FLOODPLAINS ON THE PRAIRIE:
AN ECOLOGICAL SCHOOLYARD DESIGN

by

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A REPORT

submitted in partial fulfillment of the requirements for the degree

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Abstract

Man has been learning in the outdoors since the beginning of humankind. Modern times have reduced the amount of time people spend learning and exploring outside. This causes humans to be disconnected from the natural environment. By making schoolyards more environmentally focused, conducive to outdoor education and play, formal education can return to the original classroom–nature– and inspire people to reconnect with their environment.

Much literature supports the ideas of aligning the efforts of play and education, environmental interpretation and education, and outdoor education with formal education; by incorporating all of these elements in a schoolyard, the potential for enriched learning is greatly increased.

This project explores nature interpretation strategies used by public botanic gardens and translates these strategies to an ecological schoolyard. At Northview Elementary School in Manhattan, Kansas, the students face a simple, sterile play-yard with flooding limiting site use after storm events. The design for Northview Elementary will integrate stormwater features with school needs into a new ecological master plan for campus. Interpreting this landscape using the strategies adapted from botanical gardens for educational approaches, methods, and interpretive displays, provides the school and community a resource to enhance their lives, education, and the environment.

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Acknowledgements

I would like to thank my parents, Tom and Lisa, for taking the family camping at National Parks instead of on cruises and for letting us 'grow up' outside. Many thanks to my sister, Ellen, for all of her daily words of wisdom, advice, encouragement, and time spent listening to my project 'rants'. To my friends who took this long journey with me, everyone in studio and out—you kept life interesting and entertaining—I loved every minute of it.

I would also like to thank each of my professors for challenging me to do better and for teaching me so much about the world. Finally, a special thank you to my committee, Katie Kingery-Page, Jon Hunt, and Dr. Ted Cable for all the time and energy spent to help me complete this project and report.

Dedication

To my family who have loved and supported me through thick and thin.

To my friends who have always made me smile and laugh.

And to my professors who have helped me see the world in a whole new way.

Foreword

The Landscape Architecture/Regional & Community Planning graduates of 2012 are the first class to participate in a collaborative studio process leading to completion of their individual master's reports. Seven of these graduates chose to work under the topic Landscapes of Learning. The interests of the group were broad: biophilia, access to nature for children, childhood development and special needs, ecological interpretation, participatory design, public play spaces, and landform as art. The common conversation centered around big questions: How can all children have access to nature for learning through play? What creates a rich, outdoor environment for all kinds of children and young adults?

A formative experience in my understanding of landscapes for learning occurred in 2008-2010, when I helped create a learning garden at a local elementary school. One hundred eighty people built the school garden over eighteen weekends. The garden was handmade. Raised planters were built by Boy Scouts and a kind dad with a miter saw. A talented landscape contractor helped build a 14-foot long limestone bench. The Parent-Teacher Organization's unofficial 'dad of the year' made it a family affair — his siblings, mother, father, and children all returned to the garden site for many weekends of work.

Sadly, the garden existed for just 153 days. The voting public passed a bond for school renovation and the elementary school received funds for a beautiful building expansion. The garden turned out to be too difficult to stage around during construction.

The learning garden had become a talisman to me. In it, I saw a kind of landscape I had never made in a professional firm. The garden was decidedly humble and handcrafted, made of creamy Kansas limestone and native plants bought or

donated and dug in a few at a time. The garden was 'quiet' aesthetically: native wildflowers and grasses, crushed stone paths, tree shade, planters with compost-rich soil. The garden was designed for diverse experiences: learning across the grades and curriculum, quiet time, and play. There was always a puddle somewhere, reflecting leaves and strands of switchgrass. During the fall it was completed, 4th graders would run to the side of the garden intern at recess to ask if they could help weed, or mulch, or rake. When the news sunk in that the garden was gone, I looked at its photographic ghost in satellite imagery. How could so many people want something, work so hard to make it happen, and yet it could not survive?

The humble learning garden had answered a creative drive for me. I had wanted to make social sculpture: to bring a socially-significant place to life beyond words and images. The garden's absence opened me to questions about landscapes of/by/for learning.

The 2012 Landscapes of Learning studio became a forum for these questions. Seven master of landscape architecture and master of regional and community planning students selected the studio as the crucible for their final year's projects. The graduate student researchers conceived of their bond as a colloquium, where each shared information freely to raise the expertise of all.

Though each student defined his or her own project, all projects engaged the community of Manhattan, Kansas (the setting for Kansas State University); and all projects questioned what we as future landscape architects and planners assume about landscapes for children. In nine months' time, a diverse set of projects took shape to address a range of questions:

If we assume access to nature to be beneficial to children, are some children denied access due to socioeconomic status and its impact upon housing choice?
Jonathan Knight, Wichita, Kansas

In a neighborhood with no parks, can an oversized middle school property serve a joint use for school and neighbors?
Shuang Hao, Manhattan, Kansas / Suihua, China

How can an elementary school in a flood plain landscape meet diverse schoolyard needs while also interpreting the hydrologic cycle for children and the community?
Laura Weatherholt, Tulsa, Oklahoma

How can a schoolyard be designed to be a therapeutic environment for all children, with an emphasis on benefiting those children with autism?
Chelsey King, St. Peters, Missouri

How can planners and landscape architects improve community participatory design methods for determining what children need and desire in a school landscape?
Kweku Addo-Atuah, Accra, Ghana

Contemporary schoolyards often lack creative expression. How can humanities research serve as evidence for the design of a functional schoolyard that is also a sculptural work of art?
Rebecca Melvin, Seattle, Washington

In the temperate Midwest United States, interiorscapes are seldom a feature of public schools. How should an interiorscape be designed to integrate the natural and built environment within an existing high school?
Sukaina Fakhraldeen, Kuwait

The reports address landscapes of learning at a range of scales: from city planning to interior scale. The projects also exhibit a great variety in conceptual approach: from personal and poetic design driven by humanities knowledge to participatory design process including nearly one hundred students. What is not evident in the list of questions is the interrelationship between projects. The individual report which follows will provide a point of reference. The individual researcher's goals will be made clear, but will also be linked to a collective annotated bibliography made by the studio. Some reports refer to the work of other students, as several projects were interdependent, but each report is original work, completed by the individual author.

As a whole, the 2012 Landscapes of Learning master's reports do not focus narrowly upon the most popular topics of the day: encouraging active play and control of childhood obesity. Instead, our holistic approach demonstrates creative and scholarly inquiry representing a breadth of themes in contemporary discourse about experiential learning environments for children.

Assistant Professor Katie Kingery-Page
Major Professor to the Landscapes of Learning Students
April, 2012

"In the end, we conserve only what we love.
We will love only what we understand.
We will understand only what we are taught."
–Baba Dioum

(Daley 2009, 5)

Chapter One:
School Landscapes

Switchgrass. *Panicum virgatum.* Sketch by Author

Project Introduction-
School Landscapes

Dilemma

Our world is facing a critical point in its history. Population growth, increase in resource consumption, and the resulting pollution, are poised to overwhelm the earth in the near future (Chiras and Reganold 2010). Today's youth are the generation who will have to deal with the consequences of today's actions. In order to address these problems, individuals must care about what is at stake. Is their education fully preparing them—do they understand what might be lost? Does their education foster stewardship? Is there more we can do? A solid foundation in ecological literacy is necessary for this generation to have in order for them to face tomorrow's challenges with success (National Wildlife Federation 2001, Carnegie Mellon University 2003).

On a smaller scale, the city of Manhattan, Kansas, has experienced a number of damaging flood incidents. Northview Elementary School in Manhattan is located in a floodplain and often experiences flooding on the grounds, considerably limiting student use of the site and play areas. In order to mitigate future flood severity, residents must be aware of the preventative actions that can be taken on personal property. However, there are currently few local examples to provide inspiration, education, and awareness to the public.

Thesis

While the standard playfield, blacktop, and play structures are commonplace for many schools, a "new normal" is necessary. An ecologically and educationally complex schoolyard model would allow children to explore, learn, play, and connect with nature, fostering curiosity and compassion for the natural world. It would simultaneously increase their knowledge and provide a strong foundation for environmental stewardship.

Implementing ecological design in school settings can bring about behavior change, making students more environmentally aware and inclined to be stewards of the environment (Danks 2010). Transforming school grounds into gardens and natural areas embraces the concept of immersing children in the physical world (Dannenmaier 2008).

Schools have the potential to turn their campuses into opportunities to remind us that nature exists all around—in backyards and schoolyards, not only on far off mountains. To embrace the playgrounds, outdoor classrooms, and gardens and incorporate them into an overall environmentally focused campus would create a setting that focuses on natural resource conservation and education. "We can engage and encourage everyone to appreciate the natural world around us and take action to help conserve it" (National Wildlife Federation 2001).

Taking a local issue—for example flooding in Manhattan—and using the school campus as a site to display environmental solutions accomplishes two objectives. Not only does it enrich the students' learning environment, it also provides an example of stormwater management for the public.

Research goals:

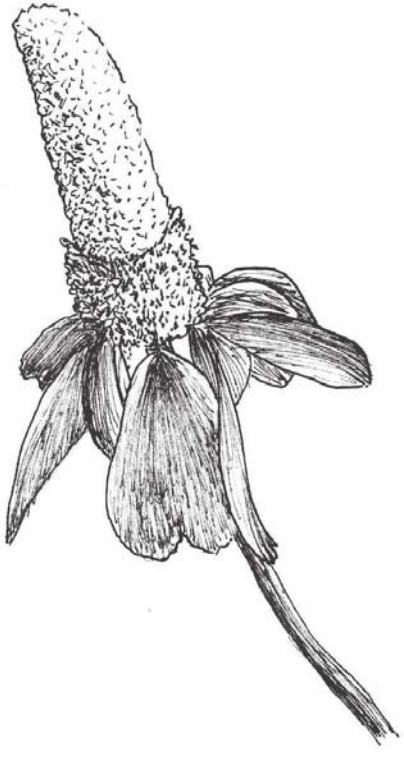
- To study the influences of outdoor play and education on students.
- Discover what changes can be made in the school landscape to enhance students' interaction and connection with the natural world.
- Explore how stormwater features and interpretation can integrate and combine with everyday school needs.
- To help the reader understand how a childhood connection with nature, develops into a life of environmental awareness and stewardship.

"A true conservationist is a man who knows that the world is not given by his fathers but borrowed from his children."

–John James Audubon

(Daley 2009, 2)

Chapter Two:
Northview Elementary School



Prairie Coneflower. *Ratibida columnifera.* Sketch by Author

Site Introduction
Northview Elementary School

Northview Elementary School is located on fifteen acres on the northeast side of Manhattan at 300 Griffith Drive, shown in Figure 2.1. The adjacent right-of-way property north of the school and the eastern edge of Northview City Park is also included in the design scope. The field to the east of the school building will not be explored in this design. Classmate Rebecca Melvin is using this site for her project *Site as Playground: Expanding the Experience of Play.* Collaboration between projects is discussed at a later time.

As an exemplary school, Northview Elementary is a pillar in this community. With the majority of the student body walking to and from school (over 80%), it is very much a neighborhood school. The school building and grounds are used for many purposes beyond the traditional school schedule. Before and after school care and summer school offer important services for working parents, providing a safe and educational haven for students beyond the hours of the school day.

Recent construction on the building has improved the indoor facilities but has left the outdoor facilities lacking. One of two playgrounds is now gone, as is a learning garden area. The faculty supports the idea of spending more time outdoors educating, but the current post-construction facilities do not provide favorable conditions for this. This project explores the potential for outdoor education at this campus.

Figure 2.1. Aerial image of Northview Elementary School. Project boundaries marked with dashed box. Not to scale. Image by Google Earth

Site Conditions

Areas of standing water or mud are prevalent throughout the Northview campus after a storm event (Figs. 2.2-2.9).

After visiting the site and gathering base data, the following framework laid the foundation for the site inventory and site analysis. The site exploration uses the project philosophy to keep the findings focused on key issues.

Some key issues at Northview Elementary addressed further in the site inventory and analysis (Figs. 2.10-2.19) include:

- Stormwater drainage issues throughout site.

- Connectivity to the neighborhoods, across the site and around the building.

- Outdoor Education Facilities-School desires more opportunities for outdoor education, expanding both the subjects and facilities.

- Some of the non-site specific topics being explored in this project include environmental, educational, and play issues.

Site Conditions
After A Storm Event

Figure 2.4. East side courtyard. Photo by Author

Figure 2.7. West edge of playground. Photo by Author

Figure 2.2. Blacktop area. Photo by Author

Figure 2.5. Roof drains creating erosion channels. Photo by Author

Figure 2.8. West side of playground. Photo by Author

Figure 2.3. Playground. Photo by Author

Figure 2.6. West exit, near playground. Photo by Author

Figure 2.9. Back of building. Photo by Author

Flood Zone Map

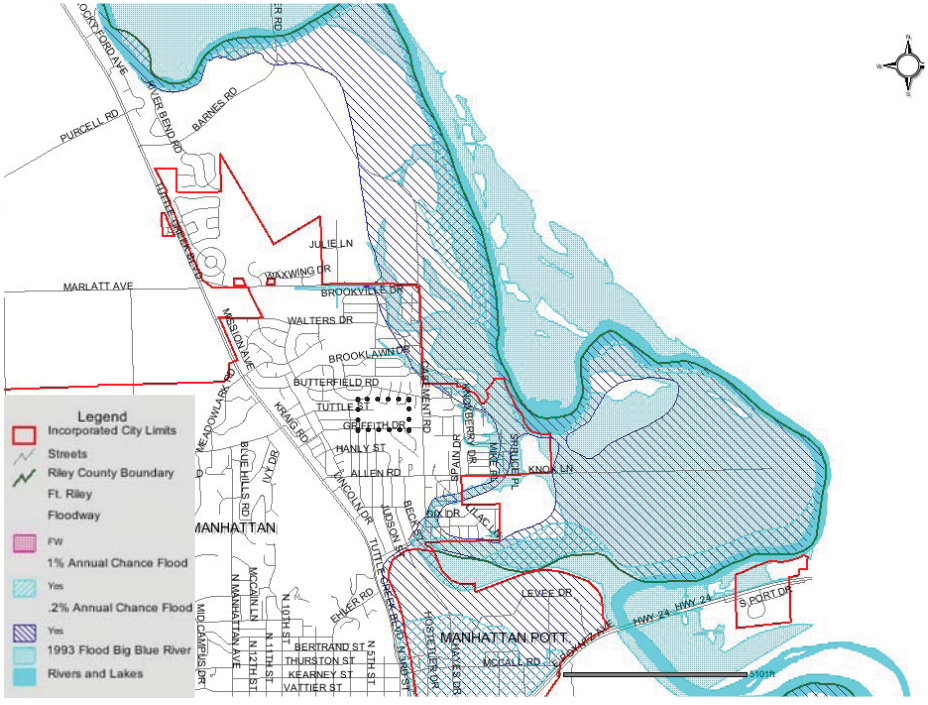


Figure 2.10. Flood Zone of Big Blue River. School location within dotted box. Map Courtesy of Riley County GIS.

Inventory: The flood zone plays a large role in this community. With the nearby river and constant risk of flood during a storm event, the community is more aware of this than most Manhattan residents.
Analysis: The elementary school has an opportunity to set an example and educate the students and community about how to help alleviate the stresses on the storm sewer and mitigate stormwater runoff on their own property, potentially reducing flood intensity and damage.

Attendance Zones Map

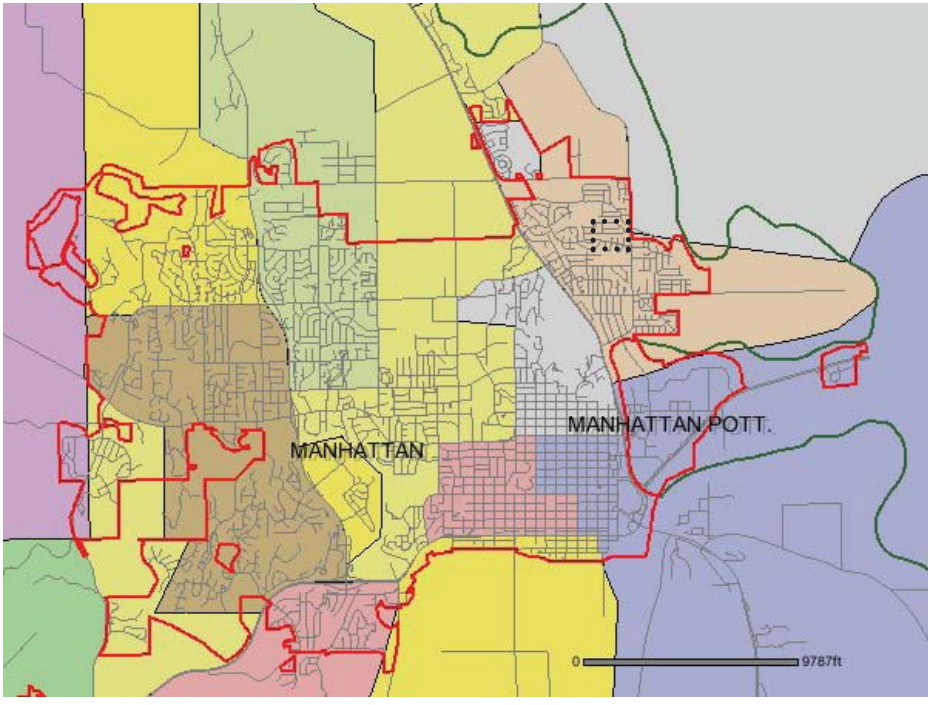


Figure 2.11. Manhattan, Kansas, Elementary school attendance zones. Northview school located within dotted box. Map Courtesy of Riley County GIS.

Inventory: The attendance zones show the neighborhoods that comprise Northview's community. The school placement in the attendance zone is accessible by students walking and biking.
Analysis: This area of Manhattan is topographically similar throughout, allowing for the message and strategies used on the campus to be applicable to most of the community.

Topography Map

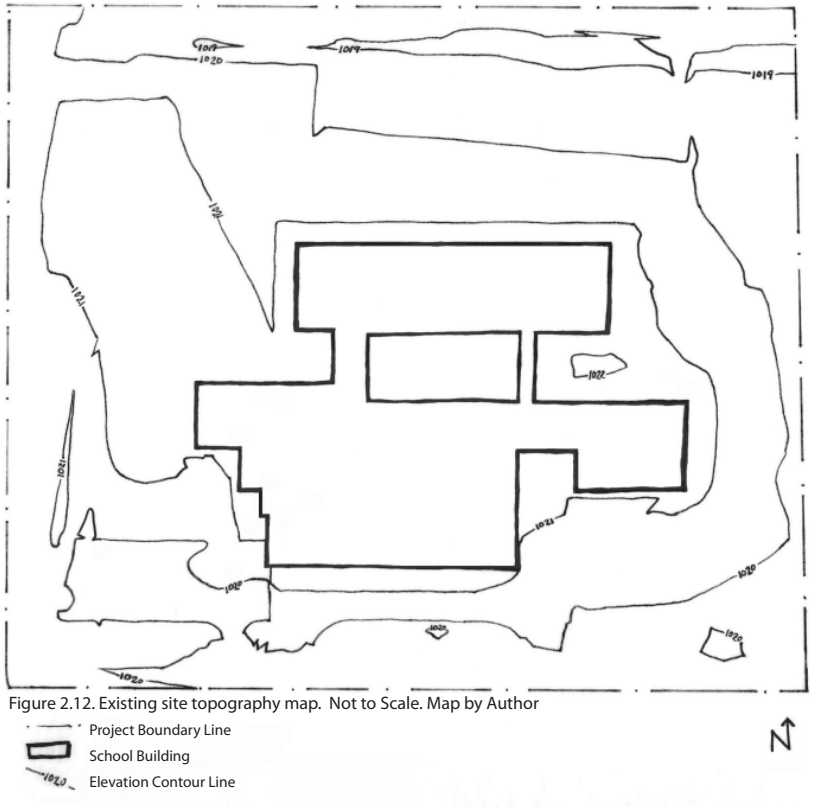


Figure 2.12. Existing site topography map. Not to Scale. Map by Author

Inventory: The amount of elevation change on the site is minimal. This is typical for an area within a flood zone. The highest elevation level on the site is 1022 with the lowest being 1019.
Analysis: The average slope of the site is about 1.7%. This means drainage of stormwater is a pertinent issue and creating drainage through design grading will be essential to a successful design. The optimal design will prepare the site to handle a 100–year flood event.

Drainage Map

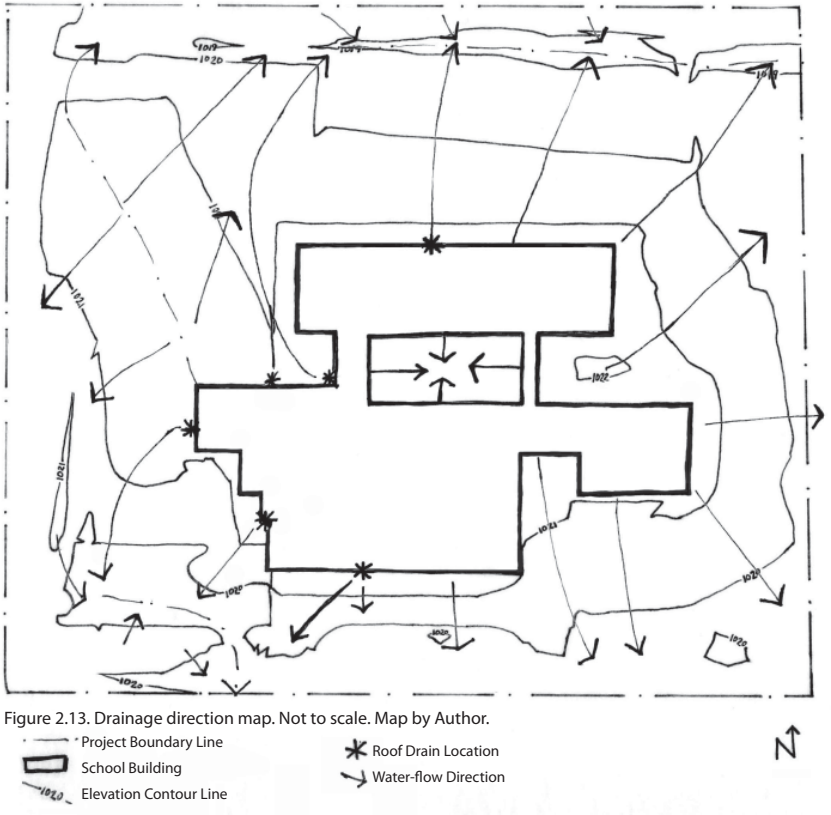


Figure 2.13. Drainage direction map. Not to scale. Map by Author.

Inventory: This map shows the direction of drainage across the site. The downspouts for roof drainage are concentrated on the west and north sides of the building. Located on the north edge of the project boundary is a small, shallow drainage ditch that connects to the neighboring properties.

Analysis: The concentration of roof drains at these locations will lead to erosion problems. The resulting areas of standing water near the building pose a potential for foundation problems.

Site Circulation Map

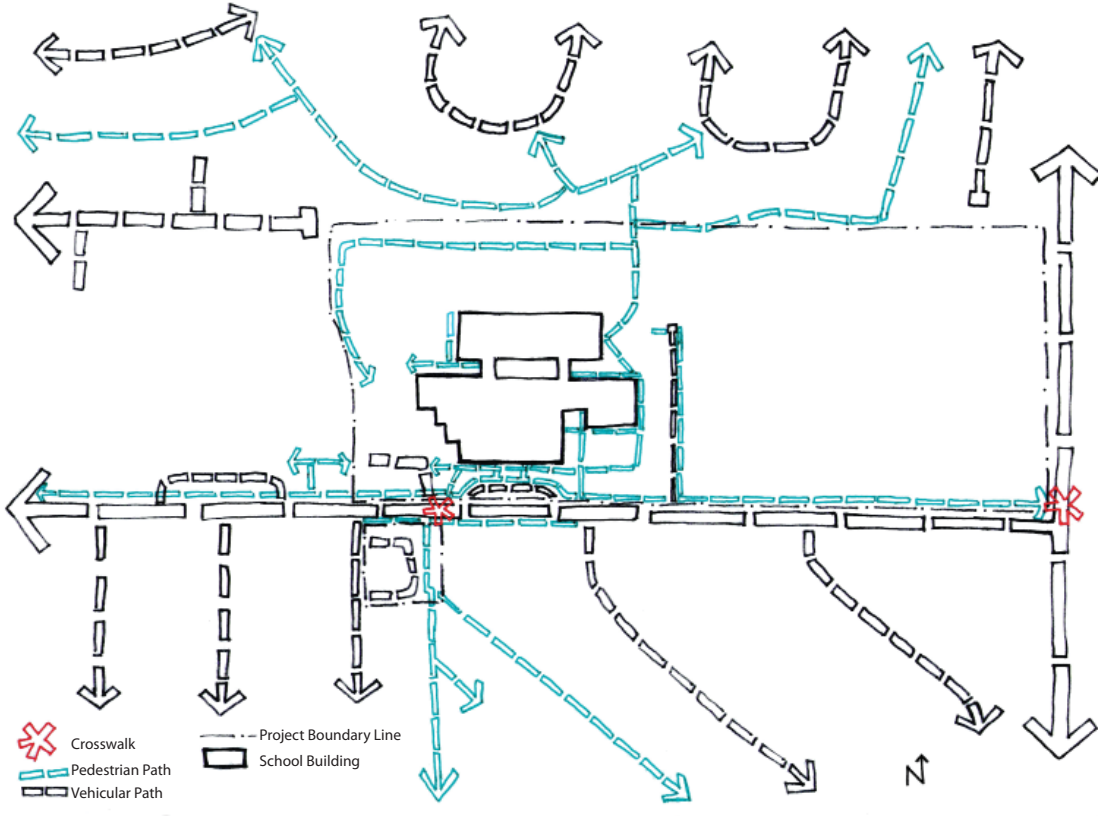


Figure 2.14. Pedestrian and Vehicular Circulation Map. Not to scale. Map by Author.

Inventory: As previously discussed, a large portion of the student body walks to and from school on a regular basis. Connectivity throughout the neighborhoods is a key part of this pattern. This map shows where those connections are made with the campus and where crosswalk intersections occur for pedestrians.

Analysis: Improving the connections to the school for pedestrians would greatly improve the community. Both students and adults use these routes and expanding the network would benefit everyone.

Building Circulation Map

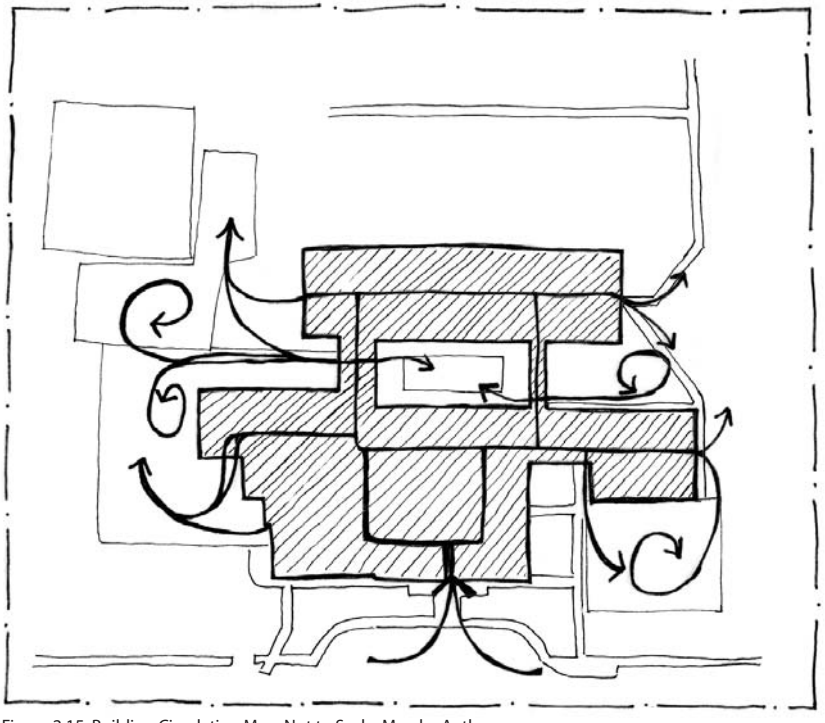


Figure 2.15. Building Circulation Map. Not to Scale. Map by Author.

Inventory: This map shows building circulation and the various exits. The exits most heavily used are by the playground and blacktop areas, located on the southeast and west sides of the building. Building entry is limited to the front door or key entry for building security.
Analysis: This progression of space will be considered when designing the order of spaces and for the locations of program elements and signage on the campus.

Standing Water Map

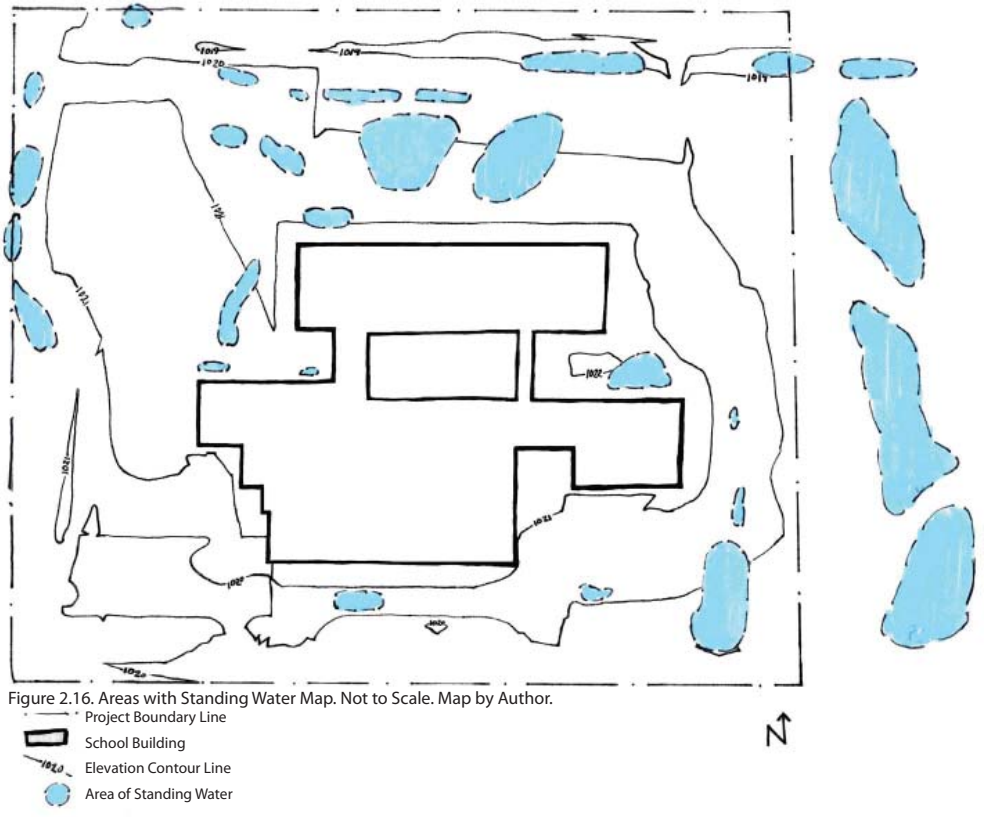


Figure 2.16. Areas with Standing Water Map. Not to Scale. Map by Author.

Inventory: A site visit after a storm event revealed multiple areas of standing water on the campus. This places many limitations on school use of the grounds when these conditions exist, as shown in Figure 2.16.

Analysis: To keep the school and students mud-free, outdoor time is limited to the blacktops and gravel areas. Stagnant water during the summer can lead to mosquito breeding grounds and during the winter to potentially dangerous sheets of ice. Allowing water to linger and infiltrate back into the groundwater system is a favorable occurrence, but these areas of standing water are not conducive to site needs or successful infiltration. Turning these areas into an asset instead of a burden is a major goal the project.

Surface Cover Map

Figure 2.17. Surface Cover Map. Not to scale. Map by Author.

Inventory: Figure 2.17 specifies the types of surface cover used on campus and the amount of existing tree cover. The school has an extensive blacktop system. The gravel playgrounds offer a different texture experience for the student, which is important in play areas. However, the loose gravel often spills across sidewalks creating a tripping hazard for running children. The tree cover is limited, creating many areas that are full sun.

Analysis: Creating more shaded areas will increase the comfort level of the user. Moving gravel and sand play areas away from paved areas will reduce tripping hazards. The design may also request removal of portions of the pavement to further the purpose of the design.

Activity Levels Map

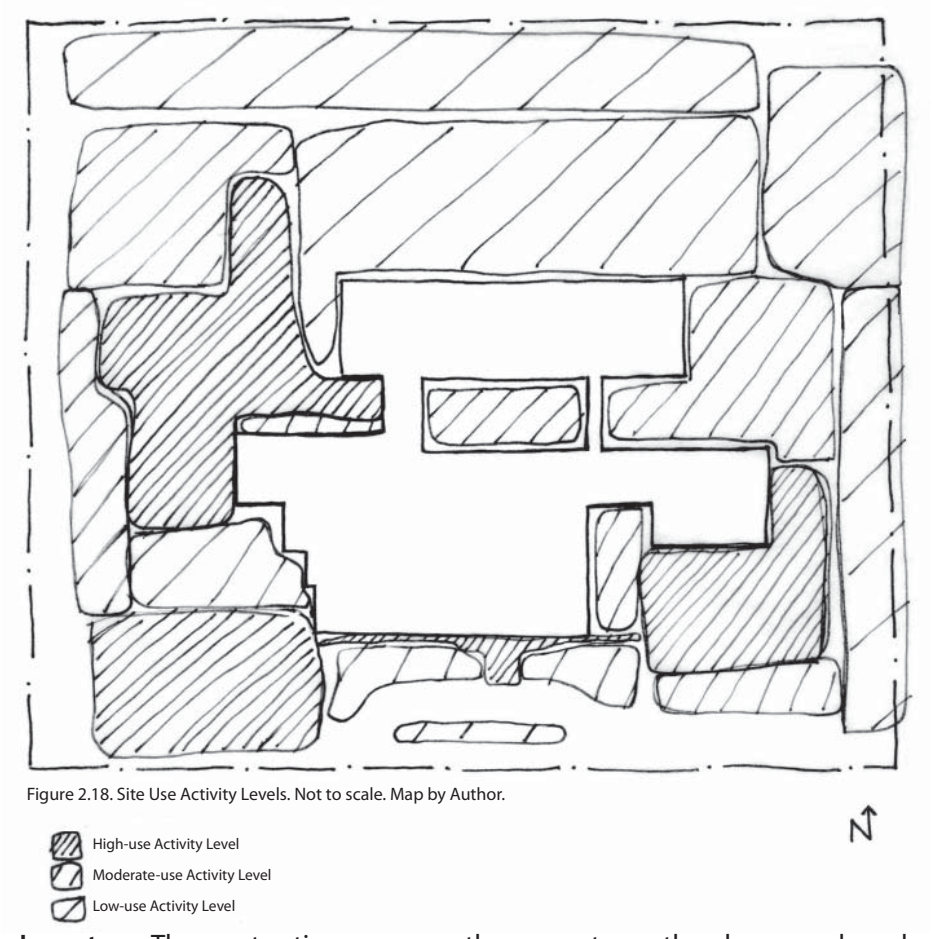


Figure 2.18. Site Use Activity Levels. Not to scale. Map by Author.

Inventory: The most active spaces on the property are the playgrounds and blacktop areas. The areas further from the building and doorways are less frequented during the school day.

Analysis: Elements of the design that are compatible with active areas will be included here. Conversely, the low-use areas on the north side will be appropriate for low-use elements and activities, for example a nature area and trail system.

Classroom Grade Division Map

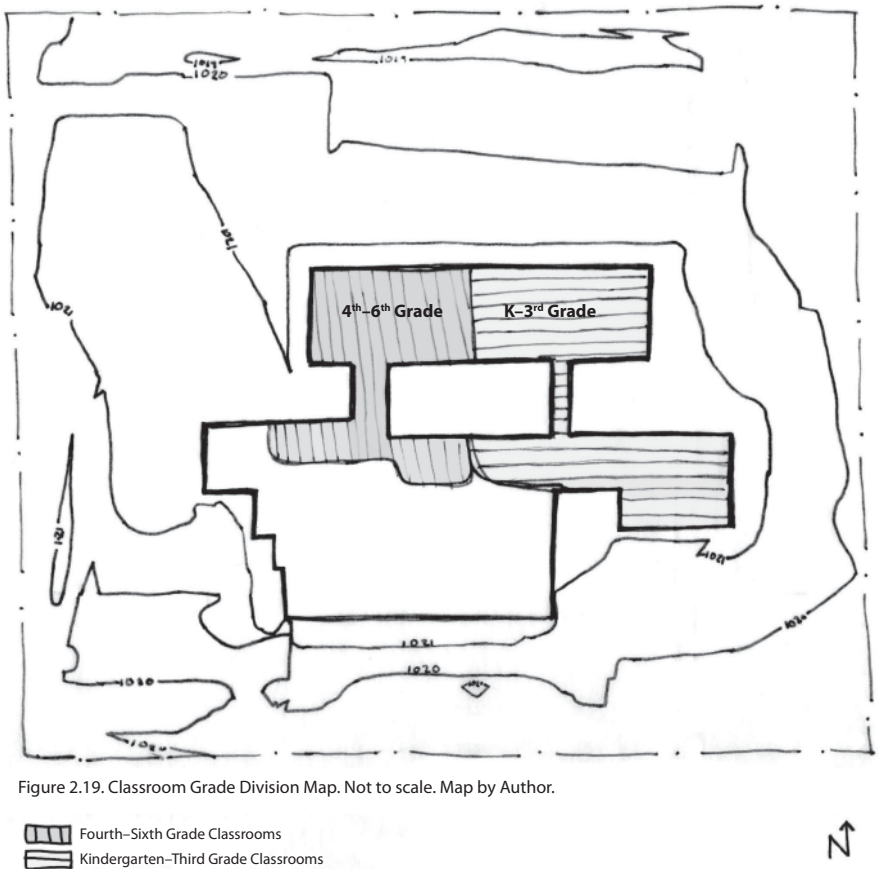


Figure 2.19. Classroom Grade Division Map. Not to scale. Map by Author.

Inventory: This diagram shows the age division of the classrooms in the building. The fourth through sixth grade classrooms are located on the west side, while kindergarten through third grade classrooms are on the east side of the building.
Analysis: In the design, areas adjacent to each side should correspond to the age levels of the students to make access easier for classes to use outdoor elements. This would also allow age-appropriate elements to be located close to the users.

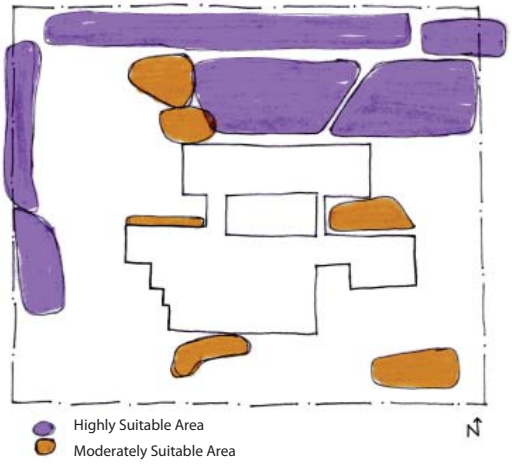


Figure 2.20. Wetland Suitability Map. Not to scale. Map by Author.

Figure 2.21. Stormwater Remediation Suitability Map. Not to scale. Map by Author.

Wetland Suitability Map

The factors considered in the development of this map incorporate low-use areas, areas with standing water, low site elevations, and permeable surfaces. **Analysis:** By noting the suitable wetland areas in this diagram guides their placement in the final design. However, not all of these areas will be included as wetlands in the final design. Much of the north end of the site is highly suitable for wetlands. This portion of the site is close to neighborhoods and may encourage more visitors to explore the area.

Stormwater Remediation Suitability Map

The factors included in this map include the presence of a downspout, areas of standing water, permeable ground cover (turf), and close proximity to the building or pavement areas. **Analysis:** These areas will be considered for the locations of raingardens, bioswales, and other rainwater mitigation techniques. These approaches focus on reducing the expanse of ground with standing water by directing the water into these sites and the wetland areas.

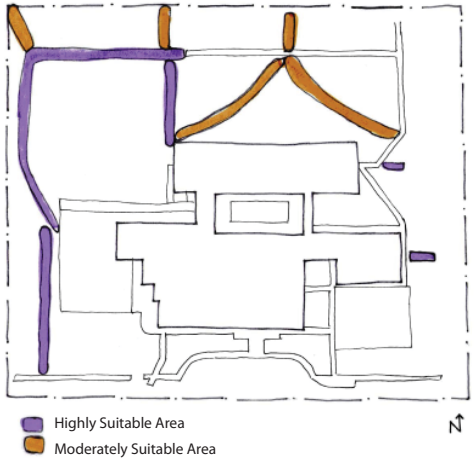


Figure 2.22. New Sidewalk/Trail Suitability Map. Not to scale. Map by Author.

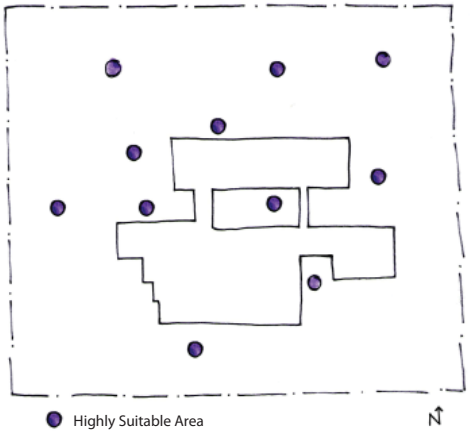


Figure 2.23. Educational Display Suitability Map. Not to scale. Map by Author.

New Sidewalk/Trail Suitability Map

The factors considered for this map include the placement of current sidewalks, building exits, and neighborhood proximity.
Analysis: The goal of trails in the design is to expand the current connection to the neighborhood and encourage exploration of the site and exhibit areas. These paths may change as the design progresses, but serve as a starting point.

Educational Display Suitability Map

The factors considered in the suitability of the interpretive signage and exhibits include the locations of educational opportunities such as wetland or raingarden areas, proximity to high-use areas, and location of sidewalks.
Analysis: Final location of the displays may change with the final design, but this provides a sound foundation and framework for the placement of future displays.

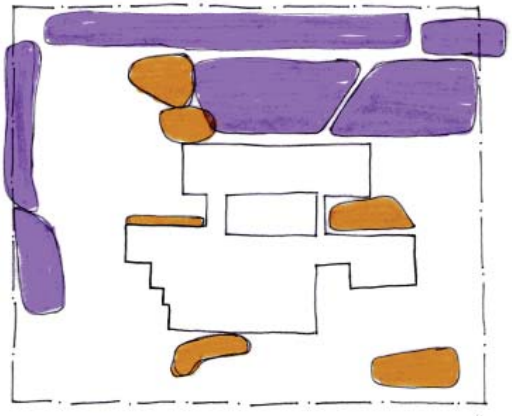


Figure 2.20. Wetland Suitability Map. Not to scale. Map by Author.

Figure 2.21. Stormwater Remediation Suitability Map. Not to scale. Map by Author.

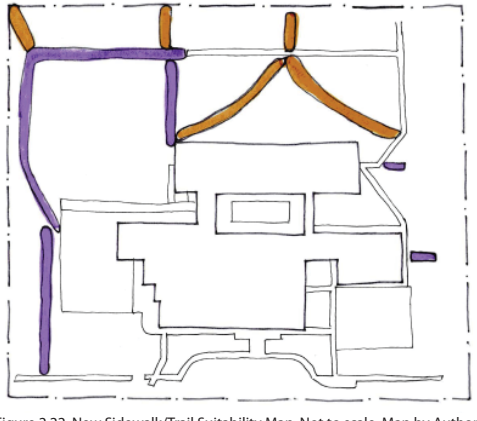


Figure 2.22. New Sidewalk/Trail Suitability Map. Not to scale. Map by Author.

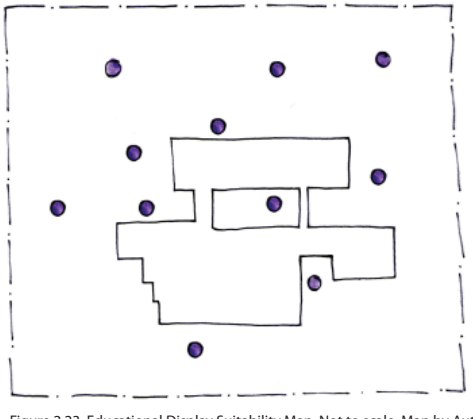


Figure 2.23. Educational Display Suitability Map. Not to scale. Map by Author.

Suitability Compilation Map

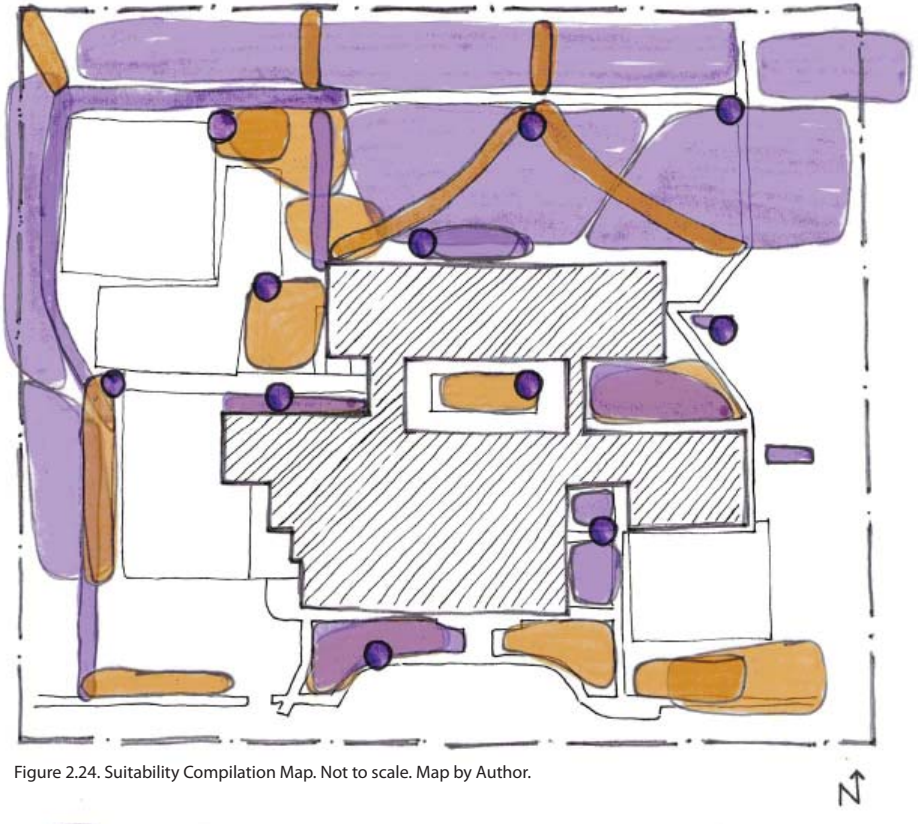


Figure 2.24. Suitability Compilation Map. Not to scale. Map by Author.

This map, Figure 2.24, compiles Figures 2.20 through 2.23 to show their relationships and interconnectedness. By doing this, it is easier to determine priority of placement for the program elements being considered. It also shows the areas not currently suitable for these elements, most of them being playground or parking areas, and will generally retain the same location and function in the final design.

"Earth and sky, woods and fields, lakes and rivers, the mountain and the sea, are excellent schoolmasters, and teach some of us more than we can ever learn in books."

–Sir John Lubbock

(Daley 2009, 108)

Chapter Three:

Case Studies on Botanic Gardens: Education and Interpretive Displays

Wild Prairie Rose. *Rosa arkansana*. Sketch by Author

Case Studies: Botanic Gardens

Education and Interpretive displays

The question providing the focus and direction of the precedent study was "What educational methods and approaches have been used outside of the classroom to teach young audiences about nature?" Finding approaches and methods to educate students about plants, the environment, and core academic subjects while outside the classroom is the focus of this study.

The following sites were chosen to study as precedents:

- Phipps Conservatory & Botanic Gardens
- Longwood Gardens
- Queens Botanic Gardens
- Cheyenne Botanic Garden
- Powell Gardens
- Botanica: The Wichita Gardens.

All of the selected sites have a commitment to the environment, stewardship, and education, correlating with the philosophy of the project. Two of the gardens offer a regional example while the others offer a variety of scale, approach, and location. Studying gardens provides a glimpse at education in a setting away from the school, in an environment that must attract visitors, when schools generally have a captive audience.

These sites are analyzed and compared based on: their educational approach and programs, the topics covered within the garden, interpretive displays, use of signage and possible applications to the design project. The findings provided a baseline of information for the educational aspects and signage that are included in the design portion.

Figure 3.1. Entrance to Phipps Conservatory. Photo by E. Weatherholt

Figure 3.2. Aerial View of Phipps Conservatory. Not to scale. Image by Google Earth

Phipps Conservatory & Botanic Gardens

Schenley Park- Pittsburgh, PA
Size: 43,493 sq.ft.
Established: 1893-1903

Mission
"To inspire and educate visitors with the beauty and importance of plants; to advance sustainability and worldwide biodiversity through action and research; and to celebrate its historic glasshouse" (Phipps Conservatory 2011).

History
Inspired by the City Beautiful Movement of the 1890s, Henry Phipps gave the city of Pittsburgh a conservatory and stocked it with tropical plants from the 1893 Columbian Exposition in Chicago. The conservatory (Fig. 3.1) became part of the then-new Schenley Park and helped to put the city on par with parks and urban development in major American and European cities at the time (Fig. 3.2). In 1937, a large storm damaged many of the buildings and plants. The WPA crews in 1940 reconstructed the garden's hardscape, which remains today. In 1976, the conservatory was placed on the National register of Historic Places. Their educational docent program started in 1980 and has grown to include classes for both children and adults. Today their Welcome Center is LEED Certified and construction is underway for a 'living' building to house their Center for Sustainable Landscapes. Phipps again takes the lead through green building initiatives that have set the region on a more sustainable course (Cunningham 2000, Phipps Conservatory 2011).

Educational Approach
At Phipps, the educational approach taken is one where real world experiences are more important than learning from textbooks. The conservatory has many opportunities to inspire and educate students about the beauty and importance of the world of plants (Fig. 3.3). Although most opportunities throughout the garden are geared towards children, they provide lessons and interpretation that can be enjoyed by all visitors (Fig. 3.4).

Educational Methods
Many of the exhibits host interactive displays engaging the visitors and providing an experience to remember. Their student workshops embrace science-based knowledge ranging from biomes to insects.

Figure 3.3. Chihuly Glass Art Exhibit. Photo by E. Weatherholt

Figure 3.4. Hands-on Plant Activity. Photo by E. Weatherholt

Figure 3.5. Interactive Rain Forest Exhibit. Photo by E. Weatherholt

Each program changes in depth and focus, depending on the students' grade in school. Visitors have numerous opportunities to interact with staff and docents, lending a personal touch to the visit. This shows a commitment to the quality of the experience and helps visitors leave with a sense of the 'grand themes', along with the desire to return. The following is a list of their elementary school workshop opportunities. Other opportunities in the garden include story-time, Scout programs, summer camp, and other seasonal events.

Educational Topics

•(Biomes) Tropical Forests—explore the rainforest conservatory to learn about forest plants and animals, the products produced from rainforests, explore a native's hut, all while walking among the canopy (Fig. 3.5).

•Desert—allows students to explore the desert environment, how plants store water; students get to plant and take home their very own succulent.

•(Growth) Seeds—learn about the cycle of life for plants and plant your own seed to take home and grow.

•Butterflies—Learn about butterflies in the butterfly room where the insects are growing in all stages of their life cycle, how important they are as pollinators for the plant cycle.

•(Recycling) Compost—learn about how Mother Nature recycles using worms turning dead plants and animals into soil. Also, learn about how humans recycle and why it is important (Phipps Conservatory 2011).

Signage Use

The daily exhibit plant signs are a simple black and white with the plant name and two levels of information— a larger bold phrase to give impact, smaller text, information about the plant (Fig. 3.6). At the special exhibits bolder signs are used. They have color, images, maps, and vary in physical shape. More information is shared on these, making them text heavy, and geared toward older visitors (Figs. 3.7-3.9). The use of pictures does allow easier transferring of information to the younger visitors.

Figure 3.6. Exhibit Signage. Photo by E. Weatherholt

Figure 3.8. Signage Promoting Green Practices. Photo by E. Weatherholt

Figure 3.7. Rain Forest Exhibit Signage. Photo by E. Weatherholt

Figure 3.9. Rain Forest Exhibit Signage. Photo by E. Weatherholt

Figure 3.10. Longwood Conservatories. Photo by E. Weatherholt

Figure 3.11. Aerial View of Longwood Gardens in Kennett Square, Pennsylvania. Not to scale. Image by Google Earth

Longwood Gardens

Kennett Square, Pennsylvania
Size: 1,077 acres
Established: 1906

Mission
"Longwood Gardens is the living legacy of Pierre S. du Pont, inspiring people through excellence in garden design, horticulture, education and the arts. "
"Longwood Gardens is one of the great gardens of the world. We strive for innovation in horticulture and display. We present the arts in an unparalleled setting to bring pleasure and inspire the imagination of our guests. We contribute to society through excellent and diverse education programs, horticulture research, environmental stewardship, and cultural and community engagement" (Longwood Gardens 2011).

History
Having been a working farm, arboretum, and park all prior to 1850, Industrialist Pierre S. du Pont purchased the property in 1906 to save the arboretum from being sold off as lumber. Until 1930, du Pont added to the property, and enhanced it with inspiration from his world travels. This included a conservatory (Fig. 3.10), extensive fountains, an open-air theater, and a massive pipe organ. Though open to the public while du Pont lived on the estate, the gardens were turned over to the Longwood Foundation in 1946 and became what we know as Longwood Gardens today (Fig. 3.11). Through the years, they have gone through many renovations and additions. This includes the 2007 Indoor Children's Garden, creating a large, engaging horticultural world to stimulate kids' imaginations.

Their Continuing Education program started in 1958 and has since grown to include graduate programs, internships, and classes for all ages and experience (Cunningham 2000, Longwood Gardens 2011).

Educational Approach
The focus of the garden is for the visitors' experience to be aesthetically pleasing and to enjoy the beauty of the gardens (Fig. 3.12).

Educational Methods
Most of the educational aspects are fulfilled with formal lessons and workshop programs led by garden staff or self-led lessons with pamphlets. Their educational philosophy states, "Our hands-on curriculum programs are designed to nurture student curiosity, while focusing on learning." Curriculum

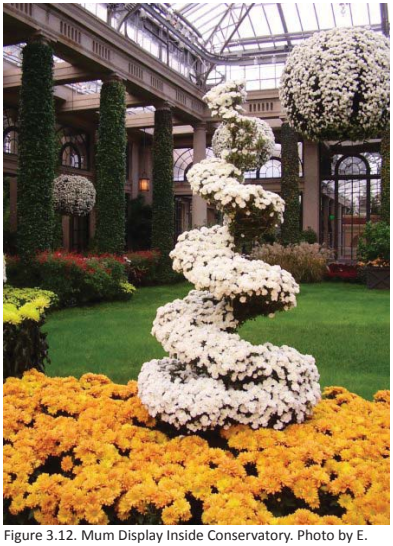


Figure 3.12. Mum Display Inside Conservatory. Photo by E. Weatherholt

for each subject can vary in difficulty depending on school year of students (Longwood Gardens 2011).

Educational Topics

Many core subjects in school are covered in the workshops.

"•NatureVoice-Writing and Literature-Write poetry inspired by the gardens.

•GoFigure-Mathematics-Design garden plots with different units of measure.

•CaptureIt-Visual Arts-Look at Claude Monet's Water Lilies and paint your own, learn how to mix colors.

•LandMark-Geography-Learn about the Earth's surface, read a map, create a map, and go orienteering.

•MakingScents-Science-Sensory activity relating smells from plants and the products they make-tea, soap Self-guided curriculum is a part of a backpack check out program, which includes:

•Pollination- Journal, math sheets, drawing, and mapping the garden.

•Trees-Learn about the parts- bark, leafs, growth rings, and different types of trees.

•Flowers-Design a garden, identify flowers, learn the parts of the flower, write story, map the site, discover pollinator insects, and go on a plant search" (Longwood Gardens 2011).

Other opportunities for self-guided activities include a scavenger hunt, the Indoor Children's Garden with music, mazes, and water fun, the Bee Garden, and forest Treehouses. They also have programs for summer camp, Scouts, professional development for teachers, and seasonal events (Longwood Gardens 2011).

Signage Use

Longwood's approach to sign use is a minimal one. Plant labels are small and unobtrusive with minimal text (Fig. 3.13). The overall desired focus is on the plants, not the signs. Where signs are used, each is placed deliberately and conveys information precisely.

The special exhibit signage is more evident, using color and varied shapes to draw attention (Figs. 3.14-3.15). The information directly correlates to the exhibit display behind it. These signs use text, images, and diagrams to convey information. The Indoor Children's Garden and outdoor Bee A-Mazed Flower Garden have little to no signage, preferring to allow the children to explore and experiment to discover all that the spaces have to offer.

Figure 3.13. Plant Identification Signage. Photo by A. Byrd

Figure 3.14. Special Exhibit Signage. Photo by A. Byrd

Figure 3.15. Special Exhibit Signage. Photo by A. Byrd

Figure 3.16. LEED Certified Visitor Center. Photo by E. Weatherholt

Figure 3.17. Aerial of Queens Botanical Garden in Flushing, New York. Not to scale. Image by Google Earth

Queens Botanical Garden

Queens Borough, Flushing, New York
Size: 39 acres
Established: 1939

Mission
"Queens Botanical Garden is an urban oasis where people, plants and cultures are celebrated through inspiring gardens, innovative educational programs and demonstrations of environmental stewardship" (Queens Botanical Garden 2006).

History
The Queens Botanical Garden began as a part of the 1939 New York World's Fair, and was again a part of the 1964 World's Fair. It has grown since then to become a leading example of sustainability for both buildings and landscape. The Visitor Center is LEED Platinum and the surrounding landscape qualified for a Sustainable Sites Initiative certification (Fig. 3.16). It is considered by locals to be "an extension of their own backyards" and this in dense urban environment (Fig. 3.17), it is an important green space (Queens Botanical Garden 2006, Sustainable Sites Initiative 2008).

Unique Challenges
With the garden's location in one of the densest urban areas on the planet, the pressure is increased on the site as an amenity to the city. It is also located in a very culturally diverse area, complicating communication efforts with users. To deal with these issues, creative solutions are necessary. All signs are in the borough's three most common languages (Fig. 3.18). To alleviate pressure on city infrastructure, the building functions are now environmentally focused and the landscape functions are being used to their fullest potential (bioswales, grey water use, greenroof). They are also dealing with an audience that may not always realize their actions within the city or 'concrete jungle' have an effect on nature; this offers a chance to engage visitors and remind them that we are all connected to the natural world. With such a diverse audience, the garden strives to be a refuge for all (Fig. 3.19), and because of this diversity every visitor leaves with a different experience (Queens Botanical Garden 2006).

Educational Approach
Queens Botanical Garden designed their environmental tours and workshops to be hands-on, encourage inquiry, and are based on science curriculum-satisfying National and New York State Science Standards. They

Figure 3.18. Multi-Lingual Way-Finding. Photo by E. Weatherholt

Figure 3.19. Garden Entrance. Photo by E. Weatherholt

Figure 3.20. Bee Garden. Photo by E. Weatherholt

also address interdependence, plant and animal adaptations (Fig. 3.20), biomes and plant communities, as well as special seasonal and special city considerations.

Educational Methods

In addition to outdoor learning opportunities, their new Visitor Center is a "living encyclopedia of sustainable technologies" promoting principles of environmental stewardship. Beyond this, they also offer a Children's Garden program spring through fall, summer camps, Scout programs, professional development for teachers, and other seasonal events (Queens Botanical Garden 2006).

Educational Topics

Workshops offered cover the following topics:

- Biomes and their plants
- City plants
- Seasons
- Good and bad insects
- Growing together-multicultural aspects of plants
- Trees
- Plants to eat
- Plants and animals
- Cultures
- Bee garden-pollination, honey production
- Herb garden-plant parts, uses, food production
- Compost in Woodland gardens, leaf litter (Queens Botanical Garden 2006).

Figure 3.21. Green Trail Signage. Photo by E. Weatherholt

Figure 3.22. Green Trail Signage. Photo by E. Weatherholt

Figure 3.23. Educational Signage. Photo by E. Weatherholt

Signage Use

At Queens Botanical Garden, they have several types of signs for visitor education. Two of their newest additions include the "Green Trail" signage (Figs. 3.21, 3.22) and large exhibit signs about their new building and landscapes (Fig. 3.23). They also have specific garden signage and way-finding signs throughout the gardens (Figs. 3.24-3.26). All signs are in color and most include multiple languages. The "Green Trail" signs are small but abundant throughout the garden and building. This creates a scavenger-hunt feeling of 'trying to find them all' promoting further exploration of the garden. The text explains the systems at work and asks questions to encourage the reader to consider their own 'green' behavior.

Figure 3.24. Garden Exhibit Signage. Photo by E. Weatherholt

Figure 3.25. Multi-Lingual Directional Signage. Photo by E. Weatherholt

The larger signs give a more in-depth description of the systems at work using text, images, and cross section diagrams. The way-finding signs are clear and simple, with information in three languages. The remaining garden signs are geared towards older visitors due to the amount of text and minimal use of images, but still convey information about the topic.

Figure 3.26. Multi-Lingual Signage. Photo by E. Weatherholt

Figure 3.27. Cheyenne Botanic Gardens Entrance. Photo by E. Weatherholt

Figure 3.28. Aerial of Cheyenne Botanic Gardens in Cheyenne, Wyoming. Not to Scale. Image by Google Earth

Cheyenne Botanic Gardens

Cheyenne, Wyoming
Size: 9.1 acres
Established: 1977

Mission
"The Cheyenne Botanic Gardens inspires, beautifies, and enriches the High Plains through gardening, volunteerism, education, and stewardship. This is accomplished through these focus areas: Plants–Exhibit diverse plant collections and landscapes Service and therapy–Provide meaningful opportunities for seniors, handicapped and youth-at-risk volunteers who are essential in growing the Gardens. Education and Outreach–Provide educational and therapeutic opportunities and create demonstrations in landscaping, gardening, renewable energy and sustainable earth-friendly solutions" (Cheyenne Botanic Gardens 2011).

History
Founded in 1977 as the "Cheyenne Community Solar Greenhouse", the garden and solar conservatory were moved to Lions Park and incorporated into the City Parks and Recreation Department in 1986 (Figs. 3.27, 3.28). The Paul Smith Children's Village was added in 2009, which features many sustainable aspects. The Children's Village received a LEED Platinum award, the only children's center to have done so. Sustainability has been a daily focus since the beginning, with features such as solar panels, solar heating, wind power turbines, and sustainable landscapes (Cheyenne Botanic Gardens 2011).

Unique Challenges
Cheyenne is one of the nation's most difficult garden climates ranking number one for hail and fourth for wind nationwide. "At an elevation of 6,000 feet above sea level and receiving about fifteen inches of rain annually, they have cool summers, gorgeous falls, and long winters." With these extreme conditions, success in the garden lies with good environmental practices. In addition, volunteers are the majority of the workforce—including senior citizens, the handicapped and at-risk youth—so challenges must be overcome daily to keep the garden running smoothly (Cheyenne Botanic Gardens 2011).

Figure 3.29. Elevated Wetlands Trail. Photo by E. Weatherholt

Figure 3.30. Children's Village. Photo by E. Weatherholt

Figure 3.31. Photovoltaics on LEED Certified Children's Center. Photo by E. Weatherholt

Educational Approach

The Cheyenne Botanic Gardens is committed to sustainability in the environment and the same can be said about their educational programs. The garden is focused on bringing issues to light that effect the community and the region. One area that embodies this is the Children's Village (Figs. 3.29-3.34) where the underlying theme is to "teach concepts of sustainability past, present, future" (Cheyenne Botanic Gardens 2011).

Educational Methods

With several interactive displays and theme spaces, the garden is supportive of hands-on learning. With fun, engaging displays the visitor is more likely to remember the experience and take the message home with them, inciting behavior change.

Educational Topics

The many concepts include:

- Shelterbelts
- Xeriscape gardening
- Wetlands pond
- Herb garden for public use
- Community garden plots
- Streambeds
- History of the area-Indians, ranchers, farmers

Children's Village also covers:

- Theater
- Wind turbine
- Solar panels
- Solar path tracker
- Evergreen walk-ABC's of trees
- World food garden
- Music
- Solar powered well pump
- Water powered wheel

Figure 3.32. Greenroof on Dog House. Photo by E. Weatherholt

Figure 3.33. Water Powered Wheel. Photo by E. Weatherholt

Figure 3.34. Wind Turbine and Solar Panels. Photo by E. Weatherholt

- Irrigation screw
- Solar-heated green house
- Labyrinth
- Green roof

Other programs offered include seasonal activities, story-time, Scout programs, and a large volunteer program. The garden places a high priority on involving the community. It is viewed as a leader in the community, helping the community realize 'green living' is easy, money saving, and easy to do (Cheyenne Botanic Gardens 2011).

Signage Use

Cheyenne Botanic Garden took a creative approach with wetland trail signage, collaborating with a local sixth grade class to provide illustrations and educational poems about each topic (Figs. 3.35-3.37). The signs are simple, but effectively communicate their message. Signage design changes for each garden area but follows similar design guidelines, including the use of two tones, keeping text to a minimum and incorporating an image in the sign. The signs are all made of metal for ease of cleaning and a longer lifespan of materials, making the choice more environmentally sound.

Figure 3.35. Wetlands Signage Designed by Local School Children. Photo by E. Weatherholt

Figure 3.36. Wetland Habitat Exhibit Signage. Photo by E. Weatherholt

Figure 3.37. Wetland Habitat Exhibit Signage. Photo by E. Weatherholt

Figure 3.38. Outdoor Classroom Area at Botanica. Photo by E. Weatherholt

Figure 3.39. Aerial Photo of Botanica in Wichita, Kansas. Not to scale. Image by Google Earth

Botanica:
The Wichita Gardens

Wichita, Kansas
Size: 9.5 acres
Established: 1985

Mission
"To generate enthusiasm for horticulture and enlighten people through educational, artistic, and cultural experiences" (Botanica 2012).

History
In 1987, Botanica opened in Wichita to be the "community center for horticulture". The process started in 1982 when the Wichita Area Garden council and the City of Wichita worked together to plan the center. Over three years the plans were formed for the center and gardens and in 1985, construction began on the project. After two years, the project was complete and open to the public. Since then they have added twenty themed gardens to the original four gardens (Figs. 3.38, 3.39). The visitor center hosts a horticultural library and takes pride in developing the community (Botanica 2012).

Educational Approach
This garden is geared heavily towards the local community and the region. Educating visitors about local issues and helping them enjoy the gardens and local wildlife is a large focus of the garden.

Educational Methods
They approach each exhibit with the home gardener, or backyard naturalists in mind. With many volunteers on staff in the garden and visitors center, Botanica is literally 'by the people, for the people'.

Educational Topics
- Wildlife Habitat
- Native plants
- Art
- Xeriscaping
- Geology
- Water systems
- Butterflies

Signage Use
Each garden area is marked with a trail marker. These signs are two-tone bronze and are mounted to a large stone, as shown in Figure 3.44. Each themed area of the garden has unique signage pertaining to the topic. The two main exhibit displays have signs in color, with text and images. In the Xeriscape garden area, the signs are very simple and direct with their information, in both text and imagery.

Figure 3.40 & 3.42. Xeriscape Garden Signage. Photos by Author

Figure 3.41. Xeriscape Garden Signage. Photo by Author

Figure 3.43. Xeriscape Garden Signage. Photo by Author

The signs shown in Figures 3.40 through 3.43 all follow the same design format of image placement, title, and text layout. This allows for a wider target audience and ease of comprehension while visitors are moving along a path.

Displays within the woodland walk are more complex, directing the information more toward adults. The text on the signs is lengthy and small, conveying a lot of information to the visitor, shown in Figures 3.45 through 3.48. Color images and a hands-on portion do accompany the text on the signs, allowing for some interest for younger visitors. The area is designed to keep the visitor in one spot for several minutes, not only to read the display, but also to observe the wildlife in the space.

Both approaches convey the information with different strategies, changing for the audience, topic, and use of the space.

Figure 3.45. Bird Habitat Exhibit Signage. Photo by Author

Figure 3.47. Bird Habitat Exhibit Signage. Photo by Author

Figure 3.44. Bronze Garden Markers. Photo by E. Weatherholt


Figure 3.46. Interactive Bird-Feeder Exhibit. Photo by Author


Figure 3.48. Bird Identification Exhibit Signage. Photo by E. Weatherholt

Figure 3.49. Powell Gardens Chapel. Photo by Author

Figure 3.50. Aerial View of Powell Gardens in Kingsville, Missouri. Not to scale. Image by Google Earth

Powell Gardens

Kingsville, Missouri
Size: 950 acres
Established: 1988

Mission
"To offer an experience that embraces the Midwest's spirit of place and inspires an appreciation for the importance of plants in our lives" (Powell Gardens 2012).

History
Prominent businessman George E. Powell Sr. bought the land in 1948 and having grown up on a farm, had interest in the farmlands of Missouri. In 1969, Powell donated the land to the Kansas City Boy Scouts. The land was used as a regional camp until 1984. At this point, the Powell Family Foundation worked with the University of Missouri's School of Agriculture to create a horticultural and natural resource facility—the Powell Center. In 1988, the decision was made to develop a botanic garden. Environmental Planning and Design firm were brought on as consultants for the botanic garden and architect Fay Jones for the buildings (Figs. 3.49, 3.50). With the addition of the Heartland Harvest Garden, the garden now has a resource for educating visitors about the history of the Midwest and about fresh food (Powell Gardens 2012).

Educational Approach
The focus of this garden is one that returns visitors to the heritage of the region—farming, ranching, prairie expanses, and wildlife. The approach taken at this garden is very hands-on.

Educational Methods
Many displays and exhibits offer interactive, sensory experiences that can be enjoyed by all visitors. Many other educational programs are offered throughout the year, including classes, nature hikes, food harvests, and nature crafts. The Kid's Club provides additional opportunities to go behind the scenes at the garden and get up close and personal with plants, compost, insects, animals, and all the wonders of nature.

Educational Topics
All aspects of farm life including:

- Ranching
- Crops
- Household gardens
- Orchards
- Vineyards

Figure 3.51. Interactive Exhibit Signage. Photo by Author

Figure 3.54. Exhibit Signage. Photo by Author

Figures 3.57 & 3.58. Earthworm Dig Interactive Exhibit. Photo by Author

Figure 3.52. Way-Finding Signage. Photo by Author

Figure 3.55. Exhibit Signage. Photo by Author

Figure 3.59. Earthworm Dig Interactive Exhibit. Photo by Author

Figure 3.53. Exhibit Signage. Photo by Author

Figure 3.56. Exhibit Signage. Photo by Author

Figure 3.60. Insect Play Structures Interactive Exhibit. Photo by Author

Figure 3.61. Dual Purpose Information Display. Photo by Author

Figure 3.62. Dual Purpose Information Display. Photo by Author

Figure 3.63. Dual Purpose Information Booth. Photo by Author

Other general topics included:

- Water use and conservation
- Composting
- Recycling
- Insects
- Wildlife habitat
- Art
- Regional Culture

Signage Use

The signs used in the Heartland Garden mainly fall within plant identification and special exhibit display categories. The main exhibit displays use color, images, and text to transfer information (Figs. 3.51-3.56). Most exhibit signs have uniform placement of images, titles, and text. This allows ease of use for the visitor. The placement of the signs within the garden is such that one sign represents each space or portion of trail. This approach allows visitors to keep from feeling overwhelmed by information or signage and establishes a comfortable rhythm of reading the displays and exploring the spaces. Text on the signs is simple and focused, augmented by images of the topic as a border. Many signs include an interactive exhibit feature to engage visitors even further while educating (Figs. 3.57-3.60, 3.64). Another element used in this garden is the dual purpose exhibit boards as shown in Figures 3.61-3.63. These provide flexibility for site use.

The plant identification signs in the Heartland Garden are black and white, small, and are placed directly beside the plant. Beyond listing the plant's common name and Latin name, they also describe how the plant is edible, keeping with the theme of the garden.

Figure 3.64. Interactive Exhibit Play Elements. Photo by Author

These signs are abundant throughout, but very discreet placement keeps them from overwhelming the displays. One could imagine an adult stopping along the trail to read the plant identifications as they wait on their children to finish playing with an interactive display. These sign strategies offer interest for both children and adult visitors.

Conclusions:
Signage Use

The types of signage identified:

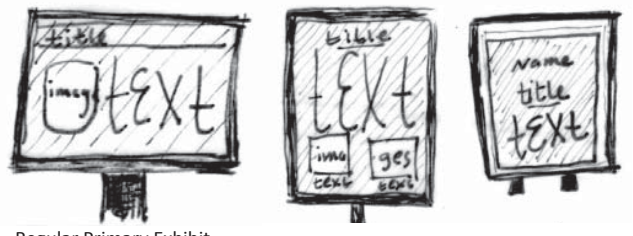
- Directional or Way-Finding
- Special or Secondary Exhibit
- Regular or Primary Exhibit
- Plant Labels
- Trail Markers

The educational signs, like those shown in Figure 3.65, have a hierarchy of importance and use. The directional signage is the most widely used in the gardens, and varied the most in size. Though they varied in size, they all contained a map off the site and explanatory text.

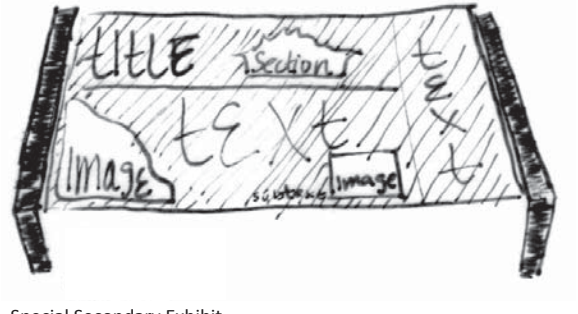
The special exhibit signs were all larger than the other respective signs in each garden, used more selectively, and contained the most color, text, and graphics. The regular exhibit signs used minimal color and images and had simple text. Plant labels commonly focused on three pieces of information: the common name, scientific or Latin name, and brief details about the plant.

The trail marker signs varied in complexity but generally had short, simple text, and were small enough to be unobtrusive on the trail while conveying the information.

The signs used in the design will follow the same structure of those identified here.

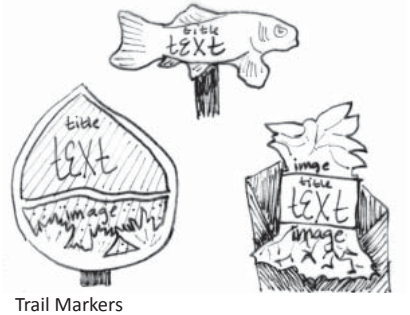


Regular Primary Exhibit



Special Secondary Exhibit

Trail Markers



Trail Markers

Directional or Way-Finding

Figure 3.65. Educational Signage Hierarchy. Sketches by Author

Conclusions:
Garden Comparisons

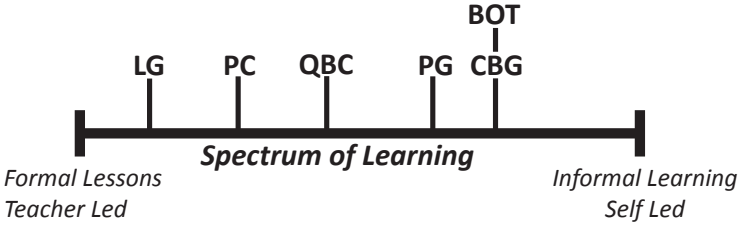


Figure 3.66. Spectrum of Learning. Diagram and strategy by Author

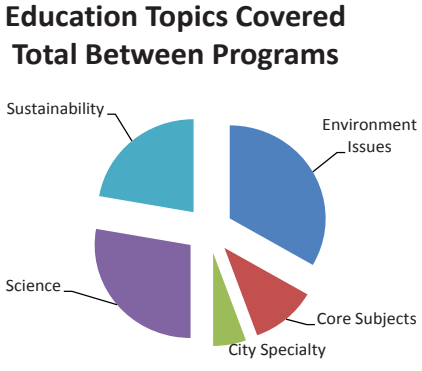


Figure 3.67. Garden Topic Pie Chart. Diagram by Author

Educational Approach

Gardens are positioned on the spectrum of learning, as shown in Figure 3.66, based on analysis of how much of their educational approach is formal lesson based versus self-led exhibits. Queens Botanical Garden has approximately equal formal and informal based lessons, while Longwood Gardens mostly uses primarily formal lessons. Cheyenne Botanic Garden and Botanica have mostly informal self-led educational opportunities.

Strategies from the gardens positioned on the self-guided end of the spectrum will be used for reaching community visitors to the project site. Teacher-led strategies will also be included for classroom use of the project site.

Educational Topics

Figure 3.67 shows the overall amount each topic is covered among the six gardens. The three topic areas covered most among all the gardens were the environment, sustainability, and science. The area least emphasized was city specialty—growing plants in an urban environment. This topic area should be addressed more in future gardens. Two gardens embraced teaching all the core academic subjects in an outdoor setting. The design project will try to provide opportunities to include all of the educational topics identified in the chart.

Topical Garden Ranking Chart

Garden Ranking in...	Sustainability	Educational Opportunities	Display Quality	Kid-Focused	Culture
Phipps Conservatory	2	2	3	2	2
Longwood Gardens	4	1	4	4	4
Queens Botanical Garden	1	2	2	2	1
Cheyenne Botanic Garden	3	4	1	1	3
Powell Gardens	3	1	1	1	1
Botanica	4	3	2	3	2

Table 3.1. Garden Ranking Program Areas. Table by Author

Educational Methods

Each garden was analyzed based on the previous Figures 3.66 and 3.67, the criteria Table 3.2 for each category, and the perceptions of the Author from studying each garden. Each site was then ranked accordingly for each category. Please note: The ratings are based upon the subjective perception of the researcher, and may not correlate with what actually occurs in all programming at the garden.

Ranking Scale: 1=Best, 4=Lowest

Program Areas	PC	LG	QBG	CBG	PG	BOT
Interactive displays on:						
Alternative energy	x		x	x	x	
Water		x	x	x	x	x
Plants	x	x	x	x	x	x
Wildlife	x			x	x	x
Insects	x	x	x	x	x	x
History		x	x	x	x	x
Culture	x		x	x	x	x
Ecosystems	x	x	x	x		x
Food	x		x	x	x	
Signage on:						
Alternative Energy	x		x	x	x	
Water	x		x	x	x	x
Plants	x	x	x	x	x	x
Wildlife	x		x	x	x	x
Insects	x	x	x	x	x	x
History	x	x	x	x	x	x
Culture			x	x	x	x
Ecosystems	x		x	x	x	x
Food	x	x	x	x	x	x
Other Factors:						
Native Plant Use				x	x	x
Outdoor Classroom Space			x	x	x	x
Trails		x	x	x	x	x
Art	x	x	x	x	x	x
Theory: Water	x	x	x	x	x	x
Creatures	x	x	x	x	x	x
Refuges	x	x		x	x	x
Dirt	x	x	x	x	x	x
Heights	x		x	x	x	
Movement		x	x	x	x	x
Make-Believe	x	x		x	x	x
Nurture	x		x	x	x	x
Learning	x	x	x	x	x	x
Space Characteristics:						
Accessible/Inaccessible	x	x	x	x	x	x
Active/Passive	x	x	x	x	x	x
Challenge or risk/ Repetition or security				x		x
Hard/Soft	x	x	x	x	x	x
Natural/People-built	x	x	x	x	x	x
Open/Closed activities	x			x	x	
Permanence/Change	x	x	x	x	x	x
Private/Public	x	x	x	x	x	x
Simple/Complex activities	x			x	x	

Program Elements of Study

The elements in Table 3.2 are items that were studied at each site. The elements on the top half compare the gardens on educational displays and signage. The elements listed on the lower half of the table are factors derived from the literature review and are incorporated in the design framework (further discussed in chapter four). These elements include the theory and characteristics of children's playscapes (Dannenmaier 2008, Stine 1997). This comparison was done to ensure compatibility with the project site and goals. The analysis of this chart helped guide the results of the comparison study.

Table 3.2. Garden Program Areas. Table by Author, portions adapted from Dannenmaier 2008, Stine1997.

Conclusions:
Summary

By diagramming the educational approaches of each garden, the strengths and weaknesses were identified to help guide the design project. It became clear that each garden considered had a different way to focus on its education program. There was no one exact solution or approach—gardens ranged from an environmental focus, to incorporating all academic subjects, to focusing on a specialty, and to a sustainability focus; but all were able to relay its desired message. The larger gardens focused more on the structured learning programs while the smaller sites had more applications of self-guided interactive displays.

An area of weakness for some of the approaches and programs offered were they are only possible for sites with a green house or conservatory, limiting the use of those displays at other sites (e.g. rainforest or desert display).

One program element that should have been more prevalent was local culture and history. This can be an integral part of the garden attraction and experience—in signs, choice of plants, exhibits, events, and visitors. After performing these case studies, the design project will be more responsive to educational aspects of the site and their incorporation in design elements. Ideally, the final site design will be able to balance the needs of formal lessons with the needs of informal learning.

Important items for project design:

1. Avoid lack of signage
2. Use appropriate placement and spacing of signage along paths
3. Use of appropriate signage type
4. Use elements that are multi-purpose, and potentially multi-lingual
5. Include student ideas for final signage design
6. Program uses such as Scout programs, community events, and summer camps should be considered during design.

"The world is mud-luscious and puddle wonderful."
–E.E. Cummings

(Daley 2009, 22)

Chapter Four:

Floodplains on the Prairie:
A Schoolyard Design for Northview Elementary

Woolly Verbena. *Verbena stricta.* Sketch by Author

Design Framework

Figure 4.1 and Table 4.1 illustrate the relationship between the four parts of the design framework:

- **Literature**— Three elements create this section. Design theory for children's play areas (Dannenmaier 2008); Design characteristics for play areas (Stine 1997); Program elements for playgrounds within nature areas (Moore 1997).
- **Precedent Studies**—The study of botanical gardens provided insight on educational signage and exhibits.
- **Site Analysis**—This study highlighted areas of emphasis to address in the final design. Two of the most prominent focus areas are site circulation and site drainage.
- **Collaborations**—Two other students are also working with Northview Elementary projects, providing a complete site design proposal that incorporates both student and faculty input.

Figure 4.1. Design Framework Diagram. Diagram by Author

	In Relation to Children's Playscapes		
Literature	**Theory- Dannenmaier**	**Characteristics- Stine**	**Program- Moore**
	Water	Hard/Soft	Permanent Play Structures
	Creatures	Risk/Security	Traditional equipment
	Refugees	Nature/Man-made	Space for ball play
	Dirt	Accessible/Inaccessible	Spaces for meeting and working
	Heights	Active/Passive	Natural systems present
	Movement	Challenge/Repetition	Weather/microclimates
	Make-Believe	Open/Closed	Circulation path locations
	Nurture	Permanence/Change	Working and storage areas
	Learning	Private/Public	
		Simple/Complex	
Precedents	**Educational Signage**	**Educational Programs**	
	Types of signs	Self led	
	Information layout	Teacher led	
Site Analysis	**Drainage**	**Circulation**	**Outdoor Education**
	Grounds	Around site	Facilities
	Building	Neighborhood access	Locations
Collaboration	**Rebecca Melvin**	**Kweku Addo-Atuah**	**Laura Weatherholt**
	Adjacent Site Design	Program elements	Ecological Master Plan
	Planting palette	Active/Functional spaces	Interpretive Exhibit Plan
	Circulation connections	Exploratory spaces	Planting palette
		Constructive spaces	Circulation connections
		Games with rules	
		Natural areas	

Table 4.1. Design Framework Elements. Table by Author, elements adapted from Dannenmaier 2008, Moore 1997, Stine 1997.

Design Collaboration

Collaboration occurred in program design with the participatory design project. It focuses on incorporating student desires for their playgrounds and the different types of play to complete the schoolyard (see Appendix D for further details). Figure 4.2 illustrates key points in the project timeline where key collaboration efforts took place.

The design also progressed with the collaboration of the site design of the adjacent project-*Site as Playground: Expanding the Experience of Play.* Circulation issues were addressed across both sites (Fig. 4.3) and both share similar planting palettes. Site function needs are shared between the projects, for example, the adjacent site project provides space for large field sports, and the ecological master plan in turn provides some formal learning elements absent in the adjacent site project.

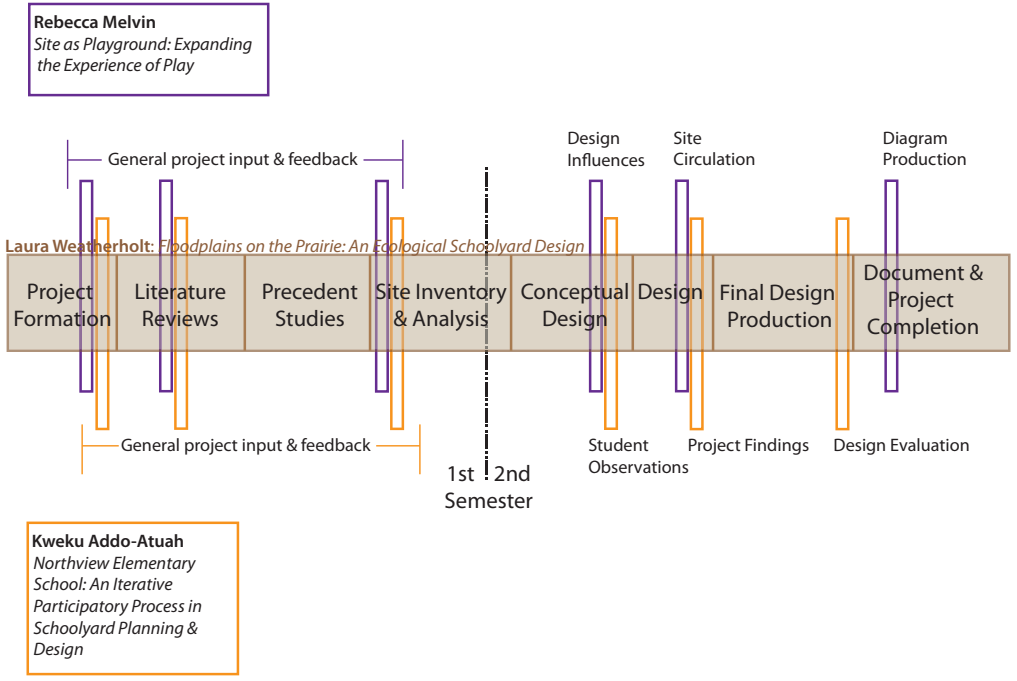


Figure 4.2. Diagram of Collaboration with Classmates. Diagram by Author

Ecological Schoolyard

Site as Playground

Figure 4.3. Diagram of Project Collaboration. Plan left by Author, plan right by Rebecca Melvin

Ecological Master Plan

The Ecological Master Plan incorporates school, community, and wildlife needs. Figure 4.4 shows the final proposed design for Northview Elementary. Education, environment, and stewardship are the guiding philosophies in the design (see Appendix E for Fig. 6.1).

Using an octagonal design motif to shape spaces and other site elements the site facilitates many class uses. The octagons provide a teaching tool for mathematics and geometry. Small and large gathering areas provide places to teach or simply read a book outside. The prairie mounds make history come alive as students learn about the region's past. Science classes can be in the butterfly gardens or on the observation decks learning first-hand about the topics of the day. The possibilities for using the ecological schoolyard as a teaching tool are limited only by the imagination.

Goals for the site:

1. Improve local wildlife habitat
2. Improve water drainage and increase infiltration to recharge groundwater
3. Connectivity improved around site and to neighborhoods
4. Provide a local example of stormwater remediation techniques, leading and educating community
5. Increase student awareness and interaction with nature
6. Provide many useful teaching tools for classroom use
7. Create an exciting, engaging campus with many opportunities for learning and play

Legend

1. Trail system
2. Labyrinth
3. Rock Seat Wall
4. Outdoor Classroom
5. Observation Deck
6. Boardwalk
7. Dry Creek Bed
8. Butterfly Garden
9. Blacktop Activity Area
10. Playground
11. Sandbox
12. Bike Parking
13. Parking Lot
14. Rain Garden
15. Infiltration Cell
16. Mounds
17. Picnic Table
18. Stepping Stones
19. Garden Planters
20. Garden Shed
21. Blacktop Paintings
22. Flower Bed
23. Sign
24. Basketball Hoop
25. Emergency Access Road
26. Connection to Adjacent Site

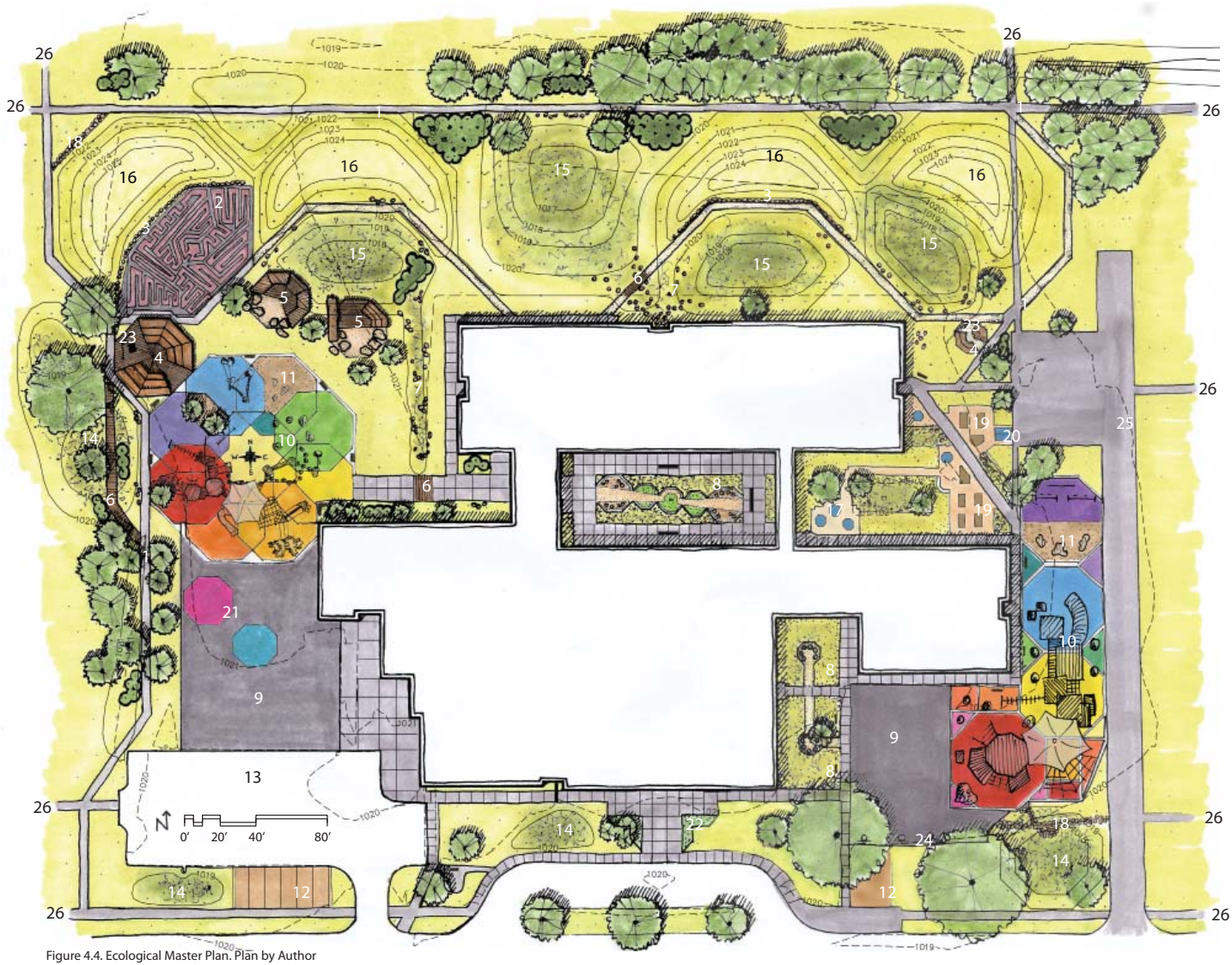


Figure 4.4. Ecological Master Plan. Plan by Author

Nature Trail Area

The north end of the site features a system of mounds and depressions that form different spaces for educational opportunities and wildlife habitat (Figs. 4.5-4.8, 4.13). The depressions form infiltration cells to catch stormwater runoff from the building and the site, allowing it to infiltrate back into the ground. In these areas, suitable native plants are used to help with this function.

Two overlooks allow students to observe the systems functioning without disturbing the area (Figs. 4.9, 4.11, 4.12). The mounds provide a prairie setting designed at a child's scale. This allows for exploration and adventure that topography change brings. The mound areas are easily viewed over by an adult, allowing for student safety.

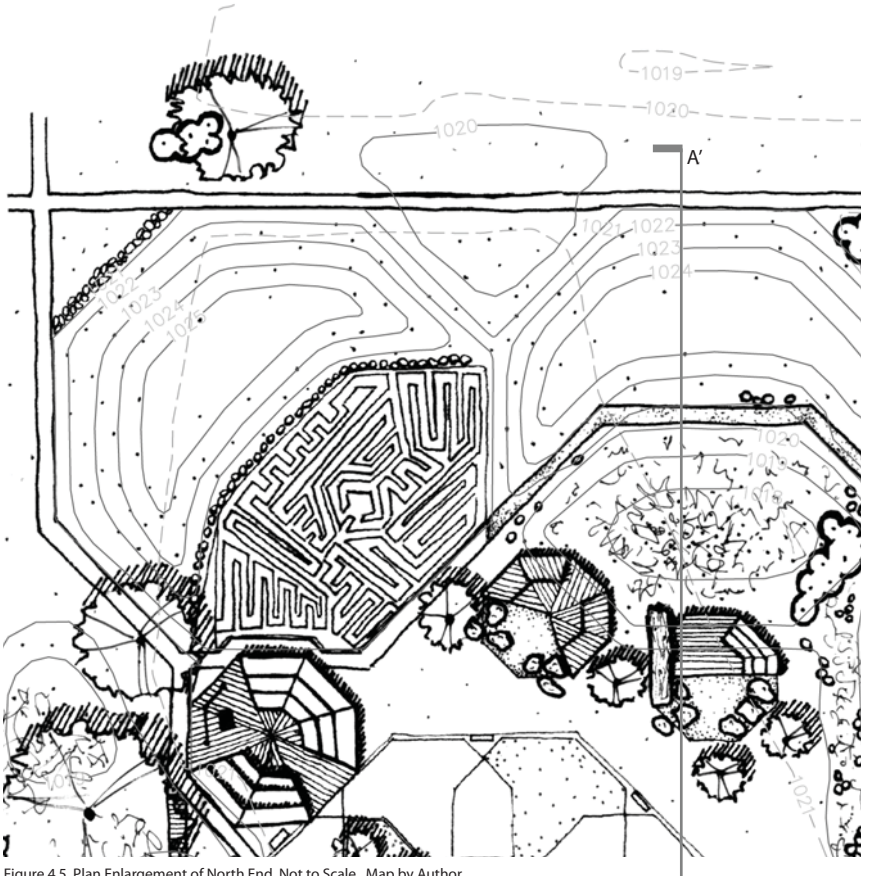


Figure 4.5. Plan Enlargement of North End. Not to Scale. Map by Author

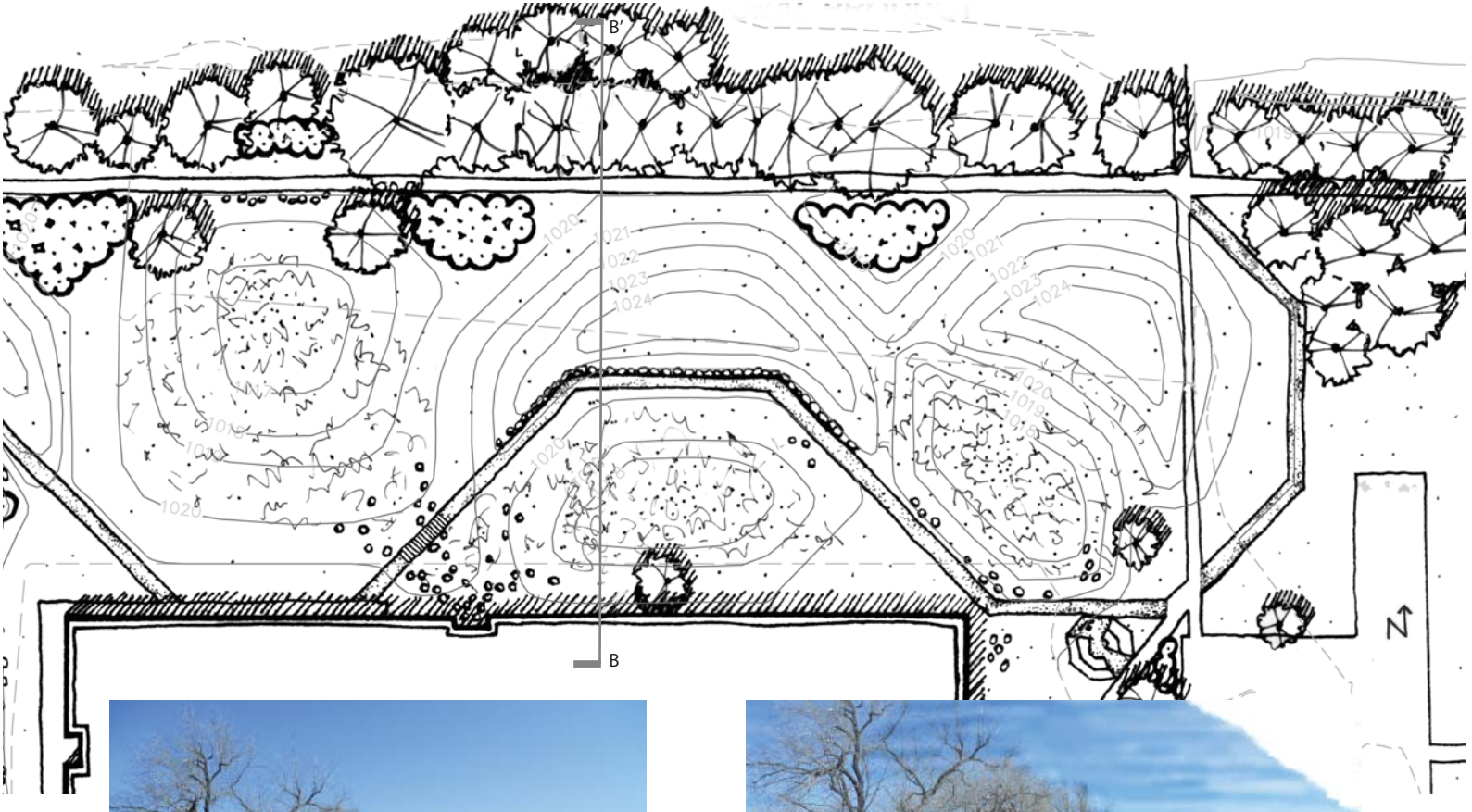


Figure 4.6. Existing Campus Conditions of North Side. Photo by Author

Figure 4.7. Character Montage of Proposed North Side. Image by Author

Nature Trail Area

Cross Section of West Edge of Nature Area

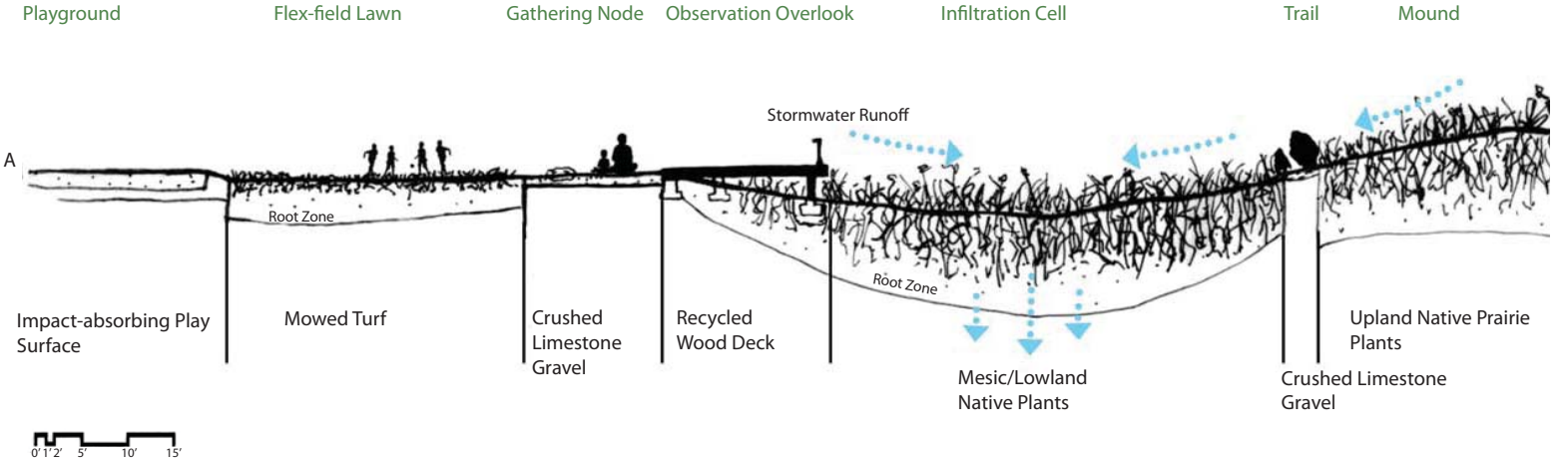


Figure 4.8. Section A-A' Showing Transition to Infiltration Cell and Mound. Illustration by Author

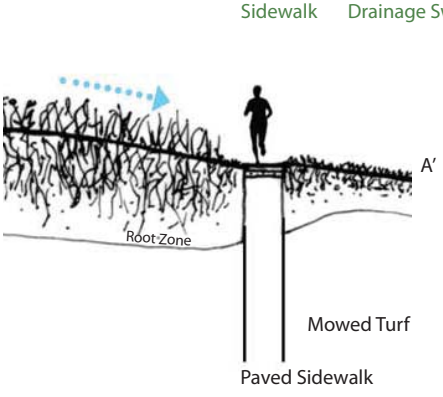


Figure 4.9. West Observation Overlook and Gathering Space. Illustration by Author

In order to be most effective, the capacity for infiltration cells should be designed to handle rain runoff from a 100-year flood event. For Manhattan, Kansas, the expected amount is 3.50 inches of rain in an hour every 100 years (Seelye 1960).

To determine the capacity of the cells, the volume of each is established. The area of the contribution watershed is then calculated and multiplied by the amount of rainfall (3.50 inches) to determine the amount of runoff going into each cell. If the capacity of the cell is larger than the amount of rainfall, then the cell should be able to hold all of the runoff. When calculated for this site, all cells are sized larger than the expected runoff except for the western-most cell. Further design revision could solve this dilemma, but was not explored due to time limitations.

Nature Trail Area

One important aspect in wildlife management is meeting wildlife habitat needs—cover, food, water, and places to nest and raise young (Chiras and Reganold 2010). The diagram in Figure 4.10 illustrates some of the locations providing these elements in the proposed site design. Tables 4.3 and 4.4 further describe the areas with planting palettes for the native planting areas located throughout.

1. **Cover**—Shrub thickets, prairie grasses, trees, evergreens, rock piles, and rock walls provide cover.

2. **Food sources**—Food provided by plants includes seeds, berries, and foliage, with potential for supplemental feeders providing seed.

3. **Water sources**—The site hosts many areas to provide water after a storm event such as the infiltration cells, rain gardens, and puddles around the site. A birdbath may also be installed.

4. **Places to nest and raise young**—Mature trees, shrubs, prairie/ meadow, wetland areas and nesting boxes provide areas to nest and raise young.

Legend for Habitat Needs Map

Cover

Food sources

Water sources

Places to nest and raise young

Habitat Needs Map

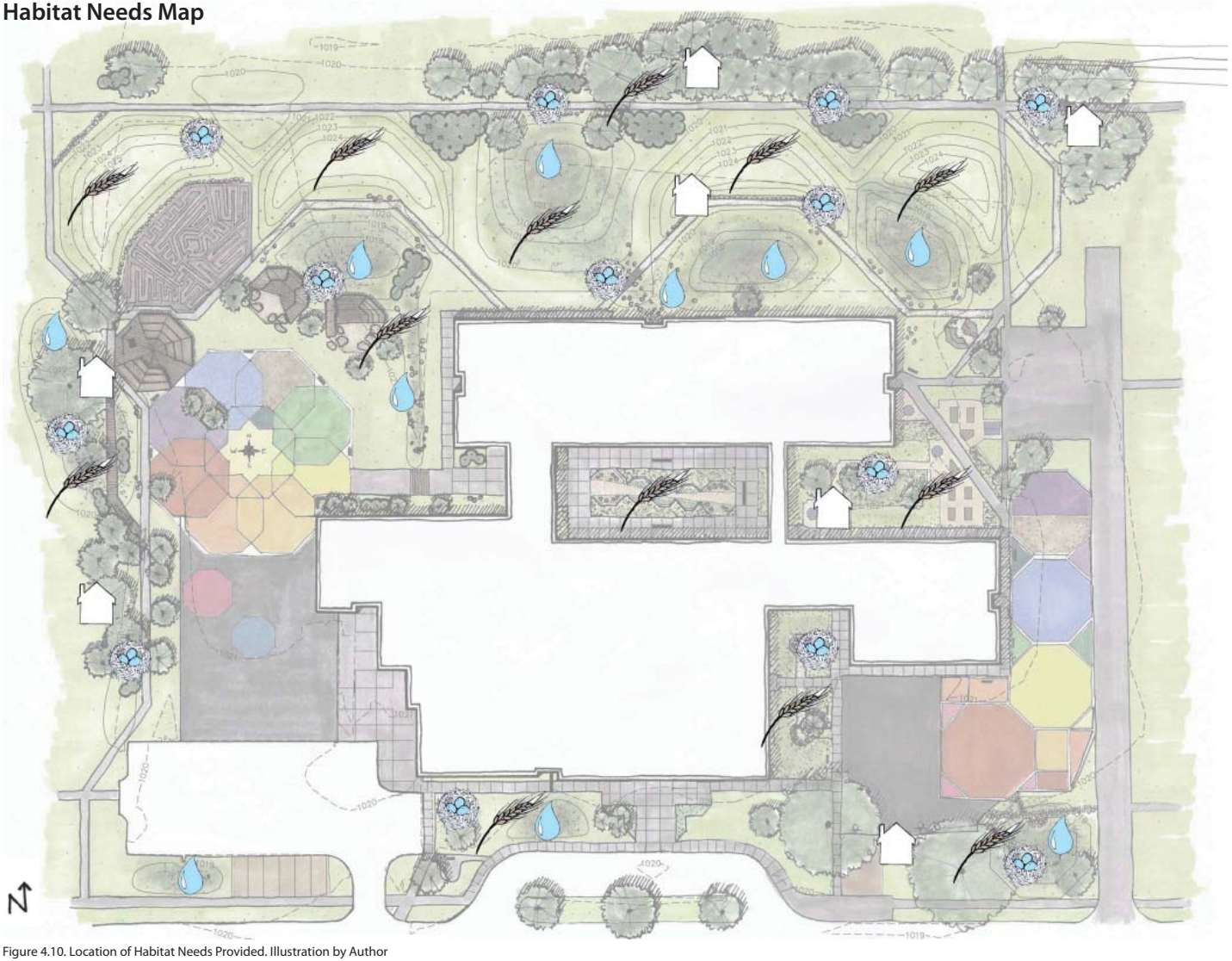


Figure 4.10. Location of Habitat Needs Provided. Illustration by Author

Nature Trail Area

Figure 4.12. East Observation Overlook and Gathering Space. Illustration by Author

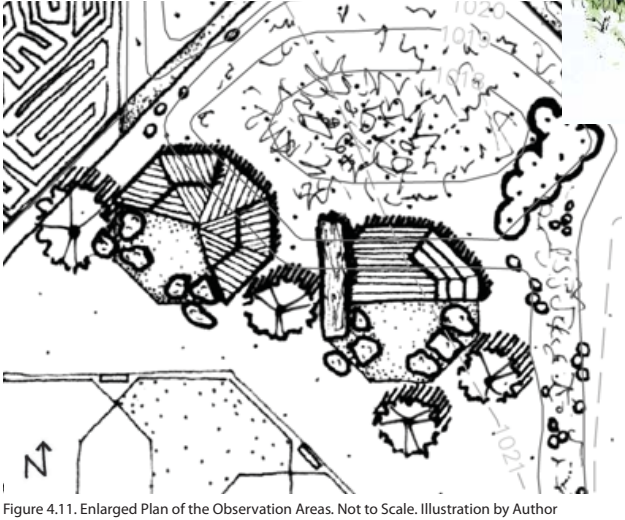


Figure 4.11. Enlarged Plan of the Observation Areas. Not to Scale. Illustration by Author

Cross Section of Central Portion of Nature Area

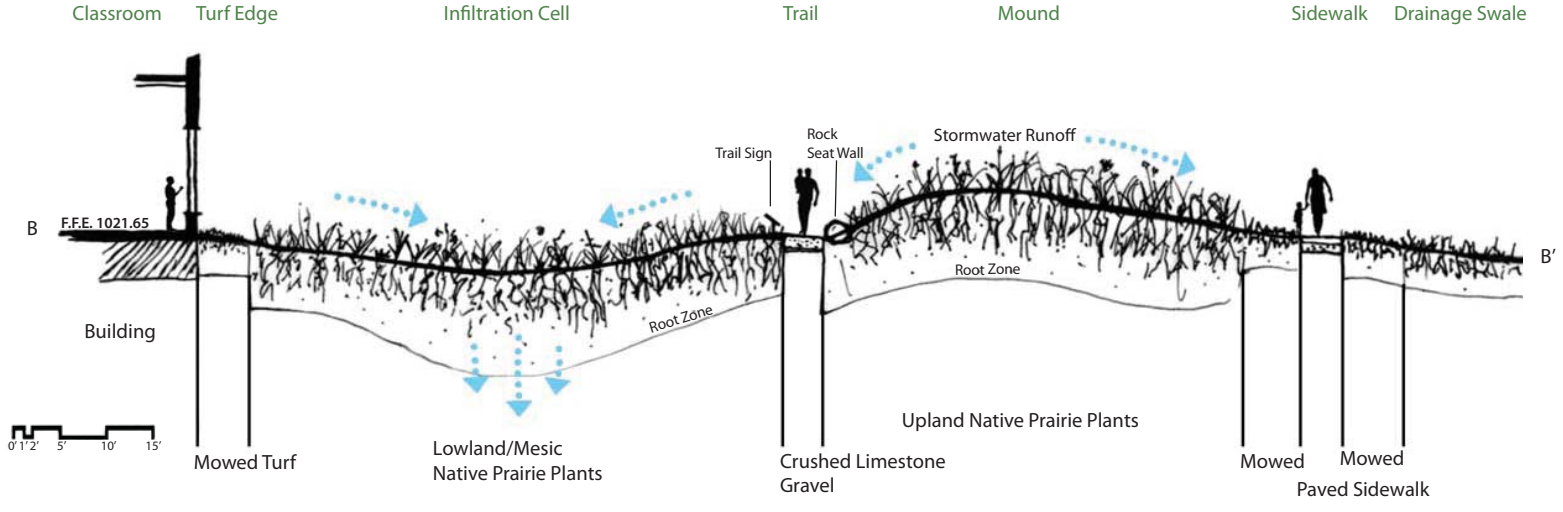


Figure 4.13. Section B-B' Showing View from Building of Infiltration Cell and Mound. Illustration by Author

Outdoor Classrooms

Figure 4.14. Enlarged Plan of Large Outdoor Classroom. Not to Scale. Plan by Author

There are two formal outdoor classrooms in the design. One large space for several classes to use together and one small space for a single class group to have a more intimate setting. The large classroom space is located central to the playground, labyrinth, and trail (Figs. 4.14, 4.15), while the small classroom is located near the garden space as well as the trail system (Figs. 4.16, 4.17).

One special feature of both spaces is the multi-purpose board space for teachers and visitors. On the trail side of the board is the signage for the nature trail and on the other side is board space for the teacher. Both are made of a recycled decking material with the height of the risers made for children, the back edge however, is comfortable for adults to sit on. The large classroom has a canopy sunscreen to allow for extended use.

Figure 4.15. Large Outdoor Classroom. Illustration by Author

Figure 4.16. Enlarged Plan of Small Outdoor Classroom. Not to Scale. Plan by Author

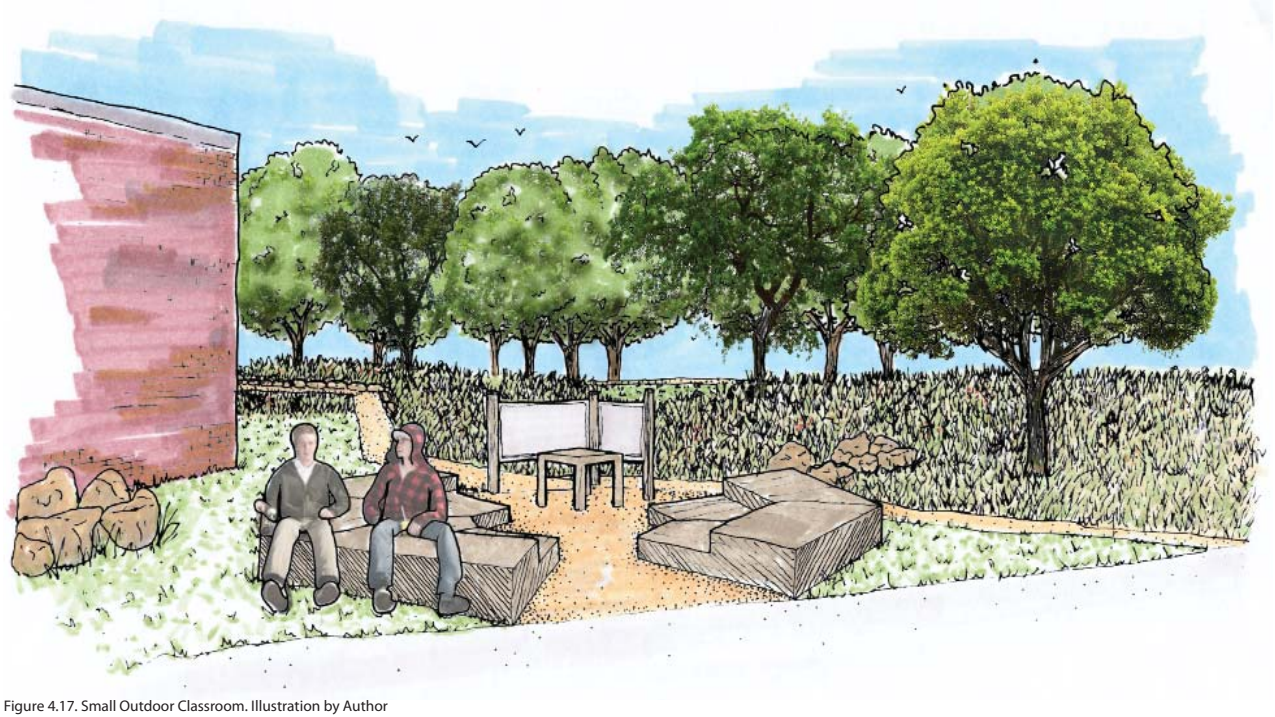


Figure 4.17. Small Outdoor Classroom. Illustration by Author

Courtyard Butterfly Garden & Bird Sanctuary

Figure 4.18. Existing Courtyard Space. Photo by Author

This courtyard space offers a secure yet easily accessible outdoor space for classroom use (Fig. 4.18). It is at the heart of the school, and because of this, at the heart of the project. The central green space is a butterfly garden–in accordance with the school's wishes– planted with native plants, with a path through it and small gathering spaces on each end of the path. The octagon shapes are also present here, forming the path layout and adjacent garden and gathering spaces (Figs. 4.19-4.21). To encourage year-round use of the space by wildlife, amenities for birds are included with a bird bath with small warming element for winter use, and space for bird feeders.

Second to the butterfly garden, the next most important element of this area is the site furniture. Two 'discovery tables' have a removable, clear Plexiglas top to allow for different items to be kept inside that correspond with the curriculum. This allows for easy viewing and access to the objects inside. These tables can also serve as a countertop during teachers' lessons or workspace for students. Small plastic cubes in bright colors provide movable seating or additional work surfaces for students. These cubes would be too heavy for a student to lift comfortably, but easily pushed in order to keep cubes from being blown around, or stacked to climb up on.

Also envisioned for this space is the opportunity for a solar energy lab, wind exhibit, weather station, or space for any other learning elements that need to be outside but in a secure setting.

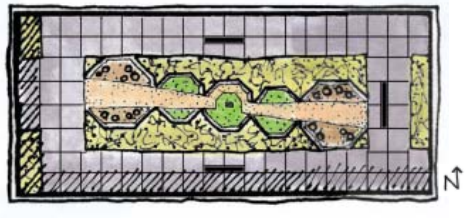


Figure 4.19. Enlarged Plan of Courtyard Space. Not to Scale. Plan by Author

Figure 4.20. De-vegetated Courtyard, Showing Geometry. Image by Author

Figure 4.21. Character Montage of Proposed Courtyard Butterfly Garden. Image by Author

Playgrounds

The playground areas are divided into two spaces–Kindergarten through third grade on the east, and fourth through sixth grade on the west. This division allows for age and developmentally appropriate playground equipment and uses. Current conditions of these areas area shown in Figures 4.22 through 4.24.

The play surface pattern on the east playground is a series of simple geometric shapes to provide a teaching tool (Fig. 4.27) while the play surface pattern on the west playground is a more complex series of octagons (Fig. 4.26), corresponding to the level of development and curriculum. The blacktop areas will have painted images for play including a map of the globe and the United States, hopscotch, four-square, and other fun shapes.

Some of the designated play areas include quiet areas, active areas, sand space, swing space, play structures, and individual play elements. The school is in contact with a playground designer for the permanent structures; however, Figure 4.25 provides a character vision for the proposed playgrounds.

Figure 4.22. Exiting Site Conditions. Photo by Author

Figure 4.23. Existing Site Conditions. Photo by Author

Figure 4.24. Existing Playground Conditions. Photo by Author

Figure 4.25. Character Montage of Proposed West Playground. Montage by Author, Play Structure Adapted from Existing Playground in Trento, Italy Image by Author.

Playgrounds

The suggested elements for the permanent structures include but are not limited to:

- Swings (ADA and traditional styles)
- Replicated fossils to "excavate" in the sandbox areas
- Climbing structures
- "Tree Fort" lookout tower play structure
- Balance elements
- Cargo net
- Monkey bars
- Spinning stools
- Rope bridges
- Slides
- Solo bouncy rides
- Spinning motion rides
- Zip-line
- Shade structures

Figures 4.26 and 4.27 show potential play structure configurations for each playground. The placement of the play elements in these diagrams are determined by circulation patterns, safety measures, noise concerns, and types of play activities.

Legend

1. Shade Structure
2. Swings
3. Individual Play Elements
4. Climbing Elements
5. Balancing Elements
6. Slides
7. Lookout Tower Play Structure
8. Monkey Bars
9. Blacktop Activity Area
10. Rope Bridges
11. Sandbox with Fossils
12. Zip-line
13. Stepping Stones
14. Blacktop Paintings
15. Basketball Hoop
16. Compass
17. Cargo Net

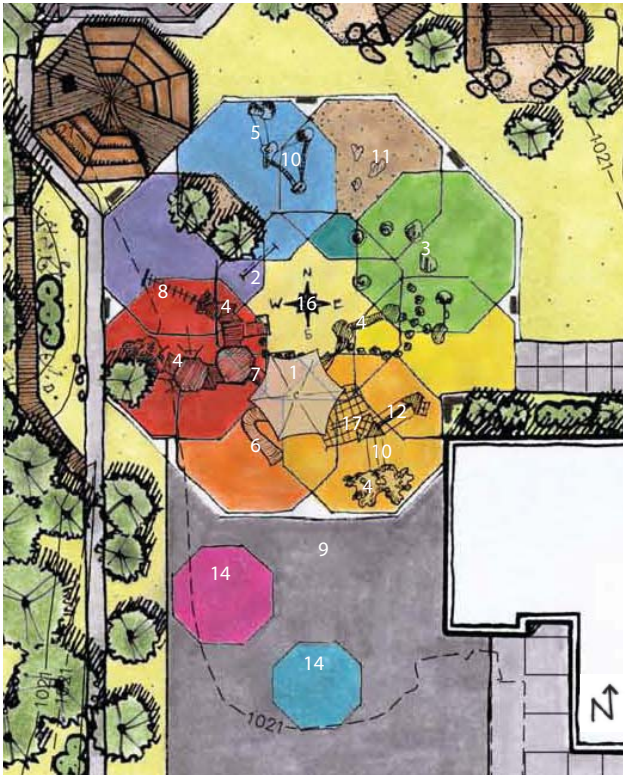


Figure 4.26. Enlarged Plan of West Playground. Not to Scale. Plan by Author

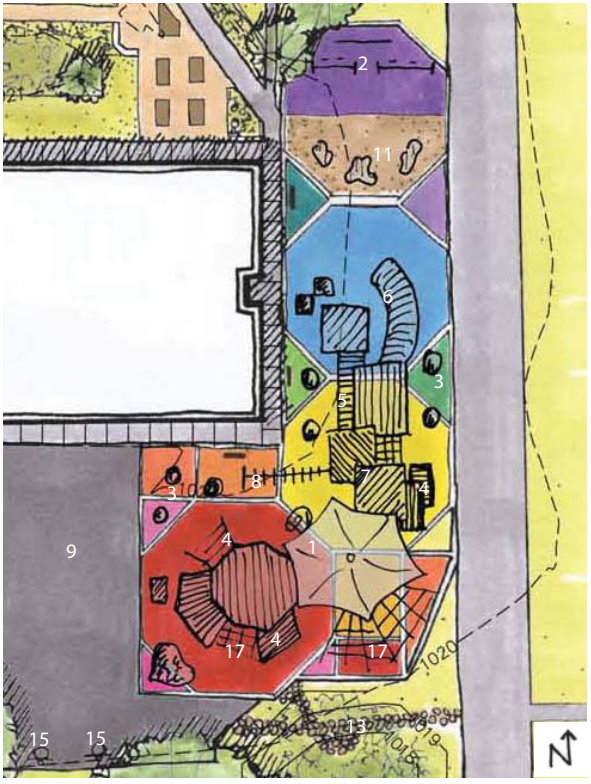


Figure 4.27. Enlarged Plan of East Playground. Not to Scale. Plan by Author

Additional Site Features

Several additional features of the site include a labyrinth made of permeable brick pavers, two dry creek bed areas to aid stormwater runoff, butterfly gardens, and a classroom garden area.

The garden space is in the process of being rebuilt since building construction was completed. The design shown in the plan is solely conceptual. The garden will contain several raised, accessible planters for class vegetable gardens, shade beds for experimental growing, octagonal picnic tables for dining or group workstations, storage shed for tools, a native perennial garden, and raingarden. The existing trees will remain to provide shade for the area however; planters will be placed in full sun areas for favorable growing conditions.

The butterfly gardens offer a quiet gathering space for reading or playing. As shown in Figures 4.28, 4.29, and 4.30, the space is visible from the interior hallway and accessible from the blacktop, the location is protected and ideal for insect watching or reading a book.

The Labyrinth, shown in Figure 4.31, offers an alternative for students who may desire a more solitary and reflective activity at recess. The space is designed such that it can also be used as a large gathering space, or a performance area with a long rock seat wall and hillside seating behind it.

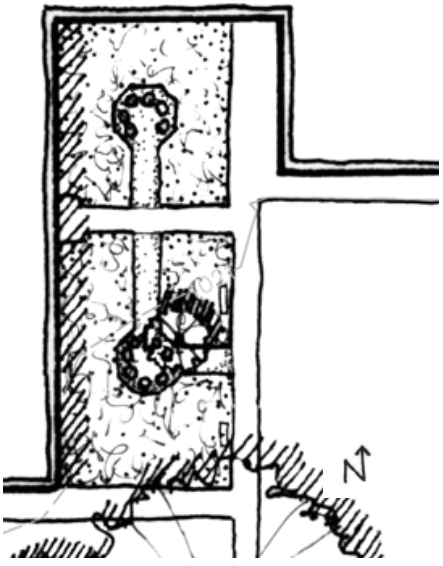


Figure 4.28. Enlarged Plan of Butterfly Reading Gardens. Not to Scale. Plan by Author

Figure 4.29. Existing Site Conditions. Photo by Author

Figure 4.30. Butterfly Garden and Small Gathering Spaces. Illustration by Author

Additional Site Features

The dry creek beds have rocks to delineate the streambed; tall grasses grow in the area for habitat and student exploration before, during, and after a rainstorm. Figures 4.32, 4.33, and 4.34 illustrate the character of the creek beds. Located in relation to roof drains, the streambeds channel stormwater runoff into infiltration cells.

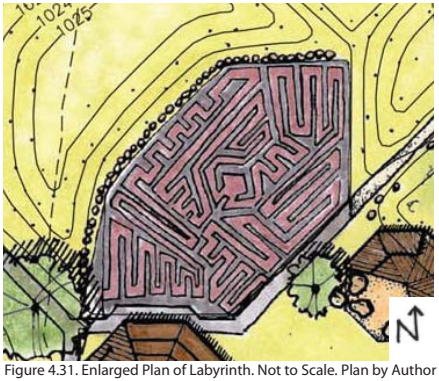


Figure 4.31. Enlarged Plan of Labyrinth. Not to Scale. Plan by Author

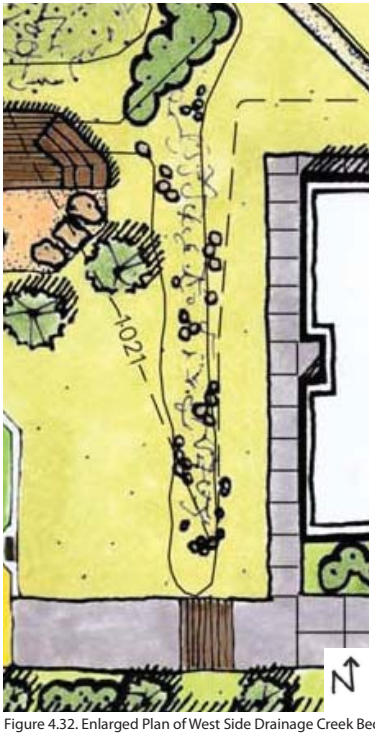


Figure 4.32. Enlarged Plan of West Side Drainage Creek Bed. Not to Scale. Plan by Author

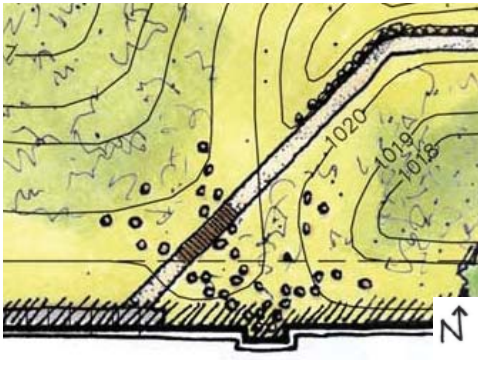


Figure 4.33. Enlarged Plan of North Roof Drain Area. Not to Scale. Plan by Author

Figure 4.34. Dry Creek Bed Drainage-way on North Trail. Illustration by Author

The campus trails serve as an ideal location for educational exhibits and signage. Proposed places for these locations are shown in Figure 4.36. The five signage types identified in the case study are suggested for this site.

1. Directional signage—at all entries to site and school building, contains map information and may be paired with exhibit information.

2. Primary exhibit signage—located on main trails, has information about floodplain and wetlands; information engages the visitor with the landscape around them.

3. Trail markers/signs—located on the nature trail loop and at other key places throughout site; contains simple messages about ecosystem at each location, augments information on exhibit signage.

4. Special exhibit signage—located near the vegetable garden, butterfly garden, and outdoor classrooms, these signs are multi-purpose, have the potential for changing information, and cover topics outside of the main theme of wetlands and floodplains.

5. Plant signs—in garden area, on trees near trail system, provides plant name and information.

Table 4.2 illustrates the target audiences the primary site messages will be directed to. It also elaborates the educational messages the site provides. The table is a guide for the school in sign design, information topics, implementation, and use of the interpretive trail. Figure 4.35 provides character ideas for the different signage types in design.

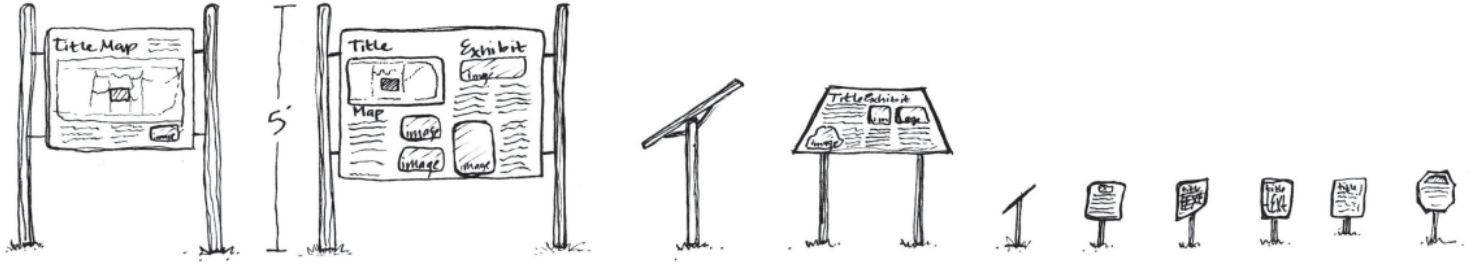
Target Audience	Messages	Products	Learning outcomes
Campus Visitor This is the broadest audience. It includes community members, exercisers, University students, parents visiting with students, class groups, and the school faculty, staff and volunteers. This target group is a visitor who is a topic generalist coming to use the school campus, either for the nature trail or for some other site use. This group cares about the environment, but may not be 'activists' or aware of the issues surrounding wetland communities on the prairie and how to better live in a floodplain.	**1**.Floodplains are comprised of wetland communities. **2.**The Northview community is located in a floodplain. **3.**To have healthy wetlands requires human protection of existing sites and intervention to create or promote new sites. **4.**The campus is one such location for wetland re-establishment, potentially visitors property as well. **5.**Many constructed waterway elements in this floodplain are not good for the wetland environment.	Interpretive signage on campus paths and designated nature trail. Trail showcases different self-guided opportunities to interact with prairie and wetland habitat. Provides ideas for how to change personal behaviors and attitudes towards nature.	After walking through the site, visitors will be able to: Understand complexity of relationships in a wetland ecosystem. Give examples of stormwater remediation techniques that could be transferred to their yard. Appreciate the systems at work around them in the floodplains and the prairie region. Understand the benefits and value of wetlands in the floodplain. Moves visitors to become better stewards to the environment.
Students grades k-3 Children in these grades are just forming their ideas and opinions about the world around them. Simple hands-on activities help introduce them to the environment, forging an emotional bond.	**1.** In a healthy habitat, all things depend on one another to survive. **2.** A healthy community is complex with many different living things. **3.**The presence or absence of water determines what can grow and where. **4.**Everyone can help protect these habitats.	Schoolyard and play areas incorporated with natural elements to encourage exploration and familiarity. Trail signage geared towards younger audience with simple ideas and messages, used along with teacher-led activities help form foundational knowledge.	After exploring the play areas and natural areas young students should be able to: Explain what water is needed for and its importance. Describe how organisms are connected in the web of life. Become future stewards to wildlife habitats and the environment.
Students grades 4-6 Students are starting to care about the environment. Students build on their emotional bond with nature by exploring and having adventures. Teachers start lessons in ecology and wildlife habitats at this age, in accordance with state and national curriculum goals and standards.	**1.** Wetland habitat is in need of protection and restoration. **2.**What choices you make in life have an impact on nature, directly and indirectly. Natural and man-made impacts can change things in ecosystems drastically. **3.**You have the opportunity to think about your actions and the impact they will have on the environment.	Schoolyard and play areas incorporated with natural elements to encourage exploration and familiarity. Teacher led activities outside, support curriculum and environmental awareness. Class gardens helps students take responsibility in the life of a living thing. Trail signage and exhibit signage encourage self-led learning.	Students exploring schoolyard and participating in teacher led activities will be able to: Name some native plants and animals. Name different habitats. Describe the effect our actions can have on the ecosystem. Become future advocates for the environment.
Faculty These are adults familiar with the site and are seeking to understand it better in order to better use the site in their lesson plans and class activities.	**1.**The outdoors can be a tremendous and memorable teaching aid for many subjects and topics. **2.**Understanding wetland ecosystems and educating students about it improves the community.	Grounds facilities that provide opportunities for easy transition into outdoor lessons and activities in local native habitats. Special exhibit, exhibit, and trail signage available as teaching aids.	After visiting the grounds, teachers should be able to incorporate the outdoors of the schoolyard into another teaching tool; and help their students understand what is occurring in the natural systems on campus.

Table 4.2. Target Audience and Primary Messages for Exhibit Signage. Table by Author, Adapted from Chicago Botanic Garden 2000.

Legend for Signage Placement Map

- Directional Signs
- Exhibit Signs
- Special Exhibit Signs
- Trail Markers

Signage Hierarchy



Directional Signage

Directional and Exhibit Combined Signage

Primary Exhibit Signage

Trail Markers/Signs

Special Exhibit Signage-
Vegetable Garden

Special Exhibit Signage-
Butterfly Garden

Special Exhibit Signage, Trail Side

Special Exhibit Signage, Classroom Side

Figure 4.35. Character Sketches of Signage Types. Illustration by Author

Signage Placement Map

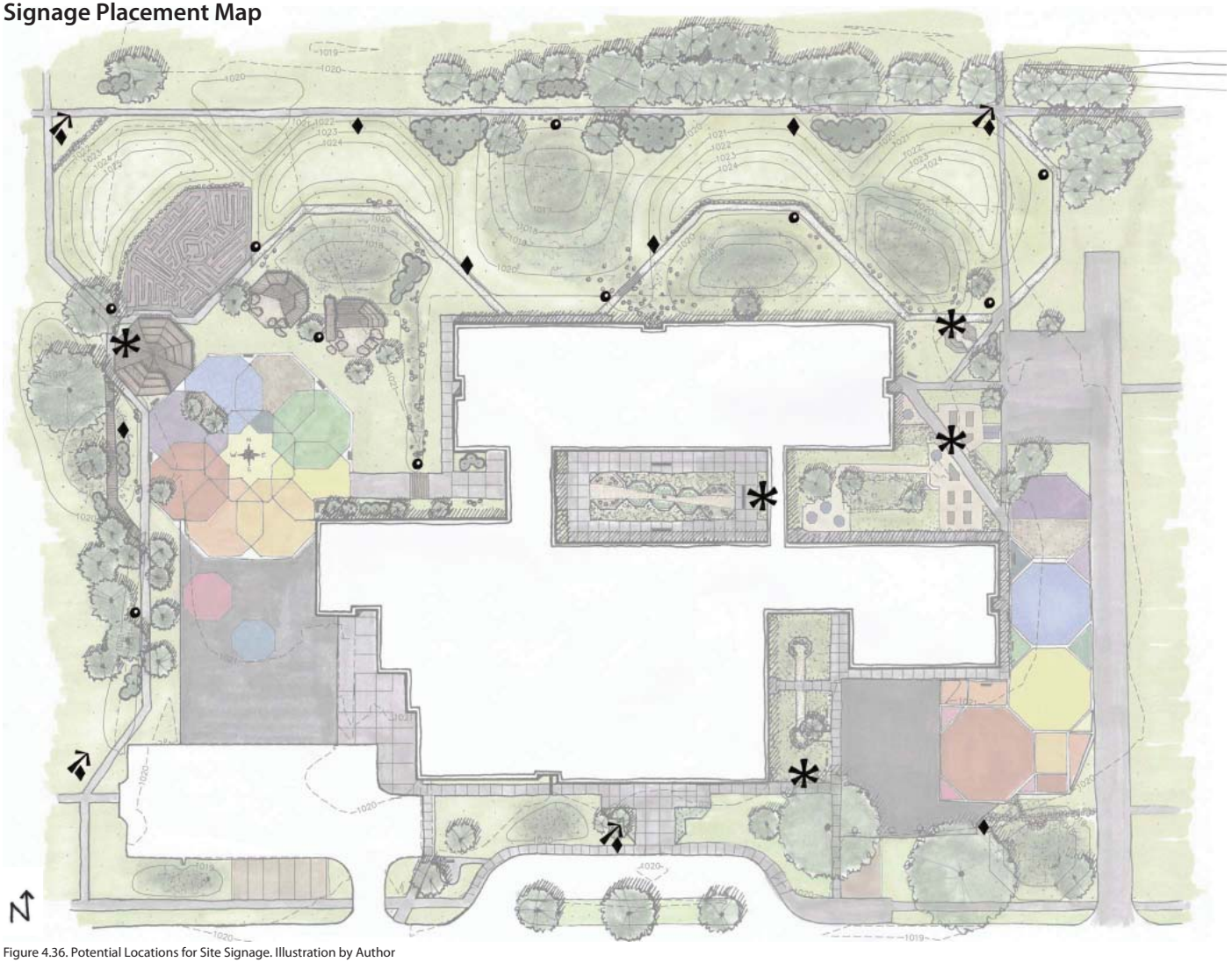


Figure 4.36. Potential Locations for Site Signage. Illustration by Author

Trail Hierarchy Map

Ecological Schoolyard

Site as Playground

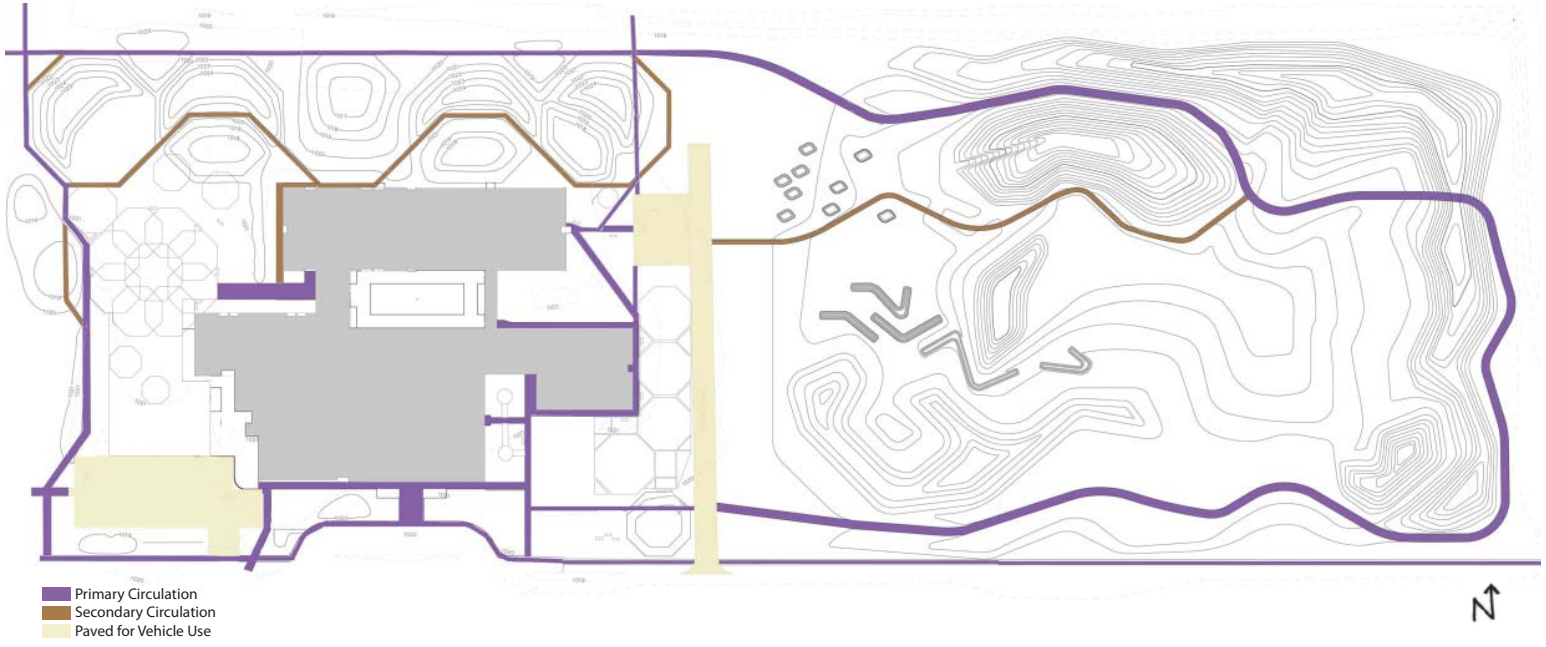


Figure 4.37. Trail Systems Hierarchy. Not to scale. Map by Author, working with R. Melvin

Maintenance Plan

Figure 4.37 shows the trail hierarchy. The primary circulation paths, shown in purple, allow for movement around the site and between neighborhoods. These paths are paved sidewalk. The secondary trails, shown in brown, are used for internal site circulation. These paths may be a different surface material based on where its located. Most of this system is properly-maintained crushed limestone trail, with some portions boardwalk or other materials.

Figure 4.38 highlights areas of the site requiring special maintenance needs. These areas include the prairie mounds and infiltration cells, raingardens and butterfly gardens. A 3-foot mown buffer will be kept along all primary paths. Areas not highlighted are to be maintained according to district standards.

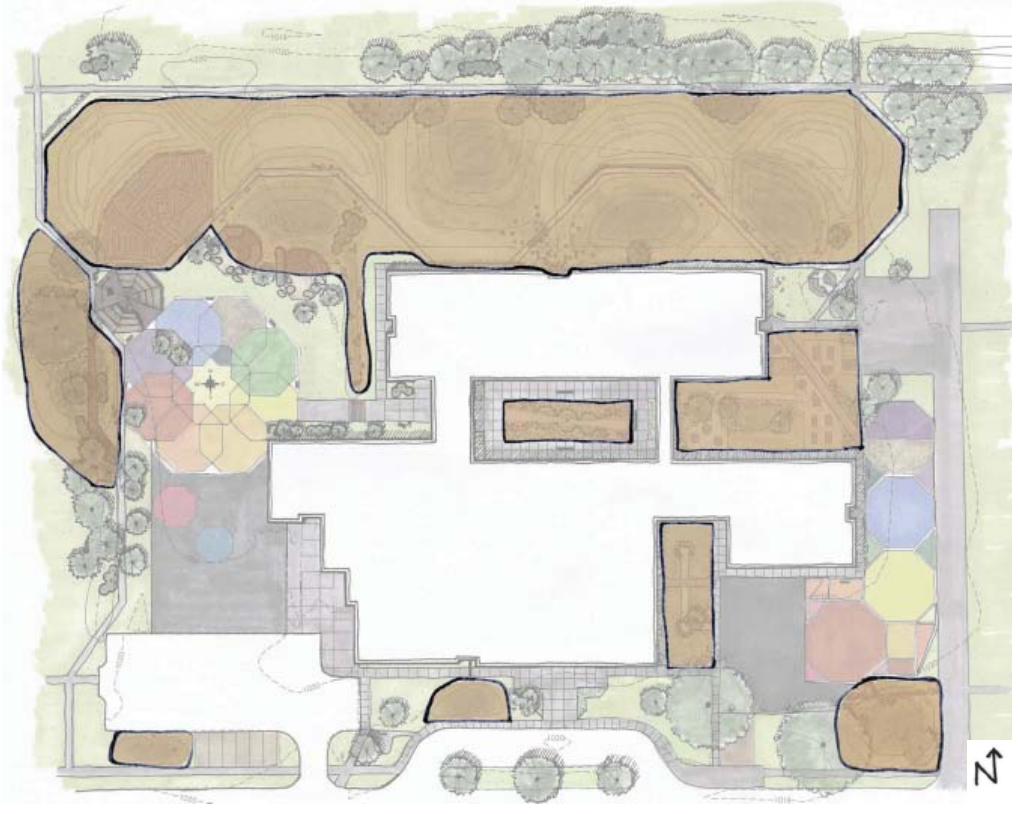


Figure 4.38. Proposed Maintenance Plan. Illustration by Author

Planting Palettes

Common Name	Latin Name	Height	Habitat	Comments	Flowering period
Upland Short					
Blue Grama	*Bouteloua gracilis*	6-20 inches	Found on dry prairies, full sun	Will survive extreme drought	June, July, August
Buffalo Grass	*Buchloe dactyloides*	2-8 inches	Full sun, well drained sites, exposed	Sod-forming	May, June
Upland Tall					
Aromatic Aster	*Symphyotrichum oblongifolium*	6-18 inches	Dry, rocky or sandy open sites, often on hillsides.	Fall interest	September, October
Big Bluestem	*Andropogon gerardii*	2-7 feet	Lowland prairies, plains, dry soils	High quality grass	July, August, September
Butterfly Milkweed	*Asclepias tuberosa*	18-24 inches	Occurs on prairie soils throughout eastern half of U.S.	Stout perennial forb with a deep root system, flowers attract many insects	June, July, August
Dotted Gayfeather	*Liatris punctata*	1-2 feet	Will grow on a variety of sites, moderate water use, dry soils	drought-tolerant because of long taproot, attracts butterflies	August, September, October
Indian grass	*Sorghastrum nutans*	3-7 feet	Dry slopes	High quality grass	July, August, September
Little Bluestem	*Schizachyrium scoparium*	2-4 feet	Prairies, dry hills, and open woods.	Its roots, which grow 5-8 feet long, enable it to resist moderate drought	July, August, September
Plains Coreopsis	*Coreopsis tinctoria*	2-4 feet	Disturbed sites	All summer interest	June, July, August, September
Prairie coneflower	*Ratibida columnifera*	1-3 feet	Dry prairies, open waste ground, and roadsides.	All summer interest	May, June, July, August
Silky Aster	*Symphyotrichum sericeum*	1-2 feet	Dry, open, upland sites or occasionally open woods, most abundant in limestone soils.	Fall interest	August, September, October
Switchgrass	*Panicum virgatum*	2-7 feet	Broad range of soils, moist, open lowland prairies	Roots can sometimes grow up to 10-11 feet long	August, September
Western Yarrow	*Achillea millefolium*	8-36 inches	Dry prairies, open woodlands, roadsides, and partially disturbed areas	Western yarrow is hardy, surviving well during drought conditions	June, July, August, September
Woolly Verbena	*Verbena stricta*	1-5 feet	Dry soils of pastures, roadsides, disturbed areas, farmyards, and waste ground.	Woolly verbena is very drought-resistant, with roots that can descend to 12 feet.	June, July, August, September
Woody Plants - Trees					
American Elm	*Ulmus americana*	60-80 feet	Grows well under a variety of conditions	Medium, growing 10-12 feet in 5 years	March
Cottonwood	*Populus deltoides*	70-100 feet	Easily grown, tolerates dry soils	Fast growing, 4-5 feet a year	March, April
Honey Locust	*gleditsia triacanthos var. inermis*	30-70 feet	Soils of a limestone origin, drought tolerant	Fine leaves, eliminates fall maintenance	May, June
Redbud	*Cercis canadensis*	20-30 feet	Well drained, full sun or light shade	Spring interest, fall color	March, April
Western Buckeye	*Aesculus glabra*	20-40 feet	Well drained, full sun or partial shade	Spring interest, good fall color	May

Maintenance	**In order to maintain the prairie environment, the following maintenance practices should be observed:** **Burning:** Annual burning is necessary in late winter-early spring before the grasses grow, to enrich the soil, stimulate plant growth, and reduce growth of invasive species. The site should be divided into thirds that will be burned in a three year rotation only burning one third per year. Before burning, precautions must be taken to protect all site features including young trees, benches, lights, and signs. Burning should be conducted in a safe, supervised manner to prevent spread and damage. **Mowing:** For this urban area, burning may not always be an option. In lieu of burning annually the area can be mowed annually. Mowing only once a year allows for the plants to still provide visual interest, wildlife habitat, and soil protection throughout the year.

Table 4.3. Prairie Plant Palette. Table by Author, adapted from Fort Hays State University 2006, Stephens 1969.

Common Name	Latin Name	Height	Habitat	Comments	Flowering Period
Mesic					
Blue Wild Indigo	*Baptisia australis*	1-4 feet	Rocky prairies, hillsides, open woods, and roadsides	Most abundant in limestone or clay soils	May, June
Bracted Spiderwort	*Tradescantia bracteata*	4-12 in	Moist prairies, roadsides, and disturbed areas	Summer interest	May, June, July
Curly-Styled Wood Sedge	*Carex rosea*	8-20 in	Moist to dry open woods	Late Spring interest	April, May, June
Switchgrass	*Panicum virgatum*	2-7 feet	Moist, open lowland prairies, sand prairies, and open woods	Grows in a broad range of soils	August, September
Mesic Shade/Lowland Part Shade					
New England Aster	*Symphyotrichum novae-angliae*	2-6 feet	Stream banks, wet medows, thickets, low areas, and roadsides	Most abundant in moist or drying sandy soils; shade tolerant	September, October
Virginia Wild Rye	*Elymus virginicus*	2-4 feet	Bottomlands, low prairies, stream banks, and edges of woods	Most abundant in moist, fertile soils	May, June, July
Western Wheatgrass	*Pascopyrum smithii*	1-3 feet	Moist to dry prairies, waste prairies, ditch banks, roadsides	Most abundant in fine-textured alkaline soils	June, July, August, September
Wet/Lowland					
Cardinal Flower	*Lobelia cardinalis*	1-5 feet	Wet sites with partial sunlight, stream banks, marshy areas, and moist thickets	Early Fall interest	August, September
Fox Sedge	*Carex vulpinoidea*	1-3 feet	Wet ditches, ravines, prairie swales, edges of marshes, lakes, and ponds	Most abundant in clay soils	April, May, June
Softstem Bullrush	*Schoenoplectus tabernaemonta*	3-10 feet	Marshy areas, pond and stream edges, and wet roadside ditches	Most abundant in shallow water or moisture-saturated soils.	June, July, August
Switchgrass	*Panicum virgatum*	2-7 feet	Moist, open lowland prairies, sand prairies, and open woods	Grows in a broad range of soils	August, September
Tall Goldenrod	*Solidago canadensis*	1-6 feet	Open, damp or drying sites, hillsides, thickets, banks of streams, disturbed areas, and open woods	Late Summer interest	July, August, September
Woody Plants - Shrubs					
Dewberry	*Rubus flagellaris*	3-4 feet	Grows in thickets in open areas of tall grass	Attracts wildlife, insects providing food and cover	May
Elderberrry	*Sambucus canadensis*	6-12 feet	Prefers wet soils, but tolerates dry soils, medium water use, part shade	Helps control erosion on moist sites, wildlife benefits food and shelter	May, June
Golden Currant	*Ribes odoratum*	6-12 feet	Hillsides, river valleys, sun to part shade and moist to dry soils, with low water use	Very adaptable plant, tolerates standing water to drought	April, May, June, July
Smooth Sumac	*Rhus glabra*	6-12 feet	Grows in most soils, has low water use and can tolerate sun to shade conditions	Females form berries, attracting wildlife in winter, Fall color	May, June, July, August

Maintenance	**In order to maintain the prairie environment, the following maintenance practices should be observed:** **Burning:** Annual burning is necessary in late winter-early spring before the grasses grow, to enrich the soil, stimulate plant growth, and reduce growth of invasive species. The site should be divided into thirds that will be burned in a three year rotation only burning one third per year. Precautions must be taken to protect all site features including young trees, benches, lights, and signs. Burning should be conducted in a safe, supervised manner to prevent spread and damage. **Mowing:** For this urban area, burning may not always be an option. In lieu of burning annually the area can be mowed annually. Mowing only once a year allows for the plants to still provide visual interest, wildlife habitat, and soil protection throughout the year.

Table 4.4. Prairie Plant Palette. Table by Author, adapted from Fort Hays State University 2006, Stephens 1969.

"Man shapes himself through the decisions that shape his environment."
–Rene Dubos

(Daley 2009, 34)

Chapter Five:

Conclusions from the Northview Elementary Design Process

Western Yarrow. *Achillea millefolium*. Sketch by Author

Conclusions
Project Evaluation

What has been discovered

The Participatory Project provided the opportunity to incorporate student desires. This process was very enlightening. Hearing their suggestions shaped many design decisions that were made in the course of the project. Listed are some of the common remarks:

- Students do not always like sand/ gravel for entire play surface
- Students want slides and tall observation points
- Color was requested frequently
- Most students requested traditional play elements of sports fields—in part because they have never experienced any other model different than that (Observations made from Participatory Project Questionnaires).

What to study further

The potential for ecological schoolyards are tremendous. Because of project deadlines, some areas of study were not explored as thoroughly as others. Some of the ideas and research that could be pursued more include:

- Involving community members in the design process and installation/ maintenance of some areas.
- Building more thorough curriculum linkages to the site through collaboration with teachers.
- Providing guides for teachers for using gardens and other nature areas.
- Program development for extended site use–Scout programs, summer programs, garden clubs, community classes.
- The integration of interpretive signage and curriculum on a school campus.
- Use of technology, website, or a mobile device application as part of the interpretive displays.

Preliminary stormwater calculations for storing a 100-year flood indicate the stormwater infiltration cells are adequately sized except for the cell furthest west. Due to time limitations a design revision did not occur. Expanding the cell footprint or deepening the cell could easily solve this issue. Further study of stormwater capacity in light of the site's heavy clay soils will be needed to create a final design proposal.

The inclusion of information from the participatory design project was difficult to fully utilize due to timing of project deadlines. This led to unfulfilled desires of stakeholders. For example, teachers indicated a strong preference for expressing the diverse ethnic identity of the school through site design. This need was not accounted for in the design development and was therefore under-developed in the final design.

What was successful

The ecological master plan in this report proposes many improvements to the campus for the benefit of both the school and community. Some of these benefits include:

- Using stormwater remediation as a tool to teach students and community
- Improves connectivity between the site and the neighborhood
- Increases student awareness and interaction with nature
- Provides many useful teaching tools for classroom use
- Improves local wildlife habitat
- Improves water drainage and increases infiltration
- Improves quality of life for school and community
- Creates an exciting, engaging campus

School implementation-
Taking the next step

For stakeholders interested in implementing an ecological schoolyard there are many resources available to aid in the planning, design, funding, building, and certifications of projects. There are a few listed here:

- Sunflower Trails Grant
- O.W.L.-Outdoor Wildlife Learning Program
- National Wildlife Federation
  - –Wildlife Habitat Certification
  - –Schoolyard Habitats Program
  - –www.nwf.org
- National Audubon Society
  - –www.audubon.org
- National Gardening Association
  - –www.kidsgardening.org
- *Asphalt to Ecosystems* by Sharon Danks
- *Natural Learning* by Robin C. Moore
- *How to Grow a School Garden* by Arden Bucklin-Sporer
- *A Child's Garden* by Molly Dannenmaier

(For full list of references see appendix A)

Overall, the design for Northview Elementary's Ecological master plan promotes exploration, education, play, and connection with nature. The project provides a solid solution to the problems facing the campus, while beginning to explore the potential of what ecological schoolyards can provide to a school and a community.

"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."

–Aldo Leopold

(Daley 2009, 10)

Appendices

References, Glossary, Annotated Bibliography, Collaboration, & Additional Diagrams

Silky Aster. *Symphyotrichum sericeum*. Sketch by Author

Appendix A:
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Appendix B:
Glossary

Alternative Energy: Sources of energy that do not rely on the widely used sources of fossil fuels (oil, natural gas, coal) like solar power, wind energy, hydro-electric.

Bioswale: a landscape element that is designed to remove silt and pollution from surface fun off water (Chiras and Reganold 2010).

Closed Activities: Activities that provide feedback, showing that a puzzle was solved or a product made. Activities are bounded by rules and guidelines, i.e. sports, puzzle, games (Stine 1997).

Compost: Composting is the process of using active, controlled decomposition to recycle waste organic matter into various finished products that are useful for growing plants and improving soil (Longwood Gardens 2011).

Ecology: Study of the interrelationships that occur between organisms and their environment (Chiras and Reganold 2010).

Environmental Stewardship: Environmental stewardship is the responsibility for environmental quality shared by all those whose actions affect the environment (Environmental Protection Agency 2011).

Environmental Literacy: The capability for an understanding of an environmental problem in order to make an informed decision by interpreting and acting for the environment. This means that the "environmentally literate" person will have the knowledge, tools, and sensitivity to properly address an environmental problem in their own capacity, and include the environment as one of the considerations in their daily living (Carnegie Mellon University 2003).

Interactive Display: A display that engages the viewer physically, calling upon the senses to fully experience the exhibit.

Invasive Plant: A plant that is both non-native and able to establish on many sites, grow quickly, and spread to the point of disrupting plant communities or ecosystems (Natural Resources Conservation Service 2011).

Habitat: The immediate environment in which an organism lives. A habitat includes such components as cover, food, shelter, water, and breeding sites (Chiras and Reganold 2010).

Learning Styles: Manner in which a person learns (Gilbertson, et al. 2006).

Outdoor Education: Leaning in and through the natural world (Gilbertson, et al. 2006).

Open Activities: Provide an opportunity to explore, to create, to become enchanted by the process without any consideration for an end product (Stine 1997).

Native Plants: A plant that is a part of the balance of nature that has developed over hundreds or thousands of years in a particular region or ecosystem (Natural Resources Conservation Service 2011).

Natural Resource: Any component of the natural environment—such as soil, water, rangeland, forest, wildlife, and minerals—that species depend on for their welfare (Chiras and Reganold 2010).

Play: "As a behavior, play has generated many definitions, descriptions, and theories. Most frequently, play refers to spontaneous activity that is child initiated and terminated (Stine 1997)." "Play enhances cognitive, affective, and psychomotor development… integrating all aspects of development (Brett, Moore and Provenzo 1993)."

Schoolyard or **school grounds:** Any property belonging to the school that is outside of the school building.

Wetlands: Lands which retain water at or near the surface long enough during the growing season to permit the formation of hydric soils and growth of wetland vegetation (Natural Resources Conservation Service 2011).

Wildlife: All plants and animals on Earth that are not domesticated (Chiras and Reganold 2010).

Appendix C:
Annotated Bibliography

Please Note: To view the collective literature review and annotated bibliography by the Landscapes of Learning group, please visit the K-State Research Exchange database under the Landscapes of Learning Collection.
The URL to this site is https://krex.k-state.edu/dspace/handle/2097/13625

Title/Author: Interpretive Planning, Lisa Brochu

Full Citation: Brochu, Lisa. *Interpretive Planning: The 5-M Model for Successful Planning Projects*. Fort Collins: The National Association for Interpretation, 2003.

Keywords: Interpretation, Management, Markets, Message, Mechanics, Media

Summary:

This text relays the importance of interpretive planning for communicating ideas between visitors to a space and the meaning of the resource. Effective interpretation that uses the 5-M model: management, message, market, mechanics, and media, should always lead to success when addressing a wide array of variables when presenting information.

Management refers to the details of running of an interpretive display; this includes the mission, goals, policies, budget, and maintenance.

Message covers the ideas to be addressed in the display; including the "theme, subtheme, and storylines based on resource, audience, and management considerations".

Market considers who the users will be and who might have interest in the subject or site.

Mechanics deal with the physical properties that influence what is being planned.

Media is most effective method of communication based on the situation at hand.

The text also goes into detail on the various plans necessary to put a display into action. This includes the master plan, but also other plans such as the interpretation plan, exhibit plan, sign plan, and program plan. Also brought to light is how to set goals and objectives for the mission and vision of a project; how circulation patterns change depending on user; and how to provide an overall experience through interpretation.

Take Home Point:

This text provided insight to some aspects that had been previously overlooked, for example the need for an interpretation plan and exhibit plan. The discussion in the book about circulation patterns around displays reinforced ideas that I had gathered from personal observations, and added further insight into that topic. This text also gives a good overall view of how much work can go into planning an interpretive display, helping gage how much can be done for the purposes of this project.

Title/Author: Principles and Practices of Outdoor/Environmental Education, Phyllis M. Ford

Full Citation: Ford, Phyllis M. *Principles and Practices of Outdoor/Environmental Education*. New York: John Wiley & Sons, Inc., 1981.

Keywords: Outdoor, Education, Teaching, Recreation, Environment

Summary: Humans have been receiving an 'outdoor education' since the beginning of mankind. This text looks at the history, application, and use of outdoor education, describing it in all its different capacities. There are three sub-areas that relate within the category of outdoor education: environmental education, conservation education, and outdoor recreation. Environmental education is broader and more inclusive, looking at urban as well as natural environments and how humans can learn to think with an ecological perspective for every aspect of learning. Conservation education is no longer a widely used term because it represents a limited concept, focusing solely on the wise conservation of resources, be it money, energy, plants, animals, water, or soil. This topic is just one of the many parts looked at in outdoor education. Outdoor recreation overlaps with education in the sense that "only through education can one develop the skills, knowledge, and attitudes necessary for wise leisure use of the natural environment".

Because of the multi-faceted nature of the topic, the author felt that the most comprehensive way to describe outdoor education is through the 17 basic concepts as written by Charles Lewis in The Administration of Outdoor Education Programs (1975). The following concepts correlate most with the project at hand: **Concept 1** "Outdoor education is a method of education. It includes the use of the out-of-doors for the study of all areas of the curriculum when the subject matter can best be learned out-of-doors." **Concept 3** "Outdoor education is not a separate discipline or area of study such as history, English, math, or other subject areas." **Concept 7** "Outdoor education enhances the goals of conservation by enabling students to develop a reverence for life through an ecological exploration…and assists them in developing a land ethic which illustrates man's temporary stewardship of the land." **Concept 8** "The major emphasis in education should be should be the teaching of attitudes, appreciation, understanding, and expression rather than the mastery of techniques and bodies of factual information." **Concept 12** "Modern conditions of living have increased the need for outdoor education." The summary concept statement perhaps states it best "…it is a direct, simple method of learning that extends the curriculum to the out-of-doors for the purpose of learning. It is based on the discovery approach to learning and it appeals to the use of the senses—audio, visual, taste, touch, and smell—for observation and perception."

The author also discusses the different viewpoints of education about the outdoors, a topic that divides some educators; "some believe that outdoor education must be about outdoor resources…whereas others feel that outdoor education is not a subject, but a location and a process whereby one can learn any subject through the outdoors."

Take Home Point:

This text describes the different angles and approaches to outdoor education well. Knowing the past issues with this topic will enable all angles to be considered when planning and designing for outdoor education spaces. This knowledge also informs the approach to be taken in how outdoor education is handled.

Title/Author: A Child's Garden, Molly Dannenmaier

Full Citation: Dannenmaier, Molly. *A Child's Garden: 60 Ideas to make any garden come alive for children*. Portland: Timber Press, 2008.

Keywords: Children, Play, Education, Design, Nature

Summary:

This text focuses on the child's experience during outdoor play and the parts of landscapes that evoke different feelings, inquiries, and emotions. She states that children need a place where they can run, play, climb, and freely experience "natural materials and bodily sensations". She tries to capture what they really do, as opposed to what adults think they do. Dannenmaier breaks their experiences into nine parts that outlines how children relate to nature: water, creatures, refuges, dirt, heights, movement, make-believe, nurture, and learning. Within each topic, she dives deeper into why each of these entices children to go outside.

Water: She notes that children have the ability to find water anywhere and it can be included in the garden in many forms, providing a soothing, inviting feature. **Creatures:** Whether it is wild visitors or a family pet, environmentally sensitive landscapes make the perfect home for the creatures children find so intriguing. **Refuges:** One activity that she deems as being universal is the creation of refuges-caves, forts, nests, all offer comfort and the perfect setting for hide and seek. **Dirt:** Though not the favorite of adults, the "loose parts" of nature—dirt, sand, sticks, and stones –are favorites for creating outdoor worlds from their imaginations. **Heights:** Climbing is one of the most alluring of all activities and as such, should be addressed safely while pushing beyond prefabricated climbing structures. **Movement:** One thing children excel at is moving. Providing space to accommodate space to twirling, dancing, running, jumping, sliding, and swinging allows children to be active in whatever way makes them happiest. **Make-believe:** No matter where they are, children can make up imaginary worlds, but being somewhere designed to enhance imaginative play can open doors into even more worlds within their imagination. **Nurture:** Nurture takes the form of caring for something other than themselves and in the garden; plants offer much opportunity for nurturing with the right guidance. **Learning:** Though learning takes place throughout the garden and play, spaces that merge fact and fancy capture their imaginations while teaching them about things in the real world.

Take Home Point:

This text breaks down its information into well-defined sections that creates a framework upon which to base the design. This book uses numerous examples of built landscapes, a good source for precedent studies. This also brings up the way children play, which is a vitally important aspect to consider when designing schoolyards. Using this framework to evaluate the design against her criteria will strengthen the project.

Title/Author: Landscapes for Learning, Sharon Stine

Full Citation: Stine, Sharon. *Landscapes for Learning: Creating Outdoor Environments for Children and Youth*. New York: John Wiley & Sons Inc., 1997.

Keywords: Outdoor, Design, Education, Play, School

Summary: Stine begins by reminding the reader who the players are in the creation of this setting "the maker, the maintainer, and the messer", with the focus audience being the children or the 'messers'. In a way that is often different from the other players (teachers and designers), children experience nature through direct body-contact, that is often messy and disorderly. Meanwhile, the teacher has the role of caretaker and shaper of the class environment, and the landscape architect designs the space to support the teacher and the child, while providing a catalyst for change. Play is also discussed, referring to it as "spontaneous activity that is child initiated and terminated" (Moore 1990) but Stine goes beyond this to include that children learn, grow, and develop through play; play is not limited to children; playing outside offers a unique experience that is non-replicable; and play environments are educational settings. With the basics established, her next point covers design element pairs that should be included within a design in order to "meet the needs of children intellectually, socially, cognitively, and physically."

Accessible and Inaccessible-This is different for children than for adults due to their size and view of the world. Ground surfaces are easily accessible and affect their play, while access to elevation gives them a previously inaccessible vantage point.

Active and Passive-Though outside spaces are thought of as loud, active spaces, the option of an outdoor setting that allows passive, quiet, peaceful activities should be included as well. Balancing both spaces without compromising either is a difficult task.

Challenge/Risk and Repetition/Security-Being able to challenge their abilities and take new risks in a safe environment is important for growth, but also allowing for strengthening skills through repetition, which also provides a sense of security.

Hard and Soft-Children experience the physical world with their whole bodies and providing a variety of experiences both hard and soft are enriching. However, if an environment becomes primarily hard, resisting human imprint it becomes impersonal and less responsive to needs of children.

Natural and People-Built-As our society becomes technological and urban; it becomes harder for children to explore how things are made and the processes of the natural world. By exposure to a range of activities in the natural world, they can experience both nature and built environments, allowing them to learn about, value, and protect their world.

Open and Closed-Open-ended play allows discovery, creativity, exploring, and decision making without constraints. Closed activities provide feedback showing success at completing a puzzle or product made, and accomplishment from group sports.

Permanence and Change-Permanent landmarks or routines allow for a sense of place to be established, giving meaning and structure to their lives, and a sense of security. Also understanding the concept of change is important and strengthens problem-solving skills. **Private and Public-**Especially in schools where children spend a lot of time together, having private spaces is important. Being able to provide this while enabling visibility for teachers is the ideal solution. Providing space for group activities is also essential. **Simple and Complex-**Simple activities where only one use is encouraged provide structure and direction. Complex environments offer the chance to manipulate or improvise, encouraging them to make choices and play in unpredictable ways.

Take Home Point:

This text offers a strong foundation of design elements to incorporate into the outdoor environment at the elementary school. This will help provide a program for the schoolyard and guide design choices made. It also discusses the benefits of play, strengthening the argument for outdoor educational play environments.

Title/Author: Natural Resource Conservation, Chiras & Reganold

Full Citation: Chiras, Daniel D., and John P. Reganold. *Natural Resource Conservation, Management for a Sustainable Future.* 10th. Upper Saddle River, New Jersey: Pearson Prentice Hall, 2010.

Keywords: Resource Management, Nature, Education, Sustainability

Summary:
This text describes the complex issues of resource management: its history, practices, theories, and approaches on how to proceed into the future. This text also describes how the increasing population, resource consumption and resulting pollution are the main problems we face, with all other issues stemming from these problems. The goal of this book is to prepare the readers for creating a sustainable future. It covers all topics from vegetation and soils to wildlife management and waste management. Its comprehensive coverage covered issues at local, regional, national, and global scales. They try to get the readers to "adopt an attitude that seeks cooperation with, rather than domination of, nature." The text explains that in order to do this it will require dramatic changes in the way we live our lives and conduct commerce. "The Earth is the source of all goods and services and the sink for all of our wastes. What we do to the environment we do to ourselves."

Take Home Point:
This text has helped me gain a more broad and thorough understanding of the issues facing our natural resources and those that this project is focusing on. The lessons taught in this text will be conveyed in the design. Through this reading and project, I hope to take active steps to reduce our impact on the environment.

Title/Author: Interpreting 'visions': Addressing Environmental Education Goals through Interpretation, Roy Ballantyne

Full Citation: Ballantyne, Roy. "Interpreting 'visions': Addressing Environmental Education Goals through Interpretation." In *Contemporary Issues in Heritage and Environmental Interpretation: Problems and Prospects,* by David Uzzell and Roy Ballantyne, 77-97. London: The Stationary Office, 1998.

Keywords: Interpretation, environment, behavior change, experience, education

Summary:

This text explores the connection between interpretation and environmental education and the role it plays in formal education. Visiting environmental centers and displays has the potential to augment formal education goals. They discuss how visits to interpretive sites "allow students to apply theoretical knowledge 'in the field', discover real life examples of problem solving and decision making within a real world setting." But despite having the potential to be a useful tool in education, many exhibits and displays are often not designed for use by school groups, reducing their effectiveness, having been designed for who are there for entertainment and enjoyment rather than a learning experience. In order for interpretation to be able to provide a better learning experience, they need to "join with environmental educators and extend their vision to include the development of an environmentally literate society."

Also discussed are the goals each has for the results of their efforts. Ultimately, education aims to develop "responsible environmental behavior which is informed by accurate knowledge and supporting attitudes". Similarly, interpretation goals aim to bring about behavior change, confirming the relationship between environmental interpretation and education.

Interpretation goals were further synthesized to discover the variables covered in the form of behavior change in the context of environmental education. The three major variable categories are: Entry-level variables, such as environmental sensitivity and attitudes outwards pollution; Ownership variables which go further in-depth and require a personal investment and connection with the issue at hand; and empowerment variables that such using knowledge to take action towards an environmental issue. Once these were established, they reviewed interpretation goals and found that most fell within the entry-level category, leaving the other areas less represented and weaker. The text promotes an active partnership with interpreters and educators to address the weaknesses both side have, also extending the reach of their message

Take Home Point:

This text reinforced the idea that interpretive displays and exhibits have a valid place in education. It also brought focus to the areas that need to be addressed more in both interpretation and education. This refers to bringing more hands-on, real-world experiences to formal education and to broadening the depth and reach of interpretation.

Title/Author: Commitments of the Heart: Odysseys in West African Conservation, Ted Cable

Full Citation: Cable, Ted T. *Commitments of the Heart: Odysseys in West African Conservation.* Sagamore Publishing, 2002.

Keywords: Conservation, Education, Nature, Developing Countries

Summary:
This text focuses on the journeys key individuals have taken in order to pursue conservation throughout West Africa. Cable captures their inspiration, accomplishments, and methods with captivating spirit. He also reveals the scope of the problems facing West Africa and their impact on global systems. This text also brings to light the fact that these dedicated people come from all walks of life and backgrounds embodying the phrase "where there's a will, there's a way". The common thread between all the featured conservationists is their experience and connection to nature as children leading to lives of stewardship. Another similar thread connecting stories is that education and exposure to the issues at hand are important for spreading the word to villagers, young and old. One of the conservationists, Yaa, stated her philosophy as such, "I believe that the survival of people depends on having a healthy environment and living in harmony with nature. Conservation of nature is necessary for human survival." She also felt that, "…if you start with a child, you're more likely to win than with an adult who already has very set ideas."

Take Home Point:
This text has served as inspiration, pushing the importance of education and introduction to nature at a young age to the forefront. Some of the individual stories have really instilled a personal desire to do more and one way I can make a difference in the lives of youth and the environment is through this project, helping to provide a good foundation for future conservationists. This text also shows the impact environmental education can have on youth and the difference it can make in the environment.

Appendix D: Collaboration
Northview Participatory Process Synopsis

Northview Elementary School: An iterative participatory process in schoolyard planning and design

Iteration - means to use one step as a starting point for another. I almost never did something without basing it off another action. For example, the coding categories I used to organize the data from Northview were influenced by a review of those products.

The purpose of the Iterative participatory process at Northview Elementary School was to understand and identify the wishes and aspirations of stakeholders in the proposed redesign of their schoolyard site. The participatory process began on January 20, 12 and ended on February 1, 2012. The three stakeholder groups engaged were students (primary); teachers (secondary) and parents (tertiary)). Altogether, there were 61 student participants, 13 teacher participants and 2 parent participants that contributed to the process. To gather input from students, the Kweku used workshop sessions, diary entries and reflection questionnaires; for teachers and parents, Kweku used participation and reflection questionnaires.

The driving research motivation was to help Laura Weatherholt and Rebecca Melvin in developing a schoolyard site that supports and maximizes cognitive development, physical activity and recreation. Kweku used the childhood cognitive development theories of Piaget and Vygotsky as well as five operational categories adapted from Diana Omet and Kenneth H. Rubin in achieving these goals. The five play categories were as follows: active/functional play; constructive play; exploratory play; games with rules and natural play. All of these play categories were cross-referenced with the responses of Northview stakeholders to highlight the gaps existing in one or more categories. The two designers' challenges were to fill in those gaps and offer proposals that reflected a balance between the play categories and desires of Elementary School.

Kweku Addo-Atuah
Regional & Community Planning Student

Assessment of Ecological Master Plan by Kweku Addo-Atuah:

This section offers an assessment of the Ecological Master Plan developed by Laura Weatherholt for the proposed re-design of the Northview Elementary 15-acre schoolyard site. The Ecological Master Plan includes two playground spaces, one of the eastern (K-2) and the western (3-6) sections of the school site, amenities like an outdoor classroom and ecological systems like infiltration cells. The purpose of the evaluation was to assess the designer's success in synthesizing varying user interests in creating a learning landscape supportive of cognitive development, physical activity and recreation. In reviewing the design, the researcher used the 5 operational play categories as defined in the Methods section of the report. The play categories were as follows: active/functional; constructive; exploratory; games with rules and natural.

Active/Functional Play–Concerning elements of active/functional play, the Ecological Master Plan contained two playground spaces and several play mounds. Within these playground spaces, the Ecological Master Plan contained a myriad of play features designed to keep children moving and enhance fine and gross motor skills. These play spaces included handicap-accessible and traditional swing sets, an array of slides, roped bridges, monkey bars, balance beams and spring riders. Other play opportunities designed to develop dexterity included spring riders and whirligigs. The mounds combine both elements of active/functional and natural play; this play feature allows both climbing and sledding opportunities while its physical composition exposes students to play through natural materials as grass and sand.

Constructive Play–The Ecological Master Plan incorporated such elements as an outdoor classroom, rain and flower gardens and blacktop activity area as representative of constructive play. The outdoor classroom was a particularly important preference for several parties, particularly the Northview Administration. Such a space, cleverly enclosed with an overhead cover to protect from inclement weather, allows for teachers and students to expand the learning process outdoors. In addition, it allows for students to engage in such acridities such as artwork and clay-modeling, thus removing worries of cleanliness typical of indoor classrooms.

The rain gardens offer several opportunities and benefits for both the stakeholders and for the school grounds. The rain and flower gardens or planters present a real learning opportunity in teaching Northview students how to properly maintain the day-to-day functions of the garden, including proper care and maintenance of plant species. The rain gardens will also help control the substantial water drainage issues at the school. The blacktop activity area also encourages patronage as a multi-use space for both Northview students and teachers, ranging from kickball to tic-tac-toe. All of these amenities allow for e exchange of knowledge and encourage interaction between peers and teachers in contributing to tasks, either by creating art or caring for the garden spaces.

Exploratory Play–Regarding features characterizing exploratory play, the Ecological Master Plan provided such amenities as a labyrinth, observation decks and boardwalks. More so than the other elements incorporated in the Northview master plan, the labyrinth allows for a deeply personal, introspective experience. It presents an opportunity for self-reflection and understanding in the midst of a highly-social setting at school. The observation decks expand Northview students' play vertically, helping develop spatial visualization skills through instruments like telescopes or binoculars in observing the activity occurring within the play site. Perhaps one of the researcher's favorite elements in the playground master plan is the boardwalk at select vantage points within the Northview property boundaries. The boardwalks encourage movement within the school grounds as well as a sense of adventure in discovering what occurs in other sections of the site; they also allow for spontaneous interaction between users.

Games with Rules–For this play category, the Ecological Master Plan relied on basketball hoops and a blacktop activity area. The designer envisioned the blacktop activity area as serving multiple purposes, ranging from kickball to tag play to tic-tac-toe. While these amenities are sufficient for games with rules opportunities, the researcher would have liked to see a dedicated turf section for multi-use as a soccer and football field. The researcher believes games with rules are an important component of any playground or schoolyard space, a statement supported by Northview students in their play preferences. These activities are critical in helping

develop children's ability to adapt to and follow set rules as well as promoting emotional maturity through sportsmanship. Aside from these benefits, games with rules also support social interaction, physical activity and recreational opportunities.

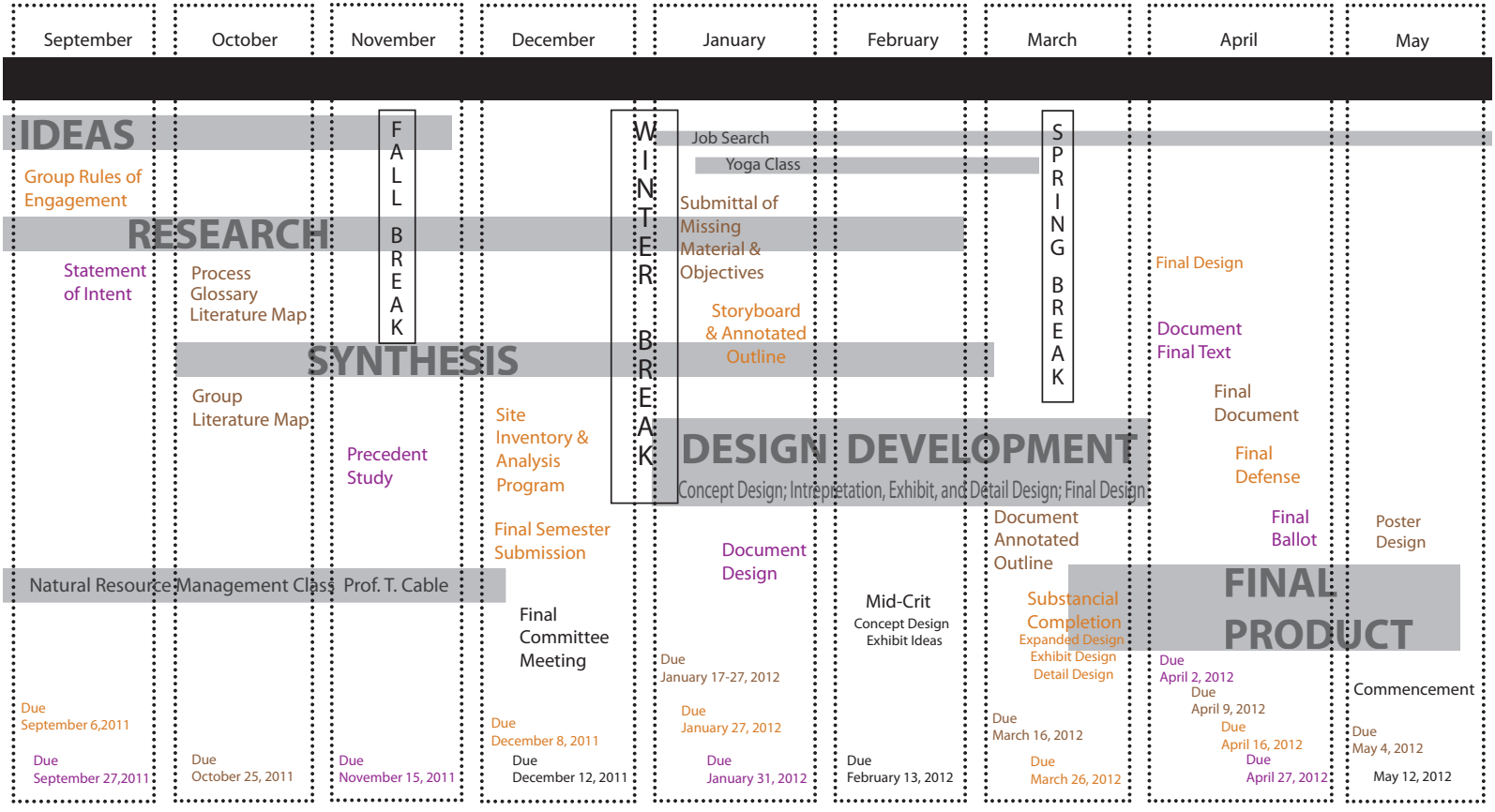
Natural Play–The Ecological Master Plan provided several amenities of choice for this play category, including such features as a trail system, a butterfly garden, sand boxes, mounds and tree forts. Particular favorites include the tree forts which provide climbing and observation opportunities through telescopes and sand boxes which contain wooden or bone artifacts from which children can mimic archaeological digging. Aside from supporting both active and passive recreational opportunities, natural play helps stimulates children's understanding and appreciation of the natural environment. Learning, discovery and creative reasoning can occur through natural play when children can observe and manipulate objects like plant species and sand structures to their heart's content. While not specifically designed for play, the inclusion of dry creek beds an infiltration cells help to maintain and control the levels of on-site rainwater. This presents another learning opportunity for children with instruction by teachers on the proper function and relevance of these water management systems to the site's usability.

The Ecological Master Plan proved successful in synthesizing the interests of the three Northview Elementary stakeholder groups, the researcher and Laura Weatherholt's personal design ethic. In addition to deftly accommodating a learning landscape through the defined play categories, the Ecological Master Plan also provided strategies like infiltration cells in helping Northview manage its significant stormwater drainage issues. In attempting to identify how the Ecological Master Plan translated ethnic diversity, one need not look further than the labyrinth, the variety of intimate or large gathering spaces and use of color. These site amenities pay homage to the diverse Northview population, offering an interchange between those cultures that prefer personal, inward interaction to those that thrive on expansive, highly-social spaces. Another aspect worth including would be a dedicated permanent mural feature where the children could express their culture through media like traditional paint, spray paints or even screen prints.

Through the course of final edits, the researcher came across the issue of site interpretation as discussed in Julie Johnson's Design For Learning: Values, Qualities, and Processes of Enriching School Landscapes. Discussion regarding the manner in which designers translated such intangible elements as cultural and ethnic diversity into physical elements further inspired the researcher to expand assessment of the Ecological Master Plan. Taking a cue from this article, the Ecological Master could further enhance its celebration of Northview's cultural and ethnic diversity through the establishment of an international garden. An international garden, brimming with plant and food cultivars representative of the diverse Northview population, provides an additional learning experience for the school and community (Johnson 2000, 50).

As expressed in Johnson's article, the school which contained an international garden used this simple element to organize such events as festivals. Not only did this further engender cultural understanding, but also increased user's attachment to the schoolyard and established the site as an important community resource. The school's expansion of this element into something so meaningful has strengthened the researcher's opinion concerning the qualities of a site, be they tangible or intangible. A site's success extends far beyond its planner or designer's intended use. It is the manner in which its users decide to adapt these prescribed functions to fit daily needs that define its success in providing choice and flexibility.

Appendix E:
Additional Diagrams



Process Timeline. Illustration by Author

Design Philosophy Diagram

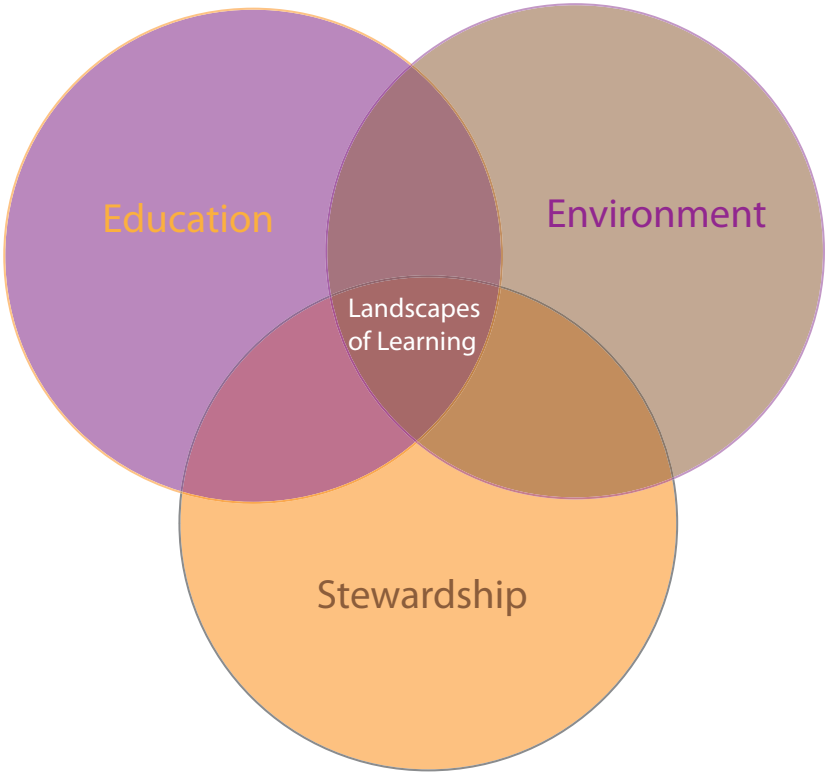
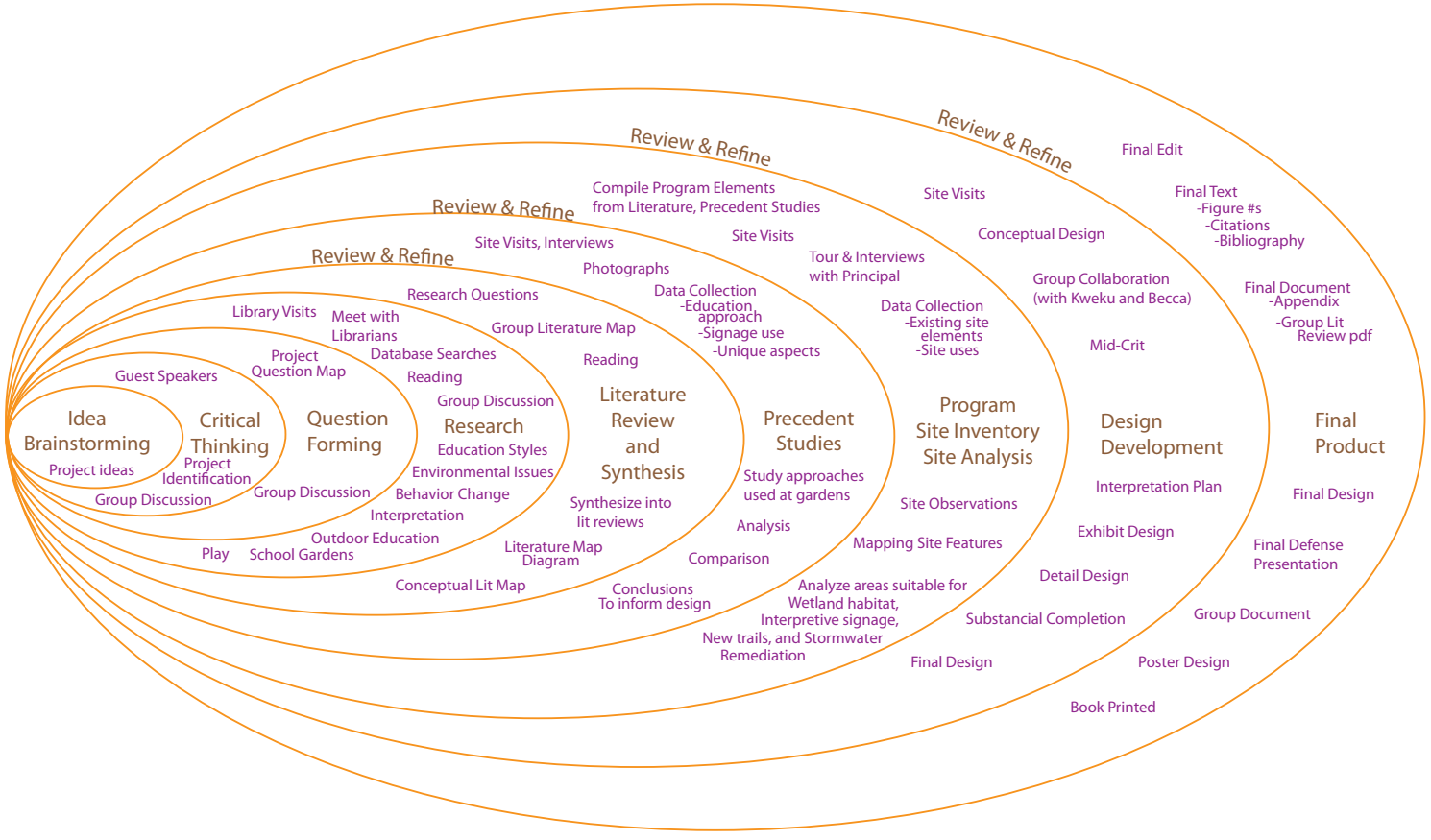


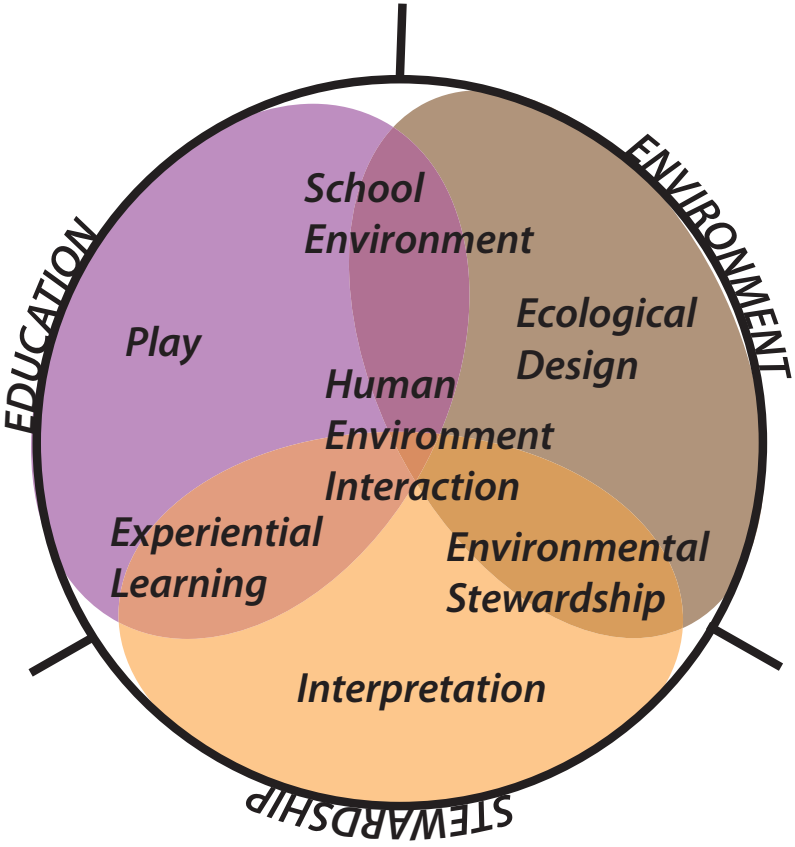
Figure 6.1. Project Philosophy. Diagram by Author

Process and Task Diagram



Project Task Diagram. Illustration by Author

Literature Topic Relations Diagram



Literature Topic Relationships Diagram. Diagram by Author

Literature Relations Map

Book/Source	Ecological Design	Experiential Learning	Environmental Stewardship	School Environment	Human Environment Interaction	Interpretation	Play
Carnegie Mellon University. **What is Environmental Literacy?** 2003. http://telstar.ote.cmu.edu/environ/m2/s1/envlit.shtml (accessed October 16, 2011).							
Chiras, Daniel D., and John P. Reganold. **Natural Resource Conservation, Management for a Sustainable Future**. 2010.							
National Wildlife Federation. **Schoolyard Habitats**: A How-to guide for K-12 school communities. 2001.							
Dannenmaier, Molly. **A Child's Garden** : 60 Ideas to make any garden come alive for children. 2008.							
Cable, Ted T. **Commitments of the Heart**: Odysseys in West African Conservation. 2002.							
Spencer, Christopher, and Mark Blades. **Children and their Environments**: Learning, Using and Designing Spaces. 2006.							
Stine, Sharon. **Landscapes for Learning**: Creating Outdoor Environments for Children and Youth. 1997.							
Marsh, Dr. Peter. The Marshall Cavendish Encyclopedia of Personal Relationships: Human Behavior Vol.12 **The Wider Environment**. 1990.							
Brett, Arlene, Robin C. Moore, and Eugene F. Provenzo. **The Complete Playground Book**. 1993.							
Nichols, Martha. **Guilt Trip Into the Woods**. http://www.brainchildmag.com/essays/spring2010_nichols.asp (accessed October 12, 2011)							
Tai, Lolly, et al. **Designing Outdoor Environments for Children:** Landscaping Schoolyards, Gardens, and Playgrounds. 2006.							
Jost, Daniel. **"New York Loosens Up".** Landscape Architecture, November 2010: 80-94							
Johnson, Lauri Macmillan, and Kim Duffek. **Creating Outdoor Classroom**s: Schoolyard Habitats and Gardens for the Southwest. 2008							
National Gardening Association. **Schoolyard Mosaics**: Designing Gardens and Habitats. 2002.							
Bucklin-Sporer, Arden, and Rachel Pringle. **How to Grow a School Garden**: A complete Guide for Parents and Teachers. 2010.							
Dahl, Bernie, and Donald J. Molnar. **Anatomy of a Park**. 2003.							
Ford, Phyllis M. Pr**inciples & Practices of Outdoor/Environmental Education.**1981							
Brochu, Lisa. **Interpretive Planning.** 2003							

Literature Map. Table by Author

Site Program Relations to Literature Review Components Matrix

Table of Relationships between Program Elements and Literature Components		Literature Components for Children's Playscapes: Design Theory Elements (Dannenmaier 2010)								
		Water	Creatures	Refuges	Dirt	Heights	Movement	Make-Believe	Nurture	Learning
Program Elements	Play-areas	■	■	■	■	■	■	■	■	■
	Blacktop areas (ball-play)						■	■		■
	Swings					■	■			■
	Slide					■	■			■
	Climbing elements			■		■	■	■		■
	Seating areas			■		■				■
	Other forms to incite imaginative play			■			■	■		■
	Prairie areas	■	■	■	■		■	■	■	■
	Classroom garden planters		■		■				■	■
	Wetland areas	■	■	■	■				■	■
	Bioswales	■	■		■					■
	Raingardens	■							■	■
	Plantings to provide wildlife habitat	■	■	■	■		■			■
	Educational interpretive signage	■	■		■				■	■
	Outdoor classroom									■
	Rain barrels	■								■
	Storage shed with green roof				■	■				■
	Courtyard Butterfly Garden		■	■	■		■	■	■	■
	Table surfaces						■			■
	Discovery tables	■	■						■	■
	Art						■	■		■

Relationships between Site Program Elements and Literature Topics. Table by Author, adapted from Dannenmaier 2010, Stine 1997.

Design Characteristics (Stine 1997)								
Accessible/ Inaccessible	Active/ Passive	Challenge or risk/ Repetition or security	Hard/ Soft	Natural/ People-built	Open/ Closed	Permanence/ Change	Private/ Public	Simple/ Complex