JOSH STEIN
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D. REID WILSON
Secretary
TANCRED MILLER
Director

NORTH CAROLINA
Environmental Quality

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MEMORANDUM

TO: Coastal Resources Advisory Council (CRAC)

FROM: Ken Richardson, *Shoreline Management Specialist*

SUBJECT: Summary of NC's Sediment Criteria Rules (07H.0312):

Prior to the adoption of North Carolina's sediment criteria rules, engineering practice for beach nourishment generally emphasized matching borrow material to native beach sediment, recognizing grain size as critical to beach morphology, ecological function, and project longevity. Despite this understanding, between 2001 and 2005 several nourishment projects placed large amounts of incompatible coarse material, such as marl cobbles, shell hash, and mudballs, on beaches in Oak Island, Pine Knoll Shores, Emerald Isle, and Atlantic Beach. These projects exposed weaknesses in existing regulations, which required only that nourishment sediment be "*compatible*" with native grain size and type, a term that was vague, subjective, and difficult to enforce.

Recognizing the inherent subjectivity in defining sediment compatibility, the Coastal Resources Commission (CRC) requested that its Science Panel on Coastal Hazards, in 2002, evaluate concerns associated with incompatible sediment placement and provide guidance or proposed rule language. The overarching goals were to:

1. define acceptable environmental impacts to borrow sites,
2. determine how to ensure sediment is clean and free of pollutants and highly erodible material, and
3. develop an objective definition of sediment compatibility. While early discussions debated guidance versus rulemaking, it became clear that enforceable standards were necessary to support permitting, compliance, and federal consistency review. Because the Science Panel is not a rulemaking body, it provided technical recommendations that DCM staff translated into regulatory language.

The Panel reviewed sediment standards from other states, notably Florida, and undertook a comprehensive analysis of native North Carolina beach sediment using existing datasets, including

statewide grain size data compiled by Rice (2003)[1] and additional USACE data. The Panel concluded that a single statewide "ideal" sediment type was inappropriate given North Carolina's wide variability in native beach conditions. Instead, it recommended compatibility thresholds based on natural variation, allowing borrow material to closely match the recipient beach within defined limits. Emphasis was placed on restricting excessive fine material (silt and clay) and coarse material (gravel and cobbles), which are uncommon on most North Carolina beaches and can significantly alter beach hydraulics and ecology.

Statistical analysis of more than 2,000 native beach samples showed that sand (Figure 1) comprises approximately 96% of North Carolina beach sediment. Grain size fractions with the greatest potential impact, fines, granules, and gravel, generally make up less than 5% of native sediment. Based on calculated standard deviations across coastal regions, statewide compatibility thresholds of ±5% above native conditions were established for fine-grained sediment, granules, and gravel. Calcium carbonate thresholds were initially set at recipient beach plus 10–15%, reflecting natural variability and lessons learned from projects with excessive shell content.

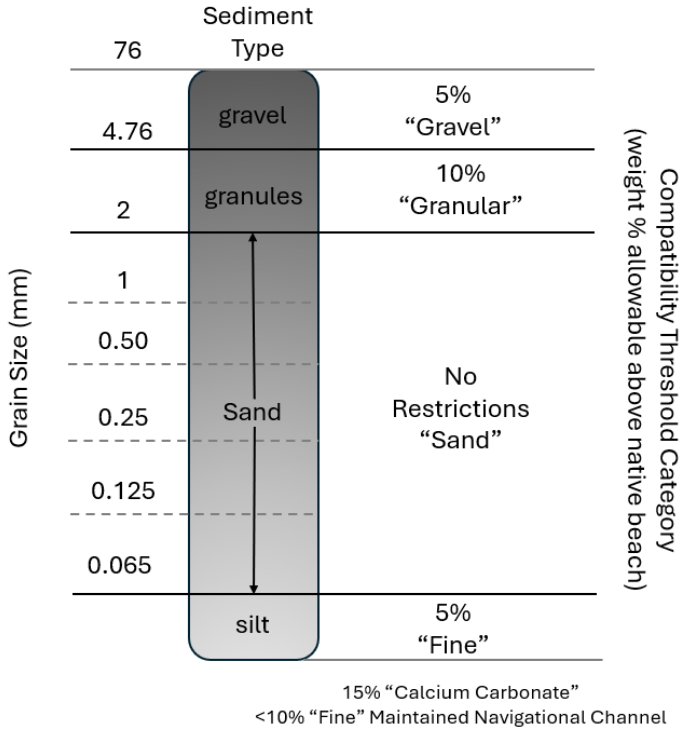

Figure 1. Sediment grain size scale, grain size categories, and original compatibility thresholds.

In regard to environmental impacts, the Panel emphasized that beach nourishment and dredging can cause mortality of nonmotile benthic organisms due to burial, though some species, particularly bivalves, can survive by migrating upward through deposited sediment. Survival and recovery depend on multiple factors, including burial depth and duration, season, sediment grain size and quality, and site-specific conditions. Species with planktonic larvae or the ability to

[1] *Rice, T.M., 2003, Native Sediment Characteristics of North Carolina Beaches: USDI Fish & Wildlife Service, Raleigh, NC, 6pp., + Appendices*

recolonize from adjacent areas typically recover more quickly, while sediment-dwelling species recover more slowly; however, benthic communities generally return to pre-project conditions within one to two seasons after nourishment is completed. Recovery rates are strongly influenced by sediment compatibility and timing, as mismatched or fine-grained material can significantly alter beach biota and prolong recovery.

Offshore impacts from dredging can include damage to commercially important shellfish, seagrass beds, corals, and sea turtles, though these impacts can be minimized through careful borrow-area selection and dredging methods that reduce sedimentation and turbidity. Coarse and shell-rich sediments above natural levels can substantially degrade habitat value by impairing the ability of swash-zone benthic invertebrates to rebury, with cascading effects on surf fish and shorebird species that depend on them as prey.

The Science Panel's guidance recommendations were adapted into rule language by DCM and formally presented to the CRC in January 2005 and, following extensive evaluation, stakeholder outreach, and technical review, resulted in adoption of a new rule: **07H.0312 – Technical Standards for Beach Fill Projects**. The rule aligned closely with USACE practices while providing North Carolina with unique, quantitative compatibility standards that enhanced regulatory clarity without imposing significant additional costs.

Subsequent amendments refined the sediment criteria rules:

- In 2013–2014, allowable granular sediment was increased to recipient beach plus 10% (originally 5%) based on concerns expressed by the USACE.
- In 2020, amendments exempted certain cape shoal systems from beach sediment characterization (*Session Law 2017-10, S131 Section 3.15*), introduced more flexible sampling protocols, updated definitions for large material (1-in. in diameter) and shell (3-in. in diameter), and revised large-material sampling requirements.

Collectively, North Carolina's sediment criteria rules represent a multi-year integration of science, policy, and stakeholder collaboration. By grounding compatibility thresholds in natural variability and site-specific conditions, the rules ensure that nourishment projects more closely mimic native beach characteristics, protecting both ecological integrity and long-term project performance.