Appendix Section 12
USGS National Assessment of Shoreline Change 2010-1118

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National Assessment of Shoreline Change: Historical Shoreline Change along the New England and Mid-Atlantic Coasts

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U.S. Department of the Interior
U.S. Geological Survey

National Assessment of Shoreline Change: Historical Shoreline Change along the New England and Mid-Atlantic Coasts

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U.S. Department of the Interior
U.S. Geological Survey

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Executive Summary

Beach erosion is a chronic problem along many open-ocean shores of the United States. As coastal populations continue to grow and community infrastructures are threatened by erosion, there is increased demand for accurate information regarding past and present trends and rates of shoreline movement. There is also a need for a comprehensive analysis of shoreline movement that is consistent from one coastal region to another. To meet these national needs, the U.S. Geological Survey (USGS) is conducting an analysis of historical shoreline changes along open-ocean sandy shores of the conterminous United States and parts of Hawaii, Alaska, and the Great Lakes. One purpose of this work is to develop standard, repeatable methods for mapping and analyzing shoreline movement so that periodic, systematic, internally consistent updates regarding coastal erosion and land loss can be made nationally. In the case of this study, the shoreline is the interpreted boundary between the ocean water surface and the sandy beach.

This report on the New England and Mid-Atlantic coasts is the fifth in a series of reports on historical shoreline change. Previous investigations include analyses and descriptive reports of the Gulf of Mexico (Morton and others, 2004), the Southeast Atlantic (Morton and Miller, 2005), and, for California, the sandy shoreline (Hapke and others, 2006) and the coastal cliffs (Hapke and Reid, 2007). This report, like the earlier reports, summarizes the methods of analysis, interprets the results, provides explanations regarding long-term and short-term trends and rates of change, and describes how different coastal communities are responding to coastal erosion. This report differs from the earlier USGS reports in the series in that the previous shoreline change analyses incorporated only four total shorelines to represent specific time periods. The New England and Mid-Atlantic assessment incorporates all shorelines that are available and can be quality-checked. Shoreline change evaluations are based on a comparison of historical shoreline positions digitized from maps or aerial photographic data sources with recent shorelines, at least one of which is derived from lidar (light detection and ranging) surveys. The historical shorelines cover a variety of time periods ranging from the 1800s through the 2000s, whereas the lidar shoreline is from either 1997 or 2000. *Long-term* rates of change are calculated using all shorelines and *short-term* rates of change are calculated using the lidar shoreline and the historical shoreline that will produce an assessment for a 25- to 30-year time period. The rates of change presented in this report represent conditions up to the date of the most recent shoreline data and therefore are not intended for predicting future shoreline positions or rates of change. Because of the geomorphology of the New England and Mid-Atlantic (rocky coastlines, large embayments and beaches) as well as data gaps in some areas, this report presents beach erosion rates for 78 percent of the 1,360 kilometers of the New England and Mid-Atlantic coasts.

The New England and Mid-Atlantic shores were subdivided into a total of 10 analysis regions for the purpose of reporting regional trends in shoreline change rates. The average rate of long-term shoreline change for the New England and Mid-Atlantic coasts was -0.5 meters per year with an uncertainty in the long-term trend of ±0.09 meters per year. The rate is based on shoreline change rates averaged from 21,184 individual transects, of which 68 percent were eroding. In both the long and short term, the average rates of shoreline change for New England and the Mid-Atlantic were erosional. Long-term erosion rates were generally lower in New England than in the Mid-Atlantic. This is a function of the dominant coastal geomorphology; New England has a greater percentage of shore types that tend to erode more slowly (rocky coasts, pocket beaches, and mainland beaches), whereas the Mid-Atlantic is dominated by more vulnerable barrier islands and dynamic spit/inlet environments. However, the percentage of coastline eroding was higher in New England than in the Mid-Atlantic, highlighting that although rates of shoreline erosion may not be extreme, coastal erosion is still widespread along this region of the U.S. coastline.

The average rate of short-term shoreline change for the New England and Mid-Atlantic coasts was also erosional but the rate of erosion decreased in comparison to long-term rates. The net short-term rate as averaged along 17,045 transects was -0.3 meters per year. Uncertainties for these rates range from 0.06 to 0.1 meters per year depending on the data sources used in the rate calculations. Of transects used to measure *short-term* change, 60 percent were erosional, as compared to 65 percent of coast eroding in the *long term*. The slight decrease (5 percent) in the amount of coastline eroding may be related to an increase in the frequency and extent of nourishment programs and (or) the effects of hardened structures during the more recent time period. The most stable (lower rates of erosion) beaches were more commonly found in New England. Despite an overall lowering of the average rates of erosion from long-term to short-term, the amount of coastline undergoing more extreme erosion (rates greater than -1.0 meters per year) experienced widespread increase.

Coastal engineering structures that exist all along the New England and Mid-Atlantic coasts affect the rates of shoreline change, which vary substantially along the coast. However, it is difficult to isolate the influence of structures and nourishment projects on the regional long- and short-term rates, and such an endeavor is beyond the scope of this report.