



July 19, 2012

Memorandum

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

FROM: HL Kaczowski, Project Engineer
TW Kana, Project Director
SB Traynum, Project Manager

RE: Nags Head Post-Project Monitoring [CSE 2387–Year 1]
Semi-Annual Beach Condition Survey – June 2012 – Preliminary Results

CSE completed a condition survey of Nags Head between 12 and 22 June for purposes of determining the volume of nourishment sand remaining on the beach in the project area. We measured profiles from the foredune to deep water at the same stations used before and after dredging. The calculations treat the beach like a big sand box and give us quantities remaining between the foredune and a particular contour [ie – reference elevation along the beach such as mean low water, or offshore such as 12 feet (ft) below the mean tide level]. We also subdivide the sand box into the same reaches referenced during the project planning: Reach 1 is the northern half of the project, and Reach 4 is the 1,500-ft-long transition zone at the southern end of Nags Head around McCall Court.

Four graphs are included herein. The first shows the overall volumes remaining in the ~10-mile project area. The other three graphs show results by reach from the foredune to a particular contour. Each graph shows the nourishment volume placed within the various portions of the sand box during the dredging operations (tan bars). The brownish-red bars show the sand remaining in November 2011 after Hurricane *Irene* and the fall 2011 northeasters. The green bars show the results of the June 2012 survey.

Late August to early November 2011 was the period of “adjustment” of the new beach. Remember, to build the beach efficiently at lower cost and with more control over sand placement, the contractor was directed to put more sand on the visible beach. Storm waves were then expected to redistribute the sand — at no cost — to a natural configuration (equilibrium profiles). This process at the middle section of the project around Jennette’s Pier was essentially complete by September 2011 in time for the Easterns® Surfing Championships. Some sand moved from the visible beach to the nearshore zone (inside the 12-ft depth contour). This formed a gentler slope and made the surf break more favorable for the tournament. We found in November 2011 that there were about 4,714,000 cubic yards (cy) more sand in the “sand

box” measured to the 12-ft contour compared with November 2010 (same-season comparison). This was confirmation of the nourishment volume of ~4,615,000 cy reported by the contractor.

The June 2012 survey shows some favorable results. Start with Graph A and look at the fifth set of bars from the left. This shows that, overall, there are ~4,737,000 cy more sand in the project area measured to the 12-ft depth contour than there were in November 2010 (before nourishment). This result is so similar to the November 2011 condition that it can be considered — no change. Similarly, the third set of bars from the left (measuring the volume contained on the **visible** beach between the foredune and mean low water) remained virtually the same between November 2011 and June 2012 (at ~2,400,000 cy).

The other changes of note in Graph A are seen in the first and last sets of bars. The left-hand bars show the sand accumulation at the base of the foredune. Since project completion, this area has increased from ~171,000 cy to nearly 500,000 cy. The increase averages about 6 cubic yards per foot (cy/ft) which, coincidentally, is similar to the volume of sand trucked into place for dune restoration after Hurricane *Isabel* (2005). The buildup along the backbeach since project completion is due to washovers and wind-blown sand. This volume will help rebuild the foredune and bury exposed sand bags. The right-hand bars show an increase in sand volume measured to –19 ft or –24 ft depths. The increase (~550,000 cy or ~10 cy/ft) likely represents accretion from deeper water. Large, long-period waves associated with distant storms can move sand landward over the gentle slopes of the continental shelf. We cannot be sure this occurred off Nags Head this past winter, but we have clear evidence the gain was not at the expense of the project. Otherwise, we would not have detected 4.7 million cubic yards remaining **landward** of the 12-ft depth contour.

A simple way to interpret the results of Graph A is to cover up all the bars except the fifth set from the left. Measurements to –12 ft show the full nourishment volume remains in the project area and is essentially unchanged since November 2011.

The other three graphs provide results by reach. Graph B represents the volumes remaining between the foredune and mean low water (~2 ft below mean tide level). Note that Reach 1 gained ~40,000 cy; Reach 2 lost ~15,000 cy; and Reach 3 lost about 30,000 cy to that contour. These are relatively small changes but they suggest that some sand shifted north from Reach 2 to Reach 1 and some sand shifted from Reach 3 to Reach 4 (downcoast transition zone).

Graph C shows the volumes remaining between the foredune and the –12-ft contour. [All nourishment sand was placed landward of this contour.] The results show increases of ~80,000 cy in Reach 1 and 30,000 cy in Reach 2. Reach 3, which includes Seagull Drive, lost ~113,000 cy (~8 percent of the volume placed). Some of the Reach 3 loss likely shifted to Reach 2 and Reach 4 given the fact that the



project left a bulge in the shoreline along Reach 3 because a higher density of fill was placed there to accommodate the higher, historic erosion rate along south Nags Head. The favorable result of Graph C is the evidence of northerly transport during the past six months. Northerly transport tends to increase the life of the project because the sand remains along Nags Head rather than shifting quickly to the National Seashore.

The final graph (D) extends the calculation to the –19-ft contour which is the depth limit established for FEMA reimbursement of sand losses. This result shows a gain of ~400,000 cy in Reach 1 (~14 cy/ft), ~75,000 cy in Reach 2 (~6 cy/ft), and 15,000 cy in Reach 3 (~1.5 cy/ft). The transition zone (Reach 4) gained ~35,000 cy (~23 cy/ft).

Key Findings

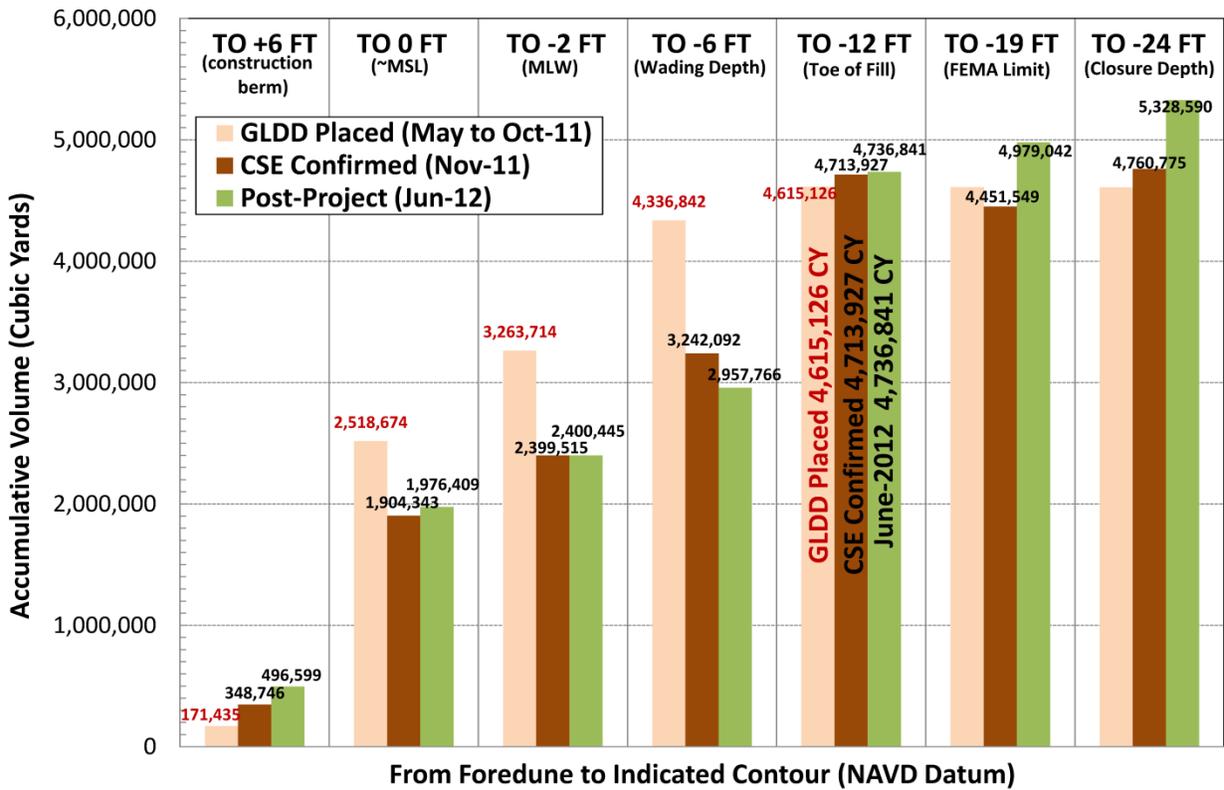
So to summarize, Nags Head in June 2012 retains virtually the same volume of sand (~4.7 million cubic yards) within the project area between the foredune and the –12-ft depth contour and has not lost any nourishment volume. A relatively small quantity of nourishment sand has shifted from south Nags Head (Reach 3) to Reach 1 and Reach 2 (northern 8 miles) and Reach 4 (southern one-quarter mile). Winter waves appear to have shifted an additional 550,000 cy from deep water into the zone between –12 ft and –24 ft depths. The project design anticipated **average** annual losses of ~275,000 cy per year; therefore, these results from the June 2012 survey indicate the project is performing better than expected.

Please contact us if you have any questions about these results. Thank you for your consideration.



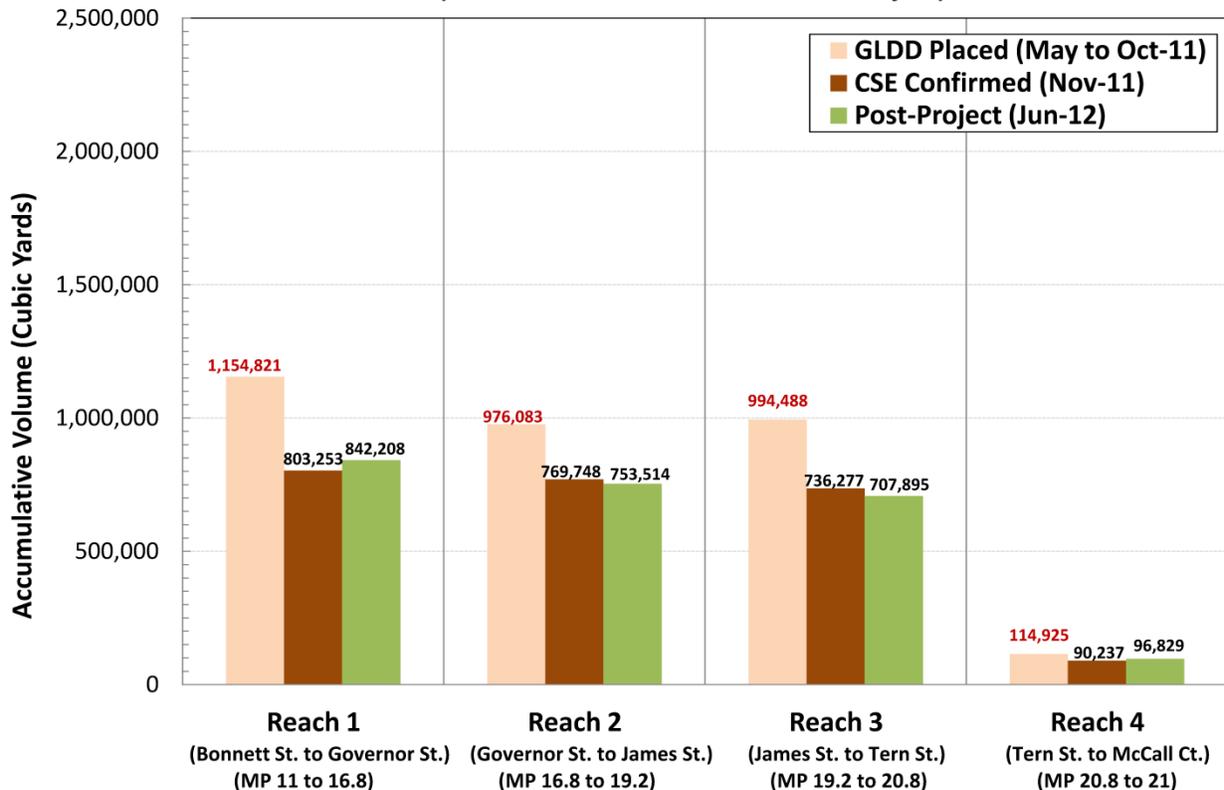
GRAPH A

**Nags Head Accumulative Beach Volume Changes
 (Relative To November 2010 - Pre-Project)**



GRAPH B

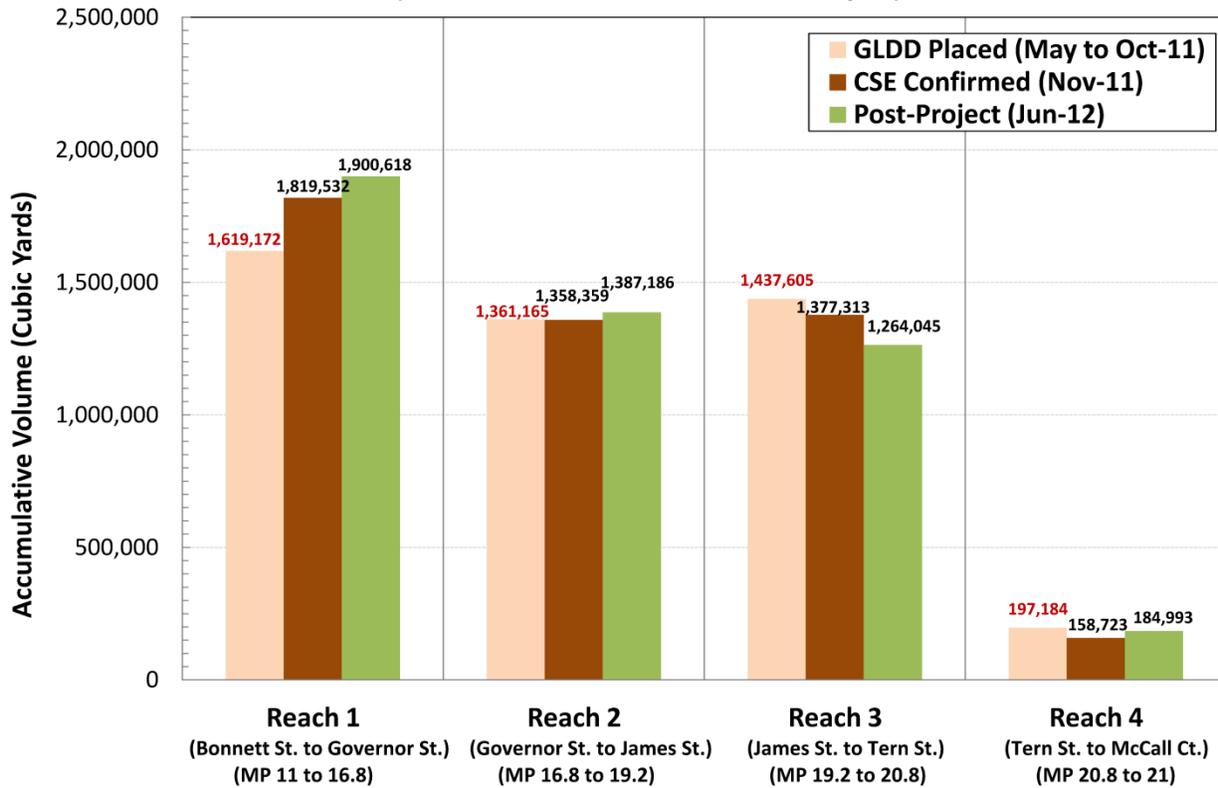
**Nags Head Beach Volume Changes To MLW (-2 FT NAVD) By Reach
 (Relative To November 2010 - Pre-Project)**





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)

