FEASIBILITY REPORT

SHORELINE EROSION ASSESSMENT AND PLAN FOR BEACH RESTORATION

SAGAPONACK BEACH, NEW YORK

Prepared for:

Sagaponack Erosion Control District

Town of Southampton New York

FEASIBILITY REPORT

Shoreline Erosion Assessment and Plan for Beach Restoration Sagaponack, New York

Prepared for:

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COVER PHOTO: Ground photo of Sagaponack Beach at Gibson Lane in July 2011.

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SYNOPSIS

The team of First Coastal Corporation and Coastal Science & Engineering Inc (CSE) was retained by the Sagaponack Erosion Control District (ECD) to evaluate shoreline erosion along the ~2.7-mile ocean beach within the village limits and develop alternate plans for beach restoration (Fig A). The goal of the project is to improve the beach-dune system via additions of sand from an external source so that:

- Recreational opportunities are enhanced via a wider beach.
- The community tax base is preserved.
- Normal seasonal processes of erosion and accretion may occur without adverse impact to the dune system or development.
- The aesthetic quality and ecological values of the beach are maintained.
- Flooding in storms is reduced.

The target design life for the project is a minimum of ten years* consistent with a majority of locally sponsored beach restoration projects. Beach improvements at 5-year, 10-year, and 20-year levels are also evaluated in the present report.

*[*Design life is defined herein as a significant additional volume of sand remaining within the littoral zone of the project area after 10 years such that the overall condition of the beach dune system is better than preproject conditions.]*

FIGURE A. Vicinity map showing the Sagaponack-Bridgehampton-Water Mill project areas situated along the 30-miles strand beach between East Hampton and Shinnecock Inlet. Net sand transport is east to west along the south shore of Long Island.

The findings assume that a parallel project can be accomplished at the same time along the Bridgehampton-Water Mill shoreline, thereby yielding economies of scale. The longevity of beach nourishment increases geometrically with project length. Combining the Sagaponack project with the Bridgehampton-Water Mill project will double the length and likely quadruple the project life (NRC 1995, Dean 2002).

The general approach of the team was to review historical data and related projects along the Southampton coast, conduct detailed condition surveys of Sagaponack Beach, and determine the sand deficit and average annual erosion rates for two reaches. A recommended project was formulated based on analysis of the existing level of protection seaward of buildings, the relative condition of the beach and inshore zone from one reach to the other, and the controlling coastal processes and net sediment transport rates. The team reviewed potential offshore borrow areas designated by the US Army Corps of Engineers (USACE) and conducted additional field surveys for purposes of identifying other potential borrow areas.

Two feasible borrow areas were identified based on results of new borings in depths around 50 feet (ft) of water about 1 mile offshore of Sagaponack Beach. Preliminary geotechnical surveys by USACE and the present study indicate there is likely to be sufficient beach-quality sediment in the offshore area to accomplish a locally sponsored project (pending detailed confirmation of sediment quality and approval for use by the USACE and NYDEC).

KEY FINDINGS

Condition Survey, Sand Deficit, and Annual Erosion Rate

The team completed a detailed condition survey in July 2011 and confirmed the volumes of sand in the foredune, on the beach, and in the nearshore zone (Fig B). The survey demonstrated that differences in volume reflect positions and depths of the offshore bar with more sand indicating the bar is closer to shore, its crest is shallower, and the adjacent visible beach is wider. The eastern half of Sagaponack Beach (Reach 1) was found to have less dune protection seaward of houses and pools. The western half (Reach 2) generally has greater development setbacks and dune protection, which meets or exceeds FEMA-recommended criteria for the 100-year storm. Reach 1 has a sand deficit along the foredune of ~50,000 cubic yards compared with Reach 2.

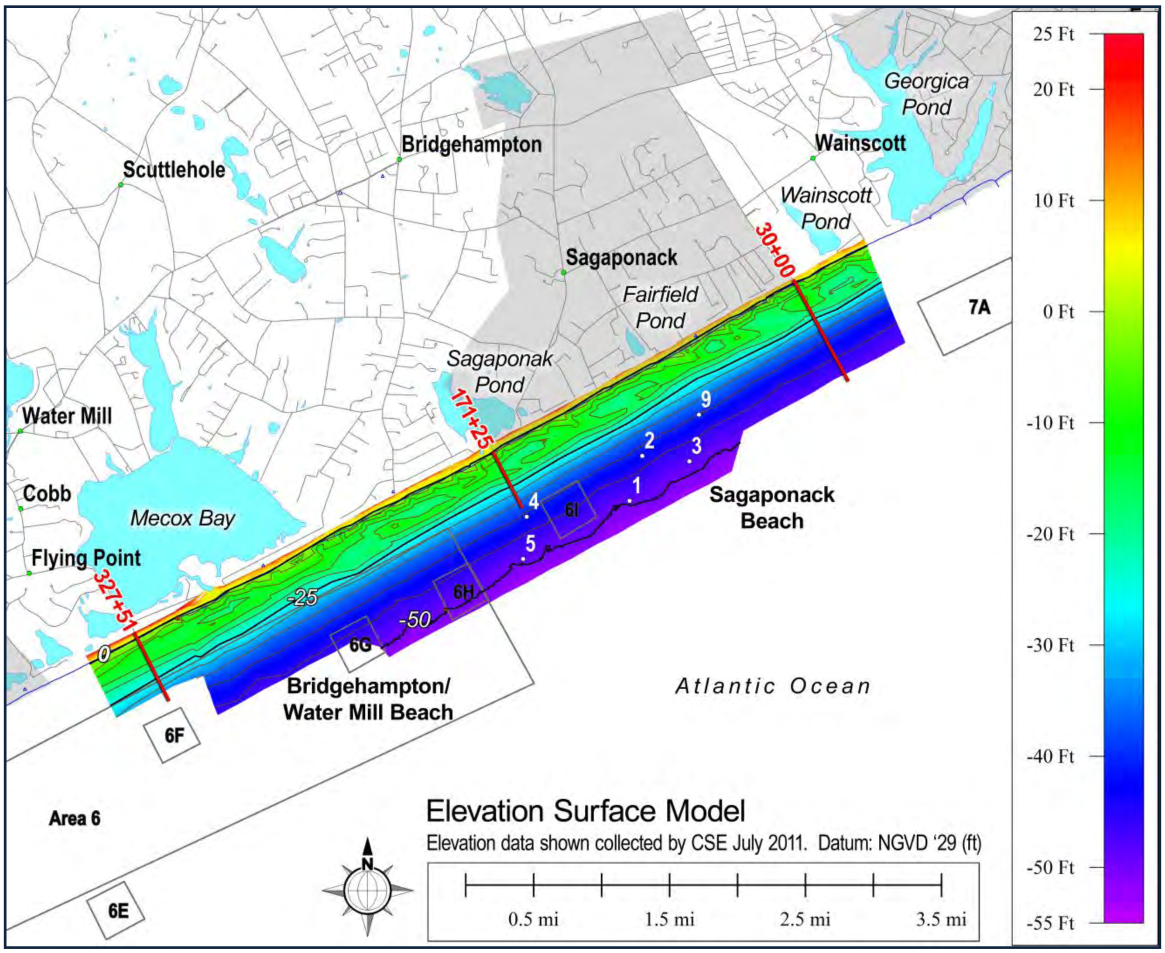

FIGURE B. Results of a condition survey in July 2011. The digital terrain model (DTM) was developed by the team from profiles collected at 500–1,000-ft spacing and continuous LiDAR imagery in the dunes between the baseline and ~4,500 ft offshore.

Annual erosion rates from 1955 to 2011 range from 2.2 to 5.5 cubic yards per foot per year (cy/ft/yr), depending on the period covered by available data. The weighted average annual erosion rate over the past ~55 years has been 4.0 cy/ft/yr. The team formulated the beach restoration plan based on an adopted rate of 4.5 cy/ft/yr, which corresponds with best-available data from the period 1998 to present. This equates to average sand losses totaling ~63,500 cubic yards (cy) each year along Sagaponack Beach.

A property with 100 ft of frontage along the beach has been losing ~400–500 cy/yr over the past several decades. This is equivalent to ~30 large dump trucks of sand removed each year in front of one house. At this loss rate, the seaward dune vegetation line is expected to migrate ~40–80 ft inland over the next 10 or 20 years (respectively). Properties having less than 40 ft of vegetation between the beach and structures are most susceptible to storm damage in the next decade.

Ten-Year Nourishment Requirement

The team developed 5-year, 10-year, and 20-year beach restoration plans calling for 475,000 cy, 900,000 cy, and 1,750,000 cy (respectively). The ten-year plan is recommended as the most practicable plan considering economies of scale and the greater uncertainty of 20-year plans. The ten-year plan incorporates an additional volume (50,000 cy) in Reach 1 to feed the dune system over time and applies an additional 35 percent safety factor (extra volume over the length of the beach) to account for uncertainties and variability of loss rates from year to year.

Sediment Quality and Potential Borrow Sources

Sediment quality on the beach was determined via sampling. The "native" beach consists of moderately-sorted medium sand with a mean grain size of 0.41 millimeters (mm) (based on 60 samples along Sagaponack Beach and Bridgehampton-Water Mill Beach).

The USACE has identified several potential borrow areas near Sagaponack Beach including a 90-acre area designated 6I and a similar area off Wainscott Pond to the east designated 7A (Fig C). CSE collected six borings for the present study and determined that they all contained beach-quality sediment with negligible mud. Two of the borings (SAG-03 and SAG-05) obtained in ~50-ft depths about 1 mile offshore are deemed to have the most similar quality sediment as the native beach.

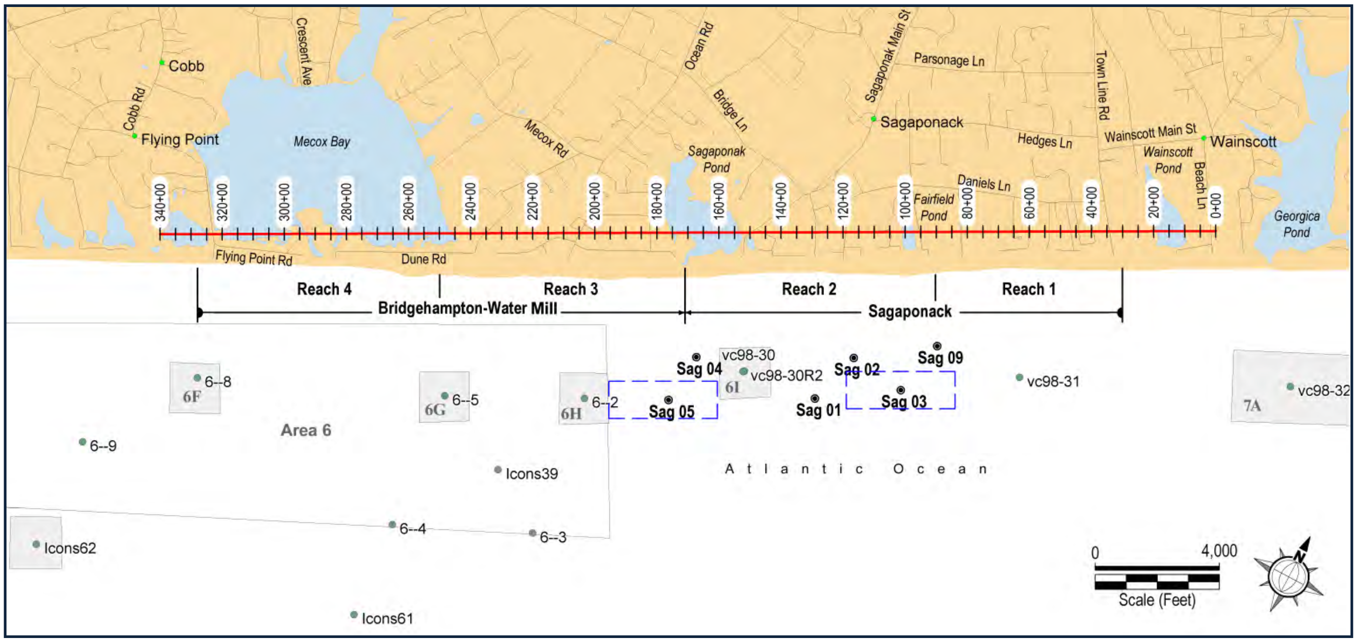

FIGURE C. Location of USACE cores, CSE cores (SAG-series, this study), and USACE-designated borrow areas. [Source: USACE 2008]

Pending confirmation via additional borings (applies to USACE-designated and CSE-designated borrow areas), an area ~3,500 ft long and ~1,200 ft wide centered on SAG-03 or SAG-05 (Fig C) could potentially provide over 1.2 million cubic yards if dredged to ~8 ft below the seabed. Sediments around SAG-03 and SAG-05 have an average grain-size of 0.47 mm, indicating they would perform well as nourishment material. If borrow sediments are finer than the native beach, much more volume is required to achieve a given dry-beach width.

Assuming a viable borrow area can be confirmed around the 50-ft depth contour off Sagaponack Beach, excavations by ocean-certified hopper dredge or cutterhead suction dredges is feasible during fair-weather periods. Hopper dredging is likely to be favored if the dredging window is limited to winter months because these vessels can operate in higher wave conditions.

Environmental Impacts

The primary environmental impacts that apply in the Sagaponack setting for projects of this type are changes to biota in the borrow area and on the beach (particularly surf clams, a commercial species), impacts to threatened and endangered species (particularly piping plovers), and impacts to water quality. Sediment quality is the most important variable that can be controlled. Borrow areas containing beach-quality sand with negligible mud, gravel, or cemented limestone fragments tend to reduce turbidity and minimize adverse impacts.

Recommended Plan

Figure D summarizes the recommended nourishment plan for Sagaponack Beach assuming an offshore borrow area about 1 mile offshore (see Fig C) is permitable. Table A presents a realistic range of cost scenarios based on similar project experience. The recommended plan would provide a range of profile volumes differing by reach. Figure E illustrates the typical nourishment sections and areas of impact across the littoral zone by reach.

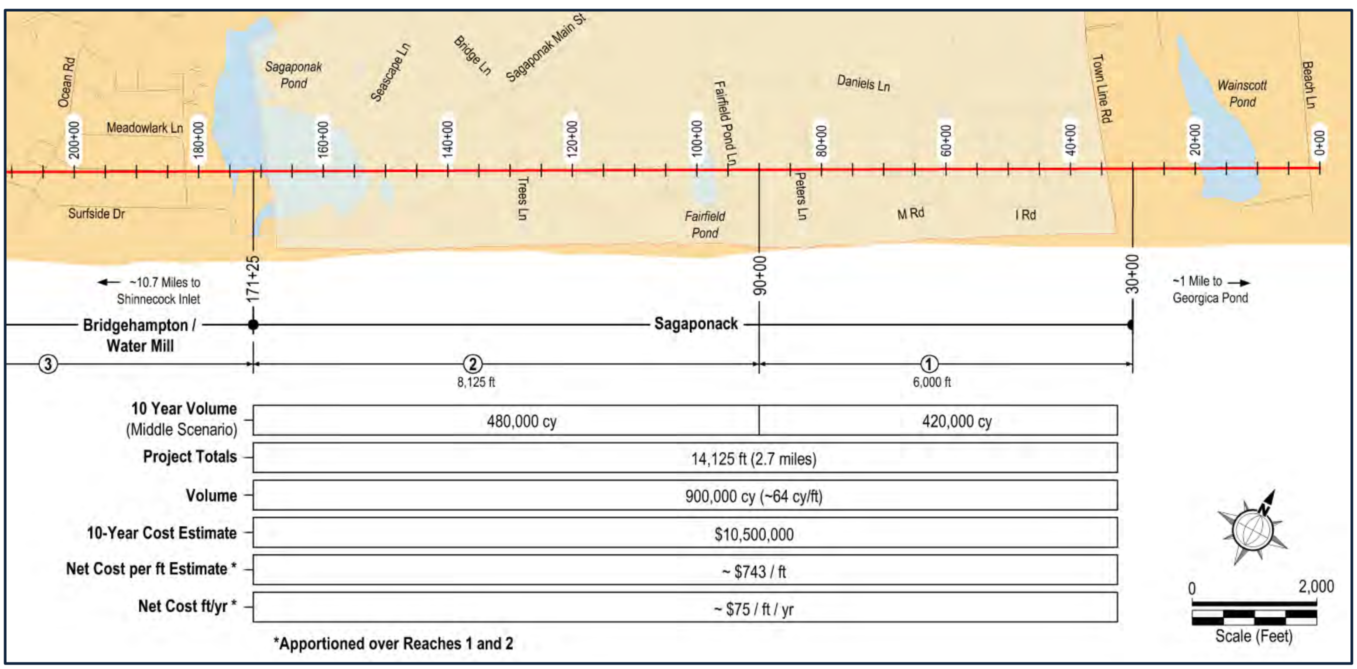

FIGURE D. Recommended "ten-year" beach restoration plan for Sagaponack involving ~900,000 cy from the USACE-designated offshore borrow areas (as available) or CSE-designated borrow areas. [All areas to be confirmed via additional borings. See Figure 2.34 for potential borrow areas.]

TABLE A.

Beach restoration plan for Sagaponack Beach — "ten-year project."

Offshore borrow sources USACE 6I, 7A or CSE (SAG-03), CSE (SAG-05) are assumed feasible for construction.

The low and high scenarios are ±15 percent of the middle (recommended) plan and considered to provide a realistic range of outcomes at the time of bids to assist the community in establishing a fixed budget (not to exceed) for the project.

Unit Cost Assumptions:	Dredging @	$ 8.25	per cubic yard
	Mobilization/Demobilization @	$ 2,000,000	

Notes: Unit cost estimate is based on recent projects at Smith Point (NY) and Nags Head (NC).

Mobilization/Demobilization cost is based on recent project at Westhampton (NY), and assumes Bridgehampton-Water Mill is constructed at the same time with shared mobilization.

CSE Recommended Ten-Year Plan — Middle Scenario

Reaches	Reach Limits	Length (ft)	Nourishment Volume (cy)	Average Unit Volume (cy/ft)	Pumping Costs
Reach 1	**30+00-90+00**	6,000	420,000	70	$ 3,465,000
Reach 2	**90+00-171+25**	8,125	480,000	59	$ 3,960,000
Totals	**30+00-171+25**	14,125	900,000	64	$ 7,425,000
				Mobilization/Demobilization	$ 2,000,000
				Final Design, Surveys, Engineering, Construction Admin @ 6%	$ 565,500
				Permitting and Environmental Reports @ 2%	$ 188,500
				Contingency @ ~3%	$ 321,000
				Total Project	$ 10,500,000
				Cost per Linear Foot of Beach	$ 743

CSE Recommended Ten-Year Plan — Low Scenario

Reaches	Reach Limits	Length (ft)	Nourishment Volume (cy)	Average Unit Volume (cy/ft)	Pumping Costs
Reach 1	**30+00-90+00**	6,000	357,000	60	$ 2,945,250
Reach 2	**90+00-171+25**	8,125	408,000	50	$ 3,366,000
Totals	**30+00-171+25**	14,125	765,000	54	$ 6,311,250
				Mobilization/Demobilization	$ 2,000,000
				Final Design, Surveys, Engineering, Construction Admin @ 6%	$ 498,675
				Permitting and Environmental Reports @ 2%	$ 166,225
				Contingency @ ~3%	$ 323,850
				Total Project	$ 9,300,000
				Cost per Linear Foot of Beach	$ 658

CSE Recommended Ten-Year Plan — Upper Scenario

Reaches	Reach Limits	Length (ft)	Nourishment Volume (cy)	Average Unit Volume (cy/ft)	Pumping Costs
Reach 1	**30+00-90+00**	6,000	483,000	81	$ 3,984,750
Reach 2	**90+00-171+25**	8,125	552,000	68	$ 4,554,000
Totals	**30+00-171+25**	14,125	1,035,000	73	$ 8,538,750
				Mobilization/Demobilization	$ 2,000,000
				Final Design, Surveys, Engineering, Construction Admin @ 6%	$ 632,325
				Permitting and Environmental Reports @ 2%	$ 210,775
				Contingency @ ~3%	$ 316,163
				Total Project	$ 11,500,000
				Cost per Linear Foot of Beach	$ 814

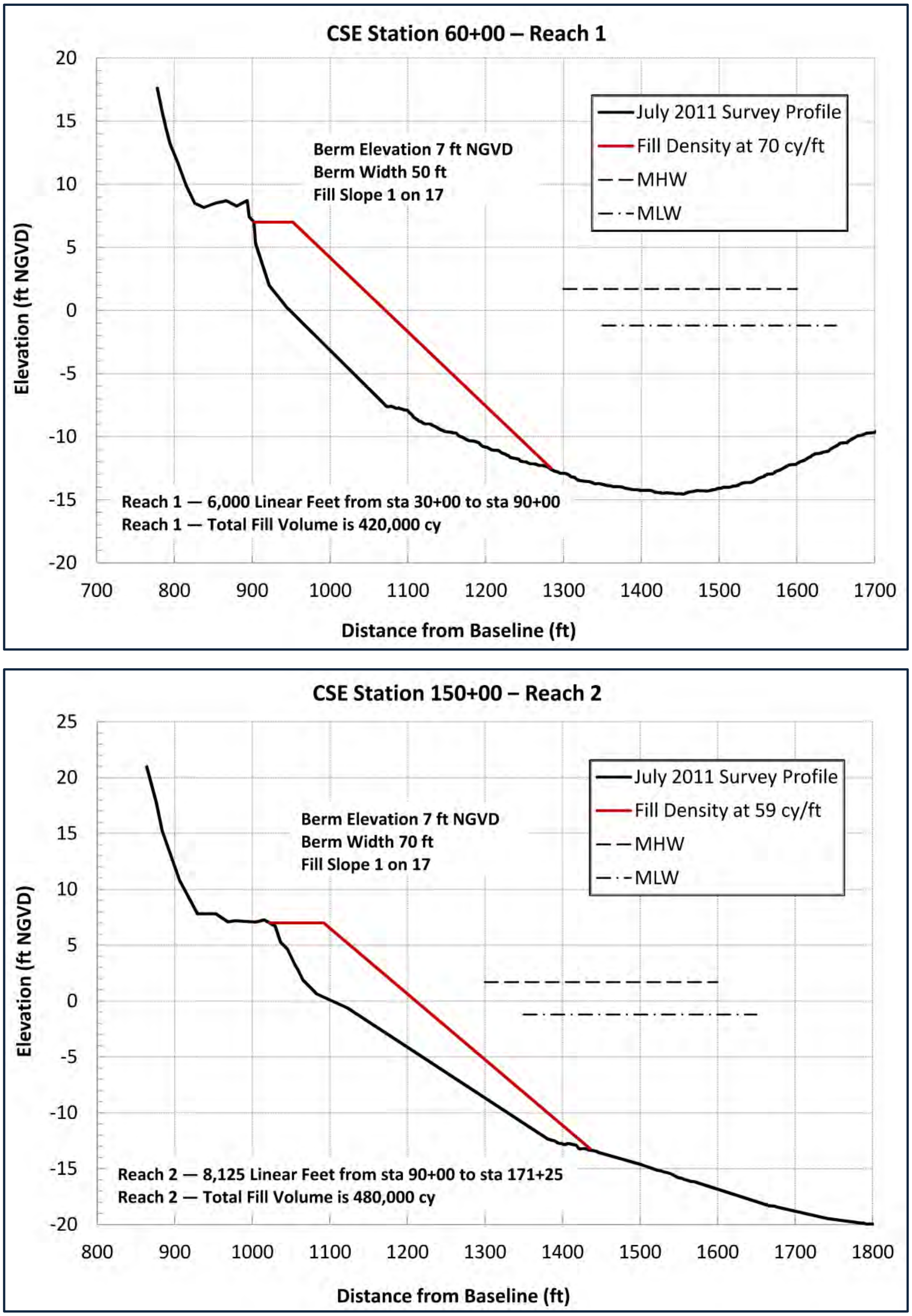

FIGURE E. Representative nourishment profiles for Reach 1 (eastern half) and Reach 2 (western half) of Sagaponack Beach based on the recommended plan. Profiles with average fill densities of 60–70 cy/ft are expected to widen the beach by ~60–75 ft after normal adjustment.

ACKNOWLEDGMENTS

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For the project team, Aram Terchunian (First Coastal) is project director assisted by Billy Mack Andrew Baird, Regina Grant, Mathew Quinn, and Sandra Segelke. Field data collection was performed by Philip McKee (CSE), Dennis Burns (CSE), Trey Hair (CSE), and Mathew Quinn. Bob Fox (PLS) provided baseline control and QA/QC of the data collection procedures of the team. Data reduction and analysis were directed by Dr. H. Kaczkowski PE (CSE senior coastal engineer, NY 090164) with assistance by CSE staff–Steven Traynum and Philip McKee. Trey Hair and Diana Sangster of CSE prepared the graphics and manuscript. The authors of the report were Tim Kana, Haiqing Kaczkowski, and Aram Terchunian.