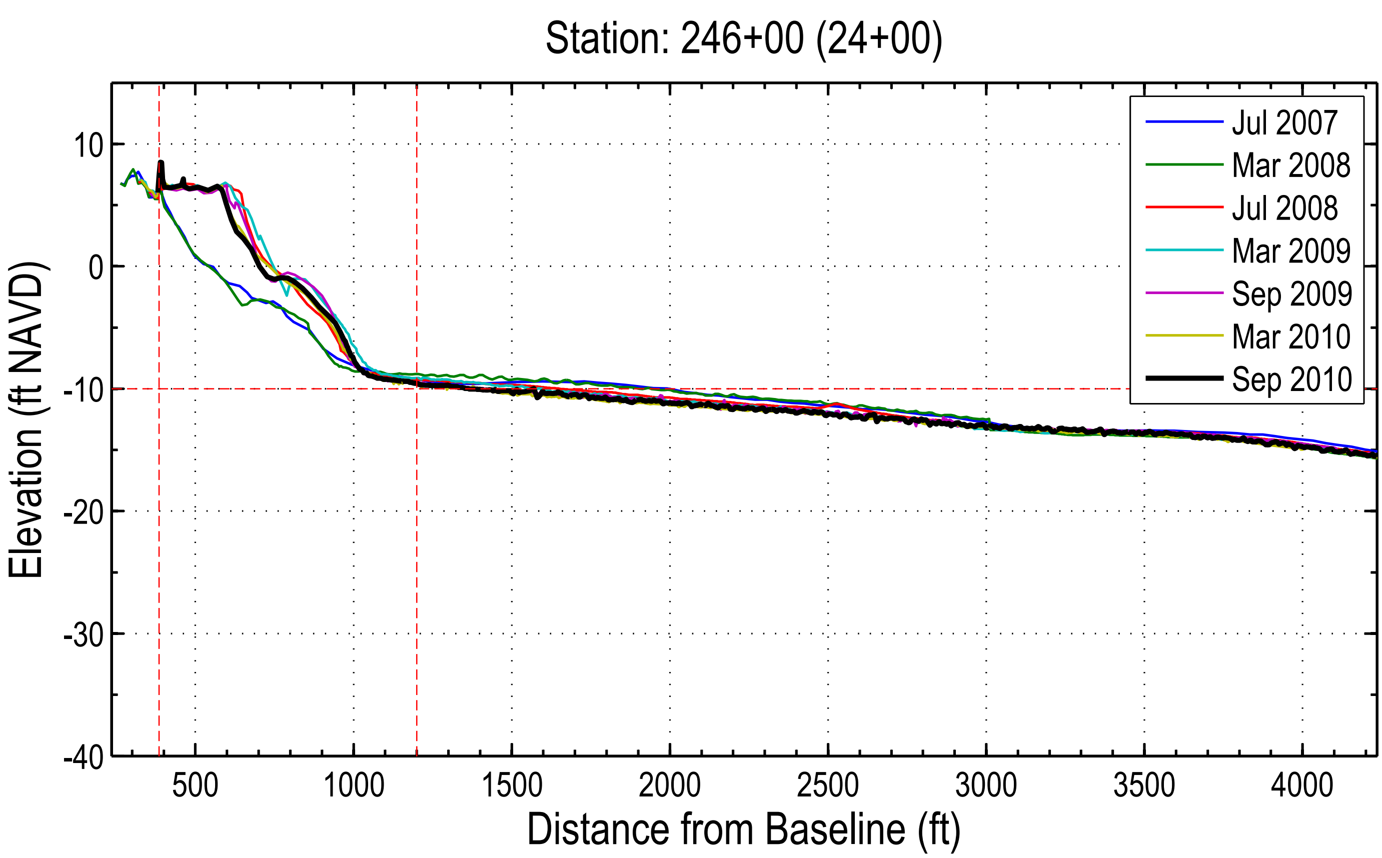
Station: 244+00 (22+00)
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200
Distance from Baseline (ft)



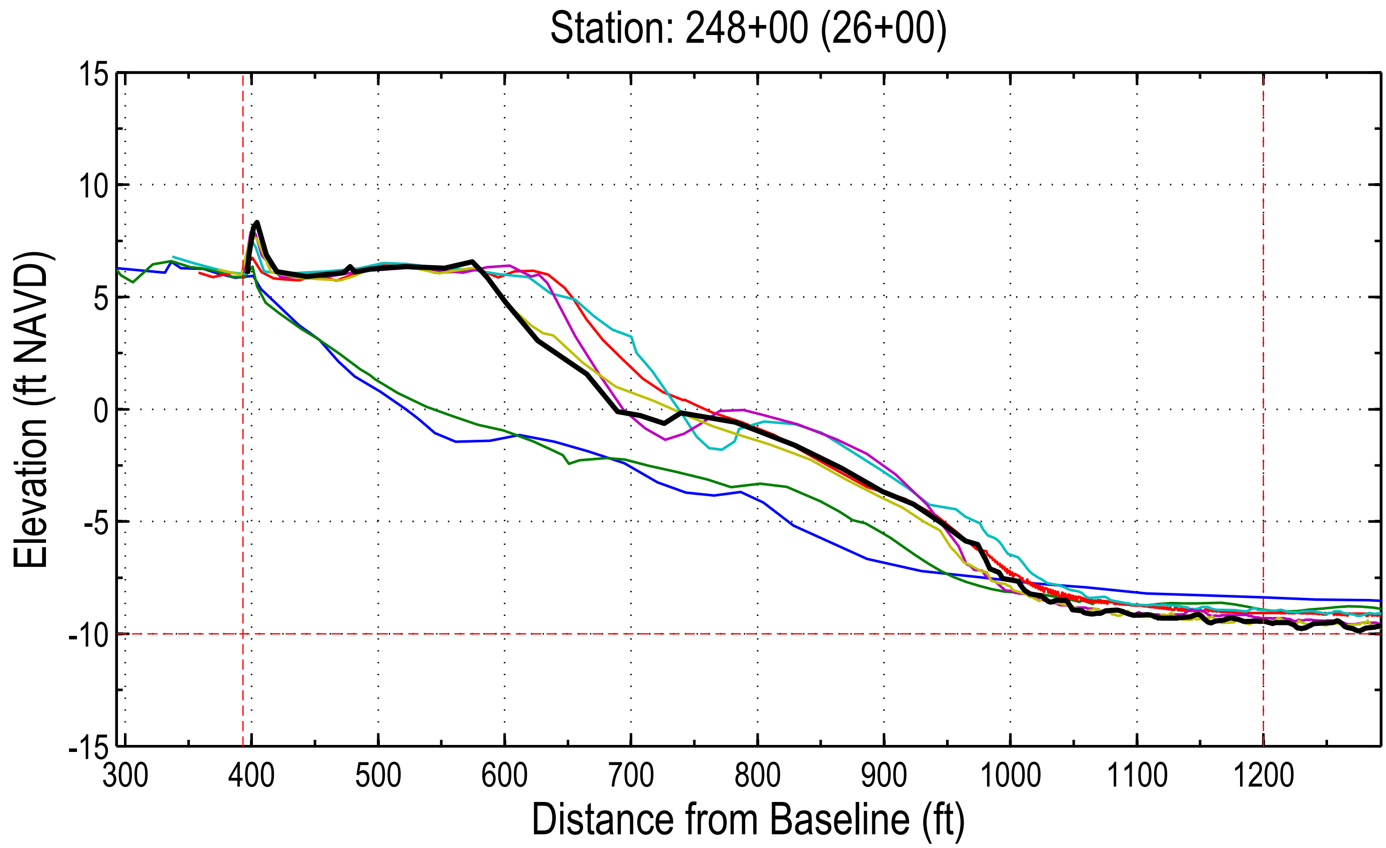
Station: 244+00 (22+00)
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



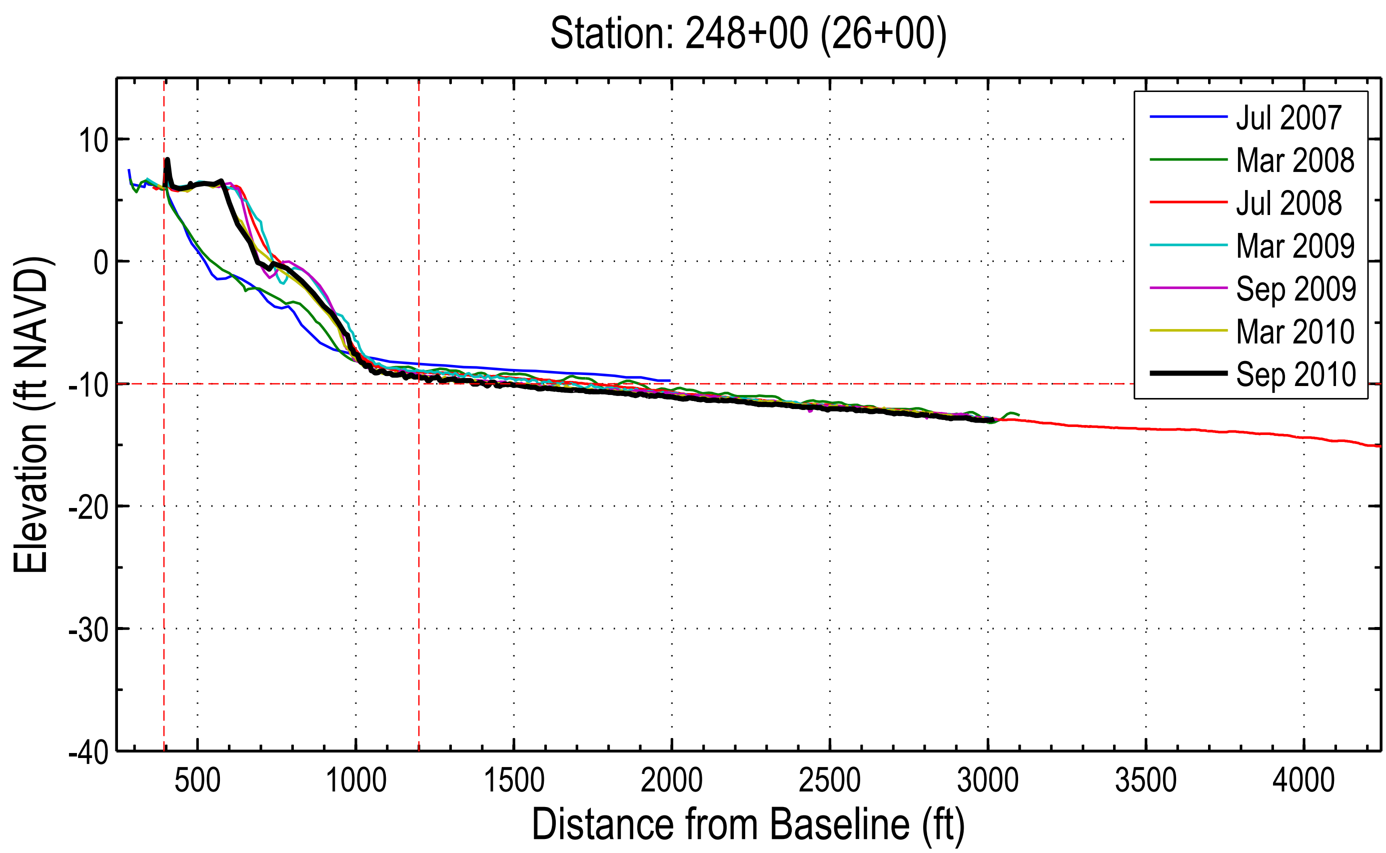
Station: 246+00 (24+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200



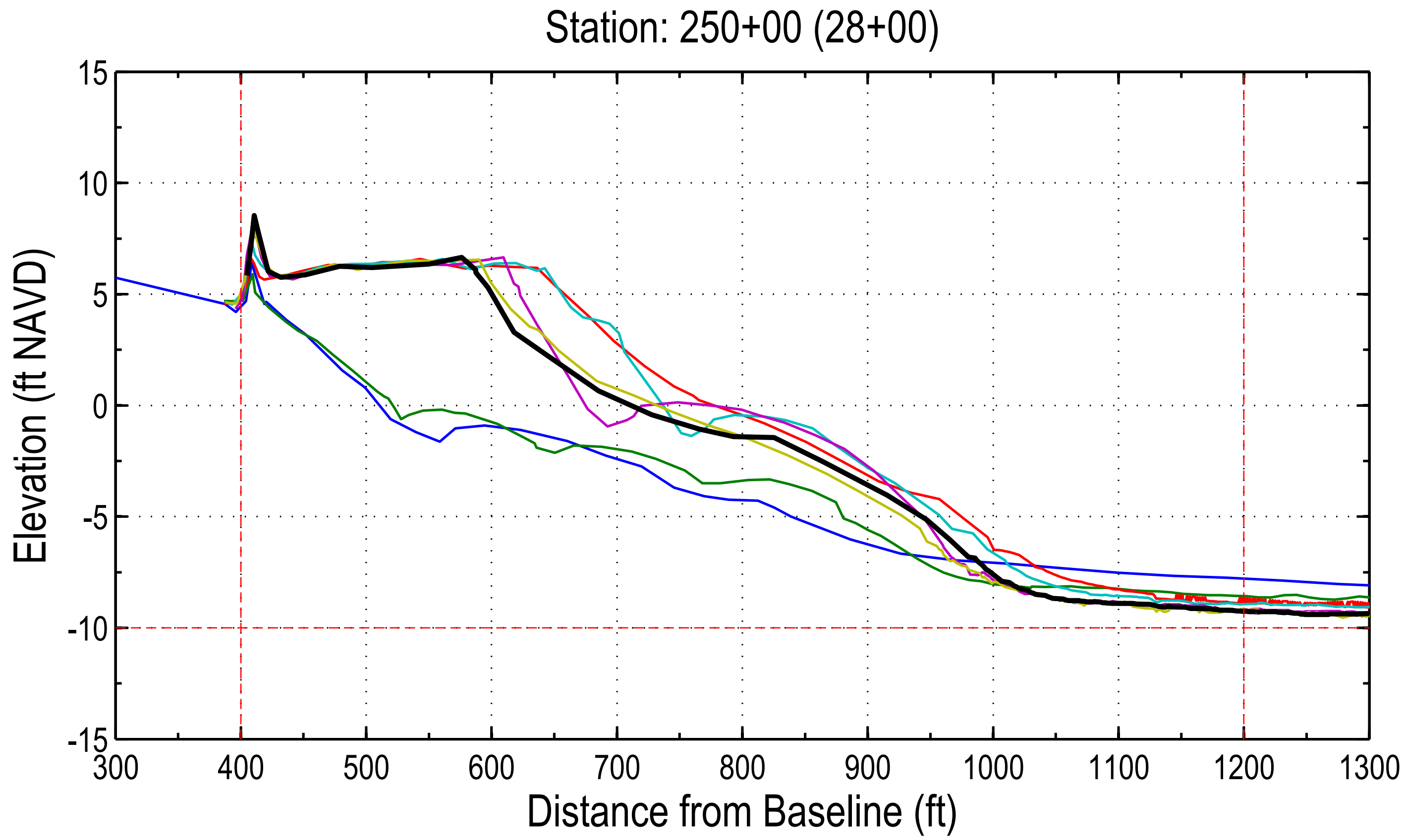
Station: 246+00 (24+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

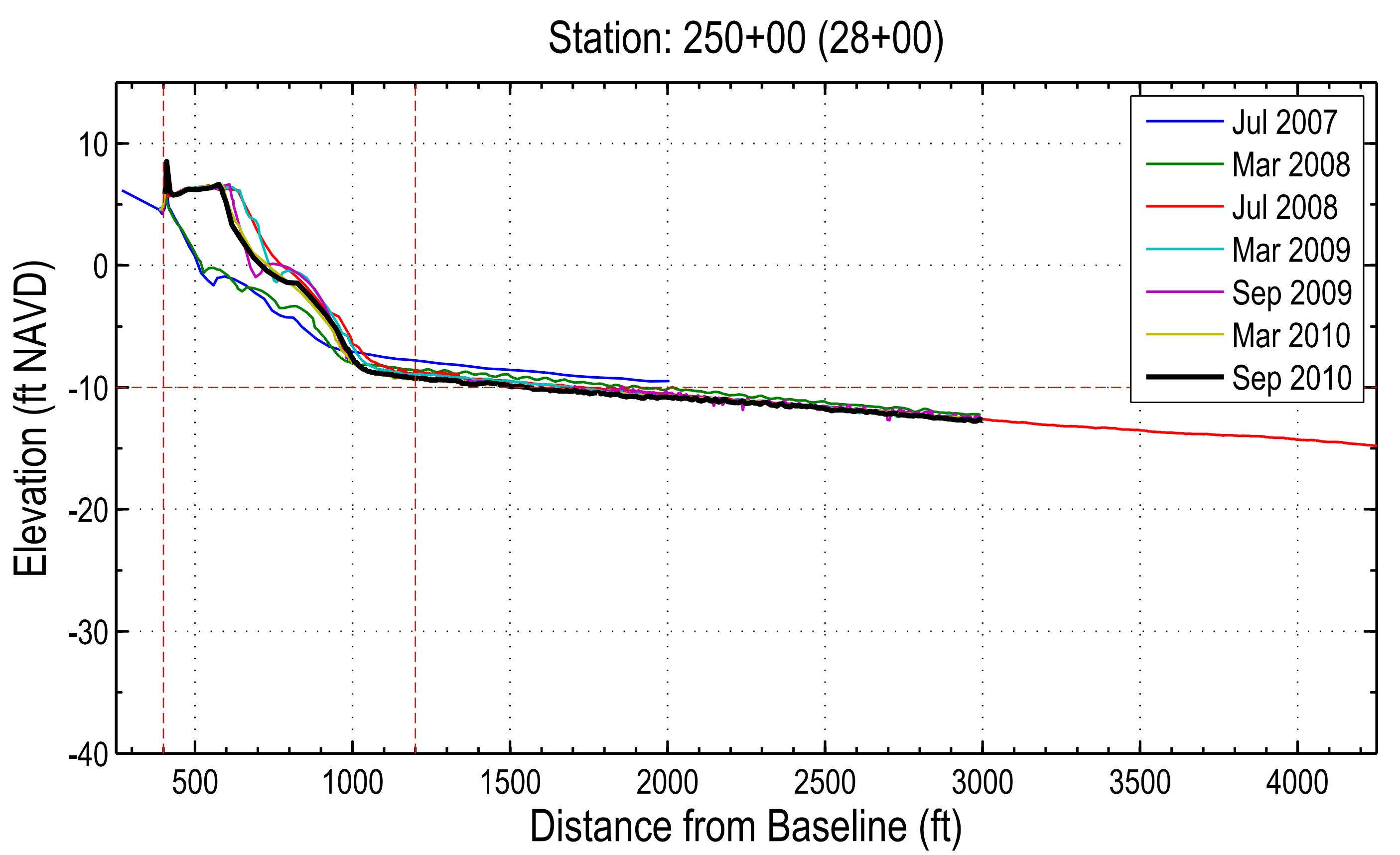


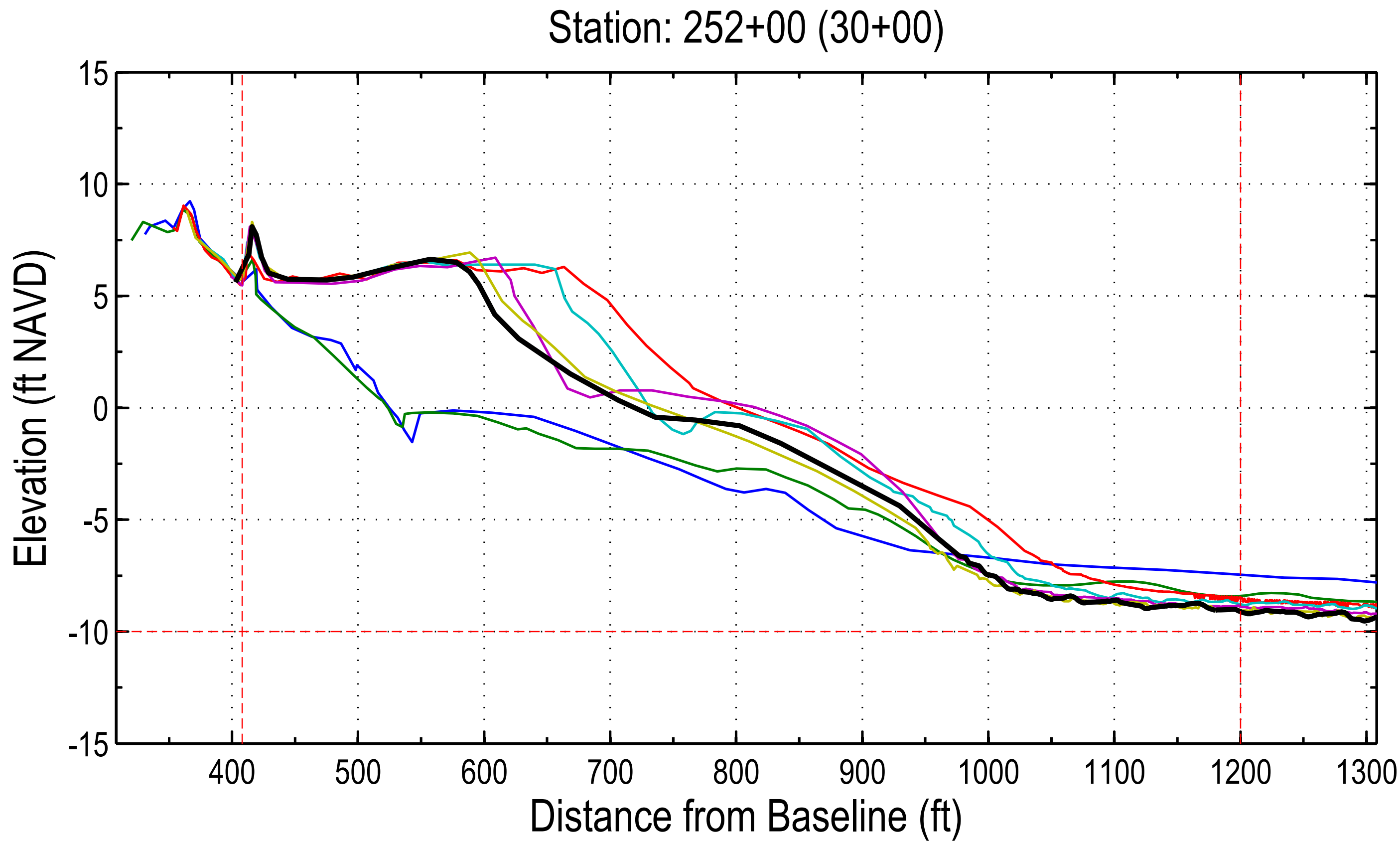
Station: 248+00 (26+00)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200
Elevation (ft NAVD)
Distance from Baseline (ft)



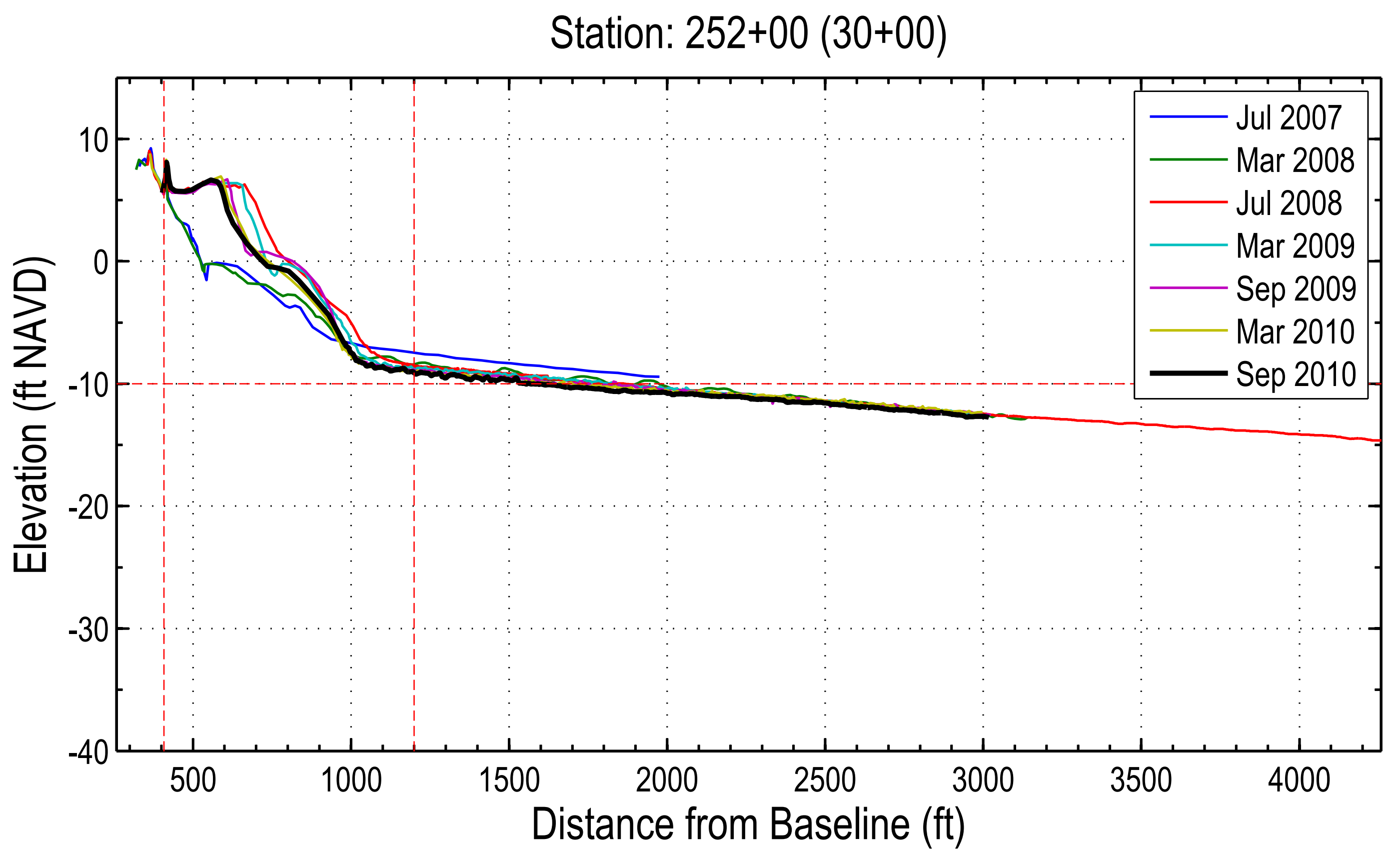
Station: 248+00 (26+00)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 250+00 (28+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200
1300

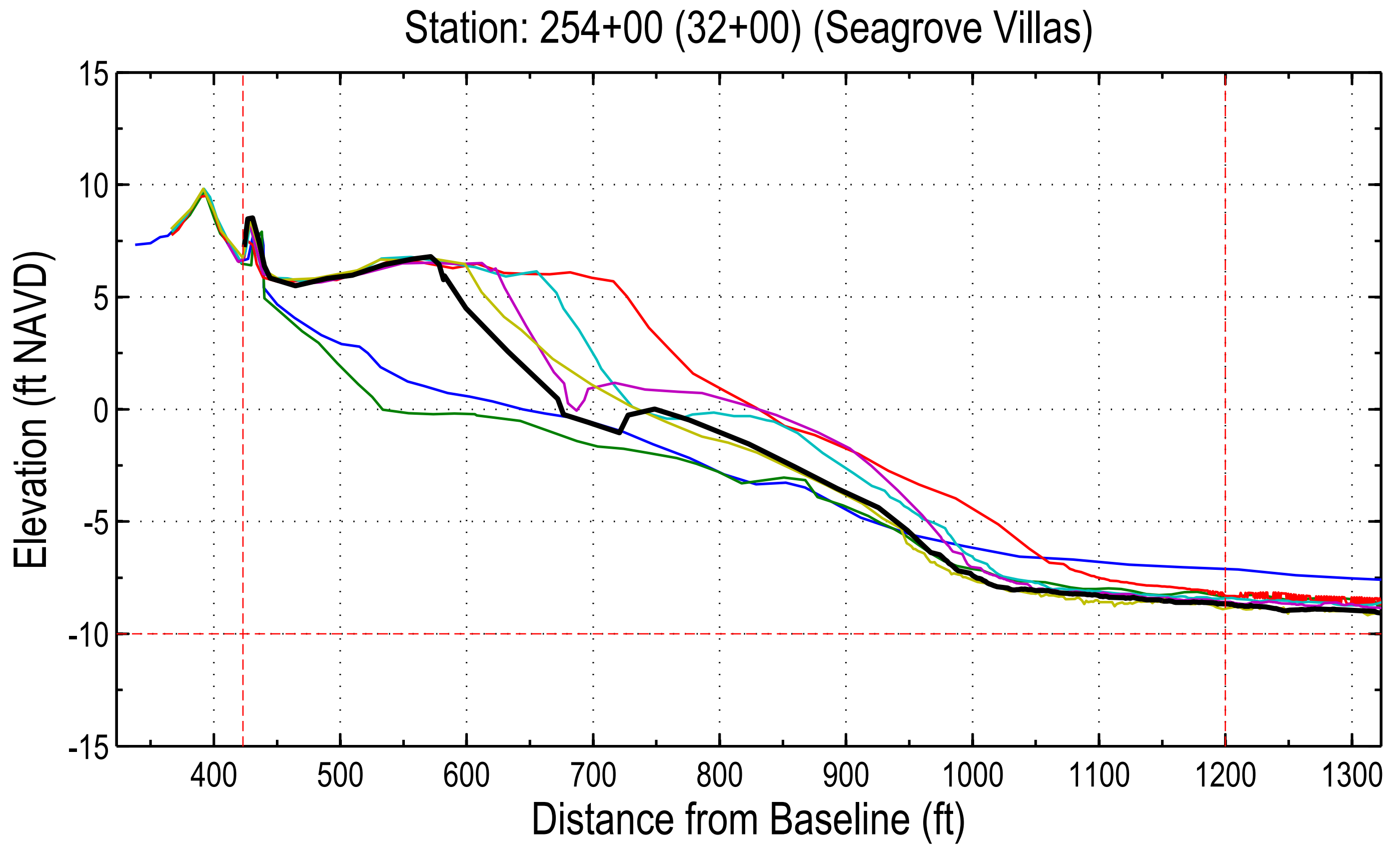

Station: 250+00 (28+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



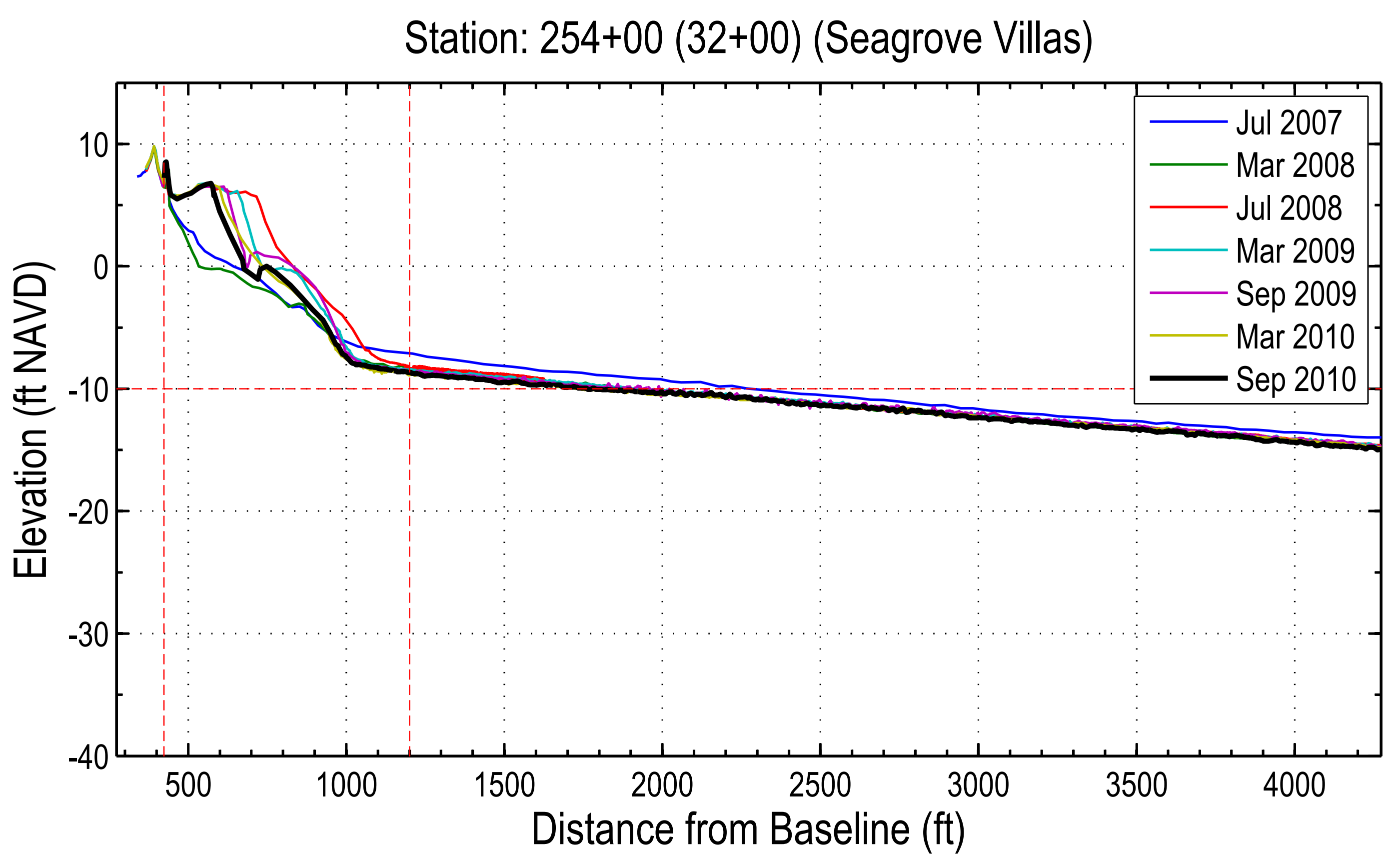
Station: 252+00 (30+00)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300
Elevation (ft NAVD)
Distance from Baseline (ft)



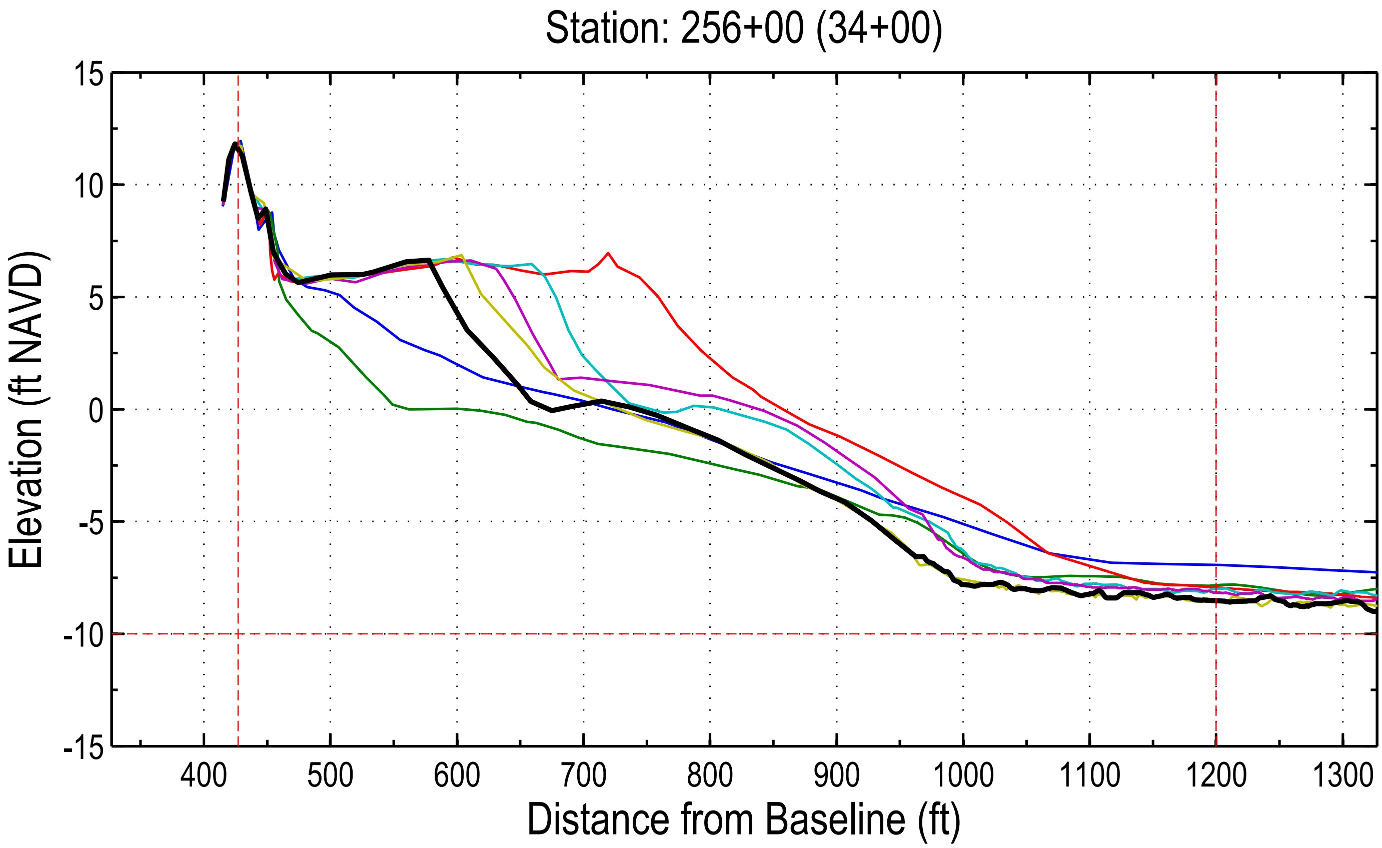
Station: 252+00 (30+00)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



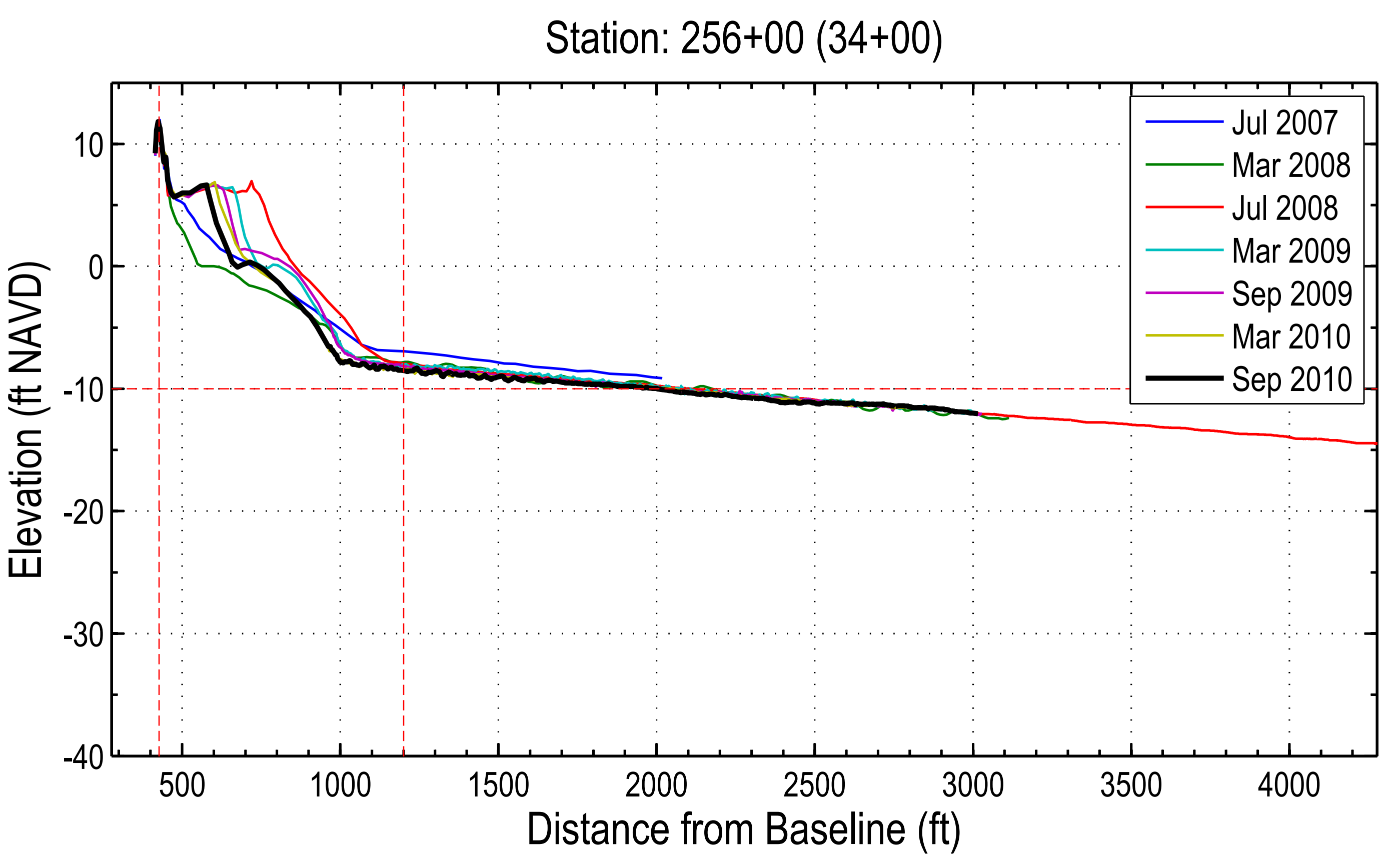
Station: 254+00 (32+00) (Seagrove Villas)
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300
Distance from Baseline (ft)



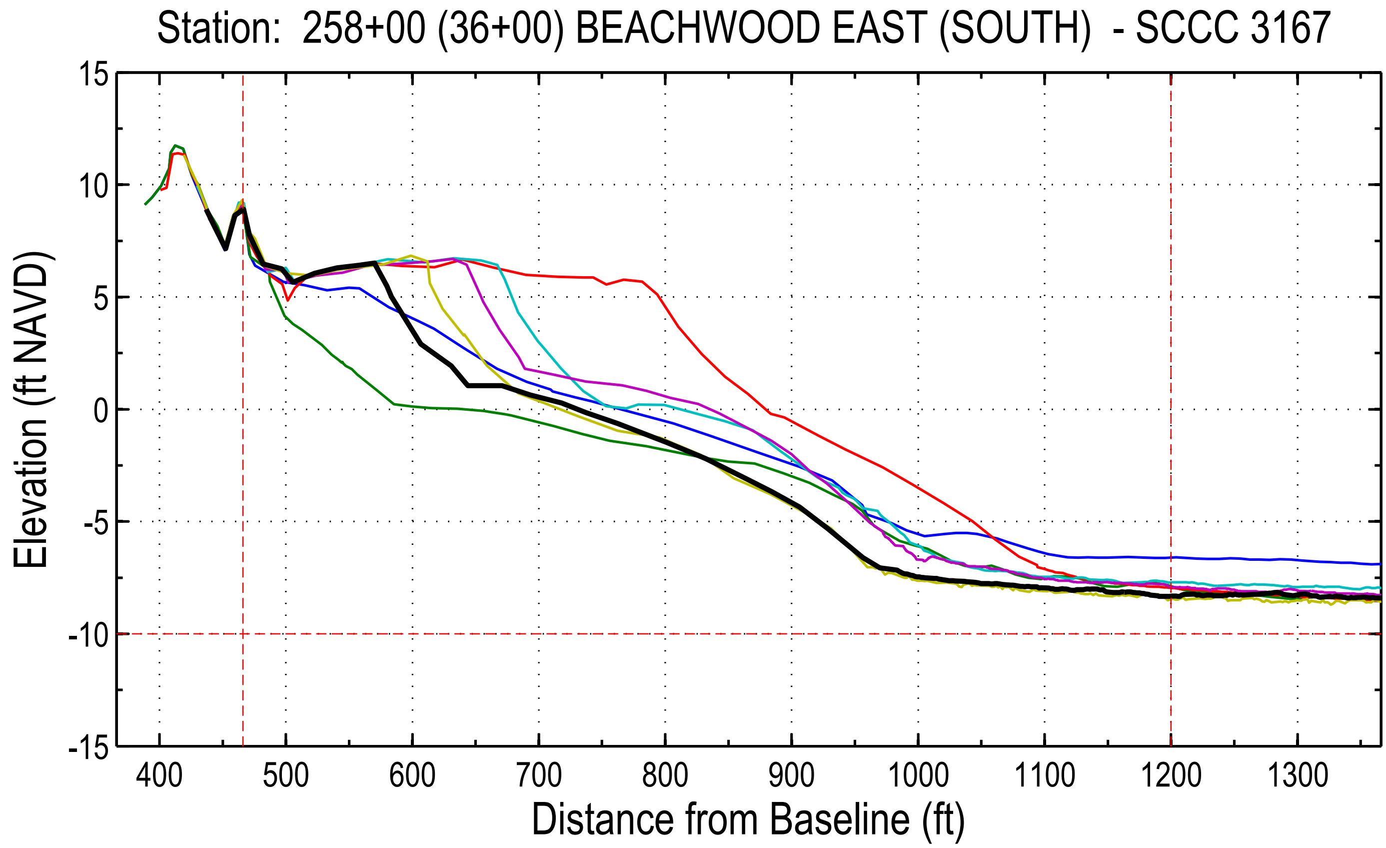
Station: 254+00 (32+00) (Seagrove Villas)
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



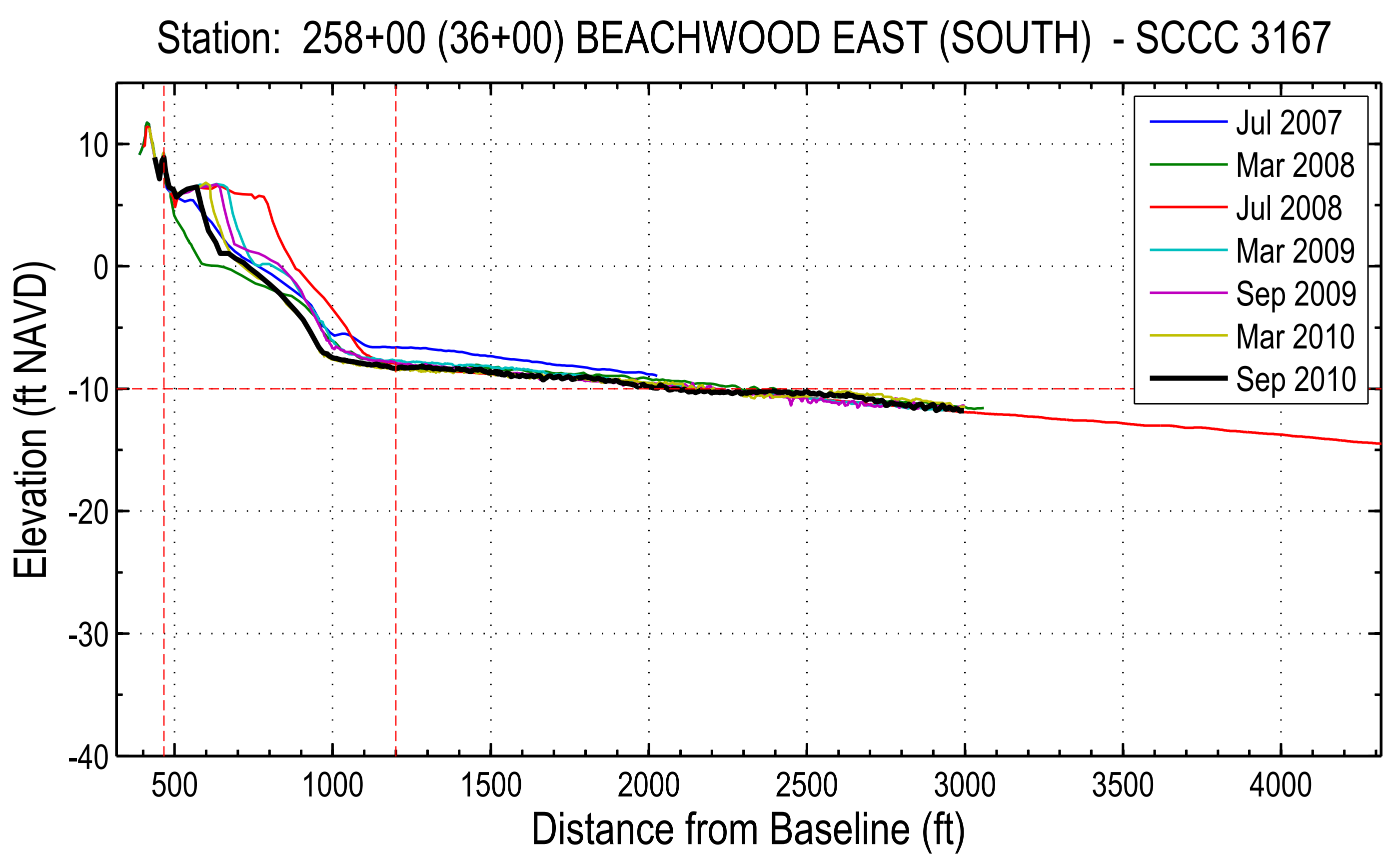
Station: 256+00 (34+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300



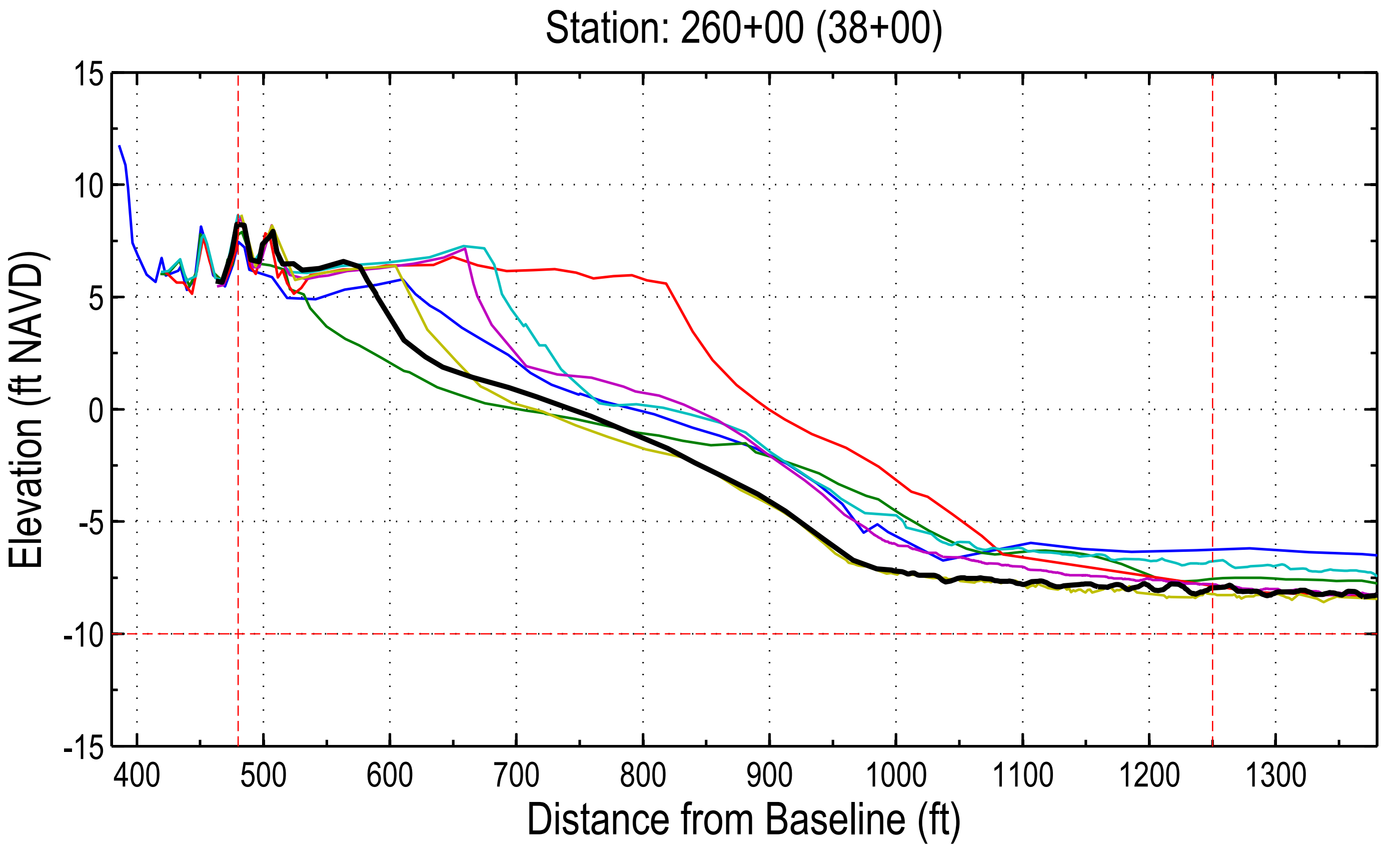
Station: 256+00 (34+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



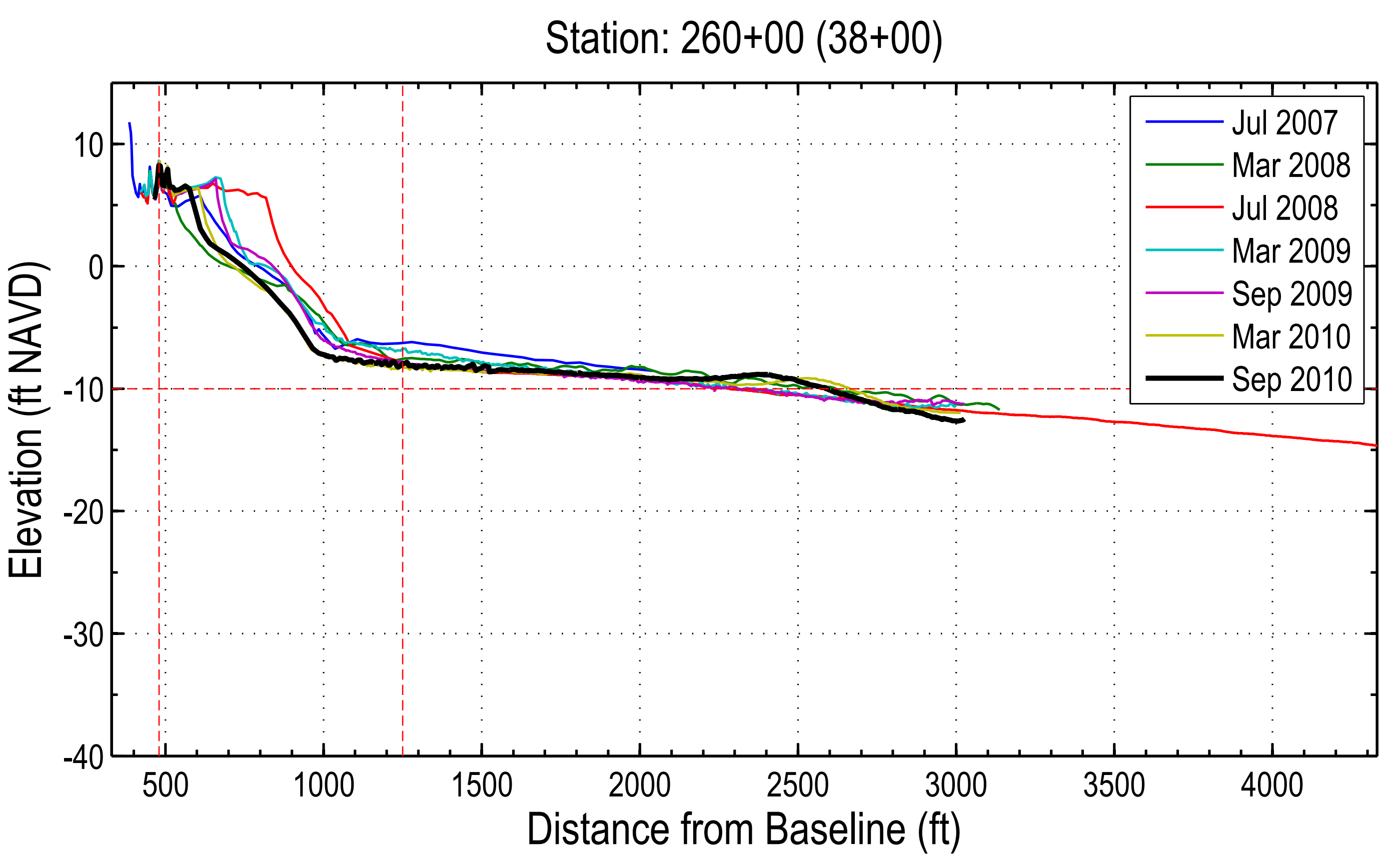
Station: 258+00 (36+00) BEACHWOOD EAST (SOUTH) - SCCC 3167
15
10
5
0
-5
-10
-15
Elevation (ft NAVD)
400
500
600
700
800
900
1000
1100
1200
1300
Distance from Baseline (ft)



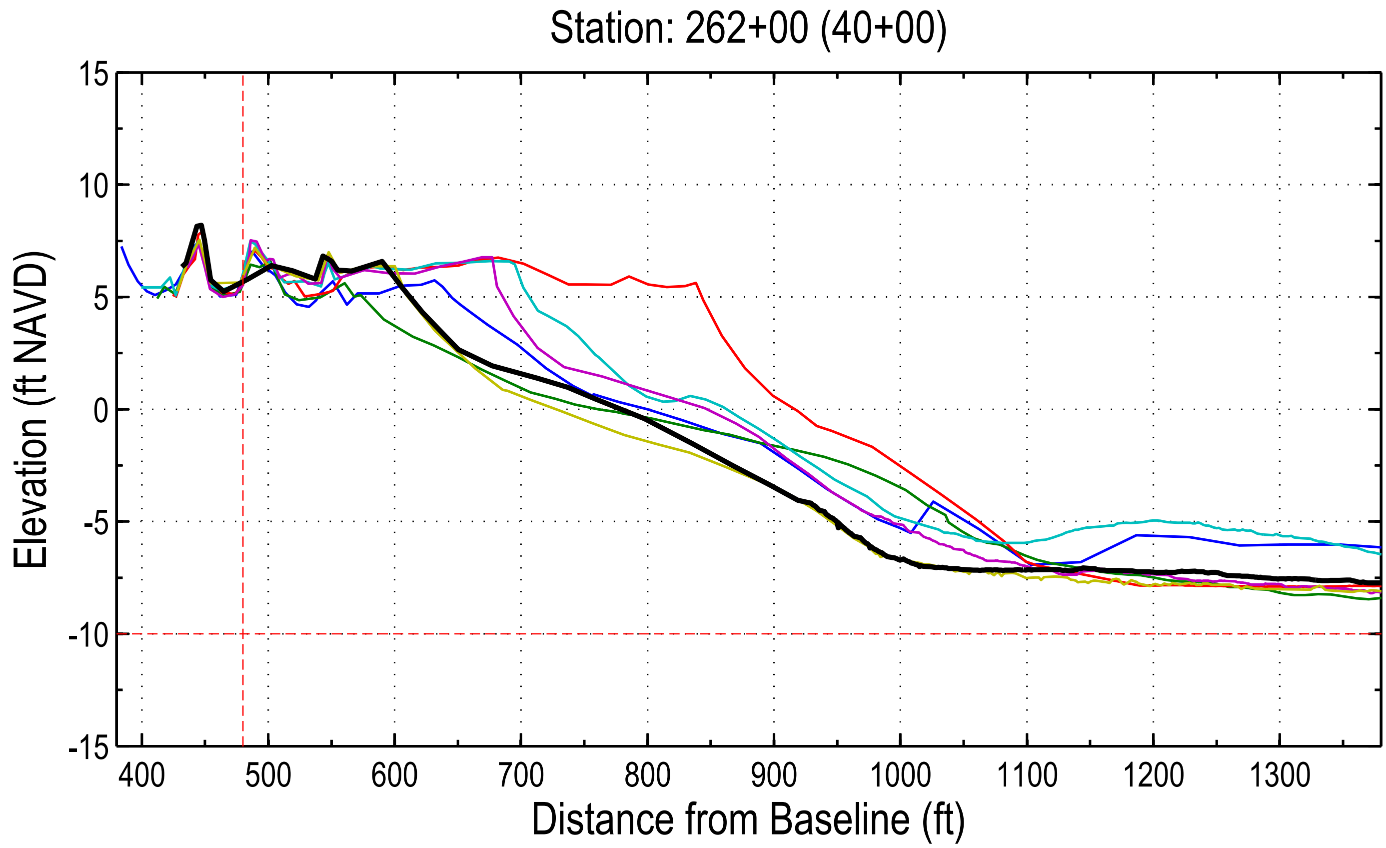
Station: 258+00 (36+00) BEACHWOOD EAST (SOUTH) - SCCC 3167
10
0
-10
-20
-30
-40
Elevation (ft NAVD)
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



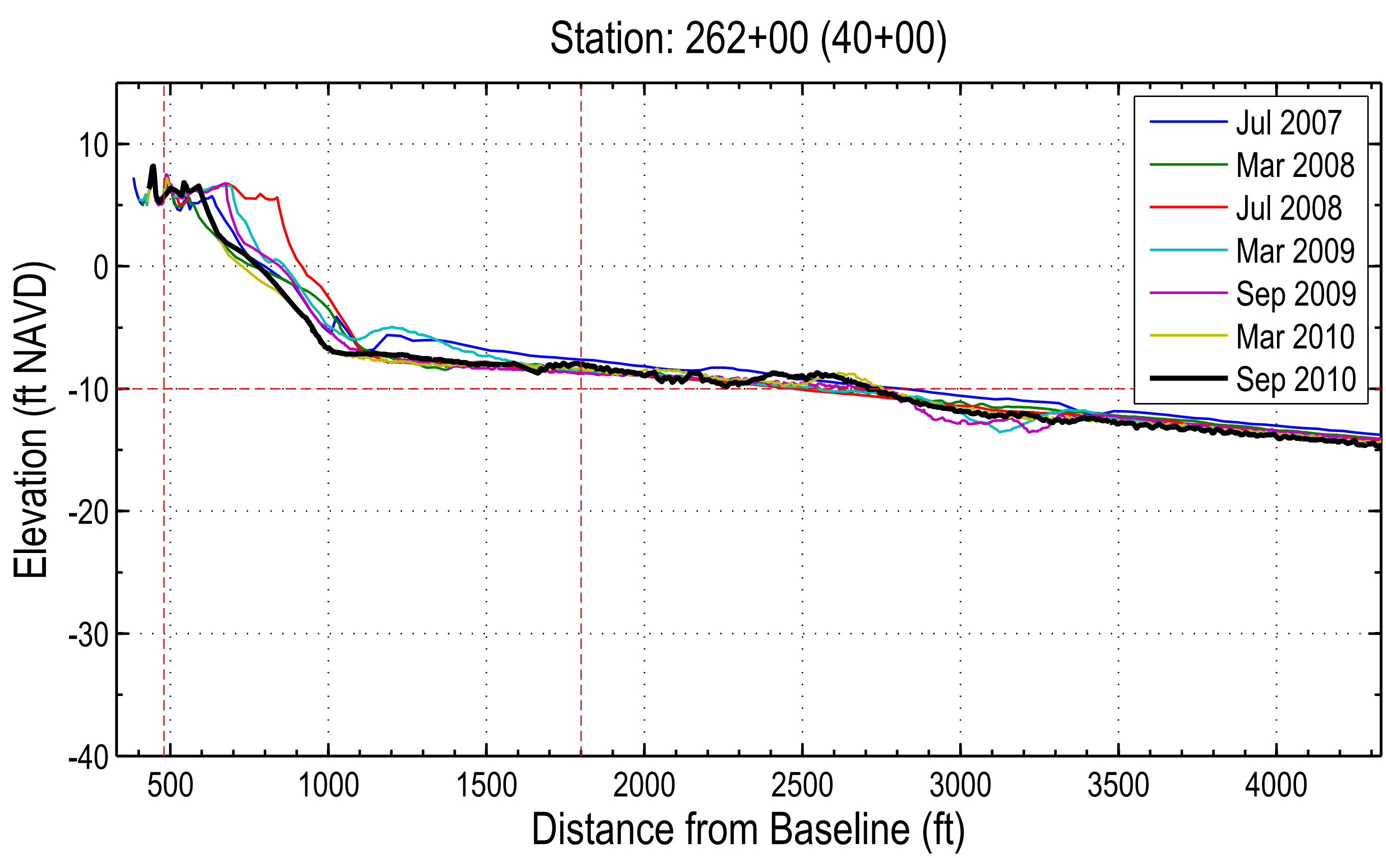
Station: 260+00 (38+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300



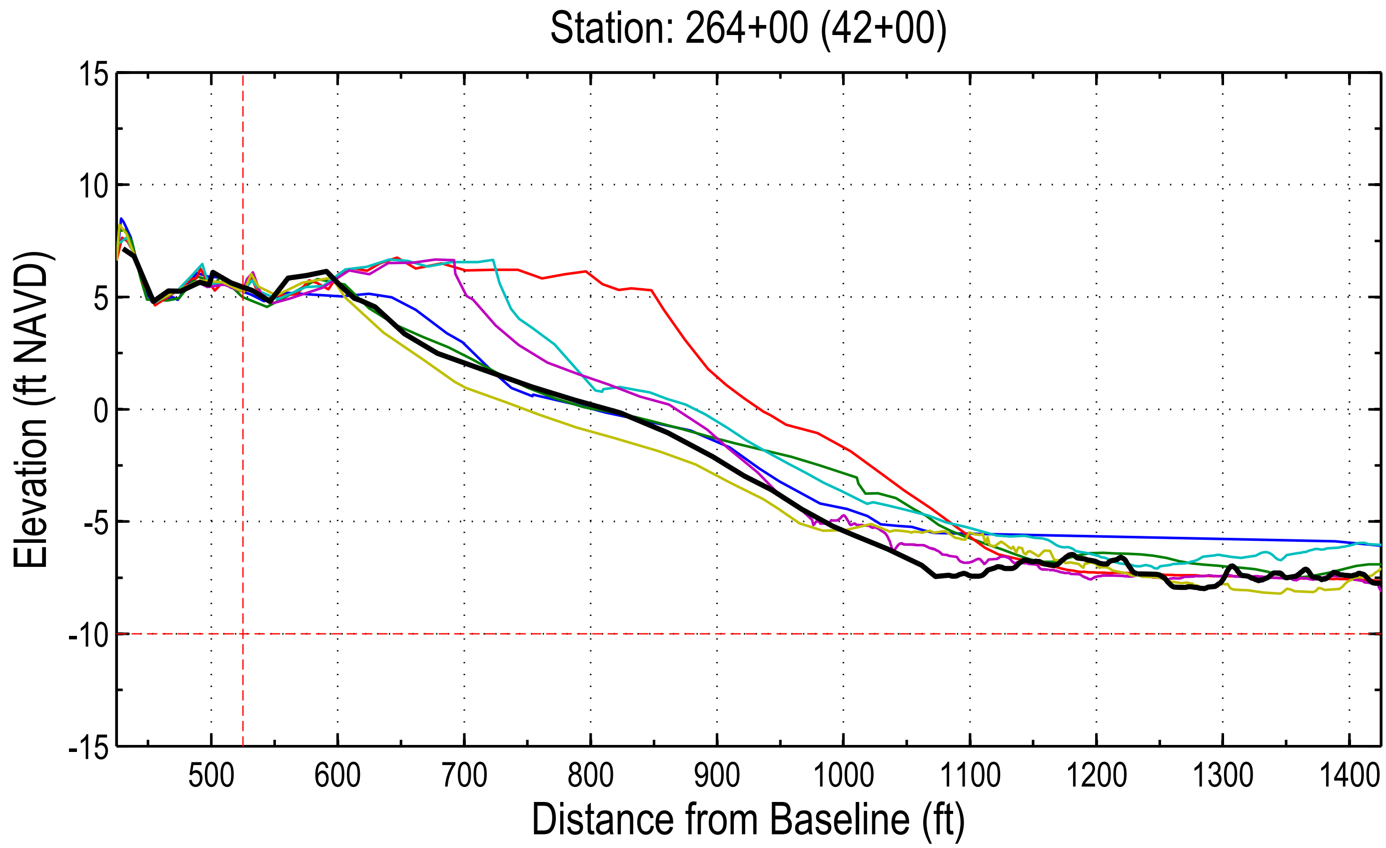
Station: 260+00 (38+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



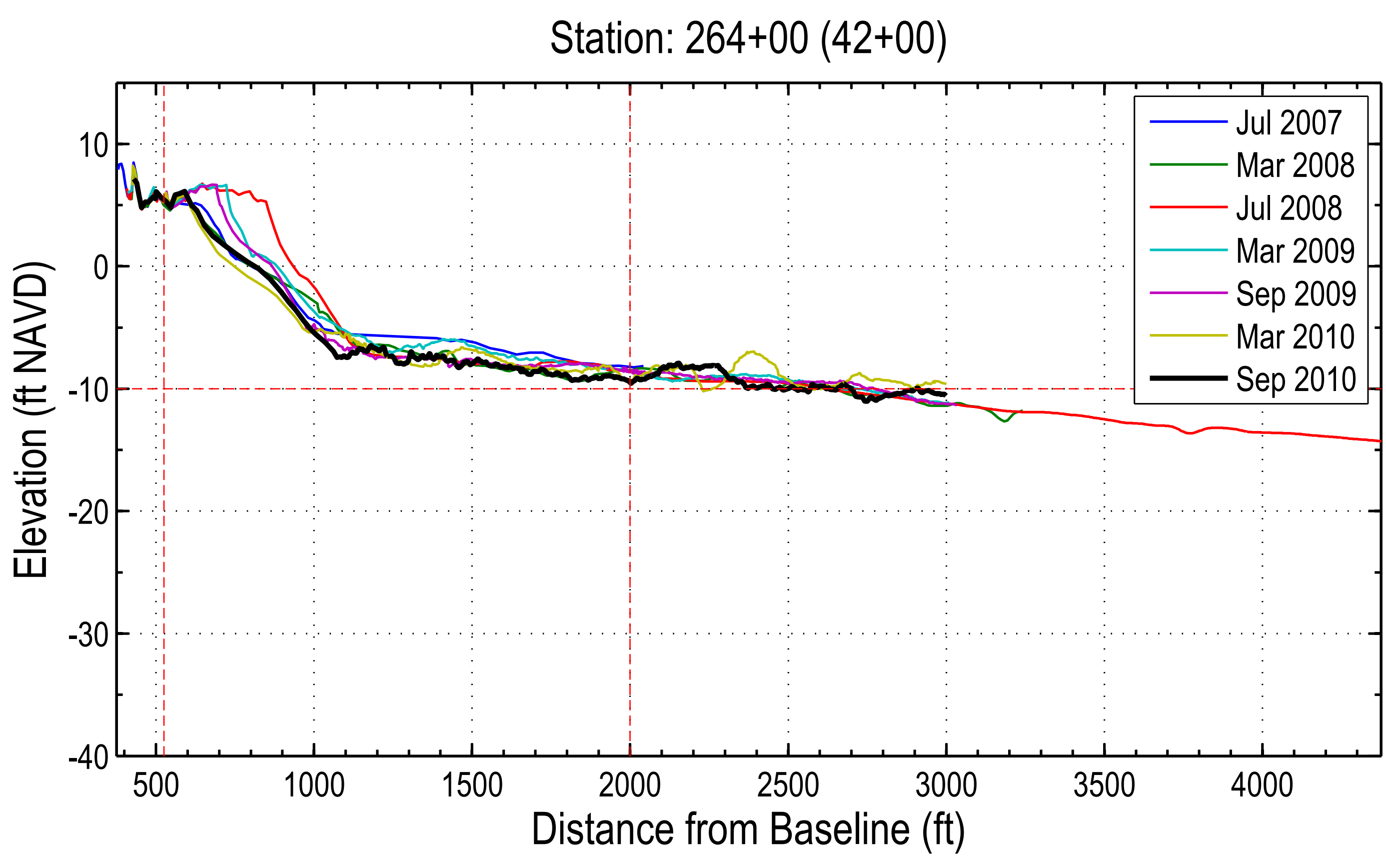
Station: 262+00 (40+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300



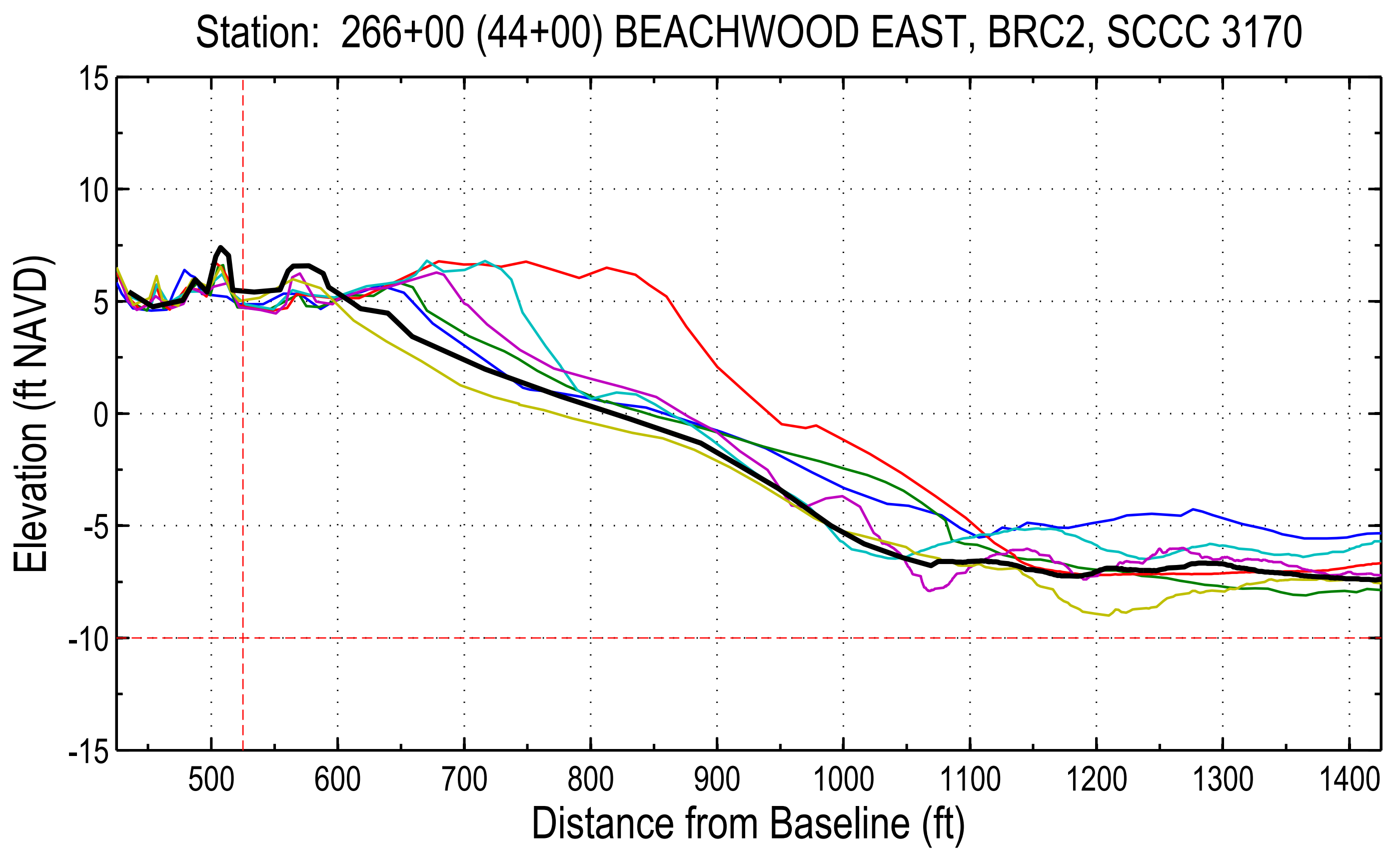
Station: 262+00 (40+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

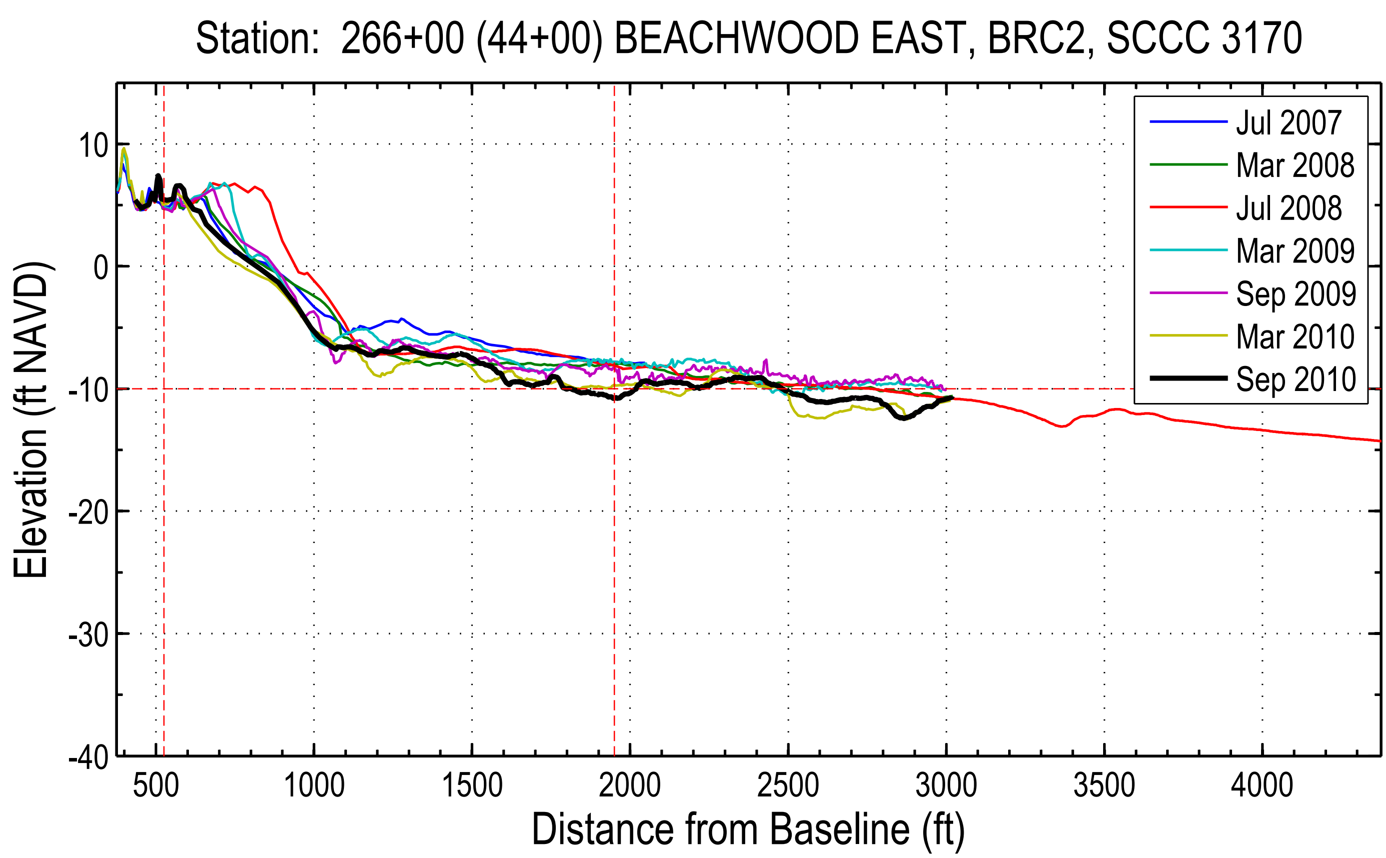


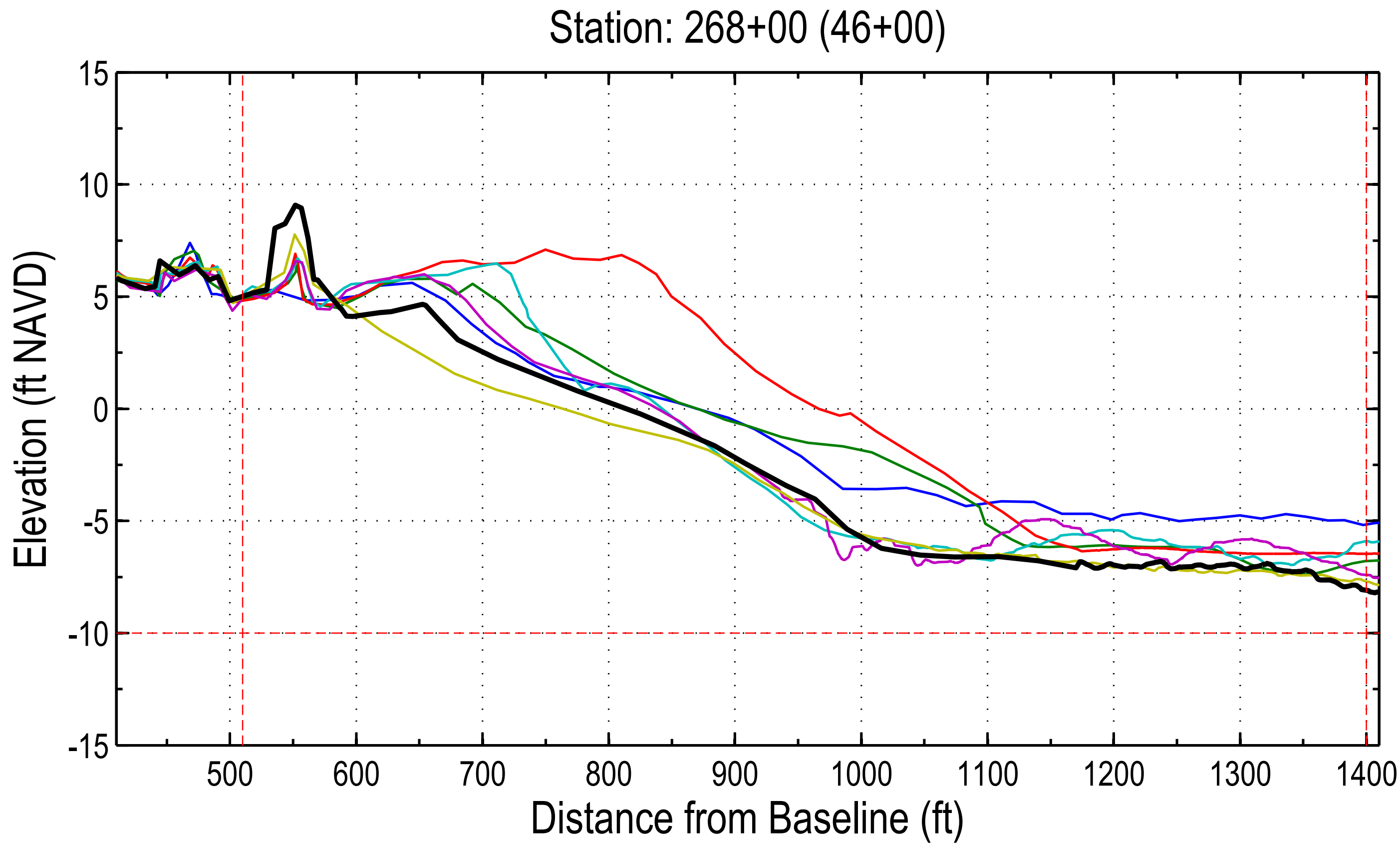
Station: 264+00 (42+00)
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
500
600
700
800
900
1000
1100
1200
1300
1400
Distance from Baseline (ft)



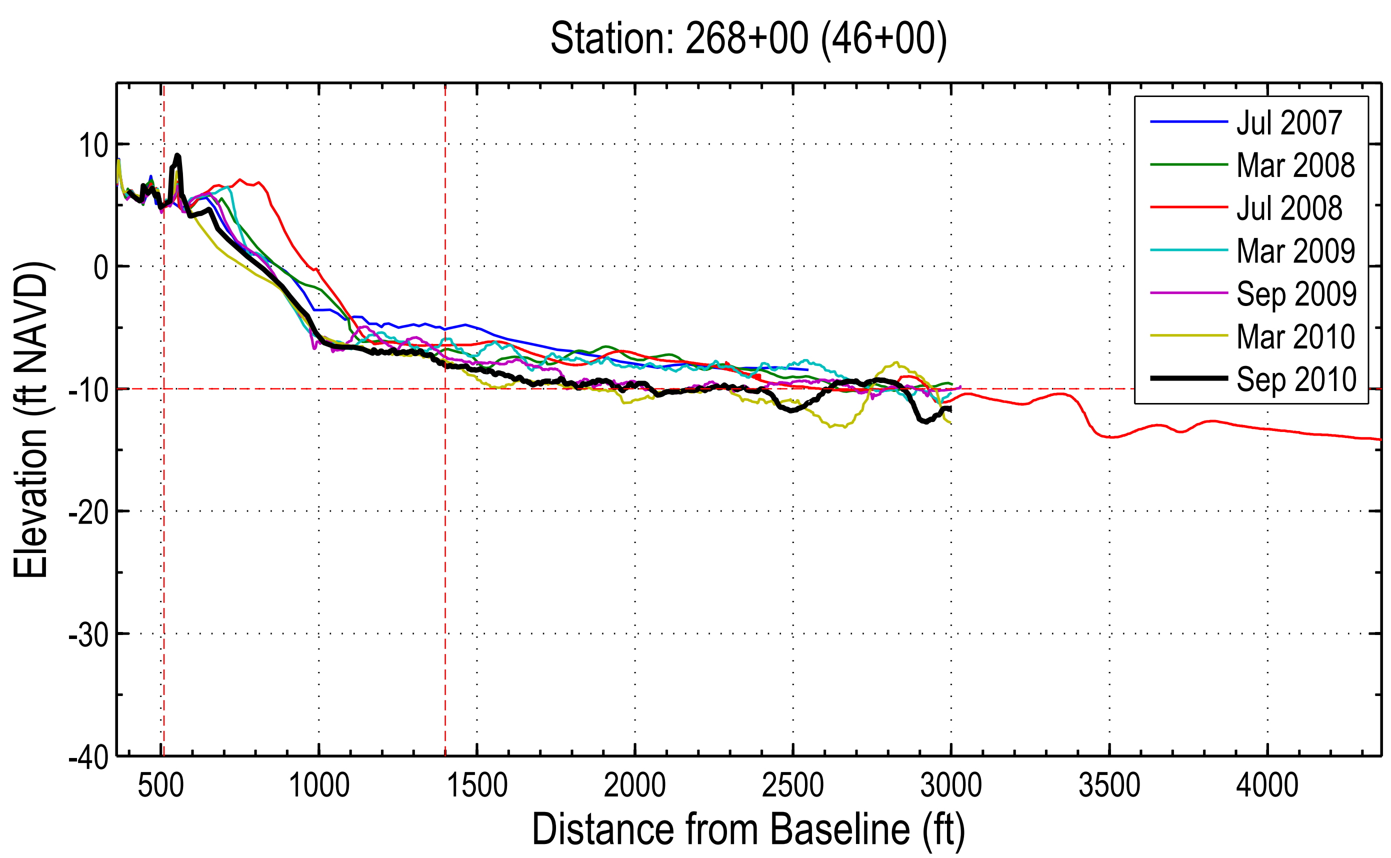
Station: 264+00 (42+00)
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 266+00 (44+00) BEACHWOOD EAST, BRC2, SCCC 3170
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
500
600
700
800
900
1000
1100
1200
1300
1400

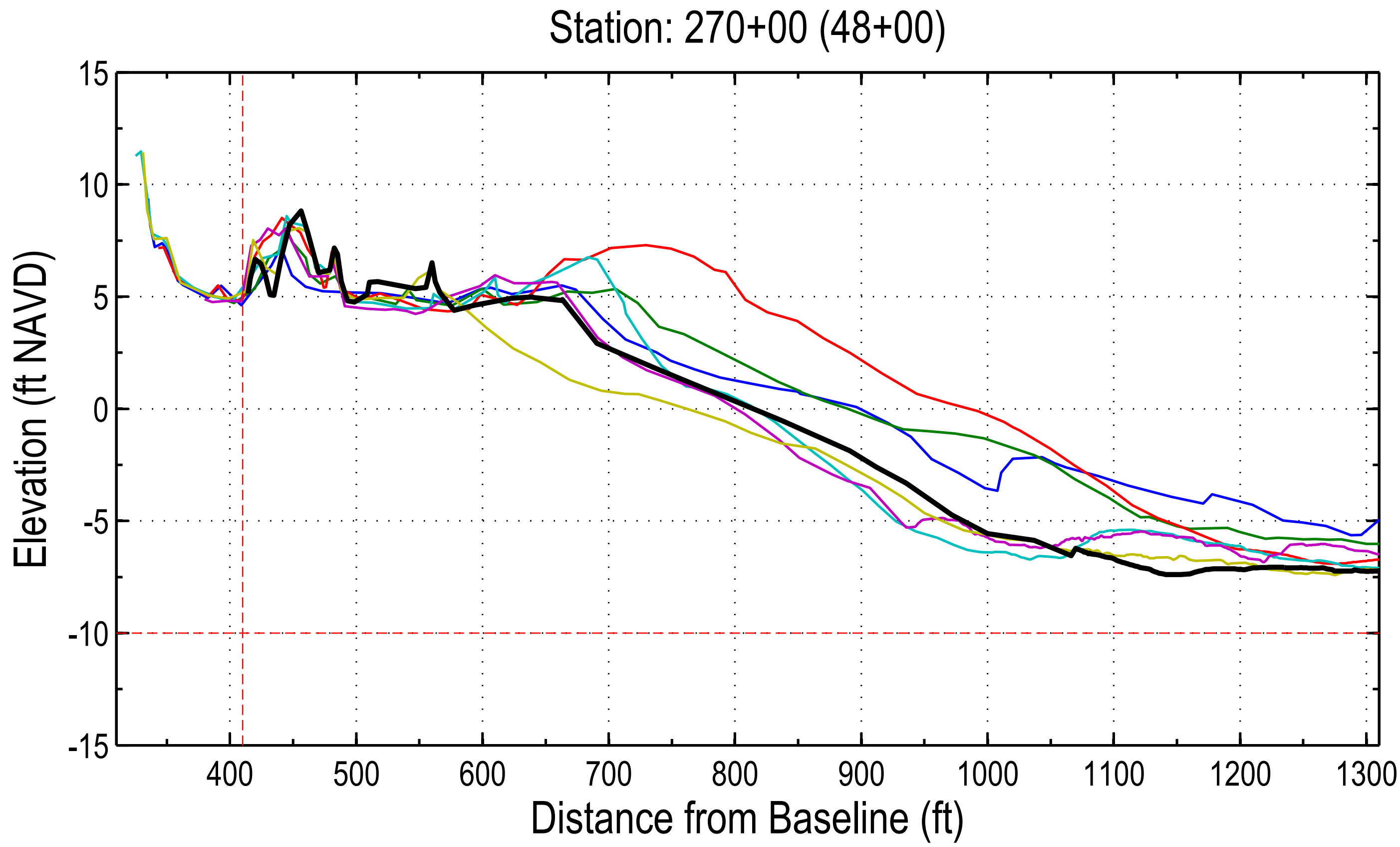

Station: 266+00 (44+00) BEACHWOOD EAST, BRC2, SCCC 3170
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000

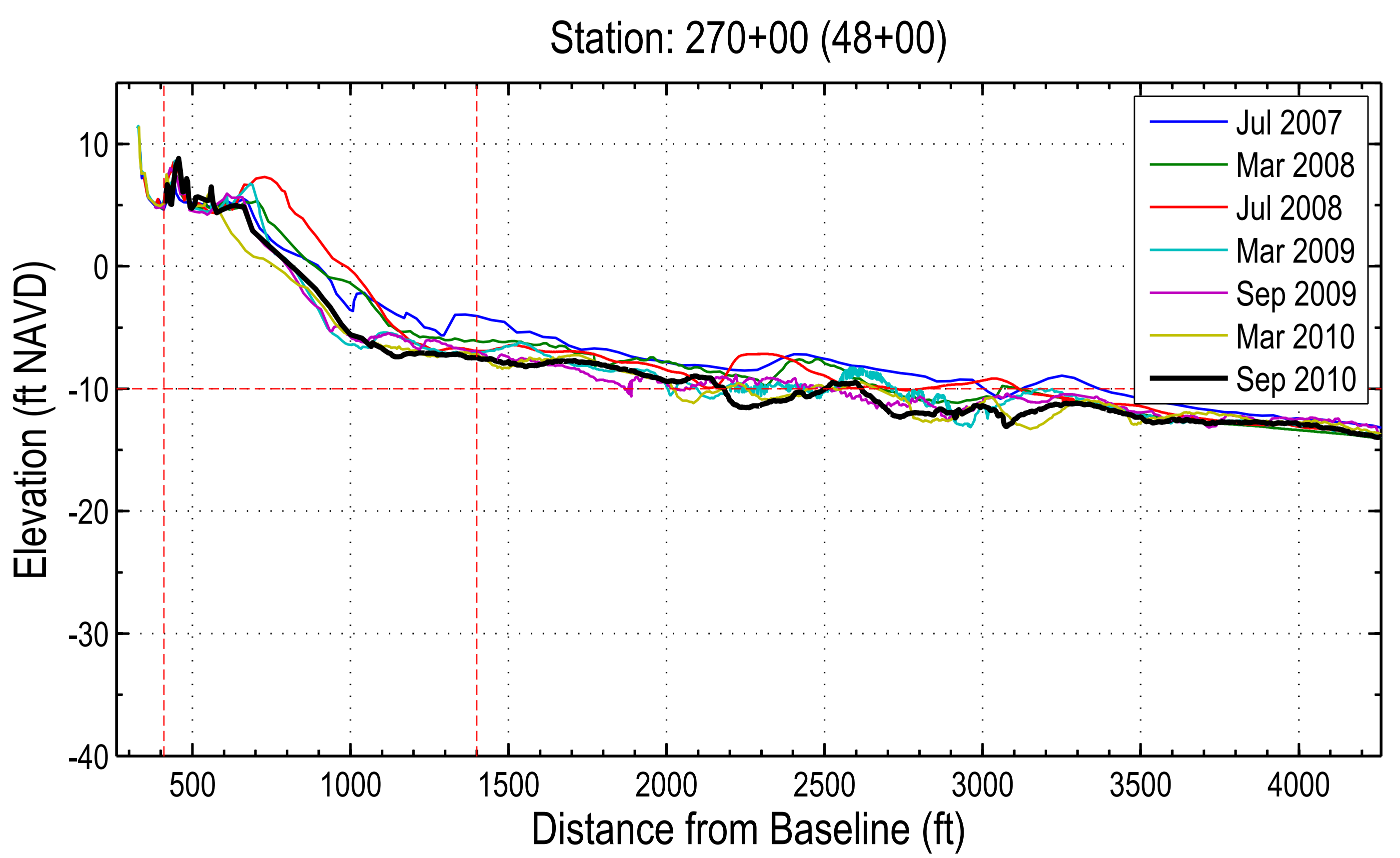


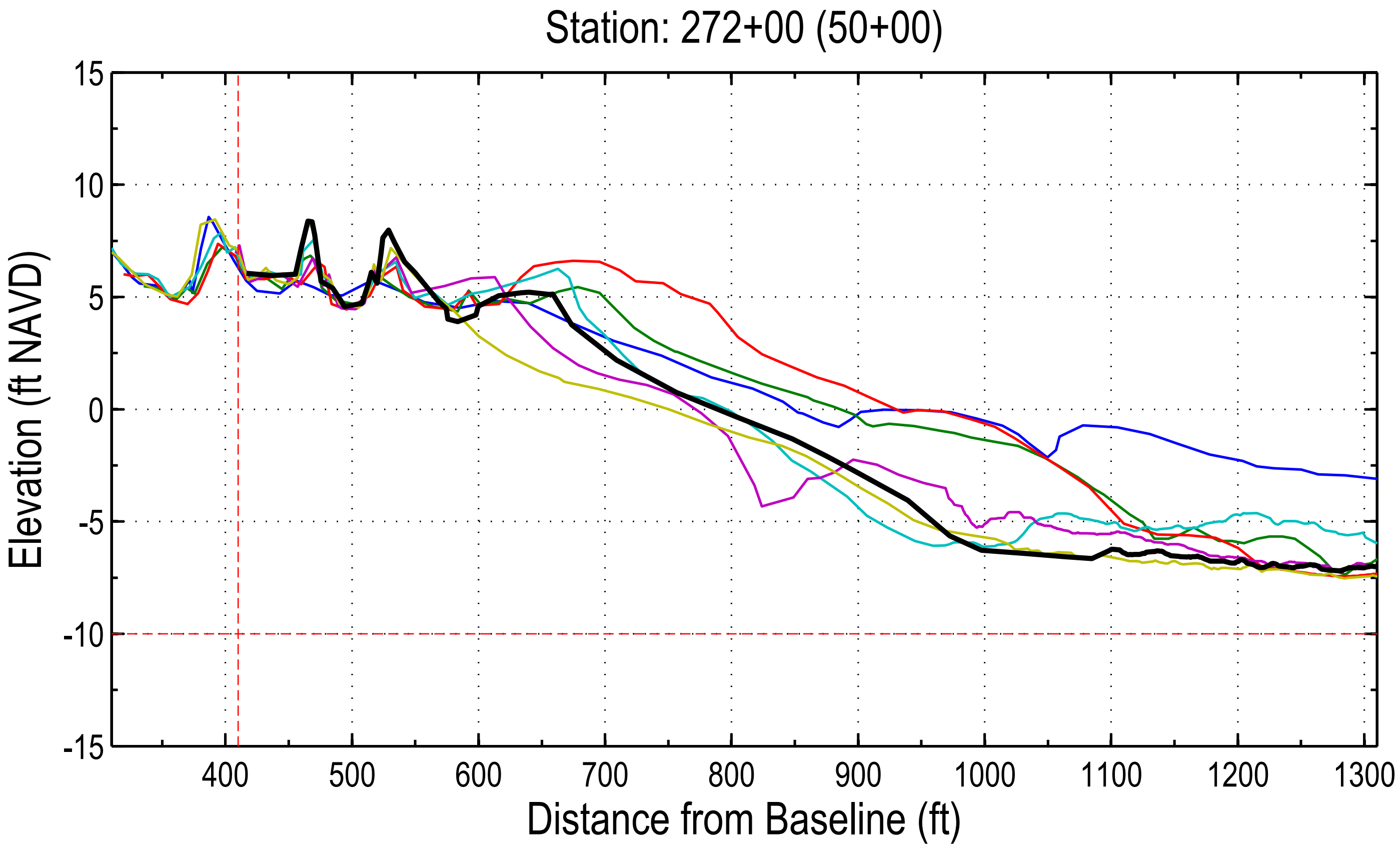
Station: 268+00 (46+00)
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
500
600
700
800
900
1000
1100
1200
1300
1400
Distance from Baseline (ft)

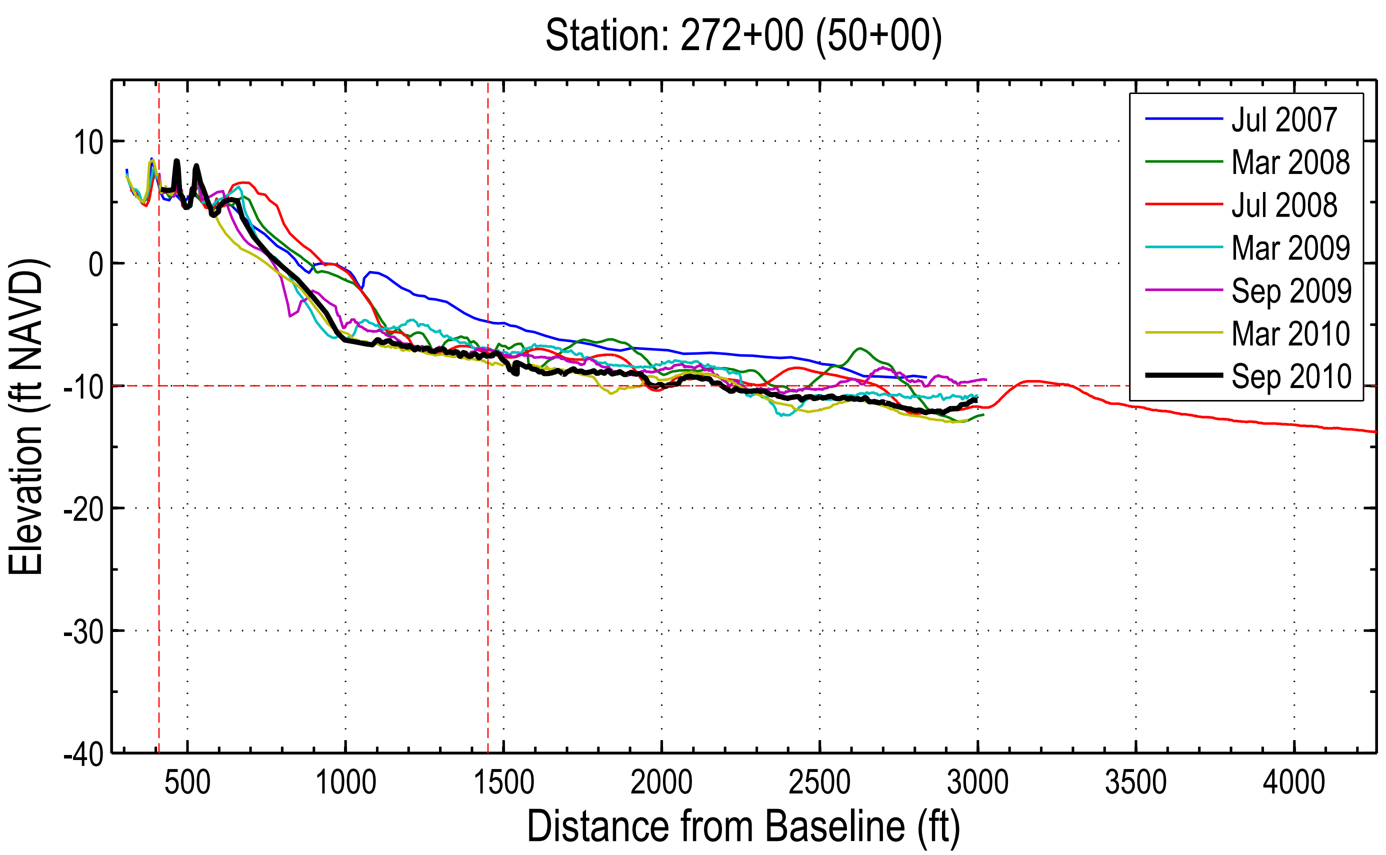


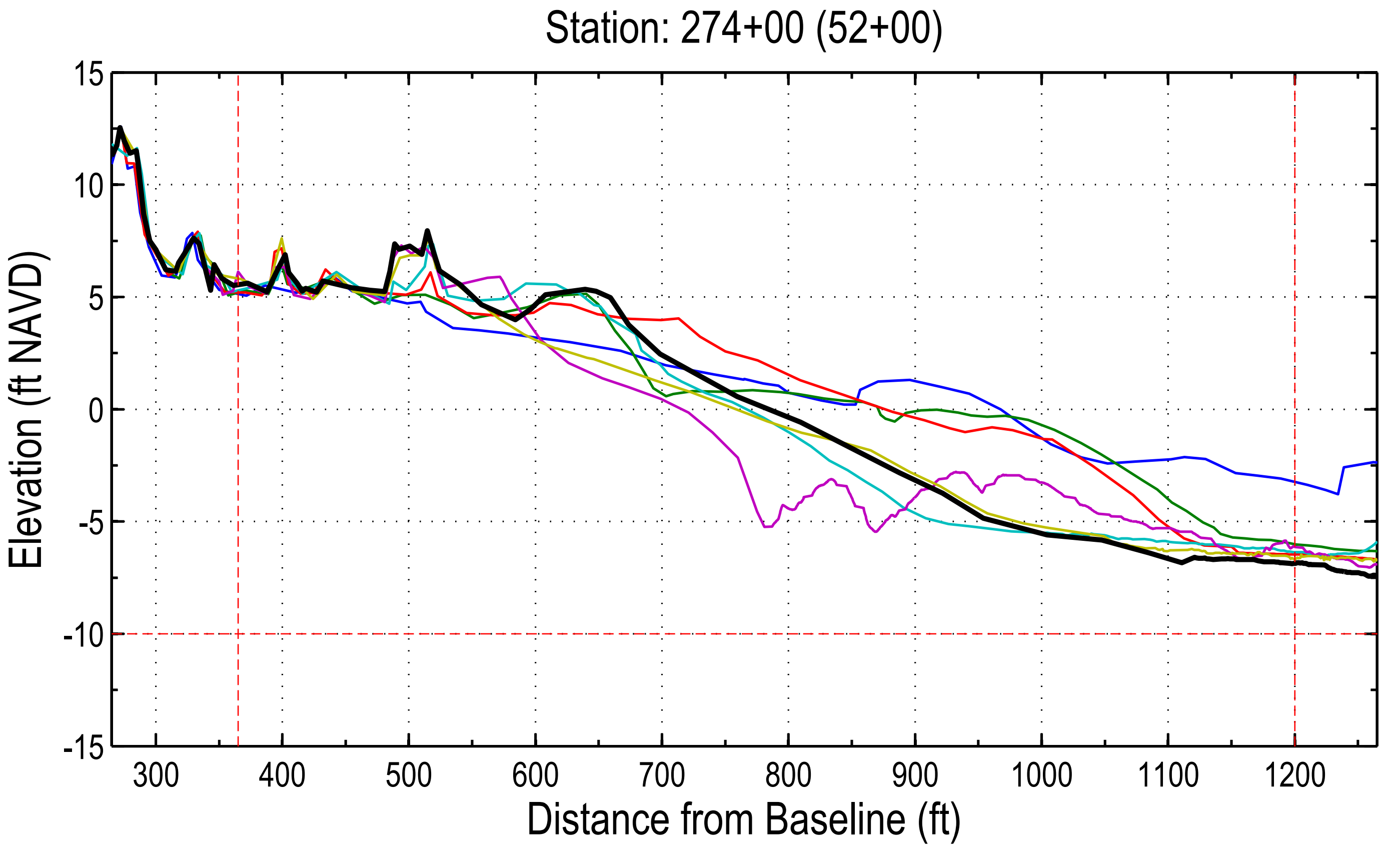
Station: 268+00 (46+00)
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 270+00 (48+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300

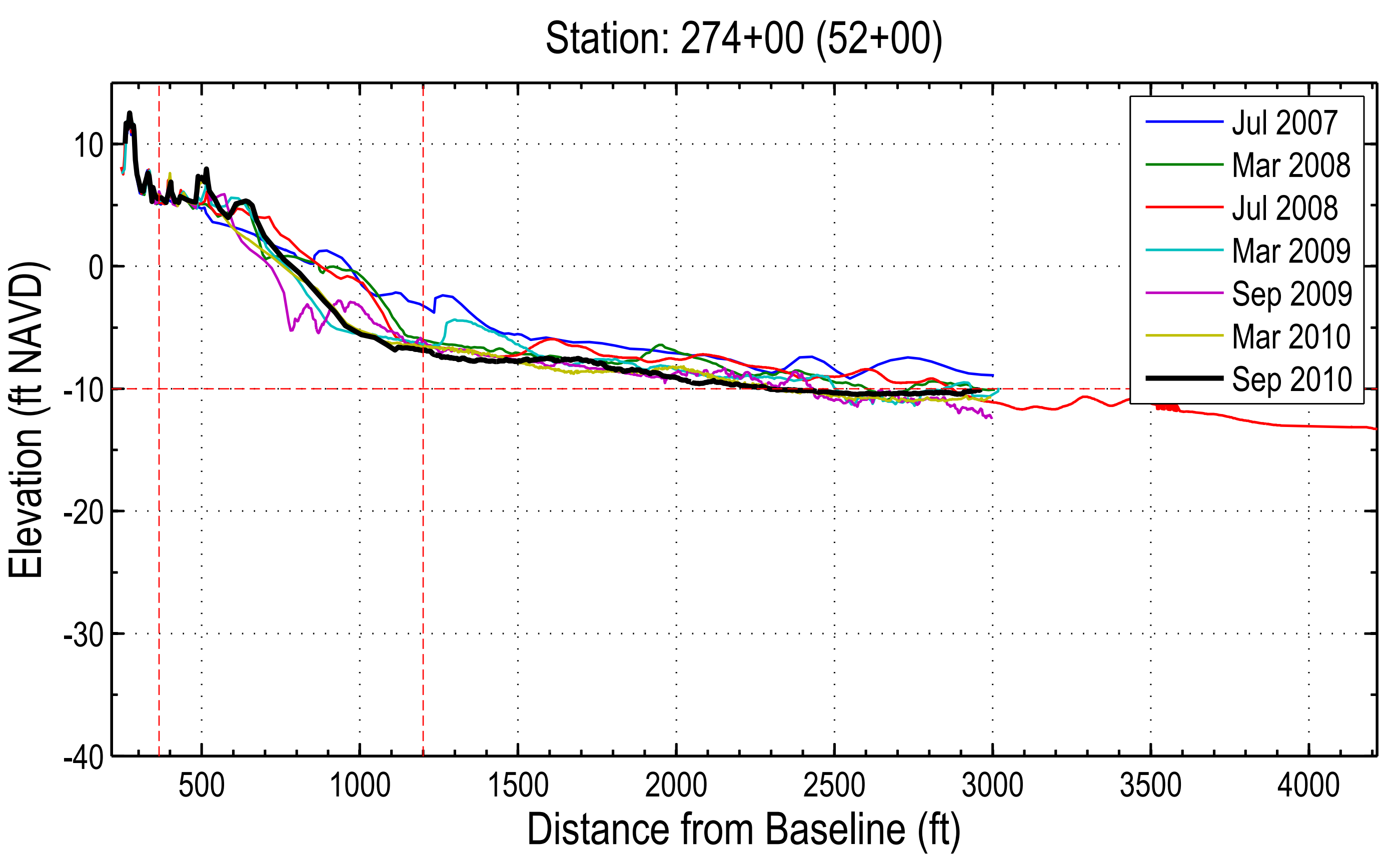

Station: 270+00 (48+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 272+00 (50+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300

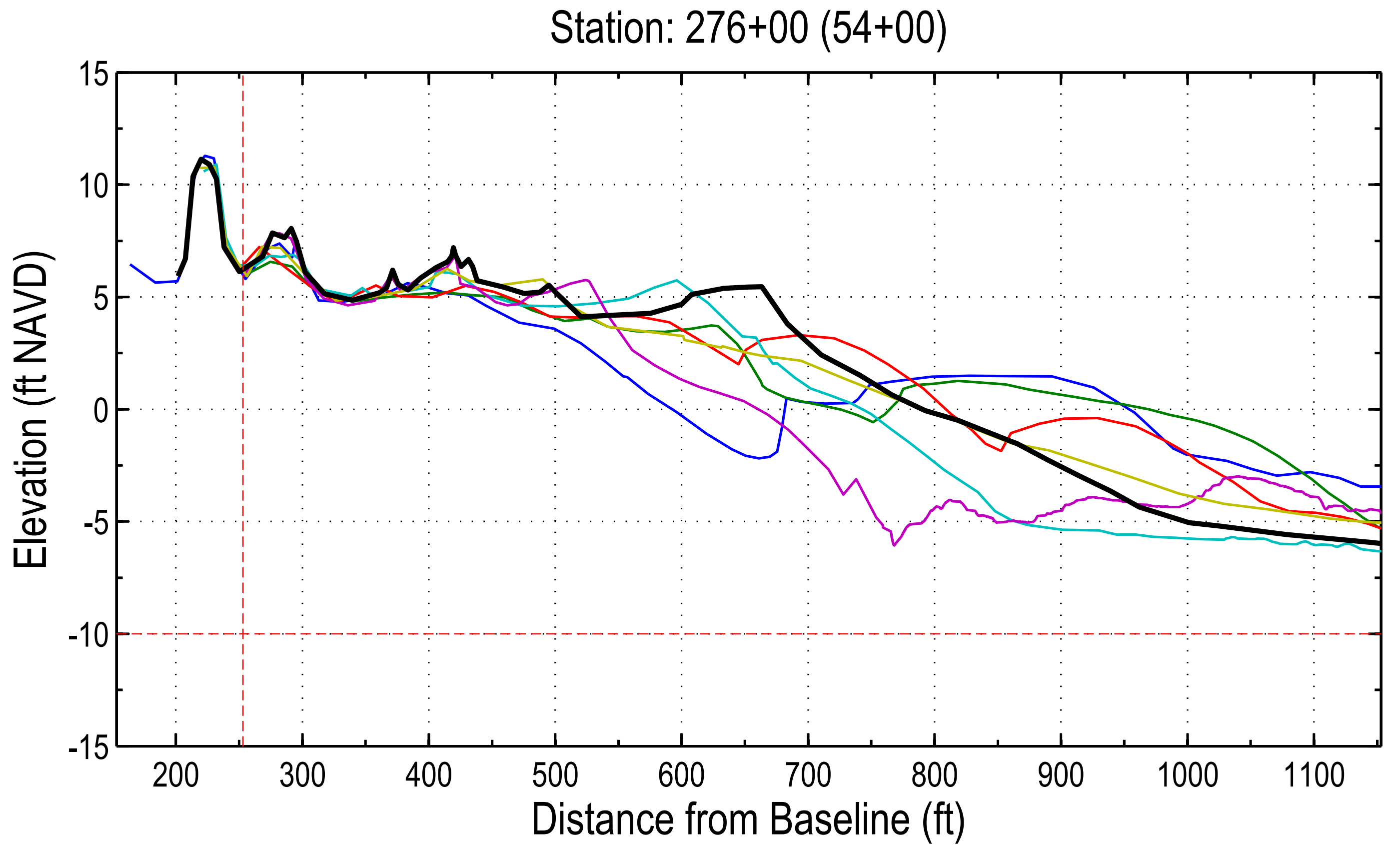

Station: 272+00 (50+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



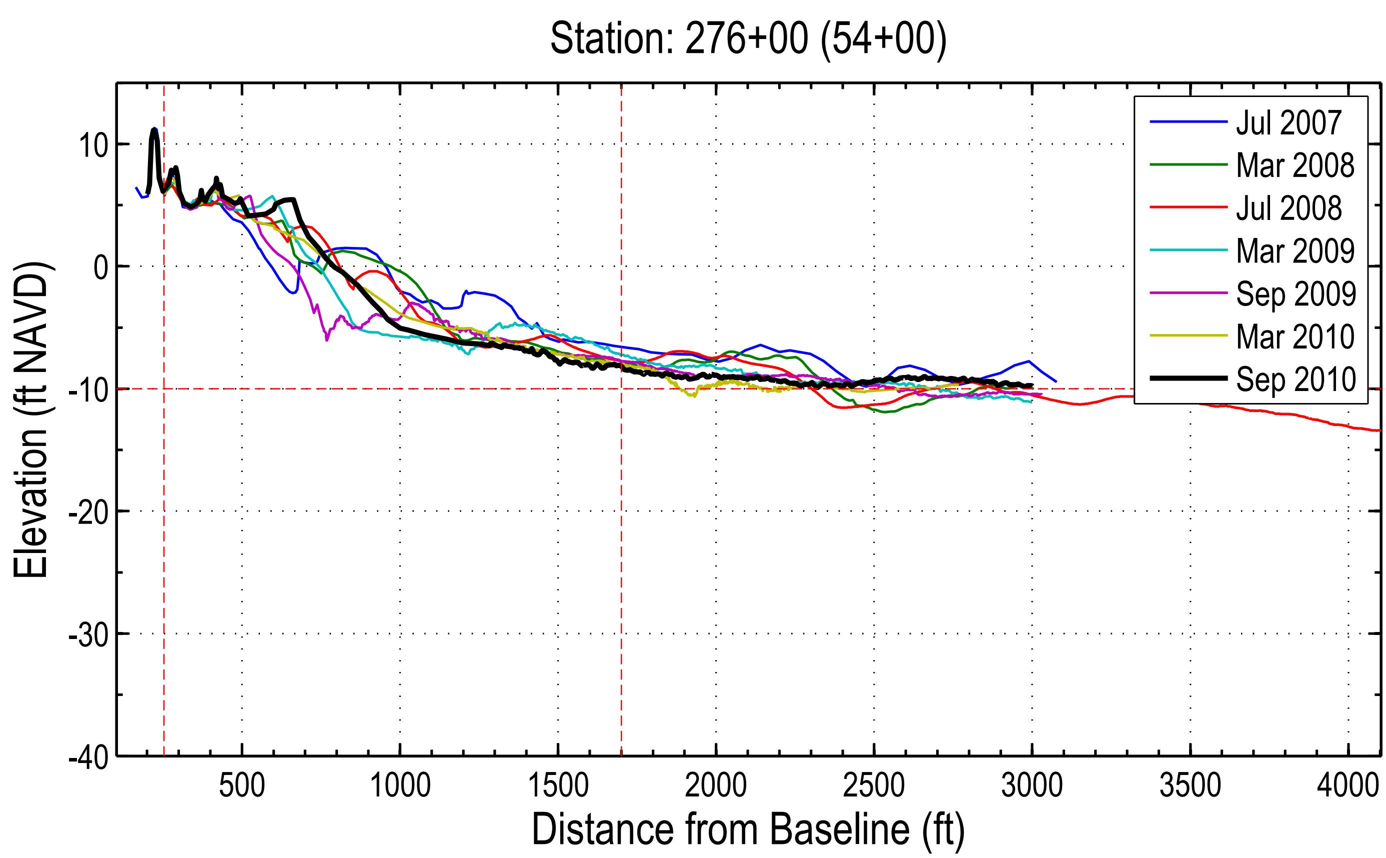
Station: 274+00 (52+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200



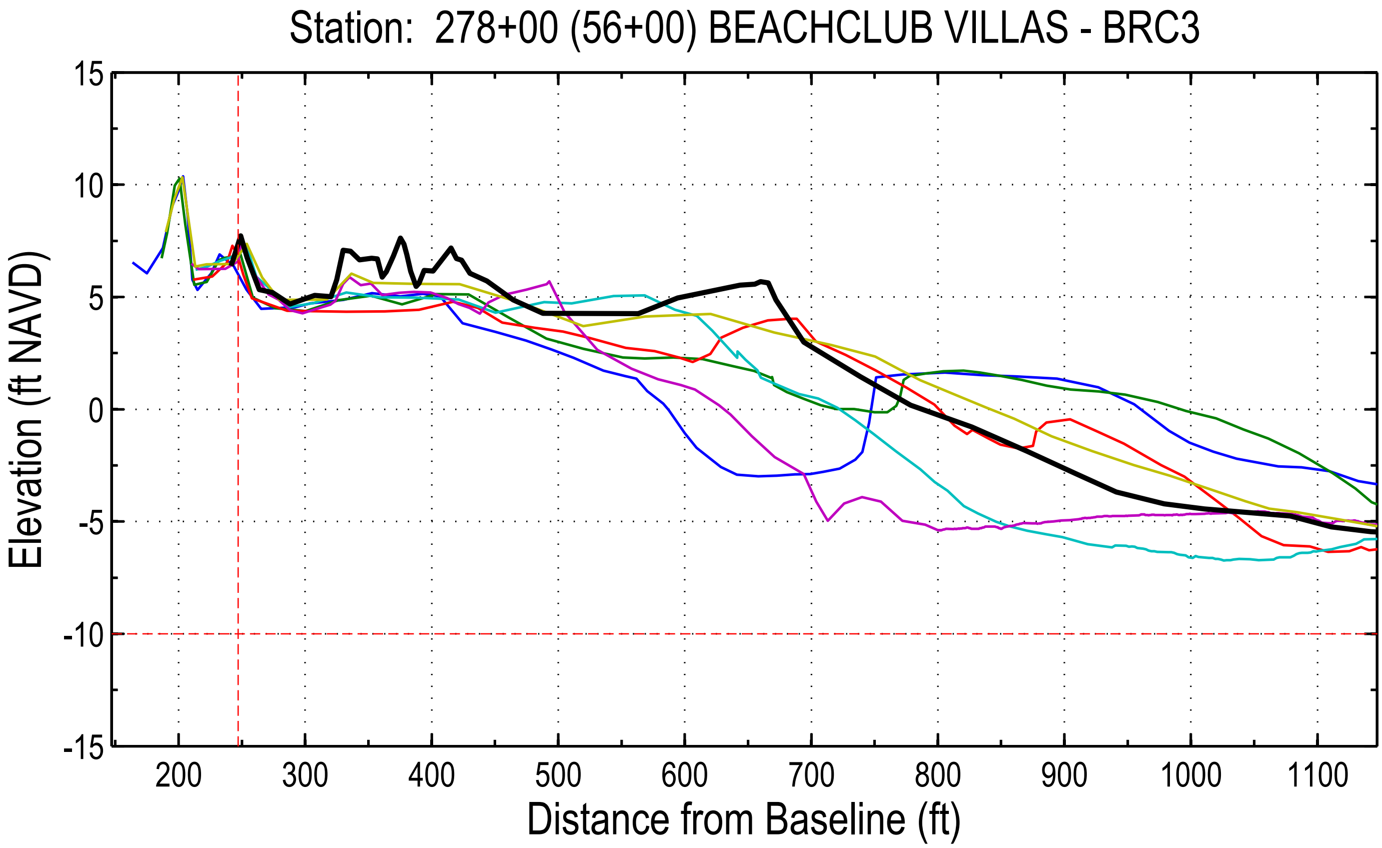
Station: 274+00 (52+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



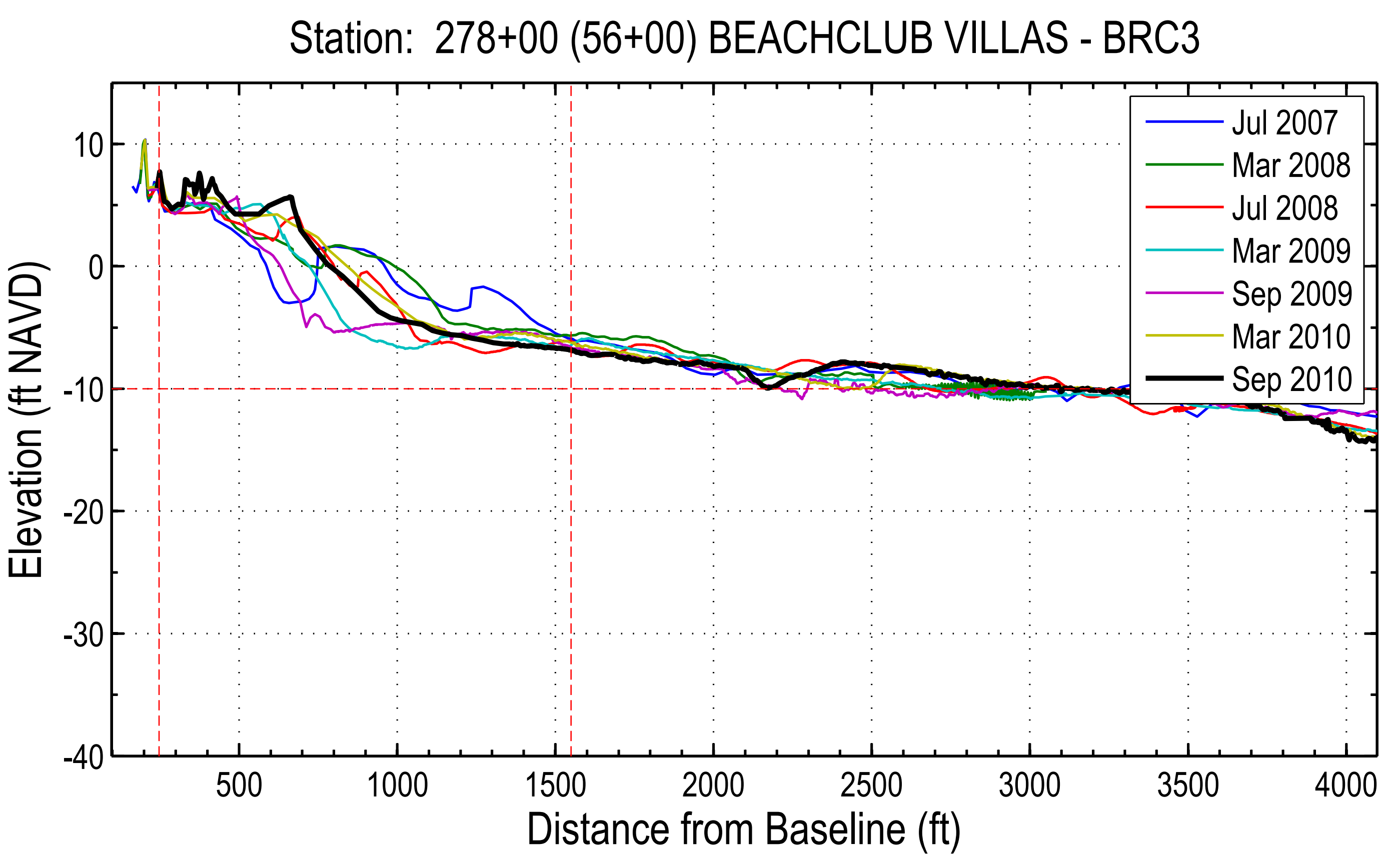
Station: 276+00 (54+00)
Elevation (ft NAVD)
Distance from Baseline (ft)



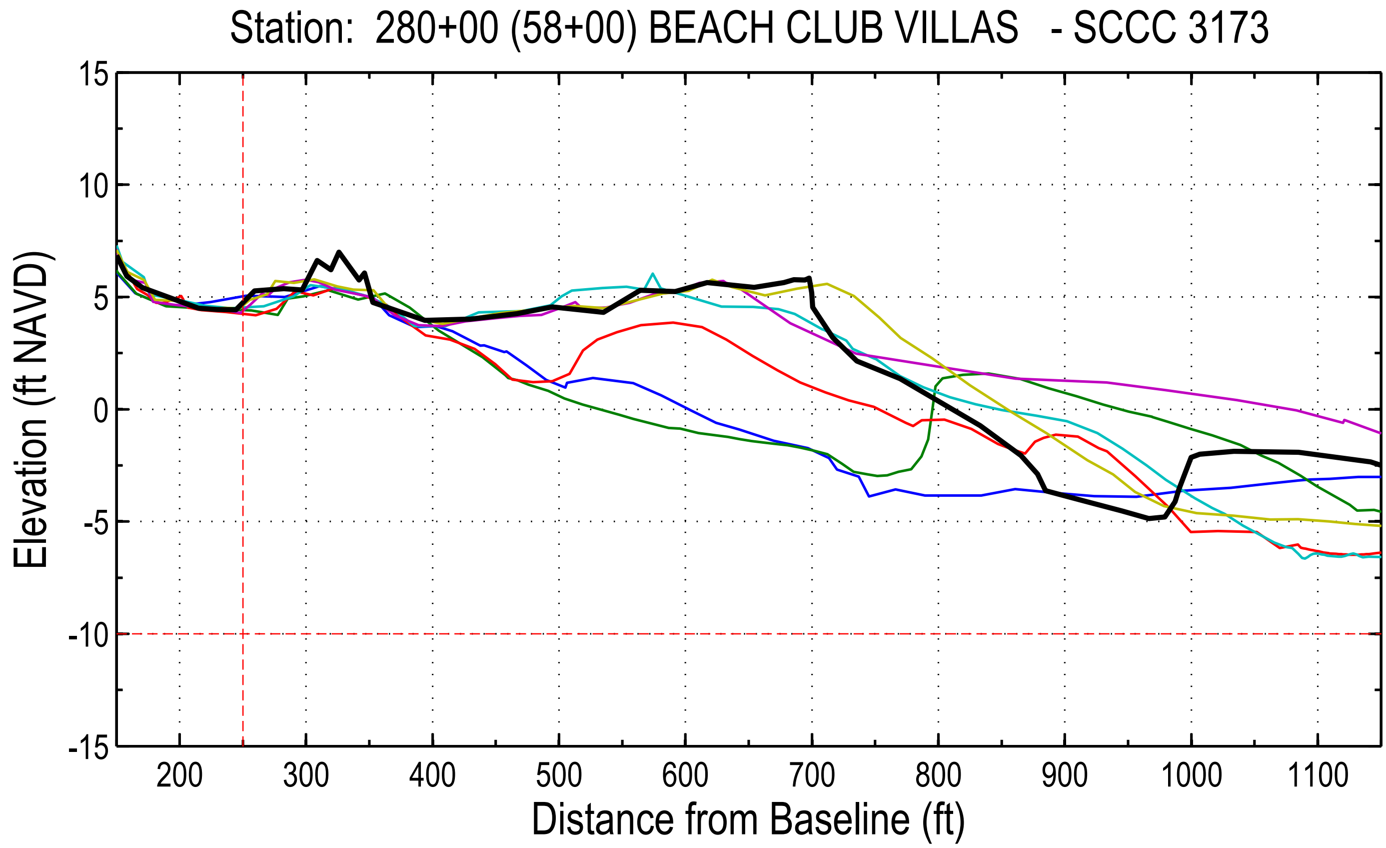
Station: 276+00 (54+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



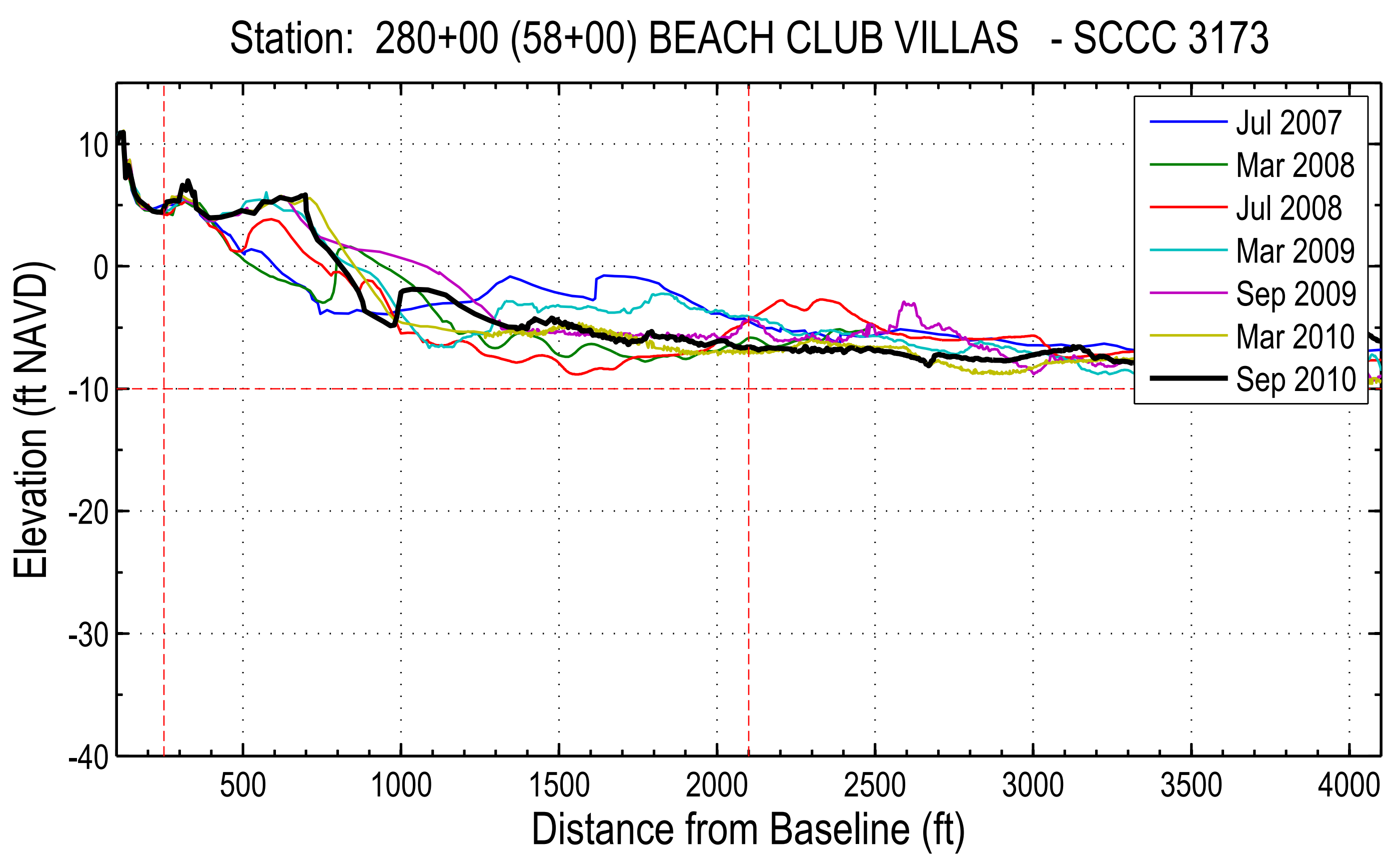
Station: 278+00 (56+00) BEACHCLUB VILLAS - BRC3
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100



Station: 278+00 (56+00) BEACHCLUB VILLAS - BRC3
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000



Station: 280+00 (58+00) BEACH CLUB VILLAS - SCCC 3173
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100



Station: 280+00 (58+00) BEACH CLUB VILLAS - SCCC 3173
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
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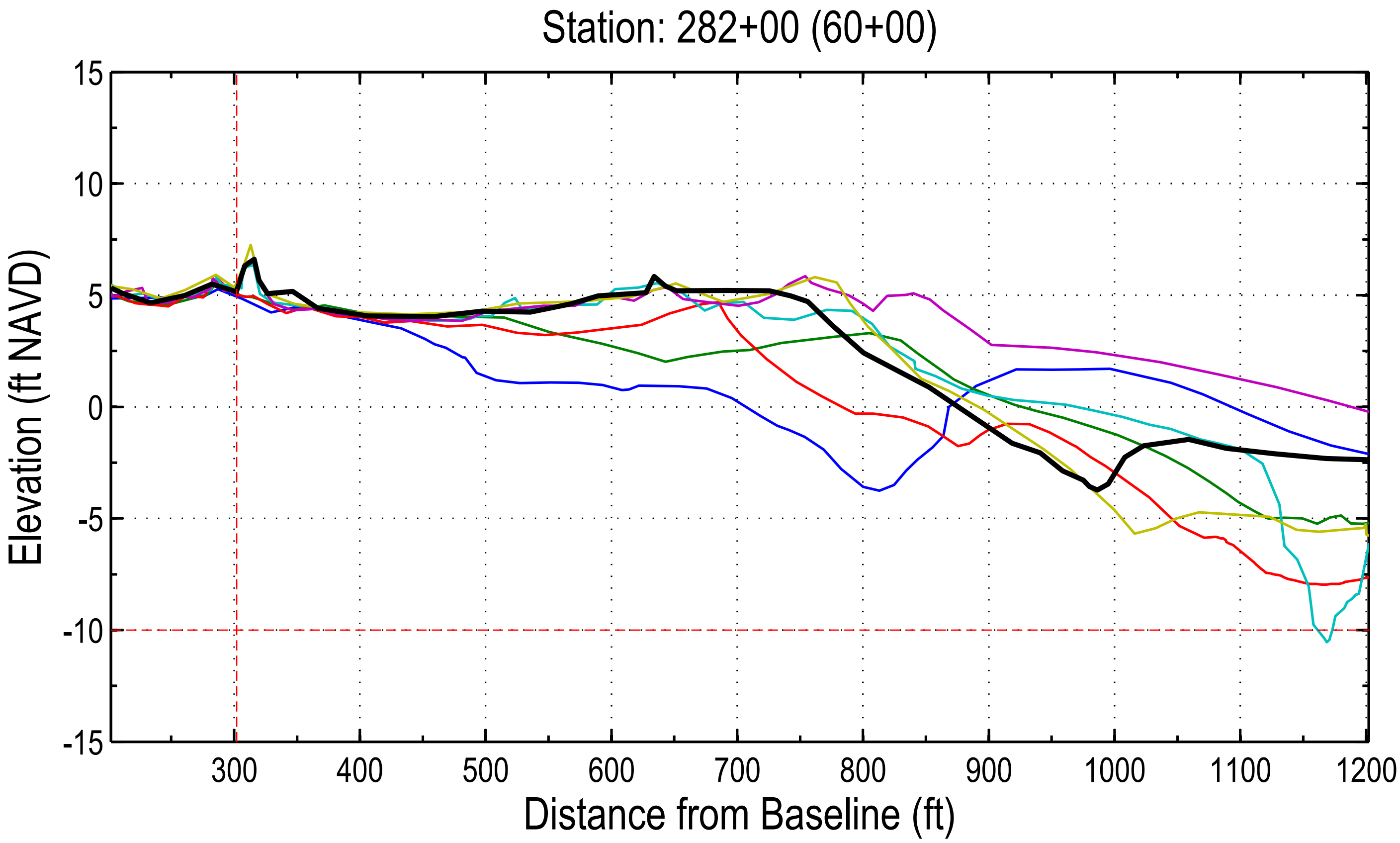
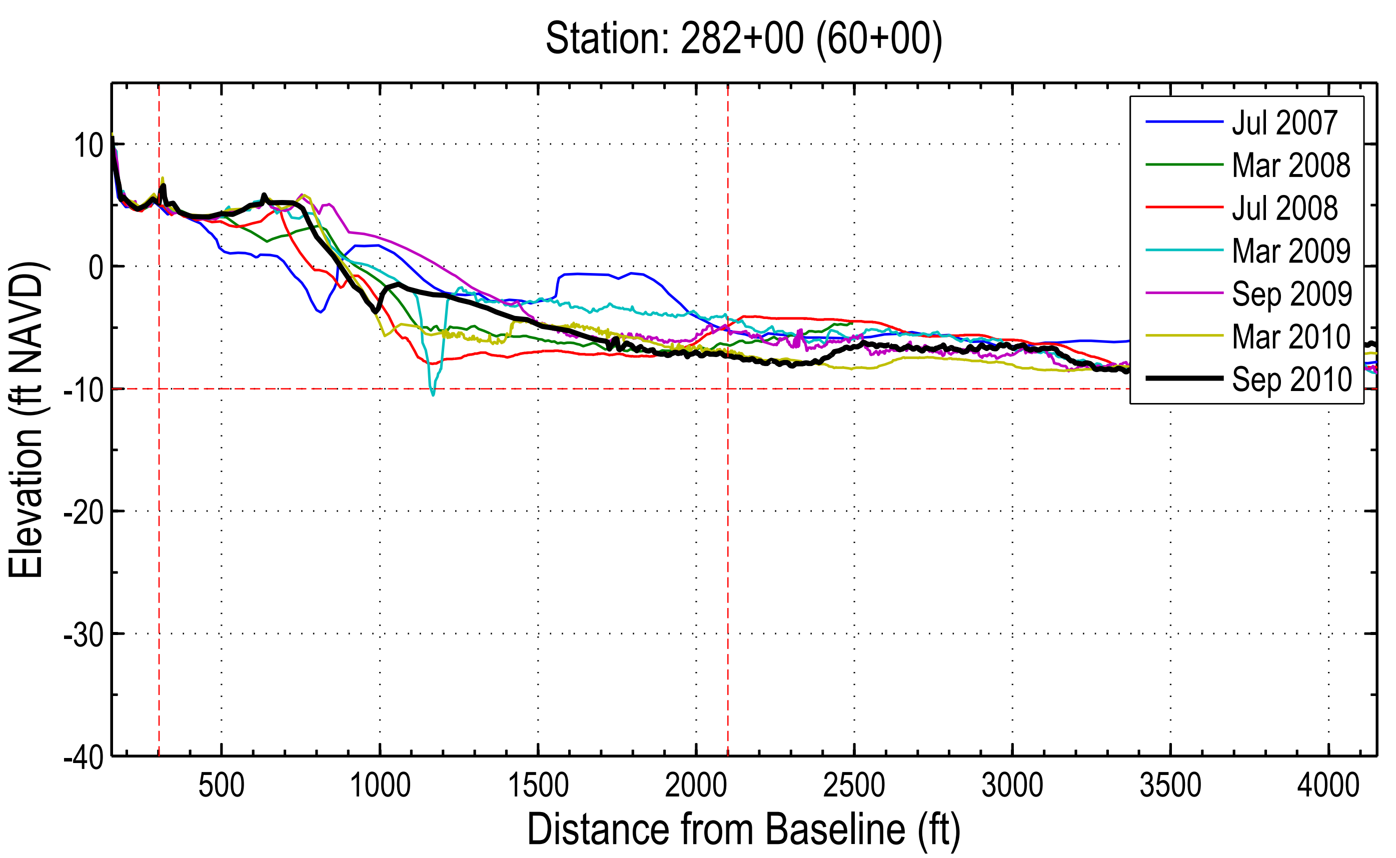
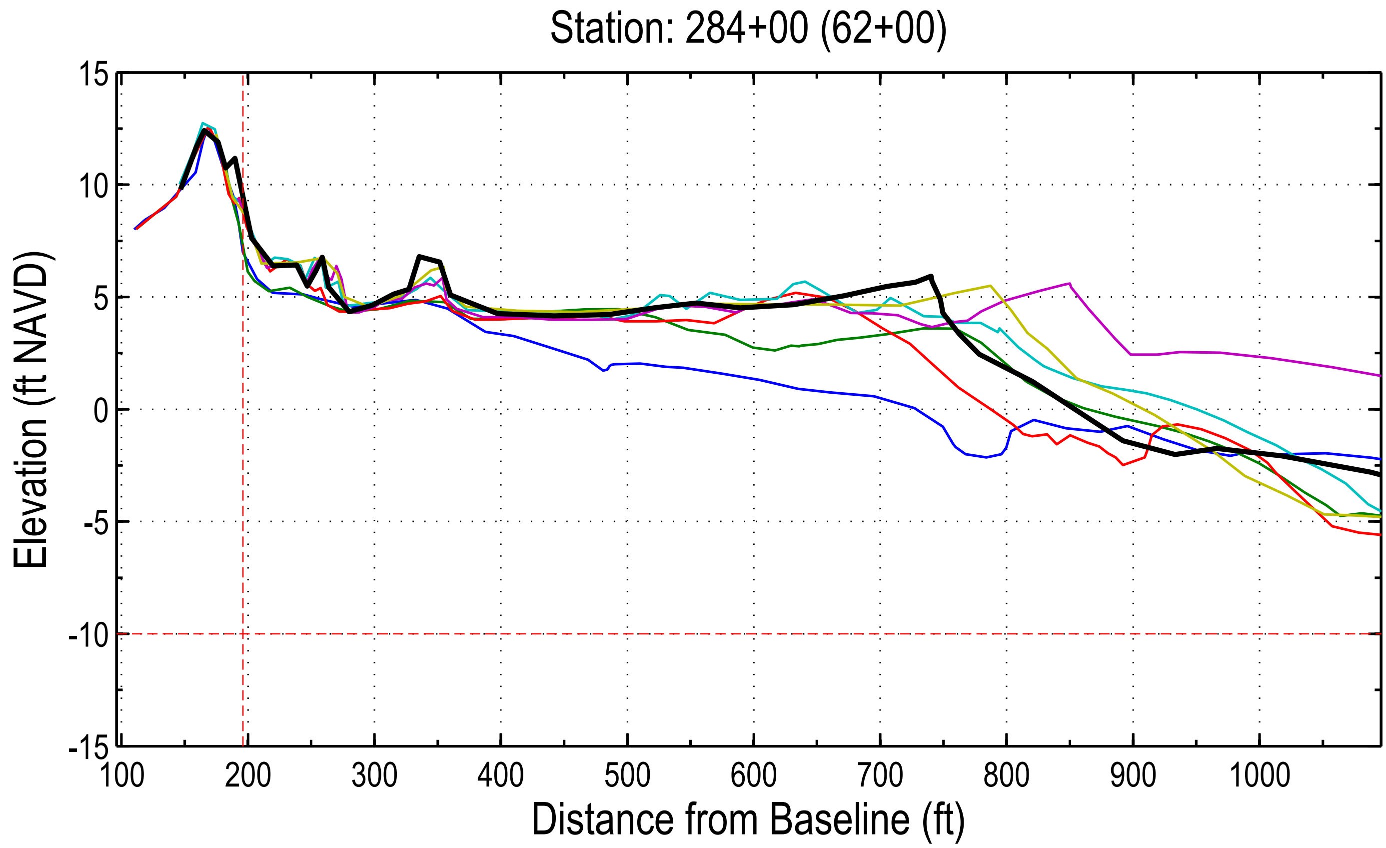
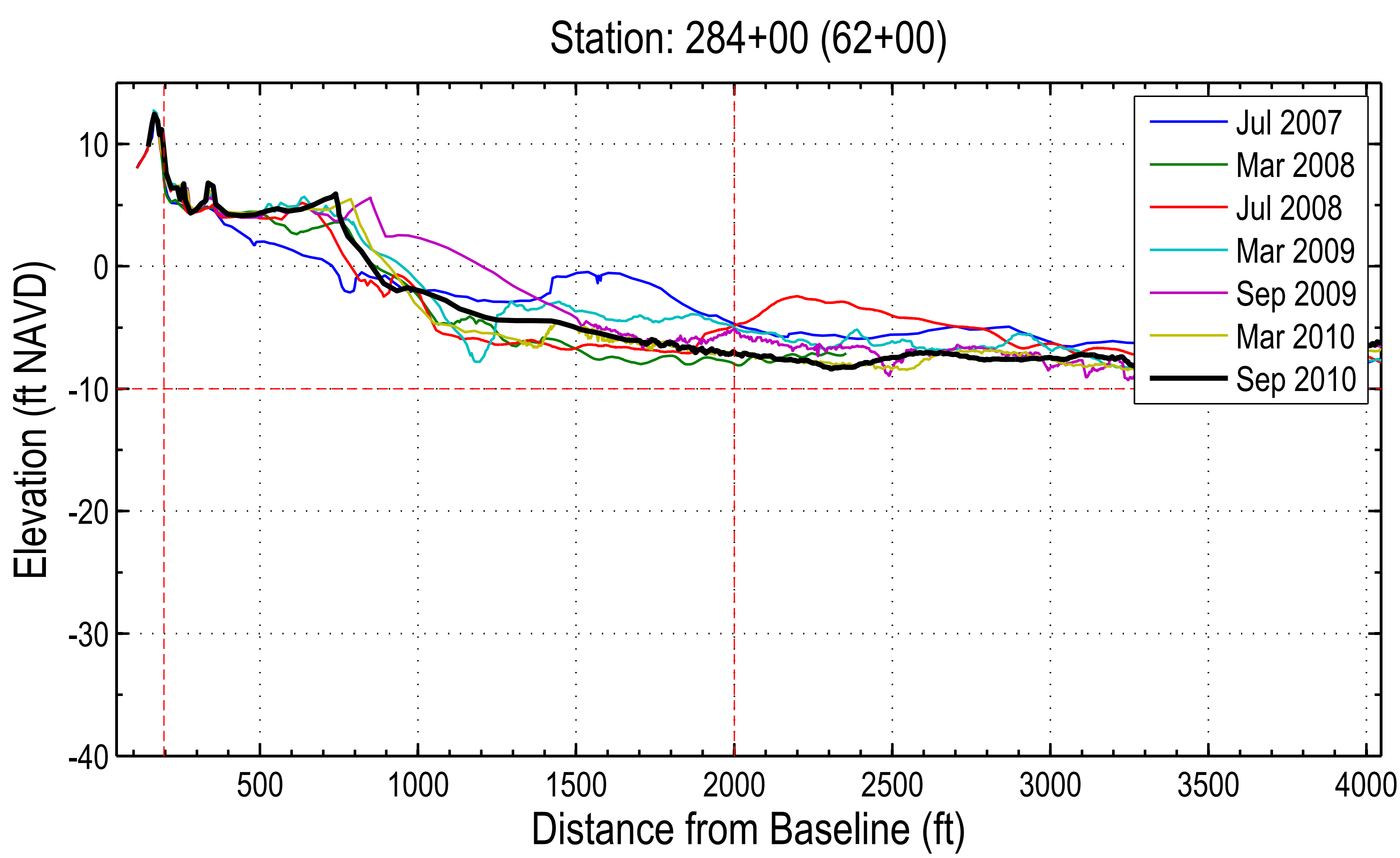
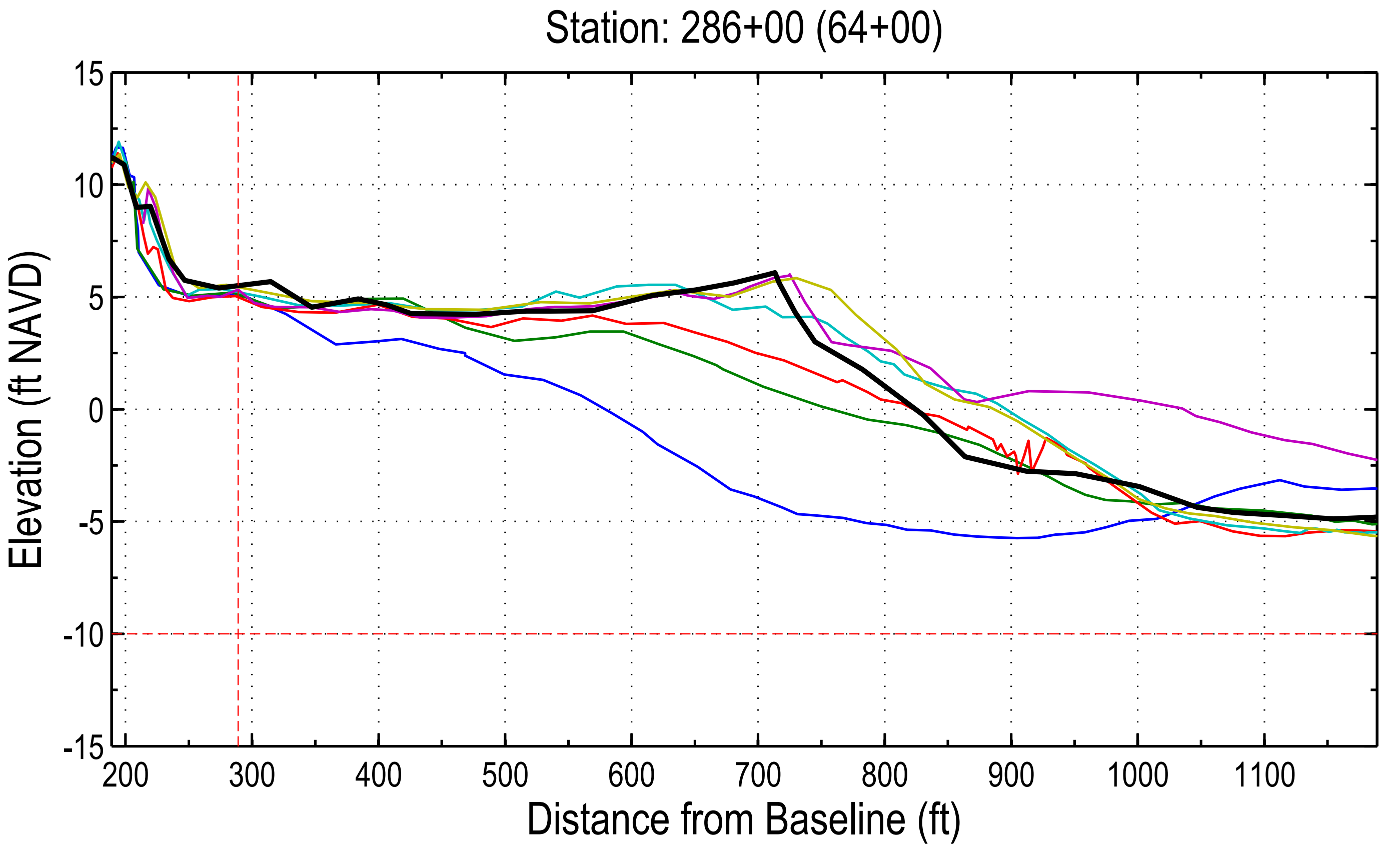
2500
3000
3500
4000

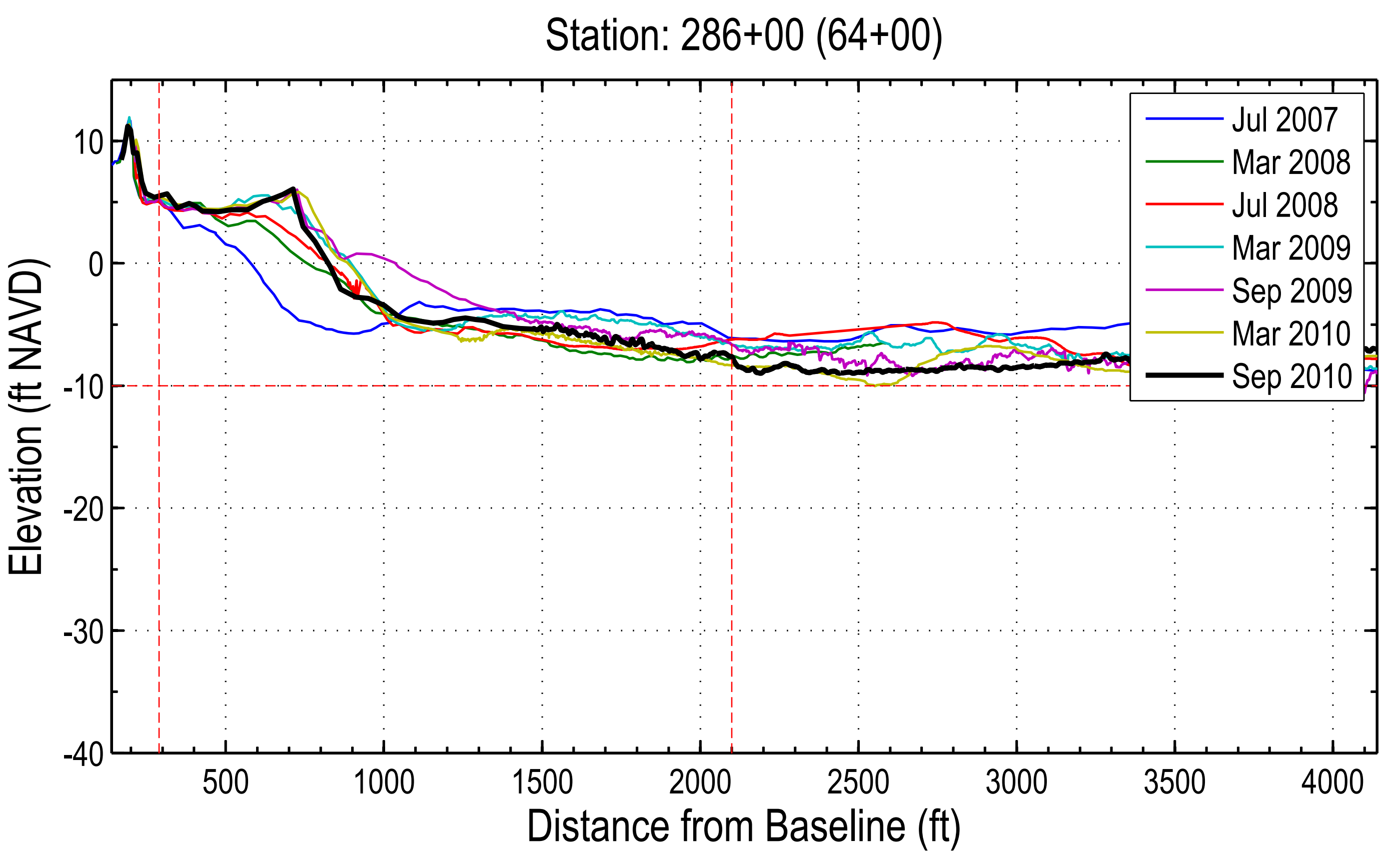

Station: 282+00 (60+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200

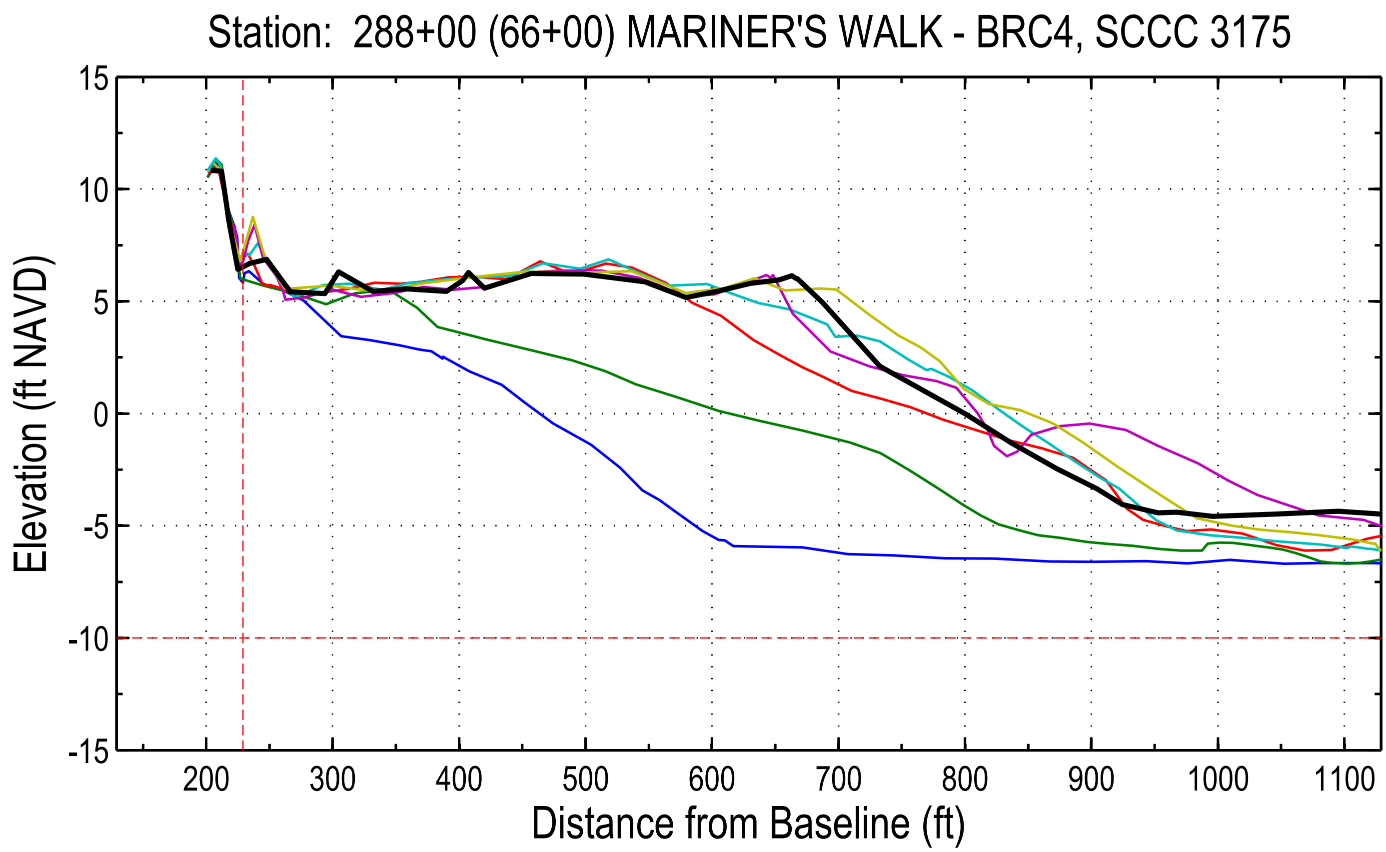

Station: 282+00 (60+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

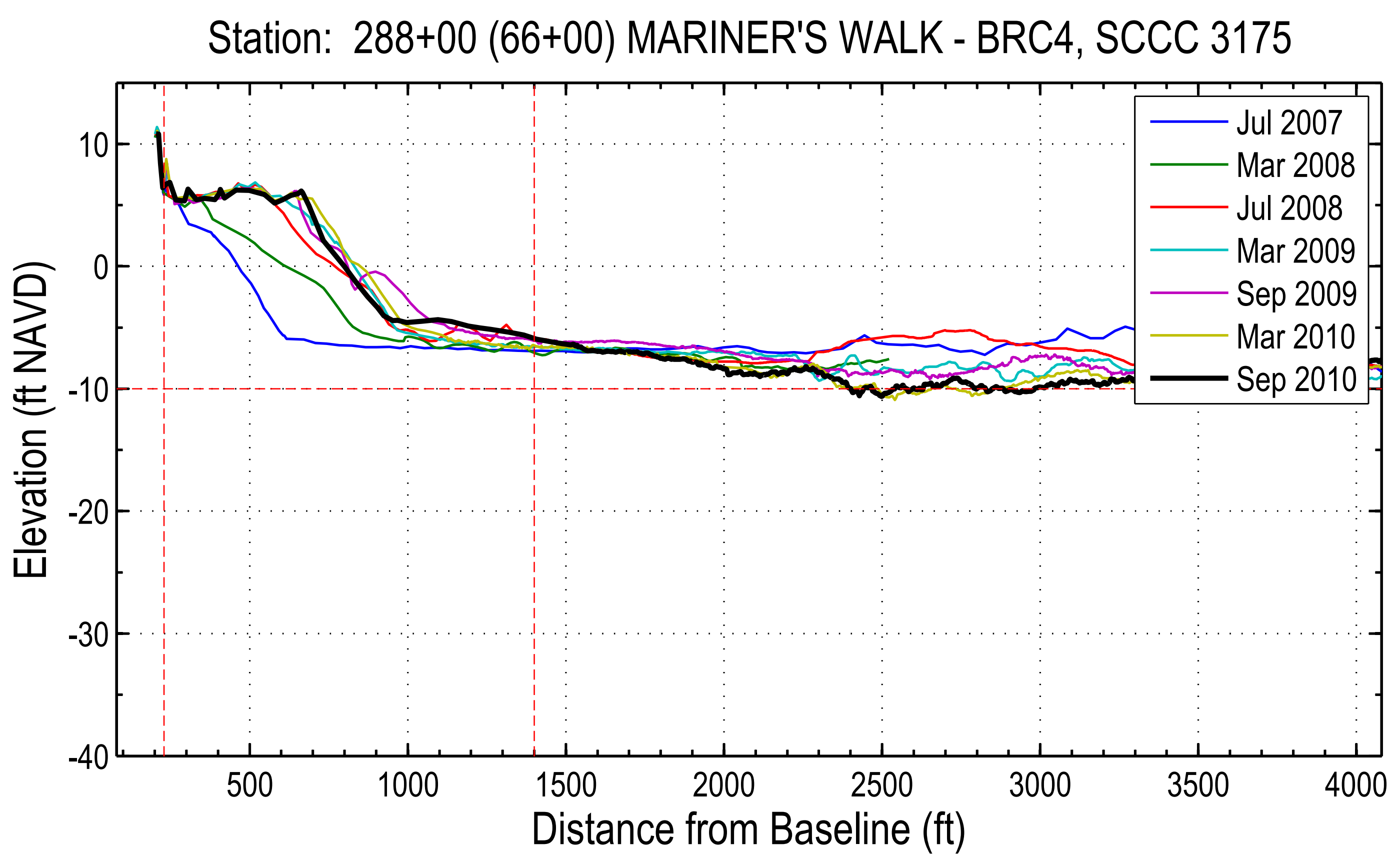

Station: 284+00 (62+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000

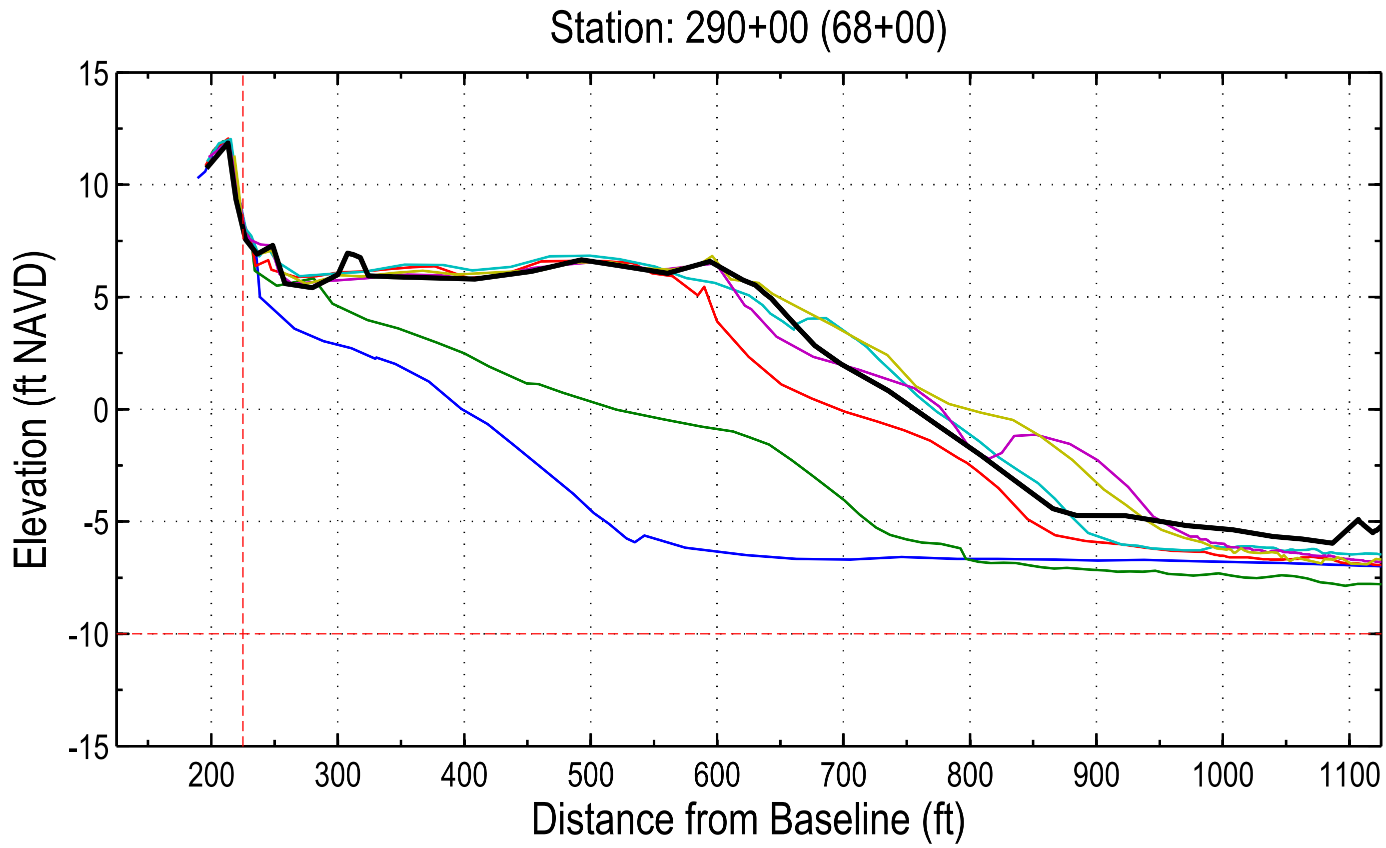

Station: 284+00 (62+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

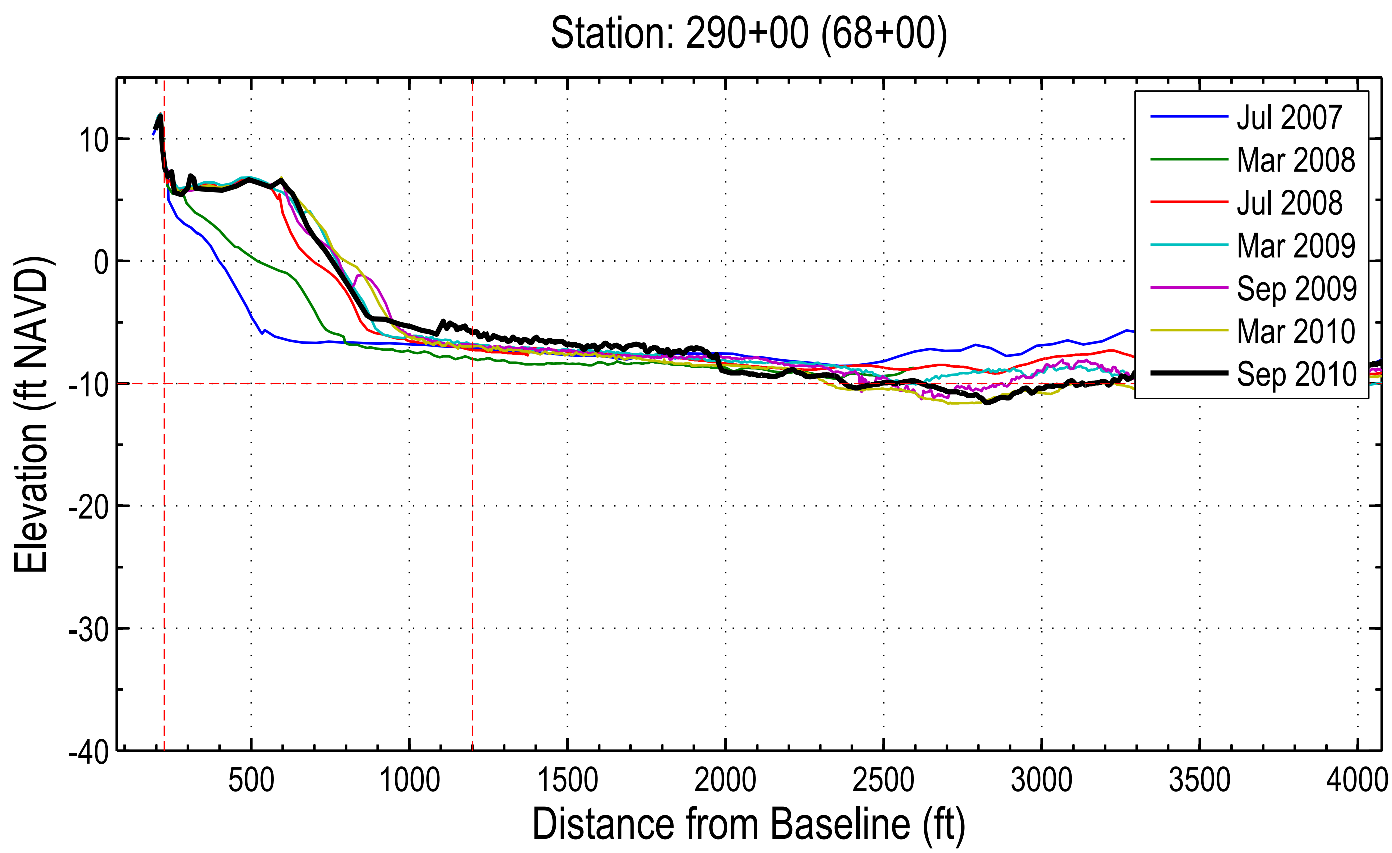

Station: 286+00 (64+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100

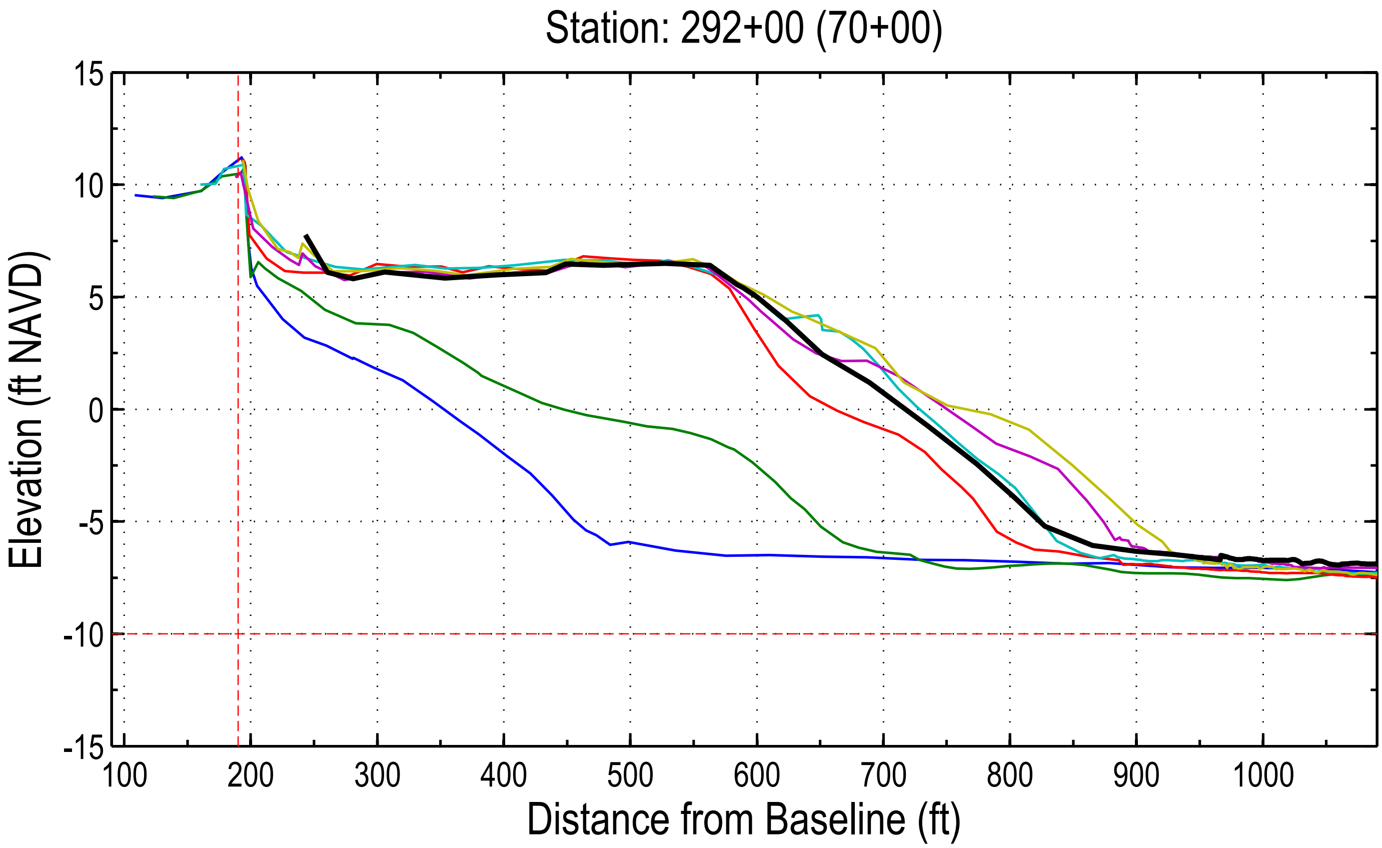

Station: 286+00 (64+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000


Station: 288+00 (66+00) MARINER'S WALK - BRC4, SCCC 3175
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100

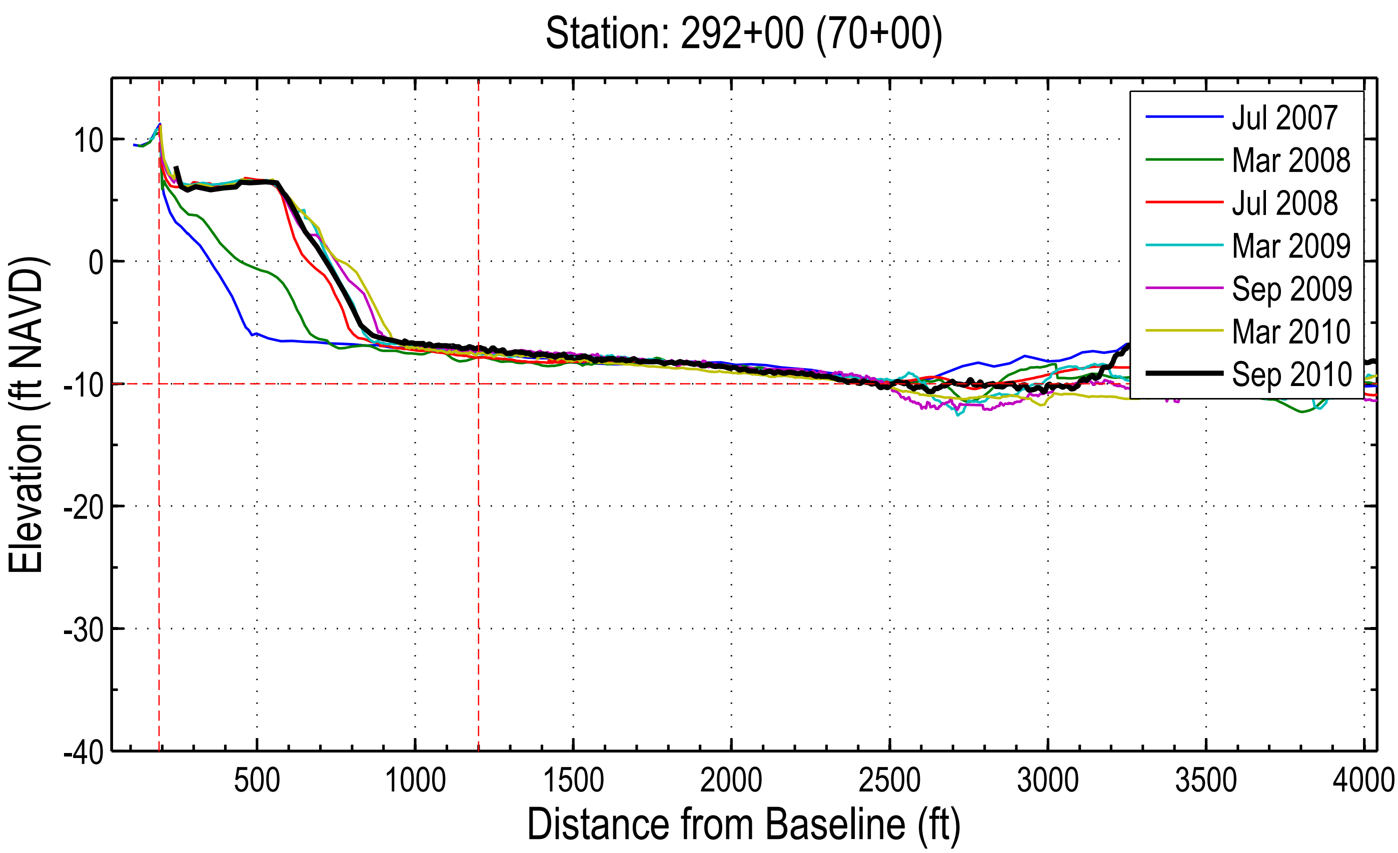

Station: 288+00 (66+00) MARINER'S WALK - BRC4, SCCC 3175
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 290+00 (68+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100

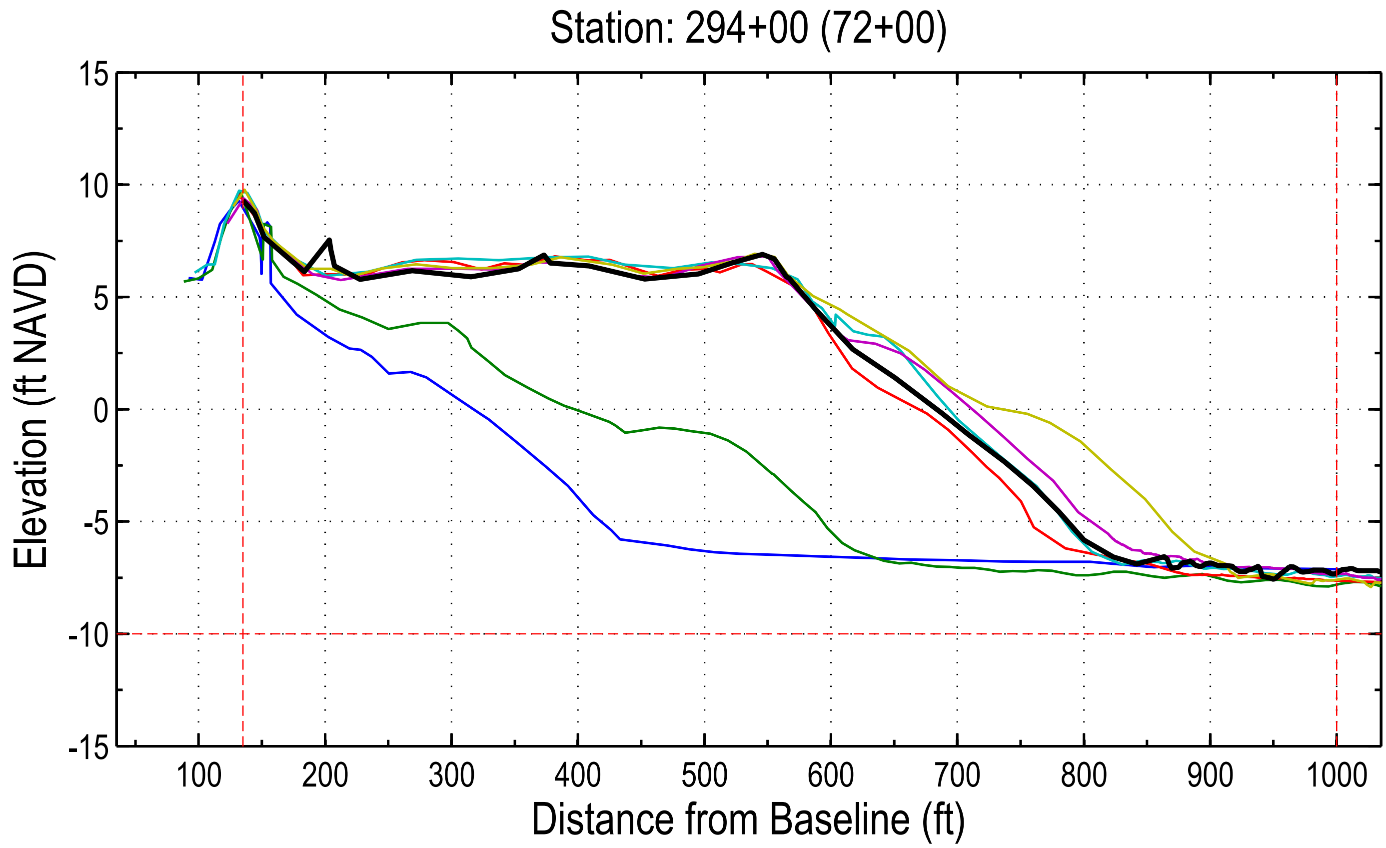

Station: 290+00 (68+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



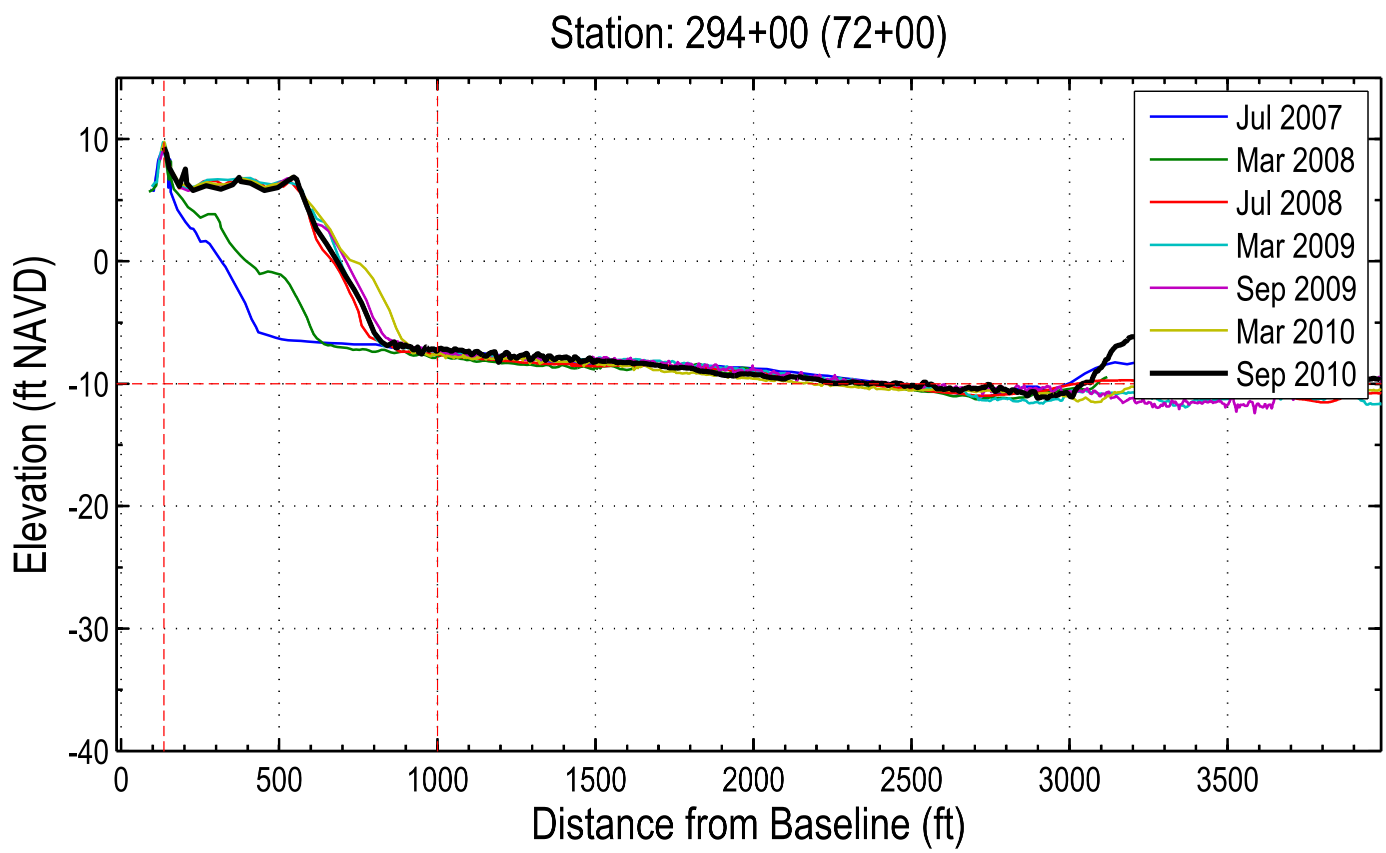
Station: 292+00 (70+00)
15
10
5
0
-5
-10
-15
Elevation (ft NAVD)
100
200
300
400
500
600
700
800
900
1000
Distance from Baseline (ft)



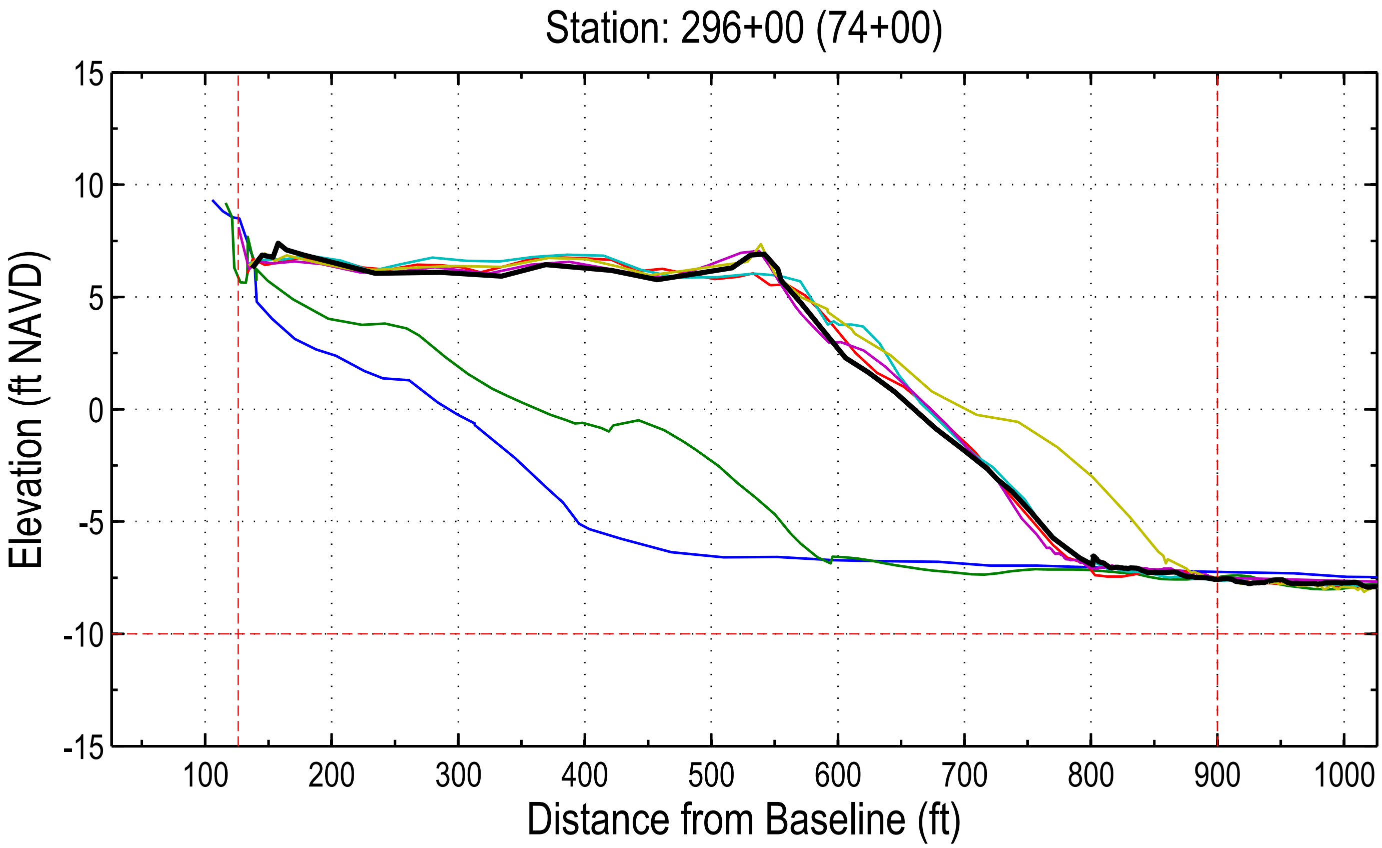
Station: 292+00 (70+00)
10
0
-10
-20
-30
-40
Elevation (ft NAVD)
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



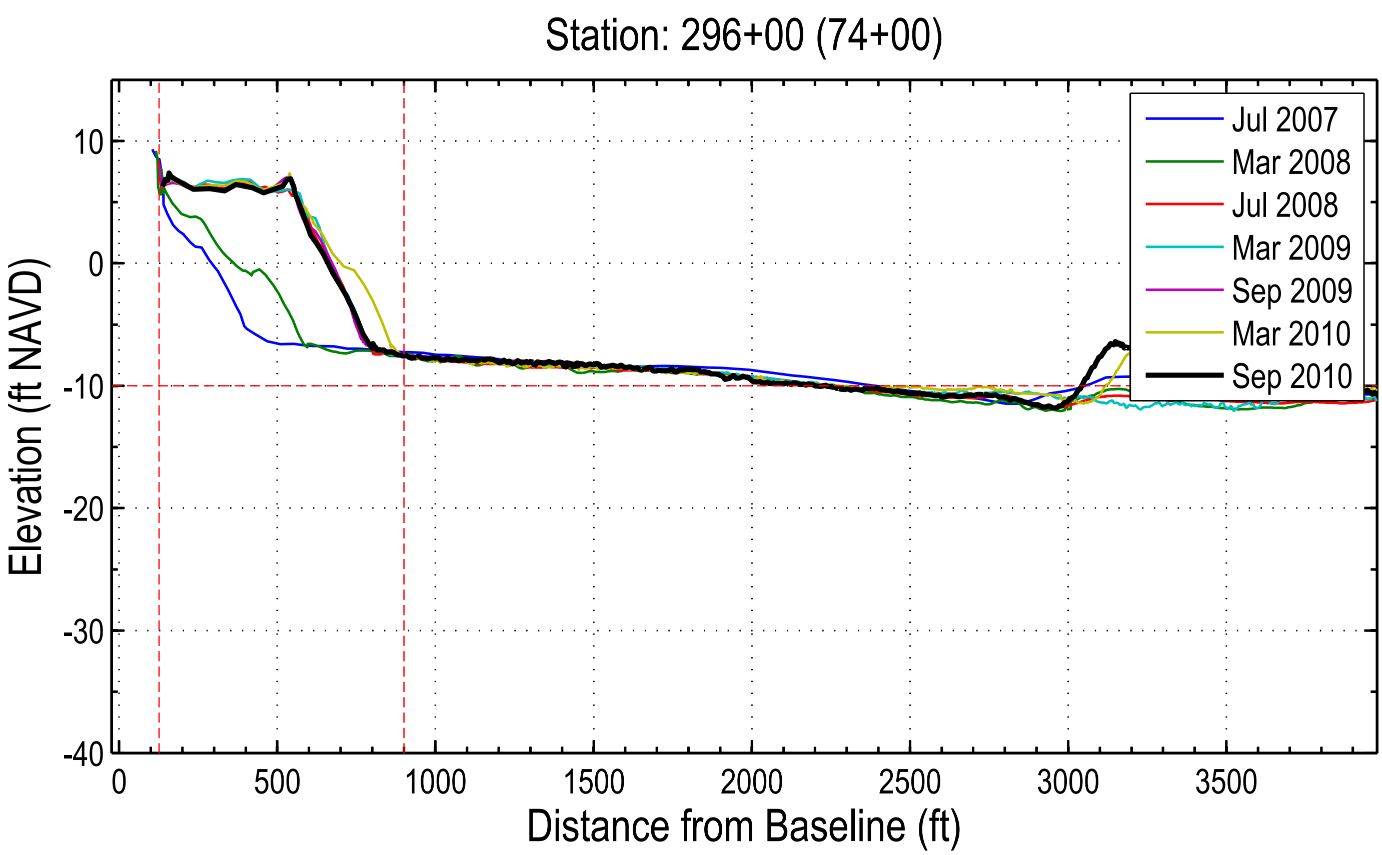
Station: 294+00 (72+00)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000
Elevation (ft NAVD)
Distance from Baseline (ft)



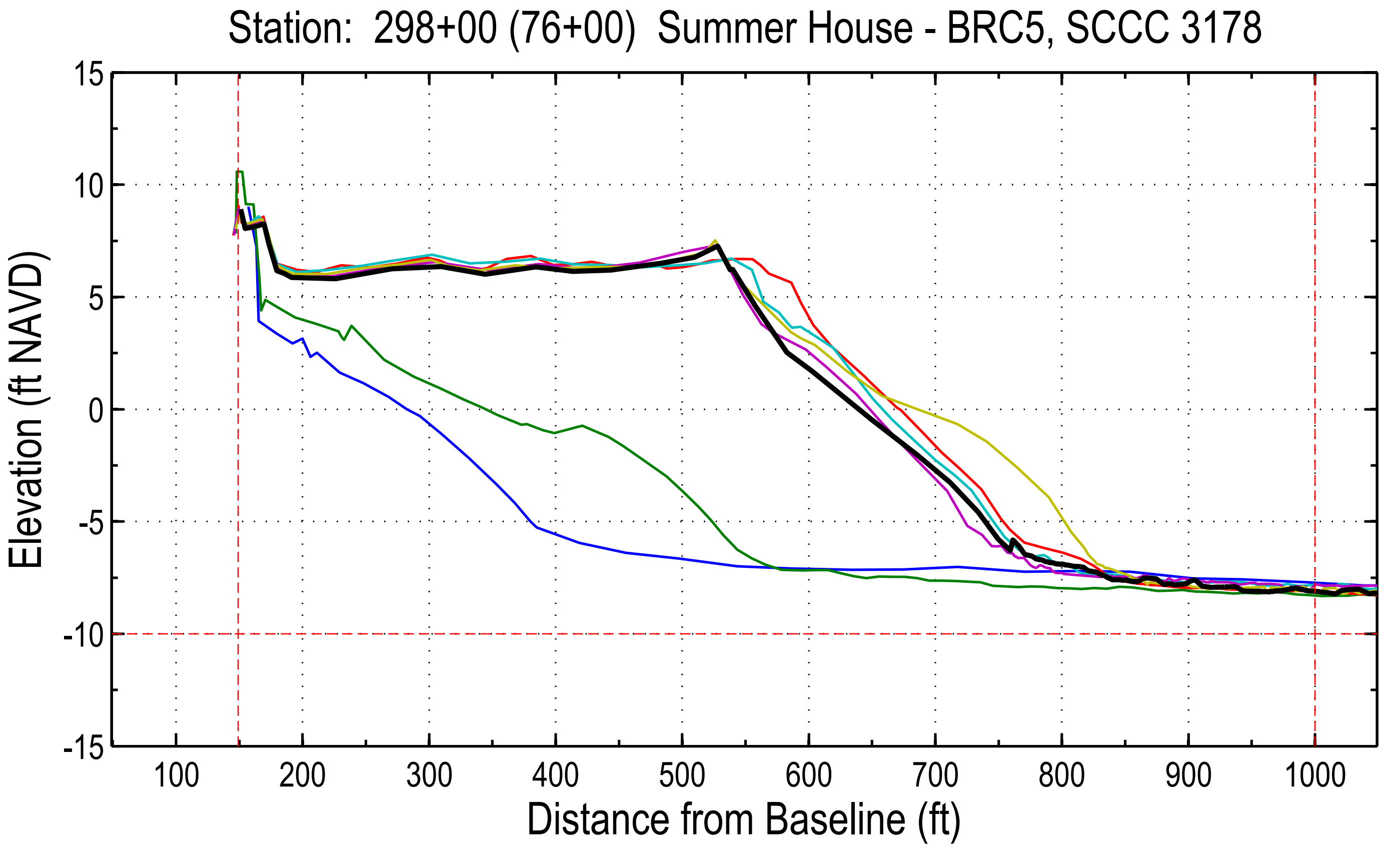
Station: 294+00 (72+00)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



Station: 296+00 (74+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



Station: 296+00 (74+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500



Station: 298+00 (76+00) Summer House - BRC5, SCCC 3178
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
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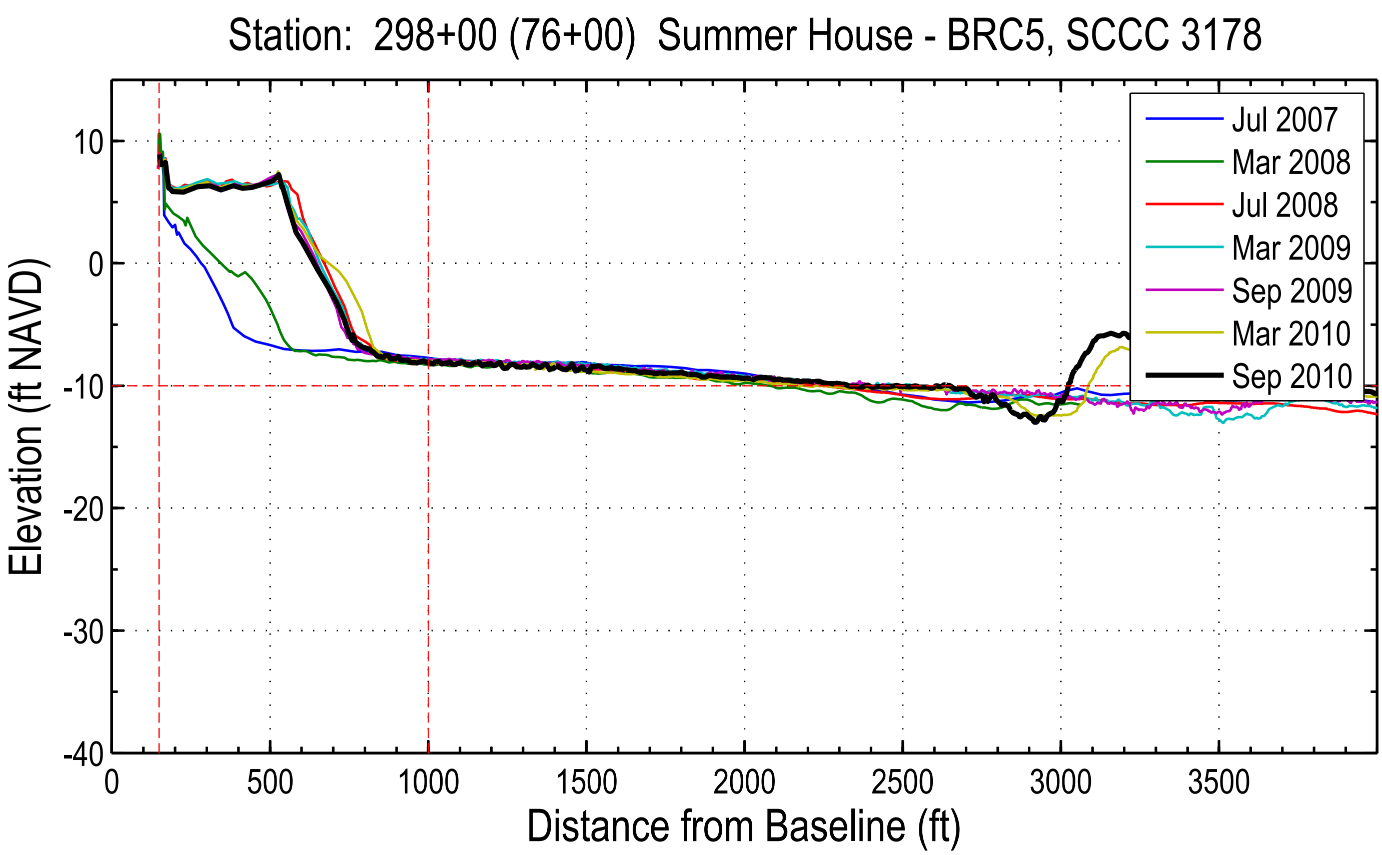
400
500
600
700
800
900
1000



Station: 298+00 (76+00) Summer House - BRC5, SCCC 3178
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
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2000
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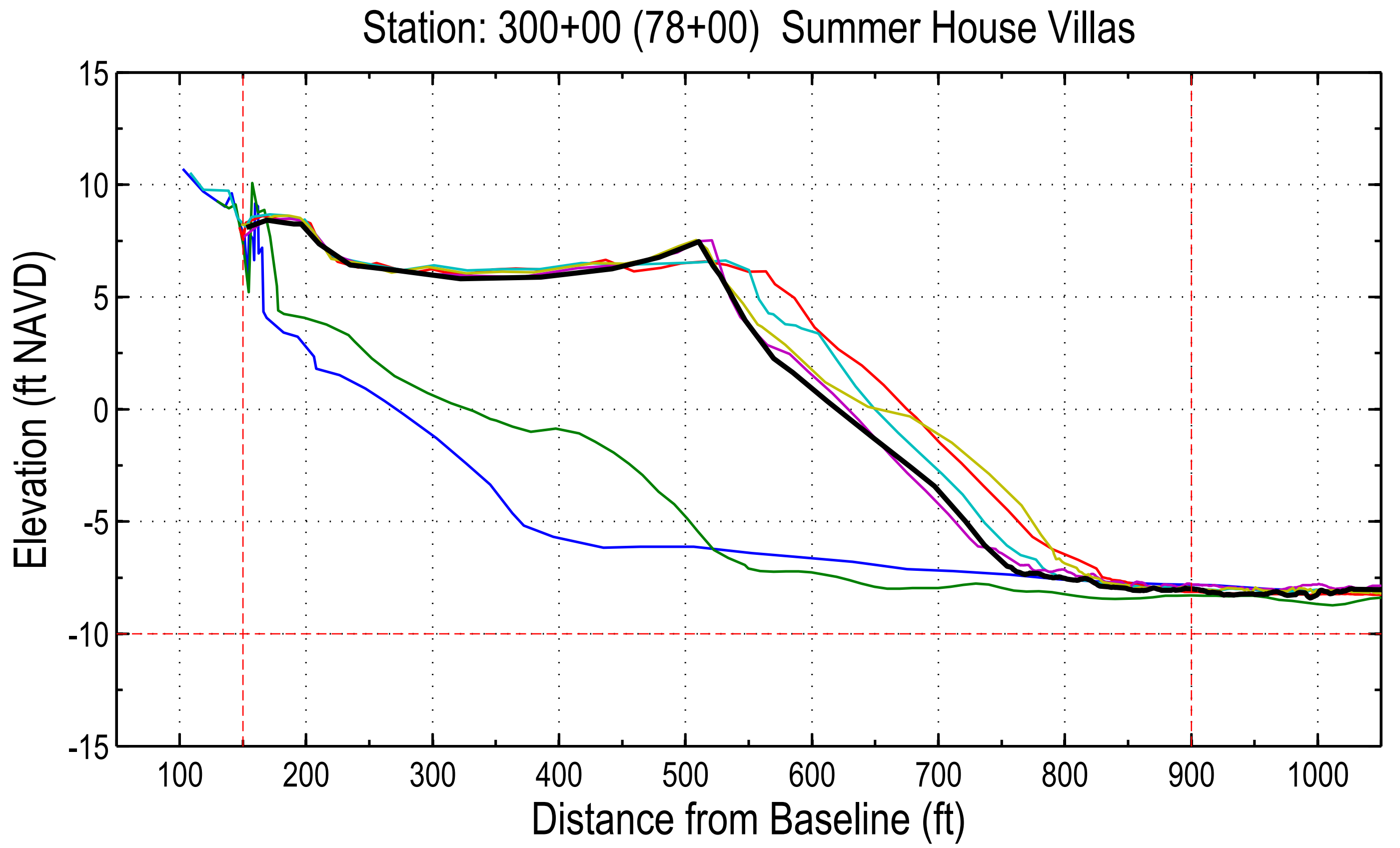
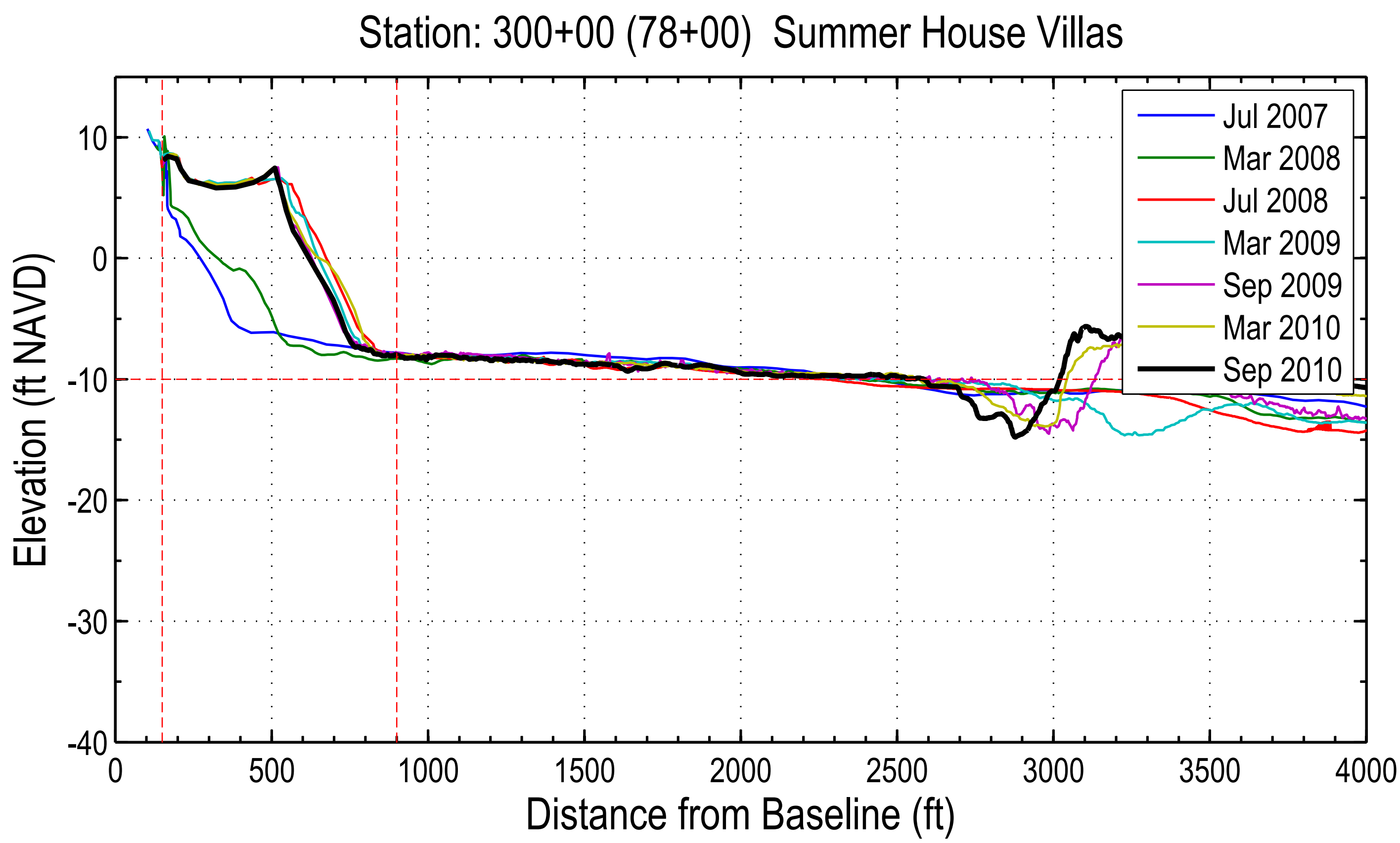
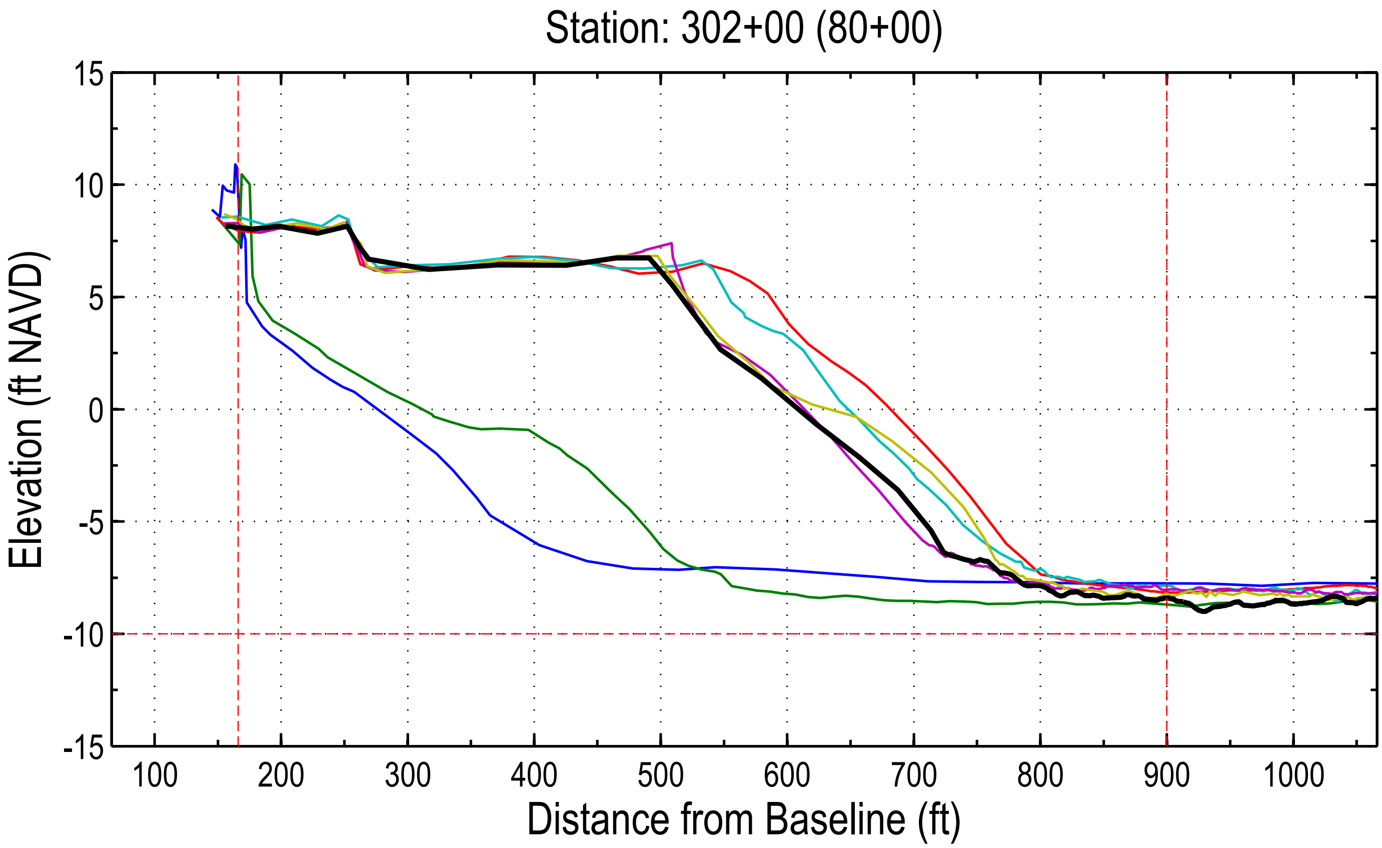
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



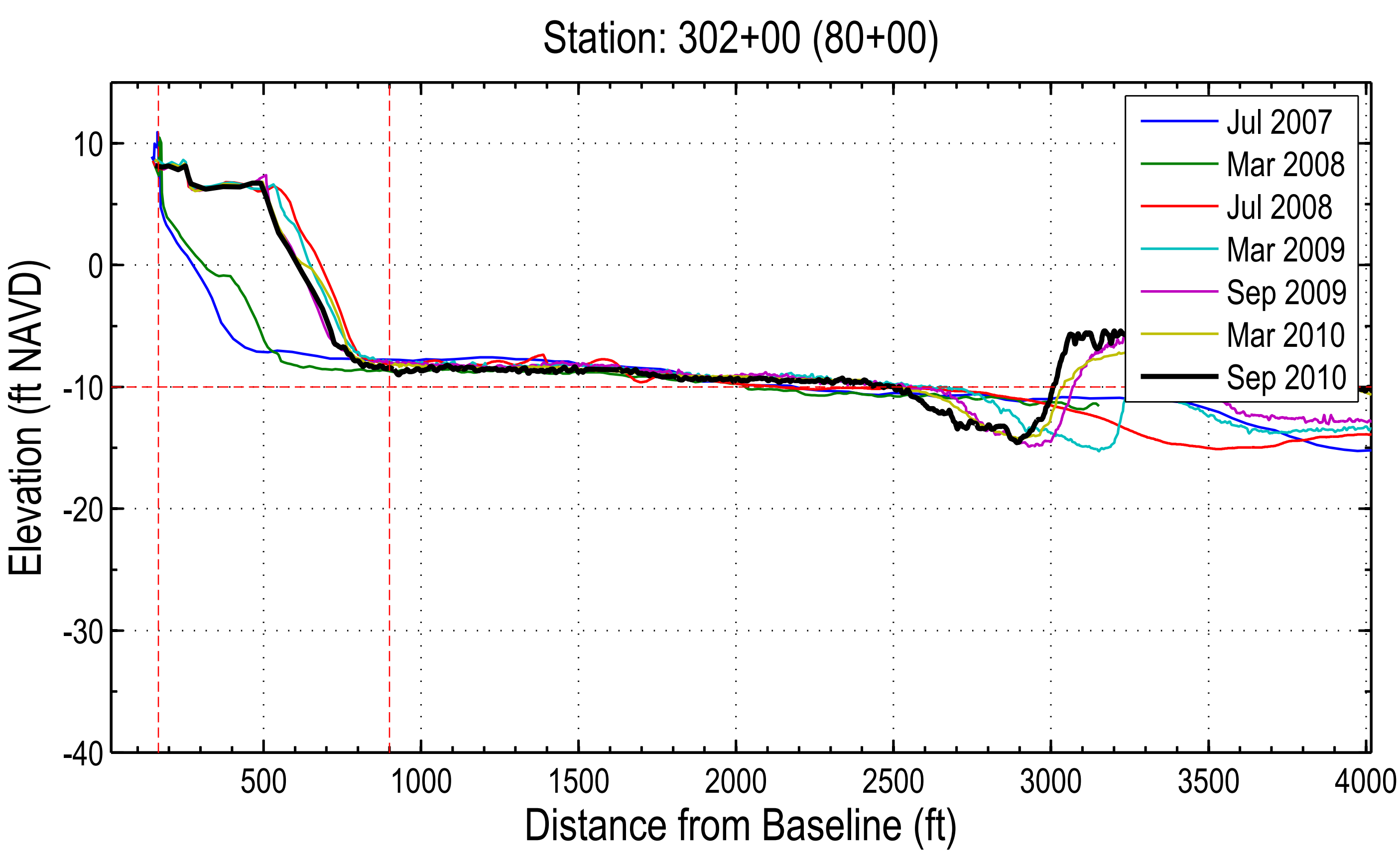
Station: 300+00 (78+00) Summer House Villas
Elevation (ft NAVD)
Distance from Baseline (ft)



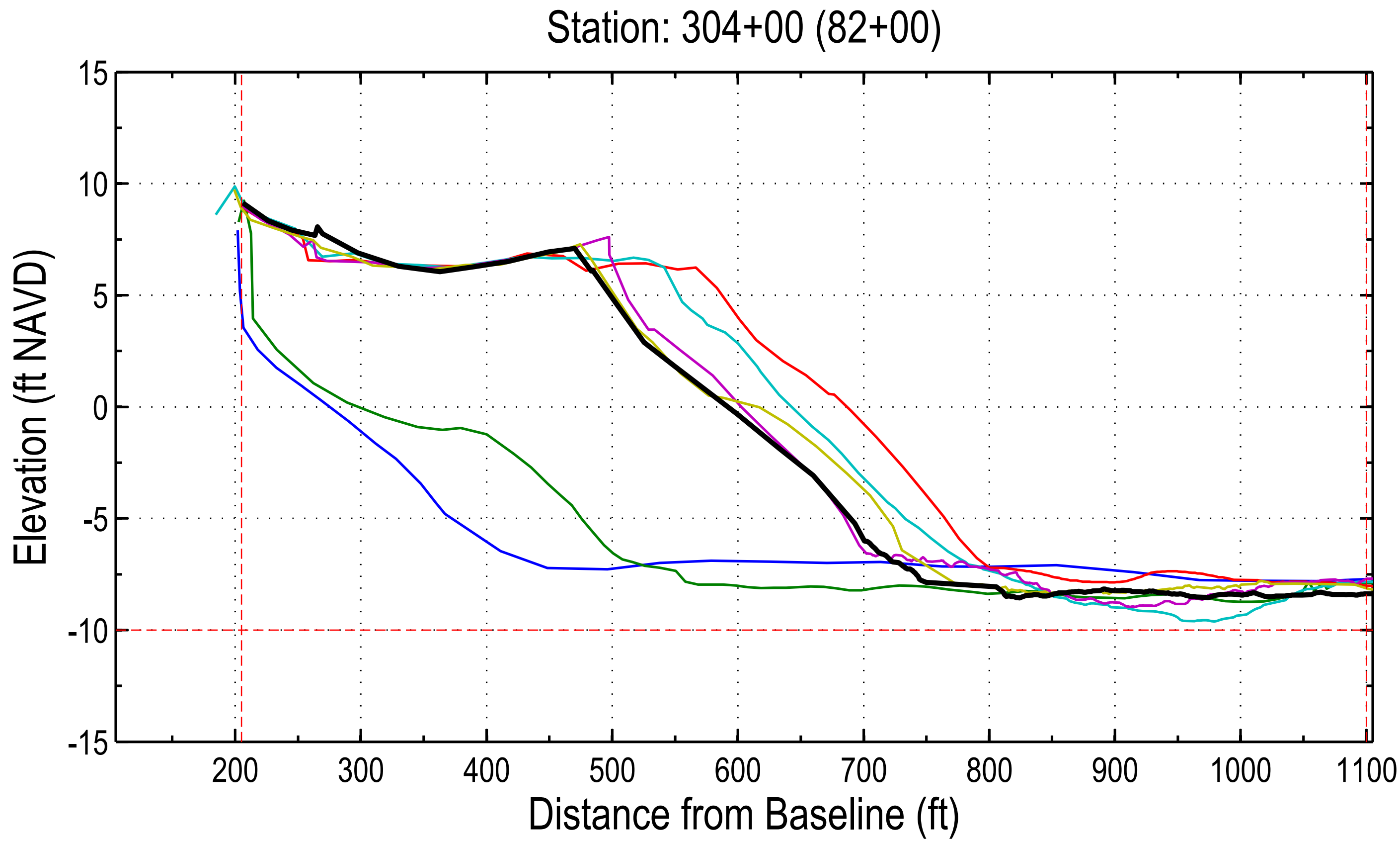
Station: 300+00 (78+00) Summer House Villas
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



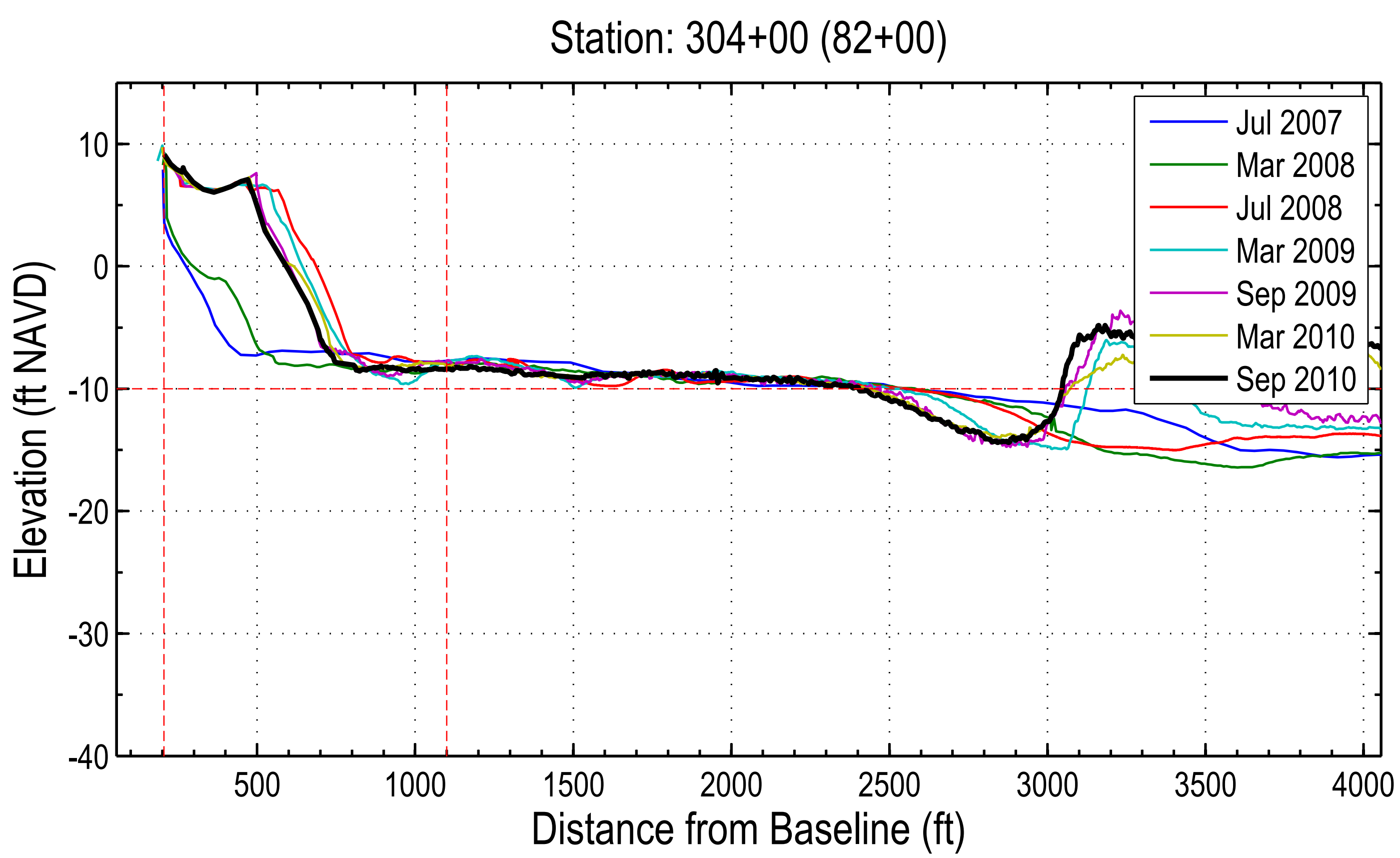
Station: 302+00 (80+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



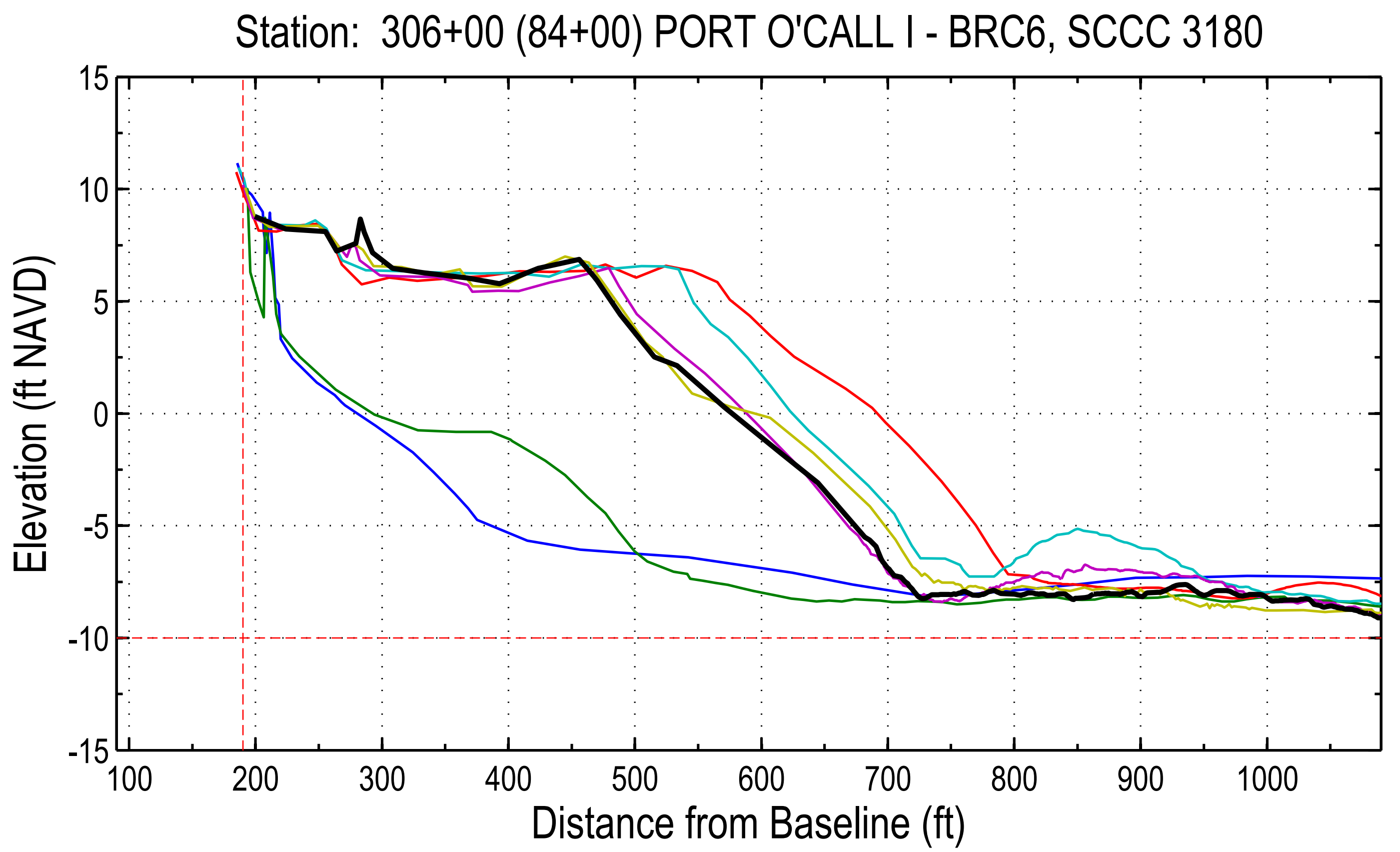
Station: 302+00 (80+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

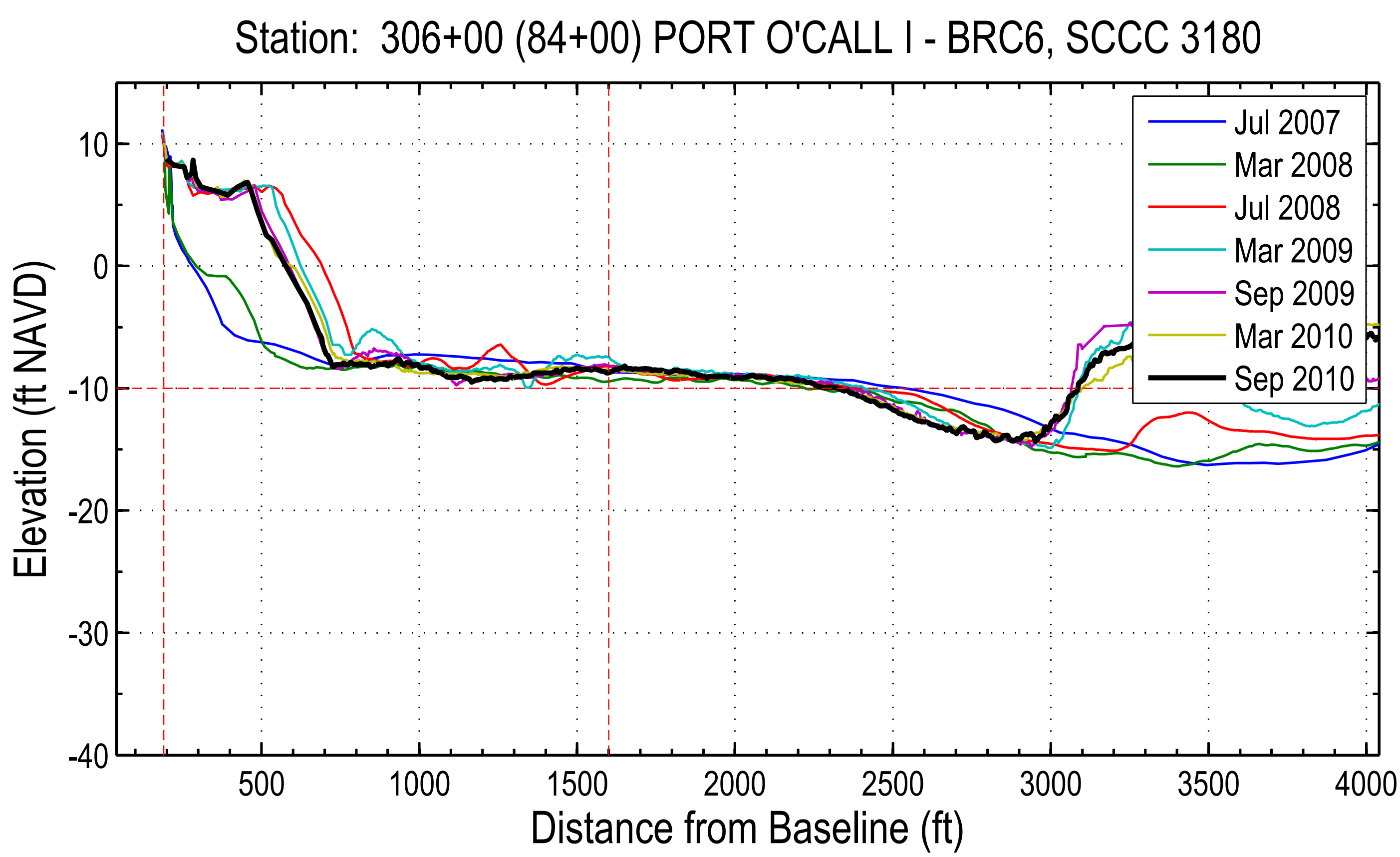


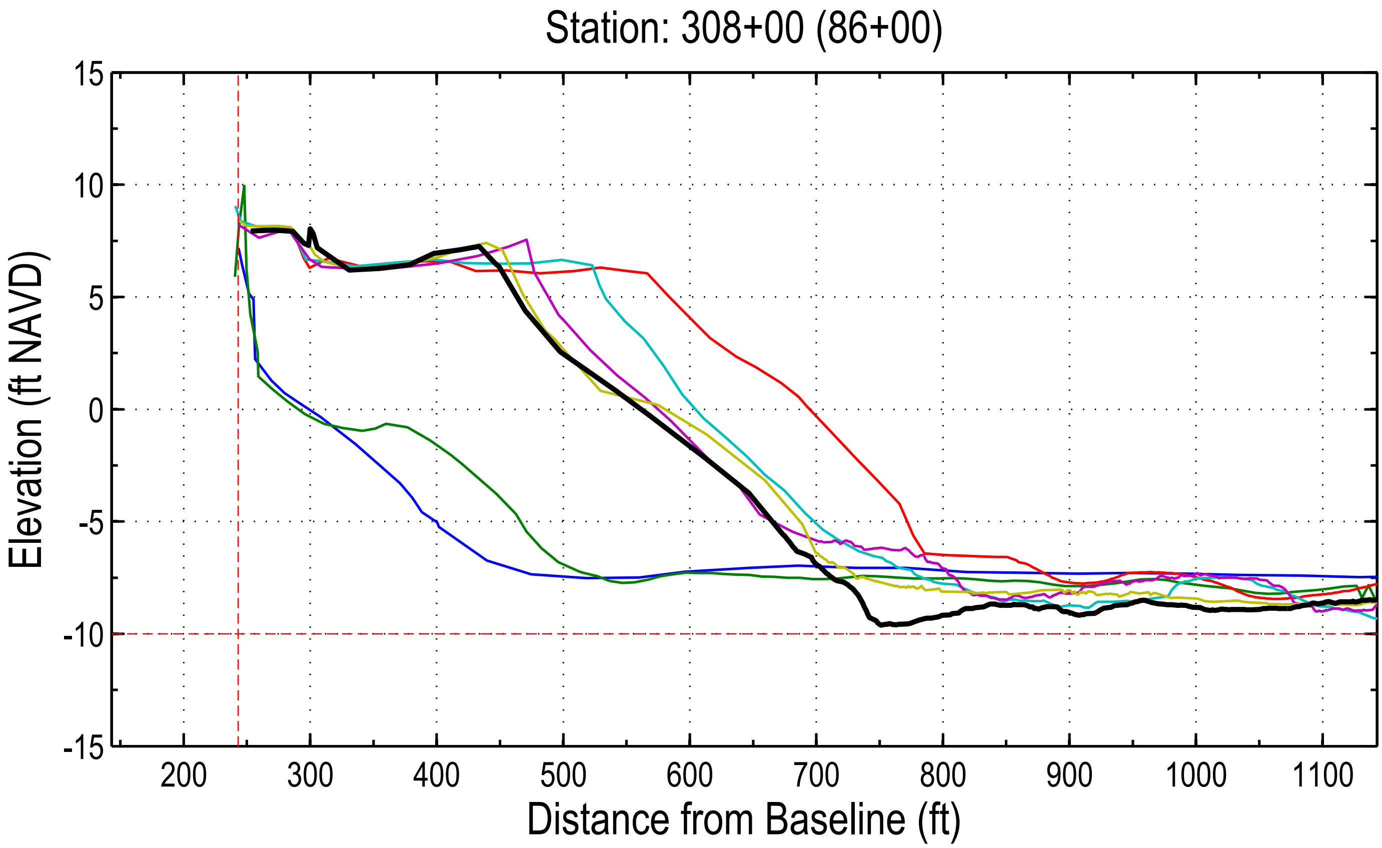
Station: 304+00 (82+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100

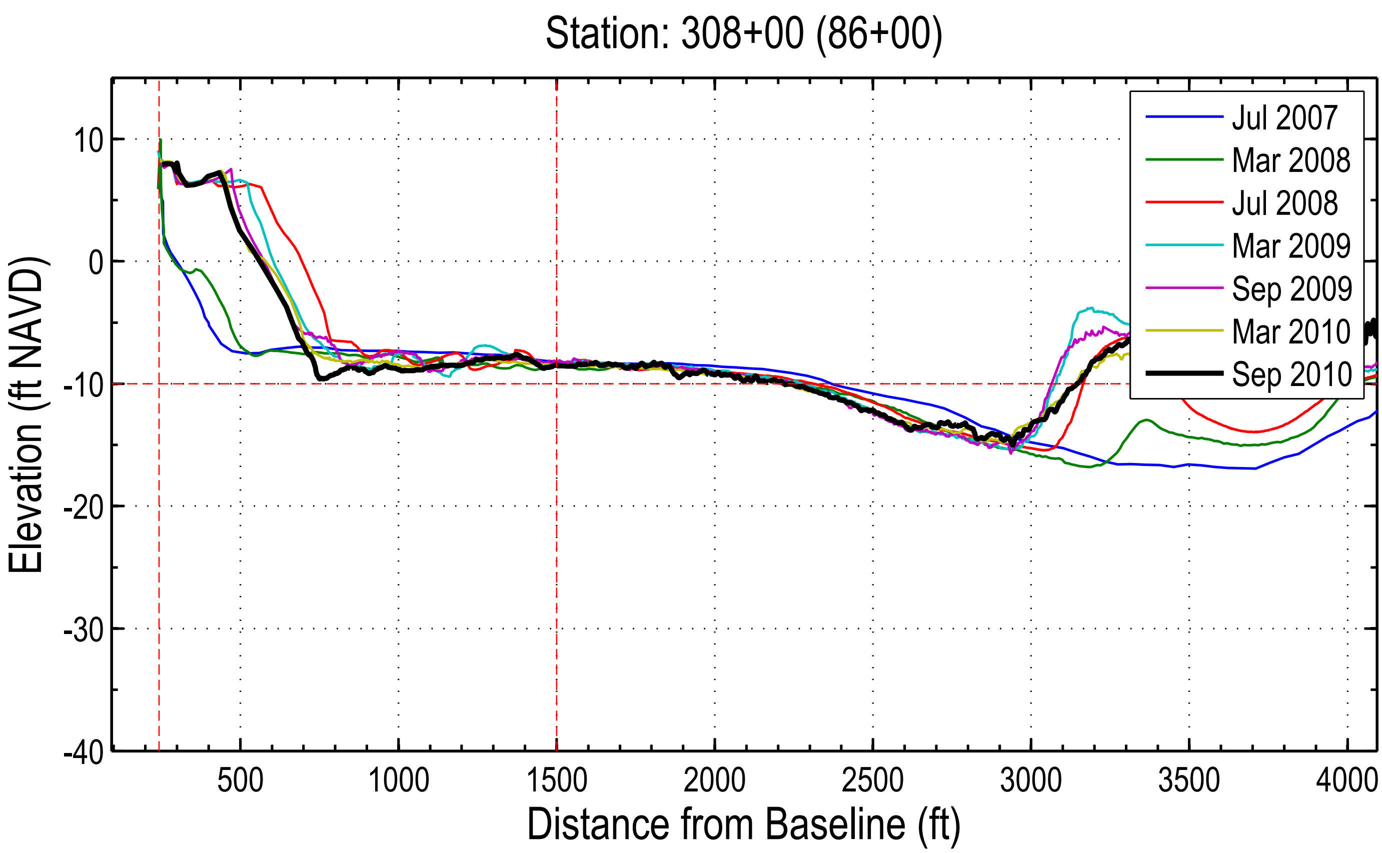


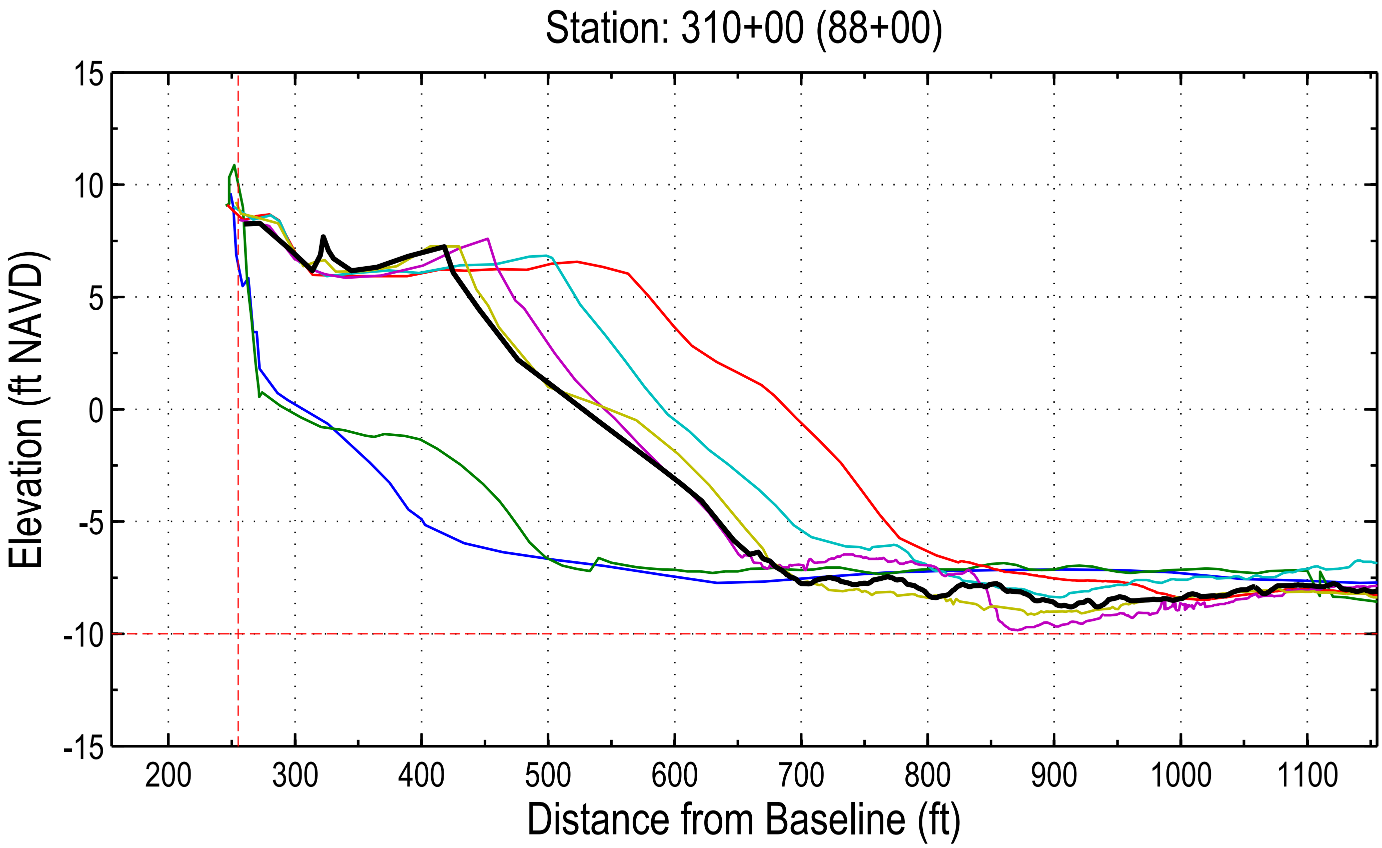
Station: 304+00 (82+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 306+00 (84+00) PORT O'CALL I - BRC6, SCCC 3180
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000

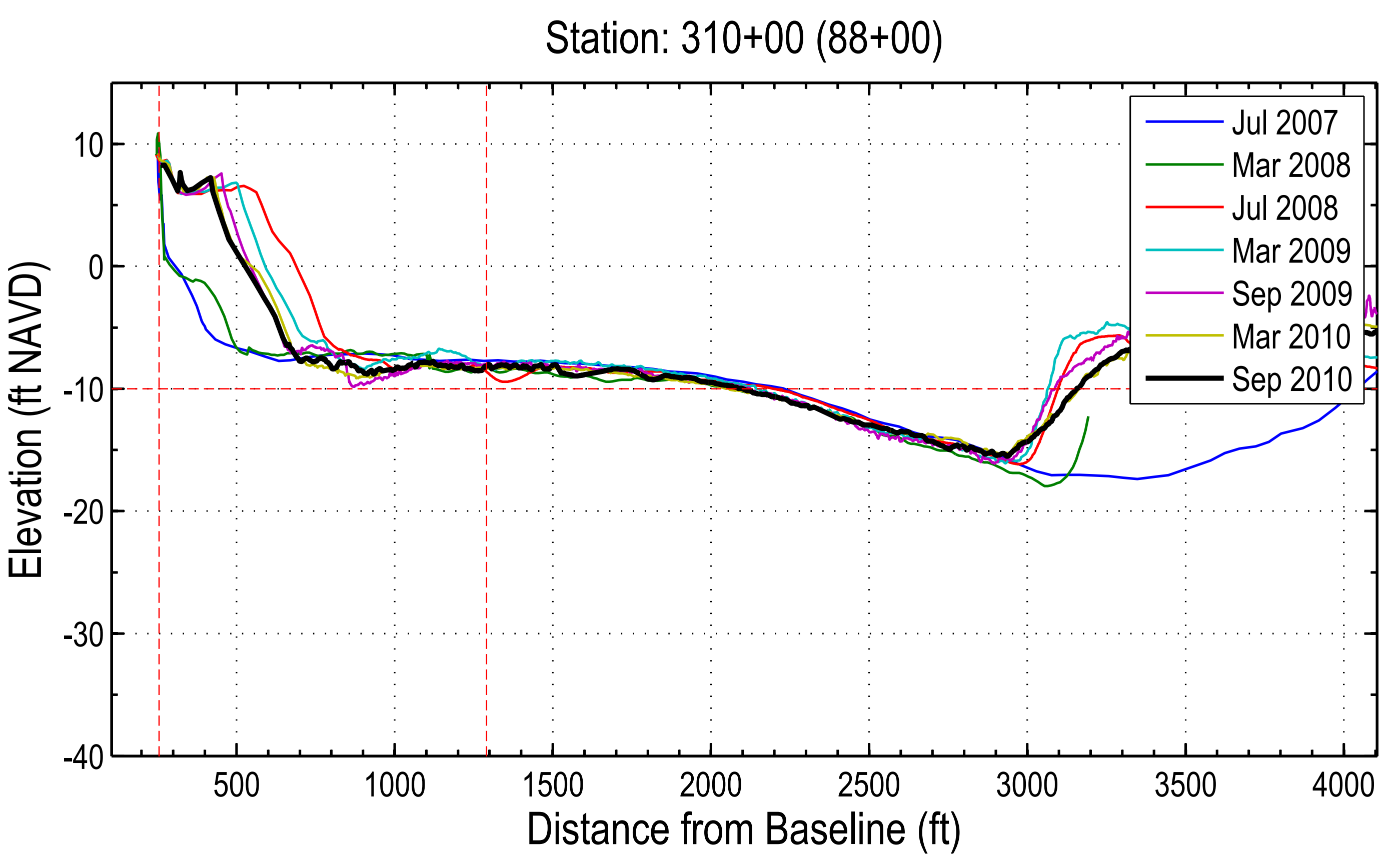

Station: 306+00 (84+00) PORT O'CALL I - BRC6, SCCC 3180
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 308+00 (86+00)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100
Elevation (ft NAVD)
Distance from Baseline (ft)

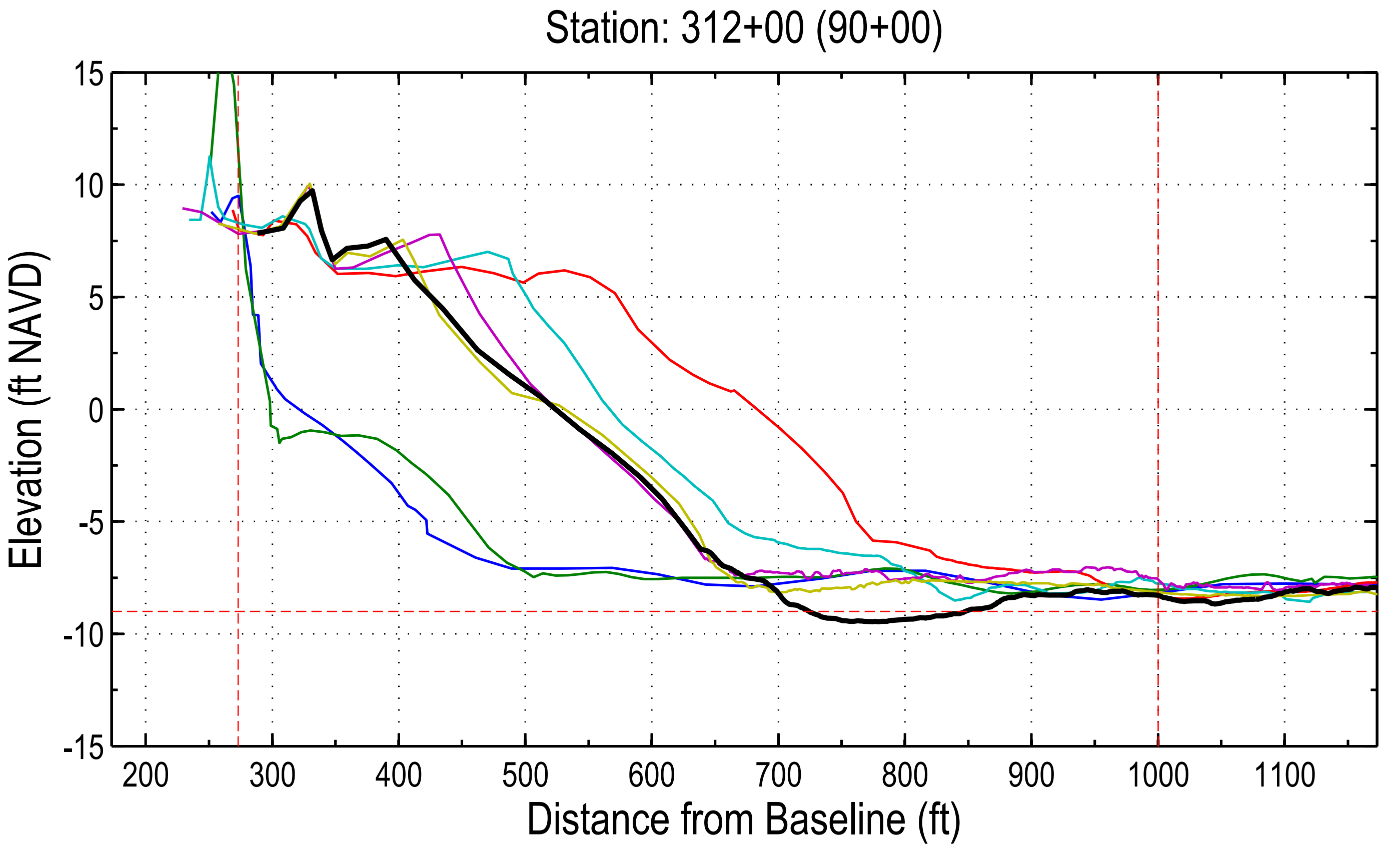

Station: 308+00 (86+00)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



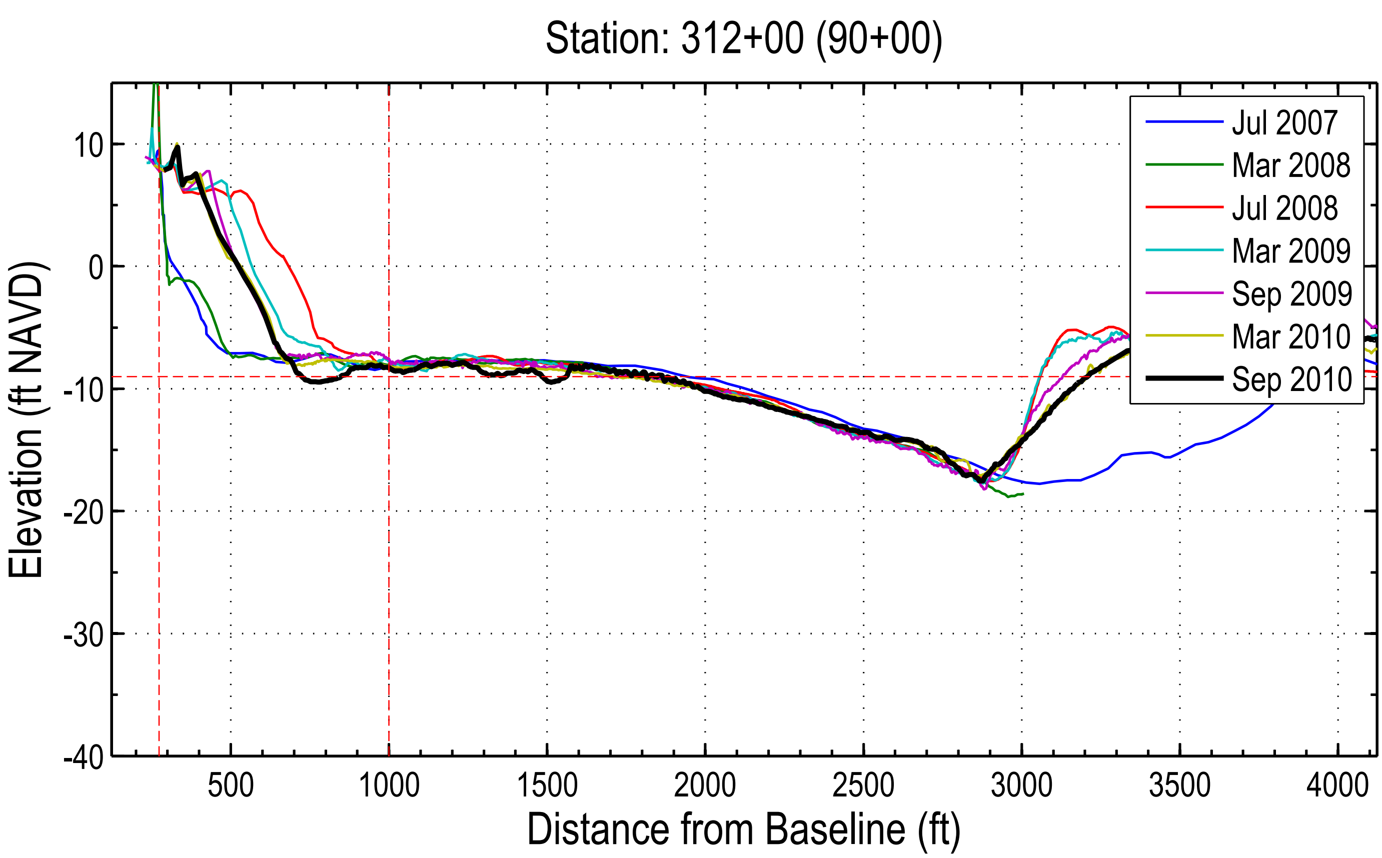
Station: 310+00 (88+00)
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100
Distance from Baseline (ft)



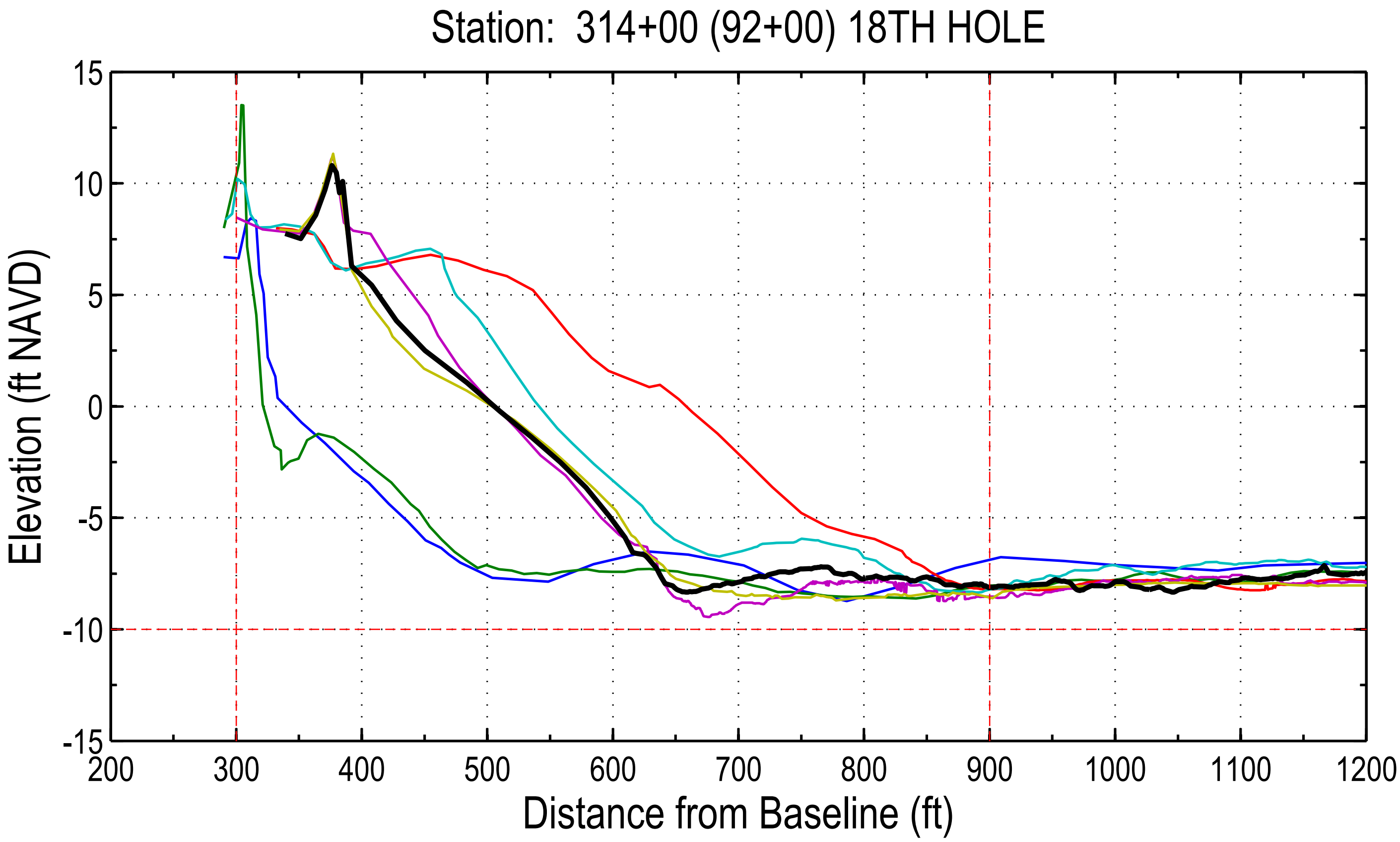
Station: 310+00 (88+00)
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

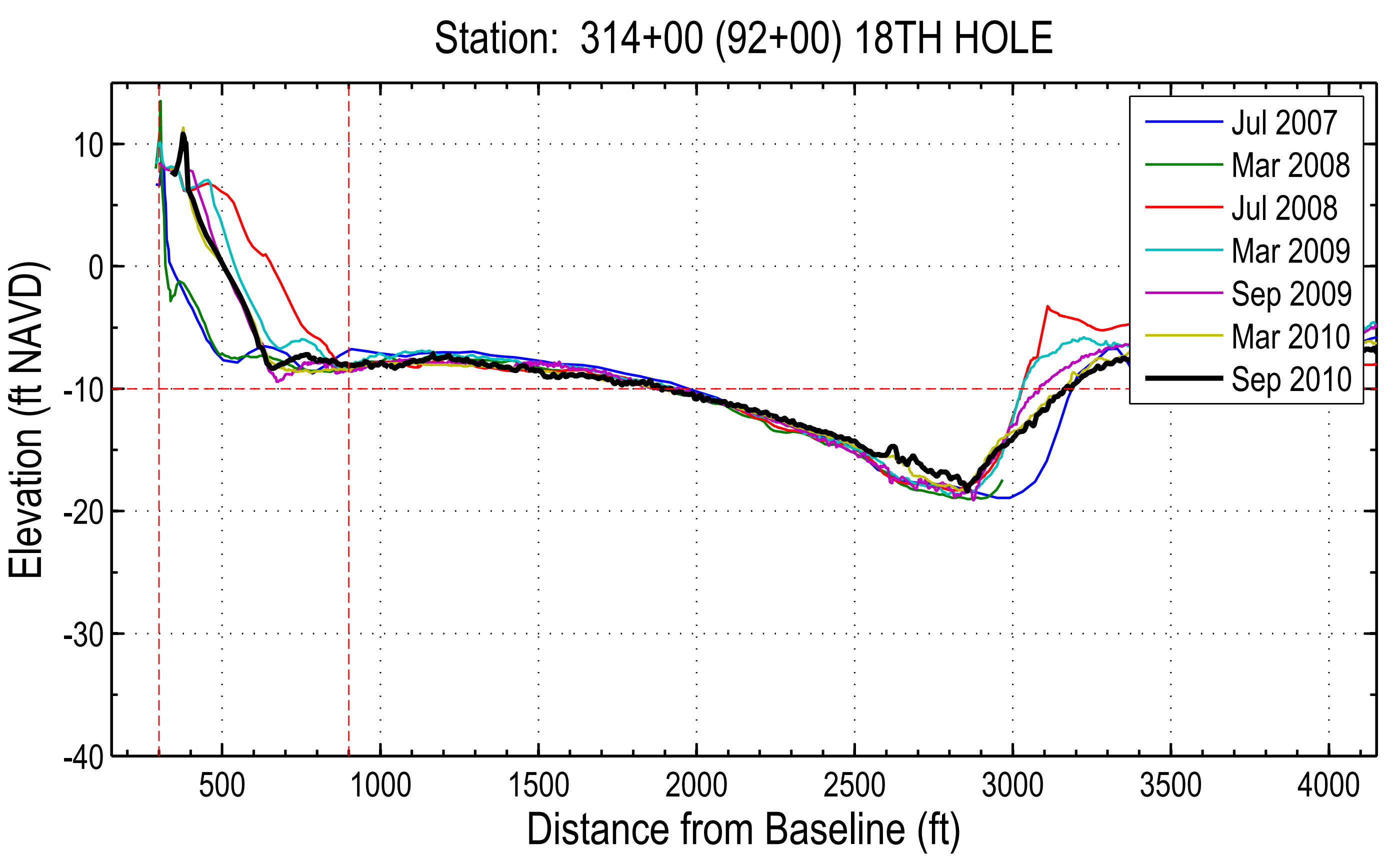


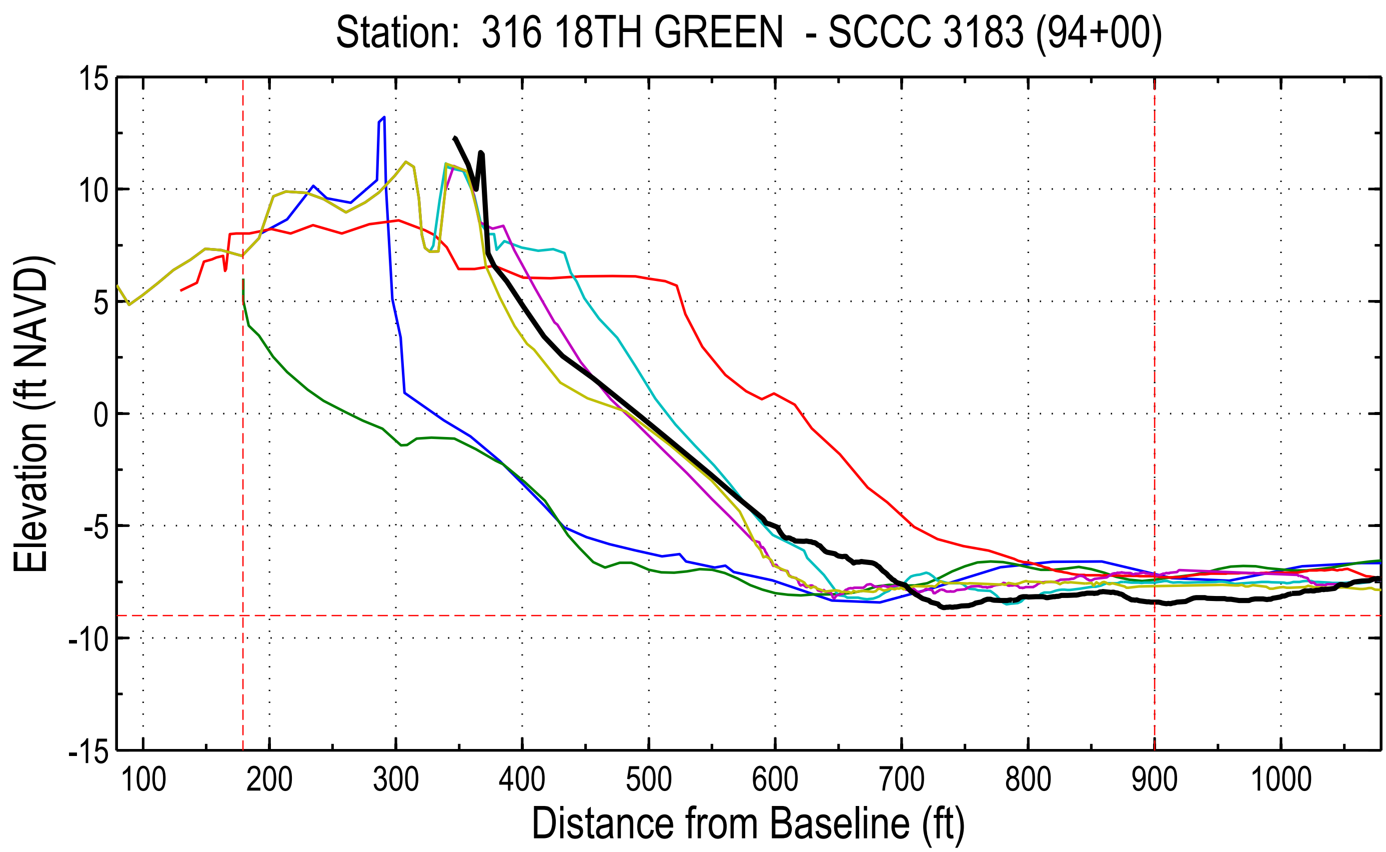
Station: 312+00 (90+00)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100
Elevation (ft NAVD)
Distance from Baseline (ft)



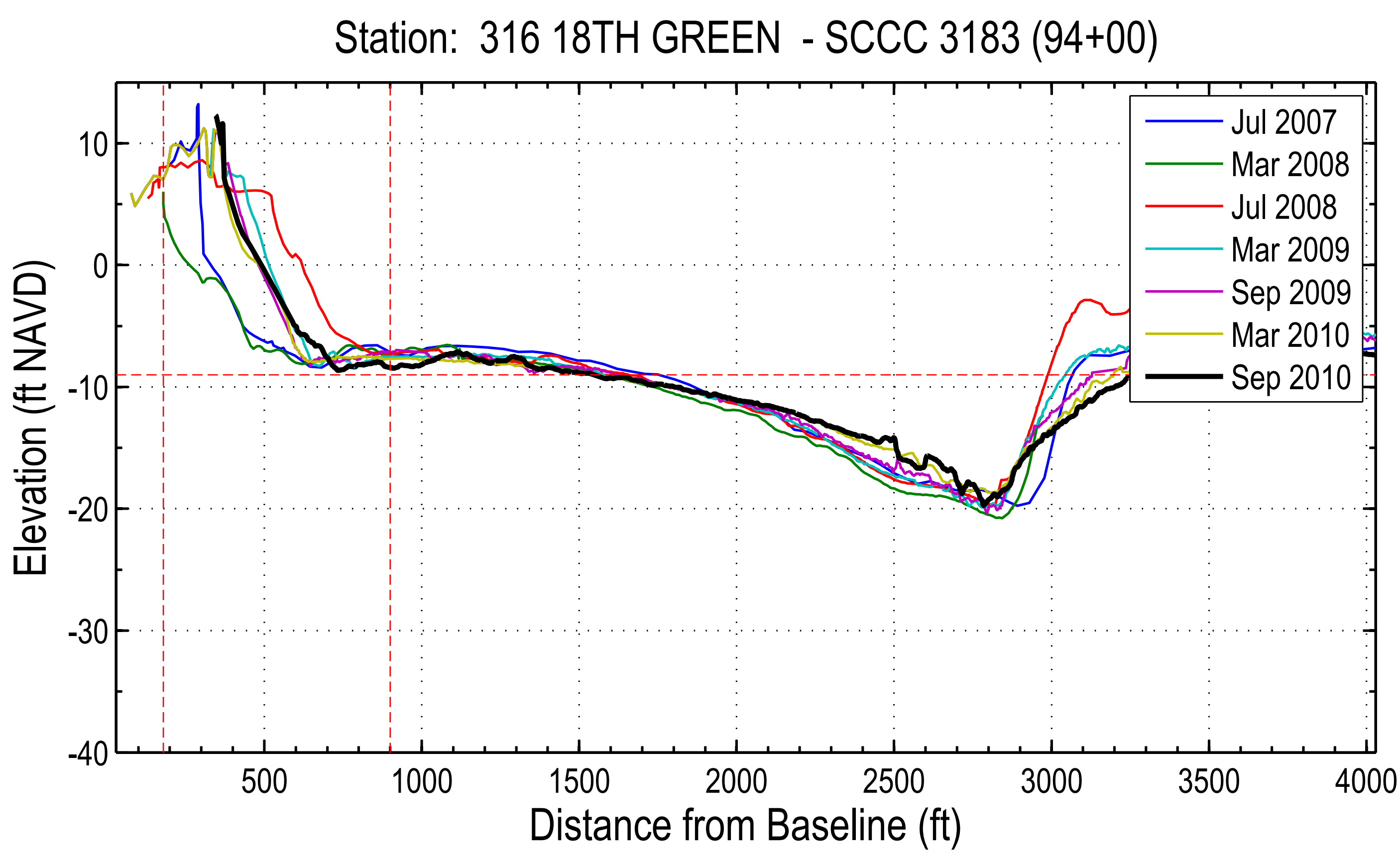
Station: 312+00 (90+00)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 314+00 (92+00) 18TH HOLE
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
200
300
400
500
600
700
800
900
1000
1100
1200

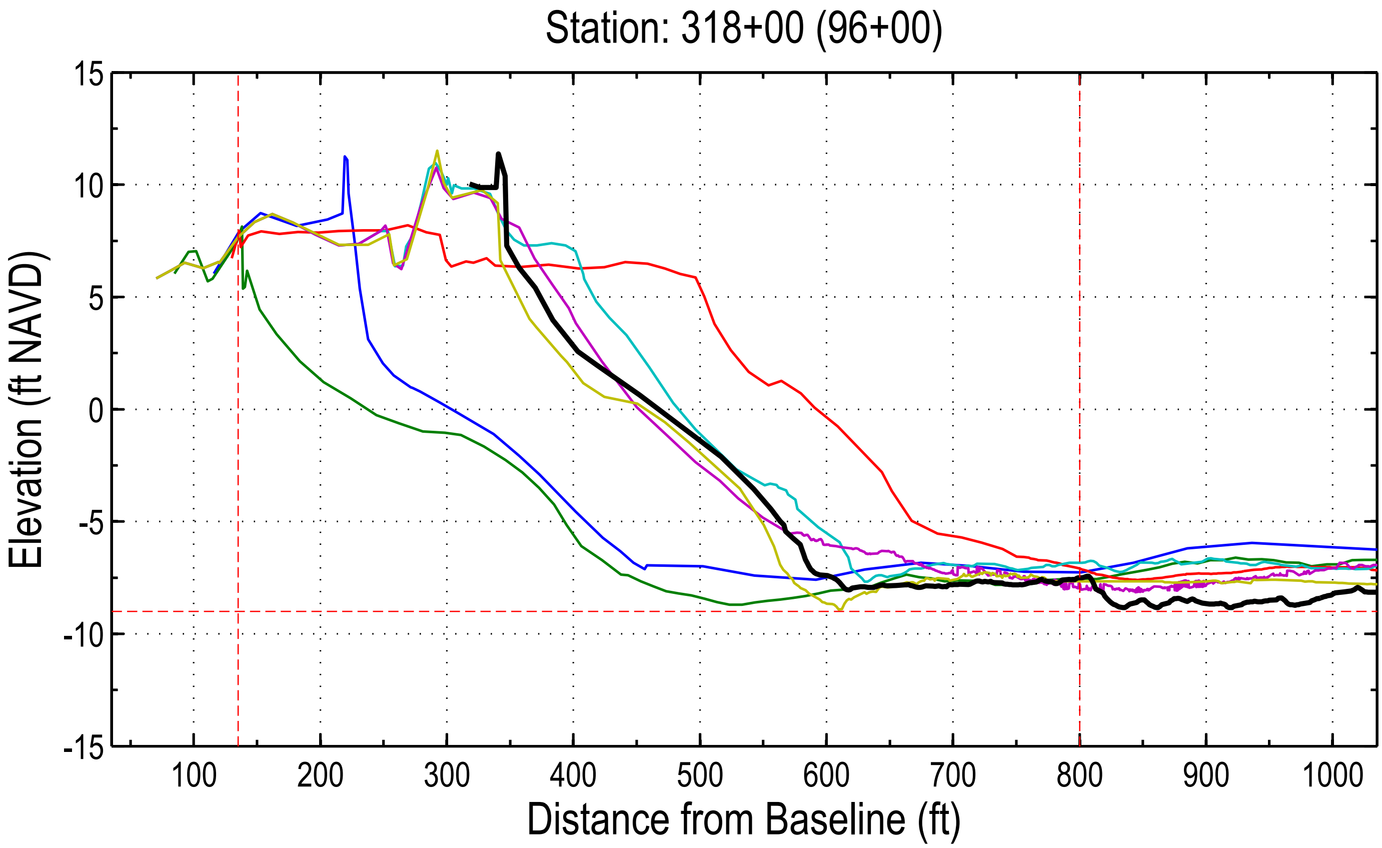

Station: 314+00 (92+00) 18TH HOLE
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



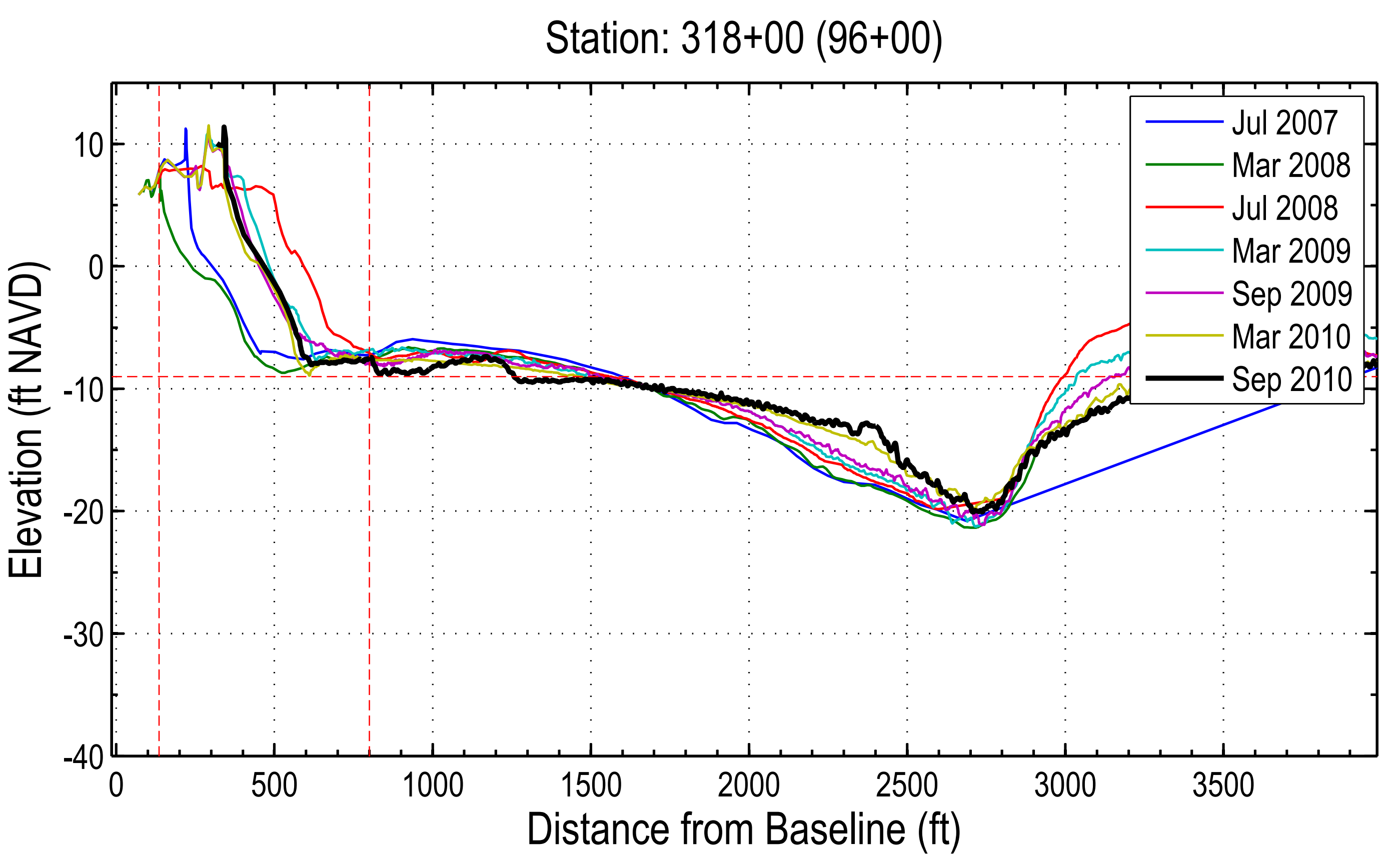
Station: 316 18TH GREEN - SCCC 3183 (94+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000



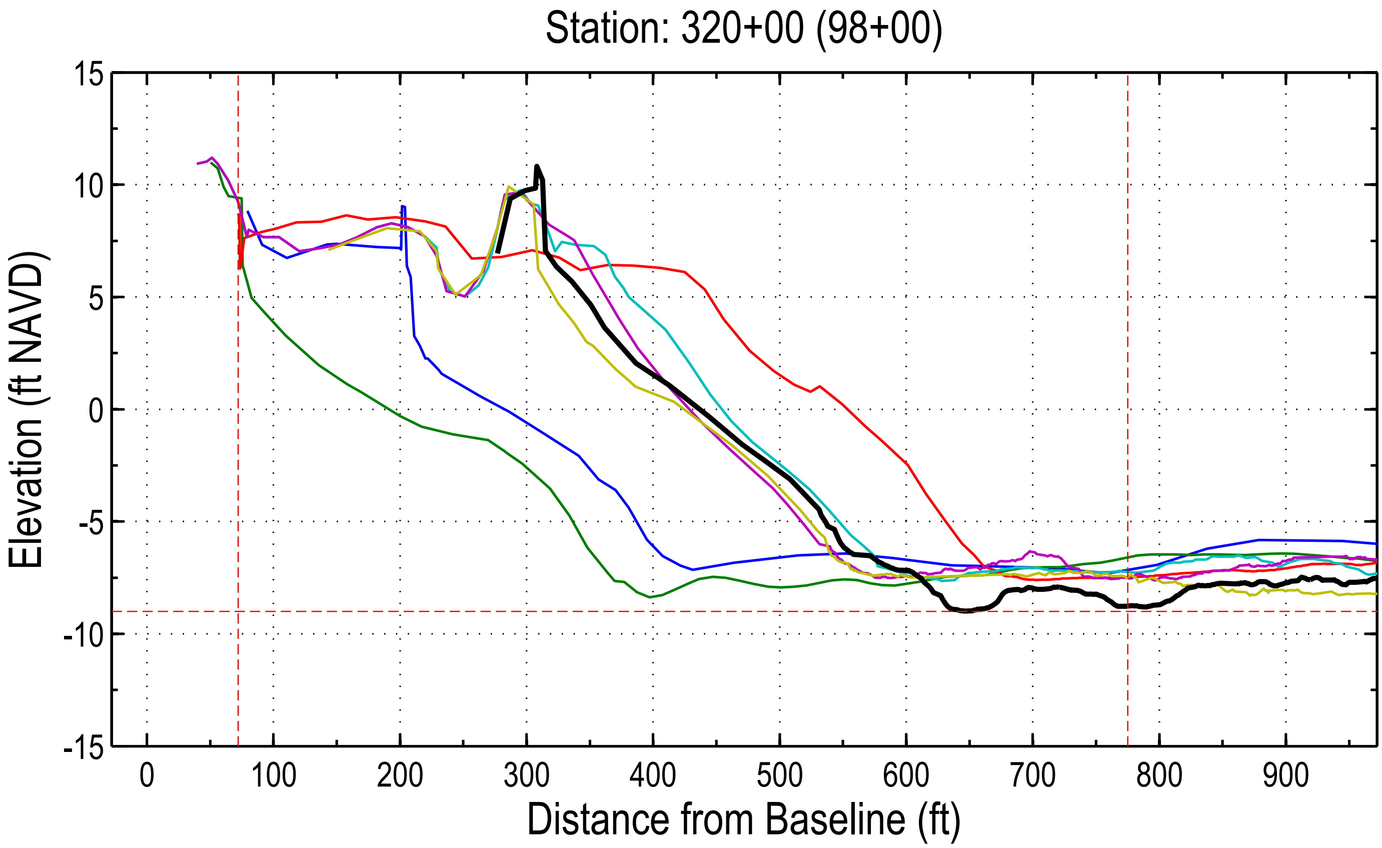
Station: 316 18TH GREEN - SCCC 3183 (94+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

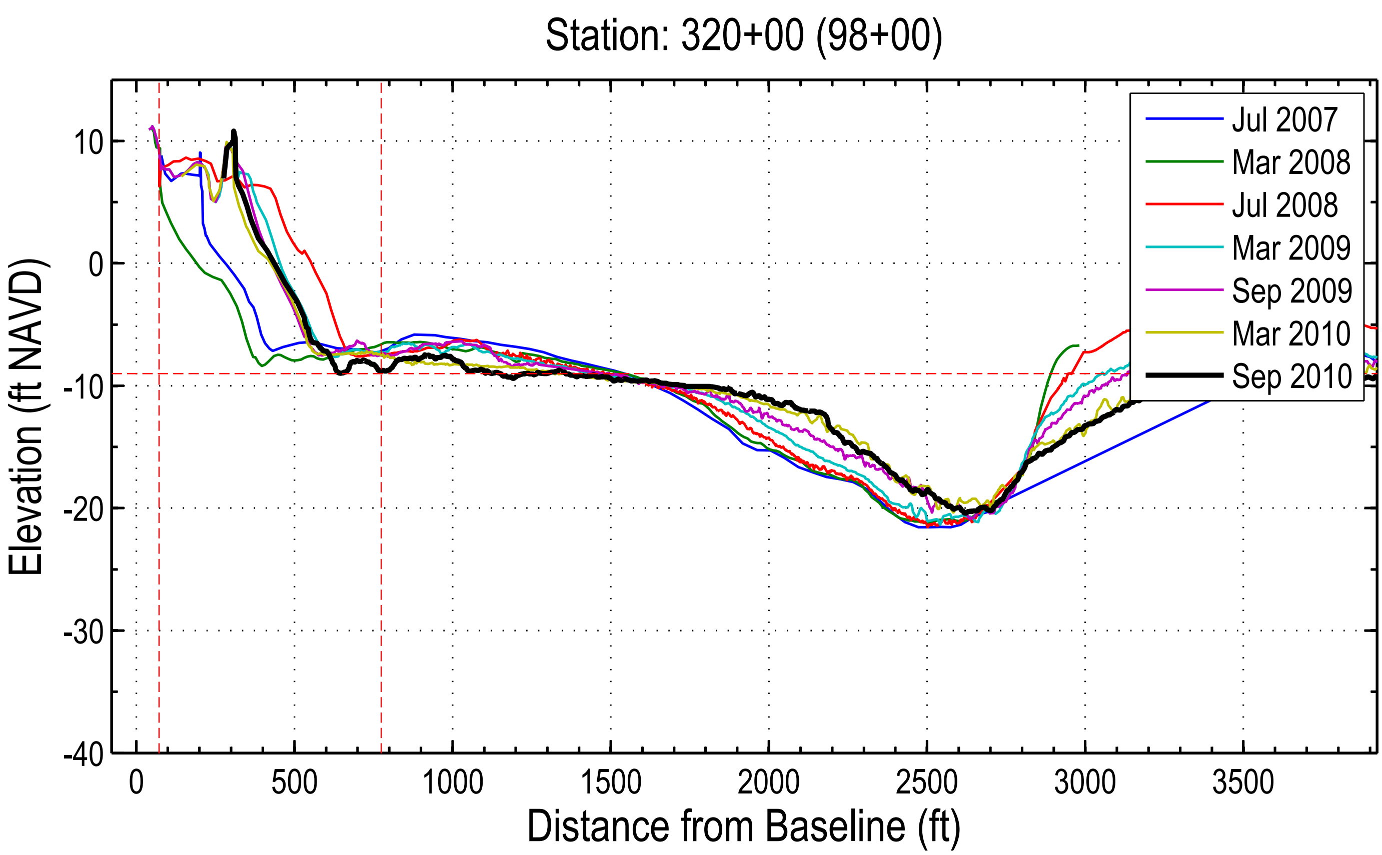


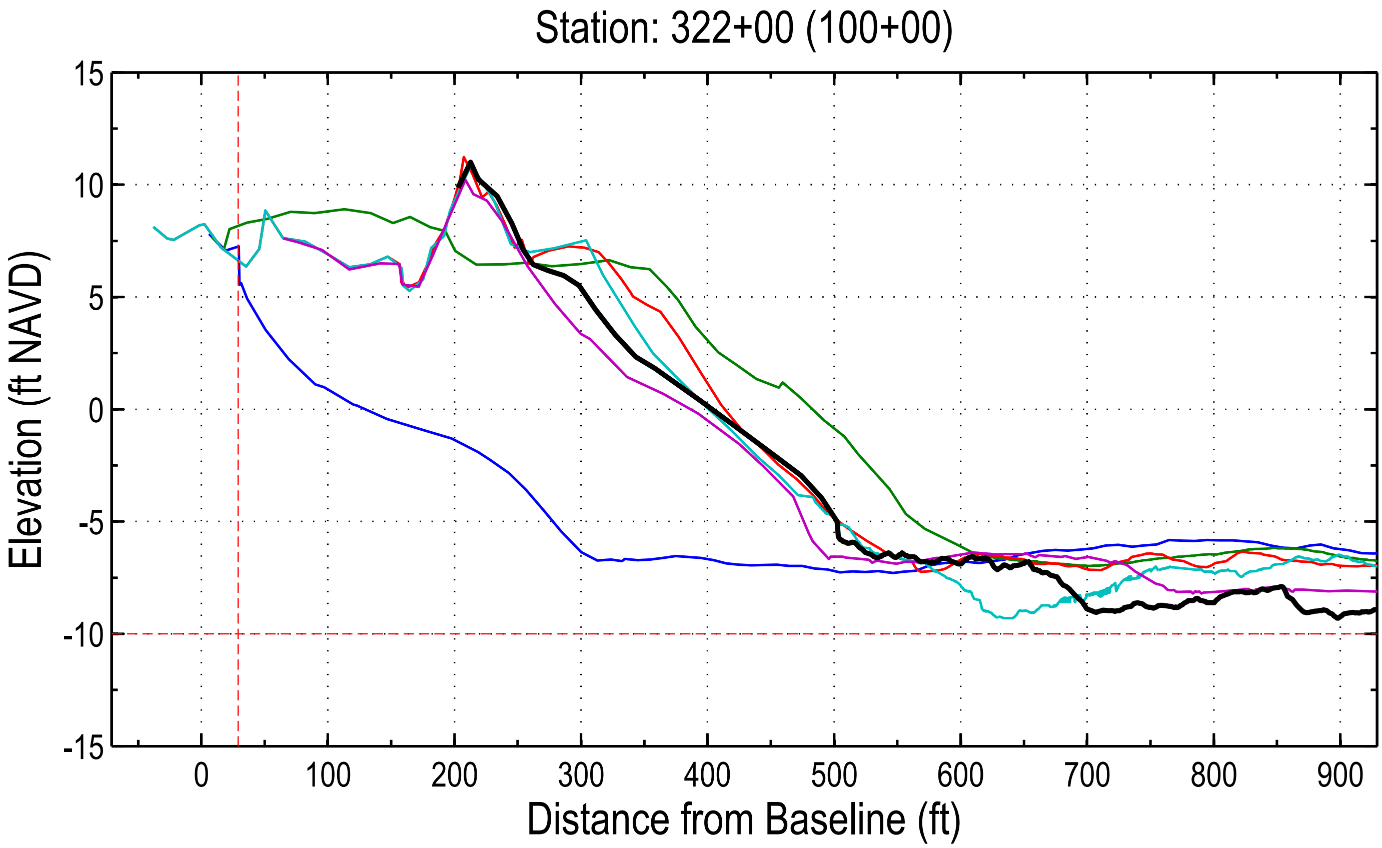
Station: 318+00 (96+00)
15
10
5
0
-5
-10
-15
Elevation (ft NAVD)
100
200
300
400
500
600
700
800
900
1000
Distance from Baseline (ft)



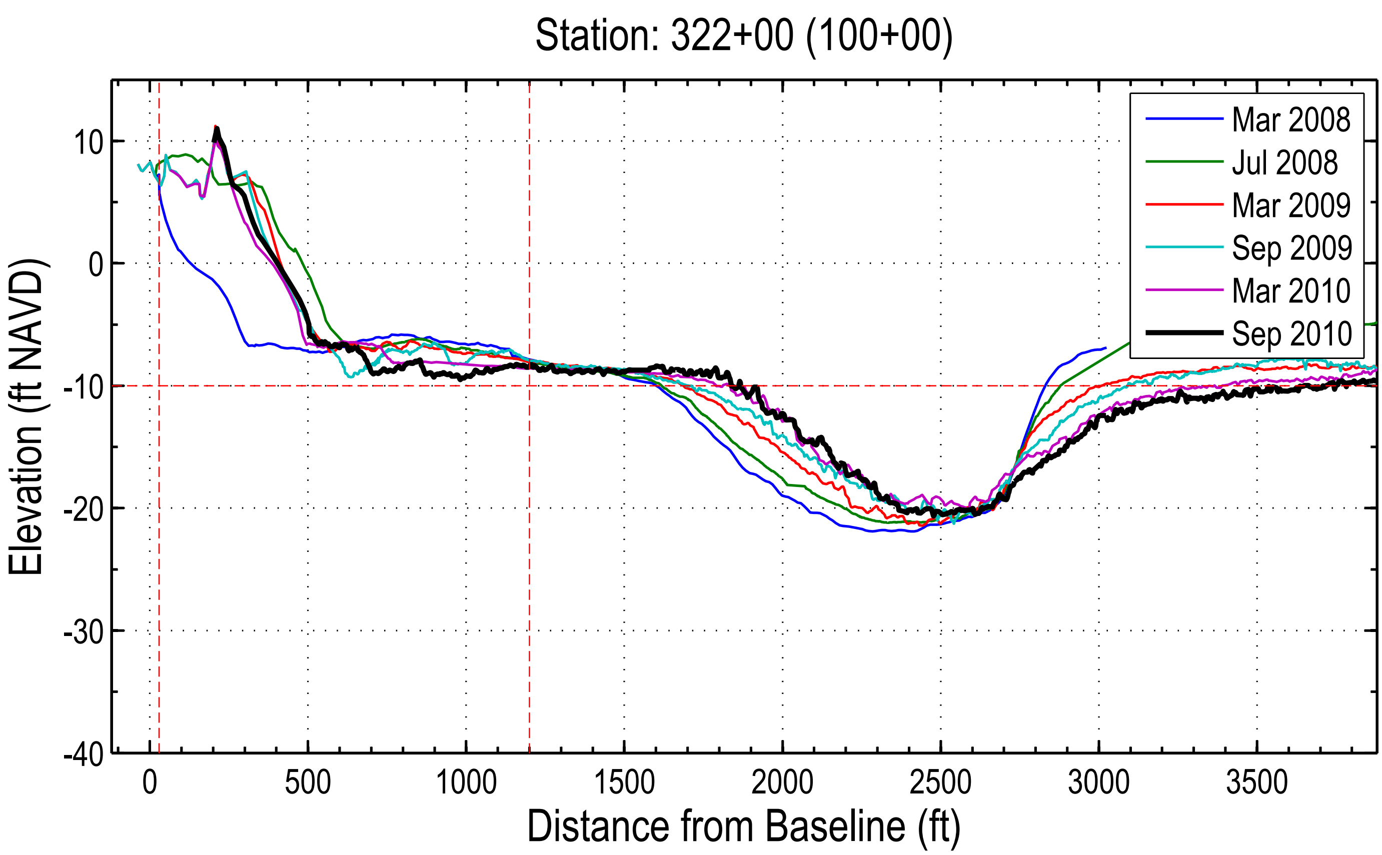
Station: 318+00 (96+00)
10
0
-10
-20
-30
-40
Elevation (ft NAVD)
0
500
1000
1500
2000
2500
3000
3500
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 320+00 (98+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900


Station: 320+00 (98+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

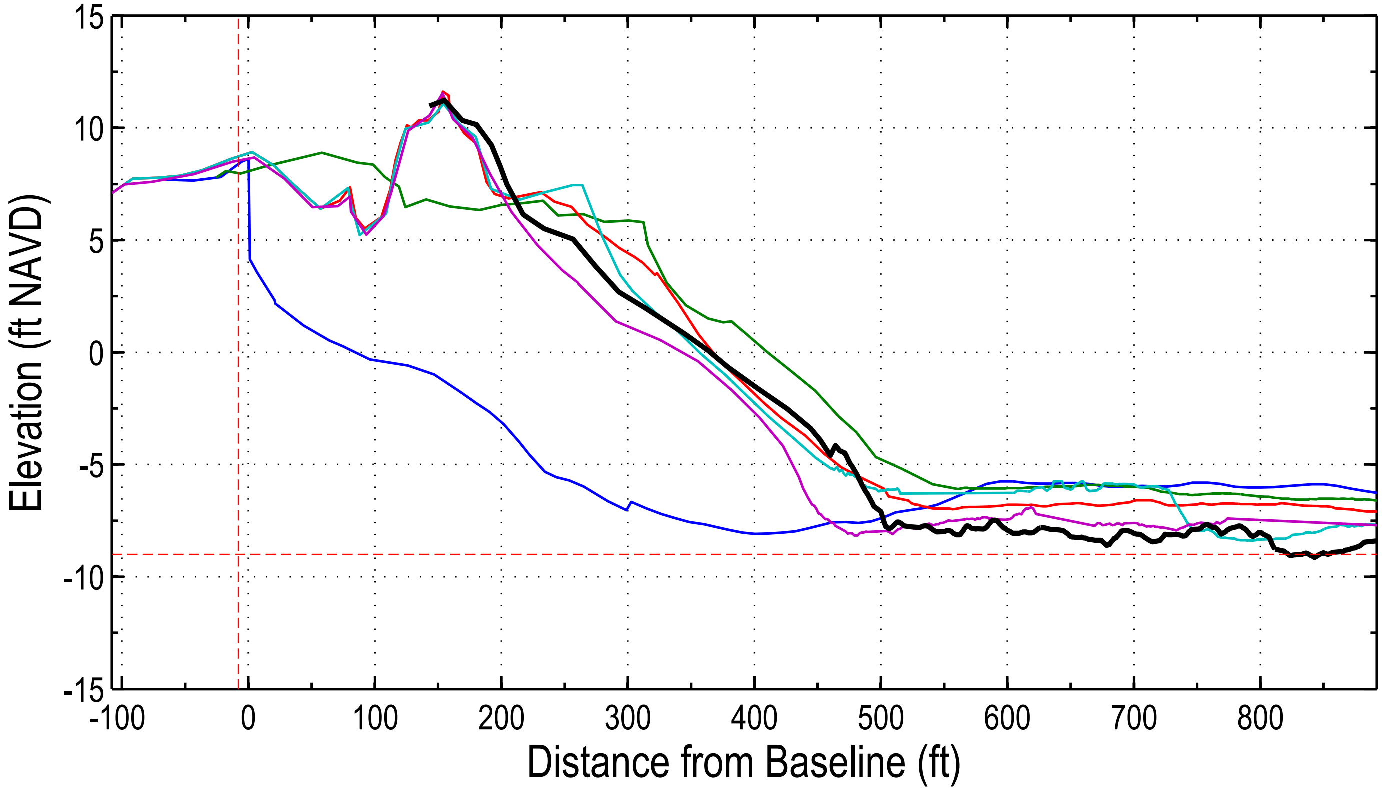


Station: 322+00 (100+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900

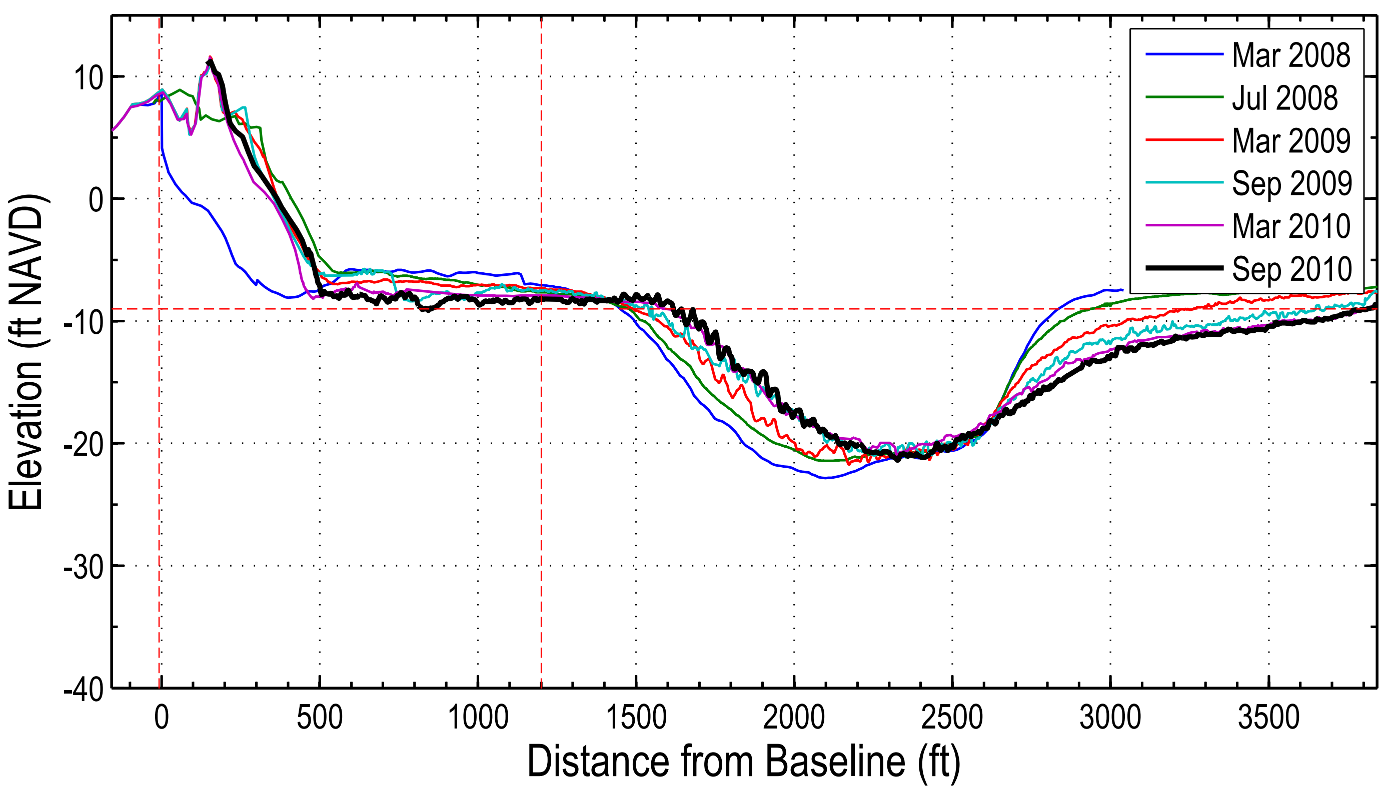


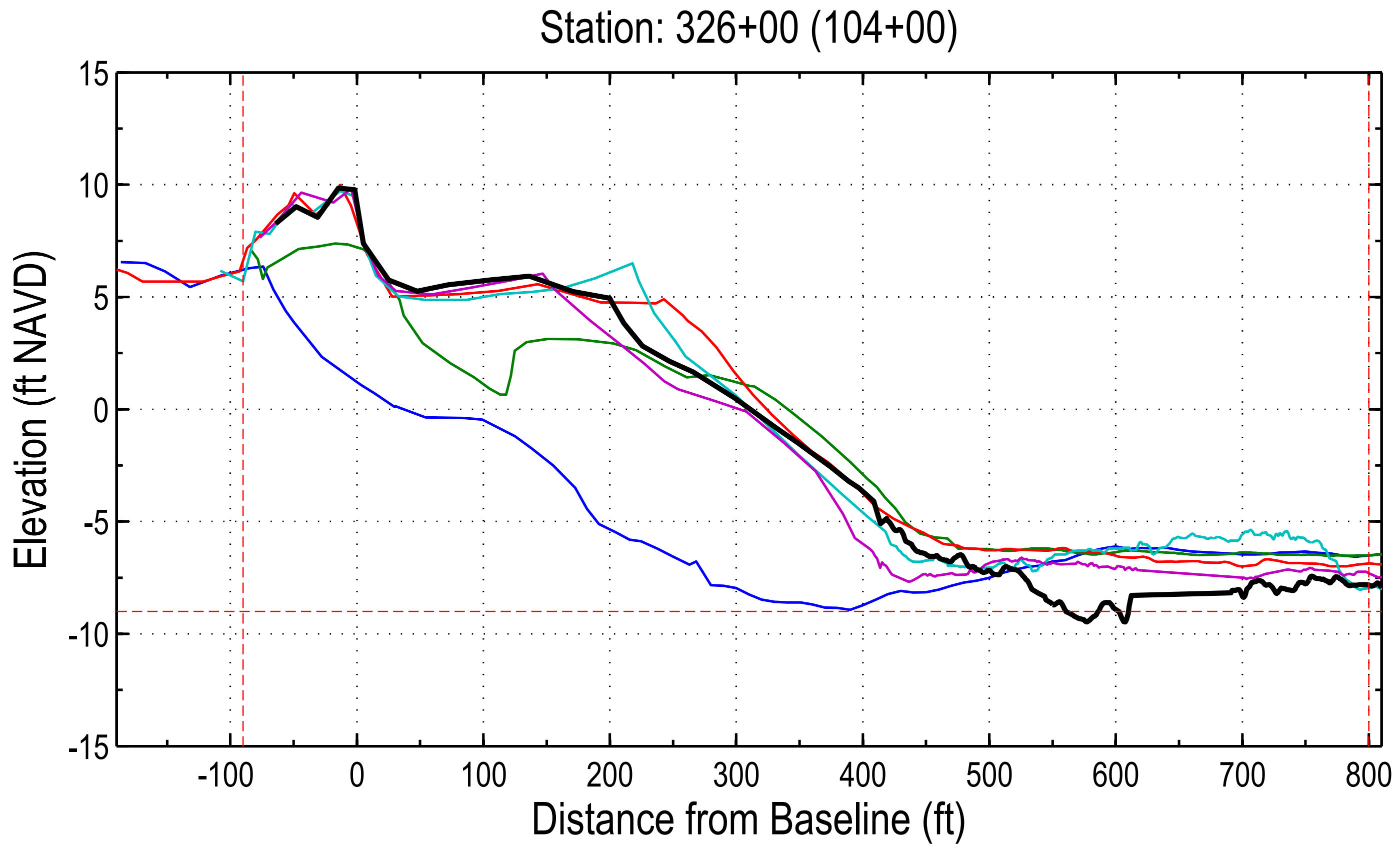
Station: 322+00 (100+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500

Station: 324+00 (102+00)

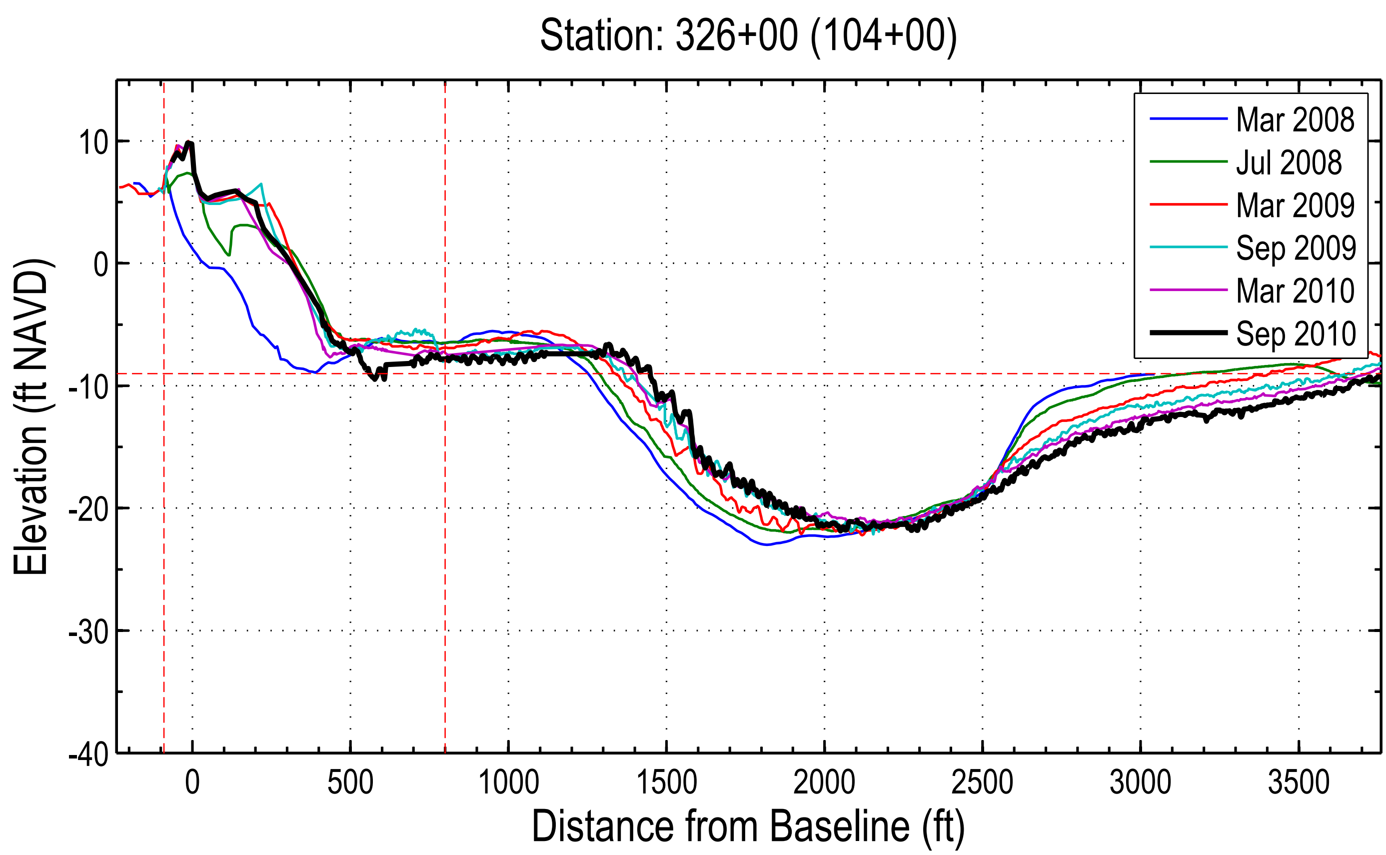


Station: 324+00 (102+00)



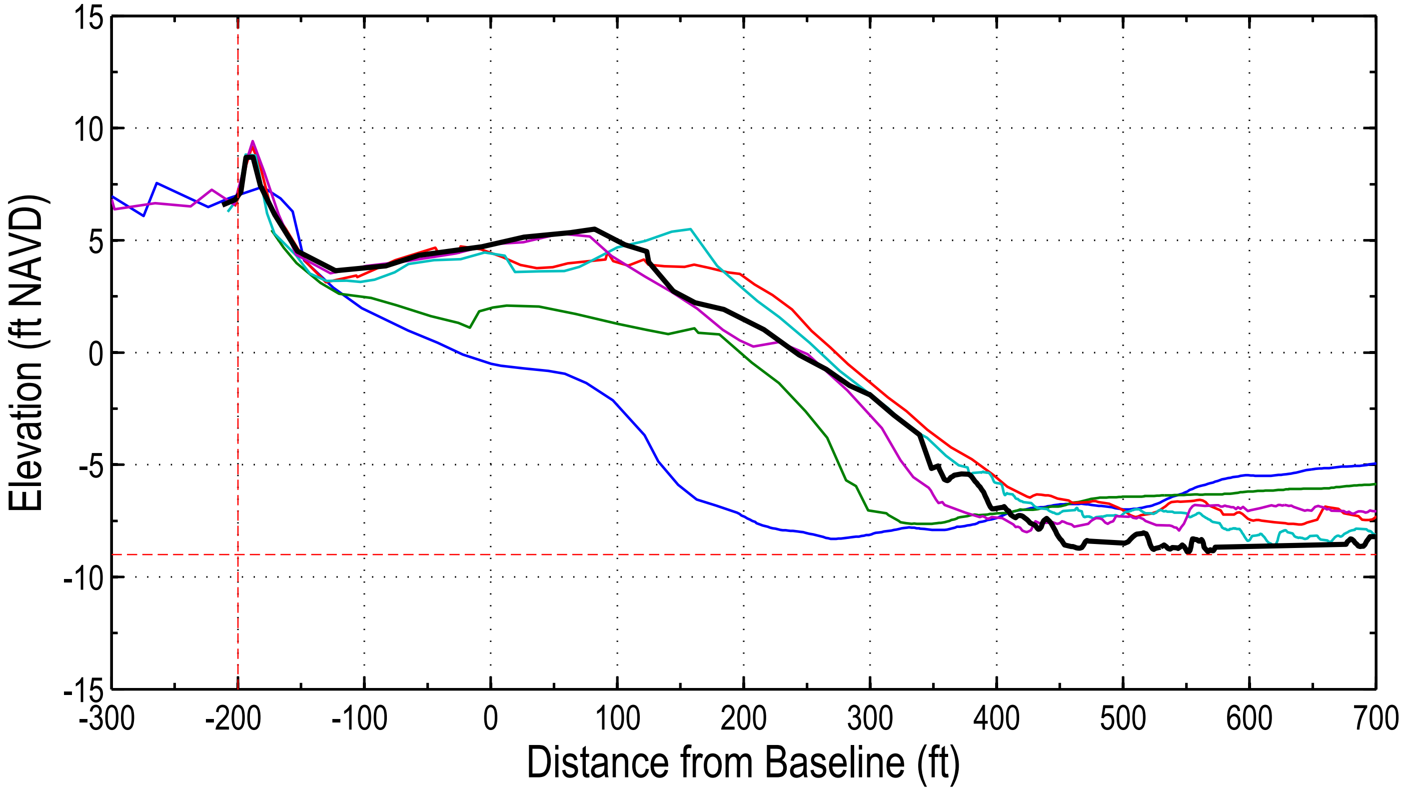


Station: 326+00 (104+00)
Elevation (ft NAVD)
Distance from Baseline (ft)

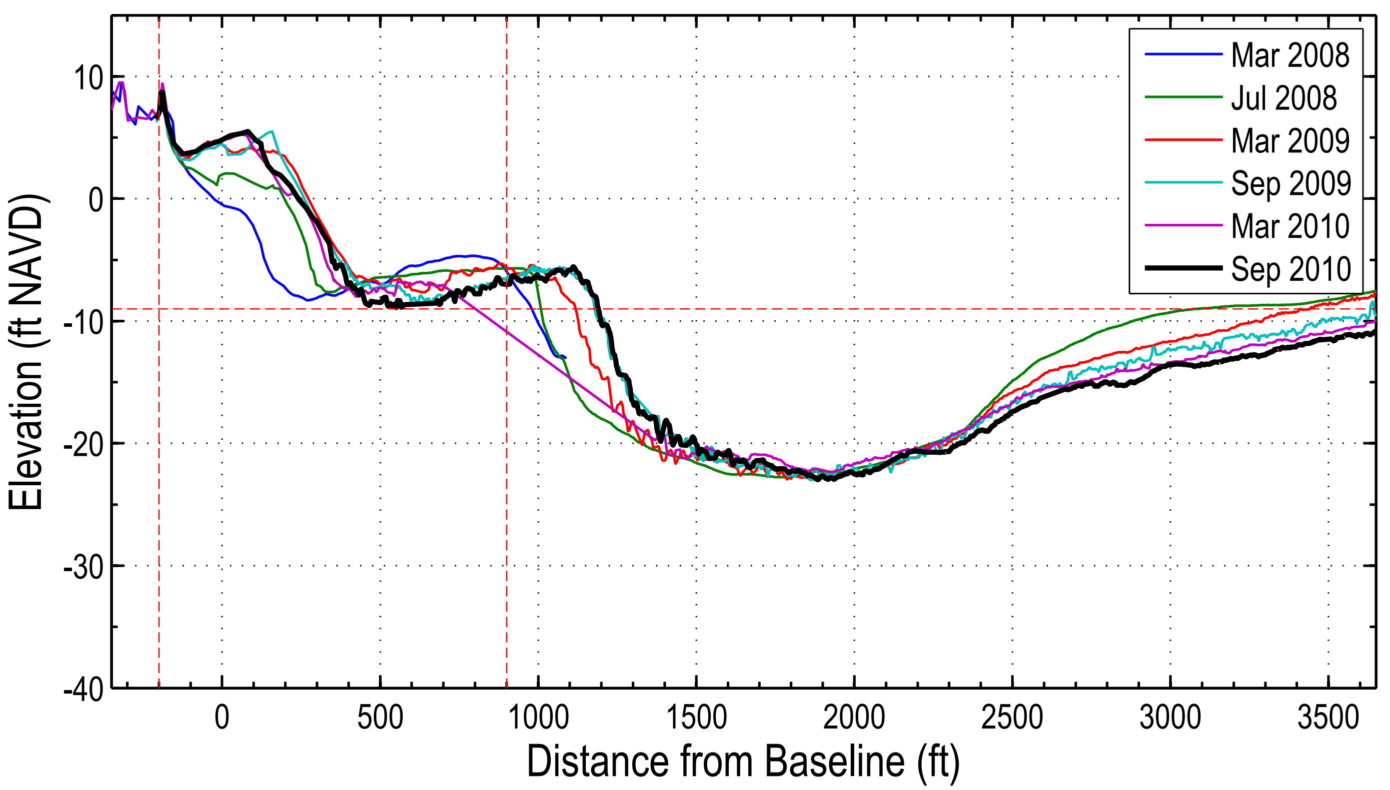


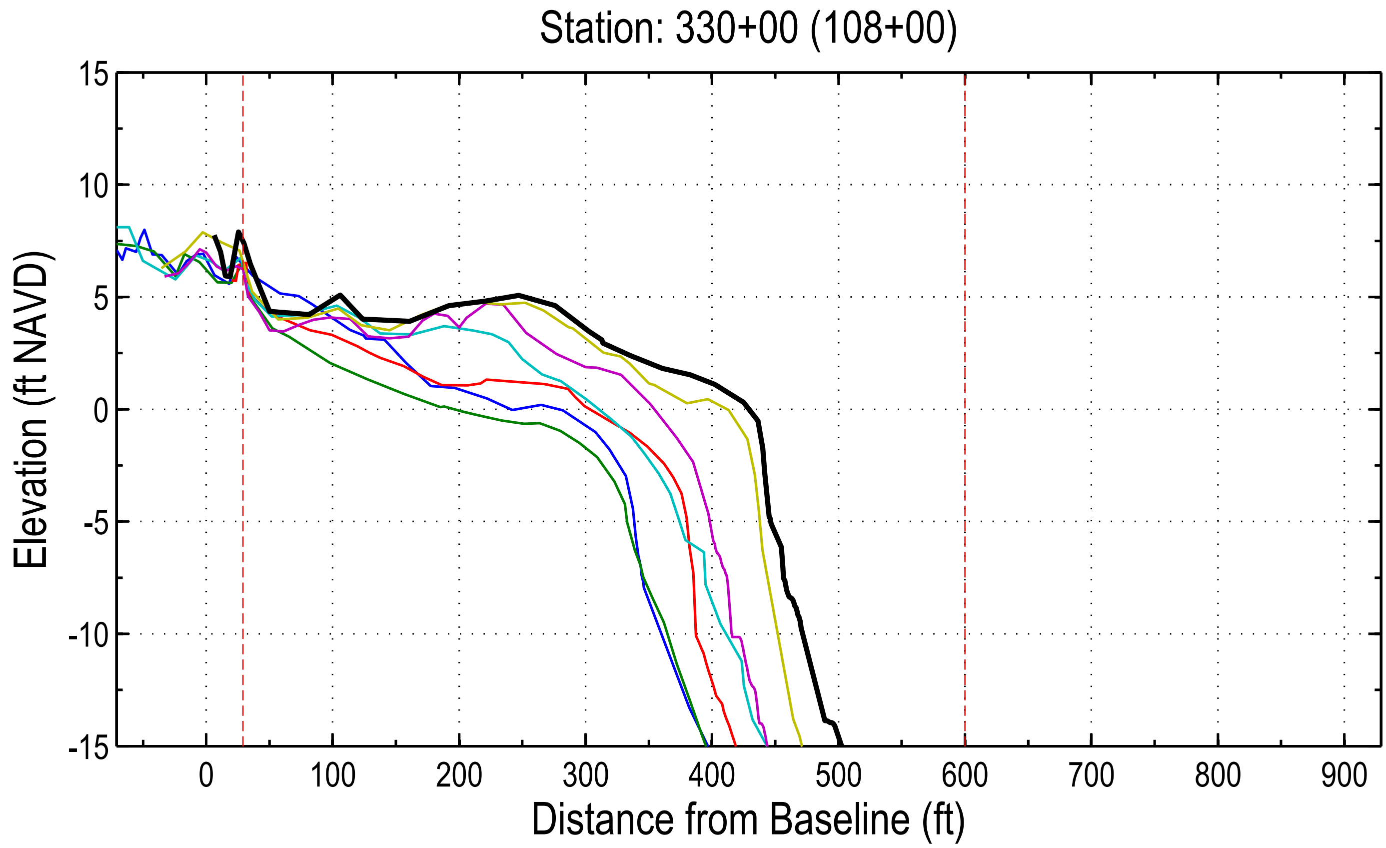
Station: 326+00 (104+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

Station: 328+00 (106+00)

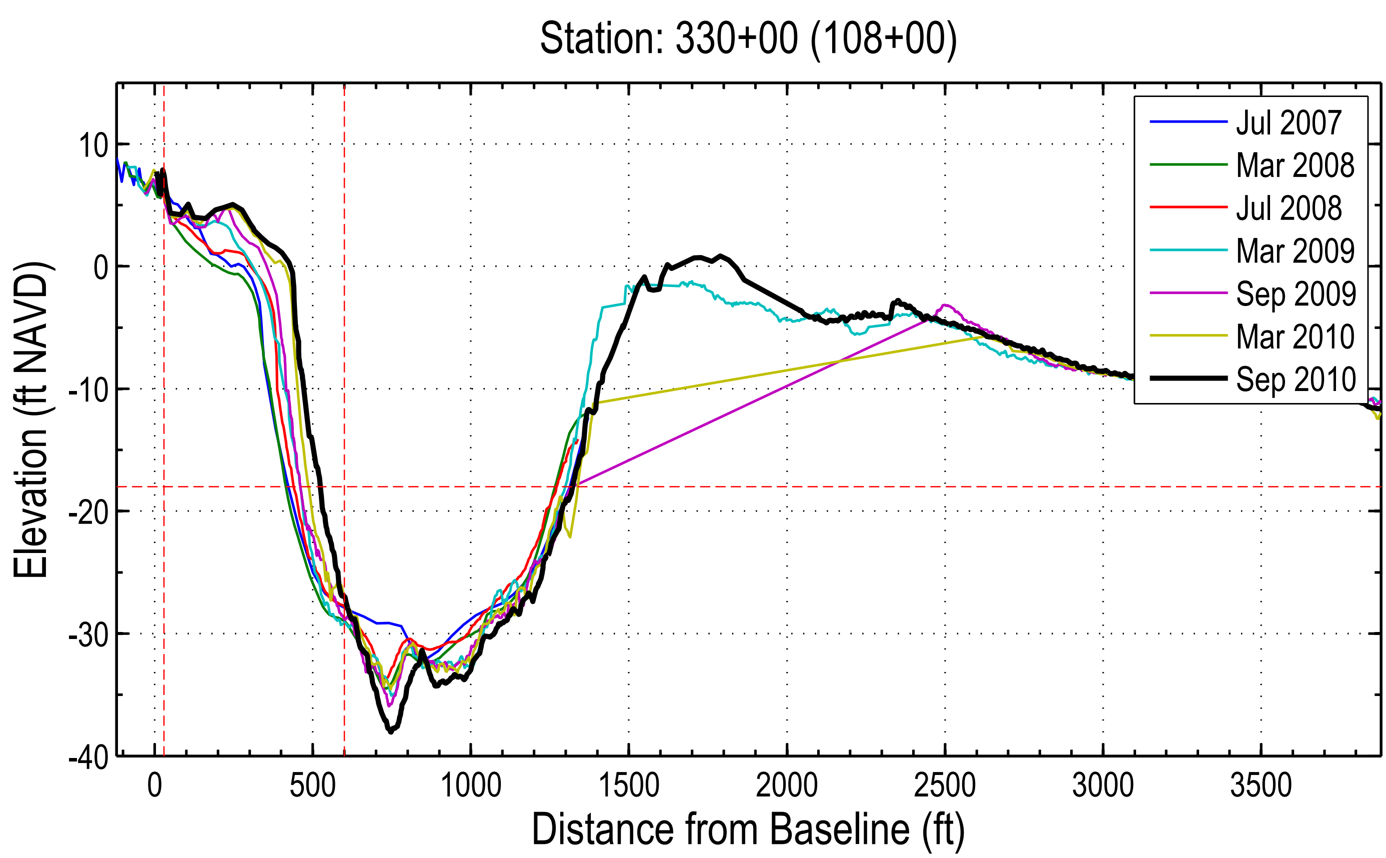


Station: 328+00 (106+00)

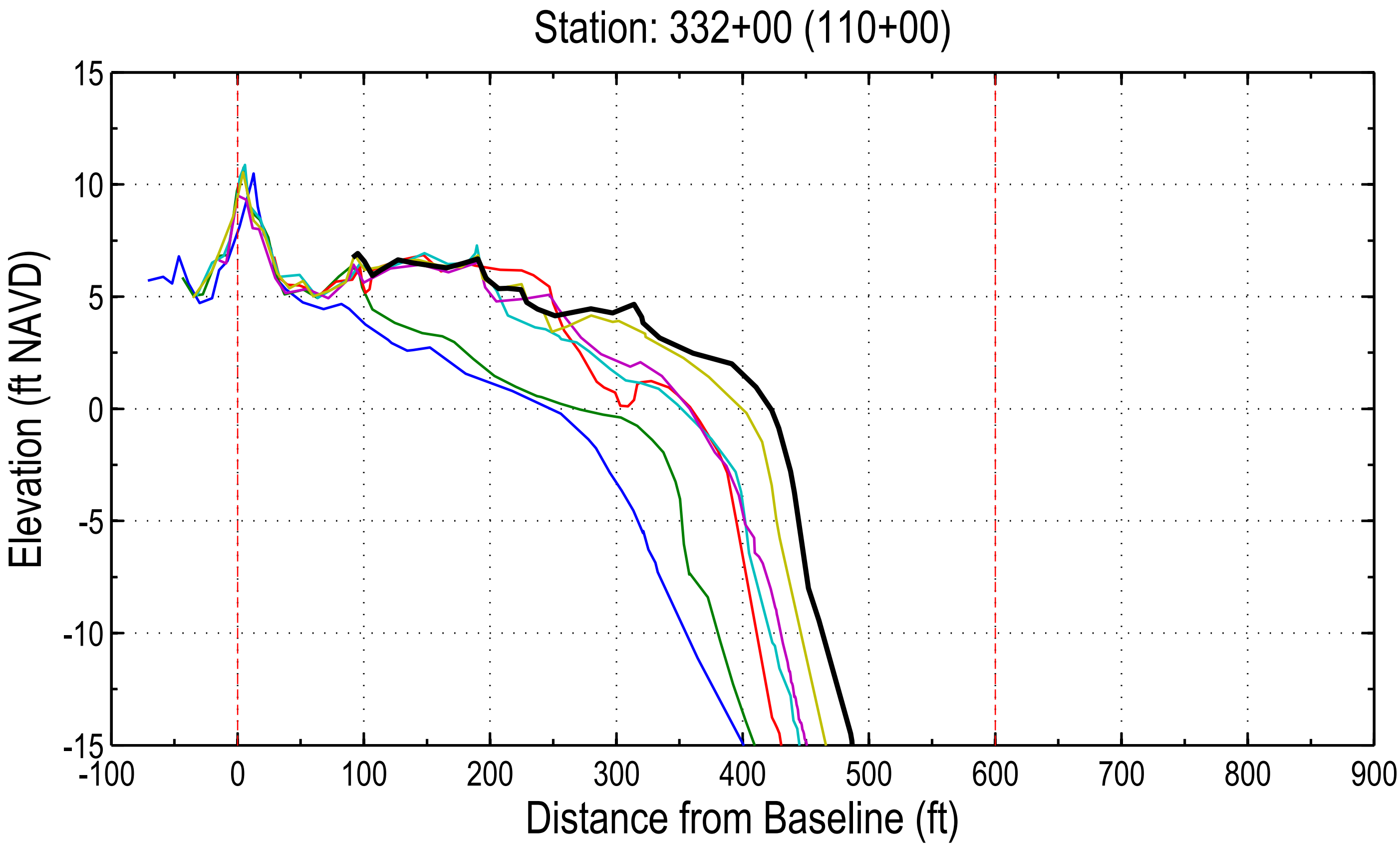




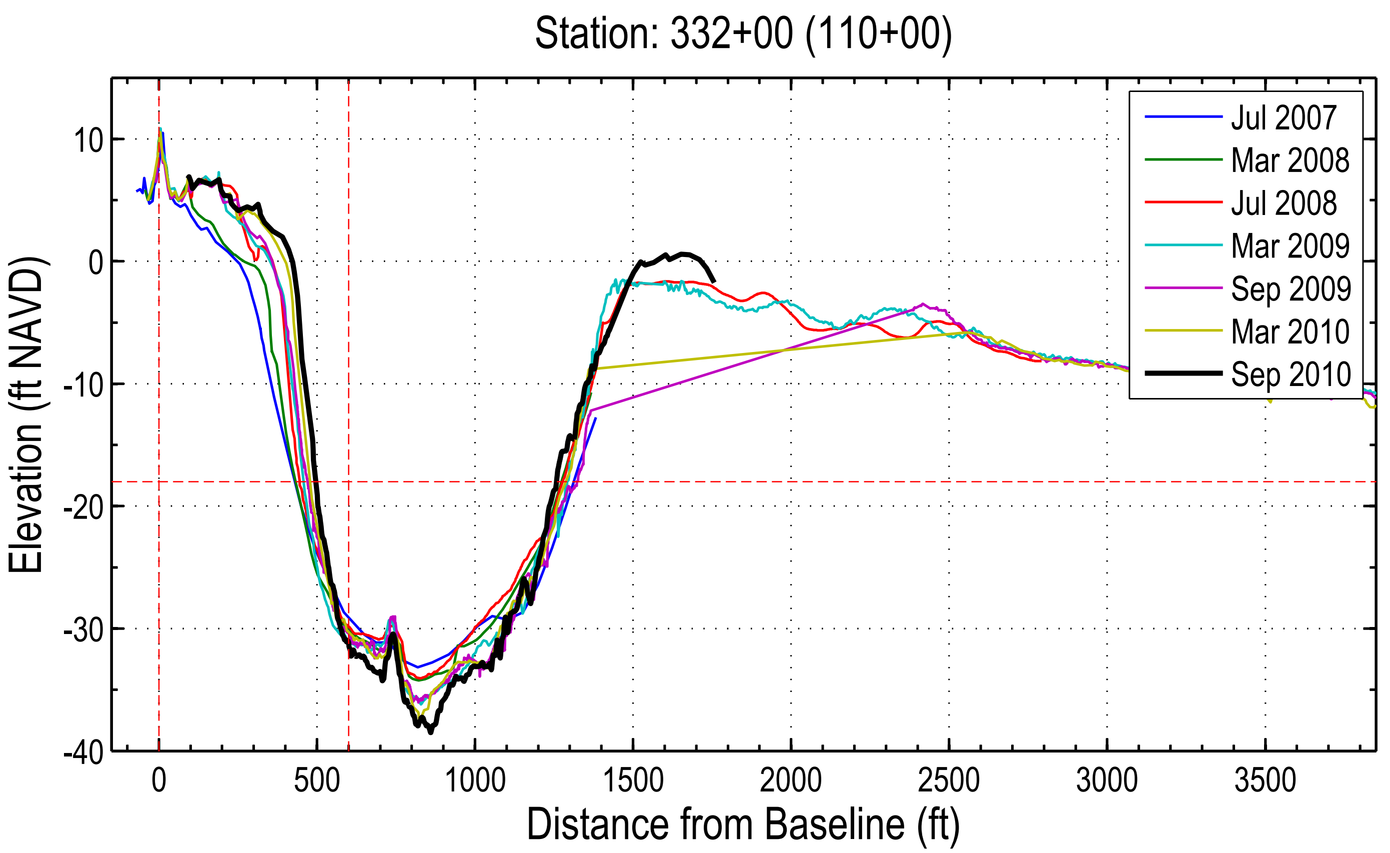
Station: 330+00 (108+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900



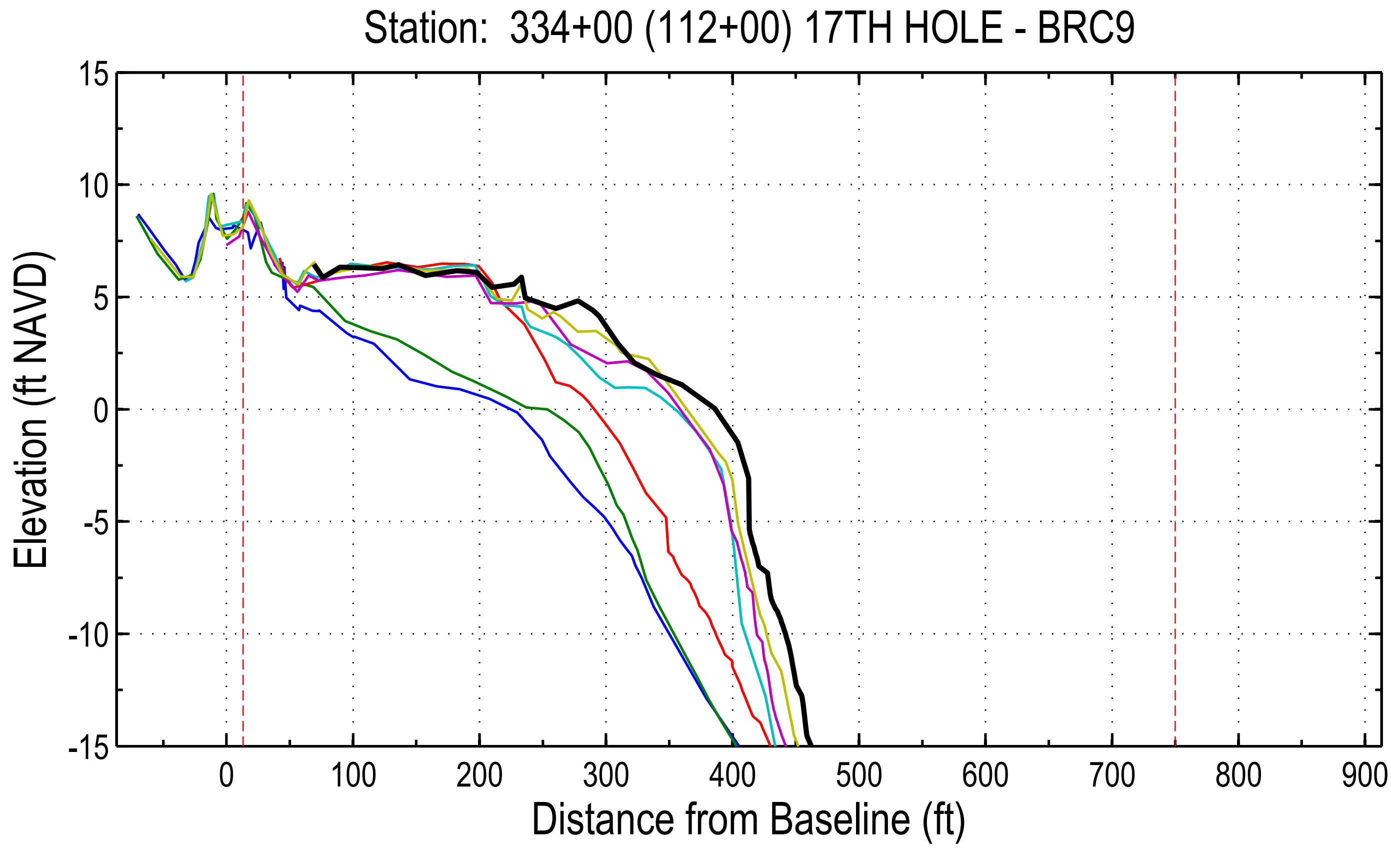
Station: 330+00 (108+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



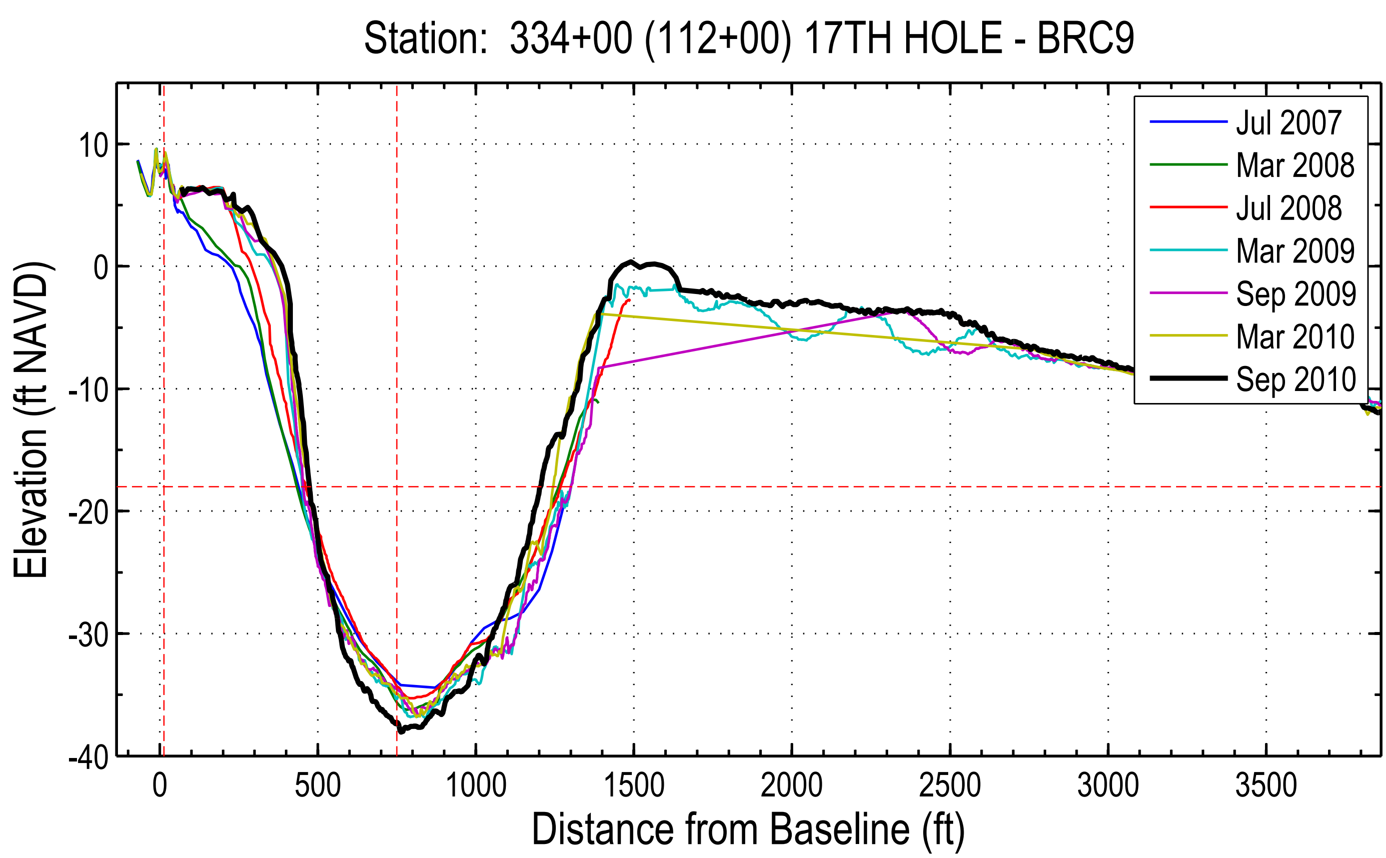
Station: 332+00 (110+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800
900



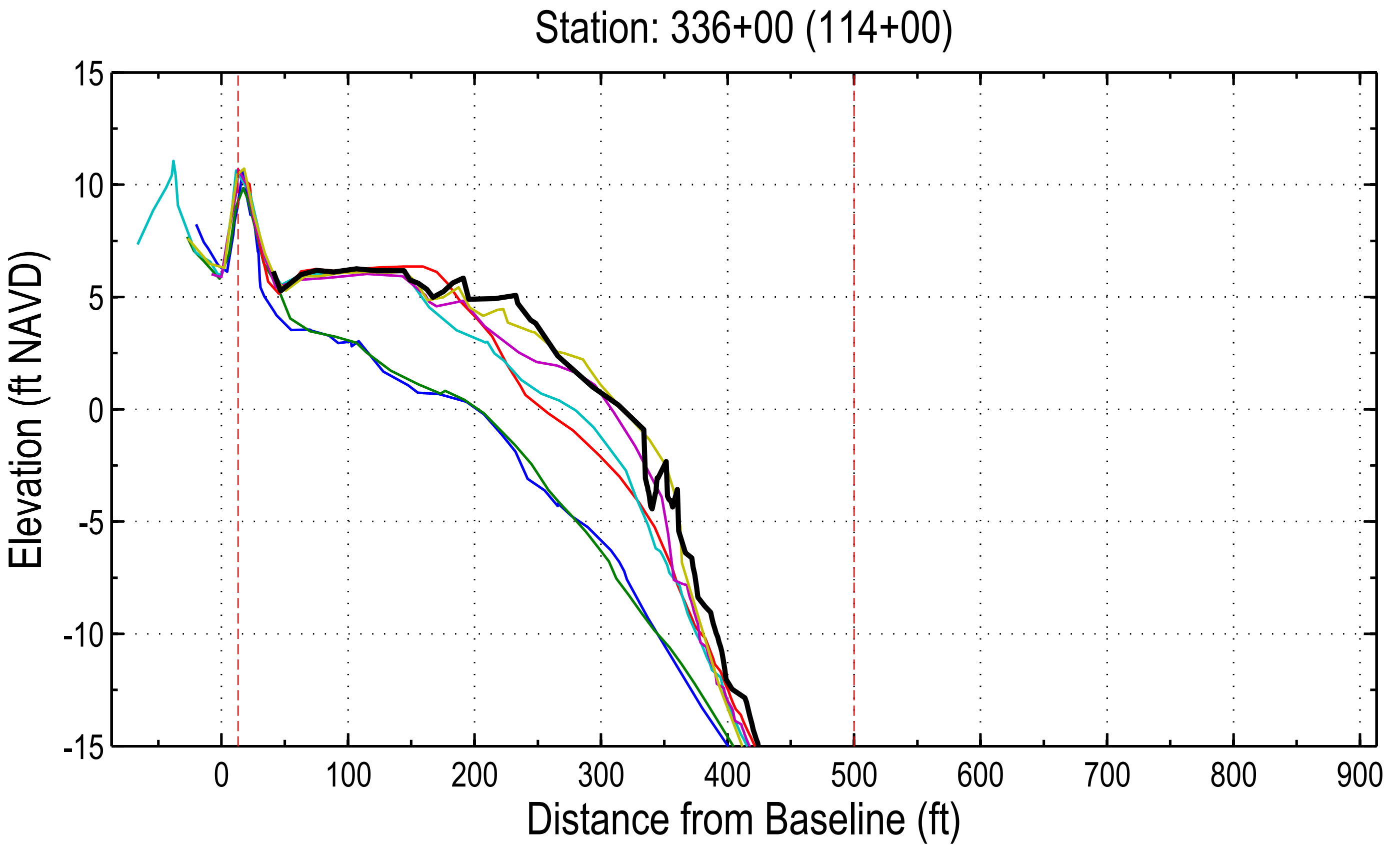
Station: 332+00 (110+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500



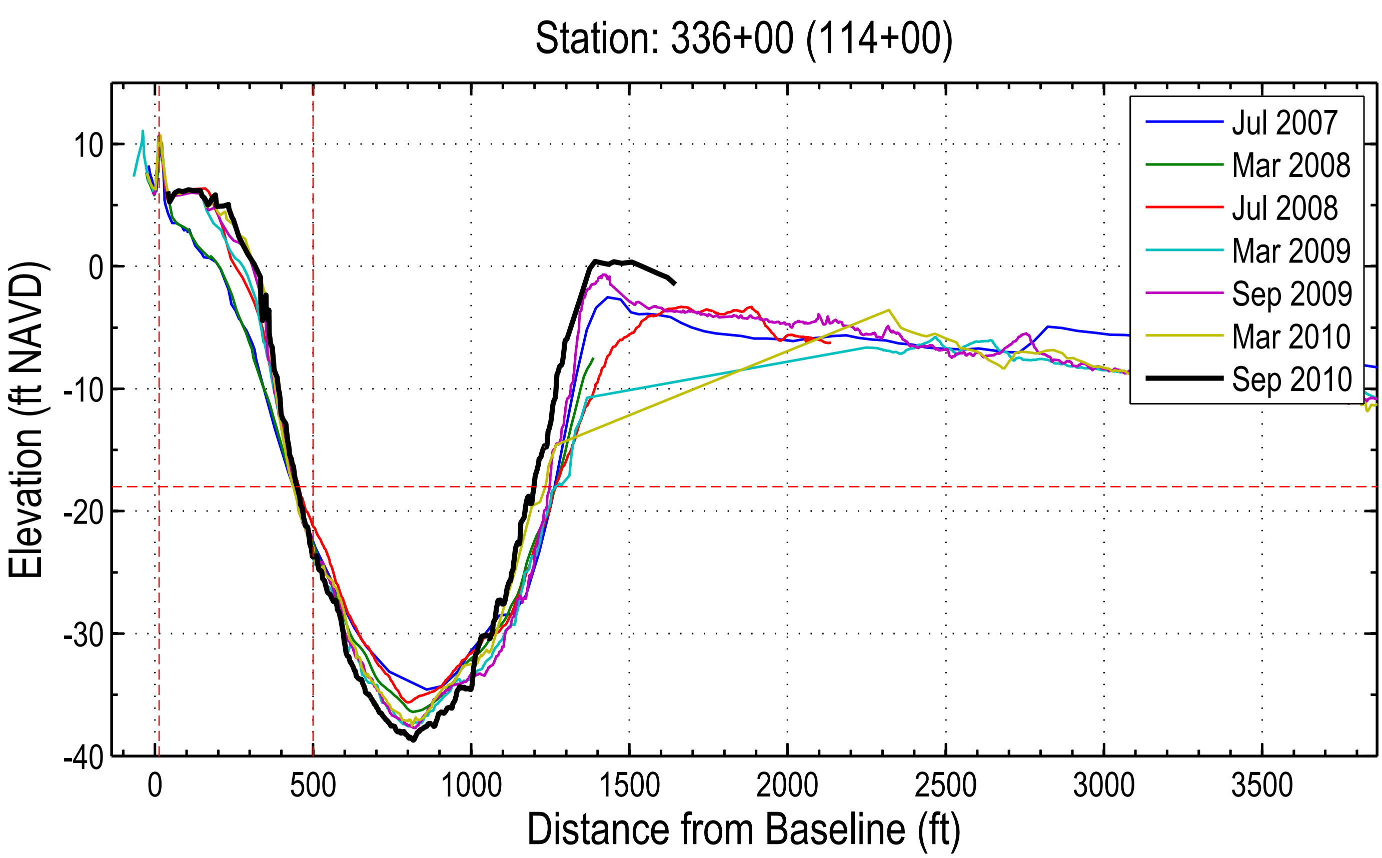
Station: 334+00 (112+00) 17TH HOLE - BRC9
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900



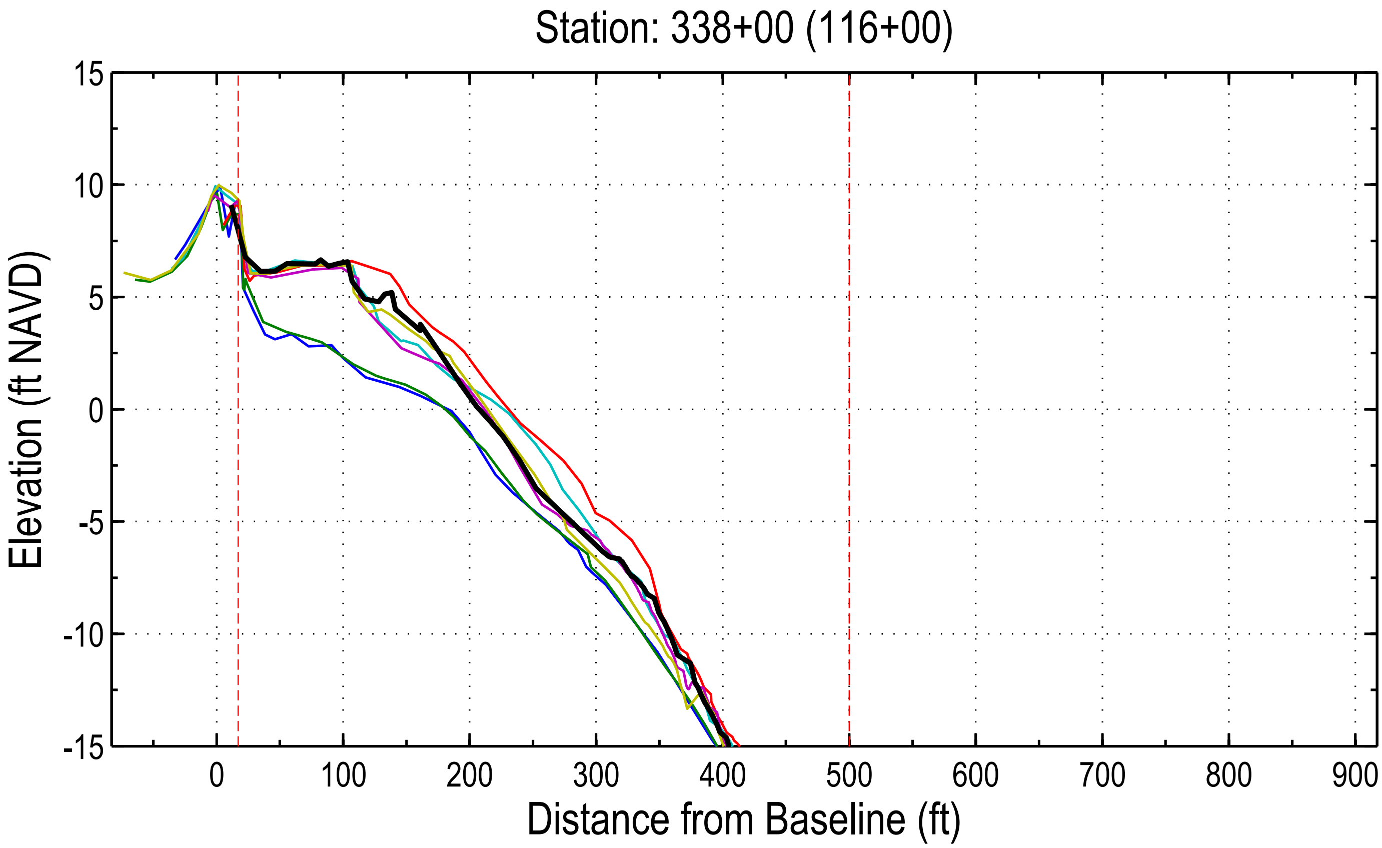
Station: 334+00 (112+00) 17TH HOLE - BRC9
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500



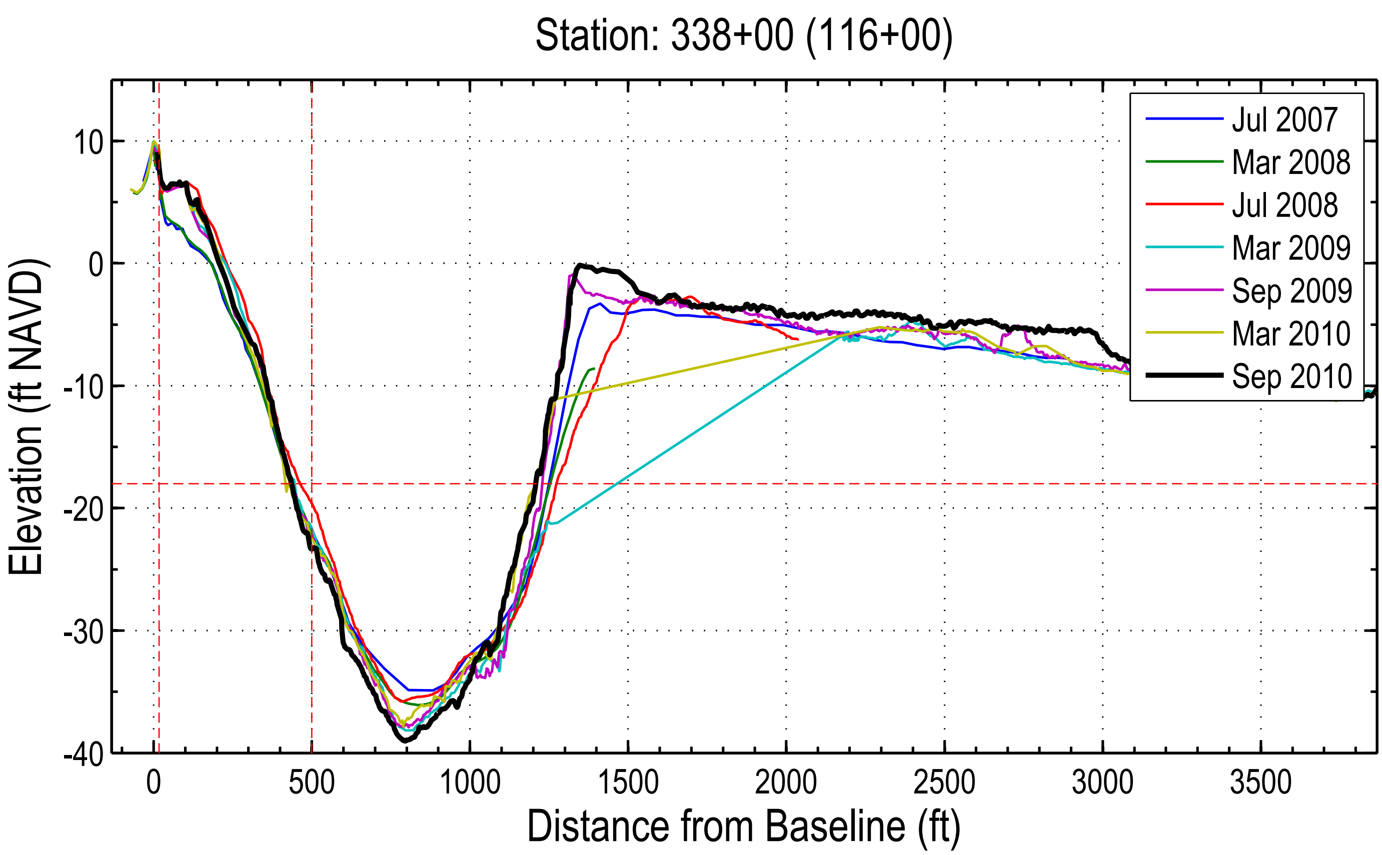
Station: 336+00 (114+00)
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900
Distance from Baseline (ft)



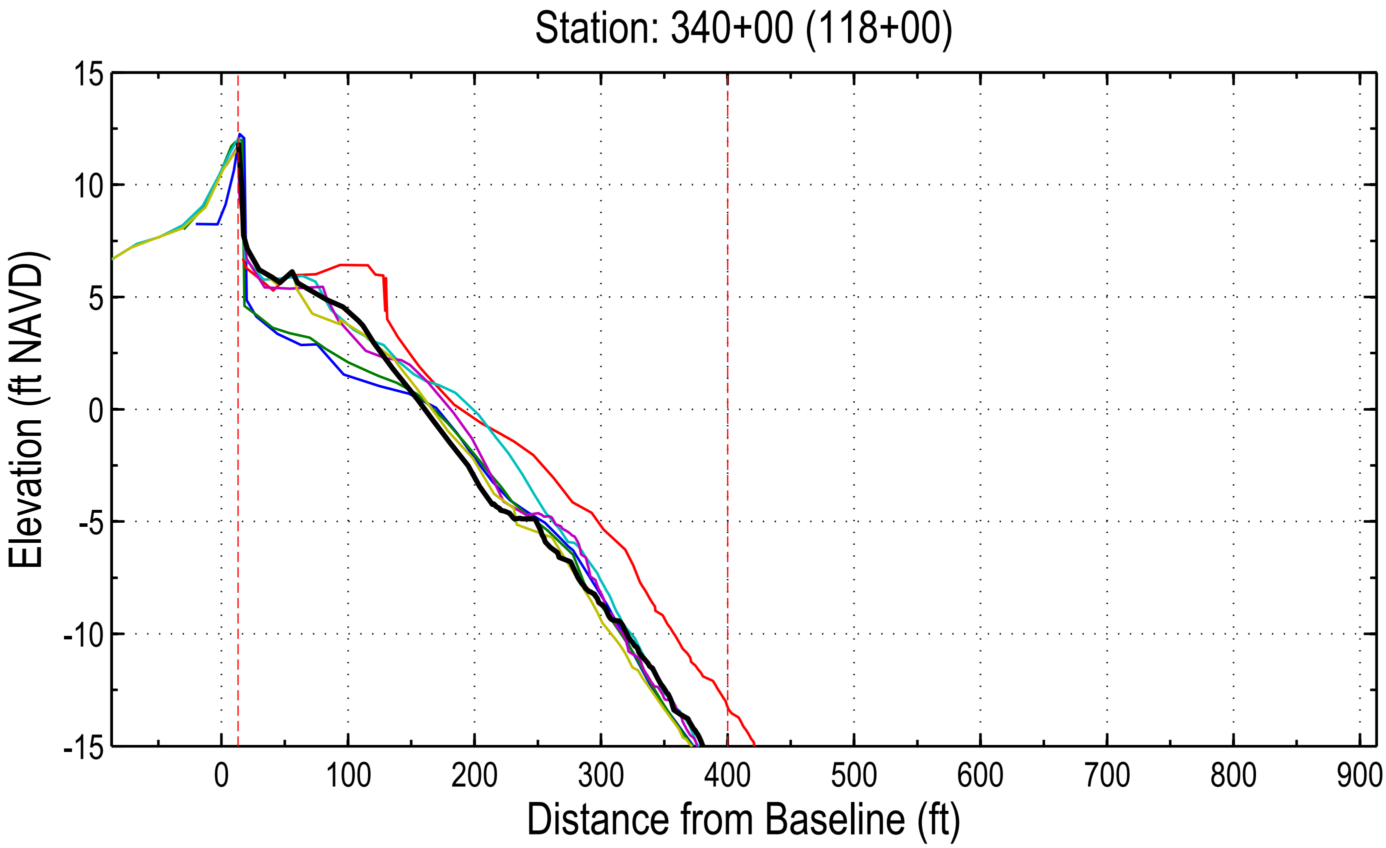
Station: 336+00 (114+00)
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

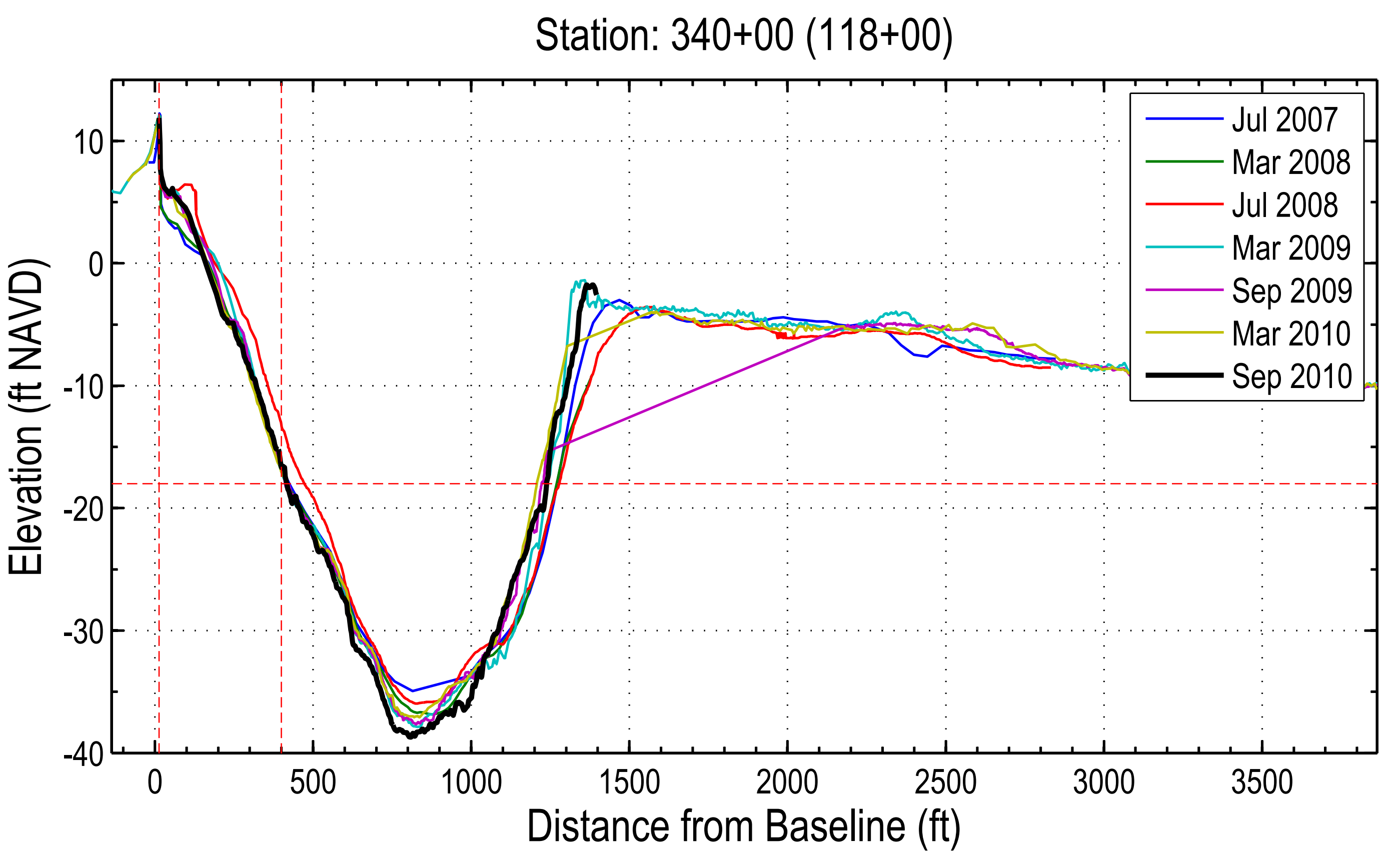


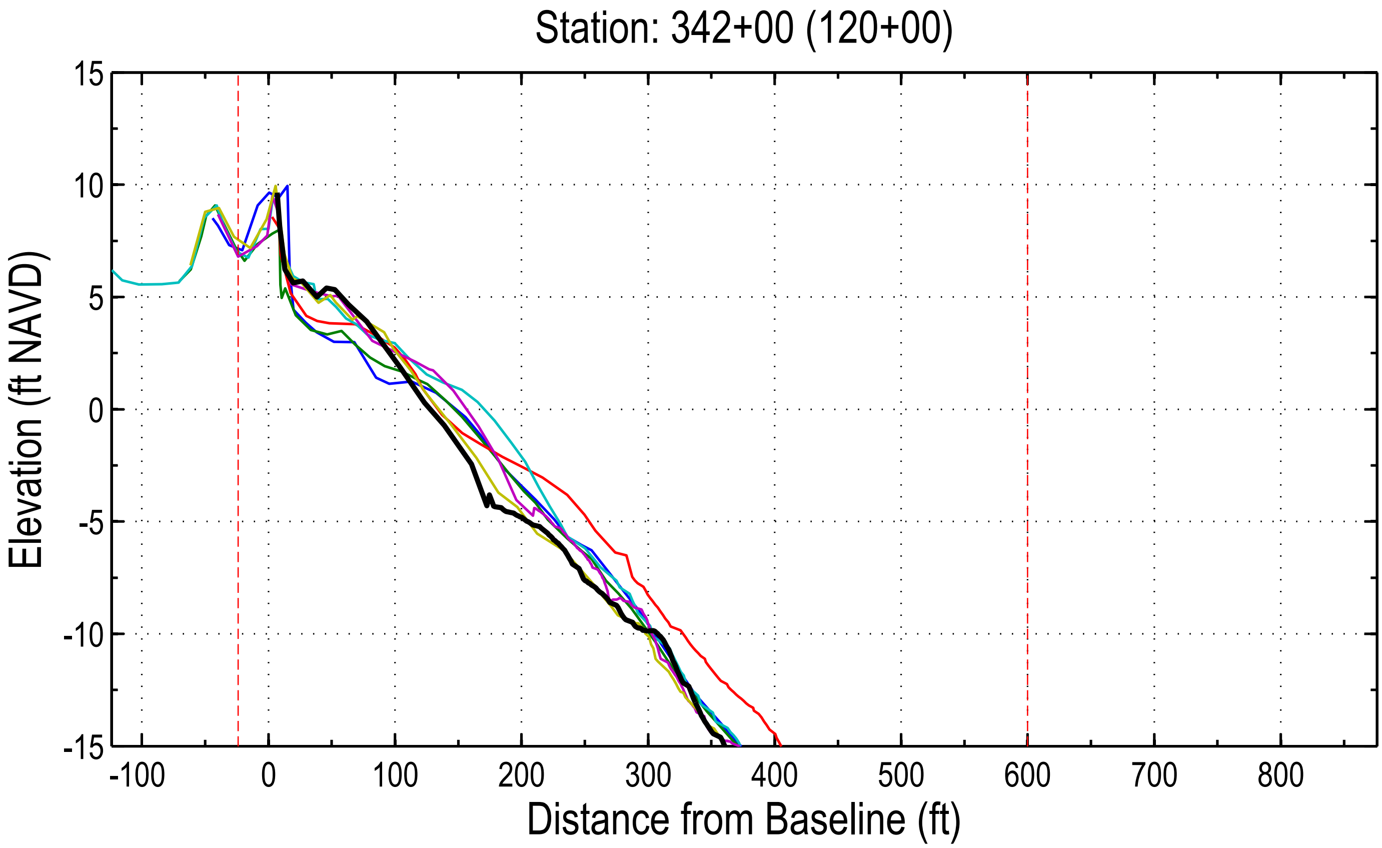
Station: 338+00 (116+00)
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900
Distance from Baseline (ft)



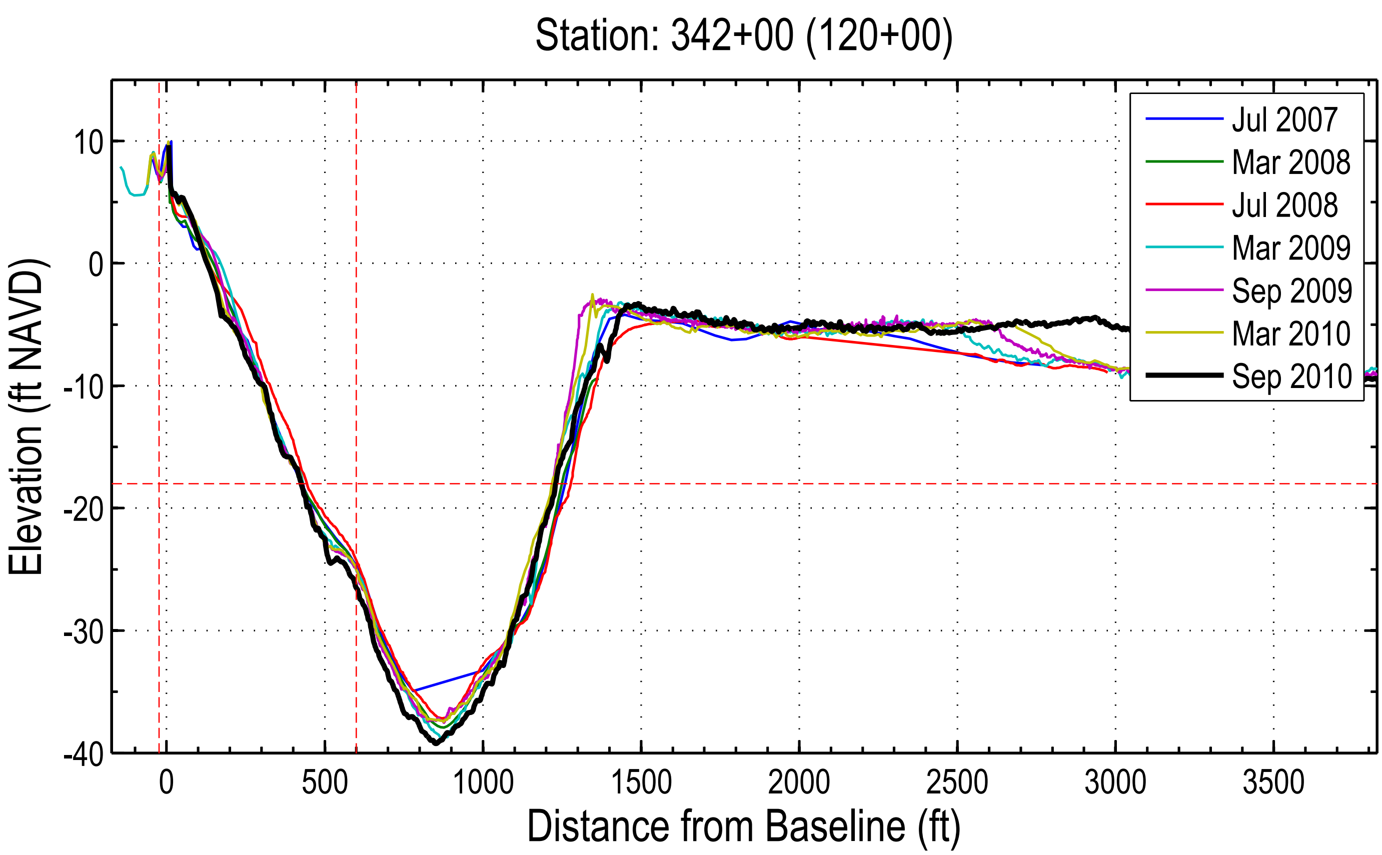
Station: 338+00 (116+00)
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 340+00 (118+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900

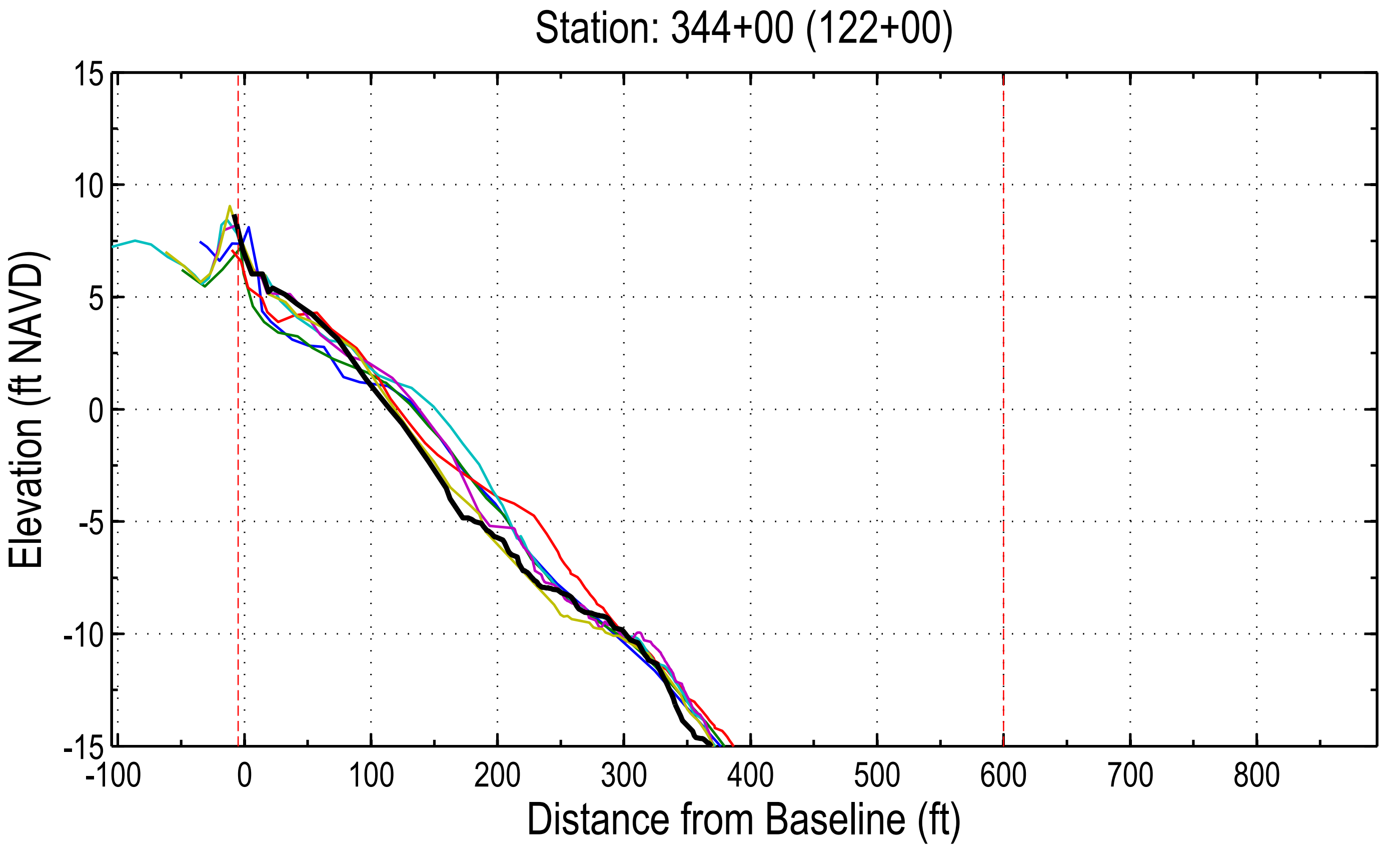

Station: 340+00 (118+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



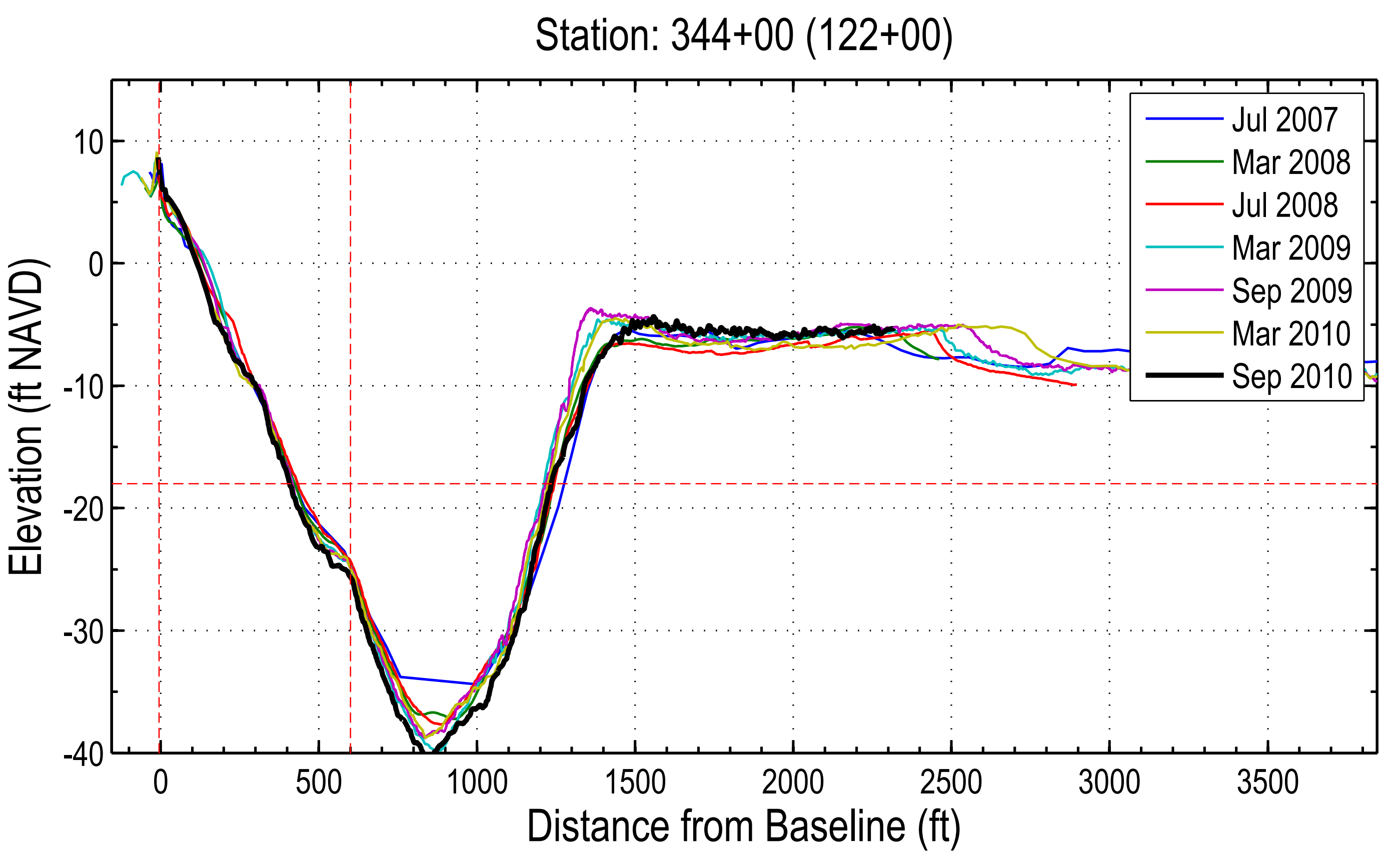
Station: 342+00 (120+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800



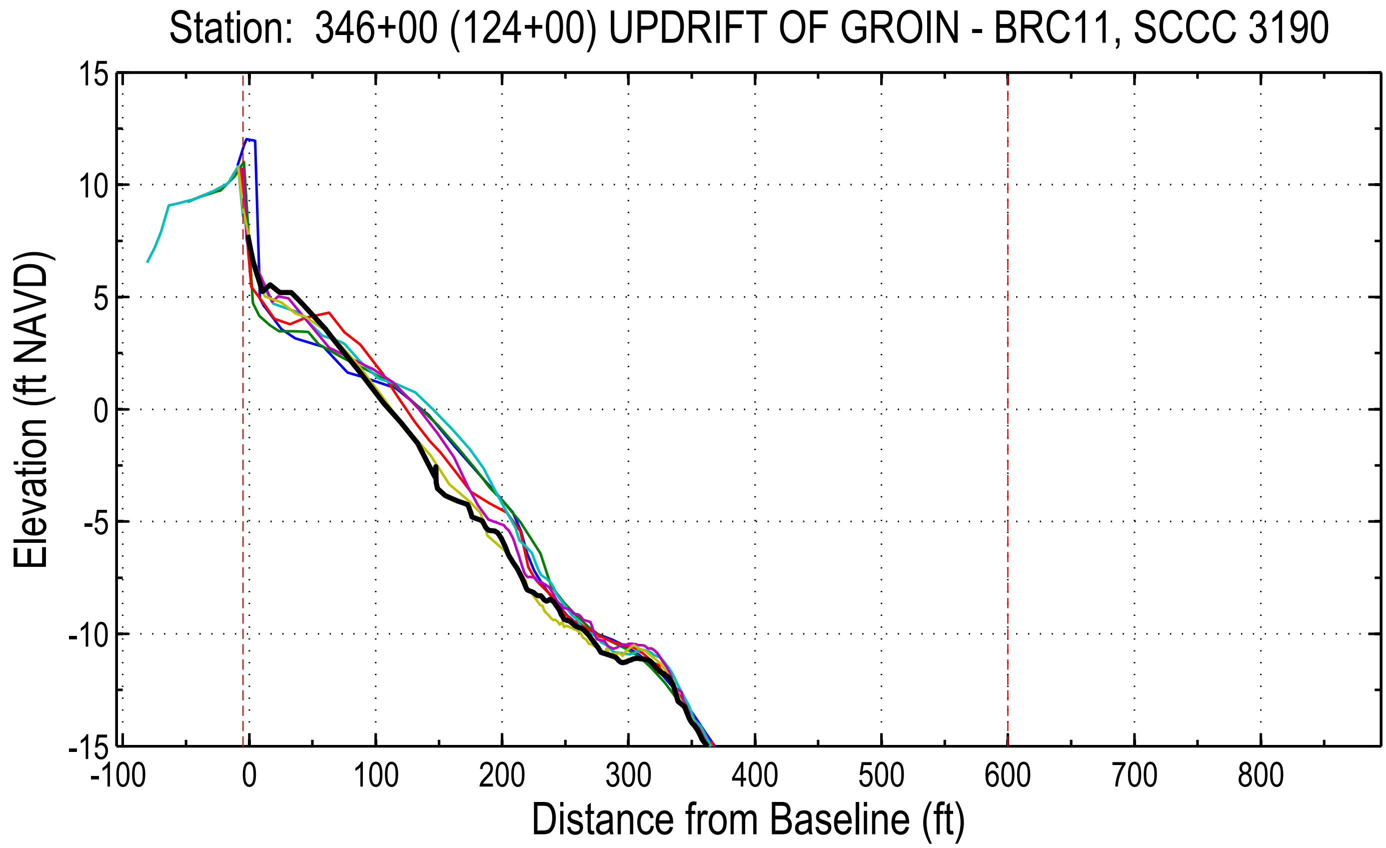
Station: 342+00 (120+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

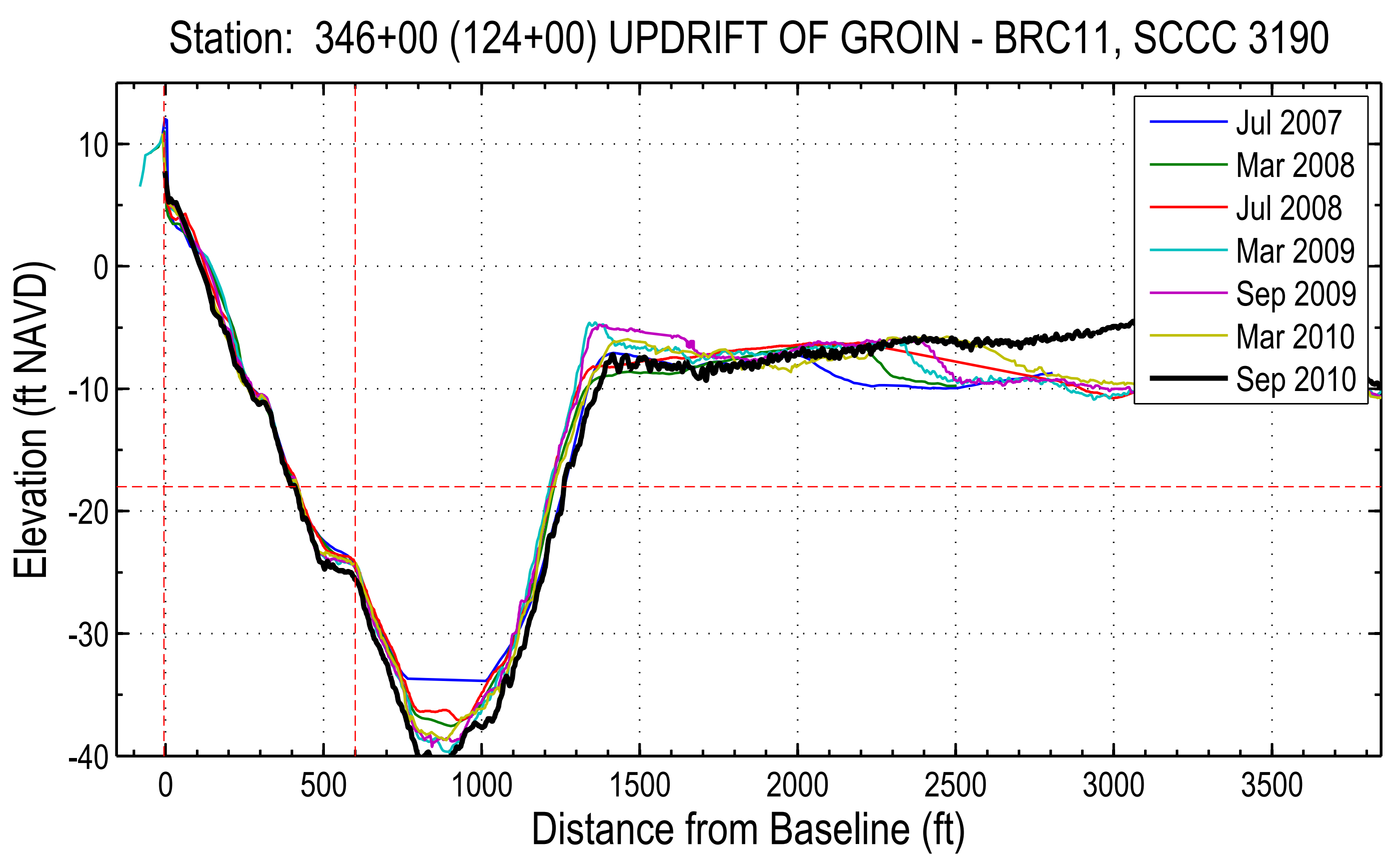


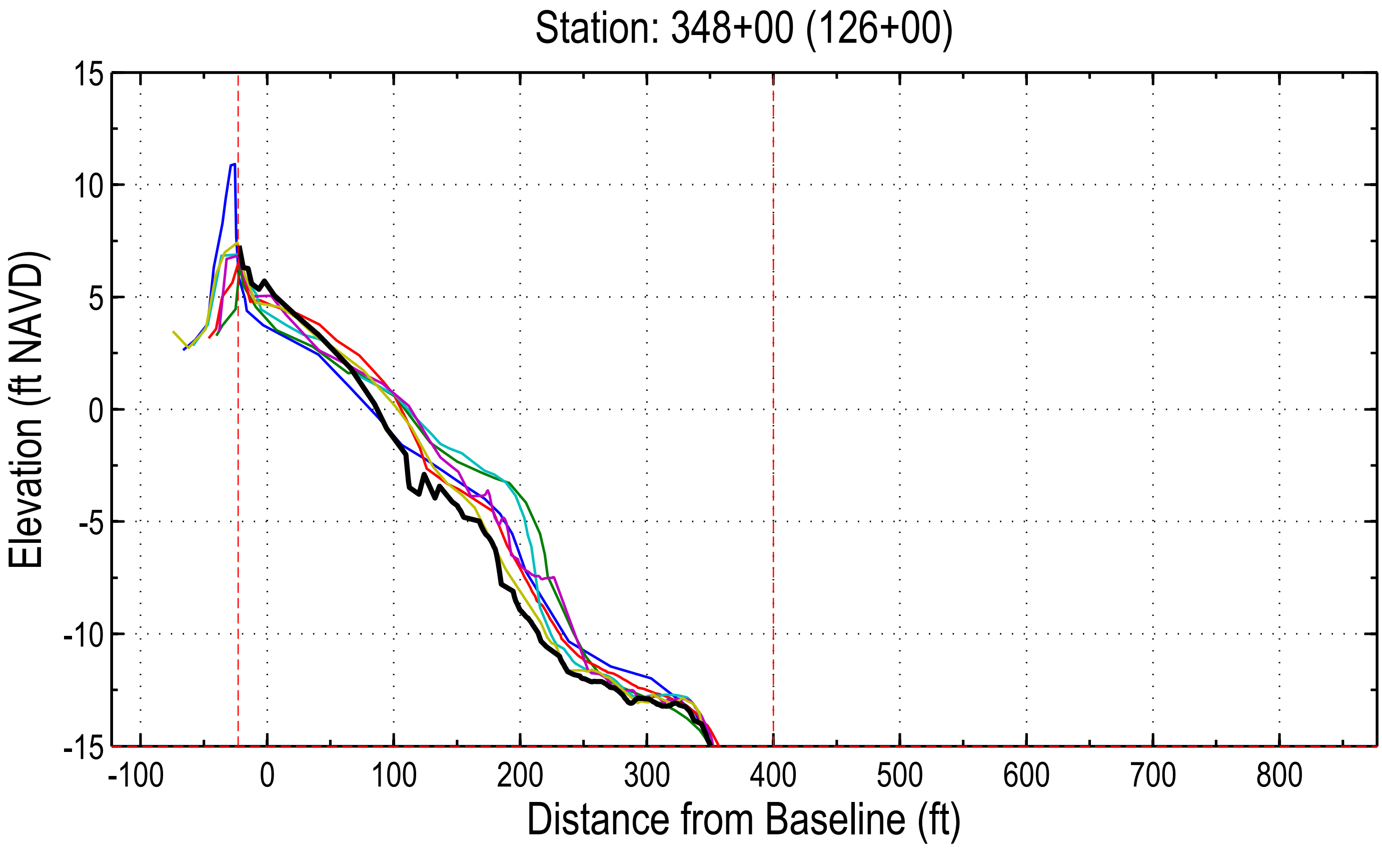
Station: 344+00 (122+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800

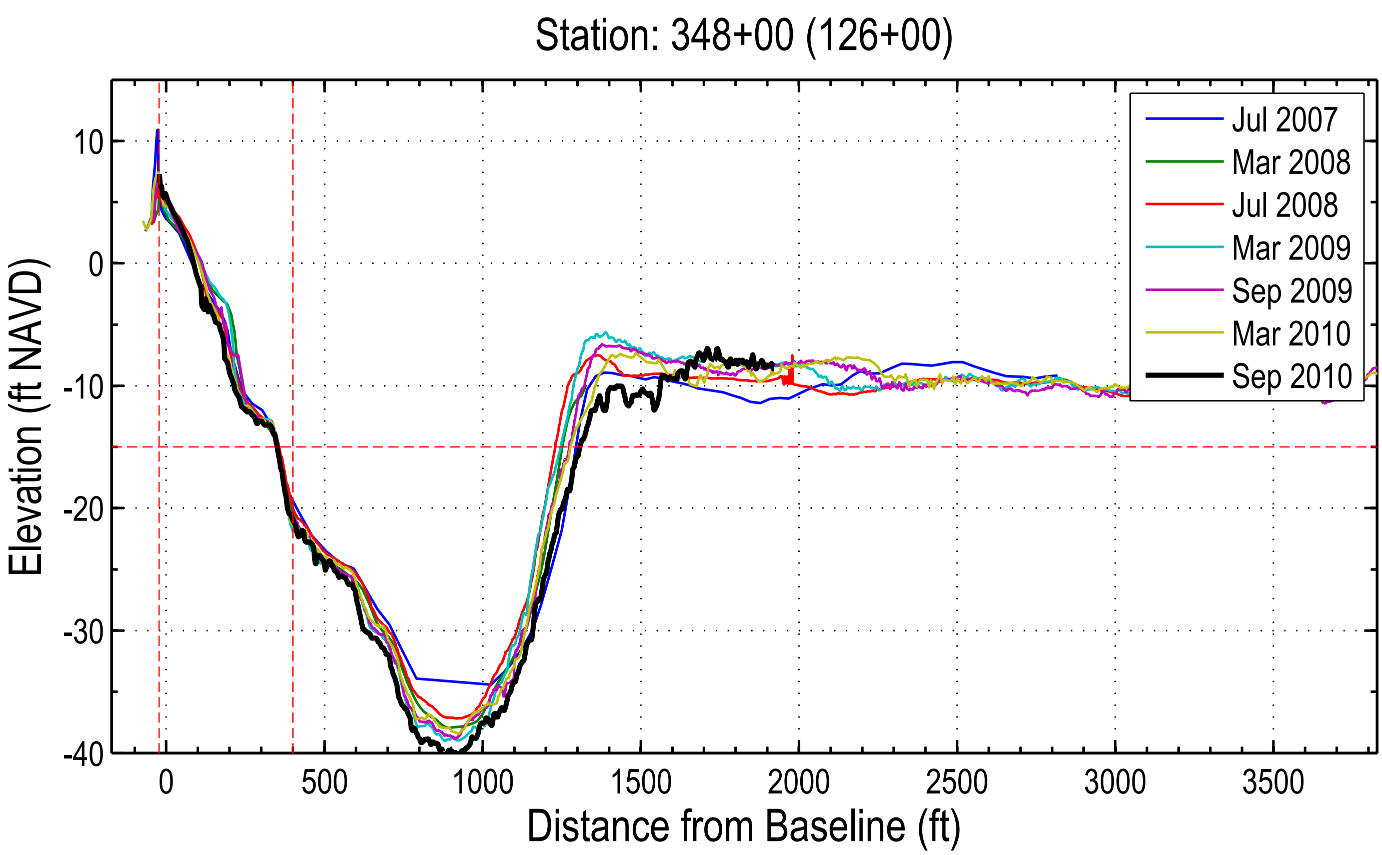


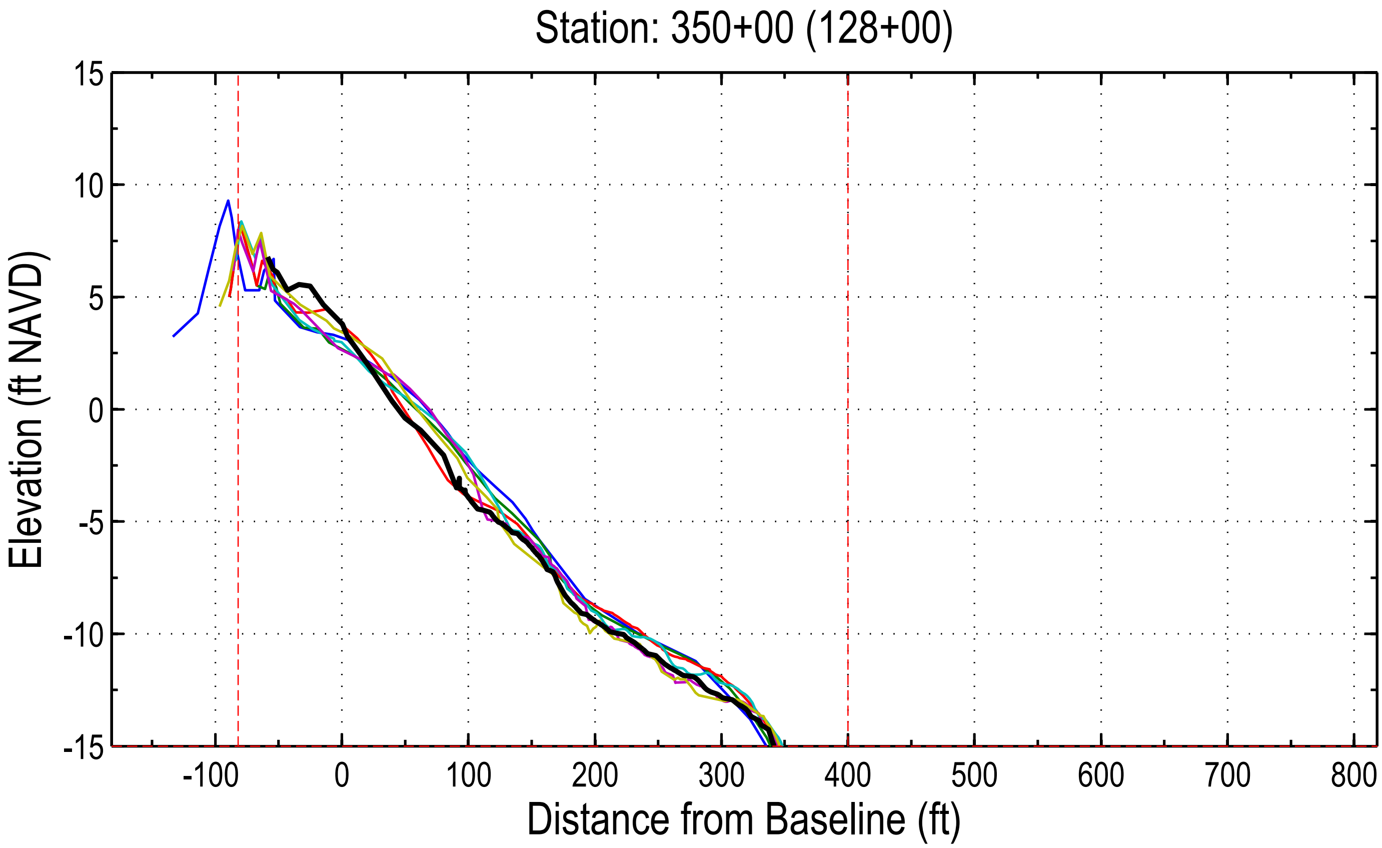
Station: 344+00 (122+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 346+00 (124+00) UPDRIFT OF GROIN - BRC11, SCCC 3190
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800


Station: 346+00 (124+00) UPDRIFT OF GROIN - BRC11, SCCC 3190
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500


Station: 348+00 (126+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800


Station: 348+00 (126+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 350+00 (128+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
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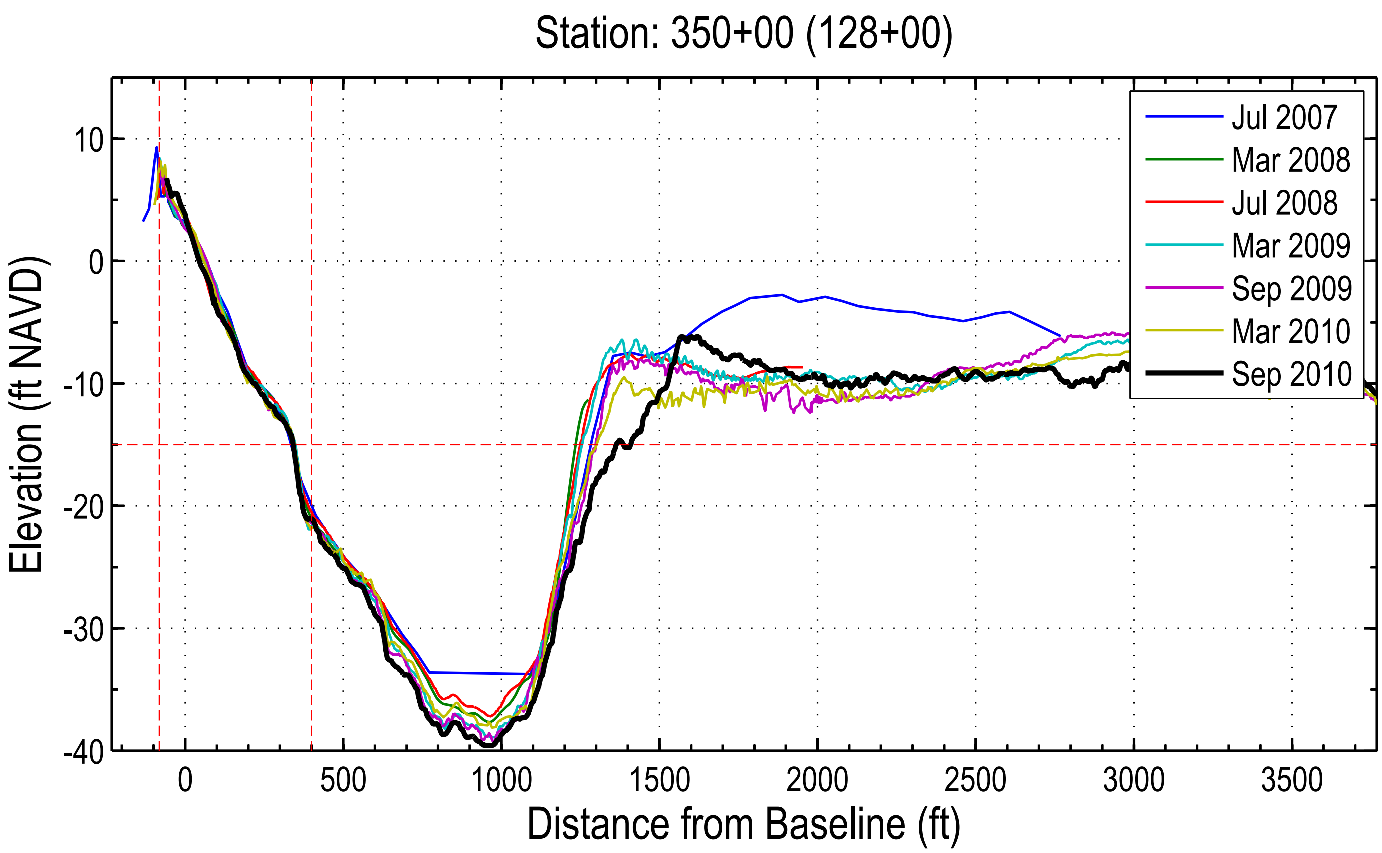
200
300
400
500
600
700
800


Station: 350+00 (128+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
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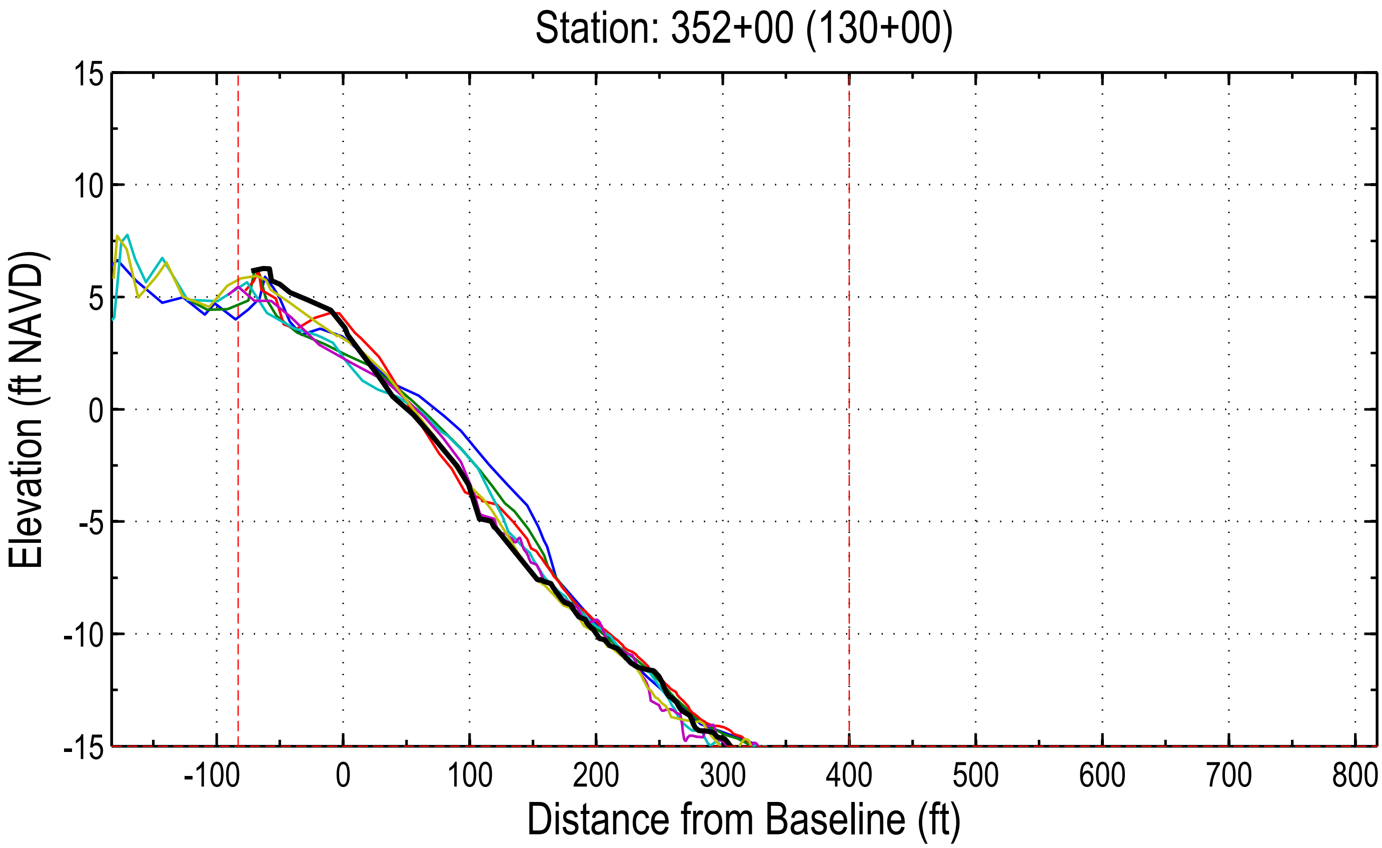
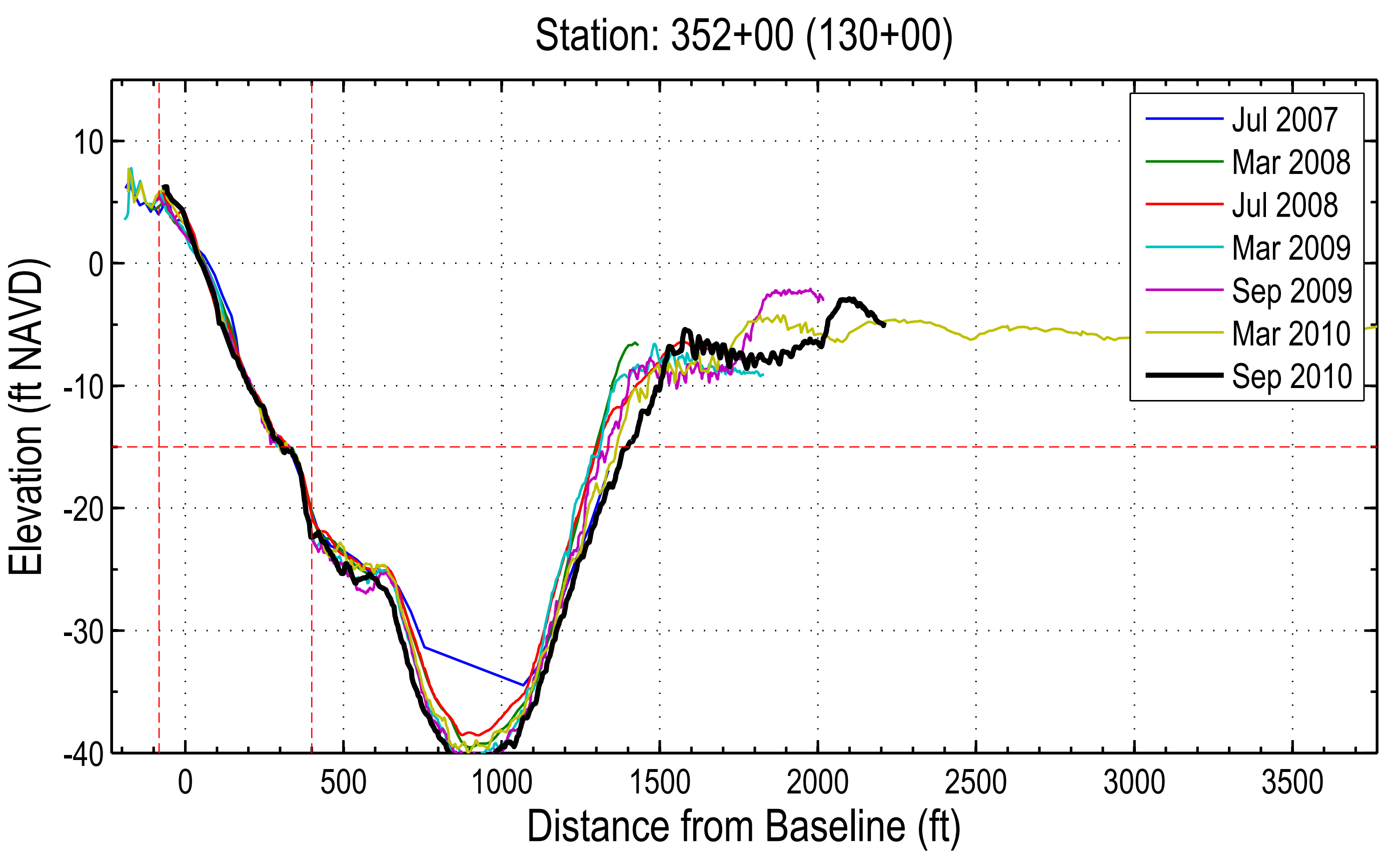
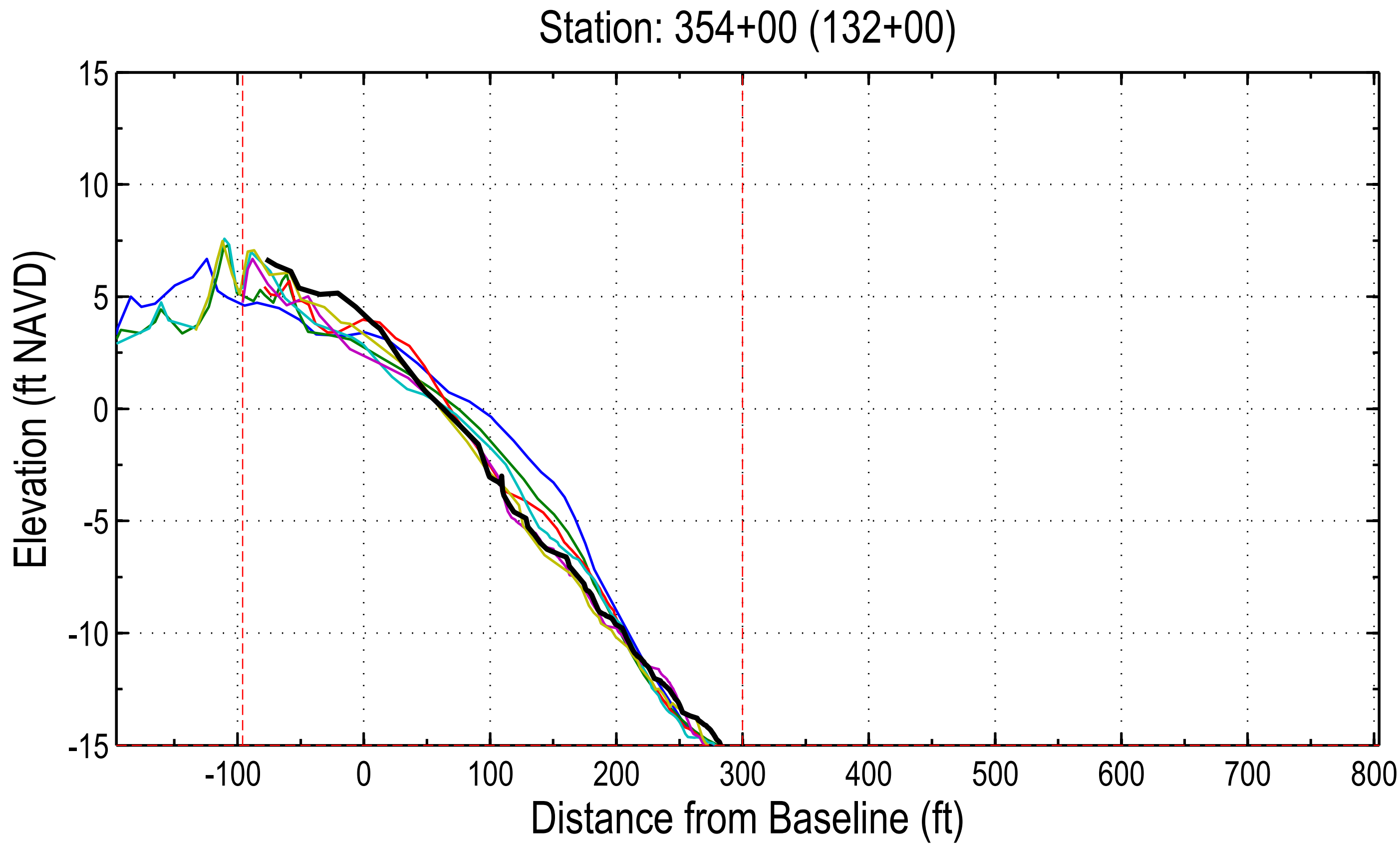
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 352+00 (130+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800


Station: 352+00 (130+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



Station: 354+00 (132+00)
Elevation (ft NAVD)
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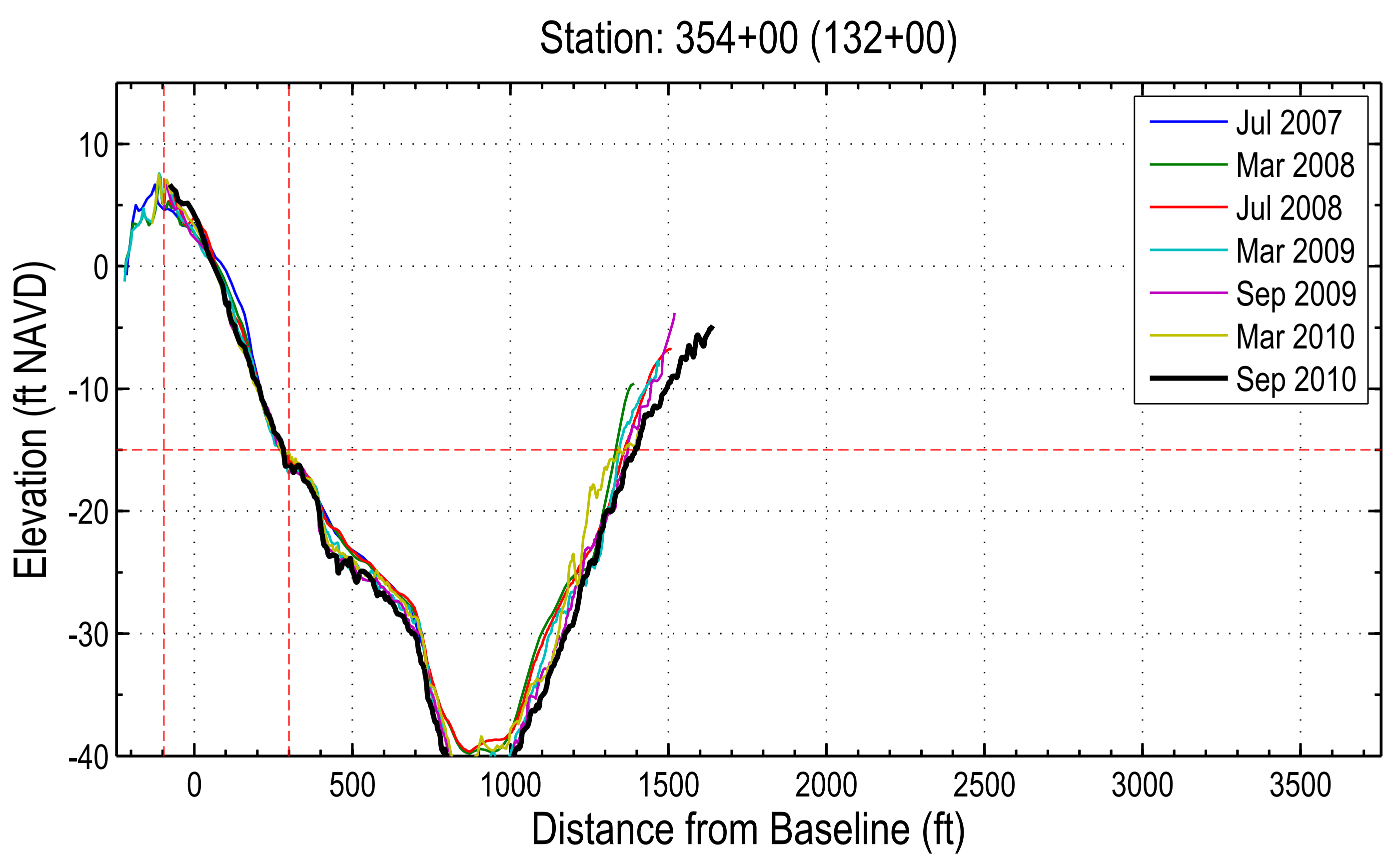
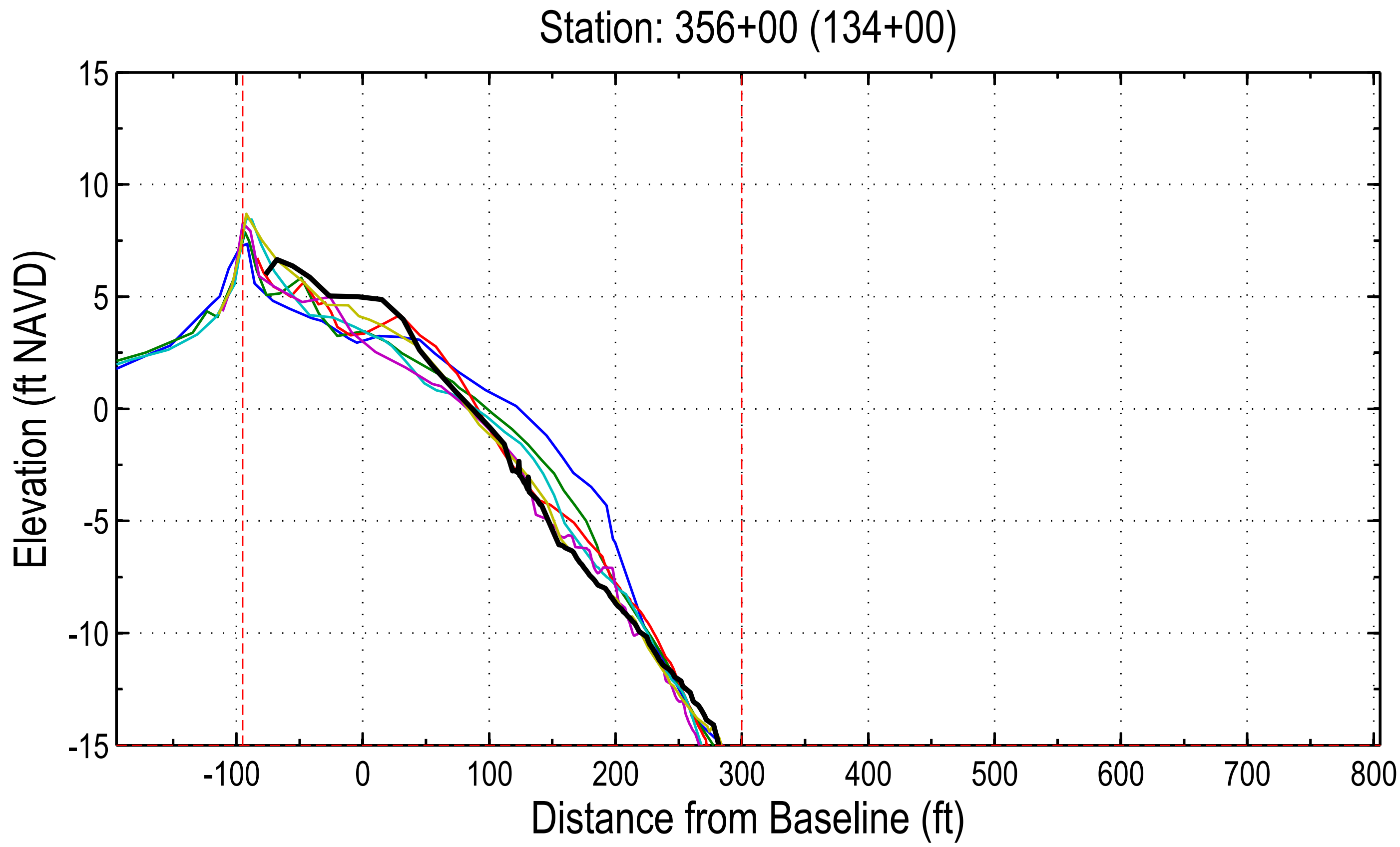
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800
Distance from Baseline (ft)



Station: 354+00 (132+00)
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



Station: 356+00 (134+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
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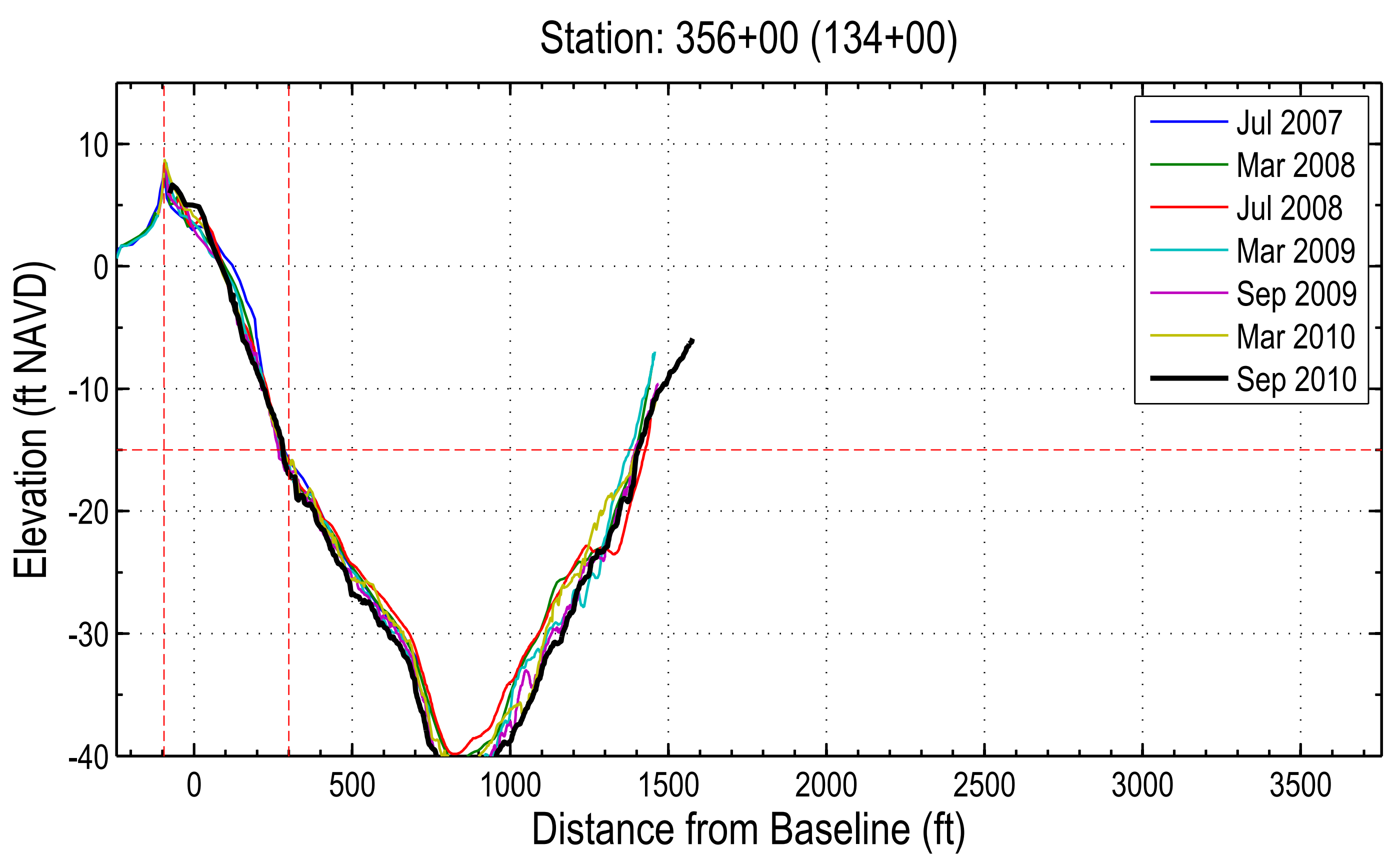
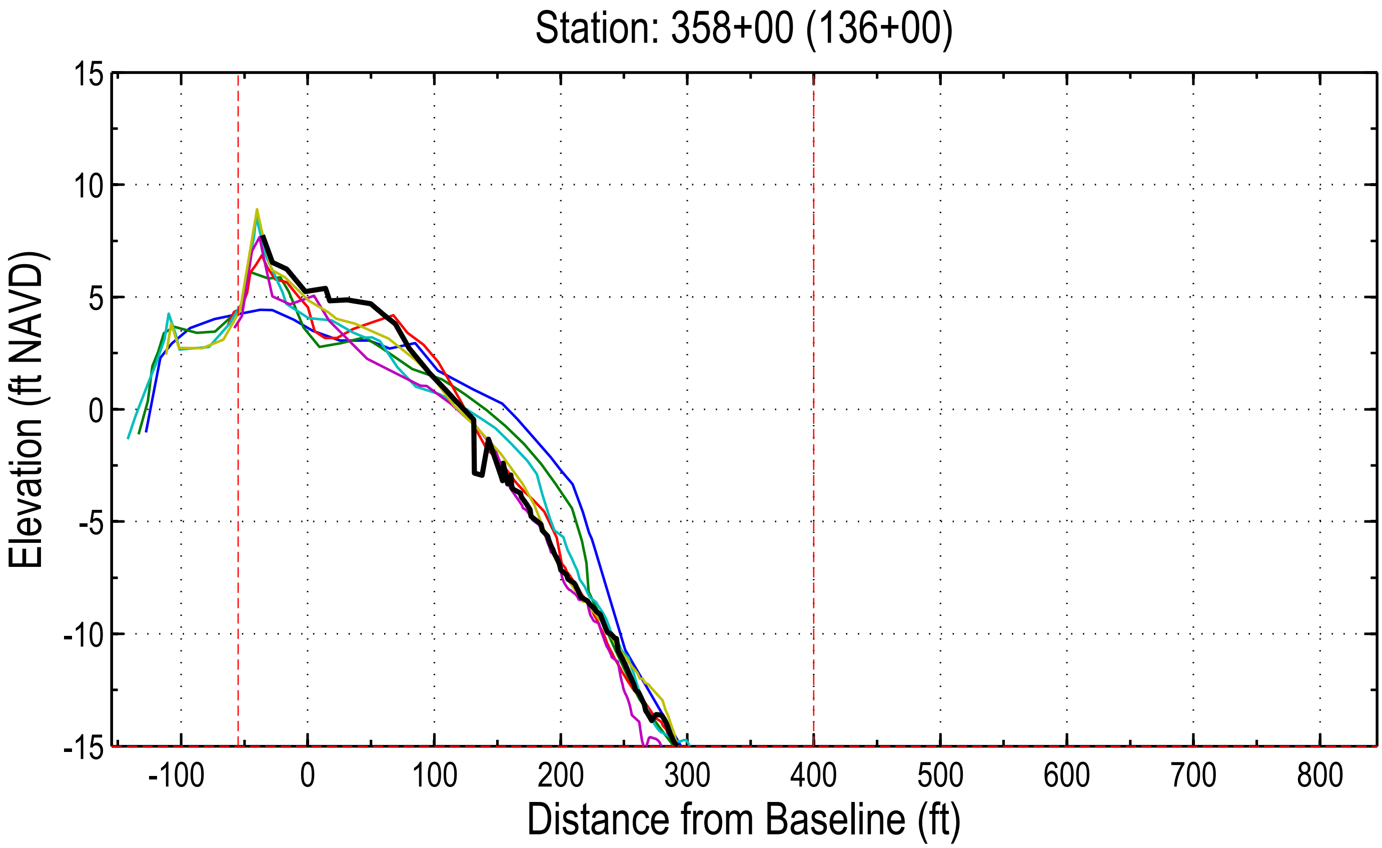
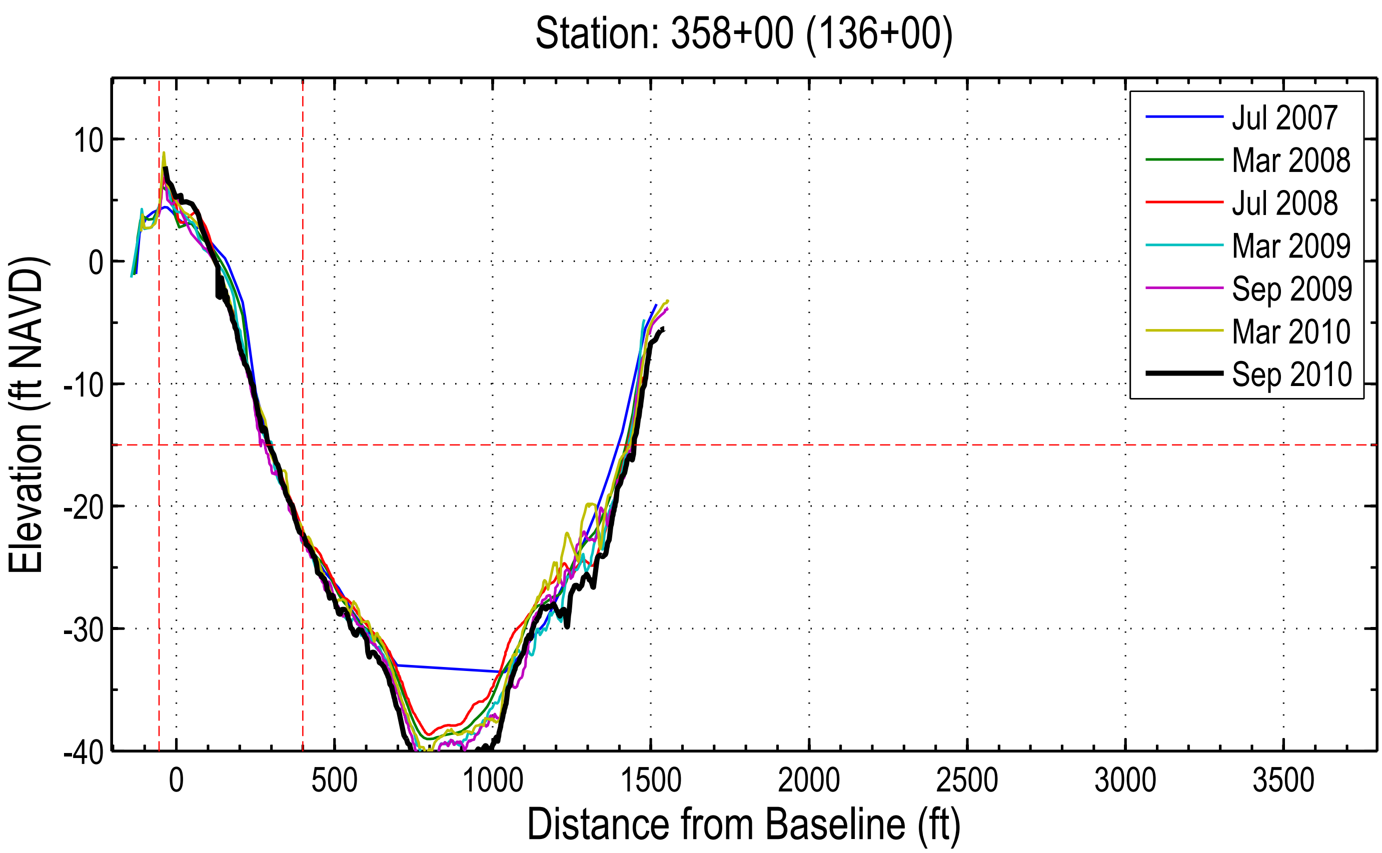
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800



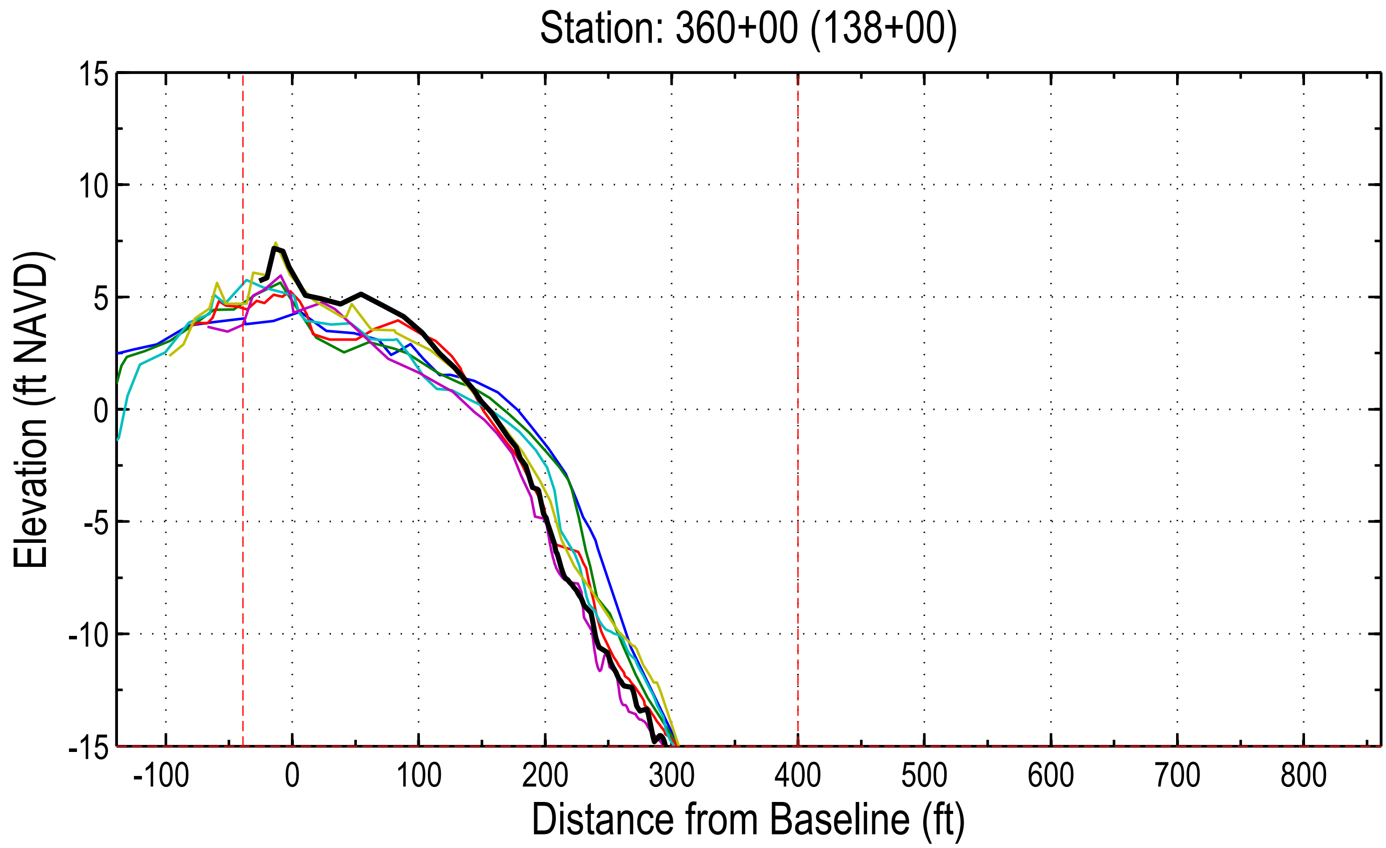
Station: 356+00 (134+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010



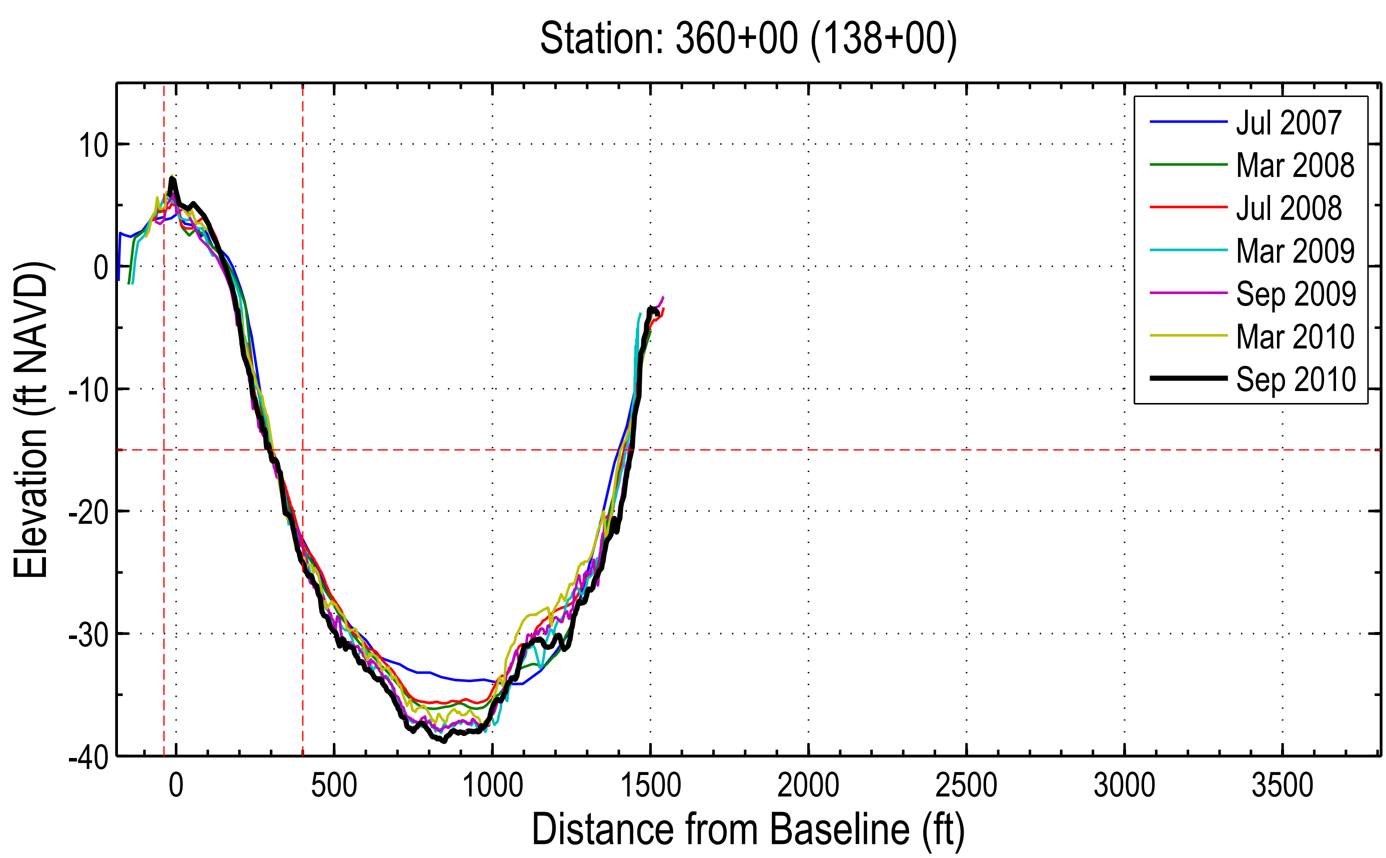
Station: 358+00 (136+00)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800
Elevation (ft NAVD)
Distance from Baseline (ft)



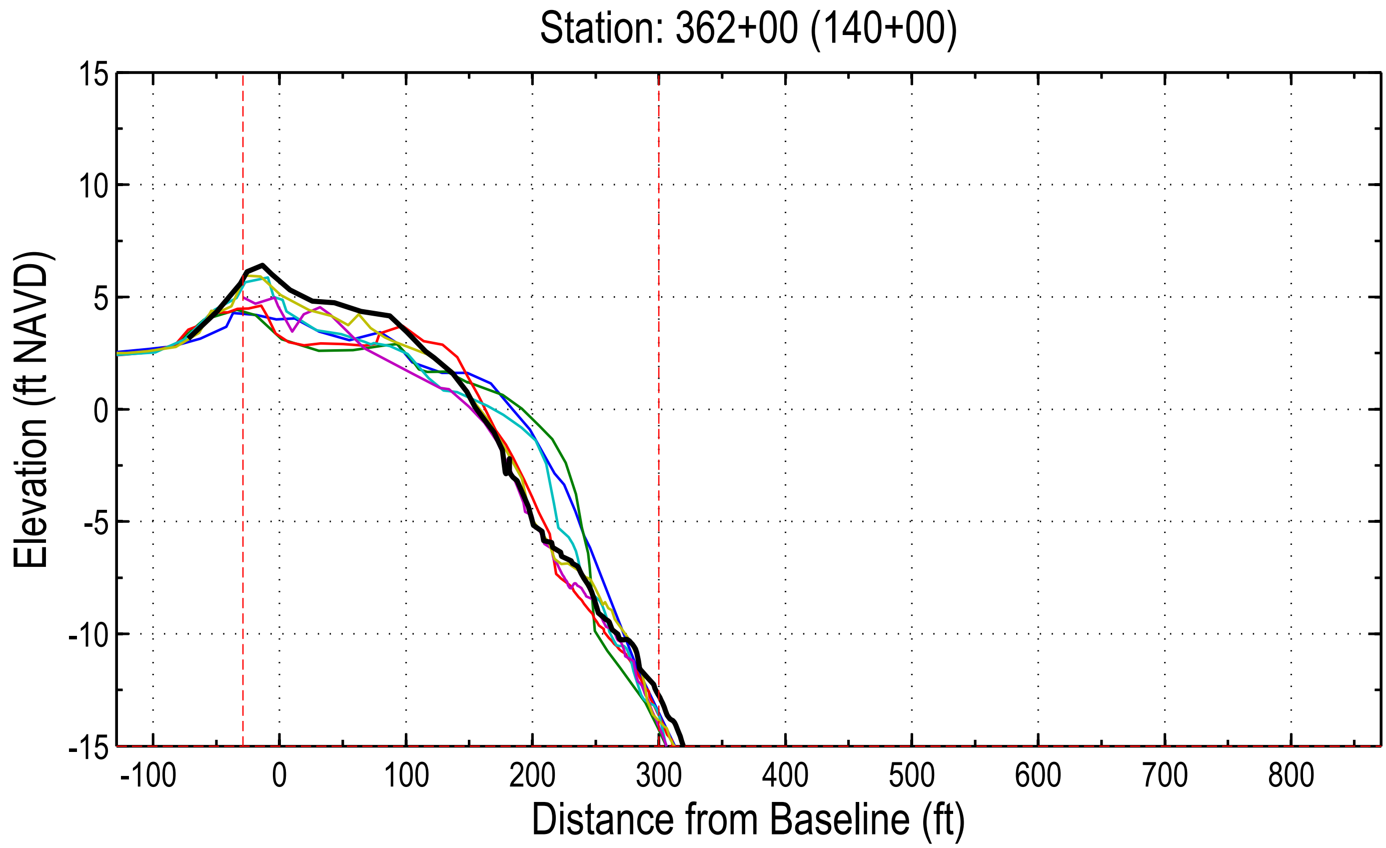
Station: 358+00 (136+00)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

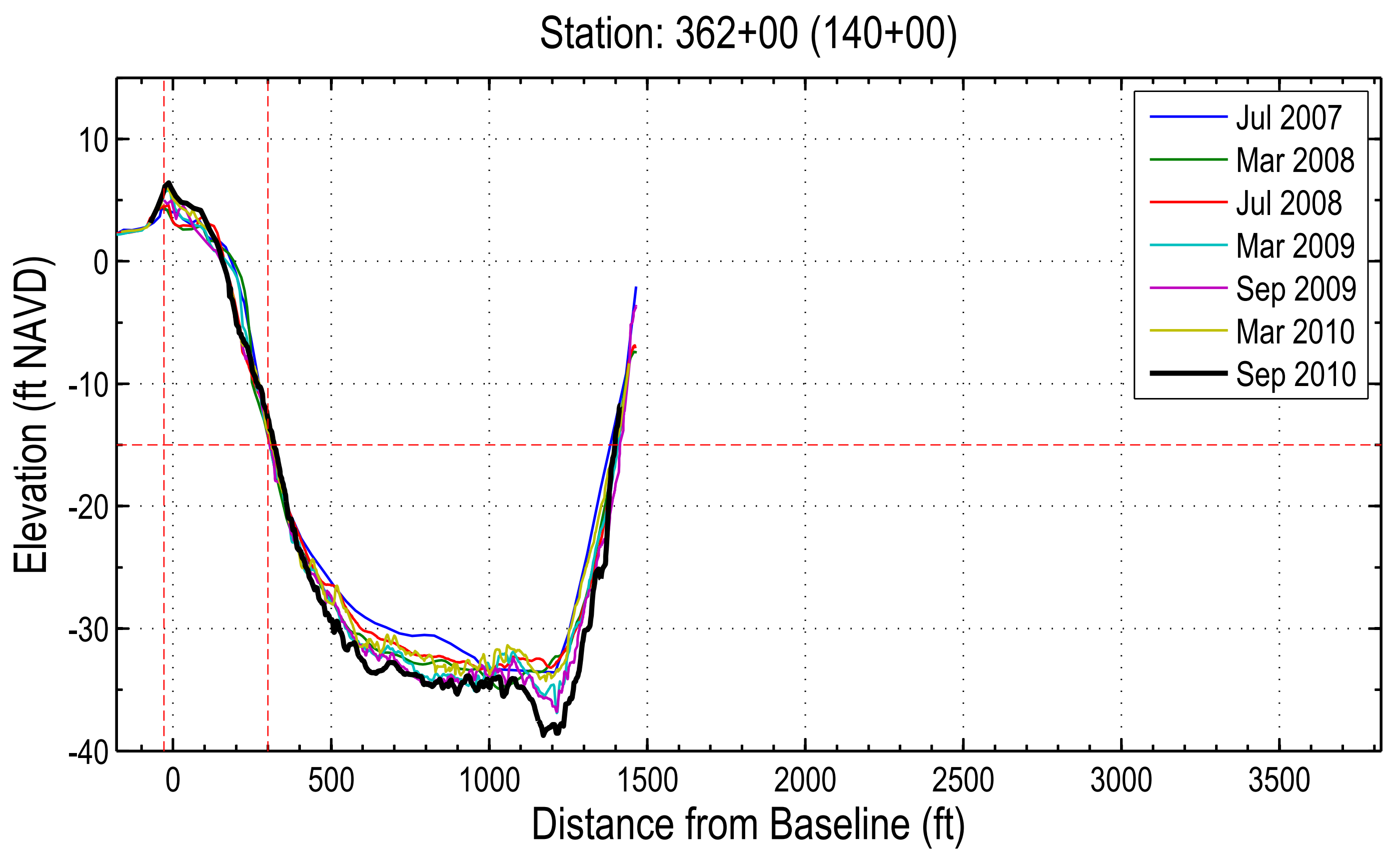


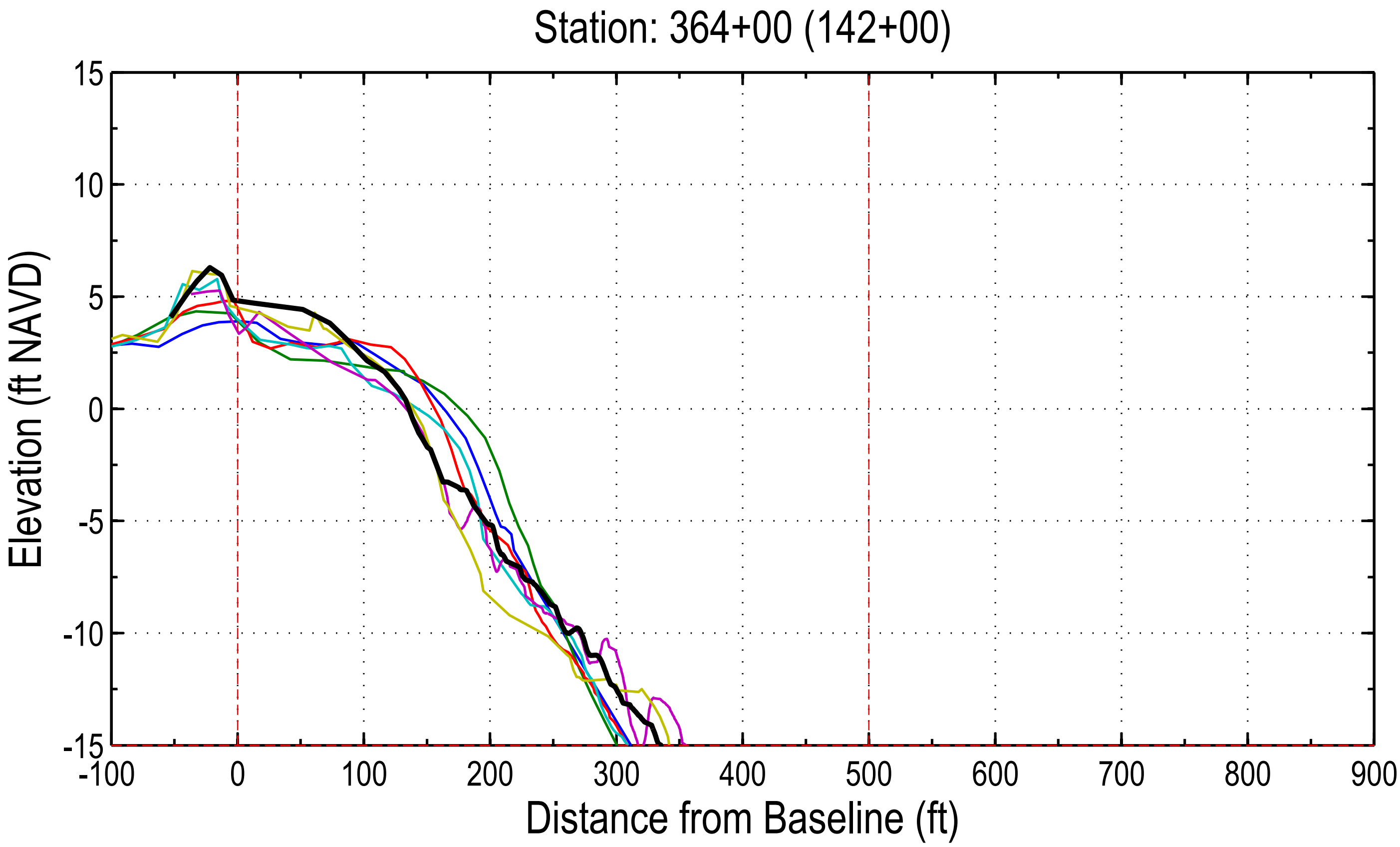
Station: 360+00 (138+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800

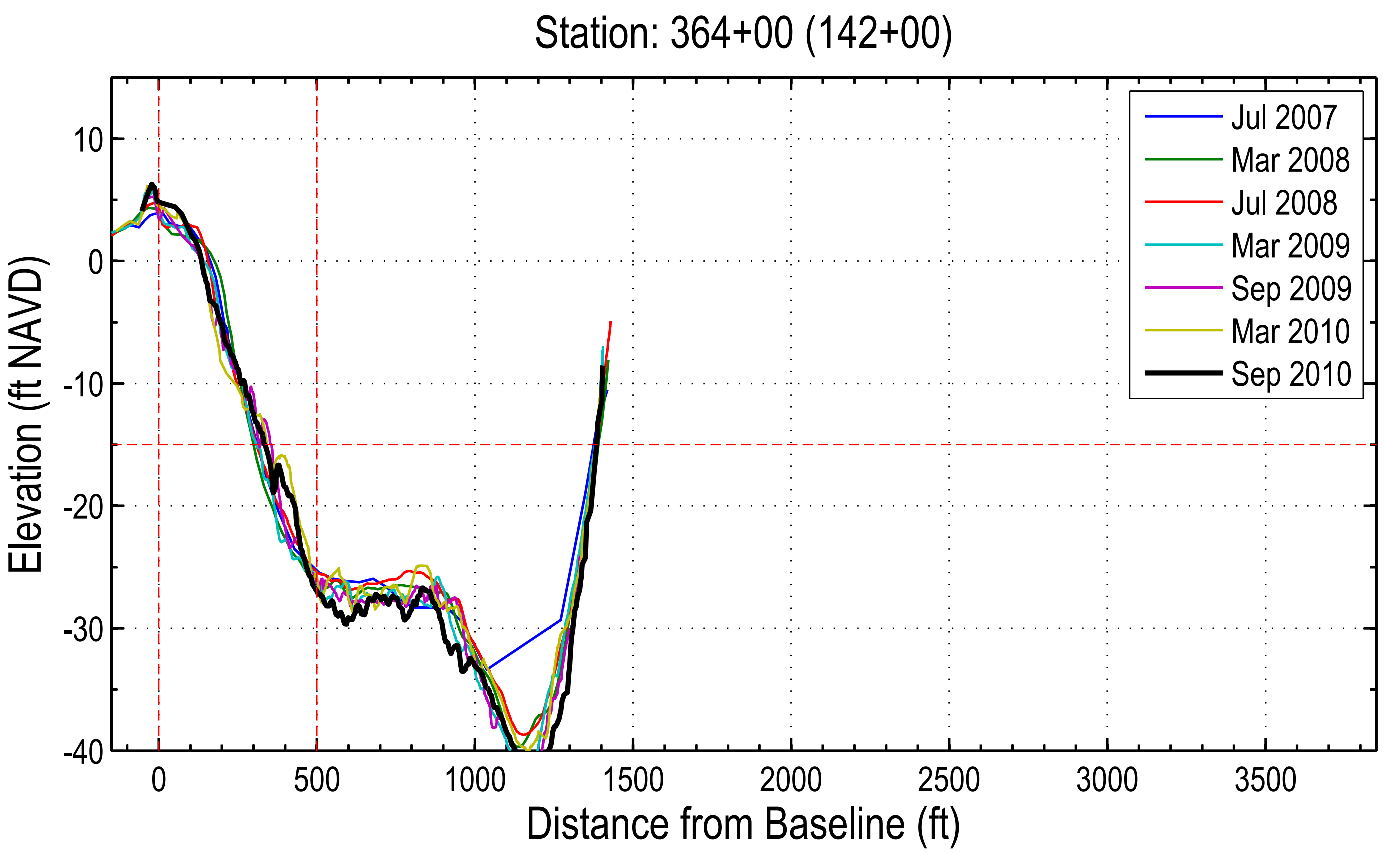


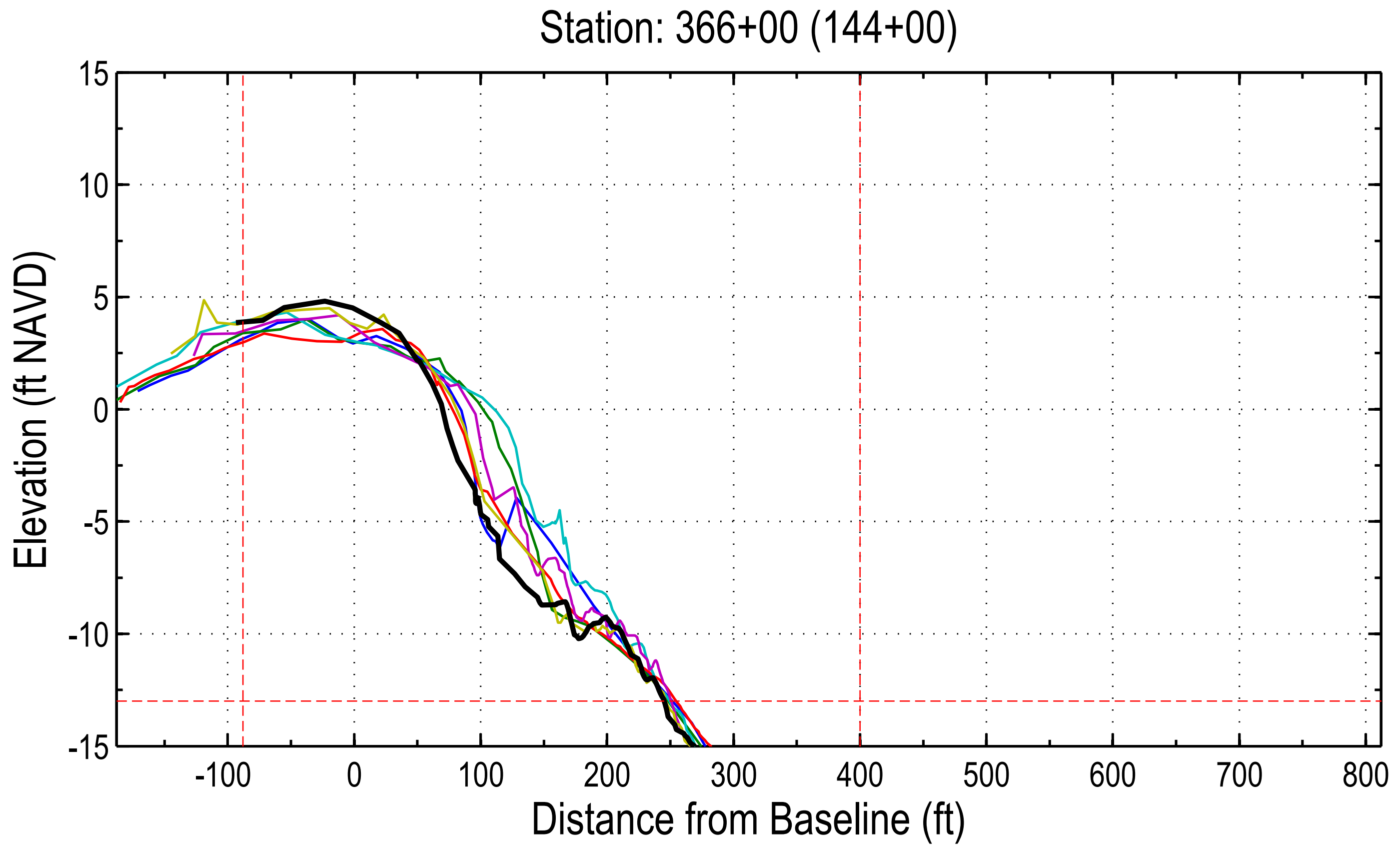
Station: 360+00 (138+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 362+00 (140+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800

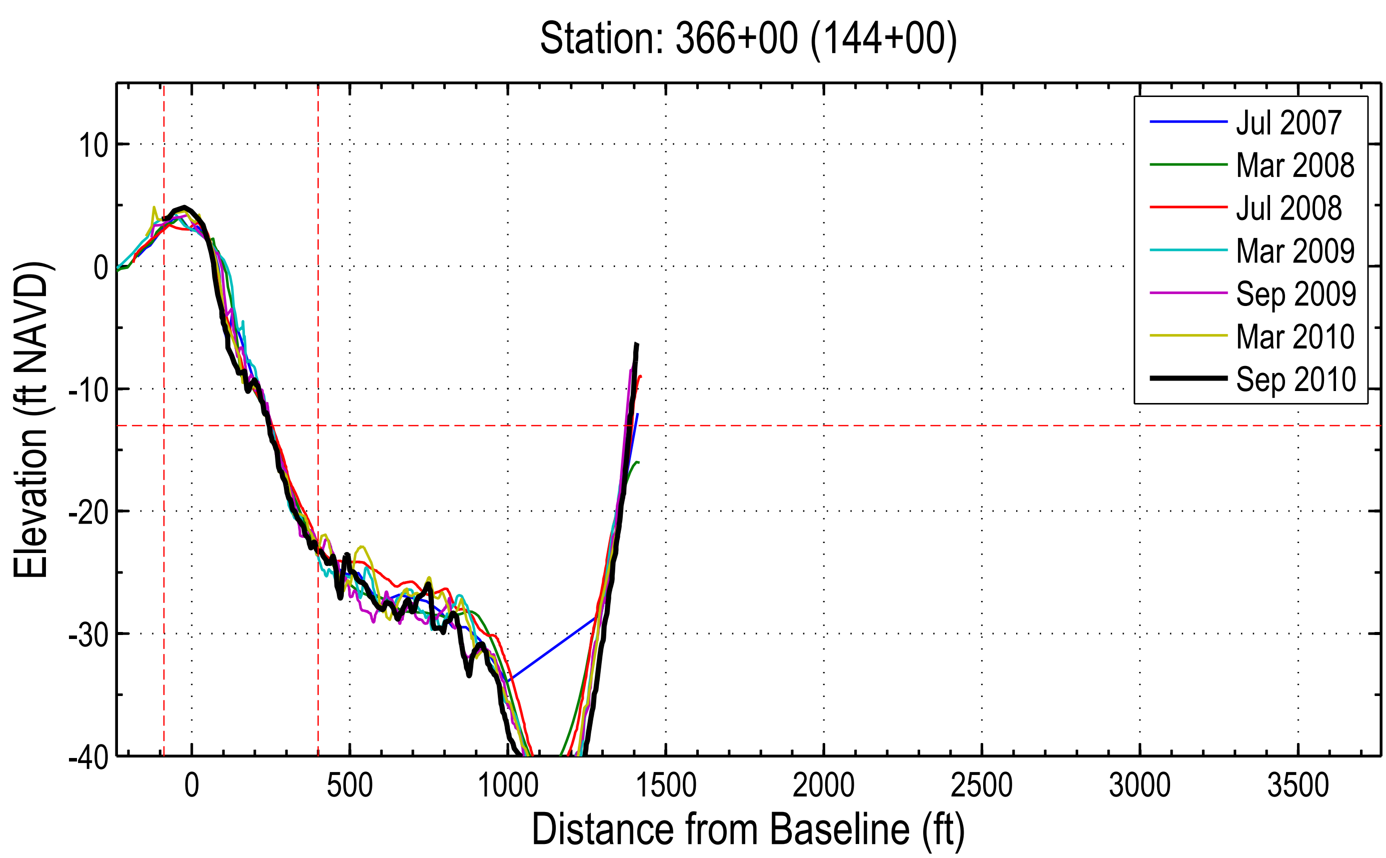

Station: 362+00 (140+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 364+00 (142+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800
900

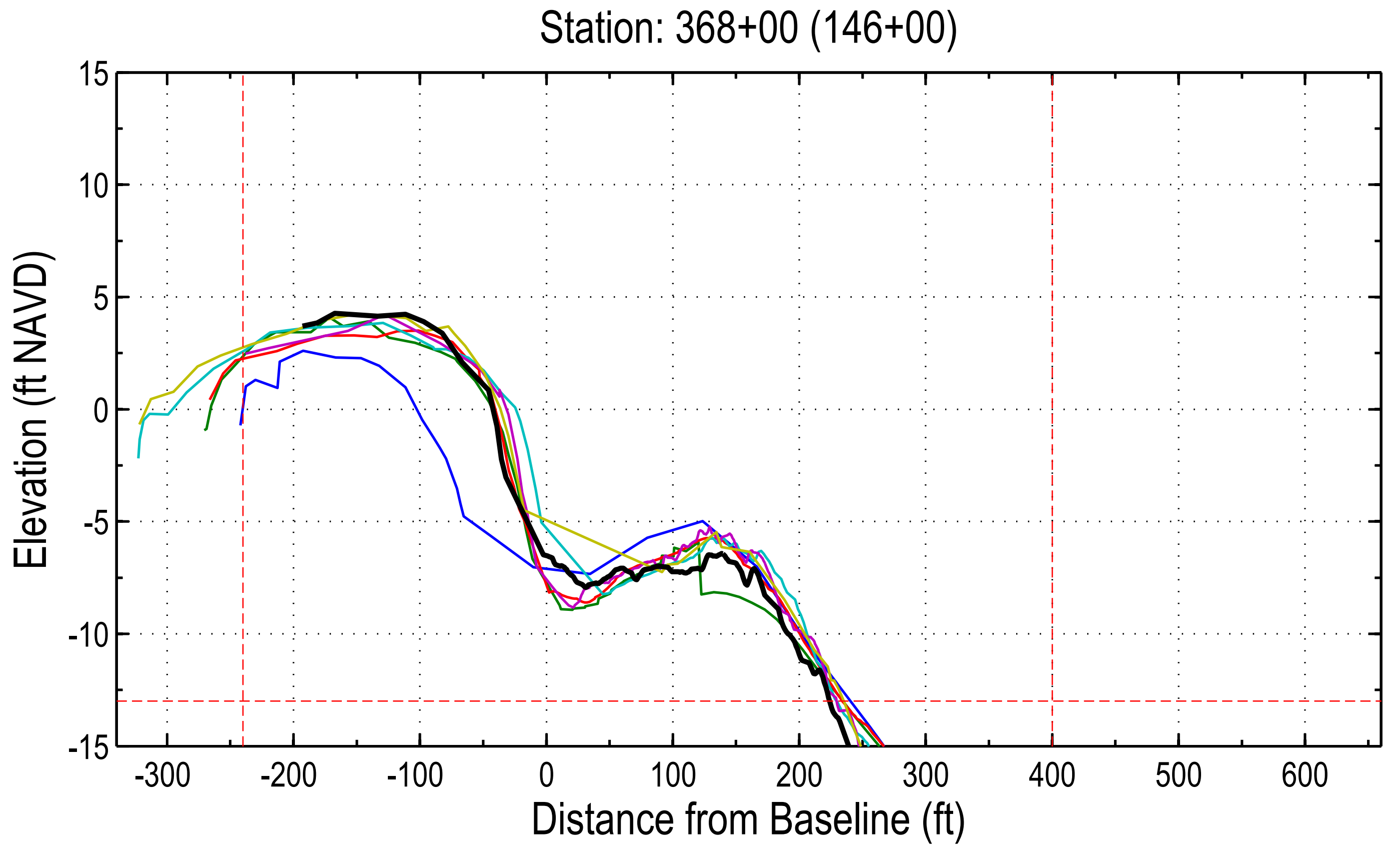

Station: 364+00 (142+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500

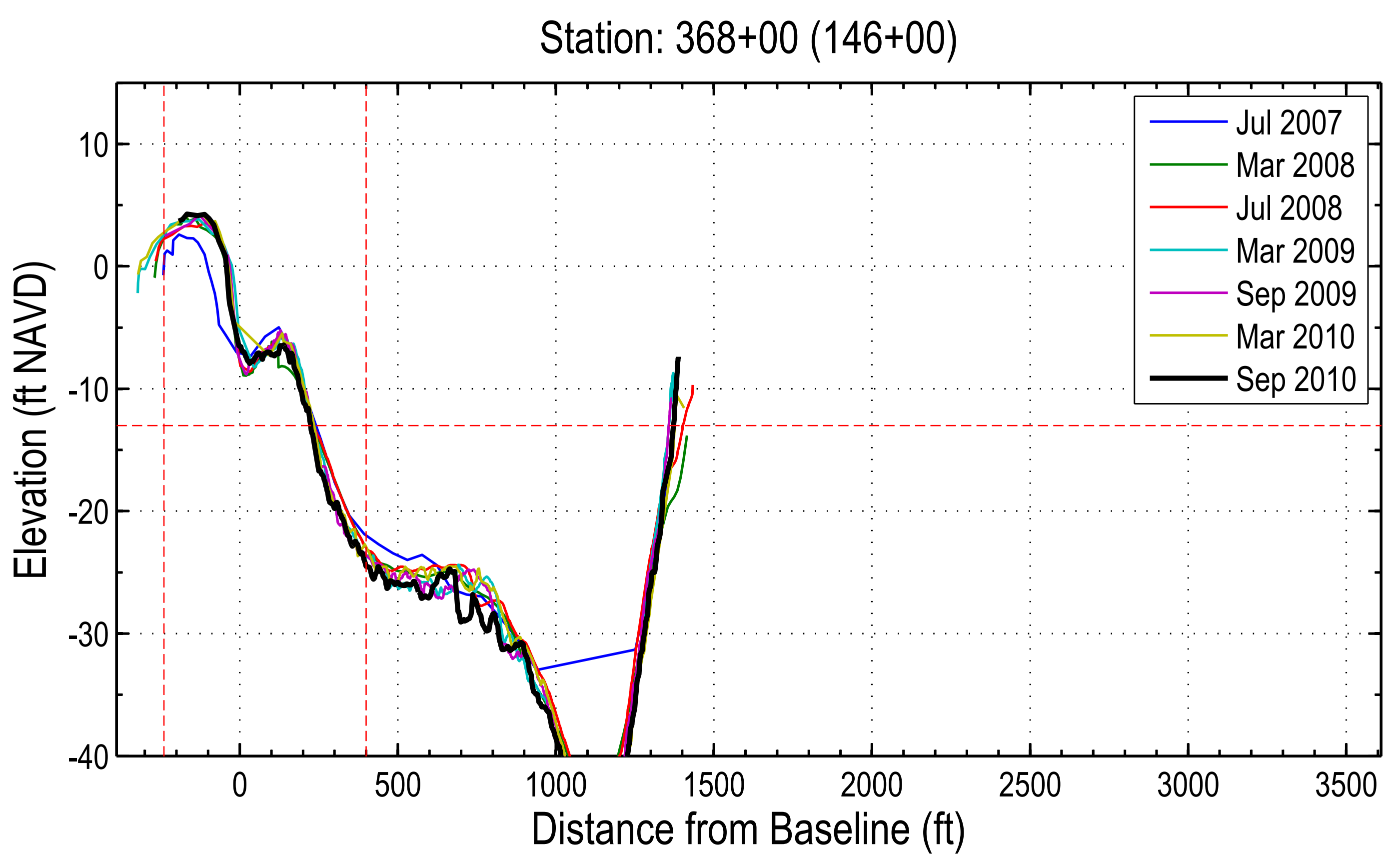


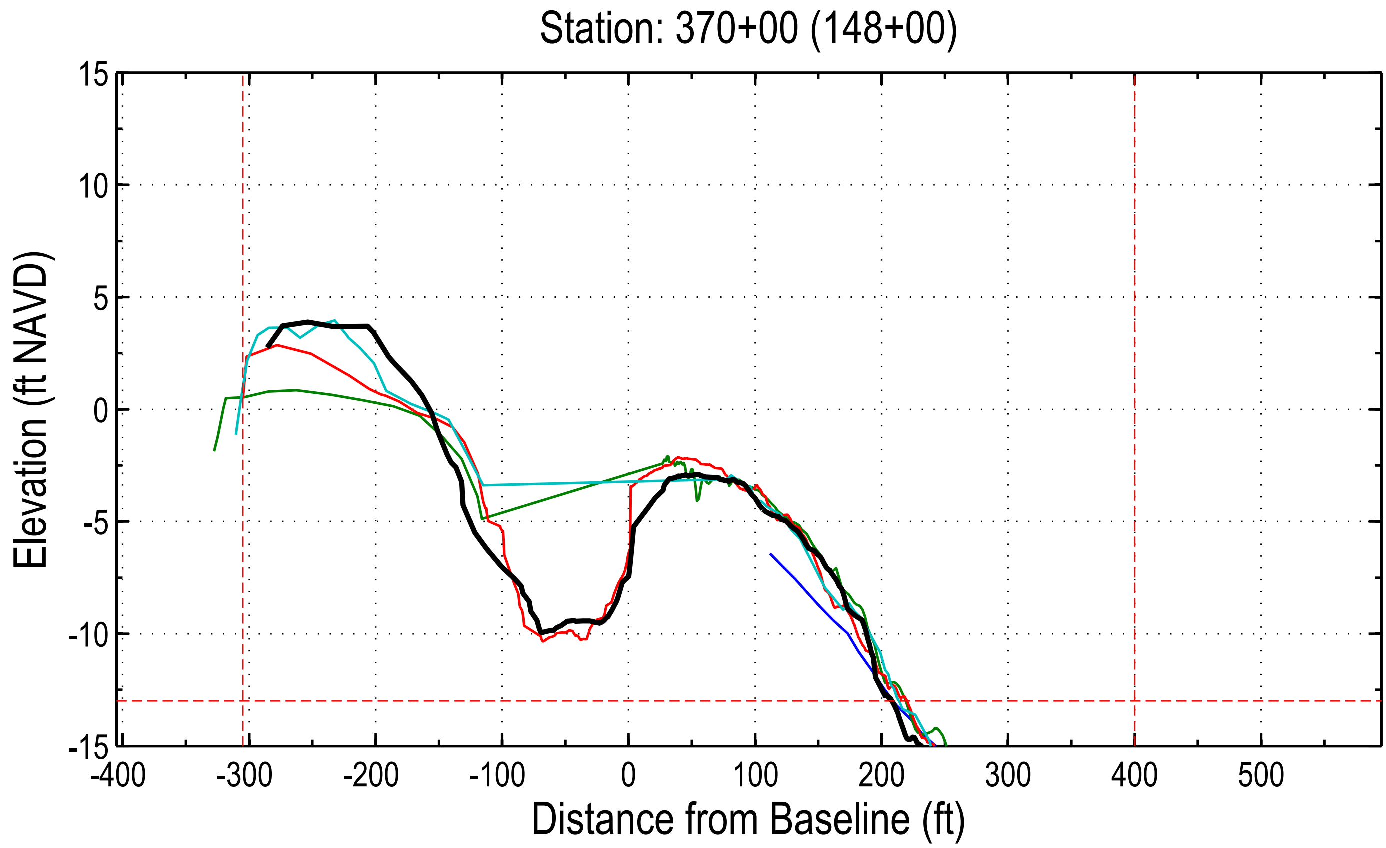
Station: 366+00 (144+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800



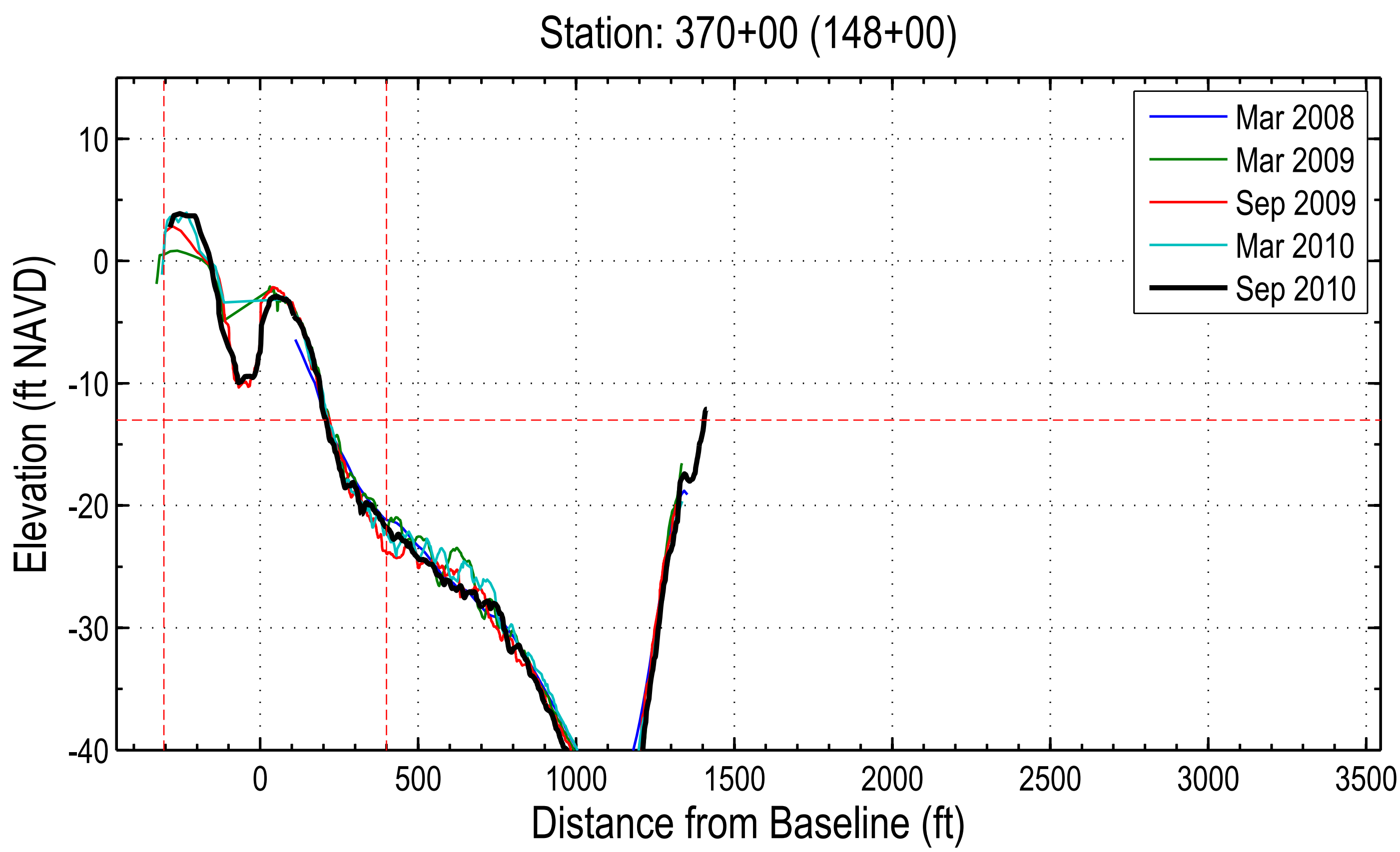
Station: 366+00 (144+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: 368+00 (146+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-300
-200
-100
0
100
200
300
400
500
600

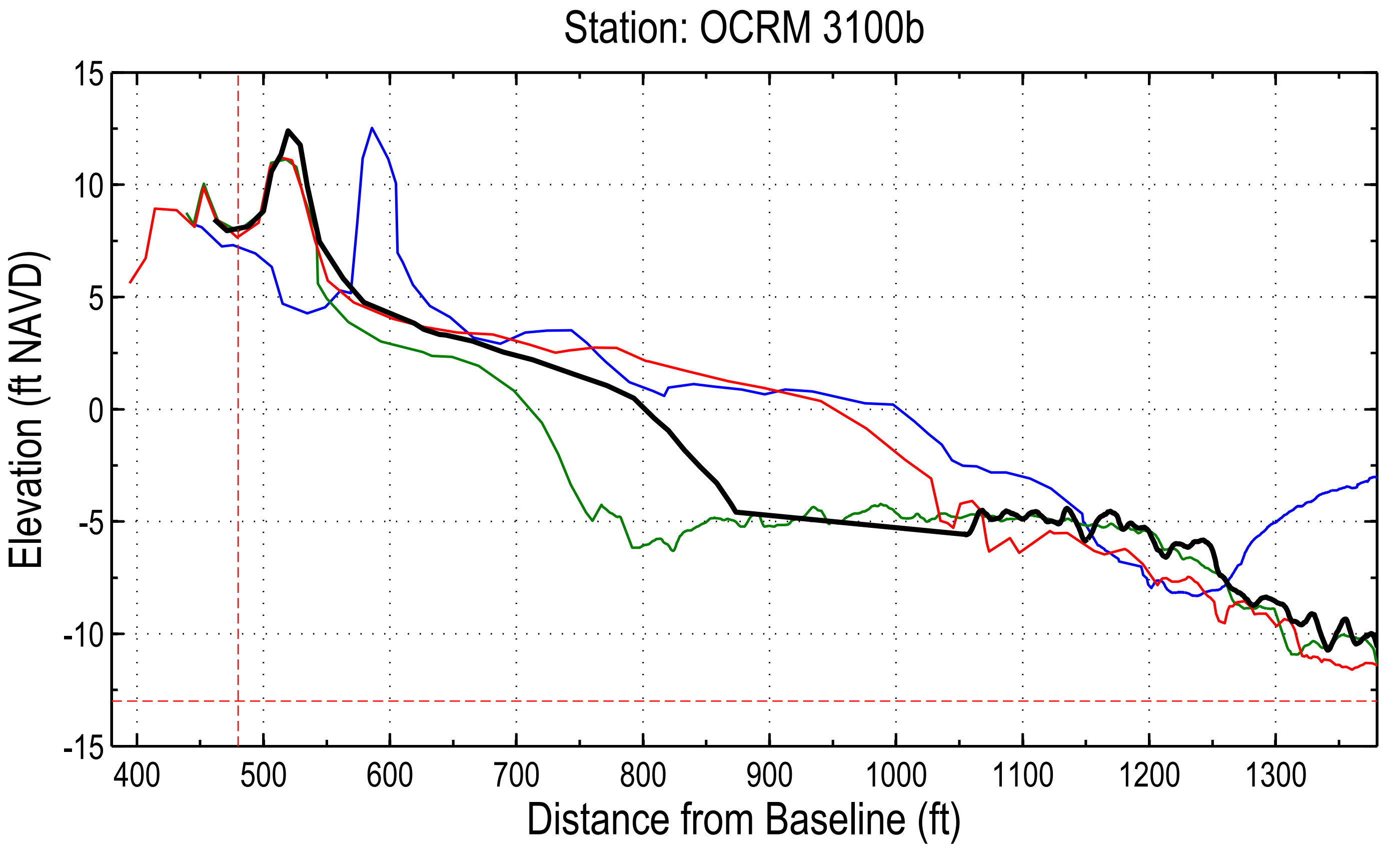

Station: 368+00 (146+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Jul 2007
Mar 2008
Jul 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010

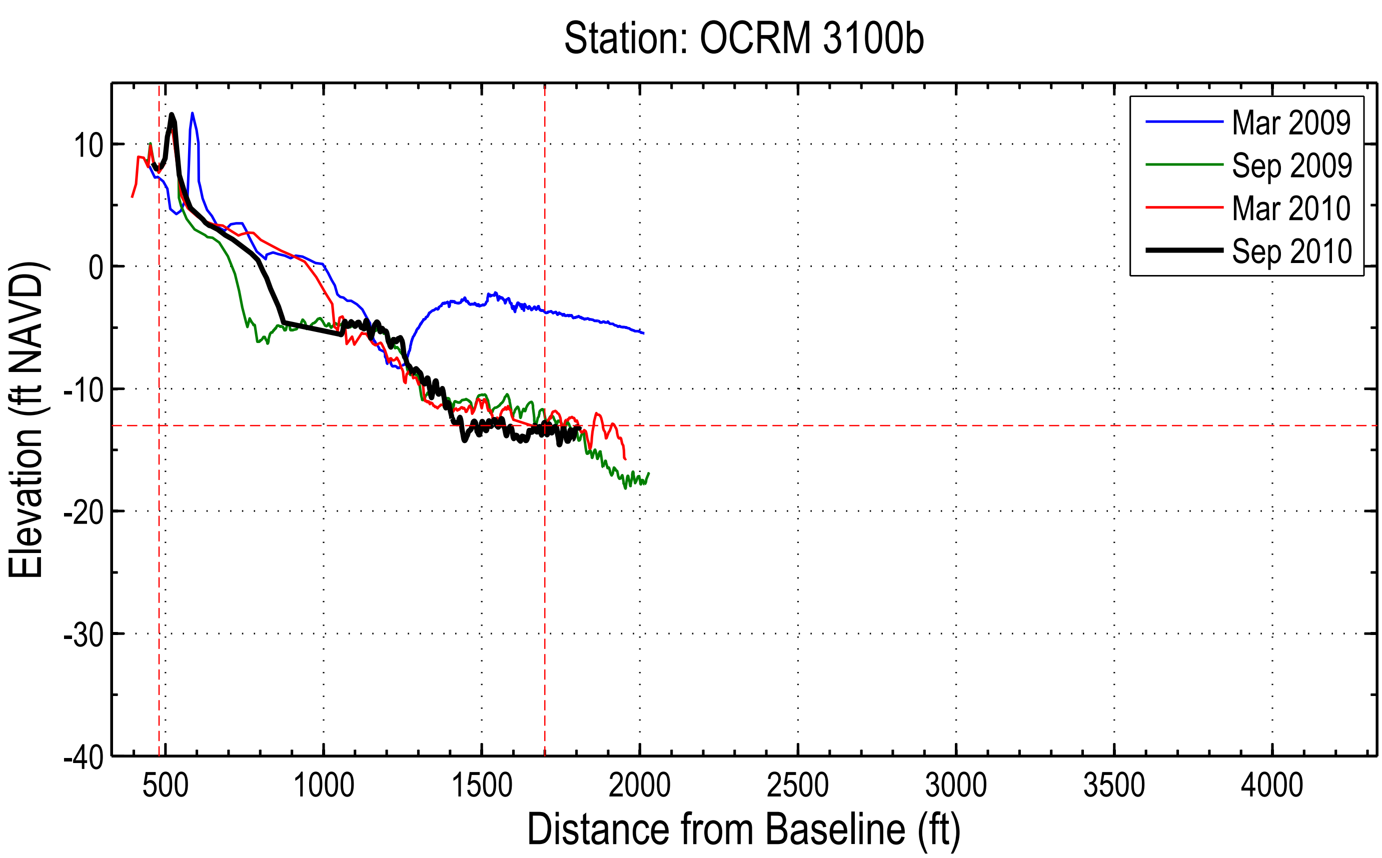


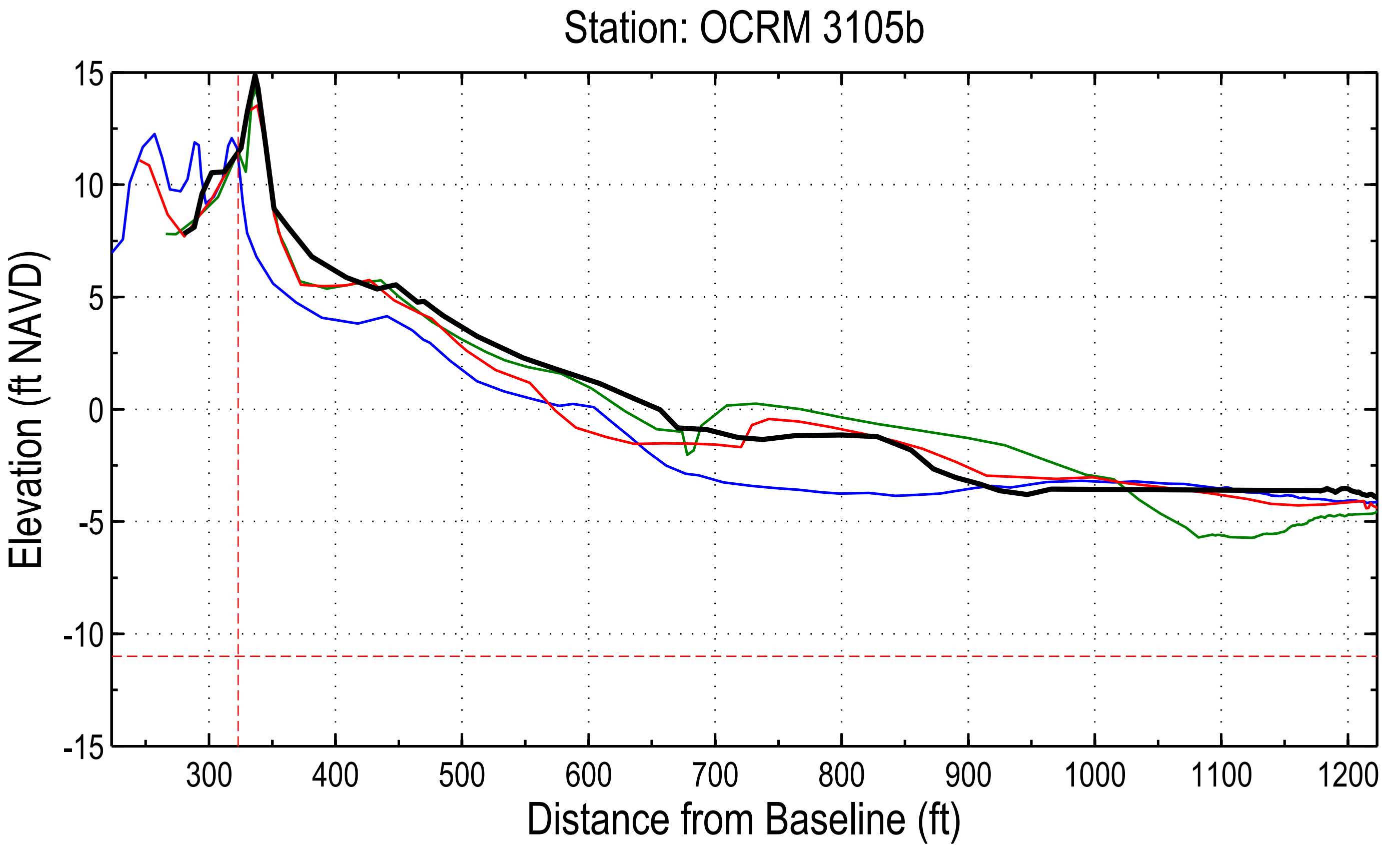
Station: 370+00 (148+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-400
-300
-200
-100
0
100
200
300
400
500



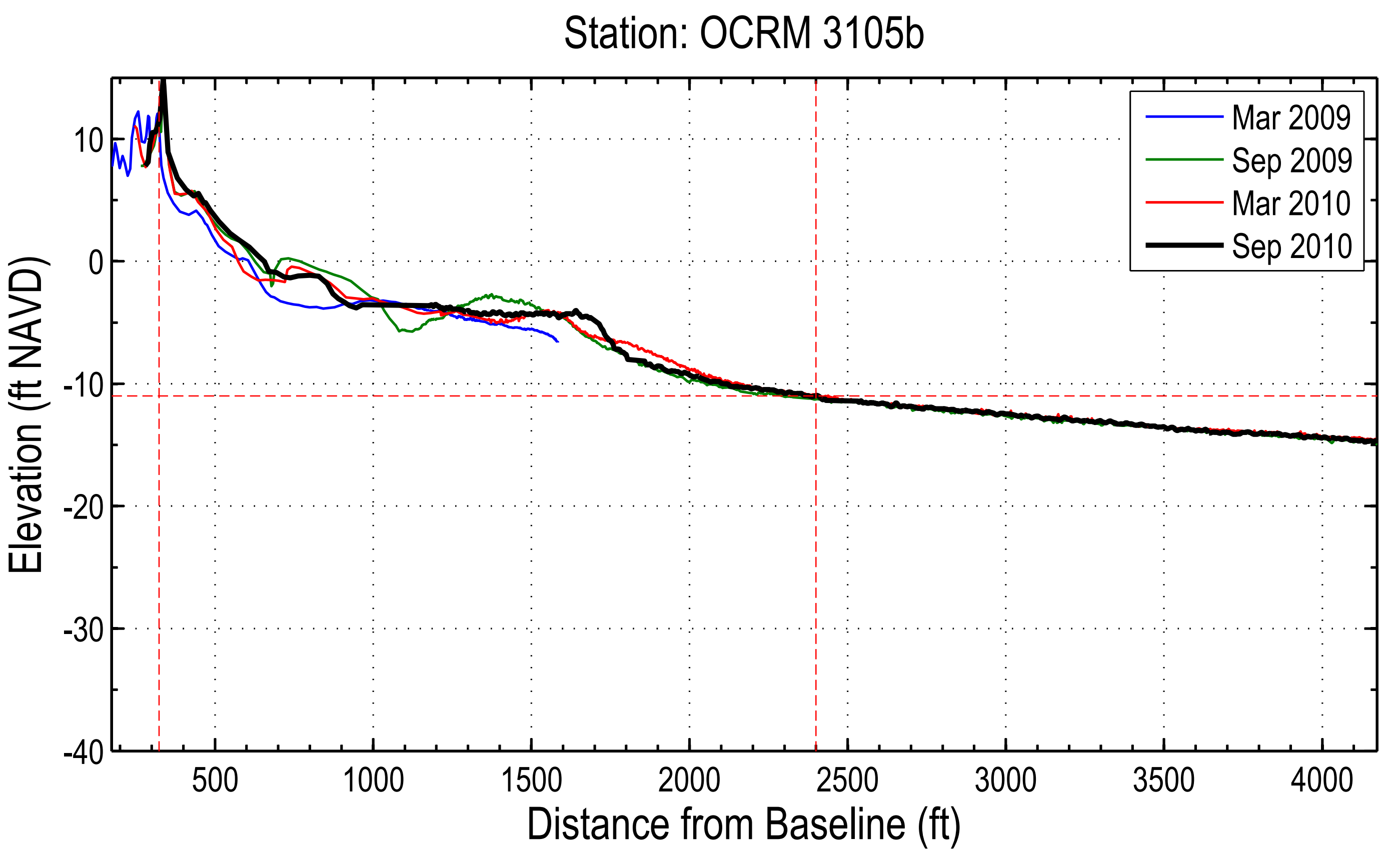
Station: 370+00 (148+00)
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Mar 2008
Mar 2009
Sep 2009
Mar 2010
Sep 2010


Station: OCRM 3100b
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300

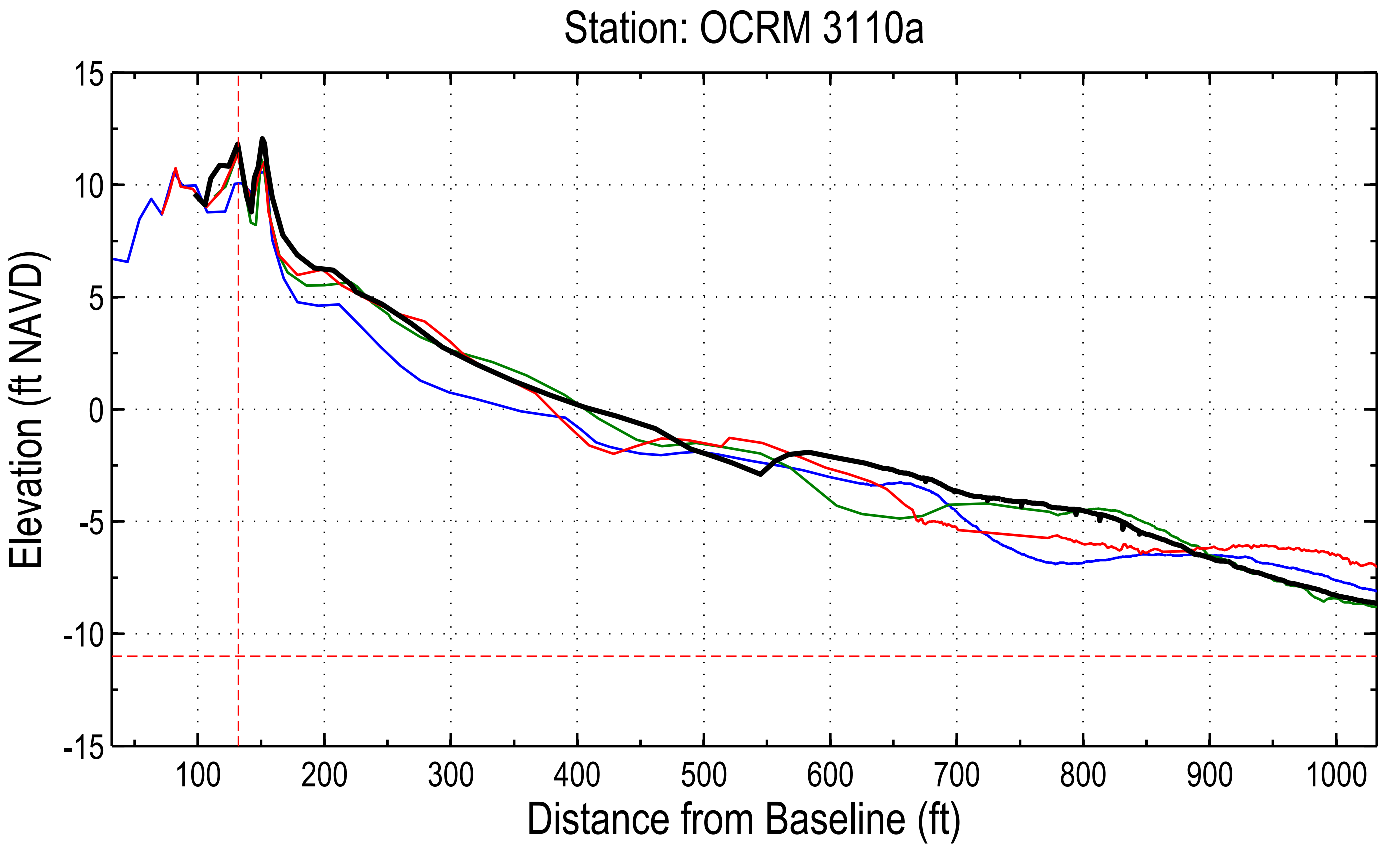

Station: OCRM 3100b
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000

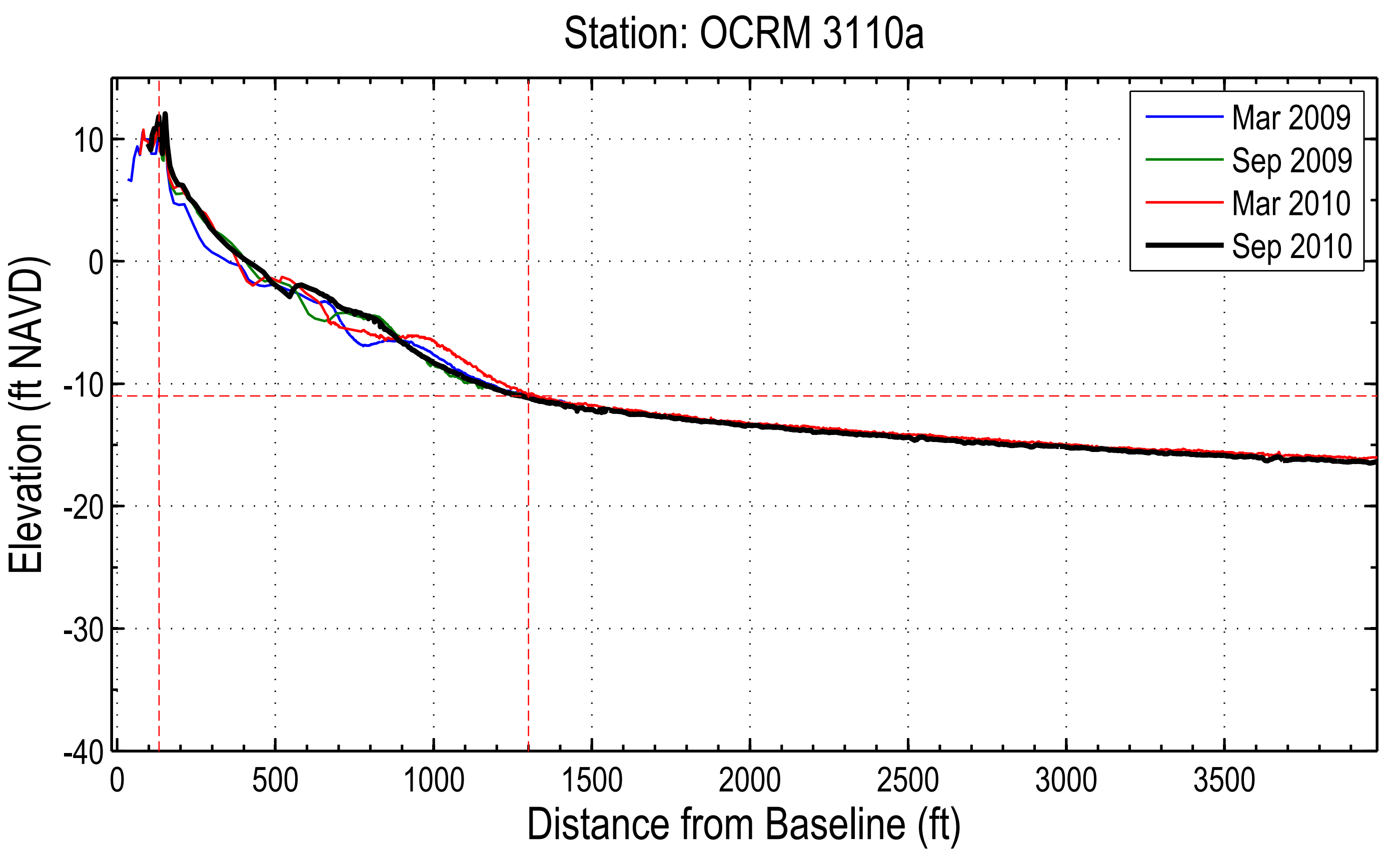


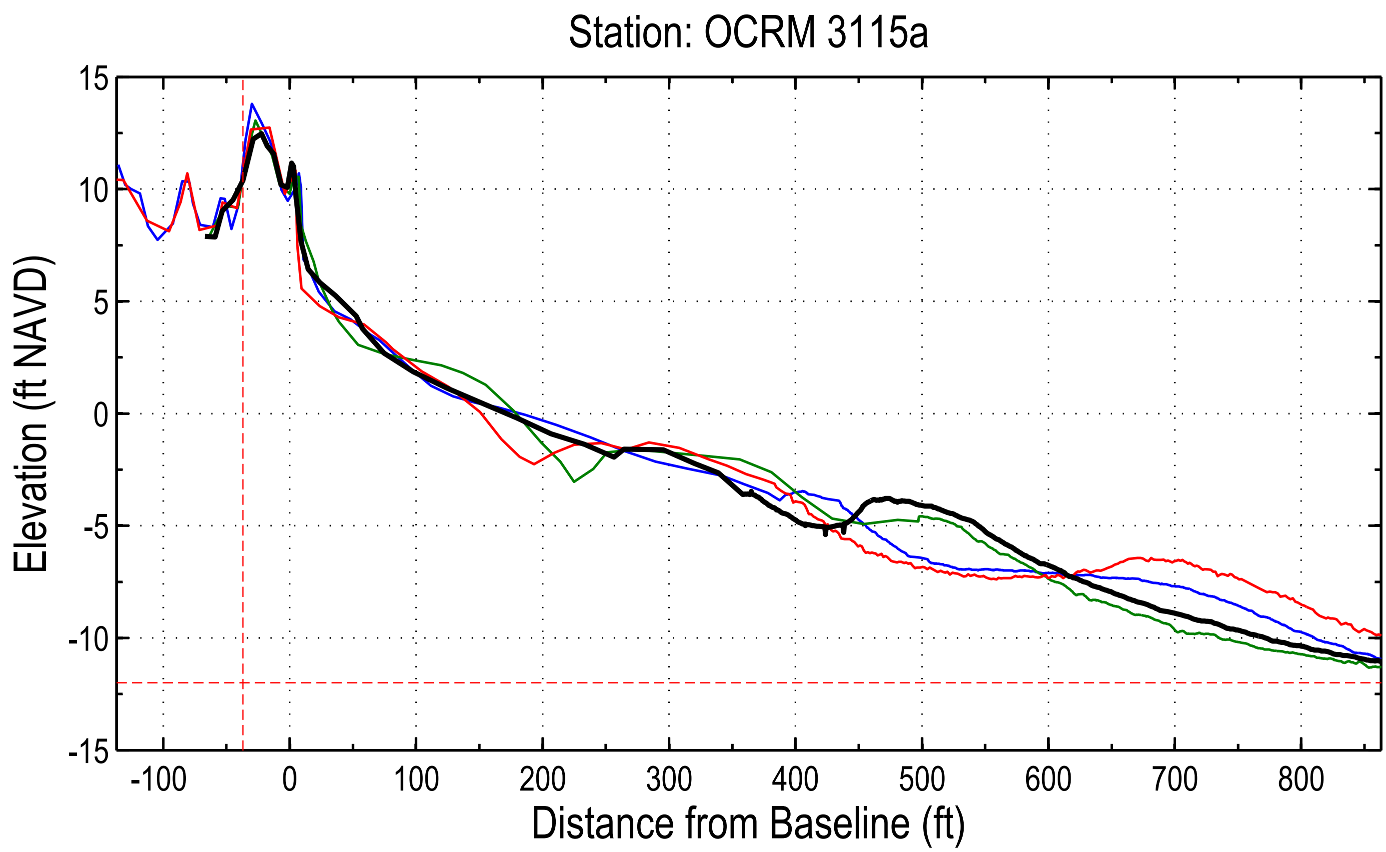
Station: OCRM 3105b
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200



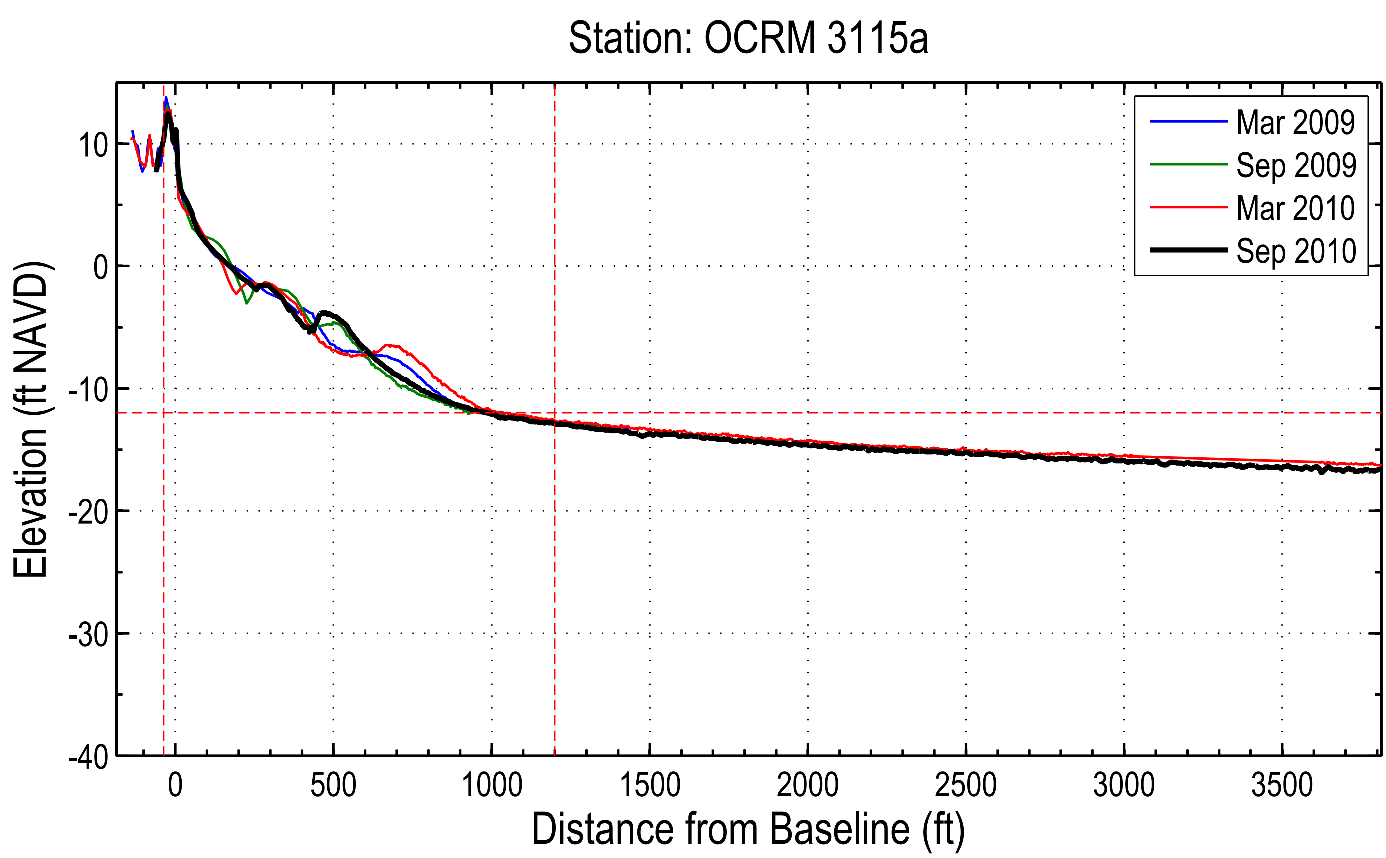
Station: OCRM 3105b
Mar 2009
Sep 2009
Mar 2010
Sep 2010
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000


Station: OCRM 3110a
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000

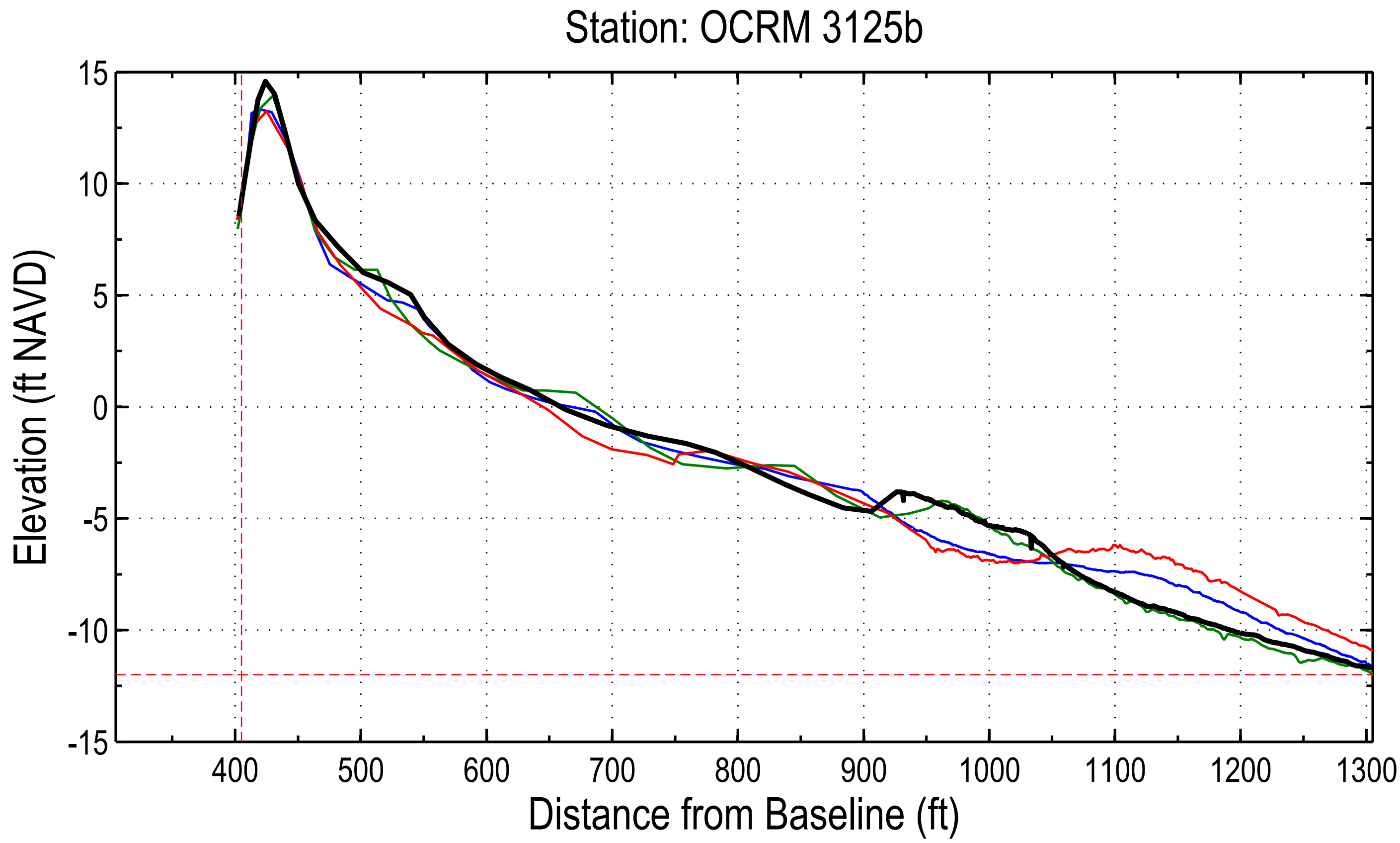

Station: OCRM 3110a
Mar 2009
Sep 2009
Mar 2010
Sep 2010
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500



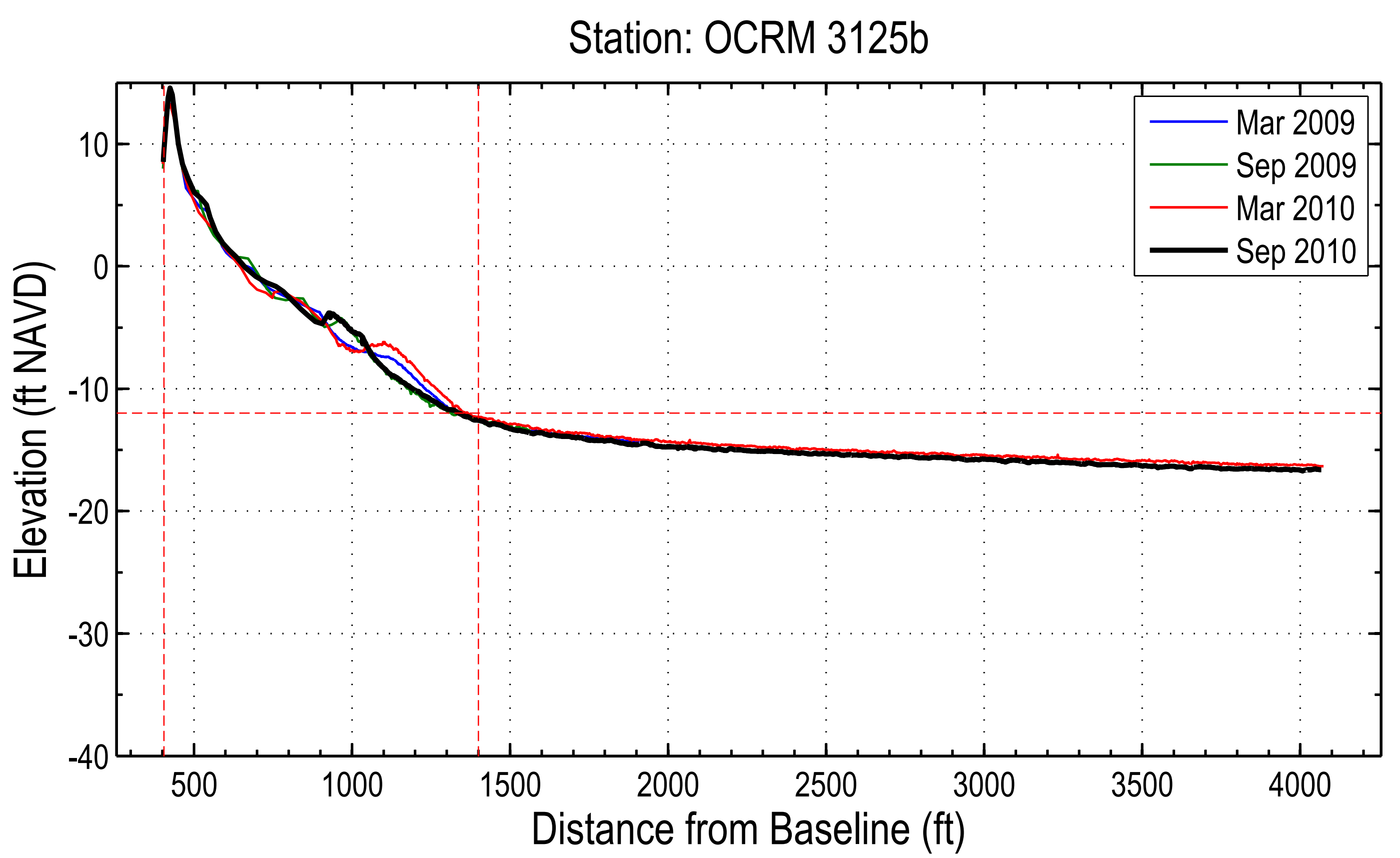
Station: OCRM 3115a
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
-100
0
100
200
300
400
500
600
700
800



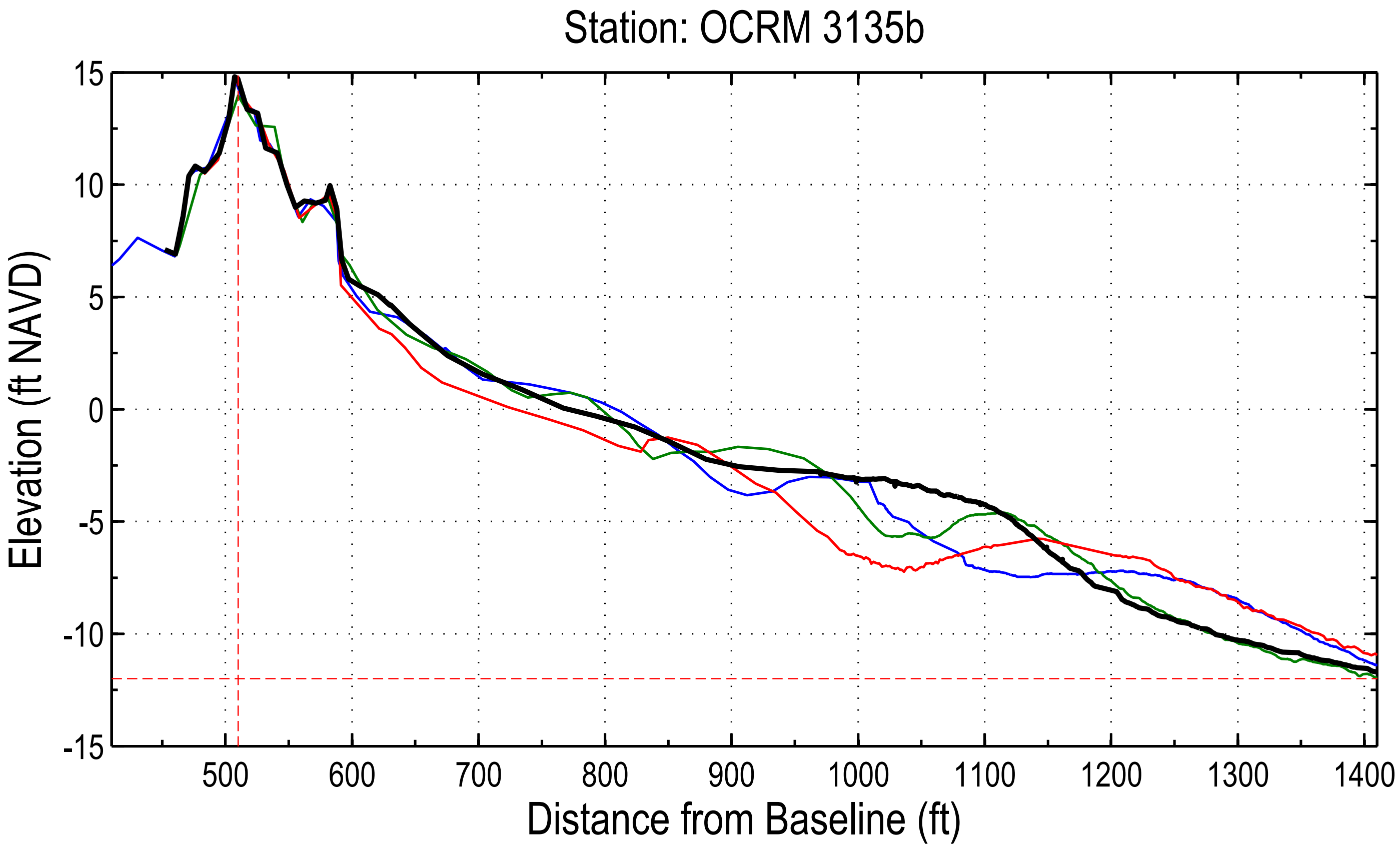
Station: OCRM 3115a
Elevation (ft NAVD)
Distance from Baseline (ft)
10
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
Mar 2009
Sep 2009
Mar 2010
Sep 2010



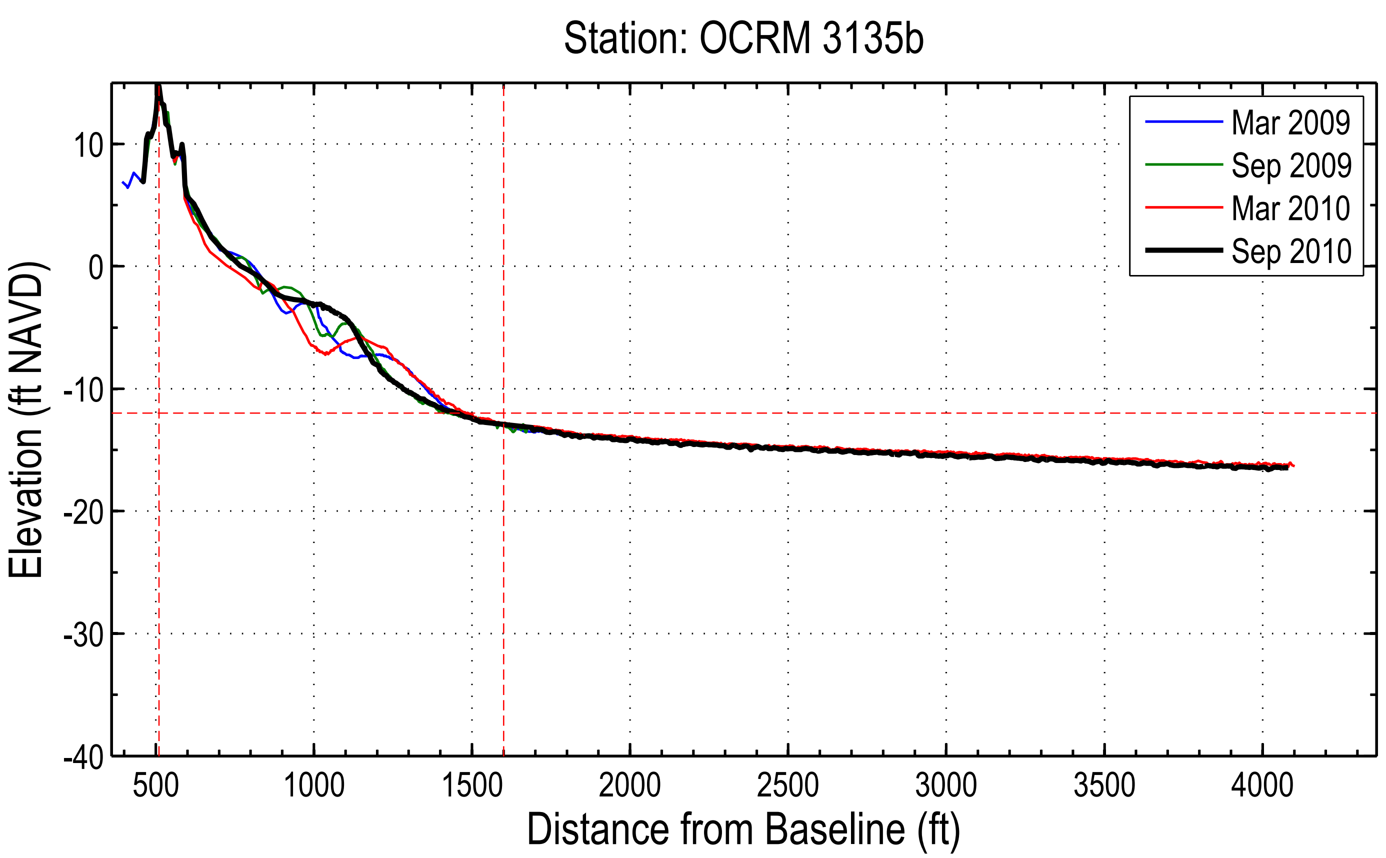
Station: OCRM 3125b
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
400
500
600
700
800
900
1000
1100
1200
1300



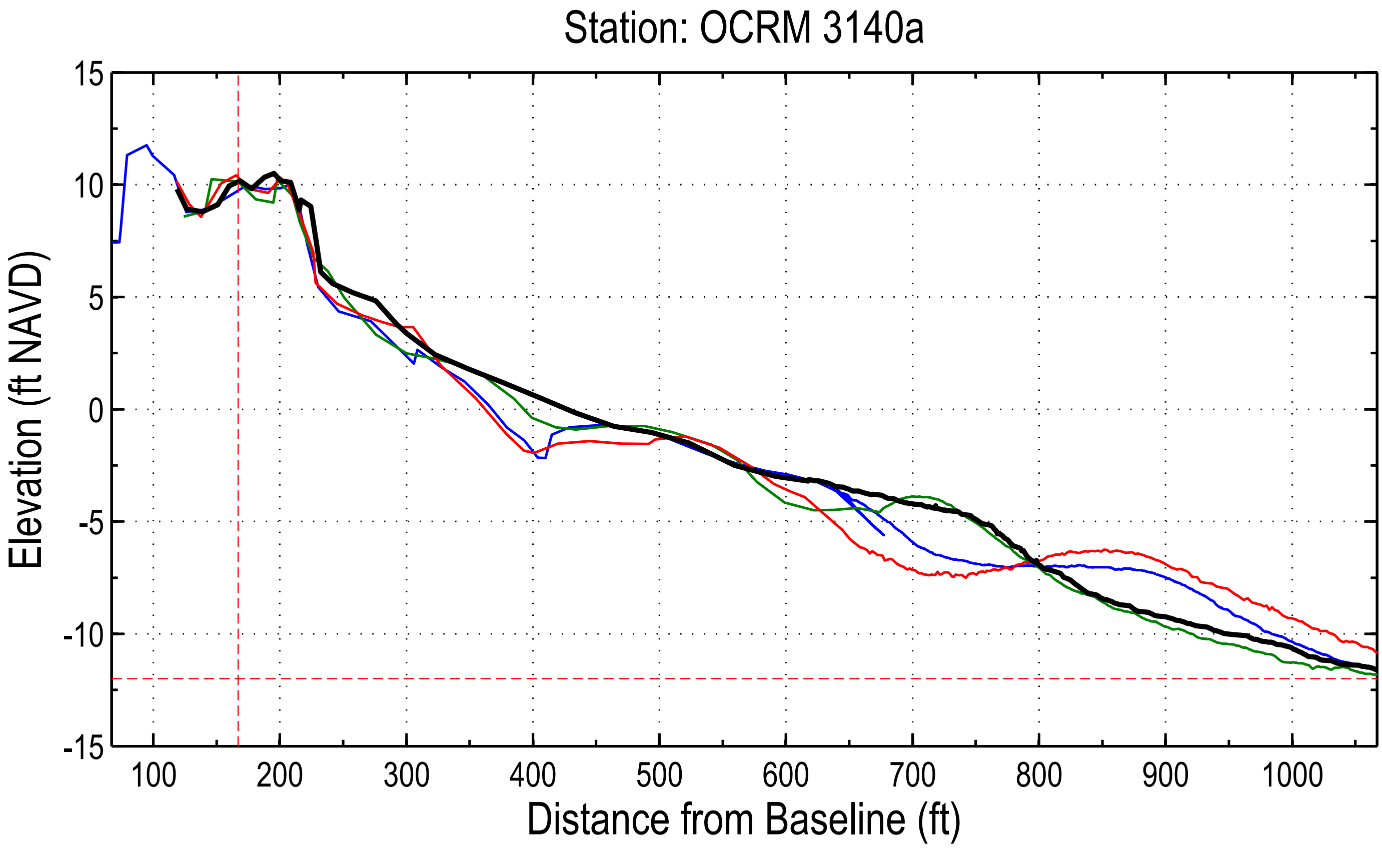
Station: OCRM 3125b
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000

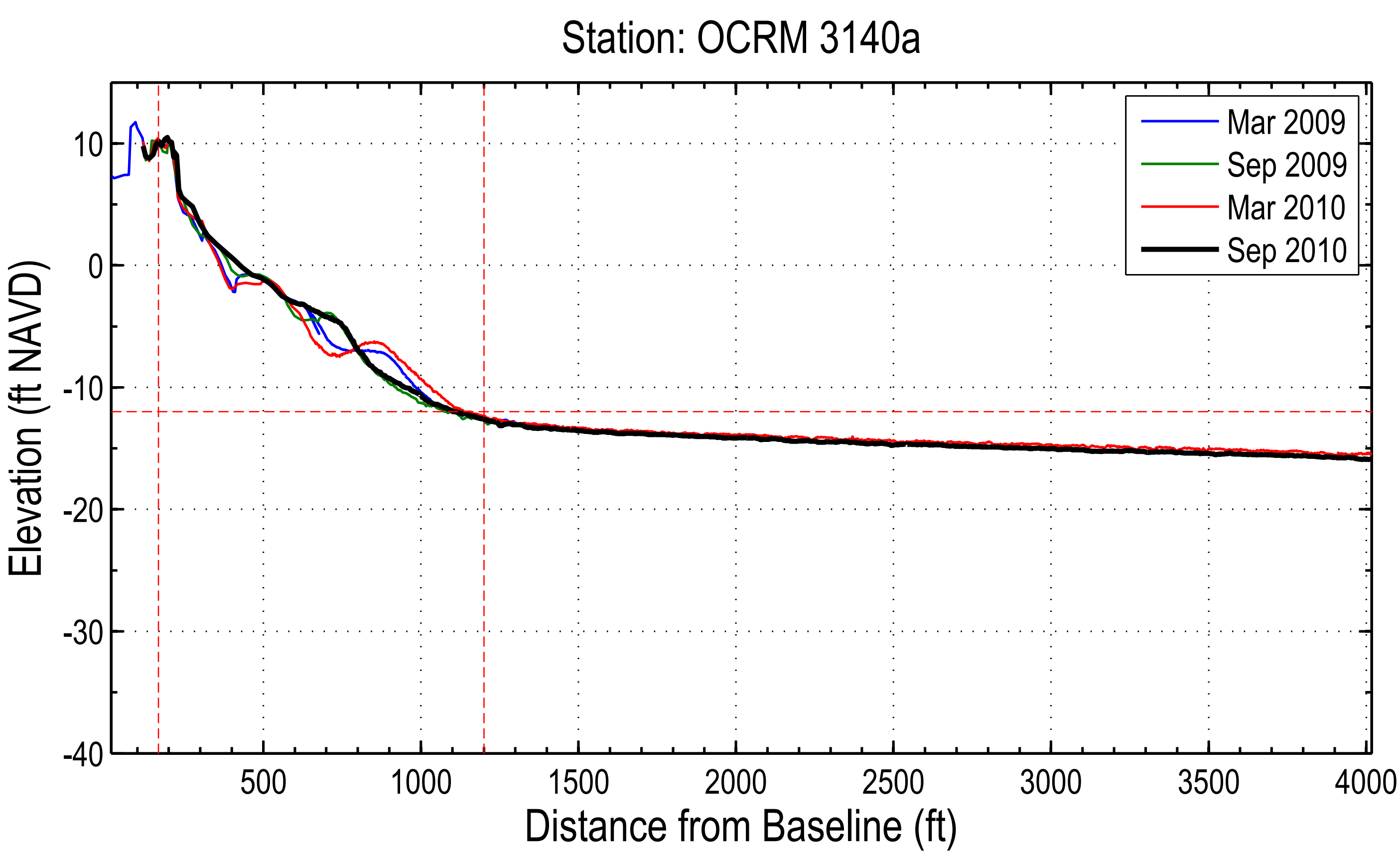


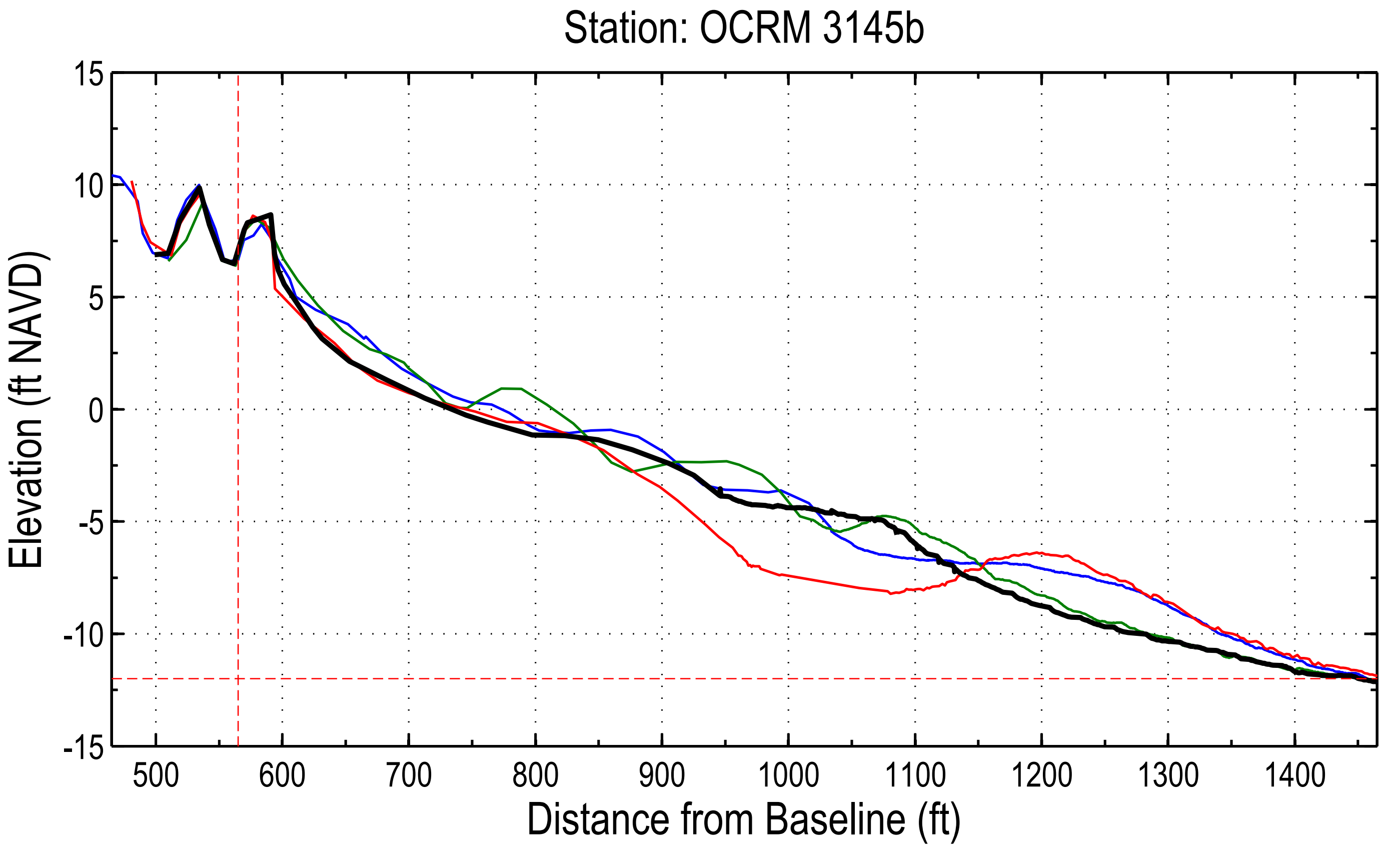
Station: OCRM 3135b
15
10
5
0
-5
-10
-15
500
600
700
800
900
1000
1100
1200
1300
1400
Elevation (ft NAVD)
Distance from Baseline (ft)

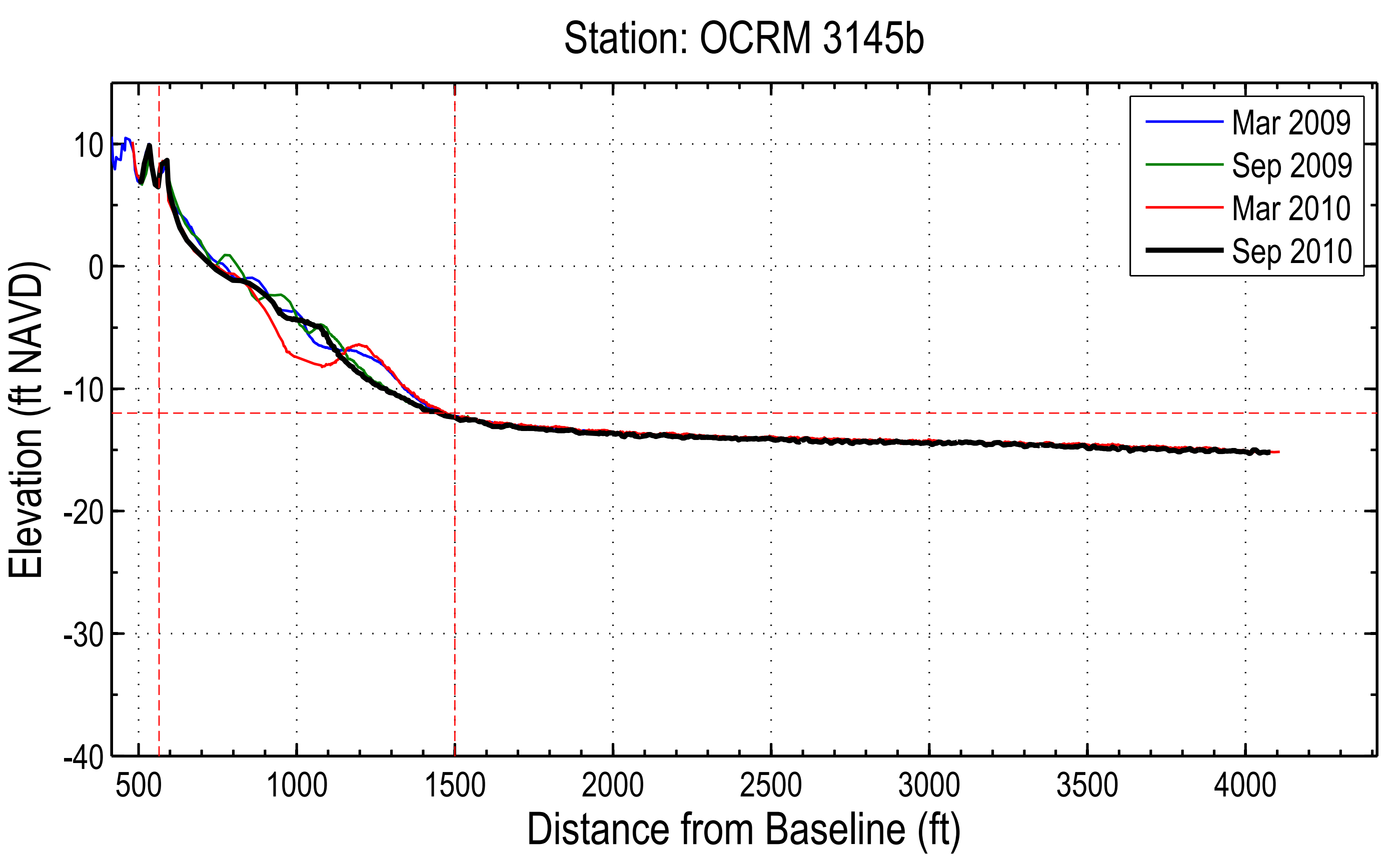


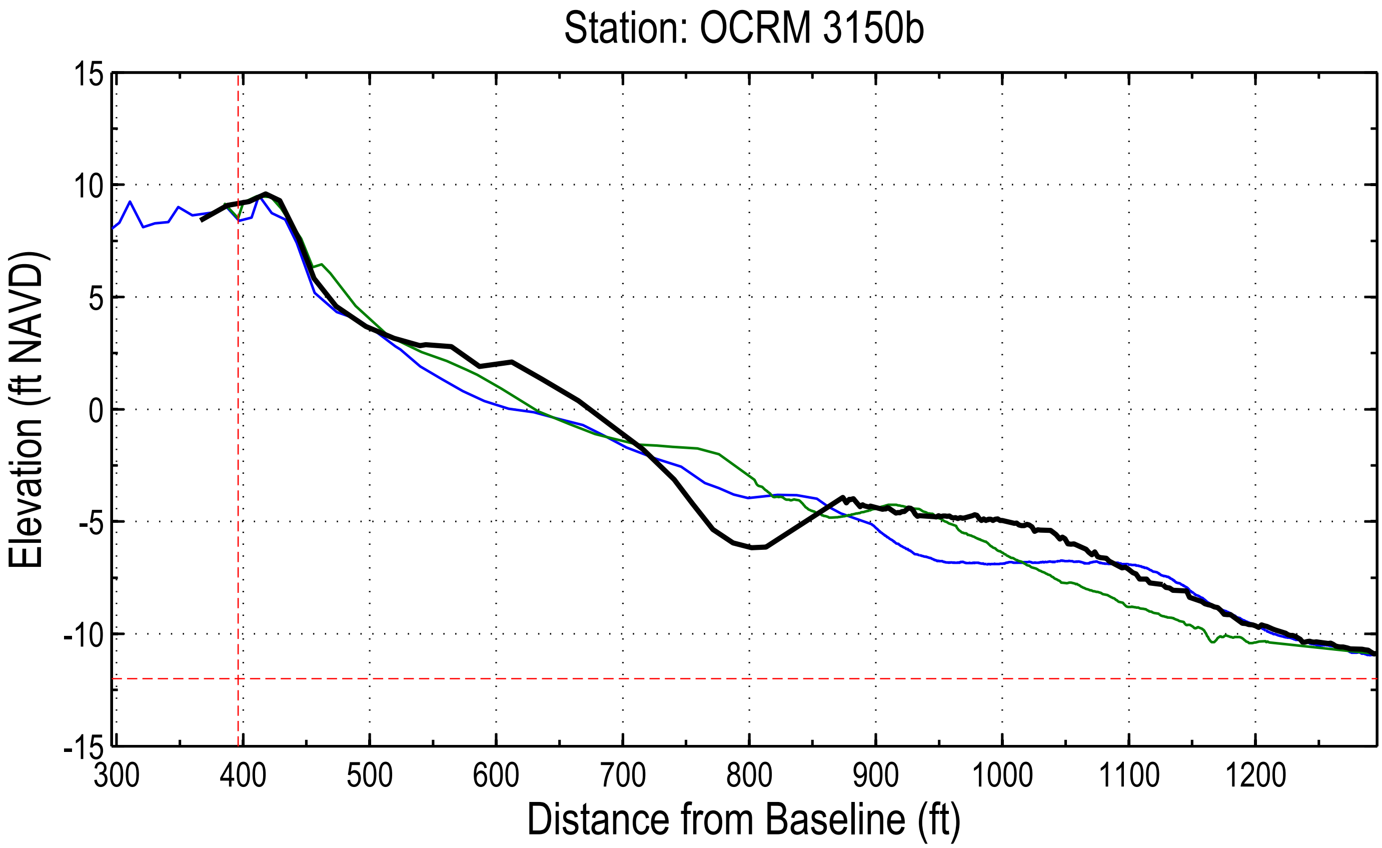
Station: OCRM 3135b
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Elevation (ft NAVD)
Distance from Baseline (ft)

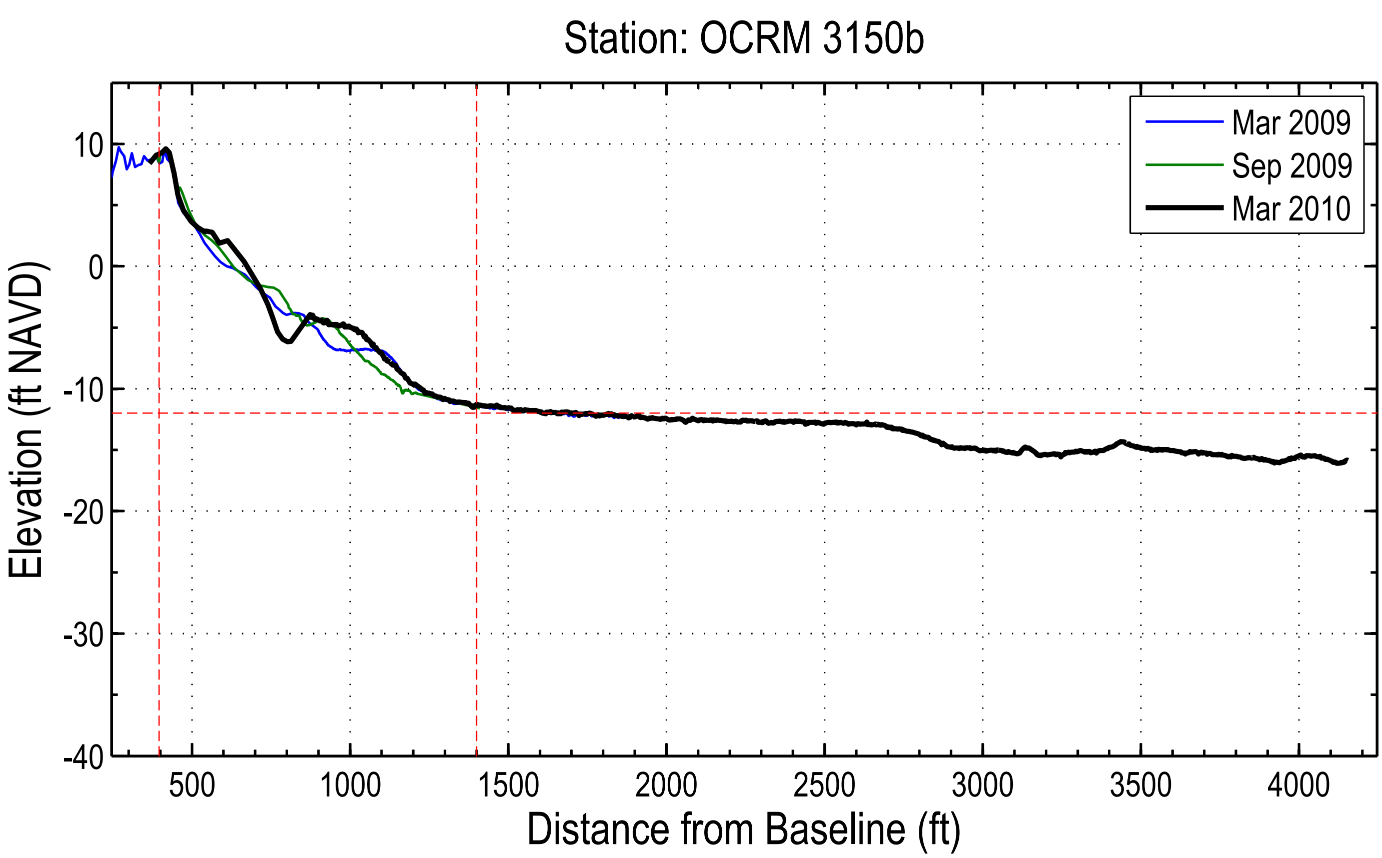

Station: OCRM 3140a
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
100
200
300
400
500
600
700
800
900
1000


Station: OCRM 3140a
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
Sep 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000


Station: OCRM 3145b
Elevation (ft NAVD)
15
10
5
0
-5
-10
-15
500
600
700
800
900
1000
1100
1200
1300
1400
Distance from Baseline (ft)


Station: OCRM 3145b
Mar 2009
Sep 2009
Mar 2010
Sep 2010
Elevation (ft NAVD)
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000
Distance from Baseline (ft)


Station: OCRM 3150b
Elevation (ft NAVD)
Distance from Baseline (ft)
15
10
5
0
-5
-10
-15
300
400
500
600
700
800
900
1000
1100
1200


Station: OCRM 3150b
Elevation (ft NAVD)
Distance from Baseline (ft)
Mar 2009
Sep 2009
Mar 2010
10
0
-10
-20
-30
-40
500
1000
1500
2000
2500
3000
3500
4000

APPENDIX B

Beach Compaction Results

March 2010 – Memo to USFWS

[Isle of Palms – Year 2]

COASTAL SCIENCE & ENGINEERING
PO BOX 8056 COLUMBIA SC 29202 • TEL 803-799-8949 • FAX 803-799-9481 • EMAIL cse@coastalscience.com

DATE: March 1, 2010

To: USFWS
ATTN: Melissa Bimbi

cc: Linda Lovvorn Tucker, City of Isle of Palms

FROM: Steven Traynum, Coastal Science and Engineering

RE: Isle of Palms Beach Restoration Project
2010 Sediment Compaction Results (Permit No 2007-02631-2IG-P) [CSE 2300]

Enclosed is the spreadsheet of 2010 beach-compaction readings for the Isle of Palms Beach Restoration Project. As per conditions of permit No 2002007-02631-2IG-P, annual sediment compaction test are required along the project area prior to turtle nesting season. In the event USFWS deems it necessary, CSE will arrange for the City of Isle of Palms to contract for tilling to reduce compaction.

Sediment compaction readings were taken 11 February 2010 and encompassed the beach from 47th Avenue to CSE's monitoring baseline station 337+00 (near the 17th Fairway, see attached maps). A total of 21 locations were measured at both the vegetation line (toe of dune) and middle of the berm at each location. Fifteen of the locations were in nourished areas, while six of the locations were not nourished and will be used as a native control values. Triplicate measurements were made with a cone penetrometer at 6", 12", and 18" depths, for a total of 378 measurements. A value of 1000 was given where sand was too compact or shell content prevented penetration to the appropriate depth. The triplicate measurements were averaged for each depth and location. Attachment 1 lists the raw and averaged results from the February 2010 sample.

The results are summarized as follows:

Nourished Areas

Dune

6" - The average reading was 343 psi, 3 out of 15 stations averaged ≥ 500 psi.

12" - The average reading was 579 psi, 8 out of 15 stations averaged ≥ 500 psi.

18" - The average reading was 680 psi, 10 out of 15 stations averaged ≥ 500 psi.

Berm

6" - The average reading was 328 psi, 0 out of 15 stations averaged ≥ 500 psi.

12" - The average reading was 488 psi, 5 out of 15 stations averaged ≥ 500 psi.

18" - The average reading was 715 psi, 10 out of 15 stations averaged ≥ 500 psi.

Non-Nourished Areas

Dune

6" - The average reading was 282 psi, 0 out of 6 stations averaged ≥ 500 psi.

12" - The average reading was 644 psi, 1 out of 6 stations averaged ≥ 500 psi.

18" - The average reading was 808 psi, 2 out of 6 stations averaged ≥ 500 psi.

Berm

6" - The average reading was 306 psi, 0 out of 6 stations averaged ≥ 500 psi.

12" - The average reading was 534 psi, 2 out of 6 stations averaged ≥ 500 psi.

18" - The average reading was 780 psi, 5 out of 6 stations averaged ≥ 500 psi.

The project area was tilled following nourishment in July 2008. Effects of the tilling are still evident, shown by the large deviation between compaction values at some stations (for example, the berm location at station 307+00 shows one value of 440 psi, and two where the instrument could not penetrate to depth. This is likely due to the 440 psi reading being directly where the tilling plow blade passed, and the others being taken between the blade paths).

It is also important to note that the dune stations were located near the seaward edge of sand fencing in areas where fencing was installed over the past year (between stations 292+00 and 337+00). Prior to the installation of the fencing, no substantial dunes were present in this area, and nourishment generally was placed all the way to buildings. Finally, some areas no longer possess nourishment sand, or do not presently possess a stable dune and/or berm (near the 18th hole of the Links Course, stations 312+00 through 330+00). These areas were not measured for compaction, as tilling would not be possible.

The present compaction survey represents the second year compaction measurements are required under special conditions of the permit. Compaction measurements will be repeated prior to turtle nesting season in 2011. Please contact Dr. Kana or me if you require additional information on CSE's compaction test methodology or results.

Sincerely,

Steven Traynum, MS

Attachments

Isle of Palms Compaction Measurements, March 2009

Grey shaded samples are native locations
D= Seaward edge of dune/structure
B=Middle of berm
Measurement taken 11 Feb 2010
Units are psi

Stations refer to the monitoring baseline (222+00 at 53rd Ave)
Dune measurements were taken at seaward edge of sand fencing, where present
Colored values indicated >500 psi threshold.

Station	Sample	6"	12"	18"	Averages 6"	Averages 12"	Averages 18"
202+00	D	320	460	100	317	433	150
		330	400	180			
		300	440	170			
	B	300	680	700	317	720	773
		300	680	780			
		350	800	840			
207+00	D	180	440	100	193	280	140
		200	240	140			
		200	160	180			
	B	220	480	800	260	483	733
		280	490	700			
		280	480	700			
212+00	D	300	300	440	227	300	447
		180	280	560			
		200	320	340			
	B	340	280	380	320	320	393
		300	340	460			
		320	340	340			
217+00	D	360	200	220	333	227	347
		320	200	360			
		320	280	460			
	B	180	500	620	173	547	687
		160	500	660			
		180	640	780			
222+00	D	210	640	940	230	597	807
		280	640	820			
		200	510	660			
	B	180	170	660	173	157	560
		180	140	510			
		160	160	510			
227+00	D	200	320	420	227	307	453
		180	300	500			
		300	300	440			
	B	300	300	160	280	353	393
		220	300	320			
		320	460	700			
232+00	D	330	320	500	330	433	547
		320	480	520			
		340	500	620			
	B	330	340	440	317	333	453
		300	320	160			
		320	340	760			
237+00	D	180	200	200	167	267	240
		160	300	200			
		160	300	320			
	B	300	200	620	227	233	513
		180	400	760			
		200	100	160			

Station	Sample	6"	12"	18"	Averages 6"	Averages 12"	Averages 18"
242+00	D	320	650	840	300	643	827
		300	640	800			
		280	640	840			
	B	340	320	1000	473	767	1000
		640	980	1000			
		440	1000	1000			
247+00	D	300	600	940	273	460	940
		220	460	940			
		300	320	940			
	B	460	640	1000	453	640	1000
		460	640	1000			
		440	640	1000			
252+00	D	300	650	1000	367	683	887
		340	740	960			
		460	660	700			
	B	300	200	940	313	373	807
		300	320	480			
		340	600	1000			
257+00	D	180	480	460	180	393	477
		180	380	500			
		180	320	470			
	B	340	700	1000	317	393	940
		310	180	1000			
		300	300	820			
262+00	D	620	800	1000	633	793	1000
		640	800	1000			
		640	780	1000			
	B	330	310	300	380	367	260
		480	460	320			
		330	330	160			
277+00	D	200	180	620	193	227	537
		80	320	500			
		300	180	490			
	B	300	480	780	487	433	760
		340	340	780			
		820	480	720			
292+00	D	330	660	660	310	690	600
		300	650	640			
		300	760	500			
	B	320	960	1000	327	987	1000
		480	1000	1000			
		180	1000	1000			
297+00	D	460	460	640	520	600	647
		480	380	300			
		620	960	1000			
	B	300	340	520	327	393	493
		320	200	120			
		360	640	840			

Station	Sample	6"	12"	18"	Averages 6"	Averages 12"	Averages 18"
302+00	D	340	620	240	333	640	467
		340	540	520			
		320	760	640			
	B	440	340	1000	407	413	813
		420	700	1000			
		360	200	440			
307+00	D	340	720	860	360	740	940
		420	780	1000			
		320	720	960			
	B	320	240	440	400	500	813
		560	260	1000			
		320	1000	1000			
312+00	D	160	480	640	207	493	633
		260	480	620			
		200	520	640			
	B	200	740	880	233	693	840
		240	680	800			
		260	660	840			
332+00	D	400	700	600	427	680	540
		400	600	520			
		480	740	500			
	B	280	840	1000	287	627	1000
		340	720	1000			
		240	320	1000			
337+00	D	540	840	1000	513	867	1000
		480	880	1000			
		520	880	1000			
	B	200	260	640	187	247	400
		140	140	180			
		220	340	380			

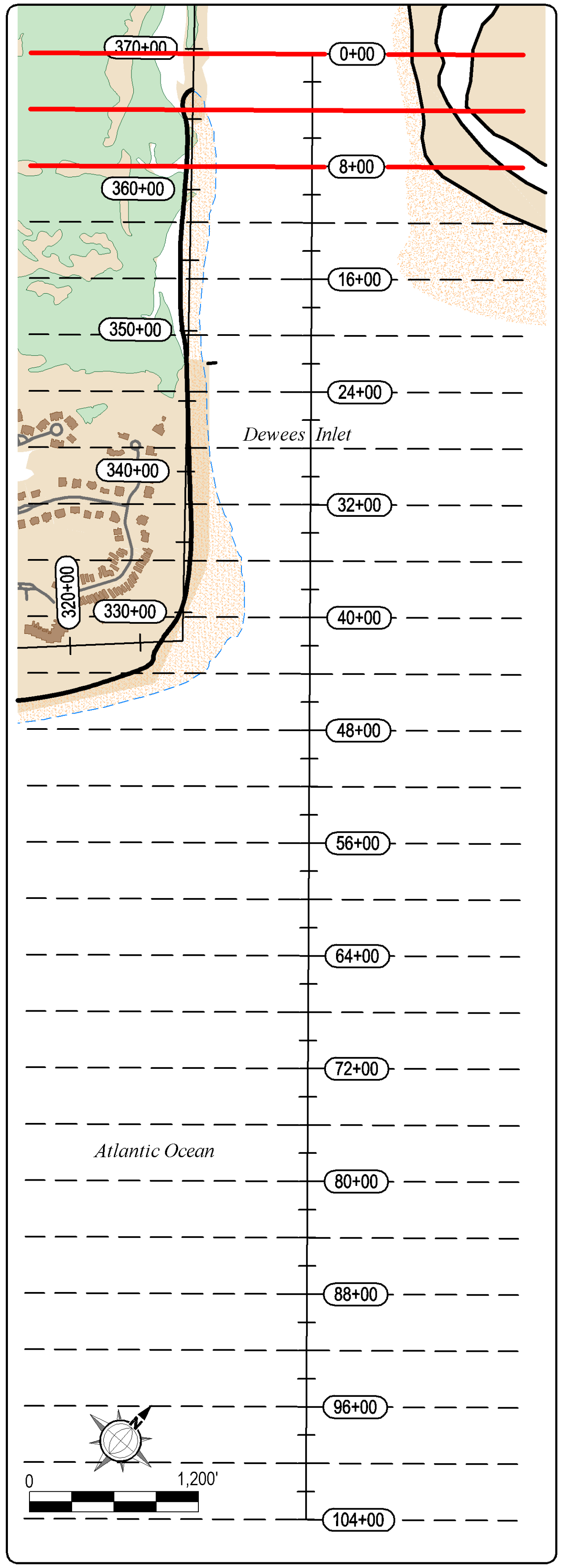
	6"	12"	18"
Native Dune	249	344	404
Native Berm	288	443	651
Nourished Dune	343	579	680
Nourished Berm	328	488	715

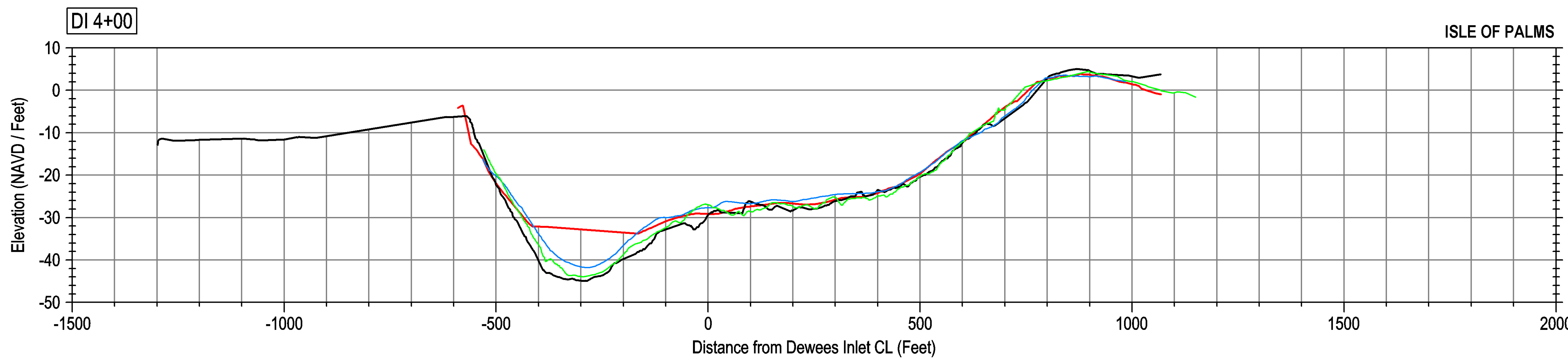
APPENDIX C

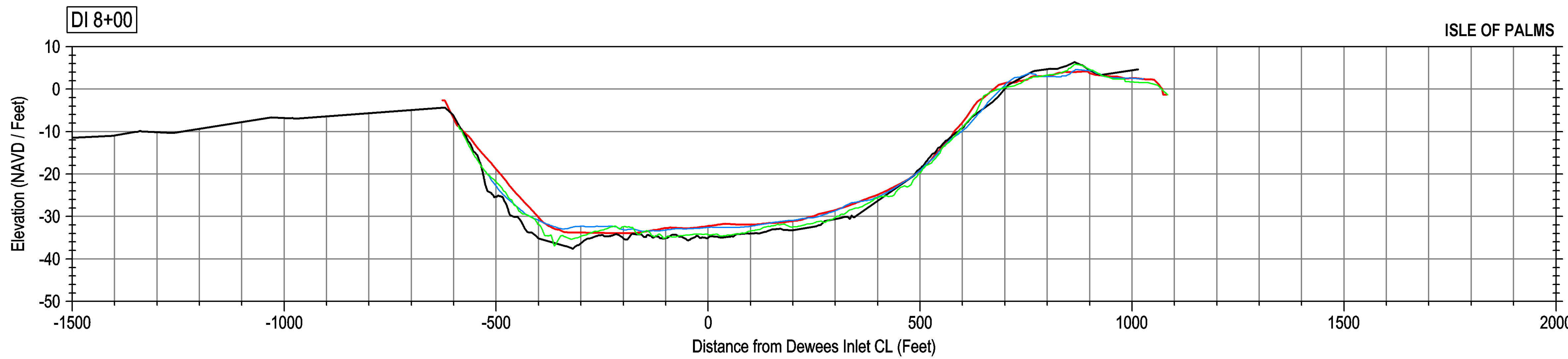
Dewees Inlet

Secondary Channel Cross-Sections

[Isle of Palms – Year 2]







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VERTICAL EXAGGERATION: 10
Data Notes: Data collected by Coastal Science & Engineering, Inc via RTK GPS:

LEGEND
July 2007
July 2008
Mar 2009
Sept 2010

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DEWEES INLET
CROSS SECTIONS

SCALE: AS SHOWN
DATE: Mar 2011
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APPROVED BY: SBT
PROJECT #: 2300

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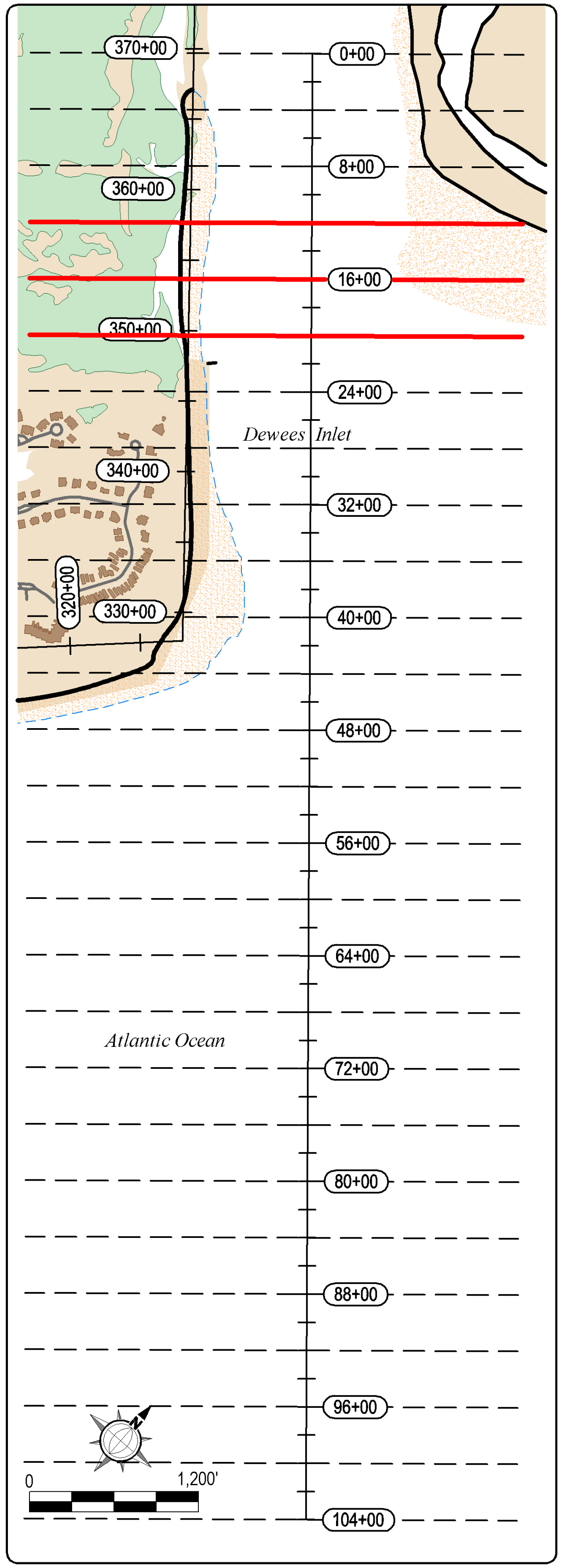

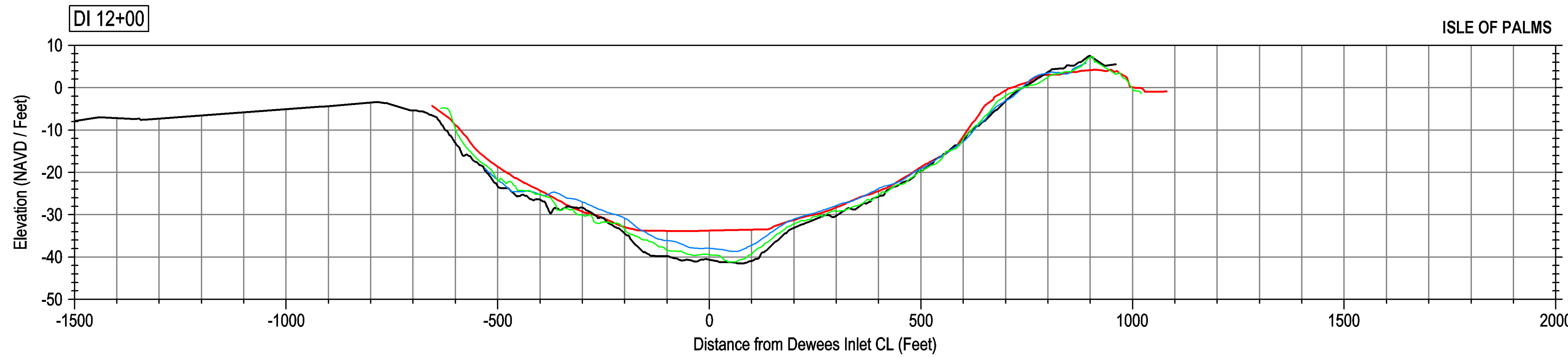

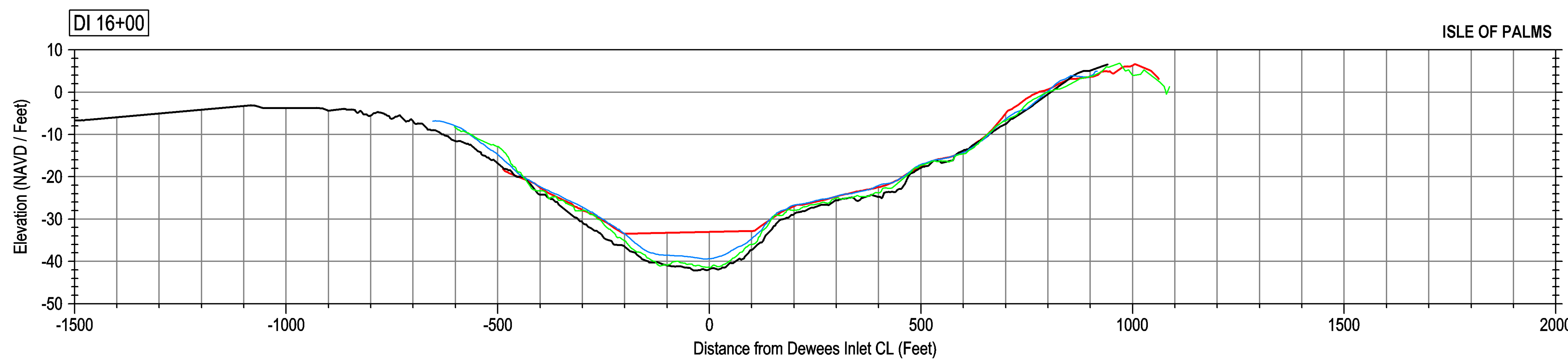

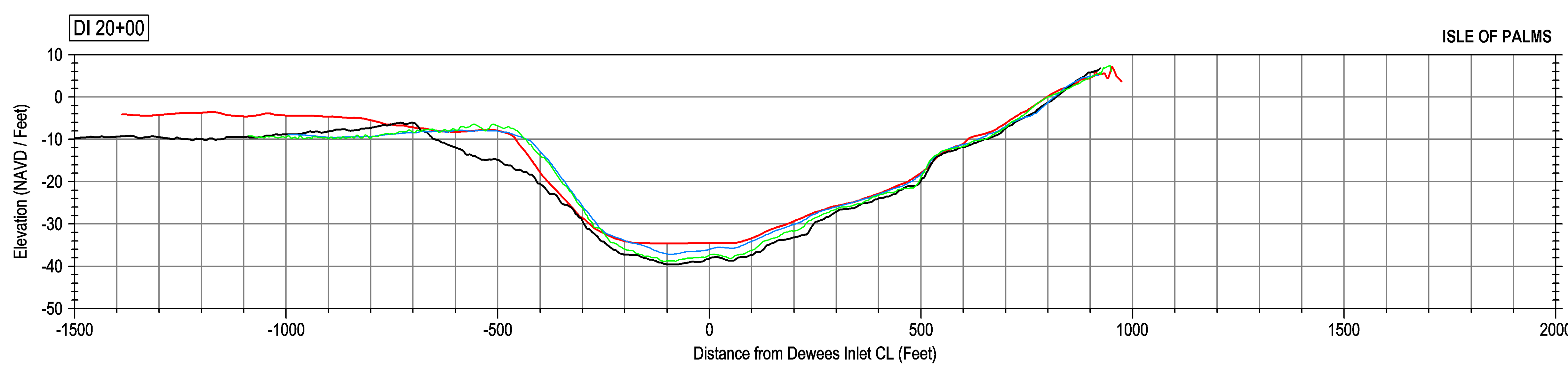

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Data Notes: Data collected by Coastal Science & Engineering, Inc via RTK GPS:

LEGEND
- July 2007 (red)
- July 2008 (blue)
- Mar 2009 (green)
- Sept 2010 (black)

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APPROVED BY:	SBT
PROJECT #:	2300

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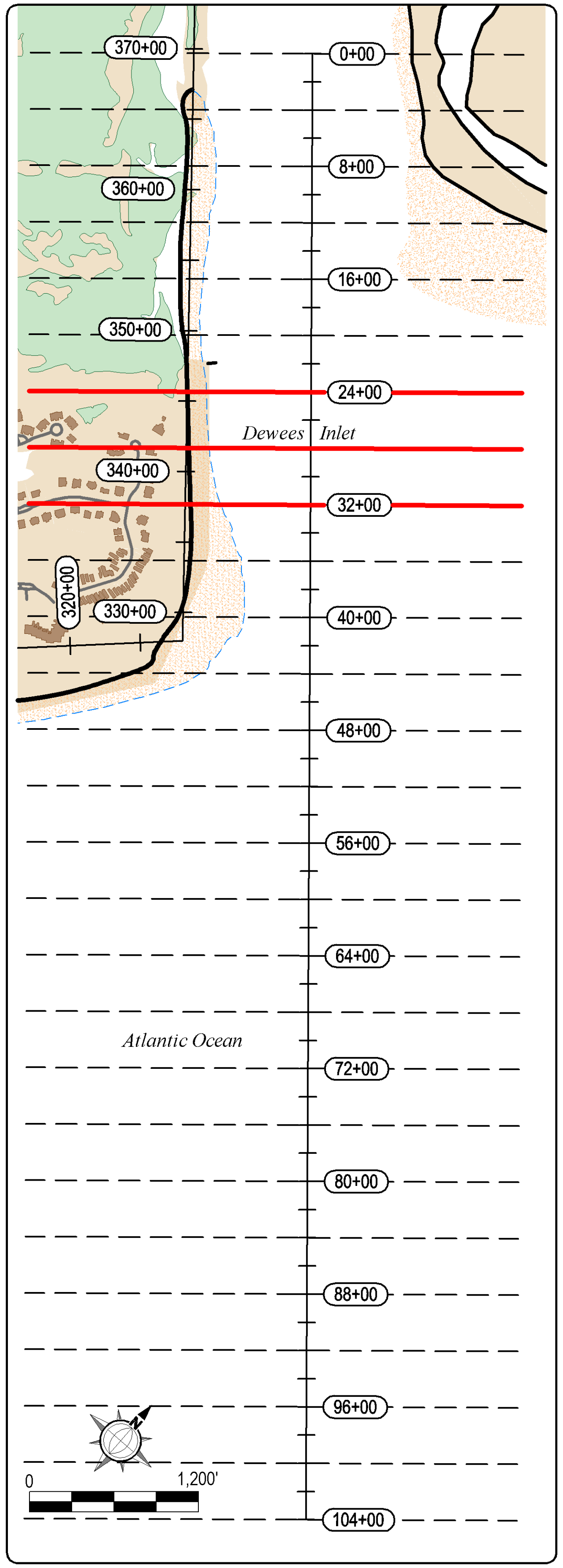

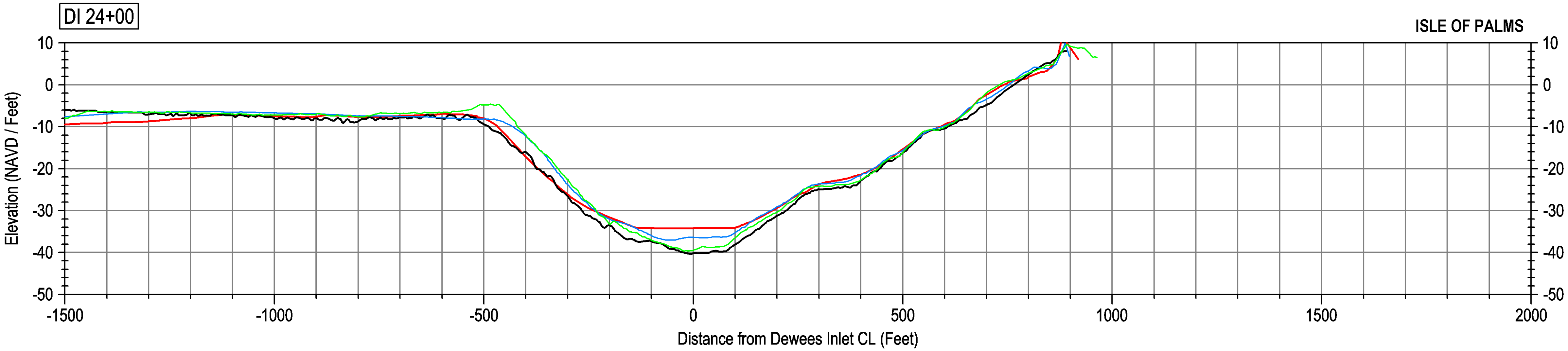

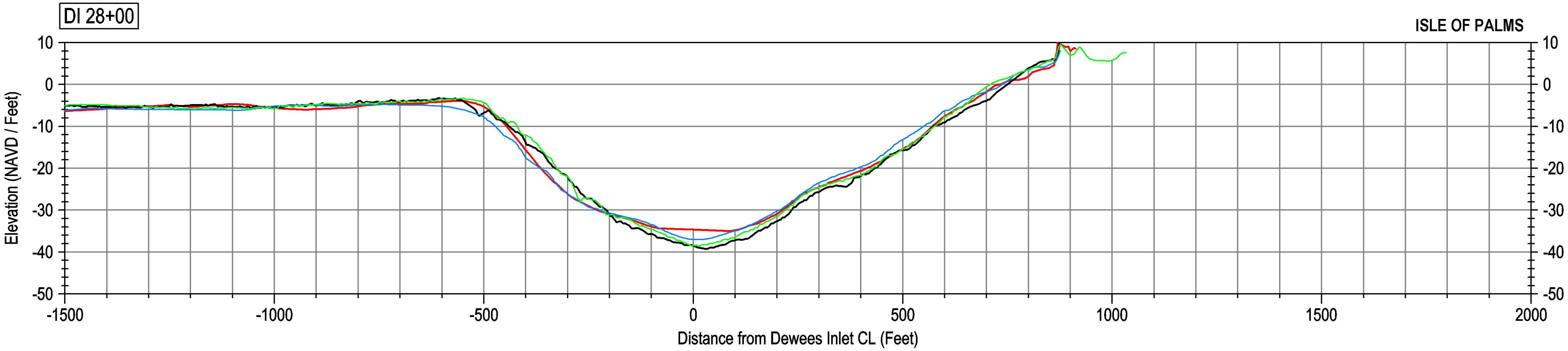

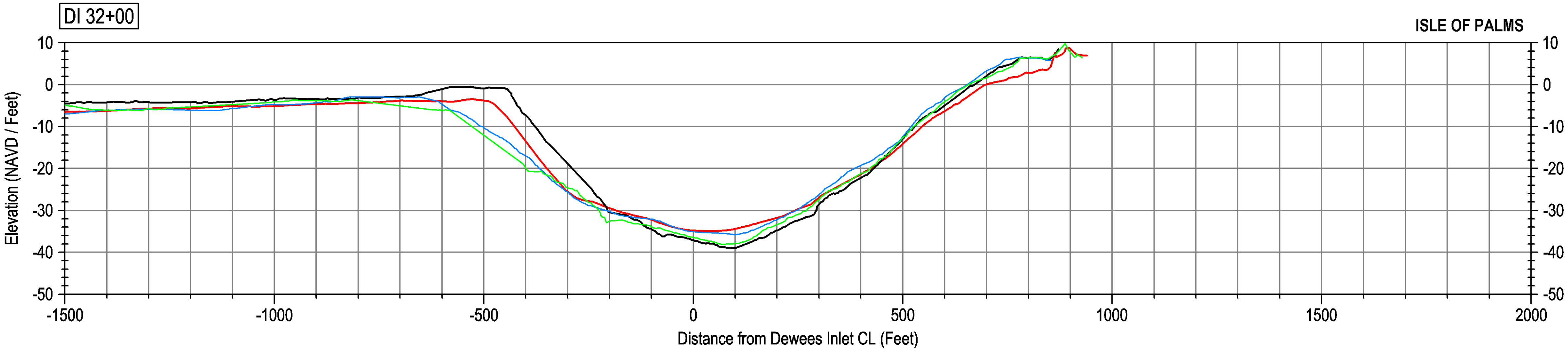

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Data Notes: Data collected by Coastal Science & Engineering, Inc via RTK GPS:

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Sept 2010

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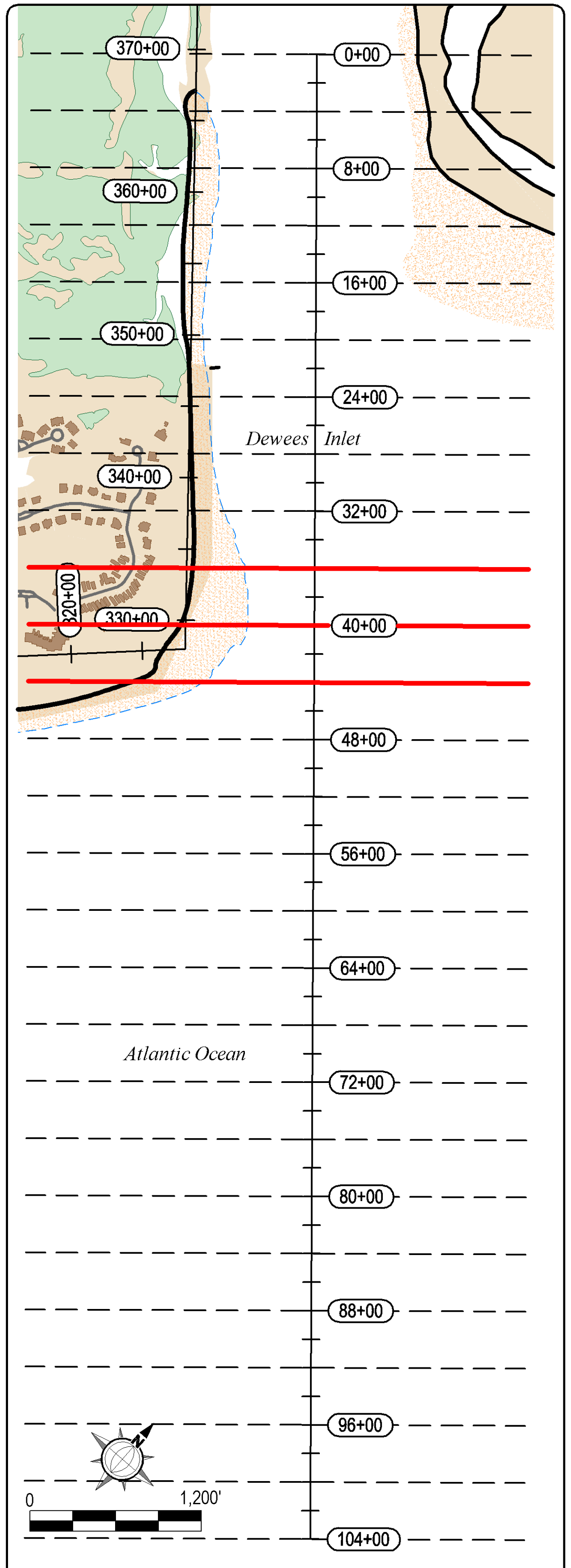

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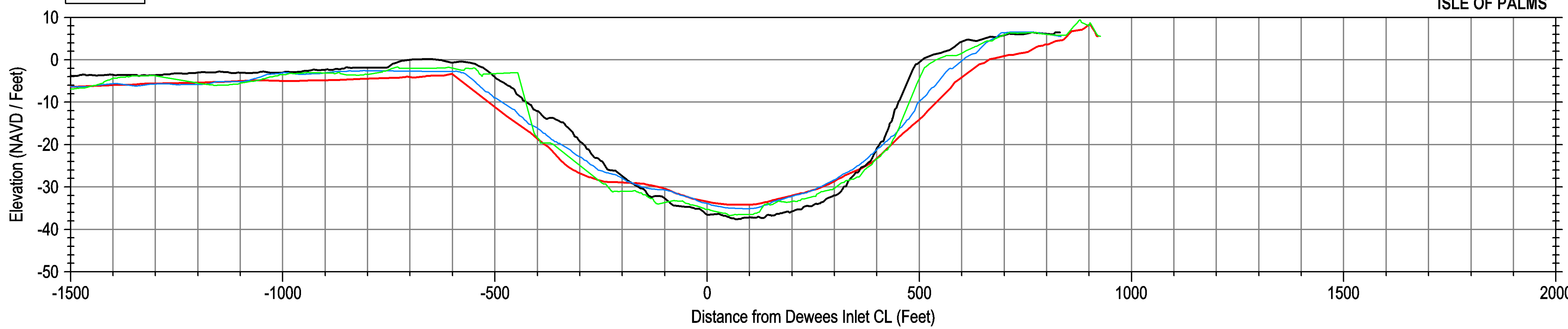

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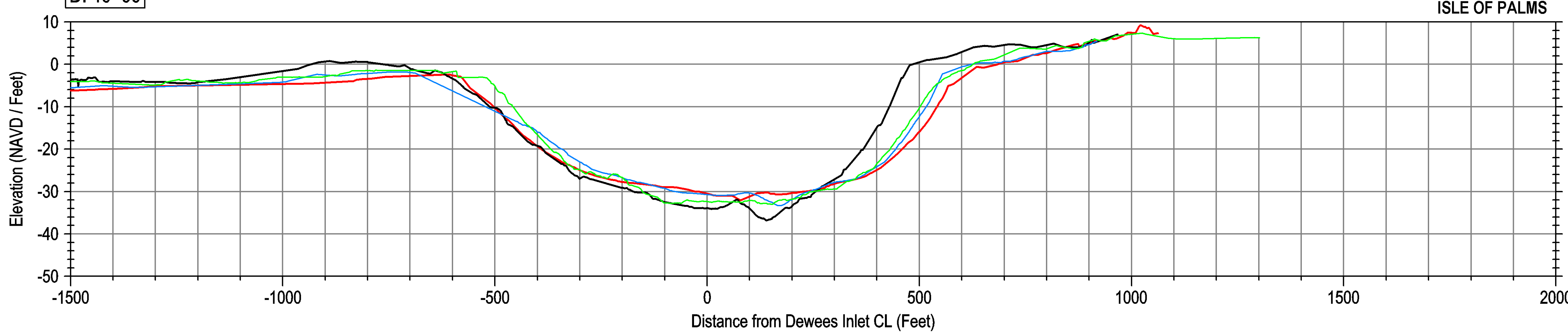

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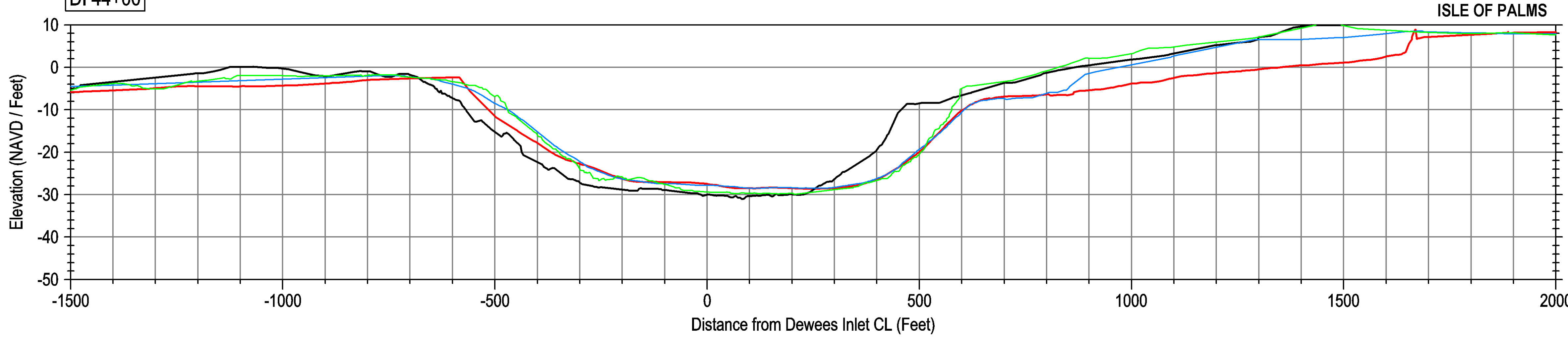

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PROJECT #: 2300
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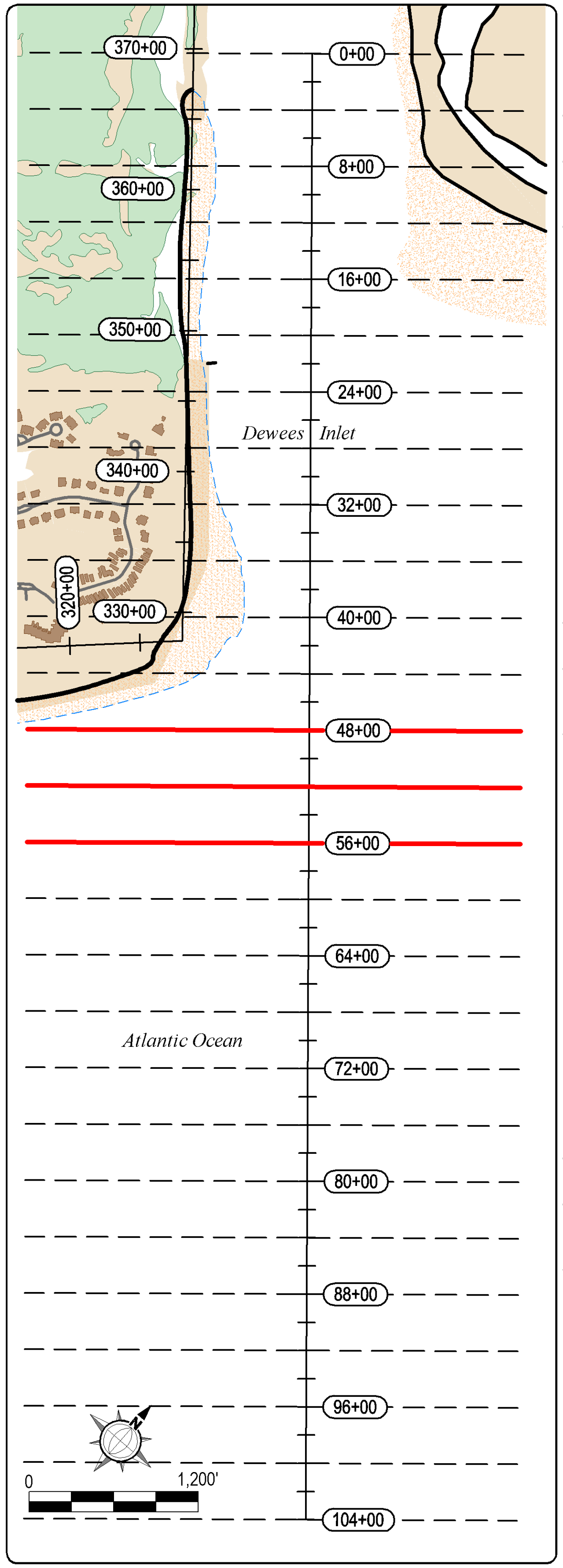

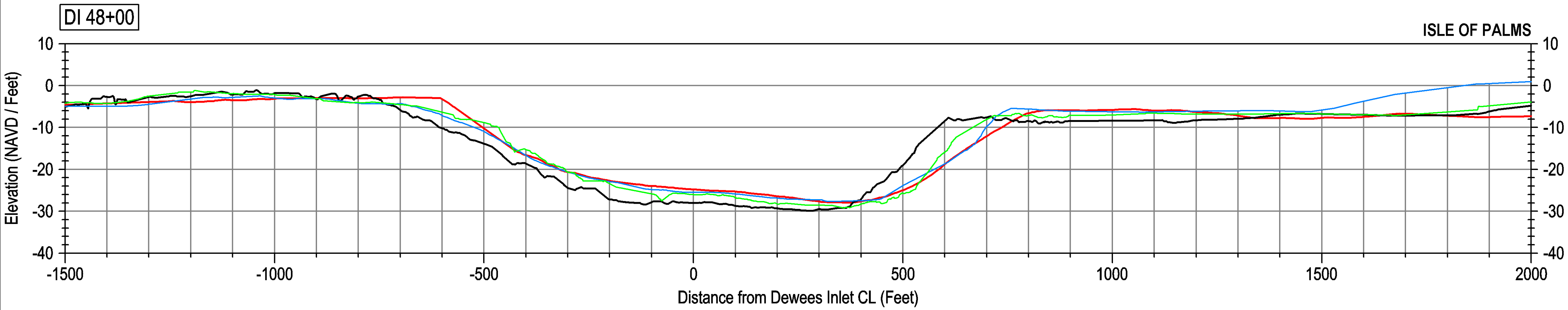

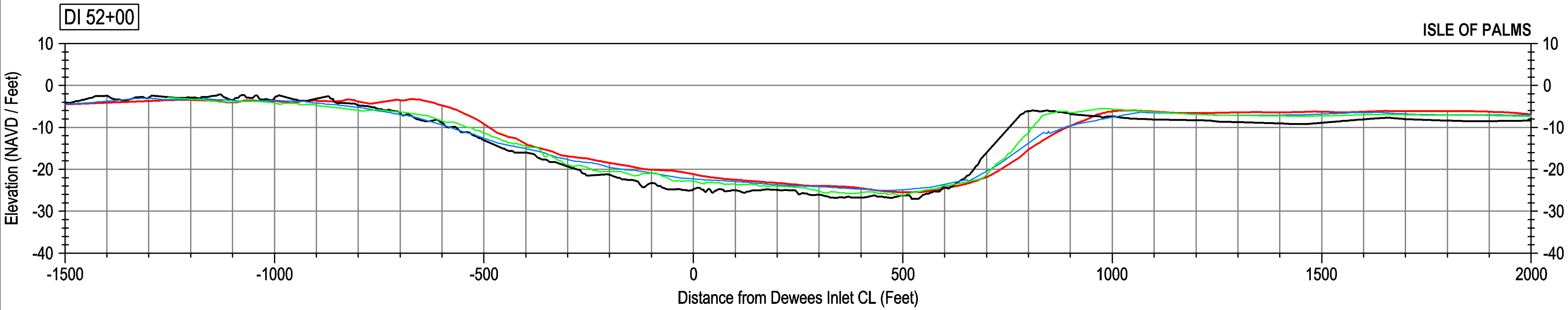

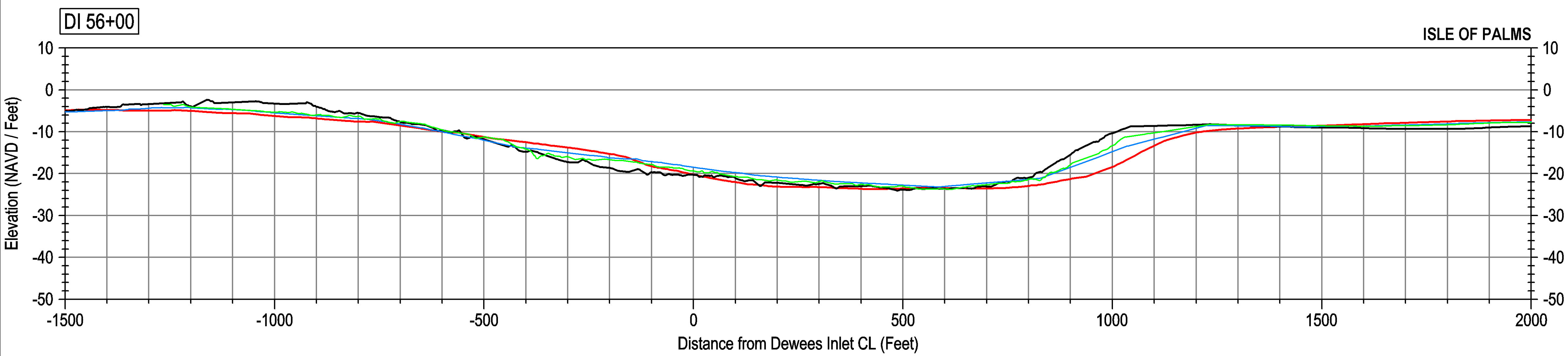

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VERTICAL EXAGGERATION: 10
Data Notes: Data collected by Coastal Science & Engineering, Inc via RTK GPS:

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SHEET #
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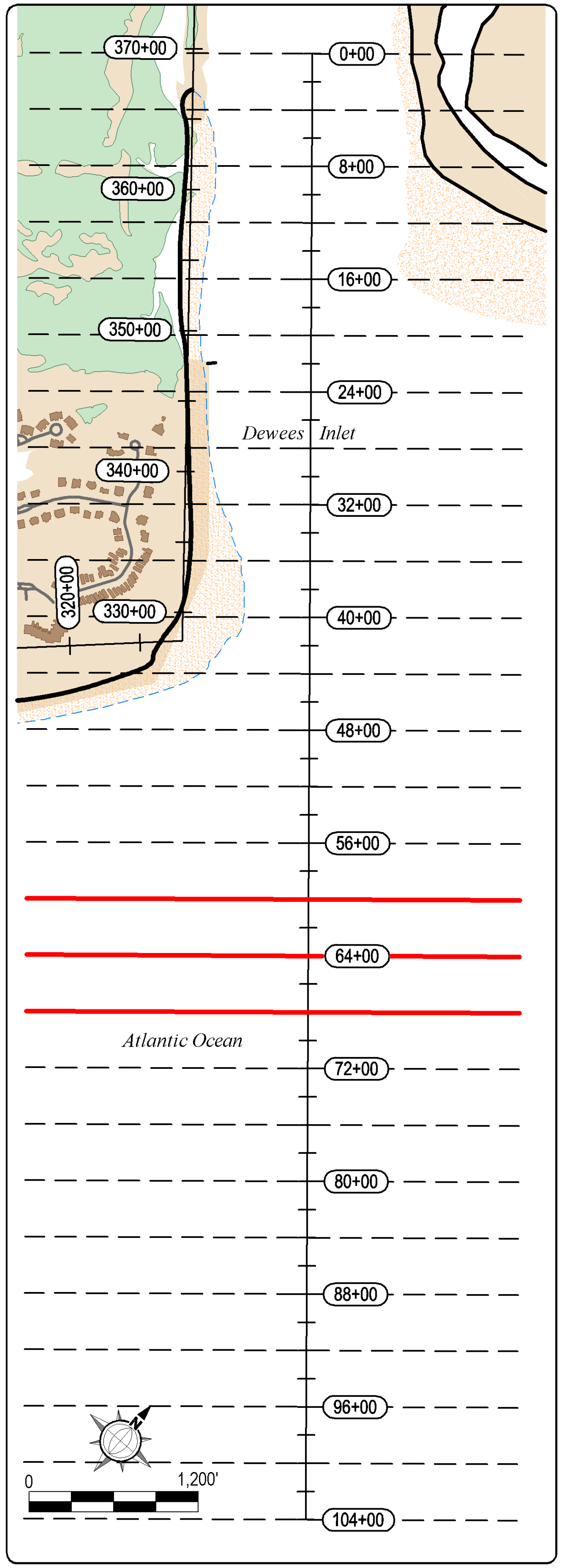

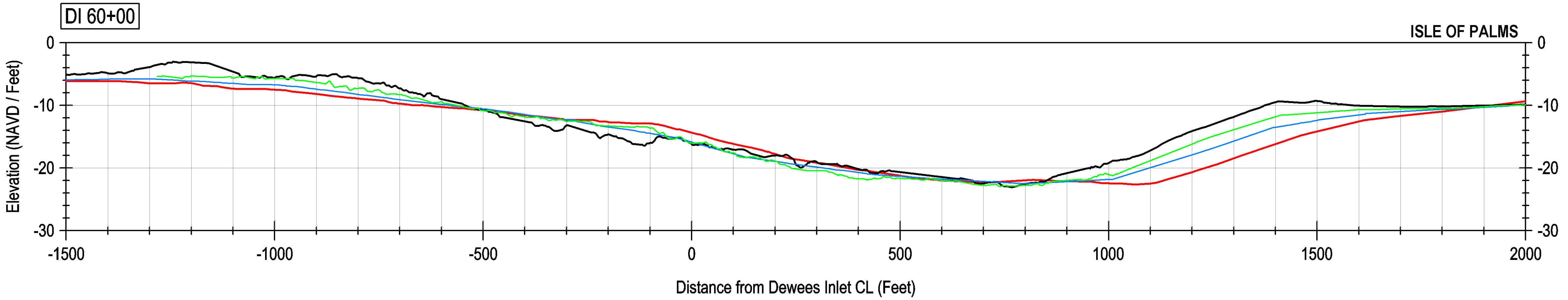

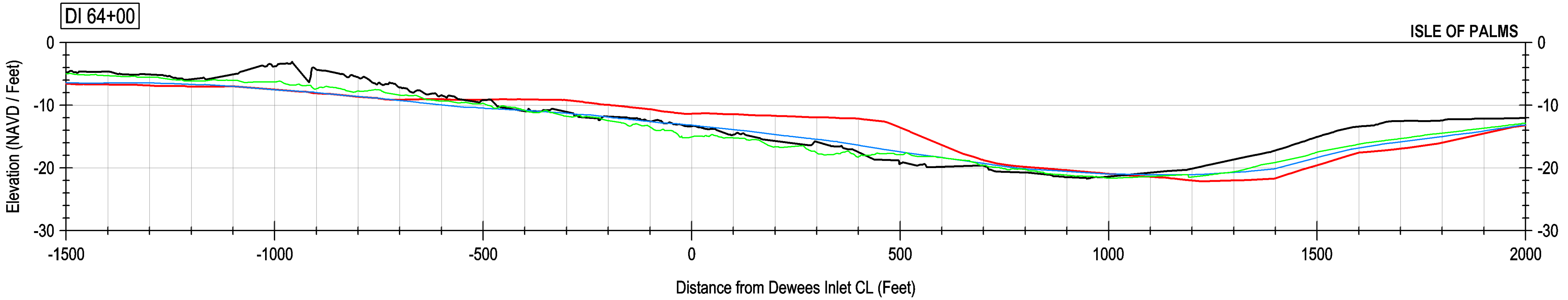

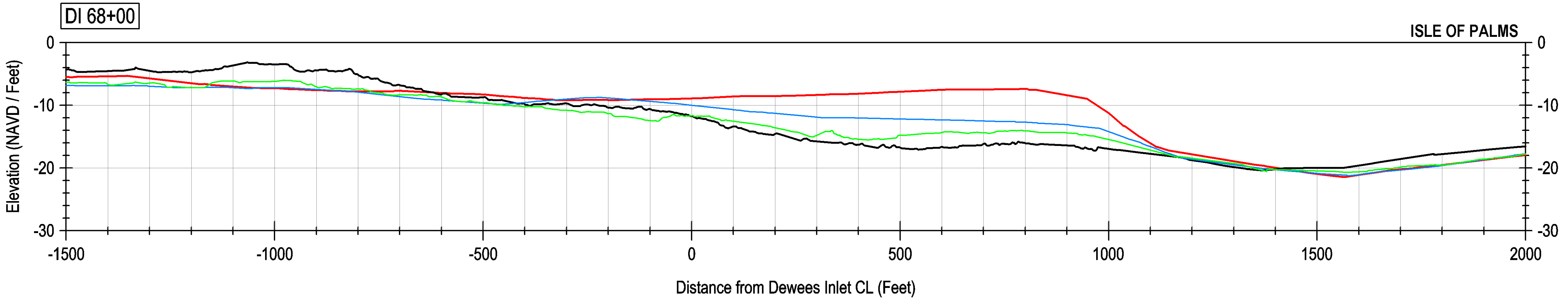

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Vertical: NAVD '83 (Feet)

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PROJECT #:	2300

SHEET #
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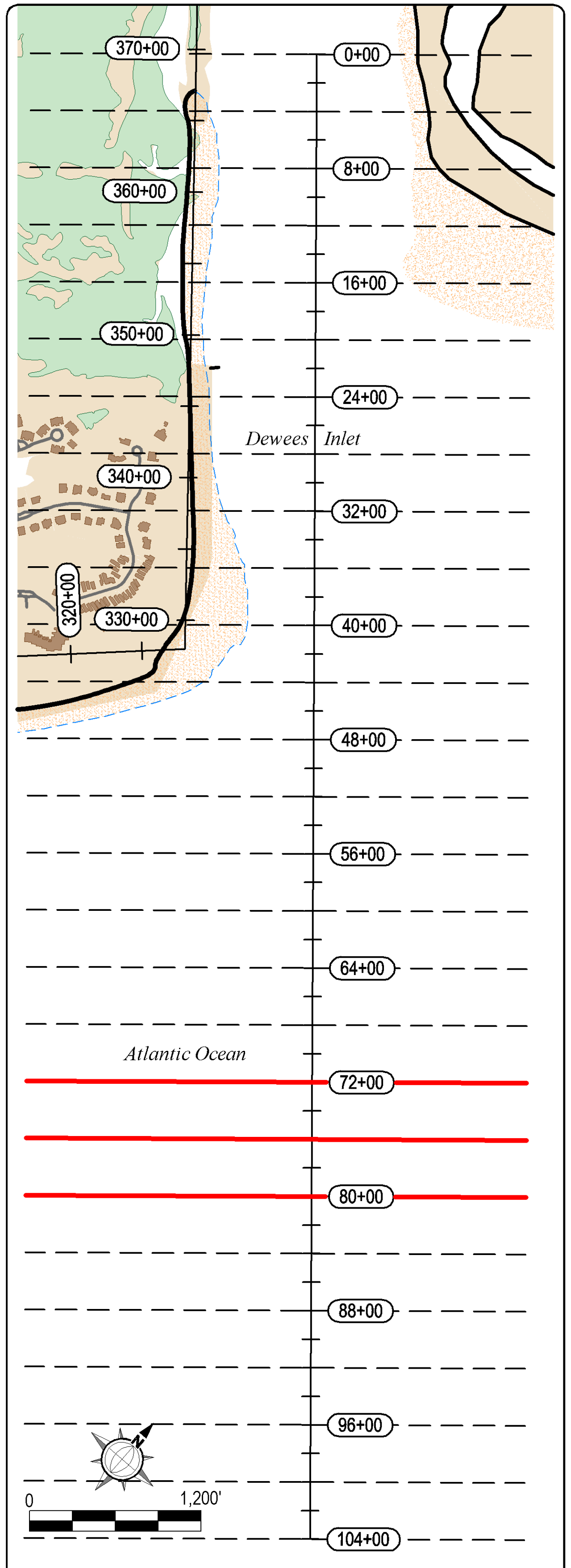

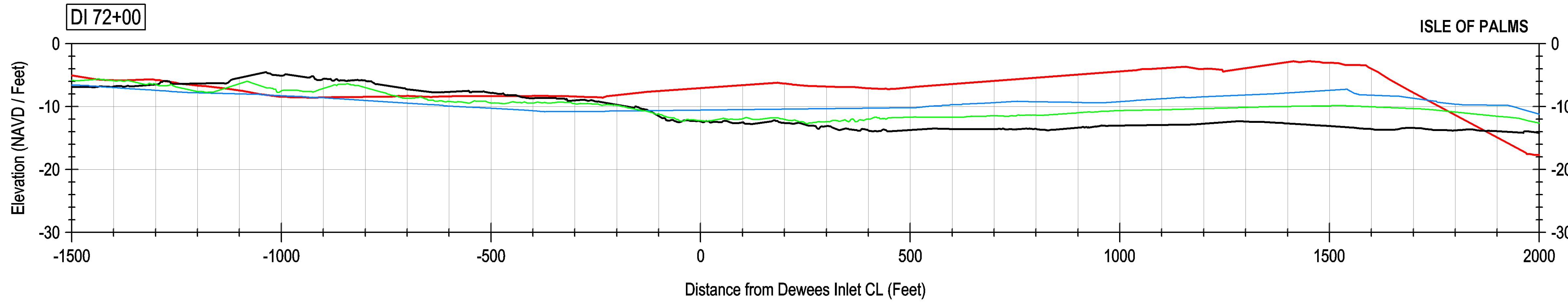

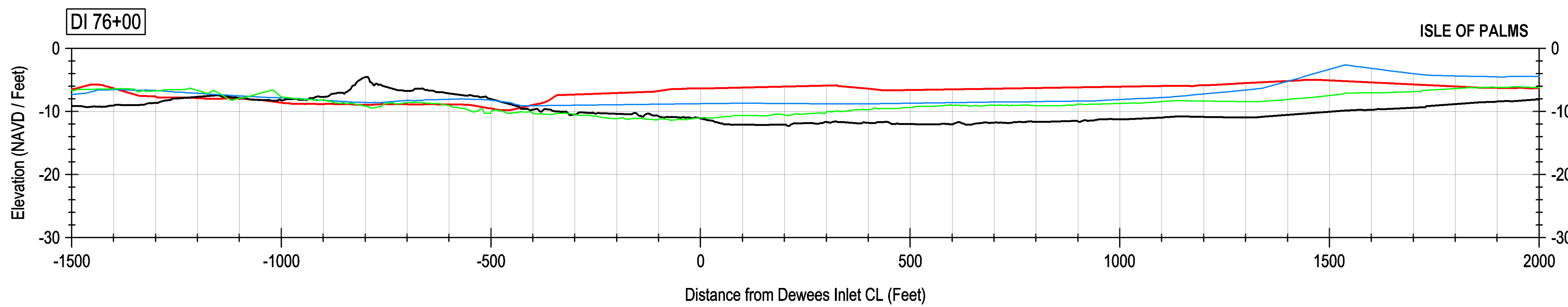

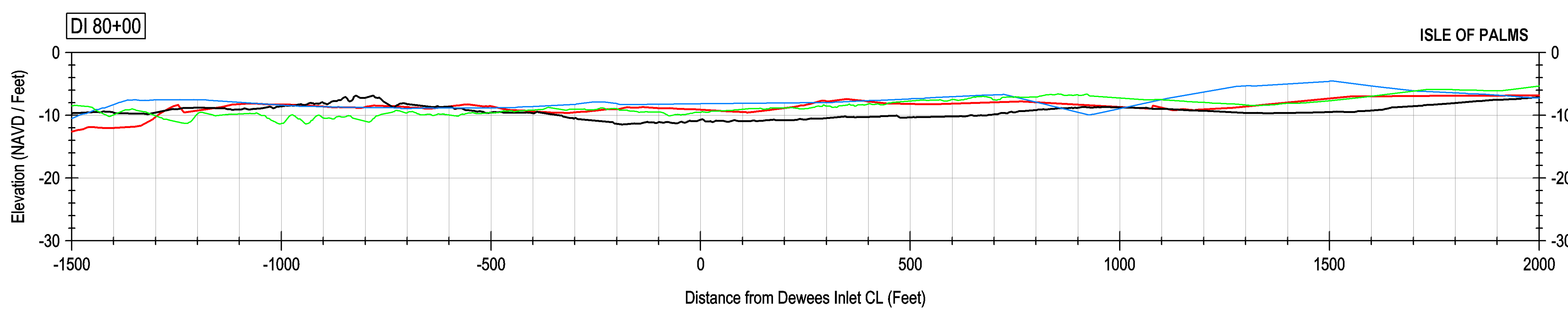

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Data Notes: Data collected by Coastal Science & Engineering, Inc via RTK GPS:

LEGEND
July 2007
July 2008
Mar 2009
Sept 2010

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PROJECT:
ISLE OF PALMS ANNUAL MONITORING REPORT

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SCALE:	AS SHOWN
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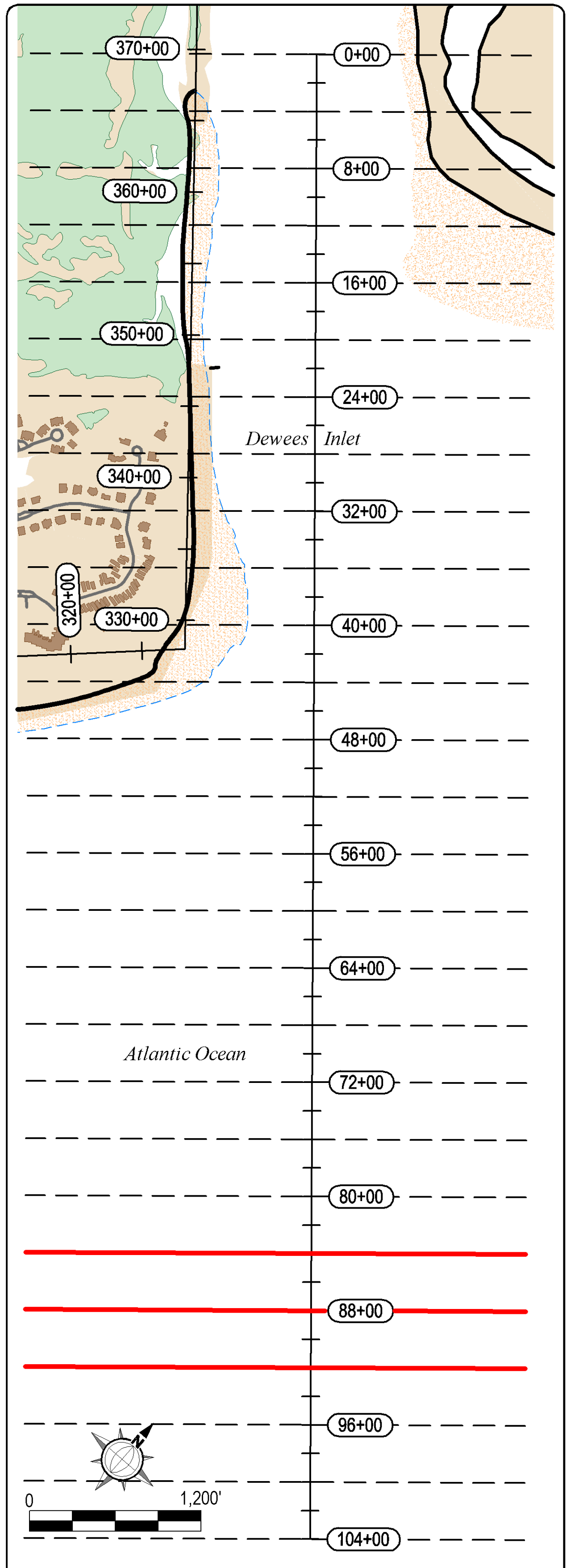
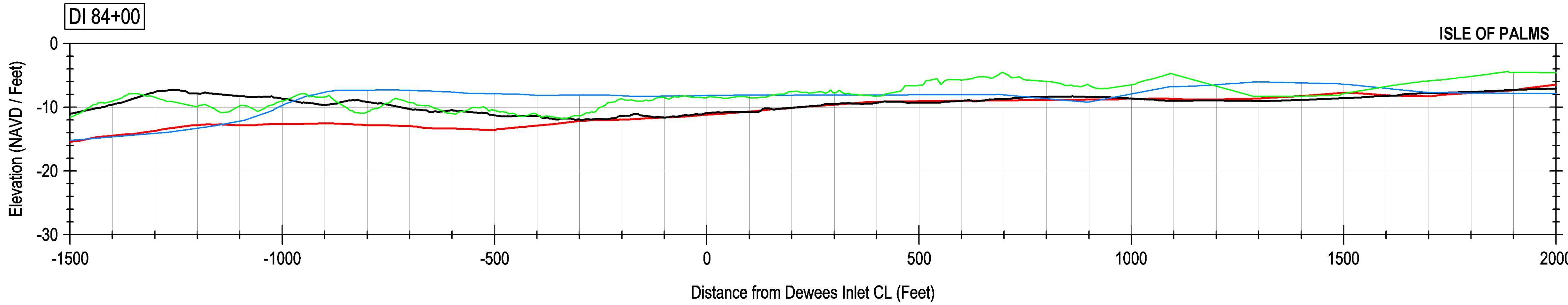
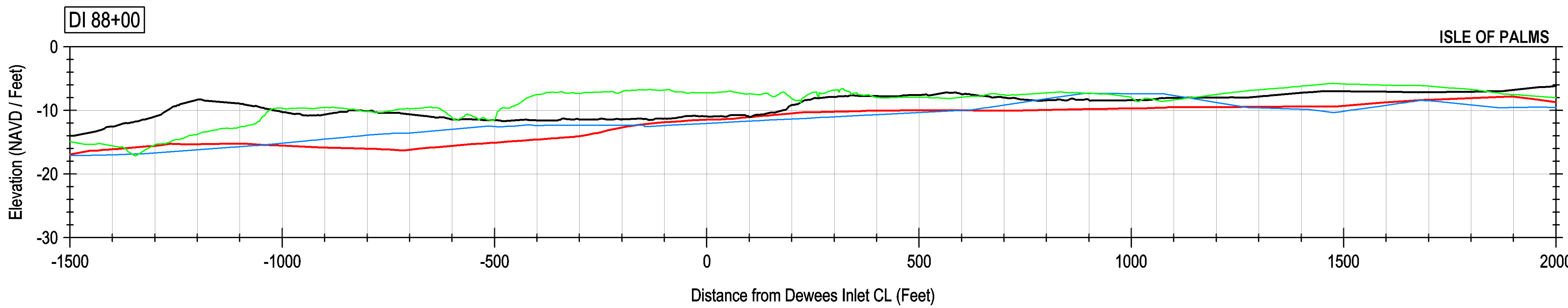
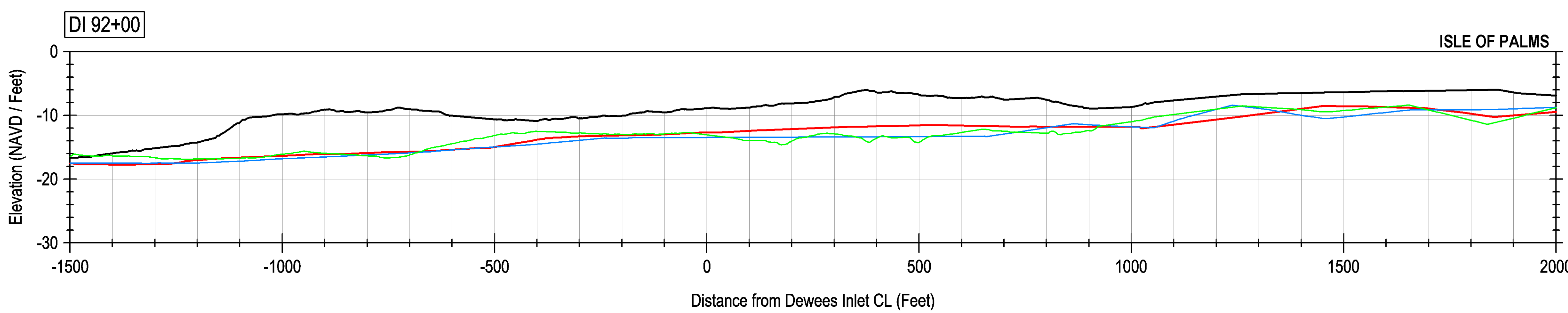
APPROVED BY:	SBT
PROJECT #:	2300

SHEET # 07









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Vertical: NAVD '83 (Feet)

VERTICAL EXAGGERATION: 20
Data Notes: Data collected by Coastal Science & Engineering, Inc via RTK GPS:

LEGEND
July 2007
July 2008
Mar 2009
Sept 2010

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ISLE OF PALMS
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PROJECT #:	2300

SHEET #
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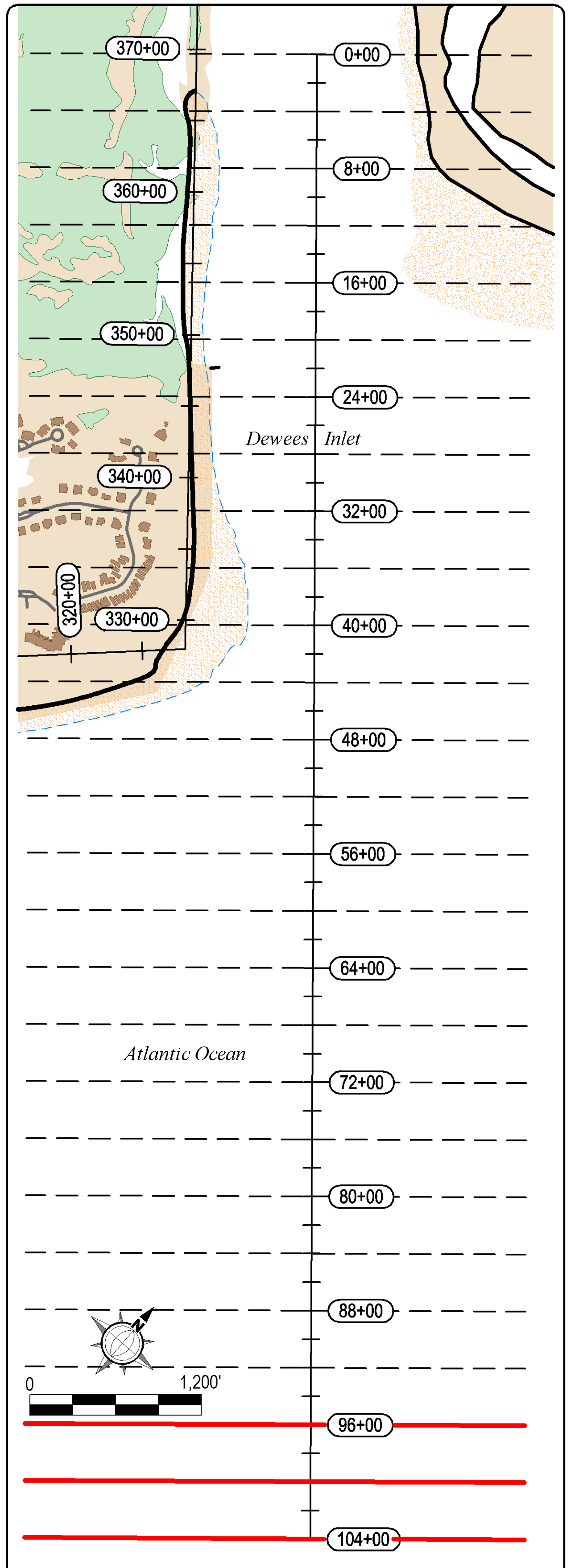

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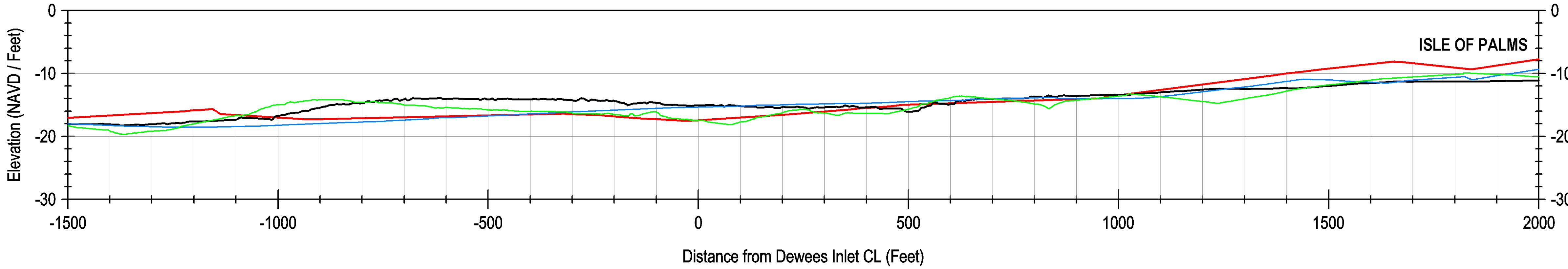

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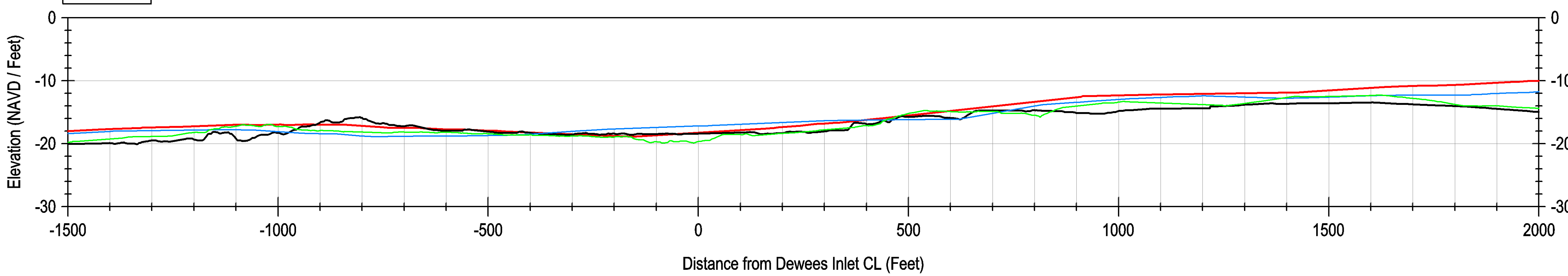

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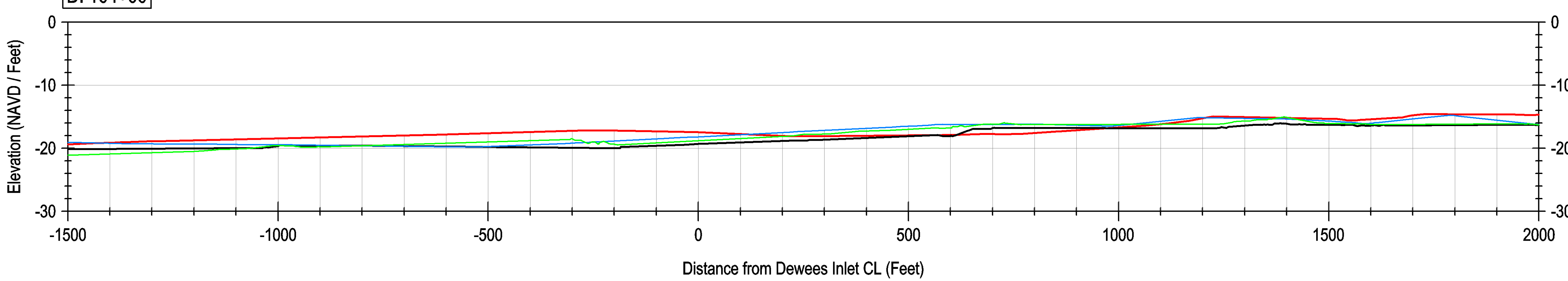

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Vertical: NAVD '83 (Feet)

VERTICAL EXAGGERATION: 20
Data Notes: Data collected by Coastal Science & Engineering, Inc via RTK GPS:

LEGEND
July 2007
Sept 2009
Mar 2010
Sept 2010

PREPARED FOR:
ANNUAL MONITORING
REPORT APPENDIX

PROJECT:
ISLE OF PALMS
ANNUAL MONITORING REPORT

DRAWING TITLE:
DEWEES INLET
CROSS SECTIONS

SCALE:	AS SHOWN
DATE:	Nov 2010
DRAWN BY:	III
APPROVED BY:	SBT
PROJECT #:	2300

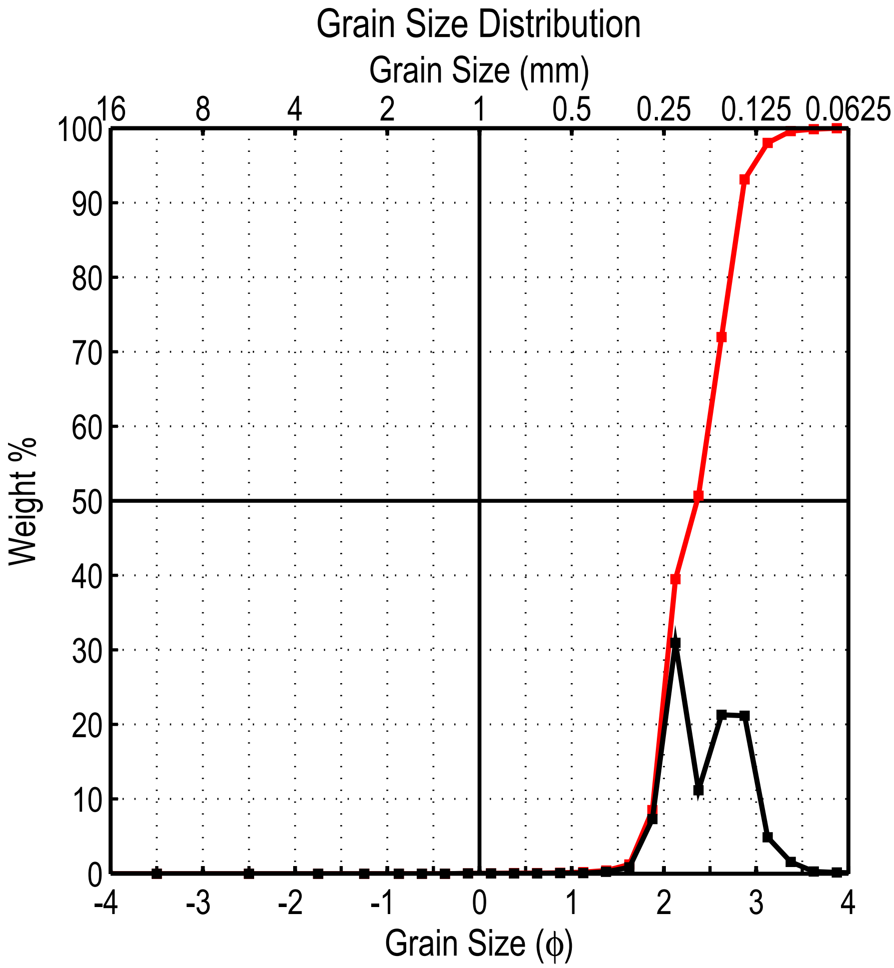
SHEET #
09

APPENDIX D

Sediment Grain-Size Distributions

July 2010 – Two Years Post-Project

[Isle of Palms – Year 2]



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**Breach Inlet**
Interval	**Dune**
Mean	**0.181 mm**
STD	**0.759 mm**
Skewness	**0.064**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Mesokurtic

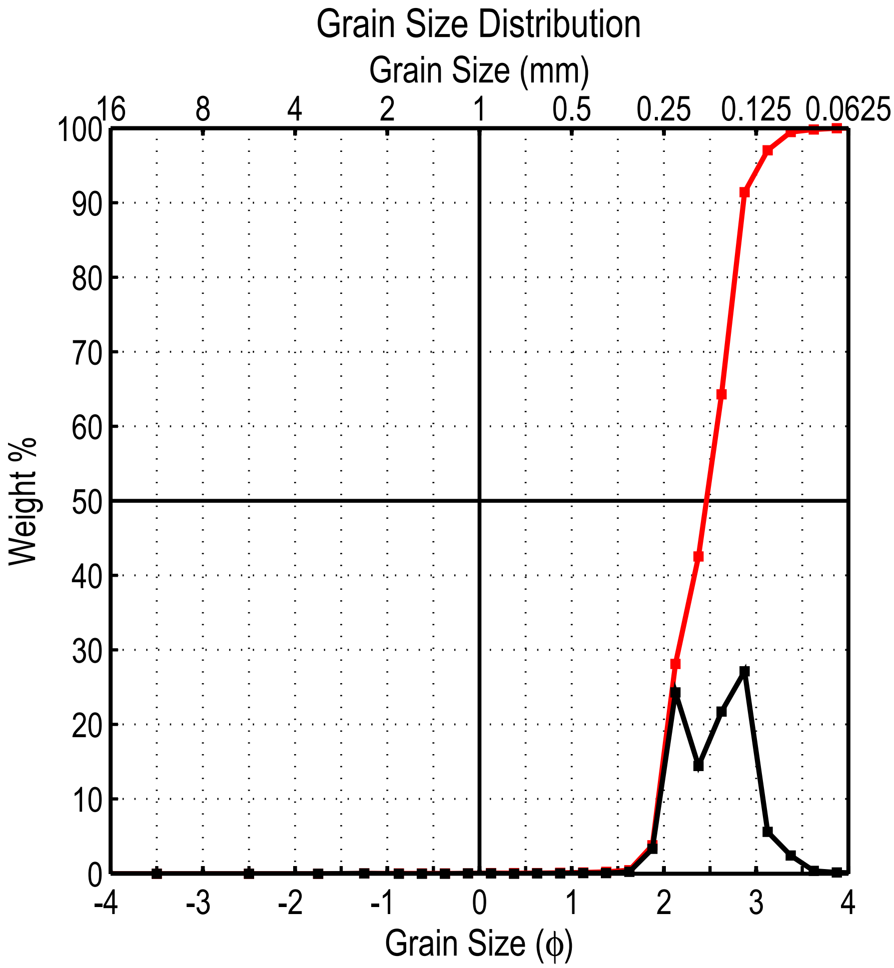
Total weight (gram)	102.67
% finer than 4.00 phi	0.02
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.0

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.01	0.01	0.01
0.25	0.125	0.01	0.01	0.02
0.5	0.375	0.03	0.03	0.05
0.75	0.625	0.02	0.02	0.07
1	0.875	0.05	0.05	0.12
1.25	1.125	0.07	0.07	0.19
1.5	1.375	0.23	0.22	0.41
1.75	1.625	0.85	0.83	1.24
2	1.875	7.49	7.30	8.53
2.25	2.125	31.77	30.94	39.48
2.5	2.375	11.49	11.19	50.67
2.75	2.625	21.85	21.28	71.95
3	2.875	21.75	21.18	93.13
3.25	3.125	5.00	4.87	98.00
3.5	3.375	1.62	1.58	99.58
3.75	3.625	0.27	0.26	99.84
4	3.875	0.14	0.14	99.98
>4.0	4.25	0.02	0.02	100.00

Percentiles	
1	1.555
5	1.755
16	1.935
25	2.010
50	2.360
75	2.660
84	2.765
95	2.970
99	3.285

Moment Measures	**(phi)**	**(mm)**
Mean	2.467	0.181
Standard Deviation	0.398	0.759
Skewness	0.064	
Kurtosis	3.149	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.350	2.353
Standard Deviation	0.415	0.392
Skewness (1)	-0.024	-0.010
Skewness (2)	0.006	
Kurtosis	0.464	0.766



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**Breach Inlet**
Interval	**Mid Berm**
Mean	**0.170 mm**
STD	**0.767 mm**
Skewness	**-0.142**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

Total weight (gram)	106.40
% finer than 4.00 phi	0.03
% coarser than -1.00 phi	0.01
% $CaCO_3$	2.5

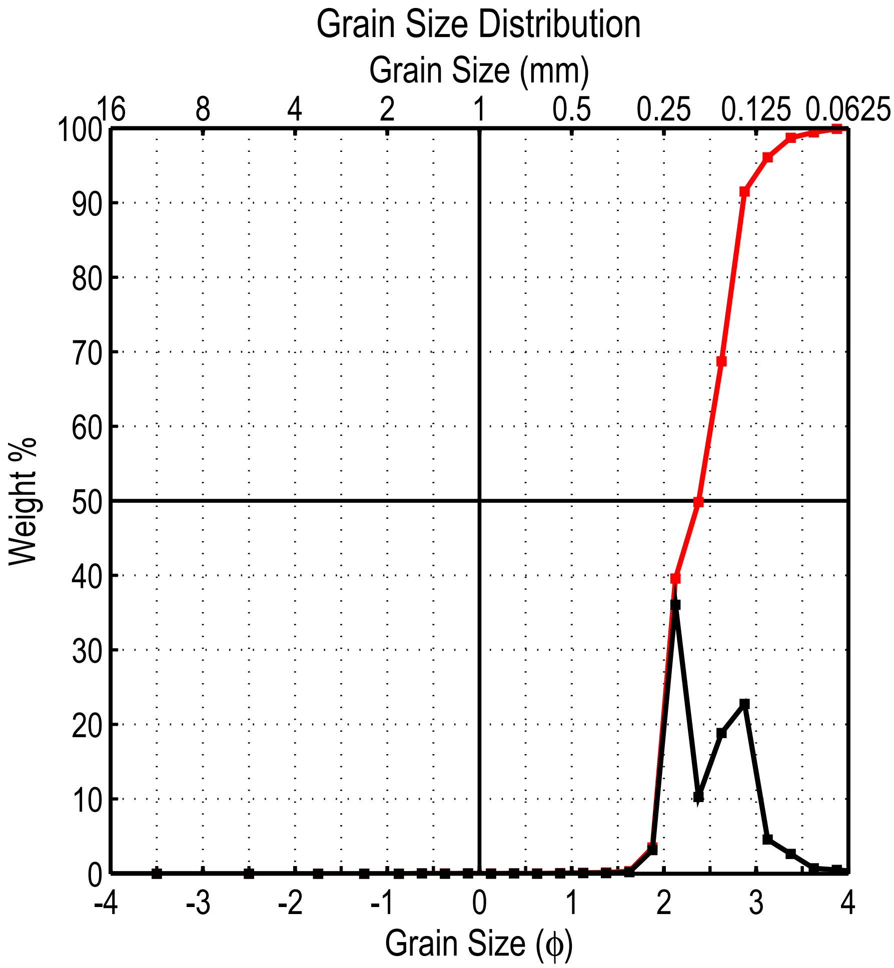
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.01	0.01	0.01
-0.75	-0.875	0.00	0.00	0.01
-0.5	-0.625	0.00	0.00	0.01
-0.25	-0.375	0.00	0.00	0.01
0	-0.125	0.03	0.03	0.04
0.25	0.125	0.01	0.01	0.05
0.5	0.375	0.00	0.00	0.05
0.75	0.625	0.02	0.02	0.07
1	0.875	0.03	0.03	0.09
1.25	1.125	0.05	0.05	0.14
1.5	1.375	0.08	0.08	0.22
1.75	1.625	0.24	0.23	0.44
2	1.875	3.56	3.35	3.79
2.25	2.125	25.88	24.32	28.11
2.5	2.375	15.37	14.45	42.56
2.75	2.625	23.12	21.73	64.29
3	2.875	28.85	27.11	91.40
3.25	3.125	5.96	5.60	97.00
3.5	3.375	2.60	2.44	99.45
3.75	3.625	0.38	0.36	99.80
4	3.875	0.18	0.17	99.97
>4.0	4.25	0.03	0.03	100.00

Percentiles

1	1.665
5	1.885
16	2.000
25	2.095
50	2.460
75	2.725
84	2.805
95	3.035
99	3.330

Moment Measures	**(phi)**	**(mm)**
Mean	2.556	0.170
Standard Deviation	0.382	0.767
Skewness	-0.142	
Kurtosis	4.472	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.402	2.422
Standard Deviation	0.402	0.375
Skewness (1)	-0.143	-0.071
Skewness (2)	0.000	
Kurtosis	0.429	0.748



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**Breach Inlet**
Interval	**Berm Crest**
Mean	**0.176 mm**
STD	**0.755 mm**
Skewness	**0.449**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Fine Skewed
	Mesokurtic

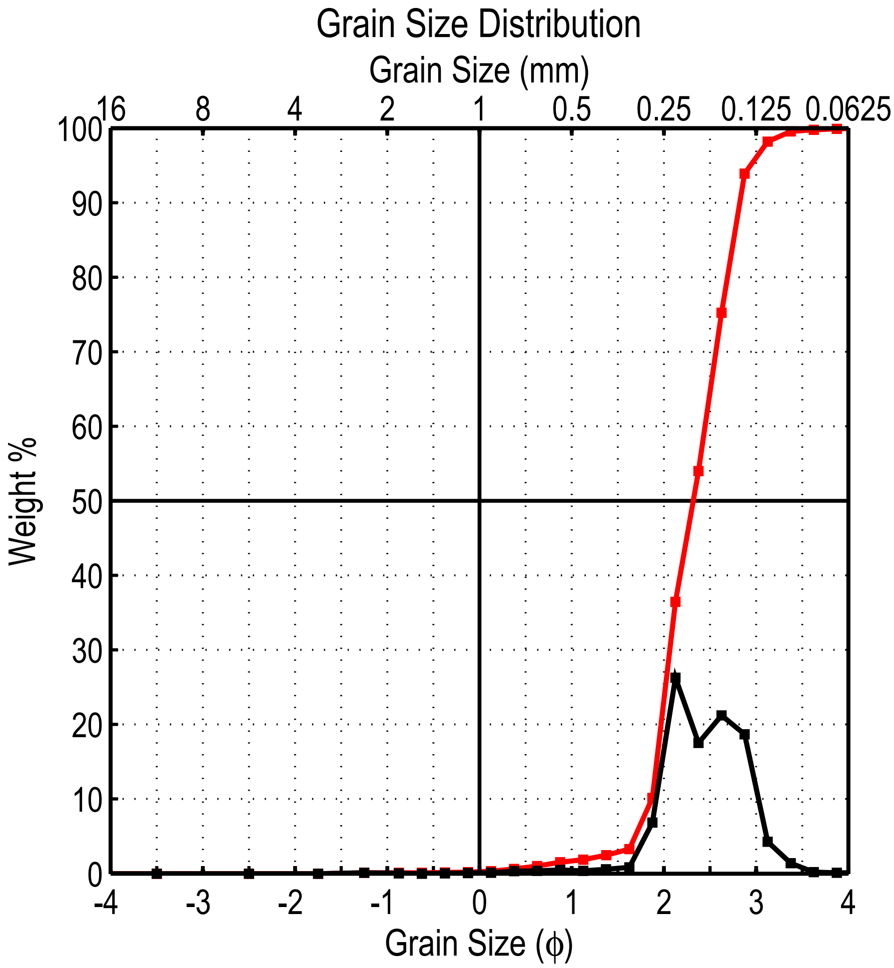
Total weight (gram)	109.49
% finer than 4.00 phi	0.10
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.7

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.01	0.01	0.01
-0.25	-0.375	0.00	0.00	0.01
0	-0.125	0.01	0.01	0.02
0.25	0.125	0.00	0.00	0.02
0.5	0.375	0.01	0.01	0.03
0.75	0.625	0.00	0.00	0.03
1	0.875	0.03	0.03	0.05
1.25	1.125	0.06	0.05	0.11
1.5	1.375	0.05	0.05	0.16
1.75	1.625	0.20	0.18	0.34
2	1.875	3.46	3.16	3.50
2.25	2.125	39.50	36.08	39.57
2.5	2.375	11.25	10.27	49.85
2.75	2.625	20.65	18.86	68.71
3	2.875	24.94	22.78	91.49
3.25	3.125	5.01	4.58	96.06
3.5	3.375	2.89	2.64	98.70
3.75	3.625	0.79	0.72	99.42
4	3.875	0.52	0.47	99.90
>4.0	4.25	0.11	0.10	100.00

Percentiles	
1	1.675
5	1.885
16	1.960
25	2.025
50	2.375
75	2.695
84	2.795
95	3.065
99	3.480

Moment Measures	**(phi)**	**(mm)**
Mean	2.505	0.176
Standard Deviation	0.406	0.755
Skewness	0.449	
Kurtosis	3.577	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.377	2.377
Standard Deviation	0.417	0.388
Skewness (1)	0.006	0.088
Skewness (2)	0.240	
Kurtosis	0.413	0.722



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**Breach Inlet**
Interval	**Beach Face**
Mean	**0.186 mm**
STD	**0.724 mm**
Skewness	**-1.292**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Coarse Skewed
	Very Leptokurtic

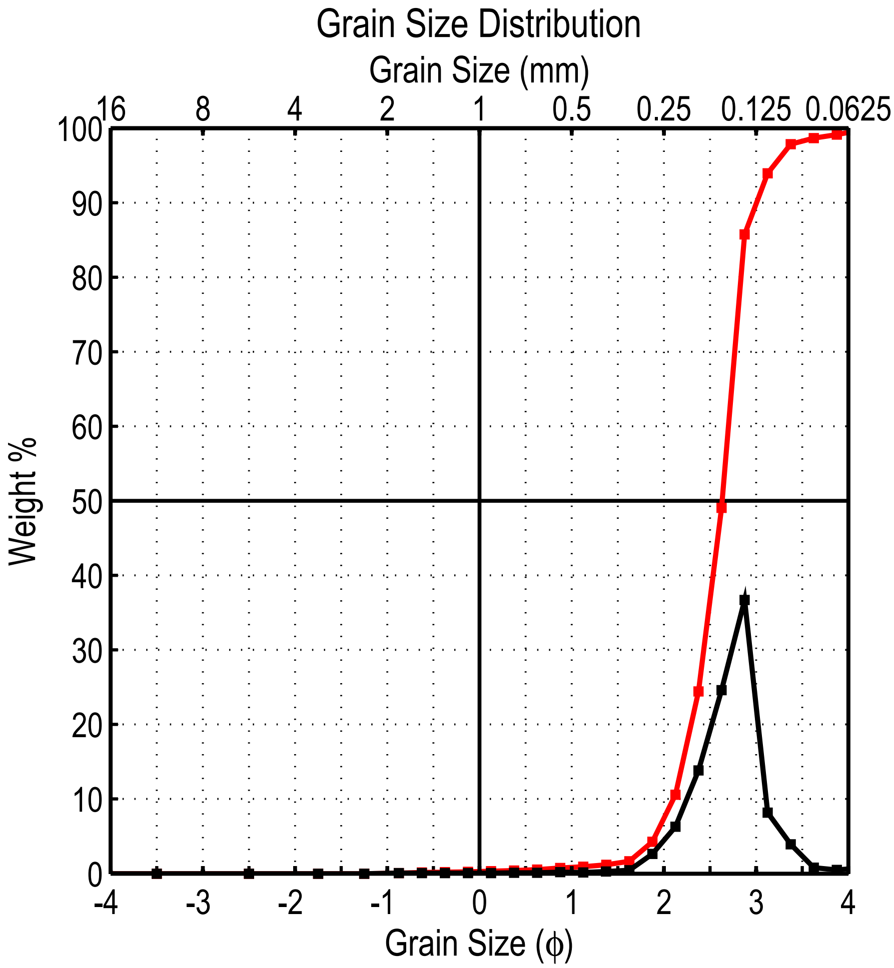
Total weight (gram)	109.86
% finer than 4.00 phi	0.12
% coarser than -1.00 phi	0.09
% $CaCO_3$	4.4

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.10	0.09	0.09
-0.75	-0.875	0.01	0.01	0.10
-0.5	-0.625	0.00	0.00	0.10
-0.25	-0.375	0.04	0.04	0.14
0	-0.125	0.08	0.07	0.21
0.25	0.125	0.14	0.13	0.34
0.5	0.375	0.33	0.30	0.64
0.75	0.625	0.42	0.38	1.02
1	0.875	0.53	0.48	1.50
1.25	1.125	0.41	0.37	1.88
1.5	1.375	0.63	0.57	2.45
1.75	1.625	0.93	0.85	3.30
2	1.875	7.53	6.85	10.15
2.25	2.125	28.89	26.30	36.45
2.5	2.375	19.27	17.54	53.99
2.75	2.625	23.32	21.23	75.21
3	2.875	20.51	18.67	93.88
3.25	3.125	4.70	4.28	98.16
3.5	3.375	1.54	1.40	99.56
3.75	3.625	0.21	0.19	99.75
4	3.875	0.14	0.13	99.88
>4.0	4.25	0.13	0.12	100.00

Percentiles	
1	0.610
5	1.685
16	1.930
25	2.015
50	2.320
75	2.620
84	2.745
95	2.940
99	3.275

Moment Measures	**(phi)**	**(mm)**
Mean	2.428	0.186
Standard Deviation	0.465	0.724
Skewness	-1.292	
Kurtosis	10.042	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.338	2.332
Standard Deviation	0.407	0.394
Skewness (1)	0.043	0.015
Skewness (2)	-0.018	
Kurtosis	0.540	0.850



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**Breach Inlet**
Interval	**Low Tide Terrace**
Mean	**0.154 mm**
STD	**0.737 mm**
Skewness	**-1.321**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

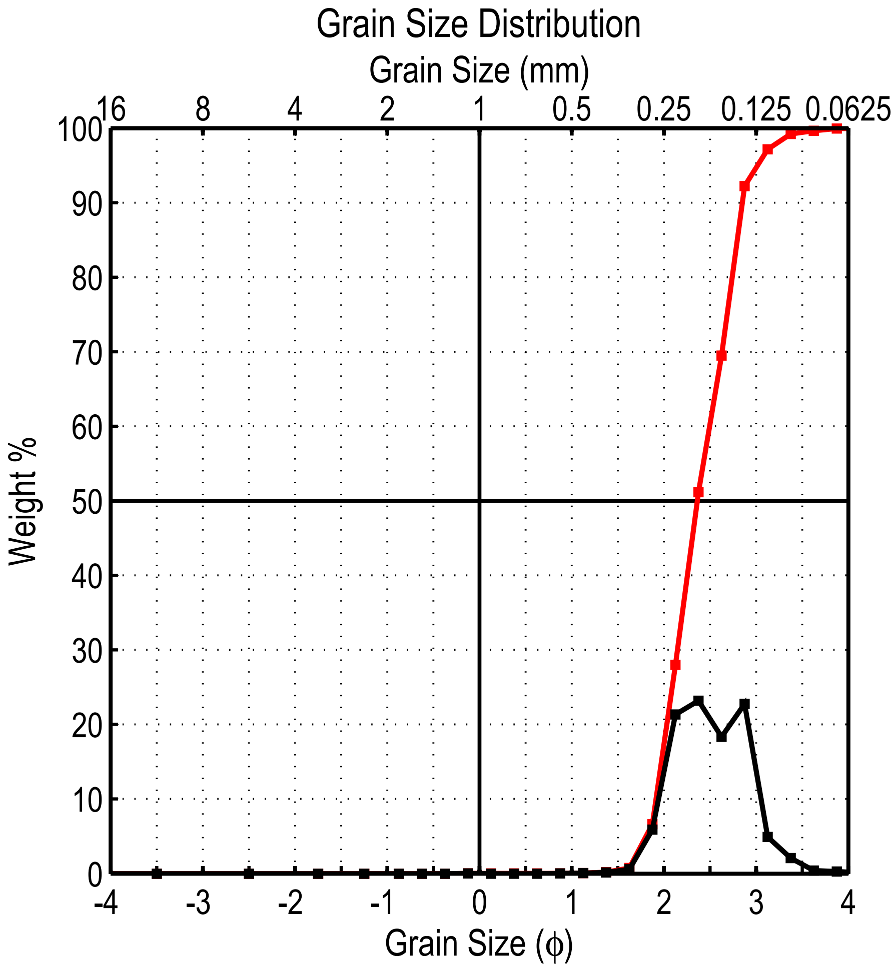
Total weight (gram)	114.00
% finer than 4.00 phi	0.86
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.8

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.06	0.05	0.05
-0.5	-0.625	0.09	0.08	0.13
-0.25	-0.375	0.05	0.04	0.18
0	-0.125	0.08	0.07	0.25
0.25	0.125	0.08	0.07	0.32
0.5	0.375	0.11	0.10	0.41
0.75	0.625	0.14	0.12	0.54
1	0.875	0.23	0.20	0.74
1.25	1.125	0.19	0.17	0.90
1.5	1.375	0.31	0.27	1.18
1.75	1.625	0.53	0.46	1.64
2	1.875	3.02	2.65	4.29
2.25	2.125	7.18	6.30	10.59
2.5	2.375	15.77	13.83	24.42
2.75	2.625	28.06	24.61	49.04
3	2.875	41.85	36.71	85.75
3.25	3.125	9.33	8.18	93.93
3.5	3.375	4.47	3.92	97.85
3.75	3.625	0.89	0.78	98.63
4	3.875	0.58	0.51	99.14
>4.0	4.25	0.98	0.86	100.00

Percentiles	
1	1.215
5	1.905
16	2.225
25	2.380
50	2.630
75	2.800
84	2.865
95	3.195
99	3.805

Moment Measures	**(phi)**	**(mm)**
Mean	2.701	0.154
Standard Deviation	0.441	0.737
Skewness	-1.321	
Kurtosis	13.034	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.545	2.573
Standard Deviation	0.320	0.355
Skewness (1)	-0.266	-0.195
Skewness (2)	-0.250	
Kurtosis	1.016	1.259



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**9th Ave**
Interval	**Dune**
Mean	**0.175 mm**
STD	**0.767 mm**
Skewness	**0.257**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Mesokurtic

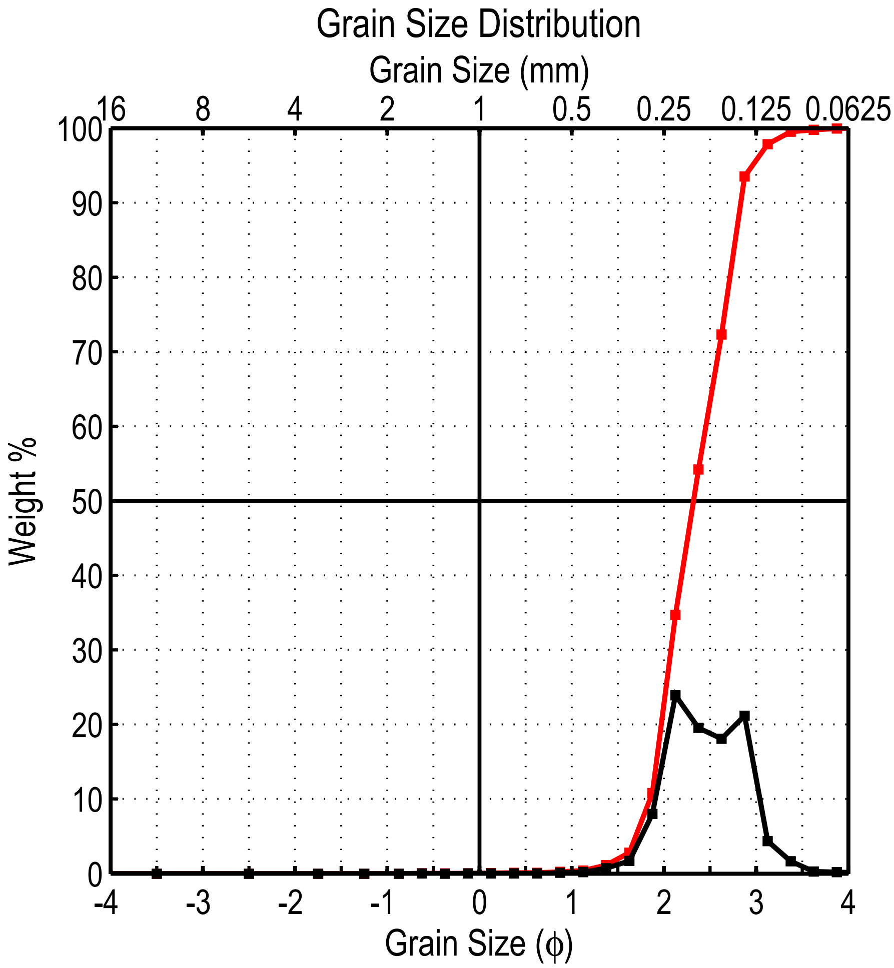
Total weight (gram)	107.75
% finer than 4.00 phi	0.07
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.2

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.01	0.01	0.01
0.25	0.125	0.00	0.00	0.01
0.5	0.375	0.00	0.00	0.01
0.75	0.625	0.00	0.00	0.01
1	0.875	0.01	0.01	0.02
1.25	1.125	0.05	0.05	0.06
1.5	1.375	0.14	0.13	0.19
1.75	1.625	0.61	0.57	0.76
2	1.875	6.34	5.88	6.65
2.25	2.125	23.00	21.35	27.99
2.5	2.375	24.97	23.17	51.16
2.75	2.625	19.74	18.32	69.48
3	2.875	24.50	22.74	92.22
3.25	3.125	5.29	4.91	97.13
3.5	3.375	2.25	2.09	99.22
3.75	3.625	0.46	0.43	99.65
4	3.875	0.30	0.28	99.93
>4.0	4.25	0.08	0.07	100.00

Percentiles	
1	1.635
5	1.805
16	1.985
25	2.090
50	2.360
75	2.685
84	2.785
95	3.015
99	3.350

Moment Measures	**(phi)**	**(mm)**
Mean	2.514	0.175
Standard Deviation	0.384	0.767
Skewness	0.257	
Kurtosis	3.346	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.385	2.377
Standard Deviation	0.400	0.383
Skewness (1)	0.062	0.073
Skewness (2)	0.125	
Kurtosis	0.512	0.833



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**9th Ave**
Interval	**Mid Berm**
Mean	**0.182 mm**
STD	**0.751 mm**
Skewness	**-0.162**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

Total weight (gram)	102.12
% finer than 4.00 phi	0.05
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.0

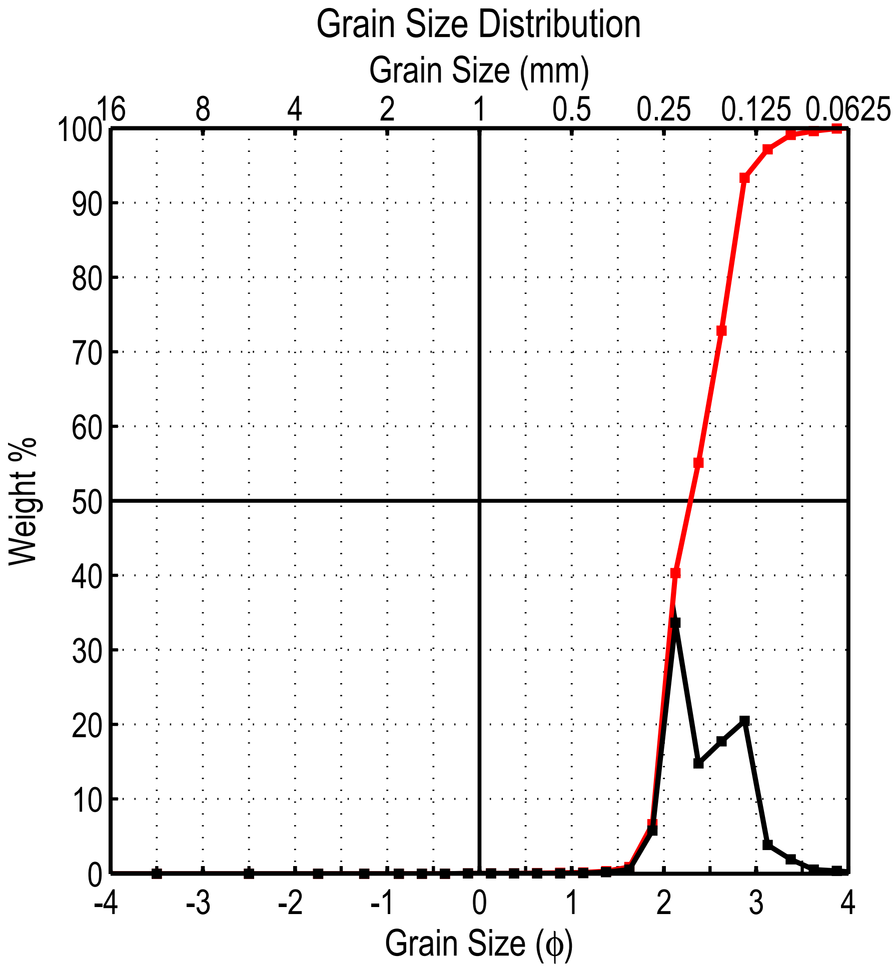
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.01	0.01	0.01
-0.25	-0.375	0.00	0.00	0.01
0	-0.125	0.02	0.02	0.03
0.25	0.125	0.02	0.02	0.05
0.5	0.375	0.04	0.04	0.09
0.75	0.625	0.04	0.04	0.13
1	0.875	0.10	0.10	0.23
1.25	1.125	0.19	0.19	0.41
1.5	1.375	0.72	0.71	1.12
1.75	1.625	1.71	1.67	2.79
2	1.875	8.17	8.00	10.79
2.25	2.125	24.41	23.90	34.69
2.5	2.375	19.94	19.53	54.22
2.75	2.625	18.48	18.10	72.32
3	2.875	21.62	21.17	93.49
3.25	3.125	4.45	4.36	97.85
3.5	3.375	1.68	1.65	99.49
3.75	3.625	0.29	0.28	99.77
4	3.875	0.18	0.18	99.95
>4.0	4.25	0.05	0.05	100.00

Percentiles

1	1.335
5	1.695
16	1.930
25	2.025
50	2.320
75	2.655
84	2.765
95	2.960
99	3.300

Moment Measures	**(phi)**	**(mm)**
Mean	2.456	0.182
Standard Deviation	0.414	0.751
Skewness	-0.162	
Kurtosis	4.145	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.348	2.338
Standard Deviation	0.417	0.400
Skewness (1)	0.066	0.039
Skewness (2)	0.018	
Kurtosis	0.515	0.823



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**9th Ave**
Interval	**Berm Crest**
Mean	**0.182 mm**
STD	**0.759 mm**
Skewness	**0.393**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Mesokurtic

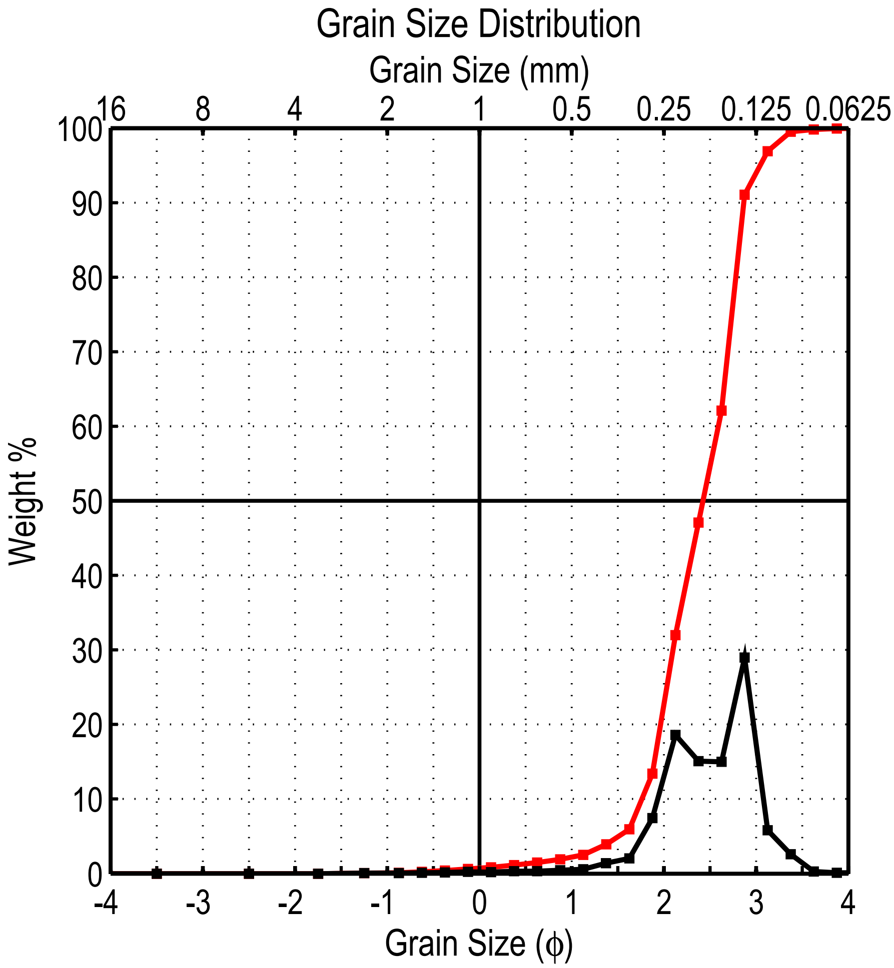
Total weight (gram)	109.41
% finer than 4.00 phi	0.06
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.6

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.01	0.01	0.01
0.25	0.125	0.01	0.01	0.02
0.5	0.375	0.02	0.02	0.04
0.75	0.625	0.02	0.02	0.05
1	0.875	0.04	0.04	0.09
1.25	1.125	0.05	0.05	0.14
1.5	1.375	0.20	0.18	0.32
1.75	1.625	0.59	0.54	0.86
2	1.875	6.31	5.77	6.63
2.25	2.125	36.84	33.67	40.30
2.5	2.375	16.18	14.79	55.09
2.75	2.625	19.41	17.74	72.83
3	2.875	22.41	20.48	93.31
3.25	3.125	4.20	3.84	97.15
3.5	3.375	2.09	1.91	99.06
3.75	3.625	0.58	0.53	99.59
4	3.875	0.38	0.35	99.94
>4.0	4.25	0.07	0.06	100.00

Percentiles	
1	1.630
5	1.805
16	1.945
25	2.010
50	2.290
75	2.650
84	2.760
95	2.985
99	3.365

Moment Measures	**(phi)**	**(mm)**
Mean	2.462	0.182
Standard Deviation	0.398	0.759
Skewness	0.393	
Kurtosis	3.582	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.353	2.332
Standard Deviation	0.407	0.383
Skewness (1)	0.153	0.166
Skewness (2)	0.258	
Kurtosis	0.448	0.756



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**9th Ave**
Interval	**Beach Face**
Mean	**0.180 mm**
STD	**0.684 mm**
Skewness	**-1.604**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

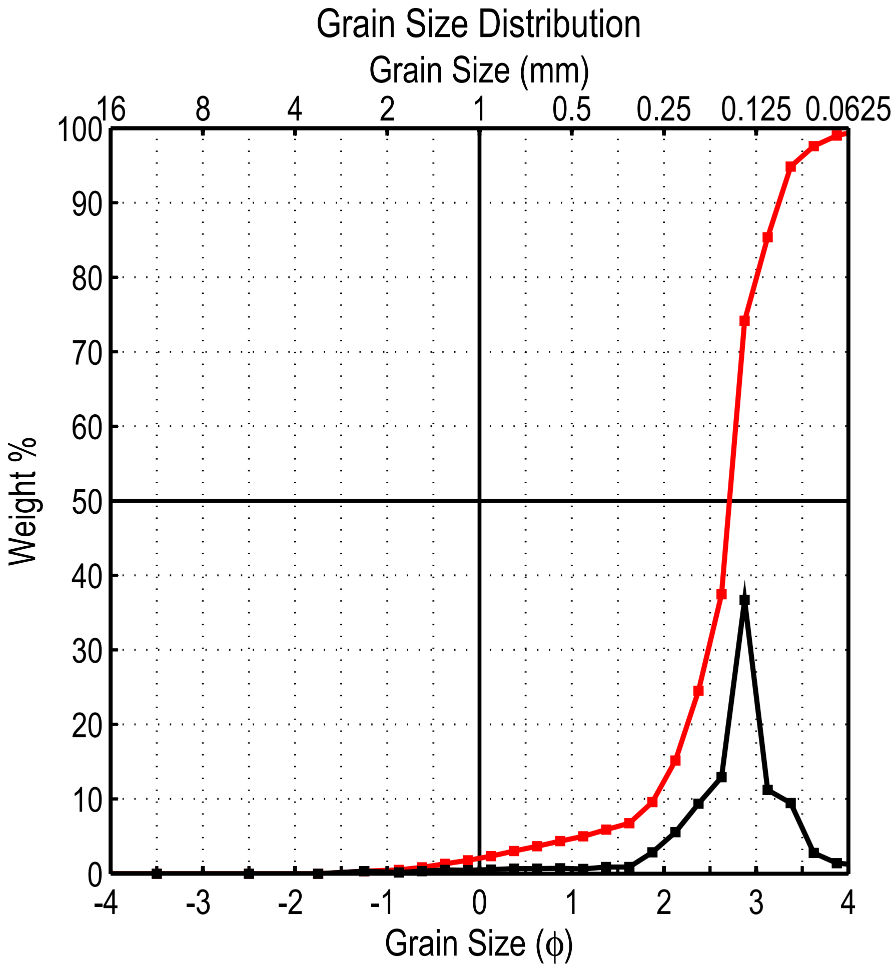
Total weight (gram)	101.14
% finer than 4.00 phi	0.08
% coarser than -1.00 phi	0.07
% $CaCO_3$	4.6

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.07	0.07	0.07
-0.75	-0.875	0.05	0.05	0.12
-0.5	-0.625	0.13	0.13	0.25
-0.25	-0.375	0.15	0.15	0.40
0	-0.125	0.24	0.24	0.63
0.25	0.125	0.21	0.21	0.84
0.5	0.375	0.31	0.31	1.15
0.75	0.625	0.32	0.32	1.46
1	0.875	0.45	0.44	1.91
1.25	1.125	0.60	0.59	2.50
1.5	1.375	1.42	1.40	3.91
1.75	1.625	2.05	2.03	5.93
2	1.875	7.54	7.46	13.39
2.25	2.125	18.81	18.60	31.99
2.5	2.375	15.27	15.10	47.08
2.75	2.625	15.18	15.01	62.09
3	2.875	29.31	28.98	91.07
3.25	3.125	5.90	5.83	96.91
3.5	3.375	2.64	2.61	99.52
3.75	3.625	0.30	0.30	99.81
4	3.875	0.11	0.11	99.92
>4.0	4.25	0.08	0.08	100.00

Percentiles	
1	0.255
5	1.510
16	1.910
25	2.030
50	2.425
75	2.735
84	2.815
95	3.045
99	3.325

Moment Measures	**(phi)**	**(mm)**
Mean	2.473	0.180
Standard Deviation	0.548	0.684
Skewness	-1.604	
Kurtosis	9.115	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.362	2.383
Standard Deviation	0.452	0.459
Skewness (1)	-0.138	-0.165
Skewness (2)	-0.326	
Kurtosis	0.696	0.892



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**9th Ave**
Interval	**Low Tide Terrace**
Mean	**0.155 mm**
STD	**0.598 mm**
Skewness	**-2.168**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

Total weight (gram)	112.22
% finer than 4.00 phi	1.00
% coarser than -1.00 phi	0.34
% $CaCO_3$	9.2

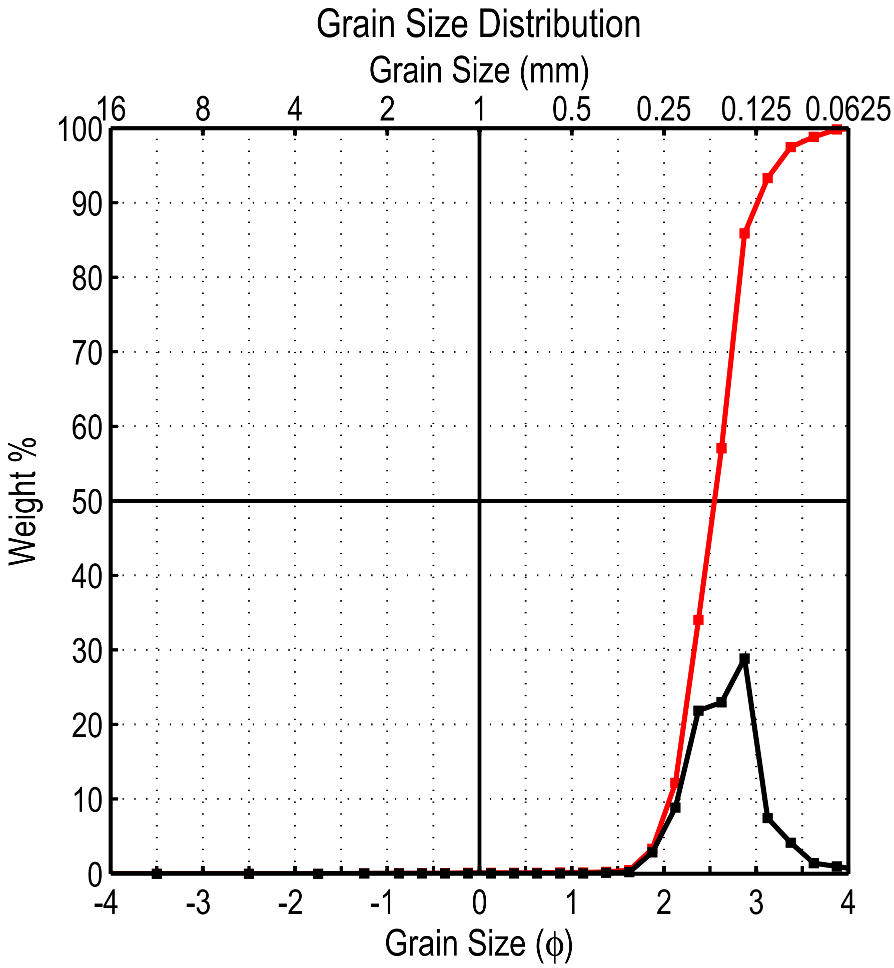
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.38	0.34	0.34
-0.75	-0.875	0.19	0.17	0.51
-0.5	-0.625	0.38	0.34	0.85
-0.25	-0.375	0.53	0.47	1.32
0	-0.125	0.51	0.45	1.77
0.25	0.125	0.62	0.55	2.33
0.5	0.375	0.77	0.69	3.01
0.75	0.625	0.74	0.66	3.67
1	0.875	0.79	0.70	4.38
1.25	1.125	0.72	0.64	5.02
1.5	1.375	0.97	0.86	5.88
1.75	1.625	1.00	0.89	6.77
2	1.875	3.18	2.83	9.61
2.25	2.125	6.25	5.57	15.18
2.5	2.375	10.50	9.36	24.53
2.75	2.625	14.51	12.93	37.46
3	2.875	41.19	36.70	74.17
3.25	3.125	12.57	11.20	85.37
3.5	3.375	10.60	9.45	94.81
3.75	3.625	3.12	2.78	97.59
4	3.875	1.58	1.41	99.00
>4.0	4.25	1.12	1.00	100.00

Percentiles

1	-0.545
5	1.120
16	2.145
25	2.385
50	2.710
75	2.895
84	3.095
95	3.390
99	3.875

Moment Measures	**(phi)**	**(mm)**
Mean	2.692	0.155
Standard Deviation	0.741	0.598
Skewness	-2.168	
Kurtosis	10.152	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.620	2.650
Standard Deviation	0.475	0.581
Skewness (1)	-0.189	-0.295
Skewness (2)	-0.958	
Kurtosis	1.389	1.824



Project **2300**
Location **Isle of Palms, SC**
Date **Jul 2010**

Station **25th Ave**
Interval **Dune**

Mean **0.158 mm**
STD **0.757 mm**
Skewness **-0.385**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Very Leptokurtic

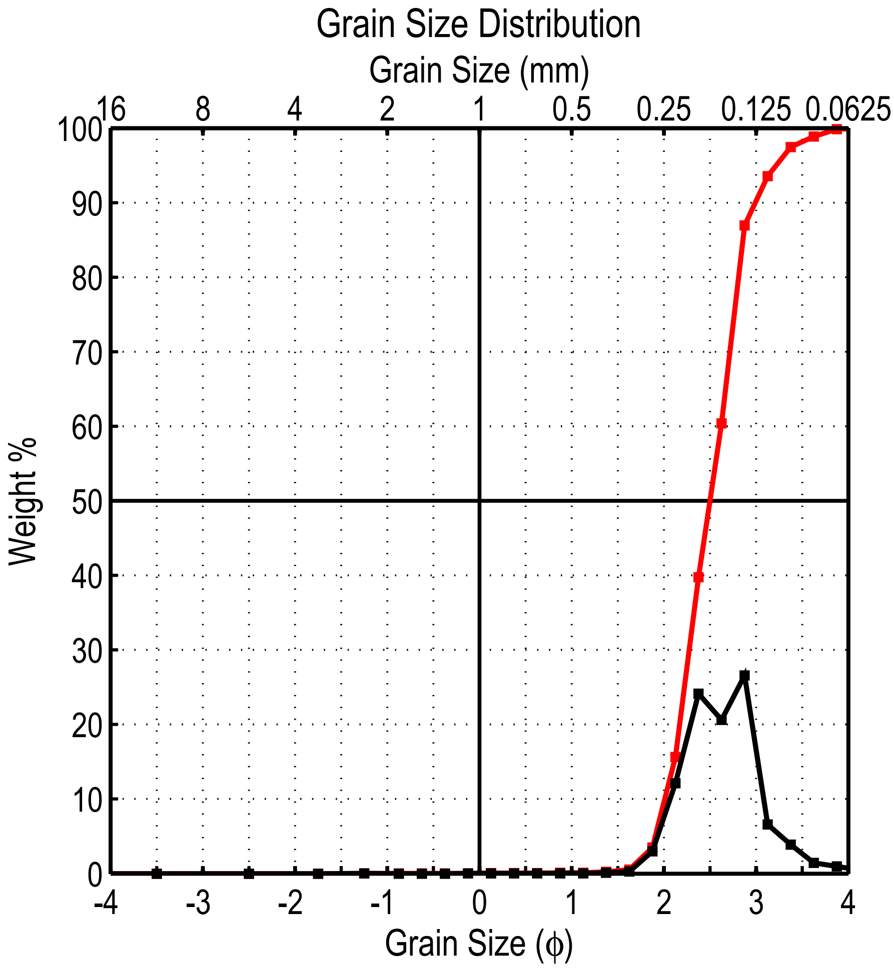
Total weight (gram)	110.16
% finer than 4.00 phi	0.18
% coarser than -1.00 phi	0.04
% $CaCO_3$	3.1

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.04	0.04	0.04
-0.75	-0.875	0.03	0.03	0.06
-0.5	-0.625	0.01	0.01	0.07
-0.25	-0.375	0.01	0.01	0.08
0	-0.125	0.02	0.02	0.10
0.25	0.125	0.01	0.01	0.11
0.5	0.375	0.01	0.01	0.12
0.75	0.625	0.01	0.01	0.13
1	0.875	0.02	0.02	0.15
1.25	1.125	0.01	0.01	0.15
1.5	1.375	0.10	0.09	0.25
1.75	1.625	0.23	0.21	0.45
2	1.875	3.16	2.87	3.32
2.25	2.125	9.76	8.86	12.18
2.5	2.375	24.06	21.84	34.02
2.75	2.625	25.33	22.99	57.02
3	2.875	31.77	28.84	85.86
3.25	3.125	8.20	7.44	93.30
3.5	3.375	4.56	4.14	97.44
3.75	3.625	1.54	1.40	98.84
4	3.875	1.08	0.98	99.82
>4.0	4.25	0.20	0.18	100.00

Percentiles	
1	1.675
5	1.920
16	2.170
25	2.270
50	2.550
75	2.780
84	2.860
95	3.230
99	3.665

Moment Measures	**(phi)**	**(mm)**
Mean	2.666	0.158
Standard Deviation	0.402	0.757
Skewness	-0.385	
Kurtosis	9.615	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.515	2.527
Standard Deviation	0.345	0.371
Skewness (1)	-0.101	-0.032
Skewness (2)	0.072	
Kurtosis	0.899	1.053



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**25th Ave**
Interval	**Mid Berm**
Mean	**0.161 mm**
STD	**0.756 mm**
Skewness	**0.148**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

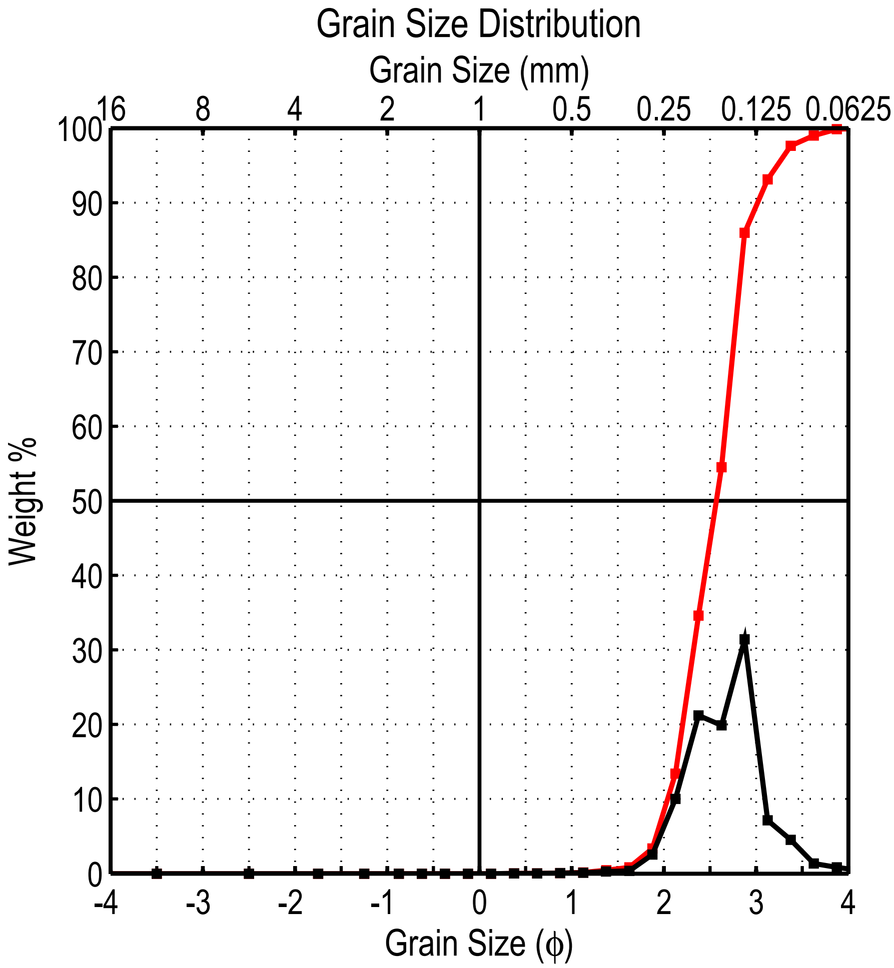
Total weight (gram)	111.86
% finer than 4.00 phi	0.17
% coarser than -1.00 phi	0.02
% $CaCO_3$	3.3

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.02	0.02	0.02
-0.75	-0.875	0.00	0.00	0.02
-0.5	-0.625	0.00	0.00	0.02
-0.25	-0.375	0.00	0.00	0.02
0	-0.125	0.02	0.02	0.04
0.25	0.125	0.01	0.01	0.04
0.5	0.375	0.01	0.01	0.05
0.75	0.625	0.01	0.01	0.06
1	0.875	0.03	0.03	0.09
1.25	1.125	0.02	0.02	0.11
1.5	1.375	0.13	0.12	0.22
1.75	1.625	0.33	0.30	0.52
2	1.875	3.33	2.98	3.50
2.25	2.125	13.57	12.13	15.63
2.5	2.375	26.97	24.11	39.74
2.75	2.625	23.07	20.62	60.36
3	2.875	29.75	26.60	86.96
3.25	3.125	7.36	6.58	93.54
3.5	3.375	4.36	3.90	97.43
3.75	3.625	1.59	1.42	98.86
4	3.875	1.09	0.97	99.83
>4.0	4.25	0.19	0.17	100.00

Percentiles	
1	1.665
5	1.905
16	2.130
25	2.220
50	2.500
75	2.765
84	2.845
95	3.220
99	3.660

Moment Measures	**(phi)**	**(mm)**
Mean	2.633	0.161
Standard Deviation	0.403	0.756
Skewness	0.148	
Kurtosis	5.759	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.487	2.492
Standard Deviation	0.357	0.378
Skewness (1)	-0.035	0.030
Skewness (2)	0.175	
Kurtosis	0.839	0.989



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**25th Ave**
Interval	**Berm Crest**
Mean	**0.157 mm**
STD	**0.759 mm**
Skewness	**0.102**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

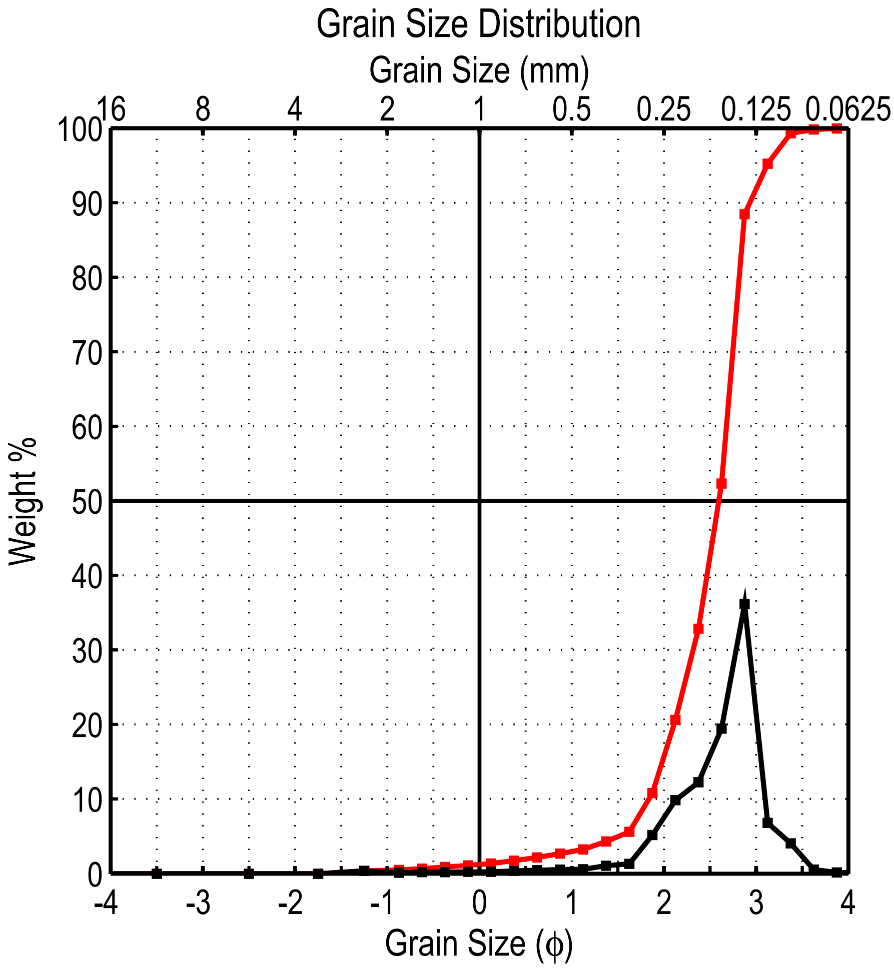
Total weight (gram)	106.26
% finer than 4.00 phi	0.17
% coarser than -1.00 phi	0.00
% $CaCO_3$	5.3

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.00	0.00	0.00
0.25	0.125	0.00	0.00	0.00
0.5	0.375	0.01	0.01	0.01
0.75	0.625	0.01	0.01	0.02
1	0.875	0.05	0.05	0.07
1.25	1.125	0.11	0.10	0.17
1.5	1.375	0.28	0.26	0.43
1.75	1.625	0.41	0.39	0.82
2	1.875	2.72	2.56	3.38
2.25	2.125	10.64	10.01	13.39
2.5	2.375	22.54	21.21	34.60
2.75	2.625	21.14	19.89	54.50
3	2.875	33.41	31.44	85.94
3.25	3.125	7.61	7.16	93.10
3.5	3.375	4.81	4.53	97.63
3.75	3.625	1.44	1.36	98.98
4	3.875	0.90	0.85	99.83
>4.0	4.25	0.18	0.17	100.00

Percentiles	
1	1.645
5	1.915
16	2.155
25	2.260
50	2.570
75	2.790
84	2.860
95	3.230
99	3.630

Moment Measures	**(phi)**	**(mm)**
Mean	2.668	0.157
Standard Deviation	0.397	0.759
Skewness	0.102	
Kurtosis	4.111	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.508	2.528
Standard Deviation	0.352	0.375
Skewness (1)	-0.177	-0.087
Skewness (2)	0.007	
Kurtosis	0.865	1.017



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**25th Ave**
Interval	**Beach Face**
Mean	**0.169 mm**
STD	**0.658 mm**
Skewness	**-2.540**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

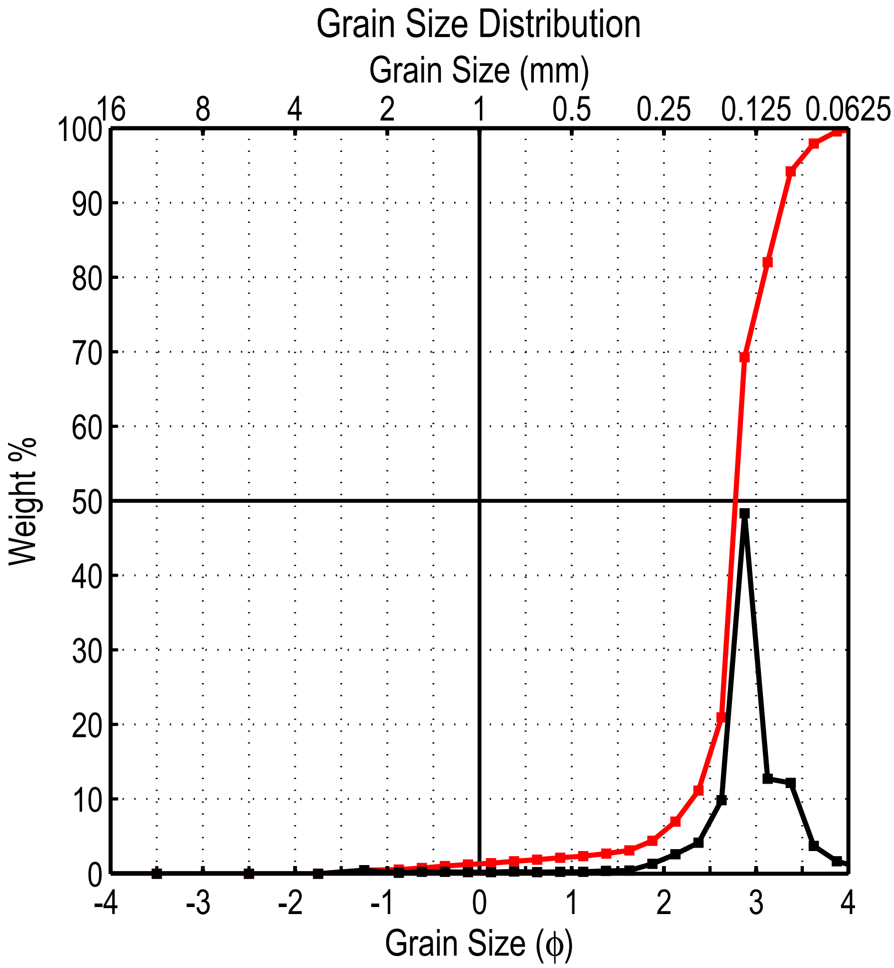
Total weight (gram)	106.77
% finer than 4.00 phi	0.06
% coarser than -1.00 phi	0.38
% $CaCO_3$	5.7

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.41	0.38	0.38
-0.75	-0.875	0.12	0.11	0.50
-0.5	-0.625	0.19	0.18	0.67
-0.25	-0.375	0.21	0.20	0.87
0	-0.125	0.23	0.22	1.09
0.25	0.125	0.27	0.25	1.34
0.5	0.375	0.41	0.38	1.72
0.75	0.625	0.46	0.43	2.15
1	0.875	0.56	0.52	2.68
1.25	1.125	0.61	0.57	3.25
1.5	1.375	1.12	1.05	4.30
1.75	1.625	1.40	1.31	5.61
2	1.875	5.51	5.16	10.77
2.25	2.125	10.50	9.83	20.61
2.5	2.375	13.06	12.23	32.84
2.75	2.625	20.79	19.47	52.31
3	2.875	38.58	36.13	88.44
3.25	3.125	7.24	6.78	95.22
3.5	3.375	4.33	4.06	99.28
3.75	3.625	0.55	0.52	99.79
4	3.875	0.16	0.15	99.94
>4.0	4.25	0.06	0.06	100.00

Percentiles	
1	-0.225
5	1.510
16	2.010
25	2.215
50	2.595
75	2.780
84	2.845
95	3.115
99	3.360

Moment Measures	**(phi)**	**(mm)**
Mean	2.565	0.169
Standard Deviation	0.603	0.658
Skewness	-2.540	
Kurtosis	13.661	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.427	2.483
Standard Deviation	0.417	0.452
Skewness (1)	-0.401	-0.377
Skewness (2)	-0.677	
Kurtosis	0.922	1.164



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**25th Ave**
Interval	**Low Tide Terrace**
Mean	**0.138 mm**
STD	**0.660 mm**
Skewness	**-3.257**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

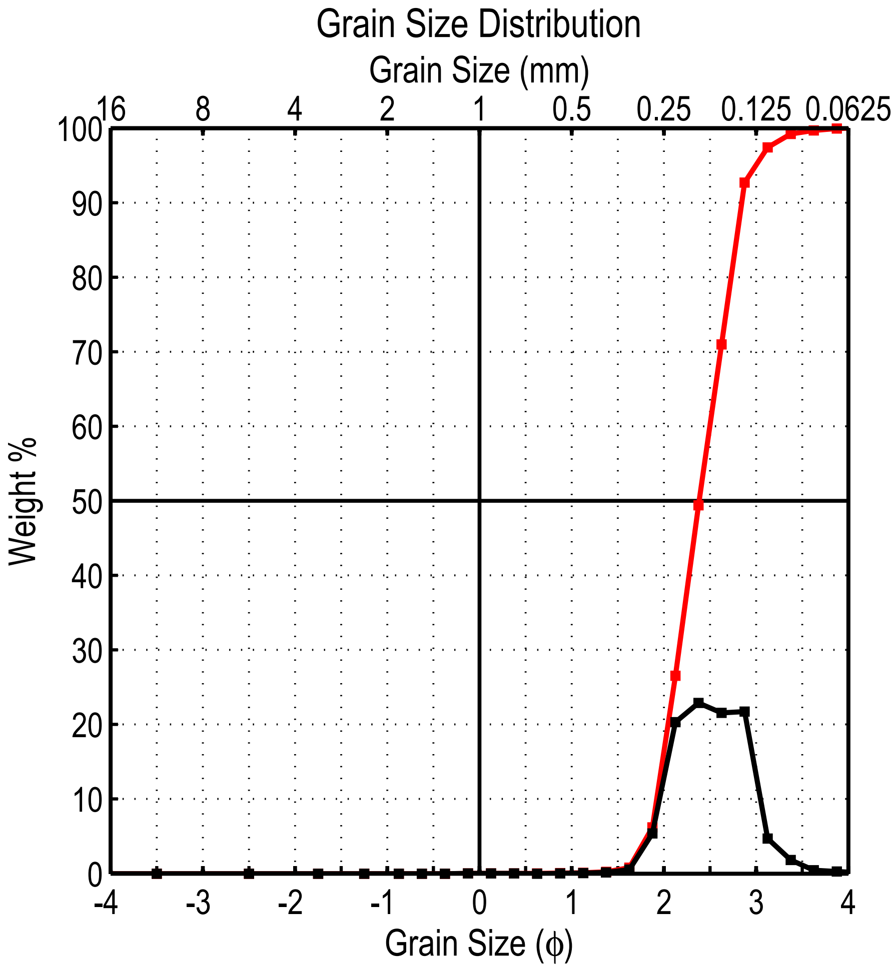
Total weight (gram)	118.04
% finer than 4.00 phi	0.45
% coarser than -1.00 phi	0.44
% $CaCO_3$	7.4

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.52	0.44	0.44
-0.75	-0.875	0.12	0.10	0.54
-0.5	-0.625	0.26	0.22	0.76
-0.25	-0.375	0.27	0.23	0.99
0	-0.125	0.25	0.21	1.20
0.25	0.125	0.23	0.19	1.40
0.5	0.375	0.32	0.27	1.67
0.75	0.625	0.22	0.19	1.86
1	0.875	0.30	0.25	2.11
1.25	1.125	0.27	0.23	2.34
1.5	1.375	0.43	0.36	2.70
1.75	1.625	0.47	0.40	3.10
2	1.875	1.53	1.30	4.40
2.25	2.125	3.04	2.58	6.97
2.5	2.375	4.90	4.15	11.12
2.75	2.625	11.61	9.84	20.96
3	2.875	57.04	48.32	69.28
3.25	3.125	15.01	12.72	82.00
3.5	3.375	14.37	12.17	94.17
3.75	3.625	4.40	3.73	97.90
4	3.875	1.95	1.65	99.55
>4.0	4.25	0.53	0.45	100.00

Percentiles	
1	-0.365
5	1.935
16	2.500
25	2.645
50	2.775
75	2.985
84	3.165
95	3.430
99	3.790

Moment Measures	**(phi)**	**(mm)**
Mean	2.861	0.138
Standard Deviation	0.600	0.660
Skewness	-3.257	
Kurtosis	20.234	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.833	2.813
Standard Deviation	0.333	0.393
Skewness (1)	0.173	0.025
Skewness (2)	-0.278	
Kurtosis	1.248	1.802



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**38th Ave**
Interval	**Dune**
Mean	**0.175 mm**
STD	**0.771 mm**
Skewness	**0.133**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

Total weight (gram)	112.63
% finer than 4.00 phi	0.04
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.1

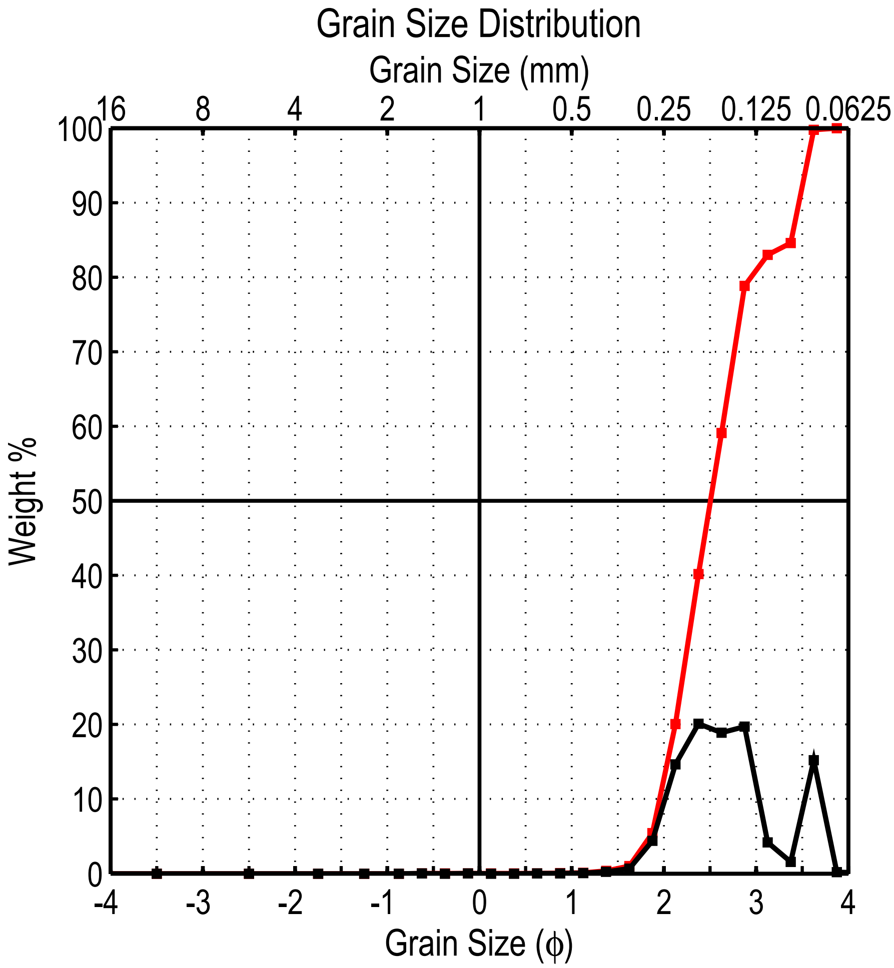
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.02	0.02	0.02
0.25	0.125	0.01	0.01	0.03
0.5	0.375	0.01	0.01	0.04
0.75	0.625	0.00	0.00	0.04
1	0.875	0.02	0.02	0.05
1.25	1.125	0.06	0.05	0.11
1.5	1.375	0.16	0.14	0.25
1.75	1.625	0.61	0.54	0.79
2	1.875	6.08	5.40	6.19
2.25	2.125	22.90	20.33	26.52
2.5	2.375	25.76	22.87	49.39
2.75	2.625	24.29	21.57	70.96
3	2.875	24.47	21.73	92.68
3.25	3.125	5.30	4.71	97.39
3.5	3.375	2.07	1.84	99.23
3.75	3.625	0.52	0.46	99.69
4	3.875	0.30	0.27	99.96
>4.0	4.25	0.05	0.04	100.00

Percentiles	
1	1.635
5	1.820
16	1.995
25	2.105
50	2.380
75	2.670
84	2.775
95	3.000
99	3.345

Moment Measures	**(phi)**	**(mm)**
Mean	2.517	0.175
Standard Deviation	0.376	0.771
Skewness	0.133	
Kurtosis	3.848	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.385	2.383
Standard Deviation	0.390	0.374
Skewness (1)	0.013	0.032
Skewness (2)	0.077	
Kurtosis	0.513	0.856

Grain Size Distribution



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**38th Ave**
Interval	**Mid Berm**
Mean	**0.155 mm**
STD	**0.697 mm**
Skewness	**0.398**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Symmetrical
	Mesokurtic

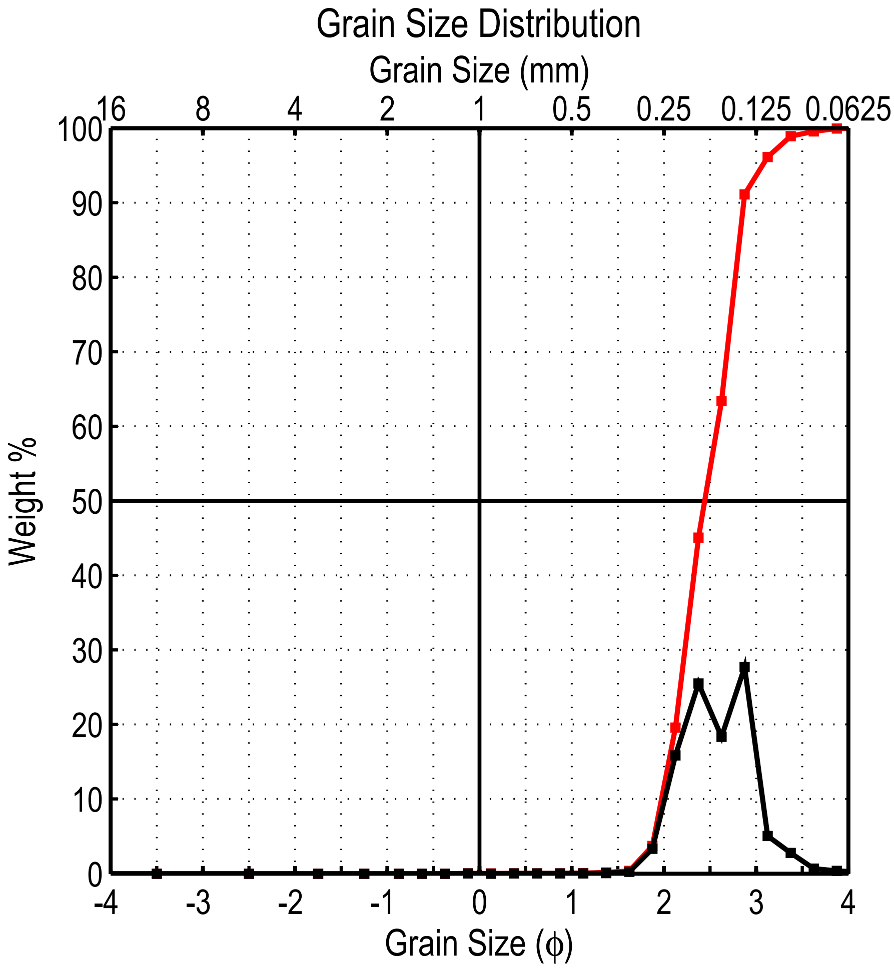
Total weight (gram)	124.87
% finer than 4.00 phi	0.04
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.8

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.01	0.01	0.01
-0.25	-0.375	0.00	0.00	0.01
0	-0.125	0.01	0.01	0.02
0.25	0.125	0.00	0.00	0.02
0.5	0.375	0.00	0.00	0.02
0.75	0.625	0.01	0.01	0.02
1	0.875	0.03	0.02	0.05
1.25	1.125	0.07	0.06	0.10
1.5	1.375	0.31	0.25	0.35
1.75	1.625	0.83	0.66	1.02
2	1.875	5.51	4.41	5.43
2.25	2.125	18.29	14.65	20.08
2.5	2.375	25.10	20.10	40.18
2.75	2.625	23.61	18.91	59.09
3	2.875	24.64	19.73	78.82
3.25	3.125	5.20	4.16	82.98
3.5	3.375	1.97	1.58	84.56
3.75	3.625	18.99	15.21	99.77
4	3.875	0.24	0.19	99.96
>4.0	4.25	0.05	0.04	100.00

Percentiles	
1	1.620
5	1.850
16	2.055
25	2.185
50	2.505
75	2.825
84	3.285
95	3.545
99	3.610

Moment Measures	**(phi)**	**(mm)**
Mean	2.694	0.155
Standard Deviation	0.521	0.697
Skewness	0.398	
Kurtosis	2.733	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.670	2.615
Standard Deviation	0.615	0.564
Skewness (1)	0.268	0.248
Skewness (2)	0.313	
Kurtosis	0.378	1.085



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**38th Ave**
Interval	**Berm Crest**
Mean	**0.167 mm**
STD	**0.773 mm**
Skewness	**0.214**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

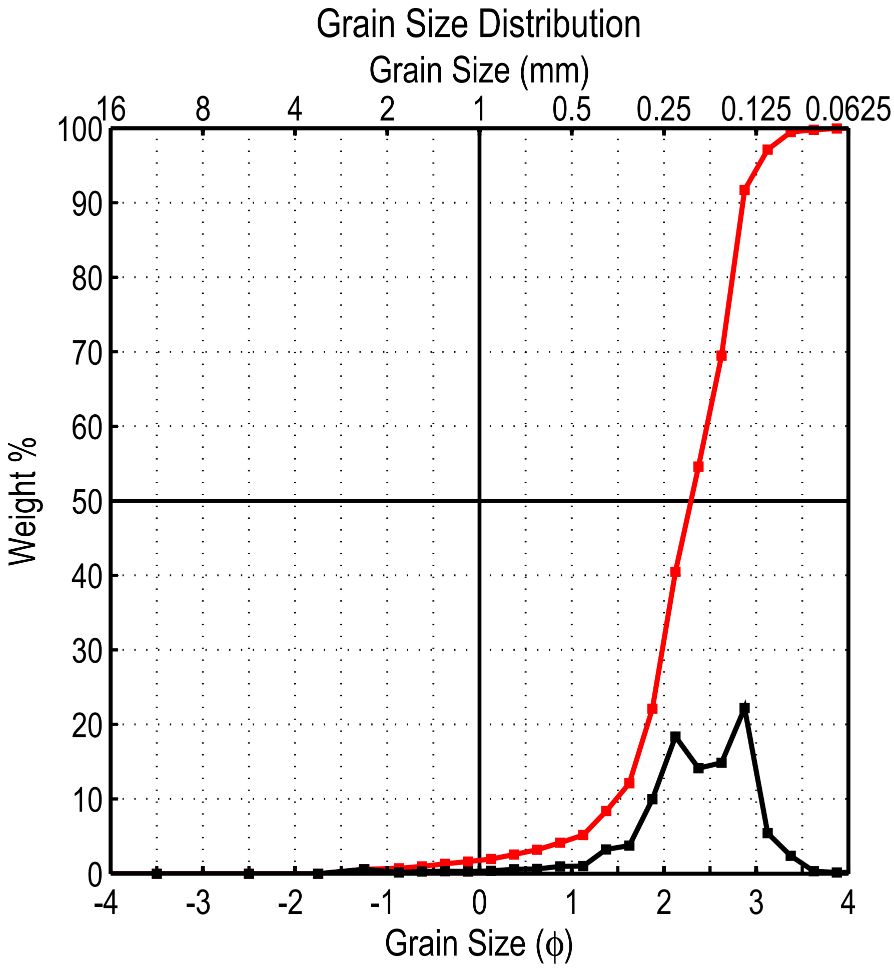
Total weight (gram)	118.54
% finer than 4.00 phi	0.07
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.2

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.01	0.01	0.01
0.25	0.125	0.00	0.00	0.01
0.5	0.375	0.01	0.01	0.02
0.75	0.625	0.01	0.01	0.03
1	0.875	0.02	0.02	0.04
1.25	1.125	0.03	0.03	0.07
1.5	1.375	0.10	0.08	0.15
1.75	1.625	0.26	0.22	0.37
2	1.875	3.96	3.34	3.71
2.25	2.125	18.80	15.86	19.57
2.5	2.375	30.23	25.50	45.07
2.75	2.625	21.72	18.32	63.40
3	2.875	32.84	27.70	91.10
3.25	3.125	5.96	5.03	96.13
3.5	3.375	3.28	2.77	98.89
3.75	3.625	0.79	0.67	99.56
4	3.875	0.44	0.37	99.93
>4.0	4.25	0.08	0.07	100.00

Percentiles	
1	1.670
5	1.895
16	2.070
25	2.180
50	2.440
75	2.730
84	2.810
95	3.070
99	3.415

Moment Measures	**(phi)**	**(mm)**
Mean	2.580	0.167
Standard Deviation	0.372	0.773
Skewness	0.214	
Kurtosis	3.707	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.440	2.440
Standard Deviation	0.370	0.363
Skewness (1)	0.000	0.036
Skewness (2)	0.115	
Kurtosis	0.588	0.876



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**38th Ave**
Interval	**Beach Face**
Mean	**0.199 mm**
STD	**0.621 mm**
Skewness	**-1.810**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

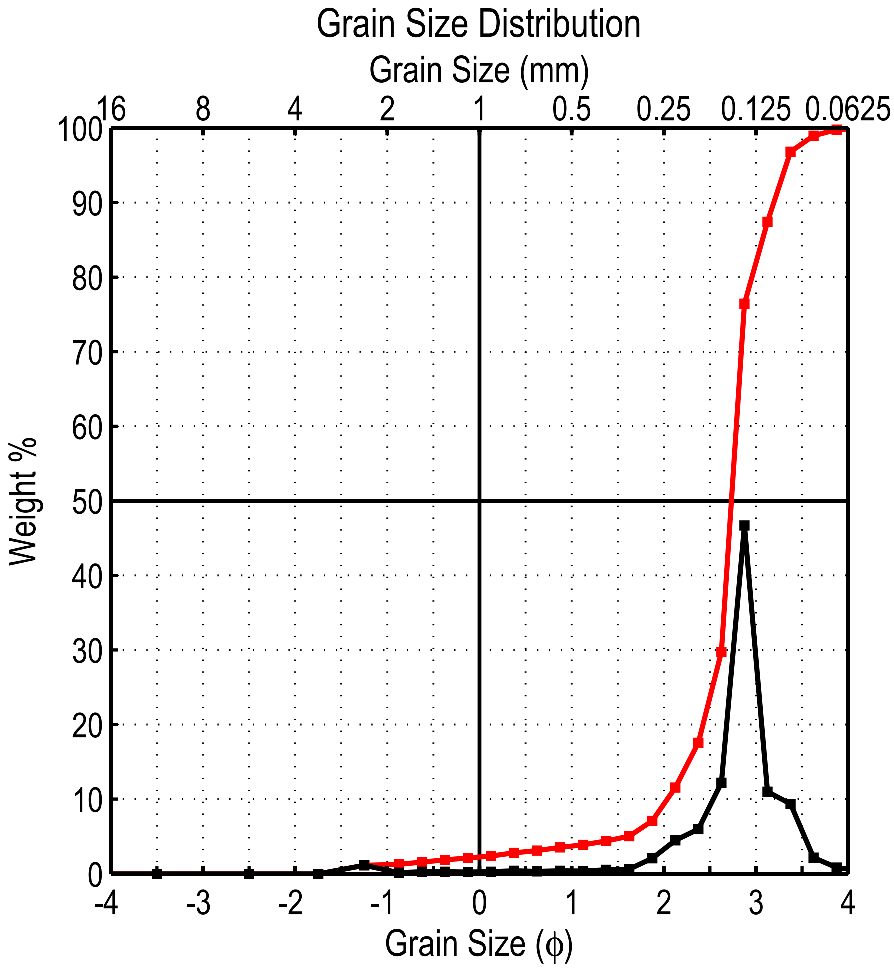
Total weight (gram)	115.60
% finer than 4.00 phi	0.06
% coarser than -1.00 phi	0.56
% $CaCO_3$	7.4

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.65	0.56	0.56
-0.75	-0.875	0.17	0.15	0.71
-0.5	-0.625	0.32	0.28	0.99
-0.25	-0.375	0.37	0.32	1.31
0	-0.125	0.33	0.29	1.59
0.25	0.125	0.44	0.38	1.97
0.5	0.375	0.68	0.59	2.56
0.75	0.625	0.72	0.62	3.18
1	0.875	1.10	0.95	4.13
1.25	1.125	1.19	1.03	5.16
1.5	1.375	3.74	3.24	8.40
1.75	1.625	4.32	3.74	12.14
2	1.875	11.52	9.97	22.10
2.25	2.125	21.25	18.38	40.48
2.5	2.375	16.32	14.12	54.60
2.75	2.625	17.19	14.87	69.47
3	2.875	25.68	22.21	91.69
3.25	3.125	6.26	5.42	97.10
3.5	3.375	2.74	2.37	99.47
3.75	3.625	0.35	0.30	99.78
4	3.875	0.19	0.16	99.94
>4.0	4.25	0.07	0.06	100.00

Percentiles	
1	-0.615
5	1.085
16	1.720
25	1.915
50	2.295
75	2.685
84	2.790
95	3.030
99	3.325

Moment Measures	**(phi)**	**(mm)**
Mean	2.331	0.199
Standard Deviation	0.688	0.621
Skewness	-1.810	
Kurtosis	8.924	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.255	2.268
Standard Deviation	0.535	0.562
Skewness (1)	-0.075	-0.159
Skewness (2)	-0.444	
Kurtosis	0.818	1.035



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**38th Ave**
Interval	**Low Tide Terrace**
Mean	**0.151 mm**
STD	**0.608 mm**
Skewness	**-3.203**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

Total weight (gram)	110.70
% finer than 4.00 phi	0.22
% coarser than -1.00 phi	1.12
% $CaCO_3$	8.6

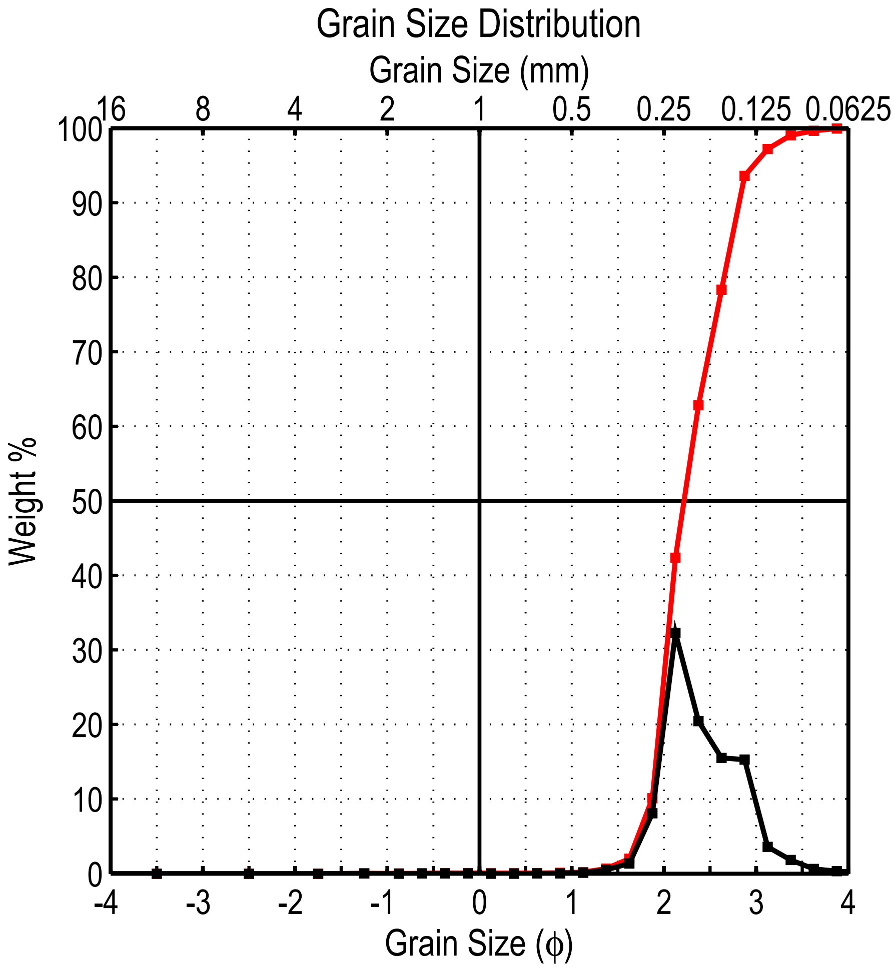
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	1.24	1.12	1.12
-0.75	-0.875	0.18	0.16	1.28
-0.5	-0.625	0.31	0.28	1.56
-0.25	-0.375	0.33	0.30	1.86
0	-0.125	0.28	0.25	2.11
0.25	0.125	0.31	0.28	2.39
0.5	0.375	0.44	0.40	2.79
0.75	0.625	0.36	0.33	3.12
1	0.875	0.45	0.41	3.52
1.25	1.125	0.42	0.38	3.90
1.5	1.375	0.57	0.51	4.42
1.75	1.625	0.67	0.61	5.02
2	1.875	2.28	2.06	7.08
2.25	2.125	4.97	4.49	11.57
2.5	2.375	6.63	5.99	17.56
2.75	2.625	13.49	12.19	29.75
3	2.875	51.69	46.69	76.44
3.25	3.125	12.16	10.98	87.43
3.5	3.375	10.36	9.36	96.78
3.75	3.625	2.41	2.18	98.96
4	3.875	0.91	0.82	99.78
>4.0	4.25	0.24	0.22	100.00

Percentiles

1	-1.305
5	1.615
16	2.310
25	2.530
50	2.735
75	2.865
84	3.045
95	3.325
99	3.635

Moment Measures	**(phi)**	**(mm)**
Mean	2.728	0.151
Standard Deviation	0.718	0.608
Skewness	-3.203	
Kurtosis	16.461	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.678	2.697
Standard Deviation	0.367	0.443
Skewness (1)	-0.156	-0.233
Skewness (2)	-0.721	
Kurtosis	1.327	2.092



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**48th Ave**
Interval	**Dune**
Mean	**0.188 mm**
STD	**0.755 mm**
Skewness	**0.262**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

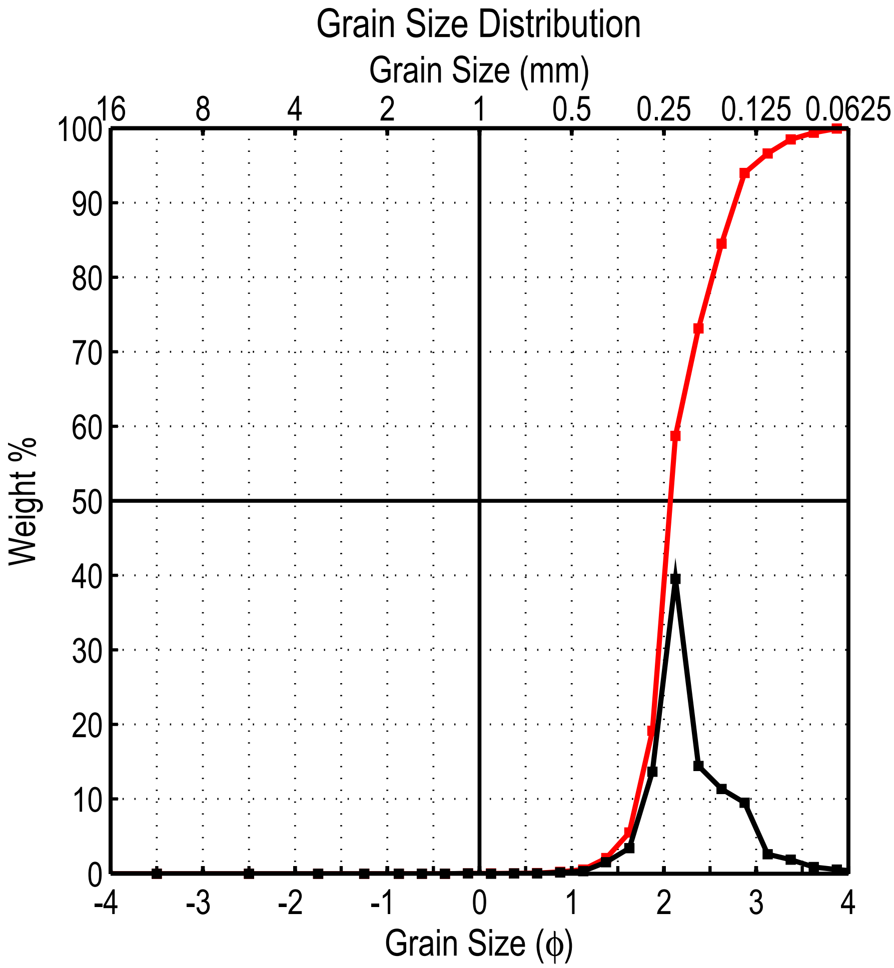
Total weight (gram)	115.57
% finer than 4.00 phi	0.07
% coarser than -1.00 phi	0.03
% $CaCO_3$	2.2

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.03	0.03	0.03
-0.75	-0.875	0.00	0.00	0.03
-0.5	-0.625	0.01	0.01	0.03
-0.25	-0.375	0.01	0.01	0.04
0	-0.125	0.01	0.01	0.05
0.25	0.125	0.00	0.00	0.05
0.5	0.375	0.00	0.00	0.05
0.75	0.625	0.01	0.01	0.06
1	0.875	0.04	0.03	0.10
1.25	1.125	0.12	0.10	0.20
1.5	1.375	0.56	0.48	0.68
1.75	1.625	1.54	1.33	2.02
2	1.875	9.36	8.10	10.12
2.25	2.125	37.29	32.27	42.38
2.5	2.375	23.61	20.43	62.81
2.75	2.625	17.92	15.51	78.32
3	2.875	17.67	15.29	93.61
3.25	3.125	4.13	3.57	97.18
3.5	3.375	2.13	1.84	99.02
3.75	3.625	0.70	0.61	99.63
4	3.875	0.35	0.30	99.93
>4.0	4.25	0.08	0.07	100.00

Percentiles	
1	1.435
5	1.715
16	1.920
25	1.990
50	2.220
75	2.570
84	2.720
95	2.975
99	3.370

Moment Measures	**(phi)**	**(mm)**
Mean	2.409	0.188
Standard Deviation	0.406	0.755
Skewness	0.262	
Kurtosis	5.732	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.320	2.287
Standard Deviation	0.400	0.391
Skewness (1)	0.250	0.224
Skewness (2)	0.313	
Kurtosis	0.575	0.890



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**48th Ave**
Interval	**Mid Berm**
Mean	**0.204 mm**
STD	**0.738 mm**
Skewness	**0.727**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Fine Skewed
	Leptokurtic

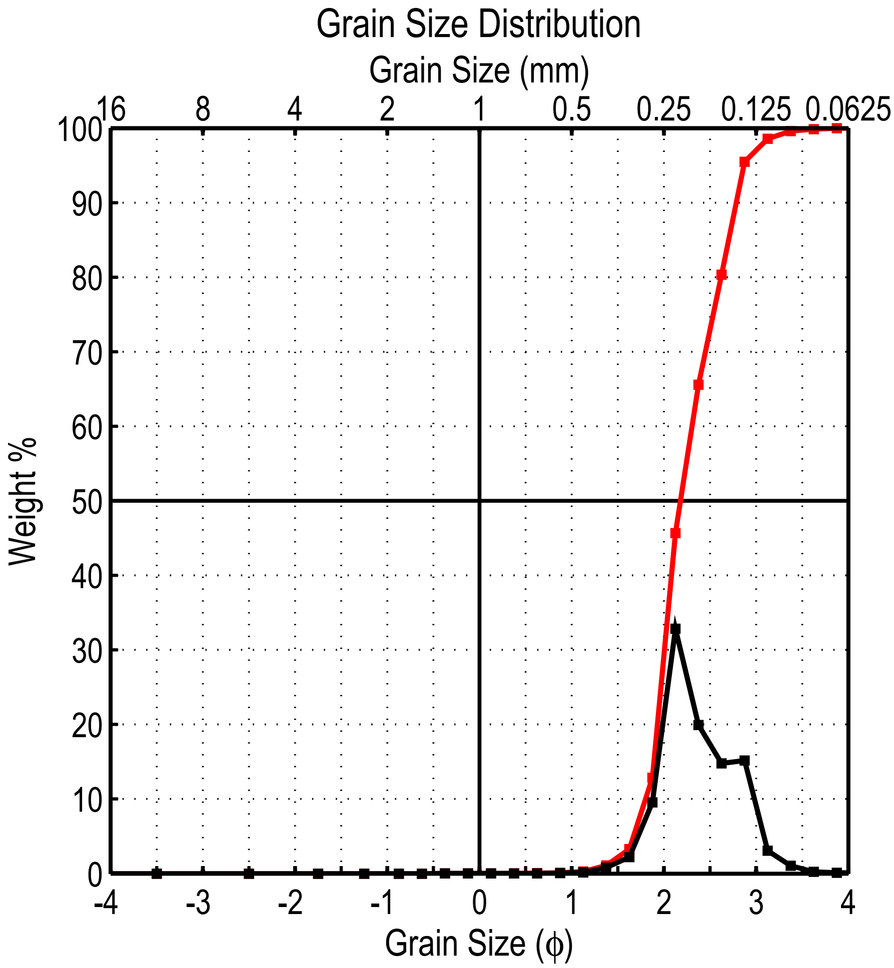
Total weight (gram)	116.61
% finer than 4.00 phi	0.08
% coarser than -1.00 phi	0.00
% $CaCO_3$	4.4

Class Limits (φ)	Mid Point (φ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.02	0.02	0.02
0.25	0.125	0.00	0.00	0.02
0.5	0.375	0.02	0.02	0.03
0.75	0.625	0.04	0.03	0.07
1	0.875	0.18	0.15	0.22
1.25	1.125	0.39	0.33	0.56
1.5	1.375	1.77	1.52	2.08
1.75	1.625	4.00	3.43	5.51
2	1.875	15.94	13.67	19.18
2.25	2.125	46.12	39.55	58.73
2.5	2.375	16.81	14.42	73.14
2.75	2.625	13.24	11.35	84.50
3	2.875	11.07	9.49	93.99
3.25	3.125	3.05	2.62	96.60
3.5	3.375	2.20	1.89	98.49
3.75	3.625	1.02	0.87	99.37
4	3.875	0.65	0.56	99.92
>4.0	4.25	0.09	0.08	100.00

Percentiles	
1	1.200
5	1.590
16	1.815
25	1.910
50	2.070
75	2.415
84	2.615
95	2.970
99	3.520

Moment Measures	**(phi)**	**(mm)**
Mean	2.294	0.204
Standard Deviation	0.438	0.738
Skewness	0.727	
Kurtosis	4.617	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.215	2.167
Standard Deviation	0.400	0.409
Skewness (1)	0.362	0.333
Skewness (2)	0.525	
Kurtosis	0.725	1.120



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**48th Ave**
Interval	**Berm Crest**
Mean	**0.194 mm**
STD	**0.762 mm**
Skewness	**0.206**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

Total weight (gram)	109.96
% finer than 4.00 phi	0.02
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.6

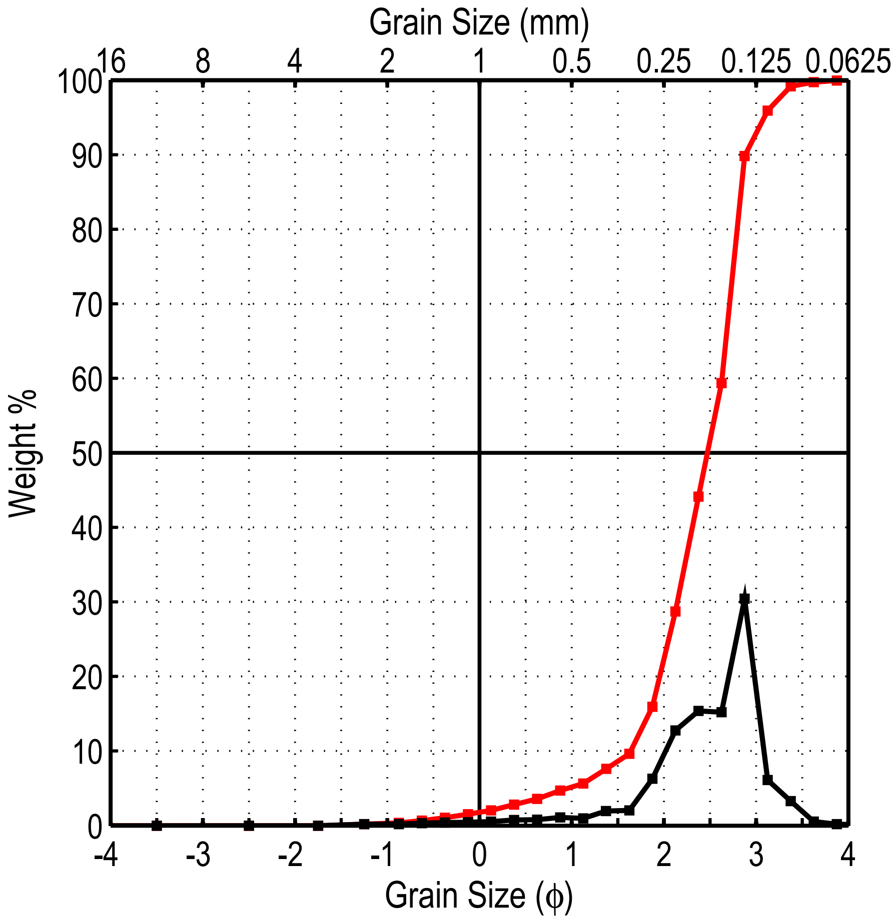
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.01	0.01	0.01
0	-0.125	0.01	0.01	0.02
0.25	0.125	0.01	0.01	0.03
0.5	0.375	0.01	0.01	0.04
0.75	0.625	0.03	0.03	0.06
1	0.875	0.06	0.05	0.12
1.25	1.125	0.18	0.16	0.28
1.5	1.375	0.88	0.80	1.08
1.75	1.625	2.44	2.22	3.30
2	1.875	10.48	9.53	12.83
2.25	2.125	36.09	32.82	45.65
2.5	2.375	21.89	19.91	65.56
2.75	2.625	16.24	14.77	80.33
3	2.875	16.66	15.15	95.48
3.25	3.125	3.37	3.06	98.54
3.5	3.375	1.16	1.05	99.60
3.75	3.625	0.28	0.25	99.85
4	3.875	0.14	0.13	99.98
>4.0	4.25	0.02	0.02	100.00

Percentiles	
1	1.350
5	1.670
16	1.900
25	1.970
50	2.180
75	2.535
84	2.685
95	2.865
99	3.235

Moment Measures	**(phi)**	**(mm)**
Mean	2.368	0.194
Standard Deviation	0.392	0.762
Skewness	0.206	
Kurtosis	3.786	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.293	2.255
Standard Deviation	0.393	0.377
Skewness (1)	0.287	0.217
Skewness (2)	0.223	
Kurtosis	0.522	0.867

Grain Size Distribution



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**48th Ave**
Interval	**Beach Face**
Mean	**0.184 mm**
STD	**0.623 mm**
Skewness	**-1.923**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

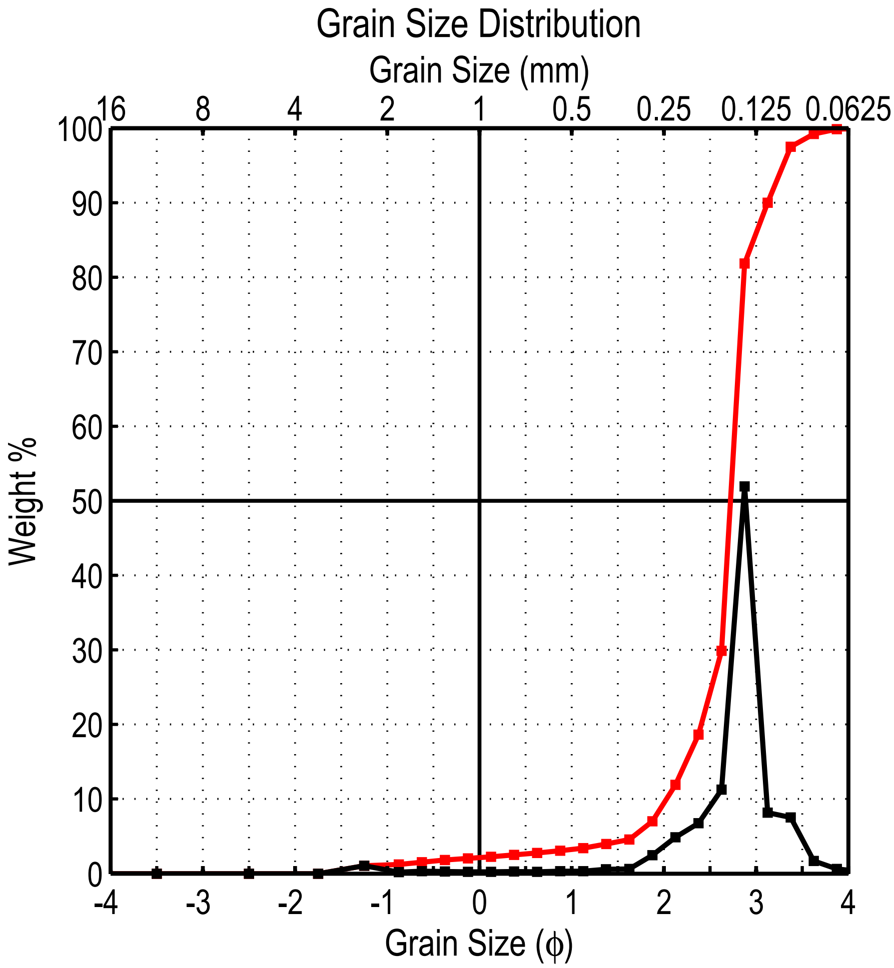
Total weight (gram)	109.02
% finer than 4.00 phi	0.06
% coarser than -1.00 phi	0.17
% $CaCO_3$	5.8

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.19	0.17	0.17
-0.75	-0.875	0.20	0.18	0.36
-0.5	-0.625	0.33	0.30	0.66
-0.25	-0.375	0.43	0.39	1.05
0	-0.125	0.50	0.46	1.51
0.25	0.125	0.58	0.53	2.05
0.5	0.375	0.83	0.76	2.81
0.75	0.625	0.85	0.78	3.59
1	0.875	1.21	1.11	4.70
1.25	1.125	1.04	0.95	5.65
1.5	1.375	2.15	1.97	7.62
1.75	1.625	2.20	2.02	9.64
2	1.875	6.87	6.30	15.94
2.25	2.125	13.92	12.77	28.71
2.5	2.375	16.79	15.40	44.11
2.75	2.625	16.60	15.23	59.34
3	2.875	33.20	30.45	89.79
3.25	3.125	6.67	6.12	95.91
3.5	3.375	3.57	3.27	99.18
3.75	3.625	0.59	0.54	99.72
4	3.875	0.23	0.21	99.94
>4.0	4.25	0.07	0.06	100.00

Percentiles	
1	-0.410
5	0.955
16	1.875
25	2.050
50	2.470
75	2.755
84	2.825
95	3.090
99	3.360

Moment Measures	**(phi)**	**(mm)**
Mean	2.444	0.184
Standard Deviation	0.684	0.623
Skewness	-1.923	
Kurtosis	8.492	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.350	2.390
Standard Deviation	0.475	0.561
Skewness (1)	-0.253	-0.336
Skewness (2)	-0.942	
Kurtosis	1.247	1.241



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**48th Ave**
Interval	**Low Tide Terrace**
Mean	**0.153 mm**
STD	**0.621 mm**
Skewness	**-3.372**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

Total weight (gram)	120.76
% finer than 4.00 phi	0.15
% coarser than -1.00 phi	1.04
% $CaCO_3$	7.2

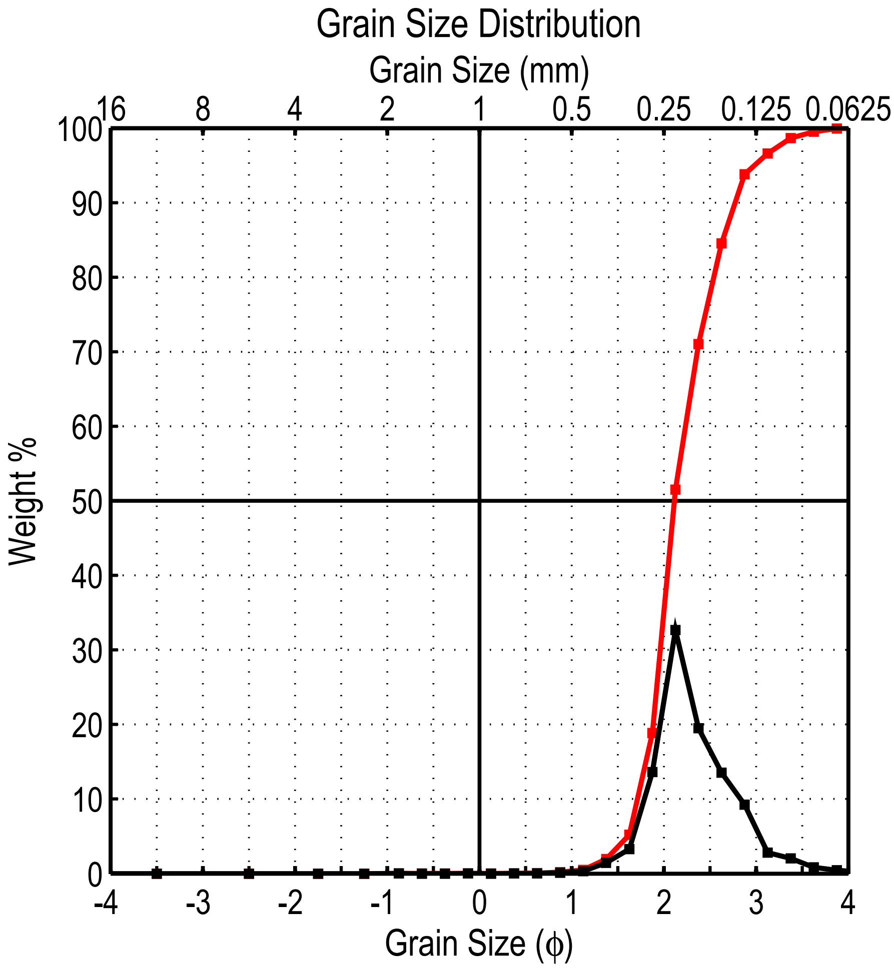
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	1.25	1.04	1.04
-0.75	-0.875	0.23	0.19	1.23
-0.5	-0.625	0.38	0.31	1.54
-0.25	-0.375	0.35	0.29	1.83
0	-0.125	0.26	0.22	2.05
0.25	0.125	0.26	0.22	2.26
0.5	0.375	0.32	0.26	2.53
0.75	0.625	0.29	0.24	2.77
1	0.875	0.39	0.32	3.09
1.25	1.125	0.37	0.31	3.40
1.5	1.375	0.68	0.56	3.96
1.75	1.625	0.74	0.61	4.57
2	1.875	2.97	2.46	7.03
2.25	2.125	5.89	4.88	11.91
2.5	2.375	8.14	6.74	18.65
2.75	2.625	13.58	11.25	29.89
3	2.875	62.72	51.94	81.83
3.25	3.125	9.85	8.16	89.99
3.5	3.375	9.07	7.51	97.50
3.75	3.625	2.07	1.71	99.21
4	3.875	0.77	0.64	99.85
>4.0	4.25	0.18	0.15	100.00

Percentiles

1	-1.265
5	1.670
16	2.275
25	2.515
50	2.720
75	2.840
84	2.940
95	3.290
99	3.595

Moment Measures	**(phi)**	**(mm)**
Mean	2.709	0.153
Standard Deviation	0.687	0.621
Skewness	-3.372	
Kurtosis	18.030	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.607	2.645
Standard Deviation	0.333	0.412
Skewness (1)	-0.338	-0.317
Skewness (2)	-0.722	
Kurtosis	1.436	2.043



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**51st Ave**
Interval	**Dune**
Mean	**0.200 mm**
STD	**0.740 mm**
Skewness	**0.553**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Fine Skewed
	Leptokurtic

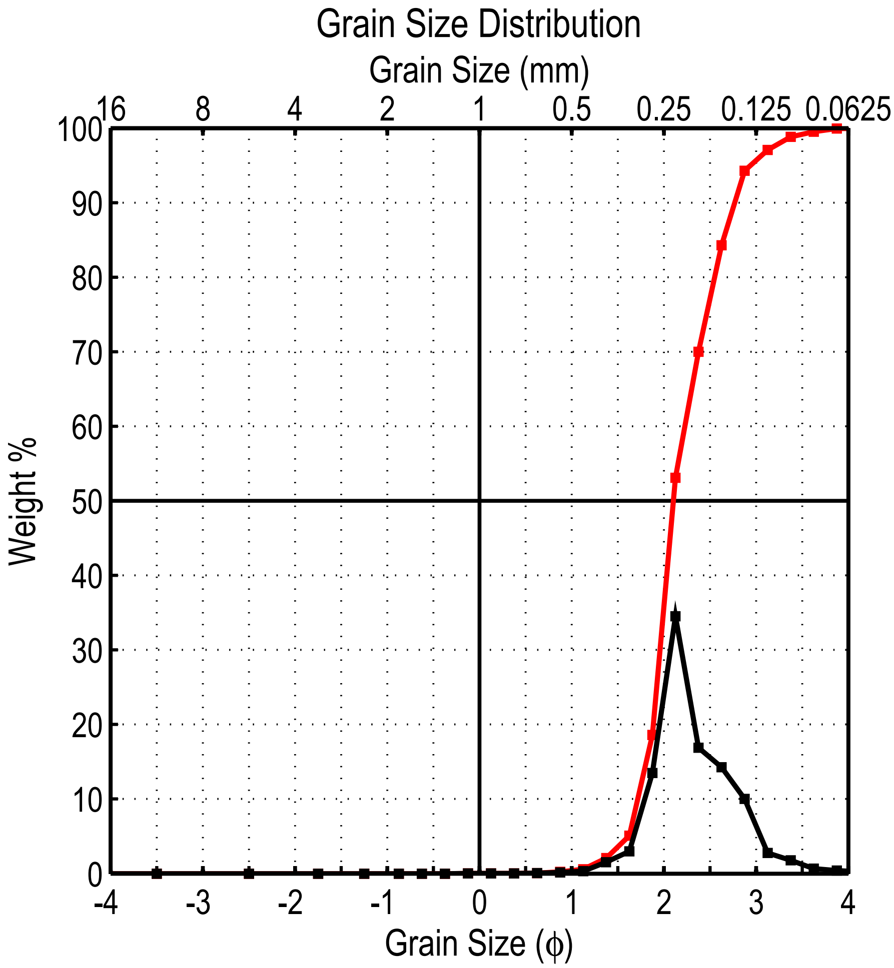
Total weight (gram)	102.09
% finer than 4.00 phi	0.08
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.0

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.01	0.01	0.01
-0.5	-0.625	0.00	0.00	0.01
-0.25	-0.375	0.00	0.00	0.01
0	-0.125	0.01	0.01	0.02
0.25	0.125	0.00	0.00	0.02
0.5	0.375	0.02	0.02	0.04
0.75	0.625	0.03	0.03	0.07
1	0.875	0.13	0.13	0.20
1.25	1.125	0.31	0.30	0.50
1.5	1.375	1.48	1.45	1.95
1.75	1.625	3.33	3.26	5.21
2	1.875	13.92	13.64	18.85
2.25	2.125	33.34	32.66	51.50
2.5	2.375	19.91	19.50	71.01
2.75	2.625	13.81	13.53	84.53
3	2.875	9.45	9.26	93.79
3.25	3.125	2.87	2.81	96.60
3.5	3.375	2.09	2.05	98.65
3.75	3.625	0.86	0.84	99.49
4	3.875	0.44	0.43	99.92
>4.0	4.25	0.08	0.08	100.00

Percentiles	
1	1.210
5	1.610
16	1.825
25	1.920
50	2.115
75	2.450
84	2.615
95	2.985
99	3.480

Moment Measures	**(phi)**	**(mm)**
Mean	2.319	0.200
Standard Deviation	0.434	0.740
Skewness	0.553	
Kurtosis	4.592	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.220	2.185
Standard Deviation	0.395	0.406
Skewness (1)	0.266	0.266
Skewness (2)	0.462	
Kurtosis	0.741	1.063



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**51st Ave**
Interval	**Mid Berm**
Mean	**0.201 mm**
STD	**0.742 mm**
Skewness	**0.514**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Fine Skewed
	Leptokurtic

Total weight (gram)	105.39
% finer than 4.00 phi	0.08
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.0

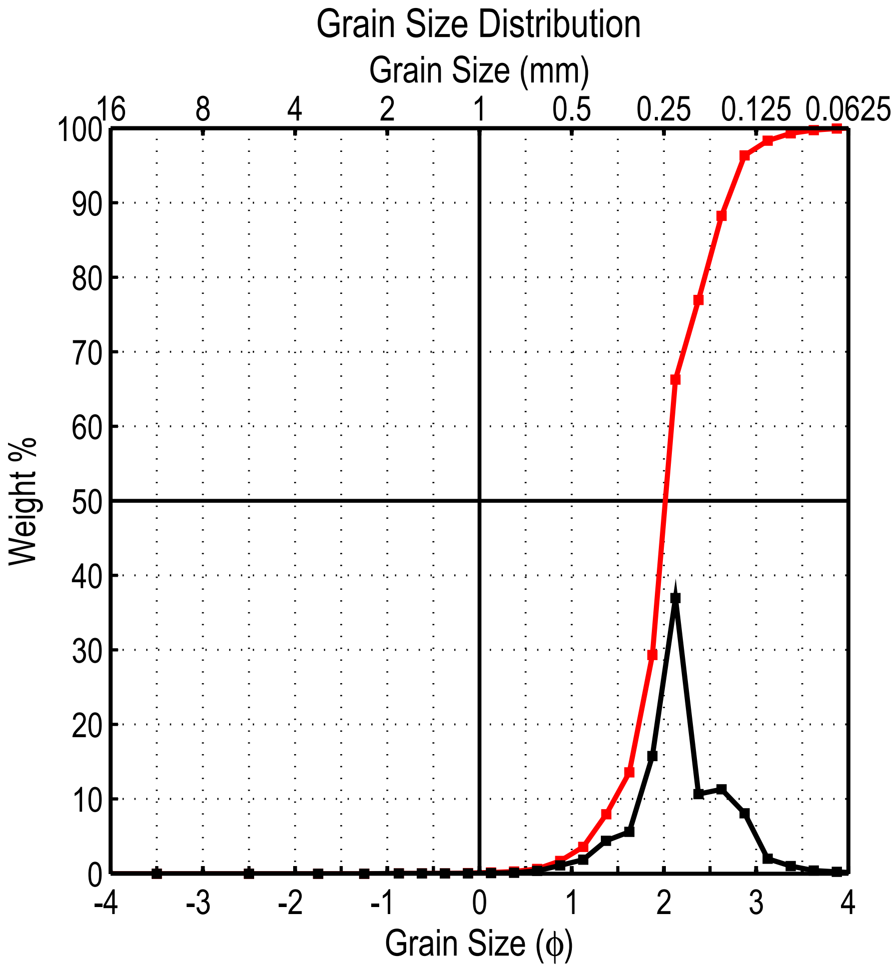
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.01	0.01	0.01
0.25	0.125	0.01	0.01	0.02
0.5	0.375	0.02	0.02	0.04
0.75	0.625	0.05	0.05	0.09
1	0.875	0.17	0.16	0.25
1.25	1.125	0.36	0.34	0.59
1.5	1.375	1.59	1.51	2.10
1.75	1.625	3.16	3.00	5.10
2	1.875	14.23	13.50	18.60
2.25	2.125	36.37	34.51	53.11
2.5	2.375	17.80	16.89	70.00
2.75	2.625	15.04	14.27	84.27
3	2.875	10.55	10.01	94.28
3.25	3.125	2.92	2.77	97.05
3.5	3.375	1.87	1.77	98.82
3.75	3.625	0.71	0.67	99.50
4	3.875	0.45	0.43	99.92
>4.0	4.25	0.08	0.08	100.00

Percentiles

1	1.195
5	1.615
16	1.825
25	1.920
50	2.100
75	2.465
84	2.620
95	2.940
99	3.440

Moment Measures	**(phi)**	**(mm)**
Mean	2.316	0.201
Standard Deviation	0.431	0.742
Skewness	0.514	
Kurtosis	4.363	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.223	2.182
Standard Deviation	0.398	0.400
Skewness (1)	0.308	0.288
Skewness (2)	0.447	
Kurtosis	0.667	0.996



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**51st Ave**
Interval	**Berm Crest**
Mean	**0.222 mm**
STD	**0.714 mm**
Skewness	**-0.136**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

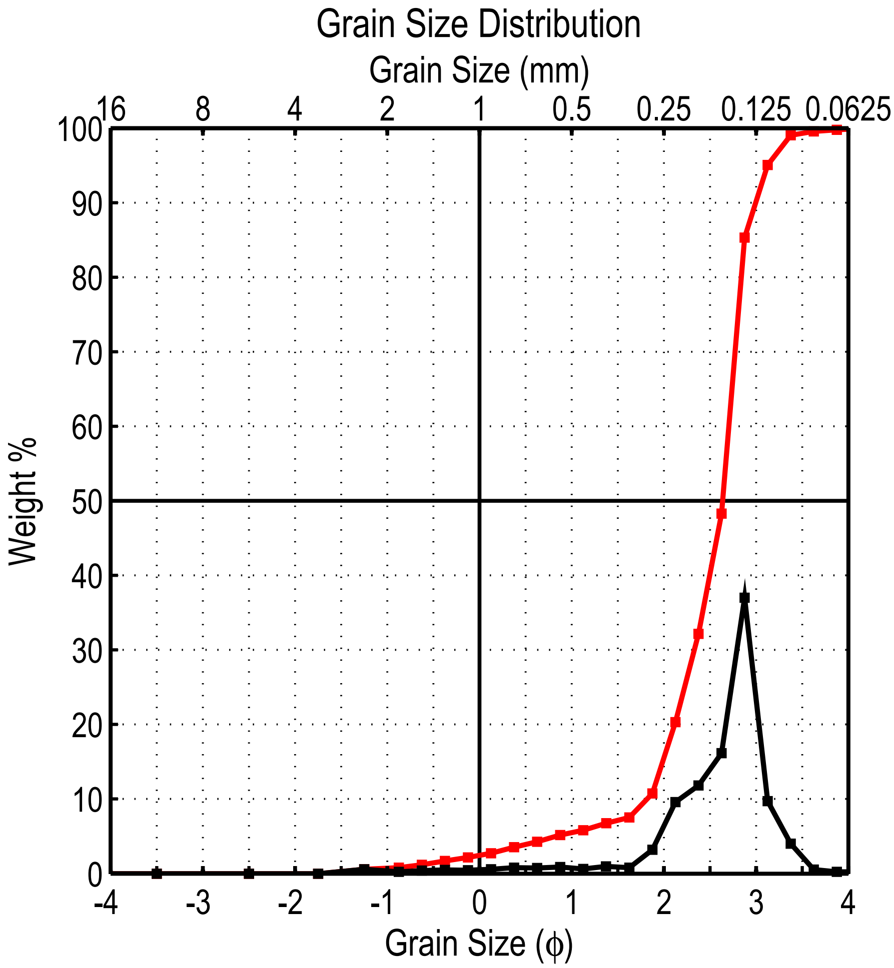
Total weight (gram)	104.12
% finer than 4.00 phi	0.05
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.5

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.02	0.02	0.02
-0.5	-0.625	0.01	0.01	0.03
-0.25	-0.375	0.01	0.01	0.04
0	-0.125	0.04	0.04	0.08
0.25	0.125	0.06	0.06	0.13
0.5	0.375	0.13	0.12	0.26
0.75	0.625	0.38	0.36	0.62
1	0.875	1.13	1.09	1.71
1.25	1.125	1.95	1.87	3.58
1.5	1.375	4.56	4.38	7.96
1.75	1.625	5.83	5.60	13.56
2	1.875	16.41	15.76	29.32
2.25	2.125	38.47	36.95	66.27
2.5	2.375	11.12	10.68	76.95
2.75	2.625	11.76	11.29	88.24
3	2.875	8.41	8.08	96.32
3.25	3.125	2.06	1.98	98.30
3.5	3.375	1.05	1.01	99.31
3.75	3.625	0.43	0.41	99.72
4	3.875	0.24	0.23	99.95
>4.0	4.25	0.05	0.05	100.00

Percentiles	
1	0.710
5	1.205
16	1.665
25	1.805
50	2.015
75	2.330
84	2.530
95	2.835
99	3.300

Moment Measures	**(phi)**	**(mm)**
Mean	2.169	0.222
Standard Deviation	0.486	0.714
Skewness	-0.136	
Kurtosis	4.795	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.098	2.070
Standard Deviation	0.433	0.463
Skewness (1)	0.191	0.098
Skewness (2)	0.012	
Kurtosis	0.884	1.272



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**51st Ave**
Interval	**Beach Face**
Mean	**0.172 mm**
STD	**0.603 mm**
Skewness	**-2.505**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

Total weight (gram)	103.99
% finer than 4.00 phi	0.22
% coarser than -1.00 phi	0.57
% $CaCO_3$	8.6

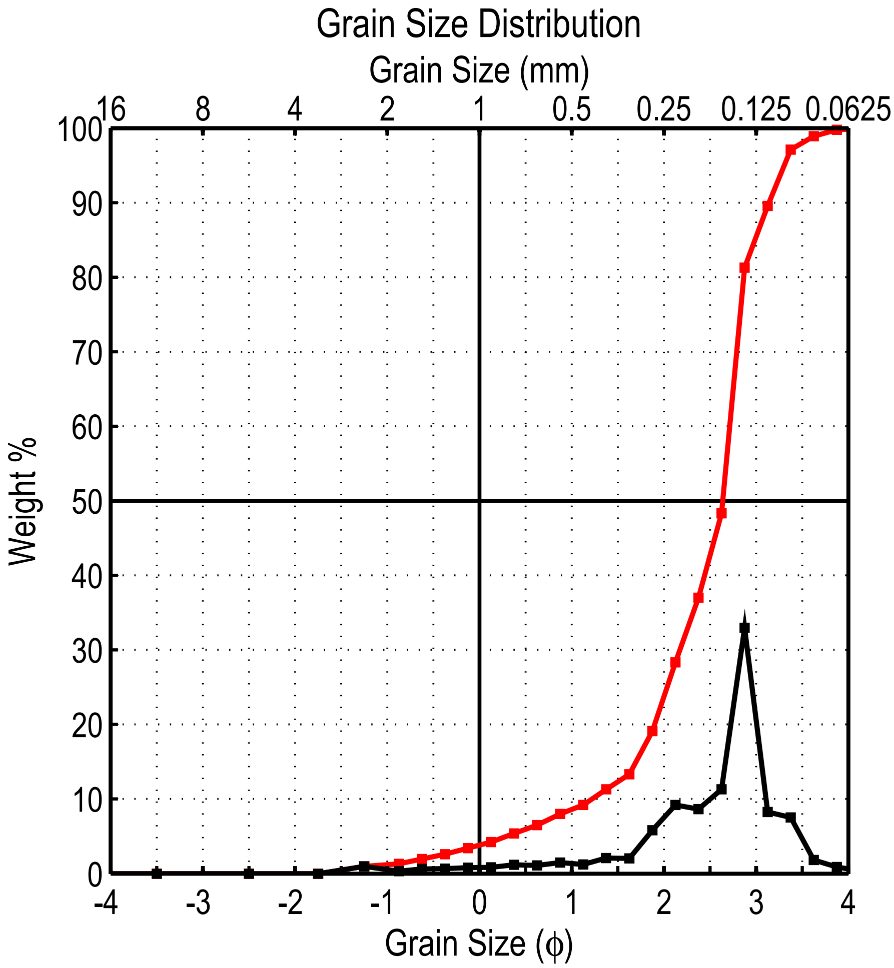
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.59	0.57	0.57
-0.75	-0.875	0.24	0.23	0.80
-0.5	-0.625	0.41	0.39	1.19
-0.25	-0.375	0.52	0.50	1.69
0	-0.125	0.49	0.47	2.16
0.25	0.125	0.60	0.58	2.74
0.5	0.375	0.81	0.78	3.52
0.75	0.625	0.80	0.77	4.29
1	0.875	0.93	0.89	5.18
1.25	1.125	0.65	0.63	5.81
1.5	1.375	0.99	0.95	6.76
1.75	1.625	0.81	0.78	7.54
2	1.875	3.33	3.20	10.74
2.25	2.125	9.95	9.57	20.31
2.5	2.375	12.30	11.83	32.14
2.75	2.625	16.79	16.15	48.28
3	2.875	38.49	37.01	85.30
3.25	3.125	10.12	9.73	95.03
3.5	3.375	4.16	4.00	99.03
3.75	3.625	0.55	0.53	99.56
4	3.875	0.23	0.22	99.78
>4.0	4.25	0.23	0.22	100.00

Percentiles

1	-0.745
5	0.825
16	2.010
25	2.225
50	2.635
75	2.805
84	2.865
95	3.125
99	3.375

Moment Measures	**(phi)**	**(mm)**
Mean	2.544	0.172
Standard Deviation	0.730	0.603
Skewness	-2.505	
Kurtosis	11.102	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.438	2.503
Standard Deviation	0.428	0.562
Skewness (1)	-0.462	-0.518
Skewness (2)	-1.544	
Kurtosis	1.690	1.625



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**51st Ave**
Interval	**Low Tide Terrace**
Mean	**0.182 mm**
STD	**0.536 mm**
Skewness	**-1.836**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

Total weight (gram)	100.06
% finer than 4.00 phi	0.22
% coarser than -1.00 phi	0.98
% $CaCO_3$	7.3

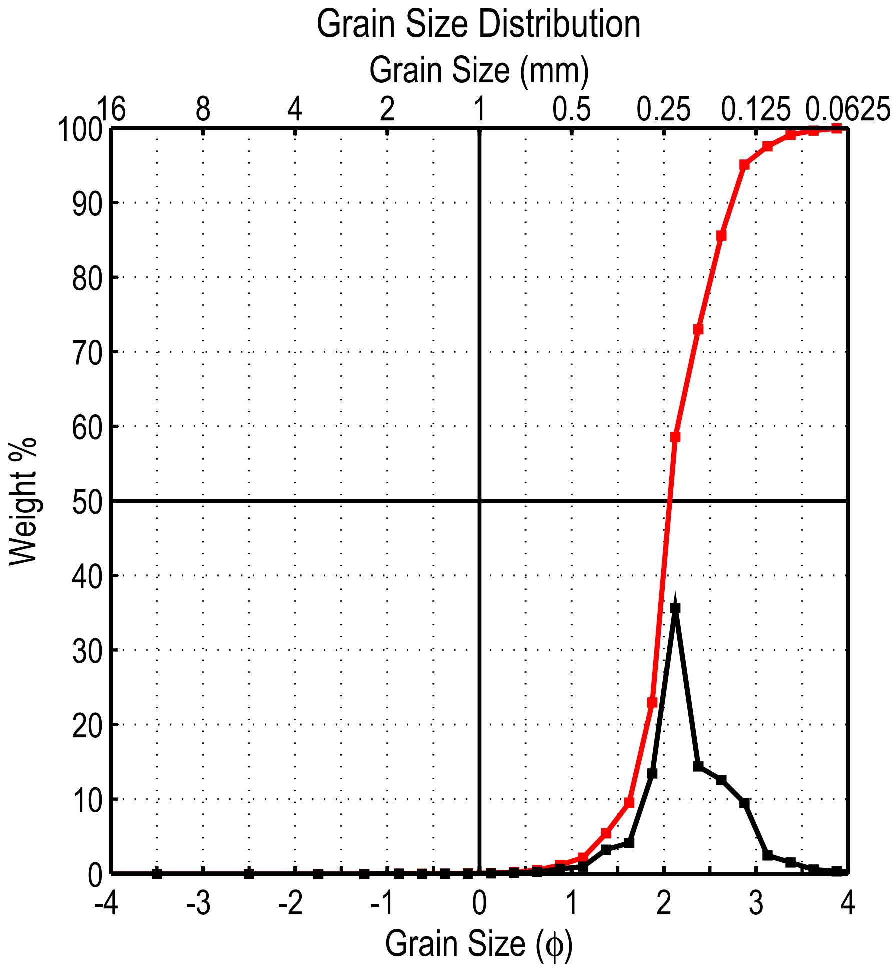
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.98	0.98	0.98
-0.75	-0.875	0.34	0.34	1.32
-0.5	-0.625	0.64	0.64	1.96
-0.25	-0.375	0.65	0.65	2.61
0	-0.125	0.80	0.80	3.41
0.25	0.125	0.82	0.82	4.23
0.5	0.375	1.16	1.16	5.39
0.75	0.625	1.11	1.11	6.50
1	0.875	1.49	1.49	7.99
1.25	1.125	1.22	1.22	9.20
1.5	1.375	2.09	2.09	11.29
1.75	1.625	2.04	2.04	13.33
2	1.875	5.80	5.80	19.13
2.25	2.125	9.22	9.21	28.34
2.5	2.375	8.67	8.66	37.01
2.75	2.625	11.31	11.30	48.31
3	2.875	32.99	32.97	81.28
3.25	3.125	8.28	8.28	89.56
3.5	3.375	7.54	7.54	97.09
3.75	3.625	1.83	1.83	98.92
4	3.875	0.86	0.86	99.78
>4.0	4.25	0.22	0.22	100.00

Percentiles

1	-1.225
5	0.290
16	1.740
25	2.035
50	2.640
75	2.825
84	2.955
95	3.305
99	3.650

Moment Measures	**(phi)**	**(mm)**
Mean	2.455	0.182
Standard Deviation	0.899	0.536
Skewness	-1.836	
Kurtosis	6.943	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.348	2.445
Standard Deviation	0.608	0.761
Skewness (1)	-0.481	-0.520
Skewness (2)	-1.387	
Kurtosis	1.481	1.564



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**222+00**
Interval	**Dune**
Mean	**0.210 mm**
STD	**0.720 mm**
Skewness	**-0.030**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

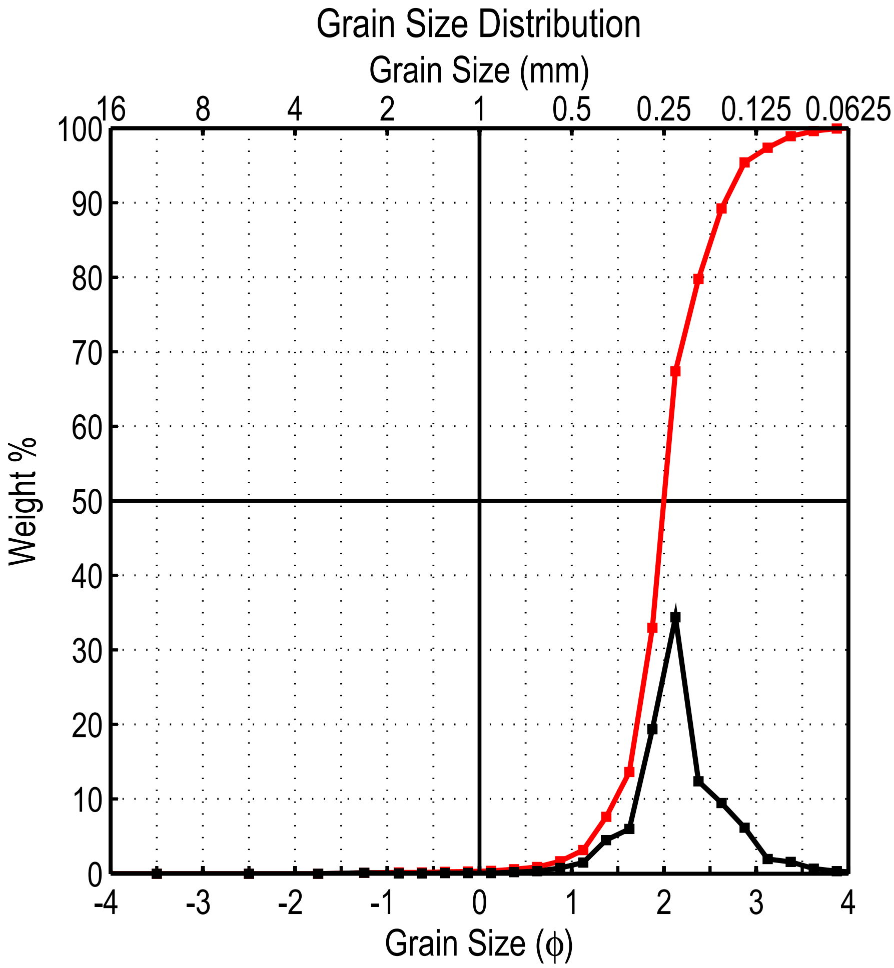
Total weight (gram)	116.32
% finer than 4.00 phi	0.07
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.4

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.01	0.01	0.01
-0.5	-0.625	0.00	0.00	0.01
-0.25	-0.375	0.02	0.02	0.03
0	-0.125	0.04	0.03	0.06
0.25	0.125	0.06	0.05	0.11
0.5	0.375	0.15	0.13	0.24
0.75	0.625	0.29	0.25	0.49
1	0.875	0.79	0.68	1.17
1.25	1.125	1.14	0.98	2.15
1.5	1.375	3.79	3.26	5.41
1.75	1.625	4.83	4.15	9.56
2	1.875	15.62	13.43	22.99
2.25	2.125	41.42	35.61	58.60
2.5	2.375	16.74	14.39	72.99
2.75	2.625	14.65	12.59	85.58
3	2.875	11.04	9.49	95.07
3.25	3.125	2.85	2.45	97.52
3.5	3.375	1.79	1.54	99.06
3.75	3.625	0.65	0.56	99.62
4	3.875	0.36	0.31	99.93
>4.0	4.25	0.08	0.07	100.00

Percentiles	
1	0.815
5	1.345
16	1.745
25	1.890
50	2.065
75	2.415
84	2.595
95	2.875
99	3.365

Moment Measures	**(phi)**	**(mm)**
Mean	2.249	0.210
Standard Deviation	0.474	0.720
Skewness	-0.030	
Kurtosis	4.895	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.170	2.135
Standard Deviation	0.425	0.444
Skewness (1)	0.247	0.153
Skewness (2)	0.106	
Kurtosis	0.800	1.194



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**222+00**
Interval	**Mid Berm**
Mean	**0.225 mm**
STD	**0.703 mm**
Skewness	**-0.340**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

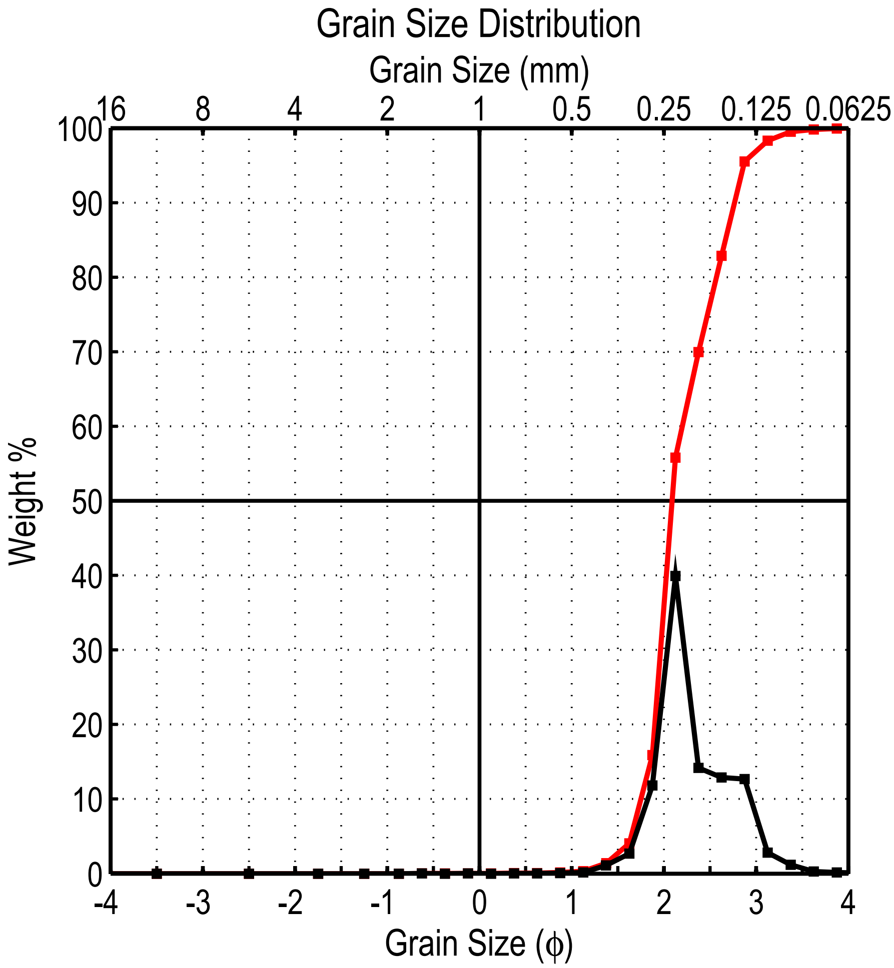
Total weight (gram)	105.05
% finer than 4.00 phi	0.06
% coarser than -1.00 phi	0.11
% $CaCO_3$	5.1

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.12	0.11	0.11
-0.75	-0.875	0.03	0.03	0.14
-0.5	-0.625	0.03	0.03	0.17
-0.25	-0.375	0.06	0.06	0.23
0	-0.125	0.07	0.07	0.30
0.25	0.125	0.08	0.08	0.37
0.5	0.375	0.21	0.20	0.57
0.75	0.625	0.33	0.31	0.89
1	0.875	0.81	0.77	1.66
1.25	1.125	1.56	1.49	3.14
1.5	1.375	4.72	4.49	7.63
1.75	1.625	6.29	5.99	13.62
2	1.875	20.33	19.35	32.97
2.25	2.125	36.14	34.40	67.38
2.5	2.375	13.00	12.38	79.75
2.75	2.625	9.94	9.46	89.21
3	2.875	6.48	6.17	95.38
3.25	3.125	2.07	1.97	97.35
3.5	3.375	1.65	1.57	98.92
3.75	3.625	0.71	0.68	99.60
4	3.875	0.36	0.34	99.94
>4.0	4.25	0.06	0.06	100.00

Percentiles	
1	0.660
5	1.230
16	1.655
25	1.770
50	2.000
75	2.280
84	2.485
95	2.860
99	3.405

Moment Measures	**(phi)**	**(mm)**
Mean	2.152	0.225
Standard Deviation	0.508	0.703
Skewness	-0.340	
Kurtosis	7.386	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.070	2.047
Standard Deviation	0.415	0.454
Skewness (1)	0.169	0.112
Skewness (2)	0.108	
Kurtosis	0.964	1.310



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**222+00**
Interval	**Berm Crest**
Mean	**0.201 mm**
STD	**0.756 mm**
Skewness	**0.406**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

Total weight (gram)	105.21
% finer than 4.00 phi	0.05
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.8

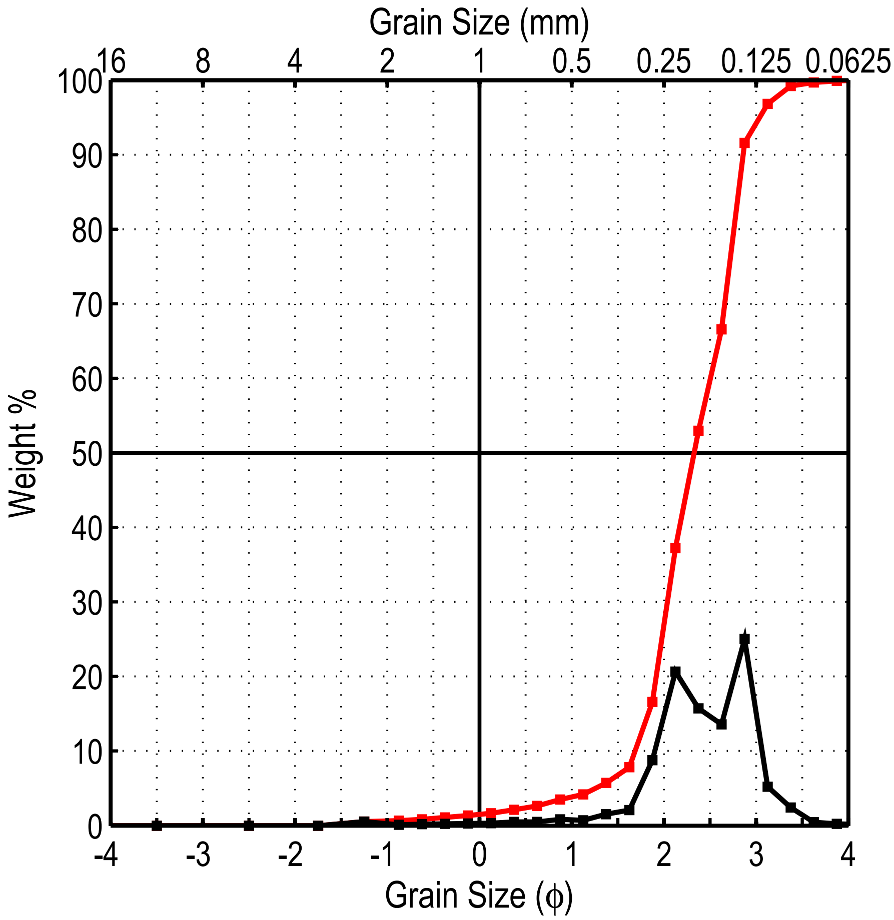
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.01	0.01	0.01
-0.25	-0.375	0.00	0.00	0.01
0	-0.125	0.03	0.03	0.04
0.25	0.125	0.00	0.00	0.04
0.5	0.375	0.02	0.02	0.06
0.75	0.625	0.02	0.02	0.08
1	0.875	0.08	0.08	0.15
1.25	1.125	0.17	0.16	0.31
1.5	1.375	1.13	1.07	1.39
1.75	1.625	2.80	2.66	4.05
2	1.875	12.45	11.83	15.88
2.25	2.125	41.98	39.90	55.78
2.5	2.375	14.91	14.17	69.96
2.75	2.625	13.56	12.89	82.84
3	2.875	13.33	12.67	95.51
3.25	3.125	2.95	2.80	98.32
3.5	3.375	1.24	1.18	99.50
3.75	3.625	0.31	0.29	99.79
4	3.875	0.17	0.16	99.95
>4.0	4.25	0.05	0.05	100.00

Percentiles	
1	1.285
5	1.645
16	1.875
25	1.930
50	2.090
75	2.475
84	2.650
95	2.865
99	3.270

Moment Measures	**(phi)**	**(mm)**
Mean	2.316	0.201
Standard Deviation	0.403	0.756
Skewness	0.406	
Kurtosis	4.288	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.263	2.205
Standard Deviation	0.387	0.379
Skewness (1)	0.445	0.358
Skewness (2)	0.426	
Kurtosis	0.574	0.917

Grain Size Distribution



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**222+00**
Interval	**Beach Face**
Mean	**0.190 mm**
STD	**0.639 mm**
Skewness	**-2.007**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

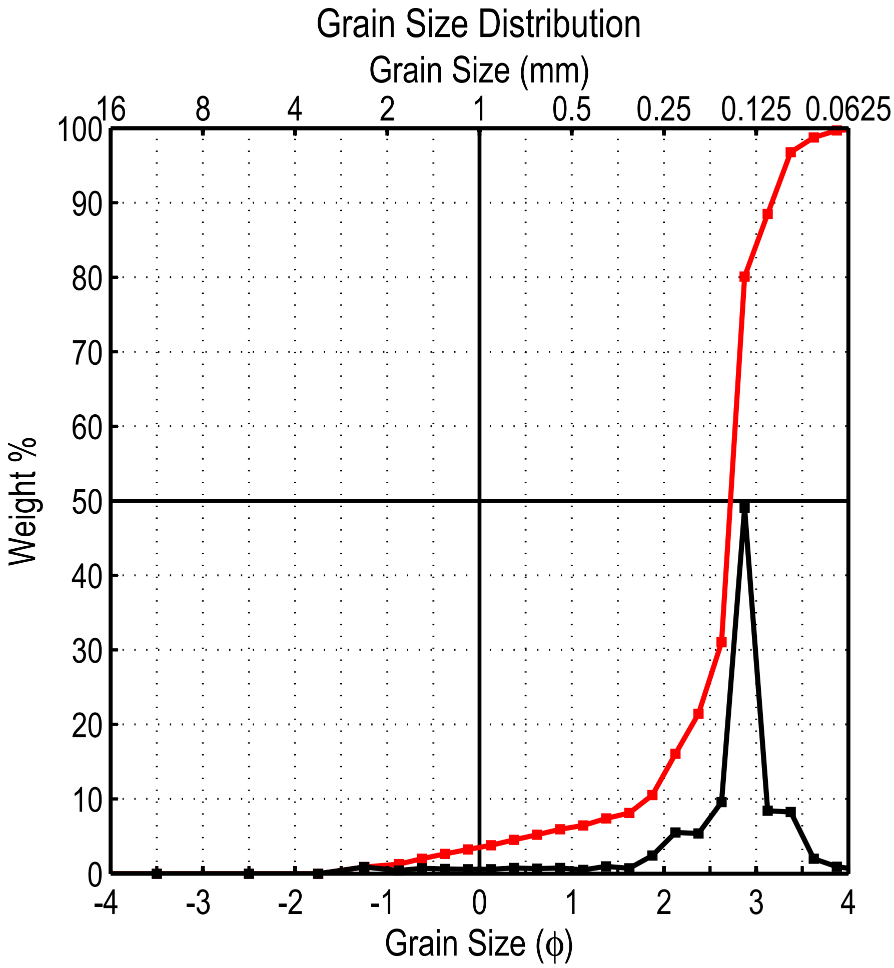
Total weight (gram)	101.19
% finer than 4.00 phi	0.09
% coarser than -1.00 phi	0.53
% $CaCO_3$	4.4

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.54	0.53	0.53
-0.75	-0.875	0.13	0.13	0.66
-0.5	-0.625	0.18	0.18	0.84
-0.25	-0.375	0.26	0.26	1.10
0	-0.125	0.27	0.27	1.36
0.25	0.125	0.31	0.31	1.67
0.5	0.375	0.48	0.47	2.14
0.75	0.625	0.52	0.51	2.66
1	0.875	0.83	0.82	3.48
1.25	1.125	0.72	0.71	4.19
1.5	1.375	1.56	1.54	5.73
1.75	1.625	2.12	2.10	7.83
2	1.875	8.87	8.77	16.59
2.25	2.125	20.89	20.64	37.24
2.5	2.375	15.92	15.73	52.97
2.75	2.625	13.74	13.58	66.55
3	2.875	25.33	25.03	91.58
3.25	3.125	5.27	5.21	96.79
3.5	3.375	2.46	2.43	99.22
3.75	3.625	0.46	0.45	99.67
4	3.875	0.24	0.24	99.91
>4.0	4.25	0.09	0.09	100.00

Percentiles	
1	-0.470
5	1.255
16	1.860
25	1.975
50	2.330
75	2.710
84	2.800
95	3.040
99	3.350

Moment Measures	**(phi)**	**(mm)**
Mean	2.393	0.190
Standard Deviation	0.646	0.639
Skewness	-2.007	
Kurtosis	10.774	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.330	2.330
Standard Deviation	0.470	0.505
Skewness (1)	0.000	-0.102
Skewness (2)	-0.388	
Kurtosis	0.899	0.995



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**222+00**
Interval	**Low Tide Terrace**
Mean	**0.161 mm**
STD	**0.563 mm**
Skewness	**-2.590**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

Total weight (gram)	113.04
% finer than 4.00 phi	0.34
% coarser than -1.00 phi	0.88
% $CaCO_3$	7.7

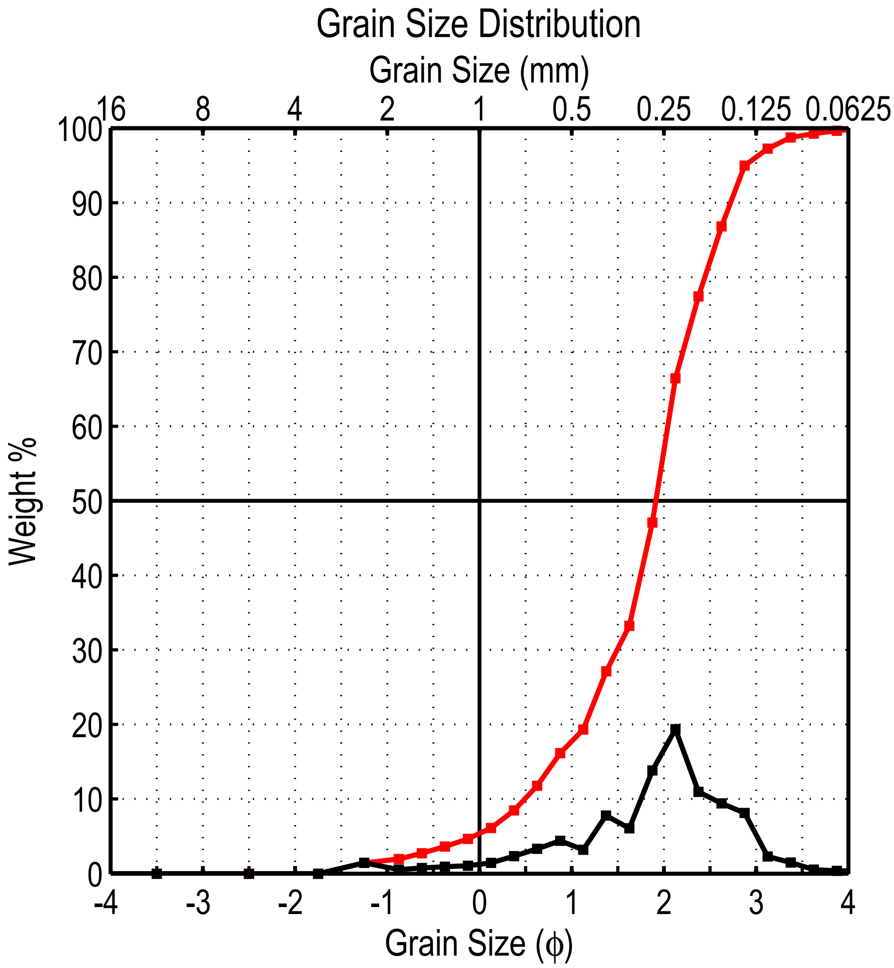
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.99	0.88	0.88
-0.75	-0.875	0.45	0.40	1.27
-0.5	-0.625	0.82	0.73	2.00
-0.25	-0.375	0.71	0.63	2.63
0	-0.125	0.67	0.59	3.22
0.25	0.125	0.64	0.57	3.79
0.5	0.375	0.84	0.74	4.53
0.75	0.625	0.76	0.67	5.20
1	0.875	0.84	0.74	5.94
1.25	1.125	0.58	0.51	6.46
1.5	1.375	1.08	0.96	7.41
1.75	1.625	0.81	0.72	8.13
2	1.875	2.73	2.42	10.54
2.25	2.125	6.23	5.51	16.06
2.5	2.375	6.08	5.38	21.43
2.75	2.625	10.85	9.60	31.03
3	2.875	55.43	49.04	80.07
3.25	3.125	9.53	8.43	88.50
3.5	3.375	9.33	8.25	96.75
3.75	3.625	2.25	1.99	98.74
4	3.875	1.04	0.92	99.66
>4.0	4.25	0.38	0.34	100.00

Percentiles

1	-1.135
5	0.550
16	2.120
25	2.470
50	2.720
75	2.850
84	2.990
95	3.320
99	3.695

Moment Measures	**(phi)**	**(mm)**
Mean	2.639	0.161
Standard Deviation	0.828	0.563
Skewness	-2.590	
Kurtosis	10.750	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.555	2.610
Standard Deviation	0.435	0.637
Skewness (1)	-0.379	-0.473
Skewness (2)	-1.805	
Kurtosis	2.184	2.987



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**242+00**
Interval	**Dune**
Mean	**0.275 mm**
STD	**0.529 mm**
Skewness	**-0.997**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Moderately Sorted
Poorly Graded	Coarse Skewed
	Leptokurtic

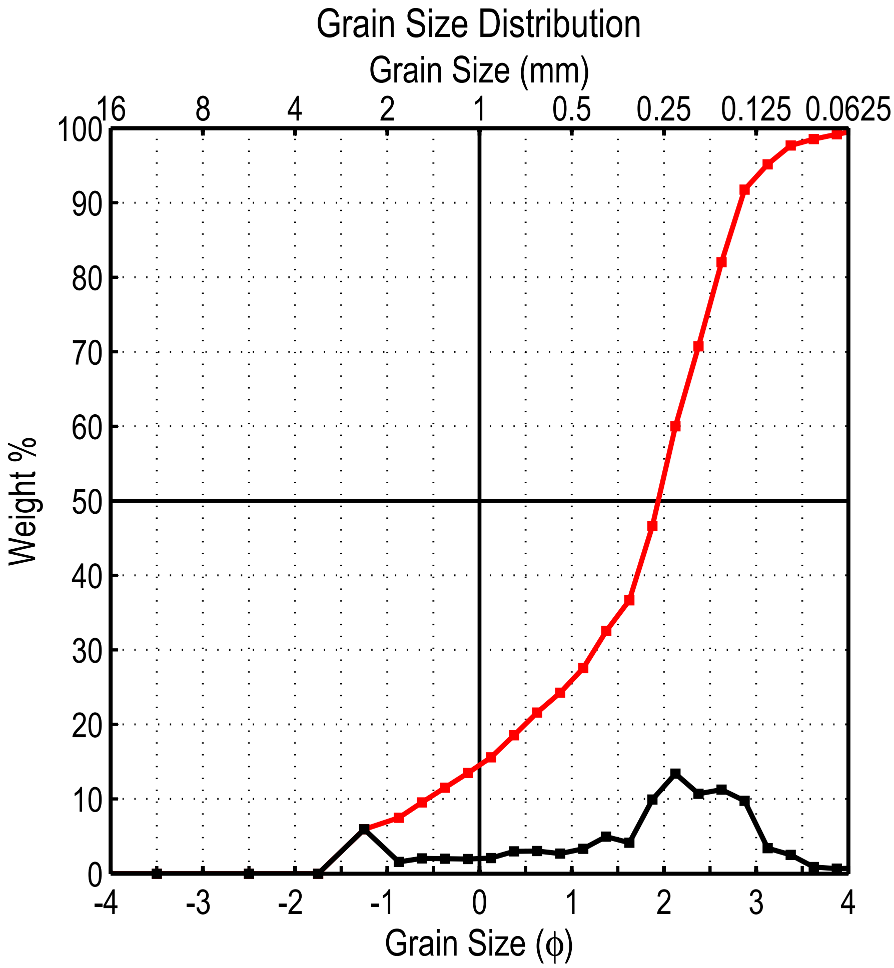
Total weight (gram)	107.39
% finer than 4.00 phi	0.38
% coarser than -1.00 phi	1.44
% $CaCO_3$	13.0

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	1.55	1.44	1.44
-0.75	-0.875	0.56	0.52	1.96
-0.5	-0.625	0.80	0.74	2.71
-0.25	-0.375	1.00	0.93	3.64
0	-0.125	1.11	1.03	4.67
0.25	0.125	1.55	1.44	6.12
0.5	0.375	2.51	2.34	8.46
0.75	0.625	3.55	3.31	11.76
1	0.875	4.71	4.39	16.15
1.25	1.125	3.42	3.18	19.33
1.5	1.375	8.38	7.80	27.13
1.75	1.625	6.52	6.07	33.21
2	1.875	14.88	13.86	47.06
2.25	2.125	20.79	19.36	66.42
2.5	2.375	11.79	10.98	77.40
2.75	2.625	10.12	9.42	86.82
3	2.875	8.72	8.12	94.94
3.25	3.125	2.47	2.30	97.24
3.5	3.375	1.60	1.49	98.73
3.75	3.625	0.57	0.53	99.26
4	3.875	0.38	0.35	99.62
>4.0	4.25	0.41	0.38	100.00

Percentiles	
1	-1.405
5	-0.070
16	0.865
25	1.305
50	1.915
75	2.320
84	2.550
95	2.880
99	3.500

Moment Measures	**(phi)**	**(mm)**
Mean	1.863	0.275
Standard Deviation	0.919	0.529
Skewness	-0.997	
Kurtosis	4.499	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.707	1.777
Standard Deviation	0.843	0.868
Skewness (1)	-0.246	-0.296
Skewness (2)	-0.605	
Kurtosis	0.751	1.191



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**242+00**
Interval	**Mid Berm**
Mean	**0.307 mm**
STD	**0.414 mm**
Skewness	**-0.872**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Poorly Sorted
Poorly Graded	Coarse Skewed
	Mesokurtic

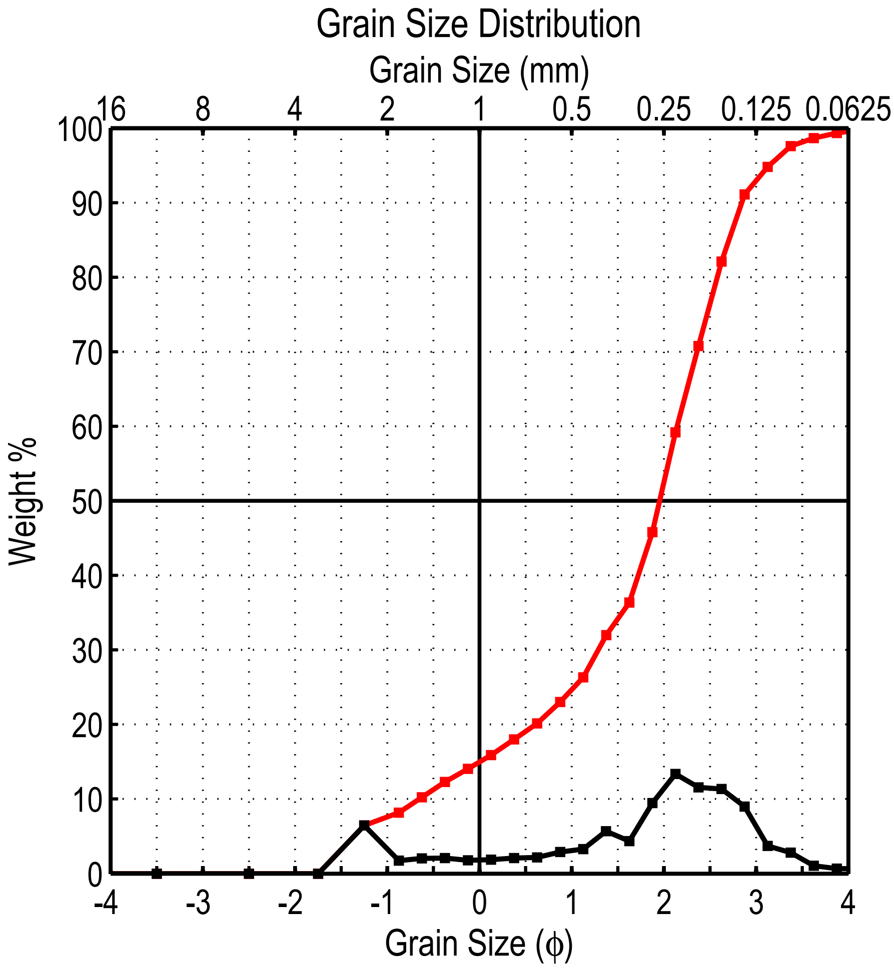
Total weight (gram)	107.06
% finer than 4.00 phi	0.82
% coarser than -1.00 phi	5.95
% $CaCO_3$	21.2

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	6.37	5.95	5.95
-0.75	-0.875	1.66	1.55	7.50
-0.5	-0.625	2.17	2.03	9.53
-0.25	-0.375	2.13	1.99	11.52
0	-0.125	2.11	1.97	13.49
0.25	0.125	2.25	2.10	15.59
0.5	0.375	3.19	2.98	18.57
0.75	0.625	3.26	3.05	21.61
1	0.875	2.85	2.66	24.28
1.25	1.125	3.54	3.31	27.58
1.5	1.375	5.31	4.96	32.54
1.75	1.625	4.42	4.13	36.67
2	1.875	10.64	9.94	46.61
2.25	2.125	14.34	13.39	60.00
2.5	2.375	11.47	10.71	70.72
2.75	2.625	12.07	11.27	81.99
3	2.875	10.44	9.75	91.74
3.25	3.125	3.64	3.40	95.14
3.5	3.375	2.68	2.50	97.65
3.75	3.625	0.94	0.88	98.52
4	3.875	0.70	0.65	99.18
>4.0	4.25	0.88	0.82	100.00

Percentiles	
1	-1.665
5	-1.330
16	0.160
25	0.930
50	1.940
75	2.470
84	2.675
95	3.115
99	3.805

Moment Measures	**(phi)**	**(mm)**
Mean	1.703	0.307
Standard Deviation	1.272	0.414
Skewness	-0.872	
Kurtosis	3.018	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.418	1.592
Standard Deviation	1.257	1.302
Skewness (1)	-0.416	-0.443
Skewness (2)	-0.833	
Kurtosis	0.767	1.183



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**242+00**
Interval	**Berm Crest**
Mean	**0.305 mm**
STD	**0.411 mm**
Skewness	**-0.923**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Poorly Sorted
Poorly Graded	Coarse Skewed
	Mesokurtic

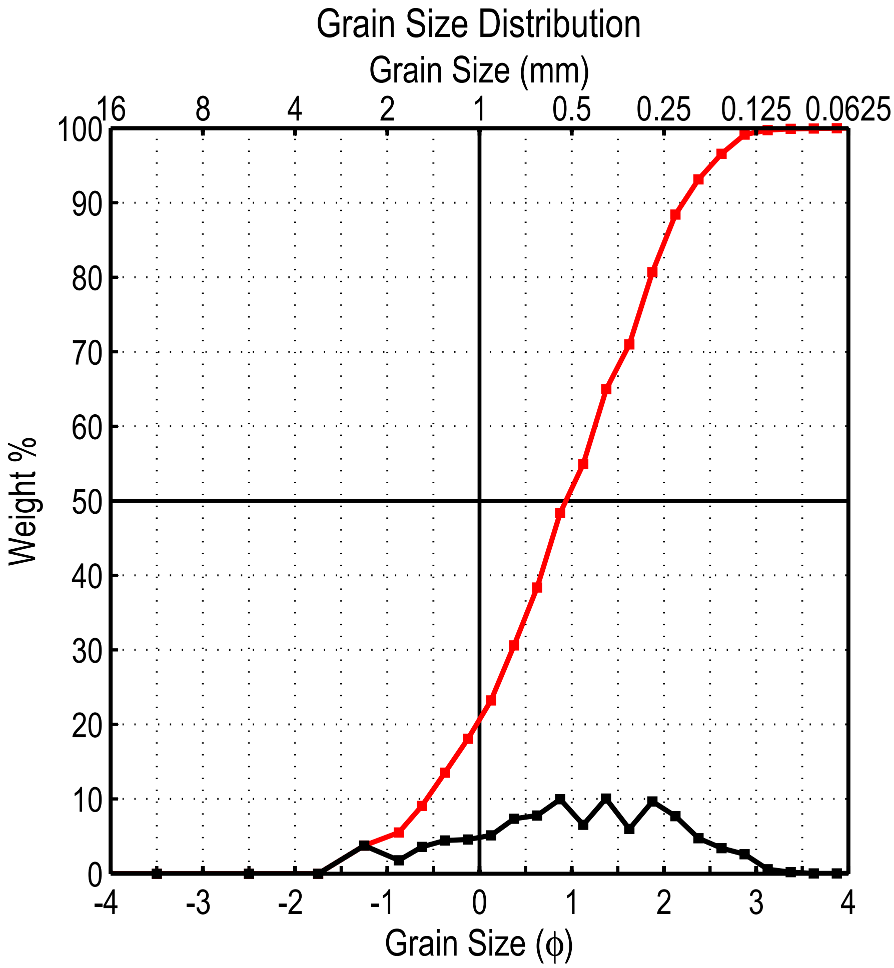
Total weight (gram)	114.38
% finer than 4.00 phi	0.68
% coarser than -1.00 phi	6.44
% $CaCO_3$	22.8

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	7.37	6.44	6.44
-0.75	-0.875	1.97	1.72	8.17
-0.5	-0.625	2.35	2.05	10.22
-0.25	-0.375	2.38	2.08	12.30
0	-0.125	2.02	1.77	14.07
0.25	0.125	2.11	1.84	15.91
0.5	0.375	2.37	2.07	17.98
0.75	0.625	2.46	2.15	20.13
1	0.875	3.31	2.89	23.03
1.25	1.125	3.75	3.28	26.31
1.5	1.375	6.51	5.69	32.00
1.75	1.625	4.98	4.35	36.35
2	1.875	10.82	9.46	45.81
2.25	2.125	15.30	13.38	59.19
2.5	2.375	13.23	11.57	70.76
2.75	2.625	12.97	11.34	82.09
3	2.875	10.28	8.99	91.08
3.25	3.125	4.22	3.69	94.77
3.5	3.375	3.23	2.82	97.60
3.75	3.625	1.19	1.04	98.64
4	3.875	0.78	0.68	99.32
>4.0	4.25	0.78	0.68	100.00

Percentiles	
1	-1.670
5	-1.360
16	0.135
25	1.025
50	1.955
75	2.470
84	2.680
95	3.145
99	3.760

Moment Measures	**(phi)**	**(mm)**
Mean	1.712	0.305
Standard Deviation	1.284	0.411
Skewness	-0.923	
Kurtosis	3.084	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.407	1.590
Standard Deviation	1.273	1.319
Skewness (1)	-0.430	-0.451
Skewness (2)	-0.835	
Kurtosis	0.770	1.278



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**242+00**
Interval	**Beach Face**
Mean	**0.492 mm**
STD	**0.484 mm**
Skewness	**-0.237**
USCS	**Wentworth**
SP Medium Sand Poorly Graded	Medium Sand Poorly Sorted Symmetrical Platykurtic

Total weight (gram)	103.78
% finer than 4.00 phi	0.02
% coarser than -1.00 phi	3.74
% $CaCO_3$	25.3

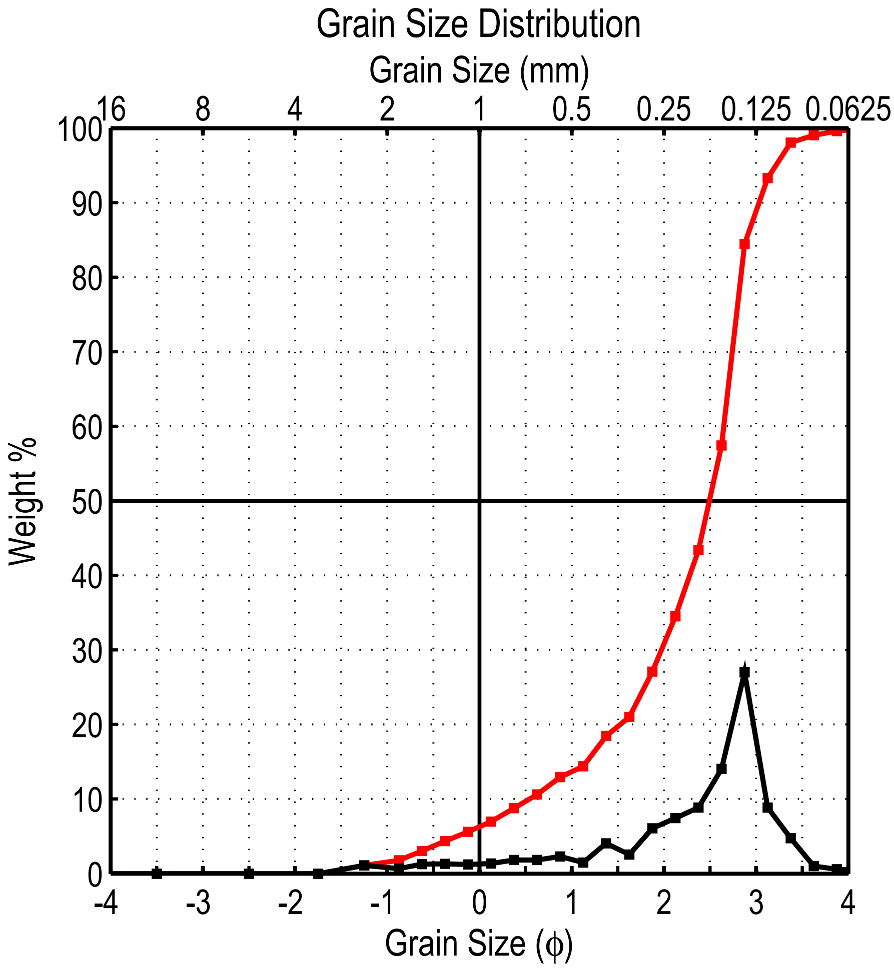
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	3.88	3.74	3.74
-0.75	-0.875	1.83	1.76	5.50
-0.5	-0.625	3.72	3.58	9.09
-0.25	-0.375	4.61	4.44	13.53
0	-0.125	4.74	4.57	18.10
0.25	0.125	5.34	5.15	23.24
0.5	0.375	7.64	7.36	30.60
0.75	0.625	8.06	7.77	38.37
1	0.875	10.37	9.99	48.36
1.25	1.125	6.81	6.56	54.92
1.5	1.375	10.45	10.07	64.99
1.75	1.625	6.22	5.99	70.99
2	1.875	10.05	9.68	80.67
2.25	2.125	8.00	7.71	88.38
2.5	2.375	4.92	4.74	93.12
2.75	2.625	3.55	3.42	96.54
3	2.875	2.68	2.58	99.12
3.25	3.125	0.62	0.60	99.72
3.5	3.375	0.20	0.19	99.91
3.75	3.625	0.04	0.04	99.95
4	3.875	0.03	0.03	99.98
>4.0	4.25	0.02	0.02	100.00

Percentiles

1	-1.615
5	-0.980
16	-0.240
25	0.185
50	0.935
75	1.730
84	1.985
95	2.510
99	2.865

Moment Measures	**(phi)**	**(mm)**
Mean	1.023	0.492
Standard Deviation	1.046	0.484
Skewness	-0.237	
Kurtosis	2.411	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	0.873	0.893
Standard Deviation	1.112	1.085
Skewness (1)	-0.056	-0.077
Skewness (2)	-0.153	
Kurtosis	0.569	0.926



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**242+00**
Interval	**Low Tide Terrace**
Mean	**0.209 mm**
STD	**0.490 mm**
Skewness	**-1.452**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Poorly Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

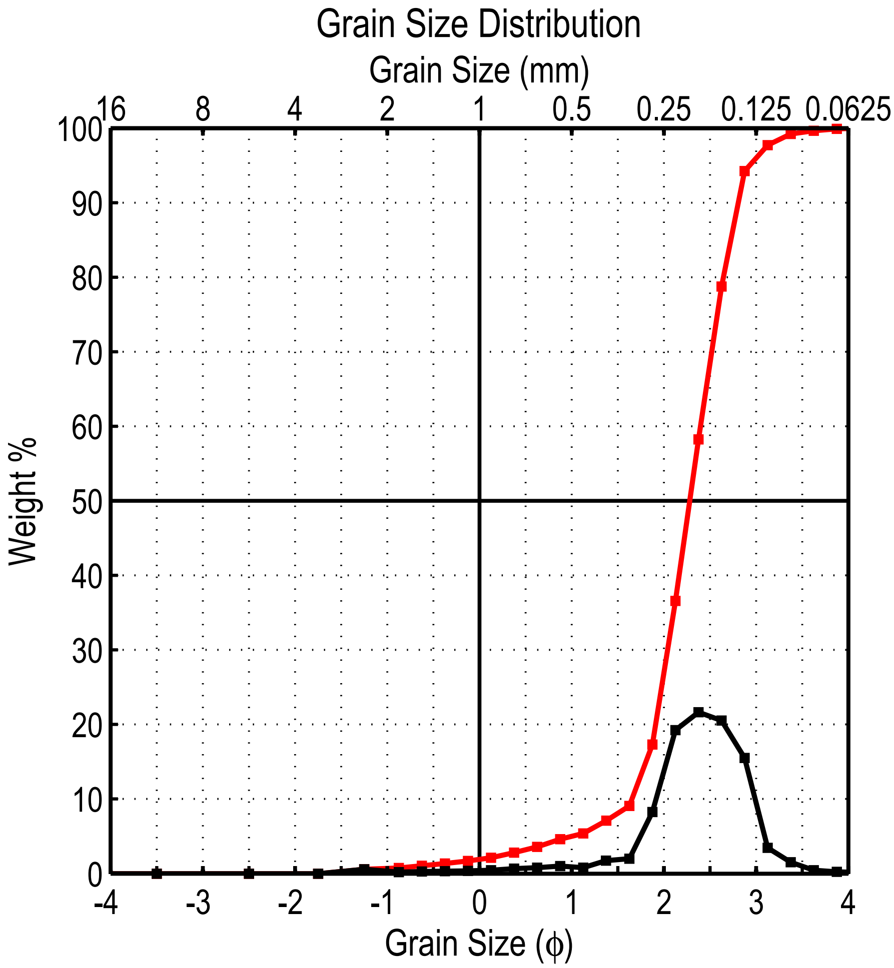
Total weight (gram)	103.59
% finer than 4.00 phi	0.39
% coarser than -1.00 phi	1.10
% $CaCO_3$	11.1

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	1.14	1.10	1.10
-0.75	-0.875	0.70	0.68	1.78
-0.5	-0.625	1.31	1.26	3.04
-0.25	-0.375	1.36	1.31	4.35
0	-0.125	1.28	1.24	5.59
0.25	0.125	1.42	1.37	6.96
0.5	0.375	1.88	1.81	8.77
0.75	0.625	1.91	1.84	10.62
1	0.875	2.39	2.31	12.93
1.25	1.125	1.54	1.49	14.41
1.5	1.375	4.20	4.05	18.47
1.75	1.625	2.64	2.55	21.02
2	1.875	6.30	6.08	27.10
2.25	2.125	7.70	7.43	34.53
2.5	2.375	9.17	8.85	43.38
2.75	2.625	14.56	14.06	57.44
3	2.875	27.96	26.99	84.43
3.25	3.125	9.19	8.87	93.30
3.5	3.375	4.93	4.76	98.06
3.75	3.625	1.03	0.99	99.05
4	3.875	0.58	0.56	99.61
>4.0	4.25	0.40	0.39	100.00

Percentiles	
1	-1.295
5	-0.245
16	1.225
25	1.790
50	2.495
75	2.790
84	2.870
95	3.215
99	3.610

Moment Measures	**(phi)**	**(mm)**
Mean	2.259	0.209
Standard Deviation	1.028	0.490
Skewness	-1.452	
Kurtosis	4.756	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.048	2.197
Standard Deviation	0.823	0.935
Skewness (1)	-0.544	-0.564
Skewness (2)	-1.228	
Kurtosis	1.103	1.418



Project 2300
Location Isle of Palms, SC
Date Jul 2010

Station 262+00
Interval Dune

Mean 0.200 mm
STD 0.634 mm
Skewness -2.159

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

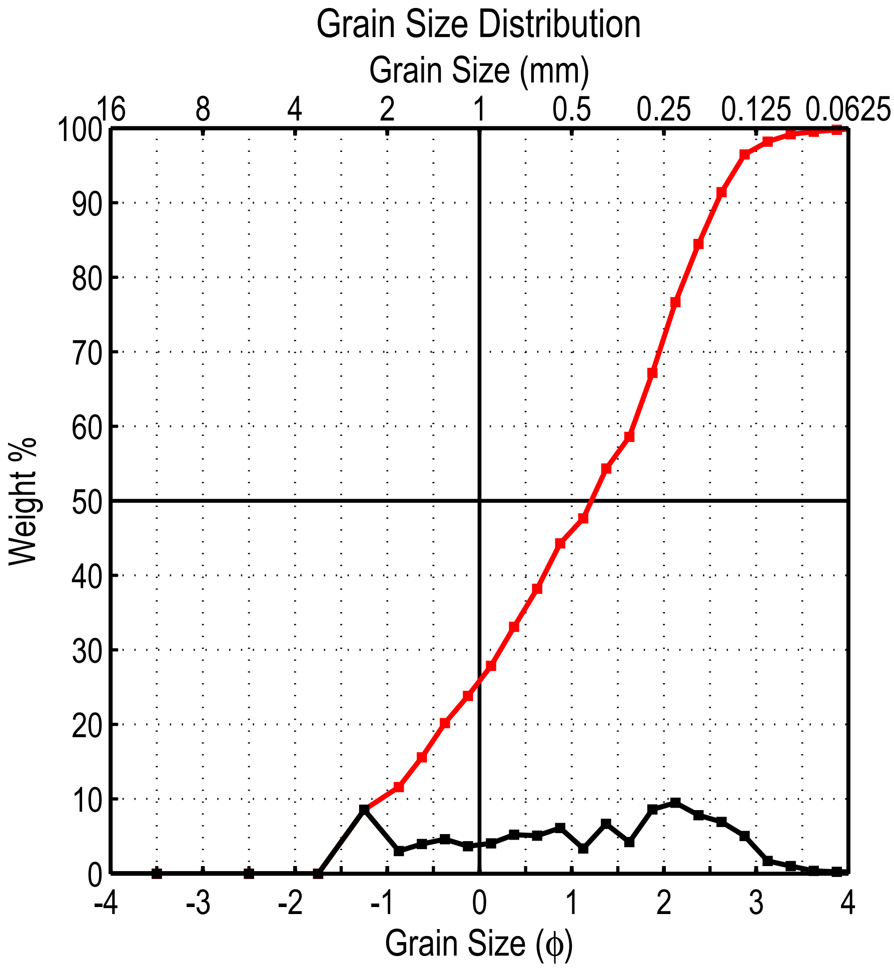
Total weight (gram)	104.80
% finer than 4.00 phi	0.11
% coarser than -1.00 phi	0.56
% $CaCO_3$	6.0

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.59	0.56	0.56
-0.75	-0.875	0.19	0.18	0.74
-0.5	-0.625	0.31	0.30	1.04
-0.25	-0.375	0.32	0.31	1.35
0	-0.125	0.38	0.36	1.71
0.25	0.125	0.45	0.43	2.14
0.5	0.375	0.69	0.66	2.80
0.75	0.625	0.84	0.80	3.60
1	0.875	1.05	1.00	4.60
1.25	1.125	0.82	0.78	5.38
1.5	1.375	1.80	1.72	7.10
1.75	1.625	2.08	1.98	9.08
2	1.875	8.64	8.24	17.33
2.25	2.125	20.16	19.24	36.56
2.5	2.375	22.69	21.65	58.22
2.75	2.625	21.51	20.52	78.74
3	2.875	16.25	15.51	94.25
3.25	3.125	3.62	3.45	97.70
3.5	3.375	1.59	1.52	99.22
3.75	3.625	0.45	0.43	99.65
4	3.875	0.25	0.24	99.89
>4.0	4.25	0.12	0.11	100.00

Percentiles	
1	-0.660
5	1.005
16	1.835
25	1.975
50	2.280
75	2.580
84	2.710
95	2.930
99	3.340

Moment Measures	**(phi)**	**(mm)**
Mean	2.320	0.200
Standard Deviation	0.658	0.634
Skewness	-2.159	
Kurtosis	10.930	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.273	2.275
Standard Deviation	0.438	0.510
Skewness (1)	-0.017	-0.171
Skewness (2)	-0.714	
Kurtosis	1.200	1.304



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**262+00**
Interval	**Mid Berm**
Mean	**0.459 mm**
STD	**0.400 mm**
Skewness	**-0.290**

USCS	**Wentworth**
SP	Medium Sand
Medium Sand	Poorly Sorted
Poorly Graded	Symmetrical
	Platykurtic

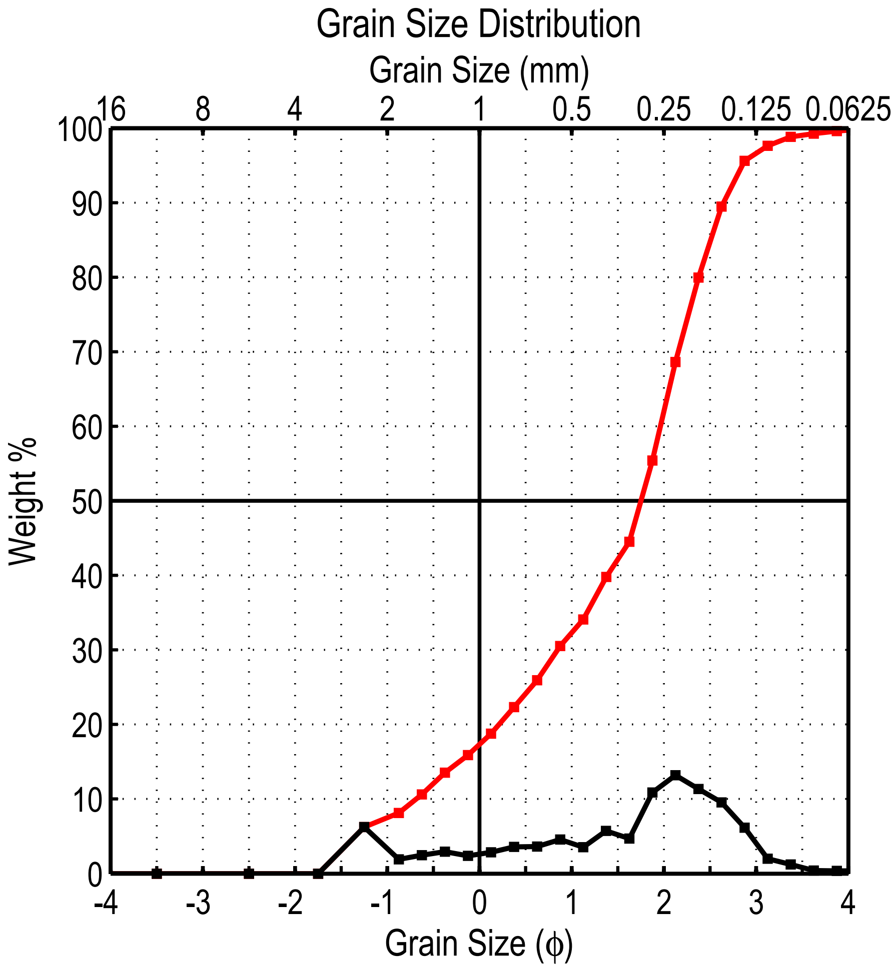
Total weight (gram)	106.91
% finer than 4.00 phi	0.22
% coarser than -1.00 phi	8.57
% $CaCO_3$	28.4

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	9.16	8.57	8.57
-0.75	-0.875	3.23	3.02	11.59
-0.5	-0.625	4.26	3.98	15.57
-0.25	-0.375	4.91	4.59	20.17
0	-0.125	3.90	3.65	23.81
0.25	0.125	4.35	4.07	27.88
0.5	0.375	5.57	5.21	33.09
0.75	0.625	5.44	5.09	38.18
1	0.875	6.55	6.13	44.31
1.25	1.125	3.58	3.35	47.66
1.5	1.375	7.12	6.66	54.32
1.75	1.625	4.54	4.25	58.56
2	1.875	9.20	8.61	67.17
2.25	2.125	10.14	9.48	76.65
2.5	2.375	8.35	7.81	84.46
2.75	2.625	7.42	6.94	91.40
3	2.875	5.41	5.06	96.46
3.25	3.125	1.81	1.69	98.16
3.5	3.375	1.09	1.02	99.18
3.75	3.625	0.37	0.35	99.52
4	3.875	0.27	0.25	99.78
>4.0	4.25	0.24	0.22	100.00

Percentiles	
1	-1.690
5	-1.460
16	-0.600
25	-0.050
50	1.215
75	2.080
84	2.360
95	2.805
99	3.330

Moment Measures	**(phi)**	**(mm)**
Mean	1.123	0.459
Standard Deviation	1.321	0.400
Skewness	-0.290	
Kurtosis	2.010	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	0.880	0.992
Standard Deviation	1.480	1.386
Skewness (1)	-0.226	-0.240
Skewness (2)	-0.367	
Kurtosis	0.441	0.821



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**262+00**
Interval	**Berm Crest**
Mean	**0.358 mm**
STD	**0.420 mm**
Skewness	**-0.722**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Poorly Sorted
Poorly Graded	Coarse Skewed
	Mesokurtic

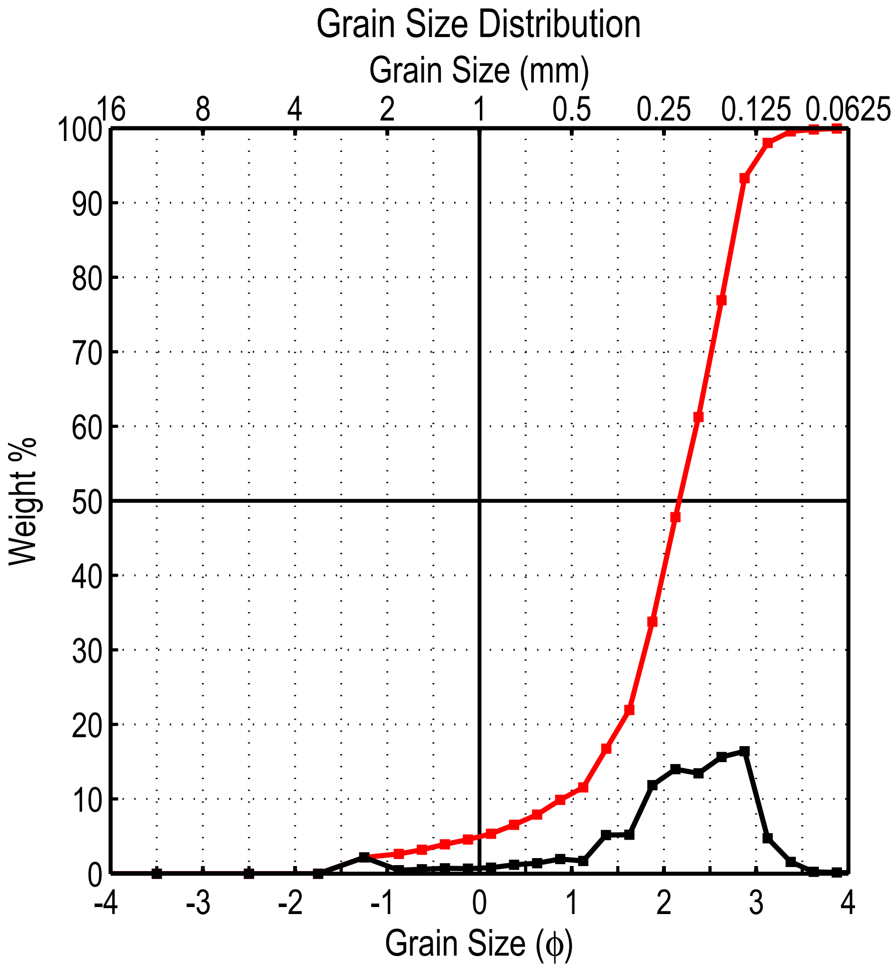
Total weight (gram)	104.56
% finer than 4.00 phi	0.42
% coarser than -1.00 phi	6.25
% $CaCO_3$	23.7

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	6.53	6.25	6.25
-0.75	-0.875	1.99	1.90	8.15
-0.5	-0.625	2.56	2.45	10.60
-0.25	-0.375	3.06	2.93	13.52
0	-0.125	2.49	2.38	15.90
0.25	0.125	2.99	2.86	18.76
0.5	0.375	3.74	3.58	22.34
0.75	0.625	3.77	3.61	25.95
1	0.875	4.78	4.57	30.52
1.25	1.125	3.71	3.55	34.07
1.5	1.375	6.00	5.74	39.80
1.75	1.625	4.93	4.71	44.52
2	1.875	11.38	10.88	55.40
2.25	2.125	13.80	13.20	68.60
2.5	2.375	11.86	11.34	79.94
2.75	2.625	9.96	9.53	89.47
3	2.875	6.43	6.15	95.62
3.25	3.125	2.08	1.99	97.61
3.5	3.375	1.27	1.21	98.82
3.75	3.625	0.43	0.41	99.23
4	3.875	0.36	0.34	99.58
>4.0	4.25	0.44	0.42	100.00

Percentiles	
1	-1.670
5	-1.350
16	-0.115
25	0.560
50	1.750
75	2.265
84	2.480
95	2.850
99	3.480

Moment Measures	**(phi)**	**(mm)**
Mean	1.481	0.358
Standard Deviation	1.250	0.420
Skewness	-0.722	
Kurtosis	2.648	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.182	1.372
Standard Deviation	1.298	1.285
Skewness (1)	-0.437	-0.457
Skewness (2)	-0.771	
Kurtosis	0.618	1.010



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**262+00**
Interval	**Beach Face**
Mean	**0.232 mm**
STD	**0.532 mm**
Skewness	**-1.702**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

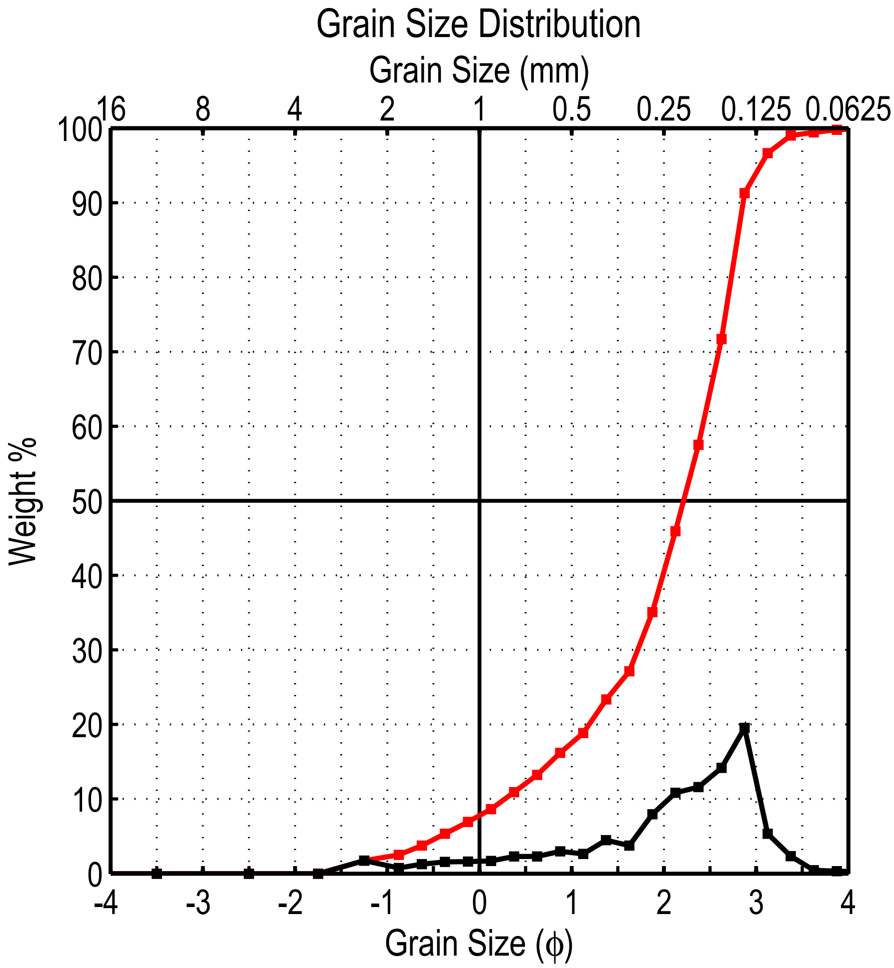
Total weight (gram)	103.95
% finer than 4.00 phi	0.05
% coarser than -1.00 phi	2.15
% $CaCO_3$	12.3

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	2.24	2.15	2.15
-0.75	-0.875	0.49	0.47	2.63
-0.5	-0.625	0.59	0.57	3.19
-0.25	-0.375	0.75	0.72	3.92
0	-0.125	0.67	0.64	4.56
0.25	0.125	0.82	0.79	5.35
0.5	0.375	1.22	1.17	6.52
0.75	0.625	1.44	1.39	7.91
1	0.875	2.05	1.97	9.88
1.25	1.125	1.77	1.70	11.58
1.5	1.375	5.36	5.16	16.74
1.75	1.625	5.43	5.22	21.96
2	1.875	12.31	11.84	33.80
2.25	2.125	14.55	14.00	47.80
2.5	2.375	13.99	13.46	61.26
2.75	2.625	16.26	15.64	76.90
3	2.875	17.04	16.39	93.29
3.25	3.125	4.91	4.72	98.02
3.5	3.375	1.61	1.55	99.57
3.75	3.625	0.25	0.24	99.81
4	3.875	0.15	0.14	99.95
>4.0	4.25	0.05	0.05	100.00

Percentiles	
1	-1.520
5	0.015
16	1.340
25	1.690
50	2.165
75	2.595
84	2.735
95	2.965
99	3.285

Moment Measures	**(phi)**	**(mm)**
Mean	2.105	0.232
Standard Deviation	0.910	0.532
Skewness	-1.702	
Kurtosis	6.460	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.037	2.080
Standard Deviation	0.698	0.796
Skewness (1)	-0.183	-0.320
Skewness (2)	-0.968	
Kurtosis	1.115	1.336



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**262+00**
Interval	**Low Tide Terrace**
Mean	**0.244 mm**
STD	**0.482 mm**
Skewness	**-1.245**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Poorly Sorted
Poorly Graded	Coarse Skewed
	Leptokurtic

Total weight (gram)	112.90
% finer than 4.00 phi	0.26
% coarser than -1.00 phi	1.75
% $CaCO_3$	16.0

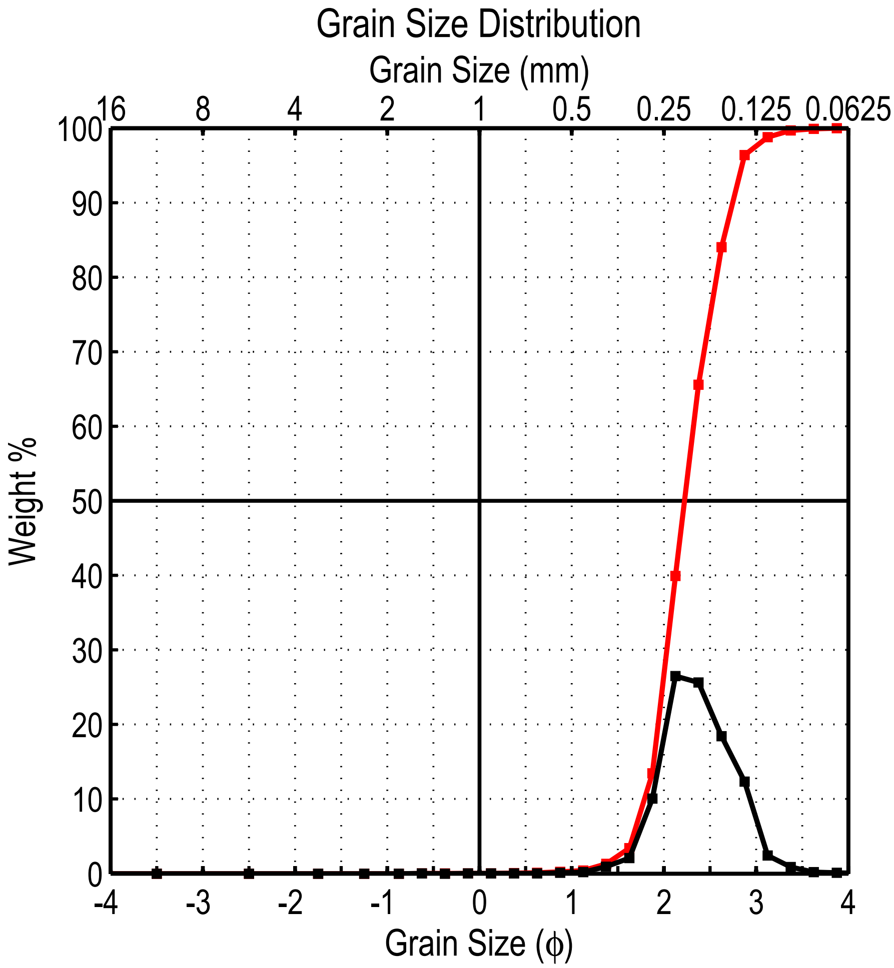
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	1.98	1.75	1.75
-0.75	-0.875	0.85	0.75	2.51
-0.5	-0.625	1.42	1.26	3.76
-0.25	-0.375	1.78	1.58	5.34
0	-0.125	1.81	1.60	6.94
0.25	0.125	1.93	1.71	8.65
0.5	0.375	2.57	2.28	10.93
0.75	0.625	2.61	2.31	13.24
1	0.875	3.35	2.97	16.21
1.25	1.125	2.98	2.64	18.85
1.5	1.375	5.08	4.50	23.35
1.75	1.625	4.26	3.77	27.12
2	1.875	8.98	7.95	35.08
2.25	2.125	12.25	10.85	45.93
2.5	2.375	13.10	11.60	57.53
2.75	2.625	16.03	14.20	71.73
3	2.875	22.08	19.56	91.28
3.25	3.125	6.03	5.34	96.63
3.5	3.375	2.66	2.36	98.98
3.75	3.625	0.52	0.46	99.44
4	3.875	0.34	0.30	99.74
>4.0	4.25	0.29	0.26	100.00

Percentiles

1	-1.465
5	-0.430
16	0.855
25	1.485
50	2.215
75	2.665
84	2.780
95	3.050
99	3.385

Moment Measures	**(phi)**	**(mm)**
Mean	2.036	0.244
Standard Deviation	1.054	0.482
Skewness	-1.245	
Kurtosis	4.101	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.818	1.950
Standard Deviation	0.963	1.009
Skewness (1)	-0.413	-0.467
Skewness (2)	-0.940	
Kurtosis	0.808	1.209



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**282+00**
Interval	**Dune**
Mean	**0.194 mm**
STD	**0.769 mm**
Skewness	**-0.054**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

Total weight (gram)	111.52
% finer than 4.00 phi	0.03
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.7

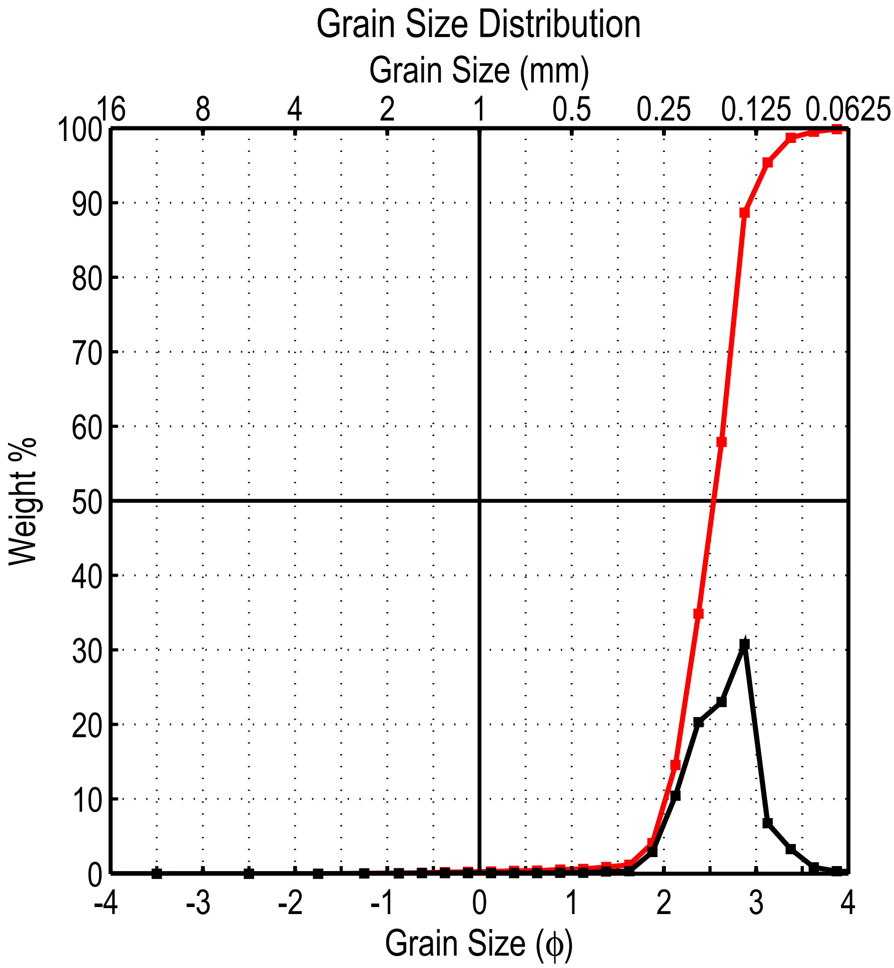
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.01	0.01	0.01
-0.25	-0.375	0.00	0.00	0.01
0	-0.125	0.02	0.02	0.03
0.25	0.125	0.01	0.01	0.04
0.5	0.375	0.03	0.03	0.06
0.75	0.625	0.04	0.04	0.10
1	0.875	0.14	0.13	0.22
1.25	1.125	0.20	0.18	0.40
1.5	1.375	1.03	0.92	1.33
1.75	1.625	2.32	2.08	3.41
2	1.875	11.21	10.05	13.46
2.25	2.125	29.53	26.48	39.94
2.5	2.375	28.59	25.64	65.58
2.75	2.625	20.57	18.45	84.02
3	2.875	13.77	12.35	96.37
3.25	3.125	2.71	2.43	98.80
3.5	3.375	0.98	0.88	99.68
3.75	3.625	0.22	0.20	99.87
4	3.875	0.11	0.10	99.97
>4.0	4.25	0.03	0.03	100.00

Percentiles

1	1.285
5	1.665
16	1.900
25	1.985
50	2.225
75	2.505
84	2.625
95	2.845
99	3.180

Moment Measures	**(phi)**	**(mm)**
Mean	2.367	0.194
Standard Deviation	0.379	0.769
Skewness	-0.054	
Kurtosis	4.640	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.263	2.250
Standard Deviation	0.363	0.360
Skewness (1)	0.103	0.077
Skewness (2)	0.083	
Kurtosis	0.628	0.930



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**282+00**
Interval	**Mid Berm**
Mean	**0.162 mm**
STD	**0.750 mm**
Skewness	**-1.348**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

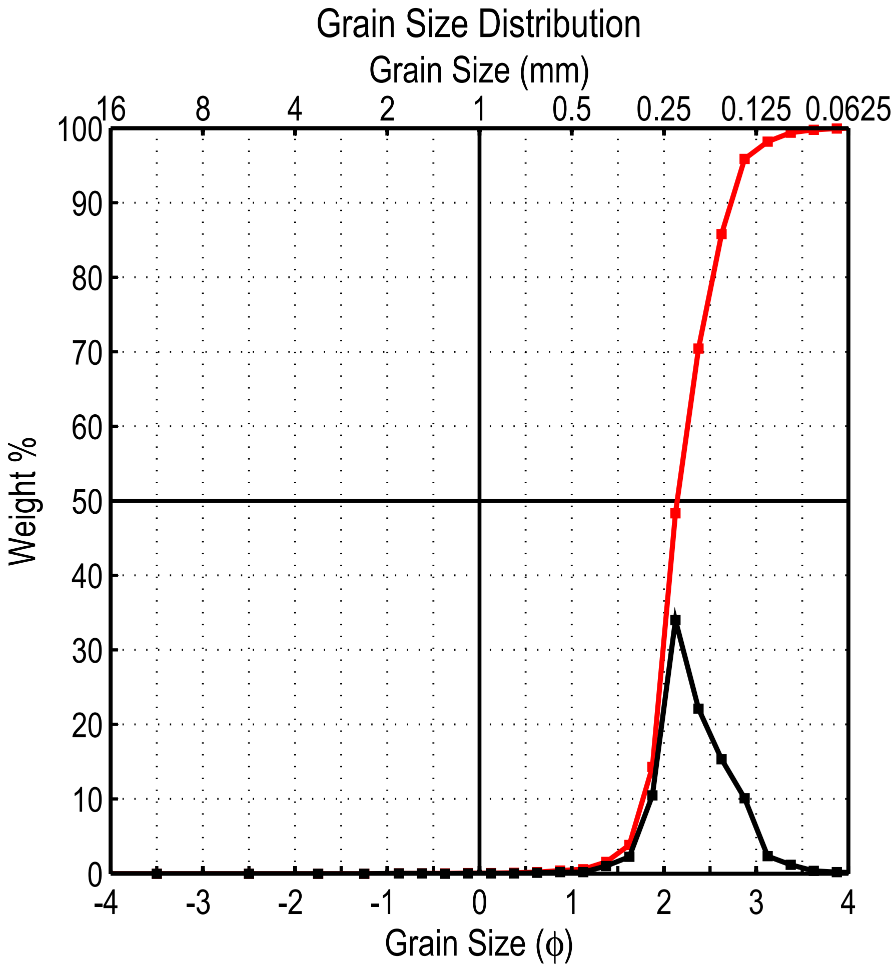
Total weight (gram)	105.94
% finer than 4.00 phi	0.13
% coarser than -1.00 phi	0.02
% $CaCO_3$	2.6

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.02	0.02	0.02
-0.75	-0.875	0.04	0.04	0.06
-0.5	-0.625	0.06	0.06	0.11
-0.25	-0.375	0.07	0.07	0.18
0	-0.125	0.06	0.06	0.24
0.25	0.125	0.05	0.05	0.28
0.5	0.375	0.07	0.07	0.35
0.75	0.625	0.07	0.07	0.42
1	0.875	0.11	0.10	0.52
1.25	1.125	0.10	0.09	0.61
1.5	1.375	0.28	0.26	0.88
1.75	1.625	0.33	0.31	1.19
2	1.875	3.08	2.91	4.10
2.25	2.125	11.08	10.46	14.56
2.5	2.375	21.51	20.30	34.86
2.75	2.625	24.40	23.03	57.89
3	2.875	32.59	30.76	88.65
3.25	3.125	7.14	6.74	95.39
3.5	3.375	3.49	3.29	98.69
3.75	3.625	0.89	0.84	99.53
4	3.875	0.36	0.34	99.87
>4.0	4.25	0.14	0.13	100.00

Percentiles	
1	1.475
5	1.895
16	2.145
25	2.255
50	2.540
75	2.765
84	2.835
95	3.110
99	3.470

Moment Measures	**(phi)**	**(mm)**
Mean	2.629	0.162
Standard Deviation	0.415	0.750
Skewness	-1.348	
Kurtosis	12.764	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.490	2.507
Standard Deviation	0.345	0.357
Skewness (1)	-0.145	-0.103
Skewness (2)	-0.109	
Kurtosis	0.761	0.976



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**282+00**
Interval	**Berm Crest**
Mean	**0.199 mm**
STD	**0.760 mm**
Skewness	**0.128**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

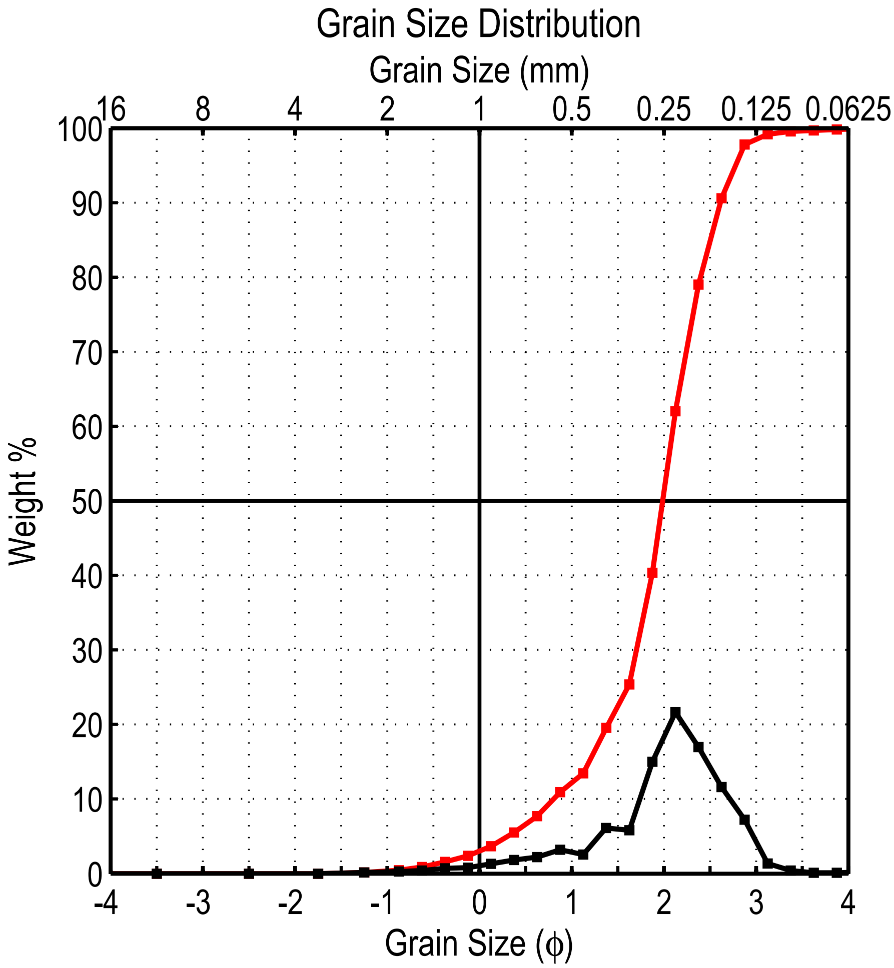
Total weight (gram)	101.22
% finer than 4.00 phi	0.06
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.1

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.01	0.01	0.01
-0.5	-0.625	0.01	0.01	0.02
-0.25	-0.375	0.00	0.00	0.02
0	-0.125	0.03	0.03	0.05
0.25	0.125	0.02	0.02	0.07
0.5	0.375	0.03	0.03	0.10
0.75	0.625	0.09	0.09	0.19
1	0.875	0.21	0.21	0.40
1.25	1.125	0.19	0.19	0.58
1.5	1.375	1.00	0.99	1.57
1.75	1.625	2.30	2.27	3.84
2	1.875	10.60	10.47	14.32
2.25	2.125	34.43	34.02	48.33
2.5	2.375	22.37	22.10	70.43
2.75	2.625	15.52	15.33	85.76
3	2.875	10.22	10.10	95.86
3.25	3.125	2.36	2.33	98.19
3.5	3.375	1.20	1.19	99.38
3.75	3.625	0.37	0.37	99.74
4	3.875	0.20	0.20	99.94
>4.0	4.25	0.06	0.06	100.00

Percentiles	
1	1.230
5	1.655
16	1.885
25	1.955
50	2.145
75	2.450
84	2.595
95	2.855
99	3.295

Moment Measures	**(phi)**	**(mm)**
Mean	2.328	0.199
Standard Deviation	0.395	0.760
Skewness	0.128	
Kurtosis	5.760	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.240	2.208
Standard Deviation	0.355	0.359
Skewness (1)	0.268	0.225
Skewness (2)	0.310	
Kurtosis	0.690	0.994



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**282+00**
Interval	**Beach Face**
Mean	**0.254 mm**
STD	**0.600 mm**
Skewness	**-1.197**
USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Moderately Sorted
Poorly Graded	Coarse Skewed
	Leptokurtic

Total weight (gram)	101.33
% finer than 4.00 phi	0.21
% coarser than -1.00 phi	0.17
% $CaCO_3$	8.1

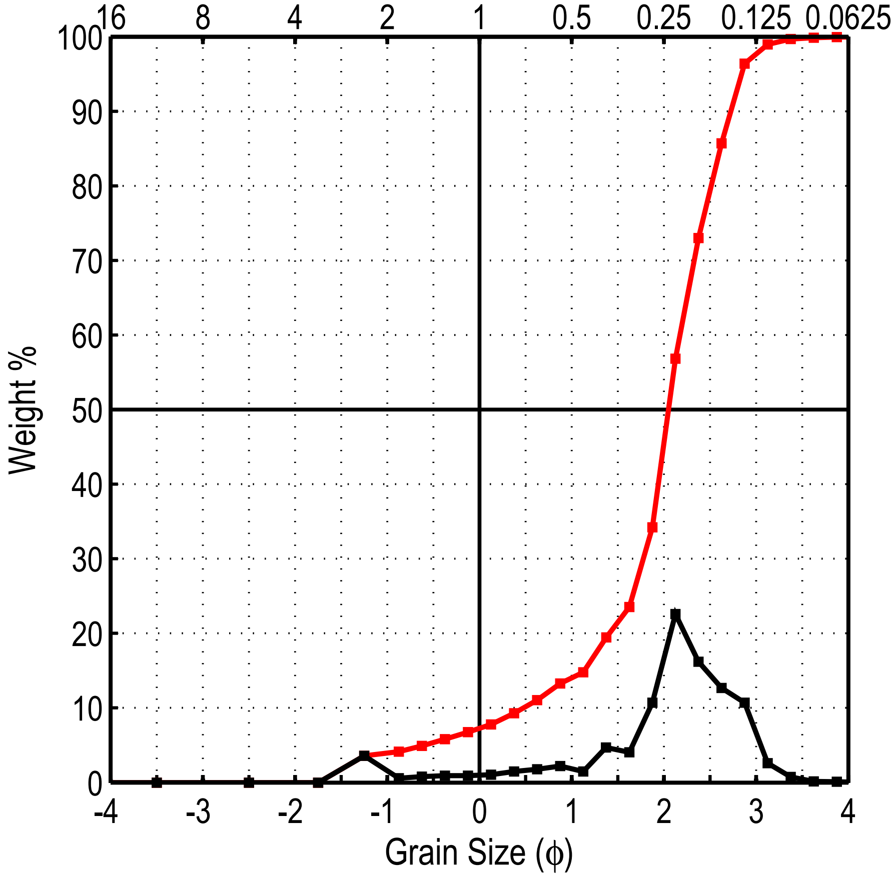
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.17	0.17	0.17
-0.75	-0.875	0.27	0.27	0.43
-0.5	-0.625	0.43	0.42	0.86
-0.25	-0.375	0.71	0.70	1.56
0	-0.125	0.82	0.81	2.37
0.25	0.125	1.32	1.30	3.67
0.5	0.375	1.86	1.84	5.51
0.75	0.625	2.22	2.19	7.70
1	0.875	3.26	3.22	10.91
1.25	1.125	2.57	2.54	13.45
1.5	1.375	6.18	6.10	19.55
1.75	1.625	5.90	5.82	25.37
2	1.875	15.18	14.98	40.35
2.25	2.125	21.94	21.65	62.01
2.5	2.375	17.21	16.98	78.99
2.75	2.625	11.75	11.60	90.59
3	2.875	7.32	7.22	97.81
3.25	3.125	1.38	1.36	99.17
3.5	3.375	0.40	0.39	99.57
3.75	3.625	0.11	0.11	99.67
4	3.875	0.12	0.12	99.79
>4.0	4.25	0.21	0.21	100.00

Percentiles	
1	-0.575
5	0.305
16	1.230
25	1.610
50	1.985
75	2.315
84	2.485
95	2.780
99	3.095

Moment Measures	**(phi)**	**(mm)**
Mean	1.976	0.254
Standard Deviation	0.738	0.600
Skewness	-1.197	
Kurtosis	5.156	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.857	1.900
Standard Deviation	0.627	0.689
Skewness (1)	-0.203	-0.280
Skewness (2)	-0.705	
Kurtosis	0.972	1.439

Grain Size Distribution



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**282+00**
Interval	**Low Tide Terrace**
Mean	**0.259 mm**
STD	**0.507 mm**
Skewness	**-1.718**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

Total weight (gram)	110.81
% finer than 4.00 phi	0.07
% coarser than -1.00 phi	3.57
% $CaCO_3$	9.9

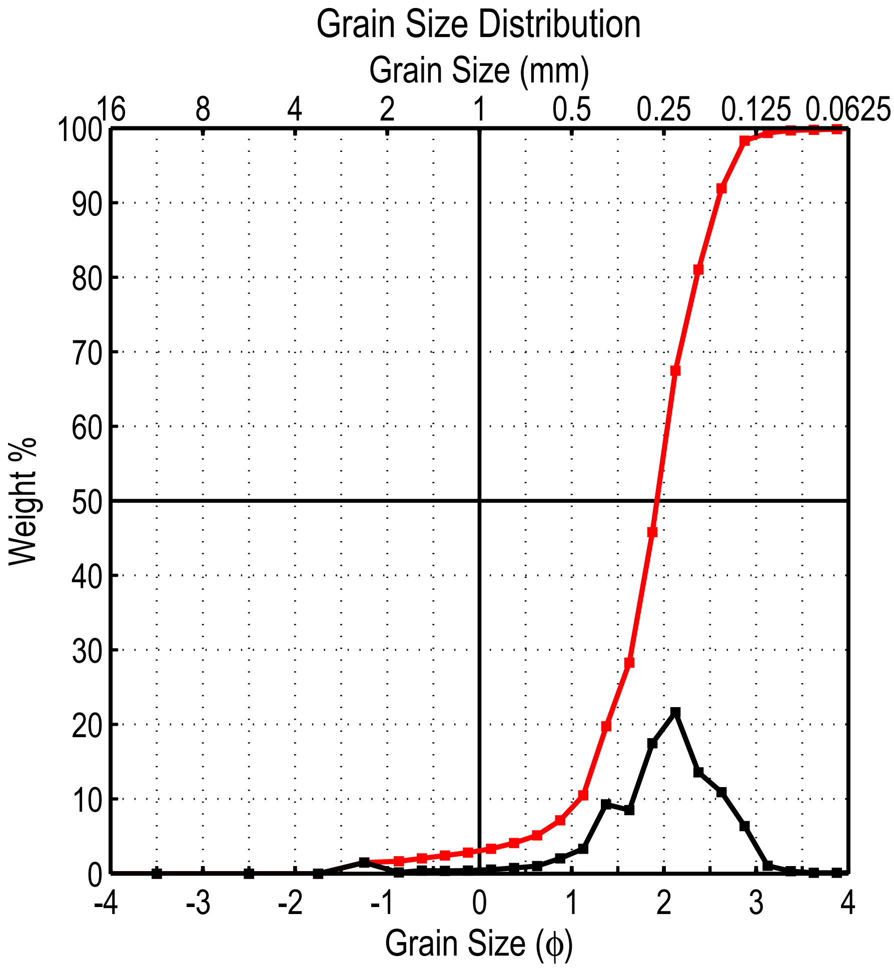
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	3.96	3.57	3.57
-0.75	-0.875	0.62	0.56	4.13
-0.5	-0.625	0.87	0.79	4.92
-0.25	-0.375	1.00	0.90	5.82
0	-0.125	1.02	0.92	6.74
0.25	0.125	1.17	1.06	7.80
0.5	0.375	1.63	1.47	9.27
0.75	0.625	1.99	1.80	11.06
1	0.875	2.47	2.23	13.29
1.25	1.125	1.63	1.47	14.76
1.5	1.375	5.21	4.70	19.47
1.75	1.625	4.51	4.07	23.54
2	1.875	11.84	10.68	34.22
2.25	2.125	25.03	22.59	56.81
2.5	2.375	17.93	16.18	72.99
2.75	2.625	14.07	12.70	85.69
3	2.875	11.85	10.69	96.38
3.25	3.125	2.86	2.58	98.96
3.5	3.375	0.81	0.73	99.69
3.75	3.625	0.16	0.14	99.84
4	3.875	0.10	0.09	99.93
>4.0	4.25	0.08	0.07	100.00

Percentiles

1	-1.610
5	-0.600
16	1.190
25	1.660
50	2.050
75	2.415
84	2.590
95	2.845
99	3.140

Moment Measures	**(phi)**	**(mm)**
Mean	1.948	0.259
Standard Deviation	0.979	0.507
Skewness	-1.718	
Kurtosis	5.901	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.890	1.943
Standard Deviation	0.700	0.872
Skewness (1)	-0.229	-0.384
Skewness (2)	-1.325	
Kurtosis	1.461	1.870



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**302+00**
Interval	**Dune**
Mean	**0.260 mm**
STD	**0.601 mm**
Skewness	**-1.673**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

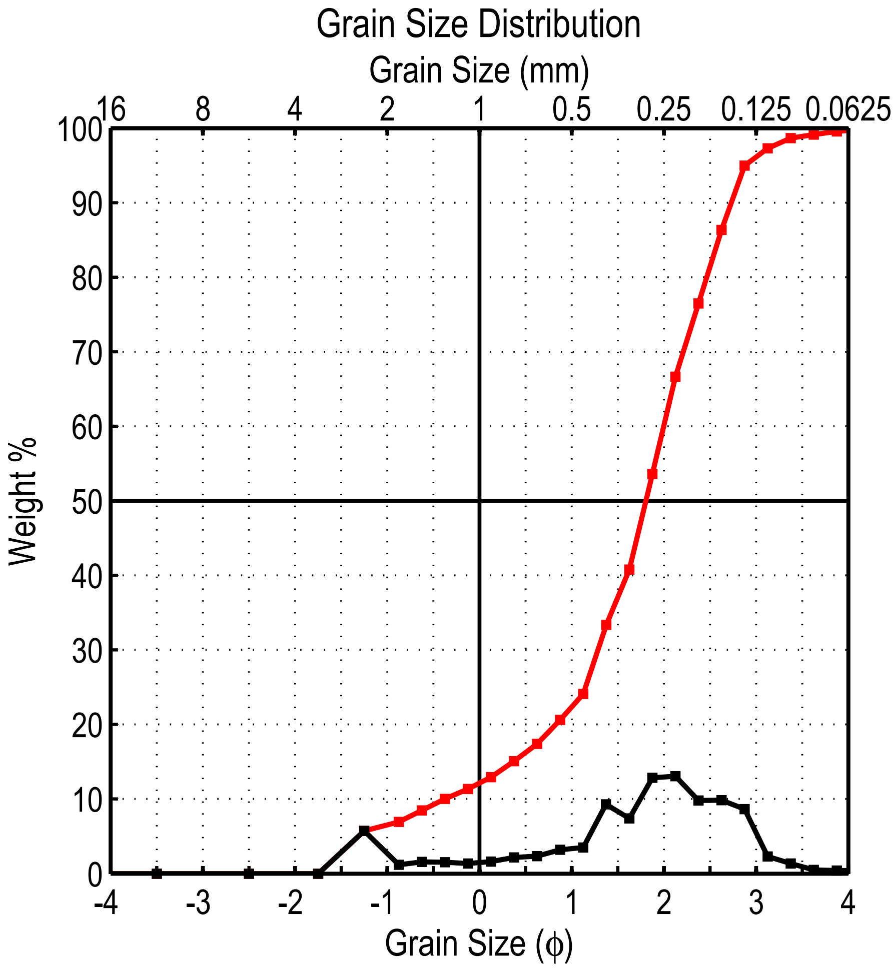
Total weight (gram)	123.94
% finer than 4.00 phi	0.13
% coarser than -1.00 phi	1.47
% $CaCO_3$	10.0

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	1.82	1.47	1.47
-0.75	-0.875	0.21	0.17	1.64
-0.5	-0.625	0.50	0.40	2.04
-0.25	-0.375	0.46	0.37	2.41
0	-0.125	0.49	0.40	2.81
0.25	0.125	0.65	0.52	3.33
0.5	0.375	0.94	0.76	4.09
0.75	0.625	1.27	1.02	5.12
1	0.875	2.53	2.04	7.16
1.25	1.125	4.12	3.32	10.48
1.5	1.375	11.51	9.29	19.77
1.75	1.625	10.58	8.54	28.30
2	1.875	21.67	17.48	45.79
2.25	2.125	26.84	21.66	67.44
2.5	2.375	16.82	13.57	81.02
2.75	2.625	13.53	10.92	91.93
3	2.875	7.88	6.36	98.29
3.25	3.125	1.31	1.06	99.35
3.5	3.375	0.41	0.33	99.68
3.75	3.625	0.12	0.10	99.77
4	3.875	0.12	0.10	99.87
>4.0	4.25	0.16	0.13	100.00

Percentiles	
1	-1.410
5	0.595
16	1.275
25	1.530
50	1.925
75	2.265
84	2.445
95	2.745
99	3.045

Moment Measures	**(phi)**	**(mm)**
Mean	1.944	0.260
Standard Deviation	0.734	0.601
Skewness	-1.673	
Kurtosis	8.085	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.860	1.882
Standard Deviation	0.585	0.618
Skewness (1)	-0.111	-0.174
Skewness (2)	-0.436	
Kurtosis	0.838	1.199



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**302+00**
Interval	**Mid Berm**
Mean	**0.314 mm**
STD	**0.447 mm**
Skewness	**-1.018**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Poorly Sorted
Poorly Graded	Coarse Skewed
	Mesokurtic

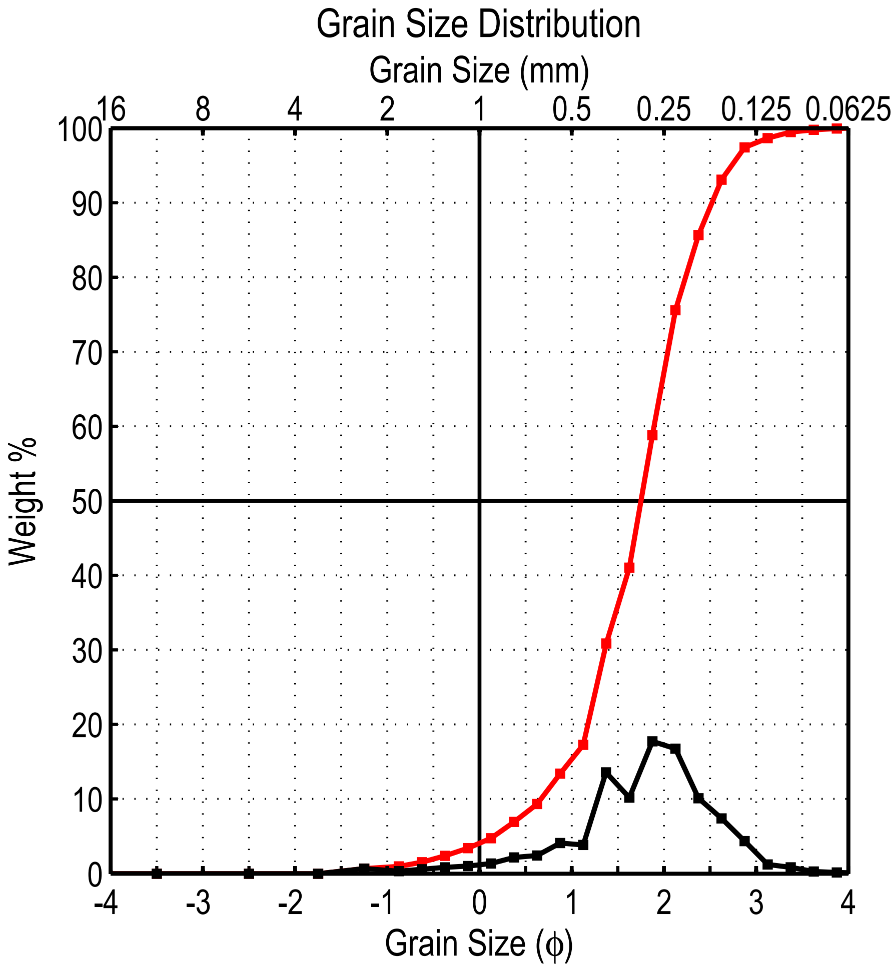
Total weight (gram)	106.94
% finer than 4.00 phi	0.47
% coarser than -1.00 phi	5.74
% $CaCO_3$	25.4

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	6.14	5.74	5.74
-0.75	-0.875	1.26	1.18	6.92
-0.5	-0.625	1.67	1.56	8.48
-0.25	-0.375	1.62	1.51	10.00
0	-0.125	1.45	1.36	11.35
0.25	0.125	1.70	1.59	12.94
0.5	0.375	2.30	2.15	15.09
0.75	0.625	2.48	2.32	17.41
1	0.875	3.41	3.19	20.60
1.25	1.125	3.73	3.49	24.09
1.5	1.375	9.91	9.27	33.36
1.75	1.625	7.92	7.41	40.76
2	1.875	13.74	12.85	53.61
2.25	2.125	13.96	13.05	66.66
2.5	2.375	10.48	9.80	76.46
2.75	2.625	10.54	9.86	86.32
3	2.875	9.26	8.66	94.98
3.25	3.125	2.45	2.29	97.27
3.5	3.375	1.46	1.37	98.63
3.75	3.625	0.53	0.50	99.13
4	3.875	0.43	0.40	99.53
>4.0	4.25	0.50	0.47	100.00

Percentiles	
1	-1.665
5	-1.315
16	0.475
25	1.150
50	1.805
75	2.340
84	2.565
95	2.875
99	3.560

Moment Measures	**(phi)**	**(mm)**
Mean	1.670	0.314
Standard Deviation	1.161	0.447
Skewness	-1.018	
Kurtosis	3.628	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.520	1.615
Standard Deviation	1.045	1.157
Skewness (1)	-0.273	-0.381
Skewness (2)	-0.981	
Kurtosis	1.005	1.443



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**302+00**
Interval	**Berm Crest**
Mean	**0.293 mm**
STD	**0.583 mm**
Skewness	**-0.919**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Moderately Sorted
Poorly Graded	Coarse Skewed
	Leptokurtic

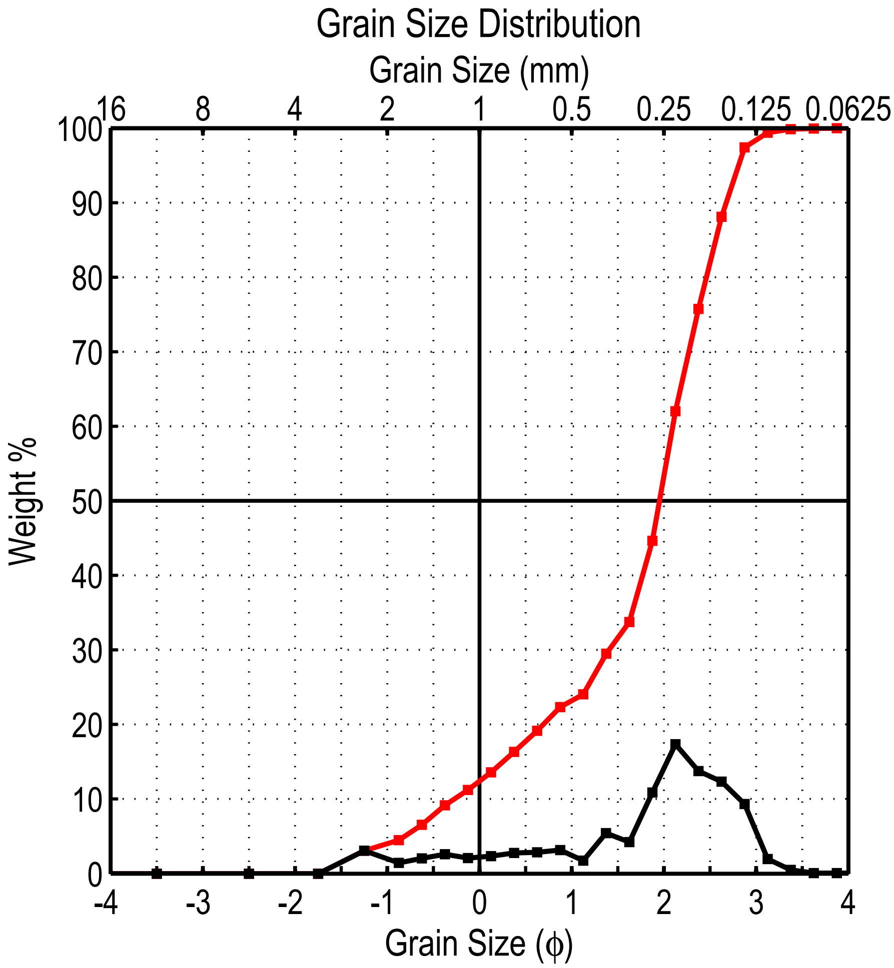
Total weight (gram)	110.70
% finer than 4.00 phi	0.06
% coarser than -1.00 phi	0.65
% $CaCO_3$	16.1

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.72	0.65	0.65
-0.75	-0.875	0.35	0.32	0.97
-0.5	-0.625	0.63	0.57	1.54
-0.25	-0.375	0.94	0.85	2.38
0	-0.125	1.12	1.01	3.40
0.25	0.125	1.50	1.36	4.75
0.5	0.375	2.39	2.16	6.91
0.75	0.625	2.68	2.42	9.33
1	0.875	4.53	4.09	13.42
1.25	1.125	4.27	3.86	17.28
1.5	1.375	15.05	13.60	30.88
1.75	1.625	11.26	10.17	41.05
2	1.875	19.65	17.75	58.80
2.25	2.125	18.55	16.76	75.56
2.5	2.375	11.18	10.10	85.65
2.75	2.625	8.19	7.40	93.05
3	2.875	4.81	4.35	97.40
3.25	3.125	1.37	1.24	98.64
3.5	3.375	0.94	0.85	99.49
3.75	3.625	0.33	0.30	99.78
4	3.875	0.17	0.15	99.94
>4.0	4.25	0.07	0.06	100.00

Percentiles	
1	-0.860
5	0.155
16	1.040
25	1.265
50	1.750
75	2.115
84	2.335
95	2.735
99	3.230

Moment Measures	**(phi)**	**(mm)**
Mean	1.772	0.293
Standard Deviation	0.778	0.583
Skewness	-0.919	
Kurtosis	4.822	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.688	1.708
Standard Deviation	0.647	0.715
Skewness (1)	-0.097	-0.166
Skewness (2)	-0.471	
Kurtosis	0.992	1.244



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**302+00**
Interval	**Beach Face**
Mean	**0.303 mm**
STD	**0.465 mm**
Skewness	**-1.143**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Poorly Sorted
Poorly Graded	Coarse Skewed
	Mesokurtic

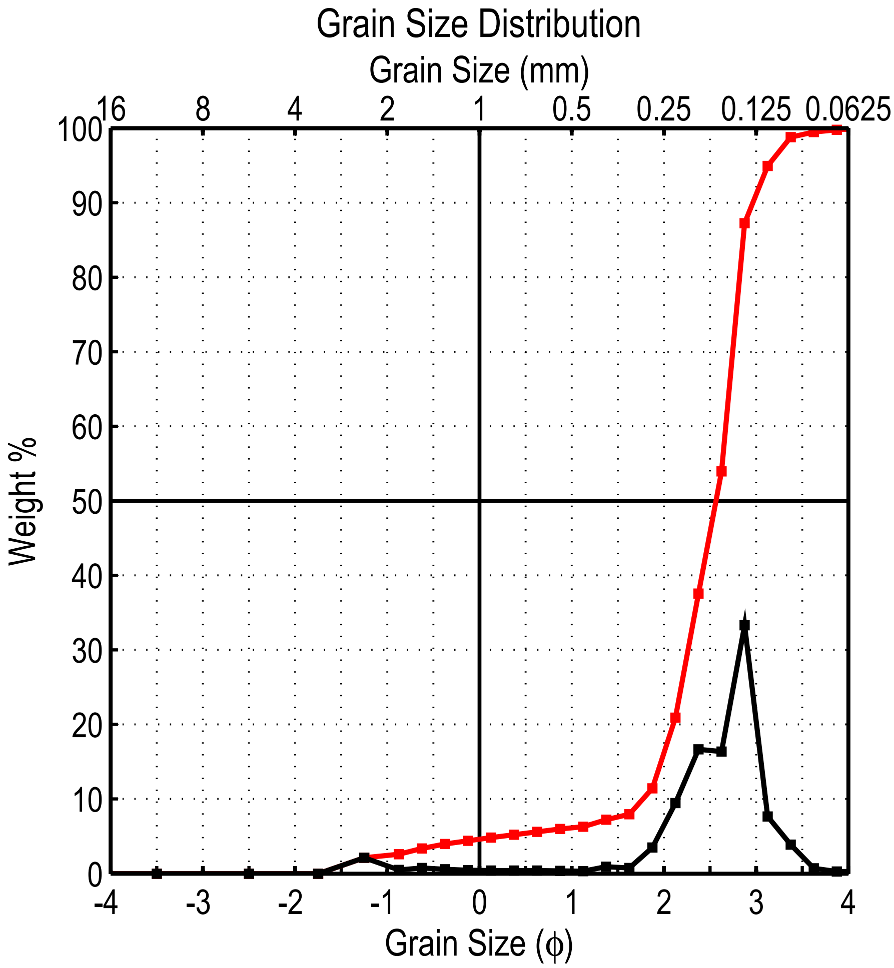
Total weight (gram)	106.12
% finer than 4.00 phi	0.04
% coarser than -1.00 phi	3.05
% $CaCO_3$	13.4

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	3.24	3.05	3.05
-0.75	-0.875	1.54	1.45	4.50
-0.5	-0.625	2.18	2.05	6.56
-0.25	-0.375	2.75	2.59	9.15
0	-0.125	2.21	2.08	11.23
0.25	0.125	2.47	2.33	13.56
0.5	0.375	2.94	2.77	16.33
0.75	0.625	3.01	2.84	19.17
1	0.875	3.36	3.17	22.33
1.25	1.125	1.83	1.72	24.06
1.5	1.375	5.78	5.45	29.50
1.75	1.625	4.49	4.23	33.74
2	1.875	11.56	10.89	44.63
2.25	2.125	18.43	17.37	62.00
2.5	2.375	14.58	13.74	75.74
2.75	2.625	13.10	12.34	88.08
3	2.875	9.90	9.33	97.41
3.25	3.125	2.07	1.95	99.36
3.5	3.375	0.51	0.48	99.84
3.75	3.625	0.08	0.08	99.92
4	3.875	0.05	0.05	99.96
>4.0	4.25	0.04	0.04	100.00

Percentiles	
1	-1.585
5	-0.815
16	0.345
25	1.170
50	1.950
75	2.360
84	2.540
95	2.810
99	3.080

Moment Measures	**(phi)**	**(mm)**
Mean	1.721	0.303
Standard Deviation	1.104	0.465
Skewness	-1.143	
Kurtosis	3.456	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.442	1.612
Standard Deviation	1.098	1.098
Skewness (1)	-0.462	-0.494
Skewness (2)	-0.868	
Kurtosis	0.651	1.248



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**302+00**
Interval	**Low Tide Terrace**
Mean	**0.181 mm**
STD	**0.548 mm**
Skewness	**-2.687**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

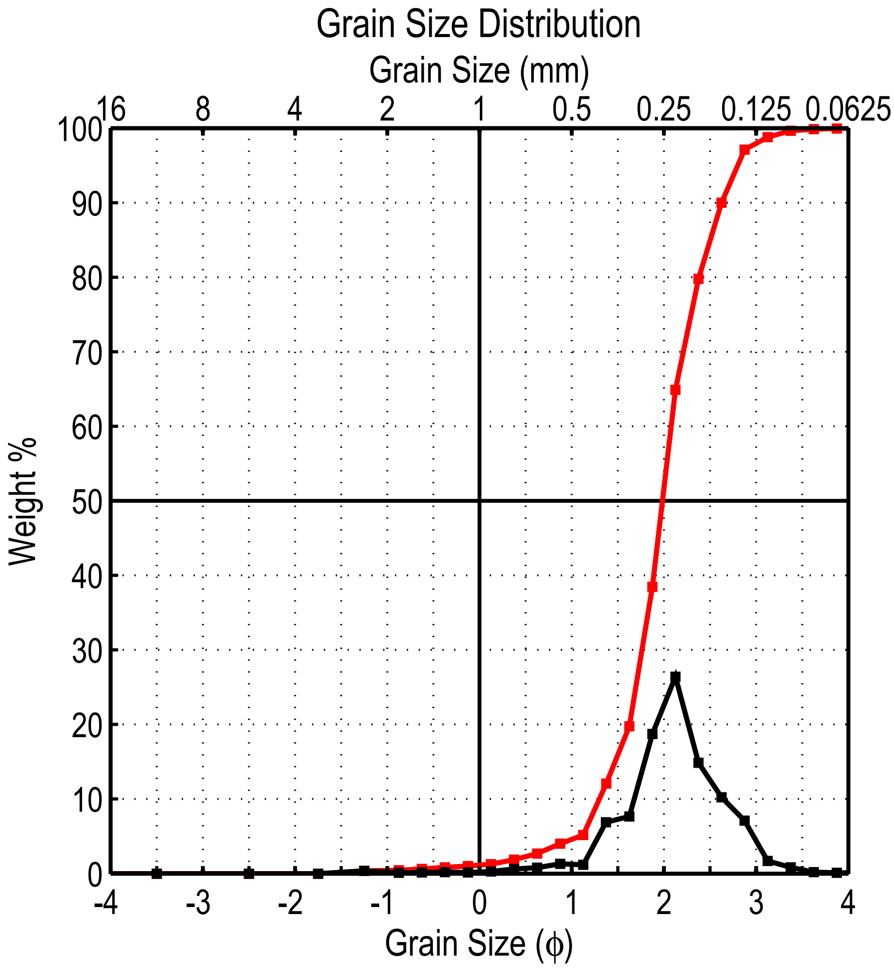
Total weight (gram)	110.57
% finer than 4.00 phi	0.22
% coarser than -1.00 phi	2.11
% $CaCO_3$	9.7

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	2.33	2.11	2.11
-0.75	-0.875	0.55	0.50	2.60
-0.5	-0.625	0.83	0.75	3.36
-0.25	-0.375	0.66	0.60	3.95
0	-0.125	0.51	0.46	4.41
0.25	0.125	0.44	0.40	4.81
0.5	0.375	0.45	0.41	5.22
0.75	0.625	0.43	0.39	5.61
1	0.875	0.41	0.37	5.98
1.25	1.125	0.34	0.31	6.29
1.5	1.375	1.04	0.94	7.23
1.75	1.625	0.81	0.73	7.96
2	1.875	3.86	3.49	11.45
2.25	2.125	10.45	9.45	20.90
2.5	2.375	18.42	16.66	37.56
2.75	2.625	18.11	16.38	53.94
3	2.875	36.81	33.29	87.23
3.25	3.125	8.48	7.67	94.90
3.5	3.375	4.31	3.90	98.80
3.75	3.625	0.76	0.69	99.48
4	3.875	0.33	0.30	99.78
>4.0	4.25	0.24	0.22	100.00

Percentiles	
1	-1.515
5	0.240
16	1.995
25	2.185
50	2.565
75	2.785
84	2.850
95	3.130
99	3.450

Moment Measures	**(phi)**	**(mm)**
Mean	2.464	0.181
Standard Deviation	0.868	0.548
Skewness	-2.687	
Kurtosis	11.097	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.422	2.470
Standard Deviation	0.427	0.652
Skewness (1)	-0.333	-0.471
Skewness (2)	-2.058	
Kurtosis	2.380	1.974



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**322+00**
Interval	**Dune**
Mean	**0.237 mm**
STD	**0.665 mm**
Skewness	**-1.298**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Well Sorted
Poorly Graded	Coarse Skewed
	Very Leptokurtic

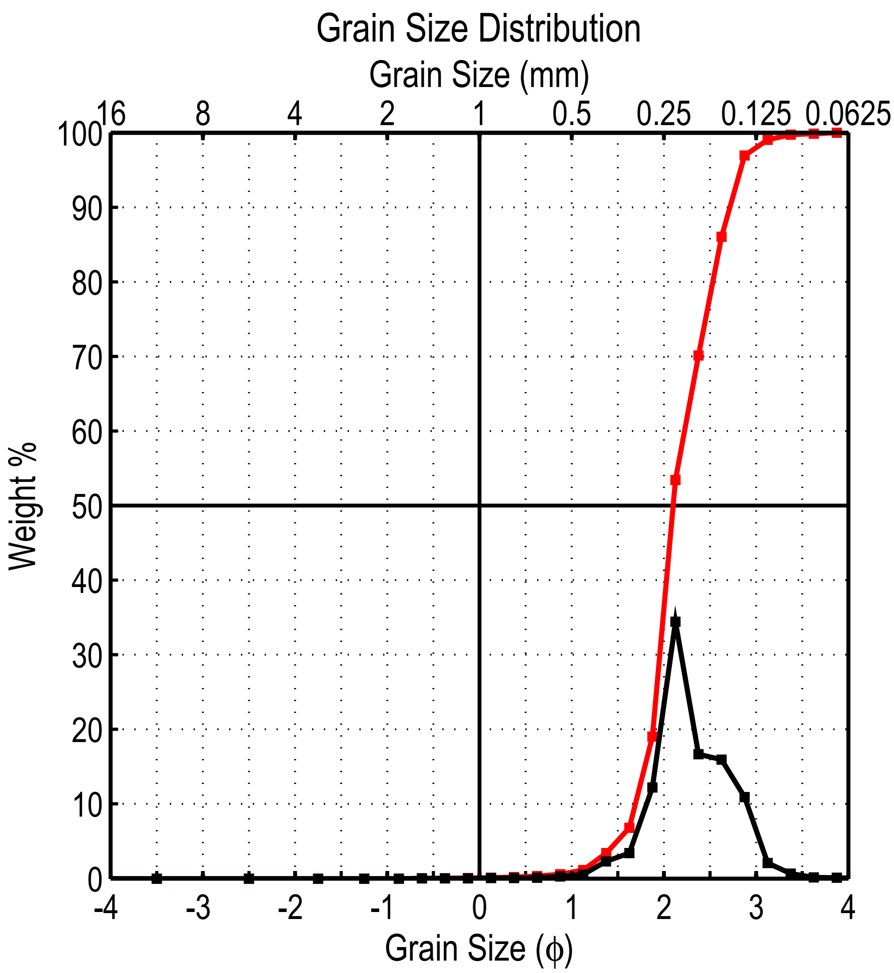
Total weight (gram)	108.17
% finer than 4.00 phi	0.05
% coarser than -1.00 phi	0.35
% $CaCO_3$	6.9

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.38	0.35	0.35
-0.75	-0.875	0.10	0.09	0.44
-0.5	-0.625	0.18	0.17	0.61
-0.25	-0.375	0.23	0.21	0.82
0	-0.125	0.18	0.17	0.99
0.25	0.125	0.30	0.28	1.27
0.5	0.375	0.66	0.61	1.88
0.75	0.625	0.87	0.80	2.68
1	0.875	1.43	1.32	4.00
1.25	1.125	1.28	1.18	5.19
1.5	1.375	7.45	6.89	12.07
1.75	1.625	8.29	7.66	19.74
2	1.875	20.27	18.74	38.48
2.25	2.125	28.58	26.42	64.90
2.5	2.375	16.09	14.87	79.77
2.75	2.625	11.05	10.22	89.99
3	2.875	7.68	7.10	97.09
3.25	3.125	1.84	1.70	98.79
3.5	3.375	0.92	0.85	99.64
3.75	3.625	0.22	0.20	99.84
4	3.875	0.12	0.11	99.95
>4.0	4.25	0.05	0.05	100.00

Percentiles	
1	-0.115
5	1.085
16	1.505
25	1.695
50	1.985
75	2.295
84	2.480
95	2.800
99	3.185

Moment Measures	**(phi)**	**(mm)**
Mean	2.078	0.237
Standard Deviation	0.588	0.665
Skewness	-1.298	
Kurtosis	8.449	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.992	1.990
Standard Deviation	0.488	0.504
Skewness (1)	0.015	-0.017
Skewness (2)	-0.087	
Kurtosis	0.759	1.171



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**322+00**
Interval	**Mid Berm**
Mean	**0.205 mm**
STD	**0.748 mm**
Skewness	**-0.247**
USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

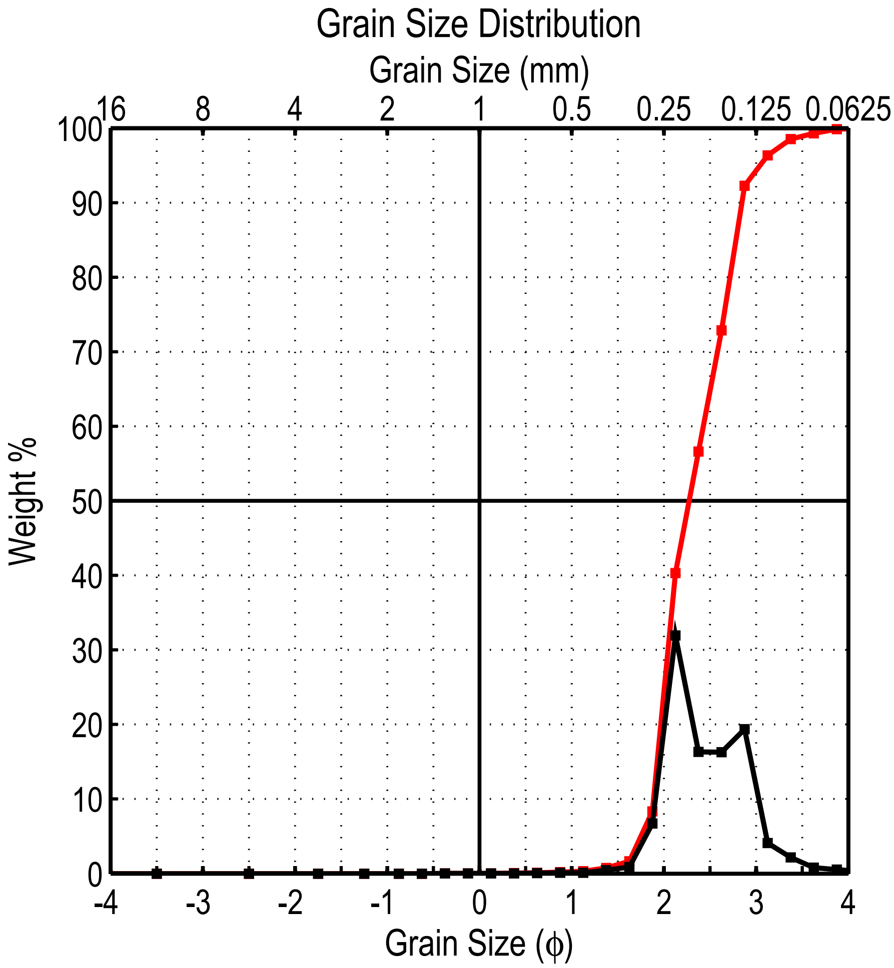
Total weight (gram)	104.61
% finer than 4.00 phi	0.03
% coarser than -1.00 phi	0.00
% $CaCO_3$	3.1

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.01	0.01	0.01
-0.25	-0.375	0.02	0.02	0.03
0	-0.125	0.04	0.04	0.07
0.25	0.125	0.05	0.05	0.11
0.5	0.375	0.07	0.07	0.18
0.75	0.625	0.13	0.12	0.31
1	0.875	0.27	0.26	0.56
1.25	1.125	0.58	0.55	1.12
1.5	1.375	2.38	2.28	3.39
1.75	1.625	3.58	3.42	6.82
2	1.875	12.76	12.20	19.01
2.25	2.125	36.02	34.43	53.45
2.5	2.375	17.43	16.66	70.11
2.75	2.625	16.66	15.93	86.03
3	2.875	11.42	10.92	96.95
3.25	3.125	2.19	2.09	99.04
3.5	3.375	0.69	0.66	99.70
3.75	3.625	0.17	0.16	99.87
4	3.875	0.11	0.11	99.97
>4.0	4.25	0.03	0.03	100.00

Percentiles	
1	1.070
5	1.490
16	1.815
25	1.920
50	2.100
75	2.450
84	2.595
95	2.830
99	3.120

Moment Measures	**(phi)**	**(mm)**
Mean	2.283	0.205
Standard Deviation	0.419	0.748
Skewness	-0.247	
Kurtosis	5.060	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.205	2.170
Standard Deviation	0.390	0.398
Skewness (1)	0.269	0.179
Skewness (2)	0.154	
Kurtosis	0.718	1.036



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**322+00**
Interval	**Berm Crest**
Mean	**0.182 mm**
STD	**0.744 mm**
Skewness	**0.366**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

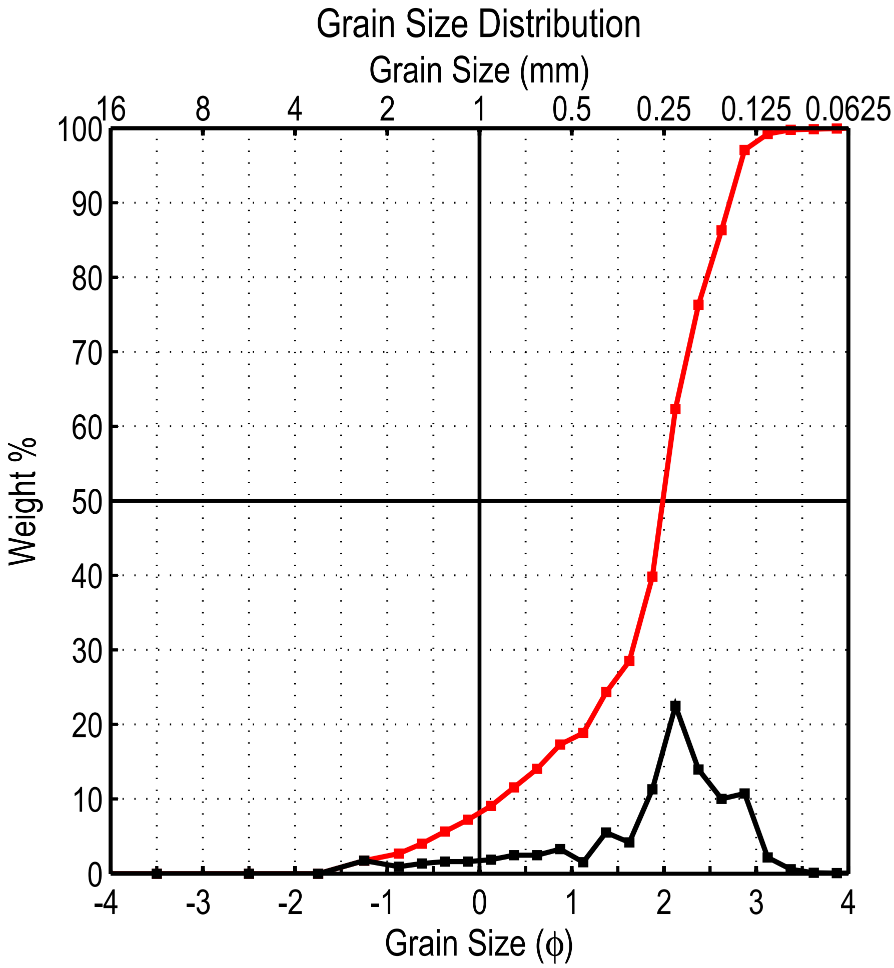
Total weight (gram)	112.71
% finer than 4.00 phi	0.17
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.7

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.01	0.01	0.01
0	-0.125	0.02	0.02	0.03
0.25	0.125	0.01	0.01	0.04
0.5	0.375	0.03	0.03	0.06
0.75	0.625	0.05	0.04	0.11
1	0.875	0.10	0.09	0.20
1.25	1.125	0.14	0.12	0.32
1.5	1.375	0.49	0.43	0.75
1.75	1.625	1.00	0.89	1.64
2	1.875	7.57	6.72	8.36
2.25	2.125	36.00	31.94	40.30
2.5	2.375	18.40	16.33	56.62
2.75	2.625	18.33	16.26	72.89
3	2.875	21.82	19.36	92.25
3.25	3.125	4.63	4.11	96.35
3.5	3.375	2.42	2.15	98.50
3.75	3.625	0.90	0.80	99.30
4	3.875	0.60	0.53	99.83
>4.0	4.25	0.19	0.17	100.00

Percentiles	
1	1.445
5	1.750
16	1.935
25	2.005
50	2.275
75	2.650
84	2.770
95	3.045
99	3.530

Moment Measures	**(phi)**	**(mm)**
Mean	2.456	0.182
Standard Deviation	0.426	0.744
Skewness	0.366	
Kurtosis	4.271	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.353	2.327
Standard Deviation	0.417	0.405
Skewness (1)	0.186	0.187
Skewness (2)	0.293	
Kurtosis	0.551	0.823



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**322+00**
Interval	**Beach Face**
Mean	**0.276 mm**
STD	**0.509 mm**
Skewness	**-1.332**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

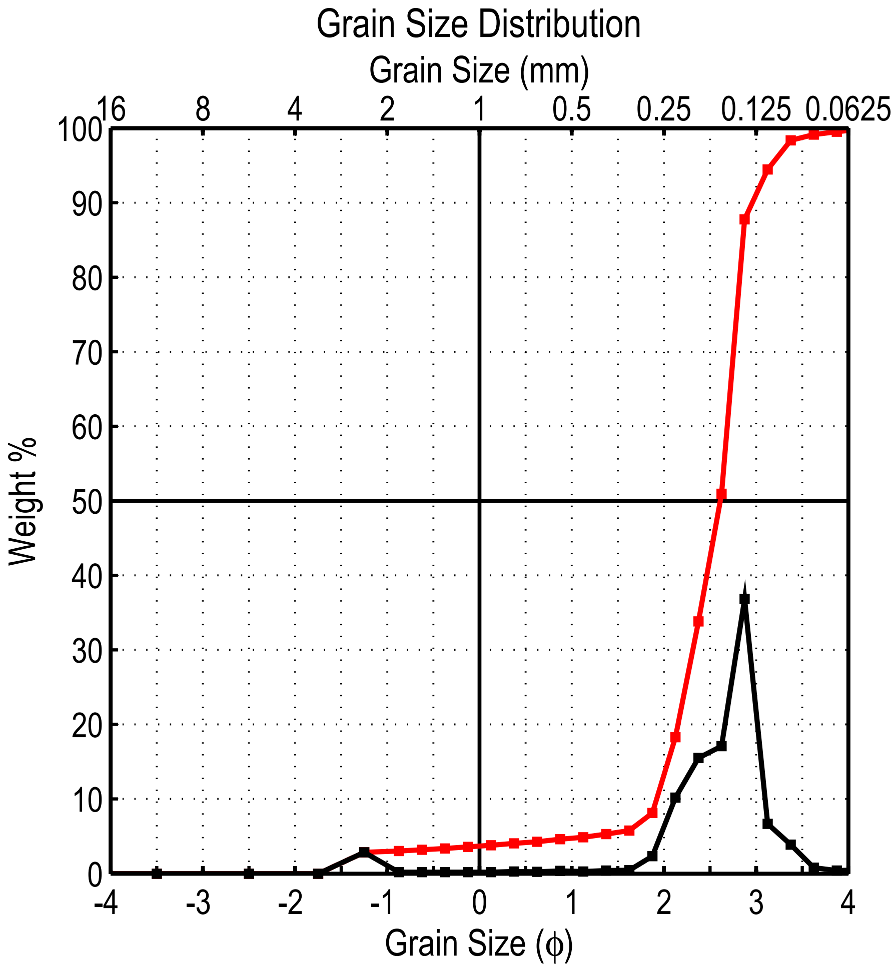
Total weight (gram)	109.87
% finer than 4.00 phi	0.06
% coarser than -1.00 phi	1.76
% $CaCO_3$	11.5

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	1.93	1.76	1.76
-0.75	-0.875	1.01	0.92	2.68
-0.5	-0.625	1.47	1.34	4.01
-0.25	-0.375	1.77	1.61	5.62
0	-0.125	1.77	1.61	7.24
0.25	0.125	2.03	1.85	9.08
0.5	0.375	2.72	2.48	11.56
0.75	0.625	2.72	2.48	14.03
1	0.875	3.61	3.29	17.32
1.25	1.125	1.69	1.54	18.86
1.5	1.375	6.04	5.50	24.36
1.75	1.625	4.58	4.17	28.52
2	1.875	12.42	11.30	39.83
2.25	2.125	24.72	22.50	62.33
2.5	2.375	15.35	13.97	76.30
2.75	2.625	10.99	10.00	86.30
3	2.875	11.81	10.75	97.05
3.25	3.125	2.36	2.15	99.20
3.5	3.375	0.62	0.56	99.76
3.75	3.625	0.11	0.10	99.86
4	3.875	0.08	0.07	99.94
>4.0	4.25	0.07	0.06	100.00

Percentiles	
1	-1.465
5	-0.470
16	0.775
25	1.415
50	1.990
75	2.350
84	2.565
95	2.825
99	3.100

Moment Measures	**(phi)**	**(mm)**
Mean	1.859	0.276
Standard Deviation	0.974	0.509
Skewness	-1.332	
Kurtosis	4.436	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.670	1.777
Standard Deviation	0.895	0.947
Skewness (1)	-0.358	-0.425
Skewness (2)	-0.908	
Kurtosis	0.841	1.444



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**322+00**
Interval	**Low Tide Terrace**
Mean	**0.174 mm**
STD	**0.563 mm**
Skewness	**-3.068**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

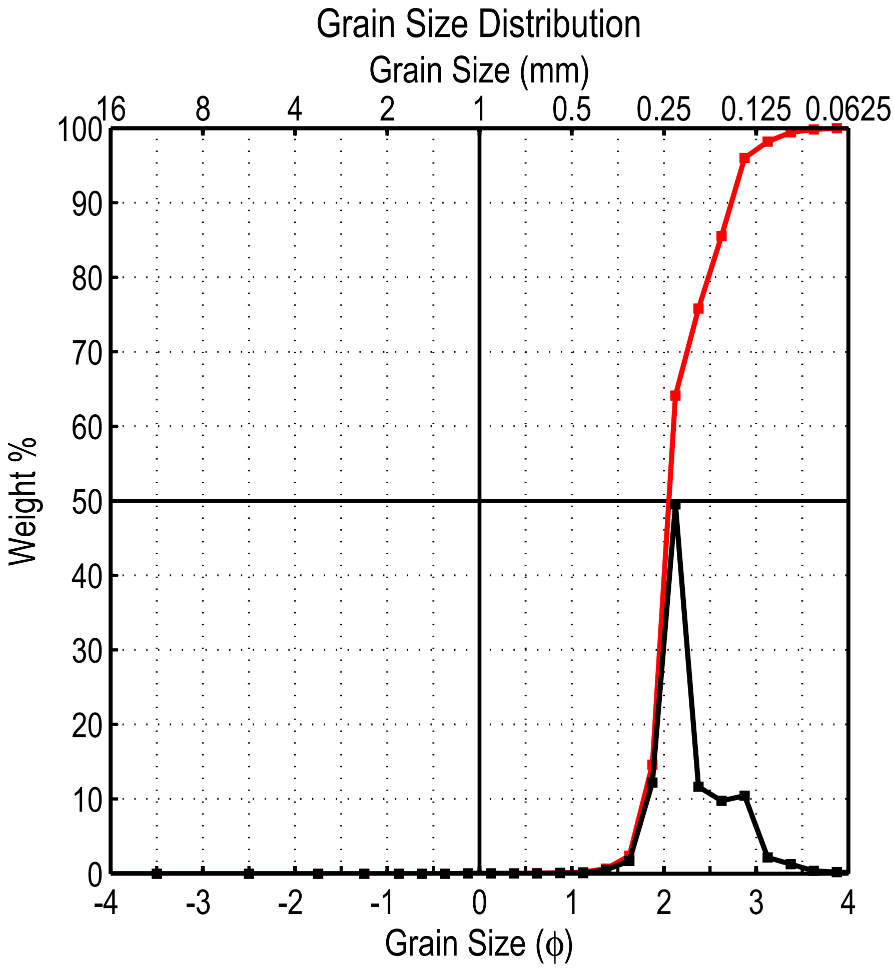
Total weight (gram)	108.67
% finer than 4.00 phi	0.48
% coarser than -1.00 phi	2.84
% $CaCO_3$	6.3

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	3.09	2.84	2.84
-0.75	-0.875	0.20	0.18	3.03
-0.5	-0.625	0.20	0.18	3.21
-0.25	-0.375	0.19	0.17	3.39
0	-0.125	0.20	0.18	3.57
0.25	0.125	0.23	0.21	3.78
0.5	0.375	0.28	0.26	4.04
0.75	0.625	0.25	0.23	4.27
1	0.875	0.39	0.36	4.63
1.25	1.125	0.28	0.26	4.89
1.5	1.375	0.45	0.41	5.30
1.75	1.625	0.50	0.46	5.76
2	1.875	2.56	2.36	8.12
2.25	2.125	11.07	10.19	18.30
2.5	2.375	16.87	15.52	33.83
2.75	2.625	18.60	17.12	50.94
3	2.875	40.02	36.83	87.77
3.25	3.125	7.27	6.69	94.46
3.5	3.375	4.22	3.88	98.34
3.75	3.625	0.84	0.77	99.12
4	3.875	0.44	0.40	99.52
>4.0	4.25	0.52	0.48	100.00

Percentiles	
1	-1.575
5	1.195
16	2.070
25	2.235
50	2.610
75	2.790
84	2.850
95	3.160
99	3.585

Moment Measures	**(phi)**	**(mm)**
Mean	2.524	0.174
Standard Deviation	0.830	0.563
Skewness	-3.068	
Kurtosis	14.180	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.460	2.510
Standard Deviation	0.390	0.493
Skewness (1)	-0.385	-0.412
Skewness (2)	-1.109	
Kurtosis	1.519	1.451



Project 2300
Location Isle of Palms, SC
Date Jul 2010

Station 334+00
Interval Dune

Mean 0.205 mm
STD 0.771 mm
Skewness 0.909

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Fine Skewed
	Leptokurtic

Total weight (gram)	103.40
% finer than 4.00 phi	0.03
% coarser than -1.00 phi	0.00
% $CaCO_3$	4.2

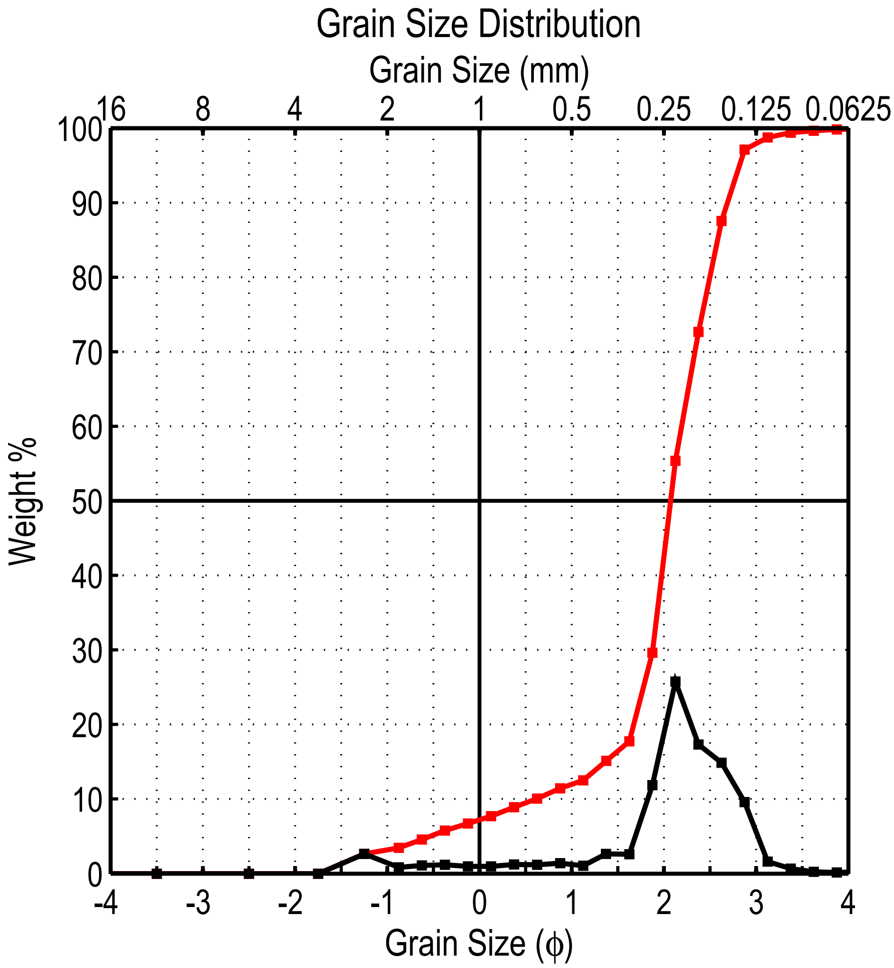
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.01	0.01	0.01
0.25	0.125	0.01	0.01	0.02
0.5	0.375	0.02	0.02	0.04
0.75	0.625	0.02	0.02	0.06
1	0.875	0.05	0.05	0.11
1.25	1.125	0.08	0.08	0.18
1.5	1.375	0.51	0.49	0.68
1.75	1.625	1.77	1.71	2.39
2	1.875	12.63	12.21	14.60
2.25	2.125	51.21	49.53	64.13
2.5	2.375	12.06	11.66	75.79
2.75	2.625	10.08	9.75	85.54
3	2.875	10.82	10.46	96.01
3.25	3.125	2.23	2.16	98.16
3.5	3.375	1.29	1.25	99.41
3.75	3.625	0.39	0.38	99.79
4	3.875	0.19	0.18	99.97
>4.0	4.25	0.03	0.03	100.00

Percentiles

1	1.420
5	1.680
16	1.880
25	1.925
50	2.055
75	2.360
84	2.585
95	2.850
99	3.295

Moment Measures	**(phi)**	**(mm)**
Mean	2.283	0.205
Standard Deviation	0.374	0.771
Skewness	0.909	
Kurtosis	4.786	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.232	2.173
Standard Deviation	0.353	0.354
Skewness (1)	0.504	0.431
Skewness (2)	0.596	
Kurtosis	0.660	1.102



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**334+00**
Interval	**Mid Berm**
Mean	**0.249 mm**
STD	**0.522 mm**
Skewness	**-1.889**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

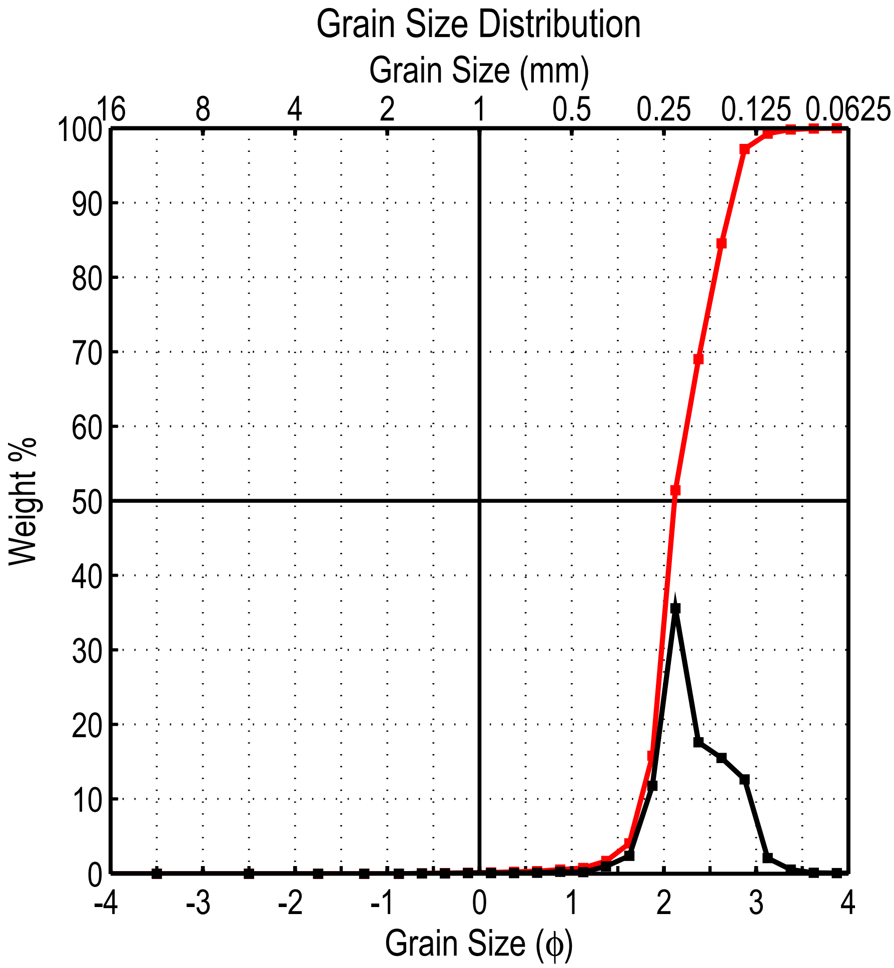
Total weight (gram)	101.50
% finer than 4.00 phi	0.21
% coarser than -1.00 phi	2.64
% $CaCO_3$	14.7

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	2.68	2.64	2.64
-0.75	-0.875	0.83	0.82	3.46
-0.5	-0.625	1.12	1.10	4.56
-0.25	-0.375	1.21	1.19	5.75
0	-0.125	0.99	0.98	6.73
0.25	0.125	0.98	0.97	7.69
0.5	0.375	1.22	1.20	8.90
0.75	0.625	1.19	1.17	10.07
1	0.875	1.40	1.38	11.45
1.25	1.125	1.07	1.05	12.50
1.5	1.375	2.68	2.64	15.14
1.75	1.625	2.64	2.60	17.74
2	1.875	12.05	11.87	29.62
2.25	2.125	26.14	25.75	55.37
2.5	2.375	17.55	17.29	72.66
2.75	2.625	15.09	14.87	87.53
3	2.875	9.72	9.58	97.10
3.25	3.125	1.65	1.63	98.73
3.5	3.375	0.68	0.67	99.40
3.75	3.625	0.24	0.24	99.64
4	3.875	0.16	0.16	99.79
>4.0	4.25	0.21	0.21	100.00

Percentiles	
1	-1.560
5	-0.535
16	1.455
25	1.780
50	2.075
75	2.415
84	2.565
95	2.820
99	3.225

Moment Measures	**(phi)**	**(mm)**
Mean	2.006	0.249
Standard Deviation	0.937	0.522
Skewness	-1.889	
Kurtosis	6.666	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.010	2.032
Standard Deviation	0.555	0.786
Skewness (1)	-0.117	-0.337
Skewness (2)	-1.680	
Kurtosis	2.023	2.165



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**334+00**
Interval	**Berm Crest**
Mean	**0.201 mm**
STD	**0.760 mm**
Skewness	**-0.361**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

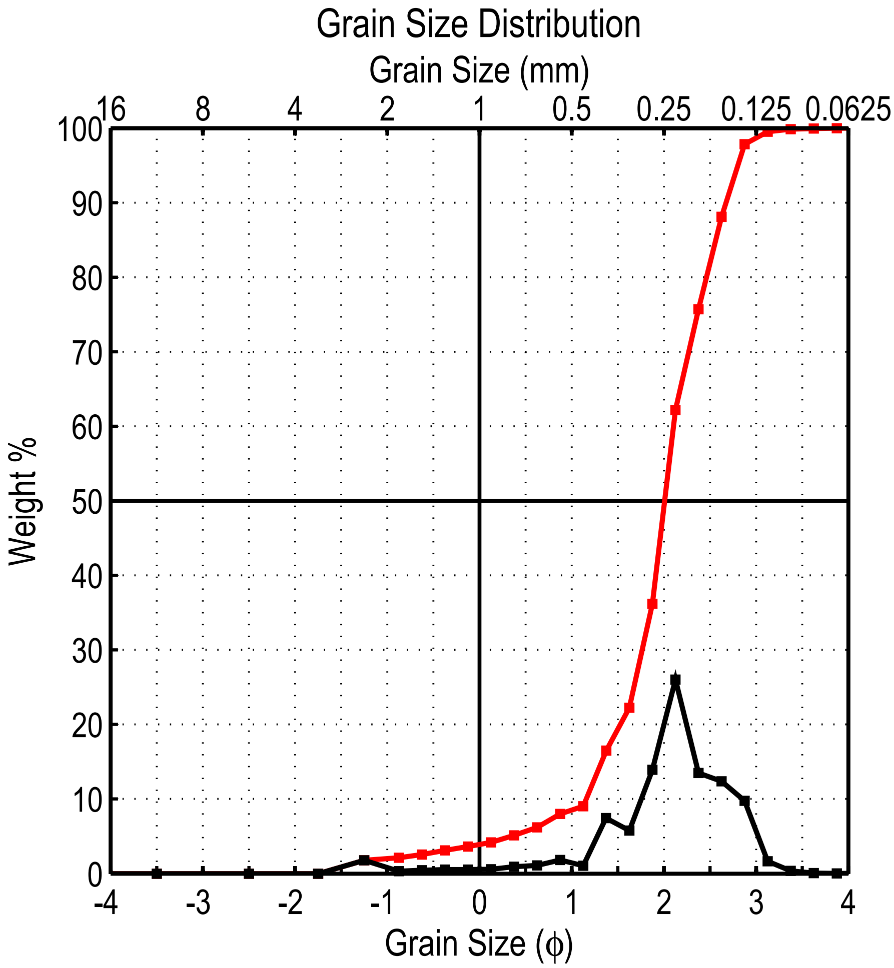
Total weight (gram)	104.74
% finer than 4.00 phi	0.01
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.7

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.03	0.03	0.03
-0.25	-0.375	0.03	0.03	0.06
0	-0.125	0.06	0.06	0.11
0.25	0.125	0.05	0.05	0.16
0.5	0.375	0.07	0.07	0.23
0.75	0.625	0.11	0.11	0.33
1	0.875	0.23	0.22	0.55
1.25	1.125	0.19	0.18	0.74
1.5	1.375	1.01	0.96	1.70
1.75	1.625	2.48	2.37	4.07
2	1.875	12.32	11.76	15.83
2.25	2.125	37.28	35.59	51.42
2.5	2.375	18.43	17.60	69.02
2.75	2.625	16.25	15.51	84.53
3	2.875	13.24	12.64	97.17
3.25	3.125	2.19	2.09	99.26
3.5	3.375	0.56	0.53	99.80
3.75	3.625	0.13	0.12	99.92
4	3.875	0.07	0.07	99.99
>4.0	4.25	0.01	0.01	100.00

Percentiles	
1	1.195
5	1.645
16	1.875
25	1.940
50	2.115
75	2.470
84	2.615
95	2.830
99	3.095

Moment Measures	**(phi)**	**(mm)**
Mean	2.313	0.201
Standard Deviation	0.397	0.760
Skewness	-0.361	
Kurtosis	6.259	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.245	2.202
Standard Deviation	0.370	0.365
Skewness (1)	0.351	0.279
Skewness (2)	0.331	
Kurtosis	0.601	0.916



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**334+00**
Interval	**Beach Face**
Mean	**0.248 mm**
STD	**0.581 mm**
Skewness	**-1.943**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

Total weight (gram)	103.78
% finer than 4.00 phi	0.02
% coarser than -1.00 phi	1.78
% $CaCO_3$	8.7

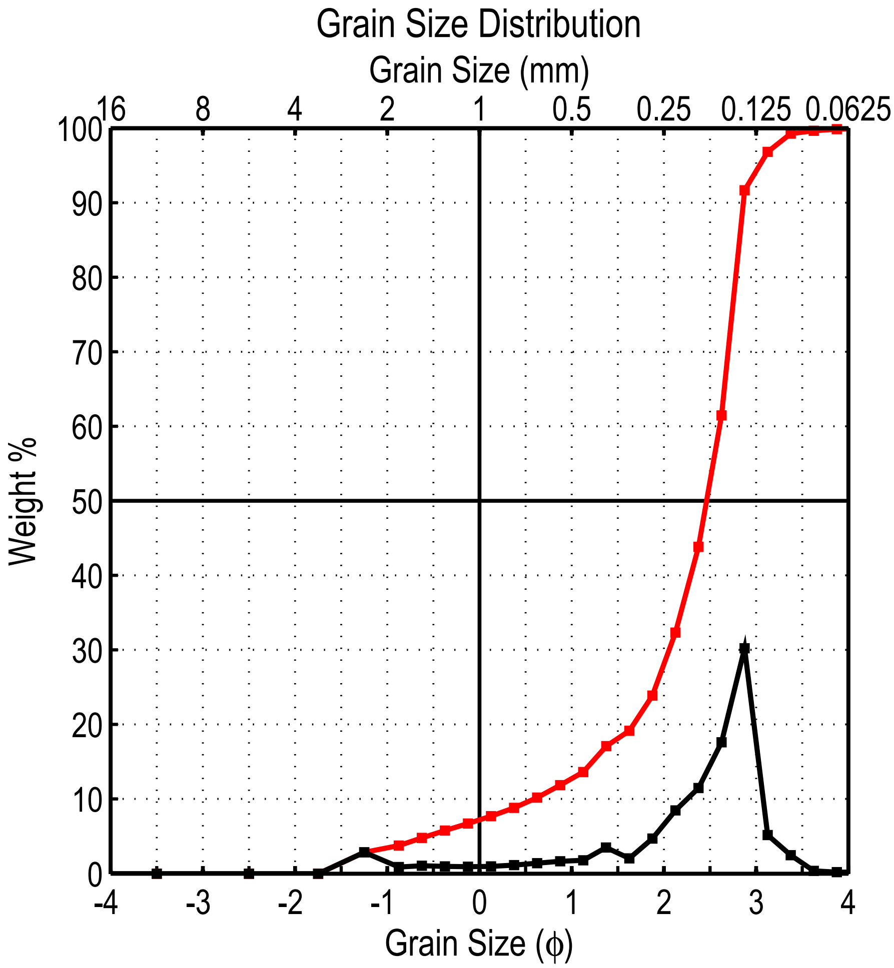
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	1.85	1.78	1.78
-0.75	-0.875	0.35	0.34	2.12
-0.5	-0.625	0.47	0.45	2.57
-0.25	-0.375	0.54	0.52	3.09
0	-0.125	0.55	0.53	3.62
0.25	0.125	0.60	0.58	4.20
0.5	0.375	0.95	0.92	5.12
0.75	0.625	1.12	1.08	6.20
1	0.875	1.89	1.82	8.02
1.25	1.125	1.07	1.03	9.05
1.5	1.375	7.73	7.45	16.50
1.75	1.625	5.98	5.76	22.26
2	1.875	14.44	13.91	36.17
2.25	2.125	27.01	26.03	62.20
2.5	2.375	14.01	13.50	75.70
2.75	2.625	12.85	12.38	88.08
3	2.875	10.14	9.77	97.85
3.25	3.125	1.73	1.67	99.52
3.5	3.375	0.36	0.35	99.87
3.75	3.625	0.08	0.08	99.94
4	3.875	0.04	0.04	99.98
>4.0	4.25	0.02	0.02	100.00

Percentiles

1	-1.470
5	0.345
16	1.360
25	1.675
50	2.010
75	2.360
84	2.545
95	2.800
99	3.045

Moment Measures	**(phi)**	**(mm)**
Mean	2.013	0.248
Standard Deviation	0.784	0.581
Skewness	-1.943	
Kurtosis	8.254	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.952	1.972
Standard Deviation	0.593	0.668
Skewness (1)	-0.097	-0.227
Skewness (2)	-0.738	
Kurtosis	1.072	1.469



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**334+00**
Interval	**Low Tide Terrace**
Mean	**0.215 mm**
STD	**0.484 mm**
Skewness	**-1.826**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Poorly Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

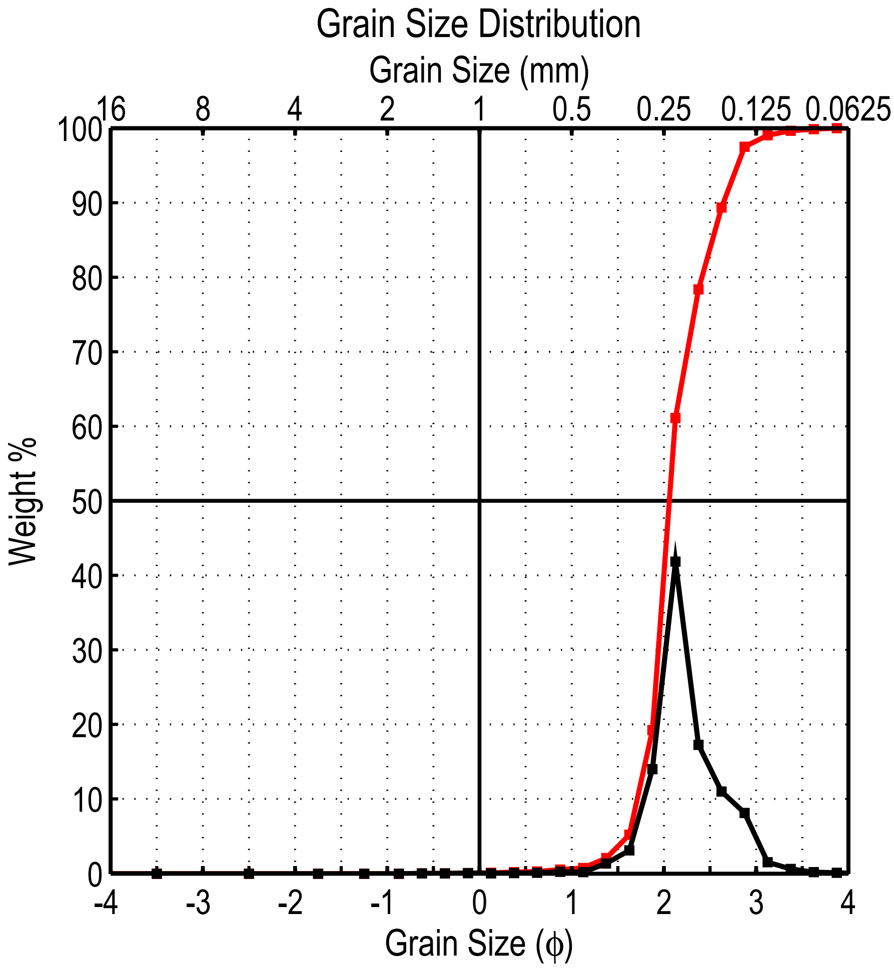
Total weight (gram)	102.84
% finer than 4.00 phi	0.17
% coarser than -1.00 phi	2.85
% $CaCO_3$	14.2

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	2.93	2.85	2.85
-0.75	-0.875	0.92	0.89	3.74
-0.5	-0.625	1.08	1.05	4.79
-0.25	-0.375	1.01	0.98	5.78
0	-0.125	0.97	0.94	6.72
0.25	0.125	0.99	0.96	7.68
0.5	0.375	1.18	1.15	8.83
0.75	0.625	1.42	1.38	10.21
1	0.875	1.69	1.64	11.85
1.25	1.125	1.81	1.76	13.61
1.5	1.375	3.60	3.50	17.11
1.75	1.625	2.10	2.04	19.16
2	1.875	4.84	4.71	23.86
2.25	2.125	8.72	8.48	32.34
2.5	2.375	11.82	11.49	43.84
2.75	2.625	18.10	17.60	61.44
3	2.875	31.06	30.20	91.64
3.25	3.125	5.30	5.15	96.79
3.5	3.375	2.54	2.47	99.26
3.75	3.625	0.39	0.38	99.64
4	3.875	0.20	0.19	99.83
>4.0	4.25	0.17	0.17	100.00

Percentiles	
1	-1.575
5	-0.575
16	1.295
25	1.910
50	2.465
75	2.735
84	2.810
95	3.040
99	3.350

Moment Measures	**(phi)**	**(mm)**
Mean	2.219	0.215
Standard Deviation	1.046	0.484
Skewness	-1.826	
Kurtosis	5.910	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.053	2.190
Standard Deviation	0.758	0.926
Skewness (1)	-0.545	-0.613
Skewness (2)	-1.627	
Kurtosis	1.386	1.796



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**342+00**
Interval	**Dune**
Mean	**0.211 mm**
STD	**0.768 mm**
Skewness	**0.034**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

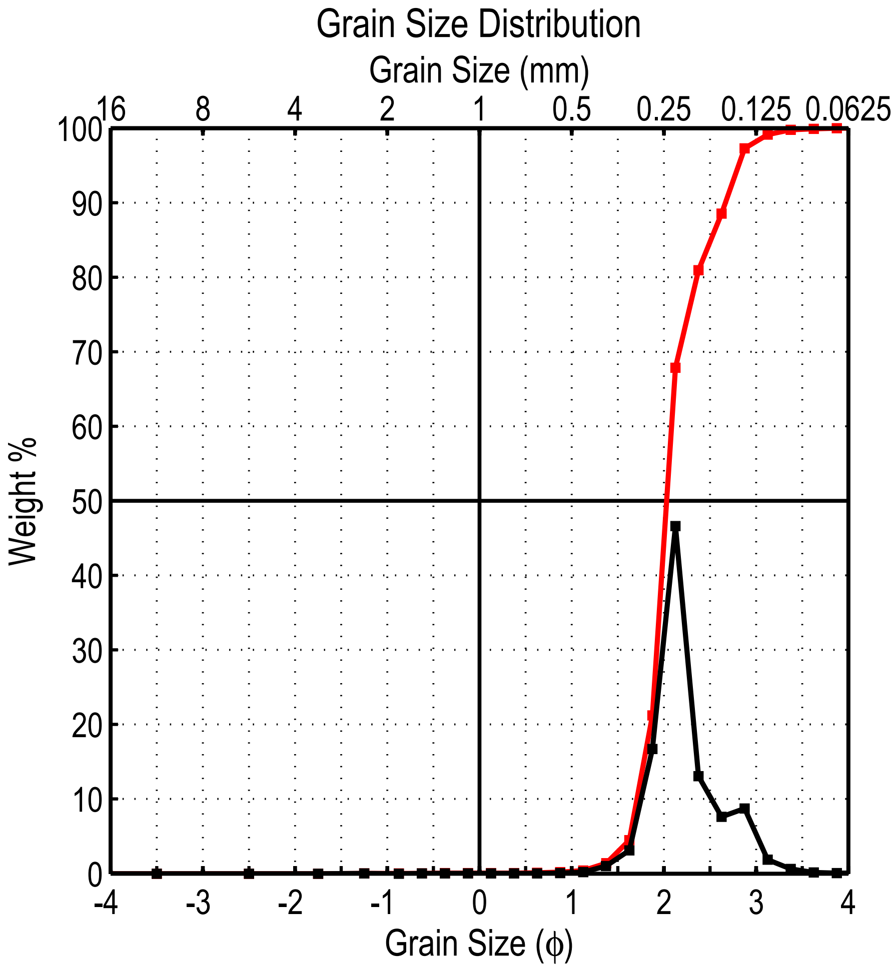
Total weight (gram)	104.31
% finer than 4.00 phi	0.03
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.8

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.01	0.01	0.01
-0.25	-0.375	0.02	0.02	0.03
0	-0.125	0.05	0.05	0.08
0.25	0.125	0.04	0.04	0.12
0.5	0.375	0.08	0.08	0.19
0.75	0.625	0.11	0.11	0.30
1	0.875	0.25	0.24	0.54
1.25	1.125	0.22	0.21	0.75
1.5	1.375	1.41	1.35	2.10
1.75	1.625	3.26	3.13	5.22
2	1.875	14.63	14.03	19.25
2.25	2.125	43.66	41.86	61.11
2.5	2.375	17.99	17.25	78.35
2.75	2.625	11.47	11.00	89.35
3	2.875	8.49	8.14	97.49
3.25	3.125	1.60	1.53	99.02
3.5	3.375	0.66	0.63	99.65
3.75	3.625	0.21	0.20	99.86
4	3.875	0.12	0.12	99.97
>4.0	4.25	0.03	0.03	100.00

Percentiles	
1	1.170
5	1.605
16	1.815
25	1.910
50	2.060
75	2.325
84	2.505
95	2.800
99	3.120

Moment Measures	**(phi)**	**(mm)**
Mean	2.242	0.211
Standard Deviation	0.382	0.768
Skewness	0.034	
Kurtosis	6.439	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.160	2.127
Standard Deviation	0.345	0.354
Skewness (1)	0.290	0.264
Skewness (2)	0.413	
Kurtosis	0.732	1.180



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**342+00**
Interval	**Mid Berm**
Mean	**0.214 mm**
STD	**0.775 mm**
Skewness	**0.421**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

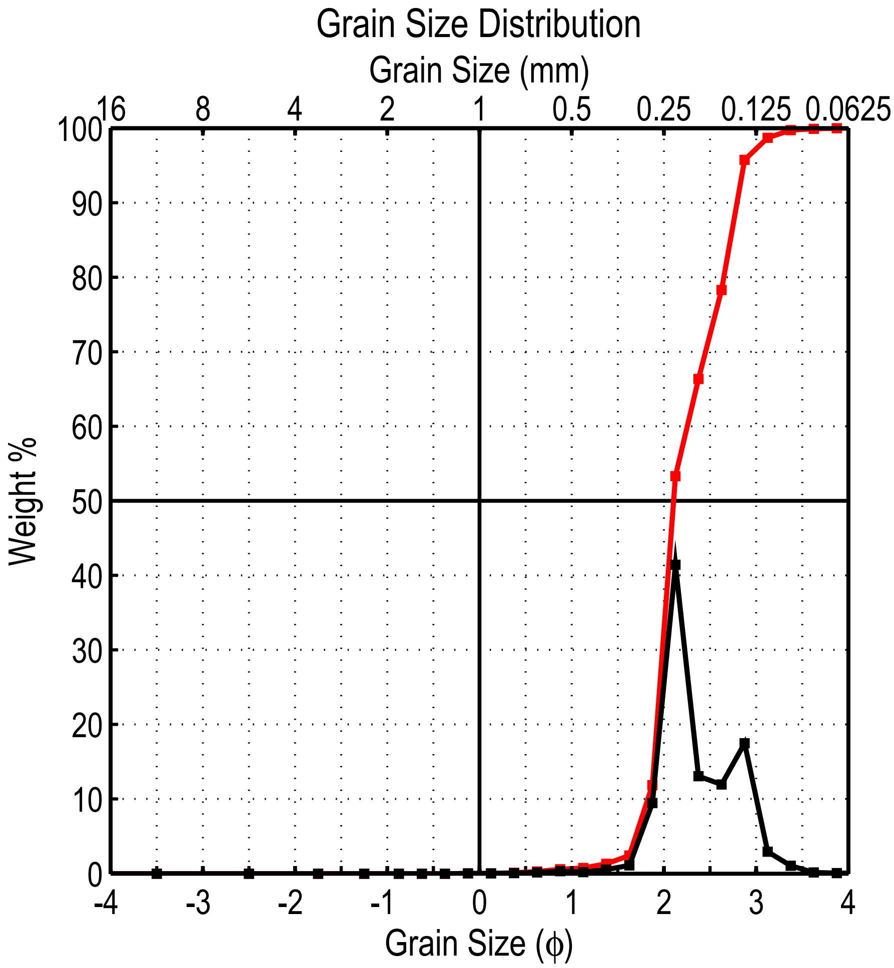
Total weight (gram)	106.81
% finer than 4.00 phi	0.03
% coarser than -1.00 phi	0.02
% $CaCO_3$	3.6

Class Limits (φ)	Mid Point (φ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.02	0.02	0.02
-0.75	-0.875	0.00	0.00	0.02
-0.5	-0.625	0.01	0.01	0.03
-0.25	-0.375	0.02	0.02	0.05
0	-0.125	0.01	0.01	0.06
0.25	0.125	0.01	0.01	0.07
0.5	0.375	0.01	0.01	0.07
0.75	0.625	0.03	0.03	0.10
1	0.875	0.09	0.08	0.19
1.25	1.125	0.22	0.21	0.39
1.5	1.375	1.09	1.02	1.41
1.75	1.625	3.30	3.09	4.50
2	1.875	17.87	16.73	21.23
2.25	2.125	49.78	46.61	67.84
2.5	2.375	13.97	13.08	80.92
2.75	2.625	8.13	7.61	88.53
3	2.875	9.34	8.74	97.28
3.25	3.125	1.99	1.86	99.14
3.5	3.375	0.65	0.61	99.75
3.75	3.625	0.16	0.15	99.90
4	3.875	0.08	0.07	99.97
>4.0	4.25	0.03	0.03	100.00

Percentiles	
1	1.275
5	1.630
16	1.795
25	1.895
50	2.030
75	2.260
84	2.475
95	2.810
99	3.105

Moment Measures	**(phi)**	**(mm)**
Mean	2.221	0.214
Standard Deviation	0.368	0.775
Skewness	0.421	
Kurtosis	6.787	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.135	2.100
Standard Deviation	0.340	0.349
Skewness (1)	0.309	0.315
Skewness (2)	0.559	
Kurtosis	0.735	1.325



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**342+00**
Interval	**Berm Crest**
Mean	**0.196 mm**
STD	**0.755 mm**
Skewness	**0.062**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

Total weight (gram)	104.95
% finer than 4.00 phi	0.04
% coarser than -1.00 phi	0.00
% $CaCO_3$	2.7

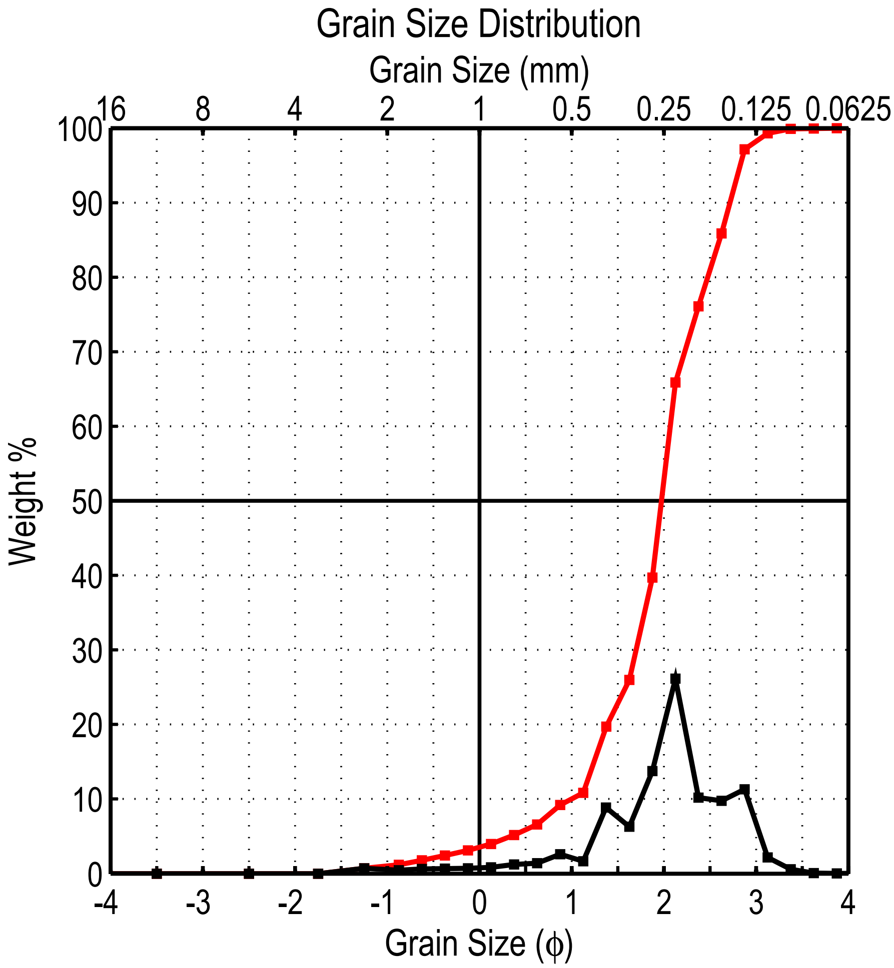
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.00	0.00	0.00
-0.75	-0.875	0.00	0.00	0.00
-0.5	-0.625	0.00	0.00	0.00
-0.25	-0.375	0.00	0.00	0.00
0	-0.125	0.02	0.02	0.02
0.25	0.125	0.02	0.02	0.04
0.5	0.375	0.08	0.08	0.11
0.75	0.625	0.16	0.15	0.27
1	0.875	0.32	0.30	0.57
1.25	1.125	0.21	0.20	0.77
1.5	1.375	0.57	0.54	1.31
1.75	1.625	1.15	1.10	2.41
2	1.875	9.91	9.44	11.85
2.25	2.125	43.48	41.43	53.28
2.5	2.375	13.69	13.04	66.33
2.75	2.625	12.52	11.93	78.26
3	2.875	18.34	17.47	95.73
3.25	3.125	3.10	2.95	98.69
3.5	3.375	1.10	1.05	99.73
3.75	3.625	0.16	0.15	99.89
4	3.875	0.08	0.08	99.96
>4.0	4.25	0.04	0.04	100.00

Percentiles

1	1.230
5	1.695
16	1.900
25	1.955
50	2.105
75	2.555
84	2.705
95	2.865
99	3.200

Moment Measures	**(phi)**	**(mm)**
Mean	2.352	0.196
Standard Deviation	0.405	0.755
Skewness	0.062	
Kurtosis	4.416	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.303	2.237
Standard Deviation	0.403	0.379
Skewness (1)	0.491	0.395
Skewness (2)	0.435	
Kurtosis	0.453	0.799



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**342+00**
Interval	**Beach Face**
Mean	**0.252 mm**
STD	**0.588 mm**
Skewness	**-1.450**

USCS	**Wentworth**
SP	Medium Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

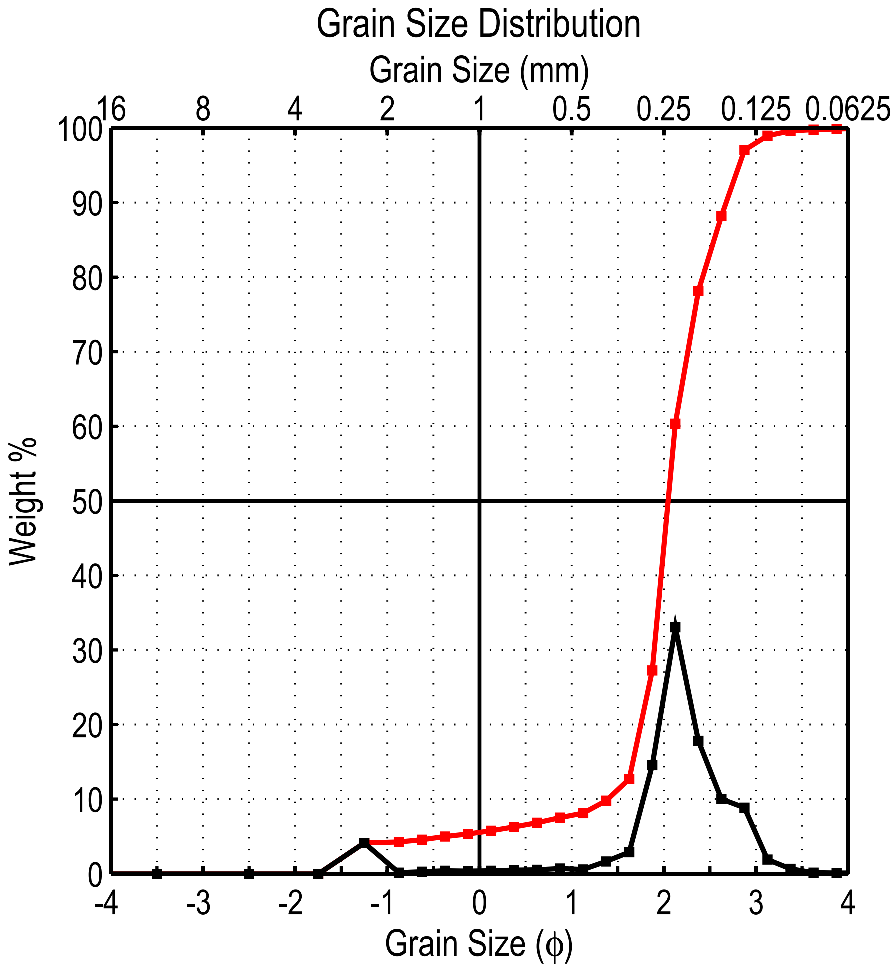
Total weight (gram)	103.94
% finer than 4.00 phi	0.04
% coarser than -1.00 phi	0.71
% $CaCO_3$	9.1

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.74	0.71	0.71
-0.75	-0.875	0.47	0.45	1.16
-0.5	-0.625	0.64	0.62	1.78
-0.25	-0.375	0.68	0.65	2.43
0	-0.125	0.72	0.69	3.13
0.25	0.125	0.87	0.84	3.96
0.5	0.375	1.25	1.20	5.17
0.75	0.625	1.47	1.41	6.58
1	0.875	2.72	2.62	9.20
1.25	1.125	1.72	1.65	10.85
1.5	1.375	9.19	8.84	19.69
1.75	1.625	6.52	6.27	25.97
2	1.875	14.30	13.76	39.72
2.25	2.125	27.18	26.15	65.87
2.5	2.375	10.61	10.21	76.08
2.75	2.625	10.16	9.77	85.86
3	2.875	11.74	11.29	97.15
3.25	3.125	2.24	2.16	99.31
3.5	3.375	0.59	0.57	99.87
3.75	3.625	0.05	0.05	99.92
4	3.875	0.04	0.04	99.96
>4.0	4.25	0.04	0.04	100.00

Percentiles	
1	-1.010
5	0.340
16	1.270
25	1.585
50	1.975
75	2.350
84	2.580
95	2.825
99	3.090

Moment Measures	**(phi)**	**(mm)**
Mean	1.988	0.252
Standard Deviation	0.767	0.588
Skewness	-1.450	
Kurtosis	6.288	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	1.925	1.942
Standard Deviation	0.655	0.704
Skewness (1)	-0.076	-0.196
Skewness (2)	-0.599	
Kurtosis	0.897	1.331



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**342+00**
Interval	**Low Tide Terrace**
Mean	**0.242 mm**
STD	**0.547 mm**
Skewness	**-2.441**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Moderately Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

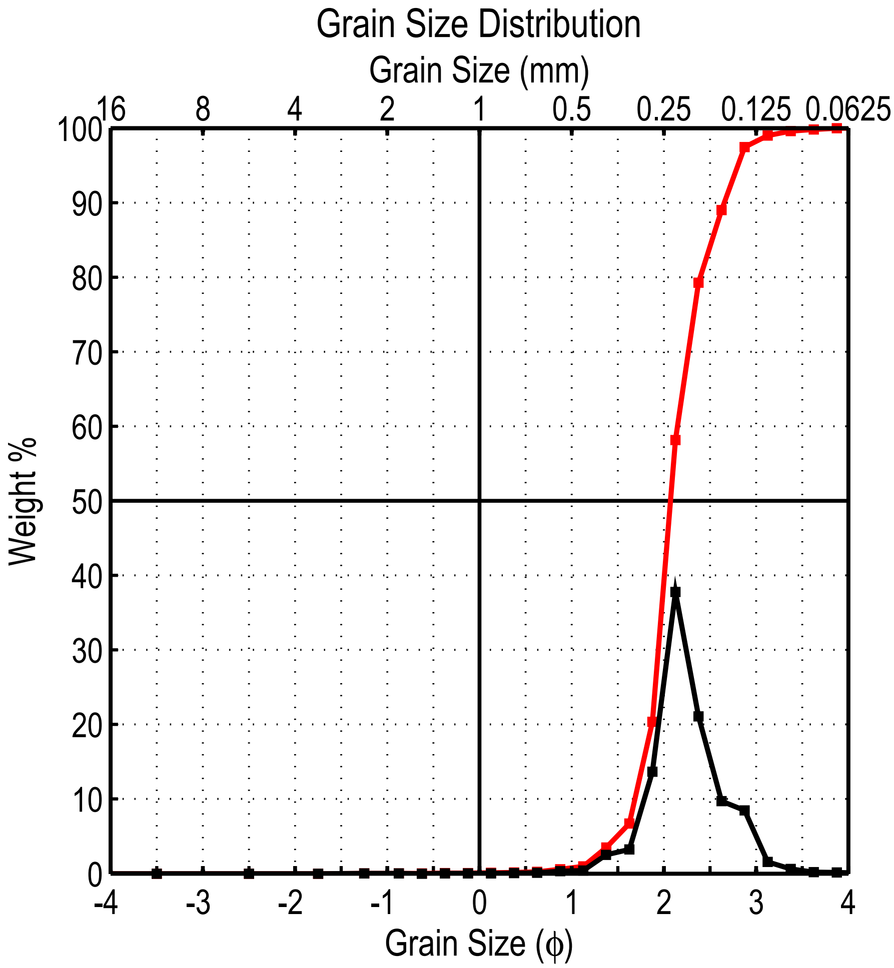
Total weight (gram)	102.25
% finer than 4.00 phi	0.14
% coarser than -1.00 phi	4.13
% $CaCO_3$	5.8

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	4.22	4.13	4.13
-0.75	-0.875	0.15	0.15	4.27
-0.5	-0.625	0.29	0.28	4.56
-0.25	-0.375	0.43	0.42	4.98
0	-0.125	0.38	0.37	5.35
0.25	0.125	0.43	0.42	5.77
0.5	0.375	0.51	0.50	6.27
0.75	0.625	0.57	0.56	6.83
1	0.875	0.73	0.71	7.54
1.25	1.125	0.61	0.60	8.14
1.5	1.375	1.71	1.67	9.81
1.75	1.625	2.97	2.90	12.71
2	1.875	14.89	14.56	27.28
2.25	2.125	33.82	33.08	60.35
2.5	2.375	18.21	17.81	78.16
2.75	2.625	10.24	10.01	88.18
3	2.875	9.04	8.84	97.02
3.25	3.125	1.97	1.93	98.94
3.5	3.375	0.67	0.66	99.60
3.75	3.625	0.15	0.15	99.75
4	3.875	0.12	0.12	99.86
>4.0	4.25	0.14	0.14	100.00

Percentiles	
1	-1.630
5	-0.360
16	1.680
25	1.835
50	2.045
75	2.330
84	2.520
95	2.820
99	3.145

Moment Measures	**(phi)**	**(mm)**
Mean	2.046	0.242
Standard Deviation	0.872	0.547
Skewness	-2.441	
Kurtosis	9.787	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.100	2.082
Standard Deviation	0.420	0.692
Skewness (1)	0.131	-0.191
Skewness (2)	-1.940	
Kurtosis	2.786	2.633



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**353+00**
Interval	**Dune**
Mean	**0.212 mm**
STD	**0.759 mm**
Skewness	**-0.143**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

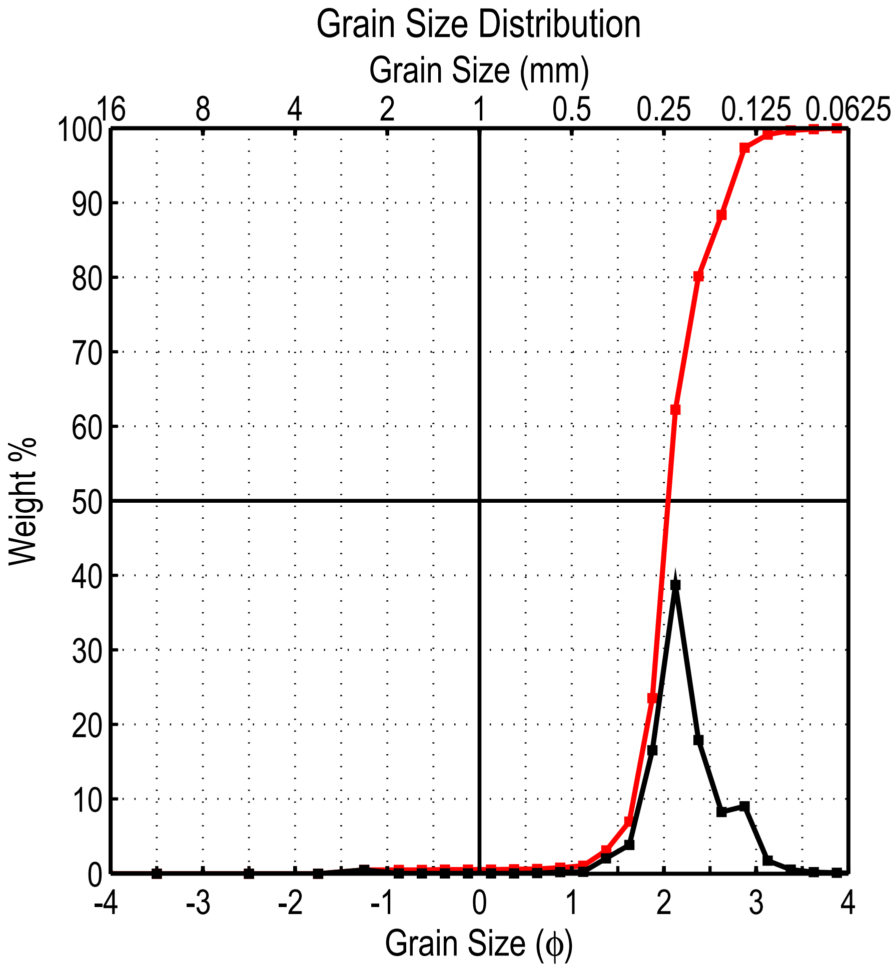
Total weight (gram)	102.61
% finer than 4.00 phi	0.04
% coarser than -1.00 phi	0.02
% $CaCO_3$	3.9

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.02	0.02	0.02
-0.75	-0.875	0.01	0.01	0.03
-0.5	-0.625	0.00	0.00	0.03
-0.25	-0.375	0.02	0.02	0.05
0	-0.125	0.03	0.03	0.08
0.25	0.125	0.02	0.02	0.10
0.5	0.375	0.05	0.05	0.15
0.75	0.625	0.11	0.11	0.25
1	0.875	0.33	0.32	0.57
1.25	1.125	0.40	0.39	0.96
1.5	1.375	2.58	2.51	3.48
1.75	1.625	3.31	3.23	6.70
2	1.875	14.02	13.66	20.37
2.25	2.125	38.76	37.77	58.14
2.5	2.375	21.65	21.10	79.24
2.75	2.625	9.99	9.74	88.98
3	2.875	8.69	8.47	97.45
3.25	3.125	1.59	1.55	99.00
3.5	3.375	0.63	0.61	99.61
3.75	3.625	0.21	0.20	99.81
4	3.875	0.15	0.15	99.96
>4.0	4.25	0.04	0.04	100.00

Percentiles	
1	1.130
5	1.495
16	1.795
25	1.905
50	2.070
75	2.325
84	2.495
95	2.805
99	3.125

Moment Measures	**(phi)**	**(mm)**
Mean	2.238	0.212
Standard Deviation	0.398	0.759
Skewness	-0.143	
Kurtosis	6.829	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.145	2.120
Standard Deviation	0.350	0.373
Skewness (1)	0.214	0.168
Skewness (2)	0.229	
Kurtosis	0.871	1.278



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**353+00**
Interval	**Mid Berm**
Mean	**0.216 mm**
STD	**0.729 mm**
Skewness	**-1.895**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Strongly Coarse Skewed
	Very Leptokurtic

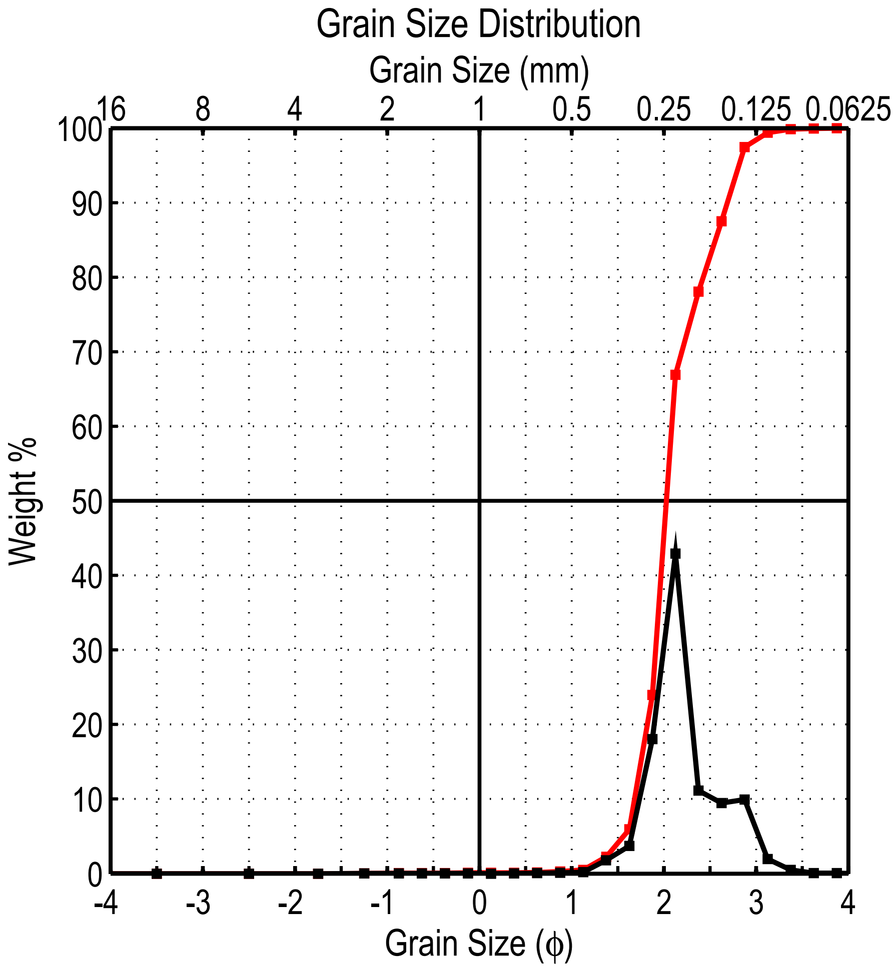
Total weight (gram)	107.00
% finer than 4.00 phi	0.04
% coarser than -1.00 phi	0.49
% $CaCO_3$	3.2

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.52	0.49	0.49
-0.75	-0.875	0.01	0.01	0.50
-0.5	-0.625	0.02	0.02	0.51
-0.25	-0.375	0.01	0.01	0.52
0	-0.125	0.02	0.02	0.54
0.25	0.125	0.01	0.01	0.55
0.5	0.375	0.02	0.02	0.57
0.75	0.625	0.06	0.06	0.63
1	0.875	0.20	0.19	0.81
1.25	1.125	0.26	0.24	1.06
1.5	1.375	2.19	2.05	3.10
1.75	1.625	4.13	3.86	6.96
2	1.875	17.71	16.55	23.51
2.25	2.125	41.42	38.71	62.22
2.5	2.375	19.15	17.90	80.12
2.75	2.625	8.82	8.24	88.36
3	2.875	9.64	9.01	97.37
3.25	3.125	1.88	1.76	99.13
3.5	3.375	0.59	0.55	99.68
3.75	3.625	0.19	0.18	99.86
4	3.875	0.11	0.10	99.96
>4.0	4.25	0.04	0.04	100.00

Percentiles	
1	1.065
5	1.500
16	1.760
25	1.885
50	2.045
75	2.305
84	2.495
95	2.810
99	3.105

Moment Measures	**(phi)**	**(mm)**
Mean	2.208	0.216
Standard Deviation	0.457	0.729
Skewness	-1.895	
Kurtosis	18.883	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.127	2.100
Standard Deviation	0.368	0.382
Skewness (1)	0.224	0.196
Skewness (2)	0.299	
Kurtosis	0.782	1.278



Project 2300
Location Isle of Palms, SC
Date Jul 2010

Station 353+00
Interval Berm Crest

Mean 0.215 mm
STD 0.763 mm
Skewness 0.045

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Well Sorted
Poorly Graded	Symmetrical
	Leptokurtic

Total weight (gram)	109.68
% finer than 4.00 phi	0.02
% coarser than -1.00 phi	0.03
% $CaCO_3$	3.7

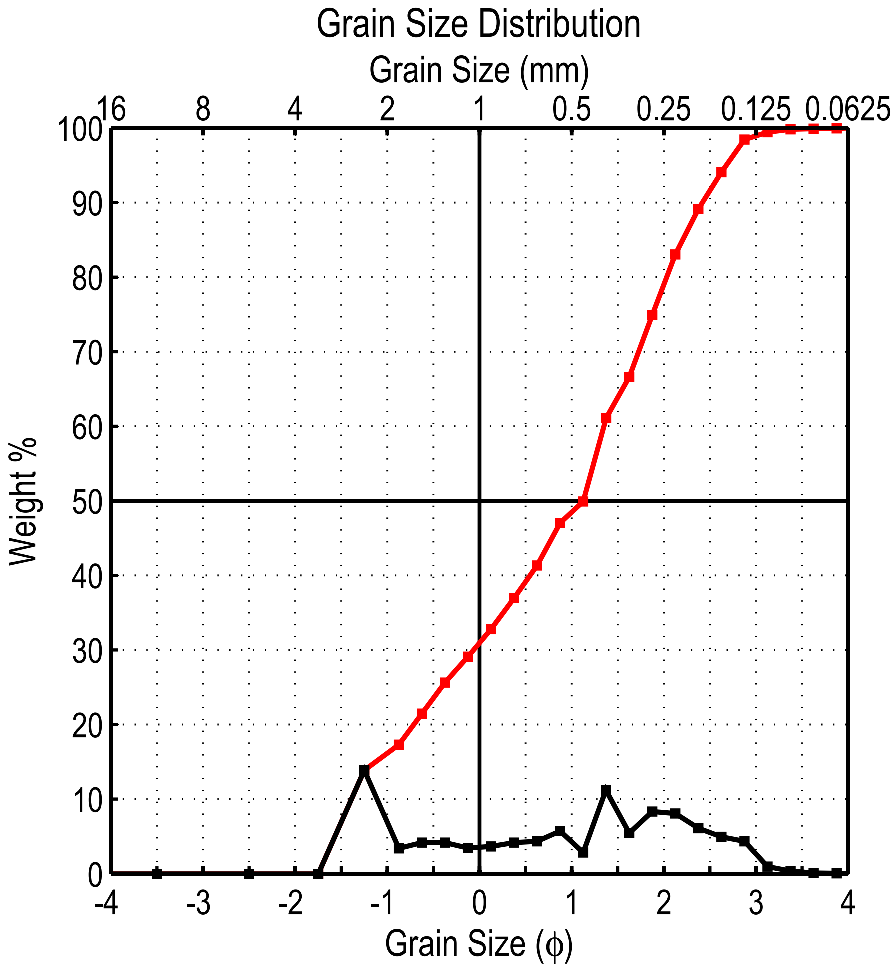
Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	0.03	0.03	0.03
-0.75	-0.875	0.02	0.02	0.05
-0.5	-0.625	0.02	0.02	0.06
-0.25	-0.375	0.01	0.01	0.07
0	-0.125	0.02	0.02	0.09
0.25	0.125	0.00	0.00	0.09
0.5	0.375	0.03	0.03	0.12
0.75	0.625	0.05	0.05	0.16
1	0.875	0.12	0.11	0.27
1.25	1.125	0.22	0.20	0.47
1.5	1.375	1.93	1.76	2.23
1.75	1.625	4.07	3.71	5.94
2	1.875	19.77	18.03	23.97
2.25	2.125	47.09	42.93	66.90
2.5	2.375	12.21	11.13	78.04
2.75	2.625	10.39	9.47	87.51
3	2.875	10.88	9.92	97.43
3.25	3.125	2.15	1.96	99.39
3.5	3.375	0.52	0.47	99.86
3.75	3.625	0.08	0.07	99.94
4	3.875	0.05	0.05	99.98
>4.0	4.25	0.02	0.02	100.00

Percentiles

1	1.200
5	1.560
16	1.765
25	1.880
50	2.025
75	2.305
84	2.530
95	2.815
99	3.075

Moment Measures	**(phi)**	**(mm)**
Mean	2.218	0.215
Standard Deviation	0.390	0.763
Skewness	0.045	
Kurtosis	6.845	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.148	2.107
Standard Deviation	0.383	0.381
Skewness (1)	0.320	0.290
Skewness (2)	0.425	
Kurtosis	0.641	1.210



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**353+00**
Interval	**Beach Face**
Mean	**0.535 mm**
STD	**0.396 mm**
Skewness	**-0.260**
USCS	**Wentworth**
SP	Coarse Sand
Medium Sand	Poorly Sorted
Poorly Graded	Symmetrical
	Platykurtic

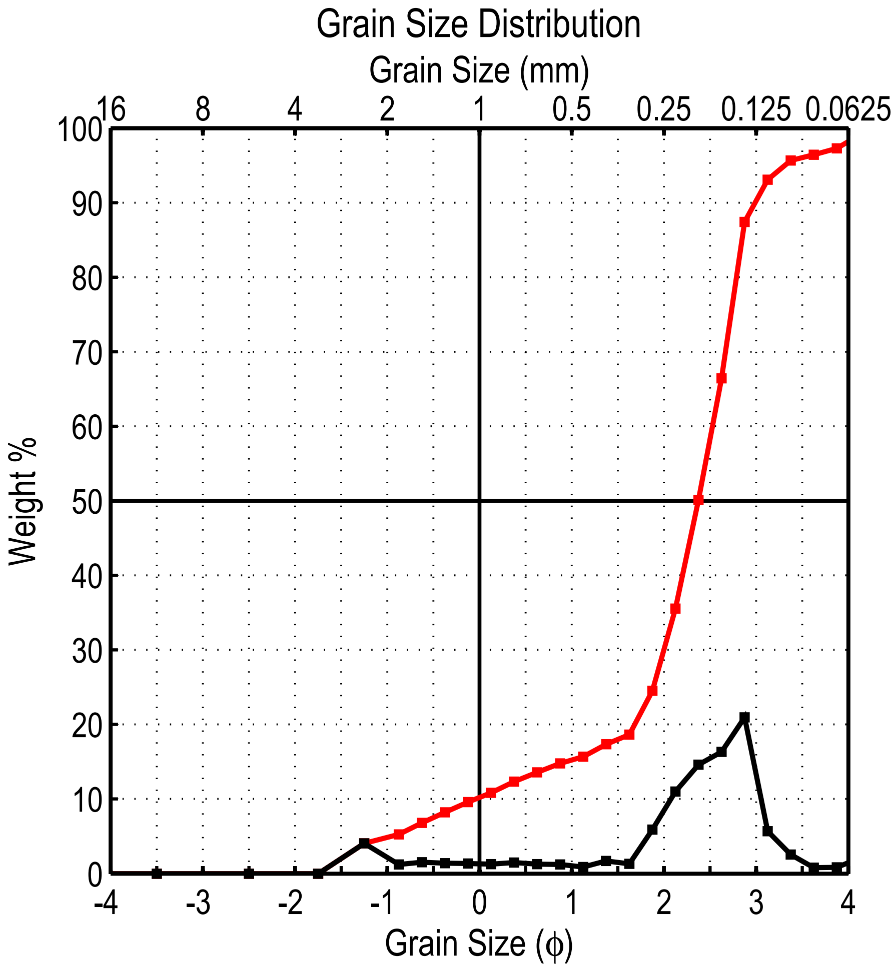
Total weight (gram)	103.38
% finer than 4.00 phi	0.05
% coarser than -1.00 phi	13.89
% $CaCO_3$	26.6

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	14.36	13.89	13.89
-0.75	-0.875	3.53	3.41	17.31
-0.5	-0.625	4.31	4.17	21.47
-0.25	-0.375	4.31	4.17	25.64
0	-0.125	3.57	3.45	29.10
0.25	0.125	3.81	3.69	32.78
0.5	0.375	4.33	4.19	36.97
0.75	0.625	4.52	4.37	41.34
1	0.875	5.91	5.72	47.06
1.25	1.125	2.94	2.84	49.90
1.5	1.375	11.60	11.22	61.12
1.75	1.625	5.66	5.47	66.60
2	1.875	8.61	8.33	74.93
2.25	2.125	8.36	8.09	83.01
2.5	2.375	6.30	6.09	89.11
2.75	2.625	5.13	4.96	94.07
3	2.875	4.51	4.36	98.43
3.25	3.125	1.02	0.99	99.42
3.5	3.375	0.39	0.38	99.80
3.75	3.625	0.09	0.09	99.88
4	3.875	0.07	0.07	99.95
>4.0	4.25	0.05	0.05	100.00

Percentiles	
1	-1.715
5	-1.570
16	-1.020
25	-0.415
50	1.125
75	1.875
84	2.165
95	2.680
99	3.020

Moment Measures	**(phi)**	**(mm)**
Mean	0.903	0.535
Standard Deviation	1.336	0.396
Skewness	-0.260	
Kurtosis	1.860	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	0.573	0.757
Standard Deviation	1.593	1.440
Skewness (1)	-0.347	-0.308
Skewness (2)	-0.358	
Kurtosis	0.334	0.761



Project	**2300**
Location	**Isle of Palms, SC**
Date	**Jul 2010**
Station	**353+00**
Interval	**Low Tide Terrace**
Mean	**0.223 mm**
STD	**0.435 mm**
Skewness	**-1.424**

USCS	**Wentworth**
SP	Fine Sand
Fine Sand	Poorly Sorted
Poorly Graded	Strongly Coarse Skewed
	Leptokurtic

Total weight (gram)	104.41
% finer than 4.00 phi	2.71
% coarser than -1.00 phi	4.06
% $CaCO_3$	18.2

Class Limits (ϕ)	Mid Point (ϕ)	Weight (gram)	Weight %	Cumm. Wt %
-4	-4.5	0.00	0.00	0.00
-3	-3.5	0.00	0.00	0.00
-2	-2.5	0.00	0.00	0.00
-1.5	-1.75	0.00	0.00	0.00
-1	-1.25	4.24	4.06	4.06
-0.75	-0.875	1.26	1.21	5.27
-0.5	-0.625	1.61	1.54	6.81
-0.25	-0.375	1.47	1.41	8.22
0	-0.125	1.41	1.35	9.57
0.25	0.125	1.34	1.28	10.85
0.5	0.375	1.54	1.47	12.33
0.75	0.625	1.30	1.25	13.57
1	0.875	1.28	1.23	14.80
1.25	1.125	0.90	0.86	15.66
1.5	1.375	1.75	1.68	17.34
1.75	1.625	1.38	1.32	18.66
2	1.875	6.14	5.88	24.54
2.25	2.125	11.48	11.00	35.53
2.5	2.375	15.23	14.59	50.12
2.75	2.625	17.04	16.32	66.44
3	2.875	21.90	20.98	87.41
3.25	3.125	5.92	5.67	93.08
3.5	3.375	2.67	2.56	95.64
3.75	3.625	0.83	0.79	96.44
4	3.875	0.89	0.85	97.29
>4.0	4.25	2.83	2.71	100.00

Percentiles	
1	-1.625
5	-0.960
16	1.175
25	1.885
50	2.375
75	2.725
84	2.835
95	3.310
99	4.000

Moment Measures	**(phi)**	**(mm)**
Mean	2.164	0.223
Standard Deviation	1.201	0.435
Skewness	-1.424	
Kurtosis	4.672	
Dispersion		
Standard Deviation		
Deviation from Normal		

Graphic Phi Parameters	**Inman 1952**	**Folk & Ward 1957**
Mean	2.005	2.128
Standard Deviation	0.830	1.062
Skewness (1)	-0.446	-0.504
Skewness (2)	-1.446	
Kurtosis	1.572	2.083