

**Morganton, NC: Building a Healthier Community through
Open Spaces, Greenways, and Natural Resource Enhancement**



Prepared for the City of Morganton, NC

July 2015

**Morganton, NC: Building a Healthier Community through
Open Spaces, Greenways, and Natural Resource Enhancement**

PROJECT TEAM

Elizabeth Gilboy
Director

Lara Browning
Landscape Architecture Project Coordinator

Amy Eliason
Undergraduate Student, Landscape Designer

Carter Gresham
Undergraduate Student, Landscape Designer



CDAC Team Members: Lara Browning, Amy Eliason, Elizabeth Gilboy, and Carter Gresham

The Community Design Assistance Center (CDAC) is an outreach center in the College of Architecture and Urban Studies at Virginia Tech that assists communities, neighborhood groups and non-profit organizations in improving their natural and built environments. Assistance is provided in the areas of landscape architecture, architecture, planning, and interior design. Working with communities, the conceptual planning and design provides communities with a graphic vision of their project that can then be used for grant applications and fundraising for the next steps toward implementation.

Community Design Assistance Center
101 South Main Street, Blacksburg, Virginia 24060
p: 540.231.5644 f: 540.231.6089
w: <http://cdac.arch.vt.edu>



ACKNOWLEDGMENTS

The team would like to acknowledge the following individuals for their contributions and tireless involvement throughout the project.

Mr. Michael Helmick, Ph.D

President, Western Piedmont Community College

Mrs. Sandy Hoilman

Vice President for Administrative Services/Chief Financial Officer, WPCC

Mr. Lee Kiser

Dean, Workforce and Professional Development, WPCC

Mr. Andrew Kota

Stewardship Director, Foothills Conservancy

Mr. Lee Anderson

Director, City of Morganton Development and Design Services

Ms. Nancy Stairs

Coordinator, Urban and Community Forestry Program, North Carolina Forest Service

Mr. Eric Muecke

Western Urban Forestry Specialist, North Carolina Forest Service

Mr. Brian Fuller

Virginia Outdoors Foundation, Design Review Panelist

ACKNOWLEDGMENTS



The work upon which this publication is based was funded in whole or in part through a grant awarded by the Southern Region, State and Private Forestry, U.S. Forest Service.

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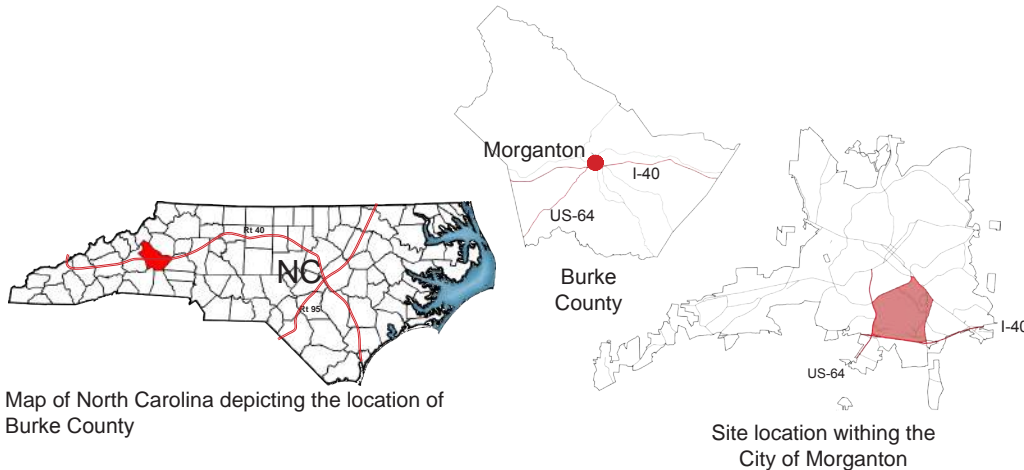
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PROJECT DESCRIPTION



“Established in 1777, Morganton is the county seat and cultural, governmental, financial, and commercial center of Burke County, the largest county in Western North Carolina. Sitting in the foothills of the Blue Ridge Mountains between Hickory and Asheville, Morganton’s location along I-40 makes it an important economic center for the region.

Morganton and the surrounding counties, cities, and towns are blessed with scenic rural landscapes, bountiful natural resources, and a rich historic and cultural heritage. Lake James State Park, the Linville Gorge, Pisgah National Forest, and South Mountains State Park are short drives from the city. Morganton prides itself on providing big city services wrapped in small town charm.”¹

The Foothills Conservancy approached the Community Design Assistance Center (CDAC) looking to evaluate an existing trail system on a site just south of Downtown Morganton. An array of different types of trails exist on the various properties of the site. In addition, the largest stakeholder on this “Pentagon” site, Western Piedmont Community College (WPCC), seeks to welcome and attract community members to the area for recreational use. With this in mind, WPCC is requesting options for an enhanced trail system that will connect with the various other sites, including the North Carolina School for the Deaf (NCSD) and Broughton Hospital. Burke County, hailed as “Nature’s Playground,”² also seeks to create an environment that promotes healthy living. This project will work in conjunction with the North Carolina Forest Service’s goal of appropriate large scale reforestation.

The Community Design Assistance Center prepared a conceptual master plan for trails, as well as detailed amenity spaces, planting recommendations, and reforestation guidelines.

1 Mission 2030 Plan: A Vision for Economic Success for Morganton, North Carolina
2 Burke County Tourism Development Authority

**Morganton, NC: Building a Healthier Community through
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PROJECT DESCRIPTION



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The site covers roughly 882 acres and includes the Western Piedmont Community College in the southwest corner (326 acres), the North Carolina School for the Deaf in the northwest (112 acres), and Broughton Hospital in the northeast corner of the site (192 acres). An existing trail system with varying character traverses the entirety of the site; however, its full connectivity was a major focus throughout the design process.

This report summarizes the design process and includes descriptions of the final designs as well as a summary of the work that led to the final designs.

Part I: Final Designs

DESIGN PROCESS

The design process began with an initial site visit to Morganton in February 2015. The CDAC team held a preliminary stakeholders meeting and gathered information about stakeholder's desires and concerns for the future of the site. The CDAC team walked the entire pentagon site, including WPCC, NC School for the Deaf, and Broughton Hospital campuses while focusing on the existing trails, viewsheds, and the current condition of Hunting Creek. The team also toured the city of Morganton including the Historic Downtown, Catawba Meadows Park, Liberty Park, and the Catawba Greenway. By gathering on-site data, documenting existing conditions, and taking soil samples, the team was able to better understand and visualize the opportunities and constraints of the site. A follow-up site visit was conducted in March 2015 to collect further information on Hunting Creek conditions as well as trail character.

In April 2015, the CDAC team had the opportunity to meet with the stakeholders and community to present two preliminary design concepts influenced by the stakeholder's desires as well as our own site analysis. These designs were presented to and reviewed by stakeholders as well as community members. The design alternatives were then revised and combined into a final conceptual master plan. Specific detail amenity areas were also chosen to further describe the possibilities of the site.

The final conceptual master plan, detail plans, and planting recommendations were then presented at a final meeting in May of 2015 on the Western Piedmont Campus. Both community members and property stakeholders were in attendance.



The CDAC team meeting with stakeholders in February 2015.



The CDAC team exploring the culvert below I-40.



CDAC team members Carter Gresham and Amy Eliason presenting preliminary concepts to stakeholders.



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**FINAL CONCEPT
Conceptual Master Plan**

The final conceptual master plan seeks to create a unique outdoor experience for the residents of Morganton. A new trail system is proposed to both highlight the beauty of the entire site as well as the specific character of each of the properties within the site. A wide asphalt “Loop Trail,” designed based on DeafSpace and universal design principles, allows deaf users and hearing residents to enjoy the trail simultaneously. This trail links the three smaller trail systems situated within each of the properties. In addition, a mountain biking trail has been proposed in the center of the site that takes advantage of the steep topography and variation in vegetative cover. Finally, reforestation area has been proposed along the Hunting Creek corridor as well as along its many tributaries within the site. Reforestation along Hunting Creek is vital to the re-creation of a vegetative buffer (roughly 300’ on each side) along the impaired creek. In addition, those areas that lie under utility lines will be designated as no mow zones. This new trail system may attract community members as well as provide opportunities for large scale event use. These new trails would provide a valuable asset for Western Piedmont Community College and the broader community.

Design Breakdown:

- 5k Loop Trail for both hearing and deaf residents and users
- Specific trail systems for NCSD, WPCC, and Broughton Hospital, each with their own trail character (see p. 12-17 for trail character descriptions)
- Mountain biking course in the center of the site utilizing the steep land gradient and variation in vegetated cover
- Northwest connection to downtown and surrounding residential areas/developments
- Viewsheds towards Table Rock and NCSD campus are maintained and highlighted by trail stops and overlooks
- Trailhead with public parking and restrooms located on WPCC campus

Following is a trail master plan delineating each of the proposed trail systems as well as more detailed descriptions of the trails and focal areas. In addition, we have created several “existing versus proposed” perspectives to allow the community to more easily see the possibilities latent in the site.

**FINAL CONCEPT
Conceptual Master Plan**

Connectivity and Circulation beyond the Trails

Certain key circulation adjustments are also proposed to both increase the security of the entire pentagon site (especially the WPCC campus) as well as increase connectivity. These adjustments are solely in the southern half of the site and lie within the grounds of WPCC. They are as follows:

Connection to Riddle Center through Culvert under I-40

One of the three culverts crossing under I-40 is proposed as a retrofitted pedestrian connection. It is recommended that asphalt be poured creating a pedestrian and cyclist friendly path towards the Riddle Center and beyond. During higher flow or flood events this path's use will be prohibited so that all three culverts can efficiently funnel water towards the pentagon site. See page 30 for a perspective view of the proposed connection.

Proposed Secondary Entrance to the WPCC Campus

A secondary entrance is proposed using the existing Government Drive thoroughfare. This road would be used in case a threat to the safety of the students and staff of WPCC arises. The road cuts westward through the eastern campus of WPCC and across Hunting Creek, following the course of the creek north, then joining the existing road near the firing range. This placement was decided upon due to its lack of infringement on any other campus structures as well as the topography of the site. Strict care must be taken so that no construction pollution seeps into the Hunting Creek watercourse.

Connections to Downtown and Catawba Greenway

Two minor changes are proposed on the western portion of the pentagon site. Connectivity to downtown and the Catawba Greenway will be achieved through a proposed pedestrian crosswalk near the NCSD campus. This walk will cross US Highway 70. In addition, connections to surrounding businesses closer to the pentagon site will be afforded through a new sidewalk system that follows Community College Drive to Burkemont Avenue.

FINAL CONCEPT
Conceptual Master Plan



**FINAL CONCEPT
Interpretive Trails**

Each property presents a unique history, character, and culture that the team thought should be highlighted as one moves through the respective campuses and their surroundings. The following pages describe each of these experiences starting with the WPCC campus and moving clockwise through the pentagon site.

Western Piedmont Community College

As one moves through the WPCC campus they become enveloped in portions of the curriculum (especially nature-based) being taught within the school. Here one can learn about horticulture and nature-based play in several activity zones located within the trail system. Tree and plant identification placards dot the forest trails south of campus and a large nature play area has been recently renovated and added to. At the nature play area, early childhood development comes out of the classroom and onto the grounds. Proposed slides are placed on steeper topography and felled trees are sliced and may become “tree cookies” for children to stack and enjoy. In addition, all furniture and play elements are constructed of natural materials, further teaching children about the surrounding environment. Just south of this nature play area visitors can view the ropes course in use by the physical therapy students.

A large amphitheater is also proposed just west of campus. This placement takes advantage of the naturally sloping hill. Stone or wooden seating could be easily placed down the hill with a stage suitable for organized performances or events. In addition, ample parking is afforded in the current lots west of campus.



Treehouses



Nature Play



Amphitheater using natural
topography

FINAL CONCEPT

Interpretive Trails

Reforestation Zone

When one travels up the western border of the site they come upon a savannah landscape. Here woodland trails through savannah and more densely forested stands offer opportunities for reforestation interpretation. A large interpretive space is proposed to teach visitors about forestry in North Carolina and in the Piedmont region. In addition, each of the tree stands represented (oak-hickory, loblolly pine) is described in detail through signage and tree placards scattered throughout the area. For more information about reforestation and to see a perspective view of proposed reforestation, see pages 30 and 31.

North Carolina School for the Deaf

The NCSD is situated in the northwest corner of the site and offers an extensive history and fascinating culture. Here, the trails are wide enough for the deaf community to use (8-12' wide). Residents communicate through American Sign Language which requires a larger walking space for dialogue. This "area of triangulation" (two sign while a third walker acts as a guide) has been investigated in depth by researchers at Gallaudet University. They developed the concept of DeafSpace, a premise focusing on universal design, or design geared to all possible users. For more information on DeafSpace and Universal Design, see page 41. In addition, signage throughout the NCSD campus will teach about the history of the prestigious school and its grounds. This trail system will have a terminus at the NCSD Museum to bring even more visitors to this extremely rich museum and its wonderfully knowledgeable curator.



NCSD Patch



NCSD Class Pride

FINAL CONCEPT
Interpretive Trails

Best Management Practice Trail

Moving east from the NCSD campus, visitors come upon a rolling grassland with a boardwalk trail system. This is the Best Management Practice (BMP) trail section. Here, visitors can learn about how natural elements such as rain gardens or stepped retention ponds can aid in stormwater retention. In addition, as one moves through the open grassland, they in fact are interacting with a large BMP. Here, stormwater runoff flows across the grassland and filters into the groundwater.

Signage throughout the park-like space teaches hikers about the ongoing processes and the users' effects on them. As one moves closer to Hunting Creek a large riparian buffer including dense forest and understory plantings encloses the trail. Here, visitors are taught about stream ecology and riparian buffers. For more information on the BMP trail see pages 26-29.

In addition, due to the proximity of Broughton Hospital, we feel that this space could become a restorative landscape. Swings and ample seating are scattered throughout the grassland as well as the riparian buffer corridor. Here, patients and family alike can come to relax and unwind in a large but intimate space.



A young riparian buffer



A rolling grassland



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FINAL CONCEPT

Interpretive Trails

Broughton Hospital

The Broughton Hospital campus is located in the northeast corner of the site and offers a rich history and culture as well. Here, the team believes the trail system should both celebrate the past and look toward the future of mental health. We propose that the path be made of crushed brick recycled from the ongoing demolition of some of the original structures as a nod to the original campus. In addition, signage scattered throughout this trail will focus on the history of the hospital as well as on the history of mental health in North Carolina and the United States.

Loop Fitness Trail

The final trail is the large asphalt trail (roughly 5 kilometers or 3 miles in length) that connects each of the smaller trail systems. This trail is roughly 8-12 feet wide to facilitate triangulation and DeafSpace (see pages 10 and 41 for more information). In addition, a forgotten fitness trail will be revitalized. Small fitness stations with elements for a variety of intensity levels will be scattered along the path. For more information on possible fitness stations see page 48. Additionally, due to the path's larger width, organized races and events, such as the American Cancer Society's Relay for Life, can be staged.

The final concept for interpretive trail character can be found on the following page.



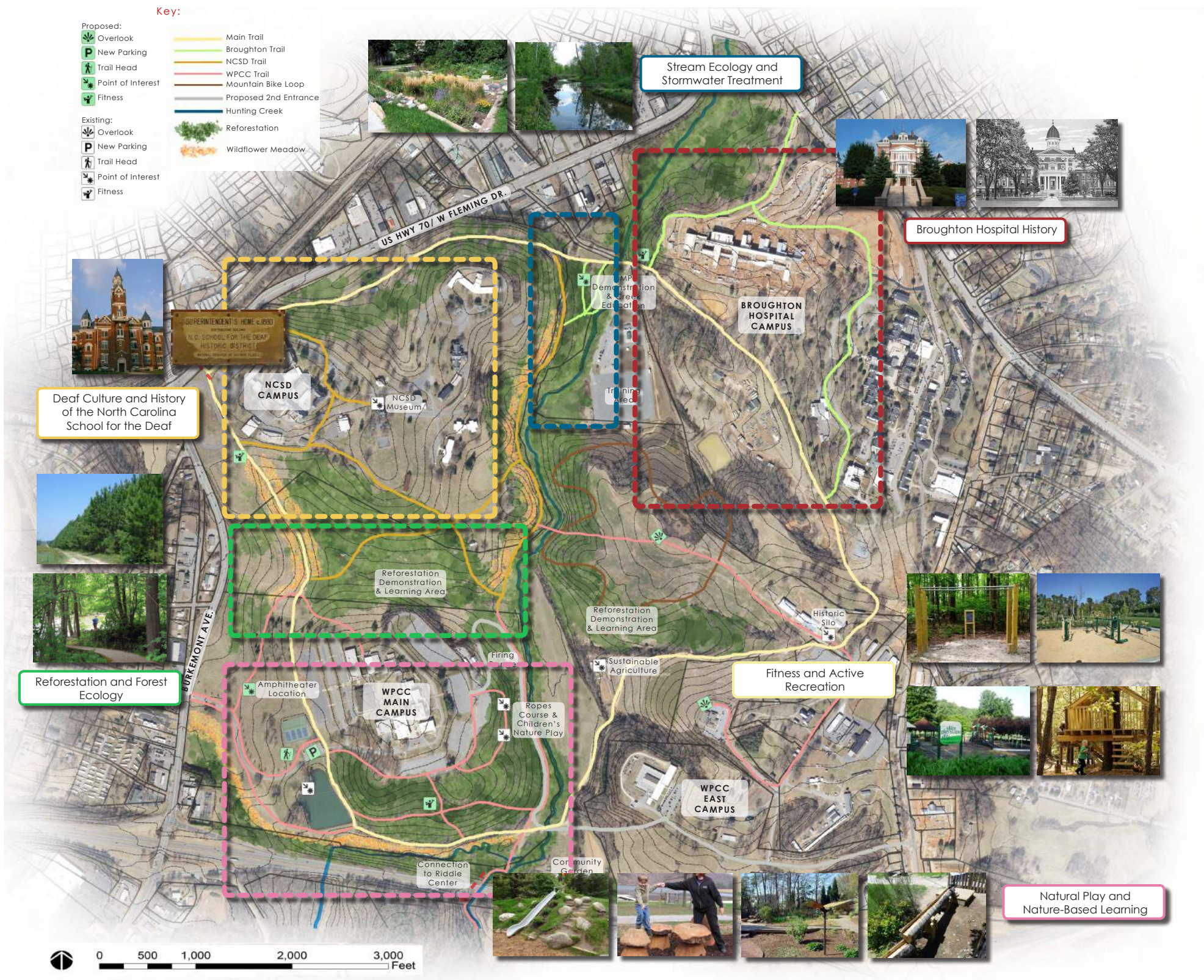
Examples of fitness stations along the length of the loop fitness trail



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FINAL CONCEPT
Interpretive Trail Character



FINAL CONCEPT

Trailhead

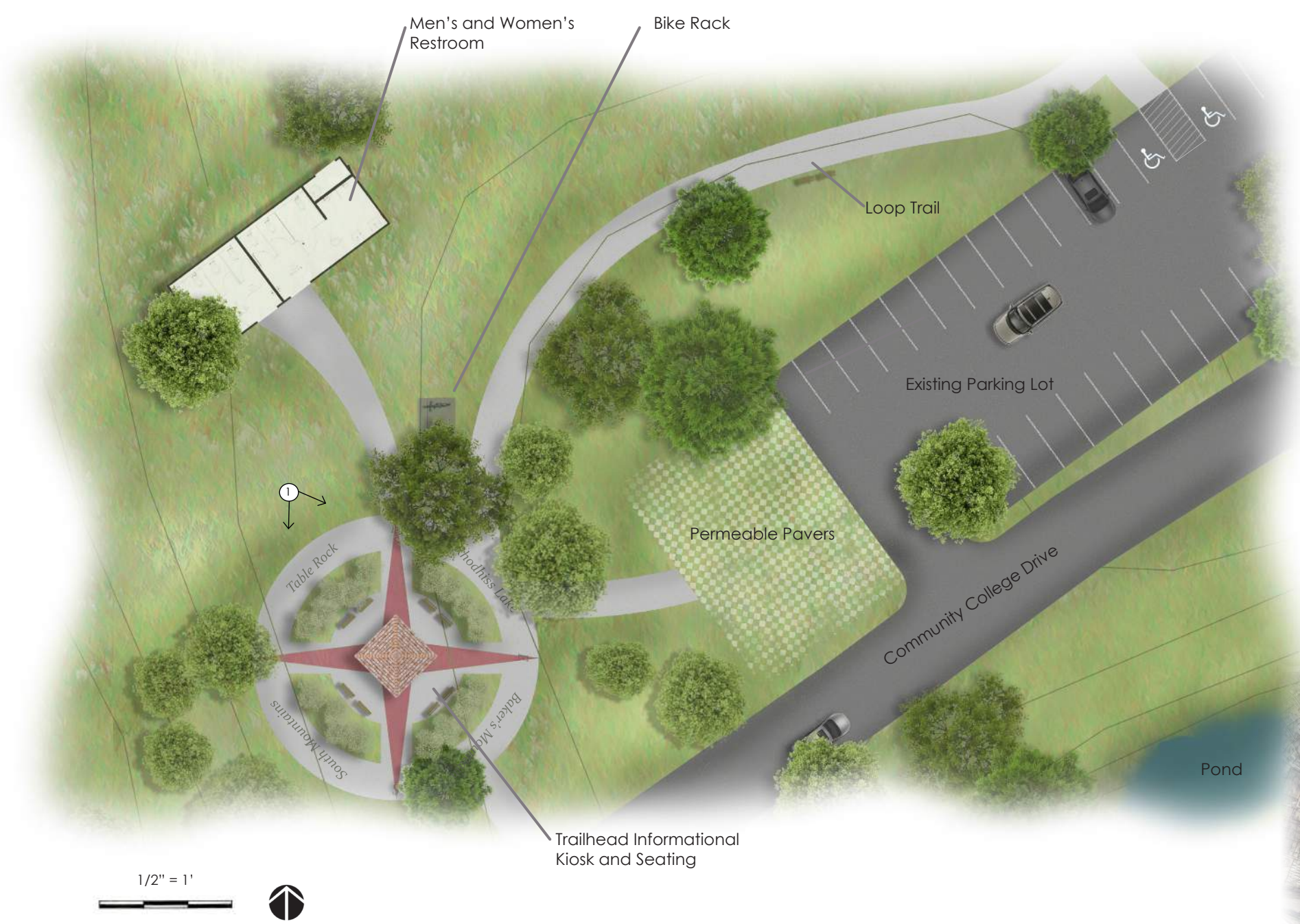
The new system of connected trails needs a convergence point, a point to set out from, or an ending point. It is proposed that the trailhead be situated just southwest of the main WPCC campus in close proximity to the existing tennis courts. This new space would serve several functions. First, a three-sided informational kiosk would be situated within the new central compass element. This kiosk would display trail maps, information, and safety instructions, as well as information about orienteering or mountain biking courses. The kiosk would be located in the center of a new compass space. The four cardinal directions would be imprinted in the paving. Within the directional imprints, natural features would also be imprinted in the paving. As one moves between North and West on the compass they will be standing in direct orientation to Table Rock. When standing in between East and South, they would be looking towards Baker's Mountain. This element also helps create a sense of place or identity; one can now "meet at the Compass."

In addition, to alleviate any need of additional asphalt parking, it is proposed that permeable pavers be laid directly southwest of the existing parking lot. Permeable pavers will allow stormwater to infiltrate into the ground. Grass could grow around these pavers, especially during low traffic periods. By doing this, more parking would be available for trail users while diminishing the impact on the existing landscape around the current parking lot.

Finally, a small restroom facility is proposed in close proximity to the informational kiosk. This was done for ease of access purposes as well as security. This site is in clear view of the local police station for added security.

The following pages include the trailhead concept plan, an eye-level perspective of the site, as well as informational descriptions for the elements and materials included in the trailhead concept.

FINAL CONCEPT
Trailhead



Location



Perspective of the Central Compass Trailhead

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**FINAL CONCEPT
Trailhead**

Trailhead Elements and Materials

Following are a variety of ways to achieve the proposed trailhead amenity space. The examples shown here have been built in other locations and provide an idea of what is being proposed for the trailhead area.

Examples of Trailhead Informational Kiosks

These structures serve as meeting points as well as informational kiosks. Here one can view a map of the trail system as well as learn about any nearby attractions or points of interest. In addition, orienteering trips can begin here.



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Examples of Compass Paving Elements

The compass element not only provides a beautiful focal piece, but also highlights local natural attractions (Table Rock, etc.). It serves as a focal point, where users and visitors could more readily remember the space, "Let's meet at the Compass."



FINAL CONCEPT
Trailhead

Examples of Permeable Pavement

Eight to ten parking spots are proposed using permeable pavers as the base material. These pavers allow runoff to infiltrate into the groundwater. They also provide space for grass to grow through the voids, creating a clean, natural parking lot.



Examples of Trail Restrooms

A small restroom facility is proposed within this new trailhead space. Full accessibility for handicapped users is also accommodated here.

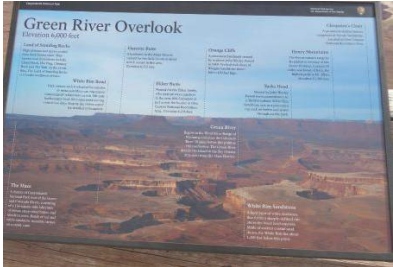
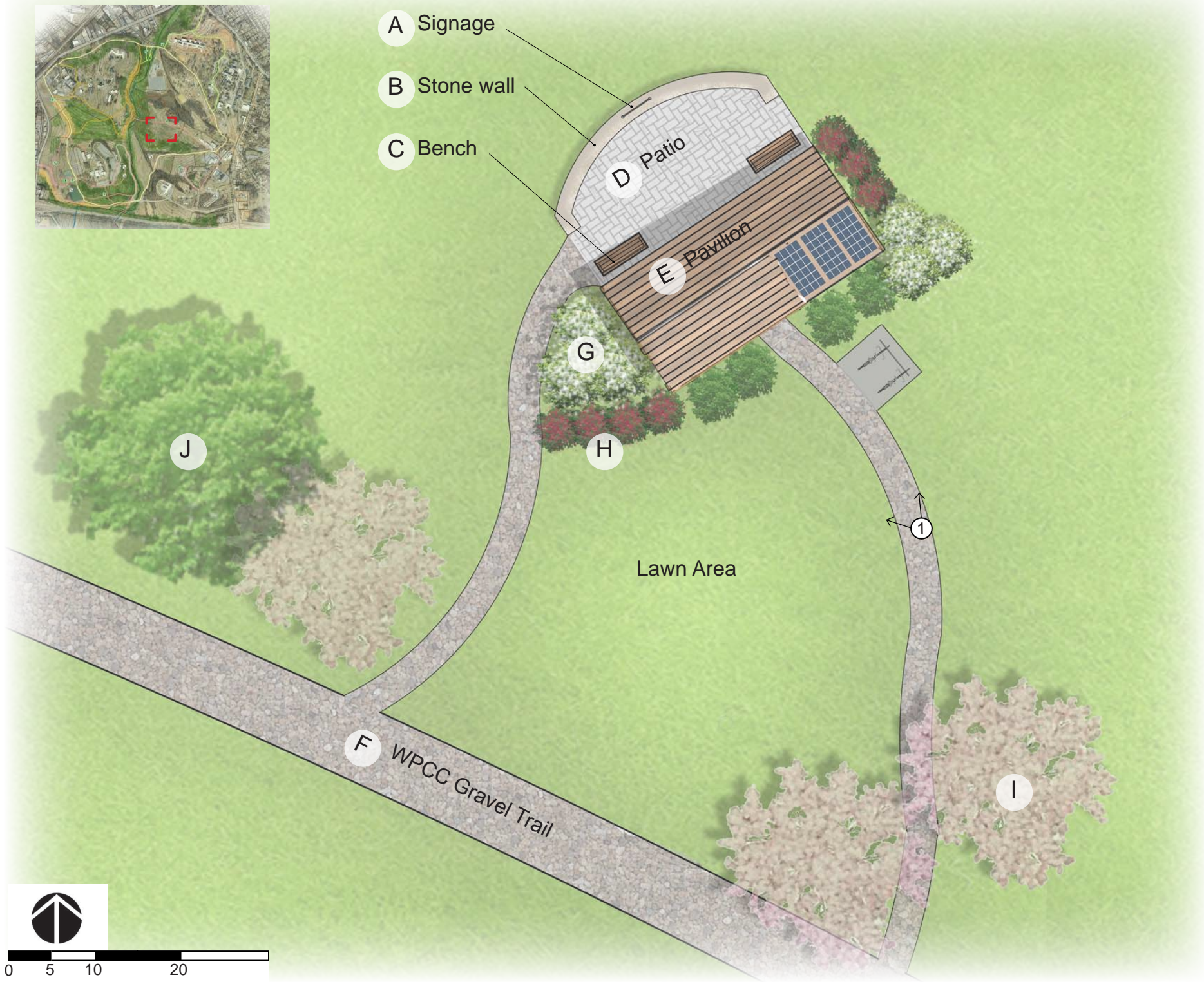


FINAL CONCEPT
Overlook

The overlook design was located to take advantage of the beautiful, existing view of Table Rock, located east of the pentagon site. The overlook design includes a wooden pavilion, bike rack, outdoor seating and informative signage. The pavilion is oriented to face the Table Rock view and proposes solar panels on the roof which can power the lighting at the overlook. There are picnic tables and benches are oriented towards the view. Here trail users could stop and relax during one's hike, bike ride, or lunchtime break. The proposed signage would be educational and include information about Table Rock, Linville Gorge, and Pisgah National Forest. The surrounding landscaped area includes all native plants, which can also be used as an educational tool for visitors. The overlook was designed to be duplicated throughout the property to take advantage of the other fantastic views the pentagon site has to offer.

The following pages include the overlook design, an eye-level perspective of the site, and planting recommendations.

FINAL CONCEPT
Overlook Plan and Materials



A. Informative Signage



B. Stone Seat Wall



C. Wooden Benches



D. Patio Pavers



E. Pavilion with Solar Panels



F. Gravel Trail



G. Virginia Sweetspire



H. PJM Rhododendron



I. Flowering Dogwood



J. Yellowwood



Perspective of an overlook pavilion with picnic tables, signage, and solar panels

FINAL CONCEPT
Best Management Practice Interpretive Trail Concept

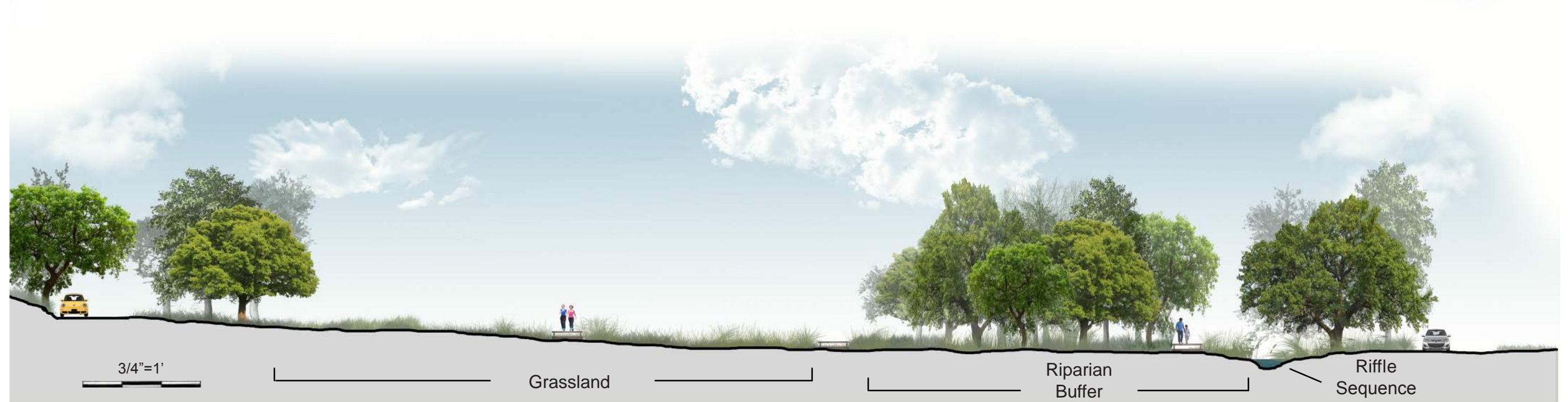
This large space focuses on both creating a completely new experience for users as well as educating them on stormwater management best practices and Hunting Creek. One can traverse an expansive grassland on a system of elevated boardwalks and view the entire space. As a breeze comes down the ridge to the east, the entire grassland comes to life through motion. If one would like to walk through a more secluded space, they can take the trail that meanders parallel to Hunting Creek.

Each of these spaces present opportunities for interpretation. As one enters the site in the northwest corner, they would trek through a system of rain gardens with interpretive signage throughout. After moving through the rain gardens on the site margins, another set of signage discusses the importance of grasslands in stormwater retention and treatment. As one nears Hunting Creek, they learn about the condition of the impaired stream and view a small riffle sequence. Finally, if a walker prefers to exit the space towards the NCSD campus, they move uphill through a sequence of stepped retention ponds and their accompanying interpretive signage.

In addition, due to the space's proximity to Broughton Hospital, the area could be used as a restorative space. The boardwalk system provides sweeping views out over the grassland and of the surrounding valley landscape, as well as benches and swings along the boardwalk. In addition, the quiet splashing of the water within the riffle sequence can serve as a calming tool for patients and their families.

The following pages include the interpretive trail concept, a section view cut through the width of the site, best management practice descriptions, and existing and proposed perspectives.



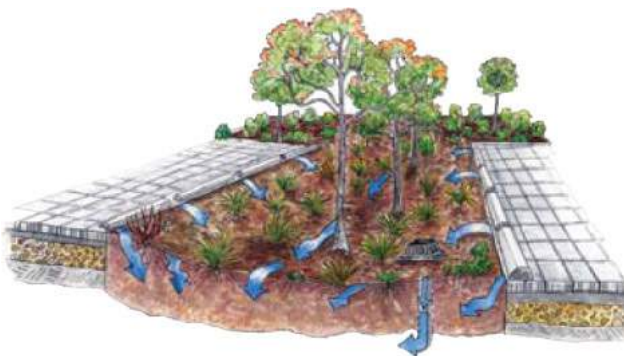
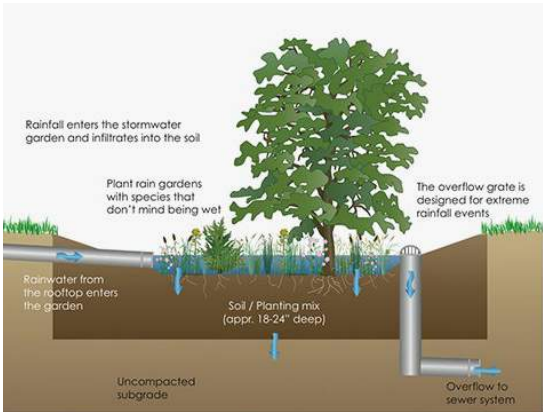


Section through the Grassland and Hunting Creek a-a'



Boardwalk

Grassland should be planted with alfalfa (which can choke out Johnson Grass), little bluestem, cave-in-rock switchgrass, or blackwell switchgrass



Rain
Garden

Rain gardens will be strategically placed within this space and throughout the entire property. They should be placed where ponding of water is observed. As water runs off of surfaces, it can pond in these areas and seep into the ground. This water can also be treated by certain filter-facilitating plant species, listed to the right.

(Shrubs & Grasses) swamp milkweed, cardinal flower, common ironweed, lady fern, royal fern, cinnamon fern, drooping sedge, black-eyed susan, coneflower, beebalm, arrowwood, bottlebrush buckeye, cranberry bush, false indigo, swamp azalea, river oats
(Trees) ironwood, possumhaw, sweetbay magnolia, river birch



Riffle
Sequence

Riffle sequences not only add aesthetic appeal to a stream, but they also add several ecological benefits. Riffles toss the current and disturb suspended solids. In addition, they add oxygen to the stream, which helps sustain biological diversity.



Stepped
Ponds

As one moves up the ridge, several stepped retention ponds form the boundary of the path. Here, runoff collects in a primary pond, then cascades into lower ponds if water levels are high. These spaces are also rich in biological diversity.

FINAL CONCEPT
Existing and Proposed Perspectives



Proposed Overlook
Space



Proposed Culvert Connection
under Interstate 40



Proposed Savannah-type
Reforestation

FINAL CONCEPT
Reforestation Recommendations

The following pages discuss the recommendations for reforestation and complementary interpretation within portions of the site. Approximately 100 acres are proposed for reforestation, divided into different forest stands and associated plantings. The specific forest and vegetative cover locations are noted below and described on the following pages.



Current forest and vegetative cover



Proposed forest and vegetative cover

FINAL CONCEPT
Reforestation Recommendations

A. Loblolly-Shortleaf Pine Forest Association



This association is often found in muddier soils surrounding smaller tributaries, therefore we have placed this stand in the tributaries west of Hunting Creek.

-Loblolly pine (*Pinus taeda*)
-Shortleaf pine (*Pinus echinata*)
The proportion of these two species varies; however, loblolly pine usually dominates. Herbaceous plants are usually sparse because little light reaches the forest floor.

Associated Tree Species:
sweetgum, blackgum, southern red oak, post oak, mockernut hickory and pignut hickory

Understory Plant Species:
southern red oak, post oak, white oak, dogwood, blackgum, persimmon, hickory, sweetgum, eastern red cedar, black oak and blackjack oak

Shrub + Vine Species:
southern bayberry, inkberry, mapleleaf viburnum, arrowwood, greenbrier, blackberry, virginia creeper, low blueberry, honeysuckle, french mulberry, witch-hazel, sumac



Sweetgum



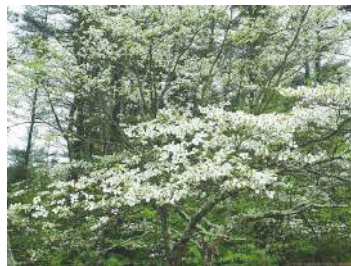
White oak



Witch-hazel



Red maple



Dogwood



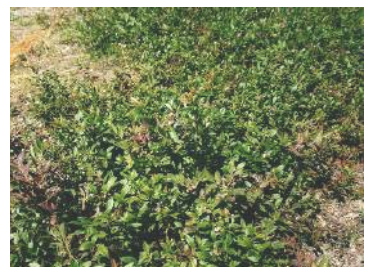
Mapleleaf viburnum



Southern red oak



Black oak



Low blueberry

FINAL CONCEPT
Reforestation Recommendations

B. Oak-Hickory Forest Association



The oak-hickory association prefers dry open sites, therefore we have chosen the knobs on the site for this association.

- Northern red oak
- Black oak
- White oak
- Chesnut oak
- All Hickory species

The proportions of each species vary greatly. Species makeup depends on amounts of precipitation, and how water drains through soils.

Associated Tree Species:

yellow-poplar, red maple, blackgum, persimmon, black walnut, butternut, pitch pine, sweetgum, black locust, dogwood and sassafras

Understory Plant Species:

dogwood, sassafras, sourwood, serviceberry, eastern redbud, american hornbeam, eastern hophornbeam

Shrub + Vine Species:

witch-hazel, hazelnut, blueberry, viburnum, spicebush, mountain-laurel, rhododendron, virginia creeper, greenbrier, wild grape



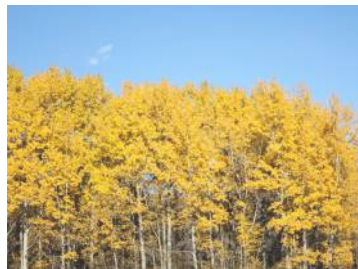
Black walnut



Serviceberry



Mountain laurel



Yellow poplar



Redbud



Rhododendron



Black locust



Sassafras



Spicebush

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**FINAL CONCEPT
Reforestation Recommendations**

C. Riparian Buffer Plantings



Southern sugar maple



Ironwood



River birch



Common elderberry



Mountain laurel



New Jersey tea

D. Orchard + Wild Edibles



Red delicious apple



Pecan



Persimmon

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Signage



These images provide suggestions for possible means of interpretative signage within the proposed reforested regions.

FINAL CONCEPT Phasing Plan



Phase 1: The first phase of construction should include the construction of the asphalt loop trail as well as the trailhead space. This would create a clear, legible, foundation trail on which the smaller systems can build. The proposed trailhead construction would also increase legibility. In addition, a portion of the loop trail is already in existence and would require minimal changes (portion of road through the Broughton Hospital).

Phase 2: The second phase involves the WPCU campus. Since the majority of trails already exist, the main construction would involve the creation of the sidewalks along Community College Drive, the trailhead, and the retrofitting of the culvert below Interstate 40. This connection to the Riddle Center is vital to the external connectivity of the pentagon site.

Phase 3: The third phase is focused on the NCSU campus and though it covers the most landmass, the actual construction is relatively minimal. The main focus is east-west trails crossing Hunting Creek. A bridge would need to be constructed and some minimal land grading would need to take place to facilitate a trail just east of the site center.

Phase 4: The final phase of construction is located on the Broughton Hospital campus and is dependent on the proposals of the consultant currently working on the master plan for the property. The Grassland boardwalks would be created during this phase.

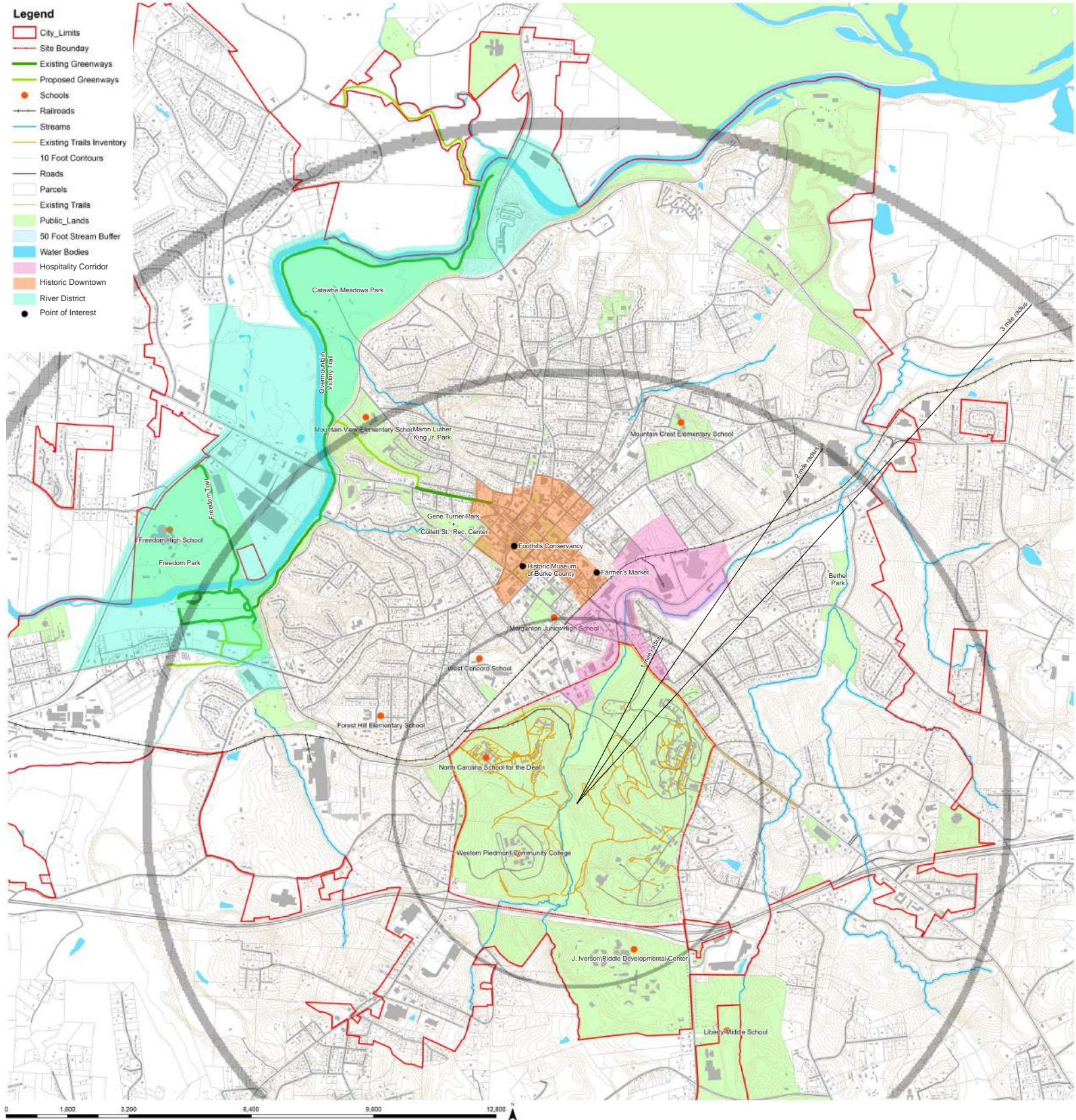
NC DOT: The creation of the second entrance road is contingent on the plans of the North Carolina Department of Transportation, therefore the recommendation falls to their discretion. Ideally, this entrance would be implemented around the same time as the WPCU enhancements (Phase 2) so that construction disturbances are limited to a shorter period.

CONCLUSION

The Community Design Assistance Center worked closely with WPCC and the greater Morganton community to create a conceptual master plan for the campus property and neighboring sites. We hope that our proposal both highlights existing opportunities already in progress on the site as well as new ideas that can be implemented in the future. In addition, we hope that our trail system proposal attracts even more community members to the site and its current and proposed amenities. It is our hope that the WPCC site and the greater pentagon property serve as a tool for the residents of Morganton and of Burke County to promote a more healthy and happy lifestyle in western North Carolina. We would like to thank all involved stakeholders as they have contributed an immeasurable amount to the design process and to the final product.

Part II: Analysis and Preliminary Concepts

INVENTORY AND ANALYSIS
Regional Analysis



Places of Interest

Downtown Morganton



Downtown has a lot to offer and is the hub for local business. There are several craft breweries and local boutiques as well as live music and art festivals. Located just a over a mile from the 'Pentagon', the downtown area has the potential to connect our site to the Catawba Greenway System.

Farmer's Market



Morganton's farmers markets offer the best locally grown products in the area. The Saturday Market is located at 300 Beach Street and the Wednesday Mini-Market is located at 111 North Green Street.

Historic Museum of Burke County



The History Museum of Burke County seeks to promote the collection, preservation, educational interpretation and display of those artifacts, documents, and events most representative of Burke County. It opened in 2003 and is located in downtown Morganton.

The "Pentagon"



Western Piedmont
Community College

North Carolina
School for the Deaf

Broughton
Hospital

Parks + Trails

Catawba + Freedom Trail Greenway



The Catawba River Greenway is 3.8 miles of paved walking and biking trails running along the Catawba with access points throughout the park. Picnic shelters, ADA compliant rest rooms, a playground, fishing piers, canoe launches, multilevel observation decks dot the trail.

Catawba Meadows Park



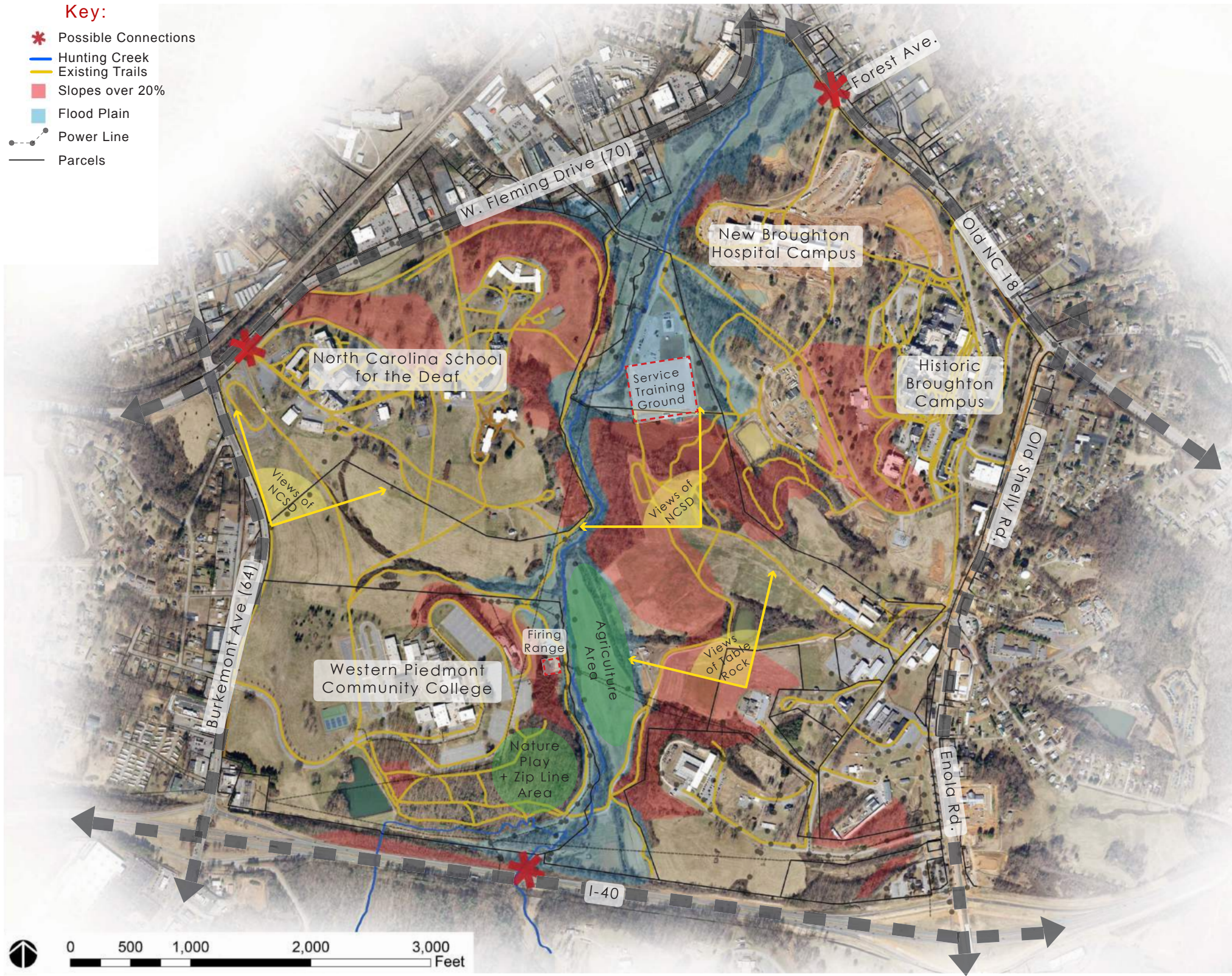
Catawba Meadows Park is one of the largest in Morganton and connects to the Catawba greenway system. The park's program is unique, including a zip line adventure area, disc golf, and soccer and baseball fields.

Overmountain Victory Trail



The Overmountain Victory Trail traces the route used by Patriot militia during the King's Mountain Campaign in 1780. The trail runs through VA, TN, NC and SC. Morganton has formally certified the Catawba Greenway and Freedom Trail as part of the Overmountain Victory Trail.

INVENTORY AND ANALYSIS
Site Analysis



During our initial analysis of the site, we focused our efforts on several different site aspects. The first was focusing in on the existing trails. The trail system is extensive and quite complex, consequently there was a need to simplify the system and make it more legible. In addition, major viewsheds were not well delineated. These included views towards the NCSD campus as well as to Table Rock toward the northwest. We also evaluated steep slopes that were not suitable for development. These areas are indicated in red on the map. Sewer and overhead power lines on the site also impact the height of development as well as the location and type of plantings. For connectivity, the most efficient access points from outside the property are at Forest Ave., the culvert under I-40, and the NW intersection of Burkemont and W. Fleming. Finally, Hunting Creek needs a 300' buffer to serve as a "low-development zone" so that riparian buffers and degraded stream banks have a buffer for reforestation and revitalization efforts. This analysis was then used as a guide during the design process.



View towards NCSD from Burkemont Avenue



Overhead powerlines as a development restriction



Current condition of Hunting Creek

CASE STUDIES

DeafSpace and Universal Design

The following pages include case studies completed by the CDAC team for various aspects of the design. Completed in the initial design stages, these serve as a form of guidelines focusing on specific aspects of the site and of the final site design.

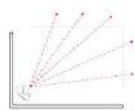
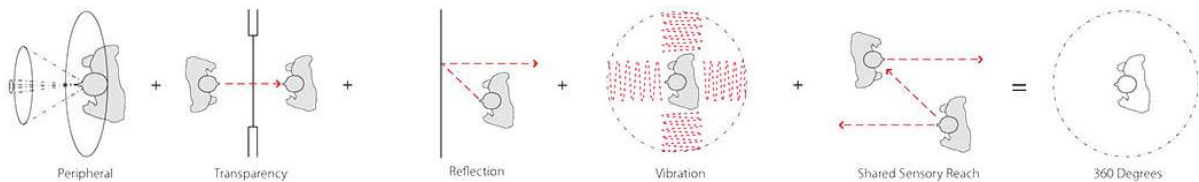
The team chose to conduct focused studies on designing for deaf communities, interpretive trails (especially in North Carolina), greenways and accompanying riparian buffers, and green campuses.

CASE STUDIES

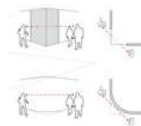
DeafSpace and Universal Design

DeafSpace deals with areas needed by the deaf community for an efficient flow of communication. There is a major focus on free-flowing, circular space that allows for easy interaction among individuals.¹ Below is a brief summary of the information.

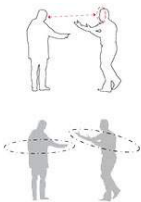
1 Gallaudet University



Sensory Reach
Focuses on an individual's ability to read and understand the area around them



Mobility and Proximity
Ability to move through wide spaces and understanding of disturbances



Space and Proximity
Ability to visually connect with another signing individual easily and efficiently



Light and Color
Soft, diffused lighting creates the optimal signing light for deaf individuals

41



Design Implications:

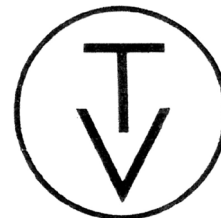
1. One must find the balance between the needs of deaf and hearing communities to create a cohesive and successful design for all parties
2. The majority of deaf-engaging spaces should involve "maluma" or free-flowing, circular spaces that easily facilitate interaction
3. More acceptable acoustics for deaf individuals can be created by limiting spaces and surfaces that may increase sound reverberation
4. Third Person Mentality: Three walking individuals form a triangle of interaction; two sign/ converse with each other and the third individual serves as a guide
5. NC School for the Deaf cannot stand alone as an island on the site. Having secure connectivity to surrounding properties is key

CASE STUDIES

Interpretive Trails

Overmountain Victory Trail

The Overmountain Victory Trail commemorates the Kings Mountain Campaign of September 1780. Aspects of the trail include walkable paths (light brown) and highways (dark brown) that delineate the campaign march of patriot militia through VA, TN, NC, and SC. Roughly 87 miles of walkable pathways as well as marked highways, one of which (Route 64) forms the western boundary of the site.



"V for Victory, T for Trail."
Symbol drawn by Warren Dennis.
from 1976 OVT brochure



Design Implications:

1. Began as a commemorative march every September since 1975 and has become a lasting trail system
2. Grade schools are heavily involved in interpretive events
3. Teaching devices (plaques, signage) are seen at many historic sites along trail course

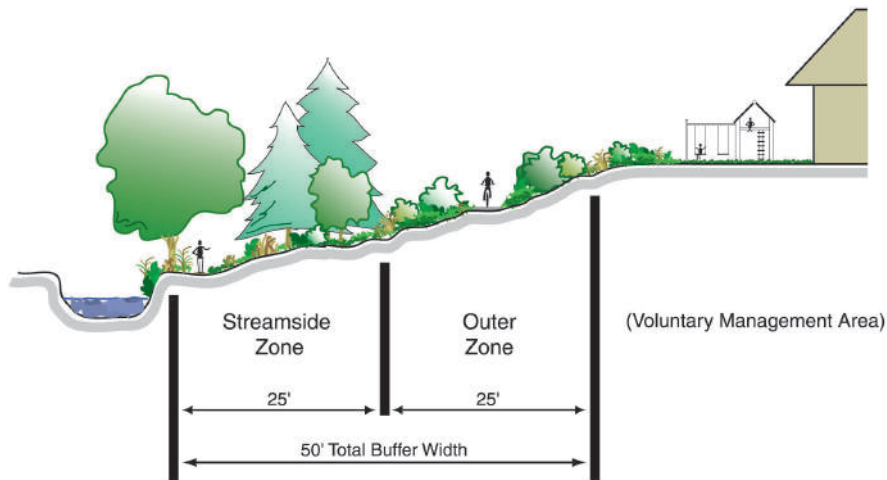
CASE STUDIES

Greenways and Riparian Buffers

Lake Superior Watershed Project - Upper Peninsula of Michigan

Superior Watershed Partnership (Lake Superior) protects water quality and quality of life by maintaining the ecological integrity and health of the peninsula's waterways. They, like Morganton, are growing, and therefore there are fewer opportunities for runoff infiltration. They created zones along waterways to aid in improving water quality and reducing runoff.

The Streamside Zone is responsible for maintaining the structural integrity of the watercourse. Pedestrian paths and flood control structures are allowed here. The Outer Zone mainly serves as a buffer between upland development and the stream. In this zone, heavy recreation and stormwater management practices are more safely put in place. The Voluntary Management Area falls beyond the zones and is at the discretion of the property owner.



Design Implications:

1. Aim to reduce amount of impervious surfaces in close proximity to riparian buffers.
2. All spaces beyond a certain distance for buffer fall under the judgement of the property owner (Voluntary Management Owner)
3. Temporary structures, such as jungle gyms or picnic areas should be placed outside of the Streamside Zone
4. Wetlands and steep slopes should also add to the width of zones. Add roughly 10' for 15-17% slopes and roughly 70' for slopes greater than 25%

CASE STUDIES
Greenways and Riparian Buffers

**United States Department of Agroforestry Guidelines for Riparian
Buffers**

The USDA has set forth guidelines for all riparian buffer trail designs. The following is a brief summary of those guidelines.

The primary trail should be located outside of the riparian corridor. Some riparian areas should be left as refuges without trail infringement. All stream access must be at strategic positions. Minimize trail crossings and keep all trail crossings away from each and every trail confluence.



Before and After Pedestrian Path
Implementation



Trail
Recommendations

**Morganton, NC: Building a Healthier Community through
Open Spaces, Greenways, and Natural Resource Enhancement**

**CASE STUDIES
Green Campuses**

Sustainable Agriculture at Evergreen State College

The following is a brief summary of the efforts of Cornell University as it updates its campus to become more ecologically efficient.



Internship Program

Interns during entire growing season, yearly research projects to test new crops and composting methods



Composting Facility

Composting bins throughout campus buildings, feeds and fertilizes organic community gardens



Organic Farm

Includes 3 acres of orchards, fields, community gardens and greenhouses, a compost facility, chickens and sheep



Stormwater Management at Cornell University

The following is a brief summary of the efforts of Cornell University as it updates its campus to become more ecologically efficient.

45

Green roofs

Fenlow Hall as well as the new architecture building have unique green roofs that are visible to the public with informational signs about their ecological benefits

BMP's

Throughout the campus there are several BMP's such as rain gardens and constructed wetlands. These visible stormwater practices help promote water stewardship and act as educational resources.



Design Implications:

1. Expand and enhance on the existing sustainable agriculture program at WPCC.
2. Create a composting facility and program for the entire WPCC campus.
3. Create classes and internships around the sustainable agriculture program.
4. Make stormwater management practices more prevalent on the site.
5. Utilize unique BMPs to protect and enhance Hunting Creek.
6. Create classes and internships around sustainable stormwater practices.



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PRELIMINARY CONCEPTS

After completing the site analysis of the pentagon site and specific case studies, the team focused on creating loose conceptual plans based off of certain aspects of the site that we deemed important. Two concepts were created, one focusing on the ecological identity of the site, and the second building on the cultural character. After receiving feedback in the initial conceptual presentation, the concepts were revised and consolidated into the final concept seen on page 12.

The following pages include conceptual plans, discussions of each of the concepts, and images of possible ways to implement the concepts.

PRELIMINARY CONCEPTS
Ecological Concept



The ecological concept seeks to emphasize the natural features of the site as a whole. Using the existing trail system as a base, small sections of new trails are proposed for more legible connectivity. An existing trail through the center of the site will be used as a “green spine” from which smaller trails emanate. Reforestation efforts are focused more towards areas with steep slopes on which development could not take place.

In addition, the majority of amenity spaces are located in the lower half of the site near the convergence of two small tributaries and Hunting Creek. Finally, expansive patches of wildflower plantings are placed below overhead power lines to deter major development from taking place, as well as adding even more aesthetic and ecological diversity to the site.

PRELIMINARY CONCEPTS
Cultural Concept

The cultural concept focuses on the subjects presented by the specific properties. As one moves through the Western Piedmont Campus trails, one will come into contact with interpretive signage focusing on the school's curriculum. Early childhood development can be studied in the existing Nature Play Area, and users will learn about physical therapy as they near the Ropes Course. Additionally, users can learn about basic law enforcement near the shooting range when permitted. As one moves north along Burkemont Avenue, they arrive at the North Carolina School for the Deaf. Here, the campus' system of trails will focus on the history and culture of NCSD. In addition, signage can speak to the idea of 'Universal Design,' or the premise that design should be for all user communities¹ These trails would have a major terminus at the NCSD Museum for further exploration. The third trail system is located on the campus of Broughton Hospital. These trails would feature interpretive signage focusing on the history of the Hospital as well as the scientific innovations that resulted from the mental health period of American history.

The final trail system would be a loop trail that linked each of the three smaller systems. This "loop trail" would be a 10 to 12' width asphalt path that can facilitate a large group of people. In addition, this width allows for triangulation, the means of dialogue between a group of signing deaf users.

Reforestation is focused to increasing the size of riparian buffers as well as highlighting existing viewsheds.

1 www.universaldesign.com

- Key:
- Reforestation Efforts
 - NCSD Trails
 - Broughton Hospital Trails
 - WPCC Trails
 - DeafSpace Trail
 - Possible Second Entrance to WPCC
 - Pedestrian Connections
 - Places of Interest



PRELIMINARY CONCEPTS
Concept Inspiration Images

Trail Conditions:



Native wildflowers with mowed grass trail



Traditional asphalt with bike lanes



Elevated Boardwalk



Compacted dirt for vehicular access

Amenities:



Amphitheater for events or outdoor classroom



Viewpoint Overlook



Picnic Pavilion



Seating

Recreation Along Trail:



Fitness along Trail



Fitness along Trail



Play Areas



Tree House

PRELIMINARY CONCEPTS
Concept Inspiration Images

Sustainable Agriculture:



Farm Stand on campus



Composting for agricultural soil



Composting facilities on campus



Agricultural fields

Public Events:



Farm Stand



Organized Races



Community Tree Planting



Community Garden Beds

Outdoor Learning + Signage:



Tree Identification



Tree Identification



Native Plant Identification



Historic Markers

Part III: Appendices

Morganton, NC: Building a Healthier Community through Open Spaces, Greenways, and Natural Resource Enhancement

APPENDIX Community Stakeholder Feedback

Community Design Assistance Center Stakeholders Meeting and Site Analysis Morganton, NC

3/4/15

10:30am-12pm, Western Piedmont Community College

Present:

Western Piedmont Community College

Dorri Barron	<i>Director, Financial Aid</i>
Bob Benner	<i>Former Instructor and Author</i>
McSofferd	<i>Standing in for David Benner, Coordinator/Instructor, Physical Education</i>
Bill Childers	<i>Instructor, Computer Information Technology</i>
Dr. Michael Helmick	<i>President</i>
Sandy Hoilman	<i>Vice President Administrative Services and Chief Financial Officer</i>
Scott Kerley	<i>Chief Security and Safety Officer</i>
Lee Kiser	<i>Dean of Workforce and Professional Development</i>
Eddie McGimsey	<i>Director, Small Business Center/Entrepreneurship Development</i>
Lisa Miller	<i>Institution Advancement Grants Development and Administration Director</i>
Tim Mull	<i>Maintenance</i>
Lisa Sessions	<i>Director, Human Resources</i>

Broughton Hospital

Peter Cvelich *Project Manager, Development Finance Initiative | School of Government, UNC- Chapel Hill*

City of Morganton

Lee Anderson *Director, Development and Design Services*
Michael Berley *Project Manager, Design and Engineering*

Foothills Conservancy

Andrew Kota *Stewardship Director*

North Carolina School for the Deaf

Audrey M. Garvin *Director*

Other

Bryant Lindsey *Overmountain Victory Trail*
Travis Smith *Burke County Soil and Water Conservation District*

Community Design Assistance Center

Lara Browning *Project Manager*
Amy Eliason *Student Designer*
Carter Gresham *Student Designer*

Notes:

Western Piedmont Community College:

- Currently rough trails exist throughout the site that are well-used by community
- No formal or well-delineated mapping/inventory of these trails
 - Major push for a full, in depth inventory of the existing trails/infrastructure on site
 - Approximately 12 miles of unmapped trails
- Currently have mountain biking trails but would like for them to be more developed (paved).

Morganton, NC: Building a Healthier Community through Open Spaces, Greenways, and Natural Resource Enhancement

APPENDIX Community Stakeholder Feedback

- Want us to identify areas that need improvement (parking, kiosks, security issues, maintenance issues etc.)
- Campus/ site used by entire community, encourage more public use. Currently the community uses the pond/pavilion and walking trails
- Want connections to existing greenway and to downtown
- Interconnectivity within the 'pentagon'
- New building planned within next ~2 years within existing campus 'proper' footprint, won't affect trails system
- Concern with safety with more public access, balance between welcoming public and safety
- Vandalism issues: four-wheeling and skate boarding
- Sledding spots: off of Carr Hall, Grant Hall, and across from Fire Hall, would like to encourage sledding behind the deaf school
- Interested in a state park atmosphere where they have year-round activities and programs
- Wayfinding is important- consider hospitality and park maintenance training
- Entrance to WPCC (Community College Dr.) has no sidewalk for safety
- College Farm:
 - Sustainable Agriculture Program
 - Row crops and hot houses
 - Create farm incubators for students (contact Chip Hope)
 - Community gardens, how to maintain interest
 - Collaboration with local brewery on hops, wheat barley fields?
 - Another farmer's market location or collaboration with existing
 - Expand orchards
 - Farm to table operation?
- Pay attention to East and West Campus Connections
- Create incubators, demonstrations and educational resources for people to learn (Sustainable agriculture, sustainable water management practices, nature play, etc.)
- Concerns about only 1 entry to campus in state of emergency. Currently a single road enters the campus. They currently have a road that exits the back end of the property, but they would like to explore other ways of getting off of campus without dumping everyone out on Burkemont Road. (Propose 2nd entry)
- Burke County is one of the county in the Kate B. Reynolds Charitable Trust's Healthy Places NC Initiative. Could apply for a grant to help fund project implementation.
- They want to be the precedent for how to do it right

Broughton Hospital:

- Currently in initial stages of considering potential opportunities for re-use for the Broughton property
- Looking for anchor institutions and mixed-use development
- They are considering surplus property as well as other public properties
- Their project should be completed by June 30th
- Get information on their new building plans, does it include a master plan for North side of site?

City of Morganton:

- Overmountain Victory Trail
- Connections into the 'pentagon' (Department of Transportation)
- Make sure focus stays on 'building healthier communities'
- Connections to greenway, downtown, hospitality corridor on South Sterling Street off of I-40 (Exit 105), highschool (Anula Road Bridge), and Liberty Middle School
- Tourism for Morganton is huge, can we attract more people with this site enhancement?
- View or sign about trails from I-40?



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Morganton, NC: Building a Healthier Community through Open Spaces, Greenways, and Natural Resource Enhancement

APPENDIX Community Stakeholder Feedback

- *Nature's Playground*

Foothills Conservancy:

- Property has significant natural resources (farmland, recreational, forested, watershed)
- Would love to be a resource to us on conservation, preservation, Hunting Creek, etc.
- Interested in applying for grants for environmental conservation
- Improve and protect the site
- Consider viewsapes, water quality, and sensitive areas

North Carolina School for the Deaf:

- Heavy collaboration and shared resources with WPCC
- Interested in how to align curriculum with WPCC
- Consider STEAM curricula
- Outdoor learning environments
- Residential school
- K-12
- Interested in going year-around in the future
- 5k, 10k on site for fundraising
- Vocational rehabilitation and training for adults and older students
- History of campus and deaf community/ culture
- iPhone app? Visual/ auditory walking tour of NCSD and campus that goes into the history of the property
- Planning to build a retirement center for deaf and blind senior citizens

Other:

- How connect to regional trail systems such as Overmountain Victory Trail and the Mountain to Sea Trail?
- Consider connections to Riddle Center Trail System
- Major Culvert System (Exit 103) is large enough to potentially have a pedestrian crossing under I-40
- Branding based on access to natural lands (South Mountains, Linville Gorge, NPS, Historic Lands associated with the Revolutionary War)
- Integrating farmland, forestry, and recreation

Morganton, NC: Building a Healthier Community through Open Spaces, Greenways, and Natural Resource Enhancement

APPENDIX Community Stakeholder Feedback

Community Design Assistance Center

Preliminary Concept Community Feedback

Presenters: Amy Eliason and Carter Gresham

Facilitator: Lara Browning

Morganton, NC

4/3/15

1:00 pm, 2:00 pm, 7:00 pm, Western Piedmont Community College

Ecological Concept

- Community is interested in proposed reforestation spaces and “no mow zones” such as wildflower meadows
- Desire for paved trails for biking and strollers
- interest in having secondary trails with a different character than primary trail
- Primary trail should be paved, accessible, and have ample lighting for security

Hunting Creek:

- Focus on creating pool riffle sequences and viewsheds
- Create an emotional attachment to the stream for inherent stewardship
- Create safe public access to water
- Views of possible habitats (nesting areas) should be highlighted
- First priority when focusing on reforestation is enlarging the riparian buffer along Hunting Creek

Reforestation:

- Types of species of trees
 - Different types of forest stands preferred
- Possibility for fruit tree stands near sustainable agriculture center
- Wild edibles and native species throughout the site
- Possible weed issues for no mow zones
 - Johnson grass issue presented
- Reforestation along Burkemont must maintain viewshed of NCSD as well as WPCC
 - Understory species presented as a viable option for this section of reforestation
- Are there any tangible effects on hay harvesting on the site as a whole?
 - Mr. Kiser says hay production is not a revenue-generating process
 - We should, however maintain some open green spaces so hay production can still be facilitated in some capacity
- Openness of trail between WPCC and NCSD is a major concern - no “forbidden forest” feel
- Savannah type open feel with scattered tree plantings is preferable
- Native, warm season grasses should be used for their hardiness
 - Small plots of different varieties can be used throughout the site
- Forest service and local nurseries may be used as a resource for plantings
- Morganton Forestry Center is also a resource to be contacted



Morganton, NC: Building a Healthier Community through Open Spaces, Greenways, and Natural Resource Enhancement

APPENDIX Community Stakeholder Feedback

- Ecological learning should be the main focus for WPCC trails - possibility for a push for the Tree Campus USA designation
 - Demonstration spaces
 - Campus leaders want to set the precedent with a new Green Campus
- Natural slope in front of WPCC campus has been proposed in the past as a possible amphitheater
- Wetland and Bioretention areas within the campus may be used as educational opportunities
- Along stream buffer - show/teach guests about plant species within the riparian buffer
- What happens to existing infrastructure within newly delineated easements? - Needs to be discussed at length in the final proposal

Cultural Concept

- History of the sites can be tied into humanities curriculum
- Basic Law Enforcement Training can be incorporated into the interpretive trails
- Early childhood development, outdoor play proposed as another opportunity for learning
 - work, play, create
 - forts, pathways, tree cookies as possible play spaces
 - tie into existing system of nature play area
- Closer knowledge and understanding of culture and history for younger population should be a major goal
 - Give them ownership of their space - give them pride in their Hometown

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Amenity Spaces

- Trail loop with adjacent fitness stations used to exist on the site
 - P.E. classes used them heavily
 - These clusters could be dispersed throughout one of the trail systems
 - Passive fitness elements - low impact
 - Stations should be catered to different age groups
 - Slopes/incline
 - Steps
 - Balance Beam
- Possibility for amenity areas in close proximity to Historic Broughton Farm and Avery Hall
- Areas for Restrooms - hot button issue throughout all meetings
 - Standard for Catawba Greenway is one restroom every one mile
 - Major target for vandalism and inappropriate uses over time
 - Do we actually need one at this point in time
 - Community member proposes that any new developers on the old Broughton Hospital site should agree to construct a restroom facility as a part of their lease
- Possibility for Food Trucks?
- Pet walking trails proposed - would a dog park be advantageous

APPENDIX
Community Stakeholder Feedback

Overall Comments

- We need to create a *unique* experience that is set apart from other offerings in the area
- Better connections to Broughton Hospital are needed
- Possibly rehabilitation training near Broughton - "Workforce West?"
- Advertised parking areas and restrooms throughout the site and throughout Morganton
 - Signage
 - Safe and secure zones throughout
- Parking lot 1 + 2 and tennis courts as a viable area for a major trailhead
 - Connections to nature trail and pond area already exist
- Firing range used mainly in Fall and Spring
 - Need to keep parking areas away from these restricted areas
 - Possibility of creating a clear schedule and opening adjacent trails on days the range is not in use
- Security
 - Pond and tennis court parking is currently perfectly visible from Police Station on Burkemont
 - Need to keep visitor parking concentrated to that area for safety purposes
 - Designated parking for R.V.'s desired
 - Students already have a five dollar parking fee - how do we mediate the issue of users on the site who pay nothing to park?
 - Possible system of Blue Lights to possibly be implemented
- Transportation from both sides of campus proposed by WPCC stakeholders
 - Small shuttle for students around campus?
- This whole effort must be a Public/Private partnership at its core
- NCSD may be more restrictive in the future due to safety concerns involving their students
 - May lead to limited trail access, gates? Final proposal should address this
- Design for adaptability over time
- Focus on reforestation as a means of emphasizing and solidifying viewsheds
- Government Drive to Enola may be the best bet for a second connection to WPCC
 - Safety is key here
 - Exit only? Automatic, key activated gate?
 - Seems to be the community consensus to place the second entrance here
- Crushed brick trail for change in texture proposed - could help with trail character differentiation
- Mountain biking trails should be clearly delineated - seems to be a desire for at least one biking trail
- Possibility of a state rest area just off I-40? - More than likely falls under NCDOT jurisdiction

**APPENDIX
Hunting Creek Watershed Plan**

Executive Summary

Hunting Creek is listed on North Carolina's 303(d) list of impaired streams due to compromised ecological and biological integrity (NCDWQ 2007). Fish community samples conducted by the North Carolina Division of Water Quality (NCDWQ) in Hunting Creek found an absence of pollution intolerant fish and a high percentage of diseased fish leading to a bioclassification of 'Fair' (NCDWQ, unpublished data). In addition, NCDWQ also noted the presence of easily erodable, vertical stream banks, a sandy substrate, and the absence of true rock riffles in Hunting Creek (NCDWQ 2003).

The primary goal of this plan is to improve water quality in the Hunting Creek Watershed so that its fish communities will improve and Hunting Creek can support its designated use of maintaining biological integrity once again. In doing so, it will be removed from the state's 303(d) list of impaired waters. Additional goals of the Hunting Creek Watershed include:

- Develop additional partnerships to facilitate better land stewardship among the state, county, city, and private citizens.
- Engage the community in water quality awareness and education.
- Complement the Mission 2030 Plan (City of Morganton 2010), a comprehensive land use plan developed by the City of Morganton in 2009.
- Stimulate economic opportunities in the community and create jobs as management measures are implemented

The Hunting Creek Watershed is a 25.5 square mile urban watershed located in central Burke County and drains eastern Morganton. It is part of the Upper Catawba River Basin that originates in the South Mountains and flows north into the Catawba River upstream of Lake Rhodhiss. Interstate 40 and US Highway 70 traverse the watershed in an east-west direction. Thirty-seven percent of the Hunting Creek Watershed is developed with including residential, commercial, institutional, and industrial land uses. Forested land covers 49% of the watershed and primarily occurs in the southeastern portion of the watershed, but also occurs sporadically in the northern areas of the watershed.

Although no watershed plan exists specifically for the Hunting Creek Watershed, there are several plans and programs that have been adopted in the City of Morganton, Burke County, and the Upper Catawba River Basin. These plans and programs are important tools in directing growth, managing impervious land cover, and protecting natural resources. Further integration of advances in best management practices and low impact development would take these programs to a higher level of preventing further degradation of water quality.

To address the impairment of Hunting Creek and develop a plan of action to improve stream conditions in within the watershed, a group of stakeholders representing local governments, state agencies, institutions, and interested citizens was assembled. This group, called the Hunting Creek Partners, met on eight separate occasions to provide input to the watershed assessment and restoration plan.

APPENDIX

Hunting Creek Watershed Plan

A watershed assessment was conducted by Equinox Environmental Consultation & Design, Inc. (Equinox) in 2009 to begin to understand the causes of Hunting Creek's impairment. The results of that assessment are as follows:

- *Fish Community* - Overall, the species richness and composition were below normal at all sites in the Hunting Creek Watershed and are likely associated with degraded habitat.
- *Benthic Macro Invertebrate Community* - The benthic macro invertebrate communities found in Hunting Creek indicate that poor habitat is certainly a concern in the watershed as are nutrients and possibly toxic substances.
- *Water Chemistry* - Nitrogen concentrations are consistently high at all sample sites and appear to be higher in areas that drain agricultural land and low density development rather than areas with denser development.
- *Fecal Coliform Bacteria* - All sites sampled contain fecal coliform bacteria levels well over the level considered safe by the State standard.
- *Windshield Survey* - All stream channels appear to exhibit some degree of stream bank erosion and in-stream sedimentation. Sand or silt substrate dominated the majority of sites, which filled and covered aquatic habitat including riffles, pools, and other features.
- *Habitat Assessment* - Aquatic habitat assessments reflect habitat conditions that are not conducive to supporting a robust fish community.
- *Erosion Sites* - Eroding stream banks are a significant source of sediment input to streams resulting in sedimentation of riffles, pools, and other aquatic habitat features.
- *Impacted Riparian Areas* - Riparian areas were often found to be degraded due to lack of woody vegetation and soil disturbances.
- *Utility Crossings* - Over 80 miles of sewer lines exist in the Hunting Creek Watershed with a large portion of them paralleling Hunting Creek.

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Data collected indicate that aquatic habitat is degraded throughout the watershed and that it is likely a combination of factors leading to stream impairment. Land cover alteration from forest to development over time has led to an increase in impervious surfaces. An increase in impervious surfaces such as roads, parking lots, and roof tops contributes to an increase in stormwater runoff. Stormwater runoff flowing off impervious surfaces carries pollutants as well as builds volume and velocity as it enters adjacent streams. The increased volume and velocity leads to stream bank erosion as the stream attempts to handle the increase in water levels. Sediment originating from eroding stream banks is causing increased sedimentation in streams. Pools and riffles have become dominated by fine sediments and lack interstitial spaces, large woody debris, and organic matter where aquatic organisms live and feed. As a result, the aquatic organism habitat has become degraded and the fish community impaired.

In addition to these impacts, agricultural and residential land management practices in the watershed are compounding matters. Agricultural practices in the watershed often include pasture or cropland directly adjacent to the stream bank resulting in a lack of woody riparian vegetation. Furthermore residential and institutional landscaping practices include mowing stream banks, which also reduce the effectiveness of riparian vegetation to filter pollutants and hold stream bank soil in place.

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Hunting Creek Watershed Plan

Implementing on-the-ground management measures and practices targeted towards remediating these impacts are necessary if conditions in Hunting Creek are to improve. The Hunting Creek Watershed Plan recommends four main management measures:

- *Stormwater Best Management Practices (BMPs)* – Stormwater BMPs offset the impacts of impervious cover and filter pollutants from stormwater runoff. The on-site detention and infiltration of runoff protects adjacent streams from increased water volumes and velocities leading to stream bank erosion by slowly releasing stormwater to match pre-development hydrology.
- *Stream Channel Restoration and Riparian Area Enhancement* - Stream restoration techniques that reestablish the proper dimension, pattern, and profile to the stream channel will result in reduced stream bank erosion, improved sediment transport, and better in-stream habitat conditions. Revegetation of the riparian area adjacent to the restored stream channel with native shrubs, trees, and herbaceous plants will reestablish a riparian area's ability to filter sediment and other pollutants originating from upland areas.
- *Protect Intact Forests* - To address future impacts to areas in the watershed with functioning stream channels and intact riparian areas, protecting undeveloped, private, forested lands will ensure the long-term health of the watershed.
- *Local Government Programs and Practices* – Programs and practices such as catch basin clean out, storm drain stenciling, low impact development, and land stewardship go above and beyond physical improvements. These practices often involve improving programs already underway and set a positive example of good stewardship that the public can learn from and follow.

Each management measure contains an outreach and education component as well as an implementation strategy consisting of specific actions, an implementation schedule that includes a timeline over which the actions are expected to be achieved, and a success indicator that tracks progress and monitors the effectiveness of the management measures.

In addition to management measures, the plan includes a watershed monitoring component and discusses the need for additional watershed assessments. Additional assessments are needed to address data gaps that still exist, particularly for water quality related issues. Routine monitoring of water quality parameters will determine whether or not implementation of management measures is resulting in reduced pollutant levels. General fish community monitoring will provide an overall indication of whether or not the ecological health of Hunting Creek is improving.

Completion of management measures over time will contribute to improving watershed conditions. It should be noted that lag times between implementation and response at a watershed level often occur and that fish communities may or may not improve greatly once restoration efforts are implemented. Based on the results of restoration efforts, it may be necessary to modify management actions during the planning period. At the end of the 10-year life span of this document, the plan will need to be re-evaluated and updated.

The Hunting Creek Watershed Plan is organized into five Sections. Section 1 introduces Hunting Creek's impairment and discusses why citizens living in the watershed should be

**APPENDIX
Hunting Creek Watershed Plan**

concerned. It also introduces the Hunting Creek Partners and the process that took place in developing the Hunting Creek Watershed Plan. Section 2 characterizes the Hunting Creek Watershed with a description of its geographic location, population, and land use. It goes on to highlight existing plans in the City of Morganton, Burke County, and the Upper Catawba River Basin. Existing watershed conditions are described in Section 3. These conditions are based upon findings from the watershed assessment and include a synopsis of causes and sources of stressors. Section 4 states the watershed plan goals and describes in detail recommended management measures. This section also discusses the types of additional watershed assessments that should be undertaken to gather more information about stressors as well as a monitoring component that is intended to track improvements over time. The strategy for implementing management measures is discussed in Section 5. A plan for completing these actions is offered in a series of tables. Partners can utilize these tables to track progress over time.

The process of restoring Hunting Creek will take many years and will require broad, collaborative partnerships across multiple agencies, organizations, and jurisdictions. The Hunting Creek Watershed Plan is intended to guide planning and restoration efforts in the Hunting Creek Watershed for the next 10 years. It serves as a road map to restoring the ecological health and function of streams in the watershed so that fish communities will improve and Hunting Creek can support its designated use of maintaining biological integrity once again.

**Entire document can be found at
<http://www.ci.morganton.nc.us/index.php/component/jdownloads/send/13-educational-information/160-hunting-creek-watershed-plan>**

APPENDIX
Conservation Easements and the Foothills Conservancy

Foothills Conservancy of North Carolina, Inc. is a Morganton-based, non-profit, nationally-accredited land trust that works cooperatively with landowners and community partners to permanently preserve and protect important natural areas, watersheds, forests, and farmlands in eight Blue Ridge Mountain and foothills counties and in the upper basins of the Broad, Catawba and Yadkin rivers. Since 1995, it has protected more than 49,000 acres, expanding state parks at South Mountains, Chimney Rock and Lake James; state game lands at the Linville Gorge, Johns River, National Wild & Scenic Wilson Creek and the South Mountains; Pisgah National Forest and the Blue Ridge Parkway. The land trust has helped landowners protect thousands of acres of private farm and forest lands with permanent conservation agreements and maintains four conservancy-owned preserves.

Foothills Conservancy staff partnered with Western Piedmont Community College to develop the “Building a Healthier Community through Open Spaces, Greenways, and Natural Resource Enhancement” project concept and submit the grant application to the NC Forest Service that resulted in the planning project completed by the Community Design Assistance Center. The land trust is highly motivated to continue the partnership with WPCC to explore formal conservation options for the college’s campus. A property evaluation revealed that a conservation agreement would be the most likely tool to utilize to achieve natural resource conservation. A conservation agreement establishes land use restrictions on property for the goal of protecting, improving, and enhancing resource values such as water quality, wildlife habitat, biodiversity, recreation, education, agricultural soils protection, and many others. The recommendations for open space use in this plan are compatible with the typical provisions of a conservation agreement.

In some cases, landowners are paid for the development rights forfeited when a conservation agreement is implemented. Foothills Conservancy has raised millions of dollars from federal, state, and private conservation funding programs to purchase conservation agreements on private property throughout the land trust’s service area. Please contact Foothills Conservancy for more information about these programs and the process the organization follows to execute conservation agreements.

Learn more about Foothills Conservancy and how you can help support its efforts at www.foothillsconservancy.org or by calling 828-437-9930.

Following is information about Voluntary Conservation Agreements, which can help landowners preserve their undeveloped property.

**Morganton, NC: Building a Healthier Community through
Open Spaces, Greenways, and Natural Resource Enhancement**

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Conservation Easements and the Foothills Conservancy
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Produced by: Conservation Trust for North Carolina on behalf of

North Carolina LAND TRUSTS

Saving the Places You Love

with funding from WalMart



4th Edition – 2010 by the Conservation Trust for North Carolina
and N.C. Coastal Land Trust

4th Edition Credits:

Text: Camilla Herlevich and Edward Norvell

Editing and project management: Reid Wilson, Margaret Lillard and Margaret Newbold

Design: Nicole Leech; inside pages original design by Ashley Warriner

Printing: Harperprints

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Saving the Places You Love



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A **conservation agreement** is an effective means of protecting land in North Carolina. Conservation agreements (also called conservation easements) have been used to protect lands as varied as mountain ridgetops, Piedmont river corridors, farms, working forests and coastal marshes.

Conservation agreements enable landowners to preserve their land and maintain ownership of it while potentially realizing significant economic benefits. Landowners may sell a conservation agreement if funds are available, or they may receive tax savings for donating a conservation agreement.

This brochure is designed to answer the basic questions that a landowner might have about conservation agreements. It is not intended to provide legal advice. As with any real estate transaction, landowners should consult their personal legal, financial and tax advisors before finalizing a conservation agreement.

Contact your local land trust to discuss conservation options that may be available for your property. North Carolina's local land trusts are listed on the last page of this booklet, and further information about them and the counties they serve is available at www.ctnc.org/lmap.



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Conservation Easements and the Foothills Conservancy
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What is a conservation agreement?

A conservation agreement (or conservation easement) is a written agreement between a landowner and a qualified conservation organization or public agency, in which:

- the landowner (also called grantor or donor) promises to keep his or her land in its natural condition without extensive disturbance, and
- the conservation organization or public agency (also called grantee) has the right to monitor the property and enforce the terms of the agreement.

A conservation agreement is similar to restrictive covenants in a subdivision in that it restricts various uses of land. Each conservation agreement is voluntary and tailored to meet the needs of the landowner while protecting the property's natural assets.

There are different types of conservation agreements, and they go by different names. For example, a conservation agreement may also be referred to as a deed of conservation easement, a grant of development rights, a historic preservation agreement, a farmland agreement, a facade easement, a working forest easement, a water quality easement or an agricultural easement.

Conservation agreements are intended to preserve undeveloped property, and provide a benefit to the public by conserving open lands, forests, wildlife habitat, scenic vistas, farmland, stream banks and other significant natural resources.

Because of this public benefit, landowners who donate conservation agreements are eligible for significant federal, state and local tax incentives. In addition, grant programs exist to purchase conservation agreements from landowners who have eligible property but may not be in a position to donate an easement.

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**When is a conservation agreement the right method for land
protection?**

To begin with, the land itself must contain significant natural resources such as forestland, wildlife habitat, stream buffers or farmland, or provide scenic enjoyment from public locations so that the public will benefit from its protection.

Conservation agreements work best when:

- the landowner is motivated by the desire to conserve and preserve the land,
- the land is not heavily developed or subdivided,
- the land does not require intensive management, and
- current and future uses of the land are compatible with preservation of its natural features.

A conservation agreement is not generally a good tool for landowners who want to maximize their financial return from their land. However, if a landowner is interested in receiving either **tax benefits** (such as a federal income tax deduction, state income tax credit or a reduction in estate taxes) or a **cash payment that is less than the value of the property if it were to be developed**, then a conservation agreement may be a good option to consider.

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How long does a conservation agreement last?

Under North Carolina law, a conservation agreement may be created for a period of years or it may be permanent. A landowner who wants to claim federal and state income tax benefits must agree to a permanent easement. In addition, most grant programs that provide funds for the purchase of conservation agreements require that the agreements last forever.

What restrictions are contained in a conservation agreement?

A conservation agreement's restrictions are tailored to the particular conservation values of the land and interests of the landowner and grantee. Some activities that may be prohibited or restricted include industrial use or commercial development, mineral development or exploration, subdivision, residential use, access for road or power line construction, and extensive timbering.

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What current and future uses do conservation agreements allow?

Depending on the size and character of the land, conservation agreements may allow limited subdivision of the land, timbering and forest management, agricultural use, wildlife management, hunting and fishing, or even the construction and maintenance of a limited number of buildings or homes.

Can I put some land into the conservation agreement and leave some land out?

Sometimes it may be appropriate to make only part of a tract subject to a conservation agreement and reserve a portion for other uses. Some landowners may use different types of conservation agreements for different areas of their property. For example, a landowner might use an agricultural agreement on upland farm fields and a more restrictive conservation agreement on adjoining riverbank lands.



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Who is responsible for maintaining the property?

The landowner retains ownership along with the right and duty to manage and care for the property. In cases where the conservation organization has experience in managing a property's particular natural assets (for example, rare species habitat), it may be appropriate for the organization to be given the right or opportunity to undertake certain land management tasks.

Will a conservation agreement reduce the property taxes on my land?

Maybe. North Carolina requires county tax assessors to consider the reduction in property value caused by the granting of any conservation agreement. The land owner should apply to the local tax assessor for a change in the ad valorem tax value of land after a conservation agreement is granted, and may find that the tax bill is lowered as a result. However, if the land is already in a "special use" program, such as forestry use or farm use, there may be little, if any, additional property tax savings as a result of the conservation agreement.

What organizations may accept conservation agreements?

Conservation agreements may be granted to nonprofit tax-exempt conservation organizations such as a land trust or conservancy, or to public agencies such as the State of North Carolina, counties and towns.

Will my land be accepted under a conservation agreement program?

It depends. Factors that must be considered include your land's natural assets, the capacity of conservation organizations that serve your area, and the availability of funding. If you wish to sell a conservation agreement, be aware that programs that fund these purchases follow specific criteria, are highly competitive and may have limited assets depending on the current economic climate and other conservation projects being considered.

Several state and federal programs have funds available for the purchase of conservation agreements. They include the North Carolina Clean Water Management Trust Fund, NC Natural Heritage Trust Fund, NC Agricultural Development and Farmland Preservation Trust Fund, NC Parks and Recreation Trust Fund, federal Forest Legacy Program, and federal Farm and Ranchland Protection Program.

The best way to find out whether your land has conservation value is to contact your local land trust. A representative will talk with you about your property and may arrange for a site visit. North Carolina's local land trusts are listed in the back of this document and at www.ctnc.org/lmap.

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What rights and obligations does a conservation agreement create in the grantee/conservation organization?

The grantee/conservation organization is required to monitor and enforce the terms of the conservation agreement. Thus, the agreement must allow the organization access to the property at least annually. The parties may also agree to allow the organization access for scientific research and occasional field trips.

If the landowner reserves rights, such as the right to timber or to subdivide, the grantee may be required to review and approve the exercise of such rights.

The grantee must maintain sufficient assets to finance its monitoring and enforcement obligations into the future. Therefore, organizations that agree to hold conservation agreements must have a stewardship fund or endowment for this purpose, and will usually raise money to add to this fund whenever a new conservation agreement is signed. The grantor and others interested in the project are generally asked to contribute.

Is the conservation agreement a private or public document?

A conservation agreement is a public document like any other land deed, easement or similar legal document, and must be recorded in the Registry of Deeds in the county where the land is located.

Grantee organizations may publicize the gift depending on the preference of the landowner. For example, a corporation may welcome the goodwill generated by protecting natural areas, while a family may prefer relative anonymity.

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Will the public have access to land under a conservation agreement?

A conservation agreement does not generally require or allow entry by the public. There are two exceptions:

- a) If the conservation values of the property include its scenic character, then the public must be able to *see* the land; and
- b) If the conservation values of the property include public recreation, such as a hiking trail, then the public must have *physical access* to the land.

Since most conservation agreements protect lands that have much broader conservation values (for example, significant natural systems, wildlife or plant habitat, or forestland and farmland), they do not include public access to the land.

Can the land be sold, mortgaged or bequeathed after a conservation agreement is granted?

Yes, landowners may sell, mortgage or otherwise convey a property with a conservation agreement.

However, the land will remain subject to the conservation agreement. For example:

- The value of the land as security will be its value as restricted by the agreement, not its potential value for all unrestricted purposes and uses;
- The property may be subdivided only as permitted by the agreement;
- Any rights reserved by the grantor will be passed to any heir or purchaser.

If there is a pre-existing deed of trust on the land, it must be subordinated to the conservation agreement before the agreement is granted.



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Can a conservation agreement be amended or revoked?

Because conservation agreements are designed to be permanent, amendment or revocation is difficult. Revocation is usually accomplished only through a court proceeding and depends upon demonstrating that the original conservation purposes of the agreement can no longer be sustained due to a change in circumstances (for example, significant changes in the use of surrounding land).

If the conservation agreement is extinguished, the interest in the land (or the proceeds from any sale) is allocated between grantee and grantor, respectively, in proportion to the value of the conservation agreement and the value of the land.



In unusual circumstances an easement can be amended, but only with the agreement of both parties. This is usually done to clarify an ambiguity in the easement. Amendments will not be allowed if they diminish protection measures for the conservation values protected by the conservation agreement or somehow enrich the landowner without properly compensating the grantee.

What are the pros and cons of selling a conservation agreement?

The primary advantage of selling a conservation agreement is the actual net cash received. If a grant award funds the purchase, it may also pay for any stewardship endowment needed. However, funds for purchases of conservation agreements are scarce and the grant process is very competitive. Therefore, grants frequently do not cover the entire value of the conservation agreement being sold. If the landowner is willing to sell the conservation agreement for less than its value (a "bargain sale"), then the landowner may claim a federal tax deduction and state tax credit for the difference between the sale price and the appraised value of the conservation agreement. Like any other sale of property, any sales proceeds are subject to capital gains taxes.

The disadvantage of selling a conservation agreement derives from the fact that purchase funds typically come from government grants. This requires the land trust to go through an application process to receive the grant, and requires government agency review of appraisals, survey, title and all other documentation. Purchase of a conservation agreement can take years to complete. Some government grants require that the government agency, rather than the land trust, be the grantee of the conservation agreement.

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What are the pros and cons of *donating* a conservation agreement?

Apart from protecting sensitive natural resources, the primary advantages of donating a conservation agreement are tax benefits that the landowner may claim (see flyer insert for current information on the North Carolina Conservation Tax Credit and federal tax deductions for donated easements). A conservation agreement may be donated within a matter of months, while a sale may take longer to finalize. The majority of conservation agreements are donated rather than sold.

Regardless of whether the conservation agreement is sold or donated, land trusts must secure adequate funds for a stewardship endowment to finance future monitoring of the conservation agreement. The land trust will explain this cost and may seek a gift in this amount from the landowner as part of the transaction.

**Will I receive
tax benefits
for donating a
conservation
agreement?**

A landowner who donates a conservation agreement may be able to claim the donation as a charitable contribution. To qualify as a charitable contribution for

federal tax purposes, a conservation agreement must be permanent, it must be made to a qualified grantee (generally a nonprofit organization or a public agency), and it must meet one or more of the following conservation purposes:

- protection of relatively natural habitat of fish, wildlife or plants;
- preservation of open space including farm and forestland;
- preservation of land for public outdoor recreation or education;
- preservation of historically important land or buildings;
- protection of scenic views.



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What are the tax advantages from donating a conservation agreement?

The donor of a qualifying conservation agreement may claim the value of the conservation agreement as a deduction for income, gift and estate tax purposes.

Tax laws are occasionally revised, so please refer to the insert in the center of this booklet for details of current federal and North Carolina tax benefits.

How is the value of a conservation agreement determined?

To determine a conservation agreement's value, a licensed appraiser uses a "before and after test" in which the value of the property as restricted by the conservation agreement is subtracted from the value of the property before the restrictions were granted. The difference between the two calculations is the value of the conservation agreement.

The presence of a conservation property provides a benefit to adjacent land, resulting in added value for the neighboring parcels. If granting a conservation agreement has this effect on any other property owned by the donor or donor's family, the appraiser must reduce the value of the donated conservation agreement by the amount of the benefit to the other property.

Whenever possible, a professional appraiser familiar with both the local real estate market and conservation agreements should undertake the appraisal.

- If a conservation agreement is *donated*, it is the landowner's responsibility to provide an appraisal to the IRS, the state and the land trust. There are substantial penalties imposed on both the donor and the appraiser for fraudulent overvaluation used in claiming a charitable contribution. The donor, appraiser and the grantee of the conservation agreement must all review and sign IRS tax form 8283 in order for the donor to claim a federal income tax deduction.
- If a conservation agreement is *purchased for its appraised value*, then the grantee of the agreement must secure an appraisal that substantiates the purchase price.
- If a conservation agreement is *purchased for less than its appraised value* (a "bargain sale") and the landowner seeks tax benefits for the difference between the sale price and the value, then the landowner must provide an appraisal to the IRS, the state and the land trust.

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What is required to complete and convey a conservation agreement?

For a landowner to donate a conservation agreement that qualifies for a federal tax deduction and/or state tax credit, the following documents must be prepared:

- Conservation agreement (drafted by either the grantee's or the grantor's attorney and agreed upon by all parties)
- Baseline documentation report of the property (prepared by land trust staff, a biologist, planner or other consultant; see below)
- Qualified independent appraisal
- Title work (prepared by an attorney)
- Survey and legal description (prepared by a surveyor)
- Subordination of any deeds of trust and mineral rights
- IRS Form 8283 (to be attached to the federal tax return of all individuals claiming charitable contributions more than \$5,000, prepared by the grantor or his accountant, and signed by the grantor, grantee and appraiser)
- Environmental assessment of the property for hazardous materials, also known as a "Phase I Report"
- Owner's affidavits and certifications

If a landowner is selling a conservation agreement, all documents are subject to review by the funding source(s) and the agreement's grantee.

In either case (sale or donation), an inventory of the property called a "baseline documentation report" is required to document the condition of the property, any improvements and its conservation values at the time the transaction is completed. This report includes maps, photographs of existing improvements such as buildings and roads, and a description of natural habitats. The report identifies areas where reserved rights (such as timbering or future home sites) are permitted and more ecologically sensitive areas where such uses might not be allowed as determined in the conservation agreement.

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Conservation Easements and the Foothills Conservancy
Voluntary Conservation Agreements

North Carolina's Land Trusts

For additional information about conservation agreements, please contact:

Land Trust Alliance

Southeast Program

P.O. Box 33355

Raleigh, NC 27636

(T) 919.515.0760

(F) 919.515.0767

southeast@lta.org

www.landtrustalliance.org/community/southeast

Conservation Trust for North Carolina

1028 Washington St.

Raleigh, NC 27605

(T) 919-828-4199

(F) 919-828-4508

info@ctnc.org

www.ctnc.org

One of North Carolina's local land trusts:

Black Family Land Trust	919-682-5969	www.bflt.org
Blue Ridge Conservancy	828-264-2511	www.blueridgeconservancy.org
Carolina Mountain Land Conservancy	828-697-5777	www.carolinamountain.org
Catawba Lands Conservancy	704-342-3330	www.catawbalands.org
Davidson Lands Conservancy	704-892-1910	www.davidsonlands.org
Eno River Association	919-620-9099	www.enoriver.org
Foothills Conservancy of North Carolina	828-437-9930	www.foothillsconservancy.org
Highlands-Cashiers Land Trust	828-526-1111	www.hicashlt.org
Land Trust for the Little Tennessee	828-524-2711	www.ltltr.org
LandTrust for Central North Carolina	704-747-0302	www.landtrustcnc.org
Lumber River Conservancy	910-522-5751	
National Committee for the New River	336-982-6267	www.ncnr.org
North Carolina Coastal Land Trust	910-790-4524	www.coastallandtrust.org
North Carolina Rail-Trails	919-542-0022	www.ncrailtrails.org
Northeast New Hanover Conservancy	910-686-1554	
Pacolet Area Conservancy	828-859-5060	www.pacolet.org
Piedmont Land Conservancy	336-691-0088	www.piedmontland.org
Sandhills Area Land Trust	910-695-4323	www.sandhillslandtrust.org
Smith Island Land Trust	910-457-0089	www.bhic.org
<i>A subsidiary of Bald Head Island Conservancy</i>		
Southern Appalachian Highlands Conservancy	828-253-0095	www.appalachian.org
Tar River Land Conservancy	919-496-5902	www.tarriver.org
Triangle Greenways Council	919-828-8322	www.trianglegreenways.org
Triangle Land Conservancy	919-833-3662	www.triangleland.org



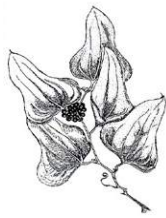
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Riparian Buffers**

Guidelines for Riparian Buffer Restoration

Department of Environment and Natural Resources
Division of Water Quality
Wetlands Restoration Program
Raleigh, NC
January 2001



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Purpose of these Guidelines

Riparian buffers have been identified as a valuable tool for protection of water quality when properly designed and established in the appropriate landscape setting. For this reason, the goal of the North Carolina Wetlands Restoration Program (NCWRP) is to implement projects to restore riparian buffers that have the greatest value for reducing pollutants in our surface waters as well as provide important aquatic and wildlife habitat. The purpose of these guidelines is to provide the technical information necessary for the successful planning and establishment of riparian buffers. The guidelines are intended for use by private consultants in developing restoration plans for the NCWRP but should also have utility for private landowners as well as local governments involved in the restoration of riparian buffers.

**Entire document can be found at
<http://www.nceep.net/images/buffers.pdf>**

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Riparian Buffers



Criteria for Priority Riparian Buffer Restoration Projects

A number of factors determine the success of particular riparian buffer restoration projects. In addition to the physical characteristics of the site, issues such as land costs, land ownership, and logistical constraints must be taken into consideration. The following physical characteristics are intended to provide general guidance when identifying sites and are not intended to exclude sites that may have merit based on other criteria.

- Woody vegetation absent or sparse (less than 100 stems per acre that are ≥ 5 inches diameter at breast height) measured within 50 feet of intermittent and perennial streams, lakes, ponds, and shorelines.
- Adjacent to headwater streams or those streams defined as first, second, or third order.
- Project length greater than 1,000 feet (for projects implemented by the NCWRP).
- Ditches, gullies, or evidence of concentrated flow within 50 feet of intermittent and perennial streams, lakes, ponds, and estuaries.
- Adjacent source of nitrogen including cropland, pasture, golf course, residential development, ball fields, etc.
- Water table depth within three to four feet of surface as determined by characteristics of soil cores.



Components of a Riparian Buffer Restoration/Enhancement Plan

Site Assessment

The riparian area to be restored should be evaluated with respect to these factors that control the viability of riparian plants:

- Soil moisture
- Soil pH
- Soil texture
- Seasonal high water table depth
- Flooding potential
- Aspect, topography, and microtopographic relief

Site Preparation

The restoration/enhancement plan should address these items regarding preparation of the site for planting:

- Plow or rip site to improve compacted soil and/or eliminate areas where channelized flow has developed.
- Control of sod-forming grasses such as fescue and Kentucky bluegrass that will compete with plantings for nutrients.
- Control of invasive, exotic plants that would hinder the re-establishment of woody vegetation. Proposals for pesticide use should always be reviewed by the North Carolina Division of Water Quality staff to insure compliance with the Neuse and Tar-Pamlico Riparian Buffer Rules.



APPENDIX

Riparian Buffers

Common Invasive Exotic Plants
in North Carolina

Ailanthus altissima (Tree-of-Heaven)

Albizia julibrissin (Mimosa)

Elaeagnus umbellata (Autumn
Olive)

Hedera helix (English Ivy)

Lespedeza cuneata (Korean or
Sericea Lespedeza)

Ligustrum sinense (Chinese Privet)

Lonisera japonica (Japanese
Honeysuckle)

Microstegium vimineum (Japanese
Grass)

Paulownia tomentosa (Princess
Tree)

Pueraria lobata (Kudzu)

Rosa multiflora (Multiflora Rose)

Wisteria sinensis (Chinese Wisteria)

- Stabilize areas of bare soil. Refer to the following list for species of grasses/sedge appropriate for soil stabilization. The majority of these species are by necessity not native to North Carolina. At present, there are only a few species of native grasses useful for erosion control that are commercially available. Please note that fescue grasses should not be used for soil stabilization. Fescue grasses, particularly tall fescue, are competitive and will inhibit the eventual re-establishment of native species.

Agrostis alba (Redtop)

Found in fields, pastures, roadsides, and other disturbed places throughout North Carolina, this native warm season grass should be

used sparingly for erosion control and soil stabilization.

Carex stricta (Sedge)

This sedge occurs naturally in marshes and low meadows throughout the mountains and northern piedmont and coastal plain of North Carolina. This species has utility in a mix for soil stabilization in moist areas.

Dactylis glomerata (Orchardgrass)

This perennial, cool season bunchgrass is a good alternative to fescue because it is less competitive and allows native herbs to colonize the site.

Hordeum spp. (Barley)

A number of species of barley can be used for soil stabilization. Barley is a cool season, annual grass that when moisture is available will germinate in the fall, stay green during the winter, and then die in the spring as competition for warm season plants increases.

Panicum clandestinum (Deer
Tongue)

This native, perennial, warm season bunchgrass can be used in moist low woods primarily in the piedmont and mountains.

Panicum spp. (Panic Grasses)

A number of species of panic grasses can be used for soil stabilization

APPENDIX

Riparian Buffers

depending on the moisture regime and soils of the site.

Panicum virgatum (Switchgrass)

This native, perennial, warm season bunchgrass can tolerate a wide range of moisture regimes. It can be used along streams, in wet or dry woods, brackish and freshwater marshes, sloughs, swales, and low pinelands primarily in the eastern piedmont and coastal plain.

Pennisetum glaucum (Brown Top or Pearl Millet)

This fast-growing, robust, annual grass exhibits good drought tolerance which makes this species an important warm season option for soil stabilization.

Phalaris arundinacea (Reed Canarygrass)

A native to North Carolina, this perennial cool season grass is used for the stabilization of pond shorelines, drainage ditches, and streambanks in the mountains and western piedmont. It is established by planting freshly cut stem slips or rhizome fragments. Please note that this species is aggressive and forms large monotypic stands that displace other species. It should only be used if no other species are available.

Secale cereale (Winter Rye or Rye Grain)

Winter rye is a cold-hardy annual grass that will germinate and grow at low temperatures. By maturing early, it offers less competition

during the late spring, a critical time in the establishment of perennial species. Winter rye germinates quickly and is tolerant of poor soils.

Sorghum bicolor (Sudangrass)

Only the small-stemmed varieties of this annual warm season grass should be used. Sudangrass is useful for temporary seeding, and it is adapted to soils relatively high in clay content. Seed for common Sudangrass is not always available, but other small-stemmed types may be used, such as the hybrid Trudan. The coarse-stemmed Sorghum-Sudangrass hybrids are not appropriate for erosion control.

Suppliers of Grass Seed*

Ernst Conservation Seeds
9006 Mercer Pike
Meadville, PA 16335
814-336-2404
800-873-3321

Lofts Seed Company, Inc.
P.O. Box 26223
Winston-Salem, NC 27114-6223
800-543-7333

Mellow Marsh Farm
205 Anolis Road
Pittsboro, NC 27312
919-542-3532

Southern Tier Consulting, Inc.
2701-A Route 305
P.O. Box 30
West Clarksville, NY 14786
800-848-7614

*North Carolina suppliers are preferred.



**APPENDIX
Reforestation and Wild Edibles**

Forestry and Tree Planting in North Carolina

North Carolina's forests cover more than 18.6 million acres (7.5 million hectares), equaling more than 59 percent of the State's land area. Nearly 97 percent of this forest land is capable of timber production. Forestry contributes more than \$6 billion annually to the State's economy. The State's forests are genetically and commercially diverse and support more than 60 major tree species. Many other species are also important to the State's native forest ecosystems. Major forest types are oak and hickory; loblolly and shortleaf pine; oak, gum, and cypress; oak and pine; and longleaf pine. State forestry programs support these species, other important species, and ecosystem restoration efforts. More than 50 million tree seedlings are planted annually, 16 million of which are produced by State nurseries. While most of these seedlings are softwoods, local hardwood seed is also collected and expansion of container seedling operations continues. Inroads have been made in growing more specialty species for wetland and streambank restoration needs. Understory herbaceous plants are also being grown for longleaf pine ecosystem restoration projects. Support for the State nursery is still strong, and landowners are encouraged to plant and reforest lands as part of their long-term forest management.

**Entire document can be found at
http://www.rngr.net/publications/tpn/54-2/forestry-and-tree-planting-in-north-carolina/at_download/file**

APPENDIX
Reforestation and Wild Edibles

Wild Edible Plants in North Carolina

North Carolina is a state with a variety of terrains and climates. Eastern North Carolina is home to the Atlantic coast and the adjacent coastal plain. In the center is the Piedmont. The western part of the state is dominated by the Appalachian Mountains and its foothills. This diversity creates an abundance of edible plants and fungi. Being able to identify these plants can be useful for anything from getting a quick snack to developing survival skills.

Berries and Nuts	The state is home to elderberries, but these should be approached cautiously as they are easily confused with other poisonous berries. The cooler areas of the Piedmont and Appalachian North Carolina are also home to wild blueberries, although these are not very common. The main nut-bearers of the state are the hickory tree and the American black walnut.
Mushrooms	Mushrooms may be tasty, but some species are poisonous, and those that are poisonous are potentially lethal. This makes gathering wild mushrooms much riskier than gathering berries. One way to tell them apart is by the white dots on the cap of that cousin. Be very, very cautious when looking for wild mushrooms to eat.
Tubers, Shoots, and Bulbs	Cattails, broad arrowheads, and wood sorrels all produce edible tubers, of which the wood sorrel tubers are the most substantial. For all intents and purposes, they are all sources for small, wild potatoes. The cattail and broad arrowhead also have edible shoots. Other plants with edible shoots are onion grass and spring onions with the bulbs of the latter edible as well. Wood sorrels, spring onions, and onion grass are found just about everywhere else in the state.
Vegetables and Others	The prickly leaf lettuce plant is not only edible, but also has a stronger flavor than some types of normal lettuce. Nettles are also found wild in the state and have been used to make soup for ages. Edible watercress is an invasive plant species that is not native to North Carolina. However, it can sometimes be found growing wild in fresh watercourses, especially in the east.
Wild Bread	The pollen of the aforementioned cattail can be collected and made into a kind of ersatz flour. This, in turn, can be used to make a peculiar kind of bread.
Wild Coffee	The Kentucky coffee tree is common in western North Carolina. Its seeds have been roasted and used as a substitute for coffee since colonial times, although the results are not very tasty. It is considered a “poor man’s coffee” even by frontiersmen. Furthermore, even after being roasted and brewed, the seeds still carry traces of toxins, and therefore, should never be consumed in quantity. A better idea is to collect the petals of dandelion flowers and use them to brew tea. ¹

¹ Wild Edible Plants in North Carolina, trails.com

APPENDIX Soils

Virginia Cooperative Extension

PUBLICATION 452-701

Explanation of Soil Tests

Rory Maguire, Extension Nutrient Management Specialist, Virginia Tech

Steve Heckendorn, Soil Test Laboratory Manager, Virginia Tech

The accompanying Soil Test Report (and supplemental Soil Test Notes, when provided) will help you assess your plant's need for fertilizer and lime.

The "History of Sampled Area" section restates the information you filled in on the Soil Sample Information Sheet you submitted with the soil sample.

The "Lab Test Results" section shows the relative availability of nutrients numerically and if appropriate, as a rating. The rating may be interpreted as follows: L=Low, M=Medium, H=High, VH=Very High, EH=Excessively High (soluble salt test only), DEF=Deficient, or SUFF=Sufficient, and sometimes a "+" or "-" When soils test Low, plants almost always respond to fertilizer. When soils test Medium, plants sometimes respond to fertilizer and a moderate amount of fertilizer is typically recommended to maintain fertility. When soils test High to Very High, plants usually do not respond to fertilizer. If there is no rating for a nutrient, the adequacy of that nutrient in the soil for the plant you specified has not been determined.

The following is an explanation of the symbols and abbreviation used in the report:

Report Symbols and Abbreviations

P = phosphorus	K = potassium
Ca = calcium	Mg = magnesium
Zn = zinc	Mn = manganese
Cu = copper	Fe = iron
B = boron	SS = soluble salts
lb/A = pounds per acre	ppm = parts per million
meq = milliequivalent	g = gram
pH = acidity	Sat. = saturation
N = nitrogen	P ₂ O ₅ = phosphate
K ₂ O = potash	% = percent
Est-CEC = estimated cation exchange capacity	
AG = agricultural limestone (dolomitic or calcitic)	

Fertilizer Recommendation

The fertilizer recommendations may be used for the same crop for two to three years. After this time, it is advisable to retest the soil to determine if significant changes have occurred in nutrient levels. When the soil tests Very High for phosphorus or potassium and no fertilizer for these nutrients is recommended, you should retest the following year to determine if fertilizer will be needed. Due to the variability associated with sampling, fertilizer application rates may be varied by a plus or minus 10 percent.

No soil test is performed for **nitrogen** because this element is too mobile in the soil for laboratory results to be useful. Nitrogen fertilizer recommendations are based on the crop/plant to be grown, the previous crop, and when applicable, the soil's yield potential. Comments on the report and other enclosed Notes, if any, will have further information regarding nitrogen.

Lime Recommendation

If needed, a lime recommendation is given to neutralize soil acidity and should last two to three years. After that time, you should have the soil retested. The measured soil test levels of calcium and magnesium are used to determine the appropriate type of limestone to apply. If neither dolomitic nor calcitic lime is mentioned, or "Ag" type or "agricultural" limestone is stated on the report, then it does not matter which type is used. When no information on the Soil Sample Information Sheet was provided regarding the last lime application, the lab assumed you have not applied lime in the past 18 months. If this is not correct, contact your Extension agent for advice on adjusting the lime recommendation to take into consideration recent lime applications. Do not over lime! Too much lime can be as harmful as too little. For best results, apply lime, when possible, several months ahead of the crop/plant to be planted to allow time for more complete soil reaction.

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www.ext.vt.edu

Produced by Communications and Marketing, College of Agriculture and Life Sciences,
Virginia Polytechnic Institute and State University, 2010

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Methods and Meanings

For more detail on the lab procedures used, visit www.soiltest.vt.edu and click on “Laboratory Procedures.”

Soil pH (or soil reaction) measures the “active” acidity in the soil’s water (or hydrogen ion activity in the soil solution), which affects the availability of nutrients to plants. It is determined on a mixed suspension of 1:1, volume to volume ratio of soil material to distilled water.

Virginia soils naturally become acidic, and limestone periodically needs to be applied to neutralize some of this acidity. A slightly acid soil is where the majority of nutrients become the most available to plants, and where soil organisms that decompose organic matter and contribute to the “overall health” of soils are the most active. When a soil is strongly acidic (< 5.0-5.5), many herbicides lose effectiveness and plant growth is limited by aluminum toxicity. When soils are over-limed and become alkaline (> 7.0), micronutrients, such as manganese and zinc, become less available to plants.

For most agronomic crops and landscaping plants, lime recommendations are provided to raise the soil pH to a slightly acid level of between 5.8 and 6.8. Blueberries and acid-loving ornamentals generally prefer a 4.5 to 5.5 pH, and an application of liming material is suggested when the soil pH drops below 5.0. For the majority of other plants, lime may be suggested before the pH gets below 6.0. This is to keep the soil pH from dropping below the ideal range, since lime is slow to react and affects only a fraction of an inch of soil per year when the lime is not incorporated into the soil. If the soil pH is above the plant’s target pH, then no lime is recommended. If the pH is well above the ideal range, then sometimes an application of sulfur is recommended to help lower the pH faster; however, most of the time, one can just let the soil pH drop on its own.

A Mehlich buffer solution is used to determine the **Buffer Index** to provide an indication of the soil’s total (active + reserve) acidity and ability to resist a change in pH. This buffer measurement is the major factor in determining the amount of lime to apply. The Buffer Index starts at 6.60 and goes lower as the soil’s total acidity increases and more lime is needed to raise the soil pH. A sandy soil and a clayey soil can have the same soil pH; however, the clayey soil will have greater reserve acidity (and a lower Buffer Index) as compared to the sandy soil, and the clayey soil will require a greater quantity of lime to be applied in order to raise the soil pH the same amount as the sandy soil. A reported

Buffer Index of “N/A” means that it was not measured since the soil (water) pH was either neutral or alkaline and not acidic (soil pH \geq 7.0) and therefore requires no lime.

Nutrients that are available for plant uptake are extracted from the soil with a Mehlich 1 solution using a 1:5 vol:vol soil to extractant ratio, and are then analyzed on an ICP-AES instrument. An extractable Mehlich 1 level of phosphorus from 12 to 35 pounds per acre (lb/A) is rated as medium or optimum. A medium level of potassium is from 76 to 175 lb/A. Medium levels of calcium and magnesium are 721 to 1440 and 73 to 144 lb/A, respectively. Calcium and magnesium are normally added to the soil through the application of limestone. It is rare for very high fertility levels of P, K, Ca and Mg to cause a reduction in crop yield or plant growth. Levels of micronutrients (Zn, Mn, Cu, Fe and B) are typically present in the soil at adequate levels for plants if the soil pH is in its proper range. See Soil Test Note 4, at www.soiltest.vt.edu/stnotes, for documented micronutrient deficiencies in Virginia.

Soluble Salts (**S.Salts**) or fertilizer salts are estimated by measuring the electrical conductivity of a 1:2, vol:vol ratio of soil material to distilled water. Injury to plants may start at a soluble salts level above 844 ppm when grown in natural soil, especially under dry conditions and to germinating seeds and seedlings. Established plants will begin to look wilted and show signs related to drought. This test is used primarily for greenhouse, nursery and home garden soils where very high application rates of fertilizer may have led to an excessive buildup of soluble salts.

Soil Organic Matter (SOM) is the percentage by weight of the soil that consist of decomposed plant and animal residues, and is estimated by using either the weight Loss-On-Ignition (LOI method) from 150° to 360°C, or a modified Walkley-Black method. Generally, the greater the organic matter level, the better the overall soil tilth or soil quality, as nutrient and water holding capacities are greater, and improved aeration and soil structure enhance root growth. The percent of organic matter in a soil can affect the application rate of some herbicides. Soil organic matter levels from 0.5% to 2.5% are ordinary for natural, well-drained Virginia soils. A soil organic matter greater than 3% would be considered very high for a cultivated field on a farm, but can be beneficial. Due to relatively large amounts of organic materials being commonly added to gardens, the soil organic matter in garden soils can be raised into the range of 5% to 10%.



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The remaining values that are reported under the “Lab Test Results” section are calculated from the previous measured values and are of little use to most growers.

Estimated Cation Exchange Capacity (**Est-CEC**) gives an indication of a soil’s ability to hold some nutrients against leaching. Natural soils in Virginia usually range in CEC from 1 to 12 meq/100g. A very sandy soil will normally have a CEC of 1 to 3 meq/100g. The CEC value will increase as the amount of clay and organic matter in the soil increases. This reported CEC is an estimation because it is calculated by summing the Mehlich 1 extractable cations (Ca + Mg + K), and the acidity estimated from the Buffer Index and converting to units commonly used for CEC. This is also an Effective CEC since it is the CEC at the current soil pH. This value can be erroneously high when the soil pH or soluble salts level is high.

The percent **Acidity** is a ratio of the amount of acid-generating cations (as measured by the Buffer Index) that occupy soil cation exchange sites to the total CEC sites. The higher this percentage, the higher the amount

of reserve acidity in the soil, and the higher the amount of acidity there will be in the soil solution and the lower the soil pH will be. A reported Acidity% of “N/A” means that a buffer index was not determined, and the acidity is probably less than 1 meq/100g and/or 5%, and the soil pH is alkaline (greater than 7.0).

The percent **Base Saturation** is the ratio of the quantity of non-acid generating cations (i.e., the exchangeable bases, Ca, Mg, and K) that occupy the cation exchange (CEC) sites.

The percent **Ca, Mg, or K Saturation** refers to the relative number of CEC sites that are occupied by that particular nutrient and is a way of evaluating for any gross nutrient imbalance.

Additional Information

For questions and more information, contact your local Virginia Cooperative Extension (VCE) office or go to www.ext.vt.edu. Contact information for your local Extension office appears on the upper left of your soil test report.

Conversion Factors

(Some Values are Approximate)

1 acre = 43,560 square feet

1 pound of 5-10-5, 5-10-10 or 10-10-10 fertilizer = 2 cups

1 pound of ground limestone or ground dolomitic limestone = 1.5 cups

1 pound of aluminum sulfate or magnesium sulfate = 2.5 cups

1 pound of sulfur = 3.3 cups

1 quart = 2 pints = 4 cups

1 pint = 2 cups = 32 tablespoons

1 tablespoon = 3 teaspoons

1 bushel = 35.24 liters = 1.25 cubic feet

Pounds per 100 square feet x 0.54 = lbs per cubic yard

100 square feet = 5 feet x 20 feet, 10 feet x 10 feet, or 2 feet x 50 feet

1,000 square feet = 50 feet x 20 feet, 10 feet x 100 feet, or 25 feet x 40 feet

Pounds per 100 square feet x 436 = pounds per acre

Pounds per 1,000 square feet x 43.6 = pounds per acre

Pounds per acre x 0.0023 = pounds per 100 square feet

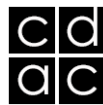
Pounds per acre x 0.023 = pounds per 1,000 square feet



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Sample ID	LabID	pH	BpH	P ppm	K ppm	Ca ppm	Mg ppm	Zn ppm	Mn ppm	Cu ppm	Fe ppm	B ppm	% OM
MOR01	19472	5.48	6.14	3	32	560	87	7.6	5.2	1	13.7	0.2	
MOR02	19473	6.81	6.33	39	59	870	245	9.5	2.3	2.3	15.3	0.3	
MOR03	19474	6.14	6.26	7	71	704	177	2.5	8.8	0.5	21.5	0.3	
MOR04	19475	6.51	6.31	26	116	968	233	3.3	9.6	0.2	7.2	0.4	
MOR05	19476	6.87	6.35	32	103	1056	245	6.4	9.1	0.3	4.4	0.5	
MOR06	19477	5.15	5.89	87	96	735	106	5.9	10.3	0.6	16.4	0.2	
MOR07	19478	5.8	6.11	11	20	647	95	1.9	28.7	1.2	34.8	0.3	
MOR08	19479	6.14	6.17	17	91	662	162	1.9	7.5	0.3	9	0.3	
MOR09	19480	5.59	6.17	4	57	367	98	1.9	7	0.8	46.6	0.1	
MOR10	19481	5.68	6.21	4	51	411	64	14	6.6	0.9	30.2	0.1	
MOR11	19482	5.5	6.02	4	53	494	105	13.5	15.5	0.8	13.3	0.3	
MOR12	19483	5.52	6.03	25	36	279	62	2.3	7.2	0.9	45.2	0.1	
MOR13	19484	5.92	6.1	18	45	413	99	1.6	8.8	1.2	42.8	0.2	
MOR14	19485	5.52	6.04	22	69	418	78	2.9	6.5	1.3	53.3	0.1	
MOR15	19486	6	6.18	9	80	514	116	2	15.2	1.2	73.5	0.2	
MOR16	19489	5.6	6.02	11	56	441	91	2.6	7.8	1	33.1	0.2	
MOR17	19488	5.67	6	13	30	599	112	4	10.9	0.6	15.7	0.3	

Sample ID	CEC meq/100g	% Acidity	% Base Sat	% Ca Sat	% Mg Sat	% K Sat	P Rating	K Rating	Ca Rating	Mg Rating	SS Rating	OM Rating
MOR01	5.1	30.1	69.9	54.4	14	1.6 L	L+	L+	M	H		
MOR02	6.9	6	94	62.7	29.1	2.2 H	M	M	H	VH		
MOR03	6	13.9	86.1	58.7	24.4	3 M-	M	M	M+	VH		
MOR04	7.6	7.1	92.9	63.8	25.3	3.9 H-	H	H	H+	VH		
MOR05	7.8	3.8	96.2	67.2	25.7	3.4 H	H-	H	H+	VH		
MOR06	7.8	38.7	61.3	46.9	11.2	3.1 VH	H-	H	H-	H+		
MOR07	5.8	29.8	70.2	55.9	13.5	0.9 M	L	L	M+	H		
MOR08	6.2	21.9	78.1	53	21.4	3.7 M+	H-	H	M+	VH		
MOR09	4.1	32.9	67.1	44.2	19.4	3.5 L	M	M	M-	H+		
MOR10	3.8	29.4	70.6	53.5	13.7	3.4 L	M	M	M-	M+		
MOR11	5.7	39.4	60.6	43.1	15.1	2.4 L	M	M	M	H+		
MOR12	4.2	52.5	47.5	33.3	12.1	2.2 H-	L+	L+	L+	M+		
MOR13	4.8	37.3	62.7	43.2	17.1	2.4 H-	M-	M-	M-	H+		
MOR14	5	42.4	57.6	41.4	12.7	3.5 H-	M	M	M-	H-		
MOR15	5	26	74	51	18.9	4.1 M-	M+	M+	M	VH		
MOR16	5.3	42.2	57.8	41.2	14	2.7 M	M	M	M-	H		
MOR17	6.4	37.4	62.6	47	14.5	1.2 M	L+	L+	M	VH		



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Site Soils

