Arlington
Echo

Outdoor Education Center

UNIVERSITY OF MARYLAND

Arlington Echo Outdoor Education Center

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Executive Summary

Arlington Echo is an outdoor education facility serving all primary and secondary public schools in Anne Arundel County. The facility is aging with one key building in need of replacement due to earthquake damage. It's location along the Severn River makes it a popular place for county agencies to book meetings and retreats leading to a major parking deficit onsite. In addition, the campus was not originally designed to accommodate wheel chair accessibility and needs to be fitted with trails and accommodations that enable physically challenged children to participate in the environmental learning activities offered at Arlington Echo.

A collaboration between the staff of Arlington Echo, the Partnership for Active Learning in Sustainability (PALS), and a team of undergraduate students in the Landscape Architecture Program at the University of Maryland led to four unique, conceptual master plans and site designs that allows for improved learning opportunities and allow students/participants of all abilities to have equal access on site and to experiences. The designs are presented in this report.

Following a three month process of research, design, interim reviews, and final design proposals, the design team recommends the following:

Figure 1. View across the Severn River

Improve campus infrastructure to current design standards. Arlington Echo has been serving Anne Arundel County Public Schools as the site for outdoor education for the past 40 years. Some of the buildings are in need of remodeling to maintain functionality and the level service needed to support the educational mission.

Expand the available parking spaces. There are currently 64 parking spaces spread ad hoc throughout the campus. Frequently there are more vehicles than parking spaces available, cars are being directed to double stack parking spaces and to park on the only on-site recreational field (damaging the field). Expanding the number of parking spaces, removing the ad hoc parking spaces and designing a standard parking lot will help reduce damage to the campus and preserve the teaching spaces.

Implement ADA accessible Trails. Students in wheelchairs are currently limited to the upper area of the campus, and a small stretch of dock at the water's edge. They are excluded from the forest trail educational system and the majority of the opportunities along the wetland edges. Arlington Echo's mission is to provide outdoor educational experiences to all students in Anne Arundel County. Implementing ADA accessible trails along the entirety of the site will enable Arlington Echo to fully achieve its mission.

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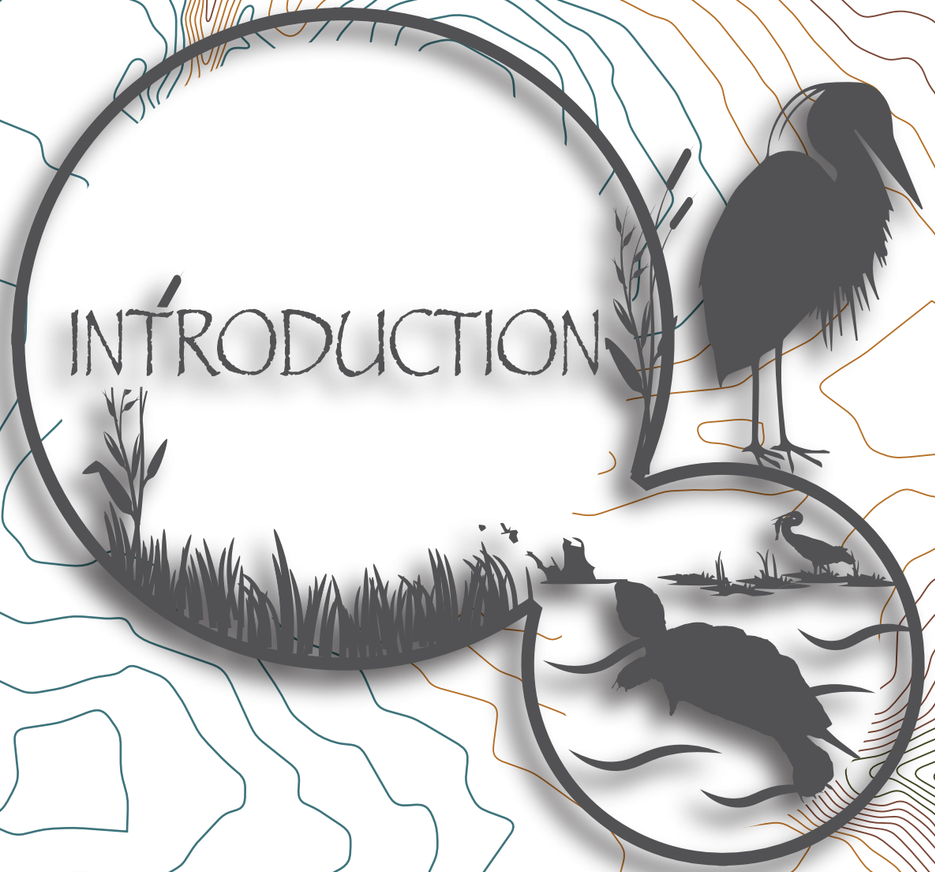


SEVERN RIVER

Introduction

Arlington Echo is The Environmental Literacy and Outdoor Education Office of Anne Arundel County Public Schools (AACPS). The 24-acer site located on the Severn River was purchased in 1971 from Arlington Presbyterian Church of Baltimore. It was then transformed from a youth camp into the Outdoor Education Center it is today. The site is dedicated to "Empowering students of all ages through authentic hands-on outdoor experiences with the environmental knowledge, skills, and motivation to make and act upon responsible environmental decisions." Through programs that are developed on site, Arlington Echo is able to provide face-to-face instruction to more than 25,000 students and 8,000 adults each school year. Since they are part of the curriculum and instruction of Anne Arundel County Public Schools, they are able to reach students at all grade levels.

Arlington Echo states that their goals are to:

Develop and implement a prekindergarten through high school environmental literacy curriculum and program that align the MSDE Environmental Literacy standards with up-to-date standards in other core content areas.

Empower teachers to use the environment and outdoors as a context for learning

Support the AACPS Strategic Plan of Community Involvement and Chesapeake Bay Watershed Agreement by serving as a community resource for educating and building stewardship among the citizens of Anne Arundel County

Design

Anne Arundel County has partnered with the Smart Growth Center PALS program to provide the design opportunity to the University of Maryland Landscape Architecture Studio of Spring 2017. The design process began with research on site design standards and analysis of the abiotic, biotic and cultural systems. These are documented in the following pages. The extensive analysis enabled a comprehensive understanding of what is on and around the site, as well as the issues that must be address through innovative design practices. A set of specific goals and objectives were developed to help guide design decision making.

Figure 2. Image found on the Arlington Echo web page

Goals:

- make all important site facilities accessible by wheelchair
- enhance the visual quality of the center along an environmental sustainability theme
- improve the outdoor teaching and activity spaces on site
- strengthen the resiliency of the center to accommodate the high student traffic
- maintain the goal to be a demonstration center for sustainability practices
- maintain and enhance the native biodiversity

Objectives:

- improve accessibility to the wetland walk
- reorganize the gathering spaces outside the dining facility
- develop a strategy to accommodate parking that protects people and the environment
- review current standards and opportunities for the challenge courses
- review/revise the existing trail circulation system
- enhance the function and visual quality of the arrival/drop off area
- identify opportunities for habitat creation/preservation
- develop a plan for a nature play space
- develop a stormwater master plan for improved water quality treatment (with a learning component)

Challenges:

- expansion of parking facilities
- creation of an accessible trail system to handicap
- re-envisioning of campus activity spaces
- improvement of visual quality and environmentally sustainable aesthetic
- maintenance and enhanced resiliency of the site biodiversity

Four design teams were established leading to four unique master plans for the Arlington Echo property. Each of these are presented after the analyses and standards. It is hoped that these designs will provide a foundation upon which a comprehensive upgrade for the outdoor education center can be built.

History of Arlington Echo

Arlington Echo Outdoor Education Center started out as a church camp in Millersville by the Arlington Presbyterian Church in Baltimore back in 1968. In 1971, the Board of Education purchased the 24-acre site called Camp Arlington Echo.

Throughout the years, the program grew to include site improvement, turning the original rustic camp into a year-round facility with heated cabins, a large Dining Hall, instructional Resource Lab, and a Field Hall. Arlington Echo continues to be the primary residential program facility for Anne Arundel County Public Schools.

In 2009, work began on the site to restore natural banits to the site. The restorations resulted in two bogs, native gardens, and a natural shoreline. Approximately 6,000 square feet of tidal wetlands and 250 linear feet of shoreline were created. The living shoreline stabilizes 250 linear feet of deteriorating bulkheads.

Mission Statement

The Arlington Echo mission is "To empower students of all ages through authentic hands-on outdoor experiences with the environmental knowledge, skills, and motivation to make and act upon responsible environmental decisions." According to the staff, their main goal is to connect children to the outdoors; "The more you are exposed to nature as a child, the better you will take care of the nature as an adult."

Present Day

Arlington Echo Outdoor Education Center offers students opportunities to explore and experience the natural environment on a year-round basis. Fourth graders are the main focus for their programs, but middle school, high school, and adult groups are also welcome. The center offers both daytrips and overnight stays. The activities at the Outdoor Education Center depend on the season. For example, in March, there is a lot of focus on learning about the weather, while the activities in June are often focused on learning about erosion.

Arlington Echo is located right next to the Severn River which enhances the natural hands-on experience for the children, such as catching/releasing & learning about fish and plankton. One of the most popular activities at Arlington Echo is canoeing on Severn River. The programs also have expansive weather and tree studies.

Figure 3. Site before restoration http://ecosystemrestoration.com/arlington-echo/

Figure 4. Site after restoration http://ecosystemrestoration.com/arlington-echo/

The camp is open year round, with lots of activity during the summer. Popular activities include canoeing, fishing, being out in the dark, the I & C course (Initiative Confidence Course), and hands-on experiences.

By the numbers:

~ 6,000 students per year

10-12 students per group

~ 1 1/2 foot tidal difference

Forest Habitat

The Atlantic White Cedar Restoration project seeks to restore the tree population because they are globally threatened. The east side of Arlington Echo's site is bordered by the Indian Creek Branch Cove. The soil conditions and hydrology in the cove are suitable for growing Atlantic White Cedars. Arlington Echo received funding to propogate the trees because they help improve the health of the Chesapeake Bay. Currently there are 40 seedlings, 88 living trees, and 25 dead trees.

Maintaining Forest

The goal is to maintain the natural feel of the site through minimal design disruption. There is a need to develop, expand, and preserve the site to rejuvenate its efficiency. Saving as many trees as possible through low impact development design will help preserve existing wildlife habitat. Designing within the exisitng forest and canopy cover will promote a cohesive space throughout the site.

Existing Trees

Some of the most prominent trees on the site are Inkberry (Ilex glabra), Red Oak (Quercus Rubra), Loblolly Pine (Pinus taeda), American Holly (Ilex opaca), Spanish Oak (Quercus falcata), and Chestnut Oak (Quercus montana).

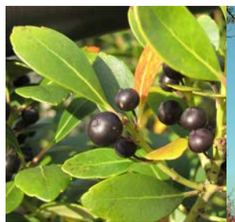


Figure 5. Inkberry-Ilex glabra

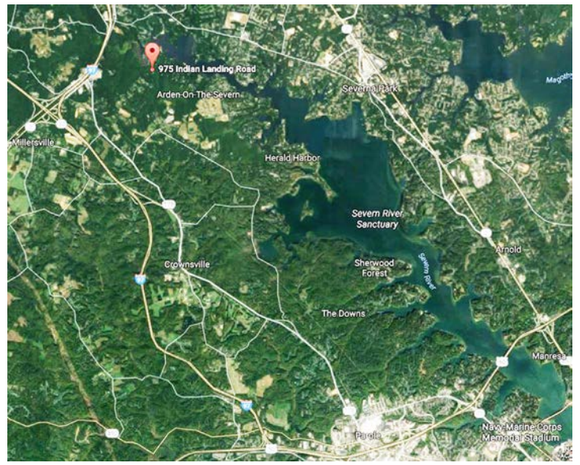
Figure 6. Red Oak Quercus rubra

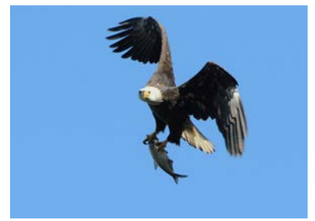
Figure 7. Loblolly Pine Pinus taeda

Figure 8. Chestnut Oak Quercus montana

Figure 9. Spanish Oak Quercus falcata

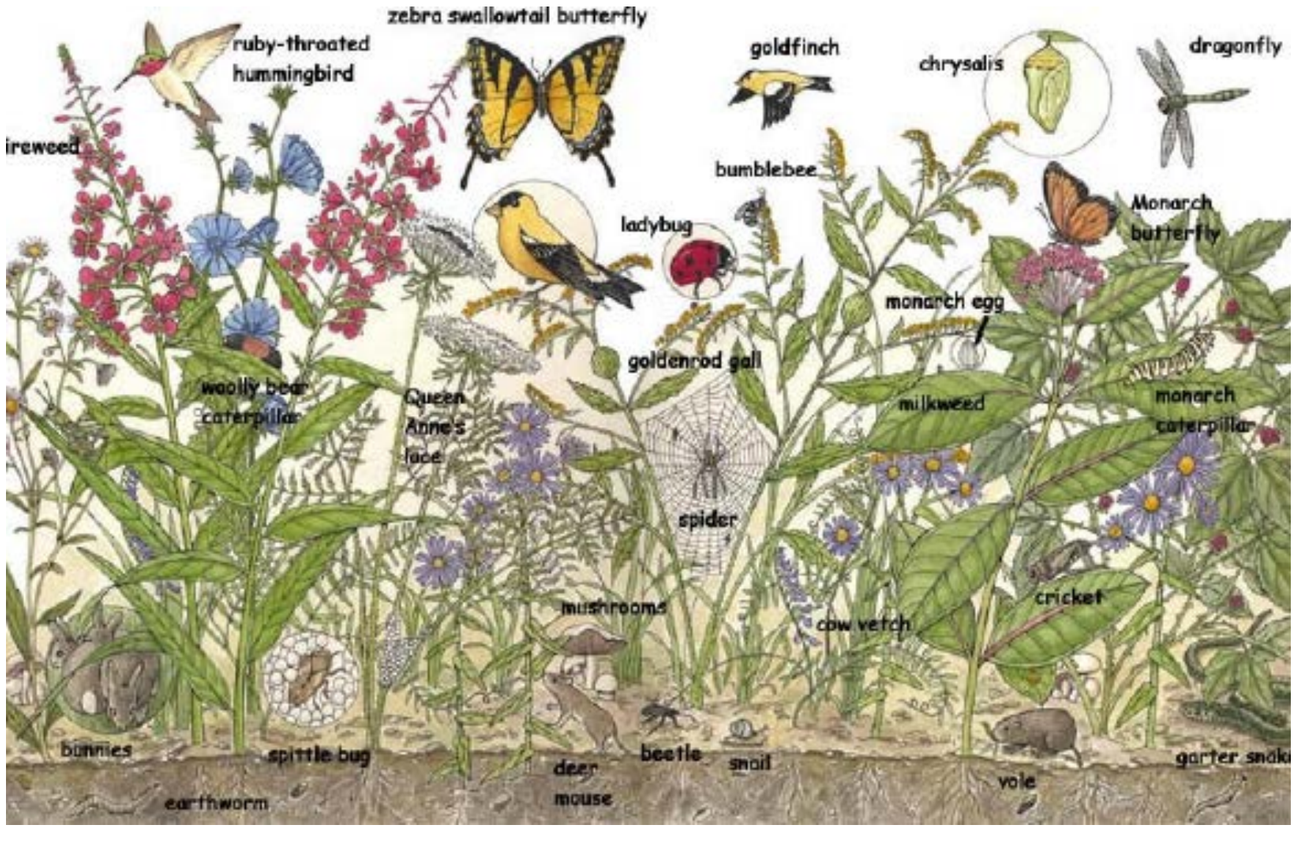
Figure 10. American Holly Ilex opaca





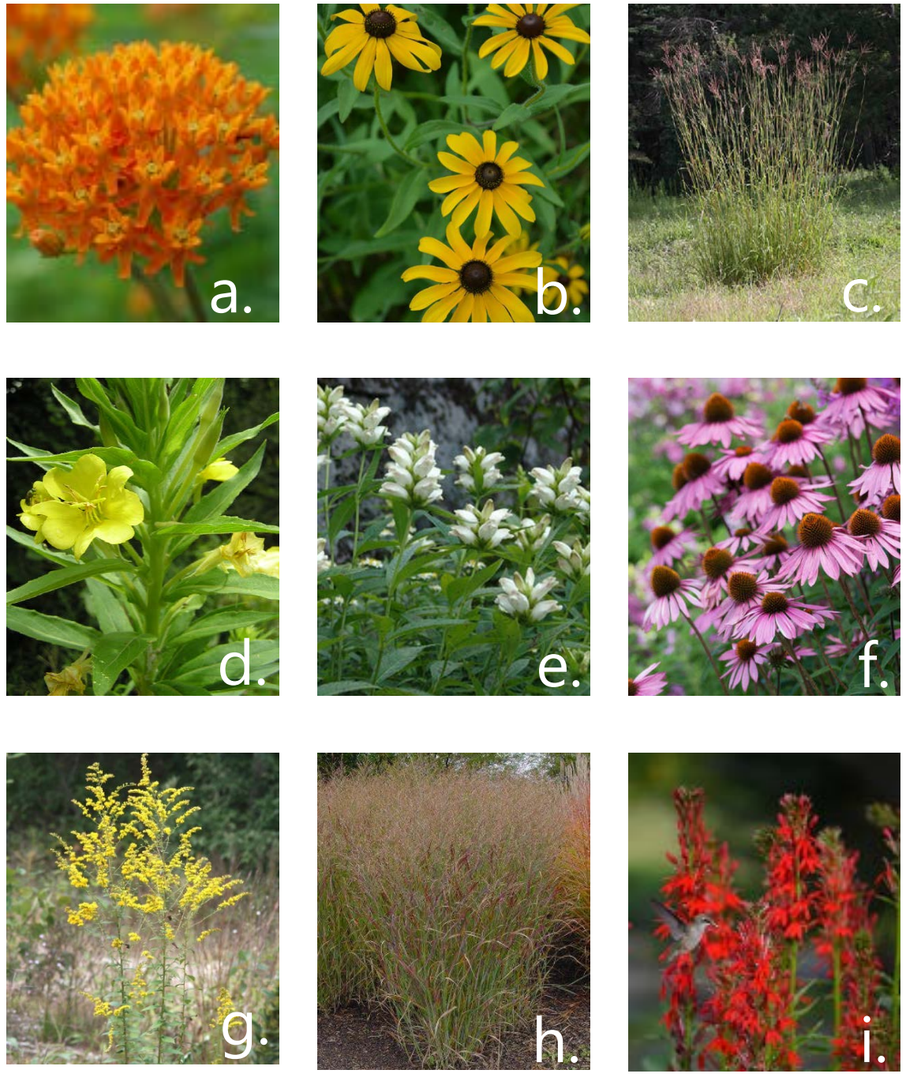
Meadow Habitat

A meadow habitat is an ecosystem composed of one or more plant communities dominated by herbaceous species; woody vegetation may also be present but is not a dominate characteristic. Meadows serve many functions between serving as a stormwater filter to an area that supports breeding grounds for many different species of animals and insects while also serving as a key source of food for many different species of bird. Meadows can be either dry or wet so when locating a proper meadow habitat it is more important that the site receives a minimum of direct sunlight for 6 hours a day.



Native Plant Selection

A. Butterfly Weed- (Asclepias tuberosa)
B. Black Eyed Susan- (Rudbeckia hirta)
C. Big bluestem (Andropogon gerardii)
D. Evening primrose (Oenothera biennis)
E. White turtlehead (Chelone glabra)
F. Purple coneflower (Echinacea purpurea)
G. Rough goldenrod (Solidago rugosa)
H. Switchgrass (Panicum virgatum)
I. Cardinal flower (Lobelia cardinalis)



https://www.nps.gov/plants/pubs/chesapeake/pdf/

Figure 11. https://www.exploringnature.org/db/view/1712

Aquatic Habitat

Arlington Echo's aquatic habitat is located along the Severn River within Anne Arundel County. The Severn River watershed is approximately 43,000 acres and has 40 smaller tributaries. The tributary located on Arlington Echo's site is known as the Indian Creek Branch. The salinity is dominated by the adjacent Chesapeake which is a balance between fresh water coming down the Bay from the Susquehanna River and denser salty water moving up the Bay near the south. During the spring and the fall maximum averages 11-12 parts per thousand while during the summer there is a low salinity. This means that many marine fish species that frequent saltier lower Chesapeake will not be found here. This also makes the Severn River a good place for oyster restoration because organisms that cause oyster disease do not flourish at these low salinities.

The temperatures of the surface water is much warmer than bottom water due to solar heating during the summer. This surface water has a lower density than the cooler bottom water, creating a layering effect that slows vertical mixing and prevents water with low dissolved oxygen levels to rise and become re-oxygenated by atmospheric oxygen.

Within the Severn river, there are many types of species that benefit from the habitat that the watershed provides. Among these species are the American Eel, Blue Catfish Bluegill, Brook Trout, Brown Bullhead, Channel Catfish, Common Carp, Flathead Catfish. Approximately 350 species of fish live in the Chesapeake Bay. Some fish are in the area all year-round round, while others swim into the Bay from the ocean to feed, reproduce or find shelter. Other species that live in this habitat are Great blue heron, Louisiana water-thrush and the yellow-crowned night-heron.

The Severn's water quality is measured through a monitoring program where 15 sampling stations are monitored every 1-2 weeks. Through these studies, it has been discovered that dissolved oxygen is a major problem affecting the water. There are multiple "dead zones" located throughout the Severn River, which are areas where the oxygen levels are below 0.2mg/liter; these levels would kill benthic organisms which are adapted to low oxygen levels such as 1mg/liter. There is a potential dead zone known as the Indian Landing, which is located across from the site's water front with about 41%-100% of waters having a dissolved oxygen level of >0.2 mg/l.

The Severn River relies on submerged aquatic vegetation (SAV) which is a critical habitat for fish and crabs. There are many species that sprout from roots or seeds each spring, but if the water is not clear, their leaves will not obtain adequate light for levels of photosynthesis needed for the plants to grow and reproduce. SAV growth had a set-back in 2000 but made a come back only in the mid-Severn, with minimal growth in the lower Severn below the Route 50 Bridge.

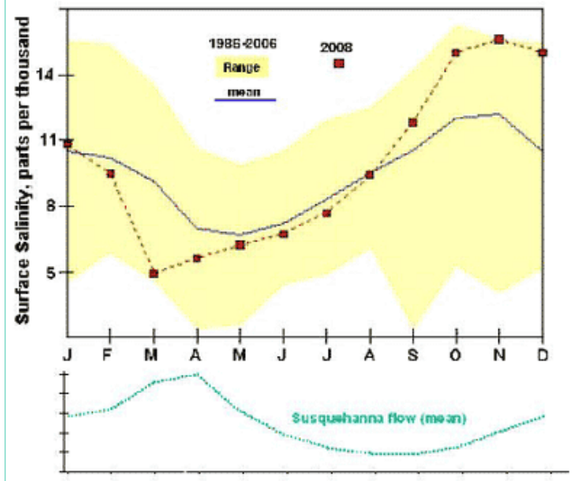


Figure 12. Annual Salinity Fluxuation

Figure 13. Severn River Watershed

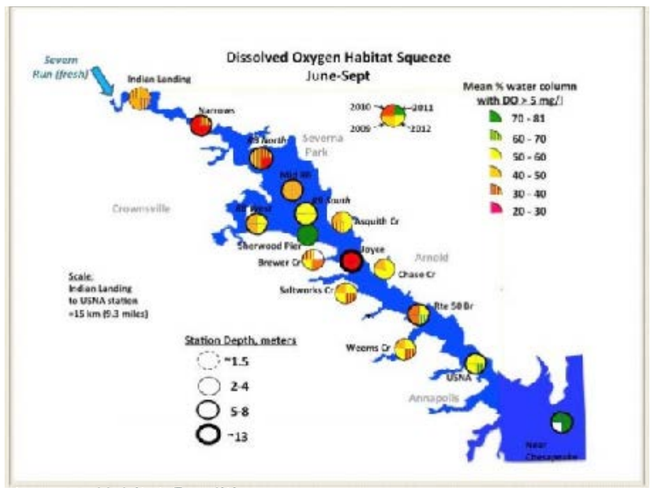


Figure 14. Habitat Conditions

Soils

Web Soil Survey Data

Arlingtopn Echo consists of four major soil groups. They are MZA, GaB, ZBA, and SME. Each of the soils listedhas unique qualities that make them suitable for different applications. For instance ZBA soils are not suitable for the application of roads like SME. The USDA web soil survey data has produced a soils report that gives the specific uses for all soils on the site.

Soils:

Galestown Loamy Sand

- Somewhat limited for paths and trails
- Hydrologic rating A

Mispillion and Transquaking Soils

- Very limited for paths and trails
- Hydrologic rating A/D
- High seedling mortality rate

Sassafras and Tranquaking

- Somewhat limited for paths and trails
- Hydrologic rating C
- Steep slopes

W -Water

Zekiah and Issue

- Very limited for paths and trails
- Has a .37 K factor for Erosion
- Frequently flooded
- Hydrologic rating B/D
- High seedling mortality rate

Map Unit Legend (ArlingtonEcho)

Anne Arundel County, Maryland (MD003)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
GaB	Galestown loamy sand, 0 to 5 percent slopes	10.4	44.8%
MZA	Mispillion and Transquaking soils, 0 to 1 percent slopes, tidally flooded	0.5	2.0%
SME	Sassafras and Croom soils, 15 to 25 percent slopes	11.2	48.1%
W	Water	0.5	2.2%
ZBA	Zekiah and Issue soils, 0 to 2 percent slopes, frequently flooded	0.7	2.8%
Totals for Area of Interest		**23.2**	**100.0%**

Figure 15. Soils Chart

Figure 16. Soil Boundaries

Figure 17. Trail Compatable Soils in Yellow

Slope and Drainage

Slope Analysis

The Arlington Echo campus is located on a ridge peninsula with steep slopes on the North, East, and South faces. The slope for the main activity spaces on top of the ridge or more gradual, no where achieving a slope greater than 5%. Along the faces with the steep slopes, there are existing pedestrian trails ranging from 2% up to 10%+ in some stretches. This slope percentage makes hiking more challenging, and prevents entirely anyone in a wheelchair or who requires ADA regulated walkways to get around. To be in compliance with ADA regulations, walkways and trails less than 5% do not require the presence of handrails, walkways between 5% and 8.3% require handrails as well as landings every 30 feet. Walkways and trails greater than 8.3% are considered not ADA accessible. The staff of Arlington Echo placed a strong emphasis on the desire to have as much of the site be ADA accessible, to allow the same benefits and experiences to everyone regardless of abilities. To achieve this goal, it will be necessary to use switchback style trails to make the change in elevation more gradual.

Drainage Analysis

To the north of the Arlington Echo peninsula is the Severn River, and to the south is Indian Creek, which flows directly into the Severn River. The Severn River flows directly into the Chesapeake Bay, entering the bay around Annapolis Port. The drainage area for the entirety of the Severn River is 44,203 acres. The arrows on the diagram indicate the direction of water flow based on contours. The site shows little evidence of water damage on the main campus where the slope is less than 5%, due to the drainage size of this relatively flatter portion of the site. There is evidence of erosion from stormwater runoff along several of the trails that lead towards the waters edge. This is due to the fact that several trails run perpendicular to the contours, following the natural drainage path for water. To prevent trails from being eroded by water, and to preserve the natural drainage systems on site, some of the trails require relocation.

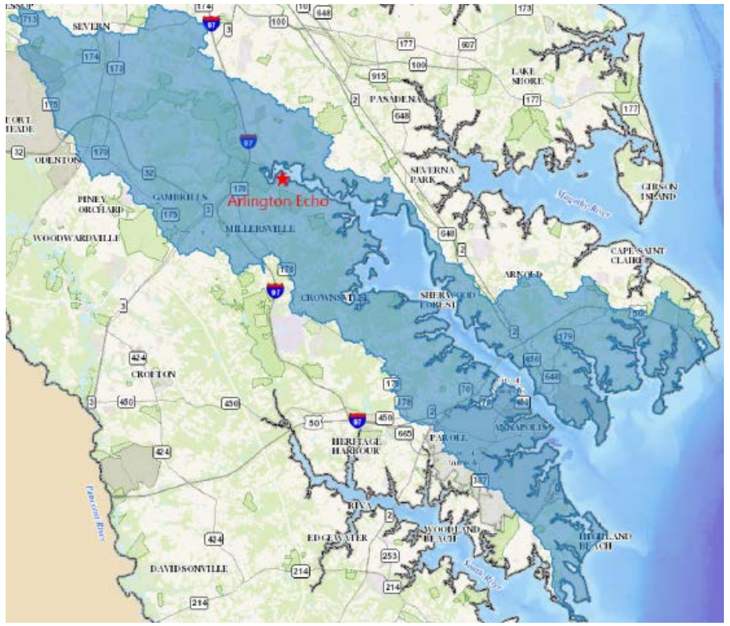


Figure 20. Map of the Severn River drainage area.

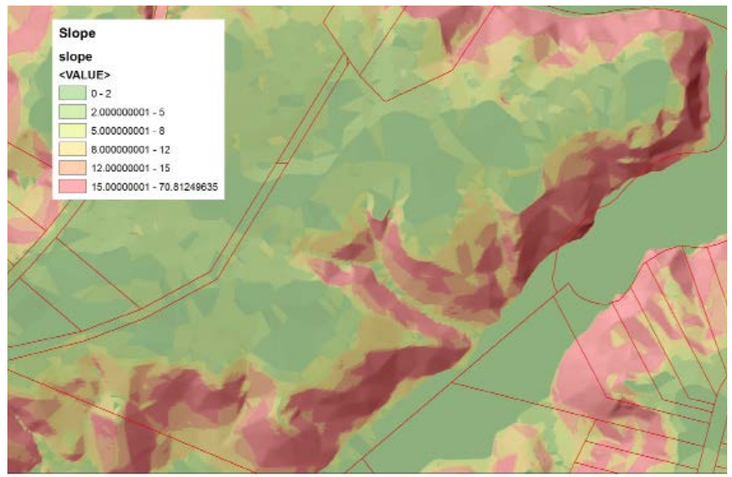


Figure 18. Slope percent map; Created using GIS and data from GIS

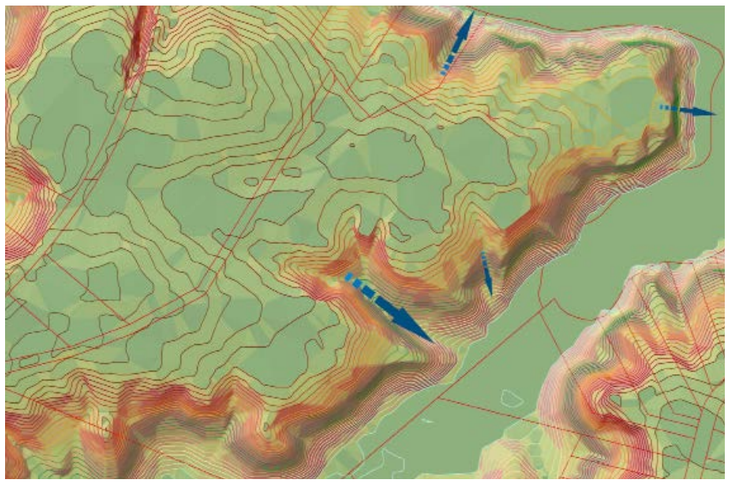


Figure 19. Drainage Map; Created using GIS and data from GIS

Figure 21. Map of the Chesapeake Bay Watershed.

Aspect and Climate

Climate Statistics

Located in Annapolis, MD, along the Severn River, Arlingon Echo has a fairly mild climate. The average annual teperature is 59°F, with a high of 67.8 °F and a low of 50.2 °F. The site recives a fair amount of precipiation, with an annual average of 47.32" of rain and 9" of snow.

Depending on the time of the year, the ammout of daylight that the site recieves rages from 9 to 14 hours. Humidity alos varies with the seasons, often raching up to 90 percent during the summer months. Natural disasters are somewhat uncomon. Very few hurricanes directly hit Maryland, although the effects from some can still be felt.

Site Conditions

The majority of the site is wooded so direct sunlight is reduced, often helping to reduce heat during summer days. The wooded conditions also help with reducing wind. Due to the sites changing topology, the orientation of the site is varied, with many of the slopes facing the sun between southeast and southwest.

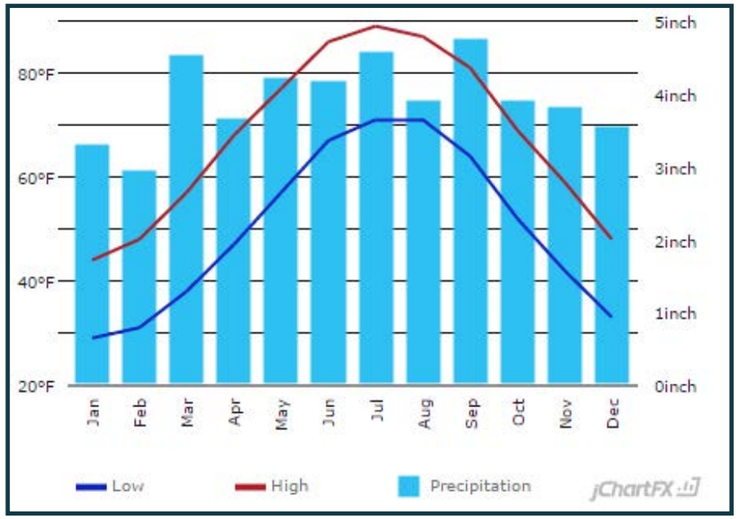


Figure 22. Annual Climate Data For Annapolis

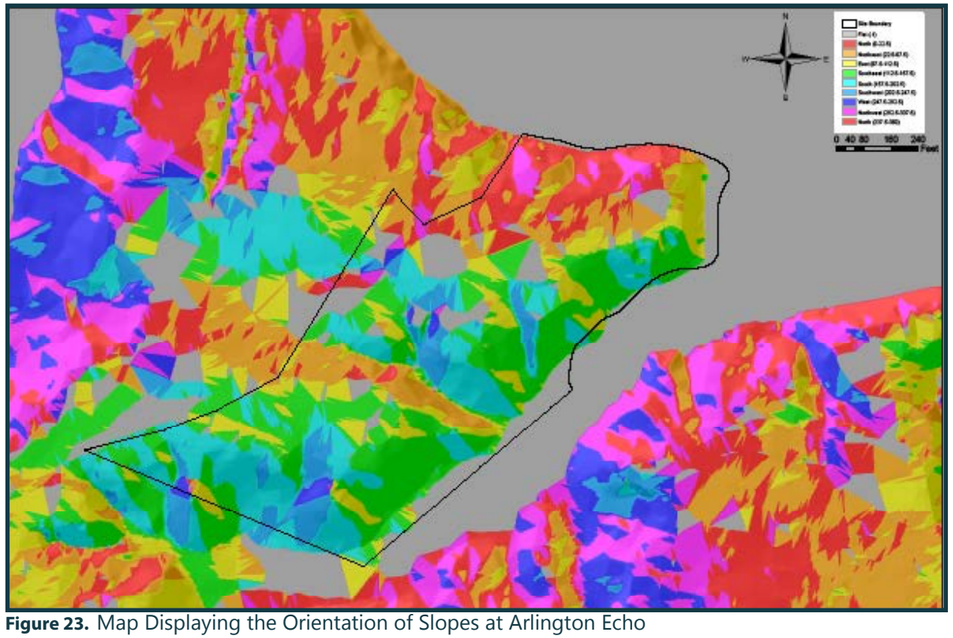


Figure 23. Map Displaying the Orientation of Slopes at Arlington Echo

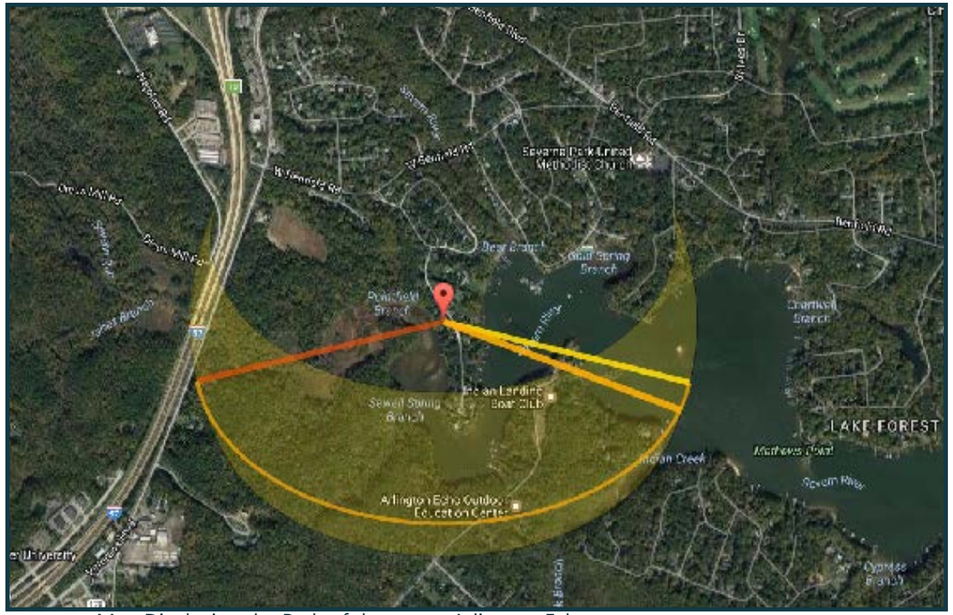


Figure 24. Map Displaying the Path of the sun at Arlington Echo

Site Circulation (Vehicular, Walkways, Trails)

Figure 25. Circulation of Arlington Echo

Arlington Echo Site Map

a. bus circle

b. amphitheater

c. parking spaces

d. wheelchair lift

e. trails

Problems

- limited accessibility
  - cannot access many areas such as the amphitheater and trails.
- poorly designed drive way for buses and food trucks.
  - the roads are too narrow for buses to make a U-turn to leave the site
- Not enough parking spaces

Traffic

- most vehicle traffic occurs at the entrance to the site and the parking lot.
- pedestrian traffic varies depending on time.
  - day time: trail, cabin and dining area, and shore
  - Night time: cabin and dining area.

Existing Pavement

- vehicular path: asphalt
- walkways: concrete
- trails: unimproved natural soil

Minimum Turning Radius (ft-in)

Vehicle Type	Outside Front R	Inside Rear R
- Composite Private Vehicle	26-0	15-6
- School Bus	43-6	28-7

Natural History of the Severn River

The name Severn comes from the river that separated England and wales, out Severn River exends from Annpolis northwest ward for approximately 10 miles as a tidal tributary of the chesapakeake. It serves as the main source of fresh water to the tidal river with over a dozen tidal creeks joining throuhou its entire length.

The Severn River was identified as “imparied” under the Clean Water Act. And that is where the Severn Riverkeeper Program(SRK)comes into play; founded in 2002, it currently workis on the improvement of the the Severn River through watershed restoration, public outreach/education, advocacy, and water quality monitoring.

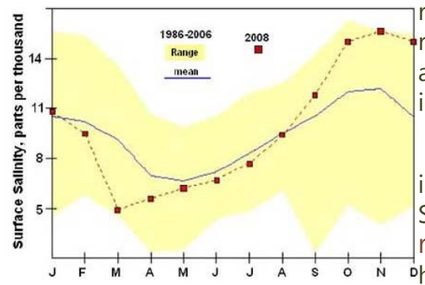


Figure 27. Surface Salinity

One of the biggest issue that is effecting the Severn River is Polluted runoff. Runoffs from roads, houses, and parking lots collect pollutants such as fertilizer, oil, and trash that are then brought to the nearest creek, which ultimately feeds that river.

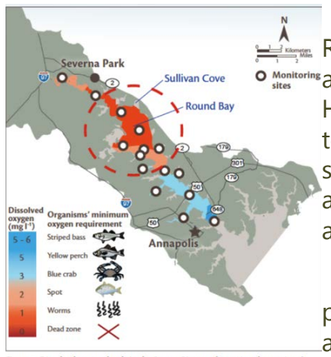


Figure 2. Dissolved oxygen levels in the Severn River and associated organisms' oxygen requirements. Organisms' oxygen requirements adapted from United States Environmental Protection Agency (EPA).

Figure 28. Polluted Runoff

As a reponse to this issue, the Regenerative Groundwater Conveyance(RGC)system was installed at Howard’s Branch on Brewer’s creek to reduce polluted runoff. Similar systems are being designed by SRK and the installation of rain gardens are being promoted.

The shoreline edge is vital to providing the habitat for wildlife, and to maintain the water quality through the trapping of excess nutrients and sedmients. Currently, the shoreline edge is being hardend in critical areas due to the use of riprap, whivh is used by landowners as a way of controlling erosion, but it hardens the shoreline that ultimately decrease the habitat for wildlife and water quality control.

In 2008, the Living Shoreline Protection Act was signed to mandate the use of erosion control, and only allowed non-structural erosion control techniques to be used. i.e: soft shorelines, and marsh creation.

Major restoration projects such as the Cabin Branch Stream restoration attemps to restor the polluted Creek throgh the use of wetlands. The sedimes are now settled out through the installation of shallow pools and water falls.

Figure 26. Severn River Watershed

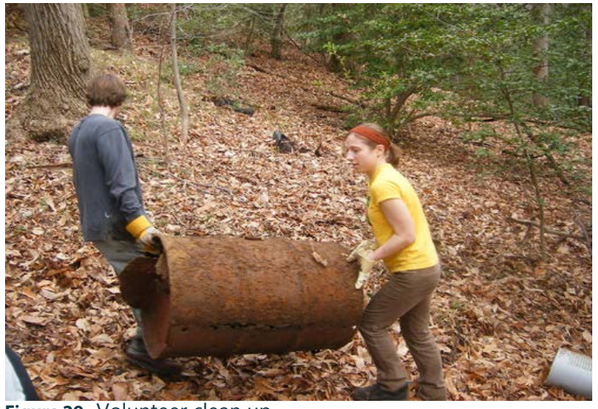
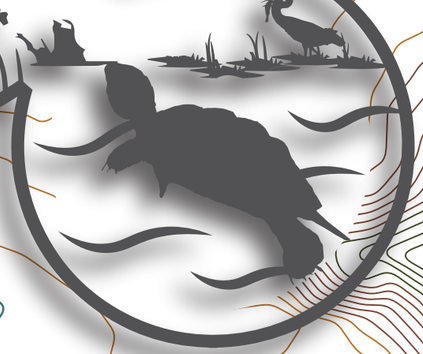


Figure 29. Volunteer clean up

Figure 30. Volunteer clean up

DESIGN STANDARDS



"Make this planet a better place to live."

Trail Standards

Trails must be designed to be the path of least resistance for all users. With that said, keep the user's desired experience in mind when designing the difficulty level of trails. Before planning the route, identify control points, destinations that you intend to incorporate in the design. Utilize positive control points such as scenic vistas, water bodies, and lakes and avoid negative control points, such as weeds, threatened and endangered species areas, critical wildlife habitat, or poor soils.

Trail Specifications

The Half Rule says that the trail grade should be no more than half the side slope grade. If the trail is any steeper then it will be suceptible to erosion. The average trail grade should be between 5-10%, ADA accessible trails will need hand rails at 8% slopes.

Trail Corridor

Within 1 foot of the edge of the tread, plant material and debris should be cleared all the way to the ground. Farther than 1.5 ft from the trail edge, do not have to be cleared unless they are taller than 1.5ft. Trees need to be pruned close to the trunk, but if more than half of the tree's limbs need to be pruned then the tree should be removed. Figure 1. displays that the current trail systems contain plant material all throughout the trail as well as failure to remove the tree disrupting the trail.

Natural Forces

The trail slope must be at least 5% so that water will not sit in the middle or form bogs. To keep water off the site, new trails should have grade reversals every 5-15 meters so that water flows on the outslope.

Tread

Tread are areas of compacted soil that are constructed and maintained to suppoert the use of the trial. The durability is heavily influenced by the soil type. It is best to have a mixture of sand, silt, and clay. The outslope of the trail needs to be at least 5%.

Figure 31. Tree roots disturbing placement of wood steps on trails.

Slough and Berms

Slough is soil, rock, and debris that has moved to the inside of the tread. Berms are made of soils that has built along the side of the trail creating a false edge. Both need to be removed as part of tread maintenance and safety.

Trail Elements

Switchbacks, Retaining walls, Steps, Pavers

Figure 32. Current start of trail routes.

List of drainage structures used in wet areas:

Geosynthetics, Rock Underdrains, Turnpikes, Turnpikes without ditches, Puncheons, Corduroy, Culverts, and Bridges.

Accessibility Standards

Clear Tread Width

Minimum of 36 inches must be maintained for the entire distance of the trail and may not be reduced by gates, or other obstacles

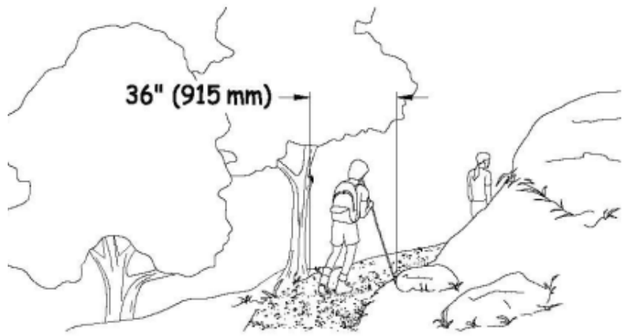
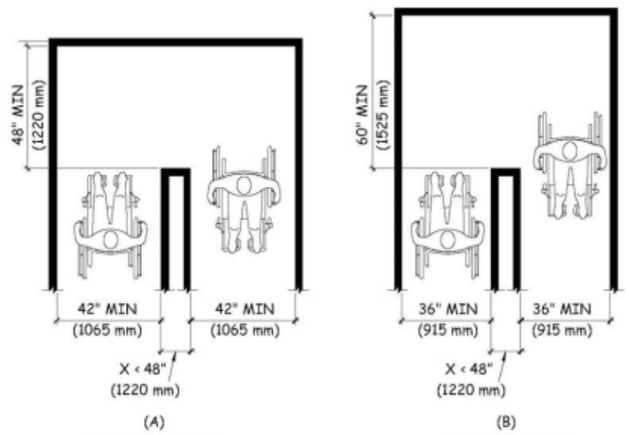


Figure 33. Minimum clear trail tread width.

Areas where users are required to make 90-degree or 180-degree turns, sufficient space should be provided for people using mobility devices to make the turns



Passing Spaces

- Trails less than 60 inches do not permit two people using mobility devices to pass each other
- Trails less than 60 inches must have passing spaces of at least 1000 foot intervals
- Areas where the trail is heavily used or the trail changes, such as, a bridge crossing a ravine, increasing passing spaces or widening the trail to a minimum of 60 inches provides greater access
- Passing spaces are also used to turn around

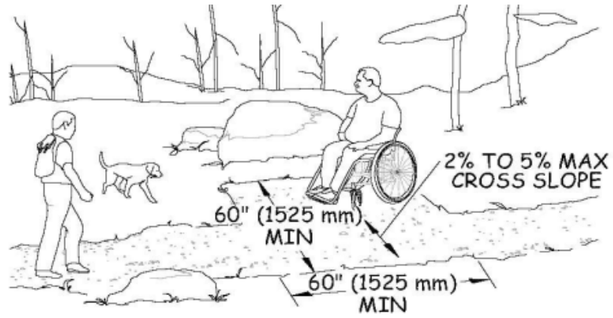
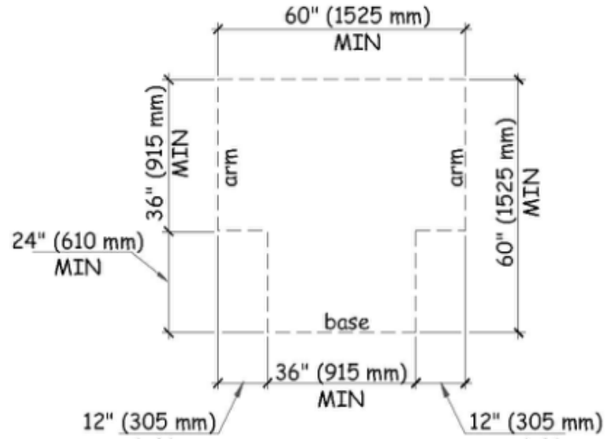


Figure 34. Minimum dimensions for a passing space.

Passing spaces must be 60 by 60 inches



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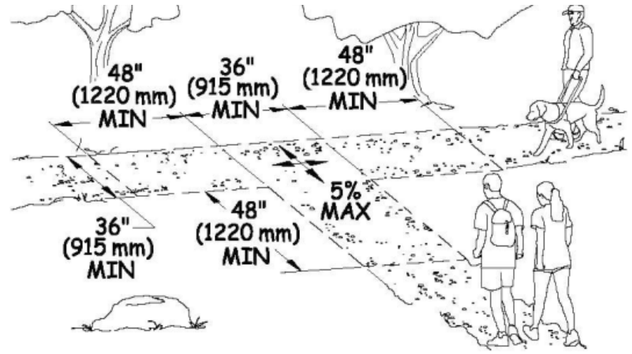


Accessibility Standards

Tread Obstacles

- Anything that interrupts the evenness of the tread surface
- Vertical alignment of joints in concrete, asphalt, or board surfaces, as well as natural features
- Concrete, asphalt, or boards, tread obstacles cannot exceed one-half inch in height
- Other trail surface materials are permitted to be a maximum of 2 inches high
- Trail obstacles should be separated at least 48 inches apart from one another to allow mobility devices to fully cross one obstacle before confronting another

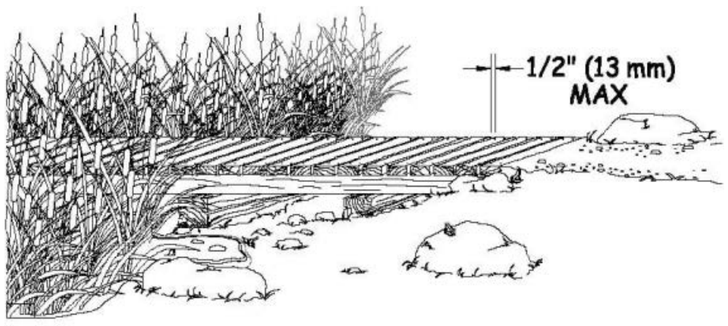


Figure 7—Where possible, openings in boardwalk decking should be placed perpendicular to the direction of travel.

Openings

Gaps, including slots in a drainage grate and spaces between the planks on a bridge

or boardwalk, that are big enough for wheels, canes, or crutch tips to drop through or become trapped in are potential hazards

Maximum gap must not exceed ½ inch

Running Slope

The running slope is the lengthwise slope of a trail, parallel to the direction of travel

To accommodate steep terrain, trails may be designed with shorter segments that have a running slope and length, as shown in table 2, with resting intervals at the top and bottom of each segment.

Maximum Running Slope and Segment Length		
Running Slope of Trail Segment		Maximum Length of Segment
Steeper Than	But Not Steeper Than	
1:20 (5%)	1:12 (8.33%)	200 feet
1:12 (8.33%)	1:10 (10%)	30 feet
1:10 (10%)	1:8 (12%)	10 feet

Cross Slope & Resting Intervals

- Trails of concrete, asphalt, or boards, the cross slope must be no steeper than 1:48 (2%)
- Cross slopes of other materials must be no steeper than 1:20 (5%)
- Resting intervals are leveled areas that provide an opportunity for people to stop and recover before continuing on the trail
- Resting intervals are required when the running slope exceeds 1:20 (5%)
- Resting interval is constructed of concrete, asphalt, or boards,the slope of the resting interval must be no steeper than 1:48 (2%) in any direction
- Other material resting intervals can be no steeper than 1:20 (5%)

Running Slope

No more than 30% of the total length of the trail may have a running slope exceeding 1:12 (8.33%)
The running slope may never exceed 1:8 (12%)
Place resting intervals more frequently as the slope increases

Figure 8—The running slope is measured along a trail's length; the cross slope is measured across its width.

Challenge Course Standards

Goal

Revamp low rope equipment and implement signage in order to create an engaging space that accommodates all ages and abilities, and requires little to no supervision without compromising safety.

Precedent

True Friends Camp Courage, Minnesota

Visitors partake in activities and experiences including a giant swing, zip line and rope circuit Equipment is built by Universal Ropes Course Builders, Inc who offer experiences to accommodate the special needs.

Green Park Wheelchair Challenge Course, United Kingdom

Visitors assemble an entry ramp, then overcome drawer bridges, a moving platform, and a swing bridge. Wheelchairs are provided for the entire group.

Figure 35. True Friends Camp Courage, Minnesota (TrueFriends)

Objectives

Implement a course that accommodates accessi-

Add nighttime activities for courses

Develop clear circulation and provide ADA accessi-

Produce signage for equipment/intro. to area

Fix warn out obstacles and build replacements

Standards

- Standards set by the Association for Challenge Course Technology (ACCT)
- Site evaluation: consider location of underground utilities, level areas ground, flood areas, shade and proximity to bathroom facilities and water.
- Planning: determine the best package of activities for organization.
- Arborist inspection: A Certified Arborist must approve all trees used.
- Materials and labor: must meet or exceed the min. standards set by the ACCT.
- Ground improvement and landscaping: recommended that 4" to 6" of wood chips or similar surface be placed under all challenge course elements
- Staff training: staff must know how to operate and maintain the elements installed. Staff ratio of 1:15 is required.
- Insurance: Additional coverage may be necessary to operate course and protect it from damage or vandalism.
- Annual inspection: All facilities/element receive an annual inspection by a qualified professional to ensure structural integrity. (PRCA)

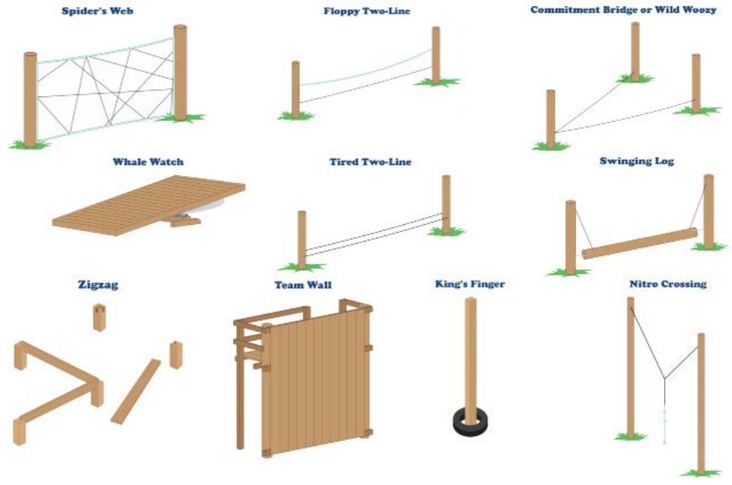


Figure 36. Low ropes course types on site (Adventure Network)

Figure 37. Green Park, United Kingdom - Wheelchair Course (GreenPark)

Permeable Pavers

Four Types of Surfaces

1. Permeable Ashalt
2. Permeable Conrete
3. Permeable Pavers
4. Open-Cell Pavers

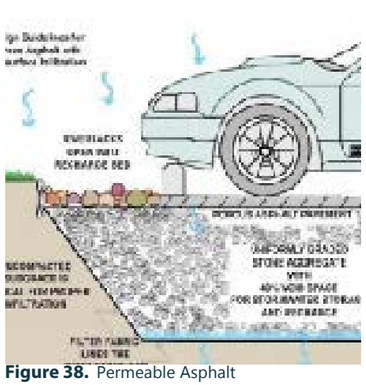


Figure 38. Permeable Asphalt

Figure 39. Permeable Concrete

Figure 40. Permeable Paver

Figure 41. Open Cell Paver

Criteria & Standards

Soil tests are recommended before installing permeable systems if soil substrate is unknown. If soil infiltrates slower than 1/2" an hour, than an underdrain is needed.

The drainage area should not be more than 5 times the size of the permeable system, 2 times the size is ideal. The contributing area should be as permeable as possible itself.

The pavement surface slope must be less than 5%. Terracing is common in areas where slope is greater than 5%

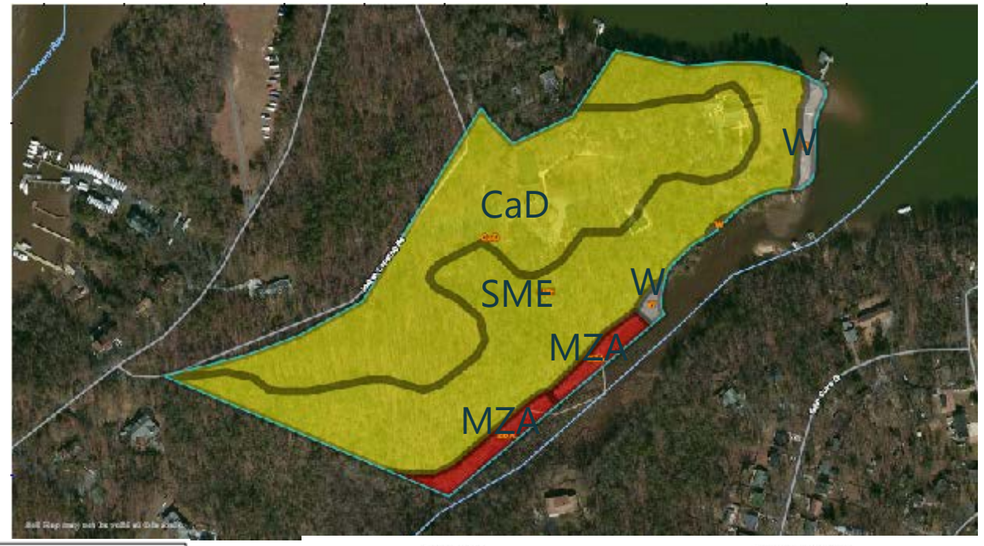
Measured from bottom of the insallation there must be a minimum of 2' to the water table for proper infiltration

Permeable systems must be set back 10' from a structure and cannot be hydrolically connected to a building. In areas where a 10' setback is not possible, an impermeable liner may be used to prevent seepage into building foundations.

Systems with no liner require the bottom slope of the permeable pavement system to be as close to 0 as possible to ensure even infiltration and distribution

https://extension.umd.edu/sites/extension.umd.edu/files/_docs/programs/master-gardeners/Howardcounty/Baywise/PermeablePavingHowardCountyMasterGardeners10_5_11%20Final.pdf

SME: Good for Permeable pavement
CaD:Good for permeable pavement
MZA: Not good for permeable pavement
W: Not good for permeable pavement



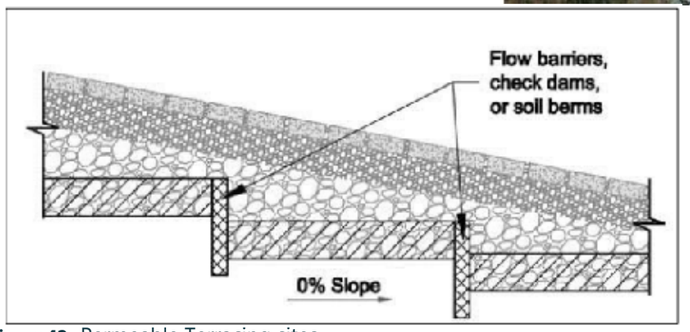


Figure 42. Permeable Terracing sites

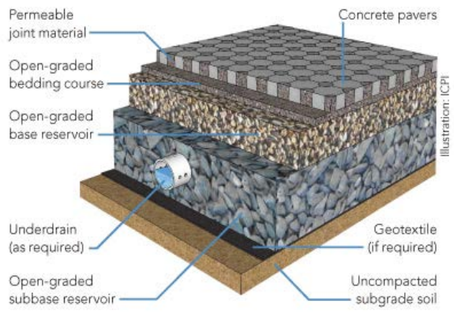


Figure 43. Permable Diagram

Green Roof Standards

A green roof or living roof is typically a modular system that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane attached to a roof structure.

Structure

Wooden constructions and metal sheeting as well as reinforced concrete decks are appropriate roof substructures; you must waterproof roof construction with the appropriate load bearing capacity.

Load

Extensive greenroofs normally weigh between 13 to 30 lb/sq.ft. depending on thickness and material of the green roof system.

Wind

Green roofs should be constructed tight to the roof due to cases of strong wind. The influence of wind is dependent on the height of the building structure, the roof type, the slope of the roof, the area of the roof, substructure, and local wind zone for surrounding area.

Storm-Water

Due to saftey precautions, roof areas with inlayed drainage must always have two drainage outlets or one outlet and a safety overflow.

Fire Safety

Criteria that green roofs must meet to be considered fire-resistant, are already met by most green roof suppliers. Openings within green roof need to be installed with a a vegetation free zone of at least 20 in.

Access/Maintenance

Access to the roof has to be guaranteed throughout the installation and for annual maintainance and service of the green roof.

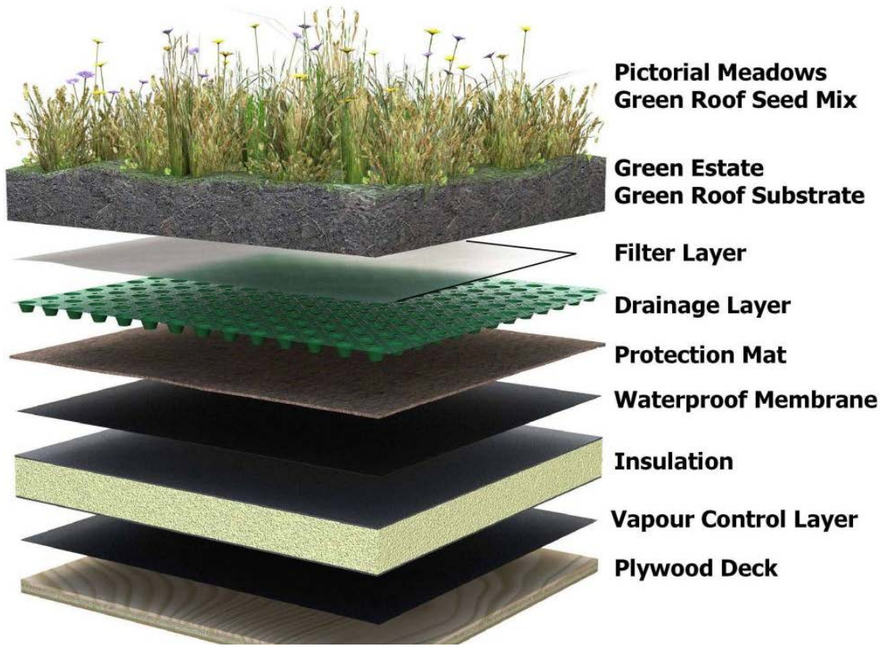


Figure 44. Layers of a green roof

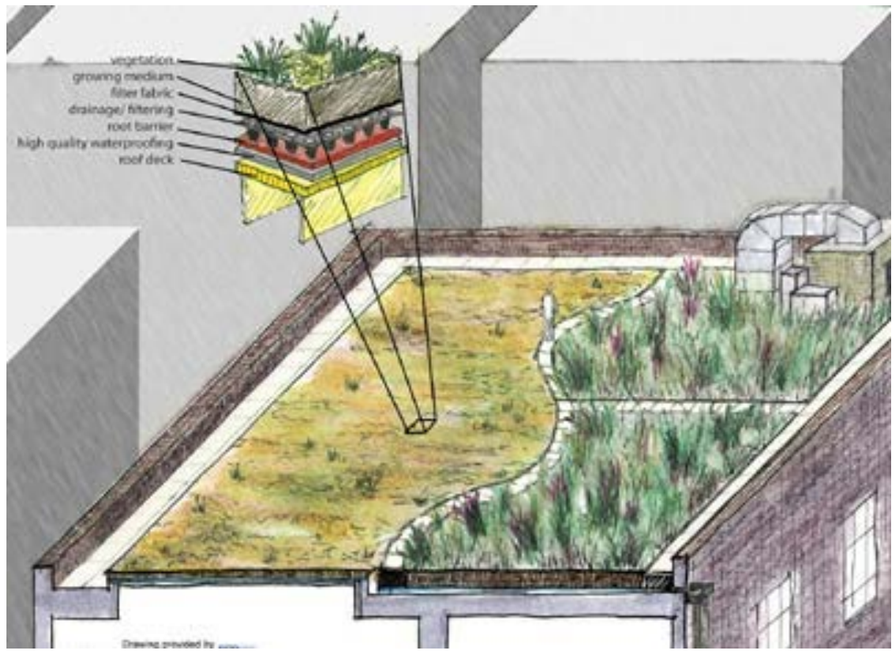


Figure 45. Green roof diagram

Rain Garden Standards

Rain gardens are shallow depressions in the ground planted with native plants, that can handle both wet and dry environments. Rain gardens are designed to retain water up to 48 hours after a rain event. The purpose of having a rain garden located on site is to capture and filter pollutants out of water, before the stormwater is able to leave the site.

Key Attributes

- Safely move, control, and contain rainwater
- Infiltrate the first flush of storm water runoff
- Reduce pollutant loads in rainwater
- Reduce downstream damage from runoff
- Capture rain for reuse
- Restore or create habitat for native wildlife

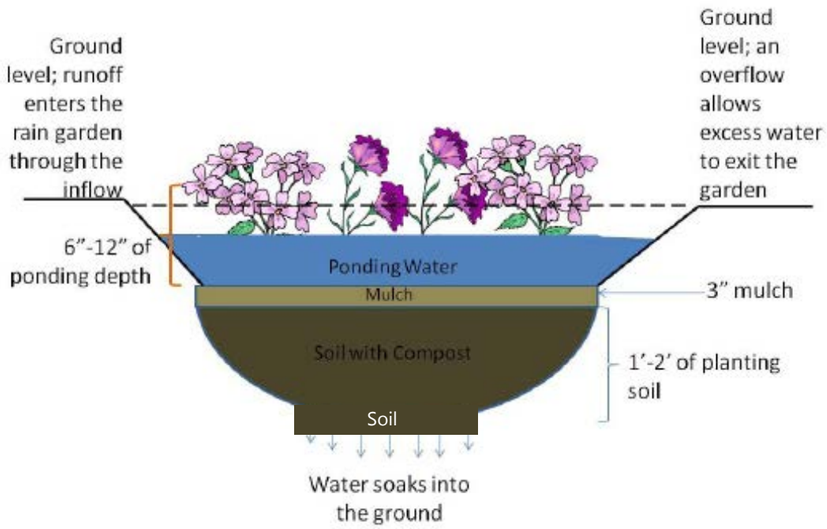


Figure 46. Rain garden diagram

Figure 47. **Rain Garden**

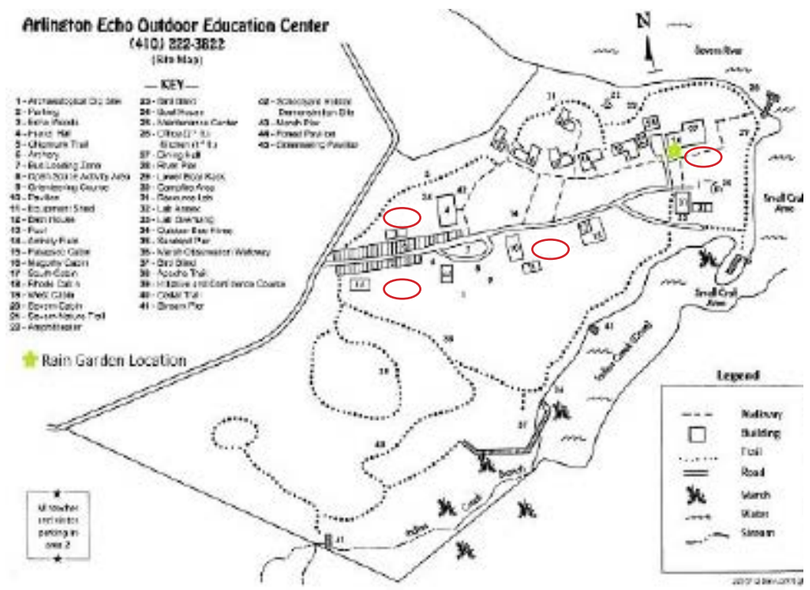


Figure 48. Potential Rain Gardens

Regenerative Stormwater Conveyance

Regenerative stormwater conveyance, RSC, is a way of dealing with and treating stormwater on a site. It is a fairly new approach and is innovative in the way it combines treatment, infiltration, and conveyance in one single system. RSC can be used to restore ecosystems where drainage channels have issues with eroded or degraded outfalls. RSC is meant to resemble a natural stream channel and works by conveying the stormwater through a series of shallow aquatic pools, which leads the water downhill in a controlled manner. The stormwater is then treated and infiltrated in sand and woodchip beds that are planted with native plants. RSC is a good approach to use where it is difficult to implement traditional stormwater management systems due to grades. RSC systems efficiently combines features from other stormwater management practices, such as swales and wetlands, to treat stormwater runoff. RSC systems are designed to handle extreme floods, such as a 100-year storm. (Anne Arundel County, Ch. 2-4-7, 2011)

Regenerative stormwater conveyance systems are successful in treating the first flush, reduce pollutants, and can also be used to meet stormwater detention standards.

Figure 49. Example of an outfall erosion before RSC (Myer, 2006)

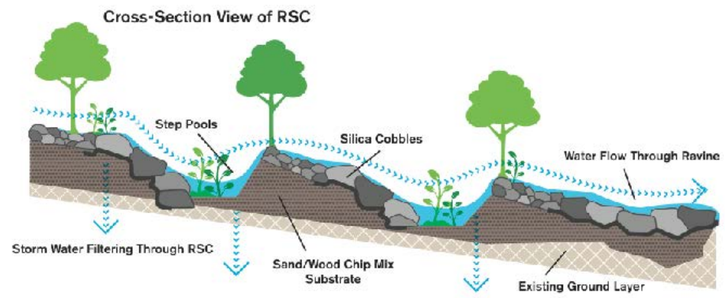


Figure 50. Cross-section of an RSC system (Scripp, 2016-2017) Example of an RSC system (Travaglini, 2013)

Figure 51. Example of an RSC system (Travaglini, 2013)

RSC is useful when it comes to conveying and treating stormwater on moderate to steep slopes. If a slope is steeper than 10%, the size of cobbles and boulders should be increased in order to accommodate the slope and be able to slow down and control the water.

Design Considerations

RSC should not be used to treat runoff from hotspot generating areas. Stormwater hotspots are industrial, commercial or transportation related operations that produce higher levels of stormwater pollutants. These areas often also present a higher risk of spills or leaks. Examples of stormwater hotspots are highway maintenance facilities, scrapyards, and wastewater. (Anne Arundel County, Ch. 5, 2011)

Normally, the soil conditions of a site does not constrain the use of RSC systems as the storage areas for water is accounted for in the designed pools and sand/woodchip beds.

The storage areas above the ponding depth in the pools must be available for storm events and should not be inundated by seasonal groundwater. The pools should be designed to drain down and reach their 'normal' ponding levels within 72 hours.

RSC drainage areas typically ranges from 10-30 acres and tend to be highly impervious. Drainage areas larger than 50 acres typically impacts available space and cost factors considerably. Drainage areas that are highly impervious require larger storage.

Figure 52. Outfall erosion after RSC has been implemented (Gannett Fleming, 2014)

Living Shoreline

Living Shorelines are a creative and proven approach to protecting tidal shorelines from erosion. This technique consists of planting native wetland plants and grasses, shrubs, and trees at various points along the water line. Plantings are coordinated with carefully placed bioengineering materials, such as coconut-fiber rolls to protect vegetation and soils. Where viable, oysters can be included as well.

Benefits that Living Shorelines provide to a site include:

- Improvement of water quality by settling sediments and filtering pollution
- Provide shoreline access to wildlife, such as nesting turtles, horseshoe crabs, and shorebirds
- Provide shallow water habitat and diversity of plant species for aquatic and terrestrial animals
- Provide shade to keep water temperatures cool, helping to increase oxygen levels for fish and other aquatic species
- Looks natural rather than man-made and artificial
- Absorbs wave energy so that reflected waves do not scour the shallow sub-tidal zone and hamper the growth of underwater grasses
- Are often less costly than wooden bulkheads and rock walls

Implementing a living shoreline requires a fair amount of planning and analysis of specific site characteristics and needs.

These steps include: site analysis, permit approval and legal compliance, site preparation, installation, and post-construction monitoring and maintenance.

New Regulations have been put in place in Maryland in recent years to address shore erosion along the Chesapeake Bay

- As of February 2013, Maryland passed a regluations act stating that bank stabilization methods may only consist of natural methods, i.e. living shorelines (unless a waiver is obtained)
- Must be filled with coarse sand
- At a minimum the sand shall contain less than 10% fine material, passing a #100 sieve
- The sand shall not be placed in a manner that raises the elevation of any existing wetland area above the elevation of juristictional tidal wetlands (1.5 times the mean tide range above mean low water.

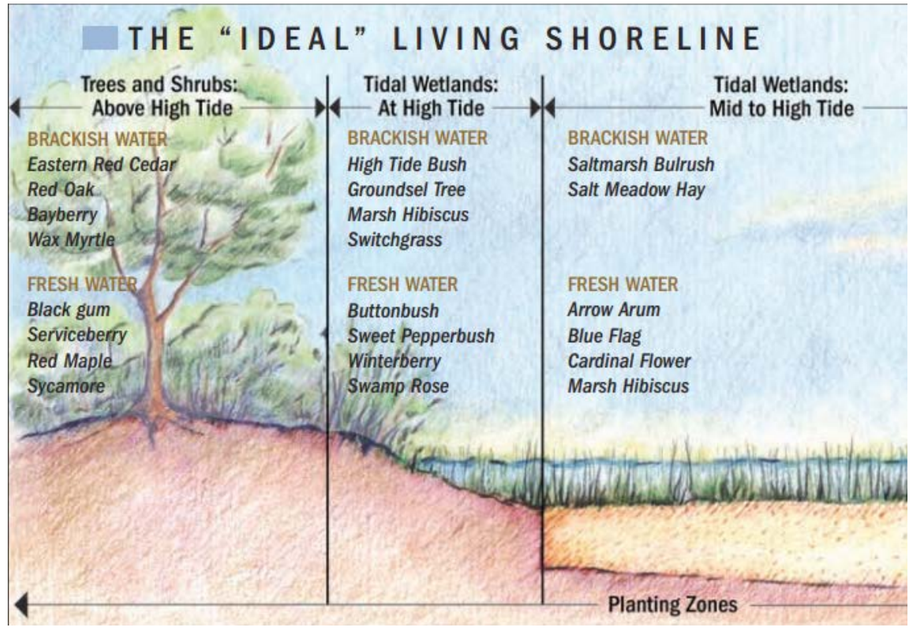


Figure 53. The Ideal Living Shoreline

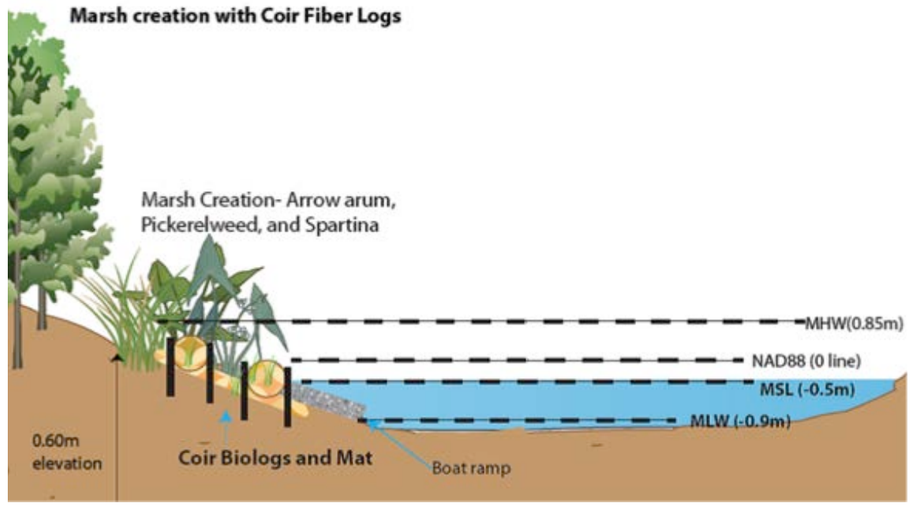


Figure 54. Marsh creation with Coir Fiber Logs

Vehicular Circulation and Parking Standards

Travelways

Two-way travelways shall be a minimum of 22′ and a maximum of 26′ wide. A one-way travelway shall be a minimum of 11′ in width provided it is clearly marked with signs and pavement markings. The minimum inside turning radius for automobiles shall be 18′ (figure 1).

Parking/loading requirements

The dimensions for a standard parking space shall be 9′ x 20′. Parallel parking spaces must have a minimum length of 22′ and a minimum width of 9′. Open off-street parking areas with more than 40 spaces shall have a maximum of 10 contiguous spaces without an island. The minimum width of a parking island shall be 9′. Parking areas must have a slope no greater than 5%. No dead end parkings are allowed. The standard bus loading/unloading space shall be 12′ x 45′.

Drop-off/Pick-up Areas

Drop-off/pick-up areas must be designed to allow for the safe movement of vehicles and pedestrians. Drop-off/ pick-up areas shall have a minimum length of 22′ per vehicle and a minimum width of 9′.

Service areas

Service areas shall incorporate a minimum 20′ turnaround to accommodate small service vehicles (such as panel vans) (Figure 2).

Accessible Parking

Accessible parking spaces shall be 8′ x 20′ and shall have a 5′ wide access aisle adjacent to one side of the parking space. Access aisles may be shared by two adjacent parking spaces (figure 3). Accessible parking spaces serving a particular building shall be located on the shortest accessible route of travel from adjacent parking to an accessible entrance. One in four handicapped spaces must be van accessible. All van spaces must be a minimum of 11′ wide. The slope of all handicapped spaces shall not exceed 2%. Parking spaces for vans and their access aisle and vehicular routes serving them shall have a min. vertical clearance of 98″.

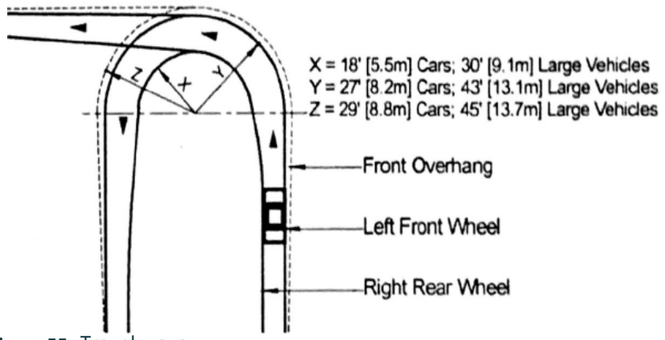


Figure 55. Travel ways

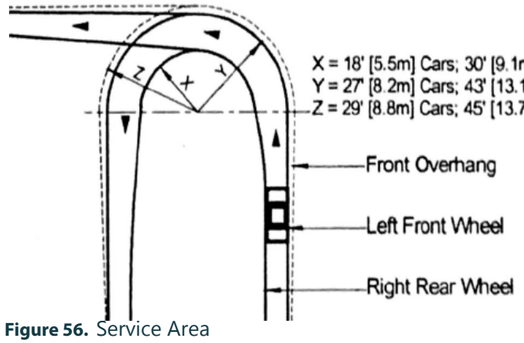


Figure 56. Service Area

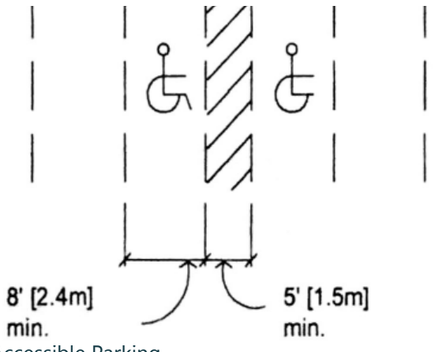


Figure 57. Accessible Parking

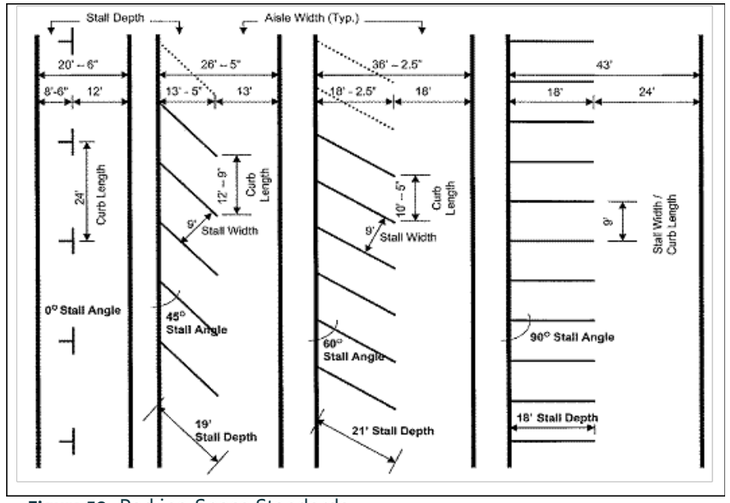


Figure 58. Parking Space Standards

Total Parking in Lot	Required Minimum Number of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2 percent of total
1000 and over	20 plus 1 for each 100 over 1000

Figure 59. Handicapped Parking Space Requirements

TEAM ONE

"Clean the Water, Recover the Shores, Honor the Heritage."

Rain Story

As an outdoor learning center, Arlington Echo Park is designed to provide various activity spaces for children with trails and nature playgrounds that are ADA accessible, The design also attempts to be age inclusive with sites such as the enhanced marsh boardwalk, the living shoreline. The existing parking is being renovated with permeable pavings, biorention buffers, and increased parking spaces.

The entrance incorporates rainwater features that can also serve as entrance guides, interactive equipment, and lights throughout the site to reinforce the journey of stormwater for visiting students.

The rest of the site design incorporates stormwater design elements that can be utilized for teaching purposes. Stormwater management features can be aesthetically pleasing, environmentally conscious, and functional for outdoor teaching exercises.

Objectives

- Provide stormwater management system throughout campus to narrate the journey of run-off to visiting students.
- Improve open areas, marsh, and living shoreline for more outdoor teaching opportunities.
- Expand parking lot to relieve parking and bus arrivals.
- Provide accessiable trail systems for all people to enjoy their time at Arlington Echo.

Figure 60. Precedents used to provide inspiration for Rain Story.

Trail Circulation

Overview

The campus trail system and overall circulation has also been redesigned to better support ADA accessibility. The current trails often feature very steep sections that would be difficult to traverse by wheelchairs, which prevent certain users from enjoying Arlington Echo's natural environment. The current trails have been kept where they are, but new, entirely ADA accessible trails have also been created. These trails range from 5 to 8 percent slope, with the majority being 5 percent for ease of use. These will allow those in wheelchairs to comfortably and confidently explore Arlington Echo.

These trails run from the start of the challenge course, down to the marsh boardwalk, and around the living shoreline, eventually connecting with the northern amphitheater. The boardwalk itself has also been modified to allow for wheelchair access. The new boardwalk features a more curvilinear and natural shape, and is completely flat across the whole distance. A handrail has also been added to ensure safety. These new paths allow for full access across the campus for anyone who wishes to use it.

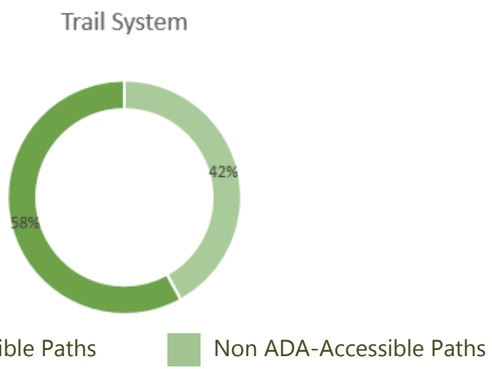


Figure 61. Breakdown of trail types

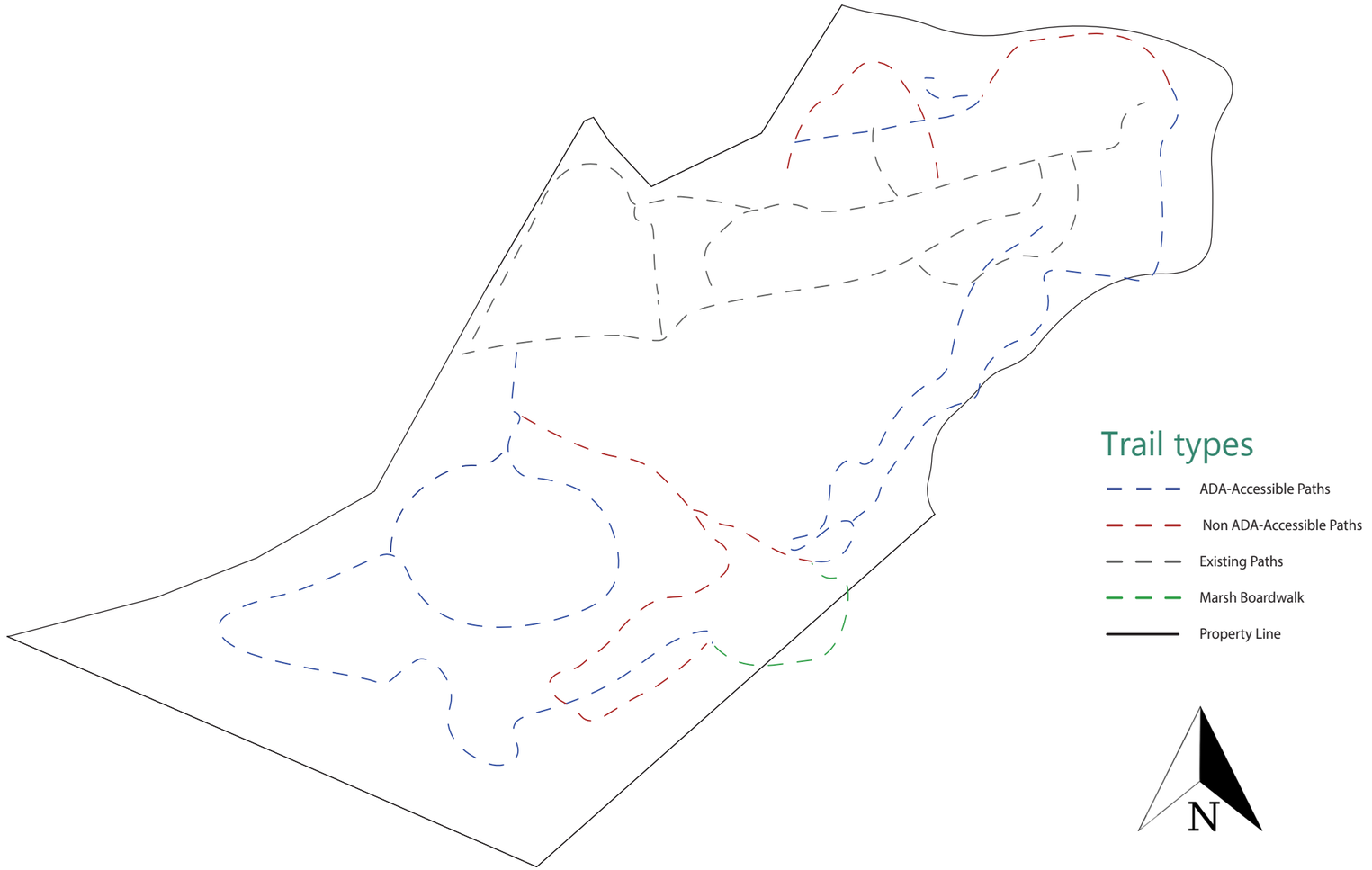


Figure 62. Map of the proposed circulation paths for Arlington Echo

Parking

Overview

One of the major proposed changes to Arlington Echo is the expansion of the current parking area. The current parking situation includes around 40 spaces which are spread throughout the campus. The lack of centralized parking often forces cars to find non conventional areas to park during crowded days. The redesigned parking lot solves this problem by providing 64 total spaces located by the entrance to Arlington Echo.

The parking lot features 10,368 square feet of permeable paving, designed to collect and filter water that would otherwise end up as polluted runoff. In conjunction with the permeable paving are bioswale medians, which are designed to capture and transport rainwater to a nearby educational rainwater trail that runs through the campus. All of the water that flows into this parking lot will be filtered for reuse as clean water. The outer edge parking lot will be enclosed by a green wall, in order to screen the campus from the external properties and to preserve the natural aesthetics of Arlington Echo. A new truck turnaround has also been added by the diner, to provide ease for any deliveries that need to be made.

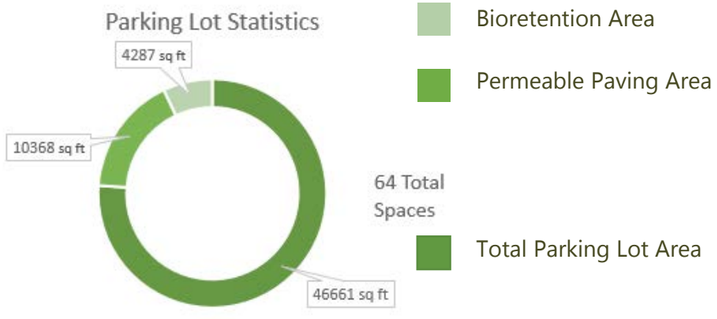


Figure 63. Breakdown of parking lot area

Figure 64. Detailed plan view of the proposed parking lot

Perspectives

Figure 65. Resource Building:

The resource building is made for classrooms and office space as well as a greenhouse for hands-on learning purposes. Freestanding green walls create an interactive learning facade for the resource building as well as an inviting entry way.

Figure 66. Marsh Walk:

Curvilinear and 8-foot-wide marsh boardwalk design provides wheel chair accessibility and a more aesthetically pleasing boardwalk feature to the site.

Figure 67. Dining Hall Amphitheather:

An expanded and centered amphitheater provides more seating for main events. Stone seating prevents moisture issues after precipitation events. Stormwater sculpture designs are repeated for connectity throughout the site.

Figure 68. Bio-retention/ Navigation:

Interactive bio-retention Rain water design serves as destination for storm-water from rooftop, sidewalks, and excess rainwater not captured by parking lot permeable paving system. Water map is located in center of design for fun wayfinding purposes.

Figure 66. Marsh Walk created by Akin Jaiye

Figure 65. Resource Building created by Akin Jaiye

Figure 67. Dining Hall Amphitheater created by Cecilia Tran

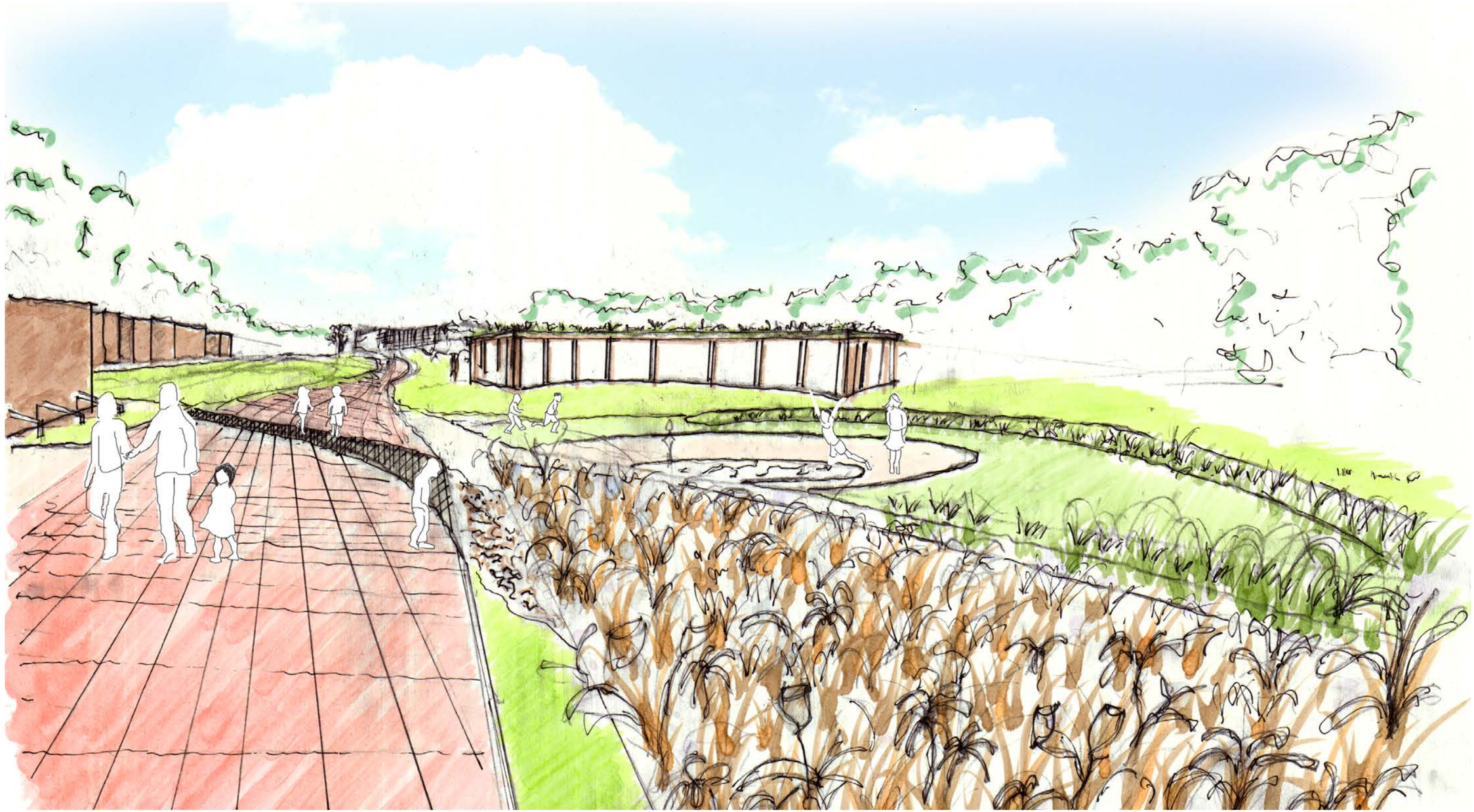


Figure 68. Bio-retention/ Navigation created by Akin Jaiye

Perspectives

Figure 69. Foot Bridge:

Foot bridge to travel over swale that can be susceptible to heavy runoff and erosion

Figure 70. Permeable Parking Lot:

Turning parking it into a major asset to environmental learning for the campus- permeable paving and bio-swales throughout the parking lot collect and treat storm water providing teaching opportunities

Figure 71. Wheel Chair Challenge Course:

The ADA accessible challenge course opens the site up for wheelchair bound visitors. The course incorporates team building exercises where members must make sure the path is set for the person in the wheelchair to go through smoothly.

Figure 72. Living shore line:

Wheel chair accessible living shoreline, that is part of the wheel chair accessible looping trail system, provides a great view of the water and surrounding area. The living shoreline creates habitat for natural vegetation and provides ecosystem services.

Figure 70. Permeable Parking Lot createdy by Garrett Foss

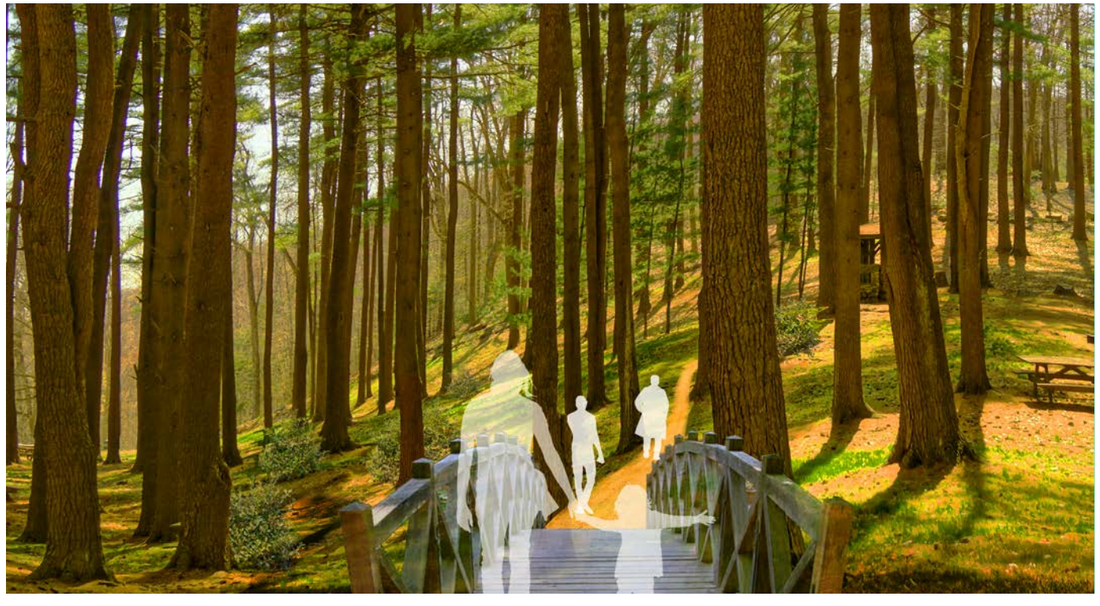


Figure 69. Foot Bridge created by Dong Hyun Kim

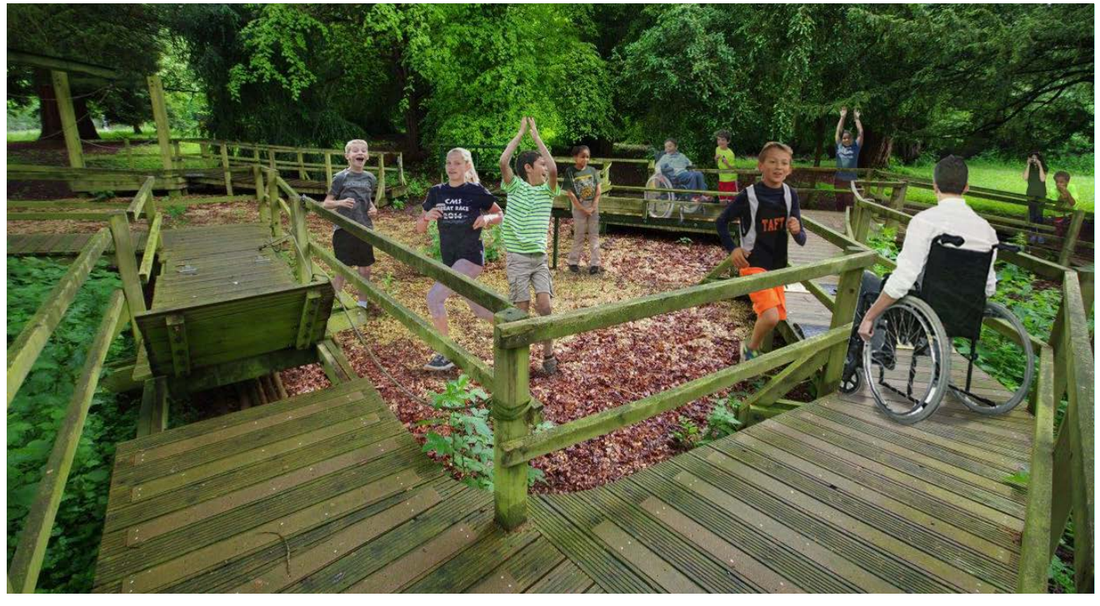


Figure 71. Wheel Chair Challenge Course created Cecilia Tran

Figure 72. Living Shoreline created by Dong Hyun Kim

Perspectives

Figure 73. Storm-water Feature:

Interactive storm-water sculptures demonstrating the storm water conveyance system throughout site.

Figure 74. North Amphitheater:

Accessible to all, this amphitheather uses stone seating to prevent moisture buildup and create a fluid seating area around the stage below.

Figure 75. Nature Play:

This natural playscape is economical and sustainable for children visiting site instead of the conventional playground. Wood is repurposed to create play structures.

Figure 73. Storm-Water Feature created by Qi Zhou

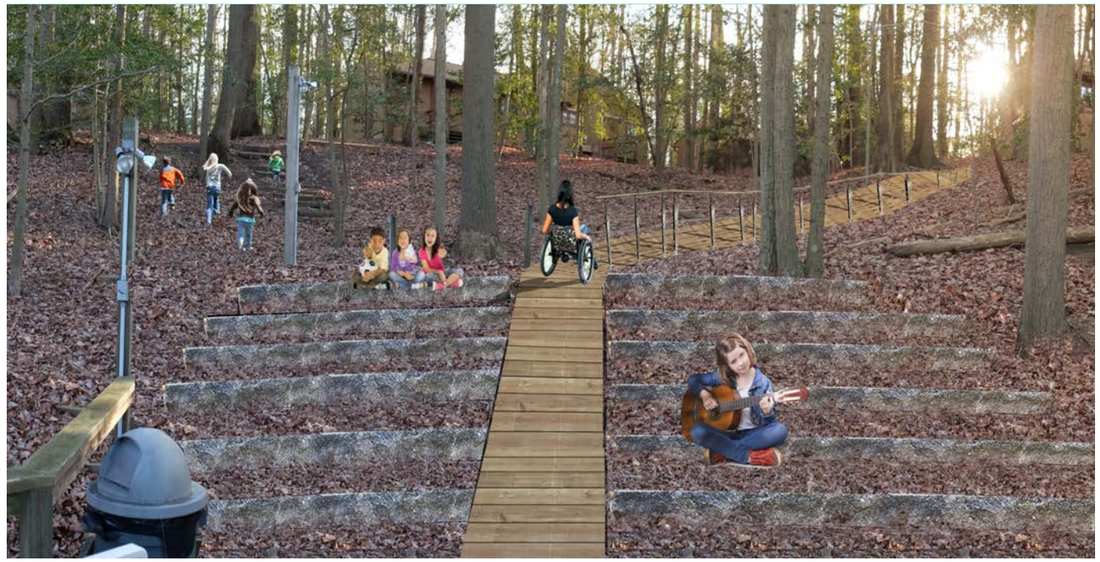


Figure 74. North Amphitheater created by Garrett Foss

Figure 75. Nature Play created by Qi Zhou

Performance Metrics

Parking Lot will produce 77,418 gallons of runoff during a storm event producing an average of 2.7" of rain. The average for this site is about 1.7" permeable pavers in parking lot can store up to 61,635 gallons of water which is more than enough for the site's average of about 1.7 inches of rain

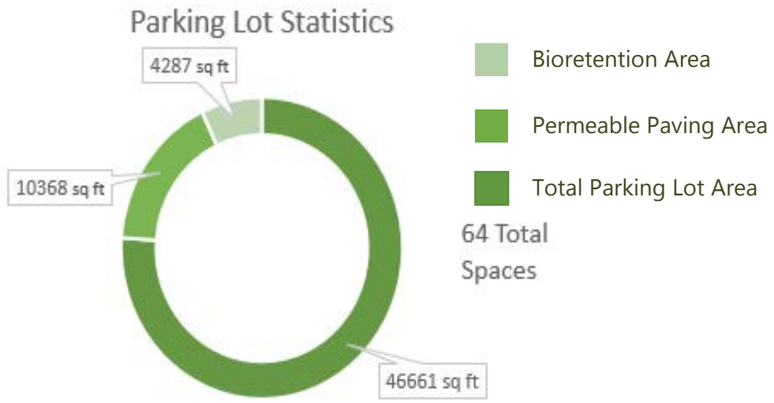


Figure 76. Parking Lot Statistics.

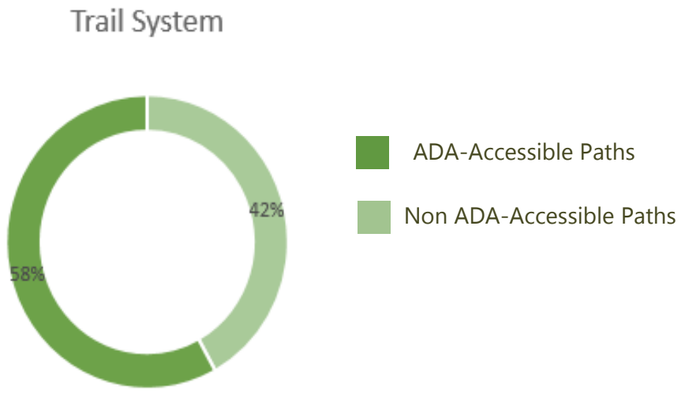


Figure 77. Trail System Statistics.

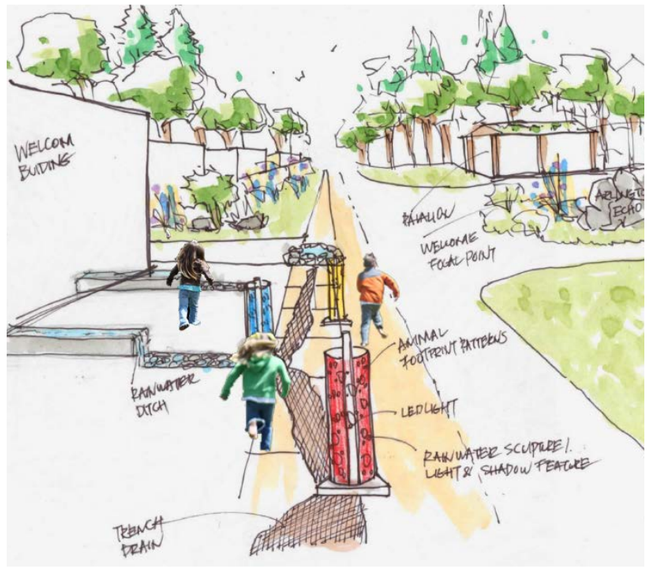


Figure 78. Preliminary design of Rain Story's stormwater feature.

Figure 79. Permeable Paving

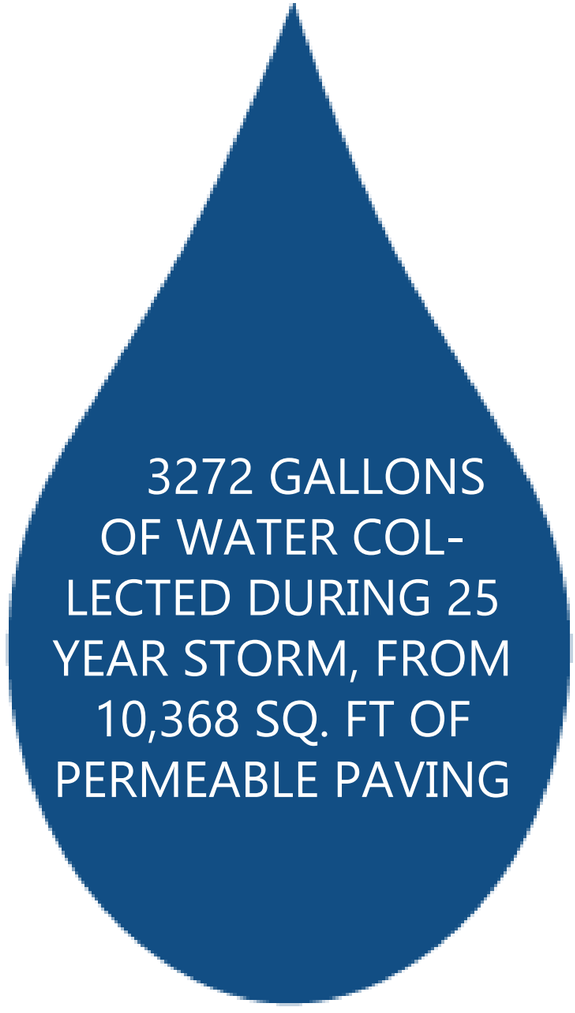


Figure 80. Statistics of how much water collected during 25-year storm.

Arlington Echo Stormwater

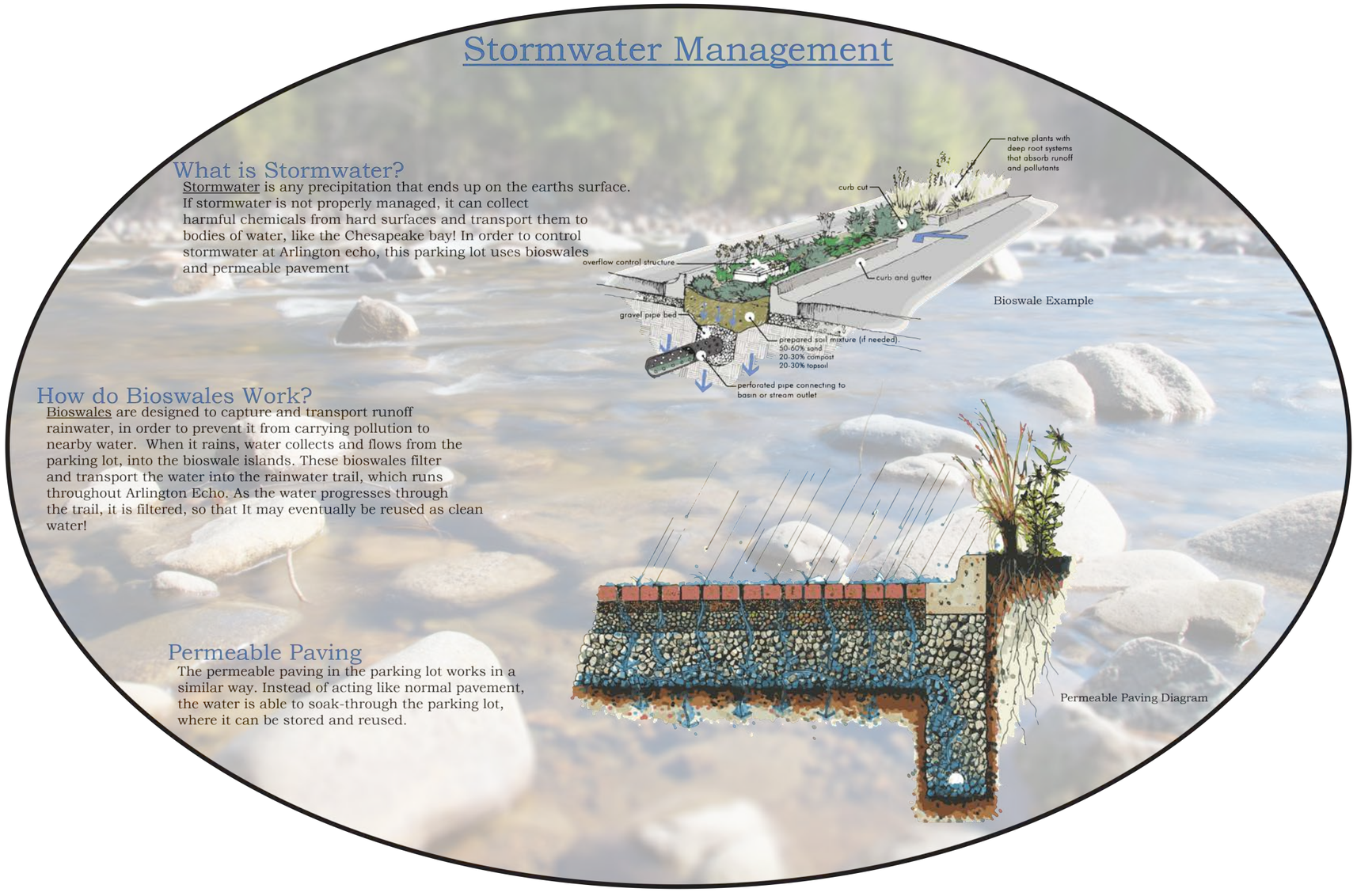


Figure 81. Bioswale Signage Example

TEAM TWO

"Problems cannot be solved at the same level of awareness that created them."

Walk in the Wild

Mission

Create an outdoor education campus that brings students of all ages and abilites closer to nature through on-hands learning and makes lasting impressions.

Goals

- Improve ADA accessibility on site for pedestrians
- Increase the number of parking spaces while using LID techniques
- Increase on-site learning through memorable experiences
- Create new views

To achieve these design goals, new trails and a parking spaces have been added, as well as new, unique spaces for visitors to experience and learn about nature.

To achieve the third design goal, floating wetlands proposed are installed near the boating docks. Floating wetlands are a versatile educational tool, as they not only create additional habitat to study wildlife, but they also filter and clean the water. These will need to be replaced every few years. The replacement process provides another hands-on learning opportunitiy in getting students to learn about recycling materials, and how to make floating wetlands out of recycled materials.

Precedents







Figure 82. Precedents used to provide inspiration for the site design.

Circulation Diagram

It is important that the visitors at Arlington Echo are able to safely and easily move around the campus. In the current conditions many of the trails are too steep and dangerous for anyone with a disability to maneuevor, preventing them from reaching the water's edge. There is also the issue of food delivery trucks backing up a long stretch of road in the middle of campus, which is a safety concern with children running around. To combat this problem, there is going to be a turn around pad installed next to the Resource Building.

A major focus of this design was to bring as many people as possible to the water's edge on the south side of the campus. The habitat located along the creek provides a unique educational opportunity to learn about marshes, and marsh wildlife that is otherwise not accessible to many Prince George's County students. To achieve this goal, new trails are created with a gentler slope, and compacted tread material to allow everyone, regardless of ability, to travel freely throughout the campus. There is also a new trail connecting the existing boardwalks; from the boating docks to the marsh boardwalk.

The other major goal was to remove the presence of vehicles from around the site, and condense them into an efficient, low impact parking lot. The parking lot utilizes techniques, such as vegetated islands and bioswales, to add vegetation back to the site as well as manage stormwater runoff.

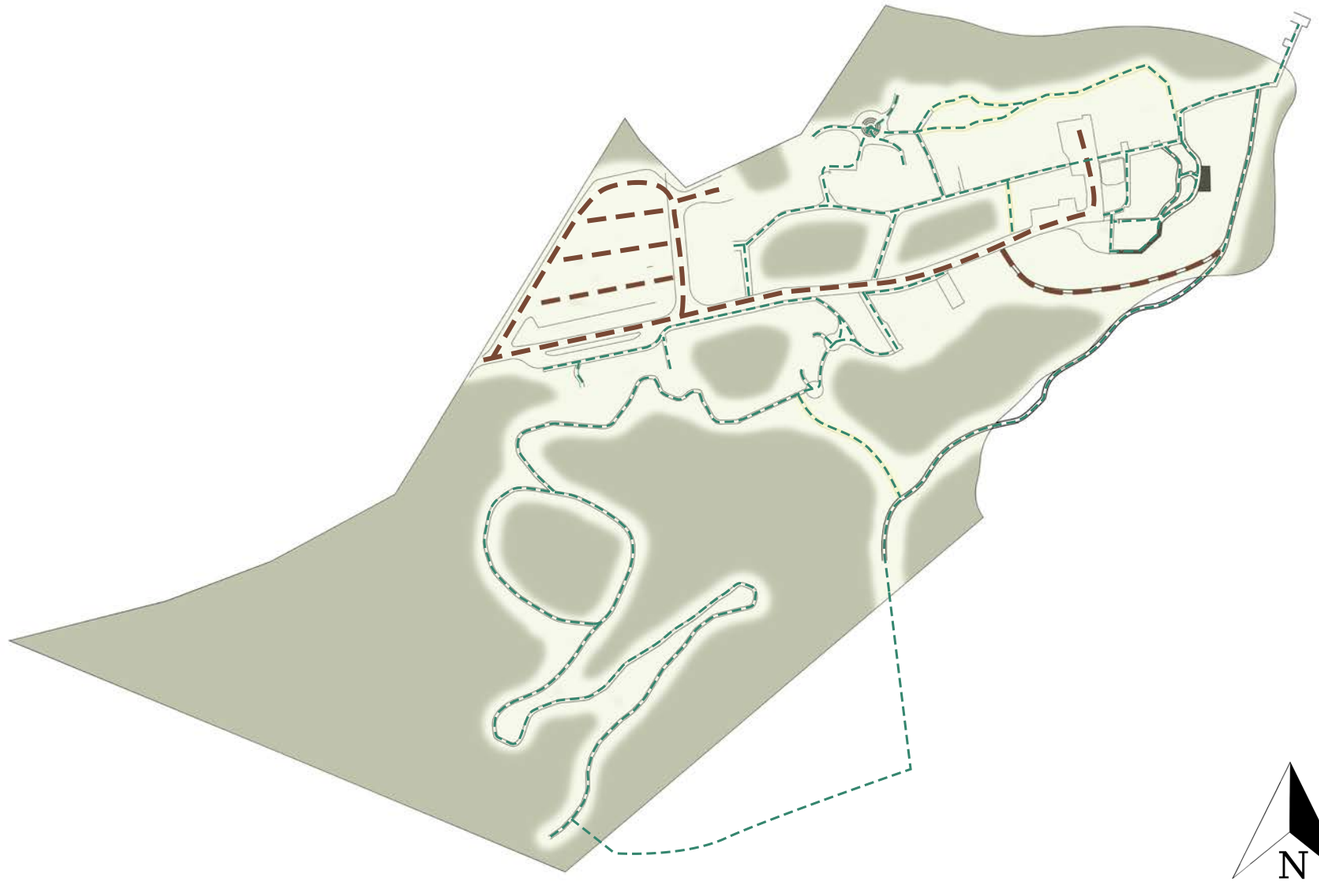


Figure 83. Circulation diagram showing vehicular and pedestrian walkways.

Perspectives

Figure 84. View of the parking lot, featuring the new entrance sign.

Figure 85. View of bus drop off and parking islands.

Figure 86. View of the pavilion, showing the new field to the right and nature play to the left.

Figure 87. View of the new nature play area.

Figure 88. View of the gardens near the cafeteria

Perspectives

Figure 89. View of the I&C loop and the ADA accessible trail.

Figure 90. View of the hammock nesting area.

Figure 91. View of the new camp fire gathering area.

Figure 92. View of the new overlook deck.

Figure 93. View of the new water invertebrate collection dock.

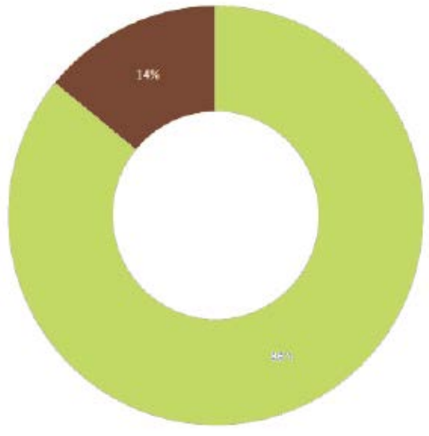
Performance Metrics

ADA Accessiblity

Before

After

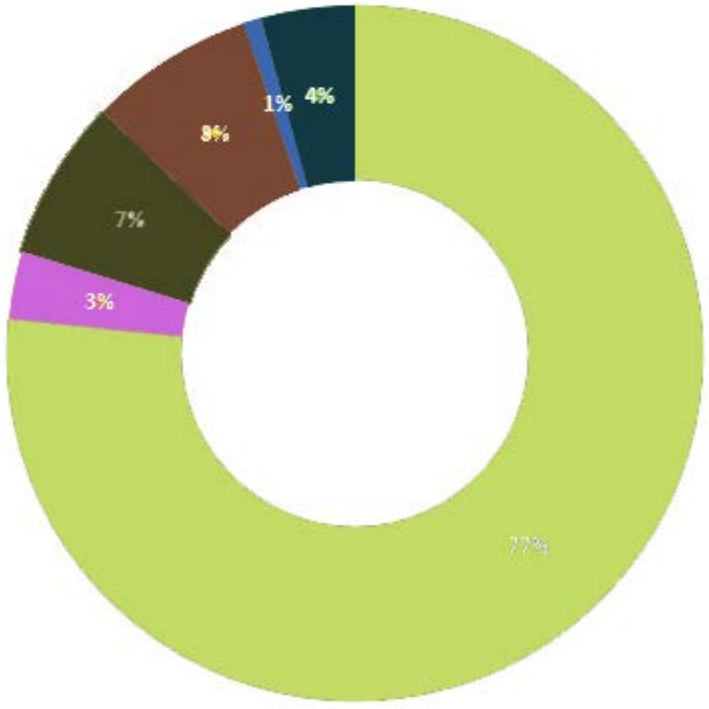
86% ADA Accessible



Non- ADA: 0.23

ADA: 1.64 Miles

Site Usage Breakdown



Total Acreage: 23.5

Wetland - 1 ac.

Campus - 1.8

Play - .2 ac.

Forest - 18 ac.

Meadow - .75

Roads - 1.75

Parking Spaces

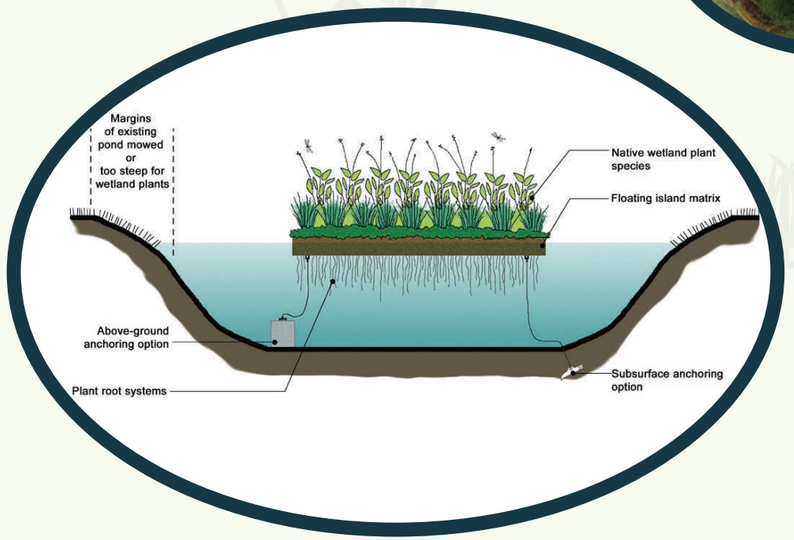
Before: 64

After: 92

60% More Parking provided

FLOATING WETLANDS

Floating Wetlands, also known as Floating Treatment Wetlands (FTWs), are self-sustaining water treatment systems designed to filter water and provide additional habitat for wildlife. These sytems use bacteria, algae and native wetland plants to effectively filter out the excess nutrients and pollutants from the contaminated water. Floating Wetlands not only improve water quality, but also allow for habitat regeneration to occur for many species, such as crabs, oysters,mussels, eels, fish and even birds.



Floating Wetlands should be incorporated into more sites to combat the habitat loss caused by development. These systems are a great way to recover from that loss, as they serve both as a water detention system and as a standard wetland. Wetlands are among the most productive ecosystems there are, so creating wetlands have huge benefits to the ecosystem when installed on a site. Even small patches of floating wetlands can prove to be very beneficial to the health of productivity of existing ecosystems.

Baltimore Waterfront. (n.d.). Retrieved from http://baltimorewaterfront.com/healthy-harbor/floating-wetlands/
Floating Treatment Wetlands:A Deeper Understanding. (2017). Retrieved from http://www.floatingislandinternational.com/products/ftw-a-deeper-understanding/

Figure 94. Sample educational sign about Floating Wetlands

TEAM THREE

“Look deep into nature, and then you will understand everything better.”

Rejuvenate. Enhance. Integrate.

Mission

Encouraging development and imagination in the minds' of Arlington Echo's visitors.

The main focus of this design was to rejuvenate Arlington Echo, while maintaining the identity of the site as a whole. The extensive history and continual use lead to the preservation of this character, while also giving all users the opportunity to experience everything Arlington Echo has to offer, regardless of age or ability. In order to maintain these values, a set of goals was devised.

Goals

- Integrate seamless design to connect all elements of the site
- Provide spaces that bridge the gap between the classroom and the outdoors
- Transform the entire site to be completely accessible to individuals of all ages and abilities

Implement a comprehensive and sustainable solution to vehicular and pedestrian circulation

The existing site, was intended for use by everyone, regardless of disability. However, there were many accessibility issues throughout Arlington Echo's 24 acres; including the extensive trail system and piers along the Severn River.

Through site inventory and analysis, as well as multiple visits to the site and conversations with staff, a "vision" was formed for the site. In addition to preserving as many defining elements as possible, trails were regraded, educational opportunities added wherever possible, and new and exciting spaces for all of Arlington Echo's visitors were created, including a proposal for the Resource building and more efficient gathering space adjacent to the diner.

Figure 95. Existing site entrance off of private drive

Figure 96. Existing non-ADA accessible boardwalk

Figure 97. Precedent Image: ADA accessible boardwalk

Figure 98. Precedent Image: ADA accessible hiking trail

Figure 99. Precedent Image: ADA accessible low ropes course elements

Figure 100. Precedent Image: Educational native plant walk

Functional and Circulation Diagrams

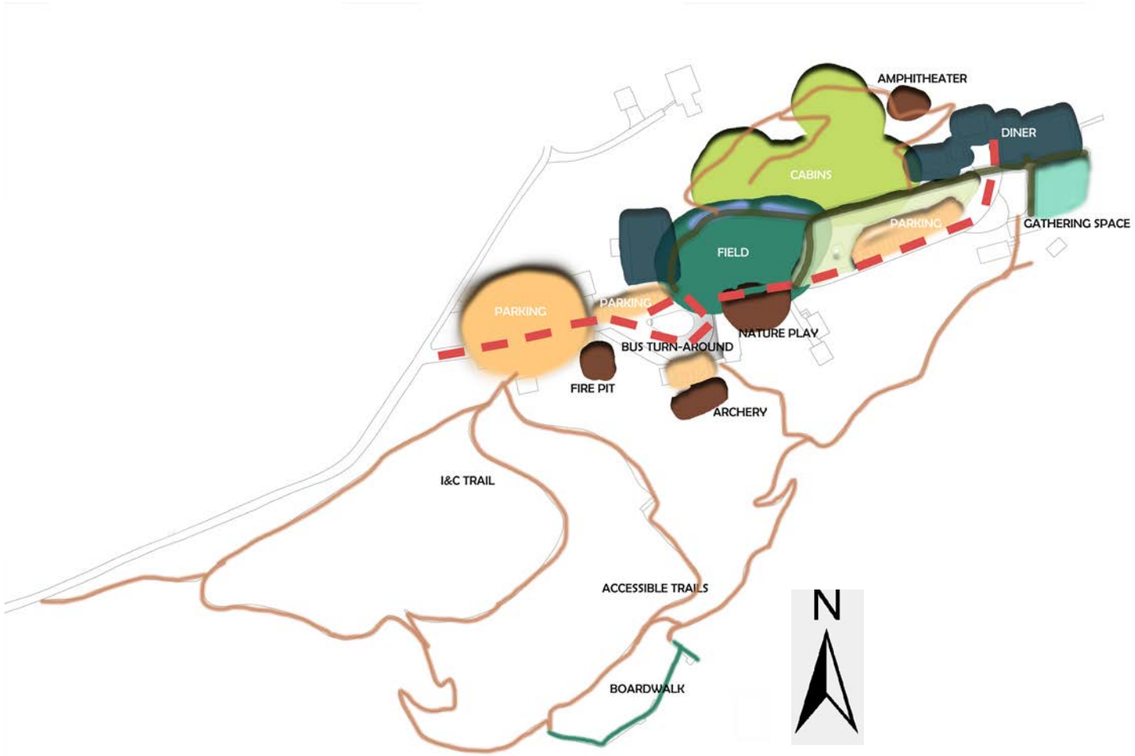


Figure 101. The functional diagram demonstrates the larger areas and defines the overarching

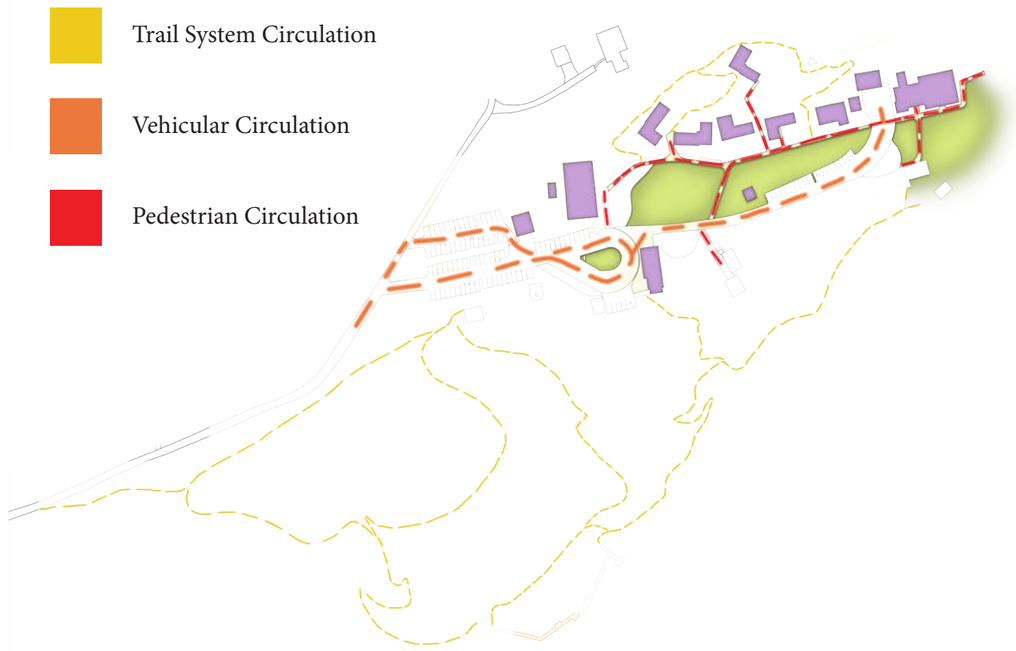


Figure 102. The circulation diagram demonstrates the main and sub circulations on the site.

The functional diagram demonstrates the overall layout of the site. It gives a visual of where different areas such as recreation and trails are relative to the site. This diagram shows areas on the site that have been expanded or added. For example, the design implemented a larger parking lot in order to accommodate more vehicles. Several other parking spots were also integrated specifically made for employees only.

Several of these areas were added or moved to better fit the needs of the users. The fire pit was moved from the side of the Resource building and moved to an area where the wind will not affect the fire while the archery activities that occurred in this area moved to behind the portable building. Aside the pavilion, a nature play will be integrated to give the area a sense of life and enjoyment so that when the children are dropped off, they are welcomed by it.

The circulation diagram outlines the main paths and routes for the trails, pedestrians, and vehicles. The trail system is outlined in yellow, the vehicle circulation in orange, and the pedestrian circulation in red.

Perspectives

Figure 103. Informative Nature Boardwalk

Figure 106. Low Ropes Course

Figure 104. Freshly Planted Dining Hall Entrance

Figure 105. Proposed Resource Building

Figure 107. Fire Pit Gathering Space (Previously Archery Range)

Figure 112. Redesigned Turn Around

Figure 108. Reconstructed Lawn & Added Meadow Planting Beds

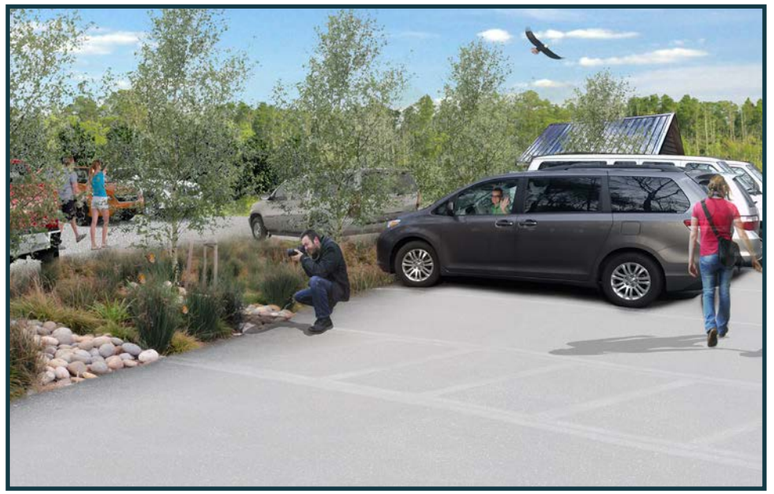


Figure 110. Expanded Parking & Environmental Site Design Implimentation

Figure 111. Redesigned Main Entrance

Figure 109. Outdoor Dining & Gathering Space

Performance Metrics

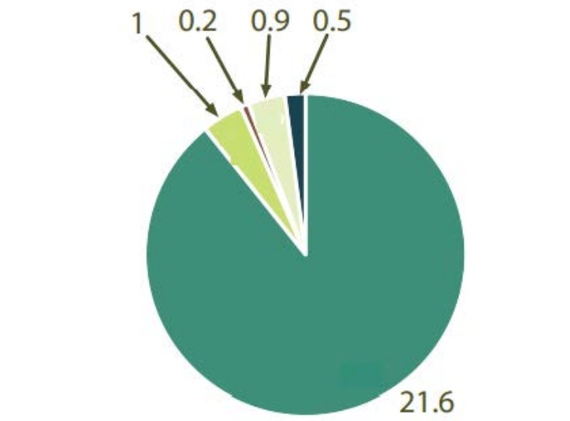
Rejuvinate. Enhance. Integrate

During consultations with members of Arlington Echo, there were concerns with parking, ADA accessibility, nature conservation and overall aesthetics of the site. These topics were taken into consideration while developing designs for the rejuvination of Arlington Echo. In cases where applicable, there were implementations for permeable pavement, addition of native plants and stormwater management. With a large majority of the site composed of forest, application of forest conservation was critical in the design of the parking lot and roads, and the placement of elements.

ADA accessibility was a necessary element of the site design, due to the fact that the site needs to accommodate children from Anne Arundel County schools regardless of physcal capability. Trail ADA accessibility was also critical to the site design . By making all trails ADA accessible, the design enables people of all ages and capabilities to explore and enjoy the experience that Arlington Echo provides.

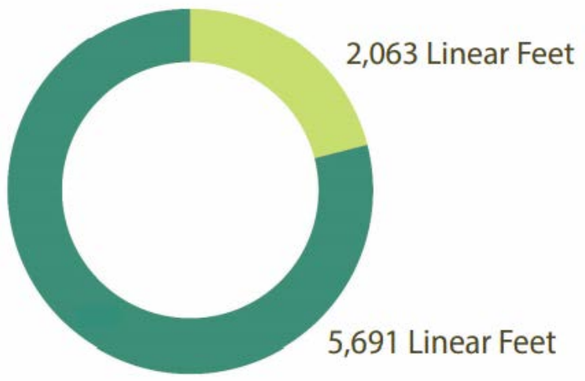
Parking at Alington Echo was a major concern due to both safety and capacity limits. By increasing parking in the proposed design we are nearly doubling the number of spots on the current site. The proposed bus parking/ pull-off also helps enable proper circulation of the site while providing safe visitor drop-offs. The proposed design has a total of 4 accessible parking spots located in various locations of the site.

SITE USAGE IN ACRES



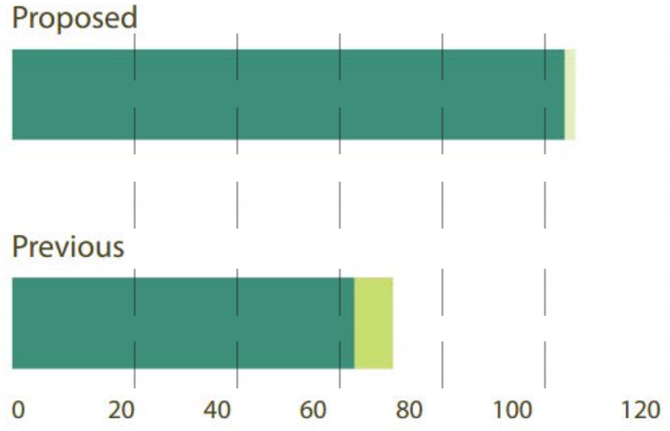
FOREST
PLAY AREA
PARKING/ROADS
LAWN
PERMEBALE PARKING

ADA ACCESSIBLE PATHS



PREVIOUS TRAILS
NEW PATHS/TRAILS

PARKING AT ARLINGTON ECHO



ACCESSIBLE
NON-ACCESSIBLE
BUS PARKING

Interpretive Sign

Made of glass, this particular educational sign allows its viewer to peer through its face and see the names of the rivers reflected on the bodies of water themselves.

In addition to general information about the Severn River, the major body of water surrounding Arlington Echo, it depicts a few of the native organisms that inhabit these rivers, as well as the im-

Figure 113. Educational signage depicting bodies of water around Arlington Echo and the organisms that inhabit them.

TEAM FOUR

“Nature does nothing uselessly.”

Treasure Trunk

Objective: Create a safe environment that accommodates people of all ages, abilities, and backgrounds, while maintaining the integrity and natural essence of Arlington Echo.

Develop ADA accessible trails throughout site.

Provide adequate parking.

Maintain the history and natural feel of Arlington Echo

Arlington Echo provides children of all ages with motivation, knowledge, and skills to make responsible environmental decisions through hands-on outdoor experiences. It also provides face-to-face instruction, each school year, to more than 25,000 students and 8,000 adults. In this new innovated design scheme, great emphasis is put into maintaining the integrity of Arlington Echo, by introducing new features that accommodate the many children and adults that visit the site.

The theme developed for the design of this site is inspired by the *Quercus rubra*, commonly known as northern red oak. Following the site plan, one sees that the main road follows the form of a tree trunk, while the surrounding buildings and activity spaces allude to the branches and leaves of the tree canopy. The northern red oak is also known for the acorns it produces, that provide ecological benefits. As a result, the acorn symbol drives the new design of Arlington Echo, and is utilized throughout the site, beginning with the grand entrance.

As visitors drive through the front gates of Arlington Echo located on the western edge of the site, they are immediately immersed by oak trees. The two lane parking lot, consisting of 92 spaces and equipped with four accessible spots, and two bus spaces is reminiscent of a meadow. Tall grasses and rain gardens consisting of water loving plant species bring color, height, and stormwater management to the parking lot. Traveling east on the road, a high arch adorned with the monumental acorn symbol and welcome sign, signify the entrance to Arlington Echo.

Once visitors enter the site they will be surrounded by an array of activity spaces. These spaces range from open fields, a nature play area, and acorn shaped tree houses that are attached to the newly renovated research center.

Trails are located at both the northern and southern edges of the property and have been altered from their previous forms to become ADA accessible. These trails lead to different activity spaces located on the perimeter of the site including the marsh walk which has also been altered to be ADA accessible.

Every space incorporated into the site serves as an educational experience through which visitors can be guided by either an activity leader or educational signage strategically placed throughout the entirety of the site.

Perspectives

Treasure Trunk

The main parking lot, located on the west side of the site, has been expanded to accommodate the increased amount of visitors to the outdoor center. The wood from the inevitable clearing of trees, has been recycled throughout the site in an effort to educate visitors about the importance of recycling. It also emphasizes and how art can visually improve and unify a site. The way the wood has been distributed on the site is becoming a characteristic of the design, and gives the outdoor education a strong identity.

A meadow has been planted in the bioswales that divide the rows (Figure 114) and have several functions; screen parts of the cars, infiltrate and filter stormwater on site, expand the educational field, as well as enhancing wildlife on site through the native plantings.

Figure 114. Expanded parking lot and Meadow. Created by Akira Shepherd

(Figure 118) shows the entrance to the outdoor education center. An arch with an acorn symbol is the focal point, which invites visitors to enter into the nature center. The acorn has been given a central position, symbolizing the natural feel of the site and giving the outdoor education center a strong identity.

The entryway is an active space, meant to guide visitors in the right directions. Signage has therefore been provided in order to successfully do this.

A few of the obstacles that used to be part of the obstacle

Figure 118. Entryway. Created by Blair Danies

The wooden arch, signs, and the acorn symbol are all made from the recycled wood taken from the trees that occupied the parking lot space.

The beautiful arch with the acorn giving the site a strong identity is a great spot for taking class pictures.

To accommodate for more play on green lush grass, an additional field has been implemented. This new field can be seen in (Figure 115). It is located in front of the orienteering pavilion, where the old bus drop-off used to be.

The lush grass field is lined by wood chips. This has been done to make the transition onto the field easier on the grass edges, and to visually unify the old field with the new. The wood chip edges also serve as a place to distribute damaged tree branches and materials that are found on the site.

A nature play space has been added in the area between

Figure 115. Additional Field. Created by Jenny Dibra

Figure 116. New Nature Play Space. Created by Sara Saernwald

the pool and the pavilion. It is a central location and has some slight elevations for enhanced natural play. The proximity to the Field Hall and access to the parking lot makes this an ideal place to spend time.

The nature play is targeted for children between ages 3 and 5, however, any age group is welcome. The nature play offers a range of play; from jumping on logs, climbing on stones, counting tree cones, and practicing building skills with sticks and branches. The area is adapted for ADA-usage.

The Nature play space can be seen in figure 116.The Initiative and Confidence Course (I & C Course) is located in the woods, to the right of the parking lot. New obstacles have been added in order to enhance the experience. Many of the obstacles are now also ADA friendly, which can be seen in (Figure 117). These include the creative spiderweb obstacle, and the exciting elevated ramp obstacle.

Figure 117. Improved I & C Course. Created by Devan Hare

Perspectives

Treasure Trunk

At the far northwest part of the educational center, the Resource Lab has been replaced by a net-zero building. A net-zero building uses energy that can be produced from clean, renewable resources.

The space between the Dining Hall and the new Resource Lab has been redesigned to unify the space with the net-zero building, and to emphasize opportunities for gathering, such as for informational meetings. The existing bog has been expanded and beautified and extends deeper in to the space. Its location and size has turned it into a visual focal point that can be seen from many places on the site.

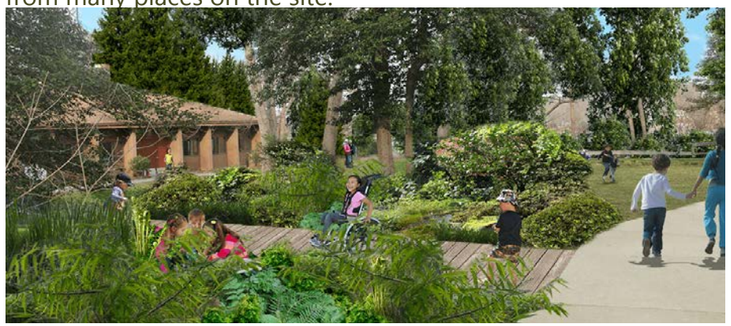


Figure 119. Expanded bog next to the Dining Hall. Created by Akira Shepherd

Behind the new net-zero Resource Lab, a tree-house has been installed in the lush tree canopies, (Figure 119). The tree-house is shaped like an acorn to emphasize the theme and identity of the outdoor center further. This shape adds interest to the experience when being inside the tree-house.

The tree house is accessed through an elevated walkway, from the flat area outside the Resource Lab. The Resource Lab has a green roof, as well as a small hut for adults to easily supervise the area.

The tree-house is supported by posts attached to the ground, and offers a breathtaking view. One can see birds, wildlife, and investigate the lush canopies of the different tree species. The amazing overview of the marsh along the Severn River can also be enjoyed.

Figure 120. Tree-House. Created by Blair Danies

The Marsh Observation Walkway (Figure 120) is located in the south, along the Indian Creek Cove. The walkway has been modified to fit ADA- accessibility standards, with curbs on each side for safety measures. Additional plants have been added for a richer experience and to contrast the grasses that now occupy most of the marsh.

A pavilion has been installed along the walkway to provide a place for resting and to protect from the sunlight during the warmer days. Seating is available under the pavilion, which is large enough to hold a class of 10-15 people.

Figure 121. Improved Walkway and Marsh. Created by Devan Hare

The loading area next to the Dining Hall has been modified to serve as a hard-scape activity space. Lush vegetation has been planted around the edges to unify it with the nature (Figure 121). Flowers and vines beautifies the space and creates a lush enclosure.

Here, visitors can play sports and games on days when the field is occupied, or on days when the field is moist from a rainfall.

Figure 122. Hard-scape Activity Area/ Loading Area. Created by Jenny Dibra

The amphitheater located on the north slope of the site has been modified to accommodate a fireplace (Figure 122). The fireplace is set on gravel with adequate space around it for safety. The trails that lead down to the amphitheater are ADA-accessible, allowing everyone an opportunity to take part of evening fun, grilling s'mores, and enjoying the beautiful view over the Severn River. A stone wall has been installed behind the fireplace for safety measures, and to protect against wind. The colors and rough surface of the stones also complement the view of the water.

The amphitheater can hold up to 106 people, and includes 4 landings to accommodate wheelchairs.

The seatings, which were previously wood, has been changed into stone, enhancing a more naturalistic feel of the space. The previous wood benches were also becoming damaged by rainfall and the lack of sun, which is not an issue for the stone seatings.

Figure 123. Amphitheater, North side. Created by Sara Saernwald

Plant Palette

Treasure Trunk

The plant palette diagram shows the the native vegetation that may be planted in various locations throughout the site. This palette illustrates where each plant may best be suited to the local site conditions. This includes rain garden species, living shoreline species, and marsh vegetation. The palette shows representations of species that can be supported through these native plants.

Animal Key:

- Butterfly
- Deer Resistant
- Hummingbird
- Song bird
- Small Mammals

Wax Myrtle

Shrub
Sun: Part shade, Full sun
Moisture: DRY, MOIST, WET

American Beautyberry

Shrub
Sun: Part shade, Full sun
Moisture: DRY, MOIST

Witchhazel

Shrub
Sun: Part Shade
Moisture: DRY, MOIST

Summer Sweet

Shrub
Sun: Part Shade to Full Shade
Moisture: WET

Arrow Wood

Shrub
Sun: Full sun to Shade
Moisture: MOIST, WET, DRY

Eastern Redbud

Understory Tree
Sun: Part to Full Shade
Moisture: DRY, MOIST

Sassafras

Understory Tree
Sun: Full sun to Part Shade
Moisture: DRY, MOIST

White Fringetree

Understory Tree
Sun: Full sun to Shade
Moisture: DRY, MOIST

Sweetbay Magnolia

Understory Tree
Sun: Full sun to Shade
Moisture: MOIST, WET

Ironwood

Understory Tree
Sun: Full sun to Shade
Moisture: MOIST

Red Maple

Tree
Sun: Full sun to Part Shade
Moisture: MOIST, WET

Silver Maple

Tree
Sun: Full sun to Part Shade
Moisture: MOIST, WET

Cinnomon Fern

Rain Garden & Marsh

Sun: Full sun to Shade
Moisture: MOIST

Cinnomon Fern

Living Shoreline & Marsh

Sun: Full sun to Part Shade
Moisture: MOIST TO WET

Black Walnut

Tree
Sun: Full Sun
Moisture: MOIST

Pin Oak

Tree
Sun: Full Sun
Moisture: MOIST, WET

Eastern White Pine

Tree
Sun: Full Sun
Moisture: DRY, MOIST

Broomsedge

Rain Garden
Sun: Full Sun
Moisture: MOIST, WET, DRY

Marsh Marigold

Rain Garden & Marsh

Sun: Full sun to Part Shade
Moisture: MOIST

Gay Feather

Rain Garden & Marsh

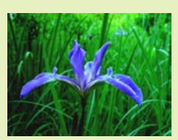
Sun: Full sun
Moisture: MOIST

Turtle Head

Rain Garden
Sun: Full sun to Part Shade
Moisture: MOIST, WET

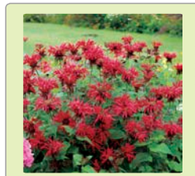
Black eyed Susan

Rain Garden
Sun: Full sun to Part Shade
Moisture: MOIST, DRY



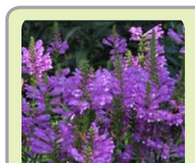
Blueflag Iris

Rain Garden
Sun: Full sun to Part Shade
Moisture: MOIST, DRY



Bee Balm

Rain Garden
Sun: Full sun to Part Shade
Moisture: WET



Virginia lions-heart

Rain Garden & Marsh & Living Shoreline

Sun: Full sun to Shade
Moisture: MOIST

Blue Cardinal Flower

Rain Garden & Marsh

Sun: Full sun to Shade
Moisture: MOIST TO WET

Golden rod

Rain Garden
Sun: Full sun to Part Shade
Moisture: DRY, MOIST

Swamp Milkweed

Rain Garden
Sun: Full sun to Part Shade
Moisture: MOIST, WET

Pink Azalea

Rain Garden
Sun: Full sun to Shade
Moisture: MOIST, WET, DRY

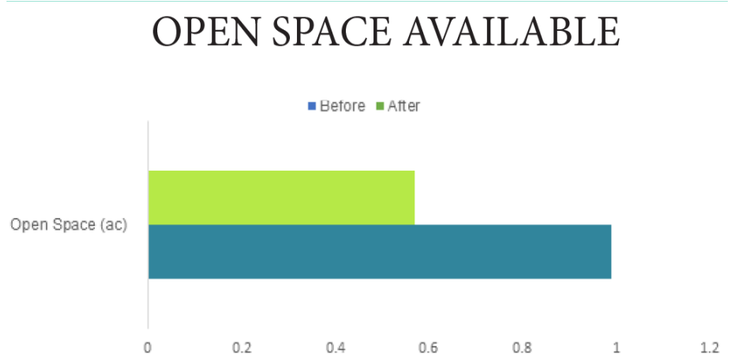
White Beardtounge

Rain Garden
Sun: Full sun to Part Shade
Moisture: MOIST, DRY

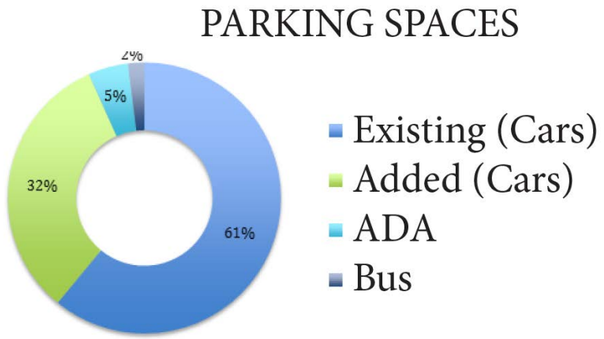
Performance Metrics

Treasure Trunk

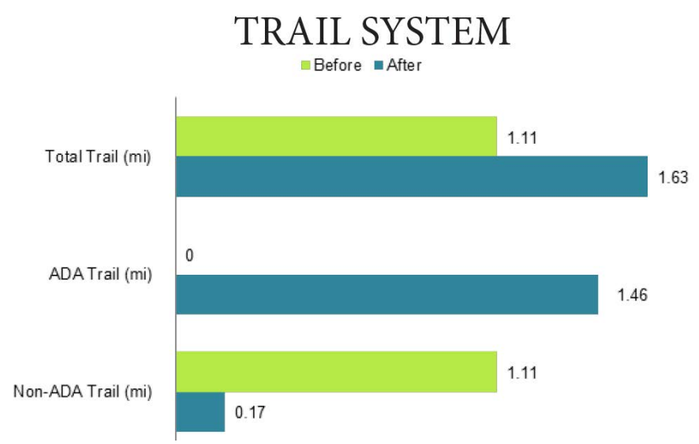
Metrics used were to highlight the positive changes that Arlington Echo's designs would have on their property. An emphasis in storm water management, number of available parking spaces, ADA accessible trails, and open lawn spaces was created. Diagrams were developed to visually represent the data collected.



The bar chart above represents the amount of existing and proposed open lawn space on Arlington Echo's campus. Existing conditions show only 0.57 acres of land, but proposed conditions allow a 42% increase to 0.99 acres of open lawn space.



The circular bar graph illustration depicts the percentage of parking spaces proposed on Arlington Echo's site out of 100 spaces. With Treasure Trunk's proposed plan, Arlington Echo would gain 32% more parking spaces for standard vehicles as well as 2 new bus drop-off spaces.



This illustration above was used to depict the differences of the existing trail conditions with proposed conditions. Currently, Arlington Echo has 1.11 miles of trail along its site of which 0 miles is ADA accessible, not including the elevator with landing by the Dining Hall area and river shore. The Treasure Trunk proposed plan would add 52 miles of trail and ensure that 90% of it (1.46 miles) would be ADA-accessible, leaving only 0.17 miles non-ADA accessible. The reason for these non-ADA accessible trails is to serve as emergency pathways and quick access from the main campus to the river shore.

The rain drop illustration was used to depict the amount of water gathered by the rain gardens proposed in the main parking lot. An astounding 6,124.6 gallons of water can be retained during the first 2 inches of any rainfall event.

The image shown on the page to the right is an example of an informational sign that would be implemented in various spaces around Arlington Echo's campus. Each sign would contain new information relating to an activity or an educational opportunity that the Anne Arundel County school curriculum would like to establish. The Treasure Trunk Design wanted to focus on the native tree habitats that are within Arlington Echo so students can learn about the common species they may see on a day to day basis. The sign would be made from recycled wood that has been taken down from the parking lot so students can understand humanities appreciation for these important natural materials.


WOODLAND
QUERCUS RUBA...
also known as red oak or Northern red oak, is a tree native to the Eastern United States.
Scan QR Code To Learn More!
o Grows up to 75 ft tall
o Vibrant red colored leaves in
o Supports native wildlife
QUERCUS MONTANA...
also known as chestnut oak, is native to Eastern United States and grows up to 70ft tall.
Scan QR Code To Learn More!
o Long-lived tree
o Drought tolerant
o Produce acorns
o Supports native wildlife.
QUERCUS FALCATA...
also known as Spanish oak or Southern red oak is native to United States. Long -lived, fast growing trees grow up to 80ft tall.
Larvae host for the Banded Hairstreak butterfly.
Scan QR Code To Learn More!
o Glossy green leaves
o Leaves change color in fall
o Sandy soil tolerant
o High drought tolerant
o Produces acorns in the fall

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