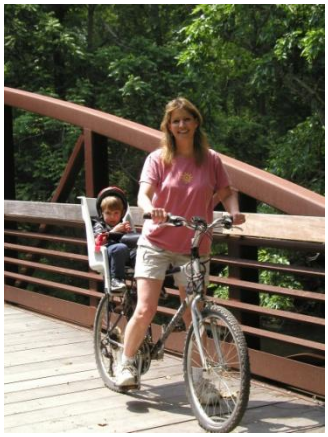
White Clay Creek State Park
Trail Plan



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Acknowledgements

The White Clay Creek State Park Trail Plan was guided and developed by the Division of Parks and Recreation's Trail Committee and through a broad public participation process. Existing trail conditions and natural and cultural resources were assessed. Recreation demand and trends were assessed and future trail-related recreation facilities were determined. Using information derived from the assessments, this trail design plan was developed identifying new trail alignments, reroutes, and that has achieve social, natural and cultural sustainability. As this Trail Plan was developed, it was done so to reduce impacts to natural and cultural resources, to reduce trail maintenance costs, to reduce staff time performing maintenance, and to continue best practices to attain a sustainable trail network.

Division of Parks personnel with expertise in park management and operations, administration, enforcement, programming, environmental education, natural and cultural resource stewardship, trail construction, and planning lead the development of the White Clay Creek State Park Trail Plan. The following staff participated in planning process: Charles Salkin, Matthew Chesser, David Bartoo, Ray Bivens, Scott Carrow, Cherie Clark, Gary Focht, Nick McFadden, Angel Burns, Thomas Kneavel, Mike Krumrine, Rob Line, Chris Bennett, Don Long, Susan Moerschel, Paul Nicholson, Becky Webb, Bob Ehemann, Rich Phifer, and Kendall Sommers. Thanks also to Marco Boyce, Anthony Aglio, and Tom Meyer from DelDOT.

In the Spring and Summer of 2010, meetings were held with stakeholder organizations for the purpose of presenting an early version of the proposed Trail Plan. Meetings were held with the following groups: Park and Recreation Council; Council on Greenways and Trails; Wilmington Trail Club Board; an alliance of running clubs that include the Pike Creek Running Club and Trail Dawgs; Delaware Trail Spinners; Newark Bicycle Council; Bi-State Preserve Council; Equine Council Trail Committee; and the Friends of White Clay Creek State Park Executive Committee and Advisory Board. Input from these groups was valuable in shaping a second draft Trail Plan.

Additional input to the first draft Trail Plan was received from organizations and businesses with whom the Division did not meet. Those groups are: Bikeline; Brandywine Cyclery; DE Audubon Society; DE Ornithological Society; Delaware Nature Society; Eastern Mountain Sports; First State Velo Sports; Garrison's Cyclery; Henry's Bikes; International Mountain Biking Association; Senator David Sokola; The Bicycle Boutique; White Clay Bicycle Club; and Wooden Wheels. Their input was considered and helped shape the Trail Plan's second draft.

Other discussions or meetings were held with staff from Pennsylvania Department of Conservation and Natural Resources; Charles Emerson, Director, Newark Department of Parks & Recreation; Jonathan Husband, Engineering & Environmental Services Manager, New Castle County; Heather Dunigan, Principal Planner; and Bill Swiatek, , Principal Planner at WILMAPCO. Valuable input to the proposed Trail Plan was received as a result of these discussions.

In February 2011, two public open house workshops were held at Deerfield in Newark to present the draft Trail Plan for White Clay Creek State Park. 142 people attended the workshops. 550 comments were received by the Division regarding the proposed Trail Plan. Public comments are summarized in Appendix F . Public input and a final analysis and review shaped the Trail Plan presented in this document.

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 the analysis and assessment, connections to existing facilities, level of use, type of trail use, and impacts of the existing trail network on natural and cultural resources were identified. Recreational opportunity demand and need information were evaluated. Analyses and recommendations outlined in this planned trail system plan for White Clay Creek State Park are based on the principles of sustainable trail design and development. Trail sustainability is the location of any given trail segment and how it relates directly to contours, drainage, and soil types and how well that trail segment withstands the impacts of weather and recreational impacts over time. The better a trail segment withstands these impacts, the more sustainable it is.

Today's trail planning, design and construction has a strong knowledge-based foundation. Data and information, subject matter experts and trail users are part of the knowledge base. Previous generations of trail designers/builders did not have Global Positioning System equipment, aerial photography, digital data, automated counters and other tools that consequently result in better planning and design. Up to date methods of gleaning public outdoor recreation demand and trend data attain better results, and more reliable and informative data. Findings from the State Comprehensive Outdoor Recreation Plan and nationwide recreational analyses are consulted in planning for recreation opportunity investments. Population and health data are valuable tools when recommending outdoor recreation systems.

Designing and constructing sustainable trails is paramount to protecting natural and cultural resources, providing great trail experiences, providing diverse recreational opportunities and maintaining life span of trail systems. Many trail management problems, from erosion to user conflict, stem from poor trail planning, design, and construction. Ignoring present day best management trail design and construction practices results in accelerated trail degradation, degradation that can have a profound effect on maintenance activities and impact trail use. 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-mitigating these impacts is of highest priority.

The basic principles of sustainable trails include the following objectives: maximize natural and cultural resource protection; support current and future uses; have no adverse effects or reduced impacts on plant or animal life in the area; and alignments are arranged to minimize or eliminate reoccurring maintenance costs (staff time, materials, contractual services and volunteer labor). The Division of Parks and Recreation has adopted the principles of sustainable trail design and construction to ensure that trails remain accessible to users, valuable resources are protected, and future maintenance costs are minimized.

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; characteristics of trail users; and providing interesting experiences within the landscape.

Trails constructed over the past ten years in Delaware State Parks were planned according to sustainability objectives. Current practices adopted by the Division have proven that this planning method is very effective in minimizing environmental effects of trail. Trail building in Judge Morris, for example, was the initial "testing ground" for sustainable trail planning followed by new, state of the art trail construction techniques. Today, trails in Judge Morris are mostly maintenance free except for trimming trail-side vegetation. Trails constructed in 2000 have required little, if any maintenance to their treads.

The objectives for all State Park trail plans, specifically the trail system for White Clay Creek State Park include 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 reduces habitat fragmentation;
- Recommend a system that will support robust environmental education opportunities;
- Recommend a system that supports pedestrian, biking, and equestrian activities;
- Recommend a system that considers existing and future recreational trends;
- Recommend a system that integrates the park's trail system as part of wider regional network of existing and future trail opportunities and makes community connections;
- Recommend a system that considers and is adaptable to future land conservation measures;
- 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 a trail system that includes a diverse recreational appeal;
- Recommend a trail system that has a visual environmental quality;
- Recommend a trail system that includes opportunities to enjoy a great diversity of physical settings;
- Recommend a trail system that provides visitors with a dynamic mix of interesting experiences that range from easy to challenging;
- Recommend a trail system that is safe; and
- Recommend a system that considers the existing high school cross country running program.

Social and economic components are intrinsically linked to outdoor recreation activities. Healthy lifestyles and livable communities are two major national initiatives that have roles in recreational planning decision making. Walkability and bikeability play a role in how trails are planned and constructed. As outlined in trail plan objectives, creating diverse opportunities for more people and connecting trails to people is critical in helping to turn around the trend of declining number of kids, and adults who participate in outdoor recreation and help mitigate obesity and other health issues.

Background & History

Within Delaware, the State Park trail system hosts 151 miles of trail that serve hikers, walkers, runners, mountain bikers, bicyclists, and equestrian users. Of this total, 61 trail miles are designated pedestrian only; this represents 40% of the total trail miles. Ninety trail miles are shared-use for non-motorized trail uses - pedestrian, 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. Table 1 below details trail miles and width by county across the state.

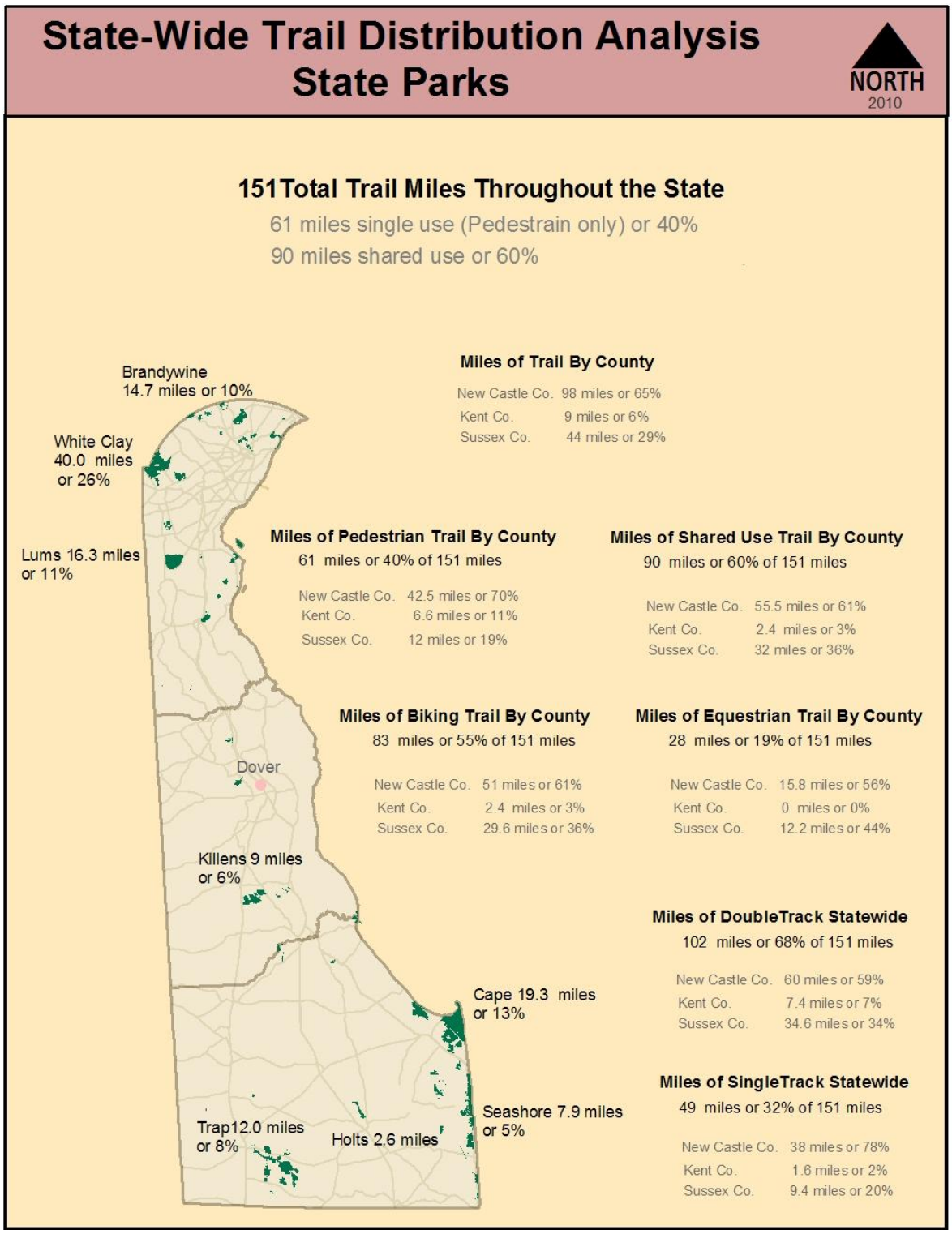
Table 1 - 2010 Delaware Trail Mileage and Width

County	2010 Mileage	2010 Single Track	2010 Double Track
Total Mileage	151	49	102
New Castle	98	38	60
Kent	9	1.6	7.4
Sussex	44	9.4	34.6

From a statewide context, White Clay Creek State Park plays an integral part from the perspective of a state network of trails. Delaware State Parks manages a network of over 150 miles trail and is part of a larger regional system exceeding more than 400 miles. White Clay Creek State Park ranks first for having more trail miles than any state park or other protected area in the state, and accounts for 26% of all Delaware State Park trails. This vital role is reflected in Figure 1.

Figure 1, Statewide Trail Distribution Analysis, provides an overview of trail miles by park with data of trail use types. Recommendations and decisions for Delaware State Park trail network are made in the context of focus areas, local, county and the entire State Park system.

Figure 1 – State Park Trail Distribution Analysis

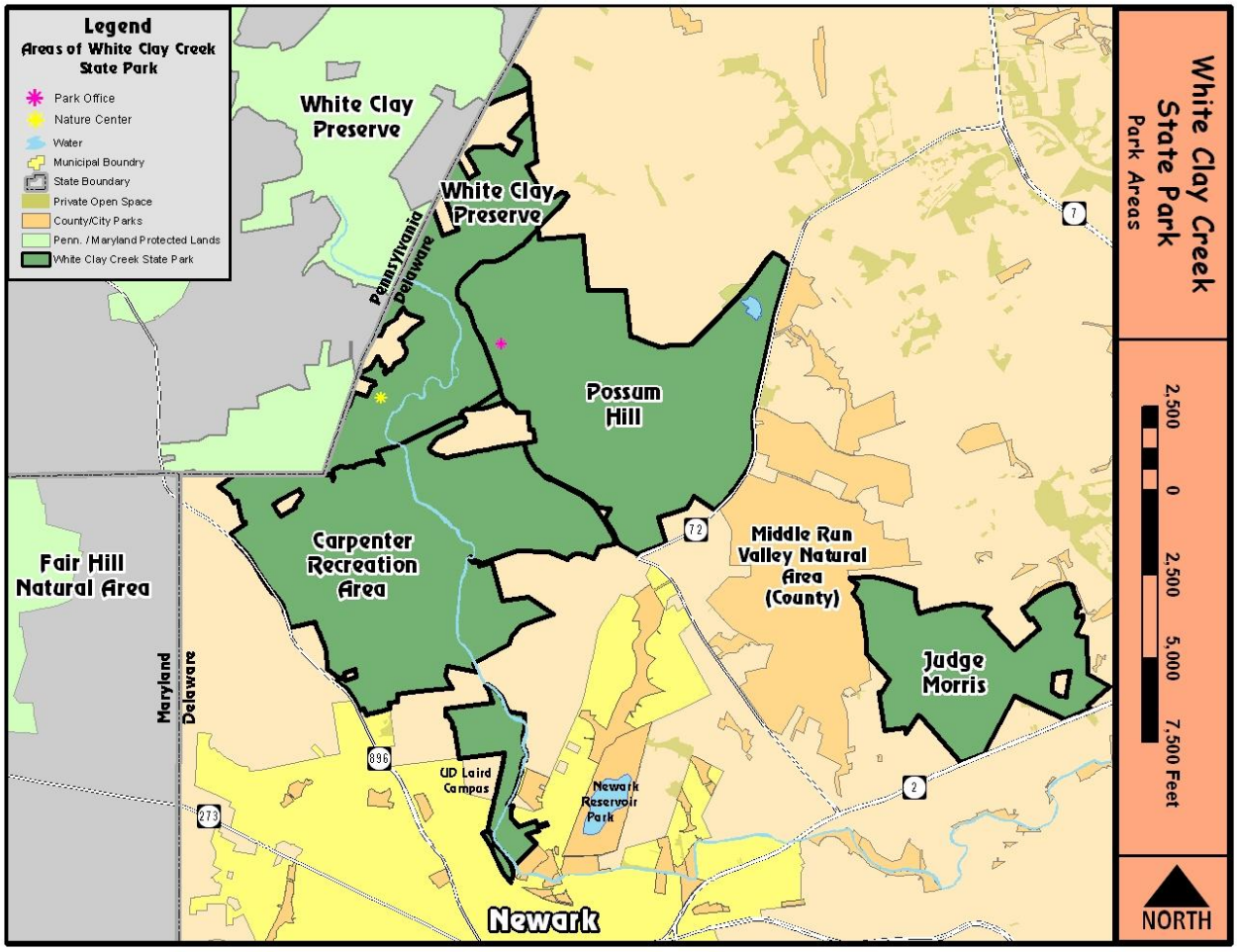


Trails in White Clay Creek State Park have been an integral part of the landscape since the park's opening in 1968. Yesterday's and today's trail system serve hikers, walkers, runners, bicyclists, and equestrian trail users. The original 24 acre parcel (located on Route 896, New London Road) that comprised the park has been enlarged across the White Clay Valley to now encompass 3,642 acres.

There are four units that comprise the park – Carpenter Recreation Area (1367 acres), White Clay Preserve (603 acres), Possum Hill (1144 acres) and Judge Morris Estate (527 acres). Each of these areas contains special landscape features, facilities and recreational opportunities. All units contain trails. Carpenter is characterized as an active day use area hosting a playground, picnic pavilion, a performance band stage, disc golf, picnic tables, cross country course, and trails. The other areas- White Clay Preserve, Possum Hill, and Judge Morris Estate- are characterized as passive day use areas providing trails for pedestrians, bikers, and equestrians.

White Clay Creek State Park and its management units are represented in Map 1.

Map 1 - White Clay Creek State Park Management Units



From 1968 to 1998 trails were created in various ways. Abandoned roads, farmer tracks, logging or woods roads, deer trails, and fisherman's paths were often features in lands acquired and added to the park. As new lands were acquired over the years the use of these types of corridors were adopted as recreational trails.

In the 1970s trail development was managed in concert with the Youth Conservation Corps Program. During this period many of the older trails at the park were constructed including the Loggers Trail and the Life Course Trail. Corridors of vegetation and earth were opened to create these trails; tree branches were laid at that time to define trail edges. After the addition of White Clay Preserve lands in 1984, pre-existing trails and old roads were designated as recreational trails. These included the Fisherman's Trail paralleling the creek and Cart Road, and were developed in part to connect to Pennsylvania trails. This practice of designating trails from what had once been woods roads and pre-existing trail-like features continued as the lands at Judge Morris and Possum Hill were added to the park.

The first trail markers were 4x4 posts. In the late 1980s and early 1990s, Carsonite® posts were adopted for trail wayfinding. Trails permitting pedestrian, horse and bicycles uses became known as multi-use trails and subsequently were constructed wider than preceding trails. During this period of trail development/management, trails grew to approximately ten (10) feet wide to accommodate both multiple trail uses and maintenance vehicles. Single-use trails, i.e. pedestrian/hiking trails, remained three to four feet wide.

The trail system has been subject to soil erosion and wet, muddy areas have developed, and trail degradation has become exacerbated by maintenance practices. Use of heavy equipment to maintain trails lead to accelerated rates of soil erosion, soil compaction and displacement, and most likely, the spread of invasive plant species. Though some of these problems can be attributed directly to maintenance activities, the majority of them are related to how and when the trail gets used, the trail alignment (fall-line trails for example) and how natural processes interact with the trail.

The first comprehensive trail data collection began in 1998 when all state park trail alignments were recorded using global positioning system (GPS) equipment. That data has proven to be invaluable in analyzing and assessing the park's infrastructure in relation to its resources. Today, the baseline trail alignment data can be evaluated with the existing trail system demonstrating that this plan's objectives have been partially implemented. In 1999 the trail system in White Clay Creek State Park started undergoing changes. A new model of trail design and building - now excepted as the global standard - focused on refining water management and has since been referred to as sustainable trail design. This new model has been pivotal in guiding trail realignments in the park, and ten years later has redefined the trail experience provided. Many of the trail changes focused on segments of trail flowing perpendicular to the contours (called fall-line trails). Utilizing the new model, trail planning has evolved from a focus on sub-region project area to viewing the trail system holistically. This holistic approach considers topography, natural and cultural resources, trail usage (quantity), trail use (types), access points, hydrology, and existing park facilities. Map 2 shows the trail system in 1998 – the baseline for today's trail analysis and assessment.

Regional Context

White Clay Creek State Park lies in the Piedmont physiographic region with its characteristic rolling hills and steep slopes. The landscape is a mix of open fields and forests which mirrors other protected landscapes locally. Over the past few decades, land uses surrounding White Clay Creek State Park have changed dramatically from agricultural to residential uses. The US Census shows the New Castle County population in 2010 to be 538,479, a 7.6% increase since the 2000 census. Population projections add another 51,097 residents- an additional 9% or an overall projected increase in population from 2000 of 17% by 2030. See http://stateplanning.delaware.gov/information/dpc_projections.shtml for additional information.

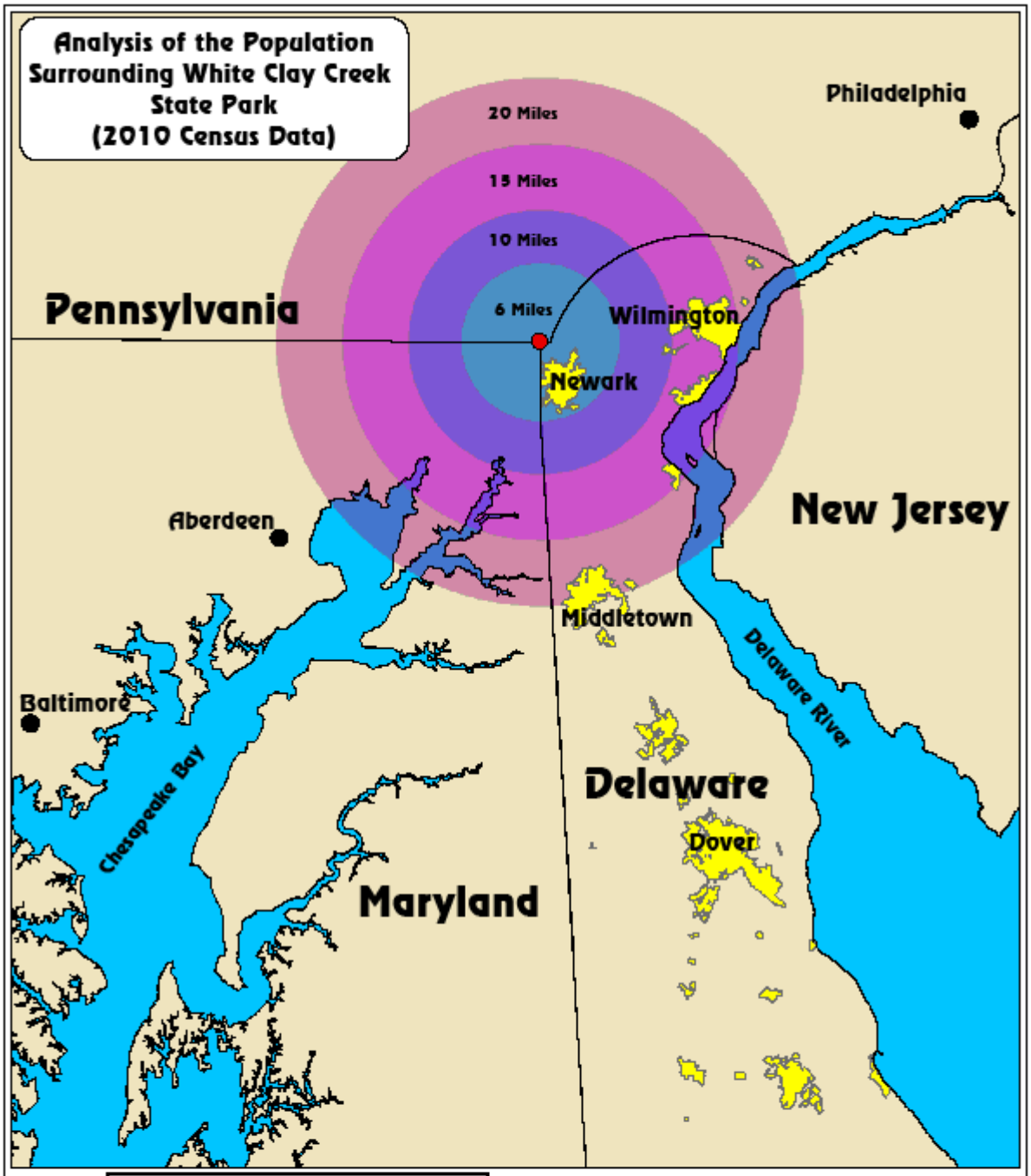
White Clay Creek State Park is situated within an easy drive of 830,000 residents in Delaware, Maryland, Pennsylvania and New Jersey. Using 2000 US Census data, Figure 2 shows the relationship of the White Clay Creek State Park to surrounding region and associated population. Concentric rings representing 6, 10, 15 and 20 mile distances graphically capture populace numbers.

The University of Delaware redevelopment plans for the former Chrysler automotive plant and restructuring of the Aberdeen Proving Grounds military base to develop a full spectrum of military research, testing and evaluation facilities will bring thousands of new employees to the region over the next five years. Net growth to Hartford and Cecil Counties (Maryland) will increase; New Castle County can expect to see community growth to accommodate personnel assigned to Aberdeen.

The park's proximity to other public lands, Newark's Main Street, the University of Delaware, White Clay Creek Preserve in Pennsylvania, and Fair Hill in Maryland present opportunities and challenges for trail planning, construction, and, ultimately for the trail user. Access into the 40 miles of trail in White Clay is available via eight parking areas dispersed throughout the park, nearby communities and New Castle County and City of Newark.

From a regional perspective, the park lies adjacent to County-owned Middle Run Valley Natural Area, the University of Delaware Laird Campus and the City of Newark. Within one-half mile of every park access point there are about 30,000 residents, not including the University of Delaware student population. And, within a 20 mile radius – that touches Delaware, Maryland, Pennsylvania and New Jersey – there are over 830,000 residents. Population location and characteristics are significant in determining future park facilities, including trails.

Figure 2 – Analysis of the Population Surrounding White Clay Creek State Park



State	Population 6 Miles	10 Miles	15 Miles	20 Miles
DE	97,207	249,908	432,039	518,123
MD	11,350	38,933	69,904	95,262
NJ	0	0	2,879	29,592
PA	16,934	61,706	103,129	275,044
Total	125,491	350,547	607,951	918,021

Regional Trail System

Trail facilities provide several critical links and are tied to a complex system recreationally, socially, and economically. The physical recreation link is between parklands and other community infrastructure and the ability to move people easily from one area to another both within and outside state park boundaries. The 3.5-mile long Tri-Valley Trail links Possum Hill, Middle Run Valley Natural Area and the Judge Morris Estate. Middle Run and Paper Mill Parks, both County recreational sites, are also linked.

Newark's planned southern segment of the Pomeroy Trail will be instrumental in establishing a regional trail linking the eastern portions of White Clay to the City of Newark and the Laird Campus. White Clay hosts the uppermost 1.5 miles of the Pomeroy Trail. Just over 1 mile (1.1 miles) of new trail will be constructed from Creek Road, south, crossing College and Cleveland Avenues, Main Street, and Delaware and Wyoming Avenues. This segment will intersect the James Hall Trail. Pomeroy Trail construction, with its link to the Laird Campus and White Clay State Park, is expected to begin in 2011.

The Mason-Dixon Trail, maintained by the Mason-Dixon Trail Club, is a 193 mile regional trail that connects the Appalachian Trail with the Brandywine Trail winding its way through Delaware, Maryland and Pennsylvania. The Mason-Dixon Trail starts at the Appalachian Trail at Whiskey Springs in Cumberland County, PA and heads east to the Susquehanna River. The trail then follows the west bank of the Susquehanna southward in Maryland, crosses the river and winds its way east into Delaware and Iron Hill Park. The trail follows the Christina River and White Clay Creek and through White Clay Creek State Park. The Mason-Dixon exits White Clay Creek State Park at the border with PA where it enters the White Clay Preserve. The trail continues northeast to its eastern terminus at Chadds Ford, Pennsylvania on the banks of the Brandywine River.

In the regional picture, Maryland's Fair Hill Natural Resource Management Area (over 5,600 acres) lies a few miles west of White Clay Creek State Park. Although a direct off-road connection does not exist between Delaware and Fair Hill, the state of Pennsylvania, Chester County, and other land protection organizations are actively seeking a direct public connection between Pennsylvania public lands and Fair Hill.

Public Demand for Trail Opportunities

Trail related activities are the number one outdoor recreation pursuits in Delaware. These findings are documented in the 2009-2011 Statewide Comprehensive Outdoor Recreation Plan (SCORP), a statewide plan that outlines both the demand and need for outdoor recreation facilities. The Plan recommends facilities that will fulfill gaps in outdoor recreation opportunities. (See http://www.dnrec.delaware.gov/parks/Information/Documents/2009-2011_SCORP.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 are the foundation of the 2009-2011 update of the Statewide Comprehensive Outdoor Recreation Plan (SCORP).

For purposes of planning and projecting outdoor recreational facility needs, the State was divided into five SCORP Planning Regions for reporting results taken during the public participation phase of the Plan's development.

White Clay Creek State Park falls within Region 1. Updated SCORP research of 402 Delaware households within Region 1 found that 86% of telephone survey respondents expected a member of their household to participate in walking or jogging; 60% participate in bicycling; 51% in hiking; 21% in mountain biking; and 18% 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 in this region.

Outdoor recreation facility needs are prioritized based on research and findings from the public opinion survey. A common thread in all SCORP Planning 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. Results from the 2008 public opinion telephone survey indicate facility needs in Region 1 for walking/jogging, biking, and hiking continue to be a high priority. Furthermore, 75% or respondents living in Region 1 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) to be close to nature, and 4) for relaxation.

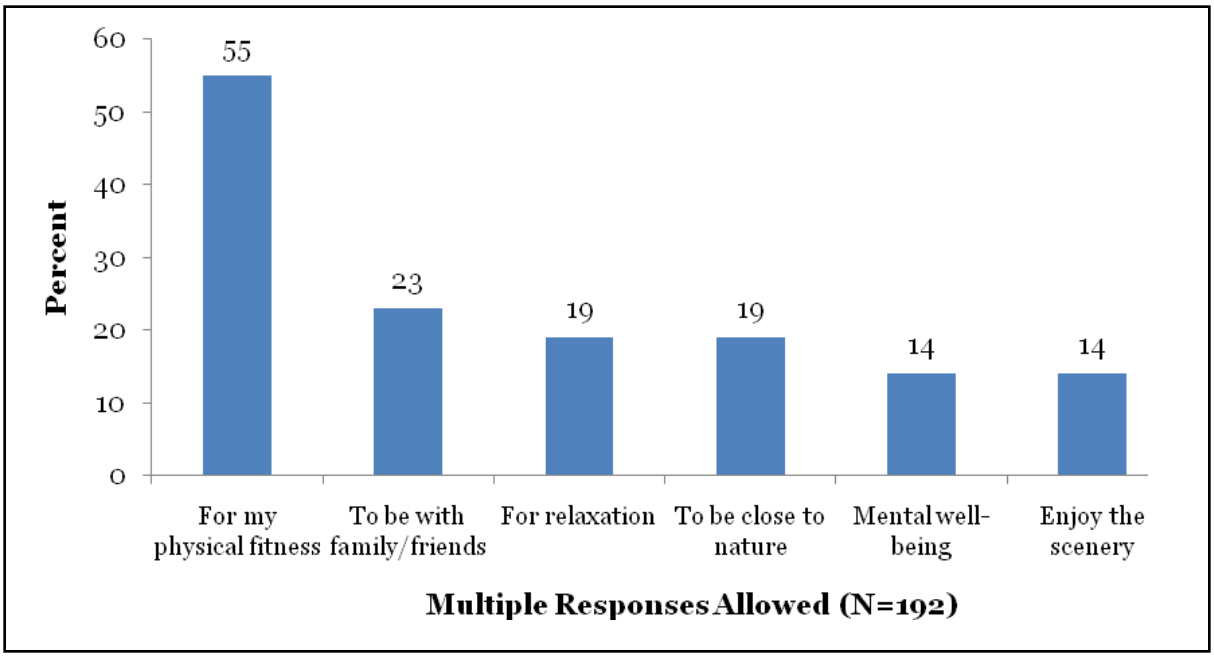
In addition to the SCORP, the Division has done two recent trail surveys and the Outdoor Foundation* has released their 2010 Outdoor Recreation Participation Report. Findings suggest a continued disturbing trend of lower participation rates among many groups. Specifically, this study continues to track an overall downward slide in outdoor recreation among 6 to 12 year olds. While the drop wasn't as significant as seen in past years, 62 percent of that group participated in some form of outdoor recreation in 2009 compared to 64 percent in 2008 and 78 percent in 2006. Also of major note is that out of 48.9 percent of Americans that do participate in outdoor recreation, only 22 percent get out two times or more a week.

*The Outdoor Foundation is a non-profit established to inspire and grow future generations of outdoor enthusiasts. It measured outdoor activities include: adventure racing, backpacking, bicycling (BMX), bicycling (mountain/non-paved surface), bicycling (road/paved surface), bird watching, boardsailing/windsurfing, car or backyard camping, RV camping, canoeing, climbing (sport/indoor/boulder), climbing (traditional/ice/mountaineering), fly fishing, freshwater fishing, saltwater fishing, hiking, hunting (rifle), hunting (shotgun), hunting (handgun), hunting (bow), kayaking (recreational), kayaking (sea/touring), kayaking (white water), rafting, running/jogging, sailing, scuba diving, skateboarding, skiing (alpine/downhill), skiing (cross-country), snorkeling, snowboarding, snowshoeing, surfing, telemarking (downhill), trail running, triathlon (non-traditional/off road), triathlon (traditional/road), wakeboarding and wildlife viewing.

City of Newark Outdoor Recreation Demand

Locally, a majority of Newark residents (91%) responding to an outdoor recreation and trends survey indicate that outdoor recreation is 'very' or 'somewhat' important to them personally. Figure 3 illustrates their motivations for participating in outdoor recreation activities, with 55% of respondents citing for physical fitness as the most important reason. Survey respondents chose to visit a particular outdoor recreation facility based on living nearby (59%), the existence of facilities for activities of interest (39%), aesthetics (12%), and the existence of facilities for children (9%), cleanliness (9%) and safety (5%).

Figure 3 - Newark Residents' Most Important Reasons for Participating in Outdoor Recreation



Additionally, Table 2 shows the facilities most commonly cited by respondents as desired additions to parks in the City of Newark.

Table 2 - Facilities Newark Residents Would Like to See Added to Parks

Facility (Multiple Responses Allowed, N=80)	Percent
More cleaner, better bathrooms	16
Playgrounds for kids ages 2-5	10
Playgrounds for kids ages 6-12	10
Outdoor basketball courts	10
Hiking/walking trails	9
Biking paths	9
Indoor recreation facilities	9
Public tennis courts	9
Baseball fields	8
Paved walkways	6

Access to Recreation Opportunities in the City of Newark

Ninety percent of survey respondents "strongly" or "moderately" agree that there are parks and outdoor recreation areas in or near their neighborhoods that are easy to get to. Proximity is important because many Newark residents (54%) said that more recreation opportunities close to home are likely to encourage them to participate more actively in outdoor recreation activities. Other important factors for encouraging Newark residents to participate in outdoor recreation activities include: more information about facilities and opportunities (45%); more opportunity to participate in organized activities (38%); and better security within facilities (34%).

1998 Trail System Overview, Analysis & Assessment

In 1998 a first-ever comprehensive inventory of the trail system was undertaken. Information gathered consisted of trail location, width, surface, designated use, and condition. In addition to being the first-ever trail system assessment it was the first time GPS technology was used by Delaware State Parks to gather information about park infrastructure. The GPS technology allowed for very accurate line and point data locations and also paved the way for an easy systematic approach to collect and describe the various trail characteristics. It enabled the Division to compare/evaluate current trail conditions to sustainability objectives.

In 1998, there were 40.0 miles of trail in White Clay Creek State Park - including the cross country course (refer to Table 3 and Map 2). At that time, only 8.7 miles (23%) were sustainable by today's acceptable planning/assessment standards. 19.8 miles are designated as pedestrian-only, 19.1 miles are shared-use for pedestrians and bikers, and 1.1 miles of shared-use on Creek Road are designated for equestrians, pedestrians and bikers. All 1998 trail conditions are depicted in Maps 2 through 6.

Table 3 below shows a full breakdown of all trail characteristic categories, including environmental sustainability, surfaces, widths, and permitted uses. Map 2 shows the trail system as it was in 1998. Red lines on Map 3 indicate the trail segments that were not sustainable. Only short segments of contour trail were in place in Judge Morris, White Clay Preserve and Possum Hill. The remaining 77% of trails were not sustainable.

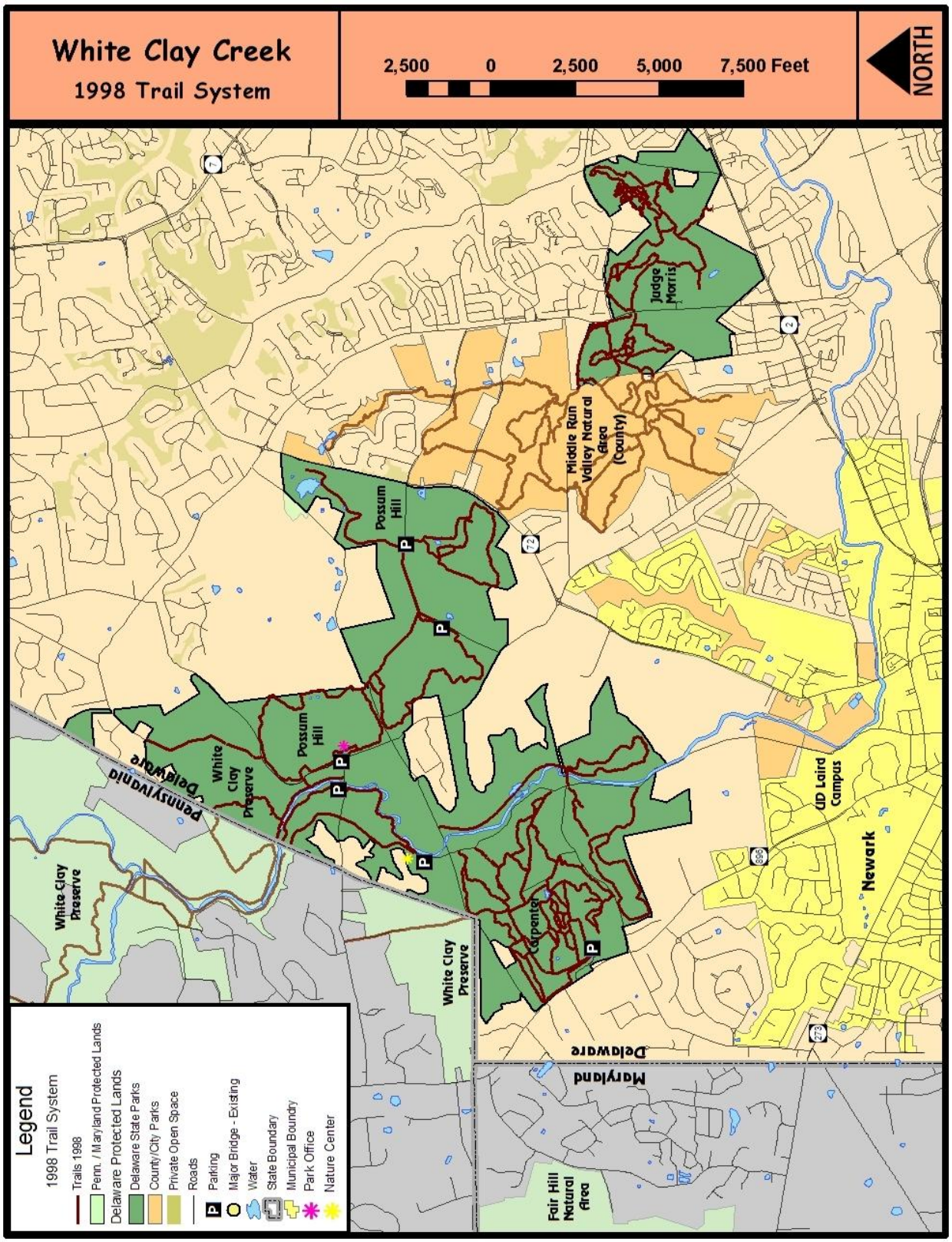
Table 3 -1998 Trail Characteristics

Trail Characteristics	1998 Trail Mileage	Percentage of System
Total Mileage	40.0	100%
Sustainability		
Fall-line	28.7	71%
Contour	8.7	22%
Agricultural Fields	0	0
Flat/Poor Draining	0.7	2%
Flood Plain	1.9	5%
Surface		
Natural	29.0	72%
Hardened	11.0	28%
Width		
Single Track	19.2	48%
Double Track	20.8	52%
Permitted Use		
Pedestrian	19.8	50%
Pedestrian /Bike	19.1	48%
Pedestrian /Bike/Equine	1.1	2%

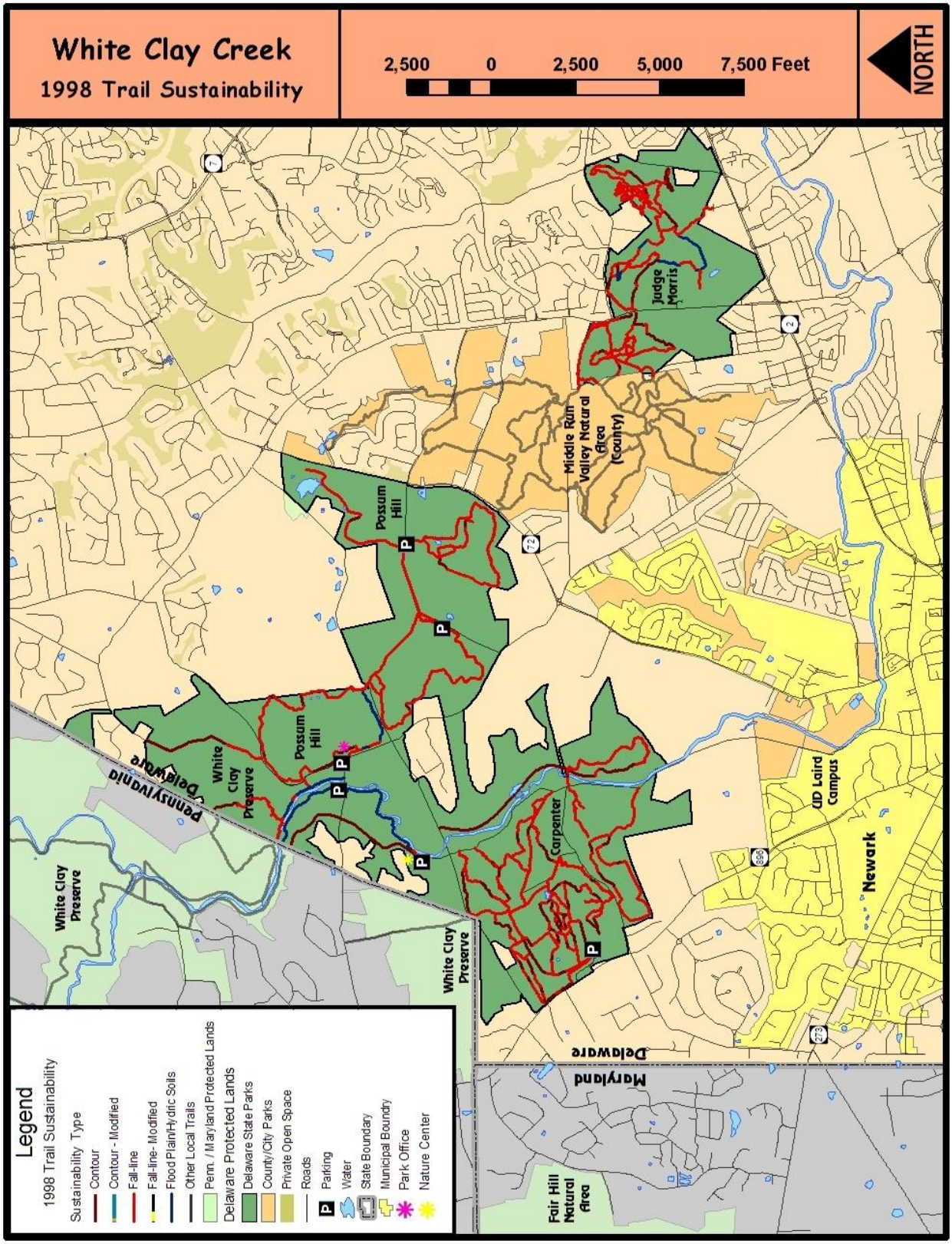
In 1998, permitted trail uses varied. Carpenter held predominately pedestrian only trails, though a loop existed for shared trail uses that included equestrian riding. When Judge Morris was acquired, along with it came many miles of trail created by area residents and users. Hikers, runners and mountain bikers all shared the trails at this site. Possum Hill contained many old woods roads that became single use, pedestrian only, and shared use trails. The White Clay Preserve hosted both shared use and single use trails. Map 4 shows the trail uses throughout the park.

What today is characterized as double track trail (trail corridors greater than 36 inches wide), were county roads, farm lanes/roads, cart roads, former rail corridors and old woods roads that looped through forests and along agricultural fields or paralleled the creek. Map 5 shows the layout of both double track and single track (less than 36 inches wide) trails. Trails that were once the roads described above tended to be hardened by gravel. In 1998, 11 miles of trail had a hardened surface- see Map 6 for the location of hardened and natural earth trails.

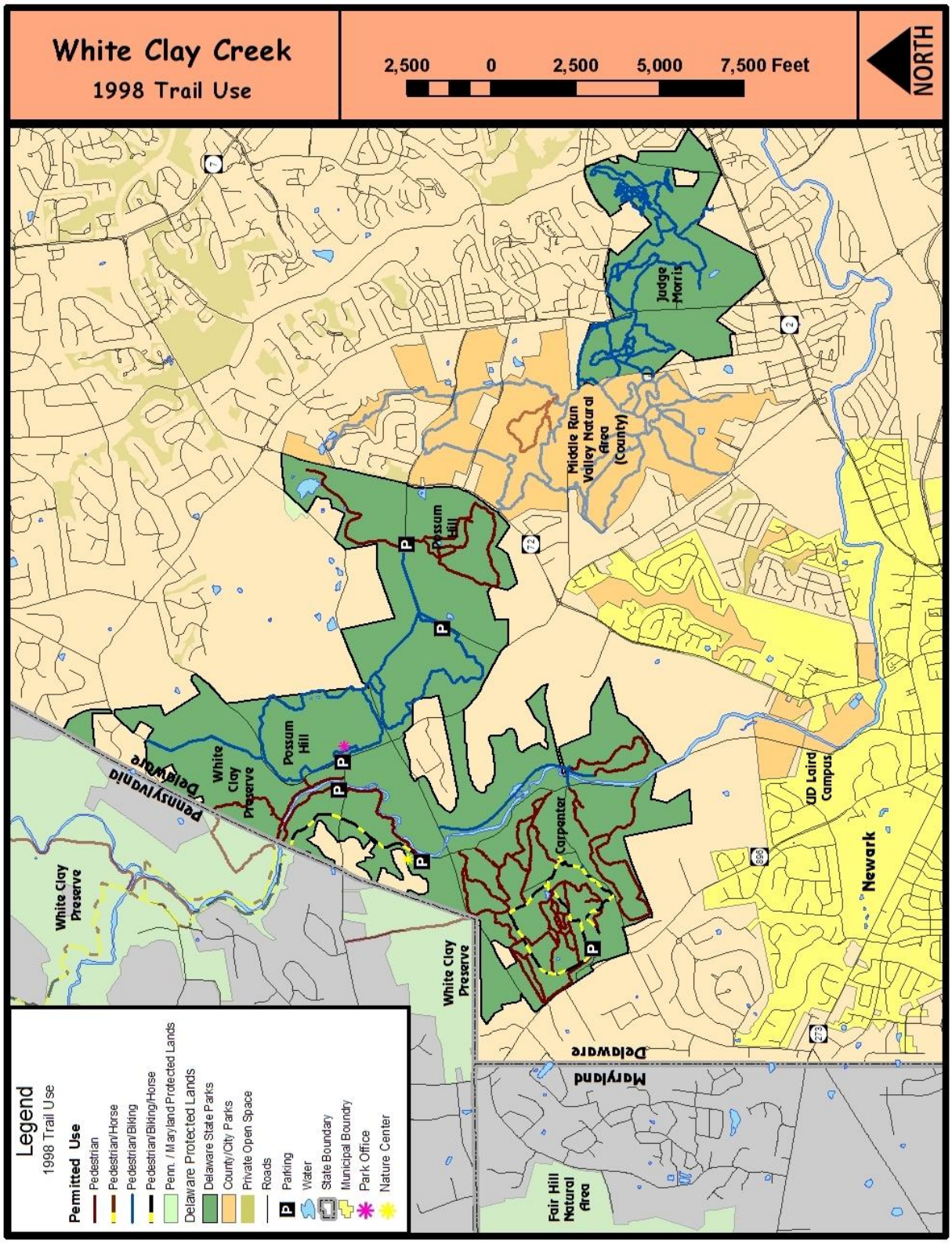
Map 2 - 1998 Trail System



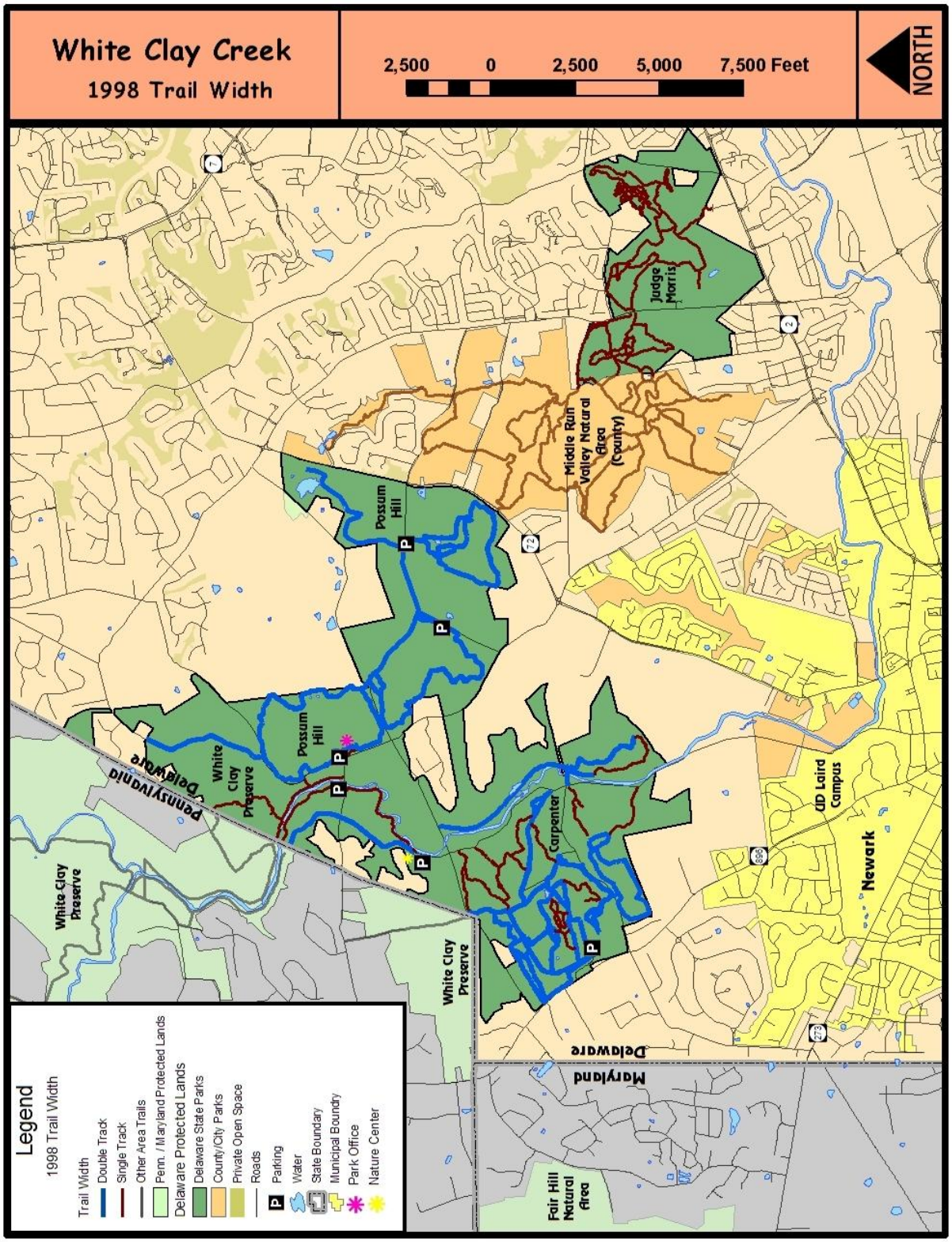
Map 3 - 1998 Trail System Sustainability Analysis



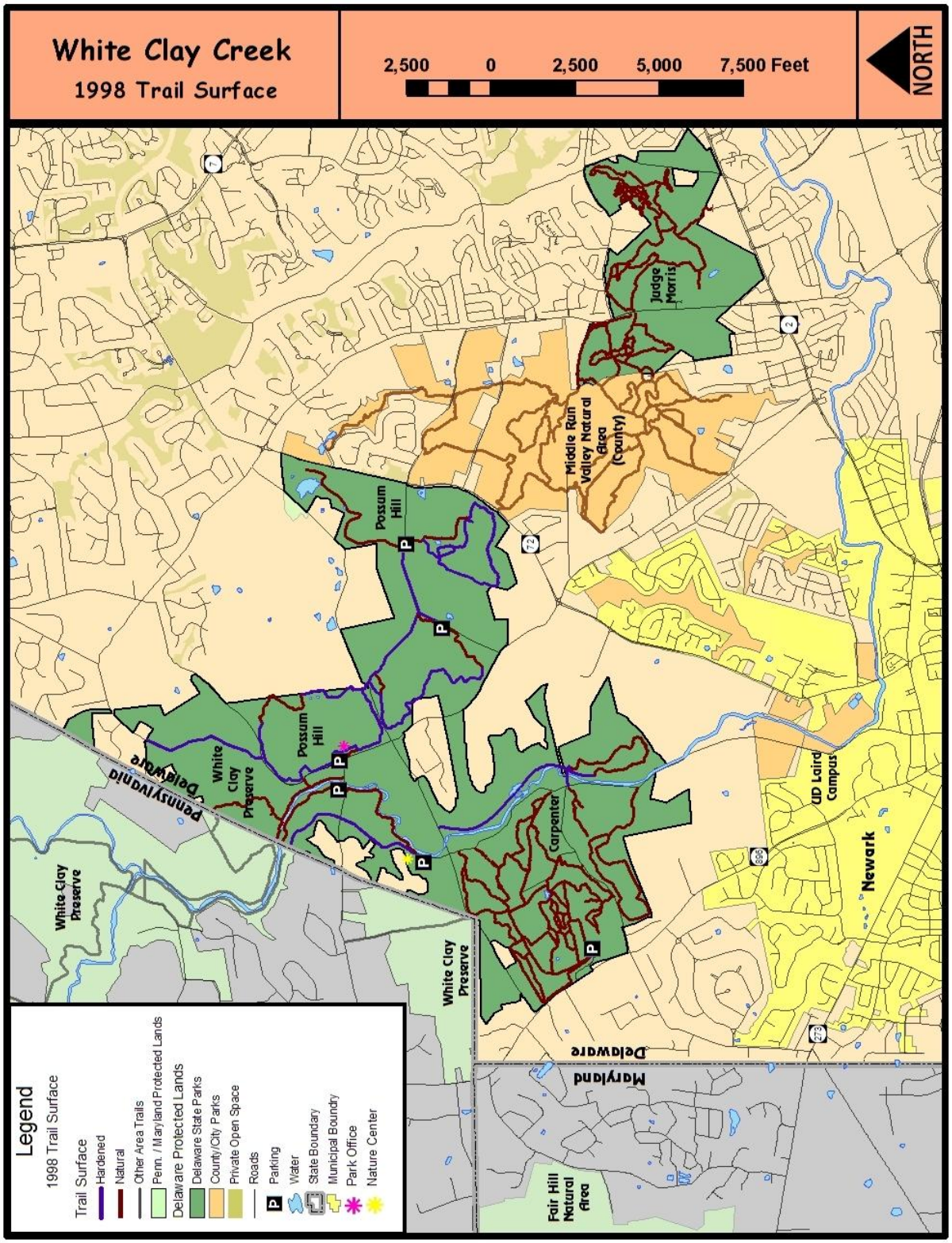
Map 4 - 1998 Trail Uses



Map 5 - 1998 Trail Width



Map 6 - 1998 Trail Surfaces



2010 Trail System Overview, Analysis & Assessment

Today, the trail network at White Clay Creek State Park is comprised of 40 miles of trail that serve hikers, walkers, runners, mountain bikers, bicyclists, equestrians, and other non-motorized trail users. There were 40 trail miles in 1998 and 40 miles in the current system, yet new trail construction and realignment has occurred in the Park. Inherited trails that came with the Judge Morris Estate totaled 9.1 miles; today mileage there total is 6.5 miles. Unsustainable trails were closed; new alignments on contour comprise that network today. While trail miles were reduced in the Judge Morris system, Possum Hill and Preserve trail mileage grew. Although total trail mileage has not changed in over a decade, the location of trail segments on contours, trail character (surfaces and width), and permitted uses have transformed trail user experiences.

Trail Descriptions and Existing Conditions

White Clay Creek State Park contains 40 miles of trails including the cross country course. This represents 26% of all miles in the State Park trail system combined, the highest mileage in any state park (see Figure 1). Of those 40 trail miles in White Clay, 14.8 are designated as pedestrian-only, 24.3 miles are shared-use for pedestrians and bikers, and 1.1 miles of shared-use on Creek Road are designated for equestrians, pedestrians and bikers. Of the 40 trail miles, 20.9 miles (52%) are sustainable by today's standards. By comparison, only 23% were sustainable in 1998. Table 4 below shows a full breakdown in miles of trail characteristic categories - sustainability, surface, widths, and permitted uses – the percent that each characteristic represents in the trail system assessed in 2010. All existing conditions are depicted in Maps 7 through 11.

Table 4 - 2010 Trail Characteristics

Trail Characteristics	2010 Trail Mileage	Percentage of System
Total Mileage	40.0	100%
Sustainability		
Fall-line	16.7	42
Contour	20.9	52
Agricultural Fields	0.5	1
Flat/Poor Draining	0.4	1
Flood Plain	1.5	4
Surface		
Natural	34.8	87
Hardened	5.2	13
Width		
Single Track	23.7	59
Double Track	16.3	41
Permitted Use		
Pedestrian	14.8	37
Pedestrian /Bike	24.3	61
Pedestrian/ Bike/Equestrian	0.9	2

Due to its location in the Piedmont physiographic region, White Clay Creek State Park offers trail users an array of recreational opportunities and unique, protected landscapes in which to spend active recreation time close to nature, and so close to home. White Clay contains a unique array of rolling, hilly terrain and well-drained soils that compact well, are impact resistant, and excel in draining quickly shedding water. These characteristics, in addition to a vast protected landscape, are an enormous benefit to outdoor enthusiasts.

Map 7 shows the trail system in 2010. Red lines on Map 8 indicate the trail segments that are not environmentally sustainable. While significant improvements have resulted in greater levels of sustainability, just over half (52%) of trail miles are sustainable; the remaining 48% need improvement to reach sustainable objectives. The highest concentration of unsustainable trail miles is in the Carpenter Recreation Area where there has been little trail realignment work. Created in 1999, Delaware State Parks, Trail Crew, with assistance from volunteers, have completed all trail reconstruction projects. The recently completed segment of the Pomeroy Trail was completed under contract.

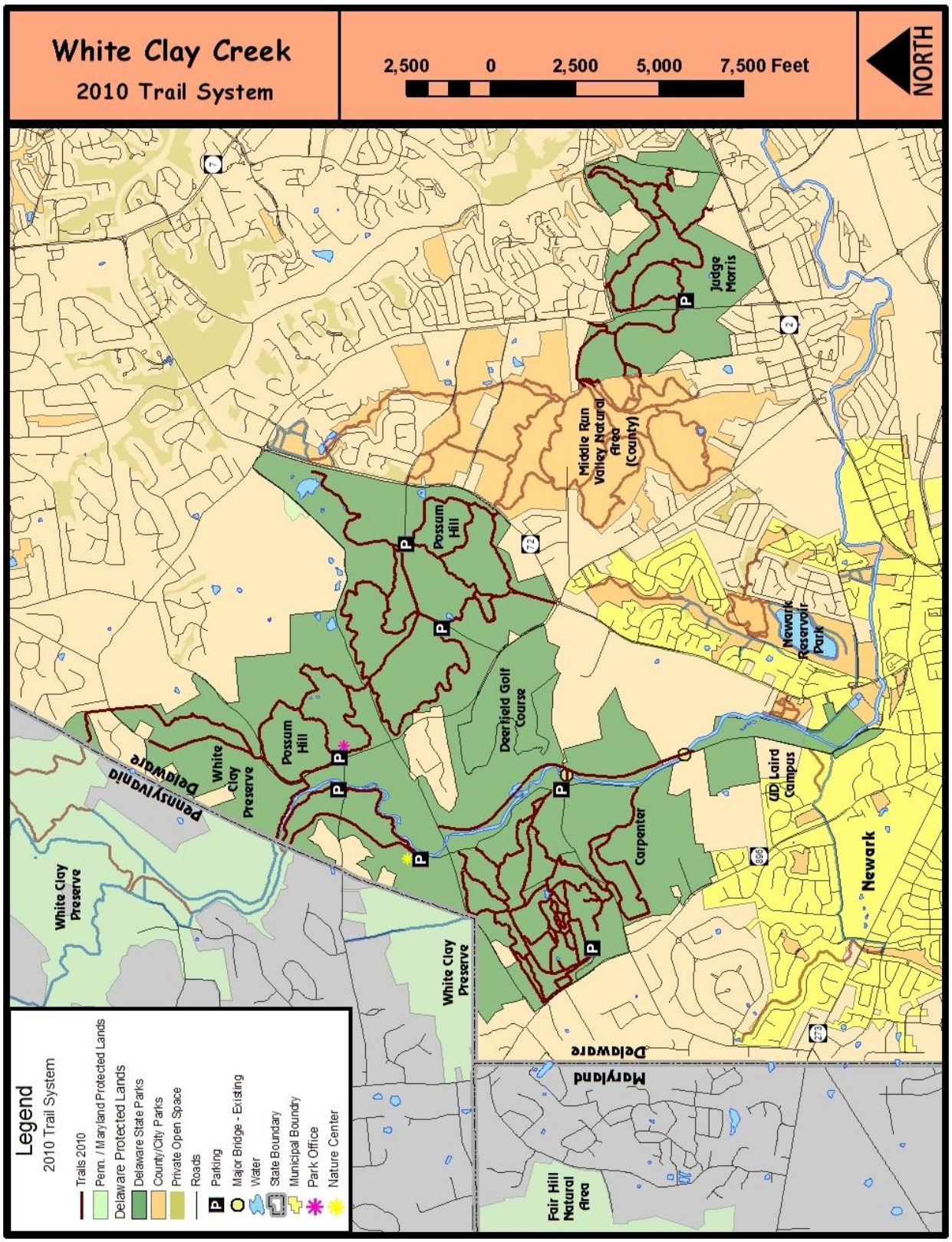
In 2010, permitted uses on park trails included pedestrian, biking and equestrian activities – details represented in Map 9. Carpenter contains the highest level of pedestrian-only trails in White Clay. Equestrian riding was phased out from the shared-use trail after the public horse boarding program ceased operation. Equestrian riding presently is only permitted on a segment of Creek Road north of Nature Center and continues into the Pennsylvania portion of White Clay Preserve. Judge Morris remains available for both pedestrians and bikers. Possum Hill has seen the most changes, shifting from single-use trails to a stacked loop network of shared-use trails.

The 2010 trail system is comprised of 23.7 miles of single track (36 inches or less) and 16.3 miles of double track (greater than 36 inches wide) trails. Many double track trails have been closed that were part of the 1998 trail network; these corridor surfaces were deactivated and planted with native vegetation. 4.2 miles of hardened trail have been closed since 1998. Carpenter Recreation Area is dominated by wider trails. See Map 10 for trail width information. Selected double track trails are vital to creating all-weather corridors that traverse the park from Newark to the Pennsylvania border and across the park from east to west. See Map 11 for a layout of hardened and natural earth trails that are present today in the park.

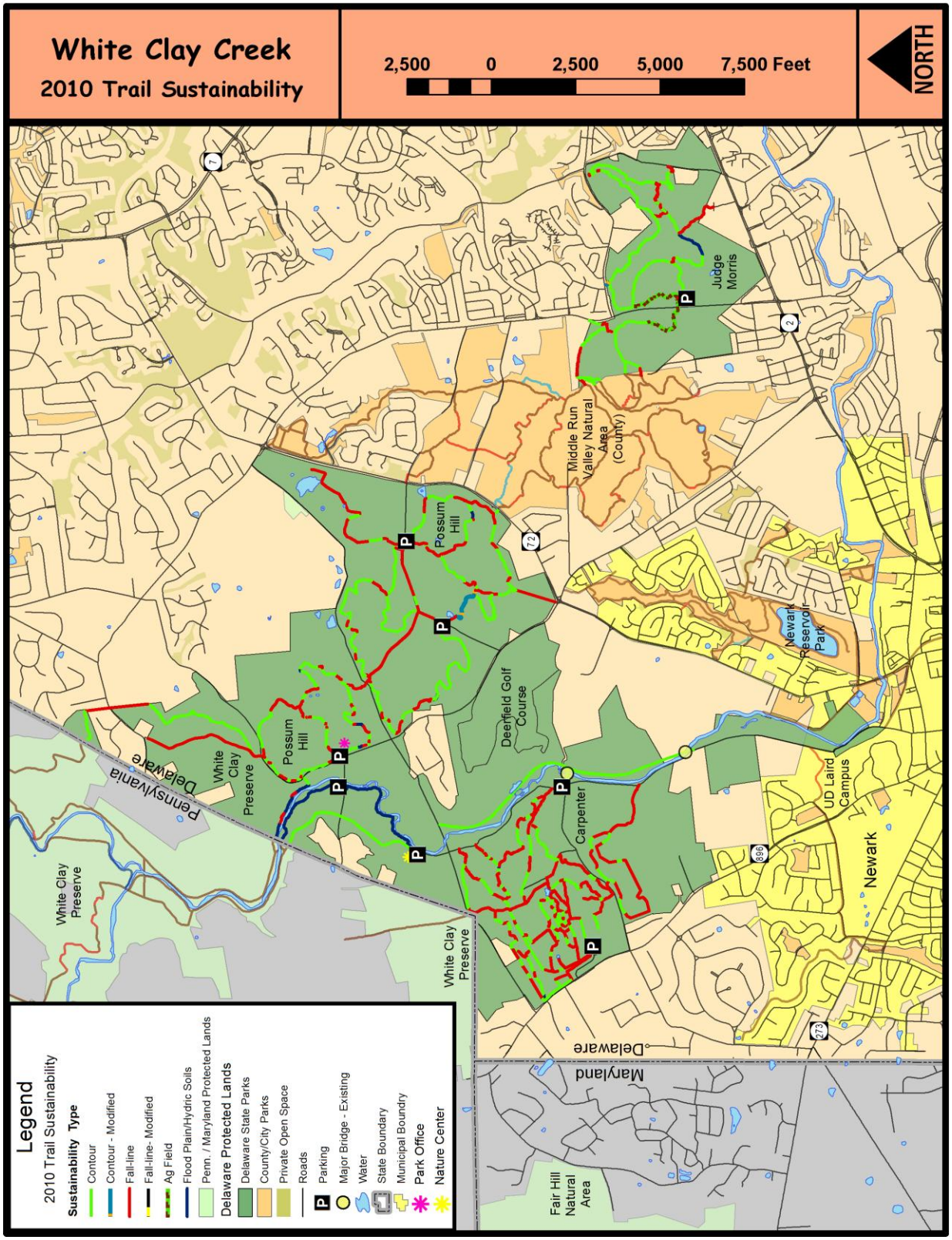
Access to the trail system is available via eight parking areas and a number of other locations dispersed throughout the park, connecting communities, other local protected lands, and major roads. All parking lots are depicted by the P icon on Maps 7 through 11.

Area high schools currently use White Clay for cross country meets. A 3.1 mile course located in the Carpenter Recreation Area meanders over trails and non-trail areas. Course start and finish lie adjacent to the Carpenter parking lot. Course use will be reduced as the University of Delaware has eliminated men's track from its athletic program. Map 12 illustrates the current course layout.

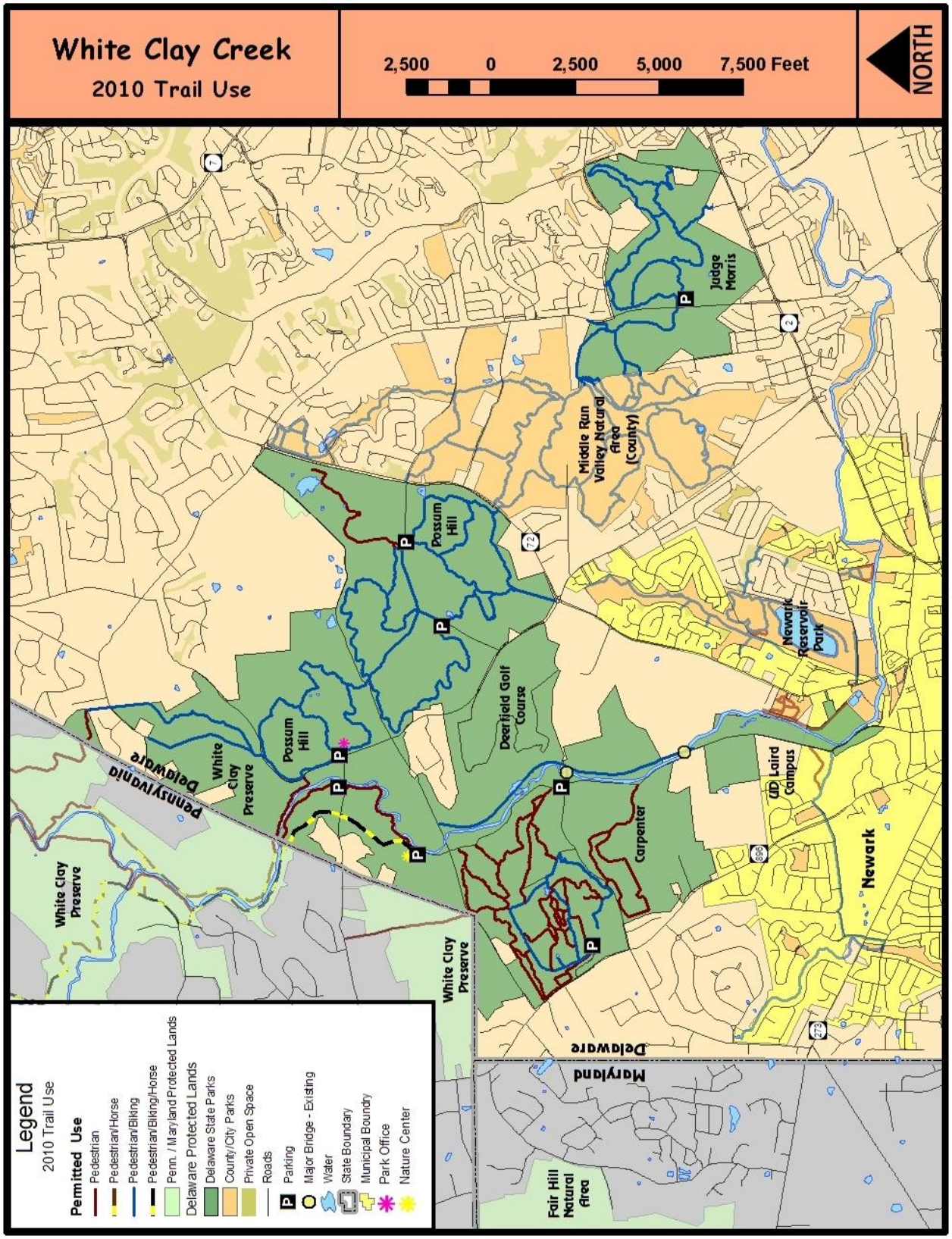
Map 7 - 2010 Existing Trail System



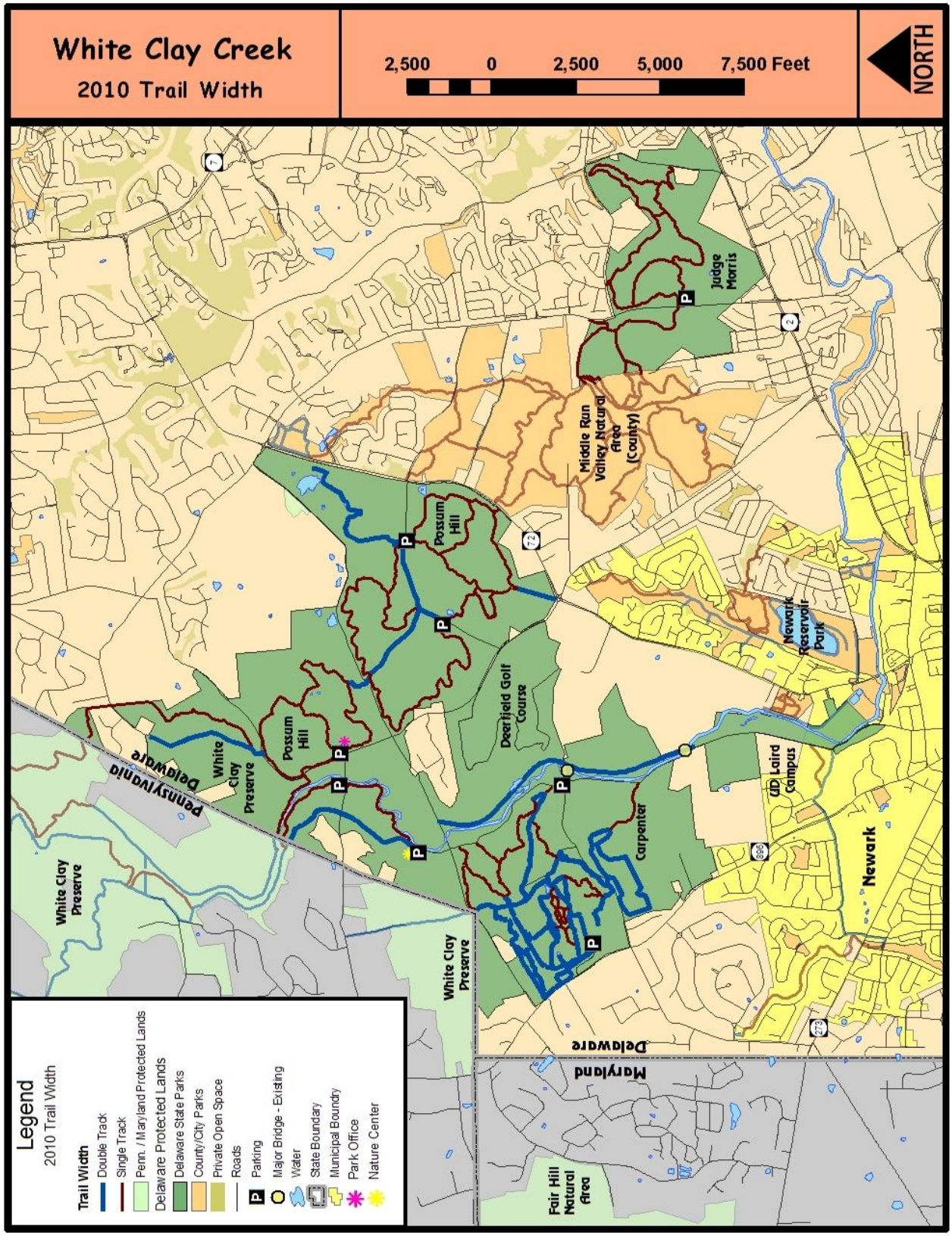
Map 8 - 2010 Existing Trail Sustainability



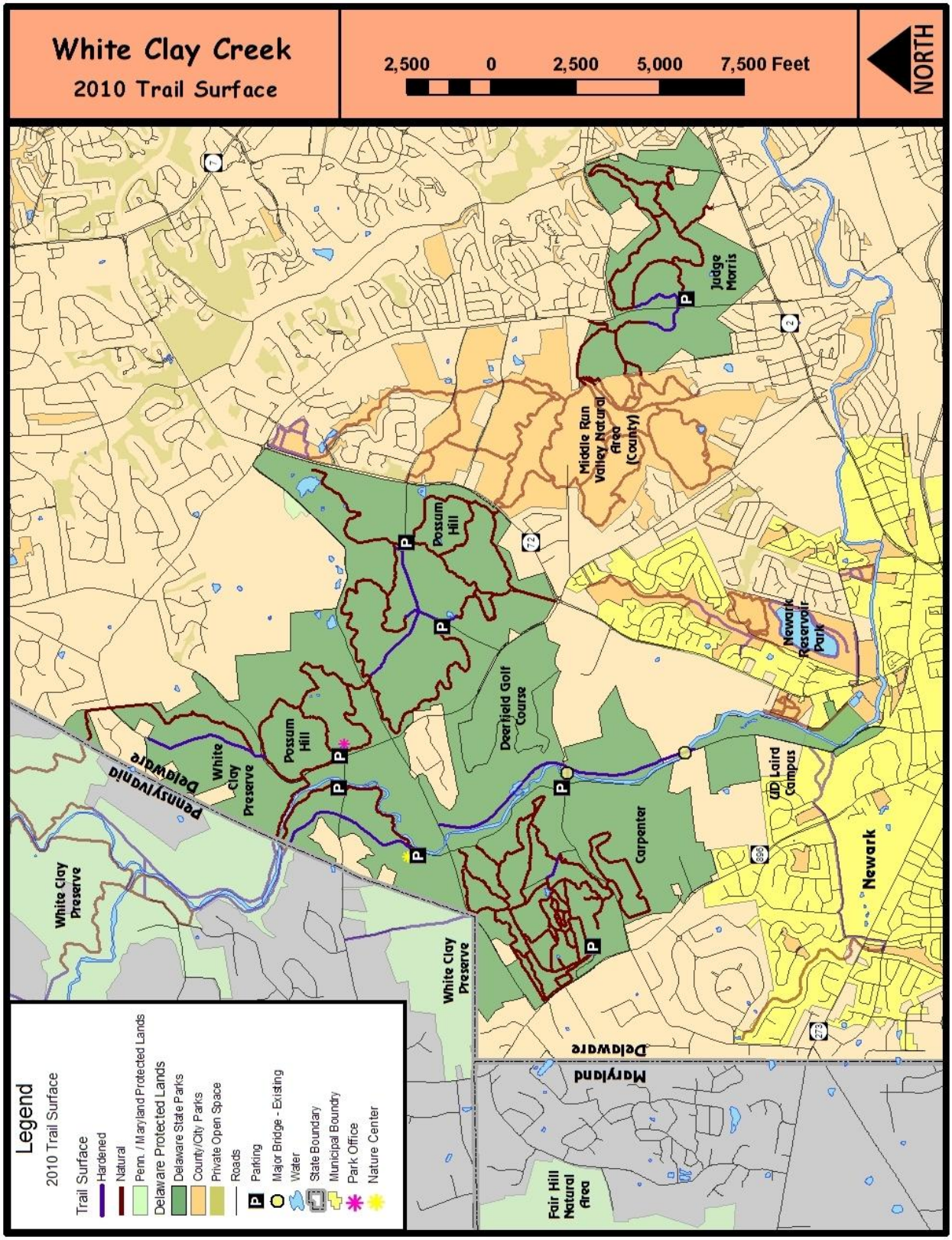
Map 9 - 2010 Existing Trail Uses



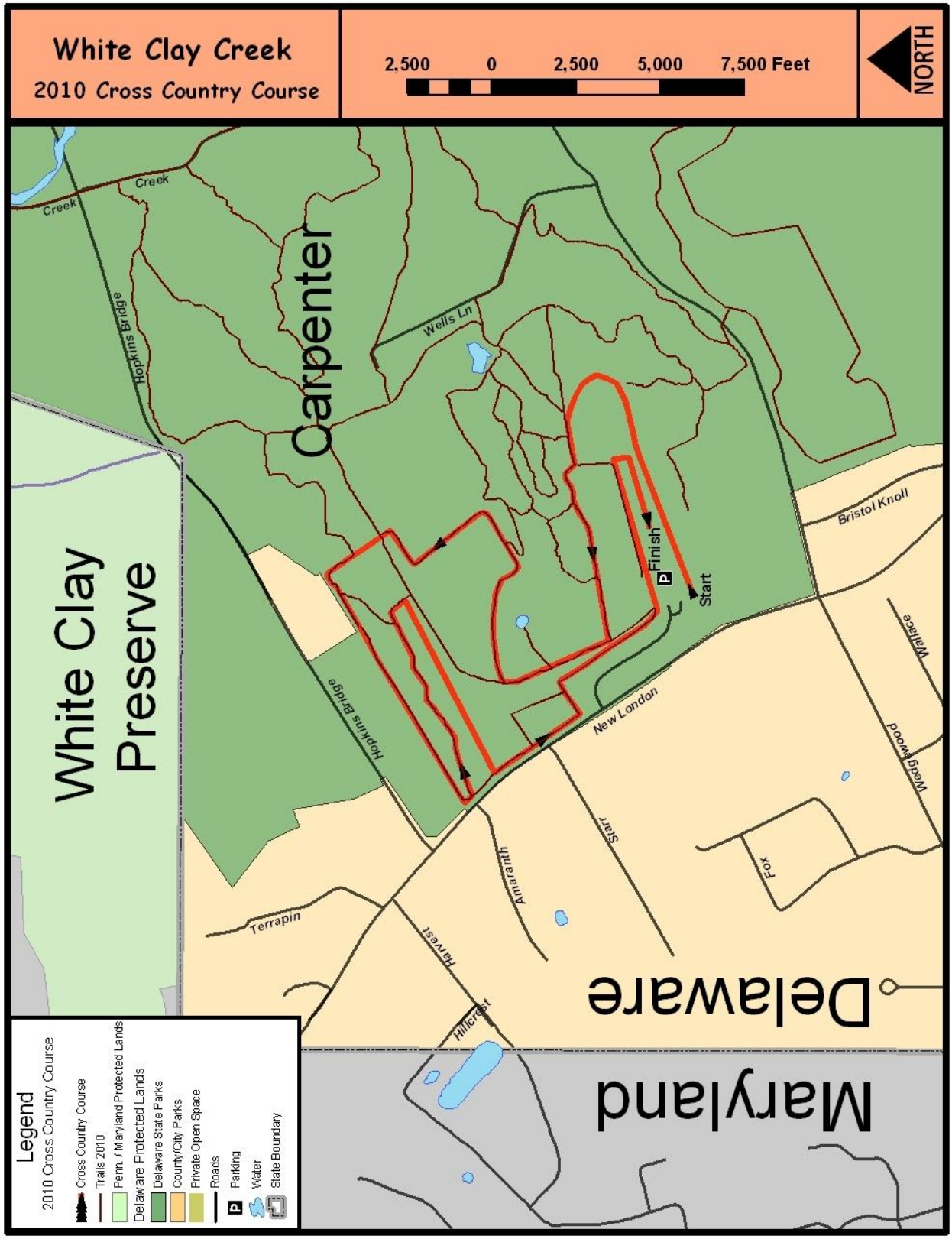
Map 10 - 2010 Existing Trail Widths



Map 11 – 2010 Existing Trail Surface



Map 12 – 2010 Existing Cross-Country Course



There are fifteen named trails in the park and several unnamed trails. Table 5 summarizes lengths and current permitted trail uses.

Table 5 - 2010 Trail Miles and Uses

Park Area	Trail Name	Length in Miles	Pedestrian	Biking	Equestrian
Carpenter Recreation Area	Cross Country Course	3.1	√	√	
	Millstone	1.3	√		
	Multi Use	3.1	√	√	
	Pomeroy	1.6	√	√	
	Twin Valley	3.9	√		
	Wells Field	1.4	√		
Judge Morris Estate	Chestnut Hill	3.4	√	√	
	Tri-Valley	1.1	√	√	
Possum Hill	Big Pond	1.2	√		
	Bryan's Field	2.5	√	√	
	David English	2.8	√	√	
	Skills	0.4	√	√	
	Tri-Valley	0.7	√	√	
	Whitely Farms	2.9	√	√	
Preserve	Boundary Line	1.4	√	√	
	Cart Road	0.7	√	√	
	Charles Bailey	0.4	√		
	Creek Road (Preserve)	0.8	√	√	√
	Preserve	1.3	√		
	*Unnamed Trails	6.0	√	√	

**Notes: 1. Unnamed trails include connector trails*

2. Not all Unnamed Trails are shared-use

Trail Descriptions

Carpenter

A **Cross Country Course**, currently marked as 3.1 miles long, is situated within the Carpenter Recreation Area. This course primarily utilizes meadow and some existing trail to fulfill course length requirements. All trail used throughout the course has a minimum tread width of five feet. Large mowed areas close to the parking lot is currently used as the start and finish area - the only site wide and long enough that complies with national course regulations.

> Existing Condition: Presently 1.1 miles of the 3.1 mile course conforms to present sustainable trail design standards. Of the remaining 2.0 miles, unsustainable alignments, erosion, wet areas, and tread obstacles such as roots, remain a problem. Since the alignment falls mostly on mowed meadow, the predominant surface is grass. However, where the course utilizes exiting trail, the surface is packed earth.

The 1.3 mile **Millstone Trail** follows an easy to moderate contour over grass and packed earth. The trail traverses a boardwalk at Millstone Pond below a geological feature of rock outcropping. This trail is designated for pedestrian use.

> Existing Condition: Only a few minor changes have been made to the trail over the past ten years. Presently 45% of the trail falls within trail design standards. Of the remaining 55%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots do not meet sustainability standards or present unsafe trail conditions.

3.1 mile **Multi-Use Trail** has been the historic eight foot wide shared use trail in Carpenter. Starting and ending at the main parking lot, the trail meanders through the meadows and woods providing visitors with expansive views and intimate wooded settings. This trail is designated for pedestrian and biking uses.

> Existing Condition: Presently 30% of the trail falls within trail design standards. Of the remaining 70%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots do not meet sustainability standards or present unsafe trail conditions.

Pomeroy Trail follows the former Pomeroy Rail Road alignment for 1.6 miles falling between Hopkins Road (north end) and Creek Road, the current southern terminus. This segment of the Pomeroy Trail is situated east of White Clay Creek providing excellent views of this National Scenic River and wooded hillsides. The trail can be linked with Creek Road to make several loops. Slated for construction, approximately 1.1 miles of trail will extend the Pomeroy through the southernmost portion of the park linking the Laird Campus, downtown Newark and the James Hall Trail. Two bridges provide vital pedestrian and bicycle crossings and trail system linkages at the Tweeds Mill Bridge and the newest bridge one mile further south.

> Existing Condition: This trail is situated just above the flood plain of the White Clay Creek, is 10 feet wide, surfaced with crushed stone, and has less than a 5% trail grade. The stone surface is a bit rough and poorly drained in some sections.

Twin Valley Trail meanders 3.9 miles through mature beech, maple, and tulip forests on a moderate grade. The trail passes the Arc Corner Monument marking the point where Delaware and Pennsylvania join, and an old foundation and cellar hole. This trail is accessed via the parking lot in the Carpenter Recreation Area of the park.

> Existing Condition: Only a few minor changes have been made to the trail over the past ten years. Presently 25% of the trail falls within trail design standards. Of the remaining 75%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots do not meet sustainability standards or present unsafe trail conditions.

Wells Field, south of Wedgewood Road, has an eight foot wide mowed strip around the edge of the meadow. 1.4 miles long this loop is designated as pedestrian use only.

> Existing Condition: Presently 25% of the trail falls within trail design standards- the remaining 70% is fall-line on moderate to steep grades.

Judge Morris Estate

The **Chestnut Hill Trail**, a 3.4 mile long trail meanders through forests, meadows and agricultural fields on the eastern portion of the Judge Morris Estate. A cut-off trail is located at the approximate midpoint along the trail and returns to the trailhead. This single-track trail (3 feet in width) is classified as shared-use permitting pedestrian and biking uses.

> Existing Condition: Since 1999 there have been many trail segment realignments that have drastically reduced erosion, maintenance, and tread obstacles. Today, 74% of the trail conforms to trail design standards. Of the remaining 26%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots do not meet sustainability standards or present unsafe trail conditions.

The **Tri-Valley Trail** is as a spine trail linking portions of White Clay Creek State Park and Middle Run Natural Area (managed by New Castle County) - 1.1 miles of this 3.5 mile trail fall within the Judge Morris unit and 0.7 mile segment in the Possum Hill unit. Middle Run Natural Area is situated between these two management units of White Clay. As a spine trail, over 30 miles of trail are accessed from the Tri-Valley Trail. As shown in this plan the Tri-Valley Trail would overlay existing and planned trails providing a link to the White Clay Creek valley.

> Existing Condition: Since 2000 there have been many trail segment realignments that have drastically reduced erosion, maintenance, and tread obstacles. Presently 65% (state park land only) of the trail conforms to sustainable trail design standards. Of the remaining 35%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots do not meet sustainability standards or present unsafe trail conditions.

Possum Hill

Big Pond Trail at 1.2 miles long starts across from the Bryan's Field trailhead. The trail meanders through the meadows and end at the shore of Big Pond. Grades are gentle. This trail is designated for pedestrian use.

> Existing Condition: Mowed double track, this trail is situated on poorly draining soils. Presently, only 5% of the trail falls within trail design standards. Of the remaining, 95% do not meet sustainability standards or present unsafe trail conditions. Since the alignment falls on meadow, the surface is mowed grass.

Bryan's Field Trail at 2.5 miles in length, this loop trail passes through meadow and mature hardwood forest of maple, oak, and popular over a packed earth surface. The grade is moderate throughout. On the outer loop trail -shortened by a cut-off splitting the trail in half-, users will traverse an area of reforestation and witness early forest succession.. This single-track trail is designated for pedestrian and biking uses. Access this trail from the Possum Hill area via a 12 car parking lot on Smith Mill Road.

> Existing Condition: Since 2002 there have been many trail segment realignments that have drastically reduced erosion, maintenance, and tread obstacles. Presently 52% of the trail conforms to present trail design standards. Of the remaining 48%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots do not meet sustainability standards or present unsafe trail conditions.

David English Trail, at 2.8 miles long, this is a single track loop trail **-**a cut-off trail effectively splits the trail in half- which passes through hardwood forest and hayfields over a packed earth surface. The grade is moderate throughout. This single-track trail is designated for pedestrian and mountain biking uses.. Access the David English Trail from the Park Office parking lot.

> Existing Condition: Since 2001 there have been many trail segment realignments that have drastically reduced erosion, maintenance, and tread obstacles. Presently 65% of the trail conforms to present trail design standards. Of the remaining 35%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots do not meet sustainability standards or present unsafe trail conditions.

Skills Trail at 0.4 miles long the trail starts about midway around the Bryan's Field Trail. A horseshoe shaped trail, it provides a rare technical experience for bikers and pedestrians alike. Narrower than the standard single track, the trail offers up natural and constructed features such and raised wooden structures, teeter-tauter, and a suspension bridge. This trail has a little something for everyone. This single-track trail is designated for pedestrian and biking uses. Access is from the Whitely Farms or Bryan's Field parking lot.

> Existing Condition: Contour trail following the border of a small patch of woods 70+ years old was first opened in 2003. It has undergone yearly changes to keep the trail technically interesting.

At 2.9 mile long the **Whitely Farms Trail -**a cut-off trail effectively splits the trail in half- rambles through hayfields and forest of mature hardwoods in the Possum Hill area. It has a packed earth surface. The grade is moderate throughout with a rapid descent near the approach of the Hopkins Road crossing and the connector to the David English Trail. This single-track trail is designated for pedestrian and biking uses. Direct access to this trail is via the parking lot on Smith Mill Road in Possum Hill.

> Existing Condition: Since 2003 there have been many trail segment realignments that have drastically reduced erosion, maintenance, and tread obstacles. Presently 67% of the trail conforms to trail design standards. Of the remaining 33%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots do not meet sustainability standards or present unsafe trail conditions.

White Clay Preserve

From Thompson Station Road the **Boundary Line Trail** crosses an old County bridge and then climbs on a moderate grade to an open field. It runs past mature Osage-orange hedgerow to Corner Ketch Road and the highest point in the park. Continue on to connect with White Clay Creek Preserve in Pennsylvania or reverse direction and enjoy a downhill hike or ride.

> Existing Condition: A 1.4 mile newer designed and constructed trail, most trail segments meet present sustainability standards. Presently 90% of the trail conforms to present trail design standards. Of the remaining 10%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots remain a problem.

Cart Road at 0.7 miles long the trail utilizes an old road alignment that dates back more than one hundred years. Running north south, the trail connects to Corner Ketch and Thompson Station Roads. The trail borders young forest to the east and an older forested, picturesque stream corridor to the west. Erosion over the decades has worn down the old road bed up to five feet below grade in some areas. This now single-track trail is designated for pedestrian and biking uses.

> Existing Condition: 100% of the trail is fall-line at moderate to steep grades and can change dramatically year to year from perpetual erosion.

The Charles Bailey at 0.4 miles meanders along the east side White Clay Creek north of the park office and connects to existing trail north of the state border in Pennsylvania (also by the same name). In years past the trail was used primarily for hunting and fishing access, but it is now heavily used by pedestrians throughout the year as part of a large five mile loop utilizing trail in both Delaware and Pennsylvania.

> Existing Condition: Plagued with stream bank erosion, fall-line segments, and flood plain issues, this trail the poorest shape of any trail in the park. Presently only about 10% of the trail conforms to present trail design standards. Of the remaining 90%, unsustainable alignments, erosion, invasive plants, and tread obstacles such as roots remain a problem.

The **Preserve Trail**, at 1.3 miles long, starts at the Nature Center trailhead. The trail closely follows the meandering White Clay Creek north and terminates at the state line with Pennsylvania. Grades are generally level.

> Existing Condition: 99% of the trail is located in the flood plain of the White Clay Creek, a very dynamic environment. The soils are hydric to loamy. The entire area is flat, poorly draining, and constantly changing due to flooding. Over the last ten years there has been considerable bank erosion that has led to bank collapse and trail loss. Frequent trail re-routes are needed as segments of trail are washed away.

Creek Road has been the major north-south travel way along the creek for over one hundred years. Although not an official trail over the entire length, Creek Road functions as a trail. North College Avenue becomes Creek Road at Newark's city limit. The road is 3.8 miles long to the Pennsylvania border, then extends about one mile into southern Pennsylvania. For decades, pedestrians and bicyclists have recreated on Creek Road. Due to low traffic volumes, flooding and erosion the Department of Transportation has closed 0.8 miles of the road south of Wedgewood Road. Between Wedgewood and Hopkins Roads, Creek Road is open for pedestrian and bicycle uses and closed to vehicles except during the first month of the spring trout run.

Because much of **Creek Road** is not officially a trail its lengths are not included in mileage figures for existing trail calculations nor shown on any maps. This plan calls for new trail designations that officially add road segments into the White Clay Creek State Park trail network. Road-with-Trail and Road-to-Trail designations acknowledge that certain road segments are vital links of a greater trail network.

> Existing Condition: 3.8 miles long, Creek Road varies in surface type and use. From Newark 2 miles north it is paved and in disrepair in sections. At the intersection of Wedgewood Road the surface transitions to gravel and remains so until it terminates at the north end in Pennsylvania. Along the segment from Wedgewood to the Pennsylvania border, the old road bed is plagued with pot holes and wet seep areas. The road sections from Wedgewood to Hopkins Bridge and Hopkins Road north to the Nature Center is shared by trail users and vehicle traffic. North of the Nature Center the road is limited to trail users and park maintenance vehicles. Presently about 60% of the trail conforms to present trail design standards. Of the remaining 40%, unsustainable alignments, wet muddy areas, and erosion remain a problem.

Impacts & Assessment of Today's Trail System

In the park today there are a variety of activities that impact trails and trail corridors. Trail location and park activities such as trail maintenance or patrol, or trail users on foot, bike, or horse will have some impact on the landscape. Some soil disturbance is expected in the development and use of trails, however better trail design and management can drastically reduce widespread trail erosion.

User type and volume impacts are most notable on natural surface trails. Over the years there have been a number of studies that have looked at the relationship between user and the trail. The ability to loosen or displace (move short distances) tread materials will help determine the sustainability of any given trail. Although the "footprint" may look different, the foot and the tire exhibit about the same amount of wear and tear on the trail-pounds per square foot on the tread are actually lower for a bike. The equestrian, at least four times the weight, can have a dramatic effect on loosening the tread. Once tread materials are loose they become susceptible to erosion. Depending on soil conditions, the amount and distance of displacement will vary, but in general the distance will not exceed one to two feet. Erosion on the other hand is not confined to short distances; in fact soil may be carried hundreds if not thousands of feet by water.

Site conditions all being equal, the heavier horse will loosen and displace many times more tread material than either the pedestrian or biker. However, sheer numbers of any one user type can overwhelm just a few of another. The impact of one horse in a muddy area is no match for twenty hikers. Nor are a handful of hikers going through a stream comparable to ten bikers splashing across at speed.

As is the case in White Clay Creek State Park, many segments of trail are currently located on the fall-line, flood plain, flat areas, or on a limited basis in hydric soil zones. When trails are located where these conditions prevail, poor drainage, erosion, or tread muddiness will become persistent safety, maintenance, and resource protection problems. Volume and user type will directly influence the severity of these conditions. The more sever the impact less sustainable the trail is.

In White Clay Creek State Park, existing trails located in the flood plain, flat areas, or hydric soil zones and on the fall-line have reduced trail utility and created and perpetuate on-going maintenance issues and impact sustainability. Muddy and wet conditions renders trails less usable and aggravates tread widening, additional soil compaction, and associated vegetation loss as visitors and staff seek to circumvent mud holes and wet soils. Soil erosion reduces tread height, exposes roots and rocks, transports sediment into streams, and, if severe, will cause visitors to create alternate alignments. These conditions also greatly diminish the visitor experience and can affect safety.

Many miles of fall-line trail are located in White Clay Creek State Park; the majority of the remaining fall-line trails are located in the Carpenter Recreation Area. Where trails are located across landscape contours, water flowing downhill follows the path of least resistance. Fall-line trails focus water down their length, enabling speeding water to strip the trail tread of soil, exposing plant and tree roots, creating gullies, and scarring the native landscape. Eroded sediment is transported downhill and potentially into streams and wetlands, damaging fragile habitat.

Where trails are located in poorly drained soils or organically rich soils that hold moisture, tread muddiness and exposed roots can become a persistent problem. When grades remain flat, water may become trapped creating chronic wet trail conditions. Soil compaction and displacement can create or exacerbate problems with standing water and mud due to the creation of cupped treads that collect and hold water. Muddy and wet conditions render trails less usable. As trail users circumvent mud holes and wet soils, trail tread is widened, soil compaction adjacent to original trail increases, and associated vegetation is lost.

Trails in Judge Morris, Possum Hill, White Clay Preserve and minor segments in Carpenter, have seen reconstruction and realignments to improve environmental, social and economic sustainability. Trails existing at the time of acquisition (believed to be created by nearby residents, and by previous owners) were opened for public recreational use by Delaware State Park managers. An early assessment and evaluation of trails in Judge Morris determined that fall-line trail segments, erosion, wet soils, and intrusions into sensitive habitat required significant changes. Trail segments were closed and replaced with trails meeting environmentally sustainable objectives. As a result, more than 5 miles of improved trails are open today to pedestrians and bikers. Links to local communities and Middle Run Natural Area (900 acre county park), from the westernmost portions of the Judge Morris area, have been added. Bridges were constructed where trail users once forded streams or used wood pallets that spanned wet areas. A trailhead and 68 car parking lot, information board and a composting toilet have led to greater public utilization of Judge Morris.

When the Possum Hill Area first opened for public use in 1994, previously existing old woods roads were adopted as trails. An assessment of Possum Hill area found fall-line trail segments, erosion, and impacts to both cultural resource sites and sensitive habitat. These conditions became the basis to alter existing trail alignments. Trail improvements occurred incrementally. Fall-line trail sections were eliminated then re-vegetated with on-site native vegetation. Old roads were removed by re-contouring or their widths reduced, and previously open corridors were re-vegetated. Bridges were installed in locations where trail users once forded Piedmont streams. Three major loops were constructed as a stacking loop system, creating multiple choices for trail users. Today, Bryan's Field Trail (2.5-miles), Whitely Farms Trail (2.9-miles), and David English Trail (2.8 miles), are open to pedestrians and bikers – the primary recreational activities available in this area of the park.

Branching from the Bryan's Field Trail is the Skills Trail designed to provide a controlled and structured environment to challenge cyclists and pedestrians. Here, trail riders can learn and practice mountain bike handling on set-piece technical features where the natural terrain does not offer such challenge. This course provides interesting challenges for hikers and trail runners as well. Trail counters show that use from pedestrians is equal to and higher than pedestrian only trails located in other areas of the park. In addition to the Skills Trail there are several technical features scattered throughout the Possum Hill area that provide trail users optional challenging lines.

Carpenter Recreation Area, hosting the park's most active recreation features, contains 16.2 trail miles, the greatest trail density in White Clay Creek State Park. Similar to other park areas, trails in Carpenter are an assemblage of old roads, hunting paths, deer paths adopted as official trails, and trails constructed in earlier decades. Of the total 16.2 miles of trail, 9.5 of miles are designated pedestrian use only; the balance is open to shared-use for pedestrians and bikers.

The Pomeroy Trail (1.6 miles) and the Multi Use Trail (3.1 miles), starting from the main parking lot, is designated for shared pedestrian and biking use. Equestrian use is allowed on Creek Road. No major alternations have been made to trails in the Carpenter Recreation Area. In depth analysis indicates extensive (9.1 miles) fall-line trail segments, erosion, and habitat fragmentation.

Within the White Clay Preserve, there are three distinct trails, each approximately one-mile long. Creek Road, an old road running north south and parallel to the western side of the creek, connects protected lands in Delaware to the Pennsylvania portion of the White Clay Preserve. In Delaware, a portion of Creek Road is closed to vehicles, yet open for shared-use to pedestrians, bikers, and equestrians. The Preserve Trail runs along the western bank of the creek providing a pedestrian only alternative. The Boundary Trail is a shared-use trail open to pedestrians and bikers and also links to trails in Pennsylvania.

Trail Users and Uses

Trail use volume data was gathered during 2010 for the following trails: Bryan's Field, Skills, David English, and Twin Ponds (Possum Hill); Chestnut Hill (Judge Morris); Loggers, Arc Monument, and Pomeroy (Carpenter); and Preserve Loop (White Clay Preserve). A total of 162,595 users were recorded by trail counters. On shared-use trails, both magnetic and infrared collect data. Infrared counters collect data for all trail users that pass by the device. Magnetic counters only record bicyclists as they pass by this type of counter. Table 6 indicates current trail uses across the trail network by unit. Winter trail uses, cross-country skiing and snow shoeing are not presented, however they are permitted trail activities when the park is open and snow is present.

Average daily trail use ranges from a 3.2 per day at the Loggers Trail to 77.9 users per day on the Pomeroy Trail. Table 7 outlines the total average daily use by trail, total trail users and the total hikers and bikers. Hikers represent 32% of the users on the Skills Trail; and hikers comprise the 18% (David English Trail), 39% (Twin Ponds Trail), 61% (Chestnut Hill Trail) and 81% (Pomeroy Trail). Counters will continue to be used to monitor levels of trail use and trail user type to inform trail management and planning.

Table 6 - Trail Uses

Trail Users	Judge Morris	Possum Hill	Preserve	Carpenter	Community Connections
Hiking	√	√	√	√	√
Trail Running	√	√	√	√	√
Dog Walking	√	√	√	√	√
Wildlife Watching	√	√	√	√	√
Geo-cachers	√	√	√	√	√
Mountain Biking	√	√	√	√	√
Technical Biking	√	√			
Bicycling	√	√	√	√	√
Equestrians			√	√	

Table 7 - Level of Trail Use

2010 Trail Use Levels for White Clay Creek State Park					
Site	**Annual Average Daily Trail Traffic**	**Days With Data**	**Total**	**Total Bike Riders**	**Total Hikers & Runners**
Bryan's Field IR [A]	39.785	209	14,521		
Skills Trail IR	19.166	283	6,996	4,692	2,304
Skills Trail Mag	12.856	278	4,692		
David English IR	40.087	289	14,632	11,978	2,654
David English Mag	32.817	289	11,978		
Twin Ponds IR	11.228	298	4,098	2,498	1,600
Twin Ponds Mag	06.845	284	2,498		
Judge Morris IR	55.811	318	20,371	7,766	12,605
Judge Morris Mag	21.278	324	7,766		
Loggers IR	03.208	212	1,171		
Arc Monument IR	10.577	326	3,860		
Pomeroy IR	77.953	298	28,453	5,307	23,146
Pomeroy Mag	14.539	180	5,307		
Preserve Loop IR	58.383	298	21,310		
Total	445.466		162,595	32,241	42,309

A *– A magnetic counter is located on Bryan's Field Trail. Unfortunately, this counter did not function properly thus data for level of bicycle use is not reliable. Though over 14,000 trail users visited this trail, comparisons of hikers/runners and bikers cannot be made.*

Mag *= Magnetic Counter. Magnetic counter collect data predominately from bicycle riders that pass by these counters.*

IR *= Infrared Counter. Infrared counters collect data from every trail user that pass by these counters.*

Below is a summary of the trail users most likely to use the park trail system.

- Pedestrians
  The term pedestrian encompasses a variety of users, including walkers, hikers, nature watchers, cross-country skiers, geo-cashers, and trail runners.

- Bicycle Riders
  Like pedestrians, there are a number of sub groups that fall into this category. A few examples are road riders, commuters, competitors, mountain bikers, and general recreationalists.

- Equestrians
  As diverse a group as any, equestrians partake in trail riding, mounted orienteering, endurance riding, carriage rides, and cross country jumping to name a few.

- Motorized Trail Use
  There are no trails available in White Clay Creek State Park for motorized trail use such as ATV or off-highway vehicles (OHV).

- 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 or greater, grades of 5% and less, no obstacles (no staircases or steps, roots or rocks), and cross slopes 2% or less will be more accommodating to more people. Presently there is guidance available for recreation facilities-including trails. Some federal agencies (Forest Service and Park Service) have adopted these guidelines and can be referenced at http://www.fs.fed.us/recreation/programs/accessibility/.

Visitor Assessment

In June 2009, the Division conducted a survey of trail users in White Clay Creek State Park. The primary purpose of surveying park visitors, more specifically trail users, within White Clay was to better understand and identify the level of conflict between trail users on shared-use trails. Another purpose was to begin to document how and when trail users visit, why White Clay was selected for trail activity, demographics, and degree of satisfaction on several elements of our visitors' experiences.

The Rapid Assessment Visitor Inventory (RAVI) methodology was used to direct survey structure and technique (see Appendix G). RAVI is a reliable, tested scientific method for obtaining representative samples of place-specific visitor activity levels, experiences, perceptions, numbers and uses. The RAVI method utilizes four day sampling periods – two weekdays and two weekend days – within heavy-use seasons. Trail users at shared-use trailheads were targeted for data. The RAVI method is an excellent, quick method for gathering a representative sample of park visitors including trail users. Due diligence was taken to structure questions that would not be leading so as to glean the best possible information.

During the four RAVI survey days (June 25-28, 2009) 391 surveys were completed representing 742 total trail users. Overall, trail users rated, on a scale of 1-5 with 5 being best, their satisfaction with the days visit at 4.86. Respectively, this was reported by hikers (4.81); bikers (4.87); and runners (4.90).

Respondents were asked if they encountered problems with other trail users while out on trails; if a problem was reported, the nature of the problem was recorded. Respondents reported twenty problems, that is 20 of 391, or 5.1%. Looked at another way for all trail users, problems occurred in 33 out of 742 trail users, or 4.4% of all people on trails during the four day survey. The latter projection assumes that all members in a group experienced the same problem. (The twenty problems reported were expressed by 8 individuals; 11 groups of 2; and 1 group of 3.)

Specific types of reported problems were recorded. Dogs off leash were a cause of conflict among all those that responded. Hikers reported conflicts with bikers not yielding and riding too fast. Hikers reported problems with other hikers with head phones. Mountain bikers reported walkers and runners with headphones as problems. Runners reported that using trails while conditions are wet causes rutted trails.

Respondents were asked to rate encounters/interactions with other trail users (scale of 1-5, 5 being best). The overall rating was 4.78. Further cross-tabulated, level of satisfaction with encounters/interactions was reported this way: hikers 4.73; bikers 4.81; and runners 4.81.

Access Points and Signage

Currently White Clay Creek State Park is accessed predominately by car. Parking lots of various sizes are dispersed across the park. Some access spots reach capacity and are inadequate at times to meet trail use needs. Parking at the Park Office, Smith Mill Road and Creek Road (at Wedgewood) is limited yet directly adjacent to significant portions of the trail network. Table 8 below represents site specific trailhead parking sites and capacity information.

Table 8 – Trail Access Sites and Trailhead Enhancements

Parking Area	Location	Parking Spaces	Comfort Station	Information Board
Carpenter Recreation Area	New London Road	104	Yes	Yes
Nature Center	Hopkins Road	18	Composting toilet	Yes
Park Office	Thompson Station Road	6	No	Yes
Chambers Rock	Chambers Rock Road	16	No	Yes
Nine Foot Road	Nine Foot Road	26	Portable toilet	Yes
Possum Hill	Smith Mill Road	12	Composting toilet	Yes
Carpenter Recreation Area	Wedgewood and Creek Rd	6	No	Yes
Judge Morris Estate	Polly Drummond Hill Rd	68	Composting toilet	Yes

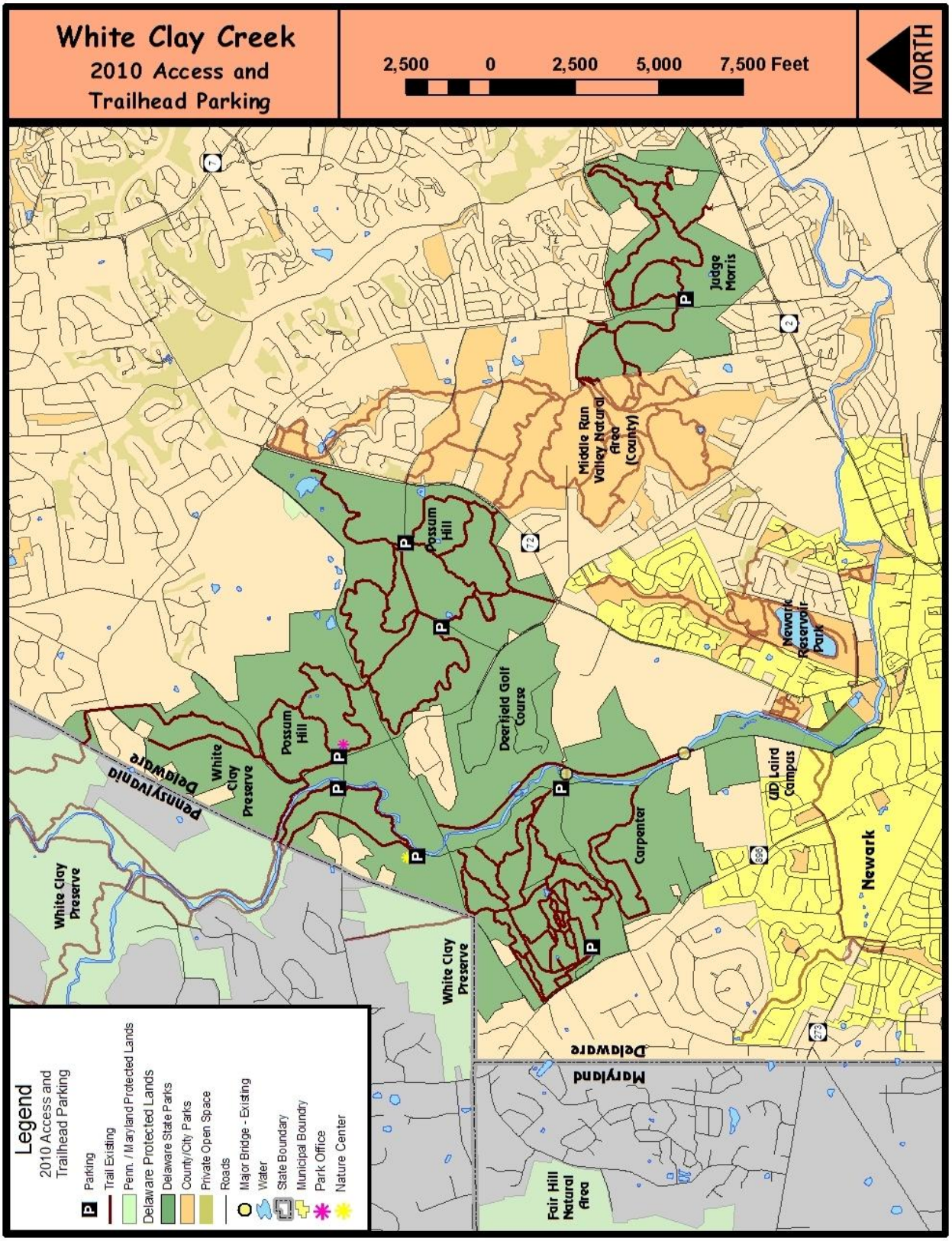
This plan proposes to shift the parking lot at Possum Hill from its present location to 1200 feet east on Smith Mill Road. As planned, a new lot is entered from the south side of Smith Mill Road, within 50 feet of Paper Mill Road. Amenities such as a composting toilet and information would be included in parking lot design. Total spaces and configuration would be determined through a detailed engineering and site plan. The current 15 space lot would be closed. Advantages of shifting the Possum Hill lot to this site include: 1) new lot location is visible from Paper Mill Road increasing safety; 2) permits approximately 1300 feet of Smith Mill Road to be designated as Road-to-Trail; 3) increases visitor capacity; and 4) eliminates fall-line trail conditions on Bryan's Field Trail currently in place at the trailhead.

Trail way-finding starts at a trailhead. Every trailhead is equipped with an information board and state park map. Four-by-four posts with the trail names are installed at intersections where there are directional choices. Trail names have a corresponding color code, that same color is used on park maps to highlight the specific trail. For example, the blue disks mark the Bryan's Field Trail, with disks inset on 4x4 posts. White Clay Creek State Park maps depict Bryan's Field Trail as a blue line. Maps are located at trailheads and on the Delaware State Park web site at www.destateparks.com/activities/trails/maps.asp. For examples of information boards, trail marker posts and other standard trail enhancements see Appendix B. These standards are implemented by Delaware State Parks.

Icons for parking, permitted uses and other information are placed on marker posts to provide additional information for trail users. Maps indicate trail length, permitted uses, and trail surfaces. More robust trail descriptions are found on at www.destateparks.com/activities/trails/index.asp

Map 13 below outline locations of trailheads, parking lots, and trail markers within the existing White Clay Creek State Park trail system.

Map 13 - Existing Access and Trailhead Parking



Natural and Cultural Resource Assessment

Natural Environment

White Clay Creek State Park lies within the Piedmont physiographic region of Delaware. It is a region characterized by rolling terrain incised by steep-sided stream valleys. In addition to the White Clay Creek, Middle Run, Pike Creek, Lamborn Run, Turkey Run and numerous unnamed tributaries flow across and drain the lands of the park. Within its boundaries the park includes forest, hedgerows, scrub-shrub, old fields, hayfields, cropland, maintained recreational areas dominated by lawn as well as buildings, parking lots, roads and other man-made infrastructure.

In terms of its natural resources, White Clay Creek State Park is a study in contradictions. Less than seventy years ago it was a patchwork of isolated small woodlots in a rural agricultural landscape of fields and pastures. Over the past seven decades fields within the park have reverted to forest, while many of those without have sprouted housing developments and strip malls. Today the park is an island of green in an ever-expanding sea of urban and suburban development. It provides habitat for migratory birds in both spring and fall. Its forests, fields, wetlands and waterways provide habitat for a wide variety or plants and animals. It provides a refuge for a wide range of species that are rare or declining in Delaware's Piedmont region. Eighty-two rare plant species and twenty-three rare animal species are known to occur here. It is regionally known as a spring "hotspot" for migrating birds. During the month of May birders flock to the White Clay Valley within the park to observe dozens of species of warblers, flycatchers and other neotropical migrant birds that rest and feed in the riparian habitat along the creek before continuing their migration to more northern nesting areas.

For those who look beyond this diversity of life, White Clay Creek State Park is a landscape converted by centuries old land use practices and bruised by more recent human forces at work in the surrounding watershed. Nearly one third of the plants (239 species) found in the park are not native. Of these, thirty-five are considered invasive, and pose a serious threat to the Park's native plants and plant communities. Eighty-four percent of the park's forests are of relatively poor quality. (DE Natural Heritage Program 2000) They are characterized by low canopy species and age class diversity, with a high percentage of invasives, especially in the understory and herb layers.

White-tailed deer are present in densities so high that they have a profound impact on native plant populations and communities. Deer may be contributing not only to the poor quality of the majority of the Park's forests, but also degrading the few remaining high quality forest stands.

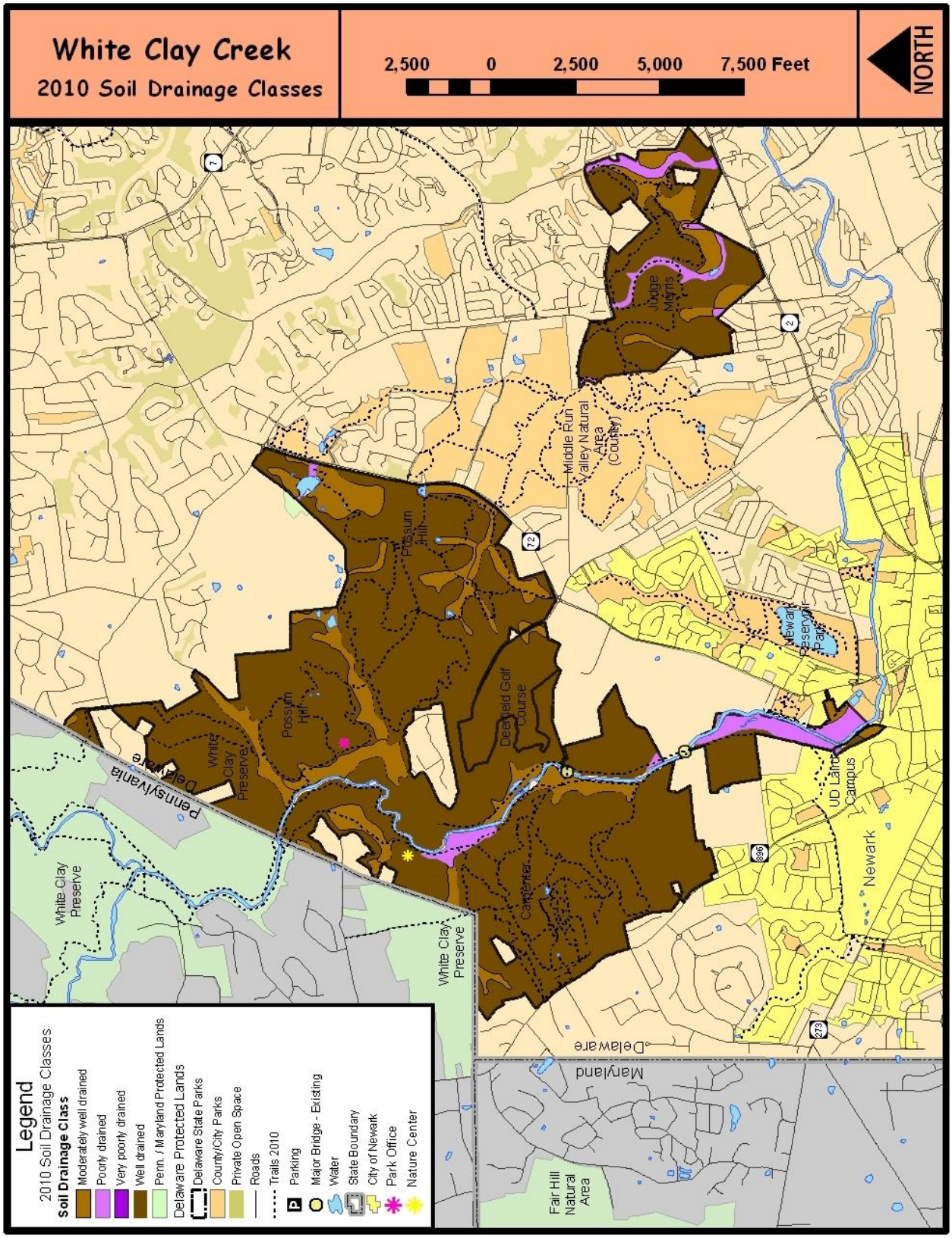
The waters of White Clay Creek do not support insect life indicative of high water quality. Freshwater mussels, another indicator of good water quality, do not occur in White Clay Creek in Delaware. Run-off from the surrounding watershed carries higher than normal levels of phosphorus and often rushes down the creek channel in volumes great enough to erode the streams banks, scour its gravel bars and smother the bottom in a blanket of mud and silt.

Geology and Soils

The ancient underlying bedrock, which can be regularly found protruding from the more recent alluvial deposits of the Holocene epoch in rock outcroppings throughout the Park, is dominated by metamorphic gneisses and schists of the Wissihickon formation. The soils overlying the bedrock in upland areas of the Park are primarily composed of loamy soils of the Glenelg, Manore and Chester series. Along the floodplains and in low areas the soils are primarily in the Codorus, Comus and Hatboro series. These soils range from well-drained to poorly-drained silty loams.

The southern portion of the Judge Morris Estate is underlain by bedrock in the Wilmington formation. Composed of the same rock types of the Wissihickon it tends to have less rugged topography. Overlying these rocks are soils in the Elsinboro and Keyport series. Elsinboro soils are composed of well-drained silty loam and are typically found at the transition between Piedmont and Coastal Plain. Keyport soils are moderately well-drained silty loam that contain some clay and are typical of Coastal Plain uplands. See soils Map 14.

Map 14 - Soil Drainage Classes



Vegetative Communities

The park is composed of a number of natural as well as managed habitats. The major habitat types within the park include the White Clay Creek and its tributaries, numerous small man-made ponds and impoundments, Wetland, Forest, Hayfields, Cropland, Hedgerows, Scrubland and Lawn. Roughly 2,297 acres or 63% of the Park is forested. Hayfields and crop fields make up the next largest percentage of the Park at 369 acres and 365 acres or about 10% each. Early successional habitats such as scrub-shrub and old fields account for 194 acres or 5.3%. Disturbed and developed areas account for 147 acres or 4% and lawn totals 124 acres or 3%. The remaining 5% is in ponds, wetlands and the White Clay Creek waterway.

A Delaware Natural Heritage Program (DNHP) survey of the Park was conducted in 1999. During that survey nine distinct vegetative communities were identified within areas of the park characterized by high quality forest habitat. High quality forest habitats included those forested areas that exhibited a closed canopy of mature trees with the invasive component of the understory and herbaceous layer comprising less than 25 percent cover. The nine communities were Beech-Mixed Oak/Mountain Laurel Forest, Chestnut Oak Forest, Tuliptree-Beech-Mixed Oak/Spicebush Forest, Sycamore-Green Ash-Boxelder/Spicebush Forest, Rock Outcrop Community, Skunk Cabbage/Moss spp. Seepage Slope Wetland, Stream Valley Herbaceous Seepage Wetland, False Nettle-Floating Manna Grass Oxbow Wetland and Twisted Sedge Herabaceous Community.

The Natural Heritage and Endangered Species Program (formerly DNHP) in 2006 began a statewide vegetation community mapping project. A comprehensive study of White Clay Creek State Park will begin in March 2011. While the DNHP 1999 survey did not characterize the areas of the Park deemed "poor quality", this new survey should describe all the vegetation communities within White Clay. Two forest communities identified in the survey, correspond to the good quality forest communities of the 1999 survey. They are the Northern Coastal Plain/Piedmont Oak-Beech/Heath Forest and the Northern Piedmont Mesic Oak-Beech Forest. The vast majority of forest considered "poor quality," in the 1999 DNHP survey is identified as Northeastern Modified Successional Forest in the 2011 survey. Other forest communities identified in the 2011 survey include Successional Sweet Gum Forest, Successional Tuliptree Forest, Mid to Late-Successional Loblolly-Sweet Gum Forest, Early to Mid-Successional Loblolly Pine Forest, Norway Spruce Planted Forest and White Pine Planted Forest. The vegetation community survey also identified two early successional vegetative communities within the Park, Northeastern Successional Scrubland and Northeastern Old Field. It is anticipated that a more thorough survey of the park's vegetative communities will add to and refine this list.

Flora

The Park contains a diverse assemblage of plant life represented by nearly 800 species of vascular plants. Of this total 239, or 30% of the park's flora, are non-native species. Thirty-five of these non-native plant species are considered invasive and pose a serious threat to the natural plant communities within the park. The native flora of the park includes 82 rare plant species. Eleven of these are found nowhere else in the state. The park's catalog of flora also includes 88 species of Mosses and Liverworts or Bryophytes. Bryophytes were most numerous and diverse in moderate to steep-sided ravines which tend to contain mature forest and numerous rock outcrops.

Fauna

White Clay Creek State Park and the surrounding protected lands in Delaware, Pennsylvania and Maryland provide important habitat for a wide range of animal species. Two hundred species of birds (nearly half of which breed in the park), sixteen species of amphibians, seventeen species of reptiles, twenty-three species of fish and twenty-eight species of odonates (dragonflies and damselflies) are known to occur within the park's boundaries. While no comprehensive mammal surveys have been completed in the park in recent years (or possibly ever) it is possible that up to at least 35 species of mammals occur within the park. The most recent addition to the park's mammalian fauna is the Coyote, which has quietly emigrated into Delaware from surrounding states within the last decade or so.

Resource Ranking

Forest Ages in White Clay Creek State Park are exhibited in Map 15 while the park's natural resources are ranked and exhibited in Map 16 . Both types of information are valuable in determining the potential impact trails may have on any given habitat type and/or quality. Map 17 exhibits forest fragmentation in a section of the Carpenter Recreation Area. Five levels define natural resource ranks. The following outline defines the ranking system.

Level 1

- Area known to be important feeding and resting area for numbers of migrant birds during spring and/or fall migration;
- and/or Large Blocks of Mature Forest;
- and/or 1 Heritage Element Occurrence of S1.1;
- and/or Multiple Heritage Element Occurrences with a single S1 or S2 species; and
- and/or A single Heritage Element Occurrence with 3 or more S1 or S2 species.

Level 2

- Large area of forest adjacent to a Level 1 area creating a large contiguous forest block,
- and/or Single Heritage Element Occurrence of a single S1 or 2 S2 species

In instances where a single EO was the primary criteria for an area receiving Level 1 or Level 2 designation, a buffer determined to be large enough to protect the EO was used to determine the boundaries of the area.

Level 3

- Area of intact habitat including early successional habitats (grassland, meadow, old field, scrub-shrub) with relatively low invasive species cover; and
- May include bordering agricultural fields that could easily convert to similar habitat if agricultural practices were stopped.

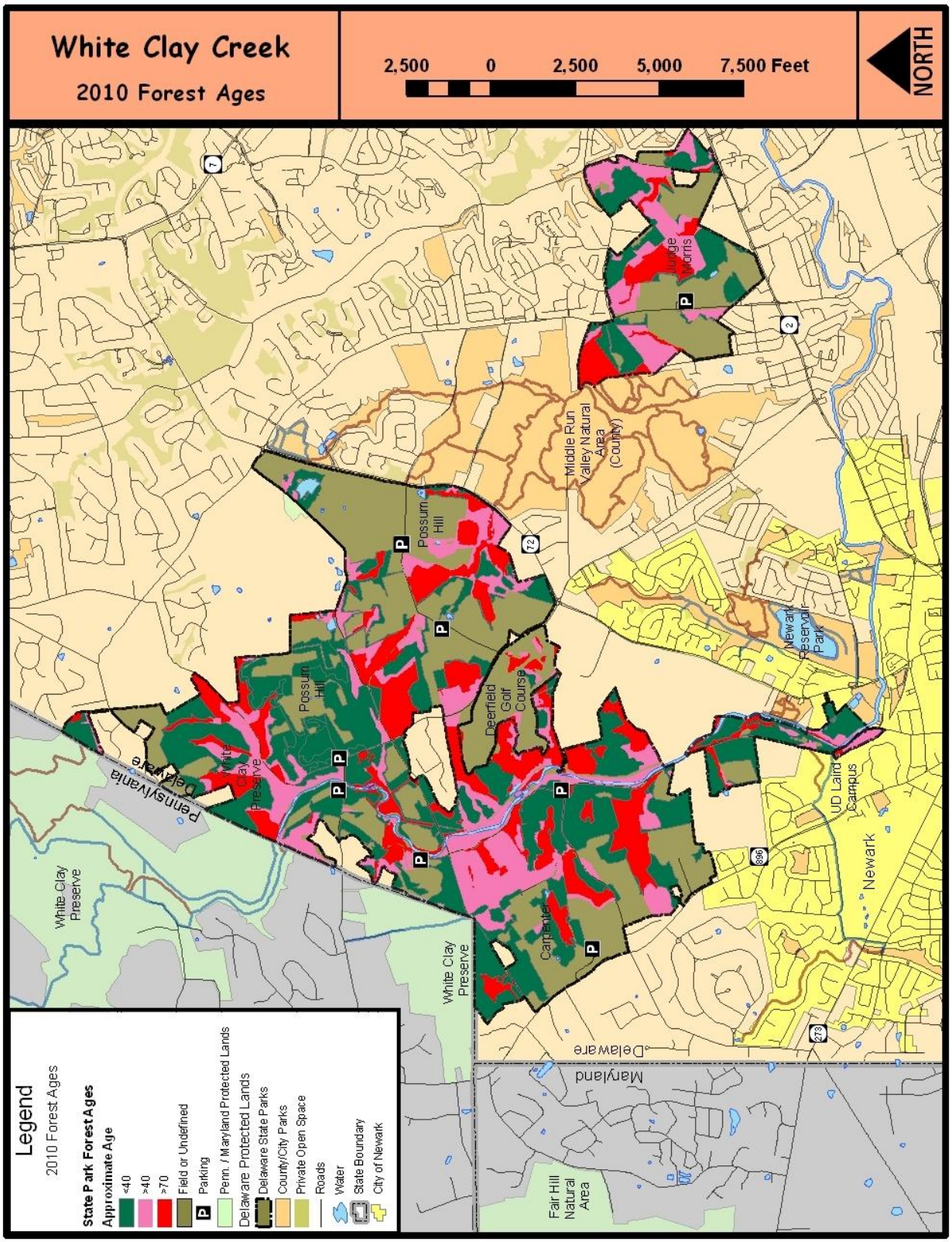
Level 4

- Area currently used for passive recreation, or agriculture adjacent to an active recreation area with significant infrastructure that could be relatively easily converted to the same purpose with little impact to moderate to adjacent high quality natural resource areas.

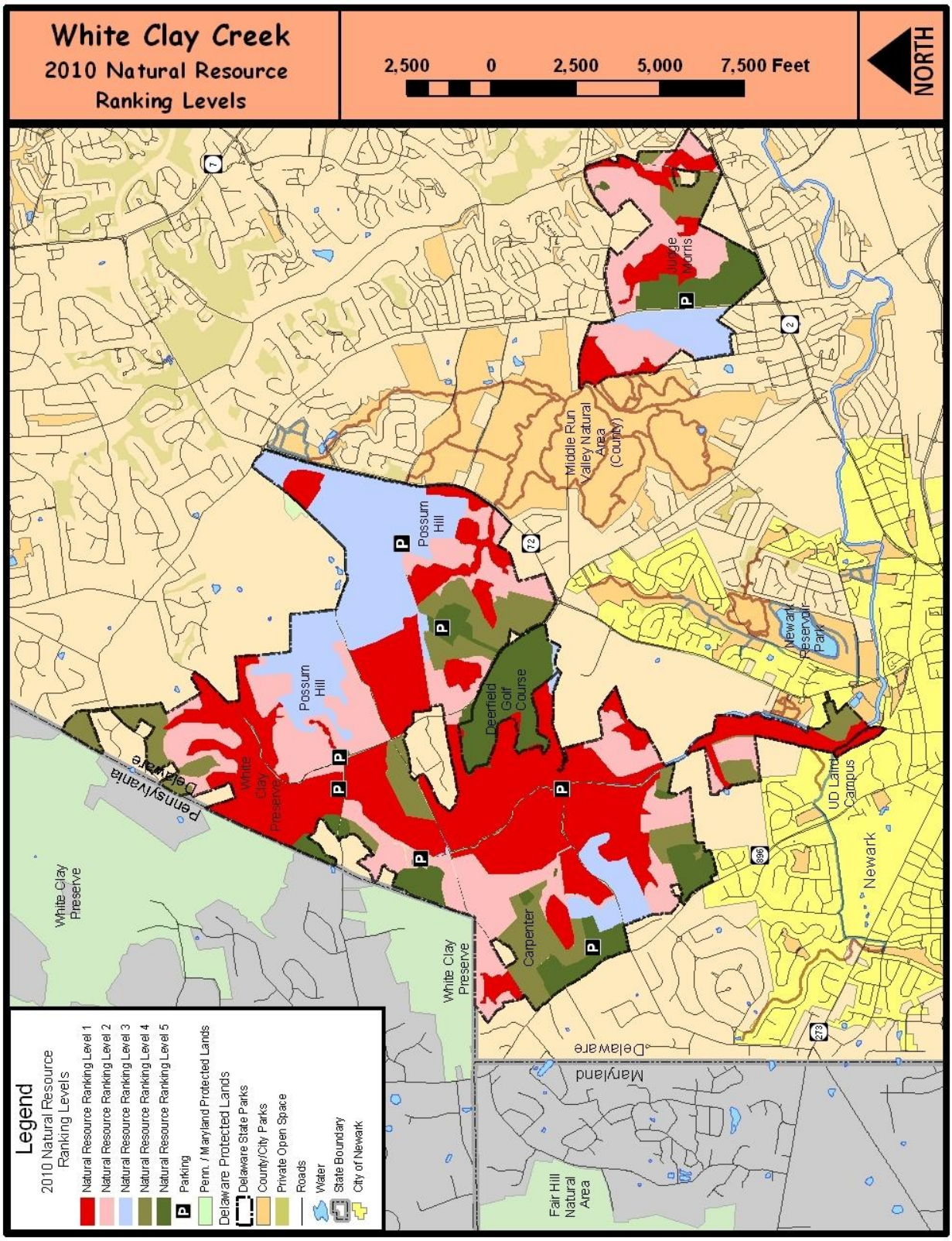
Level 5

- An active recreation area with significant infrastructure or an area with significant disturbance from past or present land use practices.

Map 15 - Forest Ages



Map 16 - Resource Ranking

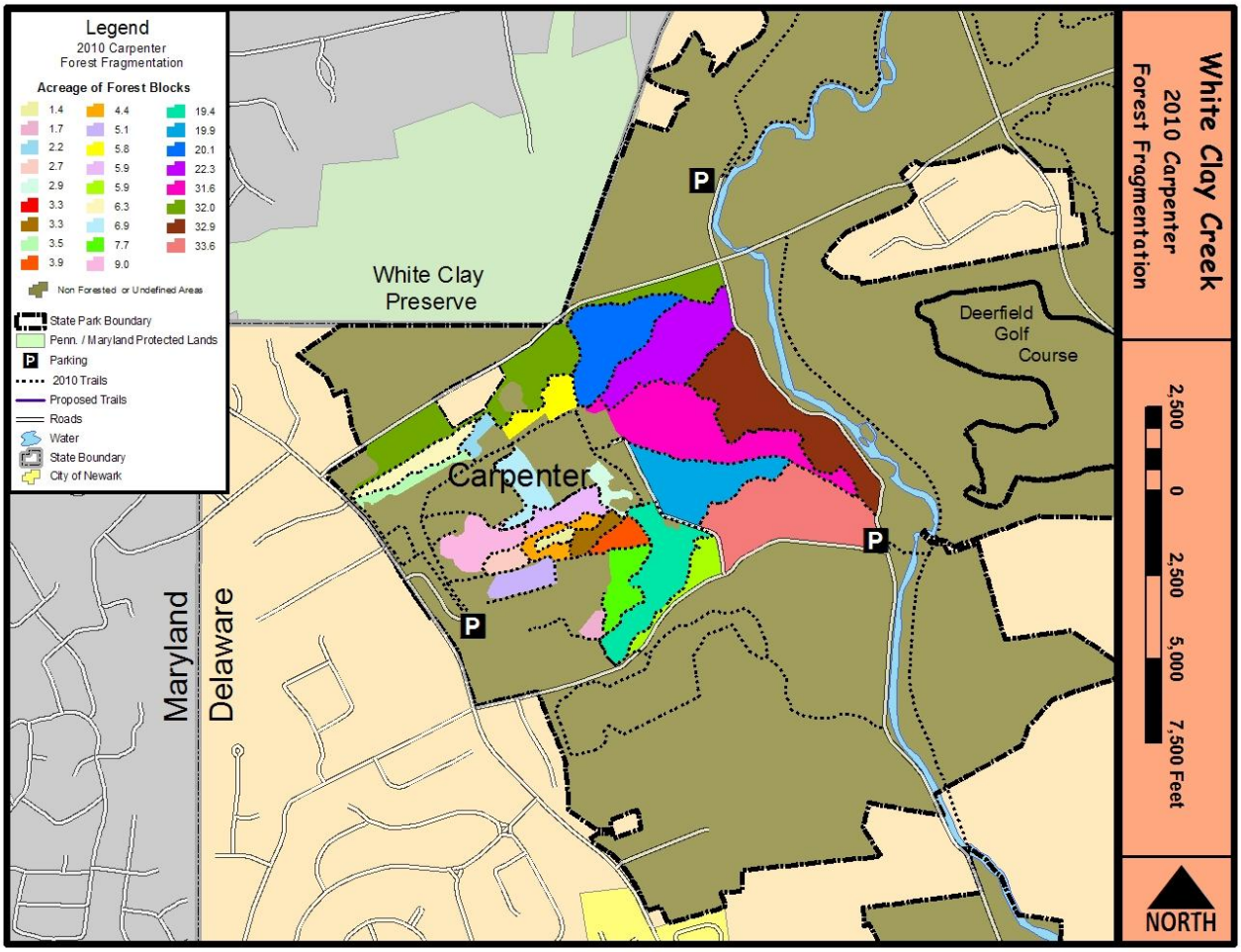


Habitat Fragmentation

Trails fragment habitat by bringing a previously non-existent disturbance corridor into once isolated habitat. This disturbance can encompass all levels of the affected ecological habitat, including foraging and reproductive habitat of animals (primarily birds), rare and significant plant populations, and poorly placed trails can even affect tree canopy by destroying tree roots of individual trees within trail alignments. Trails frequently establish invasive plant corridors along their alignments, especially into previously isolated interior forest tracts.

The degree of disturbance to plant and animal communities can be partially mitigated by the choice of the type of habitat being disturbed. The trail planning process evaluated proposed trail alignments with habitat data resulting in avoidance of the highest quality habitats within the park. Mitigating the effects of fragmentation caused by trails and use is an objective of this Trail Plan. Natural resource planners worked closely with recreation trail planners and park managers to minimize the impacts of trails on the park's natural resources. That interface and collaboration will continue as portions of trail plans are implemented. Map 17 below shows fragmentation in the Carpenter Recreation Area of the park today. Map 24 shows how fragmentation would be reduced as changes are made to the trail system.

Map 17 – 2010 Habitat Fragmentation



Trail Plan

In analyzing and assessing the existing trail system, the Division evaluated changes made since the 1998 comprehensive assemblage of trail data and determined progress made in achieving trail-related objectives. Geographic Information System (GIS) instruments were used to assess factors that characterize White Clay Creek State Park. This tool has been most valuable in discovering the relationship of trails within landscapes and habitat. GIS analysis has been a powerful tool in moving from diagnosis to prevention, mitigation and enhancement.

GIS analyses, combined with field reviews, have revealed trail segments that fragment habitat. Habitat and natural heritage findings identified by both the Division's Stewardship Program and DNREC Natural Heritage and Endangered Species Program (NHESP) were examined within the context of the existing trail system. Trail relationships to forested blocks, ranked habitat, and natural heritage data revealed site specific impacts. Other analyses quantified the scale of trail system overlap with fall-line, floodplain, flat area and hydric soil conditions. Known and potential cultural resource sites were analyzed for their relationship to both the existing and planned trail network.

Using GIS tools and field review, resource experts determined impacts to natural resources, cultural resources, and to unsustainable trail conditions (fall-line, hydric soils, etc.) can be ameliorated by shifting trail alignments. This section of the plan outlines the locations of new trail alignments. The planned trail system is the result of extensive evaluation and assessment, input from stakeholders, and collaboration with resource professionals. Planned trail changes are not wide-sweeping across the park, yet areas of the White Clay require trail reroutes, realignments, closures and new trail construction to continue to achieve the objectives outlined within this plan. While the existing trail system totals 40 miles, planned changes result in a net increase of 3.6 miles, for a new system total of 43.6 miles.

Minimizing Impacts upon Natural and Cultural Resources

Minimizing impacts on natural and cultural resources is critical. The intersection of recreational trails, trail use, and resource protection leads to the most effective way to minimize impacts-sustainable trail design, construction, and maintenance principles (see Appendix A).

What is a sustainable trail? Although there are many elements that determine whether a trail is sustainable, there are four main trail goals that help determine how sustainable a trail will be; resistance to erosion; fulfills the user's needs; requires little maintenance; and mitigates conflicts between different users. The more successful one is in meeting these goals, the more sustainable a trail is. By far, the biggest threat to non-paved trail sustainability is erosion.

Erosion is the natural process by which soil and other material is transported by wind or water. If left unchecked, erosion can quickly cause serious damage to trails and the very resources we are charged to protect. Trail erosion can be accelerated by seasonal conditions, weather patterns, trail use, use volume, use type, terrain, vegetative cover, and gravity to name a few. Depending on the combination of the listed conditions above, tread material susceptibility will vary. However, one can only mitigate trail erosion through the utilization of sustainable trail principles.

Sustainable trail principles work together and when applied will create contour trails that will effectively manage erosion, provide high quality low maintenance trails that are fun to use, and help to reduce environmental impact, risk, and user conflicts. The main two goals of these principles are to manage water and users. Success is measured by keeping water off the trail and users on the trail. The following is a list of the main principles of best practices to achieve sustainable trail systems.

Trail Sustainability Best Practices

- Trail location: along hillsides are best
- Trail alignment: along contours
- Trail grades: keep grades 10% or less on average
- Grade reversals: incorporate *frequent* drainage throughout trail system
- Outslope: slope tread toward downhill side to encourage sheet flow across trail
- Adaptive trail design: consider trail design change as soil texture, vegetation cover and other site characteristics change
- Minimize soil displacement: design must take into account type of users
- Prevent user created trails: close all unofficial trail created by users
- Maintain trails: perform regular maintenance

Trail layout and design must take into account the natural and cultural resources of the site. The highest quality habitats and sensitive cultural sites should be avoided to minimize the impact of trail construction on rare species and habitats and archaeological sites. As ongoing trail design and recreational needs intersect with protection of natural and cultural resources at the park, the problem of identification, conflict and resolution of the challenges faced has led to a more sustainable trail system. Keeping trails dry necessitates locating trails on the steeper slopes (8% and steeper) whenever possible. Utilizing steep slopes often avoids cultural resources but slopes of 25% and greater are often the best remaining intact native habitats in White Clay. Many species found on steeper slopes are not as common in the younger habitats that dominate the other less steep areas of the park.

Reducing and minimizing trail impacts in zones of high quality habitat and archaeological sites are planning objectives. Creating a trail system that maintains stable firm tread conditions is a main objective and achieves a higher level of sustainability, yet this very objective can play differently against the balance of protecting certain natural and cultural resources. Because of this, trail planning for high quality sites must occur over no less than one growing season to observe habitat conditions in the context of planned trails and how that may relate to targeted higher protection sites. In preparing this Trail Plan, observations have occurred over several growing seasons to assess potential impacts planned trails may have.

Natural Resource Impacts

As noted elsewhere in this plan, if not planned or constructed properly, trails can lead to unacceptable levels of erosion, compaction, displacement, habitat fragmentation and other ecosystem disturbances. Trails themselves can be avenues for invasive species (plant or animal) introduction - or proliferation - a serious problem in many of the state parks. Trail users, no matter whether by foot, horse, or bike, are sources of seed dispersal. Unknowingly, trail users may bring in unwanted seed on shoes, boots, clothing, bicycle tires, and horses, which may take root. Some of the most highly invasive plants on Delaware's forested landscapes include Japanese stiltgrass and garlic mustard. These plants are not only a nuisance, they can alter local ecology. Even the cocoons (containing eggs) of invasive earthworms can be moved this way. This is the greatest threat to intact forested habitat with a closed canopy in the park.

Regular yearly monitoring (and treatment if required) is necessary along all existing and closed trails. In the younger forest areas and successional habitats that dominate White Clay Creek State Park invasive species introduction has been exacerbated. In areas where the trail corridor is wider, long sinuous 'edges' (one on each side of the trail) have been created that can extend through miles of successional habitat. There are frequent and sometimes permanent canopy gaps established above the trail that increase light exposure to the trail edges, creating better growing conditions for harmful invasive species. Multiflora rose, wineberry, autumn olive, bush honeysuckles, Japanese honeysuckle and others species are known to take hold were trail corridors are wide. Unfortunately, this is the typical trail condition in White Clay Creek State Park, challenging park staff to keep pace with undesirable plants over-running trails and landscapes. The use of flail mowers and brush hogs for park maintenance has undoubtedly contributed to the spread of invasive plants.

Cultural Resources Impacts

Although archaeologists are not yet certain exactly when the first human occupation of Delaware took place, we can say with certainty that people were living in the area by at least 12,000 years ago. These earliest inhabitants lived by hunting animals, particularly large game such as mastodons, mammoths, and other Pleistocene megafauna, and by gathering plant foods –both linked to resource availability. During this early period until the Historic Period, the grassland settings of the floodplain and the ecotone between the grasslands and the forests along White Clay Creek would have provided an attractive setting for big game and more plan variety. It was within these areas during prehistoric times where small micro-band camps would have been located in sheltered locations overlooking low order streams.

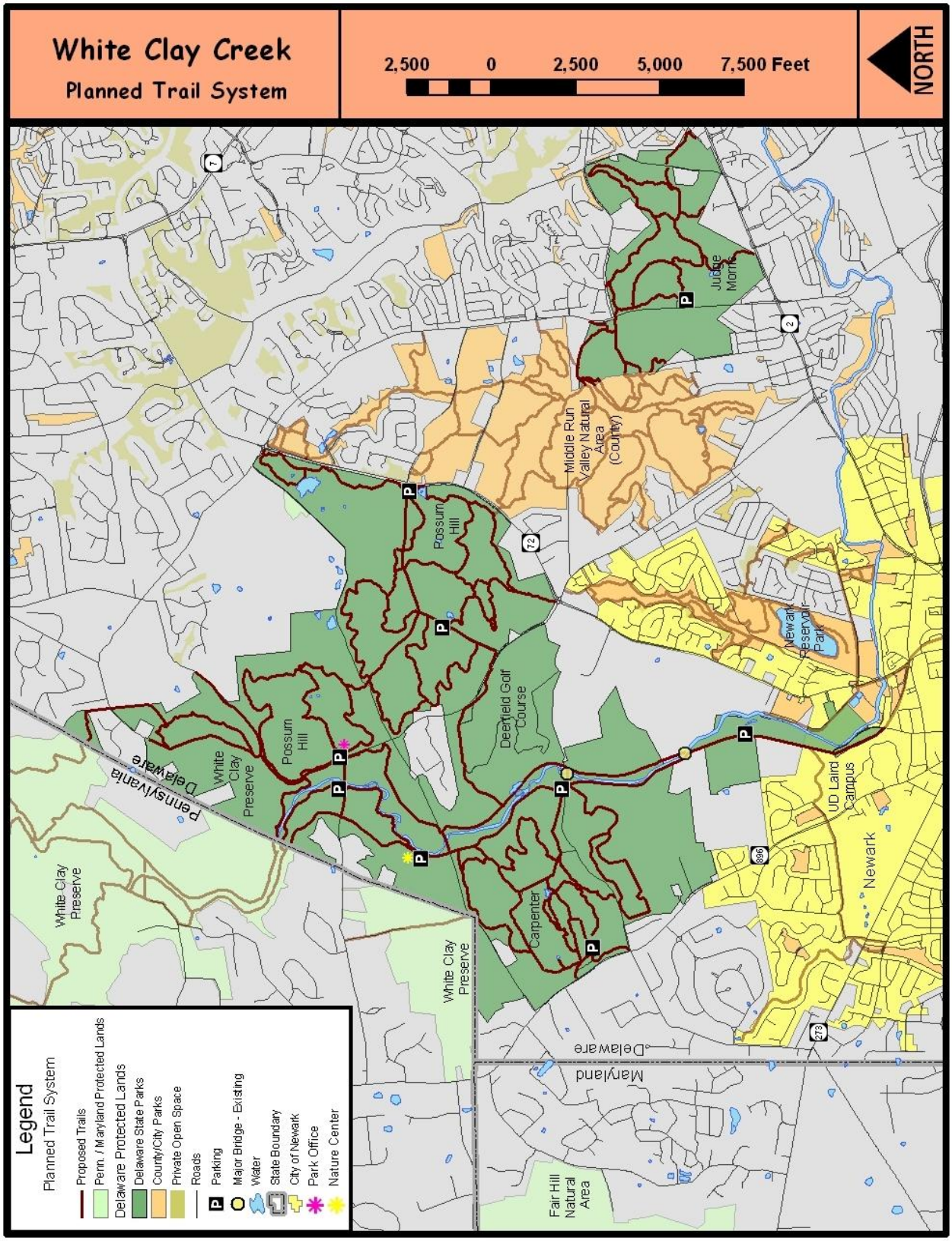
The advent of maize agriculture increased the size and length of stay of camps, thus increasing the likelihood of evidence left behind. The biggest change occurred during the Historic Period. The history of White Clay Creek area strongly reflects the agricultural and small-scale industrial heritage of northern New Castle County when European settlers established farmsteads. It is these historic farmsteads, existing structures of today, remains, known homestead locations, and likely prehistoric sites that warrant investigation as they relate to trail development to ensure protection.

Planned Trail Network

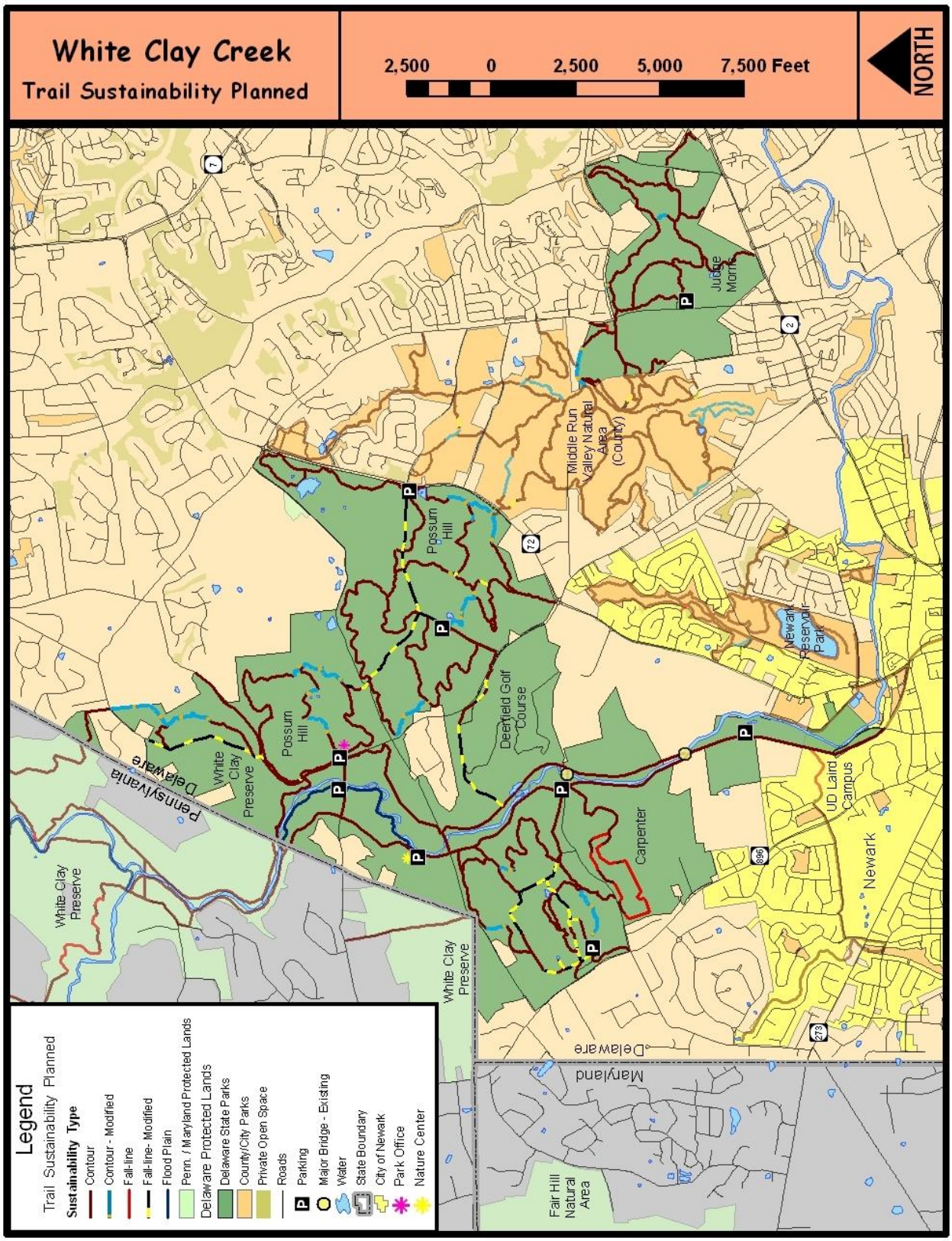
Based on a wide range of factors that include the existing trail system, natural and cultural resources, trail use data, and social science findings, changes to the existing trail system are essential to create more sustainable conditions, reduce fragmented habitat, and to achieve greater connectivity between park management units and the surrounding community. The analysis of the White Clay Creek State Park demonstrates that of the 40 total existing trail miles, 13.2 trail miles of new trail or existing trail needing some degree of change or enhancement is required. Planned trail alignments are designed to mitigate habitat fragmentation, reduce or eliminate fall-line trail segments, connect to communities, link other area of the park, and reduce impacts to natural and cultural resources. Map 18 depicts the planned trail system for White Clay Creek State Park. New trail construction will provide connections between park management units allowing recreational trail users to progress across the entire park and to travel safely between Newark, area parks and neighborhoods. After planned changes – closures, new Road-to-Trail and Road-with-Trail designations, small reroutes, and new segment construction – White Clay Creek's trail network will grow from 40 miles to 43.6 miles long.

Within the trail network sections of roads, which are used for trail activity to some extent, are not included in the park's trail mileage totals. This Trail Plan establishes new designations that address trails within, and, on road corridors. New designations include the following categories: 1) Road-with-Trail and 2) Road-to-Trail. For example, Thompson Station Road is open during the week for vehicle traffic, but closed on weekends making it open for trail use. Thompson Station Road will be designated as Road-with-Trail and its mileage calculated into the trail network for the Possum Hill management unit. In this Trail Plan, distances of road corridors with new designations are reflected in Tables 11, 13, and 14 for Carpenter, Possum Hill, and White Clay Preserve respectively.

Map 18 - Planned Trail Alignments



Map 19 - Planned Trail Sustainability



Significant improvements have been made to achieve environmental trail sustainability (Map 19) and will continue to be made with the implementation of this Trail Plan. However, due to landscape characteristics and the position of existing roads planned to designate as trail alignments, environmental sustainability is not one-hundred percent achievable. For example, the analysis of Smith Mill Road determined that its position crosses contours classifying the alignment as fall-line. It is not feasible or desirable to realign the road segment recommended for road-to-trail designation. The road-to-trail segment is expected to remain in its current condition, though if funds were available it could be hardened. Mitigating or preventing erosion on fall-line trails requires hardening the surfaces to stabilize current conditions. Where on-contour alignments cannot be achieved, soil erosion should be reduced or where higher water table conditions prevail, trail surfaces should be hardened. Those locations include: the planned loop trail in Carpenter Recreation Area; the connector trail from the main shared use loop to Wedgewood Road; the connector trail between the Pomeroy Trail and Thompson Station Road; and both trails in the Big Pond region. Map 20, Planned Trail Surface, depicts locations where stone/fines or asphalt surfaces will be required to maintain stable trail treads.

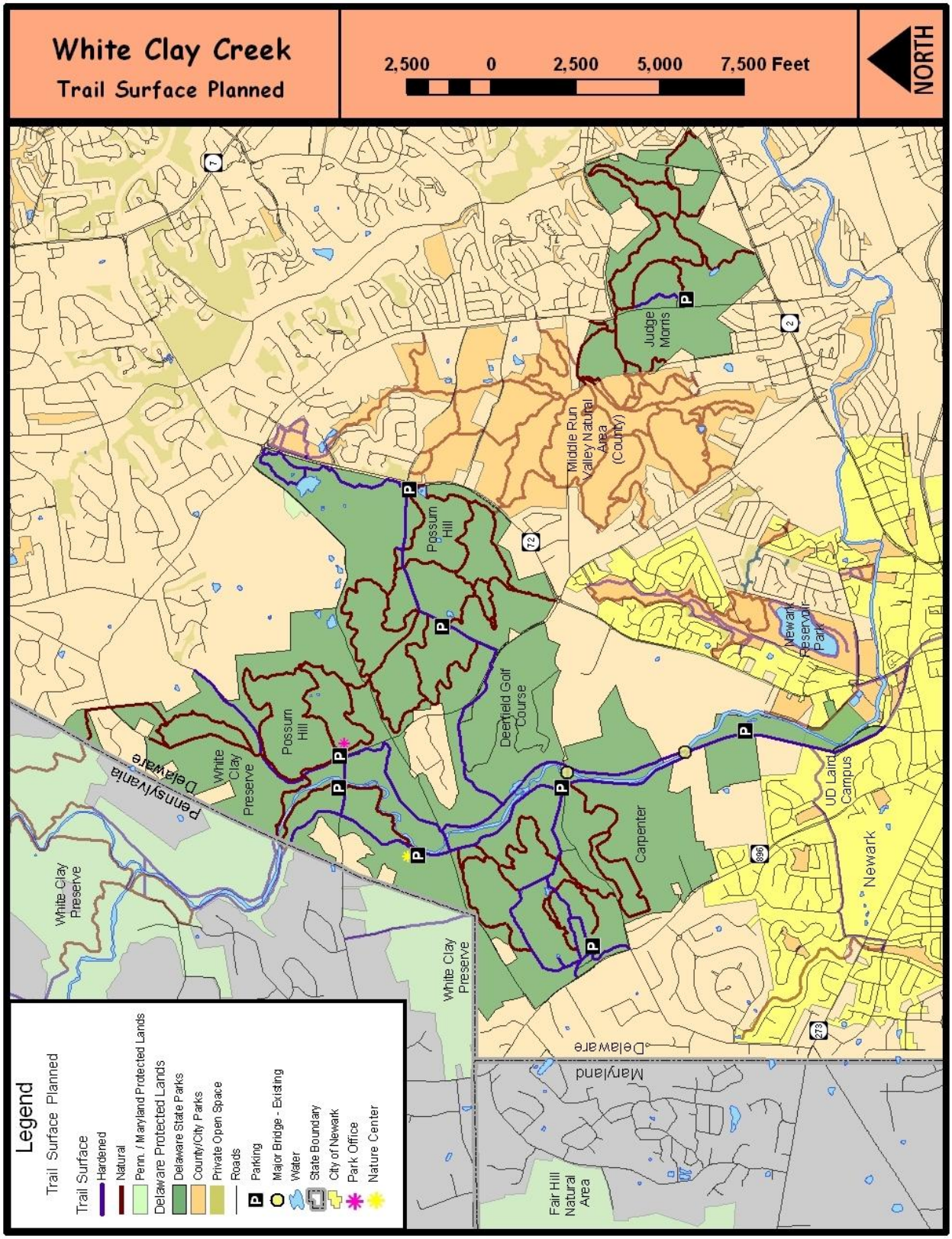
Improvements in trail sustainability have been accomplished over a period of more than ten years. Between 1998 and 2010, looking at contour trail alone, trail system sustainability improved from 22% to 52%. That is, today 52% or 20.8 miles of trail meet higher sustainability standards. This Trail Plan outlines new alignments to continue meeting sustainability objectives. Under the planned trail system, a minimum of 84% of all trail miles will become sustainable when the plan reaches full implementation. Trail tread sustainability would increase beyond 84% if additional natural surfaces are transformed to paved surfaces. Short trail segments would benefit from trail tread changes. Table 9 lays out a comparison of trail sustainability levels beginning with the assessment of 1998 data, the 2010 data, and projected levels based on the planned system of trails.

Table 9 – Degree of Sustainability 1998, 2010 and Planned

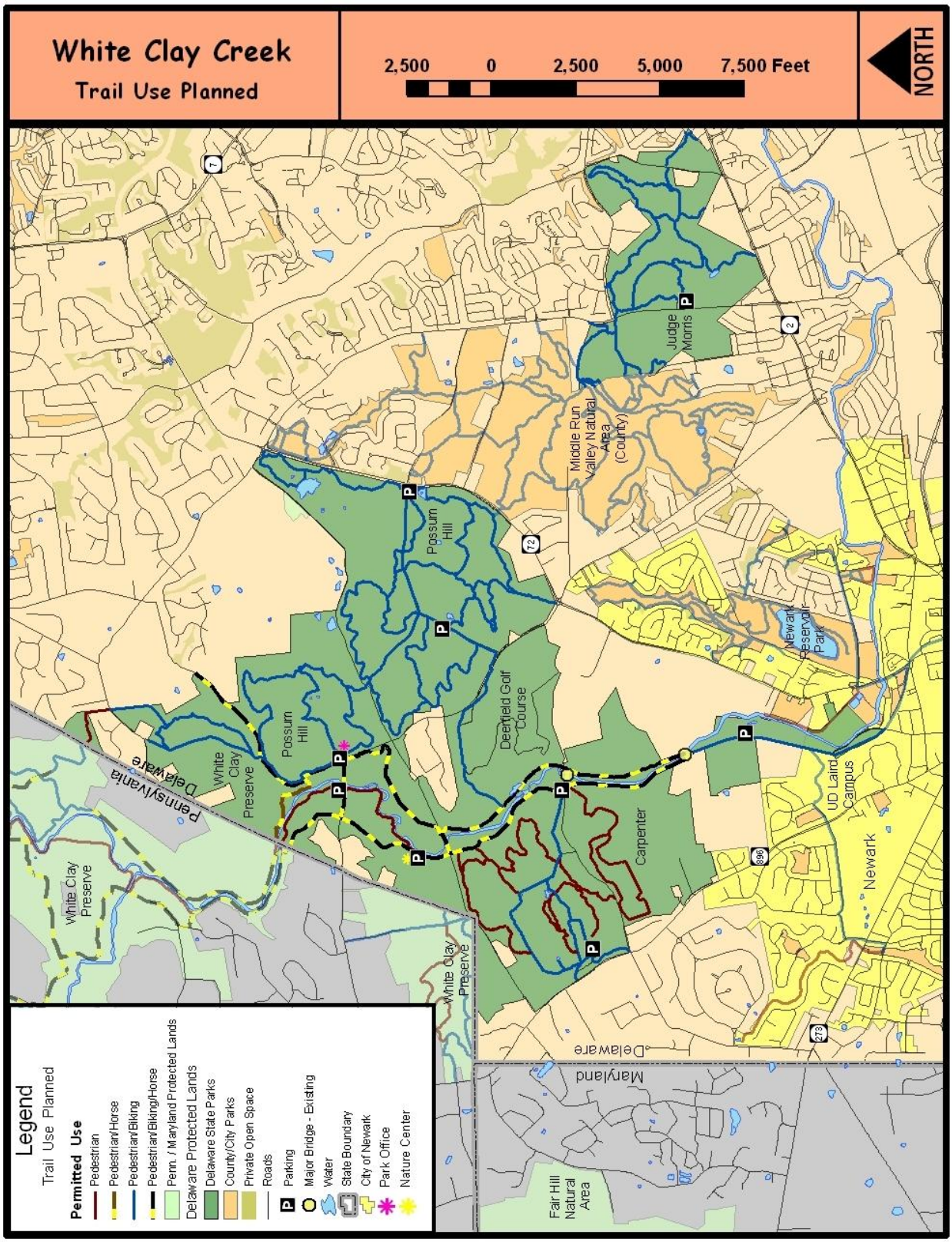
	1998 Mileage	Percentage	2010 Mileage	Percentage	Planned Mileage	Percentage
Total Mileage	40.0	100%	40.0	100%	43.6	100%
Sustainability Type						
Fall-line	28.7	71%	16.7	42%	6.4	15%
Contour	8.7	22%	20.9	52%	36.5	84%
Agricultural Fields	0	0	0.5	1%	0	0
Flat/Poor Draining	0.7	2%	0.4	1%	0	0
Flood Plain	1.9	5%	1.5	4%	0.7	1%

Connecting communities and connecting management units of White Clay Creek State Park are objectives of this Trail Plan. To achieve these objectives, an all-weather hardened surface trail traversing the park - north to south and east to west – is planned to be created. Map 20 outlines the planned surfaces. Purple lines on Map 20 indicate all-weather trails - some that are in place today, while other trails would be constructed to complete the cross-park network. When complete trail users will be able to walk or bike between Newark, the Nature Center, Park Office, Corner Ketch, Carpenter Recreation Area, Possum Hill and even Paper Mill Park (a New Castle County managed site). While road crossings would be necessary, trail users could recreate continuously around the park without interruption. Promoting healthy lifestyles and connecting park units with greater ease furthers the Division of Parks and Recreation's objectives to promote healthy lifestyles.

Map 20 – Planned Trail Surfaces



Map 21 - Planned Trail Use



Recreational trail use will undergo some changes– pedestrian-only, shared-use by pedestrians/bikers and shared-use by pedestrians/bikers/equestrians – though not profoundly different from what is permitted today. For example, the addition of a shared-use trail link between Hopkins Road and the Park Office adds 0.9 miles of trail. This link would become shared-use by pedestrians/bikers/equestrians. This segment adds a major missing link between Carpenter and Possum Hill (north of Hopkins Road) and increases recreational opportunities for all trail users. A link between Hopkins Road and Park Office will, for example, allow equestrians looped riding opportunities that reach into Pennsylvania. The current trail system offers horse riders only out-and-back riding.

Shared-use by pedestrians/bikes would continue where these uses are currently permitted, and, where new links between management units are planned. At Possum Hill a shared-use trail (pedestrian/bike) will be created in Big Pond area. These new alignments will link the intersection of Paper Mill and Corner Ketch Roads (at Paper Mill Park) with Smith Mill Road. See Map 21 for the planned trails uses and Table 10 for the trail uses and their associated miles.

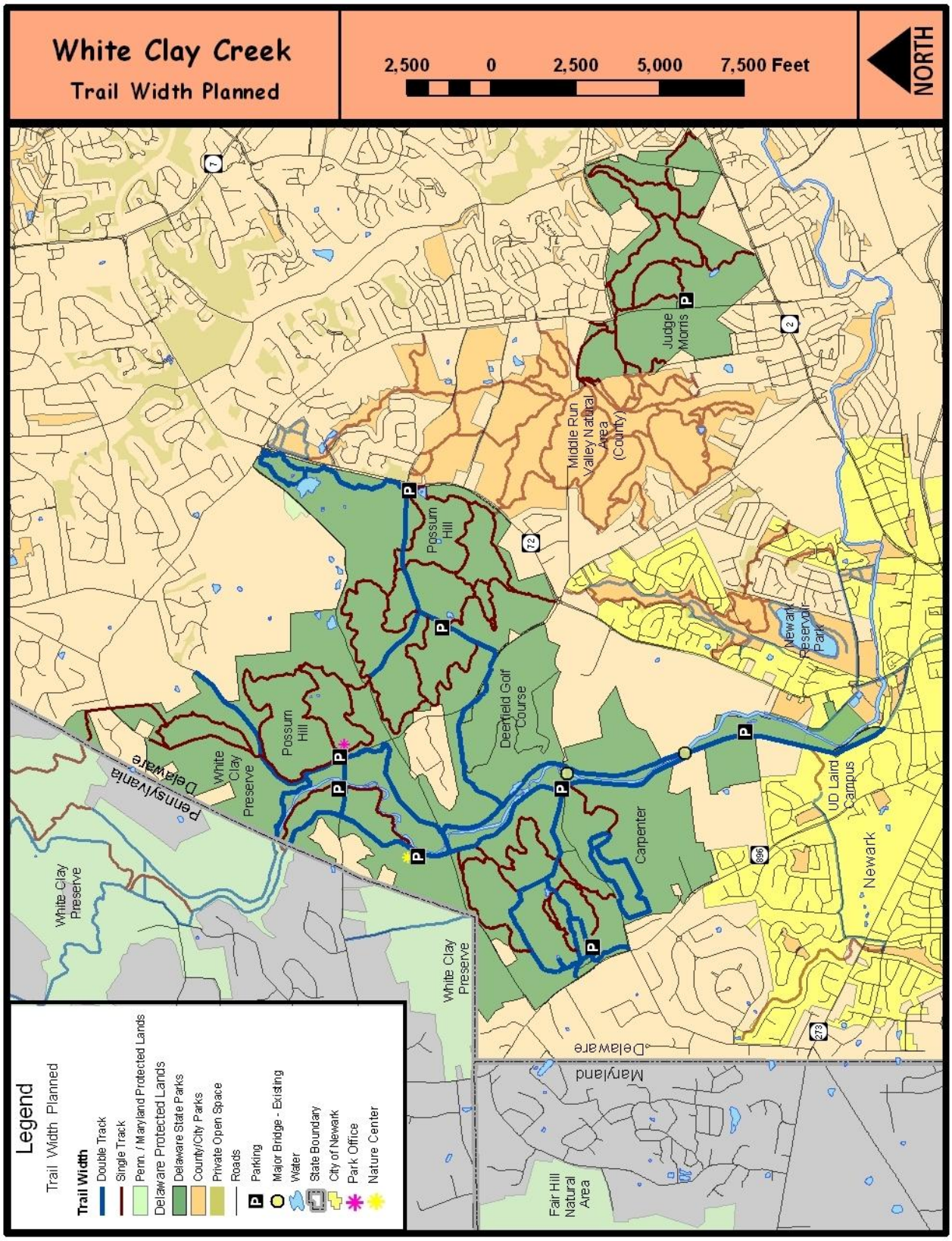
In the Trail Plan, pedestrians can recreate on one-hundred percent (100%) of the trails – 43.6 miles total. Eighty one percent (81%) or 34.5 miles will be open to biking and mountain biking while 17% or 7.4 miles will accommodate equestrian riding.

Table 10 - Planned Trail Mileage Available for Users

Trail Use	Miles	% of Total Miles Available
Pedestrian	43.6	100%
Biking	35.3	81%
Equestrian	7.4	17%

Trail widths are defined as single track (36 inches and under) and double track (3 to 8 feet). Hardened all-weather trails (stone with fines or asphalt) are expected to range from 5 to 8 feet wide. Earthen, natural surface trails, generally fall between 2 to 4 feet wide. Creek Road, Smith Mill Road, Nine Foot Road, Thompson Station Road, a segment of the Whitely Farms Trail, and the Pomeroy Trail will remain surfaced as they are today, either surfaced in stone/fines, concrete, or asphalt. A connector trail between the Pomeroy Trail and Thompson Station Road cannot be aligned to avoid fall-line conditions. As a result this segment will require an asphalt surface, a requirement to stabilize its surface, reduce erosion, increase sustainability conditions and provide trail users with a safe trail tread. New trails in the Big Pond region of Possum Hill will have variable widths; the shared-use segment will be approximately 8 feet wide to accommodate a community connection. However, the pedestrian-only segments will likely range under 5 feet wide. See Map 22 for a composite view of trail widths.

Map 22 - Planned Trail Widths



Two new parking lots are planned for White Clay Creek State Park. One parking lot will be at the park's southern end between the new Pomeroy Trail Bridge and North College Avenue. It is situated approximately 0.8 miles north where North College and Creek Roads converge. Adding this site will promote park accessibility. At Possum Hill, the existing parking lot on Smith Mill Road will be moved east, but remaining on Smith Mill, to a location close to Paper Mill Road. Moving this lot will provide more secure parking conditions for park visitors, permit realignment of fall-line trail segments and allow for 1200 feet of Smith Mill Road to be designated as Road-to-Trail. Map 23 depicts planned trail access and trailhead parking.

Trail Safety

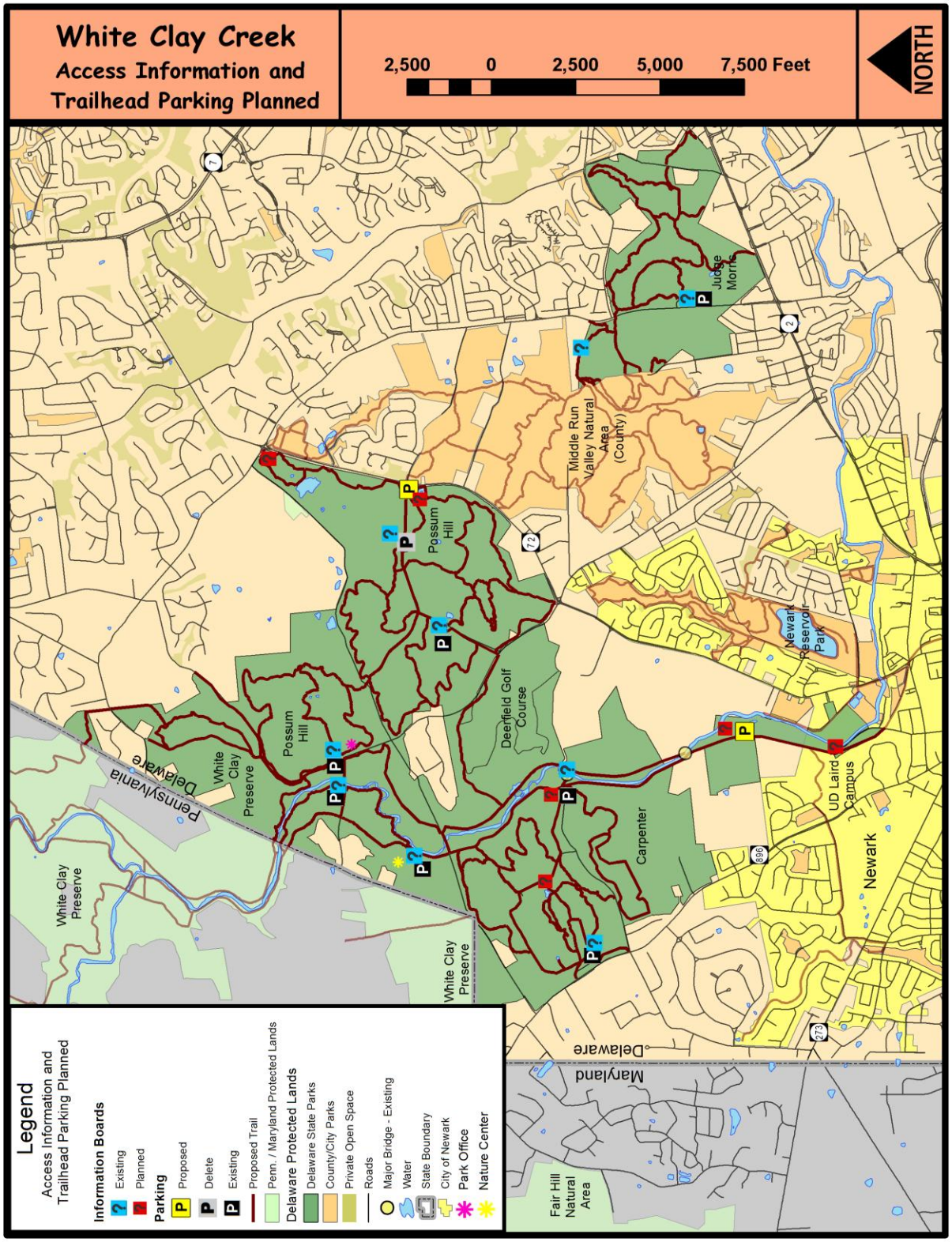
Integral to any trail plan is user safety. Providing the safest experience possible is a culmination of understanding the landscape design challenges, breadth of trail experiences being offered, types of users, volume of users, and signage and information to best guide the trail visitors. Where to park, what activities are allowed, how to navigate, what type of users one can expect, how wide, long, and steep is the trail, trail etiquette, and how to seek help are some items that must be addressed to keep trails safe. Not everyone will feel the same level of safety for all the different trail experience such as narrow vs. wide trail, single use vs. shared use, or smooth vs. rough tread surface. However, providing the right information for the users is critical in fostering users or potential users to make informed decisions on what experiences are right for them.

Another component of trail safety is road crossings. Unique in the number of road crossings, White Clay Creek State Park has seven official locations across the trail system-more are planned. Whether it be a hiker, biker, or trail runner, at least one road crossing will have to be negotiated if the intention is to link to other areas of the park. Working with DelDOT is critical in addressing and providing the safest road crossings locations and associated infrastructure possible. At a minimum, trail crossing warning signs to alert drivers should be installed. Map 24 provides the locations for existing and proposed road crossings.

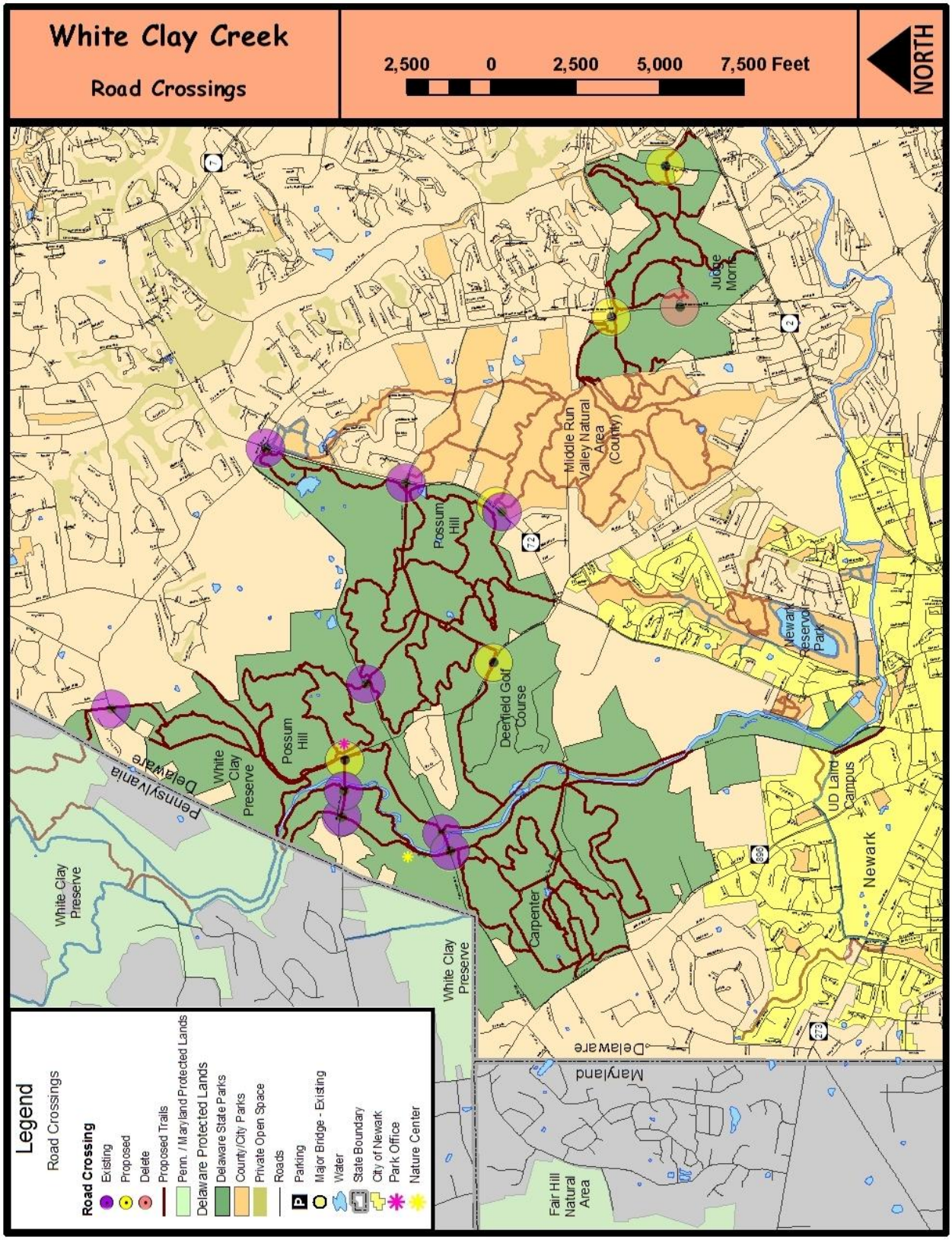
Wayfinding

Park user navigation aids are in the top five for most used and sought after trail amenities. Wayfinding amenities include trail maps and markers. Information Centers, to be located at all trailhead parking areas (see Map 23), will include maps and general park rules and information. Trailhead maps will show all the official trails and include names, uses, colors (which coincides with the coloring system of the trail markers), width, length, average grade, and location (see web map example B1). Marker posts (see Map B2 for trail sign plan), located at all trail and road intersections, must include trail name (color coded to match map), allowable uses, and destination information as needed. Each marker post location will dictate what information should be provided. See Figure B4 and Appendix B for trail standards and a typical marker post example and additional design details.

Map 23 - Planned Trail Access and Trailhead Parking



Map 24 - Planned Road Crossing Locations

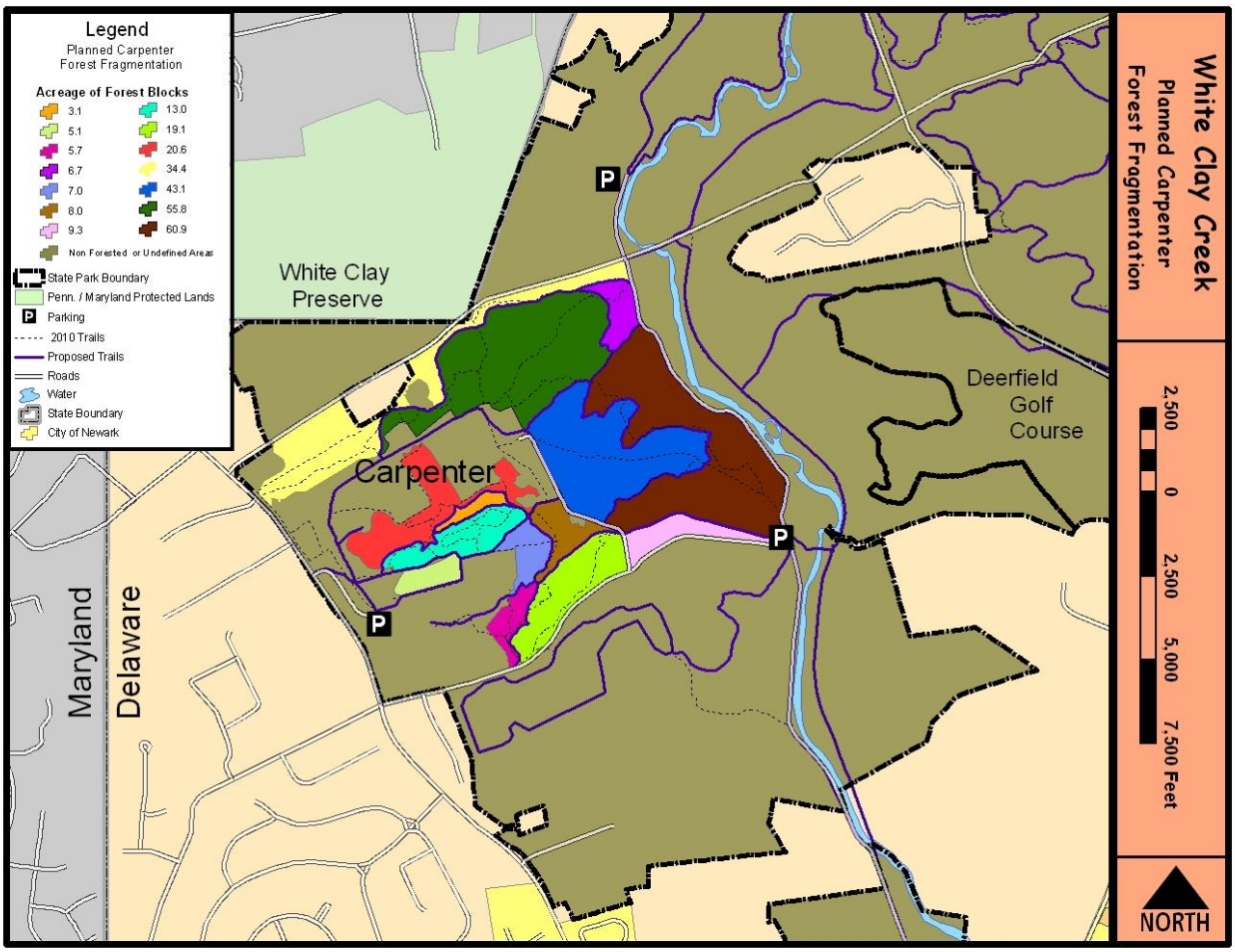


Trail Network Plan - Carpenter Recreation Area

Carpenter Recreation Area contains 1,367.8 acres and 16.2 miles of trail. This park unit is the largest in White Clay Creek State Park and covers a wide geographic area lying between Route 896 and Thompson Station Road, and the City of Newark and Hopkins Road. Carpenter hosts the Park's most active outdoor recreation facilities including a playground, picnic pavilion and picnic grove, a performing arts stage, disc golf course and cross-country running course. Scenic White Clay Creek bisects this park unit. Two major pedestrian/bicycle bridges cross the White Clay Creek representing significant trail system investments and enhancements.

In the core Carpenter area, closest to the day use parking lot, a confusing and duplicative system of trails is in place. Input received from stakeholder review (a result of meetings held in spring and summer 2010) indicate support for transforming the "spaghetti bowl" of trails in Carpenter. Over 8 trail miles in Carpenter are not sustainable, while other trails fragment natural resource habitats that rank as Levels 1 and 2, and, oldest forests within the park. (See Maps 16 and 17 for data.) While the existing trail network in Carpenter has segmented habitat into 31 separate blocks, the planned trail network consolidates and unifies blocks of habitat. The Trail Plan for Carpenter reduces the number of blocks from 31 to 18 resulting in far less fragmentation of some of the park's best natural resource components. See Map 25 for a graphic representation of unified forest blocks that are an outcome of realigned and closed trails.

Map 25 – Carpenter Forest Fragmentation Planned



While the Carpenter Recreation Area physically links the White Clay Preserve and Possum Hill, it has but one linear connection via Creek Road to the west side of the Preserve. There is no linear connection for park users to Possum Hill and to the east side of Preserve. Constructing a trail segment east of the Pomeroy Trail on the Golf Course Road alignment to Thompson Station Road will fill the gap creating a link to the Possum Hill management unit. Completing this segment fulfills a significant portion of the west to east spine trail traversing the park.

New trail designations of Road-to-Trail and Road-with-Trail; closing duplicative trails; closing or realigning unsustainable trails; realigning trails that fragment the best habitat sites; creating an all-weather loop trail; and creating links that connect the Carpenter management unit to the White Clay Preserve, Possum Hill, City of Newark and the University of Delaware Laird Campus comprise the significant changes within the Carpenter Recreation Area. Creating a nearly 2-mile long all-weather loop will provide a firm wide surface on which to walk-accommodating a regular contingent of park visitors who walk in loops around the Carpenter parking lot. Nearby asphalt loops in Paper Mill Park (County) and Reservoir Park (Newark) are heavily used by walkers, strollers, and families. Built as planned, this loop will provide a largely shaded route that is expected to attract a similar park clientele and better serve the parking lot walkers.

Based on input from cross country coaches, park development and visitor uses, soil conditions and other natural resource conditions, and natural obstacles it is recommended that the current location of the 3.1 mile-long cross-country running course be adjusted. Runner safety, resource protection, park user conflict mitigation, parking, and course appeal are principal concerns in selecting a new course layout. At the time of this writing a new alignment has not been determined.

Table 11 below outlines existing and planned network metrics and associated net changes in Carpenter. Carpenter will see a net change of 2.5 fewer miles of new/improved/existing trail for a total of 13.7 miles. Planned changes in Carpenter Recreation Area include the following:

- Close 2.3 miles of double track trail that are currently old farm roads or poorly placed trails.

- Road-to-Trail - 2.5 miles of existing road corridor will be designated for:
    - Creek Road between Wedgewood Road and the new pedestrian/bike bridge (0.8 miles)
    - Creek Road – between Wedgewood Road and Hopkins Bridge Road (0.8 miles)
    - Wells Lane (0.3 miles)
    - Golf course access road to the Creek (0.6 miles)

- Road-with-Trail - 0.9 miles of existing road will be designated:
    - Creek Road – south of new pedestrian /bike bridge to Bubble Gum Rock (0.8 miles)
    - Hopkins Bridge Road – road shoulder from Pomeroy Trail to Creek Road (0.1)

- Construct an all-weather loop trail that promotes physical fitness (1.8 miles).

- Construct 2 miles of new trail that link Carpenter to other park units and Newark.
    - Connector from planned loop trail to Wedgwood (0.7 miles)
    - Connector from Pomeroy Trail to Thompson Station on the Golf Course Road alignment (1.0 miles)
    - Pomeroy Trail adjacent to UD Laird Campus (0.3 miles)

Table 11 - Carpenter Recreation Area Net Changes

Trail Characteristics	2010 Trail Network (miles)	Planned Trail Network (miles)	Net Change (miles)
	16.2	14.5	-1.7
Surface			
Natural	14.3	6.1	-8.2 [a]
Hardened	1.9	8.0	+6.5 [b]
Width			
Single Track	4.4	4.7	+0.3
Double Track	11.8	9.8	-2.0 [c]
Permitted Use			
Pedestrian	9.5	6.1	-3.4 [d]
Pedestrian Bike	4.3	5.1	-0.8
Pedestrian Bike Equestrian	0	3.3	+3.3
New Trail Designations			
Road-to-Trail	0	2.5	+2.5 [e]
Road-with-Trail	0	0.9	+0.9 [f]

Footnotes for Carpenter Recreation Area

a. 8.5 miles of existing trail that is not sustainable will be closed and replaced by 3.1 new miles of sustainable trail alignments.

b. 5.7 miles of hardened trail would be added to the trail system; 3.7 of the 5.7 miles is currently hardened (paved). Under the trail plan, hardened surfacing would increase due to new designation status of Road-to-Trail or Road-with-Trail.

c. Decrease is attributed to closure or realignment of unsustainable trails: old farm roads or poorly placed trails.

d. Decrease is attributed to reduction of amount of unsustainable, poorly placed trails.

e. Road-to-Trail - 2.5 miles of existing road corridor will receive a new designation:
Creek Road between Wedgewood Road and the new pedestrian /bike bridge (0.8 miles)
Creek Road between Wedgewood Road and Hopkins Bridge Road (0.8 miles)
Wells Lane (0.3 miles)
Golf course access road to the Creek (0.6 miles)

f. Road-with-Trail -- 1.8 miles of existing road will receive a new designation:
Creek Road – south of new pedestrian /bike bridge to Bubble Gum Rock (0.8 miles)
Hopkins Bridge Road – road shoulder from Pomeroy Trail to Creek Road (0.1 miles)

Trail Network Plan – Judge Morris Estate

Judge Morris Estate contains 527.1 acres and 6.5 miles of trail. This park unit is the smallest management unit in White Clay Creek State Park. It is bounded by Pike Creek Road, Route 2 and Old Coach Road, and adjacent to Middle Run Valley Natural Area (managed by New Castle County). Polly Drummond Hill Road bisects this unit. A portion of Pike Creek flows through the easternmost portion of Judge Morris.

Trails in Judge Morris saw significant changes and improvements over the last ten years. In fact, state-of-the-art trail planning and construction techniques were implemented here, resulting in the first sustainable trail network in Delaware's State Park System. Trail network changes in Judge Morris have resulted in the following: construction of the Chestnut Hill Trail; construction of stacking trail loops that provide recreational users with several trail distance choices; significant decreases in fragmented habitat; a reduction of 6.5 miles of fall-line trail; connections to the Middle Run Valley Natural Area; community links from Old Coach Road; and building of a 68- space parking lot and trailhead with an information board and composting toilet.

Due to these earlier efforts, the trail network in the Judge Morris Estate markedly meets Division objectives. Except for altering 0.4 miles of trail from a hardened surface to natural surface and an equal amount of trail reroutes, including community connections, there is no net change planned for Judge Morris. Table 12 outlines the net changes between the current and planned trail characteristics in Judge Morris.

Table 12 - Judge Morris Estate Net Changes

Trail Characteristics	2010 Trail Network (miles)	Planned Trail Network (miles)	Net Change (miles)
	6.5	6.5	0
Surface			
Natural	5.8	6.2	0.4 [a]
Hardened	.7	0.3	-0.4 [b]
Width			
Single Track	6.5	6.5	0
Double Track	0	0	0
Permitted Use			
Pedestrian	0	0	0
Pedestrian Bike	6.5	6.5	0
Pedestrian Bike Equestrian	0	0	0
New Trail Designations			
Road-to-Trail	0	0	0
Road-with-Trail	0	0	0

Footnotes for Judge Morris Estate

a. 0.4 miles of existing trail that is not sustainable will be closed and replaced with sustainable trail alignments.

b. 0.4 miles of hardened trail would be removed from the trail system; trail currently bisecting an active agricultural field just west of the yard waste site.

Trail Network Plan – Possum Hill

Possum Hill contains 1,144.5 acres and 12.7 miles of trail. This area ranks as the park's second largest management area. It is bound by Paper Mill, Thompson Station, and Pleasant Hill Roads. The Park's office is located in this management unit situated on Thompson Station Road. Trail activities are the predominating outdoor recreation endeavor here. Trails are accessed from a very small parking lot at the Park Office, Nine Foot Road, and a small parking lot on Smith Mill Road.

Trails in Possum Hill received significant changes over the last ten years. Refined state-of-the-art trail planning and construction techniques were utilized here, resulting in a noticeable difference and a more sustainable trail network. An inherited trail system of woods and farm roads in place at the time of acquisition were transformed with the following changes: reconstruction of significant segments of Bryan's Field Trail, Whitely Farms Trail, and the David English Trail; creation of stacking trail loops that provide recreational users with many trail distance, challenge, and landscape choices; significant decreases in fragmented habitat; a reduction of 6.0 miles of fall-line trail; connections to the Park Office and to Thompson Station Road (across from the Bank of America campus); construction of the 0.5 mile long Skills Trail; construction of a beginner/intermediate skills area adjacent to the Possum Hill Park Management Shop; construction of both the Nine Foot Road parking lot and trailhead; and construction of the Smith Mill parking lot (20-25 cars) and trailhead with an information board and composting toilet.

Skills areas are small, contained, and comprised an assortment of built "features" that help foster riding skill advancement. These areas are places to learn riding skills, hone balance, and fostering confidence and trail sharing etiquette. This Plan proposes to add a skills area, pavilion, and composting toilet adjacent to Nine Foot Road. It is envisioned that a skills area will include technical riding features and a pump track (The web link that follows is located in New Jersey) www.youtube.com/watch?v=vOVmLeekZWY&feature=youtube_gdata_player).

Table 13 outlines existing and planned network metrics and associated net changes for the Possum Hill area. Overall Possum Hill will gain a net increase of 3.5 miles for a new total of 16.2 trail miles. Planned changes in Possum Hill include the following:

- Remove 2.4 miles of unsustainable fall-line trail.
- Construct 6.5 miles of sustainable trail.
- Create an overlook stop at Big Pond.
- Construct 1.0 mile community connector trail between Paper Mill and Smith Mill Roads.
- Add 1,000 feet to the existing Skills Trails.
- Add a stand-alone skills and education area for bicycle riders adjacent to the Nine Foot Road parking lot.
- Add a pavilion and composting toilet at the Nine Foot Road parking lot.
- 0.3 mile of Smith Mill Road will be closed to vehicles and designated Road-to-Trail.
- Shift existing parking lot on Smith Mill Road east to site close to the intersection with Paper Mill Road.

Table 13 - Possum Hill Net Changes

Trail Characteristics	2010 Trail Network (miles)	Planned Trail Network (miles)	Net Change (miles)
	12.7	16.2	+3.5
Surface			
Natural	11.3	12.2	+0.9 [a]
Hardened	1.4	4.0	+2.6 [b]
Width			
Single Track	10.0	11.8	+1.8
Double Track	2.7	4.4	+1.7
Permitted Use			
Pedestrian	0	0	0
Pedestrian Bike	12.7	16.2	+3.5
Pedestrian Bike Equestrian	0	0	0
New Trail Designations			
Road-to-Trail		0	+0.3 [c]
Road-with-Trail	0	0.3	+1.1 [d]

Footnotes for Possum Hill

a. 2.4 miles of existing trail that is not sustainable will be closed and replaced with sustainable trail alignments.

b. 2.6 miles of hardened trail would be added to the trail system; 1.4 of the 4.0 miles is currently hardened (paved). Under the trail plan, hardened surfacing would increase due to new designation status of Road-to-Trail or Road-with-Trail, and new trail construction.

c. Road-to-Trail - 0.3 miles of existing road corridor will receive a new designation:
Smith Mill Road (0.3 miles)

d. Road-with-Trail - 1.1 miles of existing road will receive a new designation:
Thompson Station Road (1.1 miles)

Trail Network Plan – White Clay Preserve

White Clay Preserve contains 603.3 acres and 4.7 miles of trail. This park unit ranks as the White Clay Creek State Park's second smallest management unit. It is bordered by the State of Pennsylvania, and Thompson Station and Hopkins Roads. The Nature Center, located in this unit, north of Hopkins Road, hosts exhibits and programs. Scenic White Clay Creek bisects this park management unit.

Trails in Preserve received some changes over that last ten years. Those changes include: addition of the Boundary Trail (1.3 miles); regular relocations (due to flooding and bank erosion) of Preserve Trail segments; and some minor maintenance on Cart Road Trail. Trails in the Preserve area can be accessed from the Nature Center, Chambers Rock Road parking lot, and a few parking spaces at the Park Office.

Thompson Station Road lies between the White Clay Preserve and the Possum Hill management units. However, there is no linear connection between the Preserve and Carpenter on the east side of White Clay Creek. Constructing a trail segment between Hopkins Road and the Park Office will fill the gap creating a direct link to Carpenter Recreation Area and the Pomeroy Trail. Completing a 0.7 mile segment fulfills a significant portion of the north-south spine trail traversing the park. Table 14 outlines existing and planned network metrics and associated net changes for the White Clay Preserve area. Planned trail additions in the Preserve include the following:

- Construct a 0.7 mile link between Hopkins Road and Thompson Station Road (near the Park Office).
- Construct a 0.1 mile connector between Cart Road Trail and the Boundary Trail.
- Construct a Child Discovery Trail at the Nature Center with play features – approximately 1000 feet long.
- Construct a 0.3 mile connector along Chambers Rock Road between the park office and Creek Road

Table 14 - White Clay Preserve Net Changes

Trail Characteristics	2010 Trail Network (miles)	Planned Trail Network (miles)	Net Change (miles)
	4.7	6.4	+1.7
Surface			
Natural	3.1	4.1	+1.0 [a]
Hardened	1.6	2.3	+0.7 [b]
Width			
Single Track	3.1	3.6	+0.5
Double Track	1.6	2.9	+1.3
Permitted Use			
Pedestrian	1.9	1.7	-0.2
Pedestrian Bike	1.9	1.9	0
Pedestrian Equestrian	0	0.5	+0.5
Pedestrian Bike Equestrian	0.9	2.3	+1.4
New Trail Designations			
Road-to-Trail Conversion	0	0	0
Road-with-Trail	0	0.2	0.2 [c]

Footnotes for White Clay Preserve

a. 0.4 miles of existing trail that is not sustainable will be closed and replaced with sustainable trail alignments.

b. 0.7 miles of hardened trail would be added to the trail system; 0.2 of the 2.3 miles is currently hardened (paved). Under planned trail plan, hardened surfacing would increase due to new designation status of Road-with-Trail and new construction.

c. 0.2 miles of existing road will be designated as a Road-with-Trail segment.
Creek Road between Hopkins Bridge Road and the Nature Center (0.2 miles)

Technical Trail Challenge

National and state recreational use trends indicate adventure sports, including triathlon, adventure racing, backpacking, mountain biking, and climbing (to name a few), showing significant growth in the past several years and in 2010, up 2.3 percent in participation as a group. In addition, jogging and trail running were up 12.6%. A reoccurring and increasing trend is the interest of users from all trail related activities seeking a challenge. There are various ways to incorporate "challenge" into a trail experience. Integrating tread obstacles and/or maintaining narrow widths are two options for increasing the technical nature of a trail. Creating more technical optional lines along a trail corridor, utilizing man-made or natural features such as logs or rocks, can provide additional interest and challenge to an otherwise easy trail. Skills areas or parks can also provide opportunities that otherwise would not exist.

Specific locations for skills areas or trails are shown in the planning maps, but in many instances identifying exact locations and challenge type is not practical and must be addressed on a case by case basis when opportunities are identified. Such opportunities could be newly fallen trees adjacent to a trail used for climbing or riding, or embedding rocks into the tread for more challenge. Regardless of the type of challenge, providing a diversity of trail experiences across the entire system is critical in keeping interest high and people coming back for more.

Phased Construction & Reconstruction

Trail construction and reconstruction in White Clay Creek State Park would occur in phases over time. Following environmental and cultural resource review, statewide park project priorities and availability of funding are criteria that determine when projects can be implemented. System wide trail projects will fall into two main categories - projects handled by park staff and/or volunteers or large contract projects requiring engineering. These two categories will guide both funding and implementation strategies from year to year. Overall project ranking will be guided by trail plan objectives and how any given project meets those objectives. The more objectives met for any given project, that project will likely be ranked higher. Ranking criteria include: community linkage, improve sustainability, alternative pedestrian biking transportation corridor, potential or existing high level of use, multiple use, available funding, available work force, engineering complete, targets key activity, and links other key areas of the park, trails, or other regional trail systems. See Appendix I for details.

Conclusion

Striving to establish meaningful engagement and exchange with the public, the Division began an extensive public participation process with a series of trail user stakeholder meetings in May and June, 2010. A first draft of the proposed trail plan was presented. At each stakeholder meeting, Division staff summarized the objectives for trail planning and presented proposed trail alignments. Maps and a PowerPoint presentation were tools used to convey trail plan alignments, as well as proposed trail network widths, uses, surfaces and trailhead locations. These collaborative discussions resulted in clearer definition of public values and additional trail alignment alternatives. Each group was provided a set of maps for further evaluation; by mid-July comments were submitted to the Division by all stakeholder groups. The Division met with the following organizations to garner input and comments on the first draft White Clay Creek State Park Trail Plan:

- Park and Recreation Council (Division advisory council)
- Council on Greenways and Trails (Division advisory council)
- Friends of White Clay Creek State Park Executive Committee and Advisory Board

- Wilmington Trail Club Board
- An alliance of running clubs that include the Pike Creek Running Club and Trail Dawgs
- Delaware Trail Spinners
- Newark Bicycle Council
- Bi-State Council for the White Clay Creek Preserve (former advisory council to DE & PA)
- Delaware Equine Council Trail Committee

Presentation and proposed Trail Plan review meetings were also held with staff from Pennsylvania State Parks; Wilmington Area Planning Council (WILMAPCO); City of Newark Department of Parks & Recreation; and New Castle County Department of Special Services.

While the Division's initial public participation outreach focused on the groups listed above, input was received from the following organizations with whom we did not meet: Bikeline; Brandywine Cyclery; Audubon Society; Delaware Ornithological Society; Delaware Nature Society; Eastern Mountain Sports; First State Velo Sports; Garrison's Cyclery; Henry's Bikes; International Mountain Biking Association; Senator David Sokola; The Bicycle Boutique; White Clay Bicycle Club; and Wooden Wheels.

Thoughtful and thorough Trail Plan comments from the trail user community, advisory councils and agencies were valuable in shaping a second draft plan. A second draft plan was posted on the Delaware's government web site and announcements made that a draft plan was available for wider public review. On February 22 & 23, 2011, public Open Houses were held at Deerfield to review the second draft plan. 144 people attended the Open Houses. 550 responses to draft Trail Plan were submitted via a Comment Form, an online equivalent of the Comment Form, and by email and letter correspondence. Of the 550 responses, 198 respondents provided constructive comments to add specific trail segments/links and enhancements to the proposed Trail Plan. An additional 102 respondents approved the Plan as proposed in February. 217 respondents did not indicate Plan support or objection. Only 19 respondents opposed the Plan as presented in the public Open Houses. Additional information gleaned from the Comment Forms can be found in Appendix F.

Following the February 2011 Open Houses, the Division's Trail Committee evaluated all public comments to consider the following: how comments met Trail Plan objectives; how comments fit into a larger regional system; how potential recreational alternatives might contribute to regional recreation diversity; and how opportunities can be linked to larger systems. The Trail Committee gave full and fair consideration to all public input. Based on principled and reasoned analysis from the best science and expertise available to our Division, a final Trail Plan was developed.

Feedback on the proposed Trail Plan (reviewed in the Open Houses) resulted in changes to trail system alignments that are reflected in the final Trail Plan. Overall, there was a 5.2 mile net change (decrease) in total trail miles from the first draft Plan to the final Plan; that decrease is directly attributed to input gleaned throughout the public participation process.

As demonstrated by the components, elements and assessments of this Trail Plan, the system alignments outlined on Map 18 meet many, if not most, of the Division's objectives. Alignments are planned and designed to reduce habitat fragmentation, avoid cultural resources, reduce or eliminate unsustainable trail conditions, create links between park management units and build community connections where none exist today. Alignments provide for varied trail experiences

and deliver access to different trail users. These objectives result in a sound foundation to achieve an environmentally, socially and recreationally sustainable trail system. Utilizing best practices for design, construction and maintenance will result in enhanced and diverse recreational experiences; reduce costly and frequent maintenance; and promote use among recreational trail users.

With limited land resources to provide outdoor recreational opportunities and even fewer terrain-rich landscapes of hills and valleys statewide, planning for diverse trail use is critical. There are few public lands, particularly those managed as State Parks, that host landscapes with challenging, not flat, trail opportunities. Considering that a significant portion of Delaware is level and coastal in nature, White Clay and Brandywine Creek State Parks (and to some degree Alapocas Run State Park) are the principle sites to offer trail opportunities within sloped topographies.

White Clay and other public lands in the region and their associated recreational opportunities play a substantial role in creating a community that promotes exercise and makes access to the natural environment easy. Three plus decades of suburban development have separated where people work, live, shop, are schooled and play. Our communities have lacked the infrastructure that promotes not only recreation, but also exercise and access to the outdoors, and even alternative transportation. White Clay Creek State Park is integral to a region-wide pedestrian and bicycle network that will change how the greater Newark community and visitors to the region spend time and live better lifestyles.

In the trail planning process, natural and cultural resource assessments were weighted factors in determining trail alignments. Those evaluations have resulted in alignments that achieve the following: 1) minimizes impacts to high quality habitats; 2) re-unites habitat blocks; 3) reduces erosion; and 4) protects cultural resources. To ensure that natural resources are minimally impacted, the Division has made a commitment to on-going biological evaluations and studies. The results from this work will be assessed and used to further inform park and trail planning, and, guide management objectives and processes.

Through the entire public participation process it was clear that not all respondents agreed on the location of proposed trail system alignments. However, it was very clear that stakeholders, regular users and occasional visitors alike have a deep appreciation for White Clay Creek State Park. White Clay holds great significance as a treasured natural resource, and, as a valuable haven for recreational outings. Enthusiasm to protect resources while ensuring recreation access opportunities will instill continued stewardship of White Clay Creek State Park.

Appendices

Appendix A: 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 degrade at a faster rate 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, soil displacement, 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, and continuation, of this knowledge that has led 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; minimize adverse effects 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. In essence, greater level of sustainability relates directly to water and user management. 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, soils, slope and grade changes; ease of access from control points such as trailheads; user type and volume; user safety; and providing interesting experiences within the landscape. A sustainable trail 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 (grade reversals) 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, such as using ATVs or gators instead of trucks to access trails, or small mowers replacing 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 B: Trail Standards

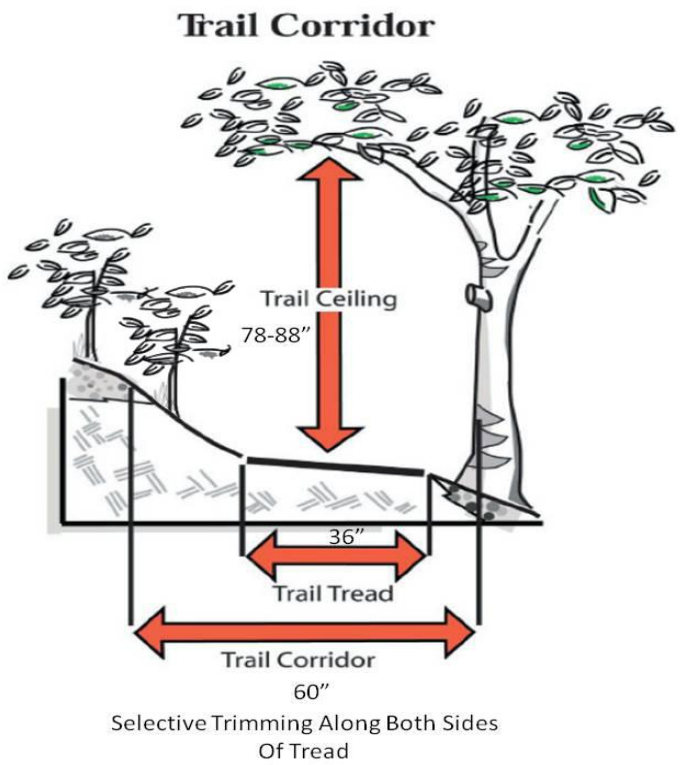
Trail standards comprise two main groups, trail characteristics and structures. Trails characteristics such as types, configurations, class, width, and surface, and grade are measurable values for a trail that will dictate use and experience, but also take into account environmental impact. Trail structures 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.

Figure B1 – Typical Class III Trail Corridor



Trail Widths

Although trail widths may vary greatly, there are two basic categories- single track class III trail (36" tread) and double track (greater than 36"). Several factors are used to determine the optimal width of a trail. Those factors are: anticipated traffic volume; type of use; site conditions; experience desired; construction and maintenance costs; and environmental protection.. 2010 trail widths in the park are classified as follows: 23.7 miles of single track and 16.3 miles of double track. 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.

Trail Corridor Ceiling

Height of the trail corridor is the optimal distance between the trail surface and overhead clearance. Clearance above a hiker or biker's head (and a trail's width) is considered carefully to permit ease of travel, safety, improve sightlines and speed control. Hiking and biking trails 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".

Trail Type

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- crushed stone and asphalt is also present. Trail surfaces in 2010 in the park are classified as follows: 34.8 miles of packed earth (native soil) and 5.2 miles of wooden boardwalk, stone or asphalt surfaces. 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 for all recreational types than firm or hardened ones. Good trail maintenance guidance suggests that 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.

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, insloped, or outsloped. Tread grading that leaves the outside edge of the trail lower than the inside is considered outsloped. For best drainage the tread should be outsloped 3-7%.

Bollards

Bollards are to be placed at access points and trailheads if these areas are accessible by vehicles. Bollards restrict maintenance staff and park visitors from driving on trails which could damage tread surface and endanger trail users.

Bridges

Trail 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.

Figure B 2 Typical Bridge- Detailed drawings available

Sustainability is of highest priority when choosing building materials. Today, the primary materials used are pressure treated wood, composite decking, 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.

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, will be placed at the trailheads 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.

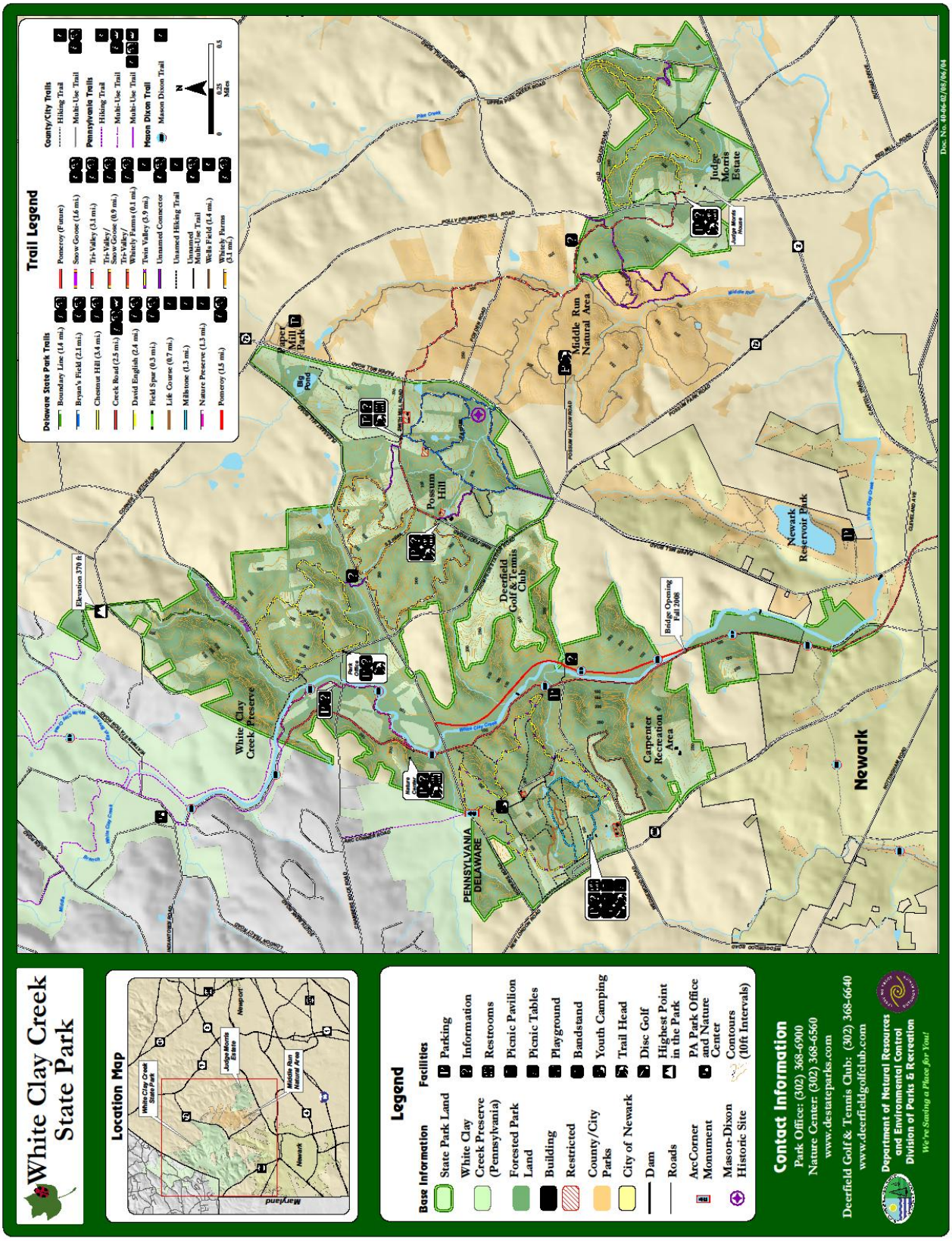
Interpretative waysides exhibits are excellent educational tools. Waysides can be found in any park area including nature centers, trails, historic sites, overlooks and other places. For example, a Pomeroy Rail Road wayside exhibit is located on the Pomeroy Rail Trail north of the Tweeds Mill Bridge site. Potential waysides sites are not specifically identified in this plan; an interpretative plan examines suitable topics and sites for educational materials and programs.

Maps and Information Boards

Maps of each park are developed and available in two formats (see Map B1 below). 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/park/white-clay-creek/maps/index.asp

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.

Map B1 – Park Map – Web Version



Trail Markers Posts

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. Sequence order for individual marker disks is as follows:

- Main trail
- Secondary trail
- Uses allowed: in order from the top- hiking, biking, equestrian
- Destinations within park such as park office, nature center, etc.
- Place names such as roads or developments

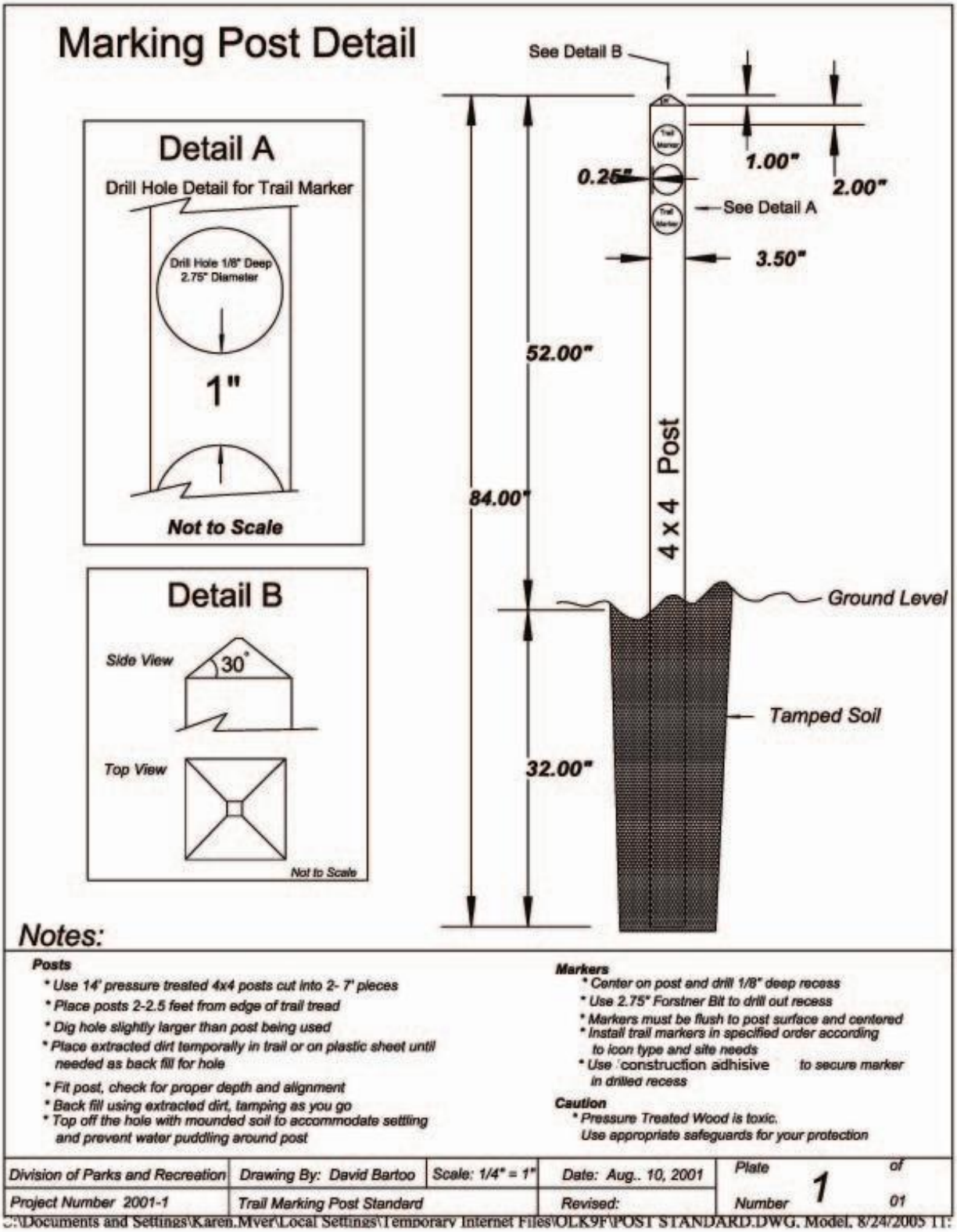
Markers are installed at all trail and road intersections.

Figure B 3 - Examples of Trail Marker Posts

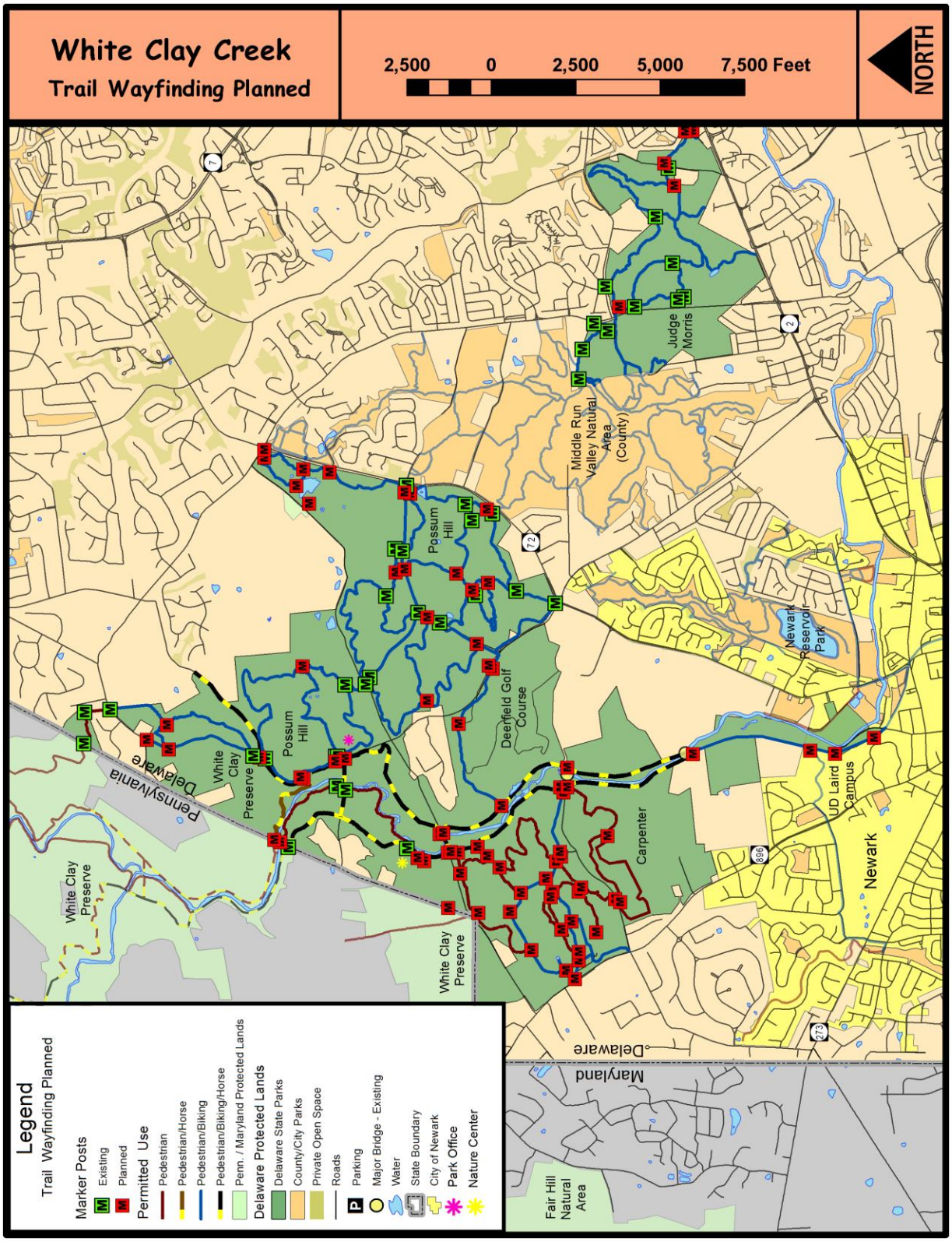
Trail Marker

Cross Country Marker

Figure B 4 - Trail Marker Post Detail



Map B2 - Planned Wayfinding Markers



Appendix C: Trail Management Fundamentals

Trail Sustainability and User Interactions and Management

Core elements of sustainable trail systems may vary depending on a number of different user group perspectives. Hikers, runners, equestrians, mountain bikers, and birders (just to name a few) all have specific expectations, and similar or the same expectation, for their trail experiences. In fact, each individual user may have-and probably does-a different view of how they like to interact with the environment and what it takes to have positive interactions or what defines a negative interaction. These interactions are between people and people with the environment. Positive social interaction between trail users and the environment is called Social Sustainability. Sustainable trails supports current and future use, has positive public use, and minimizes potential conflict between the same and different users.

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. User designation and trail type may be the same, but user preference, terrain and location may play the deciding role on whether or not a park or trail sees a much higher volume of use. Understanding these variables and using them to better plan will help increase the sustainability of any trail. A park superintendent 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. In addition, outside support for any trail changes will come primarily from outdoor recreationists who understand the objectives and goals to be accomplished.

The trails at White Clay Creek State Park are presently designated for various uses which include pedestrians, bikers, 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 within groups and different groups may experience conflicts over competition for space, trail infrastructure, viewscapes, 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 below outlines the spectrum of recreation interactions. Table C1 below shows 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 designations for the park.

Table C1 - Interaction Types and Recreational Outcomes

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: WI SCORP 2005

Trail Management Characteristics

(Adopted from the USFS)

To consistently manage trails, establishing management guidelines and trail classifications is essential. Knowing when and how to maintain trails will help to simplify all aspects of trail management. The following are basic trail categories.

Trail Type ▪ Trail Management 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 a host of attributes such as 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. The general criteria, as seen in Table C2 , define each Trail Class and are applicable to all system trails. Trail Class descriptions define "typical" attributes and exceptions may occur for any attribute.

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. Table C3 and Map C1 outlines trail classifications of White Clay Creek State Park- a system based on US Forest Service trail management class system.

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.

Table C2- 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
Tread and Traffic Flow	▪Tread intermittent and often indistinct 12-24" and rough ▪May require route finding ▪Native materials only	▪Tread discernible and continuous, 18-24" and rough ▪Few or no allowances constructed for passing ▪Native materials only	▪Tread obvious and continuous 36-42" wide ▪Width accommodates unhindered one-lane travel (occasional allowances constructed for passing) ▪Typically native materials	▪Tread wide and relatively smooth with few irregularities 42+" wide ▪Width consistently accommodate two-lane travel ▪Native or imported materials ▪May be hardened	▪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	▪Obstacles common ▪Narrow passages; brush, rocks and logs, wet stream crossing present ▪Grades typically <10%	▪Obstacles occasionally present ▪Blockages cleared to define route and protect resources ▪Vegetation may encroach into trail treadway ▪Grades typically <10%	▪Obstacles infrequent except with alternate lines or specified as more challenging ▪Grades typically <8% ▪Vegetation selectively trimmed 12" each side of treadway	▪Few or no obstacles exist except with alternate lines ▪Grades typically <8% ▪Vegetation selectively trimmed 12" each side of treadway	▪No obstacles ▪Grades typically <6% ▪Vegetation selectively trimmed 12" each side of treadway
Constructed Features & Trail Elements	▪Minimal to non-existent ▪Drainage may be functional ▪No or limited constructed bridges or foot crossings ▪Native materials used	▪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	▪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	▪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	▪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	▪Minimum required ▪Generally limited to regulation and resource protection ▪No destination signs present	▪Minimum required for basic direction ▪Generally limited to regulation and resource protection Typically very few or no destination signs present	▪Wide variety of signs likely present ▪Informational signs likely ▪Interpretive signs possible ▪Trail Universal Access information likely displayed at trailhead	▪Wide variety of signs likely present ▪Informational signs likely ▪Interpretive signs possible ▪Trail Universal Access information likely displayed at trailhead	▪Wide variety of signage is present ▪Information and interpretive signs likely ▪Trail Universal Access information is typically displayed at trailhead

Table C2-Trail Management Classes (Continued)

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
Recreation Environs & Experience	▪Natural, unmodified ▪Primitive or wilderness like setting ▪Challenging	▪Natural, essentially unmodified ▪Typically semi-primitive setting ▪Challenging	▪Natural, primarily unmodified ▪Typically natural setting ▪May contain alternate lines or incorporate natural or built challenging features	▪May be modified ▪Natural to Rural setting ▪May contain alternate lines or incorporate natural or built challenging features	▪Can be highly modified ▪Typically Rural to urban setting ▪Commonly associated with visitor centers or high-use recreation sites
Water Trails For Portage sections of Water Trails, see "General Criteria" above. 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.	▪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.	▪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.	▪Managed for paddlecraft as primary use type. ▪Buoys 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.	▪Managed for paddlecraft as primary use type. ▪Buoys 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.	▪Managed for motorized watercraft as primary use type. ▪Buoys 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

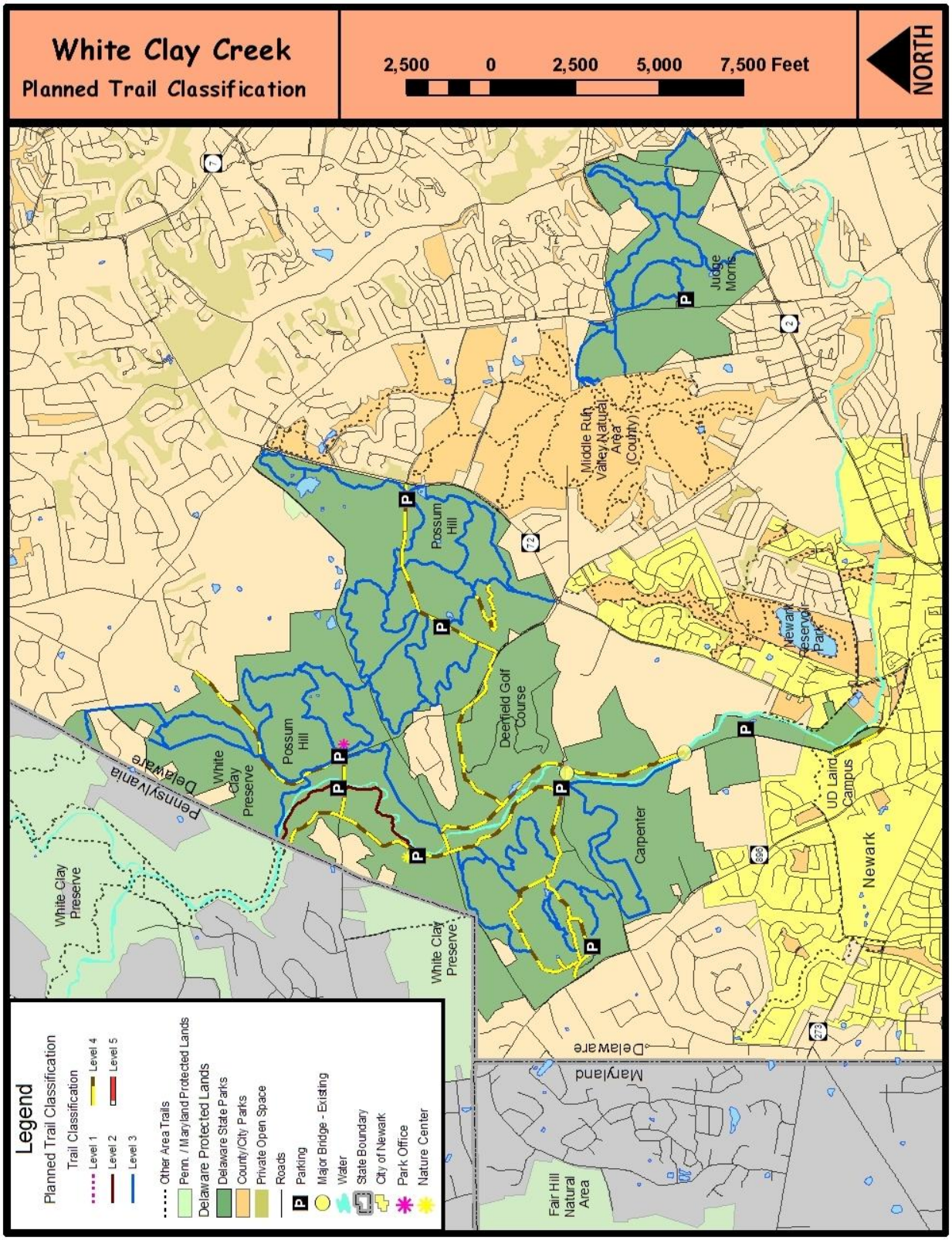
Table C3–Trail Management Classification of WCCSP Trails

Park Area	Trail Name	Trail Class	Width	Design Parameter
Carpenter Recreation Area	Creek Road (Road with/to Trail)	3	10-16 feet	Easy
	Cross Country Course	2	8-10 feet	More Difficult
	Golf Access Rd (Road-to-Trail)	3	8-10 feet	More Difficult
	Multi Use	4	8-10 feet	More Difficult
	Pomeroy	3	8-10 feet	Easy
	Twin Valley	3	2-3 feet	More Difficult
	Wells Lane (Road-to-Trail)	4	8-10 feet	More Difficult
	Wells Field	2	4-6 feet	More Difficult
Preserve	Boundary Line	3	2-3 feet	More Difficult
	Chamber Rock Rd.	3	4-6 feet	More Difficult
	Cart Road	2	2-3 feet	Most Difficult
	Charles Bailey	3	4-6 feet	More Difficult
	Creek Road (Preserve)	3	8-10 feet	Easy
	Pomeroy (Hopkins to Office)	3	4-6	Easy
	Preserve	2	2-3 feet	More Difficult
Judge Morris Estate	Chestnut Hill	3	2-3 feet	More Difficult
	Tri-Valley	3	2-3 feet	More Difficult
Possum Hill	Big Pond	3	4-8 feet	More Difficult
	Bryan's Field	3	2-3 feet	More Difficult
	David English	3	2-3 feet	More Difficult
	Skills	4	2-3 feet	Most Difficult
	Smith Mill Road (Road-to-Trail)	3	10-12 feet	Easy
	Thompson St. Rd (Road-with-Trail)	3	10-12 feet	Easy
	Tri-Valley	3	8-10 feet	More Difficult
	Whitely Farms	3	2-3 feet	More Difficult
	*Unnamed Trails	3	Variable	Variable

**Notes:* 1. *"Unnamed Trails" includes connector trails*

2. *Not all trails in Other Trails category are shared-use*

Map C1 – Trail Classification Planned



Appendix D: Trail Maintenance

This document is to establish guidelines and principals to maintain all trails within White Clay Creek State Park. Table D1 below covers trail designations and widths, the basis of establishing trail maintenance guidelines. Trail guidelines utilize the best industry practices available and provide the optimal experience for pedestrians, cyclists, and equestrians, 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" in Table D2.

Table D1- Planned Trail Designations and Tread Widths

Park Area	Trail Name	Trail Type	Width	Recommended Users	Suitable Trail Users
Carpenter Recreation Area	Creek Road (Road with/to Trail)	Double track	8-16 feet	Pedestrian Bicycles Equestrian	Pedestrian Bicycles Equestrian
	Cross Country Course	Double track	8-10 feet	Pedestrian	Pedestrian
	Golf Access Rd (Road-to-Trail)	Double track	5-8 feet	Pedestrian Bicycles	Pedestrian Bicycles Equestrian
	Multi Use	Double track	5-8 feet	Pedestrian Bicycles	Pedestrian Bicycles Equestrian
	Pomeroy	Double track	5-8 feet	Pedestrian Bicycles Equestrian	Pedestrian Bicycles Equestrian
	Twin Valley	Single track	2-3 feet	Pedestrian	Pedestrian Bicycles
	Wells Lane (Road-to-Trail)	Double track	8-10 feet	Pedestrian Bicycles	Pedestrian Bicycles Equestrian
	Wells Field	Double track	4-6 feet	Pedestrian	Pedestrian
Preserve	Boundary Line	Single track	2-3 feet	Pedestrian Bicycles	Pedestrian Bicycles
	Cart Road	Single track	2-3 feet	Pedestrian Bicycles	Pedestrian Bicycles
	Charles Bailey	Double track	4-6 feet	Pedestrian Equestrian	Pedestrian Bicycles Equestrian
	Creek Road (Preserve)	Double track	8-16+ feet	Pedestrian Bicycles Equestrian	Pedestrian Bicycles Equestrian
	Pomeroy (Hopkins to Office)	Double track	5-8	Pedestrian Bicycles Equestrian	Pedestrian Bicycles Equestrian
	Preserve	Single track	2-3 feet	Pedestrian	Pedestrian
	Unnamed Trails	Variable	Variable	Variable	Variable

Table D1- Planned Trail Designations and Tread Widths (Continued)

Park Area	Trail Name	Trail Type	Width	Recommended Users	Suitable Trail Users
Judge Morris Estate	Chestnut Hill	Single track	2-3 feet	Pedestrian Bicycles	Pedestrian Bicycles
	Tri-Valley	Single track	2-3 feet	Pedestrian Bicycles	Pedestrian Bicycles
Possum Hill	Big Pond	Double track	4-8 feet	Pedestrian Bicycles	Pedestrian Bicycles
	Bryan's Field	Single track	2-3 feet	Pedestrian Bicycles	Pedestrian Bicycles
	David English	Single track	2-3 feet	Pedestrian Bicycles	Pedestrian Bicycles
	Skills	Single track	2-3 feet	Pedestrian Bicycles	Pedestrian Bicycles
	Smith Mill Road (Road-to-Trail)	Double track	8-12 feet	Pedestrian Bicycles	Pedestrian Bicycles Equestrian
	Thompson St. Rd (Road-with-Trail)	Double track	10-12 feet	Pedestrian Bicycles Equestrian	Pedestrian Bicycles Equestrian
	Tri-Valley	Double track	8-12 feet	Pedestrian Bicycles	Pedestrian Bicycles Equestrian
	Whitely Farms	Single track	2-3 feet	Pedestrian Bicycles	Pedestrian Bicycles
	Unnamed Trails	Variable	Variable	Variable	Variable

Trail Management & Maintenance Goals

- Create a maintenance plan for each trail in the Park that meets sustainability goals.
- Develop and recommend policies or regulations regarding the use of trails following rain events and the winter freeze thaw, or other environmentally sensitive times.
- Develop a plan of action to mitigate trail conflicts issues.
- Develop a policy position on technical trail features (TTF)

Minimizing Environmental Impacts During Trail Maintenance

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 double track trail with access to the trail system by foot, Gator, DR Mower, or ATV without the use of shortcuts or social trails. 6 MPH speed limit by park staff on all stone trails will help protect surface from premature breakdown and displacement. Routine maintenance on singletrack trails will be performed by Park Staff on foot only. ATV use on singletrack is restricted to stone trail repairs only and not routine maintenance.

Inspection/ Maintenance

All trails and trail features should 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, rutted stone trail, and large areas of muddy or flooded trail. The list below is a general guide for trail inspection and maintenance.

- Minimize impact whenever possible- in all phases of maintenance
- Any trail maintenance should 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.

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, subsequent program management, and operations and maintenance. The broad guidance outlined in Table D2 below, reflects "typical" considerations for trails in different Trail Classes. For detailed information on Electronic Personal Assistance Mobility Devices, refer to that policy and detailed park trail class maps.

Table D2- Trail Operation & Maintenance Considerations

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: •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: •Low-to-moderate use levels •Mid-to-highly skilled users, capable of traveling over awkward condition/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/piloting skills required.	Typically managed to accommodate: •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/piloting skills required.	Typically managed to accommodate: •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: •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
Electronic Personal Assistance Mobility Devices	None allowed	None allowed	26" wide/5 mph/250 lb max	36" wide/5 mph/250 lb max	36" wide/5 mph/250 lb max

Appendix E: 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 effect 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 responsibility. 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 F: Public Participation and Outreach

A series of meetings were held in the Spring and Summer of 2010 with trail user stakeholder organizations to present an early version of the proposed Trail Plan. At each meeting, Division staff summarized the objectives for trail planning and presented proposed trail alignments. Maps and a PowerPoint presentation were tools used to convey proposals staff had developed as of May 2009. Each group was provided a set of maps to review. The comments provided by groups were thoughtful and deliberative. The Division met with the following organizations to garner input and comments on the proposed White Clay Creek State Park Trail Plan:

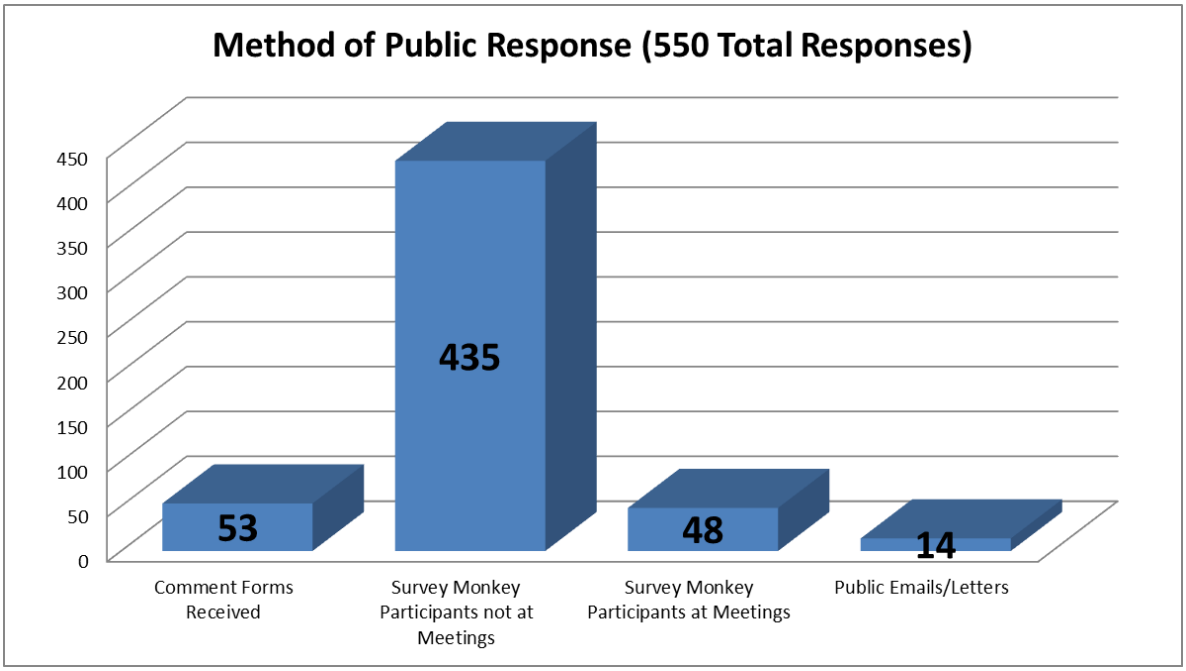
Park and Recreation Council; Council on Greenways and Trails; Friends of White Clay Creek State Park Executive Committee and Advisory Board; Wilmington Trail Club Board; an alliance of running clubs that include the Pike Creek Running Club and Trail Dawgs; Delaware Trail Spinners; Newark Bicycle Council; Bi-State Preserve Council; Equine Council Trail Committee members; and staff from Pennsylvania State Parks and the Wilmington Area Planning Council (WILMAPCO). Input from these groups was valuable in shaping the plan that was presented in the draft.

While the Division initial outreach focused on the groups listed above, input was received from the following organizations with whom we have not meet: Bikeline; Brandywine Cyclery; DE Audubon Society; DE Ornithological Society; Delaware Nature Society; Eastern Mountain Sports; First State Velo Sports; Garrison's Cyclery; Henry's Bikes; International Mountain Biking Association; Senator David Sokola; The Bicycle Boutique; White Clay Bicycle Club; and Wooden Wheels.

Other discussions or meetings were held with staff from Pennsylvania Department of Conservation and Natural Resources; Charles Emerson, City of Newark Park Director; Jonathan Husband, Engineering & Environmental Services Manager, New Castle County; Heather Dunigan, WILMAPCO Principal Planner; and Bill Swiatek, WILMAPCO, Principal Planner. Valuable input to the proposed trail plan was received as a result of these discussions.

In the February of 2011 two public open house events were held to roll out a final draft plan to the general public. The draft plan and comment forms were posted on line. Over 140 people attended the open houses and overall the Division received 550 total responses to the plan. Some highlights from the 550 responses are graphically shown below in Tables F1 through F6.

Table F1- Public Open House Responses



The following graphs are based on the number of useable public comment surveys completed and submitted to the Division.

Table F2- Primary Trail Use

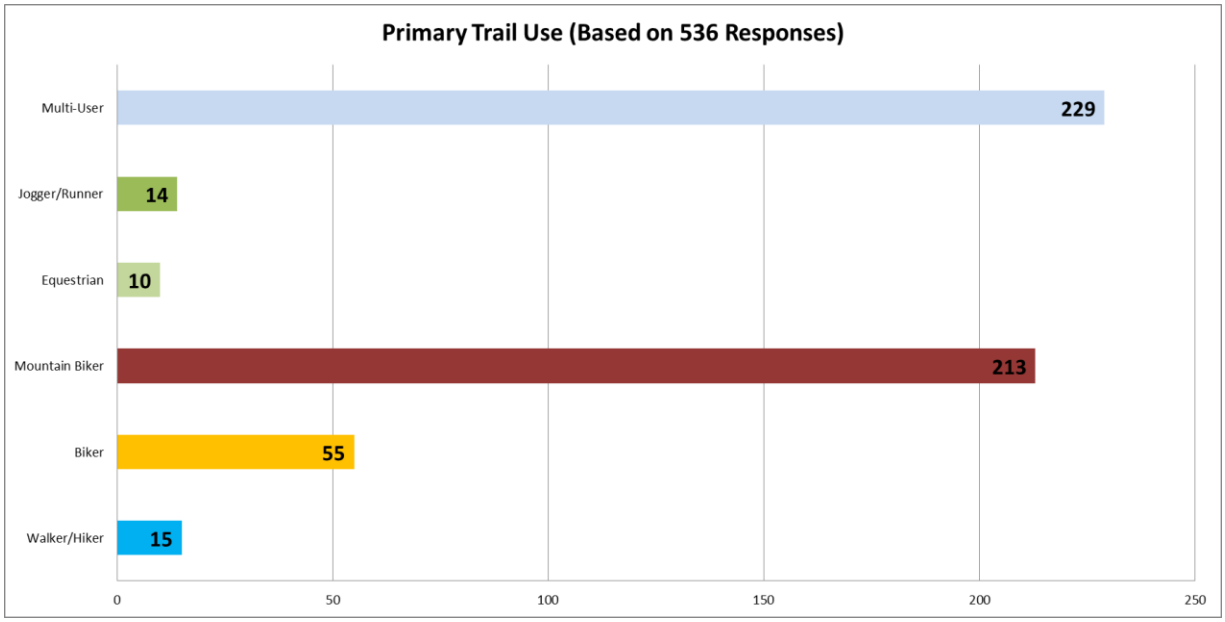


Table F3- Trail Use Frequency

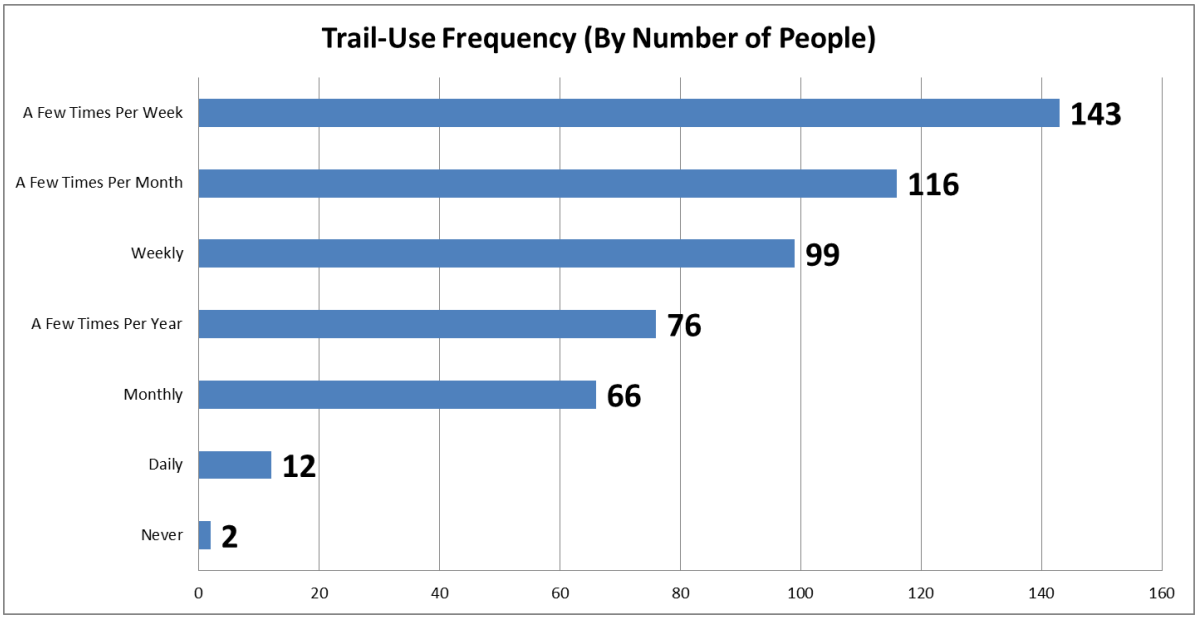


Table F4- Most Used Trail Features

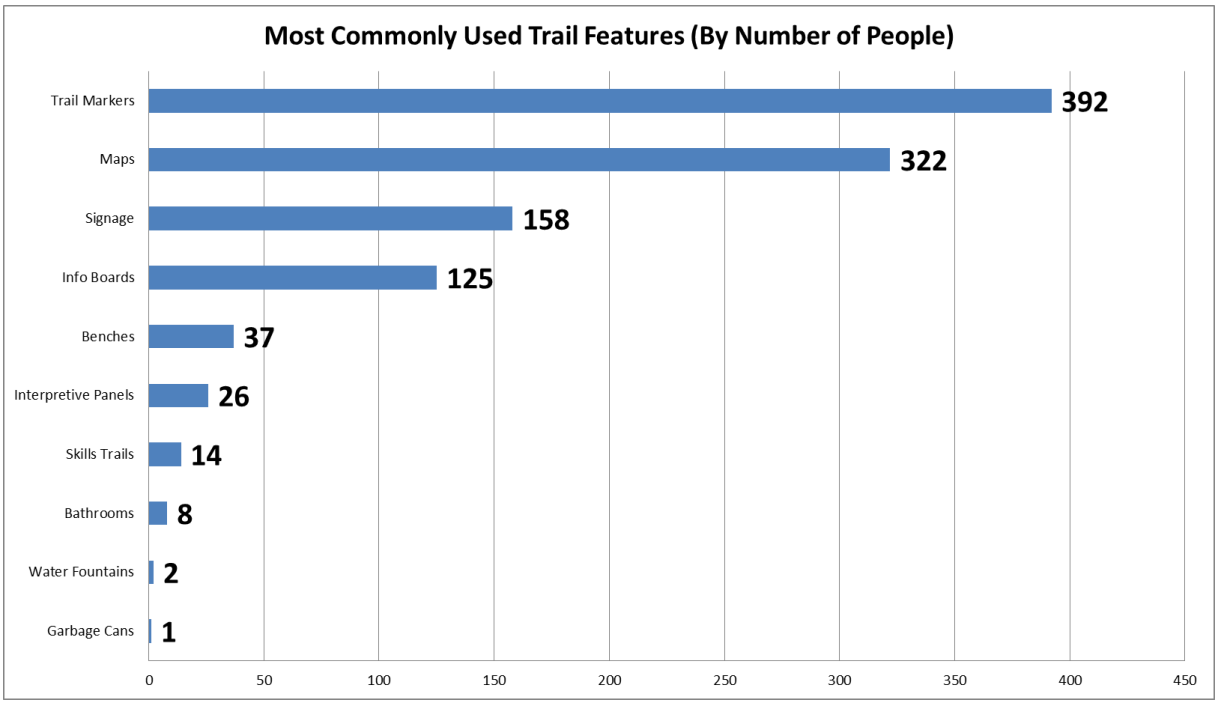


Table F5- Responses by State

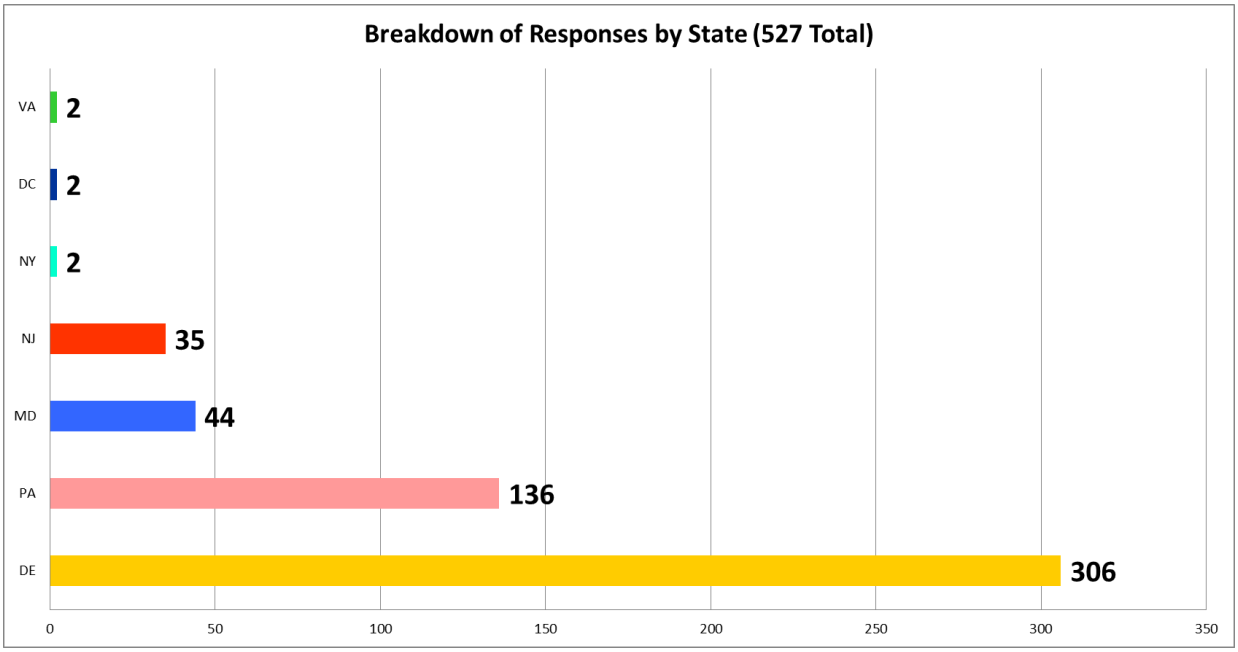


Table F6- Public Acceptance of Plan

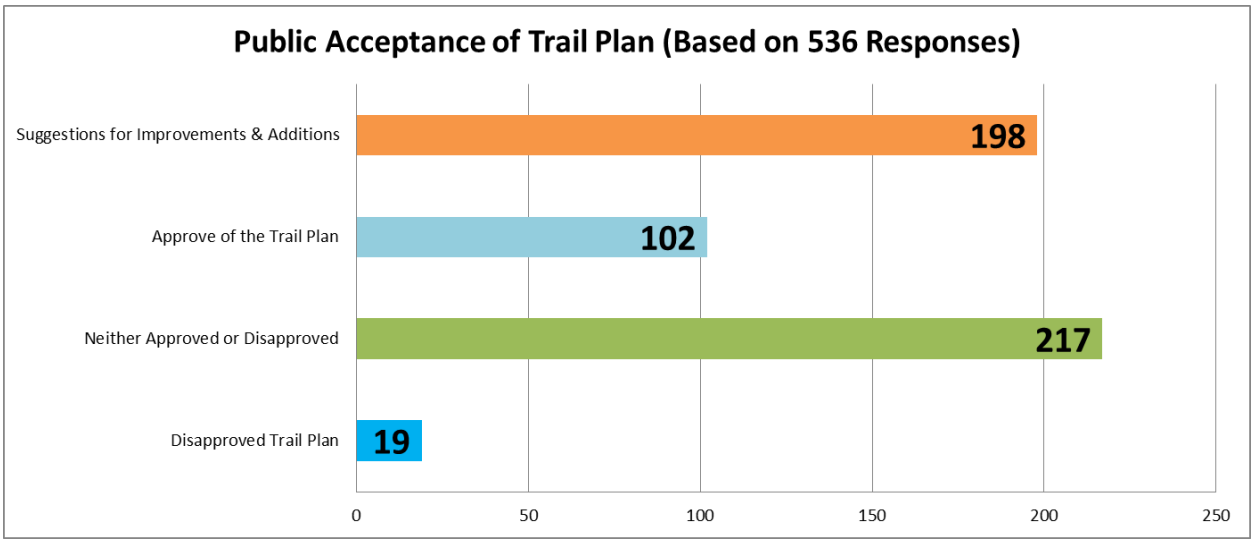
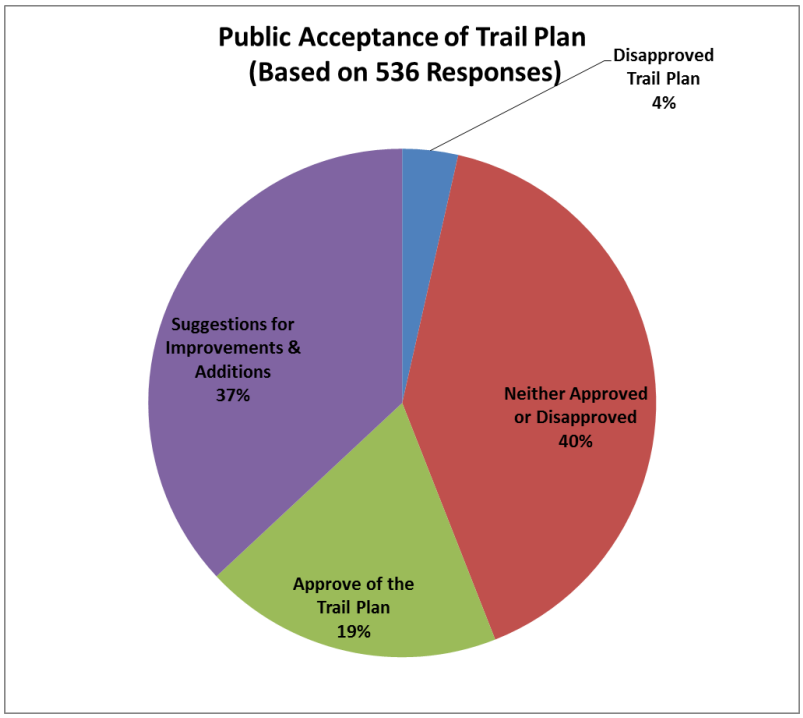


Table F7- Public Acceptance of Plan



The culmination of all feedback received resulted in changes in the final plan. The main highlights are:

- A removal of a segment of trail along Pleasant Hill Rd. near Big Pond in Possum Hill
- The addition of trail along Chambers Rock Road connecting the park office and Creek Rd.
- The addition of a community link from Chestnut Hill Trail to Kirkwood Hwy and the middle school
- A location change and shortening of a community connector to Snow Goose Trail on the east side of Judge Morris Estate
- The removal of a proposed bike specific trail in Possum Hill (David English)
- The addition of a community connector from Wedgewood Rd. and Rt. 896 to the Carpenter trailhead
- The removal of a proposed single track trail segment along the Pomeroy Trail in Carpenter
- The removal of a proposed trail segment connecting Cart Path and Charles Bailey in the Preserve
- The addition of a trail segment connecting the Boundary and Cart Trails

Overall, there was a 5.2 mile change (decrease) in total trail miles from the first draft plan to the final plan directly related to public participation.

Appendix G: RAVI Survey

Division of Parks & Recreation, DNREC

Rapid Assessment Visitor Inventory (RAVI) Methodology For White Clay Creek State Park

A rapid assessment method for inexpensively obtaining representative samples of place-specific visitor numbers and perceptions of visit quality has been tested on mid-west and west public lands. Developed in Southern Illinois University by Dr. Kenneth Chilman, rapid assessment visitor inventory (RAVI) has been employed extensively in national forest areas in Indiana and Illinois. The data are used in meetings focusing on visitor capacity management. The (RAVI) method utilizes four-day sampling periods (two weekend days plus two weekdays) within heavy use seasons. Counts of visitors by types are recorded along with one-page surveys focusing on visitors' perceptions of conditions. RAVI studies are conducted at travel pattern concentration sites, places where most visitors tend to visit or pass by. Then decisions can be made about maintaining different levels of use in similar places and providing information for visitor choices. A short, approximately eight page report of survey findings and summary, makes this a quick and reliable information source for land managers.

The first and basic step of any park management plan is inventory – to include the natural environment, social and management aspects. RAVI is a source of information for the social inventory: how many and what type of visitors are using the management area now, and what are their area perceptions and visit conditions.

- Survey Sampling
  - To be statistically sound the following is needed
    - 4 day sample (Thurday to Sunday) - Represents 7.7% of 13 weekends in a season (spring, summer, fall, winter)
    - Can sample (Saturday to Tuesday)
    - Sampling system is sound as an "indicator sample".
    - Particularly effective when visitation to an area or facility is unknown or there is an estimate
    - Indicator sample provides a useful indication of user numbers and perceptions in a particular time frame
    - 7 hrs/day on-site; can split survey times to coincide with visitor patterns
    - Follow-up sampling useful to monitor specific numbers and changes occurring

  - Select sites that have concentrated visitation/traffic/level of use
    - Concentration points - Parking lots, vista points, historic sites, trail junctions.
    - In White Clay Creek State Park -
      - Judge Morris
      - Possum Hill
      - Nine Foot
      - Wedgewood Bridge – stage on the bridge
      - Carpenter
      - Park Office –
      - Middle Run-JM bridge

- Collection
    - 2 surveyors ideal
        - In busy times – 1 to survey, 1 to count users
        - Other times – both can survey
    - Talk to respondent at end of trips or mid-point in trips
    - Record respondent info on group size and user type as group approaches
    - Record as many respondents as possible. Some will get by because you are working with a group.
    - Do not ask "nice to know" info. Stick to basic needs.
    - Uniform – shirt, hat or id tag to identify surveyors
    - Sign – At survey site, Illinois uses a sign.
        - ____Survey_____
          Your input on quality recreation visits (w/ logo)
- Dr. Chilman finds that most people are willing to stop when they learn this about the quality of their recreation experience.
- Dr. Chilman may be available to work with us, depending on his schedule. Would need housing.

Survey Times:
Max visitation periods for June/July are as follows
Thursday 1-8pm
Friday 1-8pm
Saturday 8-3
Sunday 9-4

Weekends times at WCC are consistent throughout the year. Weekday times are simply relative to sunset, so max visitation occurs in the seven hours prior to sunset.

Survey Dates:
June 25-28

Rapid Assessment Visitor Inventory – Survey Instrument
White Clay Creek State Park

Site:_____
Date/Times: _____
Weather: _____
Surveyors: _____

I am [name] with Delaware State Parks. We are interested to learn about your trail experiences.
Can we ask you a few questions about the quality of today's recreation visit?

Respondent
Estimated Age: ___ <20 ___ <30 ___ <40 ___<50 ___<60 ___above
Male: ___ Female: _____Group size: _____
User Type: ___ hiker ___ mt bike _____ equestrian

How many times have you visited this area? _____
How many times this year? _____
Year of first visit? _____
Briefly describe your visit on this trip.
Length of visit (hours) _____
Activities_____
Where did you begin your trip *today*? _____

Visitor Choice of Recreation Setting
What other areas (in state & out of state) have you visited where you would have similar experiences?
_____
_____

Why did you choose this [name of site] *today* rather than the others you just named?
_____
_____

Visitor Perception of Changes Occuring
Since your first visit to this [fill in name of survey site], have you noticed any changes in the area or management conditions? Y N
If yes, what changes _____
_____
_____

In particular, is there anything you like or dislike about the trails in this area?
_____
_____
_____

Visitor Perception of Use Densities
On your visit *today*, did you encounter about the number of visitors that you expected? Y N Greater Less About the same

In terms of an ideal visit, would you prefer the same number of encounters? _____

Were other trail users a problem for you during your visit *today*? Y N
If yes, how were they a problem? What trail(s) were you on?
_____
_____

Visitor Satisfaction
On a scale of 1-10 (with 1 being low), how would you rate your satisfaction with *today's* visit? _____

What would be necessary for you to have rated this visit a 10?
_____

Comments
Do you have any additional comments you would like to pass along to Delaware State Parks?
_____
_____

Visitor's Zip Code _____

Appendix H: Investment in Parks and Recreation in Children's Health

Nemours. Health & Prevention Services

Investment in Parks and Recreation is Necessary for Children's Health

By Patti Miller and Marina Kaplan

SUMMARY

State and local policy makers should maintain at least level funding for Delaware's parks, trails, greenways and recreation services in order to provide children and families access to active recreation opportunities.

Funding for parks and recreation should be dedicated to developing more education programs and outdoor recreation programs for children, teens and persons with disabilities, and providing additional information on existing facilities and programs. Public opinion supports these priorities.

Concerned citizens should demonstrate their support for parks and recreation by becoming regular park users, volunteering to assist with maintenance and clean-up activities, and sending the message to policy makers that parks and recreation are not just nice to have, but essential to quality of life.

Introduction

Approximately 37% of Delaware's children and youth are overweight or obese[1] as are nearly two-thirds of adult Delawareans.[2] Regular physical activity, which can be achieved by running in the park, hiking as a family on nearby trails, or playing on ball fields and playgrounds, helps maintain a healthy weight and prevent heart disease, type 2 diabetes, and other chronic diseases.[3] Delaware is home to an abundance of state, local, and neighborhood parks, trails and greenways. These outdoor recreation facilities can provide a safe, fun, accessible and convenient location for physical activity, which is critical amidst the growing obesity epidemic both in Delaware and nationally. Although this brief focuses on the benefits of outdoor recreation, it should be noted that indoor recreation facilities and the programming that municipal, county and state parks departments offer also are critical to promoting healthy lifestyles among children and families.

Parks and Recreation Facilities Promote Healthy Lifestyles for Children

The Centers for Disease Control and Prevention's (CDC) comprehensive recommendations for reducing the prevalence of obesity identified improving access to outdoor recreational facilities as a key strategy for creating safe communities that support physical activity.[4] A comprehensive review of more than 100 studies supports the CDC's recommendation. The review found that time spent outdoors and access to recreation facilities and programs near their homes correlated positively with increased physical activity among children and adolescents.[5] Additionally, an American Academy of Pediatrics (AAP) policy statement on the built environment and children's physical activity recommends that government create and maintain playgrounds, parks and open space within communities and provide the means for safe access to these recreation sites.[6]

Public Demand for Parks and Recreation: What do families in Delaware want?

Families in Delaware consider outdoor recreation very important and think that outdoor recreation programs should be a priority for state and local funding, according to the 2008 Outdoor Recreation Participation and Trends Survey (ORPTS).[7] Residents responding to the 2008 ORPTS survey also believe that there are a number of facilities that should be added to parks.

Usage

The overwhelming majority (91%) of Delaware residents responding to the survey reported that outdoor recreation is "very" or "somewhat" important to them personally. The primary reason given for participating in outdoor recreation is physical fitness (59%). Other reasons include being with family and friends (22%) and for relaxation (18%). Consistent with these findings, almost half (48%) of residents surveyed reported

About Nemours Health and Prevention Services

Nemours Health and Prevention Services (NHPS) is a division of Nemours, one of the nation's largest pediatric health systems, operating the Alfred I. duPont Hospital for Children and outpatient facilities throughout the Delaware Valley and northern and central Florida. The goal of NHPS is to drive long-term improvements in policies and practices that promote child health, and to leverage community strengths and resources to help children grow up healthy. One of our initial areas of emphasis is the prevention of childhood obesity through promotion of healthy lifestyles, the centerpiece of which is the *5-2-1-Almost None* prescription for a healthy lifestyle:

- Eat five or more servings of fruits and vegetables per day.
- Spend no more than two hours per day in front of a screen (TV, video games, recreational computer time).
- Get at least one hour of physical activity per day.
- Drink almost no sugary beverages like soda and sports drinks.

Investment in Parks and Recreation is Necessary for Children's Health

About the Delaware Division of Parks and Recreation and the Delaware Recreation and Parks Society

The mission of the Delaware Division of Parks and Recreation is to provide Delaware's residents and visitors with safe and enjoyable recreational opportunities and open spaces, responsible stewardship of the lands and cultural and natural resources, and resource-based interpretive and educational services.

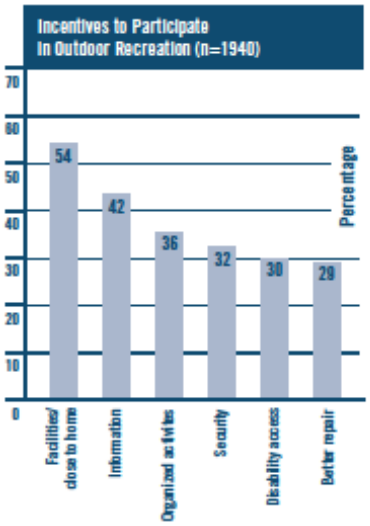
For over 40 years, the Delaware Recreation and Parks Society (DRPS) has provided leadership in fostering the expansion of recreation and parks. The Society unites in one organization all persons responsible for professionally planned leisure time activities, programs and facilities in the State of Delaware that include: recreation; parks; natural, historical and cultural resources; environmental education and interpretation; and conservation.

Special thanks to DRPS members from the parks and recreation departments of the State of Delaware; New Castle County; Kent County; City of Wilmington; City of Newark; City of Dover; City of Milford; and City of Seaford for their input on development of this policy brief.

walking and jogging as the physical activity they engaged in most often within the last 12 months, followed by bicycling (18%) and hiking (13%). Survey results reveal that the proximity and availability of facilities also factor into decisions about use of recreation areas. Most residents responding to the survey reported choosing to visit recreation areas close to home (61%) and sites with facilities designated for their activity of interest (29%).

Figure 1 illustrates what residents said would encourage them to participate or to participate more actively in outdoor recreation activities. Cited most frequently were more outdoor facilities and opportunities close to home (54%), more information about facilities and opportunities (42%), more opportunity to participate in organized activities (36%), and better security at facilities (32%).

Figure 1: Incentives to Participate in Outdoor Recreation



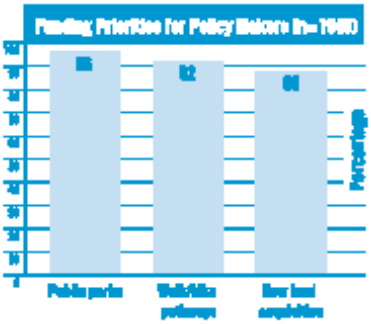
Priorities for state and local funding

The following were the results when survey respondents were asked if funding for parks, bike and pedestrian pathways, and open space should be priorities for state and local policymakers:

- 96% indicated that funding for public parks should be a "very" or "somewhat" important priority
- 92% responded that bike and pedestrian pathways between places of work, schools, shopping areas and neighborhoods should be a "very" or "somewhat" important priority
- 88% stated that acquiring more land for parks and open space in the state of Delaware should be a "very" or "somewhat" important priority (See Figure 2: Priorities for State and Local Funding.)

Additionally, survey respondents offered their opinion on programmatic funding priorities. Nature education programs (91%), historic education programs (87%), outdoor recreation programs for teens (87%), programs for person with disabilities (87%), and programs for children ages 4-12 (86%) were the recreational programs cited most frequently as "very" or "somewhat" important priorities for state and local funding. These results are consistent with the need for "more opportunities to participate in organized activities" expressed by respondents as incentives to encourage participation in outdoor recreation activities.

Figure 2: Priorities for State and Local Funding



Investment in Parks and Recreation is Necessary for Children's Health

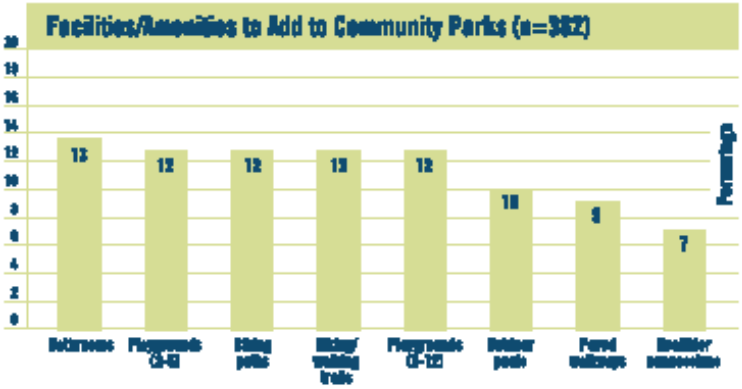
Access

Nearly two-thirds of residents reported visiting recreation areas that are between one and nine miles from home, with the majority travelling to the most visited area by car (76%), rather than by walking or jogging (19%). Distance and traffic or dangerous roads were cited most frequently as reasons for not walking, jogging, or biking to the most visited recreation area. Although just under half of respondents (49%) reported living within a 15-minute walk of a park with recreational facilities, the majority (78%) "strongly" or "moderately" agree that there are parks and recreation areas near their neighborhood that are easy to get to.

Facilities

The majority of residents rated the upkeep of existing community parks and outdoor recreation areas as "excellent" (30%) or "good" (48%). When asked what facilities they wanted added to community parks, survey respondents identified a range of facilities including: more, cleaner, better bathrooms (13%); playgrounds for children ages 2-5 (12%); biking paths (12%); hiking/walking trails (12%); playgrounds for children ages 6-12 (12%); outdoor public swimming pools (10%); paved walkways (9%); and concessions/vendors with healthier foods (7%). Figure 3 illustrates the top eight types of facilities mentioned.

Figure 3: Facilities/Amenities Respondents Want Added to Community Parks



Conclusion

Amidst competing priorities in tough economic times, parks and recreation programs may sometimes be regarded as a "nice to have," rather than a necessity. Parks and recreation services are an essential component of the fabric of communities, contributing to quality of life. Both research and public demand underscore their benefits and importance. They provide a safe place for physical activity, promote economic development, aid land preservation, contribute to community cohesion, prevent crime and offer educational opportunities. Amidst a crisis in childhood obesity, these facilities must also be regarded as a health necessity.

In order to sustain the benefits parks and recreation services provide to individuals and communities, policy makers should make it a top priority to maintain safe and convenient access to these facilities for children and adults throughout the state of Delaware. Data on the usage and recreation preferences of Delawareans, such as those gathered by the ORPTS, should guide policy makers in making their funding decisions. In addition, individual citizens should tell their elected officials how much they value parks and recreation.

Communities Benefit from Parks and Recreation

Studies show that parks, trails and active recreation facilities:

- Provide a space for children and families to engage in outdoor play and be physically active[8, 9]
- Promote economic development by increasing property values for nearby residences[10, 11]
- Assist with land preservation and make compact and sustainable development more attractive[12]
- Contribute to community cohesion and increase social capital[13, 14]
- Enhance quality of life in the community[15, 16]
- Reduce crime, particularly juvenile delinquency[17, 18]
- Offer recreational and educational opportunities that benefit residents of all ages

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Recommended Action Steps

For Community Members

- Learn more about your state or local parks and recreation department's facilities, programs and funding level so that you can be an effective advocate when the opportunity arises.
- Contact local policy makers to show your support for parks and recreation in your community.
- Become an avid user of parks and recreation programs by visiting Delaware's many state and local parks, joining a local hiking club, participating as a family in organized programs offered by your local parks and recreation department or attending nature education programs. Volunteer to assist with trail clean-up days and park maintenance activities.

For Policy makers

- Maintain at least level funding to ensure Delaware residents continue to have access to safe, convenient and nearby parks and recreation services.
- Allocate funding to parks and recreation services identified as priorities by the general public, such as creation of additional education programs and outdoor recreation programs for children, teens and persons with disabilities and more information on existing facilities and programs.
- When the economic climate improves, allocate funding for the development of more outdoor recreation facilities near residential areas, such as public parks and bike and pedestrian pathways connecting places of work, schools, shopping areas and neighborhoods.

Notes

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Appendix I: Phased Construction and Trail Project Ranking

Project Ranking and Phased Construction prioritization will be related to a number of different variables as outlined in Table I1 below. Funding availability and amounts will most critical.

Table I1- Phased Construction and Trail Project Ranking

White Clay Creek State Park Trail Projects									
Prioritization Catagories									
Park Area	**Project**	**Improves Susstainability**	**Community Connection**	**Shared Use**	**Increases Level of Use**	**Links Other Key Trails or Areas**	**Improves Safety**	**Broad Public Support**	**Possible Funding Source**
Judge Morris	General trail improvements and realignments	√		√	√	√	√		RTP
Judge Morris	community connection to School and Kirkwood Hwy		√	√	√			√	RTP
Judge Morris	community connection to Meadowood		√	√	√				RTP
Judge Morris	community connection to Delaplane Monor		√	√	√				DOT RTP
Judge Morris	Polly Drummond Rd. at grade crossing	√		√	√	√	√	√	DOT RTP
Judge Morris	Connectors to Polly Drummond Rd. crossing	√		√	√	√	√	√	RTP
Possum Hill	Bryan's Field trail improvements and realignments	√		√	√		√		RTP
Possum Hill	Whitely Farms trail improvements and realignments	√		√	√		√		RTP
Possum Hill	David English trail improvements and realignments	√		√	√		√		RTP
Possum Hill	Big Pond New trail around pond		√	√	√	√		√	Bond
Possum Hill	Skills Trail improvements	√		√	√		√		RTP
Possum Hill	Skills Area-Nine Foot Rd.			√	√		√		RTP
Possum Hill	Middle Run Possum Hill connector tunnel			√	√	√	√	√	Bond RTP
Possum Hill	New parking lot	√		√	√		√		Bond RTP
Possum Hill	Papermill Park to Thompson Rd.connector trail	√	√	√	√	√	√	√	Bond RTP TIGER
Possum Hill	Bank of America Connection improvements	√	√	√	√	√	√		RTP
Carpenter	Connector from Pomeroy to Creek Rd across Hopkins Road bridge			√	√	√	√	√	RTP DOT TIGER
Carpenter	Twin Valley trail improvements and realignments	√					√		RTP TIGER
Carpenter	Wells Ln to Creek Rd connector			√	√	√	√	√	RTP
Carpenter	Paved loop trails	√		√	√		√	√	Bond
Carpenter	Single track trail improvements and realignments	√			√		√		RTP
Carpenter	Pomeroy Trail adjacent to UD Laird	√	√	√	√	√	√	√	TE
Carpenter	Pomeroy Trail to Thompson Rd connector (golf course)	√		√	√	√		√	Bond
Preserve	Cart Trail Boundary Trail link			√	√	√		√	RTP
Preserve	Childrens Discovery Trail				√				RTP
Preserve	Park Office to Creek Rd connector along Chamber Rock Rd			√	√	√	√	√	Bond TE
Preserve	Park Office to Hopkin bridge connector			√	√	√		√	RTP
Preserve	Upgrade Creek Rd	√		√	√	√	√	√	Bond RTP
Preserve	Charles Bailey Trail improvements and realignments	√		√	√		√	√	RTP