Preliminary assessment of trail alternatives

Gordons Pond Working Group
December 2010

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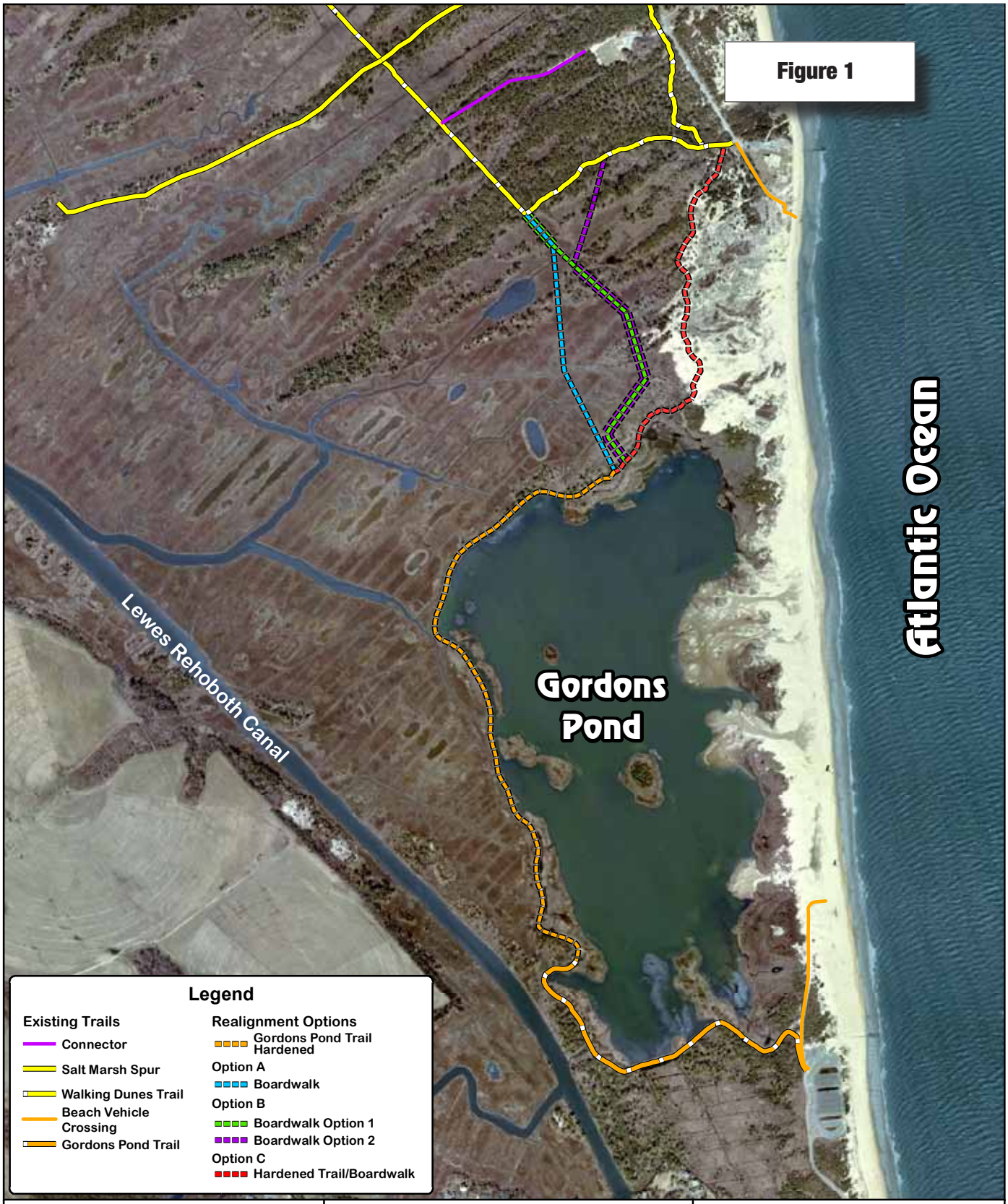

Department of Natural Resources and Environmental Control
October 2010

Gordons Pond Proposed Trail Realignment
Proposed Trail Alignments and Alternatives

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1 - Introduction

Purpose of this report

Secretary O'Mara charged the Gordons Pond Working Group with identifying and commenting on the natural resources, regulatory and other environmental issues involved in building an improved trail that connects the Gordons Pond parking lot at the south end of Cape Henlopen State Park to Herring Point.

The working group, comprised of scientific, technical and planning staff from within the department, reviewed the original proposed alignment (Option A), which includes plans for a boardwalk of almost 3,000 feet over tidal marsh. The group also developed an alternative alignment (Option B), which attempted to avoid the marsh fragmentation of Option A by crossing upland spits along the marsh/upland boundary. Third, the group revisited the concept of avoiding most wetland impacts altogether and upgrading the existing alignment through the dunes (Option C). Finally, the group compared these options to the impacts of leaving the trail in its mostly primitive state (Option D). A summary of issues identified for each option is included in a matrix on page 21 at the end of Section 2, which describes each option in detail.

These options are shown in *Figures 3, 5 and 7*. The working group did not vote to support any particular alignment or a no-build option. However, members were asked to apply their expertise to assess each of the four options. The issues reviewed by the Gordons Pond Working Group included assessments of:

- Tidal wetland impacts
- Regulatory issues – State Wetlands Act and US Army Corps of Engineers
- Sea level rise
- Species of conservation concern and habitat
- Cultural resources
- Dune stability
- Visual impacts
- Management issues
- Sustainable trail construction, materials and maintenance

In addition, the Parks Resource Office developed a series of material and cost estimates for each of the options. They are included in **Section 6**.

History of Gordons Pond trail

The concept of an improved trail through Gordons Pond has been discussed for decades. In 1990, a "Study of Potential Routes for a Bikeway/Pedestrian Trail between the Cities of Lewes, Delaware, and Rehoboth, Delaware" evaluated a route along the dunes and a route along the railroad right of way.

That 1990 study did not make a definitive recommendation, but did conclude that "based on input

gained from various bicycle groups and local community leaders, it is likely that a designated pathway between the cities of Lewes and Rehoboth would be utilized extensively by bicyclists and pedestrians. In addition, the findings of the Outdoor Recreation Demand and Needs Survey . . . conclude that development of an additional trail facility in Coastal Sussex County will augment participation in trail-based recreation for the residents there and other Delawareans."

In 2003, DNREC opened the first 3.6 miles of the Junction and Breakwater Trail, following segments of the rail line that connected Lewes and Rehoboth in the mid-19th Century. The current length is just under 5 miles. The finely crushed stone trail has an average width of 12 feet.

The working group, created to assess environmental impacts and regulatory issues, recognizes there are several motivations for realigning and improving the primitive existing Gordons Pond trail, including:

- Providing a key link for a 15.5-mile loop *(Figure 2)* that connects Lewes, Rehoboth, Cape Henlopen and the Junction-Breakwater Trail;
- Meeting the highest priority recreational need in Delaware - walking, hiking, jogging and bicycle paths;
- Promoting public health and safety and decreasing air emissions by creating an alternative to bicycling or driving on Route 1;

Gordon's Pond Working Group

Note: This document is intended for internal use and represents the assessment of a selected group of employees who were tasked to consider potential impacts of a trail and boardwalk on environmental and cultural resources.

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- Preventing off-trail use by pedestrians and bikers that jeopardizes rare species, including the piping plover, and cultural sites;
- Giving the public the opportunity to be informed about and appreciate the beauty and ecological importance of the tidal marsh, uplands and dunes;
- Providing accessibility to this area tfor all Park visitors; and
- Promoting tourism and economic development

Several members of the group were concerned about realigning or improving the trail on a scale that would invite significantly more people into this section of Cape Henlopen, while acknowledging that the area has not been pristine throughout recent centuries.

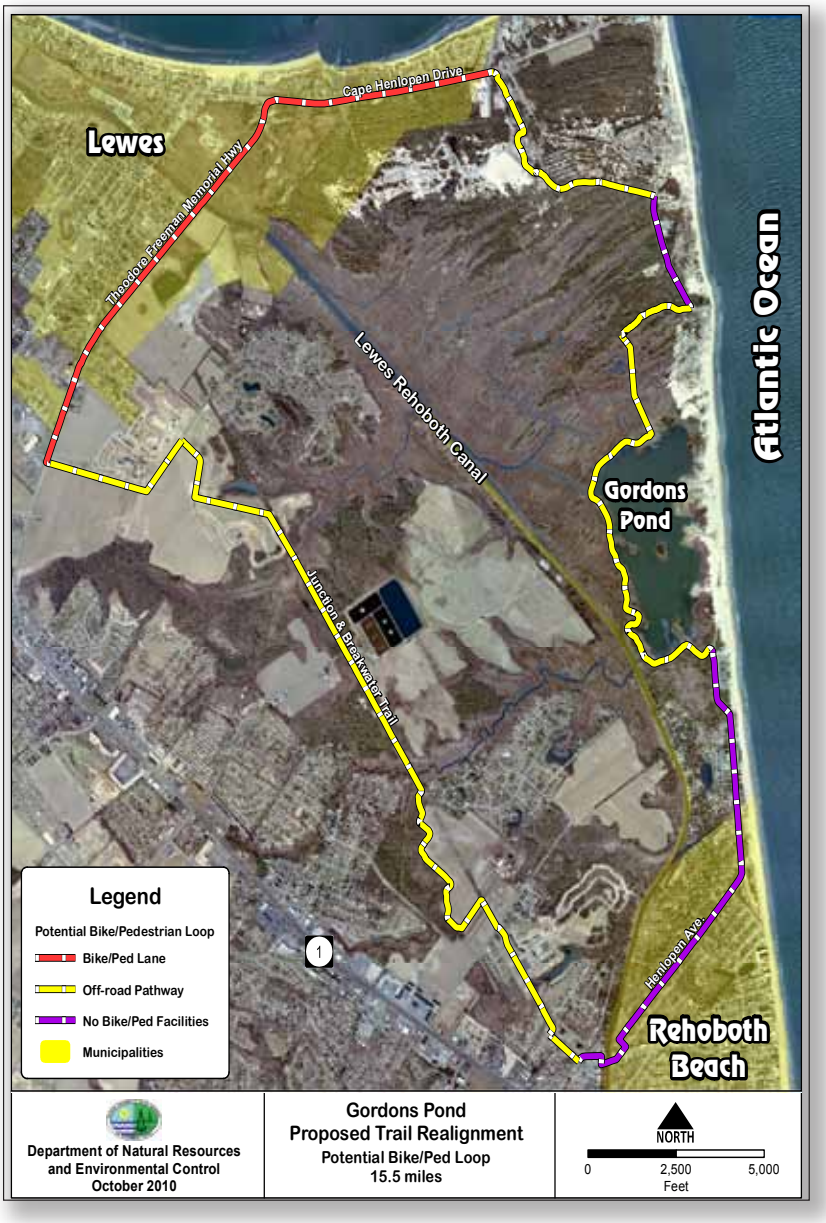


Figure 2

Rekindling of interest

In January 2010, Parks Staff met with the Secretary's Office to discuss a potential realignment and imrprovement of the existing Gordons Pond Trail. The potential realignment would move the northern section of the Gordons Pond Trail from the dune area crossing to a tidal salt marsh crossing west of the existing location. A 10-page assessment of the proposed realignment project was prepared by the Parks Resource Office in March 2010.

Anticipating internal DNREC concerns about state tidal wetlands regulations, wetlands fragmentation, rare and endangered species and cultural resources, Secretary O'Mara asked the working group to review the proposed realignment and suggest alternatives.

Next steps

The working group presented this report to DNREC's leadership team on January 4, 2011. After discussion among the group members and leadership, the Secretary directed the group to focus on Option C and identify alternative alignments along this general route that would minimize wetland impacts and possibly intersect the dune at an alternate location. At the same time, the route must continue to avoid cultural and natural resource impacts.

2 - Evaluation of options

DNREC's Gordons Pond Working Group reviewed four trail options during four meetings and a late September 2010 field visit to the Gordons Pond Area. The group discussed challenges and impacts of each option including rare species and habitats impacts, cultural resources and visual impacts, state wetlands law and regulations, Army Corps of Engineers permitting, sea level rise, dune stability, and visitor management. Cost estimates also were considered; however, the group acknowledges that costs estimates will vary as trail specifications are refined to deal with identified challenges and impacts. They are included in **Section 6**.

Ultimately, each option carries with it a unique set of impacts. Shifting the alignment to avoid one set of impacts results in a different set of impacts. For example, moving the proposed boardwalk out of the marsh reduces impacts to the tidal wetlands and some regionally declining birds, but affects rare plant species and other animal species of conservation concern as well as archeological resources in the area. Nonetheless, the working group attempted to explore various options in an effort to find a reasonable balance between our agency's mission of protecting cultural and natural resources while providing recreational opportunities.

OPTION A *(Figure 3)* is the starting point for Parks' planning efforts. This route consists of hardening approximately 6,300 feet along the existing trail alignment (beginning at the Gordons Pond overlook) with crushed stone and constructing a fiberglass boardwalk of approximately 2,678 feet across the tidal marsh. The trail would be 8 feet wide and join with the Walking Dunes Trail near Herring Point to the north.

Principal issues

Fragmentation of salt marsh. Though not pristine, the area represents the highest quality of what remains, not only in Cape Henlopen, but along Delaware's Atlantic coastline. Wetlands are shown in *Figure 3,* the map depicting Option A.

The construction of a boardwalk across this marsh would raise the following concerns, both among DNREC scientists and permit reviewers:

- Habitat fragmentation
- Disturbance to marsh-nesting birds (particularly marsh-dependent nesters which have been shown to be vulnerable from these types of structures by our own agency)
- Impacts to animal species of regional and state conservation concern
- Impacts to cultural sites
- Enhanced access to isolated marsh areas for predators
- Increased human activity in the marsh
- Noise, trash, and nuisance impacts

- Potential cumulative impacts resulting from the changed expectations of the regulated community once such a large structure is constructed in the marsh
- Effects of sea level rise on the viability (cost-benefit) of the trail and boardwalk
- Temporary construction impacts

Option A:

This original proposed alignment traverses tidal marsh with a boardwalk length of almost 2,700 feet.

Species of conservation concern. Though many species of concern are associated with the marsh west of Gordons Pond, the critical species that could be impacted by fragmentation and disturbance are: Seaside Sparrow *(Ammodramus maritimus)* and Saltmarsh Sharp-tailed Sparrow *(Ammodramus caudacutus)* have the following designations:

- Delaware Wildlife Action Plan: Tier 1 Species of Greatest Conservation Need
- Bird Conservation Region 30 (Mid-Atlantic): Highest Tier
- Partners-In-Flight Region 44 (Mid-Atlantic): Level I High Continental Importance

In addition, the Saltmarsh Sharp-tailed Sparrow is further designated by:

- Northeast Fish and Wildlife Diversity Technical Committee: Species of Concern
- IUCN Designation of "Near Threatened" (IUCN = International Union for the Conservation of Nature)

State wetlands law and regulations. A boardwalk of any length over wetlands needs to have a water dependent purpose. Section 7.1.4 of the Wetlands Regulations states that:

"No permit will be issued to utilize wetlands for any activity unless it:

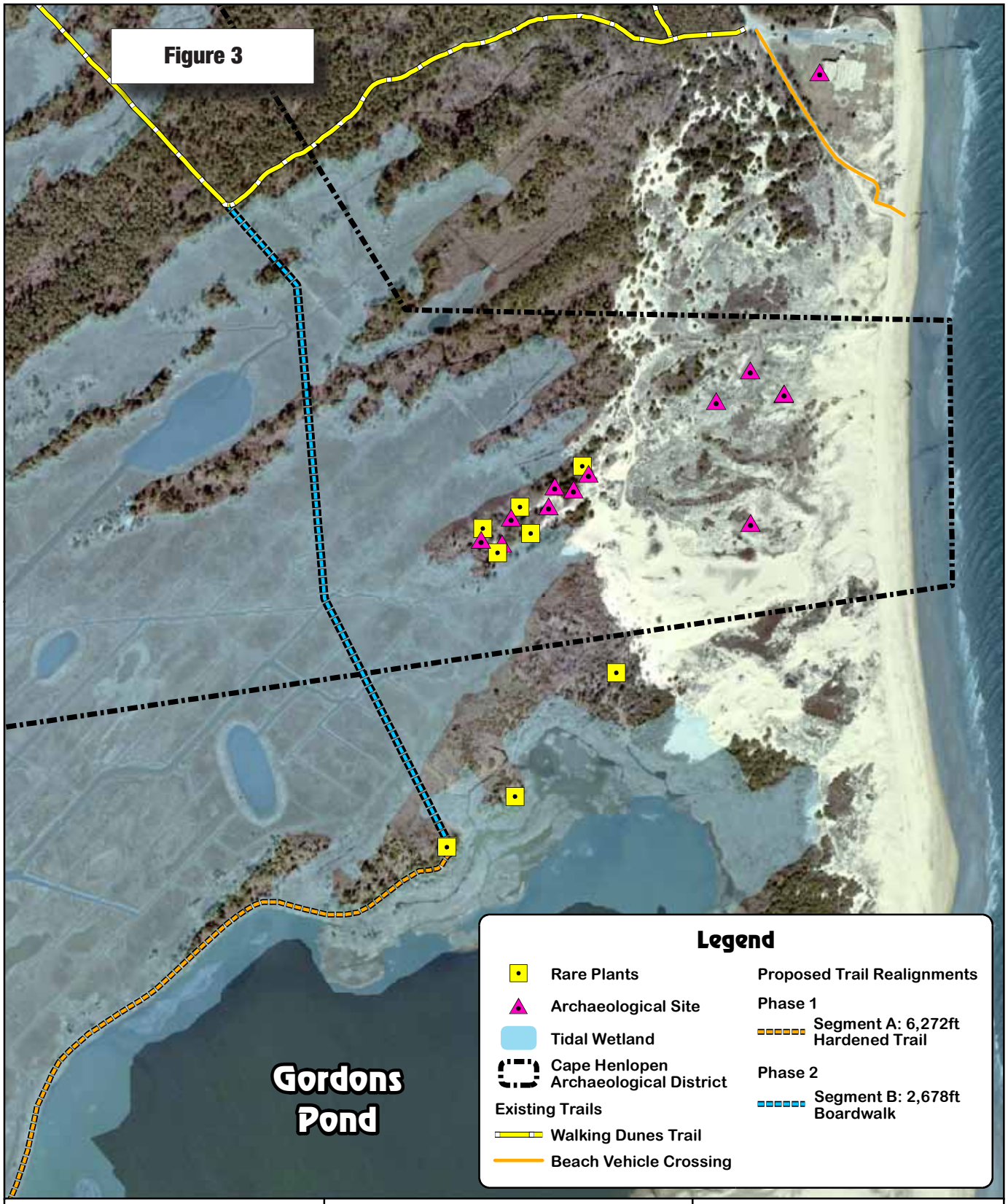
- Requires water access or water for the central purpose of the activity; and
- Has no alternative on adjoining non-wetland property of the owner."

This project is a trail realignment of a decades-old trail used for hiking and providing pedestrian passage through Cape Henlopen State Park. Historically, the trail has not required water access or water for its central purpose.

The proposed project is the largest boardwalk project ever proposed in State-regulated wetlands. The proposed boardwalk segment in Option A would cross roughly 2,600 linear feet of State-regulated wetlands. At the proposed 8-foot width, the structure would directly impact 21,080 square feet (.48 acres) of wetlands. However, it is likely that the impact to the marsh ecosystem and associated marsh bird community will go beyond the footprint of a boardwalk. A recent study has shown that piers and docks negatively impact obligate marsh bird communities, with lower species richness and lower relative abundance at sites with piers compared to sites without piers[1]. Among other factors, these effects may be the result of human disturbance or increased predator access.

For a more complete discussion of wetland regulatory issues, see **Section 5.** This alignment links up with the Walking Dunes Trail west of Herring Point; additional wetlands crossings would be required along that trail if it became part of a higher-volume bicycle loop. This section floods with the tides.

[1] Banning, A.E. 2007. The Effect of Long Piers on Birds Using Tidal Wetlands in Worcester County, Maryland. Master's Thesis; University of Delaware Department of Entomology and Wildlife Ecology.



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Gordons Pond
Proposed Trail Realignment
Option A

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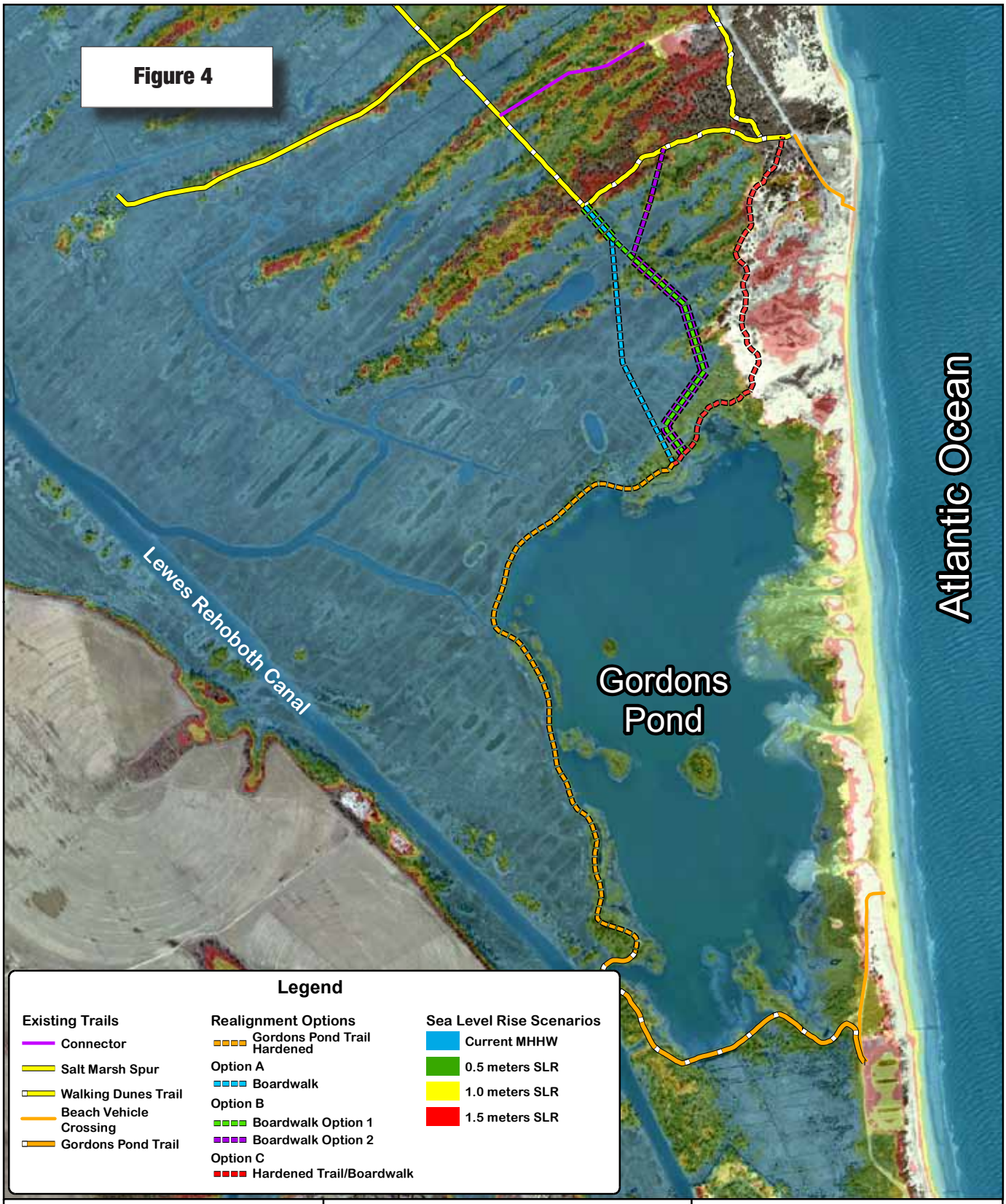
US Army Corps of Engineers. The Corps of Engineers may require a permit for the boardwalk over wetlands. Final determination of the need for a Corps permit will require consultation with the Corps. Because federal funding is likely to be used to finance this project, Section 106 National Historic Preservation Act, Coastal Zone Management Federal Consistency, and Endangered Species Act **(Section 7)** reviews would be required similar to the requirements mandated by the Corps' permitting program.

Sea level rise *(Figure 4).* The Department's sea level rise policy, adopted in January 2010, tasks all DNREC programs to consider the following inundation scenarios dependent on the nature and scope of the project under evaluation: 0.5 meters for low sensitivity projects, 1.0 meters for medium sensitivity projects, and 1.5 meters for high sensitivity projects. Most boardwalks would qualify as a low sensitivity project- a simple structure with a relatively minor footprint, capital investment and not intended to last indefinitely. As such, the 0.5 meter inundation scenario is applicable.

According to the sea-level rise inundation scenarios, the Gordons Pond area will be completely underwater. Of note, the area is currently depicted as underwater at mean higher high water, and portions of the Gordons Pond trail are flooded during spring tides and extreme weather. The area is vulnerable to coastal hazards now, and this vulnerability will only increase over time.

While the boardwalk itself would likely not be overtopped at 0.5 meter sea level rise, the at-grade trail leading to the boardwalk would be impassable, rendering the project functionally useless. Further, the predicted increased frequency and intensity of coastal storms and the propensity for storm related damage to the structure should be considered.

Primitive trail would still exist. If this alignment were chosen, the existing primitive trail may continue to be used by visitors and park staff unless aggressive management and enforcement efforts were undertaken to make it inaccessible. Traversing the dunes and taking in the views from the higher elevation would still be attractive to many visitors, perpetuating the same problems with encroachment on piping plover nesting areas, cultural sites and other species of concern.



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October 2010

Gordons Pond Proposed Trail Realignment
Sea Level Rise Scenarios and Trail Options

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OPTION B *(Figure 5)* is an alternative to Option A. Members of the working group, in an effort to lessen impacts to the salt water marsh, scouted an alternative that followed the tidal wetland fringe, nontidal forested wetlands, several sand spits and upland maritime thickets – closer to the dunes and through areas previously disturbed by utility rights of way and the Fort Miles bondary fence.

Option B:
This alignment follows the tidal wetland friinge, nontidal forested wetlands and other upland areas closer to the dunes.

This version consists of hardening 6,427 feet of the existing alignment around Gordons Pond and constructing a boardwalk of either (Alternative 1) 2,956 feet -- 23,648 sq ft. or .54 acres – or (Alternative 2) 3,373 feet -- 26,984 sq ft. or .62 acres. Alternative 2 was suggested in an effort to impact even fewer square feet of tidal wetlands, by joining the Walking Dunes Trail (in yellow) closer to Herring Point. The group initially thought this option would require a shorter boardwalk, but the proposed length turned out to be longer.

Principal issues

Fragmentation of salt marsh. The same concerns expressed in Option A apply to this alternative, although impacts would be closer to habitat edge rather than fragmenting core sparrow habitat.

State wetlands law and regulations. The same concerns expressed regarding Option A apply to this alternative.

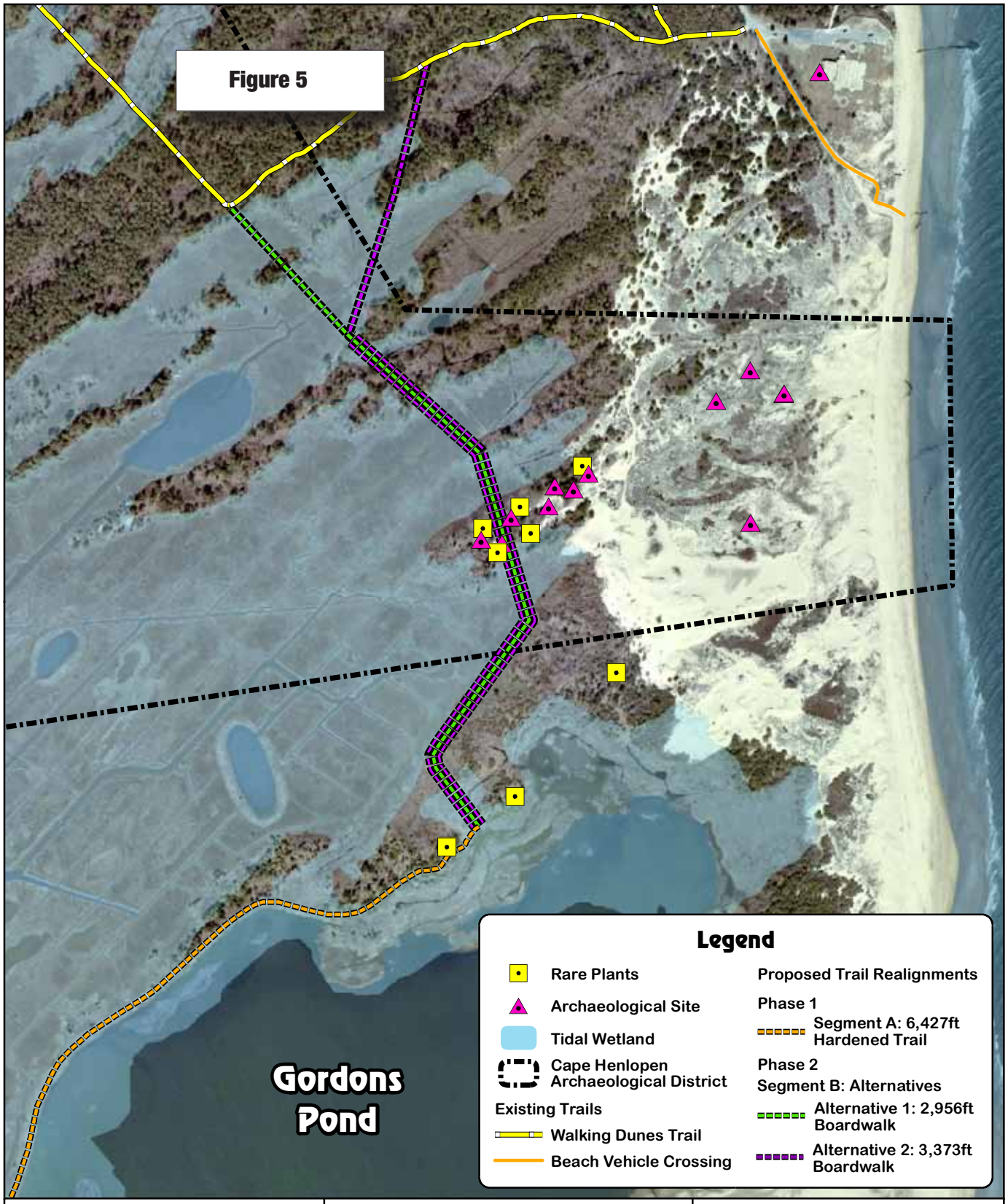
US Army Corps of Engineers. The same statement made regarding Corps involvement in Option A applies to this option.

Species of conservation concern. Six species of state rare and uncommon plants were found during this survey. Small openings within the thickets and woodlands, supporting a reoccurring suite of herbaceous plants, were frequently encountered. Within these openings several state rare and uncommon plants were discovered: saw greenbriar (*Smilax bona-nox,* S1), sand dayflower *(Commelina erecta,* S2*)*, grassleaf blazing star *(Liatris pilosa,* S2), big-top lovegrass *(Eragrostis hirsuta,* S3), and Carolina rose (*Rosa carolina,* S3).

State Rank:
S1- extremely rare within the state (typically 5 or fewer occurrences); S2- very rare within the state (6 to 20 occurrences); S3- rare to uncommon in Delaware

The non-tidal forested wetlands, which range in width from being very broad to very narrow, develop on poorly drained soils that likely receive fresh groundwater flow from the surrounding area and are high enough to escape a typical daily tide. The canopy of these wetlands is primarily red maple (*Acer rubrum*), with some loblolly pine. The understory can be impenetrable in places, with shrubs and small trees such as: inkberry (*Ilex glabra*), sweetbay magnolia (*Magnolia virginiana*), southern bayberry (*Myrica cerifera*), and highbush blueberry (*Vaccinium corymbosum*). Infrequently encountered within these forested wetlands, are small canopy gaps where the slender spikegrass (*Chasmanthium laxum*) is common, and where the state rare white-fringe orchis (*Platanthera belphariglottis,* S1) was found. In one canopy opening, about 4x5 meters in size, 80 fruiting stems of the white-fringe orchis were counted. Habitat quality of these non-tidal forested wetlands is good, but management (expanding/creating canopy gaps) would greatly enhance habitat for the white-fringe orchis and perhaps other rare species that may be lying dormant.

The group expressed concerns that an influx of new visitors, particularly along this alignment, would jeopardize the rare species especially in the absence of an intentional habitat management effort. *Figure 6* describes the various vegetation communities in this area.



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Gordons Pond
Proposed Trail Realignment
Option B

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Cultural sites. This option presents the potential for higher impacts to cultural sites (See *Figure 9* on page 27) within the Cape Henlopen Archaeological District. The district consists of several east-west trending sand spits which have been stabilized by Native American shell middens (piles). These settings provided an ideal location for Native Americans to harvest fish and shellfish from the shallow bay now known as Lewes Creek Marsh At least six micro-band base camps were occupied on each of these vegetated sand spits with ceramic associations that date from 500 BC to 1600 AD. Site 7S-D-9 is the most easterly and the oldest of these sites and it is located in the middle of Option B in the project area. Previous testing indicates the presence of significant cultural features and alternating layers of shell and sand deposits up to 12 feet below surface in this location.

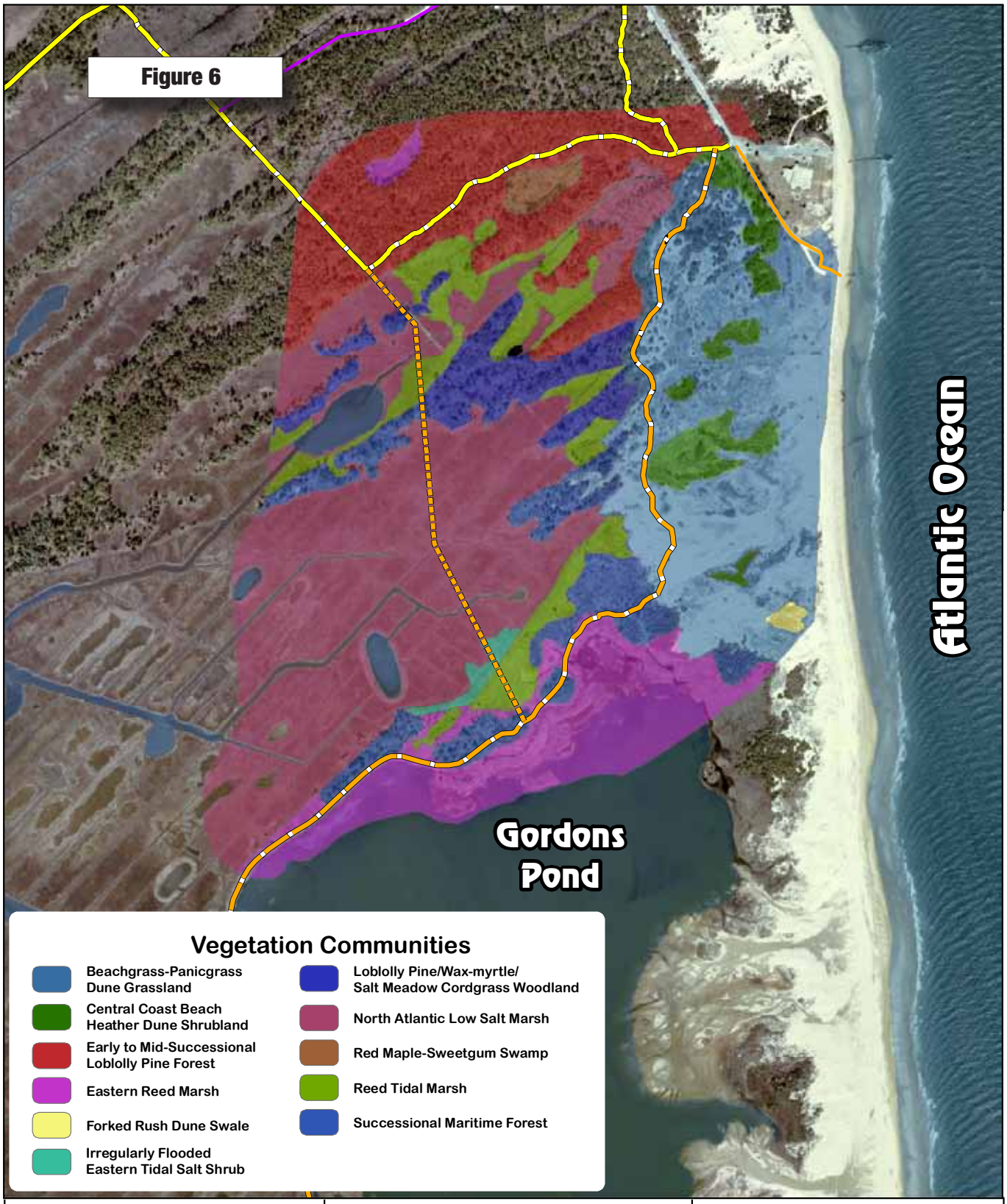
An influx of visitors would severely impact cultural sites such as 7S-D-9 especially in such a remote and highly visible area. (See **Section 4** for a more complete description of the archeological sites in this area, as well as a prescription for addressing cultural resources along any alignment.)

Upland habitat. Generally, this particular upland habitat is being squeezed between the dune line migrating westward and the tidal wetlands. Upland habitat is usually afforded the least legal protection in Delaware, even though it contains the most rare species in this case.

Sea level rise. The same concerns exist with respect to future inundation of the crushed stone segment of the Gordons Pond trail.

Primitive trail would still exist. Again, if this alignment were chosen, the existing primitive trail may continue to be utilized by visitors and staff alike, unless aggressive management and enforcement efforts were undertaken to make it inaccessible.

While scouting a potential upland alignment, group members encountered a boundary marker for Fort Miles. Option B includes land previously disturbed by the military reservation boundary fence along with a significant concentration of cultural sites and rare species.



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October 2010

Gordons Pond Proposed Trail Realignment

Vegetation Communities

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OPTION C *(Figure 7)* follows the alignment of the entire existing trail from the Gordons Pond overlook to Herring Point. Approximately 6,700 feet of existing trail would be hardened, followed by approximately 628 feet of wooden boardwalk over state-regulated wetlands with hardened trail in two segments, leading up to the dunes where 1,022 feet of elevated boardwalk with rails would be constructed. Possibly an elevated boardwalk would not be required along this entire section; areas prone to migration should be left with as little structure as possible so that segment of the trail can be easily modified when necessary following intense storms.

Option C: This allignment follows the current primitive trail, with an elevated boardwalk over a portion ot the dunes.

North of the boardwalk, still in the dune area, approximately 1,712 feet of trail would be hardened leading up to the Walking Dunes Trail at Herring Point. It is possible that a smaller area of wetlands would have to be crossed if the trail were moved slightly to the west onto the upland area, but such a shift would likely impact more rare species.

Principal issues

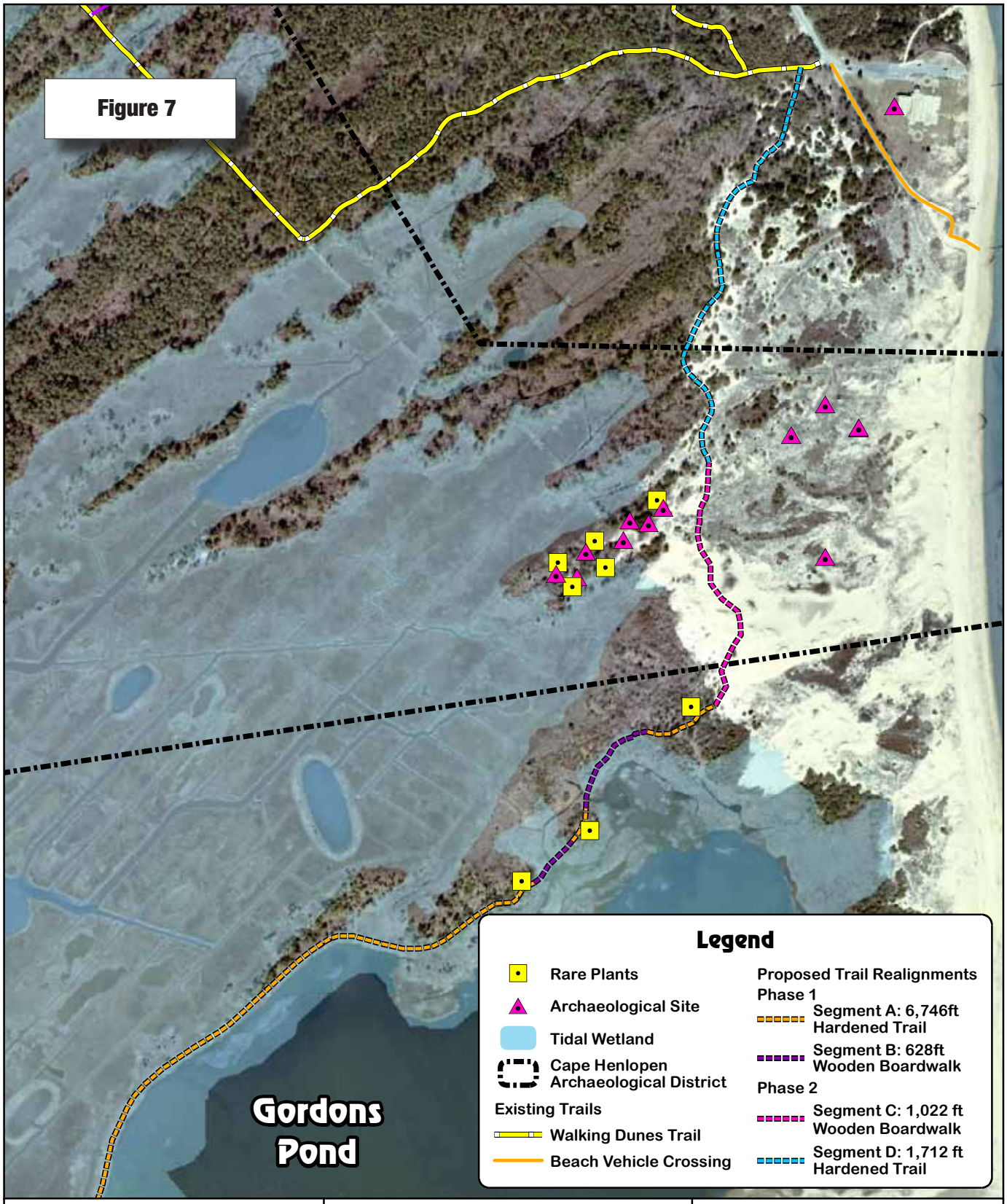
Fragmentation of salt marsh. This option impacts a much smaller area (628 feet) of tidal wetlands. Changing the alignment along this portion to the west could further reduce wetland impacts (although moving into upland areas could affect species of concern). It is recommended that an updated wetlands delineation be performed in this area.

State wetlands law and regulations. While this route represents a much shorter wetland crossing than Option A or B, the same regulatory issues apply even though the trail would follow an existing alignment, according to Wetlands and Subaqueous Lands Section. See **Section 3** for a discussion of those issues. According to that section, over the last 5 years the maximum length of a permitted wetland walkway has not exceeded 160 linear feet.

Species of conservation concern. Dunes (shrub-scrub, herbaceous, sparsely vegetated), overwash sand flats and beach habitat between Herring Point and Gordons Pond provide habitat for several rare and endangered species. Two species that occur in this area are protected under the federal Endangered Species Act: piping plover (*Charadrius melodus*) and seabeach amaranth (*Amaranthus pumilis*). Piping plovers typically nest in overwash or dune blow-out areas anywhere between Herring Point and Gordons Pond, with most nesting activity on the overwash areas between the ocean and Gordons Pond. Nesting can and has occurred just to the south of Herring Point as well.

Other state-rare beach-nesting birds that nest in the Gordons Pond area include least tern (*Sternula antillarum*) and American oystercatcher (*Haematopus palliatus*). Nests are formed in the sand as a simple depression, and incubating adults, eggs, and chicks of all species are highly susceptible to disturbance and trampling throughout the nesting season, typically between March to August. Seabeach amaranth, an annual plant, grows on the foredune and is at risk from trampling and off-road vehicles; closures in this area for piping plovers also benefit *Amarathus* and the globally rare seabeach knotweed (*Polygonum glaucum*), which in Delaware is found only at Cape Henlopen State Park.

The shrub-scrub dune and wetland swales along Cape Henlopen provide nesting and foraging habitat for the state-rare common nighthawk (*Chordeiles minor*). Wetland swales among the dunes provide the only known habitat for the globally rare Bethany firefly (*Photuris bethaniensis*). This tiny firefly occurs only in Delaware's dune swales; despite targeted habitat searches in other coastal states, it has been found nowhere else. The state-rare little white tiger beetle (*Cicindela*



Department of Natural Resources and Environmental Control
October 2010

Gordons Pond
Proposed Trail Realignment
Option C

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lepida) occurs in the sandy dunes primarily at the Point but may also occur south to Gordons Pond – anywhere sparsely vegetated dunes are protected from trampling and off-road vehicles.

Several rare plants are found: *Carex silicea* (seabeach sedge, S2) is scattered in the dunes and swales throughout the area between Herring Point and Gordons Pond. There is also the "Orchid Bog" that sits in amongst the pines on the north edge of Gordons Pond. The bog supports three state rare species: *Pogonia ophioglossoides* (rose pogonia, S2), *Platanthera blephariglottis* (white-fringe orchis, S1), *Calopogon tuberosus* (grass pink, S1); and one state uncommon species (*Listera australis*, southern twayblade).

Details regarding all of these species and the vegetation communities/habitat types that support them can be found in the 1996 report of the Delaware Natural Heritage Program's survey of Cape Henlopen State Park.

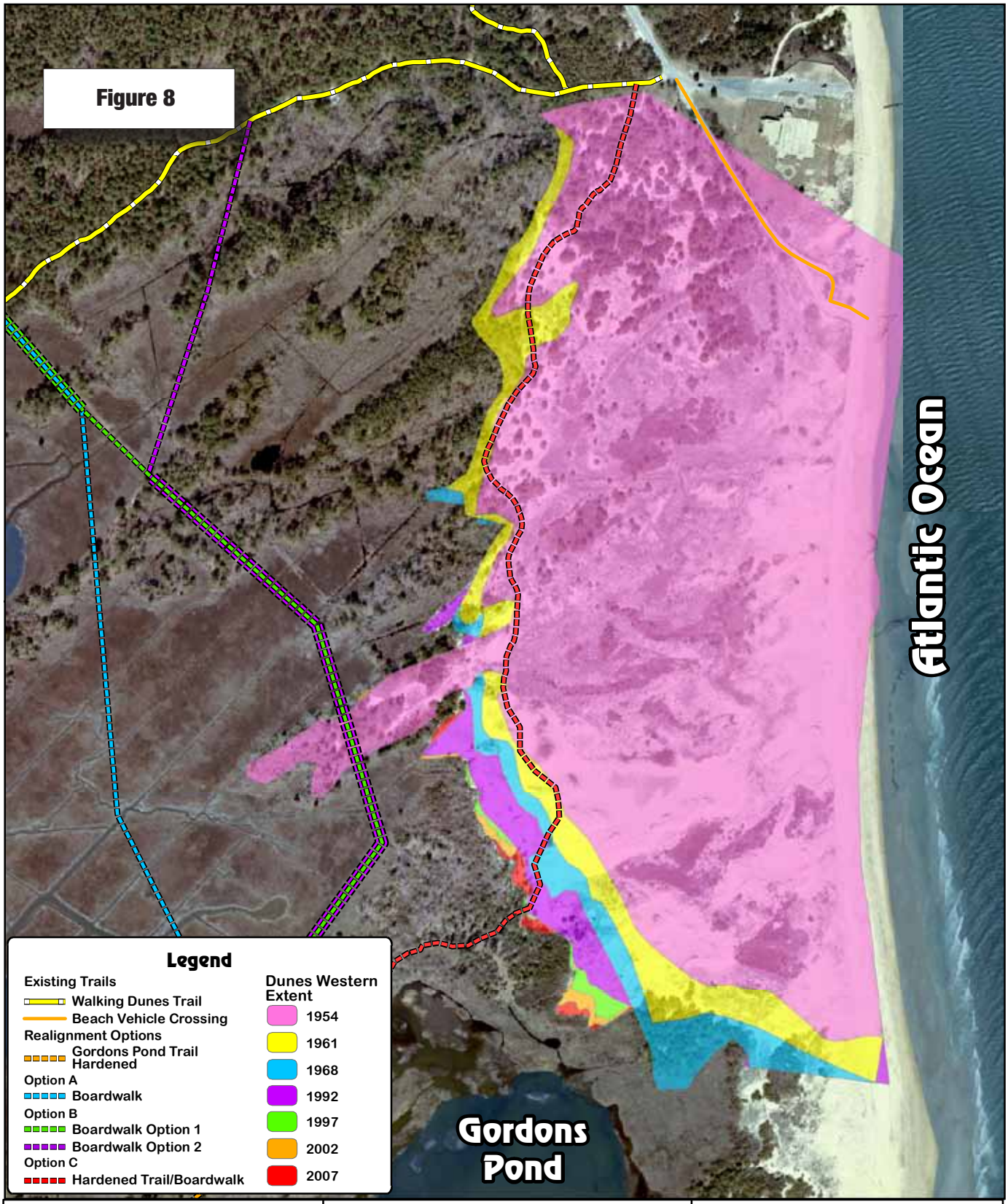
Despite the fact that the primitive trail between Herring Point and Gordons Pond is closed from Memorial Day to Labor Day, staff conducting daily monitoring of beach-nesting birds during this period regularly observe hikers and bikers using this trail. Trail users regularly veer off the trail at the higher elevations in the dunes, head toward the ocean, and enter areas closed to protect nesting piping plovers. Once trail users leave the primitive trail, the topography of the dunes naturally funnels them toward the closed nesting area. During the times of year when the park receives the heaviest visitation, fresh footprints and bicycle tracks observed by staff monitoring beach-nesting birds suggest that trespassing into the closed area from the primitive trail occurs about 2-3 times a week.

Dune stability. The southernmost end of the elevated boardwalk over the dunes would be located in a relatively dynamic area *(Figure 8)* where the dune has been actively migrating westward. An engineering study of this segment should be required, with a goal of maintaining the natural profile of the dune as closely as possible. Due to the dynamic nature of this area, this section of the trail will need to be revisited on a regular basis and modifications may need to be made to either the location or the type of materials being used to mark the trail.

Cultural sites. The existing trail over the dune field currently brings visitors within 300 feet of the Cape Henlopen Salt Works (7S-D-22) and prehistoric site 7S-D-9. These sites are not easily visible from the current trail, and the raised boardwalk will encourage people to stay on the trail.

Visual impact. Visual impacts may affect archeological sites in the District in an aesthetic manner by introduction of a fixed, linear structure that is not compatible to a dynamic and changing environment. Construction materials and design and efforts to minimize the size, scale and proportion of the walk will minimize visual impacts and physical disturbance to the landscape. The group suggests a line-of-sight analysis that would attempt to minimize the view of the boardwalk from the beach, as well as construction materials that blend in with the surrounding dunes. A boardwalk and hardened trail through the dunes would make the current (and rather unsightly) PVC piping that marks the trail unnecessary. Increasing the length of the boardwalk by 500 feet would provide better protection to these sites and carry visitors beyond the limits of the archeological district.

Sea-level rise. Sea-level rise issues would still exist along the Gordons Pond section of this trail.



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Gordons Pond
Proposed Trail Realignment
Dune Migration 1954 - 2007

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OPTION D would involve no new major construction, but should include improvements in signage and enforcement along the existing primitive trail. The group agrees that this area is unique along the Atlantic coast. An improved and promoted trail designed to attract thousands of people to this area would pose a threat to its wetlands, rare species and cultural sites.

Option D:

No new major construction, just improved signage and enforcement along the existing primitive trail.

If the primitive trail were improved and use of the trail were to increase, it can be expected that trespass into the closed area would also increase unless more effective preventive measures were taken to inform, educate and warn trail users (e.g., risk of violating the Federal Endangered Species Act) considering entry into closed areas. Preventive measures could include:

- Increasing enforcement presence along the trail;
- Installing and maintaining fencing that would deter trespass (e.g., snow fencing or other barrier that is difficult to cross);
- Posting signs at trail heads warning users of difficult conditions (i.e., extreme heat, sun exposure, soft sand (if applicable), ticks, chiggers, mosquitoes, deer flies, poison ivy, snakes, etc.;
- Posting signs designating the area beyond the trail as closed, and warning risk of violating federal and state laws; and
- Installing educational signs along the trail.

Without taking these and additional preventive measures, threats to the primary dune, cultural sites, habitats and the plant and animal species described in Option C could increase.

Sea level rise. The same concerns exist with respect to future inundation of the crushed stone segment of the Gordons Pond trail.

Also, see **Section 5** (page 28) for an in-depth discussion of management issues in the area that apply whether or not new infrastructure is constructed and/or the existing trail improved.

This option would prevent the trail from being more widely used by bicycles and from complying with the Americans for Disabilities Act.

Options at a glance

	Option A	Option B	Option C	Option D
Plant Species of Conservation Concern	Minimal impact.	Multiple state-rare plants (including orchids) in uplands and non-tidal wetlands are at direct risk from alignment footprint and at risk if trail users leave alignment and / or if prescribed fire is hindered.	State-rare plants at base of dune trail (southern end) are at direct risk from trail footprint and if prescribed fire is hindered. Federally listed and globally rare plants present on beach/dune overwash and state-rare plants (including orchids) in dune wetlands are at risk if trail users leave alignment.	Same as Option C, but risk of trail users leaving alignment is greater without trail infrastructure and physical barriers.
Animal Species of Conservation Concern	Bald Eagle nest not currently at risk unless trail users leave alignment and wander onto sand spit; USFWS may need to be consulted to ensure compliance with BGEPA.		Not an issue.	Not an issue.
	Osprey nesting platform at risk from disturbance along existing Gordons Pond section of trail.			
	Several marsh-dependent bird species of state and regional concern at risk from alignment footprint, fragmentation of core habitat, and disturbance impacts.	Less risk to marsh-dependent birds with fragmentation and disturbance effects closer to edge of habitat.	Federally threatened Piping Plover and state-rare bird nesting area on beach / dune overwash, state-rare bird nesting area in shrub-scrub dunes, state-rare tiger beetle in dunes, and globally rare firefly in dune wetlands are at risk if trail users leave alignment. Coordination with USFWS required to review compliance with USESA.	Same as Option C, but risk of trail users leaving alignment is greater without trail infrastructure and physical barriers.
Sea level rise	Existing Gordons Pond trail section already floods at mean higher high water (MHHW); at 0.5-meter sea level rise, at-grade trail would be impassable under all options.			
Dune stability	Not an issue.	Not an issue.	Southern end of proposed boardwalk in dynamic area (See Figure 8); construction and maintenance could be challenging and cost estimates may need revision.	Without infrastructure, shifting sand less of a problem for trail maintenance, but alignement may have to be adjusted and re-marked to avoid steep dune slopes.
Cultural resources	Consultation with State Historic Preservation Office required for all alignments			
	Minimal impact to sand spits within archeological district. Likely finding of "No Adverse Effect."	Native American prehistoric site with ceramic associations and cultural shell middens is within footprint of alignment and at direct risk; oldest of sites is exposed over a wide surface area within the alignment. High risk of site loss if trail users leave alignment. Like finding of "Adverse Effect" and mitigation may be required.	Cape Henlopen Salt Works and a prehistoric site among dunes are at risk if trail users leave alignment. Likely finding of "No Adverse Effect" only with appropriate measures.	Same as Option C, but risk of trail users leaving alignment is greater without trail infrastructure and physical barriers. Likely finding of "No Adverse Effect" with appropriate measures.
Visual impact (subset of cultural resources)	Evaluate visibility of trail barriers/railings through open marsh	Introduces linear divide through an upland habitat of high cultural and natural conservation quality.	Trail infrastructure may affect archeological sites in District by introducing a fixed linear structuure in dynamic environment. Line-of-sight analysis needed to determine if impacts can be avoided or minimized.	Existing PVC currently used to mark existing primitive trail should be replaced with more trail markers that are more visually compatible with dune environment.
State tidal wetlands law	No precedent for permitting a boardwalk of this length; law requires that access to water must be central purpose of the activity and there is no non-wetland alternative.		Wetlands permit would be required for boardwalks totaling 628 feet. An updated wetlands delineation should be done for this alignment. Some wetland impacts could be avoided by going west of current alignment into upland areas.	Wetlands impacts will have to be addressed between base of dune and northern end of dike portion of trail if current trail is improved. There are low wet areas that have to be bridged. Footbridges wider than 3 feet require a Wetlands permit
US Army Corps of Engineers	The Corps of Engineers may require a permit for the boardwalk over wetlands. Final determination of the need for a Corps permit will require consultation with the Corps. Because federal funding is likely to be used to finance this project, Section 106 National Historic Preservation Act, Coastal Zone Management Federal Consistency, and Endangered Species Act (Section 7) reviews would be required similar to the requirements mandated by the Corps' permitting program.			
Visitor management	All options will bring more people to the area than the number currently using the area, which will require careful consideration of measures to minimize, to the greatest extent possible, trail users leaving the aligment. Addressing this problem will increase costs to protect natural and cultural sites in remote areas of the Park.			

3 - Wetlands law and regulations

DNREC's Wetlands and Subaqueous Lands Section was asked to comment on the proposed realignment of the of the Gordons Pond Trail. The project (Options A and B) proposes constructing between 2,700 and 3,400 feet of boardwalk, at a width of 8 feet, across mostly State-regulated tidal wetlands in Cape Henlopen State Park. Option C would require crossing 628 feet.

Under 7 Del. C. §6604 a permit is required for any activity in wetlands (an activity is defined, in part as "construction of any kind") and consequently, the boardwalk will need to comply with the Department's rules and regulations regarding construction in State-regulated wetlands. The following provides the Department's regulatory requirements, programmatic concerns, environmental issues and an evaluation of the relative size and scope of the proposed boardwalk to other projects in State regulated wetlands.

Regulatory requirements

Of foremost concern regarding this project is that it needs to have a water dependent purpose. Section 7.1.4 of the Wetlands Regulations states that:

"No permit will be issued to utilize wetlands for any activity unless it:

- Requires water access or water for the central purpose of the activity; and
- Has no alternative on adjoining non-wetland property of the owner."

This project is a trail realignment of a decades old trail used for hiking and providing pedestrian passage through Cape Henlopen Park. Historically the trail has not required water access or water for its central purpose. Moreover, the stated purpose of the trail realignment and enhancements "would be to permit year-round use for pedestrians and cyclists" as stated in the Cost Estimates and Specifications document prepared by Delaware State Parks/Parks Resource Office. Consequently, based on the historical and proposed purpose for the trail the proposed boardwalk over wetlands does not meet above stated criteria in Section 7.1.4 of the Wetlands Regulations and is not eligible for a State Wetlands Permit.

It should also be noted that in the Wetlands statute preamble it states:

"... the ***preservation*** of the coastal wetlands is crucial to the protection of the natural environment of these coastal areas. Therefore, it is declared to be in the ***public policy*** of the State to ***preserve*** and protect the productive ***public*** and private ***wetlands*** and to prevent their despoliation and destruction ..."

The Wetlands law and regulations state that the *preservation* (not conservation) of Delaware's coastal wetlands is the *public policy* of the State. They furthermore, require a water dependent project purpose, and they enforce a presumption that if a project can be placed on adjoining non-wetland areas owned by the applicant, the wetlands *must* be avoided.

Since the proposed boardwalk does not have a water dependent purpose and there are non-wetland alternatives (e.g. no action or improve the existing trail) on the property, it is difficult to see how the design of this project, incorporating the boardwalk, can comply with the Delaware

Wetlands Law or can receive a permit under the Wetlands Regulations.

Some mention has been made of the "foot bridge exemption" allowed by the Wetlands statute. A foot bridge is defined in the Wetlands Regulations as "a structure, no wider than three (3) feet that does not project into open water and is not a dock." No foot bridge has ever been constructed under this exemption greater than 3 feet wide. In addition, the purpose of the exemption has been to allow small, simple structures, primarily for access by hunters to hunting blinds where wetlands must be crossed, and in no way contemplated structures as large and significant as the one proposed.

An existing footbridge along the current trail

Programmatic concerns

To be effective, laws and regulations require the consent of the governed. Delaware's forty year old Wetlands Law has a long history of agency interpretation and implementation that underlie its success in protecting wetlands. Those interpretations have been tested in court and before Delaware's Environmental Appeals Board (EAB) throughout the years and have created a degree of expectation and certainty within the regulated community about what is allowable. It should be noted that the EAB has consistently supported our decisions to deny permits to construct walkways across State regulated wetlands. Furthermore, the Department's concern about the adverse effects of wetland walkways has increased over the years which have led to a significant reduction in the permitting of these structures. The kinds of structures permitted in the 1970s and 1980s are likely no longer acceptable in light of these concerns.

The construction of this project by Delaware's environmental agency will jeopardize the credibility and viability of this critically important and long-standing wetland protection program.

Environmental issues

Two of the five boardwalk design options include some of the innovative design features currently required on shorter boardwalks permitted by the WSLS. These features are designed to minimize the shading impacts on wetland vegetation and we commend their inclusion as a consideration of the proposed design. However, shading is not the only impact of concern. The WSLS would also be concerned about the following impacts:

- Habitat fragmentation
- Disturbance to marsh nesting birds (particularly obligate marsh nesters which have been shown to be vulnerable from these types of structures by our own agency)
- Impacts to rare plant and animal species
- Enhanced access to isolated marsh areas for predators
- Increased human activity in the marsh
- Noise, trash, and nuisance impacts
- Potential cumulative impacts resulting from the changed expectations of the regulated community once such a large structure is constructed in the marsh
- Effects sea level rise on the viability of the trail and boardwalk

- Temporary construction impacts

Relative size and scope of project

The proposed project (Option A or B) is the largest boardwalk project in State-regulated wetlands ever proposed. The proposed boardwalk design would cross 2,635 linear of State-regulated wetlands. At the proposed eight foot width that would impact 21,080 square feet (.48 acres) of wetlands. At an alternative minimum 5-foot width it would impact 13,175 square feet (.3 acres) of wetlands. The following details are presented to show how the boardwalk compares to other wetland projects permitted by the Wetlands and Subaqueous Lands Section.

The project is four times longer than the longest public or private boardwalk ever permitted by the Department -- the St. Jones Reserve public project constructed 18 years ago in 1992.

No wetland walkways, public or private, longer than 233 linear feet have been permitted since the year 2000 (Natter Greenway – Town of Bethany public project – 2003). It should also be noted that over the last 5 years the maximum length of a permitted wetland walkway has not exceeded 160 linear feet. This reflects the Department's growing concern over the past decade about the adverse impacts of boardwalks constructed in wetlands. Construction of this project would reverse the long standing trend toward minimizing the size and number of such structures in wetlands.

The project, proposed at the 8-foot width, has a greater area of impact in State wetlands than all the boardwalks/walkways (including public, community and private structures) permitted Statewide in the last 12 years combined. Even if the project were designed at the 5-foot width it would still impact an area of wetlands comparable to all of the projects permitted over the last 7-8 years. To illustrate, the annual square footage of wetlands impacted is presented as follows:

2010:	0 ft^2 (through 6/1/2010)	
2009:	249 ft^2	
2008:	1527 ft^2	
2007:	3214 ft^2	
2006:	1965 ft^2	
2005:	1701 ft^2	
2004:	2211 ft^2	
2003;	2707 ft^2 (subtotal 13,574 ft^2)	
2002:	1044 ft^2	
2001:	1049 ft^2	
2000:	1503 ft^2	
1999:	2310 ft^2	
Total:	**19480 ft^2**	Proposed boardwalk @ 8-foot width: 21,080 ft^2 (=.48 acre)

For reasons stated above, this project, as proposed in Options A and B, will not meet the Department's regulatory criteria for a wetlands permit.

4 - Cultural resources

The Cape Henlopen Archaeological District *(Figure 9)* consists of several east-west trending sand spits which have been stabilized by Native American shell middens and the resulting vegetative cover. At least six micro-band base camps were occupied on each of these vegetated sand spits with ceramic associations that date from 500 BC to 1600 AD. Ground penetrating radar studies by Bill Chadwick indicate that all of the spits and hummocks in Lewes Creek Marsh are likely to be stabilized by cultural deposits of shell midden. Site 7S-D-9 is the most easterly and the oldest of these sites and it is located in the middle of Option B in the project area. Previous testing indicates the presence of significant cultural features and alternating layers of shell and sand deposits up to 12 feet below surface in this location.

The proposed boardwalk from Gordons Pond to the Walking Dunes Trail has the potential to affect several sites within the Cape Henlopen Archaeological District which is listed on the National Register of Historic Places. Archaeological consideration of the alternatives will allow us the opportunity, in consultation with the State Historic Preservation Office, to identify alternatives that will have the least effect on sand spits that will be crossed by the boardwalk.

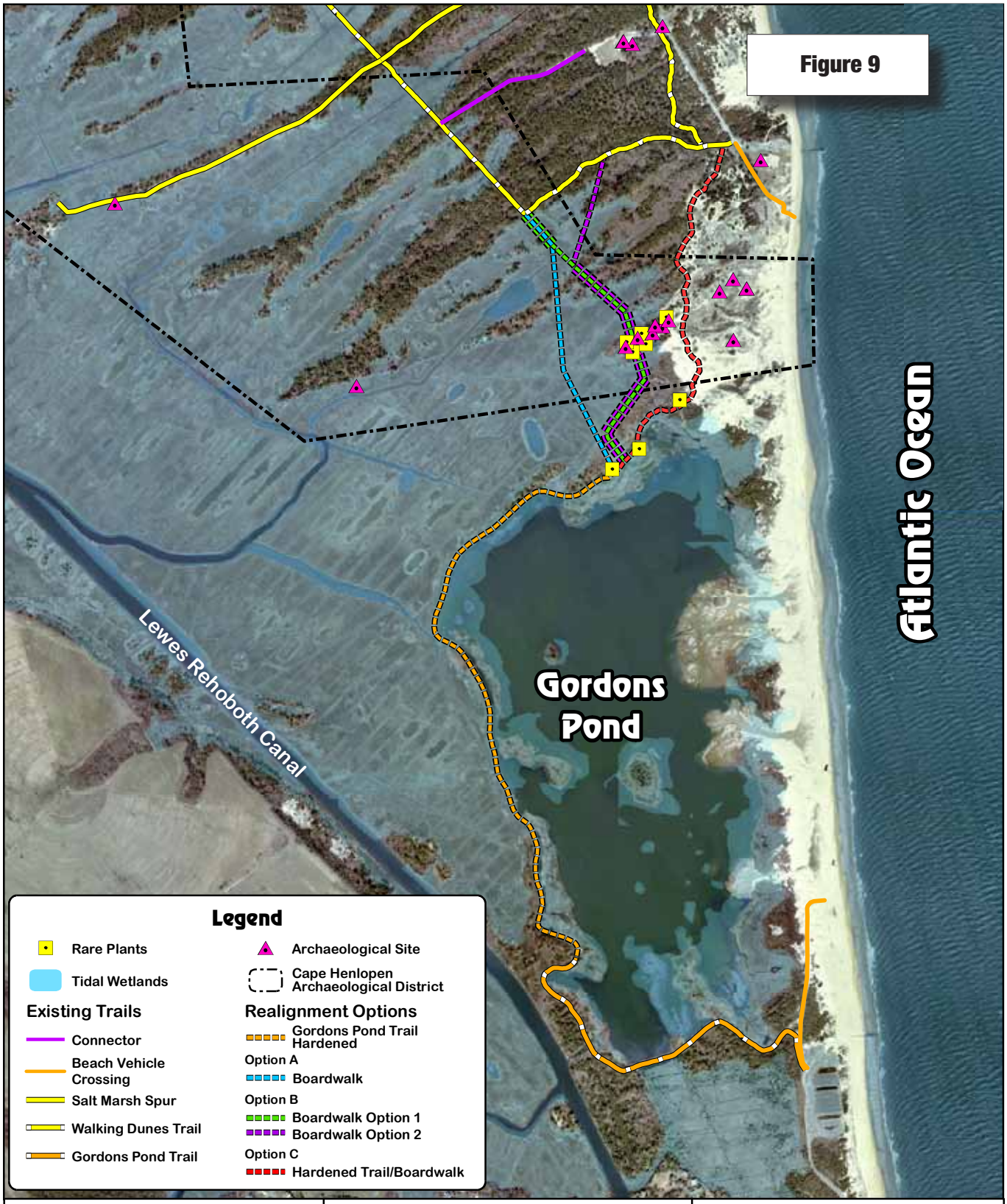
These effects will include the direct effect of increased foot traffic to the sand spits as well as the construction of a raised boardwalk across two of the sand spits. If the effect is not adverse, and the State Historic Preservation Office concurs, then the project may proceed. If the effect is found to be adverse, the findings are reviewed by the Advisory Council on Historic Preservation for review and approval. A memorandum of agreement is prepared which will outline steps which must be taken to mitigate this effect. This could add additional time and financial constraints to the selected route.

An initial assessment of the proposed Boardwalk alignment and the two alternatives provides the following cultural perspective. In the past, we have expressed concern about bringing people onto the dune or sand spits where archaeological sites are located (Four Seashores CRM Plan 1985). We feel that our concerns will be adequately met if Option B is voided and the following conditions are obtained:

- Vegetation within the construction zone must be cut at or above ground level.
- Soil removal or disturbance must be minimal. If ground disturbance is anticipated, archaeological monitoring will be required in accordance with cultural heritage program recommendations
- Any areas where shell is exposed at the surface that are visible from the boardwalk must be planted with appropriate vegetation.
- The boardwalk must have railings on both sides where it crosses both spits or open dune.
- There must be signage which informs visitors that they must stay on the boardwalk.

Alternatives consideration

Option A provides the maximum buffer to Site 7S-D-9. This route crosses at a low point along the sand spit north of 7S-D-9. This crossing will have minimal construction impacts and it is likely to result in a finding of No Adverse Effect.



Department of Natural Resources and Environmental Control
October 2010

Gordons Pond Proposed Trail Realignment

Wetlands, Rare Plants, and Cultural Sites

NORTH

0 1,000 2,000
Feet

Option B will place the route in the direct vicinity of the Site 7S-D-9. Though helical anchors will result in very limited displacement of cultural deposits, the direct impact of bringing visitors to this upland clearing north of Gordons Pond is certain to attract a high degree of foot traffic to the site. Given the difficulty of protecting sites in isolated areas, especially where artifacts are lying on the surface in full view, this alternative could result in a finding of Adverse Effect and require mitigation.

> **A variation of the purple route or the green route (part of Option B):** Considered as an addition to either route, this alternative may cross a small hummock before intersecting the Walking Dune Trail. Maintaining vegetation at this location may discourage visitors from opting off the trail and damaging cultural resources.

Option C. The existing trail over the dune field currently brings visitors within 300 feet of the Cape Henlopen Salt Works (7S-D-22) and prehistoric site 7S-D-9. These sites are not easily visible from the current trail and the raised boardwalk will encourage people to stay on the trail. We also need to assess the visual and archeological effects of construction on the Cape Henlopen Archaeological District. Visual effects may affect sites in the District in an aesthetic manner by introduction of a fixed, linear structure that is not compatible to a dynamic and changing environment. Efforts to minimize the size, scale and proportion of the walk will minimize visual impacts and physical disturbance to the landscape.

This option is likely to provide an alternative having No Adverse Effect **only** with appropriate measures to protect the dune field (fore and back) from pedestrian access. Activities that intensify sand movement and dune migration may result in negative impacts to sites located in the fore and back side of the dune.

Option D (No-infrastructure alternative) . The existing trail minimizes pedestrian use by its degree of difficulty. Appropriate signage is needed to encourage people to stay on the trail and improve site protection. Minimal effect.

5 - Management issues

The Gordons Pond area of Cape Henlopen State Park has a complex array of management issues that should be considered when evaluating the feasibility of proposed trail alignments. Several of these management issues are ongoing, but may be more complicated by adding trail infrastructure and bringing more trail users into the area. Other management issues have yet to be fully implemented due to lack of funding and personnel; these management issues should receive full commitment and a management plan should be initiated prior to adding trail infrastructure to the area. This will help ensure natural and cultural resource protection remains a high priority balanced with recreational use of the area. The cost of bringing major habitat threats under control (e.g., invasive species, fire suppression, over-abundant wildlife) is expected to be far less than the cost of new trail construction. Regular and consistent management of these issues will cost even less. Regardless of whether a trail alignment through the Gordons Pond area is improved, continued management of these issues is essential to maintaining the ecological functions and historical significance of the area.

Current management actions

Cultural heritage resource protection. The protection of cultural resources has been accomplished via documentation, National Historic District designation and mostly simple isolation rather than active management. Though construction of any trail has the potential to cause direct disturbance to these sites, there is also concern that the area will no longer be isolated from the park visitors. Inviting a higher volume of trail users to the area increases the risk to cultural resources from accidental and intentional disturbance. A linear design with structural and vegetation barriers could limit the need or desire of trail users to wander off the trail and go exploring. Drawing any additional attention to specific cultural resource locations should be avoided to protect these areas from curious visitors and artifact collectors. See also **Section 4.**

Issues such as wildlife management, invasive species control, mosquito control, and fire management should be major considerations with a new trail alignment and infrastructure.

Natural resource protection and management. Protection of natural resources in the Gordons Pond area is driven by a variety of ecological, legal and social influences and at least two cooperative agreements. Ultimately, the goal of natural resource protection is to provide conditions under which the diverse array of habitats and many rare species found in the area can persist and adapt to the dynamic environment. Endangered and other protected species mandate some management actions, whereas public health and tolerance for mosquitoes dictate others.

Threats to rare species and their habitats generally fall into four categories in the Gordons Pond area: disturbance, invasive species, over-abundant wildlife and fire suppression. The latter is not yet implemented, but may be one of the most effective for bringing about habitat and species response. The park also seeks to maintain opportunities for hunters to participate in deer man-

agement efforts, and in the tradition of waterfowl hunting. All of these natural resource management activities will have some level of increased complexity should recreational trail use in the Gordons Pond area be improved and increased.

- **Gordons Pond Management Agreement.** This agreement between the Divisions of Fish and Wildlife and Parks and Recreation was established to maintain the dike and water levels (via water control structures) in Gordons Pond. Both the dike and water levels are critical for maintaining habitat for a variety of species and for controlling mosquitoes in the pond. The dike itself serves as the existing primitive trail around the pond, and any future trail alignments would also have to include the dike as part of a trail corridor. Prior to finalizing a decision on improvements to the trail alignment, the Divisions should re-visit this agreement to ensure goals for managing the dike and pond are agreed upon, and roles and responsibilities are clear.

  As it stands today, the original outfalls for the pond no longer control water levels, and diesel engines that once pumped water into the pond have long since been removed. Today the pond is gradually filling with sand washed in from the ocean during coastal storms. This natural process will eventually fill the pond creating marsh habitat. The consequences of this habitat shift should be evaluated in terms of which species/species groups will be most affected and the cost-effectiveness of maintaining the area in light of sea level rise. Adaptive management, Structured Decision Making and Rapid Prototype Modeling processes currently being applied to Delaware's bayshore impoundments could be applied to the Gordons Pond area.

- **Mosquito control.** Open marsh water management (OMWM) is a non-chemical technique used to reduce mosquito production by providing tidal killifish with access to isolated marsh ponds where they eat developing mosquito larvae. Using OMWM to facilitate natural predation reduces the need for pesticides sprayed by helicopter. The Mosquito Control Section of the Division of Fish and Wildlife has conducted OMWM activities in Gordons Pond, and currently OMWM is confined to the interior rim of the Pond. However, in highly (human) populated areas OMWM alone may not be enough to satisfy the public's expectation for mosquito control. It is anticipated that increasing the number of people using trails in this area will likely increase pressure to spray the marsh to reduce mosquitoes. This presents two significant concerns: 1) spraying sensitive bird nesting habitats during the nesting season should be avoided, and 2) trails should be closed during spraying periods.

  Regarding the latter, advanced notification and planning trail closures is often not possible because spraying is conducted when weather conditions (e.g., wind speed and direction) will minimize pesticide drift. This often results in last minute 'intent to spray' notifications for management staff and park users. Managing trail closures for mosquito spraying will become more frequent in order to adequately warn trail users and ensure trail closure signs are posted and removed promptly.

- **Piping Plover Recovery Plan.** The Piping Plover *(Charadrius melodus)* is protected as 'Threatened' under the U.S. Endangered Species Act (USESA). As a result, the USFWS will need to be consulted to determine compliance with the USESA if any changes to the existing trail alignment are considered. This review will occur automatically under

Section 7 of the USESA if federal funds are used or federal permits are needed for trail construction; early discussion with the USFWS can help prepare for this review.

To participate in a cooperative effort to help recover this species, the Divisions of Fish and Wildlife, Parks and Recreation, and (formerly) Soil and Water Conservation signed a Piping Plover Recovery Plan with the United States Fish and Wildlife Service in the 1990s. Several other species are known to have benefitted from management efforts to protect plovers, including two other beach-nesting bird species that are declining range-wide, a federally threatened plant, a globally rare plant, and a state-rare tiger beetle.

Parks continues to work closely with the Division of Fish and Wildlife to implement this plan. The most critical management action under this plan is beach closures that prevent human and vehicle disturbance to nesting birds and trampling of eggs and chicks. And yet, human disturbance is still a management problem in the Gordons Pond area because primitive trail users regularly leave the trail alignment through the back dune area and wander (intentionally and accidentally) into the nesting areas. Theoretically, a designated trail with physical barriers should be more effective at keeping visitors on the trail corridor. However, because an improved and promoted trail would bring a higher volume of people into the area, more trail users are likely to wander into areas of both cultural and natural significance. This is a significant management issue that needs to be address regardless of whether or not an improved trail is constructed.

Photo by Tony Pratt

Predator management has also been critical to plover nesting success. Recent unprecedented success of plovers nesting at Cape Henlopen during the past few years is largely because of red fox control efforts, some of which occurs in the Gordons Pond area. Fox are trapped by legal and humane methods and humanely dispatched. Trapping occurs for a few weeks during the December through February period. Though dogs off leash could potentially be caught in the traps, which causes stress to some animals, the traps themselves do not cause physical damage to dogs and traps are checked daily once set. This conflict is probably minor due to the timing of trapping. Though unleashed dogs are not permitted in this area, signs and enforcement will need to be increased regardless of whether or not an improved trail is constructed.

Dense vegetation tends to conceal predators and is avoided by plovers. Vegetation management – especially Phragmites (discussed below) – will be an ongoing management issue for Piping Plovers and other species associated with open, sparsely vegetated beach and dune habitats.

- **Rare plant populations.** Several rare plant populations, including a federally listed species, occur in the Gordons Pond area. Each is discussed above under the respective proposed trail options where they occur. As with cultural resources, isolation from people has been critical to protecting rare plants. Efforts to close habitat for plovers have also benefited rare plants that need protection from trampling. Other rare plant populations associated with swale wetlands found in the dunes (e.g., orchids, which are subject to illegal collection) are managed by removing encroaching woody vegetation (shrubs and trees) and monitoring invasive species.

Some rare plants in this area would benefit from prescribed fire; however, adding trail

infrastructure would complicate if not eliminate use of fire as a management tool in some areas. Other rare plants are at risk from deer browe; deer management (discussed below) is a critical to ensuring the persistence of rare plants.

- **Bald Eagle nest protection.** A recent addition to the park is a nesting pair of Bald Eagles that are located on a nearby spit, high in a pine tree. Although no longer listed under the federal Endangered Species Act, eagles are protected from take, disturbance and other factors under the U.S. Bald and Golden Eagle Protection Act (BGEPA) and a state statute that prohibits eagle nest disturbance (CITE STATUE). Although the nest location is currently far enough away from any proposed trail corridor, this pair may build alternate nests particularly if the current nest is damaged or disturbed.

  There will be some level of disturbance to this nesting pair if the trail is built near foraging and perching / roosting areas. These eagles are monitored annually to determine nest success and to determine if additional nest structures are being constructed. This information should be updated and consulted regularly as decisions regarding proposed trail alignments are considered; the USFWS may need to be consulted to determine compliance with BGEPA.

- **Osprey nesting platforms.** Only one osprey nest platform currently exists directly adjacent to the existing trail along the dike. This trail is normally closed to the public during Osprey nesting season; however, if this trail will be open year-round and construction work is needed (e.g., laying crushed stone), the nest should be moved at least 100 m from the trail (farther is preferable) after the young have fledged and prior to trail construction.

- **Invasive species control.** Common reed *(Phragmites australis)* and Japanese black pine *(Pinus thunbergiana)*, described below, are the two most urgent and critical invasive species threats in the Gordons Pond area. Other invasive species are present in the area and along proposed trail corridors, but most are not currently abundant and can be easily controlled. However, opening any new trail corridors through habitat increases the possibility that existing or new invasive species will establish and become more widespread. Pre and post trail construction monitoring and removal of invasive species must be considered an obligate maintenance action to protect habitat and species of conservation concern.

  Common Reed *(Phragmites australis).* For a decade, nearly annual aerial spraying (in the fall) from helicopters was used to control Phragmites in the vicinity of Gordons Pond. These efforts have been interrupted in recent years due to the lack of funding. Parks has conducted some local ground treatments of Phragmites, particularly along foraging areas used by Piping Plovers and their chicks on the east side of the pond. Re-establishing regular and more widespread Phragmites control in the Gordons Pond area is critical for habitat management, regardless of whether or not a new trail is constructed. In addition to the direct threat to habitat, Phragmites will be a major wildfire threat when more people use the area because there will be an increase in possible ignition sources from cigarettes and vandals. Focusing on Phragmites reduction will reduce the wildfire threat and improve habitat throughout the Gordons Pond area.

Japanese Black Pine *(Pinus thunbergiana).* Since the military introduced this tree in the 1940s the Japanese black pine has persisted on the dunes in the park. This pine is not an issue in the pinelands west of the current primitive trail, although it is threat to swale wetlands in the dunes and possibly the cultural resources near the salt works. Work on controlling this pine has been ongoing for four years, primarily in the northern areas of the park. Japanese black pine management is a non-issue regarding proposed trail alignments because most pines affected would be native species (loblolly, pitch and Virginia pine).

- **Deer management.** White-tailed deer *(Odocoileus virginianus)* browse on local herbs, shrubs and saplings (including rare plants) exerting tremendous pressure on vegetation communities and changing habitat structure and species composition. At Cape Henlopen, deer are being sustained by the agricultural lands west of the Lewes-Rehoboth Canal, which deer cross regularly. Removing a significant number of deer each year is absolutely necessary to retain any ecological balance in these habitats. A final deer management plan has not been developed for the park, but it is clear that an active trail through this area will make the accomplishment of this goal more difficult. Closing trails periodically for intense hunting must be considered in order to effectively manage deer herds in and around the park.

  Though the use of 100-yard safety (or buffer) zones along the Junction Breakwater Trail has worked to segregate park users (i.e., hunters assisting with deer management and recreational trail users), it is not working to support effective herd management. Closing areas of the park for hunting is controversial to some park visitors who view closures for deer hunting as a special privilege for a select user group, rather than as a critical management tool necessary to maintain habitat. It will be critical to address the need for trail closures and educate all users prior to opening any new trail alignment so that public expectations are clear.

- **Waterfowl hunting.** This is a minor element of hunting in the park and is an artifact of the 'traditional waterfowl hunting' that was once characteristic of these marshes. Opportunities to hunt waterfowl are becoming more and more scarce, and although Parks does not view waterfowl hunting as an imperative management objective for the park, it has been retained due to the historic use of Gordons Pond and at the request of the Division of Fish and Wildlife. Accommodations for a trail could be easily accomplished by closing the trail corridor to waterfowl hunting activity.

Future management actions

Fire management. An absolutely vital component to the management of the Cape is the return of fire to the park - once a stochastic event here that maintained the unique pitch pine and dune woodland communities. Many of the rare plants associated with these communities are fire dependent. Pines needle duff is thick throughout the park and a dense vine and shrub understory has smothered and shaded out some species that are now rare. Pine needle duff that has built up over decades is a wildfire waiting to happen.

Rather than letting nature take its course in a catastrophic wildfire event, Parks is developing

a burn plan for the park, including the Gordons Pond trail area. It is likely that a combination of deer management and reintroduction of fire will also reduce the park's high tick and chigger population as well. If boardwalk sections are included in an existing or new trail alignment, fire management will be more complicated to avoid damaging trail infrastructure (e.g., additional fire breaks might be needed which would require vegetation removal adjacent to boardwalk sections). Additional fire breaks or other prep work might also be necessary to protect nearby structures from fire damage. Regardless of whether boardwalk sections or other infrastructure needs to be protected, fire management will pose a serious challenge to managing park visitors and trail users during the implementation of a burn. Trails will have to be closed during active fires, whether wild or prescribed, and sufficient notice will have to be posted locally to ensure the community at-large is aware of prescribed burns.

Traversing the dune during the September field visit. PVC piping is visible on the sand at left.

6 - Cost estimates

Trail Use and Sustainability Assessment (from the CHSP Trail Plan)

Trail sustainability is paramount in protecting the natural and cultural resources, managing the costs of development and maintenance projects, and providing trail facilities that meet public need. A dynamic approach to trail management is critical in maintaining or improving the health of our protected landscapes and the trails that flow across them. Trail sustainability is linked directly to trail use designations, experiences sought, trail design, location, conditions, and interactions between visitors. Trail sustainability covers three main areas: environmental, social, and economic.

Environmental Sustainability - Any trail alignment that supports current and future use with minimal impact to the natural resources; does not adversely affect the plant and animal life; recognizes that pruning or removal of certain plant species may be necessary for proper maintenance; produces negligible soil loss or movement.

Social Sustainability - Any trail alignment that supports current and future use as it pertains to the public's acceptance and use of that trail. Considerations include recreational opportunities, community connections, and regional land use plans.

Economic Sustainability - Any trail alignment that supports current and future use as it relates to the cost/benefit of that trail to the public. Considerations include the health benefits for users (residents and visitors) and the use of the Cape Henlopen State Park trail system as a means for alternative transportation.

Although one might want to view sustainability as a static set of guidelines, it is quite the opposite. Site and trail characteristics and visitor base play an important role in determining whether a trail is sustainable. Visitor base, terrain, park location, available facilities are a few characteristics that might influence who and how a particular park or trail is used. A park superintendant may hear few complaints about a trail system that gets little visitation, but on the other hand may get a lot of negative feedback about a popular trail. User designation and trail type may be the same, but the terrain and location may play the deciding role on whether or not a park or trail experiences a much higher volume of use. Understanding these variables and using them to better plan will help increase the sustainability of any trail.

Potential realignments and enhancements. *Phase 1* of the project would include hardening, with crushed stone and fines the existing 8-foot wide Gordons Pond Trail from the wildlife observation platform north for a length of approximately 6,300 to 6,746 feet depending on the option. North of the proposed hardened trail section, potential trail realignments - *phase 2* of the project- could run on or to the west of the existing alignment. *Phase 2* construction options (see map for trail alignment alternatives) may include an elevated structure set on helical anchor pilings with fiberglass, CCA pressure treated lumber, or Ecoboard framing material, and Thruflow decking. *Phase 2* may include a combination of elevated structure and stone trail (see **Cost Estimates** box at right). The potential trail realignments and enhancements would adhere to current Delaware State Park trail construction standards.

Construction materials and cost estimates

Option	Segment	Length (feet)	Square feet	Cost/sq. ft.	Cost
A	1 Stone	6,300	50,400	$2	$100,800
A	2a Wood	2,678	21,424	$90	$1,928,160
A	2b Fiberglass	2,678	21,424	$100	$2,142,400
B	1 Stone	6,427	51,416	$2	$102,843
B1	2a Wood	2,956	23,648	$90	$2,128,320
B1	2b Fiberglass	2,956	23,648	$100	$2,366,480
B2	2a Wood	3,373	26,984	$90	$2,428,560
B2	2b Fiberglass	3,373	26,984	$100	$2,609,840
C	1 Stone	6,746	53,968	$2	$107,963
C	1a Wood	628	5,024	$90	$452,160
C	1b Fiberglass	628	5,024	$100	$502,400
C	2 Stone	1,712	13,696	$2	$27,392
C	*2a Wood	1,023	8,184	$100	$818,400
C	*2b Fiberglass	1,023	8,184	$110	$900,240

All per-foot costs assume an average anchor depth of 14 feet for boardwalks and an average width of all trails to be 8 feet. In-depth soil, wetland, natural and cultural resource analysis would be required along any chosen alignment before construction and could alter costs.

** Indicates raised boardwalk structure with a railing system.*

To determine total projected cost, add the phases together for each option. For example, for Option C, Phase One would include 6,746 feet of crushed stone around the pond ($107,963), plus 628 feet of wetland crossing (either wood or Fiberglass), plus 1,023 feet of elevated boardwalk (either wood or Fiberglass), plus 1,712 feet of crushed stone north of the elevated boardwalk.

***Option C** is unique in that shifting sands of the dune create a dynamic environment unlike other areas. Thorough examination of aerial photos dating to the 1930s how the dune has moved over time. There is a clear stabilization of about two-thirds of the dune (north section -- see Figure 8), with the southern third moving westward in varying increments. Calculations of costs and construction methods were most difficult in this areas; however, the projected boardwalk and stone segment lengths were determined by using the boundary between what is currently active and stabilized dune area.*

Trail Operation, Maintenance, & Stewardship (also see AmericanTrails.org)

Operations and Maintenance refers to the day-to-day upkeep as well as the smooth and safe functioning of a trail, greenway or trail/greenway system.

Routine Maintenance refers to the day-to-day regimen of litter pick-up, trash and debris removal, weed and dust control; trail sweeping, sign replacement, tree and shrub trimming and other regularly scheduled activities.

Remedial Maintenance refers to correcting significant defects as well as repairing, replacing, or restoring major components that have been destroyed, damaged, or significantly deteriorated during the life of the project.

Stewardship refers to long-term care and oversight of the trail resource. This is essential to assure it will be sustained as a quality component of the community infrastructure and a good neighbor to adjacent properties and surrounding natural environment. Stewardship also includes building community support and advocacy so the integrity of the trail or greenway will not be compromised in the future.

Trail Maintenance Costs: Life cycle projections and routine and remedial maintenance costs should be included in the overall budget for this project.

Boardwalk: The life span of CCA pressure treated lumber exposed to a coastal marine environment is approximately 15-20 years for the framing material and 20-25 years for the marine grade beams. The posts and curbing or handrails will receive more exposure to the elements and could require more frequent repair or replacement. Component replacement may be required within 6-10 years of construction and continue for the life of the structure.

Stone trail: Maintenance costs are approximately $5 / linear foot per year or $32,500 - $38,500. This cost includes vegetation management and mowing trail corridor. Stone trail resurfacing will be required every 7-10 years.

Fiberglass: 30+ years

Project Construction Standards: The following construction materials are more eco-sensitive for coastal marine application: Galvanized steel helical anchors, Fiberglass framing, Thru-Flow decking, and CCA framing materials.

Stone Trail:

1) Stone depth: 6-8 inches
2) Stone material: CR – 6
3) PP15 Geo-textile material
4) Minimum width: 6 feet
5) Maximum width: 8 feet

Elevated Structure:

1) Minimum height: 2.5 feet
2) Maximum height: 3.0 feet with curbing; 3.1 - 8.0 feet with handrails
3) Minimum width: 6 feet
4) Maximum width: 8 feet

Structural Supports:

1) Galvanized steel helical anchor pilings (2 per station)
2) 1 station every 8' or 20' dependent on design

Structural Span Members:

1) CCA pressure treated #2Yellow pine or structural fiberglass (Life span: 15-20 years)
2) Beams - marine grade 2.5 lbs. minimum retention (Life span: 20-25 years)
3) Fiberglass: (Life span 30+ years)

Decking Material:

1) Thruflow® Decking (allows a minimum of 40%-50% more light penetration compared to wood decking)

Samples of modern decking material

Top, the salt marsh adjacent to Gordons Pond. Above, members of the working group survey the steep dropoff of the dune.