UNIVERSITY OF CINCINNATI

Date: 9-Apr-2010

I, Mitchell S Duyser, hereby submit this original work as part of the requirements for the degree of:

Master of Architecture

in Architecture (Master of)

It is entitled:

Hybrid Landscapes: Territories of Shared Ecological and Infrastructural Value

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Hybrid Landscapes:
Territories of Shared Ecological and
Infrastructural Value

A thesis submitted to the
Graduate School
of the University of Cincinnati
in partial fulfillment of the
requirements for the degree of
Master of Architecture
in the School of Architecture
and Interior Design
by

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B.S. Architecture University of Cincinnati
2008

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Abstract

Today’s landscape is defined by the artificial dichotomy of civilization and nature. This divide is not an actual, physical boundary, but a deeply rooted cultural construct with a lineage that can be traced through the evolution of Western culture. Intellectually dissociating the built environment from the rest of the planet has proven ecologically catastrophic. The current model of sustainability is incapable of reconnecting the two, as it does nothing to reorient the relationship between urbanization and environmentalism. A new model that recognizes the fundamentality and universality of nature, Landscape Urbanism, is beginning to emerge. Within this ethos, environmental design and technology actively seek integration with the ecological systems of the earth. Architecture therefore becomes a hybrid infrastructure that seamlessly supports both human and nonhuman needs. Accordingly, designs must operate at the scales of ecology; mapping and responding to the intricate webs of information and interaction far beyond the edges of the project site. Nature needs to be recognized not as an idyllic vision, but as an infrastructural system capable of organizing conflicting needs into an improved and unified whole. Thus allowing for intentional human participation in the complex and emergent system we understand the environment to be.
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Introduction

The construct of modern human life is built upon an invisible foundation. Not invisible as in undetectable, but invisible as in hidden and forgotten. Representative of the infrastructure that enables civilization, this foundation is formed from the human and ecological systems that support the continued expansion of modern society. Often unnoticed, this myriad of pipes, wires, rivers, and oil fields is pushed out of the collective conscious and awareness. So dependent have we become on these systems, minor disruptions in their functionality can threaten civilization itself. As exemplified by events like the 2007 Minneapolis bridge disaster, and more abstract issues like climate change, these systems are approaching the point of widespread failure. Such threats of disaster are currently the only events capable of bringing infrastructure to the surface of everyday experience, and will occur with increasing frequency unless widespread societal action is taken. Humans need to change how they interact with the rest of the world, specifically focusing on the technologies that enable civilization, and the collectively held societal perspective of the environment. Civilization can no longer afford to forget about the systems that enable existence, nor can it assume that such infrastructures will be available indefinitely.

Infrastructure has traditionally been intentionally and methodically hidden from view, buried underground, and moved to the outskirts of town. Allowing humans to live free of concern for how necessities are acquired, organized, and distributed. The infrastructure that is exposed, such as power lines, roads, and cellular towers, are rendered invisible by their ubiquity, subsumed by the contemporary urban landscape. Throughout modern time, infrastructure has served to insulate human activity from its effects on the rest of the planet. “Away” was a place anywhere but here, removed from influence over problems like water quality and climate change. The unavoidable truth however, that this isolation is not physical but psychological, has been slowly revealing itself over the past fifty years. Book’s like Rachel Carson’s Silent

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Spring, published in 1962, and movies like Al Gore’s An Inconvenient Truth, (2006) have helped illuminate the previously “invisible” systems binding civilization to the rhythms of the planet. We can now attribute much of the current environmental fluxus to the ignorance of our participation in global and local ecology. Today, truly no place exists that has not experienced the impacts of humanity.²

This ignorance or rather, willingness to overlook man’s interaction with the environment is not a recent societal or cultural development. Our actions and reasoning are deeply rooted in the classical tradition, dating back to the founding myths of Christianity and ancient Greece. Perpetuated and augmented through the Enlightenment and Industrialization, western culture has been left with a fractured view of nature. One that idolizes and romanticizes the “virgin wilderness” while simultaneously working feverishly to exploit every available natural resource in the name of societal and economic progress. Romanticism values nature for its aesthetic and sentimental appeal, while Industrialization’s commoditization of the environment makes it subservient to human needs and desires. The assimilation of these views has led to the perception of nature-as-beauty, allowing for the consumption of less beautiful landscapes with disregard for ecological consequences.³

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³ Caroline Merchant, Reinventing Eden (New York: Routledge, 2003), 6
New conceptualizations of nature must recognize the presence of complex and emergent systems, where the whole behaves in a way that cannot be understood through the isolation of individual parts. Work in the field of biomimicry, championed by the biologist Janine Benyus and the architect William McDonough, is already moving towards this end. Both call for a new industrial organization that looks to nature to provide specific technologies as well as methodologies for production that displace consumption and disposal with nutrient cycles that are endlessly renewable and detoxifying for the environment.

An architecture responsive to a redefined conception of "nature" must address both the physical and cultural relationships humans have with their environment. Such an architecture must visually and functionally integrate the previously disparate activities of civilization and nature. Infrastructural solutions can no longer come through human ingenuity alone, but through mentorship and comprehension of the complex systems already existing in nature. This use of biomimicry allows environmental design to evolve beyond the current sustainability movement where simply being "less bad" is still good enough. Concepts like the USGBC’s LEED (Leadership in Energy and Environmental Design) system, and other supposedly “green” building practices do nothing to change the fundamental relationship humans have with the planet. They function under the dated and false assumption of humanity as a separate system from the rest of nature. Polluting and consuming at a slightly slower rate is not a thoughtful means of reintegrating civilization with ecology.

Environmental designers, recognizing this failure, now have the capability to acknowledge the complex and interactive systems present in the environment and appropriately respond to them. Following the lines of Landscape Urbanism, designers can begin to effectively and intentionally reintegrate human infrastructure, both social and economic, with non-human ecological systems. Every site, regardless of location and status,

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5 Janine Benyus, Biomimicry: Innovation Inspired by Nature (New York: Perennial, 202), 4
6 William McDonough and Michael Braungart, Cradle to Cradle (New York: North Point, 2002), 14
7 Ibid. p 11
functions at some capacity in the local and global ecology. By mapping and understanding environmental and infrastructural layers, constraints become opportunities. Design responses can then be crafted to function at multiple scales and for multiple constituencies.

The Mill Creek Valley near Cincinnati Ohio is a prototypical example of modern society’s historical relationship with its environment. This valley has been essential for the development of Cincinnati into the regional center of commerce it is today. Mill Creek provided the easiest means of access to nearby land for the earliest settlers, and starting with their mills, its banks became the industrial heart of the city. The valley floor provided the easiest route for rail, turning it into the city’s most valuable transportation corridor as well. Extreme amounts of pollution and human waste almost completely destroyed the creek’s functionality as a habitat, and endangered the lives of many living along its edges.

The mistreatment of one of Cincinnati’s most valuable assets is representative of Man’s tendency to destroy exactly what enables his success and survival. The continued state of decay in the Mill Creek’s waters reflects the decay present in surrounding neighborhoods like Queensgate and Lower Price Hill. Social and economic depression is common in the areas of the city bordering the creek, suggesting an intimate connection between the ecological, economic, and social states of the local environment.

The location of this thesis project on a site at the mouth of the Mill Creek along the Ohio River allows for the demonstration of how the confluence of competing and seemingly opposed interests can provide for design opportunity. The existing owner and developer want a barge to rail terminal on the site for economic development. The local community is opposed to this plan and instead would like this site to become a public park. The land itself sits in the flood plain of both the Ohio and the Mill Creek, serving an important mitigation function during flood events. Combining social and utilitarian infrastructure in the same project attaches cultural

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9 Stanley Hedeen, *The Mill Creek: An Unnatural History of an Urban Stream* (Cincinnati: Blue Heron, 1994), 3
10 Fuller et al., *Mill Creek Watershed Greenway Master Plan* (Cincinnati: Rhinoworks, 1999), 12
11 Bruce Martin, *Welcome to Queensgate Terminals* (Cincinnati: Queensgate Terminals, 2009) queensgateterminals.blogspot.com
value to the new technologies supporting civilization. By actively engaging all of these programmatic conditions, a more satisfactory and beneficial solution can be reached than could be achieved with any of the constituents’ projects individually.

The essence of this investigation is in the exploration and dissolution of what is “natural” versus what is “human.” By blurring the line between the two through hybrid infrastructure and manufactured landscapes, we see that the current separation between the two is not physical but psychological, not rigid but malleable, and only an unnecessary limitation on the potential for successful design.
An essential preliminary discussion must be had about *Nature*, a term that has become generic and indeterminate, describing a conflicting multitude of cultural, historical and physical concepts. The social and environmental multiplicity of “nature’s” meanings threatens to render the word useless in describing the world today. The confusion stems from the root word of nature as explained by Caroline Merchant in her work “Recovering Eden: “Nature was a principle...derived from the Latin word *nascere*, “to be born.”...The word *nation* also derived from nascere; hence the nation state was born from the state of nature.”¹² *Nature* and *Nation* are bound together in lineage, familially related instead of polemically opposed. This disagreement of meaning and contextual meaning, that is, between definition and use, is inherent in any use of *Nature*. Therefore any attempt to redefine and clarify the term must limit the usage as well. Currently the term means both an inherent way of functioning, and also how humans perceive the world to be functioning around them. Nature has become both the world around us, and the cultural image of what nature is thought to be. By limiting *Nature* to this mental image, the lens of expectations about the environment, we can strategically trace the history of the concept and how it has influenced human-environment interaction. The other meaning of nature, inherency, can be separated into the term *Ecology*, which is discussed and further defined later on.

The Greeks were among the first to describe the break between the ideal and the experience of an object. Plato’s theory of Forms argues that an abstract realm beyond human experience exists with the true form or essence of objects. What we experience through sensation are not the forms themselves but representations of these forms in a material world of change. The most famous example of this being his allegory of the cave, where only the shadows cast by flickering firelight are seen, and not the

objects the themselves.\textsuperscript{13} In the same way, humans have developed a split understanding of the world around them, both as they perceive it to be, and how it must actually exist, regardless of our understanding.

Carolyn Merchant describes such a lensatic conceptualization of nature in her work, \textit{The Death of Nature}. She states that our past “frameworks” of understanding nature have intentionally changed in order to allow the exploitation of the environment. Early civilization revered the “Mother Earth” as a life giver and nurturer, but the development of science during the Renaissance and the Enlightenment required a shift in perspective so that humans could use the earth without moral ramifications. In her words, “Whereas the nurturing earth image can be viewed as a cultural constraint restricting the types of socially and morally sanctioned human actions...the new images of mastery and domination functioned as cultural sanctions for the denudation of nature.” Nature was mechanized to remove any anthropomorphism from societal perceptions and to enable the “rape” of the environment and its resources.\textsuperscript{14}

Bundled into these natural “frameworks” are the multiple histories


\textsuperscript{14} Caroline Merchant, \textit{Reinventing Eden} (New York: Routledge, 2003), 35
and accounts of the relationship between humans and the environment. These social traditions have significantly influenced how modern individuals and societies interact with the planet. The Christian story of creation is the most influential and likely the most familiar. Competing with the Christian narrative are those of pagan American and European cultures that worship the earth itself as a supreme, divine being. The “Mother-Earth”–“God’s Earth” dichotomy establishes an internal conflict that can simultaneously call for environmental preservation and consumption. The Christian creation story, places man in a position of power over the planet and all its inhabitants, while the Mother-Earth perspective places humans within the system, as partners and constituents of a planetary whole. The direct conflict between these two lines of belief becomes the conflict experienced in the modern world. Humanity recognizes the implications of its actions on the rest of the planet, but feels entitled to use the resources of the planet for its own advancement.

This duality is described more specifically by environmental scholars like Merchant as arising from what are known as the Declination and Recovery Narratives. The former describes a world once in a pure state of balance and harmony, where humanity coexisted with the planet in perfect equality. The world has since fallen from this paradise due to the continued development of human civilization, and will eventually be completely destroyed by the progress of humanity. The planet exists in a constant state of decline towards an inevitable end, at some indeterminate time in the future. The most familiar form of this myth is the Christian creation story found in the biblical book of Genesis. Adam and Eve are created by God and live in the Earthly paradise of Eden, after they eat from the Tree of Knowledge they are cast out of paradise into the fallen world. Here the sinful actions of humanity begin the decline of the world that ends with God purging humanity from the planet in the book of Revelation.

Historically, this narrative can be seen as a metaphor of the advent of developed agricultural societies, and the switch from worshiping multiple Earth-based divinities to a singular heavenly divinity during the

15 Ibid. 11
16 Caroline Merchant, Reinventing Eden (New York: Routledge, 2003), 36
rise of Judaism.\textsuperscript{18} A de-sanctified earth is easier to exploit, and technological advances like the plow and the tractor make this exploitation ever more efficient and beneficial to humanity. Not all blame can be placed on the Bible however, as conflicts within the creation texts provide an alternative point of view. In Genesis 1:28, God places Adam and Eve in a position of power over all the animals and creatures of the Earth by giving them authority to name the animals. This passage suggests humanity’s right to use the planet and its resources as it sees fit. In Genesis 2:15 however, God instructs man to “dress and keep” the garden, making mankind stewards of God’s Creation, maintaining and preserving it. This second interpretation is a path favored by many modern Christians now concerned with the condition of the planet, searching for answers within their existing doctrine. Both passages however, are still anthropocentric, implying that man is central to God’s creation instead of equitable to all of creation.\textsuperscript{19}

The Recovery Narrative, in turn, is the method by which humanity can avoid destruction and return to balance with the rest of the planet.\textsuperscript{20} This narrative is generally described as the process of humanity transforming

\textsuperscript{18} Caroline Merchant, Reinventing Eden (New York: Routledge, 2003), 27
\textsuperscript{19} Ibid, 34
\textsuperscript{20} Ibid, 38
the entire planet into a new Garden of Eden. This new garden is carefully designed, in an attempt to recreate the pre-declination paradise through human ingenuity. Cultivation, and the spread of settled Civilization slowly transforms the “savage wilderness,” where Adam an Eve were cast out of the garden, into a new, man-made paradise. The original garden is no longer needed, as man has created one himself. Wilderness is no longer everything outside the walls of Eden, but everything untouched by man.21 This concept first emerges during the Renaissance and Enlightenment and will have drastic ramifications for the planet.

The Enlightenment processes of scientific inquiry and the corresponding compartmentalization of knowledge had specific implications for how humans view their relationship with the environment. Emerging out of the Renaissance, the scientific method of deconstructing nature as if it were a machine understood as the sum of its parts, led to a loss of comprehension of environmental interconnection as nature was broken down into specific scientific disciplines like biology, chemistry, and geology.22 Diderot’s publication of the encyclopedia in 1751 dividing all knowledge into chapters, subjects, and topics epitomized this. The specialization of knowledge and science created a framework for greater informational depth at the cost of breadth. The behaviors present at the system level were not manifest at the component level, and so went unrecognized by science. This newfound knowledge further cemented human’s belief that they were different from other living things, and contributed to the creation of a human superiority complex.23 Urbanizing city centers seemed so removed from nature spatially and technologically as to no longer be of that world. Society managed to cognitively dissociate its existence from the rest of the planet. Anthropocentrism was no longer a cultural mainstay but also a scientific precondition. The combined positions of isolation and dominance provide the basic ingredients to use environmental resources with disregard for potential side effects. The minds of westerners now felt that humans were entitled to use the planet, but were immune from any environmental consequences. 24 The deeply layered connections of ecology were hidden by a rigid structure that ordered information itself.

21 Ibid, 48
22 Caroline Merchant, The Death of Nature (New York, HarperOne, 1990), 17
23 Ibid, 52
24 Ibid, 64
This intellectual position was physically manifested in garden design, specifically French gardens during the late 1600s and early 1700s. Individuals like Andre Le Notre and his work at the palaces of Versailles and Vaux-le-Vicomte demonstrated that the wilderness could be ordered and domesticated by human knowledge. The hunting grounds surrounding the original "hunting lodge" at Versailles were converted into well-tended and civilized gardens. The rigid geometric organization on display in these gardens existed in complete opposition to what was perceived as the savage and godless wilderness present in places untouched by civilization. Western Europeans, felt they possessed the knowledge to perfect the disorder and chaos they saw in the world around them, and by doing so, recreate the lost Garden of Eden.  

Civilization and nature clearly diverge during this period in history. Whereas ancient civilizations depended upon and worshiped the Earth as the source of their existence, Enlightenment era western civilization viewed itself as completely separate from nature. This is primarily due to society's ability to dominate the environment and use it for human intentions. The perceived power granted by advancing scientific knowledge and technology allowed individuals to remove themselves from direct relationships with the

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25 Marian Moffet et al., Buildings Across Time (Singapore, McGraw Hill, 2004), 386
environment. Survival was no longer dependent upon the will and bounty of nature, because now the state of nature depended upon the will of humans. This separation gave further impetus for the exploitation of the planet’s resources, as the connections between organisms and the planet were hidden by the continued development of urban places far removed from the “wilderness.”

Such destructive practices and ideas did not go unnoticed or unchallenged, and the progression from the age of Enlightenment to the Industrial Revolution resulted in some of the first widespread consideration of the impact human activity was having on the planet. Smog filled cities, overcrowded slums, and disease led many to consider if modern society was indeed better than the primarily pastoral and agrarian lives led by their ancestors. Questioning the validity of the Recovery Narrative, many asked what was being lost, both physically, and culturally with the loss of “wilderness.” To this growing group of people, society was not returning to Eden but continuing to fall away from it, a return to the Declination Narrative that foretells of the fall of humanity by its own hand. The concept of Wilderness became representative of what was untouched by the caustic and destructive practices of society. Instead of being godless and something to be feared, the wilderness became something that should be protected because it embodied the mysteries of the divine and the unknown. This sense of mystery is lost when nature is mechanized and dissected as a tool for human use.

This movement that embraced wilderness as valuable was Romanticism, capturing the feeling of loss and turning it into nostalgia for a somehow more perfect and naive past. Romanticism has since become an integral part of the declination narrative and how this narrative is expressed by society. A danger however, exists in any attempt to reclaim the “unknown,” in that merely the image of nature will actually be created. When this occurs, nature is no longer a place of fear, but a place of recreation. Nature becomes the escape from civilization, a respite from the activity of urban life without the risk and danger associated with anything that is truly unknown. We returned to the woods seeking wilderness as an emotion, not as physical hardship. We sought the image of nature, but not nature itself.

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27 Ibid, 125
Romanticizing the image of nature is most clearly physically embodied in the rise to prominence of the English Garden Style during the mid and late eighteenth century. The English Style represents an attempt to improve the inherent qualities of the existing environment by creating wilderness within the already domesticated landscape. This “improved” image of nature was just as meticulously designed as the geometric patterns found earlier at Versailles, and emphasized visual similarity to an idealized nature above all else. As exemplified by the Royal Gardens at Stowe, these picturesque landscapes contained architectural follies reminiscent of past civilizations as well as predetermined paths and views to ensure visitors received the appropriate experience. The commoditization of the image of nature as a place for recreation is no different than earlier, more obvious efforts to domesticate nature for human use. Both reinforce the notion of the environment as separate from and opposite to civilization, and both operate under the assumption that nature exists for human consumption visually or physically. Within these gardens, “wilderness” became recreational instead of religious, and the image of nature became confused with nature itself. Instead of being understood through functional conditions, nature became

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28 Marian Moffet et al., Buildings Across Time (Singapore, McGraw Hill, 2004), 401
an aesthetic condition. Any nature worth imitating or saving should be visually beautiful, anything else can be used as a resource for other forms of exploitation like mining or urban expansion.

Both dominance and romanticism have been continually reinforced, allowing for humans to romanticize the lost wilderness while simultaneously calling for more development to occur. This ability to condone and lament destruction indicates another split similar to that which occurred earlier between Civilization and Nature. Now the concept of nature itself splits in two, becoming the romanticized image nature based in human aesthetic perception, and also the bank of resources and commodities available for human use. The isolation of nature-as-beauty from nature-as-commodity created a means of justifying the exploitation of land with no aesthetic, and therefore no additional, value other than as an economic resource.29

By the height of the Industrial Revolution in Europe, all the pieces are in place for the modern human relationship with the environment to emerge. We value pieces of nature separately for their aesthetic, recreational, and economic importance. The aesthetic and recreational values stem from a collectively held image of nature, while the economic values are

derived from the goods and services the materials found in nature, can be transformed into. The compartmentalization of knowledge made hidden the importance of the environment as a system, and a combination of Christian mythology and technological development allows humans to use the earth as they see fit without significant internal conflict or opposition. This basic mode of operations has been established as business as usual, expanding globally through the present day.

The momentum built by this model prevents any significant opposition to its methods from gaining a foothold. Treadmills of Production and consumption, as spoken of by Michael Bell, encourage more consumption and more production to ensure continued economic growth as the sole measure of the health/success of civilization. The vast scales of extraction are hidden from consumers by the globalized economy. Hiding the environmental cost both physically and economically by subsidizing production in less developed countries. The humans and environment in these countries are often marginalized, and long-term degradation is exchanged for short-term profits, economic growth, and political status. These treadmills move individuals in societies to do more at a constantly increasing rate. Factory owners are pushed by demand for profits to produce as many goods as possible at as low a cost as possible. Reciprocally, consumers want to be able to purchase more of what is produced based on social pressures for status and perceived norms. These two cycles, or treadmills, feed off each other, encouraging one another to even greater feats of consumption and production.

The current stagnant and outdated image of nature held by developed society is a founding condition of man-made environmental problems. Until the environment is recognized as an equal party to the economy and social welfare, little can be done to slow the destruction. Humans are actively engaged in changing the environment and these actions have wide reaching effects.

The work of photographer Edward Burtynsky chronicles this phenomenon through imagery. His images highlight the direct physical transformation the planet is undergoing as a result of human activity.

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30 Michael Bell, An Invitation to Environmental Sociology (London, Sage, 2004), 56
31 Ibid, p. 70
32 Ibid, 61
Focusing on issues of accumulation, the pictures show the scale of change possible due to the cumulative effects of individual choices like replacing a tire, buying something new, or throwing something away. Landfills and mines are revealed as man-made landscapes, manufactured in much the same way as consumer goods and products. Humans are as much a force of nature as erosion or other geological processes, and if we posses the ability to enact these changes perhaps we also carry the responsibility to understand the implications of our actions.\textsuperscript{33} Wrapped up in the imagery are concepts of domination, waste, and destruction. At scale, his images of mines and refuse appear as both scars upon the body of the landscape, and also new forms within the landscape that are the assimilation of civilization and nature. Implied is an urgency to educate as many as possible so that society can actively decide if this is the path that should be taken. Environmental change thus far has occurred relatively passively in that it is the byproduct of our economic and social goals. Civilization must actively make choices with an understanding of and justification for the consequences of its actions.

\textsuperscript{33} Baichwal, Jennifer, Manufactured Landscapes (New York, Zeitgeist Films, 2006)
Chapter 2: Ecological Progression

Civilization now has the opportunity to knowingly choose between long-term economic, environmental, and social stability, and short-term economic growth. Burtnysky’s work is representative of this choice, recognizing that we are changing the planet and that these changes negatively affect human and non-human life forms alike. We see the social and environmental problems caused by the economic pressures of global economies, but are reluctant to change the system we have become comfortable with. More importantly, these concerns show that we are beginning to scientifically and culturally comprehend the environment as a complex whole.

The model of the environment as nature, described in chapter one, is being replaced by the much more accurate and realistic model of the environment as ecology. Instead of being rooted in social constructs like religion and economics, ecology is based in a scientific and unbiased analysis of the systems and actors participating in the environment. Ecology employs a gestalt worldview that sees life not as a kit of mechanical parts but as the cumulative effects of an infinite number of unrelated decisions and actions occurring simultaneously. Like Nature, Ecology as a concept has the potential to act as both a functional model, and a social philosophy that governs how humans interact with the environment. More importantly, ecology reconnects nature with the image of nature, removing the conflicts of interest that exist in the nature-based belief system. In this way, ecology has the ability to reconnect previously separate concepts into a single “environmental theory of everything.”

Though the nature-based model of the environment has been dominant in modern history, the ecological model is not brand new. Ecology as a scientific and cultural concept has existed for over one hundred years. Significant quantities of writing and research have been published within the subject. Ernst Haeckel first used the term (Oekologie in German) in his

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1866 work, *Generelle Morphologie der Organismen*, though some trace the
corecept even earlier to the work of Swedish botanist Carl Linnaeus in the
mid to late 18th century. Much of the basis for Charles Darwin’s *On the Origin
of Species* can be found in Linnaeus’ concept of the *economy of nature*.35

These first ecologists were interested in understanding not just individual
organisms but how all the organisms in an environment collectively interact
and influence one another:

> By ecology we mean the body of knowledge concerning the
economy of nature—the investigation of the total relations of
the animal both to its inorganic and its organic environment;
including, above all, its friendly and inimical relations with those
animals and plants with which it comes directly or indirectly
into contact—in a word, ecology is the study of all those complex
interrelations referred to by Darwin as the conditions of the
struggle of existence. —Haeckel36

Some, like the American Fredrick Clements, saw environments and plant
communities as *super organisms* that develop and change in phases
not unlike individual plants and animals.37 The science of ecology is the
foundation that modern environmental movements like sustainability are
based in. Sustainable principles are ecological principles as they mandate
an ecological basis through which decisions and actions can be evaluated for
their benefits and detriments.

The twentieth century saw a continued expansion of research in
the field of ecology with an emphasis on *holism*. Extending out of the super
organism idea, holism describes ecosystem-scale interdependent behaviors
without considering them as part of a larger organism. First proposed by Jan
Christian Smuts in 1926, holism is now nearly universally understood due
particularly to the food cycle, or food web concept first illustrated by Charles
Elton during the 1920s as well.38 Paralleling this growth of scientific awareness
during the 20th century was the growth of public awareness of environmental

Integral Theory and Practice 1 (1), 2005), 13
36 Ibid. p. 16
37 F.E. Clements, Research Methods in Ecology (Lincoln, Nebraska: University Publishers,
1905) p. 12
38 McIntosh, R. The Background of Ecology, p. 132
issues. The publication of *Silent Spring* by Rachel Carson in 1962 is widely regarded as a watershed moment when the American public woke up to the very real effects human action was having on the environment. Highlighting issues of industrial pesticides like DDT damaging bird eggs, Carson showed that humans were endangering other species and also themselves when interaction with the environment goes unchecked. Silent Spring helped the environmental movement become mainstream, and by connecting specific issues with human well-being, showed that environmental decisions are more than just a scientific exercise.

Bill McKibben speaks to the notion of ecology in his work, *The End of Nature*, where he tracks the social perception of “nature” transform from wilderness to playground. More importantly, he reveals the direct connection between human action and the environment; “We have changed the atmosphere, and thus we are changing the weather. By changing the weather, we make every spot on earth man-made and artificial.” *The End of Nature* is the recognition of human causes of climate change and in turn its effect on nearly every other “natural” process on the planet. Nature

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is no longer the wild animal of nightmares but the domesticated pet of civilization. The romanticism of the wilderness that developed culturally out of westward expansion and the pioneer spirit remains even though there are no valleys left to discover, and pollution continues to modify “natural” processes in ways still being discovered by science. Mckibben summarizes this problem in a statement from his reading, “We have deprived nature of its independence, and that is fatal to its meaning. Nature’s independence is its meaning; without it there is nothing but us.”

Pushed to its fullest, ecology, not unlike religion or humanism, can even become a social philosophy. Many specific groups and belief systems have emerged championing the environment, perhaps the most complete being those belonging to the Deep Ecology movement. Founded by the philosopher Arne Naess during the 1960s, Deep Ecology is a philosophy or, “ecosophy,” that is “ecopocentric” instead of anthropocentric. That is to say that every living thing has a much a right to live as humans. The movement offers an alternative belief system to religions and professes that humans must find their “ecological selves” and identify with nature both as a place and as an abstract experience. Diversity and richness of life are intrinsically valuable and humans have no right to reduce this diversity for strictly self-serving purposes. Naess established 8 core beliefs about what the movement is and what about modern society must change for the goals of the movement to be realized.

_The Eight Points of Deep Ecology:_

1. All Living Beings have intrinsic value
2. The richness and diversity of life has intrinsic value
3. Except to satisfy vital needs, humans do not have the right to reduce this diversity and richness
4. It would be better for humans if there were fewer of them, and much better for other living creatures
5. Today the extent and nature of human interference in the various ecological systems in not sustainable, and the lack of sustainability is rising.

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41 Arne Naess, _The Ecology of Wisdom_ , Ed. Alan Drengson (Berkley: Counterpoint, 2008),
42 Ibid., 82
6. Decisive improvement requires considerable changes, social, economic, technological, and ideological

7. An ideological change would essentially entail seeking a better quality of life rather than a raised standard of living

8. Those who accept the aforementioned points are responsible for trying to contribute directly or indirectly to the necessary changes.\(^{43}\)

As a result of ecology possessing the capability to act as the governor of physical and philosophical systems, designers and architects have frequently been interested accessing the concept as sources for design. As early as the 1800s, environmental designers like architects, landscape architects, and urban planners took notice of the emerging science of ecology and began applying the principles to their own work. The most notable of these early pioneers is Ebenezer Howard (a stenographer by trade) who in 1898 published, *Garden Cities of To-morrow*, a breakthrough book that outlined potential methods of balancing the needs of industrialized cities with the needs of the countryside. The work called for the decentralization of overpopulated and crowded cities like London, by building smaller

\(^{43}\) Ibid., 107
peripheral towns separated from the main city by a large greenbelt. The ideological underpinnings of the concept are explained through the “Three Magnets” diagram. The figure shows the attraction of people (society) to both the town and the country. By intentionally integrating the two, Howard felt the benefits of each could be retained and the detriments mitigated or removed. His work can be seen as the first attempt at sustainable planning as a remedy for the recognized problems in industrial cities like sanitation, air quality, water quality, and slums. The English garden city movement that emerged from Howard’s ideas even managed to spread across the Atlantic to the United States, and in the 1930s the federal government sponsored the creation of Greenbelt, MD, Greenhills, OH, and Greendale, WI.

Frank Lloyd Wright also proposed a form of garden suburbs throughout his career similar to the ideas of Howard called Broadacre City. Instead of clustering small towns around a larger urban center, Wright envisioned a completely decentralized landscape of single-family homes on acre plus lots arranged in an organized grid that would stretch across the country. Every family would be able to cultivate some of their own food on

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44 Steven M. Wheeler et al., The Sustainable Urban Development Reader. (Routledge: New York, 2009), 9
45 Ibid. p. 11
their own land, and the low density would ensure everyone was exposed to the environment and landscape. This, like the garden city, was a response to the perceived problems of overcrowded industrial cities, but adapted to the American physical and cultural landscape.46

Today, the utopian vision of the garden city, seen as a solution for the extremely dense industrial cities at the turn of the 19th century, has been replaced by the dystopian suburbs of modern America. Now the problem is not too much density but too little. The population spread and resulting dependence upon automobiles for ever-increasing daily commutes has placed new pressures on the environment that Howard and Wright could have never foreseen. Many central cities sit in a state of decay as investment and population move outward, while new transportation networks allow necessities like food to be grown farther away, opening up even more land for suburban development.47

The seemingly endless expansion of the American suburb and the accompanying extension of infrastructure like roads, sewers, and electrical wires, often proceeded with little regard for environments that were being

46 Marian Moffet et al., Buildings Across Time (Singapore, McGraw Hill, 2004), 523
transformed and destroyed. This reckless advance led to a backlash movement of people choosing to live with as little impact upon their environment as possible. Removing oneself from “the grid” and becoming as self-sufficient as possible became the counterpoint to the modern, consumptive world. “Earth Ships” as they were known, began appearing in the 1970s. Constructed of rammed earth, used tires, and other readily available materials, the primary intent of these structures was to disconnect from the wasteful infrastructural grid. They did so by being powered by naturally available energy like solar and wind, being made of readily available materials, and being constructible by individuals with little construction experience. Located primarily in the desert southwest of the United States, where the climate makes such dwellings feasible, entire communities of earth ships have developed, often with shared ideologies about minimizing consumption and pollution.48

The architect Paolo Soleri has attempted to expand upon the concept by designing and planning for an ecologically integrated city independent from the infrastructural grid called Arcosanti. Deemed “Arcology” by Soleri, the town attempts to integrate architecture and ecology in an environment that combines the social benefits of urban living with the environmental

48 Mike Reynolds, Comfort in Any Climate (Taos: Solar Survival Press, 2000), 52
benefits of minimizing pollution and access to nature. Construction commenced in 1970 and when (if) completed, the town will be capable of supporting 5000 people, though currently less than one hundred live there year round.49

Out of these early pioneers of earth ships and eco-villages came the sustainability and sustainable development movements known today. Widespread industrialization during the twentieth century along with improved environmental awareness and monitoring techniques brought environmental concerns to the surface of public awareness at the national and international levels. Groups like the 1987 UN World Commission on Environment and Development established the basis for what is now known as triple bottom line sustainability. Suggesting that sustainable solutions must address not only environmental issues, but economic, and social issues as well.50 Today, not only has sustainability become a widespread cultural movement, but also has continually become more important for architecture and building construction. No longer is sustainable design limited to the fringe of earth ships and desert communes, the concept has gone mainstream.

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49 Arcosanti, Archology Theory, Arcosanti, Arcosanti.org/theory/main.html
Numerous building rating systems have emerged, the most well known being LEED, but also including Green Globes, Energy Star, and Cradle to Cradle, that provide means of benchmarking sustainable building practices. Quickly adopted during the flurry of building construction that occurred in the U.S. during the first decade of the 21\textsuperscript{st} century, product manufactures, contractors, and architects alike have integrated these systems into modern architectural practice.

Undoubtedly such systems have resulted in construction that is less detrimental to the environment than before, reducing rates of consumption and pollution of both material resources and the energy used to produce them. Simultaneously, they have managed to economically incentivize many sustainable building practices, accelerating their adoption by the industry.\textsuperscript{51} Many questions however, have been, and are being raised about these systems. These concerns range from the specifics of individual points, to sweeping indictments regarding the effectiveness of rating systems as a whole.\textsuperscript{52} The most condemning critique is that these protocols are not doing enough, and what they are doing is being done in the wrong way.\textsuperscript{53} Under this

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{pine_cone.png}
\caption{Pine Cone transforms based on humidity}
\end{figure}

\textsuperscript{52} Ibid., 278
\textsuperscript{53} James, Steele, Ecological Architecture: A Critical History (London: Thames & Hudson, 2005), 72
system buildings are still only buildings, they are not tied into the ecological network of the planet, or even their immediate surroundings. Dealing with human systems as separate and isolated from the environment is exactly the practice creating environmental problems in the first place. Failure to recognize this fundamental connection in the way buildings are designed and constructed creates projects that are merely “less bad” instead of good. As long as civilization is polluting more than cleaning, and consuming more than replenishing, human activity is only prolonging the poisoning and destruction of the planet. Watering down unsustainable practices does nothing to break the chain of production, consumption, and disposal so disconnected from the cyclical processes of the environment.

Society and architecture need to significantly change their relationship with the environment if current unsustainable practices are to be unseated. Humans must intentionally reinsert themselves into the planetary ecology. This means designing and building with a critical awareness of how projects are going to interact with and change the local environment. Best practices must be found that ensure human endeavors partner with the environment instead of compete with it. One such field of study already being developed is called Biomimicry and can be simplistically

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*fig. 18 & 19: Adaptive Architectural Surface Based on the Pine Cone*

54 William McDonough and Michael Braungart, Cradle to Cradle (New York: North Point, 2002), 81
55 Ibid., 142
described as innovation inspired by nature. Instead of viewing nature as a physical resource to be mined and consumed, nature should be seen as a storehouse of technology and information that humans can use to exist in a symbiotic manner with the rest of the world. Janine Benyus, a founder of the movement and creator of both the Biomimicry Guild and the Biomimicry Institute, divides the topic into three distinct methods nature can influence human development: nature-as-model, nature-as-measure, and nature-as-mentor.

Nature-as-model relates to the underlying systems in the natural world such as self-assembly, self-sufficiency, self-organization, and reproduction. This is perhaps the most difficult area for architects to work today, but provides the most potential for the future of the field both practically and theoretically. Nature-as-measure utilizes the concepts of fitness and efficiency to compare human endeavors to natural processes. Buildings are considered as organisms, those that perform well in their environment survive and reproduce. Those that are inefficient or ill suited to their environment must evolve or become extinct. Nature has spent

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57 Ibid., 6
billions of years pushing solutions to their most efficient and most elegant and humanity has been foolish to ignore this resource when trying to solve problems. 58

The transfer of technology between life forms and synthetic constructs is desirable because evolutionary pressure typically forces natural systems to become highly efficient as well as formally elegant. Biomimetics can be relevant to architecture in terms of design, systems, and processes and can refer to both morphological and behavioral characteristics.59 –Tom Wiscombe

Last is nature as mentor, where specific knowledge or technologies can be appropriated from the natural world. This is not about what can be extracted from the earth but what can be learned from it. Implied is a technological partnership, but also a reconnection between humans, society,
and the environment where the planet is valued not for physical resources, but for the information inherent in its living systems. Such a reconnection to nature is not born out of a nostalgic, romanticized re-creation of the past forsaking modern technology. Instead, biomimicry seeks to refocus efforts on technologies that improve the quality of life for the entire environment instead of only that of humans. Now, with the ability to comprehend and learn from the natural world, we must seek partnerships instead of subjugation; “quiet our human cleverness,” and see what can be learned.

“The road to Rural Life exists, a certain return to the country, to the slow pace of life, to the simple cave. But I believe in the road forward, towards the construction of natural landscape with technology. Architecture is life. It has to be mutant, evolutionary, interactive, integrated, progressive. Spaces with sensors, that feel.” –Enric Ruiz-Geli

Yet biomimicry is not in itself a solution to ecological reintegration. The field is merely an area of scientific and technological research, and lacks a unifying structure regarding how research and discoveries are implemented, especially within the built environment. Though many architects, including Francois Roche, Greg Lynn, and Tom Wiscombe, have created theoretical projects about what a biomimetic, and morphogenetic architecture could look like, very few large scale applications realistically exist today. Much of the promise of this kind of technology lies currently in non-architectural applications like diesel fuel from algae, or new swimsuits based on sharkskin. As these examples indicate, no guarantee exists that new technological innovation through biomimicry will directly benefit the environment. As a result, those with an interest in ecological design must choose specific opportunities presented by biomimcry, and apply them to

61 Ibid., 153
This theoretical project by François Roche postulates a future architecture that is intelligent and self-assembling. The resultant structures are complete hybrids where the lines between civilization and nature, as well as life and inanimacy cease to exist. The "buildings" respond as life forms to changing environmental conditions and the "growth" of the project changes as a result. This utopian (or perhaps dystopian) view of the potential of biomimetic design pushes the concept to its limit.
architectural and environmental design. The designer is responsible for creating the operational methodology that appropriate technologies can fit into in order to achieve environmental integration. To begin, the first step, as suggested by Michael Hensel, could be to shed the vocabulary of the current sustainability movement. The terms green and sustainable should not be used in reference to a new biomimetic paradigm. These words do not convey the drastic departure from past models that biomimicry and similar concepts represent. Instead, the new movement should be referred to in terms of ecology, environment, and organisms.65

The methodology, or ethic for environmental designers should be based in ecology, recognizing the influence of a project extends far beyond the edges of its site, into the surrounding region and ultimately to the entire planet. The scale and scope of designers’ vision must expand to effectively comprehend this web of connections they work within. New layers of ecological awareness must be integrated with the human conditions traditionally recognized and addressed through design. No longer, can projects be thought of as islands, isolated conditions independent of outside forces. They are undeniably part of a continuous landscape of ecological, social, and economic activity.

Landscape Urbanism is an emerging urban design philosophy that already encapsulates this evolving paradigm. The approach operates by removing the focus of urban design from the buildings, and instead focuses on the space between and around them.66 Codified through the works and writings of Charles Waldheim and James Corner during the 1990s, Landscape Urbanism operates through surfaces instead of collections of discrete objects. Corner in his writing, describes 4 key tenants of Landscape Urbanism; processes over time, the staging of surfaces, the operational method, and imagination.67 As emphasized by the concept of ecology, everything is a part of the contiguous environment and participates in its development. Therefore, the creation of spaces and urban spaces must focus on the connection a place has with the local and global ecology. Instead of imposing the exclusive will of humanity upon a landscape, designers and

67 Christopher Girot, Four Trace Concepts in Landscape Architecture, in Recovering Landscapes, Ed. James Corner (New York: Princeton Architectural Press, 1999), 59
planners should look to see what the landscape offers and respond with human programming that integrates well with the existing conditions. These conditions include active biological, geographical, and mechanical systems as well as important conditions from the site’s history. Just as crucial as understanding the past is planning for the continued existence of a project long after “completion.” Allowing sites to continue developing, growing, and aging as the changing environment dictates removes some of the authorship of the site from the designer, and intentionally returns it to the environment. Natural habitat progressions within forested and un-maintained land work with the environment instead of fighting against it.\textsuperscript{68}

Inherent in Landscape Urbanism though not necessarily specifically enunciated, is a lineage and connection to the underpinning of the sustainability movement. The all-inclusive scope of this approach and form of analysis is connected to the original triple bottom line model of sustainability first conceived over twenty years ago. The three categories of environment, economics, and society all have spatial implications. Responding to any one of the components without the others creates an incomplete project incapable of functioning properly in the environment.

Any ecologically conscious architecture and urban design methodology must be grounded in the understanding that everything is part of the ecological environment including man made urban spaces. This environment is emergent in nature with a complexity that is intrinsically valuable.\textsuperscript{69} With this basic knowledge, all decisions must then be framed by the triple bottom line principles of political, social, and environmental equity. Physically manifesting representations or embodiments of these values with a project enables active societal engagement and a corresponding growth in awareness to occur. No longer hidden, connections between humans and the rest of the environment can be celebrated as opportunities for mutual benefit. The resulting hybrid value structures of these symbiotic relationships cement the importance of the connection into the fabric of the society, and create a system of mutually ensured survival.

\textsuperscript{68} James Corner, \textit{Edic Operations and New Landscapes, in Recovering Landscape, Ed. James Corner (New York, Princeton Architectural Press, 1999), 153}

Landscape Urbanism is an urban design approach appropriate for large-scale systemic implementation. An effective application of this methodology is in projects that already sit at the perceptual or functional edge between humans and the environment, but do nothing to take advantage of their position. Infrastructural sites and programs frequently fit this description, and offer opportunities for substantial impact due to the scale often inherent in an infrastructural project like a power plant or a water treatment facility. Integration of ecological concepts at the infrastructural level means such integration can occur at any level of civilization.

Modern infrastructure currently enables civilization to disconnect from the ecological environment. This relationship must be reversed so that infrastructure instead connects civilization to the environment. By supplanting ecological functions with man made systems that do the same thing, the presence of the natural environment is removed from daily life. Sewers and plumbing remove the connection to water sources, countless miles of wires disconnect us from power plants, and mines where resources like coal or oil are extracted are even further removed. Humans are increasingly reliant on centralized distribution systems that transport resources over long distances, directly to consumers, and then transport waste similarly long distances away. The modern city depends on infrastructure to deliver the vast quantities of resources necessary to support large populations. Most forms of infrastructure are seen by society as less than beautiful and at times even dirty, or unsanitary. Removing infrastructure from view, both by burying it underground, or moving it away from population centers satisfies Not-In-My-Back-Yard pressures and also the very real concerns of air, water, and soil pollution. Society prefers for such processes to be removed, and even what can be seen like highways, telephone lines, and radio antennae fade into the background. The problem with this, as by now is well apparent, is that the negative effects much of this infrastructure has on the environment occur whether they are noticed or not. Forgetting about these issues won’t make them go away and they can no longer be so easily ignored.

Chapter 3: Integrated Infrastructure
The current state of infrastructure in the United States provides a unique opportunity to replace the existing, failing, infrastructure with a more ecologically integrated system. As is evident from the tragic Minneapolis Bridge Disaster in 2006, much of the county’s infrastructure is in need of repair or replacement. The American Institute of Civil Engineers has given the country’s infrastructure a grade of C-, suggesting this reinvestment is long overdue. The estimated 3 trillion dollars necessary to rebuild the existing system could instead be used as a down payment and a strong start to create a new method of supporting human activity within the country and on the planet.

These systems are key to any reintegration plans for humans and ecology as the goal is not to destroy infrastructure, but make its often hidden systems more visible to the end user. New infrastructure should not be hidden but exposed, and made a part of everyday society. By making infrastructure more visible and transparent, people will be able to see how they interact with the environment, and more likely to chose actions that are less damaging. Similarly, by placing the infrastructure in the visible realm, environmental responsibility and accountability are no longer optional but
required, resulting in infrastructure that is less dangerous and damaging as well. Thoughtfully considering issues of aesthetic and experiential quality can create infrastructure integrated into the physical and cultural fabric of a community instead of isolated from it. Layering cultural functionality into projects that would otherwise be relegated to exclusively economic or utilitarian duties forms hybrid value structures and results in strengthened connections between humans and their support systems.

Nature has already proven itself capable of performing many of the duties currently reserved for man-made utilitarian infrastructure. We must recognize this infrastructure as our primary connection to the rest of the planet. The way it interacts with the environment should be representative of our own ecological goals and aspirations. Many architects are already considering the potential of a new, more ecologically integrated civilization, and what the architecture of such a civilization might be like. Several specific projects serve as examples of how nature can act as a measuring stick to compare human achievements against. Many projects, both built and un-built, already embody many of the ideas of a model based in ecological and Landscape Urbanism principles. These projects actively engage the various types of infrastructure that enables modern life, and demonstrate the novel environments and design solutions possible using this paradigm.
Fresh Kills, located on Staten Island, is one of the largest landfills in the country and the primary landfill of New York City for decades. The now decommissioned dump is to be repurposed into public recreation area and wildlife habitat, becoming a community asset instead of a detriment. Field Operations won the contract for the park design and have come up with a concept that embodies many Landscape Urbanism principles. Converting the landfill into a public park epitomizes the notion that seemingly opposing spatial uses and programs can be combined in successful and beneficial ways. The reintroduction of plant life not only stabilizes the earth containing the trash, but also the new saltwater wetlands surrounding the site will help to scrub any contaminants leaching from the landfill before they are dispersed into the environment. This new ecological system will provide habitat for migratory birds and wildlife feeling the pressure of habitat destruction from human encroachment. Recreational trails pass through these spaces as well, creating a landscape of views and experiences capable of educating users through observation. The designers expect this landscape, initiated by man, to continue to change through natural progression and habitat succession without further significant intervention from human hands; eventually returning to nature a site once completely dominated by mankind.71

Fig. 28: Stephen Ferry, Fresh Kills Landfill, 1990

Fig. 29: Plan Organization

Fig. 30: Aerial Perspective, Fresh Kills Project, Field Operations

Fig. 31: Adjacent but Separate Human and Ecological Programming

Fig. 32: Expected Ecological Progression
The Geofluidic Landscape, a theoretical proposal by the London based firm Smout Allen assimilates economic, social, and environmental needs into a single performative landscape. Located on the Nesodden Peninsula across the fjord from Oslo, the project connects itself to the socio-cultural and environmental conditions inherent to the site. The constructed spaces of the project hold two gardens and a café. One of the gardens grows food for the café, while the other grows algae to support the local fishing industry, connecting the project to both the social and economic traditions of the local population. Tidal water flowing across the site is channeled through a series of pathways into a “fluidic computer.” The “geofluidic computer” consisting of fountains, jets, fluidic switches, and other devices that use water to compute the proper arrangement of the interior spaces and exterior forms. The water is then used as the force that transforms the building physically by providing the energy to move parts of the actual structure as well as the system of lifts for moving material around the project. The building is constantly adapting in a very literal sense to the tidal conditions of the site. Every detail of the project is carefully interpolated out of an intensive understanding of the existing site conditions, both physical and cultural. The work becomes animate; alive through the designers’ ability to manifest cultural connections in built form. The work is not a building placed on the landscape but is a new, integrated landscape in itself. The needs of humans are seamlessly integrated into the potential energy already being provided by the environment.  

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The Rio Besos Tertiary Treatment Wetlands are a series of man made wetlands that treat the polluted floodwaters of the Rio Besos in Barcelona. Due to local climate, and demands on the river’s water supply, the Rio Besos, has a very low flow during non-flood events, and only flows at all due to discharges from water treatment plants upstream. During heavy rains, the channel quickly floods and before this intervention, often overflowed its banks into the surrounding neighborhoods. Contamination of the water by human waste is common during these rain events due to the aging combined sewer system of the surrounding city. The construction of the treatment wetlands canalized the riverbed to eliminate most of the flooding, and now directs floodwaters to specially designed treatment zones. Shallow gravel beds containing water tolerant plants slowly break down the hazardous organic compounds in the water from the sewage. Most of the treatment occurs below the surface, in the root zones of the plants, mitigating potential odor, while purifying the water at the same time. The system effectively minimizes the flood risk to adjacent communities, and improves the water quality downstream.

The success of the project comes from allowing plants to do what before would have been done by treatment plants that are expensive to build, operate, and maintain. The city saved a substantial amount of money in choosing a biological treatment system and also prevented future costs related to flood damage, clean up and recovery. Simultaneously, the added greenery contributes to improving the physical environment for inhabitants, making the riverbed more aesthetically pleasing to look at.73 This is not a perfect ecological solution as the river is still being polluted and overused by humans. However, the project does improve the health of the river, while simultaneously meeting the needs of the surrounding human population as well.

Out of these projects several essential criteria can be established that describe successful ecologically integrated projects. One is that some form of environmental remediation or non-destructive interaction occurs. Using plants to clean water polluted by humans, or reforesting land once wiped clean by human activity demonstrates a project prioritizing its connection with the natural environment. Another is an implied educational agenda. The project can teach and inform visitors/users about the site’s ecology, and this information can be learned through experience and observation. By making people aware of environmental interaction, support and value is built for ecological systems as equal to social and economic concerns. This information is not found on a plaque or a sign, but is transmitted through curiosity and discovery to the user. Third is the achievement of some form of emergent complexity. The final assembly is more interesting, aesthetically pleasing, and overall successful than the sum of the individual components. The combination of programs and spaces creates unexpected relationships and adjacencies that cannot be intentionally or specifically planned for, but are vital to the ultimate success and life of the project. Emblematic of this trait is natural progression, allowing for habitats and spaces to develop and change over time as dictated by the environment.

These projects and proposals demonstrate that it is more than possible for humans to interact with the environment in sensitive and symbiotic ways. Given our ability to do better, and the knowledge of the problems that can occur when ecological considerations are ignored, humans have the responsibility to act in the best interests of the planet as a whole. Short-term benefits can no longer be an excuse for ecological destruction, and ecologically integrated projects must become an essential component of future civilization.
Fig. 41: Model for Human-Ecological Integration
Fig. 42: The Mill Creek Watershed
Part II: Ecology (re)formed
Chapter 4: The Nature of Mill Creek

The Mill Creek Valley separates Cincinnati from the multitude of similar settlements founded along this area of the Ohio River around the same time. This geographic feature enabled colonization, transportation, industrialization and urbanization. Transforming the city in under 100 years from wilderness into one of the most important centers of trade along the Ohio River. Unfortunately, the benefits afforded to civilization by the creek also nearly became its undoing. Everything from industrial effluents, to pigs’ blood, to raw sewage destroyed most of the original ecosystem. The stench became so foul, the creek was almost encased in a concrete pipe.\(^{74}\) The pollution and disruption of the waterway led in 1997 to its designation as one of the most endangered urban stream in America by the conservation group American Rivers\(^{75}\). Today, however, a new life and future exists for the Mill Creek, as it again has the opportunity to serve as a cultural and infrastructural artery for the population of the Greater Cincinnati area. The multitude of social, political, and environmental concerns that converge on the Mill Creek Valley make it the ideal location for a project that demonstrates the potential synergy between these often-conflicting interests. The specific conditions of the valley give rise to the overall program and design response of the proposed project.

The current form of the valley evolved over millions of years, through the formative effects of the Ohio River and multiple glacial incursions. Early geologists, who were puzzled as to how such a small creek could have carved such a large valley, slowly uncovered this geologic history around the start of the 20\(^{th}\) century. The path of the modern Ohio is not the path of the ancient river, which changed many times, incorporating portions of what are now the Mill Creek, the Licking River, the Great Miami River and the Little Miami River. Glaciers reshaped the landscape by rerouting the river and

\(^{74}\) Stanley Hedeen, The Mill Creek: An Unnatural History of an Urban Stream (Cincinnati: Blue Heron, 1994), 100

\(^{75}\) The Mill Creek Restoration Project, www.millcreekrestoration.org/history.php
acting as temporary dams; forcing the water to carve new valleys through the surface.

The path of the Ohio shifted often, with the current location merely being the most recent iteration in a continually evolving natural system. The now Mill Creek Valley was formed by what is known as the “Deep Stage” Ohio and Licking Rivers. The waterway turned north at what is now Cincinnati, prevented from heading west by a large earthen embankment connecting Ohio and Kentucky across what has become the Ohio River Valley. This route carved out the Mill Creek Valley, with the Deep Stage Ohio running north until it hit a wall of glacial ice that forced the river to turn again. This time back south, along a westerly route that formed what is now the valley of the Greater Miami River. The Ohio then rejoined with its current path,
heading west towards the Mississippi. As the glaciers melted, vast amounts of water were sent south, switching the flow direction near Cincinnati and carving out even more land to form the current path of the Ohio River. When all was settled, a wide flat valley had formed with only a small, wandering creek flowing along its bottom to the new, modern Ohio River.\textsuperscript{76} \textsuperscript{77} The unique combination of a wide flat valley with a strong flowing, but small stream on its floor is fundamental to the formation and development of what would become Cincinnati.

Before settlers of European descent arrived, the area was inhabited and used by Native Americans of several tribes including the Shawnee. The land was valued for its agricultural fertility and use as summer hunting grounds. Some Native American stories even recount a great war that was fought for supremacy over the region.\textsuperscript{78} The flat valley floor and flowing creek were the easiest methods of movement through the surrounding hills and dense forests. Many native trails are described by early white settlers as moving up the valley parallel to the Mill Creek, providing the first transportation routes for the colonists to explore the land away from the banks of the Ohio River. Sadly and ironically, these routes were also used by colonists to hunt down and push out the remaining Native Americans from the region during the late 1700s.\textsuperscript{79}

White land surveyors first arrived in 1773, and in 1787. John Symmes completed the Miami Purchase of 1 million acres (Bounded east and west by the two Miami rivers), encompassing all of the Mill Creek Valley and modern Cincinnati.\textsuperscript{80} The name Mill Creek, applying to the stream the Native Americans referred to as “Maketewa”\textsuperscript{81} was first used in this land grant request, most likely as a marketing tool to entice potential colonists by suggesting the creek was ideal for building mills. The group arrived in 1789 and quickly began building settlements as well as clearing land for agriculture. Within a few years a growing and permanent settlement had been established with homesteaders spreading out into the valley, purchasing individual plots of the initial land grant. The Native American population however, had not yet

\textsuperscript{76} Stanley Hedeen, The Mill Creek: An Unnatural History of an Urban Stream (Cincinnati: Blue Heron, 1994), 50
\textsuperscript{77} Ibid., 65-75
\textsuperscript{78} Ibid., 7
\textsuperscript{79} Ibid., 13
\textsuperscript{80} Ibid., 9
\textsuperscript{81} The Mill Creek Restoration Project, www.millcreekrestoration.org/history.php
been completely removed, and the small settlements/dwellings far up the valley and away from the Ohio were prone to attack, often resulting in the settlers moving back to the river’s edge. It took several years and multiple forays by militias and the army before the natives were finally driven from the land in 1795. The victory over the natives allowed white settlers to once again spread up the valley, cultivating and colonizing land. The flat terrain of the valley floor became a natural highway for land development. The fertile nature of the floodplain was ideal for growing crops and by 1820 much of the forest had already been tilled under and numerous mills had been set up along the stream banks. 

The mill building along the creek began a process of industrialization that would stretch into the 20th century. Here again, the physical form of the Mill Creek Valley would prove a boon for Cincinnati and the primary reason for its continued development and prosperity. The construction of the Miami-Erie canal began in 1825, and its connection to the Ohio River at Cincinnati was chosen due to the shallow slope of the Mill Creek Valley and the passage it provided through the surrounding hills to the river. By the time the canal was completed in 1849 factories and mills that valued the flat land near the creek, and the water that they could use for their industrial processes, were replacing the agricultural settlements that once covered the valley floor. The proximity of the creek to the canal also ensured easy transportation of their goods out of the city and to all parts of the country along the canal or Ohio River systems.

Just after the canal finished construction, the railroads began arriving as well. The railways found the Mill Creek Valley to be the path of least resistance, just as the canal did before them. The Little Miami Railroad first ran trains up the valley in 1842, and the Cincinnati, Hamilton, and Dayton Railroad followed suit in 1851. Along with the rest of the country, the mid to late 1800s saw a boom in rail construction in the Cincinnati area that lasted through till 1900. This infrastructural system enabled the economic and cultural golden age of the city. Cincinnati was already a significant center of river commerce, and the advent of the railroad meant goods could be distributed even faster and more efficiently. The floodplain of the Mill Creek

82 Stanley Hedeen, The Mill Creek: An Unnatural History of an Urban Stream (Cincinnati: Blue Heron, 1994), 26
83 Ibid., 56
84 Ibid., 68
near its mouth on the Ohio, became the home to numerous train yards that solidified Cincinnati as a regional center of transportation and distribution. Much later on, the exact same route through the valley would again be chosen for the new interstate highway system’s connection through Cincinnati. Today this portion of I-75 is even known as the “Mill Creek Expressway” following not only the valley, but portions of the path of the Miami-Erie Canal as well. The valley and its transportation infrastructure enabled the success of all the industries and institutions currently associated with Cincinnati. Without the railroads, “Porkopolis” would never have existed, as there would have been no way to get pigs into or out of the city for slaughtering. Similarly, products like Ivory Soap, made by Proctor and Gamble, and much of the beer coming out of the city’s famous Brewery District during the late 1800s and early 1900s depended on the water of the Mill Creek for production, and the rails of the valley for distribution.

85 Mill Creek Expressway Project, www.i75millexpressway.com/index.htm
86 Stanley Hedeen, The Mill Creek: An Unnatural History of an Urban Stream (Cincinnati: Blue Heron, 1994), 79
87 Ibid., 83
All these products and processes have become a part of the Cincinnati identity and have been built into the very foundations of the city itself. Central Parkway runs through downtown on top of what used to be the Miami-Erie Canal. Cincinnatians take pride in calling their city Porkopolis, and most of the plaster used for walls in homes in the city uses pig hair. Oktoberfest is the largest celebration of its kind in the United States, and the area of Mill Creek where Proctor and Gamble produced Ivory soap is now known as Ivorydale.\textsuperscript{88} Cincinnati’s history and therefore its identity is rooted in the events and activities of the Mill Creek Valley.

Unfortunately this human development and prosperity came at an ecological and environmental cost. The Cincinnati sewer system was serving a population of over 325,000 people by 1900, and much of their waste ended up in the Mill Creek. The multitude of industries along the creek used so much of its water, and discharged so much effluent into the stream that in 1913, one quarter of every gallon of water that reached the Ohio River from the creek was human waste of one form or another.\textsuperscript{89} The stench from the Mill Creek, which had essentially become an open sewer, was so strong that a habit developed of “flushing” the creek in much the same way one flushes a toilet. This would occur once a week by diverting water out of the Erie Canal and into the Creek on Sundays to try and push all the foul water that had accumulated into the Ohio. This practice continued for some time until the Canal was permanently closed and drained. The resulting situation was so unpalatable as to final force the city into redesigning its sewer system to carry waste further away from the city, though only after determining that enclosing the creek would be too expensive.\textsuperscript{90} The high levels of chemicals and industrial solvents disturbed and destroyed much of the ecosystem. The creek, once home to a wide variety of fish, birds, and mammals, became almost completely devoid of its original life. The microbes in the water consumed nearly all the dissolved oxygen, killing fish and turning the water into a muddy and foul mess. The destruction of most of the forests also led to the disappearance of many of the native bird species, along with most of the major mammal species due to habitat loss and over hunting.\textsuperscript{91}

While the problems mentioned above can be seen as unintentional

\textsuperscript{88} Ibid., 67
\textsuperscript{89} Ibid., 105
\textsuperscript{90} Ibid., 113
\textsuperscript{91} Ibid., 19-27
side effects of human activity, there was also a very intentional move to disrupt one of the natural patterns that led to Cincinnati being such an ideal place to settle in the first place. The occasionally severe flooding along the Ohio and the Mill Creek became increasingly disruptive as the area’s population increased. Early on, most of the valley floor had been farmland, which benefited from the occasional flood that deposited new sediment and soil. By the late 1800s however, this had all been replaced by industry and urban development. Now when it flooded, bridges were destroyed, along with factories and the economic might of the city itself was threatened. Severe flooding of the Ohio could flood all the way up the Mill Creek to the neighborhood of Northside, several miles upstream from where Mill Creek meets the Ohio. One of the area’s worst floods in recorded history occurred in 1937 and finally led to federal intervention, when the Army Core of Engineers stepped in with a solution to build a dam across the mouth of the Mill Creek. The dam would prevent Ohio River floodwater from moving up the valley and damaging the city, and its construction, interrupted by WWII, was finally completed in 1948. The water of Mill Creek is then pumped over the dam and down to the Ohio River, when water levels are below flood stage. To help mitigate flooding of the Mill Creek itself, several dams were constructed, and an ambitious canalization project was begun in 1981 though never completed.

Canalization is done by building a concrete liner for the creek, making the water flow faster, counteracting heavy rain events, and preventing flooding. Unfortunately, it also completely destroys anything left of the existing ecosystem, turning the creek bed into a giant rain gutter. The increased water velocity tends to move sediment downstream, pushing more polluted soil into the Ohio River, and creating more problems for communities downstream.

All the intentional and unintentional forces acting on the Mill Creek Valley near Cincinnati Ohio, led it to become something of a forgotten space. Its stench and pollution ensured that no one wanted to go near it, and the way in which its banks were encapsulated by industry prevented access anyway. The slow decline of industry in Cincinnati during the 20th century allowed the creek to fade into the background. Like utility poles and parking

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92 Ibid., 155
93 Ibid., 165
94 “Mill Creek Discharge Investigated” Ohio Environmental Protection Agency Water Quality Inventory (Columbus: Ohio EPA, 1986), 225-227
lots, the Mill Creek became an anonymous member of Cincinnati’s urban landscape. The decline of the Creek foreshadowed the economic decline of the areas around it and perhaps even contributed to the slide. The Mill Creek Valley is what enabled the initial growth and development of the area, but once it was tapped out, its fading health became indicative of the economic health of the city as well.

The creek remained an afterthought for most of the area’s inhabitants aside from the occasional expose by a newspaper about its continually decrepit state, or a company caught dumping chemicals illegally into it. All that finally began to change when in the early 1990s canalization work came to a halt once several areas along the creek were identified by the EPA as hazardous waste sites, preventing any further construction. More importantly, political and social will had been building to return the stream to a more ecologically sound state. The political gears and community action groups were finally aligned to begin work on returning the body of water and its surroundings into a community asset instead of an embarrassment. The founding of groups like the Mill Creek Watershed Council, and the Mill Creek Restoration Project helped to renew interest in cleaning up this neglected area of the city. The hard work of these groups during the 1990s led to the creation of the Mill Creek Master Plan, a roadmap to guide efforts to clean up the creek and also get the community reconnected to it as well. Education outreach programs that involve Cincinnati Public School students are having great success in teaching students about pollution, biology, and environmental sustainability.\(^{95}\) Stringent water regulation in place since the middle of the 20\(^{th}\) century have drastically improved overall water quality, and the decline of industry also means less of the water is being turned into factory effluent. The Metropolitan Sewer District of Greater Cincinnati is also actively working to eliminate the problem of combine sewer overflows that can dump raw sewage into the creek during severe rains.\(^{96}\)

Perhaps the most significant outcome of the restoration efforts has been the Greenway and Habitat Master Plan. It calls for a series of parks along the edge of the Mill Creek and its tributaries, all connected by greenways that will eventually extend all the way down to the Ohio River. A proposed

\(^{95}\) Mill Creek Restoration Project, www.millcreekrestoration.org/learn.php
\(^{96}\) Municipal Sewer District of Greater Cincinnati, “Combined Sewer Overflows,” www.msdgc.org/overflows
“confluence park” would then connect this set of trails and greenways to the planned Ohio River trail, tying them into a national trail system. These parks will not only provide recreation and alternative transportation routes for people, but will also be habitat restoration projects that return some semblance of ecological balance to the creek. Canal walls will be removed and replanted with native vegetation. The idea is to seed what will eventually become a self-sustaining ecosystem that resembles what was in existence before human intervention.

Groups supporting this initiative are hoping that in the same way the Mill Creek was a spark for the initial development of Cincinnati, The revitalized Mill Creek can again be a spark to renew what has become a degraded and depressed area of the city. The greenway trail system could become a source of tourism, and the improved environmental quality could spur new development and rehabilitation of the properties adjacent to the trail.

97 Fuller et al., Mill Creek Watershed Greenway Master Plan (Cincinnati: Rhinoworks, 1999), 25
98 Fuller et al., Mill Creek Watershed Greenway Master Plan (Cincinnati: Rhinoworks, 1999), 120
system. One such development could be a renewed interest in rail transport, long a staple industry of the Mill Creek Valley. The widening of the Panama Canal, currently set for completion within a decade, will enable an increase in both the size and quantity of container ships passing from the Pacific to the Caribbean. The inland waterways of the United States could become a significant route for distributing the new container traffic. The Ohio River is a major inland water route that already carries many bulk goods like coal and grain, and the Cincinnati area is ideal for product distribution, as it sits within a two-day drive of 80 percent of the country’s population. Significant efforts are already underway to build a barge to rail facility near the mouth of the Mill Creek, incorporating the proposed “Confluence Park” while taking advantage of the already existing rail infrastructure. The rebirth of a Cincinnati industrial tradition could be enabled by the same geographic factors that were key to the city’s birth; The Ohio River and the Mill Creek Valley.

Many small settlements formed along the stretch of the Ohio River bounding the original Miami Purchase, but Cincinnati became the most successful. Much of the success can be directly attributed to the benefits

99 David Martin, “Welcome to Queensgate Terminals” queensgateterminals.blogspot.com
derived from the form of the Mill Creek Valley and the Mill Creek itself. This geographic feature is embedded in the history, and economy of the city. The degradation, pollution, and abandonment of the creek, caused by rapid industrial expansion and population growth foreshadowed the post-industrial decline of the region as a whole. Now the plans to reinvest in the Mill Creek have the potential to again lead the way for economic and environmental growth. A healthy ecosystem is no longer something to be plundered for its resources, but a resource in itself, indicative of the ideals and goals of the communities it serves.
Chapter 5: Building Ecology

Locating this thesis project at the mouth of the Mill Creek enables the design to tap into the history and conflict that exists within the valley as a means of demonstrating how opposing interests like industry and ecology can be combined into new, hybrid urban spaces. Local inhabitants have shown that community support exists for the ecological restoration of as much of the creek as possible. The Mill Creek Greenway Master Plan is aggressive in calling for the creation of continuous greenways that extend along the entire 27-mile length of the creek including all major tributaries as well.100 This could improve the how the creek looks, but also the ecological environment by including treatment wetlands within the greenway parks that treat creek water and pre-treat combined sewer overflow water before it gets to the creek. Neighborhoods adjacent to the Creek have long suffered economically, and many community leaders see the greenway as a means of reinvestment in dilapidated areas of the city like Queensgate, St. Bernard, Camp Washington, Elmwood Place, and Carthage.101 Combining ecological and social needs is a start, but the area will still be missing an ingredient to long-term sustainability; economic stability. By utilizing the existing rail assets of the valley, a new intermodal terminal that transfers containers to barges could add jobs and tax money to the Queensgate neighborhood. Local opposition to an existing proposal for such a project is currently based on the thought that they cannot have both a functioning port and a pleasant park at the same time. The community is afraid that the terminal will cut off access the Ohio River waterfront adjacent to Lower Price Hill, preventing potentially lucrative development that would otherwise use this location as an asset in the future.102 This project proposes to combine the terminal functions with the park functions, creating an entirely new hybrid where economic, social, and ecological space mutually contribute to shared success.

100 Fuller et al., Mill Creek Watershed Greenway Master Plan (Cincinnati: Rhinoworks, 1999), 186
101 Ibid., 93
fig. 48: The Mill Creek Valley near Cincinnati
Project Site Highlighted in Lower Left
The primary location for this project is on a 30 acre site at the mouth of the Mill Creek along the Ohio River near Lower Price Hill. Historically the site was a rail yard for a now defunct railroad, closing in the 1980s. Most of the tracks were removed, aside from the through tracks that connect into the CSX Queensgate yard farther up the valley. Currently the site is owned by Hilltop Basic Resources, a concrete recycling operation that crushes old concrete and stores it in piles on the site until it can be recycled and reused. This company agreed to sell the site to Blue Grass Farms, a company looking to build an intermodal barge to rail terminal that will connect up to a distribution center built on their property near Jeffersonville, Oh. Containers filled with goods would be unloaded at the port and placed on trains that would carry the containers to the distribution center. There, the containers would be transferred to trucks, and distributed across the region. Once emptied the containers would then be filled with goods like soy, the primary crop of Blue Grass Farms, and sent by train back down to the port, where they would be shipped to Asian markets back through New Orleans and the Panama Canal. The Cincinnati area is an ideal location for such a system as it is within a 1 day drive of 40 percent of the country’s population, and recent expansion plans for the Panama Canal could result in additional barge traffic on the Mississippi and Ohio River Systems.103

103 David Martin, “Welcome to Queensgate Terminals” queensgateterminals.blogspot.com
This process was moving along fine until the neighborhood objected to what they felt would be an industrial eyesore near their neighborhood. They argue that the land would be better used as a public park or made available for real estate development. To them, the river and views of downtown Cincinnati are a community asset, and a means to revitalize a relatively depressed area of the city.\textsuperscript{104} Despite redesigning the project to alleviate community concerns, opposition voices still managed to convince the city to deny permits to the project, putting it on hold and causing the developer to sue the city. Courts decided that the city had no right to prevent the development, and either had to allow construction by purchasing the land themselves and leasing it to the company, or finding a satisfactory alternate site for the project. After months of foot dragging, and additional opposition to suggested alternate sites. The project is still on hold and the city will soon be faced with needing to pay the company lost revenue for the port it could have been operating without the illegal city intervention.\textsuperscript{105}

By placing this thesis, in the middle of such a volatile situation, the project can demonstrate the ability of hybrid spaces and programs to mediate between conflicting desires. The project can deliver everyone their desired


\footnotesize{\textsuperscript{105} Ibid.}
benefits, and additionally, an appreciation for the added value provided by what they otherwise consider conflicting interests.

The project program is tripartite, including a container port, a public park, and a series of constructed wetlands. The park acts as a destination and a connection, a place and a non-place linking the proposed Greenway Trail to the proposed Ohio River Trail. Through these pedestrian connections, downtown Cincinnati is linked along the river to the community of Lower Price Hill, and its newly accessible waterfront nearby.

For an extended period of time, the Waldvogel Viaduct, effectively cut off Lower Price Hill from the river. The height and bulk of the structure acted as a visual, and often physical barrier preventing the community from any real access to the Ohio. The existing plan to rebuild this crumbling piece of transportation infrastructure folds well into the thesis project goals, as the new viaduct will be less imposing, with a design intended to return as much direct visual and physical access across the roadway as possible. The rebuilding project even reinforces these aims, as now individuals will have a reason to cross the viaduct (the park) whereas before, the only activities on the other side were River road, and the concrete recycling operation.
fig. 52, 53, 54: Existing Condition of the Waldvogel Viaduct
The proposed port also acts as a connection, linking Cincinnati to the rest of the world through the inland waterways of the Ohio and Mississippi River system. The terminal would act as an economic and social catalyst, spurring new development and investment in Lower Price Hill. The container facility must effectively and efficiently transfer standard shipping containers from barges to waiting rail cars and vice versa. The operation must be quiet enough to continue without disturbing the nearby residential neighborhood. Space must be provided for assembling and loading trains along with space for staging trains waiting to be unloaded. No storing or warehousing of containers will occur on the site, and no barge to truck connection will exist at the site either at the request of the local community. The distribution warehouse is to be built north of the city on the property of Blue Grass Farms, where access to the interstate and less traffic congestion and neighbors will make the center have less of a human impact. Historically, the health of these communities has been tied to the health of the Mill Creek and the Ohio River. The situation is no different today, and as the ecology improves, the neighborhoods will follow.

The existing plans for the barge terminal occupy the entire site with parallel rail lines that would be used to load and unload cargo to/from the barges. The multiple lines enable multiple trains to be loaded simultaneously so that then can then depart to varying destinations without needing to be immediately resorted in an adjacent location. In an attempt to appease the local community, Blue Grass Farms proposed incorporating trail connections to the Ohio River Trail and the proposed Mill Creek Greenway system. A vegetated barrier of trees helps eliminate sound pollution of the nearby neighborhood and to visually isolate the port from the more community oriented surrounding land uses. A small headquarters building is needed on the site for the management and oversight activities of the port.

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fig. 55: Container Barge Route to New Orleans
fig. 56: Existing Proposed Design for Intermodal Terminal
The wetlands on the site will offer an opportunity for creating a visually pleasant environment for the park, but also a much more ecologically health one as well. Ideally, as these wetlands mature they will become effective habitats for local wildlife suffering from the pressure of human expansion and habitat destruction. The Mill Creek and Ohio River continue to be actively polluted by human activity. This project offers an opportunity to combat this problem by treating and cleaning the water flowing across the site without need for mechanical or chemical processes. The two primary sources of the water are from Cincinnati’s Combined Sewer Overflow system and the frequently changing conditions of the Ohio River. Several CSO discharges are located on the site, which is also subject to occasional flooding from the Ohio. The site sits well within the one hundred year floodplain of the Ohio, and as such any construction on the site must take into account the potential effects of the river.

The sewer system in Cincinnati is quite typical of older America cities. Instead of having two separate systems to deal with sanitary wastewater and storm water runoff, all the water is combined in a single pipe system. During heavy rain events the pipes quickly fill to capacity. In order to prevent breaks and leaks, excess water is diverted out of the system, and into the environment through relief valves known as combined sewer overflows or CSOs. Water coming out of a CSO is untreated and can contain human waste or other biological and chemical contaminants. Though diluted by the excess rainwater, these discharges pose a significant threat to human and non-human health. The excess of “nutrients” in the water can lead to explosions in algae and other micro-organism populations, threatening entire ecosystems in the process. Cincinnati is responsible for hundreds of CSOs around the city, and finding a cost effective and environmentally sensitive solution to discharges is economically, socially, and ecologically desirable.

Nearby Combined Sewer Overflows are directed to wetlands on the site to treat contaminated water before it reaches the river.

fig. 57: Constructed Wetlands
fig. 58: Locations of CSOs near Project Site
fig. 59: Diagram of a Combined Sewer Overflow
The design solution for the project consists of objectives and strategies. The objectives are goals and concepts that the final design should embody. The strategies are the methods through which the form of the project will be shaped in order to meet the objectives. The three formal strategies include utilizing a language of strands, activating datums within the site, and juxtaposing varying scales and uses. The three objectives for the project were extracted from the projects analyzed at the end of part one and include education through exploration, environmental remediation, and emergent complexity.

Each programmatic element is conceived of as a layer that when superimposed upon the site, simultaneously reveal the project. Each portion of the site proposal is a form of infrastructure, be it social (park) economic, (port) or ecological (wetlands). As such, other forms of infrastructure were looked to when searching for a formal and organizational language for the site. Already mentioned has been the importance of the site as connective tissue that not only connects places, but also reconnects society to the ecological environment. The purpose of infrastructure is frequently about connection and its formal appearance reflects this. A language of strands and filaments has developed as a solution for this needed connectivity. Intentionally reflecting upon the formal language of infrastructure, a strand connects two locations with a primary program of transportation or movement. People can move between the strands of a highway through interchanges, exits, and on-ramps, also part of the formal language of strands. A significant amount of this strand-language already exists nearby within the Mill Creek Valley. Interstate I-75 runs the length of the valley and just to the east of the site, interchanges with I-71 before crossing the Ohio River into Kentucky. The Waldvogel Viaduct embodies this strand language in the way that it connects to the multitude of surface streets along the base of Price Hill immediately to the west of the site. All of the rail lines running through the valley embody this strand language as well.
The Integration of Parkland, Container Port, and Water Treatment creates a Hybrid Landscape. Mixing Programs Creates Emergent Benefits that go Unrecognized when Spaces are Segregated. The Project Tangibly Demonstrates the Interaction of Civilization and Ecology.

fig. 60: Preliminary Proposal for Project Organization

fig. 61: Preliminary Site Plan
Datum

The most powerful force present within the project site is the Ohio River. A powerful storm upstream can raise the water level from an average depth of 25 feet at Cincinnati, to the flood stage of 53 feet in a matter of days. Understanding the variable height of the river and the consequences this has for the site is extremely important. Beyond the basic need to protect portions of the project from floods, the changing water level offers a design opportunity for the site to act as a large river gauge. Acknowledging established datum lines for the river like action stage (40’ deep), flood stage (53’ deep), and the one hundred year flood (80’ deep) reminds site users of the power and potential that resides in the natural environment. The needs of the port to remain open ensures that it holds the highest ground within the design. The wetlands, able to withstand extreme fluctuations in water level, occupy the lowlands and are frequently submerged during rain events. The walkways of the park mediate between the two, connecting the high ground with the marshes and riverbanks. During floods, portions of the site become islands, and other portions are submerged all together. Walkways disappear into the water only to emerge again like a serpent coming up for air. The site becomes a celebration of the ability of nature to interact with the built environment.
Multi-scaled Response

The project is both very large and very small at the same time. The site is big, and organizing the entire 30 acres pushes well into the realm of urban planning and design. Massive gantry cranes towering two hundred feet high move along the port, and trains up to a mile long move into and out of the site. The ability of users to experience up close, industrial objects like container barges and cranes is a rare opportunity that should be highlighted. Many of the ecological details however, are occurring at an extremely small scale. Microbes inhabiting the roots and gravel beds of the wetlands purify water at a scale only visible under a microscope. Hidden amongst the wetland plants are flowers, insects, and animals that only a discerning and inquisitive eye can discover. The design must effectively navigate this surreal environment and mediate between these extreme scales if it is to provide a meaningful and enjoyable experience for individual. Bringing people as close as possible to both the big and the small creates the opportunity to create unique and meaningful experiences. Allowing focus to pass from a dragonfly to a crane to a bird, seamlessly.
For the project to achieve its goal of demonstrating and encouraging ecological integration three needs must be satisfied. First the project must interact with and improve the environment by mitigating pollution that results from human activity. This project does so through treatment wetlands that remove toxins from combined sewer overflows, creating a healthier environment for humans and non-humans alike. Additionally, the project converts a former concrete recycling facility into wetland habitat for a variety of plant and animal species. The compliment to this is the spatial integration of port and wetland functions. Portions of the terminal rail yard are also treatment wetlands; the two programs compliment each other well and do not interfere in their respective functionality.

Second, the project needs to offer opportunities for visitors to learn about the important relationships that exist between humans and the rest of the ecological environment. Awareness recognizing that humans and civilization are a much a part of ecology as frogs and forests can no longer be reserved only for those with a professional or personal interest in the matter. The project accomplishes this by encouraging exploration and observation of the site habitat. Walkways lead users from wetland to wetland so they can watch the water getting cleaner until it is finally discharged into the Ohio River. Through sequentially connecting the sewer pipe to the wetland to the river, visitors can make connections themselves without the need for signage or exhibits directly enumerating the process. The more people can discover for themselves, the more they will become vested and interested in what they find.

Third, the site must create an emergent and complex environment. An emergent condition is one where the whole is greater than the sum of its parts. The interaction of the pieces gives rise to new and unforeseen occurrences not predicted by the parts individually. This is important both ecologically and experientially, as all ecological environments exhibit emergent behavior, and unexpected or novel spaces can make for enjoyable human experiences. The project will allow the wetlands and animal habitats to evolve and change as dictated by the environment. This ecological succession will eventually tune the project perfectly to the needs and abilities of the site environment. Multiple systems within the site are codependent and interconnected. The accessibility of much of the park space is dependent
upon river levels, and some of the wetlands are dependent upon the sewer system for their water supply. Experientially, the complex and unique space created by the presence of the port is an improvement over the spaces that would be created if the site were exclusively a park or a port.

The true test of such a project is not in how well intentioned and thoughtful the initial design is, but how well the finished product performs over time. Success can only be understood ten, twenty-five, or even one hundred years into the future, after both the needs of people and the environment have substantially changed beyond the foresight of the designer. Ideally the site becomes an essential, but anonymous element in the local ecological, economic, and social community. The project becomes a model, and lessons learned here are reapplied many times over, until the entire community has built up symbiotic relationships with the environment understanding that, “Nature cannot be elsewhere”, it is all around them, “even if it is aged, mutilated, and ailing.”


Baichwal, Jennifer, Manufactured Landscapes (New York, Zeitgeist Films, 2006)


Periodicals


