

Holts Landing State Park Trail Plan

Department of Natural Resources & Environmental Control Division of Parks & Recreation
Drafted: December 2010



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Holts Landing Trail Plan

Table of Contents

Acknowledgements	4
<u>Trail Plan Objectives</u>.....	4
<u>Regional Context</u>	4
Public Demand for Trail Opportunities.....	7
<u>Existing Trail System Overview & Assessment</u>.....	8
Trail Descriptions and Existing Conditions	
Existing Trails	
Impacts to the Trail System	
Trail Users	
Pedestrians	
Mountain Bikers	
Equestrians	
Special Needs Populations	
Access Points and Signage	
<u>Natural Resource Assessment</u>.....	18
Natural Environment	
Flora	
Invasive Species	
Soils	
Natural Resources and Trail Development	
<u>Cultural Resource Assessment</u>.....	23
Cultural Resources	
Cultural Resources and Trail Development	
<u>Trail Use and Sustainability Assessment</u>.....	24
<u>Trail System Plan</u>.....	27
Trail Changes	
New Trail Segments	
Permitted Trail Uses, Miles & Widths	
Phased Construction	
<u>Trail Signing, & Information, Access Point Improvements</u>.....	34
Signs & Trail Markers	
Access Points	
Nearby Community Connections	
Regional Connections	
<u>Conclusion</u>.....	35

<u>Agreements</u>	36
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Appendices

<u>Appendix A</u> : Trail Planning and Management Fundamentals.....	39
<u>Appendix B</u> : Trail Maintenance Guidelines.....	44
<u>Appendix C</u> : Principles of Sustainable Trail Design & Development.....	45
<u>Appendix D</u> : Statewide Trail System Overview.....	46
<u>Appendix E</u> : Trail Standards.....	47
<u>Appendix F</u> : User Conflicts.....	54
<u>Appendix G</u> : References.....	55

Maps

<u>Map 1</u> : Holts Landing State Park Overview.....	5
<u>Map 2</u> : Existing State Park Trail System Analysis.....	8
<u>Map 3</u> : Existing Trails.....	11
<u>Map 4</u> : Existing Trail Uses.....	12
<u>Map 5</u> : Existing Trail Width.....	13
<u>Map 6</u> : Existing Trail Access.....	15
<u>Map 7</u> : Existing Signage & Information Board.....	16
<u>Map 8</u> : Natural Resources.....	18
<u>Map 9</u> : Natural Resources & Heritage Sites.....	19
<u>Map 10</u> : Soil Drainage Class.....	20
<u>Map 11</u> : Existing & Proposed Trails / Phased Implementation (Option 1).....	28
<u>Map 12</u> : Existing & Proposed Trails / Phased Implementation (Option 2).....	29
<u>Map 13</u> : Existing & Proposed Trails / Phased Implementation (Option 3).....	30

Tables

<u>Table 1</u> : Existing Trail Miles & Uses.....	9
<u>Table 2</u> : Interaction Types and Their Recreational Outcomes.....	24
<u>Table 3</u> : Average Land-Based Recreation Activity Compatibility.....	24
<u>Table 4</u> : Trail Use Compatibility.....	25
<u>Table 5</u> : Existing Total Park Trail Miles for Each User Group.....	30
<u>Table 6</u> : Existing & Planned Trail Uses Miles and Uses.....	30
<u>Table 7</u> : Trail Widths & Planned Uses.....	30
<u>Table 8</u> : Trail Designations and Tread Widths	34

Acknowledgements

The Holts Landing Trail Plan developed with the full involvement of state park staff and members of the Trail Committee. Existing trail conditions and natural and cultural resources were assessed. Using information derived from the assessments, the development of this trail plan identifies new trail alignments and reroutes that achieve social, natural and cultural sustainability. Trail enhancements identified include; improved accessibility, fewer impacts to hydric soils, signage, and information centers. The implementation of this plan will reduce impacts to natural and cultural resources, reduce trail maintenance costs, and reduce staff time performing maintenance.

Staff participating in the development of the Holts Landing Trail Plan includes the following people: David Bartoo, Cherie Clark, Emily Hassel, Thomas Kneavel, Rob Line, Don Long, and Doug Long.

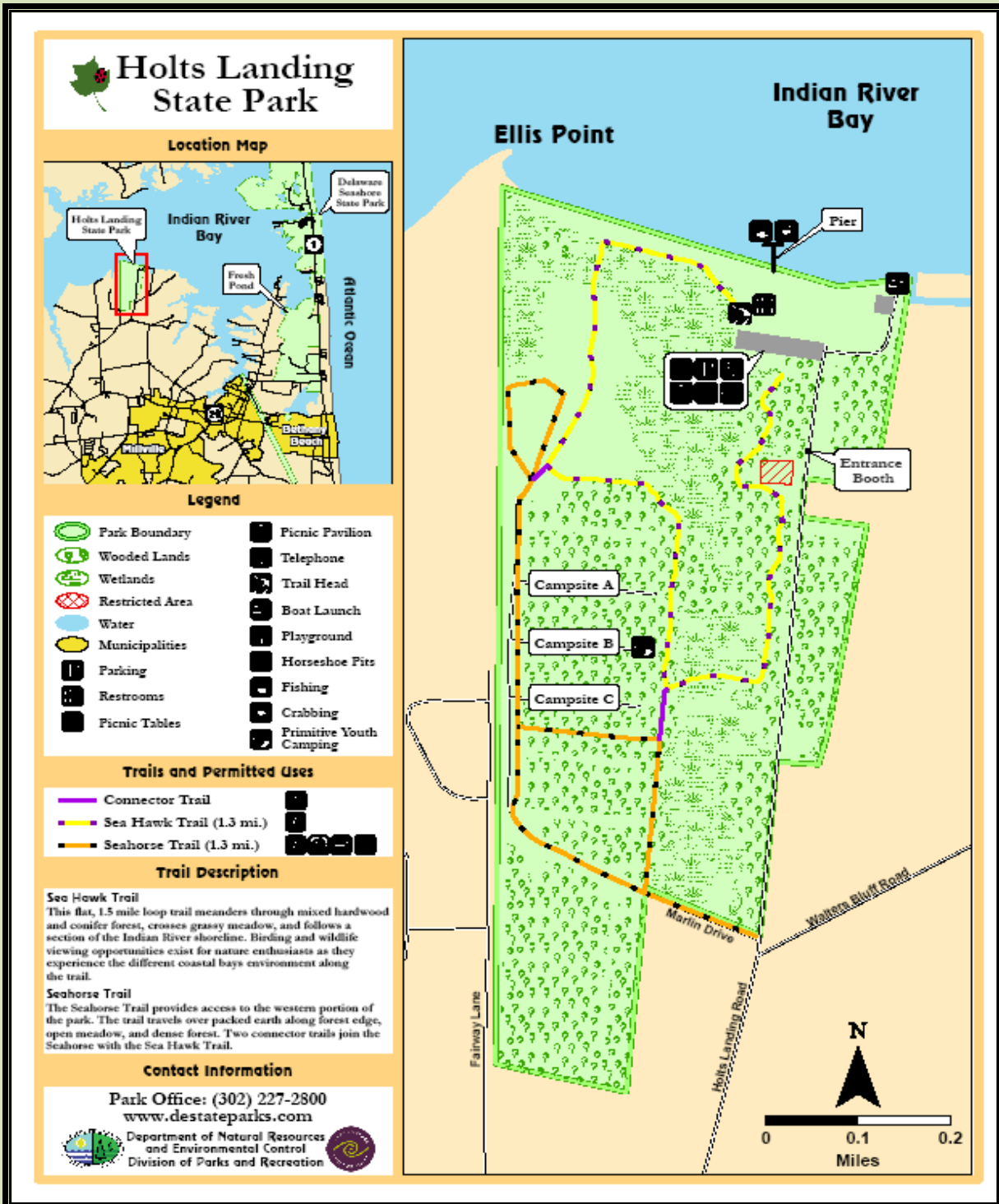
Trail Plan Objectives

This Trail Plan analyzes the existing trail system and natural and cultural resources in the Park. Data and findings gathered for the trail assessment provide the science for recommendations outlined in this plan. In this analysis connections to existing facilities and adverse impacts to environmentally and culturally sensitive areas is deemed critical. Analyses and recommendations are based on the principles of sustainable trail design and development. These principles are outlined in detail in Appendix A. The Plan set out to do the following:

- Determine trail segments that do not meet socially, environmentally and culturally sustainable trail principles.
- Recommend changes to the trail system that meet socially, environmentally and culturally sustainable principles.
- Recommend a system that will sustain and support environmental educational opportunities.
- Recommend a system that supports the existing pedestrian, biking, and equestrian activities.
- Recommend a system that considers existing and future recreational trends.
- Recommend a system that integrates existing and future regional trail opportunities.
- Recommend a system that considers future land acquisitions.
- Recommend a system that reduces costly trail maintenance tasks.
- Recommend trail system enhancements including trail realignments and closures, bridges, trail uses and trail enhancements within accepted sustainable trail standards.
- Recommend trail system that includes a dynamic mix of interesting and challenging experiences.

Background & History

The 203-acres of Holts Landing contain a variety of landscapes, from Bay Shore beach to grassy meadows and hardwood forests. Historically, the shores of the inland bays were home to Native Americans, who harvested seafood and hunted in the surrounding marshes and forests. After the European settlers arrived, agriculture developed slowly in the coastal areas. The property that is now Holts Landing State Park has a long recorded history as a small family farm. The Holt family maintained a farm with a Bay Shore boat landing on this site until 1957, when the property sold to the state highway department. Sand mining activities occurred on site to supply material for the widening of State Route 1. In 1965, the parcel of land transferred to the State Park Commission and created Holts Landing State Park.



Regional Context

Holts Landing is located on the south shore of the Indian River Bay west of White’s Creek and north of the town of Millville in Sussex County, Delaware. This area is on the Delmarva Peninsula and falls within the Atlantic Coastal Plain physiographic region. The Atlantic Coastal Plain lies south of the Piedmont Ecoregion fall line and makes up about 95% of the State. This fall zone

divides the state geologically and ecologically. The modern geomorphology of the coastal plain is characterized by low elevation, gentle topography, sandy soils, meandering streams, and shallow stream valleys. The tidal streams are fed by swamps and tributaries and drain into the Delaware Bay, Atlantic Ocean, Inland Bays, and the Chesapeake Bay. Holts Landing hosts a variety of ecosystems including wooded uplands, non-tidal wetlands, open meadows, and low-lying coastal marshes. The land consists of a knoll of Evesboro sand with a narrow border of coastal and dune sands along the shore of Indian River Bay (Wise 1985). The park and surrounding area has traditionally been rural agricultural in character with more urban concentrations in the coastal towns of Bethany Beach and Rehoboth Beach. The Park lies west of the Route 1 corridor and is accessible from Route 26 to the south. The coastal area, east of Route 113 and including Holts Landing, has experienced dramatic land conversion from agricultural fields to residential units. From 2000 to 2005, the population of Sussex County has grown from 156,638 to 176,548 residents, an increase of 12.7%. This increase and population projections for the next 30 years, place a high demand on Park resources now and in the future.

Public Demand for Trail Opportunities

Trail-related activities are the number one outdoor recreation activities in Delaware to fulfill public needs and trends. These findings were documented in the 2003 - 2008 Statewide Comprehensive Outdoor Recreation Plan (SCORP), a 5-year plan outlining both the demand and need for outdoor recreation facilities. The Plan then projects facilities that will fulfill gaps in outdoor recreation opportunities that meet the public's recreational needs. (See www.destateparks.com/SCORP/SCORP_2-2-04.pdf)

In May and June 2008, the Division of Parks and Recreation conducted a telephone survey of Delaware residents to gather information and trends on outdoor recreation patterns and preferences as well as other information on their landscape perception. These findings will be the foundation of the 2008-2011 update of the Statewide Comprehensive Outdoor Recreation Plan. For purposes of planning and projecting outdoor recreational facility needs, the State was divided into five regions for reporting results taken during public participation phase of the Plan's development. Holts Landing falls in Region 5. Updated SCORP research of 380 Delaware households within Region 5 found that 86% of telephone survey respondents expected a member of their household to participate in walking or jogging; 65% participate in bicycling; 40% in hiking; 9% in mountain biking; and 13% in horseback riding. Based on a comparison of findings (from the previously published 2003-2008 SCORP), the trend for trail-related activities continues to be popular among the recreating public.

Priority outdoor recreation facility needs are projected that best fulfill the public's foreseen activities based on research and findings from the public opinion survey. Because Delaware is home to diverse population centers, landscape types, and varying development patterns, regional variations in outdoor recreation needed are to be expected. A common thread in all regions is the need for linear facilities, such as trails, and paved pathways, that accommodate walkers, joggers, hikers, bicyclists and horse riders. These activities ranked high in every region, as well as among different ethnic groups and age categories, meaning that more linear facilities should be constructed to keep pace with the population growth and the public's participation.

Results of the 2003-2008 statewide facility needs analysis are presented in Tables 5.1 to 5.6 of the SCORP (SCORP, pages 5-2 through 5-7). Table 5.6 - Region 5 Facility Needs - place walking/jogging and biking paths as highest priorities for outdoor recreation facilities. Results from the 2008 public opinion telephone survey indicate walking/jogging and biking paths as well as hiking trails continue to be high priority facility needs for this region. Furthermore, SCORP identifies major issues of outdoor recreation and conservation concern. In response to the 2008

SCORP telephone survey, 75% of respondents living in Region 5 reported that bike and pedestrian facilities should be a very important funding priority.

The SCORP survey queried participants on several aspects of their recreational lifestyles. When asked why they participate in outdoor recreation, telephone survey respondents gave these top four answers: 1) for physical fitness, 2) to be with family and friends, 3) for relaxation, and 4) to be close to nature.

Holts Landing Attendance

An estimated 31,982 park users visited Holts Landing State Park in FY 2009. The total estimated visitation in all Delaware State Parks for FY 2009 was 4,649,252 visitors.

Existing Trail System Overview & Assessment

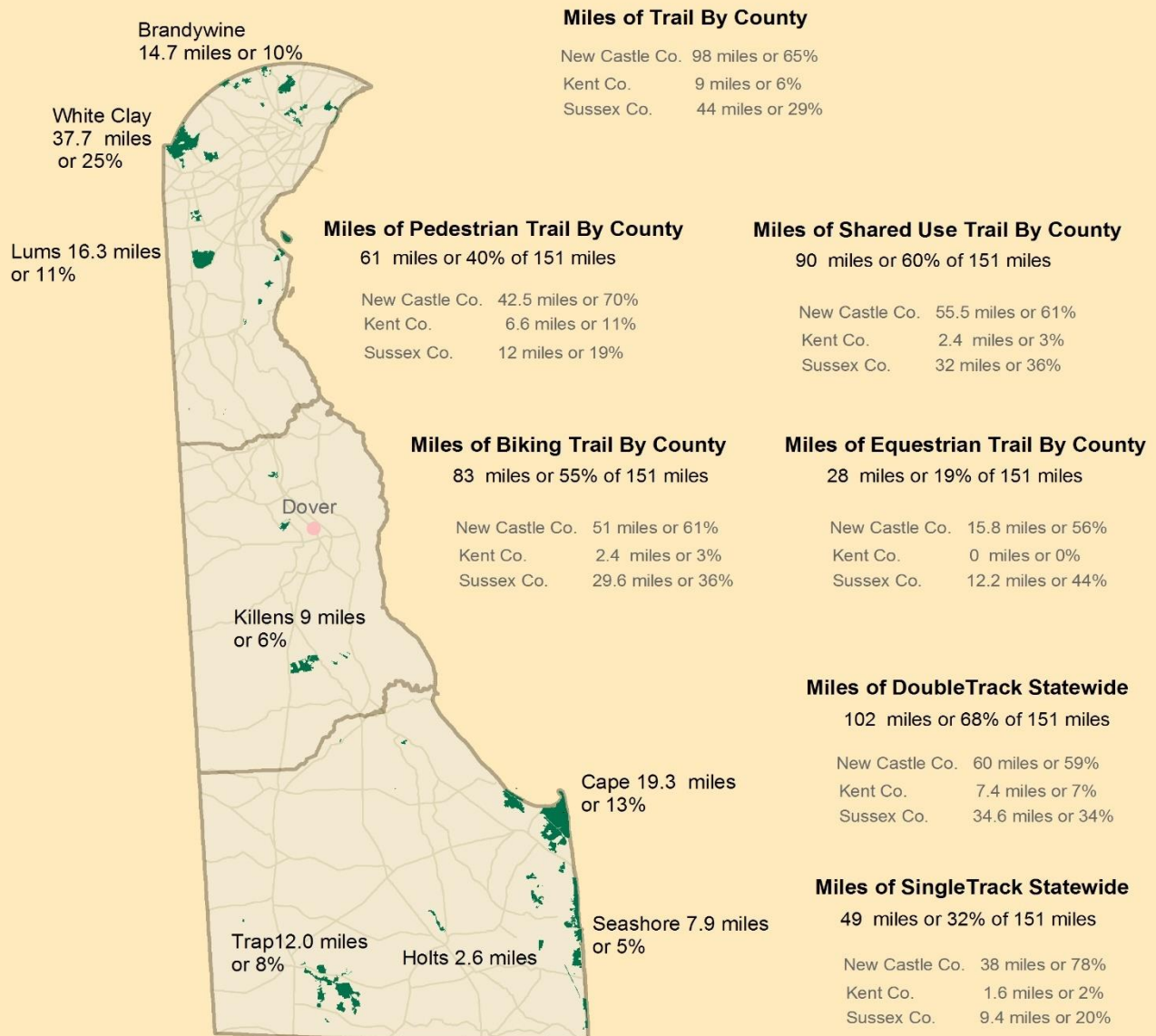
Within Delaware State Parks, there are 151 miles of trail that serve hikers, walkers, runners, mountain bikers, bicyclists, equestrians, and snowmobile users. Of this total, 61 trail miles are designated pedestrian only; this represents 39% of the total trail miles. Ninety trail miles is shared-use for non-motorized trail uses - pedestrian, mountain biking and equestrian - representing 61% of the total trail miles in Delaware State Parks. Map 2, Statewide Trail Analysis, provides an overview of trail miles by park with an analysis of trail use types.

State-Wide Trail Distribution Analysis State Parks



151 Total Trail Miles Throughout the State

61 miles single use (Pedestrian only) or 40%
90 miles shared use or 60%



Trail Descriptions and Existing Conditions

There are 2.7 miles of existing trails in Holts Landing State Park. Of these 2.7 miles, 1.4 miles are designated as pedestrian only and 1.3 miles are designated for pedestrians, bicycles, and equestrian. Access to the trail system is available from the main parking area. There are two designated trails in the park.

Table 1 – Trail Miles and Uses - is a summary of the trail system with lengths and current permitted trail uses. Map 3 depicts the existing trail system. Map 4 and 5 show existing trail use and width respectively. GPS information for the Universal Trail Assessment Program (UTAP) was collected on all existing trails at Holts Landing in August 2008.

Existing Trail Miles & Uses

Table 1

Trail	Length in Miles	Pedestrian	Biking	Equestrian
Sea Hawk	1.3	√		
Sea Horse	1.3	√	√	√

Sea Horse Trail: This shared use trail travels over packed earth and sand, along forest edge on sand road, across open meadow, and through mixed forests. The Sea Horse Trail provides access to the primitive camping areas in the park. Two connector trails join this trail with the Sea Hawk. Trail users can also access the trail from Marlin Drive off of Holts Landing Road.

Existing Condition: Segments of the Sea Horse Trail follow straight alignments with long sightlines. The soils are characterized as well drained or somewhat excessively well drained.

Sea Hawk Trail: Loop trail meanders through mixed hardwood and conifer forest, grassy meadow, and along the Indian River Bay shoreline. The trail can provide birding and wildlife viewing opportunities and trail users can experience different coastal bay environments.

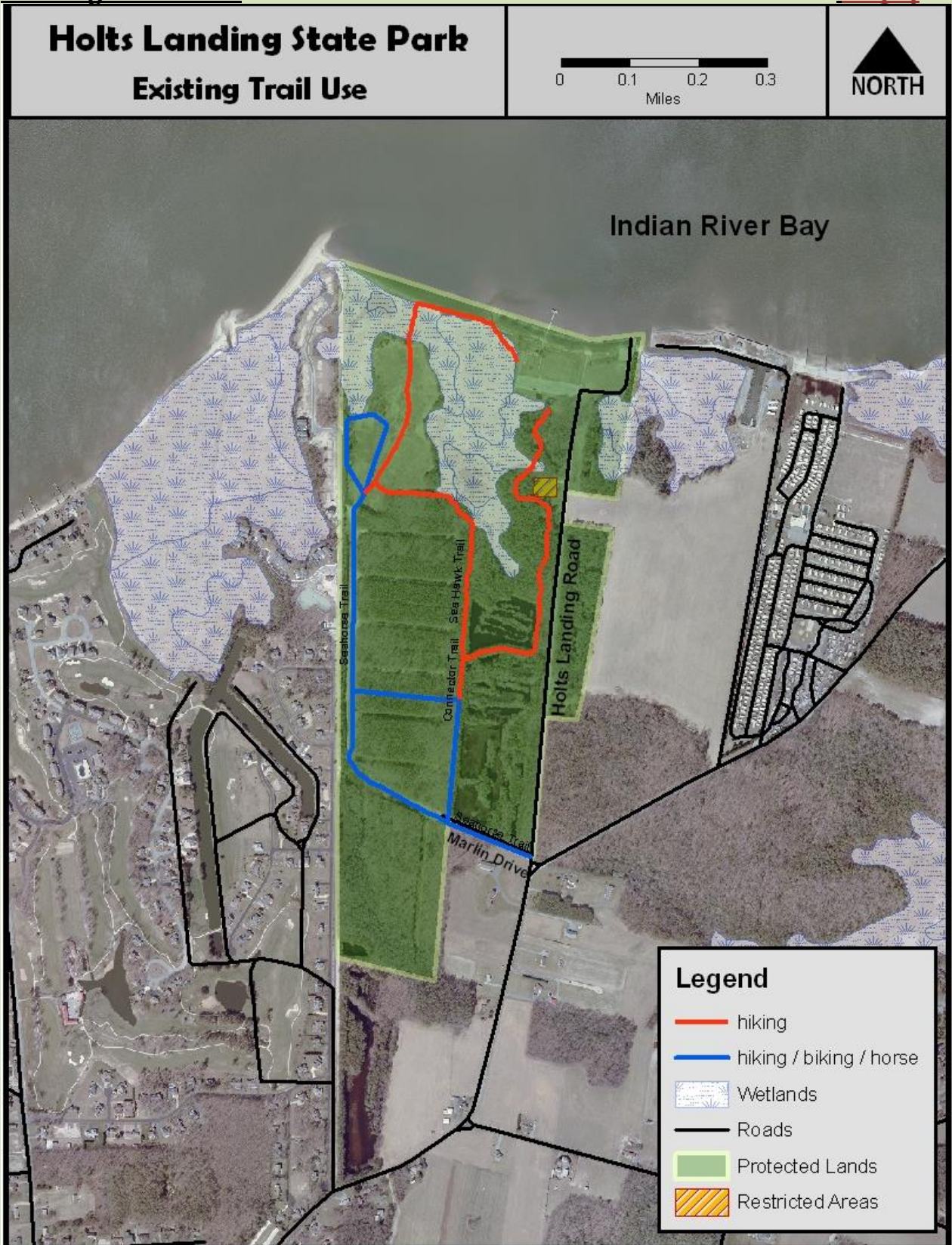
Existing Condition: Segments of the Sea Hawk Trail have experienced repeated storm event and tidal flooding. The trail segment that runs parallel to the Indian River Bay Shoreline experienced severe erosion during the fall of 2009. Several sections of the trail are wet with some areas seasonally under water.

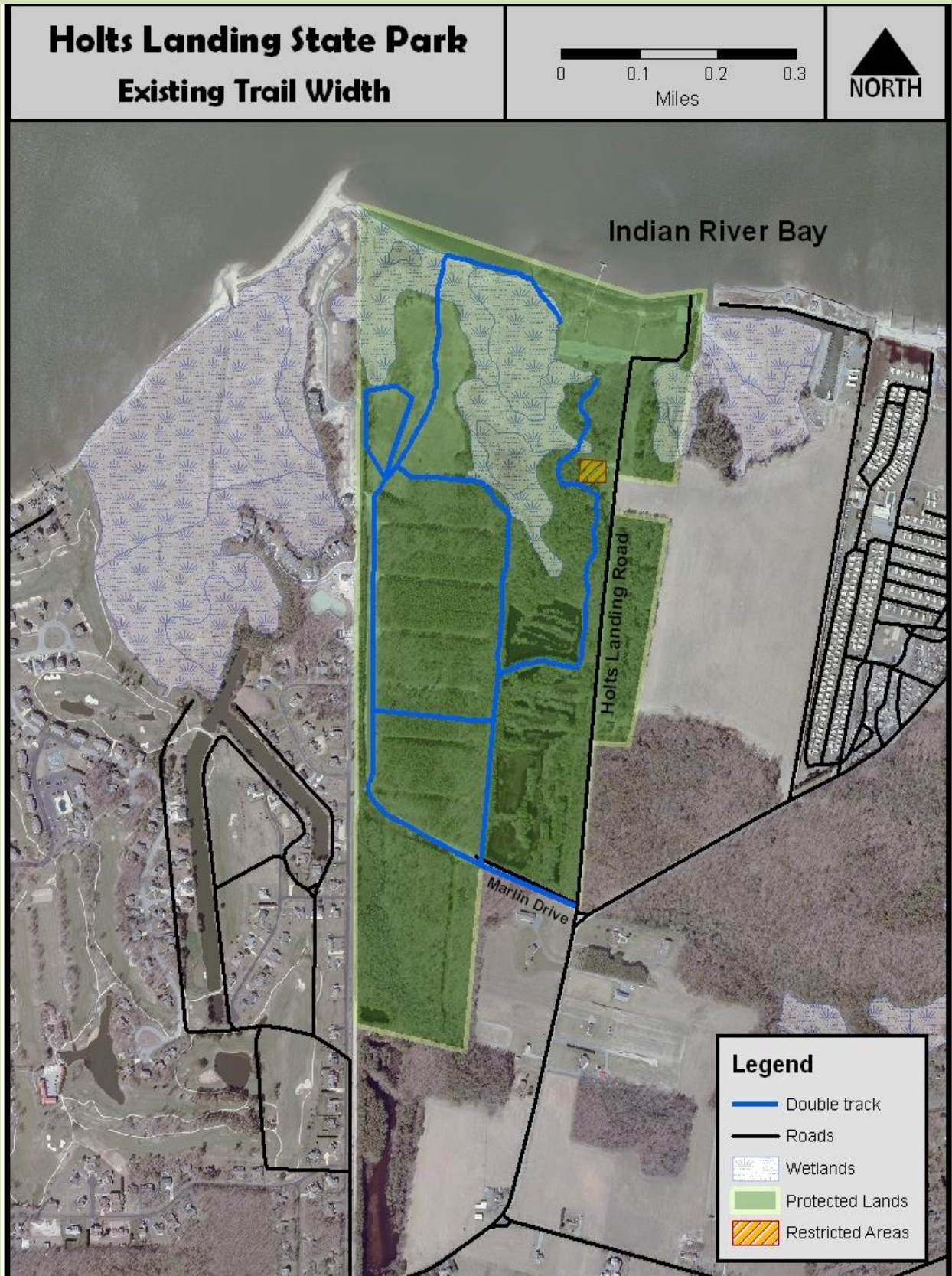
Segment of the Sea Hawk Trail



**Indian River Bay Shoreline Erosion – fall 2009
(View to the east)**







Impacts to the Trail System

In the park today there are a variety of activities that impact trails and trail corridors. Park staff activities such as trail maintenance or patrol, and visitors on trails using their feet, bike, or horse will have some influence on the landscape. Some soil disturbance is expected in the development and use of trails. The trails at Holts Landing State Park are mostly well drained packed sandy soils with organic matter.

Trail Users

For purposes of this Trail Plan, the Division did not gather characteristic profiles of the current trail users. However, below is a summary of general preferences within varying trail users groups based on input from Division recreation experts.

Pedestrians

The term pedestrian encompasses a variety of users, including walkers, hikers, nature watchers and trail runners. Walkers usually are interested in exercise, spending time with family friends and pets. Walkers tend to prefer loop or destination trails. Hikers tend to be more familiar with the outdoor environment, often prefer or seek a more strenuous and adventurous experience. Nature watchers are generally more interested in opportunities to spot wildlife and to observe natural surroundings. Runners may prefer a wide variety of trail experiences or trail configurations, although the main focus is exercise.

Mountain Bikers

Trail choices and skill sets among mountain bikers is diverse. Mountain bikers ride singletrack and doubletrack, are challenged by climbs and descents, rough and smooth terrain, and open and flowing to technical trail. Mountain bikers tend to prefer connection to nature, ride for exercise, and to improve their riding abilities. They prefer to customize their experiences by linking trails together in a series of segments and loops and across varying landscapes, features, distance and degree of difficulty.

Equestrians

Equestrians, like other trail user groups, have diverse trail interests. Rider skill, trail diversity and being close to nature are variables that determine the experience sought. Riders and mounts are the heaviest and tallest of non-motorized trail users and require trail wider than 3 feet to accommodate safe passage. Not only do trails need to be designed to take the dimensions of mounts and their riders into consideration, they have to provide for the needs, abilities, and heightened sensitivities of horses and mules. Paved and hard surfaces – asphalt, concrete, metal, and loose stone – offer little or no traction to a shod animal. Trail tread must be extremely durable to withstand the pounding of rider and mount.

Special Needs Populations

The Americans with Disabilities Act is a 1990 federal law that helps people with a disability gain equal access to public facilities. Trail widths of 3 feet, grades of 5% and less, no obstacles (no staircases steps, roots or rocks), and cross slopes 2% or less will best accommodate special needs.

Access Points and Signage

Map 6 shows access points to the existing Holts Landing State Park trail system. Map 7 shows locations of information boards and trail markers throughout the park.





Natural Resource Assessment

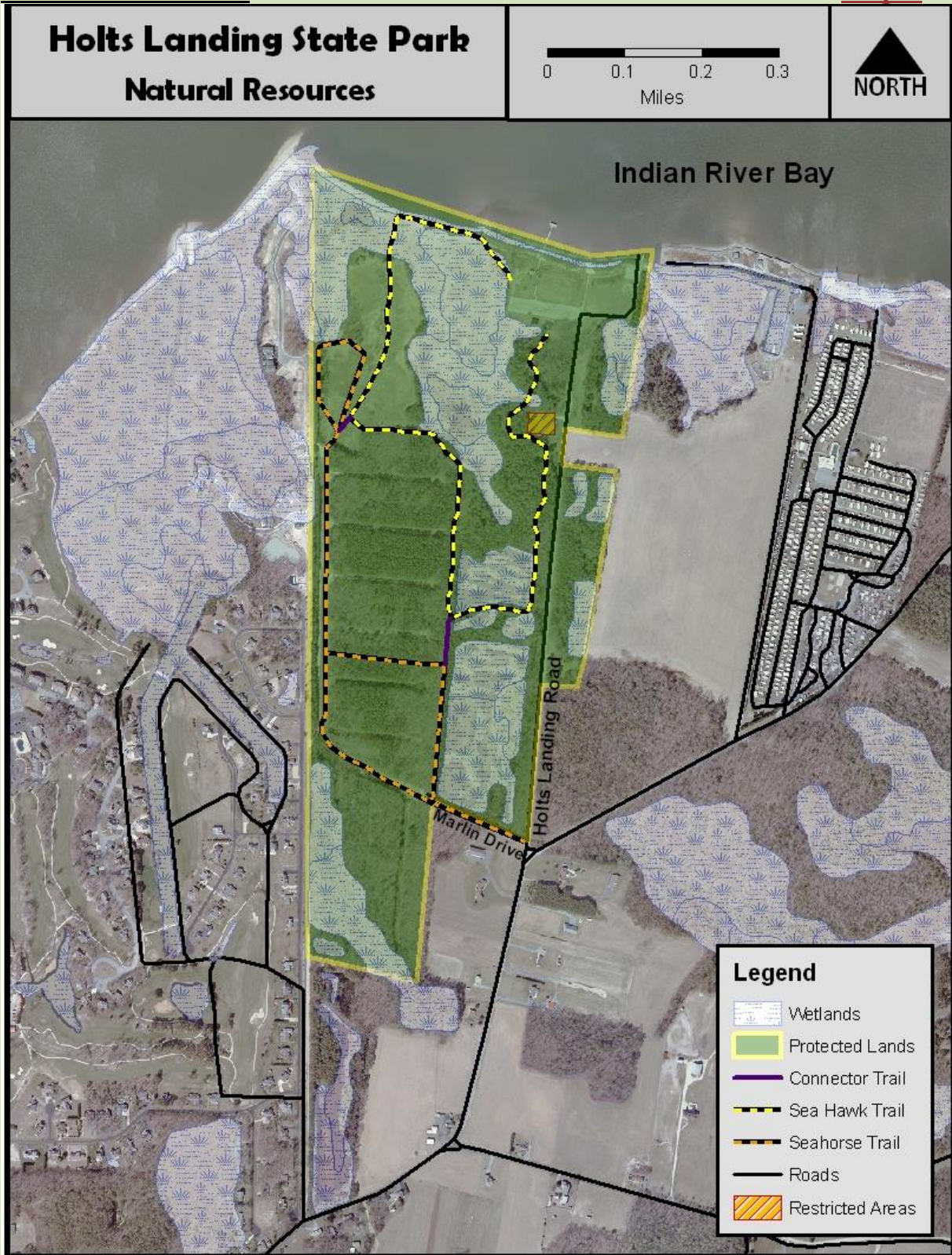
Natural Environment

Holts Landing hosts a variety of ecosystems including: wooded uplands, non-tidal wetlands, open meadows, and low-lying coastal marshes. The land consists of a knoll of Evesboro sand with a narrow border of coastal and dune sands along the shore of Indian River Bay (Wise 1985).

Invasive Species

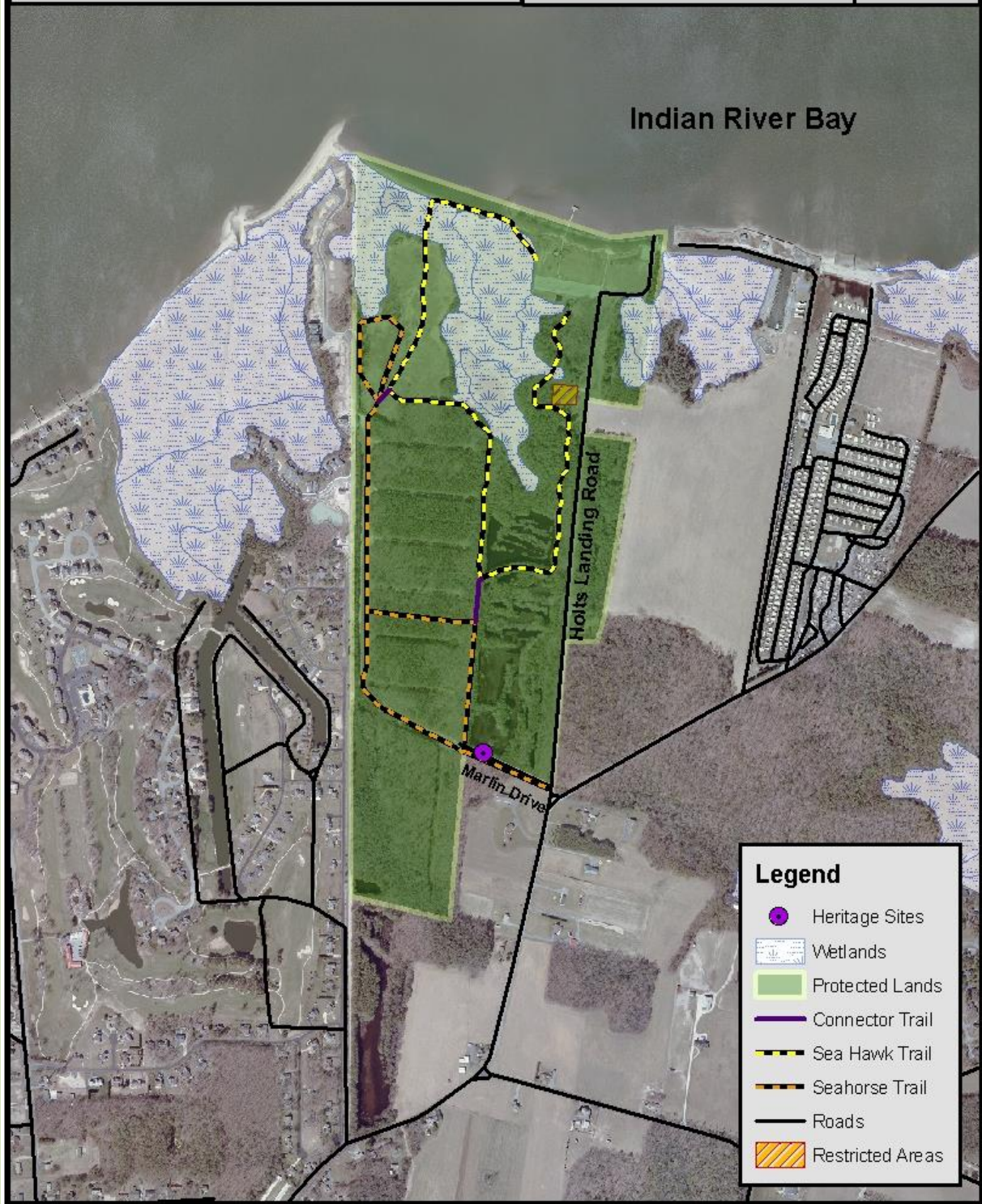
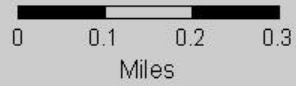
As noted elsewhere in this plan, trails can be sources of erosion, compaction and of habitat division and disturbance. But the greatest impacts of trails upon the park's natural resources are as avenues of incursion for non-native invasive plant species into native habitats. This occurs because of the constant soil disturbance and exposure that is typical of even lightly used trails. The passing of humans, no matter whether by foot, horse, bike or maintenance vehicle, is a persistent source of seed dispersal of some of the most highly invasive plants in Delaware's forested landscapes. These plants are not just a nuisance; they can alter and degrade the local ecology. Even the cocoons (containing eggs) of invasive earthworms can be moved this way. Introduction of these invasive plants and animals are the greatest threat to intact native forest habitat throughout our park system. Regular annual monitoring (and treatment if required) is necessary along all trails: existing and abandoned.

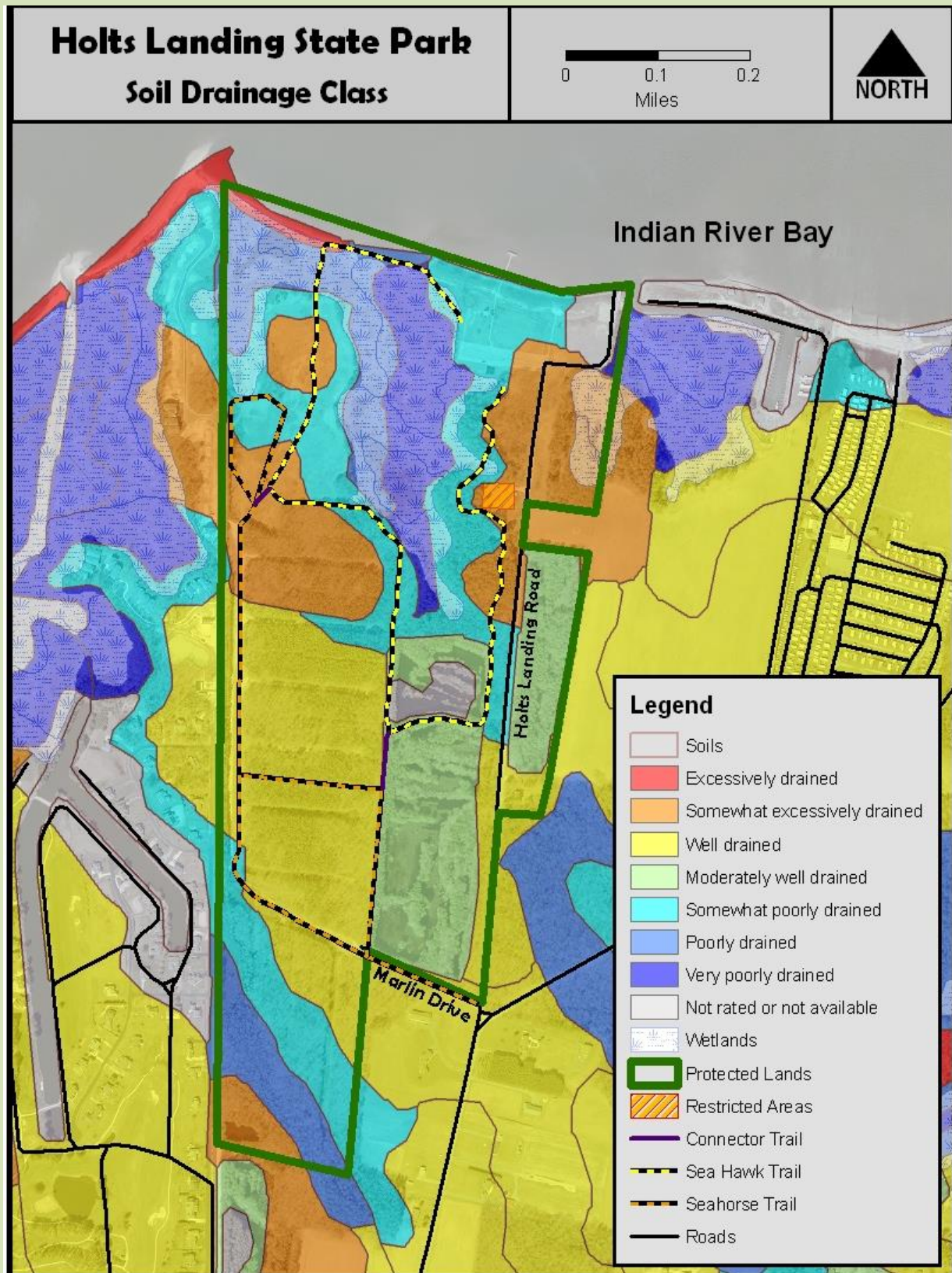
Soils: Soil characteristics vary within the park ranging from sandy to well draining sandy loam to poorly draining perennially wet soils. Current trail alignments fall within all of these soil characteristics. Map 10 illustrates Soil Types and Hydric Soil variables in Holts Landing. U.S. Department of Agriculture, Natural Resources Conservation Service published soil characteristic limitations for pathways, trails and other facilities on October 27, 2006.



Holts Landing State Park

Natural Resources / Heritage Sites





Natural Resources and Trail Development

Minimizing Trail Impacts upon Natural Resources

Trail layout and design must take into account the natural resources of the site. The highest quality habitat areas are to be left intact with little or no human disturbance. Efforts to do this have met with success in other parks. Overall, the experience gained from consideration of both recreational and habitat impact has engendered a better approach for minimizing the impact of trail construction on rare species and habitats. Trail design and recreational needs intersect with the protection of natural and cultural resources within state parks. The conflict and resolution of the challenges faced has led to a better sustainable trail system and contributed to the protection of resources. Trail planning in state parks will occur over the span of at least one full growing season to allow for seasonal evaluations and to determine the true potential natural resource impact.

As noted elsewhere in this plan, trails can be sources of erosion, compaction and of habitat division and disturbance. But the greatest impacts of trails upon the park's natural resources are as avenues of incursion for non-native invasive plant species into native habitats. This occurs because of the constant soil disturbance and exposure that is typical of even lightly used trails. The passing of humans, no matter whether by foot, horse, bike or maintenance vehicle, is a persistent source of seed dispersal of some of the most highly invasive plants in Delaware's forested landscapes. These plants are not just a nuisance; they can alter and degrade the local ecology. Even the cocoons (containing eggs) of invasive earthworms can be moved this way. Introduction of these invasive plants and animals are the greatest threat to intact native forest habitat throughout our park system. Regular annual monitoring (and treatment if required) is necessary along all trails: existing and abandoned.

The goal should be to manage all trails for the long-term maintenance stability of both the trail and surrounding habitats that reduce overall maintenance costs of both recreational and natural resources. Intact native habitats, especially forested habitats with increased canopy coverage, generally are more resistant to many of the potential invasive species threats. Invasive plants are generally less tolerant to shade produced by increased canopy coverage. Trail construction can recreate, disturb and maintain the gaps along trail and road corridors with the indiscriminate use of heavy equipment. This approach is viewed as a quick and cheap way to maintain trails. When in fact it's like constantly ripping a scab off of a wound. The edge of the habitat, whether along a forest edge or along an interior trail, never is allowed to 'heal' and stabilize. Trail maintenance goals must include efforts to maintain or restore corridor habitats. This will not require planting new plants. It simply requires the removal or control of existing invasive plants thereby releasing native species to fill the vacant habitat and 'seal' the edge preventing a reestablishment of non-native invaders. Selective trimming will be required as needed and of a type appropriate for the trail and vegetative edge. The Environmental Stewardship Program of the Division of Parks and Recreation is developing a maintenance guide (including setting priorities, techniques and parameters) to accomplish this objective.

Cultural Resource Assessment

A prehistoric site was identified at Holts Landing State Park but has been partially destroyed (Wise 1985). One archaeological site (7S-G-8) was recorded at Holts Landing in 1954 from private surface collections by the Sussex County Archaeological Society. The site was located during a surface collection from a borrow pit located on the sandy upland about 500 feet south of the boat ramp. Sand mining activities have destroyed significant portions of this site (Clark 2007)

Cultural Resources and Trail Development

Potential Impact High Incident Areas: The construction of **stone surface trail** has the greatest potential for disturbance of archaeological deposits because the construction requires the removal of approximately 6 inches of soil.

Recommendations for High Incident Areas: Shovel-testing should be conducted along the length of stone surface trail to determine whether there will be any impact. If the shovel testing in any locations produces cultural material, the excavation of soil in preparation for placing the stone should be monitored in those locations during construction.

Potential Impact Lower Incident Areas: The relocation of **earthen surface** trail sections to higher, better drained soils has some potential to impact archaeological sites. Trails constructed on slopes less than 8% has been determined to cause minimal disturbance to sites as excavation is minimal. Additionally, trails constructed on slopes greater than 8% has been determined to cause minimal disturbance to sites as it is unlikely sites are on slopes that steep or higher.

Recommendations: When final new segment locations for earthen trails have been more firmly marked, the potential for impact should be reviewed, and limited shovel-testing conducted, if appropriate.

Potential Impact for Bridge and Overlook Areas: Typically, the impact of bridges and overlooks has little potential to affect any archaeological resources. Never-the-less, evaluation during construction planning should be conducted if it is determined to be appropriate. The newest construction methods used for anchoring such structures (helical anchors) are unlikely to cause any significant disturbance. However, if post-holes are dug for placing the supports for the structures, impact should be reviewed and limited shovel-testing conducted, if appropriate.

Recommendations: When final locations for bridges and overlooks have been firmly marked just before construction, the potential for impact should be reviewed, and limited shovel-testing conducted, if appropriate.

Trail Use and Sustainability Assessment

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 & interpretative 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 trail users.

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 or not 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.

Recreational Activities and Interaction Types

The trails at Holts Landing State Park are presently designated for various uses which include pedestrians, bicyclists, and equestrians. Trail activities interact in a variety of ways. Much depends on each individual visitor and their breadth of experiences and how they like to recreate. Some activities positively impact one another and are complementary. Other recreation activities are merely compatible, having a neutral impact on another recreation activity and are called supplementary. Many activities, however, experience some form of conflict when encountering other activities. Users from different groups may experience conflicts over competition for space, trail infrastructure, viewscales, and soundscapes. In minor cases, these conflicts are called competitive interactions. In more extreme cases, two activities may be completely incompatible and interactions between them are described as antagonistic. The table 2 below outlines the spectrum of recreation interactions. Table 3 shows the existing trail uses in the park. Table 4 and 5 below show the different interaction types and how different recreational activities interact with one another.

The use of this information is an important aspect in determining future trail use management for the park.

Interaction Types and Their Recreational Outcomes

Table 2

Interaction Type	Key Characteristic	Outcome	Example
Complementary	Increasing compatibility with increased use	No conflict	Camping and hiking
Supplementary	Neutral interaction – no impact on compatibility	Minor conflict	Wildlife watching and hiking
Competitive	Decreasing compatibility with increased use	Conflict	Hiking and mountain biking
Antagonistic	Activities completely incompatible	Strong conflict	Wildlife watching and hunting

Source: Wisconsin SCORP 2005

Average Land-Based Recreation Activity Compatibility Ratings

Table 3

PRIMARY USE:	INTERACTS:										
	ATV Riding	Hunting	Snow-mobiling	Horseback Riding	Mountain Biking	Cross-Country Skiing	Linear Trail Biking	Hiking	Wildlife Watching	Camping	Average Compatibility
ATV Riding	X	5.3	6.5	5.1	5.5	4.9	5.5	6.1	6.9	7.5	6.0
Hunting	3.3	X	3.7	4.7	4.3	5.3	5.7	5.4	6.0	6.3	5.0
Snowmobiling	4.3	4.0	X	4.0	4.8	4.3	5.8	5.3	6.3	7.2	5.1
Horseback Riding	2.2	3.5	3.0	X	3.8	4.9	4.5	6.3	7.3	7.7	4.8
Mountain Biking	3.1	3.6	4.7	4.8	X	5.7	8.1	6.1	7.4	8.0	5.7
Cross-Country Skiing	1.8	3.6	2.6	3.3	4.2	X	5.6	4.9	8.1	8.5	4.7
Linear Trail Biking	2.6	3.9	5.5	5.3	8.2	7.1	X	7.4	8.0	8.7	6.3
Hiking	2.4	3.5	3.5	5.7	4.7	6.1	6.5	X	8.9	9.2	5.6
Wildlife Watching	2.2	3.2	2.9	6.4	5.2	7.6	6.8	8.6	X	8.3	5.7
Camping	3.9	4.1	5.0	7.5	7.8	8.2	8.2	8.9	8.5	X	6.9
Average Compatibility	2.9	3.9	4.2	5.2	5.4	6	6.3	6.6	7.5	7.9	

Ratings below 4.0 are highly competitive or antagonistic.	Ratings between 4.0 and below 7.0 are moderately to mildly competitive.	Ratings 7.0 and above are supplementary or complementary
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Source: WI SCORP 2005

How to read Table 3 – Ratings reflect the perceived level of conflict from the perspective of users listed in the vertical Y axis (labeled as Primary Use). Ratings indicating a user’s level of perceived recreation conflict should therefore be read horizontally across rows.

Trail Use Compatibility

Table 4

Primary Use	Seahorse Trail	Sea Hawk Trail	Community Connections
Hikers	√	√	√
Running	√	√	√
Dog Walkers	√	√	√
Wildlife Watching	√	√	
Geo-cachers	√	√	
Mountain Biking	√	√	√
Equestrian	√	√	√

Trail System Plan

Trail Changes

Based on the existing natural and cultural resources, including areas with preclusive soil conditions, and the social science data, some changes to the existing trail system are needed for Holts Landing State Park. The Trail Committee considered the variables and conditions in making recommendations for new trail alignments. Those factors include the following: current trail alignments; trail safety; soil types; topography; hydrology; plant and animal distribution; current and future use; trail use trends; anticipated regional land use growth; park staffing levels; maintenance practices; and trail sustainability.

Current trail sustainability principles dictate that all impacts present and future must not burden social, economic and environmental systems. The trails at Holts Landing State Park fail to meet the sustainability assessment criteria. The analysis of the Holts Landing State Park shows that of the 2.6 total trail miles, about 10 - 15% (0.26 - 0.4 miles) is in need of some degree of change or enhancement.

Final alignment changes account for natural resource protection and hydric soil avoidance. Trail alignments on the Indian River Bay Shoreline are subject to tidal and storm event flooding.

Option 1

Map 11 shows proposed and existing trail alignments and phased implementation for Option 1. Phase 1 would involve the creation of two reroutes on the Sea Hawk Trail around perennially wet areas with soils classified as somewhat poorly drained. Phase 2, a loop segment of the Sea Horse Trail will be closed. During Phase 3 of the project a new layout will be established for a (1.25) mile trail just east of Holts Landing Road. This new trail segment would be created in the narrow corridor between Holts Landing Road and the Park's east boundary. The trail would pass through a small field to be reforested and create a loop with the Seahawk Trail. Phase 4 will see the construction of an elevated observation platform with a connector to the Sea Hawk Trail. The shoreline segment of the Sea Hawk Trail is subject to flooding and erosion and would be closed during phase 5 of the project.

Option 2

Map 12 shows proposed trail alignments and the existing alignments and phased implementation. A segment of the Sea Hawk Trail would be rerouted to avoid hydric soils and seasonal flooding. A 20' elevated boardwalk / bridge with 20' ramps would be constructed to replace the bridge washed out in the fall 2009 northeaster. A short loop segment of the Seahorse Trail would be closed.

Option 3

Map 13 shows proposed and existing trail alignments with phased implementation including a 500' elevated boardwalk constructed over wetland on the Sea Hawk Trail. The boardwalk segment would replace the section of shoreline trail subject to storm event flooding & erosion. A segment of the Seahawk Trail located just northeast of the primitive camping area would be rerouted to avoid hydric soils and seasonal flooding. A loop section of the Seahorse Trail would be closed.

Option 3 (cont) - Proposed Sea Hawk Trail Boardwalk Material List & Costs

Elevated Structure – 500’ of trail @ 5’ wide = 2500sq ft
 (1 station every 8’ = 63 stations)

Anchors:

1) 126 @ 8.0’ spacingbetween stations (\$156.17each)	\$19,677
2) 31 diagonals @ 16’ spacing (\$91each)	\$ 2,821
3) 126 extensions (\$98each)	\$12,348
4) 126 brackets (\$40each)	\$5,040
5) 31 diagonal brackets (\$40 each)	\$1,240

Wooden Structure: CCA #2 Southern yellow pine

1) 2x8x10’ stringers - 315 pieces @ 12.00/piece	\$3,780
2) 2x8x10’ blocking – 32 pieces @ 12.00/piece (2’’x8’’x15’’)	\$ 384
3) 2x4x10’ nailers – 96 pieces @ 10.25/piece	\$ 984
4) 3x10x12’beams (3’’x10’’x 6’) @ 54.00/piece	\$3,402
5) 4x4x16’ curb uprights – 16 (4’’x4’’x12’’) @ 24.95/piece	\$ 400
6) 4x4x16’ curb top rail – 63 pieces @ 24.95/piece	\$1,572

Decking:

1) Thru flow® - @ \$5.47/sq ft.	\$13,675
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Fasteners:

1) Hot dipped galvanized and stainless steel	\$ 463
2) TS12 twist straps – 313 @ \$.83 piece	\$ 260
3) Galvanized 2d strap nails – 28lbs @ \$2.58 lb.	\$ 72

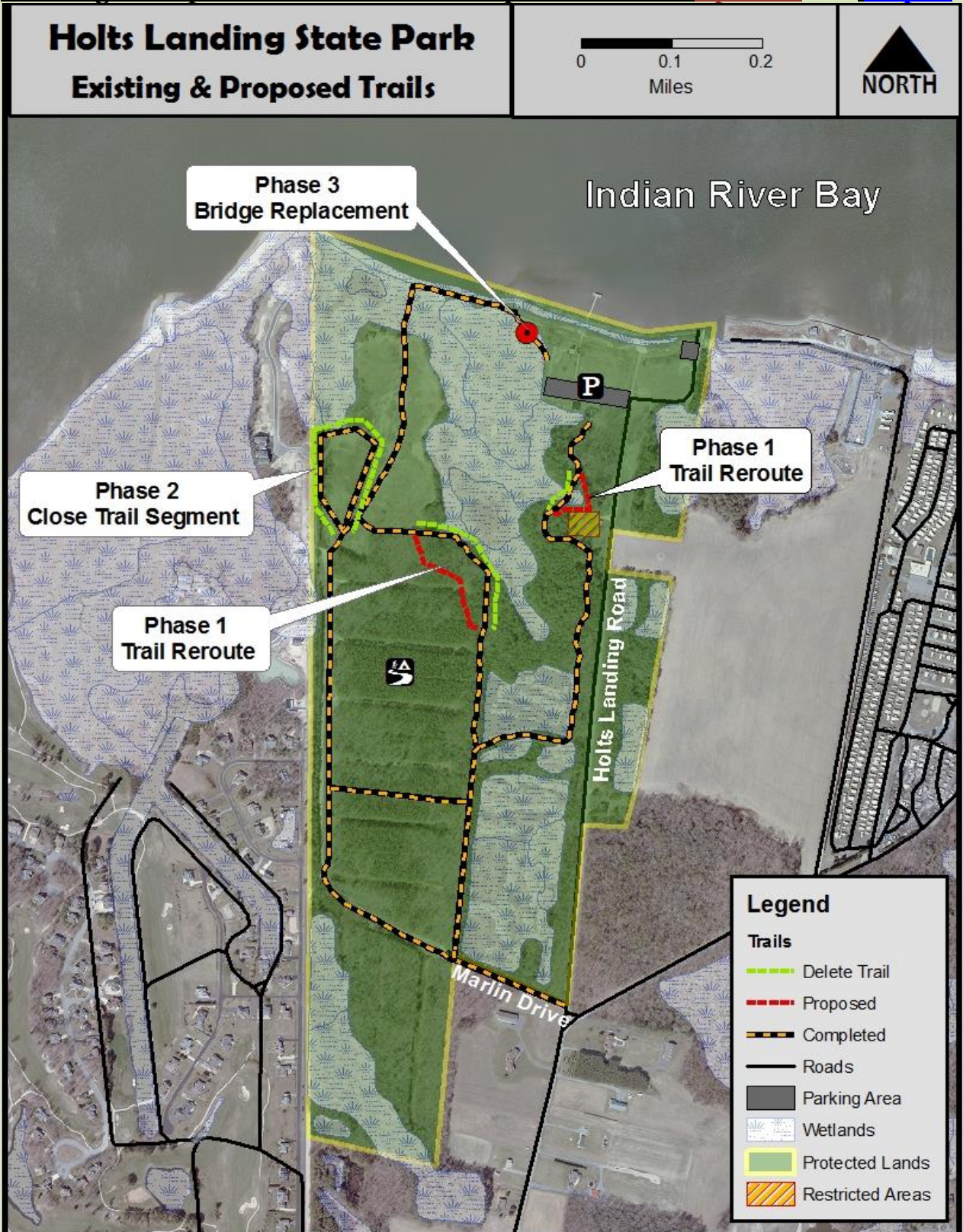
Subtotal \$ 66,118

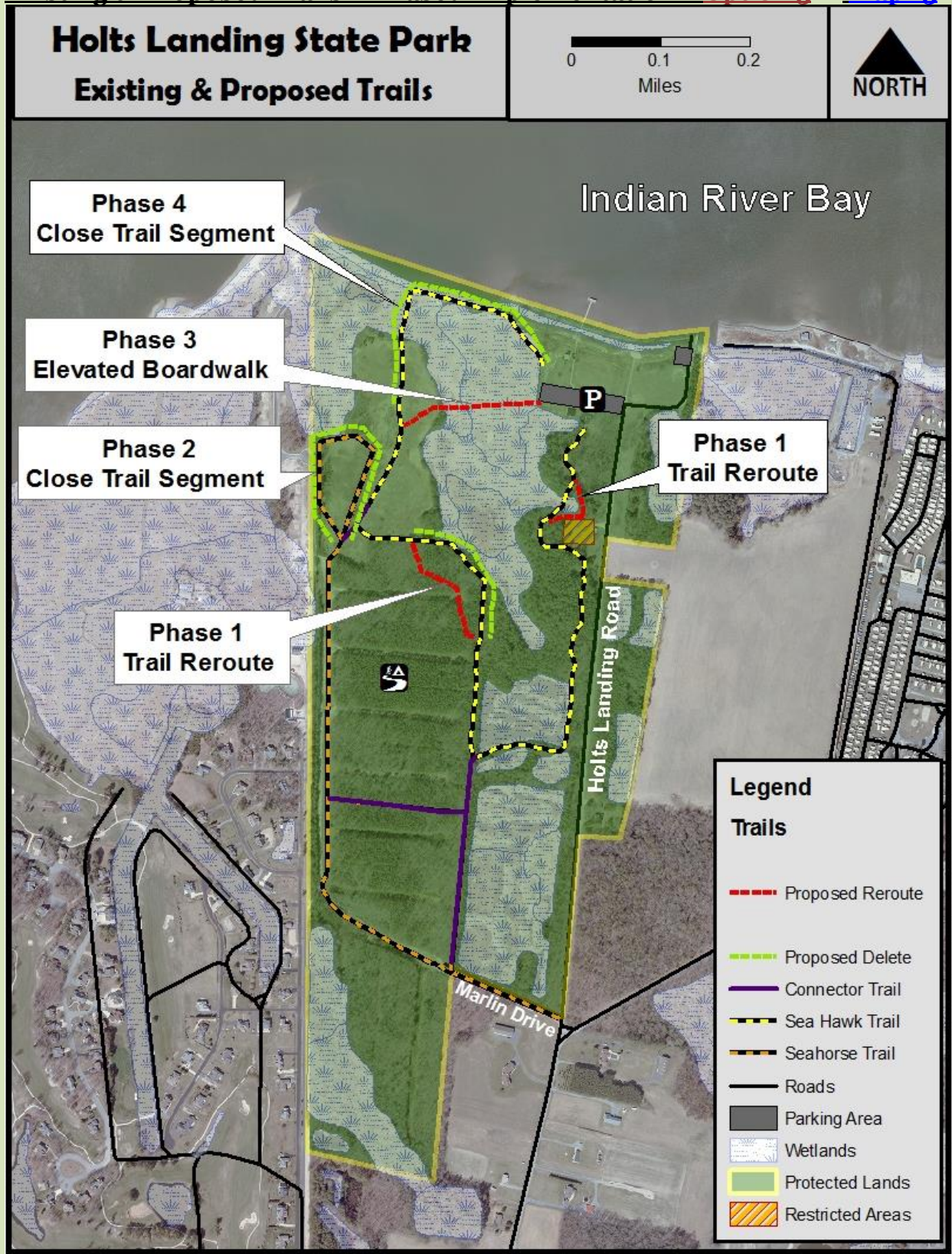
Labor:

1600 hours @ \$25 hour	\$ 40,000
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Option 1 Totals	\$ 106,118
Contractor Cost Estimate (based on \$100 sq ft)	\$ 250,000







Permitted Trail Uses, Miles & Widths

Table 5 shows existing total park trail miles for each user group. Table 6 shows existing and planned trail miles and current trail designated uses. Table 7 outlines planned trail widths and planned trail uses.

Existing Total Park Trail Miles for Each User Group

Table 5

Trail Use by Type	Miles	% of Total Miles
Pedestrian	2.4	100
Biking	1.3	54
Equestrian	1.3	54
Total Trail Miles	2.4	

Existing & Planned Trail Uses Miles and Uses

Table 6

Trail	Present Miles	Planned Miles	Pedestrian	Mt. Biking	Equestrian	Trail Running
Sea Hawk	1.3	1.3 or 1.1	√	√	√	√
Sea Horse	1.3	1.3	√	√	√	√

Trail Widths & Planned Uses

Table 7

Trail	Trail Width	Width Avg.	Current Trail Users	Recommended Users	Suitable Trail Users
Sea Hawk	Doubletrack	6 feet	Pedestrian	Pedestrian Mountain Biking Equestrian	Pedestrian Mountain Biking Equestrian
Sea Horse	Doubletrack	6 feet	Pedestrian Mountain biking Equestrian	Pedestrian Mountain Biking Equestrian	Pedestrian Mountain Biking Equestrian

Trail Signing, Information Boards, & Access Point Improvements

The inclusion of a sign plan is an integral part of a comprehensive trail plan. However, this trail plan will not lay out exact sign plan specifications for the entire park but general trail sign guidelines. A sign plan should include roadside directions to trailheads or major trail access points throughout the park; trailhead information such as mapping and trail characteristics; and clear trail markings throughout the system that will provide clear direction and safely guide visitors through the trail system back to their point of origin or to their intended destination.

It is recommended that all major parking lot trail access points have information boards that provide visitors with a trail map, trail use designations, etiquette, universal accessibility information and additional park information. Mapping will show trail system within the park and have trails color coded such that the coding matching the trail markers. See appendix E for information board detail. All access points will be clearly labeled on maps.

Each trail needs to be marked at all access points and at every trail intersection using the standard marking post. Minimum signage on each post will include trail name with directional arrow. Additional information may include designated use, intersecting trail names, and destinations. Trail markers will correspond with trail color coding as seen on trail maps. See appendix for marker post detail. Additional signs may be added to cover special seasonal activities (such as hunting or cross country) or to enhance target areas that warrant additional guidance to visitors (See appendix E - "Trail Standards").

Signs & Trail Markers

Two additional marker posts will be installed for the proposed new trail segment on the east side of Holts Landing Road. See Map 14. Some existing posts will be removed or moved and some trail marker discs replaced.

Access Points

No additional access points will be established.

External Connections

This plan does not include any proposed community or regional connector trails for the Holts Landing Area.

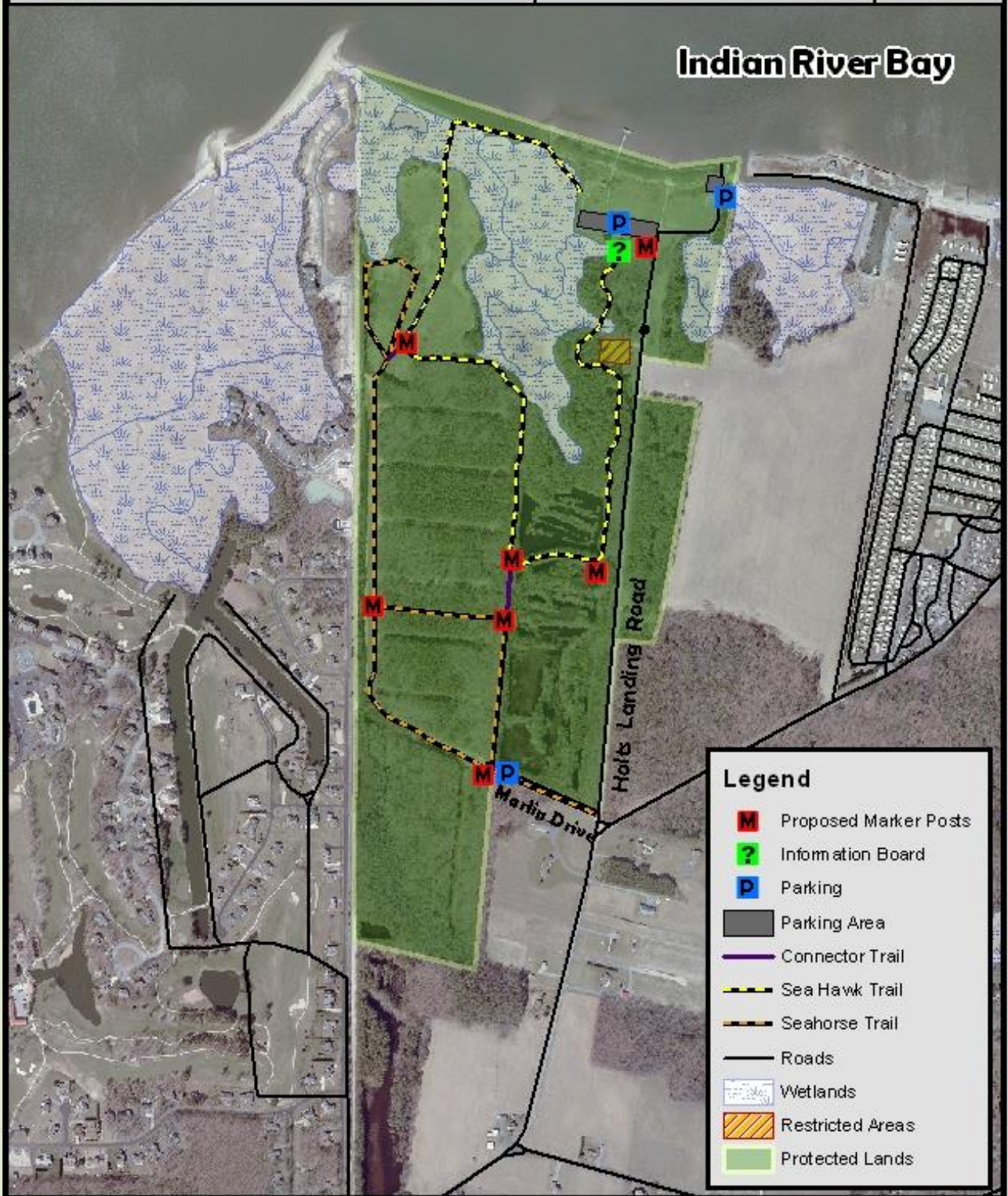
Proposed Trail Signage

Map 14

Holts Landing State Park Proposed Trail Signage



Indian River Bay



This document is to establish guidelines and principals to maintain all trails within Holts Landing State Park. These guidelines utilize the best industry practices available and provide the optimal experience for pedestrians and bikers, minimize the risk for visitors and park staff, and maximize environmental protection. This is not a “How to” narrative- for detailed guidance on trail maintenance, refer to the established “Trail Operation and Maintenance Considerations.”

Trail Designations and Tread Widths

Table 8

Trail	Trail Type	Width Avg.	Current Trail Users	Recommended Users	Suitable Trail Users
Seahorse	Double track	5 ft	Pedestrian Equestrian Bicycles	Pedestrian Equestrian Bicycles	Pedestrian Equestrian Bicycles
Sea Hawk	Double track	5 ft	Pedestrian	Pedestrian Bicycles Equestrian	Pedestrian Bicycles Equestrian

Minimize Environmental Impact

Trails will be located in less environmentally sensitive ecosystems as approved by the Division’s Stewardship Program to minimize environmental impact. All maintenance activities will follow trail maintenance guidelines and practices that will support low environmental impact and provide an assortment of recreational opportunities.

Vehicle use is restricted on all trails unless an emergency is present. Routine maintenance will be performed on **doubletrack** trail with access to the trail system by foot, Gator, DR Mower, or ATV without the use of shortcuts, service corridors, or social trails. Routine maintenance on **singletrack** trails will be performed by Park Staff on foot only.

Minimize Conflict

Posting trail use designation, appropriate signage, and best maintenance practices will minimize conflict.

Trail Characters and Infrastructure

- Widths- all single use and shared use single track trail will be maintained at 36” of cleared tread with an additional 12” of **selective** trimming on each side of the tread. All double track trails will be maintained at designed tread width with an additional 12” of selective trimming on each side of the tread unless otherwise specified.
- Height- Trails open to hiking and biking will have a maintained height of no less than 78” and no more than 88”. Trails open to equestrian use will have a maintained height of no less than 96” and no more than 120”.

- **Surface**- the tread will be firm and stable and maintained to provide a safe smooth surface (unless otherwise noted), free of obstacles and erosional features such as washouts, gullies, and mud holes, and is well draining.
- **Signage**- Signage will be provided at trailheads or major access sites to the trail to provide users information about the nature of the trail.
 - Trail markers will be placed at all trail intersections to guide the user through the trail system.

Inspection/ Maintenance

All trails and trail features are to be inspected on a monthly basis. Each inspection will be logged. If a trail is in need of maintenance or infrastructure is in need of repair it is to be repaired as quickly as possible and if repairs cannot be made immediately and there is a safety risk to visitors the trail or trail area is to be signed or closed down until said repairs occur.

Examples of unsafe infrastructures include but are not limited to: loose boards on bridges and boardwalks, protruding nails/ bolts, loose rocks in rock armored sections, excessive erosion, and missing or damaged signs, trees blocking trail passage, encroaching patches of poison ivy, and large areas of muddy or flooded trail.

General Principles

- **Minimize** impact whenever possible- in **all** phases of maintenance
- **Any** trail maintenance **will only** take place when soil conditions are firm.
- **Do not** use heavy equipment on trails when soils are prone to displacement and compaction.
- **Only** use and maintain open designated trails.
- **Do not** create short cuts or service corridors.
- **Avoid** maintenance activities during wet weather or when the ground is saturated
- **Know** the nature of the project and the materials and tools being used.
- **Check** marker posts and report any missing markers.
- **Check** trail information signs for damage

Conclusion

Final trail alignments have little or no impact to sensitive habitats outlined in the Natural Resource Assessment section of this document. Alignments provide for a varied trail experience, and provide access for many different user groups. This approach will provide a sound foundation for the most sustainable trails. The Seahorse Trail and the Seahawk Trail are proposed for shared-use and are to include hiking, bicycling, and equestrian. Reconstruction or hardening of trails in perennially wet soil zones provide for the highest protection of species of concern, and will in turn provide the best site conditions for sustainable trail alignments. Current alignments that fall in hydric soil zones will be reviewed for reroute, hardening, or the construction of boardwalks using helical anchor piles and other eco-sensitive construction methods. These methods will avoid unnecessary impacts on natural and cultural resources and eliminate costly on-going maintenance. Utilizing best practices for design, construction and maintenance will better provide and enhance diverse recreational experiences for visitors, reduce costly and frequent maintenance, and mitigate conflict between users.

Agreements

Park Superintendent

Park Operations Manager

Cultural Resources

Division Director

Stewardship Program

Trail Planner

Appendices

Appendix A: Trail Planning and Management Fundamentals (Adopted from the USFS)

Trail Type ▪ Trail Class ▪ Designed Use ▪ Managed Use ▪ Design Parameters

Trail Type

Trail Type is a fundamental trail category that indicates the predominant trail surface or trail foundation, and the general mode of travel the trail accommodates.

Trail Types are exclusive, that is there can only be one Trail Type assigned per trail or trail segment. This allows managers to identify specific trail Design Parameters (technical specifications), management needs and the cost of managing the trail for particular uses and/or seasons by trail or trail segment.

Standard/Terra Trail: *The predominant foundation of the trail is ground (as opposed to water). It is designed and managed to accommodate ground-based trail use.*

Water Trail: *The predominant foundation of the trail is water (as opposed to ground or snow). It is designed and managed to accommodate trail use by water craft. There may be ground-based portage segments of water trails.*

Trail Management Classes

Trail prescriptions describe the desired management of each trail, based on Park Trail Plan direction. Prescriptions take into account user preferences, setting, protection of sensitive resources, and other management activities. To meet a prescription, each trail is assigned an appropriate Trail Class. These general categories are used to identify applicable Trail Design Parameters and to identify basic indicators used for determining the cost to meet quality standards.

There is only one Trail Class identified per trail or trail segment. The Classes provide a chronological classification of trail development on a scale ranging from Trail Class 1 to Trail Class 5. Trail Class descriptions define “typical” attributes, exceptions may occur for any attribute. Apply the Trail Class that most closely matches the managed objective of the trail.

- Trail Class 1: Minimal/Undeveloped Trail
- Trail Class 2: Simple/Minor Development Trail
- Trail Class 3: Developed/Improved Trail
- Trail Class 4: Highly Developed Trail
- Trail Class 5: Fully Developed Trail

Each Trail Class is defined in terms of applicable Tread and Traffic Flow, Obstacles, Constructed Feature and Trail Elements, Signs, Typical Recreation Environment and Experience. Trail Class descriptions define “typical” scenarios or combined factors, and exceptions may occur for any factor. In applying Trail Classes choose the one that most closely matches the managed objective of the trail. See Trail Class Table for specifics.

There is a direct relationship between Trail Class and Managed Use (defined below); one cannot be determined without consideration of the other.

These general trail class categories are used to identify applicable Trail Design Parameters (defined below) and to identify basic indicators used for determining the cost to meet quality standards.

Trail Designed Use and Managed Use

Designed Use and Managed Use are basic concepts that are fundamental to effective trail planning, design, construction, maintenance, and management. When applied proactively, and in combination with Trail Class, these technical trail management concepts can form the basis for sound trail planning and management.

Designed Use is the intended use that controls the geometric design of the trail, and determines the subsequent maintenance parameters for the trail. There is only one Designed Use ("design driver") per trail or trail segment.

Although a trail may be actively managed for more than one use, and numerous uses may be allowed, only one use is identified as the critical design driver. The Designed Use determines the technical specifications for the design, construction and maintenance of the trail or trail segment. For each Designed Use and applicable Trail Class, there is a corresponding set of standardized technical specifications or Design Parameters.

Of the actively Managed Uses for which a trail is developed and managed; the Designed Use is the single design driver that determines the technical specifications for the trail. This is somewhat subjective, but the Designed Use is most often the Managed Use that requires the highest level of development. (i.e.: horses require higher and wider clearance than a trail designed for hikers; or technical trail elements or trails designed specifically for bikes but open to other users-such as the Skills Trail).

Managed Use is the mode(s) of travel that is actively managed (pedestrian, biking, and/or equestrian). There may be more than one Managed Use per trail or trail segment. Managed Use indicates a management decision or intent to accommodate and/or encourage a specified type of trail use.

Of these Managed Uses, only one is the Designed Use, which determines the technical design, construction and maintenance specifications for the trail.

Designed Use / Managed Use Types

- Bicycle
- Hiker/Pedestrian
- Equestrian

Design Parameters

- Design Parameters are technical specifications for trail construction and maintenance, based on the Designed Use and Trail Class. Trail Design Parameters represent a standardized set of commonly expected construction and maintenance specifications based on Designed Use and Trail Class. Local deviations to the Design Parameters may be established based on specific trail conditions, topography and other factors, providing that the variations continue to reflect the general intent of the Trail Classes. Design Parameters are a refinement and expansion of the commonly used "Easiest, More Difficult, and Most Difficult" trail categories for communicating construction, maintenance and management specifications.

Design Parameters include technical specifications that include the following: tread width, surface, grade, cross-slope, length, clearing limits, trail elements (obstacles-natural or constructed), and turn radius.

Trail Management Classes

Trail prescriptions describe the desired management of each trail, based on Trail Plan direction. These prescriptions take into account user preferences, setting, protection of sensitive resources, and other management activities. To meet prescription, each trail is assigned an appropriate Trail Class. These general categories are used to identify applicable Trail Design Parameters and to identify basic indicators used for determining the cost to meet quality standards. The General Criteria below define each Trail Class and are applicable to all system trails. Trail Class descriptions define "typical" attributes and exceptions may occur for any attribute. Apply the Trail Class that most closely matches the managed objective of the trail.

Trail Attributes	Trail Class 1 Minimal/Undeveloped Trail	Trail Class 2 Simple/Minor Development Trail	Trail Class 3 Developed/Improved Trail	Trail Class 4 Highly Developed Trail	Trail Class 5 Fully Developed Trail
Tread and Traffic Flow	<ul style="list-style-type: none"> •Tread intermittent and often indistinct 12-24" and rough •May require route finding •Native materials only 	<ul style="list-style-type: none"> •Tread discernible and continuous, 18-24" and rough •Few or no allowances constructed for passing •Native materials only 	<ul style="list-style-type: none"> •Tread obvious and continuous 36-42" wide •Width accommodates unhindered one-lane travel (occasional allowances constructed for passing) •Typically native materials 	<ul style="list-style-type: none"> •Tread wide and relatively smooth with few irregularities 42+'' wide •Width consistently accommodate two-lane travel •Native or imported materials •May be hardened 	<ul style="list-style-type: none"> •Width generally accommodates two-lane and two-directional travel, or provides frequent passing turnouts 96" or wider •Commonly hardened with asphalt or other imported material
Obstacles	<ul style="list-style-type: none"> •Obstacles common •Narrow passages; brush, rocks and logs, wet stream crossing present •Grades typically <10% 	<ul style="list-style-type: none"> •Obstacles occasionally present •Blockages cleared to define route and protect resources •Vegetation may encroach into trail treadway •Grades typically <10% 	<ul style="list-style-type: none"> •Obstacles infrequent except with alternate lines or specified as more challenging •Grades typically <8% •Vegetation selectively trimmed 12" each side of treadway 	<ul style="list-style-type: none"> •Few or no obstacles exist except with alternate lines •Grades typically <8% •Vegetation selectively trimmed 12" each side of treadway 	<ul style="list-style-type: none"> •No obstacles •Grades typically <6% •Vegetation selectively trimmed 12" each side of treadway
Constructed Features & Trail Elements	<ul style="list-style-type: none"> •Minimal to non-existent •Drainage may be functional •No or limited constructed bridges or foot crossings •Native materials used 	<ul style="list-style-type: none"> •Structures are of limited size, scale, and number •Obstacles common •Drainage functional •Structures adequate to protect trail infrastructure and resources •Grades typically <10% •Primitive foot crossings and fords •Native materials used •May have design elements incorporated for added challenge 	<ul style="list-style-type: none"> •Trail structures (walls, steps, drainage, raised trail) may be common and substantial •Trail bridges as needed for resource protection and appropriate access •Generally native materials used •May have design elements incorporated for added challenge 	<ul style="list-style-type: none"> •Structures may be frequent and substantial •Substantial trail bridges are appropriate at water or fragile resource crossings •Trailside amenities may be present •Native and imported materials used •May have design elements incorporated for added challenge 	<ul style="list-style-type: none"> •Structures frequent or continuous; may include curbs, handrails, trailside amenities, and boardwalks •Drainage structures frequent; may include culverts and road-like designs •Native and imported materials used
Signs	<ul style="list-style-type: none"> •Minimum required •Generally limited to regulation and resource protection •No destination signs present 	<ul style="list-style-type: none"> •Minimum required for basic direction •Generally limited to regulation and resource protection •Typically very few or no destination signs present 	<ul style="list-style-type: none"> •Wide variety of signs likely present •Informational signs likely •Interpretive signs possible •Trail Universal Access information likely displayed at trailhead 	<ul style="list-style-type: none"> •Wide variety of signs likely present •Informational signs likely •Interpretive signs possible •Trail Universal Access information likely displayed at trailhead 	<ul style="list-style-type: none"> •Wide variety of signage is present •Information and interpretive signs likely •Trail Universal Access information is typically displayed at trailhead

Trail Management Classes

Table 11

Trail Management Classes

Trail Attributes	Trail Class 1 Minimal/Undeveloped Trail	Trail Class 2 Simple/Minor Development Trail	Trail Class 3 Developed/Improved Trail	Trail Class 4 Highly Developed Trail	Trail Class 5 Fully Developed Trail
<p>Recreation Environments & Experience</p> <ul style="list-style-type: none"> • Natural, unmodified • Primitive or wilderness like setting • Challenging 	<ul style="list-style-type: none"> • Natural, unmodified • Typically semi-primitive setting • Challenging 	<ul style="list-style-type: none"> • Natural, primarily unmodified • Typically natural setting • May contain alternate lines or incorporate natural or built challenging features 	<ul style="list-style-type: none"> • May be modified • Natural to Rural setting • May contain alternate lines or incorporate natural or built challenging features 	<ul style="list-style-type: none"> • Can be highly modified • Typically Rural to urban setting • Commonly associated with visitor centers or high-use recreation sites 	
<p>Water Trails</p> <p>For Portage sections of Water Trails, see "General Criteria" above.</p> <p>Note: Many facilities and features described in this row are commonly associated with hiking/portage trails, Concentrated Use Areas or Developed Sites (as compared to the Water Trail itself), and are described here primarily for guidance in Applying appropriate Trail Class.</p>	<ul style="list-style-type: none"> • Managed for paddlecraft as primary use type. • Designated water route, shown on maps and used to access other trails or portages, but with no trail structures, facilities, signs, or recurring maintenance needs along the route and in wilderness like setting. • Maintenance consists of occasional patrols and resource protection. • Signs and/or parking facilities if at all at initial access points only, and likely associated with other trails or sites. • In densely vegetated areas, users will commonly need to lift vessel over logs, shoals, or matted vegetation or break path through some vegetation and duck under overhanging branches. 	<ul style="list-style-type: none"> • Managed for paddlecraft as primary use type. • Very few markers or route designators, and likely none in wilderness like areas. • Low profile structures or facilities occasionally present; primarily to reduce beach and bank impacts. Structures typically consist of native material hardening of portage/water entry points. • Signs most likely found at parking facilities at initial access point, and may be associated with another trail or site. • On water trails where dense vegetation and obstructions occur, path is typically narrow, shallow, and may occasionally require user to lift over obstacles or break path through some vegetation and or duck under overhanging branches. 	<ul style="list-style-type: none"> • Managed for paddlecraft as primary use type. • Buoy or markers possible to identify route • Typically, facilities on motorized or non-wilderness trails to provide improved access and to reduce beach and bank impacts. • Well-developed parking and launch facilities at primary access points, but facilities and structures rare along trail. • Interpretive and informational displays and other signs typically present at primary access points and possibly along route. • On water trails where dense vegetation and obstructions occur (swamps), path is typically cleared wide enough for ready passage and maneuvering of at least one vessel, and usually two-way vessel passage, with only occasional low overhanging vegetation. 	<ul style="list-style-type: none"> • Managed for paddlecraft as primary use type. • Buoy or markers are high profile and may be intervisible and/or route is readily followed. • Highly developed launch facilities, docks, and amenities typically provided for user convenience. • Well-marked approaches to facilities and portages • Interpretive displays, maps, information kiosks and signs typically present at access points and along route. • On water trails where dense vegetation and obstructions occur (swamps), path is consistently cleared wide enough for unhindered, easy passage of two or more vessels. 	<ul style="list-style-type: none"> • Managed for motorized watercraft as primary use type. • Buoy or markers are high profile and may be intervisible and/or route is readily followed. • Highly developed launch facilities, docks, and amenities typically provided for user convenience. • Well-marked approaches to facilities and portages • Interpretive displays, maps, information kiosks and signs typically present at access points and along route. • On water trails where dense vegetation and obstructions occur (swamps), path is consistently cleared wide enough for unhindered, easy passage of two or more vessels. • Expect recreational and commercial traffic

Trail Operation and Maintenance Considerations – Table 12

Trail Operation and Maintenance Considerations are intended to complement the Trail Class General Criteria. These considerations can be regarded as general guidelines to assist in developing trail prescriptions, and subsequent program management, operations and maintenance. Trail O&M Considerations offer a general starting point and will likely be adapted to reflect financial limitations and specific district, forest, or regional circumstances. The broad guidance outlined below reflects “typical” considerations for trails in different Trail Classes:

Trail Attributes	Trail Class 1 Minimal/Undeveloped Trail	Trail Class 2 Simple/Minor Development Trail	Trail Class 3 Developed/Improved Trail	Trail Class 4 Highly Developed Trail	Trail Class 5 Fully Developed Trail
Trail Management	Typically managed to accommodate: <ul style="list-style-type: none"> Low use levels Highly skilled users, comfortable off-trail. Users with high degree of orienteering skill. Some travel modes and ability levels may be impractical or impossible, and may not be encouraged. Water Trails: Users require high level of navigation/orientation and paddling skills.	Typically managed to accommodate: <ul style="list-style-type: none"> Low-to-moderate use levels Mid-to-highly skilled users, capable of traveling over awkward conditions/obstacles Users with moderate orienteering skill. Trail suitable for many user types, but challenging and involves advanced skills. Water Trails: Moderate to high level of navigation/orientation and paddling/pikbing skills required.	Typically managed to accommodate: <ul style="list-style-type: none"> Moderate to heavy use. Users with intermediate skill level and experience. Users with minimal orienteering skills. Moderately easy travel by managed use types. Random potential for accessible use. Water Trails: Basic to moderate navigation and paddling/pikbing skills required.	Typically managed to accommodate: <ul style="list-style-type: none"> Very heavy use. Users with minimal skills and experience. Users with minimal or no orienteering skills. Easy/comfortable travel by managed use types. May be (or has potential to be made) accessible. Water Trails: Basic navigation and paddling/	Typically managed to accommodate: <ul style="list-style-type: none"> Intensive use. Users with limited trail skills and experience. Trail typically meets agency requirements for accessibility Includes “Pedestrian Trails”.
Maintenance Indicators	Resource protection. Safety commensurate with targeted recreational experience.	Resource protection. Safety commensurate with targeted recreational experience.	Resource protection. User convenience. Safety commensurate with targeted recreational experience.	User comfort and ease. Resource protection. Safety commensurate with targeted recreational experience.	User comfort and ease. Targeted high level of accessibility to key recreational opportunities. Safety commensurate with targeted recreational experience.
Maintenance Frequency & Intensity	Infrequent or no scheduled recurring maintenance. Heavy maintenance interval is typically 3-5 years, or in response to unusual resource problems requiring repair.	Maintenance scheduled to preserve the trail facility and route location. Heavy maintenance interval typically 3-5 years, or in response to unusual problems.	Trail cleared to make available for use early in use season, and to preserve trail integrity. Heavy Maintenance interval typically 1-3 years, Regular maintenance performed annually or in response to trail or resource damage or significant obstacles to managed use type and experience level.	Trail cleared to make available for use at earliest opportunity in use season. Regular, maintenance performed annually or as defined by maintenance plan.	Maintenance performed at least annually, or as defined by maintenance plan to meet posted conditions. Major damage or safety concerns typically corrected or posted

Appendix B: Trail Maintenance Guidelines

This document is to establish guidelines and principals to maintain all trails within Holts Landing State Park. These guidelines utilize the best industry practices available and provide the optimal experience for pedestrians and bikers, minimize the risk for visitors and park staff, and maximize environmental protection. This is not a “How to” narrative- for detailed guidance on trail maintenance, refer to the established “Trail Operation and Maintenance Considerations.”

Trail Designations and Tread Widths

Table 13

Trail	Trail Type	Width Avg.	Current Trail Users	Recommended Users	Suitable Trail Users
Seahorse	Double track	5 ft	Pedestrian Equestrian Bicycles	Pedestrian Equestrian Bicycles	Pedestrian Equestrian Bicycles
Sea Hawk	Double track	5 ft	Pedestrian	Pedestrian Bicycles Equestrian	Pedestrian Bicycles Equestrian

Minimize Environmental Impact

Trails will be located in less environmentally sensitive ecosystems as approved by the Division’s Stewardship Program to minimize environmental impact. All maintenance activities will follow trail maintenance guidelines and practices that will support low environmental impact and provide an assortment of recreational opportunities.

Vehicle use is restricted on all trails unless an emergency is present. Routine maintenance will be performed on **doubletrack** trail with access to the trail system by foot, Gator, DR Mower, or ATV without the use of shortcuts, service corridors, or social trails. Routine maintenance on **singletrack** trails will be performed by Park Staff on foot only.

Minimize Conflict

Posting trail use designation, appropriate signage, and best maintenance practices will minimize conflict.

Trail Characters and Infrastructure

- **Widths**- all single use and shared use single track trail will be maintained at 36” of cleared tread with an additional 12” of **selective** trimming on each side of the tread. All double track trails will be maintained at designed tread width with an additional 12” of selective trimming on each side of the tread unless otherwise specified.
- **Height**- Trails open to hiking and biking will have a maintained height of no less than 78” and no more than 88”. Trails open to equestrian use will have a maintained height of no less than 96” and no more than 120”.

- **Surface**- the tread will be firm and stable and maintained to provide a safe smooth surface (unless otherwise noted), free of obstacles and erosional features such as washouts, gullies, and mud holes, and is well draining.
- **Signage**- Signage will be provided at trailheads or major access sites to the trail to provide users information about the nature of the trail.
 - Trail markers will be placed at all trail intersections to guide the user through the trail system.

Inspection/ Maintenance

All trails and trail features are to be inspected on a monthly basis. Each inspection will be logged. If a trail is in need of maintenance or infrastructure is in need of repair it is to be repaired as quickly as possible and if repairs cannot be made immediately and there is a safety risk to visitors the trail or trail area is to be signed or closed down until said repairs occur.

Examples of unsafe infrastructures include but are not limited to: loose boards on bridges and boardwalks, protruding nails/ bolts, loose rocks in rock armored sections, excessive erosion, and missing or damaged signs, trees blocking trail passage, encroaching patches of poison ivy, and large areas of muddy or flooded trail.

General Principles

- **Minimize** impact whenever possible- in **all** phases of maintenance
- **Any** trail maintenance **will only** take place when soil conditions are firm.
- **Do not** use heavy equipment on trails when soils are prone to displacement and compaction.
- **Only** use and maintain open designated trails.
- **Do not** create short cuts or service corridors.
- **Avoid** maintenance activities during wet weather or when the ground is saturated
- **Know** the nature of the project and the materials and tools being used.
- **Check** marker posts and report any missing markers.
- **Check** trail information signs for damage

Appendix C: Principles of Sustainable Trail Design & Development

Designing and constructing sustainable trails is of paramount importance to maintaining the designed experience, health, and life span of the trail system. Many trail management problems, from erosion to user conflict, stem from poor trail planning and design. A poorly designed trail, no matter how well it is built, will almost always degrade and cause problems for managers and trail users. All trail users affect the trail surface and surrounding environment, especially when trails are poorly planned and constructed. Those impacts range from vegetation loss to erosion, water quality problems, and disruption of wildlife.

The increase of knowledge and understanding of the inner workings of the natural environment and how trail activities impact and interact with local site conditions, has reshaped how the Division approaches trail planning/design, development, and maintenance. It has been the accumulation of this knowledge that has lead to a broader and more in-depth approach to the planning process.

The basic principles of sustainable trails include the following: maximize natural and cultural resource protection; support current and future use; no adverse affects on plant or animal life in

the area; require little future rerouting and long-term or reoccurring maintenance; and reduce staff time and funds spent on trail maintenance. Adopting these principles ensures a more accessible and sustainable trail system for the future.

Designing a sustainable trail and trail systems requires the analysis and evaluation of the following elements and factors: cultural resources; endangered or sensitive plant and animal species; occurrence and health of native plants and animals; mature growth forests; natural drainage; topography, slope and grade changes; ease of access from control points such as trailheads; user safety; and providing interesting experiences within the landscape. A sustainable trail and system will offer trail users landscape and experiential variety.

All of the current research suggests that the most effective way to minimize the environmental effects of trail uses is to build environmentally sustainable trails. A sustainable trail balances many elements including location, expected trail use, construction methods, grade changes and employing quality construction techniques and material.

Maintaining trails to be sustainable will mean that park operations may need to be conducted differently than had been in the past. ATVs or gators replace trucks to access trails or small mowers replace large tractors with brush mowers. Park volunteers are enlisted in Trail Patrols to educate visitors and help pick up small branches and other debris. Volunteers also help out by reporting downed tree locations or other unsafe trail conditions or maintenance situations that must be carried out by park staff.

Appendix D: Statewide Trail System Overview

Within Delaware State Parks, there are 151 miles of trail that serve hikers, walkers, runners, mountain bikers, bicyclists, equestrians, and snowmobile users. Of this total, 61 trail miles are designated pedestrian only; this represents 39% of the total trail miles. Ninety trail miles is shared-use for non-motorized trail uses - pedestrian, mountain biking and equestrian – representing 61% of the total trail miles in Delaware State Parks. Two standards have been adopted for trail widths: single track (36”) and double track (36” +). Below are summaries defining the State Park trail system.

Trail Summary by County (miles and % of total)

New Castle	98	(65%)
Kent	9	(6%)
Sussex	44	(29%)
Total	151	miles

Single Track Trails (miles)

New Castle	38
Kent	1.6
Sussex	9.4
Total	49

Double Track Trails (miles)

60
7.4
34.6
102

Appendix E: Trail Standards

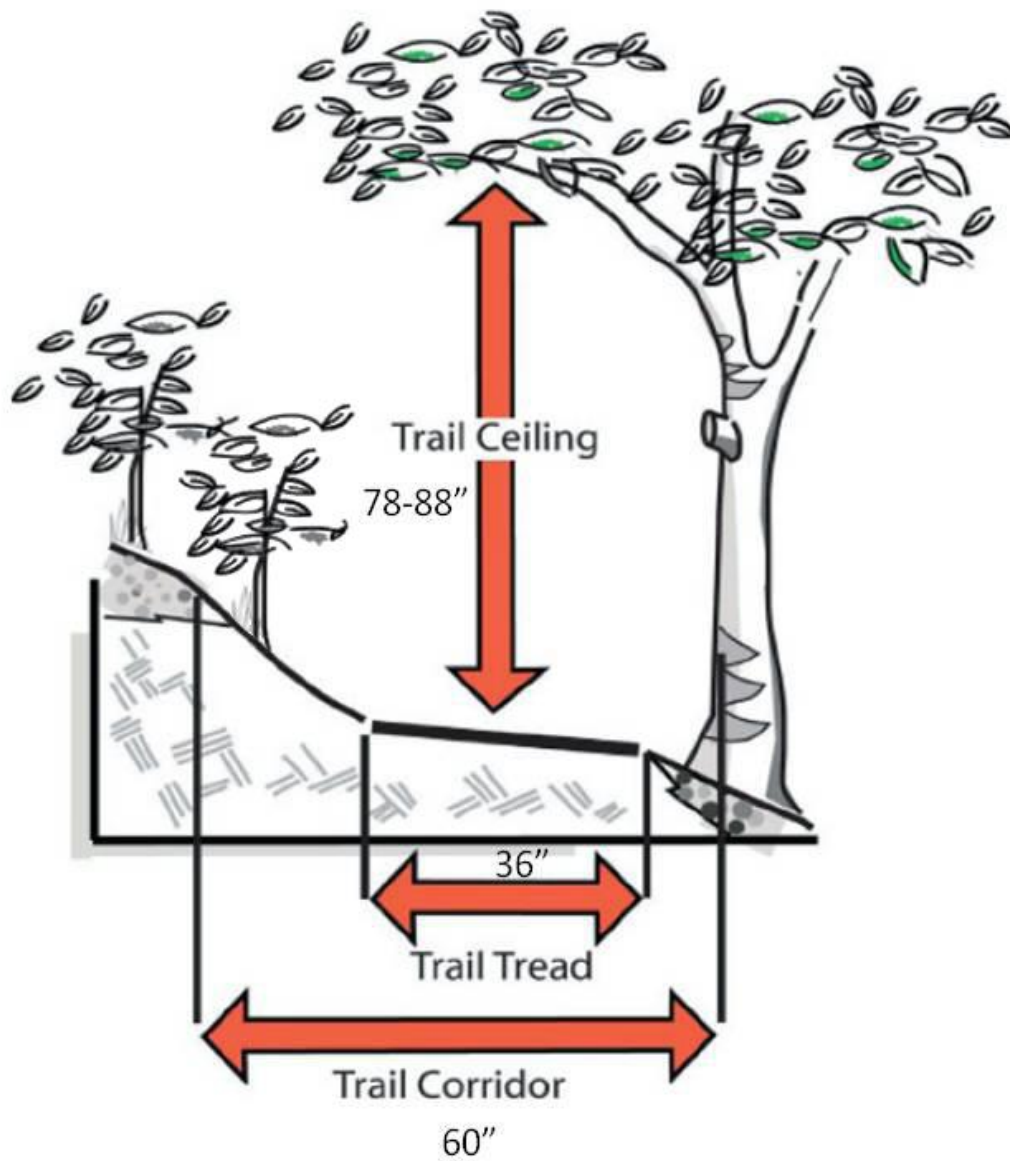
Trail standards comprise two main groups, trail characteristics and structures. Trails characteristics such as types, configurations, class, width, and surface, and grade are measurable values for a trail that will dictate use and experience, but also take into account environmental impact. Trail structures include information boards, bridges, design trail elements, signage, access, and parking. Delaware's State Park system hosts examples within each category.

Trail Configurations

Within any trail system there could be several types of trail configurations -loops, stacked loops, destination, connector, and "spine" trails. Loops are simple trails of various lengths that offer variety and have the advantage of returning the visitor to the beginning without repeating any section of trail. Stacked loops refer to a series of loops connected to each other. Stacked loops offer visitors multiple opportunities of experiences, distances, or difficulty with the convenience of parking at a single location.

Destination, connector and spine trails provide a means for visitors to travel to points of interest or connect to other trail systems, parks and even neighborhoods or cities. Unlike the loop system, one must travel back to the starting point using the same trail.

Trail Corridor



Selective Trimming Along Both Sides
Of Tread

Although trail widths may vary greatly, there are two basic categories- single track (36" tread) and double track (greater than 36"). Several factors – anticipated traffic volume; type of use; site conditions; experience desired; construction and maintenance costs; and environmental protection – are used to determine the optimal width of a trail. Trail widths in the park are classified as follows: 5.4 miles of single track and 12.5 miles of double track.

Trail Configuration

Trail type indicates the intended use, difficulty, or direction. Examples of trail type include the following: single use, shared use, one-way, open and flowing, and technical. Providing a diverse system of trail types ensures meeting the needs of the spectrum of trail users.

Trail Surfaces

There is a vast array of surfaces a trail user may encounter in the park. By far the most prevalent is compacted native soil, but crushed stone and asphalt is also present. Trail surfaces in the park are classified as follows: 15.7 miles of packed earth (native soil) and 2.2 miles of wooden boardwalk, stone or asphalt. In determining the appropriate trail surface type, the following factors are considered: type and volume of traffic; durability; experience; site conditions; construction and maintenance costs; and continuity. Soft surfaces are less sustainable than firm or hardened ones.

Trail Grade and Cross-Slope (maximum and average)

Grade and cross-slope are extremely important for drainage, sustainability, and accessibility. Trail grade is measured down the length of the trail and is the change in elevation between two points over a given distance measured in percent. Maximum grade is defined as the steepest section of trail and average grade is the steepness of trail over the entire length. As a general rule average grade should not exceed 8% and maximum grades should not exceed 15% over 10 feet.

Cross-slope, also measured in percent, is the change in elevation from the inside of the trail to the outside. The trail surface can be flat, in sloped, or out sloped. Tread grading that leaves the outside edge of the trail lower than the inside is considered out sloped. For best drainage the tread should be out sloped 3-7%.

Bridges

A new bridge design was first tested and installed in White Clay Creek State Park on the Chestnut Hill Trail of the Judge Morris Estate property. The need to standardize a bridge style was recognized in order to provide sustainability, continuity within the state park trail system, reduce design time and increase the ease at which structures could be built, repaired or replaced.

Sustainability is of highest priority when choosing building materials. Today, the primary materials used are pressure treated woods and galvanized fasteners. New products, such as fiberglass bridge structures, are starting to be used and as other new products are developed the use of those products may be incorporated to increase sustainability of new structures, reduce costs, and reduce construction time.



Typical Bridge
Detailed drawings available

Trail Signage and Maps

Signs provide trail users with various types of information and give land managers a means of communicating with park visitors. There are several types of signs including directional, regulatory, educational, and warning/safety. Trail and other park information are displayed on maps in information boards located throughout the park.

Trail markers, also detailed in Appendix B, should be placed at the trailhead and at intersections along the trail. Markers will include the following standard information: trail name, directional arrow, and direction to nearby park facilities (For example, a marker post may include the direction to restrooms or parking lot).

Interpretative Waysides – will be installed at key locations determined by CARS staff.

Maps and Information Boards

Maps of each park are developed and available in two formats. A smaller version sometimes referred to as a handout map, display park boundaries, roads, buildings such as nature centers, park offices, and restrooms, trails, camping and visitor services. These maps are available in park offices, nature centers and on-line. For the web version, go to:
<http://www.destateparks.com/downloads/maps/holts-landing/holts-landing-2009.pdf>
for the park's hand out maps in pdf format.

Larger format maps, displaying the same information as the smaller version, are placed throughout the park system at information boards. These maps show the park's regional location, include a park overview, and descriptions of major trails. Trails are depicted in different colors and these colors correspond to the colors used on the trail marking system. Information boards are constructed of cedar and they are not painted or stained which minimizes maintenance. They are installed at locations such as parking areas, day use areas, trail heads, campgrounds, nature centers, and park offices. They serve to provide the visitor with information such as maps, trails, nature programs, and rules.



Small Information board
Detailed drawings available



Large Information Board
Detailed drawings available

Trail Markers

A comprehensive trail marking system was first tested and installed in White Clay Creek State Park and at Killens Pond State Park. Round markers are embedded in 4x4 posts and provide specific information to inform and help direct trail users. A trail name marker color corresponds to lines on park maps representing trails. For example, the Swamp Forest Trail marker is yellow and is depicted on the map at the trailhead in yellow. Cross country markers are white posts with turn colors on the top portion. Blue indicates straight, red indicates left turns, and yellow indicates right turns. In addition to trail names, markers include directional arrows to aid navigation; designate permitted uses such as hiking or mountain biking or equestrian; destination place names; and direct trail users to visitor services and park facilities such as nature centers, parking, and information. Markers are installed at trail intersections.

Examples of Trail Marker Posts



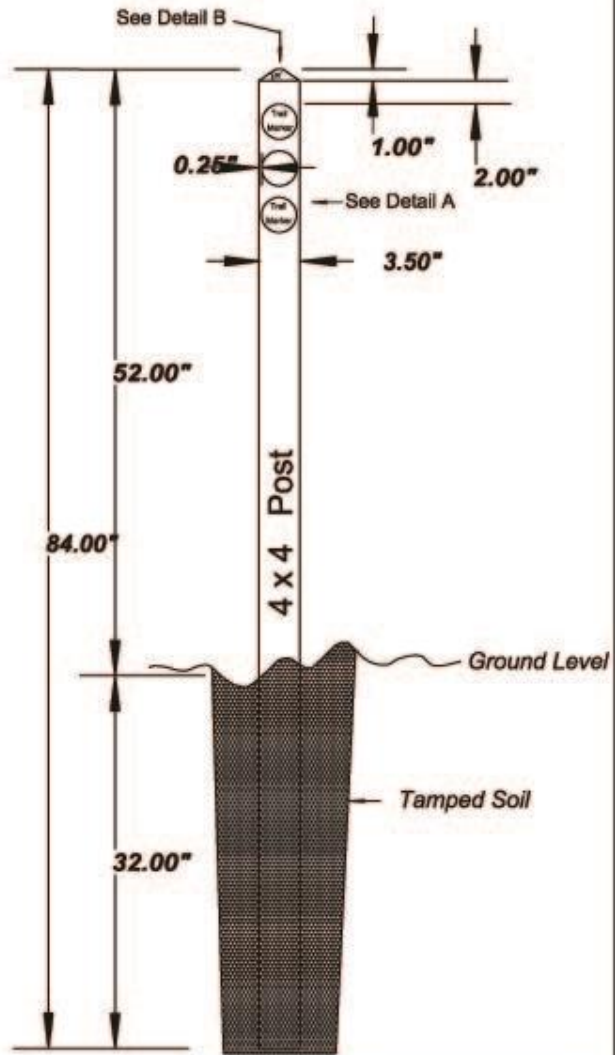
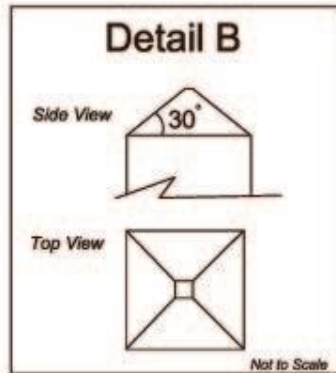
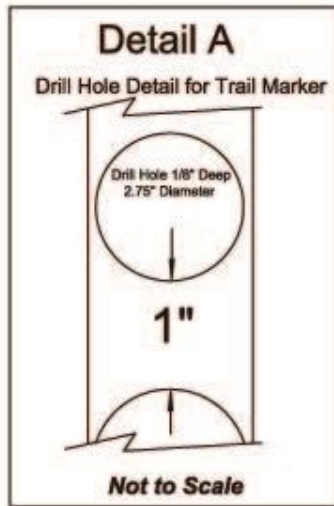
Trail Marker



Cross Country Marker

Trail Marker Post Detail

Marking Post Detail



Notes:

Posts

- * Use 14' pressure treated 4x4 posts cut into 2- 7' pieces
- * Place posts 2-2.5 feet from edge of trail tread
- * Dig hole slightly larger than post being used
- * Place extracted dirt temporarily in trail or on plastic sheet until needed as back fill for hole
- * Fit post, check for proper depth and alignment
- * Back fill using extracted dirt, tamping as you go
- * Top off the hole with mounded soil to accommodate settling and prevent water puddling around post

Markers

- * Center on post and drill 1/8" deep recess
- * Use 2.75" Forstner Bit to drill out recess
- * Markers must be flush to post surface and centered
- * Install trail markers in specified order according to icon type and site needs
- * Use construction adhesive to secure marker in drilled recess

Caution

- * Pressure Treated Wood is toxic.
- Use appropriate safeguards for your protection

Division of Parks and Recreation	Drawing By: David Bartoo	Scale: 1/4" = 1"	Date: Aug., 10, 2001	Plate 1 of
Project Number 2001-1	Trail Marking Post Standard	Revised:	Number 1	01

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Appendix F: User Conflicts

User conflict is a complicated issue. Conflicts result from both direct and indirect interactions between same and different user groups. Complaints can be broken out into three main categories: environmental; safety; and social.

Environmental complaints focus on the perception that one activity has more impact on the landscape than another. There is no question that hiking, mountain biking, and riding horses has an affect on the environment. Studies have shown that hiking and biking are on par with each other and are much less significant than impacts from equestrians (WI 2005 SCORP). On trails that host both hiking and biking, the greatest impact is not from the mode of travel but from trail design, construction, maintenance and use volumes. Trails open to equestrians see far more impact due to mode of travel. Four hooves supporting a heavy animal easily loosen and displace tread material that is more prone to erosion.

Safety complaints focus on the perception that one user group threatens the safety of another. There are real safety concerns when comparing modes of travel, speed differences, and the ability for people to recreate responsibly. Riding skittish untrained horses, riding a bike too fast, hiking or riding with headphones on, and failing to yield courteously to other users are all examples of poor choices that can lead to an undesirable interaction between users.

Social complaints focus on the perception that one user group has goals or values that do not match others. A perception that one group cares more about the environment or is seeking a different experience may raise tension between users.

There are a number of factors that can exacerbate conflict: poor trail design; trail use designation; and poor maintenance practices. However, the one factor that exacerbates conflict across all categories is user volume. Higher trail volume increases user interactions and can thus lead to conflict.

Eliminating conflict is impossible, but reducing or mitigating it is not. Regardless of perception versus reality, conflict exists on our trails. Good trail planning and design, educating the public and providing information, posting park regulations and trail etiquette, involving volunteers, and encouraging partnerships are all components that must be adequately addressed to mitigate existing and possible user conflict.

Appendix G: References

Clark, Cherie. (2007) *Holts Landing Boat Ramp*. Memorandum - Cultural & Recreational Services Section / Division of Parks & Recreation, DNREC.

Wise, Cara L. (1985) *Coastal Resources Management Plan for Four Seashore Parks and Other Coastal Properties*. Division of Parks & Recreation, DNREC.

Summary:

Protection of existing natural and cultural resources in state designated resource areas is of primary concern. Lands in Holts Landing State Park fall into two major categories, active and passive recreation. Lands that fall within the active areas should continue to take the brunt of recreational impact. Lands that fall within the passive areas should be protected to the fullest with no additional infrastructure added.

In response to an internal assessment of the state of the trails at Holts Landing a list of action items have been established that will improve upon the existing infrastructure.

Action items that will provide safer access into the park:

- Speeds reduced along Holts Landing Road for increased safety
- Crosswalks added where proposed loop trail crosses Holts Landing Road
- Share-the-Road and Trail User caution signs installed along Holts Landing Road

Action items that will provide safer, consistent trail access in the park:

- Upgrade all trails where needed
- Provide more information to visitors on trail designation and responsibilities using signs, trail marker posts, and information boards

Action items for long term protection:

- Monitor degraded areas for natural recovery
- Promote plant re-colonization
- Install barriers where needed
- Analyze access sites as they pertain to hunting in protected resource areas