Town of Nags Head
BEACH MONITORING AND MAINTENANCE PLAN
Dare County, North Carolina

August 2011

Prepared by:

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Adopted by:
The Town of Nags Head Board of Commissioners
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Purpose

The purpose of the Beach Monitoring and Maintenance plan is to:

1. Provide a brief overview of the morphological setting of the Town of Nags Head.
2. Detail the construction of the Town of Nags Head's initial beach nourishment project.
3. Briefly summarize the Town's funding for the initial beach nourishment project.
4. Specify the physical beach monitoring activities.
5. Detail the beach maintenance planning guidelines.
6. Relate a plan for periodic renourishment funding.

(1) Morphological Setting of Nags Head, NC

The Town of Nags Head encompasses ~11 miles of ocean shoreline on North Carolina's Outer Banks, a chain of barrier islands along the Atlantic Ocean, 90 miles south of Norfolk, Virginia.

The initial beach nourishment project totals ~10 miles of shoreline beginning ~1 mile from the town's northern limit, near the Bonnett Street public beach access, extending south to the town line adjacent to the Cape Hatteras National Seashore.

The Town faces east to northeast and is bordered by the Town of Kill Devil Hills to the north and the Cape Hatteras National Seashore to the south. The Roanoke Sound borders the town on the west and the Atlantic Ocean makes up the town's eastern limits. Oregon Inlet, the closest inlet to Nags Head, is located ~5.2 miles south of the town line. Due to its location, Nags Head has sustained chronic erosion over the past 50 years due to storms and sand losses. Erosion rates ranging from ~2 feet per year (ft/yr) to upward of 10 ft/yr (NCDENR 1998, 2004) have forced abandonment of property and left numerous structures with no dune protection. The Town is exposed to high wave energy during storm events (particularly hurricanes and northeasters) which are common in fall and winter. Net sand transport is south along Nags Head. Erosion rates increase from north to south and remain high in the National Seashore reach between Nags Head and Oregon Inlet. There are presently three ocean piers and five stormwater outfalls crossing the beach along the Town of Nags Head. The beach is composed of medium sand with a mean grain size of ~0.4 mm. Mean monthly average significant wave height ranges from 2.1 ft (July) to 3.9 ft (Oct) based on records from 1986-2006 (source: USACE-FRF unpublished data). Details regarding the morphological setting are given in CSE (2005) and CSE (2011a).

(2) Initial Beach Nourishment Project Design

The initial project encompasses the same section of Nags Head shoreline as the "South Project Area" of the Dare County Hurricane Protection and Erosion Control Project (federal project), which has been in planning since the initial authorization by the US Congress on August 1, 1990. Funding for construction of the federal project has never been approved.

Nags Head's initial beach nourishment project consists of excavating, by hopper and cutterhead suction dredges, 4.6 million cubic yards of beach-quality sediment from ocean borrow area(s) situated ~2-3 miles offshore of the project area. Figure A summarizes the project plan. Figure B shows the basic cross-section on which the profile volume analysis for the plan is based. The borrow areas are within the originally proposed area designated "S1" to be used in the federal project. Nags Head is using only a small portion of the federally designated area. Sediment is being pumped onto the beach between the toe of the existing dune and the low waterline, and is being shaped by bulldozers into a profile that closely matches the contours and elevations of the natural beach. The dry beach elevation for the initial nourishment is +6 ft NAVD (~7.0 ft NGVD).

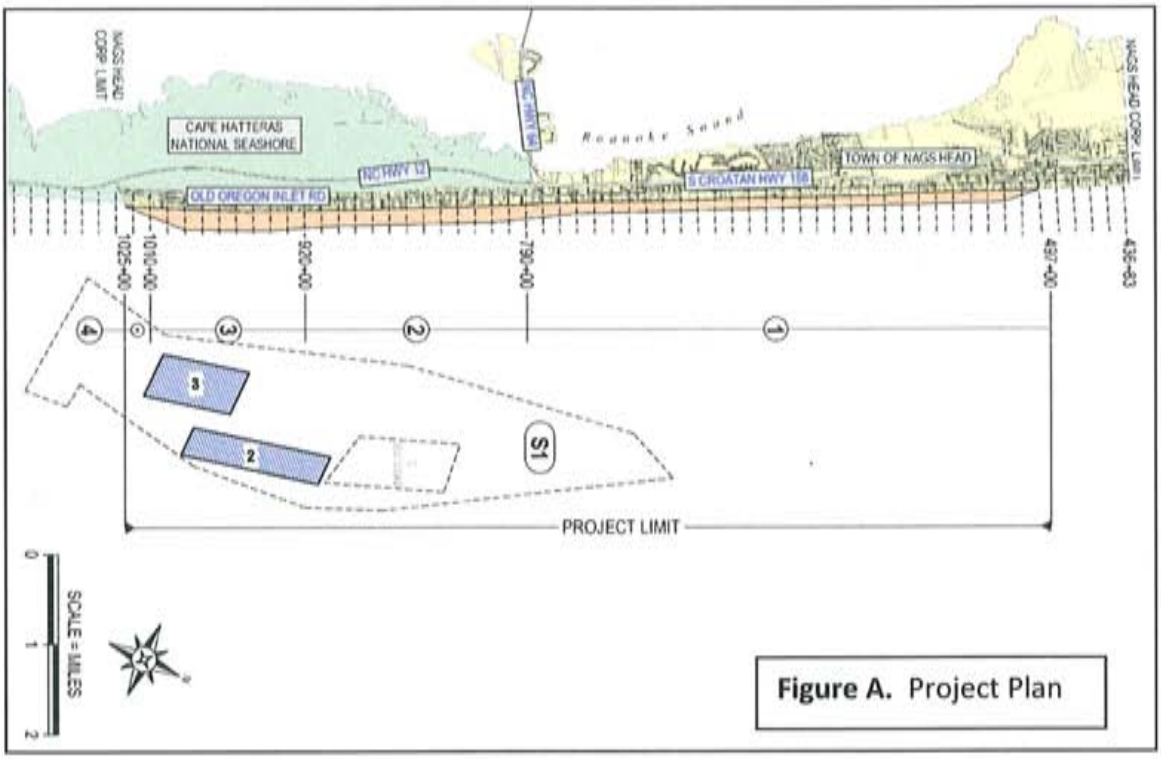

Figure A. Project Plan

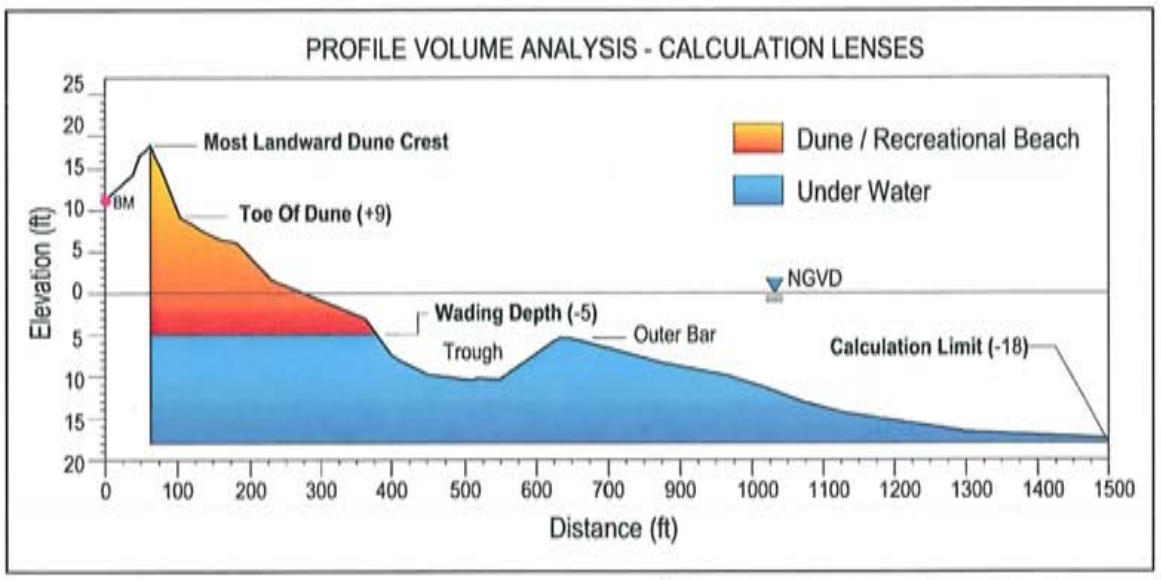

Figure B. Basis of design profiles

Approximately 50% of the excavations are being deposited by run-out from the discharge point between mean lower water and the outer bar (~500 ft offshore). Typical fill sections add ~60–160 cubic yards per linear foot (cy/ft) of beach and, upon adjustment, are expected to advance the shoreline 50 to 125 ft. The work covers 10 of Nags Head's 11 miles of coast and includes 4 reaches (from north to south):

- Reach 1 – 5.5 miles, up to 1.74 million cubic yards, base fill approximately 50.5 cy/ft
- Reach 2 – 2.5 miles, up to 1.3 million cubic yards, base fill approximately 90 cy/ft
- Reach 3 – 1.7 miles, up to 1.44 million cubic yards, base fill approximately 140 cy/ft
- Reach 4 – 0.3 miles, up to 120,000 cubic yards, base fill approximately 70 cy/ft

Construction of the project began on May 24th, 2011 and is expected to be completed by mid-September 2011. As of August 22nd , 2011, approximately 80% of the project was complete with an estimated 3.75 million cubic yards in place along 37,500 linear feet of beach. Three hopper dredges were on site and continuing to place sand in uncompleted sections of the project area according to approved state and federal permits and plans and specifications prepared by Coastal Science & Engineering (Project Engineer). The federal permit for the project is given in Attachment 1. Project plans are given in Attachment 2. The purpose of the project and basis of the design is given in Attachment 3. The final EIS for the project is contained in USACE (2010). Detailed specifications for the project are contained in CSE (2011b).

(3) Initial Beach Nourishment Project Funding

Construction funding for the Federal Dare County Hurricane Protection and Beach Erosion Control Project has never been appropriated. Therefore, Nags Head, to meet the urgent problem of erosion in the town, is using local funding for its initial project. Funding includes:

- $18 million in cash from the Dare County Beach Nourishment Fund (fund will replenish $3-$3.5 million/year from the 1% occupancy tax that it currently receives)

- $18 million revenue bond to be paid back over 6 years with proceeds from a 1% increase to the occupancy tax. The 1% tax increase will generate about $2 million/year. Nags Head will be using the $2 million/year revenue for 5 years to pay back $10 million of the bond.

  The remainder of the bond will be paid back through an increase in taxes. The Board has adopted a town-wide tax increase of 2 cents (from last year's town tax rate of 15.75 cents to 17.75 cents) and a tax increase of 16 cents for the ocean-side properties from Bonnett Street (about Mile Post 11.25) south to the National Park Service line.

- $1 million from the Town's general fund (to cover engineering costs)

(4) Monitoring

The Town of Nags Head's initial beach nourishment project and all subsequent renourishment projects currently comply and will comply with all federal and state required environmental monitoring including sea turtle and benthic organism monitoring. All fieldwork for pre-project environmental monitoring has been completed, and the Year 1 report is expected to be completed by September 2011. The Town has committed funds to cover up to two years (up to eight quarterly monitoring events) after completion of construction in accordance with the special conditions of state and federal permits.

In addition, the Town will perform physical beach monitoring, which is a non-permit initiative that is directly attributable to FEMA requirements for disaster assistance to repair improved beaches. Details of the physical monitoring are given in Attachment 4. Systematic condition surveys and computations of nourishment volumes remaining will be based on a set of beach and inshore profiles into deepwater used for the project design. The reference baseline and stationing for the

Nags Head project is consistent with pre-project federal surveys and profile data collection by the project engineer between 1994 and 2011. Volume change computations will reference the same stations and depth contours on which the design was based. In accordance with the engineering analyses, the basis of the Nags Head beach nourishment design was the beach condition measured between the toe of the foredune and −18 ft NGVD*. An average annual volumetric sand loss rate was determined for each project reach. The design nourishment volume was varied by reach according to the sum of ten (10) times the average annual volumetric erosion rate plus an ~50% safety factor (overfill) so as to provide benefits in the form of a healthier beach for up to ten years.

*[*USACE surveys and the Town of Nags Head's preliminary design (CSE 2005, 2007) were based on surveys referencing NGVD datum. Subsequent final design documents were based on NAVD datum which is 0.96 ft above NGVD datum at Nags Head (source: http://www.ngs.noaa.gov/cgi-bin/VERTCON/vert_con.prl).]*

(5) Beach Maintenance Planning Guidelines

In accordance with FEMA Publication 321 (Appendix B) and Code of Federal Regulations 44 CFR 206.226 (j), a maintenance program involving periodic renourishment of sand must be established and adhered to by the applicant (Town of Nags Head) to qualify for FEMA assistance.

The Town's beach nourishment engineer, Coastal Science & Engineering, has determined that average annual sand losses for 1994-2005 were ~275,000 cubic yards per year (cy/yr) (ie – ~6% of the permitted nourishment volume per year). Subsequent surveys (2006-2010) show lower loss rates for the period 1994-2010 on the order of ~275,000 cy/yr.

The Town intends to renourish the beach at 6 years, unless ~50% or more of the initial nourishment sand remains on the beach within the project boundaries calculated to −18 ft NGVD.

If 50% or more of the sand remains on the beach at 6 years post initial project, then renourishment would commence when 50% or more is lost. The Town understands that erosion rates will vary along the length of the project and is basing these projections on the law of averages which has been found to apply in other nourishment projects (Dean 2002).

The Town's US Army Corps of Engineers beach nourishment project permit allows for the placement of up to 4.6 million cubic yards of sand. For planning purposes and future renourishment, the Town has adopted an annual loss rate of 275,000 cy/yr after initial nourishment.

Therefore, the six-year post-nourishment loss (if we assume an annual loss rate of ~400,000 cy/yr) would equate to ~2.3 million cubic yards of sand (ie – one-half the nourishment volume placed in the initial project).

Therefore, 6 years post initial nourishment, if we assume an annual loss rate of 400,000 cy/yr for a total 6-year loss of 2.3 million cubic yards of sand, there will be no need to conduct renourishment.

However, if 6 years post-nourishment, Nags Head has lost more than 2.3 million cubic yards of sand, the Town will renourish the beach.

To determine nourishment volume remaining post initial project, Nags Head will conduct annual condition surveys which report the nourishment volume remaining (percent lost) and the unit-width volumes by reach relative to a target unit volume (to be determined).

(6) Periodic Renourishment Funding

The Nags Head Board of Commissioners (at their 1 December 2010 meeting) proposed funding the maintenance plan through the Town's share of occupancy tax or a special assessment.

REFERENCES

CSE. 2005 (August). Preliminary coastal engineering analyses for large-scale beach restoration at Nags Head. Technical Report for Town of Nags Head (NC). CSE, Columbia, SC, 88 pp + three appendices.

CSE. 2007. Biological assessment for Nags Head beach restoration project, Dare County, North Carolina (submitted in conjunction with EIS for Action ID SAW 2006-40282-128). Appendix H, Draft EIS for US Army Corps of Engineers, Washington Regulatory Field Office, NC. CSE, Columbia (SC), 104 pp + 13 attachments.

CSE. 2011a. Coastal engineering & geotechnical analyses for beach nourishment, Nags Head, North Carolina. Draft Final Design Report for Town of Nags Head, NC. CSE, Columbia (SC), 163 pp + appendices.

CSE. 2011b. Nags Head beach nourishment, Dare County, North Carolina. Final Project Manual for Construction for Town of Nags Head, NC. CSE, Columbia (SC).

Dean, RG. 2002. *Beach Nourishment: Theory and Practice*. World Scientific, NJ, 399 pp.

NCDENR. 1998, 2004. Long-term average annual shoreline change study and setback factors. NC Department of Environment and Natural Resources, Raleigh (updated Feb 2004) [see http://dcm2.enr.state.nc.us/maps/ER_1998/SB_Factor.htm]

USACE. 2010 (MAY). Final environmental impact statement, beach nourishment project, Town of Nags Head, North Carolina. US Army Corps of Engineers, Wilmington District, Washington Regulatory Field Office, NC (Action ID SAW-2006-40282-182), 164 pp+ executive summary, references, and appendices.