Whether it serves a utilitarian purpose or is simply an aesthetic statement in the landscape, Land Art gets attention. Land Art has found favor in landscape architecture due to its powerful meaning and creativity in response to land. As a means of expression, Land Art gives landscape architects an opportunity to develop a new language in the landscape by stimulating sensory perception. Stormwater is harvested and revealed along Brooks Promenade, located on The University of Georgia campus, in a Land Art expression to increase understanding of natural processes. In the tradition of the Land Art Movement, people are encouraged to experience this landscape in a new way. This design proposal also serves educational and ecological purposes, bringing attention to environmental processes and issues. Since many ecological problems are caused by our disengagement with Nature, featuring stormwater as a valuable element in the urban landscape is a step toward reconnecting people with Nature. Hopefully, this reconnection will lead to better solutions to ecological problems in cities.

GO WITH THE FLOW
LAND ART AS A MEDIUM FOR STORMWATER MANAGEMENT

by

MARION LANCASTER RENNEKER
B.S., The University of the South, 1996

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CHAPTER ONE: INTRODUCTION

The Relevance of Land Art to Contemporary Landscape Architecture

Land Art is captivating. Whether it serves a utilitarian purpose or is simply an aesthetic statement in the landscape, land art gets attention. Although difficult to categorize, Land Art has found favor in landscape architecture due to its solid foundation in ideas and sense of creative purpose in response to land (Weilacher, 1999, 7). The field of landscape architecture has become widely diverse, some say fractured, over the years. "In short, Land Art seems to restore to landscape architecture its old and largely lost concern for the intricate melding of site, sight and insight," writes John Dixon Hunt in the Forward of Between Landscape Architecture and Land Art (Weilacher, 1999, 6). Some people find land art delightful, while others are bothered by it. In both cases, Land Art is a source of stimulation, providing a point of departure for discussion about landscape.

Land Art's Niche in the Landscape Architecture Profession

Land art with an ecological purpose can bring attention to environmental processes and issues. Tangible visual works that can be experienced daily are more likely to increase awareness and stir emotions than words alone. People can be "educated" about environmental issues, but revealing a natural process to the public through land art could have a more significant impact. As a means of expression, land art gives landscape architects an opportunity to develop a new language in the landscape by stimulating sensory perception. Whereas, technology has enabled natural systems to be removed from urban landscapes, disconnecting humans from nature, land art has the potential to "open up new avenues for landscape architecture to overcome the serious crisis in human perception" (Weilacher,
1998, 39). I will explore this idea with stormwater management where the potential for connecting people to the landscape is particularly great.

**The Ecological Issue of Stormwater Management in the Urban Context**

**Characteristics of Rainwater**

Using land art as a medium, stormwater management is a good example for influencing human perception and behavior because rain is captivating. Rain stimulates our senses with sound, smell, feel, and the patterns it makes on windows, lakes, or puddles. For children, playing in the rain is a common pastime. Rain adds drama to scenes in the movies. Outdoor surfaces that are flat and rough when dry become reflective and glossy in the rain. It is easy to find beauty in rain.

Of course, rain becomes stormwater, and its ubiquity can become overwhelming and problematic in the landscape. Rain is everywhere at once, or nowhere at all. It is heavy or light, moving quickly or slowly, raining or not raining, and rain is always moving. Stormwater by nature is also always moving. As gravity pulls it downhill, stormwater moves in pipes or gutters, gullies and swales, into pools and ponds. Humans try to slow its pace, trapping or temporarily detaining stormwater in ponds, but the city's main characteristic, a high concentration of impervious surfaces, causes stormwater to move rapidly. Landscape architecture can incorporate both the quotidian and the sublime qualities of rain and stormwater: the ordinary, everyday versus the awe-inspiring qualities. As the occurrence of rain varies depending upon the season and geographic location, so does our emotional response to it; in dry places where rain events are rare, rain and stormwater are received with a different attitude than in rainy locations where the daily occurrence becomes monotonous, even depressing. The other qualities of rain and stormwater that can be used in landscape design include its unpredictability, variability, mystery, surprise, and ephemerality.
In addition, the possibilities of symbolism concerning water are countless. Spiritual connotations of water abound in all religions as well as in secular thought. Water symbolizes: nature, life, birth, cleansing, power, wealth, healing, reflection, peace, tranquility, and relaxation, to name a few. Although landscape architects commonly feature these qualitative and symbolic aspects of water in urban, commercial, and garden design projects, in the case of urban stormwater management, they unfortunately are accustomed to designing conventional systems required by code, which do not capitalize on the delightful aesthetic characteristics and the symbolic potential of stormwater.

**Conventional Stormwater Management Inadequacies**

Traditional urban stormwater management systems are not aesthetically stimulating and obscure the natural process of stormwater movement in the landscape. Additionally, these systems are not environmentally sustainable. As more land is developed, roads, houses, buildings, and parking lots replace forests and fields. Rainwater that lands on these impervious surfaces becomes storm runoff, which can have a negative impact on watersheds. This stormwater runoff picks up pollutants from lawns and parking lots as gravity and landforms direct it through the watershed, ultimately polluting streams, rivers, lakes, and oceans. As a result of greater amounts of stormwater that accompany increasing land development, rivers have increased their erosive action in some areas while others are choked with sediment. Flooding is common, native fish and mussels are threatened, and drinking water sources are contaminated. Overall ecological health is threatened.

Conveyance and detention, the conventional methods of urban stormwater management, have not proven to be ecologically sound. These methods do not adequately address environmental problems caused by the increased percentage of impervious cover in a watershed, that results from
land development (Ferguson, 1998, 42). The problems include flooding, reduced base flows, reduced aquifer recharge, sedimentation, erosion, and water quality issues such as the presence of heavy metals, solvents, and bacteria. Alternative management methods can be used to lessen urban stormwater's negative ecological impact. Stormwater is an important force in the landscape, and the practice of designing urban landscapes with alternative methods that restore natural drainage is gaining popularity. Land art has the potential to aid in this change of practice by raising consciousness about stormwater movement in cities.

The Potential of Learning about Stormwater Management through Land Art

An approach to land art is to use it to change perceptions of natural processes in an urban context—processes that are easily forgotten in the city. We are accustomed to encountering gardens and formally designed public spaces in cities but are seldom encouraged to link our comfort in cities to the impacts we have on natural systems. Most urban parks or gardens are designed as a respite or oasis in the city, but land art has the potential to add a new dimension to civic spaces, giving expression to natural processes of stormwater movement in order to raise ecological awareness in the city. "In contrast to Edenic gardens, which coax us to look inward for tranquility, contemporary Land or Earth Art prods us to look anew at the world around us—and possibly raises our anxiety level" (Bourdon, 1995, 195).

In the Land Art Movement, focus has been shifting towards increasing sensitivity to natural processes and increasing accessibility to an urban population. Land art, used as a medium for stormwater management in the city, is a way of connecting people to natural systems. Joan Nassauer writes that land art that falls into the category of Eco-Revelatory Design "has aimed to reveal ecological function, and landscape architects have
emphasized ecological revelation in their work as well. Art can speak to the condition of the larger landscape matrix, but it does not immediately transform it," (1997, 78). Bringing stormwater out into the open in an urban context will not solve all of our ecological problems, but it is an environmentally beneficial way to transcend the Nature/Culture dichotomy.

In order to modify our behavior in light of post-industrial ecological understanding "we must use culture to advance ecological health, or we risk removing ourselves altogether from the ecosystems we know" (Nassauer, 1997, 4). Fusing land art and science in designed landscapes is a way to alter perceptions and ameliorate human impacts on the landscape. Because of growing concern for urban ecological issues and water quality, it is important to expose landscape architects and the public to potentially more successful approaches to stormwater management. Land art is an appropriate medium for this endeavor.

**Structure of the Following Chapters**

Chapter two includes: an overview of the diverse Land Art Movement; the evolution of the Land Art Movement’s environmental ethic; the idea of connecting Culture and Nature through land art; and the potential of using land art to create meaningful, ecologically sensitive landscapes.

Chapter three explains: beneficial rainfall versus non-point source pollution; the role of stormwater and its importance in the landscape; conventional and alternative stormwater management methods; and the reasons for exposing stormwater to view in the urban landscape.

Chapter four introduces and explores: changing the perception of stormwater in the landscape through art; projects that exemplify successful combination of land art and stormwater to raise human consciousness of ecological processes.
Chapter five presents a conceptual design proposal for a portion of the campus of The University of Georgia in Athens and includes: goals and objectives; D.W. Brooks Drive site selection and conditions; and description and illustration of the design concept.
Overview of Land Art: A Diverse Movement

Wide Ranging Works

"Land Art" describes a wide variety of art works, which are not only in the landscape but also of the landscape (Beardsley, 1998, 7). A defining characteristic of land art pieces is their inherent connection to place. The works "are not placed in the landscape, rather the landscape is the very means of their creation" (Weilacher, 1999, 11). The pieces initiated over the past thirty years range from monumental earth piles in the desert to unobtrusive, transient pieces created in a forest. They include documented mountain hike excursions, and a wheat field planted and harvested in Manhattan. Like other art movements, Land Art began in a certain time and place but has changed and evolved becoming international and interdisciplinary.

The movement that came to be known as Land Art "began in the American cultural crucible of New York" and in the open spaces of American

Figure 2.1 Isolated Mass, Circumflex, #9 of Nine Nevada Depressions, Michael Heizer, 1968 (Kastner, 1998, 53)
western deserts (Kastner, 1998, 12). In October of 1968, Land Art made its formal debut at the Dwan Gallery in New York under the exhibit title *Earthworks*. While some of the exhibit pieces were physically in the gallery, photographs of works represented the majority. Some pieces remained in desert locations, left to the elements, while others were destroyed after photographic documentation. The Dwan exhibit included Michael Heizer’s work titled *Nine Nevada Depressions*, which is a series of cuts in dry lakebeds stretching 520 miles across the desert. *Number 9*, named *Isolated Mass/Circumflex*, is an excavation done using a pickaxe, shovel, and wheelbarrow. It measures 120’ x 12’ x 1,’ and is located in Massacre Dry Lake, Nevada (Figure 2.1).

Another land art pioneer included in the *Earthworks* show was Robert Smithson. His *Nonsite, Franklin, New Jersey* (Figure 2.2, 2.3),

![Figure 2.2 Nonsite, Franklin, New Jersey, Robert Smithson, 1969 (Smithson, 10, 1993)]

![Figure 2.3 Franklin, New Jersey, Robert Smithson, 1969 (Smithson, 25, 1993)]
consisted of metal bins with slatted sides, devised to contain rocks, earth, chunks of broken cement, or other material evidence taken from a specific place; the exact location of the ‘find’ was represented on a complementary map that he customarily displayed on a nearby wall. (Bourdon, 1995, 211)

The indoor *Nonsite* works existed to evoke the outdoor site; the material (sand, rocks, etc.) removed from its setting represents the outdoor source and exists in the gallery as a symbol of the absent site (Beardsley, 1998, 19).

The Non-site retains a connection to its original site (through the negative [spatial] impression it leaves as well as the documentation that accompanies it), thereby setting up a dialogue about context, removal and recombination that echoes the very terms of the collecting or archiving project that underlies the museum itself. (Kastner, 1998, 31)

The two works described above exemplify the broad spectrum of expression included in the *Earthworks* exhibit: photographs of large scale impressions made in the remote desert were displayed in the gallery alongside piles of earth and rocks collected in New Jersey.

Although Land Art began with a small group of artists in New York, “its formulation involved artists from around the world, who brought very different approaches to bear” (Kastner, 1998, 12). In his book, *Earthworks and Beyond*, John Beardsley traces the evolution of the diverse Land Art Movement and explores its influence on art and landscape architecture. Now in its third edition, the book is a comprehensive study of land artists, their work, and influences. A large number of color photographs illustrate the insightful text. This chapter draws primarily upon Beardsley’s description and analysis of land art.

The following works exemplify the wide range of the movement. These examples, presented in chronological order, represent the differences in scale, materials, ecological disturbance, and artistic intent, which occur throughout land art expressions. The artists described here are major
figures in the Land Art Movement, but the intent is not to give a detailed history of land art, but rather to introduce overall themes. The artwork explained in the text is not necessarily their most famous work but is an example of a type of approach. From Smithson's massive spiral, to Mendieta's ephemeral body impressions, to Fulton's quiet walks and striking landscape photographs, each artist and each work presented below shows a variation on the land art theme.


*Figure 2.4* *Spiral Jetty*, Robert Smithson, 1970 (Kastner, 1998, 59)

An American icon of the Land Art Movement is Robert Smithson's *Spiral Jetty*, completed in 1970, in the Great Salt Lake, Utah. Beginning on a shore marked by industrial wreckage, the path of the spiral form is 15 feet wide; it spirals 1,500 linear feet and is composed of 6,650 tons of black basalt and limestone rocks (Figure 2.4). Brine shrimp, microorganisms that live in the lake and color the water pink, piqued Smithson's interest in the site. Smithson wrote a great deal about the meaning of the design and the aesthetic process of his work. The crystallization of salt on the rocks suggests time; the spiral form, commonly found in nature, is both a symbol of entropy and a time
reference, and it contrasts the solid and liquid states of matter (Matilsky, 1992, 42). This piece, submerged when the water level of the lake rose, is no longer visible.

![Hydra's Head](image)

**Figure 2.5 Hydra’s Head, Nancy Holt, 1974 (Kastner, 1998, 87)**

Nancy Holt, another pioneer land artist, is most famous for her work *Sun Tunnels*. Equally interesting is the lesser-known work, *Hydra’s Head*, installed in 1974 on the banks of the Niagara River as part of Artpark in Lewiston, New York (Figure 2.5). This piece consists of six circular concrete pools of three different diameters sunk into the earth. The smooth pools are arranged to coincide with Hydra, the stellar constellation. Holt introduces the idea of humankind’s relationship with the universe, instead of solely the immediate surroundings (Kastner, 1998, 87).

**Ana Mendieta, Silueta Series (1979)**

Known for her *Silueta* series, Ana Mendieta, a sculptor and performance artist, approached land art from another angle. In 1989 she created these works by inscribing her body onto the landscape as a self-portrait (Kastner, 1998, 121). Materials used included snow, moss, leaves, flowers, mud, rocks, blood, and ash (Figure 2.6). The works fuse cultural
aspects of her native Cuba with those of the United States, where she grew up (Kastner, 1998, 121). Her work draws “analogies between the body and the earth” in a way that is insistently feminist (Beardsley, 1998, 164). Mendieta sprinkled blood on some of the works and ignited others as a reference to the violence against women and the earth, which she attributed to a patriarchal culture (Beardsley, 1998, 163). In the landscape, these works were temporary, but they are recorded on Super-8 film and in photographs.


Hamish Fulton’s work documents his reaction to the natural environment recorded through photography during walks lasting from one day to several months. His walks are meditative and essential to his art because the "physicality of walking helps to evoke a state of mind and a relationship to the landscape" (Kastner, 1998, 129). The only signs of his work that Fulton leaves in the landscape are footprints. "He is the most emphatically reverential of these artists" (Beardsley, 1998, 44). Fulton’s art
consists of framed photographs with a title and text recording the time and place (Figure 2.7). Describing his work he said, "My art is a passive protest against urban societies that alienate people from the world of nature" (quoted in Beardsley, 1998, 44). Although he is a contemporary of Smithson, Heizer, and DeMaria, Fulton's philosophy and land art pieces are drastically different. In an interview, Fulton expressed his feeling that early pioneer land artists lack "any sense of respect" for the landscape and that their art is "a continuation of 'Manifest Destiny'" (Beardsley, 1998, 44).

Ian Hamilton Finlay, *Signature of the Artist Holder* (1987)

Ian Hamilton Finlay's highest profile work is *Little Sparta*, located at his home, in Lanarkshire, Scotland. The garden is picturesque, with sculpture and literary references in the form of quotations carved in stone. Figure 2.8 shows a portion of the garden, and stone tablets with the inscription: "the present order is the disorder of the future." Finlay's point is that rather than leaving the landscape untouched, the intellect can improve nature. In 1987, Finlay created *Signature of the Artist Holder* in Furka.
Pass, Switzerland. This land art piece is nestled in the mountains, in a location that resembles Ferdinand Holder’s landscape paintings. On this spot, Finlay carved a large copy of the Swiss painter’s signature on a stone. (Kastner, 1998, 174) (Figure 2.9).
Diverse Works with Similar Aspects

The previous examples show that "[l]ike the work that it embraces, the term Land Art is variable, complex and fraught" (Kastner, 1998, 12). Although highly diverse, many works share one or more of the following categories: sculptural works composed of site-specific earth materials to frame a view or create a form; manmade objects sited in a natural setting to provoke thought; short term individual acts in the landscape; interventions involving collaboration and raising social awareness (Kastner, 1998, 12).

Diverse Influences

Diversity within the movement results from the many influences against which Land Art reacts and the influences to which it responds. Jeffrey Kastner, in the preface of his book, *Land and Environmental Art: Themes and Movements* describes Land Art as "[n]ever a moment in the traditional sense, encompassing a range of artists who might be at odds with each other's conceptions and executions, Land Art is an imperfect hyponym for a slippery and widely interconnected brand of conceptual kinship" (quoted in Kastner, 1998, 12). The wide variety of work is in part due to the fact that Land Art emerged and developed in a period between Modernism and Post-Modernism and, therefore, embodies aspects of both movements. Land Art has been described as, "a moment of contemporary history that appears exemplary in that it is situated at the turning point between modernism and that which contested it, battled it, indeed and ultimately replaced it" (Tiberghien, 16).

Because of the diversity of locations, processes, forms, and meaning, Land Art is difficult to categorize. Cerver describes Land Art as an expansion of the sculptural field "to an unexplored area between architecture and landscape....a type of intervention inextricably bound to the specific characteristics of its surroundings and outside the values of exchange" (Cerver, 1995, 67). Its slippery nature and the unlimited possibilities of
location (from the gallery, to private land, to public spaces) make Land Art
difficult to grasp, but recognizing the art movements that preceded and
influenced it is helpful.

Two American movements of the 1960's, Minimalism and Process
Art, have a significant connection to Land Art. "Both were concerned with
extending the traditional boundaries of form, space, and materials"
(Matilsky, 1992, 38). Minimalist sculptors created large geometric works
out of industrial materials that required more space than a gallery offered
(Matilsky, 1992, 38). For Morris and Smithson, Land Art was a "logical
extension" from Minimalism because "nature provided an opportunity for
them to translate primary, abstract forms on a large scale" (Matilsky, 1992,
38).

Another influential Movement is Process Art. Using a different
approach, "process art was defined by non-rigid materials—rope, fabric, lead-
that could be scattered, thrown, or poured" (Matilsky, 1992, 38). Although
predominantly made of soft materials, Process Art pieces were occasionally
composed of rigid materials. Chance and the characteristics of the
material combined, shaping the Process Art composition (Matilsky, 1992,
38). The actual process was the subject of the work expressing "the
changeable aspects of the material and its potential to expand endlessly in
all directions" (Matilsky, 1992, 38).

Although land art draws from several movements, there is not a clear
distinction between these influences in the body of land art works.

Yet whether seen to be engaged in the interrogations of Modernism,
Minimalism or Conceptualism, as a purposefully romantic quest for
reconnection with a kind of atavistic inspiration or as a serious-
minded programme for the practical conditions of the late-industrial
biosphere, all the work included here has as its pivot the land and the
individual's responses to and activity within it. (Kastner, 1998, 12)

In spite of this diverse nature, whether land art pieces are centered on
spiritual or ecological ideas, the purpose is to connect both the artist and the viewer to the landscape.

Unifying Elements---Process, Materials, and Time

In addition to the general theme of stimulation and connection to the land, a focus on process, materials, and time is a commonality within Land Art. The influence of Process Art was significant because, in spite of the diversity within the Land Art Movement, interest in process is a common theme.

Such ideas connecting concrete spaces and ephemeral experience were very much 'in the air' in the later 60's and were institutionalized in Process Art. As part of the rebellious, anti-precious-object syndrome, the process by which a work is made and material from which it is made becomes as important as the final product. (Lippard, 1983, 130)
The importance of process, meaning the act of creating an artwork, is highly valued by the land artists. On this subject, Morris said "that existence is process, that the art itself is a form of behavior" (Beardsley, 1998, 26-27). Smithson executed several "asphalt pours" onto a sloping surface (Figure 2.10). In these land art pieces, the process was integral to the work of art. "By allowing nature itself to determine the form and content of the work, environmental artists [land artists] share many of the concerns defined by process art" (Matilsky, 1992, 38).

The Land Art Movement is also unified by: the use of local materials and the artist's interaction with and response to the landscape. Regardless of the differences and wide variety:

These projects are fundamentally sculptural (in the sense of creating in three dimensions) and/or performance based (in terms of their orientations towards process, site and temporality). They are concerned with the way both time and natural forces impact on objects and gestures; at once critical and nostalgic for the notion of 'the garden'; alternately aggressive and nurturing towards the landscape. (Kastner 1998, 12)

To land artists, the material of the work is as important as the form and equally meaningful in the philosophical interpretation of the piece.

Because of the "out of doors" location and the nature of the materials, time is another unifying element in land art works. "The artist who works with earth, works with time.' This statement made by Walter de Maria at the beginning of the seventies not only illustrates the connection between material and time generally, but also emphasizes the particular meaning of time in art in the landscape" (Weilacher, 1999, 21). Time, the fourth dimension, has a significant impact on land art works. Exposure to the elements over the years has altered, obscured, or destroyed even the grandest marks upon the earth. Some of Heizer's famous Nevada Depressions have "deteriorated" over the years. Time has made its mark on those "permanent" works. Other works are purposefully ephemeral. Whether
a factor in the design or an external force acting upon pieces in the landscape, the aspect of time is important to the works of land artists, regardless of philosophical views or approach. "The artists' intentions are as diverse as their end results, but all of them contribute to the spirit of our time by enabling us to perceive, as if with newly opened eyes, the scope of humankind's past and potential imprint upon the world" (Bourdon, 1995, 195).

**Evolution of Land Art's Environmental Ethic**

**Aesthetic Roots of the Movement**

In early Land Art, the primary concern was making an aesthetic statement. The emphasis on aesthetics is summed up in Michael Heizer's proclamation that Land Art is "about art, not about landscape" (quoted in Beardsley, 1998, 19). Artists trained in the pure "isms" of art reacted against constraints of the past, and the beginning of Land Art marked a philosophical break with tradition. Aesthetic statement and expression of values were of high importance. The materials used, the process of creation, and the site were fundamental elements. Because of the centrality of aesthetics, some artists have "displayed a chilling insensitivity to nature, regarding the great outdoors as nothing more than a colossal sketch pad on which to impose their artistic egos" (Bourdon, 1995, 223).

At the time of its debut, the purpose of Land Art was not integration of art and nature, but quite the opposite, "to impose an idea of art in the forum of the exterior landscape" (Grande, 1994, 87). Land Art pioneers wanted to move out of the gallery to make their work more accessible and less of a commodity. Land Art (also called Environmental Art or Earthworks) was a statement to the art world, a radical, anti-establishment expression. Initially, large-scaled imposing earthworks in remote western "natural" sites attracted the most attention. In these early works, the earth
on site was moved, removed, blasted, and bulldozed. The artist’s aim was to impose an idea of art on the landscape (Grande, 1994, 87). A well-known example of this is Michael Heizer’s Double Negative in the desert of Overton, Nevada, which involved a team of bulldozers displacing more than 244,800 tons of sandstone and rhyolite (Figure 2.11). For most early land artists, making gestures with monumental forms in the landscape was a higher priority than ecological sensitivity or concern for possible adverse impacts on natural systems. This is evident in a declaration Heizer made in the early 1970’s, "I don't care about landscape. I'm a sculptor. Real estate is dirt, and dirt is the material" (Grande, 1994, 87). Materiality, location, and aesthetic gesture were the priorities.

Shifting focus: Environmental values gain momentum

As the movement matured, the land ethic of the artists and the process of creating land art works have ranged from the ecologically destructive to the ecologically healing. Examples along this continuum are
wide-ranging. For Joseph Beuys, a German artist, life was art. He made artistic “initiatitves” to call attention to enviromental causes (Beardsley, 1998, 159). One example is Bog Action, a performance piece in which he waded into a marsh fully clothed to emphasize concern about wetlands infilling in the Netherlands.

Whereas Heizer was using the earth as a neutral surface on which to act and the source of raw materials for his sculptures, Beuys-like his English contemporaries Richard Long and Hamish Fulton-was staking out a more conspicuously empathetic relationship to landscape. He also provided a model for the artist as environmental activist and cultural critic, a model that has grown increasingly influential as the years have passed. (Beardsley, 1998, 159)

At the same time, Smithson, Herbert Bayer, and Heizer also worked on repairing damaged landscapes with mineland reclamation projects, "but their primary intent was to make art, not to direct attention to environmental ills" (Beardsley, 1998, 159).

Robert Smithson is a land art pioneer who falls between Michael Heizer and Andy Goldsworthy at the two extremes on the continuum of ecological sensitivity. Some of his works were not particularly sensitive, while other projects showed concern for ecology. In 1971, Smithson began to work on disrupted sites: exhausted quarries, abandoned minelands, polluted lakes and rivers. His aim was to "enhance the visual qualities of their reclamation activities" and recycle these disturbed and useless sites by transforming them into "Earth Art" (Beardsley, 1998, 23). Smithson did not want to recreate a pre-disturbance landscape; rather he proposed a noticeably man-made landscape that recognized technological use (Beardsley, 1998, 26). He was not working for ecological reclamation or restoration, but "[h]is projects for tailings would have stood as memorials to industrial disruption of the landscape, and as provocations to contemplate the efficacy and necessity of our resource development policies" (Beardsley, 1998, 26). Unfortunately, Smithson’s tragic death in 1973, while working
on *Amarillo Ramp* precluded his reclamation proposals from implementation, but his ideas have inspired the work of many artists. It was Smithson who declared, "'Art can become a physical resource that mediates between the ecologist and the industrialist, facilitating the aims of both'" (quoted in Beardsley, 1998, 23).

In 1979, The King County Arts Commission and the Department of Public Works in Washington held a symposium based on a project, that invited eight artists to submit design proposals for reclamation of mineland sites (Matilsky, 1992, 46). Robert Morris' response was the inaugural presentation "*Earthworks: Land Reclamation as Sculpture.*" The idea of artists working on mineland reclamation was controversial because companies were looking for the least expensive route, and the earthworks "seldom addressed life-support systems or the transformation of those sites into viable spaces for plants and animals" (Matilsky, 1992, 47).

During the late 1960s "while Land Art certainly contributed to citizens' interest in ecology, few of its makers would have qualified as environmental activists" (Bourdon, 1995, 223). In the early years, land artists were primarily concerned with aesthetics as opposed to raising awareness about environmental issues. Over time, as Land Art has diversified and evolved, so has its relationship to ecological conscience. When artists join the movement, each adds an original perspective, taking the Land Art Movement in various directions. "The great earthmovers who worked to forcibly rearrange the stuff of the natural world in a effort to mediate our sensory relationship with the landscape were succeeded by artists who sought to change our emotional and spiritual relationship with it"(Weilacher, 1998, 17). One example is Andy Goldsworthy, who, in contrast to the early American land artists who made grand statements in the desert or the gallery, created pieces such as *Yellow Elm Leaves Laid over a Rock, Low Water*, a stream boulder wrapped in leaves (Figure 2.12). Like
the majority of his works, it was photographed upon completion, because it might last a week or less than an hour in the landscape. Goldsworthy's "ephemeral brand of art seeks to integrate nature as culture into an environmental expression", and his "art is a silent, sensitized integration into a given environment" (Grande, 1994, 87, 92). Goldsworthy's work is particularly captivating because of this silent quality and the way he juxtaposes Euclidean geometries and natural materials.

The physically imposing land art works of Michael Heizer and Robert Smithson were followed by sensitive, emotional works by Ana Mendieta, Hamish Fulton, and Andy Goldsworthy. “The spiritual and emotionally focused land artists, in turn, spawned a third approach, that of the literally 'environmental' artist, a practice which turned back to the terrain, but this time with an activity meant to remedy damage rather than poeticize it" (Weilacher, 1998, 17). Artists such as Haacke, Goldsworthy, and Finlay, "provided a glimpse of a possible new relationship between culture and nature" (Calabria, 1995, 82). Although a large portion of their work
emphasized “the dichotomy of nature and culture, they also sought to transcend division through ecologically sensitive observation and engagement of natural process” (Calabria, 1995, 82).

The art media centered attention on the "earthworks" projects, although artists such as Hans Haacke were working with ecological systems in the early years of the Land Art Movement. His Condensation Boxes work exhibited in 1962 showed the changing states of water (Matilsky, 1992, 42). Haacke's Rhinewater Purification Plant, 1972, installation in the Museum Haus Lange in Krefeld, Germany brought attention to pollution of the local river and water quality issues. Large glass bottles containing samples of polluted water released by the sewage treatment plant were put on display (Figure 2.13). A system pumped this contaminated water into a container, where it was purified before flowing into a glass rectangular basin stocked with goldfish. "The presence of a large fish bowl and the picture-window view into the wooded landscape served as a point of contrast between a life supporting ecosystem and one on the verge of collapse" (Matilsky, 1992, 41). This work is "a political and ecological statement" and "Haacke was one of the first artists to focus on nature's processes and systems" (Matilsky, 1992, 42).

Figure 2.13 Rhinewater Purification Plant, Hans Haacke, 1972 (Matilsky, 1992, 41)
During the 1980s ecologically centered works became more prolific. In 1982, Herbert Bayer, who participated in the 1979 exhibition and symposium, completed *Mill Creek Canyon Earthworks* in Kent, Washington (Figure 2.14). This project was one of the first earthworks to address both environmental problems and human needs. Bayer’s design consists of five geometric landforms: a round mound; an oblong mound; a cone with a bridge over a creek; a ring mound surrounded by a pond; and a ring mound that the creek runs across (Matilsky, 1992, 47). This design is located inside of a detention basin which manages stormwater runoff into Mill Creek Canyon. Stormwater is used as a design element, but the art alone does not contribute to the management effect. The park is successful as a gathering place, and the city calls the project "a landmark in park design, and a revolutionary concept in solving the problem of how to control surface water" (Beardsley, 1998, 97).

In the early 1990's scientific remediation of contaminated sites through land art gained popularity. "Although earthworks promoted the notion of art as land reclamation, it was left for other artists such as Mel Chin to fulfill its potential" (Matilsky, 1992, 47). Mel Chin’s *Revival Field* (1990-1993) created in collaboration with Rufus Chaney, a research scientist
at the U.S. Department of Agriculture, is an experimental effort to clean heavy metals from the soil of the Pig's Eye landfill in St. Paul, Minnesota, using natural processes (Matilsky, 1992, 108). (Figure 2.15) Certain plants that are "hyperaccumulaters" take up zinc and cadmium through their roots and store the heavy metals in their biomass. These plants, which tolerate high toxicity levels, are planted and harvested on a continuing basis until the soil has been cleaned (Matilsky, 1992, 110) (Figure 2.16). Chin explains the idea behind this work in his proposal, "'For a time, an intended invisible
aesthetic will exist that can be measured scientifically by the quality of a revitalized earth. Eventually that aesthetic will be revealed in the return of growth to the soil' (Matilsky, 1992, 111). Chin views art and nature as inseparable and feels that "[t]his is as it should be since the processes, life forms, and physical configurations of the planet are the ultimate works of art" (Matilsky, 1992, 111). Early land artists were the first to introduce the “notion of art as a living and changing entity” and Revival Field “expands [this] concept of organic growth” (Matilsky, 1992, 47).

Since Revival Field is a work combining art and science, it provokes discussion about the traditional separation between the two disciplines, when in fact, as Mel Chin says, they are not dichotomies, but interconnected. Tiberghien echoes this view:

Artists’ theories are like scientific theories, in that they are both rooted in the same process of imaginary elaboration. But artists’ theories do not prove anything; at most, they produce real effects, which, in transforming the world, also have the function of helping us to know it, in a certain sense. (1995, 18)

Something exciting takes place when ideas of science and art are merged.

One example of ecologically conscious land art is Helen Mayer Harrison and Newton Harrison's, The Lagoon Cycle, 1972-1982 (Figure 2.17). This work consists of more than 50 pieces that make up a 350-foot-long
mural installation, accompanied by limited edition prints and performances (Matilsky, 1992, 69). Matilsky calls *The Lagoon Cycle* “a personal and philosophical journey, beginning with observations on the life of a small crustacean and ending with prophesies of global warming” (1992, 61). The sepia photographs and collage are accompanied by poetic discourse between the artists to produce "an ecological ethos" (Matilsky, 1992, 70).

Helen Mayer and Newton Harrison's work has encompassed watersheds and spanned political boundaries. It often illustrates conflict between humans and nature. The Harrisons are environmental activists and continue to spark debate with works across the globe. Their work has been categorized as "didactic art" because it calls attention to ensuing ecological crisis and demands action (Kemal & Gaskell, 1993, 158). Beardsley describes the Harrisons as "virtual ambassadors-at-large to the environment" (1998, 161).

Taking action to create dialogue about ecological damage is a priority of many artists. The human relationship with nature is often a theme explored by artists, as "Herbert Marcuse said that 'man's struggle with nature is increasingly a struggle with society' " (Lippard, 1983, 230). This educational approach can be influential, but it does not always engage those who do not have initial interest.

**Connecting Culture and Nature in the City**

Land art presents a new opportunity to influence perception and shape the Nature-Culture dialogue in the city. Expressing this idea, Mary Miss said, "[t]here is a chance for the first time in years for art to be part of part of people's lives-something they walk through, or by or stop and sit on while on the way to work" (Cerver, 1995, 60). Instead of creating land art works in desolate locations, the urban landscape is a fitting site for expression. John Beardsley explains, that quite a few of the most significant recent environmental projects have
been incorporated into intensively developed urban spaces...This paradigmatic shift in the location and intention of environmental art in less than two decades results from a number of notable changes in the attitudes of artists and patrons alike.....they have recovered the idea that art can attempt to determine its own social function and thereby attain a prominent position in public discourse. (1998, 127)

It is fitting to combine the aesthetic power and environmental component of land art works to connect nature and culture in an urban context. Although the subject of aesthetic value is often an abstract philosophical topic, it is relevant to an evaluation of Land Art and its societal influence. Nassauer points out that Marcia Muelder Eaton's definition of aesthetic experience “clarifies why aesthetics is fundamental, in part because it indicates cultural values.” According to Eaton, “aesthetic experience is marked by perception of and reflection upon intrinsic properties of objects and events that a community considers worthy of sustained attention' ” (Quoted in Nassauer, 1997, 74). Land art has the potential to affect urban society in this manner, by altering human perceptions of natural processes that are often ignored.

In 1992, Agenda 21 was adopted as the "plan of action for the 21st Century" by the Conference of Environment and Development in Rio de Janeiro, to reorient human behavior toward the environment (Strelow, 1999, 20). A basic tenant of the manifesto is that "[e]nvironmental protection must be combined with social, cultural and economic action and must not stand aside as an 'extra expense" (Strelow, 1999, 20). The 1998 German exhibition, Natural Reality, Artistic Positions between Nature and Culture, aims to use art as a means to this realization. Aachen, Germany was the setting for explorations by world-renowned artists. The project defines “elements of ‘ecological aesthetics’ and “is created in a compulsory economy where man and nature are bound in an indissoluble way. Art no longer has the choice of being nature or counter nature” (Strelow, 1999, 12).
Another recent exhibit, *Eco-Revelatory Design: Nature Constructed/Nature Revealed* included works by both land artists and landscape architects. *Landscape Journal Special Issue, 1998*, is the catalog for the exhibit, which was organized, curated, and edited by Brenda Brown, Terry Harkness, and Doug Johnston, and opened at the University of Illinois at Urbana-Champaign before traveling further. The intent of this exhibit is for landscape architects to explore 'eco-revelatory design', which is defined as "landscape architecture intended to reveal and interpret ecological phenomena, processes and relationships" (Brown, Harkness, and Johnston, 1998, xvi). The exhibit documents and features fifteen design works with those concerns in common and includes eight essays addressing the works from various perspectives. Projects within this exhibition show how landscape architecture can be used to "integrate ecological function back into the city" (Nassauer, 1997, 6). The exhibit catalogue's description of the position of landscape architects also applies to land artists: "They change perspectives by structuring how we interact with landscapes as well as by structuring the forms and processes of landscapes themselves. In these landscapes, both nature and how we see nature are dynamic" (Brown, Harkness, and Johnston, 1998, xvi).

These two exhibits, *Natural Reality* and *Eco-Revelatory Design*, emphasize the increasing concern for cultural issues as they relate to environmental and aesthetic issues; the two should not be separated.

Whatever the nuances of their particular approaches to nature, artists and landscape architects alike have provided dramatic proof that the landscape is one of the primary forums of cultural expression, where environmental and aesthetic values are articulated. Every work that engages the landscape underscores the crucial connection between nature and culture and helps to revitalize-and, with any luck, improve-that relationship. (Beardsley, 1998, 201)
The Potential of Land Art

Multidisciplinary Approach

Through the Land Art Movement, some artists assumed the role of social critics. Many land artists fused art with other disciplines such as landscape architecture, garden design, anthropology, and environmental science (Beardsley, 1998, 164). Because land artists lacked formal training in those fields, crossing the boundaries brought their qualifications into question. Beardsley comments on the situation in *Earthworks and Beyond*:

In so doing they have raised questions about whether they were stepping beyond the limits of their competence and whether their work might not be better if executed by someone from another discipline. These are questions to be faced by all artists who would be environmentalists. As their work has shaded toward ecological activism, it has not only had trouble asserting its identity as art, it has sometimes seemed to trespass on the territory of others. (1998, 164)

A multidisciplinary approach has been a solution for this problem. Bringing together a team of specialist in related fields is a way to insure that the ecological and social aspects of the project are as effective as the artistic statement. For some projects, the artist or landscape architect works as the team leader, while other specialists resolve the scientific details. In the 1990's, a growing trend among artists and landscape architects was collaboration with scientists, engineers, ecologists, and other specialists.

One such project, the 27th Avenue Solid Waste Management Facility, is located on top of a full landfill on the outskirts of Phoenix, Arizona. The city's Director of Public Works was able to secure support from the Phoenix Arts Commission to hire a team "charged with imagining a new kind of public place, where people could observe the parade of their waste and learn about its impact on the environment" (Beardsley, 1998, 166). Artists Michael Singer and Linnea Glatt, heads of the design team, worked with designers and planners Sterling McMurrin and Richard Epstein, the architect
Dino Sakellar, and the engineering firm of Black and Veatch Inc., to create plans for the twenty-five acre site and a solid waste transfer and recycling building. This project was so successful that Singer, who was constructing ephemeral land art projects in the 1970’s, has continued to work on other public infrastructure projects from Connecticut to Prague (Beardsley, 1998, 168). This “assumption of widely disparate roles in different contexts---sculptor, landscape architect, environmental planner, civil engineer-has raised a few eyebrows” but “it is becoming more typical for artists” (Beardsley, 1998, 168). Helen Mayer and Newton Harrison often collaborate with experts in related disciplines, too, increasing the scope of inquiry of their projects. Beardsley explains that this strategy has been used by those "artists who have been most successful at integrating art with environmental activism" (1998, 165).

**Exposing Process to Change Perception**

"Landscape architects not only design landscape forms and functions they design our experience. They direct our vision and our movement, they accentuate, they reveal" (Brown, Harkness, and Johnston, 1998, xvi). The same statement also applies to land artists. Land art can serve as the frame for re-introducing once-hidden ecological processes into an urban location to influence human perception. In such a situation, Nassauer explains that,

> [c]ultural expectations can change when familiar aesthetic conventions are used to frame the novel appearance of ecological function... framing ecological change in recognizable aesthetic features allows us to use the cultural momentum of the present to benefit the ecological function of the future. (Nassauer, 1997, 78)

Exposing a forgotten or buried natural process in an urban context will place that particular process in a new light. This concept is familiar to many land artists who create with the intent of changing the way people see nature. Strelow identifies Joseph Beuys, the Harrisons, Alan Sonfist, Hermann
Prigann, or Tim Collins and Reiko Goto as artists who

within the extended discourse of art and environment...want to bring about a transformation in the attitude towards nature and the environment through artistic interventions in society and living space.....The borders between art and life are not only symbolically demolished by them but are actually crossed (Strelow, 1999, 161)

The idea of affecting perception is rooted in many land art works from the early beginnings to the present. "What interested Morris was 'not simply revealing the world to the observer, but also the conditions of perception.' His goal was to create " 'a place in which the perceiving self might take measure of certain aspects of its own physical existence" (Beardsley, 1998, 26-27). Perception of a landscape influences our thoughts, sensitivities, actions, and ecological values.

Bringing Meaning, Utilitarian Function, and Ecological Function to Designed Landscapes

If implemented with subtlety, land art can be a contemporary vehicle for transcending the Nature/Culture dichotomy. It has the potential to attract attention, evoke interest, heighten awareness, and eventually alter perception of natural processes. This is not to say that a more overtly didactic approach is not effective or inspirational, but it yields different results depending on the individual. Some people do not easily grasp information presented in an "educational" way. Personal experience of a place over time can foster a deep lasting connection in the absence of didacticism.

As discussed previously, some land artists, Heizer and Goldsworthy for example, appear to be polar opposites in terms of artist intent. Heizer moved tons of earth with bulldozers to make loud statements. Goldsworthy quietly celebrates the natural environment without disturbance or domination. However, one common aspect is the fact that most people are not able to visit the works. The sites are privately owned or the work is
ephemeral and only accessible to the public through photographs in gallery
displays. The artworks are certainly thought provoking, but they are not part
of everyday experience. If land art works become part of everyday
experience, they could bring meaning and utilitarian and ecological function
to designed landscapes.

Many works of landscape architecture have a dual character; the
work is neither purely ornamental (decorative) nor purely functional
(utilitarian). My aim is to highlight the overlap between ecologically
sensitive landscape architecture and land art. At this point, integration
could bring art and ecological conscience into everyday life, connecting
people to natural processes. Using land art as a medium for stormwater
management is one way to increase ecological awareness in the urban
landscape. Land artists "force us to think deeply about nature itself, about
our relation to nature, and about nature's relation to art" (Thompson, 1999,
67). Combining land art and stormwater management can draw attention
to an environmental issue and render visible the invisible flows of
stormwater in the city.
Rain Falls on the City: a Blessing or a Curse?

In the urban landscape, stormwater can be both a positive and a negative force. For example, this water can be a precious commodity, irrigating urban trees and plantings, or it can carry pollutants to rivers. Stormwater is defined as "an environmental process, joining the atmosphere, the soil, vegetation, land use, and streams, and sustaining landscapes" (Ferguson, 1998, 1). If stormwater seeps into the ground, it ultimately recharges aquifers and replenishes groundwater supplies. This is ideal, but not the common case in most urban situations because of the large percentage of impervious surfaces. If infiltration is not possible, stormwater can become a nuisance, causing flooding or picking up pollutants as it moves through the landscape. Stormwater runoff that reaches rivers and streams without being treated falls under the classification of non-point source pollution, which accounts for approximately 70% of water pollution in the United States (Ferguson, 1998, 7). This categorization means that the contaminated water is not from a permitted discharge point, so it is difficult to track the origin or clean the water before it enters the watershed. Therefore, non-point source pollution problems are difficult to remedy.

Most of the time stormwater is hidden from sight in urban spaces, only emerging by accident, for example, when a sewer system has reached full capacity or when gutters are clogged with dirt or leaves. With this out of sight, out of mind treatment, it is easy for the average person to ignore ecological issues related to stormwater. Positive aspects of stormwater may also go unnoticed; it is not likely that stormwater’s aesthetic beauty or the possible societal benefits will be recognized.
Stormwater in the Landscape

As the modern city has evolved "a technical administrative infrastructure has been built up so that the city's natural side can be regulated as efficiently as possible" (Dreiseitl, 2001, 125). Urban infrastructure hides the movement of stormwater. "The curb and catch basin that make rainwater disappear without a trace below ground, cut the visible links between the natural water cycle, the storm sewers that dispose of it into streams and the lakes and rivers that ultimately receive it" (Hough, 1995, 30). Although developers, engineers, city planners, landscape architects, and environmentalists must consider stormwater issues in their work, most people do not think about stormwater until a flood or other disaster occurs. Most of the time, a designed "water feature," or fountain is purely aesthetic and is not connected to the natural flow of water in the landscape. Urban living has affected our values and perceptions concerning water because "The aesthetic use of water has remained separated from its functional uses...Keeping your shoes dry in the city ensures that people remain unaware of where the water comes from or where it goes" (Hough, 1995, 48). Generally, rainwater that becomes stormwater in traditional urban designs is forgotten once it enters the pipes. Its impact on the watershed, including downstream effects on fishes and aquatic organisms and increased sedimentation, is not apparent. Rainwater drains off site and "disappears from human consciousness, perpetuating environmentally destructive practices" (Hough, 1995, 48). Our perception of stormwater influences the management regime and vice versa, creating a continuous cycle of negative attitudes. We are not accustomed to stormwater's presence in the city, so it is necessary to remove stormwater from sight, which results in environmentally insensitve management.
Social Values

Regarding stormwater as a problem to be disposed of means an opportunity is missed. Michael Hough's book, Cities and Natural Process, discusses the future of urban places from the perspective of design, sustainability, and quality of life. Hough advocates the "principle that buildings should take care of their own rainwater rather than throwing the problem on to the public domain" (Hough, 1995, 79). Hough urges designers to "consider the opportunities for urban design that arise when the problems of disposing of the city's 'waste' water become opportunities for restoring hydrological and ecological balance, and enriching the experience and complexity of the city" (Hough, 1995, 70).

Stormwater can become an amenity. Countless subdivisions have centerpiece lakes that serve as stormwater retention or detention ponds, and people are happy to look over or drive by a lake on the way home but are usually unaware of its dual purpose: the lake is also a container for stormwater. On the other hand, the Village Homes development in Davis, California, is well known for featuring its accommodation of stormwater. The ephemeral qualities of rainwater are accentuated in the design. Drainage swales with check dams meander through the backyards of the subdivision, hold water during storms, and are dry between rain events after infiltration. This stormwater management system "is part of a cultural and ecological structure that binds rainfall, soil, plants, wildlife, human senses, human work, and human knowledge through direct interaction" (Ferguson, 1998, 16). The system's appearance, ecological and social function and symbolism of care are harmonious (Ferguson, 1998, 16). Examples such as this are becoming more common in American developments.

Stormwater managed through retention or detention ponds is often fenced off. This comes from the single use mentality that predominates engineering practice: designing for a one case scenario rather than multiple
uses. In this case, a single solution addresses the problem. Stormwater ponds are often deep and dangerous, and people should not have contact with these structures. This way of separating people from stormwater affects the way society relates to it mentally as well as physically. In contrast, landscape architects and planners should be working to optimize for a range of uses, and should be willing to make compromises to derive multiple benefits. The value or lack of value society places on stormwater directly relates to whether the management regime benefits the user or not.

Aesthetic Values

The beauty, mystery, movement, and unpredictability of rainwater, and therefore stormwater, are qualities that make it potentially an aesthetic material with countless possibilities for expression. Because traditional infrastructure has separated city dwellers from natural systems, "[t]he task today is to create a new design symbolism for water (and urban natural systems as a whole) that reflects the hydrological processes of the city; an urban design language that re-establishes its identity with life processes" (Hough, 1995, 81). Hough believes that this can occur if a landscape aesthetic is established with the following characteristics: ecological and functional basis for form; incorporation of design objectives where design becomes multi-faceted and experiential; the idea of visibility (Hough, 1995, 83). Land art projects have begun this undertaking and "established the potential of natural objects and processes such as stormwater and the hydrologic cycle to become aesthetic objects" (Healan, 2001, 34). In short, the aesthetic value of stormwater should not be overlooked, but maximized in the landscape.

Ecological Values

Hough explains that traditional stormwater management has caused "serious problems of discontinuity in our perceptions of urban systems and natural processes. The benefits of well-drained streets and civic spaces are
paid for by the costs of eroded stream banks, flooding, impaired water quality and the disappearance of aquatic life" (Hough, 1995, 47). Ecological sensitivity is becoming more important in the field of landscape architecture. In an interview with Udo Weilacher, famous French landscape architect Bernard Lassus discusses the way he thinks the profession of landscape architecture will be transformed in the next few years. Lassus' first point is that social symbolism will play a large role and "the aesthetic question will not be able to free itself from social responsibility" (Weilacher, 1999, 114). This relates to the previous points of discussion about social and aesthetic values of stormwater in the landscape. Lassus goes on to explain his belief that in the future "we will have to fundamentally change our conception of landscape-the world's ecological crisis gives us no other choice" (Weilacher, 1999, 116). He emphasizes his point that we have damaged the original landscape and that restoring nature "in the sense of naturalization" is impossible (Weilacher, 1999, 116). We cannot re-naturalize urban areas or remove the impervious surfaces of cities that contribute to stormwater problems. Stormwater management has become an ecological issue with an emphasis on preventing negative impacts on valuable and irreplaceable watershed ecosystems. According to Lassus, "[w]ater must be clean in the future, and we must be inventive" (Weilacher, 1999, 116). Among landscape professionals and environmentalists alike, there is strong agreement on this issue. Controlling stormwater pollution is one aspect of this clean water imperative.

Managing Stormwater---Moving from Conventional to Alternative Methods

It is important to begin the discussion of stormwater management with topic definitions and relevant terms. Wanielista & Yousef define stormwater management as “a body of knowledge used to understand, control, and utilize waters in their different forms within the hydrologic
cycle" (1993, 1). Specifically, the hydrologic cycle "encompasses the movement of water from sky to earth to sea and its transformation from liquid to vapor" (Calabria, 1995, 29). Urbanization has altered the hydrologic cycle. In developed areas, one problematic aspect is surface runoff, which is stormwater that appears "during and immediately after a precipitation event" (Wanielista & Yousef, 1993, 20). Stormwater runoff can cause flooding because it increases both the volume and rate of flow in streams and rivers. With urban and suburban development, a greater area of land is covered by impervious surfaces, such as paved roads, parking lots, and rooftops. Stormwater travels more quickly along paved surfaces than when it comes into contact with a forest, meadow, or vegetated land. These paved surfaces which prevent stormwater from soaking into the ground, not only increase the rate of runoff flow, but also cause a disruption in the natural water path. Ideally, stormwater infiltrates into groundwater and over a longer period can be "a significant amount of the total streamflow" (Wanielista & Yousef, 1993, 20). If infiltration does not take place, aquifers and streams are not recharged by rain events. Stormwater management is a system that reduces "the quantity and/or quality of water being discharged into a land or water area" and is intended "to improve quality of the receiving groundwaters and surface waters" (Wanielista, 1979, 221). Understanding the methods of stormwater management is important to gain insight into the environmental issues related to the subject.

Conventional Management

Conveyance

Conveyance moves surface runoff in pipes and channels from its point of origin to a discharge point in an off-site lake, stream, or bay (Ferguson, 1998, 40) (Figure 3.1). "Even pipes that are buried under the ground are part of surface conveyance systems, because their impervious
sides and bottoms prevent water from infiltrating the surrounding soil" (Ferguson, 1998, 40). Underground pipe systems of managing stormwater were beneficial in the modern industrial world circa 1869 when Frederick Law Olmsted pioneered this method in his Riverside, Illinois development (Ferguson, 1998, 40). These systems helped to resolve aesthetic, nuisance and health problems of muddy streets and the spread of disease, solving an environmental problem of the time (Ferguson, 1998, 40). However, conveyance was the only stormwater approach in most urban areas of the United States until about 1965 (Ferguson, 1998, 109). With this method, stormwater was not treated before it entered the watershed, so pollution washed directly into rivers. “More than a century later, unmitigated conveyance no longer has an exclusive place in responsible site development” (Ferguson, 1998, 41). Today, the health of the rivers, lakes, and bays that receive stormwater discharge is equally important as public health because the two are interdependent. Conveyance, however, cannot be dismissed as a stormwater management technique. For some sites it is the best way to treat stormwater, and it is necessary for all drainage facilities to have an overflow system for very large storms (Ferguson, 1998, 40).

**Storm Detention**

Another management method is detention, which is "the slowing down of surface flows as they move away" (Ferguson, 1998, 41) (Figure 3.2).
Detention has been commonly used since 1970 as a response to the peak rate of storm flow resulting from urban development (Ferguson, 1998, 42). It is a modification of conveyance in which storage reservoirs with constricted outlets reduce the rate of flow to minimize erosion and flooding downstream. This method reduces the peak rate of flow at the discharge point, but the same volume of flow reaches the stream over a longer period of time (Ferguson, 1998, 41). A detention basin is empty most of the time, reserving the space to hold water during a flood event (Ferguson, 1998, 150).

**Problematic Human and Ecological Impacts**

Drawbacks of these conventional methods are a lack of inherent aesthetic appeal and lack of inherent integration into the community. When drainage infrastructure is “only a technical appendage to a community, local residents, recognizing culturally dysfunctional appliances as irrelevant or hazardous to their well-being have had no motivation to learn about them or to adapt to them” (Ferguson, 1998, 14). In most cases, detention ponds are fenced off and public access is prohibited. Where the pipes take the water after that is not apparent. This treatment is often unsightly and negative, rather than a public amenity. Humans are separated from stormwater physically and mentally. The public is discouraged from observing and interacting with the natural process of stormwater movement.
In addition, managing stormwater exclusively with unmitigated conveyance and detention techniques has proven to have negative impacts on watersheds. Surface runoff picks up pollutants such as oil, sediment, chemicals, and debris, which are carried directly into rivers. This results in pollutant loading, affects habitat quality, and aquatic species abundance and diversity (Ferguson, 1998, 8). "Contemporary urban streams are characterized by high bacterial density, high oxygen demand, high concentrations of solids and nutrients, high turbidity, and high concentrations of metals and organic compounds (Ferguson, 1998, 9). As the percent of impervious cover in a watershed increases, existing low fish diversity and fish abundance further decline. During a rainstorm, high volumes of runoff cause streambank erosion, habitat destruction and increased sediment pollution. Detention basins temporarily slow storm runoff but do not filter pollutants from the stormwater. Conveyance systems consisting of a network of pipes may be connected to detention basins or may send the stormwater directly to a river, stream, or lake. In either case, water quality is not improved. Because conveyance and detention prevent stormwater percolation, aquifer recharge does not take place, and base flow of rivers is reduced. Uniform detention is not successful on a watershed-wide scale; "it has no favorable affect on base flows, does not necessarily do anything for water quality, and fails to fulfill its single explicit purpose of controlling floods" (Ferguson, 1998, 164). Used alone, detention is "inherently unable to address water quality, groundwater replenishment, or water supplies"; therefore, we must consider alternatives to address environmental problems caused by urban development (Ferguson, 1998, 42).

Alternative Management

The idea of using alternative management practices is sometimes considered radical in the United States, while Europeans have been building
alternative stormwater systems in housing developments since the 1980s. Until recently, the mainstream American method of thinking about and handling stormwater has not changed significantly. It is only recently that new ways of management have come to the forefront and gained acceptance in the landscape architecture and engineering professions. Perhaps traditional methods of stormwater management remain dominant because it is easier to rely on techniques from the past. New ways of management require more thought and creativity and need fine tuning on a site specific basis as well. Alternative management cannot be applied to all sites by a formulaic procedure, but this does not mean abandoning conventional stormwater management methods altogether. For example, conveyance, combined with other approaches, is "one of the steps in managing flow to treat runoff and restore the natural hydrologic balance" (Ferguson, 1998, 109). A discussion of these more ecologically sensitive approaches follows.

Extended Detention

Improving water quality is the goal of extended detention. When water is captured in a pond or wetland "suspended particles can settle out and chemicals can be adsorbed (adhered onto particle surfaces) in bottom sediment, taken up by biota, and biodegraded" (Ferguson, 1998, 42). Extended detention systems can be dry basins for temporary water storage or wet basins that always contain water. Required length of residence time in extended detention varies according to design intent and local required standards, but should be long enough for the processes of settlement and biodegradation to take place. Wet detention is a land-based treatment system that can "take advantage of the free natural filtering and transforming capacities of light, air, soils, and organisms" (Ferguson, 1998, 42). Other advantages are low-cost natural building materials and maintenance requirements as opposed to mechanical treatment plants. This method is also a modification of conveyance, so all the runoff
discharges to streams located off-site. When designed to improve surface water quality, wet extended detention can do so, but this method by itself, is not capable of responding to runoff volume, groundwater or water conservation (Ferguson, 1998, 42). A wet detention basin is designed to always hold a permanent pool of water with the surface rising and falling after storm events. If designed using certain criteria, a wet basin can be an amenity and address water quality in ways that a dry basin cannot (Ferguson, 1998, 152).

**Infiltration**

"Infiltration is the soaking of water into the ground" (Ferguson, 1998, 191). With an infiltration system, stormwater is captured and held, allowing it to filter through the soil. The amount of time that stormwater resides in an infiltration basin is decided by the designer. This management method addresses water quality, aquatic life, water supplies, groundwater, flooding and erosion. Infiltration "is inherently the most complete solution to stormwater issues in the environment, because it restores natural hydrologic processes" (Ferguson, 1998, 43). Infiltration converts storm flows into base flows, changing stormwater from a hazard into a resource (Ferguson, 1998, 191).

**Water Harvesting**

Water harvesting is collecting runoff for direct use. This method requires a paradigm shift from evaluating drainage in terms of nuisance runoff to planning "catchment areas to generate water supplies" (Ferguson, 1998, 223). Water harvesting makes use of runoff efficiency rather than minimizing the impact of runoff, and directs water to a place of use rather than diverting it from a location where it could cause damage (Ferguson, 1998, 223). It can supply water for irrigation, supply drinking water, or maintain water levels in wetlands and ponds (Ferguson, 1998, 43).
Why Expose Stormwater in the Urban Landscape?

Methods of stormwater management that have removed it from the landscape and hidden it from view or separated it from human contact have disconnected urban life and natural processes because we do not expect to see stormwater and, if it does emerge it is a nuisance. This management is also ecologically unsound. Exposing stormwater has a number of potential benefits. Putting stormwater back into the landscape using natural paths is better for watershed health in general. Treating stormwater through natural rather than chemical processes (through the sewer system) can be less expensive because it requires less infrastructure investment, but the land to do it on is expensive in intensely developed areas. Finally, bringing natural processes to the attention of citizens raises their awareness of this environmental issue.

Focusing attention on water quality issues in the urban context is important. "Stormwater is a major cause of water pollution in urban areas throughout the country (US EPA 1983); almost all precipitation falling in urban areas becomes stormwater runoff as so little is absorbed into the ground, but instead routed directly to local streams" (quoted in Baer, 1996, 5). Rain turns to runoff when it first falls on pavements. This runoff "flushes the accumulated pollutants into streams" (Ferguson, 1998, 9). Bruce Ferguson’s vivid description summarizes the impact of this runoff on urban streams.

As the rain continues, growing volumes of runoff erode stream banks, destroying habitats and producing further sediment pollution. Bed materials shift; banks slough in; biota of all types are flushed out of chute-like channels. After the storm flow passes, base flow declines. Fish gasp for oxygen in the shallow, warm, sluggish water. (1998, 9)

In urban areas stormwater flows along roads, falls into drains, and is conveyed directly to rivers. Because of this management method, “any point in the watershed is effectively right next to the stream” (Baer, 1996,
Stormwater in cities does not have the opportunity to come into contact with soil, this means that pollutants wash into streams and rivers. “Any constituent that hits the ground is headed directly to a stream during the next rain, and therefore the technical " riparian zone" does not have the traditional filtration benefits that it does in agricultural or forested areas” (Baer, 1996, 46). (A riparian zone is land adjacent to a river, which is required to have a vegetated or non-disturbance buffer.) Other problems caused by impervious surfaces are that they prevent stormwater from soaking into the soil and restoring a watershed’s base flow, groundwater, and water quality.

The economic dimension of stormwater management should not be overlooked. Piping stormwater through sewerage systems relies on expensive technology and infrastructure. The environmental cost of letting stormwater go untreated is also significant. Hough explains that there are serious problems of discontinuity in our perceptions of urban systems and natural processes. The benefits of well-drained streets and civic spaces are paid for by the costs of eroded stream banks, flooding, impaired water quality and the disappearance of aquatic life. (Hough, 1995, 47)

As a society, we have also failed to understand "the hidden environmental and economic costs of local water management practice, such as connecting downspouts to the sewer rather than discharging roof water directly to the ground" (Hough, 1995, 47). The annual expenditures to control erosion, ameliorate stream channelization, and maintain underground stormwater systems are “the engineering consequences of the need to keep one’s shoes dry” (Hough, 1995, 47). Hough blames conventional urban design for contributing to environmental degradation "by shifting an urban problem on to the larger environment and by the failure to recognize and act on the relationships between human actions and natural systems" (Hough, 1995, 47).
In the nineteenth century, stormwater caused floods and spread disease in urban areas. Engineers and planners developed networks of underground pipes to confine stormwater and solve the problems associated with it. Over the years, it has become apparent that the traditional method of managing stormwater is not ecologically sensitive, but potentially damaging. Keeping stormwater below ground may not be necessary in the lower density suburbs of today (Gregg and Wenk, 1998, 24). Michael Hough believes that the principle of visibility is "critical to environmentally responsible behavior" (Hough, 1995, 48). We can change the role of stormwater from a nuisance to a resource and manage it in "functional landscapes that clean and control stormwater, sustain themselves, and contribute to the beauty and livability of our communities" (Gregg and Wenk, 1998, 24). Exposing stormwater serves both ecological and social purposes and can create beautiful and functional landscapes.
CHAPTER FOUR: LAND ART + STORMWATER

Changing Perception of Stormwater in the Landscape Through Art

The validity of historic reasons for stormwater confinement underground is now being questioned because this type of management damages urban watersheds and deprives the public of an aesthetically pleasing amenity. In many cities urban waters have been neglected, but

[urban river and stream networks can become an essential structuring element of a city, can be beautiful, and can be the sustenance of a rich, urban ecology. To achieve that, we must reexamine some of our basic assumptions about the capture, conveyance, and reuse of stormwater. (Gregg and Wenk, 1998, 24)

Changing the management methods of stormwater and expressing it through an artistic medium is one way to change perceptions as we re-examine our treatment of stormwater and its role in the urban landscape. Treating stormwater as a valuable and sacred element in cities is an alternative to the historic management regimes that could have a significant impact on the public. Arnold Berleant writes about the influence of landscape on human psyche in his book, Living in the Landscape: Toward an Aesthetics of Environment, when he writes,

both art and environment share our vivid perceptual interest. At the same time, the qualititative experience they generate has not only immediate value but also effects that extend beyond the perceptual present. Experiencing an environment as sacred may change our sense of the world and affect how we live and act. To regard the world as sacred and everything that is part of it as inherently valuable can change our decisions and alter our actions. (1997, 176)

Berleant expresses the notion that we are deeply affected by our surroundings, which suggests that the landscape could be an effective educational tool. The potential for capturing attention and re-adjusting attitudes is particularly great in the case of stormwater, because it is part of the urban fabric—paved surfaces determine its quantity and quality.
Besides being an important environmental issue, stormwater is particularly well suited to land art because of its association with process. With rainwater, natural processes are visible because of the rapid changes that occur in the landscape during and after a rain event. Often land art conforms to David Orr's definition of ecological design, "the careful meshing of human purposes with the larger patterns and flows of the natural world and the study of those flows and patterns to inform human purposes" (Nassauer, 1997, 47).

Another reason for fusing stormwater management with land art is to inspire thought about natural order. By design, cities and modern suburbs keep natural processes out of the way because of the conception that a landscape should look orderly and that natural processes appear disorderly. Land art can be used as a tool to modify the "aesthetic of care" that Joan Nassauer describes in her book, Placing Nature: Culture and Landscape Ecology. According to Nassauer, "[t]he aesthetic of care must be modified to incorporate the apparent disorder of indigenous ecosystems within the reassuring visual framework of human presence" (1997, 76). A land art piece can serve as an orderly frame for a "disorderly" process. When combined, land art and stormwater can serve as a tool for engaging people and awakening interest in natural processes.

This engagement is achieved through enriching our experience of our environment rather than by educating people in an overt manner, spelling out the environmental problems and explaining the solutions. The didactic approach can be effective, but it does not always hold interest over time. A visitor gets the "take home message" and does not feel the need to return. Instead, art can provoke thought by demonstration, without interpretation, written description, or suggested answers. Expressing the hope that art inherently has this effect, Robert Morris said in 1979, that "[w]hat marks [art] off from all other organized human activity, is that it does not seek
control through explanation, that it offers the freedom to experience a question” (Lippard, 1983, 230). Learning in this way requires more time and effort on behalf of the visitor or passerby, because seeing change in the landscape on a daily, weekly, and seasonal basis is essential to understanding natural systems. Ian Thompson urges landscape architects to, “stimulate them into thinking about their lives, the environment and their place in it” in order to “work out new ways of tying ourselves into that ecosystem, into an expression of ourselves and our values in that environment” (Ian H. Thompson, 1999, 75).

**Exemplary Projects**

Recently landscape architects have addressed environmental issues in their work using a land art approach, fusing art and nature, rather than leaving the stormwater to engineers and the design to designers. The following projects aim to ameliorate stormwater problems and encourage a shift in perspective. The book *Waterscapes: Planning, Building, and Designing with Water*, published in 2001, features Dreiseitl Studio’s water related projects realized between 1980 and 2000. The diverse projects range from private estates to public spaces, from housing developments to sewage treatment plants. Herbert Dreiseitl emphasizes the importance of collaboration between architects, engineers, and designers to form a team of artists addressing water in various aspects ranging from qualitative characteristics to utilitarian movement. These specialists have also contributed to the book making it an interdisciplinary effort like the actual projects. Three of Atelier Dreiseitl’s projects that have a stormwater design focus are discussed below.

The Scharnhauser Park in Ostfildern is the largest ongoing urban development scheme in the Stuttgart area, covering 150 hectares (Dreiseitl, 2001, 80) (Figure 4.1). Ecological sensitivity is the focus of this project,
which also includes elegant hardscape elements. The Park includes a botanical garden and a new housing estate on the property that was formerly a military accommodation for the Allied Forces. A 2002 horticultural show is central to the project and a high priority for the region (Dreiseitl, 2001, 80). Because German horticultural shows often embrace new approaches to town planning, innovative rainwater management was also necessary. The residential area of the Park covers 70 hectares, housing 9,000 people and contains 60 percent impervious surface. Two stream systems flow below the site, one of which has low flows in the summer, so sensitivity to these waters was an important consideration. The project is designed for a five-year storm event. Stormwater issues addressed in this site design are water harvesting, infiltration, water quality, base flow, and surface flow. Other design requirements included sustaining the valuable biotope structure to support important regional flora and fauna and avoiding...
flooding. The solution to these design challenges involved "a different strategy of discharge reduction, discharge delay and modest infiltration into the clayey subsoil" as well as preventing rainwater from reaching the sewerage system (Dreiseitl, 2001, 82). When it is not retained in roof gardens or private storage tanks, or it has not soaked away through porous surfaces, the stormwater flows through a channel and ditch system that runs beside the streets. The most striking artistic element is the staircase that water flows down on its way to retention ponds (Figure 4.2). Located below the steps the living bottom zone purifies the water in additional retention hollows and pools. Discharged water that has been delayed and purified in this way is fed via natural gradients into the surrounding landscape, with its valuable wetlands, biotopes [planted areas] and spring areas (Dreiseitl, 2001, 82).

Another German project, an ecological housing estate called Bakumer Tal, is located in the town of Herten on the northern edge the Ruhr region. The project, which is significantly smaller in scale than Scharnhauser Park,
was completed in 2002. The site area of 13 hectares houses 1,000 residents and 30 percent of the surfaces are impervious. Stormwater drainage methods implemented include drains and trenches, infiltration basins, and use of the existing swamp area and stream. This project is designed for a thirty-year storm event (Dreiseitl, 2001, 159). The plan uses decentralized rainwater management to slow runoff (Figure 4.3). "Water from roofs and streets flows into open gutters then soaks away in grassed basins and open swales or accumulates in retention pools" (Dreiseitl, 2001, 86). This treatment places the water in clear view using brick conveyance gutters built into the streets and moves stormwater to the adjacent green areas (Figure 4.4). In this design, residents are encouraged to delight in the presence and movement of stormwater. The drainage elements intersect play areas and small paths, and crossings incorporate local limestone blocks as stepping-stones (Figure 4.5). Enabling human contact with
stormwater is central to the design. Water quality is addressed as "soiled water from the collective car parks at the edge of the estate are prepared for this running water by treatment with light density material precipitators [skimmers] and in purification biotopes" (Dreiseitl, 2001, 86). The artistic element to remind residents again of the stormwater themed design is a watercourse flowing into a fountain at the center of town (Dreiseitl, 2001, 86).

Figure 4.4 Bakumer Tal, Herten, Germany, Atelier Dreiseitl. Brick gutters (Dreiseitl, 2001, 85)

Figure 4.5 Bakumer Tal, Herten, Germany. Small paths link drainage areas (Dreiseitl, 2001, 84)
One of Dreiseitl’s early projects is the Estate Hameau de la Fontaine in Echallens, near Lausanne, Switzerland. The planning and design of the project began in 1981 with construction completed in 1986. During this time "surface water drainage, swale infiltration, purification in reed beds, installing underground cisterns and re-using rainwater were all seen as newfangled ideas in urban development that people were a little suspicious of" (Dreiseitl, 2001, 102). This site harvests or infiltrates all of its surface water, which flows along streets into a sealed treatment bed, that functions as a detention and infiltration bed. "Here the roots of reeds and rushes, in symbiosis with the filter floor, remove the harmful substances from the water before some of it runs into storage tanks" (Dreiseitl, 2001, 102). Then the water is pumped to a sculpture in the center of the village (Figure 4.6). The "impressive volume of flowing water sets currents in motion" and the "veil of water reacts to wind, and that is perhaps reminiscent of the fact
that the source of all life once sprang from the village fountain" (Dreiseitl, 2001, 102). In addition, the tanks supply water to the "play and adventure area" which contains paved basins that show how the rainwater drains. The playful aspects of water are highlighted as well as its force and power. Residents, especially children, are encouraged to feel the water. The remaining rainwater enters a retention pond "where it evaporates, soaks away, or is fed slowly into a stream" (Dreiseitl, 2001, 102). Alpine salamanders and palmated newts are sensitive creatures whose presence in the treatment bed is evidence of the high water quality in the system. These creatures "also show the importance of artificial water features as second-hand survival biotopes" (Dreiseitl, 2001, 102). The designers say that "it was clear from a very early stage in the Hameau de la Fontaine how the disciplines of art, open-space architecture, leisure research and environmental technology fuse together to form a single theme" (Dreiseitl, 2001, 102). The water moves through a purification biotope. This project manages stormwater using surface drains, a retention pond, and directing drainage into the stream.

The European projects described above show how stormwater can be handled successfully in urban areas. Interaction with stormwater is encouraged, and many qualities of water are featured. The American projects that follow place greater emphasis on symbolism—the construction of meaning in the landscape through stormwater management.

In "The Poetics of Stormwater," J. William Thompson describes Robert Murase's design for the Portland Water Pollution Control Laboratory as a design "set out to express stormwater's innate beauty as landscape form." In this example, the hand of the artist is evident; by seeing stormwater in the landscape we may examine its place in the urban ecosystem. The site covers 6.5 acres and is located on the northeast bank of the Willamette River at the base of the St. John's Bridge (Figure 4.7). The laboratory
monitors the quality of Portland’s water and educates the public about using natural systems for stormwater runoff pollutant mitigation. A striking curvilinear flume lined with loose rocks carries stormwater from the fifty-acre residential and commercial neighborhood above to a wet extended detention pond containing aquatic and emergent plants that support sedimentation and biofiltration, returning clean water to the river (Figure 4.8). The flume is "an abstraction of a glacial moraine or the curve of a river" (Thompson, 1999, 60). Bioswales on site also cleanse stormwater and reduce runoff. A sculpture representing a suspended water droplet before it falls and a fallen droplet surrounded by concentric ripples serves to remind the visitor of the significance of a single drop of water (Figure 4.9). The public has access to the site from a pier overlooking the pond.
Figure 4.8 Portland Water Pollution Control Laboratory. Portland, Oregon. Robert Murase. Aerial view (Contemporary Landscape Inquiry Project, http://www.clr.utoronto.ca/VIRTUALLIB/CLIP/)

Figure 4.9 Portland Water Pollution Control Laboratory. Portland, Oregon. Robert Murase. Water Droplet sculpture (Contemporary Landscape Inquiry Project, http://www.clr.utoronto.ca/VIRTUALLIB/CLIP/)
Networks of paths connect the site to the surrounding neighborhoods, and signage explains the stormwater garden's function. The laboratory building does not have downspouts; instead roof scuppers spout water into a rock-lined bioswale that circles the building (Figure 4.10).

Murase's innovative design removes stormwater from the underground conveyance system and integrates it with the landscape. During heavy storms, a backup system sends overflow directly into the Willamette. Mike Faha, ASLA, a Portland landscape architect, writes that the significance of the projects is the fact that "stormwater management has been elevated to an art form and is the central organizing principle for the site plan" (Thompson, 1999, 63). Summarizing the spirit of Murase's stormwater garden, Thompson writes, "It removes runoff from the shadow realm of catch basins and pipes and renders it a visible component of the landscape---and, by seeing it, we may begin to better understand stormwater's place in the urban ecosystem" (1999, 86). Overall, Murase's design expresses the utilitarian aim of cleansing stormwater in a sculptural
form (Thompson, 1999, 60). This design has won an Honor Award from the Stormwater Design Award Competition in Portland and a national Honor Award from the Waterfront Center based in Washington D.C.

A topic of discussion concerning built landscapes that serve ecological purposes is "whether the hand of the designer should be evident" (Thompson, 1999, 86). The prominence of the designer's hand is debated among landscape architects and theorists, because the naturalistic landscape aesthetic is gaining popularity. Some argue that this design style removes humans from the equation, making a questionable statement in the landscape and sending a mixed message about our coexistence with natural systems. Some ecologically sensitive stormwater detention ponds are designed with undulating edges and planted with native wetland species in order to appear as though they are naturally occurring (Thompson, 1999, 86). Robert Thayer, a landscape theorist who often writes on the subject, questions the validity of concealing human intervention. In response to this design application, Thayer wrote that "[a]pplying a wild riverbank plant association verbatim to an urban drainage swale ignores the fundamental addition of human use to the ecological equation" (Thompson, 1999, 86). Thayer suggests that naturalism may obscure natural processes (Thompson, 1999, 86).

Because sustainable landscapes represent a higher level of complexity than 'cosmetic' landscapes and incorporate ecological relationships that may be hard to observe, it is all the more important to give them 'conspicuous expression and visible interpretation, and that is where the creative and artistic skills of the landscape architect are most critically needed.' (quoted in Thompson, 1999, 86)

Richard Hansen, a sculptor and landscape architect who contributed to the Eco-Revelatory Design exhibit, takes a similar position as Thayer’s. On the topic of fusing functional design with art Hansen says,

[t]here are many folks who are struggling to make a seamless weave
between ecology and sensuous form-making. I think that separating the pragmatic and the poetic, as we have done with stormwater, is dangerous for any culture. Sometimes these early attempts to weave together a sculptural presence and an ecological process come out awkwardly, but they hold a strong portent for the future. (quoted in Thompson, 1999, 86)

Hansen's criticism of some early attempts of fusing art and ecology is less important than his positive outlook about the future of this design concept. Many people are recognizing the need for aesthetically captivating ecological design.

Buster Simpson, a land artist and sculptor based in Seattle, has been creating ecological art since the 1970s, focusing on topics ranging from water pollution to urban quality of life issues. Matilsky writes that all of his work contains "a touch of humor and individuality that contributes to the effectiveness of his art" (1992, 93). Simpson exposes stormwater in several urban projects. His 1978 work, *Downspout--Plant Life Monitoring System*, draws attention to stormwater and addresses water quality. (Figure 4.11)
Located at the Pike Place Public Market in downtown Seattle, Washington, this single project solved several problems. Simpson grew ferns in the downspouts on the side of a building. The ferns detained and cleansed stormwater runoff from the rooftop before it entered the storm-sewer system. The design trapped stormwater in pipe elbows, and Simpson added limestone to neutralize the acidic water. This project improved water quality and proved to be a low-cost solution to stormwater overflow while providing ideal plant habitat (Matilsky, 1992, 93).

*King Street Gardens*, 1993-1997, is a collaborative urban land art project created by Buster Simpson and three other individuals: a sculptor, an architect, and a landscape architect. Located in Alexandria, Virginia, the 35,000 square foot site includes a marsh, hanging gardens, and a topiary sculpture (Figure 4.13). The Sunken Garden portion is a reclaimed marsh, planted with cattails, which provides wildlife habitat and returns area rain runoff into an adjacent stream. Before Alexandria's development, a river called Hooff's Run flowed through the site. The stream and adjacent wetland have been changed from floodplain to drainage creek to storm sewer,

![Figure 4.13  King Street Gardens: Section of Sunken Garden, Topiary and Hanging Garden  Alexandria, Virginia, Buster Simpson, with Mark Spitzer, Laura Sindell, and Becca Hanson, 1993-1997 (Matilsky 1992, 97)](image-url)
reflecting our culture's attitude concerning the development of low lying areas. Recreating the marsh as a reminder of Hooff's Run "tells part of the hidden story of the site" (Matilsky, 1992, 96). The shape of the Topiary Garden "abstractly recalls the shape of a colonial tri-cornered hat, a ship's prow, and a plow. Planted with Virginia creeper, the hat/prow/plow symbolizes man's intervention in nature and his devastating changes to the land" (Matilsky, 1992, 96). Matilsky describes the project as an artwork offering "an experience of nature that heightens all of the senses and filters out urban pollution" revitalizing urban and natural life simultaneously (1992, 96).

Buster Simpson's most recent stormwater project, Water Glass & Water Table, 2001, is located in the Ellington Condominium plaza in Seattle, Washington. He describes this project, as well as other selected and ongoing works, on his website, <http://www.bustersimpson.net>. Rainwater collected on the rooftops of both condominium towers moves to the

Figure 4.14 Water Glass, Seattle, Washington, Buster Simpson, 2001 (www.bustersimpson.net)
sculptures via stainless steel downspouts attached to the building exterior. The *Water Glass* sculpture, measuring 4' in diameter and 8' in height, is built out of glass panels and stainless steel (Figure 4.14). Stormwater from the south tower is directed into the glass through a 5' diameter stainless steel downspout resembling a flexible "hospital" straw. Tensioning rings on the outside of the *Water Glass* "serve the same structural purpose as those found on wooden water tanks." The glass is cantilevered over a planted wetland contained by a circular seat wall. The tilted position is a symbolic gesture of the vessel offering its contents to the landscape. The plants below facilitate stormwater purification. Water pours over the top of the glass during major storms or drains through a "bunghole" on the side during moderate storms, "creating the 'half empty/half full' perception" (website: http://www.bustersimpson.net).

Rainwater from the north tower traverses the plaza in an underground pipe, emerging as the *Water Table's* fourth leg (Figure 4.15). “The hydraulic

**Figure 4.15** Water Table, Seattle, Washington, Buster Simpson, 2001 (www.bustersimpson.net)
‘head’ is developed during major rain events and is expressed out through a series of nozzles that spell ‘WATER’ on the top surface of the polished black granite table.” While the stormwater is en route, the pressure builds up and causing the nozzles to spray. When the granite surface is dry, the word “TABLE” appears mirroring the word “WATER.” During a rain event, stormwater flows over the granite "tablecloth" spilling into a limestone-filled bucket that decreases water acidity. The stormwater then flows into a runnel, which also collects runoff from the Water Glass and carries the water to other bio-mitigating wetlands within the plaza. "As metaphor, the Water Glass & Water Table are two elements, which create utilitarian fountains; the Glass becomes a vessel, a cistern and a detention tank, the Table expresses the philosophical approach for the plaza’s landscape irrigation water table system as well as a usable table when dry." A colonnade of Irish Yews are planted in tapered concrete stormwater pipes. The utility pipes are exposed here to "suggest a rethinking of our urban stormwater drainage system" because "presently hidden below as a liability, the urban watershed could be elevated and celebrated as a resource" (website: http://www.bustersimpson.net). Simpson’s designs creatively manage stormwater and serve as public amenities.

Scott Slaney, ASLA, of The SWA Group designed the landscape of The Kelsey-Seybold Clinic in Houston, Texas. “The design,” Slaney says, “is intended both to recall native Texas landscapes and to evoke the natural healing associated with water” (quoted in Sorvig, 2002, 69). The facility, a doctor-owned multidisciplinary outpatient clinic, needed a 250,000 square-foot building, and over 1,200 parking spaces. The region's 40-inch annual rainfall amount combined with the large project footprint required a 12 x 12 x 1,000 foot box culvert to manage the 11-acre site’s stormwater. The price of this system would have been $1 million, almost half of the site development budget.
The architect, civil engineer, and landscape architect worked together to create instead a public open space for stormwater management. A box culvert half the size of the original estimate captures the first 50% of water produced by a 100-year storm event. Stormwater exceeding that level is stored in the public open space rather than below ground. The design features a circular pool with jet fountain and a jagged-edged stylized stream (Figure 4.16) running through an expansive terraced lawn containing a single live oak tree to the detention basin (Figure 4.17). Walkways connect the building to the landscape, allowing visitor interaction with the water features. In the absence of flooding, city water circulates in the system, and the detention basin is only a few inches deep. Describing the meaning behind the design elements, Sorvig writes that, "[t]he fountain was suggested by a rock dome considered sacred and healing by the region's
Indians (Figure 4.18). The oak lawn (originally designed with purple prairie grasses) evokes Texas hill country savanna. Human geometry suggests order (Sorvig, 2002, 69). The landscape, particularly the water feature, was designed to symbolically reference the links between nature, water, and healing (Sorvig, 2002, 69).
As infiltration is preferable to detention for stormwater management in most locations, one might ask why stormwater infiltration is not included in this landscape. The answer is that Houston's heavy clay soils prevent infiltration. Bruce Ferguson explained, "infiltrating large amounts of water into this type of soil for flood control is out of the question" (quoted in Sorvig, 2002, 71). The innovative stormwater management system in this design was tested by tropical storm Allison. The storm caused death and property damage in the area, but "[t]he Kelsey-Seybold landscape handled the flood without problems, unlike conventional systems at nearby Texas Medical Center" (Sorvig, 2002, 71). Sorvig describes this project as "a carefully crafted symbolic landscape that speaks of healing and nature while meeting stormwater engineering requirements" (Sorvig, 2001, 66).

The projects described here are particularly striking in both design intent and sculptural form. Each project reveals stormwater and speaks to the visitor about its importance in the landscape. In all of the examples, certain qualities of stormwater are brought forth and placed in the visitor's path. The aim is for people to reclaim stormwater as an amenity in public spaces. These examples are inspirational, giving my design proposal a foundation and a point of departure.
"I prefer working in public domains. The complexity of any site is its asset to build upon, to distill, to reveal its layers of meaning. Process becomes part and parcel. Site conditions, social and political realities, history, existing phenomena, and ecology are the armature. The challenge is to navigate along the edge between provocateur and pedestrian, art as gift and poetic utility."----Buster Simpson, www.bustersimpson.net

**Goals and Objectives**

My proposal explores the application of ideas and concepts introduced and discussed in the preceding chapters. The goal is to use land art to attract attention to stormwater in the landscape. By diverting stormwater from a pre-existing underground conveyance system, the aim is to raise awareness of natural processes without being didactic. The main hydrologic objective is to harvest and display stormwater. A secondary hydrologic objective is to reduce the amount of urban runoff (treated or untreated) that reaches the river via storm sewers. While the upper half of the design displays and conveys stormwater, the lower half of the design is meant to improve water quality, reduce peak storm flows, and recharge groundwater reserves. The design incorporates symbolic, aesthetic, and ecological statements found in land art projects to highlight stormwater flows through a landscape. This proposal illustrates how land art and stormwater management can be intertwined to expose stormwater in an urban context.

**Site Selection: Brooks Drive**

The design application site is D.W. Brooks Drive, located on the South Campus of The University of Georgia in Athens (Figure 5.1). Currently, water is a critical topic in Georgia and the Southeast. Existing problems in the United States concerning water protection, allocation, and conservation will continue to escalate as the population grows and water demands
increase. A university campus is a fitting site for a project addressing water issues. The University is involved in solving water problems: students and professors of The University of Georgia in the fields of science, ecology, economics, plant science, agriculture, and landscape architecture, to name a few, are studying a range of water-related issues. Individuals associated with the University are working to find solutions to problems such as water pollution, water shortages, and watershed protection. As an educational institution, the University should embrace new ways of problem solving and influence a paradigm shift, and this makes the campus an ideal site for

Figure 5.1 Location of D.W. Brooks Drive on the University of Georgia Campus
exposing stormwater flows and introducing favorable management methods.

This particular location within the University campus, D.W. Brooks Drive, was selected because it is currently being redesigned in accordance with a new Master Plan for the University. The significant change in elevation along the length of Brooks Drive is also important because stormwater movement is more dynamic on a sloping site. D.W. Brooks Drive does not follow a ridgeline, but runs along a slope, cutting through a valley,
descending approximately 70 feet in elevation. The slope of the site presents an opportunity to experiment with natural and urban engineered flows directed by gravity.

**History of the Site and Existing Conditions**

In 1997, the University of Georgia unveiled a campus-wide Master Plan designed by the firm Ayers/Saint/Gross in collaboration with the University Architects (Figure 5.2). The goal of this plan is to correct problems within the campus that have developed over the past 50 or so years. One problematic area is D.W. Brooks Drive, where automobile and pedestrian traffic compete and visual unity is lacking. The designers recommended conversion of Brooks Drive into a pedestrian quadrangle to bring the tranquil North Campus atmosphere to South Campus.

An investigation of the history of the Brooks Drive area reveals how the current hodgepodge of architecture came about and why a redesign is necessary. Charles Wellford Leavitt, a landscape architect from New York,
created the University's first Master Plan in 1906 (Figure 5.3). This plan divided the campus into five sections: the Academic Group, the State Department Group, the Engineering Group, the College for Women, and the Agricultural Group. The Agricultural School was located on a hilltop, south of the Tanyard Branch ravine. The land that is now D.W. Brooks Drive was originally agricultural land donated to the University by the Lumpkin family in 1907; it was the first land acquired on South Campus. In 1909, Agricultural Hall was built in the Renaissance Revival architectural style. It housed the Agricultural College and was renamed Conner Hall in 1923. Plans to tear down the adjacent Lumpkin House were abandoned when it was realized that the deed transferring the house and surrounding acres stipulated that if the house were ever to be removed, it and the surrounding property would revert to the heirs of the Lumpkin family (Boney, 2000, 102). What is now D.W. Brooks Drive appears in Figure 5.3 as a long straight road extending from the central axis of Conner Hall.

Figure 5.4 is an aerial view from the 1920s, looking south down Brooks Drive. F.N. Boney, in *A Pictorial History of The University of Georgia,*
Figure 5.5 Aerial Photograph of Brooks Drive in the early 1930s, by William Manning survey

Figure 5.6 Mid-1920s illustration of D.W. Brooks Drive approaching Conner Hall
In the mid 1920s Conner Hall dominated the new south campus beyond Tanyard Branch. Just in front of it stands the Lumpkin House (or the Rock House), the oldest building in the area, and just behind it stands the first wing of the Farm Mechanics Building (1911) [which became Barrow Hall when combined with the Agricultural Engineering Building]. A little farther south along the road running toward the horizon is Hardman Hall (1922) for animal husbandry. Beyond that are a few barns, and the long, low, white structure is the recently completed Camp Wilkins. (2000, 141)

Boney explains that "Conner Hall and its little satellite did not remain alone long on the original 25-acre south campus. By 1928 the south campus had grown to 200 acres and acquired many new buildings" (2000, 102). Other buildings such as Barrow Hall (1916), housing Farm Mechanics and Agricultural Engineering, and Hardman Hall (built for animal husbandry) (1922), an open-air amphitheater (1922), and the Women's Physical Education Building (1928) were constructed along Brooks Drive (Figure 5.5 and 5.6).

During this time, South Campus was a place to try out new ideas. Professor McHatton began the first landscaping program on either North or South Campus and introduced Bermuda grass as an alternative to the clay and weeds on North Campus (Boney, 2000, 103). This seems ironic today since North Campus is now lush and green, while South Campus appears to be a sea of concrete. Describing the promise of South Campus circa the 1920s, Boney writes that a "new 'city on a hill' was developing there, a complex of buildings and programs and dreams dedicated to modern science and technology that would soon push Georgia and the South forward and project the American nation into a position of world leadership" (Boney, 2000, 104).

In the 1930s, the University of Georgia campus continued to expand, and agriculture-related sciences moved to D.W. Brooks Drive, including the Forest Resources Building (1938) and the Dairy Science Building (1939).
Buildings constructed during the 1920s had been sited according to the Leavitt Plan, but in the 1930s and 1940s Robert H. Driftmier and Roy Hitchcock designed many campus buildings that were sited with apparent disregard for the Leavitt plan. In 1953, Aeck and Associates, an Atlanta architectural firm, created a new Master Plan for the University (Figure 5.7). This plan brought modernistic mega structures to South Campus. In the 1960s and 1970s the Robert C. Wilson Pharmacy Building (1964) was constructed, and the amphitheater was filled in to provide the foundation of Boyd Hall (1968). Three more buildings, very different in character, the Greenhouse Complex (1969), Miller Plant Sciences (1972), and the Ecology Building (1974), were added to Brooks Drive. With this wave of development, spaces for automobile movement and parking became dominant on South Campus. At the present time, conflict between automobile and pedestrian circulation is a major safety issue.

The current configuration of D.W. Brooks Drive resulted from the layering of unrelated plans. The early development of this corridor was
driven by expansion of the University and planned in the classical Beaux Arts style. The second layer of planning came in several waves as money became available. Designers influenced by modern architectural styles created large-scale buildings friendlier to the automobile than to pedestrian scale. The present sprawl of buildings is not cohesive and is uncomfortable to the pedestrian due to traffic and expansive parking lots (Figure 5.8). The University’s vision for the future of this area is a revival of past ideals. By returning to a Beaux Arts design and incorporating contemporary elements, the result will be "a new city on a hill."

Under the new campus wide plan, the general concept for D.W. Brooks Drive was its redesign as a quadrangle analogous to the configuration of quadrangles on North Campus. In the summer of 1998, a studio class from the School of Environmental Design conducted detailed site analysis and developed design proposals for Brooks Drive to become a
Figure 5.9a. The Jaeger Company’s Conceptual Plan for D.W. Brooks Promenade. Design and drawing by The Jaeger Company.
JAEGGER MASTER PLAN FOR D.W. BROOKS PROMENADE

Figure 9.9b  The Jaeger Company's Master Plan for D.W. Brooks Drive
design and drawing by The Jaeger Company
Reduction, not to scale
pedestrian promenade. This plan was presented to the Office of the University Architects and the President of the University, and their ideas helped shape the outcome. In 2001, The Jaeger Company was selected to complete a Master Plan for D.W. Brooks Promenade (Figure 5.9a and 5.9b). Jaeger's project goals include: preserving historic landscape features; reviving historic features such as gateway columns, an outdoor amphitheater, and agricultural trial gardens; creating large open greenspaces similar to North Campus in a quadrangle style plan; and creating a unified look for the corridor. This plan is currently under construction and will be completed within five years.

My thesis proposal is a variation on The Jaeger Company's master plan. I am accepting Jaeger's goal to preserve historic landscape features, and I accept the notion of unified greenspace, the proposed infill buildings, and the proposed gateway, amphitheater and agricultural trial gardens. My conceptual design, however, departs from the Jaeger plan in the areas of pedestrian circulation and stormwater management. In form, my design differs from the Jaeger Company's turf grass, tree, and shrub selection and location where Jaeger's plant material placement conflicts with my proposal's design elements. My plan adopts the Beaux-Arts forms of the elliptical lawn in front of Conner Hall, the elliptical sidewalk between Dance and Hardeman Hall, and the turnabout on Carlton Street, as well as the sidewalks in front of the buildings, but then proposes a new layer of forms compatible with them. The reasons for these departures will be evident in the following explanation of the design. If education and ecological stormwater management were a priority, the following concept could be integrated into Jaeger's design envelope for D.W. Brooks Promenade.
Conceptual Design Explanation and Illustration

"So as ecological priorities force themselves upon attention, the patterns and abstractions of the natural world have again become more striking, and so Land Art draws us closer to the recognition of the possible coincidence of our own designs with those of nature" ---- John Dixon Hunt (Weilacher, 1999, 6).

Meaning

The traditional separation between science and art is reflected in the marked contrast between the technical, utilitarian, scientific ways we look at water versus an appreciation of the delightful, sensory qualities of water and an awareness of its magic. A major part of my design is to reconcile the scientific and artistic views--- to highlight their interconnected qualities, contradicting the view that art and science are separate and must compete against or eliminate each other to dominate a thought or a project.

People look at water from two perspectives: the qualitative versus the quantitative method; the artistic versus the scientific; nature untouched versus nature dominated. Landscape architects, garden designers, and artists often focus on the qualities of water, particularly its tactile qualities, containing and directing water in various ways for public display and enjoyment. For example, stillness of water is used for the reflective quality sought in memorials. Other designers in technical fields, such as engineers, examine water to understand and control its directional movement both above and below ground. The goal is to determine how much water is present, which way the water is moving across a site, and where to direct it. Often existing water on a site is moved out of the way or obscured to fit human purposes, effectively "designed out" of the landscape. But scientific disciplines can alert us to the magic of water.

"If there is magic on this planet, it is contained in water. Its least stir even, as now in a rain pond on a flat roof opposite my office, is enough to
bring me searching to the window. A wind ripple may be translating itself into life" (Eiseley, 1957,15). Loren Eiseley's words express a feeling about the presence of water shared by many people but not often discussed. Rainwater and other water forms possess certain qualities that attract people. When we hear rain outside, we are drawn to the window to observe, curious about the storm intensity. Children often press their noses to the window watching a rainstorm, delighted by the show outside, excited by the opportunity for puddle splashing. Rain evokes a myriad of feelings from melancholy to sleepiness to restlessness. My design goal is to reveal stormwater movement in a way that demonstrates how this ordinary element can be a delightful part of the landscape while being managed in an environmentally sensitive manner. Design elements highlight stormwater movement, ubiquity, and ephemerality, showing that a functional stormwater management system can make an artistic statement and be ecologically beneficial at the same time.

Land art can challenge the separation of science and art. While science is defined as "the systematized knowledge of nature and the physical world," the land artist responds to a site and gains knowledge from the materials of nature in a particular place (Webster's New World College Dictionary). The attraction of land art lies in "the confidence of its practitioners and critics alike that it has a firm basis in ideas. Ideas of how to respond to land, ideas of art and design together with no fear of conjoining them" (Weilacher, 1999, 6).

Description of the Design Concept

According to my proposed design, as one looks south, down D.W. Brooks Promenade, it should be apparent that the landscape forms change from an artfully detailed and controlled geometric conveyance of water to a system that has released stormwater from these confines to purify it and return it to Nature. The design presents a spectrum for the viewer. At first,
stormwater is separated from the land in a flume, which serves as a utilitarian expression. Along the way, ideas from art and science are fused to create functional forms that reveal the resonant beauty of stormwater and restore natural drainage. Contrary to common practice, this management regime maximizes human interaction with stormwater. This design proposal demonstrates the integration of functional and playful elements to ultimately serve an ecologically beneficial and educational role. The result is similar to many land art works: its bold extravagance may or may not always serve a practical function, but is intended to stimulate, captivate, and delight the observer.

**Design Concept and Illustration**

**Site and Watershed Character**

The soil in the Brooks Promenade area is Cecil Series sandy loam (CYB2), which is red in color. This soil formed mainly in material weathered from gneiss and granite but mixed in many places with quartzitic or basic material. Bedrock is at a depth of 0’ to 8.’ Current construction exposing

![Figure 5.10](image)

*Figure 5.10* Depth to bedrock appears to be 2’ or less in this section of Brooks Drive in front of Miller Plant Sciences Building
bedrock in front of the Miller Plant Sciences Building shows approximately 2’ depth to bedrock. (Figure 5.10). Permeability and the available water capacity of the soil are moderate, and surface runoff is medium.

A measurable amount of rain falls in this geographic region on about 120 days each year producing amounts averaging between 46 and 50 inches per year. Rainfall amounts fluctuate seasonally and annually. Averaging over many years, the driest months are September and October, and the wettest month is March. Thunderstorms are common in the spring and summer months and are sometimes intense.

"The drainage area, or watershed, is the land area that drains to the point at which you estimate runoff. Any rainfall runoff model requires you to identify the drainage area and to specify its size, soil, and condition" (Ferguson, 1998, 49). The watershed area and percent impervious cover are measurements that can be used to compare this design to similar designs implemented in other places. The easiest way to do this is through “on the ground experience.” Bruce Ferguson has agreed to contribute his expertise in this area to evaluate my design proposal. Two drainage points along Brooks Promenade have been identified, and the watershed area has been calculated for the central plaza between the Dance Building and Hardeman Hall and for the wetland located in front of the Miller Plant Sciences Building (Figure 5.11). The approximate watershed drainage area for the central plaza is 8.15 acres. The terminal wetland’s drainage area includes approximately 26 acres. In both watersheds, impervious surfaces cover approximately 60% of the land area, identifying the site as an urban watershed. A recent aerial photograph of the area shows that a large percent of land is covered by buildings, roads, and parking lots (Figure 5.12). Conceptual design does not require calculations, so the only calculations made for this site are the watershed area and the percent impervious cover. Precise dimensions of stormwater management elements
Figure 5.12. Aerial photograph shows existing conditions in the D.W. Brooks Drive area with approximately 60% impervious cover.
PRE-EXISTING STORMWATER UTILITIES
BELOW D.W. BROOKS PROMENADE

Figure 5.12 Existing underground stormwater utility below D.W. Brooks Drive
in the design, such as flume, runnels, pools, and wetlands are subject to hydraulic calculations and objectives determined at the construction detail level.

Existing urban storm sewer infrastructure is functional in this area including downspouts, inlets, and underground conveyance (Figure 5.13). The overflow system for my design concept will use the existing storm sewers. There are no existing surface streams on the D.W. Brooks Drive Site. A Walk Down Brooks Promenade (Figure 5.14 a and Figure 5.14 b)

The “walk” to describe the design begins at Conner Hall (A). The hydrologic objective to display stormwater is achieved by harvesting rainwater from rooftops along the Promenade. Stormwater is collected on the building roof and drains into pipes that empty into rain funnel/shade shelters located outside of the building entrances (Figure 5.15). The rain funnel/shade shelters are rainwater conduits, catching water and funneling it into a conveyance system. Water from the roofs is transported by gutters that empty into the rain funnels. The rain funnel canopy consists of layered planes of a metallic, shiny, silver colored material such as stainless steel,
that reflect light. Some panels are transparent and could be made of Uvex, a durable plastic that looks like Plexiglas or Lucite but is stronger and less likely to cloud. The rain funnel supports and building gutters that empty into the funnel are dark brown in color. The central stem of the rain funnel is either steel, cast iron, or Uvex, which would allow the water to be visible as it travels down to the conveyance system. The cool-colored industrial material of the funnels contrasts with the warm-toned brick buildings. The funnels are simple contemporary forms, placed throughout the design to tie together the different building styles with a single, repeated feature. The funnel portion of the structure, resembling an upside down umbrella, rotates in windy conditions.

The rain funnels are designed to heighten sensory awareness. Rain often draws people to the window, and when viewed from office windows, the rain funnels will provide a show across the landscape. Throughout the design, the funnels are placed along sidewalks and at building corners and/or entrances, depending on building orientation to D.W. Brooks Drive. During a storm, the sound of rainwater is magnified when raindrops hit the canopy. In dry times, the funnels provide shade. From the hilltop, one notices that the funnels increase in number and concentration in the lower half of the design. This coincides with the increasing focus on delight in water as the design progresses. These structures are whimsical and invite people to slow down or stop, whether it is raining or sunny, to interact with the stormwater features.

Stormwater flows down a central pipe in each funnel and at ground level empties into an open rectangular stainless steel flume 2’ wide and 2’ deep. The flume represents a stormwater pipe, a utilitarian device that confines water and moves it according to human intent. The stormwater flume is set in the ground and curves through the lawn in a winding pattern inspired by the decorative limestone blocks on the Conner façade (Figure
5.16). Its curlicue form is playful, suggesting curves in nature and the notion that the way humans direct water is not necessarily logical. Notched details direct stormwater around the sharp corners of the flume. The elliptical lawn in front of Conner Hall is one of the steepest slopes of the site, dropping approximately 12 vertical feet over 170 horizontal feet. The curvilinear flume pattern will help slow the water as it moves at a high velocity in the stainless steel flume on its way to the bottom of the elliptical lawn, where it drops into a crescent-shaped detention pool. In a heavy storm, sheet flow from the lawn will also add to the flow in the flume and pools. The curved stainless steel detention pool has a v-shaped notch as a weir. Steel is chosen because it is a manmade material created from earth ore. Because of its shiny, reflective quality, it will stand out against the "natural" lawn, in striking contrast to Nature. Its apparent permanence in the landscape also contrasts with the ephemerality of stormwater. The water then spills into the adjacent, lower, smaller crescent-shaped detention pool. When empty, the still flume and detention pools gleam in the sunlight and spark curiosity about the water source. To some people, they may be

**Figure 5.16.** Limestone Detail on Conner Hall Facade
mysterious until it rains and the flume and pools brim with water. This is an advantage of bringing stormwater above ground. The design is intended to be pleasing, whether it empty or full of water.

The flumes and runnels are conveyance elements set into the ground and are located throughout the design proposal. The flumes and runnels cut through staircases and flow under paths and across turf grass. The amount and velocity of water flowing through this conveyance varies with storm intensity. Periods of dryness between storm events will prevent algal growth inside the stainless steel flumes. These forms symbolize control over stormwater, or perhaps its control as a strong force in the landscape.

The flume from Conner lawn crosses the elliptical sidewalk passing into the second section of the design (B). Where stormwater intersects pedestrian paths, it remains visible, covered with a fine textured steel or cast iron grate. At this point, the flume is 3 feet wide with gently sloping sides to accommodate the greater amount of water from the large contributing watershed. In front of Barrow Hall, the flume zigzags across the lawn, intersecting the diagonal secondary sidewalk in two places before meeting it and continuing parallel to it.

The design hardscape consists of two types of porous paving. The primary sidewalk on the two sides of Brooks Promenade is linear and rectangular the secondary sidewalk connects buildings diagonally. A color difference between the sidewalks results in a strong reading of the secondary path geometry. In this upper portion of the design, stormwater from adjacent roads, sidewalks, and turf is collected in star shaped depressions, which direct water into the flumes. These depressions are lined with metallic material echoing the same geometry as the rain funnels because they serve the same purpose. Although the amount of storm runoff in this area is reduced by the porous concrete sidewalks, the star shaped depressions show that stormwater is generated not only by impervious
roofs, but also by roads and sidewalks that cover almost twice the area of roofs in urban watersheds.

As the flume carries stormwater through the promenade, more rain funnels empty into it, and its width increases to 4’ in front of the Boyd Graduate Studies building (C). Figure 5.17 is a section illustrating the area from Boyd Graduate Studies Building to the parking lot on the other side of the Promenade. In places where the flume turns sharply to change direction, a notched rectangular detail slows the flow and directs water around the corner. A change of material or an elevation drop at the junction will also slow water speed. Up close, each junction could be unique, with details worked out at the construction design stage.

The sharp angles of the flume pattern symbolize the way water is manipulated, contrary to natural cycles, to suit human purposes. This is a reference to the quantitative view of stormwater. The geometric forms convey water in a pattern that suits the designer, without regard to the natural system. The metallic flume material set in the ground contrasts with the natural course water would follow above or below ground.

The third section of the design is a central plaza located between Soule Street and Green Street (D) (Figure 5.18). Here the 4 foot wide flume enters the space parallel to the sidewalk and empties into a rectangular rill that overflows into a rectangular reflecting pool. The overlapping circular and rectangular rills are made from the same metal material as the conveyance flume. Stormwater from the Hardeman Hall rain funnels empties directly into the rill. Lined in black polished granite, the shallow rectangular pool is 6” deep. Functioning as a dry stormwater detention basin with a very low discharge. It will contain water almost all of the time. The qualities of water evident in this area most of the time are reflection and stillness. Until this point, stormwater moving through the space is temporarily detained in small areas: the crescent pools and the rectangular
D.W. Brooks Promenade
Central Plaza Section

Stormwater Flume
Zigzag Walkway
Reflecting Detention Pool
Geyser Fountain
Semicircular Detention/Infiltration Pool
Zigzag Walkway
Rain Funnel/Shade Shelter
Lawn
Sidewalk

Scaled to Fit  Original Scale: 1" = 10' 0"

Figure 5.10  D.W. Brooks Promenade Section B - B'
Central Plaza
turns in the flume. The large rectangular pool represents human control over water and scientific measuring and ordering of a natural process: detention, slowing stormwater on its journey to the river. The beauty of a still pool of water reflecting the landscape is a simultaneous reminder of stormwater’s artistic potential and its manipulation by humans.

When the rectangular pool is full, stormwater enters the overlapping circular rill and overflows into a semi-circular pool. Stormwater from the Dance Building also empties into the circular rill. The semi-circular detention/infiltration pool is a gentle, shallow bowl paved with porous material. The basin temporarily holds stormwater, slows stormwater movement, and allows infiltration. When the pool reaches capacity, stormwater is carried to the next section in a flume. A water geyser fountain in the center of the semi-circular pool runs for several days following a rain event. This fountain accentuates the movement and playful qualities of water. Some water splashes into a portion of the rectangular pool, dancing, disturbing the still water, and some water lands in the semi-circular pool.

A diagonal sidewalk cuts across the edge of the rectangular detention pool and the circular infiltration pool allowing pedestrian movement through the space. Throughout the design diagonal sidewalks intersect with and overlap other features to facilitate human access and encourage contact with the stormwater features.

The semi-circular pool contains bright-colored, notched rods marked with the International System of Units (SI) used by scientists and the foot-pound-second (fps) system of units recognized by the general public in the United States. The rods are symbolic quantitative forms to measure water depth, located here to highlight the changing levels of water in the pool. A high density of mensuration rods in the pool dramatizes stormwater fluctuation. This device relates to the way we understand the world around us by measuring and ordering. Ephemerality of stormwater is evident here;
sometimes the pool is full of water, sometimes it is partially full, and sometimes it is empty. This gesture emphasizes overlap of measurement techniques and the ephemerality that makes water difficult to measure. When the semi-circular pool is dry, the scene is stark and architectural. One may question why there is nothing to measure.

The rectangular pool, with sides measuring a 1 to 1.618 ratio, is a Golden Section Rectangle. This proportion, a way of dividing a line to create an ideal relationship between the parts, is also known as the Golden Mean or the Divine Proportion. Plato considered it to be the most binding of all mathematical relations and, therefore, the key to the physics of the cosmos. Architects and artists use this proportion in their work, and scientists, such as Roger Penrose, continue to discover new things about its place in science, mathematics, and nature (http://galaxy.cau.edu/tsmith/KW/golden.html).

The circular rill (that the rectangle overlaps) has a radius measuring 40'. This measurement multiplied by 1.618 equals 64.72', which is the length of the short side of the Golden Rectangle. This length is multiplied again by 1.618 to determine the long side of the Golden Rectangle measuring 104.7'. The balance here is both visual and philosophical. The Euclidean forms represent scientific ordering as a way to understand nature. The rectangle and the circle are linked to spark dialogue about the quantitative and qualitative understanding of water, and call into questioning the typical separation of these categories. The splashing fountain reaches both pools, strengthening the transition and blurring the boundaries.

The circular form of the rill is a reference to the water cycle. Its location in the center of the site highlights the importance of restorative drainage for returning stormwater to the natural water cycle. A goal of this design is to improve water quality and restore balance to the water cycle by returning stormwater to the watershed through evaporation and infiltration.
rather than piping it directly to a river or to a wastewater treatment plant that discharges a high volume of water into the river. Another possible interpretation of the circle is as a reference to history as cyclical as opposed to linear; for example, the Jaeger Company’s plan returns to Beaux-Arts design ideas on D.W. Brooks Drive, circling back to the original plan for the area.

This central portion of the design is a transition point, suggesting integration along the spectrum between the quantitative/utilitarian and qualitative/aesthetic aspects of stormwater. Two management regimes overlap where the rectangular detention pool pours into the circular infiltration pool. At times of slow flows the stormwater will seem to magically disappear as it pours into the circular pool and quickly soaks away. The area is also a point of intersection between functional elements symbolizing human control and conventional management in the first half of the design and the alternative "natural treatment" system in the second section. My design seeks to contradict the perception of a dichotomy between art and science and to marry land art with the functional science of ecological stormwater engineering.

Stormwater exits the central plaza in a u-shaped rock-lined channel 5’ wide that runs beside the sidewalk. The circular pool and the stone-lined overflow channel are the same color, with a difference in permeability. The circular pool is porous, while the channel is impervious. After crossing under Green Street, the stormwater flume and the path meet a circular, extended wet detention pond or wetland with a rough edge of local granite (E). Native granite is included in the design as a reference to the site geology, along D.W. Brooks Promenade, where granite bedrock lies below shallow clay soil.

Stormwater empties from the rock-lined channel into the round basin, and the sidewalk continues to zigzag throughout the length of Brooks
Promenade. The round basin is the first in a series of planted wetlands, but unlike the others, its shape is a perfect circle, showing the hand of man in a natural system. The wetlands are semi-permanent pools containing plants that can withstand both wet and dry conditions. In the case of repeated extended periods of drought, water could be harvested from building roofs, stored, and used to maintain permanent pools in the wetlands. Standing water is sometimes a concern in the landscape because it attracts and becomes a breeding ground for mosquitoes. This system is designed so that ephemeral pools hold water for no longer than three days, which is the residence time mosquito larvae require to hatch. Permanent pools can contain fish, and mosquitoes will have predators, so in this balanced ecosystem mosquitoes will not be problematic. Planted wetlands allow stormwater infiltration and purification. In the case of overflow, a serpentine, stone lined channel 5' wide conveys stormwater from each wetland through the center of the promenade, emptying into the terminal wetland. Here, too, permanent stone contrasts against ephemeral stormwater. Most of the time, this rugged rock channel will be empty because stormwater will flow from one wetland to another.

South of the circular wetland, nine raindrop-shaped wetlands edged in 1' wide granite blocks line the promenade. Distinct from naturally occurring wetlands, these wet extended detention ponds have a stylized water or rain droplet shape. The presence of the designer remains obvious in this "natural" section. The wetlands are filled with grasses and plants that adapt to dry and wet conditions. The area around the wetlands that is not paved is planted with Juncus tenuis (Path Rush), a native grass that grows in disturbed sites. This is preferable to turf grass, specified in Jaeger’s plan, which requires fertilizer and herbicide application, which would adversely impact the wetland ecosystem. Recommended wetland plant species include, but are not limited to, Andropogon virginicus, Andropogon glomeratus,
Carpinus caroliniana, Equisetum hyemale, Ilex glabra, Ilex vomitoria, Iris virginicus, Itea virginica, Juncus effusus, Juncus tenuis, Myrica cerifera, and Panicum virgatum.

Rain funnel/sun shades along the zigzag path encourage passersby to linger and notice the beauty of stormwater in an alternative management system. In places where sidewalks cross runnels or wetlands, the path is covered by a grate, allowing passage and keeping the stormwater in view. The granite coping and stylized "raindrop" shape make the hand of man evident in these constructed wetlands. The intention is for the wetlands to function as an ecosystem without appearing to be naturally occurring in this urban context. Along the promenade, the wetlands increase in size with the largest one at the end, reflecting the shift in perspective with increasing emphasis on exposing and cleansing stormwater. The last wetland pond is located in the center of the promenade in front of the Miller Plant Sciences Building. The terminal wetland is the largest because all of the stormwater from the Promenade will come to rest here. A River Birch (Betula nigra) grove is a purposeful intrusion in the wetland at this point, showing reintegration of stormwater with the land, clearly shaped by the artist's hand. The interruption makes a statement about integration and balance between art and science, where stormwater becomes both utilitarian (for humans and the water cycle) and aesthetic.

The last section of the design contains a large grove of 32 River Birch (Betula nigra) trees, planted 24' on center, that spills into the last wetland (F). Figure 5.19 is an illustrated section cut through this part of the design. River birch can withstand both wet and dry conditions. Between the trees are mist sprayers; half are 18" and the rest are 10' high. The sprayers are a reference to transpiration in the water cycle; trees absorb water through roots and release moisture into the atmosphere through leaves. The sprayers provide an opportunity for interaction, allowing visitors to feel the
D.W. Brooks Promenade
Terminal Wetland Section

Proposed Horticulture Building

Rain Gutter

Rain Funnel/Shade Shelter

Planted Wetland and River Birch Grove

Mist Sprayer

Rain Gutter

Millar Plant Sciences Building

Sidewalk

Zigzag Walkway

Scaled to Fit
Original Scale: 1" = 10' 0"

Figure 5.19  D.W. Brooks Promenade Section C - C'
Terminal Wetland with Mist Sprayers
fine mist or frolic in the spray. The sprayers are also a visual symbol of the invisible process of transpiration—completing the water cycle until the next rain.

Under the birch grove canopy, the last wetland contains a visible outlet to the existing conventional underground stormwater system. The design can manage much of the stormwater on site, but connection to a back-up system is important. In case of flooding, water drains to the storm sewer system. Because the design is not comprehensive for the entire watershed, but includes portions from several basins, runoff from adjacent streets and buildings will enter this alternative management system and could overload it. Connection to a back-up system is important during major storm events such as a fifty-year or one hundred-year flood. Overflow connections to the pre-existing storm sewer system are necessary and easily engineered in each section of the design.

Conclusions

Continuity of materials is important for design unity in this architecturally diverse setting. The rain funnel/shade shelters are unifying elements, linking buildings with varied architectural styles. Other materials described in the proposal contribute symbolic meaning to parts of the design spectrum. In the upper half of the design, stainless steel flumes and runnels refer to utilitarian, scientific management of stormwater. In the lower half, materials such as native Piedmont trees and grasses, locally mined granite, and rugged rock, come from the site to symbolize a connection with the land and Nature on the site. In addition to the rain funnels, the porous concrete pavement and steel or iron grates throughout the design proposal are unifying elements. The grates incorporated into the pavement allow integration of exposed stormwater and pedestrian movement.
The upper and lower halves of the design are linked by the zigzag sidewalk and the stormwater flowing through the site. The geometry of the sidewalks does not attempt to unify the multiple axes created in this space over the years by inconsistent building placement. The pattern of the zigzag path emphasizes the axis shift along Brooks Promenade and facilitates contact with stormwater. Throughout the design, the ephemerality of stormwater in nature contrasts with the apparent permanence of stone and manmade metals. Design elements highlight stormwater movement, ubiquity, and ephemerality. My design concept, expressing stormwater through land art is layered over the Beaux-Arts design features of the Jaeger Plan. The juxtaposition is striking yet complementary. While the Jaeger design is traditional, my contemporary design includes historic features and also addresses a pressing ecological issue. In contrast to Jaeger’s plan, which separates stormwater engineering from landscape architecture, my design proposal requires integration of the disciplines and collaboration between specialists. My goal is to create a dynamic space that will engage people, encourage interaction, awaken interest in natural processes, change perceptions about stormwater and ultimately influence actions.

This design proposal has several limitations. The design is not comprehensive on a watershed or sub-watershed level. It only handles stormwater in the immediate area of Promenade. Because the restorative drainage management method is applied only in the lower half of the design, water quality improvement, peak storm flow reduction, and recharge of groundwater reserves are minimal. Underground cisterns could be added so that stormwater could be reused for irrigation or to maintain permanent pools in the wetlands. The design proposal invites participation and response from the public, and this type of interaction is unpredictable on campus.
Strengths of the design proposal include the possibility of multiple interpretations. Intended meaning and symbolism along the spectrum have been discussed, but the design is open to a variety of explanations. The design would be thought-provoking and perhaps controversial, as is the case with many land art works. Both positive and negative reaction to this design would bring attention to the topic of stormwater management in the urban landscape. The design elements in the lower half of the design handle stormwater from Brooks Promenade in an ecologically sound manner, reducing storm runoff and pollutants and returning stormwater to the soil through infiltration. Stormwater is harvested by diverting it from storm sewers and using it for artistic and educational purposes. Further elaboration, adaptation, or extension of the design across South Campus is possible.

Stormwater flow is revealed along Brooks Promenade in a land art expression to increase understanding of natural processes. In the tradition of the Land Art Movement, people are encouraged to experience this landscape in a new way. Since many ecological problems are caused by our disengagement with Nature, featuring stormwater as a valuable element in the urban landscape is a step toward reconnecting people with Nature. Hopefully, this reconnection will lead to better solutions to ecological problems in cities.
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