United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
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Gloucester, Virginia 23061

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Memorandum

To: Supervisor, Endangered Species & Conservation Planning Assistance Programs, Virginia Field Office

From: Field Supervisor, Virginia Field Office Cynthia A Schulz

Subject: Biological Opinion for Bavon Beach Homeowners Association Shoreline Stabilization Project, Mathews County, Virginia, Permit NAO-2011-2520 (11-V1708), Project # 2012-F-0142

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the subject project and its effects on the federally listed threatened Northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) (NBTB), in accordance with section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). Formal consultation was initiated on December 9, 2011.

This biological opinion is based on information provided in the U.S. Army Corps of Engineers (Corps) permit application package, telephone conversations, field investigations, published peer reviewed literature, and other sources of information. A complete administrative record of this consultation is on file in this office.

CONSULTATION HISTORY

09-12-11 to 11-18-11 Corps and Service representatives, through emails and phone calls, discussed the proposed breakwater project for the Bavon Beach community and its potential impact to NBTB. The Service recommended that the Corps initiate formal consultation.

11-30-11 Vanasse Hangen Brustlin, Inc. submitted the joint permit application for proposed breakwater project and represents the Bavon Beach Homeowners Association (BBHOA).

12-08-11 Corps issued public notice.

12-09-11 Service indicated that all information necessary to conduct formal consultation was received.

01/20/2012 Service notified the Corps that the Service will be the designated Federal lead for this project for purposes of ESA section 7 consultation.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The applicants, BBHOA, represent a group of homeowners who have submitted a Corps' permit application to construct four breakwaters, implement beach nourishment, and create a dune system fronting the uplands along approximately 2,100 feet (ft) of shoreline. The purpose of the project is to stabilize this section of beach, protect the property from erosion, and create expanded beach habitat for NBTBs. The project should also stabilize the adjacent beach section within the Chesapeake Shores community. The project is located at the Bavon Beach Subdivision, Bavon Beach Drive, off and west of Route 600, Mathews County, Virginia (Sheet 1 of 9 of Appendix).

The breakwater design is shown in the Appendix (Sheets 2-9). At their crest the breakwaters will be 200 ft, 300 ft, 250 ft, and 200 ft in length, from north to south respectively. The northern breakwater is designed as a transition structure from this project to the Chesapeake Shores beach to the north, and will have a lower crest elevation. The southernmost structure is positioned closer to shore and is designed to protect the southern marsh headland that provides an anchoring point for the south embayment. Beach nourishment will be limited in this area since no infrastructure is in jeopardy. The beach nourishment sand (44,000 cubic yards) for this project will be obtained from a sand pit or from a dredge operation and will have a mean sand grain size of 0.3 to 0.7 millimeters (mm), the preferred size for establishing NBTB habitat and a stable beach structure. The sand fill will impact approximately 66,498 ft^2 of intertidal and sub-tidal substrate.

The project site will be accessed through The Nature Conservancy's (TNC) New Point Comfort Preserve, located at the southern end of the project where the fourth breakwater will be connected to the land area (Appendix, Sheet 6 of 9). A barge will be anchored at the shoreline and serve as a temporary pier and staging area for the stone materials needed for construction. All submerged aquatic vegetation beds are located outside the project area and will not be impacted by this project. All backshore and dune areas will be planted with saltmeadow hay (*Spartina patens*), American beachgrass (*Ammophila breviligulata*), and sea oats (*Uniola paniculata*) (Appendix, Sheets 7-9).

The Service contributed $220,000 towards this project to fund land based surveys, bathymetric surveys, development of the engineering plans, and creation of documents needed for the application process. The remaining funds will be used in the construction of the project, in addition to funds provided by the applicants and by donations of time and materials from partners involved with this project. The Service will be serving as the lead Federal agency for this project due to our interest in this partnership, and the positive outcome this project will have for NBTB.

A monitoring program for the project will be implemented with the assistance of a number of project partners, with the Service serving as the lead for this effort. NBTB surveys conducted by the Service or by contract in prior years will serve as baseline data for later analysis. Pre-construction and post-construction NBTB adult and larval surveys (for a period of five years) will be conducted annually by Service staff with the assistance of a NBTB expert. This partnership includes individuals from the Virginia Institute of Marine Science (VIMS) who have conducted shoreline studies at this site in the past and will continue to do so. The aerial photography and shoreline geomorphology data collected by VIMS will be used to analyze the shoreline response to the project over time, and the NBTB surveys will evaluate the NBTB response to the project over time.

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project is the entire 8,300 ft of shoreline beach fronting the Bavon Beach and Chesapeake Shores communities, and the shoreline to the south comprised of TNC's New Point Comfort Preserve and the New Point Comfort Natural Area Preserve owned by the Virginia Department of Conservation and Recreation (VDCR). The project area comprises 2,100 ft of this shoreline, and the average width of beach from mean low water to the start of the remaining dune is approximately 35 ft, making the project area approximately 52,500 ft^2 in size.

STATUS OF THE SPECIES RANGEWIDE

Species Description and Life History - NBTB is a beach-dwelling insect measuring approximately 0.5 inch in length. It has white to light tan wing covers, often with several fine grayish-green lines, and a bronze-green head and thorax (Service 1994). Adult NBTBs are active, diurnal surface predators. They forage along the water's edge on small amphipods, flies, and other beach arthropods, or scavenge on dead amphipods, crabs, and fish (Knisley et al. 1987, Service 1994). Most foraging occurs in the damp sand of the intertidal zone and scavenging has been observed to occur more often than predation (Knisley et al. 1987). Adult NBTBs are present on beaches from early June through early September, and spend most of the day along the water's edge (Knisley et al. 1987). Adults are active on warm, sunny days when they can be seen feeding, mating, or basking (Service 1994). They are less active on rainy, cool, or cloudy days because they cannot maintain their body temperature (C.B. Knisley, Randolph-Macon College, pers. comm. 1994). They rely on a variety of behaviors, such as foraging and basking, to maintain their high body temperatures (Knisley et al. 1987).

Adult NBTBs mate and lay eggs on the beach during the summer (starting in June and ending by mid July). Eggs are deposited on the beach near the sand surface or in shallow pits excavated by adults, usually within 1 inch of the beach surface (Knisley 1997b). The eggs hatch in 10-14 days, depending on soil moisture. Adequate moisture may allow a shorter hatch period (C.B. Knisley, pers. comm. 2008). Larvae pass through three instar stages, pupate, and emerge as adults two years following hatching (Knisley et al. 1987, Service 1994). However, some larvae that hatch early and find sufficient food may develop more rapidly and emerge as adults after only one year (Service 1994). Development through three larval stages and pupation takes place within a larval

burrow (Knisley et al. 1987). First instars generally occur from late August through September, second instars from September to late fall, and third instars from late fall to early spring and through the second year (Knisley et al. 1987). Knisley et al. (1987) found that the distribution of first and second instars was similar and that highest densities of third instars were higher on the beach in the mid- to upper-tidal zone. Therefore, most burrows were underwater during high tide. Larvae can survive flooding for 3-6 days (Service 1994). Larval burrow depths ranged from 3.5-9.5 inches and increased with distance from the water's edge, suggesting that burrow depth may be related to subsurface moisture (Knisley et al. 1987). Larvae lack a hard cuticle and are susceptible to desiccation. They tend to become inactive during hot, dry conditions (Service 1994). Larvae are active primarily at night and plug their burrows during most of the day. Generally, larval burrows are plugged and not visible when the sand is dry and warm.

Larvae feed by ambushing passing prey. Little is known about the precise types of microarthropods eaten by NBTB larvae, but prey that have been identified include beach fleas, lice, flies, ants, and other small insects (Pearson et. al. 2006, Knisley 2008). While little information on the necessary prey abundance is known, lack of prey base may explain why NBTBs are not found in certain areas.

Larvae typically occur in an area of beach 26-39 ft wide within and above the intertidal zone. However, the area where larvae occur may be wider in areas of washover or where the upper beach is flat and is periodically inundated by high tides (Service 1994). Larvae have been documented on beaches less than 26 ft wide. Larvae have been found crawling on the beach, apparently moving to dig a new burrow in a better location (Service 1994). This behavior is likely a response to variations in tide levels, soil moisture, or sand accretion and erosion patterns. Larvae overwinter in their burrows until mid-March, with low levels of activity when the sand is damp and cool (C.B. Knisley, pers. comm. 1994). Highest, most predictable periods of larval activity are from late August through early November. Larval activity is highly variable and greatly influenced by temperature, substrate moisture, tide levels, and season (Service 1994). Knisley et al. (1987) found that first emergence of adults ranged from June 5-13 in Virginia. Rainfall appears to enhance emergence since numbers of adults usually increase after a rainfall. The number of adult NBTBs increase rapidly in June, peaks in mid-July, begins to decline through August, and few adults can be found in September.

There is a period of approximately two weeks after adults emerge when there is little to no dispersal (Hill and Knisley 1994). Then, a small number of adult NBTBs disperse to other sites. There is a regular dispersal phase after peak numbers emerge in early July (Knisley and Hill 1989; Service 1994). Mark-recapture studies have determined that adult NBTBs may travel 5-12 miles (mi) (Knisley and Hill 1989) from sites where they were marked, and some individuals may disperse up to 15 mi (Knisley 1997a). In Northumberland County, Virginia a total of 10,131 adult NBTBs were marked and released; 91 NBTBs dispersed to new sites (mainly between two close, large sites 1 mi apart) (Hill and Knisley 1994). Large sites seem to serve as recruitment areas, while small sites serve as stop-overs during dispersal (Hill and Knisley 1994). "It is probable that feeding or resting occur at these smaller sites and that without them, the larger sites may not experience as much migration" (Hill and Knisley 1994). This dispersal serves to

exchange genetic material, allow for the colonization of unoccupied sites, and enable NBTBs to leave eroding sites (Hill and Knisley 1994).

Survey data from 1998-2002 (Knisley and Hill 1998, 1999; Knisley 2001; Knisley 2002) indicate that beaches with a length of at least 325 ft, a width of at least 6.5 ft, and an adult population of at least 30, serve as breeding sites and larvae should be considered present. Optimal NBTB habitat is a beach greater than 16-26 ft wide (C.B. Knisley, pers. comm. 1994). Preference for beaches with a width of 8-20 ft was found to be statistically significant, and NBTBs are rarely found on beaches less than 6.5 ft in width (Drummond 2002). Adult and larval NBTBs are typically found on highly dynamic beaches with back beach vegetation, and they prefer long, wide beaches that have low human and vehicular activity, fine sand particle size, and a high degree of exposure (Knisley et al. 1987). Although narrow beach width is frequently the reason for lack of larvae, there are instances where larvae have variable densities or are absent on wide beaches.

Knisley (1997b) found that the larvae are rare on sites with less than 5 degrees slope. Though not statistically significant, Drummond (2002) found indications that the NBTBs prefer beaches with slopes of 6.5 degrees and greater. Preliminary work indicates a correlation between the extent of shallow water fronting the beach and the number of NBTBs present (the more sand bars, the more NBTBs) (Drummond 2002). A beetle with sedentary larvae is susceptible to wave impacts, and work by Rosen (1980) has shown that the greater the shallow zone fronting a beach, the lower the wave energy. There appears to be no beach aspect preference for NBTB (Drummond 2002).

Limited studies have been conducted to define the sand characteristics at sites where NBTBs currently occur, and further studies are needed to accurately identify the sand characteristics that NBTBs need to support all life stages. Knisley (1997b) found that larval densities were highly variable relative to sand particle size, and that larvae are rare at sites with greater than 60% coarse sand (defined as the percentage of sand particles too large to sieve through the 100-size mesh sieve) (Knisley 1997b). Drummond (2002) found that adult NBTBs occupied beaches with 40-80% coarse sand. If the sand size is too coarse, too fine, or contains a high organic content, it appears unsuitable for the larvae to burrow and maintain a larval tube. Preliminary data indicate that NBTB is found on beaches with a narrow range of bulk density ranging from 1.30-1.59 ounces/inch^3 (Drummond 2002). Bulk density may impact NBTB distribution in two ways: (1) stability of larval burrows, and (2) prey base availability (Drummond 2002). Bulk density affects microarthropod abundance and type (Blair et al. 1994). During a study of two beach nourishment projects, Fenster et al. (2006) found that the NBTB prefers beaches with sands having a mean grain size of 0.0196 to 0.236 inches, and with relatively compacted sediment. Mean grain size and sediment compaction are biologically important factors during oviposition and burrow building. Females oviposit in particular sediment types based on the shape of their ovipositor (Fenster et al. 2006). Larvae require sediments that they can build burrows in that do not collapse (Fenster et al. 2006).

Population Dynamics - Populations of NBTBs are highly variable from year to year because they are subject to local extirpations (from storm events impacting the larval stage) and are affected by movements (dispersal and recolonization) (Service 1994). Two- to three-fold year-to-year variation in numbers at a given site is common (Knisley and Hill 1989, 1990). The Service funded a population viability analysis (PVA) for the Chesapeake Bay populations of the NBTB, the purpose of which was to compare management strategies, not to estimate extinction probabilities, per se (Gowan and Knisley 2001). The PVA compared six management strategies and found that without increased protection of the most important NBTB populations, the extinction probability throughout its range over the next century is high (Gowan and Knisley 2001). The PVA concluded that protection of 25-50 subpopulations is necessary to reduce extinction risk for the NBTB throughout the Chesapeake Bay (Gowan and Knisley 2001). The difficulty lies in selecting sites that assure adequate geographic coverage (Gowan and Knisley 2001).

NBTBs in the Chesapeake Bay and Massachusetts are currently physically and genetically isolated from each other. Vogler et al. (1993) examined genetic variation in these populations. They found that the isolated Martha's Vineyard population and Chesapeake Bay populations had low genetic variability. "The Martha's Vineyard population can be further distinguished by the presence of an allozyme allele . . . that has not been observed in the Chesapeake Bay NBTBs" (Service 1994). "Thus, although populations from these two areas represent the same subspecies, they should be considered as separate conservation units (Vogler and DeSalle 1994)" (Service 1994). Additional genetic work supports treating the Massachusetts population as a distinct group from the Chesapeake Bay populations with regards to species recovery and management (Vogler and Goldstein 1997).

Rangewide Status - Historically, NBTB was a common inhabitant of coastal beaches from Cape Cod, Massachusetts to central New Jersey, and along the Chesapeake Bay, from Calvert County, Maryland south through Virginia. To facilitate the reestablishment of the species across its former range, the NBTB's recovery plan established nine Geographic Recovery Areas (GRAs) to provide a framework within which protection and population efforts could be ranked and implemented (Service 1994). Table 1 provides a summary of the status of each GRA.

There are two naturally occurring NBTB populations in Massachusetts, one at Martha's Vineyard (GRA 1) and one site near Westport. Survey work documented the highest number of adult NBTBs observed at Martha's Vineyard as 3,388 in 2005, and since that time the following numbers have been documented: 1,261 in 2006, 1,196 in 2007, 1,629 in 2008, 1,513 in 2009, 3,072 in 2010, and 1,503 in 2011 (T. Simmons, Massachusetts Division of Fisheries and Wildlife, pers. comm. 2012). Surveys in 2010 and 2011 found the overall numbers at Martha's Vineyard stable. However, at the Squibnocket site on Martha's Vineyard, storm events after the 2010 survey removed extensive overwash areas dropping the numbers from 1,500 to 93 in 2011 (T. Simmons, pers. comm. 2012). The Westport population was discovered in 1994 (152 adults observed) but declined to 10 adults in 1995 and to 2 adults in 2001. The NBTB has not been seen at the Westport site since 2001 and is likely extirpated (S. von Oettingen, Service, pers. comm. 2001, 2008).

A third population was established in Massachusetts by translocation of larvae from Martha's Vineyard to Monomoy National Wildlife Refuge (Nothnagle 2001). Translocations were conducted from 2000 to 2003 (Davis 2007). Adult NBTB surveys at this site have shown a steady increase in numbers. In 2004, 26 adult NBTBs were counted, 16 in 2005, 75 in 2006, 19 in 2007, 180 in 2008, 102 in 2009, 571 in 2010, and 375 in 2011 (Kapitulik 2011). It is estimated that at peak season the number of adult NBTBs present at the site was over 1,000 in 2010 and over 800 in 2011 (Kapitulik 2011).

In 1990 when the NBTB was listed, it was considered extirpated from Rhode Island (RI), Connecticut (CT), and New York (Long Island) (55 FR 32088) (GRA 2 and 3), and is still considered extirpated in these states.

In 1994, larvae collected from multiple sites in Virginia were released at two sites on Sandy Hook, New Jersey (GRA 4), in the National Park Service's Gateway National Recreation Area. In summer 1995, adults were documented at both sites, and mating and foraging were observed (A. Scherer, Service, pers. comm. 1996). In autumn 1995, first instar larvae were documented; a result of reproduction from the reintroduced NBTBs. During autumn 1995, 367 additional larvae from Virginia were translocated (Knisley et al. 2001). During autumn 1995 and the subsequent winter of 1995/1996, severe erosion occurred and some NBTB sites were completely eroded. In 1996, little larval activity was documented and no further reintroduction took place. In spring 1997, 486 larvae from the Chesapeake Bay were released at Sandy Hook and during that summer, 178 adults were documented (Knisley et al. 2001). In April 1999, 585 larvae were translocated, and 260 adults were counted in July (Knisley et al. 2001). In 2000, 554 larvae were translocated in April, and 720 adults were counted in July (Knisley et al. 2001). The population increased to 749 adults in 2001, but the adult numbers dropped to 142 in 2002, 50 in 2003, and 2 in 2005 (A. Scherer, pers. comm. 2004, 2008). In 2006, an additional 480 larvae were released at Sandy Hook and 28 adults were observed in July. Only 2 adults were observed in the reintroduction area in 2007 (National Park Service 2007). The National Park Service conducted a limited survey in 2008, 7 adults were observed (A. Gluckstein, National Park Service, pers. comm. 2009). A survey in 2009 found no NBTBs at this site (A. Scherer, pers. comm. 2009).

The NBTB populations in Maryland have declined and many of the occupied sites show a trend toward extirpation (C.B. Knisley, pers. comm. 2008). Between 1988 and 1993, the NBTB was documented at 10 sites in Calvert County, Maryland (GRA 5) (Service 1994). By 1993, the NBTB was in decline at 6 of these 10 sites and in a few years the populations were extirpated (C.B. Knisley, pers. comm. 2008).

From 1993-2009 annual NBTB surveys were conducted at the four largest sites in Calvert County: Scientific Cliffs, Flag Ponds, Calvert Cliffs, and Western Shores/Calvert Beach (C.B. Knisley, pers. comm. 2008). Scientific Cliffs supported a sizeable population for over five years but then gradually declined and was extirpated in 2004. Flag Ponds experienced a severe decline with only 2 adults observed in 2008 and NBTB is now considered extirpated from this site (C.B. Knisley, pers. comm. 2011). The Calvert Cliffs site has degraded over the years, and due to limited access it is uncertain if the population is extirpated. Currently the only site in Calvert

County known to support a viable population is the Western Shores/Calvert Beach site, and NBTB numbers have declined from a high of 4,198 adults in 1991, to 623 in 2005 (Knisley 2005b). More recent surveys found 589 adults in 2010 and 436 adults in 2011, indicating that the adult numbers held somewhat steady at 400-600 adults for the last six years (C.B. Knisley, pers. comm. 2011).

The two NBTB sites in Maryland outside Calvert County are Cedar and Janes Islands (GRA 6) and have shown steady or increasing numbers. At Cedar Island 1,095 adults were documented in 2004, 1,298 in 2005, and 1,439 in 2010 (Knisley 2005b; C.B. Knisley, pers. comm. 2011). At Janes Island 369 adults were documented in 2004, 2,476 in 2005, and 1,163 in 2010 (Knisley 2005b; C.B. Knisley, pers. comm. 2011).

In 1999, 2002, 2005, and 2009, comprehensive NBTB adult surveys were conducted along the eastern shoreline of the Chesapeake Bay in Virginia (GRA 7). The 1999 survey found 32,143 adults (Knisley and Hill 1999), the 2002 survey found 33,469 adults (Knisley 2002), the 2005 survey found 38,498 adults (Knisley 2005a), and the 2009 survey found 46,082 adults (Knisley 2009). During the 2005 survey a site (Church Neck) was discovered with 2,297 adult NBTBs. From 2006-2008, surveys of eastern shoreline of the Chesapeake Bay in Virginia were only conducted at sites owned by the VDCR, TNC, and the Service, and indicated relatively stable populations. The 2009 survey (Knisley 2009) further supported this trend with the highest numbers documented to date. Overall, the eastern shoreline shows an increase in numbers of adults, but the number of sites occupied is declining (Knisley 2009).

In 1998, 2001, 2004, and 2008, NBTB surveys were conducted along the western shoreline of the Chesapeake Bay in Virginia (GRA 8 and 9). In 1998, 26,685 adults were found (Knisley and Hill 1998). In 2001, 33,278 adults were found (Knisley et al. 2001). In 2003, Hurricane Isabel hit the Chesapeake Bay area. In 2004, the Service completed a survey of the western shoreline to determine what impacts Hurricane Isabel may have had on the NBTB (Knisley 2005c). The 2004 survey found 12,306 adult NBTBs (a 63% decline in numbers from the 2001 surveys). All NBTBs and habitat were lost at eight sites. In 2005, a survey of the western shoreline in Virginia found 19,430 adult NBTBs. The 2005 survey suggested that while NBTBs at a number of sites were recovering slowly, other sites showed no adults present, possibly indicating that all instar stages had been lost during the 2003 hurricane. In 2006, Hurricane Ernesto made landfall in Virginia. In 2007, landowners along the Potomac River indicated that Hurricane Ernesto had caused major changes to the shoreline. The Service (2007) conducted a survey of this area to evaluate the impacts from Hurricane Ernesto to the NBTB and found the total number of adult NBTBs at the eight sites along the Potomac River declined from 3,748 in 2005 to 2,747 in 2007 (26.71%). The 2008 full survey of the western shoreline of the Chesapeake Bay found 9,933 adult NBTBs (approximately 30% of the numbers observed in the 2001 survey) (Service 2008).

In 2009, the Service finalized a 5-year status review of the NBTB (Service 2009). As a result of the continued loss of NBTB populations and habitat and the overall declining population trend described above, the Service recommended reclassifying the NBTB from threatened to endangered. To date, no action has been taken to formally propose reclassification.

Table 1. Summary of the status of the NBTB throughout its range.

GRA	Location	Status	Site Specific Comments
1	Coastal Massachusetts and Islands	Stable	• Westport - population extirpated • Martha's Vineyard - overall numbers appear stable; Squibnocket site from 2010 to 2011 had significant drop of adult NBTBs from 1,500 to 93 • Monomoy National Wildlife Refuge translocation - numbers increasing
2	Rhode Island Block Island, RI Long Island Sound, CT	Extirpated	• extirpated at time of listing, and to date still considered extirpated
3	Long Island, New York	Extirpated	• extirpated at time of listing, and to date still considered extirpated
4	Sandy Hook to Little Egg Inlet, New Jersey	Uncertain	• Sandy Hook translocation - 7 adults observed in 2008, multiple surveys since have located no NBTBs
5	Calvert County, Maryland	Extirpated/ Declining	• 8 sites - extirpated, habitat lost or in poor condition • Calvert Cliffs - status uncertain • Western Shores/Calvert Beach - declined from high count of 4,198 in 1991 and is holding at 400-600, a 90% decline.
6	Tangier Sound, Maryland	Stable/ Increasing	• Janes Island - $\geq$ 1,100 adults (protected) • Cedar Island - $\geq$ 1,100 adults (protected) • Only GRA that meets delisting criteria (Service 1994)

GRA	Location	Status	Site Specific Comments
7	Eastern Shore, Virginia	Stable to declining	• 2009 survey found the highest total count (46,082) of adults since start of comprehensive surveys • Increase primarily result of increases at 7 sites (Church Neck North, Occahannock Neck, Silver-Downings Beach, Tankards Beach, Scarborough Neck, Church Neck, Hyslop Marsh) • 7 sites with no NBTBs compared to 2 in 2005. • Significant declines from 2005 occurred at 4 sites (Picketts Harbor, Cape Charles, Elliots Creek South, Kiptopeke), coincidental with increased shoreline modifications or other human impacts • Largest decline was at Parkers Marsh (down from 12,554 in 2005, to 1,629 in 2009)
8 & 9	Western Shore, Virginia	Declining	• Since 2001 a 20% loss in occupied sites (12 of 58 occupied sites) and total numbers declined 70% • Habitat loss due to Hurricanes Isabel and Ernesto • Since 2001, the 8 largest sites that supported approximately 50% of the total NBTBs declined 78% • GRA 8 - 4 occupied sites that support large populations (not protected); 1 "other" sized population Hughlett Point (protected) • GRA 9 - 2 occupied sites that support large populations; 1 "other" sized population Bethel Beach

Factors Affecting the Species - In 1990, the Service listed the NBTB as threatened because of its greatly reduced range and susceptibility to natural and human threats (55 FR 32088). Natural limiting factors include winter storms, beach erosion, flood tides, hurricanes (Stamatov 1972), and predators. Anthropogenic threats mentioned in earlier papers included pollution, pesticides, high levels of recreational activity, off-road vehicular traffic, and shoreline alteration (Knisley et al. 1987; Knisley and Hill 1989, 1990; Service 1994). Past extirpation of the NBTB from most of its range has been attributed primarily to destruction and disturbance of natural beach habitat from shoreline development, beach stabilization, and high levels of recreational use (Service 1994). These threats continue to affect the long-term survivability of NBTB, but with the addition of sea level rise these factors are exacerbated. Sea levels will change the dynamics that

maintain beach habitats, including increased shoreline erosion rates in some areas, and changes in sand deposition (USGS 1998). The accelerated changes in shoreline structure and composition, and the location of suitable sandy beaches will influence the ability of NBTB to adapt to climate change.

Storms impact the coast throughout the year with nor'easters occurring in the winter and hurricanes in the summer/autumn. Nor'easters affect beach habitats from Massachusetts to Virginia and can cause severe and prolonged flooding and beach erosion. Hurricanes also can cause significant erosion due to high tides and water levels. In 2003, Hurricane Isabel impacted NBTB habitat on the western shoreline of Virginia. Knisley (2005c) determined that the first and second instar larvae from the 2003 adult cohort and the third instars from the 2002 cohort were likely washed out of their burrows by erosion and concluded that the reduced number of adults in 2004 were likely the result of this hurricane. These storms are natural occurrences that affect NBTB populations, and the NBTB's ability to disperse and recolonize sites, ability to survive prolonged inundation, and other adaptations help their populations persist through these events. However, with increasing shoreline modification and habitat alteration and sea level rise, the ability of the NBTB to withstand and recover from this threat has been reduced.

Erosion within the Chesapeake Bay has occurred for thousands of years from natural sea level rise and wave action. However, this process has been exacerbated by beach development activities that interfere with natural beach dynamics and longshore sand transport. Beach stabilization structures such as groins, jetties, rip-rap revetments, and bulkheads, which are designed to reduce erosion, may interrupt and capture sand from longshore transport and build up the beach around the structure but prevent sand from moving to the down-drift shoreline. Bulkheads and rip-rap typically result in reflection of wave energy onto the forebeach, which ultimately narrows the beach and steepens the profile. Such changes in the beach profile can occur over periods of 1-30 years. These structures also prevent the back beach from supplying sand to the forebeach, and concentrate wave energy at the ends of the bulkhead or revetment, resulting in erosion at these points (Knisley 1997a). "Along a given length of shoreline, the first structure installed often has an adverse impact on the neighbor's shoreline (usually downstream of a longshore current), thus forcing a sequence of other shoreline modifications. Eventually, as shoreline modifications increase in number and amount of shoreline modified, the sand 'bank' is further depleted as erosion is halted and sand moves offshore into deeper channels. The long-term (50+ years) impacts of this scenario are unknown, but may eventually lead to a collapse of the natural beach habitat. . ." (Hill and Knisley 1995).

Knisley (1997a) conducted three years (1994-96) of research on the effects of shoreline stabilization structures on the distribution and abundance of the NBTB. A total of 24 sites (51 site sections) were surveyed for adult and larval NBTBs in Virginia. The sites were placed into one of the following categories: natural beach (14 sections), narrow beach (6 sections), groins (13 sections), groins/bulkheads (10 sections), and revetments (7 sections). The mean number of adults and larvae and beach width were greatest at natural beaches. Natural beaches and those with sand deposition supported the greatest number of larval and adult NBTBs. Bulkheads and revetments had the greatest negative impact on NBTBs. "Even though larvae were found at

some bulkhead sites and at other modified or narrow sites, they probably have higher winter mortality than those at natural beaches. Because of a two-year life cycle, larvae are more likely to survive two falls and winters of erosion and beach narrowing when more beach width is available." (Knisley 1997a).

Monitoring of shoreline stabilization projects since the Knisley (1997a) study continue to show that shoreline hardening generally is detrimental to NBTBs, though there is variability in the responses of habitat and NBTBs depending on other factors, including adjacent beach conditions, project design, and site-specific characteristics.

Beach nourishment may be destructive to larvae and may render habitat unsuitable for subsequent larval recruitment and development (Knisley 1991). However, deposition of dredged material may also create habitat in some cases (Knisley 1997a). Dredged sand was placed south of Cape Charles in Northampton County, Virginia, in 1987, and the number of adult NBTBs at this site increased from 700-800 to 2,000 in 1993 (Knisley 2002). Although the addition of sand may maintain the habitat in the long term, it is likely that its immediate effects result in some larval mortality through crushing, smothering, or entombing (Service 1994). Sand deposition could also have negative effects on food (amphipod) availability (Service 1994). Fenster et al. (2006) determined that two beach nourishment projects on the western shoreline of the Chesapeake Bay had a short-term positive effect on the NBTB habitat. Within weeks of the sand placement, adults moved in and produced large numbers of larvae at both sites. The short- and long-term effects of beach nourishment on larvae need to be further investigated.

Non-jeopardy biological opinions anticipating take of NBTBs completed since 1994 have included 12,943 ft of shoreline hardening; 169 groins permanently covering 14,495 ft^2 of habitat; 12 piers; and several projects involving breakwaters, beach nourishment, concentrated human use, and unusually large piers and groins. In addition to permanent loss of habitat, most of the projects have involved additional impacts, including mortality of NBTBs (primarily larvae), during construction. Fragmentation of NBTB habitat has also resulted from the installation of these structures.

In addition, many shoreline hardening projects (particularly revetments and bulkheads) have been completed that do not require Corps permits and the associated section 7 consultation and biological opinion. Furthermore, unpermitted activities (i.e., structures built without the required Corps permit) may be contributing to the reduction of NBTB habitat in Virginia as there appears to be more groins and other structures within NBTB habitat than have been permitted (C.B. Knisley, pers. comm. 2004).

Adult foraging, mating, and ovipositing can be disrupted by human activity (Knisley et al. 1987). However, larvae are probably more affected because they spend most of their time at the tops of their burrows waiting for prey, and may be disturbed by even relatively minor activities such as vibrations, movement, and shadows (Knisley et al. 1987). Knisley and Hill (1990) examined the effects of visitor use of Flag Ponds, a park in Maryland, on the NBTB. As human use increased, no reduction in the population of adult NBTBs was found. However, human impact appeared to

result in the lack of newly emerged adults on the public beach. Larval survivorship was significantly lower on the beach area with the greatest amount of human use. Areas that were firmly stomped, to simulate increased foot traffic, resulted in a 50-100% reduction in numbers of active larvae (Knisley and Hill 1989). In addition, 25% of the burrows did not reopen within 10 days of stomping, suggesting that larvae may have been dead (Knisley and Hill 1989). Negative effects of foot traffic apparently involve compaction or disruption of burrows or direct injury to larvae. Because larvae occur in the intertidal zone, burrows can be easily compacted or collapsed by vehicles or high levels of human activity (Knisley et al. 1987).

Primary predators of adult NBTBs are wolf spiders (*Arctosa littoralis*), asilid flies (C.B. Knisley, pers. comm. 1994), and birds (Service 1994). The primary larval predator is a small, parasitoid wasp (*Methocha* sp.) that enters the larval burrow, paralyzes the larva with a sting, and lays an egg on the larvae. The egg hatches, and as it develops the larval wasp consumes the larval NBTB. Mites have also been found on larvae at Martha's Vineyard, but their effect, if any, is unknown (Service 1994).

NBTB larvae are probably more vulnerable to habitat disruption than adults (Knisley et al. 1987), and similar to other tiger beetle species, larval survivorship is low due to predators and other limiting factors. "For example, only about 5% of the first instar larvae of several Arizona species reached adulthood" (Knisley 1987). "Habitat disturbances could further reduce survivorship" (Knisley et al. 1987) and ". . . can eliminate suitable habitat (due to shoreline modification), and when combined with natural mortality factors, could reduce populations to the point of extinction" (Knisley 1987).

Oil slicks and use of pesticides for mosquito control may have contributed to the decline of this species (Stamatov 1972). Most of the large NBTB populations in Maryland and many of those in Virginia are threatened by activities associated with the increasing human population and all are subject to oil spills and beach erosion (Service 1994).

ENVIRONMENTAL BASELINE

Status of the Species Within the Action Area – The Bavon Beach site (comprised of the Bavon Beach and Chesapeake Shores communities) has experienced an accelerated shoreline erosion rate as noted by Service personnel over the years while conducting NBTB surveys. The Bavon Beach site shows a gradual decline in adult NBTB numbers since 1998. Past index surveys conducted by the Service found 853 adult NBTBs in 1998, 1,300 in 2001, 694 in 2004, 536 in 2005, and 336 in 2008. Adjacent and south of the Bavon Beach site is the New Point Comfort site, comprised of lands owned and managed by TNC and VDCR. The New Point Comfort section of shoreline with the wide sandy point has supported higher numbers of NBTBs even with the severe shoreline changes that have been observed at this site over the years. Surveys at the New Point Comfort site documented 1,031 adult NBTBs in 2001, 539 in 2004, 2,057 in 2005, and 670 in 2008 (Service 2008). These two sites are part of the same shoreline reach interrupted only by sections of non-sandy beach shoreline, and act as a single NBTB metapopulation. The most recent survey of New Point Comfort found both adult and larval

habitat, and during site visits to the Bavon Beach site in 2011 both adult and larval habitat was observed. The Service assumes the presence of both adult and larval NBTBs along all parts of the shoreline in the action area.

Factors Affecting Species Habitat Within the Action Area – The Bavon Beach and New Point Comfort sites have historically supported adult and larval NBTBs. The shoreline condition and topography has changed with each major storm event, and the New Point Comfort site continues to erode and sand is being lost to deeper water, removing it from the beach system. Bavon Beach along with Winter Harbor, Bethel Beach, Bethel Beach North, and Festival Beach in Mathews County are primarily oriented north to south. Sand transportation is primarily north to south and these sites are all impacted by nor'easter storm events that cause extensive sand loss. A nor'easter in October 2011 removed over 10 ft of shoreline in the project area.

A hardened structure was previously placed at the northern end of the Bavon Beach site. This structure has provided protection to the northern end of Bavon Beach, and has resulted in a significant increase in beach width since the structure was installed. At the southern end, where the project is proposed, the loss of beach width has been over 50 ft during the same period.

The U.S. Geological Survey (USGS) documented that the mouth of the Chesapeake Bay is experiencing a sea level rise of 0.16 inches/year, which is higher than the worldwide average (USGS 1998). These findings confirm that elevated rates of sea level rise is occurring at sites like Bavon Beach which is only 25 miles from the mouth of the Chesapeake Bay. Increased sea levels will change the dynamics that maintain beach habitats, including increased shoreline erosion rates in some areas, and changes in sand deposition (USGS 1998).

The majority of the shoreline included in this project is owned by TNC and the remainder is private property, thus there is limited use by the landowner families and their guests. The types of activities found along this shoreline are limited to foot traffic, sun-bathing, fishing, and swimming access. These types of activities pose a minimal threat to the survival of the NBTB (Knisley 2005d).

The coastal parcels to the south of the project site are owned and managed by TNC and VDCR as natural areas. The area is managed by both agencies in a natural state and provides protected habitat for NBTB. The point area is eextensively used by individuals who come to the site by boat. It is unclear how much of a concern this may be for NBTB, but it is causing disturbance to nesting birds. Both TNC and the state are working on improving the management of these areas for the wildlife.

EFFECTS OF THE ACTION

Direct Effects - Direct effects to both adult and larval NBTBs are anticipated within the 52,500 ft^2 of the project area as a result of the construction of the breakwaters, beach, and dune system. Equipment will traverse the project area to place sand, construct access paths for each breakwater, off-load rock to the site and move it for construction of each breakwater, grade sand

placed for beach augmentation, and construct the dune system. Adults may disperse to areas outside of the project area. Any adults that remain could be crushed by equipment or materials or may be prevented from conducting their daily activity patterns (i.e., foraging, mating, basking, egg-laying) which could result in increased exposure to predators, increased energy demands, or reduced reproduction.

In addition to loss of larvae within the project area from placement of materials and use of equipment, larvae will be impacted by foot traffic. All larvae in the project area are likely to be crushed or entombed in their burrows as a result of equipment traversing the project site or from the placement of materials. Larvae not killed outright may be prevented from feeding due to their sensitivity to vibrations, movements, and shadows, possibly resulting in injury or death.

Indirect Effects – Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). Changes in sand movement and beach profile may occur following breakwater construction as the beach equilibrates, but because the project area will be contoured during beach augmentation, the severity of change that could occur will be reduced and the effects are expected to be minor and temporary. The changes in sand movement and beach profile will affect the location, amount, and suitability of NBTB habitat. In response to these changes, larval burrows may be relocated, damaged or flooded and larvae may be injured or killed. Adults may be forced to find other foraging areas based on the changes in habitat, resulting in injury, death, and/or reduced reproduction.

There will be no permanent loss of larval and adult habitat. Construction of the breakwaters with beach augmentation will improve the stability of the beach and increase the extent of suitable NBTB habitat (Table 2).

Table 2. Summary of NBTB habitat increase from proposed project.

Habitat Type	**Current Amounts in Action Area (ft^2)**	**Amount after Project Completion (ft^2)**	**Increase in Habitat (ft^2)**	**Increase in Habitat (% increase)**
Larval NBTB habitat	25,000	40,000	15,000	60.0 %
Adult NBTB habitat (between larval zone and dune area)	38,000	53,000	15,000	39.5 %
Dune Area	35,000	65,000	30,000	85.7 %

Interrelated and Interdependent Actions - An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No activities interrelated to and interdependent with the proposed action are known at this time.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. There are limited opportunities for future development or modification of beach habitat along this shoreline. There are a number of undeveloped lots within these communities, but they are not beachfront and if developed would not result in an increase in recreational use of the beach that would cause adverse effects to NBTBs.

CONCLUSION

Adult and larval NBTB habitats are expected to remain at this site and NBTBs are expected to continue to occur there in numbers that will support a reproducing population. This project is expected to provide long-term stabilization of NBTB habitat at Bavon Beach, a site located within GRA 9 (western shoreline south of the Rappahannock River), and important to the long-term recovery of the species. The use of breakwaters is the only option along this shoreline that will provide adequate shoreline stabilization to benefit both the homeowner and the NBTB.

After reviewing the current status of the NBTB, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that this type of proposed project is not likely to jeopardize the continued existence of the NBTB. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Service and the Corps and become binding conditions of any permit issued by the Service or the Corps for the

exemption in section 7(o)(2) to apply. The Service and the Corps have a continuing duty to regulate the activity covered by this incidental take statement. If the Service or the Corps (1) fails to assume and implement the terms and conditions, or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Service and the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR Sec. 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates incidental take of northeastern beach tiger beetle adults and larvae will be difficult to detect because any that are injured or killed during construction will be difficult to detect due to their coloring and small body size, and the tendency of larvae to remain in burrows beneath the surface of the sand. However, the level of take can be anticipated by the areal extent of the adult and larval habitat affected.

The construction of the breakwaters, the placement of sand to augment the beach, and the construction of the vegetated dune system are anticipated to result in take of all adult NBTBs within the 52,500 ft^2 project area. Take will be in the form of injury and/or death resulting from crushing by equipment or materials, or in the form of harassment due to disruption in ability to conduct daily activity patterns (i.e., foraging, mating, basking, egg-laying).

It is anticipated that all larval NBTBs within the 25,000 ft^2 of larval habitat present within the project area will be taken. Take will be in the form of death resulting from crushing, suffocating, or entombing due to excavation and installation, placement of materials and/or equipment, and from foot traffic. Take in the form of harassment, injury, or death of larvae not killed outright is anticipated when larvae are prevented from feeding due to their sensitivity to vibrations, movements, and shadows.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or adverse modification or destruction of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the NBTB:

1. Construction activities must be conducted when adult NBTBs are not present to reduce the impact to adult NBTBs.

2. Human activity, use of equipment, and use/stockpiling of materials on the beach must be minimized to reduce the impact to adult and larval NBTBs.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Service and the Corps and any applicant must comply with the following terms and conditions which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. No construction, earth-moving, or placement of materials or equipment within the project area between June 1 and September 15 of any year.

2. No ground disturbance caused by foot traffic, equipment, or materials will occur on the beach outside of the action area.

3. Notify the Service before initiation of construction and upon completion of the project via the contact information below.

4. Care must be taken in handling any dead specimens of proposed or listed species that are found to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead specimen, notify the Service's Virginia Law Enforcement Office at 804-771-2883, 5721 South Laburnum Avenue, Richmond, Virginia 23231, and the Service's Virginia Field Office at 804-693-6694 at the address provided on the letterhead above.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to further minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

As the Corps continues to issue permits for shoreline alteration, the amount of habitat available for this species is decreasing. For recovery and delisting of the NBTB within the Chesapeake Bay area of Maryland and Virginia, at least 26 populations must be permanently protected at extant sites (Service 1994). In Virginia, 4 large (> 500 adults) populations and 4 other (100 to 499 adults) populations must be protected on the Eastern Shore; 3 large populations and 3 others

must be protected on the western shore of the Chesapeake Bay north of the Rappahannock River; and 3 large populations and 3 others must be protected on the western shore of the Bay south of the Rappahannock River. Presently, there are 6 large (2 protected) and 6 other (3 protected) populations on the Eastern Shore; 9 large (2 protected) and 12 (1 protected) others on the western shore north of the Rappahannock; and 6 large (2 protected) and 6 (1 protected) others on the western shore south of the Rappahannock.

We recommend that the Corps establish a process to mitigate for habitat loss to shoreline projects. This could include a means to establish conservation easements for the protection of the NBTB and its habitat, restoration of beach habitat in areas where it has been altered significantly, or other appropriate measures. This would contribute to recovery efforts for the NBTB by formally protecting sites through conservation easements or natural areas. The Service requests notification of the implementation of any conservation recommendations to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in your request to initiate formal consultation. As provided in 50 CFR section 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions, please contact Mike Drummond of this office at (804) 693-6694, extension 122, or via email at mike_drummond@fws.gov.

cc: USACE, Norfolk, VA (Attn: Adrian Jennings)
VDACS, Richmond, VA (Attn: Keith Tignor)
VDCR, DNH, Richmond, VA (Attn: René Hypes)

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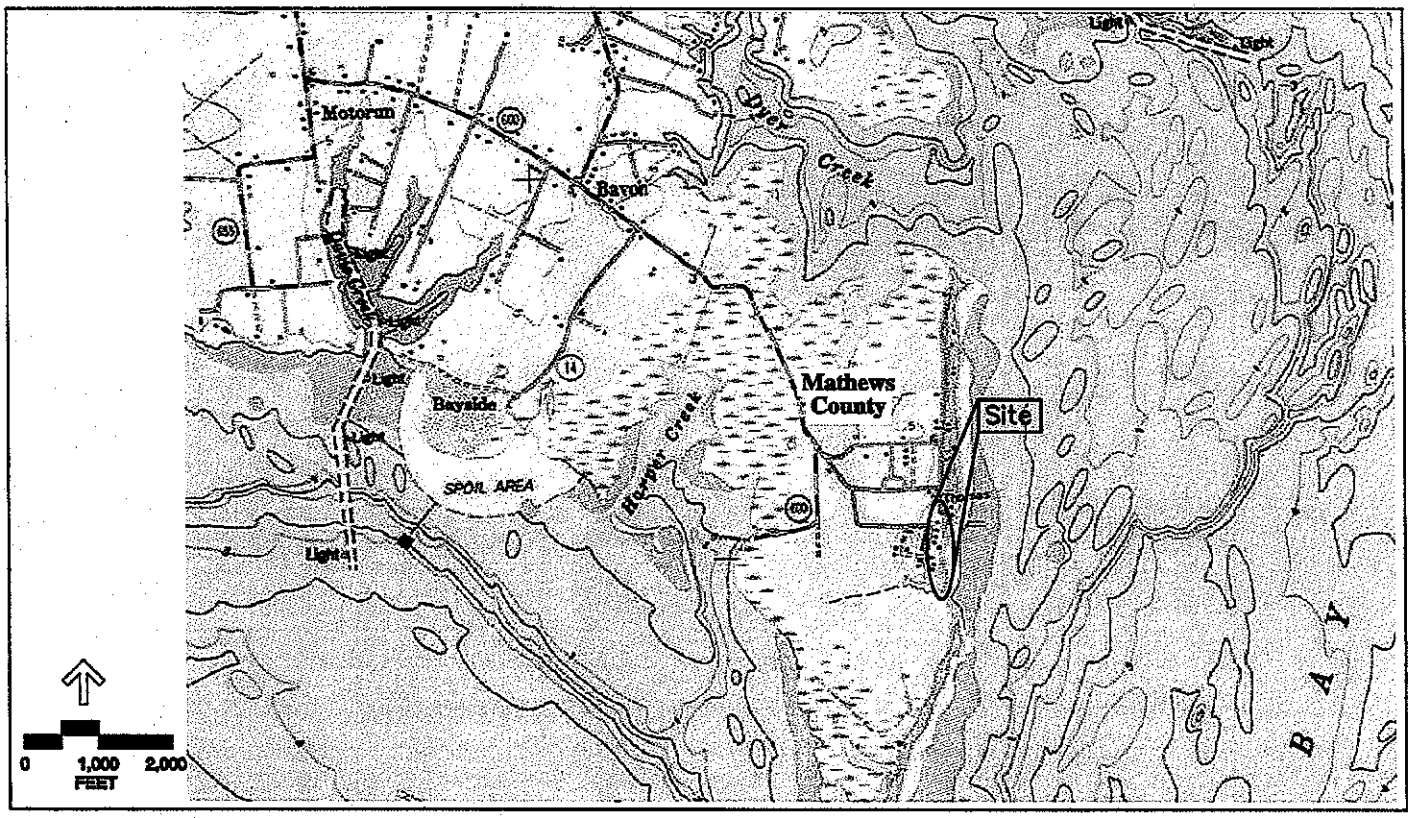
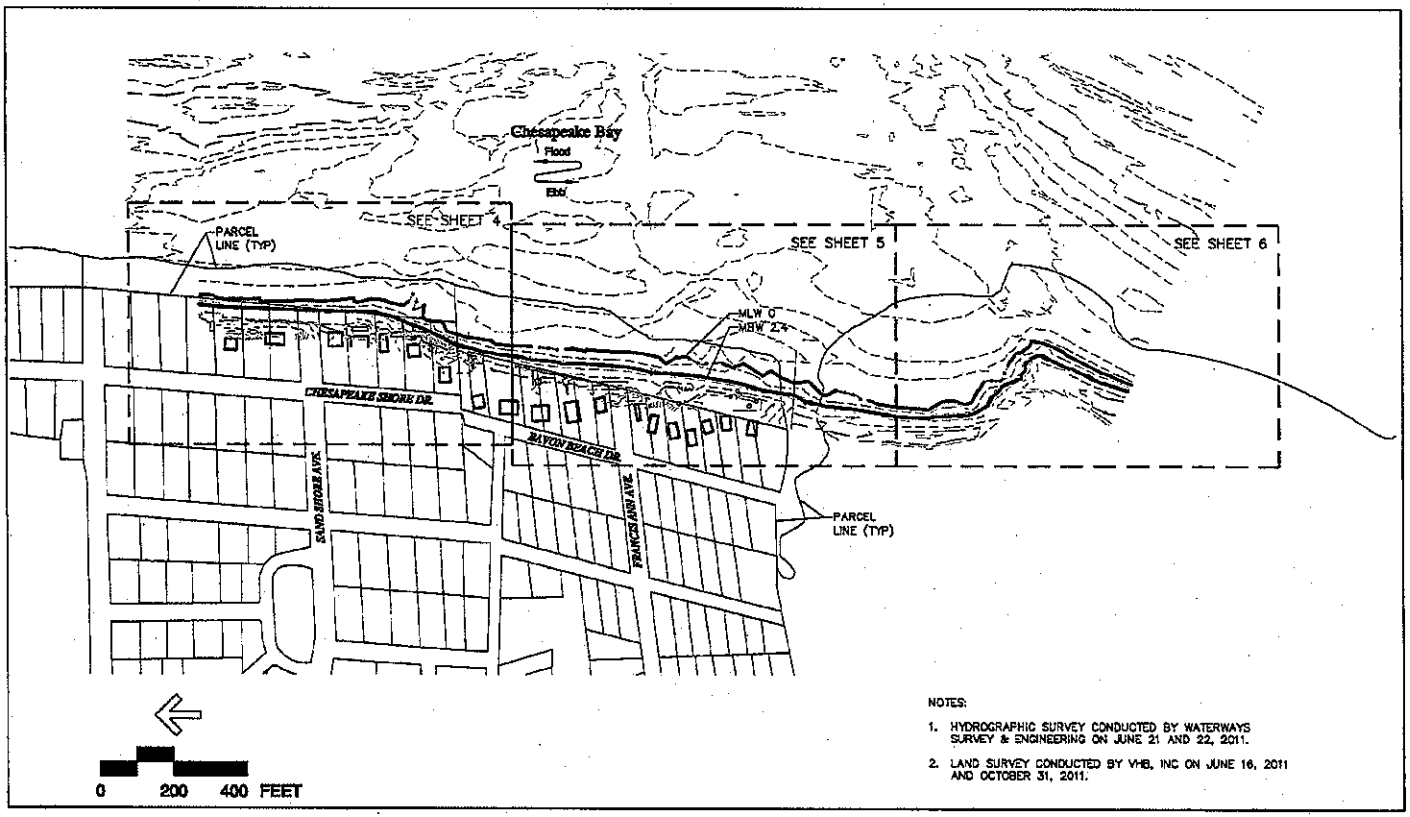
Appendix



SOURCE: USGS QUADRANGLE NEW POINT COMFORT

VHB Vanasse Hangen Brustlin, Inc. Transportation Land Development Environmental Services 301 McLaws Circle, Suite 5 Williamsburg, Virginia 23185 (757) 220-6500 • Fax: (757) 220-8544	ADJACENT PROPERTY OWNERS: SEE ATTACHED LIST	**SHORE EROSION CONTROL PLAN** **VICINITY MAP**	APPLICATION BY: Bavon Beach Homeowners Association et Al.
		AT: BAVON BEACH **IN:** MATHEWS COUNTY, VIRGINIA	PURPOSE: SHORELINE STABILIZATION	DATE: November 4, 2011
	DATUM: MEAN LOW WATER		SHEET 1 OF 9

8286705-JPA-COV



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Vanasse Hangen Brustlin, Inc.
Transportation
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Environmental Services
561 McLaws Circle, Suite 3
Williamsburg, Virginia 23185
(757) 220-6300 • Fax (757) 220-8544

ADJACENT PROPERTY OWNERS:
SEE ATTACHED LIST

DATUM: MEAN LOW WATER

SHORE EROSION CONTROL PLAN
EXISTING CONDITIONS & SHEET KEY

AT: BAVON BEACH
IN: MATHEWS COUNTY, VIRGINIA

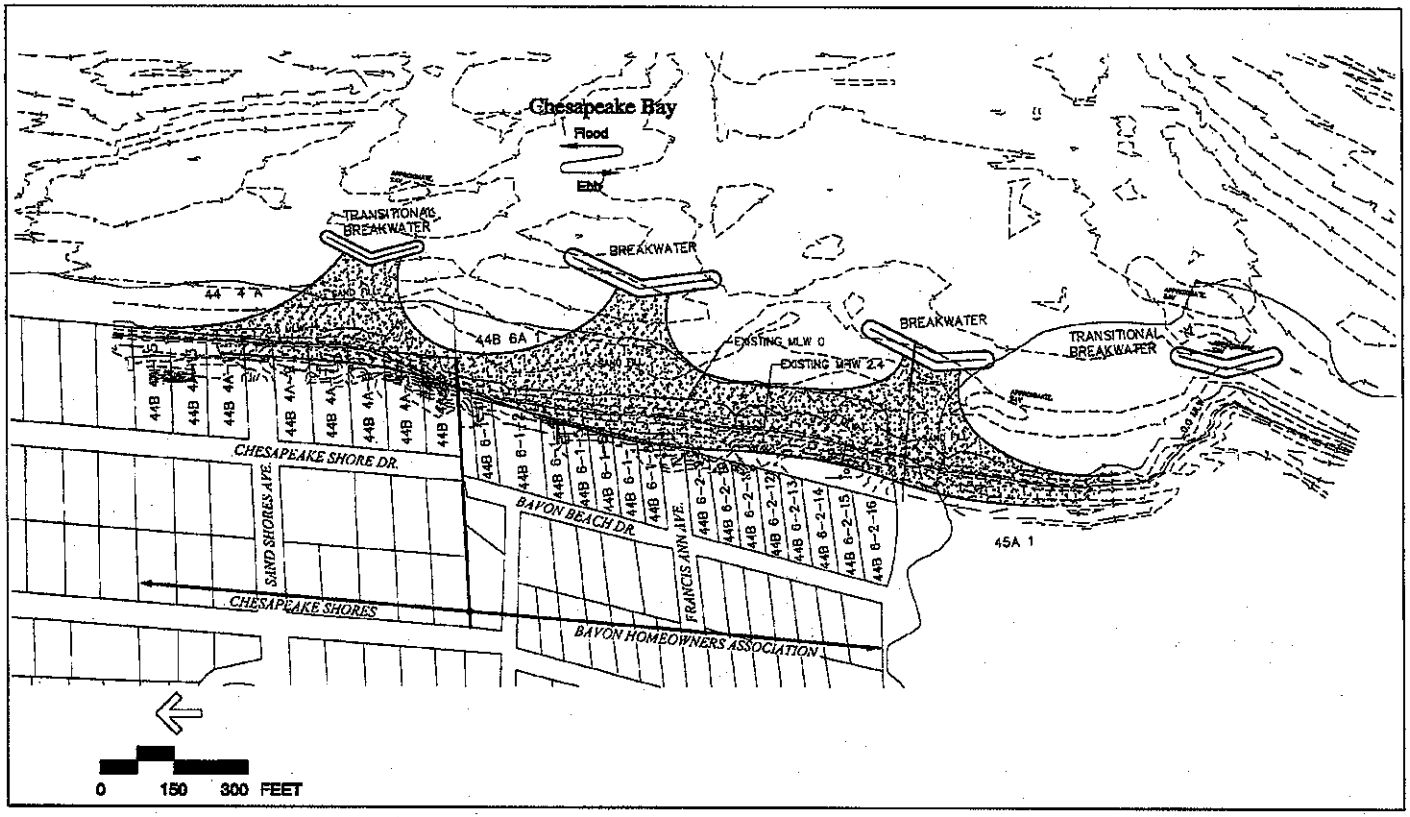
PURPOSE: SHORELINE STABILIZATION

APPLICATION BY:
Bavon Beach Homeowners Association et Al.

DATE: November 4, 2011

SHEET 2 OF 9

3286705-JPA-EC.DWG



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301 McLaws Circle, Suite 3
Williamsburg, Virginia 23185
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ADJACENT PROPERTY OWNERS:
SEE ATTACHED LIST

DATUM: MEAN LOW WATER

SHORE EROSION CONTROL PLAN
OVERALL PLAN

AT: BAYON BEACH
IN: MATHEWS COUNTY, VIRGINIA

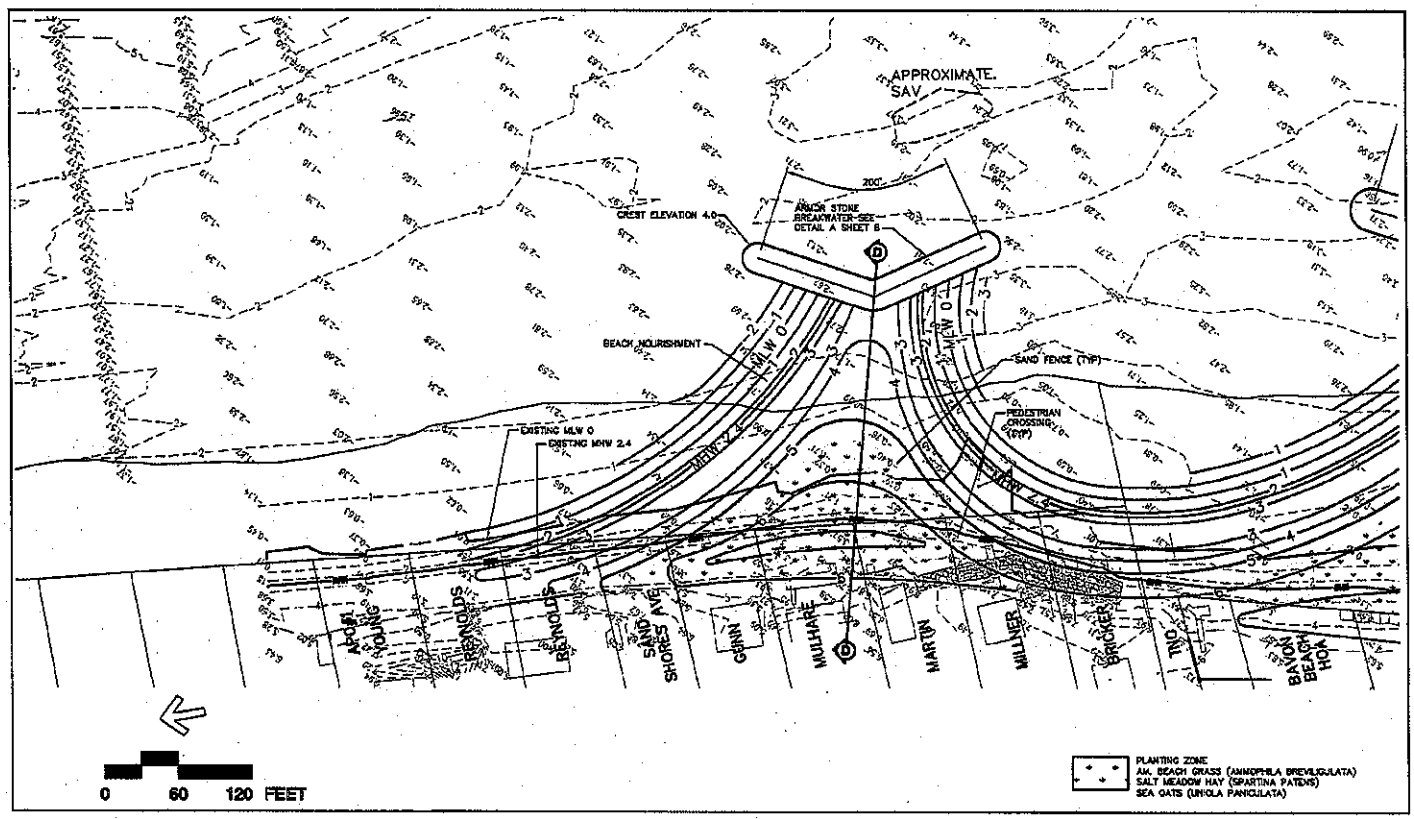
PURPOSE: SHORELINE STABILIZATION

APPLICATION BY:
Bayon Beach Homeowners Association et Al.

DATE: November 4, 2011

SHEET 3 OF 9

3286705-JPA-OA.DWG



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351 McLaws Circle, Suite 3
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ADJACENT PROPERTY OWNERS:
SEE ATTACHED LIST

DATUM: MEAN LOW WATER

SHORE EROSION CONTROL PLAN
LAYOUT

AT: BAVON BEACH
IN: MATHEWS COUNTY, VIRGINIA

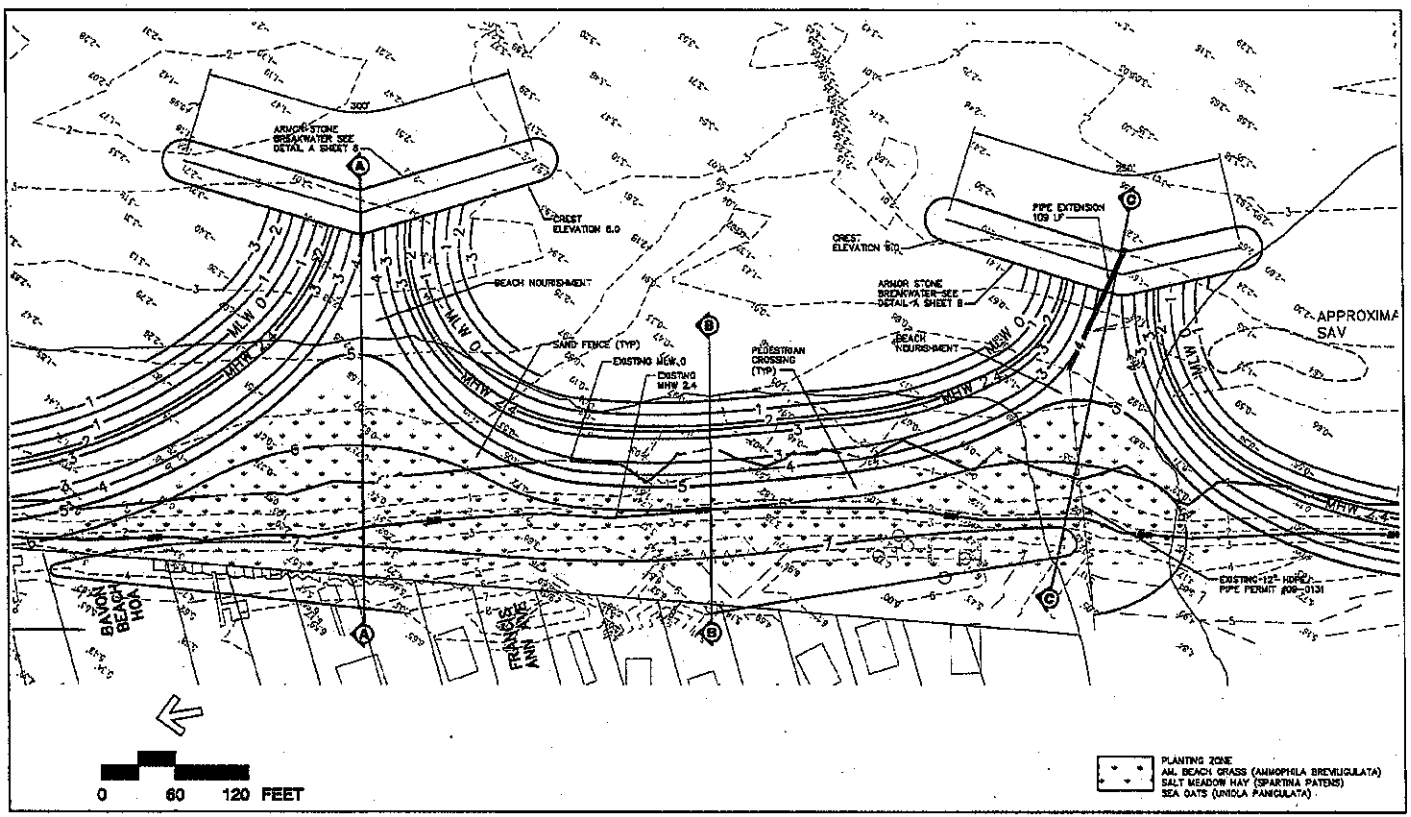
PURPOSE: SHORELINE STABILIZATION

APPLICATION BY:
Bavon Beach Homeowners Association et Al.

DATE: November 4, 2011

SHEET 4 OF 9

3286705-JPA-LAYOUT.DWG



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ADJACENT PROPERTY OWNERS:
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DATUM: MEAN LOW WATER

SHORE EROSION CONTROL PLAN
LAYOUT

AT: BAVON BEACH
IN: MATHEWS COUNTY, VIRGINIA

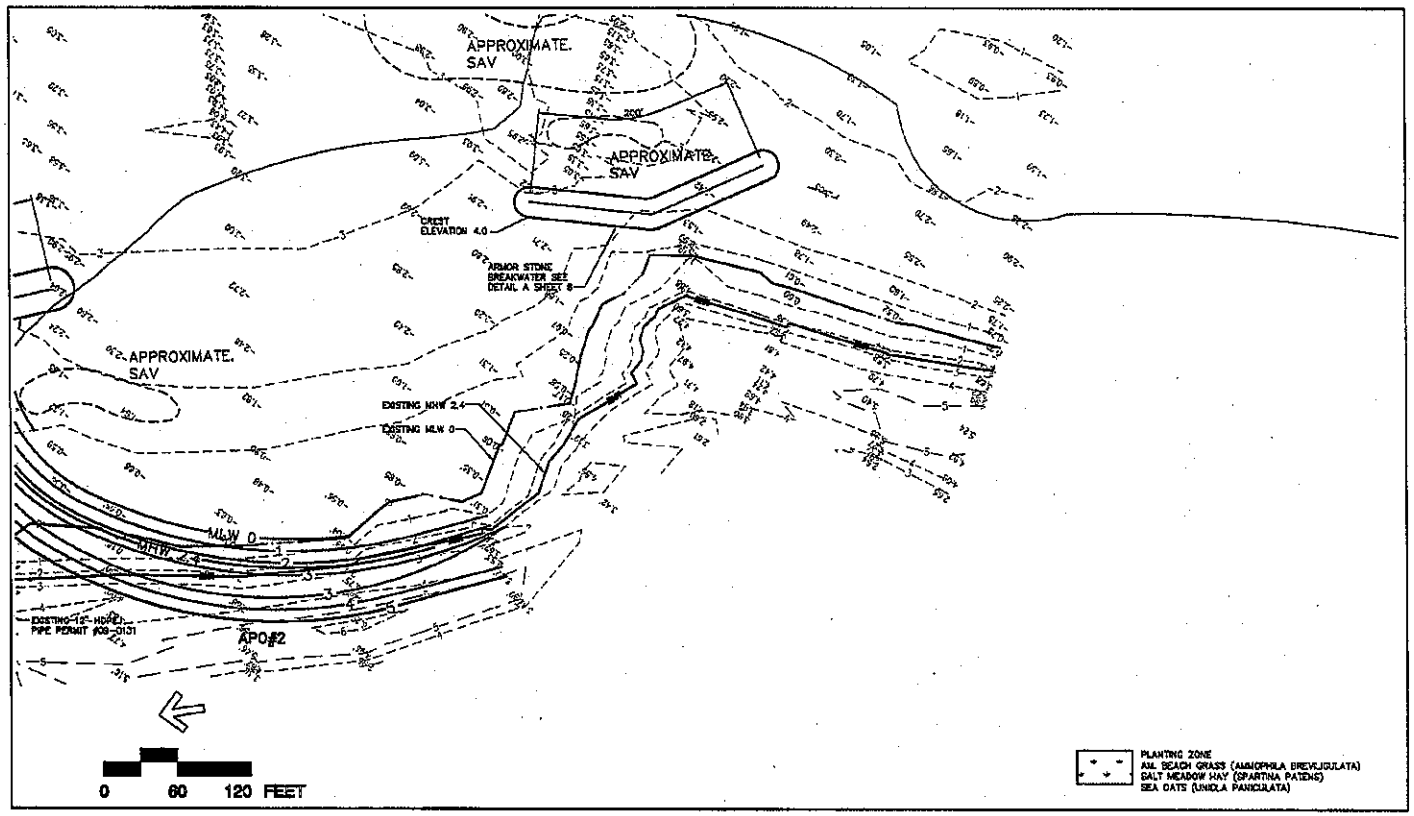
PURPOSE: SHORELINE STABILIZATION

APPLICATION BY:
Bavon Beach Homeowners Association et Al.

DATE: November 4, 2011

SHEET 5 OF 9

3286705-JPA-LAYOUT.DWG



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ADJACENT PROPERTY OWNERS:
SEE ATTACHED LIST

DATUM: MEAN LOW WATER

SHORE EROSION CONTROL PLAN
LAYOUT

AT: BAVON BEACH
IN: MATHEWS COUNTY, VIRGINIA

PURPOSE: SHORELINE STABILIZATION

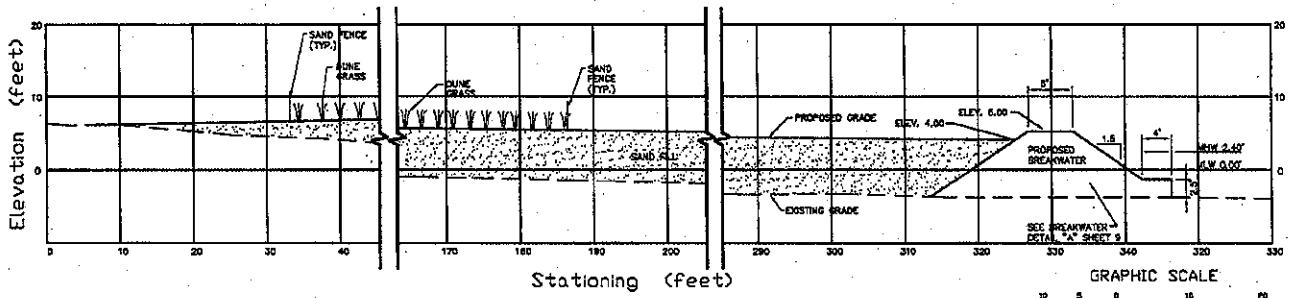
APPLICATION BY:
Bavon Beach Homeowners Association et Al.

DATE: November 4, 2011

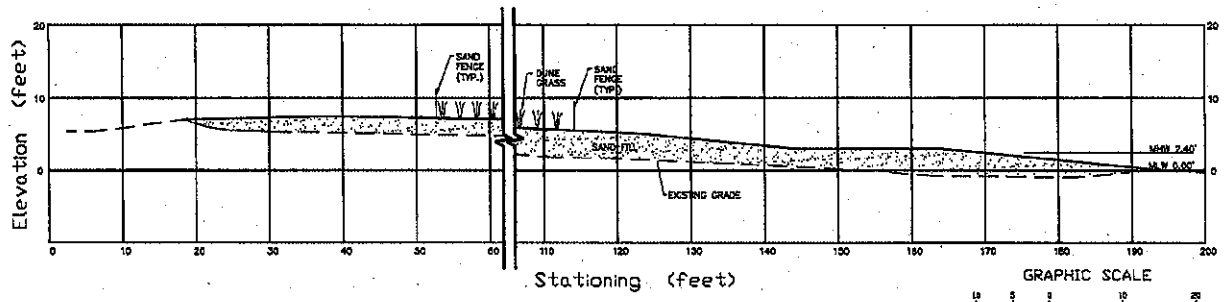
SHEET 6 OF 9

3286705-JPA-LAYOUT.DWG

Cross Section A-A



Cross Section B-B



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ADJACENT PROPERTY OWNERS:
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DATUM: MEAN LOW WATER

SHORE EROSION CONTROL PLAN
CROSS SECTIONS

AT: BAVON BEACH
IN: MATHEWS COUNTY, VIRGINIA

PURPOSE: SHORELINE STABILIZATION

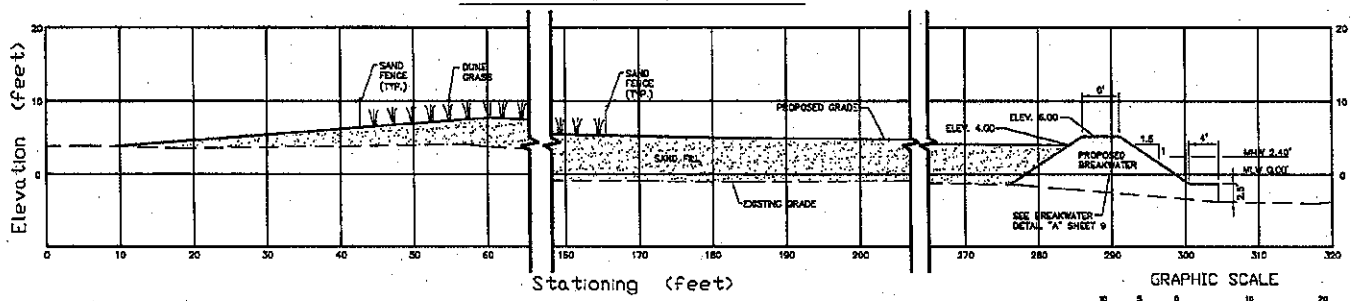
APPLICATION BY:
Bavon Beach Homeowners Association et Al.

DATE: November 4, 2011

SHEET 7 OF 9

3286705-JPA-LAYOUT.DWG

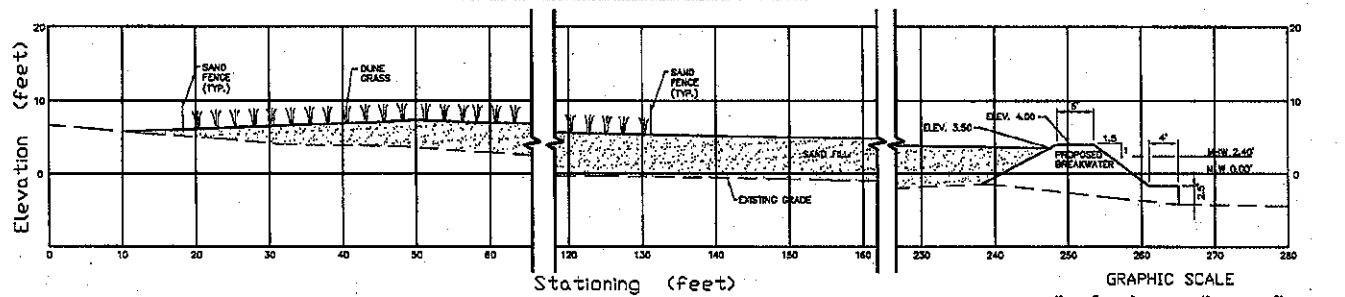
Cross Section C-C



GRAPHIC SCALE

(IN FEET)
1 inch = 20 Feet

Cross Section D-D



GRAPHIC SCALE

(IN FEET)
1 inch = 20 Feet

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ADJACENT PROPERTY OWNERS:
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DATUM: MEAN LOW WATER

SHORE EROSION CONTROL PLAN
CROSS SECTIONS

AT: BAVON BEACH
IN: MATHEWS COUNTY, VIRGINIA

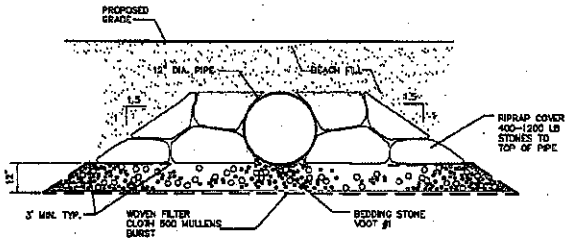
PURPOSE: SHORELINE STABILIZATION

APPLICATION BY:
Bavon Beach Homeowners Association et Al.

DATE: November 4, 2011

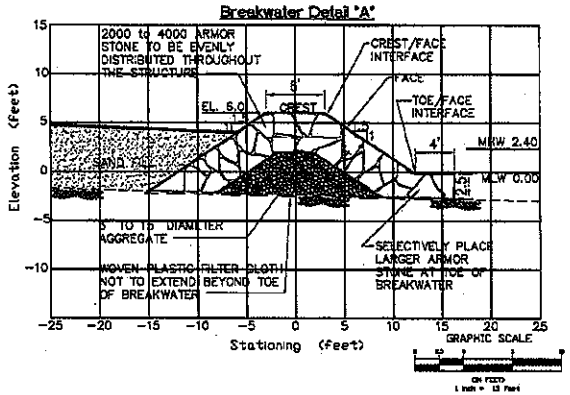
SHEET 8 OF 9

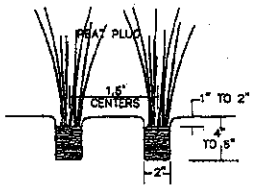
3286705-JPA-LAYOUT.DWG



Riprap Cover Detail

N.T.S. Source: VHB





GENTLY REMOVE PLANTS FROM CONTAINERS, CAREFUL TO NOT DAMAGE SECONDARY ROOT GROWTH.

REMOVAL OF BINDING MATERIALS FROM TRUNKS AND STEM SHALL CONFORM TO NURSERY STANDARDS AND SPECIFICATIONS.

PLANT AT THE SAME DEPTH AS WHEN PREVIOUSLY GROWN.

CUT LINEAR SLITS IN ORGANIC CONTAINER TO FACILITATE ROOT PENETRATION

IF CONTAINER IS NON-ORGANIC COMPLETELY REMOVE

Dune And Wetland Planting Detail

N.T.S. Source: VHB

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351 McLaws Circle, Suite 3
Williamsburg, Virginia 23185
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ADJACENT PROPERTY OWNERS:
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DATUM: MEAN LOW WATER

SHORE EROSION CONTROL PLAN
DETAILS

AT: BAVON BEACH
IN: MATHEWS COUNTY, VIRGINIA

PURPOSE: SHORELINE STABILIZATION

APPLICATION BY:
Bavon Beach Homeowners Association et Al.

DATE: November 4, 2011

SHEET 9 OF 9

3286705-JPA-LAYOUT.DWG