Hull Springs Farm: Lower Machodoc Creek, Westmoreland County, Virginia

Introduction

Hull Springs Farm was obtained by Longwood University in 2000 to serve as a research venue for various subjects including shoreline processes, habitat, and management. Longwood obtained a grant from NOAA in 2005 to develop a GIS-based shoreline management plan for Lower Machodoc Creek including the approximately two miles of tidal shoreline around Hull Springs Farm. Most of the shoreline at Hull Springs Farm has small fetches and sheltered coasts, except for the shoreline in front of the "Manor House" which was actively eroding **(Figure 1).**

Site Setting

The Hull Springs Farm sill was built in 2008 along about 300 ft of shoreline on Lower Machodoc Creek. This coast is on the distal end of a neck of land between Glebe Creek and Aimes Creek (**Figure 1**). Recent (1994-2007) changes at the site indicate that the shore is eroding between -1 and -2 ft/yr. The site has fetches to the north, northeast, and east of 700, 7,500 and 800 ft, respectively. The north and east fetches are small relative to the northeast, which has more than one mile of fetch out the mouth of Glebe Creek and across Lower Machodoc Creek and is the primary cause of shore erosion during storms. The tide range is 1.8 ft (NOAA).
The shoreline occurs as a high upland bank composed of basal clay overlain by some very sandy strata. The base of the bank is generally erosive along the project site while the bank face is erosive to transitional to stable (**Figure 2**).

The existing marsh fringe and backshore varies from nonexistent, to about 5 ft wide at about mid-neck, and widening southward to about 10 to 15 ft wide. The instability of the base of the bank is related to the narrowness of the fringe, which in turn is related to fetch. A short, concrete seawall on the north end is the remnant of a wall that once extended southward along the eroding upland (**Figure 2**). Its presence is evidence of previous efforts to abate bank erosion at the project site. The bank is graded behind the standing wall. Northward, from the end of the wall, no marsh fringe exists and the base of bank is erosive, but the bank face is stable. High water hits the base of bank. In some areas, vegetation obscured the scarp at the base of bank.

Design Elements and Construction

The presence of a large oak tree about 25 ft from the top of bank was one reason for dealing with the erosion. Longwood University also wanted to demonstrate the Living Shoreline approach to shoreline management. VIMS determined that the bank condition, nearshore bottom condition, and fetch indicated that this would be an appropriate Living Shoreline application. A low sill with sand fill and marsh plants was designed (**Figures 3 and 4**).

Due to Tropical Storm Ernesto in 2006, the base of bank was significantly impacted, and the nature of the long-term erosion was dramatically revealed. The wave cut bank scarp from the storm was 6 ft high and eroded one to 2 ft in some areas. It was evident that the proposed sill was not sufficient for immediate protection of the base of bank since continued erosion would threaten the old oak tree on top of the bank. The design was modified to include a stone revetment in the vicinity of and adjacent to the old oak. The sill was still built in front (waterside) of the revetment (**Figure 4**).
The sand fill begins at +3 on the bank and old bulkhead and extends on a 10:1 slope to about mid-tide (+0.8) at the back of the sill (A-A, **Figure 3**). This provides planting widths of about 10 ft for Spartina alterniflora and 12 ft for Spartina patens
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The revetment was set at +6 ft MLW, the approximate top of scarp resulting from Ernesto. The sill, as originally planned, began at the northernmost end of the neck and extended southward across the upland bank area of active erosion. A low weir section was designed in the sill at the bulkhead (B-B, **Figure 3**) and an open window was designed in front of the revetment. In order to keep the window open, a cobble pavement was proposed instead of sand (C-C, **Figure 4**). Less sand fill was needed toward the south end of the project and only as an amendment to the existing marsh fringe. The revetment was built first, then the sill system. The revetment was built along about 400 ft of shoreline in front of the large oak tree.

Construction and Performance

The sill system was built in August 2008 and went through the Veteran’s Day Northeaster (2009) with no impacts to the unprotected base of bank. Marsh fringes were heavily covered with snow and ice the past winters, but appear to have reemerged intact.

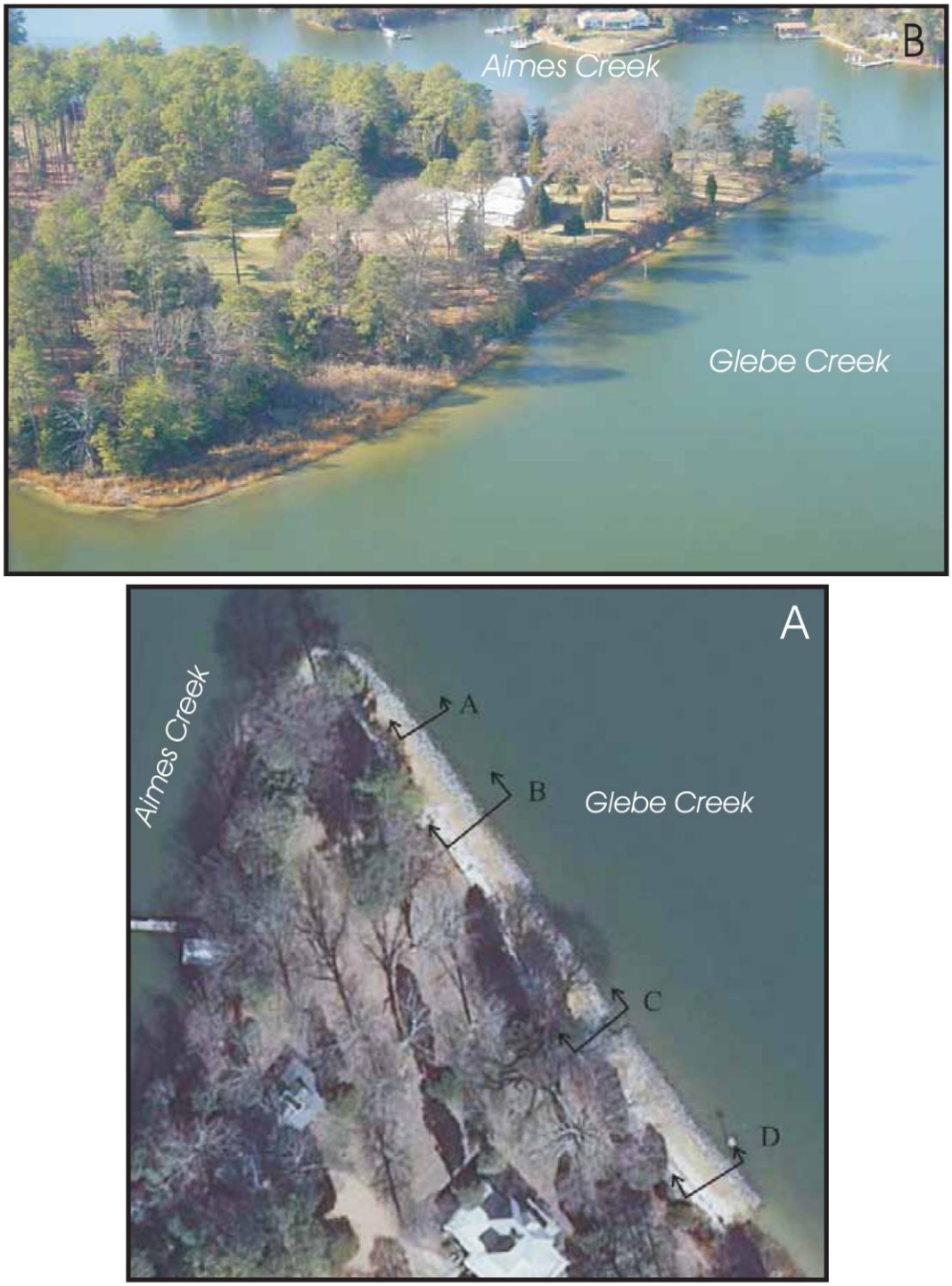

Figure 1 Longwood University's Hull Springs Farm on Glebe Creek. A) Before the shoreline project, the bank is eroding in front of the Manor House. B) After the project, the shore zone was widened with sand behind the sills.

Figure 2. Hull Springs Farm shoreline. (Top) before construction, (middle) after construction of the sill and placement of sand and (bottom) after planting.

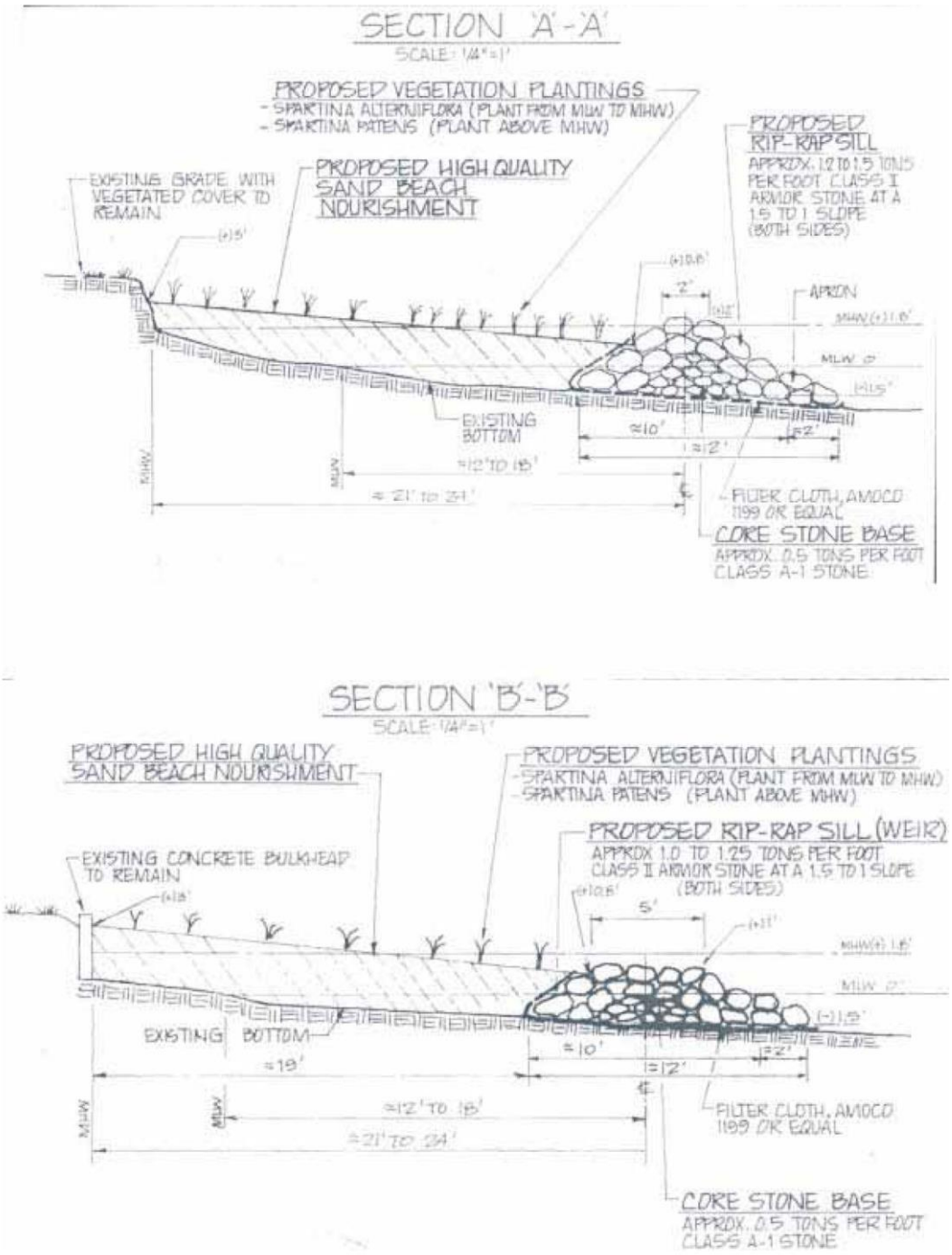

Figure 3. Typical cross-sections for sill built at Hull Springs Farm. Section locations are shown on Figure 1. Permit drawings by Bayshore Design, LLC.

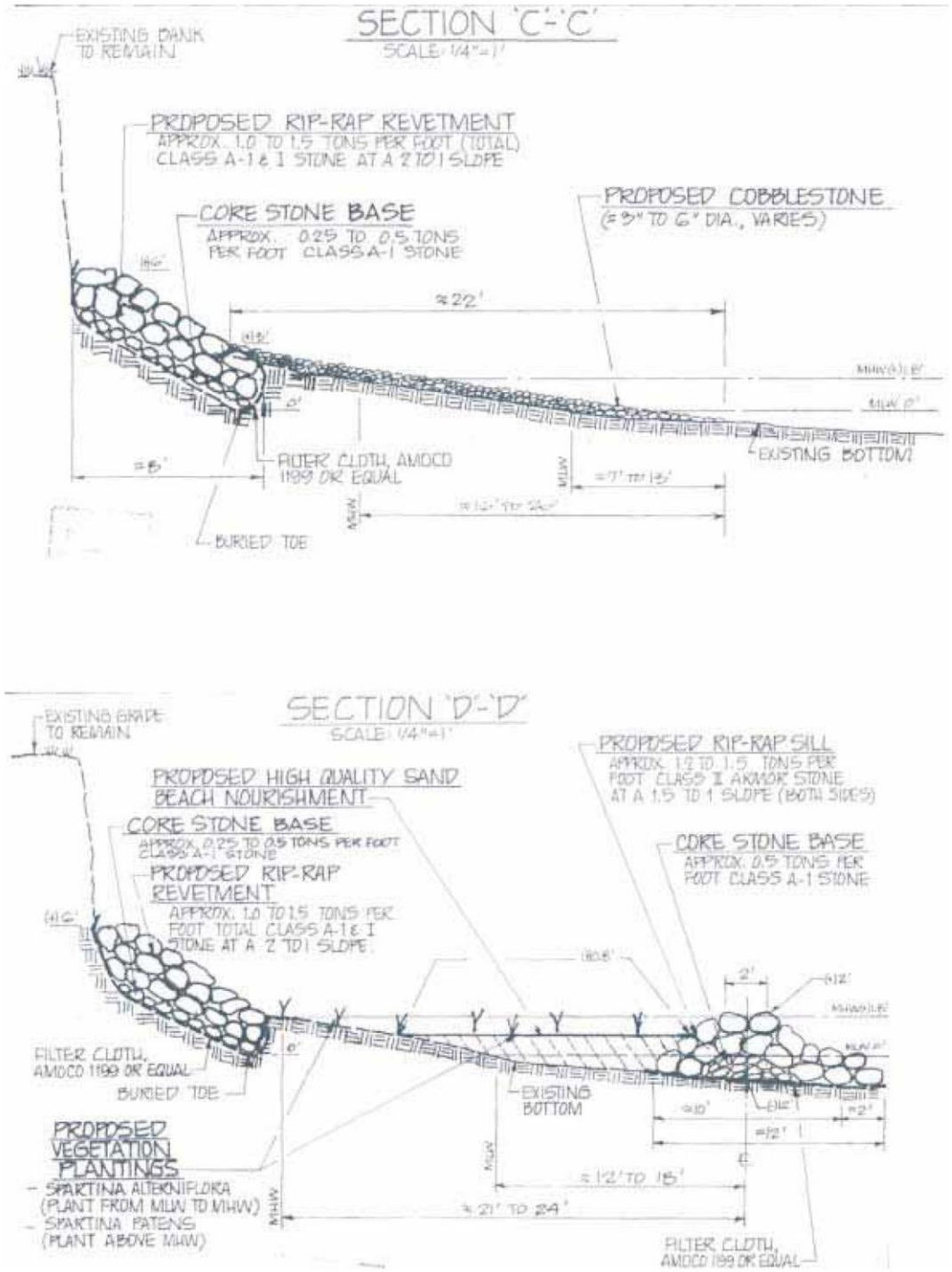

Figure 4. Typical cross-sections for sill built at Hull Springs Farm. Section locations are shown on Figure 1. Permit drawings by Bayshore Design, LLC.