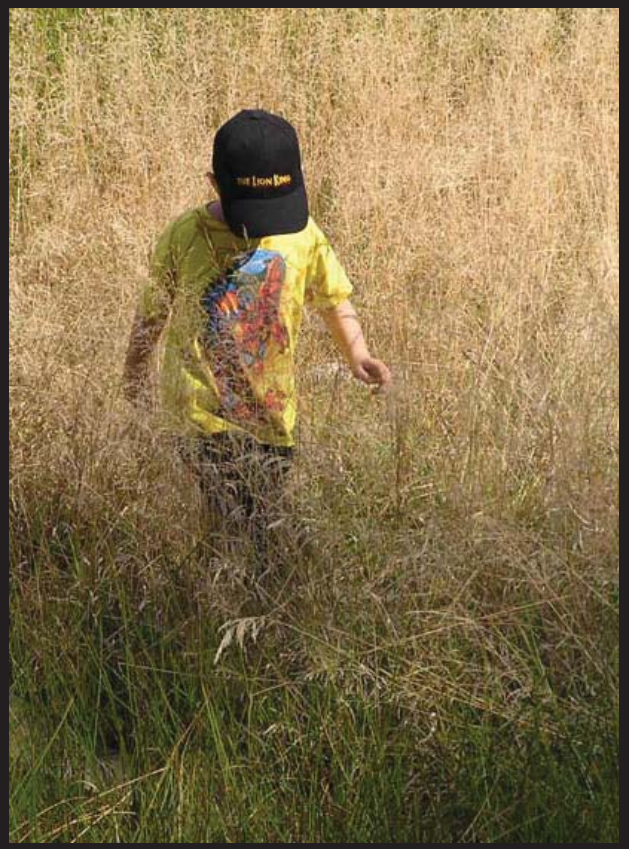

Designing for the Future:
Promoting Ecoliteracy in Children's Outdoor Play Environments

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Designing for the Future: Promoting Ecoliteracy in Children's Outdoor Play Environments

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Abstract

Rapid development of U.S. cities and towns along with changes in society and technology are dramatically affecting childhood experience. Wild places and vacant lots for kids to play in are disappearing. Parents have limited time to spend with their children and fear letting them play outside alone. Traffic is a growing safety hazard and there is an increasing desire for entertainment in the form of TV and video games over outdoor exploration. As a result, children are becoming alienated from nature. They are growing up without developing a personal attachment to their natural surroundings or an understanding of their impact on the environment.

The design of outdoor play areas can help reconnect children to their surroundings and lead to a more environmentally minded generation. Ecoliteracy suggests an understanding of ecological principles as well as appreciation for the environment and an attitude of stewardship. In addition to helping kids acquire factual knowledge, outdoor play spaces should cultivate a sense of wonder and delight and an emotional appreciation of the living world. Through research, observation and application, this thesis project identifies design criteria for promoting ecoliteracy in outdoor learning and play environments.

This work is dedicated to my mother, Rita, for always taking me out to play.

I would like to acknowledge my committee chair, Wendy Jacobson, for her time and dedication, her thoughtful comments and for helping me to find order whenever I was feeling overwhelmed. Thank you to my committee members, Terry Clements, Caren Yglesias and Margaret Bryant for all their help and encouragement throughout the thesis process. I'd like to thank Ian Tyndall and Steve Coleman of Washington Parks and People for all the time they spent talking with me about Marvin Gaye Park and the Down by the Riverside Campaign. Thanks to Kristen, my studio mate, for always listening and to all the students and faculty at WAAC for their inspirational work. I could not have done this without the support of my family and friends, in particular my husband Diego; though we were far apart in distance you were with me every step of the way.

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SECTION 1: LITERATURE REVIEW

Introduction

"If literacy is driven by the search for knowledge, ecological literacy is driven by the sense of wonder, the sheer delight in being alive in a beautiful , mysterious, bountiful world. The darkness and disorder we have brought to that world give ecological literacy an urgency it lacked a century ago."

-- David Orr (1992, p. 86)

The State of Childhood

Rapid development of U.S. cities and towns along with changes in society and technology are dramatically affecting childhood experience. Wild places and vacant lots for kids to play in are disappearing. Parents have limited time to spend with their children and fear letting them play outside alone. Traffic is a growing safety hazard and there is an increasing desire for entertainment in the form of TV and video games over outdoor exploration. As a result, children are becoming alienated from nature. They are growing up without developing a personal attachment to their natural surroundings or an understanding of their impact on the environment. The earth is facing numerous environmental threats, the future health of our planet and of our society are in danger, but we cannot expect our children to work to protect what they do not appreciate or understand.

Reconnecting children to nature

Reconnecting children to the natural environment must come from hands-on multi-sensory experience with nature, but as our urban areas develop, it becomes increasingly difficult for children to find special outdoor places where they can explore. Richard Louv (2005) has termed this growing issue "Nature Deficit Disorder." While not an official medical diagnosis, the implications of nature deficit disorder could be quite serious. Change in outdoor play behavior has been associated with the alarming rise in obesity rates and the increase in drug use for treatment of Attention Deficit Hyperactivity Disorder. Two out of ten of America's children are clinically obese (Louv, 2005) and nationwide 17% of children are on Ritalin (Orr, 2002). A growing body of research suggests that nature can have many positive effects on child development. Wells and Evans (2003) found the impact of life stress on children was lower for those with nearby opportunities to experience nature. Taylor et al. (1998) found that the amount of vegetation in

outdoor recreation areas directly affects the amount of time children play and results in higher quality creative play that cultivates language and collaborative skills.

In addition to affecting their physical and emotional development, studies suggest time spent outside as a child can influence the development of environmental values. In recent generations children developed a relationship with nature by spending time outside in the woods and undeveloped areas near their homes. We need to find a way to get kids back outside where they can discover the sense of wonder surrounding the natural world. In their book, *With People in Mind*, Researchers Rachel and Stephen Kaplan and Paul Ryan define nature to include a great variety of outdoor settings that have substantial amounts of vegetation.

> "The settings [they] emphasize are not the wild and awesome, distant and dramatic, lush and splendid. Rather the emphasis is on the everyday, often unspectacular, natural environment that is, or ideally would be, nearby. That includes parks and open spaces, street trees, vacant lots, and backyard gardens, as well as fields and forest" (1998, p.1).

Nature is everywhere; it is not something you have to take a field trip to go see. In order to help kids understand how natural processes are at work all around them we need to teach them to read what Anne Spirn (1998) refers to as the "language of landscape." The challenge is to create safe, accessible places for children to play, explore and develop an appreciation for their environment.

Paper Overview

This paper explores the current relationship between children and nature, and seeks to identify design principles for natural learning areas that will help children develop ecological awareness and environmental values. Attention is focused on elementary school age children ages 5 to 12, a period when kids are both receptive to learning and are becoming aware of their larger connection to the world around them.

Chapter 2: The Role of Childhood in Developing Environmental Values explores the concept of biophilia, the biological need for affiliating with life and nature. It goes on to look at childhood as a significant time for developing attachment to place, environmental values, and understanding of ecology.

Chapter 3: Design for Learning addresses the importance of play as a means of learning. It begins by looking at how children's play areas have changed over time to reflect evolving ideas of child development. It goes on to look at research of design professionals and psychologists related to the design elements of successful learning areas for children.

Chapter 4: Sustainability and Ecoliteracy looks at how design of children's play areas can help increase children's understanding of ecological principles. Raising a more environmentally-minded generation requires developing both a personal connection to nature and an understanding of natural systems. The chapter looks at principles for ecological design that emphasize the interrelatedness of all things.

Chapter 5: The Conclusion reflects on the literature review and analysis in order to identify principles for successful natural learning environments.

Childhood and the Development of Environmental Values

"Passion does not arrive on videotape or on a CD; passion is personal. Passion is lifted from the earth itself by the muddy hands of the young; it travels along grass stained sleeves to the heart. If we are going to save environmentalism and the environment, we must also save an endangered indicator species; the child in nature."

--Richard Louv (2005, p.158)

Introduction

The formative years of childhood are important to the way kids perceive their environment as adults. This chapter begins by looking at the concept of biophilia, the natural human tendency to affiliate with nature, and the result of fostering and ignoring this tendency. It goes on to focus on the importance of relationship to place and helping kids connect to their immediate surroundings in order to understand the value of nature as well as environmental threats. Developing this relationship on a personal and local level can help lead to an understanding of global environmental threats.

Environmental Values

To describe people's biological need for affiliating with life and nature, biologist E.O. Wilson (1984) coined the term biophilia. In *The Value of Life*, Stephen Kellert, describes a system of nine values that reflect the biophilic tendency of humans to affiliate with nature.

Table 1. Typology of Basic Values (Adapted from Kellert, 1996)

Value	Definition	Function	Change with Age
Utilitarian	Practical and material exploitation of nature	Physical sustenance/security	
Naturalistic	Direct experience and exploration of nature	Curiosity, discovery, recreation	Increase
Ecologistic-Scientific	Systematic study of structure, function, and relationship in nature	Knowledge, understanding, observational skills	Increase
Aesthetic	Physical appeal and beauty of nature	Inspiration, harmony, security	
Symbolic	Use of nature for language and thought	Communication, mental development	
Moralistic	Spiritual reverence and ethical concern for nature	Order, meaning, kinship, altruism	Increase
Dominionistic	Mastery, physical control, dominance of nature	Mechanical skills, physical prowess, ability to subdue	Decrease
Negativistic	Fear, aversion, alienation from nature	Security, protection, safety, awe	Decrease
Humanistic	Strong emotional attachment and "love" for aspects of nature	Bonding, sharing, cooperation, companionship	Decrease

Kellert notes that these values are "weak biological tendencies... requiring learning and experience if they are to become consistently stable and manifest" (1996, p.27). In order to explore formation of attitude towards nature, Kellert and his colleague Miriam Westervelt looked at how these values of nature vary among age groups. Their research identified four stages in development of values toward nature and animals.

Young children under age 6 had little understanding of the feelings of other animals and they tended to show fear of everything unfamiliar in the natural world. The next stage kids ages 6-9 exhibited more of a conscience toward the non-human world and an appreciation of the needs of other creatures. Kids ages 9-12 demonstrated a dramatic change in their factual understanding of the natural world. In what Kellert and Westervelt identified as the fourth stage, ages 13-17, children showed that they had a deeper understanding of ethical responsibilities, stewardship, and the relationship among all creatures.

Overall, Kellert and Westervelt found that the first two phases are more feeling based and the second two stages are more cognitive. Their research showed that dominionistic, negativistic and utilitarian values decreased with age while naturalistic, moralistic and ecologistic values increased with age. These observations have significance in terms of appropriate strategies for environmental education. For younger children it makes more sense to focus on developing an emotional attachment to nature. Early and middle adolescence is a good time to emphasize factual knowledge which helps kids acquire an understanding of the natural world. This emotional connection and factual understanding can then be built upon in adolescence to develop informed environmental values. If children are not exposed to the natural world and biophilic tendencies are not fostered, there is potential for biophobic tendencies to prevail.

Psychological evidence suggests that the majority of phobic occurrences relate to fear of objects that have threatened humans over time, such as snakes and spiders (Ulrich, 1993). Biophobia relates to this natural tendency to fear what is perceived as a threat. If children are not regularly exposed to nature they may develop a fear of the unknown and unfamiliar elements associated with natural areas. "Biophobia ranges from discomfort in natural places to contempt for whatever is not man-made, managed or air-conditioned." (White Hutchinson, 2001, p.1). Robin Moore and Nilda Cosco (2001), leaders of the Natural Learning Initiative at North Carolina State University, believe that allowing children to experience nature and annual cycles will dispel biophobic response. Children can be taught to appreciate rather than fear nature by exposure to appropriately designed environments that allow for development of a relationship between child and place.

Play, Place and Remembrance

In *Childhood's Domain* (1986), Robin Moore discusses the attachment to outdoor places that children develop over time through multiple play experiences. Numerous well known authors of children's literature such as A.A. Milne and Lewis Carroll write about the feeling of connection to one's surroundings and the sense of wonder associated with children's exploration of the outdoors. Moore seeks to understand the characteristics of memorable outdoor childhood places and their role in human development.

Several educators in the design field have explored this topic and found that environmental values tend to reflect childhood experience. Clare Cooper Marcus, explored how childhood experiences are reflected in the values of her landscape students by asking them to compile an environmental biography describing significant environments throughout their lives. In an analysis of 50 randomly selected biographies, Marcus found that the significance of outdoor environments stood out. Eighty-six percent of students recalled predominantly outdoor environments while only three percent described indoor environments (Cooper Marcus, 1978). Mark Francis performed a similar study by each year asking his students to recall their favorite childhood places by drawing maps. In 20

years of observation he noticed “an alarming disappearance of naturalistic places and experiences in favor of more controlled and structured places” (Francis, 1995, p.189). Author Robert Michael Pyle asks students in his classes if they can remember a particular place where they made contact with the land as a child. He generally finds that most every hand in the room goes up. However, when he follows this question by asking who can return to these special places and find them substantially intact, hardly anyone raises a hand (Pyle, 2002).

All this is attributed to the fact that undeveloped places are disappearing and opportunities for kids to make contact with nature are becoming more and more limited. In the book *Last Child in the Woods*, Richard Louv wonders if children have learned not to develop attachment to everyday nature because they subconsciously know that they will eventually lose these places to sprawl and development. We need to set aside places for children that allow them to reunite with nature.

Filling the Ark

In addition to being a key time for developing attachment to place and environmental values, childhood, particularly the ages between 5 and 12, have been identified by many as the most receptive period for learning and development (Johnson and Hurley, 2002). In *The Geography of Childhood,* Stephen Trimble (1994) discusses the importance of middle childhood in developing a connection with nature. This is when children become capable of more sophisticated learning. Trimble quotes author Paul Shepard, who describes this part of childhood as an ark of the mind “a decade from the beginnings of speech to the onset of puberty is all we have to load the ark” (Shepard, 1983, p.54)

In *The Ecology of Imagination in Childhood,* Edith Cobb summarizes her findings from hundreds of autobiographical recollections of childhood by creative thinkers across many cultures and eras. A common thread is the discussion of the importance of these early years in developing environmental values and connection to nature. Based upon her study of the child in nature, culture and society, Cobb identifies the ages of 5-12 as a special period:

> “between the strivings of animal infancy and the storms of adolescence when the natural world is experienced in some highly evocative way, producing in the child a sense of some profound continuity with natural processes and presenting overt evidence of a biological basis of intuition” (Cobb, 1959, p.540).

It is at this age that the child appears to experience both a sense of self and a broader understanding of their relationship to nature. This balance of understanding both one’s self and one’s relationship to nature is essential. Cobb argues that self-exploration, as an aim in itself, is “a dangerous trend toward neurotic self interest.” It is generally said that self exploration leads to a knowledge of the world, but Cobb’s position is that this individual line of thinking is limited, and becomes less and less effective. She goes on to suggest that “the concept of ecology, the study of relationships between organisms and their total environment, will play an important role in helping to redefine the definition of human individuality to include man’s relationship with nature itself.”

As Wilson’s biophilia hypothesis suggests, humans have a natural tendency to affiliate with nature. It is important to foster these tendencies during childhood. To do this, children must have outdoor spaces to play where they can develop a connection to place. This personal connection is important to understanding their impact on the environment as well as the impact that environmental problems such as pollution have on their lives. Middle childhood, the years between 5 and 12 are particularly important to the development of environmental values as kids are moving out of a more egocentric phase into one in which they understand their broader connection to the natural world.

Design for Learning

"By suggestion and example, I believe children can be helped to hear the many voices about them. Take time to listen and talk about the voices of the earth and what they mean – the majestic voice of thunder, the winds, and the sound of surf or flowing of streams."

--Rachel Carson (1956, p.68)

This section looks at how design of play spaces can best respond to the way that kids learn. It looks at the importance of play and how play theory has shaped and continues to affect the design of play spaces. Gardner's theory of multiple intelligences is investigated as a means of understanding the many different ways kids learn and the importance of providing diverse learning opportunities. Finally, the chapter looks at how current theories on play and learning can be applied to the design of natural learning areas.

Natural Learning Environments

To design natural learning environments landscape architects must have an understanding of how kids learn. Any environment holds potential for learning, but as Julie Johnson describes, a space "fosters learning better with qualities and elements one can discover, observe, interact with, and/ or connect to other identities, relationships and processes." (Johnson, 2000, Overview, p.2) Natural learning areas offer more opportunities for these types of experiences than traditional playgrounds or indoor learning environments. Robin Moore describes the multiple opportunities offered by natural play spaces as "affordances." Traditional playgrounds have equipment with prescribed uses or set rules such as jungle gyms and basketball court. Natural areas generally are not associated with a designated activity. This affords children many opportunities and encourages creativity and exploration.

The Importance of Play

Today play is recognized as a foundation for learning and development. Child development theorists such John Dewey, Lawrence Kohlberg and Jean Piaget all agreed that stimulating learning experiences are essential to healthy growth and development (Eriksen, 1985). However, this has not always been the case; theories on play have changed throughout time. In the 19th century, Herbert Spencer published *Principles*

of Psychology expressing his views on play as a means of simply burning off excess energy (Hart, 1993). Despite more recent theories contradicting Spencer's position, many play areas still reflect Spencer's ideas; they are unimaginative spaces that merely provide space to run around. These play areas do not acknowledge the benefit that can be derived from the sheer enjoyment of play. Simply allowing kids time to relax and have fun outside cultivates the sense of wonder and delight that is imperative to learning about the natural environment.

Contemporary landscape architects such as Herbert Dreisitl recognize the importance of play for sheer enjoyment and incorporate opportunities for this in their designs. A water playground designed by Dreisitl in the South German town of Pforzheim has two zones, one a more natural area where water meanders through meadows, the second a more "civilized" section where children are encouraged to get wet. In the civilized section, kids have the opportunity to collect water from the river with Archimedean screws, an ancient device for raising water, or act as a lock keeper and determine when to open and close weirs that allow water to flow in different directions. "While tranquility is the key feature of the natural area, fun and games are the order of the day in the civilized zone." (Dreisitl et al, 2001, p. 141)

Play Theory

Dreisitl's attempts to teach kids about how water flows by allowing them to directly interact with the water follows the doctrine of theorists such as Jean Piaget and Lawrence Kohlberg who stressed that learning comes through direct experience rather than passive observation. Piaget identified four levels of development and moral judgment: the sensorimotor stage (birth to age 2), the preoperational stage (2-7), the concrete operations stage from (7-11), and the formal operations stage (11-15) (Murray, 2005). Lawrence Kohlberg built on Piaget's concept of development stages and found parallel stages in moral development. Both insisted that mature thought must come from experience and interaction of children with their environment. The findings of Kohlberg and Piaget can be used to influence the design of children's play spaces.

In *Natural Learning: The Life History of an Environmental Schoolyard*, Herbert Wong and Robin Moore (1997) discuss the influence of Kohlberg on the transformation of a paved playground to an environmental schoolyard: "Kohlberg's ideas made key contribution to the educational philosophy of the yard, linking experience thought, and ethics" (1997, p. 197). Wong and Moore followed the teachings of Kohlberg that an educational environment should provide real life experiential problem solving situations. They agreed with Kohlberg's belief that the "development of logical and critical thought finds its larger meaning in a broad set of moral values" (p. 197). The Environmental Schoolyard afforded opportunity for students to make ethical decisions related to the environment, helping them progress through the stages of moral development.

Kohlberg identified six levels of moral development. The first two stages, classified as *Pre-Conventional*, suggest that people behave obediently because an authority tells them to and there is the threat of punishment. In stages three and four, the *Conventional* stages, good behavior is practiced in order to seek approval from others. The fifth and sixth levels fall under *Post Conventional or Principled* and are when actions are carried out on the basis of principle and personal conscience (Murray, 2005). It is this stage that we should all strive to reach.

The Eighth Intelligence

One of the benefits of natural learning areas is that they afford many different types of learning by encouraging creative play (Moore and Wong, 1997). The importance of providing this variety of learning opportunities is supported by Howard Gardner's theory of multiple intelligences.

Howard Gardner, developed the theory of multiple intelligences as an alternative to the I.Q test, the traditional measure of intelligence for evaluating human potential. Gardner's work used neurophysiology research to identify parts of the brain that correspond to each of the different categories of intelligence. In his book *Multiple Intelligences:*

Theory in Practice (1993), Gardner identifies seven types of intelligences:

1. Linguistic intelligence ("word smart")
2. Logical-mathematical intelligence ("number/ reasoning smart")
3. Spatial intelligence ("picture smart")
4. Bodily- Kinesthetic intelligence ("body smart")
5. Musical intelligence ("music smart")
6. Interpersonal intelligence ("people smart")
7. Intrapersonal intelligence ("self smart")

In *Intelligences Reframed* (1999), Gardner adds an eighth intelligence, Naturalistic intelligence (nature smart), to capture human's ability to recognize plants, animals and other aspects of the natural environment. Among the characteristics that children with the eighth intelligence may demonstrate are keen sensory skills, skillful recognition of patterns and affinity for the outdoors (Louv, 2005). The skills associated with the eighth intelligence have evolved from the time when we had to recognize carnivorous snakes and poisonous animals in order to survive. They are starting to disappear and need to be fostered.

Gardner's identification of nature smart as an eighth intelligence draws attention to the importance of natural experience to child development. Schools and other learning environments have typically focused on linguistic and logical mathematical intelligence and discounted the other intelligences as predictors of future accomplishment. Gardner draws attention to this issue and argues that intelligence should not be so narrowly defined. Children may demonstrate aspects of many of the eight different intelligences.

Educators should not interpret naturalistic intelligence as an entirely separate intelligence, but rather see how characteristics such as keen sensory skills can help children learn about other things. Schools such as Tuckahoe Elementary in Arlington, VA have created outdoor classrooms that are worked into every aspect of the school curriculum. Science is tied to observations of the changing seasons and collection of weather data, history is taught through a colonial garden and the music teachers use the natural patterns of nature to teach about rhythm. The outdoor environment affords opportunity for a variety of different learning experiences and encourages children to make full use of their senses.

Multi-Sensory Learning

Children interact with and learn from the physical environment through all the senses: (Moore, 1997;Carson, 1956). Humans are more consciously dependent on sight than the other senses, but so much more can be gained from full use of all the senses (Carson, 1956; Yi Fuan, 1990). Design of effective natural learning areas should encourage use of all the senses for relating to the environment.

Again Herbert Dresitl's work serves as an example as his designs allow for use of multiple senses. In his water designs children can do much more than just look at the water, they are encouraged to touch it and listen to the sounds it makes as it travels through the water playground. Another way to encourage use of multiple senses is to incorporate a variety of vegetation. In *Plants for Play* (1993), Robin Moore identifies plants according to their sensory characteristics such as scent and interesting textures. He also identifies plants that accentuate the movement of the wind. At Kids Together Park in Cary, North Carolina, Moore nestled play structure among a variety of plantings encouraging kids to smell and touch the plants and listen to the sounds of the wildlife that is attracted to the park.

Kids Together Park, Cary, NC

Criteria for Designing Effective Outdoor Play Environments

In recognition of the importance of play to learning and child development, designers of outdoor play areas for children have identified criteria for effective design of these spaces. Robin Moore, Susan Goltsman, and Daniel Iacofano identify five key design criteria in their book *Design for Play*: *Planning Design and Management of Outdoor Play Settings for All Children* (1997).

1. **Accessibility:** Play areas should be safely accessible to children with opportunity for integration into their daily life. The site should be both secure and understandable to users.
2. **Safe Challenge:** To advance their development, children should be given the opportunity to take risks. Play areas should be designed to allow them to take risks in a way that is safe.
3. **Diversity and Clarity:** Providing diversity in play settings is important to stimulate children's creativity. However, play areas should also provide a sense of security and be understandable to users. A play space should always be offering new opportunities while at the same time allowing kids to think of it as a comfortable, familiar space.
4. **Flexibility:** To provide diversity in a play space the elements on site need to be flexible and allow for creative play. The space should allow for easy rearrangement of elements and design components should have multiple uses.
5. **Graduated Challenge:** A successful outdoor space will provide challenges of varying levels so that kids have opportunities to test new skills.

The themes raised Moore, Goltsman and Iacofano appear throughout the writings of several designers (Talbot and Frost, 1989; Olds, 200; Stine, 1997). In her *Childcare Design Guide*, Anita Olds (2000) stresses the importance of recognizing the difference between challenge and hazard. Play spaces should offer challenges while allowing children to play safely. Play areas can be geared to effectively challenge children in a variety of ways. As they grow, children develop skills in five major areas: Cognitive Development, Social and Emotional Development, Speech and Language Development, Fine Motor Skill Development, and Gross Motor Skill Development ("How a Child Develops", 2005).

The degree of challenge a play space offers is related to age and child development. The National Program for Playground Safety (2004) notes differences in playground requirements for children age 0-5 and school age children of 5-12. At these stages children have very different abilities as well as developmental needs. School age children are generally larger, stronger and more coordinated than kids ages 0-5. Equipment and play areas should reflect these differences in abilities. Well-designed and appropriately-used play areas allow for challenges as well as emotional development of children by encouraging them to experiment and test new skills. Part of making a play space safe and encouraging kids to take qualified risks is providing supervision. Olds discusses the need to make outdoor spaces attractive to older children, parents and the community to increase both safety and the feeling of community within the site.

Sharon Stine (1997) emphasizes the need for flexibility in children's spaces. There should be variety in play areas to meet different learning needs. For example, some areas should be easily accesible, others less so, some areas for active play, others for passive and some places that signify permanence, others change.

Frost and Talbot (1989) discuss the need for open-ended elements that allow for a variety of uses and creative,

imaginative play. Common to the writings of all of these designers is recognition of the flexibility of uses that nature provides through its constantly changing states. These changes offer a lesson on sustainability. Nature's ecosystems are sustainable communities of plants, animals, and microorganisms that have evolved over billions of years. Natural learning environments can be designed to emphasize this inherent lesson.

Conclusion

Child development theorists have connected learning and development to play and simply having fun. Gardner's research concludes children have different ways to learn about the world, and it is therefore important to provide a variety of opportunities within play settings. Designers have identified a number of key principles in the design of effective play areas. Natural areas inherently fulfill many of these criteria. The changing environments allow for flexibility of use and variety in challenge while encouraging creativity, and social and emotional development.

"Nature in the city is far more than the trees and gardens, and weeds in sidewalk cracks and vacant lots. It is the air we breath, the earth we stand on, the water we drink and excrete and the organisms with which we share our habitat …It is the consequence of a complex interaction between the multiple purposes and activities of human beings and other living creatures and of the natural processes that govern the transfer of energy, the movement of air, the erosion of the earth, and the hydrologic cycle. The city is part of nature."

--Anne Whiston Spirn (1984, p. 4)

The Gaia Hypothesis introduced by James Lovelock in the 1960s considers the biosphere to be a self-regulating system sensitive to the principles of life (Lyle, 1994). Lovelock's hypothesis stimulated a new awareness of the connectedness of all things on our planet and the impacts that people have on global processes. In order to help create a more sustainable world, we must help children understand these relationships. This chapter looks at the research exploring children's current understanding of environmental issues. It identifies the importance of illustrating these concepts through design. From the larger design of our cities and towns to more intimate neighborhoods and play areas there is an opportunity to demonstrate sustainable principles and help children to understand how systems relate.

Comprehension of Environmental Threats

Where does children's perception of environmental issues currently stand? Peter Kahn (1997) has researched the question of how growing up in degraded areas affects children's environmental commitment and sensibilities. He discusses a psychological phenomenon that he has termed "environmental generational amnesia." Kahn describes this concept by addressing results from a study done with child participants in Houston, Texas. Approximately two thirds of the children understood and were aware of environmental problems, but only about one third felt that these problems had a direct effect on them. As Kahn notes, Houston is one of the more environmentally degraded cities in the U.S. with air pollution from local oil refineries and trash found in the bayous and along the streets. Despite these indications of environmental problems in Houston, children did not seem to realize the direct effect of pollution on them. Kahn explains this with his theory of environmental generational amnesia:

> "We all take the natural environment we encounter during childhood as the norm against which we measure environmental degradation later in our lives. With each ensuing generation the amount of environmental degradation increases, but each generation in its youth takes that degraded condition as the non-degraded condition --- as the normal experience" (1997, p.106).

Kahn's theory suggests the importance of clearly educating children on the principles of ecology and their direct connection to and effect on the natural environment. In the past, environmental educators have often focused on large scale environmental threats and a fear- based approach to environmental learning, such as loss of rainforest and endangered species. While these threats are quite serious, they are hard for children to relate to and understand. Children in school in Virginia might not be able to empathize with loss of the rainforest, but might relate to the threat of losing trees to development around their schoolyard or neighborhood.

We need a place-based approach to environmental education. Children's play areas and learning environments should help them connect to their natural and cultural surroundings. As demonstrated by the research of Cobb, Kellert, Moore and others, middle childhood (ages 5-12) is an ideal time to develop these connections and help children become ecoliterate.

Ecoliteracy

Educator David Orr defines the ecologically literate person as someone with "the knowledge necessary to comprehend interrelatedness, and an attitude of care or stewardship" and additionally with "the practical competence required to act on the basis of knowledge and feeling" (1992, p. 92). The Center for Ecoliteracy (CEL), a Berkeley based non-profit organization, is dedicated to education for sustainable living. CEL believes that nature's ecosystems are excellent models to learn from as they are sustainable communities of plants, animals and microorganisms. CEL cofounder, Fritjof Capra (1999), describes the principles of ecology (the study of the relationship of organisms to their natural environment) as follows:

- That an ecosystem generates no waste: one species' waste being another species' food;
- That matter cycles continually through the web of life;
- That the energy driving these ecological cycles flows from the sun;
- That diversity assures resilience;
- That life, from its beginning more than three billion years ago, did not take over the planet by combat, but by cooperation, partnership, and networking.

The Center for Ecoliteracy encourages systems thinking. They refer to a definition of "system" given by the American Association for the Advancement of Science in *Science for All Americans:*

> "Any collection of things that have some influence on each other....The things can be almost anything including objects, organisms, machines, processes, ideas, numbers, or organizations. Thinking of a collection of things as a system draws our attention to what needs to be included among the parts to make sense of it, to how its parts interact with one another, and to how the system as a whole relates to other systems." (Rutherford and Ahlgren, 1990)

Systems thinking helps children understand that individual things such as watersheds, plants, and they themselves (people) are not sustainable when they are separated from the larger system.

Place and Process

Everyday experience with nature is important to grasping

the principles of ecology and the interconnectedness of all things. John Tillman Lyle, author of *Regenerative Design for Sustainable Development*, discusses the relationship between place and process, pointing out that all that exists is process. “Every physical object exists at a point in time. Children need to be able to observe these transitions in spaces they can come to regularly to see how things change through the seasons” (Lyle, 1994). Children developed this understanding in the past through time spent outside exploring undeveloped areas near their homes. In today’s society wild places are disappearing making it difficult for children to explore nature. Attempts have been made to replace this experience through means such as ecological schoolyards, public parks and adventure playgrounds.

Ecological Schoolyards

Ecological schoolyards are a growing movement focused on illustrating the principles of ecology to students through schoolyard environments. Sharon Gamson Danks studied thirty schoolyards in 2000 and concluded that those set in an integrated ecological context are effective because they demonstrate how systems relate; for example, how waste from one system can be fuel for another. Danks writes about an experience in which she was observing students in an eco- schoolyard and witnessed a student feeding snails to a chicken. When Danks asked the student what she was doing the child was able to clearly respond that the snails were causing problems by eating the fava bean crop growing at the school so they had to be removed. Fortunately the school’s chickens loved to eat snails. To complete the cycle, students used chicken droppings to fertilize the soil where the fava beans were growing (Danks, 2000).

This example shows how an ecological schoolyard can teach students about life cycles and relationships. Not every park and schoolyard has chickens, snails, and bean crops, but there is opportunity to design other creative ways of demonstrating these principles to children. It is the overall concept of the interconnectedness of all things that it is important to convey.

Public Parks

Public parks can be designed to provide children the benefit of daily experience with nature. Though many still retain a more traditional format with programmed play areas that are largely for games with specific rules, some parks such as Kids Together Park in Cary, North Carolina, attempt to integrate nature and play. The equipment on this playground is nestled among native vegetation, allowing children to experience the texture, movement, and sounds of the local flora and fauna while exploring the playground.

Another approach to revealing ecological principles in public parks is through restoration projects. Completed in 1983, Strawberry Creek in Berkeley, CA designed by Wolfe Mason Associates incorporated one of the first stream daylighting projects in the country. The design for Strawberry Creek Park incorporates playgrounds, ball courts, and picnic areas around the restored creek. (Wolfe Mason Associates, 2005)

Strawberry Creek Park, Berkeley, CA

Adventure Playgrounds

Adventure playgrounds were not created with an ecological focus, but they can help connect children to their environment and surroundings by encouraging experiential learning and hands-on flexible use of materials in an outdoor setting. Adventure playgrounds are adult supervised play spaces where children are allowed to build their own play environments. They were designed particularly for urban areas to fulfill the activities that children had long engaged with in their yards, homes and vacant lots, but that the increasingly crowded cities were preventing (Cooper, 1970). As our society has become more urbanized, areas for recreation and play have become more structured. The idea of the adventure playground is to provide opportunity for spontaneity within the landscape. The sites were to be left "unimproved" to allow children to make their own decisions on the structure of the space and where to carry out different activities.

Adventure Playground, Berkeley, CA

Principles for Ecological Design

Natural learning environments should strive to demonstrate the ecological principles they are trying to convey and attempt to restore balance to systems disturbed by the construction of the site. This is the basis behind ecological design. Sim Van der Wyn and Stuart Cowan define ecological design as "any form of design that minimizes environmentally destructive impacts by integrating itself with living processes" (1996, p. 18). The sustainability crisis is really a design crisis (Van der Ryn and Cowan, 1996; Lyle, 1994). Our current development patterns have set up a one-way throughput system. This system only allows for transformation of materials from one state to another, not for regeneration. John Lyle's concept of regenerative design is "a system that provides for continuous replacement through its own functional processes of the energy and material used in its operation" (1994, p.10).

Cowan and Van der Ryn (1996) identify five principles for ecological design:

1. **Solutions grow from place:** Ecological design responds to the specific characteristics of place such as soil, topography, vegetation as well as the culture of the people. The design will give importance to biological diversity and cultural diversity instead of compromising both.

2. **Ecological accounting informs design:** Ecological accounting considers the environmental impacts of everything we include in a design. It is a way of gathering information to help inform a design decision when there is not necessarily a specific monetary value to reflect the environmental impact of the design.

3. **Design with nature:** This principle considers the interrelatedness of all things and strives to create designs that are compatible with the living world. This type of design engages in processes that regenerate rather than deplete, recognizing that waste is actually resource.

4. **Everyone is a designer:** Community participation is at the root of sustainability. We should all be involved in the development of our surroundings. By working to heal their surroundings, people grow attached to place. By educating the community on the value of design you help them understand the importance of investing in alternative design strategies, such as constructed wetlands rather than conventional sewage treatment plants.

5. **Make nature visible:** In today's society, many people are unaware of how things are built, where their food comes from, how the water they drink travels to their tap, or what their impacts are on the environment. We need to infuse design with explanation of structure as well as ecology.

By combining these theories for environmentally responsible design with key criteria for children's learning and play environments, we can help children develop a connection to place and a basic understanding of ecological systems.

Natural learning environments offer opportunities for communicating these principles. The following sections explore techniques that have been used to help reveal these concepts to children.

Design Strategies for Illustrating Ecological Principles

Solar Energy

Solar panels may be used to illustrate how energy driving earth cycles flows from the sun. At Tuckahoe Elementary School in Arlington, VA, a solar panel powers a water feature in the school's interior courtyard. Teachers make use of the solar panel in lessons on photosynthesis explaining how each leaf is like a solar panel taking in the sun and creating food to serve as an energy source for the plant. The simple placement of trees can also serve as a lesson to demonstrate the sun's energy by blocking the heat generated from the sun in hot summer months.

Renewable Materials

The materials chosen for use within natural learning areas should reflect the principles of ecological design. Designers can use renewable materials such as sustainably harvested wood and locally available materials in order to reduce energy costs associated with transportation. Natural play spaces can also make use of materials that may otherwise be discarded. Many items have multiple uses. Robin Moore and Herb Wong (1997) found that a five foot diameter pipe donated from the regional water utility district that had once brought water to the East Bay from Sierra Nevada made an extremely popular play structure. Tuckahoe Elementary outdoor coordinator Beth Reese noted that discarded logs transferred to the Tuckahoe Elementary Discovery Schoolyard became one of the students' favorite aspects of the site.

Food Production

A disconnect exists between kids and the sources of their food. Providing space to actually grow plants in natural learning areas offers opportunities for demonstrating a connection between food and the need for sun and good soil. Growing one's own food also saves energy costs related to transporting food. An example of using food production to teach environmental awareness is the Edible Schoolyard in Berkeley, CA, a non-profit program located on the campus of Martin Luther King Middle School. The organic food garden is designed and maintained using organic practices. It offers opportunity to demonstrate how matter cycles continuously through the web of life by recycling the waste from the garden back to the earth.

Solar panel in a school courtyard.

Children's vegetable garden.

Habitat Needs

Diversity assures resilience. It is important to teach kids about protecting the needs of other creatures. Creating wildlife habitat areas can help children better understand the needs of all living things. Showing kids habitat needs on a small scale can help them to understand threats to biodiversity that are going on at a larger scale.

Hydrologic Systems

Just as there is a lack of connection regarding where food comes from, there is a lack of understanding how water reaches your tap, where it goes when you flush the toilet, and where rain water goes after it enters a storm drain. Natural learning areas can incorporate elements that demonstrate water flow and treatment as part of their design.

Conclusion

As Kahn discusses in his theory of environmental amnesia, many children today do not understand how pollution and other environmental threats can affect them personally. This suggests the importance of a place-based approach to environmental education that helps children to understand their immediate environment as well as their impact on the natural world. Design should use sustainable techniques to show how environmental damage can be avoided and how a place can be enhanced rather than degraded by the design. The overall design should attempt to reveal natural systems. Many different techniques are available to convey these principles in children's play spaces. There is also an opportunity for designers to identify new ways to emphasize the interconnectedness of all systems through design.

Bird garden for attracting wildlife.

Wetland system for water treatment.

Conclusion

"If facts are the seeds that later produce knowledge and wisdom, then the emotions and impressions of the senses are the fertile soil in which the seeds must grow. The years of early childhood are the time to prepare the soil. Once the emotions have been aroused – a sense of the beautiful, the excitement of the new and unknown, a feeling of sympathy, pity, admiration or love – then we wish for knowledge about the object of our emotional response. Once found, it has lasting meaning."

--Rachel Carson (1956, p. 45)

Natural areas are hard to find in our rapidly developing cities. We are challenged with trying to develop connections between children and nature and restore the sense of wonder that can be the foundation for developing environmental values.

In his writings, Stephen Kellert identifies a need for both affective and cognitive environmental learning. Kellert describes affective learning as "cultivating an emotional appreciation of how the living world offers profound opportunities for kinship, wonder, and beauty" and cognitive learning as "acquiring factual and conceptual knowledge of living diversity and its importance to human well being" (1996, p.211).

Natural learning areas can cultivate both these types of learning by providing lasting places for children to interact with their surroundings. As the literature suggests, routine childhood interaction in a play space can lead to a connection and deeper appreciation of one's surroundings. The design of play spaces can also help reveal natural systems and teach through their very design. By interacting regularly with outdoor play spaces, kids can understand the changes that occur throughout time.

To effectively address cognitive and affective learning needs, designers must consider how children learn best. Returning to Gardener's theories of multiple intelligences we are reminded that kids have a variety of different ways to learn and that play spaces must provide a variety of learning opportunities. The prior sections identify the importance of middle childhood (ages 5-12) as a time for developing both an emotional connection to place and for acquiring factual knowledge. Building on the literature, the ten principles described below are guidelines for the development of natural learning for cultivation of environmental values in children of elementary school age.

Design Principles for Promotoing Ecoliteracy in Children's Play Areas

1) Allow for Safe, Routine Access

Natural play areas should be safely accessible to children by a variety of transportation modes (foot, bike, public transportation) with opportunity for integration into their daily life. Continuous experience is the foundation of a deeper understanding of the natural world.

2) Allow for Direct Experience with Elements of Nature

Natural play areas should encourage children to physically engage with their surroundings. Kids should be allowed to dig in the dirt, touch the vegetation, move elements around the site and make their own decisions on which path they want to take.

3) Provide Opportunity for New Discoveries and Safe Challenge

Empower children by giving them opportunities to make discoveries on their own and challenge them to try out new skills. Bring excitement and a sense of newness to the space, making it an interesting place to visit and play in on a routine basis

4) Design for Flexibility of Uses

To maintain a sense of excitement about the site, create elements with multiple uses to bring variety to the site and to provide opportunity for kids to learn in a variety of ways

5) Appeal to all the Senses

Design should encourage the use of all senses to help children develop a deeper understanding of their surroundings. Humans are typically more consciously dependent on sight than the other senses, but much can be gained from full use of all the senses

6) Encourage Personal Involvement and a Feeling of Ownership

Involve children in the planning, maintenance, and design of the space. Help them to develop a personal connection and relationship to the site

7) Employ Ecologically Sound Design Principles

In order to teach ecological principles, natural play areas must be environmentally responsible and incorporate these principles into the design.

8) Reveal Natural Systems

Design should reveal the presence of natural systems, helping kids to understand aspects of nature such as the flow of water, the cycling of energy and the movement of wind.

9) Respond to Environmental and Cultural Aspects of the Place

Design should respond to the specific characteristics of the place such as soil, topography, vegetation as well as the culture of the people and the history of the site.

10)Encourage systems thinking

Natural play areas should demonstrate how all elements are interrelated and help children understand how the site is related to its surroundings.

All of these principles are important to the design of effective outdoor play areas that promote ecoliteracy. Designs should emphasize the importance of understanding how systems relate, and how the kids themselves fit into the larger system. Edith Cobb describes the time in childhood when children develop this broader understanding of their connection to nature. She quotes Bernard Berenson's description of this moment from his autobiography. One balmy morning in his childhood he "climbed up a tree stump and felt suddenly immersed in Itness. I did not call it by that name; I had no need for words. It and I were one" (Cobb, 1977).

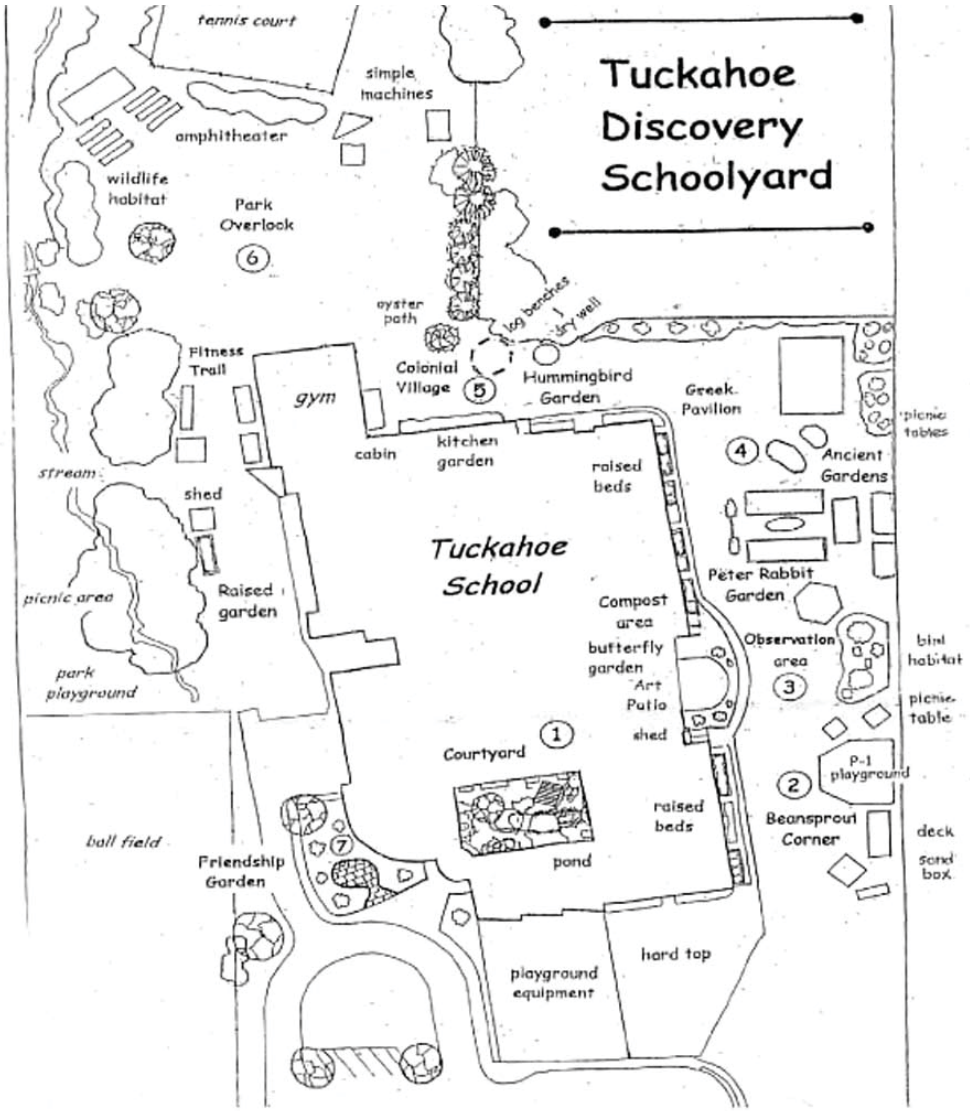
The guiding principles for natural learning areas are fairly straightforward: provide safe, accessible outdoor spaces, allow for flexibility of use, demonstrate how natural systems work; however, the challenges to achieving these principles are numerous. As described in the introduction, wild places are disappearing, growing traffic poses a threat to outdoor play, and fear of strangers, what Richard Louv refers to as "the bogeyman syndrome", makes it difficult for kids to get outside. There is also the issue of generating interest in outdoor play, with all of the new technology, TV and videogames, many kids seem to prefer screen time to outdoor time. There are definitely challenges to the implementation of effective natural learning areas, but with improved design and growing recognition of the benefits of outdoor play to child development and the future health of our planet, and with better designed natural learning areas, we can work to overcome these barriers.

The case studies and the design portion of the project seek to further evaluate the design principles and to generate new ideas for the design of effective natural learning areas.

SECTION 2: CASE STUDIES

Schoolyards, parks and other places that children frequent offer inherent opportunity for environmental learning experiences. There is growing recognition of the potential of these places to engage children with nature. Using the principles for the design of natural learning areas identified in Section One, the following case studies evaluate two children's play areas that are designed to teach ecological principles and connect children with their environment. One of the sites is a schoolyard, the other a county park. The purpose of the case studies is to apply the principles identified for the design of natural learning areas to actual learning environments and through this process to identify omissions and aspects of the principles that require refinement.

Tuckahoe Elementary Discovery Schoolyard
Arlington, VA



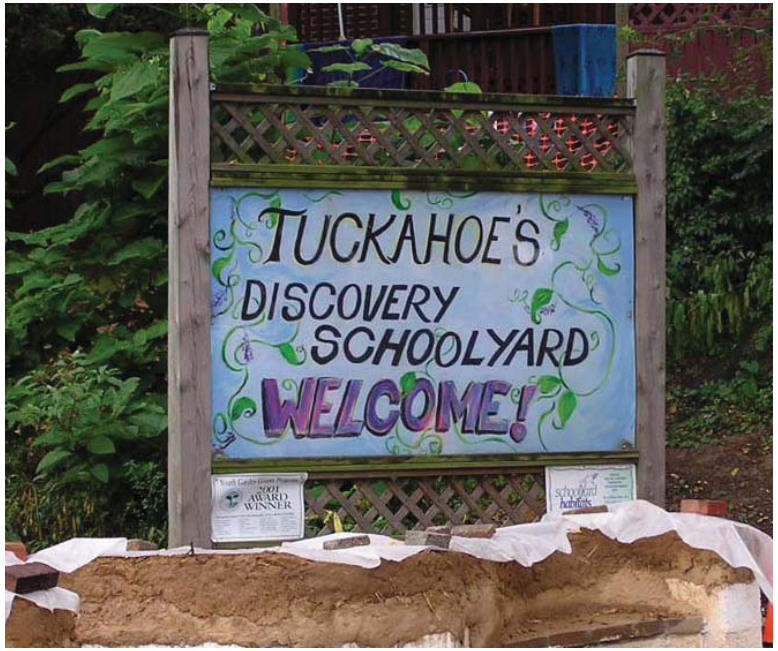
(Base map provided by Tuckahoe Elementary School)

Background

Tuckahoe Elementary is a public school for pre- kindergarten through 5th grade students located in Arlington, VA. Prior to 1994, the Tuckahoe Elementary schoolyard contained very little natural vegetation and was used mainly as a "a dog run," where students were let out for recess and called back in after 30 minutes. Significant changes have occurred over the last decade and the schoolyard continues to evolve today. This follows the belief of designers such as Robin Moore and Sharon Stine that natural learning environments should always be changing, affording children constant opportunity for new experiences. The schoolyard design developed as a result of volunteer efforts from master gardeners, parents, teachers, community members, and most importantly, the kids themselves. Years of organizational efforts, fundraising, and developing strong community connections led to the initial construction of the Discovery Schoolyard.

Design

Central to the schoolyard plan is a courtyard designed pro-bono by landscape designer Rick Blaine. Blaine worked with the students to model the courtyard after the varying ecosystems comprising the Chesapeake Bay Watershed, from the mountains to the coastal wetlands (Reese and Striniste, 2003). In addition to the courtyard, the school is surrounded by outdoor classrooms and learning areas. Each grade has a garden space designed according to their age and curriculum. For example, the first grade has a Beatrix Potter Garden that gives the students opportunities to learn from the famous naturalist and author. Students use the space to sketch, plant vegetables, weed, water and harvest. The fifth graders have a Colonial Village where they replicate life in 17th Century Virginia. Garden beds contain medicinal and culinary herbs and students grow cash crops like cotton and beans. The outdoor spaces have been worked into most every aspect of the school curriculum. The art teacher creates garden decorations using recycled items such as old shoes and ties and the music teachers uses the natural patterns of nature to teach about rhythm.



Welcome sign and cobb wall (in progress)made with the help of students.

Central courtyard at Tuckahoe Elementary School.

Observations Based on the 10 Design Principles Developed for Promoting Ecoliteracy in Natural Learning Areas

Principle 1: Allow for Safe, Routine Access
The schoolyard is a place students come to each day and therefore offers opportunity for daily observation of changes that occur throughout the seasons. In addition to serving the students, the school encourages the community to visit after school and on weekends. In some areas, signage identifies vegetation and describes student projects in the hope that the schoolyard will continue to teach outside of the normal school hours.

Next to the schoolyard is the county owned Tuckahoe Park. This is also easily accessible to teachers and students and could be used on a routine basis. Though they don't make trip to the park every day, the school does organize what they call "Expedition Days," where the children are allowed to choose an outdoor activity they would like to participate in. Often there are options that involve exploration of Tuckahoe Park.

Principle 2: Allow for Direct Experience with Elements of Nature
Tuckahoe discovery schoolyard provides a place for students to interact with nature on a regular basis. Kids have the opportunity to get their hands dirty by helping to plant flowers and vegetables, compost, weed, and more. Teachers are encouraged to make use of the outside teaching environment as frequently as possible.

One thing that appears to be missing from the site is sufficient un-programmed space for kids to make their own decisions about how to interact with nature. An eroding hillside does offer limited space for this type of experience. The hillside is a popular recess spot where kids hide among the trees at the top of the hill, roll logs from the bottom to the top, and make mud pies. Plans are currently underway to redesign the hillside with a natural play area that will stabilize the hill while providing exciting opportunities for the kids.

Eroding hillside and moveable logs in the natural play area.

Principle 3: Provide Opportunity for New Discoveries and Safe Challenge

The ecological schoolyard is an excellent learning resource that challenges students to make new discoveries. One way students do this is by collecting data on weather patterns and drawing conclusions about changes that occur throughout the seasons.

Because of the unbalanced teacher to student ratio, the teacher must exercise a fair amount of control when he or she is outside with the children during class time. At recess children are still limited (for supervision purposes) to the playground equipment, blacktop, and the previously referred to eroding hillside. Observation of the children at recess indicated that the play equipment fails to challenge most of the kids, particularly older students. By 2nd and 3rd grade the equipment has lost all physical challenge. Whereas natural areas can afford multiple opportunities, the function of the play equipment is fairly specific and so it remains more or less empty at recess, occasionally used by the older kids to simply hang out and talk, but not as a place for challenging physical play.

Principle 4: Design for Flexibility of Uses

To complement the educational curriculum many of the gardens around the school have been given themes and have designated activities associated with them. For example, areas for planting and areas for displaying materials made in art class are well marked. What may be missing are more un-programmed areas such as the eroding hillside in front of the school which children use for creative play.

Principle 5: Appeal to all the Senses

The Discovery Schoolyard succeeds in encouraging students to use multiple senses to explore their natural surroundings. Students are encouraged to touch, smell, and interact with all of the elements in the schoolyard. They use these skills to record observation about the weather, sketch, and note changes in the yard.

Beatrix Potter Garden allows for multiple activities such as planting, reading, sketching and observation.

Principle 6: Encourage Personal Involvement and a feeling of Ownership
The Discovery Schoolyard strives to develop a feeling of ownership between students and the schoolyard. Kids are encouraged to help with the maintenance of the yard; they assist with weeding, planting, composting, and more. Many students enjoy the work and request to become more involved. Students who come to family work days are often written up in school newsletters. According to the outdoor program coordinator, this makes them quite proud. Students have also been involved with the design and construction of the schoolyard. A recently completed cobb wall (clay, sand, and straw mixture similar to adobe) was a collaborative effort built by students, parents and other volunteers. By helping to create and maintain the discovery schoolyard, children become invested and protective of the space.

Principle 7: Employ Ecologically Sound Design Principles
The schoolyard finds numerous ways to reuse materials, such as the old ties and shoes used to decorate the art garden. Logs cut from a fallen tree provide objects of play for the students. Energy concerns are addressed by the use of a solar panel to power the water pump in their courtyard.

There is further opportunity to help students understand the impact of the built environment on the natural environment. Runoff from the roof, school parking lot and playground could be treated and the process could serve as a lesson for the students.

Principle 8: Reveal Natural Systems
The school's composting efforts illustrate how waste can be a resource and how material can be returned to the earth. There is opportunity to further demonstrate to the kids that natural systems are indeed at work in their schoolyard. One way to do this would be to help kids understand where rain disappears to after falling on the roof and parking lot of the school.

The "Art Garden."

Principle 9: Environmental and Cultural Aspects of the Place
The schoolyard acknowledges cultural aspects of place by attempting to make a historical connection through the colonial garden where students replicate a typical garden from 17th century Virginia.

Environmental aspects are considered by providing a habitat for birds and other wildlife and there is an area the school is trying to maintain as a "no mow" meadow. Many Americans tend to view ordered and manicured landscapes as aesthetically pleasing. If a landscape does not appear manicured, it is often considered rundown. There is an opportunity to provide more areas like the "no mow" meadow. Though some might consider these areas overgrown and therefore unattractive, they can be very educational places for students. Kids should be taught that not all gardens need to consist of neatly trimmed lawns and manicured bushes and, more importantly, that this is not always the most environmentally sensitive option.

Principle 10: Encourage systems thinking
Through all the activities and elements described above helps children to better understand their surroundings. The schoolyard provides opportunities for students to get outside to learn about the environment through experience rather than from a text book.

Conclusion
Tuckahoe Schoolyard provides students with an amazing educational resource and offers a refreshing perspective on the educational possibilities of a schoolyard. Students' daily interaction with the site allows them to observe changes in the yard throughout the seasons. The integrated curriculum encourages kids to actively engage in the yard, to plant, build and get their hands dirty. While the school has done an excellent job of working the yard into their curriculum, there is also value in allowing for more undirected opportunities for exploration and play. At a school there is often pressure for a teacher to maintain control of the students as well as cover a demanding amount of information related to required testing and state standards of learning. In addition to experiencing nature as part of an educational school day, there may be a more informal interaction with nature that kids need in order to fully develop what Rachel Carson refers to as a sense of wonder for the natural world.

Children's Rain Garden at Powhatan Springs Park Arlington, VA

(Base map provided by Arlington County Department of Parks, Recreation, and Cultural Resources.)

Background

The Children's Rain Garden at Powhatan Springs Park in Arlington, Virginia turns the process of bioretention into a children's playground. The park opened in October of 2004 and is managed by the Arlington Department of Parks, Recreation and Cultural Resources. Oeculus, a Washington D.C based landscape architecture firm worked with artist Jann Rosen-Queralt to design the play area.

Design

Water running off the parking lot is carried to the rain garden in decorative concrete swales. Leaf impressions, jade pebbles, and copper pieces draw the viewer's attention to these swales. Water entering the garden is filtered by sand before entering into a constructed wetland which further purifies the water. The purified water is stored in a tank underneath the garden and children can pump the clean water into a plume that runs through a natural area and into Reeves Run, a tributary of Four Mile Run which connects to the Potomac River and eventually runs into the Chesapeake Bay.

Powhatan Springs Park offers a variety of play opportunities. In addition to the rain garden there is a wooded play area The major draws to the site are the Skateboard Park and adjacent soccer field. Observation of the site indicated that users of the rain garden are generally the younger siblings of kids playing soccer and skateboarding.

Principle 1: Allow for Safe, Routine Access
The parking lot of the park is often full on weekends. It appears to be a park that many families access by car rather than foot. It is located off a busy Arlington Road that is not particularly bike friendly. This may limit the number of children who are able to visit the park regularly.

Principle 2: Allow for direct experience with Elements of Nature
The park offers opportunity for different levels of understanding. Small children may simply be content to splash in the puddles of water. Older kids might question where water is actually coming from and what is happening as it passes through the various elements of the garden. They may even begin to understand the impact that we as humans have on the environment and pollution that results from development.

Principle 3: Provide Opportunity for New Discoveries and Safe Challenge
The rain garden is constantly changing. The amount of water present in the garden varies with the weather. On a trip to the park at the end of a very dry September there was no water at all to pump out of the storage tank beneath the garden, and children wandered through the grassy wetland area without getting their feet damp. These changes through time allow for new discoveries. The more physically challenging aspects of the park appear to be associated with the skate park rather than the rain garden, suggesting that perhaps there is opportunity to integrate a variety of activities into children's play areas to fully stimulate their senses as well as the need for safe challenge.

Principle 4: Design for Flexibility of Uses
By combining the soccer field and skate park with the children's rain garden and natural area the site provides opportunity for a variety of activities. The rain garden itself does not have any prescribed activity associated with it so children have the freedom to use it in multiple different ways.

Children's Rain Garden at Powhatan Springs Park.

A child pumps purified water into Reeves Run.

Principle 5: Appeal to all the Senses
The site supports multi-sensory stimulation by providing so much to look at, touch and smell, and hear. You can always hear the sound of the water dripping because rain water is collected and stored in a tank on the roof of the adjacent pavillion. The water is then slowly released over time so that there is a constant dripping of water off the roof onto the splash blocks below.

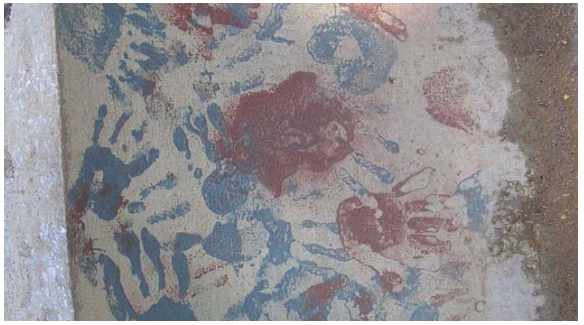
Principle 6: Encourage Personal Involvement and a feeling of Ownership
Children's handprints decorate the flume that takes treated water down to the river showing that children involved in the decoration of he site. Kids sometimes create boats or other structures to send floating down the flume and they can build castles in the sand, so there are opportunities to make daily impressions on the site. However, there are fewer opportunities for kids to leave more lasting impressions on the site.

Principle 7: Employ Ecologically Sound Design Principles
The park goes to great effort to minimize the impact of development on the site by treating the stormwater runoff from the entire site.

Principle 8: Reveal Natural Systems
The children's rain garden clearly illustrates water flow on the site. Stormwater runoff from developed areas is purified by the rain garden and the clean water is then returned to Reeves Run. Another interesting detail of the site is the long pieces of wood that are embedded in the concrete wall surrounding the garden. These pieces of wood call attention to how different materials break down over time, as the wood decays interesting impressions are left behind in the wall.

Splash pads collect water that drips off the pavillion roof.

Wood forms embedded in the concrete wall around the rain garden.



Hand prints decorate the flume carrying purified water to Reeves Run.

Principle 9: Respond to Environmental and Cultural Aspects of the Place

The site makes a clear effort to respond to the environmental aspects of the place . It respects the hydrological connection of Reeves Run (which travels through the site) to the greater Chesapeake Bay Watershed. The design also strives to acknowledge historical aspects of the site. The landscape architecture firm Oeculus worked with the artist Jann Rosen-Queralt to integrate a public art project within the rain garden. The title of the space is "Cultivus Loci: Suckahanna." *Cultivus Loci* means cultivated place in Latin, and "Suckahanna" refers to the Powhatan Indian word for water.

Principle 10: Encourage systems thinking

The park demonstrates how human development affects nature and how the design can minimize this impact. There is one sign in the rain garden explaining the larger connection of the site to Reeves Run, Four Mile Run and Chesapeake Bay. The sign is fairly small and does not shout out its message, it allows children time to ponder, and hopefully to come to their own understanding of the process.

Conclusion

Powhatan Springs Park strives to provide learning opportunity through experience. Kids begin to develop an understanding of water flow through observation and experience. Even when it is not raining kids find a way to watch and understand water flow. Kids were observed filling water bottles and pouring them in drains near the skate park portion of the park, then running over to the rain garden to see the water flow out the other end of the pipe.

The site is unique in that it allows children to observe water flow in an area constructed by humans (the rain garden and water flow in the ephemeral stream adjacent to the rain garden. There is a connection between the two spaces in that kids can pump the purified water from the rain garden down a flume to the stream running through the natural area. The park is also interesting because it combines skateboarding, soccer and water play drawing a variety of users. This raises some interesting ideas about how play areas should be designed to attract a wide variety of people. Kids might not initially find the idea of a rain garden for play exciting because they are used to more traditional outdoor activities such as basketball and other organized sports. By grouping organized activities with more natural play you may encourage greater visitation.

One drawback of the space is the limited access. The location off a busy road may make it difficult for children to access on a routine basis by foot or bike. Once children reach the site, it does feel very safe though. By encouraging a variety of users you draw people to the space creating a feeling of safety through informal surveillance.

Conclusion

As noted in the case studies, both sites have limitations. However, they also both introduce exciting new ideas for reconnecting children to their surroundings and teaching environmental values. They take bold steps to address the dire need to change the way we think about school grounds and parks and to completely reject the earlier view that playgrounds were simply a place for kids to burn off steam.

The case studies helped identify areas where the principles may require refinement. For example the issue of the eroding hillside at Tuckahoe raises questions regarding Principle 2: Allow for Direct Experience with Nature. The plan to design the eroding hillside that is so popular with kids in its current state raises the question: Should there be places within play areas where we allow natural processes to take their course so that children can visually observe their effect on the land? Perhaps some areas should be designed to hold up to intensive play and others left in a more natural state so that kids can observe the differences. Powahatan Springs demonstrated that while it is important to have flexible play spaces, integrating opportunities for more organized play (such as basketball or soccer) can help encourage greater visitation and provide variety in activity. Section Three goes on to further explore the principles through design application.

SECTION 3: DESIGN PROJECT

Design Objectives

Section One concludes that the effective design of outdoor learning areas can help to raise a more environmentally minded generation. The design portion of the project is intended to be a vehicle for exploring this position. I established the following goals for the project.

1. To apply and evaluate the principles identified in the position paper for the effective design of natural learning areas.
2. To identify and apply specific design objectives that addresses the particular conditions of the site and its context.
3. To demonstrate the potential of the design site to help stimulate a sense of wonder for the natural world and cultivate a relationship between children and their environment.

I was initially considering a schoolyard for the design portion of the project, but the long linear form of Watts Branch Park in Northeast Washington, D.C. and the exciting opportunities for the future of this part of the city led me to take a closer look at this possibility. The more I found out, the more intrigued I became about the option of using Watts Branch Park to explore my design questions. In the early part of the 20th century Watts Branch was a pristine stream valley, but years of neglect led to pollution and the development of crime. Until recently the park was considered extremely unsafe, but in 2001 the non-profit organization Washington Parks and People launched a campaign to restore, reclaim, and revitalize Watts Branch. Working with the community, Parks and People have created a master plan for the park and taken great strides to make it a cleaner, safer place.

Figure 1. Master Plan Watts Branch Park *(Map provided by Washington Parks and People)*

Park Analysis

Watts Branch Park is located in the eastern corner of the diamond that forms Washington, D.C. It is the District's longest city park, yet unfamiliar to many city residents. The park extends approximately 1.6 miles through the northeast neighborhoods of Capitol Heights, Northeast Boundary, Burrville, Lincoln Heights, Deanwood, Hillbrook, and Eastland Gardens. The park connects to residential backyards as well as a few schoolyards. It is easily accessible to many members of the community by foot or bike. A bike path that was developed in the early 1970s runs the length of the park. The trail has not been particularly well maintained, but the District's proposed Bicycle Master Plan suggests that there will be improvements to the trail as well as improved connections to other bike and multi-use trails both existing and planned. The park is also easily accessed by public transportation. In addition to bus routes serving the area, there are four metro stations near the park.

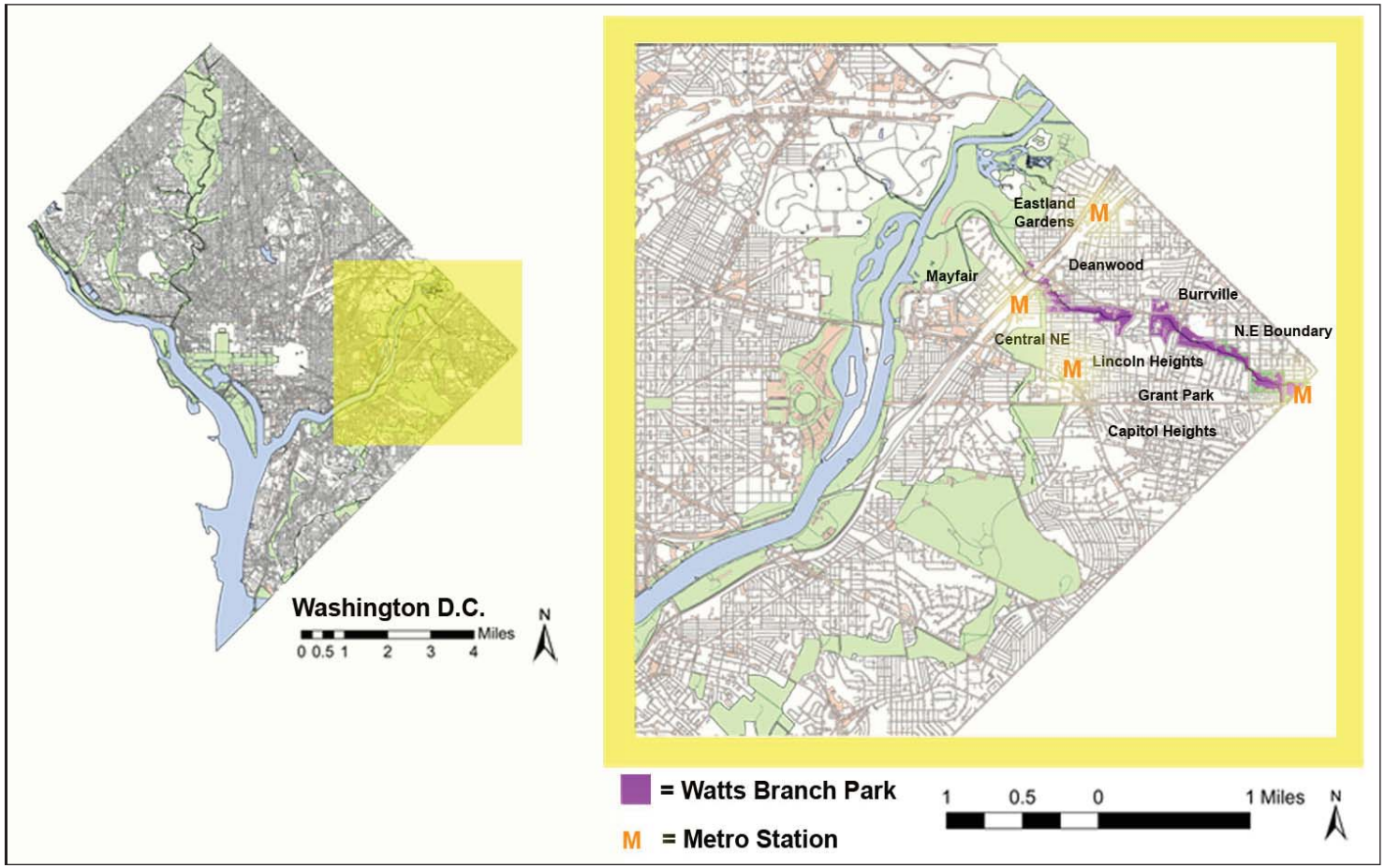


Figure 2. Park Location Map

Data source: Washington D.C GIS Atlas http://dcatlas.dcgis.dc.gov (Accessed 6 January 2006).

History of the Park

Watts Branch is a tributary feeding the Anacostia River. The land around the stream was preserved as public space in the 1930s in response to a series of floods that occurred in the area. Following the designation of the land as public space, there were several plans to complete it as a park, but unfortunately the work was never carried out and the land was largely ignored (Washington Parks and People, 2006). Initially all of Watts Branch Park was property of the National Park Service, but in 1973 the land upstream of Kenilworth Park (west of Minnesota Avenue) was transferred to D.C. Department of Parks and Recreation (D.C. Dept. of Health, 2003). City officials acknowledge that following the transfer, the park was neglected for years. Officials explain that there was confusion as to who should be maintaining the park (Donovan, 2005). The Department of Parks and Recreation didn't feel the park was their responsibility because a map showed streets running through the park making it the jurisdiction of the Department of Public Works. However, many of the streets didn't actually exist, they were 'paper streets' shown on a map, but never actually developed. As a result, the Department of Public Works did not feel responsible for trash removal. Fortunately this cycle of neglect has come to an end. Washington Parks and People's *Down by the Riverside Campaign*, launched in 2001, has engaged community members and outside volunteers to help renovate and reclaim the park. Since the start of the campaign, volunteers have cleaned up more than 2.5 million pounds of trash, 6,000 hypodermic needles and 78 abandoned cars from the park and surrounding neighborhoods (Donovan, 2005).

As part of the *Down by the Riverside Campaign*, Washington Parks and People worked with the community to rename the park Marvin Gaye Park as a tribute to the R&B legend whose boyhood home was at the southeast end of the park. The Park was officially rededicated Marvin Gaye Park on April 2, 2006, on what would have been the singer's 67th birthday (2006, Sullivan). (From here forward this paper will refer to the park as Marvin Gaye Park.)

Sign announcing the park's new name: Marvin Gaye Park

Dedicated volunteers helping to pick up trash in the rain on Earth Day, 2006.

Demographics

The first inhabitants of the land surrounding Watts Branch were the Nacotchtank Indians. The Nacotchtanks were an agriculture people and preferred the flatlands along the Potomac and Anacostia to the inland bluffs. Captain John Smith, founder of Jamestown, is recorded to have visited the area in 1608. Not long after coming in contact with European settlers, the Indians disappeared from the banks of the Anacostia. Watts Branch and the surrounding neighborhoods are now part of D.C.'s Ward 7. The land remained largely undeveloped until the 1900s. After the civil war ended, freed blacks began moving to the Ward 7 area because much of it remained unsettled. Because of its distance from the center of D.C., it was not until the 1950s, after World War II, that the D.C. city government provided these neighborhoods with basic services such as paved streets, sewers and sidewalks (Council of the District of Columbia, 2006).

Today the population of Ward 7 is 96.8% African American. 2000 census data indicates that the median household income for Ward 7 is the second lowest of D.C.'s eight wards. One-quarter of the population is below the poverty level. Approximately 70% of the population 25 and older are high school graduates, but only 13% have college degrees. The following table shows a break down of population by age. The 5-17 age group forms the highest portion of the population. The total youth population (under age 18) of Ward 7 is 27.5%; only Ward 8 has a higher youth population.

Table 2. District of Columbia Ward 7 Population by age (2000 Census Data)								
	Age							
Total	0-4	5-17	18-24	25-34	35-44	45-54	55-64	65+
70,540	4,963	14,457	5,721	8,808	10,634	9,382	6,726	9,849
100%	7.0%	20.5%	8.1%	12.5%	15.1%	13.3%	9.5%	14.0%

Data Source: D.C Office of Planning website http://www.planning.dc.gov/planning/cwp/view,a,1281,q,569712.asp (Accessed 6 January 2006).

Schools

Marvin Gaye Park is surrounded by schools. As the diagram below indicates, there are nearly 20 schools within a ½ mile radius of the park. More than half of them are elementary schools.

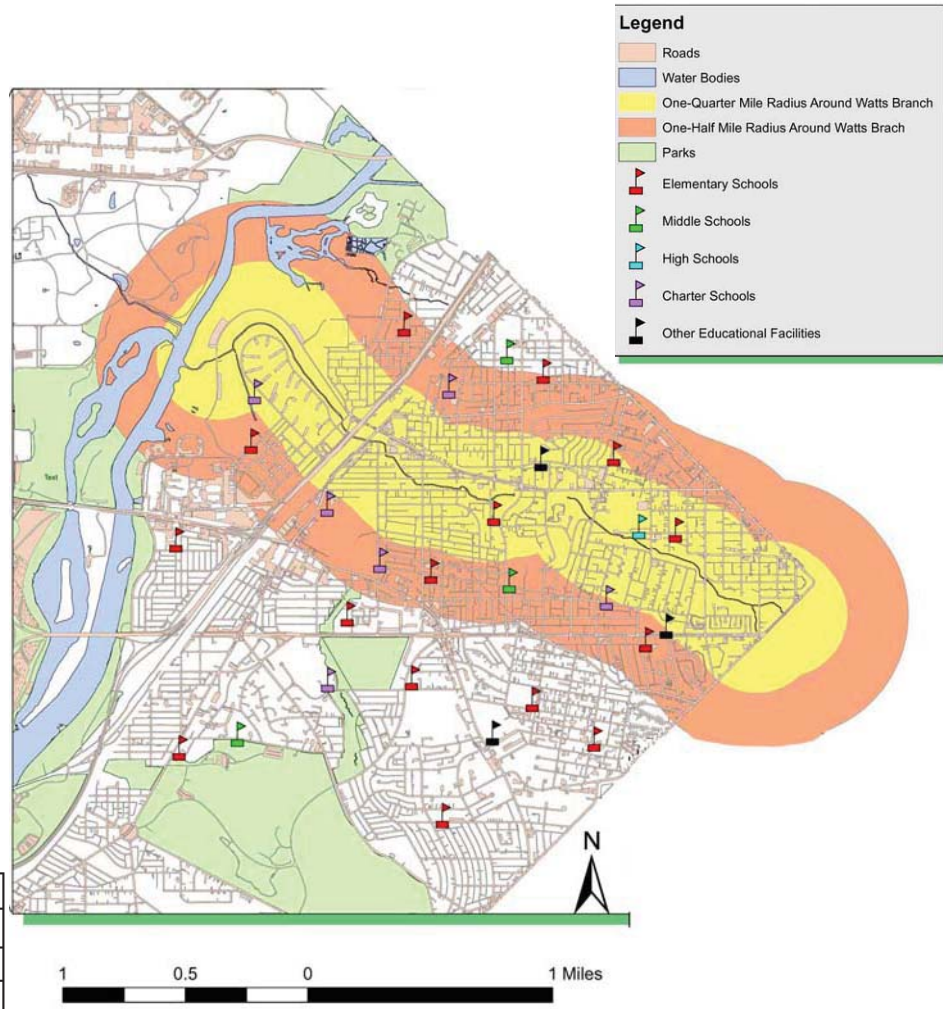


Figure 3. Relationship of Marvin Gaye Park to Surrounding Schools

Data source: Washington D.C GIS Atlas http://dcatlas.dcgis.dc.gov (Accessed 6 January 2006).

Watershed Details

The headwaters of the stream begin in Prince George's County, Maryland, but the main stem begins just above the District limits at Southern Avenue in Southeast D.C. The stream then flows 3 miles through the district to meet the Anacostia in Kenilworth Park. The tidal portion of the stream extends approximately 0.3 miles of Watts Branch from the Anacostia. The watershed is 3.53 square miles, 47% of the watershed is in the District of Columbia, the remaining 53% is in Prince George's County, MD (D.C. Dept. of Health, 2003).

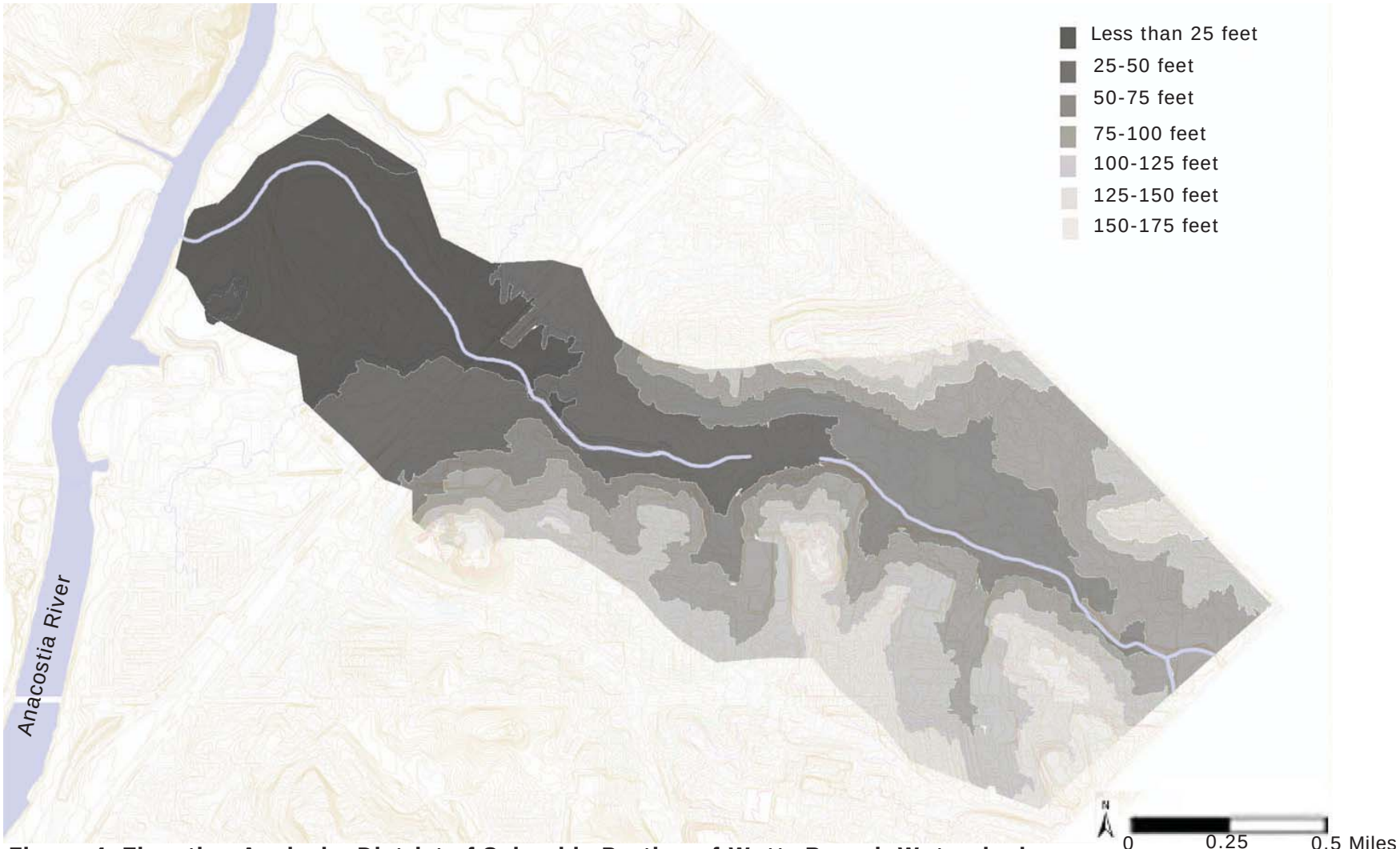


Figure 4. Elevation Analysis: District of Columbia Portion of Watts Branch Watershed

Urbanization and Channelization

The watershed is highly urbanized. Less than 15% of the watershed is forested; the dominant land use in the watershed is low and medium density residential. The table below summarizes land use in the watershed. Urbanization has led to increased impervious surfaces within the Watts Branch watershed and disturbed soils with decreased capacity to retain moisture. This increases stormwater runoff leading to water quality and erosion problems. The form of the stream has changed dramatically as a result of urbanization. In an attempt to control flooding the stream has been channelized and the floodplain lost due to fill and channel capacity enlargement (D.C. Dept. of Health, 2003). In response to these changes, the stream has been adjusting to accommodate the higher levels of discharge into the channel. Since there is no longer an active floodplain, the stream erodes laterally to increase channel capacity which results in shallower flows. Shallow water depth has a negative affect on the stream's biological integrity (D.C. Dept. of Health, 2003).

Table 3. Land Use in the Watts Branch Watershed

Land Use/Land Cover	Percent of Watershed
Low and Medium Density Residential	73.2
Deciduous Forest	11.0
Parks and Open Space	8.2
Commercial, Industrial, and Government Lands	7.3
Open Water and Wetlands	0.3

(Adapted from D.C. Dept. of Health, 2003)

Figure 5. Form of Watts Branch Before and After Channelization

Left: Stream form traced off of 1898 U.S. Geological Survey Map
Right: Stream form traced off of 1965 U.S. Geological Survey Map

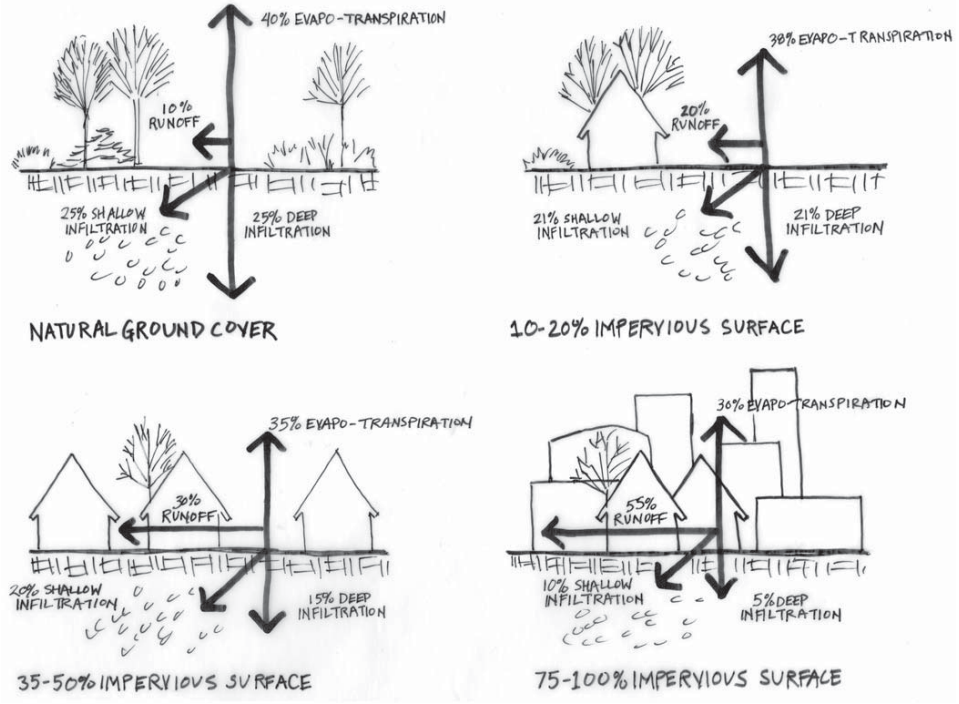


Figure 6. Water Cycle Changes Associated with Urbanization

(Adapted from Environmental Protection Agency, 1993)

Stream Flow and Water Quality

The U.S. Geological Service along with the D.C. Department of Health operates an active gauge station on Watts Branch. The gauge was established in June 1992. Observation over a nine year period (between 1992 and 2001) showed an average daily mean discharge of 4.48 cubic feet per second. The lowest measured flow over this time period was .28 cubic feet per second (cfs) and the highest peak flow was 1510 cfs (D.C. DOH, 2003). The force of peak flows scour the stream banks causing erosion and sedimentation. Due to the high levels of sedimentation, the D.C. Department of Health released the Total Maximum Daily Load (TMDL) document for Total Suspended Solids (TSS) in Watts Branch in June, 2003. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards established by the Clean Water Act.

Efforts to improve the water quality of Watts Branch are linked to the larger Anacostia Watershed Initiative. In 2000, Mayor Anthony Williams brought together all the federal and District agencies that own or control land along the Anacostia River to sign the Anacostia Waterfront Initiative (AWI) Memorandum of Understanding (MOU). The intention of this partnership is to revitalize the Anacostia River and surrounding environs. The District has also signed the Chesapeake Bay agreement which commits to restoring the health of the bay and its living resources.

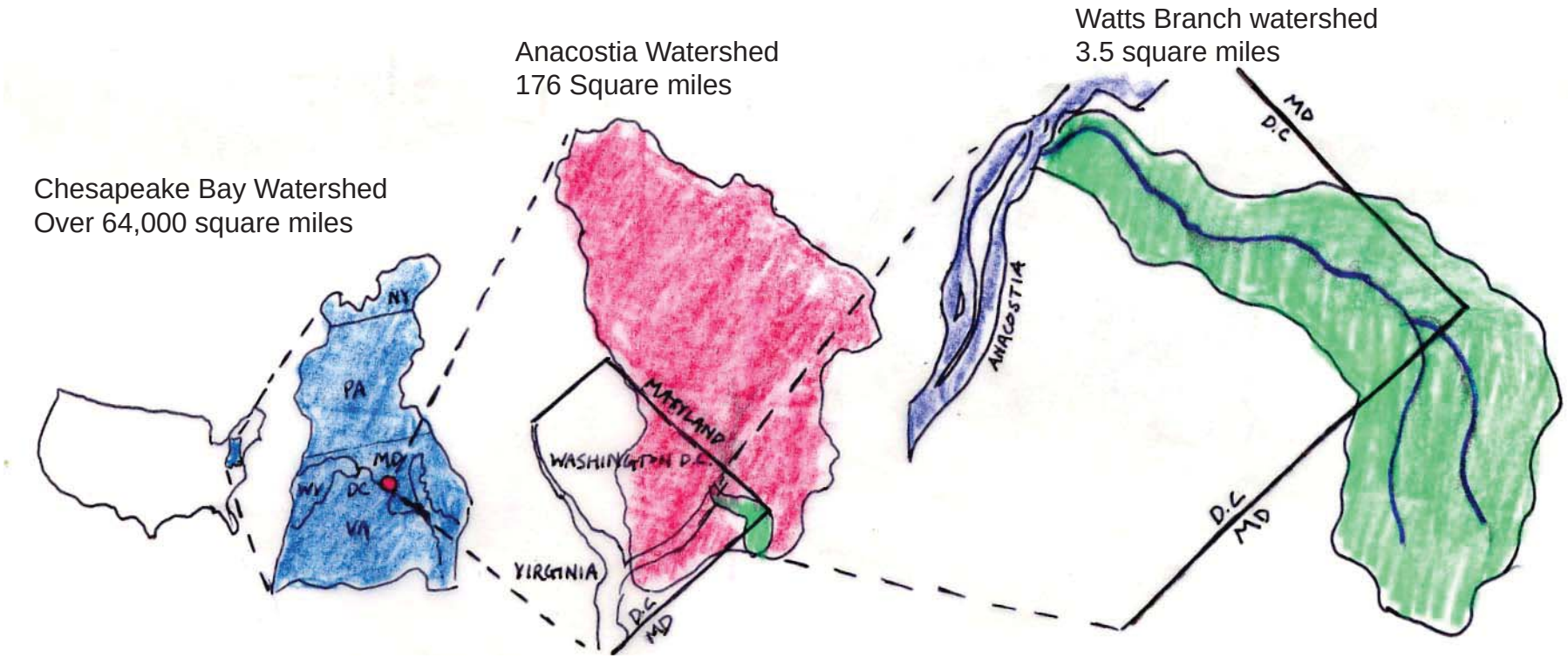


Figure 7. Watershed Relationships

Combined Sewer System

Another threat to water quality of Watts Branch is combined sewer overflows. Most of Washington D.C. has a combined sewer system meaning that rainfall and sanitary sewage are transported by the same system. Dry weather flows are transported to Blue Plains Treatment center but when there are storms, the flows are often greater than the capacity of the system which results in overflows into the local waterways (D.C. DOH, 2003). Sewage discharge has been a major problem for Watts Branch, not only during major storm events, but also as a result of old and faulty pipes. During a cleanup event at Watts Branch on Martin Luther King Day in January of 2006, volunteers were horrified to find sewage flowing into the stream from a broken pipe. Workers were off duty when the problem was discovered. The sewage continued to flow for over 24 hours before D.C. Water and Sewer Authority were able to address the problem. As a result, tens of thousands of gallons of sewage were dumped into the stream (Levine, 2006).

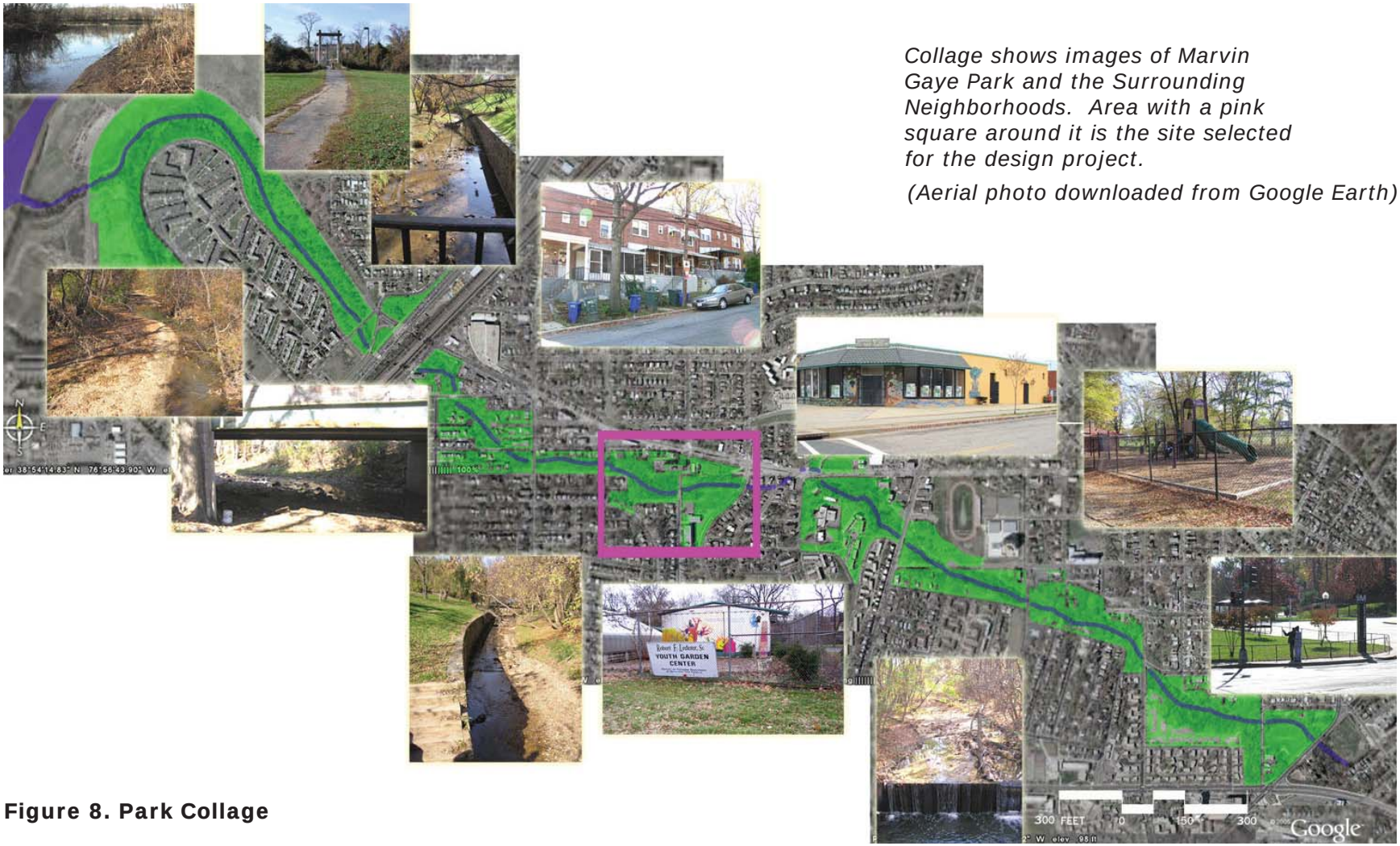
Water draining off the street into a sewer inlet after a storm.

In addition to polluting the stream, the sewage spill on Martin Luther King Day 2006 resulted in damage to the riparian vegetation. Image shows pump intended to divert sewage from a broken sewer pipe.

Typical view of eroding streambank.

Park Challenges and Opportunities

Marvin Gaye Park offers a unique setting for exploration of the design principles established in Section One. *The Down by the Riverside Campaign* has served as a catalyst for the area generating exciting opportunities for the future of the park. Plans for improvement of pedestrian and bike paths, along with existing public transportation routes will make the park easily accessible for routine visitation. The high population of youth makes it an excellent location for focusing on education and the proximity of local schools challenges the park to augment the schools curriculum and serve as an outdoor classroom for students. Along with the strengths of the park, the analysis indicates several design challenges. Many of these relate to water quality and erosion issues resulting from urbanization. Additionally there are crime and safety issues that remain as a result of years of neglect and local poverty. After looking at the park as a whole and gaining a better sense of the neighborhoods and surrounding areas I chose to focus on one section of the park for my design project.



Collage shows images of Marvin Gaye Park and the Surrounding Neighborhoods. Area with a pink square around it is the site selected for the design project.

(Aerial photo downloaded from Google Earth)

Figure 8. Park Collage

Site Analysis

The selected site is approximately seven acres and lies between 46th St. NE and 49th St. NE. The eastern portion of the site is bound by Nannie Helen Burroughs Avenue to the north and Aiton Elementary to the south. Residential property lies to the north and south of the western portion of the site. There are a number of characteristics that drew me to this particular section of the park. One of the major reasons is its proximity to three local elementary schools, each within one-quarter mile walking distance. Additionally the site already has an environmental education component; it is the site of the Lederer Environmental Education Center. The Lederer Center is run by D.C. Parks and Recreation which describes the center as "a citywide environmental science resource center designed to provide District youth and visitors with multiple learning experiences about nature, gardening, animals, weather reporting and forecasting, and the preservation of the environment" (D.C. Department of Parks and Recreation, 2006). The center is used for a variety of activities including an after school program and a summer youth gardening program. The center is a definite asset and could be futher developed to maximize its potential. Currently the facilities are surrounded by a large chain link fence and tall row of hollies partially block the Center from view.

Figure 9. Existing Conditions *Base Map Data: Washington D.C GIS Atlas http://dcatlas.dcgis.dc.gov (Accessed 6 January 2006).*

Circulation

A strength of the site is that it is connected to a pedestrian/bike path that runs the length of Watts Branch. However, it is also located adjacent to a major thoroughfare and currently lacks a sidewalk along the north side of the site (Burroughs Ave.). Figure 10. below illustrates existing circulation patterns and highlights concerns.

Lack of a sidewalk along Burroughs Ave.

The intersection of Nannie Helen Burroughs Ave. and 49th St. NE

Figure 10. Site Circulation

Slope

In addition to safety concerns related to high traffic volume, the steep banks of Watts Branch are an issue. Visitors to the site walking along the stream currently have poor visibility. Someone could be walking along the top of the bank with no knowledge that someone was at the edge of the stream below them. This suggests the need to reduce the severity of the incline and improve views. Figure 11 below looks at stream bank slope throughout the site. The banks on the eastern portion of the site are particularly steep. It is an area to think about employing stabilization techniques that allow for visitor access and prevent erosion.

Figure 11. Slope Analysis

Eroding streambanks.

Vegetation

Figure 12 looks at existing stream bank vegetation. The eastern portion of the site is more heavily vegetated. The analysis suggests that design should avoid removing significant vegetation in this area. There is an opportunity to clear out invasive plants and create a more accessible area with distinct canopy layers. The western portion of the site has minimal existing riparian buffer.

Figure 12. Existing Vegetation

Typical (winter) view of denser vegetation in the western portion of site.

Thin riparian buffer eastern portion of site.

Path of Watts Branch

An interesting aspect of the site is that it is where the stream reappears after traveling in a pipe underground for two blocks. Based on information from the 1898 U.S. Geological survey map, the dashed blue line in the image below indicates the approximate path of the stream before this section was buried. Restoration of the original path would be difficult as it travels underneath Burroughs Avenue, a major traffic corridor. There is possibility that the stream could one day be daylighted in an alternate path. Since removing houses or businesses runs counter to the need for full community support of the Watts Branch Revitalization, daylighting the stream is best thought of as a future phase for the project. When land turns over, the city could purchase it for the Park. For the purposes of this design, the decision was made not to daylight the stream, but to build on the existing circumstances and find a way to celebrate the reappearance of the steam as part of the project.

Figure 13. Original Path of Watts Branch

Stormwater Runoff

Urbanization and resulting stormwater runoff are problematic for the health of Watts Branch. As a site geared toward environmental education and awareness there is opportunity to help kids to make a connection between the built environment and its impact on natural systems. The diagram below looks at current areas of stormwater collection on the site (leading into storm sewers) as potential locations for alternative forms of collection and treatment. As the graphic indicates, streets have been engineered to carry water flow and water is generally collected at the intersection of streets. The areas of collection around the site selected for design happen to be located near the entrances of the park where visitors could observe stormwater treatment as they enter the park.

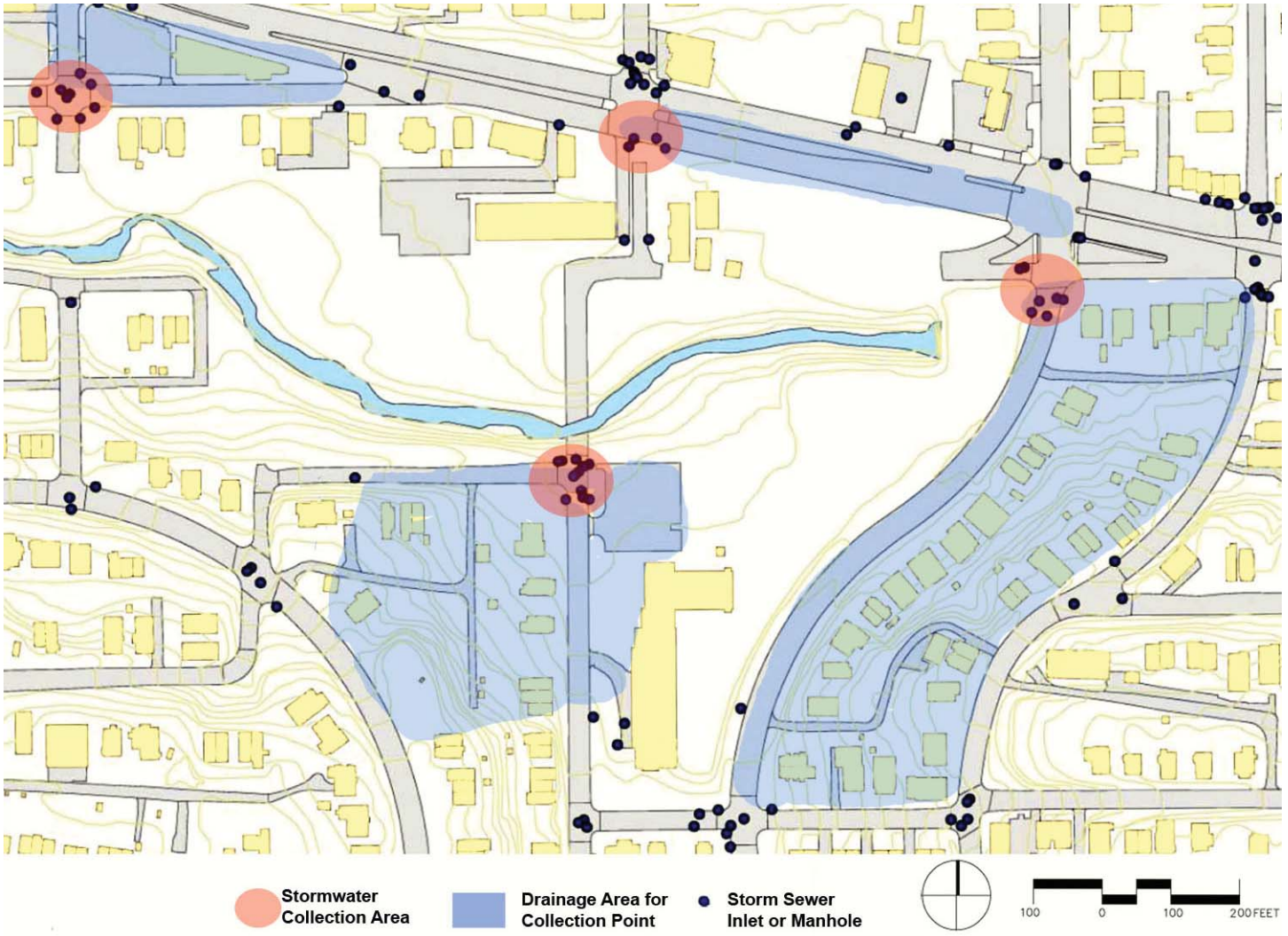


Figure 14. Storm Water Runoff: Drainage and Collection

(Data source: Washington D.C GIS Atlas http://dcatlas.dcgis.dc.gov Accessed 6 January 2006)

Synthesis

The site has numerous strengths and opportunities such as its connection to local schools and the existing youth gardens, however, it also faces numerous design challenges. The diagram below reviews the challenges and opportunities of the existing site.

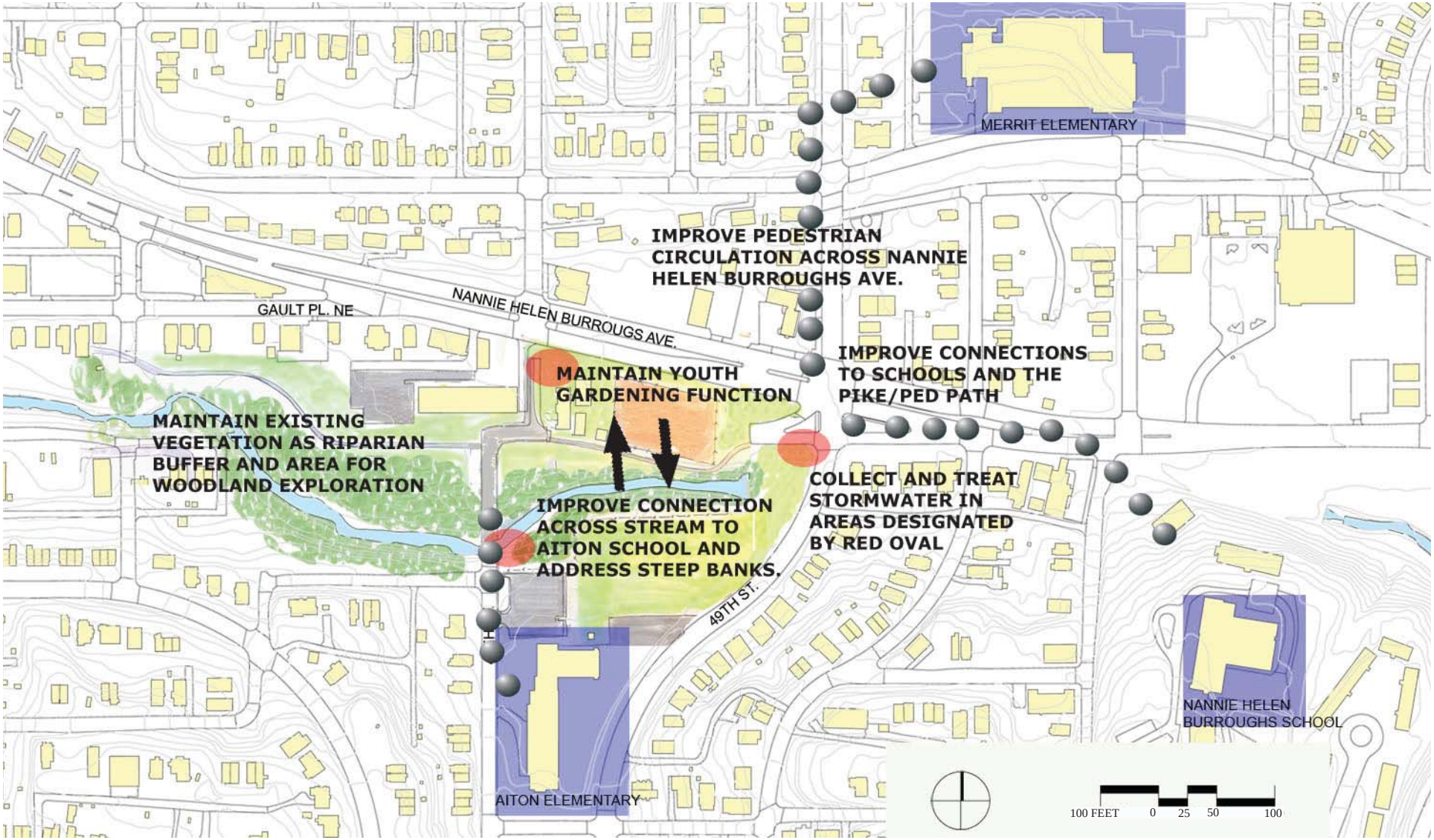


Figure 15. Synthesis: Site Challenges and Opportunties

Site Challenges and Opportunities

Based on the analysis, the following were identified as important issues to address in the design of the site.

- ***Unrealized Potential*:** The Park went unused for many years because it was considered dangerous. The design must be inviting to the community and help residents to recognize the greater potential of the park.
- ***Reframing Children's Perspective*:** For a long time the park served as trash dump and marketplace for drug dealers. The new design must help children to feel safe and recognize the park as a beautiful and fun place to play.
- ***Water Quality and Crime*:** Despite on-going efforts to clean up the park, water quality and crime remain relevant issues. The design must recognize and address concerns such as steep, eroded banks and areas of poor visibility.
- ***Involving Local Schools*:** The design should encourage the many local schools to make routine use of the park.
- ***Long Term Maintenance*:** To ensure the park is maintained, the design requires a long term plan that indicates how the space will be cared for and sustained over time.

The overall goal for the design is to create a place that is multifunctional, addressing the ecological needs of stream while allowing visitor access. The space should serve multiple users and activities. It should provide outdoor classroom space for schools, complement the functions of the Lederer Environmental Center, and serve as a gathering space for children and families.

Concept and Form

Concept

For years Watts Branch and the surrounding park were neglected. As development occurred the park became further separated from the surrounding community. The design concept is to weave together the fabric of the city with the fabric of nature to create a multifunctional landscape that serves ecological as well as cultural needs.

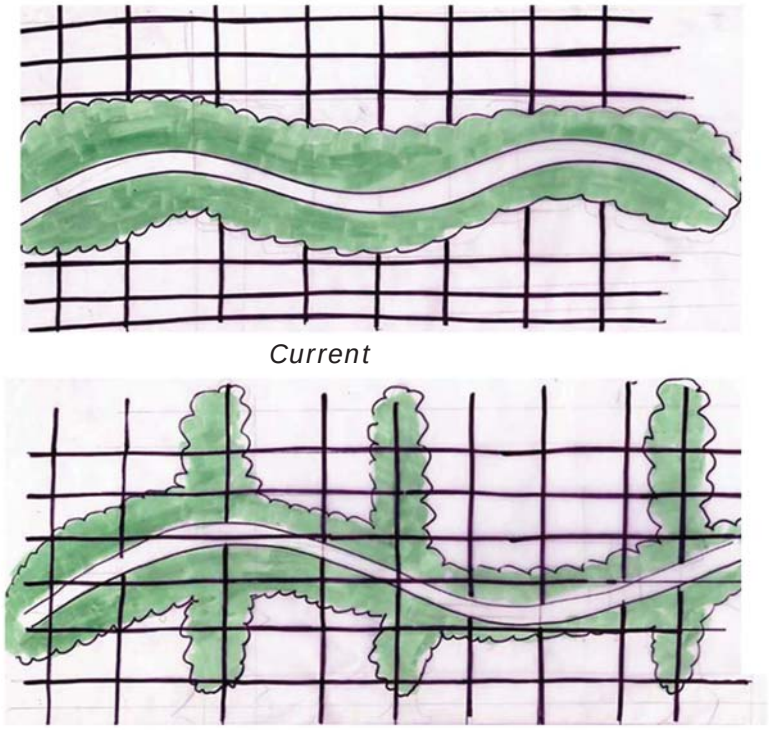


Figure 16. Design Concept Diagram

It is important to recognize the natural systems at work in the city and design accordingly. Marvin Gaye Park is located in a highly urbanized area and provides opportunity to show kids that although the surfaces in the surrounding area may be largely paved over, natural systems are still in place. John Tillman Lyle, in his book *Regenerative Design (1994),* calls for a complete change in the way we design urban areas. He talks about how we have traditionally developed our cities from pre-industrial times when we concentrated farming and development around our city centers, to the industrial trend of separating developed areas from agriculture and open space. In order to create a more sustainable landscape Lyle suggests we need to reintegrate urban areas, agriculture and open space by moving into the next phase of design, what he has termed regenerative design.

A transition to regenerative design will require innovative new techniques as well as revival of successful techniques from the past. William Wenk (2002) points to the McMillan Reservoir Park in D.C. as a historical design with lessons for today. The reservoir once supplied the city of Washington with most of its drinking water. Sand filled underground vaults were used to filter out the impurities. A formal park above the vaults was designed by Frederick Law Olmsted. During the City Beautiful movement at the turn of the century it was common for architects, landscape architects, engineers and artists to work together on projects to form the public realm. The result was landscapes that combined function, recreation, and art. Early technologies like the use of sand to filter water worked with natural processes, but today we treat water with chemicals, and move water through pipes underground. Stormwater ponds are often fenced off and treated as a liability rather than an asset to the community. In future design there is opportunity to work with, rather than against, the flow of natural systems.

The design of outdoor learning and play areas can be developed to demonstrate possibilities for designs to serve multiple functions. One example of a design that serves multiple functions is Wallace Park in Denver. Structures in the river designed by Wenk and Associates serve as seating and outdoor tables in times of low flow. During storms the structures are covered by water and help to dissipate the energy of high flows resulting from stormwater runoff. “They celebrate the value of an urban stream as a neighborhood resources and the potential of drainage structures to be both a recreation resource and a functional part of the city’s stormwater system” (Wenk, 2002, p.187).

Innovative designs that serve ecological function and allow cultural access may help tackle some of the issues that Joan Nassauer raises in her “Messy Ecosystems, Orderly Frames” (1995). Nassauer begins by discussing how landscapes with high ecological value tend to look messy to people because nature had come to be identified with the picturesque. In an economically depressed area, such as the neighborhoods surrounding Marvin Gaye Park, it seems particularly important to consider that riparian vegetation around the stream bank may look messy and overgrown to residents and could account for part of the reason the stream has been treated as a dump. Reframing the community’s perspective may require a new approach to stream restoration and park design.

Program Elements

Site programming began with the decision that the existing youth gardens should remain (in a revised form) and continue to play an influential role within the site. In *City Form and Natural Process*, Michael Hough (1984) writes about the significant potential of urban areas for productive farming. Growing transportation and energy costs and health threats from chemicals related to food production suggests that we should reconsider our current system of food production and distribution. Expanding on the existing function of the site as a place for youth gardening has multiple benefits. It allows kids to engage directly with the land; it helps to teach responsibility, and it encourages kids to develop a closer relationship with the site. It also serves as an example of what kids could grow at home in their backyard, on their roof, in their front yard, or at their school. There are spaces all over our cities that could be used for urban gardening. The drawing below shows a programmatic concept drawing for the site.

Figure 17. Programmatic Concept Diagram
(Aerial photo downloaded from Google Earth)

Main Entrance
- Eye catching
- Inviting
- Identifies with neigbhorhood
- Multiple uses (space for setting up a farmstand or other community activity).

Gardens/Education Center
- Improve accessiblility
- Enhance connection to overall space
- Encourage school involvement
- Incorporate Tree Nursery

Flexible Play
- Access/views of stream
- Digging area
- Encourage indirect movement

Gathering Areas
- Flexible uses, able to serve as outdoor classrooms, performance areas and storytelling circles
- Variety in feeling and form, some open, others more enclosed and intimate

Woodland Area
- Area for exploration and play
- Plants that attract birds and wildlife
- Hierarchy of plants to create levels of canopy

Form

The idea of creating a multi-functional design led to initial ideas about the form of the design. I was influenced by water and its significance to the site. I also started thinking about the variety of problems associated with water such as erosion of the stream banks and stormwater polluting the stream. I acknowledged that the watershed has been significantly altered by urbanization and decided that realistically the stream would never be able to replicate a clean mountain stream. I began to think about alternate ways of addressing the stream banks that may not look like the typical stream section, but would prevent erosion while providing opportunities for exploration and discovery.

The stream needs space for the water level to rise and expand in relation to rainfall. I was reminded of ancient stepwells in western India. These structures were developed when people were faced with the need to address the drastic difference in water levels between the dry season and the monsoon season. Deep earthen trenches with stone stairs lining the sides allowed access to the water at varying levels (Livingston, 2002). Terracing the stream banks of Watts Branch could serve a similar function. It would allow visitors to reach the level of the water and it would allow water to rise to different levels after storm events. This would help to restore the floodplain and prevent the continued lateral erosion of the channel.

Building on this idea I decided to expand the terracing concept to the children's youth gardens. Terracing the gardens as well as the banks of the stream could create a continuous transition from the level of the street down to the level of the stream. The section and sketch below were developed as initial concept drawings for the site.

Having decided on terracing as a means of addressing the site vertically, I went in search of way to unify the program elements of the site. I thought of the sinuous swirls of the navy-marine memorial located along the George Washington Parkway in Arlington County Virginia (see image below). The ridges in the picture are reminiscent of terraces and the winding form provides a sense of fluidity in movement (I felt this was important because kids never seem to move in a straight line). Most importantly the form speaks of the significance of water; since Watts Branch was neglected for many years the design should celebrate the importance of the stream to the site.

Image of Navy-Marine Memorial Sculpture

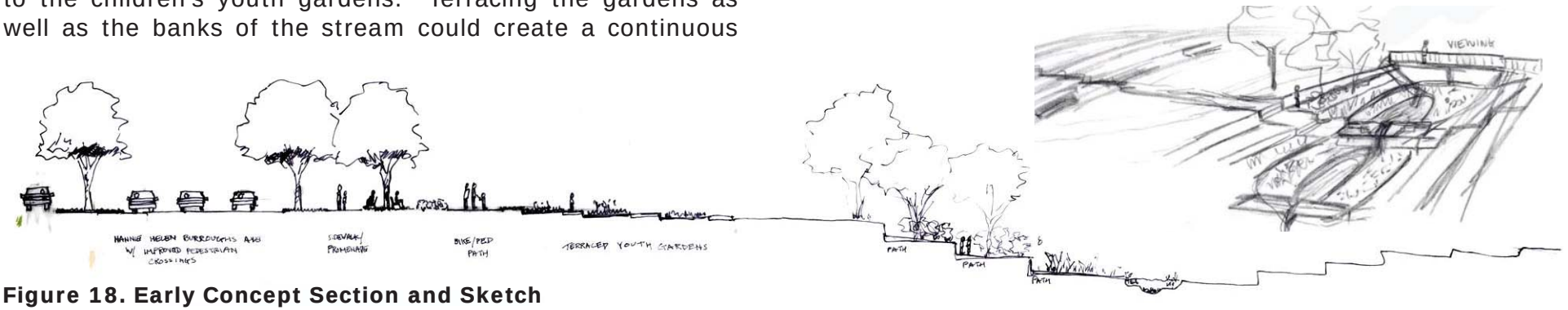


Figure 18. Early Concept Section and Sketch

The images below demonstrate how the ideas on form were explored and used to create initial site plan concept drawings and models. The intention was to create a site that encourages visitors to wind their way through slowly and use all their senses to explore the multiple layers. The form is intended to provide the foundation for a space that serves multiple users and activities.

Figure 19. Concept Plan Sketches and Form Model

Master Plan

The master plan was developed in response to the site analysis and decisions regarding form and program elements. A variety of spaces are woven together to make up the design as a whole. The western part of the site is more heavily wooded to build upon the strength of the existing vegetation in this area and to contrast the experience of the eastern portion of the site. The main entrance is located at the corner of 49th Street and Burroughs Avenue. This entrance takes people through an interactive rain garden. The garden is both a playful and interactive element and is intended to make a statement about the relationship between the built environment and natural systems as visitors enter the site. From here there is a choice in which direction to travel, you can head down to the pools and overlook, traverse the climbing mounds or explore the woodland. Groups visiting the site can find several places to gather for an outdoor class or activity, whether it be down by the stream, in the sun along the south facing lawn terraces or in the more enclosed and shaded woodland gathering area. The following pages describe the various site elements and their characteristics.

Figure 20. Master Plan

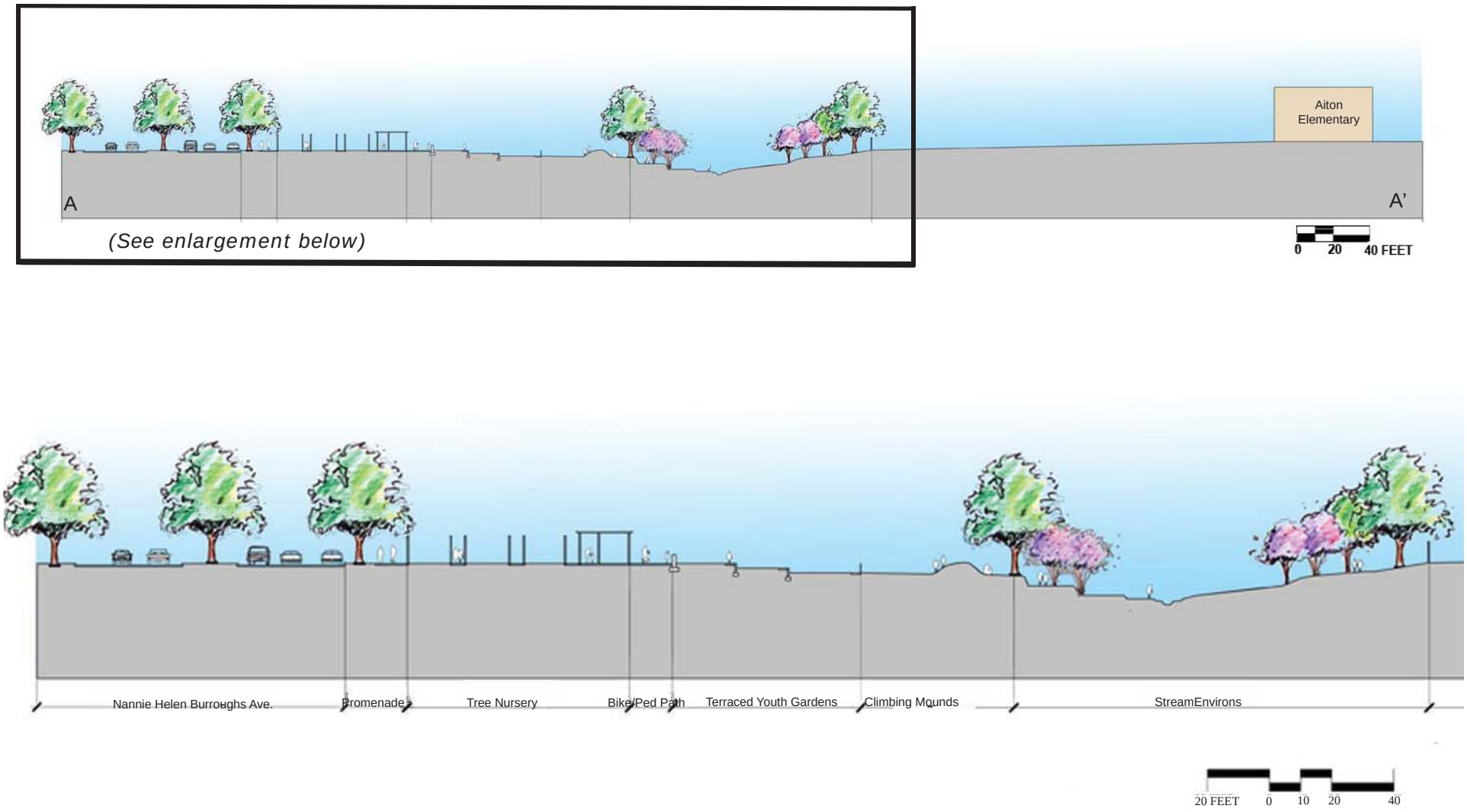
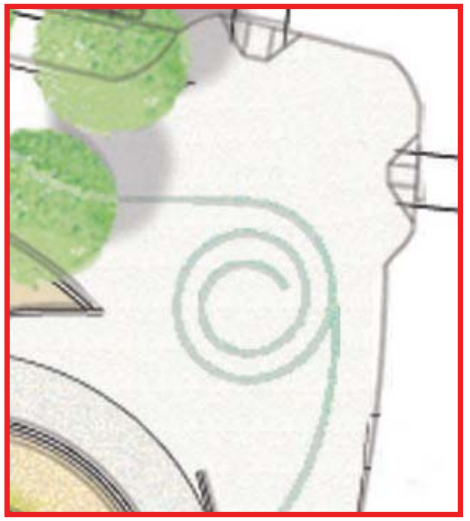


Figure 21. Master Plan Section A

Main Entrance

In order to integrate the site into surrounding neighborhoods and make it easily accessible, there are multiple entrances to the space. The main entrance is located at the corner of Burroughs Avenue and 49th Street, the corner with the highest visibility. As visitors approach the main entrance from Burroughs Avenue or 49th Street they become aware of the blue and green recycled glass embedded in the paving that winds its way down the sidewalk, symbolic of the flow of the river and acknowledging the importance of water to the park. The glass culminates in a spiral form at the entrance plaza. The spiral form is echoed in the adjacent rain garden. The entrance plaza provides a setback between the park and the street. It is a place where people can meet and congregate, where kids can set up a small vegetable market on the weekends and where community members can hang out and observe travelers that pass by. The entrance to the park is framed by the children's art wall. The art wall is a dynamic element within the site that allows neighborhood children to help define the character of the space. The wall is intended to be routinely repainted so that kids are continuously involved in helping decorate the space.

Detail of recycled glass inlay in concrete sidewalk.



Entry Plaza, enlarged plan view.

Recyled glass inlay winding down the promenade.

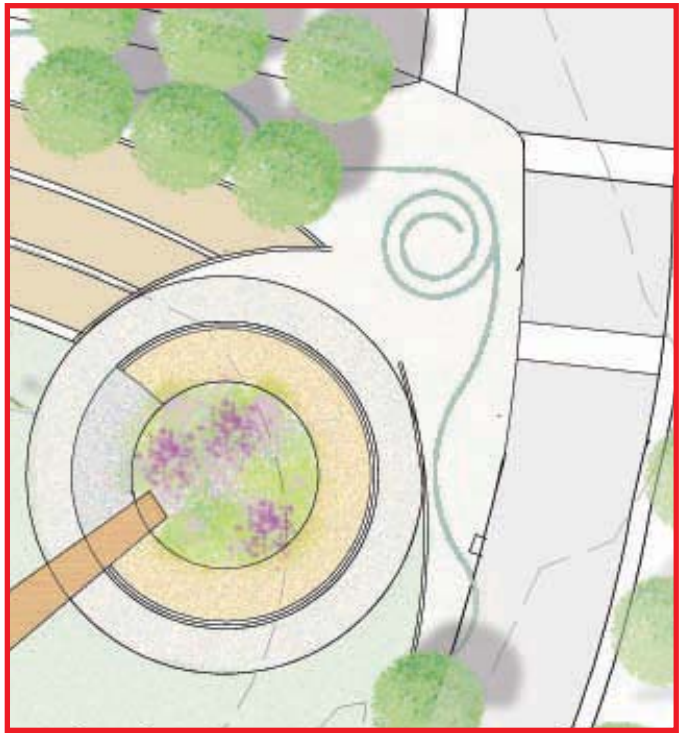
Kids Art Wall framing entrance to the Interactive Rain Garden.

Figure 22. Main Entrance Sketches, Plan and Detail

Interactive Rain Garden

The main entrance connects directly to the interactive rain garden. The rain garden collects stormwater off the street and directs it into this children's garden where it is filtered and cleaned. The garden is designed as both a functional and a playful space with a variety of textures, levels and activities. The rain garden helps demonstrate the effect of the built environment on natural systems and how innovative design strategies can help mitigate this impact. The master plan calls for smaller rain gardens to be located at other entrances to the space as well to help demonstrate this point.

Sketch showing Interactive Rain Garden and dry river bed transporting purified stormwater runoff into the stream.



Interactive Rain Garden, enlarged plan view.

Figure 23. Interactive Rain Garden Sketch and Plan

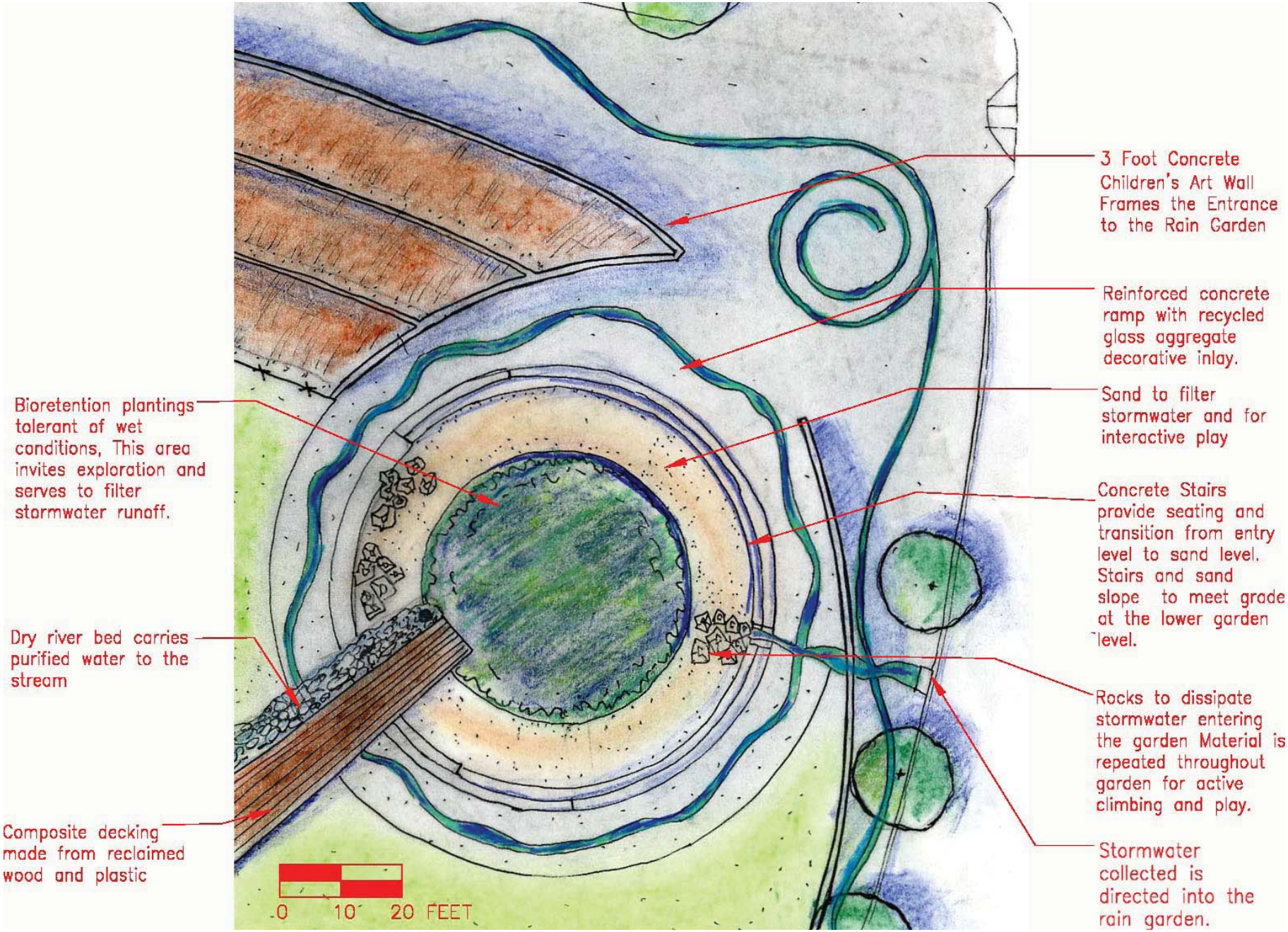


Figure 24. Interactive Rain Garden Design Characteristics

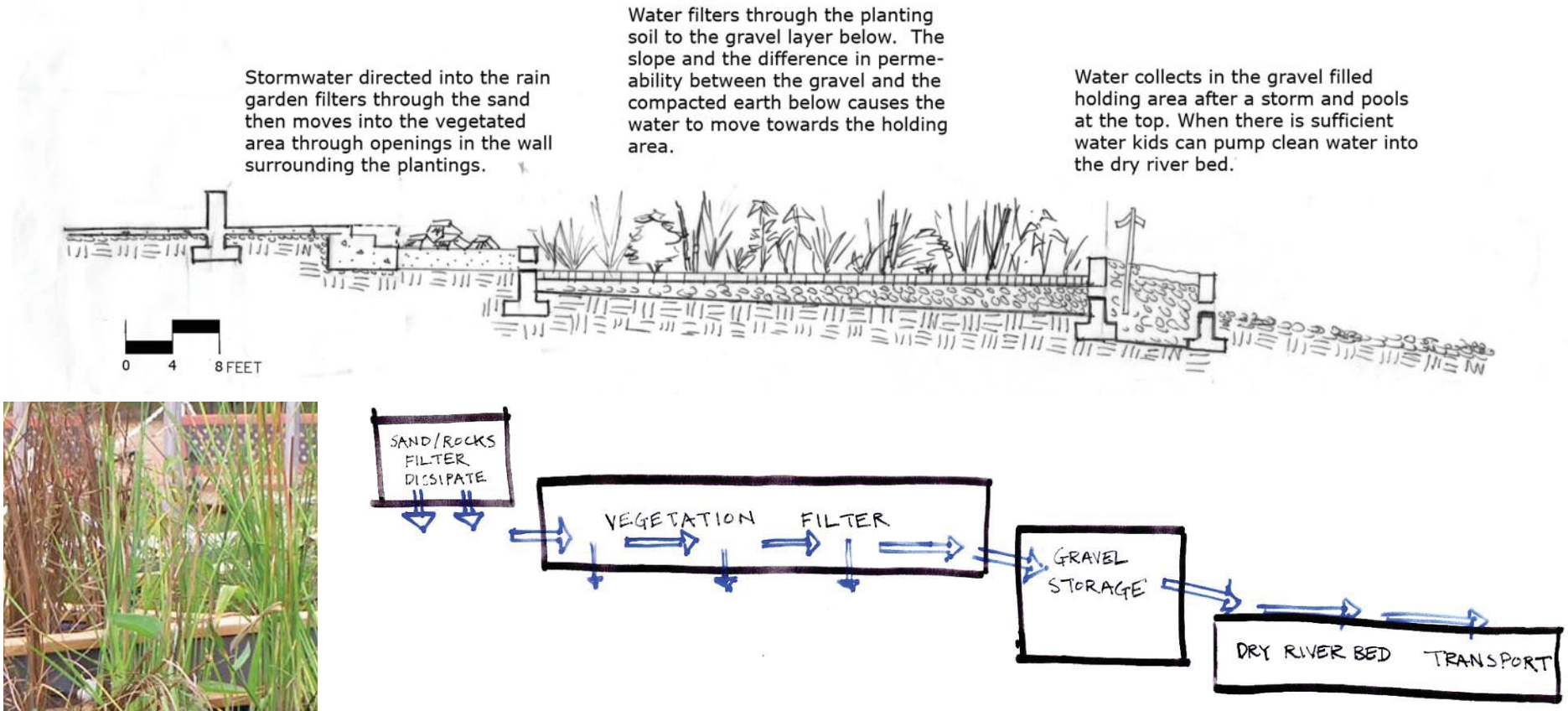
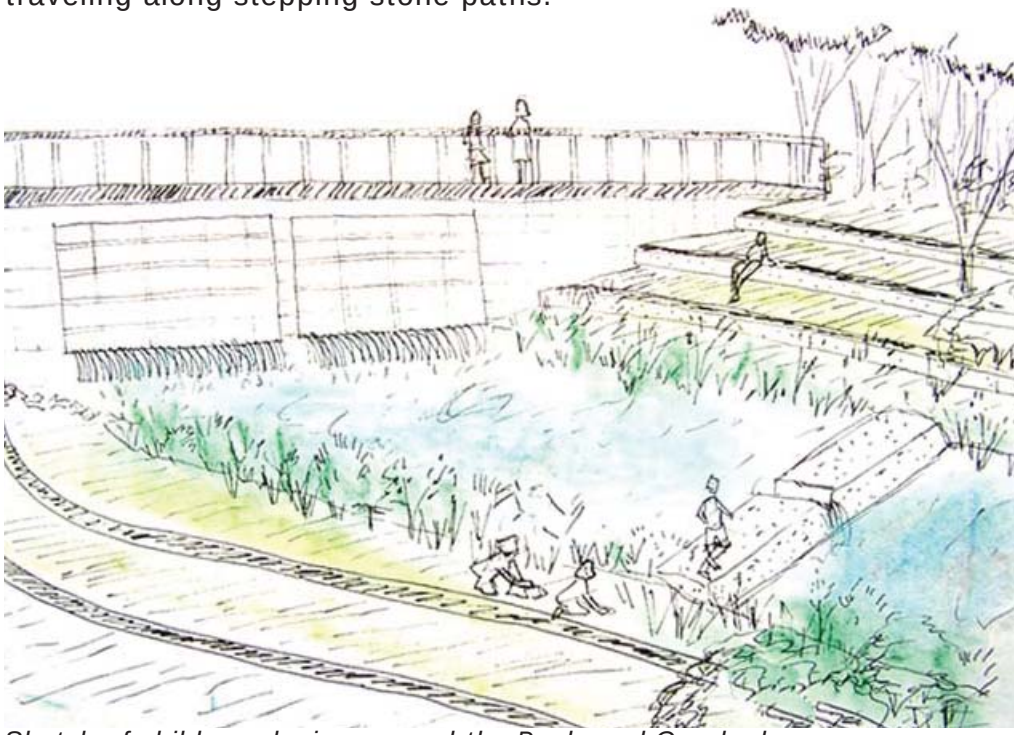


Figure 25. Interactive Rain Garden Section and Water Flow Diagram

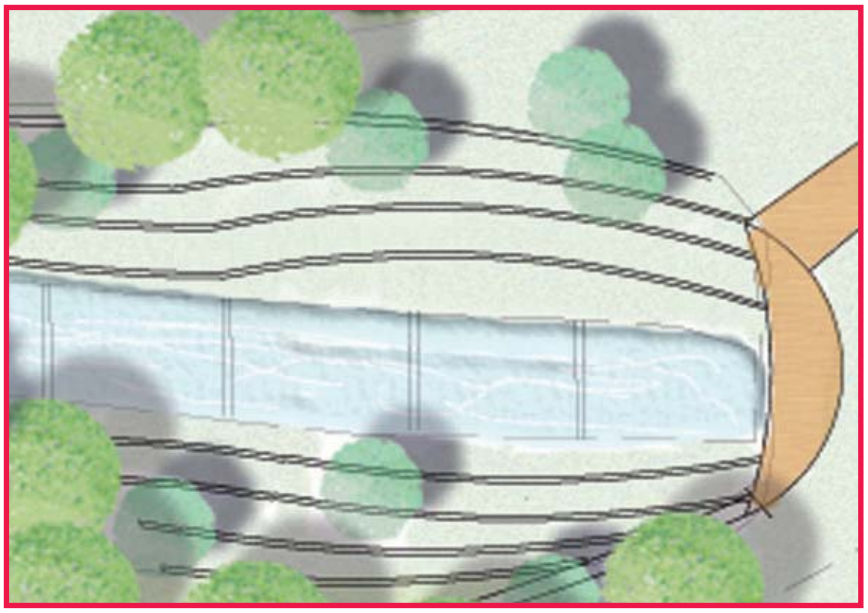
Water tolerant plantings typical of vegetated area.

The Pools and Overlook

Composite decking made from reclaimed wood and plastic leads from the Rain Garden to a scenic overlook where kids can view the river from above and interact with friends on the levels below. V-Notch weirs form pools that help to accommodate aquatic life and provide the refreshing sound of moving water. Terraces on both sides of the bank allow visitors to access the stream and celebrate the water as it emerges from the culvert. At this location the terraces are concrete seat walls that allow for frequent access and heavy traffic. Other areas of the stream bank employ wood cribbing and live willow bundles as an alternate means of stream bank stabilization. These areas are more heavily planted; children are encouraged to respect the vegetation and fragile banks by traveling along stepping stone paths.



Sketch of children playing around the Pools and Overlook.



The Pools and Overlook, enlarged plan view.

Figure 26. Pools and Overlook Sketch and Plan

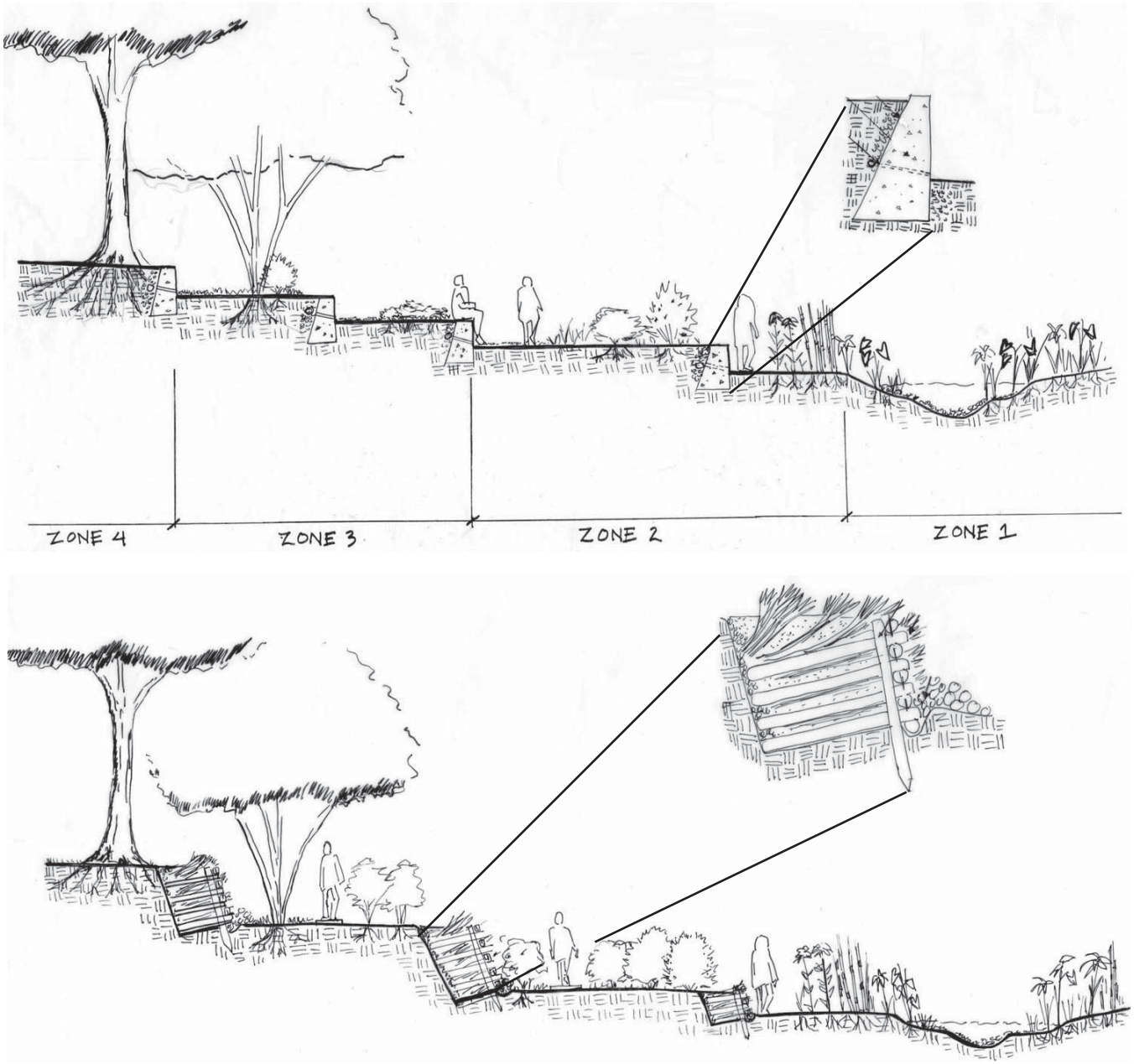


Figure 27. Terraced Streambank Sections

Top: section with concrete seat walls.
Bottom: section with wood cribbing and live willow bundles.

Zone 1, the emergent vegetation zone, is permanently to semipermanently flooded and often dominated by grasses, sedges, rushes, and herbaceous plants.

Zone 2, the riverside thicket, may be seasonally to temporarily flooded and is often characterized by emergent species, shrubs, and a few tree species.

Zone 3, the saturated forest, has soils which are saturated to poorly drained.

Zone 4, the well-drained forest, is also known as upland forest. Zones 3 and 4 are dominated by trees, but also contain shrub and herb layers in the understory.

(Riparian Zones as defined by the Virginia Department of Conservation and Recreation http://www.dcr.virginia.gov/dnh/riparian.htm Accessed 22 February 2006)

Table 4. Terraced Streambanks Partial Plant List

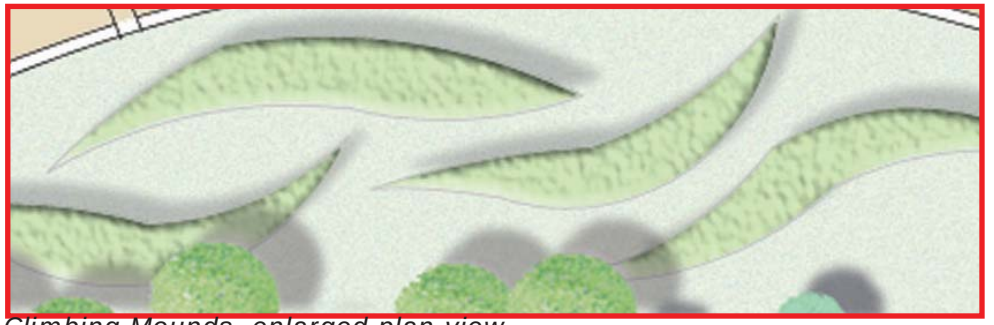
Common Name	Botanical Name	Characteristics/Sensroy Appeal
ZONE 1		
Herbaceous Plants		
Acorus calamus	Sweet Flag	Arrow shaped leaves
Iris virginica	Virginia Blue Flag	Spring/Summer Flower
Grasses/Sedges		
Carex crinita var. crinita	Long Hair Sedge	Fine Texture/Wind Movement
Carex lurida	Sallow Sedge	Fine Texture/Wind Movement
Panicum virgatum	Switch Grass	Fine Texture/Wind Movement
ZONE 2		
Herbaceous Plants		
Chelone glabra	White Turtlehead	Flowers Summer/Fall
Equisetum hyemale	Horsetail	Bamboo like, hollow
Lobelia cardinalis	Cardinal Flower	Flowers in Summer
Rudbeckia laciniata	Tall coneflower	Flowers in Summer
Shrubs		
Cephalanthus occidentalis	Button Bush	Interesting Flower
Clethra alnifolia	Sweet Pepper Bush	Fragrant
Rhododendron viscosum	Swamp Azalea	Fragrant

Common Name	Botanical Name	Characteristics/Sensroy Appeal
ZONE 3		
Herbaceous Plants		
Aster novae-angliae	New England Aster	Flowers in Fall
Phlox divaricata	Woodland Pholox	Flowers in Spring/Fall
Shrubs		
Ilex verticillata	Winterberry	Bright Red Berries in Winter
Itea virginica	Virginia willow	Good Fall color
Sambucus canadensis	Common Elderberry	
Small Trees		
Magnolia virginiana	Sweetbay Magnolia	Fragrant, Flowers in Spring
Amelanchier canadensis	Serviceberry	Good Fall color
Large Trees		
Nyssa Sylvatica	Black Gum	Good Fall color
ZONE 4		
Large Trees		
Acer rubrum	Red Maple	Good Fall color
Betula Nigra	River Birch	Textured Bark, Wind movement
Small Trees		
Cornus florida	Dogwood	Year Round Interest
Cercis canadensis	Eastern Redbud	Early Spring Flower
Shrubs		
Lindera benzoin	Spicebush	Fragrant
Viburnum dentatum	Southern Arrow-wood	Creamy White Flowers

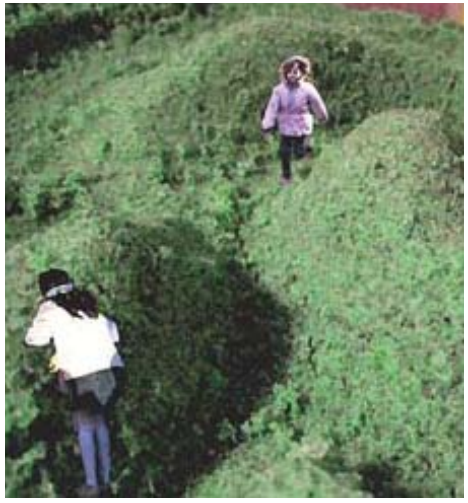
Climbing Mounds

The mound forms echo the meandering form of a stream, providing a play space for kids where they can climb and explore. The mounds encourage children to take a circuitous route through the space rather than moving in a direct line. With consideration for maintenance, the land forms are created so that one side has a more moderate slope that can be mowed and the other side is steeper and planted with decorative grasses that can be left to grow longer.

Navigating the Climbing Mounds.



Climbing Mounds, enlarged plan view.



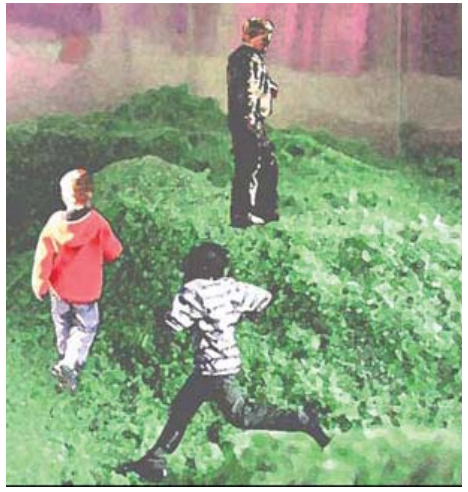
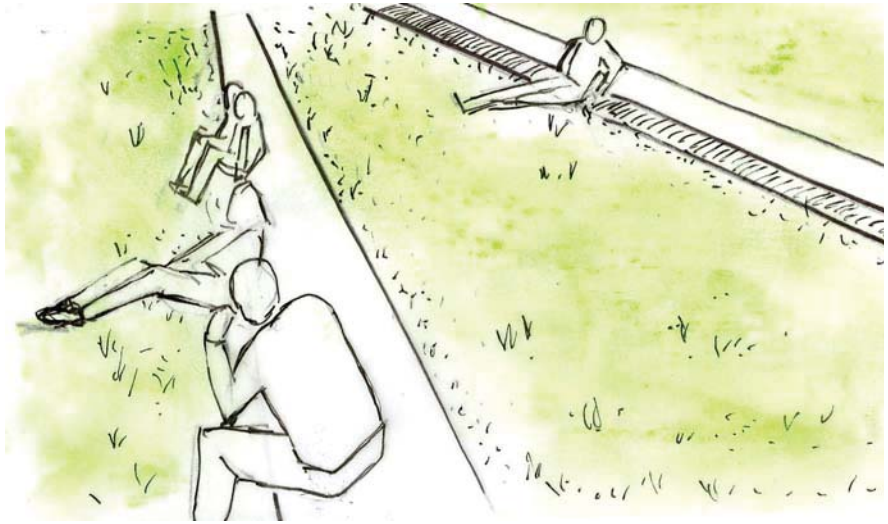


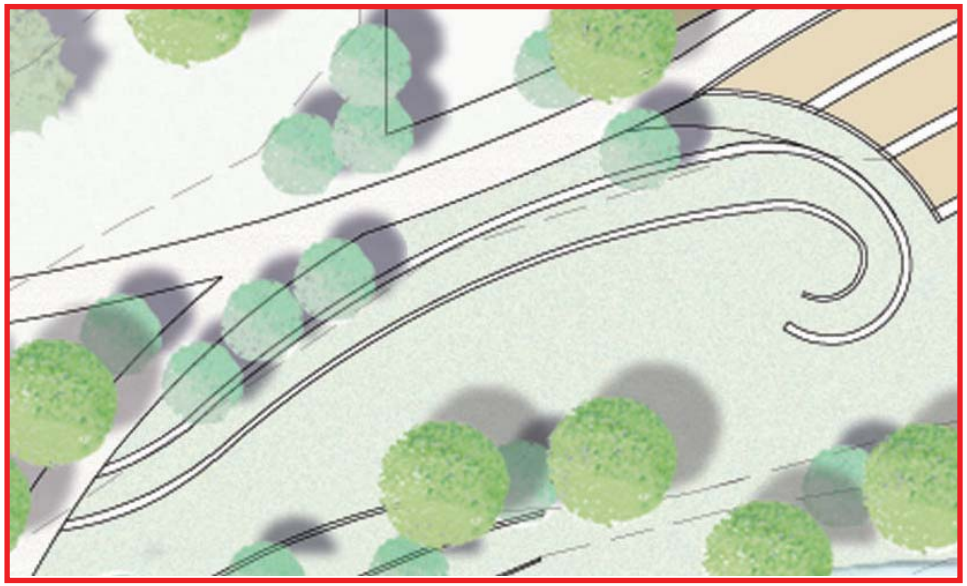
Figure 28. Climbing Mounds Sketches and Plan

Lawn Terraces

One foot concrete seat walls form the Lawn Terraces. This area provides a place to sit and relax in the sun or to gather as a group for an outdoor class or activity. The form of the lawn terraces flow into the adjacent youth gardens.



Lounging on the Lawn Terraces.



Lawn Terraces, enlarged plan view.

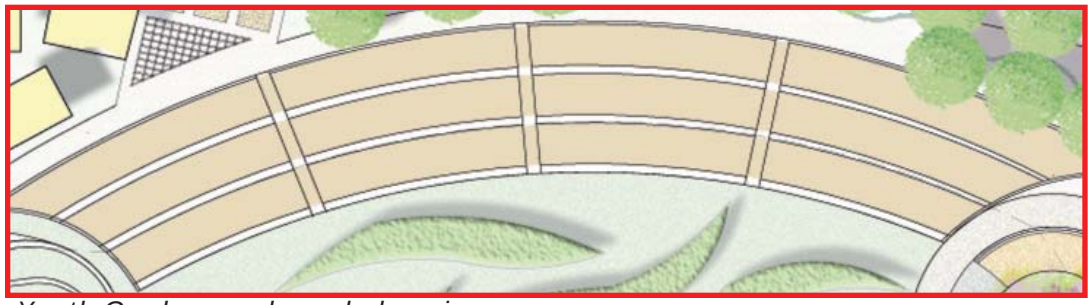
Figure 29. Lawn Terraces Sketch and Plan

Youth Gardens

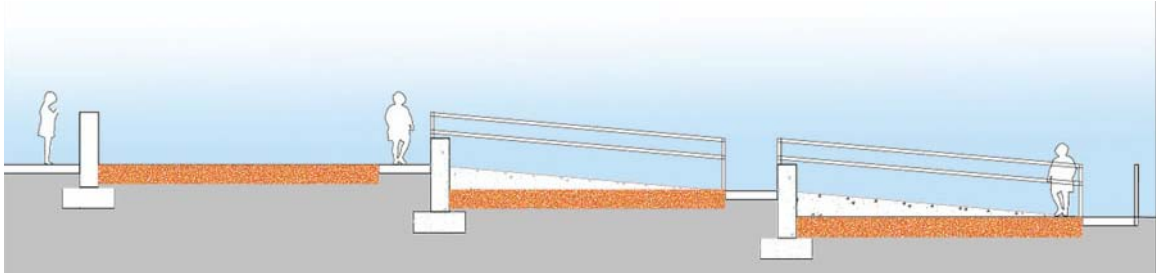
Youth gardening has occurred on the site for decades; the gardens have been rearranged so that they are more inviting and fit with the flowing form of the site. The gardens are terraced to continue the form of the stream bank and to create a continuous transition from the street down to the stream. Paths and ramps provide access through the gardens and address the need for wheelbarrow access to all terrace levels.

The gardens are currently surrounded by a tall chain link fence. Though I recognized that a fence is a deterrent to theft, I also noticed that community gardens in other part of the D.C. metro area such as Alexandria, VA and Arlington, VA do not have such high fences. This design was carried out with the future in mind (i.e. that improvements in the neighborhood and revitalization of the park will make it a safer place and one where there is more trust.)

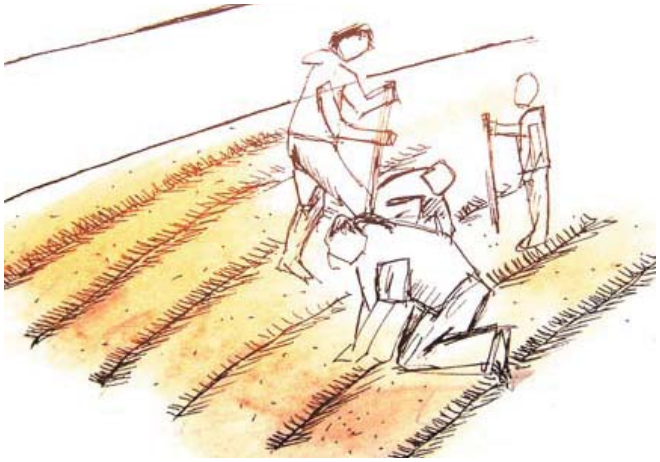
Talking with community gardeners I have learned that vegetables occasionally get stolen everywhere. I decided the trade off of making the space more inviting and open was greater than the need for a tall fence to prevent theft. The three foot Children's Art Wall surrounds the gardens on three sides and a three foot fence forms the fourth border at the base of the gardens in order to keep animals out of the garden



Youth Gardens, enlarged plan view.



Section indicates how ramps provide wheelbarrow access to the different garden levels.



Children gardening.

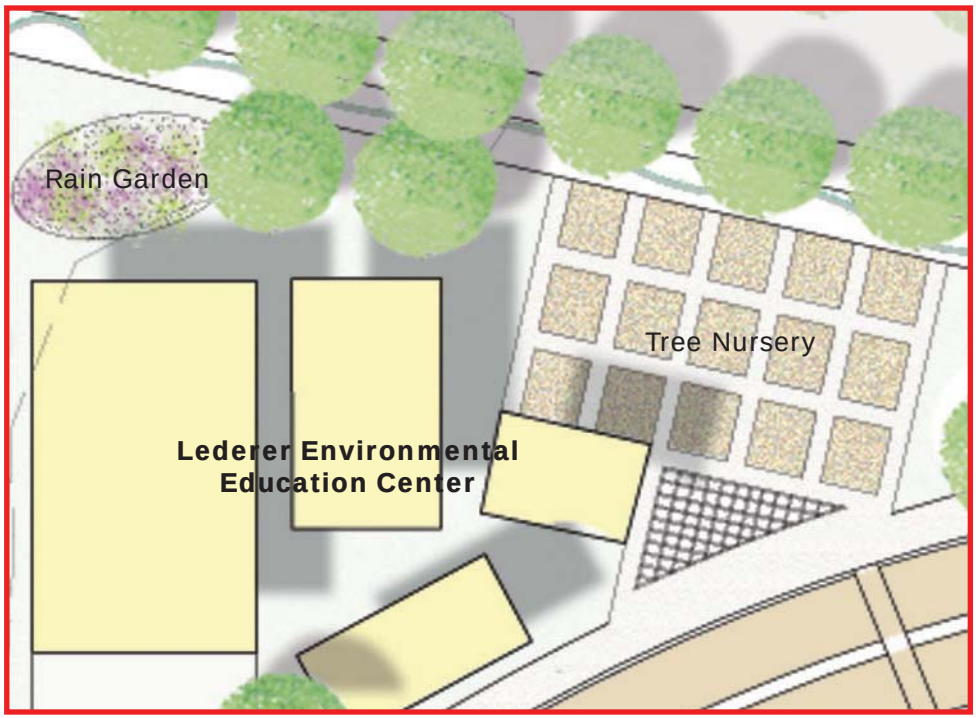
Figure 30. Youth Gardens Plan, Section and Sketch

Environmental Education Center and Tree Nursery

A temporary structure for environmental education exists on the site along with a greenhouse and storage buildings. There are plans for the future redesign and replacement of these buildings. The buildings shown on the master plan suggest how the structures may be reorganized in the future.

The design integrates an urban tree nursery into the plan. The nursery is sited along the promenade in prominent view of passing visitors. The nursery is intended to be open to the public, encouragin people to come in and learn about the importance of trees in an urban environment. The tree nursery would provide opportunity for kids to grow seedlings and plant them along the stream banks. Children have already started to plant and label trees along the banks. The design builds on this idea by encouraging the development of a Children's arboretum around the section of the site designated as a woodland gathering area.

Exploring the tree nursery.



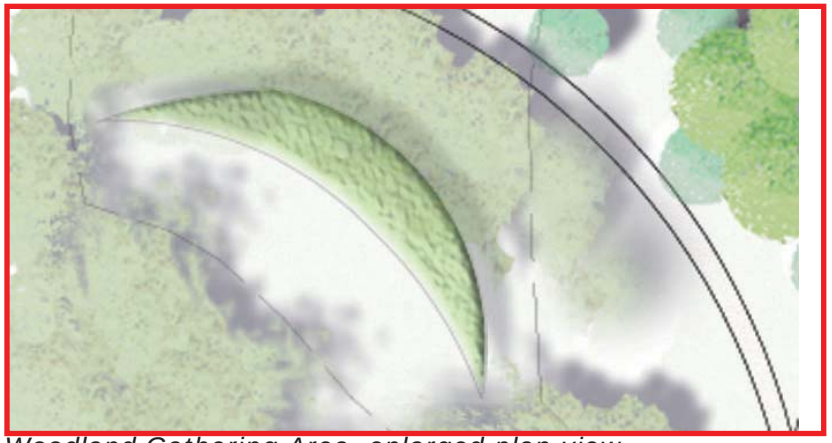
Environmental Education Center and Tree Nursery, enlarged plan view.

Figure 31. Education Center and Tree Nursery Sketch and Plan

Woodland Gathering Area

The woodland gathering area provides a special place for outdoor meetings or gatherings among the trees. An earthen berm forms a backdrop to the space giving it a more enclosed, intimate feel and continuing the form introduced in the climbing mounds portion of the site. The gathering area transitions into an unprogrammed wooded area. Existing invasive vegetation in this area is thinned and replaced with native plants that attract birds and wildlife. A hierarchy of canopy is established with shade, under story and groundcover levels so that kids can explore the space.

Gathering Area nestled among the trees.



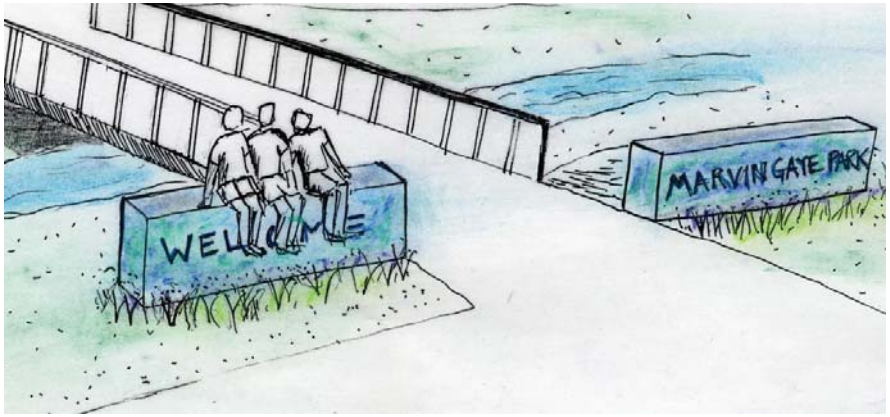
Woodland Gathering Area, enlarged plan view.

Typical understory trees surrounding the woodland gathering area. Left: Dogwood Right: Eastern Redbud

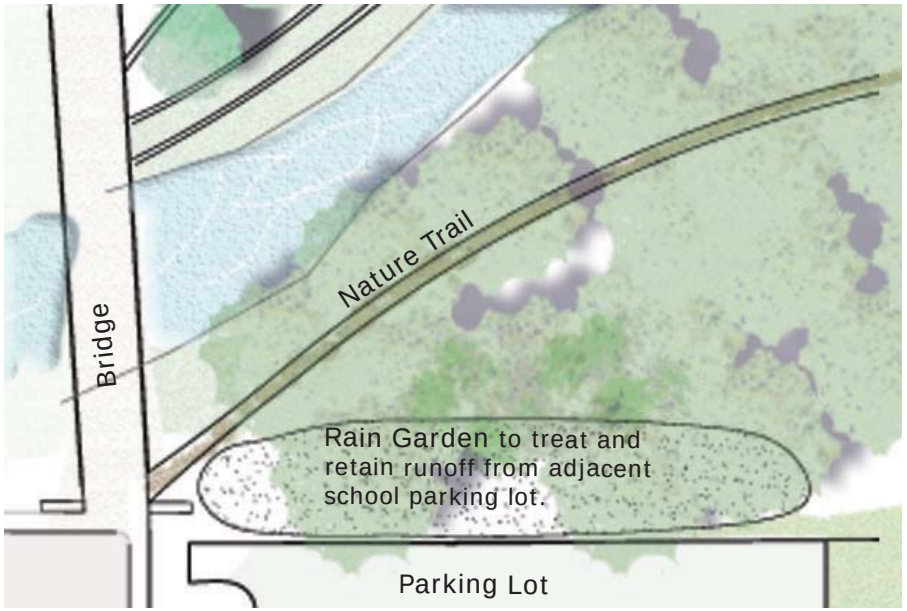
Figure 32. Woodland Gathering Area Sketch and Plan

Bridge and Nature Trail

An existing vehicle sized bridge currently spans Watts Branch and dead ends in the middle of the site. It has been blocked off with jersey barriers to prevent auto access. The bridge is an important point that serves as an entrance to children from Aiton Elementary School. The master plan proposes removing the existing bridge and replacing it with a pedestrian scale bridge that better responds to the site and to visitors. To mark the importance of this entrance, two walls frame the pedestrian bridge. The walls serve as signs welcoming visitors to the park. The glass theme used in the pavement by the main entrance is employed once again. Recycled glass is used to decorate the walls and create a mural. Just beyond the entrance walls a nature trail begins and runs along the south bank of the stream. The trail provides an activity for school groups and helps to form a continuous loop through the space that links the school side of the site to the park side.



Kids hanging out at the entrance to the park from Aiton School.



Bridge and Nature Trail, enlarged plan view.

Figure 33. Pedestrian Bridge and Nature Trail Sketch and Plan

Maintenance

To help create a sense of variety within the space and respond to the surrounding neighborhood conditions, some areas, such as those of more active use along the street, should be routinely maintained while others, such as the woodland area, should receive maintenance only a few times a year. Three general levels of maintenance are described below and the graphic represents how the maintenance zones should be applied to the site.

Figure 34. Maintenace Plan

Conclusion

The master plan responsd to the design principles identified in Section One. It allows for variety in experience, makes ecological connections and provides opportunity for kids to influence the development of the site. Designs for children should always be evolving. My intention was to provide a foundation to attract kids. The kids themselves would then make the space come alive.

SECTION 4: REFLECTION

Revised Principles

Through the design process I was able to further test the principles generated through my research and review of the literature. This section evaluates how the design was successful in addressing the principles, where I faced challenges, and how the principles were revised in response to what I learned from the case studies and the design process. To begin with, the principles were condensed from ten to six in order to simplify and combine similar principles. There was also additional thought given to the order of the principles. The first two principles are broad, general concepts that emphasize accessibility, safety, and children's involvement as the foundations of designing outdoor learning environments. The next two principles address the need for variety in opportunity and experience. The final two principles describe the educational content of outdoor learning areas suggesting that designs should respond to environmental and cultural aspects of place and encourage kids to think about how systems are interconnected.

Below are the revised principles. The section that follows evaluates how the design project addresses the principles and describes how the design process led to these revisions.

1) Design for Safety and Routine Access

Play areas should be safely accessible to children with varying capabilities by a variety of transportation modes (such as foot, bike and public transportation) to allow opportunity for integration into their daily life. The language and layout of the site should be understandable to users and inviting to members of the community in order to attract visitors and encourage informal surveillance of the site.

2) Encourage Personal Involvement and a Feeling of Ownership

Involve children in the planning, maintenance, and design of the space. Allow for continuous involvement with the decoration and definition of the space and help kids to develop a personal relationship to the site that can be maintained over time.

3) Appeal to all the Senses by Allowing for Direct Experience with Elements of Nature

Design should encourage use of all the senses to help children develop a deeper understanding of their surroundings. While some areas may be less accessible and purposefully discourage foot traffic in order help children understand the importance of respecting natural systems, other areas should allow children to dig in the dirt, touch the vegetation, and make decisions about how they move through the site.

4) Design for Flexibility of Use and Provide Opportunity for New Discoveries

Create elements with multiple uses to maintain a sense of excitement about the play area. Provide children with opportunities to make discoveries, test new skills, and manipulate their environment.

5) Respond to Environmental and Cultural Aspects of the Place

Designs should employ ecologically sound design principles that respond to the specific characteristics of the place such as soil, topography, vegetation as well as the culture of the people and the history of the site.

6) Encourage Systems Thinking

Design should reveal the presence of natural systems, helping kids to understand aspects of nature such as the flow of water and the cycling of energy. Natural play areas should demonstrate how all elements are interrelated and help children understand how the site relates to its surroundings.

Design for Safety and Routine Access

This principle helped to guide my decision on a site for the design project. It suggests that outdoor learning areas should be easily accessible to children on a routine basis. Marvin Gaye Park has great potential for this type of access. As discussed in the site analysis, the site is within a quarter mile walking distance of three elementary schools and an environmental education center. A bike path runs the length of the park and D.C.'s proposed bicycle master plan suggests improved connections of the path to existing and future bike trails. Additionally, the site is accessible by public transportation with four metro stations near the park, and bus routes serving the area.

In an attempt to address safety concerns, the design incorporates sidewalks in places they were previously absent and suggests the need for improved crosswalks and traffic calming measures on the streets surrounding the park. The proposed streambank terracing also addresses the need for improved views and access to the stream. The banks are currently so steep that visitors walking along the path at the top of the banks may be unaware if someone was below them at the level of the stream.

Challenges and Conclusions

The design process made me think about the realities of dangers related to outdoor play environments. The measures described above are definite improvements over the existing conditions, however, the challenge of making the site one that is safe and accessible remains. Even with traffic calming measures and improved sidewalks, Nannie Helen Burroughs Avenue, running along the north side of the park, could be considered a safety hazard. Improving views through the site and of the stream help to address issues of safety, but with its history of crime, the park is not going to become a safe place overnight.

In addition to making the site safely accessible, I became aware of the importance of making the site itself a safe place to be. Design must respond to the issues of increased traffic and crime. Encouraging routine use of the site by the community is important to enhancing the overall safety of the site. An important aspect of making a play area safe is to create informal surveillance by increasing the number of "eyes" on the site. Evaluation of this principle suggested that it should be broadened to address both accessibility of the site and safety of the site itself.

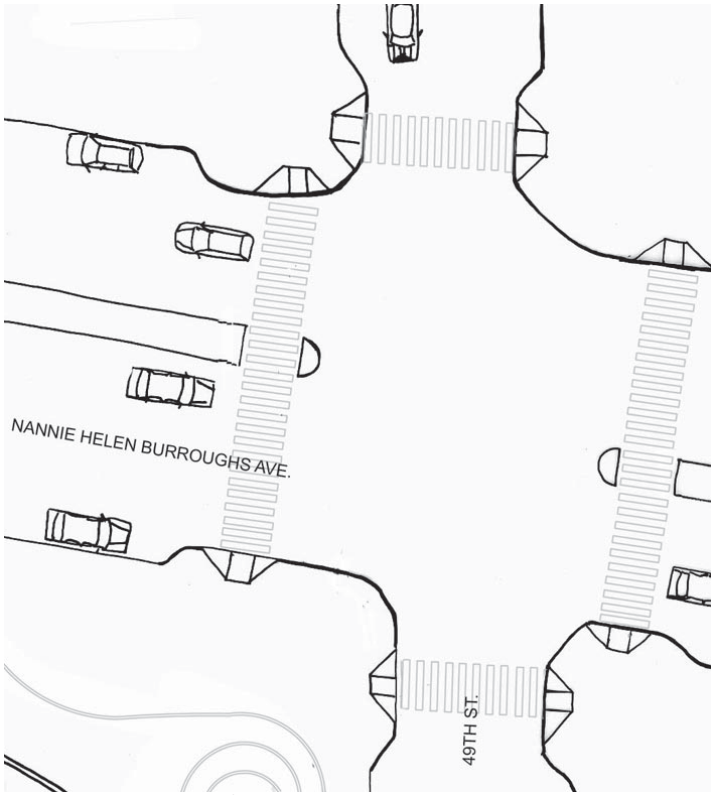


Figure 35. Traffic Calming Measures

Proposed curb bump-outs at the corner of Burroughs Avenue and 49th Street would slow traffic and reduce the distance that pedestrians have to travel to cross the street.

Encourage Personal Involvement and a Feeling of Ownership

The design searches for ways to invite continuous involvement from the local schools and neighborhood kids while at the same time providing opportunity for kids to leave a lasting mark on the site. The art wall around the perimeter of the site was inspired by a peace wall in Berkeley California. The peace wall is covered in tiles made by children; many of the tiles have dates on them so you can see they were made by kids in the early 1980s. The art wall is intended to be something that can regularly be repainted so that it allows kids to be involved with the decoration of the site each year.

Tiled Peace Wall, Berekely, CA

It is also important for children to have a way of making long term contributions to the site. One way the design allows for this is by encouraging them to help grow and plant trees. The act of growing seedlings and planting them along the stream bank could help kids to develop an appreciation for the many beneficial functions that trees perform. Having trees they planted to come back and visit would also provide a reason for kids to keep returning to the site. Along with planting trees, kids could be involved with the overall maintenance of the site. In this way kids would be empowered to see how they can truly make a difference within the space.

American Holly planted and labeled planted by local children that live near Marvin Gaye Park.

Challenges and Conclusions

As described above, the design sought to involve kids in the short term and the long term. Further reflection made me realize there is also need for daily impact and involvement. To some extent the design provides this by providing space to build and dig in the sand, to plant in the garden. The design should also encourage daily decoration such as chalk murals and sculptures. When initially defining this principle I had not realized the multiple levels of children's participation. There are opportunities for daily contributions, semi-permanent contributions and permanent contributions. There should be a place for all of these within the design.

Appeal to all the sense by allowing for Direct Experience with Elements of Nature

The design encourages use of multiple sense and hands on experiences in a number of ways. The youth gardening aspect of the site encourages kids to get their hands dirty. The interactive rain garden gives children a place to dig in the sand, hop from rock to rock, or traverse the vegetation. The terraced banks give kids access to stream and allow them to explore the different zones of vegetation. The woodland area also encourages use of the senses in exploration of the space. Humans tend to rely more on sight than other sense. The following are some examples of how the design appeals to all five senses:

Hear *birds and wildlife, the sound of water, wind rustling the leaves.*
Touch *plants with varied textures, dig in the dirt, play in the sand.*
Taste *vegetables from the garden.*
Smell *variety of scented plants.*
See: *texture, flowers, seasonal changes.*

Magnolia tree shows signs of spring

Challenges and Conclusions

Applying this principle to a design forced me to think further about when it is appropriate to allow for direct experience with elements of nature. A schoolyard I visited when researching children's environments had restored a stream running through the property. I was initially disappointed by signs posted telling kids to keep out of the stream. However, there were also signs designating an area where kids could play in the water.

When trying to apply this principle to a site myself I realized that although it is important to allow for experience with elements of nature, it is also important to include areas that are not as accessible where kids are encouraged to let nature take its course and not trample vegetation. This contrast could allow kids to enjoy natural areas while also learning to respect them. A design that incorporates both helps show kids that designs can meet the needs of people and of natural systems.

Plants can attract butterflies and other wildlife.

Design for Flexibility of Uses in Order to Provide Opportunity for New Discoveries

Natural play areas inherently provide variety in opportunity and activity. The design is intended to create a space where the appearance of the site is always changing. The vegetation changes through the seasons and the water level of the stream varies with rainfall. The V-notch weirs incorporated into the area of the design referred to as "The Pools" would help to illustrate the changes in water level (See Figure 37). During times of low flow water would flow through the V, in times of higher flow water would flow over the top of the weir and after a big storm the weir would be entirely covered. Changes such as these provide opportunity for new discoveries each time kids visit the site.

The design avoids over-programming the spaces within the site so that they can meet the needs of a variety of users and facilitate multiple activities such as outdoor classes, community gatherings and children's games.

Challenges and Conclusions

As noted above the design tries to allow for a variety of uses. As the case study of Powhatan Springs demonstrated a variety of activities and a balance of organized recreation and more informal play opportunities can help to attract more visitors to a park. Powhatan Springs successfully blends organized sports and recreation with a less traditional rain garden and natural play area. Because of the narrow form of the site, I found it challenging trying to incorporate organized activity directly into the site, but the schoolyard adjacent to the park has playing fields that allow for more organized sports.

Further reflection on this principle caused me to think about how technology today (TV, video games, movies etc.) has changed expectation of kids. Designers today are challenged to create outdoor play areas that are exciting and interactive for kids. Outdoor play areas require innovation in design to help kids truly regain that sense of wonder related to the outdoor environment.

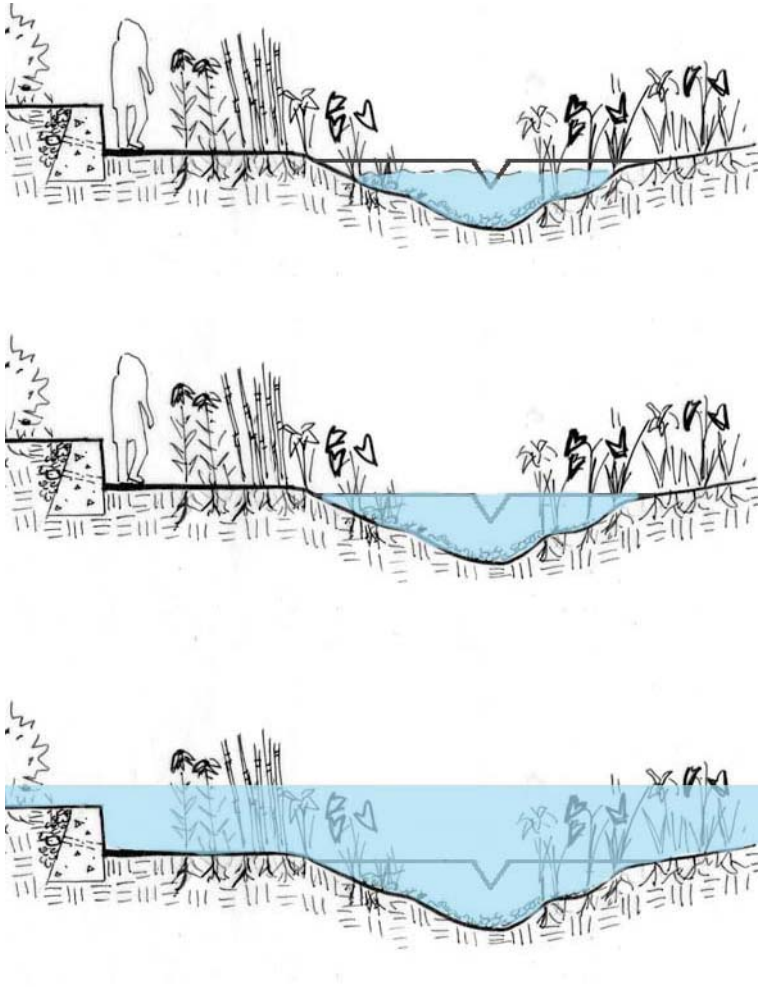


Figure 36. Stream Water Level and V-Notch Weir Relationship

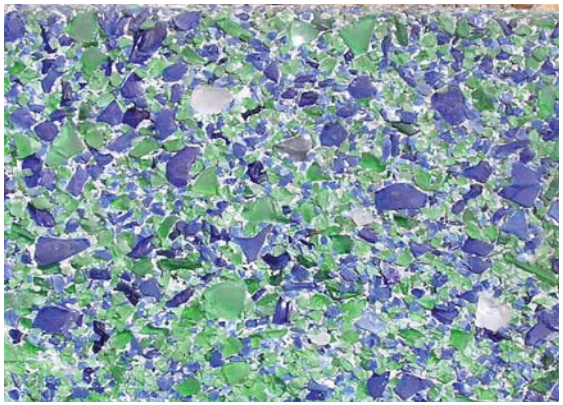
Respond to Environmental and Cultural Aspects of the Place

The design tries to illustrate that a space can be both environmentally responsible and functional for human use. In the past Watts Branch has been ignored. The design celebrates the stream by providing access to the community and exploring ways to reduce erosion. The design also looks at water quality and ways that we can treat stormwater runoff before it enters our waterways. Additionally the space incorporates many native plants selected to tolerate either inundation or drought conditions based on their location within the site. Recycled material such as the recycled glass pavers meandering through the promenade and the composite decking by the overlook are ways that recycled materials were incorporated into the site. In addition to responding to the natural environment, designs should teach kids about the historical and cultural aspects of their surroundings and address the values of the community. The design tries to address some of these values and interests such as health, safety and education for children. There is also opportunity to personalize the space with references to the areas unique history and ties to historical figures such as Martin Luther King. The kids art wall could have rotating themes and encourage graphical depiction of some of these historical events.

Challenges and Conclusions

This was one of the more challenging principles to apply to the site. I found that trying to creating a multi-functional space that serves the needs of both the community and the natural systems on a site raises a lot of ecological questions. For designs be multi-functional, they require extensive research and site analysis to ensure that the design solution is appropriate. Designs could benefit from interdisciplinary work that incorporates the knowledge of hydrologists, wildlife biologists, landscape architects and other specialists.

Another significant challenge I faced was trying to respond to the specific interests of the community, particularly the kids that will use the site. I felt that to truly understand what resonates with the community it would be important to invest time in attending neighborhood meetings, conducting interviews, holding planning sessions and of course involving local kids who would be using the site regularly.



Recycled glass incorporated throughout the design.

Existing Mural at Merrit Elementary.

Martin Luther King Mural on the existing Lederer Environmental Education Building.

Encourage Systems Thinking

As discussed in the Site Analysis, in recent decades the park was neglected and thought of as a trash dump. The design works to reframe the way visitors view the site and helps them to understand that natural systems are at work all around them. Because the stream was ignored for so many years, it is important that the design celebrates water on the site and teaches kids how the hydrologic cycle is impacted by urbanization. The interactive rain garden is intended to help children learn about stormwater runoff and watershed protection through experience and play. The connection of Watts Branch to the Anacostia and greater Chesapeake Bay Watershed makes the park an ideal location to learn about watersheds. Teachers using the space as an outdoor classroom could focus lessons on these relationships.

The design encourages kids to think about the interconnectedness of all systems and how matter cycles through the web of life. The youth gardens incorporate composting areas which allow kids to observe how leaves and other organic matter can be used to return nutrients to the soil. By providing a space kids can visit on a regular basis the design allows children to observe natural processes at work, such as how water levels change with weather patterns and how vegetation varies throughout the seasons.

Conclusions

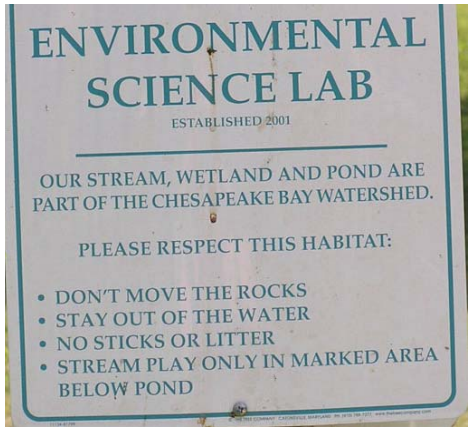
Application of this principle made me think in greater depth about how design can encourage systems thinking and reveal natural systems. Eco-revelatory design is a growing interest within landscape architecture. However, many projects labeled as eco-revelatory design fail to make a true ecological connection. I struggled with how to provide access to the stream in a way that also provides ecological function. The terraced form of the stream bank at this point is intended to not only provide access down to the stream, but to respond to the erosion problem currently undermining the banks. Encouraging systems thinking and revealing natural systems should be carried out in way that provides true ecological function.

Conclusion

The case studies and design process helped to further define the principles identified for promoting ecoliteracy in children's outdoor play environments. Some of the more significant discoveries related to designing opportunities for multiple levels of involvement (i.e. allowing kids to impact the site on a day to day basis as well as long term), the need to involve the community (especially the children) in the design process, and the fine line between providing access to elements of nature and discouraging foot traffic in order to protect natural systems.

This last discovery warrants further exploration. The need to provide access to elements of nature to help kids learn to enjoy and appreciate their environment can clash with the need to protect natural systems. Good design should be able to achieve both; it should allow kids to enjoy interacting with elements of nature while also learning to respect them.

Opportunities for the application of all of the principles exist throughout our cities and towns. We need to think about revitalizing public spaces such as Marvin Gaye Park, incorporating natural play areas into new developments, redesigning our schoolyards, and creating backyard habitats. Restoring a sense of excitement about nature will require application of these principles on multiple levels. By designing outdoor places that are accessible, educational, and interactive, we can help kids to develop a relationship with their surroundings and an appreciation for their environment. This is important to the health of our children and the health of the planet for they are interdependent.



Signs along a restored stream adjacent to an elementary school. Where is the balance between prohibiting access and allowing for play?

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