

**Mound Study Project
Cape Fear, North Carolina
Report Summary
VIMS Reports: CHSD-2003-02 to CHSD-2003-06
EHI Project No. 6000.21**



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Final VIMS Report CHSD-2003-01
Prepared for Evans-Hamilton, Inc
By

Grace M. Battisto and Carl T. Friedrichs
Phone: 804-884-7606, -7303; Fax: 804-684-7198
Email: battisto@vims.edu; cfried@vims.edu

**Department of Physical Sciences
Virginia Institute of Marine Science
Gloucester Point, VA 23062**

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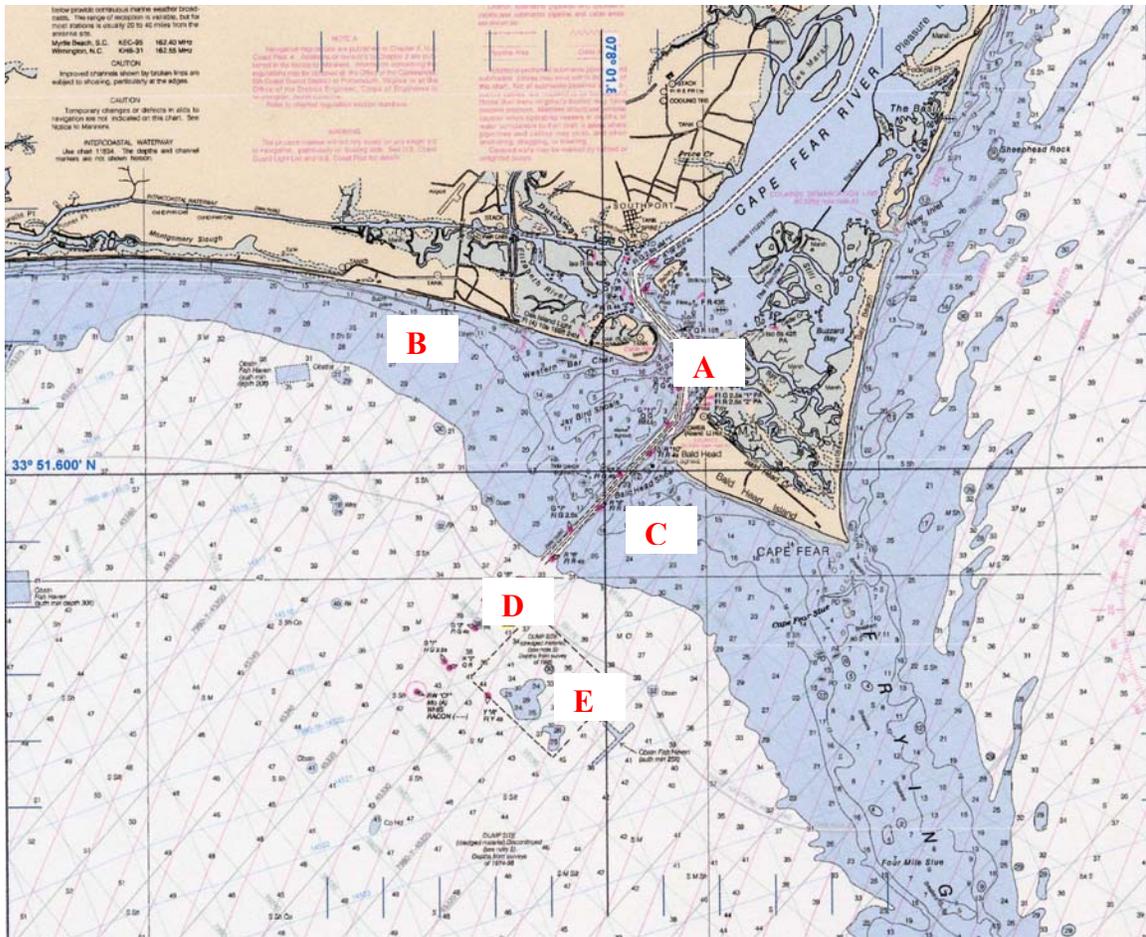


Figure 1. Section of NOAA chart 11536 (Approaches to Cape Fear River). Sites A through D represent the Harbor, Oak Island, Bald Head Island and, 11-Mile sites, respectively, visited during the first field survey in May 2001. Site E represents the four sites on and around the disposal mound.

1. INTRODUCTION

This work was conducted in support of an ongoing investigation on sediment dispersal and evolution of a mixed-sediment disposal mound off Cape Fear, NC, by the US Army Corps of Engineers (USACE) and Evan-Hamilton, Inc. (EHI), project number 6000.21. Five reports were generated from the work performed by the Virginia Institute of Marine Science (VIMS), College of William and Mary, under the direction of Grace Battisto. The first three reports document data collected during three field surveys conducted around the entrance of the Cape Fear River (Figure 1). The first report, *Initial Water Column Profiles and Sediment Grabs* (VIMS Report CHSD-2003-02), describes data collected during the first field survey conducted in May 2001. The second report, *Water*

Column Profiles (VIMS Report CHSD-2003-03), contains data collected during the second field survey conducted in July 2001. The third report, *Mound Surface Sediment Characterization* (VIMS Report CHSD-2003-04), summarizes data collected during the third, and final field survey conducted in September 2001. The fourth report, *Pre-Deployment Calibration of OBS and ADV Sensors* (VIMS Report CHSD-2003-05), documents the results from the calibration of Optical Backscatter (OBS) and Acoustic Doppler Velocimeter (ADV) sensors performed in June and July 2001, before deployment of the sensor arrays on bi-pods by USACE and EHI. The fifth report, *Sediment Entrainment Devices* (VIMS Report CHSD-2003-06), contains the laboratory results of sediment collected in the Sediment Entrainment Devices (SED) from June 2001 through November 2002.



Figure 2. Deployment of profiler during the first field survey to collect on May 1, 2001.

1. SUMMARY

2.1 Initial Water Column Profiles and Sediment Grabs

VIMS report CHSD-2003-02 describes the results of a field survey conducted at sites corresponding to future locations of Acoustic Doppler Current Profiles (ADCP) or Optical Backscatter Sensors (OBS) mounted on bi-pods to be deployed by USACE and EHI on the site of the disposal mound and in the immediate vicinity. The data collected in this survey provide an initial characterization of the bottom sediment and overlying water column. For this survey the R/V Langley was anchored at eight sites on May 1, 2001. One in the harbor, one off Oak Island, one off Bald Head Island, four on and around the dredge spoil disposal mound, and one at the 11-mile site (Figure 1). At each site water column profiles, suspended sediment concentration samples, and bottom sediment grabs were collected. Percent distributions by weight of clay (<20 microns), silt (20-63 microns), sand (63-2 mm) and gravel (>2mm) of the bottom sediment collected at each site were determined by wet sieve and pipette analysis methods. Grain size distribution of the sand fraction was determined by the Rapid Sand Analyzer (RSA).

Water Column profiles were collected by lowering a profiler equipped with a conductivity, temperature and depth sensor (CTD), a Laser *in-situ* Scattering Transmissometer (LISST-100), an ADV, a compass and a submersible pump deployed through the water column in real-time mode. The submersible pump was used to collect water samples for determining the suspended solid concentrations of the mud fraction (0.7-60 microns) and the sand fraction (>60 microns) by gravimetric methods and also the organic component (portion volatile at 550 degrees C) of each fraction.

2.2 Water Column Profiles

VIMS report CHSD-2003-03 contains the results of the second field survey. In this survey repetitive water column profiles and pump samples for suspended sediment



Figure 3. Collection of at least 10 liters of water pumped from depth in churn splitter during July 2001 field survey. An aliquot was split from each sample, filtered on board R/V Langley and analyzed later for Suspended Solids.

concentration were collected for calibration of ADCP and OBS sensors deployed on the long-term deployment stations maintained by USACE and EHI. The pump samples collected for this survey will be used by John Land and EHI personnel to calibrate the SEDIVIEW software program designed to convert ADCP backscatter to suspended sediment concentrations. LISST 100 and calibrated OBS backscatter data collected during water column profiles will be used by John Land in another study for comparison purposes with the SEDIVIEW suspended sediment concentration results.

For this survey the R/V Langley was anchored at four sites between July 24 to July 26, 2001: two in the mouth of the Cape Fear River, one on the mixed-sediment dredge spoil mound located offshore, and one off the beach of Bald Head Island. The sites correspond to bottom mounted ADCP long-term deployment stations. At each anchor site a series of “stations” were performed. At each of these stations a profiler equipped with a CTD,

OBS, LISST-100, ADV, compass and submersible pump was deployed in real-time mode for data collection. Also mounted on the profiler was a LISST-25 provided by Chuck Pottsmith of Sequoia Inc., Redmond, WA, using an internal data collection mode. The profiler was lowered from a near surface depth to a near bottom depth to collect a “profile” of the water column at the beginning of the station. The profiler was then raised from the bottom depth to a depth that corresponded to an ADCP bin depth that would contain good data, and the profiler was then kept at that depth while at least 10 liters of water were pumped to the surface and collected in a churn splitter. An aliquot of the sample from the splitter was collected for determining the suspended solid concentrations

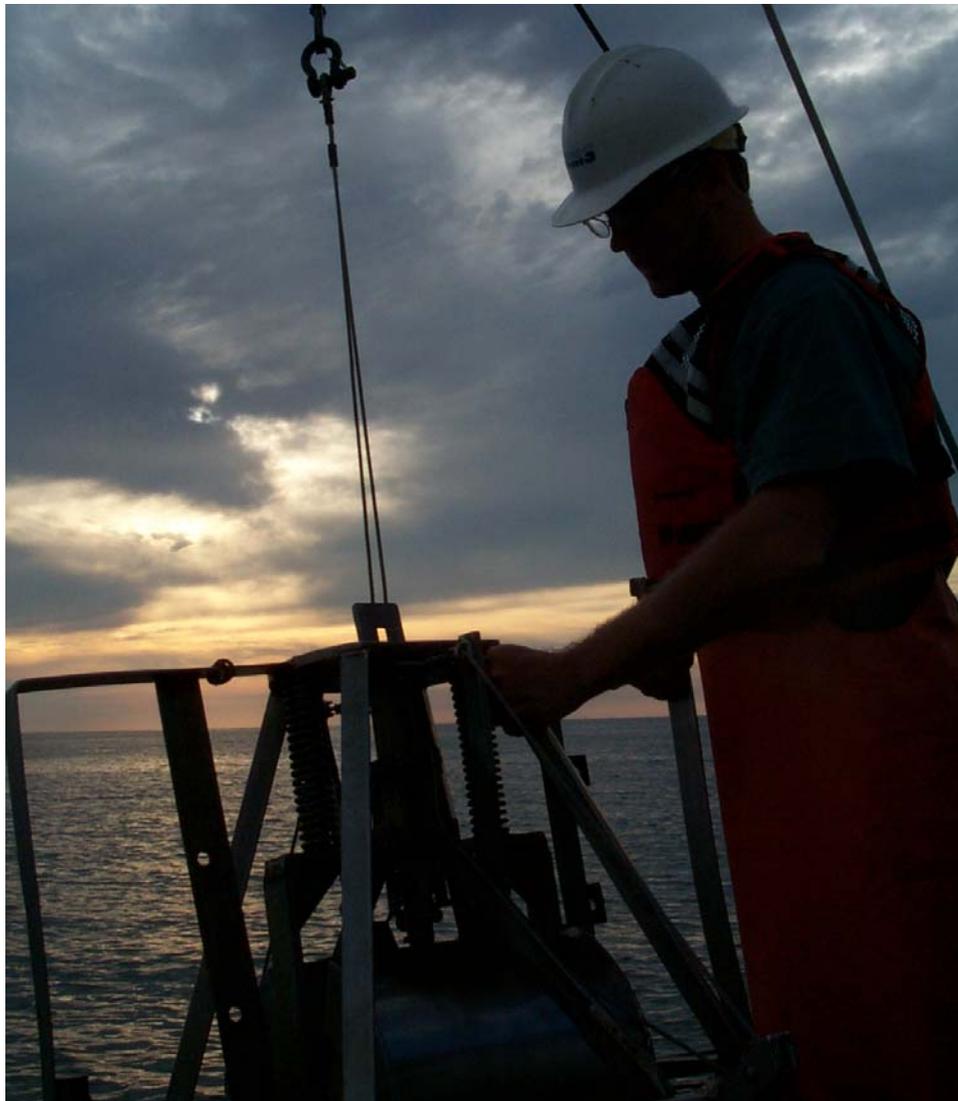


Figure 4. Deployment of Smith-Mac bottom grab during field survey in September 2001 to characterize the mound surface sediment

of the mud fraction (0.7-60 microns) and the sand fraction (>60 microns) by gravimetric methods and also the organic component (portion volatile at 550 degrees C) of each fraction. Results in the report contain plots of profiles as a function of depth of the output from each instrument on the profiler and also corresponding data for each stationary depth. The data for each site include: suspended solids concentrations from the pump samples, the raw and calculated solids concentrations from the LISST-100, the raw and calculated solids concentrations from the OBS, and the mean and standard deviation grain-size volume distribution from the LISST-100.

2.3 Mound Surface Sediment Characterization

VIMS report CHSD-2003-04 describes the results of the third and final field survey. In



Figure 5. Addition of sand into Modified Downing-Beach calibration chamber used to calibrate OBS sensors.

this survey, over 70 bottom sediment grabs using a Smith-Mac bottom grab (Figure 4) were collected in an effort to characterize the grain-size distribution of the sediment on and around the mound. The top five centimeters of sub-cores from each of the sediment grabs were analyzed for percent by weight of clay, silt, sand and gravel using wet sieve and pipette methods. The same samples were also analyzed for grain-size volume distribution and D50 grain-size for mud (5 to <63 microns) and sand (63 microns to <500 microns) using a LISST-100. Sediment fractions greater than 500 microns were digitally photographed for documentation purposes.

2.4 Pre-Deployment Calibration of OBS and ADV Sensors

VIMS report CHSD-2003-05 contains the results from the pre-deployment calibration of the OBS and ADV sensors deployed at the long-term stations maintained by USACE and EHI. Two Sontek ADV arrays equipped with three D&A OBS sensors were calibrated in specialized calibration chambers to verify the instruments' response range to water velocity (ADV) or suspended sediment concentration (OBS) before deployment. Calibrations showed stable OBS response to suspended sediment with linear curves at low concentrations and quadratic curves at high concentrations. ADV response to current speed was stable and linear with gains and offsets consistent with the factory calibration. Sediment for the OBS calibrations was collected during the May 2001 field survey (VIMS report CHSD-2003-02) from the proposed bi-pod site on the western end of the mound.

2.5 Sediment Entrainment Devices

VIMS report CHSD-2003-06 includes the analysis of sediment collected in Sediment Entrainment Devices (SEDs), fabricated by VIMS and College of William and Mary personnel. The SEDs were deployed by USACE and EHI on the bipods. Each SED collected suspended sediment at a specific height over a period of weeks in an effort to provide a representative sample of the suspended sediment for that height at a specific site over the deployment time period. After retrieval, the sediment samples were analyzed for grain-size distribution by weight and by volume concentration for the mud and sand

fractions, and for the associated D50 grain-size for each fraction. Results of the sediment analyzes are to be used by EHI in the analyses of OBS data collected at the same site and during the same period as each SED.



Figure 6. Sediment Entrainment Device (SED) fabricated to collect in-situ suspended sediment from a distinct height, usually the same height as an Obstacle Backscatter Sensor.