CHALLENGES IN USING SCIENCE-BASED SHORELINE SETBACKS: EXAMPLES FROM SOUTH CAROLINA

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Introduction

Beachfront jurisdictional lines were established by the South Carolina Beachfront Management Act (SC Code §48-39-250 et seq.) in 1988 to regulate the new construction, repair, or reconstruction of buildings and erosion control structures along the state's ocean shorelines. Building within the state's beachfront "setback area" is allowed, but is subject to special regulations. For "standard beaches" (those not influenced by tidal inlets or associated shoals), a baseline is established at the crest of the primary oceanfront sand dune; for "unstabilized inlet zones," the baseline is drawn at the most landward point of erosion during the past forty years. The parallel setback line is then established landward of the baseline a distance of forty times the long-term average annual erosion rate (not less than twenty feet from the baseline in stable or accreting areas). The positions of the baseline and setback line are updated every 8-10 years using the best available scientific and historical data, including aerial imagery, LiDAR, historical shorelines, beach profiles, and long-term erosion rates. One advantage of science-based setbacks is that, by using actual historical and current shoreline positions and beach profile data, they reflect the general erosion threat to beachfront structures. However, recent experiences with revising the baseline and setback line indicate that significant challenges and management implications also exist.

Historical Shoreline Source Data

In addition to georeferenced aerial photographs, topographic surveys (T-sheets) are frequently digitized to obtain historical shoreline positions. Early T-sheets were created by the U.S. Coast Survey and are considered to be exceptionally accurate (Grossinger et al., 2005). SCDHEC-OCRM recently completed revising the baseline and setback line for the entire state, and for the first time, the recalculated erosion rates incorporated historical shorelines derived from T-sheets dating back as far as the 1850s. The validity of these 1850s-era historical shorelines has been questioned, but SCDHEC-OCRM believes that T-sheet data is a component of "the best available scientific and historical data" that the agency is required to utilize (SC Code §48-39-280).

Influence of Beach Renourishment Projects

Beach renourishment and other "soft" solutions to erosion control are the preferred alternatives to hard stabilization in South Carolina. At least 24 renourishment projects have occurred in the state since 1985, with a total of over 27.5 million cubic yards of sand added at a price of nearly $225 million (not adjusted for inflation).

Over time, these renourishment projects have essentially fixed the shoreline position in many areas and resulted in a minimal short-term erosion rate. To recalculate long-term erosion rates for nourished beaches, SCDHEC-OCRM only uses pre-1988 shorelines in an effort to remove the influence of the artificial accretions on the new setback line position. However, natural dunes frequently form after new sand is added to a beach through renourishment. Since the jurisdictional baseline is set at the primary dune crest for "standard beaches," the formation of new dunes can cause the baseline and the setback line to move seaward following renourishment (Figure 1). Additionally, ecosystem values and services of dune features are not fully considered in current baseline and setback line revision procedures. Dune fields are not adequately protected if they lie outside of the state's beachfront setback area.

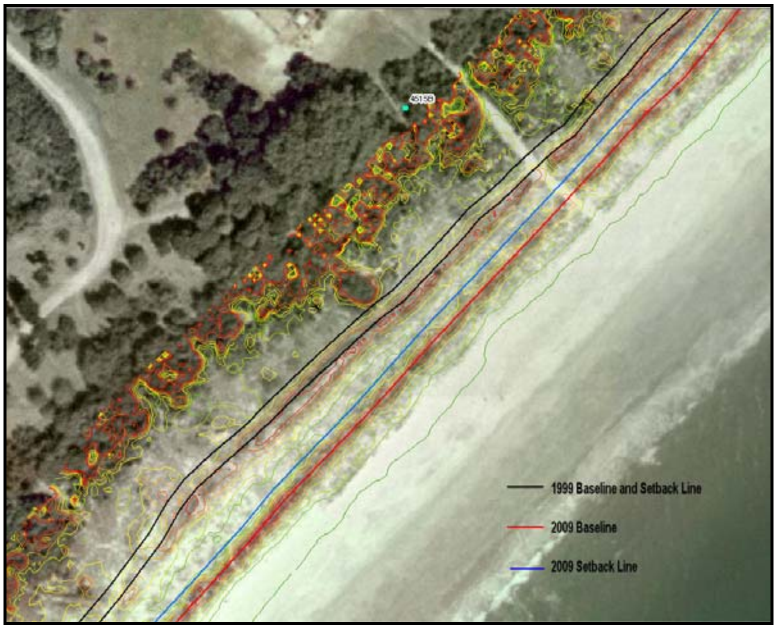

Figure 1: 1999 and 2009 (revised) baseline and setback line positions for a portion of Huntington Beach State Park, SC. A new dune line has formed seaward of the previous dune line following renourishment projects. The revised baseline and setback line moved about 85 feet seaward to the new primary dune.

Inlet Zones

Inlet zones are very dynamic areas, but they can have low long-term erosion rates and therefore a smaller setback distance. The long-term erosion rate calculation assesses the erosion that occurs in a shore-perpendicular direction, but it does not assess the lateral movements of shoreline position that frequently occur in the vicinity of tidal inlets (Figure 2). In inlet zones, a better measure of the dynamic nature of the shoreline may include the standard deviation in addition to the long-term erosion rate calculation (Harris et al., 2009).

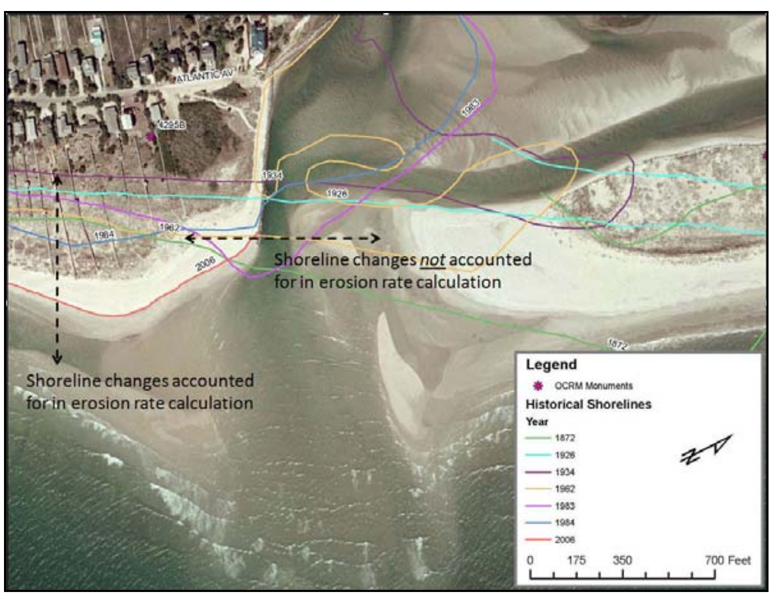

Figure 2: Historical shoreline positions for the northern end of Pawleys Island, SC in the vicinity of Midway Inlet.

Future Projections

Since the long-term erosion rates are based only on current and historical data, the setback line does not take into account projections for accelerated sea level rise or other climate change uncertainties. Additionally, the setback line is based on chronic, long-term erosion hazards, but it is not based on other shorter-term hazards such as storm surge and flooding.

Conclusion

In light of these challenges in using science-based setbacks, two alternative approaches could be to use parcel-based setbacks or to use a standard, uniform setback distance for the entire coast of South Carolina (Figure 3). The challenges identified in this paper will need to be discussed to ensure the adequate protection of South Carolina's valuable beachfront natural and economic resources.

Figure 3: Current baseline and setback line, conceptual parcel-based setback line, and conceptual uniform 200-ft setback line for Myrtle Beach, SC.

References

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