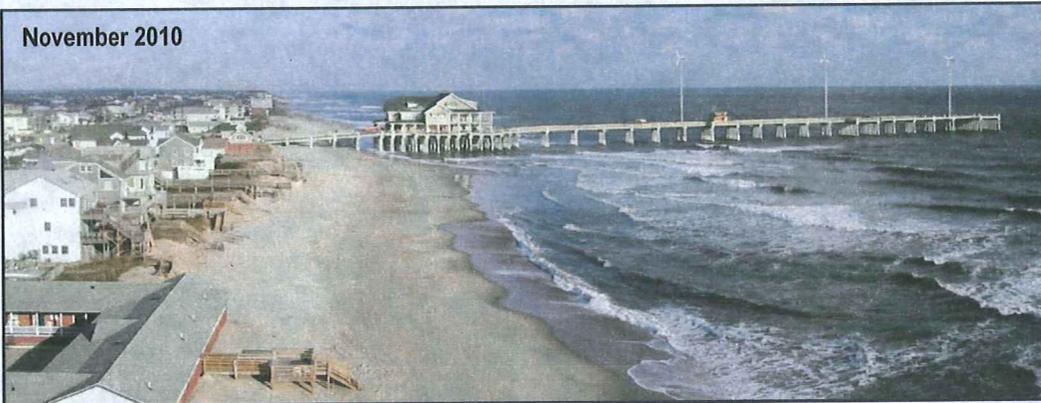


**MONITORING AND ANALYSES  
OF THE 2011 NAGS HEAD  
BEACH NOURISHMENT PROJECT**

**2012 BEACH MONITORING**

November 2010



June 2012



*Prepared for:*

**Town of Nags Head  
Dare County North Carolina**



**Monitoring and Analyses of the  
2011 Nags Head Beach Nourishment Project**

**2012  
BEACH MONITORING REPORT**

*Prepared for:*

Town of Nags Head  
PO Box 99 Nags Head NC 27959

*Prepared by:*

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[CSE2387-YR1]  
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**COVER PHOTOS:** Governor Street looking northeast on the roof of Comfort Inn. The width of the beach from the toe of dune (at +9 ft NAVD) to mean low water (at -2.05 ft NAVD) was 170 feet before the nourishment project and 315 feet one year after the project. New vegetation lines and a protective dune are evolving rapidly.

**[UPPER]** November 2010 — before nourishment. [Photo by Trey Hair]

**[LOWER]** June 2012 — after nourishment.

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## EXECUTIVE SUMMARY

This report presents results of physical monitoring surveys for 2012 along Nags Head (NC) following construction of the 2011 nourishment project (24 May to 27 October). The Beach Monitoring & Maintenance Plan (Ogburn 2011) prescribes methodology and requirements for annual monitoring after nourishment to satisfy special conditions of the permits and to provide a measure of beach condition each year. Annual surveys define the condition of the beach prior to major storm events and are used by FEMA for evaluation of post-disaster claims for beach restoration under Category G community assistance grants. The scope of monitoring is detailed in a proposal and agreement dated 20 April 2012 between the Town of Nags Head and CSE, and is summarized in Section 2.0 of the present report.

CSE performed comprehensive surveys of the beach and inshore zone in June and November 2012 as part of the Year 1 monitoring effort. These data were compared with similar surveys obtained in November 2010 (pre-project) and November 2011 (post-construction). The surveys allow detailed calculations of volume changes by reach and by depth contour, and provide a direct measure of nourishment volume remaining. The present analysis is based on profiles at 500-foot (ft) spacing encompassing four project reaches and two adjacent reaches (upcoast and downcoast).

The present report includes a description of the project setting, design, and nourishment volumes by reach (Table A). The project extended from station 497+00 (Bonnett Street) to station 1025+00 (McCall Court), a length of 52,800 linear feet (10 miles). Total volume placed was 4,615,126 cubic yards (cy), with 4.71 million cubic yards confirmed change between November 2010 and November 2011. During the period of construction, Hurricane *Irene* (27 August) impacted the project area, but produced no net loss of sand (CSE 2012, Kana et al 2012).

**TABLE A.** Summary of fill volume versus design volume for each reach based on before-dredging and after-dredging surveys by GLDD and November 2010 (pre-project) and November 2011 (post-construction) surveys by CSE. Volume calculations for the November 2011 survey extended to the -12-ft depth contour ~800 ft from the foredune.

Reach	Limits	Length (ft)	CSE Design Volume (cy)	GLDD Applied Fill Volume (cy)	Diff between Design and Fill (%)	CSE Verified Volume (cy)
1	497+00 to 790+00	29,900	1,634,700	1,645,812	0.68%	1,819,532
2	790+00 to 920+00	13,000	1,366,500	1,405,498	2.85%	1,358,359
3	920+00 to 1010+00	9,000	1,480,000	1,423,771	-3.80%	1,377,313
4	1010+00 to 1025+00	1,500	118,800	140,045	17.88%	158,723
<b>Total</b>	<b>497+00 to 1025+00</b>	<b>52,800</b>	<b>4,600,000</b>	<b>4,615,126</b>	<b>0.33%</b>	<b>4,713,927</b>

Year 1 monitoring included a comprehensive survey in June 2012. The results confirmed there was negligible change in sand volume from November 2011 to June 2012 measured between the foredune and -12 ft NAVD depth contour. A total of 4,736,841 cy were detected within these project boundaries in June 2012 (versus 4,713,927 cy measured in November 2011). These volumes are relative to the November 2010 pre-project condition and, therefore, reflect the impact of nourishment. The June 2012 survey also detected an additional 242,200 cy gained between the -12 ft and -19 ft contour, and 591,750 cy gained between the -12 ft and -24 ft contour. In short, by June 2012, there was significantly more sand gained in the project area (measured into deep water) than was placed in the nourishment project. The overall results are shown as green bars in Figure A. A breakdown of results by reach is given in Section 6.0 of the report.

Following the June 2012 survey, a series of northeasters and Hurricane *Sandy* (28 October 2012) impacted the project area. CSE's second survey of 2012 (planned under the present scope of services) was accomplished within ~2 weeks after *Sandy*. The timing of this survey was fortuitous after the storm. Results (purple bars in Figure A) confirm that the project area lost upward of 846,000 cy (measured to -12 ft) between June 2012 and November 2012. Losses to the -19 ft contour (FEMA – reference contour) totaled nearly 945,000 cy, relative to the June 2012 condition and ~416,000 cy relative to the November 2011 post-nourishment condition.

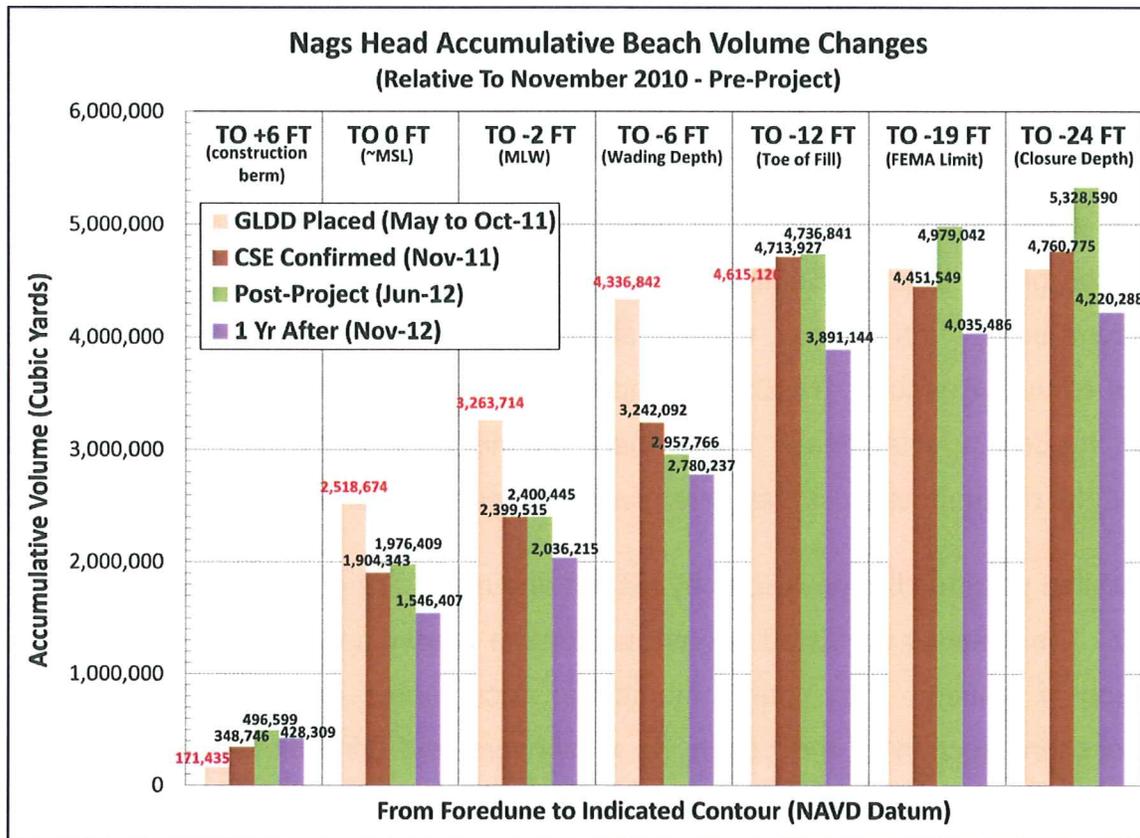


FIGURE A. Accumulated overall beach volume changes relative to November 2010 survey results between the foredune and indicated contours.

As Figure A illustrates, the overall changes in sand volume vary with the depth contour used as a reference. The deeper contours introduce more error because the changes are applied over a much broader beach zone. Nevertheless, **results confirm that at least 4 million cy remain in the project area.** This implies ~600,000 cy have been lost since November 2010, or an average of ~300,000 cubic yards per year (cy/yr). The project design was based on average annual losses of ~275,000 cy. This is considered a favorable result because of the storms that have impacted Nags Head since 2010, particularly *Irene* and *Sandy*.

Surveys along the upcoast and downcoast reaches extending about one mile in either direction from the project area indicate there are an additional 255,000 cy (upcoast) and 197,000 cy (downcoast) as of November 2012 relative to the pre-project condition. Therefore, some of the losses within the project area are

accounted for in gains upcoast and downcoast. These results are one indication of nourishment spreading in either direction although the magnitudes are relatively low compared with the overall nourishment volume.

The present report also includes results of compaction tests and representative photos of the beach. Sediment compaction was found to be comparable to the natural beach. As a result, officials at North Carolina Department of Environment and Natural Resource (NCDENR) and US Army Corps of Engineers (USACE) did not request special beach tilling ahead of the 2012 sea-turtle nesting season. Results of compaction surveys are given in Section 3.0 and Appendix 2.

Detailed volume change results by station and reach are given in Sections 5.0 and 6.0. The volumes are listed for various contour intervals to allow detailed interpretation of results. The Year 1 monitoring documented continued buildup of the backshore section of the beach via washovers and wind-blown sand. Fencing placed by the Town along portions of south Nags Head has been effective in trapping sand and building up the foredune. This effort should be continued with installation of additional fencing where the buildup has buried the original fence line.

CSE expects the dry sand beach to narrow as the nourishment project continues to adjust. Narrowing will occur for three reasons:

- 1) Washover and wind-blown sand shifts significant volumes to the back beach and higher elevations where it provides additional storm protection to the community.
- 2) Chronic erosion and spreading of the nourishment will carry some sand offshore or downcoast.
- 3) As the backshore is raised and out of range of storm tides, vegetation will propagate, leaving a narrower dry sand beach.

Perceptions of nourishment performance are often based on visual observations of the dry-beach width. The volume data herein are intended to offer an unbiased measure of nourishment performance.

CSE confirmed that Hurricane *Sandy* and other fall storms in 2012 produced measurable sand losses in the project area (order of ~10 percent). However, Dare County did not obtain a disaster declaration which is necessary to apply for FEMA Category G restoration funds. The fact that the net losses to date track with the average annual loss rate on which the project was designed confirm the project is performing well despite the storm impacts.

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