

# **ECOLOGICAL SCHOOLYARDS LANDSCAPES OF EMPOWERMENT**

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SARAH BELCHER

## **ABSTRACT**

This thesis explores the ecological design of schoolyard environments. It employs a systems approach, and considers energy, hydrologic, biotic, and social systems and their interrelation. The question of how to integrate experiential learning with the school landscape is also examined, as the concept of empowerment through experience in the landscape is a strong component of this project. With insights gained from an extensive literature review, the author tests the design position through the design explorations of a single schoolyard. The design process, described herein, illustrates the potential for ecological schoolyard design.

## **DEDICATION**

This book is dedicated to my nephew, Zeke, and the next generation.

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# CHAPTER ONE

## INTRODUCTION

*“In the end, we will conserve only what we love.  
We will love only what we understand.  
We will understand only what we are taught.” --Lao-Tzu*



### PURPOSE

The purpose of this thesis is to explore ecological design in a schoolyard setting. The underlying question explored through this research is how ecological design of schoolyards creates a connection between youth and nature while providing a positive learning atmosphere. Van der Ryn and Cowan (1996) define ecological design (eco-design) as: “any form of design that minimizes environmentally destructive impacts by integrating itself with living processes” (p. 18). Such integration demands that design respect species diversity, minimize resource depletion, preserve nutrient and water cycles, maintain habitat quality, and attend to all the other preconditions of human and ecosystem health (Van der Ryn & Cowan, 1996). Where better to instill such values than the schoolyard?

This approach to schoolyard design has great teaching potential, and some municipalities and states are beginning to apply this philosophy through the creation of eco-schools. In *Ecological Schoolyards*, Sharon Danks (2000) defines eco-schoolyards as “K-12 outdoor learning environments that teach ecological principles through the design of the schoolyard landscape” (p. 2). The prototypical ecological schoolyard combines elements of multiple ecological systems on a single site, enabling students to interact with nature and see how ecosystems function (Danks, 2000).

## OUTLINE

Four chapters follow this introduction. The second chapter is a discussion of the following issues:

- ◆ Deterioration of the school environment;
- ◆ Disconnections between humanity's relationship with nature;
- ◆ Reasons that these disconnections should be repaired;
- ◆ Relationships between learning and environment; and
- ◆ Underutilized connection between school and community.

Understanding these relationships provides a background for later discussion and is important if one is to fulfill the potential of eco-schoolyard design.

The third chapter is divided into specific ecological systems and human needs that can be addressed through ecological design. The chapter outlines specific design components that integrate the following: hydrologic, biotic, energy, decomposition, and social systems. Also included in this section are examples and successful uses of these components on school grounds.

The fourth chapter presents a study that applies the framework of ecological design established in earlier chapters. A premise for this study rests on the assumption that society must develop an awareness and appreciation for natural systems in order for continued function of these systems. It is the author's position that schoolyards may be an appropriate starting place to instill such awareness and appreciation. Through a series of design explorations, the framework of eco-schoolyard design is investigated through the design of a single schoolyard: Gladesboro Elementary School, located in Hillsville, Virginia. Implementing sustainable and ecologically sensitive design in schoolyards has potential to yield numerous benefits, both today and in the future.

Chapter five, the conclusion, reflects upon the process of this project, and contemplates some of the surprises and obstacles encountered.

## **CHAPTER TWO**

### **THE PROBLEM**

#### **WHY SCHOOLYARDS NEED OUR ATTENTION**

*“Children live on the Earth - more precisely, they live in the biosphere.  
They also live in an era when, for the first time in history,  
the healthy future of the biosphere has become a serious political issue,  
given the awesome powers of destruction now possessed by adult humans.” --Robin Moore*

#### **THE DETERIORATING STATE OF SCHOOLS**

In 1996, the General Accounting Office of the United States (GAO), reported that three out of five schools required extensive repair or replacement. Almost 14 million students attend school in buildings regarded by the GAO as dangerous or below standard. Over half of the schools have substantial environmental problems, such as poor indoor air quality. Past design approaches and deferment of maintenance have yielded school buildings that are inefficient, cost a great deal to operate and maintain, and demonstrate little thought for the outdoor environment and ecological design (Weiss, 2000).

While schools continue to deteriorate, school age populations are growing (Duke, 2000). In 2000, the school population reached 52.2 million, and is expected to exceed 54 million by 2007 (Duke, 2000). An estimated 2,400 new schools are currently needed to serve the growing K-12 student population (Sustainable Buildings Council, 2002). This increasing need for school expansion presents an opportunity to integrate ecological design into educational spaces. Through exposure to natural environments, students will recognize and embrace the interdependence of living systems. Evidence to support these claims is detailed in the following sections.

#### **DISCONNECTION WITH NATURE**

Historically, nature was viewed as an inexhaustible resource, with society failing to monitor consumption or pollution habits. The population is growing at a rapid rate. Consequently, urban sprawl and development are infiltrating and destroying many natural environments. Today, particularly in densely urban areas, green spaces have virtually disappeared. The American landscape

is increasingly being replaced by a generic brand of buildings and planting palettes that do not reflect the region's unique attributes (Van der Ryn & Cowen, 1996).

In the past 35 years, awareness of environmental problems associated with unmonitored development has spawned both national and regional legislation to curb and correct these problems. However, without the support of the people, legislation is futile. If these resources are to be valued and preserved for future generations, such values must be instilled in youth who will one day be faced with the consequences of current practices.

*“Our dignity arises within nature, not against it.” --Mary Midgley*

Most contemporary youth spend less time outdoors than in generations past (Cheskey, 2001). Television, video games, and the Internet consume valuable time, which could be spent experiencing nature's beauty, intricacies, and life secrets. The subtle pleasures of nature are often replaced by time spent indoors viewing ecosystems through digital media, or not experiencing nature at all. Though technology can be a valuable teaching tool, there is no substitute for experiencing nature first hand. When nature seems far away, it seems less vital to take actions to protect and ensure its existence. The individual is removed, disconnected from the problems, and in many cases the benefits.

Time outside is often closely monitored. In generations past, youth had much more freedom to play and experience the outdoors, independent of their parents. Such freedom and safe independence has in many cases vanished as, “many urban youth are not allowed outside without close adult supervision. Supervised time in the schoolyard may be the only opportunity children have to be outdoors” (Education Development Center Inc. and the Boston Schoolyard Funders Collaborative, 2000, p.1). Unfortunately, many schoolyards are physically and psychologically uncomfortable spaces, and the time students are allowed outside is extremely limited (Cheskey, 2001).

## **ENVIRONMENT AND WELL-BEING**

People need supportive environments for social development (Rivlin & Weinstein, 1995). Students of all ages need informal spaces to interact and learn from their peers. “The powerful socializing role of the educational system cannot be ignored. Schools act as a major system for integrating children into society and designating their places within it. Schools become the arena for communicating to children the value system of our culture” (Rivlin & Weinstein, 1995, p. 250).

Schools are institutions. However, these settings should be educational before they are institutional. Yet, many students are forced to spend time in bleak, institutional environments (Education World Hard Hat Area, 2002). Every part of the school should be a rich and rewarding learning experience. Both the interior and exterior environments should support a high quality of life and a sense of well-being.

Environmental psychologists recognize that contact with nature and vegetation promotes a sense of well-being. Some studies suggest that individuals who are exposed to certain environmental patterns are less likely to become ill, and are more likely to heal faster (Ulrich & Parsons, 1992; Ulrich, 1993). Other studies suggest that simply knowing there is a place where one can interact with nature improves one's sense of well being (Kaplan, Kaplan and Ryan, 1998).

Stephen Kaplan emphasizes that nature fosters the experience of cognitive clarity (Kaplan, 1977). In his writing about adolescence, he stresses that having opportunities to experience increased vegetative complexity "at a time when issues of identity and one's relation to the environment are pressing could have lasting impact on the character and functioning of the individual" (Kaplan, 1977).

Ideally, schools are safe havens, where students are protected from the dangers of the adult world. The character of the schoolyard promotes this sense of safety and well-being. Children in contemporary America face an ever-increasing array of dangers and stresses, and the youth of today are forced to "grow up" at a rapid rate. School grounds should provide both an emotional and intellectual respite from the hectic world in which they live.

## **SCHOOLYARDS AND LEARNING**

In recent years, a movement to integrate schoolyards to core learning and teaching has gained prominence. Theories such as the outdoor classroom concept support a number of hands-on experiential learning activities. As is noted in *Schoolyard Learning: The Impact of Schoolgrounds*,

"From mapping and measuring to gardening and meteorology, to drama productions and student drawn murals, we are witnessing a pedagogical surge that combines the best aspect of creative play and academic learning" (Education Development Center Inc. and the Boston Schoolyard Funders Collaborative, 2000, page 2).

Implementing some of these concepts, schoolyards that were once devoid of life and intellectual promise, have been transformed into dynamic spaces supporting learning and ecological function. This transformation has initiated both statewide and national programs to encourage ecological design of schoolyards.

“Environmental Yard,” studied by Robin Moore and Herb Wong at Washington Elementary School, in Berkeley, California, is a well-documented example of the benefits of eco-design. Beginning in 1971 with a paved schoolyard, over a period of ten years, the school community transformed the yard into an “ecologically valid educational resource and community open space” (Moore & Wong, 1997, p.xvii). Using multiple research methods such as behavior mapping, questionnaires, interviews, drawings, and photographs, Moore and Wang developed data on the educational relationship of the yard and its users. The post-occupancy evaluation included questionnaires and drawings from the students, which indicated that the natural elements were the most memorable and attractive to them (Moore & Wong, 1997).

More recently, California has adopted a philosophy that aims to have a working garden on every school ground. In the Berkeley school district, there is a focus on nutrition and correlating garden and kitchen classes to the curriculum (Jackson, 1999). Several other states, including New Jersey and Maryland, promote greening school grounds by reverting to a naturalistic landscape design approach. In the words of Nancy S. Grasmick, Maryland State Superintendent of Schools,

“Conserving and enhancing the natural environment on school sites in the form of forests, wetlands, meadows, streams, rain gardens, or native landscaping meets this vision. Natural environments on school sites provide a wealth of multi- disciplinary educational opportunities, many of which are ‘hands on’ experiences that stimulate learning . . .

The way in which we conserve, develop, and use our school sites provides by example an environmental ethic to students. These guidelines promote a positive stewardship of the natural environment on school sites, which in turn, provides students with ecological and conservation principles that they can apply as adults.” (Maryland State Department of Education, 1999, p. ii)

Across the nation, on small scales and large, communities are claiming schoolgrounds as a space to represent nature in an experiential learning environment. Often spaces previously paved and devoid of biological diversity are transformed by these committed groups of individual into spaces that connect users to nature, reinforce an environmental ethic, and provide a teaching tool.

Researchers with the State Education and Environmental Roundtable (SEER) have studied the impact of learning environments outside the classroom on student education. This study compared student achievement from American schools that use natural environments as integrated contexts (EIC) for learning to those schools that do not use this learning approach. The results indicate that 92 percent of students who have EIC opportunities outperform their peers in traditional programs (Education Development Center Inc. and the Boston Schoolyard Funders Collaborative,

2000, p.11). As Lieberman and Hoody (1998) note, schools in this study used “nature as a framework in all areas; general and disciplinary knowledge; thinking and problems solving skills; and basic life skills; such as cooperation and interpersonal communications” (Lieberman & Hoody, as quoted in Evergreen, 2000, p 5).

The outdoor classroom offers different avenues for student-teacher interaction. Moreover, these spaces support participation from students and community members. Student participation reinforces pride and ownership of their outdoor spaces. Adults can buttress these feelings by being patient and showing confidence in the problem solving ability of the students. According to the literature, participatory experience invokes a much greater response and excitement from students when compared to learning experiences that are not as engaging. When given the opportunity, most students love to explore and learn.

These EIC programs propose that experiential learning be employed across the curriculum and at all grade levels. Schoolyard design can facilitate such learning processes. For example, a courtyard can house several different habitats on a micro-cosmos level. Biology classes can dissect and count layers of biota. Chemistry classes can conduct experiments relating to compost and the anaerobic and aerobic reactions taking place. The same courtyard can inspire a haiku in English, serve as a gallery for sculpture, and a studio for drawing and painting. Math teachers can use this space in a number of ways, from determining the area of the courtyard, to counting the number of rows in a planting bed or number of peas in a pod. History and social studies teachers can incorporate the space into their curriculum by planting native heirloom gardens, dye gardens, and including plants used in native cultures to dye fabric. Indigenous plants provide a connection to one’s cultural heritage. For example, Native Americans and early pioneers used native species for virtually everything from food and medicine, to building materials, textiles, and dyes. This information can be used to teach about past and present cultures.

When student populations are culturally diverse, or in instances where English is a second language, outdoor education can help bridge cultural gaps. For example, plants and foods from different cultures can be used to illustrate differences and similarities of people living in those areas.

Innovative teachers and well-designed schoolyards provide an exciting environment for illustrating both abstract concepts and concrete, real-world situations. Student participation in “hands on” activities in the schoolyard reinforces learning. The natural environment’s potential to foster “cognitive clarity” also contributes to focusing on the learning material being presented. This learning can be encouraged through the use of schoolyards as outdoor classrooms and laboratories. Proactive groups of students, teachers, administrators, parents, and community members can boost morale and re-invigorate enthusiasm for teaching and learning by incorporating the outdoor environment into the educational experience.

## CONNECTION TO THE COMMUNITY

The living learning schoolyard extends beyond the school grounds and into the community. As knowledge spreads about landscaping that mimics nature, community members may question their own yards and consider the benefits of natural landscaping. Many school grounds serve as community open space. For example, in Boston, Massachusetts, approximately ten percent of community open space is found on public schoolyards. The city's Grey to Green program is an effort to convert spaces previously paved to vibrant green spaces that support both ecosystem function as well as enrich the lives of community members. The program is a collaborative effort between public and private enterprises. The city of Boston has committed millions of dollars a year to green these school grounds. Since the program's inception in 1994 more than half of the schools and every neighborhood has participated in the project (Boston Schoolyard Initiative, 2003).

Schools are often community centers. They house activities for the community before school, during school hours, after school, on weekends, and during the summer. Activities range from dog walking and evening exercise, to formal camps, meetings, special events, fairs, athletics, workshops, informal gatherings, and evening classes. Public spaces of school grounds are often overlooked, despite their potential to serve the community (United States Department of Education B, 2002). In addition, if these spaces are combined with community park attributes and made available to the community, the cost of maintenance can be shared with the parks/recreation department (Erikson 1985). Community garden plots are another mechanism for sharing responsibility with community members and encourage a sense of ownership with the neighborhood (Lewis, 1996). School grounds have the potential to serve diverse groups and fulfill both the needs of the school, as well as the community. By making a conscious effort to plan a school's atmosphere ecologically, the scope and benefits reach beyond the schoolyard into the realm of the community. It is clear that schoolyards have potential to serve both the community and the student population if these spaces are designed to be multi-functional, vibrant, green spaces.

## **CHAPTER THREE**

# **ESSENTIAL DESIGN CONSIDERATIONS FOR ECO-SCHOOLYARDS**

*“The ecological view requires that we look upon the world, listen, and learn.*

*Our phenomenal world contains our origins, our history, our milieu: it is our home” --Ian McHarg*

### **BASIC PRINCIPLES OF ECOLOGICAL DESIGN**

The word *ecology*, derived from *oikos*, or home, signifies that ecology is the science of the home. As Ian McHarg recognized, the world is the home for all living things. Espousing an approach to design that encompasses and supports the function of ecological systems is necessary for the continued appreciation and ultimate survival of these systems (McHarg, 1992). All systems are dependent on one another. Therefore, society must understand these systems in relation to one another. Ecological design begins with analyzing and understanding the ecological and cultural context of a site. The first principle of ecological design suggested by Van der Ryn and Cowan (1996) is, “solutions grow from place”(p. 54). Every site is different. Ecological design responds to the specific conditions of that place. This contrasts with conventional design, which forces standardized designs and imposes boundaries upon natural systems rather than responding to the integral function of these systems (Van der Ryn & Cowan 1996). Both the site and regional scale analysis contribute to the understanding of one’s sense of place.

Van der Ryn and Cowan (1996) propose, “ecological accounting informs design”(p. 54). This approach recognizes ecological costs of design, such as pollution, habitat destruction, and resource depletion. Recognizing and considering the ecologic consequences rests upon the designer. Questions designers must ask include: What are the impacts of existing development? How can one mitigate and ameliorate these impacts through design?

Designing with nature is a second key principle of ecological design. Ecological designers look to nature as a primary collaborator (Van der Ryn & Cowan, 1996). This collaboration involves evaluating the following questions: How can nature guide the design? How are the natural systems functioning? Are these systems visible? In nature, living organisms are constantly breaking down and

supporting overlapping and inter-connected systems. Ecological design facilitates and reinforces the function of these systems.

A third principle outlined by Van der Ryn and Cowan is the concept that “everyone is a designer” (Van der Ryn & Cowan, 1996, p. 55). This relates back to the idea that solutions grow from place. Designs must be responsive both to local conditions and local people (Van der Ryn & Cowan, 1996). Users of the space should be involved in the design process. This is particularly true with schoolyards. Including all segments of the school community increases the level of commitment, interest, and empowerment for those involved.

Last, but central to the idea of ecological schoolyard design, is that design should engage the user and make nature visible (Van der Ryn & Cowan, 1996). Through this engagement, the design supports the users’ understanding of the biological processes on the site. Perhaps this understanding, or connection to nature, will extend beyond the boundaries of the site, as nature extends beyond these boundaries.

## COMPONENTS OF ECO-SCHOOLYARDS

*“Being ecologically literate, or ecoliterate, means understanding the basic principles, or core concepts of ecology and being able to embody them in the daily life of human communities.” --Fritof Capra*

Ecological and human functions are primary considerations for the ecological designer. The systems are interrelated and overlapping. It is difficult to dissect one apart from another. However, in an effort to identify potential components of an ecologically designed schoolyard, five systems have been identified: energy, hydrologic, biotic, decomposition, and social cycles. Ecologically designed schoolyards have the potential to reveal interconnected aspects of these natural systems. Schoolyards with some or all of these components are being designed nationally and worldwide. These designs reveal the vibrant capacity for these systems to evolve and support each other, on even the smallest site.

## ENERGY SYSTEMS

*“When you turn to face the sun, all shadows are behind you”*—African proverb



Energy, “the ability to do work” (Nebel, 1990, p. 576), takes on many different forms. Energy systems vary in scale and time necessary to complete the cycle. For example, a plant transforms the sun’s rays to sugar, and is subsequently consumed by an animal; the plant provides energy to the animal, and the animal may “fertilize” other plant growth only to be consumed for fuel by another animal, and so on down the food chain. Trees and other biofuels combust to generate different forms of energy, for various purposes, including, heat and transportation.

The United States heavily relies on oil, coal and natural gas for most of its energy production. These fossil fuels are considered non-renewable, as they took millions of years to form, and are finite. These fuels also have high environmental costs. As a country that contains a mere 4.5 percent of the world’s population, we produce over 25 percent of its pollution and control 25 percent of the world’s wealth (Raven, 2002). Domestic oil production is in a state of decline. Over sixty percent of oil used in the United States is from foreign sources. Consumption rates are continuing to expand, and dependence on foreign oil is growing.

Energy systems exposed in ecological schoolyard environments help students recognize the similarities and connections between systems, depending on the number and complexity of the systems represented. Energy is a dynamic process that is integrated into the daily life of everyone. The eco-schoolyard concept supports the exposure and exploration of these connections through design.

## ENERGY EFFICIENCY

Americans consume more resources than are produced in the United States. “The amount of energy consumed by one American is equivalent to that used by three Japanese or 531 Ethiopians” (Lerner, 1998, p. 76). Almost one half of the energy consumed in the United States can be traced to building maintenance, construction, and materials (Van der Ryn & Cowan, 1996). Several national programs exist to assist and establish guidelines and legislation for improving the energy efficiency of public schools.

The Federal High Performance School Act of 1999 was written in response to the poor environmental conditions and inefficient energy consumption of schools in the United States. The act proposes funding for schools to achieve energy efficiency. The Congressional Committee found that American K-12 schools spend more money on energy costs than books and computers combined. Section 2.a.6 of this Act calls for adopting a “whole building approach in the design of new schools and the renovation of existing schools—considering how materials, systems, and products overlap and how a school is integrated on the site and within the surrounding community—will result in high performance school buildings” (H.R. 3143, 1999).

## SOLAR ENERGY



Solar power is energy produced from the sun. This energy is harnessed in several ways, which vary in complexity and form. Probably, the most common and the one most essential to our survival, is photosynthesis. Photosynthesis is essentially fueled by solar power, and in this way, many other forms of energy are directly tied to the sun's energy. Here exists numerous opportunities to teach students in the outdoor environment about interconnectedness, the sun's role in the cycle of life, and our interdependence on other systems.

Student-led energy audits have sparked a range of energy conservation and in some cases energy production measures. For example, Chicago's Frank W. Reilly Elementary School installed a photovoltaic system on the school's roof in 1999. A year later, the Reilly Solar Corporation (RSC) was formed. This student organization sells the solar energy produced by the panels to the Reilly School and invests the proceeds in conservation curriculum and other student activities. RSC sponsors an energy fair called "Solarbration" at the end of the year in which student presentations related to the solar curriculum as well as international performers and exhibits are celebrated. The city of Chicago and the Chicago Public Schools worked together to execute this initiative and plan to incorporate other schools in the near future (Chicago Solar Partnership, 2002).

Using solar power is one way to educate students about photosynthesis, the dependence of living systems on the sun, and safe ways to experiment with electricity. Alice Fong-Yu Elementary School in San Francisco recently added a solar powered pump to their newly built pond. The panels are mounted on a pivoting structure for students to manipulate towards or away from the sun. The rate of water flow through the pump varies directly with the intensity of the sun's rays. Students view this variation and associate the amount of sunlight with the activity of the pump.

Energy efficiency is linked to reduction of pollution. The U.S. Environmental Protection Agency's Facilities Management and Service Division (FMSD) Conservation Information Clearinghouse provides information that allows students to determine the amount of pollution produced per kWh of energy utilized at their school (Green Schools, 2002). Students of all ages can conduct an energy audit of their school by closely examining such things as lights left on overnight or

in unused rooms, inefficient appliances or fixtures and poorly insulated windows and doors. By following student recommendations, many schools have saved energy and money (Danks, 2002).

#### **ALTERNATIVE FUEL BUSES**

The eco-schoolyard supports experimentation with technologies that have a lower impact on the environment than most standard technology. The Antelope Valley Schools Transportation Agency (AVSTA) is located approximately 70 miles northeast of Los Angeles. Prior to 1992, AVSTA was accumulating up to \$ 3,000 a day for not complying with California air emissions standards for the use of their aging diesel powered school buses. AVSTA had no funds to replace the 30 –35 year old buses. In 1992, AVSTA's chief executive officer learned of the California Energy Commission's (CEC) Clean School Bus Efficiency Project. CEC along with several other funding agencies provided funding for replacement of AVSTA's aging fleet of buses with one that runs on alternative fuels. AVSTA now has a fleet of 157 vehicles, 48 of which are alternative-fuel. Now, AVSTA is making positive contributions to the environment by contributing to better air quality, and reducing dependence on imported oil. The alternative fuels are compressed natural gas, methanol and electric buses. The grants also funded onsite-fueling stations and training for the bus drivers on safe and proper handling of these fuels (United States Department of Energy, 1998).

#### **WIND POWER**

Wind power is another energy system represented in the eco-schoolyard. This representation varies in complexity, from a windsock, to wind mills, to wind turbines, or kinetic sculptures engaged by wind power. Wind turbines transform wind into mechanical power, and is further refined for electrical generation. This type of energy generation is virtually pollution free after the turbines are constructed. Generating energy on school sites educates about energy and saves money for future use on books, festivals, and other amenities for the students (American Wind Energy Association, 1999).

In Forest City, Iowa, several school districts rely on wind energy to power their electrical needs. The program was inspired by a wind energy presentation to the Forest City school board by former student, Paul Smith, in the mid 1990's. From there, interest grew to the current wind turbine program. At the Akron-Westfield school, students have been involved in the wind project from the inception. They worked with mentors on the analysis, schematic design, construction documentation, and construction administration. Turbines provide 80% to 90% of the electrical needs in the Forest City school district. The school is in the process of developing a website with real time data about the electrical production and wind energy (American Wind Energy Association, 1999).

## ENERGY EFFICIENCY AND LANDSCAPE DESIGN

When designing landscapes, planting and paving materials and locations should be chosen for their energy saving potential. Evergreen windbreaks can block out cold winter winds and reduce heating costs by 10 to 25 percent. The effectiveness of vegetation and energy efficiency depends on the prevailing wind direction, and a planting design that responds to the specific site conditions. Deciduous trees near buildings produce shade during hot summers and allow the sun's warmth to penetrate during winter, saving on air cooling and heating costs (Foster 1994). Also, reducing or shading hardscapes near structures minimizes heat absorption and heat island effect in warmer climates (Thompson & Sorvig, 2000). In colder regions, microclimates are created against buildings or walls to generate warm winter seating or to maximize passive solar receipt.

## EMBODIED ENERGY



When choosing materials, ecological designers take into account the embodied energy of products. Embodied energy includes the energy spent in harvesting, producing, and transporting the material. Energy audits during the construction process raise awareness of workers and reduce pollution, energy, and costs. This record keeping includes making a log of travel time and energy expense for commuting workers or volunteers. Choosing regional materials lowers embodied energy and pays tribute to the culture of the community because materials do not have to be transported from distant locations. Also the materials require less maintenance because they are inherently suited to the environmental conditions of the area. In addition, recycled or found materials are often utilized in eco-schoolyard design. These materials add character to the schoolyard and are often free or donated. (Schaeffer, 1997).

## ENERGY AND NUTRITION



The link between the sun, energy, and the food that sustains us is not typically apparent in our increasingly global, consumer-based society. When asked where food comes from, many students will answer, “the store.” The lack of recognition and misunderstanding of our dependence on good soil, water, and sun to produce the food that sustains our bodies is substantial and alarming. Allowing students to grow food or edible crops on school grounds is one way of promoting active learning about both sources of energy and nutrition.

One of the most well-known examples of food production and nutrition implications is the Edible Schoolyard project at Martin Luther King (MLK) Jr. Middle School in Berkeley, California. The project was inspired by the chef, Alice Waters of Chez Pannise, in the mid-1980’s. She remarked during an interview, how neglected and abandoned this school in her neighborhood seemed. After the interview was published, Waters received a call from Neil Smith the new principal at MLK, to discuss her comments. This was the beginning of the Edible Schoolyard project. Smith and a proactive staff formed a “Revolutionary Committee,” as the school was experiencing academic failure and behavior problems, and needed a revolution (Comnes, 1999). This committee combined with Waters vision of integrating the garden into the school lunch program, culminated in the Edible Schoolyard project and transformed an urban lot into a garden full of life. This project started small and has grown through the dedication and support of staff, students, and volunteers, as well as grant monies from the Chez Pannise Foundation, and other funding sources. The Edible Schoolyard has yielded a positive learning climate, and has made the King school a better place for students. (Comnes, 1999).

Eating is a daily requirement with the potential to excite the senses. School children’s interests are peaked as food is introduced as a part of the curriculum (Waters, 1999). Implications on health and nutrition are growing as society shifts from a family sit down meal culture to a fast-food culture. Alice Waters cites Francine du Plessix Grey’s concept of the “ritual of nutrition.” This ritual requires inputs of time and sacrifice, “but making these sacrifices nurtures both family and society.

Cooking and eating together teaches us compassion” (Waters, 1999, p.13). At MLK the kitchen classroom transforms daily harvests into daily meals. The garden project sparked a shift in the length of class time from 45 to 95-minutes, to allow time for harvest, a brief lecture/demonstration, food preparation by the students, the sharing of food and conversation, and class clean-up. About 30 students collaborate on tasks from harvest to setting the table, complete with flowers and tablecloth (Cook, 1999).

In some instances the students are given only copies of the recipe, and they take it from there. Students at MLK have also ground their own corn and wheat into flour, and made butter from scratch. Students approach food preparation with enthusiasm. Some examples of dishes prepared include Jerusalem artichoke fritters, sweet potato biscuits, pumpkin and kale soup, and cucumber sushi. Students grow more than 15 types of salad greens year round (Cook, 1999).

#### COOKING AT THE ECO-SCHOOLYARD



Cooking is encouraged within the eco-schoolyard concept. By allowing students to participate in cooking exercises, an active connection between food that is grown by the students, and their dependence on good food for nutrition is reinforced. A simple solar oven constructed from donated materials is the pizza box solar oven. This oven is constructed from a pizza box, lined with aluminum foil, a turkey bag and a thermometer. “Turkey bags,” plastic bags sold commercially for cooking turkeys, are meant to withstand high temperatures. The item to be baked is placed inside the turkey bag, and the oven is set in the full sun, which provides the energy to cook the food (H. Aronson, personal communication, October 26, 2002). Other methods and activities for building solar power systems are available through the US Department of Energy’s website.

Another method for cooking in the eco-schoolyard is cooking with wood. This is an activity that requires close monitoring and containment. At San Francisco Community Day School, parents, staff, and students along with SLUG- San Francisco’s League of Urban Gardeners, built a wood fired oven in the shape of a frog out of cob, a mud sand and straw mixture. The oven is fueled by burning wood, another natural resource that is managed sustainability. At San Francisco Community Day,

students make pizza from the ingredients they grew in their pizza garden. Other ways of bringing cooking to the eco-schoolyard, include brick ovens, fire pits, and barbeque pits. Food can be prepared for recreational events and festivals through out the year.

## HYDROLOGIC SYSTEMS



Water, a precious resource, is taken for granted in most of the United States. Ecologically managed water systems recognize the importance of water and convey this stance through design. Ecological design includes measures that conserve water and prevent and/or treat polluted water. This is achieved through numerous design methods, some of which are applied to the eco-schoolyard concept and are outlined in the next sections.

## STORMWATER SYSTEMS



Historically, stormwater and flood management was an engineering endeavor, tackled through structural works designed to move water quickly or hold water behind levees or in reservoirs. Further understanding of the correlation between land use, stormwater, and flooding problems has led to more comprehensive approaches involving land managers, as much as engineers, in the decision-making process (Randolph, 2001).

Impervious surfaces created by urbanization include parking lots, streets, sidewalks, and rooftops. These surfaces increase the rate of accumulation and amount of stormwater runoff and transport nonpoint source (NPS) water pollutants. NPS pollution is the nation's largest water quality

problem (United States Environmental Protection Agency, 2002 a). The Virginia Stormwater Management Handbook defines NPS pollution as contaminants such as “sediment, nitrogen, phosphorous, hydrocarbons, heavy metals, and toxins whose sources cannot be pinpointed but are rather washed from the land surface in a diffuse manner by stormwater runoff” (Commonwealth of Virginia, 1999, p. 1-3). These pollutants are carried into rivers, streams, and lakes where they cause detrimental effects to drinking water, recreation, fisheries, and wildlife. Many traditional stormwater management strategies do not effectively address water quality.

Approximately 40 percent of rivers, lakes, and estuaries surveyed by the EPA are not clean enough to meet basic uses, such as fishing or swimming, due to NPS pollution (United States Environmental Protection Agency, 2002 b). Urbanization is a leading cause of NPS pollution through urban runoff and stream and habitat changes. Urbanization and the creation of impervious surfaces drastically alter watershed hydrology and water quality. As the percent of impervious surfaces increases, runoff volume and velocity increase, and evapo-transpiration and infiltration decrease (Randolph, 2001).

These modifications lead to erosion of stream banks, increases in water temperature, destruction of in-stream and riparian habitat, and downstream sedimentation of riparian areas, estuarine habitats, and streambed substrates. Many analysts agree that percent impervious surface coverage in a watershed indicates impact on stream health (Randolph, 2001).

As established in Chapter One, the school-aged populations are growing. In many cases, the footprint of the building has more than doubled to accommodate these increasing student populations. Unfortunately, this has resulted in increased impervious surfaces and less outdoor space available for student use. Land managers recognize the impact of nonpoint (NPS) source pollution and the detrimental effects of stormwater runoff. Schoolgrounds are an appropriate location for public education and outreach. Community and school members can actively monitor and mitigate stormwater management issues. In order for this to be achieved, both the problem and potential solutions must be exposed in this public, community, and educational setting.

## ECOLOGICAL DESIGN ALTERNATIVES



Conventional stormwater systems often miss opportunities to design for recreational and habitat quality or to educate about water systems and accompanying biodiversity in the design. In a typical parking lot, planted areas are raised, promoting runoff onto impervious parking surfaces. Gutters and curbs speed runoff, as well as collect and concentrate pollutants from vehicles. Alternatively, eco-designs for gutters and curbs allow water to flow into vegetated infiltration trenches or bioswales. In addition to slowing flow and maximizing infiltration, the vegetation and soil microbes in bioswales cleanse runoff, thereby reducing the amount of pollution directed to waterways or groundwater (Thompson & Sorvig, 2000; Murase, 2002).

Designs utilizing bioswales keep curbs open and allow the water to pass into the swale in a sheet flow fashion. Raised drain inlets are put in place to direct overflow to secondary swales or other infiltration systems. Tom Liptan, a landscape architect for Portland's Bureau of Environmental Affairs, says the bioswales designed by Murase Associates for Museum of Science and Industry, in Portland, Oregon, are sufficient for 75 percent of Portland's annual rainfall. Computer models estimate that bioswale topsoil captures 60 percent of suspended solids in the runoff. Liptan expects a 90 percent pollutant capture with a few improvements (Thompson & Sorvig, 2000).

Bioswales incorporated into school parking lot designs provide a wonderful opportunity to improve the water quality and reduce the amount of runoff. These measures can also teach the community about the impact of impervious surfaces and NPS pollutants and how to mitigate this impact through design.

## PERMEABLE PAVING MATERIALS

Aside from bioswales, other infiltration systems such as permeable paving materials, infiltration trenches, and bioretention systems are used for ecological stormwater management.

Permeable paving materials should be considered as alternatives to paved surfaces such as black-topped playgrounds and parking lots. Some examples of permeable and porous paving materials include: geotextile reinforcement systems for grass and gravel, concrete turf pavers, porous asphalt, permeable concrete, concrete-paving units, and loosely laid brick. Numerous manufacturers, with a variety of types, sizes, shapes, colors, and textures of permeable paving materials are available to the designer.

Paving systems, which incorporate vegetation, are best suited for low volume use: overflow parking, emergency access, or any area that is not in constant use. Some concrete pavers have spaces for wildflowers, grasses, or other vegetation. Typical permeable paving systems require a sub grade comprised of a stone reservoir that stores water until it infiltrates into the subsoil (Rollings & Rollings, 1999).

Porous asphalt and concrete are similar to traditional materials. However, the fine particles are omitted in the permeable products. This omission allows water to soak through the openings in the aggregate. Traditionally, a combination of “fines” aggregate and sealant make the pavement effectively impermeable. Under the porous asphalt or concrete is a sublayer of gravel or a holding tank to allow for infiltration, or storage of water for irrigation (Cahill Associates, 2001).

There are numerous ways to design these systems. When using porous asphalt, filter fabrics are placed on the bottom of a recharge bed to promote percolation and prevent clogging. Crushed stone with 40 percent void make up the recharge bed. Heavy truck traffic on the bed bottom is minimized during construction to prevent compaction. Compaction on clay soils makes the surface impervious. The use of geotextiles in conjunction with the filter fabric helps to spread the load. Roadways and parking stalls are edged with large river stone or vegetated swales that provide an overflow to a recharge bed in the event that clogging of porous pavement occurs (Cahill Associates, 2001).

Overflow from these systems is also diverted into sand filters that continue the filtering process and slow the velocity of the runoff. When the first flush of rainwater travels through the sand filter, the coarse sediment is trapped, and the velocity of the runoff is decreased. Sand filters have a high to moderate rate of pollutant removal, have few limitations, and require a small amount of land space (Cahill Associates, 2001).

Another important consideration for the selection of porous paving materials is temperature range. In colder climates, the effects of freeze-thaw are a concern; porous asphalt may be a better choice than porous concrete because it tends to be more flexible. It should be noted that there are ways to design and install porous concrete so that freeze-thaw does not compromise its integrity (Ferguson, 1998).

There are several ways to reduce the amount of paving. Parking garages and shared parking save valuable space for preservation or future development. In addition, the general specifications for parking spaces are often larger than necessary for most vehicles. It is viable to offer compact car parking in the overall design proposal (Thompson & Sorvig, 2000). Many schoolyards are reclaiming paved playgrounds and parking areas and transforming this land into natural areas or garden plots.

Wetland pockets and vegetated bioswales are incorporated into eco-schoolyard parking lot design, as well as a multitude of other stormwater management techniques. Such techniques include green roofs, permeable paving for parking lots, rain gardens, rainwater catchment system, and ponds. These designs encourage a connection to the hydrologic systems and the biotic systems that depend on healthy water. These designs can also promote education about water quality and water management issues by exposing a system that is often invisible from public perception.

## **GREENROOFS**

Rooftops are under-utilized spaces in the majority of buildings. Schools are no exception. Though, some pioneering schools recognize the potential of these spaces and are utilizing greenroofs, rooftop gardens, rooftop playgrounds, or rooftop learning environments, such as spaces for energy production. Many school buildings are single-story structures with expansive ecological footprints. In addition, these roofs are often flat, making them a great location for these interventions. The need to reconcile and utilized rooftop spaces is becoming increasingly apparent.

Rooftops are generally impervious surfaces that alter the pre-existing hydrology. Alternatively, greenroofs convert impervious roofs into surfaces that reduce runoff. “A greenroof is a living, vegetative roofing alternative to standard non-porous roofs” (Greenroofs.Com Website, 2001). Rooftop stormwater storage delays rainwater from entering the stormwater system. These storage barriers are placed on a flat roof, and are usually designed to carry about two inches of water or 20 to 30 pounds of snow (Randolph, 2001).

Greenroofs have the potential to act as micro-cosmos and benefit several ecological systems. *Design Guidelines for Greenroofs*, by Steven Peck and Monica Kuhn, suggest that life cycle economic analysis indicate that green roofs cost the same or less than conventional roofing. Greenroof infrastructures mimic natural processes. These green additions to rooftops have numerous environmental and economic benefits such as retarding and filtering stormwater runoff, filtering particulate matter, contributing to habitat quality of airborne species, reducing urban heat island effect, and increasing energy efficiency (Peck & Kuhn, 2003).

It is important to note the difference between extensive and intensive greenroofs. Extensive greenroofs are characterized by lightweight planting mediums, minimal maintenance, and low capital

cost. Extensive green roofs are often inaccessible, or only accessible visually through windows overlooking the roof (Peck & Kuhn, 2003).

Intensive green roofs include rooftop gardens with deeper soil, are often accessible with a diversity of plantings and utilization, and have higher maintenance and capital costs. The increased soil depths of intensive roofs yield greater insulation and storm water capacity. Intensive roofs require more technical expertise, may require irrigation and drainage systems, thus require more energy water and materials (Peck & Kuhn, 2003).

There are several safety considerations for implementing greenroofs in school settings. First and foremost is the load bearing capacity of the roof. This will dictate the location of heavier objects or the need for additional structural support. A second consideration is accessibility: How and in what way will the rooftop be accessible? Ample access and egress are required to meet fire code regulations if the roof is physically accessible. Creating a safe-edge condition through fencing or railing is necessary to guard from falls and liability concerns. However, these are considerations that must be made in many areas of design of the public physical environment.

Greenroofs are increasingly recognized for their environmental and economic contributions and should be considered for schools in rural and urban environments alike. Green Roofs for Healthy Cities, Toronto Hydro Energy Services, and the Catholic School Board are collaborating on creating an outdoor rooftop classroom at Saint Patrick Secondary School in Toronto. This project began in 2001, and is designed to create a learning environment and outdoor laboratory for students to study science, math, biology, and ecology (The Greenroof Infrastructure Monitor, 2001).

The potentials for learning associated with greenroofs should not be underestimated. Calculations about stormwater and load bearing potential are but one option for applying theoretical knowledge to a real site. Science standard of learning relating to vegetation, and basic necessities for plant life to thrive are can be explored through monitoring the plant life on rooftop gardens, and the harsh conditions that are exhibited in these dynamic environments. The learning benefits are limited only by one's imagination.

## RAINWATER CATCHMENT SYSTEMS



The raingarden is another eco-design technique that exposes and utilizes rainwater. Raingardens are defined as “shallow two to six inch deep landscaped stormwater storage areas” (Maryland State Department of Education, 1999, p.23). Similarly to bioswales, raingardens filter pollutants and allow for water to infiltrate into groundwater supply. Rainwater from rooftops and other impervious surfaces is routed into infiltration gardens via traditional guttering or alternative conveyance systems. Additionally, pitched roofs with ample overhang allow rooftop runoff to flow directly into gardens. The gardens are designed for aesthetics, habitat and stormwater management, and environmental protection.

Depending on mitigation needs, type of application, plant materials, and site constraints, rain gardens can effectively remove pollutants from runoff, promote groundwater recharge, restore watershed hydrology, enhance terrestrial habitat, provide shade to reduce thermal impacts, and improve aesthetics (Maryland State Department of Education, 1999, p. 23).

Details such as splash blocks engage the senses. Rain gardens reveal the impact of the built structure on the natural flow and infiltration of the hydrologic cycle by bringing runoff to the surface.

At Corkran Middle School, in Anne Arundel County, Maryland, more than 300 seventh grade students participated in transforming a grassed inner courtyard into a lively raingarden stormwater retrofit. Different classes took responsibility for various aspects of the project. Math students measured the courtyard and made scale drawings. Art students were responsible for the garden design. Language arts classes wrote articles for the school newspaper. Social studies students raised funds for benches and birdhouses. And science students were responsible for much of the physical labor, and design implementation (Maryland State Department of Education, 1999).

Rain barrels are another means of harnessing rainwater for irrigation of planted areas. The barrels are attached to downspouts of gutters and contain water in a sealed environment for later use.

Materials used to build these rainwater storage tanks vary from ferrocement, glazed ceramic, reinforced concrete, galvanized metal, and plastic. Some tanks are buried, while others are accessible at grade (Gould & Nissen-Peterson, 2002). The decision of material and above ground or below ground location depends on the regional temperature fluctuations, budget, as well as physical and spatial constraints of the site. A roof or mechanism for sealing the container is necessary to keep contaminants, insects and wildlife out of the water supply. The method of transporting water also depends on the site-specific design. In some cases, a pump or bucket/dipper system is necessary to move water. In other cases, the force of gravity is utilized to move the water effectively.

The choice and detail of design for rainwater harvesting depends on site-specific concerns and goals. These rainwater-harvesting mechanisms are incorporated into other site elements and curriculum needs by integrating the design into a weather station component. On the smallest scale, rain gauges measure and illustrate this vigorous system. Connecting the hydrologic system to plant growth and drinking water needs reinforces the dependence of clean water sources for healthy life on the planet.

#### WATER CONSERVATION



Xeriscaping, or water conserving planting, is on the other end of the water spectrum. In dry ecosystems, planning efforts must embrace climatic and regional conditions of that place. This is achieved by planting species of plants that require little water for flourishing. Considerations such as seasonal temperature fluctuations, native ranges, and rainfall patterns should be examined during plant selection. Some regions periodically face draught conditions on the east coast, and more predictable water shortages are found in some regions of the west.

The water consumption tendencies of American society exemplify the disconnection of contemporary society to hydrologic systems. In circumstances of food crops and plants that user groups identify with culturally, it may be necessary to irrigate or subsidize water to plants between rainfalls. Soaker hoses buried beneath a thick layer of mulch deliver water directly to the roots. The

mulch, which should be one to three inches thick, will decrease the amount of water lost to evaporation. Mulch also has an added benefit of acting as a weed barrier while newly transplanted specimens acclimate to their new surroundings.

One example of an ecologically managed irrigation system is found at the Solar Living Center in Hopland California, where a watercourse is connected to solar panels. The irrigation and movement of water is directly linked to the sun's energy. On sunnier days, more energy is pumping the water, and on rainy or cloudy days, the panels are receiving less energy, and little to no water is circulated (Schaeffer, 1997).

In arid New Mexico, Los Padillas Elementary School incorporates a xeriscape garden planted by each grade level. The garden was completed in 1990 and now requires little maintenance. With the droughts experienced on both the East and West coast of the United States, knowledge of water conservation and rainwater harvesting will contribute to more mindful action relating to water usage (Los Padillas Elementary School Website, 2002).

Water conservation is an excellent and important concept to teach in eco-schoolyards. Clean water is essential to the health of the planet, and is a resource taken for granted in much of the United States. Xeriscaping and water conserving irrigation systems are superb interventions for the ecologically designed landscape. Landscapes, which exhibit plant material that have evolved to conserve water, can teach numerous concepts to students. One concept is the benefit of water conservation. Another concept is how plant and animal ecosystems have adapted in response to environmental conditions over time.

#### **GRAY-WATER RECYCLING**

Recycling gray water (wash water) from sinks and showers is one method of conserving water. This water is utilized to flush commodes then treated as black water. If biocompatible soaps are used, gray water is used for irrigation in the landscape. Presently, biocompatible soaps are not widely available, and most building codes have not been updated to encourage gray water recycling, particularly on the East Coast.

Each gray-water system is designed on a case-by-case basis and few blanket rules apply. Some considerations include: space, pipe accessibility, climate, soil, health, cost, and legality. Benefits of a gray-water system include: reclamation of otherwise waste-water resources, decrease in chemical use, decrease in fresh water use, decrease in energy use, increase in groundwater recharge, and increase in awareness and sensitivity of the water cycle (Ludwig, 2000).

## WETLANDS AND PONDS



An eco-revelatory approach to water management is appropriate in many instances. This approach is achieved by exposing, or revealing (revelatory) ecosystems otherwise hidden. The hydrologic system is often hidden in pipes or under pavement. One eco-revelatory approach is by bringing the water to the surface by “daylighting” pipes and integrating a series of visible waterways. Ponds and wetlands can also be incorporated into the design; this dramatically increases biodiversity associated with the system, as ponds and wetlands serve a rich habitat, especially when compared to a pipe. Wetlands are recognized for their filtering capacity, which may be necessary to treat NPS pollution from stormwater runoff, or in some cases are used to filter other pollutants.

Constructed wetlands vary in size and purpose. In some instances, human waste is recycled onsite. Sometimes wetlands are created solely to improve habitat quality in the outdoor classroom. Certainly, constructed wetlands are not meant to replace natural wetlands, but rather to mimic the natural process fulfilled by natural wetlands. Wetland pockets or bioswales are also included in parking lots to filter stormwater runoff containing pollutants from parking lots and encourage groundwater recharge. Larger constructed wetlands can be designed for site- or community-scale storm water treatment and retention, or for bioremediation of wastewater (Companion, 2002).

In Marion County, Oregon, the Soil and Water Conservation District (SWCD) unites schools interested in outdoor classrooms with constructed wetlands with developers looking for places to build a mitigated wetland. This program allows schools that otherwise might not be able to afford the cost of building the wetland (Gerke, 2003). This program is a good model for other counties that allow wetland banking, and has schools interested in the outdoor classroom concept.

The learning benefits of wetlands, including constructed wetlands, are numerous. The concepts of filtration as well as the habitat potential are some ideas that are demonstrated through wetlands on school sites. In some cases, wetlands are preferred to ponds on schoolyards to teach



water habitats. Concerns about liability restrict the use of ponds in some school districts. However numerous schools have built ponds as learning and teaching tools. Water safety is one of the principles that can be taught. Students can also monitor life cycles of water plant and creatures. For example, the life cycle of frogs can be witnessed and documented by students.



Ponds on schoolgrounds vary in size. As was previously mentioned, solar panels can be integrated into pump and re-circulating waterfall systems ponds aeration systems. Such integration emphasizes learning on a number of levels. Tadpoles or fish can be raised in the classroom or in hatcheries in the pond. Water quality and evolution of life in the schoolyard pond allow avenues for experiential learning that would otherwise require fieldtrips. In many cases, ponds are fenced or located in areas that have limited access such as courtyards. In other cases, ponds, wetlands, and water systems are present throughout the site.

#### LIVING MACHINES

Wastewater treatment can also be approached ecologically. One such approach is through the use of living machines. Eco-pioneer and biologist John Todd is known for bioremediation and water purification technologies applied at a site scale. Living machines are defined as technologies for purifying wastewaters to without the use of chemicals (Todd, 1994). These machines are similar to constructed wetlands as they simulate the way nature cleans water by utilizing plants and animals to treat municipal sewage and industrial wastewater. The Southeast Center for Restoration of Water, in Chattanooga, Tennessee has installed miniature living machines in six schools to demonstrate this ecological approach to cleansing wastewater (Lerner, 1998).

Another example of this style of water purification on school property is illustrated at the Darrow School in New Lebanon, New York. The school installed a living machine in 1998 to treat the wastewater for a community of 140. The machine is housed in the boarding school's environmental education center. The students are trained to monitor the health of the living machine and lead tours for visiting student groups and organizations. The facility is utilized for classwork ranging from art, to political economy, science and environmental ethics (Riker, 2002).

Other schools can model this technology in the classroom by building or purchasing desktop living systems (Keffer, 2002). Desktop living machines consist of several connected containers or “cells” holding an aquatic ecosystem. Each container starts out with a different life form in water: floating vegetation, fish, emergent plants and several cups of water from a pond or lake to seed the system. A bubbler and light source also feed into the system. The students monitor the health and life of the system and use it as a means to explore ecological concepts.

When these desktop aquatic ecosystems are incorporated inside schools, they also help amend the “sick building syndrome,” in which building materials deteriorate air quality. Poor air quality is one of the leading environmental problems in existing schools as previously mentioned in the first chapter. Both aquatic and terrestrial plants act to remove toxins from the air and replenish the oxygen supply, improving air quality for a healthier environment.

The school landscape is a great place to recognize and implement positive contributions to both water quality and conservation. As an experiential learning landscape, the schoolyard serves as an important building block in the evolution of the often-unseen responsibility of human beings by exposing and educating about otherwise hidden systems. When students are involved as stewards of their school environment and active participants in the learning process, they recognize the responsibility of human kind, the dominant species on this planet, to wisely manage the resources on which we depend.

## BIOTIC SYSTEMS



The biotic, or living system, is another system the schoolyard environment may highlight. The diversity of life on this planet is in a state of decline. On one hand, death is a part of life, and this state of decline may be yet another cycle at work. However, it is hard to ignore the impact developed nations have on pre-existing conditions. Over the past fifty years, we have lost a fifth of the world's topsoil, a third of its forests, and a fifth of its agricultural land (Raven, 2002). Through the development and altering of one's environment for human comfort and existence, other life has been displaced. Habitats have been decimated by both accidentally and intentionally introduced plants and animals. For the past 65 million years, the rate of species extinction remained at the rate of approximately one species per million per year. This rate has risen to nearly 1000 species per million per year, and continues to rise as habitats are destroyed. A worldwide species-area relationship, in relation to habitat destruction, projects the loss of two-thirds of all species on Earth by the end of this century (Raven, 2002). These are grim statistics. However, they must fuel action. Each individual must work to improve and make positive contributions to life on this planet.

A schoolyard can be viewed as a biome, or a group of ecosystems made up of similar climate and vegetation. The biotic potential, or life supporting qualities of schoolyards, can be enhanced through thoughtful ecological design. Such design provides for basic life needs, such as food, water, and potential escape routes from predators. The food chain is a concept that can be incorporated into the outdoor classroom curriculum. Every living system is an interconnected network. By making positive contributions to the environment, and increasing biodiversity at a schoolyard, students feel a sense of pride and accomplishment that they will carry with them throughout their lives. It is

empowering to recognize and make efforts to offset some of the negative conditions that are taking place worldwide.

Ecological designs of schoolyards embrace natural living systems. In many cases, a need for ecological restoration exists. Ecological functions take place even on damaged and impacted sites, though these functions have been altered and in many cases hindered. It is important to consider the pre-existing conditions and the necessity to mitigate impacted sites. In urban environments, the diversity of life has been seriously diminished. Rural ecosystems are also altered by agricultural, farming, and industrial practices. Ecological restoration activities begin as small projects on schoolyards. Existing conditions of school grounds vary in terms of what is already thriving. In a grassy mowed lawn, the diversity is relatively low. Students document and compare existing diversity to the diversity found on a restored prairie or woodland plot. Most schools will work in phases to achieve the eco-schoolyard vision. This phased development allows a control environment for comparison of diversity. Again, restored short or tall grass prairies, or reforested areas, for example, yield a richer diversity of life than a paved or mowed area.

Specific landscape components that invite a diversity of life to schoolyards include habitat gardens that target specific wildlife populations. As these habitats become established, the diversity of life improves. Garden journals and class webpages are useful tools for recording the augmentation of life on schoolyards. Encouraging students to consider the needs of the wildlife they want to attract is an appropriate starting place. On smaller sites, considerations such as escape routes for wildlife are integrated into the site context.

Food, water, and shelter are the basic needs not only of wildlife, but of people. Urban environments are isolated, in terms of habitat diversity. Airborne creatures or those that have adapted to transportation by other creatures find respite in the habitats created by students on school grounds. The intricacies of the food chain become apparent in habitat gardens. For example, students observe butterflies feeding on nectar producing plants; the butterflies in turn, become food for birds and mammals drawn to their abundance. This trend continues up the food chain. Properly designed ponds evolve a diversity of life, including fish, without being stocked. Students that are not engaged in the classroom often surprise teachers with their interest when given experiential learning opportunities in the outdoor classroom.

#### **TRADITIONAL GRASSED LAWNS LACK BIODIVERSITY**

Traditional schoolyard design consists of a grassed yard, paved parking lots, open recreational fields, paved ball courts, and play structures. Expansive areas of turf and paved lots for parking and play dominate the majority of American schoolyards with most activity occurring on the

playground, blacktop, or recreational fields. In many instances the “front yard,” or entranceway to the school, is a large grassed area that is largely unused. The diversity of life can be increased exponentially by diversifying the plant structure and reducing the grassed areas.

The typical “front yard” or entranceway to the school is a green grass lawn, a landscape that originates in Europe. The short grasses brought from Europe, however, are not as well-suited to many of the climates and soils found in the United States (Jenkins, 2003). Planting and maintaining these cropped lawns is costly, both monetarily and in terms of environmental impact. According to *The Sourcebook on Natural Landscaping for Public Officials*, prepared by the Northeastern Illinois Planning Commission (NIPC), the average lawn requires 9,000 gallons of water per week and 5-10 pounds of fertilizer per year. Standard lawn care equipment creates a significant amount of air and noise pollution. The NIPC estimate that the few ounces of fuel spilled when refueling lawn and garden equipment add up to 17,000,000 gallons of gasoline nationwide per summer. This gasoline in turn travels as non-point source pollution to nearby waterways. Reducing the need for these fuel-driven machines would reduce the amount of pollution generated and the occurrence of associated health risks (Northeastern Illinois Planning Commission, 1998).

An ecologically sensitive design utilizes alternative plantings with fewer environmental impacts than those associated with most grassed lawns. In a schoolyard setting, the school community could monitor and document these ecologically sensitive plantings and compare them to traditional grassed lawns. The school community could also measure expenditures of energy, including people power, gasoline, water, fertilizer, and money. Finally, students also could compare the quantity and diversity of life found in the different plots.

#### **LANDSCAPING WITH NATIVE PLANTS**

Native plants are hardy and naturally well adapted to their region. They require little irrigation, maintenance, fertilizers, or pesticides. The Northeastern Illinois Planning Commission conducted a study based on installation and maintenance cost analyses and project experience of firms with expertise in natural landscaping. The installation cost of turf grass ranges from \$4,000 to \$8,000 per acre. The seeding of native prairie grasses and forbs costs from \$2,000 to \$4,000 per acre. Over a ten-year period, the combined cost of installation and maintenance of a natural landscape may be one-fifth the cost of maintaining a conventional landscape (Northeastern Illinois Planning Commission, 1998).

The Federal Government recognizes the importance of native plants. In April 1994, the White House issued an Executive Memorandum on Environmentally Beneficial Landscaping stipulating the use of native plants for all federally funded landscape projects. The memorandum

recommends that federal properties use regionally native plants and plantings that promote water and energy conservation and minimize adverse effects on natural habitats (Executive Order No. 13148, 1994). The schoolyard is another location that should encourage the use of native species. In this way, students become acquainted with their natural history and native heritage. The schools save money, water, and energy through the design and placement of native plants.

In 1995, Wheaton Warrenville South High School, in Wheaton, Illinois developed a landscape master plan to address several landscape goals: to restore native habitats, reduce maintenance on unused lawn areas, improve overall aesthetics and create a “living laboratory for hands-on environmental education” (Northeastern Illinois Planning Commission, 1998). To address these goals, the master plan identified zones for the re-introduction of a variety of prairie community plants. This included 2.5 acres of wet prairie and upland mesic plantings (Northeastern Illinois Planning Commission, 1998). Students and staff are responsible for stewardship of the natural plant communities. According to science teacher Gloria Latta, first few years required “lots of weeding,” the Wheaton Park District assists with the periodic burning necessary to maintain the prairie habitat, and student involvement has been integral to the success of the project (Latta personal communication, January 2003). In biology class, students conduct population density studies. The students inventory indicator plants in quadrangles and compare this data to the floral quality index. Students share this and other information with the “ecowatch network,” a program facilitated by the Illinois Department of Natural Resources. The class conducts similar biodiversity studies at a nearby abandoned field that is in a stage of succession for comparison to their restored landscape (Latta personal communication, January 2003).

In conclusion, schoolyards have huge potential to increase the biotic diversity. This begins by diversifying the vegetation found on the site. Vegetation is the primary structure from which other creatures subsist. Natural communities are mimicked or restored on otherwise unused or mowed land. Habitats gardens targeting specific wildlife are one way of teaching students about the interdependency of life. Plants serve as the structure for which many other species survive. Trees and other vegetation serve as the lungs of the earth, by converting carbon dioxide into oxygen, an element vital to healthy life on this planet.

## DECOMPOSITION CYCLE

*“Behold this compost, behold it well, it grows such sweet things from it’s corruption.” --Walt Whitman*



## WASTE AND REGENERATION

As William McDonough and Michael Braungart describe in their book, *Cradle to Cradle*, waste equals food. However, “more than 90 percent of materials extracted to make durable products in the United States become waste almost immediately” (McDonough & Braungart, 2002, p. 27). This waste often ends up in a landfill, instead of being a part of a circular model, where uses for this waste are incorporated into the manufacture of other goods or are broken down by nature. The linear, “cradle to grave” model was shaped when land managers developed a different awareness of nature, dating back to the industrial revolution (McDonough & Braungart, 2002).

As discussed in previous sections, society needs to reshape practices to align with current awareness of the vulnerability, complexities, and interconnectedness of natural systems. The concept of “throwing away,” should not exist. But this paradigm is still rampant in the minds and actions of most Americans. Indeed, it is impossible not to participate in the mass generation of waste. Society must relearn this cradle-to-cradle concept. Integrating composting and recycling in the school system can dramatically increase awareness about landfill problems and reduce materials being landfilled.

## WHAT IS COMPOSTING?

Composting is nature's way of recycling. Many food scraps from school cafeterias can be composted on site. Meat, dairy, and oily products are not recommended for composting, as they form strong odors and attract mice and other rodents. These undesirable creatures may carry disease that can be passed on to the garden. However, many items including eggshells, grains, beans, breads, fruits, vegetables, lawn clippings, leaves, weeds, teabags, coffee grinds, paper napkins, and shredded paper can all be composted. Glossy paper should be avoided as it may contain harmful inks.

Food service and custodial staff should be included in the waste management planning and programming. Training students in proper sorting and composting materials is an excellent and productive way to foster ownership in the program. Activities such as poster making educate the school community about how to compost, and the experience makes the students the experts, and can have far reaching results. Students can also initiate and conduct mini-workshops to both the school and region about the benefits of waste reduction and composting. Starting small, but dreaming big is the motto of most school gardens and most school composting efforts. Keeping the program simple allows flexibility and for the ability to build on successes (Pagan and Steen, 2001).

## VERMICOMPOSTING

Vermicomposting, utilizes worms to transform organic food waste into nutrient rich soil. Worms along with microorganisms digest decaying food and produce vermicompost, a rich soil amendment. According to *The Worm Guide: A Vermicomposting Guide for Teachers*, vermiculture, or worm farms, are an excellent ways to teach students about waste management, as well as concepts such as the life cycle and nutrition. This method of waste reduction takes place in worm bins, filled with *Eisenis foetida*, or red worms, also know as "red wigglers, or "manure worms." These creatures are known to eat their weight in decomposing organic matter each day. Worm farms are used in schools across the country because they are convenient and efficient means of composting waste on site (Pagan and Steen, 2001). In addition, many children are fascinated by worms, which peaks their interest in learning about the system.

Worm bins can be built or purchased. They are often stored in either the kitchen or classroom as well as outside. They require temperatures between 55 and 77 degrees Fahrenheit to achieve the highest level of productivity. Vermicomposting is a aerobic activity, requiring sufficient airflow and oxygen for a healthy worm farm. Insufficient airflow will result in odor problems. Worm farms require a dark environment and adequate drainage. It is recommended that the bins be propped up or elevated. Any liquid seeping from the bin can also be harvested as "compost tea."

The worms require a moist environment, and shredded paper serves as excellent bedding. Paper along with food waste comprises the majority of waste produced on school sites. Paper is also a carbon-based matter, while the food scraps are high in nitrogen. As with any type of composting, this balance between carbon and nitrogen results in healthy compost (Pagan and Steen, 2001).

#### SCHOOL PROGRAMS

Recognizing the relationship of waste and regeneration is another important concept of the life cycle and food chain. Composting is encouraged in the cafeteria, and has been integrated into citywide programs in some municipalities. For example, in San Francisco, community members have curbside compost and recycling bins placed along side their trash bins. These are picked up by the city waste management agency. For schools with limited space on site, this program allows them to compost kitchen waste and leftover food scraps. Later, loads of composted materials are available to schools and community members for enriching soils in garden plots.

If space allows, students build compost piles or worm farms to generate compost on site. This reduces the embodied energy produced by hauling the materials away and back to the school site. Composting on-site supports a visual connection for the students and another space for experimentation and curriculum connections. Students design and conduct research on worm bins and composting food waste (Metro Region Organization, 2002).

Another method of learning about wastes generated at schools is through waste assessment. This helps schools identify waste reduction measures and establishes a baseline to measure progress. The EPA's voluntary Waste Wise program provides free technical help to assist facilities in the development, implementation, and measurement of waste reduction goals (United States Environmental Protection Agency, 2002 c).

A classroom activity recommended by Oregon's *Metro: Waste Reduction Education* for middle and high schools encourages students to analyze ecological footprints from around the world and consider how differing cultural lifestyles impact waste generation and how natural resource management affects finite resources. Another program recommends investigating the impact advertising and consumption has on society's excessive garbage generation. Some projects include: diagramming the life cycle of a common product or the impact of packaging on the solid waste stream, examining samples of compost and understanding the role of biological decomposition in recycling our organic materials, and understanding the toxic dangers inherent in many household products and how to safely dispose of them or choose or make less toxic products (Metro Region Organization, 2002).

Integrating and exposing the interdependence of life on death and growth on decay is a profitable experience on a number of different levels. Eco-designed schoolyards not only reduce the amount of materials being trucked to the land field but also expand student's understanding of these integral cycles. Some schools are profiting economically by selling compost as a soil amendment, and using this money to fund outdoor classrooms. These schools utilize the composting program as a teaching tool for numerous concepts ranging from the scientific method, anaerobic and aerobic reactions, to teaching math and economics. Integrating the decomposition cycle into the eco-schoolyard can be a helpful teaching tool for classroom concepts and achieving Standards of Learning (SOL's), as well as increasing awareness about "waste."

## SOCIAL SYSTEMS

*“The right to a stimulating developmentally- appropriate environment and the right to play are part of the United Nations Declaration of the Rights of the Child.” --Robin Moore*



People components must be addressed in schoolyard environments. Social systems refer to the interaction of people and the needs of those that use schoolyards, specifically, the students and staff. The concept of empowerment is geared toward the primary users of schoolyards: the students. Schoolyards can be vigorous environments that support social and physical development. Learning can be both a formal and informal experience. This section of the thesis addresses the importance of play in childhood development and the value of environment in the learning process. Territoriality and the need for private space, safety issues, and other design elements often present in schoolyards that integrate the outside environment with the learning process are also initiated under social systems.

### THE IMPORTANCE OF PLAY



Theorists and researchers of childhood development, such as Maria Montessori, Jean Piaget, Rudolf Steiner, and John Dewey agree on several principles of childhood development including the value of play. These experts agree that the development of the “whole child,” is a consequence of healthy physical, intellectual, emotional, and social growth built upon stimulating learning experiences. These principles are founded on the belief that the child has a natural curiosity and innate ability and desire to learn. Theorists concur that play is an activity that will be guided by this natural curiosity (Eriksen, 1985).

Learning and development are relevant to each other. Children should be given the opportunity to proceed at their own pace, and therefore develop a sense of independence and self worth. When children are ready to undertake a certain stage of development, they are likely to choose tasks and activities that support this development. Research indicates that social and physical environments directly influence child development. Stimulating, varied and rich environments are essential to enabling children to reach their greatest potential. Environments designed for children's play and learning should provide different types of experiences and should allow the child to manipulate and explore their environment (Eriksen, 1985).

The aforementioned principles of growth and development are important in designed spaces for children. Planned environments offering a variety of settings incite the child in various ways simultaneously, and allow the student to develop and explore at their own pace. Such environments stimulate the student in a number of ways including: physical, perceptual, emotional, social, and intellectual (Eriksen, 1985).

Physical incentives should include both motor and sensory stimulation. That, which the students discern through the use of the senses- by hearing, seeing, and touching, defines sensory stimuli. An environment rich in sights of colors and forms, and a variety of sounds contribute greatly to the development of the child. Motor stimulation comprises small and large muscle development and activities that support hand-eye and hand-foot coordination. Research shows that the greater diversity of play options allowed to children, the happier, livelier and healthier they will be (Eriksen, 1985).



Opportunities for motor skill development, including fine and large muscle development, balancing and locomotion skills, and eye-hand-foot coordination should be supported.

Children should have the opportunities to practice and extend the skills they already possess (Moore et al 1992).

Accommodating large muscle activity is the primary purpose of many play structures. Desirable large muscle activities identified in the *Play for All Guidelines* include climbing, rolling, sliding, lifting, swinging, balancing, pulling, pushing, bouncing, jumping, crawling, skipping, hopping, hanging by arms, hand over hand, twirling/spinning, and knee walking.

A diversity of settings including safe, graduated challenges stimulate an extensive range of play activity, and provide challenges to those at different levels of development.

(Moore et al., 1992). Promoting risk-taking, trust building, sharing, co-operation and group problem solving can be integrated into play programming. Construction activities and activities that support creative expression should also be encouraged (Moore et al., 1992). Constructive play is play with a purpose. This play encourages students to manipulate and create with play materials and can be conducted both independently and cooperatively (Eriksen, 1985).

Children should have control over their environs either partially or wholly. They should be able make their own decisions about their activities. Experiences in the landscape should have decision points that allow the user options for continuing the activity, ending it, or beginning a new one (Moore et al., 1992). Children gain a great sense of pleasure and satisfaction about having control over themselves and their environment. This sense of independence contributes to the development of the whole child (Eriksen, 1985).

Architect Aase Erikson (1985) states that, “to perceive is to put stimuli in order and to learn to recognize patterns, such as the recurrence of a familiar street or the repetition of sounds as rhythm and music” (p. 3). Perceptual development is related to sensory and motor experiences, as well as social, intellectual, and emotional experiences. Perceptual development increases as children repeat



activities and experiences. Activities that develop representational skills such as role-playing, building with sand, and playing make believe, all contribute to perceptual growth and should be encouraged in environments designed for children (Eriksen, 1985). Children enjoy playing with their parents and older siblings. Play equipment should be strong enough to hold up sporadic adult use. Sand is considered the most desirable impact-resistant surfacing material as it has intrinsic play value. Falls onto non-protective surfaces are the leading cause of playground injury (Marcus & Francis, 1998).

Experiences that encourage the advancement of a child’s ability to control and understand their emotions are equally significant as those that affect physical and perceptual development. Emotional stimulation is fundamental to the development of children’s skills to process difficult and stressful situations. In order to develop emotions, children must experience them—feeling the joy and anxiety of swinging high, the frustration of being shoved, and the contentment of exploring a nature trail. Feelings of sympathy, confidence, being liked and trusted, and the ability to channel destructive impulses into constructive energy are fostered by one’s environment (Eriksen, 1985).



Socialization is recognized as being the core of the learning process. Social development entails interaction with other people. This interaction with groups of children and adults encourages the inclusion of other viewpoints in their otherwise egocentric worldview. Socialization includes experimentation with self-images, connecting with peers, and establishing human relationships, some of the necessary

resources for growing up (Eriksen, 1985).

Research also strongly suggests that social development is enhanced by mixing children of different ages, as opposed to segregating younger children from older children. Children of different ages have different developmental needs, but providing spaces for interaction can encourage social stimulation. Younger children look to older children to provide role models and this interaction accelerates development. Younger students are curious about the older students, and by watching them, they gain awareness about their future abilities. Learning to care for and understand younger children also enhances social development of older children (Eriksen, 1985). At a location such as an elementary school, allowing students of differing grade levels and skills to be connected visually encourages learning. To avoid age-related conflicts, the areas can be clearly defined, without blocking this interaction (Marcus & Francis, 1998).

Activities that promote the development of intelligence are as important in the schoolyard and playground as in the classroom. Behaviors that promote intellectual stimulation include: undergoing new experiences, fantasizing, working on one's own, communicating, using new materials, and exploring. Children have an innate curiosity and desire to learn and explore. The design of schoolyard spaces can encourage activities that kindle intellectual development and independent investigation. For example, rules, puzzles, and the marvel of growing plants promote intellectual development (Eriksen, 1985).

#### **PREFERENCE FOR NATURE**



Users ages six to twelve enjoy natural areas that give more opportunities to imagine and fantasize than a designed environment. Varied topography give students the opportunity to run, roll, and sit. Natural watercourses or drainage ways offer incredible prospects for play. Hardy, low branching trees are entire environments for children. These trees should be strong enough to withstand heavy use.

Natural elements such as boulders, logs, and sand areas are often preferred to jungle gyms, particularly if they offer challenges (Marcus & Francis, 1998).

MaryAnn Kirby's research studied an elementary schoolyard that had a naturalized area comprising ten percent of the total yard. Her data showed that activity in these spaces took up "almost half (47 percent) of the total time students spent outside" (Evergreen, p. 4, 2000). Again, people of every age have a distinctive preference for nature. The schoolyard is an appropriate location to foster this relationship and build a supportive environment for developmental needs.

## **SAFETY**

Typical schoolyard design focuses on team sports and surveillance. There is mounting support that this design "exacerbates discipline problems, promotes aggressive behavior...Increasing vegetation complexity and structural diversity reduces aggression and violence and appears to promote positive human values" (Cheskey, 2001, p. 6). Certainly, the need for visual connection between staff and student is an important issues addressed through thoughtful design. Often, the outdoor spaces at schools are an afterthought, and "misconceived notions of safety make for sterile settings" (Taylor & Vlastos, 1975, p.73). Children are recognized as a powerless segment of society. They depend on adults to remove hazards and known dangers from their environments. There is also a developmental need for students to have a safe atmosphere where they can take risks and gain skills and confidence. Providing safe challenges will also reduce the risk of students looking for challenges in more hazardous localities (Moore et al., 1992). The typical flat yards without vertical elements are not the only answer to play spaces in schoolyards. Vertical elements provide visual and physical characteristics to both define the space and respond to user needs. Undoubtedly, the design should consider safety and surveillance needs and should not jeopardize or prohibit these needs being met. Similarly, safety and surveillance needs should not prevent schoolyards from being vibrant spaces that respond to the developmental needs, learning needs and a quality of life for the users.

Planters, trees, and informal seating arrangements can act as vertical elements in playground design. According to research conducted in the Toronto School District by landscape architect Ann Milovosoroff, these vertical elements slow children down and reduce accidents involving students bumping into and knocking down others by up to 80 percent (Coffey, 2001).

Pressure treated lumber or nails should not be utilized on schoolgrounds, as arsenic and other pollutants can leach into the soil and working with the materials can be a health hazard. Chromated copper arsenate, CCA, is a chemical preservative used to pressure treat lumber since the 1930's. The US Consumer Production Safety Commission in collaboration with the EPA, reached a voluntary agreement with the manufacturers of CCA to end the manufacture of CCA-treated wood for most consumer applications by the end of 2003. The concern of CCA-treated wood is that the

exposure to arsenic found in the wood might increase the probability of a person developing bladder or lung cancer over their lifetime. Soils should be tested to ensure other hazards such as lead are not present. (United States Environmental Protection Agency, 2003).

As previously stated, youth of today have little unsupervised time outdoors, and in some cases, the only time spent outside is at school. In response, schoolyards need to accommodate safe spaces for play, learning, and reflection. When considering safety at the schoolyard, healthy environments that support physical, emotional, intellectual, and social developmental needs should be safely integrated in the design of schoolyards.

## TERRITORIALITY



Territoriality is defined by Mark Hayman in his book, *Places and Spaces: Environmental Psychology in Education* as: “the act of laying claim to and defending an area, the desire to possess and occupy portions of space, and achieving and exerting control over a particular space” (Hayman, 1978, p.12). This psychological mechanism comes from the idea that one’s self does not specifically end at the extremities of one’s body. Designs on schoolyards should not ignore the user’s need for personal and private space. Personalization of space is an important mechanism for claiming territory. This can be achieved through numerous expressions of self such as physical images and boundaries, which enforce ownership of specific user groups. For example, boundaries between play areas designed for lower and upper grades reinforce territories owned by the different user groups. This can reduce conflict between the two groups while still allowing them to observe and learn from each other.

Classroom murals, art projects, class owned garden plots, and student designed signs are other opportunities for students to claim ownership in their outdoor learning environment. Signs direct and guide visitors and raise awareness of the community about schoolyard activities. These objects can also be used for way finding and as landmarks in the landscape. Student made signs at Alice

Fong-Yu elementary are in both English and Chinese, as the school is a Chinese immersion school. Everything from the compost to individual plants can have individual signs. Each class can develop a logo for their garden beds. Claiming ownership and personal space is an important dynamic for school landscapes.

#### PRIVATE SPACE



When students are facing a disappointing grade or betrayal from a friend, personal and private space in nature assist in the processing of these emotions. Seating can provide for individual reflection as well as for meeting spaces for smaller groups. Quiet areas for studying and contemplation should be separated from noisy activities. Hayman (1978) defines privacy as “selective control of access to the self or one’s group, is achieved by establishing a barrier to sight or sound” (p.13). Again, because most schoolyards are designed for surveillance, this need is often neglected. In the case of smaller children, these private places are places that are inaccessible to adults such as under platforms, or multi-level spaces. Screening an area with vegetation can also create private spaces.

Understandably, staff need visual access to adequately monitor student activity outside. Private spaces are designed to both fulfill the need for private space as well as allow for teacher supervision. If the school houses preschool facilities, such as tot lots, they should be located well away from the street. Play areas should be well defined. This definition will re-enforce boundaries established between supervising adults and the students utilizing the play space. Enclosing the area with a three-foot hedge or fence can create a sense of security and enclosure, but more than one entrance/exit should be allowed. (Marcus & Francis, 1998). Another way of achieving this sense of security is keeping one side open, or creating a “u” shaped hedge or boundary (Moore et al., 1992). This boundary should not prevent seated adults from looking out or passerby’s from looking in. Preschool children and adults feel more secure when they can maintain visual contact. More than one bench will encourage socialization between teachers or parents visiting the site (Marcus & Francis, 1998)

## SIGNS OF OWNERSHIP



Clearly marking entrances to schoolyards and outdoor learning spaces clarify when and if the community is invited into the space. Placing signs at gateways that include the name of the schoolyard, and the rules and hours of operation achieve this objective. If the area is closed to visitors during school hours, these entrances should make it obvious to visitors when the space is open for neighborhood use. For sites with people of varying sizes and ages, making different sized arches and gateways add character and fun to coming to school. They should be located well away from traffic and designed to make the entrance itself playful.

Drop-off spaces and bus-loading zones should also clearly delineated. This includes a covered seating area for students waiting for the bus or ride home, or parents waiting for students. Separate entries for delivery and maintenance vehicles should be well away from pedestrian access points.

## OUTDOOR CLASSROOM



Formal gathering places are crucial to support social interaction and organized school functions, such as school plays, concerts, and assemblies. Outdoor classrooms need adequate sitting space for an entire class. A mobile chalkboard or flip chart can assist with class organization and visual aid. Some schoolyards have permanent chalkboards installed. These can reinforce the concept of free speech and can be a fun amenity for students of all ages. This larger gathering space serves as a starting and ending point for classroom activities. Considerations, such as writing surfaces for students, are integrated. Clipboards are one potential solution. Worktables should have a smooth surface and are durable, but lightweight to ensure ease of maneuverability (Danks, 2002).

Ideally the larger gathering space area is shaded. Deciduous trees work well as they provide shade in summer and light and warmth in winter. A permanent roof or pavilion is appropriate in some schoolyard designs. Adaptability is important to consider when designing these spaces; they should be designed to support a diversity of activities.

## CLASSROOM PLANTING BEDS

*“Some of the most successful kids in the garden or the kitchen are the ones who did the least amount of homework and other work for me. The garden is the place that they love. And seeing them there changes the relationship between me and my students.” --Akemi Hamai, Teacher, Martin Luther King Middle School, Berkeley, CA*



Classroom plots of land and gardens are extremely successful at engaging students who may not be “good students” inside the classroom. Having a little piece of land that one is responsible for is empowering to students. Voicing ideas and taking place in democratic decision-making is another extremely important and empowering idea reinforced by classroom ownership. Interaction with nature supports a healthy sense of well being. Some students spend time working in the garden as a preferred after-school and recess activity. Working outside is a great way to reward students. The experiential and experimental possibilities for teaching are limitless.

As has been previously mentioned, some schools utilize classroom-planting beds for experiential learning opportunities. A raised bed or planting plot for each classroom makes gardening accessible for those who are wheelchair bound. This also eases the strain of bending and assists reclamation on compacted soils or paved sites. Raised beds should include a small ledge to encourage the option of using the planter as a bench as well.

The beds should be wide enough to allow students to work on both sides of the beds from adjacent pathways. This facilitates avoidance of compaction from foot traffic. Seating elements are also incorporated into raised planters. Promoting classroom ownership of individual beds enforces a sense of pride among the students. This also permits individuals to assume territorial claims.

## WEATHER STATION



Studying climate and weather links students to their region and the universe. Weather vanes, thermometers, sundials, rain gauges, and windsocks are all elements that encourage observational skills. Students themselves can build most of these elements, which always adds to their interest. Building a small weather station to house daily observations assists students in making decisions about watering and planting in their gardens (Moore, 1997; Spilhaus, 1951).

## SUNDIALS



Sundials are wonderful ways of illustrating the connection between the sun and our concept of time. Learning time is an important part of the primary school curriculum, and often a difficult concept for children to grasp. Curriculum needs are met through the design and use of sundials. Here children can see first hand how closely society relies on the sun's cycle. Sundials must be laid out in harmony with the longitude and latitude of its location on the earth. This can be identified on a map and can also be part of the lesson. Living sundials can be planted with vegetation that blooms during a specific time of day, for example morning blooming plants versus evening bloomers. Interactive, or human sundials require that a person's body be the gnomon, or the object casting a shadow, and by standing in the specified spot for that time of year, a student's shadow will mark the time of day (Needham Science Center Website, 2003).

The Needham Science Center of Needham, Massachusetts has developed a software program for designing analemmatic sundials. Analemmatic sundials require the repositioning of the object casting the shadow, or gnomon, on a daily basis. This type of sundial is perfect for interactive sundials, as the student just need stand in the designated spot for that day. The Needham Science Center advocates for the placement of this type of sundial on paved playgrounds on school grounds. For a modest fee, the center will complete computations for schools that are interested in building

such a sundial. The science center has assisted numerous schools nationally and internationally. Exact latitude and longitude must be researched by the school prior to contacting the Science Center with their request (Needham Science Center Website, 2003).

## SEATING



Seating arrangements consider the variety of users. The best approach is to provide a variety of seating opportunities, both in the shade and in the sun. If smaller children are going to be using the space, comfortable seats with suitable size are important. Seats for teachers and volunteers should also be included and oriented in such a way to allow visible sight lines to the activity areas in the yard. If possible adaptable seating arrangements that can be manipulated by the users should be integrated. Seating such as rocks, logs, or other loose elements can encourage imagination, and provide visual interest when not in use as seating. Grassy slopes are another option for a seating choice, and these secondary seating elements are useful in times of heavy use (Marcus & Francis 1998; Moore et al., 1992).

Teenagers at middle and high schools need clearly defined seating for five to seven people. These should be flexible and allow for a variety of seating and postures. Hangout areas should be located to maximize views of and from passerby's. Areas near parking lots will allow those with cars to join in easily. Teens like to see and be seen; ideal socializing occurs in locations where both vehicular and pedestrian traffic passes by. Areas should be designed to allow teens to claim territory, but also allow other users to claim their own space (Marcus & Francis 1998). Privacy is a strong need among teenagers, and there are few spaces

for teens to interact unsupervised. Teenagers may use recreation fields and basketball courts for socializing, because alternatives for gathering in groups are few (Marcus & Francis, 1998). When teenagers are identified as a user group, these special needs should be incorporated in the design.

## STORAGE SHED



Often an outbuilding, necessary for storing tools and play equipment, should be incorporated into designs of eco-schoolyards. The tools such as shovels and watering cans should be of appropriate size for the user. These buildings should be sited in the landscape where they are easily accessible to the students and where they will not detract from the space used for play or learning. To facilitate the integration of these buildings into the design and re-enforce ownership, students can embellish the outer walls with murals.

## ACHIEVING LANDSCAPING GOALS



Forming partnerships and gaining approval from the local school board and government is an important first step in realizing landscape objectives at any school site. Looking with the community for resources and guidance is an important second step. There are numerous ways for students to raise money to achieve their restoration or landscaping goals. Most of these fundraising activities can simultaneously teach valuable skills, empowering students on multiple different levels. Some examples of such fundraising techniques include: plant sales, grant writing, the sale of worm castings from compost piles and worm farms and vegetables sold at market. Math, marketing, and advertising are a few of the skills tested through these fund raising experiences.

Students can write letters requesting the donation of materials or in-kind services. Community workdays lower installation and maintenance costs. Found objects can be recycled into place-making materials. Another potential resource for building materials is at construction sites, where salvageable materials can be reclaimed that would otherwise end up in the landfill. Please see appendix A for a list of funding resources.

In conclusion school landscape design can enhance the social experience of the student on numerous levels. Such design provides opportunities for users to learn about themselves, their peers, and the natural world. The following chapter presents the design position and describes the process of testing the position through design.

# **Chapter Four**

## **Research Design Experiment**

### **Gladesboro Elementary School**

*“Think about the ecology of the site, and relate it to the experience of the child.  
That’s the future.” --Han Oberlander,*

#### **POSITION**

Schoolyards are an appropriate location to implement and model ecological design. Schools are inherently places for learning. The landscapes of these spaces have in many cases untapped learning potential. Eco-schoolyards integrate and expose the five systems highlighted in the previous chapter into an experiential learning environment. The eco-schoolyard approach intends to teach students and community members about natural systems by encouraging interaction with these systems and promoting increased awareness about the interconnectedness of social systems and human need with the natural environment and ecosystem function.

As has been established, there is a need to reconcile society’s understanding and dependence on the natural systems. The ecological design of schoolyards has potential to teach the school community and the community at large. Ecological design is a concept that can be applied to any site. Community members and students can apply ecological design principles at their home landscapes. In some cases, the school landscape is the only contact that students have with nature. Children’s interaction with their schoolyard should provide a range of options and experiences. These experiences can enrich the child’s development, the health of the community, and promote awareness of the fragility of natural resources.

## GOALS

- ◆ Explore position through design
- ◆ Apply ecological schoolyard design principles to a single site

## OBJECTIVES

- ◆ Analyze, at a site scale, each of the systems outlined in the previous section: energy, hydrology, biotic, decomposition, and social
- ◆ Determine limitations and potentials for revealing and integrating these systems into the ecological design of a schoolyard
- ◆ Work with school community to learn of social systems, existing conditions, and educational objectives
- ◆ Encourage community involvement in design process through a series of participatory exercises with staff, parents, and students
- ◆ Develop design alternatives based on the five systems identified in the previous sections

## PROCESS

My methodology for pursuing this project has had many layers and levels. It began with observation of the world around me, and recognizing that “we” as a society can do better. Through the course of my academic career, I have had the privilege to ponder and intellectualize world problems. This privilege has forced me to grow, and expand my notions of “what could be.”

As an individual, I recognize the importance of being a responsible steward of the earth. Many do not have the privilege to challenge the normal day-to-day activities that they are engaged in. They are too busy “getting by.” As one that has considered and challenged these daily norms, I recognize that these norms are not sustainable, and must be replaced with norms that encompass a greater sensitivity to world problems.

The public school system has a potential to teach this sensitivity. This project evolved to encourage learning through experience in the landscape. The first step in my research methodology was a literature review of books, journal articles, and Internet sources that address learning and play environments, ecological design, and environmental psychology. This review is outlined in the first two chapters.

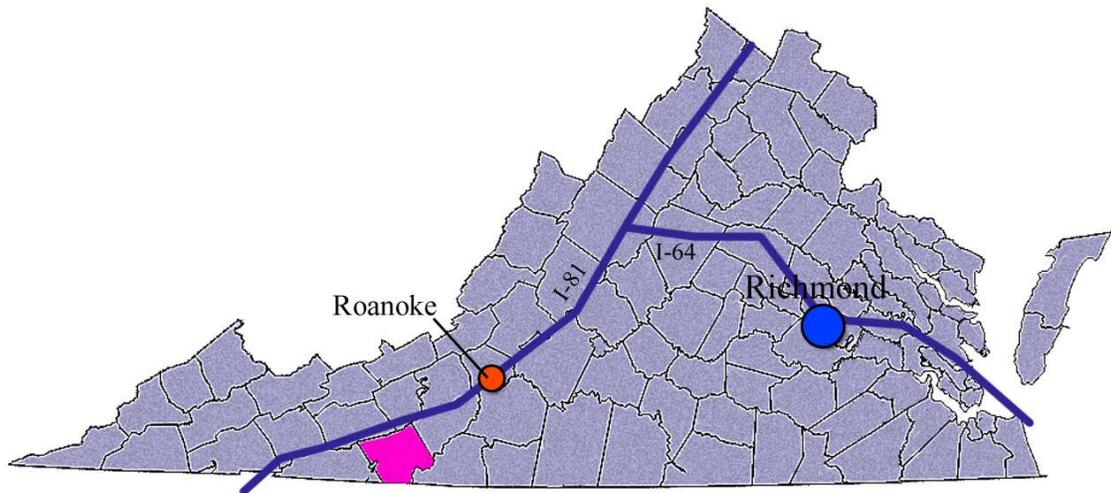
In late October 2002, I attended The Growing Greener School Grounds Conference, in San Francisco, California. Greening schoolgrounds refers not only to increasing the green spaces around

schools, but also embracing “green technology.” This technology promotes environmentally responsible development and healthy places to learn and work. During my trip, I visited several schools and learning environments that have realized some of the principles and site elements that encompass green technology and encourage experiential learning. After returning to the east coast, I have continued to visit schools and playgrounds. Techniques implemented at these learning environments, both in California and locally, have inspired my creative thinking about ecological schoolyard design.

To test the ideas and principles of ecological schoolyard design established in previous chapters, I explored design alternatives at a single site: Gladesboro Elementary School located in Carroll County, Virginia. Carroll County received a grant from the Virginia Department of Forestry to develop landscape master plans for Gladesboro and several other schools in the county. The Community Design Assistance Center (CDAC), an outreach program of Virginia Tech’s College of Architecture and Urban Studies, was hired to develop these plans. The CDAC design team consists of Shawn Tofte, a fellow landscape architecture graduate student, Kim Watson, the project co-coordinator, and myself. This project provided a real context to test and share the knowledge I have gained regarding ecological schoolyard design. The CDAC project and the thesis project overlap. As a CDAC team member, I was able to work closely with the students, staff, and parents. Products that were the result of CDAC efforts have been labeled as such. The five systems and principles of ecological design outlined in chapter two serve as the framework for the design explorations in this chapter.

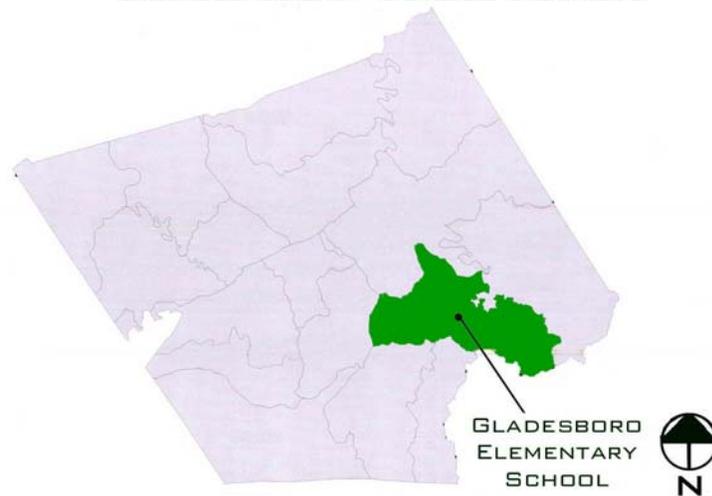
The first step in my process was to learn about and visit Carroll County. Kim Watson, Shawn Tofte and I traveled to Carroll County and were given a tour by Eddie Vaughn, the maintenance supervisor for the county schools. At this time, it was determined that Gladesboro Elementary would be the pilot project for CDAC. Gladesboro was chosen simply because it was located closer to Blacksburg than the other schools included in the Virginia Department of Forestry Grant. During this first visit to Carroll County, Mr. Vaughn introduced the CDAC team to Mr. Warren Reavis, the principal at Gladesboro, and Shawn and I set up an appointment with Mr. Reavis and the daytime maintenance worker to gather more information and begin the analysis process. At this time I was also searching for information on the Internet about Gladesboro Elementary School and the ecology of the region.

**LOCATION OF THE SITE**  
**GLADESBORO ELEMENTARY SCHOOL**  
**CARROLL COUNTY, VIRGINIA**



Carroll County is located in southwestern Virginia, as in shown in pink on this map.  
Map courtesy of Shawn Tofte, Community Design Assistance Center

**CARROLL COUNTY SCHOOL DISTRICTS**



Gladesboro Elementary is one of seventeen county school districts in Carroll County. The district is highlighted in green with the location of the school pinpointed on the map above.

## **BACKGROUND INFORMATION**

Soon after our initial tour of Carroll County, Shawn Tofte and I met with the daytime custodian and Principal Warren Reavis. From this meeting we were able to learn some additional background information about the Gladesboro School Community.

- ◆ Enrollment: 143 (Smallest School in Carroll County)
- ◆ Teacher/ Student Ratio: 16:1
- ◆ Grades: Kindergarten –5<sup>th</sup>
- ◆ School Day: 8:15- 3:15

## **TIME SPENT OUTSIDE**

- ◆ Physical Education 2 x a week (45 min/class)
- ◆ Recess 20 min/day (teacher discretion)
- ◆ Bus/Parent Pick up/ drop off- ~50 high school students catch bus here

## **COMMUNITY USE**

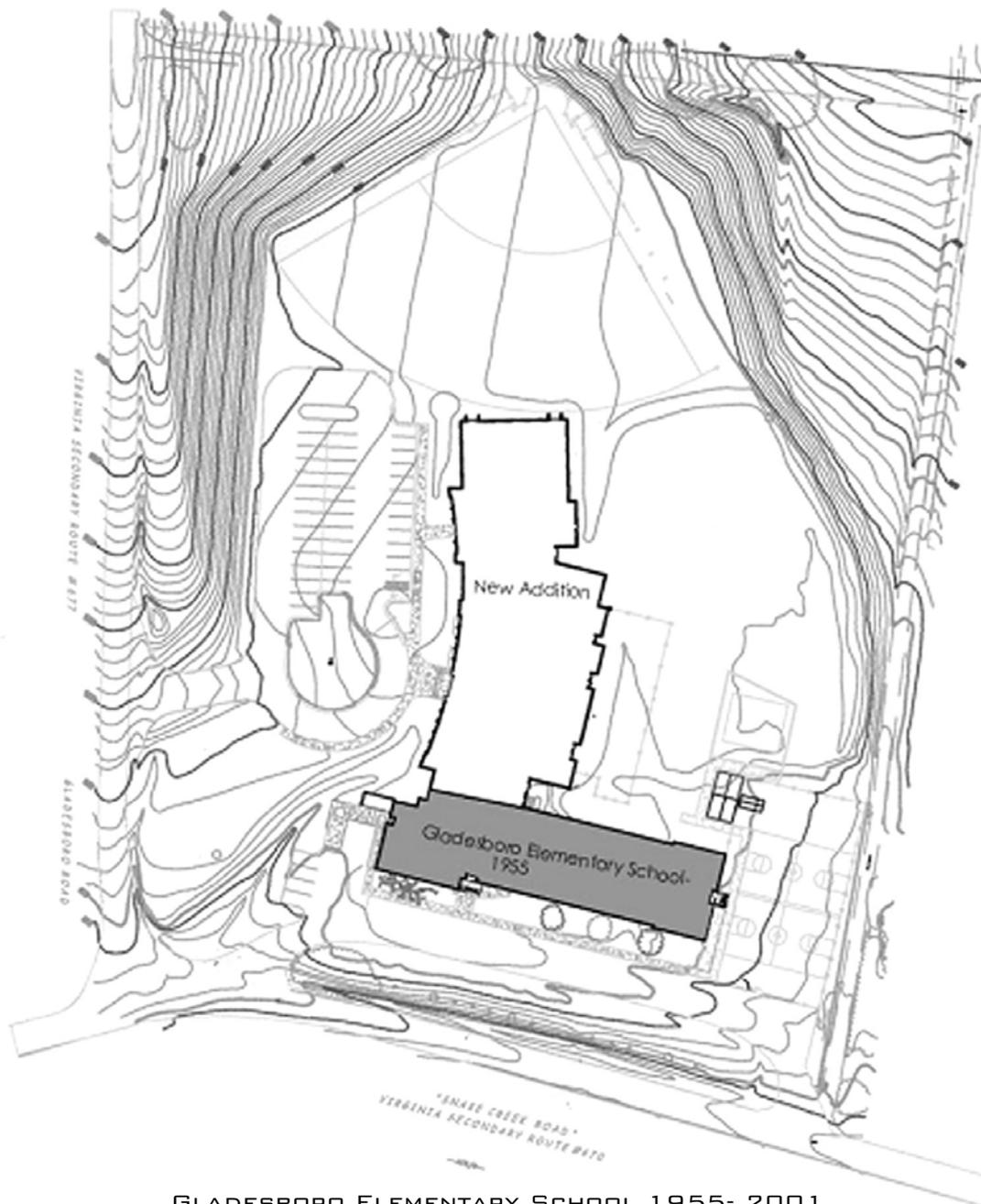
- ◆ Recreation Department: basketball, soccer
- ◆ Family Reunions- (Community Members can pay a small fee to use the facilities.)
- ◆ Cub Scouts, Girl Scouts
- ◆ Weekend and Summer Activity: Playground, ball field, and hardtop
- ◆ Tutoring Program: 3:30-6 Monday-Thursday
- ◆ Volunteers: 2 in 1<sup>st</sup> grade, 2 in 2<sup>nd</sup> grade. (Reading Program)

## **EVENTS/FESTIVALS**

- ◆ Spring Fling (near last day of school)
- ◆ Fall Festival fund raiser- (near Halloween)

## **HISTORY OF THE SITE**

According to the school's webpage, the name "Gladesborough" was given to this community around 1850 by an early settler, inspired by the numerous glades, or treeless areas in thick forest (Gladesboro Elementary School Website). In 1929, a two-room building was built to serve as the public school. Later in 1955, a larger building was erected. This building was sufficient until 1993, when the Carroll County School Board restructured and consolidated the school system. At this time, student populations expanded and the school began serving a wider area. (Gladesboro Elementary School Website).



GLADESBORO ELEMENTARY SCHOOL 1955- 2001

By 1997, overcrowding was a major issue. As a result, improvisations were made, such as a storage closet was converted to the faculty lounge, and the library to a classroom. A mobile classroom was also put in place. Around this time, Gladesboro was included in a countywide building renovation program. Groundbreaking for this renovation and enlargement took place in June 1999. The building addition was completed in late Spring 2001, the official dedication took place in September 2001. The building footprint was more than doubled by this addition, as is illustrated in Figure 3. Students and staff are pleased with the addition to the building, however, the outdoor space is lacking in even the most basic landscaping (Gladesboro Elementary School Website).

## **INVENTORY AND ANALYSIS**

For the purposes of this thesis, I fashioned an extensive set of diagrams and photographic documentation of the systems outlined in earlier chapters as they are presently represented at Gladesboro Elementary School. The methods for studying the existing conditions and relationships found on the site were achieved primarily through community workshops, questionnaires, and a series of site visits from which photographs and interpretive diagrams were developed. Site analysis included recording existing physical conditions: the buildings, vegetation, parking lots, play lots, playground equipment, and grade change. Existing conditions, potentials and limitations of the site were considered and documented in connection to pragmatic needs and preferences expressed by the school community. Ecological function and access to natural systems was investigated and recorded through a series of diagrams. To facilitate interaction with the school community, I presented some successful aspects from eco-schoolyard and outdoor learning environment case studies as “idea board.” These posters proved invaluable in showing parents, staff, and students the range of possibilities that could be implemented on their school grounds and expanding the notion of what a schoolyard could or should be. (Appendix B). The diagrams, photographs and “idea boards” were helpful references during the design process. They were also useful in the participatory workshops, as they encouraged participants to visualize existing conditions, while dreaming about the many possibilities of their schoolyard.

## **SOCIAL SYSTEMS: INVENTORY AND ANALYSIS**

This section of the thesis will present the findings of the questionnaires and ideas of the staff, parents and students. Successful schoolyard design cannot come about without the interest and active participation of the school community. Through several questionnaires and community workshops, the community offered suggestions, voiced concerns, identified needs and helped to brainstorm potential schoolyard designs.

## STAFF IDEAS AND FEEDBACK



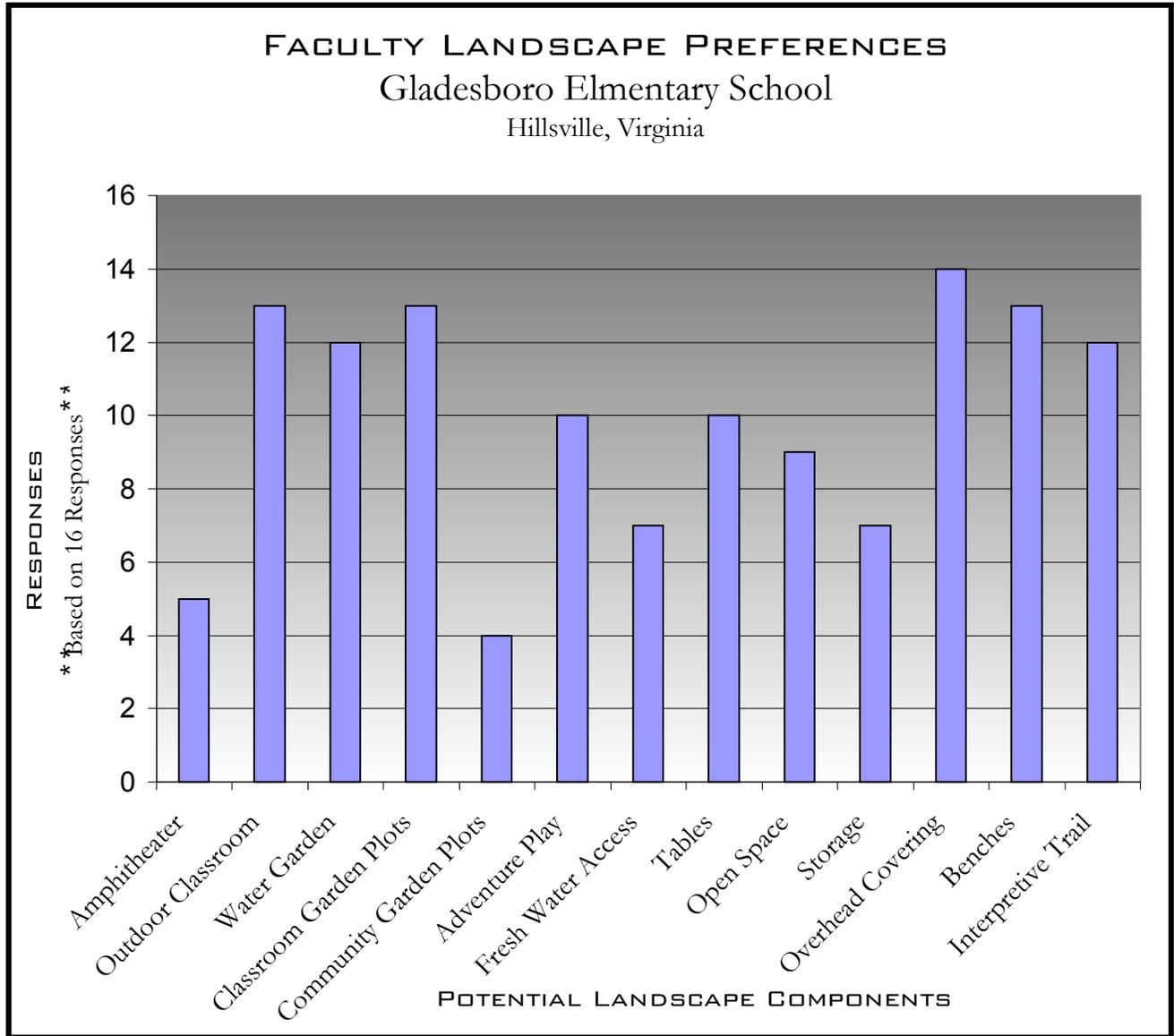
Photo courtesy of Shawn Tofte

The first questionnaire was distributed to Gladesboro Elementary staff during their January 28 staff meeting. (Please see Appendix C for a copy of the questionnaire). At this meeting, my CDAC co-worker, Shawn Tofte, and I described the project to the staff. We presented the beginnings of the eco-schoolyard idea boards and circulated books and guides relating to schoolyard design. We requested that faculty consider their curriculum needs and required Standards of Learning (SOL's), and how the school's outdoor environment can reinforce these learning objectives. During this first meeting, I also introduced my thesis project to the staff. I asked the faculty to think about how I could talk with students without disrupting their regular schedule. The staff at Gladesboro was very accommodating to my requests, and their excitement about the potentials of their schoolyard grew as they discussed their ideas. We encouraged staff to imagine a schoolyard that equals, if not surpasses, the learning potential found within the school building. The below suggestions and concerns were voiced by the staff about the school's landscape. These responses were gathered from both the staff meeting and the questionnaire.

### SPECIFIC SUGGESTIONS GENERATED BY STAFF

- |                         |                             |                            |
|-------------------------|-----------------------------|----------------------------|
| ◆ Greenhouse            | ◆ Weather Station           | ◆ Natural Area             |
| ◆ Overhead Covering**   | ◆ Sundial                   | ◆ Wire Chain Link          |
| ◆ Shade                 | ◆ Memorial Garden**         | Fence- to keep balls       |
| ◆ Outdoor Garden        | ◆ Weather Station           | from flying into street,   |
| ◆ Frog Pond             | ◆ Rock garden               | establish boundary         |
| ◆ Reading Circle        | ◆ Classroom Garden          | ◆ Concern about visibility |
| ◆ Classroom Sized       | Plots.                      | of fence around K-2        |
| Gathering Areas         | ◆ Habitat Garden-plants,    | play area~ mark with       |
| ◆ P.E./ Community Trail | shrubs, trees that would    | vegetation?                |
| around school           | invite butterflies, birds   | ◆ Considerations of bee    |
| ◆ Trees**               | and other small wildlife.   | stings                     |
| ◆ Apple Trees           | ◆ Benches                   |                            |
|                         | ◆ Flower Garden             |                            |
|                         | ** Suggested multiple times |                            |

The first question of the survey asked staff members what types of educational opportunities they would like in an outdoor environment. The following chart, Figure 4, in conjunction with the list shown on the previous page, depicts the landscape preferences of the Gladesboro faculty.



The second question asked what amenities would be helpful for outdoor classes. Nearly every respondent suggested an overhead covering and benches. A table or platform and open, grassed space were requested by over half of the respondents. And half of the respondents indicated they would like access to fresh water and facilities to store materials. Shade trees, trees and a picnic area were written in the “other” space provided. The following lists were compiled from the staff’s responses to the remaining questions on the questionnaire.

**“HOW CAN AN OUTDOOR CLASSROOM  
BENEFIT YOUR CURRICULUM REQUIREMENTS?”**

- |   |   |   |
|---|---|---|
| <ul style="list-style-type: none"> <li>◆ Enhance Science Standards of Learning**</li> <li>◆ Hands on Experiences</li> <li>◆ Definite motivation to teach SOL's that are enhanced by outdoor demonstrations.</li> <li>◆ Healing Environment</li> <li>◆ Place of Relaxation, and Spiritual Nourishment</li> </ul> | <ul style="list-style-type: none"> <li>◆ Weather Station</li> <li>◆ Assist with Social Skills, Teamwork, and Responsibility</li> <li>◆ It would adjust learning styles to suit students.</li> <li>◆ Students would be more open in discussion and feel more involved with their studies.</li> </ul> | <ul style="list-style-type: none"> <li>◆ They can see/do more things to make learning a hands-on experience.</li> <li>◆ It wouldn't really help mine per se, but it would benefit the classrooms (students) themselves. It would be a treat to go outside as a change from the outdoors.</li> </ul> |
|---|---|---|

**“WHAT DO YOU LIKE ABOUT YOUR EXISTING SCHOOL GROUNDS?”**

- |  |   |  |
|--|---|--|
| <ul style="list-style-type: none"> <li>◆ Plenty of Open Space**</li> <li>◆ Playground Equipment</li> <li>◆ Fenced in Play Area</li> <li>◆ New Building Kindergarten</li> </ul> | <ul style="list-style-type: none"> <li>◆ Play ground-New Equipment</li> <li>◆ Large play area where students can run and play. Upper and Lower Areas</li> <li>◆ Hill</li> </ul> | <ul style="list-style-type: none"> <li>◆ Plenty of level space</li> <li>◆ Contained areas for different grade levels.</li> <li>◆ Nice view**.</li> </ul> |
|--|---|--|

**“WHAT DO YOU DISLIKE OR PERCEIVE TO BE PROBLEMATIC ABOUT THE  
CURRENT LAYOUT OF YOUR SCHOOL GROUNDS?”**

- |   |   |  |
|---|---|--|
| <ul style="list-style-type: none"> <li>◆ Need Swings</li> <li>◆ Lack of Trees, Flowers, Benches –</li> <li>◆ Uninviting</li> <li>◆ Asphalt Court hazardous for kids</li> <li>◆ Lack of Development</li> <li>◆ Balls fly over Fence-Bank-</li> </ul> | <ul style="list-style-type: none"> <li>◆ No shade**</li> <li>◆ These grounds only offer at present, limited opportunities to explore and learn material that is SOL related.</li> <li>◆ Actual layout with building.</li> </ul> | <ul style="list-style-type: none"> <li>◆ Drainage-leach field down hill out back</li> <li>◆ No perimeter fencing-even like parkway (not chain link)</li> <li>◆ Bank in front of school, not enough shade.</li> </ul> |
|---|---|--|

**“HOW WOULD YOU RATE THE CURRENT LAYOUT OF YOUR SCHOOLYARD FOR  
SUPPORTING “HANDS-ON” LEARNING ON A FIVE-POINT SCALE?”**

1 BEING THE IDEAL LEARNING ENVIRONMENT, 5 BEING THE WORST.

1 (1)    2 (1)    3 (6)    4 (4)    5 (3)

HOW WOULD YOU DEFINE NATURE? IS NATURE ACCESSIBLE TO THE STUDENTS AND STAFF ON SCHOOL GROUNDS?

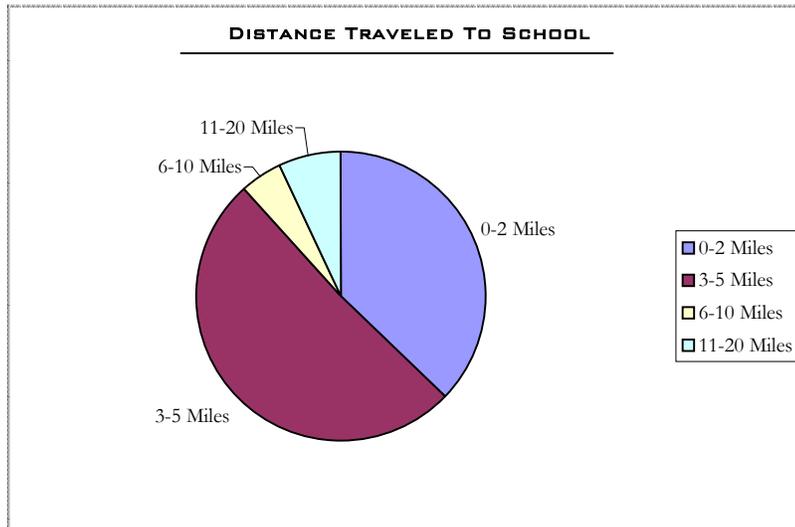
- ◆ The Enjoyment of Natural Habitats
- ◆ Anything outside that remains outside naturally
- ◆ Lack of accessibility to Plants and Animals
- ◆ Nature is what surrounds us and what the outside is made of. It's something God has made us and it's our job to keep it up best way we can. Not really accessible.
- ◆ Plants, flowers, water, natural areas
- ◆ All things living and the environments that support them
- ◆ Nature= outdoors, woods, etc. Yes, I guess nature is accessible.
- ◆ Natural growing plants in harmony with wildlife.
- ◆ Natural growing plants outdoors, wildlife.

From the feedback generated from the staff meeting and the completed staff questionnaires, a separate questionnaire was created for the parents (see Appendix D). Accompanying this questionnaire was a flyer (see Appendix E) introducing the project and the intention of the CDAC team joining the next Parent Teacher Staff Organization (PTSO) meeting, held on February 13.

## RESULTS FROM THE PARENT QUESTIONNAIRE

Approximately one third of the parents responded to the questionnaire. Several of the respondents had multiple children at Gladesboro, or have children that will be attending the school in the near future. Of the respondents, 23 percent use schoolgrounds after school, 45 percent use the grounds in the summer, 32 percent replied that they never used the school grounds during non-school hours. None of the respondents use school grounds before school. Student activities on schoolgrounds include: organized sports such as t-ball, soccer, baseball, and basketball, as well as the tutoring program, cub scouts, and girl scouts. 80 percent of the parents replied that they would utilize the school grounds more often if additional amenities were offered.

Most parents drive students to school or students take the bus, few students walk to school. According to the parent survey, none of the parents carpool or rideshare. Travel distances are outlined in the following chart, Figure 5:



The majority of students live within 5 miles of the school.

### “WHAT DO YOU LIKE ABOUT THE EXISTING SCHOOLYARD?”

- ◆ Cameras in parking lot\*
- ◆ Safe
- ◆ Fence around playground\*\*
- ◆ Playground\*\*
- ◆ Baseball/Softball field\*\*
- ◆ Easy parking and walking area
- ◆ Flat-Level\*\*
- ◆ Playgrounds, because it gives my child some exercise.
- ◆ Everything is all together visible to see where your child is
- ◆ Conveniently located close to home for sports and playground
- ◆ Close to home, neat,
- ◆ Well maintained\*\*
- ◆ Clean\*\*

**“WHAT DO YOU DISLIKE OR PERCEIVE AS PROBLEMATIC ABOUT THE EXISTING CONDITIONS AT GLADESBORO ELEMENTARY?”**

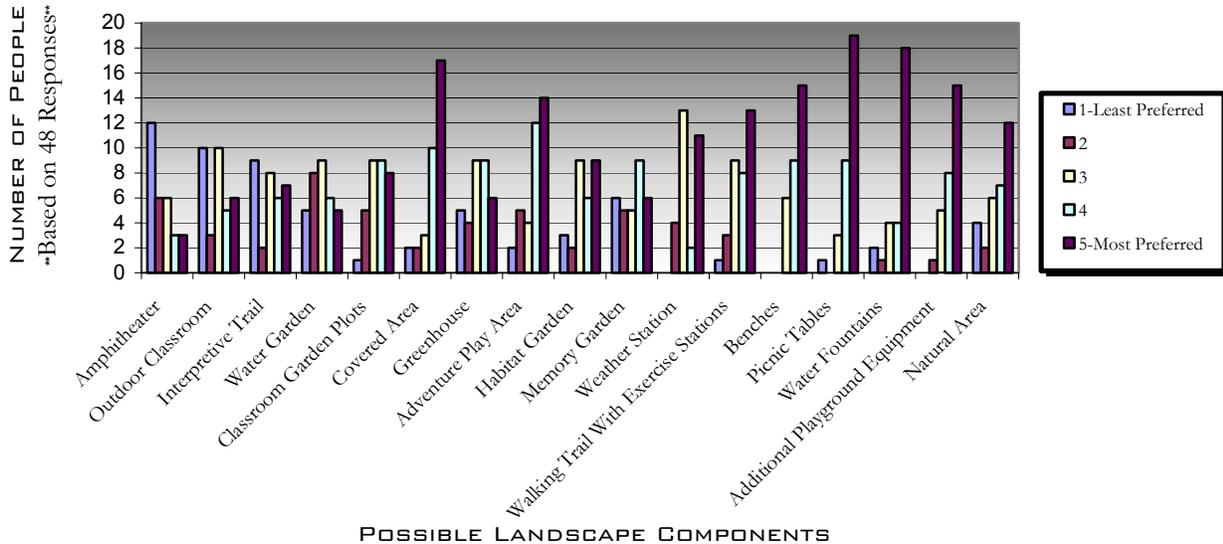
- |  |   |  |
|--|---|--|
| <ul style="list-style-type: none"> <li>◆ Need track to walk around,</li> <li>◆ Need swings**</li> <li>◆ Work on the basketball court- new paint, etc.</li> <li>◆ Need more flowers.</li> <li>◆ Too small.</li> <li>◆ Blacktop basketball court should be worked on or torn down, have a better one built- put in a lawn with tables.</li> <li>◆ Ball field ** needs more attention.</li> </ul> | <p>When it rains, it seems to wash the field.</p> <ul style="list-style-type: none"> <li>◆ No outside restroom,</li> <li>◆ Old picnic tables made of pressure treated wood</li> <li>◆ Playground equipment:</li> <li>◆ No shade**</li> <li>◆ No seating **</li> <li>◆ Limited to play equipment, little opportunity for imaginative or</li> </ul> | <p>sensory play or reading</p> <ul style="list-style-type: none"> <li>◆ Ball field not big enough for the older kids</li> <li>◆ Not enough parking spaces needs more activities to do</li> <li>◆ Not a lot for the children to do, they liked the old playground better</li> </ul> |
|--|---|--|

The chart below synthesizes the preferences for specific landscape components as measured through the questionnaire process:

**PARENT LANDSCAPE PREFERENCES**

Gladesboro Elementary School

Hillsville, Virginia



91 percent of the parents responded that they or their child enjoyed gardening and landscaping activities. 88 percent said they would be interested in volunteering for a community workday at Gladesboro.

At the PTSO meeting held on February 13, the CDAC design team introduced the project to the group and solicited ideas about how to involve the community in the design process. At this time, the PTSO members encouraged CDAC to poll the parents a second time, and asked them to indicate potential dates for a community workshop. Unfortunately, due to inclement weather, school was closed for several days following the PTSO meeting. There was no longer time in the schedule to send out a second poll, wait for responses, and schedule the event. So, we decided to move ahead with scheduling the workshop and sending out flyers (due to the limited time frame of the project). Flyers were distributed February 20 (Appendix F) inviting staff, students, and parents to attend a community workshop scheduled for March 1, a Saturday morning, and a snow date was set for the evening of March 4. (The scheduled times were in response to the preferred times noted by Parents in to question 16 of the parent questionnaire).

## PARTICIPATORY WORKSHOP



On March 4, the CDAC team conducted a participatory workshop for parents, students, and staff. The meeting was originally scheduled for Saturday, March 1, but was rescheduled due to icy weather. At this meeting, Shawn Tofte, Kim Watson, and I guided group activities with the school community. Ideas about improving the school grounds and how to achieve this improvement were explored. A warm-up visualization activity was similar to the drawing activity conducted with the students detailed in the Student Workshop section of the paper. The question proposed was, “Think back to when you were elementary school aged. What was your favorite outside activity or memory? Draw a picture that represents this memory. Or, draw a picture of what is missing from the schoolyard a Gladesboro.” Each table was covered with bond paper, and markers and colored pencils were provided. The participants had about ten minute to work on their drawings, after which, participants shared their ideas with the group.

Next, an activity packet was disseminated to each group. There were three groups comprised of staff, parents, and students (about 5 people per group). The activity packets contained a site plan with existing conditions and small card stock pictures of potential site elements identified through the questionnaires and previous brainstorming sessions with staff and students. String for laying out trails and glue was also included. Each group had access to a poster with panoramic photographs of existing conditions at Gladesboro. Markers and colored pencils were already accessible. A snack table with food and beverages contributed by participants was close at hand. The eco-schoolyard idea boards were propped up around the room. A library with numerous books relating to schoolyard and

ecological design was presented. A topographic model was available to assist participants in visualizing the site plan and their proposals. Participants were encouraged to walk around the room, and bring the idea boards or books to their group for discussion.

Participants considered their school landscape and glued the landscape idea cards, or drew their ideas on the site plans. Tofte, Watson and I were available to talk to the groups about their ideas. Each team selected a spokesperson to present their idea to the other participants. This activity allowed participants to critically think about the potentials and limitations of their school landscape. This also gave the CDAC team an opportunity to talk with participants about their ideas and concerns.



One of the biggest obstacles perceived by the school community is the funding that might be necessary to achieve their landscaping needs. The eco-schoolyard idea boards were helpful in illustrating that many of these landscaping components could be donated or built from inexpensive materials.

## STUDENT WORKSHOP AND ACTIVITIES

Because the schoolyard is primarily used by students, it is vital that they be included in the design process. This inclusion encourages ownership and empowerment. It promotes the concept that the students are important and have good ideas about what their schoolyard could be.



On Tuesday, February 25, Kim Watson, the Landscape Architecture Project Coordinator at CDAC, and I spent the day at Gladesboro. We set-up in the library and students had a 30-50-minute session with us. During this time, we explained the profession of landscape architecture and showed an example of a landscape master plan. I showed the eco-schoolyard idea boards and described some of the schoolyards illustrated in the photographs. Next, we conducted some visioning exercises with each class to encourage students to consider what they like and dislike about their schoolyard, and what they would change if given the opportunity.

Cold weather and limited time prevented us from going outside to conduct the exercises. Instead, the visioning exercises began with showing the students a three-dimensional study model of their schoolyard. The children were at tables of two to six students per table. Kim or I took the model to each table, so that the students could have a closer look at it, and fully identify the location of the library, their classroom, their playspace etc. in the model. This was an excellent tool for discussing ideas with the students. Each student was encouraged to think about and draw or write a list of “What is missing from your schoolyard,” or “What would you like to add to you outside environment.” Students wrote, “would like to add” at the

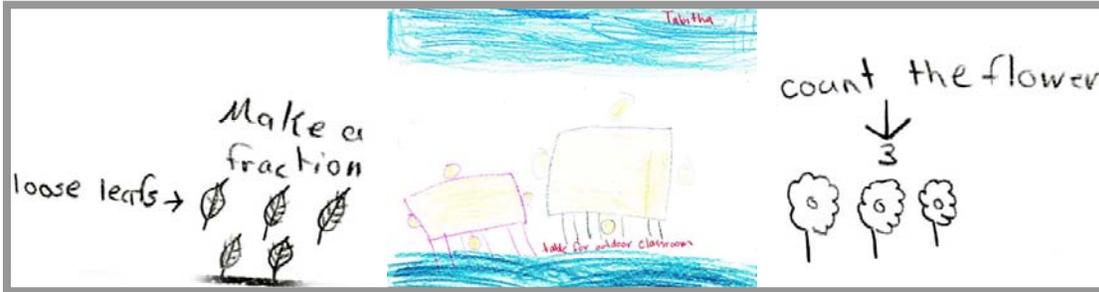
top of the page. Some students also drew “what I like about my schoolyard,” and “what I don’t like about my schoolyard.” Every class took part in a drawing exercise. My co-worker and I moved the model from table to table to allow students to talk to us about their schoolyard and their artwork. I

also had an opportunity to speak with students individually. (See Appendix G for approved expedited review memorandum.)

In an effort to understand the ideas and concerns expressed by the students verbally, through their artwork, and lists, I grouped their responses into groups and patterns. These categories were based on the learning environment and five systems identified through the literature review. Certainly these categories overlap. But organizing the comments according to themes allowed me to process the comments and consider how they might be realized in the experience of the students in their schoolyard.

LANDSCAPE ELEMENTS SUGGESTED BY STUDENTS THAT IMPLY:  
SOCIAL SYSTEMS

LEARNING



- ◆ Outdoor classroom with chalk board
- ◆ Count the flower- math, make a fraction- leaves
  - Reading WOW
- ◆ Table for outdoor classroom
- ◆ Chairs
- ◆ Benches
- ◆ Picnic table \*\*
- ◆ Add table
- ◆ A reading center \*\*
- ◆ A math center with vegetables to graph
- ◆ Lizard Lab
- ◆ Dinosaur
- ◆ Science Lab
- ◆ Weather Center
- ◆ Social Studies Center

## PASSIVE ACTIVITIES

- ◆ Activity place-crafts outside
- ◆ I want a shaded area to read
- ◆ My favorite thing to do outside is read- Mystery stories- I like trying to solve the mystery
- ◆ Place to paint
- ◆ Sandbox \*\*
- ◆ A little place to read books
- ◆ Reading area

## EMOTIONAL DEVELOPMENT

- ◆ “Remembrance” garden

### PROSPECT

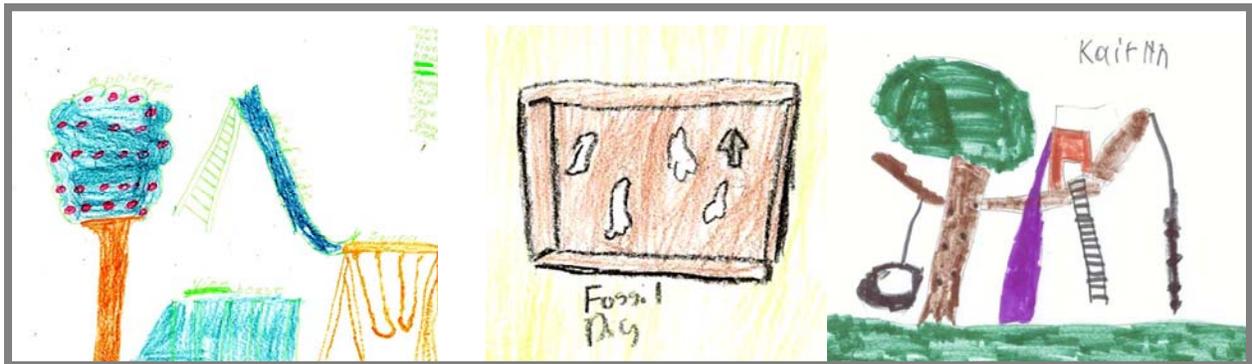
- ◆ Rocks
- ◆ Mountains
- ◆ Hill
- ◆ Ladder
- ◆ Tree house \*\*

### REFUGE

- ◆ Teepee
- ◆ Fort \*\*
- ◆ Cave
- ◆ Tunnel
- ◆ Parachute
- ◆ Gourd hut- club house \*\*
- ◆ Tent camping

## PLAY

### COOPERATIVE, IMAGINATIVE, SOCIAL



- ◆ Tree house \*\*
- ◆ Fort \*\*
- ◆ Boat clubhouse
- ◆ Teepee
- ◆ Rocks
- ◆ Gazebo
- ◆ Benches
- ◆ Chairs
- ◆ Add tables
- ◆ Porch Swing \*\*
- ◆ Lookout Tower
- ◆ Clubhouse
- ◆ Favorite place is cubby by the gym-
- ◆ I want a little place in the woods to have a meeting area
- ◆ Place for girls to talk
- ◆ See saw
- ◆ Parachute



**INDEPENDENT ACTIVITY**

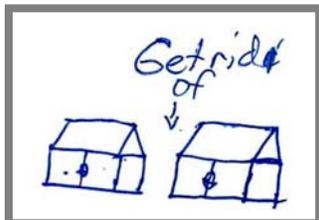
- ◆ I like to do cartwheels\*\*
- ◆ Sandbox \*\*
- ◆ A little place to read books
- ◆ Reading area
- ◆ Tunnel \*\*
- ◆ Cave \*\*
- ◆ Gliding airplanes
- ◆ Rings
- ◆ Balance beam\*\*
- ◆ Painting

**IMAGINATIVE PLAY**



- ◆ I like to play in the sand and build sand castles- it reminds me of the beach.
- ◆ Sandbox
- ◆ Toy Station
- ◆ Little treasure box with stuff so that we could go outside and dress up
- ◆ Painting \*\*
- ◆ Fossil dig
- ◆ Makeover outlet
- ◆ Face painting\*\*

**PRAGMATIC CONSIDERATIONS**



- ◆ Something to hold basketballs
- ◆ Move Sheds
- ◆ Don't like football
- ◆ I don't like the hardtop because it hurts when you fall, The cracks on the hardtop bother me
- ◆ Baseball field is my least favorite thing- I don't like baseball\*\*\*
- ◆ Too much parking
- ◆ I don't like the ballfield- get sand in my shoes
- ◆ I don't like the baseball field because it is dirty

## ENERGY SYSTEMS

### FOOD

- ◆ Picnic table \*\*
- ◆ Snack table
- ◆ Picnic Shelter- with Picnic every Friday
- ◆ Cherry Trees
- ◆ Apple Trees \*\*
- ◆ Garden
- ◆ Lots of Vegetables\*\*
- ◆ Drink Machines
- ◆ Pizza
- ◆ Picnic Tables\*\*
- ◆ Flags
- ◆ Snack Center \*\*
- ◆ Drink Center
- ◆ Kitchen
- ◆ Lemonade

## ENERGY AND SOCIAL SYSTEMS

### ACTIVITY

#### RUN

- ◆ "I like running outside
- ◆ I like to run
- ◆ I like playing tag
- ◆ I like the big whole open space to run

#### JUMP

- ◆ Trampoline \*\*
- ◆ Rocks
- ◆ Jump rope
- ◆ Dance mat
- ◆ Gymnastics
- ◆ Jumping Jupiter

#### CLIMB

- ◆ I like to hang upside down on the monkey bars
- ◆ I want monkey bars \*\*
- ◆ Jungle gym
- ◆ Rock Climb
- ◆ Mountain Climbing
- ◆ Rocks
- ◆ Tall ladders

#### EXPLORE

- ◆ Maze \*\*
- ◆ Wooden swinging bridge to walk on
- ◆ Camping\*\*
- ◆ Rocks
- ◆ Nature hike
- ◆ Nature Walk
- ◆ Tunnel \*\*
- ◆ Cave \*\*
- ◆ Trail
- ◆ Bridge

#### RIDE

- ◆ Bigger kids should have swings- little kids have all kinds of stuff- swings, sandbox
- ◆ Swings \*\*
- ◆ Tire swing
- ◆ Slide \*\*
- ◆ The big slide is my favorite thing
- ◆ Big Slide
- ◆ Waterslide\*\*
- ◆ Roller coaster \*
- ◆ Merry go round
- ◆ Swings are missing

## WHEELS



- ◆ Skatepark- “Gladesboro Extreme”
  - ◆ Bowl
  - ◆ Halfpipe
  - ◆ Grindwall
  - ◆ Jump

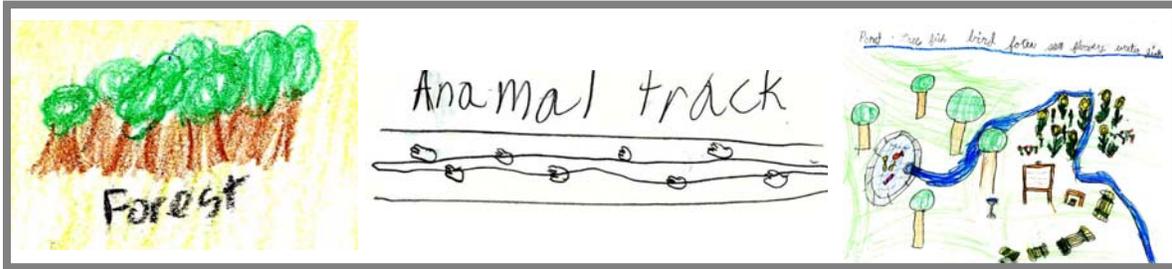
- ◆ Dirt bikes
- ◆ Dirt bike trail \*\*
- ◆ ATV
- ◆ Roller skating rink
- ◆ Skate park \*

## ORGANIZED GAMES

- ◆ Basketball\*\*
- ◆ Kick ball\*\*
- ◆ I want football Equipment
- ◆ I want a soccer field
- ◆ Ferris wheel
- ◆ Sports place- cheerleading, football- outside
- ◆ Mini golf \*\*

- ◆ Baseball Diamond
- ◆ Dodge ball
- ◆ Want new basketball goal
- ◆ A Track
- ◆ Sand-Volleyball courts\*\*
- ◆ Football field \*\*

## BIOTIC SYSTEMS



### VEGETATION

- ◆ Flower Garden \*\*
- ◆ Flowers \*\*
- ◆ Add lots of flowers \*\*
- ◆ Put a flower garden by the baseball field
- ◆ Add flowers to the playground
- ◆ I would like the field to be a flower garden
- ◆ Add flowers around fountain
- ◆ Garden \*\*
- ◆ Rock Garden\*
- ◆ Lots of trees \*\*
- ◆ A Forest
- ◆ Cherry tree
- ◆ Apple Trees\*\*
- ◆ More trees up front-all around parking
- ◆ Trees around pond
- ◆ Trees \*\* More trees \*\*
- ◆ Vegetables \*\*
- ◆ Bushes \*\*
- ◆ I want a garden center to plant potatoes and flowers
- ◆ Garden center \*\*
- ◆ Greenhouse \*\*

### ANIMALS

- ◆ Butterfly garden
- ◆ Butterfly
- ◆ Pet Store
- ◆ Eagle
- ◆ Chickens
- ◆ Horse, bird, petting and feeding room
- ◆ Pet center
- ◆ Wildlife Center- help injured animals
- ◆ Horse raising and petting
- ◆ I like to catch frogs and lizards- but then put them back!
- ◆ Zoo
- ◆ Animal Track
- ◆ Animal Trail
- ◆ Get rid of the hardtop- make it a petting zoo!
- ◆ Birdhouse
- ◆ Small animals- bunnies, goats- we'll take care of them while we are waiting for the bus
- ◆ Favorite thing to do outside is ride my horse
- ◆ I like to ride my horse fast and help my grandfather feed the cows

## HYDROLOGIC SYSTEMS



- |                                     |   |                                     |
|-------------------------------------|---|-------------------------------------|
| ◆ Swimming Pool                     | ◆ Fountain **   | ◆ Fish **                           |
| ◆ Goldfish                          | ◆ Pond **   | ◆ Family of sharks                  |
| ◆ Waterfall ***                     | ◆ Frog Pond   | ◆ Fishing                           |
| ◆ Alligator pool **                 | ◆ Fish Pond   | ◆ Add fountain outside the building |
| ◆ Mound                             | ◆ Pond  | ◆ Ducks                             |
| ◆ River                             | ◆ Bathroom  | ◆ A creek that runs into a pond     |
| ◆ Pool **                           | ◆ Add water fountain ** (with frogs, ducks, lily pads, etc to learn about wildlife) |                                     |
| ◆ Water fountain **                 | ◆ Aquarium underground  |                                     |
| ◆ Pond with bridge over it          | ◆ Pool **   |                                     |
| ◆ Pond with stepping-stones over it |   |                                     |

The students were very interested and excited about the potentials of their schoolyard. At one point, a fifth grader said, “Why should I care about what happens here, I’m getting ready to leave?” I asked him if he had any friends or siblings that were returning to Gladesboro, or if he was going to catch the bus here next year. He said, “Yeah! My friends are going to be here, and I’m going to be catching the bus here!” and immediately started focusing on his drawing.

Several themes were surmised from the student artwork and discussion. Water is a recurring theme. Water elements such as swimming pools, ponds with fish and wildlife, fountains with wildlife, waterfalls, and even an underground aquarium were some of the ideas the students had for their schoolyard. A place for animals is also represented in the artwork. This ranges from an animal rescue station, pet center, and zoo, to pictures of birds, fish, lizards, snakes and butterflies shown in the artwork. A place to ride bikes or skate was another activity represented. Nature and exercise trails, tree houses, forts, secret hideouts, caves, and tunnels were also popular. The older students, grades 3-5, are particularly interested in having a swing set added to their play equipment. Another popular theme was a place to jump, such as a trampoline, or “Jumping Jupiter.” I later found out that the PTSO rents a Jumping Jupiter for their annual spring fling. Food is another element the students

would like to see integrated into the landscape design. These ideas ranged from a snack shack, pizza shop, lemonade stand, and picnic tables, to numerous drawings of trees with fruits. Trees and flowers were represented in almost every student's artwork. In some cases, specific varieties were listed, such as "oak tree, apple tree, pansy, spider flower."

There is certainly opportunity for these ideas to be represented in some way in the school landscape. Of course, something like a Ferris Wheel would have to be represented in a different form. Perhaps this idea could be incorporated into a sculpture that would be turned by the wind, or kinetic energy, or water movement during a storm event. A trampoline or "Jumping Jupiter" could not feasibly be a permanent fixture in the school landscape. But other play equipment that encourages jumping could be implemented. Swimming pools and an underground aquarium are not going to be built at Gladesboro. But water can be represented in the landscape. Fish can potentially be invited in a water garden or pond. If the school safety requirements limit water on the school grounds, perhaps these elements can take on a more abstract form such as tiles or stepping-stones or paintings in a theme garden as educational and play elements. The students' suggestions and artwork continued to be an inspiration to me during the design process.

#### **WHY ENCOURAGE USER PARTICIPATION?**

By inviting user groups to participate in the planning process, they had a sense of ownership in the project from the beginning. This feeling will be reinforced by their continued participation in implementing and maintaining the design. In the schoolyard setting, it is necessary for the user groups to establish and work toward landscaping goals. This process includes funding and maintaining the grounds. The Carroll County School System encourages individual schools to take part in this process, but will not be responsible for implementing the landscape master plans. Commitment and dedication to landscaping goals will be necessary on the part of student, staff and parents, to transform the existing conditions at Gladesboro to a supportive learning and ecologically sound environment. These goals can be reached over time, and the project will gain momentum as one success helps fuel another.

## **SITE ANALYSIS**

By working with the CDAC team, and interacting with the staff, students, and parents at Gladesboro, I was achieved a level of awareness about the ideas, needs, and wants of these interested groups. This awareness informed my design work on both the CDAC project as well as my thesis project. Simultaneously to the participatory planning exercises, analyses of existing conditions of the schoolyard were also conducted via sites. At this time, I took extensive photographs of the site. The photographs act as an inventory in themselves and have been fundamental in recording the existing conditions at Gladesboro. The inventory and analysis of significant factors and existing conditions are presented on several different sheets. The five systems outlined in previous chapters guide the analysis of the site. A comprehensive inventory and analysis begins with existing physical site characteristics, and is overlaid with details about the social and natural systems found on the site.

The majority of the site currently accessible to the students has been graded through major earthworks, cutting and filling the otherwise southern facing slope. Please see Figure 7, a slope analysis diagram produced with the assistance of Shawn Tofte. The portions of the diagram represented in red show a slope over 20 percent. These steep grade changes present opportunities and limitations. Perceptually, these steep grade changes mark existing boundaries of the site; neither the higher or lower elevations are actively used by the students.

Following the slope analysis is Figure 8, a study of the sun/shade patterns of the school building during different times of day and different seasons. The sun/shade analysis illustrates morning entrances are shaded throughout the school year. These shadows are particularly long in December, the coldest month represented. In contrast, there is little to no opportunity for students to be in the shade in their existing playspaces. Throughout the course of the school day, this side of the building is in the sun, and there is no existing vegetation to cast a shadow. The southern facing walls of the building create a warm microclimate, as the brick absorbs and radiates heat from the sun's rays. This is advantageous during cooler days. However on warmer days, there is no respite from the heat, which could be particularly oppressive on the paved playground.

An analysis of the existing play opportunities is presented through a number of diagrams and photographs accompanying descriptions of present conditions at Gladesboro Elementary School. The biotic, hydrologic, and decomposition systems are similarly diagrammed. Ecological function and access to natural systems was investigated and recorded through these diagrams and photographic essays. The spatial limitations and assets of the site are highlighted below. Through the process of

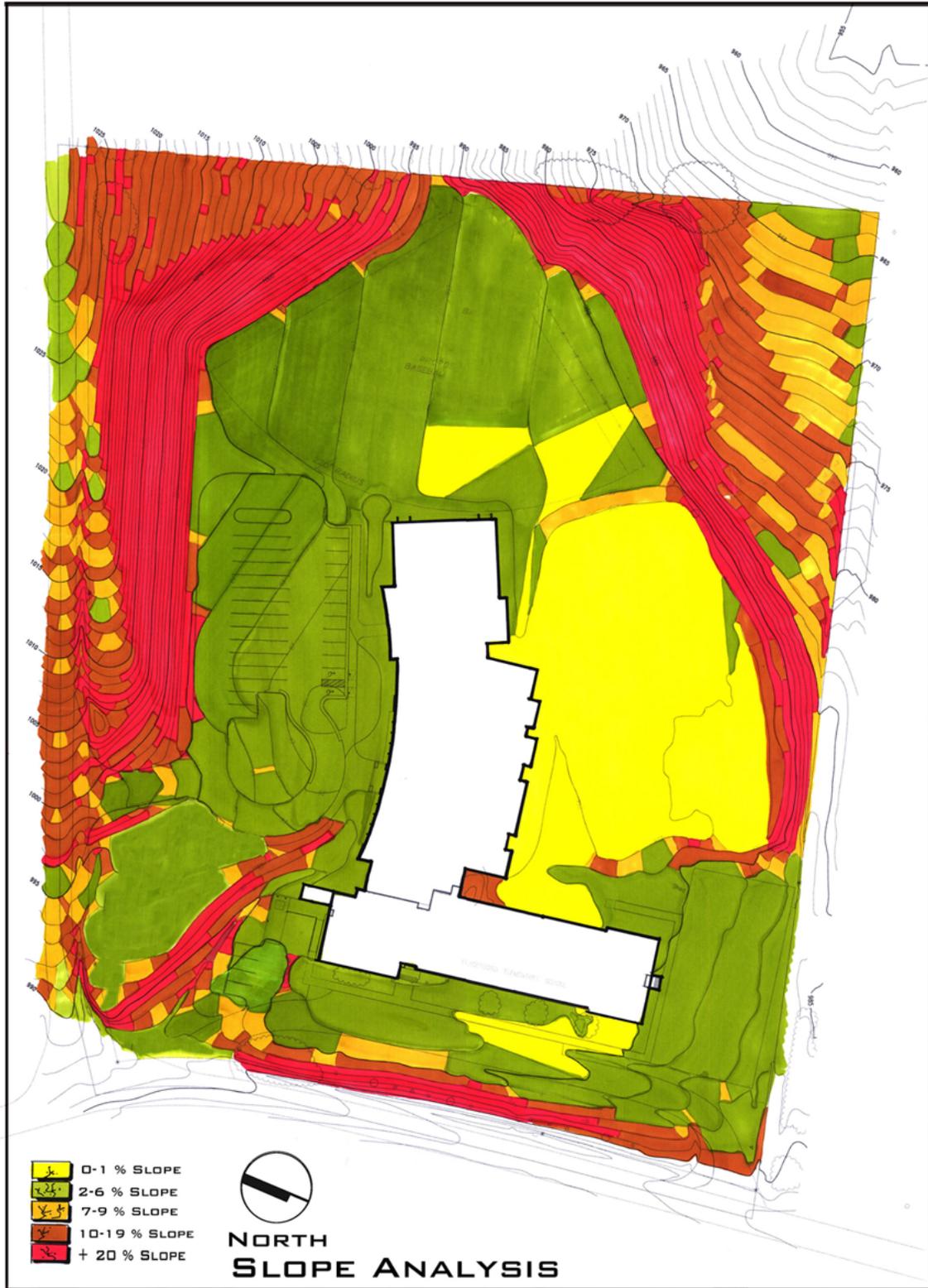
gathering information and analyzing the site, design criteria list has been developed. This criterion is presented in the design section following the site analysis.

**LIMITATIONS**

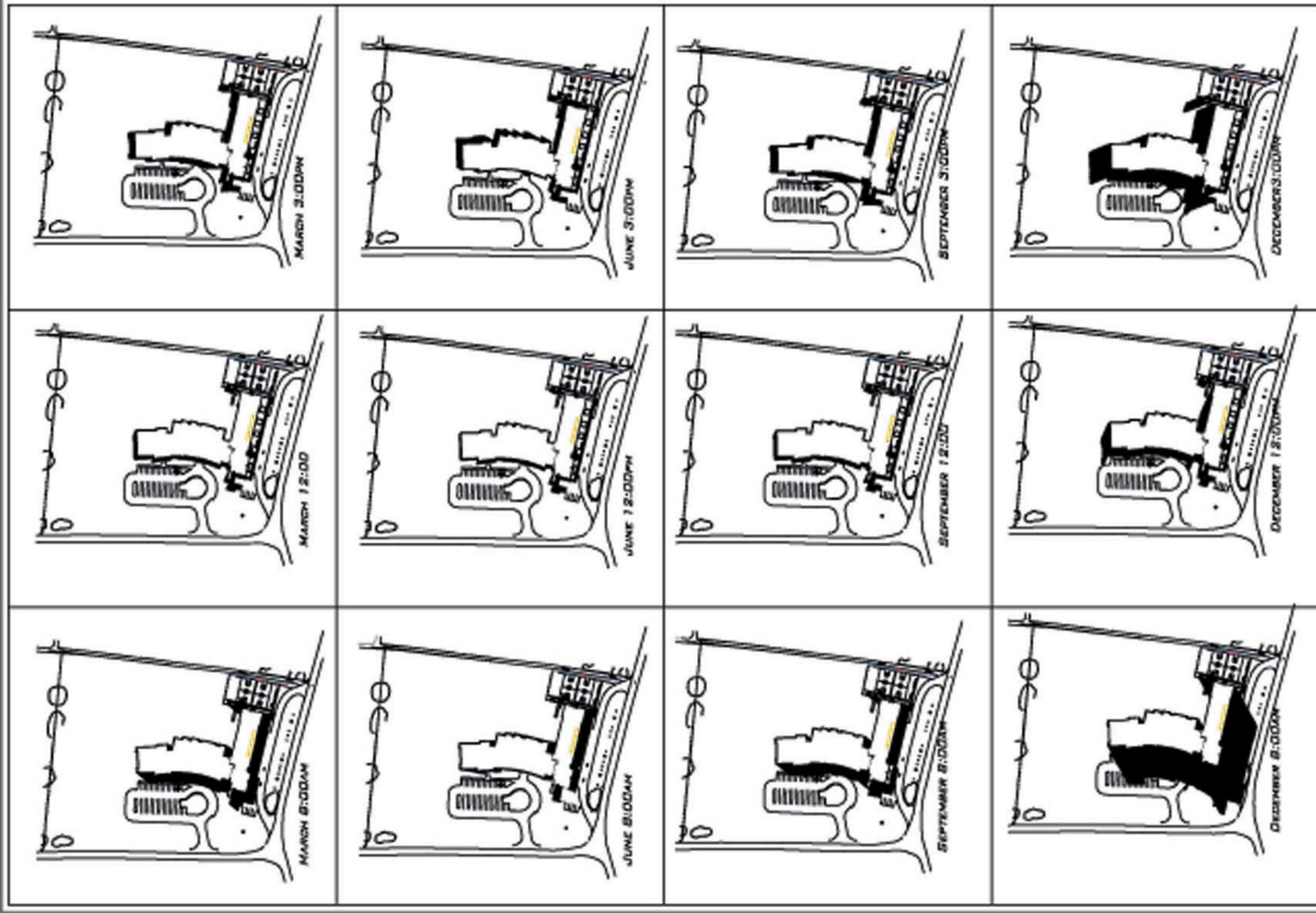
- ◆ Cameras/ Sight lines
- ◆ Building layout
- ◆ Septic Drain field- no trees
- ◆ Concrete Lids of Septic Tank in Play space
- ◆ Transformer/ Electric lines
- ◆ Service Access
- ◆ Ball field
- ◆ Cost

**ASSETS**

- ◆ Views-
- ◆ Open Space
- ◆ Microclimates
- ◆ Existing Playground Equipment
- ◆ The Buildings have similar character
- ◆ Window Visual Access to the Outside
- ◆ Classroom doors open directly into play spaces for K-2



Slope Analysis, with the assistance of Shawn Tofte, Community Design Assistance Center



**GLADESBORO ELEMENTARY SCHOOL**  
**SUN/SHADE ANALYSIS**



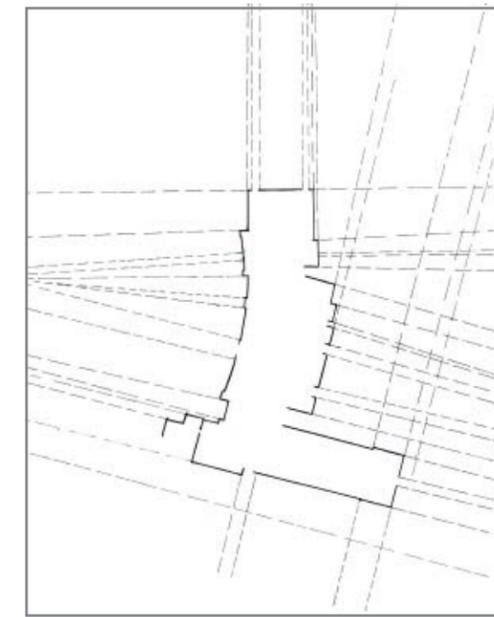
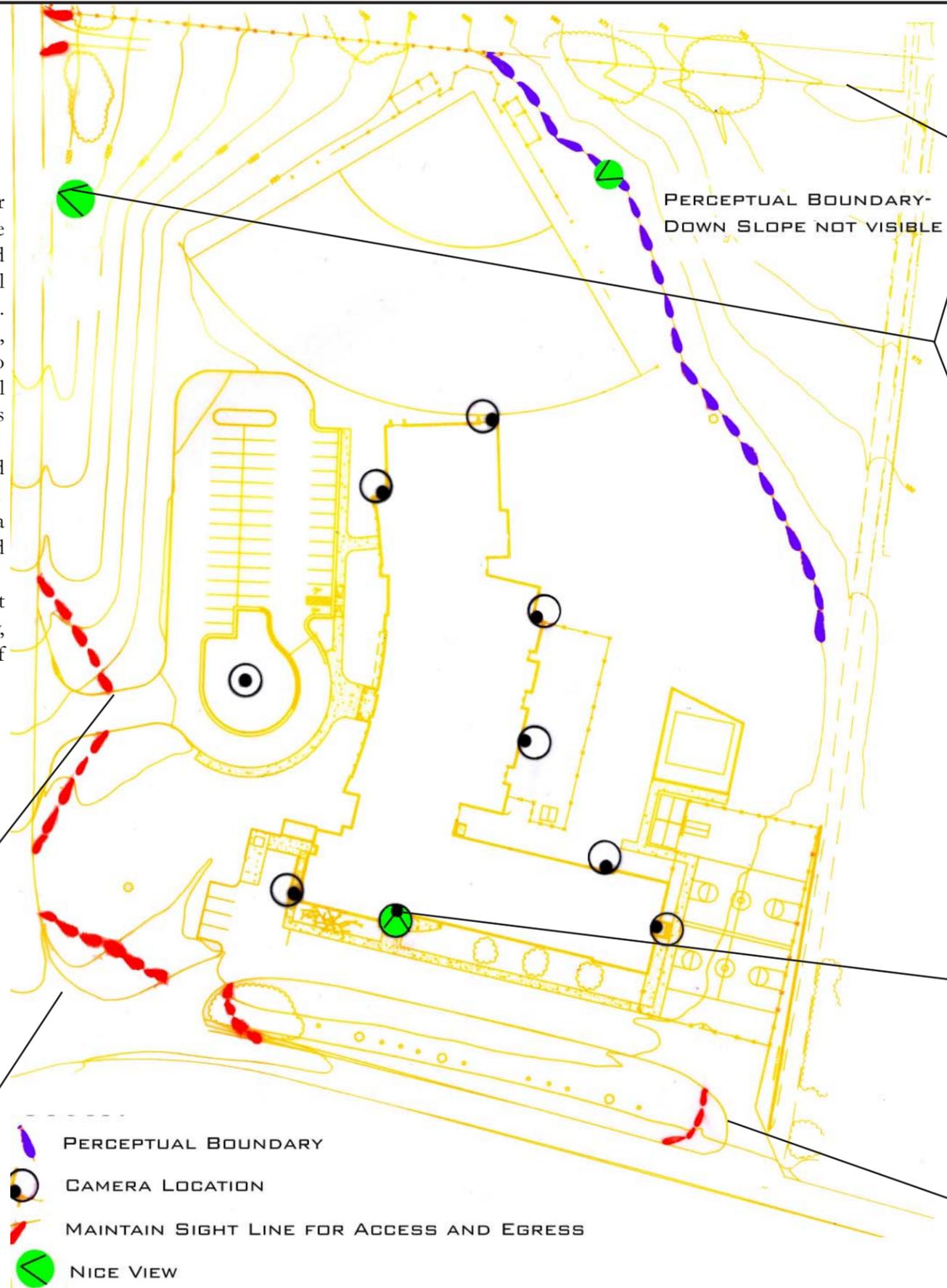
# SIGHT LINES: INVENTORY AND ANALYSIS

Cameras are significant limiting factors for proposing trees or vegetation. The cameras are intended for surveillance of entrances. It should be noted that the cameras are hidden; so potential prowlers will not be monitoring their activities. These cameras do not serve as a deterrent to crime, but will rather only be used if there is a reason to review tapes after a discrepancy occurs. Several parents noted the cameras in the parking lot as one of the site's amenities.

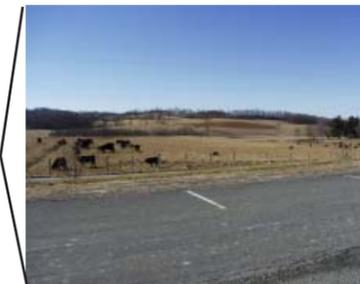
Other sight lines that need to be preserved include the access and egress points for vehicles.

The open agrarian landscape provides a number of views that can be framed and emphasized in the design.

The perceptual edge refers to the point at which the landscape begins to decline. Visually, the lower area is inaccessible from the majority of the site.



This diagram is a study of the relationship between the building to the outside environment. Sight lines from windows and doorways as well as angles implied by the building layout are considered.

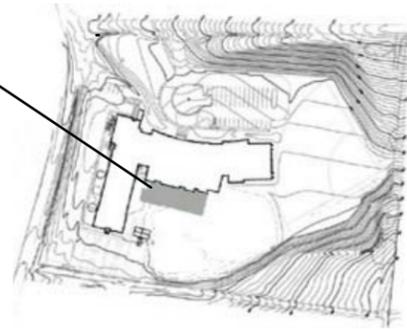


## K-2 PLAYGROUND: INVENTORY AND ANALYSIS

The playground and primary play space for the K-2 student population is a fenced off area, directly accessible from the classrooms. Windows from the classroom face this area as well. There is visual access to the upper grade playground. According to staff, students run into the fence, because it is not visually pronounced. Some of the K-2 teachers feel that this space is not large enough for younger students to run. The fence was installed to keep older students from knocking down the younger ones and to contain the younger students.

An electric transformer is located in this area. This area is adjacent to the coal service area, and just outside the gate, there are two concrete lids to septic pumps and tanks buried below. The lids present a potential trip hazard. Access to the septic must be maintained for periodic pumping. On first consideration these elements might appear to be design constraints. But they also present potential opportunities to teach about these somewhat hidden systems. The only shade in this area is that produced by the play structures. There is no seating for staff or students other than the play equipment.

The play equipment consists of four swings, a raised container for sand, a see saw, two stationary “rides,” and a play set. The play set has two slides, and a few opportunities for climbing including multi leveled platforms. The platforms allow students to gain a vantage point, while also creating places to retreat beneath. The play set could also encourage imaginative play. The swings are potentially both active and passive spaces. Students may use the swings as a place to sit and talk, or to feel the exhilaration of swinging high. The raised container for sand is potentially problematic, because this area is quite windy at times. The height of the container may also increase the likelihood of sand getting into the eyes of students playing in this area. The container was empty during my site visit. Many of the students drew sand as a favorite activity. One of the kindergartners suggested a sandbox with a lid. Play with sand encourages passive activity, and imaginative play. This activity can be either a solitary or a collective effort. The seesaw can be used as a seat, for cooperative play. There are two play structures that are intended for solitary imaginative play. If they were placed closer together, they might encourage social as well as individual play. For example there would be the option for students to sit and talk, or “race.” Other than the mulch, there is no opportunity for students to manipulate natural objects. There is no vegetation in this area. This area has potential to house class garden plots. Raised beds would provide biotic diversity as well as increased seating options.



## UPPER GRADE PLAYGROUND: INVENTORY AND ANALYSIS

The upper students have more freedom of movement than the younger students. The primary play opportunity represented in the landscape is a large play set. The play set provides opportunities for students to slide, crawl through tunnels, and climb. The play set also has several multilevel platforms providing opportunities for students to be elevated, and places for refuge beneath the platforms.

Other play opportunities are found in the open field and the paved play court. Again, the storage sheds block sight lines between the older primary play set, and the paved play court. The school has an 80 foot long swing set that they hope to install in the near future for use by the older students. A swing set with so many seats will provide opportunities for both social and individual activity.

The older students also have access to two picnic tables that are situated between the lower and upper playground. There is no opportunity for shade other than the shade created by the play set. Concrete lids to buried septic tanks and pumps are potential trip hazards to students in this area. These lids are located between the lower and upper grade playspaces.

Several of the girls in the upper grades like to talk and socialize in the doorway near the gym. This is one of the few spaces perceptually private to the students.



## THE PAVED PLAYGROUND: INVENTORY AND ANALYSIS

The paved playground is primarily used for basketball. This is one of the spaces used by students after school and during non-school hours. Upper grade students are also allowed to use this space at the discretion of the teacher. Many students identify playing basketball as one of their favorite outside activities.

They also describe this area as being almost unbearably hot at times. It is located along the south side of the building, and a microclimate is created as the building and asphalt absorb and maintain heat. This has a positive warming effect in the winter by providing a comfortable protected play space. But on warmer days, little shade is cast on the space, creating a space that is potentially too hot to enjoy spending time in this area. It should be noted that elementary school aged children are closer to the ground and the heat rising from hot asphalt will have a greater impact than on one that is taller.

The cracks in the asphalt were also identified as something the community wishes to fix. If this space is resurfaced, perhaps a lighter shade of paving could be utilized to reduce some of the heat absorbing capacity. However, if the surface is too bright, glare will be a problem. Recycling tires as aggregate in the resurfacing is a potential consideration. The Nike Corporation sponsors a program where tennis shoes are recycled into a sport and track court, another material consideration.

The sheds along the edge of the playground block visual access from the majority of the playground. According to the daytime maintenance worker, only one shed is actively used, the others are “full of junk.” These buildings also provide an area where children hide, which is perceived as being problematic among teachers. Perhaps a safer place to hide needs to be created. Bees are another problem that is reported by staff. Evidently bees periodically make their nests in the sheds.

It should be noted that the paved playground is used for service access in the winter, when coal trucks deliver fuel for heating. Depending on the weather, these coal trucks may access the site as much as six times during winter months. There is very little space to store the coal in the cinder bin.

The stairwell has the potential to be a place for social gathering, as it is in a transitional zone. The steps can easily be used for seating. The landing at the top of the stairs could also act as a stage, or vantage point.

Parents and staff are interested in diversifying the play potentials in the paved area. Games such as hop scotch and four square are potential games that can be added. Learning can also be incorporated in the space. This sunny lot would be an excellent location for an interactive sundial. If the basketball court is primarily used for shooting baskets, rather than full court games, perhaps the entire paved area can be painted. Other learning and play elements could be included in the layout. A labyrinth is one potential idea. Several of the students drew mazes as something they would like to add to their schoolyard. Students drew lizards, frogs, birds, and other animals in their drawings. Perhaps in addition to planting vegetation that provides basic needs for these animals, some of these creatures could be drawn on their schoolyard. Maybe the school could sponsor a school wide design competition.





## BIOTIC SYSTEMS: INVENTORY AND ANALYSIS

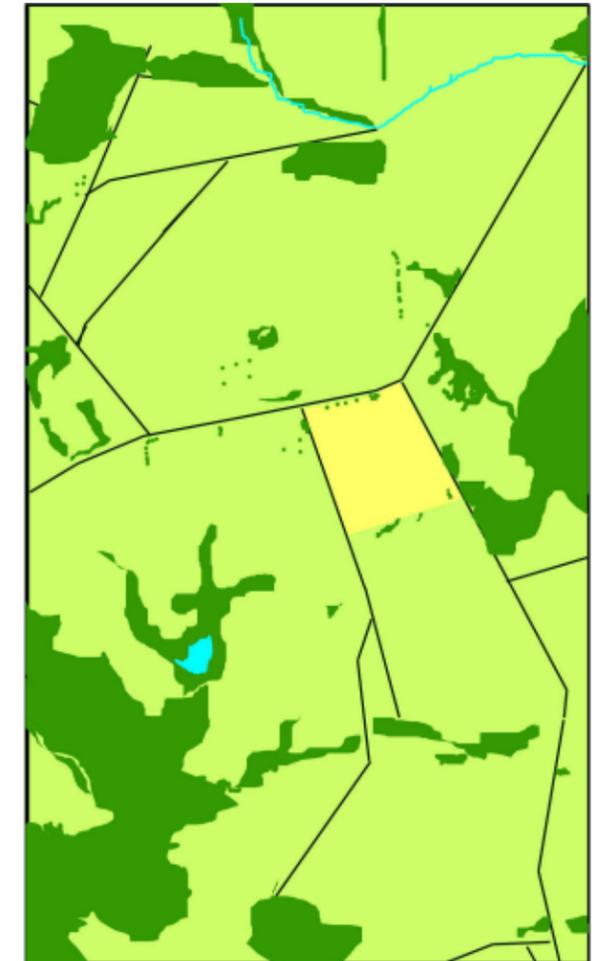
The vegetation at Gladesboro Elementary is primarily comprised of mowed grass. There are two white pine trees on the high point of the site. Other planted vegetation is along Snake Creek Road, where there are several small flowering trees and shrubs. In the small planting bed at the Snake Creek Road entrance, one living crab apple, and three rhododendrons as well as two dead crabapple trees can be found. There are several native dogwood trees, which appear to be healthy. They should be monitored closely for signs of anthracnose, a fungus attacking the native dogwood population.

At the community entrance, there are two planters, which had plastic flowers in them over the winter, and are currently planted with pansies. There are signs of wildlife despite the low level of vegetative diversity. Several bird nests are found in the trees along Snake Creek Road.

When considering a bird's eye view of the site and the surrounding region, one finds that there are patches of vegetated areas among the open rural landscape. Access to water is available to wildlife from Snake Creek and a nearby pond.



-  EVERGREEN TREE
-  DEAD DECIDUOUS TREE
-  DECIDUOUS TREE
-  SMALL SHRUB
-  GRASS



A BIRD'S EYE VIEW



-  OPEN SPACE
-  VEGETATION
-  GLADESBORO ELEMENTARY SCHOOL SITE
-  WATER
-  ROADS



# HYDROLOGIC SYSTEM: INVENTORY AND ANALYSIS

As has been mentioned, the ecological footprint of the school building at Gladesboro Elementary has more than doubled in recent years. This increase, along with existing buildings and parking lots, has the potential to cause the detrimental effects of impermeable surfaces detailed in Chapter Two. The impermeable surfaces altering the hydrology at Gladesboro Elementary School consist of the following: the rooftops of the buildings, the paved playground, paved bus loading zones and parking lots, Snake Creek and Gladesboro Roads, paved service access road, and the concrete sidewalks.

Stormwater from the rooftops is primarily routed via gutters connected to underground stormwater sewer pipes, and moved quickly away from the building. Stormwater management for the building facing Snake Creek Road (the building built in 1955) and the runoff from the bus loading area, as well as runoff from part of Gladesboro Road, is routed through a series of gutters, pipes and swales to a cow field across the street. There is one open gutter, which empties into the coal service and paved playground area. Stormwater runoff from the recent building addition, and community and staff parking lot is piped to the northeastern portion of the site, through a rip-rap ditch, then back underground where it is piped eastward, and off the site in an underground stormwater sewer conveyance system.

The diagram and photographs on this page were helpful when considering points of intervention for revealing the otherwise hidden attributes of the hydrology of the site.



## DECOMPOSITION SYSTEM: INVENTORY AND ANALYSIS

The decomposition system currently in place at Gladesboro Elementary consists of the septic system and the trash removal system. The lids of the septic tanks and pumps are located directly between the current playspaces for the upper and lower grades. These lids are large concrete slabs over 6 feet wide, and six inches above grade. Design should integrate these lids or safely cover them.

Occasional access to the septic field and tanks needs to be maintained. Limitations exist for what may be planted near the septic drainfield, tanks, or underground lines. Trees cannot be planted near the septic lines and the roots of vegetation should not penetrate these buried lines. The septic drainfield is located at lower elevations in the northwest quadrant of the site, as is shown in green in the diagram.

The dumpsters are located in close proximity to the kitchen and cafeteria for easy access by individuals disposing materials. Trash trucks access this area via the Snake Creek Road Bus entrance.



# STUDY OF RELATIONSHIPS



LOST SPACE- CURRENTLY NOT VISIBLE FROM PRIMARY USE AREA- LOCATION FOR STORMWATER AND SEPTIC DRAINFIELD

OPEN SPACE

BASEBALL FIELD/ OPEN SPACE

HIGHLY VISIBLE SLOPE- POTENTIAL LOCATION FOR FRUIT TREES

- A** ORGANIZED PLAY-GROUNDS
- B** POTENTIAL LOCATION FOR SHADE/ MULTI- ACCESS, "EYES ON THE LANDSCAPE"
- C** BUILDING
- D** MARK/MAINTAIN SIGHT LINE FROM ROAD
- E** POTENTIAL FOR STORMWATER INTERVENTION

## **DESIGN**

The design process is a somewhat fluid venture. It does not have an absolute point of beginning and or a definite end, particularly when pondering and planning for an academic pursuit such as this one. An important step in the design process was considering the range of information available to the designer: analysis of existing conditions, ideas and needs of community members and students, successful elements of the case studies, insight gained from the literature review, and my postulations about eco-schoolyard design. The landscape is a living thing. As such, it is constantly evolving. As I think back to the principles of ecological design outlined in at the beginning of chapter two, and reflect upon my process for this project, it has been a winding path. There is no straight line from beginning and end. Deadlines and time constraints have pushed me to prepare design presentations for the school community. However, through the course of my graduate career, I keep hearing, it is about *the process of design*, not just final rendered plans. This includes the little bits of trace paper that pile up as one thinks through and imagines the potentials, remembers the limitations, and considers the experience of being in this place. What is this place to be? What could it be? The design development takes on a life of it's own. One idea leads to another and one idea or concept can be expanded in several variations and extremes.

The analysis, literature review, existing conditions model, and ideas generated from the Gladesboro School Community, set the parameters for design exploration. Through my work with the school community and the course of my research, it became apparent to me that the students, and their right to a higher quality of life, were the true motivation for this project. The concept of a landscape of empowerment was born. This concept or guiding principle suggests that the landscape facilitate empowerment of the user, by providing opportunities for them to empower themselves on numerous levels. Knowledge thru education and experience is the primary tool for gaining empowerment. Certainly, programming and guidance by parents and teachers assists students in the empowerment process, but one of the hidden goals of empowerment of elementary school students is the thought that they will gain necessary skills to teach themselves. For example, confidence building cannot really be taught, but rather must be learned through experience. Opportunities to build confidence can be presented in the landscape. Raised areas such as platforms, boulders, or mounds or play equipment can provide a location for students to climb, jump, perform, and role play, and through these experiences build their confidence levels.

The following lists outline the design criteria developed to guide landscape design and programming within the eco-empowerment concept. A set of design implications separated by the systems follows.

## LANDSCAPE OF EMPOWERMENT CONCEPT

The landscape of empowerment is achieved through programming facilitated by the school community and through experience in the landscape by:

### SUPPORTING A POSITIVE LEARNING ENVIRONMENT

- ◆ Knowledge = Power

### PROVIDING OPTIONS

- ◆ Allow User to make decisions about their activities in the landscape.

### INCLUDE USER IN DECISION MAKING PROCESS

- ◆ Encouraging involvement of students in the management and manipulation of the landscape reinforces their sense of self worth and confidence about their ideas.

### MAKING POSITIVE CONTRIBUTIONS TO THE ENVIRONMENT

- ◆ Empowering, Especially since much of the news about the environment is negative. It is empowering to have the option of doing something positive.

### PLACE FOR PLAY

- ◆ Play is closely linked to the development of the “whole child.”
- ◆ Play is a key factor in social development.

## DESIGN IMPLICATIONS

Design implications were developed to further define and explore the potential of the empowering eco-schoolyard concept. The following pages outline recommendations considered during the design process. The school landscape should:

### SOCIAL SYSTEMS

#### PROVIDE FOR THE NEEDS OF STUDENTS, PARENTS AND STAFF

- ◆ Support learning
- ◆ Support physical and emotional development
- ◆ Support a healthy environment. Take into account environmental impacts

#### ESTABLISH CONNECTIONS

- ◆ Between Inside and Outside
- ◆ Connect to Curriculum/ SOLS's
- ◆ Transition between play areas

#### PROMOTE A SENSE OF OWNERSHIP- programming

- ◆ Include Students in decision-making process
- ◆ Encourage Students to maintain and plant areas
- ◆ Encourage Student participation in sign making, stepping-stones, and display art projects
- ◆ Allow a range of activity options for student to participate in

#### PROMOTE SAFETY

- ◆ Play equipment should be securely anchored
- ◆ Provide safe graduated challenges
- ◆ Provide for locations for staff and parents to supervise students
- ◆ Provide a respite from the sun

#### PROVIDE OPTIONS:

- ◆ A range of defined spaces- individual, small group, classroom
- ◆ Opportunities to be in the sun or shade
- ◆ Opportunities to interact with nature- play with natural objects
- ◆ Allow students perceptual freedom of movement and private space
- ◆ Provide a range of gathering areas- private, semi-private, and public
- ◆ Sun/Shade Opportunities
- ◆ Incorporate Nature into “Functional Playground”
- ◆ Encourage a variety of play
- ◆ Provide a range of sensory experiences by using varying textures and materials
- ◆ Opportunities to gain a vantage point, (prospect)
- ◆ Opportunities to perceptually “hide,” (refuge)

#### MAKE POSITIVE CONTRIBUTIONS TO THE ENVIRONMENT

##### HYDROLOGIC SYSTEMS

- ◆ Educate about the water cycle, watershed
- ◆ Conserve water resources
- ◆ Harvest rainfall for irrigation needs
- ◆ Expose hidden stormwater system
- ◆ Improve water quality by filtering NPS Pollution
- ◆ Prevent erosion/sedimentation

##### ENERGY SYSTEMS

- ◆ Interpretive signs about existing energy sources: transformer in play area, coal as heat.
- ◆ Nutrition/Health: Allow opportunities for students to make connection between
- ◆ sun, good soil, and water for plant life (Photosynthesis, food chain = energy)

- ◆ Possible use of alternative energy: solar panels accessible to students to illustrate concepts of energy and photosynthesis

#### DECOMPOSITION SYSTEMS

- ◆ Complete decomposition cycle of food waste through composting or vermiculture
- ◆ Reveal buried septic system
- ◆ Interpretative signage about septic and composting
- ◆ Recycling programming

#### BIOTIC SYSTEMS

- ◆ Increase biotic diversity on site
- ◆ Target specific wildlife by providing habitat needs (food, housing, water)
- ◆ Birds, butterflies, small mammals, amphibians, insects
- ◆ Wildlife watching station
- ◆ Wildlife tracking box: near water source or feeding area

Not every design will include every design implication. However, as has been previously noted, the landscape is a living thing, and is meant to evolve and grow with the passage of time. The students will also grow and change through time. The potential for students to notice the growth and maturation of their school landscape can parallel their own maturation and growth in the short term of a season or the longer term of their post elementary school life. To reinforce the concept of empowerment, programming can give students the opportunity to manipulate and make decisions about their school landscape. Classroom garden plots as well as art projects including signs, stepping-stones and environmental art projects reinforce a sense of pride and ownership among the student population.

Generally speaking, elementary school students are a powerless group in society. They depend on parents and teachers to guide their development. The empowerment concept promotes the development of a sense of responsibility, and pride in the students by encouraging their active participation in the development of their space. Public school yards essentially belong to the students that attend the school. This sense of ownership can be fostered through school programming and curricula development that gives the power of some decision-making into the hands of the students.

Below is a list of potential themes and landscape elements considered in the design process. These were formed from researching school landscapes, and themes that have been implemented, as well as considering the systems approach and the opportunities that are presented by this particular

site. This list is included as part of the design process. I find that stream of consciousness and lists of ideas an important step In the design process. This list may also be helpful to school programmers as a way of presenting options to the students, or school community for decision to make about their school landscape as the project evolves. Some of these themes would be permanent zones in the school landscape, while others might change from year to year, or season to season. The school landscape can be approached as individual class projects, or as community wide undertakings.

**SOME POTENTIAL THEMES AND LANDSCAPE ELEMENTS CONSIDERED:**

- |                       |   |
|-----------------------|---|
| Outdoor Classrooms    | Cash Crops of Virginia (corn, cotton, peanuts, tobacco, apples) |
| Habitat Gardens       | Square foot garden  |
| Nectar Garden         | Snack Garden, edibles, fruit                                    |
| Pollinator Garden     | Pond  |
| Berry squares         | Weather Station   |
| Seed garden           | Giant Theme Garden  |
| Water gardens         | Period garden   |
| Rock gardens          | Cultural Garden   |
| Wild/ Succession Area | Memory Garden   |
| Wetland Zone          | Interactive Sundial   |
| “Edge Condition”      | Living Sundial  |
| Maze/ Labrynth        | Rainbow Garden  |
| Meadow Zone           | Geology: Rocks of Virginia                                      |
| Rain Gardens          | Compost   |
| Tea Garden            | Archeology/ Fossils in Sand                                     |
| Herb Garden           | Reading- storybook theme  |
| Dye Garden            | Reading Circle  |
| Fiber Garden          | Story Ring  |
| Cereal Garden         | Patchwork Quilt Garden  |
| Pizza Garden          | Composting  |
| Sunflower house       |   |
| Wildlife viewing area |   |
| Observation Tower     |   |

For example, a class may review this list of ideas as a starting point for their schoolyard. From there, additional suggestions and ideas might evolve, or priorities may be formed and a theme or idea could progress into a classroom garden. Themes such as succession can take place in small or large experimental plots. A school landscape such as the one found at Gladesboro is essentially a blank slate. The building placement and topography dictate some limitations, but there is such a diminutive amount of biodiversity on the site, any additional vegetation would be an improvement.



As a means of inquiry, I built several study models to investigate relationships of the building, topography, play spaces, parking lots, and roads. The models were also helpful in visualizing the potentials of the site, and design concepts. These considerations informed my exploration of design alternatives for Gladesboro Elementary School. The process of building a model forces me to think about the spatial qualities in the existing landscape.

In this case, I built a 30 scale topographic model of the site at Gladesboro Elementary. The grade change at Gladesboro is significant, and the orientation of the building to the landforms and parking defines the space. The new addition is slightly curved and seems to place a centering focus on the community parking lot. The play space, the space where students spend most of their outside time, is an exposed and open space. As was mentioned in the analysis phase, there are few options currently available to the primary users of this space—the students. The existing conditions model clearly illustrates that there are few vertical elements in the play yard, and as was illustrated in the sunshade analysis, shade, is not an options for the students. The model became a touchstone to the place, and evolved as the design process evolved. I did not permanently fix site elements to the model other than the existing building. This allowed me to experiment with the placement of trees, mounds, and other proposed site elements to determine the feasibility of such proposals, and determine the best configuration to reach the proposed goals. The model has been donated to the school with the hopes that they will add trees and vegetation as their living landscaping progresses.

The following pages document some of my design explorations. Preliminary Design Alternative A was presented to the school community as such, along with a design alternative created with the cooperation of CDAC team member Shawn Tofte, not included in this thesis. Instead, Alternative B was created for the purposes of this project. To facilitate describing and comparing design explorations, I have broken the design alternatives into zones. For several of the zones, I have included rough preliminary designs or additional alternatives, as a documentation of the design progression. Again, the overarching theme for this project is a landscape of empowerment geared towards the primary user group, the students. The design proposals seek to apply the design criterion and pragmatic needs previously outlined. In many cases, design alternative A, is morphs bcomes further developed in Alternative B. In some areas, I have included more than the two alternatives as a documentation of the process. There are so many ways that this space can be designed; I felt it was important to show a range of possibilities.

The sheets that follow will first show the landscape alternatives as master plans of the entire site. Next, the narrative walks the reader through the site, and compares the alternatives presented beginning with the Snake Creek Road and Bus Entrance, followed by the community entrance, the hillside, the playground and “the edge,” or lower elevations of the site.

Guiding structures and elements of repetition are suggested to facilitate the sense of place and to unify the site. A plant selection criterion includes habitat value, architectural form, as well as specific needs of the plant. For example, requires a sunny habit, can withstand both drought and submerged conditions, or is know to have water cleansing properties. A partial plant list is included as Appendix H.



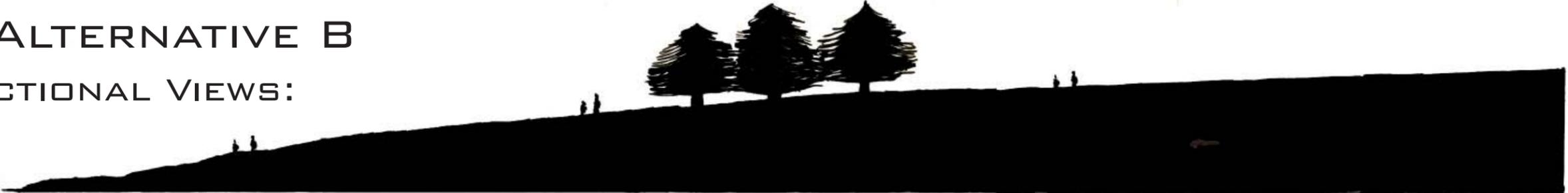
**DESIGN ALTERNATIVE A**



**DESIGN ALTERNATIVE B**

# DESIGN ALTERNATIVE B

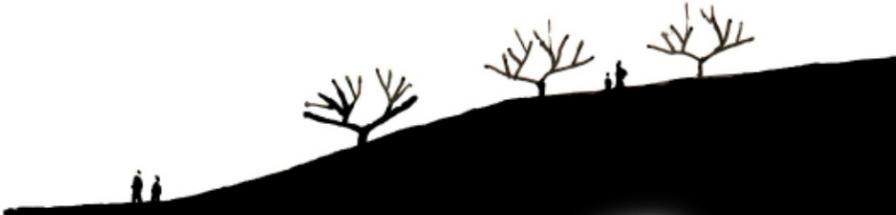
## CROSS-SECTIONAL VIEWS:



SECTION F



SECTION E



SECTION D



SECTION C



SECTION B



SECTION G



SECTION A

# DESIGN ALTERNATIVE B

## SUGGESTED LEARNING STATIONS

### STATIONS

#### DECOMPOSITION

- Compost
- Septic
- Mounds formed of leaves collected from county? Leaves are lightweight, and easy for community members to carry. This reinforces visibility of decomposition, and makes great growing median for plantings along trail.

#### HYDROLOGY

- Wetland- Filter
- Raingarden, bioswales along paved surfaces
- Snake Creek Watershed
- Rainwater harvest- cistern

#### BIOTIC

- Plants
- Animals
- Insects

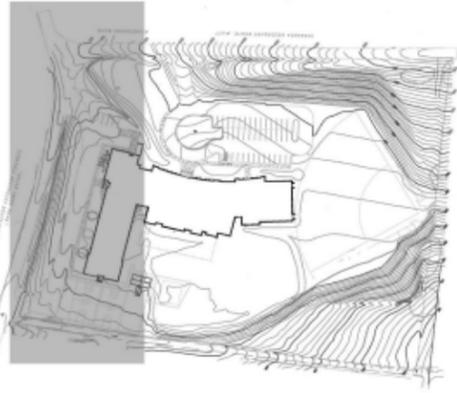
#### ENERGY

- Exercise
- Food crops- nutrition

#### SOCIAL

- Learning can occur as a group or individual experience
- Art projects and participation in shaping landscape and making signs, stepping-stones, etc. contribute to social systems
- Play spaces should encourage learning on numerous levels: social, emotional, physical and cognitive



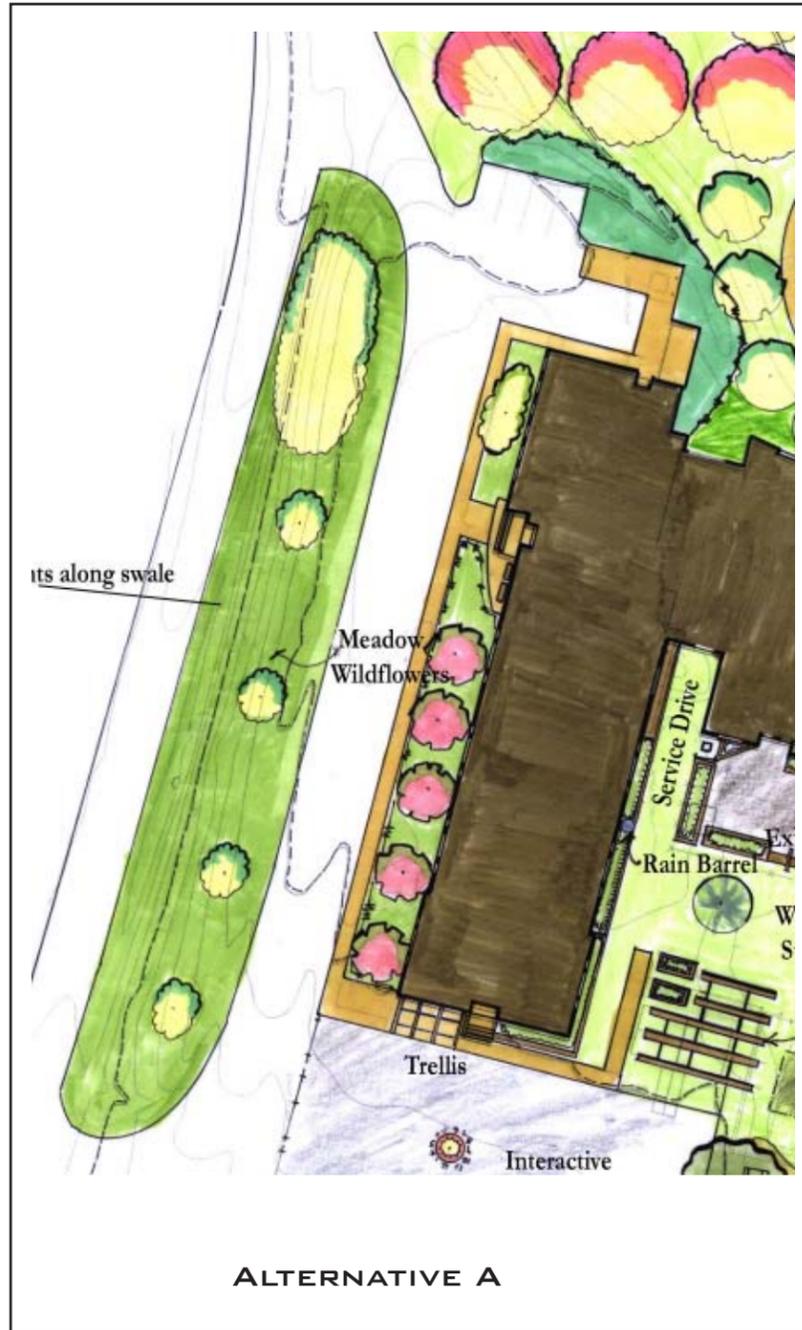


### SNAKE CREEK ROAD- BUS PICK-UP

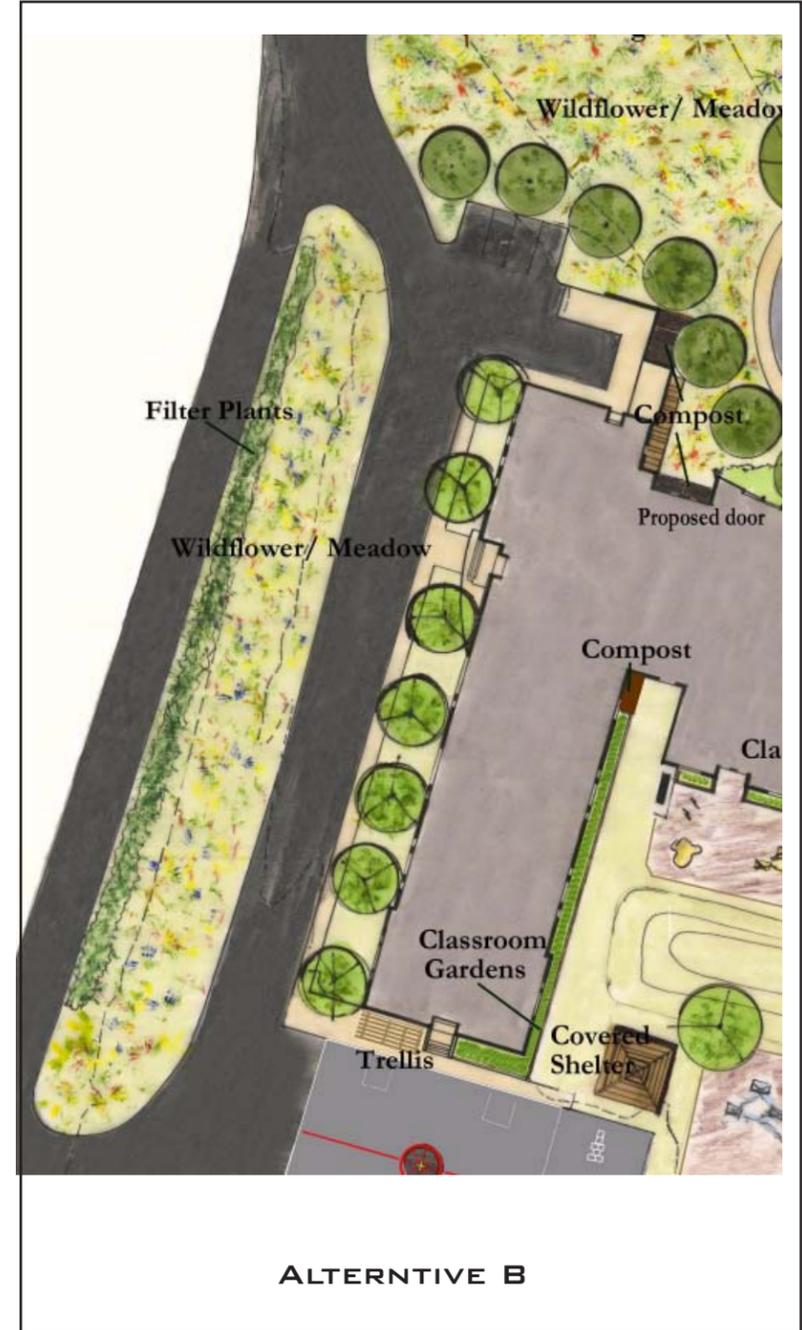
This set of drawings focus on the Bus loading zone and the Snake Creek Road Access. The design proposals are very similar for this area. As noted in the site analysis, the front bank is relatively steep, and therefore uncomfortable if not dangerous to mow. This bed is an excellent location to plant meadow and wildflowers, and a superb way to show the local community mowing alternatives. This is also a prime location for stormwater intervention. Filter plants are suggested in both of the designs along the swales length, to slow the flow of water, and to filter nonpoint source pollutants from stormwater runoff.

Views to and from the school are maintained. Because there is such a low level of biodiversity currently on the site, Alternative A retains the existing trees in the front bed. Alternative B shows the front bed meadow and wildflower plantings, emphasizing the open views of the surrounding space, and promote visual access to the building from the street. Both alternatives suggest planting small native, flowering trees with native groundcover in the planting beds along the buildings edge. This would reduce the maintenance costs over time, and send a positive message to the community.

Design Alternative B proposes an additional door be added from the kitchen and cafeteria. From this access point, a wooden ramp connects to several compost bins, for easy transport of kitchen waste. To improve the efficacy of the design, vehicular access to the compost bins should be included, to increase the ease of transporting compost to the planting beds and classroom plots.

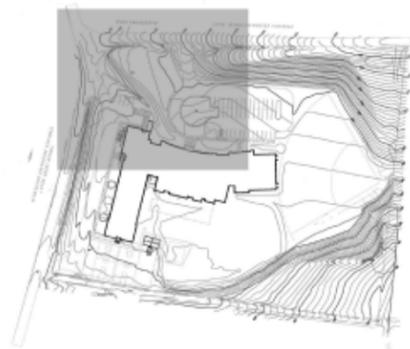


ALTERNATIVE A



ALTERNATIVE B

## THE COMMUNITY ENTRANCE



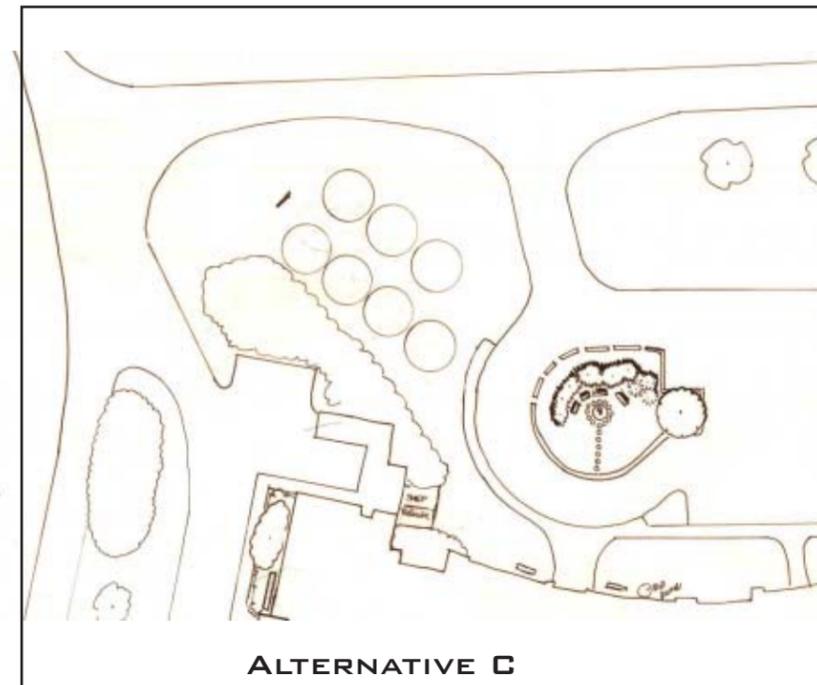
Each of the design alternatives presented intends to promote a sense of welcoming and guide the visitor to the community parking lot, as well as promote awareness about the eco-learning landscape at Gladesboro. Each design contains a welcome sign, though they may be oriented in slightly different ways. Alternative A proposes an allee of trees along Gladesboro Road to guide the visitor's eye through the open space between the vertical tree trunks to the community entrance. A low sign is placed in the middle of the allee along the Snake Creek Roadside to further orient the visitor. The welcome sign in Alternative B is oriented toward vehicular traffic traveling both ways down snake creek road. This sign should be tall enough that the proposed wildflower/meadow planting should not obscure the visibility of the sign. Filter plants are proposed in the swales along the roadsides, to capture and filter stormwater runoff. Both Alternatives

A and B propose planting small flowering trees to mark the community entrance to the building. This row of trees in Alternative B also intends to guide the visitor's eye to the community parking lot from snake creek road, without obstructing the view. Two small trees further mark the community access point.

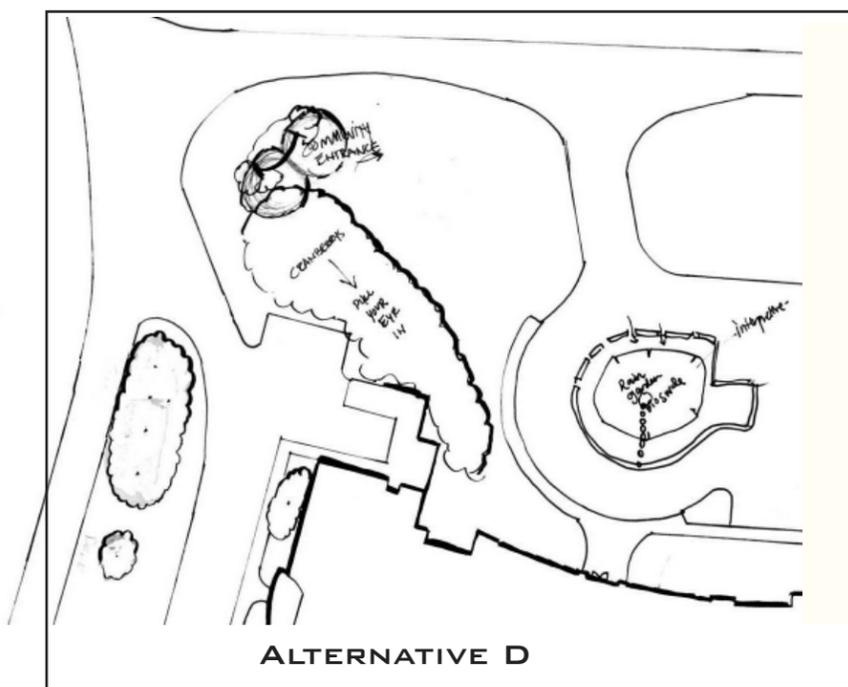
The native planting palette will signal community members and students about the native habitats and natural communities of this region. Alternatives C and D are included to show some of the early explorations considered for this area. Alternative C initially proposed to reestablish the low-growing native cranberry in the existing swale. Further research about this native community revealed that it is unlikely that such a community would be successfully reestablished. A high bush cranberry is proposed in Alternative D. This plant selection would pay tribute to the history of the site, while providing a screen of the service area, and drawing the eye around the building, particularly when the shrub is blooming. This alternative also suggests an allee of trees, with a similar intent to the one proposed in Alternative A, but the orientation of the trees has been shifted to focus on the flagpole in the community parking lot.



ALTERNATIVE A



ALTERNATIVE C



ALTERNATIVE D



ALTERNATIVE B

## THE HILLSIDE

Apple trees are proposed along this south-facing slope. These trees are excellent for Gladeboro, not only because the students, parents and staff requested them in the participatory exercises, but because they have built-in learning opportunities across the eco-schoolyard concept. Apple trees bloom in the spring and their fruit is harvested in the fall. Apples are easily manipulated, and can be dissected to teach about life cycles. They provide habitat for potential wildlife. Harvesting apples and making cider or apple sauce could also be incorporated in the school's fall festival. Nutrition and food values can be integrated into the lesson. Food gives students the energy necessary to walk through the orchard, and up the hill along this portion of the discovery trail. Apples are one of the regional crops of southeastern Virginia, and thus a connection to the area's cultural heritage.

A learning station and stopping point is designated along the ridgeline in Alternative B. Students may move through the discovery trail at different rates, and as they reach this defined stopping point, they know to wait for the rest of the group. This stopping point is made evident through a widening in the path and seating oriented towards the school. This stopping point is marked further by a tall pole containing a birdhouse, windsock, or other element as all the learning/ stopping stations are marked throughout the site. There is an excellent vantage point of the school and agrarian surrounding, as was noted in the site analysis; proposed benches are oriented towards the school to encourage users to take advantage of this view. A split rail fence is suggested in Alternative B, on the right. This suggestion also came from the community. Split rail fencing is a familiar landscape element along the nearby Blue Ridge Parkway, and also pays tribute to the culture of the area. A fence here will mark territory, and define boundaries for the students.

A proposed meadow/wildflower planting is located adjunct to the apple orchard. This is an excellent location for another learning station. The edge between the meadow and orchard will be a particularly attractive area for some wildlife. The meadow will increase biodiversity, and reduce the environmental and economic costs of mowing this hillside. The Discovery Trail in Alternative B forms a loop along the ridgeline and base line of the hill.

A bioswale is formed by planting filter plants along the swale collecting runoff from the roadway. This is one of the proposed stormwater interventions and learning stations on the site. This planting both visually marks the swale and decreases the flow of water making a positive contribution to the environment and providing an opportunity to learn about water quality. A rain garden or bioswale is proposed in the planting median of the parking lot. This is achieved by the proposed curb cuts and re-grading the bed to allow stormwater from the paved areas to infiltrate in this area. The Alternative A, also suggests a seating area around the flagpole for parents waiting for their children, or an informal, sunny gathering area.

A picnic area is proposed in Alternative B, between the parking lot and ball field. This proposal includes several picnic tables, a covered shelter as well as fire pits for cooking in the eco-schoolyard. The close proximity to the parking lot allows easy access for heavy items such as water coolers. This location provides an alternative place for community members to watch the baseball game, and is also a place for outdoor classes to take place. Additionally Alternative B takes advantage of the slope of the hill, by proposing an amphitheatre defined by logs. This space is suitable for larger gatherings. Both the picnic area and amphitheatre provide alternative vantage points for the baseball games, gathering spaces for teams before and after practice, and classroom or performance spaces.





## THE PLAYGROUND

Several design alternatives were considered for the playground area, as much of the time spent outside is in this vicinity.

In Alternative A, the classroom garden plots are visually accessible from inside the classroom, as are all the other design alternatives. However, raised planters also define the K-2 playground space. These raised planters provide an opportunity to grow and learn about plants, as well as seating alternatives facing both in and out of the K-2 playspace. (One can sit along the ledge of the raised bed). Rain barrels are proposed long the building's edge for harvesting rainwater and irrigating garden plots. A trellis is proposed as an extension of the existing K-2 playspace. If necessary this trellis could be gated to further establish a boundary to this space. This shaded area is a good location for an outdoor classroom, a space for painting, or informal activities for the younger students. Shade trees cannot be planted in this area, due to the septic line.

The younger students were interested in having a tunnel, cave, or living fort. Living teepee's are suggested as private space, however, these spaces would only be accessible to the younger

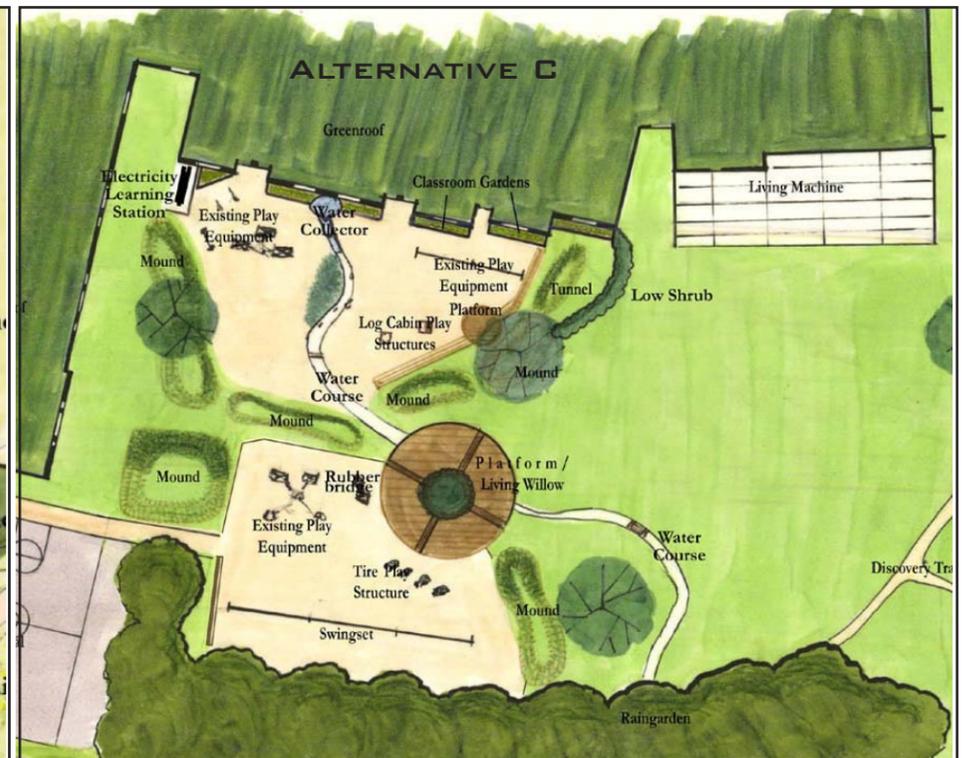
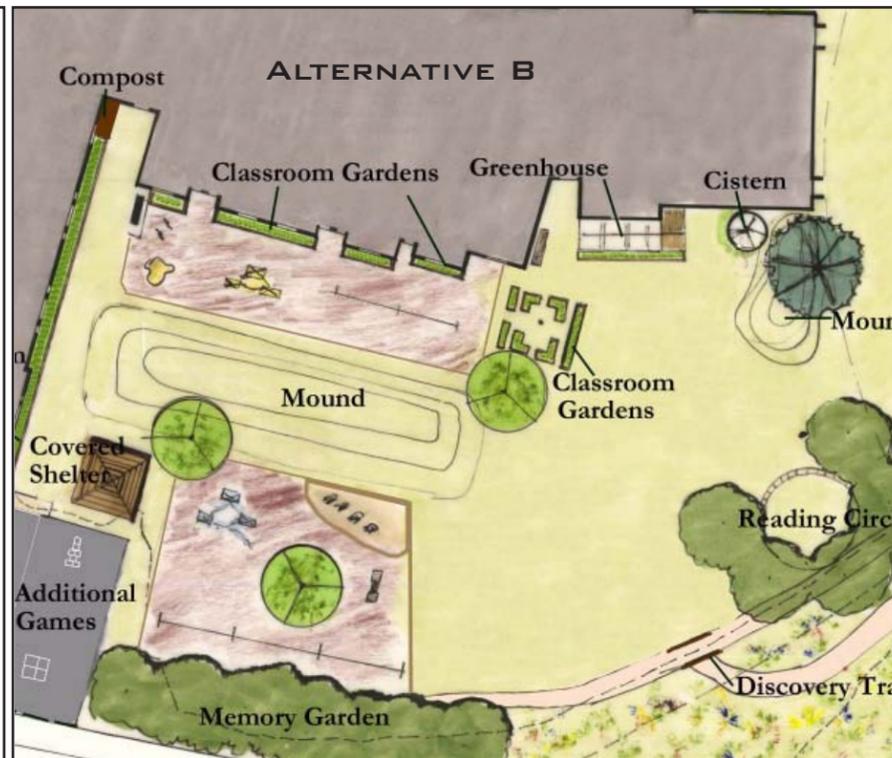
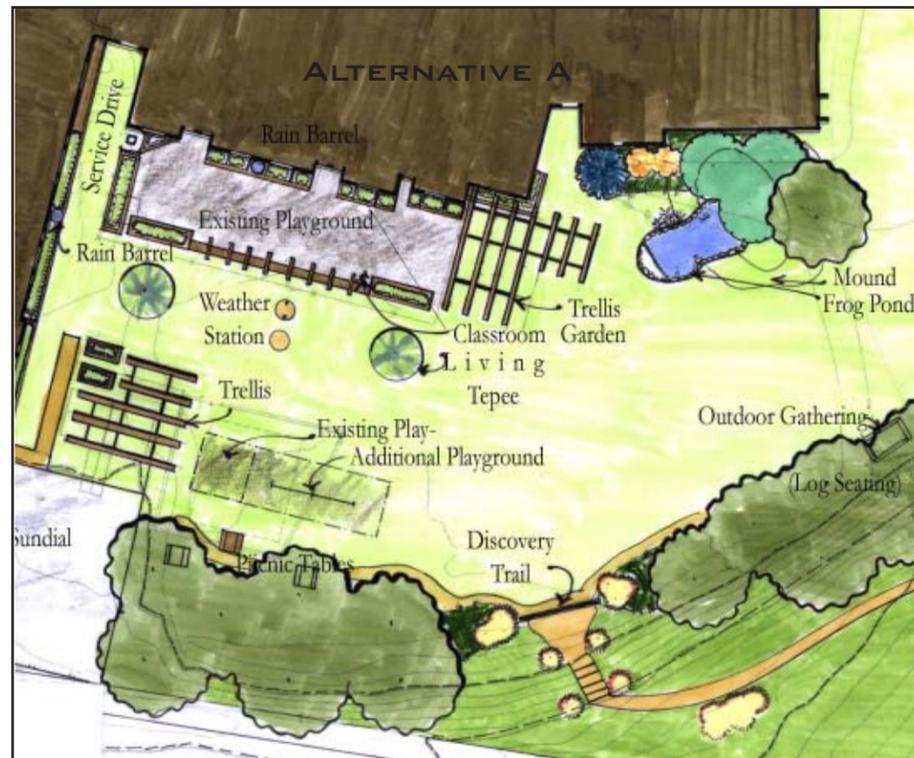
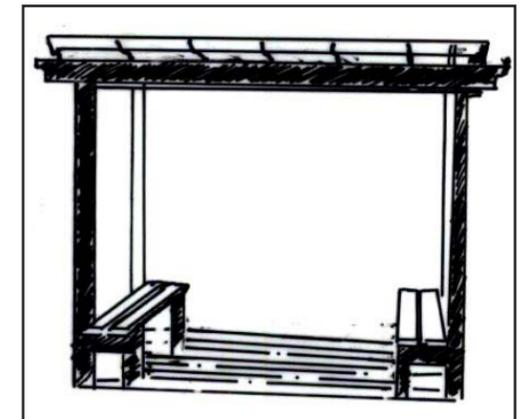
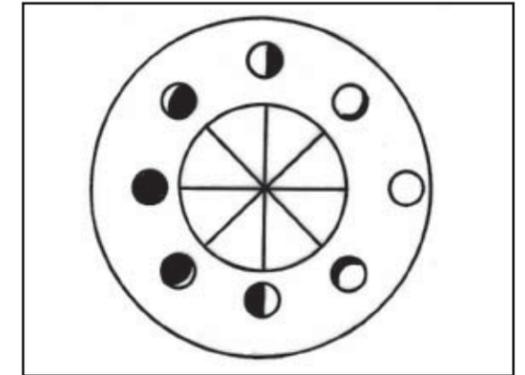
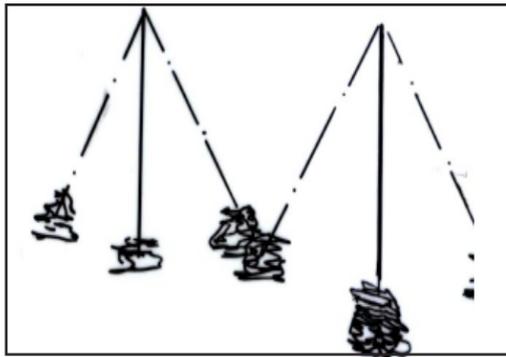
students if they were allowed outside of the defined K-2 play area. If the students would not be allowed to leave the confined play space, perhaps a living teepee should be built within the defined boundary. To make a living teepee, one stakes rope or twine, and then ties the twine to a central pole. Alternatively, three poles can be tied together. In each scenario, the perimeter of the teepee is planted with beans, gourds, or other climbing vines. Choosing plant material that can be used in later art projects or lessons is a consideration.

A weather station is proposed where the septic tank covers are exposed. The intention is to make this space a shared destination between the two age groups. The weather station could include a rain gauge, wind gauge, thermometer, barometer, as well as a small covered area to house a notebook for recording weather on a day-to-day basis. This proposal also calls for the septic lids to be painted with the lunar calendar, and a moon station to be implemented. Here, students take turns placing the current phase of the moon on a shepherd's hook. This is another way students can develop a sense of responsibility and greater awareness about their surroundings. An interactive sundial is proposed in

the paved playspace, in all of the design proposals for similar reasons.

A separate trellis is proposed where the existing sheds are located. This shaded area is in close proximity to the upper play space and provides a connection between the paved space and the rest of the playground. This is an excellent location for staff to keep a watchful eye on both playspaces. Shade trees along the upper student's playground will cast shadows on the space, and provide a connection to nature. Picnic tables are suggested as well as a swing set, both of which can provide social interaction for the students.

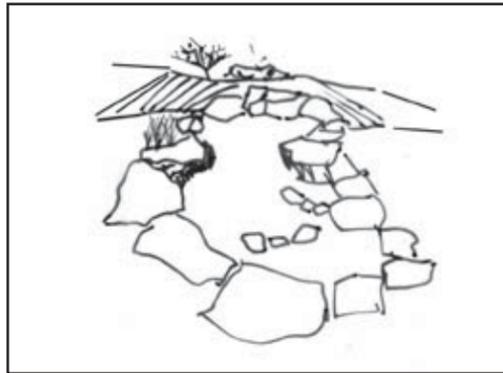
Ponds are another site element that was explored in the schoolyard at Gladesboro. Ponds, as has been detailed, have vast learning potential in the eco-schoolyard. At Gladesboro, frog ponds, fishponds, a stream the feeds into a pond, and a waterfall were present on numerous occasions in the student artwork. Ponds were also mentioned as a desirable site element from the staff and parent workshops. Some parents and staff are concerned about the safety and liability implications of having a pond on school grounds. However, ponds are being built in Virginia and





across the nation on schoolgrounds, as some communities view the positive potentials of ponds on schoolgrounds as outweighing the possible negative aspects. In these cases, the pond's teaching potential includes water safety. A split-rail fence is recommended to further define this space.

Along the outside wall of the gym is a proposed pond in alternative A. The pond is incorporated into a mound. The mound serves several purposes; first it allows a grade change and a waterfall feature to be integrated into the pond. The pond is intended to be recirculating, and interactive solar panels can be mounted at the student's level to encourage the connection between the sun's power and the flow through the pump. The mound provides a barrier to the pond from the baseball field, and allows a space for planting. This vegetated elevated space will visually soften this large gym wall. A large open space has been preserved. Shade trees have been located well away from the septic lines. Among the tree line, another informal gathering area is proposed. Logs define this area, which could be used as an outdoor classroom, or alternative viewing location for baseball games.



An archway marks the entry to the pathway of discovery leading down the hill above the buried septic line. This double arch is present in all of the design alternatives, and makes the entrance playful and marks the trail along the edge as well as the trail descending into the lower elevations.

Alternative B differs from Alternative A through the proposed mound connecting the two playspaces. This 2' high mound covers the septic lids and creates a vantage point for both staff and students. The mound is low enough to allow a visual connection between students and staff. The sides of the mound also provide seating alternatives, and a place to roll and climb.

Additional classroom gardens are located adjacent to the K-2 playspace. These raised beds form social spaces, and another boundary for students. If necessary this area can be gated. The beds also form a maze of sorts, which was one of the elements present in student artwork. This area can in itself be an outdoor classroom, and is located in close proximity to the proposed greenhouse.



A greenhouse was the first item mentioned on the staff wish list. This greenhouse is accessible from inside the building, and allows students to get a head start on the growing season. A cistern is located near the green house to capture stormwater from the rooftop. This water can be used for irrigation of greenhouse of classroom gardens. The area by the cistern and greenhouse is intended to be functional and is wide enough to allow access from trucks and garden carts. A mound along the buildings edge defines this functional space as well as provides an alternative vantage point to the baseball field and the rest of the playground. A reading circle is another idea generated during the staff meeting. Trees and straw bale seating define this area in this proposal.

A covered shelter is proposed were the existing sheds are located, this provides a connection between the paved playspace and the rest of the playground, a location for an outdoor classroom and a vantage point to all of the playspaces.

Alternative C is an example of an eco-schoolyard at Gladesboro if the septic field were replaced with a living machine. A series of mounds provide barriers as well as connections to the playspaces. Mounds are an affordable way of diversifying and defining the spaces in this area. They provide opportunities to climb and roll as well as passive activities such as sitting.

An intermittent stream is another element that connects the spaces. This element carries water during storm events, and is otherwise a play element. One of the play opportunities this element would afford include confidence-building skills by offering different levels of challenge and opportunities to cross the stream. At some points, students can step over the watercourse, at others they may run and jump across. Stepping-stones and different types of bridges offer other opportunities to cross the watercourse. At no point would the intermittent stream be deep enough to pose risk of drowning. The biggest risk of proposing such an intermittent stream is the potential trip hazard. This landscape element should be sited in such a way that it is integrated into the playspace, and marked through vertical elements to reinforce the users awareness of its location. This could be achieved through planting, rocks,

or posts. These vertical elements can also serve to limit access to the watercourse or mark points that are intended as crossing points. This landscape element is also explored with mounds, another landscape element that has plausible potential in the school landscape.

A central gathering area, or outdoor classroom is located centrally in the schoolyard. This area is intended to be accessed by both upper and lower grades. Four steel poles are oriented in the four direction, and four trees are planted and trained to grow along the poles to shade the wooden platform below. The surrounding area is planted with clumps of low growing vegetation and large boulders protruding from the earth.

Interpretive signs about existing or additional energy sources is located near the energy transformer in the play space in all of the designs. Solar panels could potentially be integrated into a shade structure or on the rooftop. Real-time energy data can be integrated into the signs about energy sources. As has been previously mentioned, an interactive solar panel at the student's level can reinforce the connection between the sun and many other energy sources, including the connection between photosynthesis and nutritional health learning opportunities. Any solar panels at the level of the child should not be connected to a battery for safety reasons. Otherwise, solar energy is a safe way to learn about electricity.

There are also opportunities for compost or vermiculture bins or piles in these spaces to teach about and complete the decomposition cycle of some of the waste produced at school such as paper and compostable kitchen waste.

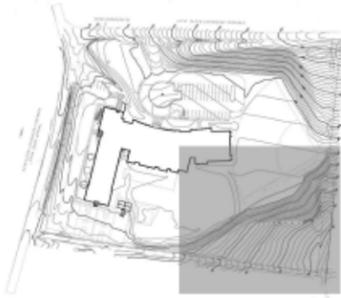
The playground alternatives explored for this project encourage interactive experiences on the level of a child. Opportunities to interact with nature, be in the shade, as well as pragmatic concerns such as the septic tank lids and connection/separation between the play areas were considered. Learning, social and emotional development, as well as playful and year around self directed learning are encouraged on different levels through out the explorations. Perceptually, the student should feel guided through the school's programming, and achieve a sense of

empowerment through their decision-making about their learning and play environment.

Classroom garden plots are but one option for students to interact with nature and improve the biotic potential found on the site. Rain gardens, an interactive stormwater course, cisterns and rain barrels and greenroofs are some of the stormwater interventions explored through my explorations. Places for interactive experiences promoting confidence and social skills development were also considered. Outdoor classrooms and informal gathering areas for varying numbers of people as well as opportunities for personal and private spaces were considered throughout the design process.

Again the concept is empowerment and the experience of the child. The schoolyard at Gladesboro has numerous potential to support learning, play, social development and interaction to the natural world.





## ENGAGING THE EDGE

One structuring element suggested in all of the design alternatives is the pathway of discovery. The path provides a challenging walkway offering views and experiences in the landscape currently unused by the school community (the hillside and the lower elevations). Community members suggested an exercise path and a nature trail. The two ideas are combined in the discovery trail. Preliminary Design Alternative A suggests the general location of the trail, which is further refined in the Final Master Plan, Design Alternative B. In Alternative B, the trail is mounded to further define the space. Learning and exercise locations are marked with 12'-15' poles topped with birdhouses, weathervanes, flags or sculpture created by the students. These poles are visible from other parts of the site, and are intended to invoke curiosity as well as define stopping points. At these locations, the trail should be wide enough to accommodate a small group, standing in a semicircle, or if it is denoting an exercise station, there should be ample room for several people to complete the task. (For example, do jumping jacks, or push-ups.) Because the tall vertical poles are visible from other points along the trail, and schoolyard. These points can be recognized as stopping points. That is, as students progress through the trail at their own pace. They can be told to stop at the learning station, and wait for the rest of the group.

The major differences are that Alternative B has a oversized double arch emphasizing the entrance to the trail, as well as marking the perimeter trail along "the edge." Alternative B takes the user through The spatial organizing structures include:

### The Trail

- Trail is mounded slightly to reinforce and guide the experience
- Trail is wide enough for several students to walk side by side
- Gathering areas/stopping points are marked by a widening in the trail entrance

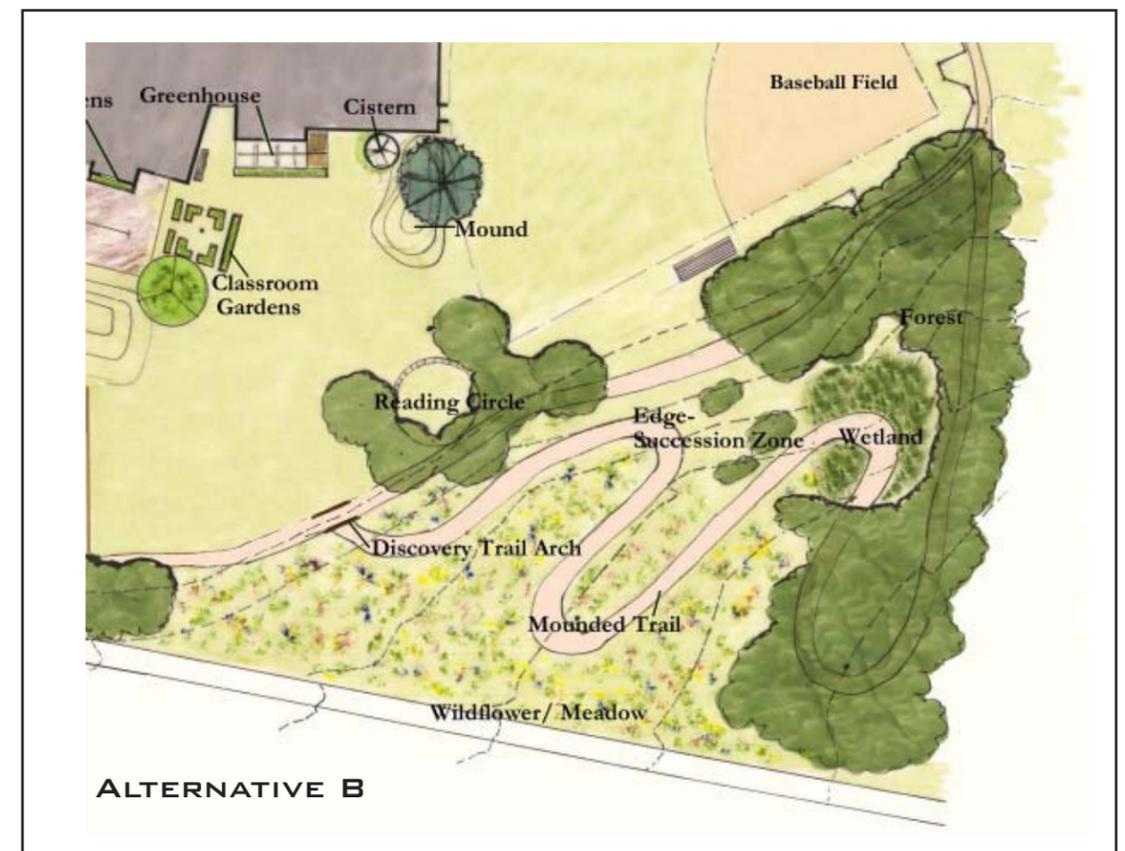
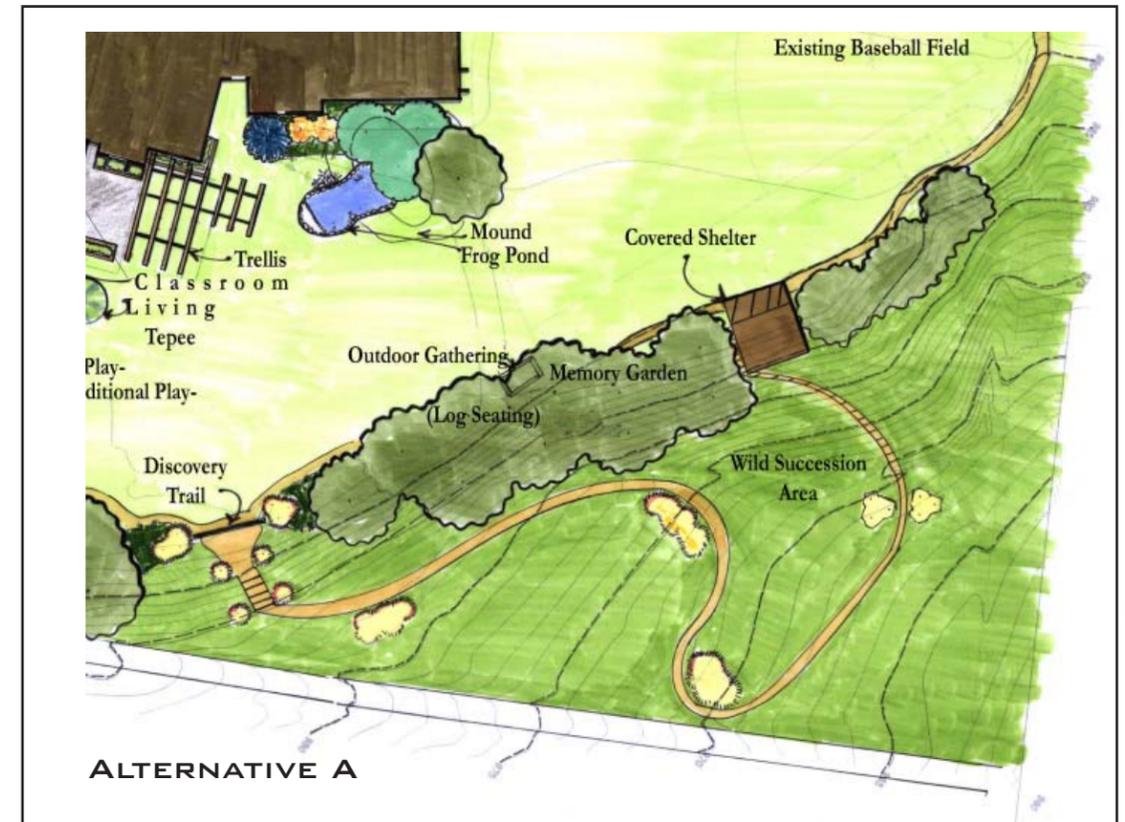
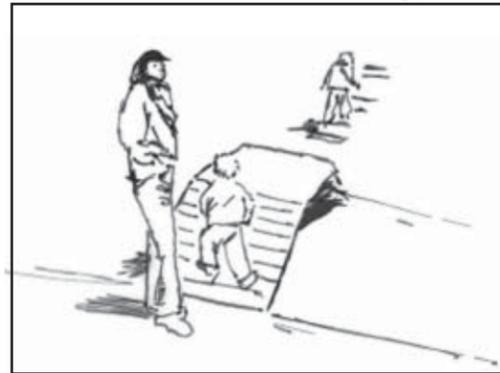
An oversized double arch marks the main entrance.

### Signage

- Signs are intended to be interpretative, interactive, and in themselves discovery.
- Signs are also an organizing element and reinforce multi-levels of experience –
- This is achieved through establishing a vertical hierarchy. A set of signs guiding an experience aimed toward the younger students is at ground level.
- Other signs marking a different element or theme are elevated two feet. Of course, some will take notice of both sets of signs. The intent is to provide options and encourage interaction and learning about the natural systems on the site.
- Students can assist in make signs, which would boost feelings of pride and ownership as well as mark territorial claims.
- Tall poles- 12- 15' with birdhouses, weathervane, flag and such to further define and designate stopping points, and mark turning points in the path.

Important to have establishing stopping points for those moving at a different rate- those that run versus those moving slowly. This makes it easier on adults walking with students to keep up with everyone, and maintain visual contact with students moving at faster rates.

Both design alternatives invoke a sense of mystery and curiosity by winding through the landscape.



## **CHAPTER FIVE**

### **RESEARCH DESIGN CONCLUSIONS**

Through the course of this project it has become apparent that schoolyards are an appropriate location for ecological design. From the literature review through to the design explorations, the potentials of such design to support learning and ecosystem function have been considered. Such design can be applied to the schoolyard setting in varying degrees. It is impossible for a schoolyard to transform from a place with few ecological and learning options to the other extreme of the ecological and learning spectrum overnight. Such transformations take the commitment and dedication of the school community.

Thus, community involvement is an essential part of eco-schoolyard design. This process requires an investment of time and patience on the part of the designer. This experience can also be extremely rewarding. Without this interaction, the project would be lacking a sense of ownership and connection to community, culture, and nature. Working with the community at Gladesboro has afforded insights into the priorities and conceptions about schoolyard design among parents, staff, and students. The biggest perceived obstacle is the anticipation of the cost of the project, and who should be responsible for implementing these plans.

Generally speaking, the school landscape is unclaimed territory. It belongs to everyone and no one. Who should be responsible for the implementation and maintenance of school landscape plans? Often these costs are offset by grants, private contributions, and fund-raising by the school community. There is a certain amount of frustration felt by school community members, as they may perceive schools a priority that is not funded by federal, state, or county government recourses. At Gladesboro, textbooks and even utility costs have to be absorbed by parent teacher organizations. So, the prospect of taking on additional fundraising seems like a daunting task. Partnerships with school administrators can make or break project development. Evidentially, the PTSO turnout is highest the first meeting of the year. The recommended strategy for the PTSO at Gladeboro is to show the landscape master plans and CDAC project at this meeting. At this time, hopefully a committee will form and keep the momentum building for this project. Principal Reavis plans on framing the final CDAC master plan and displaying it near the administrative office, a key point of contact with community members.

As a design experiment, the Gladesboro site was exemplary of the existing state of both physical landscape constraints as well as social constraints on the landscape, such as safety concerns, that limit the potential of eco-schoolyard development. Working with the school community allowed

me to witness a transformation of perception among some of the parents and staff about the potentials of the landscape to meet eco-schoolyard design goals. Coming into this project as an outsider, I was uncertain how the community would react to some of the ideas proposed. I was pleasantly surprised at the acceptance and interest of the staff. I was also taken by surprise by how easily the Virginia Standards of Learning could be incorporated into the eco-schoolyard concepts. Being able to show schoolyards, and design ideas that have been implemented with low budget solutions helped these community members imagine a different place at Gladesboro for their students and children. One parent remarked after the final CDAC presentation that there is much more to schoolyard landscaping than just planting a bunch of trees and shrubs, which is what she would have suggested, had she not been involved in the CDAC participatory process at Gladesboro.

The involvement of landscape architects, or outreach programs such as CDAC can play a substantial role in the organization of ideas and community members. Visioning exercises and landscape master plan development can make a considerable difference in the attitudes of community members, and can be a powerful fundraising tool. The reality of under funding in the school system begs the generosity of a full range of community members and organizations.

Ideally, ecological design methods would be embraced early in the design process. The school building itself could be integrated into the landscape in a holistic manner, facilitating a connection between the inside and outside of the classroom. Additional money allocation and funding on the federal, state, and county level would allow the progression of the greening schoolyard movement greatly.

The five systems outlined in this book are intended to provide a framework for discussion and consideration in the ecological design of schoolyards. These systems are representative of the essential life processes. By integrating and revealing these systems in the schoolyard environment, the potential to learn and experience the interdependence between these systems reinforces the development of an environmental ethic, awareness, and appreciation.

At the onset of this project, I had no idea that there was such a thing as a greening schoolyard movement. Most of my interactions with schools had been as a passerby, or casual observer. I usually had an emotional response to the often bleak conditions apparent through this interaction. I felt badly that so many students were forced to spend time in spaces devoid of nature and options as a user. Through the course of my research, I have had the privilege of visiting schoolyards that have reversed and reclaimed paved lots by transforming them into havens for plants, animals and community members. I hope this project will assist schools contemplating the potentials of their schoolyard.

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<http://www.cefpi.org/pdf/issue11.pdf>

## **APPENDIX**

### **POTENTIAL FUNDING SOURCES FOR SCHOOLYARD LANDSCAPING GOALS**

Looking for funding within the community is an excellent way to begin fundraising. Resources such as local hardware, lumber and nursery stores are possible sources of donated materials. Local garden clubs master gardener programs, as well as Kiwanis, Rotary and other community service organizations are also potential resources. Placing notices in the local paper or on the radio can also be an excellent way of making “wish lists” known to community members. Community members, or organizations that no longer have a use for these items may donate tools, plants, and even greenhouses to schools. Wood shop classes at local high schools may make benches or other items for the schoolyard. Remember the motto: “start small, dream big.” You can always build on your successes, and you have to start somewhere!

#### Fundraising Resources

“Make your World Better” Grant Program

The Center for EE

Antioch, New England Graduate School

40 Avon Street

Keene, NH 03431

603-357-3122

[www.cce.ane.org](http://www.cce.ane.org).

#### Schoolyard Habitats

National Wildlife Federation-Funding, Resources

8925 Leesburg Pike

Vienna, VA 22184

703-790-4582

[www.nwf.org/habitats/schoolyard/](http://www.nwf.org/habitats/schoolyard/)

#### National Gardening Association

1100 Dorset Street

Burlington, VT 05403

800-538-7476

<http://www.kidsgardening.com/grants.asp>

Environmental Protection Agency  
Office of Environmental Education  
Washington, DC  
202-260-4965

[www.epa.gov/enviroed](http://www.epa.gov/enviroed)

Resource Conservation and Community Development Division  
USDA Natural Resources Conservation Service  
Washington, DC  
202-720-2847

[www.rcdnet.org](http://www.rcdnet.org)

Community Tree Planting Program  
National Tree Trust  
1120 G Street NW, S-770  
Washington DC  
800-846-8733  
nationaltreetrust.org

Virginia Environmental Endowment  
Three James Center  
PO Box 790  
Richmond, VA 23218  
804-644-5000

[www.vee.org](http://www.vee.org)

The Cook's Garden- write to request seed packet donation  
PO Box 535  
Londonderry, VT 05148

[www.cooksgarden.com](http://www.cooksgarden.com)

Learn and Serve America- provides funding for service learning programs  
c/o The Corporation for National Service  
1201 New York Avenue  
Washington, DC 20325  
202-606-5000

[www.learnandserve.org](http://www.learnandserve.org)

Project Wild Action Grant  
Availability varies from state to state.  
e-mail: [natpwild@igc.apc.org](mailto:natpwild@igc.apc.org)  
Website: <http://eelink.umich.edu/wild/>

Lilyponds for Youth Matching Grant  
Grant that will match each dollar spent on merchandise from Lilyponds water garden catalog  
1-800-825-5459- ask for application

American Association of School Administrators- Awards Department  
Civic Star Award

801 N Quincy Street Suite 700  
Arlington, VA 22030-1730  
703-875-0727

[Http://www.aasa.org](http://www.aasa.org)

e-mail: [scannon@aaasa.org](mailto:scannon@aaasa.org)

Anthem Blue Cross Blue Shield- Healthy Minds, Bodies, and Communities

<http://www.anthem-inc.com/jsp/maroon/frameset.jsp?redir=http://www.anthem-inc.com/jsp/maroon/about/guidelines.jsp>

Check website for info about Grants

Box tops for Education

<http://www.boxtops4education.com/how/index.asp>

Braitmayer Foundation

213 Court Street Suite 1101

Middletown, Connecticut 06457-3351

860-638-5026

<http://www.braitmayerfoundation.org/>

Bricks “R Us

Personalized bricks or tiles sold as fundraising option

E-mail: [info@brickrus.com](mailto:info@brickrus.com)

<http://www.brickrus.com/theconcept/index.htm>

Capitol Quest Inc.

A fundraising consulting firm

<http://www.capitalcampaigns.com/>

Captain Planet Foundation

Grants awarded in every state, as well as international

<http://www.captainplanetfdn.org/>

The Coca-Cola Company

[http://www2.coca-cola.com/citizenship/foundation\\_guidelines.html](http://www2.coca-cola.com/citizenship/foundation_guidelines.html)

Colgate Youth for America

Award grant monies to clubs contributing to community

[http://www.colgate.com/cp/corp.class/colgate\\_cares/youthForAmer.jsp](http://www.colgate.com/cp/corp.class/colgate_cares/youthForAmer.jsp)

Cottonwood Foundation

Awards grants to those that: protect the environment, promote cultural diversity, empower people to meet their basic needs, and rely on volunteer efforts

<http://www.cottonwoodfdn.org/howapply.html>

Dunn Foundation

K-12 Grant Program

Grants that support “visual environmental education”

<http://www.dunnfoundation.org/rfp.htm>

The Foundation Center

“Helping Grantseekers Succeed”

<http://www.fdncenter.org/>

National 4-H Council:

Grant funding for activities such as: Youth Action/Community Service, Community Tree Planting, Feeding the Hungry

<http://www.fourhcouncil.edu/programs/grants/default.asp>

Funding Factory

Realize fundraising goals through recycling:

<http://www.fundingfactory.com/Default.asp>

Fund-Raising.com

Fund raising ideas and links

<http://www.fund-raising.com/fundraising-products.htm>

Empties for Cash

Recycle inkjet cartridges for cash

<http://www.fund-raising.com/cgi-bin/ybf.cgi?url==http://www.empties4cash.com%20>

Nonprofit Charitable Orgs

Info/links about non-profit and fundraising programs

<http://www.nonprofit.about.com/>

Green Schools- the Center for Environmental Education

“Green School” funding information

<http://greenschools.schoolsgogreen.org/funding.shtml>

Education World

Grant Resources

<http://www.educationworld.com/grants/>

Native Energy Fundraiser

<http://www.nativeenergy.com/index.html?ancei>

Wild Ones- Seeds for Education

Grants for School Gardens and Nature Areas

<http://www.for-wild.org/seedmony.htm>

National Science Foundation

4201 Wilson Blvd.

Arlington, VA 22230

703-292-5111

<http://www.nsf.gov/home/grants.htm>

Schoolgrants.org

Links to Federal, State, and Regional grant opportunities for k-12 schools, educators, and students

[http://www.schoolgrants.org/grant\\_opps.htm](http://www.schoolgrants.org/grant_opps.htm)

The Orion Society

Teaching Fellowships and Awards

[http://www.oriononline.org/pages/os/education/index\\_education.html](http://www.oriononline.org/pages/os/education/index_education.html)

Project Learning Tree  
Greenworks Grants

<http://www.plt.org/greenworks/index.cfm>

Environmental Excellence Awards  
Anheuser- Bush Adventure Parks sponsored grant program  
<http://www.seaworld.org/eea/index.htm>

Toyota TAPESTRY grant program  
<http://www.nsta.org/programs/tapestry/program.htm>

Hasbro Charitable Trust  
Grants for the communities in which they operate  
<http://www.hasbro.org/pl/page.grantmaking/dn/ct/default.cfm>

Hasbro Children's Foundation  
Grants guided by children, families, communities, empowerment and play  
<http://www.hasbro.org/hcf/>

National Fish and Wildlife Foundation in Partnership with the Natural Resources Conservation Service  
Matching Grants for Conservation on Private Lands  
<http://www.nfwf.org/programs/nrcsnacd.htm>

Home Depot, Inc.  
[http://www.homedepot.com/HDUS/EN\\_US/corporate/corp\\_respon/outreach\\_grants.shtml](http://www.homedepot.com/HDUS/EN_US/corporate/corp_respon/outreach_grants.shtml)

American Honda Foundation  
<http://www.hondacorporate.com/community/?subsection=foundation>

Irwin Andrew Porter Foundation  
Strong Preference given to Midwest locations  
<http://www.iapfoundation.org/lookfor.html>

Jennings Park, Play Areas, Site Products  
Fundraising Ideas  
<http://www.jenningsmi.com/fundraising.htm>

Lindbergh Foundation  
Grants in natural resources, agriculture, waste minimization, education,  
<http://www.lindberghfoundation.org/grants/index.html>

Lowe's Charitable and Educational Foundation  
<http://www.lowes.com/lkn?action=pg&p=AboutLowe's/Community>

Mitchell Kapor Foundation  
Grants to improve human well-being and sustaining healthy ecosystems  
<http://www.mkf.org/>

Monsanto Fund

Grants for the agricultural abundance, the environment, science education, and community  
<http://www.monsantofund.org/>

Newman's Own  
Charitable Grant Applications  
[http://www.newmansown.com/5b1\\_grants.html](http://www.newmansown.com/5b1_grants.html)

Nikebiz.com  
Grants for community-based youth-oriented organizations to refurbish or construct running tracks  
<http://www.nike.com/nikebiz/nikebiz.jhtml?page=26&item=bowerman>

National Wildlife Federation  
Wild Seed Mini- Grants  
<http://www.nwf.org/schoolyardhabitats/minigrants.cfm>

Fundraising ideas using original artwork  
<http://www.originalworks.com/>

Sponsorship.com  
About sponsorship  
<http://www.sponsorship.com/>

Stonyfield Farm  
Profits for the Planet Program  
<http://www.stonyfield.com/Ido/ProfitsforthePlanetProgram.shtml>

National Program for Playground Safety  
Resources for Playground Safety Funding  
<http://www.uni.edu/playground/resources/funding.html>

Wal-Mart Good Works  
<http://www.walmartfoundation.org/wmstore/goodworks/scripts/index.jsp>

The Christopher Columbus Awards  
Grants for middle school students, encouraging exploration of positive change in their community  
<http://www.nsf.gov/od/lpa/events/bayernsf/start.htm>

International Youth Exchange Association USA  
IFYE 4-H for World Understanding Mini-Grants  
Grants to enhance international understanding  
Seed Money grants  
<http://www.ifyeusa.org/association/minigrants.html>

Do Something Foundation  
Grants for young leaders with problem solving ideas  
<http://www.dosomething.org/>

Petals (Protect the Environment Through Action Learning and Service)  
National Garden Clubs and Shell Oil  
Provide funding for projects that promote education, conservation, beautification and other civic improvements  
[http://www.gardenclub.org/who\\_we\\_are/PETALS.shtml](http://www.gardenclub.org/who_we_are/PETALS.shtml)

America the Beautiful Fund

Free seeds for millennium gardens

[http://www.millenniumgreen.usda.gov/kids/freeseeds\\_order.html](http://www.millenniumgreen.usda.gov/kids/freeseeds_order.html)

Community Foods Projects Competitive Grants Program

<http://attra.ncat.org/guide/cfpcgp.htm>

Handspring Foundation

Grant monies to programs for at risk youth, and children in need

<http://www.handspring.com/company/foundation/>

Ronald McDonald House Charities

Grants for local, community, or area efforts

[http://www.rmhc.com/grant/grant\\_app/index.html](http://www.rmhc.com/grant/grant_app/index.html)

JCPenny Afterschool Program

Funding and Volunteer support for after school programs

<http://jcpennyafterschool.org/>

Kmart

Leaders on Learning Community Program

<http://www.kmartcorp.com/corp/community/index.stm>

National Youth Development Information Center

Funding Opportunities for Youth Development Programs

<http://www.nydic.org/nydic/funding.html>

US Department of Labor and Office of Youth Services

Sources of Funding for Youth Services

[http://www.doleta.gov/youth\\_services/maps-funding.asp](http://www.doleta.gov/youth_services/maps-funding.asp)

Advice on Grant Writing

EPA Grant Writing Tutorial

<http://www.epa.gov/seahome/grants/src/grant.htm>

Writing from the Winner's Circle

A guide to competitive grant proposals

<http://www.unl.edu/nepscor/newpages/noframes/pubs/winners/writing.html>

A list of links about grant writing from the University of Idaho's website:

<http://www.uro.uidaho.edu/Grantsmanship/propWriteGuide.htm>



## ALICE FONG YU

SAN FRANCISCO,  
CALIFORNIA

SIGNS ARE AN EXCELLENT WAY TO MARK ENTRANCES AND CONVEY OWNERSHIP BY THE SCHOOL COMMUNITY.



WATER IS A DYNAMIC ELEMENT IN THE SCHOOL LANDSCAPE. THE LEARNING AND PLAY OPPORTUNITIES ARE CLOSELY LINKED IN THIS INNOVATIVE AND ADAPTIVE WATERING SYSTEM AT ALICE FONG YU. TAKING FULL ADVANTAGE OF THE SLOPED LANDSCAPE, A SERIES OF MOVABLE "GUTTERS" ALLOW STUDENTS TO ROUTE WATER TO THEIR CLASSROOM GARDEN PLOTS. THE STUDENTS PICTURED HERE ARE FLOATING A NASTURTIUM FLOWER THROUGH THEIR WATERCOURSE.





## **FAIRMONT SCHOOL** **SAN FRANCISCO, CALIFORNIA**

THESE MURALS CONVEY A SENSE OF OWNERSHIP, AND REINFORCE SCHOOL IDENTITY. NOTICE THE WORKDAY ADVERTISED ON THE CHALKBOARD OF THE LOWER PHOTOGRAPH.



## ALICE FONG YU

SAN FRANCISCO,  
CALIFORNIA

THESE STUDENTS ARE WORKING ON A PATTERNING EXERCISE FOR THEIR KINDERGARTEN CLASS (A).



STRAW BALE SEATS DEFINE THIS OUTDOOR CLASSROOM (B).



SIGNS IN THE LANDSCAPE REINFORCE READING AND LANGUAGE SKILLS (C).



C.



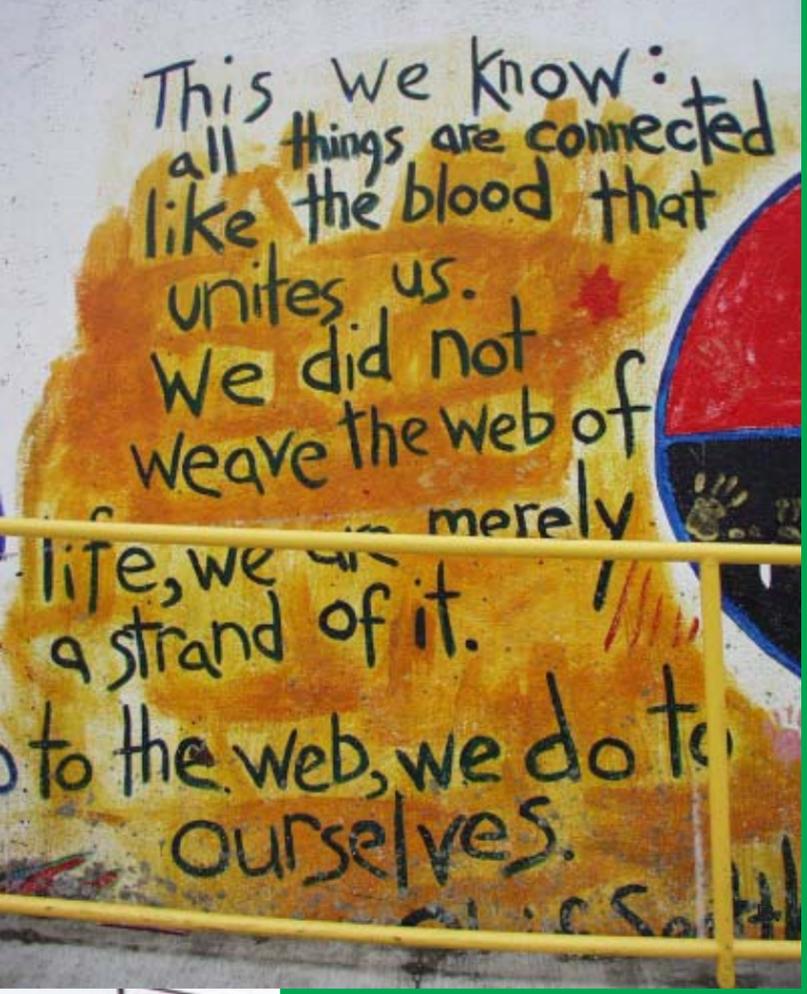
A.

# ALICE FONG YU

SAN FRANCISCO,  
CALIFORNIA

PARTICIPANTS IN A SOLAR POND ECOLOGY WORKSHOP INSTALLED A SOLAR PANELS TO FUEL THE PUMP IN A NEWLY BUILT POND. THE SOLAR PANELS ARE MOUNTED ON PIVOTING STRUCTURES IN REACH OF THE STUDENTS TO ENCOURAGE "HANDS ON" LEARNING.

MURALS CAN SPARK IMAGINATION AND CURIOSITY.



C.



## LOS ALTOS HILLS

LOS ALTOS,  
CALIFORNIA

GROWING GOURDS  
YIELD THE PROMISE  
OF ART PROJECTS.

SCHOOL-AGED CHILDREN  
NEED PRIVATE SPACES TO  
GATHER AS A SMALL  
GROUP OR INDIVIDUALLY.  
GOURD VINES DEFINE THIS  
CHILD-SIZED SPACE.





A

# LOS ALTOS HILLS

## LOS ALTOS, CALIFORNIA



B



C



d

A RAIN GAUGE (A) IS INCORPORATED INTO AN INTERPRETIVE SIGN AT LOS ALTOS HILLS, AN EDUCATIONAL FARM IN CALIFORNIA. TALL FLOWERS (B) BOTH DEFINE SPACE AND VISUAL INTEREST. . THIS EXPERIMENTAL GARDEN (C) FOCUSES ON FOUND OBJECTS CONVERTED INTO PLANTERS. THIS COBB PRODUCE STAND (D) IS ON AVENUE FOR STUDENTS AND VOLUNTEERS TO SELL PRODUCE FROM THE FARM.

# SAN FRANCISCO COMMUNITY DAY

## SAN FRANCISCO, CALIFORNIA

AT SAN FRANCISCO COMMUNITY DAY SCHOOL, THEY CONSTRUCTED A COBB STOVE IN THE SHAPE OF A FROG (A). IN THIS WOOD FIRED OVEN THEY COOK PIZZA FROM THEIR PIZZA GARDEN FOR THE SCHOOL COMMUNITY. THEY ALSO HAVE A SMALL GREENHOUSE AND SEVERAL CLASSROOM SIZED GATHERING SPACES (B).



A.



B.



# SAN FRANCISCO COMMUNITY DAY

## SAN FRANCISCO, CALIFORNIA

ACCESS TO FRESH WATER (A, C) IS INCORPORATED INTO A SAND PLAY AREA. SEVERAL CAST FOSSILS (B) ARE BURIED IN THE SAND AND ARE DUG UP IN AN IMAGNATIVE ARCHEOLOGICAL FASHION. ONE OF THE INFORMAL CLASSROOM GATHERING SPACES (D) IS PICTURED AT THE BOTTOM OF THE PAGE.



A



B



C



D

# PETER BURNETT ACADEMY

## SAN JOSE, CALIFORNIA

A LOW BRICK WALL WITH A LUSH ARBOR SHADING SEATING SURROUNDS A LARGE GRASSED AREA AT PETER BURNETT ACADEMY IN SAN JOSE, CALIFORNIA (A). A STAGE IS FRAMED BY A TRIMMED HEDGE ON ONE SIDE OF THE YARD (B). ONE OF THE COURTYARDS HAS BEEN LANDSCAPED TO CREATE A WELCOMING SPACE TO STUDENTS AND WILDLIFE ALIKE (C).



B.



A.



C.

# LOS ALTOS HILLS

## LOS ALTOS, CALIFORNIA

EDUCATIONAL ELEMENTS  
AT LOS ALTOS HILLS THAT  
COULD BE APPLIED TO A  
SCHOOL LANDSCAPE IN-  
CLUDE INTERPRETIVE MA-  
TERIALS SUCH AS AN IN-  
TERACTIVE "SOIL BOX,"  
FIBER AND DYE GARDEN,



**Questionnaire for Faculty and Staff**

Gladesboro Elementary School Landscape Design

Carroll County, Virginia

January 21, 2003

The Community Design Assistance Center (CDAC) is working on a landscape master plan for Gladesboro Elementary School. This questionnaire gives you an opportunity to express your ideas and concerns. Your responses will help us with the design process. It should take you about 10 minutes to fill out.

Please circle the letter(s) of your responses to each question. You may circle more than one response and additional suggestions are encouraged.

1. What type of outdoor educational opportunities would you like to see, if any?

- a. Amphitheater (for larger gatherings)
- b. Classroom sized gathering area
- c. Interpretive trail
- d. Water garden
- e. Classroom garden plots
- f. Community garden plots
- g. Supervised adventure play

Other: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. What amenities would be helpful to conduct class outside?

- a. Fresh water access
- b. Table or platform
- c. Open grassed space
- d. Storage for materials
- e. Overhead covering
- f. Benches

Other: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. How would an outdoor classroom benefit your curriculum? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

~Continue on other side~

4. What do you like about your existing school grounds?\_\_\_\_\_

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5. What do you dislike or perceive to be problematic about the current layout of your school grounds? \_\_\_\_\_

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6. How would you rate the current layout of your schoolyard for supporting “hands-on” learning on a five-point scale? 1 being the ideal learning environment, 5 being the worst.

1            2            3            4            5

7. How would you define nature? Is nature is accessible to the students and staff on school grounds?

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8. What grade/subject(s) do you teach? or What is your position?\_\_\_\_\_

9. How many years have you been working at Gladesboro Elementary?\_\_\_\_\_

Additional Suggestions: \_\_\_\_\_

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Thank you for taking the time to complete this questionnaire. If you have additional comments or questions feel free to contact: Sarah Belcher: [sabelche@vt.edu](mailto:sabelche@vt.edu) or Shawn Tofte: [ctofte@vt.edu](mailto:ctofte@vt.edu)  
Community Design Assistance Center (CDAC): 540-231-5644



# Parent Questionnaire ~ Gladesboro Elementary

February 5, 2003

Carroll County Public Schools has received grant funding from the Virginia Department of Forestry to assist Gladesboro Elementary School in developing a Conceptual Landscape Master Plan. To this end the Community Design Assistance Center (CDAC), an outreach center at Virginia Tech will be working with the Gladesboro School Community to develop a plan that reflects your needs and ideas. This questionnaire should take about 10 minutes to complete and will help us gauge your attitudes and ideas. Please answer as honestly as possible, adding any additional information you feel could guide the CDAC team in the development of the Landscape Master Plan. Your input is vital to the success of this project. **Please send the completed questionnaires back to school with your child by Monday, February 10th. Thank you for your participation.**

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1. Number of your children attending Gladesboro Elementary: \_\_\_\_\_
  2. Grade(s) of children at Gladesboro (*circle*):    **K**      **1**      **2**      **3**      **4**      **5**
  3. Any additional children attending Gladesboro in the future? How many? \_\_\_\_\_
  4. Does your child(ren) participate in after school activities that take place on school grounds? (*e.g. cub scouts, girl scouts, sports?*) If yes, please list.
- 

5. On average, how much time during the day does your child spend outside after school? (*Circle one*)

<i>During the Fall:</i>	<b>None</b>	<b>1/2 Hour</b>	<b>1 Hour</b>	<b>2 Hours</b>	<b>3+Hours</b>
<i>During the Winter:</i>	<b>None</b>	<b>1/2 Hour</b>	<b>1 Hour</b>	<b>2 Hours</b>	<b>3+Hours</b>
<i>During the Spring:</i>	<b>None</b>	<b>1/2 Hour</b>	<b>1 Hour</b>	<b>2 Hours</b>	<b>3+Hours</b>
<i>During the Summer</i>	<b>None</b>	<b>1/2 Hour</b>	<b>1 Hour</b>	<b>2 Hours</b>	<b>3+Hours</b>

6. Does your family utilize the school grounds during non-school hours? (*Circle all that apply*)

<b>Never</b>	<b>Before School</b>	<b>After School</b>	<b>During Summer</b>
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7. Would your family use school property more often if the grounds had more to offer?    **Yes**      **No**

8. Approximate distance traveled (one-way) from home to Gladesboro Elementary School?  
 0-2 miles     3-5 miles     6-10 miles     11-20 miles     21+ miles

9. How does your child get to school? (*Circle all that apply*)  
**Walk**      **Bus**      **Carpool**      **Bike**      **I drive my child to school**

10. What do you like about the school grounds?  


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11. What do you dislike or perceive to be problematic about the school grounds?  


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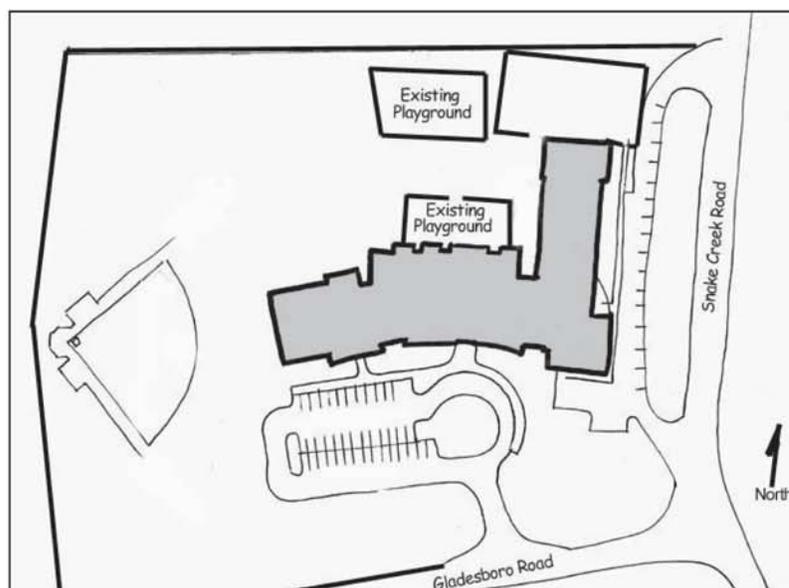
12. Do you, or does your child enjoy gardening or landscaping activities?    **Yes**      **No**

13. Would you be willing to volunteer for a community workday at Gladesboro?    **Yes**      **No**

14. Rate the facilities you would like to see in the schoolyard, (*1-Least preferable, 5-Most preferable*)  
 ~feel free to circle the same number more than once

A. Amphitheater ( <i>sized for assemblies</i> ):	1	2	3	4	5
B. Outdoor Classroom	1	2	3	4	5
C. Interpretive Trail ( <i>with informative signs</i> ):	1	2	3	4	5
D. Water Garden:	1	2	3	4	5
E. Classroom Garden plots:	1	2	3	4	5
F. Covered Area ( <i>protection from sun/ rain</i> ):	1	2	3	4	5
G. Greenhouse:	1	2	3	4	5
H. Adventure Play Area ( <i>i.e. low ropes course, movable props</i> ):	1	2	3	4	5
I. Habitat Garden ( <i>planting to attract wildlife</i> ):	1	2	3	4	5
J. Memory Garden ( <i>area of reflection, memorial plantings</i> ):	1	2	3	4	5
K. Weather Station ( <i>record temp/monitor weather patterns</i> ):	1	2	3	4	5
L. Walking Trail With Exercise Stations:	1	2	3	4	5
M. Benches	1	2	3	4	5
N. Picnic Tables	1	2	3	4	5
O. Water Fountains	1	2	3	4	5
P. Additional Playground Equipment	1	2	3	4	5
Q. Natural Area	1	2	3	4	5

15. Based on your most preferred facilities from Question 14, place the corresponding letter on the following base map where you feel is the most suitable location on the school grounds.



16. When is the most convenient time for you to attend a 2 hour community workshop?(Check all that apply)  
 ( )Not interested ( )Weekdays, 3:30- 5:30 ( )Weeknights,7:00-9:00 ( )Saturday

**Thank you...Your help is greatly appreciated!**

*If you would like to know the results of this questionnaire, or have any questions or comments, please contact:*

**Community Design Assistance Center**  
 101 South Main Street, Suite 2, Blacksburg, VA 24061  
 Sarah Belcher and Shawn Tofte  
 Sarah Belcher - [sabelche@vt.edu](mailto:sabelche@vt.edu)  
 Shawn Tofte - [ctofte@vt.edu](mailto:ctofte@vt.edu)  
 (540)-231-5644



**PARENTS! MARK YOUR CALENDARS!**  
**TUESDAY FEBRUARY 10, 6:30 PM!**

The Community Design Assistance Center (CDAC) will be joining your regularly scheduled PTO meeting on Tuesday, February 10. The Design Center is an outreach of Virginia Tech's College of Architecture and Urban Studies. CDAC provides planning and design assistance to communities throughout Virginia. A CDAC team of student landscape architects is working on a Landscape Master Plan for Gladesboro Elementary. We would like to involve the community in the planning process as much as possible. At the PTO meeting, we will explain about the design process and schedule a community workshop. If you cannot attend the meeting, feel free to contact one of the CDAC team members. Thank you.

Community Design Assistance Center  
College of Architecture & Urban Studies  
Sarah Belcher [sableche@vt.edu](mailto:sableche@vt.edu)  
Shawn Tofte [ctofte@vt.edu](mailto:ctofte@vt.edu)  
101 S. Main Street, Suite 2  
Blacksburg, VA 24061  
(540) 231-5644 Fax:(540) 231-6089  
<http://cdac.arch.vt.edu>



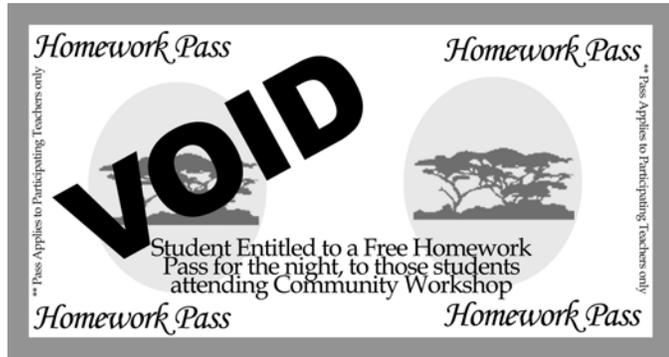
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101 S. Main Street, Suite 2  
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<http://cdac.arch.vt.edu>

\*\*\*\*\* **ATTENTION PARENTS AND STUDENTS** \*\*\*\*\*

As you know, the Community Design Assistance Center (CDAC) is working on a Landscape Master Plan for your school. **Your ideas are extremely important** and we want to maximize the number of people attending the **2-hour workshop**. This workshop will consist of brainstorming and mapping activities for all participants. These activities will help the CDAC team understand **your ideas** and form **appropriate design solutions**. To be as diplomatic as possible, we have established four potential workshop dates. Due to the limited timeframe for this project, we need to hear back from you as soon as possible to confirm the best meeting time. We will keep you posted on the final date.



*Please detach and return with student*

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**Parents and students are encouraged to attend.** Participating teachers have agreed to issue a "Homework Pass" for that night to those students attending the workshop. For those interested please fill out this form and return to the school as soon as possible. Thank You!

I can attend a Community Workshop on the following dates: *(check all that apply)*:

- Tuesday, February 25, from 6:30-8:30pm**
- Thursday, February 27, from 6:30-8:30pm**
- Saturday, March 1, from 10-12am**
- Tuesday, March 4, from 6:30-8:30pm**

Name (Please Print) \_\_\_\_\_

# of people attending \_\_\_\_\_

Phone Number \_\_\_\_\_

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**\*\*\* Please plan on bringing your favorite drink or snack to share\*\*\***

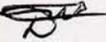
**Institutional Review Board**

Dr. David M. Moore  
IRB (Human Subjects) Chair  
Assistant Vice Provost for Research Compliance  
CVM Phase II - Duckpond Dr., Blacksburg, VA 24061-0442  
Office: 540/231-4991; FAX: 540/231-6033  
e-mail: moored@vt.edu

28 February 2003

**MEMORANDUM**

TO: M. Bryant 0113  
S. Belcher 0113

FROM: David M. Moore 

SUBJECT: **Expedited Approval** – “School yards: Models for Sustainability” – IRB #  
03-090

This memo is regarding the above-mentioned protocol. The proposed research is eligible for expedited review according to the specifications authorized by 45 CFR 46.110 and 21 CFR 56.110. As Chair of the Virginia Tech Institutional Review Board, I have granted approval to the study for a period of 12 months, effective February 28, 2003.

Approval of your research by the IRB provides the appropriate review as required by federal and state laws regarding human subject research. It is your responsibility to report to the IRB any adverse reactions that can be attributed to this study.

To continue the project past the 12 month approval period, a continuing review application must be submitted (30) days prior to the anniversary of the original approval date and a summary of the project to date must be provided. My office will send you a reminder of this (60) days prior to the anniversary date.

cc:File  
D. Bork 0113

## PARTIAL PLANT LIST

COMMON NAME	BOTANICAL NAME	ORNAMENTAL VALUE	LIGHT PREFERENCE	HEIGHT	WATER NEEDS	HABITAT VALUE
Wild White Yarrow	<i>Achillea millefolium</i> var. <i>lanulosa</i>	Bloom May-September, Fragrant Foliage	Full Sun or part shade	1-2'	Moderate Water	Medicinal, Nectar Plant attracting a number of butterflies
Butterfly Weed	<i>Asclepias tuberosa</i>	Orange Flowers, showy silky seedpods	Full Sun	2-3'	Low to Moderate Water	Nectar Plant, - Butterflies, caterpillars feed on leaves, develop bitter taste protection from predators
Purple Coneflower	<i>Echinacea purpurea</i>	Pink Flowers in summer, attractive seedpods	Full sun	2-3'	Moderate	Medicinal, Birds feed on seeds, butterflies on Nectar
Maximilian's Sunflower	<i>Helianthus maximiliani</i>	Late Blooms, multi0 stemmed yellow blooms	Full Sun	5-10'	Moderate	Edible, Flowers attract numerous butterflies, excellent birdseed,
Wild Beramot	<i>Monarda fistulosa</i>	Purple Flowers, Fragrant foliage	Full Sun or Part Shade	2-3'	Moderate-high	Medicinal( antibacterial/ anti-fungal), wide range of butterflie, hummingbirds, bees and diurnal moths attracted to flowers
Sundrops	<i>Oenothera missoutiensis</i>	Fragrant, Lemon- yellow flowers	Full Sun	6-12"	Moderate-High	Nectar attracts hummingbirds and butterflies, caterpillars feed on plants, tree crickets feed on caterpillars
Wild Columbine	<i>Aquilegia canadensis</i>	Red and yellow flowers in spring	Filtered Shade	12-15"	Moderate	Longtongued moths, checkerspot butterflies,, and hummingbirds are attracted to nectar. Ccolumbine duskywing butterfly lays it's eggs on the foliage.

New England Aster	<i>Aster novae-angliae</i>	Purple flowers in late summer to fall	Full Sun	6'	Moderate	Asters' nectar attracts butterflies, one of the few food sources late season.
Bee Balm	<i>Monarda didyma</i>	Red Flowers	Full Sun	3-4'	Moderate to high	Nectar attracts bees, butterflies, and hummingbirds
Black-eyed Susans	<i>Rudbeckia hirta</i>	Yellow daisy like flower with dark brown centers	Full Sun	3'	Low to Moderate	Numerous sources of nectar on composite flowers, plant food for larvae of silvery checkerspot
Turk's-cap lily	<i>Lilium superbum</i>	Dark spotted orange flowers in summer	Full sun or Partial Shade	3-6'	Moderate	Attracts hummingbirds
Summer phlox	<i>Phlox paniculata</i>	White, lavender, and pink flowers in summer	Full sun or Partial Shade	3'	Moderate	Attracts moths, hummingbirds, and butterflies
Joe-pye Weed	<i>Eupatorium purpureum</i>	Purple flower clusters late summer to fall	Full sun to part shade	4-7'	High	Late season butterflies feed on nectar, including spicebush swallowtail
Blue Woodland phlox	<i>Phlox diviracada</i>	Fragrant blue to white flowers in spring	Part shade to shade	8-12"		
Cardinal Flower	<i>Lobelia cardinalis</i>	Red flowers in late summer	Sun and Shade	2-4'	High	Attracts hummingbirds as well as spicebush, pipevine, and two-tailed swallowtail butterflies. Green tree frogs eat visiting insects.
Winterberry	<i>Ilex verticillata</i>	Deciduous Holly. Winter interest as berries ripen. Need 1 male/10 females	Half sun- full sun	10'	Moderate to High	Berries, cover for birds. Wollybear caterpillar feeds on leaves. Need male to pollinate females.

Spicebush	<i>Linera benzoin</i>	Early spring flowers, nice fall color, and bark, red fruit. Foliage and twig release spicy odor when crushed.	Filtered Sun or Partial Shade	3-10'	Moderate to High	Fruit valuable food source for migrating birds. One of two known host for spicebush swallowtail butterfly. (The other is sassafras)
Allegheny Serviceberry	<i>Amelanchier taevis</i>	White blooms early spring, red fruits June	Partial Shade	25'	Moderate to High	Edible, Berries food source when few fruits are ripe. Songbirds and mammals
Eastern Redbud	<i>Cercis canadensis</i>	Purple blossoms early spring, seed pods	Full Sun or Partial Shade	25'	Moderate	Sustains larval stages of Henry's elfin butterfly, nice nesting sites for birds
Sassafras	<i>Sassafras albidum</i>	Yellowish flowers in early spring resulting in blue fruit, Red leaves in fall.	Full Sun	60'	Moderate	Medicinal, Eastern kingbird, phoebe and pileated woodpeckers feed on its fruit. Host of spicebush swallowtail butterfly
Drooping Leucothoe	<i>Leucothoe fontanesiana</i>	Fragrant white clusters early spring-summer, evergreen with purple tint	Part shade to shade	3-6'		
Virginia sweetspire	<i>Itea virginica</i>	Fragrant, white clusters in late spring, bright red fall color	Sun to shade	4-8'	Adaptive	
Buttonbush	<i>Cephalanthus occidentalis</i>	White flowers in summer, seedheads in fall	Full to partial sun	3-10'	High	Butterflies and bees attracted to flowers, ducks feed on seeds
Witch hazel	<i>Hamamelis virginiana</i>	Yellow flowers immediately succeed yellow leaves	Full shade to partial sun	12-20'	Low to moderate	Medicinal Seeds attract grouse and squirrels in winter
American Hornbeam	<i>Carpinus caroliniana</i>	Ash gray bark and reddish fall colors	Sun and Shade	20-40'	Moderate, will adapt to dry	Good nesting and feeding tree for birds, and

						mammals
Highbush blueberry	<i>Vaccinium corybosum</i>	White flowers late spring, blueberries, red fall color	Sun to partial shade	6-9	Requires acid soil	Edible berries, for birds and mammals
Red Buckeye	<i>Aesculus pavia</i>	Red and yellow flowers in spring, Red shiny seeds in October poisonous to people and cattle	Full sun to shade	10-25'	Moderate	Nectar of spring flowers brings ruby-throated hummingbirds
Pawpaw	<i>Asimina triloba</i>	Interesting leaves turn soft yellow in fall, spring flowers start green and turn maroon	Full sun to part shade	30-40'	Moderate	Edible, Raccoons, gray squirrels and opossums feed on fruit. Larvae of the zebra swallowtail butterfly feeds on leaves.
Sweet Bay	<i>Magnolia virginiana</i>	Evergreen, Dark green leaves with silvery underside, fragrant pale flowers from May –June, Red fruits in late summer	Full sun to shade	60'	Moderate to high	Tiger and spicebush swallowtail butterfly larvae feed on new leaves, Catbirds feed on seeds of fruit
Fringe Tree	<i>Chionanthus virginicus</i>	Feathery white flowers in spring, foliage turns clear yellow in autumn	Full sun to part shade	12-25'	Moderate	Blue fruits in late summer attract mockingbirds, catbirds, starlings, and robins, Other birds nest in branches
American Beauty Berry	<i>Callicarpa Americana</i>	Spring flowers, summer purple berries	Sun to Shade	4-10'		
New Jersey Tea	<i>Ceanothus americanus</i>	White flowers in June	Sun to part shade	3'		
Red osier Dogwood	<i>Cornus sericea</i>	Bright red stems noted in winter, white flowers in late spring, good fall color	Sun	6-10'		

Wild hydrangea	<i>Hydrangea arborescens</i>	White flowers in summer, dried flower heads fall-winter	Sun to Partial shade	3-6'		
Big Bluestem	<i>Andropogon gerardii</i>	Blue- green foliage in summer, rich bronzing fall-winter	Sun	4-7'		Native to tall grass prairies from Canada to Mexico
Arrowood viburnum	<i>Viburnum dentatum</i>	White flowers, blur-black fruit, variable red fall color	Sun to partial shade	6-10'	Wet to dry, tolerates flooding and drought	Berries food for birds and small mammals
Blackhaw viburnum	<i>Viburnum prunifolium</i>	White flower clusters, black fruit, red fall color	Berries for birds and mammals, butterflies feed on nectar	12-15	Wet to dry	Edible fruit
Split Beard Bluestem	<i>Andropogon ternaries</i>	Decidious blue green foliage, white flower plumes	Sun	4-5'		Native to dry sandy soils in Eastern US
Broom Sedge	<i>Andropogon virginicus</i>	Greenish purple foliage, orange in fall through winter, silvery flower heads	Sun	4-5'		Native to rocky outcrops in Eastern US
Tussock Sedge	<i>Carex stricta</i>	Light green foliage in summer, light tan in winter	Sun to part shade	3-7'	Both wet and average soils	Native to wet meadows from Canada to North Carolina
Sideoats Grama	<i>Bouteloua curtipendula</i>	Green gray leaves in summer, brown in fall, and light tan in winter. Flower heads have purple and orange.	Sun	18-30"	Good in loamy and dry soils	Native to prairies and rocky hills from Maine south to Virginia
June Grass	<i>Loeleria marcanthra</i>	One of the first grasses to "green up" in spring, golden brown by midsummer	Shade tolerant	12-18"	Dry soils	Native throughout Canada and US

Switch Grass	<i>Andropogon scoparius</i>	Blue- green in summer. Reddish orange in winter	Sun	12-18	Drought-tolerant	Native to Eastern US
White Woodland Milkweed	<i>Asclepias exaltata</i>	Large white flowers in summer, attractive seed pods in fall	Dappled shade	3-5'		Native to Eastern US
Swamp milkweed	<i>Asclepias incanta</i>	Pink, white flowers early summer	Sun	3-5'	Native to moist areas, adaptive	Native to Eastern US
Purple Silkweed	<i>Asclepia purpurascens</i>	Purple flowers late spring	Sun to shade	2-3'	Adaptive	Native to Eastern US
Calico Aster	<i>Aster lateriflorus</i>	Pale purple flowers late summer early fall	Sun	24-40"		Native throughout US
Boltonia	<i>Boltonia asteroides</i>	White flowers late summer into fall	Sun to part shade	4-7'		Native to Eastern US
Lance Coreopsis	<i>Coreopsis lanceolata</i>					

## VITA

Sarah Belcher graduated in May of 1995 from Warren Wilson College, where she majored in Human Studies, with a concentration in Global Perspectives. She minored in Appalachian Studies, and received a combined minor in Sociology and Anthropology. In the interim between obtaining her undergraduate degree and beginning her studies at VPI, she worked primarily as a gardener and in the printing industry, and traveled as much as possible. During her graduate career at VPI, she interned with the National Park Service at the Blue Ridge Parkway. Currently Ms. Belcher works for the USDA Forest Service at Cherokee National Forest in Southeastern Tennessee.