United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Serviees
6669 Short Lane
Gloucester, Virginia 23061

OCT 1 . 2009

Colonel Andrew W. Baekus
U.S. Army Corps of Engineers
Norfolk Distriet
803 Front Street
Norfolk, Virginia 23510-1096

Attn: Robert Cole, Regulatory Branch

Re: Biological Opinion for Ruth Cassidy, Breakwater Construction Permit, Northampton County, Virginia, Corps Permit # 09-0533, Project # 2008-F-0258

Dcar Colonel Backus:

This document transmits the U.S. Fish and Wildlife Service's (Serviee) biologieal opinion based on our review of the referenced permit application that proposes breakwater construction and shoreline stabilization and its effeets on the Federally listed threatened northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*). This biological opinion is submitted in accordance with section 7 of the Endangered Speeies Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). Formal consultation was initiated on April 22, 2009 at the request of the U.S. Army Corps of Engineers (Corps).

This biological opinion is based on information provided in thc permit application package, received April 22, 2009; telephone conversations; field investigations; published peer-reviewed literature; and other sources of information. A complcte administrative record of this consultation is on file in this office.

Consultation History

04-22-09 The Service reccived the Corps' April 22, 2009 requcst to initiate formal consultation.

06-04-09 The Service submitted a letter to the Corps stating that all information necessary to initiatc consultation had been received.

08-19-09 The Service requested an extension on the biological opinion due date from the Corps and applicant.

08-19-09 The Corps agreed to an expected completion date of October 9, 2009.

09-03-09 The Service conducted a site visit with the Corps and applicant's representatives to evaluate the condition of tiger beetle habitat at the site, discuss and clarify details about how the project would be conducted, and identify potential avoidance and minimization measures.

10-7-09 The Service received an email from Wayne McCoy, the applicant's agent, indicating that the applicant will conduct post-construction surveys for adult and larval tiger beetles and monitor changes in beach conditions over time at the project site.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The proposed action is the issuance of a Corps' permit for the construction of breakwaters by a private landowner. The applicant, Ruth Cassidy, has submitted an application to construct four breakwaters, conduct beach nourishment, and create a planted minor dune system fronting the uplands on her property. The purpose of the project is to stabilize the beach and protect the property from erosion. The project is located on Occohannock Neck (area known as Silver-Downings Beach), at the terminus of Beach Lane, which is off of Occohannock Neck Road, Northampton County, Virginia (Figures 1 and 2).

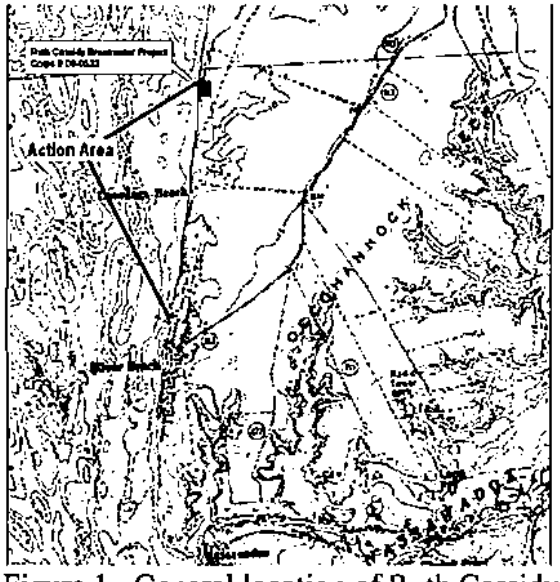

Figure 1. General location of Ruth Cassidy Breakwater Project (purple square) and action area, Silver-Downings Beach, Northampton County, Virginia.

Figure 2. Aerial photograph of Ruth Cassidy property shoreline, Northampton County, Virginia (2007 photo imagery).

The proposed breakwater design is shown in Figure 3. At their crest the four breakwaters will be 200 feet (ft), 150 ft, 150 ft, and 300 ft in length, respectively, from north to south. The gaps between the breakwater segments will be 225 ft, 30 ft, and 175 ft, respectively, from north to south. The bottom width of all breakwaters is 30 ft and the total length of the four segments is 800 ft, covering 24,000 ft^2 of subtidal substrate. The breakwaters are being placed very close to the current shoreline, and the existing eroded cliff edge will be contoured to create the new shoreline profile (Figures 4 and 5). All sand that will used to create the surface of the new beach will have a mean sand grain size between 0.4 and 0.7 millimeters (mm) to conform to the sand characteristics needed to support northeastern beach tiger beetles. If the sand within the eroding cliff on-site does not meet these characteristics, the applicant will bring in sand from an approved source and ensure that it conforms to tiger beetle sand characteristics prior to placement. From the tree island at mid shoreline to the southern property line (Figure 2), no sand from the cliff inland will be placed on the beach. Sand found within the cliff from the tree island to the northern property line (Figure 2), may be used for placement on the beach once the silty clay layer is removed and if it conforms to the sand grain size identified above. The on-site sand may be transported inland and mixed with sand from another source to meet sand grain size requirements. After sand has been mixed, the applicant will collect two grab samples and have them analyzed to confirm that they meet the acceptable mean sand grain size.

Access to the project site will be across the applicant's property, and staging of the construction materials will be on the existing agricultural field adjacent to the beach. Once the breakwater structures are completed and the shoreline is contoured, the upper beach area will be planted with appropriate materials to aid in stabilizing the upper beach. The planting plan (Figures 4 and 5) involves planting the newly created transition area between the beach and the uplands with American beachgrass (*Ammophila breviligulata*) and saltmeadow cordgrass (*Spartina patens*). In the adjacent uplands area, a mix of native grasses will be planted. There is no submerged aquatic vegetation in the project area and no mitigation is proposed.

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 proposed action lies within a section of largely contiguous beach known as Silver-Downings Beach that supports the tiger beetle, and extends for a length of 5,200 ft. The proposed breakwaters are expected to affect the processes of erosion and deposition of sand immediately adjacent to the project site, and also the transport of sand along this section of beach. The Service has determined that the action area for this project is the entire 5,200 linear ft of shoreline known as Silver-Downings Beach (Figure 1). The project area is the northernmost property within the action area.

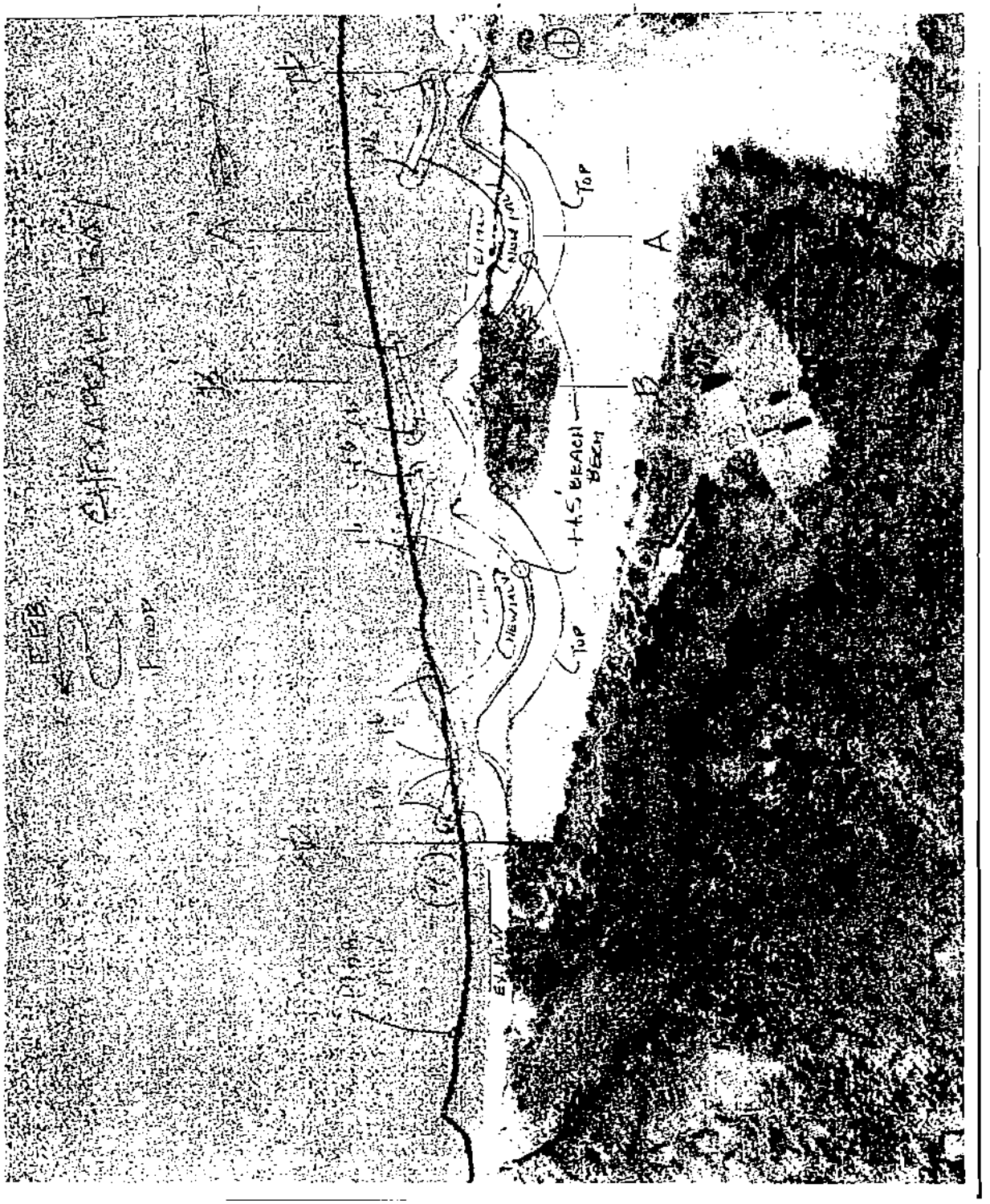

Figure 3. Diagram of planned breakwater system for Ruth Cassidy property, Northampton County, Virginia.

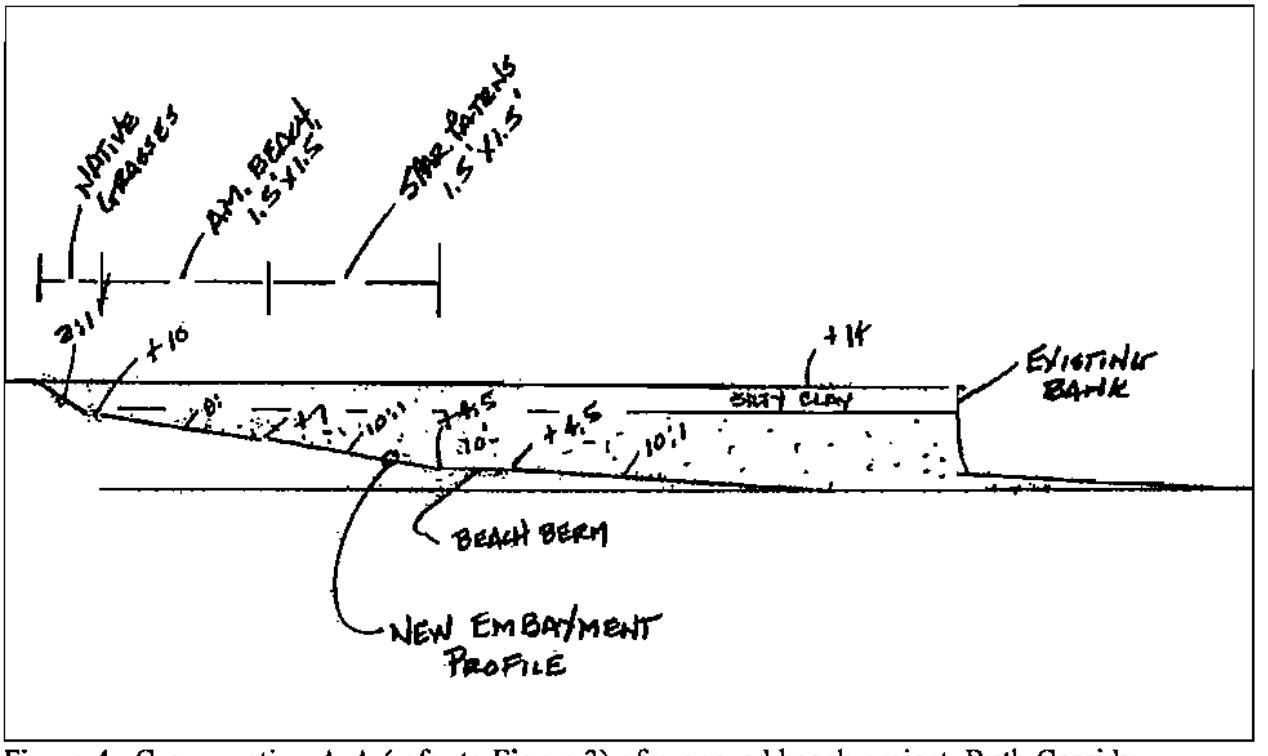

Figure 4. Cross-section A-A (refer to Figure 3) of proposed beach project, Ruth Cassidy property, Northampton County, Virginia.

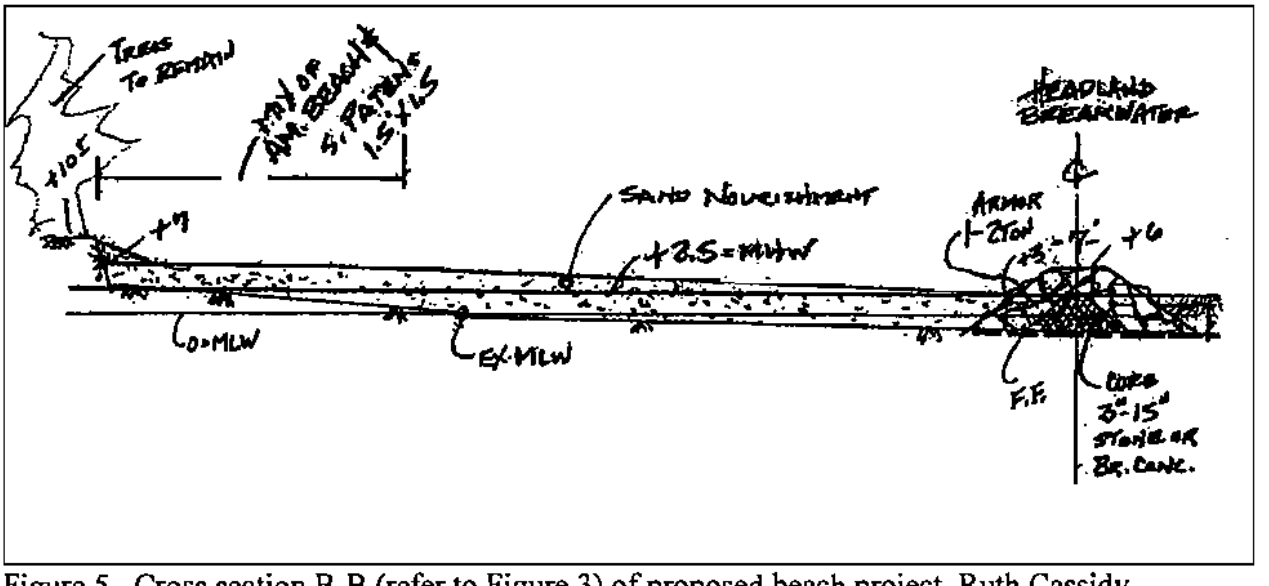

Figure 5. Cross section B-B (refer to Figure 3) of proposed beach project, Ruth Cassidy property, Northampton County, Virginia.

Following eompletion of construction, larval and adult tiger beetle monitoring will be eondueted by a qualified surveyor. The survey area will covcr the 5,200 linear ft of shoreline known as Silver-Downings Beaeh and designated as the action area (Figure 1). Surveys will be performed by a Service-approved surveyor (a list of pre-approved tiger beetle surveyors is enclosed). This list docs not include all individuals qualified or authorized to survey for thc spccies. If the applicant selects someone not on the pre-approved surveyor lists, the proposed surveyor's experience, qualifications, and the proposed survey design will be provided to this office for review and approval prior to the start of the survey. The data collcctcd from this project will allow the Scrvice, Corps, and applicant to evaluate this project over time for its impacts on thc tiger beetle. Adult and larval surveys will start after project completion and be conducted each year for five consecutive years.

Adult tiger beetles shall be surveyed on warm, sunny days between July 1 and July 25. The total number of adults observed will be recorded. Larval inventories shall be conducted between October 10 and 30 during low tidc on cool and/or cloudy days. The total number of larval burrows observed will be recorded, and an attempt will bc made to idcntify the instar stage of larvae. The surveys shall bc conducted in sufficient detail to assess the value of the beach habitat to the tiger beetle population and shall inelude detailed descriptions of the beach width and profile along the entire length of shoreline. Capture and/or collection of tiger beetles is not authorized herein, and if capture will oecur, it must be permitted separately.

As part of the monitoring, photographs shall be taken to document changes to the beach over time. Photographs, at least 4 x 6 inches (in) in size, will be taken from ten different fixed points in the action area. These fixed points will be established near the water's edge, and will be used during each survey (coordinates for thcse sites will be provided in the monitoring report to the Service). At these points, a photo of the beach will be taken to both the north and south to help document the shoreline conditions and any ehanges over time. The monitoring report, including photographs, will be providcd to the Scrvice annually in digital form.

STATUS OF THE SPECIES RANGEWIDE

Species Description and Life History - Thc northeastern beach tiger beetle is a beach-dwelling insect measuring approximately 1.3 centimeters (cm) (0.5 in) 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 tiger beetles 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 tiger beetles are prescnt on beaches from early June through early September, where they spend most of the day along the water's edge (Knisley et al. 1987). Adults are active on warm, sunny days where they ean be seen feeding, mating, or basking (Service 1994). They are less

active on rainy, cool, or cloudy days beeause they eannot maintain their body temperature (C.B. Knisley, Randolph-Macon College, pers. comm. 1994). They must rely on a variety of behaviors, sueh as foraging and basking, to maintain their high body temperatures (Knisley et al. 1987).

Adult beetles mate and lay eggs on the beaeh during the summer (starting in June and ending by mid July). The eggs hateh in 10-14 days, depending on soil moisture. Adequate moisture may allow a shorter hateh period (C.B. Knisley, pers. eomm. 2008). Larvae pass through three instar stages, pupate, and emerge as adults two years following hatehing (Knisley et al. 1987; Serviee 1994). Some larvae that hateh early and eateh an abundanee of food may develop more rapidly and emerge as adults after only one year (Serviee 1994). Development through three larval stages and pupation takes place in the burrow (Knisley et al. 1987). First instars generally oeeur from late August through September, seeond instars from September to late fall, and third instars from late fall to early spring and through the seeond year (Knisley et al. 1987). Knisley et al. (1987) found that larvae oeeurred within an 8-12 m width of beaeh within and above the intertidal zone; most burrows were underwater during high tide. Larvae ean survive flooding 3-6 days (Serviee 1994). Larval burrow depths ranged from 9-24 em (3.5-9.5 in) and increased with distanee from the water's edge, suggesting that burrow depth may be related to subsurfaee moisture (Knisley et al. 1987).

Larvae laek a hard eutiele and are suseeptible to desieeation. They tend to beeome 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 whieh species of mieroarthropods are eaten by larvae. Laek of prey may explain why beetles are not found in certain areas.

Larvae typically oceur in an area of beach 8-12 m (26-39 ft) wide within and above the intertidal zone. However, this area 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 8 m (26 ft) wide. Larvae have been found erawling on the beaeh, apparently to dig a new burrow in a better loeation (Service 1994). This behavior is likely a response to variations in tide levels, soil moisture, or sand accretion and erosion patterns. Larval activity is highly variable and greatly influenced by temperature, substrate moisture, tide levels, and season (Service 1994). Highest, most predictable periods of larval activity are from late August through early November. Lowest periods'of larval aetivity are when the sand is damp and cool (C.B. Knisley, pers. comm. 1994).

The first emergence of adults ranged from June 5-13 in Virginia (Knisley et al. 1987). Rainfall appears to enhance emergence since numbers of adults usually inerease after a rainfall. The number of adults inereases 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

adults 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 tiger beetles may travel 8-19 kilometers (km) (Knisley and Hill 1989) from sites where they were marked, and some individuals may disperse up to 24 km (Knisley 1997a). In Northumberland County, Virginia a total of 10,131 adults were marked and released; 91 beetles dispersed to new sites (mainly between two sites 1.5 km apart) (Hill and Knisley 1994). In general, larger sites seem to serve as recruitment areas, while smaller 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 mueh migration" (Hill and Knisley 1994). This dispersal serves to exchange genetic material, allow for the colonization of unoccupied sites, and enable beetles to leave eroding sites (Hill and Knisley 1994).

Survey data from 1998-2002 (Knisley and Hill 1998, 1999; Knisley 2001, 2002) indicate that beaches with a length of at least 100 m (328 ft), a width of at least 2 m (6.5 ft), and an adult population of at least 30, serve as breeding sites and larvae should be considered present. Optimal tiger beetle habitat is a beach greater than 5-8 m (16-26 ft) wide (C.B. Knisley, pers. comm. 1994). Preference for beaches between 2.5-6 m (8-20 ft) was found to be statistically significant, and beetles are rarely found on beaches less than 2 m (6.5 ft) in width (Drummond 2002). Adult and larval beetles are typically found on highly dynamic beaches with back beach vegetation, and they prefer 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 a slope of less than 5 degrees. Though not statistieally significant, Drummond (2002) found indications that the beetles 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 tiger beetles present (the more sand bars, the more beetles) (Drummond 2002). Sedentary larvae are susceptible to wave impacts and 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 the beetle (Drummond 2002).

Limited studies have been conducted to define the sand characteristics at occupied tiger beetle sites. Further studies are needed to accurately identify the sand characteristies that are neeessary for tiger beetle recolonization following beach nourishment. The following studies provide preliminary information at site in Virginia. Larval densities are highly variable relative to sand particle size and larvae are rare at sites with greater than 60% coarse sand (defined as the percentage of sand particles too large to sieve through a 100-size mesh sieve) (Knisley 1997b). Adults oceupied beaches with 40-80% coarse sand (Drummond (2002). If the sand size is too coarse, too fine, or contains high organie eontent, it is not suitable for the larvae to burrow and maintain a larval tube. Preliminary data indicate that the beetle is found on beaches with a narrow range of bulk density (2.25-2.75 grams/cm^3) (Drummond 2002). Bulk density may impact beetle distribution through: (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 beaeh nourishment projects, Fenster et al. (2006) found that the tiger beetle prefers beaches at least 6 m wide, with a mean sand grain size of 0.5 to 0.6 mm, and with relatively eompaeted sediment. Mean grain size and sedimcnt compaction are biologically important factors during oviposition and burrow building. Females oviposit in particular sediment types based on the shape of their ovipositor (Fcnstcr et al. 2006). Larvae require sediments in which they can build burrows that do not eollapse (Fenster et al. 2006).

Population Dynamics - Populations of the northeastern beach tiger beetle are highly variable from year to year because they are subject to local extirpations (from storm events impacting the larval stage) and arc affectcd 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). A population viability analysis (PVA) for the tiger beetle in the Chesapeake Bay populations, the purpose of which was to compare management strategies, not to estimate extinction probabilities, has been conducted (Gowan and Knisley 2001). The PVA compared six management strategies and found that without increased proteetion of the most important tiger beetle populations, the extinetion probability throughout its range over the next century is high (Gowan and Knisley 2001). The PVA eoncluded that protection of 25-50 subpopulations is necessary to reduce extinetion risk for the tiger beetle throughout the Bay (Gowan and Knisley 2001). The diffieulty lies in seleeting sites that assure adequate geographie eoverage (Gowan and Knisley 2001).

Northeastern beach tiger beetles in the Chesapeake Bay and Massaehusetts 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 ean be further distinguished by the presence of an allozyme allele . . . that has not been observed in the Chesapeake Bay beetles" (Service 1994). These disjunct populations should consequently be considered as separate conservation units (Service 1994). Additional genetie work supports treating the Massaehusetts population as a distinct group from the Chesapeake Bay populations with regards to speeies recovery and management (Vogler and Goldstein 1997).

Rangewide Status - Historically, the northeastern beach tiger beetle was a eommon inhabitant of coastal beaehes from Cape Cod, Massaehusetts to central New Jersey, and along the Chesapeake Bay, from Calvert County, Maryland south through Virginia. In 1990 when the beetle was listed, it was eonsidered extirpated from Rhode Island, Conneeticut, and New York (Long Island) (55 FR 32088). To facilitate the reestablishment of the speeies across its former range, the species' reeovery plan established nine Geographie 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.

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

GRA	State(s)	Status	Site Specific Comments
1	Coastal Massachusetts and Islands	Stable	• Beetle population at Westport, MA extirpated • Martha's Vineyard numbers appear stable • Monomoy National Wildlife Refuge translocation-numbers increasing (Protected)
2 & 3	Rhode Island, Block Island, Long Island Sound, and Long Island, New York	Extirpated	• At listing extirpated from RI and NY • No Potential suitable habitat known
4	Sandy Hook to Little Egg Inlet, New Jersey	Uncertain	• Sandy Hook, NJ transloeation site, 7 adults observed in 2008, status still uneertain
5	Maryland -Calvert County	Declining	• 6 of 10 oeeupied sites extirpated, habitat lost or in very poor condition • 2 of 4 remaining sites with <5 beetles in 2005, these sites have marginal habitat • The 2 primary sites (Scientifie Cliffs and Western Shores/Calvert Beach) have declined in numbers >75% sinee 2003 • One occupied site supports a large population, but it is not protected
6	Maryland - Tangier Sound	Stable	• Both sites in this GRA (Janes and Cedar Islands) are stable • Both sites support large populations (≥ 500 adults), and both are protected.
7	Virginia – Eastern Shore	Stable	• Beetle numbers appear stable • Beetle populations at 5 sites extirpated and habitat is no longer suitable. • 13 large populations showing minor to significant increases in numbers, but the sites are showing erosion and loss of larval habitat (2009). Two of theses sites are protected, Parker's Marsh and Savage Neck (DCR). • Two other sites are protected, Kiptopeke State Park (DCR) and Wise Point (FWS), but Kiptopeke as of the 2009 survey is now considered extirpated, and Wise Point is continuing to decline.

GRA	State(s)	Status	Site Specific Comments
8 & 9	Virginia – Western Shore	Declining	• Sinee 2001 there has been a 20% loss in occupied sites (12 of 58 occupied sites) • Habitat loss due to Hurricane Isabel and Ernesto • Total numbers deelined 70% sinee 2001 • Sinee 2001, the 8 largest sites that support approximately 50% of the total beetles in 2001 have deelined by 78% • GRA 8 has four oeeupied sites that support large populations, but none are protected. There is one "other" sized population that is protected, Hughlett Point (DCR). GRA 9 has two oceupied sites that support large populations and one protected, New Point Comfort (Mathews County and TNC). There is one "other" sized population that is protected, Bethel Beach (DCR).

In 2003, Hurrieane Isabel hit the Chesapeake Bay area and caused major impacts to beetle habitat on the western shoreline. In 2004, the Serviee eompleted a survey of the western shoreline to determine what impacts Hurrieane Isabel may have had on the beetle (Knisley 2005e). The 2004 survey found 12,306 adult beetles (a 63% decline in numbers from the 2001 surveys). All beetles and habitat were lost at eight sites. In 2005, a survey found 19,430 adult beetles. The 2005 survey showed that while beetles at a number of sites were recovering slowly, other sites showed no adults present, possibly indieating that all instar stages had been lost during the 2003 hurricane. In 2006, Hurricane Ernesto made landfall in Virginia and eaused major impaets to beetle habitat on the western shoreline of the Chesapeake Bay. In 2007, as a result of information from landowners along the Potomae River that indicated that Hurricane Ernesto had eaused major ehanges to the shoreline, the Service undertook a survey of this area to evaluate the impaets to the beetle and its habitat. The survey found that Hurricane Ernesto had eaused a second major impaet to beetle habitat along this shoreline area in a four year period (Service 2007). The 2008 survey of the western shoreline of the Chesapeake Bay found 9,933 adult beetles (approximately 30% of the numbers observed in the 2001 survey) (Service 2008).

Factors Affecting the Species - In 1990, the Service listed the northeastern beach tiger beetle 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 natural enemies. Anthropogenic threats to the tiger beetle include 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). The extirpation of the tiger beetle from most of its range has been attributed primarily to destruction

and disturbance of natural beach habitat from shorelinc development, beach stabilization, and high levels of recreational use (Service 1994).

Primary natural enemies of adult tiger beetles are wolf spiders (*Arctosa littoralis*), asilid flies (C.B. Knisley, pers. comm. 1994), and birds (Service 1994). The primary natural larval enemy 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 hatehes, and as it develops the larval wasp consumes the larval tiger beetle. Mites have also been found on larvae at Martha's Vineyard, but thcir effect, if any, is unknown (Service 1994).

Storms alter the coast throughout the year with nor'easters occurring in the winter and hurricanes in the summer. Nor'easters occur along the coast from Maine to Virginia and can cause severe flooding and beaeh erosion. Hurricanes ean cause signifieant erosion due to high tides and water levels. In 2003, Hurricane Isabel hit the Chesapeake Bay area and impactcd beetle habitat on the wcstem shoreline of Virginia. Knisley (2005e) determined that the first and second instar larvae from the 2003 adult cohort and third instars from the 2002 cohort were likely washed out of their shallow burrows by erosion and coneluded that the reduced number of adults in 2004 was likely the result of this hurricane.

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 natural enemies and other limiting factors. "For example, only about 5% of the first instar larvae of several Arizona species reached adulthood" (Knisley 1987). "Habitat disturbanees eould further reduce survivorship" (Knislcy et al. 1987) and ". . . ean eliminate suitable habitat (due to shoreline modifieation), and when combined with natural mortality factors, could reduce populations to the point of extinetion" (Knisley 1987).

Adult foraging, mating, and ovipositing can be disrupted by human activity (Knisley et al. 1987). However, larvae are probably more affcctcd because they spend most of their time at the tops of their burrows waiting for prey, and may be disturbed by even relatively minor aetivities sueh 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 tiger beetle. As human use increascd, no reduetion in adult tiger beetles was found. However, human impaet appeared to result in the lack of newly emerged adults on the publie beach. Larval survivorship was significantly lower on the beaeh area with the greatest amount of human use. Areas that were firmly stomped, to simulate inereased foot traffie, 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. Bccause larvae oceur in the intertidal zone, burrows can be easily compacted or collapsed by vehicles or high levels of human activity (Knisley et al. 1987).

Erosion within thc Chcsapcakc Bay has been exacerbated by beach development aetivities that interfere with natural beach dynamics and longshore sand transport. Beach stabilization structures such as groins, jettics, rip-rap revetments, and bulkheads, whieh 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 typieally result in reflection of wave energy back onto the forebeaeh, whieh ultimately narrows the beach and steepens the profile. Sueh changes in the beaeh profile ean oceur over periods of 1-30 years. These structures also prevent thc back beach from supplying sand to the forebeach, and eoneentrate 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 strueture installed often has an adverse impaet on the neighbor's shoreline (usually downstream of a longshore current), thus forcing a sequcnce of other shoreline modifications. Eventually, as shoreline modifieations 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 seenario are unknown, but may eventually lead to a collapse of the natural beach habitat. . ." (Hill and Knisley 1995).

Knisley (1997a) examined the effects of shoreline stabilization struetures on the distribution and abundanee of the tiger beetle from 1994-1996. A total of 24 sites were surveyed for adult and larval beetles in Virginia. The sites were placed into one of the following categories: natural beach, narrow beaeh, groins, groins/bulkheads, and revetments. The mean number of adults and larvae and beaeh width were greatest at natural beaches. Natural beaches and those with sand deposition supported the greatest number of larval and adult tiger beetles. Bulkheads and revetments had the greatest negative impaet on tiger beetles. "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 beaehes. Beeause of a two-year life eyele, larvae are more likely to survive two falls and winters of erosion and beach narrowing when more beaeh width is available."

In June 1994, a non-jeopardy biological opinion was issued to the Corps for Peaceful Beach Estates (a portion of the area known as Silver-Downing Beach) for the eonstruetion of a bulkhead and groins along the Chesapeake Bay, Northampton County, Virginia. In 1994, a survey was eonducted and 2,809 adults were documented (Knisley 1997c). At the end of 1997, 2,182 adults were doeumented and Knisley (1997e) concluded that the bulkhead/groin section eontinued to have a narrow beach with a eontinuing deeline in adult and larval beetles. He found that the 220 m of beach south of the bulkhead/groins had experieneed severe erosion sinee installation of the bulkhead/groins. In the 1999 survey, Knisley and Hill (1999) documented 547 adults. Surveys since 1999 focused on a larger streteh of beach and indieated that beetle numbers had rebounded, but within the section of beach with the bulkhead/groins, the beach has degraded and is considered marginal beetle habitat (C.B. Knisley, pers. comm. 2008).

In August 1995, a non-jeopardy biologieal opinion was issued to the Corps for Habitats, L.L.C. to eonstruct two rip-rap revetments, five groins, and four spurs along the Chesapeake Bay, in

Northampton County. In October 1995, Knisley conductcd a pre-construction survcy and determined that a moderate-sized tiger beetle population occurred at this site. After the 1995 survey, construction began. Adult and larval surveys were conducted from 1995-2000 and Knisley (2000) concluded that the shoreline stabilization did not negatively effect adult or larval tiger beetles at this site. More reeent surveys of this area (Elliotts Creek) show that it eontinues to support a moderate population of 200-400 adults (Knisley 2005a). These studies show that the effects of shoreline stabilization may be variable (Knisley 2000).

Beaeh nourishment may be destruetive to larvae and may render beach habitat unsuitable for subsequent larval recruitment and development (Knisley 1991). However, deposition of dredged material may also ereate habitat (Knisley 1997a). Dredged sand was plaeed south of Cape Charles in Northampton County, Virginia, in 1987, and the number of adult beetles 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 would result in some larval mortality through crushing, smothering, or entombing (Serviee 1994). Sand deposition eould have negative effects on food (amphipod) availability (Service 1994). Fenster et al. (2006) determined that two beach nourishment projeets on the westem shoreline of the Chesapeake Bay had a short-term positive effeet on beetle habitat. Within weeks of 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 biologieal opinions anticipating take of tiger beetles completed since 1994 have included 3,945 m (12,943 ft) of shoreline hardening; 167 groins permanently covering 1,119 m^2 (12,045 ft^2) of tiger beetle habitat; 13 piers and similar struetures; and several projects involving breakwaters, beach nourishment, concentrated human use, and piers. In addition to permanent loss of tiger beetle habitat, most of the projects have involved further impacts, including mortality of beetles (primarily larvae) during construction. Fragmentation of remaining beetle habitat has resulted from the installation of these structures. Furthermore, unpermitted activities may be contributing to the reduction of beetle habitat in Virginia as there appear to be more groins and other structures within beetle habitat than have been permitted (C.B. Knisley, pers. comm. 2004).

ENVIRONMENTAL BASELINE

Status of the Species Within the Action Area – The last three tiger beetle surveys in the action area found large numbers of adult beetles along the section of shoreline known as Silver-Downings Beach. The last survey, conducted in 2009 documented 4,417 adults (Knisley 2009). In 2005, 1,413 adult were documented (Knisley 2005a) and in 2002, 2,478 adult were documented (Knisley 2002). The 2009 survey found a significant increase in adult numbers at this site from previous surveys (Knisley 2009).

Of the 1,300 linear ft of beach within the project area, approximately 600 ft (the southern extent) is suitable larval habitat and the reinaining 700 ft (the northern portion) consists of an eroded

scarp with almost no beaeh to support larval habitat. Within the remainder of the aetion area south of the project area, the beach and shoreline are in a variety of conditions. Some areas are showing signs of erosion, resulting in a lack of suitable larval habitat, while some sections continue to have a large broad beaeh where larvae may thrive. Detailed information about the location and number of larval beetles at this site is not available. The action area is currently limited at the northern extent by a seetion of armored shoreline where there is no remaining beach.

Factors Affecting Speeies Within the Action Area - The majority of the area known as Silver-Downings Beach is suitable tiger beetle habitat with wide beach areas and stable dune struetures, the shoreline is contiguous and unfragmented by shoreline hardening. The applicant's property is the northern end of this reach and is eroding.

Recreational use of the beach is primarily limited to the homeowners and their guests. Beaeh erosion and modification, from natural and anthropogenic sources, have had a negative impact on habitat quality and long-term stability of the habitat along Silver-Downings Beach. The shoreline within the aetion area is moderately eroded due to storm events and sea level rise. Silver-Downings Beach is approximately 30 miles from the mouth of the Bay, where sea level rise is currently 0.16 in/year (higher than the worldwide average) (United States Geological Survey [USGS] 1998). 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).

EFFECTS OF THE ACTION

Direct Effects – Projeet implementation will result in disturbance to and temporary unavailability of habitat for adult beetles through disruption of their daily activity patterns (i.e., foraging, mating, basking, egg-laying). Any adult beetles in the project area are expeeted to leave the area during construetion. When work is not occurring, some adult tiger beetles may return to the project area and are expected to move away from the area once construetion activities resume. Because of their mobility, few adult tiger beetles are antieipated to be injured or killed by equipment operation or construction activities.

The operation of vehicles and equipment, exeavation, placement of sand, and/or grading of the shoreline during beach construction may result in injury or death of larvae due to a variety of effects (larvae may be crushed, entombed, exposed, etc.). Disturbance to beetle larvae will also result from use of equipment, and heavy foot traffic. As a result of sensitivity to vibrations, movements, and shadows, larval beetles may be unable to forage successfully such that injury or death occurs. As a result of the extent of activity that is anticipated on the beaehes, all larvae within the project footprint are expected to be injured or killed. Because of the life cycle of the tiger beetle, the loss of larvae from the projeet area will result in loss of tiger beetle reproduction within this area for a period of two years. After two years, adult beetles will begin to emerge from eggs laid by adult beetles that reoeeupy the site following construction.

Indireet Effeets - Indireet effects are defined as those that are caused by the proposed aetion and are later in time, but still are reasonably eertain to occur (50 CFR 402.02). Breakwaters are designed to dissipate wave energy to help ensure that a beach continues to exist at this site. Based on the highly dynamie coastal system and the many variables that affect the beach, the Serviee anticipates that up to 10,000 ft^2 of larval habitat south of the projeet area (i.e., on the adjacent property) will be impaetcd as a result of the erosional process as the shoreline equilibrates to the change in wave action resulting from the breakwaters. This impact will occur from the southern-most breakwater south to the adjacent creek mouth that has extensive sand built up around the outflow. This process can take an extended amount of time to oceur depending on wave aetion, tidal levels, wind, and alongshore sand drift. It may also occur over a shorter period as a result of storm activity, but in time a tombolo is expeeted to form as sand is eroded away and redistributes. There is also a chance that this will not occur due to the placement of the southern breakwater close to the eurrent shoreline or the effeets of the creek on the adjacent property. This loss of beaeh may result in mortality or disturbance of beetle larvae. The process is expected to occur gradually over enough time and at a slow enough rate of ehange to allow some beetle larvae to relocate their burrows instead of being killed or washed away.

Within the remainder of the action area, the breakwaters are expected to affect the amount and movement of sand in local currents. The breakwaters may capture sand that would have been deposited on the down-drift beaches, but the sand eroded from land adjacent to the project area may temporarily offset the sand capture. Because of the complexity of the processes affecting the outcome over time, we are unable to accurately predict the amount or extent of habitat that will be affected. However, the effcets are expected to consist of minor changes in the beach profile and contours over time.

Beneficial Effects – The project is expected to result in more available larval and adult habitat than is currently present once the breakwaters and beach nourishment have been completed. Sand placement and contouring behind the breakwaters will speed the formation of tombolos between the shoreline and the breakwaters and will result in the ereation of a greater length of sandy shoreline than is now present. This largcr area of sandy shoreline will provide a larger area of larval and adult habitat. The sand grain quality needed for suceessful beach nourishment conforms to parameters of sand grain size needed by the tiger beetle, and the project area is expected to be in a condition suitable for adult tiger beetle use immediately aftcr construction is complete.

While the long-term effects of breakwaters with beach nourishment on the tiger beetle have not been fully documented, other completed breakwater projects have shown a positive effect on tiger beetle habitat and numbers by the ereation of broader beaehes that are more stable and contain more consistent sand grain size and quality that favors the beetle.

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 indepcndent utility apart from the aetion under consultation. No aetivities 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 Seetion 7 of the ESA.

Silver-Downings beaeh is part of Occohannock Neck and the lands along this shoreline are privately owned and subject to further development. Agricultural activities on lands adjacent to the site may include use of pesticides and other chemicals that may affect tigcr beetles. The limited public access to this area results in limited pedestrian use and human disturbance that will harm or harass adult tiger beetles by interrupting feeding, breeding, and sheltering activities. Based on the relatively remote location of this property, large-scale development is not likely to oecur, and the action area will eontinue to support tiger beetles in the future.

CONCLUSION

While all larvae within the project footprint are likely to be adversely affected, the impact on the tiger beetle population in the action area should be relatively small due to the relatively poor quality of the remaining habitat within the project area, the small number of larvae expected to occur there, and the beneficial effects expected to result from the project.

Overall, the effects of the proposed action are expected to be relatively small because they will affect a small percentage of the larval tiger beetles occupying the action area and a small fraction of the total tiger beetle population within the GRA. Beeause the beaeh habitat that is anticipated to result after the project completion is expected to support tiger beetles and remain relatively stable over time, the effeets on both the tiger beetle and its habitat within the action area are relatively temporary in nature.

After reviewing the current status of the northeastern beach tiger beetle, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biologieal opinion that the proposed projeet is not likely to jeopardize the eontinued existence of the northeastern beach tiger beetle. No critical habitat has been designated for this speeies; therefore, none will be affeeted.

In formulating this opinion, the Serviee analyzed the potential impacts from temporary habitat disturbance, permanent habitat loss, and pre- and post-construction activities. In analyzing these impaets, the Service assessed the population-level effects for tiger beetles, including the estimated mortality, and determined that these losses will not appreeiably reduee the likelihood of survival and recovery of the tiger beetle.

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, eapture or eolleet, or to attempt to engage in any such conduct. Harm is further defined by the Serviee to include significant habitat modification or degradation that results in death or injury to listed speeies 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 seetion 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 eompliance with the terms and conditions of this incidental take statement.

The measures deseribed below are nondiseretionary, and must be undertaken by the Corps and become binding conditions of any permit issued by the Corps for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If 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 eoverage of Section 7(o)(2) may lapse. To monitor the impact of ineidental take, the Corps must report the progress of the aetion and its impaet on the speeies to the Serviee as speeified in the incidental take statement [50 CFR Sec. 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service antieipates incidental take of the northeastern beaeh tiger beetle will be difficult to quantify and detect because any beetles (adult or larvae) that are injured or killed during breakwater eonstruetion, shoreline eontouring, sand backfilling, and stockpiling of equipment and materials will be difficult to observe or locate due to their coloring, small body size, and tendeney for larvae to remain beneath the surfaee. However, the level of take of this species can be anticipated by the areal extent of the habitat affeeted.

The Service anticipates that all larvae within the project area will be injured or killed by equipment operation, plaeement of sand, and other activity within the beach area upon which fill is placed (16,250 ft^2 of larval tiger beetle habitat). The Serviee anticipates that harassment of adult beetles may oecur throughout the beach habitats in the northern half of the action area (the northernmost 2,900 ft of beach) during construetion due to disruption of their daily activity patterns (i.e., foraging, mating, basking, egg-laying). Over time, as the beaches adjacent to the project site equilibrate, an additional 10,000 ft^2 of larval habitat will be lost or altered to the

extent that it is no longer suitable to support beetle larvae. As these processes occur, up to half of the larval beetles that occur in this area are expected to be injured or killed, and the remaining half is expected to be able to relocate their burrows and adapt to the changing conditions.

The Service estimates that, once completed, the project will create approximately 11,250 ft^2 of adult habitat, and 9,000 ft^2 of larval habitat in the area that is now severely eroded. After the sand nourishment and shoreline contouring is completed, adult beetles are expected to return to the area quickly.

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 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 northeastern beach tiger beetle:

1. Construction activities must be conducted to avoid impacts to adult and larval tiger beetles.

2. Human activity, materials, and equipment on the beach must be minimized to reduce the impact to adult and larval tiger beetles.

3. The newly created beach should be maintained in a natural condition to continue to provide adult and larval tiger beetle habitat.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Corps and the 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 will occur on the beach between June 1 and September 15 of any year.

2. No placement and operation of heavy equipment on the beach for the purpose of maintenance of the breakwaters or sand replenishment between June 1 and September 15 of any year.

3. No refueling of equipment or vehicles will occur on the beach.

4. No use of pesticides on the beach.

5. The newly created beach is expeeted be suitable for use by tiger beetles immediately following eompletion. For this reason, the beaeh and planted zone must be maintained in a natural state to provide habitat for the tiger beetle and to maintain the condition of the beach that is ereated. No raking of the beach to remove the wrack or alter the extent of native vegetation is allowed, and use of equipment or vehieles following project completion is not allowed. A single access point should be established from the uplands to the beach (through the newly planted area) so that damage to this planted area will be limited and in turn help to stabilize the shoreline, and access to this beach through the applieant's property must be limited to the owners, their family, friends, and those with specific permission to access the area.

6. All sand used for beach nourishment will have a mean grain size between 0.4 and 0.7 millimeters. Before any sand is placed on the beach, the applicant must provide the Service and Corps information on the location of the source of the sand to be used, provide to the Service and Corps the results of sand grain analysis from two separate samples of the source sand, and obtain Service and Corps approval of sand material. The results of all sand grain size analyses will be provided to the Service, ineluding any analyses of sand samples that do not meet the size characteristics and were rejected. As the projeet progresses, the applicant must analyze sand grain size at least every 1,000 cubic yards to ensure that material placed on the beach meets the required 0.4-0.7 mm mean sand grain size.

7. The Corps (or the applicant) is required to notify the Service before initiation of construetion and upon completion of the project at the Service's Virginia Field Office at 804-693-6694 at the address provided on the letterhead above. Any additional information to be sent to the Service should be sent to the Virginia Field Office at the address provided on the letterhead above.

8. 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 intrinsie to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead speeimens 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 eonditions are appropriate and effective. Upon locating a dead specimen, notify the Service's Virginia Law Enforeement Office at 804-771-2883, 7721 South Laburnum Avenue, Riehmond, Virginia 23231, and the Service's Virginia Field Office at 804-693-6694 at the address provided on the letterhead above.

CONSERVATION RECOMMENDATIONS

Seetion 7(a)(1) of the ESA direets Federal ageneies 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 reeommendations are discretionary agency aetivities to further minimize or avoid adverse effects of a proposed aetion on listed speeies or critieal habitat, to help implement recovery plans, or to develop information.

The planting plan (Figure 3) ealls for planting the dune areas with American beaehgrass (*Ammophila breviligulata*) and saltmeadow eordgrass (*Spartina patens*). The plan also ealls for the creation of a minor beaeh berm approximately 50 ft inland from the mean low water line. This berm when planted and established may aet as a dune that may help to stabilize the shoreline in this reaeh. The Serviee would also suggest the possible ereation of a seeondary and larger dune strueture further inland planted with a mix of shrubs and tress. Sueh a strueture would also help to stabilize this shoreline. Possible plant speeies to be used are: wax myrtle (*Myrica cerifera*); eastern redbud (*Cercis canadensis*), American holly (*Ilex opaca*); Virginia pine (*Pinus virginiana*), live oak (*Quercus virginiana*), eastern red eedar (*Juniperus virginiana*), persimmon (*Diospyros virginiana*), and blaek ehcrry (*Prunus serotina*), and loblolly pine (*Pinus taeda*). The Serviee reeommends seleeting a mixture of these plants to ereate a more natural shoreline, and increase the likelihood of some plants surviving and becoming established. It will take some time for the trees and shrubs to become established. To provide stabilization quickly, the Serviee reeommends planting a mixture of switehgrass (*Panicum virgatum*) and coastal panicgrass (*Panicum amarum*) using both plugs (on 3 ft centers) and seed (15-20 pounds per acre).

Due to the amount of shoreline stabilization/alteration taking place along the shoreline of the Chesapeake Bay, the Service recommends that the Corps conduct detailed evaluation and planning of shoreline stabilization and its effects on tiger beetles and beach habitat, and develop plans and obtain resources to conduet shoreline stabilization, when necessary, in a manner that supports and maintains tiger beetle populations, as well as providing protection to these sites in the form of use restrictions, easements, or acquisition of some sites. The Service will be glad to work with the Corps and the applieants to locate and preserve an appropriate compensation site, or to plaee the newly constructed shoreline into a conservation easement for the protection of the beetle.

For the Service to be kept informed of aetions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in your request to initiate formal consultation. As provided in 50 CFR seetion 402.16, reinitiation of formal consultation is

required where discretionary Federal agency involvement or control over the aetion 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 speeies is listed or critieal 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 eease pending reinitiation.

Sineerely,

Cindy Schulz
Supervisor
Virginia Field Office

Enelosure

LITERATURE CITED

Blair, J.M., R.W. Parmelee, and R.L. Wyman. 1994. A comparison of the forest floor invertebrate communities of four forest types in northeastern U.S. Pedobiologia 38(2):146-160.

Davis, Chris. 2007. Monitoring and reintroduction of the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis*, Monomoy National Wildlife Refuge, 2007. Report to the U.S. Fish and Wildlife Service, New England Field Office.

Donoff, M.A., S.M. Roble, and C.A. Caljouw. 1994. Conservation strategy for the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) in Virginia. Natural Heritage Tech. Report # 94-7. Dept. of Conservation and Recreation, Div. of Natural Heritage, Riehmond, VA. 51pp.

Drummond, Michael R. 2008. Personal observations. U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Drummond, Michael R. 2002. The effects of gcophysical factors on the distribution of the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis* Say. Master's Thesis - Christopher Newport University.

Gowan, C. and C.B. Knisley. 2001. A population viability analysis for the northeastern beach tiger beetle in the Chesapeake Bay region. Report to the U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA

Hill, J.M. and C.B. Knisley. 1995. Distribution and Abundance of a Biological Indicator Species, *Cicindela dorsalis dorsalis* in Relation to Shoreline Structures and Modifications. Rcport to the U.S. Fish and Wildlife Servicc, Virginia Field Office, Gloucester, VA

Hill, J.M. and C.B. Knisley. 1994. A metapopulations study of the threatened northeastern beach tiger beetle *Cicindela dorsalis dorsalis* in Northumberland County, Virginia. Report to VA Dept. of Conservation and Recrcation, Richmond, VA.

Knisley, C.B. 2009. Prcliminary data results from 2009 survcy. Randolph-Macon College, Ashland, VA.

Knisley, C.B. 2008. Personal communication. Randolph-Macon College, Ashland, VA.

Knisley, C.B. 2005a. A survey of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis)* at Eastern Shore of Virginia sites of the Chesapeake Bay, 2005. Report to the U.S. Fish and Wildlife Service, Virginia Field Officc, Gloucester, VA.

Knisley, C.B. 2005b. Distribution and abundance of *Cicindela puritana* and *C. dorsalis dorsalis* in Maryland, 2005. Report to Heritage and Biodiversity Conservation Programs, Maryland Department of Natural Resources, Annapolis, MD.

Knisley, C.B. 2004. Personal eommunication. Randolph-Macon College, Ashland, VA.

Knisley, C.B. 2002. A survey of *Cicindela dorsalis dorsalis* along the eastern shoreline of the Chesapeake Bay, 2002. Report to the U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Knisley, C.B. 2001. Personal eommunication. Randolph-Macon College, Ashland, VA.

Knisley, C.B. 2001. A survey of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) along the western shoreline of the Chesapeake Bay, 2001. Report to the U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Knisley, C.B. 2000. Monitoring of the Northcastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) along the Shoreline, North of Elliott's Creek, Northampton County, Virginia. Unpublished report to U.S. Fish and Wildlife Service, Virginia Field Office.

Knisley, C.B. 1997a. Distribution and abundanee of the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis*, in relation to shoreline modifieations, in Virginia. Report to Virginia Department of Agrieulture and Consumer Affairs, Office of Plant Proteetion, Riehmond, VA.

Knisley, C.B. 1997b. Mierohabitat preferences of *Cicindela dorsalis*, the northeastern beach tiger beetle. Report to VA Dept. of Agrie. and Consumer Serv., Riehmond, VA.

Knisley, C.B. 1997c. Monitoring of the northeastern beach tiger beetle, *Cicindela d. dorsalis*, at Peaceful Beach Estates (O'Leary site) Northampton County, Virginia. Unpublished report to U.S. Fish and Wildlife Serviee, Virginia Field Office.

Knisley, C.B. 1994. Personal communication. Randolph-Macon College, Ashland, VA.

Knisley, C.B. 1991. Management plan for a population of the threatened tiger beetle, *Cicindela dorsalis* at Accawmacke Plantation, Virginia. Unpub. Report to Espy Houston & Co.

Knisley, C.B. 1987a. Status survey of two candidate species of tiger beetles, *Cicindela puritana* G. Horn and *C. dorsalis* Say. Report to U.S. Fish and Wildlife Service, Newton Corner, MA.

Knisley, C.B. 1987b. Habitats, food resources, and natural enemies of a community of larval *Cicindela* in southeastern Arizona (Coleoptera: Cieindelidae). Can. Journ. Zool. 65:1191-1200.

Knisley, C.B. and J.M. Hill. 1999. A survey of the Eastern Shore of Virginia for the northeastern beaeh tiger beetle, *Cicindela dorsalis dorsalis*, 1999. Report to the U.S. Fish and Wildlife Serviee, Virginia Field Office, Gloucester, VA.

Knisley, C.B. and J.M. Hill. 1998. Distribution and abundance of *Cicindela dorsalis dorsalis*, the northeastern beach tiger beetle, along the western shoreline of the Chesapeake Bay in Virginia. Report to the U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Knisley, C.B. and J.M. Hill. 1990. Distribution and abundance of two tiger beetles, *Cicindela dorsalis media* and *C. lepida* at Assateague Island, Maryland, 1990. Report to Maryland Dept. Nat. Res., Natural Hcritage Program, Annapolis, MD.

Knisley, C.B. and J.M. Hill. 1989. Human impact on *Cicindela dorsalis dorsalis* at Flag Ponds, Maryland. Report to the U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, MD.

Knisley, C.B., J. M. Hill, and A. M. Scherer. 2001. Transloeation of threatencd tiger beetle *Cicindela dorsalis dorsalis* (Coleoptera: Cicindelidae) to Sandy Hook, New Jcrsey. Ann. Entomol. Soc. Am. 98(4):552-557.

Knisley, C.B., J.L. Luebke, and D.R. Beatty. 1987. Natural history and population decline of the coastal tiger bcetle *Cicindela dorsalis dorsalis* Say (Coleoptera: Cieindelidae). Virginia J. of Sci. 38(4):293-303.

National Park Service. 2007. Threatened and endangered species activity report, 2007 season. Unpublished report. Gateway National Recreation Area, Sandy Hook, New Jersey. 22 pp.

Nothnagle, P.J. 2001. Monitoring of the northeastern beach tiger beetle, (*Cicindela dorsalis dorsalis*) in Massachusetts in 2001.

Roble, S.M. 1996. Distribution, abundance and conservation status of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) in Virginia: 1995 summary report. Natural Heritage Technical Report 96-4. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Richmond, VA.

Rosen, Peter S. 1980. Erosion susceptibility of the Virginia Chesapeake Bay shoreline. Marine Gcology 34: 45-59. Report to the U.S. Fish and Wildlife Service, New England Field Office.

Scherer, A. 1996. Personal communication. U.S. Fish and Wildlife Service, New Jersey Field Office, Pleasantville, NJ.

Scherer, A. 2004. Personal eommunieation. U.S. Fish and Wildlife Serviee, New Jersey Field Office, Pleasantville, NJ.

Seherer, A. 2008. Personal eommunication. U.S. Fish and Wildlife Serviee, New Jersey Field Offiee, Pleasantville, NJ.

Stamatov J. 1972. *Cicindela dorsalis* endangered on northern Atlantie eoast. Cieindela 4:78.

U.S. Fish and Wildlife Serviee. 2007. Survey of the Potomae River for the northeastern beach tiger bectle, (*Cicindela dorsalis dorsalis*). Unpublished report. Virginia Field Office, Gloueester, VA.

U.S. Fish and Wildlife Service. 1994. Northeastern Beaeh Tiger Beetle (*Cicindela dorsalis dorsalis*) Reeovery Plan. Hadley, Massaehusetts. 60 pp.

Vogler, A.P. and R. DeSalle. 1994. Diagnosing units of conservation management. Cons. Biol. 8:354-363.

Vogler, A.P. and P.Z. Goldstein. 1997. Adaptation, cladogenesis, and the evolution of habitat assoeiation in North Ameriean Tiger Beetles (Coleoptera: Carabidae). in *Molecular Evolution and Adaptive Radiation* (T. Givnish and K. Sytsma, eds.). pp. 353-373.

Vogler, A.P., R. DeSalle, T. Assmann, C.B. Knisley, and T.D. Schultz. 1993. Molecular population geneties of the endangered tiger beetle *Cicindela dorsalis dorsalis* (Coleoptera: Cieindelidae). Entomol. Soc. of Am. 86:142-152.

Von Oettingen, S. 2008. Personal eommunication. U.S. Fish and Wildlife Service, New England Field Office, Coneord, NH.

Von Oettingen, S. 2006. Personal communieation. U.S. Fish and Wildlife Service, New England Field Office, Coneord, NH.

Von Oettingen, S. 2001. Personal eommunication. U.S. Fish and Wildlife Serviee, New England Field Office, Concord, NH.

NORTHEASTERN BEACH TIGER BEETLE
(*Cicindela dorsalis dorsalis*)
SURVEY CONTACTS IN VIRGINIA

This list contains individuals who we have already determined are qualified to eonduet surveys for the species listed above. This list does not include all individuals qualified or authorized to survey for this species. If you select someone not on this pre-approved surveyor list, please provide the proposed surveyor's qualifieations to this office 30 days prior to the start of the survey. Please send eopies of all survey results to this offiee. If the survey determines that any rare species are present, please contact this office to allow us the opportunity to work with you to ensure that a project avoids or minimizes adverse effects to rare species and their habitats. Inclusion of names on this list does not constitute endorsement by the U.S. Fish and Wildlife Service or any other U.S. Government agency. Listed alphabetically. July 17, 2009.

Dot Field
Virginia Div of Natural Heritage
P.O. Box 81
Wachapreague, Virginia 23480
(757) 787-5576
dotfield@dcr.virginia.gov

Barry Knisley
Department of Biology
Randolph-Macon College
Ashland, VA 23005
(804) 752-7254
bknisley@rmc.edu

Steve Roble
Virginia Div of Natural Heritage
217 Governor St, 3rd Floor
Richmond, VA 23219
(804) 786-7951
steve.roble@dcr.virginia.gov

51411-2009-F-0258 Ruth Cassidy (Silver-Downings Beach, E020)

Consultation Core Info Summary

Consultation Title: Ruth Cassidy (Silver-Downings Beach, E020)
ARRA Fund: No ARRA funding
Consultation Description: *None entered*
Consultation Type: Formal Consultation
Consultation Complexity: Standard
Action/Work Types:
- Shoreline / Beach Protection - Renourishment
- Shoreline / Beach Protection - Breakwaters

Species:
- Northeastern beach tiger beetle (Cicindela dorsalis dorsalis)

Staff Lead: Michael Drummond

Lead Agency: Army Corps of Engineers
Other Lead Agency: *None entered*

Start Date: 04/22/2009
Formal Consultation Initiated: 04/22/2009
Days until Due: 45 day(s) overdue
Due Date: 09/04/2009
Conclusion Date: *None entered*