



July 26, 2013

**MEMORANDUM**

TO: Cliff Ogburn, Town of Nags Head (NC)

FROM: HL Kaczkowski, Project Engineer  
TW Kana, Project Director

RE: Nags Head Post-Project Monitoring [CSE 2387–Year 2]  
**Annual Beach Condition Survey – June 2013 – Preliminary Results**

This memorandum offers preliminary results of CSE's June 2013 condition survey of Nags Head. We measured profiles at 500 feet (ft) spacing between the foredune and deep water at the same stations used before and after nourishment. The June 2013 profiles are compared with corresponding profiles obtained in November 2010 (pre-project), November 2011 (post-project), June 2012 (post-project and before 2012 hurricane season), and November 2012 (1 year after the project and after Hurricane *Sandy*). Each survey provides a measure of the total volume of sand contained within the Nags Head littoral zone out to a depth of at least 24 ft NAVD. Similar to prior reports, we have computed the volume of sand contained between the foredune and various reference depth contours. We have also subdivided the shoreline by the same project reaches used in the original design. We use the volumes from November 2010 as the baseline condition (pre-nourishment) and subtract them from the results of subsequent surveys. This yields the change in beach volume since nourishment.

Graph A provides overall results of the 10.0 mile project area relative to November 2010. The first set of bars represent net volume changes along the upper beach and foredune. As of June 2013, the back beach and dune area accumulated over 860,000 cubic yards (~16.3 cubic yards per foot). This is roughly twice the volume of sand placed by trucks (in April 2004) after Hurricane *Isabel* (2003) under emergency funding by FEMA. Figure 1 shows evidence of this accumulation over buried sand fences placed by the Town after completion of the nourishment. The Town and individual property owners have installed additional sand fencing on top of the accreted dunes.

The next three sets of bars in Graph A show the total volume change to ~mean sea level (0 ft NAVD), mean low water (-2.05 ft NAVD) and low-tide wading depth (-6 ft NAVD). The June 2013 survey shows little difference in cumulative sand volumes to these respective contours compared to the November 2011 (post nourishment) condition. Results to -2.05 ft (mean low water) reflect the portion of beach people see. While the volume to this contour has not changed over the first two years of the project, the dry-sand beach now appears narrower in some areas because of dune growth and propagation of vegetation.



The final three sets of bars in Graph A show the cumulative volume (relative to November 2010) to -12 ft, -19 ft, and -24 ft NAVD. The interesting result in June 2013 is a major loss of sand between the -6 ft and -12 ft contours since November 2012. This depth zone is the usual location of an inshore bar. However, sand in the bar shifted seaward during the past winter (generally due to stormy conditions) and accumulated between the -12 and -19 ft contours. The last set of bars in Graph A provide evidence of sand accumulation between the -19 ft and -24 ft depth contours. Given the general balance of volumes to -19 ft for the November 2011 and June 2013 surveys, the added volume between -19 and -24 ft probably reflects onshore sand transport from deeper water. High waves in storms can move sand shoreward in the offshore area. While it is too early to confirm, such results are favorable because it means some nourishment sand lost to downcoast areas (due to longshore spreading) is possibly being replaced by a new source from slightly deeper water.

Figure 2 shows comparative profiles typical of conditions along the ocean front. While the profile “deflated” between -6 ft and -12 ft over the past 7 months, it has built up by an equal volume between the -12 and -19 ft contours.

Graphs B, C, and D provide comparisons of volumes remaining by reach relative to the November 2010 pre-project condition. Graph B shows results to mean low water (-2.05 ft NAVD), and Graphs C and D show results to -12 ft and -19 ft NAVD, respectively. As of June 2013 all reaches are retaining similar volumes as November 2011 to mean low water (Graph C). Graph D shows that there is more variability underwater with Reach 1 (northern half of the project) gaining approximately 200,000 cy (measured between the foredune and -19 ft contour). Reaches 3 and 4, representing the southern ~2 miles of the project area, have lost ~180,000 cy since November 2011. The annual loss rate for Reaches 3 and 4 since November 2011 has been ~11 cy/ft/yr which is consistent with CSE’s design estimates for the reach. Sand losses were projected to be higher along south Nags Head than north Nags Head based on historical trends. The higher rate of loss also reflects sand spreading to the National Seashore.

**In conclusion, the total volume remaining after nourishment to -19 ft NAVD (FEMA-reference limit) in June 2013 is ~4,473,000 cy (97% of the project volume).** There have been negligible volume changes in the project area since November 2011 (post nourishment) with a gain of ~0.4 cy/ft, which is well below design (a loss of 5.2 cy/ft/yr). There was a major loss of sand between the -6 and -12 ft contours between November 2012 and June 2013, but since offshore bars in the Nags Head setting have a natural tendency to move shoreward under fair weather conditions, the configuration of the June profiles are favorable for future accretion in this depth zone.

The results to date indicate the project is performing well. Please contact us if you have any questions about these results. Thank you for your consideration.



**FIGURE 1.** Sand accumulation and vegetation growth over sand fencing placed after nourishment. [Upper] View south near the Comfort Inn. [Lower] View north around Juncos Street. Photos by CSE on 15 July 2013.

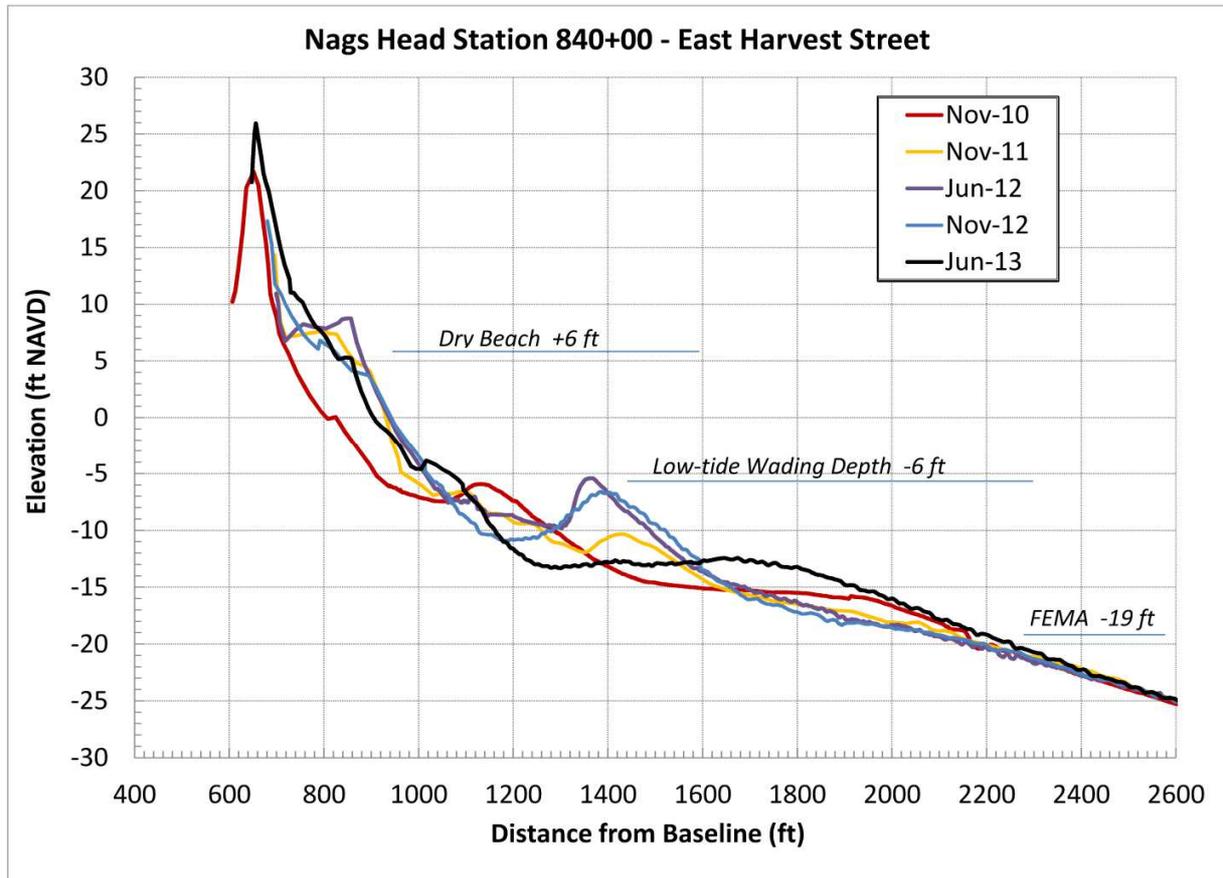
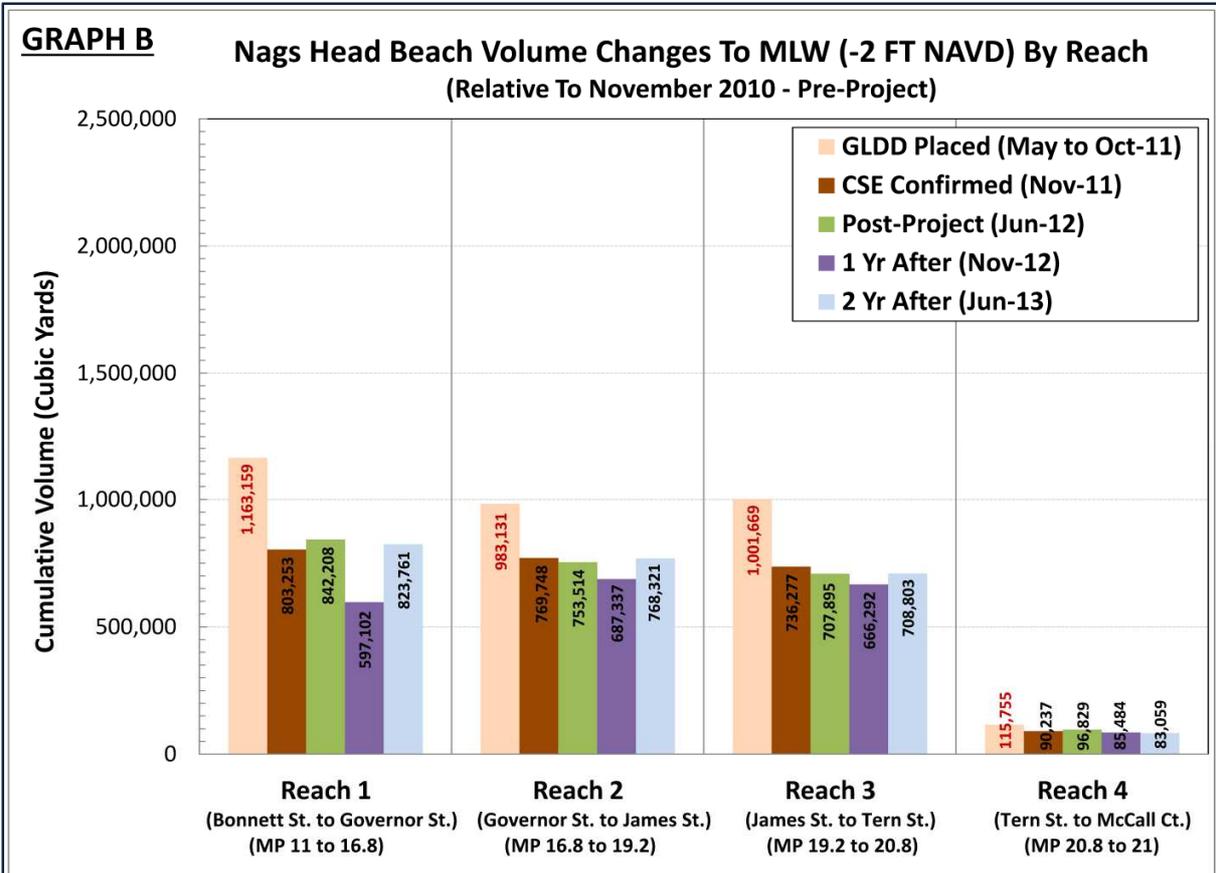
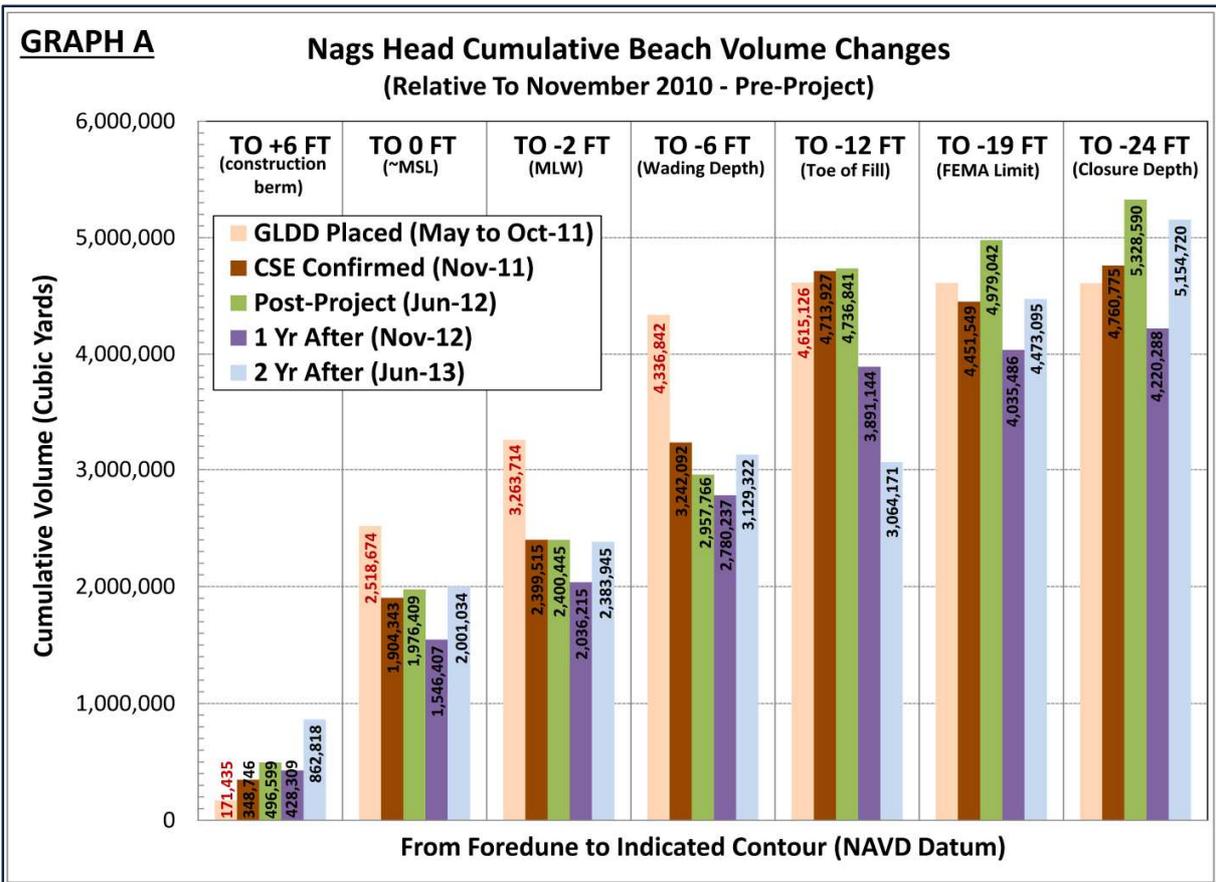


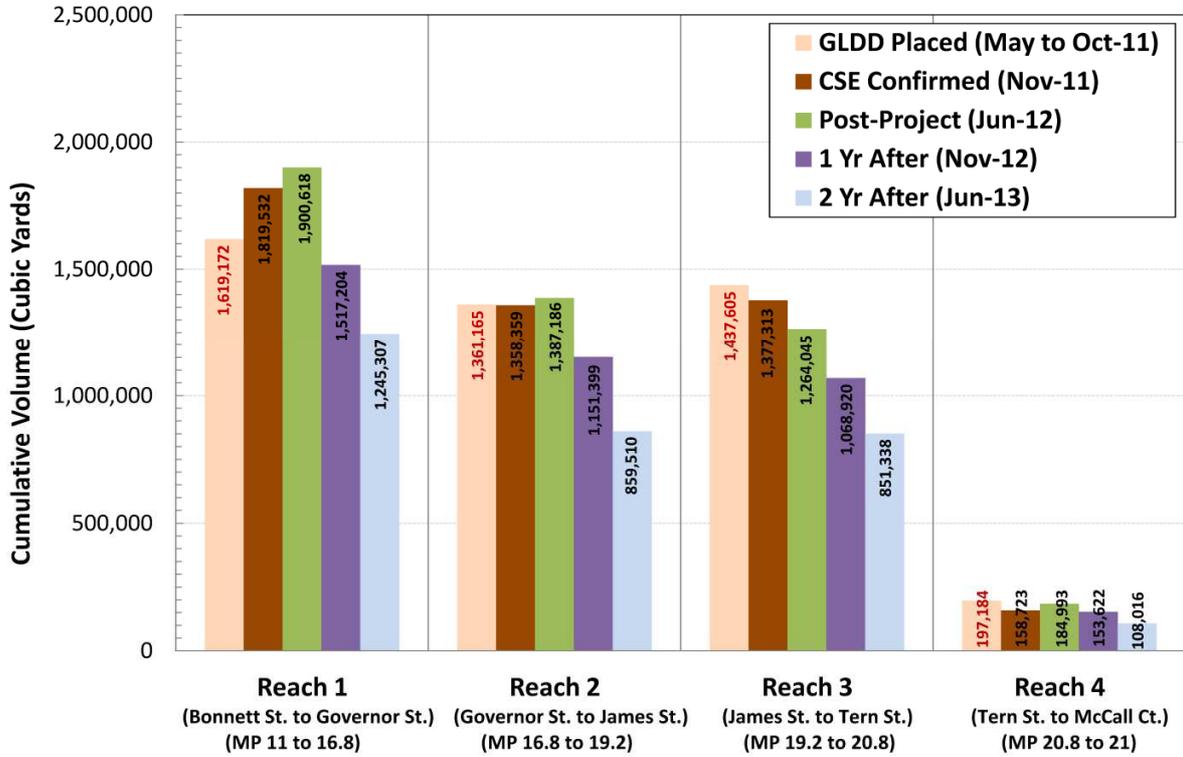
FIGURE 2. Profiles from station 840+00 (Harvest Street) showing large variation in shape but little net change in volume. Note offshore shift of the bar into deeper water between November 2012 and June 2013. This accounts for the drop in sand volume between the -6 and -12 ft contours and the increase in volume between the -12 and -19 ft contours.





**GRAPH C**

**Nags Head Beach Volume Changes To -12 FT NAVD By Reach**  
 (Relative To November 2010 - Pre-Project)



**GRAPH D**

**Nags Head Beach Volume Changes To -19 FT NAVD By Reach**  
 (Relative To November 2010 - Pre-Project)

