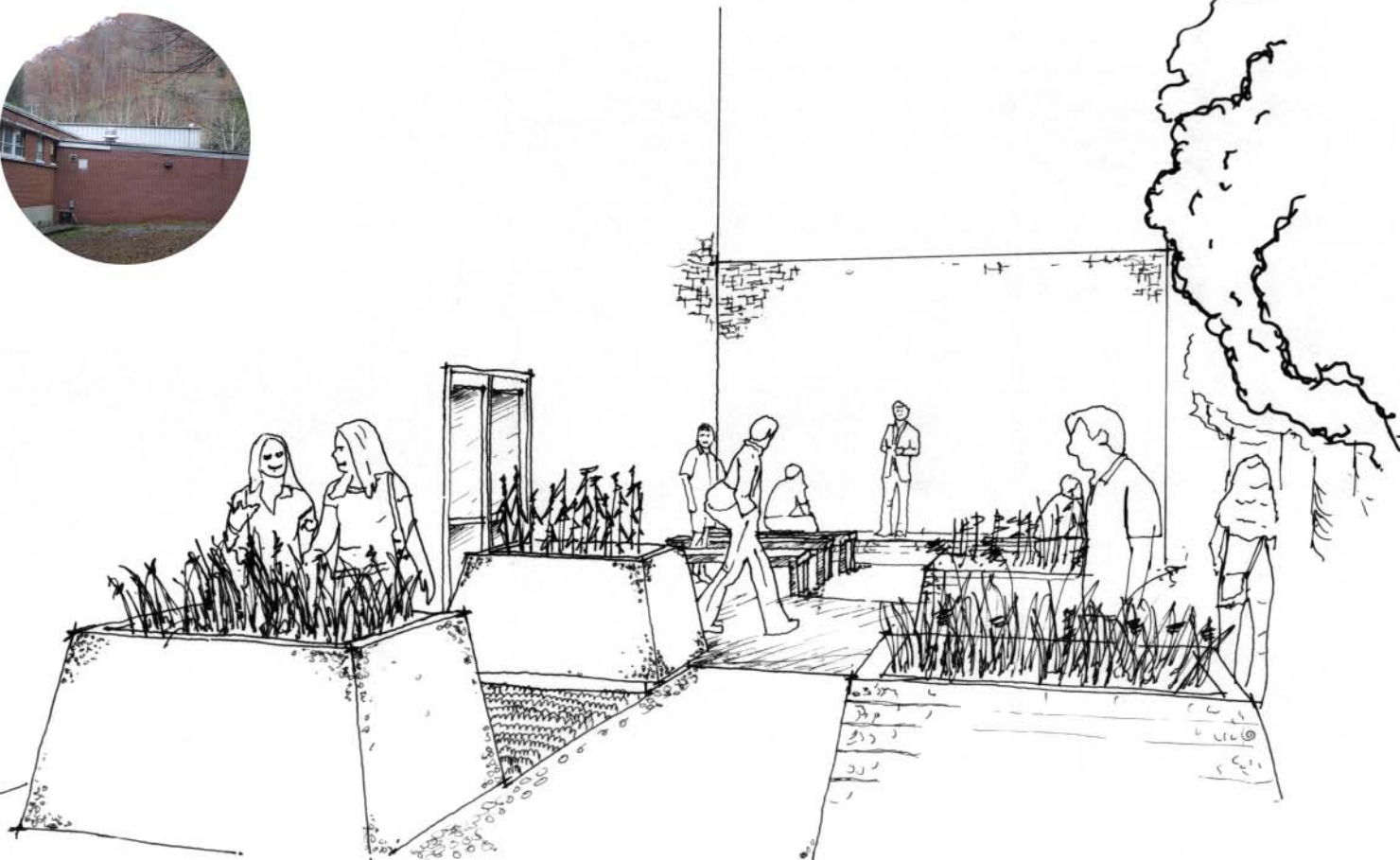


# Ervinton High School Outdoor Classroom

Nora, Virginia  
May 2007



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The Community Design Assistance Center (CDAC) is an outreach of the College of Architecture and Urban Studies at Virginia Tech that assists communities, neighborhood groups and non-profit organizations in improving the natural and built environments through design, planning, policy, and research. Through the integration of the learning and working environment, the Center will execute projects that link instruction and research and share its knowledge base with the general public.

Community Design Assistance Center  
101 South Main Street, Suite 2  
Blacksburg, Virginia 24061  
p: 540.231.5644  
f: 540.231.6089  
e: [cdac@vt.edu](mailto:cdac@vt.edu)  
<http://cdac.arch.vt.edu>

CDAC Project Team for Ervinton High School, Outdoor Classroom

Elizabeth Gilboy, CDAC Director

Kim Watson, Landscape Architecture Project Coordinator

Christopher Henry, Undergraduate Landscape Architecture Student Designer

Doug Rodes, Undergraduate Landscape Architecture Student Designer

Jacob Whitehouse, Undergraduate Horticulture Student



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E r v i n t o n   H i g h   S c h o o l

O u t d o o r   C l a s s r o o m

# Acknowledgements

The CDAC design team would like to recognize and thank the following individuals for their assistance throughout the course of this project:

**Carol Doss**            Coordinator, Upper Tennessee River Roundtable

**Hope Farmer**        Teacher, Ervinton High School

**Lisa Harris**            Watershed Project Manager, Lonesome Pine Soil and Water Conservation District

**Melissa Robinson**   Office of Surface Mining (OSM)/ Americore VISTA Appalachian Coal Country Watershed team member- McClure River Restoration Project



*Doug Rodes (c) presents design concepts to Ervinton High School students and staff.*



*Lisa Harris (l) discusses plans with school staff and CDAC team members Doug Rodes (c) and Chris Henry (r).*



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# Introduction

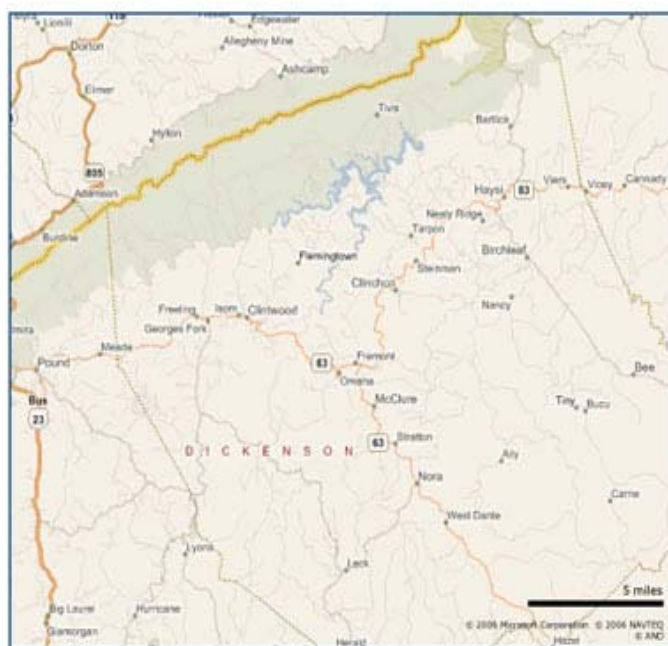
The Lonesome Pine Soil and Water Conservation District (SWCD) and the Upper Tennessee River Roundtable (UTRR) are seeking to create an outdoor classroom at Ervinton High School in the community of Nora. Nora is located in Dickenson County, roughly 12 miles southeast of the Town of Clintwood.

The SWCD and UTRR asked the Community Design Assistance Center (CDAC) to assist them with the design of the outdoor classroom. The two groups desired the components of the outdoor classroom to address forestry, geology, soils, wildlife, and aquatics. A small trail is also a desired feature of the "classroom".

The CDAC design team worked with the SWCD and Ervinton High School (EHS) faculty throughout



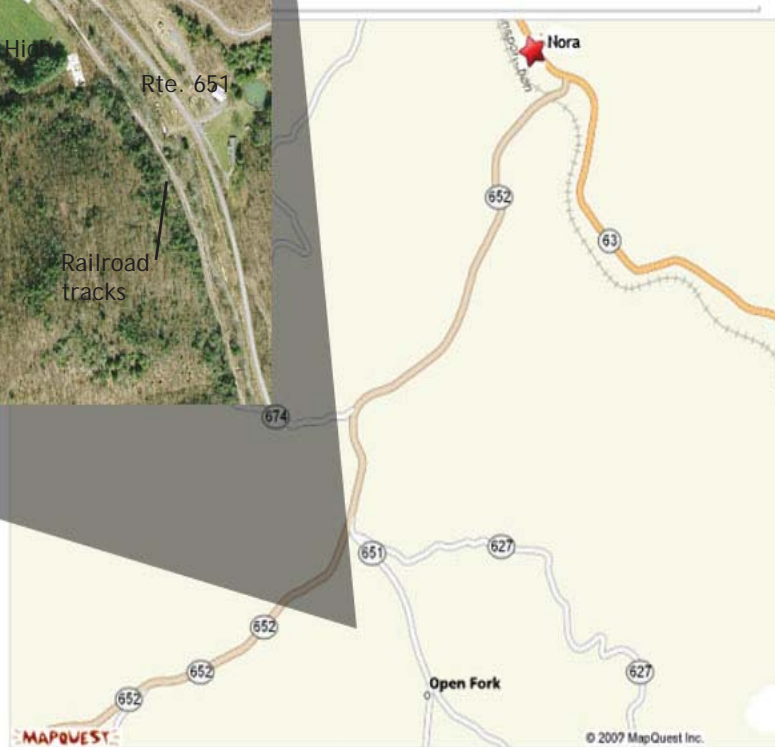
State context map



Regional context map



Area context map/  
aerial of school site



---

the design process. Students were also involved in the review and critique of the design proposals for the outdoor classroom. It was the CDAC design team's intention to have the area state forester and additional school/county officials directly involved in design review. Unfortunately, their schedules would not allow it. The CDAC design team relied on school faculty and SWCD staff that were engaged in the project to help bridge the gap and relay comments to the CDAC design team.

Final products for CDAC's role in the project include a conceptual master plan for the outdoor classroom site, conceptual focus area designs for specified components, and planting suggestions comprised solely of native species suggestions. This short supporting report documents the design process and describes the final design proposals.



# Goals and Objectives

The goals and objectives for the project are as follows:

- Create an outdoor learning environment to engage the students with hands-on learning
- Preserve and enhance the student and faculty ownership of the property
- Increase competitiveness for Canon Envirothon program (see page 5 for more information)
- Enable teachers to more effectively utilize the outdoor environment for both interactive and interpretive learning
- Imbue the students with a passion for learning

The objectives for accomplishing the goals set forth are as follows:

- Conduct meetings with students and faculty of EHS to discuss their wants and desires for outdoor learning
- Speak with involved and interested personnel regarding design, construction, and maintenance
- Produce comprehensive master plan with outdoor stations and trails that can be referred to as a general guide for final implementation



*CDAC team members Doug Rodes and Christopher Henry (right) meet with Faculty and OSM VISTA member Melissa Robinson (left center).*



*CDAC team members Jacob Whitehouse and Christopher Henry explore the site.*



# Microscopic Learning+Telescopic Knowledge

A microscope is an instrument used in the sciences to examine a small object that cannot be seen by the unaided eye. Microscopes are utilized to observe and reveal components and processes that exist within a small yet extremely critical object. Microscopy is the study of exploring objects that are too small to be seen with the naked eye<sup>1</sup>.

The concept for the Ervinton High School Outdoor Classroom is termed “Microscopic Learning + Telescopic Knowledge”. The goal is to engage the students in the local environment and expose the processes in the region of Dickenson County. In participating in outdoor activities, the students will examine aspects of the local environment that includes soils, geology, flora, water systems, habitat/wildlife, and history. It is critical to know the importance of individual elements and how they interact with surrounding elements in their immediate local environment.

On the opposite end of the spectrum, a telescope is an instrument that allows remote and foreign objects to be viewed and observed, ultimately, becoming educated about that object in particular. The concept of focusing on remote objects is used in a variety of scales as well as senses. Diversifying the types of observations is of critical importance.

“Telescopic Knowledge” speaks to the understanding the earth as one system globally by studying and engaging in the immediate environment locally. By knowing small, local characteristics, it is feasible to pull the remote locations of the world into the classroom to study their differences and similarities.



1. <http://en.wikipedia.org/wiki/Microscope>
2. <http://en.wikipedia.org/wiki/Telescope>
3. <http://www.envirothon.org/about/what.php>
4. <http://www.dnr.sc.gov>



# The Envirothon

The Envirothon, sponsored by Canon, is North America's largest high school environmental education competition. It provides students with a chance "to get upclose and personal with North America's natural resources. Envirothon offers both in-class curriculum and hands-on field experiences focused around ecology, natural resource management, and current environmental issues."<sup>1</sup> Students from Ervinton High School have participated in this competition for the several years. The competition focuses on five categories of study:

1. Soils/Land Use
2. Aquatic Ecology
3. Forestry
4. Wildlife
5. Current Environmental Issue

"The Envirothon program is an effective educational tool, capable of supplementing environmental education both inside and outside the classroom. Led by a volunteer advisor, teams usually meet from late autumn until spring. Teams work cooperatively to develop their knowledge of ecology and natural resource management and to practice their environmental problem-solving skills in preparation for Envirothon competitions."<sup>2</sup> The CDAC design team hopes the design and creation of outdoor classrooms on school groups will help to better aid in preparing students for participation in the Envirothon and will increase their competitiveness at this event.

1. <http://www.envirothon.org/about/index.php>

2. <http://www.envirothon.org/about/what.php>



# Design Process

The project began with an initial site visit in October 2006 to Ervinton High School. An inventory of the site was documented through pictures and sketches. Items that were documented include native vegetation, existing topography, unique site characteristics, potential constraints, soil conditions, and existing trails. These items later helped to inform design decisions for the site.

The CDAC team aimed not only to provide feasible and creative ideas for the outdoor classroom, but also to engage the students, faculty, and staff who will be using it. During their first visit to the site, the CDAC team met with EHS science teachers Hope Farmer and Sean Tiller to discuss priorities, desires, and overall needs that the CDAC team could address in their design. Several critical topics were discussed:

1. Community participants
2. Tree identification
3. Soils studies
4. Aquatic station
5. Geological formations
6. Trails for access
7. Priority sites
8. Current uses and activities
9. Wildlife attraction
10. Various lab experiments with potential to be located outdoors.

At the conclusion of this meeting some initial design ideas were already formulated and the excitement of such an installation could initially be felt by all of the attending parties.

Following the October meeting the four CDAC members reconvened on the Ervinton High School grounds to collect further data about the site.

A meeting was held in early February 2007 to review preliminary conceptual designs. This meeting proved to be critical in the design process. The initial design concept was presented to Hope Farmer (EHS) and Melissa Robinson (OSM/VISTA),



*CDAC team members Chris Henry (l) and Jacob Whitehouse (r) explore an existing trail on site.*



*CDAC team member Chris Henry investigates a small cemetery adjacent to the school.*



*CDAC team members Doug Rodes (r) explains design concepts to Hope Farmer (l) and Melissa Robinson (c).*



## Design Process, cont'd

as well as several other EHS faculty members in attendance. Once the ideas were conveyed, Hope and Melissa offered several suggestions on how the design could be adapted to better facilitate learning and resist vandalism.

1. Install a gate on the east side of the courtyard to regulate entry into the site.
2. Concerns were expressed about the magnitude of clearing that must take place for the wildlife and assembly point to be constructed.
3. Explore alternative ways to delineate the forestry station besides using a fence.



*CDAC member Jacob Whitehouse collecting soil samples near the stream.*

A critical component to community participation is receiving feedback from both the users and the administration. The days following the presentation, Hope Farmer was supplied with 11x17 versions of the boards that were presented. She took these and received input from students and other faculty and proceeded to email those responses to CDAC. These suggestions aided in the final design of the outdoor classroom.

In early April the CDAC team met with students, faculty, Melissa Robinson, Lisa Harris, and Hope Farmer. The meeting was successful in that there was feedback from a wider variety of people that would take ownership of the project. Overall, the students seemed excited and pleased yet had minimal suggestions.

After the students resumed their extracurricular activities, the meeting resumed with the remaining parties. More suggestions and alternatives were discussed including:

1. Add soil pits
2. Add a wall around the graveyard
3. Create an aquatic station that is mobile
4. Design with thought toward minimal maintenance and construction



# Site Inventory & Analysis

The site inventory and analysis process combines the site inventory of social and physical attributes synthesized into a drawing that depicts constraints and opportunities present on the site. Ervinton High School is located in a hilly rural portion of Dickenson County. The characteristic Appalachian Plateau landscape gives the school beautiful scenery of wilderness and mountains.

The site is bounded to the north by Spring (“Rebel”) Creek and Route 652 (Rebel Drive), a road that is heavily used by local coal mining trucks. To the south, the site is bounded by mountains. The siting of school on the north face of the mountain keeps the school shaded the majority of the time, and the surrounding steep topography creates challenges for designing large open gathering spaces.

A number of notable features presented themselves throughout the site including an old graveyard, two streams, a variety of vegetation, a worn foot-path used by the football team on game days, and culturally and economically important geologic formations.

Unfortunately most base map material was restricted due to security concerns in Dickenson and surrounding counties. This made the analysis and design extremely difficult. Without such adequate material the CDAC team was unable to precisely locate features that were identified upon visiting the high school. The CDAC design team was able to obtain aerial photography of the site from the Virginia Tech library. Using the photography along with an old plat map with property boundaries, a rough base map was produced. Dickenson County’s first soil survey is currently being undertaken. The school site has not yet been surveyed and thus soil information was not publicly available for the school either. The CDAC design team collected soils samples at various areas pertinent to the potential outdoor classroom. Soil on slopes adjacent to the

courtyard had a pH of 7 and sufficient organic matter content to support growth. Soil in the courtyard, which is primarily a gravel bed six to eight inches deep, had a slightly higher pH and a much lower organic matter content. Raised beds are proposed in this area so the soil can be amended. See Appendix H for copies of the soil survey laboratory results.

Some additional observations made about the site include:

1. The area immediately adjacent to the back of the building was found to have at least three to five inches of packed gravel.
2. The CDAC members also were able to take in the school’s fervor for football as Ervinton was having one of its most successful seasons in recent years
3. The students pride was displayed through banners and artwork throughout the school hallways. Seeing the students take ownership over their school through proud accomplishment helped the design team fashion ideas on how this pride could be transferred into the outdoor classroom.

Images of some key site attributes can be found on the following page.



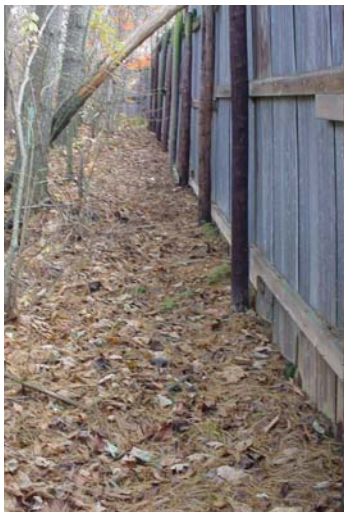
## Photographs



The graveyard found on the southside of the site exemplifies the rich history of the property.



In the woodlands behind the school one can find plant species in different micro-ecologies



Generally seen as derelict, this fence can be transformed into a canvas for artwork and school pride through murals and displays.



Stream used for testing and understanding source of pollutants



To the immediate rear of the building lies a flat gravel space with the potential to be utilized for outdoor learning activities.



Known as "Death Valley" to the students an educational station that captures the students' imagination will heighten the ownership of this area.



# Site Inventory Drawing



- 1. Ervinton High School
- 2. Rebels Football Field
- 3. Main Parking Lot
- 4. Rt. 652
- 5. "Rebel Creek"
- 6. Trail and Fence
- 7. "Death Valley"
- 8. Preferred Aquatic Station
- 9. "Courtyard" Area
- 10. Wall of Expression

Ervinton High School

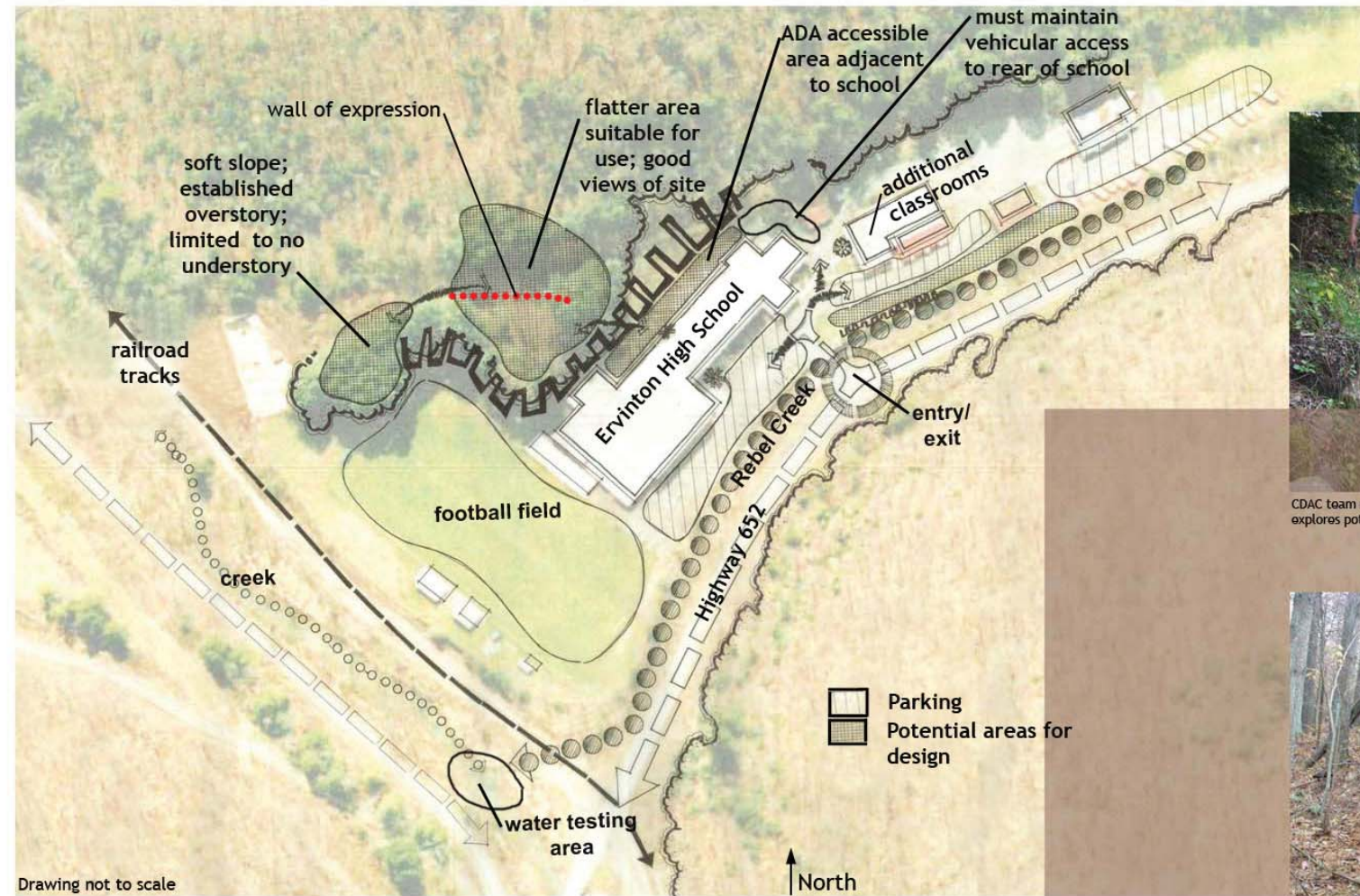
Outdoor Classroom



The Ervinton High School property possesses great potential to house outdoor classrooms due to the surrounding resources. With the woodlands, nearby creek, great changes in topography, and diversity of micro-climates the students will be **intellectually engaged** with **hands on** experience.

The property is home to several critical areas that were identified and will potentially be used for outdoor education.

1. The creek offers an opportunity to engage the students in activities that will enhance their **knowledge** of aquatic life.
2. The courtyard behind the school offers an area that is topographically flat that can be thought of as an outdoor room for potential uses.
3. Micro-ecologies and native vegetation are great **learning** media for students.
4. Existing trails and Graveyard serve as watermarks of the use of these sites before the High School's construction.



Drawing not to scale  
This drawing is conceptual and was prepared to show approximate location and arrangement of site features. It is subject to change and is not intended to replace the use of construction documents. The client should consult appropriate professionals before any construction or site work is undertaken. The Community Design Assistance Center is not responsible for the inappropriate use of this drawing.



CDAC team member Jacob Whitehouse explores potential sites for the aquatic station.



This section of the "Wall of Expression" is in good condition.



The outdoor classroom can provide another source of "Rebel Pride".



A small cemetery is located near the school.



The area immediately behind the school offers a flat area for a structured outdoor classroom that would be ADA accessible.



Vehicular access must be retained in this area to allow service vehicles to access the rear of the school.

### ANALYSIS





*Potential locations of educational stations*



# Design: Preliminary Master Plan

The preliminary master plan draws from the ideas shared at the initial site visit as well as the information gleaned during the site analysis process. Revolving around the concept of learning locally and thinking globally, there are several specific learning stations linked by a trail.

The geology, wildlife, soil, forestry, and water stations speak to the physical attributes of the site while the mural fence, "one-room" outdoor lecture classroom, and graveyard evoke visions of the local culture.

With so many different facets of learning that could be explored, the preliminary master plan investigates the best location for each learning station. The lecture room and raised planters located in the courtyard immediately adjacent to the building were chosen for ADA accessibility so that materials from other learning stations could be brought down from the less accessible areas.

The boulder garden was located at the north end zone of the football field due to the gentle grade that would allow for stratification placement of the boulders (i.e. - placing Tuscarora sandstone as the top boulders and limestone boulders at the base).

The wildlife and sundial assembly's location was also sited based on the topography of the site. This area could get sufficient sun exposure for the sundial with selective forestry clearing. The area may also be used for astronomy classes. The wildlife post located around the assembly area will attract local animal species that the students can document.

The forestry station was at a northern spot of the site where there currently exist both cleared areas and forested areas. This will allow students to see first and second succession plants. There is also a small graveyard near this area which can be use for history or poetry classes.



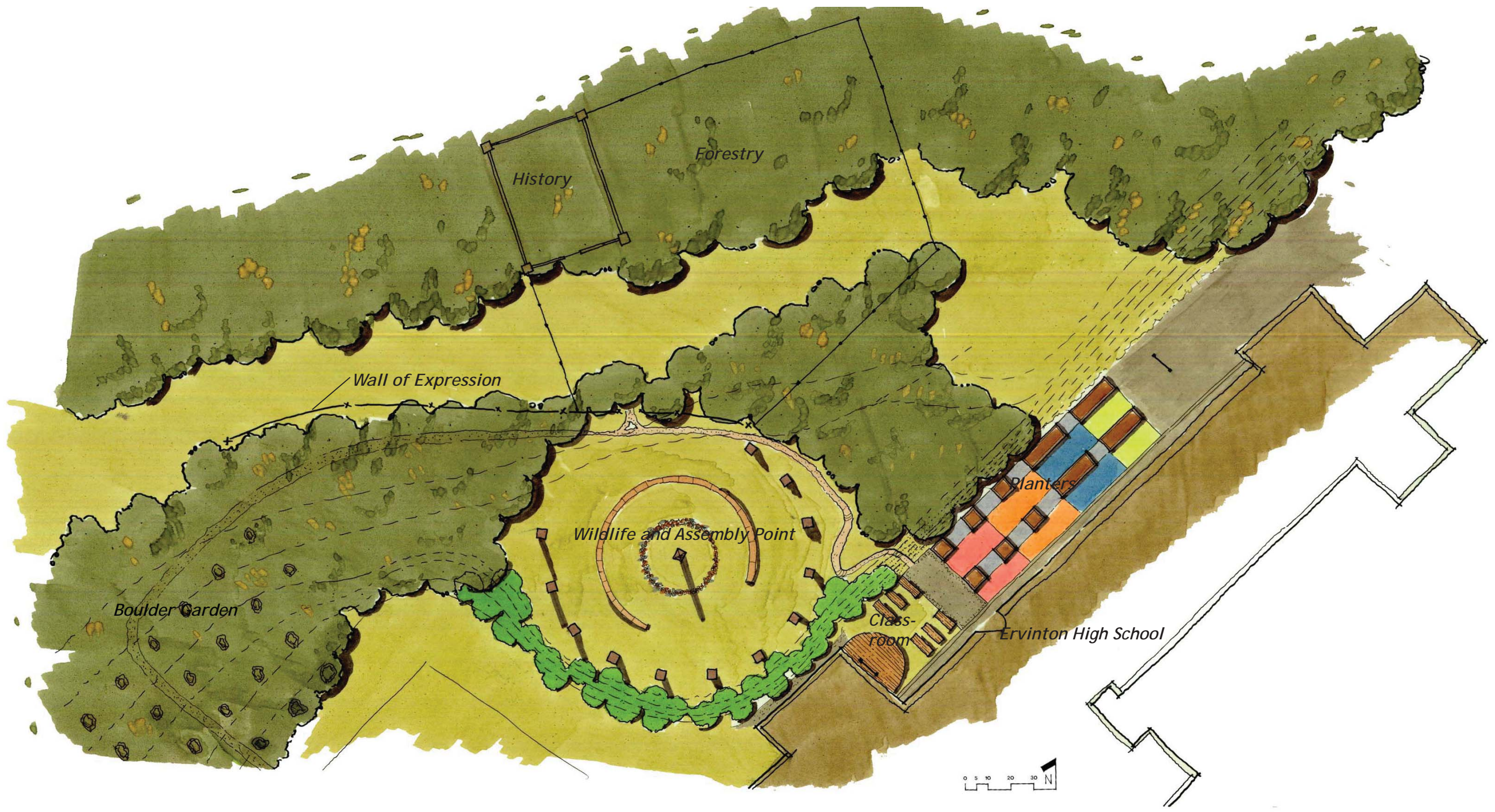
*Planter boxes and different pavement materials*



*Boulder garden*



# Preliminary Conceptual Master Plan



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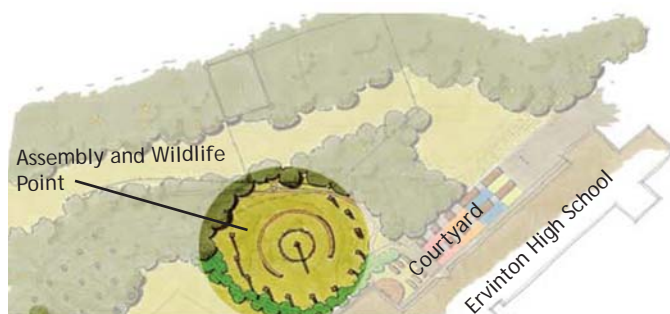


Ervinton High School  
Outdoor Classroom

# Design: Final Conceptual Master Plan

After presenting the preliminary conceptual master plan to EHS faculty and SWCD staff, the CDAC team members made adjustments to several of the learning stations based on comments received. The revised master plan was presented to EHS students and staff as well as SWCD staff. The final master plan was well received. Key components of the plan include:

1. *Courtyard*- Located immediately adjacent to the school building, the courtyard offers easily accessible opportunities for outdoor learning. A physical outdoor classroom structure is proposed. This structure is inspired by one room schoolhouses that once dotted the Appalachian region of Virginia and played a large role in the evolution of Appalachian culture. Also in the courtyard are “study cells” - constructed planters that test a variety of soil compositions and provide year round growing space, with the help of cold storage structures.
2. *Assembly and Wildlife Point*- This component provides a community gathering space with a fire pit and sundial. Natural snags as well as created elements surround the area, create a draw for local wildlife and aid the students in wildlife observation.
3. *Forest Study and History Station*- This station offers an opportunity to research the resurgence of the American Chestnut. Through forestry practices students learn the differences between invasive and native plants. There will be a diverse set of micro-ecologies to study as well.
4. *Wall of Expression*- The existing metal wall can be used by art classes and students to display school pride.
5. *Geology and Boulder Garden*- Boulders representing strata aid the students in understanding their surrounding environments. The garden’s order juxtaposes nature’s com-



*Context of the Assembly and Wildlife Point*



*The area of the Assembly and Wildlife Point was reduced in the final master plan to minimize the number of trees that would need to be selectively removed.*



plexities. It is located in "Death Valley" to preserve the entrance for the football players.

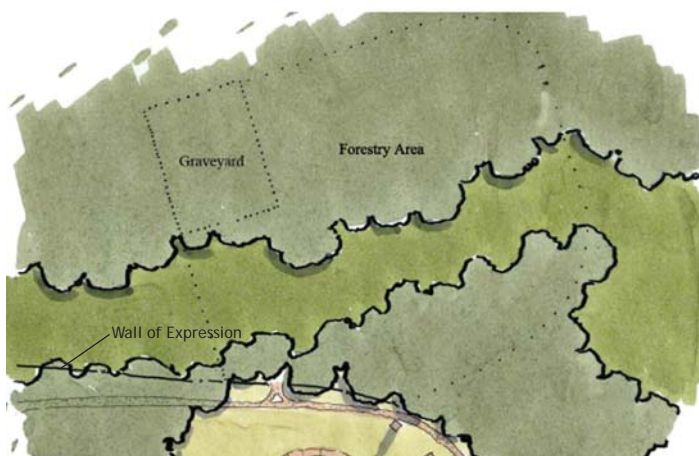
## Changes/Alternative Options

The final conceptual master plan proposes several additions and alterations to the initial concept that was presented. The primary changes include:

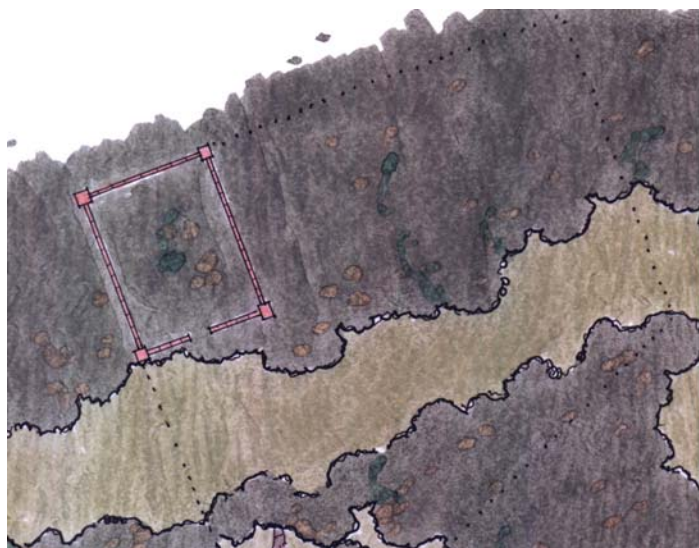
1. A proposed gate was added by the courtyard to keep unwanted trespassers from vandalizing the learning equipment.
2. The sundial assembly and wildlife station was reduced in size due to concerns about the loss of trees. The reduction of trees was cut in half and now there are two rooms for learning.
3. After presenting the new assembly areas there was a request to add soil pits which are now located within the sundial areas to allow students to explore the stratification of the soil horizons.
4. Trail blazes replace the fence that demarcates the boundaries of forestry area. Different color trail blazes can be used for tree identification.
5. A gate is also proposed for the far side of the football field so that the students will not have to walk along the busy road to access the second water testing point.



Forestry Context

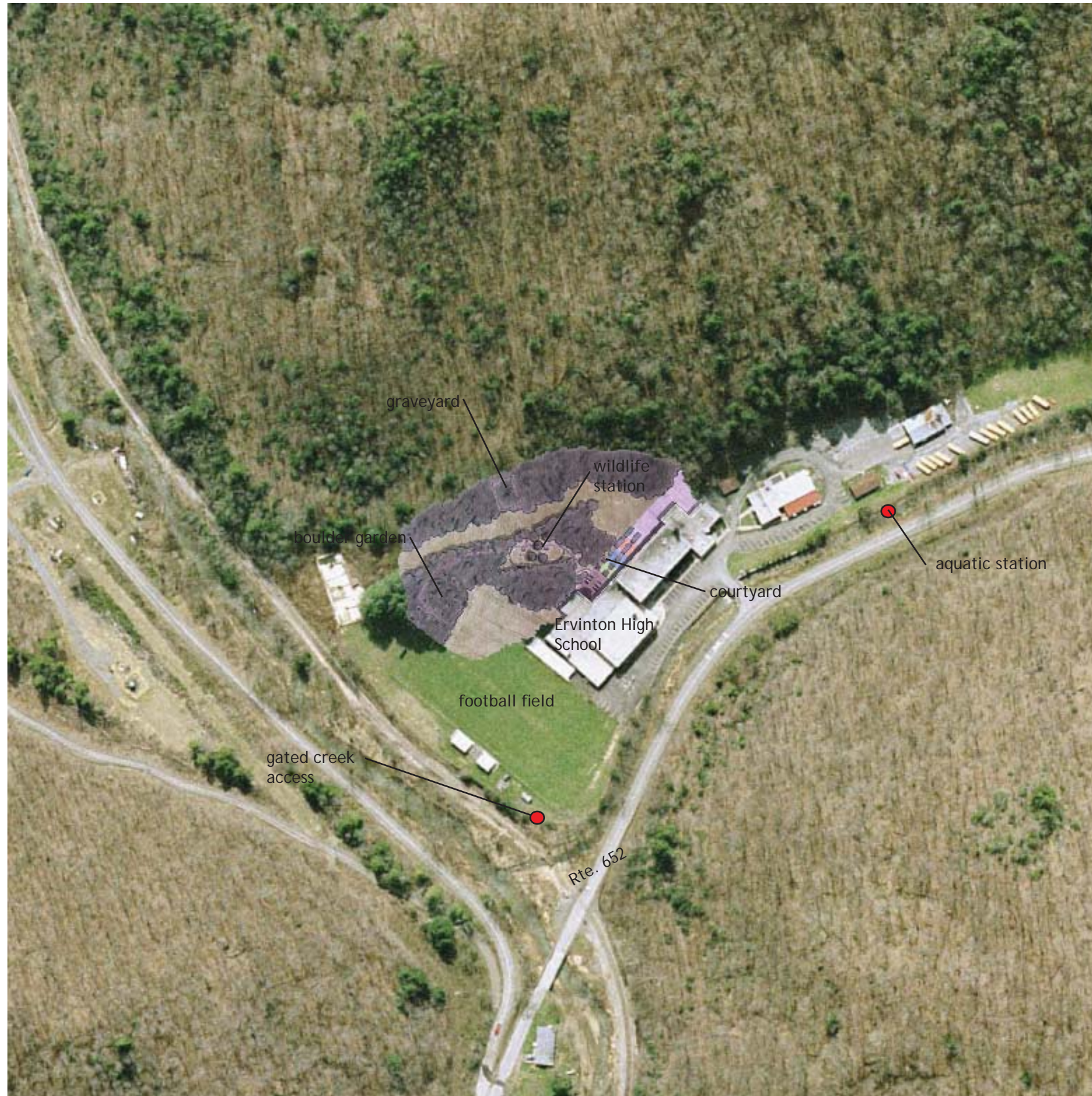


Forestry demarcated with trail blazes instead of with a fence and also without a wall around graveyard option.



Forestry area with tree blazes and wall around the graveyard





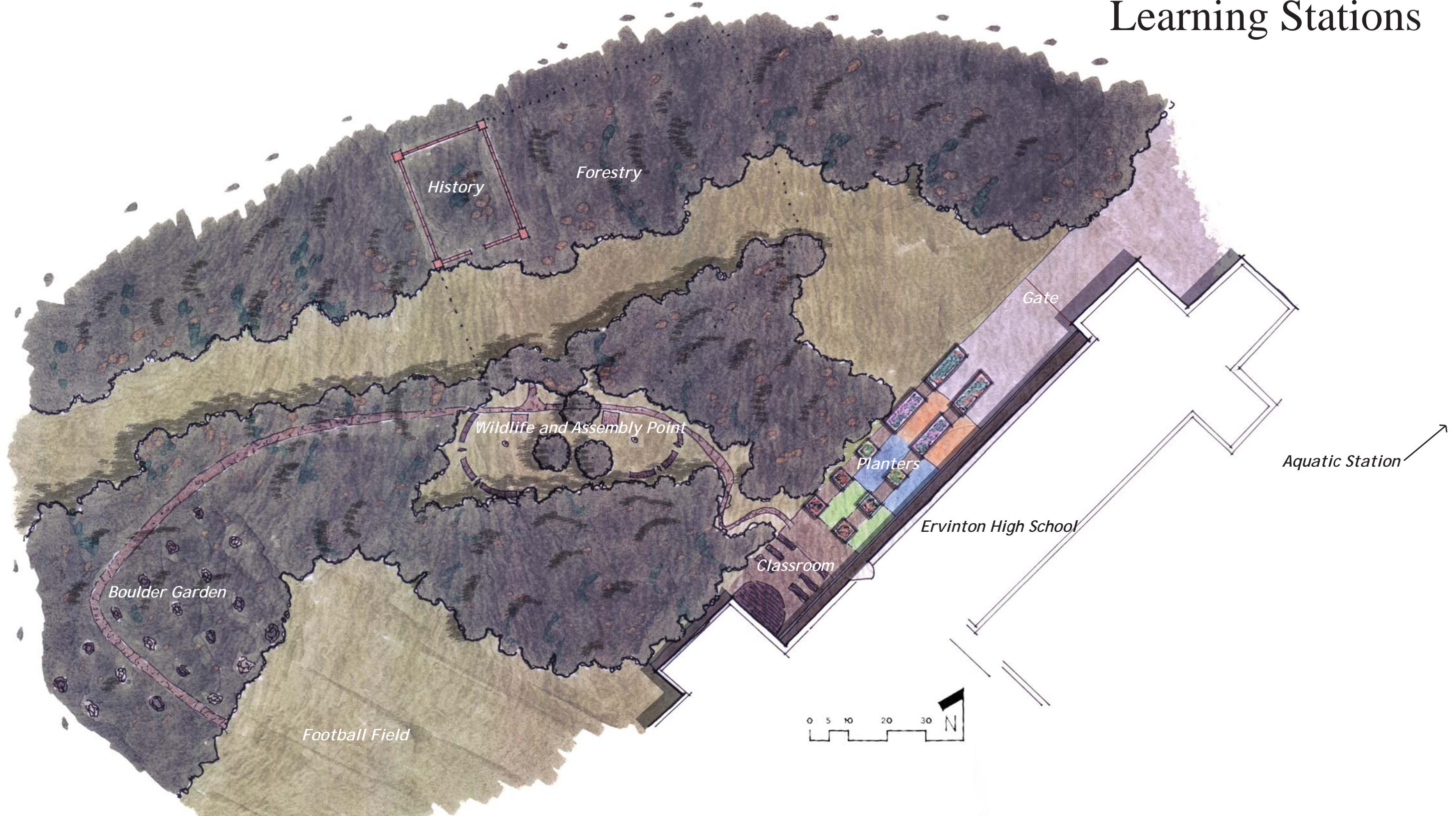
Ervinton High School  
Outdoor Classroom



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# Learning Stations

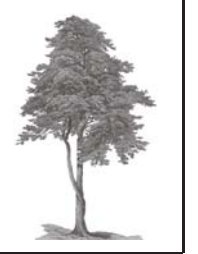


Gated access to creek

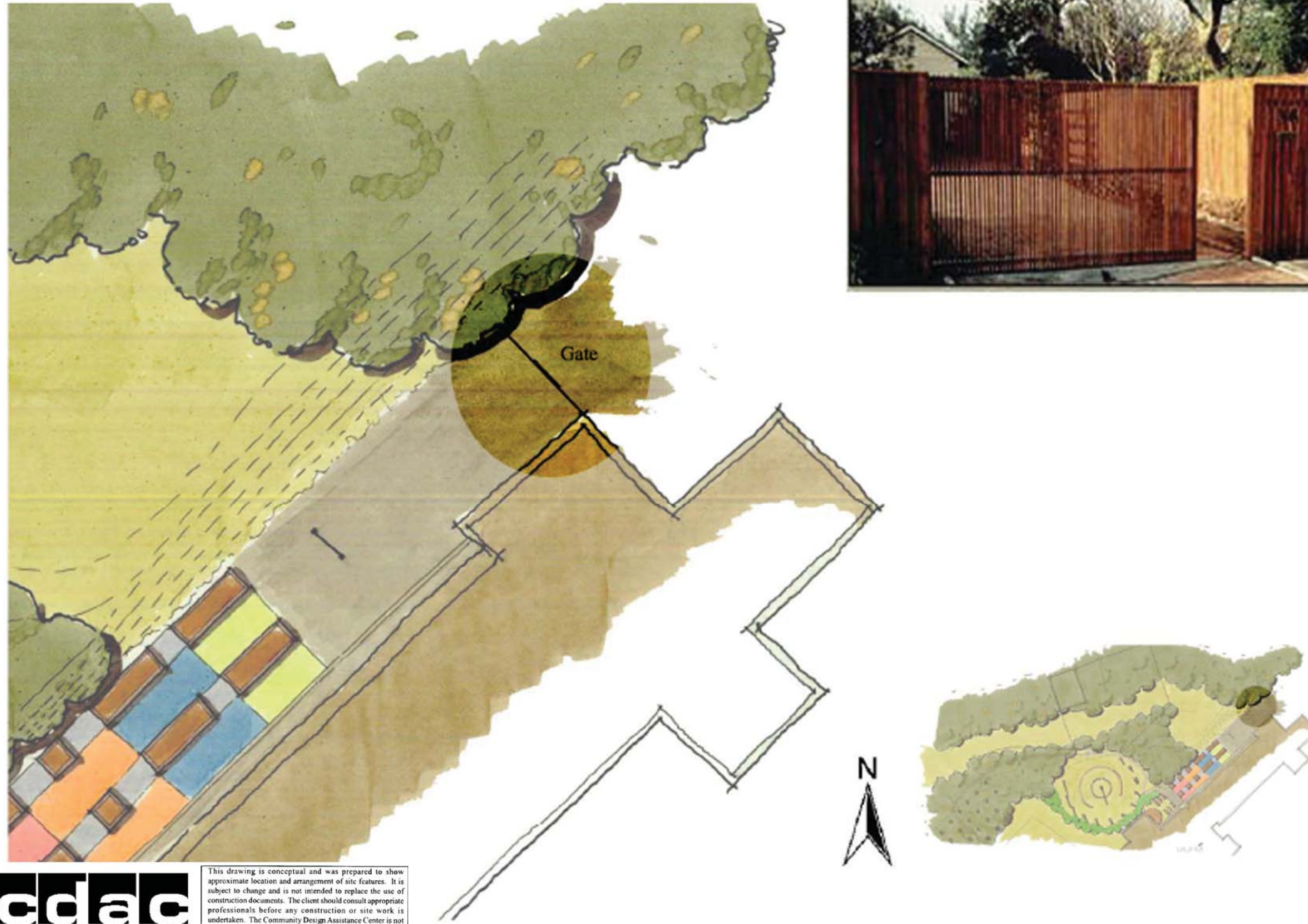
Ervinton High School  
Outdoor Classroom

**cdac**  
community design assistance center

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# Gate Options



These options can be used to protect the outdoor classroom from unwanted trespassing. The large scale sliding gates are a good option for vehicular access



Pictures from <http://home.gci.net/~glen/home/fence/fence.jpg>



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# Forestry Area and Graveyard Marking Options

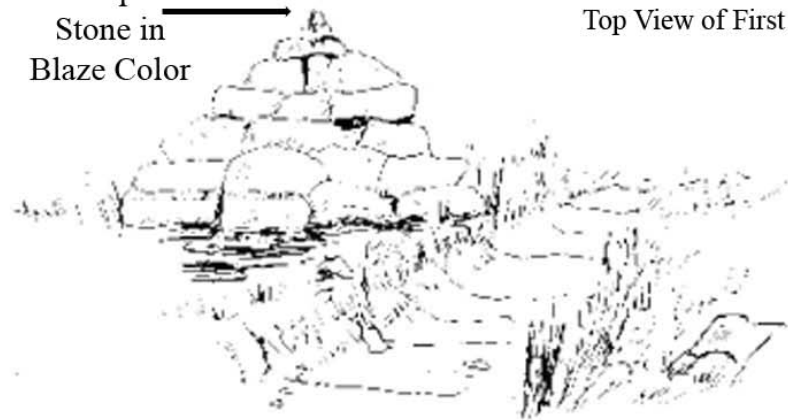
These are the options to demarcate the forestry area and graveyard

Cairns

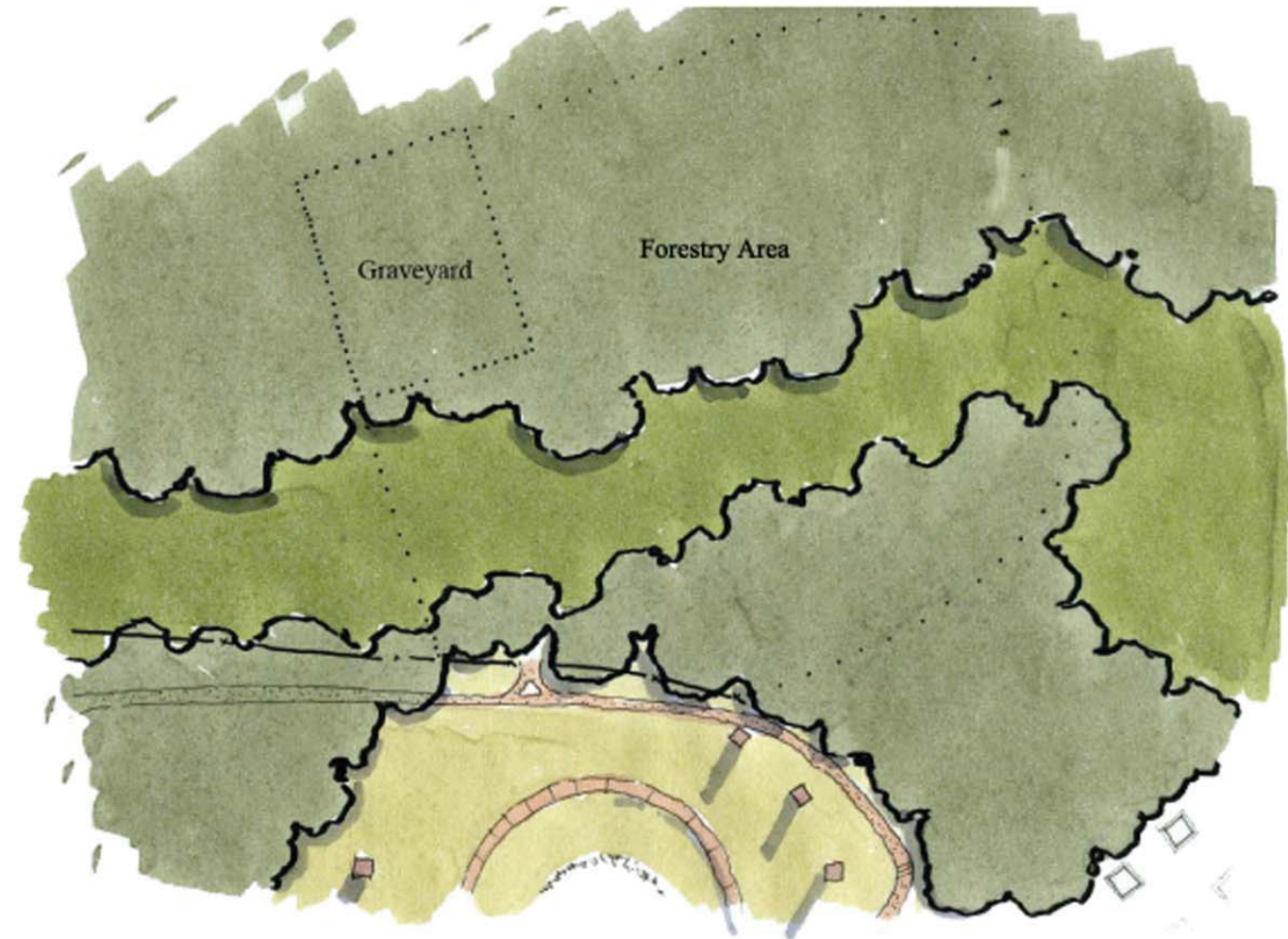


Top View of First Layer

Top Stone in Blaze Color



Cairns are a unique aesthetic installation that are composed native rocks piled together

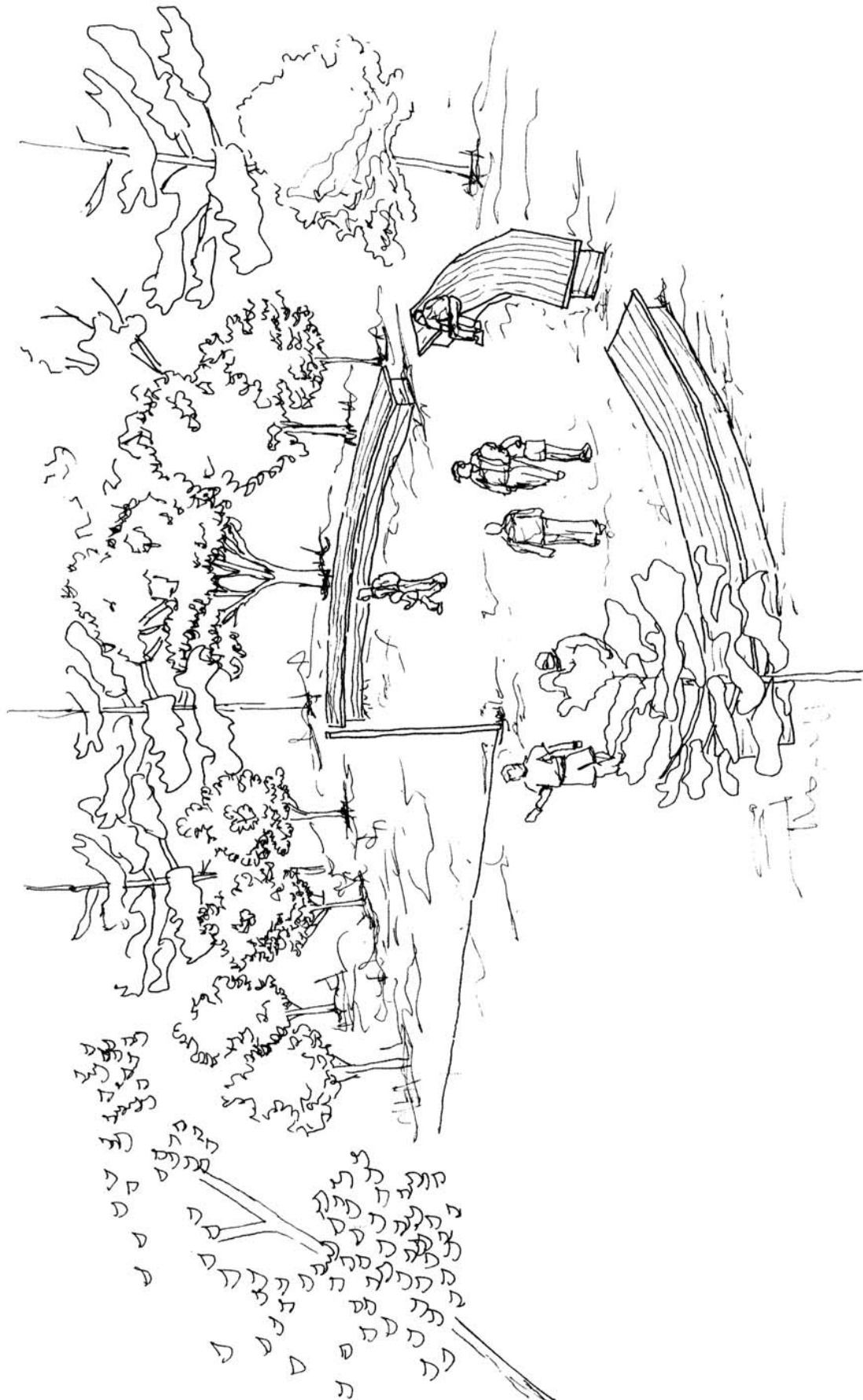


Images from [www.buckeyetrail.org/blaze.jpg](http://www.buckeyetrail.org/blaze.jpg)



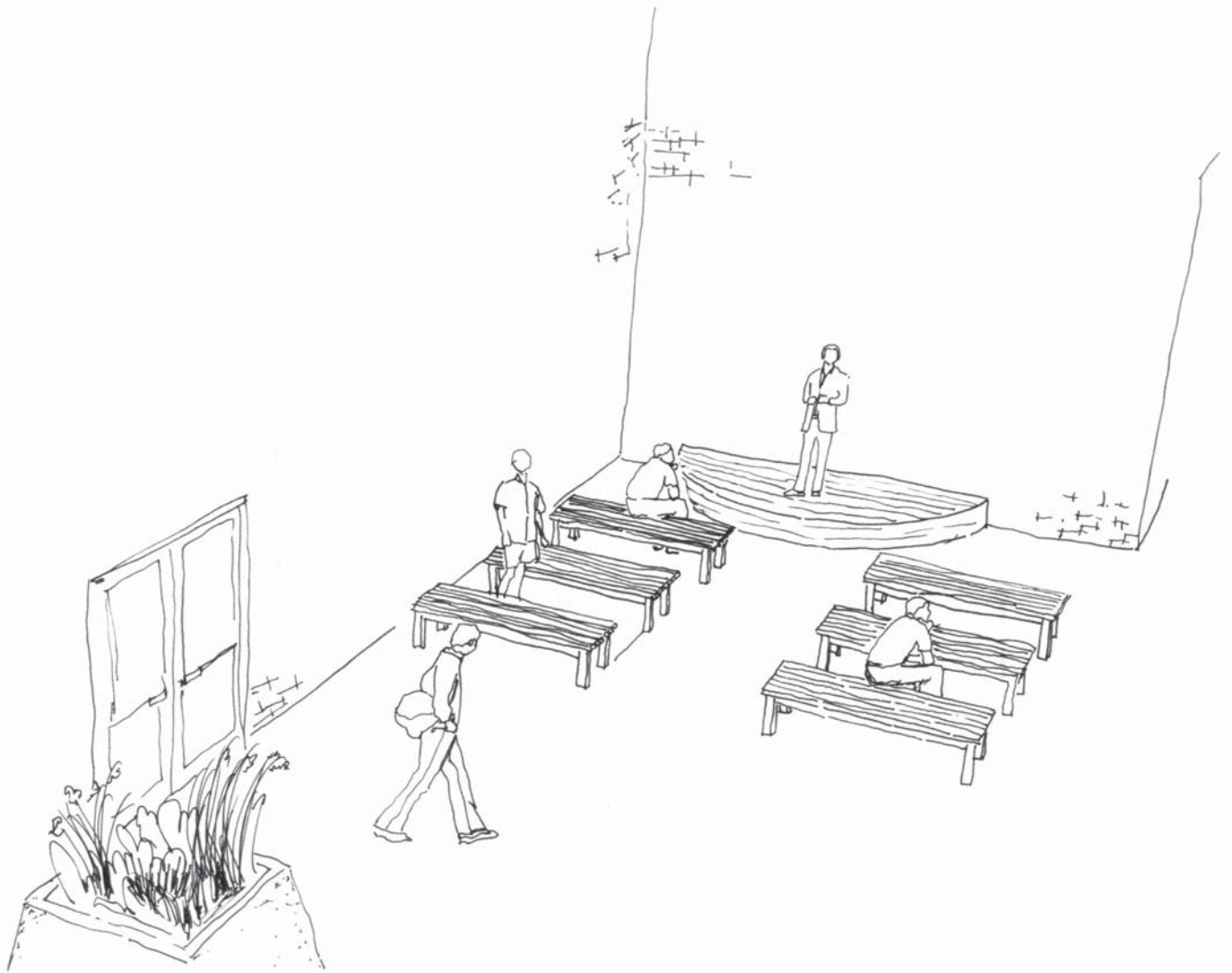
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Wildlife and Sundial Assembly Area



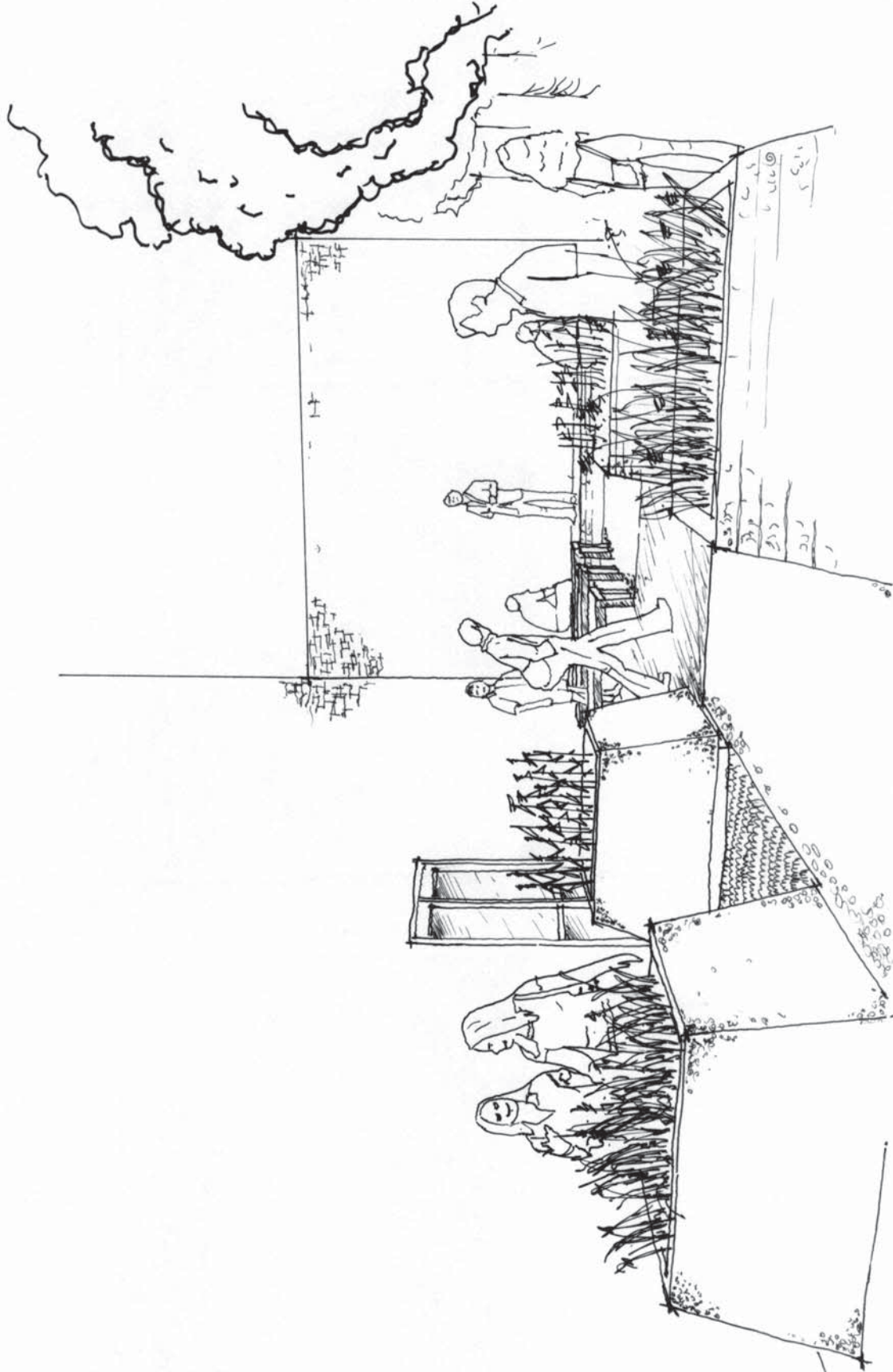


Outdoor Classroom Lecture Area

Ervinton High School

Outdoor Classroom





Planter Area



# Conclusion

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Outdoor educational facilities prove to be beneficial for schools of all grades and students of all ages. As the newly coined mental health problem of *Nature Deficit Disorder*<sup>7</sup> is realized, the importance of interaction outdoors and consistently learning in three dimensions becomes increasingly important. Engaging with nature and the processes that mold the everyday landscape will prove to increase motivation and excitement for learning.

At the base level, the construction of an outdoor lecture classroom will provide the opportunity to experience the outdoors while being taught. Also, the improvement of the trail that meanders through the woodlands and through "Death Valley" creates opportunities for recreation and observation.

The specified learning stations utilize the existing conditions on the property to engage the students in hands-on learning. Visual and interactive/participatory education can dramatically increase what students are able to learn, while at the same time making the process and lessons more interesting. The stations provide opportunities for both objective and interpretive learning, increasing the creative capacity of the students minds.

The design, when installed, will be one-of-a-kind in the county, and will serve as a model for other schools to follow. The construction phase of the design specifies that the students and the community should be involved to increase a sense of pride and ownership for the outdoor classroom; serving as a vocational learning experience as well.

Ervinton High School will positively benefit from the construction of the outdoor classroom and stations. The learning environment will be uplifting and exciting for the students now and in the future.

7. Term coined in the book [Last Child in the Woods](#) by Richard Louv



# Appendix A: Planter

Displayed is an assortment of materials and sizes for planters that can be used as models or purchased for the planter lab area of the courtyard.



Example of wooden planters that are large in scale. Image taken from <http://www.simplyplanters.com/planter-boxes/wood/products.cfm?action=view&key=WC024>



Smaller in scale, the construction of this planter is easy and can be easily adapted and modified. Image taken from <http://www.oldgrowthagain.org/planters.html>



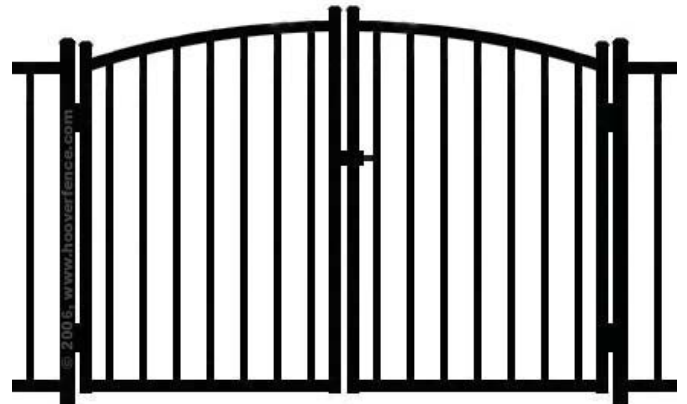
Much more durable, these planters aren't going anywhere. Their weight and large scale make these a good choice for heavy use. Image taken from [http://www.fsindustries.com/more\\_info/planters/planters.shtml](http://www.fsindustries.com/more_info/planters/planters.shtml)

# Appendix B: Gates

Displayed are gate options that could be used at the far end of the football field and at the eastern edge of the courtyard area.



Example of a wooden gate. Image taken from <http://www.hooverfence.com>



Example of a metal gate. Image taken from <http://www.hooverfence.com>



## Appendix C: Soil Pit

The soil pit is a bit tricky in construction and envisioning how it might work. Here are a few successful examples of soil pits.



Seating and viewing are critical in constructing a soil pit. Ease and effectiveness of demonstration is enhanced with an establishment such as this. Image found at [http://www.bcg.org.au/cb\\_pages/images/images/06MainFieldDay\\_SoilPit\\_640.jpg](http://www.bcg.org.au/cb_pages/images/images/06MainFieldDay_SoilPit_640.jpg)



Safety is displayed by using the caution tape and the clean cut construction keeps the audience engaged in the demonstration. Image found at <http://www.ipm.iastate.edu/ipm/icm/files/images/soilpit2.jpg>

## Appendix D: Aquatic

On display are several examples of tables that could be used for the aquatic station.



Image taken from <http://www.scalisemarine.com/Fishtable.htm>



Image taken from <http://images.google.com/imgres?imgurl=http://www.buckwoodcraft.com/>



Image taken from <http://www.buckwoodcraft.com/Central%20Drain%20Table%20Web.jpg>

# Appendix E: Tree Blazes

Various forms of markings are available for trees. The most efficient and beneficial way would be to color code or number the trees and provide the students with a legend to serve as a key, identifying species.



A color painted on the tree to signify a trail or type of tree. Image taken from <http://www.pinemountaintrail.org/photos/faq1.jpg>



A number used to label the tree. Image taken from <http://www.pinemountaintrail.org/photos/faq1.jpg>



# Appendix F: Container Crops

The CDAC design team researched crops suitable for container growth. All are easily available via seed. None require drastically different medias for growth. With this in mind, a standard soil mix could be used and then altered, per raised bed, for experimentation purposes. For example, the pH could be altered using a liming material to raise it or a sulfur substance to lower it and differences in plant quality and yield per soil type could be studied.

Some suggested crops available for harvest early in the season (in line with timing for the school calendar) include:

- broccoli
- spinach
- cabbage
- snow peas
- lettuce
- egg plant
- cauliflower
- herbs (many types would work)

A helpful website with detailed information about a plethora of crops is <http://www.ext.vt.edu/resources/>. Production and management guides can be found for any crop that is acclimated to Virginia.

Season extenders can be purchased or constructed. These structures would enable EHS to harvest vegetable crops before the end of the school year (where without a season extender, they could not be harvested until later in the season). Information on season extenders can be found at [www.ext.vt.edu/pubs/envirohort/426-381/426-381.html](http://www.ext.vt.edu/pubs/envirohort/426-381/426-381.html).

Modifying season extenders into the containers used in the courtyard area of the outdoor classroom could be easily done (See pages 29-31 for more information). Some construction materials that are less prone to weathering include versalock block, accompanied by fabric liner to prevent seepage, and a simple light-emitting top such as a plastic or fiberglass cover.





Virginia Cooperative Extension  
*Knowledge for the Commonwealth*



## Season Extenders

Authors: Diane Relf Extension Specialist, Horticulture, Virginia Tech and Alan McDaniel, Extension Specialist, Horticulture, Virginia Tech

Publication Number 426-381, posted June 2000

To get the most out of a garden, you can extend the growing season by sheltering plants from cold weather both in early spring and during the fall. Very ambitious gardeners harvest greens and other cool-weather crops all winter by providing the right conditions. There are many ways to lengthen the growing season, and your choice depends on the amount of time and money you want to invest.

## Cold frames and hot beds

Cold frames, sun boxes, and hot beds are relatively inexpensive, simple structures providing a favorable environment for growing cool-weather crops in the very early spring, the fall, and even into the winter months. Some are elaborate and require a large investment, but are reasonable for those who are serious about having homegrown fresh vegetables during the winter.

Cold frames and sun boxes have no outside energy requirements, relying on the sun for their source of heat. Hot beds are heated by soil-heating cables (Fig. 1); steam-carrying pipes; or fresh, strawy manure buried beneath the rooting zones of the plants. All of these different types of structures collect heat when the sun's rays penetrate the sash, made of clear plastic, glass, or fiberglass.

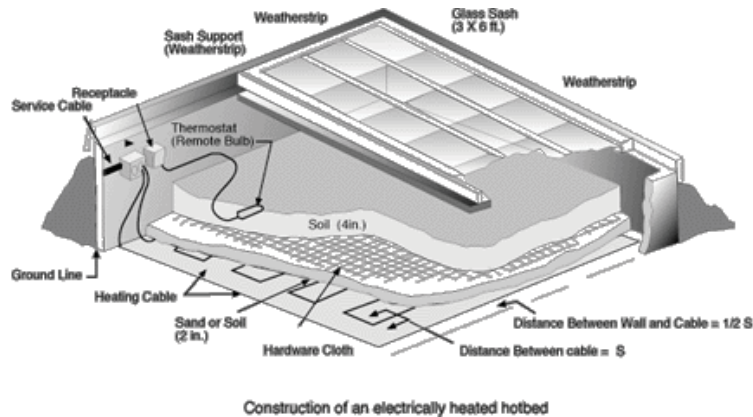


Figure 1. Construction of an electrically heated hotbed.



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The ideal location for a cold frame (Fig. 2) is a southern or southeastern exposure with a slight slope to ensure good drainage and maximum solar absorption. A sheltered spot with a wall or hedge to the north will provide protection against winter winds. Sinking the frame into the ground somewhat will also provide protection, using the earth for insulation. To simplify use of the frame, consider a walkway to the front, adequate space behind the frame to remove the sash, and perhaps weights to make raising and lowering of glass sashes easier. Some gardeners make their cold frames lightweight enough to be moved from one section of the garden to another. Another possibility is the Dutch light, which is a large, but portable, greenhouse-like structure that is moved around the garden.



Figure 2.

New designs in cold frames include passive solar energy storage. For example, barrels painted black and filled with water absorb heat during the day and release it at night. The solar pod (Fig. 3) is one design that provides for this type of heat storage. Other new cold frames are built with a very high back and a steep glass slope and insulated very well; these may also include movable insulation that is folded up during the day and down at night or during extremely cold weather.

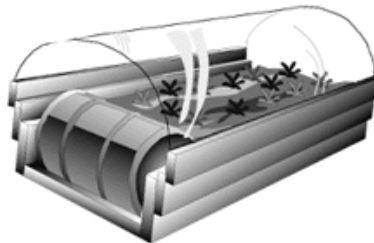


Figure 3.

You may convert your cold frame to a hotbed (Fig. 4). For a manure-heated bed: 1) dig out to 2 feet deep (deeper to add gravel for increased drainage); 2) add an 18-inch layer of strawy horse manure; and 3) cover with 6 inches of good soil. For an electric heated bed: 1) dig out an area 8 inches deep; 2) lay down thermostatically controlled electric cable in 6- to 8-inch long loops, evenly spacing cable, but never crossing; 3) cover with 2 inches of sand or soil; 4) lay out hardware cloth to protect cable; and 5) cover with 4 to 6 inches of good soil.



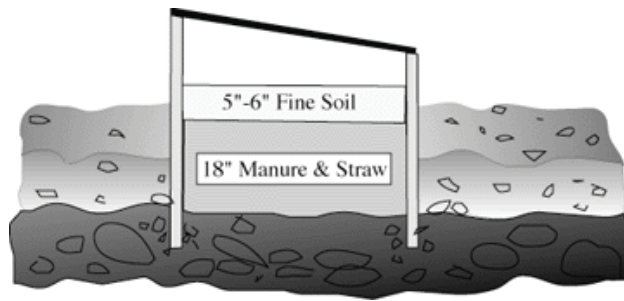


Figure 4. Hotbed using manure.

## Building a Cold Frame

Growing frames can be built from a variety of materials; wood and cement block are the most common. If you use wood, choose wood that will resist decay, such as a good grade of cypress or cedar. Wood frames are not difficult to build. Kits may also be purchased and easily assembled; some kits even contain automatic ventilation equipment.

There is no standard-sized cold frame. The dimensions of the frame will depend on amount of available space, desired crops, size of available window sash, and permanency of the structure. Do not make the structure too wide for weeding and harvesting; 3 to 4 feet is about as wide as is convenient to reach across. The sash of the frame should be sloped to the south to allow maximum exposure to the sun's rays.

Insulation may be necessary when a sudden cold snap is expected. A simple method is to throw burlap sacks filled with leaves over the sash on the frame at night to protect against freezing, or bales of straw or hay may be stacked against the frame.

Ventilation is most critical in the late winter, early spring, and early fall on clear, sunny days when temperatures rise above 45°F. The sash should be raised partially to prevent the buildup of extreme temperatures inside the frame. Lower or replace the sash each day early enough to conserve some heat for the evening.

In summer, extreme heat and intensive sunlight can damage plants. This can be avoided by shading with lath or old bamboo window blinds. Watering should be done early so that plants dry before dark, to help reduce disease problems.

## Using Your Cold Frame

In early spring, a cold frame is useful for hardening-off seedlings that were started indoors or in a greenhouse. This hardening-off period is important as seedlings can suffer serious setbacks if they are moved directly from the warmth and protection of the house to the garden. The cold frame provides a transition period for gradual adjustment to the outdoor weather. It is also possible to start cool-weather crops in the cold frame and either transplant them to the garden or grow them to maturity in the frame.

Spring and summer uses of the cold frame center on plant propagation. Young seedlings of hardy and



half-hardy annuals can be started in a frame many weeks before they can be started in the open. The soil in a portion of the bed can be replaced with sand or peat moss or other medium suitable for rooting cuttings and for starting sweet potato slips.

Fall is also a good time for sowing some cool-weather crops in frames. If provided with adequate moisture and fertilization, most cool-season crops will continue to grow through early winter in the protected environment of the cold frame. Depending on the harshness of the winter and whether or not additional heating is used, your frame may continue to provide fresh greens, herbs, and root crops throughout the cold winter months.

## Cloches, Tunnels, and Row Covers



Figure 5.

The cloche (pronounced klosch) was originally a bell-shaped glass jar set over delicate plants to protect them from the elements (Fig. 5). The definition has expanded, however, to include many types of portable structures that shelter plants from drying winds and cold air.

The idea is to provide a greenhouse-like atmosphere for seeds and small plants in order to get an early start on the season or to extend the fall garden as long as possible.

Cloches are set out over individual plants or are made into tunnels for whole rows. They trap solar radiation and moisture evaporating from the soil and plants. The hotcap is a simple form. More elaborate ones are fiberglass tunnels, special plastic cloches, row covers (Fig. 6.) with slits in them to allow some aeration, and panes of glass connected by specially designed hinges to form a tent. There are a variety of forms on the market now, some work, some don't, and some are easily constructed from materials around the home.

Cloches are generally lightweight, portable, and reusable. It is preferable to have a design that can be closed completely at night to prevent frost damage and opened or completely removed during the day for good air circulation. Cloches should be anchored or heavy enough that they don't blow away.

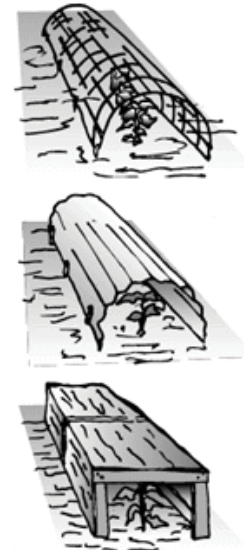


Figure 6.

## Floating Row Covers

Row covers are a more recent development in extending vegetable production past frost dates. They are simple devices, pieces of material (in spunbonded polyesters) laid over transplants in the field. As the plants grow taller, the plants push up the material. Row covers retain heat and protect against frost so crops can be planted earlier in the spring and harvested later in the fall. They have demonstrated insect and vertebrate pest protection while also protecting plants from wind damage. Row covers generally provide 4 to 5 degrees of frost protection, so cool-season crops can be planted in air temperatures as low as 28°F. Covers should be removed from the crops when air temperatures beneath the cover reach 80°F. Problems associated with row covers are lower light transmission, as nonwoven materials allow 75 to 80% transmission of light to the crop. The fabric covers can be extended through two seasons if treated with care. If used in conjunction with other season-extending techniques, row covers can mean earlier harvests with greater yields in addition to extended harvests.



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## Hotcaps

Hotcaps (Fig. 7) function as miniature greenhouses, trapping the heat from solar radiation. An effective hotcap transmits sufficient solar energy for photosynthesis and for warming the air inside, but not so much that overheating damages the plant. Hotcaps also must retain sufficient heat throughout the night to protect plants against low-temperature injury. Hotcap designs vary from wax paper cones to water-filled, plastic tepees (Wall-O-Water™). All hotcap designs are most effective during sunny weather and have little effect on temperature during cloudy periods. The greatest temperature differences occur during sunny days and clear nights. However, hotcaps transmit less than 70 and 50% of the available solar energy and photosynthetic photon flux, respectively. The reduced light transmittance contributes to poor plant development inside hotcaps. Low light transmittance may lead to stunted and/or chlorotic plants. Using hotcaps, the mean time to first ripe fruit can be decreased by as much as five to ten days.



Although the Wall-O-Water™ is reusable, cleaning is time consuming, and the Wall-O-Water™ is quite expensive compared to other hotcaps. However, research has shown them to be more effective than other materials and can add several weeks growth to the early part of the season. Wax paper hotcaps are easy to install and disposable. Plastic jugs may be difficult to secure in the field and can only protect small plants; they do not retain sufficient heat to provide frost protection. They can delay fruit development unless ventilation is provided and can become hot enough to kill plants. For most gardens, simply cover plants overnight if there is a danger of frost. Be sure to remove the covering during the day.

## Greenhouses

There is an almost overwhelming selection of greenhouses on the market, and plans for building even more types are available. If you intend to purchase or build a greenhouse, it is wise to investigate the alternatives thoroughly, preferably visiting as many operating home greenhouses as possible. List your needs and wants ahead of time, and determine how you will use your greenhouse. Then compare on that basis. Many companies will send free specifications and descriptions of the greenhouses they offer; look in gardening magazines for their ads.

The conservation-minded person may find a solar greenhouse desirable. The initial cost is generally higher for a solar greenhouse than for the simpler, free-standing, noninsulated types, but for maximum use with lower heating bills, one can insulate north and side walls, provide liberal glass area for winter sun-catching, and make use of some type of solar radiation storage. When attached to a house, these greenhouses can be used for supplementary household heating, but there is a trade-off between heating the home and growing plants (especially heat-loving ones) in the greenhouse. Some researchers have concluded that a good compromise is to forget winter tomatoes and grow cool-weather crops during the winter in a solar attached greenhouse. In addition, they may retain excessive amounts of heat from late spring to fall and can make cooling the home more difficult.

## Shading

It is not always easy to start seeds or young plants for fall crops in the hot and dry conditions of August. One simple way to provide shade in otherwise exposed conditions is to build a portable shade frame for placing over rows after seeds are sown or transplants are set out. This can be the same type of frame



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used for starting early seeds, but using lath strips or an old bamboo shade instead of plastic.

**Disclaimer:**

Commercial products are named in this publication for informational purposes only. Virginia Cooperative Extension does not endorse these products and does not intend discrimination against other products which also may be suitable.

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Visit [Virginia Cooperative Extension](#)

<http://www.ext.vt.edu/pubs/envirohort/426-381/426-381.html>

6/6/2007



# Appendix G: American Chestnut

"The American Chestnut (*Castanea dentata*) was one of the most important forest trees throughout much of the eastern United States and southeasternmost Canada. A rapidly growing deciduous hardwood tree, it reached up 100-150 ft tall and 10 ft in diameter, and ranged from Maine and southern Ontario to Mississippi, and from the Atlantic coast to the Appalachian Mountains and the Ohio Valley" ([http://en.wikipedia.org/wiki/American\\_chestnut](http://en.wikipedia.org/wiki/American_chestnut)).

"In the first 40 years of the 20th century, blight destroyed 3.5 billion American chestnuts. What had been the most important tree in our Eastern forest was reduced to insignificance. No comparable devastation of a species exists in recorded history" (<http://imp.ppws.vt.edu/griffin/accf.html>).

There exists a chestnut cooperative headed by Gary Griffin, Virginia Tech extension faculty member, Plant Pathology and Weed Science Department. "The American Chestnut Cooperators' Foundation is a nonprofit scientific and educational foundation dedicated to restoring the American Chestnut to its former place in our Eastern hardwood forests. Priorities include the development of blight-resistant all-American chestnuts and economical biological control measures against chestnut blight in the forest environment. As of April 2006, our cooperating growers have planted 113,257 seedlings and 55,580 seednuts from our all-American orchards" (<http://imp.ppws.vt.edu/griffin/accf.html>).

Detailed information on obtaining seeds can be found at the American Chestnut Cooperators' Foundation website. If students and faculty are interested in participating in the ACC program, they should visit the site and also directly contact Gary Griffin and indicate the seeds or seedlings would be used for an outdoor classroom at a public school in SW Virginia.



Stately American chestnut. Image taken from <http://news.uns.purdue.edu/images/+2004/jacobs-chestnuts.jpg>



American chestnut, showing exposed seed. Taken from <http://www.cooperativeconservationamerica.org/images/American-Chestnut.jpg>



### Explanation of Soil Tests

*Greg Mullins, 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. 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 <sub>2</sub> O <sub>5</sub> = phosphate
K <sub>2</sub> 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 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 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

The lime recommendations are for a single application that will last two to three years. After that time, you should have the soil retested. When you did not supply information on the Soil Sample Information Sheet regarding 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 to be planted to allow time for more complete soil reaction.

#### Methods and Meanings

**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



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Produced by Agriculture and Extension Communications, Virginia Tech

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VT/0305/W/452701



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to plants. It is determined on a mixed suspension of 1:1, volume to volume ratio of soil material to distilled water.

A Mehlich buffer solution is used to determine the **Buffer pH** to provide an indication of total (active + residual [or reserve]) acidity, a major factor in determining the lime recommendation. A reported Buffer pH of "N/A" means that it was not measured since the soil (water) pH was either neutral or alkaline and not acidic.

**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.

Soluble Salts (**SS**) or fertilizer salts are estimated by measuring the electrical conductivity of a 1:2, vol:vol ratio of soil material to distilled water. A too-high SS level can injure plants.

Soil **Organic Matter** is estimated by using either the weight Loss-On-Ignition from 150° to 360°C (LOI method), or a modified Walkley-Black method. The percent of organic matter in a soil affects the application rate of herbicides and generally, the greater the organic matter level, the better the overall soil quality.

Estimated Cation Exchange Capacity (**Est-CEC**) gives an indication of a soil's ability to hold some nutrients against leaching. 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 pH 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 acidity (as measured by the Buffer pH) on cation exchange sites to the total CEC sites. A reported **Acidity%** of "N/A" means that a buffer pH was not measured, and the acidity is probably less than 1 meq/100g and/or 5%.

The percent **Base Saturation** is the ratio of the quantity of exchangeable bases (Ca, Mg, and K) to the CEC.

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

### Additional Information

For more information, contact your local Virginia Cooperative Extension office or go to <http://www.ext.vt.edu>.

### 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



# Virginia Cooperative Extension

## Soil Test Report

Virginia Tech Soil Testing Laboratory  
 145 Smyth Hall (0465)  
 Blacksburg, VA 24061  
 www.soiltest.vt.edu

SEE ENCLOSED NOTES: <b>X 1 20</b>
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BLACKSBURG,

### SAMPLE HISTORY

Sample ID	Field ID	LAST CROP		LAST LIME APPLICATION		SOIL INFORMATION				
		Name	Yield	Months Prev.	Tons/Acre	SMU-1 %	SMU-2 %	SMU-3 %	Yield Estimate	Productivity Group
N1										

### LAB TEST RESULTS (see Note 1)

Analysis	P (lb/A)	K (lb/A)	Ca (lb/A)	Mg (lb/A)	Zn (ppm)	Mn (ppm)	Cu (ppm)	Fe (ppm)	B (ppm)	S.Salts (ppm)
Result	19	125	3249	400	1.5	20.2	0.2	7.8	0.5	
Rating	M-	M	VH	VH	SUFF	SUFF	SUFF	SUFF	SUFF	

Analysis	Soil pH	Buffer Index	Est.-CEC (meq/100g)	Acidity (%)	Base Sat. (%)	Ca Sat. (%)	Mg Sat. (%)	K Sat. (%)	Organic Matter (%)
Result	6.6	6.29	10.6	6.2	93.8	76.7	15.6	1.5	3.9

### FERTILIZER AND LIMESTONE RECOMMENDATIONS

CALL 540 231 5644 WHEN READY  
 Crop: SHRUBS, NON ACID-LOVING (245)

619. Lime recommendations: NONE NEEDED.

261. FERTILIZER RECOMMENDATIONS: See Note 20 (enclosed).



# Virginia Cooperative Extension Soil Test Report

Virginia Tech Soil Testing Laboratory  
145 Smyth Hall (0465)  
Blacksburg, VA 24061  
www.soiltest.vt.edu

SEE ENCLOSED NOTES: <b>1 20</b>
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**SAMPLE HISTORY**

Sample ID	Field ID	LAST CROP		LAST LIME APPLICATION		SOIL INFORMATION				
		Name	Yield	Months Prev.	Tons/Acre	SMU-1 %	SMU-2 %	SMU-3 %	Yield Estimate	Productivity Group
G1				---	None applied.					

**LAB TEST RESULTS (see Note 1)**

Analysis	P (lb/A)	K (lb/A)	Ca (lb/A)	Mg (lb/A)	Zn (ppm)	Mn (ppm)	Cu (ppm)	Fe (ppm)	B (ppm)	S.Salts (ppm)
Result	26	134	4686	336	2.3	47.9	0.8	43.2	0.8	
Rating	M	M	VH	VH	SUFF	SUFF	SUFF	SUFF	SUFF	

Analysis	Soil pH	Buffer Index	Est.-CEC (meq/100g)	Acidity (%)	Base Sat. (%)	Ca Sat. (%)	Mg Sat. (%)	K Sat. (%)	Organic Matter (%)
Result	7.5	N/A	13.2	N/A	100.0	88.3	10.4	1.3	1.7

**FERTILIZER AND LIMESTONE RECOMMENDATIONS**

Crop: SHRUBS, NON ACID-LOVING (245)

619. Lime recommendations: NONE NEEDED.

261. FERTILIZER RECOMMENDATIONS: See Note 20 (enclosed).



# Virginia Cooperative Extension Soil Test Report

Virginia Tech Soil Testing Laboratory  
145 Smyth Hall (0465)  
Blacksburg, VA 24061  
www.soiltest.vt.edu

SEE ENCLOSED NOTES:

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**WHITEHOUSE JACOB**

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**BLACKSBURG,**

### SAMPLE HISTORY

Sample ID	Field ID	LAST CROP		LAST LIME APPLICATION		SOIL INFORMATION				
		Name	Yield	Months Prev.	Tons/Acre	SMU-1 %	SMU-2 %	SMU-3 %	Yield Estimate	Productivity Group
RC1				---	None applied.					

### LAB TEST RESULTS (see Note 1)

Analysis	P (lb/A)	K (lb/A)	Ca (lb/A)	Mg (lb/A)	Zn (ppm)	Mn (ppm)	Cu (ppm)	Fe (ppm)	B (ppm)	S.Salts (ppm)
Result	8	73	2678	356	1.5	13.3	0.3	7.3	0.3	
Rating	L	L+	VH	VH	SUFF	SUFF	SUFF	SUFF	SUFF	

Analysis	Soil pH	Buffer Index	Est.-CEC (meq/100g)	Acidity (%)	Base Sat. (%)	Ca Sat. (%)	Mg Sat. (%)	K Sat. (%)	Organic Matter (%)
Result	6.8	6.39	8.3	0.7	99.3	80.5	17.7	1.1	3.0

### FERTILIZER AND LIMESTONE RECOMMENDATIONS

Crop: SHRUBS, NON ACID-LOVING (245)

619. Lime recommendations: NONE NEEDED.

261. FERTILIZER RECOMMENDATIONS: See Note 20 (enclosed).

