

SHORELINES – February 2009

State of the Beach - 2008

This past December 1st, the engineering firm of Moffatt & Nichol provided the Carteret County Beach Commission a presentation illustrating the key results and main conclusions regarding our Beach and Nearshore Surveying Program. In 1999, 111 shore-perpendicular profiles were established along Bogue Banks to gain baseline information and begin assessing the overall health of the beach in the wake of the hurricanes that impacted the region in the 1990s. Remember *Bertha* (1996), *Fran* (1996), *Bonnie* (1998), *Dennis 1 & 2* (1999), and *Floyd* (1999)? Elevations of the dry and underwater (nearshore) portion of the beach have been obtained along these same profiles on a routine basis since 1999 and with these data in hand; the annual report provided to the Beach Commission is often considered as our “State of the Beach” address. The monitoring program has grown since the formative years and now includes 122 profiles along Bogue Banks (Fig. 1), in addition to 24 profiles along Shackleford Banks, and 18 along Bear Island, located east and west of Bogue Banks, respectively. The beaches are surveyed in May or June every year.

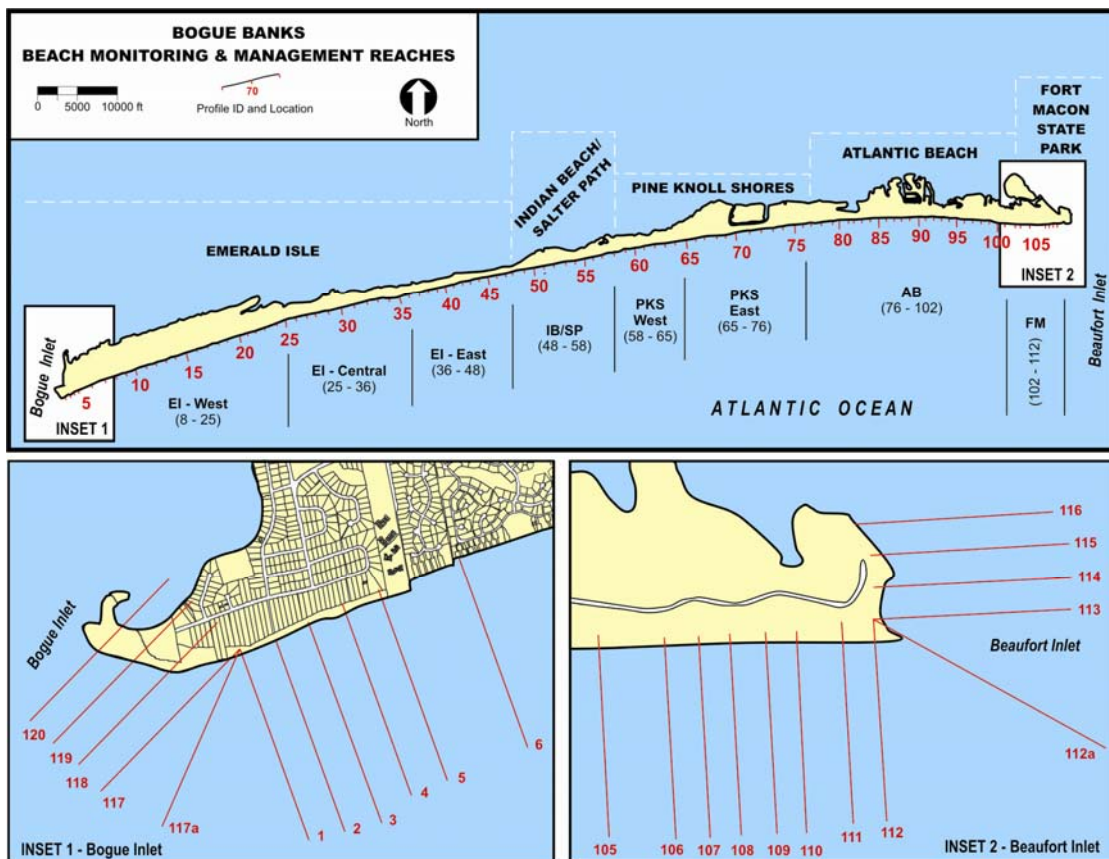


Fig. 1 – Site map depicting the location and identification scheme of the 122 profiles positioned along Bogue Banks utilized for beach/nearshore monitoring purposes.

Beach Volume

One of the means to quantify beach health is to compare the volume of sand lost or gained over time along Bogue Banks and the adjacent islands. Engineers and scientists most often use the measuring unit of a **cubic yard** to describe volume change, which can simply be envisioned as a 3 ft. by 3 ft. by 3 ft. block of sand – that's 27 ft³, or again a single cubic yard. A standard dump truck holds roughly 15 cubic yards as a convenient mental image. By utilizing a volumetric approach, we can review the past year or any other time slice in a sand debit – sand credit mindset. Generally, storms and other high-energy events serve as large “debits” and beach nourishment is envisioned as a “credit”.

Since 1999 Bogue Banks has *gained* roughly 6.9 million cubic yards of sand, which is mostly attributed to the many beach nourishment projects that have been constructed along the island beginning in 2001. Actually a total of approximately 10.3 million cubic yards of sand have been placed on Bogue Banks as a result of beach nourishment, meaning that 3.4 million cubic yards have since eroded off the beach (10.3 million placed on the beach *minus* 6.9 million cubic yards remaining). Interestingly, 2.25 million cubic yards were lost in 2005-06 alone, and most of these losses appear to be directly correlated to the notorious slow moving Hurricane *Ophelia* that impacted Bogue Banks for several days in September 2005.

If we average the volume loss (3.4 million cubic yards) across the entire 128,392 foot of Bogue Banks oceanfront, the island has lost sand at a rate of almost 3 cubic yards per linear foot per year (-3 cy/ft/yr) since 1999 (a 9 year window). This number is essentially our “background erosion rate”. The background erosion rate reported for the 1999 to 2007 timeframe was also close to -3 cy/ft/yr, meaning the erosion rate has remained relatively stable over the past year.

Another noteworthy statistic to mention is the entire island substantially meets the “target minimum volumetric threshold” established for Bogue Banks (Fig. 2). That's a admittedly a confusing term, but when Hurricane *Floyd* impacted Bogue Banks in 1999, we noticed Atlantic Beach was relatively unscathed while the remaining island communities sustained significant dune erosion and property damage. Atlantic Beach was a traditional recipient of beach nourishment projects associated with the dredging of the Morehead City Harbor prior to 1999, and if we averaged the volume of sand residing in Atlantic Beach from the toe of the dune to -12 feet, we generated an average number of over 225 cubic yards per linear foot (225 cy/ft). We soon noticed the remaining Bogue Banks municipalities that never received substantial beach nourishment prior to 1999 all averaged below this 225 cy/ft figure. Accordingly we have since utilized 225 cy/ft as the benchmark for beach health or as our “minimum volumetric threshold”.

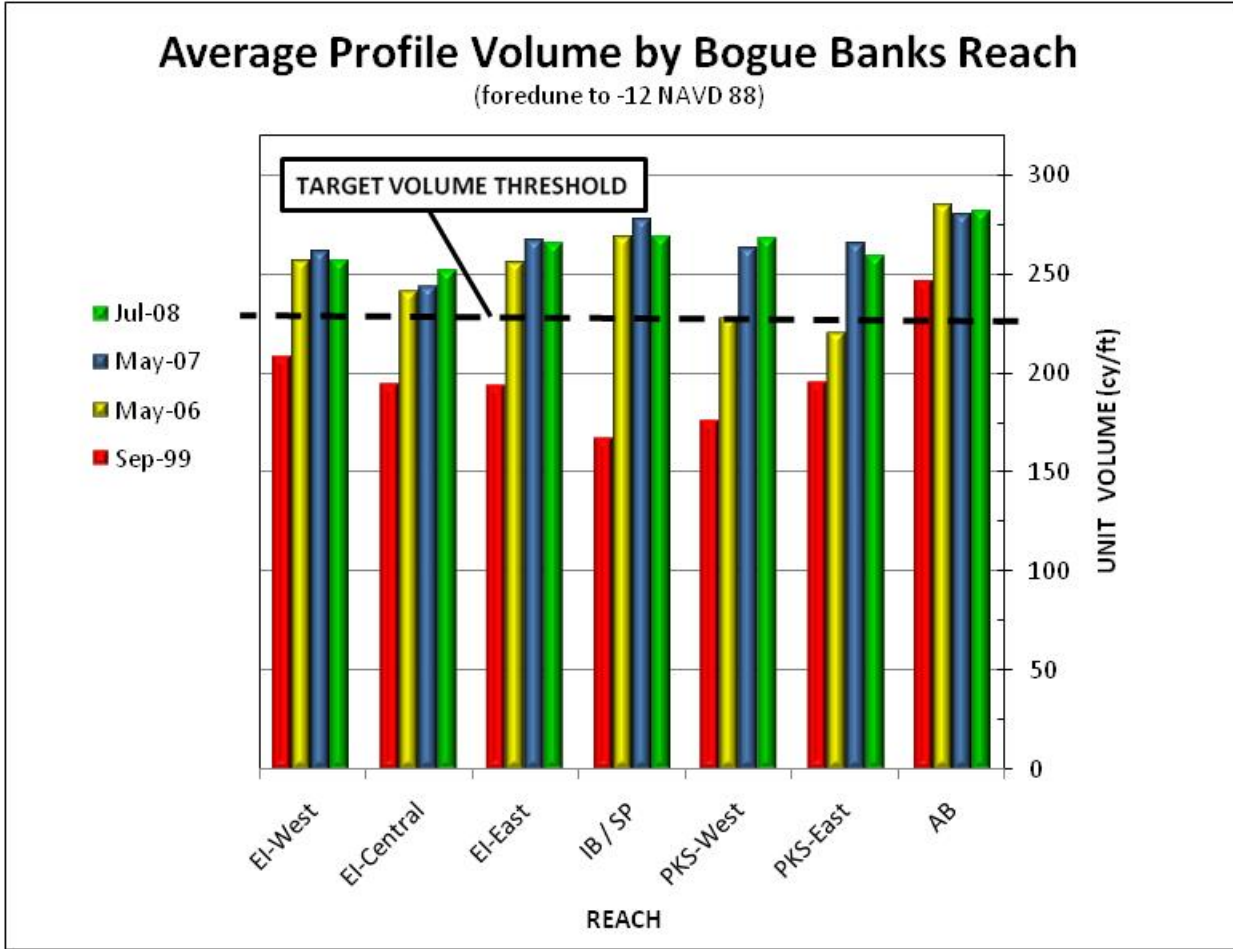


Fig. 2 – Average profile volumes for September 1999, May 2006, May 2007, and July 2008 for seven oceanfront reaches along Bogue Banks. A target volume threshold of 225 cubic yards per linear foot (cy/ft) was established in 1999 as a benchmark for beach health.

Shoreline Change

Another and more common measurement of beach health is shoreline change. To quantify and consistently compare shoreline positions over time, the “shoreline” is demarcated as the mean high water elevation established at +1.1 feet above sea level. This measurement parameter is sometimes referred to as a “datum-derived shoreline”.

Utilizing a datum-derived shoreline, the average net shoreline change for Bogue Banks was 13 feet seaward from May 2007 and July 2008 (Fig. 3). Shoreline positions have reacted to an influx of nourishment sand over the past several years and movement of that sand in the alongshore and cross shore directions. Sand may be moving east or west along the beachfront or in some places, could be migrating in the offshore direction or conversely even welding itself to the visible dry beach. Atlantic Beach experienced the largest average shoreline advancement in 2008 (+20 feet), while the eastern half of Pine Knoll Shores and Ft. Macon had the largest shoreline recession (-13 feet a piece).

Reach	Profiles	Average Shoreline Change (May 2007 - July 2008)
Emerald Isle - West	8 - 25	15 feet seaward (+)
Emerald Isle - Central	25 - 36	8 feet seaward (+)
Emerald Isle - East	36 - 48	20 feet seaward (+)
Indian Beach/Salter Path	48 - 58	3 feet seaward (+)
Pine Knoll Shores - West	58 - 65	2 feet landward (-)
Pine Knoll Shores - East	65 - 76	13 feet landward (-)
Atlantic Beach	76 - 102	24 feet seaward (+)
Fort Macon	102 - 112	13 feet landward (-)
Totals	8 - 112	13 feet seaward (+)

Fig. 3 – Average shoreline and volume changes from May 2007 to July 2008 for the eight oceanfront reaches positioned along Bogue Banks.

This is obviously a very brief review of the monitoring report, but don't hesitate to visit <http://www.protectthebeach.com/Monitoring/monitoring.htm> if you would like more information - the entire report by sections is available on-line approximately half-way down the webpage.