Environmentally Sensitive Land Use
For Golf Course Design
The Vulcan Property
Anderson, Indiana

Kevin Todd Foster

Comprehensive Project
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Professor Ron Spangler, Instructor
Professor George Young, Advisor
Without the assistance of numerous people
I would not have successfully completed this
comprehensive project.
I would especially like to thank my advisor George Young
for his help in the design of this project.
I would also like to thank the other faculty who gave of their
time to aid me in the completion of this project.
Most of all I would like to thank my parents for providing
me with the education I have received and the
opportunity to arrive at this point.
Abstract

The game of golf has become a very popular recreational activity in this country and around the world. Because of this, golf courses are being built at an incredible pace. Awareness about the environment is also something that has become increasingly important in today’s society. This has led golf courses, often questioned in terms of this land use, to come under much scrutiny as to their effect on the environment, due to their maintenance practices and general treatment of their site. The problem is that the recent trend in golf course development has been to destroy the natural character of the site to rebuild it with golf courses and housing, thus, not maximizing site potential. Some other criticisms of the game of golf are that it requires too much land and does not allow access to the site for anyone but golfers in addition to the environmental problems it causes. This was a problem that was important to address due to the amount of land that golf courses will consume in the coming years.

The solution to this problem addressed all of these issues by creating a design which integrated the game of golf, environmental sensitivity and community interaction on one site. This design came together by creating a golf course that was constructed in response to nature and did not try to control it. Linkages were then provided to surrounding park systems and trail and open space areas were intermixed with the golf course to allow for community interaction and recreation. Finally, critical areas were preserved, wildlife was provided for and alternative maintenance practices were suggested to bring the design as close to nature as possible. The result was an integrated golf facility that responded well to its surroundings and produced an outstanding test of golf.
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Part One:

Project Justification
Introduction

Awareness about the environment around us and the conditions affecting it is something that is becoming increasingly important in our society. Whether one is a golf course architect, a landscape architect or simply a caring member of society, the condition in which we leave the environment in for future generations is a major concern. The pollution of our air and water, the depletion of our natural resources and the effects of land development have made the protection of the environment one of the major concerns of public officials and the general public alike. At the same time, there has also been an increase in population and much more emphasis is being put on physical fitness and recreational activity in our society. The general public has also grown to experience a recent increase in leisure time. One of the results of all this is that the game of golf is enjoying an unprecedented popularity. However, the development of new golf courses has not kept pace with the growing golf population, thus resulting in a significant demand for new facilities (Love 3). We must realize, however, that the construction of these new courses will have a great impact on our environment and their design must be done in a responsible manner that protects our environment and improves our existing conditions for the generations that will follow us.

When looking at golf course design, one must first understand that many people feel there are a number of negative aspects associated with golf courses. The first of these aspects is that people feel that golf courses take up large amounts of land and therefore this land could be put to better use. Second, many argue that the practices used for maintenance are harmful to the environmental conditions on and around the site. Finally, it is argued that golf is an "elitist sport" and the land used is set aside for a small amount of the population. I tend to agree with these statements to a point, however there are ways of dealing with this. In the design of my project, I focused on creating a golf facility that would accommodate a wide range of activities and functions for use by the entire community, not just the golfing population, as well as addressed the environmental issues pertaining to the development and maintenance of the golf course.
Background

The game of golf is one that I have enjoyed since I was very young. It has always provided me with a great sense of enjoyment and recreation. When I was young, and still today, I would frequently go out and play a round of golf with my father or some of my friends. This has provided me with an excellent chance to spend time with them or simply be outdoors and enjoy nature. It never really mattered how I shot, unless we played for money of course, it was just being on the course that counted. As a youth, I never really payed much attention to the layout of the course or the distance from the green to the next tee. However, the thing I did notice was it felt good to simply be on the golf course. Today, golf provides we with a chance to relax, to get away from my troubles and most of all to still feel a little closer to nature. The course on which I grew up playing was a good one with a lot of natural aspects. There were a lot of wooded areas around, there were ducks on the ponds, squirrels running around and even an occasional deer could be seen and, for the most part, the only sounds that could be heard were those of nature.

Upon coming to Ball State University, I began to learn much more about the field of landscape design. Along with this came an introduction to golf course architecture. This was something that truly fascinated me. The creativity and the knowledge that was necessary for the design of a golf course was amazing. I had never realized these courses I had played all of my life were so complex. I began to take notice of each and every thing on the course when I played, the locations of hazards, where the tees were sited, how the green could and could not be approached and many, many other factors. I had then realized golf course architecture was something that interested me very much. This was the biggest reason I chose to do my comprehensive project on the design of golf courses. Second, I chose this project because I feel that many golf courses are now being developed with almost no connection to nature. Too often, the site is simply bulldozed and the site is totally rebuilt with a golf course. This goes against the whole intent of the game. Golf is a game that is supposed to be played in harmony with nature. I wanted to design a golf course that existed in harmony with the site,
nature and the surrounding community, yet still provide an enjoyable golfing experience. Recently, many golf courses have missed a great opportunity by not using their site to its fullest potential. By doing this project I feel I have acquired the base knowledge to design golf courses in the manner in which I feel they should be designed, thus, allowing me to be part of the solution rather than part of the problem.
History

At this point it is important for the reader to understand a bit more about the history of golf course development and why and how courses developed where they did before proceeding any further. This is simply to give an idea of where some of the philosophies of design on this project originated.

It is not known exactly where of when the game of golf was first played. Many countries claim to have invented the game, or games similar to golf. It is known, however, that the modern concept of golf originated in the British Isles in the late 1400s (Phillips 2). These first golf courses were laid out on strips of land near coastal regions called linksland, because the conditions here were best suited for the game. Linksland areas generally occur where the mouth of a river empties into the sea, leaving rich alluvial deposits (Cornish 10). These areas were characterized by sand dunes, small hills and numerous hollows with native grasses. There were few, if any, trees. The soils of the linksland were sand based and provided excellent drainage. During these first games of golf, a starting and ending point was agreed upon and the holes were marked as play progressed. There was no set order for play. These first courses were characterized by the fact that they took advantage of the natural features of the landscape and their advantageous settings. Because these courses were laid out with the landscape, there was very little construction and maintenance. By the sixteenth century, golf courses began to move out of the linksland. New courses began to be constructed on sites not as well suited for golf. However, these courses were still designed with the landscape in mind by working carefully with the topography and avoiding excessive disturbance to keep the integrity of the site (Phillips 3). Saint Andrews and Montrose were a couple of courses characteristic of this period. Later, golf was brought to the United States by Scottish immigrants. The early American courses followed closely in the British tradition having golf course sites chosen for their character and the ability to produce an outstanding test of golf (Love 4). These early courses were still developed in response to their site. Some examples would include Pebble Beach, Augusta National, Cypress Point and Shinnecock Hills. All of these are still among
the best courses in the game.

As the game of golf became more popular, a demand for new facilities and public accessibility rose. New courses began to be placed where the demand was the greatest (Love 4). In the years that followed, residential developments began to enclose golf courses in order to increase property values. These new residential developments gradually took away from any natural areas which might otherwise be left. This trend has continued up to the present. Today, golf courses sites are being selected for their demographic and economic possibilities. The development of new machinery for maintenance and construction, elaborate watering systems and increased demand for real estate developments centered around courses has made it possible to build a golf course almost anywhere there is a demand (Phillips 5). Golf courses are now found in all climactic and geographic locations including deserts, woodlands and marshes. Many courses are being built with the primary concern of making money for the developer while the character of the course and the effects on the landscape have become secondary. This goes against the whole intent of the game.

In looking back at the design of golf courses, the most memorable and exciting courses are the ones that have taken the natural setting into account. The golf courses that have used the qualities of the site and region, such as topography, vegetation, site character and many other factors, are the ones truly worth playing. These courses provide a unique setting in which to experience the game of golf as well as nature. They also allow the user to experience and learn a little about the site or region in which he is playing. If there is one lesson we can learn from these courses it is why not celebrate the quality and properties and individuality of each site, rather than trying to imitate something that has already been done. In his book *An Environmental Approach to Golf Course Design* William Love stated "The appeal of any golf course can be attributed to the feeling that each course seems to belong in it's setting." This feeling is one which needs to be brought back to the golf courses being built today.
Benefits of Golf Courses

As stated before, golf courses have long been questioned in terms of their land use. Many people feel that golf courses are of no particular benefit and the land they are built on could be put to better use. There are still others who feel golf courses actually harm the land they are put on and these courses should not be built at all. However, one does not have to look very far to find a wide array of benefits that golf courses provide. One major benefit is that the golf course provides open space corridors and green open space in general. With all of the development taking place today, green space is diminishing quickly and becoming a very valuable commodity. It is something we need for natural processes to take place. Any land use that can preserve a large amount of green space is a good thing.

A second benefit of golf courses is they act as wildlife refuges, when properly designed. Again, because of all the development that is taking place today, animals are running out of places to go. A well designed golf course can act as a sanctuary for large numbers of birds and animals. In many cases, golf courses have actually been known to provide habitats for greater numbers of bird and animal populations.

A third, and possibly the biggest, benefit of golf courses is the turfgrass that is on them. Turfgrass has a wide variety of benefits. It acts as an air filter by trapping dust and other pollutants, provides oxygen by allowing photosynthesis to occur, traps sun energy helping to cool surrounding areas and well established root systems aid in preventing erosion (Evans, Harker 24).

A fourth benefit is golf courses is the water that is generally contained within them. This water acts much in the same way as turfgrass by absorbing heat and helping to cool surrounding areas as well as filter out the pollutants in the air.

A couple of other benefits of golf courses would include providing a buffer for noise pollution within the property and aiding to increase property values of the surrounding area.

And finally golf courses provide a great aesthetic benefit. When properly designed, golf courses can provide some amazing views of areas such as scenic
deserts, seashores, swamps, wetlands, mountain ranges, oceans and woodlands. In many cases people would not otherwise be able to experience these scenes. The advantage of golf is it can provide a great amount of visual stimulation without destruction to the surrounding environment.
Problem Definition

Most golf courses do not take advantage of the opportunity to better the environment and maximize site potential. Rather, we often find environmental damage to the site and the ecosystems around it through the use of fertilizers and pesticides, driving off wildlife, using excessive amounts of water for maintenance, greatly altering site topography, changing the overall site character and not allowing access to the site by those who are not golfers.

Hypothesis

Through well developed designs and better maintenance practices, golf courses can provide valuable green open space within an area, act as a refuge for a wide range of species of birds and animals, preserve ecologically and environmentally sensitive areas, relay cultural and historical significance and allow for the interaction of the entire community, as well as provide recreational and housing opportunities, thus becoming a benefit rather than a hinderance to the environment and a vital link within the community.
Assumptions

In doing the research for this design project and the surrounding facilities, I looked at a wide range of factors which I felt would have an influence on my design. However, there were some questions that arose which required too much time on my part to address within the constraints of this project. In addition there were a few factors which were not addressed due to the lack of resources on my part or simply because they did not fit into the program for my site. Yet, the casual observer may have felt like they should have been addressed. In this light, I made some assumptions about the issues I chose not to address. These assumptions allowed me to proceed with the design of the elements vital to my project. These assumptions are as follows.

1. This project has been approved by the proper authorities and administration of the city of Anderson.

2. Significant funding was available for the completion of this project.

3. There was a sufficient interest in golf within the region to support such a facility.

4. The Anderson riverwalk will be connected to Mounds State Park, thus having the potential to interact with my site.

5. If left alone, the site would have continued to be depleted as a dumping ground for the city of Anderson and its residents.

6. The soils of this site were suitable for golf course development.

7. Construction of the course was done in a sensitive manner that minimized the damage to the surrounding environment.

8. The architect would pick up on the emphasis of the cultural landscape in his design of the clubhouse.

9. The damaged areas of the site which were restored have the potential to support wildlife and golf course turf through the restoration process.
Project Vision

The true vision which I had for this project was for my site to be an area in which was a major node of activity for the community. As stated before I do not feel that the land used for a golf course should simply be set aside for those who play the game. Often, the feelings evoked and the views supplied on a golf course are some of the most dramatic and highest quality within an area. If used properly, the land on which a golf course sits can also provide clues as to the history, culture, natural processes and native plant and animal communities of a region. There is simply no reason a site like this should be set aside simply for one small user group. I saw my site as being a point where three factors converged to complete the final design, the golf course, environmental sensitivity and community education and interaction. The golf course was designed as a public golf facility in which any interested party could come and play a round of golf simply by paying the daily greens fees. There would also be membership to the club for anyone interested in joining. The environmentally sensitive component insured that the course was designed to take advantage of the natural features of the site while helping the course better co-exist with nature. Finally, the education and interaction component was provided to insure that the community was able to interact with the site and learn from it. How this was done will be discussed later in the report.
Project Goals

1. **Preservation of the natural landscape.** This goal was much of the basis of my project. This involved cutting back on the areas maintained and preserving as much of the unused space as possible. This preservation included areas such as wetlands and other sensitive areas, forested areas, lakes, rivers, topography and overall site character.

2. **Design of an eighteen hole golf course that was challenging to all skill levels.** The course had to be enjoyable for everyone from the PGA tour professional to the beginning golfer for it to be successful.

3. **Conservation of wildlife on the site.** The course was to provide adequate food, space, water and shelter for the wildlife as well as preservation and enhancement of their natural habitats.

4. **Provide better, safer maintenance practices on the site.** This included providing an Integrated Pest Management system for treatment and maintenance of the course, alternative methods of chemical use and alternative mowing and watering practices.

5. **Provide for the conservation of irrigation water.** This involved cutting back on water use and setting water priorities, using vegetation to control runoff, incorporating drought tolerant turf and reducing the areas maintained.

6. **Relay the cultural and historical significance of the site.** This involved letting the user know what existed there before through suggestions, views, an educational center and other means.

7. **Interaction of golfers and community members with the site.** This was needed on the site and was done through various trail systems and connections made to other parks within the city if Anderson, allowing a wide range of people to use the site.

8. **Education of the users.** This included education about nature, wildlife on the site, history of the site and the area in general. Education media about the golf courses we play on is an areas that is missing on most courses. It is a great opportunity that must be taken advantage of.
Design Principles

In anything a designer does it is important for him or her to have a specific set of design principles or values upon which to base his decisions. These values vary slightly from one designer to the next. With each project also comes a slightly different set of challenges and issues, and therefore a slightly different set of values for every project. Thus, it is important for the designer to have a list of design principles to be used for each project. This project was no different. The set of principles which I adapted for this project allowed me to make many of my decisions for the design, especially those pertaining to the environment. The overall design guideline for this project was to work with nature and conform to it where necessary, not the other way around. However, there were a wide range of issues to be addressed on my site. Therefore, I have divided my principles into a number of categories for easier understanding. The following is a description of the problems encountered on my site and the principles that allowed me to make my decisions. The issues on the site fell into two main categories, site analysis and conservation development.

Principles for Site Analysis

1. Identify the area’s unique resources and try to preserve them.
2. Identify geographic and topographic features of the site.
3. Identify surrounding land use patterns and try to use the site to benefit those patterns of use.
4. Identify areas of archeological, natural, historical, and cultural significance.
5. Identify and conserve natural wildlife habitats.

Principles for Conservation and Development

Wildlife Conservation
1. Do not disturb or alter the food sources, shelter or local water supplies of local animal populations.
2. Do not disturb ecologically sensitive areas.
3. Do not pose threats to species through air or water pollution.
Natural Landscaping
1. Select native plants to be used almost exclusively, except for special purpose areas such as greens or fairways.
2. Design and implement the course to minimize the loss of trees.
3. Select plants to minimize the need for chemical fertilizers, pesticides and herbicides.
4. Select plants that allow for efficient irrigation methods and practices.
5. Select plants that provide good wildlife habitation and diversity.

Water Conservation
1. Utilize native and naturalized plants and turfgrasses that are biologically correct for the region.
2. Utilize a rainwater collection system for water supply.
3. Select turf species that are known to be drought tolerant.
4. Alter and minimize the program of watering turfgrass.

Wetlands and other Sensitive Areas
1. Provide an adequate buffer between areas of play involving chemical use and any sensitive areas.
2. No area deemed sensitive ecologically or environmentally by the designer shall be disturbed or destroyed.

Education and Interaction
1. Spaces such as trails and park space shall be incorporated to allow the interaction of golfers and non-golfers alike.
2. Include opportunities for local education.
3. Provide education for golfers and community on the use of the site.

Suggested Chemical Use
1. Chemicals shall only be used in areas where it is absolutely necessary for the maintenance of the course.
2. Chemicals only to be applied to tees, fairways and greens.
3. Use only chemicals approved by the EPA.
4. Use only chemicals that have been proven not to leach or run off easily.

These principles have come from a wide variety of sources and experiences. Many of these ideas have come directly from my experiences in golfing and my concern for the game and the environment. Other principles and values have come from my experiences at Ball State University. Finally, I must credit many of these design principles to the Audobon Society of New York State. Many of these principles were taken directly from their Audobon Sanctuary Program, a topic on which I have done much reading.
Program

At the beginning of this project, a set of criteria were given to the designer for elements to be included in the final design. After these requirements were made clear I, acting as the designer, added some more elements which I felt were necessary for the completion of a good design. The following is a final list of all the elements which were required of the final design.

1. Clubhouse.
   The clubhouse was to include a minimum of the following elements.

   Pro Shop-- to be used for items related to the golf facility.

   Cart Storage Area-- Preferably underground, for storage of the golf cars.

   Snack Bar-- to be used for the golfers or trail users to grab a quick bite to eat and get back to their activities.

   Educational Facility-- This was required to allow anyone who uses the site to find out more about the history, wildlife, vegetation and culture of this parcel of land. This was a very important link to integrating uses of the site.

   Outdoor Deck Space-- This allowed for the use of more space and allowed for outdoor access while in the clubhouse.

   View of Golf Play-- A view from the outdoor deck space to the eighteenth green was needed to allow for a link between the golf course and the clubhouse.

2. Parking Facility.
   A parking lot of 125 spaces was required to allow adequate space for the users of both the golf course and the trail area.

3. Practice Green.
   A practice putting and chipping green of approximately 9,000sq. ft. was required to allow golfers to warm up before playing.

   The maintenance facility was approximately 1ac. and was needed to provide a place to store the maintenance equipment, any fertilizers used to treat the golf course and any other miscellaneous items such as new plants for the course.
5. **Nature Trails.**
   Nature trails needed to integrate in with the golf course in order to allow for the interaction and education of the community with this facility as well as to provide a link, through the Anderson Riverwalk system, to a larger park network. This site has the opportunity to serve as a trail head location for the riverwalk. This will be explained in greater detail later.

6. **Green Open Space.**
   Green open space or park space was required to allow trail users to have areas of relaxation along the way for things such as picnics or simply throwing a football and other such activities.

7. **Education.**
   Opportunities for education of the trail users and golfers were required through the educational center in the clubhouse, direct site observation of wildlife and vegetation and informational signs throughout the site.

8. **Views into Golf Course.**
   Views into the course were required from various areas of the nature trails in order to allow for observation of the game without interference.

9. **Environmentally Sensitive.**
   The course was to be designed and constructed in a sensitive manner which allowed for the protection of the environmental conditions on and around this site. The concepts used to do this were discussed in the section concerning design principles.
Part Two:

Analysis and Concepts

Site Inventory
Site Analysis
Design Concepts
The Site

Location

The site chosen for this project was the Vulcan Property in Anderson, Indiana. It is located in the eastern part of the city. The site is bordered to the south by the White River, to the east by Rangeline Road, to the north by residential properties and to the west by wooded areas, with some residential creeping in on the northwest corner of the site. Rangeline road is a major north/south road in Anderson and serves as the major access point to my site, making it easily accessible from other parts of the city. Mounds State Park is located about one mile down the river from the site. In addition to Mounds there are a large number of other parks located along the river that make up the large green space network through the city of Anderson. Many of these parks are connected by a riverwalk system that runs through the city. At present, this riverwalk only runs through a part of Anderson, however, there are plans to connect this system to Mounds State Park, thus giving the riverwalk the potential to run through my site. This was an opportunity that had to be looked at.

Description

The Vulcan Property is approximately 200 acres in size and offers a wealth of opportunities. The site has a wide range of natural features and displays an unusual character for a site this size. Some parts of this property were the site of an old mining operation and many remnants of this can still be seen. A few relics of the mining operation were still on the site. Also, the topography gave many clues as to where the mining took place. Presently, the parts of the site that were used for mining are being used as a dumping ground for the leftover brush piles that the city collects. This area accounts for about 25-30% of the site. This part of the site is a landscape that has been greatly degraded and needs to be cleaned up. Unfortunately, the citizens of Anderson have begun to follow the lead of community officials and
are dumping everything from old refrigerators to concrete blocks in this area.

The rest of the site, however, was a wonderful piece of land. The feelings I experienced were ones of being very close to nature, even though the city and much development were in many cases very close. The sounds that I heard while there were those of animals and birds, not cars and buses. As I began to study this property in more detail and experience it first hand, I began to see this site was a very unique piece of land and it had a great potential to serve as a major recreational link for the city of Anderson. The site also contained a wide range of natural features and other factors that had to be studied before the final design could be implemented. These factors will be discussed in detail in the site inventory portion of this book.

**History**

The history of this site is something that could not be ignored because of its richness and clues it gives to the cultural landscape. The Vulcan Property’s history begins back in 1799 when the Moravian Mission settled on it. This group is believed to be the first white settlement in northern Indiana. They came with the intention of converting the indians to christianity, however they only stayed until about 1805 due to the fact that most of the settlers were murdered by the indians. This plot of land was then the site of a settlement called Little Muncie Town in the 1820s. I was not able to find much information about this settlement other than they reflected the common cultural attributes of the time. Later, in the 1840s and 1850s a hydraulic canal cut through the site. This canal was to be used as part of the Central Canal Project that never was completed due to lack of funding. The final major event that occurred on the site did not occur until the 1940s, when the site was used as a gravel mine. This operation functioned until the early 1980s and left behind it many relics that are still visible. This history presented a tremendous opportunity for the education of the community about their past.
Site Inventory

The following is a summary of my observations about the conditions that existed on and around the site that I feel are important when making my final design considerations.

Vegetation

The vegetation covering the site was mostly wooded areas. These wooded areas covered about 75% of the site. These woodlands were in various successional states and generally had a great deal of scrub brush and understory trees contained within them. Of the wooded areas on the site, most consisted of small trees and immature vegetation. There were only two areas of mature woodland on the site. These areas provided a good woodland setting and I felt were very valuable to the natural processes of the site. Some of the trees found in these areas were maple, oak, hickory, sycamore, beech, ash, birch, hackberry and dogwood.

The other predominant type of vegetation that was found on the site was the successional farm field areas. There were four of these areas on the site and they accounted for about 10% of the land on the site. These pieces of land had been used for farm fields in previous years but were reverting back to their natural state. This primarily consisted of meadow type grasses with some wild flowers mixed in. These areas had good potential to give variety to the golfer in vegetation patterns as well as provide education about the successional processes.

The remainder of the site was barren or supported little turf. These were generally the areas most severely damaged by the mining operation.

Slopes

The topography on the Vulcan Property was one of it’s best features. Due to the mining operation and several natural processes there was a wide variety of topography here. The slopes ranged from near nothing to approximately 60%, in
places where the mining had occurred. The overall character of the site slopes, however could be best described as rolling with an average slope of about 5-10%, which is ideal for a golf course. There were many places where the slopes dropped quickly to provide a dramatic tee area as well as provide a wide range of views. The elevations on the site range from 839 down by the river to 902 near the north boundary of the site.

**Water Features**

Another element of my site was its water features. There are two bodies of water that would be considered to be lakes. The biggest of the two lakes lies to the extreme south of the site near the White River. This lake was a beautiful area that is used for fishing and supported a large wildlife population. The second of these lakes was located near the northeast corner of the site, it also contained an unusually large wildlife population and was good for fishing. In addition to the two lakes there were seven other small ponds scattered throughout the site. These ponds were located on inundated soils. They were one source contributing to the site's character and were a real addition to the property. The White River was the final water feature, although it did not actually run through the site. However, it did provide a number of opportunities.

**Wetland Areas**

There was one wetland area within the boundaries of my site. It was located in the southwest corner of the site, in the floodplain of the with river. It is by definition a forest floodplain wetland. There were a number of trees as well as wetland vegetation contained within this area. There was also a high concentration of wildlife and unusual vegetation there. This was one of the most beautiful and interesting areas of the site. This was an area determined to have a very high value for preservation, because of it's uniqueness and sensitivity.
Floodplain

The floodplain covers about the southern one-fourth of the site. The 100 year floodplain is located at the 846 elevation. The development was kept away from this area as much as possible to avoid any flooding problems.

Views

Views are an important part of any golf course. What the golfer does or does not see will have a great affect on his or her feeling during the round as well as his route through the site. Due to the mining operation that existed before, some great views were provided on the Vulcan Property. There are some dramatic views on the top of ridgelines that exist, however, there are not a great number of these views due to the amount of the site that is covered by woodlands. The existing views were taken into account and preserved and some clearing was done to provide other dramatic views.

Wildlife

The Vulcan Property supported a wide variety of wildlife on it. This is due mainly to it’s size and natural condition. This wildlife is important to any project which deals heavily with the environment, especially this one due to the large number of species using this site as a refuge. Therefore it was important that this wildlife was taken into account and provided for in the final design. Some of the largest populations on the site included ducks, fox, deer, squirrel, coyote, skunk, beaver, wide varieties of bird populations and many aquatic species.
**Connections**

As stated before, there was already a partial riverwalk system in place for the city of Anderson which connected a number of parks, green spaces and recreational areas along the White River. At present, however, this riverwalk system only serves a portion of the Anderson area. My site is not included along this present use area. The was an effort underway, however, to connect this system to Mounds State Park to better serve its recreational users. This newly constructed area would then include a portion of my site. The only thing that stood in the way of this becoming a reality was the acquisition of a single piece of property. Assuming this property was acquired, this had the potential to serve as a vital link for community interaction.

**Accessibility**

The site is located on a major north/south road in Anderson, Rangeline Road. It is also located in close proximity to Highway 9 and Highway 232. Interstate 69 is located less than five minutes away by automobile and can be reached via either of the two above mentioned highways. Accessibility is not a problem here. The main entrance to the Vulcan Property was located off Rangeline Road.

**Community Interaction**

One of the amazing things about this property was that even though it was off limits to the public, many people still used it. I personally saw people using the site for a wide range of activities on my site visits. Some of these activities included fishing, mountain biking, motorcycle riding, running and just enjoying nature. Upon seeing this I realized just how much the community was wanting to interact with the site and needed a recreational facility to perform these activities.
Site Analysis

Upon looking at the inventory of the Vulcan Property, I then began to place some value on what the site had to offer as well as what the site was telling me to do. I decided there were a number of factors which needed to be taken into consideration and given attention to when doing the final design. So I first rated the elements which I felt were most important to be carried into the final design. This can be seen on the following map, which gives an explanation of each element that was rated high in it's value for preservation. This was an important first step in evaluating my design options.
Elements Giving Character

My next step was to begin to look at the features of the site that distinguished it from other places. This might be better explained as features contributing to the uniqueness of the site or giving it a sense of place. As stated before, working with nature and creating a unique setting in which to experience the game of golf was of the utmost importance in this project. So identifying what gave the site its character and uniqueness and trying to carry that over to the final design was a very important part of the site analysis process, which had a great effect on my final design. These features are the following.

1. **Topography.** The topography left from the mining operation created some very interesting slopes not found naturally anywhere else in the area. It also gave clues as to what previously on the site.

2. **Water Features.** The two large lakes each have their own separate identity and feel within the space. However, the small ponds are the real character giving element to the site.

3. **Wetland Areas.** The wetland areas evoke a character all their own. This is an environment that can be found in few places and that alone sets it apart from many other spaces. Also it's beauty and uniqueness help to distinguish it.

4. **Vegetation.** The wide variety of vegetation found on the Vulcan Property is something that is seen on very few sites in the area. The variety of plant life is an attraction in itself.

5. **Wildlife.** For a site of it’s size, this property supports a wide variety and large numbers of wildlife. This too could serve as an attraction and distinguishing characteristic.

6. **Views.** The views are not abundant on this site, however, the ones that exist are very distinguishing. There are also a number of potential views which were looked at in the design.

7. **Public Interaction.** The thing which set the site apart more than any other was the amount of public interaction. I felt the fact that the community already uses this land, even though it is off limits, had to be provided for in the final design.
Opportunities

The final step of my site analysis was to go back and take note of all of the opportunities that carrying out the design of this project on my chosen site provided me with. It was important that these opportunities were noted in order to be carried out in the final design process. They are as follows.

1. Preservation of green open space.
2. Reclamation of a damaged landscape.
3. Serve as a link in a larger park system.
4. Site could serve as a refuge for some species of wildlife.
5. Provide a unique setting through the site character.
6. Relay historical and cultural significance.
7. Interaction of the community with the site.
8. Provide for education.
Design Concepts

Concept One

This concept allowed for easy access to the clubhouse area as it was located near the main access point into the site. It allowed the golf course to connect to both the clubhouse and the natural and trail areas. Finally, it allowed the nature trail and natural area to pass directly along the river. The major problem of this concept, however, was its failure to integrate the site activities and thus failed to unify the site uses. The trail design provided for little interaction with the clubhouse and educational center or the golf course. Being that one focal point of this project was integration of activities, this concept was not acceptable, although there were some good ideas contained within it.
**Concept Two**

In this concept, the clubhouse area, the hub of activity for the site, was moved into a more central location on the site. The natural area containing the riverwalk trail was brought up to connect with the clubhouse and educational area. The golf course was then molded around these two areas. An access road was brought in from the main access point to the site and only cut through the golf course. The other uses such as practice putting green and parking, which needed to be in close proximity to the clubhouse, were kept near the center of the site also. This concept provided much more for the integration of all site uses and allowed the central area of the site to serve as the hub of activity that it should.
**Concept Three**

This final concept also brought the clubhouse area into the central core of the site. In this case however, the golf course completely surrounded the central hub area and the trail/natural area bisected the site in half, intersecting the clubhouse area in the middle. The golf course would then consist of two nine hole loops, one on either side of the trail area. The access was still from the main access point off Rangeline Road and the access road only came through the golf course area. This concept also allowed for interaction and integration of all site uses and provided a good trail route for the trail users. Due to the fact that the riverwalk trail needed to enter and leave the site near the southern boundary along the White River and the fact that several natural features interfered with the routing of the golf course in this manner the idea of bisection became somewhat impractical.

The final concept used for the design of this project was not taken from only one of the previous conceptual diagrams. However, because there were good portions of each concept, the final design is a combination of all three conceptual ideas, with the most emphasis on the second.
Part Three:

Final Design Solution

Masterplan Design
Golf Course Design
Education and Interaction
Environmental Issues
Conclusion
The Masterplan

The masterplan is where all of my design principles and site analysis came together to form a final design. The plan that I have conceived recognized the three separate facets of the project I have been discussing, the golf course, the trail and interactive area and the environmental considerations, and integrated them into a single working entity, the new site design. This design was carried out so that all activities provided on the site could occur simultaneously without interference to any user group.

The clubhouse was placed at a central location on the site on a relatively high piece of ground. The clubhouse served a number of functions and was to be the central hub of activity on the site. It was made accessible from the riverwalk trail, entry drive or parking lot. Within it was contained all of the necessary functions for golf as well as an educational center and snack shop to benefit all users. Outdoor patio space was also included in the clubhouse design which allowed the users to view on the 18th green while using the space.

The riverwalk recreational trail entered and left the site along the southern boundary of the White River. However, as it wound through the site, it stretched up to connect with the clubhouse in the center of the site. Through use of the trail, almost all of the distinctive features of the site can be experienced. Many good views of the golf course and some open space areas were also available on the trail. This part of the project will be discussed in more detail later in the report.

The golf course then weaved through and around the remaining areas of the site, taking advantage of the natural features provided and working with nature. Most of the existing water features were retained in the final design. Two of the small ponds were however, enlarged for purposes of irrigation and bringing water into play more within the golf course. The par for the course was finalized at 71 for both the men and women and the course played 6340 yards from the back tees. The reader should not be fooled by the somewhat short yardage however, there are many difficult shots that await on this course. The golf facility will also be discussed in more detail later in the report.
The main automobile access was kept from Rangeline Road. This was the heaviest traffic corridor bordering the site and provided for the easiest access. The entrance experience begins as the users come to the site and are greeted by the entrance signs. The entrance drive to the clubhouse provided a dramatic drive to the clubhouse by allowing the user to see selected views into the golf course and using a change in topography to control what is seen. The user would then enter into the parking lot which is heavily landscaped using native plants. Parking is provided for 125 cars, adequate to accommodate all users of the site.

A maintenance facility was also provided for the course in the extreme northeast corner of the site. The size of this facility was approximately 1.2 acres. Because of its location, this area was easily accessible from Rangeline Road and allowed for easy pickup and delivery of supplies. It was also well surrounded by vegetation so as not to be an eyesore to the golf course or neighboring houses.

Two of the four successional farm field areas were also preserved into the final design and converted into native wild flower meadows. These wild flower meadows provided for a variety in vegetative cover and scenery as well as an opportunity for education about another type of ecosystem.

A minimum of 50' buffers were placed between all site development and the other uses surrounding the site. This was done not only to keep this development from disturbing the surrounding land uses but also to keep other surrounding land uses from disturbing site activities.

With this description of the masterplan complete, it is now necessary to look at each of the three main components of the final design in more detail. This is to provide the reader with a deeper understanding of the smaller details of the design that are usually overlooked on a masterplan. Again, these three components are the golf course, the interaction and education area and the environmental concerns related to the project.
Golf Course

Course Yardage

<table>
<thead>
<tr>
<th>Blue Tee</th>
<th>White Tee</th>
<th>Red Tee</th>
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<tbody>
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MAINTENANCE AREA

WETLAND

HIDEAWAY TRAIL

MEADOW AREA

CUMHEDALE

ENTRY DRIVE

Scale 1" = 100'
The Golf Course

Course Design Philosophy

What makes a good golf course? People's feelings about a golf course are come from a wide range of factors which they experience while on the course. These factors vary from one person to the next. So, if you ask five people what makes a good course, you would probably get five different answers. One factor that can go a long way in measuring how good a course, however, is the desire to return and play it again and again. Many may not even be able to explain why this attraction exists, they just know it feels good to be on the course. There are many, many variables which contribute to the return of players to a course. It is a combination of all of these variables, not simply one or two, that are required to achieve the desired effect. The following are the variables which I have determined through my research which provide the desired outcome, a good golf course. These variables were then used to create the golfing experience taking place on my site.

--First and foremost, the course must work with nature, not against it. The work of the architect must be indistinguishable from the natural surroundings. He must listen to what nature is telling him to do.

--The course must reflect and celebrate the character of the site and region. The natural features of the site must be taken into account and used in the golf course. This will create a unique setting for the game which in turn creates a sense of place in the user's mind. This is sometimes referred to as Genus Loci. This all contributes to a memorable experience for the golfer.

--The course must be a challenge to all skill levels including high, middle and low handicappers. If a course is too difficult for a player of a low skill level they will get frustrated and will not return. This can easily be done by using multiple tees and placing hazards so they are more demanding of and require more accurate shots from highly skilled players.

--The course must provide a number of options on each hole. This is often called strategic hole design. This requires each player to think more while playing and look over their options before each shot. It also allows for easy routes for the less
skilled player and a more difficult route for the player that is willing to take a challenge. However, should the player attempting the more difficult shot, not produce the required shot, they will be penalized. The idea of providing options is very important.

--The course must also require all shot types to test the skills of the golfer. However, a balance must be achieved so that no shot type is required excessively. This ensures that a golfer must have a command of all clubs in order to score well (Hawtree 56).

--The designer must take into consideration siting, slope, shape and orientation to influence play from the tee onward. This means the designer must think through every possible option for each hole on the course before it is complete. This also requires more than simply the natural features to influence play (Hawtree 55).

--The designer must provide a different character for each hole on the course when practical. Most courses have a few holes which are more memorable than others. It is these holes, each having their own character, that distinguish themselves and provide an enjoyable golfing experience. An example of this is "Amen Corner" at Augusta National.

--The course must use irregular shapes to blend with nature. The shapes found in nature are irregular. The designer must have a certain artistic eye for this blending to occur. However, it is essential in achieving the desired feeling that the course actually belongs in its setting.

--The designer must allow for variety. This deals with variety in the length and direction of consecutive holes and shots as well as a variety in the overall distribution of holes.

--A final consideration is that the course must appear to be more difficult than it actually is. The average golfer achieves a great deal of satisfaction from mastering a difficult hole. One tool that golf course architects often use is that of illusion in order to make a hole appear more difficult. The siting of hazards so that they appear to be closer to field of play than they actually are, is one method of using illusion (Hawtree, 63).
Golf Course Planning

Now that we have discussed that variables that needed to be provided for a good golfing experience, it was important to realize that there were also a large number of factors that needed to be taken into account when planning and laying out the golf course. These were the factors which affect the safety, speed and ease with which a round of golf could be played and are critical for a good course layout and design. These factors are as follows.

--The distance from the green to the next tee should be kept to a minimum. The limit should be about a 75 yard maximum where ever possible and the two should not be closer than 30 yards for safety reasons.

--The course should consist of two nine hole loops, each beginning and ending at the clubhouse. This means that the 1st and 10th tees, as well as the 9th and 18th greens, should be located within close proximity to the clubhouse.

--The centerline of two fairways should never be closer than 150’ for safety reasons.

--A good view of the 18th green should be provided from the clubhouse to add interest in play and allow for connections between the course and facility.

--Holes should be oriented in a north/south direction when convenient to avoid interference from the sun. Westward facing holes should be avoided in the final holes of the course.

--Multiple tees should be used to allow for variety and use by different skill levels.

--Greens should generally not exceed 8,000 sq.ft. Any area bigger than this takes more effort and money to maintain and serves no real purpose (Phillips. ??).

--Hazards should be designed with an object in mind, not just for show. The object of the hazard is not always to penalize an errant shot, as most golfers tend to believe. In some cases the hazard many actually save strokes. An example of this is the sand trap that is placed to keep an errant shot from rolling into the water or out of bounds.

--Greens and hazards should be visible from the approach area. This takes away blind shots and allows the golfer to better control his own fate.

--The walk to the next green should begin from the back or side of the previous green so the golfers going to the next hole can move out of the way quickly and will not slow play.
--A variety of par 3, 4 and 5s should be provided with at least four par threes.

--A set of nine holes should not begin with a par three when ever possible. This allows golfers to get away from the tee and reduce the waiting time for the group waiting to tee off.

--Tees and greens should all be sited above the 100 year floodplain in order to prevent flooding and allow for play to continue on wet days.

--Maintained areas should not contain slopes of greater than 5-10% due to the difficulty in maintaining these areas.

**Length of Holes**

<table>
<thead>
<tr>
<th>Men</th>
<th>par</th>
<th>length</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>130 - 250</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>251 - 470</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>471 - 600+</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Women</th>
<th>par</th>
<th>length</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>100 - 210</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>211 - 400</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>401 - 560+</td>
<td></td>
</tr>
</tbody>
</table>

One consideration that should be made, however, is pertaining to the par 4 hole. The minimum distance for this hole is 251yds. The designer should be aware that the distance from 251 to about 330 is known as "no man's land". This is due to the fact that many holes of this distance are lacking in physical attributes and, unless there is some outstanding feature or hazard, the hole becomes very easy to play for most golfers. Using these distances should be avoided when ever possible.

All of the above factors of planning and philosophy were taken into account in the design of this golf course. Most all of them are reflected in the final design and play a major role as to how the course was finally laid out.
The Golf Course Design

As stated before, the golf course was a par 71 and it measured 6340 yards from the back tees. There were a number of site factors that shaped the design and layout of the course. The biggest of these was topography. The holes were cited in such a way to take advantage of the existing topography when ever possible. This allowed the natural character of the site to be retained as well as permitted many natural drainage patterns and watersheds to be left in tact. By using the topography to my advantage I was also able to site a number of tees on high points to provide dramatic views and interesting golf shots.

The second site features that affected my design were areas with a high value for preservation and sensitive areas of my site. These areas were avoided and the golf course was worked around them. Mature wooded areas as well as areas that support large wildlife populations were also worked around. This added still more to the theme of keeping the natural character of the site.

Water also played an important part in the siting of the holes. Wherever possible, holes were sited so that players would have to hit over or contend with water on their shots. This was an important feature that helped to add interest and concentration during a round. It also functions to provide an aesthetic value and install dramatic views all adding to the sense of place created. Some of the most memorable golf holes contain water features to evoke the emotions of it's players.

Another important feature of the course was reducing the areas maintained. This not only aided in challenging the players to hit accurate shots by acting as a natural hazard, but also allowed the golfers to experience the native landscape of this region of the country and reduce maintenance. This is a concept that will be discussed in more detail in the section pertaining to the environment.

In addition to the natural features that shaped the golf course and gave it identity, there were a few man made features that affected play, sand traps and mounding. These hazards were placed at strategic locations around the course to provide interest and require skillfully places shots as well as a good strategy to shoot low scores. These manmade features skillfully blended with the natural features of the site, culminate to produce and outstanding and memorable test of golf.
The Signature Hole

The 18th hole served as the signature hole for this course. It was a par 3 that played 175 yards from the back tees, 165 yards from the middle tees and 150 yards from the front tees. This provided a dramatic finishing hole to challenge golfers and add interest to the game on the final hole. Although the yardage was not terribly long the hole demanded an accurate shot, as the green was surrounded by a number of hazards. The entire left side of the green was bordered by water and sand traps were provided near the front right corner, demanding the player to carry the hazard or play closer to the water to stick the green. The elevation change of this final hole was also about 35 ft. from tee to green, providing an elevated tee bed and dramatic view to the green. All of these elements combined to create one of the best and most memorable holes on the course.
Hole Details

Green Construction

Tee Construction
Education and Interaction

When thinking about the idea of allowing interaction from the community and providing for education on the site, there were a number of questions that first had to be asked. These questions were very important in determining what uses and activities would be provided.

The first question I asked myself was who would benefit from this integrated facility. I determined that a wide range of user groups were present in the city of Anderson for this type of recreational facility. Some of these groups included golfers, community members, visitors to the site and school children or other groups being educated.

I then asked myself how this interaction could take place on my site and came up with four main ways.

1. Through the use of trails and park space which were weaved throughout the site.

2. Through the use of the educational center that was provided in the clubhouse. This began to allow the clubhouse to serve as a multi-use facility it was intended to.

3. Through making connections to the community with the trail linkage system. This allows for easy accessibility by recreational users.

4. Through student visits to the site to observe the areas provided for education.

The next question I asked myself was concerning the uses that would take place in the trail area.

1. The biggest use of the trail was determined to be recreation. This trail simply provided a place to walk, jog or ride a bicycle from one destination or station on the trail to another.

2. Education through studying the on site elements using direct observation.
3. Observing nature. There is now a big interest in bird and animal watching in our country. With the variety of wildlife present on this site, this had the potential to be a popular activity.

4. Overlooking the golf course. Many users enjoy simply stopping and watching the game of golf for a few minutes. This was provided for through selected views that allowed observation without interference.

The next questions I asked were pertaining to the education on the site. I began by asking myself what the education would be about and the following were the topics which I felt were most important to deal with on the site.

1. The history of the site and region. This dealt with how the site came to be the way it is today and the cultural influences that affected these changes.

2. The wildlife and vegetation on the site. This allowed the users to experience a wide range of native plants and animals that exist on the site and learn about them.

3. The natural systems that shaped the site. This described the natural and geological processes that have taken place over time and contributed to the present form of the site.

4. The value of this project. This described, in detail, the value of using the site to its fullest potential and being environmentally sensitive and using the native landscape to the fullest potential. It also went on to inform the users how they could be environmentally sensitive with their home landscapes.

Finally, I had to decide how this education was to take place. The following are the ways which were used on the site.

1. Through the educational center. This area provided detailed information about all of the topics discussed above and allowed easy access to it by all users by placing it in the central area of site activity.

2. Direct site observation. There is not better way to learn than first hand and this was provided for on the site. Direct observation of the wetland area, plant communities and wildlife are all easily accessible.

3. Information signs would be placed at key points on the site to allow for user information as to what previously existed on the site. One good opportunity for this was at tee areas where golfers generally have to stand and wait on occasion.
Trail Layout

After looking at all of the options for the trail and deciding what uses the it was to include, it was then possible to design the actual trail. That main function of the trail area was to serve as a connecting link to areas of the city as well as provide for an integration of site uses. Using the current Anderson Riverwalk system seemed the only natural and logical system with which to make these connections. Thus, the layout and design of the trial system was guided by the existing riverwalk system. This site provided a vital link in the connection of the trail to Mounds State Park as well as provided interesting character and uses found nowhere else on the trail, making it a very important part of the larger system.

The trail entered the site from the west along the White River. Almost immediately, the user crosses over the wetland observational area. From there the user had the option of continuing on the trail along the river or taking another trail up to the clubhouse. Should the user decide to follow it to the clubhouse, they will experience a range of landscapes on the journey including mature woodland, lake and meadow area. Also, select views of the golf course are provided on the way.

Once at the clubhouse the user many elect to visit the educational center or grab a snack at the snack bar. The user could then chose to exit the site via the entry road or return to the riverwalk trail. Once back on the trail, the user would interact with the wildlife of the site in the wooded areas as well as experience the native landscape of the White River, while still being able to see select views of the golf course. As the user was leaving the site to the east, they could also experience an open space area near the river. This open space was provided to allow for informal activities such as picnicking or throwing a baseball. The large lake is also accessible from this area. This allows the users to interact with the water or simply view the beauty of the lake.

In the end, this trail system allowed for the integration that has been left out of many golf course designs and allowed for the public as well as the golfer :o experience the qualities of the site. It was a component vital to the success of the overall project.
Open Space Area Along River
Wetland Observational Area
Trail Entering Site
Clubhouse Overlooking 18th Green
Environmental Issues

The fundamental question in terms of a golf course is whether or not a it can be an acceptable land use in terms of existing in harmony with the environment. The answer was yes. After much research and experimentation I realized that a golf course could be as beneficial to the environment as any other land use, when properly designed. In this project, there were four main issues which I felt were critical to address in the final design, if the course was to be beneficial to the environment. They were preservation of the natural landscape, conservation of wildlife, better, safer maintenance practices and the conservation of irrigation water. No single one or these issues could make for a sensitive design. It was only through placing equal and utmost importance on each one, that sensitivity was achieved.

Preservation of the Natural Landscape

This is an area which I have discussed in some detail earlier in the report so I will be somewhat brief here. The first idea that this involved, however, was retaining the elements adding to the site character and seeing that the course worked with and laid naturally on the land. How this was accomplished was described in the golf course section. This did however, involve preserving elements such as mature woodlands, wetland and other sensitive areas, topography, lakes and rivers and areas of heavy vegetation. These elements not only preserve the natural environment, but also keep the natural processes working as they should.

A second way this preservation took was through the use of native plants. Native plants were retained where ever possible and specified almost exclusively in the final design. This allows the user to experience the qualities of the native landscape first hand when on the site.

A third form of preservation was to maintain a minimum of a 50' buffer between the maintained areas of the golf course and any sensitive areas of the site. This prevented these areas from being harmed in any maintenance practices that might take place on the golf course.
The final component of this preservation was to reflect the elements of the cultural landscape where ever possible. This would then begin to give an appreciation for the area in which the site is located as well as reflect the cultural aspects of this part of the city.

**Conservation of Wildlife**

Providing a place for the wildlife was a very important aspect of the design. Because this site was contained within very natural setting before the golf course, it contained large amounts of wildlife. Therefore, it was important for the design to incorporate places to house this wildlife. As the development of the surrounding land increases, as is the trend in this part of Anderson, this land will also begin to serve as a refuge for those animals whose space is gradually being taken away.

This conservation was accomplished by first keeping the clearing of trees and natural areas to a minimum and only maintaining those areas necessary for play. The golf course was routed so as not to interfere with areas supporting high wildlife populations and care was taken during construction not to harm any areas unnecessarily.

For wildlife to remain in large numbers on the site four things needed to be present: food, water, shelter and nesting areas (New York Audobon Society, ??). All of these factors were provided for in the design. Also, a number of food plantings were provided along with native plantings that attract bird and animal communities.

It was also important to leave some natural corridors on the site to allow for the movement of different species through the site. This allowed the species to have more freedom as well as a larger accessible area on the site. This was best accomplished in the trail system on the site but also in other areas.

The final component was providing a buffer between areas of activity and areas known to have high animal populations. This would keep animal populations from being disturbed by site users and vice versa.
There is no evidence to support the fact that golf courses take away from the wildlife of a sight, when properly designed (Thompson 64). There were a number of case studies looked at with a goal of preserving wildlife. All of these have been great successes and there has been no problems with the wildlife interfering with golf play. Not only is this good for the environment, it also provides for a better course aesthetic, due to the naturalness, and allows for still more of an appreciation for the area in which the course is located. This can only benefit any golf course.

**Conservation of Irrigation Water**

Another problem often associated with golf courses is the amounts of water that is used for irrigation. Water is already a scarce resource in our society and it should not be wasted or used foolishly. Although water is a much bigger problem in some areas of the country, I felt it should still be addressed here. Effluent water is one option often used where water is a precious commodity. However, I did not have the time necessary to adequately study the principles of effluent water use and make an informed decision about it’s usefulness on this golf course. Therefore I have adopted certain principles and included a number of design elements to help in conserving water on the site.

The first consideration was to use drought tolerant turfgrasses and turfgrasses that are biologically correct for this region of the country. This greatly helped to reduce the amount of water and maintenance required for these grasses. I selected bentgrass for the tees and greens and a combination of bentgrass and bluegrass for the fairways. These grasses were selected for their hardiness and correctness for the region.

The other main component of cutting back on irrigation was to set water priorities and only water as needed (USGA, 2). A typical order of water priorities ranging from most important to least might be greens and collars, tees, approach areas, fairway landing zones and finally other fairway areas. Again these areas would only be watered as the need arises and then the areas with the highest
priority would receive water first in case of a water shortage.

Some other concerns were also addressed in the design such as maintaining natural watersheds to allow for irrigation to come from the on site lakes and reducing the areas maintained. These both contributed to water conservation on the site.

**Alternative Maintenance Practices**

Maintenance is a key issue on any golf course. In order for a course to be popular, it must be properly maintained. The course could be the best designed anywhere, but if not properly maintained, it will not be played. Unfortunately, maintenance is the area of golf courses that has received the most criticism pertaining to the environment. This is due to the amount of chemicals used. There are, however, options for this. It is possible to properly maintain a golf course without causing harm to the existing conditions. But, care must be taken and the proper methods must be used.

The first step for this project was to reduce the areas that were maintained. I have already discussed the other environmental values of this, but the are also maintenance benefits. This cuts back on the chemicals which have to be used as well as the time and expense it takes to maintain these areas. The areas maintained were cut back to tees, greens, fairways and some areas of rough. It is not conceivable to think that a course of this nature could have the roughs totally natural due to the level of play and time it would take to recover lost balls. I simply suggested that the entire course not be manicured and any area that is not necessary for play be left to grow to it's natural state.

The second step to better maintenance, using natural plantings, was achieved in the final design solution for the project. These natural plantings are generally self-sustaining communities that require little or no maintenance (Walker, 472). An example of this on my site was the wild flower meadows. Once established, they are completely self-sustaining and will never have to be touched.
The third step was to make suggestions as to the types of fertilizers to be used for maintenance. Only fertilizers that have been shown not to leach or run-off should be considered. Also, only fertilizers approved by the EPA should be used. Lists of the fertilizers that meet these requirements can be obtained from a number of sources.

The final, and possibly most important step, in having good maintenance practices is to develop an Integrated Pest Management plan (IPM). This is basically a pre-determined analysis of pest problems and their solutions where multiple plans of attack are devised before problems arise. No course should be without an IPM. This system maximizes chemical efficiency by minimizing chemical use. This method provides multiple options for controlling and managing turfgrass. In other words, a variety of biological and cultural controls are used in addition to a reduction in chemical use. A couple of examples of this would be might be to let fungal diseases run their course, as opposed to trying to treat them with chemicals or even using bio-controls to control undesirables. An example of bio-controls might be spraying bacteria on weeds rather than using chemicals. In the end an IMP provides the golf course with a maintenance system that is more sensitive to the environment as well as beneficial to all users in general.
Conclusion

The planning, design construction and maintenance of a golf course and it's supporting facilities has become a very complex process. Today's economic times, environmental issues and the demands of the developer all require careful consideration by the golf course designer. Golf courses are being built at an incredible pace and consuming large amounts of land in the process. The time has come for designers to begin looking at alternatives for course design that can be beneficial for everyone, not just a chosen few people. This can be done. The evidence can be seen in this project. In the end, my design integrated the environment, the game of golf and the community of Anderson into one site. This design produced an outstanding test of golf as well as an natural setting in which to experience it, accomplishing my goal of producing a golf course which responds naturally to the surrounding environment. I feel this project has great significance because it addresses a number of important social and environmental issues in addition to providing a recreational activity. This project will begin to become a mean rather than an extreme in the coming years, because we are continuing to deplete our natural environment more and more each day. We need to begin to address these issues by doing more projects like this now, before it is too late.
Bibliography

Books


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