Project Report for Vulcan Golf and Wildlife Recreation Area

April 25, 1996
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Acknowledgments:

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Last but not least Riitta Salonen for her support and wit. She helped to keep my spirits up at a very stressful time and provided a lift for me when my energy seemed all but drained.
Introduction
The practice of golf course development has been under scrutiny for some time. Most courses until recently did not even worry about their toll on wildlife and water quality due to chemicals. In the 1960's golf course construction began involving the moving of large quantities of earth (Kuznik 36). Courses constructed today may involve moving 2 or 3 million cubic yards. Much wildlife habitat and native plant growth is thus destroyed in the process (Smart 17). Many courses, also, replaced native under story and woodlot with turf and ornamental and exotic plants (Kuznik 37). Kendall mentions that the average golf course is sprayed with more pesticides, herbicides, fungicides, and fertilizers per square foot than most farms in the United States (Kuznik 36). Balogh lists the following as being the major detrimental effects of golf course construction and management:

1. Leaching and runoff losses of nutrients and pesticides from established turfgrass sites
2. Soil erosion and runoff losses of sediment and nutrients during construction and losses from disturbed riparian zones
3. Exposure of beneficial nontarget soil organisms, wildlife, and aquatic systems to pesticides
4. Development and resurgence of insect and disease populations resistant to current chemical management strategies
5. Excessive use of water resources for irrigation during drought conditions and in semiarid and arid climatic zones
6. Degradation of stream and lake quality resulting from sediment, chemical, and thermal pollution
7. Disturbance or loss of wetlands
8. Disturbance and toxicity impacts on wildlife

The golf industry has come under scrutiny of late due to its negative impacts. Smart says that, "now, environmentalists and the market are demanding that new golf courses be integrated into the existing natural features." According to Smart this environmental distress can be summed up in three categories (Smart 17):

1. Land use changes and soil erosion that can alter wildlife habitats, wetlands, and streams or ponds.
2. Use of chemical fertilizers and pesticides that can contaminate soil and water and harm plant and animal species.
3. The water use requirements of turf grasses.

A highly manicured landscape has come at a price. The question then becomes how can an environmentally sensitive golf course be implemented so as to respond to these issues? This project attempts to offer some solutions to the problem.
Problem Statement
I. Problem Statement

Today’s golf courses tend to be consumptive of land. Urban development is continually putting strains on what little wildlife habitat exists. Therefore, the project will be to integrate a golf course and wildlife sanctuary on the Vulcan property in Anderson, Indiana.

II. Sub-Problems

1) Determine what similarities existed between the golf course and wildlife sanctuary.

2) Determine what dissimilarities existed between the golf course and wildlife sanctuary.

3) Determine the current diversity of wildlife on the site.

4) Determine what impacts the golf course would have on the existing wildlife diversity.

5) Develop guidelines for the golf course.

6) Apply a design incorporating golf and wildlife sanctuary.

III. Hypothesis

The hypothesis was that a golf course and a wildlife preserve could coexist together on the same site harmoniously and that criteria could be established to guide such a development.

IV. Delimitations

The project did not attempt to look at the diversity of wildlife occurring on surrounding landuses.
The project focused on wildlife that could be found in the central Indiana region.

The project did not consider financing for construction and management.

**V. Assumptions**

1. A need for another golf course in Anderson, Indiana existed.

2. Golfers would be open to the idea of integration of the two uses.

3. Wildlife could and would inhabit and breed in close proximity to a golf course.

**VII. Importance of the Study**

The practice of golf course development and its practices has been under scrutiny for some time. Most courses until recently did not even worry about their toll on wildlife and water quality due to chemicals.

Today’s golf courses not only tend to be detrimental to the environment, but they also tend to cater to a small portion of society. Integrating a golf course with another use, therefore, tends to allow for a wider range of users.
Background
In understanding why this type of project can be successful it is important to look at precedents in the design of golf courses. Originally the game of golf as we know it today began in Scotland nearly five hundred years ago. Near the town of St. Andrews an area known as the linksland was used by Dutch traders to play the game of het kolven. The game itself was something that was spontaneous in nature because the traders would actually play the game on their way from their ships to the town. It is important to note that this course was entirely created by nature and not by man. It featured fine textured turf and sand dunes along the coastline and animals actually helped in the creation of the course. The traders used rabbit scrapes as targets and sand bunkers were created by sheep seeking shelter from the wind. The rabbits and sheep also helped to maintain the height of the turf (Beard 1982).

Then the game slowly evolved taking new forms and gradually adopting new technology. Courses began to become more and more designed by man and the landscape itself more and more manipulated and manicured. Golf was then introduced to the United States in the late 1700’s, but did not really take hold until the 1800’s (Love 2). The trend of manipulation and highly manicured courses continued and has become an art form. Today there are more than 27 million people who play golf in the United States and more than 50 million worldwide (Wheat 10). The current number of courses in the United States is around 15,000. Unfortunately many of these courses were not designed with the natural environment in mind.

This project attempted to turn back to that which came before and to take a more historical approach in the design of the course. It was the intent to allow the nature and the landscape to once again dictate the layout of the course instead of the course dictating the landscape. Some of the maintenance of the course was again kept in check by nature (or biological controls).
Goals
Goals:

I) To protect wildlife habitat and natural ecosystems occurring on the site.

II) To increase the biodiversity occurring on the site.

III) To create a wildlife sanctuary and golf course that are symbiotic in nature.

IV) To qualify for the Audubon Cooperative Sanctuary System by meeting criteria established by the United States Golf Association (USGA) and the Audubon Society of New York State (See Appendix A).

V) To create a space that can be used by a majority of the population of Anderson, IN.
Site Description
The Vulcan property as it is known today is located within the city limits of Anderson, Indiana. Anderson is located approximately forty-eight miles northeast of Indianapolis in the northeast region of Indiana. The site is located on Range Line Road just north of S.R. 238 (see figure 1 below). The site is bounded to the East and North by residential development, to the East by Range Line rd., and to the South by the White River. The site itself was a former gravel pit and a small portion was agriculture. The approximate size of the property is 185 acres.

The property is located in Madison County, Indiana, being a part of the South Half of the Northeast Quarter of Section Seventeen (17), Township nineteen (19) North, Range Eight (8) East, and being a part of the Southeast Quarter of Section Seventeen (17), Township Nineteen (19) North, Range Eight (8) East.

The site was originally owned by the Vulcan Materials Company, a New Jersey Corporation, and given to
the Anderson Park’s Department. The deed states that the property was only to be used by the
new owners for park purposes. Meaning that it would forever be preserved for public use.

Since the time the property was given to the Parks Department it has for the most part sat
undisturbed. There are small portions of the site that have been used by the city to dump wood
chips and lumber. Some intermittent bike trails have popped up on the site from some members
of the public sneaking onto the site. The lake located on the southern portion of the site is also
used for fishing by members of the public.

The city has considered several uses for the site over the years. One idea was to develop
a golf course funded by Jack Nicholas. A primitive camping area and a RV park were discussed
for a time. A nature preserve is one of the most recent ideas for the site. The only two things
that are certain to be located on the site are a river walk trail and fishing access area. The site
will actually be the culmination of the city river walk which currently extends out to S.R. 109
(approximately 9 miles) and is slated to be brought to the property within the next five years
(approximately 12 miles). The fishing access stems from talks with Indiana Department of
Natural Resources to fund the clean up and stalking of the lake site provided certain criteria are
met as well as a study by the council of governments for a nature preserve.
Programmatic Outline
Program Statement:

The Anderson Parks Department had a vested interest in creating a quality recreational site for its general public. The designer was asked to take the Parks Department’s ideas and dreams for a wildlife sanctuary and an environmental golf course and make them a reality. The general public had to be the first priority as they were and are the primary user group.

Client’s Goals:

The clients goals and wants could be summed up into three categories:

1) Wildlife Sanctuary and Environmental Education Area
2) Environmental Golf Course
3) Access to River Walk and Existing Fishing Pond

1) Wildlife Sanctuary and Environmental Education area (approximately 40 - 50 acres):

   A) Nature Center
      a. Conference room
      b. Kitchen facilities
      c. Restroom facilities
      d. Storage
      e. Office Space
      f. Educational / display area
      g. Wildlife observation area
   B) Walking trails
      a. Signage
      b. Connection to proposed river walk
      c. Connection to nature center
   C) Non-public access wildlife protection area
      a. protected watching areas
      b. Protective buffer from human disturbance
   D) Wetland and wildlife improvement and protection area
   E) Native hardwood planting area
   F) Parking
      a. Gravel surfacing
      b. 15 cars
2) Environmental Golf Course (see Appendix B for guidelines) (course will be roughly 120 - 140 acres, but the wildlife sanctuary will be the ultimate deciding factor on size):

A) Club House
   a. Concession (19th hole) and resting area (wildlife observation)
   b. Restroom facilities
   c. Green fees collection and golf cart rental area
B) Maintenance building
   a. Golf cart storage
   b. Storage for course maintenance equipment
   c. Access road (can be porous material)
C) Parking
   a. 85 cars
   b. Asphalt surfacing
   c. Easily accessible from Range Line Rd..
D) 18 holes in length (see golf layout guidelines)
E) Golf cart paths
   a. Gravel or other porous surface material
F) Irrigation System (see appendix B for limitations placed upon watering)
   a. Water reuse and recapture device
G) Best Management Practices and Integrated Pest Management plan devices (see Appendix B for more details)
   a. Bird houses
   b. Bat houses
   c. Vegetation

3) River walk and fishing access (to lake)
   A) Parking
      a. 10 cars
      b. Porous material (most likely gravel)
      c. Easily accessible from Range Line Rd..
   B) Trail to river walk
      a. Porous material
   C) 1 fish cleaning station near lake
Site Inventory and Analysis
The site being approximately 185 acres in size and a former gravel pit that sat vacant had many different features and unique opportunities. Being that the problem was to develop a wildlife sanctuary and an environmental golf course it was important to examine the sites natural systems.

During the inventory phase the sites characteristics were broken down into six categories: vegetation, water features and floodplain, soil wetness, slopes, disturbed areas, and wildlife. The sites vegetation consisted primarily of upland forest, successional woodlot, floodplain forest, open meadow, and scrub growth.

The upland forest was found to the northern quarter of the site. This issue was examined to see what types of wildlife habitat and feeding areas were available. Species occurring in this area included oak, hickory, beech, and maple; with maple being dominate. The successional woodlot occupied the central region of the site and consisted of sycamore, maple, and beech species, with ash dominate. A well developed and thick undergrowth occurs in the woodlot. The southern
quarter of the site contained the floodplain forest. The vegetation found in this area was comprised of ash, sycamore, cottonwood, and maple species, with hackberry being dominate. Two large open meadows were located among the successional woodlot and floodplain forest on the southwest section of the site. These meadows contained many diverse wild species. The last category of vegetation, scrub growth, was found to the southeast corner of the site situated among the floodplain forest. This vegetation was classified as well developed and thick.

The second issue focused on was water features and the floodplain. This topic was pursued in order to find areas where wildlife would have a tendency to migrate to and where foundations would be harder to construct. The site was found to have many inundated areas with the major ones occurring along the natural drainage pattern through the north east corner of the site (see graphic below). Two larger wetland areas were discovered to the northwest corner and midwest sections of the site. The
flood fringe occupied the bottom third of the site. The 100 year flood line was found to the south of the natural drainage pattern and the 500 year flood was found only to extend to two minute areas (see graphic below).

Slopes were examined to determine where prime observational points are located and what natural features would require special consideration when undertaking golf course routing. Slope would also place special consideration on placement of roads and hiking trails. The most severe slopes were found to be located to the northwest and northeast corners of the site (see graphic to the right).

Soil wetness was explored to see where it would be harder to construct foundations and to see where golf activities could be located as to conserve water during irrigation. The wettest soils were detected in the south west corner. Moderate wetness was discovered in the north.
west corner and the south east corner. The driest soils occur towards the center and northeast corner of the site.

Human influence was found in many places on the site. As mentioned previously a major road, Range Line rd., was located to the East of the site. As well several small dirt roads had been used by the mining company and more recently by the City to access the site. The city had also been using the site as a place to dump wood chips from tree trimming. These dumping areas were located toward the entrance and were used to fill small depressional areas. Two small areas on the site to the northwest and northeast had been used frequently by the public as a mountain bike trail. Other influences on the site came from several homes located to the west of the site and a residential area to the north of the site. Several foundations were like wise found on the site and are believed to have been a farmstead.

Wildlife found on the site due to the size of the property and its many different features was of a wide variety. There were open water species (waterfowl, fish, phytoplankton) and
limnopic species (frogs, snails, waterfowl) found around the large lake in the southeast corner and the small pond to the northeast corner. The next habitat, late successional species (deer, squirrels, and owls) could be found on the northern and southern third of the site. Mid-successional species (deer and foxes) covered the entire center of the site. Two areas toward the center of the site contained early successional species (raccoons, opossums, rabbits, quail).

**Analysis**

The conclusion drawn from the inventory was that the site provided many unique opportunities for both wildlife viewing and golf activities. The upland forest to the north provided excellent cover for all types of wildlife. As well this area contained the highest point on the site making a good place to locate an observational area. Steep slopes were found in this area making it more difficult to play golf on. The small pond to the east of the upland forest was a fitting place (if dredged) to protect habitat for waterfowl and create an aesth.
The successional woodlot toward the middle of the site being in a transitional stage was deemed important for its food and cover, but was not as important as other vegetative areas on the site. This made the area an superb choice for locating much of the golf course while still trying to save woodlot. It is largest of the covers.

Situated successional was the large and high point the farmsteadation. The high possibilities as a for the nature to observe wild-the meadow. The pockets of also the vegetative among the woodlot meadow containing founda-point had location center and life using meadow for this reason became a prime choice for a wildlife protected and human untouched area. Also located to the south of the meadow were several inundated areas that had potential for wildlife water sources and waterfowl.
The third high point on the site located to the east of the site on Range Line rd. was found to be overlooking a large amphitheatre type area making it possible to situate the club-house or nature center there. There was also enough room for a large parking lot without significant grading.

The large lake to the southeast of the site made an excellent choice for fishing, waterfowl habitat, and golf course hazard. A small flat area next to Range Line road and to the north of the lake would be a possible location for a parking lot. The floodplain forest located to the west of the lake due to its wildlife habitat potential and that it floods frequently made it an unlikely candidate for golf course especially right along the river. The proposed city river walk would also run through this area making safety a problem with golf.

All sides of the property except the south contained reasons for needing buffering. The western and northern edges of the property needed buffering to protect and provide privacy for the residential areas located there. The eastern edge required buffering from Range Line road to give protection to users of the site and cut down on noise.
Concepts
Based on the site analysis and the program three concepts were devised in order to solve the problem. The three concepts were: 1) the separated, 2) the integrated, 3) and the cellular.

Concept 1: the separated concept provided for both the wildlife sanctuary and golf course to occur together on the site, but kept each area and its functions apart from the other. The idea was to locate the wildlife sanctuary to the Northwestern, western, and southern edge of the site (see figure C1). This preserved the upland forest, part of the successional woodlot, and most of the floodplain forest while still providing connection to the proposed river walk. Wildlife corridors would likewise remain intact on the outskirts of the site. The area allotted for the golf course allowed it to remain contiguous and conflict with the sanctuary minimized (safety maximized).

The separated concepts disadvantages were that it did not take advantage of the sites natural features. Both of the large open meadows and some of the inundated areas located to the
interior of the site were left out. The high point towards the center of the site and that contained foundations was not utilized to its best capability. Most importantly the concept did not solve the problem of creating a symbiotic relationship between the two uses of sanctuary and golf.

Concept 2: the cellular concept called for the sanctuary to be located to the center (the nucleus) of the site while the course occurred to the outskirts of the site and around the sanctuary (see figure C2). This allowed the area for wildlife to remain a contiguous island while taking advantage of the high point and large meadow situated toward the center of the site. Part of the upland forest and most of the successional woodlot would be preserved. The concept also maximized safety for pedestrian users of the sanctuary while minimizing conflict.

The disadvantages associated with the concept was that it did not preserve as much of the upland forest as the other concepts and it did not provide vegetative corridors for protected wildlife movement. Conflict was created to the southern edge of the site between the golf
course and riverwalk due to the lack of safety buffer that wildlife habitat could provide. Golf and residential would have come dangerously close with the implementation of the concept and most importantly as with the separated concept it still did not allow for the interaction of golf and wildlife uses.

Concept 3: the final concept conceived took the best advantage of the sites natural features while still solving the problem, to integrate a wildlife sanctuary and an environmental golf course, thus the name the integrated concept. The wildlife sanctuary would mainly be located to the northwestern, and southern edges of the site as in the separated concept. The difference being that these areas would be somewhat smaller and then a corridor would provide access to the high point and large meadow to the center of the site (see figure C3). This would preserve most of the upland forest, a small portion of the successional woodlot, and most of the floodplain forest. As mentioned above it allows connection to the large meadow in the
interior of the site, but also provides protection of this meadow for wildlife habitat. The concept forced the golf areas and wildlife areas to work more closely with one another.

The main disadvantage of the integrated concept was in that it created safety issues for pedestrians using the wildlife sanctuary that had to be addressed during the design phase. As the integrated concept chopped the areas for golf course routing into smaller zones placement of holes also became more critical during the design phase than with the other concepts.
Design Phase
Figure D1  MASTER PLAN
The first step of the design phase was to locate the areas designated as wildlife sanctuary. Being that the wildlife and its habitat were deemed most important it made it imperative that the golf course routing fit around the sanctuary.

The main entrance was placed towards the northeast corner and via Range Line road. An access road was placed to take advantage of one of the existing dirt roads on the site so as to limit the amount of grading needed. Likewise the road was heavily screened to protect it from the fairways paralleling it. This access road terminated in a 16 car parking lot for the education center/environmental education center.

The environmental education center was placed on the high point located towards the center of the site. It was felt that because the area overlooked a large, open meadow, some inundated regions, and was once the site of the Victorian house that it would be a prime location. The intention for the center was to serve as the hub of the wildlife sanctuary and as a terminus for the city riverwalk. Inside the building trail users, golfers, and visitors could learn about the wildlife species and vegetation found on the site while enjoying refreshments. Information would also be available to educate users about controls for the golf course that were designed to protect the environmental systems on the site. Outside the building would be an observational deck to view wildlife in the protected meadow.

The protected meadow was situated to the south of the nature center and north of several inundated areas. The overall elevation change between the nature center and the meadow floor
was approximately thirty feet allowing for optimum viewing of wildlife. The idea was that by preserving the meadow it would allow for the protection of native vegetation as food sources for wildlife. The inundated areas located to the south would be graded so as to connect all of them into one large wetland area. Thus creating a watering spot for wild species and habitat for openwater species and limnotic species (discussed in the inventory chapter). A buffer of mature trees was left in order to create some separation and protection of the area from golf zones.

To the northwest of the protected meadow was placed a trail to provide connection between the city riverwalk (running along the south edge of the property) and the nature center. A large buffer of mature trees was left for the trail to run through. This was done in order to protect trail users from mis-hit golf shots and golfers trying to cut the corner on the dog-leg hole number thirteen. At the bend the buffer measured two hundred and fifty feet from the center of the fairway to the trail and the smallest area of buffer, occurring near the tee, measured eighty feet. This trail then connected to another trail along the west edge of the site that provided connection to the residential areas occurring along this edge and to the north of the project. A buffer of successional woodlot was left between the trail and center of the fairway measuring two hundred feet in width.

The trail provides connection to a picnic shelter which was placed on the highest spot on the site, approximately sixty-five feet above the White River. The intention of the shelter was to provide a rest area for trail users and outdoor picnic area for families living in the residential
neighborhoods close to it. Just to the south and below the shelter is situated the upland forest which most of it was saved for habitat of late successional species. To southeast edge of the upland forest is a large wetland area which was shared with the golf course and sanctuary area. In this way the wetland provided a aesthetic and hazard to golf hole number eighteen, but also allows wildlife to use the upland forest as a travel corridor to the wetland without having to come in contact with human activity.

The most difficulty that came during the design phase was in trying to fit eighteen holes on the site while staying out of areas designated as strictly wildlife sanctuary. The golf course, however, was designed to be an extension of the wildlife sanctuary. The main clubhouse and a car parking lot were positioned by the main entrance on the third high point on the site. The area is sort of a plateau and by placing the clubhouse on this spot golfers who are waiting to tee off or have just finished their round of golf can enjoy refreshments while observing wildlife and other golfers playing on holes one, nine, ten and eleven located some 30 feet below the clubhouse.

Due to clearing needed for the clubhouse and to observe the play of other golfers some of the slopes below the clubhouse will need to have erosion controls (such as silt fences) implemented during the construction phase. Then the slopes would be planted with native shrubs and grasses to control erosion. In this way a different type of habitat for wildlife would be provided from the large areas of trees and fairway turf located throughout the site. Another area that
needed to be addressed in this way was the clearing created (for observational purposes) below the picnic shelter in the northwest corner.

The fairways on the course were subjected to certain limitations during the design and construction phase. Figure D2 shows a section of the site before construction. The section shows that there is little difference in wildlife habitat and therefore the types of biodiversity. Figure D3 shows the same section through Range Line road, fairway number one, and part of
fairway two after construction. It demonstrates the creation of edge effect, the creation of biodiversity, and the different zones of vegetation and maintenance employed on the golf course to maintain wildlife corridors. Going from left to right the first zone is the maintained turf zone of hole number two and then there is the less intensively maintained turf (of a higher height and higher tolerance for pest and weed invasion) of the primary rough. The third zone is the secondary rough which is designed as a transitional, ecotone habitat of meadow (use of indigenous wildflower species), indigenous shrubs (having a high value as shelter or food source for wildlife) and drought tolerant grass species. The fourth zone is a woodland buffer which can measure between fifty and one hundred feet. The woodland becomes a conservation zone where the highest level of protection of wildlife habitat is employed and retention of contiguous connections and wildlife corridors occurs. From there the pattern starts again with secondary rough, primary rough, maintained turf, primary rough, and secondary rough. The last zone is a fifty foot buffer, conservation zone, between the secondary rough of hole one and the right-of-way of Range Line road.

The golf course also addressed the topics of water conservation and chemical pollution from fertilizers. In order to reduce the amount of detrimental runoff several biological filtration ponds were strategically placed around the course. The idea was that the course would be graded in such a way as to drain the fairways towards the filtration ponds. Likewise the greens and sand traps could be sub-drained to the ponds. This treatment can be seen in figure D4, a
section of the courses hydrological cycle. Going from left to right large trees give off oxygen and water vapor from evapotranspiration and in return clouds provide rain water. The surface of the green being sloped towards the filtration pond and the subsurface drains help direct surface runoff to the pond. From there the water is biologically filtered by plant material and then repumped onto the green as irrigation water. Thus, water conservation is employed to keep down consumption of city water and the cost of irrigation. Also, a limit of construction line was employed along the south edge of the site to protect the White River from chemical runoff. The large mature trees of the floodplain forest and their roots help in the protection of the river by creating a riparian zone.

As mentioned previously plant material in the filtration ponds were designed to absorb chemicals from the golf course. Figure D5 shows a typical section of one of the ponds and fairways. Going from left to right the maintained turf of the course can be seen and then the beginning of the filtration pond. Low growing vegetation is placed near the edge of the pond, emergent plants are placed from water level down to one foot, rooted surface plants begin at one
foot below water level and continue to two foot below, and submersent plants are placed from negative one and a half feet to negative six and a half feet. The pond was created to have gentle slopes around its edges for safety and its bottom to contain an impervious pond liner on top of subsoil. On top of the liner was placed a high, fine, mineral substrate and on top of that an organic muck or peat was installed.
APPENDIX A

Audubon Golf and Wildlife Sanctuary Certification
As stated earlier in the goals section it was the intention of the designer to make the course environmentally sensitive. One of the ways that the designer could put a check on himself was to try and qualify the course for certification in the Audubon Cooperative Sanctuary System. The system was developed by the United States Golf Association (USGA) in conjunction with the Audubon Society of New York State. In order to gain full certification six categories must be met by the golf course. As of writing there were no courses in Indiana or Kentucky currently qualifying for the program. Likewise, in Illinois and Ohio if you were to extend the northern border of Indiana there were no courses south of this line qualifying (see table 1 and figure S1).

**Certification Categories**

1) Environmental Planning  
2) Wildlife and Habitat Management  
3) Member / Public Involvement  
4) Water Conservation  
5) Water Quality Management  
6) Integrated Pest Management

**Environmental Planning**

This category really deals with the goals, inventory, and analysis phases of this project. The guidelines ask for the goals and plan-of-action over the next couple of years. The plans could include a map of quality habitat areas and places needing improvement (inventory and analysis). These plans would then be sent for certification.

**Wildlife and Habitat Management**

The category encompassed non-play areas to provide habitat for wildlife on the course. Space was to be maximized to provide the best possible habitat based on size and location of the property. The following sub-categories were addressed in the following ways:

**I. Wildlife Cover Enhancement Projects**

A) Woodlot management- understory vegetation was kept intact, after installed the management would leave dead tree snags along the buffer zones and create brush piles every 50 feet along buffer zones. The upland forest and floodplain forest remained were protected.

B) Naturalization Projects- the protected meadow taller grasses would be allowed to grow,
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<tr>
<th>No.</th>
<th>Course Name</th>
<th>Location</th>
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<tbody>
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<td>1.</td>
<td>Cranberry Resort Golf Course</td>
<td>Collingwood, Ontario, CANADA</td>
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<td>2.</td>
<td>Hindman Park Golf Course</td>
<td>Little Rock, AR</td>
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<td>3.</td>
<td>Forest Highlands Golf Club</td>
<td>Flagstaff, AZ</td>
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<td>Links at Spanish Bay: Pebble Beach Co.</td>
<td>Pebble Beach, CA</td>
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<td>18.</td>
<td>Kapalua Land Co./Village Course</td>
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<td>Treetops/Sylvan Resort</td>
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<td>Fiddler's Elbow Country Club</td>
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<td>Tournament Players Club at Summerlin</td>
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<td>40.</td>
<td>Old Westbury Golf &amp; Country Club</td>
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(over)
wildflowers and native shrubs would be planted in the secondary roughs, and shrubs, hedge rows, and trees in the buffer areas between fairways. These buffer areas would create travel corridors.

C) Protection of Special Habitats or Wildlife Species- The protected meadow is left entirely to wildlife as well as areas of the upland forest and floodplain forest. The wetland in the northeast corner and lake have protected edges. The newly created wetland is left entirely to habitat.

D) Nest Boxes- Areas around the lake and wetlands will have nestboxes mounted around them

II. Wildlife Food Enhancement Projects
A) Plant Management- Plantings of species along the buffers and secondary roughs that specifically provide food for songbirds. Plantings of flowerbeds, window boxes, and landscaped areas around the nature center, maintenance building, and clubhouse would provide food for songbirds, butterflies, and hummingbirds.

B) Native Plant Landscaping-

C) Bird Feeding- Supplemental food in bird feeders near the nature center, maintenance building, and clubhouse

III. Water Enhancement Projects
The two wetlands and lakes have at least one side where shoreline vegetation is maintained for safe access and food sources. The wetland in the protected meadow has vegetation all the way around it.

IV. Map and Wildlife list

[Map showing different species in various areas]
Member Public Involvement

I. Resource Advisory Group

Groups to be organized from the scouts, Anderson Public Schools, Madison County Garden Club, Rotary Club, and other organizations for projects around the nature center and to advise on projects to be done.

II. Education and Public Involvement

Displays, posters, brochures, and workshops to be staged at the nature center. Information will educate public on the environmental controls used on the course, types of wildlife and vegetation on the site, and things they can do to improve environmental quality.

III. Member Public Involvement in Environmental Projects

Local groups mentioned above will be encouraged to adopt a nest box. They will be in charge of mounting and monitoring the box. Scout groups will be encouraged to conduct projects around the nature center.

Water Conservation

A) Irrigation System- this area is out of the scope of the project, but an expert should be consulted to obtain a system that incorporates evapotranspiration rates, soil wetness, weather forecasts, and existing water re-capture systems.

B) Water Source- The course has been designed to use retention ponds to water greens and the long channel and lake can be used during peak periods of drought. These systems alone will not be enough all the time so the cities water will have to be employed partially.

C) Watered Areas and Frequency- This area will have to be further studied once the course is installed. However, watering should not take place at peak evaporation periods. Drought tolerant species incorporated into the primary and secondary roughs so that the only areas really needing irrigation are the fairways. (greens watered by re-pumping filtered water from ponds.)

D) Water Re-capture and Re-use- These techniques have already been mentioned in the master plan section. A quick summary of them is: 1) biological filtration ponds re-pumped onto greens, 2) during peak periods water from the lake and channel can be used.
E) Turf Grasses- Drought tolerant species are incorporated into the primary rough and secondary rough

D) Water Distribution- As this is a new course installation no distribution of irrigation water has been done

F) Mulches- mulches can be stored near the maintenance building and be used for plantings around the nature center and clubhouse.

G) Water Reduction- As mentioned previously this is a new course installation so no study of the amount of water used on the course has been done. Once the course is installed it might be possible to compare water rates with that of the other public course.

Water Quality Management

A) Baseline Data and Water Quality Monitoring- this something the course would have to initiate once the course is installed.

B) Streams- the White River is located to the south of the site. Limit of construction and limit of course use (riparian zone) were established during the design phase both to reduce silt from erosion and chemical pollution. Silt fences must be employed during construction and vegetation established immediately in areas where clearing does occur.

C) Wetlands- inundated areas south of the nature center were improved into a wetland area and the wetland in the northeast corner which was found to be stagnating was dredged and improved through vegetation to filter runoff from residential areas to the north.

D) Buffers and "No Spray" Zones- near the lakes and wetlands no spray zones must established as well as vegetation will protect

E) Drainage- most of the courses water is drained through grading and subsurface drains to specific filtration ponds where chemicals are negated by vegetation. This was in order to protect lakes and wetlands on the site.

F) Chemical Additives- No chemicals have been added to the water features and no change has been observed yet due to this being a new installation.

G) Maintenance Facility and Equipment Wash Areas- A containment system must be installed to protect the environment from leaks of chemicals and gasoline for the equipment. Careful storage and maintenance of chemicals must be employed.
Integrated Pest Management

This category is a little out of the scope of the project in that involves more the type of maintenance employed after installation, but the following highlights some of the strategies the designer would like to see.

Regular turf inspections to identify problem “hot spots”
Use of biological controls- nematodes, milky spore, birds, bats
Natural organic fertilizers and pesticides
Pesticide applications only on a curative basis
Reduction of turf stress due to low mowing heights and traffic
Education of employees on the importance of the environment on the site
APPENDIX B

Guidelines for Golf Course Layout
When designing a course there are many considerations a designer should pay close attention to. These considerations can be summed up into five categories: 1) Strategy, 2) Variety, 3) Beauty, 4) Economy, and 5) Utility (in play and in maintenance). The course was designed with all these in mind.

The course uses strategy through siting, slope, shape, and orientation to influence play from tee to green. On some holes such as holes 3, 9, and 11 contour is used to obscure the green. Water features and bunkers are used to encourage golfers to place shots to secure advantage, but not simply to punish wild shots.

Variety is used to demand all types of shots. Through distribution of short and long holes and variation of fairway slopes and outlines golfers get different challenges.

Beauty on the course comes from a very natural setting in which wildlife is encouraged to move about the site while golfers play. The course also takes advantage of existing water features as aesthetic amenities.

Economy deals much with environmental aspects of the course. Limited use of chemical fertilizers and sprays; and instead biological controls and sprays. The course used little use of grading and instead used existing features to its advantage. Where grading is done it can be added to other mounding sites as hazards to the course. Husbandry of water resources discussed earlier (design phase chapter) would fall under this category. Limited clearing of fairways and only using topsoil in these areas helps in conservation.

Utility has to do with making sure that the course is practical. Siting greens from the previous hole as close to the next tee as possible without jeopardizing safety. Two starting points are provided on the course and a direct east - west orientation was avoided. Utility of maintenance again was provided through environmental controls. Smaller area of turf to maintain than most courses occurs meaning less mowing and spraying. Adequate watering system were provided through the filtration ponds. Minimum hand labor if any would be needed on the course and adequate area was also provided on greens for changing holes.
Most 18 hole courses range in length from 6201 - 6400 yards, par 72. It is, however, to shorten the course if the holes are made more challenging, for example par 70. The latter type of course was chosen in order to protect areas designated as wildlife sanctuary. The following specifies the lengths of the holes for the course.

**Course Length:**

Hole #1- 350 yards, par 4  
Hole #2- 200 yards, par 3  
Hole #3- 500 yards, par 5  
Hole #4- 350 yards, par 4  
Hole #5- 340 yards, par 4  
Hole #6- 200 yards, par 3  
Hole #7- 380 yards, par 4  
Hole #8- 360 yards, par 4  
Hole #9- 140 yards, par 3  

Total 2820 yards, par 34

Hole #10- 290 yards, par 4  
Hole #11- 230 yards, par 4  
Hole #12- 480 yards, par 5  
Hole #13- 340 yards, par 4  
Hole #14- 340 yards, par 4  
Hole #15- 130 yards, par 3  
Hole #16- 340 yards, par 4  
Hole #17- 350 yards, par 4  
Hole #18- 240 yards, par 4  

Total 2740, par 36

Total Course Yardage = 5560  
Total Par for the Course = 70
APPENDIX C

Designer’s Thoughts
Designer’s Thoughts

This project originated out of a real life situation in that the site was being considered by its owners for a nature preserve and then a developer proposed a golf course for the site. At first review, these two functions seemed to conflict with one another.

One can quickly assume that a golf course would be a bad thing for the site and not that a golf course could be something different, something that put nature first. In addition it could be assumed that golf and wildlife habitat on the same site might be inappropriate. This project, however, shows that this thinking is inaccurate.

After much research and deliberation on what the definition of golf was in the past and what it can be shows that a properly designed golf course can be a great solution for a space. It allows for preserving open space in an urban setting, wildlife and its habitat, vegetation, and even history all while providing relaxation for humans. The other benefit is that if you go a step further and add certain elements to the course it can become a “sanctuary.” Then the course allows itself to cater to more of society and not just the stratus which enjoys playing golf and can afford it.

Most importantly is that in today’s society where monetary issues confront us daily, (especially a public entity), this type of setting would be a beneficial one. Managed properly the course over time would pay for itself and the wildlife that it protects. The hope would be that the whole project would eventually become self supporting allowing for valuable tax payer money to be used for other projects instead of maintain the sanctuary.
APPENDIX D

Bibliography


As the title suggests the source covers environmental conditions involved with golf courses. Of particular interest is the chapter devoted wildlife and golf courses. Other areas of interest include: treatment of fertilizers, treatment of pesticides, and wetlands.


This source deals with step-by-step golf course construction. Each part of the golf course is covered in great detail with special attention given to turf selection. Parts of the course covered include: the putting green, the tee, the fairway, the rough, and the bunker. Irrigation and pesticide management are also covered.


This is a little older book, but breaks down the golf course design process into the simplistics. There are three primary sections of interest dealing with planning, design, and construction. The planning section seems to be very informative on size requirements and alternatives for smaller courses. The chapter on design covers the specific parts of the course. Construction has to deal with drawings, specifications, and the method involved.

Indiana Department of Natural Resources. *Directory of Indiana’s Nature Preserves*. Indianapolis: Division of Nature Preserves, 1991

Indiana Department of Natural Resources. *Preserving Indiana’s Natural Diversity*. Indianapolis: Division of Nature Preserves


The article is a case study of a environmentally sensitive course located in South Carolina and designed by Pete Dye. The article gives some information on the insensitivity of conventional courses. The article then goes on to tell some of the environmental precautions that were taken on the course.


The article emphasizes the importance of integrating a site's natural character with the golf course. It talks of careful analysis of the species on the site, selection of species, and species requirements. The second half of the article concentrates on environmental concerns. Fertilizers, pesticides, water resources, wetlands, and soil erosion is covered.


The source basically outlines what is wrong with conventional golf courses. It provides a check-list of what not to do.