

DEVELOPMENT OF SEDIMENT CRITERIA REGULATIONS FOR BEACH FILL PROJECTS ALONG NORTH CAROLINA'S ATLANTIC COAST



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BEACH FILL & THE SEDIMENT CRITERIA

Beach fill is the practice of placing sediment on a beach to mitigate shoreline erosion. In North Carolina, state law prohibits "hard" oceanfront shoreline structures, such as seawalls and groynes, making beach fill an often-used alternative for erosion control. Sediment for many large-scale beach fill projects is dredged from offshore deposits or excavated and transported to the beach from upland sites. Because neither of these sediment sources are part of the active littoral system, the sediment may be significantly different in character (e.g., size, sorting, mineralogy) from the beach on which it is to be placed. Potential adverse consequences of placing incompatible beach fill sediment on the beach range from environmental to economic.

North Carolina's current rule governing sediment compatibility for beach fill projects is minimal in its approach and, with regards to sediment compatibility, states only that borrow sediment "...shall be compatible with existing grain size and type." The inability to quantify the term "compatible" makes the rule language vague and subjective.

Recently, between 2001 and 2005, large quantities of coarse material (marl cobbles and shell hash) and mud (cobbles and lenses) were placed on the North Carolina beaches of Oak Island, Pine Knoll Shores, Emerald Isle, and Atlantic Beach during four separate federally and non-federally funded beach fill projects (see location map: Figure 1). As a result, the rule governing sediment compatibility for beach fill projects was opened up for review in 2002 by the NC Coastal Resources Commission (CRC), the policy-making body established by the State's Coastal Area Management Act (CAMA). The CRC Science Panel on Coastal Hazards, an advisory board made up of 11 coastal experts, along with N.C. Division of Coastal Management (DCM) staff set out to quantify the term "compatible" and subsequently developed a comprehensive set of science-based regulations for beach fill projects.



Figure 1. Cobbles on Oak Island and mud (lense and cobbles) on Atlantic Beach following two beach fill projects.

North Carolina Location Map



Table 1. Native Sediment Characteristics of North Carolina Beaches (σ = standard deviation)

Location	Map	n	Mean %		Mean %		Mean %	
			Fine	Fine	Granular	Granular	Gravel	Gravel
Southern Shores	G-2	100	1.52	1.66	8.18	14.61	5.19	8.79
Kitty Hawk	G-2	80	1.28	1.12	7.55	13.04	4.55	7.51
Kill Devil Hills	H-3	120	1.22	0.88	5.32	10.80	4.10	8.83
Nags Head	H-3	280	1.25	0.93	3.32	7.08	3.54	6.08
Cape Hatteras	H-5	80	1.66	1.96	2.86	7.07	2.33	3.58
Hatteras Island	H-5	205	1.89	1.50	2.91	5.21	3.93	4.92
Alfonic Beach	E-6/7	114	2.91	3.51	0.89	1.72	0.63	1.50
Pine Knoll Shores	E-7	136	3.49	2.79	0.99	1.84	0.79	1.44
Emerald Isle	E-7	165	2.29	4.73	0.89	2.34	1.08	2.25
Onslow Beach	D-7	184	7.18	12.47	2.93	6.39	2.22	5.44
N. Topsail Beach	D-7	201	2.35	5.24	1.84	3.64	1.77	2.83
Surf City	C/D-7	102	1.49	1.00	1.80	4.16	2.23	3.83
Topsail Beach(a)	D-8	103	1.16	0.91	1.25	3.25	0.95	1.47
Topsail Beach(b)	D-8	42	2.26	1.75	4.04	6.03	10.25	15.63
Kure Beach	C-9	63	2.13	1.69	5.33	6.13	5.73	6.14
Oak Island	B-9	180	3.75	9.21	1.28	2.15	1.42	2.72
Holden Beach	B-9	101	2.65	9.88	1.52	1.22	0.79	0.72
Ocean Isle	B-9	67	2.63	2.89	0.18	0.25	0.56	1.30
			2,327					

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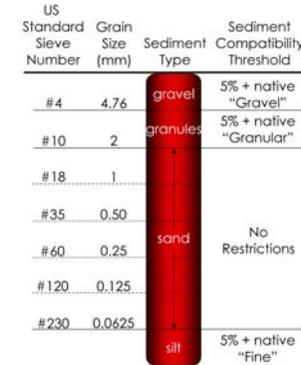


Figure 2. Sediment grain size scale and sediment compatibility thresholds.

RESULTS & CONCLUSION

After analyzing over 2,300 native beach grain size distributions (Table 1), standards that match borrow material to the pre-existing beach within limited grain size compatibility thresholds of 5% over native content for fine material (i.e., silt and mud), granules, and gravel (Figure 2) were established. A calcium carbonate threshold of 15% over native content was established through data analysis as well. In addition to sediment compatibility thresholds, specific technical protocols for characterizing the borrow site and the native beach were created so that borrow sediment can be better matched to the native beach. Grain size data from the four aforementioned "incompatible" beach fill projects were also analyzed (Figure 3), and results show that the sediment criteria would have either prevented or mitigated each project.

In March of 2006, the CRC voted unanimously to send the sediment criteria rules to public hearing in June 2006. This rule language, if approved, effectively integrates science and policy by using data and sound methodology to define sediment compatibility and ensure beach fill project consistency.

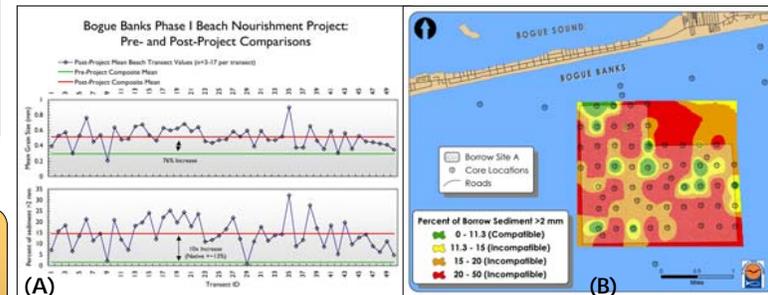


Figure 3. Post-project beach (A) and borrow site analysis (B) of the 2001 "incompatible" Pine Knoll Shores beach fill project.