Ecological Restoration and Design

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### A Land Ethic

The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land.

This sounds simple: do we not already sing our love for and obligation to the land of the free and the home of the brave? Yes, but just what and whom do we love? Certainly not the soil, which we are sending helter-skelter downriver. Certainly not the waters, which we assume have no function except to turn turbines, float barges, and carry off sewage. Certainly not the plants, of which we exterminate whole communities without batting an eye. Certainly not the animals, of which we have already extirpated many of the largest and most beautiful species. A land ethic of course cannot prevent the alteration, management, and use of these 'resources,' but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state.

- Aldo Leopold
  Sand County Almanac

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Ecological Restoration  
And Design
Abstract

The field of sustainable design has too often been reserved for site remediation projects and has too often been ignored in creating aesthetically pleasing sites. If sites are created that combine the functional aspects of these technologies with the aesthetic character of the surrounding area then the community benefits from a visual, educational, and eventually an economic level.

The chosen site for this study is located in Muncie, Indiana along the White River. Located to the southwest of McCulloch Park (* see site map on page 5) and bordering the Whitley neighborhood to the north the site offers a variety of ecological opportunities. The city owned section to the south of the river, which is still heavily maintained, is populated by a number of fowl and other river wildlife. The larger parcel to the east is also well used by wildlife, but has lost a great deal of its ecological potential through road layout and dumping. By focusing on these areas as the primary locations for ecological restoration several issues were brought forth for study. Wildlife corridor development (with breeding ground potential), vegetative management, human interaction levels, wetland restoration and maintenance, and future design implications are all subjects that were studied in the proposed ecological master plan.

The goal of this study was to take an environmentally struggling landscape within the city and begin to remediate it on an ecological level and propose how to best maintain the area within a social framework in the future. This obviously benefits the site on an ecological level, and also increases the already heavily used wildlife habitat. From an aesthetic standpoint looking at environmental art pieces provide a solid foundation for incorporating design into an ecologically sound landscape. Using the art as a functional piece as well as an obvious aesthetic work begins to fuse the natural and human interactions.
Ecological restoration is the process of returning an area's biological health to its original productive condition. Development has significantly damaged the once highly productive ecosystems that stretched throughout our communities. Recently attempts have been made primarily by the scientific community to return damaged areas to their preexisting conditions. For the most part these experiments have yielded positive results. Ecological health has improved and biodiversity has increased significantly. However, a large percentage of these projects have failed to utilize design principles that could increase aesthetic value of the land as well as the ecological condition. If a larger emphasis was placed on looking to combine ecological programs with design ideologies these revitalized areas could function to increase not only the quality of life for wildlife, but also for the surrounding community.

For the designer this project serves as a tool to gain knowledge about ecological systems, primarily wildlife ecology. As the profession of landscape architecture evolves into taking a greater role in sustainable technologies it is vital that designers stay up to date on what systems are available for implementation.

This project could be used as a model for other urban areas that have fallen into apparent ecological disrepair. By looking at sustainable design as a three part entity (social, ecological, and economic) it becomes apparent that improving one area should have a direct effect on the remaining aspects. Therefore by improving the ecological condition of an area it seems reasonable that both the social and economic qualities should also improve.
In researching this project it is important to initially divide the ideas into two categories. Logistically this works best by looking at 1) ecological concerns and 2) functional environmental art. By separating these two categories significant understanding can be gained concerning both in order to later fuse the two together in a positive manner.

Ecologically there are two areas to delve into in order to complete this project. On the one hand the designer needs to look for ways to remediate the current land use to function as it has in the past, and secondly the designer needs to address and understand the needs of the current wildlife systems. To accomplish the first aspect the site must be studied to understand the current and past land uses. From this point the designer can look for ways to use ecological technologies to begin to return the area towards its original conditions. For this project the ideas that are being looked at include wetland rehabilitation, vegetative management, plant life usage and maintenance issues.

Looking at wildlife systems, corridors, and patterns can lead a designer down a very broad path and not allow significant understanding of a system to be ascertained. It is important for this project to identify what systems will be addressed and more importantly to what extent in order to best design the area. From analysis of the area looking to identify these aspects the designer can best decide which systems should be utilized for the defined purpose. Again for this project the designer has chosen to look at developing habitat for wood ducks and mallards, which already frequent the area. By using these two types of waterfowl as indicator species a habitat can be designed that looks at the area from both a conceptual and a detailed level.
The second overall area to address is the idea of how to best incorporate human interaction with the natural systems, particularly using environmental art. By reading and viewing different types of artwork the designer can develop creative ways to involve humans with the natural ecosystem. For instance if a path system through the site is developed first and foremost as an art piece and less as simply a boardwalk then the site can be experienced in multiple ways.

The world of environmental, or ecological art offers a great deal of freedom in creating design. Art for the most part can be classified as literal, metamorphic, functional, and/or didactic. The intent of this project was to develop an art piece that was for the most part metamorphic and functional in order to make a bold statement about the dynamic that exists between built and natural systems. The designer chose to address function in how the art piece itself could aid in moving the people through the site as well as addressing wildlife concerns.

Several artists were studied in order to look at a wide variety of concepts and theories about art in the environment. Projects by Mary Miss, Patricia Johansson, and Christo were eventually singled out due to similarities in rational and purpose. All of these artists looked to address highlighting areas of the environment and form that usually was not seen or noticed by humans. As stated earlier the designer wanted first to address the relationship between natural and built forms, but also the ideas of viewline manipulation, human interaction, and physical form. By understanding some of the thought processes behind other pieces a design was created for the site that looked to address all of these issues.

These examples of Christo's work look to address the ideas of physical form and topographical change. They allow the viewer to experience common forms in new ways in order to provide a deeper understanding of spatial qualities.
The site is located in Muncie, IN and stretches along a section of the White River. The site was chosen for a variety of reasons including ecological concerns, and human interaction near the site. The combination of these two aspects identifies the site as a prime location to deal with how to juxta pose human contact with ecological needs.

The site allows the designer to look at the connection between wetland, forest, and river ecosystems. Due to the fact that the site does lie within urban surroundings there is also the obvious need to recognize the desires of the surrounding community in how people interact with nature.
These images highlight different areas within the site. The image at the top of the page shows a view directly down the road adjacent to the wetland system along the roadway. The second image is a panoramic of the levee system that runs through much of Muncie and borders part of the site. The lower photo shows the low area within the southern section of the site. It is in this area that the primary wetland exists and where the final master plan was developed.
**project requirements**

Goals & Objectives:

I. Return the site towards its original ecological condition
   A. Study past site features and how human development has affected their transformation in order to return the site to ecological productivity
   B. Understand current ecological and biological systems of the area in order to expand biodiversity
   C. Plan for site maintenance into the future in order to ensure environmental health after the site has been redeveloped

II. Study current wildlife habitat and look to expand corridors and breeding area
   A. Determine current wildlife systems and patterns in order to provide necessary elements (food sources, protection, etc)
   B. Providing proper shelter and breeding grounds will allow better protection for current waterfowl species (wood duck, dabbling duck) and attract others
   C. Through conceptual design, study how to provide a substantial “no touch” area to provide increased safety along corridor for wildlife species.
   D. Through contextual study look to see how ecological corridors can be made away from site

III. To forge a bond between human corridors and ecological corridors
   A. Understand the needs of the renewed ecosystem (space, maintenance, protection)
   B. Recognize desire of surrounding community, and other visitors to the site, to experience natural environment (more complete development of objective in program)
   C. Recognize and develop educational potential (wetland system, wildlife system)
   D. Look to incorporate environmental art studies as an element facilitating movement
Client Description & Goals:

There are two clients in this project. As discussed earlier there is an ecological "client" and the human factor "client" that must experience the site. The challenge is to identify the needs of both parties and come to manage the design in a manner that will satisfy the needs of both. From an ecological standpoint there are several aspects that compose the overall "client". Wildlife, plant life, and their basic ecological health into the future are all items that compose a more holistic concept. The human client is one that is easier for most to understand. The people of Muncie, primarily those who already utilize the Cardinal Greenway and White River Corridor are the sole beneficiaries of this study. However there are other users that must be addressed. Due to the site's educational opportunities a larger human contingency must be considered, such as the surrounding neighborhood communities.

Assumptions:

1) The designer is recognizing the Cardinal Greenway as the primary access to the site.
2) The Greenway will continue to be designed as it has been thus far.
3) There are no pollution concerns to address. The ecological concerns that are to be remediated are the result of development not point source pollutants, therefore non-point source problems.
Limitations in Scope and Design:

In order to develop the site to a more detailed state the designer chose to look at only two specific species of waterfowl, dabbling duck and wood duck. Other wildlife species are mentioned in the overall design, but merely on a generic level. Another aspect that had to be limited in order to facilitate a more detailed level of design was the amount of ecological systems. The designer looked to redevelop the wetland system in the greatest detail. Again other systems were developed such as vegetative management, and ecological corridors, but not as great a level. The last element that needs to be addressed in this section deals with construction documents. Due to the implication of a large scale environmental art piece there may be some construction issues that were glanced over in order to reach the final design. The piece will be feasible, but would need further development before actual implementation.

Program:

Ecologically the focus is to improve on the current wildlife habitat areas through returning the land systems to their original conditions. By recreating wetland and upland systems it was the intent by the designer to provide suitable areas for wildlife breeding, feeding, nesting, and safety. Another issue contributing to the overall program was the idea of sustained health through maintenance and habitat protection.

Socially the goal was to provide a visitor experience in a way that would not be experienced on a typical boardwalk. Due to the obvious educational opportunities of such a project it would be vital to allow people into the site and view systems from different perspectives. People enjoy watching nature, especially waterfowl, so establishing a viewing sequence becomes important.

Spatially there are corridors bordering the site that need to be studied and connected in order to provide physical access to the site. Most important are the Cardinal Greenway and the White River Corridor.
program requirements

Ecological/Biological Requirements:
Within the framework of ecological and biological development within the site there were two systems to consider. The first dealing with ecology is the wetland. It was necessary to develop and propose a drainage system that would allow the site to return to its original condition and function properly.

The biological system that was addressed was the waterfowl systems. This was a much broader area that was eventually organized into four categories seen at the right of this page. This brief outline touches on several of the programmatic elements that were needed for design. (These ideas are discussed in greater detail within the explanation of the master plan. Additionally much of the appendices come from this section).

Human/Social Requirements:
There were also two ideas that needed to be addressed for human interaction within the site. First, there needed to be ample opportunity to move through the site and experience as many of the microclimates that exist within the site. Secondly there needed to be attention paid to the educational opportunities that a site like this possessed. In other words smaller nodes along the path system needed to be addressed.

Art Requirements:
(This list of requirements are to be explained in much greater detail with the master plan, but it would behoove the reader to understand what the designer was trying to do at this point in the study.) The bulleted list to the right shows ideas that the designer was looking to highlight or explore with the use of an environmental art piece.

Needs of Waterfowl
- Nesting
  1) Materials
  2) Space
  3) Island and Upland Habitats
- Feeding
  1) Variety of Nutrients for Year
  2) Substantial Sources during Seasonal Change
  3) Connection to Other Sources
- Brood Rearing
  1) Substantial Water Sources
  2) Island and Upland Habitats
- Protection
  1) Cover from Predators
  2) Separation from Predators
  3) Site Lines

Artistic Points
- Site Lines
- Topographic Change
- Seasonal Variations in Water Levels
- Natural versus Built Systems
- Providing Habitat for Wildlife

Ecological Restoration And Design
Regional Inventory

Pattern Identification and Analysis:

Before beginning site specific analysis it was important to first look at the project at a broader scale. By identifying features and connections off site the project’s goals could be better developed. As previously mentioned the site itself has two larger dynamic forces that infringe upon the site itself. The first represented in the top diagram represents the human or social patterns around the site. For the most part this section is composed of Cardinal Greenway and the White River Corridor, which are by nature a highly active section, Mculloch Park, which combines both passive and active amenities, and the surrounding neighborhoods. These systems virtually surround the site with human activity and energy.

The second pattern, identified in the lower diagram, represents the ecological systems that engulf the site. Where the site itself is primarily composed of wetland systems, other systems that exist within or adjacent to the site include riverine systems, wooded area, and upland habitats. These corridors facilitate wildlife movement within Muncie and extend eventually out into the rural area surrounding the city. By developing the site with respect for these patterns it is certain that they will still exist years down the road.
Regional and Site Studies

Pattern Identification and Analysis:
By overlaying the two previous patterns (shown by the larger section in the upper diagram) it was found that the chosen site lies directly within this interaction zone. This is the best way to explain why this site was chosen for development. It offers not only the chance to develop a productive ecological system, but an active social system already surrounds the site itself.

Specific Site Information:
The lower diagram shows the site in greater detail in order to begin to show more detailed inventory and analysis. Within the outlined area a number of wildlife species already exist including wood duck, dabbling duck, blue herons, green herons, Canadian geese, and two varieties of endangered turtles. As mentioned before the study looked to address primarily the needs of wood ducks and dabbling ducks.
Site Studies

Specific Site Information

Other factors within the site itself dealt with drainage, topography, and existing vegetation. The upper diagram shows how the site used to function as a wetland. The bluish area would be flooded during the flooding process of the White River and the site maintained itself properly as a naturally occurring wetland. As development encroached into the site, the area was surrounded by roadways and the original drainage patterns ceased to exist, causing the site to lose many of its wetland qualities. (The elevation at the bottom of this page shows how the creation of the road raised the grade to destroy the original drainage.) Wildlife systems suffered, and native plants were overtaken by invasive species that could better adapt to the now much drier situation. The design for this project looked to return the site to its original drainage patterns.

Neighboring site features that figured significantly into the design were the Cardinal Greenway, and more specifically the heron overlook site that borders the Greenway. The overlook was originally designed to allow bird watching into the site, but due to invasive plant species overtaking the interior of the site, many views have been blocked by plants such as Honeysuckle, and Norway Maple. These ideas are shown in the lower diagram.
Conceptual Development:

The bubble diagram to the right represents the typical layout for an ecological park system. A protected zone is usually identified within an area and surrounded by a natural buffer in order to provide ecological safety and health. In addition an educational experience is usually programmed into the site, most typically a boardwalk and signage.

As with all designs this type of project has benefits as well as drawbacks. The most obvious benefit is that someone during the design process recognized the ecological value of such a site and looked to protect the area from development. Unfortunately this all too often occurs without looking at the patterns that surround the centralized area. If these surrounding zones are not identified and utilized the design can actually restrict ecological corridors and do nothing to increase the habitat area.

Another positive is that the educational value of such sites is recognized by attempting to establish some form of an educational program. The community is able to see an area which they may not be familiar with in order to learn more about the systems. The problem with this is that designs that simply look to feed a boardwalk into an area don’t fully capture the social experience of an area.
design process

Conceptual Development:

This second diagram represents what is normally seen within community parks. The focus of projects, such as this, is the community is serviced recreationally and aesthetically. Ecologically sensitive areas are usually encompassed by these areas in order to protect them from development and, similar to the previous concept, educational opportunities are addressed.

Socially these types of designs usually work well if human corridors have been researched. The problem lies in the fact that the ecological zones are usually constricted by programmed elements found in many parks. Due to the emphasis on human interaction and not ecological health these styles of projects usually add green space, but don’t appeal to the needs of wildlife habitats.
Conceptual Development:

The importance of this diagram lies not so much in the spatial layout but in the way in which it is conceptually designed. By developing the ecological systems at the same time as the educational systems the needs of both clients can be facilitated. Instead of focusing on simply how humans visit or how the site drains into a wetland the site can be designed to fuse the needs of both into a cohesive design.

The positives of a design that is developed in such a manner is that if done correctly both systems benefit. Where the other two concepts had only a single primary client a design such as this one actually as an ecological client as well as a human one. Designs like this are more challenging for this reason, but in the end are also more rewarding.

The primary rational for using this type of design scheme on this site is to address the patterns that exist both on and off site. By laying out the site using broad bands that look to connect to surrounding area the design actually look to spread itself out over a larger area.

Another positive that stems from relating to the larger patterns is that both clients have ample space for enjoyment and protection. The secondary path systems can be developed to allow humans into the site while still respecting the needs of the waterfowl.
Schematic Development:

Once the conceptual development process had been concluded and the theory behind the layout rationalized it was necessary to begin to apply the concept more specifically to the site. The lower diagram begins to show how the conceptual design was placed on the site.

Patterns that had already been identified around the site were again addressed and actually expanded into the site. This allowed the corridors to begin to show and how to best intersect the site with human pathways.

At this point of the design process the designer decided to focus more heavily in the area outlined in the lower diagram in order to take the final design to a more detailed level.
Plan Explanation:

In order to fully explain all the systems of the master plan the designer chose to present the material first looking at the ecological systems within the site and then juxtaposing the human systems into the site. Even though these two systems were composed together during the design phase presentation in this fashion allowed for easier audience comprehension.

The plan shown to the right is what the site would look like during periods of high water level, spring and early summer. The next three pages will look at some of the designed areas in more detail.
Plan Explanation:

- Heron Nesting Area

As mentioned in the limitation section of this book other waterfowl species than wood ducks and dabbling ducks were addressed. The designer felt the need to provide suitable habitat for the heron species that currently existed on the site. Through research it was found that these birds are among the favorites of bird watchers. With this in mind analysis showed that this upland area overlooking the wetland would provide pristine habitat for heron species. By planting a grove of either larch or pine trees the herons are given suitable nesting areas and the raised elevation allows a comfortable sense of protection for these birds.

- Island Habitats

Looking at the needs primarily of the dabbling ducks the need existed to provide ample nesting area that was safe from predators during the brood rearing period. During periods of high water primarily the spring and early summer season, when ducks are raising their young, these island formations were designed to provide ample nesting space, food sources for the young and due to the water levels an obvious protection from predators, primarily mammals. Dabbling ducks prefer to be at least eighty to a hundred feet from the main land shore with a minimum depth of three feet of water between shorelines. It was the hope of the designer to not have to excavate a large portion of the site, but some areas within the wetland would need to be dredged out in order to provide a suitable depth.

This area is the most crucial section of the design. In order to increase the numbers of waterfowl within the site over the next few years it is the island habitats that would need to function properly. If the ducks are provided with safe nesting habitat studies are shown that they will return to the site year after year. In some of the most successful sites around the country the survival rate for broods is only thirty to forty percent. This fact shows the need for more successful nesting sites.
Plan Explanation:

- Upland Areas

These sections are justly and obviously named due to their higher elevation within the wetland system. The primary biological purpose of these sections is to provide food sources other than those that can be found within the wetland itself. Waterfowl need a variety of food sources throughout the year in order to continue their annual cycle. These upland sections are designed to provide woody food sources. The plant life within these sections could be considered protective for the waterfowl, but not for nesting periods.

- Seasonal Fluctuation Area

This is the area that most people will view as the true "wetland". Where this section will constantly be changing form within the site itself, reacting to water levels, the overall character will remain. This area will be defined as having reedy type plant life, very lush vegetation, areas of standing water, and will usually be defined as quite muddy. As water moves through the site this is the area that fillers any pollutants. Another important aspect of this section is the fact that due its dynamic shifts in form a variety of plant life can function within the section.

As the reader will understand in comparing the low water level with the high water level plan, certain plant species will spend much of the time underwater and will only be exposed late in the season. What this accomplishes within the site is it provides seasonal food sources for the biological systems, and allows the ecological system to heal itself with time. As the higher elevation food sources are depleted earlier in the year the change in water level gives way to a plethora of healthy food sources that have been growing underwater.
Plan Explanation:

- **Wooded Area**
  
  This section is again an aptly named section of the site that is composed by a variety of needs. Designed primarily for wood duck habitat this section is defined by large areas of canopy level trees. Due to the wet nature of the site tree species that could be found here include Ash, Oak varieties, Dawn Redwoods, and Sweetgum. These trees provide habitat for wood ducks, some food sources, and obvious protective qualities. In order to provide initial habitat for wood ducks bird boxes would be mounted above ground in order to provide ample nesting sites.

  Other concerns within the wooded area is the idea of vegetative management along the road that separates the site from White River. As found in the analysis phase the designer recognized the need to open up views into the site primarily by removing honeysuckle groves. The plan shows how the road side has been opened up in order to allow views into the site yet still keep the site partially enclosed.
Plan Explanation:

The two diagrams to the right of the page show how the site will change appearance throughout the year. Where some of the zones would remain for the most part static such as the heavily wooded areas, other zones such as the ponds, islands, and fluctuation area will experience massive shifts. As mentioned previously this allows for continued ecological health as the wetland system rises and falls with the season, and biological health by providing necessary food sources throughout the year.

In the lower diagram the reader can see that during low points, that would occur in late fall and early winter, the site is dominated by the fluctuation zone much of which has been covered up to this point. All of the vegetation that had been underwater for the summer season now is available for waterfowl. As most waterfowl begin to migrate the islands will not be as necessary and so most will be connected back to the land during the winter season.
**master plan**

**Drainage Explanation:**

A vital aspect towards ecological health of the site is the drainage system that was designed for the site. Initially the designer had hoped to accomplish proper site drainage with as little man made design as possible. Through information derived through biological research it was determined that if the site were to function properly as a wildlife habitat it would be necessary to propose a plan to make sure that water levels could be maintained.

Analysis showed that the site originally drained from the southern edge up to the northwestern corner and back out to the White River. Therefore the designer used a system of culverts that would pump water from the south out of the river, and then allow water to flow back out along the north. The drawing at the bottom of the page shows how this system would take water into the site. By leaving the intake valve lower, closer to the river, the site could be flooded annually instead of working off of projected 5 to 10 floods. This also requires less of the site to be excavated to allow water flow.

*Section showing Proposed Culvert Design under Road*
Plant Life and Zoning Explanation:

To give the reader an idea of what types of plant life can be found on site is seen on the right of this page. This plant list was taken from comparing a list of wetland plants, native to Indiana, with a list of plants that were highly beneficial to the two types of waterfowl species studied. By researching the needs of the two species and choosing plants that were needed for nesting, protection, and feeding this list was created. What the reader needs to understand is that this list could be much longer, but that the plants listed were the absolute favorites of the waterfowl species.

Another aspect that needs to be understood in the ecological master plan is the topography under the water. In order for the water to fluctuate with the seasons, the under water environment resembles terraces. The drawing at the bottom of the page is a conceptual sketch of how the underwater cross section would look. In actuality these terraces would be much wider, but it does show how the different types of plants exist at different water levels.
Plan Explanation:

The other large scale element of the master plan is the pathway and art piece. As explained the designer designed these two elements to function as one unit in order to allow the art piece to accomplish a variety of goals.

The plan to the left shows the overall layout of the path system, as well as, the art piece itself. The blue grid lines were originally drawn on the site to simple counteract the natural fluidity of the ecological design. After laying out a path system (black lines) that fed off of these grid lines the designer chose to actually construct the lines on site in order enhance the actual difference between the natural and built environments. The next few pages will explore some of the ideas behind this layout.
Grid Line/Art Piece Layout:
During the listing of program requirements, the designer expressed interest in focusing on the relationship between the natural and built worlds. Due to the fact that this site had actually been destroyed due to development adjacent to the site it was an obvious location to explore this dynamic. Since the site itself was designed to look and function as naturally as possible the designer looked to invoke the built environment into the design. By laying out the grid lines in a very linear, geometric form the designer accomplished the visual identity of a man-made object on site.

The challenge became how to actually physically construct the gridlines with the path system in order to also satisfy the other needs defined within the program requirement section. Since the lines were supposed to represent the built environment the designer chose to construct the grid in a very simple yet very constructed looking manner. The lines are composed of 6" hollow aluminum tubes that are held up by steel rods at an interval of five feet on center. A detail of the tubing can be seen at the bottom of the page.
master plan

Grid Line/Art Piece Layout:

The design of the metal pipes allowed the designer to accomplish several other goals including site line development, enhancing topographic change, responding to seasonal change, and functionality.

- Site Line Development

Since the pipe is designed from polished metal it has a definite contrast to the natural vegetation around it, and due to it's linear quality it had the potential to direct people's vision.

- Enhancement of Topographic Change

One of the most misunderstood aspects of the wetland system is what happens underwater. There is a great deal of activity below the water due to the fact the terrace system would be in place. Therefore the designer wanted to allow the pipe to accentuate the topography by following it up into the higher areas and down below the water. In the drawing below the reader can see how this design would work as the land raises and lowers so does the pipe only a very geometric pattern.

Master Plan
- Pathway and Art Layout

Pipe Elevation over Topography

Ecological Restoration
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master plan

Grid Line/ Art Piece Layout:

- Responsiveness to Seasonal Change

  This idea works with responding to the natural topography. One of the most educational qualities of a wetland is the importance in fluctuating water levels. Unfortunately visitors rarely notice this aspect because guests have no frame of reference. In this design the pipe becomes that frame of reference. Throughout the year as the water level rises and falls the pipe will either be more apparent or somewhat hidden by water. In addition the growth of plant life around the site will also occasionally envelope the pipe system hiding it from view for part of the year. Since the pipe is designed to “float” one foot above the ground both of these effects are quite dramatic and ever changing.

- Functionality

  At this point that the designer wanted to combine the layout of the path physically with the hollow pipe. Looking at the pipe’s characteristics and rational it was decided that the pipe when in contact with the pathway would rise off of the grade lines and become a handrail for the pathway itself. This idea can be seen at the right of the lower drawing as the pipe rises out of the water to meet the pathway. The next few pages discuss the pathway itself.
master plan

Pathway Layout and Design:

The original goal of the path system was to allow visitors an experience that they could not receive at similar ecological projects. In looking at environmental art pieces by Mary Miss, and others the designer looked to bring people into the site and allowing them to see the site from a variety of perspectives. Since the site was designed biologically for waterfowl the design of the path and the programmatic experiences visitors would encounter looked to allow people to view the site how the wildlife would.

In addition the path was designed to allow people into as many different zones as possible while still respecting the spatial needs of the wildlife. With this in mind the quarter of a mile interior trail touches every zone, but never moves deep into any perimeter spaces.

Another aspect of the pathway was that had to allow for wildlife and human movement. Therefore in places, defined by the white areas on the top diagram, the designer chose to use what was deemed to be a typical boardwalk layout. A simple wooden eight foot pathway, raised a foot and a half over the existing grade would allow for human movement and wildlife movement either over or under the path. In the lower drawing the reader can see how this idea would work in section, and also notice the pipe along the handrail. In areas where the pipe is not in contact with the pathway both handrails would be constructed from wood.
Pathway Layout and Design:
One of the most dynamic areas of the design comes in the area highlighted in white on the master plan. In order to allow people to see what kind of cover is provided by the reeds within the wetland system the pathway actually dips into the water to a depth of three feet. The walls are constructed from reinforced concrete and the design is based off of the high water level, which would leave the wall at highest approximately six inches over water level.

The lower, right drawing shows in section what the experience would be like in travelling through this portion of the site. The walk actually allows children to be at eye level with the waterfowl in order for them to develop an understanding of the internal systems of the wetland. The lower left drawing shows what it would be like within the path system.
Pathway Layout and Design:

The third layer of the pathway takes visitors up into the trees in order to accomplish two goals. One it allows an overview of the entire wetland area, but more importantly it shows people the protective qualities of the canopy. The path itself is only raised five feet above the grade, but it allows guests to see how the wood duck species lives.

This path is also beneficial for the wildlife. Due to the pathway being raised movement under the path through the woodlands is easy to accomplish. The lower drawing shows what the pathway looks like in section. Again it is important to notice that the pipe line raises up onto the boardwalk.
Material Changes:

As the reader has already guessed there are places along the pathway where material change is necessary. Where the typical boardwalk section lowers into the water is one of these areas. The drawing at the bottom of the page shows how this would appear in section. The wood boardwalk would lower towards the water where it would be met with a concrete walkway that allows people down into the wetland.

*Pathway Cross Section*
Site Lines:

In describing the art piece it was noted that one of the goals was to manipulate the site lines of visitors. In the lower drawing it is apparent how the pipe's linear quality directs views into and through the site. Another point to note is the second pipe seen in the same drawing coming out of the water and travelling up over the island. This drawing is a good representation of the site's overall character.
Educational Area:

One of the most exciting parts of this project is the fact that visitors are able to get down into the wetland in order to study it in greater detail. The design of one of these spaces is shown on this page. The area itself is located directly off of the path and is designed for group gatherings. This concrete plaza allows students to take water samples, learn about vegetation, and view wildlife. Along the walls of the space are sandblasted images that will function to help teach about the elements around guests.
Secondary Path System:

A secondary path system was designed through the site that will allow visitors a quick experience through the site. This system does not get into as much detail as the interior path, but it will provide information about the site. The path itself shown in section at the bottom is lowered slightly to separate it from the road. A retaining wall holds up the surrounding landscape. Another aspect to note is the informative signage. The next page shows a perspective looking north from this point, and the page after that will talk in greater detail about the signage.
Informative Signage
- Shown in more detail on next page
Informative Signage:

In order to move people through the site, and to teach them about the systems they are witnessing, a series of signs have been designed. The signs are constructed much like the pipe itself. The joints are all very visible, and the signs are constructed completely out of metal. They allow the visitors to see where they are within the site and at times what they are seeing. The plan to the right of the page shows how the signs would appear, and the lower drawing show what the signs look like in section.

Duck Hollow
Wetland Restoration Project

For a more detailed view of the site this way
total distance – .25 miles

Ecological Restoration
And Design
Other Views:

These two drawings show the other views that would be experienced in seeing the site. The upper drawing is looking from the heron overlook, across the river. The hillside has been cleared to allow views into the site. The lower drawing shows the large central island during a period of high water. The pipe is moving up and over the land and into the water.
The goal of this study was to take an environmentally struggling landscape within the city of Muncie begin to remediate it on an ecological level and propose how to best maintain the area within a social framework in the future. This obviously benefits the site on an ecological level, and also increases the already heavily used wildlife habitat. From an aesthetic standpoint looking at environmental art pieces provide a solid foundation for incorporating design into an ecologically sound landscape. Using the art as a functional piece as well as an obvious aesthetic work begins to fuse the natural and human interactions.
appendices