

SHORELINES – November 2020

As presented to the *Island Review* magazine

State of the Beach (2020)

In late September, the engineering firm of Moffatt & Nichol provided the Carteret County Beach Commission a presentation highlighting the results of a comprehensive beach survey conducted along Bogue Banks. The survey, or “monitoring event” was completed over the course of several weeks during Spring 2020 and included our neighboring islands to the east and west of Bogue Banks as well - Shackleford Banks and Bear Island, respectively.

So what exactly constitutes a beach survey? Jokingly of course, we can’t interview sand grains and ask them about their travels over the course of the year. Rather the origins of the program date back to 1999 when 111 shore-perpendicular transects/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 impacting the region in the decade of the 1990s – most notably *Bertha* and *Fran* in 1996, *Bonnie* in 1998, and *Dennis* “1 & 2” and *Floyd* in 1999. Elevations of the dry and underwater (nearshore) portion of the beach have been obtained along these same transects on a routine basis since 1999 and these measurements are utilized to monitor two important beach parameters we will be discussing in more detail below – **(1) the volume of sand** residing in the beach system, and **(2) shoreline** movement.

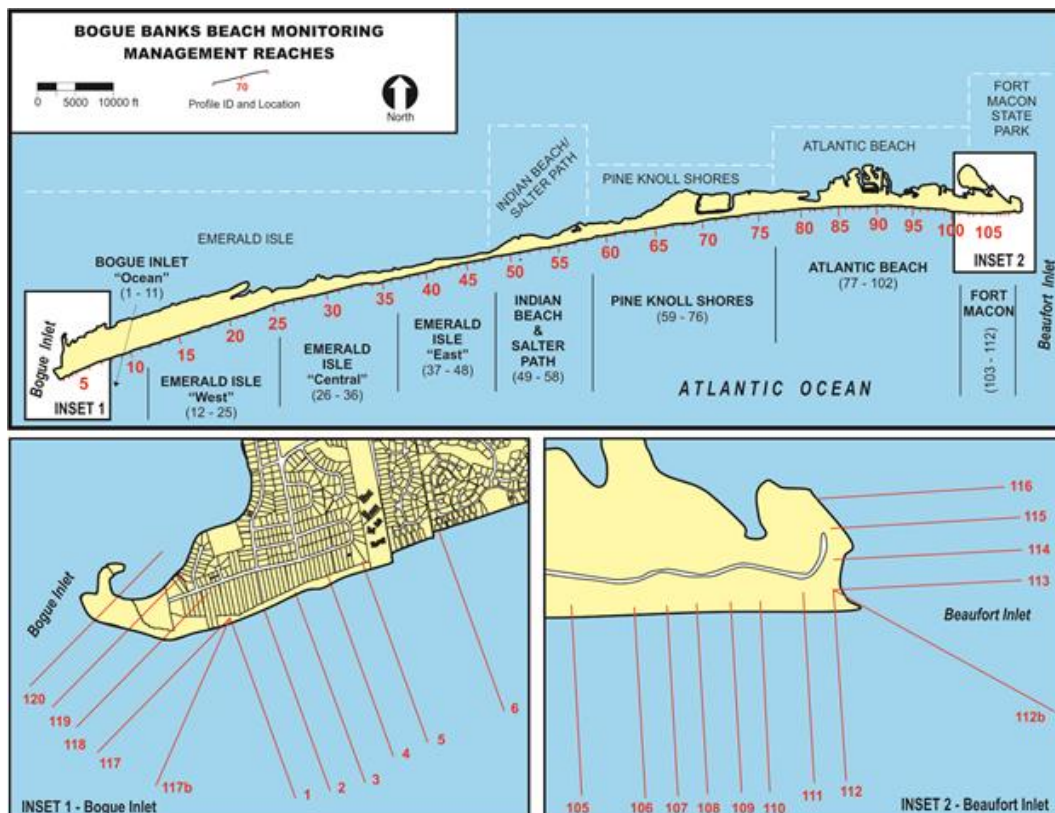


Figure 1 – Site map depicting the location/identification scheme of 122 profiles, and management reaches utilized for beach/nearshore monitoring purposes and implementation of the Bogue Banks Beach “Master Plan”.

The monitoring program has grown since its formative years and now includes 122 transects along Bogue Banks (Fig. 1), in addition to 24 transects along Shackleford Banks, and 18 along Bear Island. The beaches are ideally surveyed in the “pre-hurricane season” timeframe prior to July of each year.

If we compare the 2020 survey to that of the year prior (Spring 2019); we are capturing all of the events/storms that transpired during this yearlong time period and their impacts to those two important parameters introduced above - volume change and shoreline change. It would be cost-prohibitive to survey after each and every individual storm, thus sometimes we have to make inferences to what “minor” events may have triggered episodes of erosion and accretion throughout the year.

Results - Volume and Shoreline Changes

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 often use the measuring unit of a **cubic yard (cy)** to describe volume change, which can be envisioned as a 3 ft. x 3 ft. x 3 ft. block of sand, or 27 ft³. A standard dump truck holds roughly 15 cubic yards of dry sand as a convenient mental image.

Accordingly, we rely heavily on a “credit – debit” volumetric approach with respect to our overall beach management philosophy and to track change throughout time. Debits are usually in the form of hurricanes, tropical storms, or other high energy events that remove sand from the beach profile, while credits are almost always attributed to beach nourishment, or to the rare occurrence of storms actually moving sand up the beach profile as we observed with Hurricane *Matthew* (2016) and *Dorian* (2019). Hence from spring 2019 to spring 2020 we experienced very notable episodes of “credit” in the form of hurricane *Dorian* and even more so with the Spring 2020 [Post-Florence Phase II Nourishment Project](#) that directly placed +2,022,807 cubic yards of sand along 9.5 miles of Bogue Banks in West Atlantic Beach, Pine Knoll Shores, Salter Path (State), and West Emerald Isle. The “volumetric approach” has been a primary tenet of our beach monitoring program, and the 128,393 linear feet of oceanfront along Bogue Banks (profiles 1 – 112, Figure 1 and Table 1) interestingly gained +3,034,764 cubic yards of sand in 2019-20, equating to an average gain of +23.6 cubic yards per foot (cy/ft).

Reach	Profiles	Linear Feet	Average Shoreline Change (Spring 2019 - Spring 2020)	Average Volume Change (Spring 2019 - Spring 2020)
Bogue Inlet - Ocean	1 - 11	11,488	+59.4 feet seaward (+)	+43.5 cubic yard / linear foot
Emerald Isle - West	12 - 25	18,288	+18.9 feet seaward (+)	+15.5 cubic yard / linear foot
Emerald Isle - Central	26 - 36	15,802	+28.3 feet seaward (+)	+11.0 cubic yard / linear foot
Emerald Isle - East	37 - 48	13,220	+9.8 feet seaward (+)	-10.8 cubic yards / linear foot
Indian Beach/Salter Path	49 - 58	12,850	+43.9 feet seaward (+)	+15.7 cubic yards / linear foot
Pine Knoll Shores	59 - 76	23,878	+82.0 feet seaward (+)	+56.8 cubic yards / linear foot
Atlantic Beach	77 - 102	26,176	+43.2 feet seaward (+)	+27.1 cubic yards / linear foot
Ft. Macon State Park	103 - 112	6,691	-7.0 feet landward (-)	-6.8 cubic yards / linear foot
<i>Totals or Average =</i>	112	128,393	+40.6 feet seaward (+)	+23.6 cubic yards / linear foot

Table 1 – Average shoreline and volume change from Spring 2019 to Spring 2020 for eight oceanfront reaches positioned along Bogue Banks.

As mentioned above, the Phase II Post-*Florence* Renourishment emplaced +2,022,807 cy of sand along 9.5 miles of Bogue Banks, which means we had an additional +1,011,957 cy that moved “upslope” from depths below -12 feet NAVD88 (think -12 feet below sea level) to above that demarcation. We lost a tremendous amount of sand during *Florence* (-3,546,411 cy) and continued losing sand offshore in the interval between the post-*Florence* survey (September 2018) and our annual Spring 2019 survey. Some of that sand in the past year has moved upslope above our -12 feet NAVD88 demarcation and therefore is categorized as “a gain”.

With respect to shoreline change - the “shoreline” is determined as the mean high water elevation established at +1.5 ft. NAVD88 (Fig. 2). This measurement parameter is sometimes referred to as a “datum-derived shoreline” as we can numerically determine where along a profile the +1.5 feet elevation resides rather than depending upon more subjective determinations required by other methods, such as aerial photography (i.e., wet/dry line, the wrack line, etc.). For the 2019-20 reporting period the shoreline advanced seaward by +40.6 feet on average across Bogue Banks (see Table 1 for a summary of all the management reaches). That’s not surprising given the influx of sand described above that has transpired over the past year.

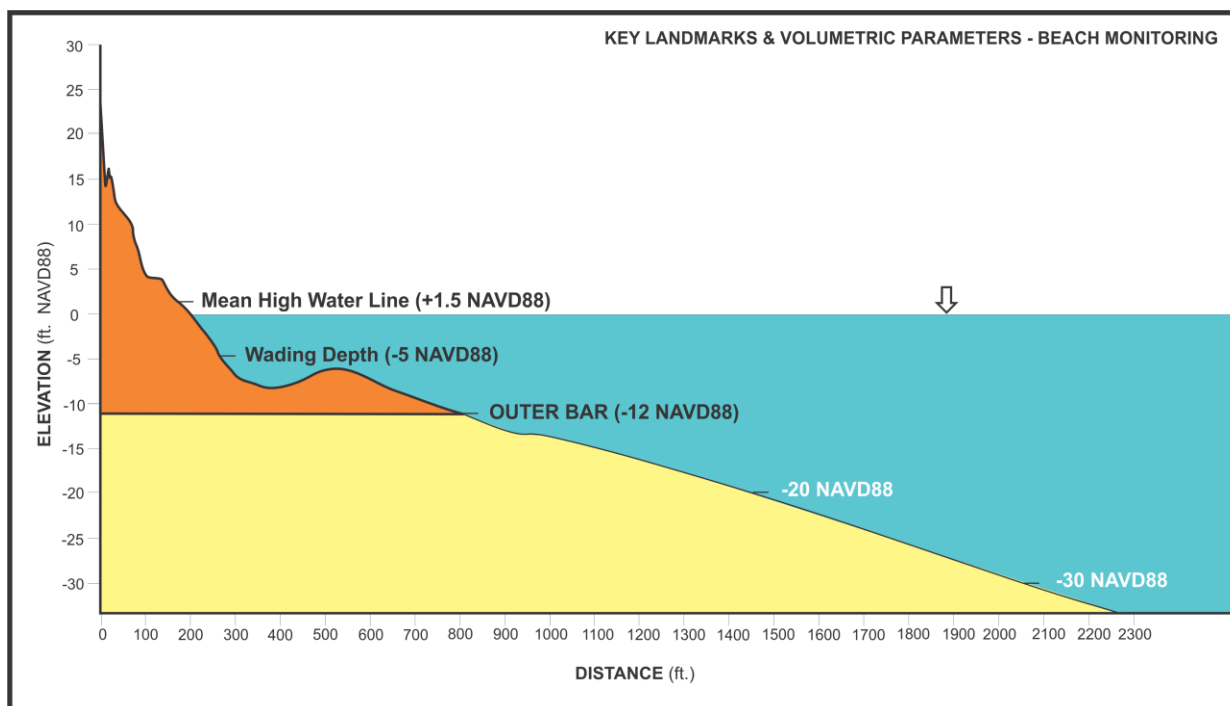


Figure 2 – Characteristic Bogue Banks profile in cross-section depicting the key “landmarks” monitored for changes in sand volume and the shoreline position designated as +1.5 feet NAVD88. Although changes are recorded above each of the landmarks depicted in the figure, the orange-colored fillet represents the positive or negative changes occurring at the elevation above “-12 ft. NAVD88”, and is utilized as a common reporting baseline for volumetric change.

And lastly and continuing with the concept of “cubic yards per linear foot” (cy/ft) - the volume of sand residing along the entire island is significantly higher than our self-determined yardstick year of 1999, and is attributable to the many beach nourishment projects that have been constructed since 2001 (Fig. 3). All the island management reaches are also in excess of our Master Plan “volumetric thresholds” -- or perhaps better conceptualized as beach nourishment triggers. Our Master Plan management reaches as referenced in Figures 1 and Table 1 were developed by; (A) evaluating dune/berm shape

and height to group similar profiles into discrete reaches, and then (B) we subsequently utilized a 25-year storm event to model the volumetric needs in each of the new management reaches. Our 2020 management reach values in terms of average cy/ft and our minimum volumetric thresholds (i.e., nourishment triggers) are presented graphically in Figure 3 below.

We are expecting significant “gains” for the upcoming year (2020-21 reporting period) as the final “[Phase III](#)” Post-Florence Renourishment Project will be constructed entailing the placement of 2,012,850 cubic yards of sand along 9.4 miles of beach in Emerald Isle. Also, 1,143,000 cubic yards of sand will be placed along the beaches of Ft. Macon and East Atlantic Beach this upcoming winter as part of [routine channel maintenance](#) (dredging) at the Morehead City Harbor shipping channel.

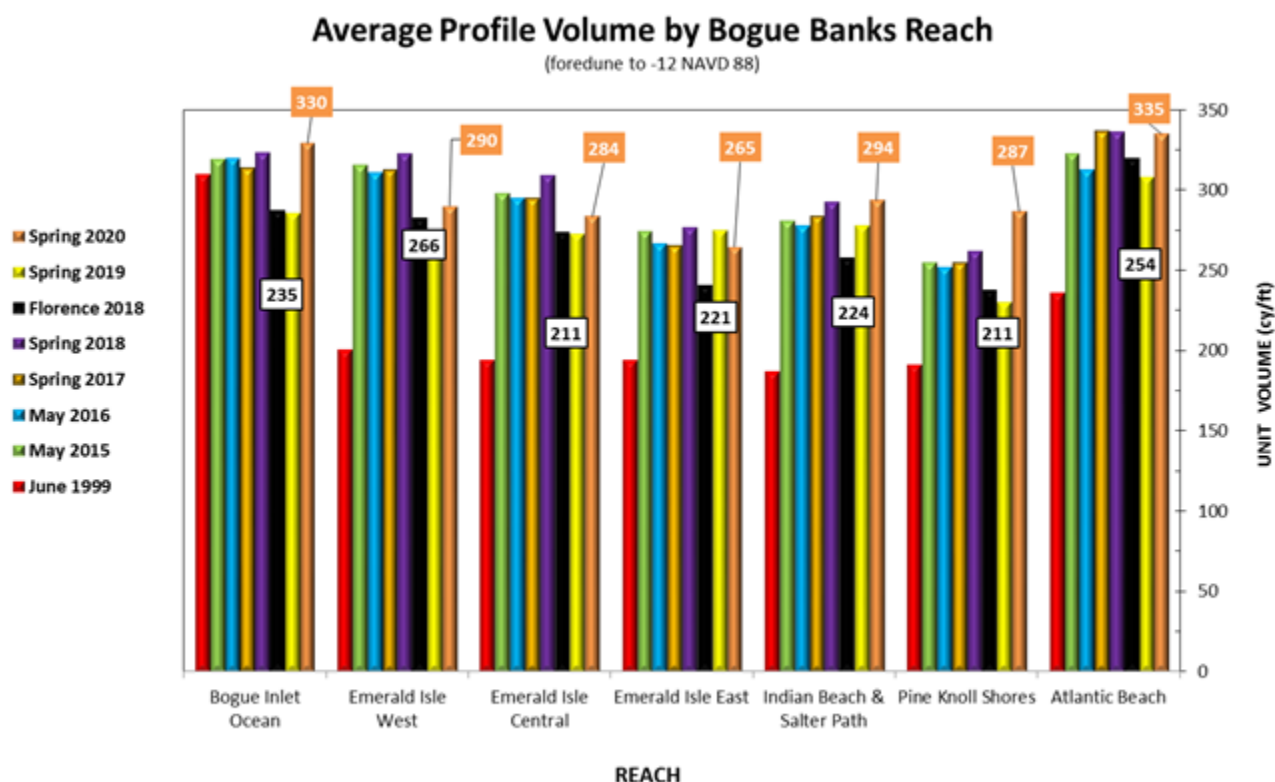


Figure 3 – Average profile volumes for September 1999 (baseline year), 2020 (the most recent survey), 2019, *Florence* (2018), 2018, 2017, 2016, and 2015 for seven oceanfront management reaches along Bogue Banks. The minimum volumetric thresholds (i.e., nourishment triggers) are provided in the white call-out boxes while the 2020 average volume is represented in the coral colored call-out boxes.

This is obviously a brief review of the monitoring report, but don’t hesitate to visit <http://www.carteretcountync.gov/329/Monitoring> if you would like more information regarding the report itself or the monitoring program in general.